

6" DIA. X 18" Work Area
Inconel Retort Furnace

For programmed continuous operation
to 1100° C in dry or wet Hydrogen.



Size: 57" (140 cm) W. x 30" (75 cm) D. x 75" (190 cm) H.

Standard Features

- Microprocessor Controlled
- 1/8" Thk. retort inconel chamber
- Open clamshell for quick cool
- Air cooled
- 240V single phase, 30 Amp
- Dry Hydrogen operation
- Automatic burnoff of exhaust Hydrogen
- Durable powdercoat painted frame & panels
- Stainless Steel top skin
- Built in leveling guides

Options

- Chart Recorder
- Stainless Steel perf. protection cage
- Tower light
- Bubbler for humidification of process gas



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Specification Sheet

Equipment Model: TF-1100 Tube Furnace

Type	Externally Heated Horizontal/Inconel Retort
Maximum Temperature	1100 Degrees C.
Hot Zone	6" (15 cm) Diameter. x 18" (40 cm) Nominal
Frame Dimensions	54" (137 cm) W. x 28" (72 cm) D. x 75" (190 cm) H.
Power Requirements	230V 1 Ph., 50/60 Hz. 30 A
Gas Requirements	30 – 50 psig, Nitrogen – ¼" swagelok connection
	30 – 50 psig, Hydrogen – ¼" swagelok connection
D I Water for Bubbler	10 – 15 PSI, DI Water – ¼" swagelok connection

- Purge gas is Nitrogen.
- Process gas is Hydrogen.

Process Hydrogen can be passed through a bubbler column to achieve either a wet or dry process gas.

Cooling Requirements – Air cooled.

Note: This equipment can reach outside temperatures exceeding 100 degrees C. Clamshell heaters open up at the beginning of the cool down portion of the run for quick cooling.

Controls – Watlow 981 Program Controller
3 Programs – 5 Segments per programs
1 cool-down program

Standard Features:

- Sightglass for calibration melt.
- Multiple heat shields at ends for uniform hot zone.
- Ramp rate 15° C per minute – empty chamber.
- Burnoff column to burn off exiting Hydrogen.
- Tower Indicator Lights
- 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.



Model TF-1100 Inconel retort tube furnace

This discussion describes a production workstation for fully automatic processing of parts to a temperature of up to 1100° C in an inert and reducing atmosphere.

Overview:

The model TF-1100 is a retort style furnace with high temperature clamshell heaters. The retort is made from heavy wall Inconel alloy chosen for its strength at high temperatures. The door, which is located at the left end of the equipment, is made of Stainless Steel. Product is loaded thru this door and pushed to the center of the 6" diameter X 16 inch hot zone. Once the door is shut it remains locked out via an electrical solenoid that can only be operated under safe conditions (no presence of hydrogen or excessive heat). A program is selected in the microprocessor controller and the "start" button is pushed. The furnace will automatically purge with nitrogen, fill with process gas, ramp and soak to a pre set temperature and cool down. The cooling is accelerated thru a motorized linear actuator that opens the clamshell allowing the furnace to cool rapidly. The furnace will revert to nitrogen for a post purge.

Base Description:

The unit main frame is constructed of heavy gauge square steel tubing and angle iron. It is approximately 52" wide. The top, on which the oven is mounted, is 36" from the floor and the unit is approximately 22" from front to back. At the front is a 19" panel 10 1/2" high, containing all of the controls and instrumentation in a convenient location. The area of the frame behind this panel is fully enclosed to prevent electrical hazard. Air is drawn into this area via a fan located at the rear of the unit and is exhausted at vents between the top of this frame and the undersurface of the oven. The frame is finished in dark blue powder coating, which is baked on for durability. Panels are coated with similar material and colored light blue as is typical of CAMCo equipment. At the rear center of this frame is a mount to which the linear actuator that raises the oven top half is secured. This actuator is further discussed below.

Oven:

Mounted at the top of this frame is the oven itself. This oven shell is fabricated of stainless steel that is 28" wide, 16" front to back and is formed in two halves each 8" high. The top half is hinged to the bottom at the rear so it may be opened to expose the 165 mm (6 1/2") diameter Inconel muffle for more rapid cooling. The muffle is constructed of Inconel for high temperature durability. It is closed at the right end except for a 3/8-exhaust tube. The left end is flanged with an "O" ring groove. The 1/2" thick stainless steel door is hinged off of the flange and is latched via a spring tensioned latch. It is further latched and locked out by a solenoid controlled latching mechanism. The solenoid keeps the operator from accessing the chamber anytime a program is running.

