



**HYDROGEN / INERT ATMOSPHERE,
COLDWALL FURNACE**
For Automatic, Programmed Operation to 1700 Deg. C

1.5" Dia. X 2" Deep Hot Zone

Model M-17 Mini Hydrogen / Inert Atmosphere Furnace

Overview

The Concepts & Methods Co., Inc. "M-17" inert atmosphere furnace is designed for fast processing and to reproducibly metallize, braze, clean fire and otherwise process small loads in a work area of approximately 1" dia x 1.5" deep. The number selected ramp and soak program is accurately controlled up to 1,700 deg. C. The furnace and gas controls, thermal controls and interlocks are integrated in a single unit to assure simple, reliable, programmed operation.

Operation

The work is loaded into the furnace hotzone, the chamber is lowered and manually latched shut. One of four selectable, user programmed thermal profiles is chosen, and the "start" key pressed. The selected time vs. temperature ramp and soak profile then runs. The chamber is automatically purged with nitrogen, then purged with hydrogen, then ramped to the pre-defined programmed temperature set point. A soak or dwell segment is run and a guaranteed soak value can be programmed. There is also a manual program hold button that the operator can use. This allows for the operator to pause the program and use a sight port to verify a flag melt. The operator can then continue on with the automatic process. Upon completion of the cooldown portion of the program, the chamber is then post purged with nitrogen.

There is a safety feature that prevents the operator from opening the chamber until it has reached a preset "safe access" temperature. The furnace will continue to purge with cool nitrogen until this safe access temperature has been met. This protects the load and the operator. The furnace can then be opened and unloaded.

Furnace

The double wall, water jacketed, stainless steel chamber is located on top of the base unit. Inside are the Molybdenum heating element, various heat shielding, water-cooled electrodes, control and over-temp thermocouples and three hearth support pins. Work is placed on a small molybdenum hearth.

A water-cooled base plate is machined to incorporate the insulated power feedthroughs, control and work thermocouples, gas in and exhaust gas feedthroughs.

The water-jacketed chamber assembly is reliably silicone gasket sealed to the base plate through use of an interlocked camming latch. A 1/2" diameter sight port is located at the center of the cover, and its centerline is vertical. A "flag" in close thermal proximity to the work monitoring thermocouple may thus be watched, and a precise calibration can thereby be obtained.

The clear sight glass is sealed through use of an "O" ring, and is readily removable to facilitate cleaning or replacement.

Temperature Control

Temperature control and monitoring functions are achieved using two reliable type "C" Tungsten / Rhenium thermocouples. Multi-stage programmed control is achieved through use of a process controller which receives its' input from the thermocouple located in close proximity to the heating element. Automatic time/temperature programmed control of up to four different, 6 segment programs may be stored, requiring the operator to merely set gas flows and specify a program by number to operate the furnace.

Over-temperature shutdown signal is provided from a second thermocouple projecting upward through the base-plate into the load space. This sensor drives a separate over-temp controller for the safety of the load and equipment.

Power Control

Power is proportionally controlled through use of a digitally controlled S C R single-phase power module. This unit as used in this application is phase angle fired control and is fuse protected. The SCR drives a 2 KVA power transformer that reduces the voltage to approximately 5 volts at 400 amps.

Atmosphere Control

Customer supplied Hydrogen and Nitrogen gasses are admitted to this equipment through programmed valves. A valve is included, which provides for automatic Nitrogen purge in the event of loss of chamber seal, low Hydrogen pressure or power interruption.

Operator set flowmeters controls the flows to achieve the appropriate operating atmosphere.

All gas plumbing and components are made of clean 304 stainless steel. All gas connections are high-pressure swagelok fittings.

An optional exhaust gas burn-off column can be ordered that thermally ignites the waste gas. Ignition is called for automatically. As the ignitor operates throughout the run, the unit attempts re-ignition should the flame be inadvertently extinguished.

An optional gas humidification system can be ordered that will humidify a portion of the process gas. The included bubbler column will humidify the process gas to a dew point of up to 18 deg. C. This gas is then re-combined with the remaining process gas in a pre-selected ratio to obtain the desired process dew point.

Please indicate at time of order if these options are required.

Base Unit

The base unit measures approximately 20" wide by 17" deep by 18" high to fit on a table top or appropriate stand. Its' substantial frame is constructed of heavy wall angle, flat bar and square steel tubing. Service access is readily gained through the removable side and panels. The plate steel floor supports the heavy heater power transformer and closes the bottom. The power components and sub-assemblies are isolated by an internal airflow-directing baffle. A fan at the rear of the base unit draws cooling air through a replaceable filter to cool the power control unit and transformer. In addition, the base frame supports the instrument chassis, chamber, cover hinge and latch assemblies.

The stainless steel top provides free area for convenient load preparation, and completes closure of the base unit.

The finish used on this, and all CAMCo equipment is baked, powder coating chosen for its' durability and solvent resistance.

Additional Standard Safety Features

Thermocouple break protection assures that heating power is removed from the furnace in the event of sensor failure. Overtemperature indication from a separate thermocouple causes the heating elements to shut down as a further backup.

Other interlock functions protecting the operator and equipment include low coolant flow, chamber pressure and low gas pressure switches.

Hydrogen is prohibited from entering the system and heating cannot begin until the chamber cover is closed, sealed and purged. The chamber is inhibited from being opened until the work has cooled to a pre-defined "safe access" temperature. A Purge Assure Circuit provides an internally set minimum timed Nitrogen purge regardless of the program status whenever a run is started or there is a power interruption. Hydrogen admission is inhibited and the ignitor does not operate during this timed period.

Documentation

Facilities information is supplied to assist in site preparation for installation of the unit. An operating manual is supplied with the equipment. Worksheets included in the manual provide a convenient form for depicting the desired process for entry into the microprocessor controller, and also serve as a hard copy of the program. The unit is shipped with an example program stored in memory, depicted by the example worksheet.

