

Edelhoff Technologies Breathing Air Supply Module

Users Manual (U.S. and CANADA ONLY)

Edelhoff Technologies Breathing
Air Supply Module for Edelhoff
Technologies Life Support Systems

Four-Man MN: ETM-1-4
Six-Man MN: ETM-1-6

User Manual

Four/Six Man Breathing Air Supply Module

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Preface

This manual is meant for those who operate or use the Edelhoff Technologies air supply module, and for those who perform minor maintenance and repairs. It is assumed that the module is maintained and repaired by competent maintenance personnel. It is advised to return the module to the manufacturer for maintenance and calibration every five years.

The module is built to supply breathing air for persons working in hazardous environments. Before using the module, always check that the unit is suitable for working in that environment. This includes a check of environmental influences such as temperature, or the resistance of the umbilical assemblies to any corrosive substance present in the working area.

1. Safety

1.1 Symbols

This manual includes a number of warnings for dangerous situations. These can be recognized by the following symbols:



Danger

This indicates a situation that is dangerous to life, or can cause severe injuries if not avoided.



Warning

This indicates a situation that can cause injuries to the user, or can cause severe damage to the equipment if not avoided.



Attention

This indicates a situation that can cause damage to the installation if not avoided.

1.2 General safety measures

The module should always be set up and used by personnel that have sufficient knowledge about working with air under high pressure.

Breathing air used with the safety unit should comply with CGA speciation G-7-1, Type 1, Grade D or better. Always check if the umbilical assemblies have sufficient resistance to any corrosive substance present in the working environment. A resistance chart is included in the appendix of this manual for checking against. If the resistance chart does not contain data about a certain substance the umbilical assembly would be exposed to, contact the manufacturer for information concerning that substance.

The module has only been tested and approved for use at temperatures between 21°F to 140°F, -6°C to +60°C

2. Module description

2.1 General

The module consists of anodized aluminum panels, factory set two stage high pressure regulators with analog and flow meter read outs for both the primary, secondary air supply and primary, secondary air out. The module can supply breathing air for up to four or six persons depending on the unit design and has built-in communication connections. The module is designed to connect to external air supply bottle banks via CGA couplings. The air pressure in the air bottle banks is monitored by an alarm unit and the air flow for each man is monitored with indicator lights. The Module is designed to run on 110 volts 50-60 Hz or 220 volts 50-60 Hz in Europe. With a 12-VDC battery back-up connection.

2.2 Specifications

Module:

Temperature range	+21°F to +140°F - 6°C to +60°C
Max. input pressure	500 psi
Power supply	1 x 110V AC, 50Hz/60Hz,
Backup battery (For communications and alarm unit)	12-VDC
Fuse	Fuse 14



Figure 1: Module Front

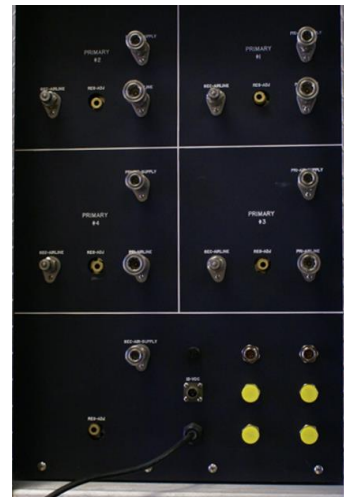


Figure 2: Module Back

2.3 The breathing air system

The breathing air system is designed to supply a maximum of four to six persons with breathing air while they are working in a hazardous environment. The air supply is built as a dual system. Two separate air banks are connected, which supply air to two identical control systems. The umbilicals have dual air hoses. One of the supply lines is used as a main supply, the other as a secondary backup line.

Each of the primary air supply systems consists of the following components:

1. Connection for the high-pressure air bank. The air bank can be connected using a CGA connector. There is a gauge on the front of the module for monitoring the bottle bank air supply pressure. See figure 3.
2. A two stage regulator that reduces the high-pressure air from the air bottle banks to a preset air out pressure of 125 psi. There is a pressure gauge to check the air supply and air out pressure and an On/Off valve control on the front of the module.
3. An internal flow meter for monitoring the breathing activity of each worker and the possibility of free flowing regulators. The internal flow meter is connected the LED FLOW light. See figure 4.
4. A panel mounted flow meter for visually monitoring flow and breathing activity of each user and the possibility of no flow occurrences. The flow meter indicates inhalation and exhalation of the user. The panel mounted flow meter is connected to the LED NO FLOW light and audible alarm unit. **(for flowmeter module only)**
5. The umbilical (breathing airlines) connects to the module via quick connect fittings. These connections can be found on the back of the module. See figure 5. The connections are opposite (socket and plug) on both the module and the umbilical to insure correct connections.
6. A test panel, located at the bottom front of the module, allows for testing of breathing apparatuses at the job site and when doing maintenance. The test panel air supply is shared with the secondary air supply. See figure 6.



Figure 3: Primary Air



Figure 4: Flow Indicator LED



Figure 5: Umbilical Connections



Figure 6: Test Panel

Below is a diagram showing the four separate primary air supplies of the modules and their related lights and flow sensors. A six man module has two additional primary air supplies identical to those seen here.

