



Product Manual

Nomad 830G MP

MicroBulk On-Site Storage and Delivery System



Designed and Built by:

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Revision Log

Revision Level	Date	Description
A	01/11/2016	Original manual
B	11/14/2018	Update cover photo and Specs, Schematics
C	12/28/2018	Further update on Schematics, Plumbing and Filling options



Preface

General

The Nomad 830 MP is a mobile version of the very popular Perma-Cyl® 3000 MicroBulk Storage System. The Nomad Series comes complete with a 4700 SCFH vaporizer, trailer and gas use connection for immediate use in a wide range of gas applications. The tank plumbing is designed with pressure building and economizer circuits to match the vaporizer flow rate for maximum efficiency.

Another feature of the Nomad 830 MP is the utilization of the FlexFill™ Piping Option technology. FlexFill is a top and bottom fill circuit that replaces the top float assembly so the driver can control the tank pressure while filling the unit.

Standard Product Features

- Premium Quality Drop-Deck Felling® Trailer
 - 2.5” Lunette Eye/Pintle Hitch
- High-Performance Ambient Vaporizer
- Robust Field-Proven Internal Tank Support System
- Thermal Efficient Super Insulation System
- Optimized Pressure Builder & Economizer Design
- Low Pressure Road Relief Circuit (CGA-341)
- High Performance Pressure Building Coil
- Stainless Steel Piping
- Dual Safety System with Diverter Valve
- One-Year Parts & Vacuum Warranty

Options

- Single End Use Regulator with 6-Port gas use manifold
- Dual Regulating Manifold with 6-Port gas use manifold
- Gooseneck Felling® trailer
- 1-1/2” Bulk Fill Connection Kit

Product Manual

The Nomad Series Product Manual is designed to be used in conjunction with Nomad 830G MP. If there are any questions regarding the operation of the tank, contact Chart’s Technical Service division at 1-800-400-4683.

This manual contains information regarding the safe operation and handling of oxygen, nitrogen and argon. It should be thoroughly read and understood by anyone that operates the equipment.

The safety requirements for operating the tank and handling or transporting extremely cold liquid products are shown in the Safety section. Use this safety section as a “Safety Checklist” each time the equipment is being used.

The Introduction/Operation section discusses the general features of the tank and the theory of operation. Also included in this section is information on the primary plumbing circuits.

In the Filling Procedure there are complete instructions on the first fill, purging and liquid delivery.

The Plumbing section contains schematics and part detail information to help in identifying various parts of the Nomad 830 MP.

A Troubleshooting section is included to help answer common questions for specific problems that may occur.

In the Specifications section there is a table that describes the capacities, general specifications and performance of the system along with more detailed drawings.

Terms

Throughout this manual safety precautions will be designated as follows:



Warning! *Description of a condition that can result in personal injury or death.*



Caution! *Description of a condition that can result in equipment or component damage.*



Note: *A statement that contains information that is important enough to emphasize or repeat.*

Acronyms / Abbreviations

The following acronyms / abbreviations are used throughout this manual:

Ar	Argon
ASME	American Society of Mechanical Engineers
BARG	Pressure Metric (Gauge)
CGA	Compressed Gas Association
CO ₂	Carbon Dioxide
MAWP	Maximum Allowable Working Pressure
N ₂	Nitrogen
NER	Nominal Evaporation Rate
NFPA	National Fire Protection Association
O ₂	Oxygen
PB	Pressure Builder
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch (Gauge)
SCF	Standard Cubic Feet
SCFH	Standard Cubic Feet/Hour
UFC	Uniform Fire Code



Safety

General

Chart equipment is designed and built to the most rigid standards, however no piece of mechanical equipment can ever be made 100% foolproof. Strict compliance with proper safety and handling practices is necessary when using a cryogenic system. We recommend that all our customers re-emphasize safety and safe handling practices to all their employees and customers.

While every possible safety feature has been designed into the unit and safe operations are anticipated, it is essential that the user of the cryogenic system carefully read and fully understand all WARNINGS and CAUTION notes listed in this safety summary and enumerated below.

The Nomad 830 MP, with its stainless steel support system is designed, manufactured and tested to function normally for many years of service.



Warning! *It is never safe to drop a liquid cylinder or let it fall over in oxygen or any cryogenic service.*

In the event a liquid cylinder is inadvertently dropped, tipped over, or abused slowly raise it to its normal vertical position and immediately open the vent valve to release any excess pressure in a safe manner. As soon as possible remove the liquid product from the vessel in a safe manner. If the vessel has been used in oxygen service, purge it with an inert gas (nitrogen). If damage is evident or suspected, return the unit to Chart prominently marked "LIQUID CYLINDER DROPPED INSPECT FOR DAMAGE."



Warning! *Any welding that is done on the outside of the 830 MP can cause loss of vacuum and will VOID any warranty on the unit.*



Warning! *Before removing any parts or loosening fittings, completely empty the cryogenic cylinder of liquid contents and release any vapor pressure in a safe manner.*

External valves and fittings can become extremely cold and may cause painful burns to personnel unless properly protected. Personnel must wear protective gloves and eye protection whenever removing parts or loosening fittings. Failure to do so may result in personal injury due to the extreme cold and pressure in the cylinder.



Warning! *Use only replacement parts that are compatible with liquid oxygen and have been cleaned for oxygen use.*

Do not use regulators, fittings, hoses, etc., which have been previously used in a compressed air environment. Failure to comply with these instructions may result in serious damage to the container.



Caution! *All valves on an empty 830 MP should always be kept closed to protect the inner vessel and plumbing from being contaminated.*

Safety Bulletin

Portions of the following information is extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. Additional information on oxygen, nitrogen, argon, and cryogenics is available from the CGA.

Cryogenic containers, stationary or portable, are from time to time subjected to assorted environmental conditions of an unforeseen nature. This safety bulletin is intended to call attention to the fact that whenever a cryogenic container is involved in any incident whereby the container or its safety devices are damaged, good safety practices must be followed. The same holds true whenever the integrity or function of a container is suspected of abnormal operation.

Incidents which require that such practices be followed include: highway accidents, immersion of a container in water, exposure to extreme heat or fire, and exposure to most adverse weather conditions (earthquake, tornadoes, etc.) Under no circumstances should a damaged container be left with product in it for an extended period of time.

Prior to reusing a damaged container, the unit must be tested, evaluated and repaired as necessary. It is highly recommended that any damaged container be returned to Chart for repair and re-certification.

In the event of known or suspected container vacuum problems (even if an extraordinary circumstance such as those noted above has not occurred), do not continue to use the unit. Continued use of a cryogenic container that has a vacuum problem can lead to embrittlement and cracking.

The remainder of this safety bulletin addresses those adverse environments that may be encountered when a cryogenic container has been severely damaged. These are oxygen deficient atmospheres, oxygen enriched atmospheres, and exposure to inert gases.



Caution! Before locating oxygen equipment, become familiar with the NFPA standard No. 55 “Compressed Gases and Cryogenic Fluids Code” (www.nfpa.org) and with all local safety codes.

Oxygen Deficient Atmospheres



Warning! Nitrogen and argon vapors in air may dilute the concentration of oxygen necessary to support or sustain life. Exposure to such an oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.

The normal oxygen content of air is approximately 21%. Depletion of the oxygen content in air, either by combustion or by displacement with inert gas, is a potential hazard and users should exercise suitable precautions.

One aspect of this possible hazard is the response of humans when exposed to an atmosphere containing only 8 to 12% oxygen. In this environment unconsciousness can be immediate with virtually no warning.

When the oxygen content of air is reduced to about 15 to 16%, the flame of ordinary combustible materials, including those commonly used as fuel for heat or light, may be extinguished. Somewhat below this concentration, an individual breathing the air is mentally incapable of diagnosing the situation because the onset of symptoms such as sleepiness, fatigue, lassitude, loss of coordination, errors in judgment and confusion can be masked by a state of “euphoria,” leaving the victim with a false sense of security and well being.

Human exposure to atmosphere containing 12% or less oxygen leads to rapid unconsciousness. Unconsciousness can occur so rapidly that the user is rendered essentially helpless. This can occur if the condition is reached by an immediate change of environment, or through the gradual depletion of oxygen.

Most individuals working in or around oxygen deficient atmospheres rely on the “buddy system” for protection - obviously the “buddy” is equally susceptible to asphyxiation if he or she enters the area to assist the unconscious partner unless equipped with a portable air supply. Best protection is obtained by equipping all individuals with a portable supply of respirable air. Life lines are acceptable only if the area is essentially free of obstructions and individuals can assist one another without constraint.

If an oxygen deficient atmosphere is suspected or known to exist:

1. Use the “buddy system.” Use more than one “buddy” if necessary to move a fellow worker in an emergency.
2. Both the worker and “buddy” should be equipped with self-contained or airline breathing equipment.

