Series 0400 Burners

Hot Air ? Adjustable Gas Orifice ? Oil

Figure 1 - Dual Fuel Hot Air Burner Complete with Adjustable Gas Orifice

Application

The Combustion Tec Series 0400 Hot Air Nozzle-Mixing Burners are suitable for many applications which range from small glass day tanks? float glass furnace working ends, refiners, distributors? to large multi-burner recuperative furnaces.

A recuperator or other means provides preheated combustion air to the burner. Using combustion air preheating, will lead to increased fuel savings. The Series 0400 Burners may be either side- or end-fired on several types of continuous furnaces. Any clean industrial gas and/or grade of fuel oil, of suitable viscosity, may be burned.

The Series 0400 Burner is constructed of stainless steel? making it less cumbersome than those that are refractory lined.

Fuel Savings

Sealed-in combustion is obtained with the burner attached to a furnace mounting plate (shown in Figure 1 above) and packed (or sealed) to the burner ignition block. Sealing the burner eliminates infiltration of the ambient air, reduces the combustion noise, and ensures that only pre-heated air is supplied through the burner.

Fuel savings up to 45 percent can be realized,

together with higher flame temperatures, due to the pre-heated combustion air.

Burner Features

Air Velocity Control
The adjustable design of the 0400 Series burner allows you to control the air velocity coming out of the burner. Adjusting the air velocity provides for well-controlled fuel-air mixing.

Gas Burner
The prime feature of the 0400 Series Burner is a specially-designed adjustable nozzle which permits a wide range of gas flow volumes and velocities. The specially-designed gas orifice adjustment mechanism allows you to set the gas flow annulus while the burner is operating, so you can select the particular gas velocity most suitable for your specific furnace operating condition.

Oil Burner
Oil firing flame shape control can be achieved by adjusting the atomizing air flow and pressure from an air-throttling valve located upstream from the burner.

Hot Air Burner
The hot air burner body is designed with a sweeping elbow which gives excellent combustion air flow distribution at a lower pressure drop than comparable burners.

The highly efficient 0400 Series Burners use a specially designed converging type nozzle for fast and thorough fuel-air mixing.

Burner refractory tiles are an integral part of the burner's stability and turndown. Most of these ignition tiles are generally locked into the furnace for a suitably rigid and reinforced furnace side wall, and for proper burner alignment. Refractory tiles can be provided, or drawings are available to specify the proper shapes, permitting you to obtain tiles that will conform to your furnace construction specifications.

Flame Shape Control

Flame shape control allows for increased fuel efficiency and can thus extend furnace life. Depending on your flame shape requirements, various burner nozzles can be incorporated on the burner to produce either a long, bushy, and luminous flame or a short, relatively clear flame.

Long flames are the result of lower combustion air pressures with reduced gas velocities on gas firing, or reduced pressures and flows of atomizing air on oil firing. Delayed mixing of the fuel and air promotes these longer flames.

Short flames are the result of higher combustion air pressures with increased gas velocities on gas firing, or increased pressures and flows of atomizing air on oil firing. Quicker mixing of the fuel and air promotes these shorter flames.

Proper burner selection requires consideration of several factors that affect burner capacity:

Flame Shape Control - A finely tuned fire is important to both furnace longevity and increased fuel efficiency. Short and clear flames require higher combustion air pressures for increased mixing than those of a long and luminous nature. Combustion air pressures of approximately 1" to 6" (25mm to 152mm) IWC produce the long, luminous

flames, while pressures of 6" (152mm) IWC, up to a maximum of 27.7" (703.1mm) IWC will produce short, clear flames.

Burner Turndown - The burner should have sufficient turndown to span various fuel usages and operating conditions? such as different production rates and furnace heat-ups. The burner capacity should account not only for the maximum and nominal ratings, but the minimum rating as well.

Generally, increasing the combustion air pressures will permit higher turndown ratios.

Combustion Air Flow - The maximum fuel flow that can be efficiently burned is regulated by the combustion air flow available. However, stoichiometric, oxidizing, or reducing ratios can be used for different production conditions with excellent flame shape control.

