

**INSTRUCTION MANUAL  
FOR  
MODEL 7360V  
VERTICAL CURING CHAMBER**

Revision E – May 2015  
98-0520

S/N \_\_\_\_\_



Поставщик: ЗАО "ТЕХИМПОРТ"  
Адрес: 614007, г. Пермь, ул. 25 Октября 72, офис 40  
Телефон: +7 (342) 262-85-56  
Факс: +7 (342) 262-85-60  
email: [office@techimport.ru](mailto:office@techimport.ru)  
[www.techimport.ru](http://www.techimport.ru)

Copyright © 2015, by Chandler Engineering Company L.L.C.

All rights reserved. Reproduction or use of contents in any manner is prohibited without express permission from Chandler Engineering Company L.L.C. While every precaution has been taken in the preparation of this manual, the publisher assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein.

This publication contains the following trademarks and/or registered trademarks. AMETEK, CHANDLER ENGINEERING. These trademarks or registered trademarks and stylized logos are all owned by AMETEK, Inc. All other company, product and service names and logos are trademarks or service marks of their respective owners.

# Table of Contents

<b>General Information .....</b>	<b>P-1</b>
Initial Inspection .....	P-1
Features .....	P-1
High Temperature Alarm .....	P-1
Specifications .....	P-1
About the High Pressure Seal .....	P-2
<b>Section 1 - Installation .....</b>	<b>1-1</b>
Site Requirements .....	1-1
Connecting Air and Water .....	1-1
Connecting Power to the Curing Chamber .....	1-2
<b>Section 2 - Curing Chamber Controls .....</b>	<b>2-1</b>
Safety Procedures .....	2-1
Power Switch .....	2-1
Model 7050 Temperature Controller.....	2-1
Drain Cylinder/Fill Cylinder switch .....	2-2
Heater Switch .....	2-2
Pressurize Cylinder Switch .....	2-2
Cool Cylinder Switch.....	2-2
Cylinder Drain Valve .....	2-2
Pump Pressure Adjust Regulator .....	2-3
Temperature Limit Alarm .....	2-3
Temperature Limit Alarm Reset .....	2-3
<b>Section 3 - Operation .....</b>	<b>3-1</b>
Preparation of Cement Sample .....	3-1
Installing Cylinder Plug.....	3-1
Filling Cylinder with Water .....	3-1
Temperature Control .....	3-2
Pressure Control .....	3-2
Running the Test .....	3-3
If Temperature Limit Alarm Occurs .....	3-3
Cooling the Cylinder .....	3-3
Draining the Cylinder .....	3-4

Section 4 - Maintenance and Servicing ..... 4-1  
    Maintenance ..... 4-1  
    Troubleshooting ..... 4-1  
Section 5 – Replacement Parts ..... 5-1  
Section 6 - Drawings and Schematics..... 6-1

# General Information

## Initial Inspection

The Model 7360V Vertical Curing Chamber was tested and inspected before the unit was shipped from Chandler Engineering. The curing chamber was run through a typical temperature and pressure profile prior to shipment. Carefully uncrate and inspect the curing chamber and any accessories. If the unit is received in a damaged condition, immediately notify Chandler Engineering in writing, and immediately file a claim with the carrier.

## Features

The Model 7360V Vertical Curing Chamber is equipped with the following features:

Ramp and soak PID temperature control using the Chandler Engineering Model 7050 Temperature Controller.

Variable high pressure limit control. High-pressure limit may be adjusted using high-pressure limit regulator located on the front panel.

The instrument is equipped with a pump pressure adjustment, which can be used to maintain the pressure in the instrument above a desired lower limit. If the instrument pressure drops below the lower limit, the pump will increase the pressure back up above the lower limit.

### **High temperature alarm**

If the cylinder temperature exceeds the limit, the high temperature alarm will cause the heater to shut off. This is indicated by a lighted pushbutton-switch on the front panel. The high temperature alarm must be reset manually using the front panel reset switch before the heater will again become operational.

## Specifications

**Temperature Control:** External 3000-Watt heater and internal thermocouple connected to Chandler Model 7050 Temperature Controller. This controller is capable of ramp and soak or multi-set-point PID control.

**Pressurizing System:** The unit is pressurized using an air driven hydraulic pump with water used as the pressurizing medium. The pressure can be accurately controlled using the HIGH PRESSURE LIMIT REGULATOR and the PUMP PRESSURE ADJUST REGULATOR.

