Algas-SDI™

ISO 9001 Certified

...Innovative liquid vaporizing and gas mixing solutions

QM-PA

Pressure Assist LPG/Air Mixing System

Operations & Maintenance Manual

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ECLIPSE Innovative Thermal Solutions

WARNING

Read the OPERATION MANUAL before operating this equipment.

NOTE: Algas-SDI reserves the right to use alternate manufacturers' components as vendor delivery applicability dictates. Literature contained in the Operation Manual has been supplied by vendors. Please check to be sure supplied data matches your configuration. Contact Algas-SDI if any questions exist.

This equipment uses LPG-a flammable fuel handled under pressure. Inherent hazards exist and a thorough understanding of the equipment is required to allow safe operation and maintenance.

Allow only a TRAINED and FULLY QUALIFIED PERSON to service this equipment.

Any time a component must be replaced, use the same type, model, etc. DO NOT SUBSTITUTE! The consequence from such actions are unpredictable and may lead to dire consequences. When components are replaced with components not approved for use in our FM/UL listed equipment, the FM/CSA listing becomes void for that unit.

QM Pressure Assist LPG / Air Mixing System Specification Sheet

Job Number: _____ **Year Built:** _____

Part Number: _____ **Serial Number:** _____

Mixer Specifications:

Mixed Gas Pressure:		PSIG
LPG Motive Pressure:		PSIG
Air Assist Pressure:		PSIG
Air Flow Requirements:		SCFM
Low Air Pressure Switch (Mixed Gas - 1 PSIG):		PSIG (N.O.)
Differential Pressure Switch (Typ. - 3 PSID):		PSID (N.O.)
Differential Pressure Switch Deadband (Typ. 0.5 PSI):		PSID (RECLOSE)
Vapor Pressure Interlock Switch (LPG Motive - 10 PSIG):		PSIG (N.O.)

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WARRANTY

Algas-SDI International, LLC (ASDI) warrants that the equipment is free of defects in materials and workmanship under normal use and service. ASDI agrees to repair or replace, at our option, without charge f.o.b. factory, any part which has proven defective to the satisfaction of Algas-SDI International, LLC within one (1) year from the date of the original installation or within 18 months from the date of shipment, whichever is earlier. Equipment, which in the opinion of ASDI, has been damaged by improper installation or operation, or has been abused or tampered with in any way, will not be accepted for return under warranty.

Algas-SDI International, LLC will not accept back charges for work performed by others upon or in conjunction with ASDI equipment, unless prior authorization is given by means of an Algas-SDI International, LLC purchase order. Algas-SDI International, LLC will not be liable by reason of shutdown, non-operation or increased expense of operation of other equipment, or any other loss or damage of any nature, whether direct or consequential, arising from any cause whatsoever.

Algas-SDI International, LLC makes NO other warranty of any kind, whatsoever expressed or implied; and all warranties of merchantability and fitness for a particular purpose are hereby disclaimed by Algas-SDI International, LLC and excluded from these terms of sale. No person has any authority to bind Algas-SDI International, LLC to any representation or warranty other than this warranty.

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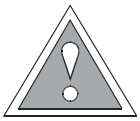
APPROVALS

Symbols and Conventions

Special symbols are used to denote hazardous or important information. You should familiarize yourself with their meaning and take special notice of the indicated information.

Please read the following explanations thoroughly.



GENERAL WARNING OR CAUTION

Indicates hazards or unsafe practices which can result in damage to the equipment or cause personal injury. Use care and follow the instructions given.

FLAMMABLE GAS HAZARD

Indicates a potential hazard which can result in severe personal injury or death. Use extreme care and follow the instructions given.

ELECTRICAL DISCONNECT REQUIRED

Indicates a potentially dangerous situation which can result in severe personal injury or death or damage to equipment. Use great care and follow the instruction given.

ASDI CONTACT NUMBERS

If you have questions, need help with your equipment, or want information on other products, contact Algas-SDI at:

Telephone: 206.789.5410

Facsimile: 206.789.5414

Email: sales@algas-sdi.com

Internet: http://www.algas-sdi.com

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Introduction 1

DESCRIPTION

This manual is used in conjunction with the QM Manual and includes the Pressure Assist (PA) aspect as they relate to the QM-PA.

The **QM-PA (PRESSURE ASSISTED MIXER)** mixes high pressure LPG with compressed air to produce a mixed gas of a specific BTU content at pressures ranging from 15 to 28 PSIG. The QM-PA requires an accumulator tank of adequate capacity pressurized LPG, compressed air and electrical service.

