



Manufacturers of High Temperature & High Vacuum Equipment

360 Industrial Rd., Suite I | Phone (650) 593-1064
San Carlos, CA 94070 | Fax (650) 593-4458

Model G-2000

3.50" Diameter by 7" Deep 2000° C Top Loading
REDUCING/INERT ATMOSPHERE,
COLDWALL LABORATORY FURNACE
TABLE TOP MODEL

For programmed continuous operation to 2000° C.



Size: 39" (100 cm) W. x 26" (66 cm) D. x 20" (51 cm) H.

Standard Features:

- Burn-off Column
- Bubbler for humidification of process gas
- Equipment fits on table top or bench
- Honeywell Controls - Ramp & Soak
- DCP302 Program Controller
- UDC2500 Overtemp Control
- 19 Programs - 20 Segments per Program
- All Stainless Steel Construction
- Sight glass for calibration melts
- Fully Automatic - One button push starts the run.
Automatically it will purge → process gas fill → ramp to temperature and soak → bubbler for humidification of process gas → cooldown → post purge.

Options:

- Paperless Chart Recorder
- Survey Thermocouple
- Dewpoint Monitor -60 to +40° C
- Vacuum Purge
- Tower Indicator Lights
- Computer Controls



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Specification Sheet

Equipment Model: G-2000



Type	Coldwall, Vertical, Top Loading
Maximum Temperature	2000° C.
Hot Zone	3.5" (90mm) Dia x 7" (180 mm) Deep
Frame Dimensions	39" (100 cm) W. x 30" (76 cm) D. x 21" (53 cm) H.
Power Requirements	240V 1 Ph. 60A 60 Hz. or 230V 1 Ph. 60A 50HZ
Gas Requirements	25 – 50 psig, Nitrogen – $\frac{1}{4}$ " Swagelok connection 25 – 50 psig, Hydrogen – $\frac{3}{8}$ " Swagelok connection

Purge gas is Nitrogen.

Process gas is Hydrogen or Nitrogen or a mixture of both.

Process gas can be humidified via a heated bubbler to over 18° C. Dewpoint.

Cooling Requirements - 25 psig at zero back pressure, at 3 gallons per min.

Note: Maximum back pressure is 15 psig.

25,000 btu (2 Ton) heat draw for chiller calculation

Heat up ramp rate 100° C per minute - empty chamber.

All Molybdenum Hot Zone & Elements. All Insulators are made of High Alumina.

Standard Features:

- Burn-off Column
- Bubbler for humidification of process gas
- Equipment fits on table top or bench
- Honeywell Controls - Ramp & Soak
- DCP302 Program Controller
- UDC2500 Overtemp Control
- 19 Programs - 20 Segments per Program
- Sight glass for calibration melts
- Fully Automatic - One button push starts the run.
Automatically it will purge → process gas fill → ramp to temperature and soak → bubbler for humidification of process gas → cooldown → post purge.

Options:

- Paperless Chart Recorder
- Multiple Survey Thermocouples
- Dewpoint Monitor -60 to +40° C
- Vacuum Purge
- Tower Indicator Lights
- Computer Controls



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Equipment Description

CAMCo 3.5" Dia x 7" D., 2000° C Top Loading, Tabletop Furnace

REDUCING/INERT ATMOSPHERE
COLDWALL LABORATORY FURNACE
For Automatic, Programmed Operation to 2000° C

Higher temperature and high vacuum versions available.

Model G-2000



Overview

This compact front-loading, bench top furnace is designed for automatic program controlled thermal processing of work in wet and dry, inert and reducing atmospheres. The heat shielded work area includes a Tungsten hearth plate, 3.50" in diameter by 7" deep for uniform ramp and soaks processing to temperatures to 2000° C. The low thermal mass heat shields allow cooldown to be programmed at a rate such that three complete process runs can be done in a day shift. The furnace chamber is constructed of double walled stainless steel with water passages between the walls. The heat shields and elements are constructed of pure Tungsten and Molybdenum refractory metals to be able to operate consistently at 2000° C.

Base Unit

The cabinet measures approximately 39" wide by 30" deep by 21" high. Its substantial frame is constructed of heavy steel structural shapes. Steel panels are readily removed to gain access for efficient, on the spot service. The square tubular support feet provide a convenient location in which to insert bars for lifting. The left side of the cabinet contains the logic controller, gas valving, bubbler column, power components and electronics. A fan located at the rear of the unit draws cooling air through the cabinet to cool the power control module. The right side of the cabinet contains the chamber, gas-plumbing bulkhead, thermocouples and is baffled from the electronics. There are no high voltage components on the chamber side of the frame. The finish used on this, and all CAMCo equipment, is baked powder coating chosen for its durability and solvent resistance. The top of the unit is 18-gauge stainless steel to provide a clean area to load product from.