Oxygen Cleaning

When replacing components, only use parts which are considered compatible with liquid oxygen and have been properly cleaned for oxygen service (Refer to CGA Bulletin G-4.1 “Equipment Cleaned for Oxygen Service”). Do not use regulators, fittings, or hoses which were previously used in a compressed air environment on these tanks. Only oxygen compatible sealants or Teflon tape should be used on threaded fittings. All new piping joints should be leak tested with an oxygen compatible leak-test solution.

Oxygen Enriched Atmospheres

An oxygen enriched atmosphere occurs whenever the normal oxygen content of air is allowed to rise above 23%. While oxygen is nonflammable, ignition of combustible materials can occur more readily in an oxygen rich atmosphere than in air; and combustion proceeds at a faster rate although no more heat is released.

It is important to locate an oxygen system in a well ventilated location since oxygen rich atmospheres may collect temporarily in confined areas during the functioning of a safety relief device or leakage from the system.

Oxygen system components, including but not limited to, containers, valves, valve seats, lubricants, fittings, gaskets and interconnecting equipment including hoses, shall have adequate compatibility with oxygen under the conditions of temperature and pressure to which the components may be exposed in the containment and use of oxygen. Easily ignitable materials shall be avoided unless they are parts of equipment or systems that are approved, listed, or proven suitable by tests or by past experience.

Compatibility involves both combustibility and ease of ignition. Materials that burn in air may burn violently in pure oxygen at normal pressure, and explosively in pressurized oxygen. In addition, many materials that do not burn in air may do so in pure oxygen, particularly when under pressure. Metals for containers and piping must be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions may call for other materials (usually copper or its alloy) because of their greater resistance to ignition and lower rate of combustion.

Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials may be ignited by friction at a valve seat or stem packing, or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.



Warning! If clothing should be splashed with liquid oxygen it will become highly flammable and easily ignited while concentrated oxygen remains. Such clothing must be aired out immediately, removing the clothing if possible, and should not be considered safe for at least 30 minutes.

Nitrogen and Argon

Nitrogen and argon (inert gases) are simple asphyxiates. Neither gas will support or sustain life and can produce immediate hazardous conditions through the displacement of oxygen. Under high pressure these gases may produce narcosis even though an adequate oxygen supply sufficient for life is present.

Nitrogen and argon vapors in air dilute the concentration of oxygen necessary to support or sustain life. Inhalation of high concentrations of these gases can cause anoxia, resulting in dizziness, nausea, vomiting, or unconsciousness and possibly death. Individuals should be prohibited from entering areas where the oxygen content is below 19% unless equipped with a self-contained breathing apparatus. Unconsciousness and death may occur with virtually no warning if the oxygen concentration is below approximately 8%. Contact with cold nitrogen or argon gas or liquid can cause cryogenic (extreme low temperature) burns and freeze body tissue.

Persons suffering from lack of oxygen should be immediately moved to areas with normal atmospheres. SELF-CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts worker's skin or eyes, the affected tissue should be flooded or soaked with tepid water (105-115°F or 41-46°C). DO NOT USE HOT WATER. Cryogenic burns that result in blistering or deeper tissue freezing should be examined promptly by a physician.

Personal Protective Equipment (PPE)

The following personal protective equipment is recommended when working around cryogenic liquid:

- Safety glasses with side shields to prevent cryogenic liquid from splashing into the eyes
- Chemical / Liquid resistant gloves to prevent cryogenic burns on exposed hands
- Long sleeve shirts to protect the arms
- Cuffless trousers worn over closed shoes



Introduction/Operation

General

The new Nomad 830 MP Storage and Delivery System is another extension of the Perma-Cyl® MicroBulk Storage System's innovative design and technology. The Nomad 830 MP maintains all the features of the existing Perma-Cyl system with the improved benefit of being mobile. The horizontal orientation and low profile of the Nomad 830 MP as well as the design of the trailer base allows for easy, versatile handling and mobility.

This product was designed for the volume MicroBulk user in mind. Several features include fast fill capability (top and bottom) and extended hold time. The fast fill feature is accomplished with two filling valves, a top and a bottom fill valve which allows for the tank to be filled efficiently without any venting or loss of product (zero losses) under normal conditions.

The cylinder also uses the most advanced pressure building and vaporization technology today. The external PB vaporizer is mounted under the tank for optimum performance. The single flat fin design allows it to shed ice easily and maintain pressure during high gas use rate situations.

The external process vaporizer is a stand alone vaporizer mounted onto the trailer. For optimum performance, the trailer should be parked with this vaporizer in as much sun exposure as possible.

Installation Common Codes and Standards

The installer will need to find out what local city ordinances and which rules they are mandated to follow. One of the following standards may apply:

- Uniform Fire Code (UFC)
- Compressed Gas Association (CGA)
- National Fire Protection Association (NFPA)



Note: Regulations vary in every part of the country. Always consult local codes!

Initial Inspection

Upon receipt of a Nomad 830 MP, inspect for the following:

- Any shipping damage to the cylinder, trailer or vaporizer, including dents, scrapes, cuts, and broken or bent plumbing components. Report damage to the shipping company before accepting delivery.
- Check relief valves and burst discs for dirt or damage.
- Warranty card, operator instructions sheet and user manual.
- Check to ensure that there is positive pressure on the inner vessel, normally about 20-25 psig.

The Nomad 830 MP is shipped with NF purity nitrogen gas. Purging is necessary prior to filling.

Transport

The vessel is built to CGA-341 (49 CFR 173.320) which requires the vessel pressure to be kept below 25.4 psig during transit. The relief valves on the Nomad 830 MP meet the ASME and CGA requirements. Maintaining transit pressure is accomplished through the road relief circuit/regulator.

Using the Trailer

The customer should attach all required tags, product labels, etc. before using the trailer. Both the pintle style and gooseneck trailers come with a Felling XPress trailer owner's manual. Always consult this publication before using the product. Most trailers are also equipped with a label that details the connection procedure (see Figure 1):



Figure 1 - Label detailing connection procedure

Preparing the Tank for Use (Refer to Figure 3)

1. Disconnect the trailer from the tow vehicle and use the drop legs at the front and rear of the trailer to ensure deck is level. This can be accomplished by referencing the levels mounted at the side and front of the trailer (see Figure 2).



Figure 2 - Level mounted on trailer

2. If optional regulating manifolds were not included, connect the proper regulator/regulating manifold to the liquid cylinder's gas use outlet.
3. Connect the proper piping / hoses between the final line regulator / 6-port gas manifold and the receiving equipment.
4. If empty, fill tank (refer to Fill Procedure on page 13).
5. Close the Road Relief isolation valve (A).
6. Open the Pressure Building isolation valve (B).
7. Open the Economizer circuit (C).
8. Monitor the PB Gauge (D) and wait for the tank to reach operating pressure.
9. Once the tank has reached operating pressure open the Gas Use isolation valve (E).
10. When gas delivery is complete, close the Gas Use valve (E).

Preparing the Tank for Transport (Refer to Figure 3)

1. Ensure the Gas Use isolation valve (E) is closed.

2. Close valves on the final line regulator or 6-port manifold.
3. Ensure pressure has been relieved from all equipment lines. Disconnect all hoses and equipment from the final line regulator or 6-port manifold.
4. Close the Economizer (C) and Pressure Building (B) valves.
5. Open the Vent valve (F) until the tank pressure is at or below 17 psig.
6. Close the Vent isolation valve.
7. Open the Road Relief isolation valve (A).
8. Connect the Trailer to the towing vehicle referencing the Felling trailer owner's manual.
9. Raise the drop legs on the front and rear of the trailer.
10. The Nomad 830 MP unit can now be transported on public roads.

Primary Plumbing Circuits (Refer to Figure 4 on Pg. 10)

Fill

The Nomad 830 MP w/FlexFill™ Piping has a top and bottom fill circuit that replaces the top float assembly so the driver can control the tank pressure while filling the Nomad MicroBulk System. The fill circuit is a one-piece manifold (VM-1) consisting of a top fill valve, a bottom fill valve, a fill check valve (V-1), and a hose drain valve.

The fill line check valve has a service fitting on the inlet side that provides the sole connection for the liquid delivery vehicle

The hose drain valve can be used to both purge the fill hose before filling the tank or to depressurize the fill hose after filling the tank.

The driver controls the pressure in the vessel during the fill process by adjusting the flow through the top and bottom fill valves. Product flowing into the bottom of the tank will raise the pressure and product flowing into the top of the tank will lower the pressure. Adjusting each valve properly will allow the driver to hold a consistent pressure in the tank throughout the entire delivery

During a first fill, only fill the vessel to 75% full to allow liquid expansion experienced with a new "hot" tank. Each fill thereafter can be filled to 100% full. Please refer to the Installation section of this manual for detailed filling procedures.

