



Product Manual

APPS-160



Designed and Built by:

Chart Inc.

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Revision Log

| Revision Level | Date | Description |
|----------------|------------|--|
| B | 07/25/2014 | Convert to new layout and combine with manual PN 13428250 for 220V |
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Preface

General

The Adjustable Pressure Phase Separator (APPS 160) unit is used to lower the saturation point of liquid nitrogen. Liquid nitrogen saturated at a high pressure flows into the APPS 160 and exits at a much lower saturation pressure and temperature. Liquid nitrogen enters the APPS 160 unit through an automatic solenoid valve and exits through a one-inch vacuum insulated female bayonet. A differential pressure switch maintains the liquid level in the cylinder.

The internal pressure of the cylinder is controlled by the combination of a pressure switch connected to the solenoid valve and a back-pressure regulator. If the pressure exceeds the set point of the back-pressure regulator, the pressure switch activates a solenoid valve that rapidly vents the APPS 160 down to the desired working pressure.

Technical Features

- Tighter pressure control for the lower pressure liquid application
- Adjustable outlet pressure ranges
- Working capacity of 160 liters
- Bayonet outlet connection is standard
- Muffler to reduce noise levels (98 to 106 dB)
- Major components moved out of the frost area
- Intuitive flip toggle switch
- More accurate and reliable level gauge located out of the frost area
- Allows low pressure liquid and high pressure gas from a single storage vessel
- More precise pressure control on liquid use
- Mini-bulk storage for under-sized vacuum lines
- Low cost alternative to two bulk tanks
- Two operating pressure ranges available
- Stainless steel plumbing

Product Manual

The APPS 160 Product Manual is designed to be used in conjunction with APPS 160 provided by Chart. If there are any questions regarding the operation of this unit, contact Chart's Technical Service division at 1-800-400-4683.

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

The safety requirements for operating the unit and handling of 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 Installation / Operation section includes information on how to install the APPS 160, initial start-up and operation of the unit and references any adjustments that may need to be made.

For information on identification of components, schematic of the unit, electrical schematic, or service information see the Specifications section.

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:

| | |
|----------|-------------------------------------|
| APPS 160 | Adjustable Pressure Phase Separator |
| dB | Decibel |
| GPM | Gallons per minute |
| Hz | Hertz |
| MAWP | Maximum Allowable Working Pressure |
| OD | Outer Dimension |
| PN | Part Number |
| PSI | Pounds per Square Inch |
| PSIG | Pounds per Square Inch (Gauge) |



Safety

General

Strict compliance with proper safety and handling practices is necessary when using an APPS 160 unit. 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 units and safe operations are anticipated, it is essential that every user of the APPS 160 unit carefully read all warnings listed in this safety section and contained in the manual itself. Periodic review of this safety summary is recommended.



Warning! ***INSTALLATION: The APPS 160 should be installed by a trained, knowledgeable technician. The cryogenic piping connected to the inlet and outlet must be constructed of materials suitable for cryogenic service and properly protected from possible over-pressure. The electrical connections to the control box should be completed by a trained technician per the wiring schematic. The APPS 160 should be located on suitable, level surface and be properly fastened to prevent movement.***



Warning! ***ASPHYZIATION HAZARD: The venting nitrogen gas may displace the available oxygen in the area to the point where the atmosphere is deficient in oxygen. The cold nitrogen vent gas can collect in low areas, increasing the potential risk. When the APPS 160 is installed indoors or in any area with poor ventilation, the installation of an oxygen monitor should be considered.***

The normal oxygen content of air is approximately 21%. Depletion of 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 obtainable 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.



Warning! ***EXTREME TEMPERATURES: Surfaces in contact with the cryogenic liquid nitrogen or the vent gas will become extremely cold. These surfaces should not be touched.***



Warning! PRESSURIZED EQUIPMENT: *In normal operation the APPS 160 and the associated piping will be pressurized. Before the pressure vessel is serviced or any plumbing components are removed, all pressure must be released.*



Warning! ELECTRICAL EQUIPMENT: *In normal operation the APPS 160 has wiring that is powered with 120 volt AC power. In addition, other wiring can be activated automatically without notice. Only knowledgeable technicians should access or repair the electrical wiring.*

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.