Compensation on combustion air flow temperature and pressure must be taken into account for determination of precise burner capacities. For applications other than basic sea-level installations, please consult with your Combustion Tec Combustion Engineer.

Combustion Air Temperature - Normal operating conditions for the 0400 Series Burner is 1000?to 1200?F (538? to 649?C). The burners are constructed of stainless steel and can be operated at temperatures up to 1400?F (760?C). [An economical carbon steel burner construction is available for burners operating at temperatures not to exceed 800?F (427?C)]. The all-metal construction is free from use of refractory lining seen in comparable burners which allows for superior operation.

Combustion Air Pressure - Higher combustion air pressures permit increased burner capacities. Burner capacities are based on the combustion air pressure at the burner inlet.

Combustion Air and Control Systems - The combustion air piping system and fan used, in most cases, will dictate burner capacities. A given combustion air pressure will permit a fixed combustion air flow, therfore producing a specific burner capacity. Note that for gas or oil firing, where a ratio regulator or an electronic ratio regulating system is employed, the respective fuel system pressure must be considered. See the following sections on Gas or Oil Firing as appropriate, as well as the Systems and Burner Piping section for further details.

Burner Selection

The Series 0400 Burner is ideally suited for straight gas or dual fuel. For convenience, a straight gas burner is available which is designed to allow you to add oil capabilities at a later date, if needed. Variable firing rates are ideally maintained on the dual fuel hot-air burners, which come equipped with an adjustable gas orifice for maximum convenience and ease of use.

Also available is a burner designed for straight oil or gas firing using a single fuel insert. The oil and gas burner inserts are interchangeable and generally used during extended periods of use of a particular fuel with given flame shape requirements. Your Combustion Tec Combustion Engineer will help you to select the correct burner size for your precise furnace requirements.

Systems and Burner Piping

A combustion control package may require either a ratio regulator or an electronic ratio regulating system. These systems should be tailored for the given furnace needs according to the degree of control accuracy required.

A furnace combustion control system will produce fuel savings in direct proportion to the reduction in system variability. For a combustion control system specific to a given furnace, consult with your Combustion Tec Combustion Engineer.

The combustion air piping system transmits low pressure air; therefore the system should be oversized for minimal pressure drops. Individual furnace zones or burner piping runs should account for their respective capacities and sized accordingly for the most efficient performance.

Air pressure loss, due to piping and recuperator size, and distance between the blower and burner, must be taken into account. Also to be considered is the combustion air temperature, as it will influence the system capacity.

Fuel and air piping systems should include indicating meters and control valves for their respective control system, as well as all insurance code shut-off valves and limit switches.

Combustion Tec can provide prepackaged fuel and air piping systems in addition to the burner(s). Ask your Combustion Tec Combustion Engineer for details.

The hot air 0400 Series Burner is available in a wide range of pipe sizes and capacities. Use of any special burner sizing and/or control should be discussed with your Combustion Engineer.

Combustion Tec can design and supply any or all of the above systems, including any special requirements for specific combustion needs.

Adjusting the Air Velocity

The air velocity is controlled by moving the gas body assembly (19)? see Figure 3? in and out of the hot air burner body (4). Tick mark settings from -4 (higher air velocity) to +2 (lower air velocity) on the gas body assembly allow you to more accurately position the burner for the desired air velocity.

Gas Firing

The gas-fired Series 0400 Burners feature a specially designed gas orifice adjustment mechanism. During burner operation, an operator may select the optimum gas velocity to suit furnace operating conditions. These gas velocities, in conjunction with the burner nozzle, promote stable firing conditions and increased flame shape control.

With gas firing, the flame shape is conical. The diameter and length depend on the input capacity. For a given capacity, various gas velocities may be obtained by adjusting the gas orifice (see Figure 2): for example, clear and short, or luminous and long flames will be produced from high and low gas velocities, respectively.

Flame shape control dictates a given gas velocity for a given gas flow. Various gas pressures are required to maintain these velocities.

For extended periods of gas firing, an air cap and air boss may be substituted for the oil venturi atomizer with stabilizer, and the oil boss and tube assembly. This offers a less expensive option when gas firing may not be feasible.

