Virtual Pipeline
Emergency Response Guide
Preface

The intent of this guide is to provide information to help you respond to emergency situations involving Quantum VP Trailers in the safest manner possible.
This guide contains a general description of how the Quantum VP trailers operate and includes illustrations of their unique components. The guide also identifies potential safety concerns with each system variation.

This equipment requires special procedures that must be followed not only when performing ordinary service on the system but also for rescuing people and or handling the trailer in the event that the trailer is damaged in an accident or a disaster.
Read the contents of this manual carefully to prevent injuries and secondary disasters.

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Technical Assistance
For questions regarding the safe use and operation of this equipment or in the event of an emergency, contact Quantum Technical Assistance at 800.816.8691 or E-Mail QTService@qtww.com.

A current copy of this emergency response guide is available on our website at:
http://www.qtww.com/service/product-documentation/
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# Table of Contents

General Fuel Safety .......................................................................................................................................................... 1

Safety ................................................................................................................................................................................... 2
  Safety Features .................................................................................................................................................................. 3
  Safety Systems .................................................................................................................................................................. 3
    Master Control System .................................................................................................................................................. 3
    Fire Check ..................................................................................................................................................................... 3
    Cylinder PRD valves ........................................................................................................................................................ 3
    Loading Pressure Relief Valve .................................................................................................................................... 3
    Brake Interlock ............................................................................................................................................................. 3
  Trailer Markings ............................................................................................................................................................. 4
  Identification .................................................................................................................................................................... 4
  Component Locator VP Lite, VP Lite MG ..................................................................................................................... 5
  Cylinder Manual Shut off valves ................................................................................................................................... 7

Response Considerations .................................................................................................................................................. 8
  Approaching the Equipment ........................................................................................................................................... 8
  Public Safety .................................................................................................................................................................. 9
  Gas Release – No Fire ..................................................................................................................................................... 9
  Static build up ............................................................................................................................................................... 9
  Gas Release with Fire .................................................................................................................................................... 10
  In the Event of Equipment Fire .................................................................................................................................... 10
  Fire Fighting Recommendations .................................................................................................................................. 10
  System Venting ............................................................................................................................................................ 11
  Using off board air to activate cylinder valves ........................................................................................................ 15

Appendix A – First Responder Quick Reference Sheet ................................................................................................. 16
Appendix B – System Specifications ................................................................................................................................ 17
  VP 650 ....................................................................................................................................................................... 17
  VPLite and VPLite MG .............................................................................................................................................. 17
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General Fuel Safety

About Compressed Natural Gas

Natural gas is lighter than air. If a leak were to develop, the gas would rise and disperse through the atmosphere giving little chance for ignition. Compare that to gasoline and diesel fuel, both of which are dense liquids that tend to pool and are easily ignitable.

Raw natural gas is odorless, so a distinctive odorant that smells very much like strong sulfur is added prior to distribution. This strong odor makes the presence of a leak very easy to detect. If an odor is detected, which has been added for your safety, please inspect the vehicle for the source of the concern, and repair as needed.

Natural gas itself is a safer fuel than either gasoline or diesel fuel. It has a limited range of flammability, meaning it requires the correct mixture of air and fuel to burn—somewhere in the 5 to 15 percent range, and an ignition temperature of approximately 1100°F. Compare that to gasoline and diesel fuel which both have lower concentrations of flammability and lower temperatures of ignition.
Safety

Important Safety Information

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE is used to address practices not related to personal injury.

CAUTION, without the safety alert symbol, is used to address practices not related to personal injuries.

CNG is extremely flammable. If something ignites it, you may be severely burned.
- Keep sparks, flames and ignition sources a minimum of 5 meters from CNG.
- Ensure work area is well ventilated.
- Always wear proper eye and hearing protection when working with pressurized gas.
- If large volumes of compressed gas are being released, safety personnel working in the immediate area should wear self contained breathing apparatus.
- Use explosion proof lights and spark proof tools when working on gaseous fuel storage systems.

Failure to follow these basic safety guidelines will result in death or serious injury.

Read this manual's safety precautions before servicing this system. Failure to do so may result in death or serious injury.

CNG is stored at pressures up to 5,000 psi (35 MPa). Verify all pressure is properly vented from any fuel cylinder or fuel line before proceeding with disassembly. Failure to properly vent fuel system components may result in death or serious injury.

When responding to an emergency situation, keep sparks, flames and ignition sources a minimum of 5 meters from the area where gas is being released.
- Turn off or disconnect the chassis electrical system.
- Keep mobile phones at a distance from the fuel storage system.

