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Operating Manual

PRAXAIR®

NitroFill ™

Container Pressurizing Unit

Note: This manual was previously titled *Praxair Liquid Nitrogen Dripper Model LND-1.*

PRAXAIR

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TRADEMARK INFORMATION

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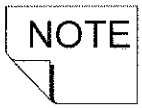
READ THESE INSTRUCTIONS

Dangers, Warnings, Cautions, and Notes appear throughout this manual. A sample of each statement appears below. Within each sample, a definition of the statement type and its purpose is given.

DANGERS alert you to an immediate hazard that causes serious injury or death and requires special precautions to be taken.

WARNINGS alert you to a potential hazard that causes serious injury or death *under certain conditions.*

CAUTIONS alert you to a non-immediate or potential hazard or an unsafe practice that presents a minor threat of personal injury or damage to equipment, data, or processes.



NOTES emphasize or remind you of an important piece of information.

1 SAFETY

NOTE

This chapter contains information to promote safety in the operation and maintenance of this equipment. It is not intended to supersede, replicate, or replace any safety documentation or procedures provided from or established by official safety sources.

All persons involved in the operation of this equipment—plant engineering, operations, and management—must understand the potential hazards involved and observe the required safety precautions. Only trained and responsible personnel should work with or around this equipment.

Your safety and the safety of equipment, nearby facilities, and personnel require a proper safety attitude and an emphasis on safe work procedures. This is the essence of any good safety program. If at any time you identify safety deficiencies, immediately correct them and bring them to the attention of management.

Before an accident can be prevented, it must be anticipated. Use pre-job discussions with your coworkers and supervisors to identify hazards and the means to avoid them. At your facility, various gases may exist in liquid and/or gaseous states. Familiarize yourself with the hazards associated with each gas found at your facility.

NOTE

Read and understand the Material Safety Data Sheets (MSDS) for the materials used with this equipment. All personnel who work in the vicinity of this equipment should read, understand, and follow all supplied safety information contained in the MSDSs, in addition to following all government and facility safety regulations. Also, obtain and read the reference publications listed in Table 1-1.

Table 1-1 Summary of Reference Publications		
Publication Number	**Title**	**Location**
P-3499	Safety Precautions	Praxair Publication call 1-800-PRAXAIR
P-12-237	Condensed Safety Information: Compressed Gases and Cryogenic Liquids	Praxair Publication call 1-800-PRAXAIR
P-14-033	Guidelines for Design and Installation of Industrial Gaseous Nitrogen/Argon Distribution Piping Systems	Praxair Publication call 1-800-PRAXAIR
	MSDS for Liquid Nitrogen	Gas Supplier, call 1-800-PRAXAIR, or see www.praxair.com
	MSDS for Gaseous Nitrogen	Gas Supplier, call 1-800-PRAXAIR, or see www.praxair.com
AV-1	Safe Handling and Storage of Compressed Gases	Compressed Gas Association (CGA) 1725 Jefferson Davis Highway Arlington, VA 22202-4100 (703) 412-0900
AV-5	Safe Handling of Liquefied Nitrogen and Neon	CGA
P-1	Safe Handling of Compressed Gases in Containers	CGA
P-9	Inert Gases – Neon, Nitrogen, and Helium	CGA
P-14	Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres	CGA
SB-2	Oxygen-Deficient Atmospheres	CGA
V-1	Compressed Gas Cylinder Valve Inlet and Outlet Connections	CGA
	Handbook of Compressed Gases	CGA

1.1 Emergency Procedures

The PRAXAIR® *NitroFill*™ Container Pressurizing Unit (referred to in this manual as the *NitroFill* LN2 Dispenser) is designed to operate safely, efficiently, and reliably. However, as with any operating system, an emergency can occur at any time. Such an emergency may involve fire, gas leakage, accident, over-pressurization, or other dangerous situation. The emergency response could involve calling for medical assistance, management notification, fire assistance, or evacuation from the vicinity of the equipment. **Obtain the following emergency phone numbers and post them at site telephone locations.** Periodically review the numbers for accuracy and update them as required.

Emergency Phone Numbers	
Ambulance	(_____) _____-_____
Fire Department	(_____) _____-_____
Sheriff or Police Department	(_____) _____-_____
Praxair Representative	(_____) _____-_____

Training and education are the most important parts of any safety program. For every possible emergency, establish an Emergency Response Plan and maintain it for immediate use.

1.2 Basic Safety Requirements

Be aware of all applicable safety guidelines to:

- **Prevent asphyxiation** – Use extra caution when entering any confined space where concentrations of gas might collect. Use a portable oxygen analyzer with an audible alarm.
- **Prevent electrical shock** – Unplug the power cord from the equipment before working on it. Use tools designed for work on electrical equipment.
- **Prevent injury** – Wear safety glasses and other appropriate safety protection when the MSDS dictates. Ensure that all tools and instruments used during installation and maintenance are in good condition. Be aware that high-velocity gas may be released at vents and pressure relief valves.
- **Protect equipment and plant personnel** – Check all safety devices periodically to ensure continued reliability. Provide proper maintenance of all pressure relief valves. Never bypass safety devices, and never operate the equipment outside its specified limits.
- **Follow posted precautions** – Read all precautionary labels attached to equipment and posted in areas of the facility. Comply with all precautions before handling the equipment.
- **Know evacuation routes** – Know the evacuation route from the facility or, if one does not exist, develop an evacuation procedure. Obtain and review all applicable on-site evacuation plans.

Situations may develop for which no written procedures exist. Think carefully before acting. Know the function of each valve and switch and its effect on the process and equipment. Carefully review all operating

procedures before starting up this equipment to ensure knowledge and understanding.

1.3 Fire Response

Fire, and equipment damage caused by fire, may result in death. The release of gases due to fire or heating of gas handling equipment may result in exposure to gases with asphyxiant properties. If fire is detected, follow the procedures in the Emergency Response Plan for your facility.

The items listed below are recommendations and are not intended to replace your facility's Emergency Response Plan.

- Turn on a fire alarm immediately and evacuate all personnel from the area except those engaged in fire fighting.
- Isolate areas where a fire or an explosion has occurred by closing equipment and/or facility doors.
- Follow appropriate fire-fighting procedures for the combustible materials involved (refer to MSDSs). Call the on-site gas manager for further instructions.
- If involved in fire fighting, use a self-contained breathing apparatus with a full-face mask.
- In the event of a fire in any electrical equipment, always use carbon dioxide or dry chemical powder. **Never use water for fighting an electrical fire.**

Electrical Fires – Failure of electronic components could initiate a fire in the equipment. Ground all equipment.

Always maintain the fire-fighting system in good working condition.

1.4 Precautionary Labels

To avoid serious injury, read all precautionary labels attached to equipment, cylinders, containers, and boxes prior to start-up.

Labels warn you of inherent hazards associated with the system. For personal safety, read the labels and perform the directed precautions **before** handling the equipment.

Read and understand the precautionary labels and follow the instructions they contain. Do not remove or obscure any label. If a label is missing or difficult to read, replace it with a new one. Labels are available from your Praxair representative. Other labels, as appropriate, may be affixed to the liquid supply vessels or containers.

1.5 Monitoring the Personnel Area

In personnel areas, continuously monitor gas levels with a gas analyzer. If high concentrations of a gas are detected, evacuate the affected area immediately and open outside doors to promote ventilation. Do not re-enter the area until the gas level is no longer dangerous.

1.6 Summary of Known Hazards

Additional hazards may be associated with the gases used in your application. Refer to your gas supplier's MSDSs as well as all government and agency safety regulations (e.g., OSHA and CGA).

Table 1-2 lists known hazards associated with the gases used in your application.

Table 1-2 Summary of Known Hazards		
Safety Hazard	**OSHA Regulations**	**Comments**
Fire Explosions, Fire Fighting	29 CFR 1910.35 - .40, Subpart E; Appendix 29 CFR 1910.155 - .165, Subpart L; Appendices A-E	Means of egress and fire protection
Asphyxiation	29 CFR 1910.94, Subpart G 29 CFR 1910.146	Atmosphere testing/Confined spaces
Electrical Shock and Equipment	29 CFR 1910.147, Subpart J; Appendix A 29 CFR 1910.301 - .399, Subpart S	Lockout/Tagout
Handling Compressed Gases or Cryogenic Liquids	29 CFR 1910.101 - .116, Subpart H	Compressed gases (gas/liquid, waste gas)
Handling Gaseous Argon, Hydrogen, Nitrogen, or Oxygen	29 CFR 1910.101 - .104, Subpart H 29 CFR 1910.166 - .171, Subpart M	Compressed product gases
Selecting Cryogenic Handling Equipment	29 CFR 1910.104, Subpart H	Liquid Product
Equipment Lockout/ Tagout Program	29 CFR 1910.147, Subpart J	Hazardous Energy Isolation
Excessive Noise	29 CFR 1910.95, Subpart G 29 CFR 1910.146, Subpart J	Occupational health and environmental control - noise exposure regulations

1.6.1 Asphyxiation

Exposure to high concentrations of nitrogen can cause asphyxiation. Ensure the personnel area does not contain high concentrations of nitrogen. Use an oxygen analyzer to verify breathability of the atmosphere.

Practically all gases can act as simple asphyxiants by displacing the natural oxygen in the air. To prevent serious personnel injury and possibly death, provide adequate ventilation in areas where any of the process gases may accumulate. Refer to section 1.5 for instructions on monitoring the personnel area.

1.6.2 Electrocution

DANGER !

Electrical shock can kill. Use extreme caution if troubleshooting or servicing this equipment. Do NOT bypass safety interlocks. An electrocution hazard exists even after the equipment has been de-energized. Only qualified personnel who are in compliance with all applicable federal, state, and local codes shall perform the electrical wiring.

Adherence to the following guidelines helps guard against possible electrocution.

- Tampering or unauthorized substitution of components may adversely affect the safety of this equipment. Use only factory-approved components for repair.
- Turn off the power before opening the equipment, or checking or replacing any component.
- Carefully follow all Hazardous Work Permit and Lockout/Tagout procedures for your facility.
- Do not touch live electrical components inside the equipment; electric shock caused by voltage in the control circuits can kill.
- Keep all equipment surfaces very clean. Normal industrial soot and dirt may constitute a combustion hazard. Do not allow grease or oil deposits on bypass interlocks or other safety devices.

1.6.3 Exposure to Cryogenic Liquid

At atmospheric pressure, normally gaseous elements such as nitrogen exist as liquids only at cryogenic temperatures—below approximately -301°F (-185°C), or 399°F (222°C) below normal body temperature. Severe frostbite (cryogenic burns) can result when cryogenic liquids contact the skin. Therefore, prevent any body contact with cryogenic liquids or with equipment chilled to the liquid temperature.

1.6.4 Pressure Hazards

Mishandling of gas cylinders can result in death, serious injury, or property damage. Handle and store gas cylinders with extreme care and in accordance with the manufacturer's instructions.

Sudden or uncontrolled release of pressurized gas can cause serious injury. The gases themselves or objects propelled by the gases may strike personnel at high speed. The hazards of high pressure can be avoided through careful inspection and proper handling of cylinders and equipment. Often, the equipment is configured to monitor system and equipment pressures and to shut down and/or warn you if pressure to the equipment is reaching dangerous levels.

Be aware of the locations at which high-pressure gases exist and the precautions for operating or maintaining equipment that handle these gases.

1.6.5 Purging Hazards

Determine equipment or system pressure limits before purging to ensure that purge gas pressure does not exceed this value. Exceeding this limit may result in damage to the equipment.

Follow applicable safety precautions to ensure that an oxygen-deficient atmosphere is not created in the work area when purging the equipment.

1.7 Special Handling Precautions

1.7.1 Gaseous Nitrogen

Nitrogen is an inert, colorless, odorless, and tasteless gas. It can be inhaled like air but cannot be detected by the human senses. Nitrogen, although non-toxic, can cause asphyxiation and death in any confined area that is not adequately ventilated.

Never enter a confined area where nitrogen may be present until the area has been purged with air and tested for breathable atmosphere using an approved gas analyzer. If dizziness, nausea, headache, or other symptoms of asphyxia occur, immediately move to a well-ventilated area. If

someone stops breathing in an oxygen-deficient atmosphere, move the victim to a well-ventilated area and administer artificial respiration. Call a physician and an ambulance immediately.

Nitrogen, as a liquid or cold gas, may cause severe frostbite to the eyes or skin. Do not touch frosted pipes or valves. If accidental exposure to liquid nitrogen occurs, consult a physician at once. Immediately warm exposed tissue with warm water not to exceed 105°F (40.5°C). Never rub the exposed body part before or after rewarming.

1.7.2 Liquid Nitrogen

Liquid nitrogen is a cryogenic liquid that causes severe frostbite upon contact with the body. The evaporating fumes can cause rapid suffocation and may cause dizziness and drowsiness. Handle with extreme caution.

Liquid nitrogen presents an **extreme cold hazard**. Skin contact at these low temperatures causes severe frostbite. Precautions must be taken to prevent exposure to liquid nitrogen.

At atmospheric pressure, normally gaseous elements such as oxygen and nitrogen exist as liquids only at cryogenic temperatures—below approximately -301°F (-185°C), which is 399°F (222°C) below normal body temperature. Severe frostbite (cryogenic burns) results when cryogenic liquids contact the skin. Therefore, avoid any body contact with cryogenic liquids or with equipment chilled to the liquid temperature.

Nitrogen is an asphyxiant. If a cylinder leaks, evacuate all personnel from the danger area. Avoid touching the liquid; it is extremely cold and causes severe frostbite on contact with the body. Allow the spilled liquid to evaporate. Ventilate the area of a leak or move the leaking container to a well-ventilated area.

Use a suitable hand truck to move containers, which must be handled and stored in an upright position. Do not drop or tip containers, or roll them on their sides. If the valve is hard to open, discontinue use and contact your Praxair representative.

1.8 Hazardous Work Permit

The purpose of a Hazardous Work Permit (HWP) is to ensure that work known to be hazardous, or that could cause a hazard, is planned and

controlled so that it is accomplished without incident. Planning the procedures and conducting a pre-job discussion with all of the participants, including a responsible manager, are necessary to ensure a safe work process.

The most successful way to avoid accidents is to anticipate them. In a pre-job discussion, the participants together identify all the potential hazards and develop procedures for accomplishing the task without risk. The process is formalized and the work is begun only after the manager has issued a written permit. Praxair uses a HWP system and urges all of its customers to adopt one.

Following are examples of work on the equipment that should be covered by an HWP:

- Pressure testing gas piping
- Confined space entry
- Welding and cutting
- Electrical repairs and troubleshooting of controls
- Repairs on piping that may be under pressure
- Any task that plant supervision has designated as being hazardous

1.9 Safe Repair Procedures

Failure to properly isolate equipment and piping can cause asphyxiation, fire, and/or explosion. Be sure to positively isolate the equipment from the gas supply and the process material before repair work is performed. It is not sufficient to simply close valves. Lines and tubing must be blanked or disconnected.

1.9.1 General Guidelines for Maintenance and Repair

- Repair work must be performed by a qualified service technician.
- Ventilate working areas to prevent any leaking supply gas from accumulating.
- Vent all gases to the outside.

- Vent all pressure relief devices out of enclosed areas. Piping must be properly sized to allow pressure relief devices to operate according to specifications.

- De-pressurize supply gas piping before working on it.

1.9.2 Lockout/Tagout

All personnel must be protected from hazards related to unexpected energizing, start-up, or release of stored energy during machinery/ equipment servicing or maintenance. Strict equipment Lockout/Tagout procedures ensure that all personnel are protected while performing necessary maintenance/servicing work.

1.9.3 Safety Valve Maintenance and Repair

All pressure-regulated piping and vessels for this equipment include pressure relief devices (i.e., pressure relief valves, bursting discs) for over-pressure protection. These pressure relief devices must be maintained at regular intervals to ensure proper operation.

1.9.4 Start-Up Following Repair

Before restarting the equipment, ensure that all parts of the equipment affected by repairs have been restored to their proper operating condition and that the lines have no leaks.

