Mobile Glassblowing Studios'
Dragon Furnace General Owner's Guide
Standard w/ Proof of Air Safety Systems

Baby, Little, & Big Dragon Furnaces

Welcome to our Growing Global Community!

Mobile Glassblowing Studios, LLC
Dragon Furnace General Owner's Guide

These instructions are guidelines for use of the **Baby, Little, or Big Dragon Glassblowing furnaces** (including Double Dragon configurations). Please read this manual and all supporting documents carefully prior to using your equipment. Should any questions arise, please contact a representative of Mobile Glassblowing Studios IMMEDIATELY. **844-452-7246 EXT 3** or **229-352-9988 EXT 3**. You can also reach us at mobileglassblowingstudios@gmail.com. We offer complimentary initial support in setting up and operating your Dragon furnace and related equipment. More information about ongoing support is on our website at www.mobileglassblowingstudios.com/customersupport.

You can also refer to the FAQ and Resources pages on our website for more information.

Mobile Glassblowing Studios, LLC, for a period of one year from date of shipment, warrants each system or product of its own manufacture, with the exception of burner tips, crucibles and other refractory materials, to the original Purchaser to be free from defects in material and workmanship under normal use, service and maintenance. Normal use, service and maintenance means: (1) Not exceeding the maximum temperatures, volumes, and other parameters specified in the Company's instructions and/or Owner's Manuals. (2) Using only the fuels specified in the Company's instructions and/or Owner's Manuals. (3) Operation and maintenance in compliance with the Company's instructions and/or Owner's Manuals. Products or goods not manufactured by the Company and supplied in piece, or as components to a system designed or supplied by the company, are not covered by this warranty. Components and parts of the equipment that are not manufactured by the Company are not covered by the Company's warranty, and the Company does not warrant the performance, use and operation of those parts. For complete details, please refer to your Terms, Conditions, and Limited Warranty document or visit www.mobileglassblowingstudios.com/warranty.

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System Specifications: Baby, Little, & Big Dragons

General Specifications:

- Electrical: Blower is 120V AC, 1A (240V available)
- Fuel Type: Propane or Natural Gas, 14" W.C. / 35 mb pressure maximum
- Fuel Consumption: Propane: +/- 1 gallon or +/- 2 kg per hour; Natural gas: +/- 93 cubic ft or 2.8 cubic meters per hour
- Btu/H range: 60,000 – 140,000
- Maximum Temp: 2300° F (1260° C)

Baby Dragon:

- Dimensions (disassembled): 31" D x 34" W x 56" H (79cm D x 86cm W x 143cm H)
- Dimensions (assembled furnace with accessories - not including bench, annealer, marver, etc.): 7.5' D x 4' W x 6.5' H (2.29m D x 1.22m W x 1.98m H)
- Curb Weight (approx.): 550 pounds (249 kg)
- Capacity: 30 pounds (13 kg)

Little Dragon:

- Dimensions (disassembled): 31" D x 34" W x 56" H (79cm D x 86cm W x 143cm H)
- Dimensions (assembled furnace with accessories - not including bench, annealer, marver, etc.): 90" D x 48" W x 78" H (229cm D x 122cm W x 198cm H)
- Curb Weight (approx.): 850 pounds (385 kg)
- Capacity: 60 pounds (27 kg)

Big Dragon:

- Dimensions (disassembled): 31" D x 34" W x 56" H (79cm D x 86cm W x 143cm H)
- Dimensions (assembled furnace with accessories - not including bench, annealer, marver, etc.): 90" D x 48" W x 78" H (229cm D x 122cm W x 198cm H)
- Curb Weight (approx.): 850 pounds (385 kg)
- Capacity: 95 pounds (43 kg)

UNPACKING

The shipping crate should be disassembled starting with the lid, followed by the top half of each narrow side. Look for the circled screw heads.

Carefully unpack the burner train. Be particularly careful with the burner train, as the pressure gauge and ceramic burner tip can be broken if not handled carefully.

Continue disassembling the crate.

Unpack all parts before removing the furnace.

Look around the crate for any loose hardware; sometimes thumbscrews can come loose during shipping.

The handle including pins was shipped assembled. Make sure to have the pins installed any time you move the furnace by the handle. The handle can be moved to either the front or the back of the furnace. It should be located to the back or completely removed when firing your furnace.

Once all loose parts are removed from the crate, you can remove the furnace from the pallet. Be aware that the Dragon furnaces range from 600-900 pounds. Be extremely cautious when moving the furnace. You will need to fashion a small ramp or use a forklift to remove it from the pallet.

The standard casters were shipped with the brakes “ON” (engaged). The brakes will need to be placed in the “OFF” (disengaged) position to move the furnace. The heavy duty spring-loaded casters (add-on option) are not equipped with brakes; you will need to use a chock system once furnace is in position.

SET-UP (before lighting up for the first time)

The initial light-up sequence should take place outdoors or with adequate ventilation, without glass in the crucible. The furnace has been cooked out at the factory, but will need an additional firing to finish the process. The furnace should be brought up to glowing orange slowly for the first time, and then allowed to cool before using. There are some noxious fumes that will be emitted during this initial firing, which is why we recommend doing it outdoors for the first time.

Before assembling ANY components (other than the handle) to the Dragon, move it into the position where you will be firing it.

The Furnace reaches internal temperatures over 2000 degrees. Extremely hot air and flame come out of the burner tip area (on top of the furnace) and from the front opening of the furnace.

The outside skin of the furnace, when in operation, will reach high temperatures. DO NOT TOUCH THE OUTSIDE OF THE FURNACE WITH BARE HANDS ONCE IT HAS BEEN TURNED ON.

Set the furnace up in an open outside or well-ventilated area.

Set up away from flammable materials.

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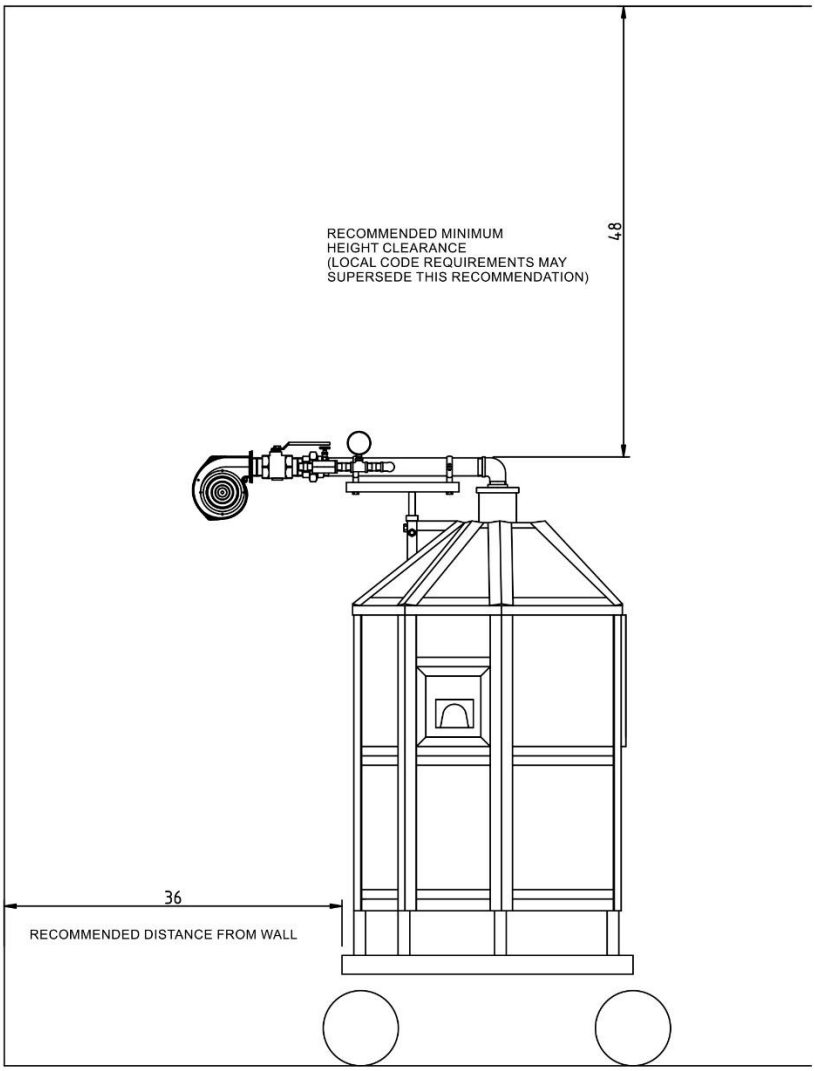
For more information, visit our website: www.mobileglassblowingstudios.com – see FAQ and Support

Below is a diagram of recommended clearance minimums:



If setting up underneath a covering, the covering must be fire-proof.

