



Algas-SDI™

...Innovative liquid vaporizing and gas mixing solutions

ISO 9001
Certified

AQUAVAIRE

Horizontal Waterbath Vaporizer
Models: Q1650H through Q15000H

Operations & Maintenance Manual

1140 NW 46 Street, Seattle, Washington, USA 98107
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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, or NH₃-a toxic gas, (depending on the model), 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/CSA listed equipment, the FM/CSA listing becomes void for that unit.

Warranty, Copyrights and Approvals

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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.

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APPROVALS



Approved

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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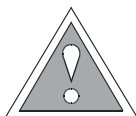
Introduction

1

GENERAL

Algas-SDI's **AQUAVAIRE** Waterbath Vaporizers use a mixture of heated water and glycol to vaporize liquid LPG for use in LPG systems. The vaporizers are designed to run continuously with automatic control. Operation is controlled manually from the control panel in the front of the vaporizer.

Safety valves and check systems are used throughout the design to ensure completely reliable and safe operation.



WARNING

The use and storage of gasoline or other flammable liquids and vapors in open containers in the vicinity of any vaporizer is hazardous.

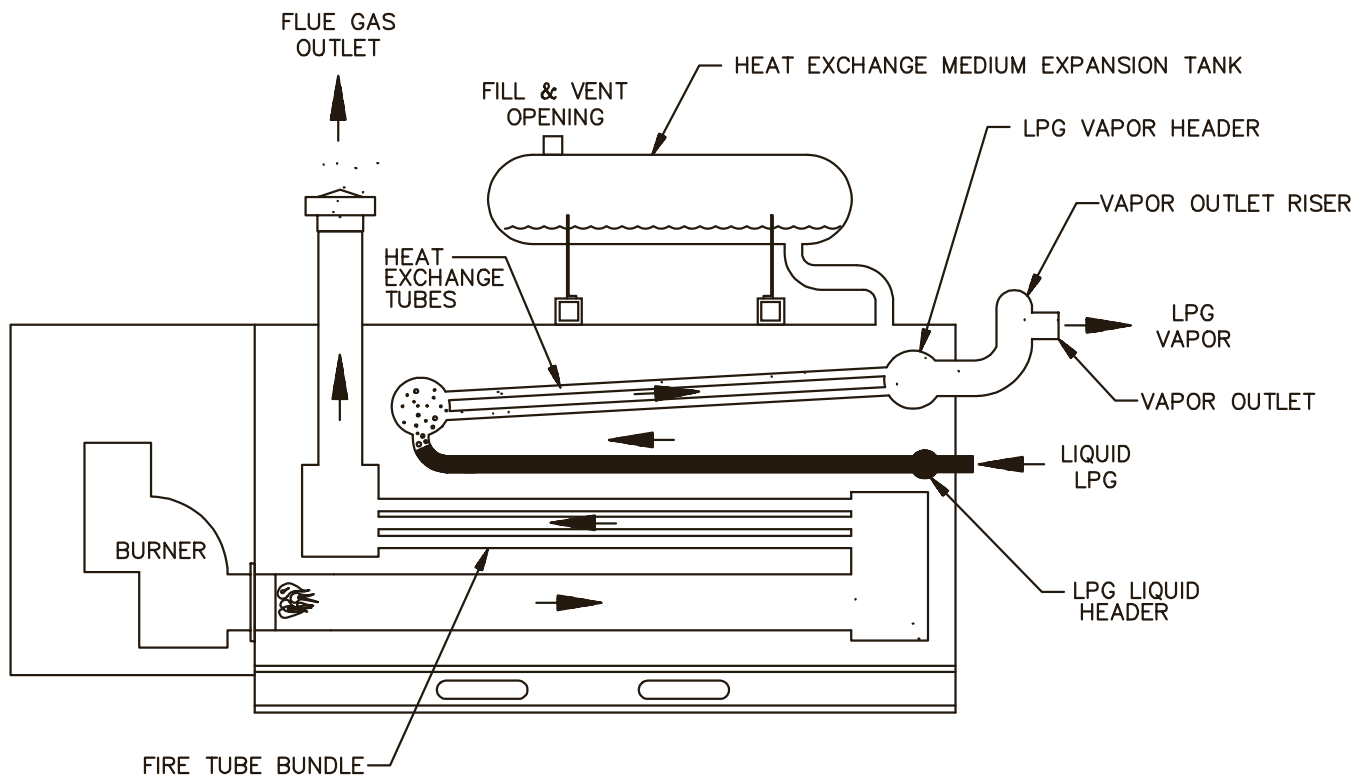


WARNING

If not installed, vented, operated and maintained in accordance with the manufacturer's instructions, this product could expose you to substances in fuel or from fuel combustion which can cause death or serious illness and which are known to the State of California to cause cancer, birth defects or other reproductive harm. Improper servicing of this equipment may create a potential hazard to equipment and operators.

Introduction

Figure 1 – Description of Operation



Operation.dxf

DESCRIPTION

Algas-SDI **AQUAVAIRE** vaporizers are indirect fired horizontal LP-Gas vaporizers that convert LPG into super-heated vapor at a balanced pressure. The vaporizers function by passing liquid LPG through steel heat exchanger coils immersed in a glycol/water bath solution which is heated by a gas-fired forced draft burner. The fire tube of the burner is isolated from the heat exchanger coils by the water/glycol solution which is constantly circulated through the vaporizer by two circulation pumps for maximum heat transfer. An expansion tank on the top of the vaporizer compensates for changes in volume due to heating and cooling.

Each vaporizer has a forced draft burner that responds to the heating demands. The level of the glycol/water for each model vaporizer is maintained by the operator. It can be easily checked by observing the water level sight glass on the front of the expansion tank.

The vaporizers have several safety features which will automatically shut them down if operating guidelines are exceeded. There are several electrically operated safety switches: flame safe guard, high temperature, high gas pressure, low gas pressure, high LPG level and low water level. If any of these operating parameters are exceeded the vaporizer will shut down. The flame is monitored by a programmed controller which will shut down the vaporizer if a flame is not detected. The burner's gas pilot flame is monitored by a flame detector for safe operation. A timed delay relay will prevent the vaporizer from shutting down if there is a momentary loss in power.

An annunciator panel inside the cabinet on the front of the control panel of the vaporizers indicates if operation parameters have been exceeded. The flame monitoring system is housed in the control panel.

There are three types of burner configurations available for the horizontal water bath vaporizers.

1. **FIXED FIRE START** - capacities up to 1,650 gal/hr.

This system uses a slow opening diaphragm or motorized valve and a quick opening solenoid valve to control gas flow. Gas pressure is adjusted and maintained by a pressure regulator. Combustion air available to the burner is fixed in an open (high fire) position.

OPERATING SEQUENCE:

When the temperature of the water bath falls below the operating level the blower motor starts and the pre-purge cycle begins. When the pre-purge cycle ends, the ignition transformer energizes, the pilot valve opens and the gas pilot is ignited.

The flame detector then verifies the flame, the safety shutoff gas valves open supplying gas to the orifices at the required pressure setting and the burner ignites. Both the ignition transformer and the pilot valve are then de-energized.

When the temperature of the waterbath reaches its operating level, the gas valves close and the blower motor is turned off, shutting down the burner for the next heat cycle.

2. **LOW FIRE START, HIGH FIRE RUN** - capacities from 2,200 Gal/Hr to 3,300 gal/hr.

This system uses a motorized gas valve and a quick opening solenoid gas valve arrangement to control gas flow. Gas pressure is adjusted and maintained by a pressure regulator. An air inlet louver linked to a motorized gas valve controls the combustion air available to the burner.

OPERATING SEQUENCE:

When the temperature of the waterbath falls below the operating level, the blower motor starts and the pre-purge cycle begins. The motorized valve is closed, allowing air for low fire combustion to pass through the louver. When the pre-purge cycle ends, the ignition transformer energizes, the pilot valve opens and the gas pilot is ignited.

The flame detector then verifies the flame, the safety shutoff gas valves open slowly supplying gas to the orifices at the low fire rate and the burner ignites in the low fire position. Both the ignition transformer and the pilot valve are then de-energized.

The motorized gas valve continues to open in the sequence, allowing the linkage to drive the air louver to the full open position. The burner then goes to the high fire mode of operation.

When the temperature of the waterbath reaches its operating level, the gas valves close and the blower motor is turned off, shutting down the burner for the next heat cycle.

3. LOW FIRE START FULL MODULATING GAS TRAIN AND BURNER - capacities from 4,400 Gal/Hr to 15,000 gal/hr

This system uses motorized gas valves and a modulating motor to provide a low fire and a high fire gas flow and simultaneously regulate the combustion air available to the burner. Gas pressure is adjusted and maintained by a pressure regulator. Head or orifice pressure is varied by a butterfly metering valve linked to the modulating motor. The butterfly metering valve is opened for high fire and gas is delivered to the orifices at the pressure setting of the pressure regulator. The air louver is also linked to the modulating motor so that combustion air is increased proportionately as the orifice pressure increases.

OPERATING SEQUENCE:

When the temperature of the waterbath falls below the operating level, the blower motor starts and the pre-purge cycle begins. The motorized valve is closed, allowing air for low fire combustion to pass through the louver and ignition to occur. When the pre-purge cycle ends, the ignition transformer is energized and the pilot valve opens, igniting the gas pilot.

The flame detector then verifies the flame, the safety shutoff gas valves open slowly supplying gas to the orifices at the low fire setting of the butterfly metering valve, and the burner ignites at the low fire rate. Both the ignition transformer and the pilot valve are then de-energized.

After a short delay, the modulating motor is switched to the control of the controller, which drives the motor from the low fire position toward the high fire position to meet the demand of the vaporizer. Because both the air inlet louver and butterfly metering valve are linked to the modulating motor, the combustion air is increased proportionately as the gas increases.