Failure to do so may result in minor to moderate injury.
Safety Features
The Quantum Virtual Pipeline has been engineered to the highest standard to ensure operator safety in any circumstance.

The system utilizes:
- Stainless steel fuel lines and fittings
- Type 4 (composite) fuel cylinders
- Over temperature protection
- Pneumatic cylinder lock off valves
- Emergency shut off switches at the front and rear of the trailer
- Parking brake/door interlock.

Safety Systems
The trailer is equipped with multiple devices to protect the system and operators in the event of a system malfunction or in the event of a fire in or around the trailer. These safety systems are detailed below

Master Control System
The trailer is equipped with a master control located at the front and the rear of the trailer. Activating either of these master control switches will close all the cylinder valves and immediately stop the loading or unloading of the trailer.

Fire Check
Located adjacent to each master control switch is a fire check protection valve, if a thermal event occurs and the fire check exceeds 165°F (74°C) the fire check valve will automatically close all the cylinder valves.
Depending on the model of your trailer this feature can either inhibit unloading only or inhibit either loading or unloading of the trailer.

Cylinder PRD valves
Each CNG storage cylinder is equipped with its own thermal pressure relief device. If a thermal event were to occur locally or globally the CNG cylinder or cylinders will protect themselves depending on the level of heat to which they are subjected. These valves should only be activated in the event of fire; ambient conditions should never cause activation of these valves.

Loading Pressure Relief Valve
The system is protected by a pressure relief valve on the loading side of the system. In the event the system pressure exceeds the preset value, the pressure relief valve will discharge the excess pressure to atmosphere.
The VP650 is set to 6250 psi (431 bar)
The VP Lite and VP Lite MG is set to 4500 psi (310 bar)

Brake Interlock
The trailer is equipped with a brake interlock system. If the rear doors are open or not closed securely, the trailer parking brakes will not release.
Do not tamper with or attempt to bypass this safety system
**Trailer Markings Identification**

First Responders must be able to recognize the equipment and manufacturer to properly assess the situation. The first and most important step is to determine the trailer contents; a placard is mounted on all 4 sides of the trailer which will identify the cargo.

- Compressed Natural Gas (CNG) placard should show Natural gas, compressed, 1971.
- Compressed Nitrogen placard should show Nitrogen compressed, 1066.
- Compressed Mixed Gas (MG) placard should show Hydrogen and Methane mixtures, compressed, 2034

Currently all Quantum virtual pipeline systems are housed in cargo containers. From a distance, the markings on the outside of the container can aid in identification, the first four digits in the container marking, identify Quantum as the manufacturer and the type of container.

The Quantum Owner code is **HPCU**, all Quantum virtual pipeline trailers will be marked with the HPCU prefix.

If it is possible to approach the vehicle, there is a data label inside the rear door that will provide the manufacturing information as well as the system capacity.
1 Rear Master Control Switch
2 Unload couplings
3 Unload manual shut off valves
4 Unload vent valve
5 Load couplings
6 Load manual shut off valves
7 Load vent valve
Master Control Switch

The trailer is equipped with a master control switch, or emergency stop switch, on the front and rear of the trailer. Each cylinder is equipped with a pneumatically controlled valve to open and close the gas storage cylinder. The pneumatic valves are defaulted to the closed position and require pneumatic pressure to hold them open.

Activating either of these switches will vent the pneumatic system controlling the cylinder valves stopping all gas flow.

The illustrations to the right show the front and rear master control switches; some trailers may have either switches or ¼ turn valves in these locations, turning either type of valve to the OFF position will stop all gas flow from the trailer.

These valves will have no affect or capability to stop gas flow during the loading cycle only during the unloading cycle.

There are indicators on the side of the trailer so the operator may determine if the valves are actively open or closed.

The valves in this illustration are shown in the open position, if the valves are in the closed position the arrows will be pointing UP or DOWN.
Cylinder Manual Shut off valves
These valves are accessible through access holes in the roof panels, there is one shut off valve for each cylinder.

Depending on the configuration of the trailer there could be up to 51 of these shut off valves.

The valve in this illustration is shown in the off position. If the handle is pointed in line with the pipe the valve (shown in the picture above right) is in the open position.
Response Considerations
Approaching the Equipment

Gas Vent locations

It is important to know the locations of the relief device vent ports, in the event of an accident or fire one or more of the relief devices may be activated. If activated, flammable gas may be directed toward equipment or personnel creating a hazardous condition.