Allow for plenty of ventilation, as the exhaust fumes from propane combustion can be harmful if allowed to build up.

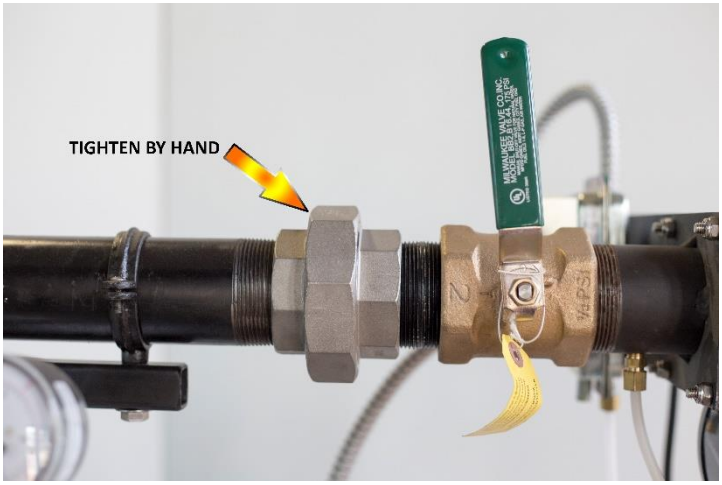
For the initial firing, there will be some smoke and fumes.

We recommend that the furnace is monitored while in operation, however the burner system is equipped with safety systems allowing for continued use.

Once the furnace is set up in a safe outdoor location, put the caster brakes to the “ON” position and secure with wheel chocks. Assembly for the initial firing can begin.

Unwrap burner system and set in place (as pictured below). Burner tip should be centered in the opening at the top of the furnace. Stop collar will place at the appropriate height. Tighten both bolts with a wrench or 9/16” socket to secure the burner train in place.

Correct burner train placement.



Attach the blower assembly to the burner train by holding in place and tightening the large union – make sure it is snug – tighten by hand.

If your furnace comes with the Air Preheat hose, it is recommended that it is engaged for your initial firing. The Preheat hose creates drag on the air flow, which allows for a slower heat-up.

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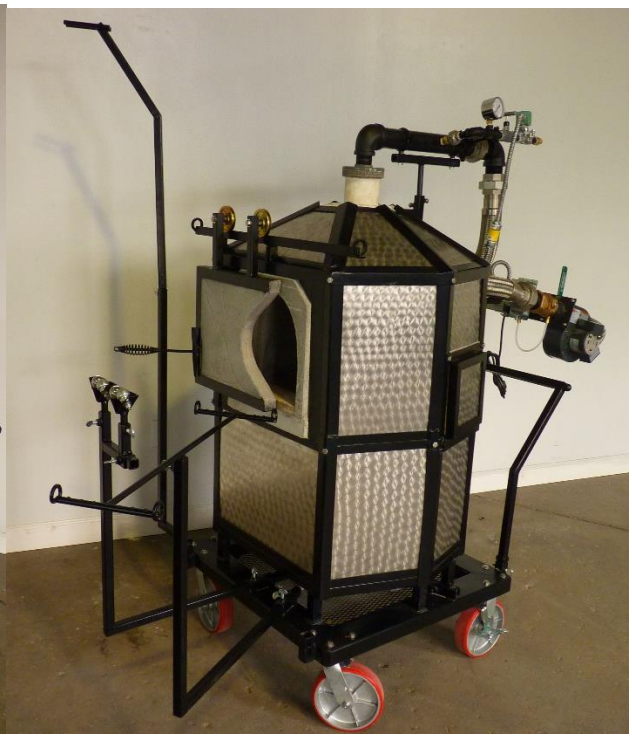
Vacuum the inside of the furnace.

Attach the door.

Attach all the accessories, yoke bar & mounts, pipe warmer and pipe hanger as pictured. Tighten thumb screws either by hand or with an adjustable wrench.



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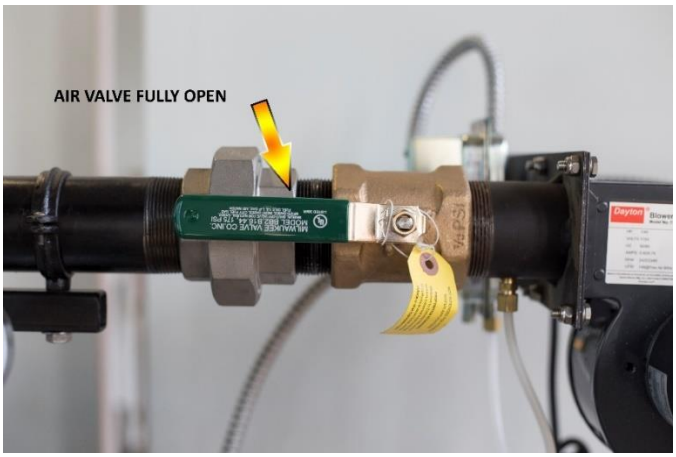
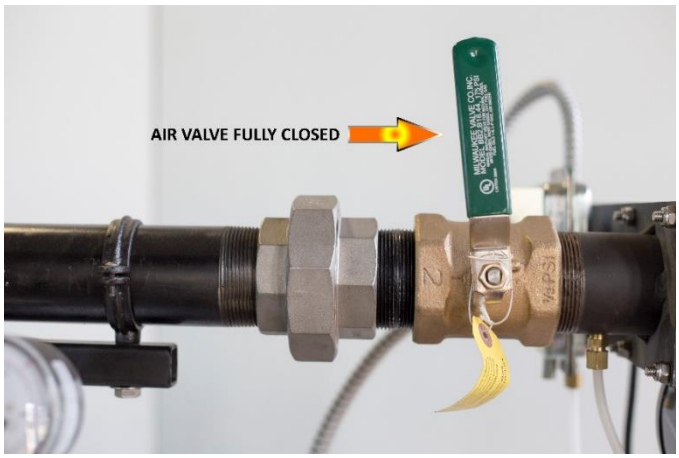
Pre- Light-Up Info

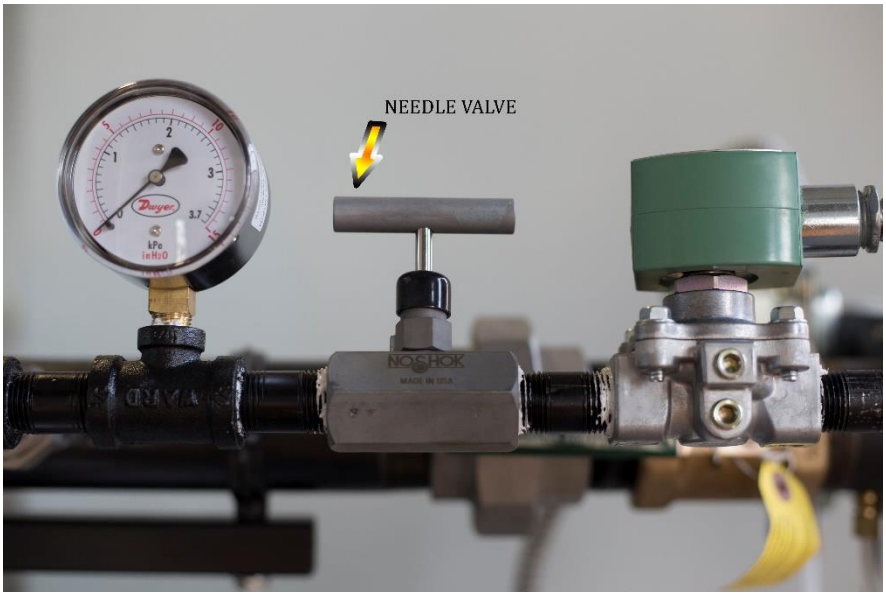
The burner system uses a combination of gas and forced air for combustion. The ratio of the gas to air mixture changes the dynamic of the flame. This proportion is changed manually by adjusting the green handle on the butterfly valve and the knob on the needle valve.