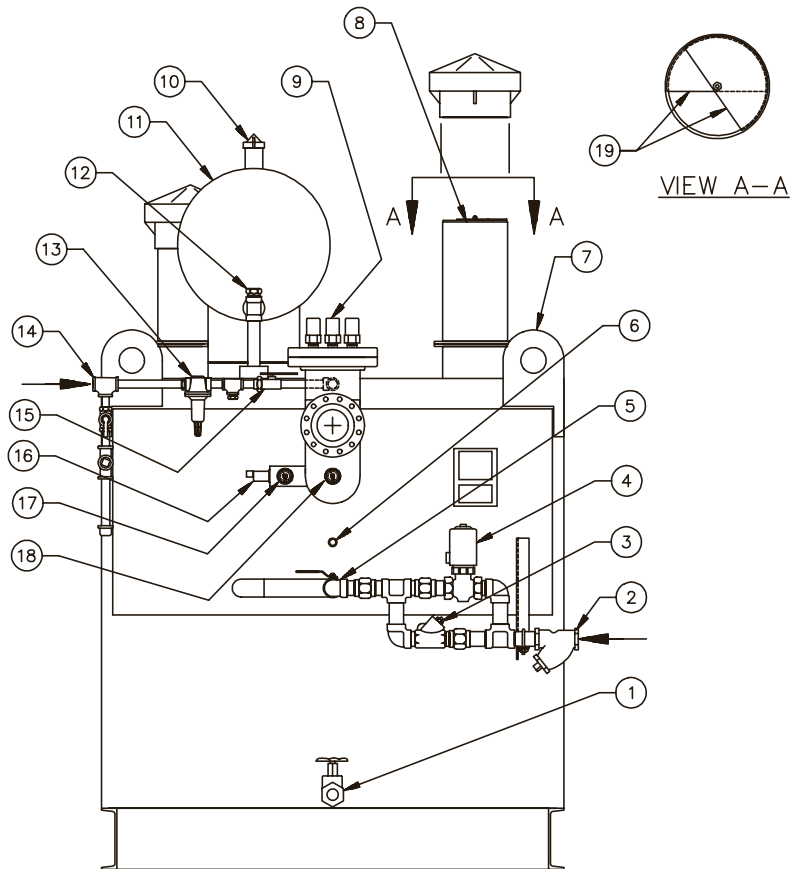
As the demand of the vaporizer is met, the controller drives the motor back toward the low fire position. The burner modulates over the range between low fire and high fire in response to demands of the vaporizer.

When the temperature of the waterbath reaches its operating level, the gas valves close and the blower motor is turned off, shutting down the burner for the next heat cycle.

Major Components

2

Figure 2 – Major Component Drawing
Propane End (Model Q7500H shown as example)

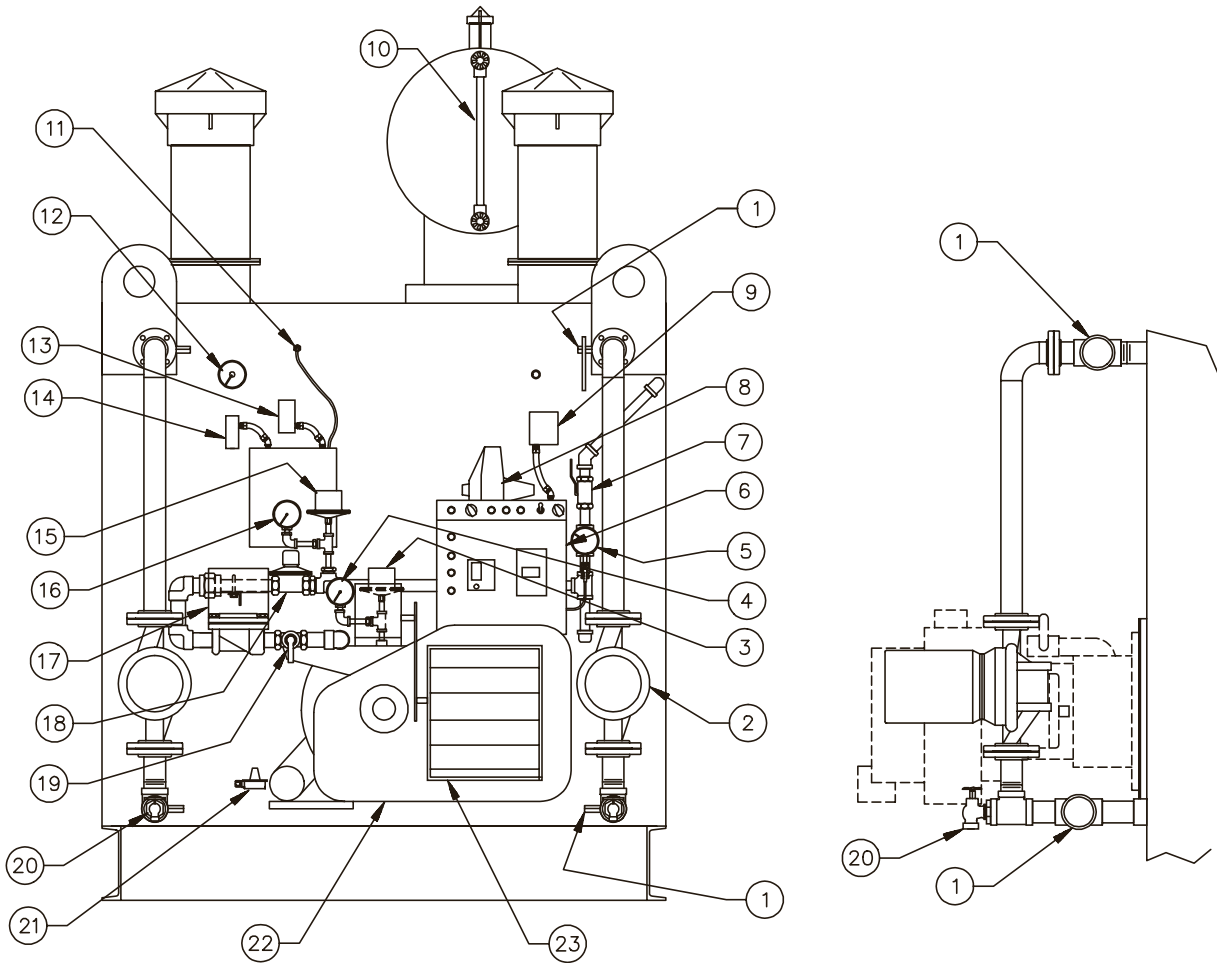


Major Components (Propane).dxf

- | | |
|---|--|
| 1. Waterbath Drain Valve. | 11. Expansion Tank. |
| 2. LPG Liquid Inlet Strainer. | 12. Main Fill Opening. |
| 3. Back Check Valve. | 13. First Stage Burner Regulator. |
| 4. Liquid Inlet Safety Solenoid Valve. | 14. Burner Auxiliary Fuel Supply (10 psi maximum). |
| 5. Isolation Valve. | 15. Isolation Valve (for auxiliary fuel supply). |
| 6. Float Chamber Drain (for removing heavy ends). | 16. High Propane Liquid Level Float Switch. |
| 7. Lifting Lugs (4). | 17. Vapor Pressure Gauge. |
| 8. Flue Outlet. | 18. Vapor Temperature Gauge. |
| 9. Pressure Relief Valve (250 psig). | 19. Suppressor Plates. |
| 10. Waterbath Fill and Vent Opening (expansion tank). | |

Major Components

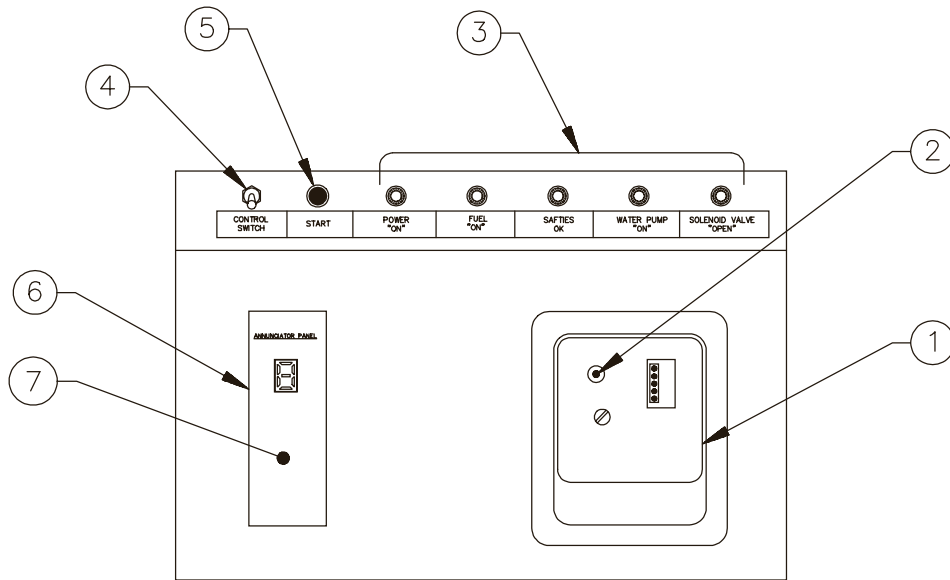
**Figure 3 – Major Component Drawing
Burner End (cabinet removed)**



Major Components (Burner).dxf

- | | |
|--|---|
| 1. Water Circulation Shutoff Valves (two for each water train). | 13. Operating Temperature Controller. |
| 2. Water Circulation Pump. | 14. Firing Rate Controller (full modulating burners only). |
| 3. High Gas Pressure Switch. | 15. Low Gas Pressure Switch. |
| 4. Burner Head Pressure. | 16. Inlet Manifold Pressure Gauge. |
| 5. First Stage Burner Regulator Pressure Gauge. | 17. Motorized Safety Gas Valve. |
| 6. Control Cabinet. | 18. Second Safety Gas Valve. |
| 7. Isolation Valve. | 19. Manual Leak Test Valve. |
| 8. 2nd Stage Burner Regulator. | 20. Water Train Drain Valve (one for each water train). |
| 9. High/Low Temperature Switch. | 21. Gas Pilot Regulator. |
| 10. Water Level Sight Glass. | 22. Forced Draft Burner. |
| 11. Low Water Level Relay. | 23. Air Inlet Louvers |
| 12. Waterbath Temperature Gauge. | |

Figure 4 – Typical Control Panel Drawing



Control Panel.dxf

- | | |
|---|---------------------------------|
| 1. Fireye Flame Safeguard Control. | 5. Start Button. |
| 2. Fireye Flame Safeguard Reset Button. | 6. First Out Annunciator Panel. |
| 3. Indicator Lights. | 7. Annunciator Reset Button. |
| 4. On/Off Control Switch. | |

ANNUNCIATOR READOUTS

Indicating which safety switches have been tripped (example only, vary according to model).