**Maximum Operating Pressure:** 6000 psi/41.4 MPa

Maximum Operating Temperature: 600°F/315°C

Heater

Heater power: 3000 Watts  
Heater type: External, 2 piece, mica band-heater  
Heater control: Solid-state relay with temperature feedback

Power Requirements

Input voltage: 220 ± 10% VAC, single phase  
Input power: 3.2 kVA  
Input frequency: 50 or 60 Hz

Mechanical

Height: 20 in/51 cm  
Width: 21.5 in/55 cm  
Length: 19 in/48 cm  
Weight: 150 lb/68 kg  
Pressure vessel material: AISI/SAE 15-5 PH stainless steel

Environmental

Operating temperature: 32°F - 105°F/0°C - 40°C  
Operating humidity: 0 - 95% non-condensing

Air and water supply

Compressed air: 75-125 psig/517 - 862 kPa  
Water: 20 - 40 psig/135 - 275 kPa  
Fittings: 1/4 in/6.4 mm

## About the High Pressure Seal

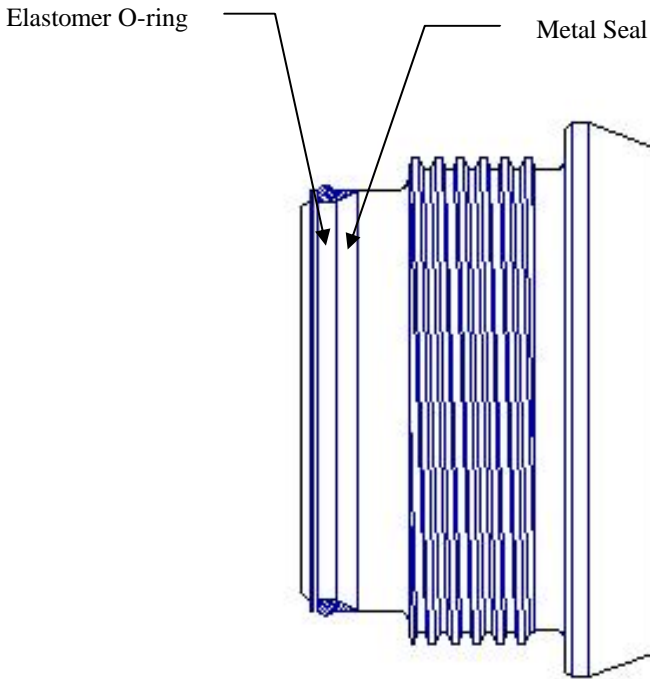
The cylinder and plug used in the Model 7360V Vertical Curing Chamber were designed for reliable sealing and ease of use. The principle behind the seal design is outlined below. You may find it convenient to refer to Figure 1 for further clarification.

The primary high-pressure sealing element is the metal seal ring (2). As the pressure inside the cylinder increases, the seal ring is wedged between the plug (1) and the cylinder forming a tight metal-to-metal seal. One feature of this seal is that as pressure increases, the seal becomes tighter.

At low pressures, however, the metal seal ring will not make an effective seal. For this reason, an internal O-ring (3) is added below the metal seal ring (2). The internal O-ring is used to make the initial seal. When the pressure inside the cylinder is increased, the internal O-ring (3) is forced against the metal seal ring (2), which wedges between the plug and cylinder and creates the metal-to-metal seal. The retaining ring (4) is simply used to secure the metal seal ring and the internal O-ring in place.

During high temperature tests (exceeding 500°F/260°C) the internal O-ring may be damaged to the extent that it can no longer form an effective seal. This will not affect the metal-to-metal seal in any way as long as the pressure in the cylinder is maintained above 1600 psi/11 MPa.

**NOTE:** Do not attempt to operate the instrument without the metal seal ring (2) and the internal O-ring (3). Doing so could cause seal failure and the release of hot water or steam.







# Section 1 - Installation

## Site Requirements

This instrument has been designed with operator safety as a primary consideration. The following safety procedures are recommended to help insure safety for both operator and other laboratory personnel.

- Locate the instrument in a low traffic area.
- Post signs where the instrument is being operated to warn other personnel.
- A fire extinguisher, Type 8 BC, should be located within 50 feet/15 meters of the instrument.
- Have the safety officer at your plant or laboratory review the safety aspects of the instrument and installation and approve the operational and installation procedures.

## Connecting Air and Water

This instrument requires compressed air at pressures between 75 and 125 psi/517 - 862 kPa. Water is also required at pressures between 20 and 40 psi/135 - 275 kPa. All of the air, water, and steam fittings have ¼-inch NPT threads.

- Connect air supply line to the fitting on the rear of the instrument marked AIR INLET.
- Connect the water supply line to the fitting on the rear of the instrument marked WATER INLET.
- Connect water drain line to the fitting on the rear of the instrument marked COOLING WATER OUTLET. Copper drain line is strongly recommended as the hot water may melt rubber or plastic drain lines.
- Connect the cylinder drain line to the fitting on the rear of the instrument marked CYLINDER WATER DRAIN. Only metal (copper or stainless steel) drain line should be used as the steam and hot water released will melt rubber or plastic drain lines.

*Caution: Connecting the COOLING WATER OUTLET and CYLINDER WATER DRAIN lines is not recommended. If these two lines are connected, water may back up into the cylinder if the plug is removed while the CYLINDER DRAIN valve is open.*

## Connecting Power to the Curing Chamber

This instrument operates on  $220 \pm 10\%$  VAC, 50 or 60 Hz, single phase, 15A electrical current. The instrument is equipped with a power cord and should be connected to an appropriately rated power source. (The earth ground connection on the rear of the instrument should be connected to a metal water pipe, a metal rod driven in the ground, or other appropriate earth ground.)