The air flow is regulated by adjusting the angle of the green handle (butterfly valve) located directly in line with the blower. When the handle is in line (parallel) with the pipe, it is fully open, allowing maximum air flow. When the handle is across (perpendicular to) the pipe, it is fully closed, allowing minimal or no air flow.





The gas valve on the system is a fine adjustment needle valve. The valve should be fully in the "off" position when the furnace is not in use. The needle valve is used to fine tune the amount of gas being fed to the burner and is adjusted as follows: turning the knob counterclockwise will allow gas to flow through the valve, turning the knob clockwise will restrict the flow of gas.



The burner system is set up for low pressure, either propane or natural gas. Do not exceed 14 water column inches of pressure on the output of the regulator. Introduction of higher pressure will result in permanent damage to the gauge and other safety components.

The burner has an output range of 50,000-140,000 BTU/hr. We recommend a minimum of ½" inside diameter for the gas delivery hose. Smaller diameter may impede the flow, and cause the burner to underperform.

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The safety system is composed of two individual safety components wired in series on a circuit that opens the gas solenoid valve, allowing gas to travel to the burner, mix with forced air from a powered blower and combust inside the furnaces to heat the interior to over 2100 degrees F. The job of the safety components is to open that electrical circuit if any of the prescribed parameters of the components are violated, thus shutting off the gas flow to the burner. These components include:

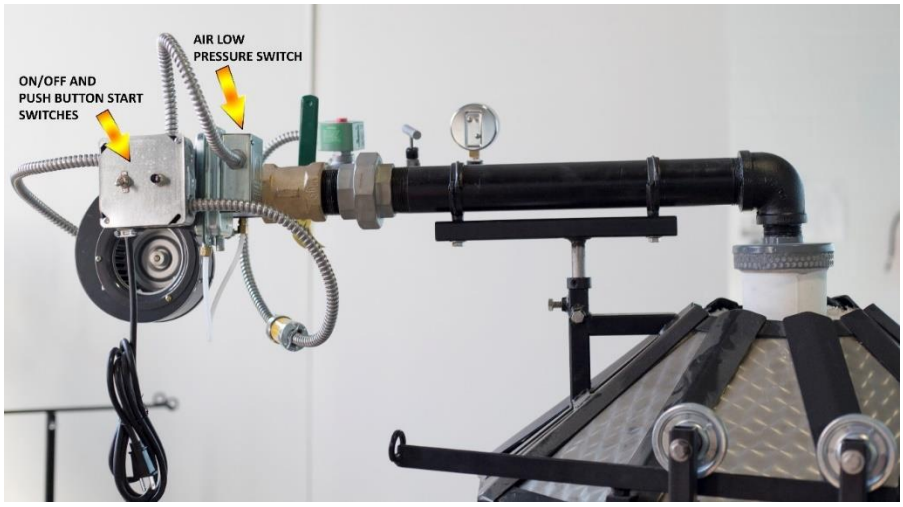
Manual Switch

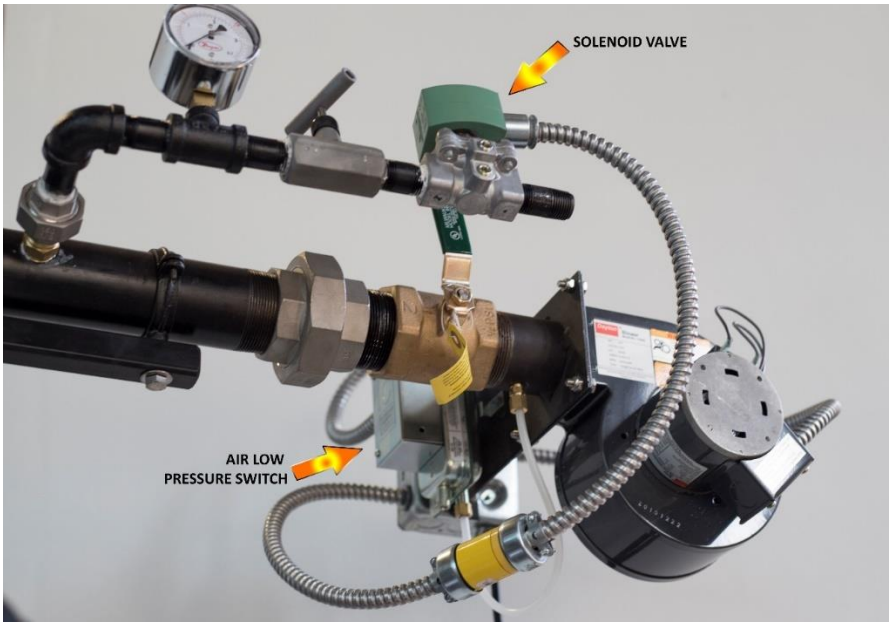
Air Low Pressure Switch

Once the furnace is lit, the components work as follows.

The Manual Switch, as well as aiding in the light up procedure, also acts as an emergency switch to open the electrical circuit to the solenoid valves, shutting down the gas flow to the burner.

If the pressure from the blower drops below a preset value, the Air Low Pressure Switch will open the electrical circuit to the solenoid valves, shutting down the gas flow to the burner.





Light-up & Firing Guidelines

When lighting up, it is a good idea to have a spray bottle with a soap & water mixture for checking for gas leaks at the field connection points. All factory assembled plumbing has been pressure checked prior to shipment. When the system is pressurized, spray the field connection areas with the mixture: if there is a leak, foam will form around the joint. If a leak is detected, shut the gas off at the source and release the gas from the lines (called "bleeding the line"). Once the system has been bled, wrench-tighten the joint that was leaking. Re-test. **DO NOT CHECK FOR LEAKS USING A FLAME**.

Light up procedure is a specific sequence that must be followed to successfully start the furnace. If a step is missed or skipped, the burner system will not ignite and you must start the sequence from the beginning.

When lighting the burner (we recommend using a Mapp gas hand torch – like the style pictured), the flame will need to cross the burner tip prior to opening the gas needle valve. **Do not open the gas valve without the blower on and flame present.** Failure to do so can cause gas to build up inside the furnace and create a hazardous condition.

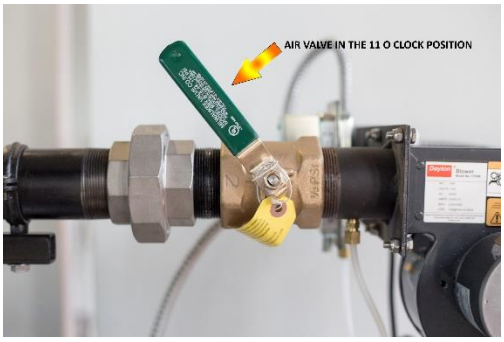
Always have the furnace door open when lighting, as this will prevent gas from building up inside the furnace.

Lighting the Furnace

Be sure to read all previous sections prior to lighting up for the first time.

1. Attach the gas delivery hose to your regulated fuel source (propane or natural gas) and the burner train in accordance to local regulations.
2. Before opening the gas valve at the fuel source, make sure the needle valve is in the "off" position. Firing will require adjusting the needle valve to dial in the proper fuel/air mix.

3. Open the furnace door (as pictured to the right).
4. Check that the blower power switch is in the "off" position.
5. Plug in the blower.
6. Turn the blower switch to the "on" position.
7. Press the push button to start the blower.
8. Turn the green handle to the "11 o'clock" position (as pictured to the right).



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9. Turn on the gas valve at the fuel source. The line will now have gas in it up to the needle valve.
10. Insert the lit flame of the Mapp gas torch so that the flame crosses the burner tip inside the furnace and open the needle valve, allowing gas to flow into the system.
11. Once the furnace is lit, use the needle valve and air butterfly valve to adjust the mixture to your desired settings.

