Eclipse AirHeat Burners

Model AH, TAH, CAH
Operating Instructions Edition 09.12
Version 1

AH, Front View
Datasheet 140-1

AH, Back View
Datasheet 140-1

TAH
Datasheet 140-3

CAH
Datasheet 140-4
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Document Conventions
There are several special symbols in this document. You must know their meaning and importance.

The explanation of these symbols follows below. Please read it thoroughly.

How To Get Help
If you need help, contact your local Eclipse representative. You can also contact Eclipse at:
1665 Elmwood Rd.
Rockford, Illinois 61103 U.S.A.
Phone: 815-877-3031
Fax: 815-877-3336
http://www.eclipsenet.com

Please have the information on the product label available when contacting the factory so we may better serve you.

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

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

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

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

Is used to address practices not related to personal injury.

Indicates an important part of text. Read thoroughly.
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Important notices which help provide safe burner operation will be found in this section. To avoid personal injury and damage to the property or facility, the following warnings must be observed. All involved personnel should read this entire manual carefully before attempting to start or operate this system. If any part of the information in this manual is not understood, contact Eclipse before continuing.

Safety Warnings

DANGER

- The burners, described herein, are designed to mix fuel with air and burn the resulting mixture. All fuel burning devices are capable of producing fires and explosions if improperly applied, installed, adjusted, controlled or maintained.
- Do not bypass any safety feature; fire or explosion could result.
- Never try to light a burner if it shows signs of damage or malfunction.

WARNING

- The burner and duct sections are likely to have HOT surfaces. Always wear the appropriate protective equipment when approaching the burner.

NOTICE

- This manual provides information regarding the use of these burners for their specific design purpose. Do not deviate from any instructions or application limits described herein without written approval from Eclipse.

Capabilities

Only qualified personnel, with sufficient mechanical aptitude and experience with combustion equipment, should adjust, maintain or troubleshoot any mechanical or electrical part of this system.

Operator Training

The best safety precaution is an alert and trained operator. Train new operators thoroughly and have them demonstrate an adequate understanding of the equipment and its operation. A regular retraining schedule should be administered to ensure operators maintain a high degree of proficiency.

Replacement Parts

Order replacement parts from Eclipse only. All Eclipse approved valves or switches should carry UL, FM, CSA, CGA and/or CE approval where applicable.

Storage

Store the burner inside. Exposure to the elements can damage the burner.
Burner Operating Parameters & Requirements

Applications

Eclipse AirHeat Burners are line type burners ideal for generating large volumes of clean, hot air. Applications include ovens, dryers, fume incinerators, and similar industrial equipment.

The "AH" models feature an integral combustion air blower mounted on the back of the burner’s steel case. By supplying the correct air volume and pressure to the burner, the blower allows stable operation over a wide range of duct velocities without installing a profile plate around the burner.

Capacities & Supply Pressures

See Datasheet 140-1 through 140-5.

Burner Environment

Weather Protection

Protect burners from the weather.

Combustion Air

Must be free of contaminants. Eclipse strongly recommends use of a combustion air filter to remove airborne particles. If corrosive fumes or materials are present in the air, supply the blower with fresh, clean air from an uncontaminated area of the plant.

Room Openings

If the burner is mounted on the side of the duct, provide at least one square inch of opening to the outdoors for every 4000 Btu/hr (1.2 kW) of burner firing rate. This will admit fresh combustion air.

Access

Provide access to the burner for inspection and maintenance.