Temperature Control

Temperature control signals are received from a type "C" thermocouples. Multi-stage programmed thermal control and atmosphere sequencing is achieved through use of a Honeywell DCP302 Microprocessor controller. The controller receives its' input signal from a thermocouple located close to the heating element. Thermocouple break protection assures that heating power is removed from the furnace in the event of sensor failure. Over-temperature monitoring is provided by a third thermocouple (Type "C") located within close proximity to the load. It drives a Honeywell UDC2500 process monitor, which provides digital readout of the load area temperature and provides the over-temperature shutdown signal. The process monitor also provides a safe chamber access interlock and access signal for the operator.

Operation

Work is loaded into the furnace, the top heat shield stack inserted, the cover closed and latched. One of nineteen selectable, user programmed thermal profiles is chosen, and the "Start" key pressed. A one button push will start the run and automatically it will purge, process gas fill, ramp to temperature and soak, activate the bubbler for humidification of process gas, cooldown and post purge. Upon completion of the cooldown portion of the program, a lamp signals when the chamber may be opened and unloaded. The top of the double wall, water-cooled chamber is closed in operation by a jacketed, water-cooled door. The door handle includes a cam locking arrangement to easily compress the silicone door seal gasket. Hydrogen is prohibited from entering the system and heating cannot begin until the door is closed and sealed and the chamber is purged of air. Power to the heating elements is prohibited if there is not enough water flow through the chamber cooling system.

Power Control

Power is proportionally controlled through use of a digitally controlled SCR single-phase power module. This unit is phase angle fired controlled, and includes current limiting made necessary by the strongly positive resistivity coefficient of the heating element. An adjustable, manual reset over current trip provides for automatic resumption of a run in the event of a brief power interruption. Impedance match of the heating elements to the incoming power is accomplished through the conservatively rated transformer driven by this power module.

Atmosphere Control

Customer supplied Hydrogen and Nitrogen gasses are admitted to the chamber through programmed valves and preset flowmeters. An interlock is included which provides for automatic Nitrogen purge in the event of loss of Hydrogen or chamber pressure. Operator set flowmeters control the flow of gasses to achieve the appropriate operating atmosphere. Included is a system which, when called to do so by the installed program, humidifies a portion of the selected process gas via a bubbler column. This gas is then recombined with the remaining process gas in a pre-selected ratio to obtain the desired process dewpoint. The included bubbler will humidify the process gas to a dewpoint of up to 20° C. Higher dewpoint equipment, and controlled temperature bubblers are available.

Exhaust gas is routed through a check valve and out a fitting at the rear of the cabinet. This valve establishes a slight positive pressure when the door is closed and sealed. As a safety feature, absence of this pressure prevents admission of Hydrogen and inhibits the application of heater power. An exhaust gas burnoff column electronically ignites the waste gas. Ignition is called for automatically at all times that Hydrogen is called for, and the unit attempts re-ignition should the flame be inadvertently extinguished. The ignitor is automatically tested to assure proper operation each time a run is started. All gas plumbing and components are stainless steel. All gas connections are high quality, high-pressure Swagelok fittings.

Standard Safety Features

Thermocouple break protection assures that heating power is removed from the furnace in the event of sensor failure. Overtemperature indication is read on a separate control module from the monitor thermocouple. This overtemp alarm causes the heating elements to shut down as a further backup.

Other numerous interlock functions protecting the operator and equipment include:

- Panel Interlock
- High Cabinet Temperature
- Low Coolant Flow
- Low Gas Pressure Switches
- Hydrogen is prohibited from entering the system and heating cannot begin until the chamber cover is closed, sealed and purged. At the end of a programmed run the chamber is inhibited from being opened until the work has cooled to a pre-defined safe temperature.
- Purge Assure Circuit provides an internally set minimum timed Nitrogen purge regardless of the program status whenever power or the program is interrupted.