For the Initial Firing

1. Adjust the mix using the air and gas valves as outlined in the "Flame Adjustment" section below. The flame should have a solid roar and a flame with a blue core.
2. Leave the door open for now and let it cook for a couple of hours on a low setting.
3. After several hours, close the door halfway, let it cook for a couple more hours.
4. Close the door so that there is only a half moon opening on the right side and continue to cook until the inside is glowing orange.
5. Shut the furnace off by turning the needle valve to the "off" position
6. Close the valve at the fuel source.
7. Leave the blower running – this helps to keep the burner tip cool, overnight if possible.

Flame Adjustment

The flame is adjusted by changing the ratio of air and gas.

Too much gas results in a bushy (or lazy) flame, whereas too little gas can result in the flame blowing out.

The desired mix will give you a nice solid roar and a flame with a blue core.

If the sound is sputtering, too much air.

If there is a big yellow flame coming out of the door and or top of the furnace, not enough air.

Once you have an even mix, you can adjust it up or down, to control the speed at which the furnace heats up.

When adjusting the flame, do so in small increments.

To adjust the furnace up (bigger flame, hotter – faster), first increase the gas, then the air. If the air is increased first, the flame could potentially blow out.

To adjust the furnace down, first decrease the amount of air, then the amount of gas.

Do not turn the furnace down to where the air is.

The burner system is manual and will require some getting used to. This takes time and experience. We recommend documenting your firings, to refer to later.

Regular Use & Light-Up

The instructions for regular use are very similar to those for the initial firing as far as furnace placement and set-up sequence.

Once you have vacuumed the inside of the furnace, place cullet into the crucible, mounding it up to the top. Another method is to place 15-20 pounds of glass in the bottom & charge 15-20 pounds at a time once the furnace is up to temperature.

Refer to the "Initial light-up" sequence 1-10 to light the furnace. Once lit, you can close the door such that there is only a half moon opening on the right side.

Be sure to empty the crucible completely when finished, this can be accomplished by either gathering, or using a casting ladle to scoop the molten glass out.

Once empty, shut the furnace off by turning the needle valve to the "off" position, close the valve at the fuel source.

Leave the blower running overnight – this helps to keep the burner tip cool.

Things to Note

Quick on and off is abusive to the refractory materials. Though the crown has been cured and cooked carefully, the rapid heat up and cool down may cause the crown to develop cracks; this is normal. These cracks do not adversely affect the functionality, or the longevity of the furnace. This is true for the door as well, small cracks may develop, but the door will stay intact.

The crucible will crack. This is also normal. It is backed up by castable refractory (semi-invested) and will last years after small cracks develop.

The best practice is to allow for a long, slow heat-up and draining as much glass out of the crucible as possible each time before shut down.

The paint around the door will burn away – there is no paint that will withstand the temperatures we are dealing with.

Transport

Do not travel with any components loose in a trailer or back of a truck.

Make sure the furnace is tied down with multiple tie down points. It is much better to over secure than under secure.

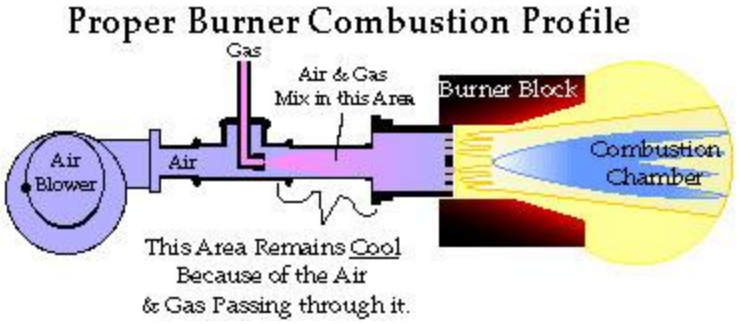
The burner tip is ceramic and can break. Use care when moving.

The following is extracted from www.joppaglass.com, written by Dudley Giberson, inventor and manufacturer of the burner tips used on the Dragon furnaces.

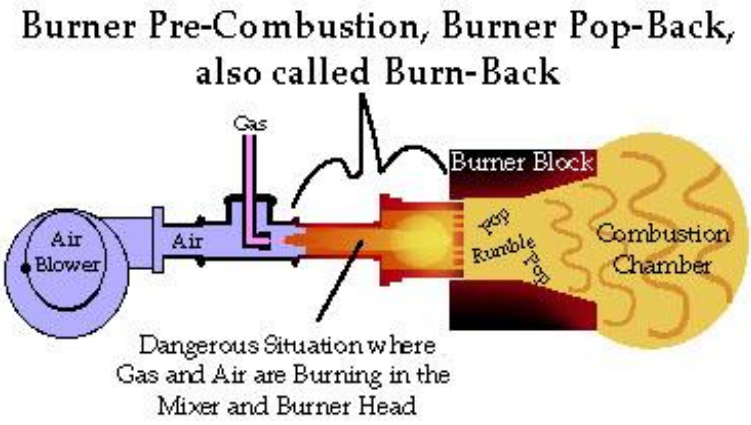
Troubleshooting Burner Instability

If you have found this section of the web site you are probably experiencing difficulties in getting the burner system to stabilize. Or perhaps you are experiencing burner pop-back. Others are prudently looking ahead to ward off any possible difficulty, "to head them off at the pass," so to speak. This is the page where we talk about a seemingly puzzling situation called "pop-back" or "pre-ignition" or sometimes called "burn back". We begin by showing what is a stable situation of ongoing combustion.

Pictured here is an environment (glory hole or furnace) which is burning in a stable manner. The flame has a blue core, the environment is at working temperature, and the burner head and mixer are cool and could pass the touch test. Even the face of the head is relatively cool because of all the combustibles (cool air and gas) which are being pushed through it. The flame is burning quietly, but steadily. This is a happy burner system.



In contrast, this next image shows a burner system with burner pop-back. This is a condition where the mixture of gas and air are burning in the mixer and head area of the burner system. If this condition goes on for a while, the head and pipe work may become cherry red. When the system is shut off and naturally left to cool for a few minutes, it most often can be re-lit and everything is fine. But sometimes there is damage to the pipe and head. An inspection of the head will reveal if there are any serious cracks, and if so the head should be repaired or replaced. If this furnace had a safety system it would have shut down immediately when the flame began to rumble (or flutter). Such a safety system could be hooked to an alarm to notify you of any burner or furnace abnormality.

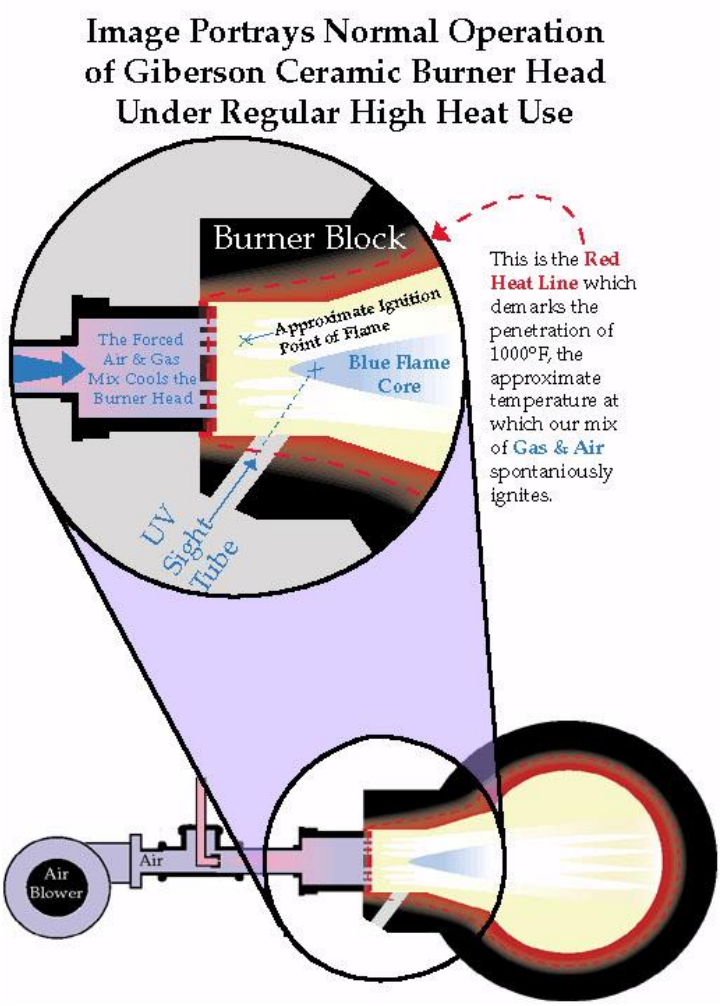


Here is a list of conditions that help identify this situation.