All Quantum VP trailers have relief valves equipped on each cylinder, the trailer may have up to 51 cylinders. Each of these cylinder relief valves will exhaust through the roof of the trailer adjacent to the cylinder it is protecting. These relief valves are thermally activated but may also be activated in the event of a shock of impact.

It is also important to understand that if the trailer will need to be vented on site, the vent pipe for the vent valves on the back of the trailer vent through the sides of the trailer at the top.

IMPORTANT: If the PRD valve has been activated and is venting gas, the cylinder valve will not stop the gas flow, there is no provision to stop the flow of gas, the cylinder must be allowed to vent until it is empty.

The cylinders are mounted vertically in the container, if any cylinder were to rupture due to physical damage or fire, the debris would likely escape the container through the top or bottom of the trailer.
Public Safety
First responders should be aware of potential evacuation areas in the event of venting. Initial isolation and evacuation distances should be determined by using ERG 2016 Guide 115.

Isolation
- As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).

Protective Clothing
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters’ protective clothing will only provide limited protection.
- Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.
  - Keep in mind that while the gases used in these systems are not cryogenic gases, the pressure drop of the escaping gas can create very cold temperatures, temperatures can easily reach in the -80F (-62C) range.

Evacuation
Large Spill
- Consider initial downwind evacuation for at least 800 meters (1/2 mile).

Fire
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping document and/or the ERAP Program Section.

Gas Release – No Fire
First responders should be aware of the potential impact area by the release of gas at high pressure. Methane is lighter than air. Venting high pressure containers are easily recognized by high pitched wind noises. Rapid decompression of CNG can create extremely cold temperatures. First responders should use caution when utilizing fog streams to control gas as this may potentially freeze safety venting systems. This fog stream may also produce a visible vapor cloud. Responders may smell the odor of mercaptan at or near the ground as this added odorant begins to separate from the lighter than air natural gas.

Static build up
When liquid or gas is passed through piping at a high flow rate, the electrostatic charge of the flowing matter generates static electricity. The amount of charge gradually increases to a point where it can easily generate high voltages, on the order of several thousand volts.
If an electrical conductor comes within a certain distance of the container, an electrical discharge can occur, this discharge can supply enough energy to initiate ignition.
The presence of fuel in the atmosphere can actually make it easier for the electrical charge to bridge the gap between the static source and a grounded conductor. If there is a sufficient concentration of flammable gas in the surrounding atmosphere, the gas is ignited.
In dry ambient conditions it may be advisable to apply a fog stream to the trailer, away from the venting location, to increase the humidity level and decrease or eliminate static build up concern.

Spark proof tools
If it is necessary to use tools when there is an active or suspect gas leak, it is strongly recommended to use only spark proof tools.
Gas Release with Fire
Quantum VP trailers are built with Type 4 all composite cylinders, these cylinders will degrade in the presence of fire.
Each cylinder in the VP trailer is equipped with its own thermal relief device to safely vent the cylinder in the event of a fire. Depending on the severity and source of the fire there is always the possibility a cylinder will suffer damage to the point of structural failure before the gas is fully vented.
Refer to Bleve safety precautions for general precautions in the event of a cylinder failure.

In the Event of Equipment Fire
If a fire should occur in the vicinity of the fuel storage system, the thermal relief devices located in the module may be activated. If any of the relief devices activate, a very rapid venting of gas may occur. If a fire caused the activation and the cylinder is full of a flammable gas, it is likely that the gas exiting the pressure relief line will ignite which may be very dangerous. Even if the gas does not ignite, debris blown away by the gas jet may be dangerous and the loud noise caused by the rapid venting may cause hearing damage.
If any of the relief devices activate, then evacuate the area immediately and call the appropriate authorities.

Each individual cylinder is equipped with its own thermal relief device, these relief devices are designed to vent through the roof of the container. In the event of a fire there may be as many as 51 separate PRD devices activated and discharging gas.
Once these relief devices are activated there is no means to shut them down, the system will continue to vent until all cylinder pressure has been depleted.
Fire department personnel should consider the use of a thermal imaging camera before approaching containers.

Fire Fighting Recommendations
First responders must be aware that if the cylinder or cylinders are venting, it is likely supplying fuel to the fire.
If the fire appears to be a pressurized stream that has ignited it is likely a cylinder PRD valve that has activated, if the fire is not from a pressurized gas source the flame should be extinguished immediately before it does cause a cylinder thermal relief device to activate and release pressurized flammable gas.

Once ignited, extinguishing a fire when pressurized gas is the source, may not be the best option as the flow of flammable gas cannot be stopped once the cylinder PRD valve has activated.