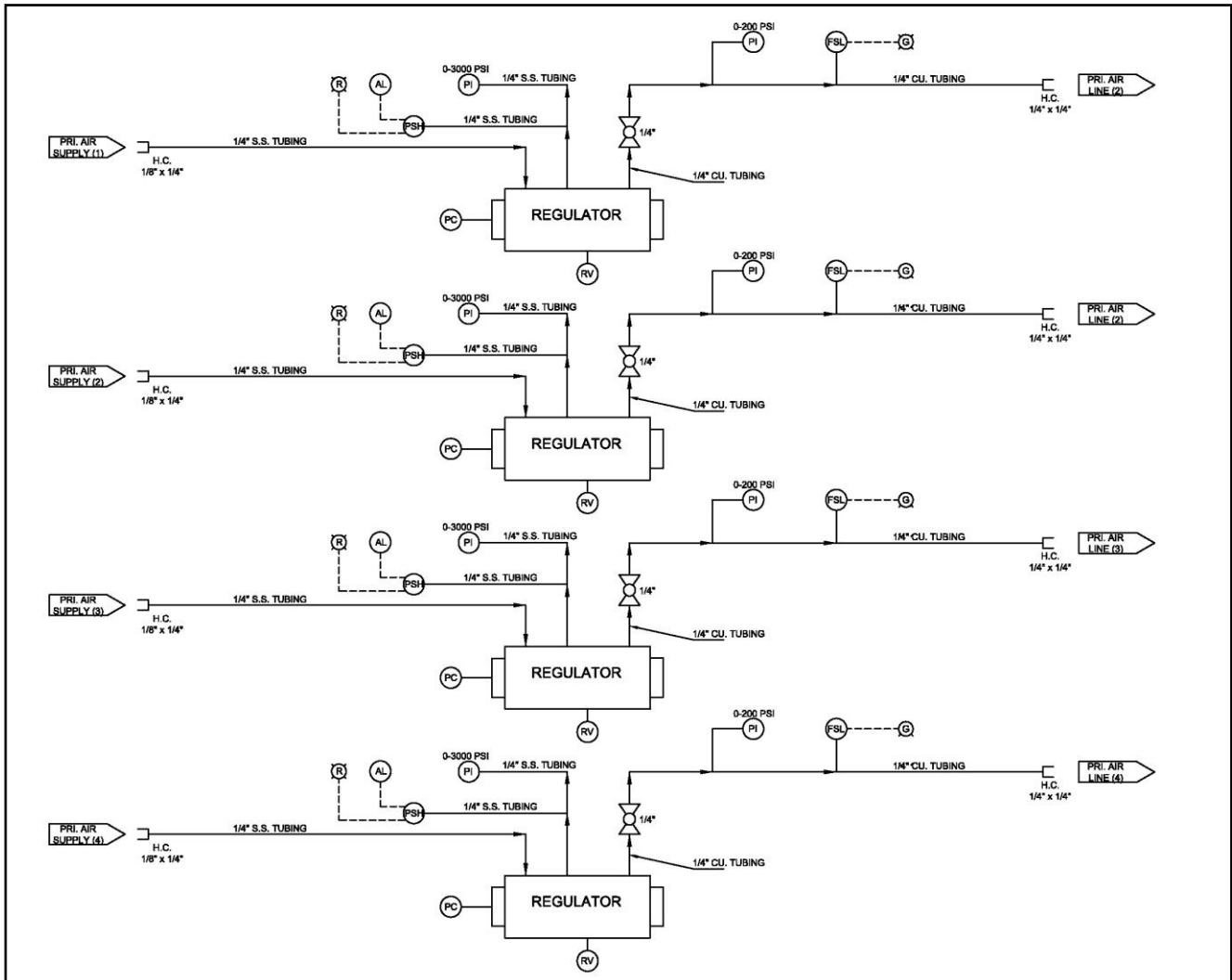


Figure 7: Primary Air Supply Schematic

Below is a diagram showing the shared secondary air supply of the modules and the related lights and flow sensors.