If all safety conditions are satisfied and the unit is started, the air and LPG safety inlet solenoids will open and it will begin producing a LPG/air mixture. The QM Sequencer monitors the delivery pressure through the use of its pressure transducer. With a demand for mixed gas, the Venturi solenoid valve is opened. The vapor passing through the vapor pressure regulator closes the vapor pressure interlock switch. This allows the venturi air interlock poppet valve to open, drawing air through the air pressure regulator. Air and LPG pass through the venturi assembly and diffuser into the mixed gas outlet header. The mixed gas then enters the accumulator. It is common for a small amount of air to discharge from the venturi air interlock poppet valve during operation.

For any given load on the system, the venturi will be cycling on and off with the **ON** cycle time increasing with the increased load (up to continuous). This process is repeated until the tank pressure is satisfied. The mixture pressure will vary 1 PSI corresponding to the on and off pressure levels (differential pressure) for the cycling venturi. If the load increases beyond the capacity of the mixer, the mixture pressure will drop.

All unit safeties must be latched before the unit is allowed to operate. The differential pressure switch checks that the air pressure at the venturi is at least 3 PSI below the mixed gas outlet pressure. The low vapor pressure control insures a minimum LPG pressure. The low air pressure switch prevents a rich mixture from forming. The high mixed gas pressure switch prevents the accumulator from over-pressurizing. In the event of power loss, all solenoid valves fail in the normally closed position and the air poppet valves in the normally open position.

Figure 1 – Poppet Operation (Open)

