



Manufacturers of High Temperature & High Vacuum Equipment

1017 Bransten Road | Phone (650) 593-1064
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Specification Sheet

Camco Equipment Model:
B-ATM-16 Hydrogen Furnace

Chamber Atmosphere	Hydrogen (Wet/Dry) or Inert Gas, Positive Pressure
Chamber	Stainless Steel Coldwall (Watercooled), Top Loading
Maximum Operating Temperature	1600° C.
Hot Zone	12" (30 cm) Diameter x 18" (45 cm) Tall
Heating Elements	Molybdenum Rod, Resistive
Frame Dimensions	65" (165 cm) W. x 28" (72 cm) D. x 50" (127 cm) H
Power Requirements (Domestic)	480VAC 3 Ph. 60A or 240VAC 3 Ph. 120A, 50/60 Hz
Power Requirements (International)	400VAC 3 Ph. 60A 50 Hz
Gas Requirement 1: Inert Gas	35 - 50 psig, Nitrogen or Argon - 1/4" Swagelok
Gas Requirement 2: Reducing Gas	35 - 50 psig, Hydrogen or H5N - 3/8" Swagelok
Cooling Requirements	5 Ton (60,000 BTU) 5 GPM minimum, at 40 PSI maximum
Hydrogen Exhaust	Burnoff Stack OR Must be vented from building - See local requirements

Heat up ramp rate 60° C per minute - empty chamber.

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

Standard Features:

- Touchscreen Controller
- Mass Flow Controllers (MFC)
- Vacuum Pump
- Oxygen Sensor
- Tower Indicator Lights
- Three Process Thermocouples
- Cascade Controls and Guaranteed Soak
- Sightglass for calibration melts
- Ethernet Webserver and FTP Connectivity
- Automatic segment-based process control
- Intuitive graphical user interface - Easy to learn, operate and use!
- Uses standard USB memory and .CSV fileype - no dongles or subscriptions
- Free updates when available

Common Options:

- Process Gas Humidifier (Bubbler)
- Dewpoint Monitor
- Burnoff Column
- Cable Lifting Hoist for heavy part loading
- Additional survey thermocouples
- High Vacuum Operation - *please inquire*
- Custom High-Temperature Furniture



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Equipment Description: Model B-ATM-16

12" Dia. X 18" H., 1600° C.

REDUCING/INERT ATMOSPHERE,
COLDWALL FURNACE

For Automatic, Programmed Operation to 1600° C



Overview

The Concepts & Methods Co., Inc. "B-ATM-1600", reducing/inert atmosphere furnace is designed to reproducibly metallize, braze, clean fire, and otherwise process loads of up to 11" diameter by 16" high. Materials may be lowered onto it's hearth within the 12" dia. by 18" high work area. Up to 40 selectable ramp and soak programs are accurately controlled up to 1600° C. The process gas, thermal controls, and interlocks are operated automatically by a single touchscreen controller to assure simple and reliable programmed operation.

The furnace chamber is located within the center of the base unit and loaded from the top. It incorporates a Molybdenum heating element of six sections supported by high alumina insulators. This surrounds the twelve-inch diameter by eighteen-inch high work area. Work is placed on a 12" molybdenum hearth, which in turn is held by the support structure within the chamber. A series of six cylindrical heat shields, the bottom end stack of nine shields, and the removable top shield stack of eight heat shields surround the element. A double wall, water jacketed stainless steel chamber contains these items as well as the six insulated power feedthroughs, control and work thermocouples and other required features.

The water-jacketed cover assembly is reliably sealed to the chamber through the use of an interlocked camming latch. A 5/8" diameter sightport is located at the center of the cover, and its centerline is vertical. In registration with this are holes of approximately 7/16" diameter, which penetrate the top heat shield stack. A "flag" in close thermal proximity to the work monitoring thermocouple may thus be watched, and a precise calibration thereby obtained. This viewpoint can also be used in conjunction with an optical pyrometer. The sight glass is sealed through use of an "O" ring, and is readily removable to facilitate cleaning or replacement. There is a feedthrough at the side of the chamber and related holes in the cylindrical shields that allow survey thermocouples to be inserted to monitor actual temperature of load. These thermocouples can be used in conjunction with additional heating modes such as "cascade controls" and guaranteed soak.