- | | |
|---------------------------|----------------------|
| 1. High LPG Level | 5. High Gas Pressure |
| 2. Low Water Level | 6. Low Gas Pressure |
| 3. Flame Fail | 7. Reset |
| 4. High Water Temperature | 8. Power Off |

FLAME MONITORING SYSTEM

The control panel for every horizontal vaporizer contains a flame monitoring system which monitors the flame via an ultra violet scanner and controls the burner's startup operation when the temperature of the waterbath falls below the operating level. It is microprocessor based and programmed at the factory for the burner operation. Some models have LED readouts, others use indicators showing the operating status of the flame safeguard.

The flame safeguard can shut down the system if there is a flame failure, safety violation, or blower failure.

FIRING RATE CONTROLLER (MODULATING BURNERS ONLY)

All vaporizers with capacities from 4,400 gal/hr. To 15,000 gal/hr utilizing modulating burners use a fire rate controller for maximum efficiency of fuel. The fire rate controller modulates the burner in response to different demands.

The controller responds to changes in the waterbath temperature sending a signal to the modulating motor which positions the burner fuel butterfly valve and air inlet louver.

A thermostat for the water/glycol mix is set at the factory determines the response of the controller. The thermostat can be reset by rotating the dial in the front to the desired temperature range.

The butterfly valve is controlled progressively in response to temperature changes: a 5°F water bath differential opens the fuel valve completely, a 2 ½° F differential opens the valve half way. At 0°F differential the valve is open 15%.

The controller also has a manual mode of operation where a potentiometer is used to control the linkage opening for adjustment of the valve, characterized linkage and fuel/air ratio.

Installation

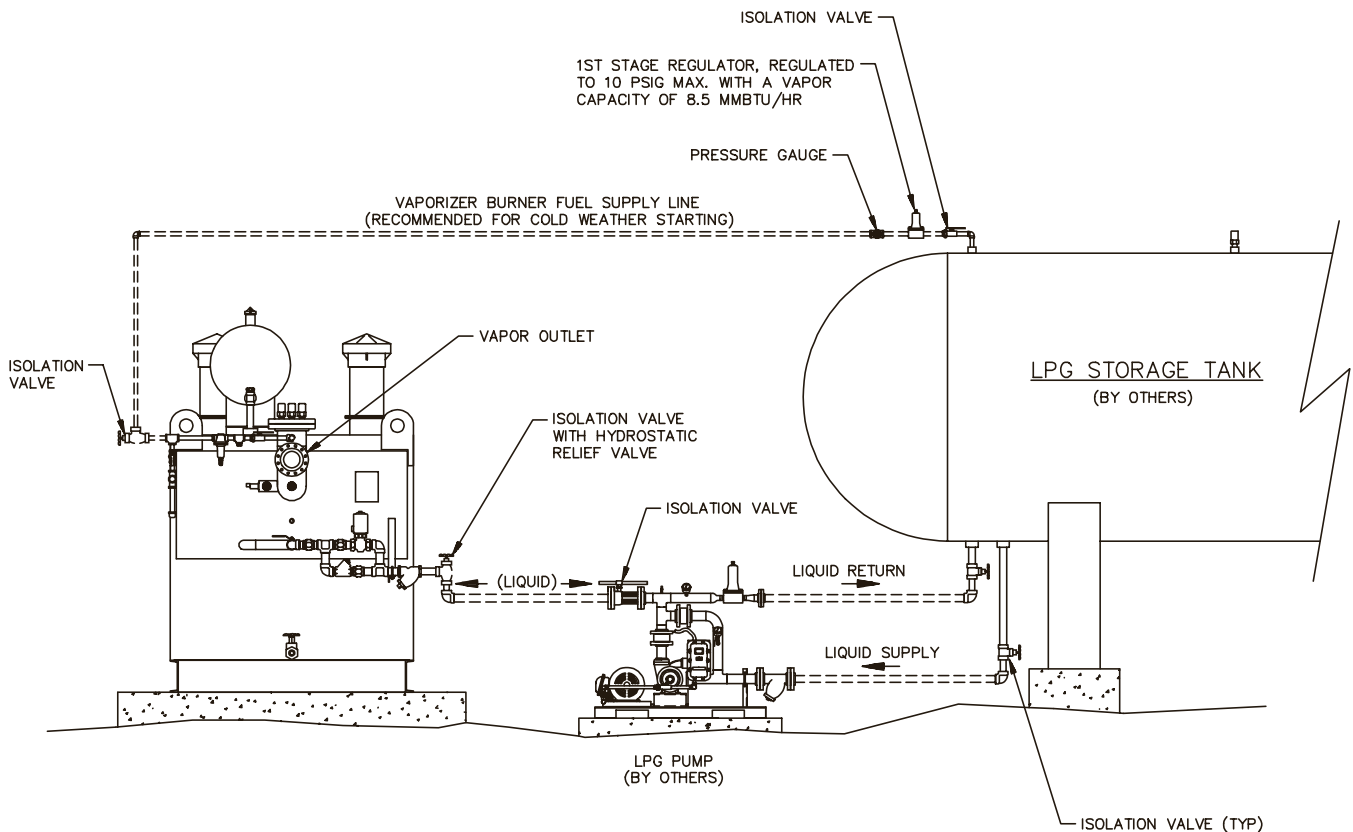
3

GENERAL

Install the vaporizer in accordance with applicable codes and local regulations as required.

Installation requirements vary according to local, provincial and state requirements. Consult state, provincial, and local authorities as well as insurance carriers installation requirements.

Figure 5 – Typical Installation Drawing



Installation.dxf

1. The **AQUAVAIRE** vaporizer is normally installed outside on an appropriately sized level concrete pad. Protect the vaporizer against damage from moving vehicles with an appropriate barrier.
2. Connect the vapor outlet to the vapor distribution piping. Piping may require insulation or heat tracing to prevent vapor from dropping below its dew point. Provide a shut off valve after the vapor outlet header.
3. Connect the liquid LPG supply line to the vaporizer's liquid inlet header. Do not install check valves or other devices that prevent back-flow in the liquid LPG line. Provide a liquid LPG pump with a liquid relief back to storage tank before the vaporizer.
4. Clean all foreign material from all pipe lines prior to making final connections. All joints require a pipe sealant suitable for LPG. Test for leaks using an inert gas such as 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!**
5. Connect vaporizer burner fuel supply line to gas supply if a separate gas supply is used.
6. Electrical service and control connections must be made to the control panel. Connections to the control panel must be water tight. A disconnect should be provided by the installer. See *data sheet* for electrical service requirements.

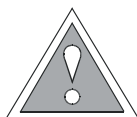
All wiring should be in accordance with NFPA 70 and all applicable state and local codes. An electrical ground must be connected to the control panel and identified by a green colored ground label. The size of the ground wire is determined by applicable codes and standards.

7. Fill vaporizer shell with an appropriate mixture of water and a heat transfer fluid for freeze protection. Vaporizer is filled when the water is approximately one inch above the bottom of the glass indicator on the expansion tank. The heat transfer fluid must contain adequate rust inhibitors for corrosion protection. Refer to the heat transfer fluid manufacturer's recommendations for freeze protection and corrosion protection.

Initial filling should be done through the main fill opening. Final filling should be done through the fill opening on the expansion tank. The expansion tank drains slowly so the water level indicator must be stable for the tank to be filled correctly.

The vaporizer is full when there is about one inch of water/glycol in the fill line indicator at ambient temperature. The volume of the water/glycol mixture is greater when it is at operating temperature than when it is at ambient temperature, therefore the indicator reads high when the vaporizer is at full operating temperature.

We recommend a heat transfer fluid type SR-1 as manufactured by the Dow Chemical Co. or an equivalent. This heat transfer fluid can provide freezing protection to -60° F. and contains corrosion inhibitors that are specially formulated for heating service. The engineering specification sheet for Dow Therm SR-1 should be consulted to determine the right water quality and correct mixing ratio. An excerpt from the specification is reproduced below.



WARNING

Do not mix glycol fluids of unknown compositions! Some contain phosphates and some contain silicates!

NOTE

Use only good quality water in solution with the ethylene glycol fluid. Use water with low levels (less than 25 PPM) of chloride and sulfate, and less than 50 PPM of hard water ions (Ca++, Mg++). Distilled or deionized water is recommended. If good quality water is unavailable, purchase pre-diluted solutions of industrially inhibited ethylene glycol fluid from the fluid manufacturer.

Table 1 – Freezing and Boiling Points of Aqueous Solutions

FREEZING TEMPERATURE (°F)	% GLYCOL BY VOLUME	BOILING TEMPERATURE (°F)
26	10	214
16	20	216
4	30	220
-12	40	222
-34	50	225
-60	60	232
<-60	70	244
-49	80	258
-20	90	287

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Startup

NOTE

Thorough knowledge of the burner operation is necessary for successful startup. Persons responsible for the startup and operation of the vaporizer should read and be familiar with the burner's instruction manual as well as this manual before starting the vaporizer.

ONLY QUALIFIED STARTUP SPECIALISTS SHOULD PERFORM INITIAL STARTUP.

WARNING

During initial startup, the operator must be on constant alert for emergency conditions such as fuel leaks, electrical malfunctions, etc. The location of all manual shut-of valves and disconnect switches should be clearly in mind so the burner can be quickly shutdown if necessary. Should the burner fail to ignite, never manually manipulate the flame safeguard sequence which provides for purging of the combustion chamber.

WARNING

FOR YOUR SAFETY – IF YOU SMELL GAS:

***Do not touch electrical switches.
Extinguish any open flame.
Shut off gas supply immediately.***

WARNING

LPG is explosive and extremely dangerous. Take all necessary safety precautions in operation of the system. No open flames or sources of electrical sparks should be in the operating facility.

STARTUP PROCEDURE

1. All operational settings were made at the factory. However, vibration in transportation may alter the operational settings so the control settings may require adjustment.
2. Check that the voltage to the vaporizer is correct by testing the line with a voltmeter. Refer to the data sheet for correct voltage.
3. If the burner malfunctions, turn off the power and refer to the burner troubleshooting guide in this manual and the burner manual in the appendix.
4. Verify operating component and safety settings. Refer to data sheet for factory settings.
5. Manually close the system control outlet valve which is located after the vaporizer outlet.
6. Purge air from the liquid line between the pump and vaporizer.
7. Turn on the electrical disconnect.
8. Turn on power to the vaporizer. From the control panel, put the fire rate controller to **AUTO** (if it is a modulating burner or if the vaporizer is so equipped) and the control switch to the **ON** position.
9. Press the **START** button and hold it for five seconds. Put the control switch to the **OFF** position. (This allows the LPG to enter the vaporizer.)
10. Purge air from the burner gas train by opening the union down-stream of the second stage regulator. When the air is purged from the burner gas train, tighten the union. Purge air from the pilot supply tube by disconnecting the pilot supply at the burner. Re-connect the pilot supply tube and test the gas train for leaks.