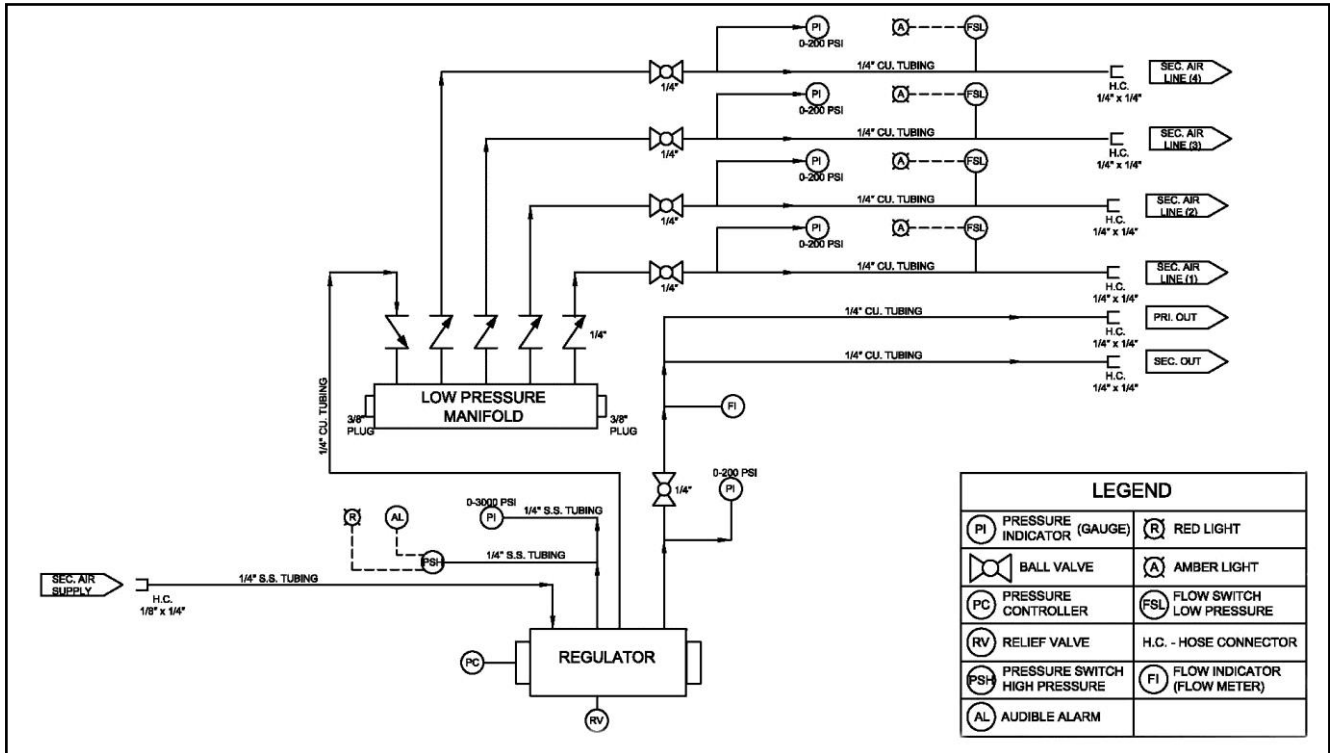


Figure 8: Secondary Air Supply Schematic

2.4 Power supply, control technology

The electrical system consists of the following components:

The alarm unit, communication set, LED indicator lights, backup battery connection and a low voltage heater.

The audible alarm unit is built into the module to monitor the pressures in the high-pressure air supply bottles and works in conjunction with the LED lights. See figure 9.

The communication set is built into module with four or six connections on the back of the module (depending on if it is a four or six man unit) and two connections on the front. See figure 10.

The LED lights, audible alarm and the communication set can be connected to a backup battery that takes over in case of a power failure at the external 12-VDC connection. The power system is fuse protected, which can be accessed as necessary on back side of the module.

Each module section has an On/Off rocker switch labeled POWER that controls the LED LOW-AIR-SUPPLY, FLOW and NO FLOW lights. The LOW-AIR-SUPPLY lights blink red. The primary LED FLOW lights are green and will turn on and off as each man breathes. A constant green light may indicate a leak or a free flowing regulator. See figure 11. The secondary LED FLOW light behaves the same as the primary LED FLOW but is amber. The red LED NO FLOW lights are connected to the audible alarm, which will sound after a 10 second interval of no flow. No flow may indicate a user has stopped breathing or flow has become obstructed. The 10 second delay prevents the alarm from sounding if the user holds their breath while working.

On some models, a heater unit can be installed inside the module and is thermostatically controlled.



Figure 9: Audible Alarm



Figure 10: Communication Fitting

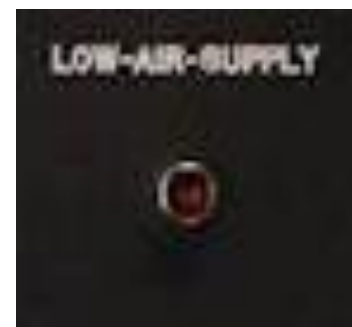


Figure. 11: LED Light

3. Setting up the system

3.1 Setting up the unit

- Check the air supply bottles contain breathing air complies with CGA speciation G-7-1, Type 1, Grade D or better
- Set the four man breathing air supply module on a level surface
- Protect the module from falls if using above ground level by securing the module to something firm and established
- All sockets shall be of a locking style.

3.2 Connecting the electrical system

- Connect an AC power cord (110/120 volts 50-60 Hz)



Attention

The electrical connection shall be grounded.

3.3 Connecting the air supply

- Connect the secondary air supply line via a CGA 346 fitting to the “SEC-AIR-SUPPLY” on the module.
- Connect the end of the High Pressure manifold to the CGA 346 fitting labeled “PRI-AIR SUPPLY” in each section labeled PRIMARY that is being used.
- Open cylinder valve momentarily to blow out any dust and dirt. Connect the High Pressure Manifold to the bottle bank.

3.4 Connecting the life support umbilicals

- Select the umbilical color that matches the color of the PRI-AIR Handle on the front of the module.
- Remove the umbilical fitting cap *(if applicable)*
- Connect the Quick Disconnect Socket on the Secondary Airline to the Quick disconnect plug labeled SEC-AIRLINE on the module. Then connect the Quick disconnect plug on the Primary Airline to the Quick Disconnect Socket Labeled PRI-AIRLINE.
- Repeat steps for each desired umbilical line.



Before connecting the umbilical hose assembly to the life support system, purge the umbilical with clean dry breathing air to remove any trash/foreign matter and condensation.

3.5 Connecting the communication fittings

- Install the communication fitting on the umbilical to the fitting on the module.
- Communication lines are not man specific.

4. Using the Module

4.1 General

4.1.1 Safety



Danger

Only use breathing air that complies with CGA speciation G-7-1, Type 1, Grade D or better.



Danger

Always check if the air supply is sufficient for the planned activities.



Danger

Always check if the working environment contains any substances that can affect the life support umbilicals. This can be checked with the hose resistance chart in this manual's appendix.



Danger

Inspect hoses for signs of damage or wear. If evident, replace hose.

4.1.2 Preparing the unit for use

- Turn on the power supply switch.
- Open the cylinder valves on the HP air banks
- Check the air supply pressure (Gauge should read 500-3000 psig)
- Check the air out pressure (120 to 125 psig).



Figure 14: Module Front

4.2 Working with the installation

4.2.1 The alarm unit

The alarm unit monitors the pressure in both the primary and secondary air supply banks. If the pressure in one of the air banks drops below 500 psi, a RED LED will start blinking and the audible alarm will sound. Low pressure in the primary supply line will activate the 500 PSI alarm. Low pressure in the secondary supply line will activate the 500 psi alarm. Both the audible alarm and the LED light will continue to be active until the pressure is restored to a pressure exceeding 500 psi.

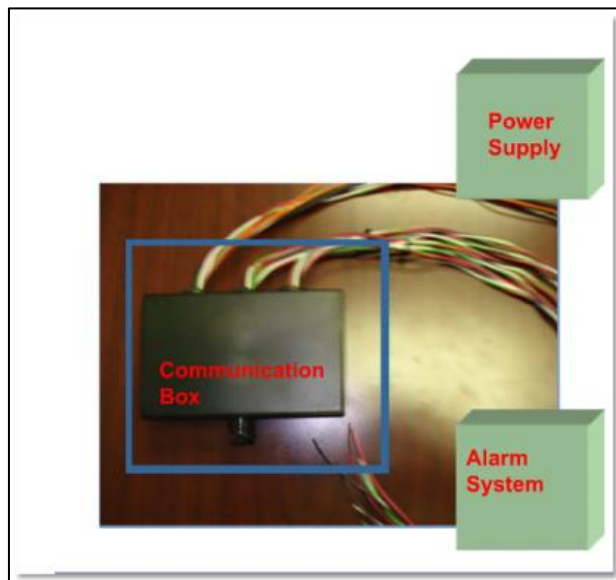


Figure 15: Alarm Unit



If the air bottle bank pressure drops below 500 psi, the alarms (audible and visual) will activate. The bottle banks shall be immediately replaced.



Stop all work if the alarm unit fails.

4.2.2 Using the air supply system

During normal operation, the system will automatically supply the masks. Breathing activity can be monitored in the primary airlines with the green LED lights labeled FLOW on the front of the module and with the panel mounted flow meters. In order to maintain a safe working situation, the operator shall continuously check the following:

- Pressure in the air bottle banks
- Air supply pressure in both the primary and secondary air lines

The normal operating pressure in the primary airline is 120/125 psig which will provide a maximum flow of 300 lpm. In the event that the helmet pressure in the oral/nasal cavity drops below 1.5 inches of water, the secondary regulator will begin to function.

Alarms

Several alarms will be indicated on the module front panel:

An air bottle is low or almost empty

When the air bottles are low, the audible and visual alarm unit will activate (at 500 psi) and the **Low-Air-Supply** LED light on the front of the panel will illuminate. The air supply cylinders shall be replaced (Once the pressure restores, the alarms will re-set).

Regulator (module) malfunction

If any regulator malfunctions occurs, abort all activities and replace immediately.

4.2.3 Shutting down the monitoring unit after use

- Turn module power off.
- Close air bank valves.
- Close all valves on control panel
- Disconnect life support umbilicals

5. Maintenance

5.1 Precautionary maintenance

The following maintenance tasks should be carried out once a year and documented accordingly:

1. Check that the umbilical supply lines are air tight (no leaks)
2. Check the entire system for leaks
3. Check that all components function correctly

5.2 Troubleshooting

Problem	Cause	Solution
Control valve is leaking	Bad or damaged seat	Replace valve
The alarm unit is not working. (POWER – LED not on)	<ol style="list-style-type: none">1. No power2. Main switch off3. Power lead damaged4. Back-up battery defect5. No fuse or blown fuse	<ol style="list-style-type: none">1. Check connection2. Turn main switch ON3. Check that back up battery is connected4. Check fuse.
No high pressure air supply	The pressurized air cylinder is empty or the valves are closed	Check the air supply cylinders and all valves.
Relief valve on the high pressure regulator is leaking	Defective regulator	Replace regulator.