Installation / Operation

Installation

- Remove the APPS 160 from the shipping crate. Visually inspect the unit to ensure there is no visible shipping damage.
- Move the APPS unit to the exact installation location. Location must be flat, level and made from a suitable material such as concrete. Normally the APPS unit is installed outdoors on the pad, near the bulk supply vessel.
 - Mark the locations of the four foot pad holes.
 - Move the APPS unit and drill holes for 3/8" cement anchors (not supplied).
 - Install cement anchors.
 - Move the APPS unit back into position and bolt down securely.
- Connect supply piping from bulk supply vessel to APPS 160 inlet (1/2" male 45° flare fitting). Optional APPS fill hose PN 11000920 can be used for this connection.
- Connect APPS outlet (1" MVE female bayonet) to vacuum insulated pipe system. Refer to the [MVIP Product Manual PN 14736238](#) located on www.chartparts.com for the proper procedure.
- Connect 120 Volt / 60 Hz 200 watts (or 220 Volt / 50 Hz) electrical supply to APPS control box.
 - Conduit connector is located on bottom of control box.
 - Wiring should be connected to control box as follows:
 - Black (hot) wire to "H" connection on terminal block
 - White (neutral) wire to "N" connection on terminal block
 - Green (ground) wire to "GND BAR"
 - Ensure both valve switches are in "AUTO" position.
 - Replace control box cover and attach securely.

Start-Up

- Ensure APPS 160 is completely and properly installed.
- The APPS 160 unit should be purged with warm, dry nitrogen gas prior to introducing liquid to ensure that the unit does not have moisture in the inner vessel.
- Turn APPS unit power switch to "ON" position.
- Open manual supply valve slightly to start flow of gas / liquid into APPS unit.
 - Throttle supply valve to prevent over-pressure of the APPS (opening the relief valves) due to vaporization / cool down losses during the initial fill.
 - Slowly open the supply valve as the APPS inner vessel is cooled to cryogenic temperature.
- After fill cycle ends, APPS will vent more often than normal for the first few hours.
- After the APPS is filled and stabilized, the vacuum insulated pipe system can be "started up" per the recommended process.

Operation

- During normal operation, the APPS 160 will function automatically.
- The liquid level switch will monitor the liquid nitrogen level. It will open and close the fill valve to maintain the liquid nitrogen level within the preset level.
- The vent regulator will release gas as required to maintain the APPS unit at the preset pressure.
- The pressure switch will monitor the pressure. If the pressure rises above the set point, it will open the vent valve and release gas to reduce the pressure.



Caution! *The vent valve will open without notice. The venting gas will be cold and loud.*

- To take the APPS unit out of service turn the power switch to "OFF." The APPS unit will still contain liquid nitrogen, therefore it will vent gas from the vent regulator and supply liquid nitrogen from the outlet until the unit is emptied.

Adjustments

Operating Pressure

- To change the operating pressure of the APPS 160, the set point of the vent regulator and pressure switch must be adjusted.
- Vent regulator should be adjusted to the desired operating pressure. Pressure switch should be adjusted to open the vent valve at 2-3 psi higher than the regulator set point.
- To adjust vent regulator, loosen lock nut and turn adjustment bolt
 - In or clockwise will increase set point
 - Out or counterclockwise will decrease set point
 - Tighten lock nut after adjustment
- To adjust the pressure switch:
 - Remove cover



Caution! *To monitor adjustment, power must be on and wires will be powered or “hot.”*

- Turn large brass hex nut
 - In or clockwise will decrease set point
 - Out or counterclockwise will increase set point
- Replace cover after adjustment

Liquid Nitrogen Level



Caution! *The liquid nitrogen level should only be changed by an experienced technician. Incorrect adjustment can result in the APPS 160 overfilling or running empty.*

- To change the liquid nitrogen level the liquid level switch must be adjusted.
 - Remove cover



Caution! *To monitor adjustment, power must be on and wires will be powered or “hot.”*

- Turn brass machine screw
 - In or clockwise will increase set point resulting in a higher liquid nitrogen level
 - Out or counterclockwise will decrease set point, resulting in a lower liquid nitrogen level
- Replace cover after adjustment

Troubleshooting

The Troubleshooting table is arranged in a “Trouble/Possible Cause/Remedy” format. Note that possible causes for specific symptoms are listed in descending order of significance. That is, check out the first cause listed before proceeding to the next. If you need further assistance please contact Chart’s Technical Service Team at 1-800-400-4683.

