

3.5" Diameter by 7" Deep 2000° C Top Loading  
 HIGH VACUUM, COLDWALL LABORATORY FURNACE  
 TABLE TOP MODEL

For programmed continuous  
 operation to 2000° C.



Frame Size: 51" (130 cm) W. x 26" (66 cm) D. x 20" (51 cm) H.

**Standard Features:**

- Equipment fits on table top or bench
- Honeywell Controls - Ramp & Soak
- DCP302 Program Controller
- UDC2300 Overtemp Control
- 19 Programs - 20 segments per program
- Stainless Steel top
- Sight glass for calibration melts
- Fully automatic - One button push starts the run. Automatically it will purge –High vacuum evacuate, ramp to temperature and soak – Vent for quick cool - cooldown - post purge.

**Options:**

- Video Chart Recorder
- Atmosphere Combination (Hydrogen)
- Tower Indicator Lights
- Computer Controls



PHONE (650) 593-1064  
FAX (650) 593-4458

CONCEPTS & METHODS CO. INC.  
370-G INDUSTRIAL ROAD • SAN CARLOS, CA 94070



## Specification Sheet

Equipment Model: GVAC-2000 Vacuum Furnace

<b>Type</b>	Coldwall, Vertical, Top Loading/High Vacuum
<b>Maximum Temperature</b>	2000 Degrees C.
<b>Hot Zone (Nominal)</b>	3.5" (90mm) Dia. X 7" (180mm) Deep Nominal
<b>Frame Dimensions</b>	51" (130 cm) W. x 26" (66 cm) D. x 20" (51 cm) H.
<b>Power Requirements</b>	240V 1 Ph. 60A 60 Hz. – 230V 1Ph. 60A 50 Hz..
<b>Gas Requirements</b>	25 – 50 psig, Nitrogen (1/4" swagelok)
<b>Compressed Air</b>	80 – 100 psi (1/4" swagelok)
<b>Element Style</b>	.010 Tungsten sheet

Process Vacuum at temperature  $10^{-6}$  Torr range  
Vacuum in  $10^{-7}$  Torr range at ambient

**Cooling Requirements** - 25 psig at 3 gallons per minute. Note maximum back pressure is 15 psig. (34,000 BTU)

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

Heating elements and heat shields are constructed of Tungsten Molybdenum. Insulators are made of High Alumina.

### Standard Features:

- 300 LP/S Turbo Pump
- High Vacuum isolation valve
- Honeywell Controls - Ramp & Soak
- DCP302 Program Controller
- UDC2300 Overtemp Control
- 19 Programs - 20 segments per program
- Sight glass for calibration melts
- Active Braze Control
- Fully automatic - One button push starts the run. Automatically it will rough pump/cross over to high vac - ramp to temperature and soak - cooldown - let up to ATM - and show amber indicator light when run is finished.

### Options:

- Chart Recorder
- Survey Thermocouple
- Tower Indicating Lights - 3 color
- Computer Controls



PHONE (650) 593-1064  
FAX (650) 593-4458

CONCEPTS & METHODS CO. INC.  
370-G INDUSTRIAL ROAD • SAN CARLOS, CA 94070

## Equipment Description

### CAMCo 3.5”(90mm) Dia X 7”(180mm) deep, 2000° C Top Loading

TABLETOP HIGH VACUUM  
TURBO-PUMPED FURNACE  
For Automatic Programmed  
Operation to 2000° C.

### Model GVAC-2000



## **Overview**

The Concepts & Methods Co., Inc. “G-VAC 2000” tabletop high vacuum furnace is designed to reproducibly vacuum braze, degas, sinter and otherwise process loads of up to 3.5 inches by 7 inches deep. The operator selected ramp and soak program is accurately controlled to 2000° C at pressures to the  $10^{-6}$  Torr range. The furnace and vacuum controls, pump system and interlocks, are integrated in a fully automated unit to assure simple reliable operation.

## **Operation**

The work is lowered from the top of the furnace onto a 3” dia hearth plate, the top heat shield stack inserted, and the door closed and latched. One of nineteen selectable, user programmed pump down and thermal profiles is chosen, and the “start” key pressed. The high vacuum gate valve opens and the Chamber is roughed out. A direct drive mechanical pump is coupled to the turbo-pump thru a foreline valve and trap. This pump serves as a roughing and foreline pump. This first stage vacuum evacuation is accomplished thru the idle 100 mm turbo-molecular high vacuum pump in approximately three minutes. At its limiting fore-pressure, the turbo-pump is automatically started. It reaches full speed within 4 minutes. As the pressure falls below  $1 \times 10^{-3}$  Torr, the high vacuum ionization gauge is powered. In the clean system, low five-scale mid six-scale pressure is reached in a total time from cold start-up of approximately fifteen minutes. The selected time vs. temperature profile then runs. Upon completion of the cooldown portion of the

program, the gate valve closes (if the program does not provide to leave the load under vacuum) the turbo-pump is powered down and the foreline valve closed. The chamber vented to Nitrogen or other inert gas to facilitate un-loading. If desired to facilitate more rapid cooling, the furnace may be programmed to close the gate valve immediately on removal of power, and as the turbo-pump is powered down, inert gas is admitted to a programmed level. The furnace is programmed to remain in this state until the safe access temperature has been reached, at which time the program ends, leaving the load in the inert atmosphere until the operator wishes to continue backfilling to remove the work.