5.3 Minimum suggested spare parts

We advise keeping the following spare parts available with the module:

- Spare gauges
- Spare flow switch
- Spare flow meter
- Spare fuses
- Spare valves
- Spare quick connectors (nipples and sockets)

6. Appendices

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6.1 Manufacturer parts list for Four Man Breathing Air Module

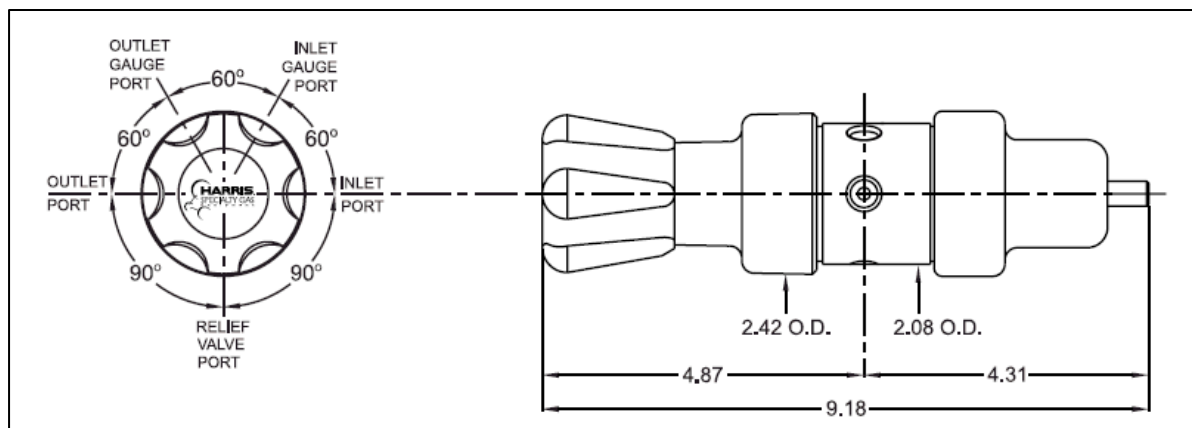
Part Number	Description	Qty	U/M
	1/4" OD x .030 Wall Copper Tubing	23.5	FT
	1/4" OD X .035" Wall Length, SS Seamless Tubing	10	FT
200-049	1/4" FPT, SS Quick Connect Socket	5	EA
400-001	High Pressure Regulator	5	EA
400-002	High Pressure Regulator Mounts	10	EA
200-054	1/4" FPT, SS Quick Connect Plug/Nipple	5	EA
400-046	Flow Meter	1	EA
400-047	Flow Switch/Sensor	8	EA
500-009	Panel Mount, Static Sensing Fitting	1	EA
500-011	Module Gauge, 0 - 200 PSI	9	EA
500-012	Module Gauge, 0 - 3000 PSI	5	EA
500-021	Magnehelic Gauge, 0 - 4.0" WC	1	EA
	SS Female Connector 1/4" Tube to 1/4" NPT	5	EA
500-033	Quarter Turn Handle, Orange	5	EA
	Quarter Turn Handle, Green	1	EA
500-034	Quarter Turn Handle, Red	1	EA
500-032	Quarter Turn Handle, Blue	1	EA
500-035	Quarter Turn Handle, Yellow	1	EA
500-019	Brass Angle Pattern Ball Valve, 1/4" Swagelok Tube Fitting	9	EA
500-064	4 Man Module Cabinet	1	EA
500-059	Rear Panel, 4 Man Module	1	EA
500-069	Anodized Side Panel, Module	2	EA
500-070	Anodized Shelf, Module	2	EA
500-071	Front Panel, 4 Man Module	1	EA
500-072	Anodized Handle, Module, Front	4	EA
	Anodized Bottom Pan, Module	1	EA
500-037	Pressure Switch 500 PSI	5	EA
500-053	SS Male Elbow, 1/4" Tube x 1/4" Male NPT	5	EA
500-049	SS Bulkhead Male Connector, 1/4" Tube to 1/18" NPT	5	EA
500-050	Bulk Head Retainer 1/4"	13	EA
500-051	SS Female Elbow, 1/4" Tube x 1/4" Female NPT	5	EA
500-052	SS Reducing Bushing, 1/4" Male NPT x 1/8" Female NPT	5	EA
500-054	Brass Bulkhead Male Connector, 1/4" Tube x 1/4" Male NPT	10	EA
500-055	Brass Hex Nipple 1/4"	5	EA
500-056	Brass Street Tee, 1/4" Female NPT x 1/4" Male NPT x 1/4" Female NPT	5	EA

