

MVE AUTOMATIC LN₂ SUPPLY SWITCH TECHNICAL MANUAL



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Innovation. Experience. Performance.



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Ball Ground, Georgia 30107

Technical Manual P/N 13934953

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MVE Automatic LN₂ Supply Switch

TECHNICAL MANUAL

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This Technical Manual covers use and maintenance of the MVE Automatic LN₂ Supply Switch. It is intended for use by experienced personnel only.



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MVE Automatic LN₂ Supply Switch

TECHNICAL MANUAL INTRODUCTION

General

The **MVE Automatic LN₂ Supply Switch** (commonly referred to as the **Tank Switch** or **Tank Switcher**) is an automated backup Liquid Nitrogen (LN₂) supply-switching device. Its purpose is to switch from a primary LN₂ supply to a backup when the primary supply is depleted. This prevents the Freezer from running out of LN₂ when there is no attendant to manually change out supply tanks. Although the unit was designed primarily for use with LN₂ storage freezers, it can be used to supply any device that uses LN₂ at low pressures between 22psi to 35psi at a rate similar to that of LN₂ freezers.

System Description

The Tank Switch uses downstream pressure in the transfer line to the LN₂ freezer to detect demand for LN₂. There is no need for an electrical signal from the freezer to indicate LN₂ demand downstream of the tank switch. The majority of competitive tank-switching devices require an electrical signal from the freezer to indicate demand. The electrical connection required for these switches to operate provides a path for electrical noise into both the controls for the freezer and the switch as well. Elimination of this electrical connection is beneficial for any electronics incorporated into the controls of the equipment.

Pressure switches are used to detect both the demand for, and the end of demand for LN₂. When downstream pressure drops below a pre-set level, a supply solenoid valve in the tank switch is opened to supply the demand. The solenoid valve that is opened is determined by the position of the primary selection switch and the status of the selected primary supply (empty or not). If the primary supply is empty, the valve for the secondary supply is opened. When both supplies are empty, an alarm is activated. This alarm is visual with an indicator on the front panel, audible with a mutable buzzer, and remote with a set of dry alarm contacts.

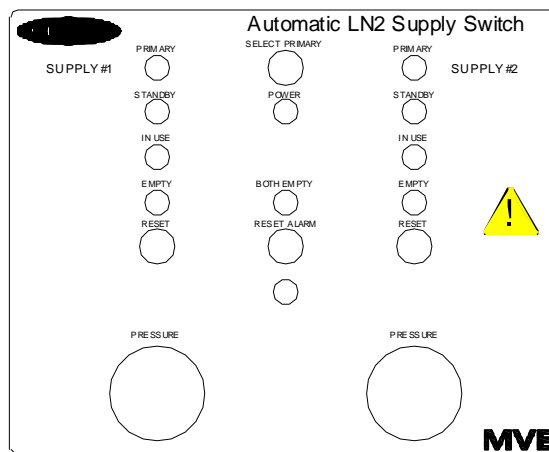
Pressure switches are also used to determine the status of the supply tanks. If supply pressure drops below 10 psi, an empty indicator on the front panel is lit and the unit will switch over to the secondary supply to provide for the LN₂ demand. If the switch from primary to secondary has occurred, and the secondary supply has become empty, neither supply valve will be energized and the both-empty alarm will be activated as described above.

Label / Overlay Text Display

The Tank Switch control panel comes from the factory with a front symbolic overlay label and meets the requirements for MDD CE. We have included an English text overlay label that can be applied over the symbolic overlay if desired. (See Fig 1)

PN 13934970 LABEL FRNT TANK SWITCH ENGLISH TEXT

Fig 1



MVE Automatic LN₂ Supply Switch

LN₂ Supply Switch and Plumbing Assembly

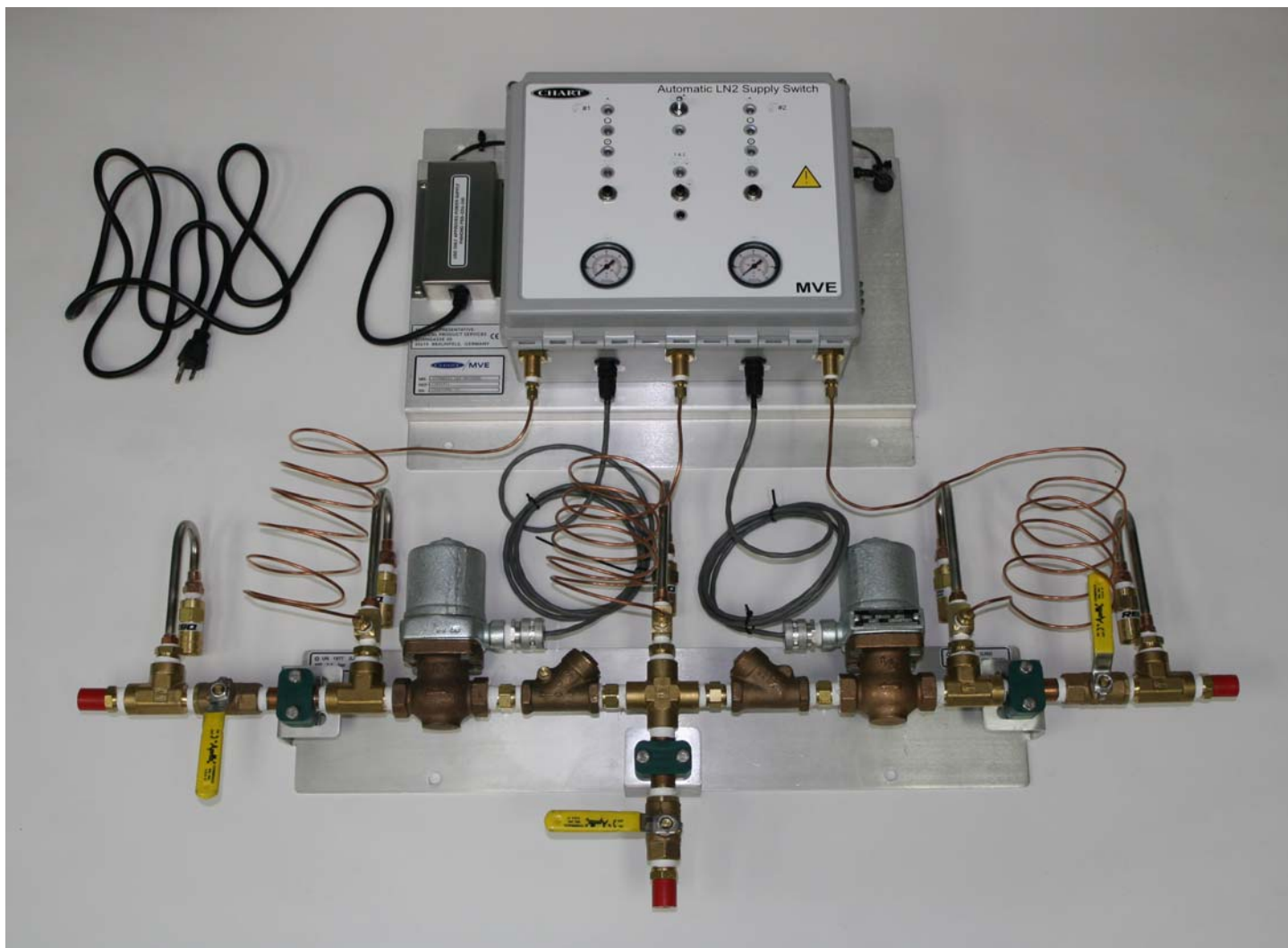
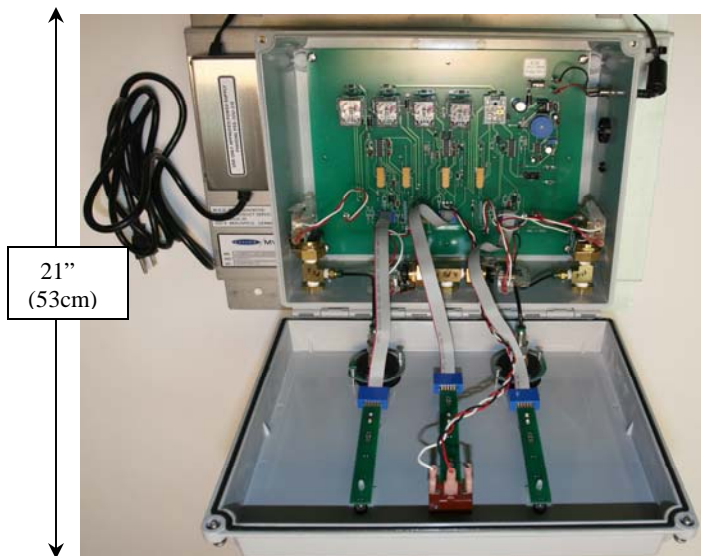