*Note: Remove **ALL** power connections from the unit before opening the covers or performing any service operations. The High Current 220 VAC or 120 VAC voltages inside the unit can **KILL***

# Section 2 - Curing Chamber Controls

## Safety Procedures

The following safety procedures are recommended to help insure operator safety:

- Read and understand the instructions before operating the instrument.
- Never exceed the temperature or pressure ratings listed on the front panel.
- Disconnect main power before servicing the instrument.
- Turn off heater at the completion of the test.
- Do not attempt to open the CYLINDER DRAIN valve until the water temperature is below 200°F (93°C).
- Use caution when opening the CYLINDER DRAIN valve at high temperatures and pressures.
- Make certain that the side panels are in place when operating the instrument.
- Always install a new plug O-ring if the cylinder temperature has exceeded 350°F/177°C.

## Control Panel Functions

Figure 2 shows how the front control panel is designed. You may find it convenient to refer to this figure as you study the control panel functions.

### **Power Switch**

The Power switch controls all electrical power to the instrument.

### **Model 7050 Temperature Controller**

The Model 7050 Temperature Controller controls the 3000-Watt cylinder heater. The water temperature is measured using a thermocouple inserted through the bottom of the cylinder. The controller may be programmed in a variety of ways to provide different test conditions.

For the heater to function, the HEATER switch must be in the ON position and the temperature controller must be operating. If a heat-up cycle must be stopped, the heater can be turned OFF by switching the HEATER switch to the OFF position or by pressing the START/STOP button on the controller.

Please refer to the *Model 7050/7051 Temperature Controller* manual for detailed instructions on the operation of the temperature controller.

### **Drain Cylinder/Fill Cylinder switch**

The DRAIN CYLINDER/FILL CYLINDER switch is used to fill the cylinder with water or to remove water from the cylinder. When the switch is in the FILL CYLINDER position, the cylinder will fill with water. The switch must be in the FILL CYLINDER position or the pump will not operate. In general, anytime the instrument is in use, the switch should be in the FILL CYLINDER position. At the conclusion of a test, the CYLINDER DRAIN valve should be opened and the switch moved to the DRAIN CYLINDER position. This will remove all water from the cylinder. When the unit is not in use, the switch should be in the OFF position.

### **Heater switch**

The HEATER switch controls all of the power to the heater elements. This switch will override any control to the heater by the Model 7050 Temperature Controller.

### **Pressurize Cylinder switch**

The PRESSURIZE CYLINDER switch is used to increase the pressure in the cylinder by turning the hydraulic pump ON.

### **Cool Cylinder switch**

The COOL CYLINDER switch controls the flow of water to the internal cooling coils. This switch should always be in the OFF position during a test and then switched to the ON position at the completion of the test to cool the cylinder.

### **Cylinder Drain valve**

The CYLINDER DRAIN valve is used in conjunction with the DRAIN CYLINDER switch to drain water from the cylinder after completion of a test. The CYLINDER DRAIN valve should never be opened until all the pressure has been bled from the cylinder and the temperature is below 200°F/93°C.

### **High Pressure Limit Regulator**

The HIGH PRESSURE LIMIT REGULATOR knob is used to select the upper set point pressure prior to the beginning of the test. To select the desired pressure upper limit, turn the HIGH PRESSURE LIMIT REGULATOR knob in (clockwise) as far as it will go. With the cylinder filled with water and the FILL CYLINDER switch in the ON position, turn the pump switch to the ON position until the desired pressure set point is reached. The PUMP PRESSURE ADJUST regulator may need to be adjusted if the pump will not reach the desired pressure. Slowly turn the HIGH PRESSURE LIMIT REGULATOR knob out (counterclockwise) until the pressure just begins to drop. The high-pressure limit regulator is

now at the proper set point. The high-pressure limit regulator will only keep the pressure from exceeding the set point. Maintaining the pressure above a certain level can be done by adjusting the PUMP PRESSURE ADJUST regulator.

### **Pump Pressure Adjust Regulator**

The PUMP PRESSURE ADJUST regulator is used to control the maximum pressure of the hydraulic pump. Turning the regulator knob in (clockwise) will increase the maximum pump pressure. Turning the regulator knob out (counterclockwise) will decrease the maximum pump pressure. When the PRESSURIZE CYLINDER switch is in the ON position, the PUMP PRESSURIZE ADJUST regulator may be used to maintain cylinder pressure above a certain level. The PUMP PRESSURE ADJUST may also be used to slowly and quietly increase the cylinder pressure. This is done by turning the PUMP PRESSURE ADJUST knob clockwise while the PRESSURIZE CYLINDER switch is in the ON position.

### **Temperature Limit Alarm**

The TEMPERATURE LIMIT ALARM switch light will come on if the maximum allowable cylinder temperature is exceeded. When a TEMPERATURE LIMIT ALARM occurs, the heaters are automatically switched off. The TEMPERATURE LIMIT ALARM switch will not go off and the heaters will not operate until the manual TEMPERATURE LIMIT ALARM switch is pressed.

### **Temperature Limit Alarm Reset**

The Temperature Limit Alarm Reset is used to reset the TEMPERATURE LIMIT ALARM. When the alarm is tripped, the light will not go off and the heaters will not operate until the TEMPERATURE LIMIT ALARM switch is pressed.