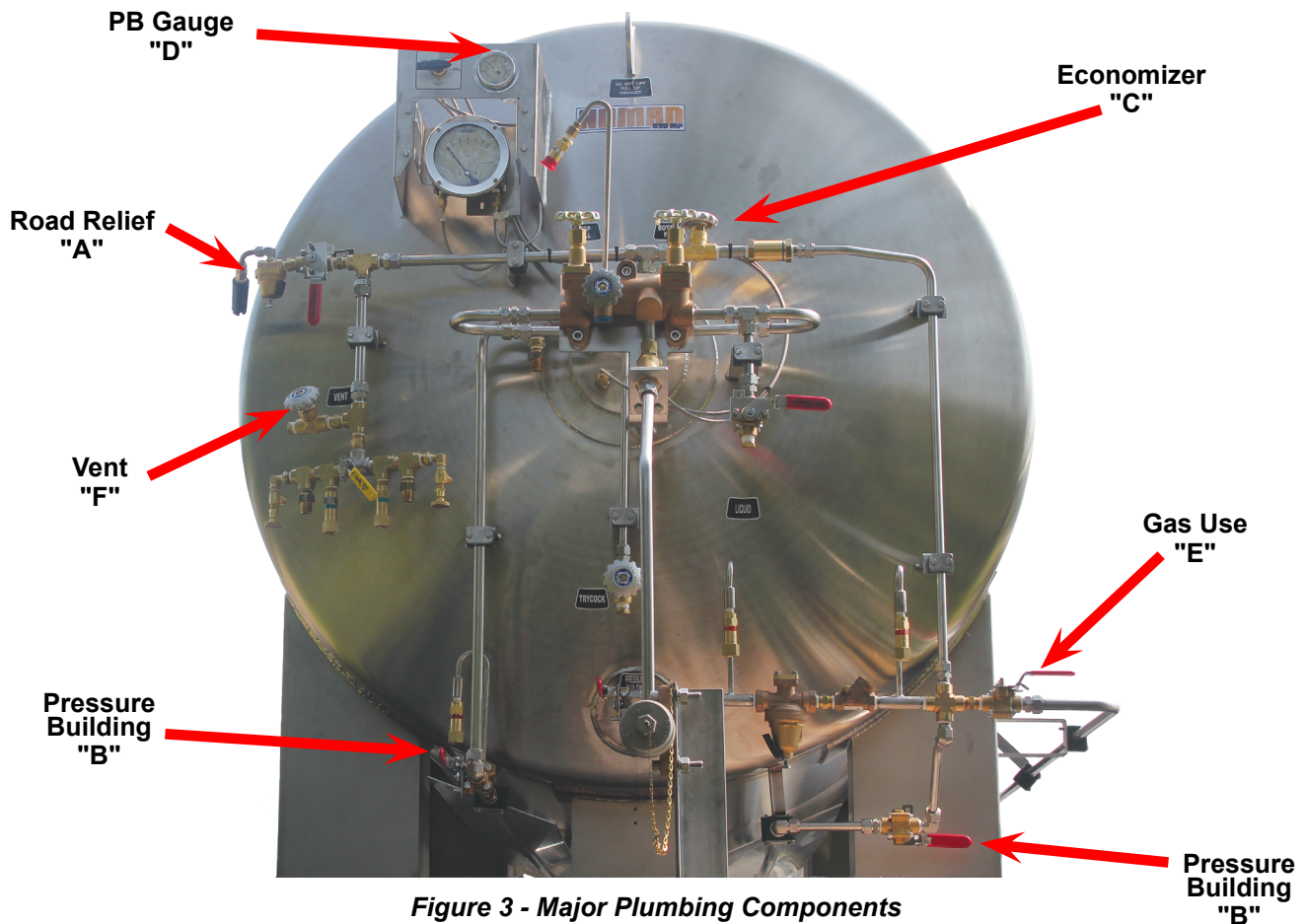


Figure 3 - Major Plumbing Components



Caution! *If liquid can be trapped in the transfer system, a suitable relief valve must be installed to prevent over pressurization.*



Caution! *Before making a liquid transfer either into or out of this vessel, be sure that protective eyeglasses and gloves are being worn. If the transfer is being made to an open top vessel, the transfer pressure should be as low as possible and a phase separator should be used to eliminate splashing and hose whip.*

Pressure Build

The pressure build circuit is used to build pressure back in the vessel after a delivery or to maintain pressure as liquid is withdrawn from the vessel. The vessel pressure is set by

adjusting the PB regulator (R-1). Standard PB set point for the Nomad is 185 psig.

As the tank pressure drops below the PB set point, the regulator opens and allows liquid to flow off the bottom of the tank, through the external PB vaporization coils and back into the gas phase of the tank. The pressure build circuit can be isolated by closing valve V-11 or V-15.

Economizer

The economizer circuit allows for the customer to utilize the natural heat leak that occurs in every cryogenic storage vessel. When the economizer isolation valve (V-5) is open, gas is drawn directly off the headspace. This allows the gas to travel through the external vaporization coils, in order to warm the cold gas, and out the gas use valve. This will result in lowering the pressure of the tank. Back flow into the headspace is prevented by check valve V-7. The economizer regulator can be isolated by closing valve V-5.



Note: *The economizer circuit will only work if the customer is using product out of the vessel.*

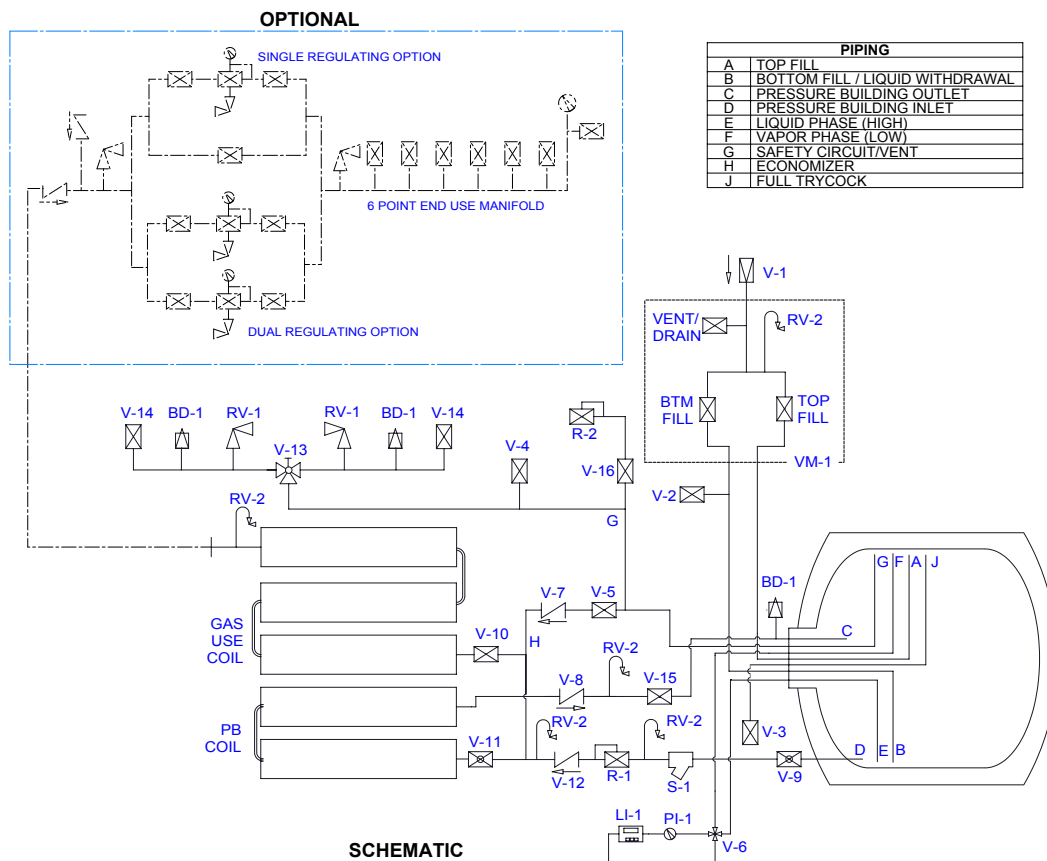


Figure 4 - Nomad 830 MP Schematic



Note: Gas is drawn through the economizer circuit until tank pressure drops below the liquid regulator set point. Then, liquid will begin flowing through the external vaporizer.

Liquid Use

The liquid use circuit can be used for any liquid applications. This circuit draws liquid directly up the bottom fill line and through the liquid use valve (V-2).

Gas Use

The gas use valve (V-10) leverages the external vaporizer on the Nomad system to supply gaseous product to the end user.