Each individual full cylinder on a trailer may vent for up to 60 minutes. During this time the PRD valves on the other cylinders may be activated and begin releasing high pressure gas. First responders must be aware this may continue to occur as long as there are heat sources present.

In addition to the hazard created by the release of flammable gas, first responders must also be aware that venting gas decompresses rapidly and can reach extremely cold temperatures at the vent opening to the point of creating a burn hazard.
At the point of release there is a very high concentration of methane and it is difficult to ignite due to the air / fuel ratio. The ignition hazard will be in the zone where the combustible gas and oxygen are in the flammable range. First responders must also be cognizant that high pressure gas releases can cause a static electricity build-up which could be a potential ignition source.

The Quantum VP trailers are completely enclosed, in the event of a fire inside the containment; the application of water may not reach the source of the fire. In these cases continued application of water may only result in cooling the thermal relief devices and delaying activation of these safety devices. This may result in the catastrophic failure of one or more of the cylinders inside the containment.
For fires involving flammable gases:

- Evacuate the area.
- The best procedure is to stop the flow of gas before attempting extinguishing the fire.
  - To extinguish the fire, while allowing continued flow of gas, is extremely dangerous; an explosive cloud of gas/air mixture may be created that, if ignited, may cause far more damage than the original fire.
- Extinguishing the flame using carbon dioxide or dry chemical may be desirable to allow immediate access to valves to shut off the flow of gas, but this must be done carefully. In many cases, it will be preferable to allow continued burning, while protecting exposures with water spray, until the flow of gas can be safely stopped or the gas is depleted.
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

System Venting

If it is necessary to vent part or all of the system the following guidelines should allow for safe system evacuation

To vent process piping

Even using this procedure there may be residual pressure left in various section of the system.

**WARNING**

*There may be portions of the fuel system that may not have been vented or that have residual pressure. Always use caution when disconnecting high pressure fuel lines or fittings. Failure to follow this instruction may result in death or serious injury.*

1. Switch the master control switch to OFF. This should close the automatic shut off valves on all fuel storage cylinders.
2. Open the system vent valves on the control panel area; this should vent pressure from all the process plumbing.

3. If gas flow continues it may be necessary to close the cylinder manual shut off valves.
Emergency vent of the fuel storage cylinders

It is always preferable to unload as much fuel as possible without venting to the atmosphere. If conditions permit and it is safe, it is recommended to transfer as much fuel as possible to another trailer or storage vessel if available.

Even using this procedure there may be residual pressure left in various section of the system. Use caution when removing any system fittings or valves.

**WARNING**  
There may be portions of the fuel system that may not have been vented or that have residual pressure.  
Always use caution when disconnecting high pressure fuel lines or fittings. Failure to follow this instruction may result in death or serious injury.

1. Switch the master control switch to OFF. This should close the automatic shut off valves on all fuel storage cylinders.

2. Open the system vent valves on the control panel area, this should vent pressure from all the process plumbing.
3. If gas flow continues it may be necessary to close the cylinder manual shut off valves directly on the cylinders or the manual shut off ¼ turn valves directly above the unloading block.

4. Once gas flow has stopped remove the plugs from the unloading block as shown in the illustration.

5. **STAND OUT OF THE WAY, WEAR EYE, EAR AND HAND PROTECTION.**

   **WARNING** *Switching the master control switch to ON will allow gas to vent to atmosphere. Ensure there are no ignition sources in the immediate vicinity and local evacuations have been performed as needed. Failure to follow this instruction may result in death or serious injury.*

6. Open any manual valves that were closed to stop fuel flow, USE CAUTION as fuel flow may resume when opening these valves

7. Switch the master control switch to ON.
Using off board air to activate cylinder valves

At the time of publication of this manual this content is still being finalized. This section will be updated when information is available.
Emergency Vent Locations and directions shown by red arrows

Unload Vent Valve

Unload Vent Valve

Emergency air Over ride

Master Control (E-Stop)

Cylinder Manual Shut Off Valves

Cylinder Manual Shut Off Valves

Each Container holds up to 51 vertically mounted cylinders

VP 650 System Capacity
- Approx. System Weight Full: 80,776 lb (36638 kg)
- Maximum System Gas Mass: 30,166 lb (13883 kg)
- Maximum System Gas Volume: 644,306 SCF
- Maximum System Pressure: 6,250 psi (431 bar)