CAUTION

- It is dangerous to use any fuel-burning equipment unless it is equipped with suitable flame sensing devices and automatic fuel shut-off valves. Eclipse can supply such equipment or information on alternate sources.
### Specifications

<table>
<thead>
<tr>
<th><strong>Input</strong></th>
<th>1,000,000 Btu/h per lineal foot (962 kW/m).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuels</strong></td>
<td>Natural gas or 100% propane vapor. Call Eclipse for information on using other fuels. See Table 1 below.</td>
</tr>
<tr>
<td><strong>Gas Turndown</strong></td>
<td>40:1</td>
</tr>
<tr>
<td><strong>Pilot Input</strong></td>
<td>Approximately 25,000 Btu/h (7.3 kW)</td>
</tr>
<tr>
<td><strong>Gas Inlet Pressure</strong></td>
<td>800,000 Btu/h/ft (769 kW/m) Natural Gas: 2.2 &quot;w.c. (5.5 mbar) Propane: 0.9 &quot;w.c. (2.2 mbar) 1,000,000 Btu/h/ft (962 kW/m) Natural Gas: 3.5 &quot;w.c. (8.7 mbar) Propane: 1.3 &quot;w.c. (3.2 mbar)</td>
</tr>
<tr>
<td><strong>Gas pressure shown is a differential measured between the gas inlet and a tap on the duct wall, 10&quot; to 20&quot; (250 to 500 mm) downstream of the burner.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient Temperature Limits</strong></td>
<td>-40° to +104°F (-40° to +40°C)</td>
</tr>
<tr>
<td><strong>Downstream Temperature Limits</strong></td>
<td>1500°F (815°C)</td>
</tr>
<tr>
<td><strong>Flame Length</strong></td>
<td>800,000 Btu/h/ft (769 kW/m): 2.3 ft (0.71 m) 1,000,000 Btu/h/ft (962 kW/m): 3.8 ft (1.17 m)</td>
</tr>
<tr>
<td><strong>Piloting</strong></td>
<td>Flame rod supplied. UV scanner adapters are available. For UV scanners, Eclipse recommends a flame monitoring system that terminates the ignition spark and proves the pilot flame without spark prior to opening the main gas valves.</td>
</tr>
<tr>
<td><strong>Flame Monitoring</strong></td>
<td>CGA requires two flame rods on burners over 3 ft (0.9 m) long. Use a flame monitoring endplate (Datasheet 140-5) to mount a second flame rod on the end opposite the gas inlet. All burners where the flame must travel over 10’ must have flame supervision at both ends. One device must be at the pilot end while the other device must be at the furthest point from the pilot.</td>
</tr>
<tr>
<td><strong>Motor</strong></td>
<td>Standard: 230/460/3/60 TEFC. Other motors can be supplied.</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>All portions of the burner exposed to the flame are cast iron or 321 stainless steel.</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td>Emissions performance depends not only on the burner, but also on other factors such as chamber temperature, chamber design, and heat loading. For estimates of emissions performance in your application, contact Eclipse.</td>
</tr>
<tr>
<td><strong>Packaging Options</strong></td>
<td>Available with complete valve trains and control systems. AH burners and systems can be supplied already mounted on duct sections as specified by the customer. Contact Eclipse for information on custom packaged systems.</td>
</tr>
<tr>
<td><strong>Models</strong></td>
<td>AH Line-shape, blower mounted on rear Datasheet 140-1 TAH “I”-shape, blower mounted on rear Datasheet 140-3 CAH Cross-shape, blower mounted on rear Datasheet 140-4</td>
</tr>
<tr>
<td><strong>Related Documents</strong></td>
<td>For more information on AirHeat accessories such as blower and motor specifications, see Datasheet 140-5</td>
</tr>
</tbody>
</table>

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*BBased on blower motor limitations.

**Based on parallel air flow. If mounted in a cross flow, the flame will be shorter.
If using an alternative fuel supply, contact Eclipse with an accurate breakdown of the fuel components.

**Control System Requirements**

**Turndown Method**

Input is normally controlled by a motorized butterfly valve placed in the gas line leading to the burner.

**Regulator Loading Lines**

Connect the top diaphragm chambers of the main gas and pilot gas regulators to the duct approximately 10” (250mm) downstream of the burner. This will allow the regulators to maintain a constant supply pressure to the burner regardless of varying pressures in the duct.

**Piloting**

Pilot gas flow is adjusted with a pilot cock as shown in Figure 4.

**Check Valve**

At high fire, the gas pressure at the burner inlet is higher than the air pressure, and the check valve is closed. At low fire, gas pressure falls below the air pressure, and the check valve opens, permitting a small amount of air to mix with the gas. This premix at low fire stabilizes the flame and helps distribute the flame evenly down the length of the burner. See Figure 1.

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**Table 1: Fuel Type**

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Symbol</th>
<th>Gross Heating Value</th>
<th>Specific Gravity</th>
<th>WOBBE Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>$\text{CH}_4\text{90%}+$</td>
<td>1000 BTU/ft$^3$ (40.1 MJ/m$^3$)</td>
<td>0.60</td>
<td>1290 BTU/ft$^3$</td>
</tr>
<tr>
<td>Propane</td>
<td>$\text{C}_3\text{H}_8$</td>
<td>2525 BTU/ft$^3$ (101.2 MJ/m$^3$)</td>
<td>1.55</td>
<td>2028 BTU/ft$^3$</td>
</tr>
<tr>
<td>Butane</td>
<td>$\text{C}<em>4\text{H}</em>{10}$</td>
<td>3330 BTU/ft$^3$ (133.7 MJ/m$^3$)</td>
<td>2.09</td>
<td>2303 BTU/ft$^3$</td>
</tr>
</tbody>
</table>

BTU/ft$^3$ at standard conditions (MJ/m$^3$ at normal conditions)

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**WARNING!**

Do Not Install Any Valves Here!

See Control System Requirements Section

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**Figure 1. Check Valve Operation**

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**WARNING**

Do not install any valve or controlling device in the gas line between the burner and the check valve tee. Because this section of the gas line carries a partial premix at low fire, it is possible under unusual conditions for the flame to travel back through the pipe to the tee. Devices installed in this section may be damaged and may melt, releasing gas to the atmosphere and causing fires or explosions.

**Pressure Switch Connection**

See Figure 2 for the typical connection of combustion air and circulating fan limit switches.

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**Figure 2. Pressure Switch Location**
Ignition
Ignition voltage should be 6000 VAC.

Approval of Components
Limit Controls & Safety Equipment
All limit controls and safety equipment must comply with all applicable local codes and/or standards and must be listed for combustion safety by an independent testing agency. Typical application examples include:

- American: NFPA 86 with listing marks from UL, FM, CSA
- European: EN 746-2 with CE mark from TuV, Gastec, Advantica

Electrical Wiring
All the electrical wiring must comply with all applicable local codes and/or standards such as:

- NFPA Standard 70
- IEC60364
- CSA C22
- BS7671

Gas Piping
All the gas piping must comply with all applicable local codes and/or standards such as:

- NFPA Standard 54
- ANSI Z223
- EN 746-2

Where to Get the Standards:
The NFPA Standards are available from:
National Fire Protection Agency
Batterymarch Park
Quincy, MA 02269
www.nfpa.org

The ANSI Standards are available from:
American National Standard Institute
1430 Broadway
New York, NY 10018
www.ansi.org

Duct Design and Burner Mounting
Duct Design
See Figure 3 for typical mounting arrangements and duct designs.

Support
The mounting flange or brackets supplied with an AH burner are capable of supporting the weight of the burner and blower. The AH burner case itself is designed to support the weight of the blower, so the blower does not require independent support.

Valve Train Support
Support valve trains independently of the burner.

Gas Piping
Use flexible nipples to allow for thermal expansion of the burner.

Check Valve Piping
Gas flow through the check valve must be horizontal. See Figure 1.
Min./Max. Velocity: 500 to 6000 fpm  
2.5 to 30 m/s  
Optimum Velocity: 1000 to 4000 fpm  
5.0 to 20 m/s

• Provide at least 3” (76 mm) clearance between burner and top, bottom, and sides of the duct.
• Profile plates are not required for good burner operation, but uniform velocity must be maintained for full length of burner. If velocity is not uniform, profile plates can be used to correct this condition.