Poppet Open.wm

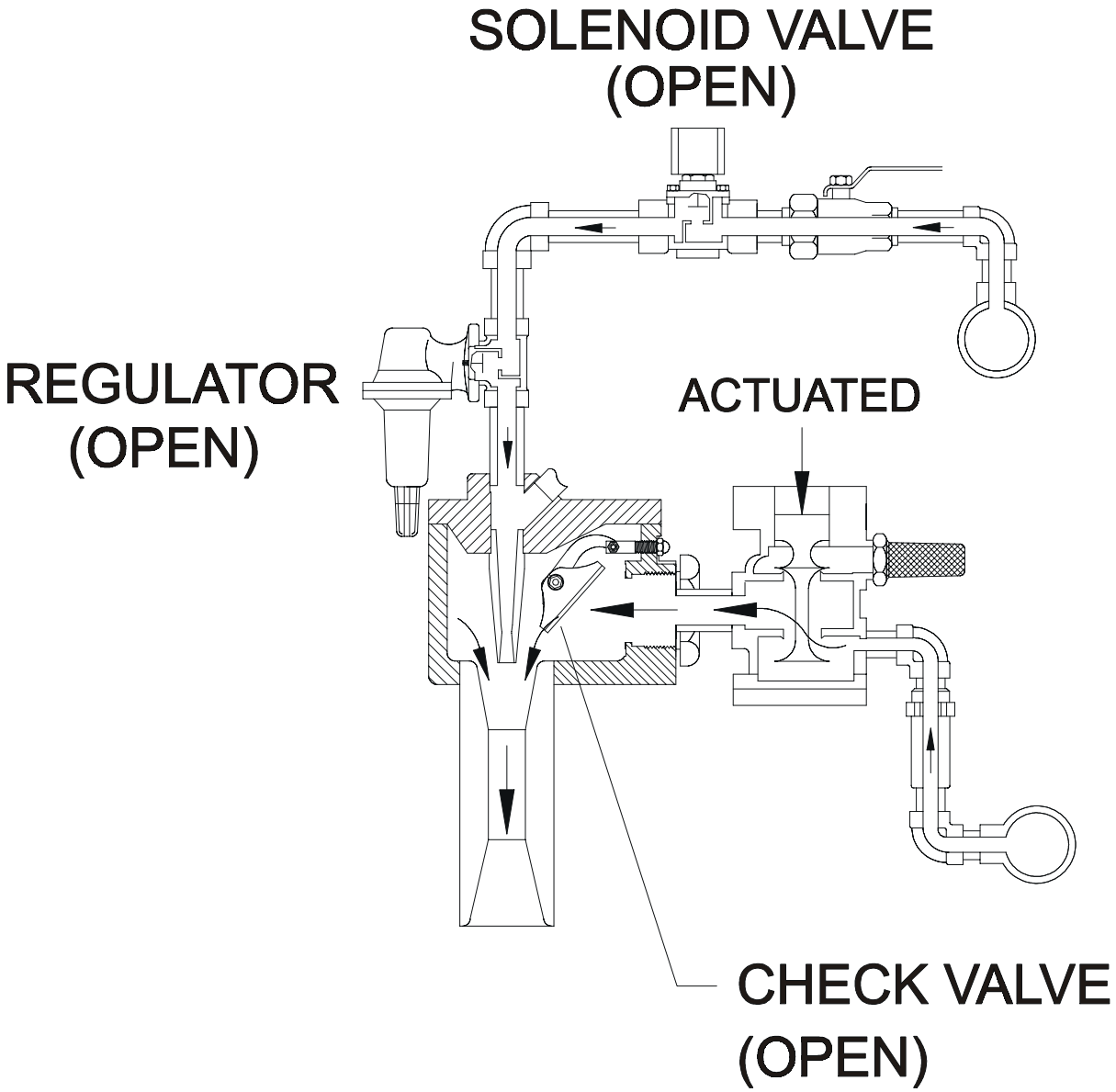


Figure 2 – Poppet Operation (Closed)