- First, you should always be able to touch the pipe work behind the burner head. Use the old spit on the finger technique. If it really sizzles, it most likely indicates the fire is burning in the head. If this condition is allowed to continue unchecked the entire pipe work can become cherry red as shown in the above image. Not a good situation. **To rectify the problem, turn the gas off and wait for head to cool for a few minutes. Then attempt a re-light. If the head is cracked, you will most likely need to replace the head with a repaired or new one.**
- The paint should not be burnt off the back of the head. If it is, this indicates there is or was a burn-back condition.
- The flame should burn evenly (not "rumbly").
- There should be no popping noise.

- Sometimes, a novice using a Giberson Head will not recognize when it is burning incorrectly, usually at a first start-up. Check using the "spit on finger technique."
- Another indication of "burn-back" is the flame will not go out of reduction, coupled with a "rumbly" burn. Call the factory 229-352-9988 and ask for help.

There are two main causes for this condition:



1. **The gas and air mix is moving too slowly through the system** so that the speed at which this mixture burns is greater than the speed of the mix being pushed through the system. It is like in the movies where the bad guy is going to blow up the bank using his trusty drum of black powder. Not being very organized that morning he's forgotten his roll of fuse material so he pours out a line of powder for some feet, lights it and runs. For the sake of argument and demonstration this highly explosive material does in fact burn with a calculable rate of speed. Gas and air, when properly mixed, have that same property. The small holes in the burner face serve this interesting purpose, they provide the "speedifier effect" where the unburned mixture speeds up through the hole structure and keeps the burning gas/air mix on the far side. What this means is **if you turn down your burner system to a point low enough, you will reach this pop-back point.** This exists in every burner system.
2. There is a second reason for burner pop-back: A given mix of gas and air has a calculable temperature at which it ignites. **If any part of the inside of the burner head reaches that ignition temperature, "pop, bang, rumble!" It is totally predictable**. You could stake your life on it. It is a very simple proposition: the gas/air mix comes through the burner head keeping it cool. When this system of cooling the head gets disrupted, such as by turning the system down off a high temperature condition too quickly, the problem can occasionally show up.

Here is a probable scenario:

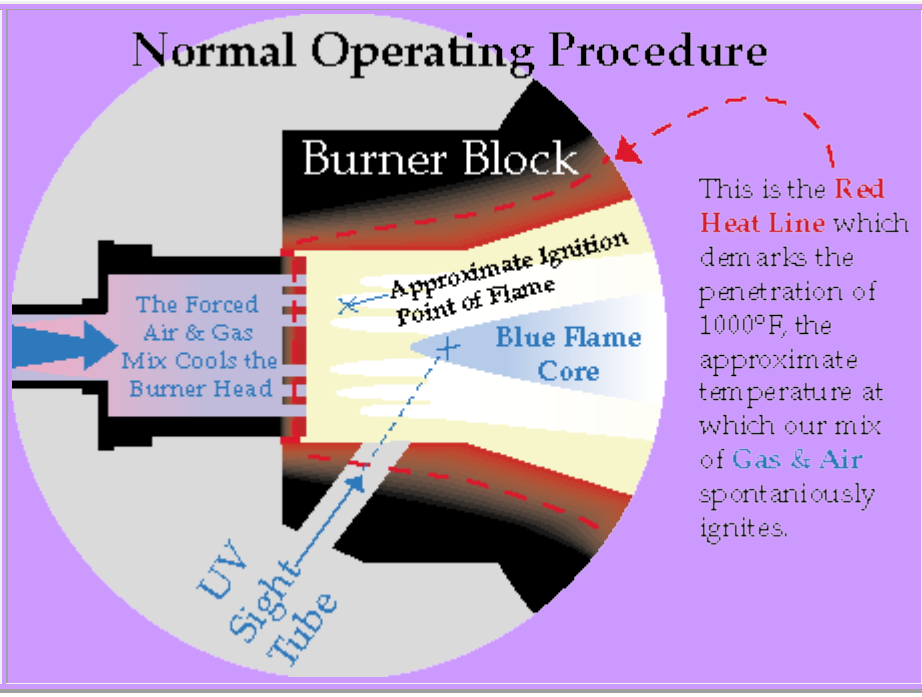
One day a glassblower makes a new melt and really gives it the business, gets the furnace really hot, and on the down side he is in a hurry and wants to plane it off because he has a hot date in a couple of hours. He turns it down to a setting which normally works when the furnace is a bit cooler and off he goes to visit his 'sweety.'

When he comes into his shop the next morning a sense of panic overcomes him. The furnace is roaring and the pipe work near the burner is red hot. The head is perhaps broken. (He did not have a safety system.) And he is indignant!

"That god dammed head! I knew it wasn't any good before I put it on! I saw some air bubbles in it. I think it was defective."

That's when I get a call from Mr. X. It takes me awhile to get Mr. X. back to the real problem and that is how to successfully turn down a burner after a melt and go on a date at the same time. I don't know about the date thing, but we can get the furnace turned down ok.

The idea of the red line (the 1000°F heat line).



Don't Blow 'Um Up
Or Whack 'Um with A Hammer Page

“There is another area we have yet to cover as a real trouble spot to the longevity of the burner heads. This is in the area of physical abuse. The most classic is the case of binding the head in the burner port...crack! The casting is 4" in diameter and the burner port is supposed to be 4.5" in diameter. This gives a little slack and allows for some slight movement, but if they are both 4," the slightest movement breaks the head.

Not surprisingly, many people lose their burner heads during a big studio move where the plumber guy applies the hammer to the pipe work to loosen it up a tad, and "whack!" If you pound on the pipe work five feet away the shock still follows the metal all the way to the burner head and plop, on the floor it goes in a couple of big pieces– don't hammer the pipe work. Constant, hard vibration will eventually shake even a good burner head to pieces.

You see, the physical strength of the burner head is not that great. It is probably twice as strong as a soft brick. I did a lot of experimenting trying to strengthen the physical mass, that's easy. I could make it hard as a rock. But the harder I got it the less well it withstood the thermal changes.

Face it, the major threat to a burner head is the thermal stress it must go through each day in its cycle, not the plumber with the hammer. So I made a mix which would take some physical abuse but which was stronger under thermal abuse. I have experimented with a lot of different things but have returned to the original formula for every burner I have ever sold.

While we are on the subject of physical abuse, occasionally I get a customer who will literally blow up a burner, like an old-fashioned pipe-bomb. Well, it's more like a gas cannon. In my youth we'd celebrate appropriate holidays by shooting off an acetylene and oxygen filled drive shaft housing plugged with a Life magazine. Boom! Instant confetti. At a hundred seventy-five dollars a pop it loses its humor. So, what's happening to cause the explosion?