## Section 3 - Operation

### Preparation of Cement Sample

Assemble two side plates, one bottom plate, two end plates, and three partitions of the mold assembly. Do not over-tighten nuts.

Fill the greased molds with cement slurry prepared in accordance with API Specification 10, *Specification for Materials and Testing for Well Cements*.

The slurry should be puddled and excess slurry removed from the mold.

Attach the top plate with the slotted side down. Place the molds in the cylinder.

### Installing Cylinder Plug

Before the plug is installed into the cylinder, make certain that the plug threads, O-rings, and metal sealing surfaces have been thoroughly lubricated with Moly grease or similar high temperature lubricant.

*Note: Install a new O-ring after any test in which the temperature exceeds 350°F/177°C.*

Check internal O-ring on bottom of plug. Replace if it becomes cut, torn, or brittle.

Screw plug into cylinder. Do not tighten plug more than hand tight. Over tightening the plug will not cause more effective sealing and may cause difficulty in removing the plug from the cylinder. See **ABOUT THE HIGH PRESSURE SEAL** in the Preface.

### Filling Cylinder with Water

Loosen the small plug on the top of the cylinder to allow air to escape while filling. Make sure that all valves are closed and all switches (except power switch) are in the off position.

Place FILL CYLINDER switch in the ON position.

When water escapes from the small plug, indicating the cylinder is full, tighten with a 5/8" wrench.

## Temperature Control

Complete instructions on the programming and operation of the Model 7050 Temperature Controller can be found in the *Model 7050/7051 Temperature Controller* manual.

## Pressure Control

1. Turn the HIGH PRESSURE LIMIT REGULATOR knob all the way in (clockwise).
2. Turn the PRESSURIZE PUMP switch to the ON position until the desired set point pressure is reached. Increase the pump pressure by turning the PUMP PRESSURE ADJUST regulator clockwise if necessary to reach the desired pressure. If the cylinder does not begin to pressurize after a few seconds, it may indicate trapped air in the cylinder. The trapped air can be removed by loosening the 5/8" hex plug in the top of the cylinder.
3. Turn the HIGH PRESSURE LIMIT REGULATOR knob out (counterclockwise) until the pressure begins to drop. The upper limit on pressure has now been set. The pressure will automatically bleed off when this set point pressure is reached.
4. Open the CYLINDER DRAIN valve to bleed the pressure.
5. Close the CYLINDER DRAIN valve.
6. Turn the PUMP PRESSURE ADJUST regulator out (counterclockwise) as far as it will go.
7. Turn the PRESSUIZE CYLINDER switch to the ON position.

*Caution: Do not set the instrument at a pressure that will allow the water to turn to steam. A pressure of 1600 psi/11 MPa at a temperature of 600°F/315°C is adequate to prevent this.*

8. Open the CYLINDER DRAIN valve to bleed the pressure, if desired.
9. Close the CLINDER DRAIN valve.



## Running the Test

If necessary, press the RESET button to reset the TEMPERATURE LIMIT ALARM.

Make certain the FILL CYLINDER switch is in the ON position; the HEATER switch is in the ON position; and the COOL CYLINDER switch is in the OFF position.

Also make certain the CYLINDER DRAIN valve is closed and the cylinder is filled with water.

Start the Model 7050 Temperature Controller.

Use the PRESSURIZE CYLINDER switch to increase the cylinder pressure to the desired level, if necessary. The PRESSURIZE CYLINDER switch may be left in the ON position to maintain a minimum pressure if the PUMP PRESSURE ADJUST regulator has been set as outlined in the *Pressure Control* section.

### **If Temperature Limit Alarm Occurs**

If the cylinder exceeds its maximum operating temperature, a TEMPERATURE LIMIT ALARM will occur. When this alarm occurs, the yellow pushbutton switch will light and the heaters will cease to operate. The only way to reset this alarm is by pressing the lighted switch on the front panel. If a TEMPERATURE LIMIT ALARM occurs, the instrument should not be operated again until the reason for the alarm is found and corrected.

## Cooling the Cylinder

The 7360V Vertical Curing Chamber is equipped with internal cooling coils for rapid cylinder cooling at the completion of a test. The following is the procedure for cylinder cooling.

1. Make certain that the PUMP PRESSURE ADJUST regulator has been set so that pressure in the cylinder is maintained at 1600 psi/11 MPa or greater until the temperature of the cylinder is below 200°F/93°C. This will prevent water in the cylinder from flashing into steam.
2. Turn the PRESSURIZE CYLINDER switch to the ON position if it is not already in the ON position.
3. Turn the HEATER switch to the OFF position.
4. Turn the COOL CYLINDER switch to the ON position.
5. Depress the STOP pad on the 7050 Temperature Controller.

6. When the cylinder has cooled below 200°F/93°C the PRESSURIZE CYLINDER switch may be turned to the OFF position and the CYLINDER DRAIN valve may be opened which will allow water to circulate through the cylinder for more rapid cooling.
7. Cool the cylinder as long as API Specification 10 permits. If cooling water circulation is stopped prematurely, heat from the cylinder may cause the temperature of the water in the cylinder to rise and flash the water to steam.