The Nomad tank will deliver gas at various flow rates and temperatures for different applications. Gas can be delivered at a sustained rate of 4700 SCFH, with short bursts up to 10,000 SCFH. The equipment that is being supplied gas from the Nomad tank controls the flow rate. Higher flow rates may provide very cold gas that could damage the equipment to

which they are attached. To supply gaseous product, follow this step by step procedure.

1. Connect the proper regulator/regulating manifold to the liquid cylinder's gas use outlet if the optional regulating manifold was not purchased.
2. Connect the proper piping / hoses between the final line regulator and the receiving equipment.
3. Open the pressure building valve (V-11 and V-15).
4. Allow pressure to build to the operating pressure (refer to gauge).
5. Open the gas use valve (V-10).
6. Adjust the gas use regulator for the proper delivery pressure.



Caution! All valves on an empty Nomad tank should always be kept closed to protect the inner vessel and plumbing from being contaminated.

The operator should review the safety precautions found in the Safety section before conducting a gas or liquid withdrawal operation. Protective eyeglasses and gloves should always be worn.

At low continuous flow rates, the Nomad tank is capable of delivering warm gas through the line regulator. As the continuous flow rate increases, the temperature of the gas decreases.

Safety Circuit

The Nomad w/FlexFill™ Piping tanks are equipped with dual spring operated relief valves (RV-1) and dual burst discs (BD-1). The dual safety manifold with diverter valve (V-13) is standard on these vessels. This allows for change out of safety relief devices without the need to empty the tank. There is a third burst disc (BD-1) located on the pressure build outlet that serves as a safety back-up should the safety circuit piping become damaged — pinched — as a result of an accident (See Fig. 4).

These devices are used to automatically relieve excess pressure in the vessel and cannot be isolated by use of a valve. Replacement of these relief devices should only be on a "like for like" basis. Substitutes should be avoided unless approved by the manufacturer.

Vent/Full Trycock

The vent valve (V-4) is used to relieve excess pressure in the cylinder. On FlexFill versions of the Nomad 830 MP, there is a separate full trycock valve (V-3). When the Nomad tank is filled by any delivery truck, the full trycock must be used to fill the vessel. When liquid starts to spit out of this valve while being filled, the filling process should be terminated.

Other Piping Circuits and Components

Phase Lines and Liquid Level Gauges

The Nomad tank is equipped with both a low pressure phase line (F) located on the top of the vessel and a high pressure liquid phase line (E) located on the bottom of the vessel. These lines are connected to a differential pressure gauge (LI-1) which is used to indicate the amount of product in the vessel. The DP gauge range can vary depending on the intended service of the tank. The proper gauge is included with the service kit at the time of purchase.

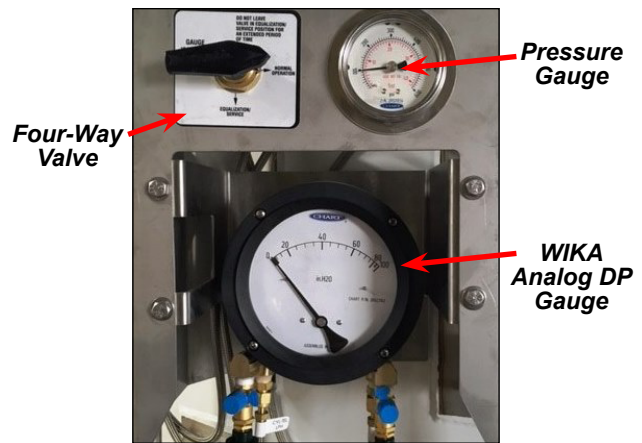


Figure 5 - Gauges and 4-way valve

Four-Way Valve (Refer to Figure 5)

The four-way valve (V-6) is used as the primary isolation valve between the DP gauge and the phase lines from the tank. This four-way valve also provides an easy method to check the zero on the DP gauge. By turning the valve into the equalization position, the DP gauge can be zeroed and isolated from the tank pressure for removal or replacement.

Pressure Gauge (Refer to Figure 5)

A single pressure gauge (PI-1) on the Nomad tank is also tied into the low phase line and gives the operator a pressure reading in the gas phase of the vessel. This pressure gauge can also be isolated with the four-way valve.

Filling Procedure

First Fill/Purge Procedure



Note: The Nomad tank is shipped with NF purity nitrogen gas. Purging is necessary prior to filling. During first fill, only fill the vessel to 75% full to allow for liquid expansion experienced with a new (warm) tank. Each fill thereafter can be filled to 100% full. All valves on an empty Nomad tank should always be kept closed to prevent the inner vessel and plumbing from being contaminated.

Purging and First Fill Procedure

1. Attach the source of liquid purge to the fill connection of the Nomad tank.
2. If the fill hose has not been kept under pressure since the last delivery, it will need to be purged. Purge the fill hose and connector through the purge valve, if so equipped, or by loosening the fill connection until vapor flows from the connection and then retighten. Use the hose drain on the tank piping if equipped as such.
3. If the Nomad tank is pressurized, open the vent valve and blow down to approximately 5 psi. To prevent drawing atmospheric contaminants back into the tank during the purging operation, a positive pressure of at least 5 psig should be maintained in the tank.
4. Partially fill the Nomad tank with approximately 5000 standard cubic feet of product (use truck meter to verify amount).

Let liquid build pressure close to safety setting.

Leak check all plumbing circuits while the tank is under maximum pressure.

While vent gas is still warm and tank is under pressure, move the four-way valve to the 'Equalization' position and loosen the fittings on either side of the liquid level gauge to allow the gauge lines to purge with gas. Check the gas stream coming out of the fittings for evidence of moisture. Continue to flow the gas until lines have been purged and there is no visible signs of moisture. Tighten fittings to stop the flow of gas. Move the four-way valve to the 'Normal Operation' position.

Vent all product out of the liquid valve and close before pressure drops below 5 psig.

5. Fill Nomad tank with 5000 standard cubic feet of product. Primarily use the bottom fill on a FlexFill style tank. Make sure some product is also routed through the top fill lines to purge them prior to totally filling the tank.

Open the PB circuit and set to maximum psi. Ensure cold gas is flowing through this circuit as indicated by frosting on the pipes. Let liquid in the tank build pressure close to safety setting. Once desired pressure is reached, open liquid valve. When liquid is out of the tank and pressure is still high, open the vent and gas use valves. If a final line manifold is already connected to the gas use valve, purge through the manifold to insure that there is a flow through the gas use circuit and any moisture is purged out before liquid is introduced into this circuit.

Once pressure is blown down to 5 psig, close the liquid vent and gas use valves.

6. Fill the Nomad tank with 5000 standard cubic feet of product and let the liquid in the tank build pressure close to the safety setting. Insure the product is flowing through and purging the economizer lines. Control the pressure by opening the gas use and vent valves. Once pressure is approximately 5 psig, close the gas use and vent valves.
7. Fill the Nomad tank with 5000 standard cubic feet of product and let the liquid in the tank build pressure to close to the safety setting. Once the desired psig has been reached, open the gas use and vent valves. Once pressure is approximately 5 psig, close the gas use and vent valves.



Note: The purge gas should be cooling the tank. If the tank vent line is HOT, always purge until the vent line is cool or even frosted. A new, warm tank should go through a minimum of four or five purge cycles before filling with liquid.

Filling the Tank After the Cool Down Process is Complete

1. If equipped with a bottom fill valve, the bottom fill valve and the tank vent valve are the valves to be used to fill a warm tank.
2. Have the driver start the pump and slowly deliver the liquid into the tank. Observe the tank pressure and control the pressure by venting the tank down or by using the top fill valve to control the pressure.

- As the filling proceeds and the tank gets cooler, you should be able to pinch off and, in some cases, close the vent valve. We recommend that you do not fill the tank to the full trycock on the first fill. Fill to 75% in order to allow for liquid expansion as the tank contents absorb heat while the metal continues to cool down over time.

Optional Equipment

Chart's Nomad 830 mobile MicroBulk system can be ordered with a variety of option kits that make it a truly versatile product.

Single / Dual Regulating Control with 6-Port Gas Use Manifold

The single/dual regulating control manifold regulates the outlet gas to 100 psig or lower, ensuring downstream equipment can be operated safely. It is equipped with pressure gauges, a backup fill port and regulator bypass for easy servicing. The dual regulating control can be configured for maximum gas flow by opening both regulator isolation valves at the same time, allowing gas to flow through both circuits simultaneously. The 6-port gas use manifold allows for high volumes of gas to be supplied to multiple users at once.