Oil Firing

Any grade of industrial fuel oil may be burned, providing the heavier oils are maintained at viscosities of 85 to 90 SSU (17 to 18 centistokes), or lower. If you are going to use oil blends, make sure your Combustion Sales Engineer is aware of this, so the proper oil atomizer for your needs can be selected.

With oil firing, the flame shape may vary from short to long, cylindrical to bushy, or luminous to clear by the use of the correct oil atomizer. When ordering, be sure to include your specific furnace requirements.

Dry steam may also be used for atomization if available. However, clear flames may be reduced in size when dry steam is used.

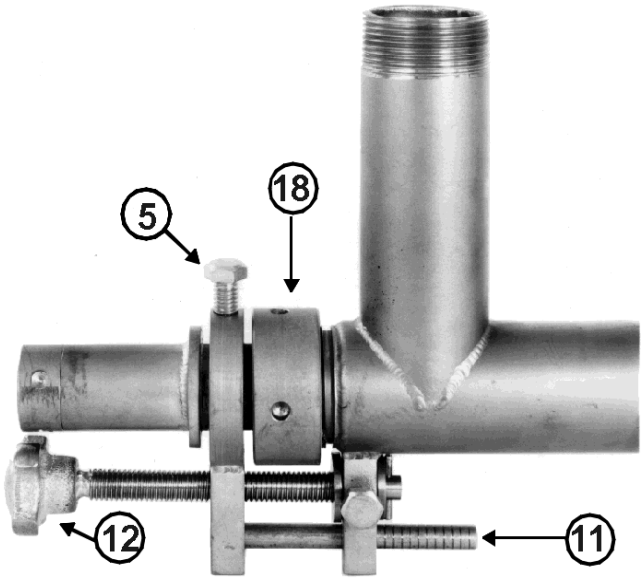
The Combustion Tec oil atomizers are constructed of premium stainless steel for increased resistance to heat and corrosion factors.

Gas Orifice Adjustment

1. Loosen the packing gland nut (18) so that it is snug but not tight.

2. Loosen the locking capscrew (5).

3. Turn the adjusting lead screw (12) clockwise to close the gas orifice; counter clockwise to open the gas orifice.



4. Use the position indicator (11) markings shown below to verify position.

5. Tighten the locking capscrew (5).

6. Tighten the packing gland nut (18).

Note: A specific flame shape is the objective, not necessarily the orifice diameter.

Maintenance and Operating Instructions

Burner Insert Removal
Removing the burner insert for inspection or cleaning is a simple process. The entire burner insert consists of the adjustable gas orifice mechanism for gas burners and the oil atomizer for the dual fuel burners. During individual burner shut-down, shut-off and disconnect the gas, oil, and atomizing air lines from the burner, then proceed as follows:

Gas Tube Removal
1. Loosen the locking screw cap (5).

2. Remove the gas body assembly (19).

3. For replacement, reverse these procedures.

Figure 2 - Gas Orifice Adjustment Mechanism

Atomizing Air Tube Assembly (Gas or Dual Fuel) Removal

1. Loosen the locking cap screw (5).

2. Loosen the packing gland nut (18).

3. Remove the atomizing air tube assembly, gas or dual fuel, (2)(13)(15) or (3)(14)(16) respectively.

4. For replacement, reverse these procedures.

5. Note that the stop collar on the air tube butts against the position indicator assembly (11) to retain the original gas orifice setting.