2 EQUIPMENT DESCRIPTION

The PRAXAIR® *NitroFill*™ Container Pressurizing Unit (referred to in this manual as the *NitroFill* LN2 Dispenser) efficiently dispenses liquid nitrogen into the headspace of filled, uncapped containers for the purpose of pressurizing or inerting the package. Products such as juices or low carbonated beverages may be packaged in containers that cannot support themselves without some form of internal pressurization (known as "product supports package"). In other cases, you may need to remove oxygen in the headspace of the container. The *NitroFill* LN2 Dispenser can accomplish both tasks.

The *NitroFill* LN2 Dispenser components are pre-assembled on a convenient stainless steel rollaway stand (see Figure 2-1). Two major components are mounted on the stand.

- liquid nitrogen container/dispenser
- electrical/flow control panel

Liquid nitrogen collects in the stainless steel vacuum-insulated container prior to dispensing into the package. Through a series of controls, the liquid nitrogen is brought from the bulk storage vessel to the *NitroFill* LN2 Dispenser container where any vapor generated in the line is removed through a vent, leaving behind only the liquid.

The NEMA 4X stainless steel electrical/flow control panel contains the operator interface and the electronics that control the delivery of the liquid nitrogen to the package.

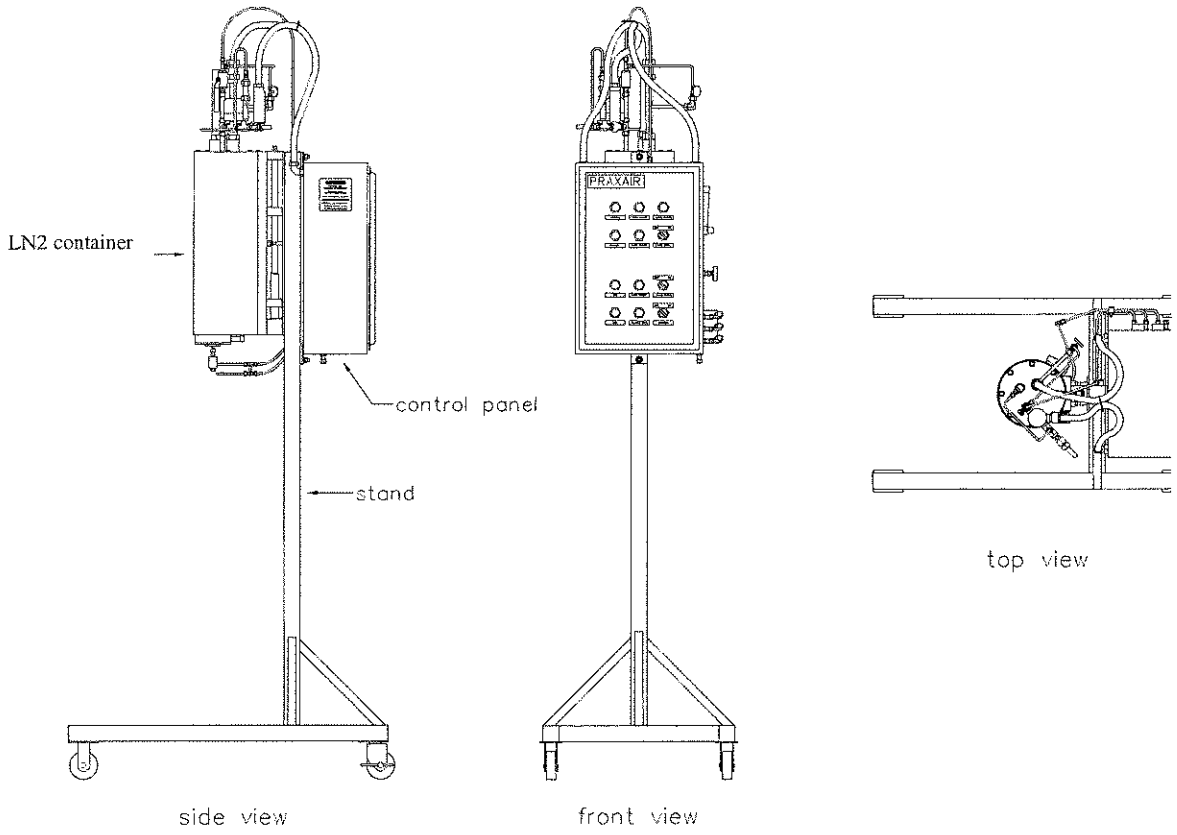


Figure 2-1: *NitroFill* LN2 Dispenser Final Assembly

Figure 2-2 shows a typical installation of the *NitroFill*™ LN2 Dispenser on a can line. The bulk storage tank is located outside the building, and the liquid nitrogen and gaseous nitrogen are piped inside the building to the *NitroFill* LN2 Dispenser liquid nitrogen dispensing unit. Area ventilation may be required to prevent unwanted accumulation of nitrogen gas in the local area.

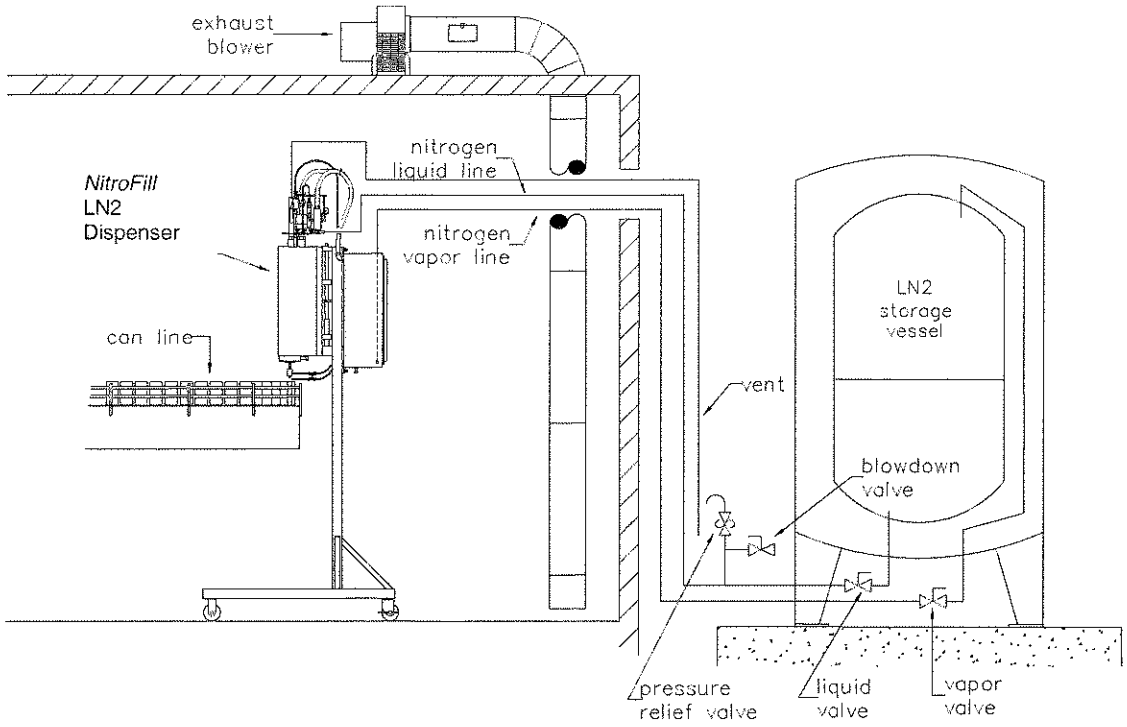


Figure 2-2: Typical *NitroFill* LN2 Dispenser Installation

2.1 Specifications

Table 2-1 shows the *NitroFill* LN2 Dispenser specifications.

Table 2-1 *NitroFill* LN2 Dispenser Specifications	
Length	40 in (101.6 cm)
Height	97 in (246.4 cm)
Width	24.6 in (62.5 cm)
Weight	300 lb, uncrated (135 kg) 350 lb, crated (157.5 kg)
Inlet connection for liquid (top of container)	½" Swagelok tube (compression)
Inlet connection for vapor (side of electrical panel)	¼" Swagelok tube (compression)
Electrical requirement	120 VAC 10 amps
Electrical enclosure	NEMA 4X
Liquid nitrogen requirement	~30-70 lb/hr (~13.6 kg (m)/hr–31.7 kg (m)/hr) ~4.4-10.3 gal/hr (16.6-39 l/hr)
Liquid nitrogen delivery pressure (gas and liquid)	20-25 psig (137.9-172.4 kPa)

2.2 Theory of Operation

2.2.1 Operating Principles

The *NitroFill*™ LN2 Dispenser allows liquid nitrogen to drain by gravity into a container for the purpose of pressurizing or inerting. The *NitroFill* LN2 Dispenser can be set up to accomplish either of the following tasks.

- **Pressurization** - Nitrogen creates a pressurized headspace on top of the product in the container as the liquid vaporizes. As the liquid nitrogen vaporizes and expands in the container, it purges the air in the headspace just before the lid is put on. After the lid is on, the remaining liquid nitrogen vaporizes and expands to pressurize the container.

- **Inerting** - Nitrogen creates an inert headspace on top of the product in the container as the liquid vaporizes. As the liquid nitrogen vaporizes and expands in the container, it purges the air in the headspace just before the lid is put on.

2.2.2 Vacuum-Insulated Container

The main part of the *NitroFill* LN2 Dispenser is the vacuum-insulated container. The container is made up of an inner container surrounded by an air space and a vacuum insulating layer (see Figure 2-3).

Liquid nitrogen enters the container via a 3/8-inch solenoid valve and a specially designed fill tube. Nitrogen tends to pick up heat as it is piped and, therefore, vapor forms. As the liquid enters the inner container, the vapor escapes through the vent while the liquid remains in the container.

The *NitroFill* LN2 Dispenser is a zero-pressure phase separator. Once the inner container is cooled, liquid begins to accumulate inside. A level control system keeps the inner container full. With liquid present in the inner container, the *NitroFill* LN2 Dispenser begins to pressurize/inert packages. The nitrogen is released through a small tube at the bottom of the inner container. A nozzle at the end of the tube prevents excessive liquid nitrogen flow from the *NitroFill* LN2 Dispenser.

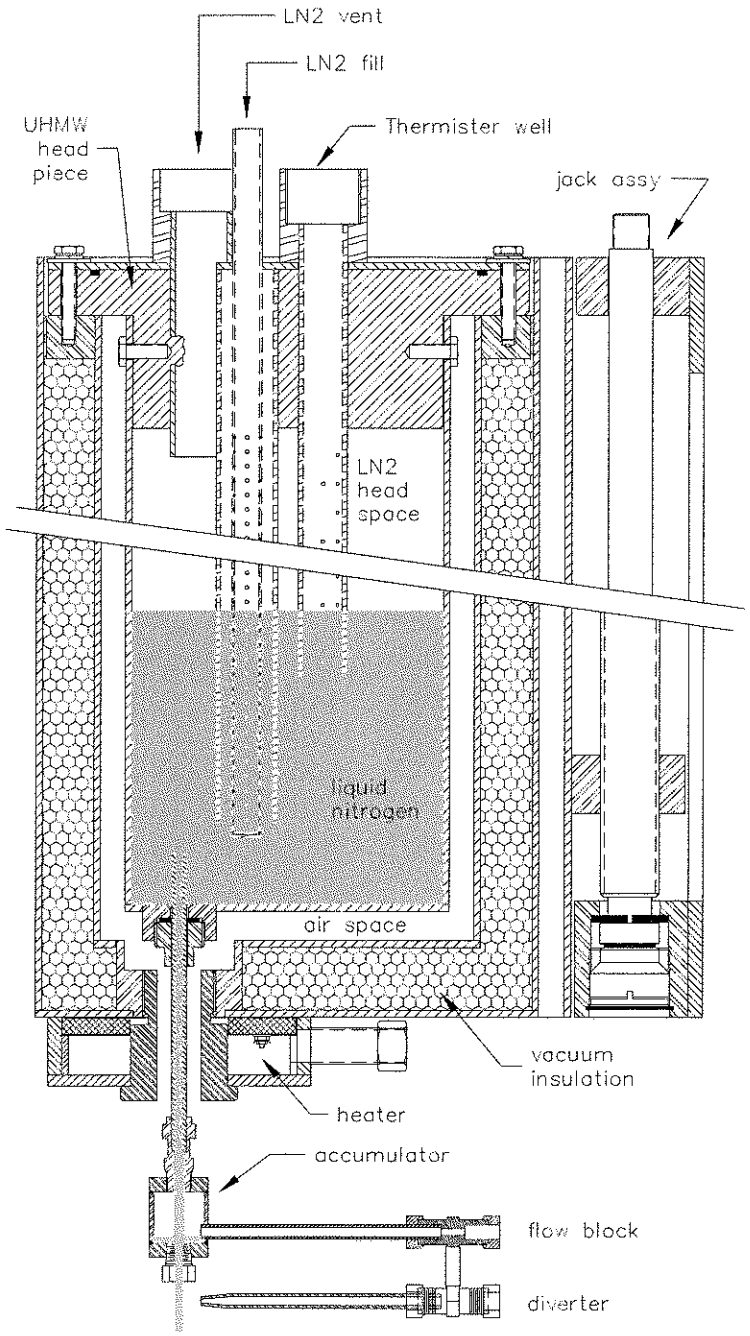


Figure 2-3: Cross Section of the *NitroFill* LN2 Dispenser

2.2.3 Controls and Electrical/Flow Control Panel

The second major component of the *NitroFill* LN2 Dispenser is the electrical/flow control panel, shown in Figure 2-4. The electrical/flow control panel is mounted on the stand opposite the container.

The electrical/flow control panel enables you to control the level and flow of liquid nitrogen. The panel also indicates the status of the level control system as well as allowing you to manage certain start-up and shutdown operations.

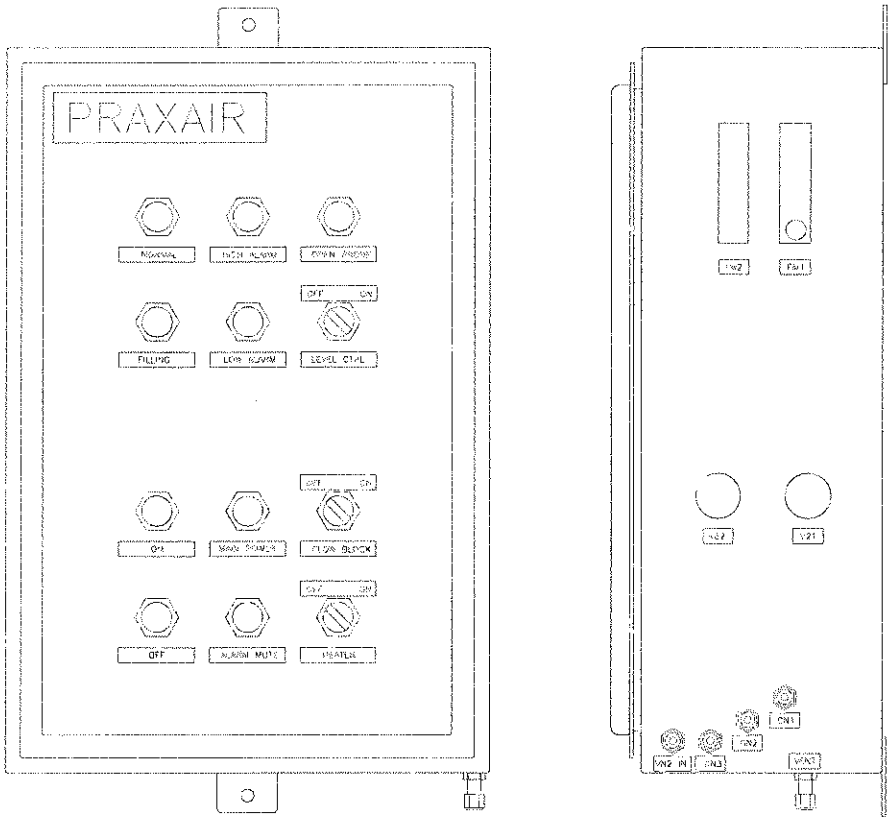


Figure 2-4: Electrical/Flow Control Panel

Level Control

A thermister-based level control system has been incorporated into the *NitroFill*™ LN2 Dispenser. Four thermisters are inserted into the inner container via the thermister well (see Figure 2-5): high level alarm, high level, low level, and low level alarm. The thermisters make electrical continuity when cooled to liquid nitrogen temperature (~320°F, 160°C).