Watlow monolithic, heater-cast-in-insulation, semi-circular heating modules capable of operating to 1100° C accomplish heating. As these are standard products from a large manufacture, replacements are always available, though long life is to be expected of these heater assemblies. The insulation integral to these modules is supplemented by refractory batt insulation occupying the space between the modules 12" outside diameter and the 16" square cross section of the stainless steel box. The electrical connections are made through the bottom of the box directly into the electrically protected area of the frame.

Control:

A Watlow 981 controller accomplishes automatic programmed control from start to finish of the process run. This program control has the capability of storing 4 programs of 6 segments each. Alternatively, it can store 2 programs of 12 segments each for more complex processes. The analog loop that controls the temperature receives its signal from a type "K" thermocouple located within the oven. The controller, in receiving this signal, compares it to its internally programmed temperature set point, and adjusts an output signal to the SCR unit accordingly. The SCR unit in turn drives the heating elements. The controller also includes, for operation at various times within the program, three event relays. Event relay 1 controls gas 1 (Nitrogen) used for purge. Event relay 2 controls the process gas flow meter labeled Hydrogen and Inert. Event relay 3 provides the signal to the linear actuator that opens the furnace for accelerated cool down and finally for access. Flow meters for the three gasses, each having a throttling valve at the bottom for flow adjustment are included on the front panel. Solenoid valves at the rear of these flow meters call for the gasses, as required and called for by the event relays.

A momentary switch on the panel is used to close the oven at the beginning of the run. As touched on earlier in this discussion, a motor driven linear actuator at the rear of the equipment connects to an arm on the oven top half, to open and close the oven. This actuator includes built in limit switches at the extended and retracted extremes of travel. By programming the amount of time the actuator is powered to raise the cover the amount of cover opening at intermediate stages can be programmed. The gasses from the flow meters previously discussed are manifolded together and come to a bulkhead fitting at the rear of the base frame. The gas is plumbed to the Inconel muffle via 1/4" stainless steel tubing. The left end of the chamber is flanged with a 1/2" thick stainless steel door, which is "O" ring sealed. An air-cooled plenum encompasses the left end of the Inconel muffle to keep the "O" ring and associated door latching mechanisms cool during the heating process. A spark type igniter ignites spent process gas at the right end of the tube where it exits through a vertical burn off tube, the tip of which is located under your heat exhausting hood. Molybdenum heat shield baffles are installed at each end to increase the temperature uniformity of the 6" x 16" (25 cm x 40 cm) hot zone.

Anticipated Process:

Parts are placed in the Inconel muffle.

The heat shield stack is installed.

The muffle door is closed and latched.

The switch is pressed to lower the upper furnace clamshell.

The program is chosen and started. It automatically proceeds as follows, completing the numbered functions:

1. Nitrogen is admitted for a preset amount of time.
2. Nitrogen is stopped, and Hydrogen flow starts. The igniter is powered. Heat-up to the programmed set-point starts. The oven heats at its inherent rate.
3. On reaching set point, the soak temperature is held for the programmed amount of time.
4. Heat is turned off, and the oven opens about three inches, and remains there for programmed time.
5. The oven opens fully. After preset time, Hydrogen flow is stopped at a safe temperature, the igniter is turned off, and Nitrogen is again admitted.
6. The furnace is cooled to ambient temperatures and gasses are turned off, the program ends, and the green access light is illuminated.

The door may now be opened for removal of the load, and another lot processed.

This furnace is well suited for clean firing, annealing, sintering and brazing of parts that require a clean controlled inert atmosphere. The process once developed is very repeatable and requires very little operator intervention.

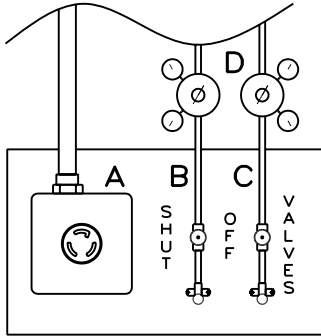
Estimated cost per run (approximately 3 hours) including power and gas is in the \$15 to \$20 range.

UTILITIES: PREPARED AS SHOWN BY CUSTOMER.