6. It is recommended that spare assemblies be available, in which case replacement for maintenance is simplified.

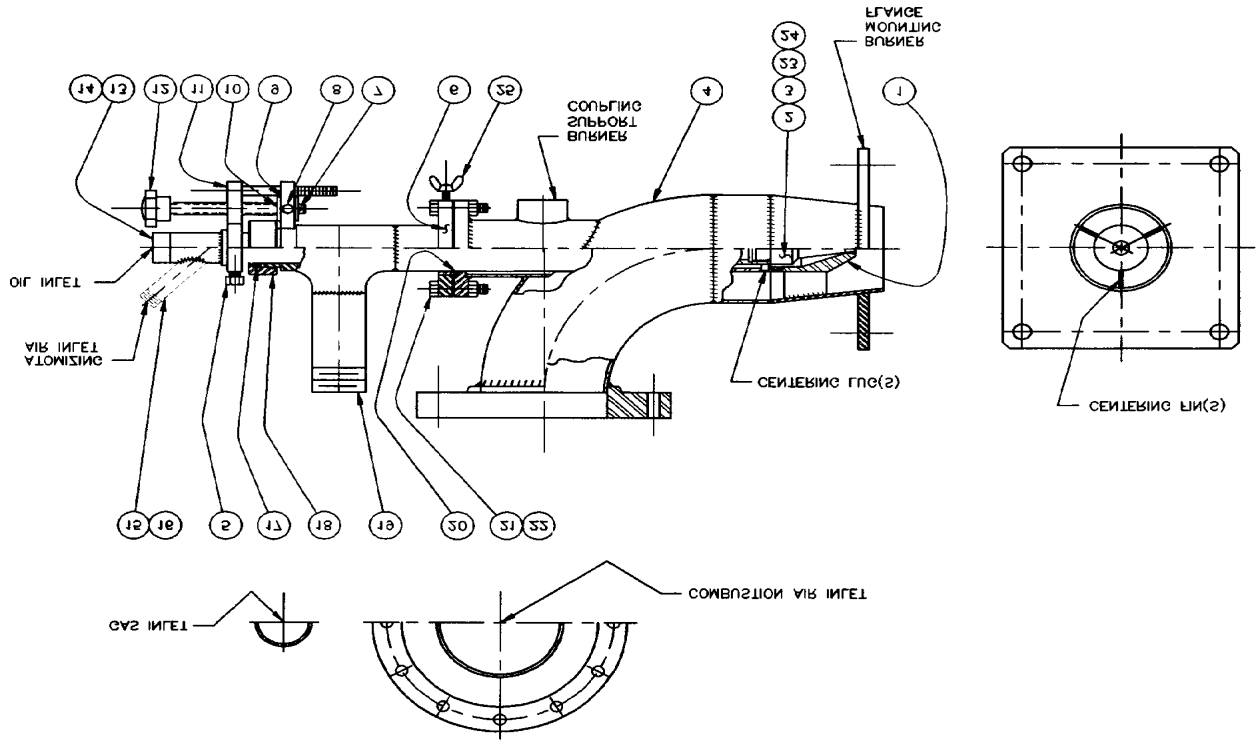


Figure 3 - Hot Air Burner Parts Identification Drawing

Table 1 - Hot Air Burner Parts List

Item No.	Required Number	Description
1	1	Burner Tip
2	1	Air Cap
3	1	Venturi Atomizer with Stabilizer
4	1	Hot Air Burner Body
5	3	Locking Cap Screw
6	1	Slip-On Flange
7	1	Roll Pin
8	1	Locking Cap Screw, Brass
9	1	Finger Spring Washer
10	2	Thrust Washer
11	1	Position Indicator Assembly
12	1	Adjusting Lead Screw Assembly
13	1	Air Boss
14	1	Oil Boss and Tube Assembly
15	1	Atomizing Air Tube Assembly, Gas
16	1	Atomizing Air Tube Assembly, Dual Fuel
17	2	Packing Ring, Gas
18	1	Packing Gland Nut
19	1	Gas Body Assembly
20	1	Packing Ring, Combustion Air
21	4	Flange Retaining Bolts
22	4	Hex Nut
23	1	Oil Tip

24	1	Oil Spinner
25	1	Thumb Screw Assembly

Miscellaneous Recommended Practices

1. Flame safeguard systems are not normally employed in high temperature (over 1400?F - 760?C) furnace applications. However, they should be used for cold start-up or on-off operating conditions. Consult with your Combustion Engineer.

2. For extended periods of gas firing, we recommend use of the air cap and air boss in lieu of the venturi atomizer and stabilizer and the oil boss and tube assembly. This provides protection to the expensive oil atomizer parts.

3. During periods of combustion air shut-off, cooling air should be provided through the burner internals for protection against furnace radiation.

4. Use a high temperature anti-seize lubricant on all threads at each reassembly. This is particularly important on the burner tip threads.