Guidelines for All Mounting Arrangements
• Center the burner in the duct.
• Allow a minimum of 3.8 ft (1.17 m) from burner to the nearest point of possible flame impingement at an input of 1,000,000 Btu/ft (962 kW/m).
• On burners longer than 3 ft (0.9 m), use a hanger or a pedestal to support the blower and motor.
Startup and Adjustment
Initial Settings
Adjust the linkage of the gas control valve so that when heat is called for, the valve is 10° from fully open, and when cooling is required, the valve is approximately 5° from fully closed.

Close all manual gas cocks
With the pilot cock handle in the closed position, remove the top screw and turn the adjusting screw five turns out from fully closed. See Figure 4.

Start Blower
Start the combustion air blower on the burner. Check the rotation to make sure it is correct. If not, have a qualified electrician rewire the blower for proper rotation.

Start Circulation Fan
Start the duct circulation fan.

Set Air Pressure Drop
Measure the air pressure drop across the burner as shown in Figure 5.

Turn the disc on the blower air inlet until the air pressure drop is between 0.4 "w.c. (1 mbar) minimum and 1.0 "w.c. (2.5 mbar) maximum. For a given input, lower air pressure drops will produce a longer flame, and higher drops will produce a shorter flame.

Large Burners Only: Some models, such as the 640, 680, and 720 TAH burners, contain a butterfly valve in the check valve line. On these models, after setting the air flow as described in the previous paragraph, measure the air pressure drop between the gas pressure tap and the duct as shown in Figure 5. Gas flow must be off. Adjust the butterfly valve to produce an air pressure drop of 0.2 "w.c. (0.5 mbar).
Start Spark
Energize the ignition spark.

![WARNING]

- Do not touch the ignition rod, ignition wire, or transformer while the spark is energized, or you will get a shock.

Set Pilot Flow
Open all pilot gas valves, including the handle of the pilot cock, see Figure 4. The pilot should light.

Turn the pilot adjusting screw to produce a bushy blue flame that provides a flame monitoring signal strong enough to reliably open the gas shut-off valves.

Set Gas Flow
Measure the gas differential pressure as demonstrated in Figure 5.

With the gas control valve at low fire, open all main gas valves. The burner should light with a stable, blue low fire flame that extends evenly down the burner length.

Drive the control valve to high fire and adjust the gas adjusting valve to produce a pressure drop that corresponds to the desired high fire rate, as shown in the datasheet.

When setting high fire, ensure the flame does not impinge on anything downstream of the burner. To shorten the flame length for a given gas input, increase the air pressure drop as described in “Set Air Pressure Drop” paragraph above.

Check All Settings
Return the burner to low fire and check to ensure the burner remains lit with a stable flame that extends down the burner length. Cycle the burner between low and high fire several times, checking pressure drops and flame lengths.

Routine Maintenance
Motor Lubrication
Oil the blower motor according to the manufacturer’s instructions as printed on the motor label.

Ignition Plug/Flame Rod
Ignition plugs and flame rods wear out over long periods of normal burner operation. Eclipse recommends that the user keep at least one of each in stock at all times to prevent nuisance shutdowns. See Figure 6 for recommended spares.