## **Construction**

The cabinet measures approximately 51” wide by 26” deep by 20” high. Its substantial frame is constructed of heavy steel structural shapes. Square tubular support feet provide a convenient location in which to insert bars for lifting. Panels are readily removed to gain access for efficient, on the spot service. A cooling fan draws air thru a disposable filter to cool the power components.

The cabinet’s sturdy steel floor supports the furnace power transformer and the mechanical pump. Mounted within this structure also, are the S.C.R. power control, turbo-pump converter, control transformer, logic electronics, interlocks and plumbing. The controls are conveniently located at the left front. The finish used on this, and all CAMCo equipment is baked powder coat paint, chosen for its’ durability and solvent resistance.

## **Vacuum Chamber Assembly**

The double wall, water-cooled stainless steel vacuum chamber, a water-cooled copper pumping port baffle within the chamber, the gate valve, and the turbo-pump are assembled as a module. This is bolted at the chamber flange to the right top panel that supports the chamber assembly within the cabinet. The chamber cylindrical wall is penetrated by the element power feedthru ports, furnace thermocouple fittings, and the vacuum system neck. This neck includes fittings for the ion and convectron gauges, and gas vent port.

## **Chamber Door Assembly**

The double walled, water-cooled stainless steel door is flanged to mate with the chamber. The door handle includes a cam locking arrangement to easily compress the “O” ring door seal. Needle-bearing hinges provide accurate registration of the door to the chamber. A centrally located sight port permits viewing the work thru the viewing holes in the front shield stack. A positive locking solenoid prevents the door assembly from opening until the temperature of the furnace has cooled to the predetermined safe access temperature setpoint.

## **Heat Shield and Element Assembly**

The furnace proper is located within the double wall water-cooled chamber in the center of the frame. It is very conservatively rated for continuous 2000° C operation. The low voltage, .010 tungsten heating element is supported by the 1500 amp water cooled power electrodes. This element is surrounded by 2 tungsten and 6 molybdenum heat shields. Work is placed on a 3” dia Tungsten metal hearth. The top shield stack assembly is removed exposing the 3.5 diameter x 7” deep hot zone. Product is lowered onto the hearth by hand.

## **Heating Power Supply**

Power is delivered by a conservative, continuously rated 10 KVA transformer. This is driven by a digital line and load regulated, phase angled fired SCR control. A current limiting feature is included, which provides long element life.

## **System and Temperature Control**

Temperature control and monitoring functions are achieved using two high temperature type “C” thermocouples. Multi-stage programmed control is achieved through use of a Honeywell DCP302 process controller which receives its' input signal from the thermocouple located in close proximity to the heating element. Automatic time/temperature ramp and soak programmed control of up to nineteen different, 19 segment programs may be stored. The operator is required only to insert the load, specify a program by letter and press the start button to operate the furnace. The process controller, in conjunction with the vacuum gauge control, also provides necessary vacuum system control functions.

Load temperature monitoring is provided by a second thermocouple located within close proximity to the load. It drives a Honeywell UDC2300 process monitor, which provides digital readout of the load area temperature and provides an over-temperature shutdown signal. The process monitor also provides a safe chamber access interlock and access signal for the operator.

## **Atmosphere Control**

Our vacuum furnaces can be ordered with Combination Vacuum and Inert Reducing Atmosphere control. Through programming, either vacuum or atmosphere can be chosen to make this an ideal R & D or laboratory furnace. When this option is ordered, the furnace can run either Nitrogen or Argon as the purge gas. The process gas can be Hydrogen, Hydrogen Argon or Hydrogen Nitrogen.

A Bubbler to humidify the process gas would come standard with this option. A burnoff column to ignite excess process gas is also standard.

As with our standard atmosphere furnaces, this combination furnace comes with all the safety interlocks required with Hydrogen operation.

## **Safety Features**

- Thermocouple break protection (Thermocouple burn-up) 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
- Vacuum Ramp Delay
- Heaters are interlocked with the vacuum gauge control so that heating will not occur if there is insufficient vacuum.
- Thermal overload protection for the Turbo Molecular Pump
- High Vacuum isolation valve to protect the Turbo Pump during vent and quick cooling of the hot zone.

An operating manual is supplied with the equipment. Blank 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, which is depicted by the enclosed example worksheet.

Included are a trouble-shooting guide, spare parts list, major component product sheets, manuals and a full equipment description with facilities drawings.

Facilities information is supplied prior to shipment to assist in preparation for receipt of the equipment.