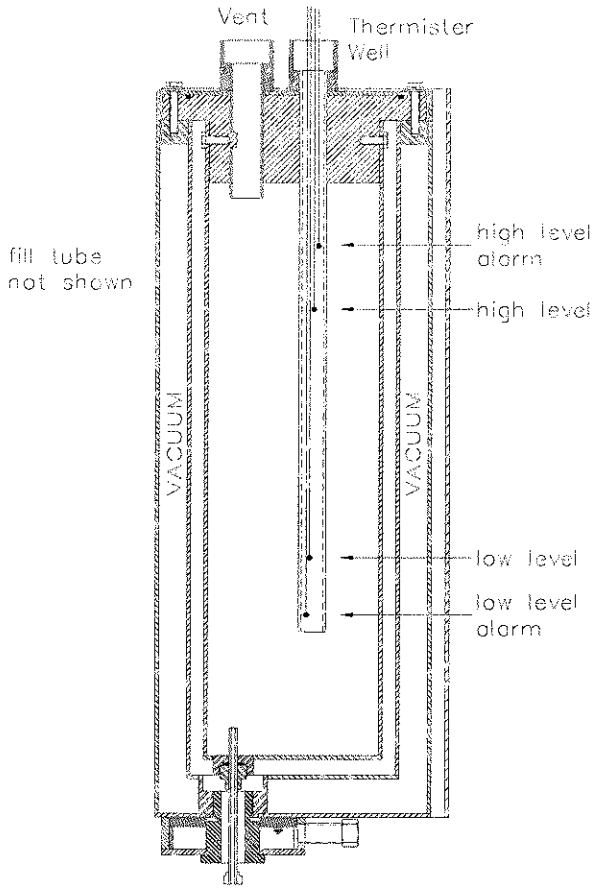


Figure 2-5: Thermister Arrangement

During normal operation, the liquid nitrogen level is somewhere between the low and high level thermisters. As liquid nitrogen drains from the unit, the liquid level drops below the low level thermister. The thermister warms slightly and sends a signal to the controller to add more liquid nitrogen. The solenoid valve opens and allows liquid nitrogen to enter the inner container until it reaches the high level thermister. Abnormal situations may cause the level of liquid nitrogen to reach the low or high level alarm thermisters, causing a light and an audible alarm on the panel. See the troubleshooting information in Chapter 5 for more details on abnormal situations.

Flow Block

Use the flow block to change the nozzle only as a last resort due to the potential for contact with liquid nitrogen. If you use this method, proceed with caution and wear protective safety clothing to guard against cryogenic burns.

The switch labeled "flow block" on the electrical/flow control panel enables you to change the nozzle while the *NitroFill*™ LN2 Dispenser is full of nitrogen. Under normal conditions, the flow block is off. Turning on the flow block causes gaseous nitrogen to flood the accumulator, preventing the flow of liquid nitrogen (see Figures 2-3 and 2-6). This allows you to remove the nozzle and install a new one. See Chapter 4 for more details.

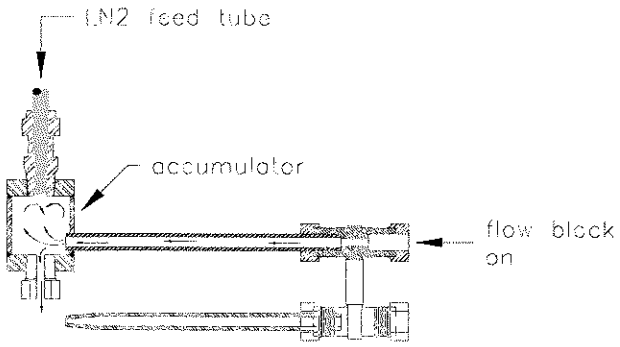


Figure 2-6: Flow Block Operation

Diverter

Liquid nitrogen flow can also be interrupted with the diverter. The diverter directs gaseous nitrogen at high velocity perpendicular to the liquid nitrogen stream causing it to miss its intended target and fall on the floor (see Figure 2-7). The diverter has no actuators, lights, or pushbuttons on the control panel. It is activated by external contacts that sense the movement of the belt. When the conveyor belt speed drops below a certain rate, the diverter prevents excessive liquid nitrogen from flowing into one or more containers.

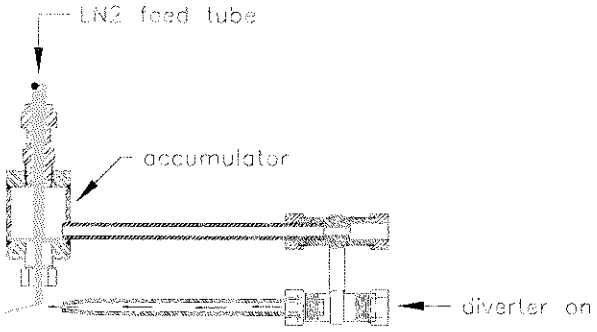


Figure 2-7: Diverter Operation

2.2.4 Normal Operation

Normal operation begins with purging all air and cooling down the system. You must purge the air to prevent water ice formation. After purging is complete, liquid begins to flow, cooling the inner container. Once the inner container has lowered to liquid temperature, the liquid nitrogen begins to accumulate and drains from the nozzle. The pressurization/inerting operation can now begin.

Frost Prevention

A heater block on the bottom of the outer container warms the surface near the drain tube and nozzle and prevents frost build-up around the nozzle. A switch on the panel allows you to control the heater. A temperature controller in the panel automatically maintains the proper temperature.

An air space is present around the inner container. The vacuum insulation does not come in contact with the inner container (see Figure 2-3). This air space serves a very important purpose. The liquid nitrogen inside the inner container is constantly warming due to heat gain from the environment. Vapor is generated as the liquid warms and boils. Most of the vapor leaves the inner container via the vent line. Some of the vapor, however, leaves the inner container and travels down through the air space and out around the drain tube and nozzle (see Figure 2-8).

The nitrogen vapor is completely free of water (humidity) and acts as a shield to the room air. The room air cannot contact the nozzle and tube since the flow of nitrogen is in the way. This prevents the accumulation of frost on the nozzle, which would impede proper flow of liquid. The discharge of nitrogen gas around the nozzle during operation is normal.

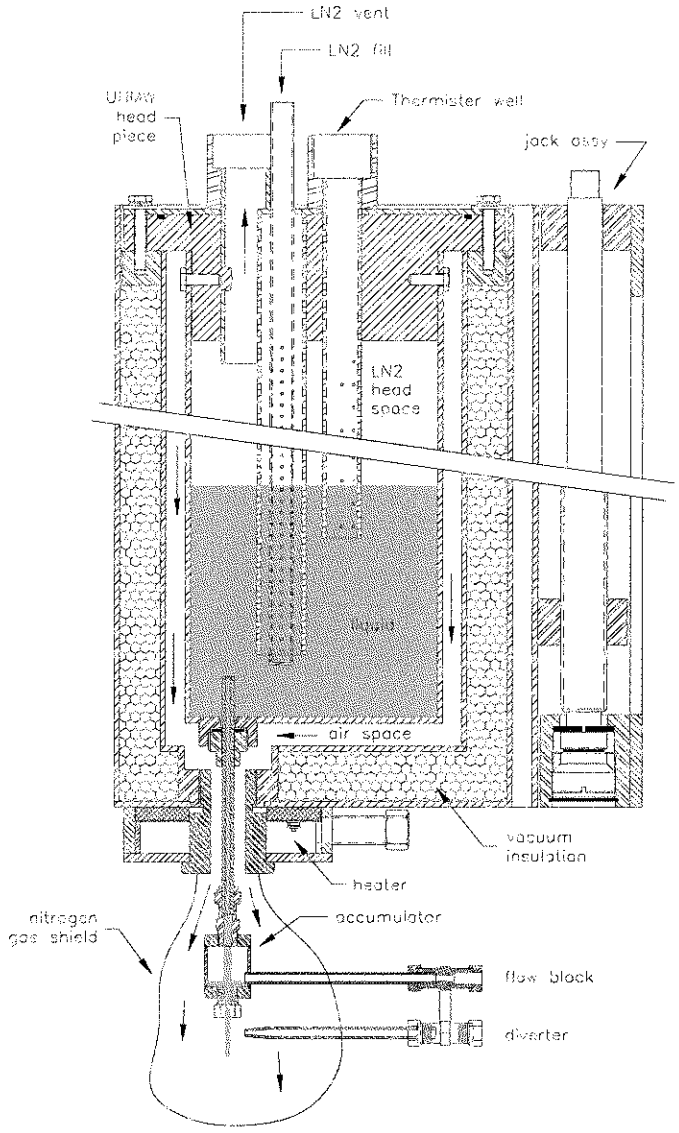


Figure 2-8: Nitrogen Gas Shielding of Nozzle to Prevent Frost Build-Up

3 INSTALLATION

Installation of the *NitroFill* LN2 Dispenser involves potentially hazardous procedures. Only trained and qualified personnel who have read and who understand the instruction in this manual shall install this equipment.

3.1 Design Considerations

3.1.1 Storage Tank Components

Liquid nitrogen can be stored in many ways. For this application, two ways are suitable:

1. A bulk storage system such as a 1500-gallon (5677.5-liter, 10,125-pound, 675-kilogram) low pressure vacuum-insulated vertical nitrogen vessel. This type of equipment can store and supply cryogenic liquid and vapor at the same pressure.

2. A GP-45 tank. This smaller portable unit is a self-contained vessel containing approximately 31.6 gallons (119.6 liters, 213 pounds, 118.8 kilograms) of liquid nitrogen. This tank can store and supply cryogenic liquid and vapor at the same pressure.

Tank Pressure Relief Valve

A liquid nitrogen storage vessel uses a pressure relief valve to protect the inner vessel from over pressurization. You should have the lowest possible pressure set on the pressure relief valve. Usually the lowest pressure available on a liquid nitrogen storage vessel is 65 psig (448.2 kPa). Arrange the installation of a low pressure relief valve with your Praxair customer service representative.

Pressure Maintenance System

Use the economizer (a back pressure regulator used to prevent high tank pressures) and the pressure building regulator (a forward pressure regulator used to keep tank pressure up) to keep the tank at its proper operating pressure. Under no circumstances should the tank pressure be set greater than 60 psig (413.7 kPa) when using the *NitroFill* LN2 Dispenser liquid nitrogen dispensing unit. Normal operating pressure for liquid nitrogen used to supply the *NitroFill* LN2 Dispenser should be 25 psig (172.4 kPa).

3.1.2 Piping

The piping design should include provisions that prevent trapping liquid nitrogen in confined spaces, especially between valves, without adequate pressure relief. As the trapped liquid warms and vaporizes, the pressure build-up in the confined space can rupture piping, possibly causing damage to equipment and injury to personnel. Always install a pressure relief device in each section of piping between shutoff valves. Praxair's field engineer is responsible for properly specifying the pipe and insulation.

NOTE

The NitroFill™ LN2 Dispenser does have an integral line pressure relief valve.

Connect process piping from the tank to the *NitroFill* LN2 Dispenser. The piping system is ordinarily ½ to 1 inch pre-insulated type K copper or vacuum-insulated stainless steel. The *NitroFill* LN2 Dispenser mates to this piping with compression fittings (see Table 2-1 for sizes). If required, reducing bushings can be used.

NOTE

Before you use the liquid nitrogen line for the first time, fully purge it of air.

3.1.3 Exhaust Vent Location

The *NitroFill* LN2 Dispenser requires a 1-inch type K copper vent pipe to direct the boiled-off nitrogen outside of the building. The vent port is located on the top of the *NitroFill* LN2 Dispenser. Insulate any portion of the vent line that runs indoors to prevent water ice formation. The selected vent location must allow safe discharge of cryogenic gas.

Install warning placard part number PA8940911B (see section 5.3) at the termination of the vent line indicating that very cold liquid and/or gaseous nitrogen could be discharged at any time

3.2 Installation Procedure

The *NitroFill* LN2 Dispenser comes fully assembled for operation. Adhere to the following procedure prior to operating the *NitroFill* LN2 Dispenser. Refer to Figures 2-2 and 3-1 while reading these instructions.

1. Locate the *NitroFill* LN2 Dispenser suitably for your application. For example, place it between the filler and the capper on a bottling line.

2. Roll the *NitroFill* LN2 Dispenser into place at the line.

3. Lock the casters.

4. Adjust the jack mechanism so the nozzle is approximately 1 inch (2.5 cm) or less above the package and no interference is possible.

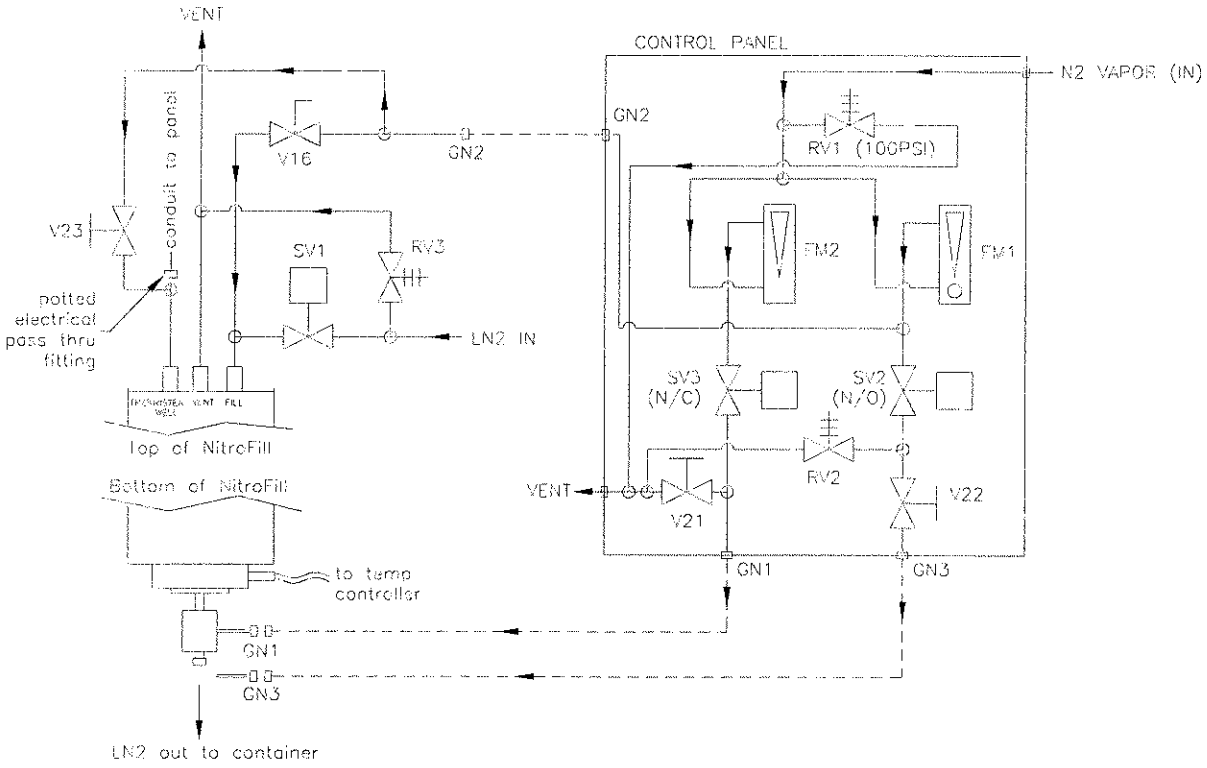


Figure 3-1: Piping Diagram

5. Connect the liquid to the ½-inch Swagelok® fitting adjacent to the solenoid valve.

6. Connect the vapor to the ¼-inch Swagelok fitting on the lower side of the control panel (see Figure 2-4).

7. Connect the vent line to the 1-inch tube on top of the insulated container.

8. Connect 115 VAC power to the unit at the terminal strip inside the panel at center bottom. (No knockout is provided for electrical pass through.)