Fig 2

Final Assembly P/N 13934911

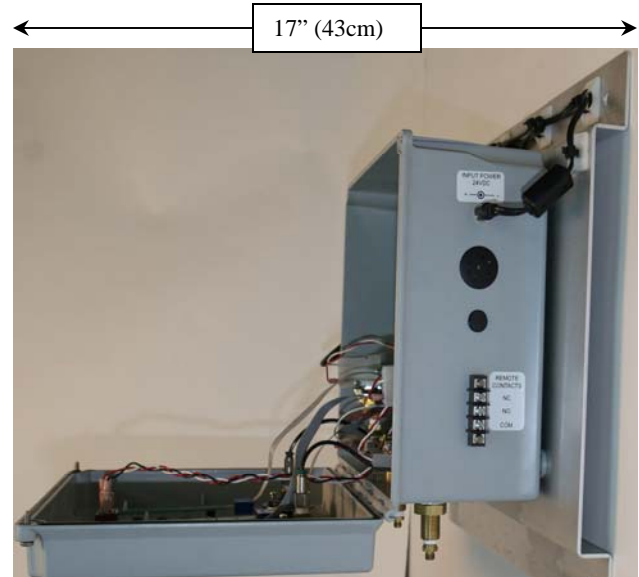
MVE Automatic LN₂ Supply Switch

Controller and Plumbing dimensions



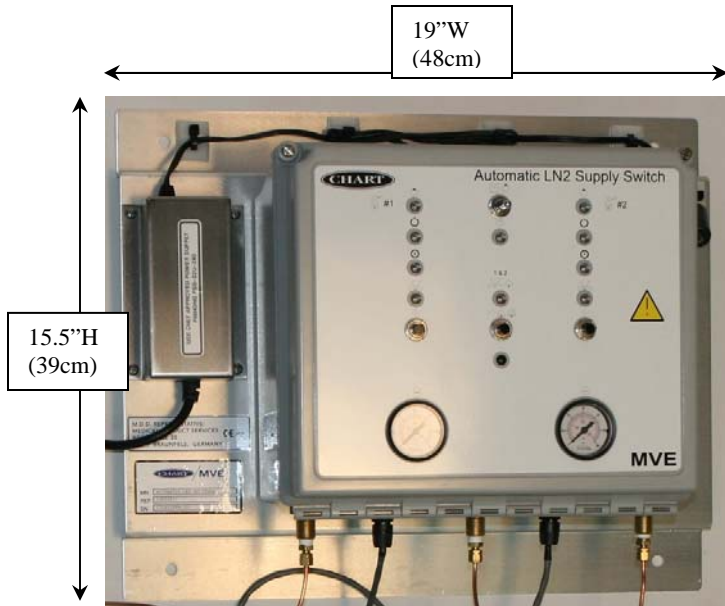
Service Door dimensions opened approximately at 135° angle

Fig 3



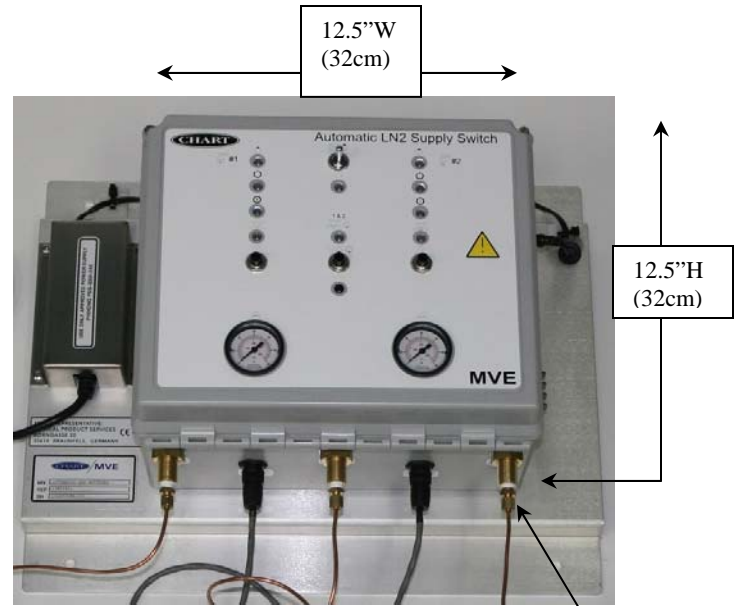
Service Door dimensions opened at 90° angle

Fig 4



Controller bracket dimensions

Fig 5



Controller Box dimensions (includes port connections)

Fig 6

The Controller attached to the bracket assembly measures 19"W (48cm) X 15.5"H (39cm) X 9.5"D (24cm). (9.5" (24cm) depth includes allowing space for the toggle switch) With the Service door opened at 90 degrees it measures 17"D (43cm).

MVE Automatic LN₂ Supply Switch

Controller and Plumbing dimensions

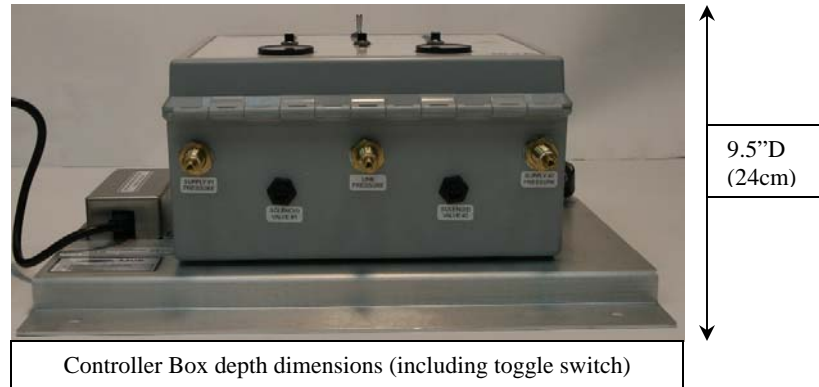


Fig 7

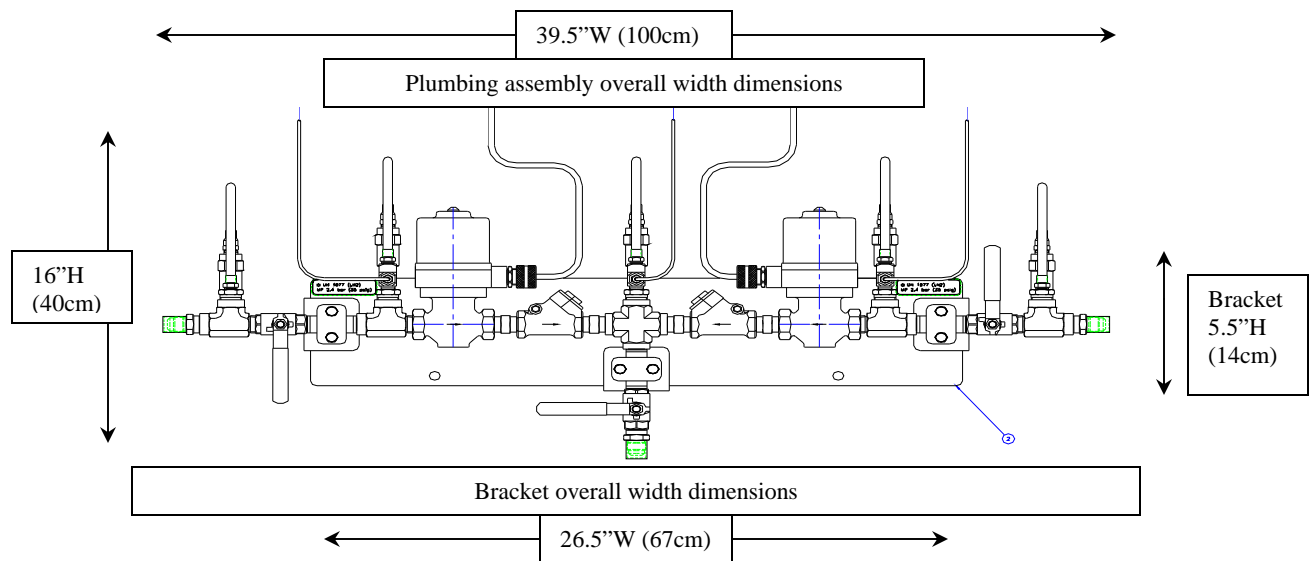


Fig 8

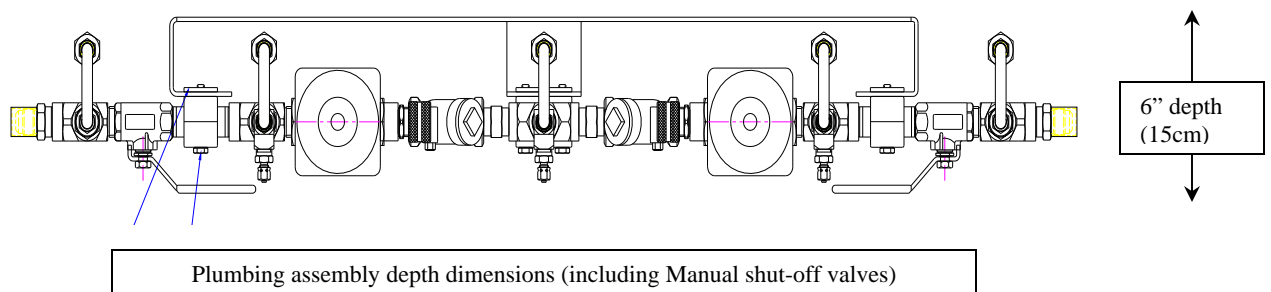


Fig 9

The plumbing assembly attached to the bracket measures 39.5"W (100cm) X 16"H (40cm) X 6" D (15cm) (6" depth (15cm) includes allowing space for the manual shut-off valves)

MVE Automatic LN₂ Supply Switch

HANDLING OF LIQUID NITROGEN



GENERAL

Liquid Nitrogen (LN₂) is used in the operation of the MVE Dewar. Although not explosive, there are a number of safety considerations to keep in mind in the handling of LN₂.

PROPERTIES

Nitrogen is a colorless, odorless, tasteless gas. Gaseous Nitrogen makes up about 78% of the Earth's atmosphere. Once collected and isolated, Nitrogen will liquefy when cooled properly. The properties of LN₂ are as follows:

PROPERTY VALUE

Boiling Point @ 1 ATM, in °K	77.4
Thermal Conductivity (Gas), w/m ² °K	0.079
Latent Heat of Vaporization, Btu/Liter	152.0
Liquid Density, lb./liter @ 1 ATM	1.782
Expansion Ratio @ STP	746:1

HANDLING CRYOGENIC STORAGE DEWARs

Cryogenic containers (Dewars) must be operated in accordance with the manufacturer's instructions. Safety instructions will also be posted on the side of each Dewar. Cryogenic Dewars must be kept in a well-ventilated place where they are protected from the weather and away from any sources of heat. A typical cryogenic Dewar is shown below in Figure 2.

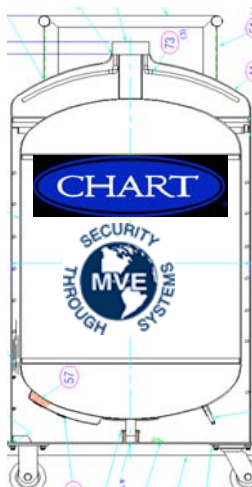


Fig 10

Typical Cryogenic Storage Dewar (Supply Tank)

MVE Automatic LN₂ Supply Switch

LIQUID NITROGEN SAFETY PRECAUTIONS

Transferring LN₂ and operation of the storage Dewar controls should be in accordance with the manufacturers/supplier Instructions. During this transfer, it is important that all safety precautions written on the storage Dewar and recommended by the manufacturer be followed.

WARNING

- Nitrogen is a potential asphyxiate and can cause rapid suffocation without warning. Store and use in area with adequate ventilation. DO NOT vent container in confined spaces. DO NOT enter confined spaces where gas may be present unless area has been well ventilated. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, supplemental Oxygen may be required. **SEEK MEDICAL ATTENTION IMMEDIATELY.**
- Liquid Nitrogen can cause severe frostbite to the eyes or skin. DO NOT touch frosted pipes or valves. In case of frostbite, consult a physician at once. If a physician is not readily available, warm the affected areas with water that is near body temperature.
- Never place LN₂ in a sealed container without a pressure relief device. The expansion ratio of LN₂ to N₂ gas is approximately 1 to 700; i.e. 1 cubic foot of LN₂ becomes 700 cubic foot of N₂ gas at 0psi when evaporated.

The two most important safety aspects to consider when handling LN₂ are adequate ventilation and eye and skin protection. Although Nitrogen gas is non-toxic, it is dangerous in that the gas will displace the Oxygen in a normal breathing atmosphere. Liquid products are of even greater threat since a small amount of liquid evaporates to create a large amount of gas. Therefore, it is imperative that cryogenic supply and storage Dewars be stored and operated in open and well-ventilated areas.

Persons transferring LN₂ should make every effort to protect the eyes and skin from accidental contact with liquid or cold gas issuing from the Dewar. Protect the eyes with a full-face shield or chemical splash goggles. Safety glasses (even with side shields) are not adequate. Always wear cryogenic gloves or equivalent when handling anything that is or may have been, in contact with the liquid, cold gas, cold pipes, or equipment. Long-sleeve shirts and cuff-less trousers of sufficient length to prevent liquid from entering the shoes are recommended.

RECOMMENDED FIRST AID

Every site that stores and uses LN₂ should have an appropriate Material Safety Data Sheet (MSDS) present. The MSDS may be obtained from the manufacturer/distributor. The MSDS will specify the symptoms of overexposure and the first aid to be used. A typical summary of these instructions is provided as follows.

- If symptoms of asphyxia such as headache, drowsiness, dizziness, excitation, excess salivation, vomiting, or unconsciousness are observed, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. **CALL A PHYSICIAN IMMEDIATELY.**
- If exposure to cryogenic liquids or cold gases occurs, restore tissue to normal body-temperature (98.6°F) as rapidly as possible, and then protect the injured tissue from further damage and infection. Call a physician immediately. Rapid warming of the affected areas is best achieved by bathing it in warm water. The water temperature should not exceed 104°F (40°C). Under no circumstances should the frozen part be rubbed, either before or after warming. If the eyes are involved, flush them thoroughly with warm water for at least 15 minutes. In case of massive exposure, remove clothing while showering with warm water. The patient should not drink alcohol or smoke. Keep warm and rest. Call a physician immediately.

MVE Automatic LN2 Supply Switch

Installation / Setup

Power connection

Note: Do not power up the controller until the installation and physical connections have been completed.

To minimize the potential for accidental shut down of the unit, there is no power switch. When the unit is connected to the power source, it is on. The unit is supplied with a self-regulating, switching power supply. The power supply will provide the 24vdc-output power required for operation whenever input power from 100-240VAC, 50/60 HZ is supplied to the inlet. The power supply has an IEC320 inlet that will accept any input power cord with the mating receptacle on it. This is the same type of detachable, power cord that is used with a PC and available at most computer supply stores. The unit is supplied with a standard domestic US power cord (NEMA 5-15P plug end configuration). The input power requirements are 100-240VAC, 50/60 HZ, 0.7A. **The power supply is a PSC-30U-24D: 100-240V, 50-60HZ output 24VDC 30W 1.25A.**

Weight of the units

The controller and plumbing assembly have a combined total weight of 41 pounds (19kg) without the transfer hoses attached. The weight of the plumbing assembly alone is 27.5 lbs (12kg) and the Controller only weighs 13.5 lbs (6kg). It is imperative that both the controller and plumbing assembly be securely mounted. If the wall stud spacing is not 16" (40cm), it is recommended that the unit be secured to a sheet of plywood at least ½" (1.3cm) thick and wide enough to be secured to the wall studs as spaced. If the unit is to be mounted to a structure other than a stud frame wall, an improvised strong steel plate or bracket should be of sufficient strength to properly support the unit.

Mounting of the units

The tank switch has 2 separate main assemblies. The controller bracket is supplied with (4) 5/16" X 3" lag bolts, and the Plumbing assembly is supplied with (4) 3/8" x 1-1/2" lag bolts. To mount the unit onto the wall, the mounting brackets have prefabricated holes provided at 16" (40cm) centers to align with the industry standard wall stud spacing. Align and drill 9/32" (.71cm) holes into the wall studs for the Plumbing assembly and 1 / 4" (.64cm) holes for the Controller. Drive the lag bolts through the bracket holes into the drilled holes to mount the unit onto the wall.

Location of the units

A suitable location should be selected for the tank switch, as close as possible to both the supply tank locations and the device that is to be supplied. The dimensions of the bracket that the controller is attached to measures 19"W (48cm) X 15.5"H (39cm) X 9.5D (24cm). (9.5" (24cm) depth includes allowing necessary space for the toggle switch) With the Service door opened at 90 degrees it measures 17"D (43cm). The bracket that the plumbing assembly is attached to measures 39.5"W (100cm) X 16"H (40cm) X 6" D (15cm) (6" (15cm) depth includes allowing space for the manual shut-off valves) The plumbing assembly must be mounted vertically.
(See dimensions on pages 6 and 7)

Available width for the units should be approximately 20" (51cm) for the controller and 48" (122cm) for the plumbing assembly. This allows adequate clearance for attaching and disconnecting the transfer hoses to the inlet connections on each side of the unit. Access to the delivery connection at the bottom of the unit, middle underneath area of the plumbing assembly, should be unobstructed as well. To allow clearance for opening the control panel when service is required, there should be approximately 17" (43cm) between the mounting surface and any potential obstruction in front of the unit. The control panel for the unit should be located at about eye level. Placement of the unit so that the cold vapor does not vent on the control panel is desirable to minimize moisture accumulation inside the control enclosure.

MVE Automatic LN₂ Supply Switch

Installation / Setup

LN₂ Connection

The tank switch plumbing assembly has three standard LN₂ transfer hose connections, (1/2" (1.3cm) ODT 45 degree SAE Flare) one on each side which connects to the supply tanks and the one outlet at the middle connects to the freezer.

Always keep the manual shut off valves closed when no supply tanks or freezer are connected.

(See pages 14 and 15)

As part of the installation process there are 3 pressure port connections (compression fittings) and 2 solenoid twist on connections. (See page 14)

The LN₂ supply tanks connected to each supply port should be set up with a maximum operating pressure between 22 to 35 PSI (1.5 to 2.4 bar) . If the supply tank is equipped with a pressure building system, the pressure-building regulator should be set to a value below 22 PSI (1.5bar). A pressure builder setting at or above 22 PSI (1.5bar) will cause the tank switch to cycle on and off during the transfer process.

When the tank switch is used to supply multiple or large freezers where large quantities of LN₂ would be delivered in a short time, a drop in pressure significant enough to cause a false empty indication can occur. In this application, supply tanks with pressure building circuits should be considered to minimize the occurrence of false empty indications. The pressure building regulators for these should be set around 18 PSI (1.2 bar).

When the LN₂ Supply Switch is on and no freezer or supply tanks are connected, the Inlet and Outlet manual valves should be closed. If there is a need to disconnect the freezer from the outlet, all these valves should also be closed. The lack of pressure in the outlet portion of the system will be seen as a demand for LN₂ and one of the supply valves will be opened discharging LN₂ from the outlet. As an alternative or secondary precaution, the primary selector switch can be placed in the center position. (See page 17, select primary switch Fig 18) In this position, no primary is selected and no supply valve will be activated.

Basic Operating Instructions

Do not apply power to the tank switcher until all connections have been completed

Close all the inlets and outlet manual valves

Toggle switch should be in the center position

Connect all 3 transfer hoses, tighten.

Connect tank switcher's power supply to your electrical source

The buzzer will sound and all 3 red empties will light (this is normal), press the reset alarm button, alarm will mute

Open the valves on the supply tanks and Open all the inlets and outlet manual valves and check for leaks.

Verify pressure gauges read 20-22PSI (1.4 to 1.5bar), if supply tanks have pressure building systems, adjust accordingly

Press each supply reset buttons and all 3 red empties will shut off

Place Toggle switch from center position to your preferred supply side

If no filling required, tank switcher will go into standby (If not; adjustment of PS2 may be necessary – see page 21)

For filling, tank switcher will switch to in use mode, (normal for in use / standby to cycle until pressure is obtained)

If the tank switch keeps cycling to the in use and standby mode; adjustment of PS2 may be necessary. (See page 21)

When supply is depleted, tank switch will switch automatically to the full side and to in use if filling is still required

When supply is satisfied, tank switcher will go into standby mode

When both supplies are depleted, both empty indicators will remain lit and the buzzer will sound

Storage and transporting the units

If switching device is not in service the panel should be kept covered. It can be stored or transported in a 0°C - 40°C, 0% - 95% Relative Humidity environment. Keep the original packing materials for transporting the tank switch assembly.

Warranty

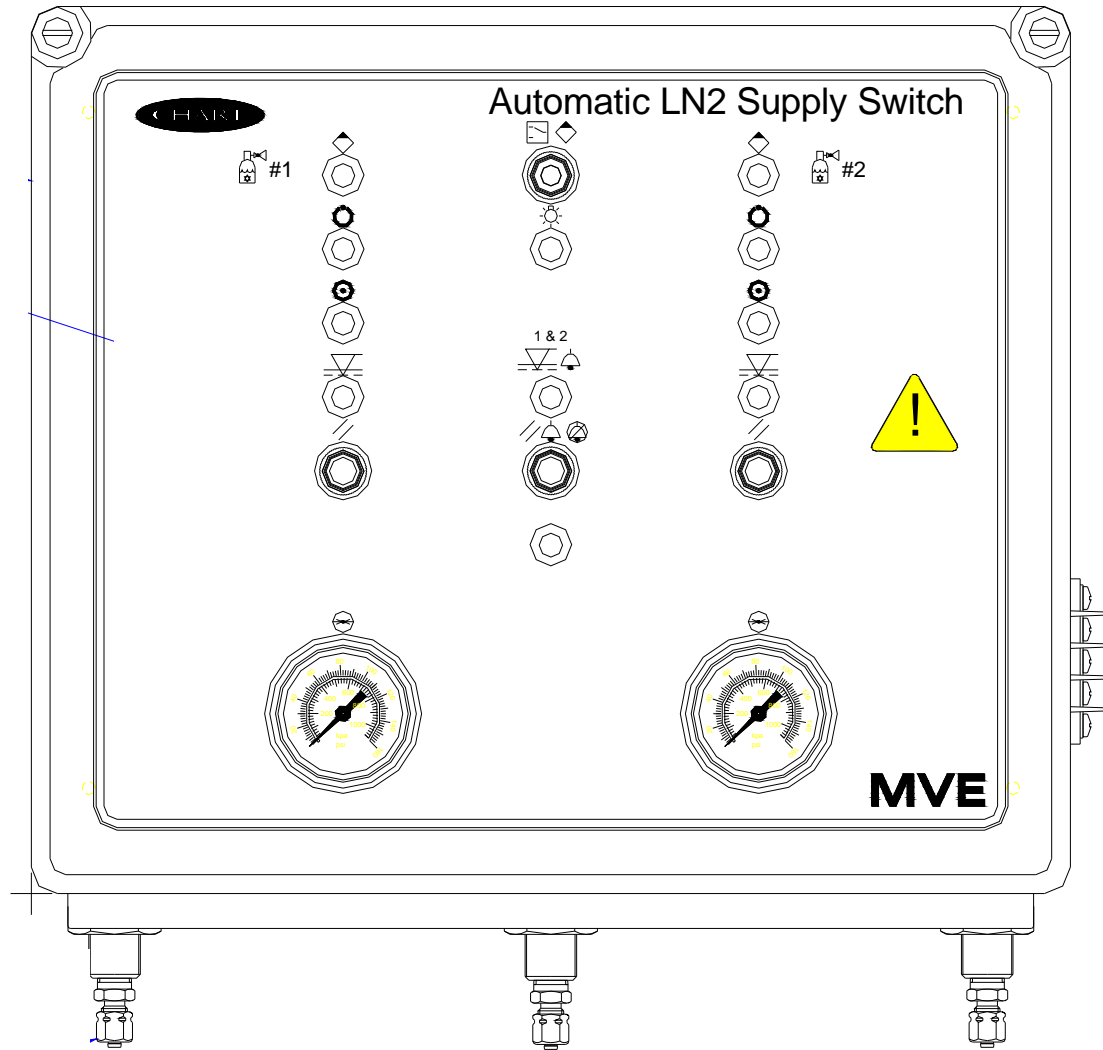
Chart Industries warrants the LN₂ Supply Switch against defects in materials and workmanship for a period of 2 years.

The warranty period commences on the date the product was first purchased. Please call our Technical Service department toll free for troubleshooting assistance: 800-482-2473.

(See page 33 for Warranty details)

MVE Automatic LN₂ Supply Switch

Product Identification



Symbolic Display Fig 11

(Supply#1)



- ◇ Primary Indicator
- Standby Indicator
- ⊙ In Use Indicator
- ≡ Empty Indicator
- // Reset Switch
- ⊕ Pressure Gauge



- ◇ Select Primary Toggle Switch
- ⊙ Power Indicator

1 & 2



- Both Empty Indicator
- Reset and Mute Alarm Switch
- Alarm Lamp

(Supply#2)



- ◇ Primary Indicator
- Standby Indicator
- ⊙ In Use Indicator
- ≡ Empty Indicator
- // Reset Switch
- ⊕ Pressure Gauge

MVE Automatic LN2 Supply Switch

Product Identification

Side Panel / Electrical / Physical Connections

1. Main Power Source Connection
2. Alarm Speaker Grille
3. Global Contact Connections 3 Terminals

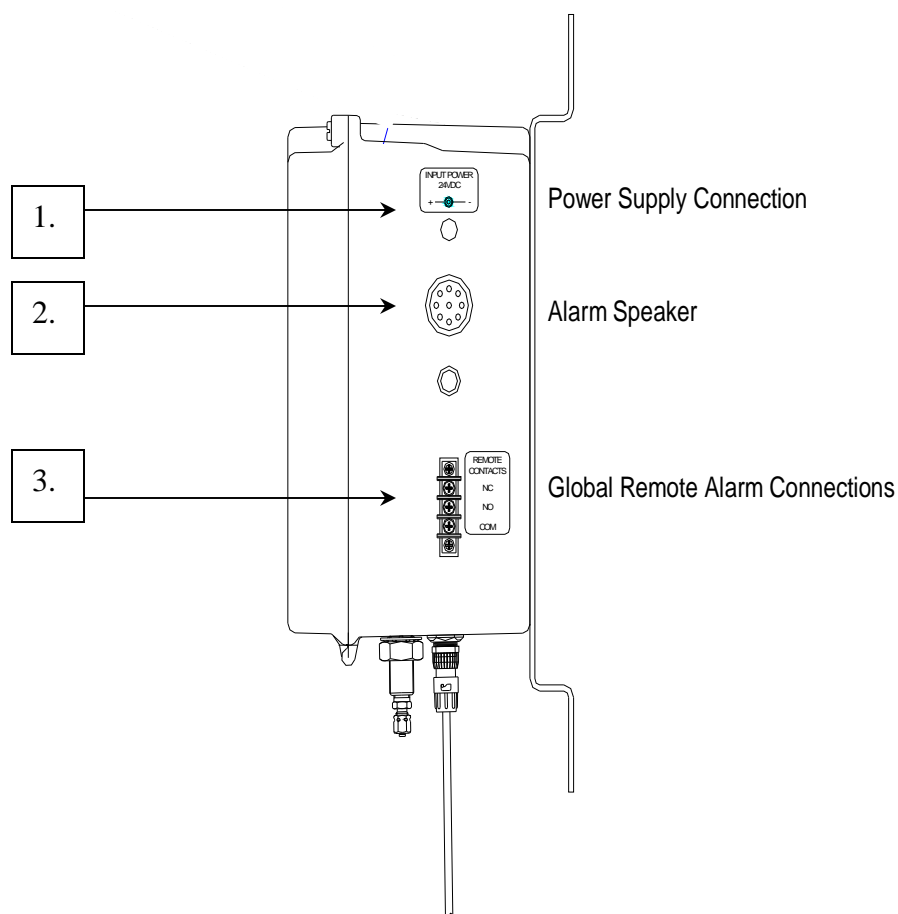


Fig 12

GLOBAL REMOTE ALARM CONNECTIONS:

These Connections monitor all alarms. They can be hardwired to any alarm system that uses Normally Open (NO) or Normally Closed (NC) contacts.

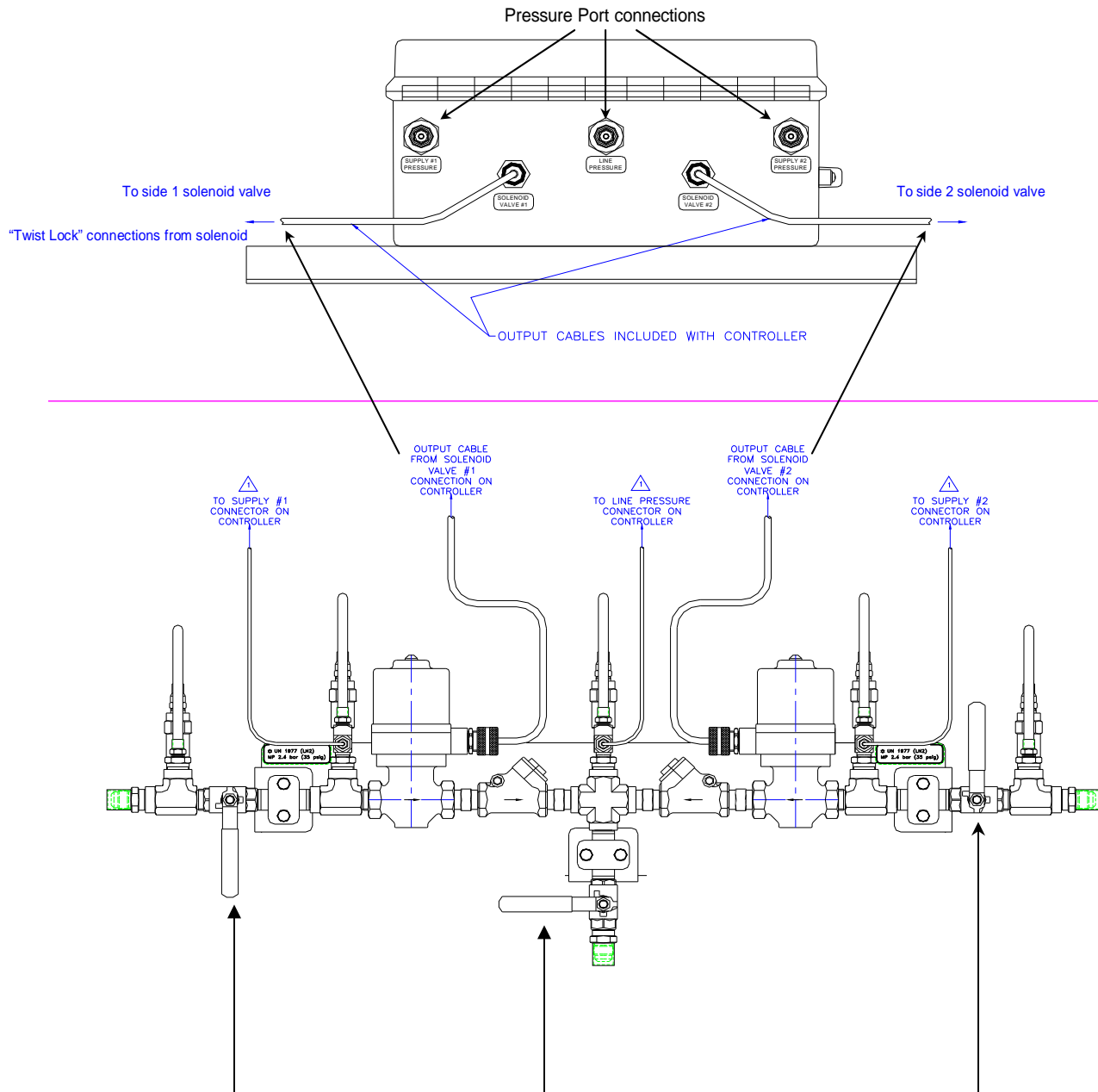
MVE Automatic LN2 Supply Switch

Product Identification

LN₂ Plumbing / Solenoid / Physical Connections

These connections below are a necessary part of the installation. There are 3 pressure port connections with compression fittings and 2 twist lock connections from the solenoid to the MVE LN₂ tank switch unit.

Fig 13



The LN₂ supply switch is equipped with three manual shut-off valves

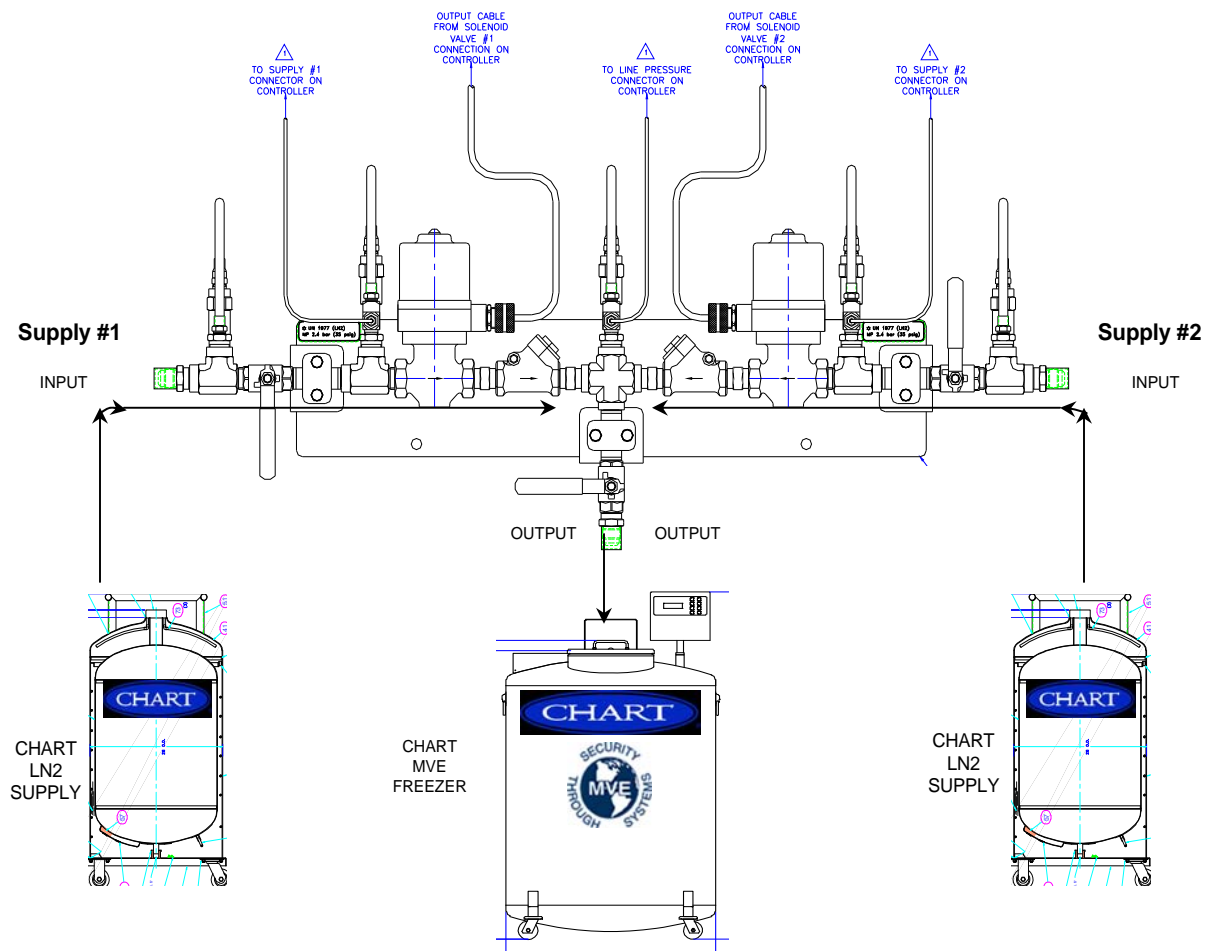
Fig 14

MVE Automatic LN2 Supply Switch

LN₂ Proper Flow Sequence

Fig 15

LN₂ Supply Switch Liquid Flow



MVE Automatic LN2 Supply Switch

Functions and Features

Operation

Operation of the unit is simple and straightforward. This is the control panel. The function of each panel component is described in the paragraphs on the next few pages.

0
200

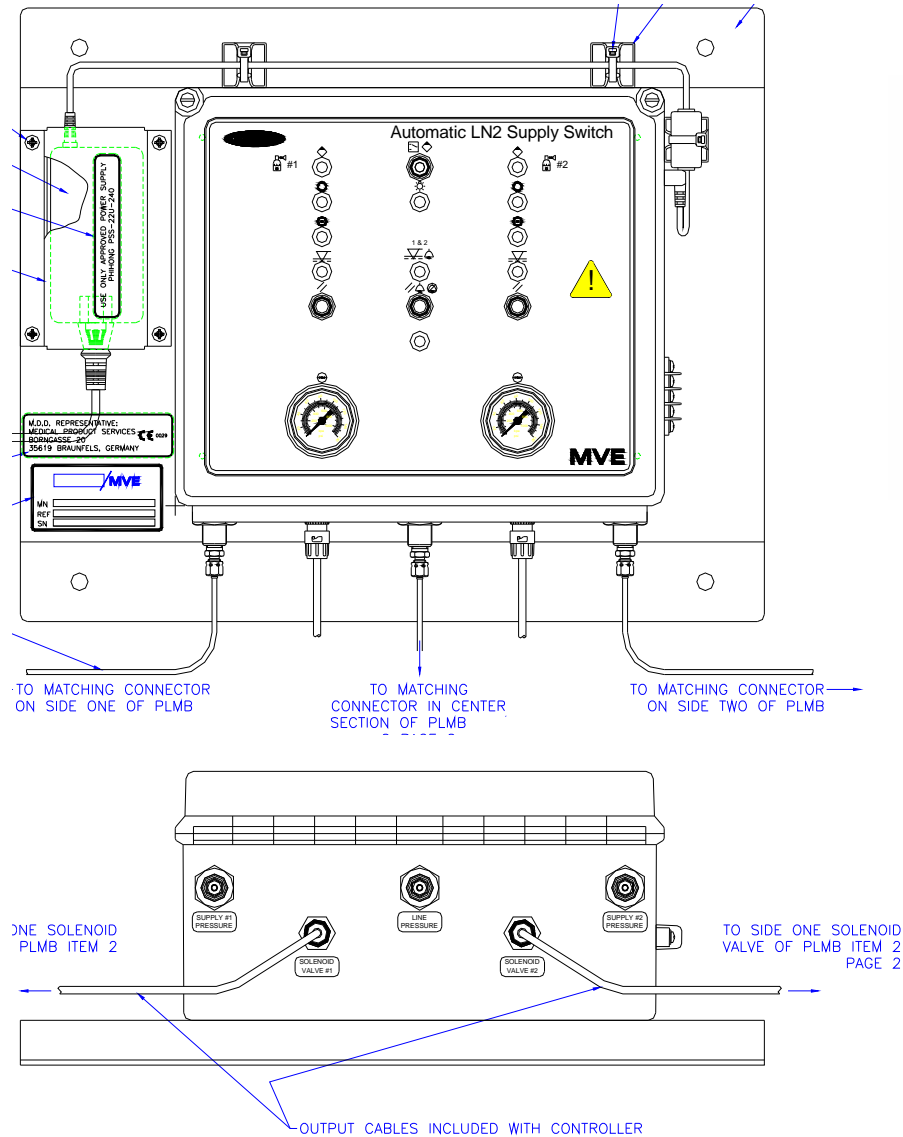


Fig 16

MVE Automatic LN2 Supply Switch

Function and features



Fig 18



SELECT PRIMARY switch:

The primary selector switch is a three-position toggle switch. Move the toggle lever toward the supply that you want to be the primary. The unit will supply any demand from the primary supply until it becomes empty. Then it will supply from the secondary. The middle position of the switch lever selects no primary. This position can be used to pause valve activity if necessary when disconnecting the outlet hose.



POWER indicator (green):

When power is supplied to the unit, the power indicator will be lit. As indicated earlier, there is no power switch. When the power cord is connected to an operational power outlet, power is supplied to the unit.



Fig 19



PRIMARY indicators (green):

The chosen primary supply is indicated by these lights. Only one primary indicator should be lit at any time. The selected primary will remain indicated even if it is empty and demand is supplied from the secondary supply. If the primary selector switch is in the middle position, no primary indicator will be lit.



STANDBY indicators (yellow):

When the associated supply is not empty and liquid is not being supplied from it, the standby indicator should be lit.



Fig 20



IN USE indicators (green):

When liquid is being supplied from the associated supply, the IN USE indicator will be lit. The corresponding STANDBY indicator will go out while the supply is in use. When the liquid demand is satisfied, the IN USE indicator will go out and the STANDBY indicator will come back on.



EMPTY indicators (red):

When the associated supply becomes empty, this indicator will come on.



RESET switches:

The reset switches in each supply column must be pressed to reset the empty indication for the associated supply. The empty indicator latches on when the supply runs out. When the supply is replenished, the corresponding reset switch must be pressed to change back to standby status. The status will not reset until pressure on the associated supply circuit indicates that it is not empty.

MVE Automatic LN2 Supply Switch

Function and features

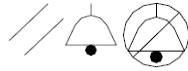


Fig 21



1 & 2 BOTH EMPTY indicator (red):

When both supplies become empty, this indicator will come on. The remote alarm contacts will be switched at this point and the audible alarm buzzer will sound.



RESET and MUTE ALARM switch:

This switch must be pressed to clear the both empty alarm status. At least one of the supply circuits must be in standby status for the alarm to be reset. This switch will mute the audible alarm for approximately 30 minutes. If the alarm condition is not corrected and cleared within that time, the audible alarm will come back on.



Fig 22



PRESSURE GAUGES:

The pressure gauges are provided for reference. They should be used to verify that the pressure of the supply tank is within the recommended parameters of 22 to 35 PSI (1.5 to 2.4 BAR) at connection time. The rough handling that portable liquid cylinders encounter can damage their gauges and cause incorrect pressure readings. If there is significant disparity between the pressure readings on the control panel and that of the supply tank, you may wish to point out the discrepancy to your liquid supplier.

NOTE: Cold gas inside an empty liquid cylinder will expand and build pressure as it warms. This will cause the pressure indication for the empty side to increase, possibly up to the relief pressure of the liquid cylinder. This is normal behavior that does not indicate a malfunction of the equipment. Pressure Gauge may read above 35 PSI (50-60 PSI) when LN2 is trapped between the Inlet and Outlet.



GLOBAL REMOTE ALARM CONNECTIONS:

These connections monitor all alarms. When there is no alarm, the Normally Open (NO) state is open and the Normally Closed (NC) is closed. Once the tank switcher alarms, these contacts change their state.

Fig 23

MVE Automatic LN2 Supply Switch

GLOBAL REMOTE ALARM CONNECTIONS

This illustration is a simple remote monitoring system wired to the (NO) Normally Open and the (COM) Common dry connections. These connections close when the tank switch alarms.

NO ALARM

COM – NC = CLOSED

COM – NO = OPEN

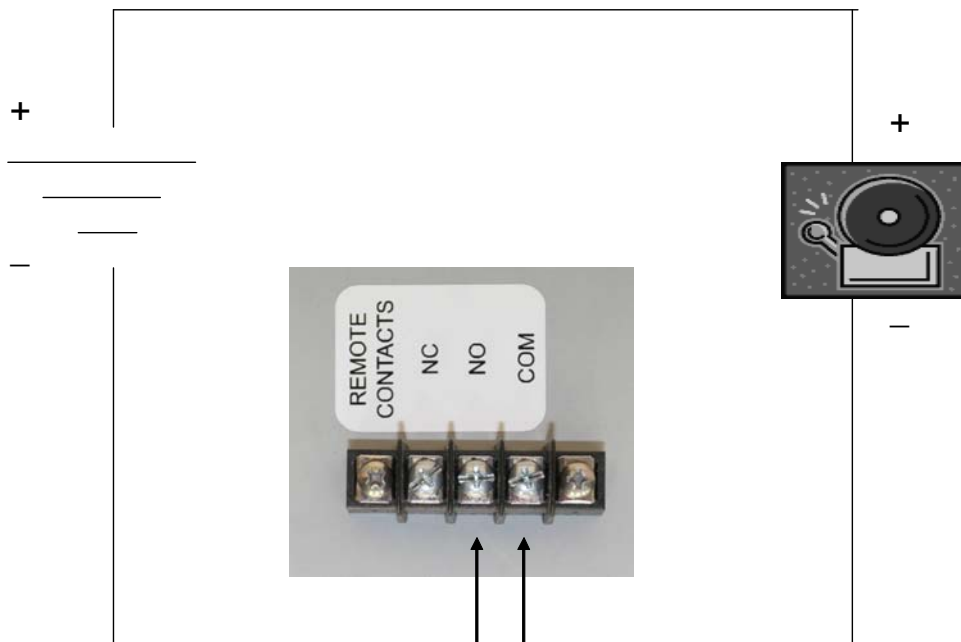
ALARM

COM – NC = OPEN

COM – NO = CLOSED



Fig 24



MVE Automatic LN2 Supply Switch

Maintenance

Controller and plumbing connections

The controller should be wiped clean regularly from dust and dirt accumulation. Inspection of the plumbing assembly, solenoid and copper connections in general should be performed at every refill or replacement of either supply tanks. Check all transfer hose connections for leaks, re-tighten as necessary.

Tech tip: Using a soapy substance in a spray bottle is useful for pinpointing suspected leak areas. Early detection of loose connections will allow for many years of trouble free service of the tank switch.

Condensation

When the tank switch begins supplying nitrogen, frost will normally appear on the supply side connected to the freezer. This is perfectly normal. Once the fill cycle is completed, the frost will eventually evaporate and there will be condensation. Absolutely avoid any electrical contact within the area.



Fig 25

MVE Automatic LN2 Supply Switch

Pressure switch test / adjustment procedure

Pressure switch location

Four pressure switches are located inside the enclosure of the LN2 Supply Switch. These are the recommended pressure settings.

PS1 @ 15PSI
PS2 @ 22PSI
PS3 and PS4 @ 10PSI.

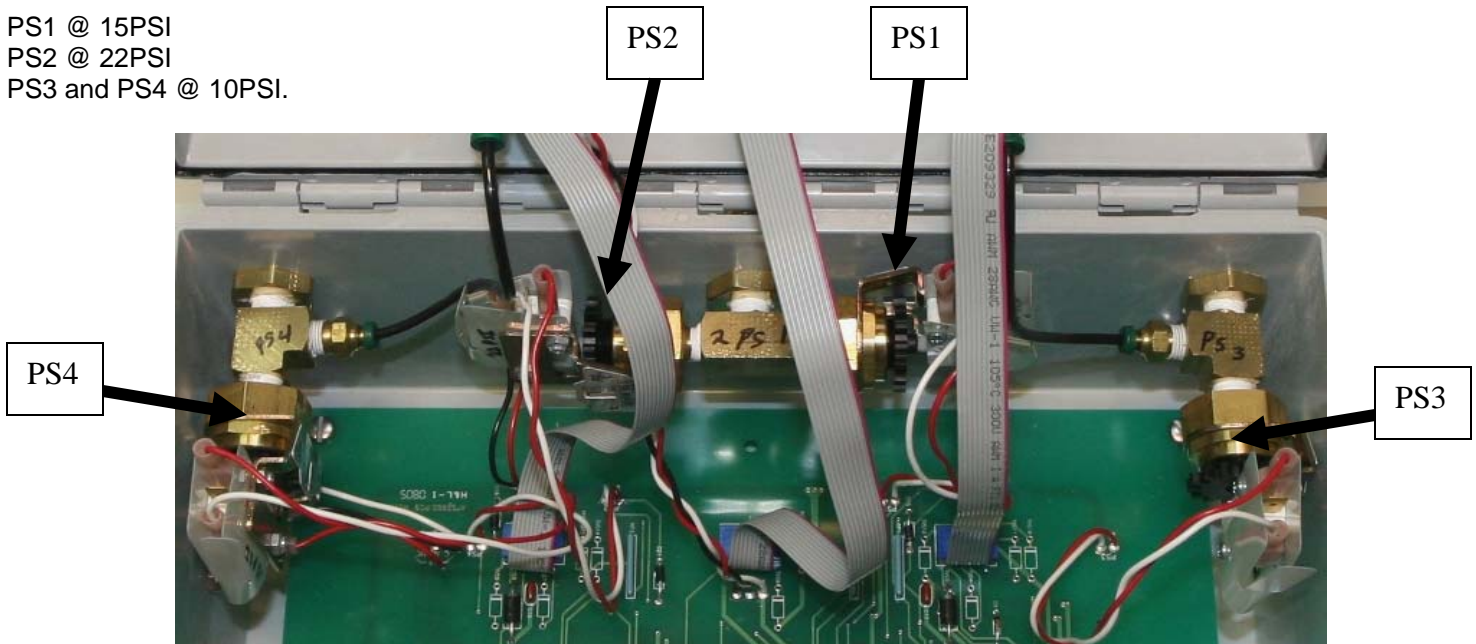


Fig 26

Pressure switch test procedure

Test and adjustments as follows

1. Disconnect power from unit.
2. Shut off and disconnect all LN₂ supplies.
3. With an ohmmeter, test for continuity between the COM (common) terminal and each of the NO (normally open) and NC (normally closed) terminals of the pressure switches.
 - 3.1 When the pressure on the switch is below the set pressure, there should be continuity between the COM and NC terminals. The COM-NO circuit should be open.
4. Connect a pressure source to the circuit to be tested. The supply tank can be used if it has sufficient pressure.
 - 4.1 If the discharge circuit that connects to the freezer (PS1 and PS2) is to be tested, the pressure source should be connected to the discharge port.
5. Open the valve from the pressure source gradually to apply pressure to the circuit slowly enough to observe the pressure build in the circuit.
 - 5.1 When the pressure rises above the set pressure, the contacts should switch. There should be continuity between the COM and NO terminals. The COM-NC circuit should be open.
6. If the contacts do not switch at the appropriate pressure, the switch is either faulty or requires adjusting.
 - 6.1 To adjust the pressure setting of the switch, turn the thumb wheel.
 - 6.1.1 Clockwise rotation increases the pressure setting.
 - 6.1.2 Counter Clockwise rotation decreases the pressure setting.
7. If adjusting the pressure setting will not cause the switch contacts to open or close at the appropriate pressure, the switch should be replaced.

MVE Automatic LN2 Supply Switch

Solenoid valve test procedure



Fig 27

1. Disconnect power to the unit.
2. Check the connections to the valve leads inside the external removable plug.
3. With an ohmmeter, check the resistance across the solenoid coil by touching the meter leads to the prongs on the external plug.
 - 3.1 The resistance of the coil should be ≈ 31.5 to 40Ω
 - 3.2 If the resistance is substantially less or greater than 31.5 to 40Ω , replace the valve.
4. Check the internal connections to the receptacle in the bottom of the enclosure.
5. Re-connect the plug to the receptacle
6. Re-connect power to the unit.
7. With a voltmeter, confirm that there is 24vdc between the + terminal (Red lead) of the receptacle and the – terminal of the incoming power jack.
 - 7.1 If there is no power to the receptacle,
 - 7.1.1 Check the connection to the + terminal bank
 - 7.1.2 Check the fuse itself for continuity.
8. With a jumper wire (18ga min), connect the – terminal of the receptacle (Red lead) to the – terminal of the incoming power jack.
 - 8.1 If the valve does not activate, replace the valve.

MVE Automatic LN2 Supply Switch

Relay test procedure

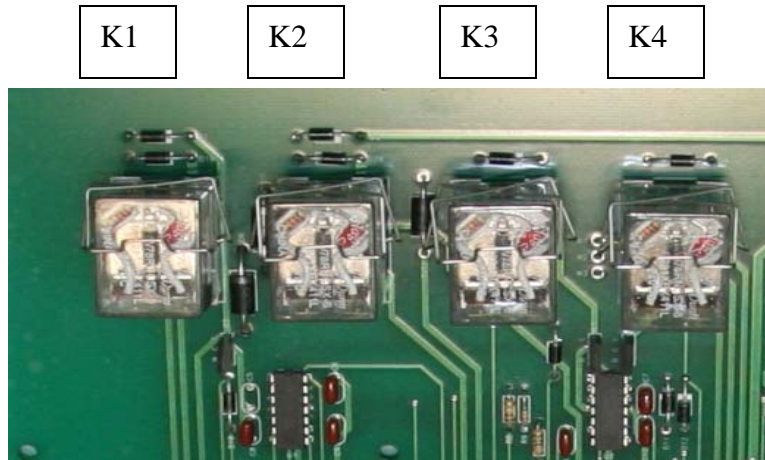


Fig 28

The logic PCB has 5 mounted sockets for relays. Four relays are used to perform the control functions of the MVE LN2 Supply Switch. All these relays have an LED indicator at the top to verify operation.

K1) Primary #1
K2) Primary #2
K3) Fill
K4) Alarm

Visually the relays can be inspected to verify its operation. They are equipped with an indicator LED that lights when the coil is powered. When the LED is lit the contacts switch from NC to the NO position, which can also be visually inspected.

Relay# 1 and #2 can be activated and deactivated via the selector switch.

Relay# 3 can be activated and deactivated several ways.

- With Supply # 1 activated and in standby mode (freezer not filling) relay # 3 will be deactivated. When the freezer calls for a fill, relay # 3 will activate. (the same for Supply #2)
- Begin a fill and simulate the supply tank running out enabling the tank switcher to switch automatically to the full supply side, relay # 3 will activate. (Either Supply 1 or 2 can be used for this test)

Relay# 4 is activated if the unit is not in alarm and can be de-activated by removing power to the box

Common Relay LED operations

TOGGLE SWITCH

<u>POSITION</u>	<u>LED CONTROL PANEL LIGHTS "ON"</u>	<u>RELAY LED "ON"</u>
CENTER	Initial power applied-Buzzer will sound-all empties are lit	None
CENTER	Press Reset Alarm-Buzzer stops-press Reset for either supply sides Connected (Supplies must be connected)	K3, K4
SUPPLY #1	POWER ON / PRIMARY ON / STANDBY ON / SUPPLY#2 STANDBY ON	= K1, K4
SUPPLY #1	POWER ON / PRIMARY ON / IN USE ON / SUPPLY#2 STANDBY ON	= K1, K3, K4
SUPPLY #2	POWER ON / PRIMARY ON / STANDBY ON / SUPPLY#1 STANDBY ON	= K2, K4
SUPPLY #2	POWER ON / PRIMARY ON / IN USE ON / SUPPLY#1 STANDBY ON	= K2, K3, K4

When the supply tank empties and the LN2 Supply Switch automatically switches over.

SUPPLY#1	POWER ON / PRIMARY ON / RED "EMPTY" / SUPPLY#2 IN USE ON	= K3, K4
SUPPLY#2	POWER ON / PRIMARY ON / RED "EMPTY" / SUPPLY#1 IN USE ON	= K3, K4
BOTH EMPTY	----->	None
ALARM MODE	NO RELAYS ACTIVATED – ALL LEDS ARE OFF	

Relay P/N 14248621

MVE Automatic LN2 Supply Switch

Troubleshooting guide

Please make certain the ribbon cables are secured to their connections to both the main PCB and the individual LED PCB's on the inside of the control panel. Verify the terminal lug connections to the pressure switches are secured as well.

The following is a guide for troubleshooting problems encountered with the operation of your MVE Automatic LN2 Supply Switch. In the event you've encountered a symptom not addressed in this guide, please contact our Technical Service Departments.

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Symptom	Possible Cause	Test and corrective actions
Power indicator not lit	1- No power to the unit	1- With a voltmeter, confirm primary power from the wall outlet. If there is no power at the outlet, contact an electrician or your facilities maintenance personnel
	2- No power from the power supply	2- Check for 24vdc power at the plug that connects to the input power jack on the control enclosure with a voltmeter, If there is no power at the plug. Replace the power supply.
	3- Blown fuse	3- Check the fuse inside the enclosure with an ohmmeter. If the fuse is blown, replace. P/N 14248648 (See pg 31)
	4- No power to the indicator	4- Check for 24vdc to the + terminal on the back of the indicator. If there is no power to the indicator, check the connection to the + terminal bank.
	5- Faulty indicator	5- If other panel indicators are lit at the appropriate times, test the indicator. Use a jumper wire to connect the - terminal of the indicator to the - side of the incoming power jack. If the indicator does not light, replace it.

Selected Primary indicator is not lit.	1- See causes 1-5 for power indicator not lit. 2- Faulty Primary selector switch	1- See corrective actions 1-5 for power indicator not lit. 2- Disconnect power from the unit. With ohmmeter, check for continuity between the top center terminal of toggle switch and the appropriate side terminal with the switch lever in the appropriate position. <u>Note: on the back of the switch, the associated terminals are opposite the indicator instead of adjacent. If there is not continuity between the appropriate terminals, replace the switch.</u>
Standby indicator is not lit at the appropriate time. Relays K1, K2 should be ON	1- See causes 1-5 for power indicator not lit. 2- Faulty relay (K1, K2) 3- Too much pressure from the supply tank	1- See corrective actions 1-5 for power indicator not lit. 2- See Relay verification on page 23 verify LED is lit and that contacts have switched from the NO to NC position. If not replace. 3- Reduce the pressure from the supply tank to 20-22PSI
Empty indicator is not lit at the appropriate time. Relays K3, K4 should be ON	1- See causes 1-5 for power indicator not lit. 2- Faulty relay (K3, K4)	1- See corrective actions 1-5 for power indicator not lit. 2- See Relay verification on page 23 verify LED is lit and that contacts have switched from the NO to NC position. If not replace.
Both empty indicator is not lit at the appropriate time Relays should be off	1- See causes 1-5 for power indicator not lit. 2- Faulty relays (K1,K2,K3,K4)	1- See corrective actions 1-5 for power indicator not lit. 2- See relay verification on page 23

No response to the supply reset button	<p>1- No supply pressure</p> <p>2- Faulty reset switch</p> <p>3- Manual shut-off valves</p>	<p>1- Confirm that the supply tank has liquid and sufficient pressure to operate. Supply pressure should be 22 to 35 PSI for proper operation. Pressure below 10PSI will not allow the bank to reset. Check that it is properly connected to the switch unit and that the valve is open.</p> <p>2- Disconnect power to the unit. With an ohmmeter, check for continuity across the switch terminals when the button is released and no continuity when it is pressed. If continuity is not interrupted when the button is pressed, replace the switch.</p> <p>3- Confirm the valves are in the open position. Turn valves in either position and note the changes on the pressure gauges.</p>
No response to the Both empty alarm Reset button	1- See causes 1&2 for no response to the supply reset button.	1- See corrective action 1&2 for no response to the supply reset button.
Audible alarm buzzer does not sound	1- Ambient noise level too high	<p>1- The alarm buzzer operates at 75db Inside the enclosure. A screened port is provided on the side of the enclosure to minimize the reduction in the sound level.</p> <p>However, if the ambient noise level is too high, it can prevent hearing the buzzer. A remote audible alarm can be connected to the remote alarm contacts if a louder audible alarm is required; but the audible mute on the control panel will not mute the remote alarm.</p>
No response to the audible mute button when buzzer is active	1- Faulty mute switch	1- Disconnect power to the unit. With an ohmmeter, check for continuity across the switch terminals when the button is released and no continuity when it is pressed. If continuity is not interrupted when the button is pressed, replace the switch.