## Draining the Cylinder

1. Turn all valves to the OFF position.
2. Turn the PRESSURIZE CYLINDER and FILL CYLINDER switches to the OFF position.
3. Open the CYLINDER DRAIN valve.
4. Turn the DRAIN CYLINDER switch to the ON position until the water has drained from the cylinder. A minimum of two minutes is recommended.
5. Close the CYLINDER DRAIN valve.
6. Turn the FILL CYLINDER/DRAIN CYLINDER switch to the OFF position.
7. When all the pressure has been removed from the cylinder, carefully remove the plug from the cylinder.

*Note: Cylinder plug may be hot. The plug weighs 22 pounds/10 kg. Use caution to prevent dropping the plug.*

The molds may now be removed from the cylinder.

# Section 4 - Maintenance and Servicing

The 7360V Curing Chamber was designed to require little maintenance and servicing. The following guidelines are recommended to help insure years of trouble free service. In the event a problem occurs, a troubleshooting guide is listed following the maintenance guidelines.

## Maintenance

Make certain that the plug and cylinder threads are clean and well lubricated with Moly grease or other high temperature lubricant.

Check the internal plug O-ring periodically for cuts, tears, or deterioration. Replace if any of these are evident.

*Note: You must install a new O-ring after any test in which the temperature exceeds 350°F/177°C.*

Clean all cement out of the bottom of the cylinder.

## Troubleshooting

The table on the following page is intended to help identify the source of any malfunctions that may occur with the 7360V Vertical Curing Chamber.

## TROUBLESHOOTING

<i>Symptom</i>	<i>Possible Cause</i>	<i>Remedy</i>
Heater will not operate	Temperature Limit Alarm  Open circuit in heater wiring	Find cause and correct, press reset  Find and eliminate open circuit
Instrument not receiving power	Instrument not plugged in  Blown fuse on rear panel  Blown fuse in external wiring	Plug into appropriate outlet  Replace fuse  Replace fuse
Pressure will not bleed	Drain line blocked with cement	Locate blockage and remove
Instrument will not hold pressure	Leak in cylinder or tubing  Damaged valve or pressure regulator seat	Visually check for leaks in cylinder and stainless steel tubing and repair  Isolate problem and repair or replace
Blown rupture disk	Pressure regulator is blocked with cement	Clean pressure regulator
Controller does not maintain adequate temperature profile	Wrong tuning parameters  Malfunctioning controller	Check tuning parameters  Repair or replace controller
Cylinder cannot be pressurized to desired level	High Pressure Limit regulator set wrong  Insufficient air pressure to pump	Adjust regulator  Check air supply and pump pressure adjust regulator.

## Section 5 – Replacement Parts

<i>Part Number</i>	<i>Description</i>
04237-24	Fuse Holder
19-0057	Thermocouple Assembly
07-0454	Cooling Coil Seal, Copper
7750-0213	Rear Cover
7750-0232	Front Cover
98-0103	Cylinder Plug
98-0106	Cylinder
98-0112	Seal Ring
98-0117	Cooling Coil, Cylinder Assembly
98-0210	Mold Assembly
98-0500	Cabinet Assembly
98-0505	Cylinder Mounting Base
98-0506	Cylinder Base
98-0506	Pressure Gauge
98-0511	Top Panel
98-0512	Cylinder Mounting Ring
98-0515	Wiring Diagram
98-0516	Valve Decal
C07357	Insulation, Cylinder
C08101	Pump
C07451	Temperature Controller
C08103	Back Pressure Valve
C08104	O-Ring
C08105	Retaining Ring
C08106	On/Off Rocker Switch
C08931	Hydraulic Pump
P-1764	Rupture Disk
P-2859	Filter



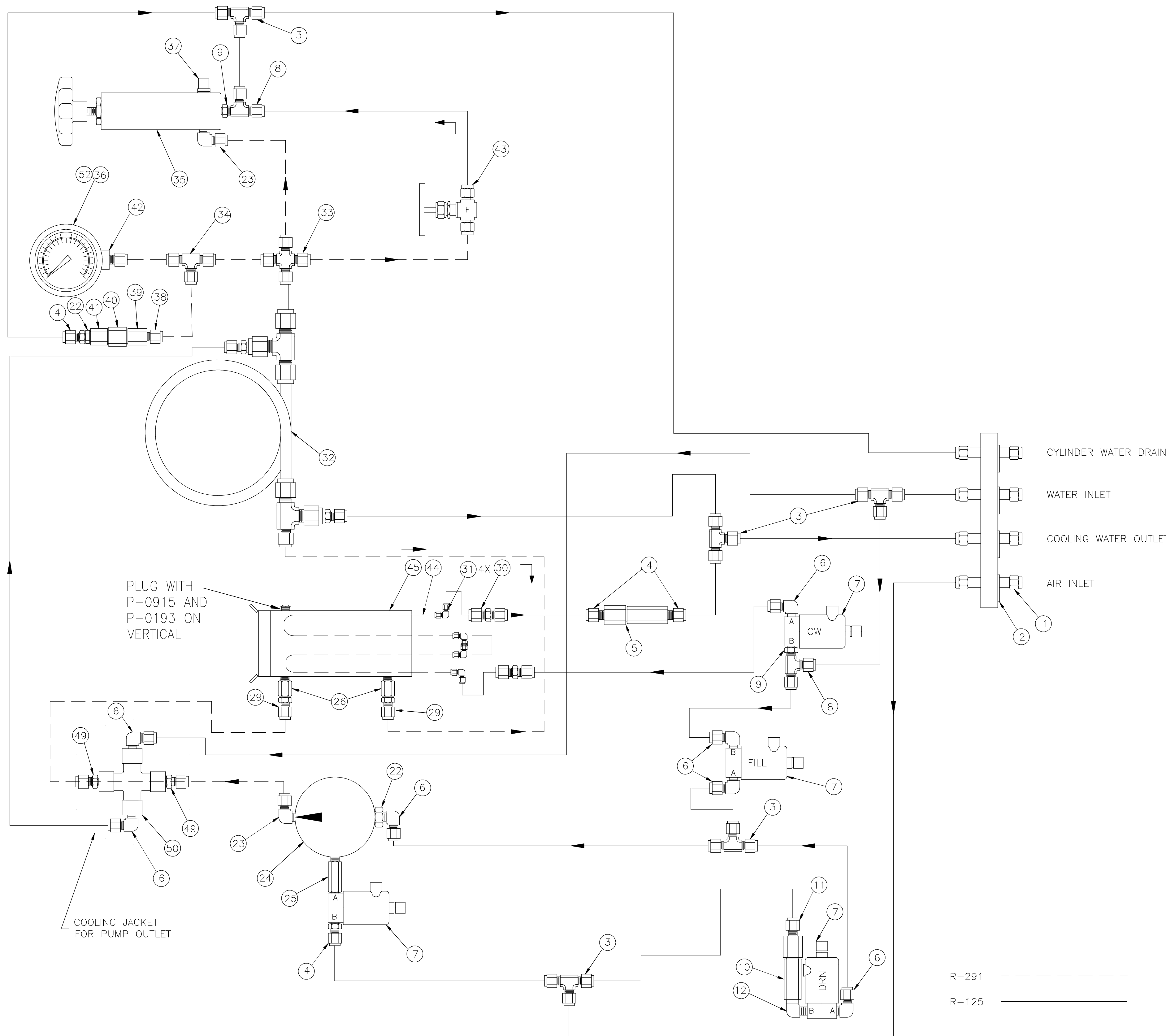
## Section 6 - Drawings and Schematics

<i>Drawing Number</i>	<i>Description</i>
98-0006	Piping Schematic
98-0518	Wiring Diagram





REVISIONS				
ZONE	REV	DESCRIPTION OF REVISION	DATE	APPROVALS
	L	ECN T3714; UPDATED BOM	3/13/12	TC TC
	M	ECN T6619; UPDATED BOM	5/21/15	TC TC



-01 FOR HORIZONTAL CURING CHAMBER  
-02 FOR VERTICAL CURING CHAMBER

QTY.	REV.	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
		1 C08121	GAUGE PRESSURE, 10,000 PSI(FOR HORIZ. C.C.)	SST	52
		1 1 P-0757	CROSS, 1/4FPT	BRASS	50
		2 2 98-0322	CONNECTOR, TUBE, MALE MODIFIED	SST	49
		25' 25' R-0125	TUBING, 1/40.D. X .032 WALL	COPPER	48
					47
		10' 10' R-0291	TUBING, 1/4 O.D. X .049 WALL	SST	46
		1 1 98-0106	SAMPLE CYLINDER	SST	45
		2 2 98-0117	COOLING COIL ASSEMBLY	COPPER	44
		2 2 C08102	VALVE	SST	43
		1 1 P-1402	CONNECTOR, 1/4FPT X 1/4T	SST	42
		1 1 P-1764	RUPTURE DISC, 7,500 PSIG	SST	41
		1 1 P-1206	SAFETY HEAD	SST	40
		1 1 P-0735	ADAPTER, 9/16-18 F X 1/8NPT	SST	39
		1 1 P-1378	CONNECTOR, 1/8FPT X 1/4T	SST	38
		1 1 188-13190	PLUG, 1/4 NPT	SST	37
		1 C11370	GAUGE, PRESSURE, 10,000 PSI, 4"	SST	36
		1 1 C08103	REGULATOR, BACK PRESSURE	SST	35
		1 1 P-1942	TEE, 1/4T	SST	34
		1 1 P-1941	CROSS, 1/4T	SST	33
		1 1 98-0314	HEAT EXCHANGER ASSEMBLY	COPPER	32
		4 4 C09218	ELBOW,BR,1/4TX1/4T,UN	BRASS	31
		2 2 P-1189	UNION, 1/4T X 1/4T	BRASS	30
		1 2 P-1486	CONNECTOR, 1/8 MPT X 1/4T	SST	29
		0 1 07-0777	ADAPTER, 1/8FPT X 1/8 NPT	SST	28
		0 2 P-1190	ELBOW, STREET, 1/8NPT	SST	27
		2 3 P-1059	REDUCER, 9/16-18 X 1/8FPT	SST	26
		1 1 P-1480	NIPPLE, 1/4NPT, 1 3/8 LONG	BRASS	25
		1 1 C08101	PUMP, PRESSURE	SST	24
		2 2 P-1772	ELBOW, 1/4NPT X 1/4T	SST	23
		2 2 P-0866	BUSHING, 3/8MPT X 1/4NPT	BRASS	22
		0 1 P-1501	ELBOW,BRS,ST,1/8FPTX1/8MP	BRASS	21
		0 1 P-1313	REDUCER, 1/4MPT X 1/8MPT	BRASS	20
		0 1 P-2859	FILTER, AIR	ALUMINUM	19
		0 P-1416	CONNECTOR, 1/8T X 1/8NPT	BRASS	18
		0 1 P-0917	CROSS, 1/8FPT	BRASS	17
		0 1 P-1477	ELBOW,1/8,PIPE	BRASS	16
		0 1 P-2288	REGULATOR, AIR PRESSURE	BRASS	15
		0 1 C07946	GAUGE, PRESSURE, 160 PSI	SST	14
		0 2 P-1246	ELBOW, 1/8 NPT X 1/4T	BRASS	13
		1 1 P-1496	ELBOW, STREET, 1/4NPT X 1/4FPT	BRASS	12
		1 1 P-1267	CONNECTOR, 1/4FPT X 1/4T	BRASS	11
		1 1 P-0853	CHECK VALVE	BRASS	10
		2 2 P-0238	BUSHING, 1/4MPT X 1/8FPT	BRS	9
		2 2 P-3644	TEE, STREET, 1/4T X 1/4T X 1/8MPT	BRASS	8
		4 4 P-3107	SOLENOID, 220VAC	SST	7
		7 7 P-1255	ELBOW, 1/4 MPT X 1/4T	BRASS	6
		1 1 P-0586	CHECK VALVE,	SST	5
		4 4 P-1254	CONNECTOR, 1/4MPT X 1/4T	BRASS	4
		5 5 P-1265	TUBE TEE, , 1/4T	BRASS	3
		4 4 C08268	RETANR,SST,3/4ID,BHD,SW	SST	2
		4 4 P-1954	CONN,BRS,1/4FPX1/4T,BHD,SW1/4T	BRASS	1