5. A tight packing nut gland nut (18), burner insert stop collar (6), and good packing rings (17)(20) are necessary to prevent gas and combustion air leaks.

6. Periodic inspection and cleaning of the burner tip face (1), and the air cap (2) and/or venturi atomizer with stabilizer (3), to remove batch dust build-up may be necessary. Frequency depends on furnace condition and firing practices.

Options and Accessories

The following options and accessories are available for the 0400 Series Burners:

1. Price includes the burner proper, and burner mounting flange. Refractory tiles are at additional cost. Make sure the standard furnace flange provided is appropriate for your installation. Alternate mounting flanges can be provided. Consult with your Combustion Engineer.

2. Burner construction is of 304 or 316 stainless steel? which is suitable for constant use in oxidizing atmospheres to 1450?F (788?C). The oil nozzle is type 310 stainless steel? which is suitable to 2000?F (1093?C). Parts not exposed to temperature are of mild steel. Alternate construction metals are available for increased temperature service.

3. Burner pilots are not required for continuous high temperature applications. For cold air start-ups or on-off applications, a burner pilot is highly recommended. Optional packages consisting of pilot assembly, nozzle mixer, electrode, U.V. scanner, ignition transformer and complete flame safeguard systems are available.

4. Consult with your Combustion Engineer for any special requirements.

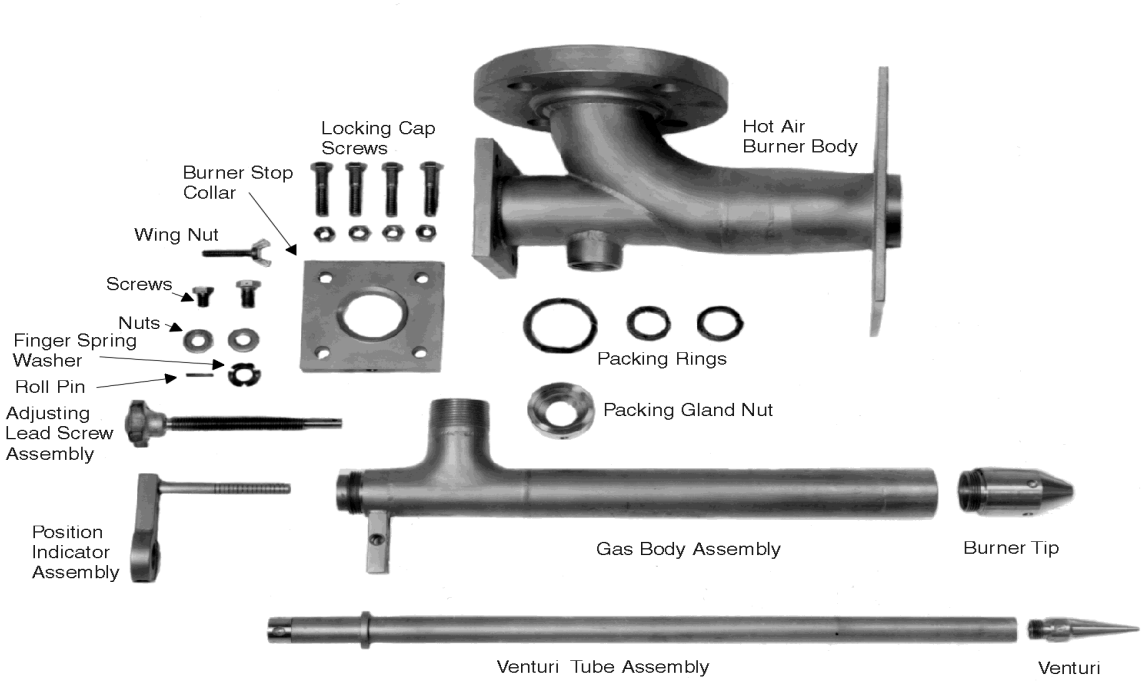


Figure 4 - Disassembly of Hot Air Burner

Attention

Combustion equipment can be dangerous to personnel and property is incorrectly installed or operated. Combustion Tec urges customers to comply with Insurance Underwriters recommendations, National Safety Standards, and to exercise proper care and maintenance in the use of combustion equipment, limit controls and other safety devices.