The remote alarm contacts do not switch at the appropriate time.	1- Faulty connections in the terminal strip	1- Check connections at the terminal strip
<p>No supply solenoid valve activated when liquid is called for.</p> <p><u>Make sure the manual shut off valves are fully opened</u></p>	<p>1- Both supplies empty</p> <p>2- Primary selector switch in the center neutral position.</p> <p>3- Faulty Primary selector switch</p> <p>4- Faulty pressure switch</p> <p>5- Faulty relay</p> <p>6- Faulty solenoid valve</p>	<p>1- Confirm that at least one supply tank have sufficient liquid and pressure to supply demand.</p> <p>2- A primary must be selected for the unit to supply the demand.</p> <p>3- See corrective action #2 for "Selected Primary indicator is not lit," above.</p> <p>4- Test pressure switches PS1, PS2, PS3 and PS4 (see page 21)</p> <p>5- See Relay verification on page 23 verify LED is lit and that contacts have switched from the NO to NC position. If not replace.</p> <p>6- Test solenoid valves (see page 22)</p>
Supply solenoid valve does not deactivate when the demand is met.	<p>1- Insufficient time allowed for deactivation.</p> <p>2- A leak in the system</p> <p>3- Faulty pressure switch</p>	<p>1- The tank switcher will deactivate the solenoid valve when the pressure in the discharge circuit rises above 22PSI setting of PS2. If the nominal supply pressure is 22PSI, time must be allowed for the liquid or cold gas in the circuit to warm up and build pressure above the 22PSI.</p> <p>2- Close the middle manual shut-off valve connected to the freezer. If this allows sufficient pressure to build to deactivate the solenoid valve, check the discharge hose connection and any other connections down stream for leakage.</p> <p>3- Test pressure switch PS2 (see page 22)</p>

Supply solenoid valve cycles on and off when freezer is filling	<p>Supply pressure too high</p> <p><u>Note: Make certain tank switcher cycles to stand by mode when not filling; solenoid valves may over heat.</u></p>	<p>If the supply tanks pressure is high enough to bring the pressure in the discharge circuit above 22PSI; when the supply solenoid valve opens, pressure switch PS2 will turn valve off.</p> <p>1- If the supply tank is equipped with a pressure building (PB) circuit, the PB regulator should be set below 22PSI, 18PSI is optimum.</p> <p>2- If the supply must be operated with PB setting at or above 22PSI, switch PS2 should be adjusted to shut off the supply valve at a pressure slightly above the PB set point. (See page 21)</p>
Supply solenoid valve cycles on and off when there is no demand	There is a leak in the discharge circuit, hose, the hose connections; or the freezer plumbing	Locate the leak using a soapy solution and repair the leak (see page 20) Maintenance
Unit does not switch to the secondary supply when the primary becomes empty	1- Abnormally high tank pressure.	<p>1- If it was necessary to increase the set pressure for PS2, due to high tank pressure, an extended amount of time may be <u>required to vent the pressure</u> down to the 10PSI setting of the empty detection switches. PS3 and PS4.</p> <p>2- Test pressure switch PS3 for supply #1 or PS4 for supply #2 (see page 20)</p>
Unit does not activate the both empty alarm when the secondary becomes empty	See causes for "Unit does not switch to the secondary supply when the primary Becomes empty" above	See corrective actions for "Unit does not switch to the secondary supply when the primary becomes empty" above

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MVE Automatic LN2 Supply Switch

Parts list

AUTOMATIC LN2 SUPPLY SWITCH WITH 1/2" VALVES & PLUMBING

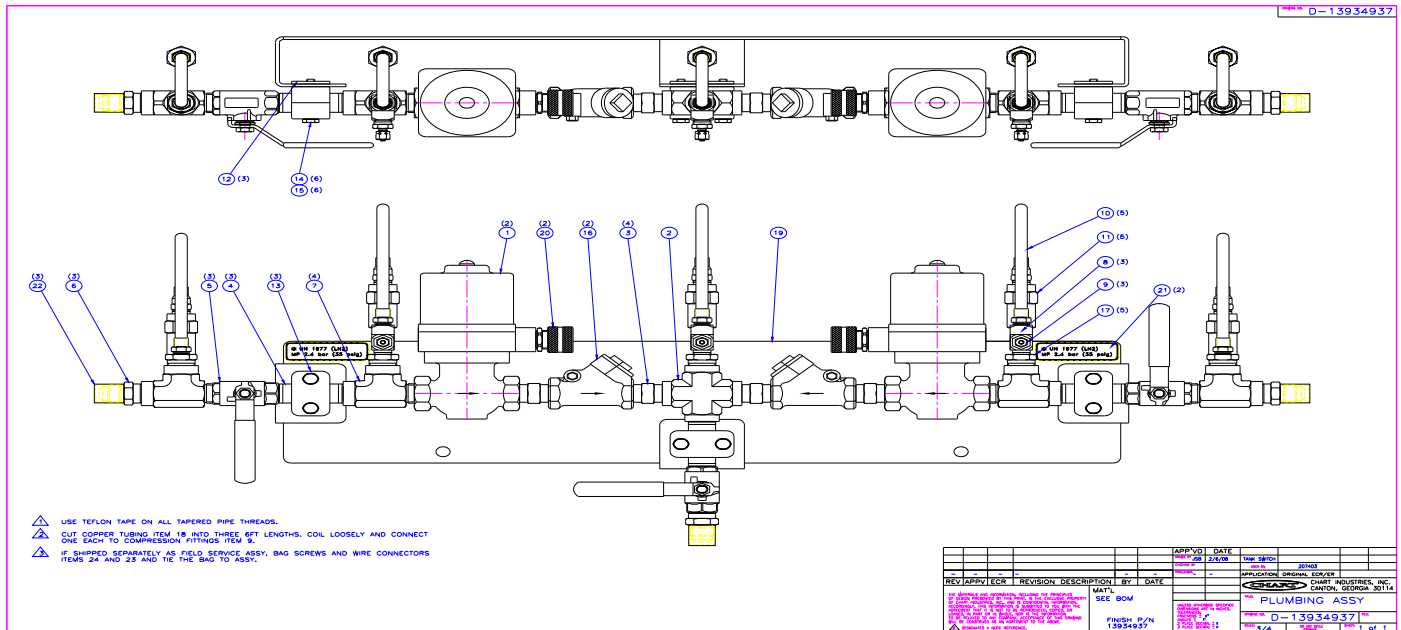
PN 13934911

<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>SEQ</u>
10619106	BOARD 1*4*14'LG	3	
10619181	FLAKEBOARD 4*8	1.5	
13934929	CONTROL ASSY TANK SWITCHER	1	1
13934937	PLUMBING ASSY TANK SWITCH 1/2"	1	2
13934945	MOUNTING BRKT TANK SWITCH	1	3
13934953	MNL AUTO TANK SWITCH LRG VLV	1	4
13902370	BOLT LAG CS 5/16*3"LG	4	6
4615746	CABLE TIE HOLDER 1-1/8"*1-1/8"	4	7
2915249	WIRE TIES 4"	4	8
2915841	PHPNHMS SS #10-32*1/2"LG	4	9
11207138	PHPNHMS SS #10-32*3/4"LG	4	10
14010103	POWER CORD DETACHABLE 18/3 SJT	1	11
10995355	POWER SUPPLY 24VDC 30W 1.25A	1	13
11029503	BRKT POWER SUPPLY BIO SERIES	1	14
14340292	LABEL SN BASIC W/BAR CODE	1	15
11795275	LABEL POWER SUPPLY PHIHONG CE	1	16
13934970	LABEL FRNT TANK SWITCH ENGLISH	1	19
14321930	MNL QK REF AUTO LN2 TANK SW		

CONTROL ASSY TANK SWITCHER W/PRINTED CIRCUIT CONTROLLER

<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>SEQ</u>
13934996	CONTROLLER TANK SW INCOMPLETE	1	1
1012262	CONN BRS 1/8ODT*1/8MPT	3	2
2811346	TUBE NYL .125"OD .031W BLACK	1	3
1013472	CONN BRS 1/8ODT*1/8FPT	2	4
1013632	CONN BRS 1/8ODT*1/8MPT	2	5
1213082	TEE BRS M BR 1/8	1	6
1213452	TEE STREET BRS 1/8 FORGED	2	7
2914202	CONN BRS ANCHOR 1/8NPT*5/8-18	3	8
13935024	KIT LABEL EXTERIOR TANK SWITCH	1	9
13935067	LABEL FRNT TANK SW SYMBOLIC	1	10
11207306	PG PNL MNT CLAMP NOSHOK 1.5"	2	11
13935112	PRESS SWITCH 6-30PSI 1/8MPT	3	12
13935139	PRESS SWITCH 20-120PSI 1/8MPT	1	13
13935219	LABEL FUSE ID PCB TANK SWITCH	1	14
14940141	PG 1-1/2"DIAL 0-60PSI 1/8"CBM	2	15
14248621	RELAY	4	
14248648	FUSE MINI ATO 32V 3A	1	

MVE Automatic LN2 Supply Switch



PLUMBING ASSY TANK SWITCH 1/2"

PN 13934937

PART NUMBER	DESCRIPTION	QTY	SEQ
13935227	VALVE SOLENOID 1/2 24VDC	2	1
11036367	CROSS BRS 1/2FPT	1	2
1310102	NIPPLE HEX BRS 1/2NPT SCH 40	4	3
1312502	NIPPLE BRS 1/2NPT*3	3	4
12962291	VALVE BALL BRS 1/2FPT W/SS	3	5
1110122	CONN BRS 1/2ODT*1/2MPT 45D FL	3	6
11551035	TEE STREET BRS 1/2NPT FORGED	4	7
1211702	TEE STREET BRS 1/4NPT	3	8
1012822	CONN BRS 1/8ODT*1/4MPT	3	9
10490955	RV TUBE S/A XLC	5	10
1810032	RV BRS 1/4MPT 50PSI	5	11
3411111	WELD PLATE SP 3000 SERIES	3	12
3411226	STAUFF CLAMP 1/2PS	3	13
10955484	INSERT PLS PIPE CLAMPS	6	14
2952051	HHCS SS 1/4-20*2"LG	6	15
11208931	VALVE CHECK BRZ 1/2FPT	2	16
1210032	BSHG HEX BRS 1/2MPT*1/4FPT	5	17
6910683	TUBE CU .125"OD D&S SOFT	18	18
13935243	MOUNTING BRKT PLMBG 1/2" TANK	1	19
4910445	HBL-SHC1020 1/2 CORD GRIP	2	20
11795291	LABEL REFRIGERANT DATA EXT PS	2	21
4010542	CAP INERT SVCE FILL & VENT FTG	3	22
10740117	SPLICE 22-16GA CRIMP ON	4	23
2915919	BOLT LAG CS 3/8 * 1-1/2 LG	4	24



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