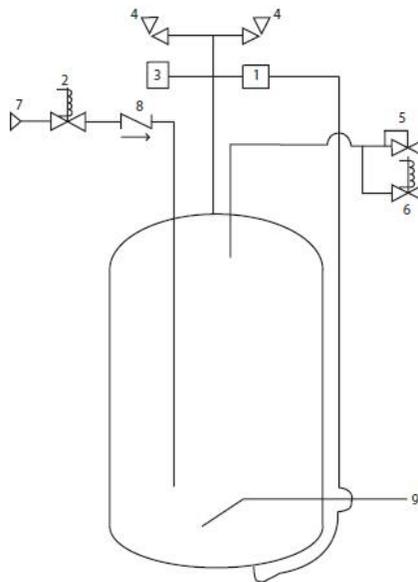
| Trouble | Possible Cause | Remedy |
|---------------------|---|--|
| Unit overfills. | Pressure gauge not working. | Remove front panel from electrical box (live voltage exists). Position the fill switch in the off position. Position and hold the vent switch in the manual position and vent the tank down to zero psi. If the pressure gauge does not read zero, replace the gauge. |
| | Stuck or bad fill valve. | After performing the above steps there should be no product flowing into the APPS unit. If a fill valve is stuck it could be debris under the seat, faulty valve, or over-tightened valve bolts. The bolts should not be tighter than 12 foot pounds and should be evenly torqued. If the gasket between the bodies leaks it needs to be replaced. |
| | No flow in the copper phase lines. | Mark the location of the copper phase lines and remove them from the liquid level switch. You may need to vent the APPS during this process. Direct the lines in a safe direction and hold the fill switch in the manual position. One line should have good gas flow and the other should have good liquid flow. If either line does not have flow the APPS will need to be emptied, warmed up and purged to free the line of moisture. |
| | Lines are not correctly connected to the liquid level switch. | If both lines flow freely verify they are connected correctly and not reversed. |
| Unit does not fill. | Faulty or incorrectly adjusted liquid level switch. | Contact Chart Technical Service at 1-800-400-4683 to verify the liquid level switch is set correctly. |
| | Coil or wiring issue. | Remove front panel from electrical box (live voltage exists). Position both switches to the off position. Position fill switch to manual position and verify that the fill valve opens. Repeat for the vent valve. If either valve does not open in the manual position it’s possible there is a burnt coil or wiring issue. |
| No unit function. | Bad fuse. | Remove front panel from electrical box and check fuse. |
| | No power. | Check supply of power to the APPS unit. |

Specifications

APPS 160 & APPS 160 (220V)

| | APPS 160 | | APPS 160 (220V) | |
|---------------------|-------------------------------|--|-------------------------------|-------------------------------|
| | PN 11914406 | PN 11918618 | PN 13417171 | PN 13417180 |
| Operating Pressure | 10 to 50 psig | 40 to 85 psig | 10 to 50 psig | 40 to 85 psig |
| Height | 61 9/16" | 61 9/16" | 61 9/16" | 61 9/16" |
| Width | 30 3/16" (20" OD cylinder) | 30 3/16" (20" OD cylinder) | 30 3/16" (20" OD cylinder) | 30 3/16" (20" OD cylinder) |
| Weight (empty) | 210 pounds | 210 pounds | 210 pounds | 210 pounds |
| Capacity (gross) | 42 gallons / 160 liters | 42 gallons / 160 liters | 42 gallons / 160 liters | 42 gallons / 160 liters |
| Cryogenic fluids* | Nitrogen | Nitrogen | Nitrogen | Nitrogen |
| Inlet connection | 1/2" male 45° flare | 1/2" male 45° flare | 1/2" male 45° flare | 1/2" male 45° flare |
| Outlet connection | 1" female MVE bayonet | 1" female MVE bayonet | 1" female MVE bayonet | 1" female MVE bayonet |
| Vent connection | 1/2" female pipe thread | 1/2" female pipe thread | 1/2" female pipe thread | 1/2" female pipe thread |
| MAWP | 100 psi | 100 psi | 100 psi | 100 psi |
| Max inlet pressure | 235 psi | 235 psi </td <td>235 psi</td> <td>235 psi</td> | 235 psi | 235 psi |
| Max withdrawal rate | 15 gpm continuous | 15 gpm continuous | 15 gpm continuous | 15 gpm continuous |
| Steady state noise | 98 - 106 dB | 98 - 106 dB | 98 - 106 dB | 98 - 106 dB |
| Power requirement | 110 Volt / 60 Hz 200 watts | 110 Volt / 60 Hz 200 watts | 220 Volt / 50 Hz | 220 Volt / 50 Hz |

* Oxygen and argon service available upon special request. Specifications subject to change at any time without notice.