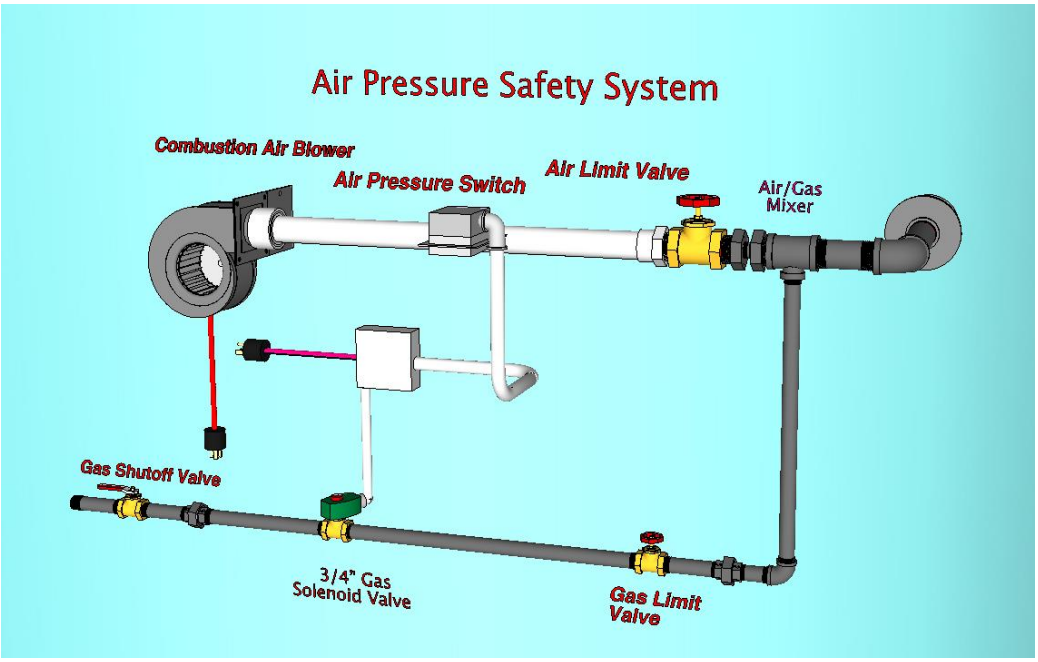
When a gas/air mix burns it expands rapidly, as much as seven times in volume. If the expansion happens in a closed space, like in the mixer section behind the burner head, we get an explosion. Earlier, I talked about how any burner system will have a pop-back point on the low end. This is true. If you turn down any system low enough it will pop back... boom! It usually is a small boom but what if there's a lot of pipe work of large sizes behind the head? Then we have a large explosion. It is a matter of physics.

Any excess piping and it is almost guaranteed that at some point you will blow the head right up. It may be the first time you light it.

Well that's about it for the exciting stuff. No more explosions. But there is one more caution in the physical abuse section. It is very important to mount the burner system by the iron pipe work behind the head. Use a regular clamp or a "U" bolt and attach it to the frame of the furnace. This provides support for all the weight of the burner/head/mixer, etc… It is especially important not to rest the totality of this weight onto the head and expect it to hold up unscathed. It might hold up for a short while but to be so cavalier is asking for trouble."

To summarize, if you set-up and operate your system by the guidelines in this manual, and use a turndown schedule that keeps the heat out of the head, we eliminate nearly all the bumps in the road.

The illustration below from Charlie Correll outlines the burner system components and their relationships to each other in the system.



Wiring Diagram

To the right is the wiring diagram for the burner system for your reference. It is recommended that should any problems arise, do not attempt to repair or modify the wiring. Contact Mobile Glassblowing Studios at 229-352-9988 ext 3 for troubleshooting advice first before hiring a certified electrician for repairs.

CORRELL
GLASS STUDIO
66 HIDDEN LEDGE DRIVE
CONWAY, MA 0134
CCORRELL@COMCAST.NET
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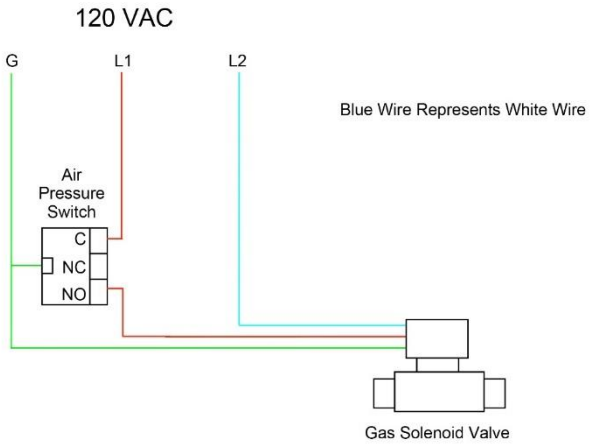
Electrical Schematic for Air Pressure Safety System



Component Spec Sheets:

The following are the manufacturer's specification sheets for the solenoid valve, air switch and blower:

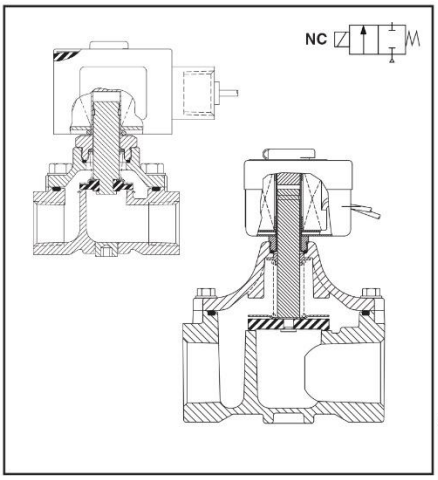
ASCO® RedHat

Direct Acting
Gas Shutoff Valves
3/8" to 1 1/4" NPT

2/2 SERIES 8040

Features

- 2-way normally closed operation
- For gas pilot or main control of commercial and industrial gas burners
- Valves provided with 1/8" NPT upstream and downstream pipe taps with plugs for routine testing
- Mountable in any position



Construction

Valve Parts in Contact with Fluids	
Body	Aluminum
Seals and Disc	NBR
Core Tube	305 Stainless Steel
Core Guide	Acetal
Rider Ring	PTFE
Core and Plugnut	430F Stainless Steel
Springs	302 Stainless Steel
Shading Coil	Copper
Pipe Plug	Zinc-Plated Steel

Electrical

Standard Coil Class of Insulation	Watt Rating and Power Consumption AC Watts	AC VA Holding	AC VA Inrush	Ambient Temp.°F	Spare Coil Family General Purpose AC	Spare Coil Family Explosionproof AC
F	10.1	25	70	-40 to 125	238610	238614
F	15.4	27	160	-40 to 125	099257	-
Standard Voltages: 24, 120, 240 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz).						

Solenoid Enclosures

Valves with the letter "G" in their catalog numbers, e.g. 8040G021, have RedHat II molded epoxy Types 1, 2, 3, 3S, 4, and 4X combinations General Purpose and Watertight solenoid enclosures with 1/2" conduit hub as standard.

Valves with the letter "C" in their catalog numbers, e.g. 8040C004, have RedHat metal Type 1 General Purpose enclosures with 7/8" hole for 1/2" conduit connection.

Valve Response Time

Opening Time: Less than 1 second; **Closing Time:** Less than 1 second

Approvals

UL listed to standard 429 "Electrically Operated Valves," Guide YIOZ, File MP618 Safety Valves.

FM Approved to Class 7400 "Liquid and Gas Safety Shutoff Valves" (3/8" thru 3/4" only).

CSA Certified to:

1) Standard C22.2 No. 139 "Electrically Operated Valves," File 010381.
2) Automatic Gas Valves Z21.21 (6.5), File 112872.
3) Automatic Gas Safety Shutoff Valves C/I (3.9), File 112872.

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COMBUSTION

ASCO®

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Gas Capacity ① Btu/hr.	Operating Pressure Differential (psi) Min.	Operating Pressure Differential (psi) Max.	Max. Fluid Temp.°F	Catalog Number	Const. Ref.	Agency UL	Agency FM	Agency CSA	Wattage	Approx. Shipping Weight (lbs)
COMBUSTION (Fuel Gas) - NORMALLY CLOSED													
3/8	3/4	3.9	210,000	0	2	125	8040G021	1	❍	❍	❍	10.1	2.8
1/2	3/4	5.4	291,000	0	2	125	8040G022	1	❍	❍	❍	10.1	2.8
3/4	3/4	9.5	512,000	0	2	125	8040G023	2	❍	❍	❍	10.1	2.8
1	1 5/8	16.8	900,000	0	0.5	125	8040C004	3	❍	-	❍	15.4	4.3
1 1/4	1 5/8	19.6	1,100,000	0	0.5	125	8040C005	3	❍	-	❍	15.4	4.3

❍ = Safety Shutoff Valve. ① 1" W.C. Drop @ 2" W.C. Inlet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.