Part Number	Description	Qty	U/M
500-057	Brass Male Elbow, 1/4" Tube x 1/4" Male NPT	13	EA
500-058	Brass Male Run Tee, 1/4" Tube x 1/4" Male NPT x 1/4" Tube	1	EA
500-061	Brass Male Connector, 1/4" Tube x 1/8" Male NPT	1	EA
	Brass Swagelok Tube Fitting, Male Connector, 1/4" Tube x 1/4" Male NPT	9	EA
500-062	Brass Female Connector, 1/4" Tube x 1/4" Female NPT	13	EA
500-063	Brass Union Tee, 1/4"	8	EA
	Brass Male Run Tee, 1/4" Tube x 1/8" Male NPT	1	EA
	On-Off Panel Mount Rocker Switch	4	EA
	Module On/Off Rocker Switch	1	EA
	Standard LED - Through Hole Blink Red Diffused	5	EA
	LED Panel Mount Indicators Green	5	EA
	LED Panel Mount Indicators Yellow	4	EA
	Trailer Panel Alarm	1	EA
	Alarm Circuit Box	1	EA
	Communication Box for Module	1	EA
100-013	12 Vdc Power Connector Plug	1	EA
	Power Supply Dual Out	1	EA
	AC Power Cord	1	EA
200-035	Check Valve, Secondary Pigtail	5	EA
	5 Hole Block Manifold	1	EA
	SS Threaded Pipe Fitting, Module Manifold	2	EA
	Power Entry Modules Green Illumination QC 10A No Drawer	1	EA
	Stranded Single-Conductor Wire UL, Red, Per Foot	12	FT
	Stranded Single-Conductor Wire UL, Black, Per Foot	18	FT
	Stranded Single-Conductor Wire UL, White, Per Foot	2	FT
	Stranded Single-Conductor Wire UL, Green, Per Foot	2	FT
	Carbon Film Resistors - Through Hole 82ohms 25%	5	EA
	Carbon Film Resistors - Through Hole 680ohms 0.05	9	EA
100-082	Pin and Socket Connect 2 Circuit Receptacle	13	EA
100-084	Pin and Socket Connect 2 Circuit Plug	16	EA
	Pin and Socket Connect 3 Circuit Plug	9	EA
	Pin and Socket Connect 3 Circuit Receptacle	5	EA
100-087	Pin and Socket Connect Crimp Pin	26	EA
100-086	Pin and Socket Connect Crimp SKT	32	EA
200-081	1/8" FPT, SS Quick Connect Socket	5	EA
	Teflon Tape	1	EA
100-016	Strain Relief for 12Vdc Power Connector Plug	1	EA
	Fuse	1	EA
Part Number	Description	Qty	U/M

	Fuse Holder for Power Entry Module	1	EA
	12V Battery	1	EA
	Non Insulated Quick-Disconnect Terminal, Standard Female, 22-18 Awg	11	EA
100-019	12 Vdc Power Connector, Socket	1	EA

6.2 Harris Calorific High Pressure Regulator

MN: H P 702-250-000-D



This section is adapted from Harris Calorific product information.

Introduction

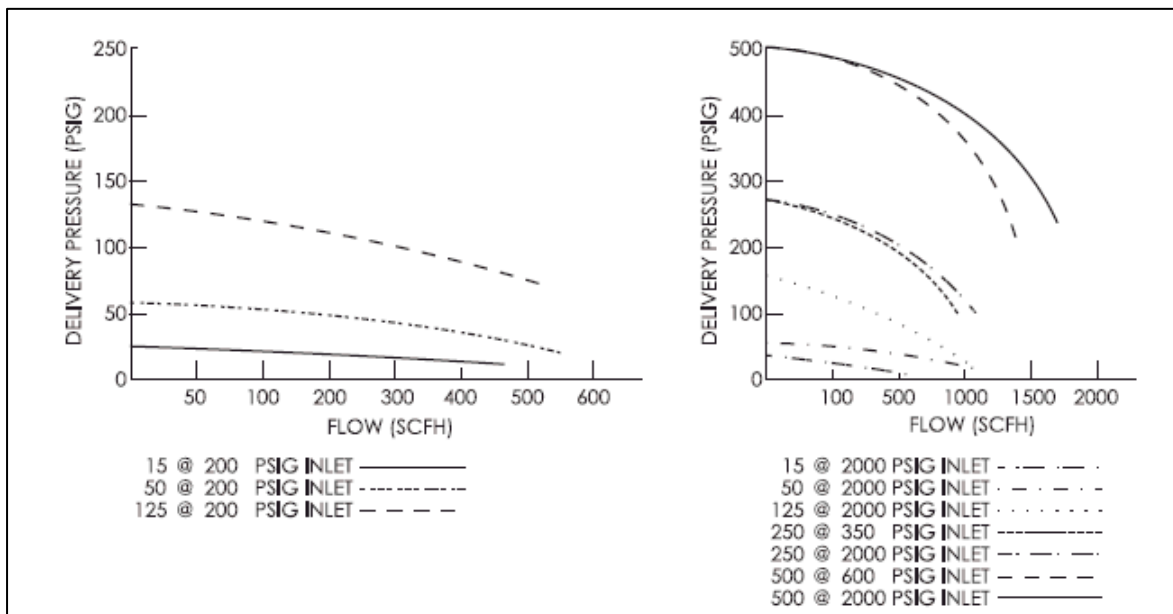
The Harris Calorific high pressure regulator is a chrome plated brass two stage cylinder regulator with a stainless steel diaphragm. The two stage regulator is two regulators in a series using a common body. The first stage (high pressure) reduces the inlet pressure approximately 90% and is preset at the factory. The second stage (low pressure) is adjustable to the desired delivery pressure and is set at the module manufacturing facility. The two stage design provides constant delivery pressure from a full to near empty cylinder. The diaphragm eliminates contamination from diffusion or out gassing. The one-piece encapsulated seat design protects the seat from particulate contamination. The relief valve vents at pressures over 500 psi and is mounted externally making replacement, when needed, easy.