Poppet Closed.wmf

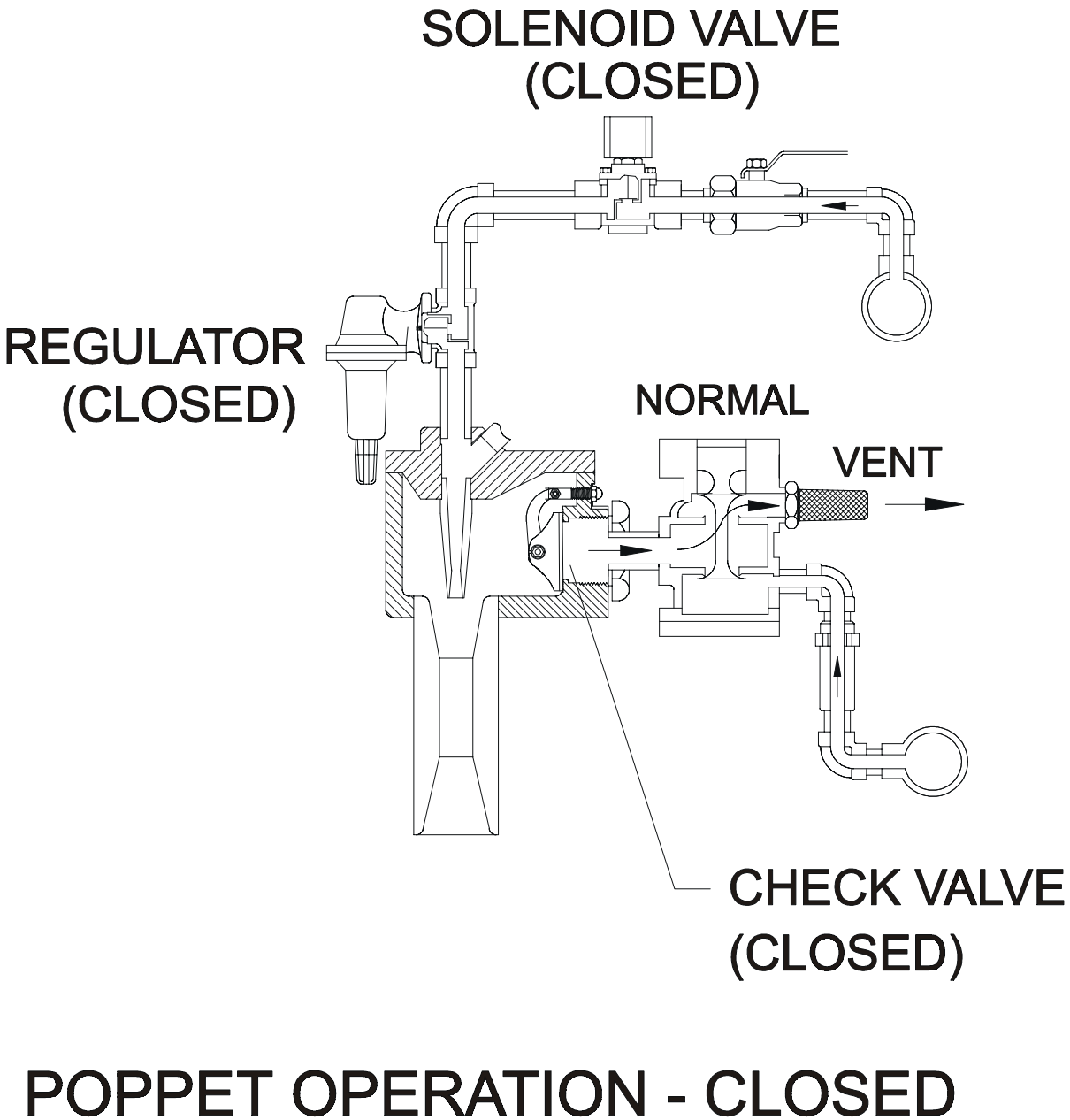


Figure 3 – QM Venturi Diagram

QM-PA MAN1.wmf

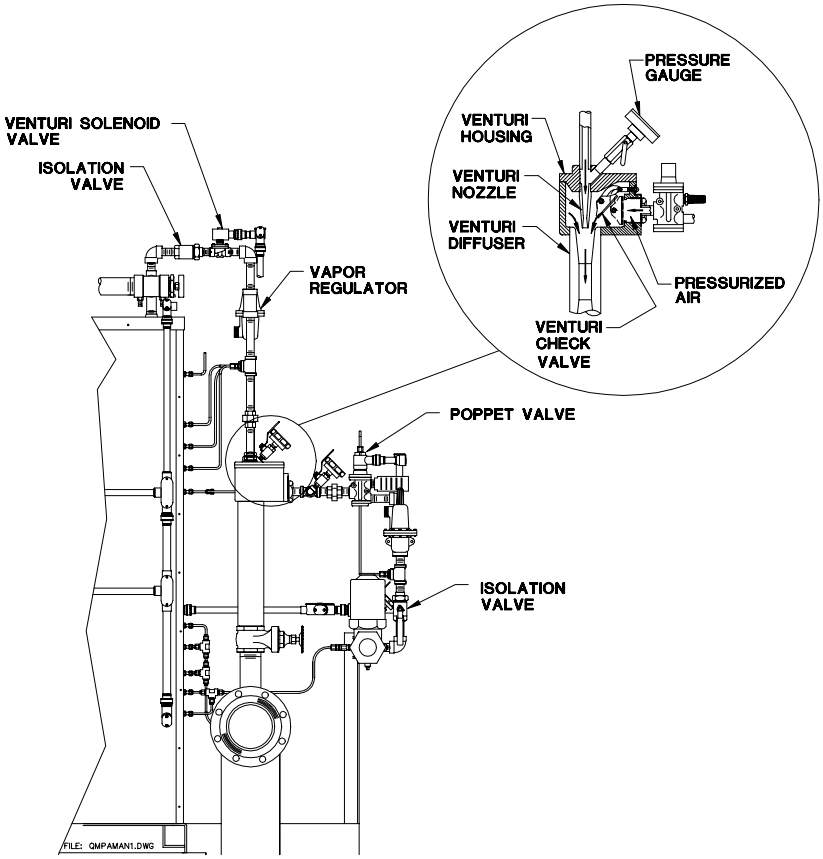
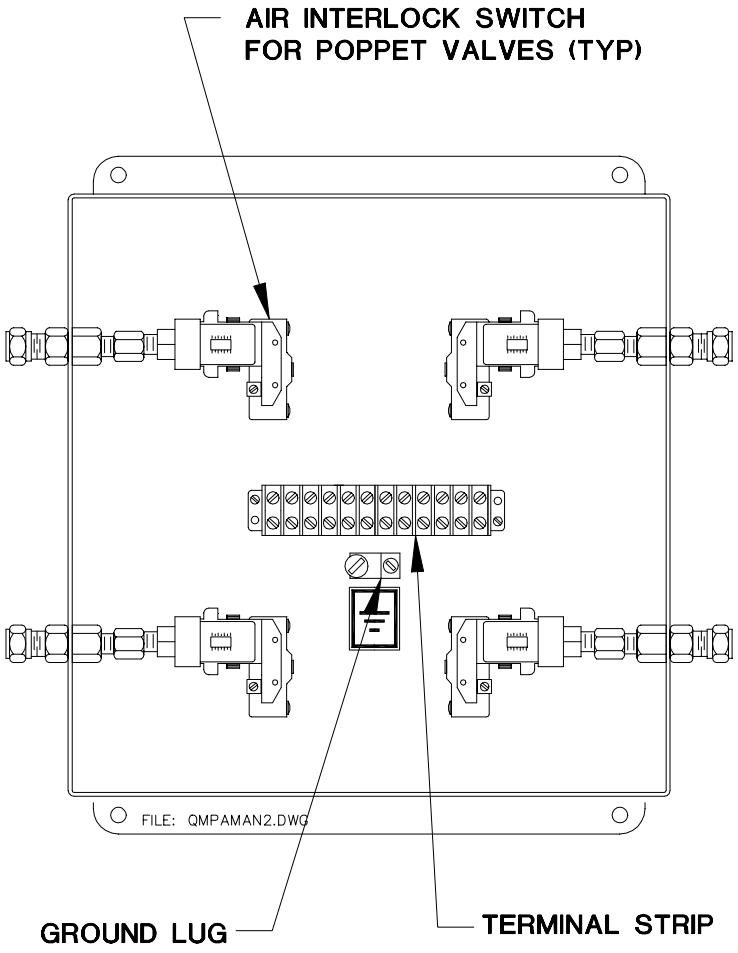


Figure 4 – QM-PA Control Box Components



QM-PA MAN2.wmf

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Installation 2

Installation requirements vary according to local, provincial and state requirements. Install QM-PA mixers in accordance with applicable codes and local requirements as required.