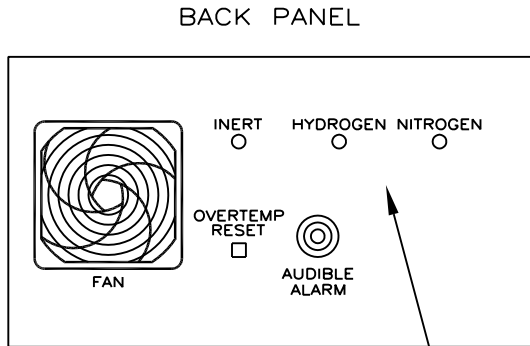
REV.	DATE	DESCRIPTION

- A: 240V SINGLE PHASE, 30A CIRCUIT BREAKER, 50/60Hz
- B: NITROGEN, 35 TO 50 PSIG AT A MAXIMUM FLOW OF 30 SCFH
- C: HYDROGEN 35 TO 50 PSIG AT A MAXIMUM FLOW OF 30 SCFH
- D: LINE PRESSURE REGULATORS SET AT 40 PSI.
- E: POWER CONNECTION 250V-30A 3 WIRE PLUG, NEMA L-6

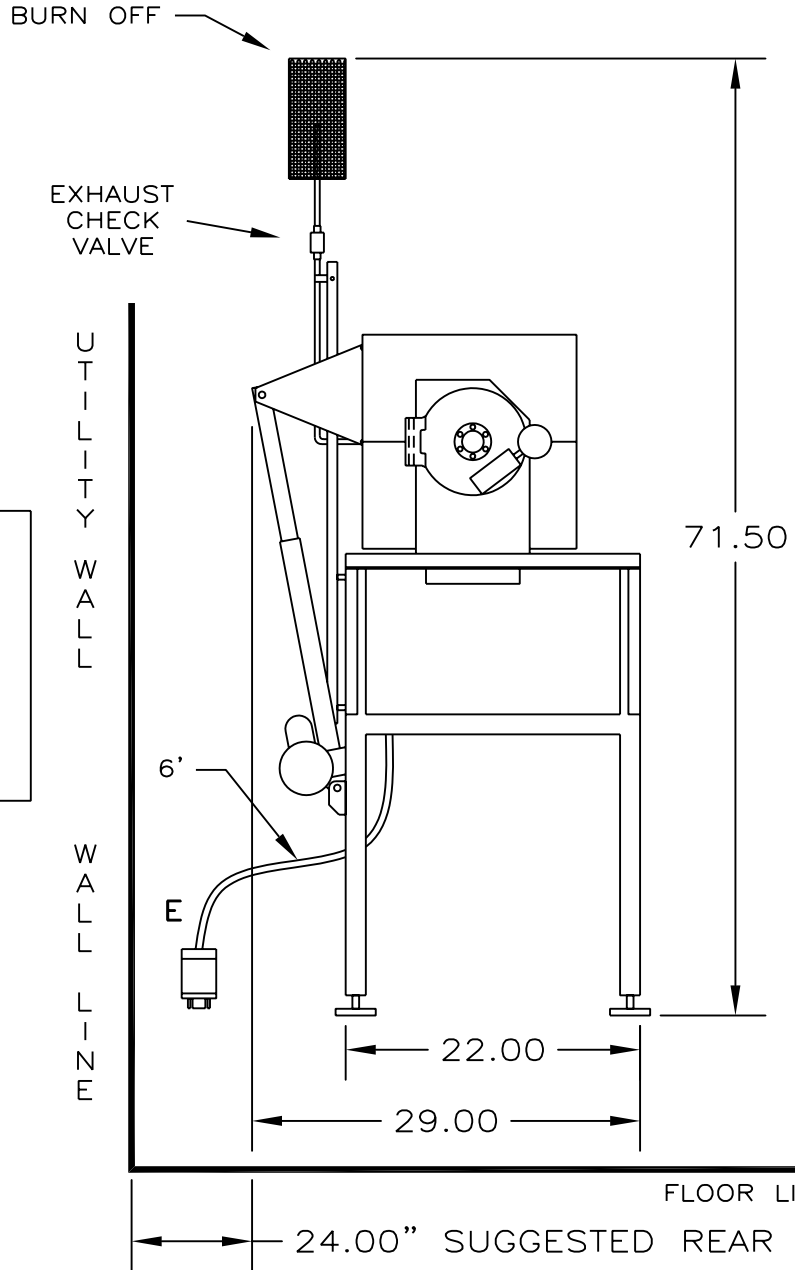
1/4" TUBE
1/4" TUBE



SUGGESTED UTILITY PANEL LAYOUT



1/4" FITTINGS FOR GAS CONNECTIONS



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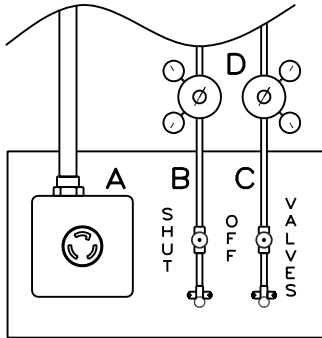
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		.XXX ±.005	MAT:			
.XXXX ±.0005	FINISH:	TITLE: TUBE FURN. FACILITIES PREP				
ANGLES ±1/2"		DWG.NO: 88747	SHEET 2 OF 2	REV:		