WARNING

LPG in pure form without odorizers is invisible to all human senses. It cannot be detected by smell. Use extreme caution in purging the vaporizer of LPG.

11. Move the control switch to the **ON** position. reset the gas pressure switches and the flame safeguard.
12. Press the **START** button. (The burner will begin its pre-purge cycle prior to ignition.) If the burner fails to light, reset the flame safeguard and press the **START** button again.
13. When the burner is running, press the **DISPLAY/RESET** button on the annunciator to clear the display.
14. Verify the gas pressure regulator settings with the data sheet before checking the air/fuel ratio. The regulator settings should be the same as indicated on the data sheet.

15. The air/fuel ratio of the burner may require adjustment to compensate for different elevations and air density. Refer to the burner/air fuel adjustment procedures.
16. Conduct a final CO₂ analysis. The final air settings should produce a flue gas analysis between 9.5% and 11.2% CO₂.
17. When the vaporizer water temperature reaches 120°F (low temperature setting), the inlet solenoid valve will open.
18. When the vaporizer has reached operating temperature, the burner will shut down. The **FUEL** lamp will be off. **POWER, SAFETY CIRCUIT, INLET SOLENOID**, and **WATER PUMP** lamps will remain lit. At this time, slowly open the system control outlet valve to introduce vapor to the load.
19. The vaporizer is now ready for operation.

BURNER SAFETY CHECK

1. Start and stop the burner several times to insure proper operation. Check for proper functioning of low-water cutoff, high limit and operating control.
2. Check operation of flame safeguard by simulating a flame failure, making certain the burner locks out on safety within the time limits of the control. (*See the Flame Safeguard manual.*)
3. Start the burner in accordance with the step by step operating sequence procedure. As the burner enters the flame safeguard sequence, verify each burner function at the timing indicated. (*See the Flame Safeguard manual.*)

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Operation Instructions

OPERATION CHECKLIST

Check these operations weekly to ensure proper operation:

1. Glycol/water level
2. Presence of LPG gas in the area
3. Verify water pump operation
4. Gas valve operation
5. Flame Safeguard tests
6. A smooth lightoff and smooth burner operation

Table 2 – LED Function

Operating Control:	Fireeye is on and operating – burner control switch and manual control switches are closed.
Air Flow:	Air flow switch is closed.
PTFI:	Energize during Pilot Trial for Ignition Period.
Flame On:	Flame is detected.
Alarm:	Safety lockout is activated.

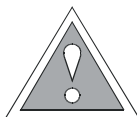
FIREYE FLAME SAFEGUARD CONTROL

If there is an ignition failure or a safety shutdown, the Fireeye monitor shuts down the vaporizer and activates an alarm. The manual reset button on the Fireeye monitor on the inside of the control panel must be reset before restarting the vaporizer.

Please refer to the Fireeye Flame Safeguard manual for further information about its operation.

TO SHUT DOWN THE VAPORIZER (LOCAL CONTROLS)

1. Close the vaporizer outlet valve.
2. Turn the power switch to **OFF**.
3. Shutdown is complete



WARNING

Do not close both outlet and inlet valves when shutting off the vaporizer. Closing both valves may trap liquid propane in the vaporizer and cause pressure build up which may open the safety relief valve.

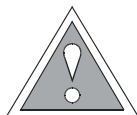
TO RESTART THE VAPORIZER (LOCAL CONTROLS)

1. Close the vaporizer outlet valve.
2. Turn the power switch to **ON**.
3. Press the start button.
4. After the vaporizer attains operating temperature, slowly open the vaporizer outlet valve.

STANDBY CONDITION (LOCAL CONTROLS)

If immediate changeover in operation is required, maintain the system as described above and leave the vaporizer outlet valve closed. Changeover is accomplished by slowly opening the vaporizer outlet valve.

Standby operation is economical and insures quick changeover. If operation is anticipated on a weekly level the vaporizer should be left in the standby mode.



WARNING

ALWAYS PUT THE VAPORIZER IN STANDBY MODE BEFORE TEMPERATURES FALL BELOW 0° F.

Operational Adjustments and Settings

SETTINGS

The table below lists all the operational settings which must be set for each vaporizer. The correct settings are given on the data sheet in the Vaporizer Technical Section (Appendix).

Table 3 - Operation Settings

Description	Setting
First Stage Regulator	10 psig
Second Stage Regulator	Refer to data sheet
Burner Head Pressure	Refer to data sheet
CO ₂	9.5 - 11.2%
O ₂	4 - 6%
High Temperature Switch	200° F, 10° F Diff.
Low Temperature Switch	120° F, 10° F Diff.
Operation Temperature Switch	170° F, 5° F Diff.
Fire Rate Controller Temperature (full modulating burners only)	170° F, 5° F Diff.
High Gas Pressure Switch	Refer to data sheet
Low Gas Pressure Switch	Refer to data sheet

* All operational settings were made at the factory. However, vibration in transport may have altered them so some settings may require adjustment.

Adjustments

REGULATOR ADJUSTMENT

The first and second stage regulators were set and adjustment of the gas pressure/gas flow rate to the burner should not be necessary. If adjustments must be made, check the data sheet for settings. The regulators are set when the burner is running.

Normally, the only adjustments that are required are changes in air requirements due to altitude as the burner fuel/air mix is set at sea level. The air inlet louver box controls the fuel/air mix. Adjustment instructions are provided later in this section.

NOTE

If the pressure in the burner gas train is too high or too low, pressure switches will shut down the burner.

The tension on the regulator spring can be adjusted to obtain the exact gas pressure required at the inlet to the controls.

1. Remove the cap or bonnet from the regulator to gain access to the adjustment screw or button.
2. Turn the screw clockwise to increase the pressure and counter-clockwise to decrease the pressure.
3. Reinstall the cap or bonnet after the regulator is adjusted.

WARNING

Adjustable air and fuel control mechanisms which modulate with the burner firing rate must be adjusted with the 0 to 90° actuator in the 0° position.

**PRIMARY – SECONDARY
AIR CYLINDER**

Separate air-adjustment at the firing head provides a unique air control system enabling quiet, stable combustion without objectionable noise or pulsation. This feature allows flexibility for a variety of job conditions and insures greater combustion efficiency.

Moving the positioning knob forward reduces the amount of air available for combustion while movement to the rear increases the air supply. An automatic positioning knob which proportions the air at the firing head as the combustion control modulates the burner to meet the vaporizer's demands.

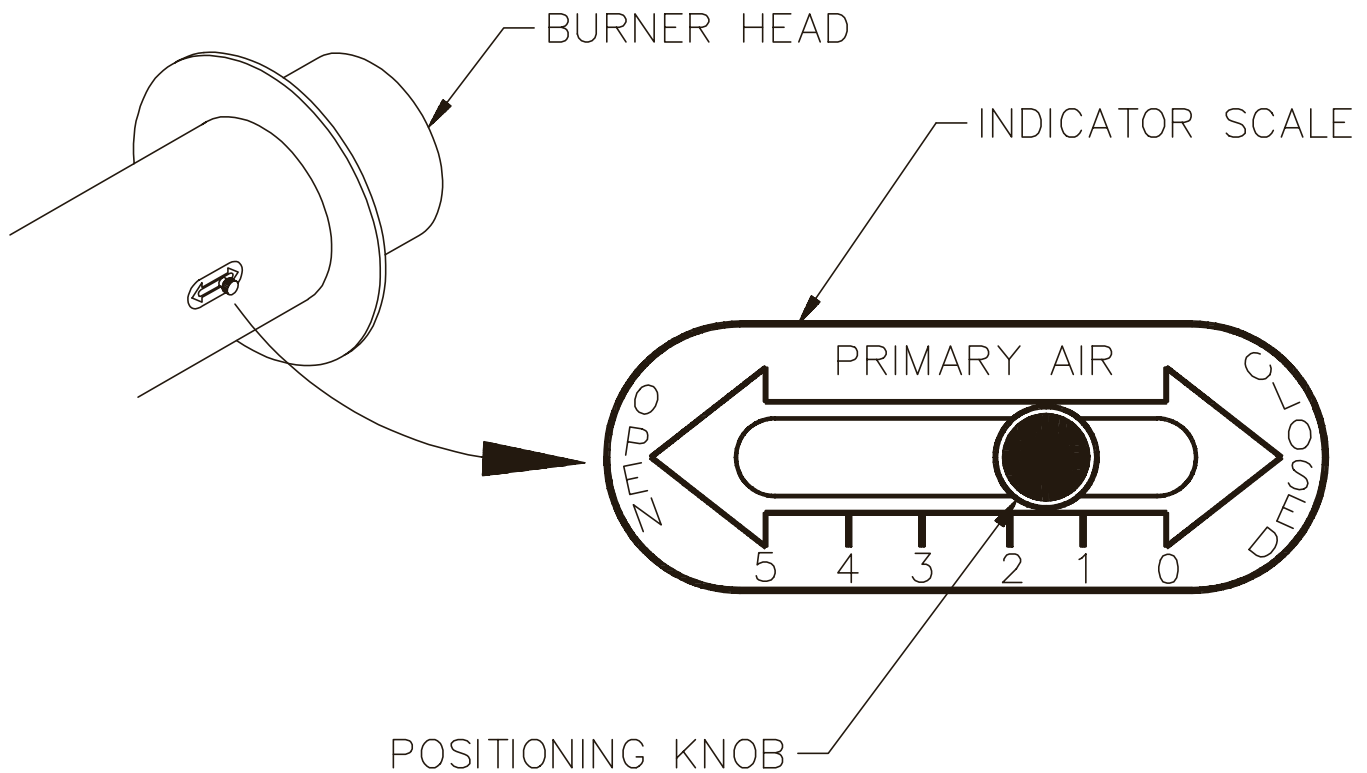
Adjusting the manually set air cylinder (refer to the figure below):

1. Loosen the positioning knobs.
2. Move the positioning knob until flame operation is even.

NOTE

If the positioning knob is too far forward, the main flame may pulsate. If too far back, the burner may rumble.

Figure 6 – Proportioning Primary-Secondary Air Control (Manual)



Air Control (Manual).dxf

ADJUSTMENT OF THE AIR INLET LOUVER BOX

The amount of air available for combustion is controlled by adjustable louver located in the air box.