Specifications (Metric units)

Pipe Size (ins.)	Orifice Size (mm)	Kv Flow (m^3/hr)	Gas Capacity ① Btu/hr.	Operating Pressure Differential (bar) Min.	Operating Pressure Differential (bar) Max.	Max. Fluid Temp.°C	Catalog Number	Const. Ref.	Agency UL	Agency FM	Agency CSA	Wattage	Approx. Shipping Weight (kgs)
COMBUSTION (Fuel Gas) - NORMALLY CLOSED													
3/8	19	3.3	210,000	0	0.1	52	8040G021	1	❍	❍	❍	10.1	1.3
1/2	19	4.6	291,000	0	0.1	52	8040G022	1	❍	❍	❍	10.1	1.3
3/4	19	8.1	512,000	0	0.1	52	8040G023	2	❍	❍	❍	10.1	1.3
1	41	14.3	900,000	0	0.03	52	8040C004	3	❍	-	❍	15.4	2.0
1 1/4	41	16.7	1,100,000	0	0.03	52	8040C005	3	❍	-	❍	15.4	2.0

❍ = Safety Shutoff Valve. ① 1" W.C. Drop @ 2" W.C. Inlet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.

Capabilities Chart

Solenoid Options				Base Catalog Number	Resilient Materials	Standard Rebuild Kit
NEMA Type 3-9	High Temp.	Junction Box	Wiring Box Screw Terminal	Aluminum	NBR	AC
EF	HT	-	JKF	8040G021	●	306633
EF	HT	JB	JKF	8040G022	●	306633
EF	HT	JB	JKF	8040G023	●	306633
-	HT	JB	JKF	8040C004	●	304079
-	HT	JB	JKF	8040C005	●	304079

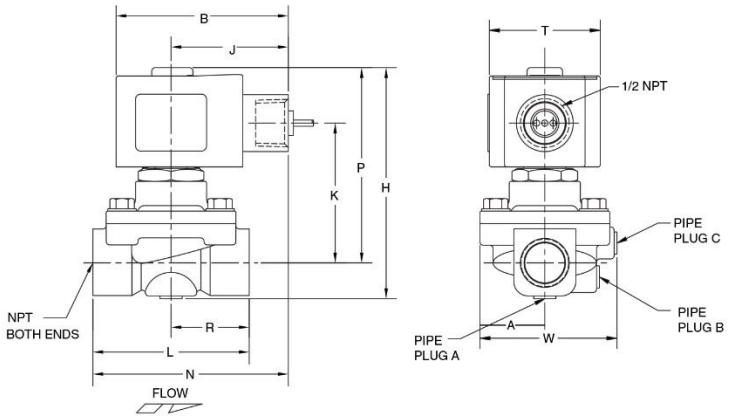
● = Standard. Other options may be available. All option combinations may not be available.

COMBUSTION

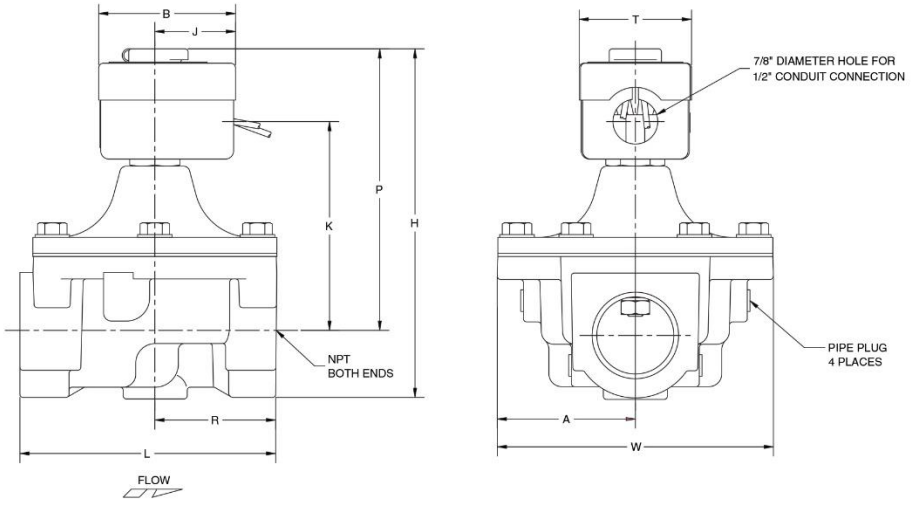
Dimensions inches (mm)

Const. Ref.		1	2	3
A	ins.	1.66	1.66	2.69
	mm	42	42	68
B	ins.	3.03	3.03	2.69
	mm	77	77	68
H	ins.	4.05	4.49	6.81
	mm	103	11405	173
J	ins.	2.04	2.04	1.59
	mm	52	52	40
K	ins.	2.46	2.65	4.09
	mm	62	67	104
L	ins.	2.75	3.31	5.00
	mm	70	84	127
N	ins.	3.42	3.70	-
	mm	87	94	-
R	ins.	1.38	1.66	2.38
	mm	35	42	60
P	ins.	3.44	3.63	5.50
	mm	87	92	140
T	ins.	1.95	1.95	2.22
	mm	50	50	56
W	ins.	2.42	2.39	5.38
	mm	61	61	137
Pipe Plug		B & C	A & C	-

Const. Ref. 1, 2



Const. Ref. 3



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COMBUSTION

Cleveland Controls
Division of UniControl Inc.

Model AFS–222

AIR PRESSURE SENSING SWITCH WITH ADJUSTABLE SET POINT RANGE

APPLICATION

Model AFS-222 Air Pressure Sensing Switch is a general purpose proving switch designed for HVAC and Energy Management applications. It may be used to sense positive, negative, or differential air pressure.

GENERAL DESCRIPTION & OPERATION

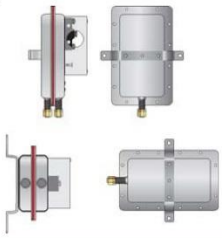
The plated housing contains a diaphragm, a calibration spring and a snap-acting SPDT switch.The sample connections located on each side of the diaphragm accept ¼" OD metallic tubing via the integral compression ferrule and nut.

An enclosure cover guards against accidental contact with the live switch terminal screws and the set point adjusting screw. The enclosure cover will accept a ½" conduit connection.

MOUNTING (SEE FIGURE 1)

Select a mounting location which is free from vibration. The **AFS-222** must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified operating set point. Avoid mounting with the sample line connections in the "up" position. Surface mount via the two 3⁄16" diameter holes in the integral mounting bracket. The mounting holes are 3-⅞" apart.

(Fig. 1)



AIR SAMPLING CONNECTION (SEE FIGURE 2)

The **AFS-222** is designed to accept firm-wall sample lines of ¼" OD tubing by means of ferrule and nut compression connections. For sample lines of up to 10 feet, ¼" OD tubing is acceptable. For lines up to 20 feet, use ¼" ID tubing. For lines up to 60 feet, use ½" ID tubing. A ¼" OD adapter, suitable for slip-on flexible tubing is available: order part number 18311.

Locate the sampling probe a minimum of 1.5 duct diameters downstream from the air source. Install the sampling probe as close to the center of the airstream as possible. Refer to Figure 2 to identify the high pressure inlet (H) and the low pressure inlet (L). Select one of the following five application options, and connect the sample lines as recommended.

POSITIVE PRESSURE ONLY: Connect the sample line to inlet H; inlet L remains open to the atmosphere.

NEGATIVE PRESSURE ONLY: Connect the sample line to inlet L; inlet H remains open to the atmosphere.

TWO NEGATIVE SAMPLES: Connect the higher negative sample to inlet L. Connect the lower negative sample to inlet H.

TWO POSITIVE SAMPLES: Connect the higher positive sample to inlet H. Connect the lower positive sample to inlet L.

ONE POSITIVE AND ONE NEGATIVE SAMPLE: Connect the positive sample to inlet H. Connect the negative sample to inlet L.

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Cleveland OH 44109

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Bulletin LTAFS222-08

ELECTRICAL CONNECTIONS (SEE FIGURE 3)

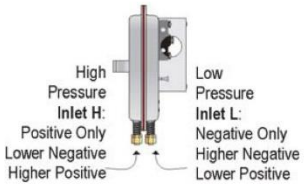
Before pressure is applied to the diaphragm, the switch contacts will be in the normally closed (NC) position. The snap switch has screw top terminals with cup washers. Wire alarm and control applications as shown in Figure 4.