- | | |
|---|------------------------------|
| 1 | Diff. Pressure Switch |
| 2 | Fill Solenoid Valve |
| 3 | Vent Pressure Switch |
| 4 | Relief Valves |
| 5 | Vent Back Pressure Regulator |
| 6 | Vent Solenoid Valve |
| 7 | Strainer |
| 8 | Check Valve |
| 9 | One Inch Female Bayonet |

Service

- The APPS 160 should only be serviced by a knowledgeable technician.
- Power should be disconnected before covers are removed from the control box, pressure switch or liquid level switch. If not, these boxes will contain “hot” wires and/or wires that will become “hot” without notice.
- Liquid nitrogen and all pressure should be released before any plumbing component is removed.
- Potential service parts are as follows:

| Part Description | 11914406 (10-50 psig) | 11918618 (40-85 psig) | 13417171 (10-50 psig) | 13417180 (40-85 psig) |
|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Vessel PRV (100 psig) | 11915572 | 11915572 | 11915572 | 11915572 |
| Vessel SRV (150 psig) | 11915581 | 11915581 | 11915581 | 11915581 |
| Inlet piping RV (235 psig) | 1810062 | 1810062 | 1810062 | 1810062 |
| Vent regulator | 11756911 | 2110582 | 11756911 | 2110582 |
| Fill or vent valve | 11542577 | 11542577 | 13428217 | 13428217 |
| Pressure switch | 10805996 | 11860241 | 10805996 | 11860241 |
| Liquid level switch | 11841147 | 11841147 | 11841147 | 11841147 |
| Inlet strainer | 11529090 | 11529090 | 11529090 | 11529090 |
| Inlet check valve | 11208931 | 11208931 | 11208931 | 11208931 |

See pictures on following pages for the identification of components.

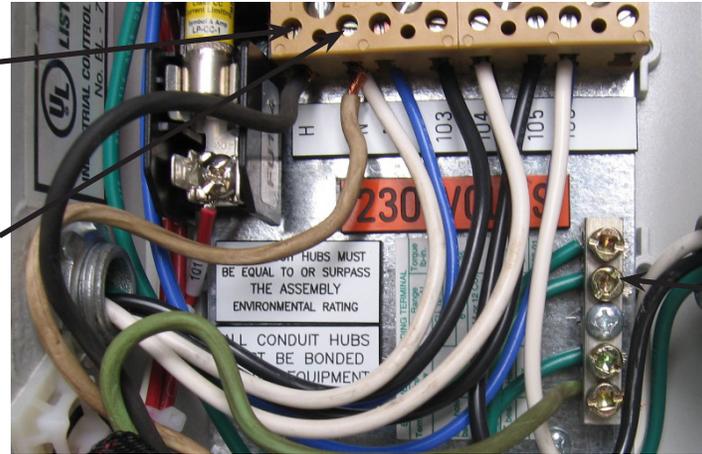
All parts are available from Chart at www.chartparts.com.





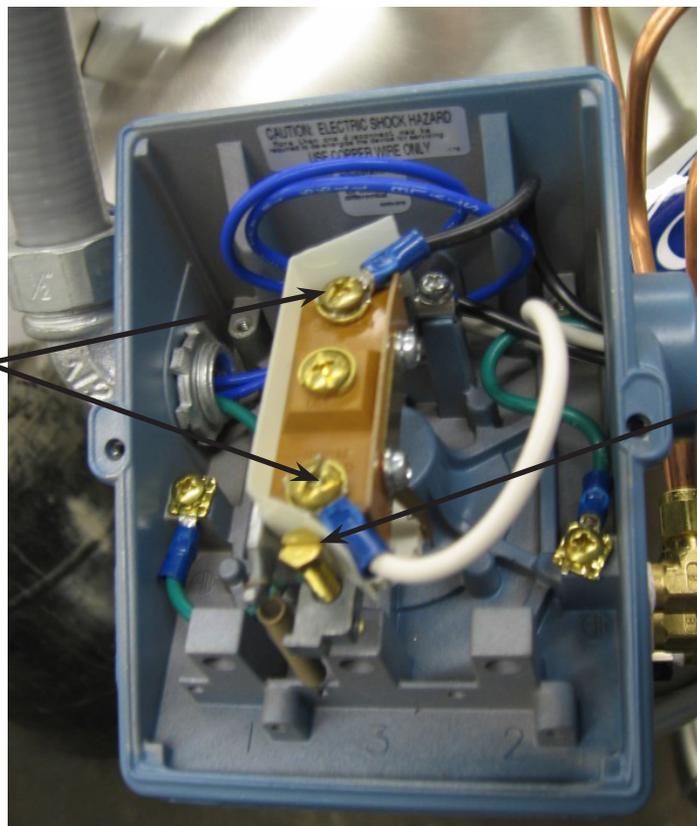
**Control Box
hot - black wire
connection**

**Control Box
neutral - white wire
connection**



**Control Box
ground - green wire
connection**

**Liquid Level
switch
connections**



**Liquid Level
switch adjustment**



Control Box Electrical Schematic