6.2.1. Specifications

6.2.1.1 Performance data

Maximum Inlet Pressure	500 psi	34.47 bar	3.44 MPa
Maximum Outlet Pressure	125 psi	8.62 bar	0.86 MPa
Inlet / outlet ports	1/4" FNPT		
Gauge ports	1/4" FNPT		

6.2.1.2 Flow Rates



6.2.1.3 Materials

Body	Chrome Plated Forged Brass
Bonnets	Chrome Plated Die Cast
Diaphragms	302 Stainless Steel
Nozzles	Brass
Seat	PTFE Teflon
Seals	PTFE Teflon
Filter	Nickel Plated Sintered Bronze - 10 Micron
Seat Return Spring	PH-17 Stainless Steel

6.2.2. Operation

The two stage regulator is two regulators in a series using a common body. High pressure air enters through the 1/4"NPT inlet port and goes into the first stage of the regulator where it is reduced by approximately 90%. The air then goes into the second stage of the regulator where it is reduced further. The outlet pressure is set to 125 psi.

Clockwise rotation of the adjusting knob (or key) increases the delivery pressure. Counter-clockwise rotation decreases the delivery pressure. The regulator inlet connections are designed for the gas to be used in accordance with CGA Standard V-11.

If the regulator malfunctions, the following steps must be taken:

1. Close the defective line's main supply valve on High pressure supply bottle banks.
2. Abort all activities and replace or repair the regulator. See 6.2.3 maintenance and repair.

6.2.2.1 Safety instructions

- Handle cylinders with care. Chain or otherwise secure cylinders to a permanent fixture. Take care when moving. To transport cylinders (except when in cylinder carts), remove regulators and manifolds and replace with valve cap. Never use any cylinder in other than an upright position.
- Use "good housekeeping" in work areas. Keep sparks and flame away from combustibles. Prepare your work area before beginning work. Keep your equipment free of oils, greases, and flammable materials.
- Do not oil or grease equipment. The equipment does not require lubrication. Oil or grease is easily ignited and burns violently with oxygen.
- "Crack" cylinder valve before installing regulators or manifold. Open valve slightly and then close. This will clear valve of dust or dirt which may be carried to hoses and regulators and cause damage or accident. Do not discharge flow of gas at any person or flammable material.
- Be sure all connections are tight. Don't force connections. Never test for leaks with a flame. Use a soapy water solution to check for leaks.
- Use recommended pressure settings. Improper pressures are wasteful. Extreme pressure build-up in regulators is a warning they need repair.
- Do not work with damaged or leaking equipment. Use soapy water when checking for leaks. Do not use frayed or damaged hose.
- Handle equipment with care. Its continued good service and your safety depend upon it.

6.2.3. Maintenance and repair

Normally the Harris high pressure regulator will operate without problems in even the roughest conditions. We would however like to add some instructions for testing and replacement or small repairs and maintenance in the field.

These procedures should only be followed by persons with experience in operation and repair of pressure regulators.

- When not in use, store regulators in a clean and safe place
- Inspect and test at least every 6 months after first use
- Have only qualified repairmen service, test and clean regulators
- Use thread sealants that are compatible with the gas being used.

6.2.3.1 Functional test of regulator

An internal leak may be detected as follows:

1. Close the regulator by turning the adjusting key counterclockwise.
2. Close cylinder valve.
3. Drain downstream line.
4. The low pressure gauge will indicate zero. The cylinder (high pressure) gauge will read full pressure. Any pressure drop will indicate leakage. Repair before use, or replace with a properly functioning unit.
5. A gauge should read zero when all the pressure is removed. If it does not, it may be damaged. Locate and correct the cause of the damage and replace the gauge

6.2.3.2 Connection leak test of regulator

To test for gas leakage, use a soapy water solution at all connections and check for bubbles. Tighten connections as required and wipe off the soap solution.

6.2.3.3 Replacing a regulator inside a module

1. To replace a regulator make sure the module is on a firm and level surface, all air pressure inside the module has been drained down and all connection hoses and communication cables have been removed.
2. Remove the module box by unscrewing the thumb knobs on the front and back of the module and lifting the module out of the box.
3. Locate the regulator that needs replacing. Remove fittings from the regulator. Loosen the screws in the regulator mounts and lift the regulator out of the module.
4. Replace with a good regulator, retightening the regulator mount screws and reinstalling the fittings.
5. Leak test the connections with a soapy water solution. Tighten connections as required and wipe off the soap solution.