Full modulating burners have louvers that are interconnected through a series of small linkage arms secured to a common drive rod. (See Figures 7A and 7B.)

Louver openings and travel are controlled by adjusting the linkage mechanism from the actuator to obtain the desired opening and stroke. The actuator drives the louvers open or closed.

There are three types of air inlet louvers for combustion control.

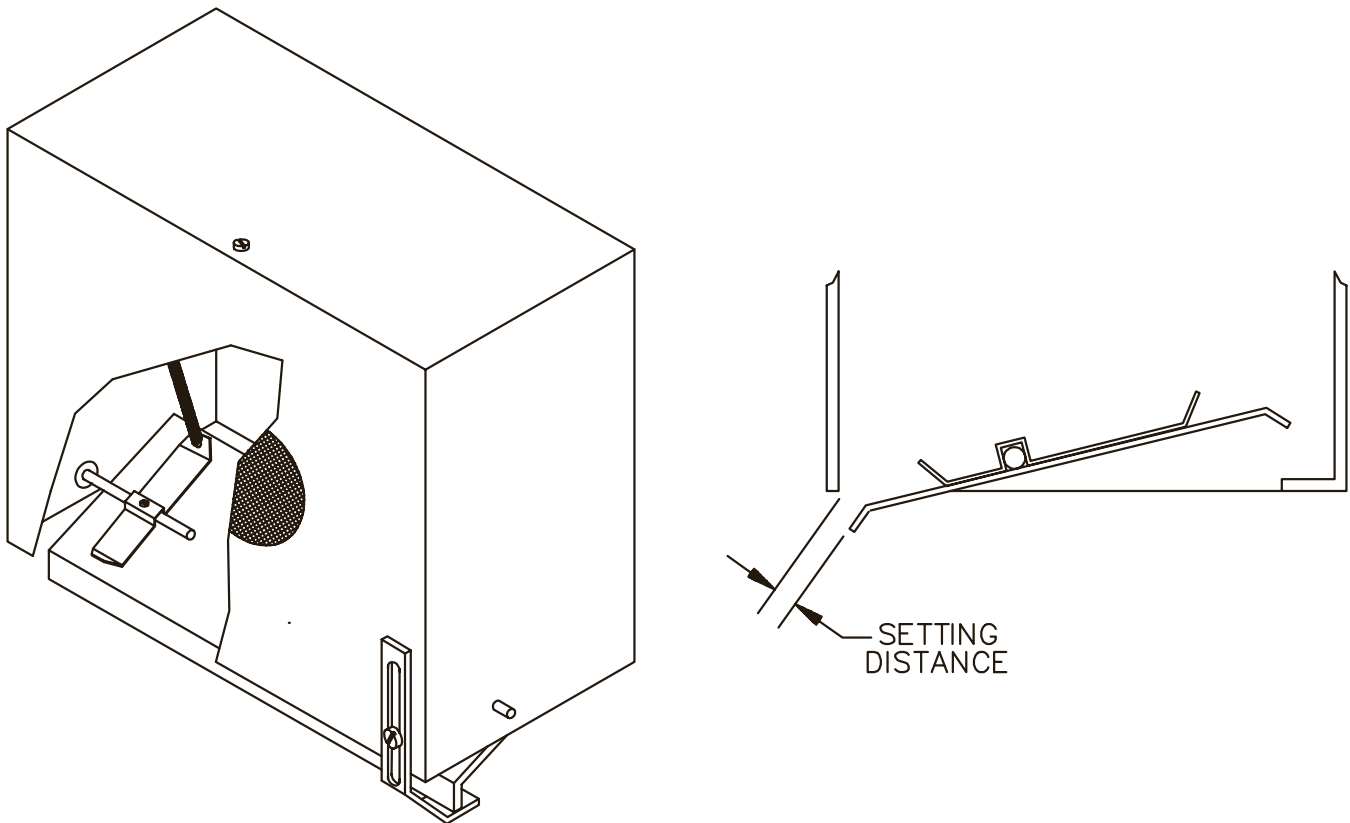
A. FIXED FIRE START – capacities up to 1650 gal/hr.

These systems use an air louver which is spring loaded **OPEN** against an adjustment stop bracket.

ADJUSTMENT PROCEDURE:

Loosen the screw holding the louver adjustment bracket and move it to the desired position, then re-tighten it.

Figure 7A – Fixed Fire Louver Adjustment



Fixed Fire Louver.dxf

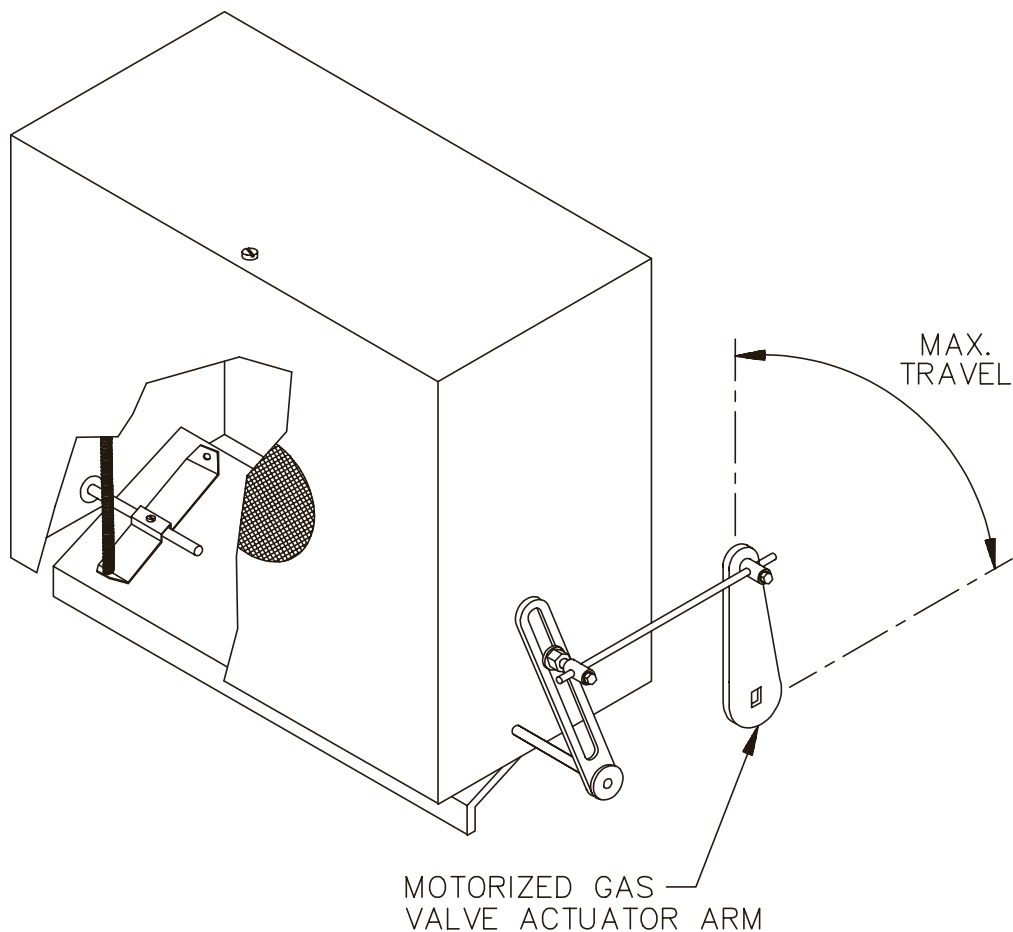
B. LOW FIRE START, HIGH FIRE RUN -
capacities from 2,200 gal/hr to 3,300 gal/hr

These systems use an air louver which is spring loaded closed against an adjustable stop bracket. A motorized gas valve moves the louver open.

ADJUSTMENT PROCEDURE:

1. Loosen the screw holding the louver adjustment bracket and move it to the desired position, then retighten it.
2. For initial startup, adjust the linkage arrangement to the motorized actuator arm so the louver will open approximately 1 1/4" when the gas valve opens.

Figure 7B – Low Fire Adjustment



Low Fire.dxf

NOTE

Motorized gas valves and the linkage arrangement used will vary. Use good mechanical judgment to insure that the linkage adjustments will open the louver as the gas valve opens.

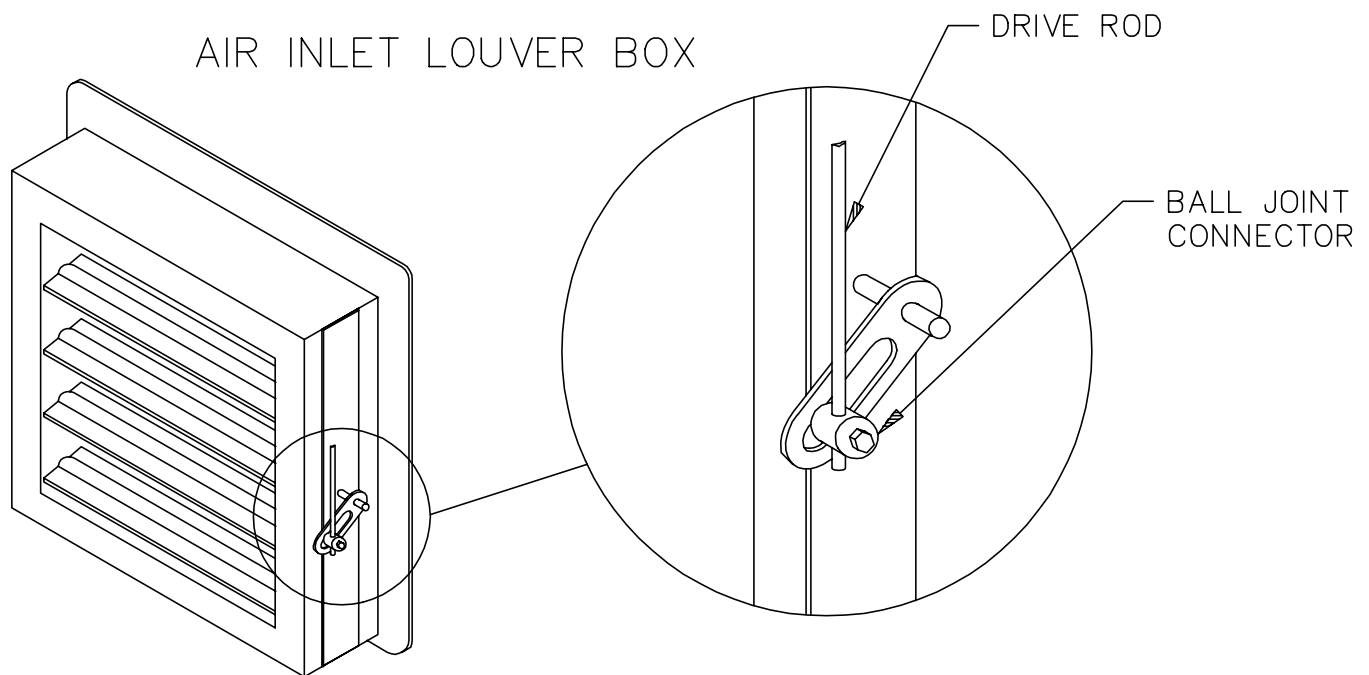
C. LOW FIRE START, FULL MODULATING GAS TRAIN AND BURNER –
capacities from 4,400 gal/hr to 15,000 gal/hr.