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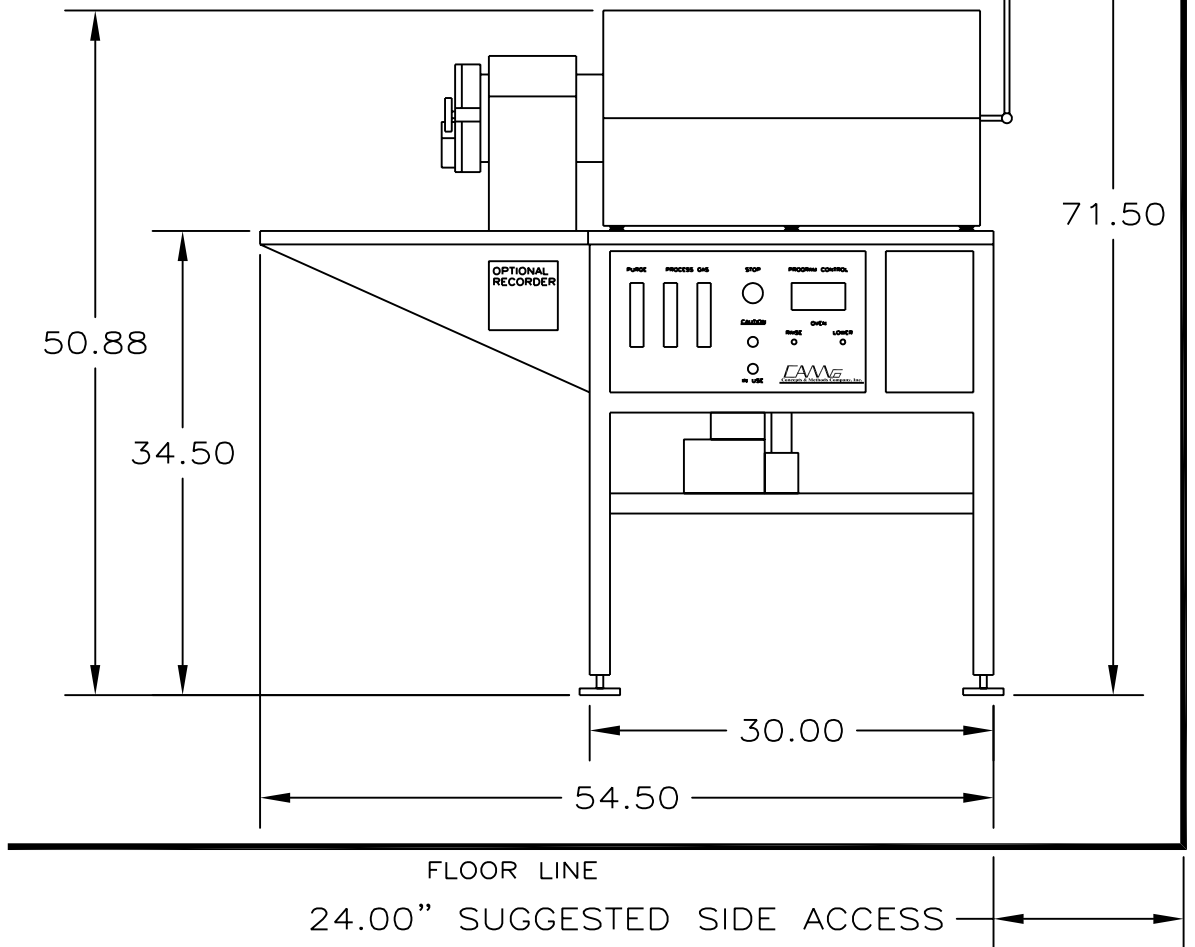
1/4" TUBE
1/4" TUBE



SUGGESTED UTILITY PANEL LAYOUT

BURN OFF

EXHAUST CHECK VALVE



W
A
L
L
L
I
N
E

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		TOL'S EXCPT AS NOTED	DRN.BY: ZEVADA 03/27/03	 Concepts & Methods Company, Inc.
		fract. ±1/32	APP.BY:	
		.XX ±.010	DATE: 03/27/03	TITLE: TUBE FURN FACILITIES PREP
		.XXX ±.005	MAT:	DWG.NO: 88747
		.XXXX ±.0005	FINISH:	SHEET 1 OF 2
USED ON TASK	FWO	ANGLES ±1/2'		REV:



TF-1100 with clamshell opened up for fast cool