All of the controls are set at the factory. However, vibration in transportation may alter the settings, in addition, it may be desired to change the system delivery pressure (within the range of the installed venturi's). Thus the control settings may need to be checked or re-adjusted. Any replacement controls will also require adjustment.

NOTE

The software program for controlling the blending operation is set at the factory. Changing the software voids the operating warranty.

PHYSICAL REQUIREMENTS

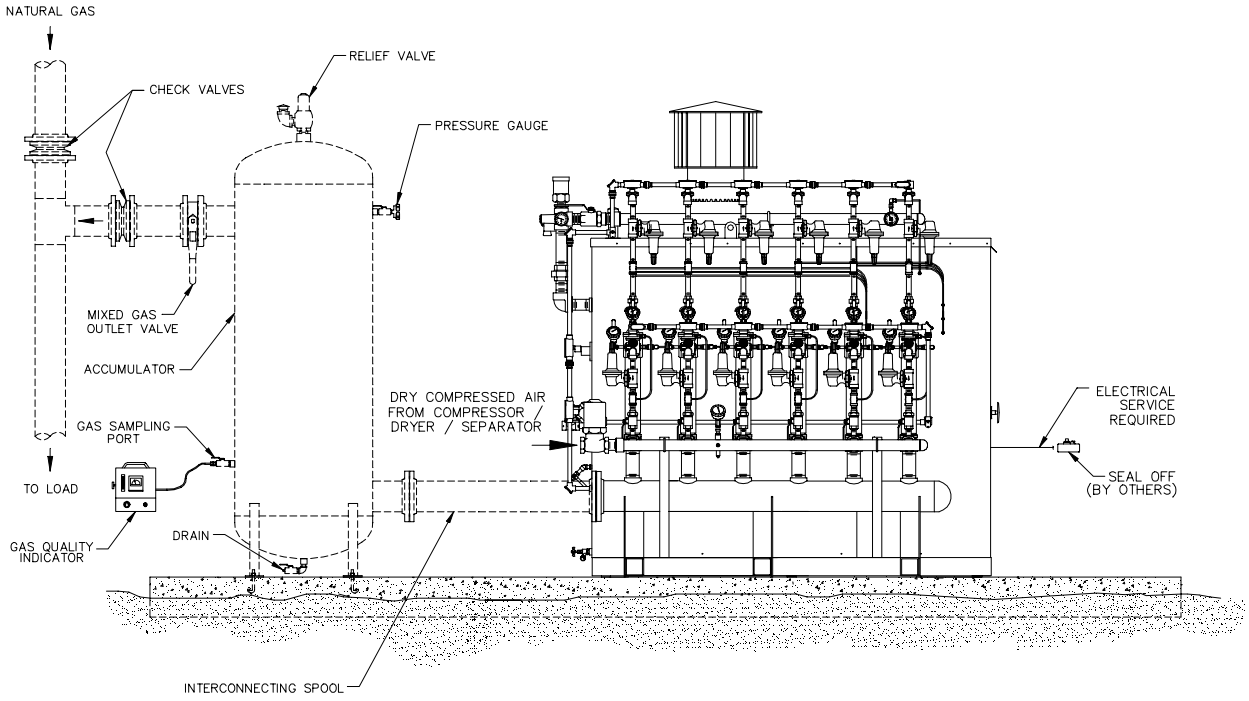
1. Refer to QM Operation & Maintenance Manual for general installation requirements.

2. Provide compressed air to the air header inlet (see data sheet for air requirements). Provide a shut off valve and install a moisture separator between compressed air source and air inlet header.

3. Provide an appropriately sized mixed gas accumulator (surge tank) suitable for the service and pressure. The tank must have a relief valve, drain, pressure gauge, inlet (inlet must be the same size as the mixed gas outlet), outlet, pressure sensing port and gas sampling port.