FIELD ADJUSTMENT

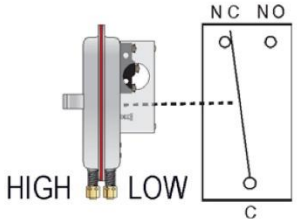
The adjustment range of an **AFS-222** Air Switch is 0.05±.02" w.c. to 12.0" w.c. To adjust the set point, turn the adjusting screw counterclockwise until motion has stopped. Next, turn the adjusting screw 4 complete turns in a clockwise direction to engage the spring. From this point, the next ten turns will be used for the actual calibration. **Each full turn represents approximately 1.2" w.c.**

Please note: To properly calibrate an air switch, a digital manometer or other measuring device should be used to confirm the actual set point.

(Figure 2)

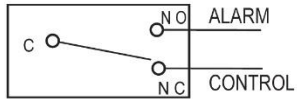


(Figure 3)

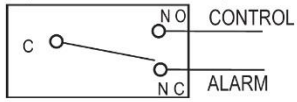


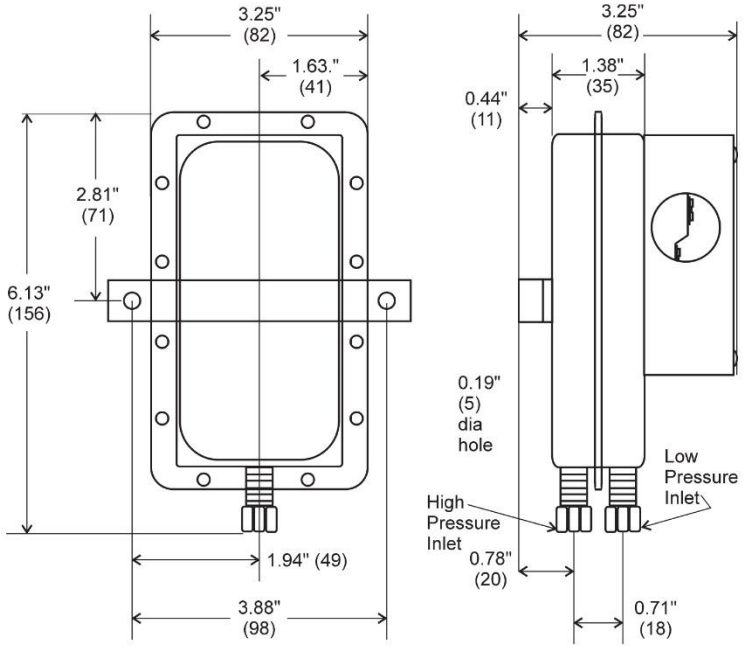
(Figure 4)

To prove excessive air flow or pressure:



To prove insufficient air flow or pressure:





Nominal Dimensions in Inches (Millimeters)

SPECIFICATIONS

MODEL AFS-222 AIR PRESSURE SENSING SWITCH WITH ADJUSTABLE SET POINT RANGE

Mounting Position:
Mount with the diaphragm in any vertical plane.

Set Point Range:
0.05 ± 0.02" w.c. to 12.0"w.c.

Field Adjustable "Operate Range":
0.07"w.c. to 12.0" w.c.

Field Adjustable "Release Range":
0.04"w.c. to 11.2" w.c.

Approximate Switching Differential:
Progressive, increasing from 0.02 ± 0.01"w.c. at minimum set point to approximately 0.8 " w.c. at maximum set point.

Measured Media:
Air, or combustion by-products that will not degrade silicone.

Maximum Pressure:
½ psi (0.03 bar).

Operating Temperature Range:
-40F to 180F (-40 to 82C).

Life:
100,000 cycles minimum at ½ psi maximum pressure each cycle and at maximum rated electrical load.

Electrical Rating:
300 VA pilot duty at 115 to 277 VAC, 15 amps noninductive to 277 VAC, 60Hz.

Contact Arrangement: SPDT.

Electrical Connections:
Screw-type terminals with cup washers.

Conduit Opening:
⅞" diameter opening accepts ½" conduit.

Sample Line Connectors:
Male, externally threaded 7/16" -24 UNS 2A thread, complete with nuts and self-aligning ferrules.

Sample Line Connections:
Connectors will accept ¼" OD rigid or semi-rigid tubing.

Approvals: UL, FM, CSA.

Shipping Weight: 1.2 lbs.

Accessories:

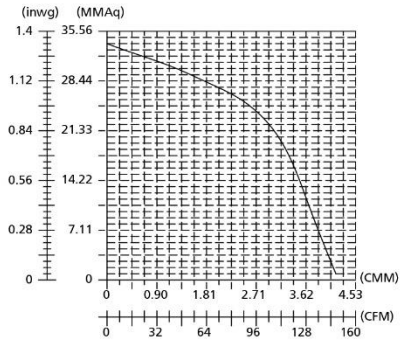
- P/N 18311 Slip-on ¼" OD Tubing Adapter, suitable for slipping on flexible plastic tubing.
- Sample line probes.
- Orifice plugs (pulsation dampers).

Dayton® PSC and Shaded Pole Blowers

Description

Dayton PSC and Shaded Pole blowers provide economical air delivery for general heating, cooling, ventilating, or component cooling. Typical applications include cooling greenhouses, blowers for wood and corn stoves, ventilating small buildings, cooling electrical enclosures and removing heat from machinery. The blowers are exact replacements for many OEM blowers with the same physical footprint. Forward curve wheels driven by Dayton motors are rated for continuous duty with all-position mount. These units incorporate balanced ball or sleeve-bearing motors with cast aluminum end shields. This provides greater heat dissipation and protection, reducing down time due to component failure and accidental damage. Direct drive blower wheels are dynamically balanced to reduce noise and vibration and to maintain CFM at higher static pressures.

60HZ



Specifications

Reference Number	CFM @0″	0.1″	0.2″	0.3″	0.4″	0.5″	0.6″	0.7″	0.8″	VOLTS	AMPS	HZ
1TDR6*	148	144	136	134	130	124	–	–	–	115	0.75	60

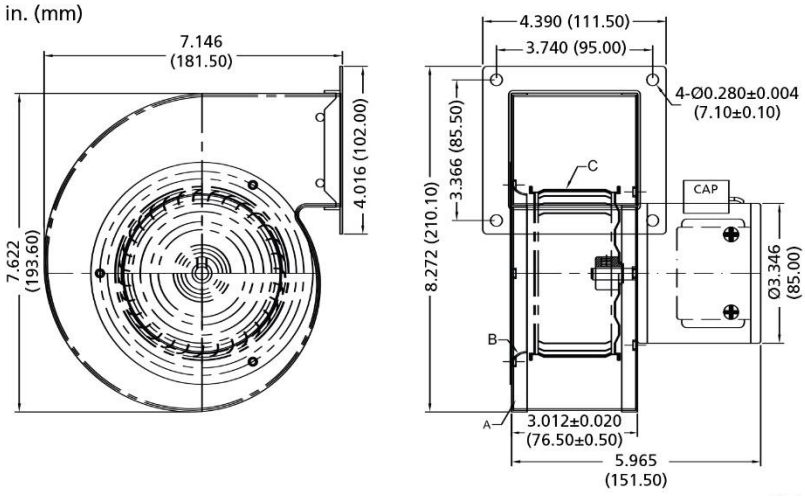
* Replaces 4C006

NOTE: Includes Conduit Box with 13″ Lead Length.

NOTE: Not suitable for use with speed-controllable devices.

Dimensions

in. (mm)



Features

- PSC motor
- Baked enamel Gray finish
- Heavy gauge steel housing
- All position Mounting
- Maximum Ambient Temperature 104°F
- Suitable for 50Hz operation

Additional Benefits

- Permanently Lubricated Ball-Bearings
- Extruded Aluminum Blower Frame for Increased Rigidity
- Auto-Thermal Protection

Motor Component Recognition c UL us E47479

Dayton®