

The Gas Flow Meter on Paragon Furnaces

Paragon Industries manufactures a large number of furnaces for different markets such as ceramics, glass, jewelry, industrial drill bit manufacturing, knife making, heat treating, etc. Many of these users have asked us for a means to inject gas into the furnace at high temperatures to effect a certain chemical reaction. These users are typically experts in their fields and fully understand the chemical reaction that will occur. Paragon Industries is not aware of, nor responsible for, the chemical reactions or formulas. We are not experts in those fields. However, we are willing to aid these customers with add-on features to satisfy their needs. It should be noted that reducing atmospheres may shorten the life of the heating elements. Inert or oxidizing atmospheres will not harm the furnace.

The Gas Injection/Flow meter we provide with our furnaces is a standard meter from Dwyer that is calibrated from 1 SCFH (Standard Cubic Feet per Hour) to 20 SCFH. The user is responsible to provide a source of gas at low pressure (less than 20 psig) to a 1/4" NPT female pipe fitting. As the source of gas is unknown to Paragon Industries, a pressure regulator may be required to reduce the high pressure in bottled gas to a usable range. If the source of gas is from a cryogenic tank, no such regulator will be required. However, we expect a 20 psig gas pressure at the inlet to the flow meter.

The Dwyer flow meter is used on furnaces with internal areas of 0.2 cubic feet to 27 cubic feet and, therefore, the setting of the flow meter will depend on the size of furnace or the amount of gas required to create a chemical reaction. If the primary function of the gas is to control the firing atmosphere, the size of the furnace is the first consideration. If the furnace is 0.2 cubic feet in volume and the flow meter is set on 1 SCFH, the atmosphere of the furnace will be changed 5 times per hour at room temperature (every 12 minutes). If, however, the furnace is over 1000F, the room temperature gas will expand to over ten times its volume when it is injected into the hot firing chamber. This equates to changing the atmosphere of a 0.2 cubic foot furnace at the rate of 50 times per hour (every 1.2 minutes). Now it is up to the user to define how pure the atmosphere is required and adjust the flow rate accordingly. Typically, this will require several test samples to fine tune the atmosphere.

All furnaces manufactured by Paragon Industries, L.P. use insulating materials that are not air tight. Neither is the surrounding metal case or door. The theory behind gas injection is to provide a slight positive pressure internal to the furnace to force air out. There will always be some mixing of air with the incoming gas, but with attrition, the amount of normal atmosphere air will decrease dramatically and the firing chamber will contain almost exclusively the injected gas.

Paragon Industries, L.P. has made many furnaces with the gas inlet/flow meter installed. However, we rely on our customers' expertise in their industries to create the products they want in a safe manner. We will modify furnaces to customers' requests but we are not responsible for the process, formulas, or resulting chemical reactions.

Example of using the GIFM to inject inert gas for heat treating of metals

The concept here is to have the inert gas injected into the firing chamber to severely decrease the amount of oxygen available to interact with the metal alloys and prevent scaling. The process below may not completely eliminate oxidation of the metals but will diminish it greatly.

Install a gas regulator on the bottle of gas. Adjust the regulator to 5 psi.

The fitting on the gas flow meter is 1/4" NPT.

Use argon gas, which is half the price of helium.

From the supplier of the metal, find the temperature at which the metal or alloy accelerates its oxidation process. Have the gas start to flow into the firing chamber so the atmosphere in the firing chamber will be turned over 5-10 times before the temperature is reached.

Adjust the gas regulator on the bottle to 3 psi. Turn the knob on the gas flow meter to the cubic feet of the furnace interior. (You can look up the interior size at www.paragonweb.com. Enter the furnace model number on the search line.)

Example: If the interior is .3 cubic feet, adjust the knob so the pointer is less than 1 SCFH (standard cubic feet per hour). The reason so little gas is required is that it expands to about 10 times its volume when it enters the hot furnace.

Examine the steel after it is heat treated. Adjust the SCFH setting or inject the gas earlier in the firing process if the metal or alloy have excessive scaling.

Argon gas is non-toxic. However, it does not support life. Therefore, the room where you operate the furnace must be well ventilated.