4. Clean all foreign material from all pipelines prior to making final connections. All joints require a pipe sealant suitable for LPG. Test for leaks using an inert gas, such as compressed air, carbon dioxide or nitrogen, at approximately 100 PSIG (7 kg/cm2). Check all connections using an appropriate leak detection solution or device. **EVEN SMALL LEAKS ARE UNACCEPTABLE! ELIMINATE ALL LEAKS PRIOR TO OPERATION.** If water is used for hydrostatic testing, make sure **ALL** water is removed from piping.

Figure 5 – Typical QM-PA Installation Drawing



QM-PA MAN3.wmf

1. The compressed air should be turned on and ready for use. (Main air outlet valve is closed.) Purge all moisture and oils from the air lines.

2. Start QM-PA per QM Operation & Maintance Manual.

3. Check tank pressure and motive pressure set points. Re-adjust if necessary. Refer to data sheet or the operating and safety controls setting table.

4. Using a flare stack or other non-critical load, adjust the mixing ratio by following the BTU adjustment procedure.

BTU Adjustment Procedure

1. With the system **ON,** in setup mode and ready for operation with **NO** load.
2. Close **ALL** LPG isolation valves.
3. Begin taking gas samples from the accumulator using a gas quality indicator or equivalent.
4. Open only **ONE** LPG isolation valve.
5. Introduce load to the system. The frequency of the venturi cycling should be approximately 50/50. (**ON** 50% of the time, **OFF** 50% of the time.)
6. Verify that the LP vapor motive pressure is set at the correct pressure.

   See data sheet for LP motive pressure setting. Adjust the LP vapor regulator if a adjustment is required.
7. Let the system operate a sufficient length of time in order for the LP1000 BTU indicator value to stabilize.
8. Adjust the air assist pressure regulator until the desired BTU value is obtained. Allow a sufficient length of time between each adjustment for the BTU value to stabilize.
9. After the first venturi is adjusted, open the LPG isolation valve on the next venturi.
10. Close the isolation valve of the previously adjusted venturi.
11. At this point, the venturi (which needs adjustment) will be cycling at the approximate rate of 50% **ON** and 50% **OFF**.
12. Repeat steps 6 - 11 until each venturi is adjusted.
13. Switch system out of setup mode and open all LPG isolation valves.
14. Increase the system load and verify the mixed gas BTU value with multiple venturi's in operation. The mixed gas blend will become slightly leaner as more venturi's operate.

Maintenance 4

The QM-PA air/vapor mixing system is designed for long-term trouble-free operation. However, due to the nature of its use, and the severe duty it may receive, it is important to provide scheduled maintenance.

The following table is our recommended maintenance schedule. Please refer to the data sheet for the proper system settings. We also provide a list of recommended spare parts located in the appendix.

Table 1 - Maintenance Schedule

DESCRIPTION	EVERY MONTH	EVERY 6 MONTHS	EVERY YEAR
Differential pressure switch		Verify setpoint.	
Low air pressure switch			Verify setpoint.
Air inlet solenoid valve	Check operation.		Install rebuild kit.
Vapor pressure interlock switch (min)			Verify setpoint.
Venturi air interlock poppet valve	Check operation.		Install rebuild kit.
Air pressure regulator			Inspect. Rebuild if necessary.
Venturi check valve assembly		Verify operation.	Install rebuild kit.
Vapor motive pressure.	Verify setpoint.		
BTU adjustment.	Verify gas quality (every two months)		
Unit connections (all)			Leak test.

Based on 500 hours of operation

Check component identification section for component location

NOTE

1. ***Verify operation prior to use if used for standby operation.***
2. ***Verify operation after extended periods of non-use.***

Adjustment Procedures for System Operating and Safety Controls

All of the controls are set at the factory. However, vibration in transportation may alter the settings. In addition, it may desirable to change the system delivery pressure (within the range of the installed venturi's). Thus, the control settings may need to be checked or adjusted. Use calibrated air supply to adjust all pressure switches.

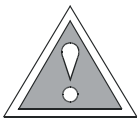
NOTE

Any replacement or repair of venturi controls will necessitate checking the BTU value of the mixed gas (using a gas quality indicator or some other means of determining BTU value) and then making the required gas and/or air adjustment (see BTU Adjustment Procedure section).

CAUTION

The pressure control switches are mounted in explosion-proof control boxes. The boxes also contain electronic devices capable of producing electric sparks when they are activated. Power to the control boxes must be turned off at a remote disconnect whenever the cover is removed.

Most of these operations require the control enclosure to be open while the circuits are tested. At all times make absolutely sure no propane vapor is present around the enclosure. The electrical arcing that occurs when the various switches and relays within the enclosure operate is a possible source of explosive ignition.