Documentation

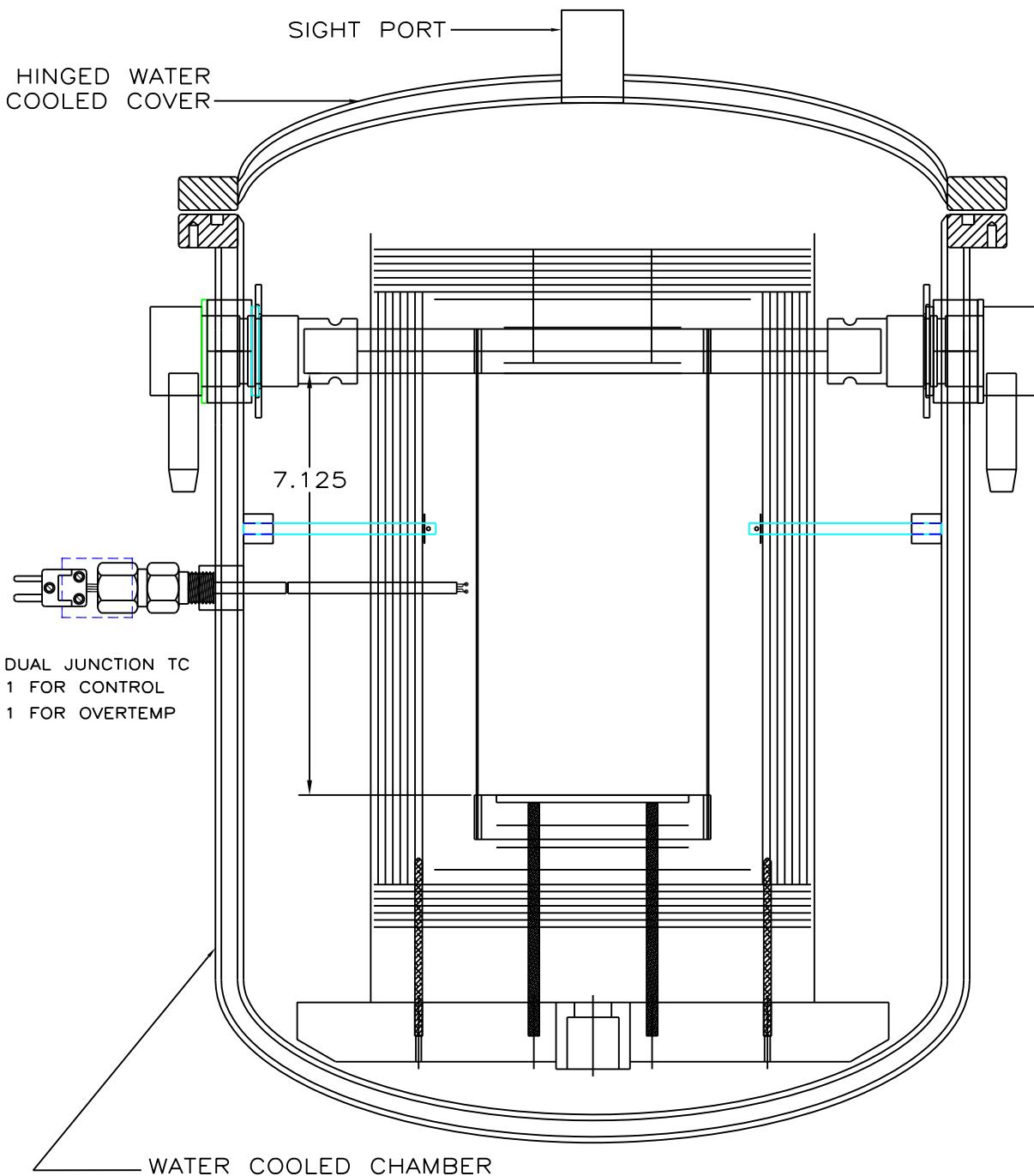
Facilities information is supplied to assist in site preparation for installation. An operating manual is supplied with the equipment. Worksheets included in the manual provide a convenient form to depict the desired process for entry into the microprocessor controller. The worksheets also serve as a hard copy of the program. The unit is shipped with an example program stored in memory, depicted by the example worksheet. Wiring and plumbing schematics along with a published spare parts list are also included in the manual. Vendor supplied manuals for the program controller, overtemp, SCR, recorder, dewpointer, and other small items are supplied in our documentation. A program and operation section has a complete button-by-button push instruction for installation of a generic program. The relatively simple operation of the furnace is well described and documented in the manual.

While the furnace is a complete, stand-alone unit as described, many applications suggest the inclusion of one or more of the options described in the enclosed data or web site. Other, less commonly ordered options can also be provided. Please inquire.

