



Bethlehem Apparatus Company, Inc.

Bethlehem Burners

890 Front St., P.O. Box Y, Hellertown, PA 18055 Phone: 610/838-7034 FAX: 610/838-6333

Bravo Operating Instructions:



The Bethlehem Bravo Bench Burner was designed for use with gas and oxygen. Propane is the preferable gas, and is readily available from gas distributors. Be sure that your gas distributor can supply you with a pressure regulator. The regulator should be equipped with a gauge so you can see how much fuel remains in your fuel tank, and indicate the pressure you are sending to the torch.

BEFORE OPERATING ANY GAS BURNER YOU SHOULD BE FAMILIAR WITH THE ODOR OF THE FUEL YOU ARE USING. ALL GAS FUELS HAVE A DISTINCT ODOR. THE MANUFACTURER PURPOSELY ADDS THE ODOR SO YOU CAN EASILY DETECT A GAS LEAK. THE ODOR IS DIFFERENT FROM THE SMELL OF BURNED FUEL (CALLED PRODUCTS OF COMBUSTION). READ ALL INSTRUCTION MANUALS SUPPLIED BY YOUR GAS DISTRIBUTOR BEFORE OPERATING YOUR NEW BURNER.

Hose Connection:

The Bravo has four modular valves attached to the side of the burner. The larger diameter valves work the outer fire and the smaller diameter valves work the inner fire. A red knob indicates gas connections and a green knob indicates oxygen connections. GAS is also stamped on the gas valve cap and OXY is stamped on the valve cap for oxygen. The four separate hose barbs, 1/4 inch inside diameter, allow for working the Bravo with a foot-pedal oxygen saver. If foot-

pedal mechanisms are not desired then the gas and oxygen connections may be combined with a Y-connector. Be sure to only connect gas lines to each other. We have supplied your burner with B-fitting hose connectors for safety reasons. The hoses with B-fittings will prevent you from connecting the gas and oxygen improperly. B-fittings have different threads to prevent mistakes in connecting gas and oxygen lines. If you want to connect your gas and oxygen lines to one main hose, you will need a Y-connector. B-fitting Y-connectors are available through welding supply companies as well as many glass art supply houses.

O-Rings:

The Bravo uses silicone O-rings at seven (7) locations. Three of the O-rings are internal connections and four of the O-rings connect to the four modular valves. While the O-rings are rated for high temperatures (approximately 400 degrees F), they may dry out over time. Replacement of the internal O-rings must be done at the factory. Replacement of the O-rings on the valve may be done in the field. If you start to experience FLASHBACK (covered below) return the burner for O-ring replacement.

Optimum Fuel Pressure:

Gas: 2 psi, 15 ft³/hr, 425 liters/hr, 7.1 liters/min, 37,740 BTU/hr.

Oxygen: 8 psi, 66 ft³/hr, 1867 liters/hr, 31.1 liters/min

DO NOT EXCEED 25 lbs. pressure on any feed. Excess pressure may cause gas or oxygen to leak through the valves and increase the chance of leakage through the hose connections.

Theory of Operation:

The Bravo is designed to produce a wide variety of flame configurations so you can have the greatest versatility in your glass working. The flame is surface-mixed and operates without loud noise or flashback. Surface-mixed flames have the distinct advantage in that they are soft, quiet flames while producing a penetrating heat. Turning the precision needle valves easily changes flame settings. For best results, keep the fuel flow to a minimum. On Bethlehem burners, loud noise does not indicate more heat. The soft, intense blue flame will bathe your work in heat which will quickly penetrate the glass.

For best results, you should light the gas flame first. Once you have the yellow flame close to the burner head, you can slowly add oxygen. As soon as oxygen is added, the color will change from yellow to blue. This indicates complete combustion. As you change the flame height you should always keep the flame color as blue as possible. The individual jets (small cones of sharp color near the burner face) should be kept from giving off any yellow "candles". Yellow candles indicate unburned fuel. They are usually caused by the addition of too much gas, either by volume or pressure.