QTY. REQD.		PARTS LIST		APPROVALS		DATE	
		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		APPROVALS		DATE	
		TOLERANCES:		DRAWN: AEB		12/06/90	
		1 PLACE +0.030		CHECKED: CCD		12/07/90	
		2 PLACE +0.010		ENGR.: GDJ		12/07/90	
		3 PLACE +0.005		SCALE: NONE		DO NOT SCALE DRAWING	
		ANGLES +1/2"		SHEET: 1 of 1			
		SURF. FINISH 63/		TITLE		PIPING DIAGRAM	
NEXT ASSY		USED ON		APPROVALS		DATE	
				DRAWN: AEB		12/06/90	
				CHECKED: CCD		12/07/90	
				ENGR.: GDJ		12/07/90	

This document and the drawings and technical data contained hereon are the property of Chandler Engineering Company LLC. Reproduction or dissemination in any form except as expressly authorized by the owner is forbidden. The holder agrees to return this document to the owner on demand.  
Copyright by Chandler Engineering Company LLC

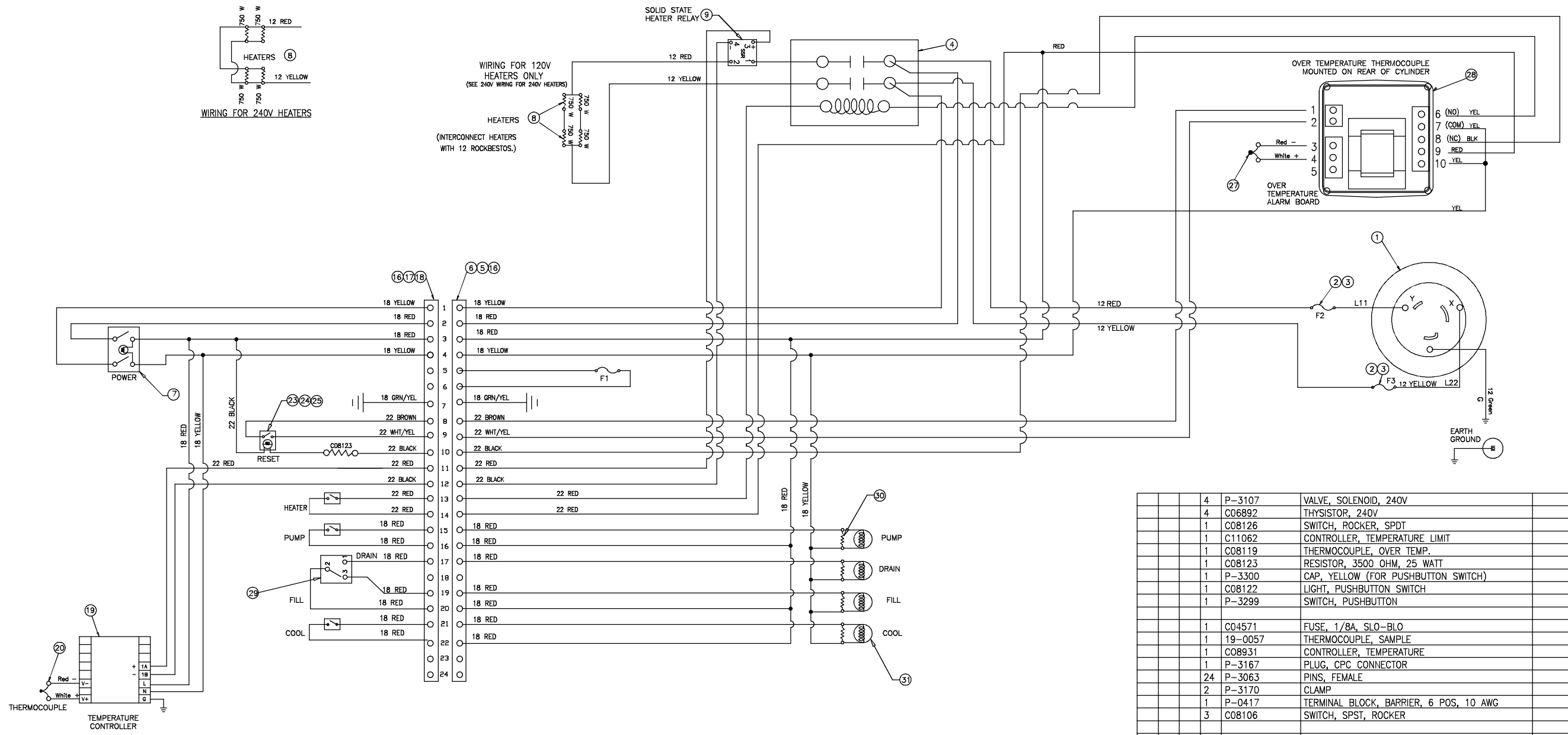
**CHANDLER ENGINEERING**

PIPING DIAGRAM

98-0006

A

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	D	ECN 9092; ADDED C11062 & REMOVED C07451	07/01/04	SB/TC
	D-9	ECN 9960; CHANGED WIRE COLORS TO RED	01/13/06	SB/TC
	G-2	ECN T3610; ADDED WIRE COLORS TO O/T MODULE	01/31/11	JJM
	D-10	ECN T3825; CHANGED WIRING OF HEATER SWITCH	05/04/2011	JJM
	H	ECN T3714; CHG ITEM 15, ADD F1	3/13/12	TC



QTY.	REQD.	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
		4	P-3107	VALVE, SOLENOID, 240V	31
		4	C06892	THYSISTOR, 240V	30
		1	C08126	SWITCH, ROCKER, SPDT	29
		1	C11062	CONTROLLER, TEMPERATURE LIMIT	28
		1	C08119	THERMOCOUPLE, OVER TEMP.	27
		1	C08123	RESISTOR, 3500 OHM, 25 WATT	26
		1	P-3300	CAP, YELLOW (FOR PUSHBUTTON SWITCH)	25
		1	C08122	LIGHT, PUSHBUTTON SWITCH	24
		1	P-3299	SWITCH, PUSHBUTTON	23
					22
		1	C04571	FUSE, 1/8A, SLO-BLO	21
		1	19-0057	THERMOCOUPLE, SAMPLE	20
		1	C08931	CONTROLLER, TEMPERATURE	19
		1	P-3167	PLUG, CPC CONNECTOR	18
		24	P-3063	PINS, FEMALE	17
		2	P-3170	CLAMP	16
		1	P-0417	TERMINAL BLOCK, BARRIER, 6 POS, 10 AWG	15
		3	C08106	SWITCH, SPST, ROCKER	14
					13
					12
					11
					10
					9
		1	C07945	SSR, DC CONTROL	8
		2	C08114	HEATERS	7
		1	P-3390	SWITCH, CIRCUIT BREAKER	6
		1	P-3165	RECEPTACLE	5
		24	P-3062	PINS, MALE	4
		1	C08112	CONTACTOR	3
		2	C08125	FUSE, CERAMIC, 15A	2
		3	C00456	FUSE HOLDER	1
		1	P-3359	POWER RECEPTACLE	

NOTES:  
ALL WIRING IS 18 AWG UNLESS NOTED OTHERWISE.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		TOLERANCES:		TITLE	
1 PLACE	+0.030 [-.76]			CHANDLER ENGINEERING	
2 PLACE	+0.010 [-.25]			WIRING DIAGRAM	
3 PLACE	+0.005 [-.127]			VERTICAL CURING CHAMBER	
ANGLES	+1/2°			DRAWN: STAFF 12/03/98	
SURF. FINISH	32/			CHECKED: JJM 12/03/98	
APPROVALS		DATE	SIZE	S.Q. NO.	DWG NO.
APPLICATOR		12/03/98			98-0518
USED ON		12/03/98			REV. H
NEXT ASSY		12/03/98			ENGR: JJM
SCALE: 1 = 1		DO NOT SCALE DRAWING		SHEET: 1 of 1	

This document and the drawings and technical data contained herein are the property of Chandler Engineering Company LLC. Reproduction or dissemination in any form except as expressly authorized by the owner is forbidden. The holder agrees to return this document to the owner on demand.  
Copyright by Chandler Engineering Company LLC