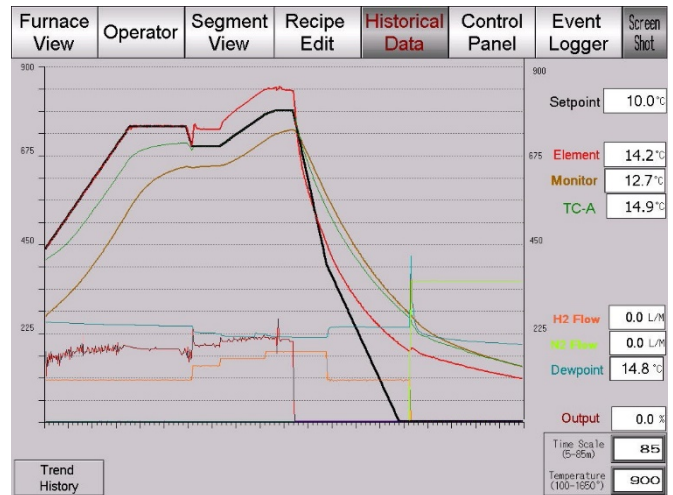
Base Unit

The base unit measures approximately 72" wide by 29" deep (to fit through a standard door) by 50" high. Its' substantial frame is constructed of heavy wall square steel tubing. Service access is readily gained through a hinged steel front-mounted door and the removable side rear and left front panels. The plate steel floor within the frame supports the heavy heater power transformer, vacuum pumps, and all high voltage electronics. The left half, containing the power components and electronics, is isolated from the rest of the machine by an internal airflow-directing baffle. A fan at the rear of the base unit draws cooling air through a replaceable filter element to cool the power control unit and transformer. In addition, the base frame supports the instrument console, chamber, cover hinge and latch assemblies. A convenient feature is the inclusion of recessed heavy-duty casters. The unit is easily rolled into place, and the leveling feet are lowered to immobilize and level the equipment. The stainless steel top provides an area for convenient load preparation and completes the closure of the base unit. There is approximately 28" x 28" area the right side of the chamber for convenient loading and unloading. The finish used on this, and all CAMCo equipment is baked, powder coating was chosen for its' durability and solvent resistance.

Temperature Control

Multi-stage programmed Ramp & Soak Temperature control and atmosphere sequencing are achieved through the use of an IDEC PLC and touchscreen controller. The controller receives its' input signal from a thermocouple located close to the heating element. A second thermocouple is used to monitor the load. A third flexible inconel sheathed type "K" thermocouple can be attached directly to the workload for processes below 1250°C. All inputs are logged by the controller for real-time monitoring as well as observing historical data.

Thermocouple break protection assures that heating power is removed from the furnace in the event of sensor failure.



Operation

The 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 "RUN" key is pressed. Gas flows and dewpoint are set. The furnace will automatically pump down, pre-purge, process gas fill, perform the pre-programmed ramp & soak temperature profile, cool down, and then post purge for safe chamber access. Upon completion of the cooldown portion of the program, the chamber is opened and unloaded.

Power Control

Power is proportionally controlled through the use of a digitally controlled SCR three-phase power module. This unit is phase angle fired control and includes three-phase current limiting made necessary by the strongly positive resistivity coefficient of the heating elements. In the event of a power outage at a higher temperature, the load temperature would drop to a level where a hard application of heat might thermally shock damage the parts. In this event, an abort relay will trip, and the program will resume and time out under the process atmosphere without the application of heat. Impedance match of the heating elements to the incoming power is accomplished through the conservatively rated 40KVA transformer driven by this power module.

Atmosphere Control

Customer supplied Hydrogen and Nitrogen gasses are admitted to the chamber through programmed valves and mass flow controllers (MFC). An interlock is included which provides for automatic Nitrogen purge in the event of loss of Hydrogen/Nitrogen or chamber pressure. Flowrates are set within each recipe and can vary between each of the 19 segments per recipe. An optional "bubbler" humidifies a portion of the selected process gas via a bubbler column. This gas is then recombined with the remaining process gas in that is controlled by a manual metering valve. This bubbler column 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, the absence of this pressure prevents the admission of Hydrogen and inhibits the application of heater power. An optional 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

All Camco machines adhere to relevant standards outlined in the NFPA 86 Standard for Industrial Ovens and Furnaces.