Do NOT attempt to adjust the pressure switches with the power on.

System Operating and Safety Controls Description

MOTIVE PRESSURE FOR VAPOR

The motive pressures at the venturi housing are set with the adjusting screws on each vapor regulator. The motive pressure for vapor can be observed on the pressure gauge located on top of the venturi housing (*see data sheet* for required LP vapor motive pressure settings).

ASSIST PRESSURE FOR AIR

The assist pressures at the venturi housings are set with the adjusting screws on each air regulator. The assist pressure for air can be observed on the pressure gauge downstream of the air regulator (*see data sheet* for approximate air pressure settings). Follow BTU adjustment procedure for correct air pressure adjustment.

LOW AIR PRESSURE SAFETY SWITCH

This safety switch protects against a failure in the air supply system. The set point is 1 PSIG below the delivery pressure. This switch opens with a decrease in air pressure which will shutdown the mixing system.

DIFFERENTIAL PRESSURE SWITCH

This safety switch verifies that the air pressure at the venturi is a minimum of 2 - 3 PSI below the mixed gas outlet. When this switch opens it shuts off the air inlet safety solenoid and the rest of the control system.

VAPOR PRESSURE INTERLOCK SWITCH (MIN)

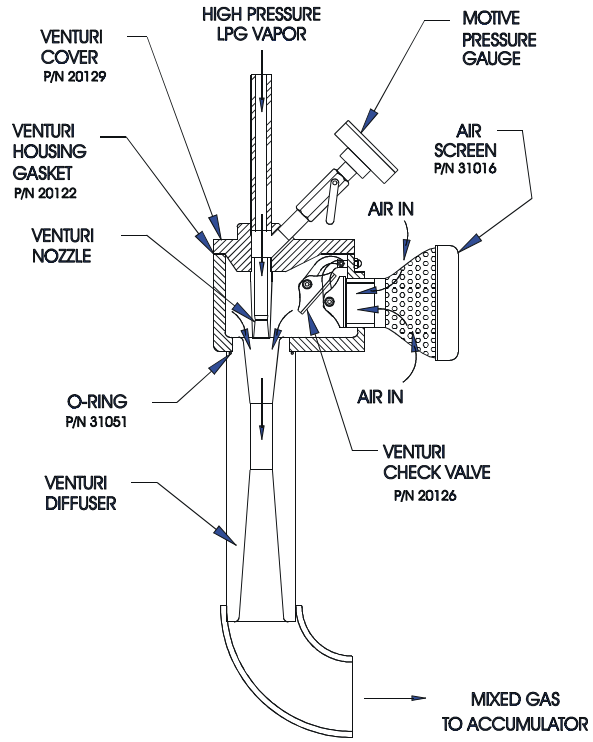
This safety switch prevents compressed air from entering the venturi without a minimum vapor motive pressure at the venturi. The switch operates the venturi interlock poppet valve directly from the proof of pressure. The setpoint is 10 - 15 PSIG below vapor motive pressure (*see data sheet* for motive pressure setpoint).

Table 2 - Maintenance Worksheet

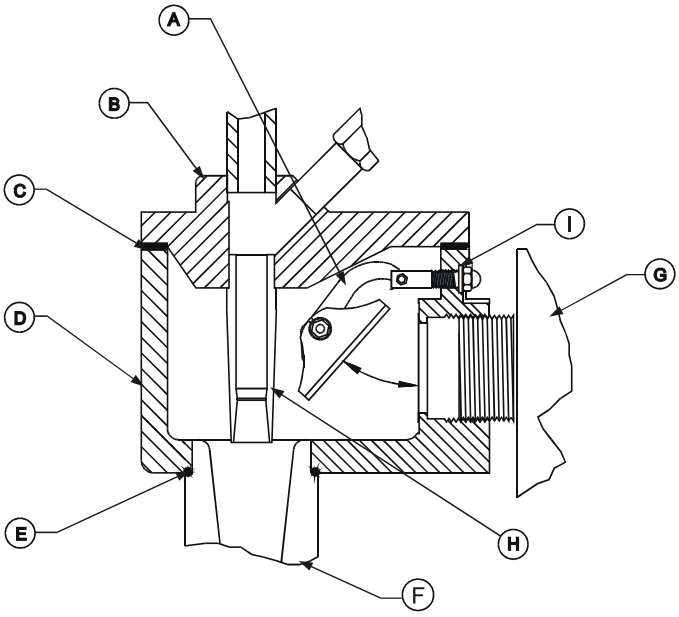
Maintenance Worksheet																								
	Set Pressure									Check Operation of Solenoid Valve														
			Air (Per Venturi Train)						BTU			Venturi Air Interlock Poppet (Per Venturi Train)						Vapor Venturi (Per Venturi Train)						
Date	Tank	Motive	1	2	3	4	5	6	ADJ.	Air Inlet	LPG Safety Inlet	1	2	3	4	5	6	1	2	3	4	5	6