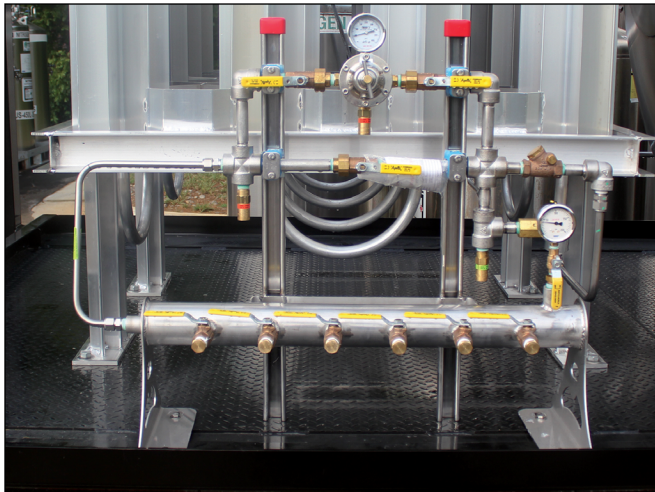


Photo 5 - Regulating control

Description	Part Number
Single Regulating Manifold	20939331
Dual Regulating Manifold	20939330

Bulk Fill Kit

The bulk fill option kit includes a 1-1/2" CGA fitting that allows the user to rapidly fill the Nomad 830. Refer to page 13 for the complete fill procedure.

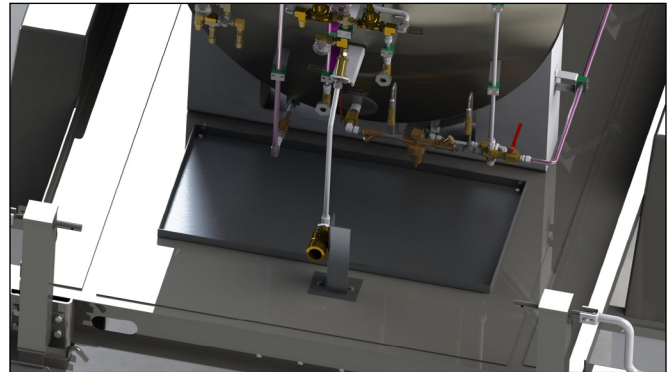


Photo 6 - Bulk fill option kit

Description	Part Number
Nitrogen Bulk Fill Kit	20939380
Argon Bulk Fill Kit	20946907
Oxygen Bulk Fill Kit	20946908

Liquid Delivery

Cryogenic liquid can be pressure transferred from the tank to other cryogenic equipment that operates at a lower pressure than the tank. To make a liquid transfer follow this procedure:



Caution! If liquid can be trapped in the transfer system, a suitable relief valve must be installed to prevent over pressurization.



Caution! Before making a liquid transfer be sure that protective eyeglasses and gloves are being worn. If the transfer is being made to an open top vessel, the transfer pressure should be as low as possible and a phase separator should be used to eliminate splashing and hose whip.

- Connect the transfer hose to the liquid valve connection of the tank.

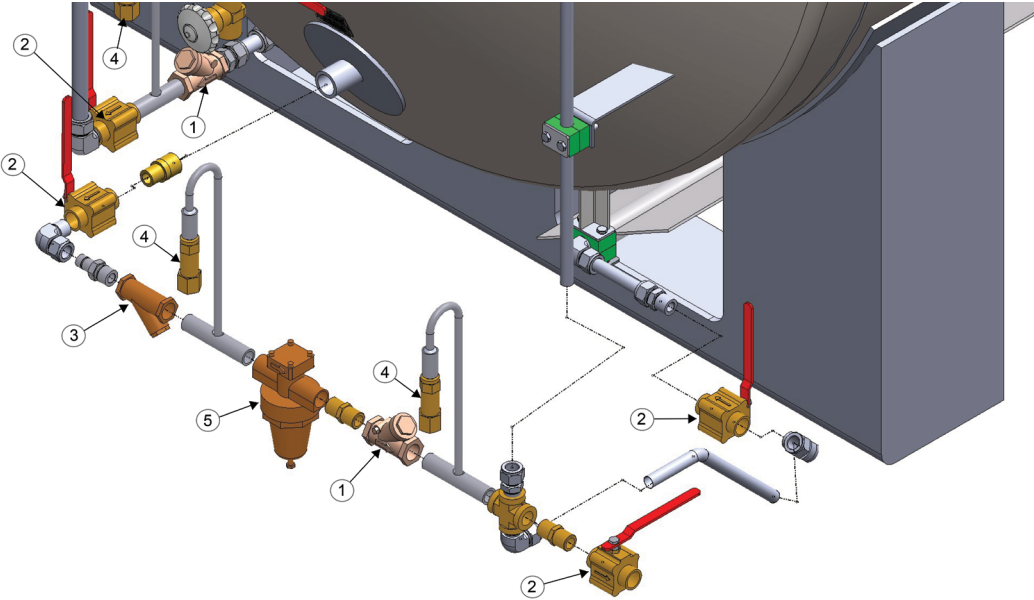
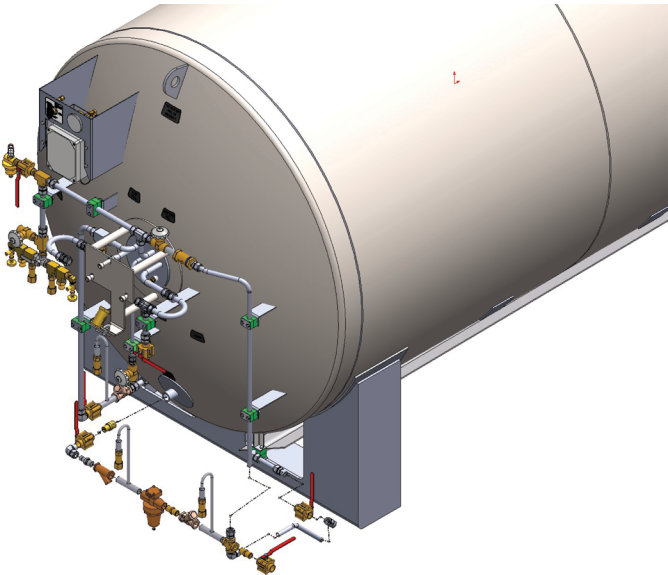
2. Connect or place the other end of the hose onto the inlet of the cryogenic equipment that will receive liquid. Atmospheric dewars are filled using a phase separator mounted to the open end of the hose.
3. Refer to the receiving equipment manual for procedures to open the fill valve and vent valve of the receiving equipment.
4. Open the liquid valve. This valve can be adjusted to obtain the proper liquid flow rate.
5. The pressure building valve can be opened to build and maintain a higher cylinder pressure during liquid transfer.
6. When the transfer is complete, close the receiving equipment's valve. Close the liquid valve and relieve pressure from the hose.
7. Disconnect or remove the hose from the receiving equipment.