G-2000

Ø3.50 X 7.00 HOTZONE

REV.	DATE	DESCRIPTION



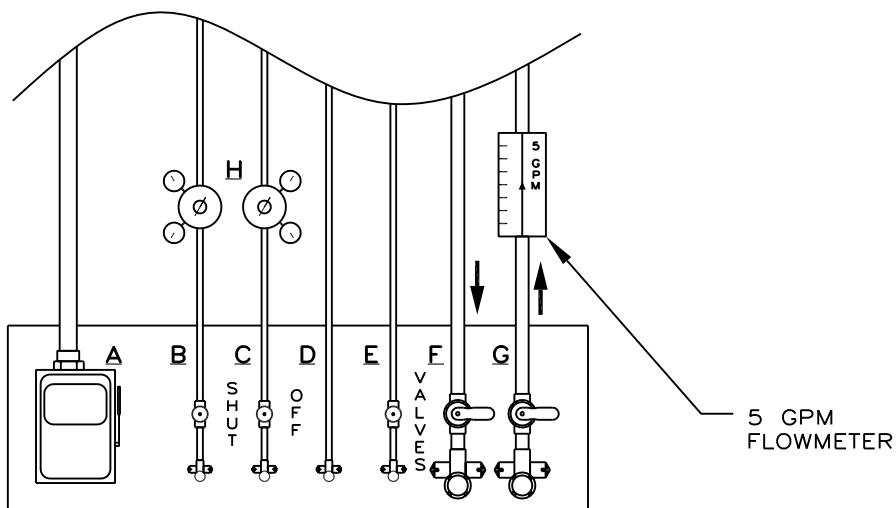
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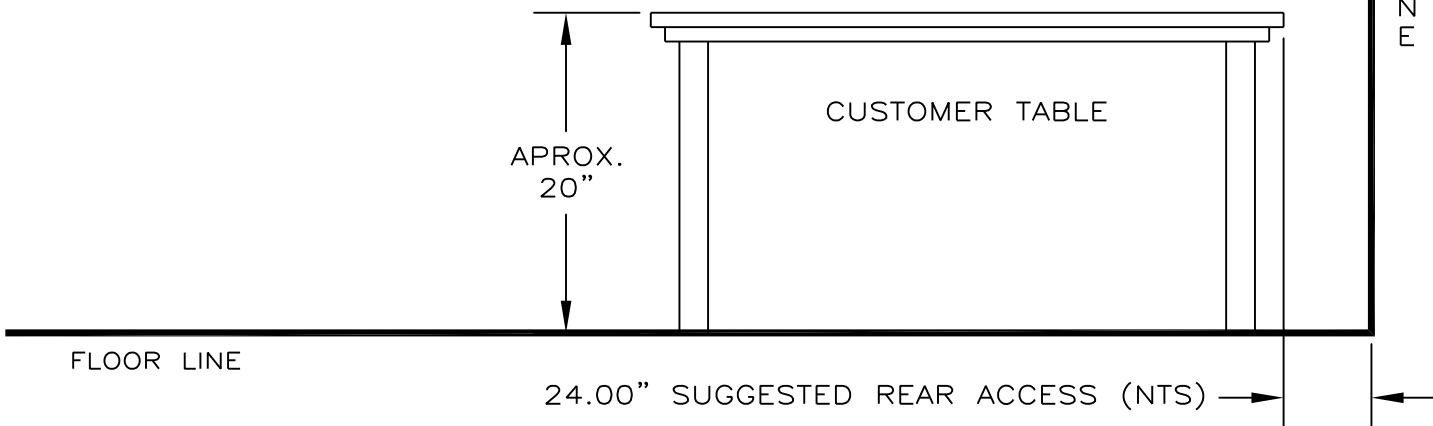
UTILITIES: PREPARED AS SHOWN
BY CUSTOMER.

REV.	DATE	DESCRIPTION
A	3-1-06	DELETE 480V OPTION
A	3-17-06	REDUCE TABLE SIZE FOR TOP LOAD

- A: 60A. @ 208 OR 240V. 60 Hz SINGLE PHASE DISCONNECT. 1/4" TUBE
- B: NITROGEN, 30 TO 50 PSIG AT A MAXIMUM FLOW OF 30 SCFH 1/4" TUBE
- C: HYDROGEN 30 TO 50 PSIG AT A MAXIMUM FLOW OF 30 SCFH 1/4" TUBE
- D: PROCESS ATMOSPHERE EXHAUST (NOT NEEDED WITH BURNOFF OPTION) 3/8" TUBE
- E: D.I. WATER FOR BUBBLER MAKEUP 1/4" POLYFLO
- F: COOLING WATER SUPPLY; 25 PSIG MIN. AT 2.5 GPM - SEE NOTE 1/2" FPT
- G: COOLING WATER RETURN OR PRESS. DRAIN IF USED--SEE NOTE 1/2" FPT
- H: LINE PRESSURE REGULATORS SET AT 40 PSI.



SUGGESTED UTILITY PANEL LAYOUT
LOCATE ON WALL BEHIND TABLE



NOTE: (MAX. BACK PRESSURE 15 PSIG AT 4 G.P.M.)
APPROXIMATELY 25,000 BTU AT FULL POWER

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		TOL'S EXCPT AS NOTED fract. $\pm 1/32$.XX $\pm .010$.XXX $\pm .005$.XXXX $\pm .0005$	DRN.BY: ZEVADA 08/22/00 APP.BY: DATE: 01/05/89	Concepts & Methods Company, Inc.
USED ON TASK	FWO	ANGLES $\pm 1/2''$	MAT: FINISH:	
				TITLE: G FURN TOP LOAD FACILITIES PREP. DWG.NO: 86531 SHEET 1 OF 2 REV: B