There are two adjustment procedures for these burners:

ADJUSTMENT PROCEDURE FOR HIGH TURNDOWN (see *Figure 7D -Method 1*):

1. Use a box end or socket wrench to loosen the ball-joint connector.
2. To adjust low fire (minimum) air setting, loosen ball-joint connector holding the drive rod and manually close all louvers
3. Re-tighten the ball-joint connector.
4. With a 3/32" allen wrench, loosen the set screws on the second from the top louver. Set the louver 3/8" open and tighten the set screws.

Figure 7C – Air Louver Box Drawing



Air Louver Box.dxf

ADJUSTMENT PROCEDURE FOR MEDIUM TURNDOWN

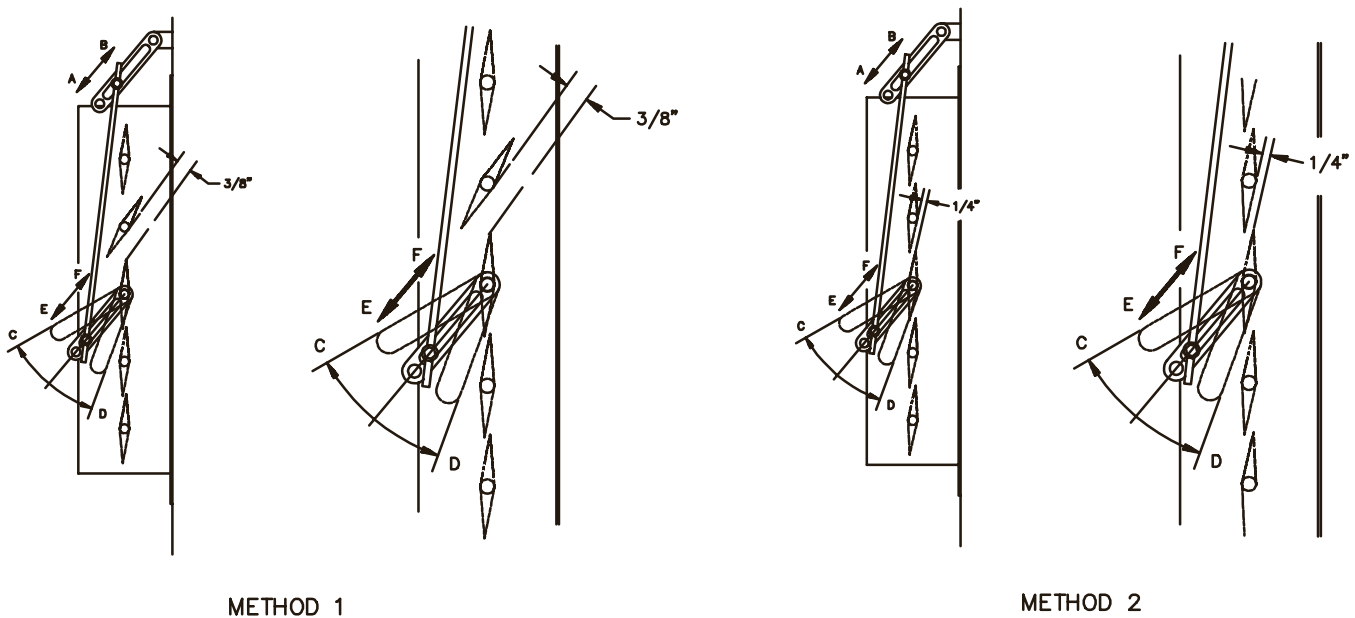
(see Figure 7B - Method 2):

1. Use a box end or socket wrench to loosen the ball-joint connector.
2. To adjust the low fire (minimum) air setting, loosen the ball-joint connector holding the drive rod and manually position the louvers to obtain the desired opening, then re-tighten the connector.
3. For initial start-up, position the air inlet louvers so they are approximately 1/4" open.

NOTE

To adjust the amount of travel (stroke), loosen the base of the ball-joint connector located in the slotted (louver) actuator arm and reposition it to the desired setting, then re-tighten the connector.

Figure 7D – Modulating Burner Adjustments'



Modulating Burner.dxf

- | | |
|--|--|
| <ul style="list-style-type: none"> A. Increases louver opening. B. Reduces louver opening. C. Slows opening of louver in first 1" of travel | <ul style="list-style-type: none"> D. Quickens opening of louver in first 1" of travel. E. Reduces louver opening F. Increases louver opening |
|--|--|

**ADJUSTMENT OF THE GAS PILOT
IGNITOR ASSEMBLY**

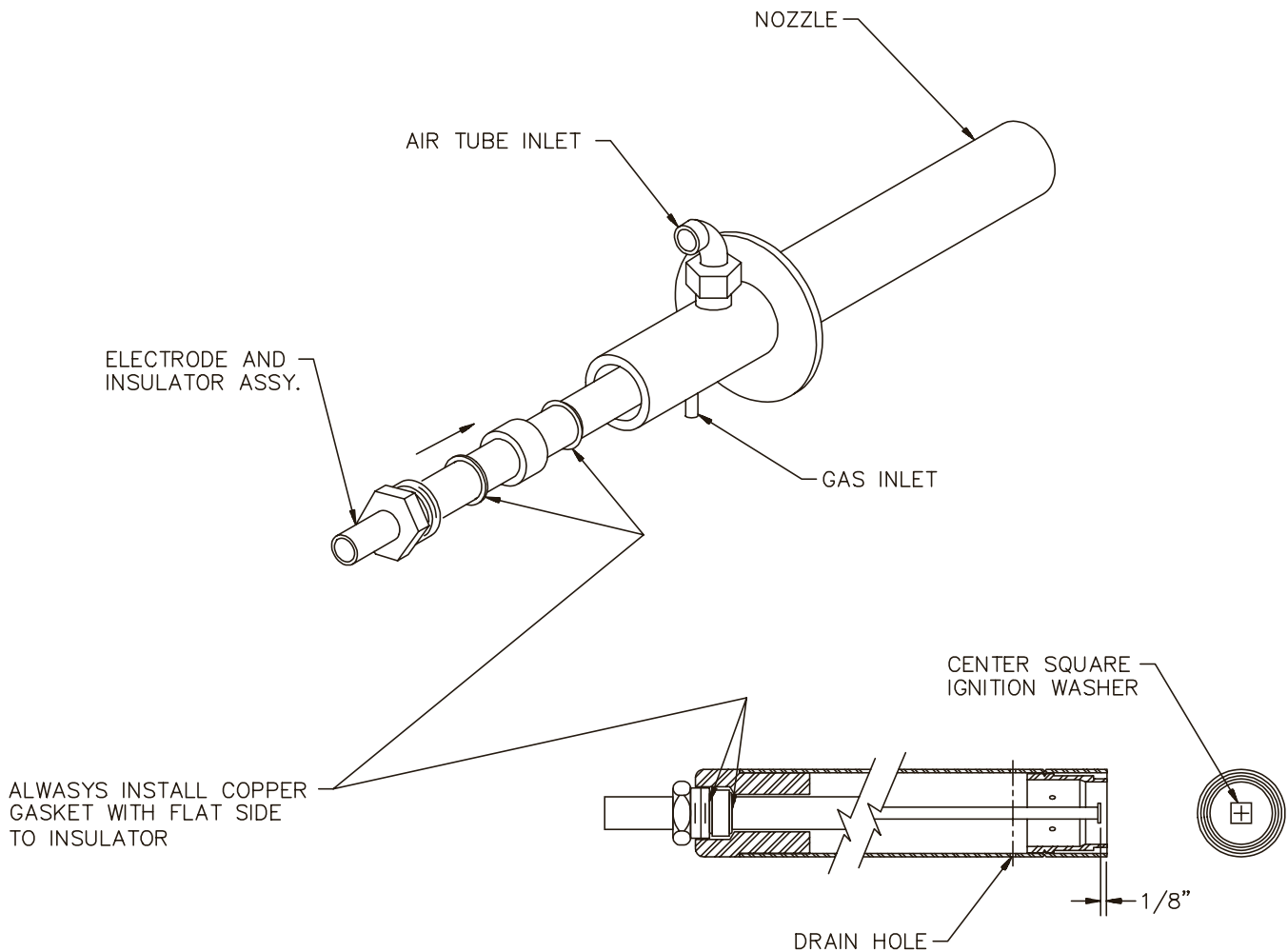
The gas pilot igniter is composed of (1) an ignition electrode with insulator which generates an arc between it and the adjacent ground, and (2) a fuel tube through which the gas is directed to the point of the electrical arc.

A charge from a high voltage transformer is routed to the ignition electrode, causing an intense arc to ground (*see the figure below*). The electrode is then immersed in a concentration of gas as the pilot solenoid valves opens allowing gas to flow to the pilot. The arc ignites the gas, the electrical discharge from the transformer terminates and the pilot stands ready to ignite the main burner flame.

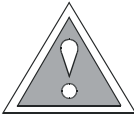
NOTE

The gas pilot igniter assembly must be kept clean and properly adjusted for reliable operation of the burner.

Figure 8 – Gas Pilot Igniter Assembly



Gas Pilot.dxf



WARNING

Turn off all electrical disconnects to the burner and any other equipment or systems electrically interlocked with the burner. Turn off the manual pilot gas valve.