9. Connect external contacts used to monitor belt movement. This activates (closes) the diverter valve (SV2) when the conveyor starts. The diverter valve is normally open when de-energized. When the conveyor stops, SV2 should be de-energized to allow gas flow.

10. Install a suitable exhaust system for the area if one is not already present.

11. Install warning placard PA8940911B at the termination of the vent location.

NOTE

You can use the NitroFill™ LN2 Dispenser without the stand. This type of installation is more difficult since the control panel must be separated from the container and should be arranged ahead of time with your Praxair representative.

To do this installation, mount the container above the production line and mount the control panel within 30 feet (91.4 meters) of it. The connections are made in the field.

For additional information, refer to the schematics in Appendix A.

4 OPERATION

Operation of the *NitroFill* LN2 Dispenser involves potentially hazardous procedures. Only trained and qualified personnel who have read and who understand the instructions in this manual shall operate this equipment.

Prior to applying pressure or power to the *NitroFill* LN2 Dispenser, ensure the valves and switches are in the positions shown in Table 4-1.

Table 4-1
Initial Positions for Valves and Switches

Main Power	Off
Flow Block	Off
Heater	Off
Level Control	Off
Liquid Nitrogen Supply Valve	Closed
Gaseous Nitrogen Supply Valve	Closed
Valve V21	Closed
Valve V22	Open
Valve V16	Closed
Valve V23	Closed
FM1 Needle Valve	Open
FM2 Needle Valve	Open

A flow regulating nozzle may be installed in the tip of the accumulator. If a nozzle is not installed, install one now. Several nozzles with various bore diameters should have been shipped with the *NitroFill* LN2 Dispenser, including a blank that can be machined to any bore diameter. The extra nozzles are conveniently stored on the rear adjustment bracket of the *NitroFill* LN2 Dispenser. Use trial and error to match the proper nozzle to the line speed keeping in mind that the larger the hole, the more nitrogen will flow. See section 4.5 for nozzle changing procedures.

4.1 Purging

The first step in operating the *NitroFill* LN2 Dispenser is to purge it when it is warm. The *NitroFill* LN2 Dispenser contains room air after shipping and during downtimes. This air must be removed before you introduce the

liquid nitrogen. If you do not remove the air, water ice can form on the inside components and cause a malfunction. To purge the *NitroFill*™ LN2 Dispenser:

1. Open the gaseous nitrogen supply valve. The supply pressure should be between 20-25 psig (137.9-172.4 kPa).
2. Open valves V16 and V23.
3. Adjust the nitrogen flow so that flowmeter FM1 reads approximately 50 scfh (393.3 cu cm/sec).
4. Turn on the main power on the control panel.
5. Turn on the heater.
6. Purge the *NitroFill* LN2 Dispenser for one hour.

4.2 Initial Start-Up

Initial start-up involves the cool down of the *NitroFill* LN2 Dispenser after purging and prior to normal operation.

1. With the main power turned on, switch on the Flow Block.
2. Set flowmeter FM2 to 30 scfh (236 cu cm/sec).
3. Open the liquid nitrogen supply valve.
4. Turn on the Level Control.
5. Mute the alarm by pressing the Alarm Mute button.
6. At this time, the liquid nitrogen solenoid valve opens to allow the liquid nitrogen to flow to the *NitroFill* LN2 Dispenser. It may take some time for the liquid to reach the warm inner container. The low alarm and filling lights should be illuminated, indicating that filling is taking place and that the level is dangerously low. This is correct since the inner container is empty. As the inner container fills, the low alarm light shuts off and the filling light illuminates. Once the inner container is full, the filling light shuts off and the normal light illuminates. Once the normal light illuminates, continue with step 6.
7. Close valves V16 and V23.

8. Fully open diverter needle valve V22. If the product line conveyor is stopped, nitrogen gas should come out of the diverter valve at this time.

9. To test the stream of liquid nitrogen, turn off the Flow Block. It may take a minute or two to cool down the accumulator and achieve a solid stream of liquid nitrogen.

4.3 Normal Operation

Now that the *NitroFill* LN2 Dispenser is cold and full of liquid nitrogen, it is ready for operation. The following tips may prove useful while operating the *NitroFill* LN2 Dispenser.

- Turn off the Flow Block when you are ready to begin the filling operation.

- If the liquid nitrogen stream is erratic, slowly open valve V21 until the stream is steady. This allows any vapor to escape from the accumulator.

- As the inner container drains and fills with liquid nitrogen, the level control system indicates either filling or normal.

- Slowing the conveyor may not activate the diverter and could result in over-pressurized containers. If the conveyor speed is changed, a nozzle change may be required (see section 4.5).

- Stopping the conveyor activates the diverter valve and causes a stream of gaseous nitrogen to divert the liquid nitrogen stream so that it misses the container and vaporizes on its way to the floor.

4.4 Brief Interruptions

For a brief interruption, you can stop the *NitroFill* LN2 Dispenser by simply turning on the Flow Block. For periods of downtime greater than 15 minutes, use the following procedure to stop the *NitroFill* LN2 Dispenser.

1. Turn on the Flow Block.

2. Turn off the Level Control.

3. Open valve V16.

To restart operation, simply reverse the above procedure.

4.5 Nozzle Changing

You should change the nozzle when the *NitroFill*™ LN2 Dispenser is empty and warm. However, if the nozzle **must** be changed while the *NitroFill* LN2 Dispenser is full, adhere to the following procedure.

Changing the nozzle while the unit is cold is extremely dangerous because the stainless steel parts are at –320°F (-195.5°C) and contact with liquid nitrogen is possible. Contact with these very low temperatures will damage skin instantly. Wear proper personal protection and proceed with caution.

1. Turn off the Level Control.
2. Turn on the Flow Block.
3. Close valve V21.
4. If necessary, adjust flowmeter FM2 to stop liquid nitrogen flow.
5. While holding the accumulator tightly with a tool to prevent it from rotating, unscrew the nozzle.
6. Install the new nozzle.
7. Turn on the Level Control.
8. Turn off the Flow Block.
9. Open valve V21, as needed, to provide a steady stream of liquid nitrogen from the liquid nitrogen flow nozzle.

4.6 Shutdown

When you are ready to shut down the *NitroFill* LN2 Dispenser for the day, adhere to the following steps.

1. Close the liquid nitrogen supply valve.
2. Close valve V21.

3. Turn on the Flow Block.
4. Open valves V16 and V23.
5. When the Low Alarm light illuminates, wait five more minutes for the remaining liquid nitrogen inside the container to vaporize. (This time may vary depending on the quantity of liquid nitrogen remaining in the container.)
6. Turn off the Level Control.
7. Close valves V16 and V23.
8. Turn off the Heater.
9. Turn off the Flow Block.
10. Close the gaseous nitrogen supply valve.
11. Open valve V22.
12. Turn off the main power.

4.7 Emergency Shutdown

In the event of an emergency, turn off the main power by pressing the main power OFF button on the control panel. A complete shutdown stops the flow of liquid nitrogen into the *NitroFill* LN2 Dispenser, but it does NOT stop the remaining liquid in the inner container from draining out of the nozzle. Depending on the amount of liquid present in the *NitroFill* LN2 Dispenser inner container, the liquid could flow for several minutes.

NOTE

If the object of the emergency shutdown is to stop the liquid from flowing from the NitroFill LN2 Dispenser, see the flow block information in section 4.3.

Before restarting the *NitroFill* LN2 Dispenser, see Table 4-1 for information on the correct switch and valve position for start-up.

5 MAINTENANCE AND REPAIR

Maintenance and repair of the *NitroFill* LN2 Dispenser involves potentially hazardous procedures. Only trained and qualified personnel who have read and who understood the instructions in this manual shall work on this equipment.

If the *NitroFill* LN2 Dispenser assembly malfunctions, contact your Praxair representative if repair by local personnel is not possible.

5.1 Maintenance

Perform the following action after every 200 hours of operation.

- Clean filters/strainers on the liquid and gaseous nitrogen connections by purging or other means.
- Maintain pipe insulation. Check for wear and repair if necessary.
- Clean out the nozzle. Remove the nozzle on the bottom of the accumulator and remove any debris.

5.2 Troubleshooting

Table 5-1 is a troubleshooting guide for the *NitroFill* LN2 Dispenser.

Table 5-1
Troubleshooting

Problem	Possible Cause	Solution
Main power does not come on.	Main power control relay CR1 is bad.	Replace relay.
	Blown fuse.	Replace fuse.
	Blown circuit breaker.	Reset breaker.
No nitrogen fills the *NitroFill* ™ LN2 Dispenser.	Liquid nitrogen supply valve from tank is closed.	Open valve.
	Supply line solenoid is stuck closed or faulty.	Clean or replace valve.
	Supply nitrogen pressure is too low.	Increase pressure.
	Storage tank is empty.	Fill tank.
Level control power does not come on.	Level control fuse is bad.	Replace fuse.
	Problem in level control circuit board.	Call your Praxair representative.
Level control alarm sounds.	This is normal when filling the warm inner container. This is abnormal during normal operation.	No action required.
High level alarm light is on and alarm is on.	Faulty level control system.	Call your Praxair representative.
	Liquid nitrogen supply pressure is higher than recommended.	Reset supply pressure.
Low level alarm light is on and alarm is on.	Faulty level control system.	Call your Praxair representative.
	Faulty liquid nitrogen supply solenoid.	Replace/repair valve.
Open probe light is on.	One or more broken thermister wires or contacts.	Replace bad thermister(s).
Frost builds up around base of *NitroFill* LN2 Dispenser.	Heater is not on.	Turn on heater switch.
	Heater is not working.	Check/replace element and/or controller.
	Heater setpoint is too low.	Check/reset setpoint to 200°F (93.3°C).
	Strong air current is blowing on the *NitroFill* LN2 Dispenser.	Remove source of all air currents near *NitroFill* LN2 Dispenser.
Venting of nitrogen gas during operation.	This is normal and may be more noticeable each time the *NitroFill* LN2 Dispenser refills itself.	No action required.
Build up of nitrogen gas around *NitroFill* LN2 Dispenser operating area.	It is normal for the *NitroFill* LN2 Dispenser to expel nitrogen gas. A build-up of nitrogen around the unit is usually due to poor local ventilation.	Improve ventilation near *NitroFill* LN2 Dispenser.

Table 5-1 Troubleshooting		
Problem	**Possible Cause**	**Solution**
Excessive vapor coming out of vent.	Supply pressure may be too high.	Check/reset supply pressure.
Nitrogen liquid drips from the vent on the bottom of the control panel.	This can be normal since the vent is a direct connection to the accumulator, which normally contains liquid nitrogen. A small amount of liquid nitrogen dripping from the vent is normal.	If dripping becomes excessive, slightly close valve V21.
The vent line on the bottom of the control panel is frosted.	This is normal.	No action required.
Liquid nitrogen comes out of the top vent.	High level thermister positioned too high inside inner container.	Reposition thermisters.
Diverter is always on.	Improperly wired conveyor belt contacts. Failed solenoid valve SV2.	Check and/or rewire. Replace valve SV2.
Diverter does not come on.	Valve V22 is completely closed.	Open valve V22.
Containers blow up or are under pressurized.	Improper amount of nitrogen in package.	Install the proper nozzle for the conveyor line speed and package headspace.
Nitrogen flow is erratic.	Water ice is clogging nozzle or drain tube. Excessive vapor in accumulator.	Water was not removed prior to cool down. *NitroFill* LN2 Dispenser must be shut down, warmed, dried, and restarted. Open valve V21.
Flow block does not come on or does not work.	Gaseous nitrogen supply valve closed. Solenoid V3 has failed closed. Low nitrogen gas pressure to flow block.	Open supply valve. Repair/replace valve. Check that supply pressure is 20-25 psig (137.9-172.4 kPa).
Nitrogen liquid leaks from the bottom of the *NitroFill* LN2 Dispenser.	Bad gasket at drain tube–inner container fitting. A leak elsewhere on the unit.	Replace gasket. Special tool PA8940062B is required. Check all fittings for leaks and repair as necessary

5.3 Spare Parts

Praxair stocks the parts used on the *NitroFill*™ LN2 Dispenser. The part number and manufacturer information for the complete *NitroFill* LN2 Dispenser assembly are as follows:

NitroFill LN2 DispenserAssembly:
Praxair Part Number PA8940002D

Warning Placard:
Praxair Part Number PA8940911B

NitroFill LN2 DispenserManufacturer:
Amko Service Co
3470 Davis Rd NW
Dover, OH 44622
phone: (330) 364-8857

Order parts from:
Praxair, Inc.
Materials Supply Center
4550 Kennedy Avenue
East Chicago, IN 46312
phone: (219) 391-5828
fax: (219) 391-583

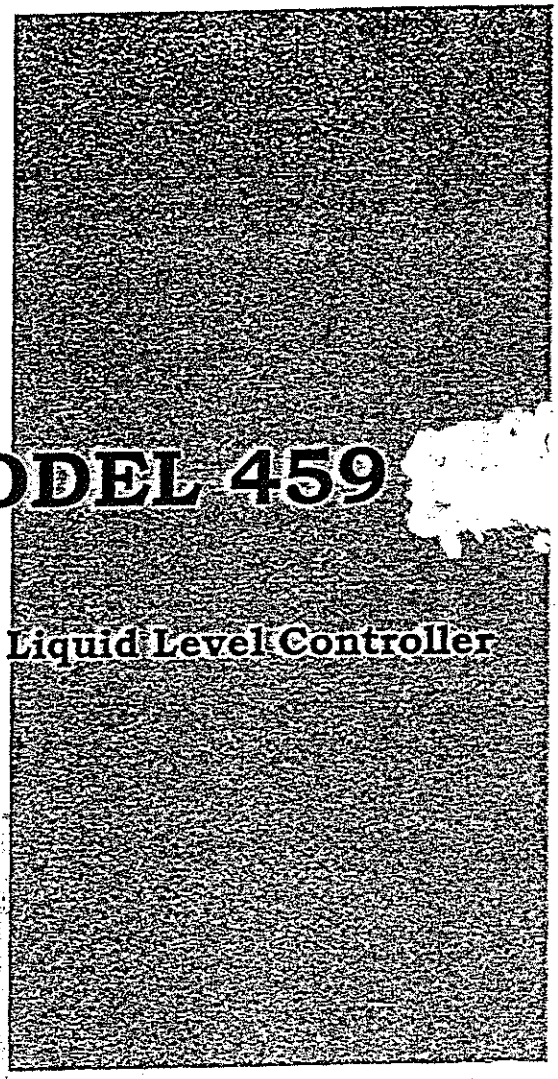
For repair parts, see Figure A-7 in Appendix A.

SUPPLIER MANUALS

Manufacturer	Title
Gordinier Electronics, Inc.	Model 459 Liquid Level Controller

MODEL 459

Liquid Level Controller



GORDINIER ELECTRONICS, INC.

Complete temperature control systems serving the cryogenic & plastic industry

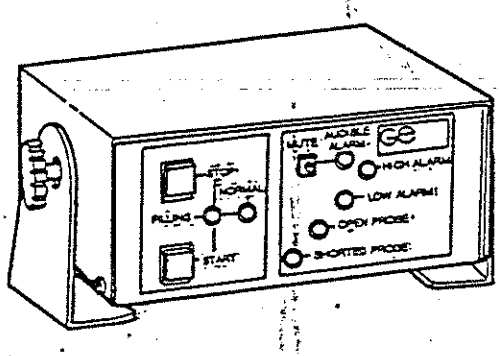
29975 Parkway . Roseville, Michigan 48066
(810) 778-0426 FAX (810) 778-0479

TABLE OF CONTENTS

LIQUID LEVEL CONTROLLER

INTRODUCTION

MODEL 459: An automatic fill system featuring LED readouts of liquid nitrogen levels status with high and low level LED alarms. It also provides you with a remote as well as audible alarm system and open or short probe protection.