6.3 Substance resistance list: umbilical air supply lines

Corrosive attack abbreviation key:

- A. Resistant: Good for continuous exposure
- B. Partially resistant: Good for intermittent exposure
- X. Not resistant: DO NOT USE
- N. No Data Available

Liquid Substance	Corrosive Attack		Notes
	Outer Jacket	Supply Hoses	
ASTM Fuel A	B	B	
ASTM Fuel B	X	X	
ASTM Fuel C	X	X	
ASTM Oil No. 1	B	B	
ASTM Oil No. 2	N	B	
ASTM Oil No. 3	N	B	
Acetate solvents	N	N	
Acetic Acid (Glacial)	N	B	
Acetic Acid	A	B	40%, 10%
Acetone	N	X	
Acrytonitrite	A	N	
Air	A	A	
Hot Air	A	A	
Alcohol	N	N	
Aluminum Chloride	N	B	
Aluminum Sulfide	N	N	
Ammonia	N	B	
Ammonia (dry gas)	N	B	
Ammonium Chloride	N	B	
Ammonium Hydroxide	N	N	
Aniline	A	X	

Chemical Substance	Corrosive Attack		Notes
	Outer Jacket	Supply Hoses	
Antifreeze Compounds	A	N	50/50 Mixture
Barium Chloride	N	N	
Barium Sulfide	N	N	
Benzene	X	X	
Benzyl	N	X	
Bitumen	N	N	
Boric Acid	N	A	
Brake Fluid	A	N	
Brake Fluid A	N	X	
Bromine	X	N	
Bromobenzene	X	N	
Butane	N	B	
Butyl Acetate	A	X	
Butyl Alcohol	N	X	
Calcium Chloride	A	B	20%, 10%
Carbon Tetrachloride	N	X	
Carbonic Acid	N	N	
Caustic Soda	N	A	
Chlorine	N	X	
Chlorine (Water Solution)	N	B	40% water mixture
Chlorobenzene	N	X	
Chloroform	N	X	
Chromic Acid	N	X	40%
Cyclohexane	X	X	
Detergents (dish washing)	A	N	
Diesel Fuel	N	B	
Diethyl Ether	A	N	

Chemical Substance	Corrosive Attack		Notes
	Outer Jacket	Supply Hoses	
Dimethyl Formamide	A	N	
Dioctyl Phthalate (DOP)	A	A	
Dioxane	A	N	
Ether	N	X	
Ethyl Acetate	N	X	
Ethyl Alcohol (Ethanol)	A	X	
Ethylene Chloride	N	B	
Ethylene Glycol	N	B	50%
Ferric Chloride	N	B	
Formic Acid	N	X	85%, 40%, 10%
Freon	X	X	
Freon12	N	X	
Gasoline - 100 Octane	N	X	
Glycerine	A	A	
Glycol	N	A	
Heptane	N	B	
Hexane	B	B	
Hydrochloric Acid	A	N	10%, 1%
Hydrogen Chloride	N	B	
Hydrogen Peroxide	N	A	
Hydraulic fluid	N	B	
Iodine Solution	N	X	
Isopropyl Alcohol	N	X	
Kerosene	N	B	
Lactic Acid	N	X	90%, 50%, 5%
Lead Acetate	N	N	

Chemical Substance	Corrosive Attack		Notes
	Outer Jacket	Supply Hoses	
Magnesium Chloride	N	B	
Methanol	N	X	
Methyl Acetate	N	X	
Methyl Alcohol	N	N	
Methyl Bromide	N	N	
Methylene Chloride	N	X	
Methyl Ethyl Ketone	A	X	
Methyl Glycol	N	X	
Mineral oil	N	B	
Motor Oil 20W	N	B	
Naptha	N	A	
Natural gas	N	N	
Nitric acid	N	X	70%, 35%, 10%
Nitrobenzene	A	N	
Oxalic acid	N	N	
Oxygen	N	N	
Paraffin Oil	N	B	
Perchloroethylene	N	X	
Petroleum	N	B	
Phosphoric Acid	N	X	85%, 50%, 10%
Potassium Chloride	N	B	40%
Potassium Hydroxide	N	B	50%
Potassium Hydroxide	A	B	10%
Potassium Permanganate	N	X	5%
Propanol	A	N	
Propyl Alcohol	N	N	

Chemical Substance	Corrosive Attack		Notes
	Outer Jacket	Supply Hoses	
Pydraul	N	N	
Pydraul Oil	B	N	
Pyridine	A	X	
Sea Water	A	A	
Skydrol Oil - Type B	A	X	
Sodium Chloride	A	B	15%
Sodium Hydroxide	N	X	
Sodium Hydroxide	A	X	50%
Sodium Hydroxide	A	B	10%
Sodium Hypochlorite	N	A	PH 13
Sulfuric Acid	A	X	75%, 40%, 25%
Sulfuric Acid	A	B	10%
Tetra Hydro Furan	N	X	
Tetrachloroethylene	N	X	
Toluene	N	X	
Transmission Oil	X	N	
Trichlorethylene	X	X	
Tricresyl Phosphate (Skydrol)	N	X	
Water (cold)	A	X	
Xylene	X	X	
Zinc Chloride	A	N	
Zinc Sulfate	N	N	

REVISION HISTORY

Rev.	Date	Modifications	Page	Prepared by:	Approved by:
0	July 2013	New document		L. Petersen	R. Cantu P. Latona C. Staples