Figure 6 – Venturi Check Valve Drawings

Venturi Check Valve (1).wmf



Venturi Check Valve.wmf



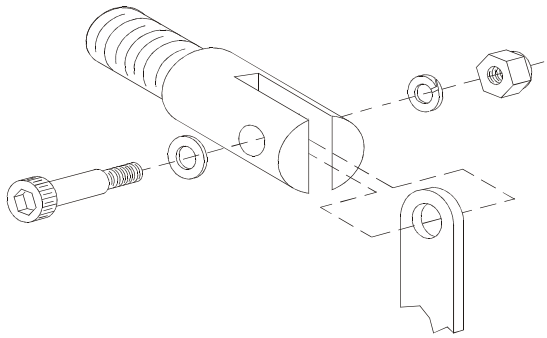
INSTALLING A NEW VENTURI CHECK VALVE

If the venturi check valve leaks or the Pivot arm mechanism operates poorly the venturi check valve assembly must be replaced. Follow the procedure below to replace the venturi check valve and pivot arm.

1. After the existing check valve (b, c) has been removed, examine the machined seating surface (a) on the venturi housing (h) to be sure it is clean and without flaws.

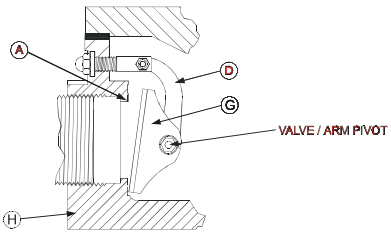
2. Screw the clevis (c) into the housing, using Permatex No. 1 or equivalent on the threads, until 3-3 1/2 threads are exposed outside of the housing. Do not use a screwdriver or other prying device to install the clevis.

3. Insert the check valve arm (d) into the slot of the clevis and connect the two pieces with the clevis/arm pivot screw through the aligned holes. Be sure that the flat washers are inserted on either side of the clevis. Tighten the lock nut (e), allowing for free swing of the arm.

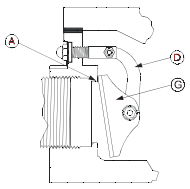


4. Check for proper clevis installation as follows:

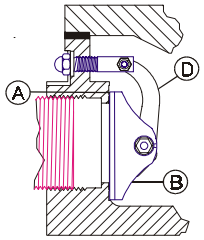
a. With the arm (d) raised, rotate the valve (b) around the valve/arm pivot so that the edge of the valve nearest the clevis is lowered without allowing the valve (b) to turn around the valve/arm pivot, only the lower part of the valve should contact the seating surface (a).



b. With the valve (b) rotated to the other extreme position around the valve/arm pivot, lowering the arm (d) should cause only the upper part of the valve (b) to contact the seating surface (a).

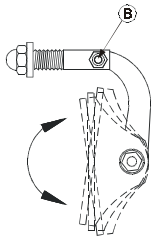


c. Lower the arm (d) a third time, allowing free rotation of the valve (b). The valve (b) should be able to contact the seating surface (a) uniformly all around.



d. If the valve does not contact the seat as described above, reposition the clevis (c) in the housing (h). At least three threads must be exposed for proper installation of the acorn nut (g).

5. Please sealing washer (I) onto clevis (c) then tighten the acorn nut (g)



onto the clevis (c) outside the housing (h), making sure that when the nut is tight, the valve is centered. Do not use any tools on the clevis inside the housing, or on the arm or valve. It may be helpful to start with the valve offset to the side and allow it to rotate to its centered position while tightening the acorn nut.

6. Tighten the lock nut (e) on the clevis/arm pivot screw until the arm is tight in the clevis. Then slowly loosen the lock nut just until the arm can swing freely. Check that the valve is centered and clears the housing on both sides.

7. Install the venturi housing lid (j), using a new gasket (k).

Apply pressure to the unit and check for leaks around the lid and around the check valve. Initially a small leak may occur around the check valve, but after a few cycles the leak should correct itself. If it persists, remove the lid and re-check the seating surfaces and the alignment.

NOTE:

As with all components containing materials subject to deterioration, the venturi check valves should routinely be checked and replaced as necessary. A minimum annual inspection should be conduct

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APPENDIX A

PARTS INFORMATION

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APPENDIX B

DRAWINGS

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