Plumbing

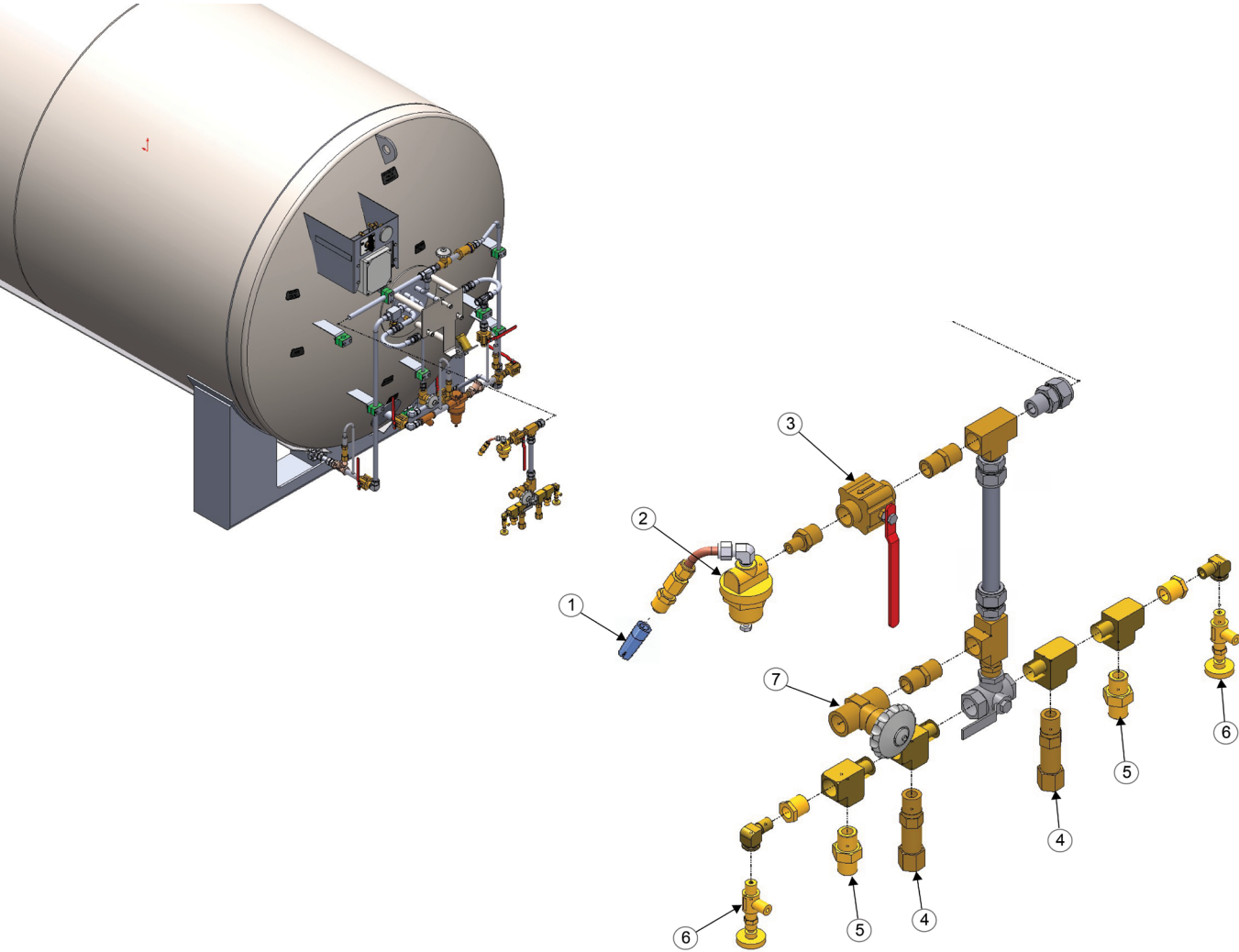
Plumbing Diagrams

PB/Gas Use Inlet

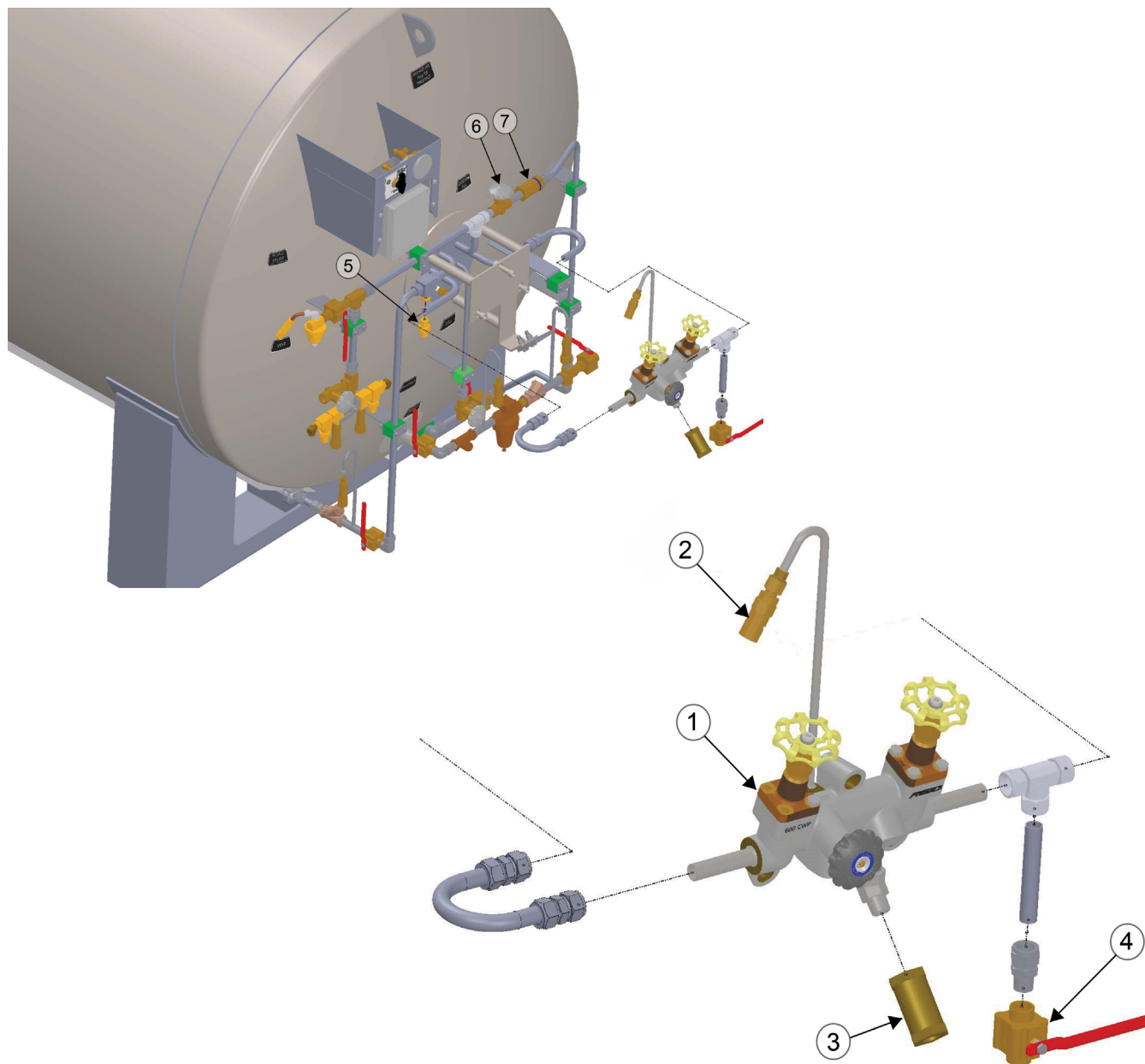


Item #	Part #	Description	Qty
1	13462175	KIT CHECK VALVE	2
2	1712202	BALL VALVE 1/2 FPT	4
3	11529090	STRAINER 1/2 NPT	1
4	1810462	RELIEF VALVE 1/4 MPT 350 PSI	3
5	20869311	REGULATOR 1/2 NPT 180 PSI	1

Safety Circuit



Item #	Part #	Description	Qty
1	9710379 / 9710399*	MUFFLER (INERT) / MUFFLER (OXYGEN)*	1
2	14871114	REGULATOR 1/4 NPT 17 PSI	1
3	1712202	BALL VALVE 1/2 FPT	4
4	11488574	RV BRS 1/2MPT 250 PSI	2
5	11671281	RPD ASSY INLINE 1/2MPT 375PSI	2
6	10907239	VALVE NEEDLE BRS 1/4MPT	2
7	10502848	VALVE SHUTOFF BRZ 1/2FPT	1
*MUFFLER PART NUMBER DEPENDANT ON TYPE OF SERVICE			

Fill Circuit/Economizer

Item #	Part #	Description	Qty
1	20820974	TOP & BTM FILL MANIFOLD 1/2NPT	1
2	1810462	RV BRS 1/4MPT 350PSI	1
3	11051090	VALVE CHECK BRS 1/2FPTX1/2FPT	1
4	1712202	VALVE BALL BRS 1/2 FPT	1
5	11671281	RPD ASSY INLINE 1/2 MPT 375 PSI	1
6	10502848	VALVE SHUTOFF BRZ 1/2FPT SHORT	1
7	13620233	VALVE CHECK BRS 1/2FPTX1/2FPT	1

Troubleshooting

The following table is arranged in a Trouble/Probable Cause/Remedy format. The probable causes for specific problems are listed in descending order of significance. That is, check out the first cause listed before proceeding to the next.

Trouble	Probable Cause	Remedy
No gas to gas-use equipment. OR Insufficient pressure to gas-use equipment	Nomad tank empty.	1. Switch to emergency gas supply. 2. Call gas supplier for delivery.
	Gas-use valve to final line regulator is closed or other valves downstream are closed.	1. Open valve or valves, as needed. 2. Ensure there is no obstruction in the line or valve.
	Pressure builder is not building sufficient pressure.	1. Open pressure building regulator control valve and allow pressure to build. 2. Adjust setting on regulator to a higher pressure. 3. If tank pressure fails to rise, see section on low tank pressure.
	Final line pressure regulator set too low or malfunctioning.	1. Insure gas use valve is open and tank pressure is at least 25 psi higher than desired working pressure of final regulator. 2. Call service technician.
	Inappropriate type of regulator (high-pressure or 2-stage or too small) installed as final line regulator and is not able to supply sufficient gas flow.	1. Insure gas use valve is open and tank pressure is at least 25 psi higher than desired working pressure of final regulator. 2. Inspect final line regulator or its specifications to determine if it has a suitable flow capacity for the required inlet and outlet pressures. 3. Call appropriate equipment supplier or service technician.
	Gas supply line, hose, or network contains excessive pressure drop.	1. Check line for sufficient diameter. 2. Remove all unnecessary bends, elbows, reducers, and small diameter valves. 3. Check for leaks in the gas supply line.
	Unknown	1. Call service technician
Ice on external vaporizers and/or plumbing	Normal condition during and following gas use, liquid use or filling.	1. None 2. User to check tank for frost / leaks before use.
	Tank is being used for continuous flow application and is not receiving sufficient ambient heat to melt the frost or ice. (Tank may have heavy ice build-up during continuous use or low ambient temperature.)	1. Move tank to a warmer location. 2. Add additional environmental heat and / or warm airflow to warm outer piping, components and sides of the tank. 3. Add additional vaporization.
	Leak in gas supply lines, gas-use equipment, or tank plumbing. (Frost is present on tank even after an extended period with no gas or liquid use.)	1. Evacuate and ventilate room. 2. If possible, locate and correct leak. 3. User to check tank for frost / leaks each morning before starting gas use. 4. Call appropriate equipment service technician.