VP Lite System Capacity
- Approx. System Weight Full: 60,923 lb (27634 kg)
- Maximum System Gas Mass: 22,074 lb (10013 kg)
- Maximum System Gas Volume: 471,443 SCF
- Maximum System Pressure: 4,500 psi (310 bar)

QUANTUM TECHNICAL ASSISTANCE/EMERGENCY NUMBER 1-800-816-8691

For additional information visit our website at http://www.qtww.com/service/product-documentation/
Appendix B – System Specifications

**VP 650**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer Length</td>
<td>45 ft (13.72 m)</td>
</tr>
<tr>
<td>Trailer Width</td>
<td>8.2 ft (2.5 m)</td>
</tr>
<tr>
<td>Trailer Height</td>
<td>13.6 ft (4.15 m)</td>
</tr>
<tr>
<td>Approximate System Weight Empty</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Approximate System Weight Full</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Approved Gases</td>
<td>Nitrogen, CNG Only</td>
</tr>
<tr>
<td>Total System Water Volume</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Maximum System Gas Mass</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Maximum System Gas Volume</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>System Working Pressure</td>
<td>5,000 psi (345 bar)</td>
</tr>
<tr>
<td>Maximum System Pressure</td>
<td>6,250 psi (431 bar)</td>
</tr>
<tr>
<td>Minimum System Ambient Temperature</td>
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<tr>
<td>Maximum System Ambient Temperature</td>
<td>135° F. (57° C.)</td>
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<tr>
<td>Maximum Cylinder Temperature</td>
<td>180° F. (82° C.)</td>
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**VPLite and VPLite MG**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tr>
<td>Trailer Length</td>
<td>45 ft (13.72 m)</td>
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<tr>
<td>Approximate System Weight Empty</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Approximate System Weight Full</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Approved Gases</td>
<td>Nitrogen, Bio Gas, CNG Only</td>
</tr>
<tr>
<td>Total System Water Volume</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Maximum System Gas Mass</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>Maximum System Gas Volume</td>
<td>See Trailer Capacity Table</td>
</tr>
<tr>
<td>System Working Pressure</td>
<td>3,600 psi (248 bar)</td>
</tr>
<tr>
<td>Maximum System Pressure</td>
<td>4,500 psi (310 bar)</td>
</tr>
<tr>
<td>Minimum System Ambient Temperature</td>
<td>-40° F. (-40° C.)</td>
</tr>
<tr>
<td>Maximum System Ambient Temperature</td>
<td>135° F. (57° C.)</td>
</tr>
<tr>
<td>Maximum Cylinder Temperature</td>
<td>185°F (85°C)</td>
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</table>
Appendix C - Trailer Gas Capacity

Trailer gas capacity will vary based on the model of the trailer, the model or part number of the trailer can be found on the inside of the left rear door on the manufacturer’s label.

**VP 650 (Model 118195)**
Total System Water Volume: .............................................................. 13,315 Gal (50,404L)
Maximum System Gas Mass: .............................................................. 29,990 lb (13603 kg)
Maximum System Gas Volume: .......................................................... 667,229 SCF
System Working Pressure: ................................................................. 5,000 psi (345 bar)
Maximum System Pressure: ............................................................... 6,250 psi (431 bar)
Approximate System Weight Empty: ................................................. 51,280 lb (23260 kg)
Approximate System Weight Full: ...................................................... 81,270 lb (36864 kg)

**VP Lite (Models 118388, 118636, 118684)**
Total System Water Volume: ........................................................... 11,745 Gal (44,460 L)
Maximum System Gas Mass: ............................................................ 21,368 lb (9,693 kg)
Maximum System Gas Volume: ......................................................... 475,407 SCF
System Working Pressure: ................................................................. 3,600 psi (248 bar)
Maximum System Pressure: ............................................................... 4,500 psi (310 bar)
Approximate System Weight Empty: ................................................ 39,373 lb (17859 kg)
Approximate System Weight Full: ...................................................... 60,741 lb (27552 kg)

**VP Lite (Model 118796)**
Total System Water Volume: ........................................................... 13,288 Gal (50,302 L)
Maximum System Gas Mass: ............................................................ 24,176 lb (10,966 kg)
Maximum System Gas Volume: ......................................................... 537,876 SCF
System Working Pressure: ................................................................. 3,600 psi (248 bar)
Maximum System Pressure: ............................................................... 4,500 psi (310 bar)
Approximate System Weight Empty: ................................................ 42,480 lb (19269 kg)
Approximate System Weight Full: ...................................................... 66,656 lb (30235 kg)
Revision History:

Revision X1: Draft release.