ADJUSTING THE GAS PILOT IGNITOR ASSEMBLY:

1. Disconnect the cables, lines or tubes from the igniter assembly and remove it from the burner housing.
2. Inspect the square ignition washer for cleanliness and proper adjustment as shown.
3. Remove the ignition electrode assembly and check the insulator for cleanliness and/or cracks.
4. Burnish the end of the electrode tip and insert of the pilot tube assembly with a battery terminal cleaner or similar device.
5. Reinstall the ignition electrode assembly and check that the square ignition washer is approximately centered in the pilot assembly. If not, loosen the electrode locking nut and rotate the assembly, then tighten the nut.
6. Reinstall the pilot assembly in the burner.

NOTE

When viewing the pilot flame, the gas should be burning on the full face of the pilot insert.

7. For additional information on gas pilot igniters refer to the Burner Manual.

ADJUSTMENT OF BUTTERFLY GAS VALVE

The butterfly gas valve is a fuel throttling device which proportions the gas in proper ratio to the combustion air. The valve is opened or closed by an actuator as the combustion control programs the burner firing rate to meet the load of the vaporizer.

A centrally located disc turns within a cylindrical body which regulates the gas flow to the main burner flame. The butterfly valves used are the non-tight shutoff type (see Figure 9).

Through a linkage system, an actuator drives the valve open or closed in response to electrical signals from the combustion control. Since the amount of air available for combustion is controlled by the same actuator, a proper fuel-air ratio is maintained at all times.

Adjusting the Butterfly Gas Valve.

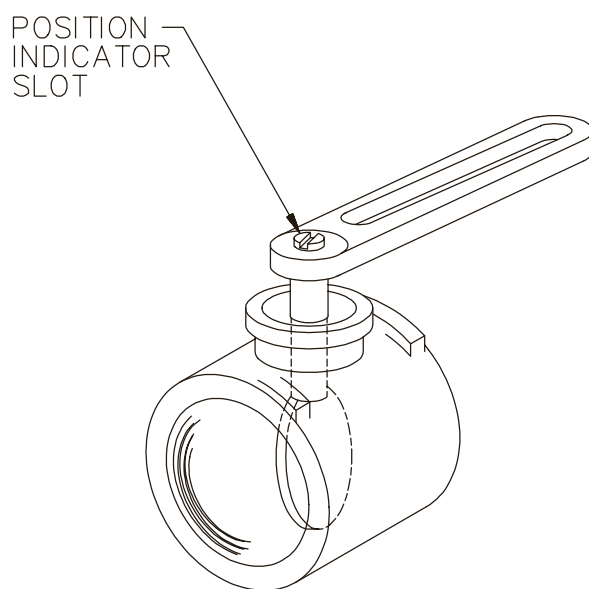
1. Use a box end or socket wrench to loosen or tighten the ball joint connectors.
2. To adjust low fire (minimum) fuel setting, loosen ball-joint connector holding drive rod and manually position the butterfly disc to the desired opening, then re-tighten the connector.

NOTE

Slot in the end of the butterfly shaft indicates the position of the internal disc.

3. For initial start-up position adjust the actuator arm so the internal disc is open approximately 15°.

Figure 9 – Butterfly Gas Valve



Butterfly Gas Valve.dxf

ADJUSTMENT OF THE AIR FLOW SWITCH (DIAPHRAGM)

The air flow switch is used to verify the flow of combustion air from the blower assembly. If combustion air is inadequate, the gas valve will close and the burner will shutdown.

The air flow switch is monitored by the flame safeguard. When the blower starts, creating an air flow through the burner housing, the switch closes delivering a signal to the flame safeguard.

ADJUSTING THE AIR FLOW SWITCH:

The adjusting switch is located under the cover. Some models have a scale plate for adjusting convenience.

1. Remove the cover.
2. Turn the adjusting screw clockwise to increase the setpoint.
3. Turn the adjusting screw counterclockwise to decrease the setpoint.
4. If the high or low adjustment stop is reached, turn the adjusting screw the other way at least 1/6 turn from the stop.

CHARACTERIZED LINKAGE ADJUSTMENT

Although initially set at the factory, larger vaporizers with full modulating burners have a roller/plunger mechanism called a characterized linkage.

The linkage is part of the fire rate controller which provides smooth burner operation for maximum fuel efficiency. The linkage is connected to a modulating motor which responds to the fire rate controller.

There are nine (9) adjustment screws which control the contour of a flexible metal track upon which a roller and plunger mechanism travel. This mechanism in turn controls the linkage to the fuel valve, providing the precise amount of travel to dispense the right amount of fuel to the burner as it modulates to meet load demand. The objective is to shape the flexible metal track into an efficient burner modulating profile.

All linkages move freely through the 90° of travel. The butterfly (throttle) valve is set at the slightly open position (15%).

Adjusting the characterized linkage to other than the factory setting should only be done after the burner has been successfully started-up and taken from low-fire to high-fire several times. Adjustments to the fuel control link ages during start-up should be done at a ball joint connector or linkage rod coupling. The vaporizer should be at operating temperature.

The fire rate controller must be put in the manual mode to adjust the linkage. The potentiometer on the controller is used to control the modulating motor and hence move the linkage so each screw can be adjusted.

CAUTION

Do not move the modulating motor shaft by hand as this may damage the motor.



Combustion readings should be taken at each of the nine (9) adjustment screws in the quadrant. The final fuel/air ratio curve must be determined on the basis of clean combustion at all firing rates. Sufficient combustion air must be available to keep the CO₂ generated by a gas fire below 50 PPM at all rates. **AS A STARTING POINT**, low and high fire flue gas composition should be in the tabulated range shown below:

NOTE

There should be no more than 3/16" variation between adjacent screws.

Table 4 – Flue Gas Composition Range

Low Fire		High Fire	
CO ₂	O ₂	CO ₂	O ₂
8 1/2 - 10 1/2	8 1/2 - 5	10 1/2 - 12	5 - 2 1/2

Once the linkage is set the fire rate controller should be put in the automatic mode.

WATERBATH TEMPERATURE CONTROLLING SWITCH (IF INSTALLED)

Under normal operating conditions the thermostat does not need to be changed. To set the switch, insert a screwdriver and rotate the dial.

HIGH SAFETY LIMIT SWITCHES, #9. (FIGURE 3)

Under normal operating conditions the high safety limit switches need no adjustment.

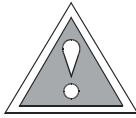
To set the switches, remove the front cover. The low limit, high limit and temperature differential switches are labeled and can be changed by easily turning the dials. (See *data sheet for setpoints.*)



CAUTION

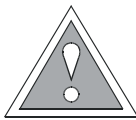
When making any adjustment on any electrical control or device, turn off all power and close the inlet valve to the vaporizer.

WARNING



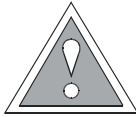
Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual and the manuals in the appendix for information. For assistance or additional information consult a qualified installer or Algas-SDI.

CAUTION



In accordance with OSHA standard 1910.147, all equipment, machines and processes shall be locked out prior to servicing.

CAUTION



SERVICING MUST BE DONE ONLY BY FULLY TRAINED AND QUALIFIED PERSONNEL.

CAUTION



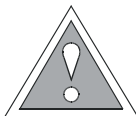
When performing any service shut off all electrical power, close all supply valves, bleed the LPG lines to zero pressure, purge them and vent any LPG vapor to a safe location.

CAUTION



LPG is explosive and extremely flammable. Appropriate safety procedures must be performed when all maintenance procedures are performed.

WARNING



Do not close both outlet and inlet valves when shutting off unit. Closing both valves may trap liquid propane in the vaporizer and cause pressure build up and safety relief opening.

Maintenance

Table 5 – Maintenance

DESCRIPTION	WEEKLY	EVERY MONTH	EVERY SIX MONTHS	EVERY YEAR
Blower wheel			Check that the wheel is tight on shaft.	
Blower Air Flow Switch			Check adjustment.	
Burner Combustion Chamber				Check burner mounting flanges.
Burner Fuel Supply Lines			Perform combustion tests.	Pressurize and check for leaks.
Burner				
Flame Safeguard	Flame failure test. Flame signal strength test.			Pilot turndown tests.
Operating Controls				Check settings, operation.
Vaporizer Housing				Check for cracks.
Strainer				Remove and clean.
Water/Glycol	Check fluid level.	Check solution ratio.		
Wiring			Check supply voltage.	Check for broken or loose wires.
Safety Set Points				Check settings, operation.
Liquid Inlet Solenoid		Check operation.		Rebuild.
Regulators		Check settings, operation.		Clean. Rebuild if required.
Burner Solenoid Valves			Check.	Rebuild.
Float Chamber				Remove drain plug, drain heavy ends.
Inlet and Outlet Lines				Purge all lines and test for leaks.
Pumps and Pump Motor	Check operation.	Apply 10-15 drops of SAE 20 non-detergent oil (3 holes)		
Igniter	Visually inspect.			
Burner Valves	Visually inspect.			Perform leak test.
Low-Water Cutoff			Perform a slow drain test.	
High-Low Gas Pressure Interlocks				Check settings, operation.
Low Fire Start Interlock				Check operation.

Maintenance is based on continuous operation.

Refer to the burner manual for additional maintenance checks.

Check component identification section for component location.

The electric motor for the blower has sealed bearings does not require lubrication.

NOTE

When the LPG system is shut down for prolonged periods, it is recommended that the system be started at least once per month and run for period of 1 hour. This procedure allows the operator to understand the operation of the system and provide a good test of the vaporizer.