Unburned fuel will cause carbon deposits in the face of the burner. Keep carbon deposits to a minimum. If a deposit builds up on the burner face, you will overheat the front face, causing the burner to deteriorate. Carbon deposits will also change the flame characteristics of your burner. Use the stainless steel cleaning wire to remove all carbon deposits.

To extinguish the flame you should always turn off the oxygen before the gas. Do not over tighten the valves.

For more information about Bethlehem Burners visit our web site at <http://bethlehemburners.com>.

Bethlehem Bravo Burner **Technical Characteristics:**

Surface-Mixed Burner

All Bethlehem Burners are gas and oxygen surface-mixed. The gas and oxygen are kept separate until they leave the face of the burner. This style of burner allows for the greatest flexibility in operation without flashback.

Bethlehem's Bravo allows the operator the freedom of regulating the flame size simply by turning the gas or oxygen valves. Whereas a standard pre-mix burner would require the operator to change burner tips to achieve similar results in performance.

Flashback

A flashback is when pre-mixed fuels burn inside the burner body, resulting in a flame blow out, or even an internal flame that will destroy a burner.

The surface-mixed burner, as in the Bravo, is safer because they will not allow the fuel mixture to burn inside the burner body. Therefore, as in pre-mix burners, fire checks and flame arrestors are not required with the Bravo. To test your burner for proper performance, just simply turn off the oxygen flow. If there is a loud bang, then pre-mixing is occurring and the burner should be returned to Bethlehem Apparatus for repairs.

CAUTION

DO NOT USE BURNERS THAT MAKE A LOUD **BANG** WHEN THE OXYGEN SUPPLY IS ABRUPTLY CUT OFF.

Gases

Bethlehem's Bravo is designed to burn natural gas, hydrogen, propane or butane fuels. Do not use acetylene. Acetylene contains excess carbon that will clog the gas ports on the burner face.

Carbon Build-Up

High carbon content fuels, like propane, will deposit carbon on the front face of the burner. Eventually, the gas holes will clog. Unless the carbon is cleaned away, the surface temperature of the burner face will get too hot. High burner front face temperatures will cause a rapid deterioration of the burner head and shorten the life of the burner.

On a daily basis, use the attached stainless steel cleaning wire to remove carbon buildup from the burner face. Push the wire through each hole on the front face of the burner. After cleaning, turn the burner onto high flame so the dirt generated from cleaning will be flushed out. A slight tapping on the burner during the high flame cleaning will also help loosen the dirt.

If the carbon is not cleaned away daily, the burner will begin to generate a localized hot spot at the carbon deposit. These hot spots will cause the front plate to deteriorate. Eventually the gas holes drilled in the front plate will become too large for proper gas and oxygen distribution causing an unbalanced flame.

Bench Burner Center Fire

The Bravo has two independent burners in one burner barrel. One center surface-mixing flame and one ring surface-mixing flame with each operated with a separate set of gas and oxygen valves. Due to this unique design, NEVER OPERATE THE OUTER RING BURNER WITHOUT SOME GAS AND OXYGEN GOING THROUGH THE CENTER FIRE BURNER. Operating the Bravo with the outer ring burner only will cause a carbon build up over the center flame gas and oxygen ports.

Carbon Monoxide Warning

All Bethlehem Burners are designed to be operated with gas and oxygen. The burners are intended to produce an open flame. EXTREME CARE must be taken to assure that combustible materials are kept away from the open flame. The burner flame is combustion, which results in the production of water vapor, carbon dioxide, and carbon monoxide, which is a highly poisonous, odorless, colorless, tasteless gas. It is very flammable. Be sure to use adequate ventilation when operating burners. Use a carbon monoxide detector in the room where burners are operated. Do not smoke around combustible gases.

Safety Regulations

All Bethlehem burners are surface-mixed and do not require a flashback arrestor, which is required for pre-mix torches. However, the need for a flashback arrestor may be subject to regulation. Therefore, we advise all of our burner customers to check with their local, state and federal regulations regarding burner/ torch requirements.