These numerous interlocking safety features include:

- Panel Interlocks remove high voltage when open
- Over-temperature Limit Abort
- Adjustable chamber “Safe Access Temperature” to protect operators
- High cabinet temperature
- Chamber exterior temperature
- Low coolant flow
- Low Process Gas pressure switches
- Mandatory vacuum pumpdown and rate-of-rise leakback test before every run
- Oxygen sensor on exhaust lines
- Hard-coded minimum Nitrogen purge time and flowrates regardless of the recipe
- Mandatory “Must-Purge” Nitrogen events in the case of abort or power failures
- A normally open solenoid valve on the nitrogen purge circuit assures that the furnace is always under a constant flow of gas in the event of a power failure. This feature will purge the chamber of hydrogen so that the furnace chamber will have a safe atmosphere to be opened to.

Documentation

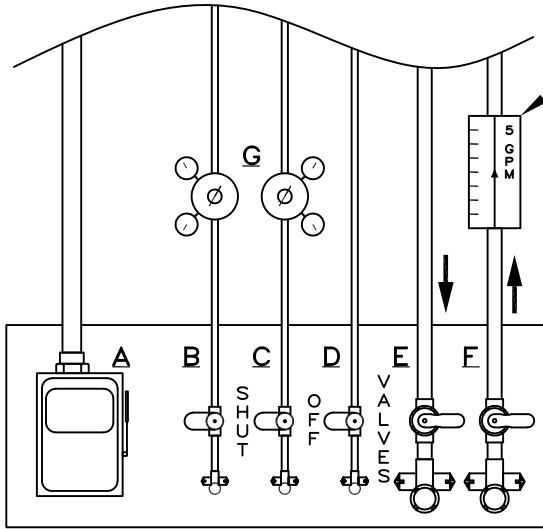
Facilities information is supplied to assist in site preparation for installation. An operating manual is supplied with the equipment. Worksheets included in the manual provide a convenient form to depict the desired process for entry into the touchscreen controller. The worksheets also serve as a hard 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, dewpoint monitor, and other small items are supplied in our documentation. A recommended startup sequence and relatively simple operation of the furnace are 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. Other, less commonly ordered options can also be provided. Please inquire.

UTILITIES: PREPARED AS SHOWN BY CUSTOMER.

- A: 150 A/LEG 208V. OR 120@240V. OR 60@480V. 60Hz 3 PH DISCONNECT
- B: NITROGEN, 25 TO 50 PSIG AT A MAXIMUM FLOW OF 30 SCFH
- C: HYDROGEN 25 TO 50 PSIG AT A MAXIMUM FLOW OF 30 SCFH
- D: D.I. WATER FOR BUBBLER MAKEUP
- E: COOLING WATER SUPPLY; 25 PSIG MIN. AT 4 GPM MAX.—SEE NOTE
- F: COOLING WATER RETURN OR PRESS. DRAIN IF USED—SEE NOTE
- G: LINE PRESSURE REGULATORS SET AT 40 PSI.