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Troubleshooting

7

Table 6 – Troubleshooting Guide – Annunciator Readouts

TROUBLE	PROBABLE CAUSE	SOLUTION
HIGH LPG LEVEL		
High LPG Level	Capacity of vaporizer exceeded.	Reduce load on vaporizer.
	Float contact magnet dirty.	Remove float and clean contact magnet.
	Faulty float, wiring.	Replace float and/or wiring.
	Water pump failure.	Replace or repair water pump, check wiring.
	Operating temperature switch differential too high.	Adjust 5" differential.
	Operating temperature switch setting too low.	Reset temperature control per data sheet.
LOW WATER LEVEL		
Low Water Level	Water level low.	Fill vaporizer.
	Check controls for loose wires.	Repair or replace defective wiring.
	Malfunction of float switch.	Check wiring and float. Replace wiring, clean and/or replace float.
FLAME FAILURE		
Motor runs, but ignition spark does not occur.	Air flow switch fails to make contact.	Adjust switch and tighten set screw. Replace mercury bulb if broken.
	Dirty contact in main relay.	Check voltage to primary coil of ignition transformer during trial for ignition.
	Pilot ignition transformer defective.	Check for 120 volts on ignition transformer panel terminal. Replace transformer if required.
	Ignition cable or electrode loose or grounded.	Check to insure that ignition cable is securely plugged into the electrode. Check cable and clean if necessary. Remove and check electrode insulator for cracks.
	Defective flame safeguard.	Check voltage on ignition terminal. Replace flame safeguard if required.
	Carbon hair on ignition electrode to ground.	Carefully remove pilot assembly and check for carbon hair. Remove, clean pilot assembly and ignition electrode, re-install and re-adjust gas pressure for a leaner burning pilot.
Motor runs, ignition occurs, but gas pilot does not ignite	No gas being supplied to pilot.	Check the manual pilot gas valve to insure that it is open.
		Make sure gas line has been purged of air.
		Pilot orifice plugged, clean.
		Gas pilot regulator locked up. Check inlet gas supply pressure. Replace gas pilot regulator.
	Pilot gas valve does not open.	Check voltage to coil during trial for ignition. Check valve action by sound and feel. A click sound indicates it is operating. Replace coil or valve body as needed.

Troubleshooting

Table 6 – Troubleshooting Guide – Annunciator Readouts (continued)

TROUBLE	PROBABLE CAUSE	SOLUTION
FLAME FAILURE (continued)		
Motor runs, ignition occurs, but gas pilot does not ignite (continued)	Insufficient gas flow to pilot.	Increases gas flow to pilot. Check for crushed or blocked pilot gas supply line.
	Low LPG pressure in vaporizer.	See <i>Low LPG Pressure section</i> .
Motor runs, gas pilot establishes, pilot flame does not prove	Improper gas flow.	Increase gas pressure to pilot. Verify flame safeguard installation testing.
	Flame sensor lens dirty.	Clean lens.
	Flame sensor cannot see pilot.	Look down through sight tube. If unable to get clear view of pilot, correct problem.
	Sight tube misaligned.	Adjust alignment of sight tube.
	Flame sensor defective.	Replace flame sensor.
	Plugged orifice in burner pilot.	Remove pilot assembly, check and clean pilot orifice and replace pilot assembly.
	Improper ground circuit.	Check for voltage on neutral wire to panel ground. Voltage must not be more than .5 volts.
	Pilot air supply incorrect.	Check static pressure on pilot air pickup tube. It must be more than .35" WC pressure. Adjust pilot air shutter for proper flame.
	Defective amplifier.	Check or replace amplifier.
Motor runs, gas pilot establishes, main gas flame does not ignite.	Manual valve not in proper position.	Open manual valve.
	Main and/or secondary gas valves do not open.	Check voltage to coil of gas valve. Check valve action by sound and feel. A good secondary valve has a click sound. Replace coil or valve body as needed.
		If not voltage to coil, check wiring replace the flame safeguard control if required.
		Pressure relief port on main fuel valve plugged. Clean main fuel valve fitting.
	Manifold gas pressure too low.	Adjust pressure regulator to valve at setting shown on data sheet.
	Excessive air to fuel ratio.	Adjust air/fuel ratio to specification on data sheet.
	Low LPG pressure in vaporizer.	See <i>Low LPG Pressure section</i> .
Lockout of flame failure	Interrupted fuel supply.	Establish fuel supply to burner.
	Improper combustion.	Adjust burner to obtain a clean flame.
	Weak flame signal.	Refer to flame safeguard control manufacturer's bulletin. Check flame signal strength, clean scanner with a clean cloth and detergent.
HIGH WATER TEMPERATURE		
High water temperature	Temperature control switch malfunction.	Check wiring and switch – repair or replace.
	High temperature switch malfunction.	Check wiring and high temperature switch. Repair or replace.
	Temperature control switch not set correctly.	Reset temperature control switch per data sheet.
	High temperature switch not set correctly.	Reset high temperature controls per data sheet.

Table 6 – Troubleshooting Guide – Annunciator Readouts (continued)

TROUBLE	PROBABLE CAUSE	SOLUTION
HIGH GAS PRESSURE		
High gas pressure	Regulator failed.	Repair or replace regulator.
	Regulator not set correctly.	Check data sheet for proper setting.
	High gas switch setting too low.	Increase setting minimal amount, reset switch.
	Plugged vent line on high gas pressure switch.	Check and clean vent line on switch.
	High pressure switch malfunctioning.	Check wiring an/or replace switch.
	Switch not reset	Reset annunciator and switch.
LOW GAS PRESSURE		
Low gas pressure	Regulator failed.	Repair or replace regulator.
	Regulator not set correctly.	Check data sheet for proper setting.
	Low gas switch setting too low.	Decrease setting minimal amount, reset switch.
	Plugged vent line on high gas pressure switch.	Make sure vent is open and clean.
	Low pressure switch malfunctioning.	Check wiring an/or replace switch.
	Switch not reset	Reset annunciator and switch.
	Low LPG pressure in vaporizer.	See <i>Low LPG Pressure</i> section.
RESET		
Reset	Power outages longer than three seconds.	Reset vaporizer, flame monitor, and annunciator.
POWER OFF		
Power off	Blown fuse.	Check cause of problem, replace fuse.
	Power switch malfunction.	Check wiring and switch, repair as necessary.



NOTE

Make sure power is off and the burner is shut down when testing first or second stage regulators.

Troubleshooting

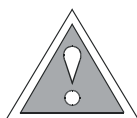
Table 6 – Troubleshooting Guide – Annunciator Readouts (continued)

TROUBLE	PROBABLE CAUSE	SOLUTION
LOW LPG PRESSURE IN VAPORIZER		
Low LPG pressure in tube bundle (less than 50 psig)	High LPG level switch damages or defective.	Remove wires from liquid level switch. Jumper wires together, then recycle the burner. If the burner starts, check the high liquid level switch using a low volt ohm meter. Replace the high liquid level switch.
	Liquid inlet valves are not opened.	Open liquid inlet valves.
	Liquid inlet solenoid valve not opening.	Check electrical circuit, make sure there is power to the solenoid.
		Check the low temperature switch setting.
	Liquid inlet stuck closed.	Check, clean or replace the liquid inlet solenoid.
	Outlet valve on storage tank not open.	Open valve.
BLOWER MOTOR		
Burner blower motor fails to start	Operating control not calling for heat or high limit control open.	Check for open operating and/or limit control. Check annunciator display.
	Lockout reset tripped on flame safeguard unit.	Reset red button on flame safeguard unit.
	No voltage to burner or improper voltage to burner.	Turn on all electrical power. Check voltage requirement.
	Overload tripped on blower motor.	Reset. Check motor current for possible overload.
	Improper wiring – blown fuse in control panel.	Change wiring as required. Check fuse, install new one in burner control panel.
	Defective control switch.	Repair or replace switch.
	Loose wiring in terminal strip.	Check and tighten all wires on the terminal strip.
	Loose wire on terminal box of flame safeguard.	Remove flame safeguard unit, check and tighten all wires at terminal.
	Defective flame safeguard unit.	Check and replace flame safeguard. Refer to manufacturer's instructions in the appendix.
Defective blower motor.	If voltage at motor terminals is correct, replace the motor.	
REGULATOR		
First stage regulator pressure	Diaphragm damaged or torn.	Remove regulator, replace or repair.
	Seat on regulator cut or plugged.	Clean and check seat. Clean out any obstruction.
Second stage regulator pressure	Diaphragm damaged or torn.	Remove regulator and repair diaphragm or replace.
	Defective seat assembly or obstruction of orifice.	Replace seat assembly or remove any obstruction.
	Improper burner head pressure.	Install water manometer or 0-15 inch gauge at ¼" tap located on the top of the burner housing. Check setting on data sheet.
CARBON MONOXIDE FORMATION		
Carbon monoxide formation during operation	Regulator incorrectly set.	Reset regulator per data sheet.
	Incorrect fuel/air ratio.	Check CO ₂ level. Adjust the fuel/air ratio as required. Check with a combustion analyzer.

Table 6 – Troubleshooting Guide – Annunciator Readouts (continued)

TROUBLE	PROBABLE CAUSE	SOLUTION
EXCESSIVE RUMBLING AND VIBRATION		
Burner cycles properly, but rumbles and vibrates.	Too much primary air.	Check and adjust primary air shutter or register. See <i>Operational Adjustments and Settings</i> for correct adjustments.
	Burner drawer assembly out of adjustment.	Adjust burner drawer to (B) mark on the slide.
	Burner regulator pressure out of adjustment.	Re-adjust regulator per data sheet.
	Defective secondary pressure regulator or plugged vent on the regulator.	Check pressure, repair or replace regulator, clean vent line.
	Liquid LPG trapped in burner fuel lines.	Shut off inlet valves, close burner gas valve. Remove pilot line and vent off liquid LPG from lines. Replace pilot tubing, open valves and recycle burner.
Burner rumbles when modulating hi-fire	Burner is too lean.	Check CO ₂ . Reset air linkage arms on louver.
	Air louver is opening too fast.	Reset air linkage arms on louvers.
FAULTY BURNER FLAME		
Burner flame retains to head on low fire, but blows off head while modulating to hi-fire and/or blows out resulting in flame failure.	Louver box may be opening too fast, causing a lean spot about 25% or 50% of range.	Reduce air louver travel: Move the ball swivel in on the jack shaft. To slow down the louver opening in the first 1" of travel: loosen the two set screws in the linkage arm at the louver box operated from the common jack shaft. Swing the arm up until it is about 10° off center (or almost straight out from the burner) then tighten set screws and linkage rod. The louver will open much slower in the first 1° of travel, but open the same for hi-fire.
		Increasing air louver travel: To speed up the louver travel in the first 1° of travel, do the same as above except in this case increase the angle or move the arm down until it is 70° or so down from the center. This will cause the louver to "pop" open at the start but still open to the same amount for hi-fire.
		Lean spot testing: The only exact test for a lean spot is to check CO ₂ . Low fire reading should be 9.5% and increase to a hi-fire reading of 11.2% without dips to 8%.

CAUTION



When making any burner adjustments or tests, follow the instructions of the manufacturer in the appendix. Read all notes and follow all WARNINGS and CAUTIONS.

APPENDIX A

EQUIPMENT DIAGRAMS

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APPENDIX B

ELECTRICAL WIRING DIAGRAM

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APPENDIX C

BURNER MANUAL

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APPENDIX D

PROPANE LIQUID TRAIN COMPONENTS

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