Trouble	Probable Cause	Remedy
Ice on external vaporizers and/or plumbing (continued)	Weak vacuum or failed vacuum.	<ol style="list-style-type: none"> 1. Check if tank pressure is routinely high even during gas use and / or if tank has cold or ice spots even when not in operation as sign of vacuum problem. 2. Condensation or sweating is seen over the entire outer shell as a sign of vacuum problem. 3. Call gas service agent.
	Unknown.	<ol style="list-style-type: none"> 1. Call gas service agent.
Routinely low pressure in tank.	PB shut-off valve is closed. (If PB is not operating, no frost ring will appear at the bottom of the tank during gas use.)	<ol style="list-style-type: none"> 1. Open pressure building regulator control valve and allow pressure to build. 2. Call service agent to repair, replace or adjust regulator.
	Pressure builder setting is too low. (If PB is not operating, no frost ring will appear at the bottom of the tank during gas use.)	<ol style="list-style-type: none"> 1. Adjust regulator to higher pressure and allow pressure to build. 2. Call service agent to repair, replace or adjust regulator.
	Economizer check valve is flowing	<ol style="list-style-type: none"> 1. Only flows when PB regulator is closed. 2. Check PB regulator.
	Relief valve(s) stuck open.	<ol style="list-style-type: none"> 1. Evacuate and ventilate the room. 2. Check exhaust of relief valve to see if gas is flowing at a pressure below the pressure stamped on the valve. 3. Tap lightly on the side of the relief valve to attempt to dislodge any obstruction holding valve open. Repeat several times, if needed. 4. If equipped with dual relief valves and a diverter valve, switch diverter to second set of relief valves. 5. Call gas service technician to replace relief valve, if necessary.
	Large gas leak from tank plumbing or from gas use system.	<ol style="list-style-type: none"> 1. Evacuate and ventilate the room. 2. If possible, locate and repair leak or call gas equipment service technician.
	Gas or liquid withdrawal rate exceeds the tank specifications.	<ol style="list-style-type: none"> 1. Excess usage will cause tank pressure to decrease as PB is unable to maintain pressure. Decrease withdrawal rate to within design specifications. 2. Increase pressure setting on PB regulator. 3. If withdrawing gas, consider: (a) withdrawing liquid and using external vaporizer, (b) installing larger tank, (c) installing additional tank(s), or (d) splitting application. 4. If withdrawing liquid, consider: (a) installing larger tank, (b) splitting application or (c) installing additional tank(s). 5. Call gas service agent.
	Unknown	<ol style="list-style-type: none"> 1. Switch to emergency gas cylinder. 2. Call gas service technician.
Gas supply to gas-use equipment is too cold.	Ambient temperature surrounding the Nomad tank is too cold.	<ol style="list-style-type: none"> 1. Move tank to warmer location. 2. Install freestanding ambient vaporizer on gas supply line in warmer location or install in-line gas heater.

Trouble	Probable Cause	Remedy
Gas supply to gas-use equipment is too cold. (continued)	Gas withdrawal rate from Nomad tank exceeds the capacity of tank's ambient vaporizer.	<ol style="list-style-type: none"> 1. Reduce gas withdrawal rate to within specified parameters. 2. Install freestanding ambient vaporizer on gas supply line in warm location or install in-line heated vaporizer on gas supply circuit. 3. Install larger tank with greater withdrawal rate capacity.
Routinely high tank pressure.	Normal when little or no gas has been used for several days.	<ol style="list-style-type: none"> 1. None - Routine use of gas will automatically reduce the tank pressure. 2. Gas usage must exceed NER of tank, if not, contact gas supplier for different tank model.
	Economizer function on regulator is malfunctioning.	<ol style="list-style-type: none"> 1. Call gas service technician to clean, repair, or replace regulator.
	Tank is over-filled	<ol style="list-style-type: none"> 1. If tank is filled to or beyond proper fill level, pressure builds very rapidly and relief valve may open. 2. Use gas or liquid as soon as possible to reduce tank contents. 3. Vent tank until no liquid is coming out the vent valve.
	Pressure building function on regulator is set too high or regulator is malfunctioning.	<ol style="list-style-type: none"> 1. Reduce pressure setting by turning adjustment knob counter-clockwise to the desired pressure setting and continuing normal gas use until pressure drops. 2. Close PB isolation valve and carefully observe pressure to ensure tank pressure does not drop too low during use. 3. Call gas service technician to adjust PB regulator.
	Weak or failed vacuum.	<ol style="list-style-type: none"> 1. Observe if condensation and / or frost are present even during periods of non-use as possible sign of vacuum problem. 2. Call gas service technician.
	Unknown.	<ol style="list-style-type: none"> 1. Call gas service technician.
Hissing sounds or evidence of gas leaking near tank, gas lines, or gas-use equipment.	Normal for short periods of time from some regulators and relief valves.	<ol style="list-style-type: none"> 1. Evacuate and ventilate room or area, if necessary. 2. If possible, observe leak. If leak is not large, does not last long, does not occur frequently and is in a well-ventilated area, no action may be needed. If in doubt, call appropriate equipment service technician. 3. If above combined conditions do not exist, call equipment service technician and observe "Safety" precautions.
	Large leaks, leaks from elsewhere in the system, sustained leaks, or frequent leaks (not normal).	<ol style="list-style-type: none"> 1. Evacuate all personnel from affected areas. Ventilate room / area. 2. If possible, locate the leak and repair it or call gas service or gas-use equipment service technician.

Trouble	Probable Cause	Remedy
High gas usage.	Unrecognized increase in actual gas use.	<ol style="list-style-type: none"> 1. None for Nomad or gas supplier 2. Gas user to determine reason for increase in gas use.
	Leak in gas supply line or network or in gas-use equipment or tank plumbing, e.g. relief valve.	<ol style="list-style-type: none"> 1. Evacuate and ventilate room, if necessary. 2. If possible, locate and repair leak or call gas-use equipment service agent. 3. User to check tank for frost / leaks before operation.
	Tank pressure routinely too high and venting.	<ol style="list-style-type: none"> 1. See Troubleshooting section on routinely high tank pressure.
	High flash or vaporization losses in liquid use application due to high pressure / temperature liquid in tank.	<ol style="list-style-type: none"> 1. Vent tank to approximately 25 psi. Follow safety procedures. 2. In future only refill the Nomad with low-pressure cryogenic product.
	Error in gas delivery or supplier invoice.	<ol style="list-style-type: none"> 1. Check gas usage history / pattern against supplier invoices. 2. Call gas supplier, if necessary.
Nomad tank cannot be filled.	Nomad tank is full.	<ol style="list-style-type: none"> 1. None
	Fill line is blocked or inoperative.	<ol style="list-style-type: none"> 1. Check for obstructions in the fill line. Clear if necessary. 2. Gently tap on check valve to assure proper operation. 3. Call gas service technician.
	Orca™ MicroBulk Delivery System is not functioning properly.	<ol style="list-style-type: none"> 1. Refer to Orca system Troubleshooting.
	Transfer hose is obstructed, e.g. hose is bent excessively, crimped or plugged.	<ol style="list-style-type: none"> 1. Clean obstruction, inspect hose for damage, and if everything is satisfactory, continue the filling.
Liquid withdrawal contains high level of gas.	Saturates liquid pressure in Nomad tank is too high. (Temperature or energy level of contents is too high due to excess pressure.)	<ol style="list-style-type: none"> 1. Ensure PB shut-off valve is closed. 2. Open vent valve to allow excess pressure to vent until desired pressure is obtained. Follow "Safety" guidelines and procedures for venting. 3. Install secondary lower pressure relief valve to reduce saturated pressure of liquid in the future. 4. In future only refill the Nomad tank with low-pressure cryogenic product.
Trouble	Probable Cause	Remedy
Vacuum pump-out port and / or vacuum plug are open or damaged.	Pump-out plug or port have been damaged or tampered with.	<ol style="list-style-type: none"> 1. If possible, transfer any remaining contents to another tank. 2. Call gas service technician to replace and repair tank.
	Inner vacuum space leak has dislodged safety pump-out plug.	<ol style="list-style-type: none"> 1. If possible, transfer any remaining contents to another tank. 2. Cover pump-out port to keep moisture from getting into the annular space. 3. Call gas service technician to replace and repair tank.



Warning! Use only parts which are cleaned and approved for oxygen service. Chart recommends the use of only Chart approved parts.

Specifications

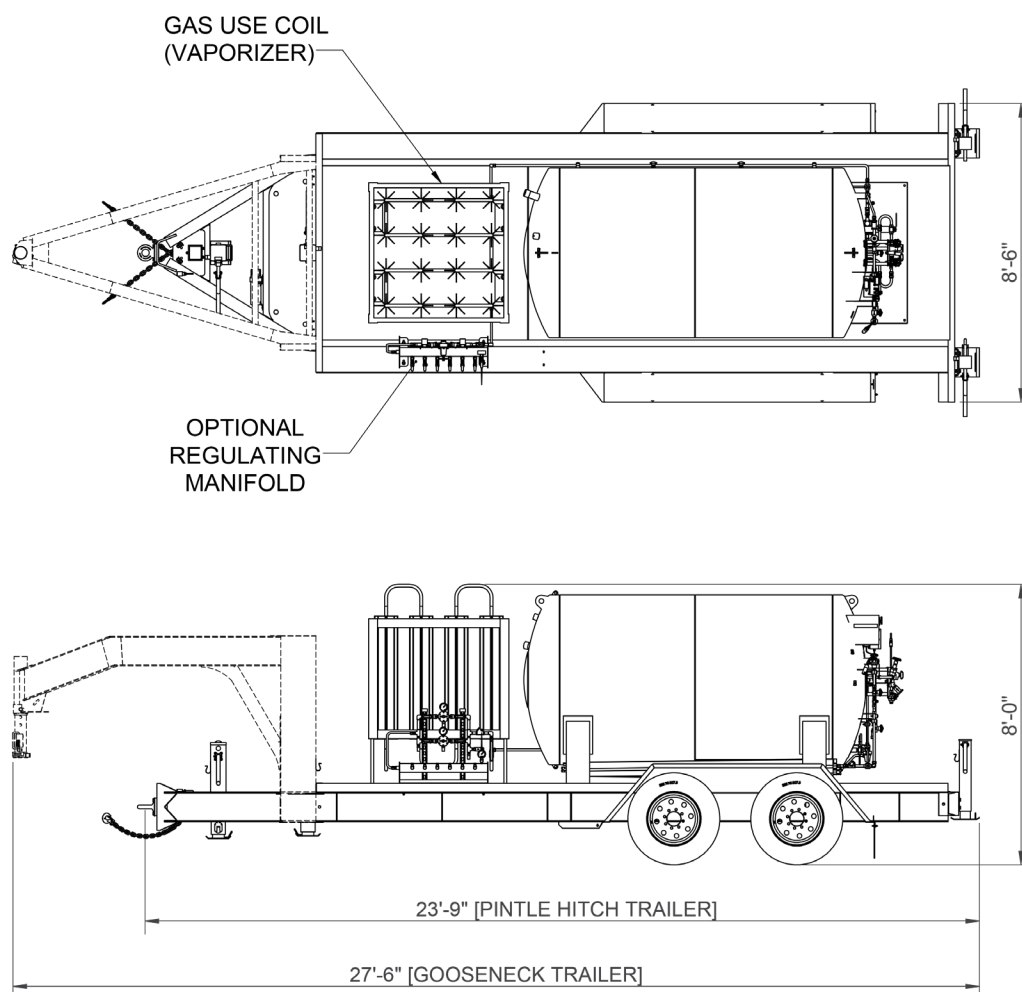
Model	830G MP	
Gross Capacity	829 gallons	3,138 liters
Net Capacity ⁽¹⁾	746 gallons	2,824 liters
MAWP ⁽²⁾	250 psig	17.23 barg
Length (overall) ⁽³⁾	23 feet	700 centimeters
Tank Diameter	58 inches	147 centimeters
Height (overall)	96 inches	243 centimeters
Trailer Width	102 inches	259 centimeters
Total Weight (tare)	9500 pounds	20,900 kilograms
Total Weight (gross) ⁽⁴⁾	18,000 pounds	39,600 kilograms
Vaporizer	4,700 SCFH	
NER (%/day) N ₂	1.18%	
NER (%/day) O ₂ /Ar	.73%	
N ₂ Capacity	69,469 SCF	
O ₂ Capacity	85,835 SCF	
Ar Capacity	83,886 SCF	
N ₂ , O ₂ & Ar Flow Rate	4,700 SCFH	

(1) Based on 10% Ullage

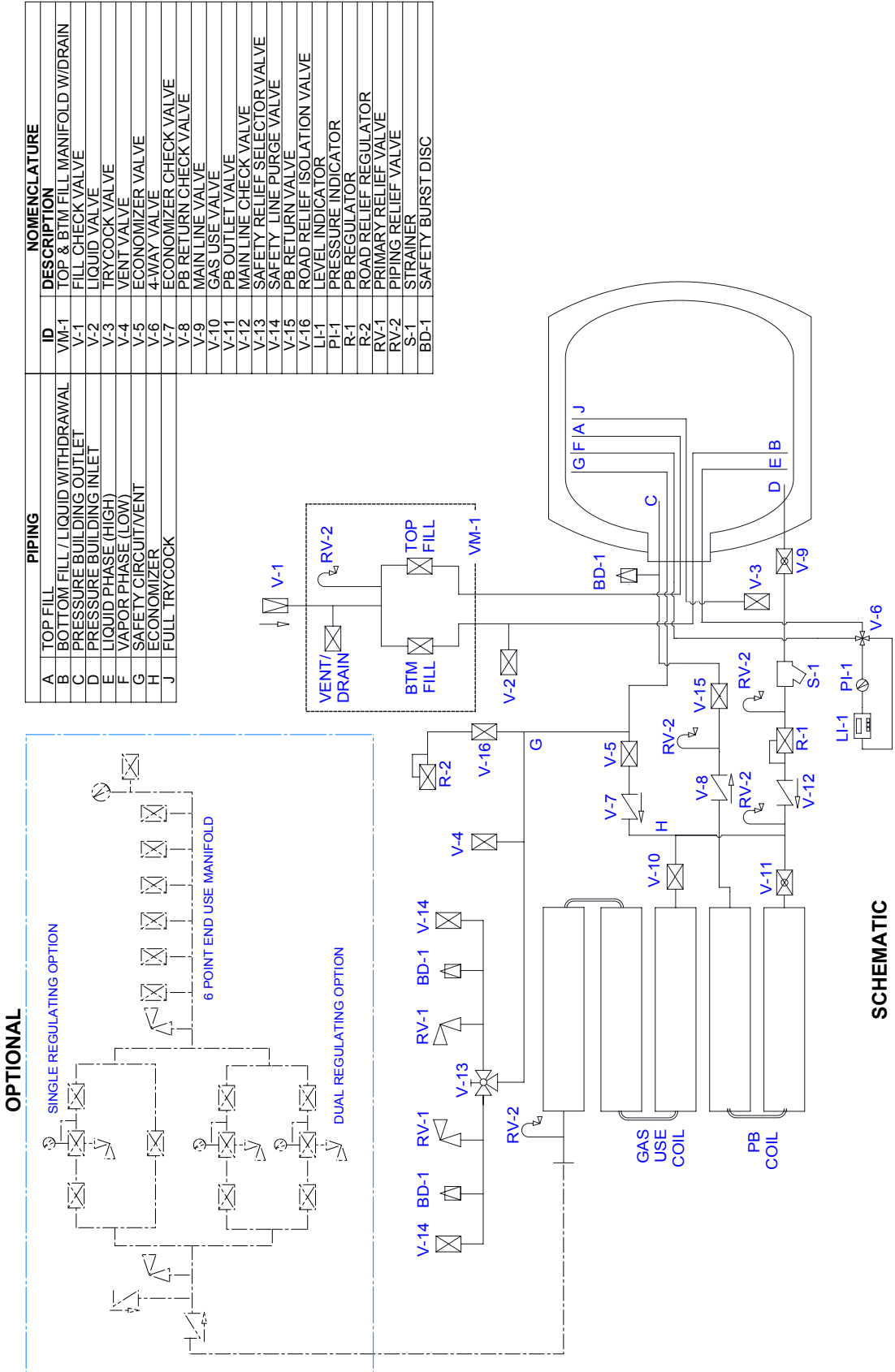
(2) Inner: ASME Section VIII Division 1

(3) Pintle Hitch Trailer: 23'-9", Gooseneck Trailer: 27'-6"

(4) When filled with Argon



Schematic for FlexFill™ Nomad with Trycock



SCHEMATIC