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Figure 6. Ignition, Flame Monitoring, and Pilot Component
## Troubleshooting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Check</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burner does not start initially.</td>
<td>• Air pressure switches not making.</td>
<td>• Check pressures in duct at location of switch connections.</td>
<td>• Change pressure connections where a more positive pressure is present.</td>
</tr>
<tr>
<td></td>
<td>• Faulty pressure switches.</td>
<td>• Check electrical portion of switch.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check pressures in duct at location of switch connections.</td>
<td></td>
</tr>
<tr>
<td>Burner kicks out shortly after start-up.</td>
<td>• Low gas pressure switch set too high.</td>
<td>• Check low pressure switch setting.</td>
<td>• Reset</td>
</tr>
<tr>
<td>Pilot will not ignite on initial light-off.</td>
<td>• Raw gas fed into pilot causing carbon hair on spark plug.</td>
<td>• Check spark plug for carbon hair; also check gap on plug. This gap should be 3/64&quot; (1.3 mm) - 3/32&quot; (2.3 mm).</td>
<td>• Adjust pilot gas cock. Screw needle closed. With transformer powered, open needle slowly, 1/4 turn at a time.</td>
</tr>
<tr>
<td>Flame failure when burner goes too high fire.</td>
<td>• Gas pressure to pilot regulator too high.</td>
<td>• Check pilot gas pressure to regulator (should be 1 PSIG, 70 mbar, maximum).</td>
<td>• Relocate pilot gas line or use second pilot regulator.</td>
</tr>
<tr>
<td></td>
<td>• Pilot casting bolts are not tight enough.</td>
<td>• Check tightness of bolts.</td>
<td>• Tighten bolts.</td>
</tr>
<tr>
<td></td>
<td>• Pilot regulator not reacting fast enough to duct pressure changes.</td>
<td>• Check impulse line for possible dirt clogging. Check impulse line duct connection for effective pressure being transmitted to regulator.</td>
<td>• Clean impulse line of any dirt particles and relocate duct connection to transmit maximum duct pressure.</td>
</tr>
<tr>
<td></td>
<td>• Make sure the check valve operates freely.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Too much pilot gas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flame failure when main burner returns from high to low fire</td>
<td>• Gas pressure to pilot regulator.</td>
<td>• Check pilot gas pressure to regulator (should be 1 PSIG, 70 mbar, maximum).</td>
<td>• Relocate pilot gas line or use second pilot regulator.</td>
</tr>
<tr>
<td></td>
<td>• Under-gassing pilot</td>
<td>• Check pilot regulator inlet and outlet gas pressures. Check pilot flame.</td>
<td>• Open needle on pilot adjusting cock slowly 1/4 turn at a time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check impulse line for possible dirt clogging. Check impulse line duct connection for effective pressure being transmitted to regulator.</td>
<td>• Clean impulse line of any dirt particles and relocate duct connection to transmit maximum duct pressure.</td>
</tr>
<tr>
<td>Main flame too large at high fire</td>
<td>• Gas pressure too high at burner inlet.</td>
<td>• Check gas pressures.</td>
<td>• Screw out on main gas pressure regulator. Adjust linkage on gas control valve to hold valve less than fully open when at high fire.</td>
</tr>
<tr>
<td></td>
<td>• Combustion air pressure too low.</td>
<td>• Check air pressure differential.</td>
<td>• Open air shutter on makeup air blower.</td>
</tr>
<tr>
<td></td>
<td>• Check valve stuck open</td>
<td></td>
<td>• Clean check valve</td>
</tr>
<tr>
<td>Main flame not extending beyond face of burner at high fire</td>
<td>• Air pressure differential too high.</td>
<td>• Check air pressure differential between combustion air manifold and main duct.</td>
<td>• Close air shutter on makeup air blower.</td>
</tr>
<tr>
<td></td>
<td>• Burner not firing rated input.</td>
<td>• Check gas pressure differential.</td>
<td>• Screw in on main gas pressure regulator to provide more gas.</td>
</tr>
<tr>
<td></td>
<td>• Burner gas holes plugged.</td>
<td>• Check gas holes for dirt or lint.</td>
<td>• Clean gas holes with #42 MTD (2.3 mm) drill. Clean air holes with #27 MTD (3.6 mm) drill.</td>
</tr>
<tr>
<td>Main flame long and yellow</td>
<td>• Velocity past burner lower than 500 FPM (2.5m/s).</td>
<td>• Check velocities and rotation of main circulating fan.</td>
<td>• Open shutter on makeup air blower.</td>
</tr>
<tr>
<td></td>
<td>• Check valve stuck open</td>
<td></td>
<td>• Clean check valve</td>
</tr>
</tbody>
</table>