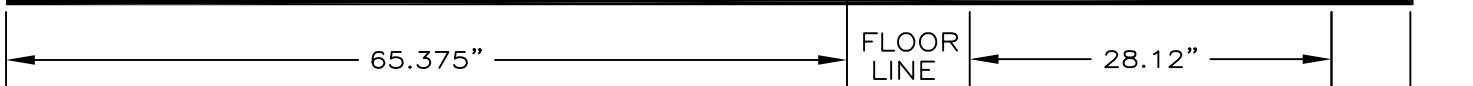
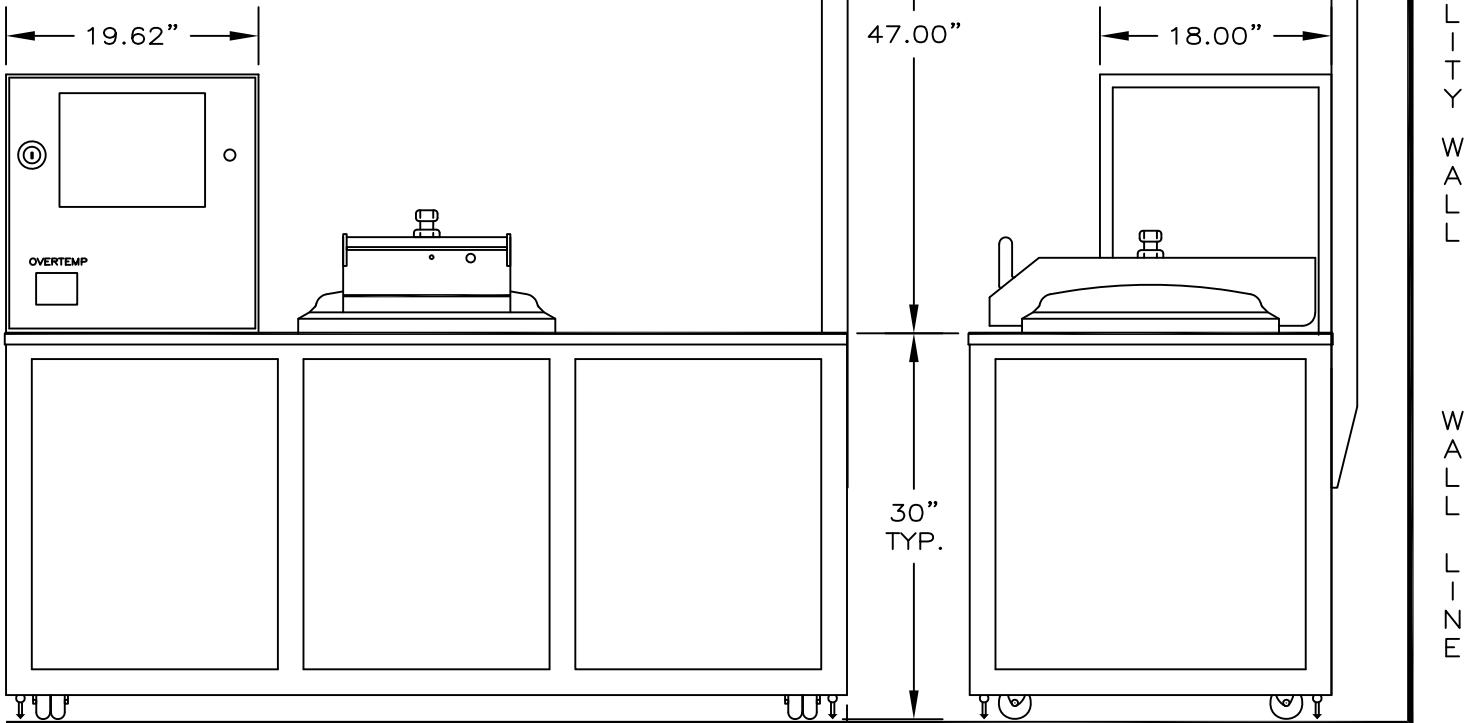
- 1/4" TUBE
- 3/8" TUBE
- 1/4" TUBE
- 1/2" FPT
- 1/2" FPT