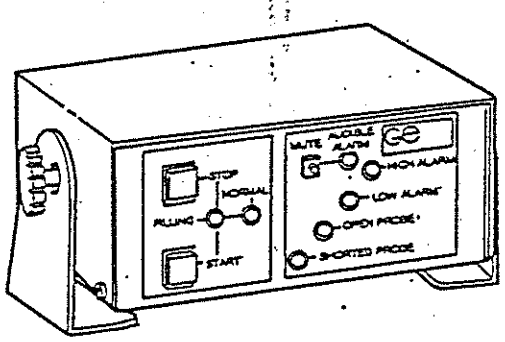
THEORY OF OPERATION:

The filling cycle is the same for both systems. That is, they both use thermistors to control the start and stop functions of the filling cycle.

MODEL 459:

The Model 459 requires four (4) thermistors. Two (2) are used for alarms, one (1) for High and one (1) for Low. The Start and Stop thermistors are located between the High and Low thermistors.

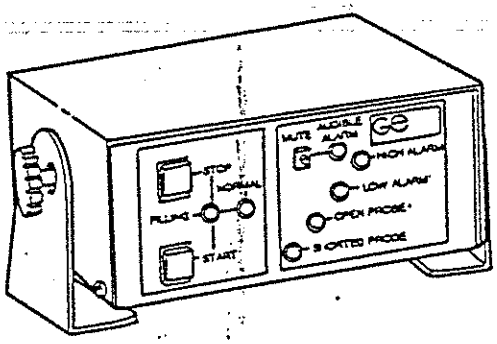
As the liquid nitrogen covers the Low Level Alarm thermistor the Low Alarm LED will go out, and the Audible Horn will stop. The filling will continue until the LN2 has covered the High Level thermistor, turning ON the Normal LED. If filling continues past this point, the HIGH LEVEL ALARM thermistor will be covered, causing a HIGH LEVEL ALARM, along with a Remote Alarm relay being de-energized.



SPECIFICATIONS:

MODEL 459:

- Size: 3 1/2" high x 8" wide x 6" deep
- Automatic fill system
- Liquid nitrogen level status LED lamp indicator
- High and low level arm with LED lamp indicator
- Remote alarm relays output
- Audible alarm
- Probe Protection



459 LED INDICATORS

1 FILLING: During the Start Filling cycle, this LED indicates the solenoid valve has been energized and the LN2 has begun filling.

2 NORMAL: At the end of the filling cycle, the LN2 has filled the storage unit up to the High Level thermistor (Stop Fill) and has de-activated the solenoid valve and has stopped the filling cycle.

3 SHORTED PROBE: In the event the thermistor element has become shorted, this LED will light. It should be noted that during the first time filling cycle, this indicator LED could show shorted probe but will adjust itself after the storage unit has stabi lized.

4 OPEN PROBE: This indicator will light in the event, one of the thermistors should open -indicating a defective probe.

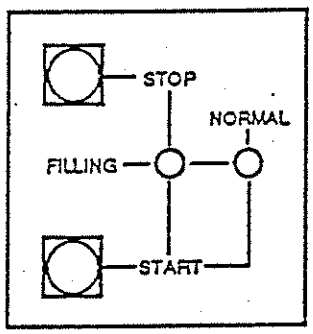
5 LOW ALARM: This LED will light during the first timer filling, but as the liquid nitrogen covers the Low Level Alarm thermistor this LED will go out.

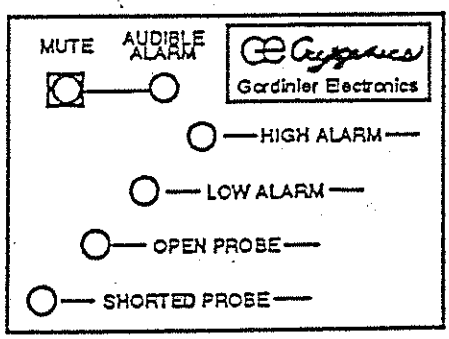
6 HIGH ALARM: If for some reason, the LN2 has covered the High Alarm thermistor, this LED will light.

7 STOP BUTTON: Stopping the fill cycle can only be accomplished after the LN2 has covered the Low Level thermistor.

8 START BUTTON: Once the filling cycle has been disrupted, either by manually stopping the filling or allowing it to stop filling automatically, filling can continue by press ing the Start Button. If LN2 has covered the High level thermistor, continued filling can beaccomplished, only by holding in the Start Button. If the LN2 has not reached theHigh Level thermistor, both the Stop and Start Button will start or stop the filling cycle.

9 MUTE BUTTON: If any of the Alarm LEDS are lit, the Model 459 will produce an audible tone and the remote relay will de-energize. The audible tone can only be heard, as long as the audible LED is lit. Pressing the Mute Button will cycle the audible circuit.





BACK PANEL

POWER SWITCH: This switch has been placed in the rear of the controller to avoid accidently turning off the system.

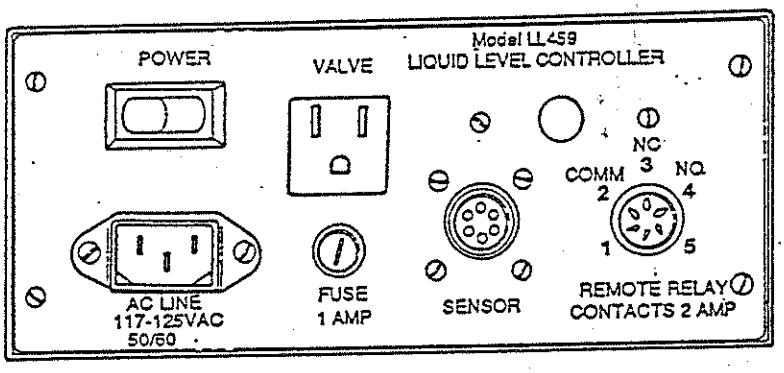
> **NOTE**
> In the event the power is turned off, the remote alarm relay will be de-energized indicating an alarm.

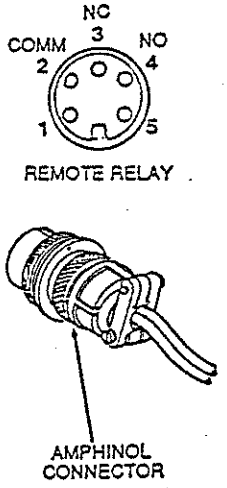
VALVE RECEPTACLE: This outlet provides the necessary voltage (117 VAC to activate the LN2 solenoid valve during the filling cycle).

SENSOR: The six (6) pin amphenol receptacle has been standard on all Gordinier Electronic's boxtype Liquid Level Controllers, and use the same wiring for 1 - 2 - 3 or 4 Sensor Probes.

AC LINE: The universal receptacle has been chosen to accept all international type power cords.

REMOTE RELAY: COMM (2) NC normally closed (3) NO normally open (4).





CONNECTING TO REMOTE RELAY CONTACTS

The common (2) must be used at all times for ALL ALARM hook-ups. To determine which contacts to use, the type of alarm systems being used must be observed.

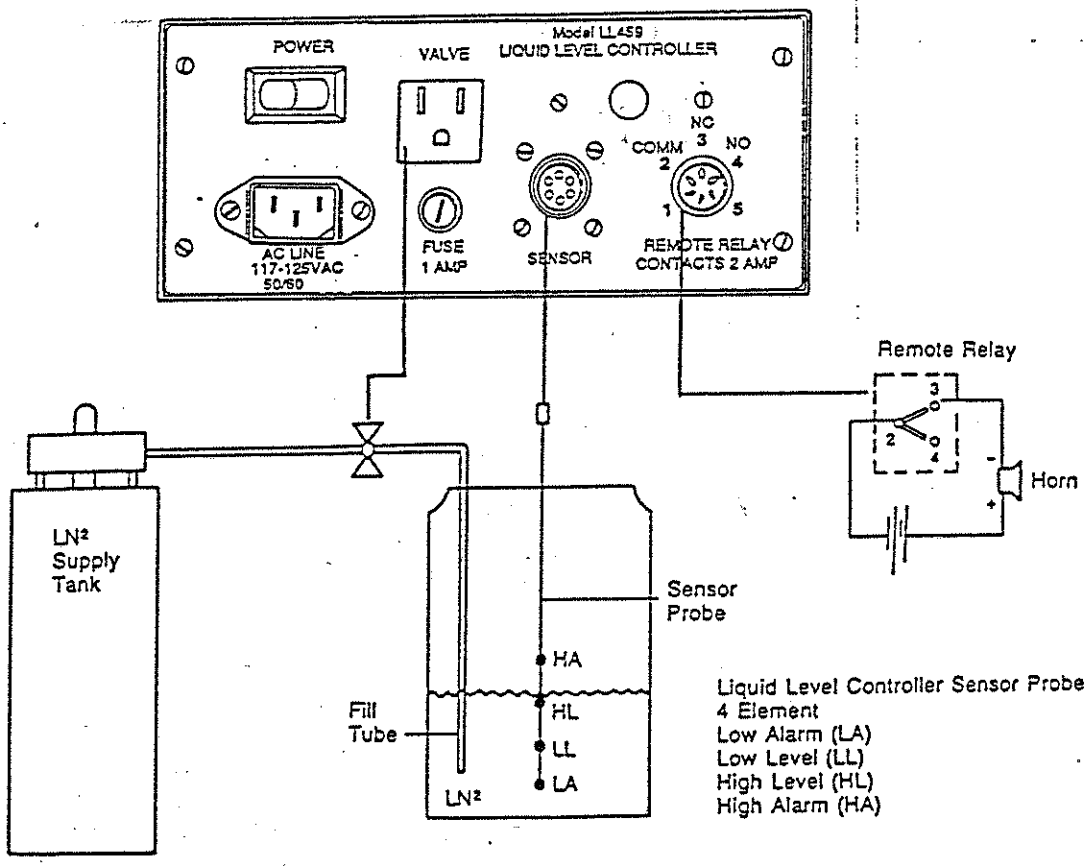
1. If a closing contact turns ON the alarm system you are using, then you must use COMMON (2) and NC (3).
2. If a opening contact turns ON the alarm system you are using, then you must use COMMON (2) and NO (4).

INSTALLATION

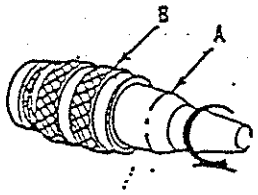
Place the Liquid Level Controller on a shelf in a convenient location away from the cold vapors of the LN2.

> **NOTE**
> If longer probe wires are required contact Gordinier Electronics for Assistance.

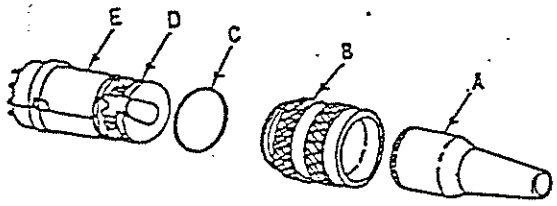
Slowly lower the sensor probe into the storage tank's sensor probe tube.



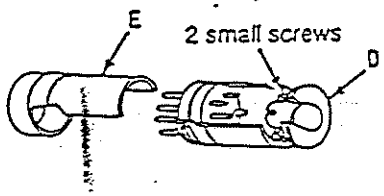
REMOTE ALARM ASSEMBLY



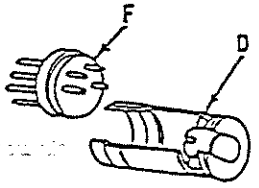
Step 1: Hold part "B" and turn part "A" counter clockwise.



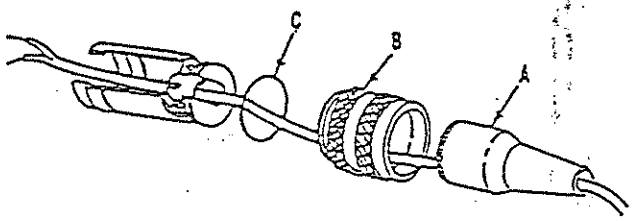
Step 2: Slip parts "A", "B", and "C" from "E" and "D"



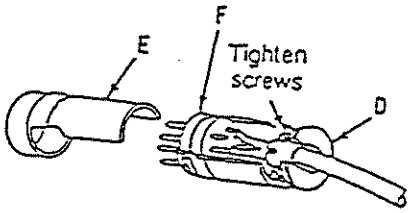
Step 3: Remove cover plate "E" from "D" and loosen 2 small screws at the wire clamp.



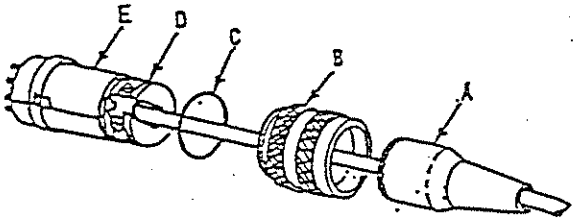
Step 4: Lift connector "F" from part "D" (observe Keyway.)



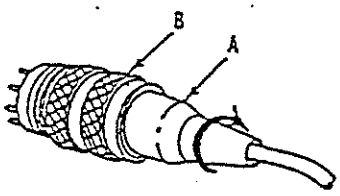
Step 5. Slide alarm wire thru parts "A", "B", and "C", then slide wire under wire clamp and solder alarm wire to proper pins (shown below)



Step 6: Set connector "F" back into part "D" tighten screws, to hold wire in place, and replace cover plate "E".



Step 7: Slide ring "C" parts "B" and "A" over parts "D" and "E".



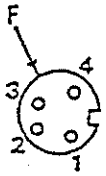
Step 8: Push part "A" into "B" and turn Clockwise

REAR VIEW

5 PINS
CONNECTOR PINS
1 - NOT USED
2 - COMMON
3 - NC - NORMAL CLOSED
4 - NO - NORMAL OPEN
5 - NOT USED

SOLDER SIDE

REAR VIEW



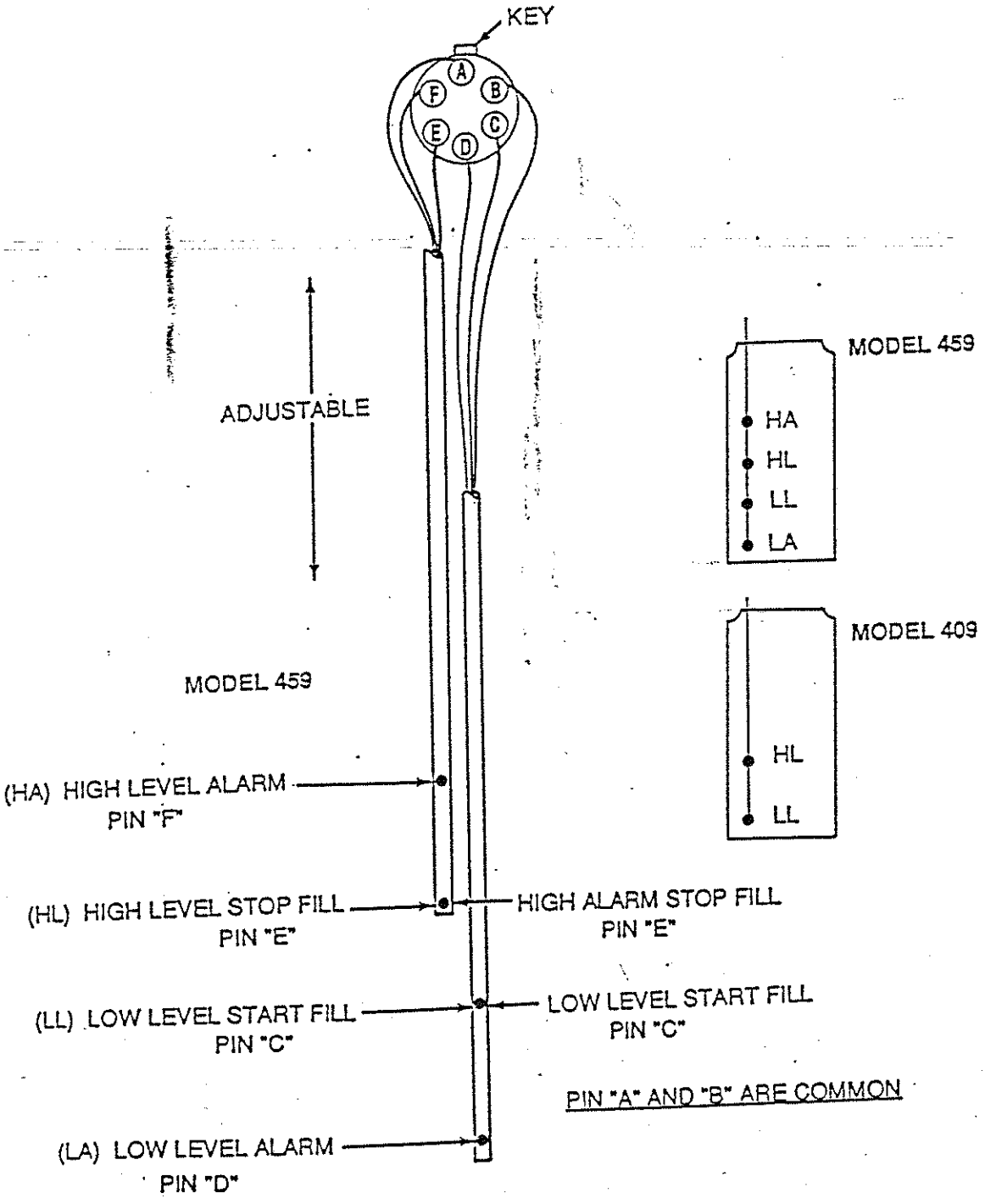
4 PINS
CONNECTOR PINS

1 - CASE GROUND
2 - COMMON
3 - NC - NORMAL CLOSED
4 - NO - NORMAL OPEN

SOLDER SIDE

ALARM MODES

NC - IS THE DE-ENERGIZED POSITIONS
(2) COMMON AND (3) NC ALARM CONDITION
(2) COMMON AND (4) NO ALARM CONDITION


KEY
A
B
C
D
E
F
ADJUSTABLE
MODEL 459
(HA) HIGH LEVEL ALARM
PIN "F"
(HL) HIGH LEVEL STOP FILL
PIN "E"
HIGH ALARM STOP FILL
PIN "E"
(LL) LOW LEVEL START FILL
PIN "C"
LOW LEVEL START FILL
PIN "C"
PIN "A" AND "B" ARE COMMON
(LA) LOW LEVEL ALARM
PIN "D"
MODEL 459
HA
HL
LL
LA
MODEL 409
HL
LL

FIRST TIME FILLING STORAGE UNIT

First time filling does require a little more time and effort on the operator's part. ALWAYS leave the lid open to allow the vapors to flow freely from the tank.

> **NOTE**
>
> If your storage tank has it's electronics built into the front panel, place a piece of cardboard on the edge of the tank to allow the cold vapors to escape over the edge of the cardboard away from the front plate.

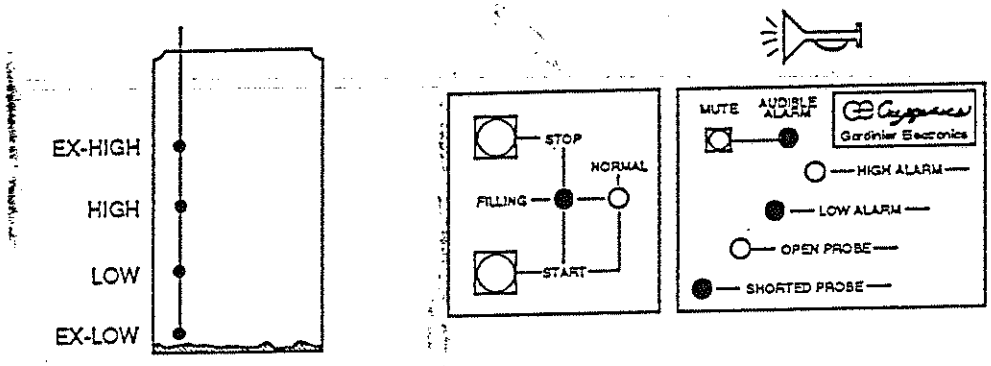
TURN POWER OFF After the storage unit has retained 1/2 inch of liquid, stop the filling cycle and close the lid. This will allow the storage unit to cool down on it's own. This should be done every so often to reduce the violent Hot to Cold reaction.

As the first filling is being accomplished some false indicator LED will light, but take no concern until the storage unit is at a point where the STOP button will then turn the controller to NORMAL. Again close the lid and allow the storage unit to fill automatically. At this point, the sensor LED may still be lit.

After the storage tank stabilizes (approximately) one (1) to two (2) hours, all functions of the Liquid Level Controller will work properly.

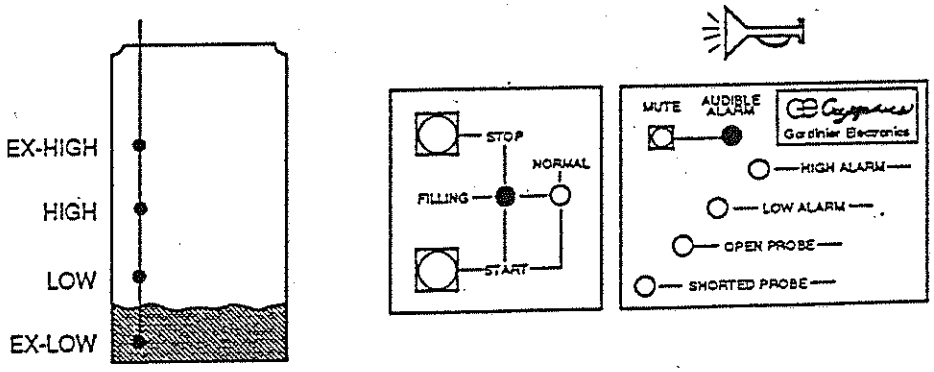
START FILLING:

Liquid has just begun to fill storage unit. This will cause the HORN to sound.Pressing the MUTE BUTTON will cycle the AUDIBLE LED and MUTE the HORN . The AUDIBLE LED must be lit if the HORN is to be heard . The remote alarm has been activated (De-activating relay).



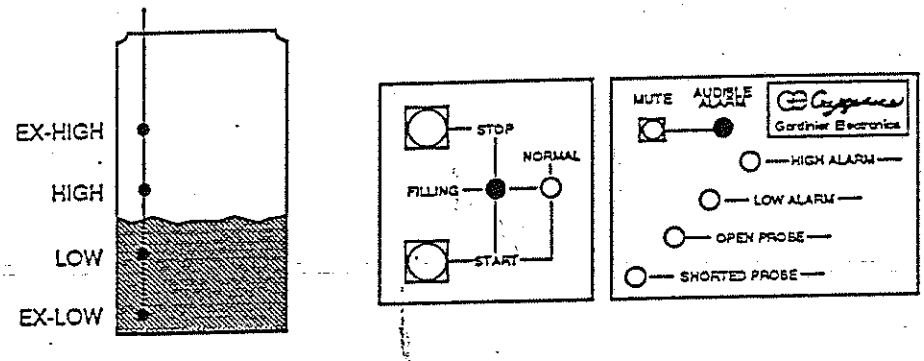
SECOND STAGE OF FILLING

LOW LEVEL ALARM element has been covered, but the ALARM will sound due to the PROBE ALARM.

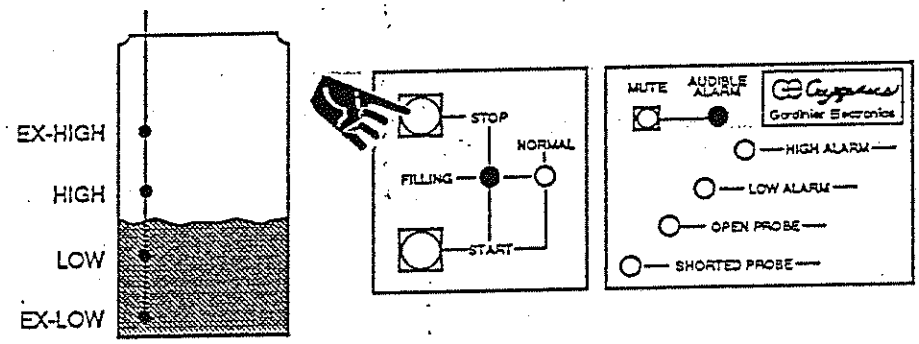


THIRD STAGE OF THE FILLING CYCLE:

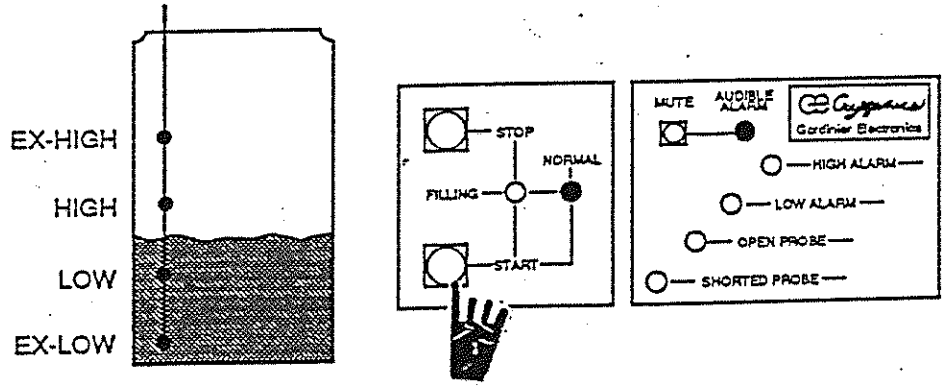
The Low Level element has been covered.



This stage will allow the operator to operate the **STOP** filling cycle button.

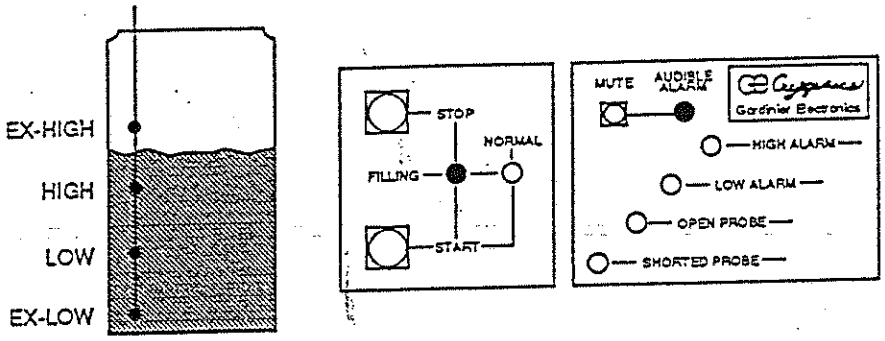


The operator can now operate the **START** filling button.



FILLING (CONTINUED)

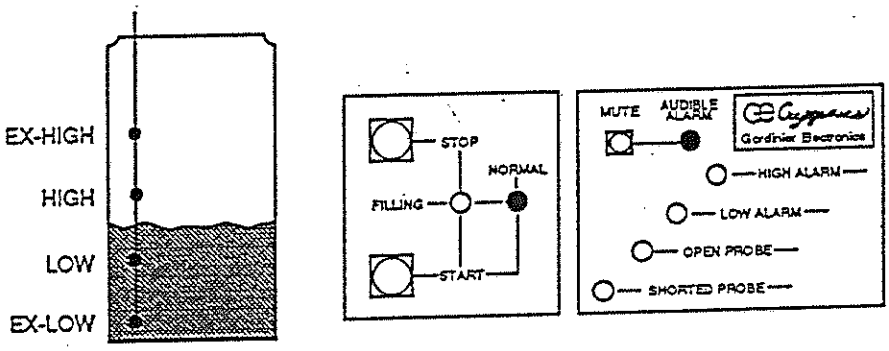
The liquid has now covered the **HIGH LEVEL** element, this will automatically stop the filling cycle.



FUNCTIONAL STAGES OF THE PROBE

BELOW HIGH LEVEL ELEMENT

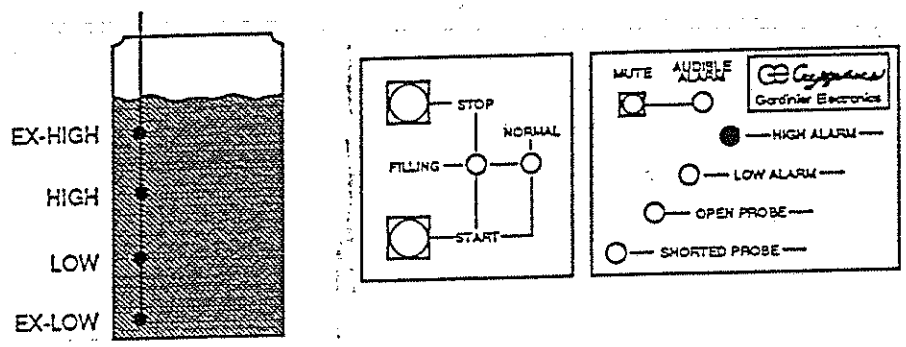
When evaporation of liquid has fallen below the **HIGH** level element - Automatically the **NORMAL LED** will be lit.



FUNCTIONAL STAGES OF THE PROBE (CONTINUED)

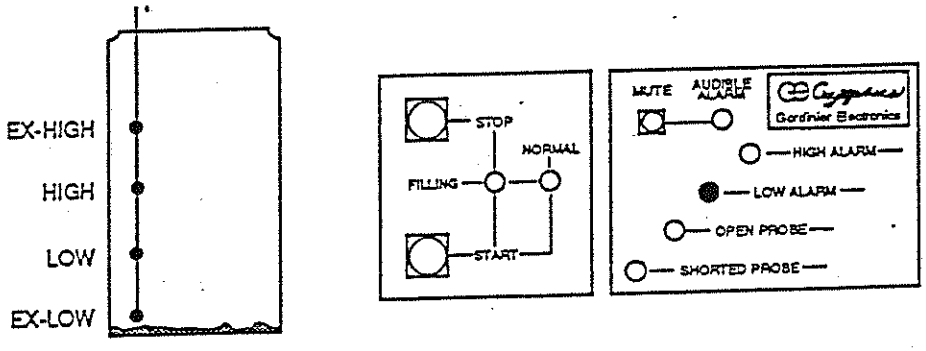
MUTING AUDIBLE ALARM:

Press the **MUTE** button - THIS ONLY TURNS OFF THE HORN. All other leds will remain lit to show you the condition that persists.



LOW LEVEL ALARMS:

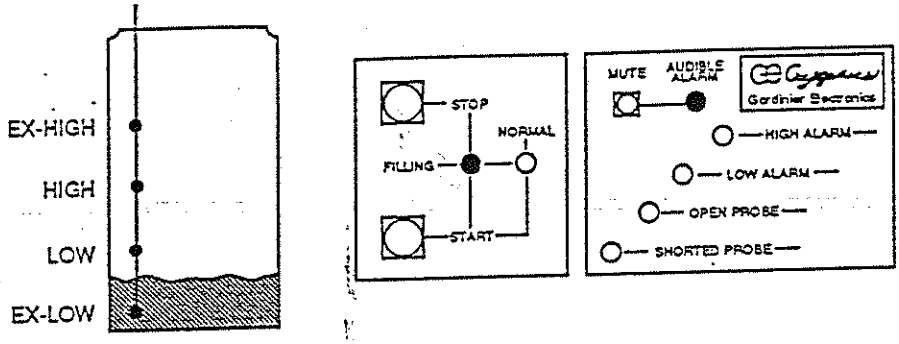
Caused by the **LOW LEVEL** element being uncovered.



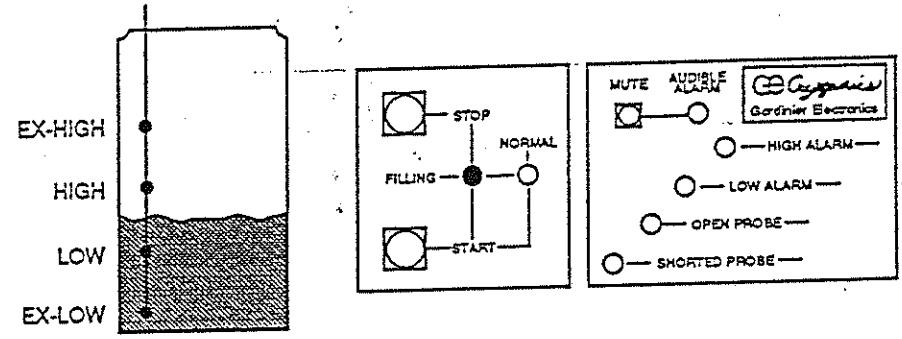
FUNCTIONAL STAGES OF THE PROBE (CONTINUED)

BELOW LOW LEVEL ELEMENT

When the liquid has fallen below the LOW LEVEL element the START filling will automatically begin.

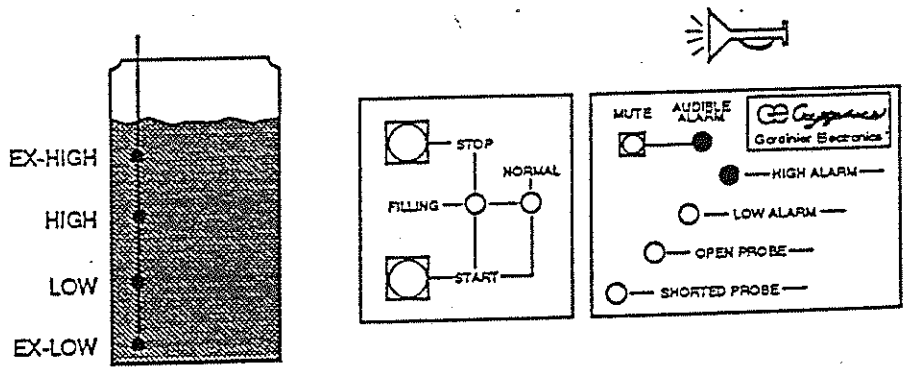


Filling has begun once again covering the **LOW LEVEL** element.



HIGH LEVEL ALARM

The liquid has covered the **EX-HIGH** element which causes the alarm.



APPENDIX A – *NITROFILL* LN2 DISPENSER SCHEMATICS

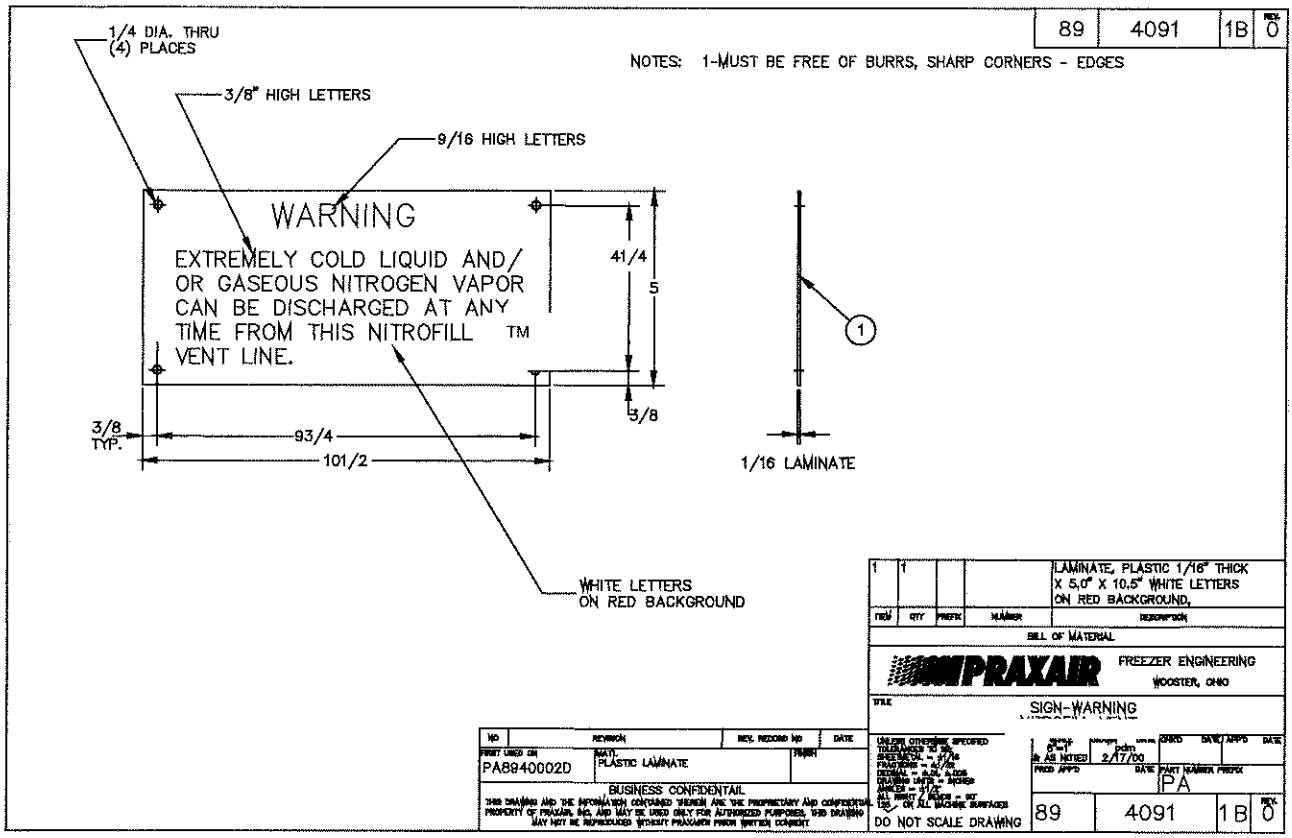


Figure A-1: *NitroFill* LN2 Dispenser Vent Warning Placard

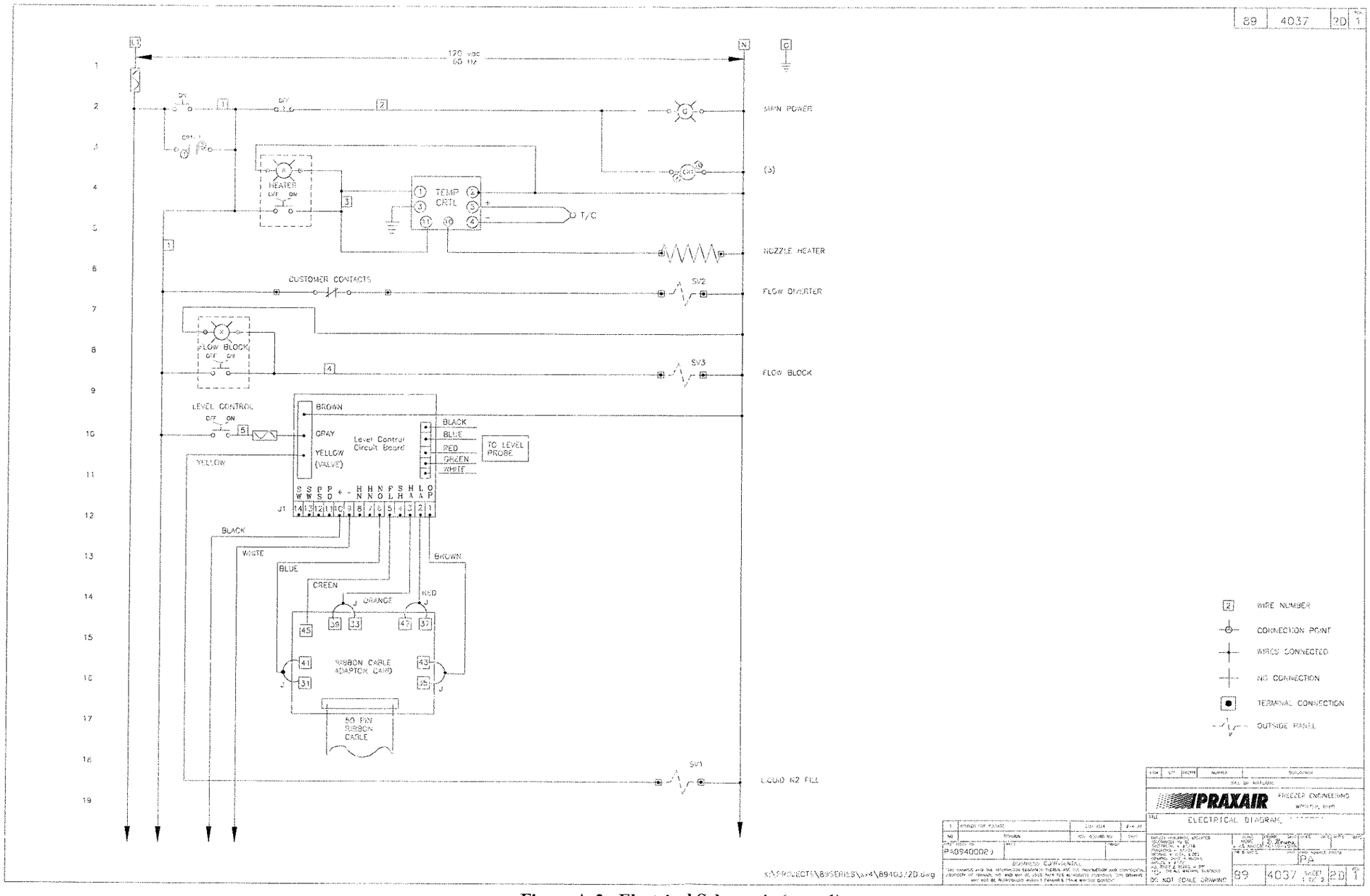


Figure A-2: Electrical Schematic (page 1)

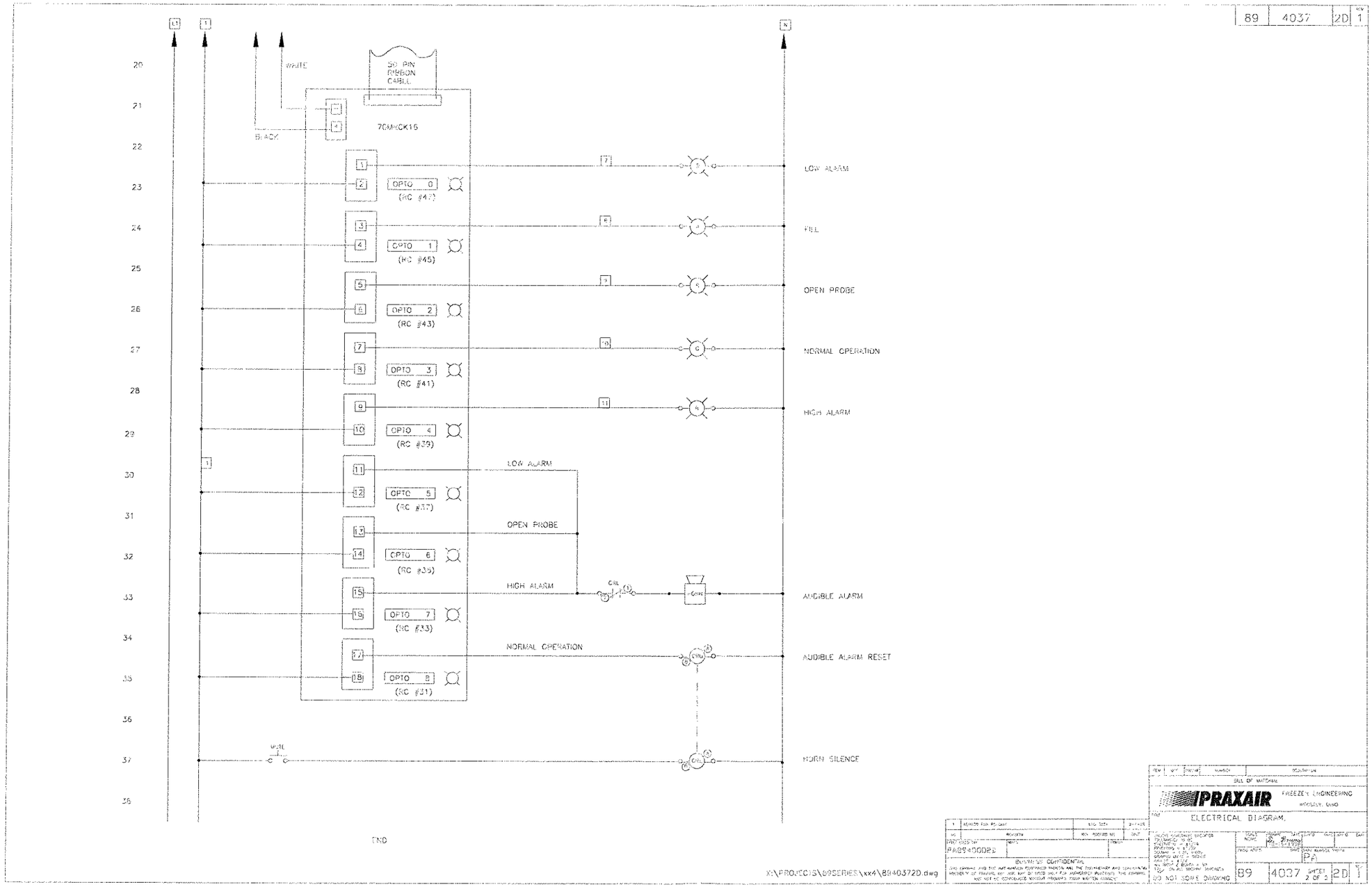


Figure A-3: Electrical Schematic (page 2)

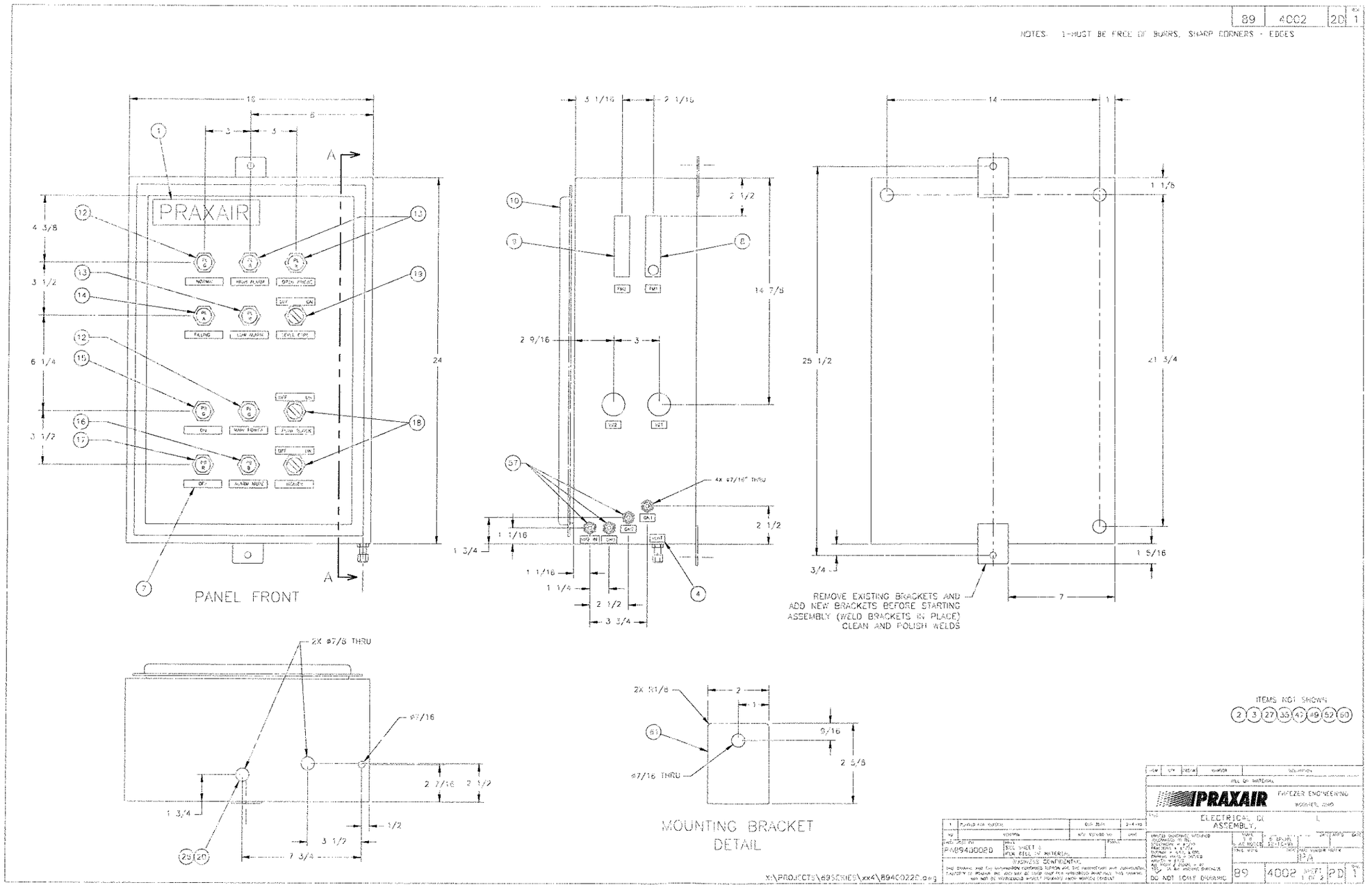


Figure A-4: Electrical Control Panel Schematic

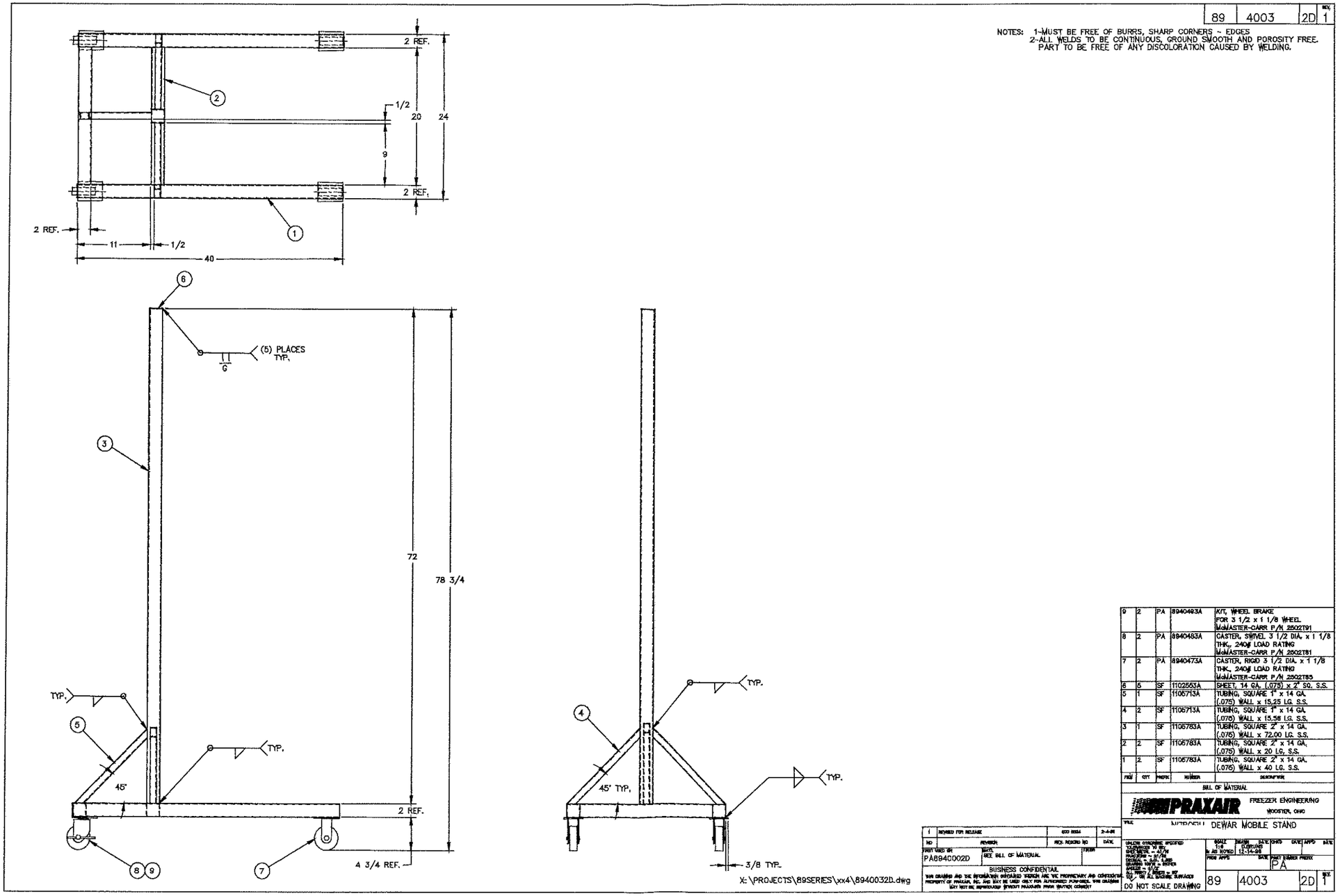


Figure A-5: Dewar Mobile Stand

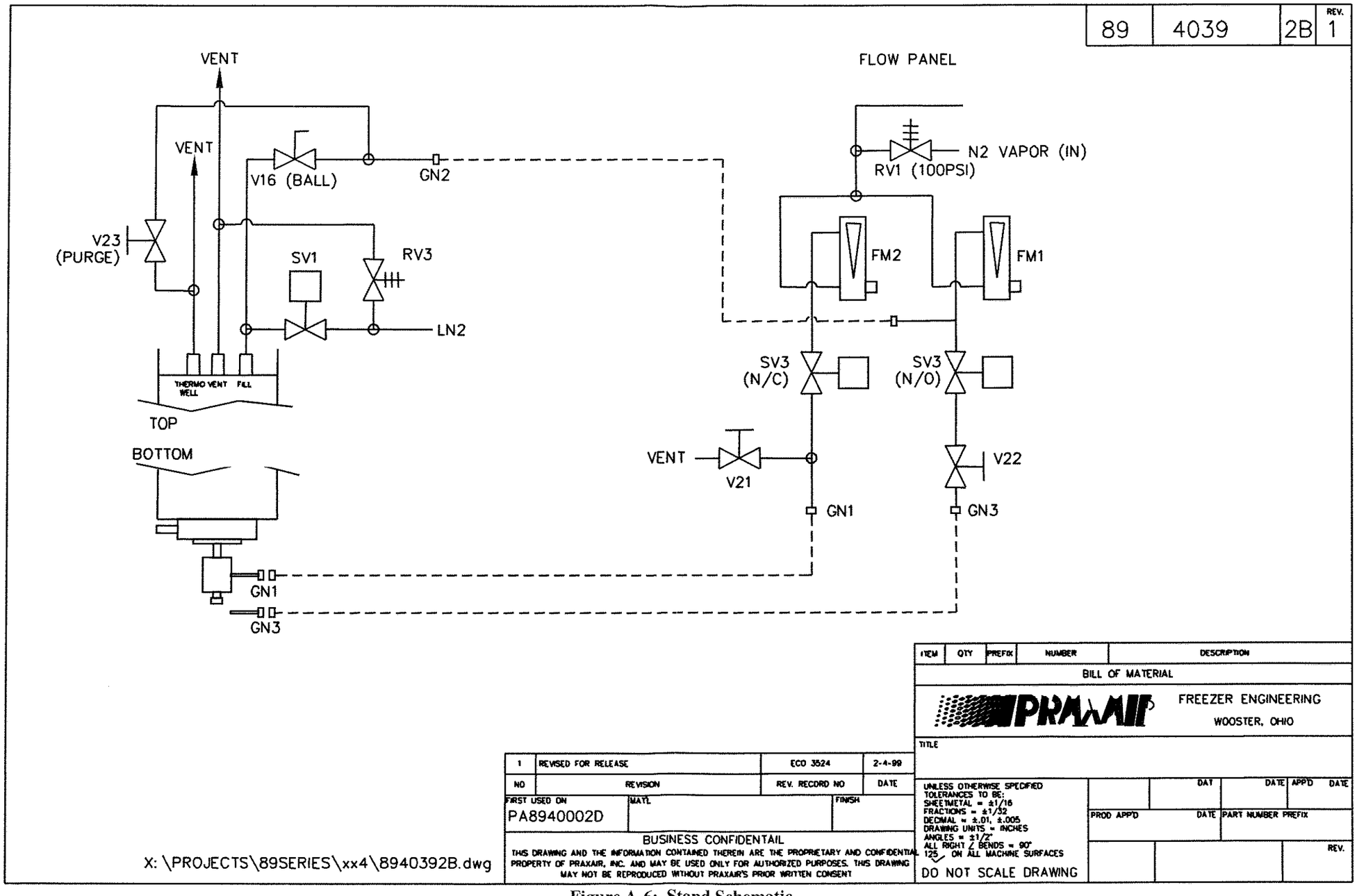
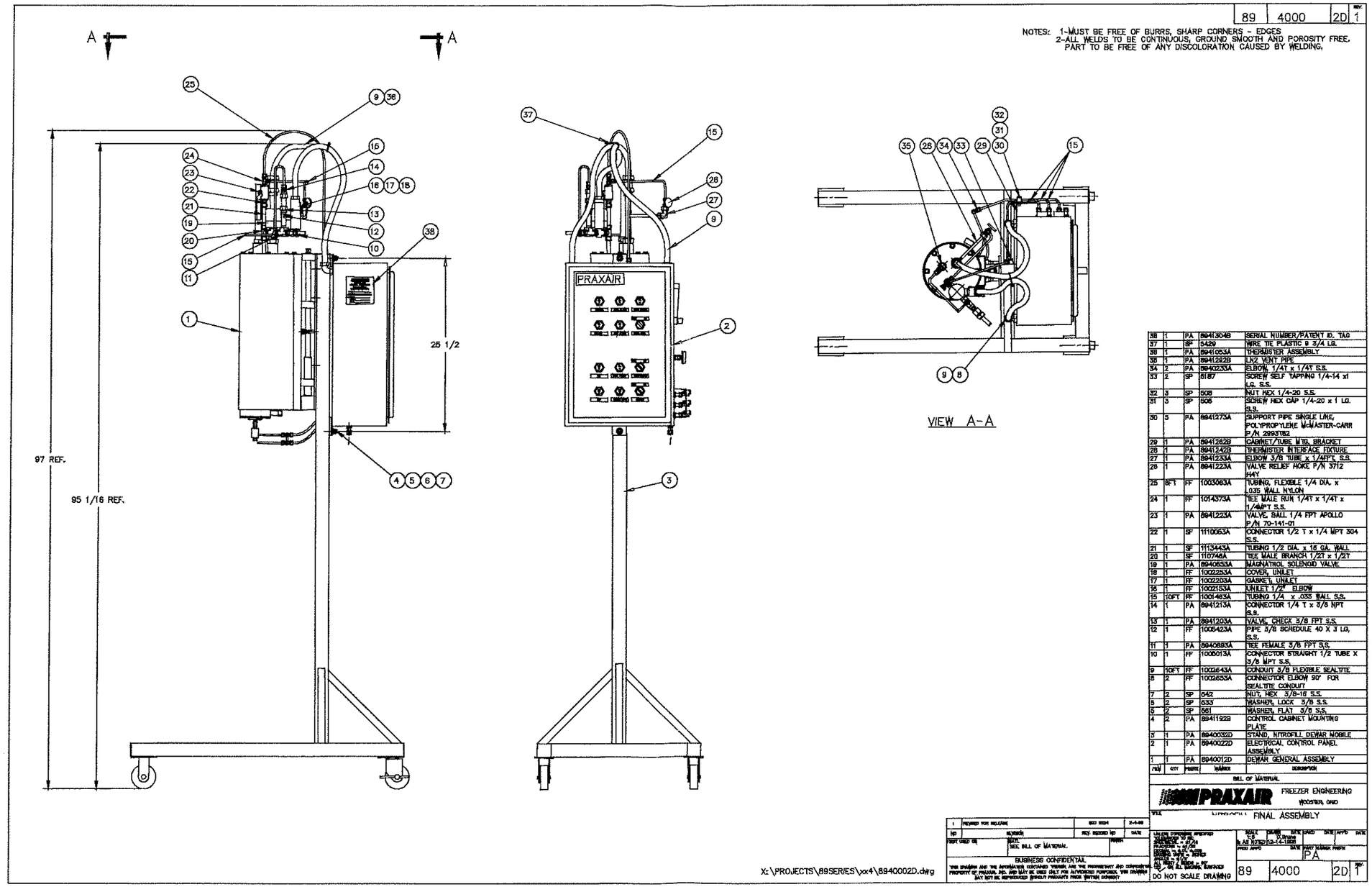


Figure A-6: Stand Schematic



38	1	PA	8941304B	SERIAL NUMBER/PATENT ID. TAG
37	1	SP	5429	WIRE TIE PLASTIC 8 3/4 LG.
36	1	PA	8941053A	THERMISTER ASSEMBLY
35	1	PA	8941262B	LN2 VENT PIPE
34	2	PA	8940233A	ELBOW, 1/4T x 1/4T S.S.
33	2	SP	5187	SCREW SELF TAPPING 1/4-14 x1 LG. S.S.
32	3	SP	508	NUT HEX 1/4-20 S.S.
31	3	SP	506	SCREW HEX CAP 1/4-20 x 1 LG. S.S.
30	5	PA	8941273A	SUPPORT PIPE SINGLE LINE, POLYPROPYLENE McMASTER-CARR P/N 2993182
29	1	PA	8941262B	CABINET/TUBE MTG. BRACKET
28	1	PA	8941242B	THERMISTER INTERFACE FIXTURE
27	1	PA	8941233A	ELBOW 3/8 TUBE x 1/4FPT, S.S.
26	1	PA	8941223A	VALVE RELIEF HOKE P/N 3712 H4Y
25	8FT	FF	1003083A	TUBING, FLEXIBLE 1/4 DIA. x .035 WALL NYLON
24	1	FF	1014373A	TEE MALE RUN 1/4T x 1/4T x 1/4MPT S.S.
23	1	PA	8941223A	VALVE, BALL 1/4 FPT APOLLO P/N 70-141-01
22	1	SF	1110063A	CONNECTOR 1/2 T x 1/4 MPT 304 S.S.
21	1	SF	1113443A	TUBING 1/2 DIA. x 16 GA. WALL
20	1	SF	1107748A	TEE MALE BRANCH 1/2T x 1/2T
19	1	PA	8940853A	MAGNATROL SOLENOID VALVE
18	1	FF	1002253A	COVER, UNILET
17	1	FF	1002203A	GASKET, UNILET
16	1	FF	1002153A	UNILET 1/2# ELBOW
15	10FT	FF	1001483A	TUBING 1/4 x .035 WALL S.S.
14	1	PA	8941213A	CONNECTOR 1/4 T x 3/8 NPT S.S.
13	1	PA	8941203A	VALVE, CHECK 3/8 FPT S.S.
12	1	FF	1005423A	PIPE 3/8 SCHEDULE 40 X 3 LG, S.S.
11	1	PA	8940883A	TEE FEMALE 3/8 FPT S.S.
10	1	FF	1005013A	CONNECTOR STRAIGHT 1/2 TUBE X 3/8 MPT S.S.
9	10FT	FF	1002643A	CONDUIT 3/8 FLEXIBLE SEALTITE
8	2	FF	1002653A	CONNECTOR ELBOW 90° FOR SEALTITE CONDUIT
7	2	SP	642	NUT, HEX 3/8-16 S.S.
6	2	SP	633	WASHER, LOCK 3/8 S.S.
5	2	SP	661	WASHER, FLAT 3/8 S.S.
4	2	PA	8941192B	CONTROL CABINET MOUNTING PLATE
3	1	PA	8940032D	STAND, NITROFILL DEWAR MOBILE
2	1	PA	8940022D	ELECTRICAL CONTROL PANEL ASSEMBLY
1	1	PA	8940012D	DEWAR GENERAL ASSEMBLY
ITEM	QTY	PRFX	NUMBER	DESCRIPTION

Figure A-7: Final Assembly

INDEX

T

V