5 GPM FLOWMETER

NOTE: (MAX. BACK PRESSURE 15 PSIG AT 4 G.P.M.)
(MAX LOAD—60K BTU (5 TON) FOR CHILLER CALC)
INLET WATER TEMP 60—80F

SUGGESTED UTILITY PANEL LAYOUT



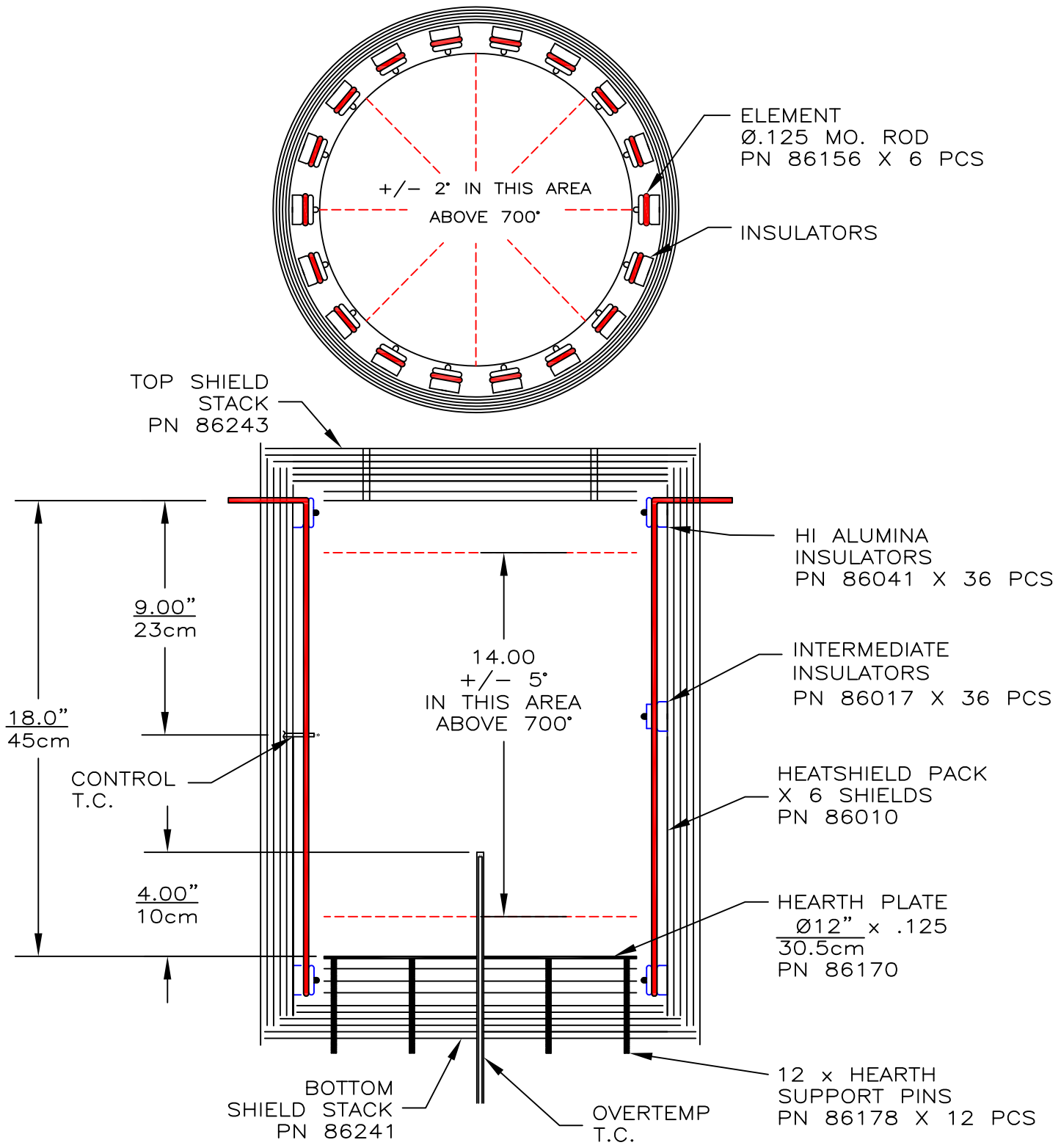
(ALL CASTERS SWIVEL.)

24.00" SUGGESTED REAR ACCESS


		TITLE: B FURNACE FACILITIES PREP.		
		DRN.BY: T BARULICH	APP.BY: TONY BARULICH	
USED ON TASK	FWO	DATE: 8-26-21	DWG.NO: 86263-B	SHEET 1 OF 3

B-16 HOT ZONE
12"DIA X 18"

REV.	DATE	DESCRIPTION



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USED ON TASK	FWO	TOL'S EXCPT AS NOTED	DRN.BY: T BARULICH	 Concepts & Methods Company, Inc.
		fract. ±1/32	APP.BY:	
.XX ±.010	DATE: 8-4-18			
.XXX ±.005	MAT:			
.XXXX ±.0005	FINISH:			
ANGLES ±1/2°		TITLE: B-16 HOT ZONE TEMP UNIFORMITY		DWG.NO: 88202-3
				SHEET 3 OF 3
				REV: