Instruction Manual
Pressurized Curing Chamber
Model 1910
(Original Instructions)

Revision B – September 2019
P/N: 19-0175-CE

S/N: _____

CHANDLER ENGINEERING®

AMETEK®

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General Information

Introduction

This manual contains installation, operation, and maintenance instructions for the Chandler Engineering Model 1910 Pressurized Curing Chamber.

Purpose and Use
The Pressure Curing Chamber is used for curing tensile or compression specimens of oil well cements at elevated temperatures and at pressures above atmospheric, simulating conditions in the well.

Briefly, the procedure is to prepare the test specimens according to API Spec. 10[(1)]. The specimen slurries are poured into molds, and the molds are lowered into the pressure curing cylinder. The cylinder plug is installed, the thermocouple is inserted into the cylinder head, and the cylinder is filled to expel air. Heat and pressure is applied to the cylinder in accordance with applicable schedules of API Spec. Maximum pressure and temperature are maintained until shortly before the end of the curing time specified. The temperature is then reduced, pressure is released, and the test specimens are removed for testing.

Description
Safety features are incorporated into the curing chamber. A rupture disc rated at 25,500 psi/175.8 MPa is incorporated as an additional safety feature.

Features and Benefits

- Microprocessor-based temperature controller
- High wattage heater
- Metal-to-metal sealing ring
- Operating temperatures to 700°F/371°C
- Operating pressures to 25,000 psi/172 MPa
- Stainless steel enclosure

References

[(1)]American Petroleum Institute; API Specification 10 for Materials and Testing for Well cements, Latest Edition; Dallas, Texas

Specifications

Operating Conditions

Input Voltage:	**208 – 240 VAC**
Input Current:	**40A**
Frequency:	**50 / 60 HZ, 1PHASE**
Pressure:	**25,000 psi (1,723.68 BAR)**
Maximum Working Temperature:	**700°F (371°C)**
Minimum Working Temperature:	**41°F (5°C)**
Heater Wattage:	**1500 W**
Overvoltage Condition:	**Category 2**
Hoist Maximum Load:	**100 lbm**

Environmental Conditions

Environment:	**Indoor Use**
Altitude:	**6561.6 ft (2000m)**
Temperature:	**5 - 40°C (41 - 104°F)**
Relative Humidity:	**0% to 95% non-condensing**
Pollution Degree:	**Category 2**

Weights and Dimensions

Dimensions:	**80in (203cm) high x 33in (83cm) wide x 31in (78cm) deep**
Shipping Dimensions:	**87in (221cm) high x 44in (112cm) wide x 42in (107cm) deep**
Net Weight:	**1,462 lbs (663 kg)**
Shipping Weight:	**1,737 lbs (788 kg)**

Note: ***Must use a lifting device (i.e. forklift) to load, lift, package, or transport. The 1910 Curing Chamber does have castors installed to allow the unit to be moved over short level distances.***

Safety Requirements

READ BEFORE ATTEMPTING OPERATION OF INSTRUMENT

The Chandler Engineering Model 1910 Curing Chamber is designed for operator safety. Any instrument that is capable of high temperatures should always be operated with **CAUTION**!!

To ensure safety:

- Locate the instrument in a low traffic area. Allow a minimum of 12 inches (305mm) unobstructed clearance around side, back and top faces to provide for adequate ventilation.
- Locate the instrument on a level surface to prevent involuntary movement.
- Always position the instrument in such a manner that allows easy access to the power cord.
- Have the safety officer at your location or laboratory review the safety aspects of the instrument and installation and approve the operational and installation procedures.
- Read and understand instructions before attempting instrument operation.
- Observe caution notes!
- Observe and follow the warning labels on the instrument.
- If the instrument is not used in accordance to this manual, the safety of the instrument may be impaired.
- In case of malfunction, unplug power cords from the voltage source.
- Always disconnect main power to the instrument before attempting any repair.
- Never replace the power cord with an inadequately rated power cord.
- Post signs where the instrument is being operated to warn non-operating personnel.
- Where appropriate PPE when operating the instrument especially in respect to fluids being used.
- Appropriately rated fire extinguishers should be located within close proximity.
- Turn off the heater at completion of each test.
- As the top of the instrument gets hot during service it is not recommended that top surface be obstructed.
- Avoid contact with moving parts.
- Never exceed the instrument maximum pressure and temperature ratings. The safety requirements associated with the handling and use of the medium to be tested, especially the additional requirements associated with handling potentially flammable liquids or otherwise hazardous agents are the responsibility of the customer – proper precautions must be taken to reduce the risk of fire or explosion.
- The swing arm's rotational radius is controlled by mechanical stops.
- Only use Chandler approved components.

Symbols Used on Equipment

Symbol	Meaning
	Chassis Ground Terminal
	Protective Conductor Terminal
	Hazardous Voltage Inside Disconnect power before opening
	Hot Surface Do Not Touch Allow to cool before servicing
	Documentation must be consulted in all cases where this caution symbol is marked.
	Pinch Point Don’t touch rotating parts
	On (Control Switch)
	Off (Control Switch)

Where to Find Help

In the event of problems, your local sales representative will be able to help or you can contact the personnel at Chandler Engineering using the following:

- Telephone: 918-250-7200
- FAX: 918-459-0165
- E-mail: chandler.sales@ametek.com
- Website: www.chandlereng.com

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Section 1 - Installation

Unpacking the Instrument

After the instrument is removed from the shipping crate, the operating equipment and spare parts on the packing list should be checked to affirm that all have been received and none are damaged. Due to the size and weight of the instrument, ensure that the Curing Chamber is always level during unpacking, transportation, and installation to prevent tipping taking into consideration that the instrument is heavier on the side with the hoist. A lifting device (i.e. forklift) must be used to load, lift, package, or transport the instrument and ensure that the personal operating the lifting device is properly trained. Casters are installed on the unit to allow it to be moved over short, level distances. Set the brake on the casters to ensure the instrument will stay in place.

Note: File an insurance claim with your freight carrier if damage has occurred during shipment. Verify all parts received appear on the enclosed packing list. If items are missing, please notify Chandler Engineering, immediately.

Utilities Required

The utilities required to operate the instrument are:

- dry compressed air at 100 psi/700 KPa,
- 200-240 volt, single-phase, 50 Hz/60 Hz, 40-ampere capacity.

Tools and Equipment Required

A standard maintenance or mechanics tool set is adequate for the installation, operation, and maintenance of the instrument. An accessory torque wrench is provided.

Preparing for Operation

Prior to operating this instrument, the technician should study the drawings accompanying the operating and maintenance instructions to become thoroughly familiar with the curing chamber operation and its parts.

1. Ensure the instrument is on a level surface and position the instrument in such a way that it isn't difficult to plug in or remove the power cord.
   Note: Lock the wheels to keep it stationary as you make the necessary connections.
2. Connect the air hose from the "Air Inlet" port located on the back of the instrument to the air supply.
3. Fill the reservoir with white oil by opening the right-hand cabinet door and ensure that the drain valve on the bottom of the reservoir is closed. Remove the brass fill plug from the top of the reservoir and fill the reservoir with the white oil and replace the fill plug.
4. Close and lock the cabinet door before operating the instrument.
5. Connect the power cord to the receptacle located on the back of the instrument.

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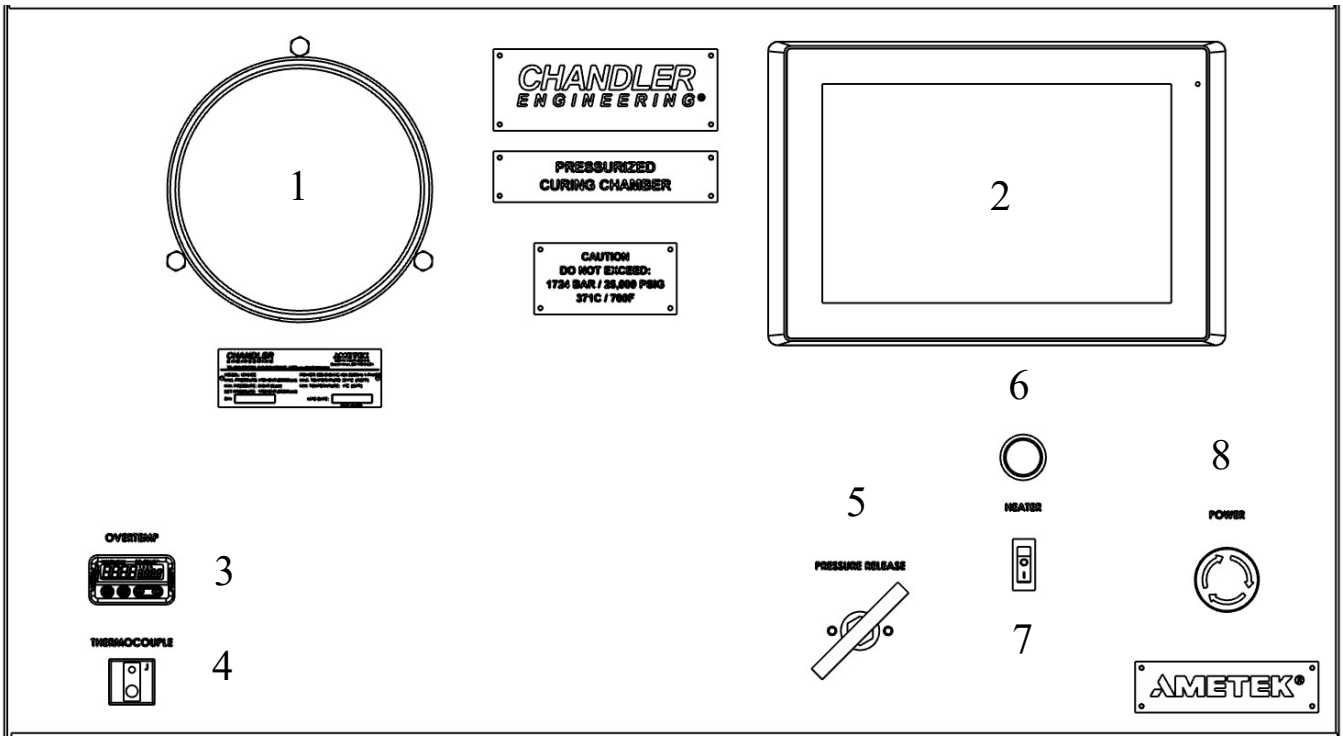
Section 2 - Operation

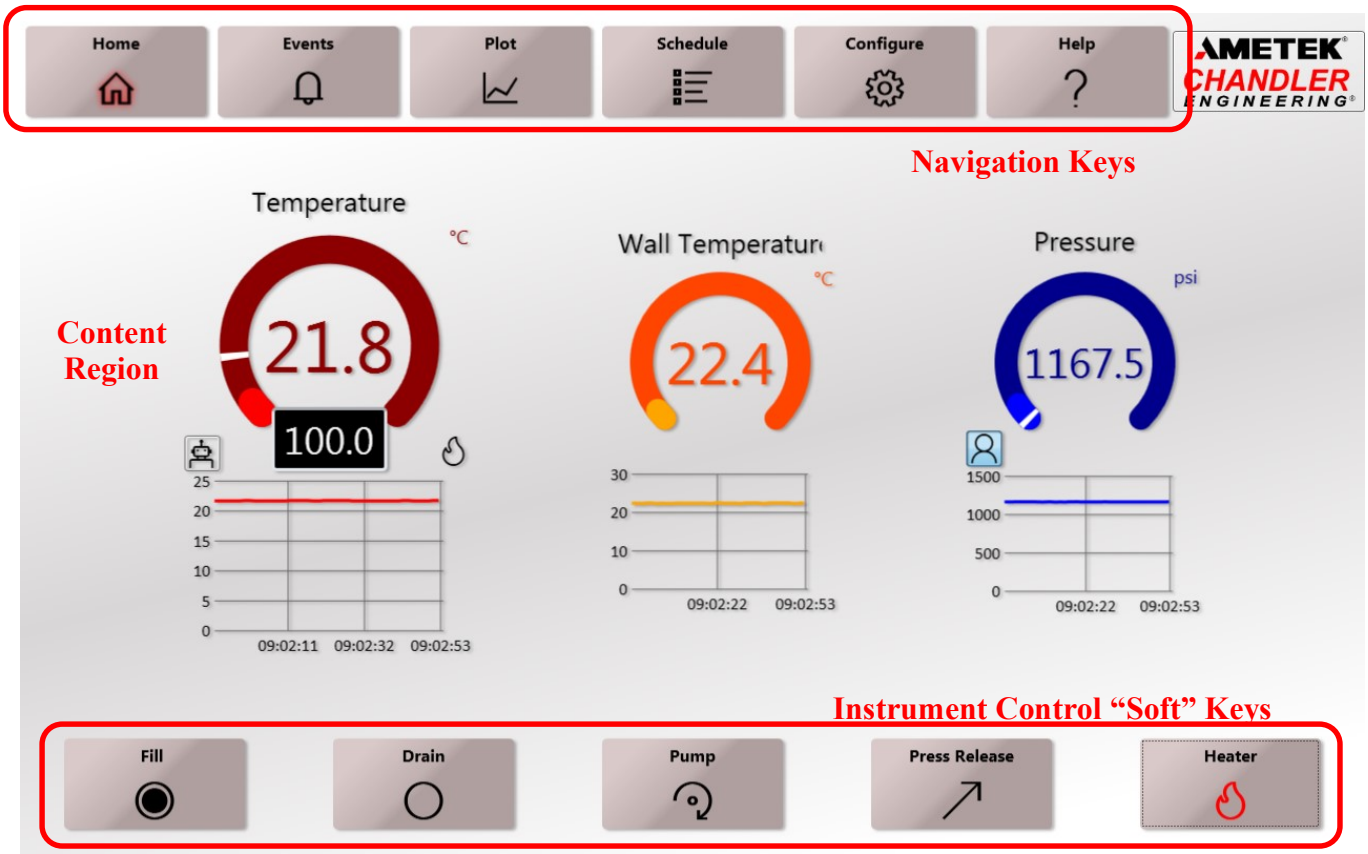
Before attempting operation of the instrument, you should study the drawings in this manual.

Front Panel Controls



1. Chamber Pressure Gauge
2. Touchscreen Instrument Controller
3. Over-Temperature Indicator
4. Chamber Thermocouple Connection
5. Pressure Release valve
6. Heater Indicator
7. Heater Switch
8. Power Switch

Touchscreen Controls



Navigation Keys

Navigation Keys allow the user to change the Content Region to display the different views such as Home (pictured), Plot, Schedule, etc.

Content Region

This area displays the appropriate content based on which Navigation Key is active.

Instrument Control "Soft" Keys

This area displays instrument-specific "soft" keys. The button will glow red when the key is active (as displayed above, the Home screen is active).

Fill: When active, oil is pushed from the Reservoir to the Chamber. This button must be active to pressurize the Chamber.

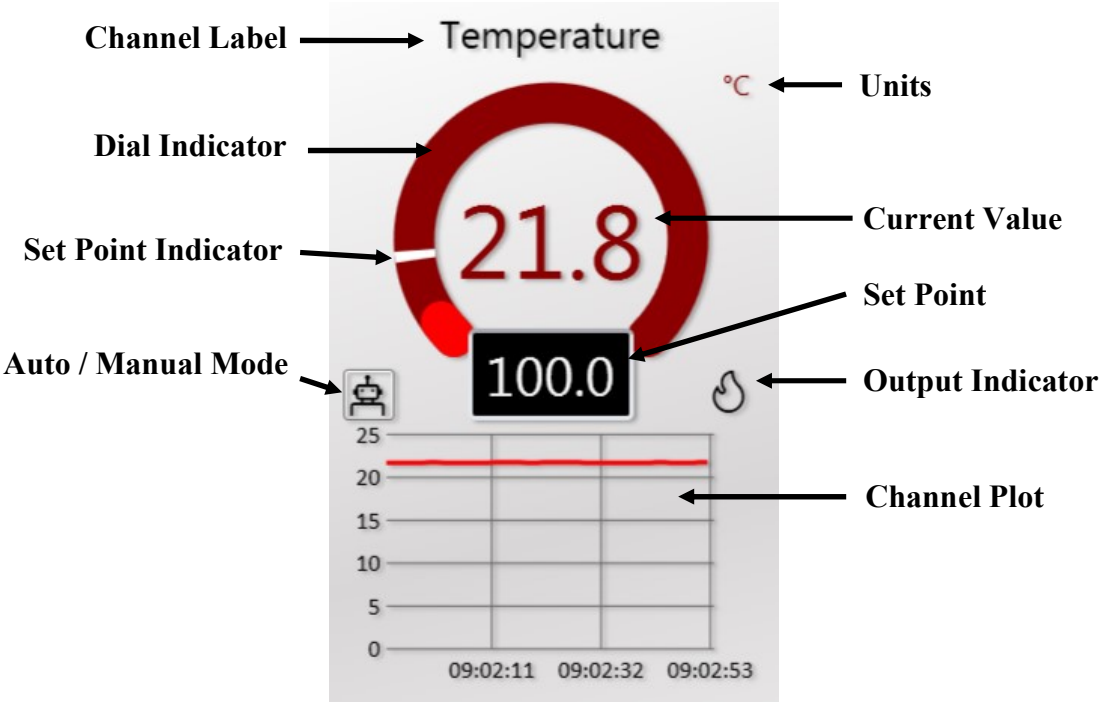
Drain: When active, oil is pushed from the Chamber back to the Reservoir. This button must be inactive to pressurize the Chamber.

Pump: This button will activate/deactivate the pump used to pressurize the Chamber. Pressing this button when the Pressure Controller is active has no effect.

Press Release: This button will open the Chamber to the Reservoir through a depressurizing capillary tube. Pressing this button when the Pressure Controller is active has no effect.

Heater: When active, the Heaters are enabled. This button and the physical Heater button must both be active to enable heating.

Home Screen Indicator Controls



Channel Label: The name given to this channel. This can be changed on the Indicators tab of the Configuration Screen.

Dial Indicator: A visual representation of the current value relative to the maximum value for the Channel.

Set Point Indicator: A visual representation of the current set point relative to the maximum value of the Channel.

Auto / Manual Mode: Displays the current control mode.

- : Indicates Manual Mode, the Set Point is in "Percent Output" (0-100% for Temperature or ±100% for Pressure).
- : Indicates Automatic Mode, the Set Point is in Units. When a Schedule is started, the control is automatically placed in Automatic Mode.

Units: the currently calibrated units of the Channel.

Current Value: a live reading of the input.

Output Indicator: Indicates the current action of the Control Loop. When heating, a flame icon appears. On the Pressure Indicator, this icon matches the Pump icon when Pressurizing and the Press Release icon when de-pressurizing.

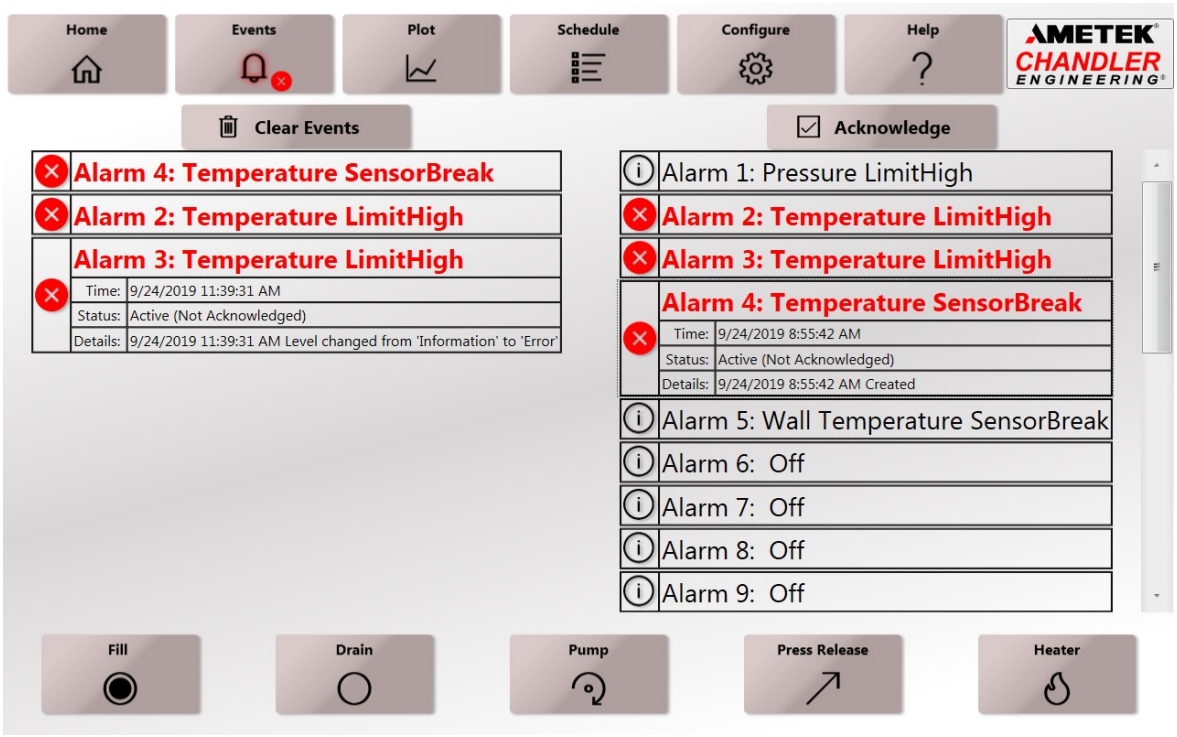
Channel Plot: a short historical plot of the Current Value. The width of this plot can be configured on the General Tab of the Configuration Screen.

To Enter a Set Point

From the Home screen, tap the desired Indicator (Temperature or Pressure). The Indicator will increase in size and the Set Point control will appear (black box). Tap the Set Point control to enter a Set Point from the Number Pad that appears. Changing this Set Point has no effect while a Schedule is running.

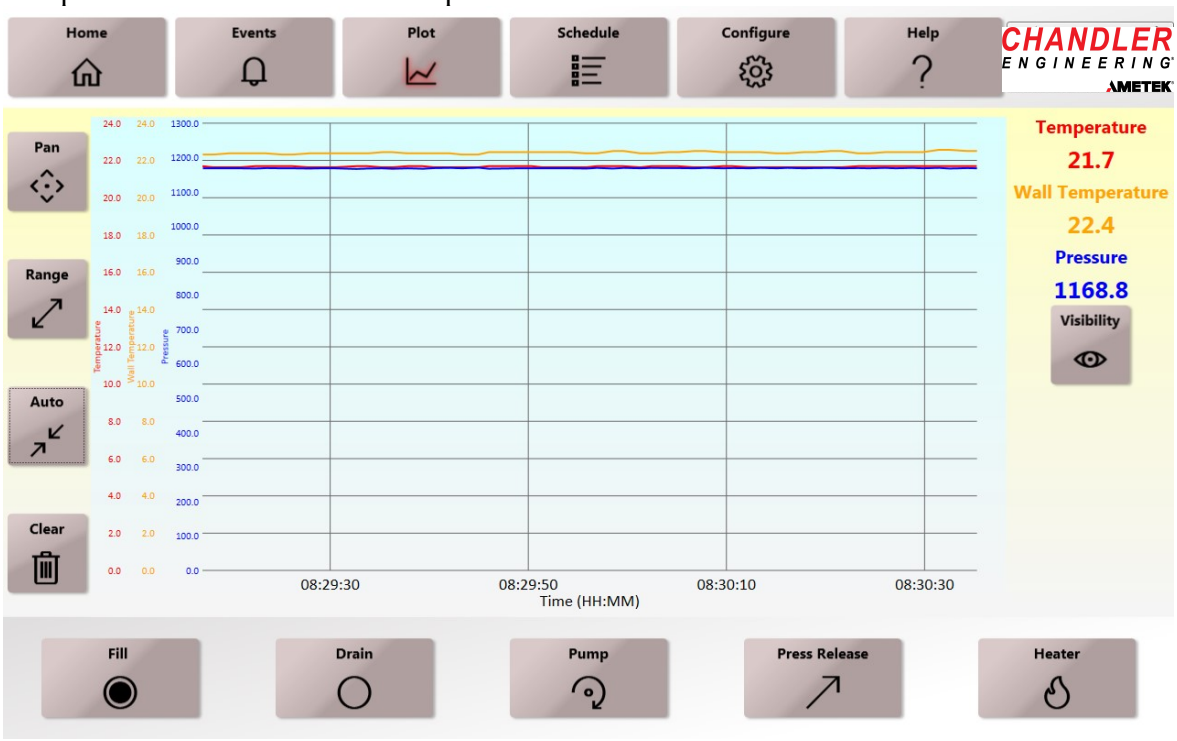
Events Screen

The Events Screen displays Events from the Controller and the current status of the Alarms. Events can be Informational (Schedule Started, Schedule Stopped, etc.), Warnings (such as an Alarm Condition no longer exists but the Alarm is unacknowledged, etc.) and Errors (Active Alarms, etc.). The Events Navigation key displays an icon when a Warning or Error condition exists. Use the Clear Events button to clear the Events list. Use the Acknowledge Alarm button to Acknowledge Alarms (silence the buzzer). Tap individual Events or Alarms to display more information.



Plot Screen

The plot screen shows a historical plot of the data.



Pan: Tap and drag the plot around the screen.

Range: Auto-scale each Y-Axis from 0 to the highest historical value of each channel.

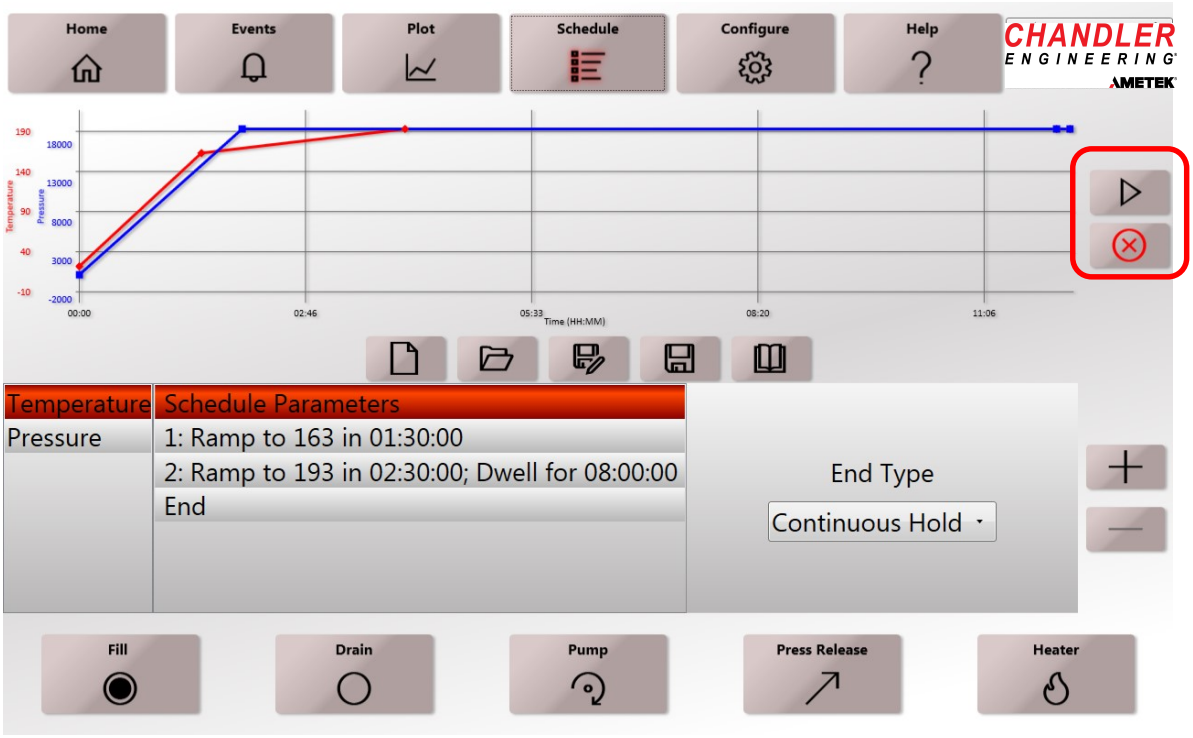
Auto: Auto-scale the Y-Axis from 0 to the maximum for each channel.

Clear: Clears the historical data.

Visibility: Shows or Hides the currently selected Channels (select the channels from the list above this button).

Schedule Screen

Open the Schedule Editor by tapping the Schedule Navigation Button. When the Schedule Editor is opened, the current schedule is read from the controller and displayed as shown below.



Execution Controls
These buttons allow the user to Run and Stop the current schedule. If the button is read, that action is currently active. If the button is black, that action is available. If the button is grey, that action is unavailable.
Note: When the run button is first clicked, the currently displayed schedule is first sent to the controller and then the schedule is started.

Edit Controls
New: Discard the currently displayed schedule (the user is prompted to save) and load a default schedule.
Open: Load a previously saved schedule.
Save: Save the currently displayed schedule to a file.
Upload: Send the currently displayed schedule to the controller.
Download: Read the schedule from the controller (the user is prompted to save).

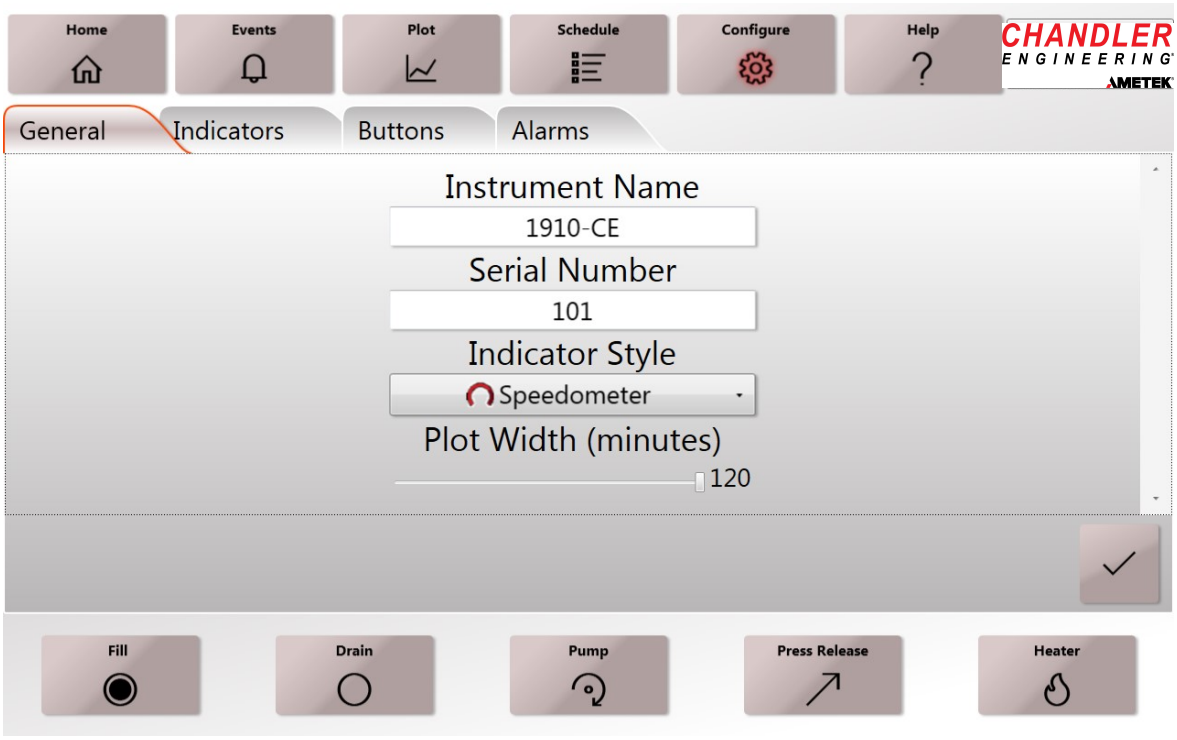
Controller Selection: Select a Controller to populate the Step Selection list.
Step Selection List: Select a Step to populate the Step Controls list
Step Controls: Edit parameters for the currently selected Step.
+: Insert a blank step after the currently selected Step.
-: Delete the currently selected Step. Schedule Parameters and the End Step cannot be deleted.

A Schedule consists of 3 types of Steps: Schedule Parameters, Segment List and End Step.

- **Schedule Parameters**: every schedule must have Schedule Parameters. No segments can be defined prior to this segment. This segment cannot be deleted.
  - **End Type**: Defines the action to be taken at the End of the Schedule. Options are:
    - **Output Off**: The Controller will not be active.
    - **Continuous Hold**: The Controller will maintain the Set Point reached at the end of the schedule.
    - **Reset to Set Point**: The End Set Point will become the active Set Point.
    - **End Set Point**: The set point to use when the **End Type** is **Reset to Set Point**.
- **Segment List**: Segments are executed in order. There is a maximum of 13 segments.
  - **Step Type**: Options are:
    - **Time to Set Point**: From the current set point, ramp to the **Target Set Point** over the **Step Time** and then Dwell (maintain the Set Point) for the **Dwell Time**. Step Time and Dwell Time can be zero.
    - **Ramp at Rate:** From the current set point, ramp to the **Target Set Point** at the **Ramp Rate** and then Dwell (maintain the Set Point) for the **Dwell Time**. Dwell Time can be zero.
    - **Stop**: defines this Segment to be the End Segment. No further segments can be defined.
- **End Step**: every schedule must have a defined End Step. No segments can be defined after this segment. This segment cannot be deleted.

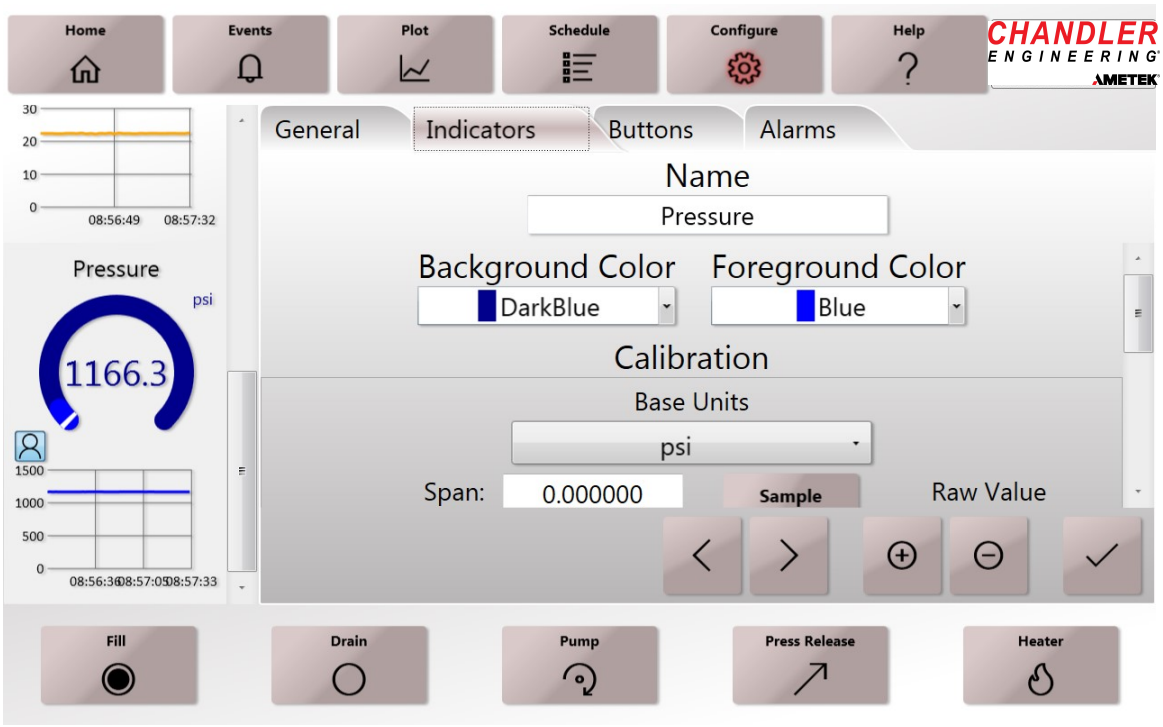
Configure Screen

The Configure Screen allows the operator to customize the Indicators, Buttons and Alarms as well as Calibrate the inputs.



Configure Indicators

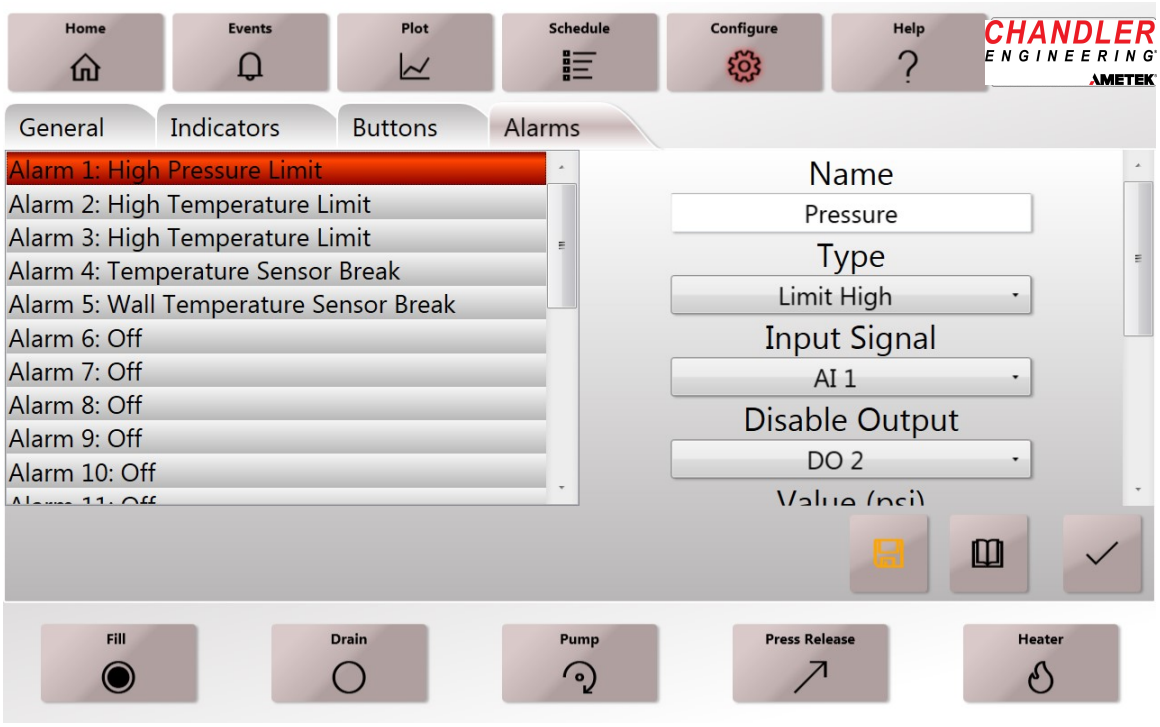
This tab allows the operator to change the Name of the input, change the color of the Dial Indicator on the Home Screen and calibrate the input. Select the appropriate indicator from the list of indicators on the left. Our service department can perform a calibration procedure using specialized instrumentation to assure that temperature drift and inaccuracies as a result of time and usage are compensated for in order to keep your instrument compliant with API specifications.



Configure Alarms

This tab allows the operator to configure Alarms. When configuring alarms, the following should be considered:

- Temperature uses Input Signal TC1
- Wall Temperature uses Input Signal TC2
- Pressure uses Input Signal AI1
- Output DO2 controls the Pump (should be disabled on a High-Pressure Alarm)
- Output DO3 controls the Pressure Release
- Output GPO 0 controls the Heater Relay
- Output Relay 1 controls the Heater Contactor (Heater Soft key and Heater switch)
- PID 1 is the Temperature Control Loop
- PID 2 is the Pressure Control Loop



Help Screen

The Help Screen displays this manual.

Operating the Curing Chamber

1. Prepare a cement slurry, fill molds and insert the molds into the mold bucket.
2. Add water to the mold bucket while its suspended from the hoist.
3. Place the filled mold-bucket assembly into the chamber.
4. Thoroughly lubricate plug threads and seal ring with "Liqui-Moly" or similar high temperature lubricant, lower plug into cylinder and screw down firmly to ensure metal-to-metal seat.
5. Unhook the hoist from the top plug and move it out of the way.
6. Use torque wrench to tighten set screws. See 19-0107 drawing for proper tightening and torque rating.
7. Install center thermocouple and insert the plug into the jack on the front panel. Screw the nut into the gland but do not tighten.
8. Open the Fill valve (activate the **Fill** "Soft" Key) to remove all trapped air in the chamber. When all the air has leaked by the thermocouple nut and oil appears, immediately tighten the nut.

Note: While removing trapped air, some oil can spill onto the top plug. Thoroughly wipe off and remove any oil residue to prevent fumes at high temperatures.

9. Activate the Pump "Soft" Key to Pump the chamber to the desired curing pressure. Alternatively, enter the desired starting pressure as the Pressure Set Point.

Warning: This pressure vessel is designed to operate at pressures that are considerably above 10,150 psi/70 MPa. Therefore, we recommend that the operators shall take all possible safety precautions to reduce the possibility of an accident.

To Apply Heat To Cylinder

1. Turn physical Heater switch to on and activate the Heater "Soft" key. The red Heater light will illuminate. The heaters are not enabled unless both the physical and soft Heater switches are on. Current will not be supplied to the element until a Temperature Set Point has been entered or a Schedule has been started.
2. Program the desired schedule into the Controller.

To Cool Cylinder at End of Test

1. Turn Heater switch to OFF (either the physical or "soft" Heater switch), allowing the vessel to air-cool.
2. Set the Pressure Set Point to the desired end-of-test pressure.
3. Cool until the internal temperature is below 38°C (100°F), set the Pressure Set Point to 0 and open the manual Pressure Release valve.

Warning: The instrument could still be hot, use appropriate PPE when removing the top plug and sample rack.

Empty the Chamber of Oil

1. Deactivate the **Fill**, **Pump** and **Vent** "Soft" keys; activate the **Drain** "Soft" Key. Wait about two minutes for the chamber to empty, as indicated by air blowing into the oil reservoir.
2. Deactivate the **Drain** "Soft" key.
3. Loosen the thermocouple nut and remove the thermocouple.
4. Open the chamber. Loosen the set screws and turn the seal shaft and plug counterclockwise with the handles. **Do not remove the ring**.

Removing the Cylinder Plug

1. Hook the hoist to the cylinder plug hook and lift slowly.
2. Lower the plug using the hoist to a stable work platform.
3. Remove the hoist hook from the cylinder plug hook.

Remove the hoist Removing the Sample Rack

4. Hook the hoist to the sample rack and remove slowly.
5. Lower the hoist to a stable work platform.
6. Remove the hoist hook from the sample rack.

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Section 3 – Maintenance Schedule

Cleaning and Service Tips

1. Before each test, cement and other foreign matter should be cleaned off the plug and cylinder threads, the threads should be wiped dry, and the threads and seal ring should be lubricated with "Liqui-Moly" or similar high-temperature lubricant. The factory application of “Everlube" and the technician's application of lubricant before each test enable effortless cylinder-plug removal, even after the most severe high-temperature testing.
2. The top and sealing surface of the seal ring (see cylinder assembly drawings) and mating surface of the cylinder plug should also be kept clean and lubricated to prevent metal galling.
3. If loose cement falls into the bottom of the cylinder, the waste should be removed immediately to prevent it from being forced out through the pressure bleed valve. This will erode the stem and seat, shortening the valve life and plug the connecting tubing.
4. Add SAE 10 oil to the air lubricator on the air-operated pressure pump as required (avoid running the lubricator dry). Occasionally, this lubricator should be checked to affirm that oil is being fed into the air inlet to the pump at a rate of three to five drops per minute when the pump is operating.
5. Cool down the equipment prior to servicing, as the surfaces will be hot.
6. Clean exterior surfaces of the instrument as required using mild soap and water. Dry all surfaces thoroughly and do not soak vents, fan or back electrical panel with water.
7. Keep all test cell surfaces exposed to cement coated with a thin layer of grease. This reduces the chance of corrosion and prevents cement from adhering to the metal.
8. Keep cement off threads and out of the high-pressure ports on the top plug of the test cell.
9. Lubricate the threads on the test cell plugs periodically with grease.
10. Thoroughly clean test cell of all cement immediately after each test.
11. It is the responsibility of the user to follow any local rules or regulations concerning cement slurry and water waste removal.
12. It is the responsibility of the user to ensure that appropriate decontamination is carried out if hazardous material is spilled onto or into the instrument.
13. It is the responsibility of the user to ensure no decontamination or cleaning agents are used which could cause a hazard as a result of a reaction with parts of the instrument or with material contained in it.
14. It is the responsibility of the user to consult the manufacturer if there is any doubt about the compatibility of decontamination or cleaning agents with part of the instrument or with material contained in it.

Maintenance Schedule

Component	Each Test	As Needed	Monthly	6 Months	Annual
Cylinder	Check Plug Seal Surface				Test by Qualified Technician
Pressure Gauge				Check Calibration	Calibrate by Qualified Technician
Thermocouple Circuits				Check Calibration	Calibrate by Qualified Technician
Lubrication		Lubricate Plug Threads			
Rupture Disk					Replace
Pump Lubricator					Replace Oil in Lubricator
Heaters					Test by Qualified Technician

Section 4 – Troubleshooting Guide

PROBLEM	CHECK THIS	DO THIS
No Power	Circuit Breakers	Reset or Replace
Will Not Heat	Heater Switch (physical AND "Soft" key) Heater Circuit Breaker (40A, Type D, 2 Pole) Computer	Turn On Reset Check Program
Won't Hold Pressure	Pressure Relief Valve External Leak Rupture Disk Pneumatically Controlled Pressure Relief Valve	Close Tighten Connections Replace Check for Leaks
Can't Release Pressure	Pressure Release Valve	Replace
Will Not Pump	Computer	Turn on
Erratic Temperature	Thermocouple Socket or Plug Computer	Clean Configure
Cylinder Plug Leaking	Plug Loose Seal Dirty or Damaged Set Screws	Tighten Clean and Inspect Torque to Rated Specification

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Section 5 - Replacement Parts

Part Number	Description
07-0772	HANDLE,PLUG
70-0023	TC,SPECIAL TYPE J,15.3"L
C15155	BREAKER,40A,TYPE D,DIN,2P
C16390	CONTROLLER, LIMIT, EZ-ZONE, 1/32
C16981	THERMOCOUPLE, TYPE J, BOLT ON
C17096	XDCR,PRESSURE,40KPSI,AE F250-C,BENDIX PTIH-10-6P
C18036	DISK,RUPTURE,25500 PSI,.250,IN,CE
P-2380	JACK,PNL,TC,1.12,SQ FACE
07-1273	CABLE ASSY,POWER,200-240 VAC

To ensure correct part replacement, always specify Model and Serial Number of instrument when ordering or corresponding.

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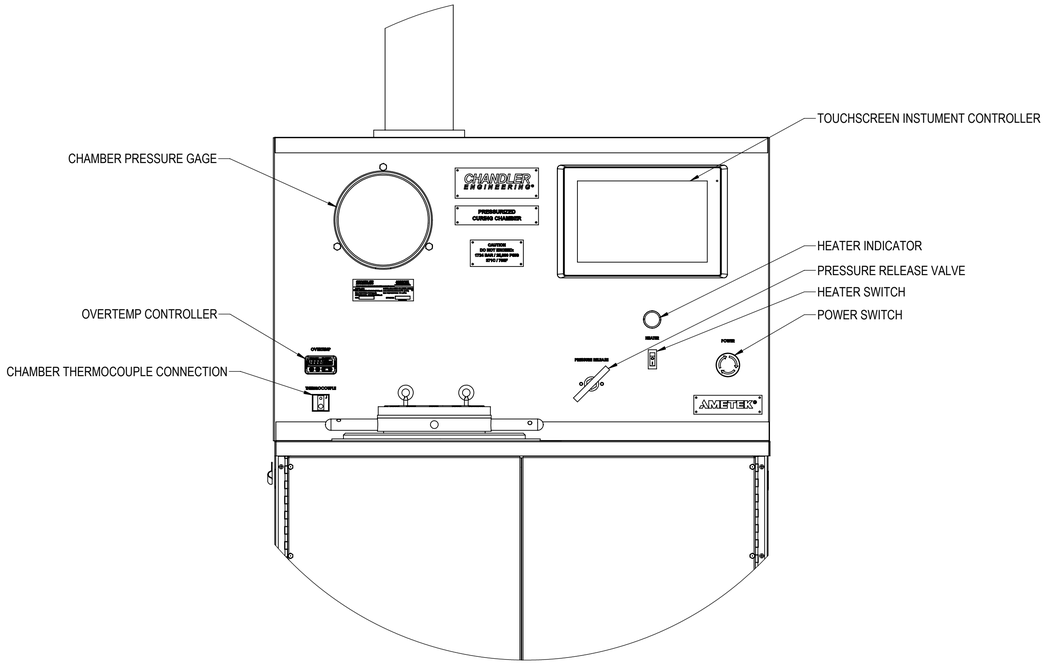
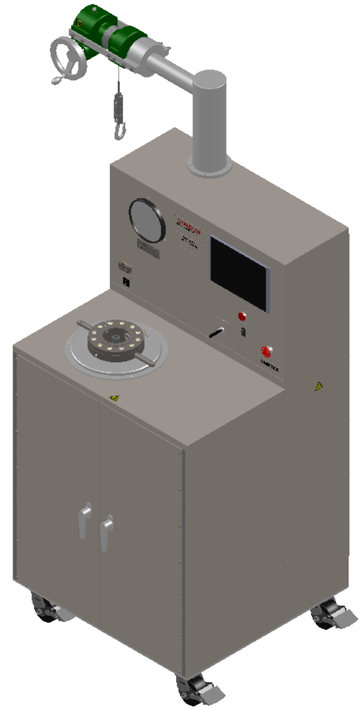
Section 6 - Drawings and Schematics

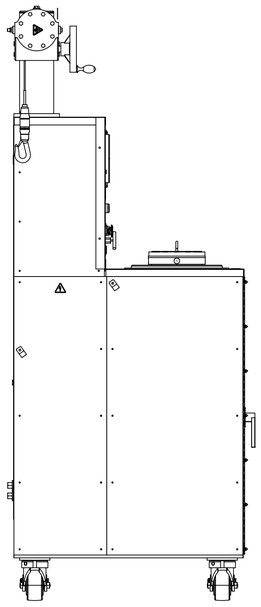
Drawing Number	Description
1910-CE	Model 1910-CE Curing Chamber
19-0090-CE	Model 1910-CE Curing Chamber
19-0095-CE	Cylinder Assembly
19-0096-CE	Schematic, Piping
19-0097-CE	Schematic, Wiring
19-0107	Modified Bridgman Seal
19-0120-CE	Reservoir Assembly
19-0750-CE	Electronics Assembly

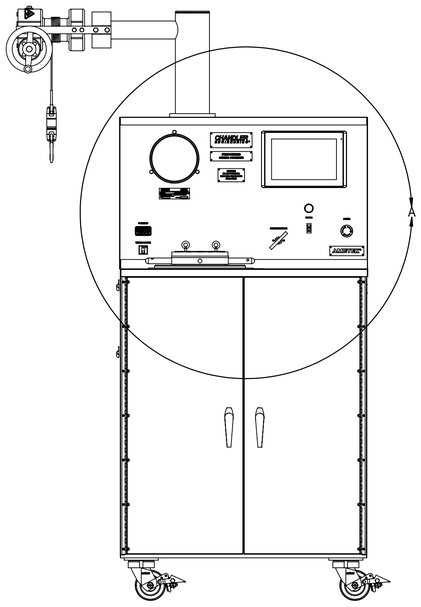
REV	DESCRIPTION	DATE	APPROVED
A	ISSUED	08/02/18	JJM
B	ECN T8589; ADDED INPUTS/OUTPUTS	7/3/2019	JJM

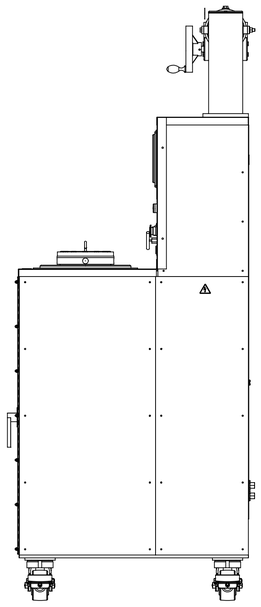


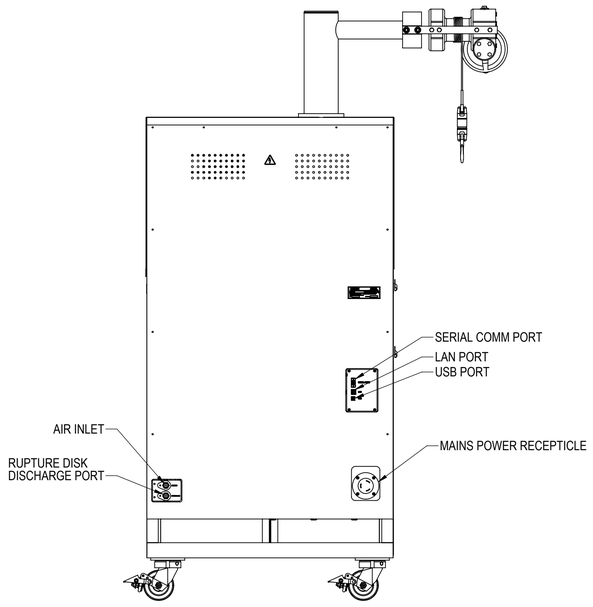
DETAIL A











ITEM	PART NUMBER	DESCRIPTION	QTY	UoM
1	19-0090-CE	MODEL 1910,CURING CHAMBER,CE	1	EA
2	1910-CE-ACCESS	ACCESSORIES,MODEL 1910-CE	1	EA
3	1910-CE-SHIP	SHIPPING LIST,1910-CE	1	EA
4	1910-CE-INSP	FINAL INSPECTION CHECKLIST, 1910-CE	1	EA
5	19-0175-CE	MANUAL,1910 CURING CHAMBER	1	EA
6	1910-CE-TEST	PROC,TEST,CURING CHAMBER	1	EA

BREAK EDGES, DEBURR
UON DIMS ARE IN INCHES
1 PLC ±0.030 2 PLC ±0.010
3 PLC ±0.005 ANGL ±1/2°
SURFACE FINISH 63 RMS
THIRD ANGLE PROJECTION

DRAWN: JJM 8/6/2018
MFG: ADMN8/14/2018
ENGR: JJM 8/6/2018

TYPE:
STRUCT:

CHANDLER ENGINEERING
MODEL 1910-CE CURING CHAMBER

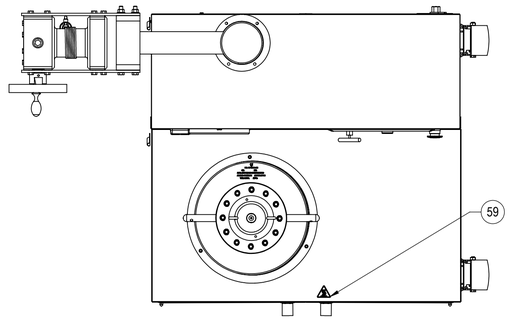
PN: 1910-CE
PROJ: 1910

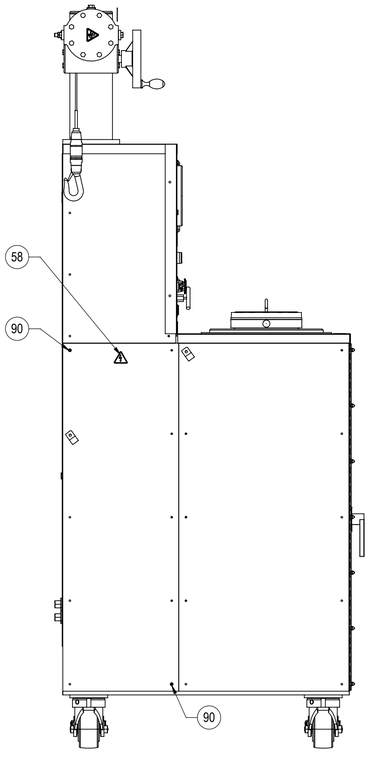
REV B | SIZE D
SHEET 1 OF 1

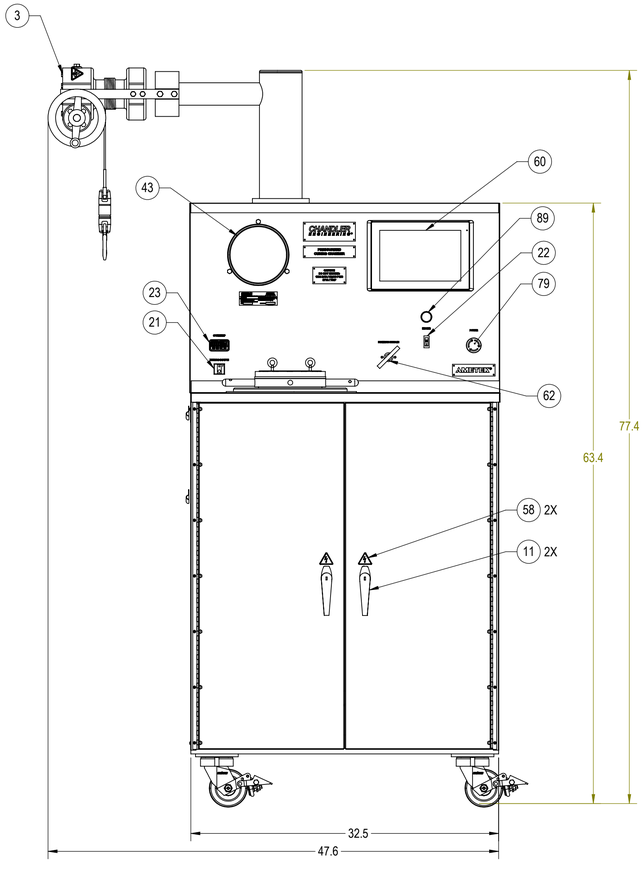
TITLE BLOCK REV 3

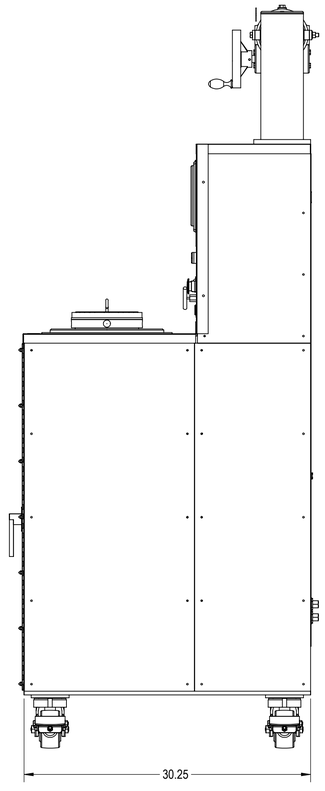
NOTE:
1. ADD BOTH TORX SCREWS (90) AS SHOWN.

REV	DESCRIPTION	DATE	APPROVED
A	ISSUED	07/30/18	JJM
B	ECN T8317; ADDED 7500-3186	10/5/2018	JS
C	ECN T8329; ADDED QTY 2 EA H-25-007, H-25-001, C18084 FASTENERS	10/18/2018	JJM
D	ECN T8415; REPLACED C13348 W/ C18133	1/23/2019	JS
E	ECN T8573; REPLACED C18133 WITH C18295	6/20/2019	JJM
F	ECN T8622; REPLACED C08150 W/ C14023	8/6/2019	JS







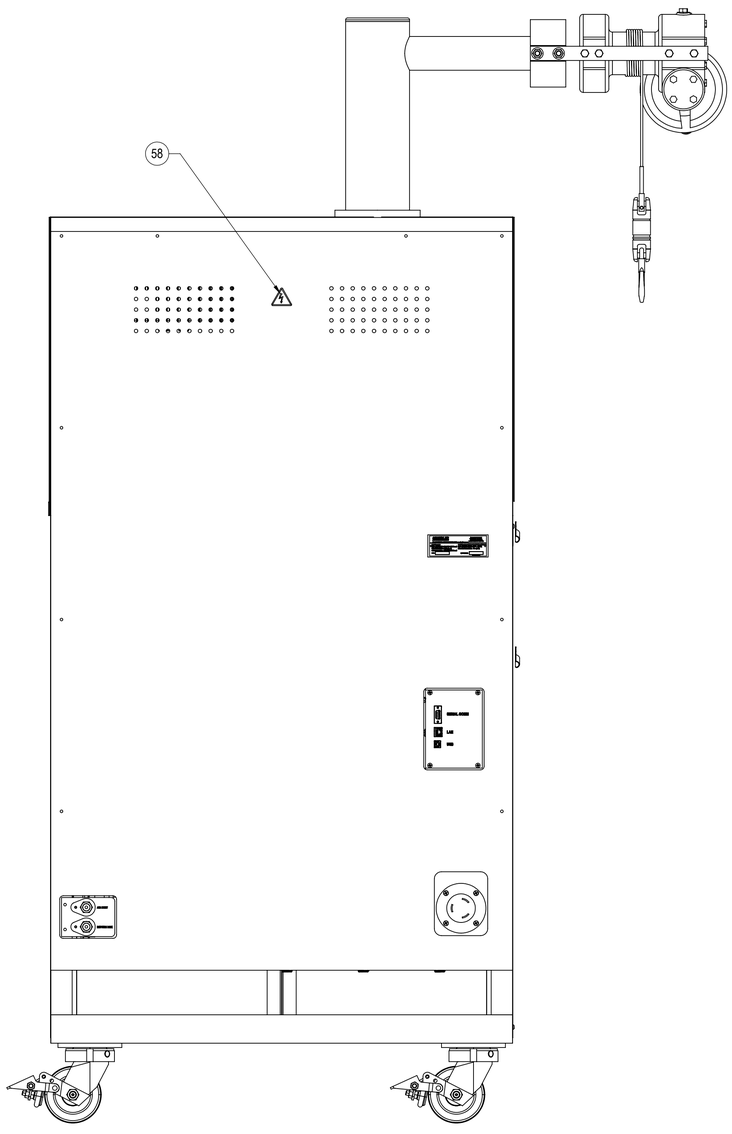


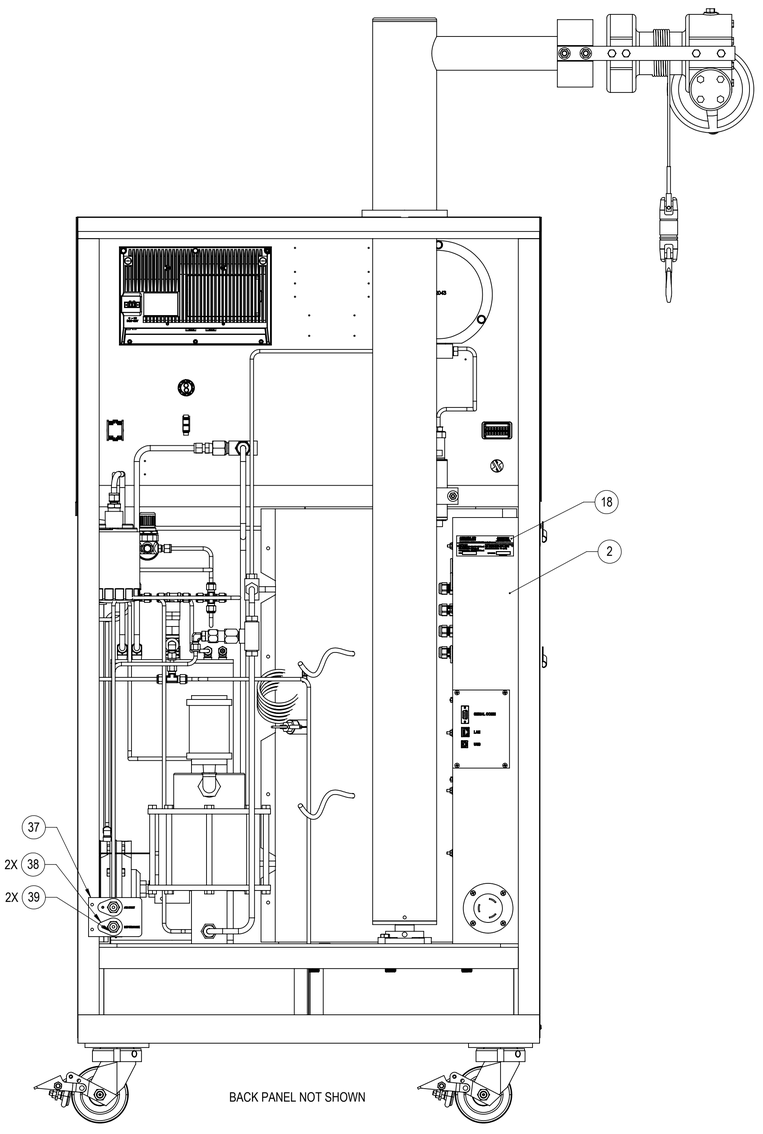
ITEM	PART NUMBER	DESCRIPTION	QTY	UoM
1	19-0101-CE	FRAMEWORK,1910	1	
2	19-0750-CE	ELECTRONICS ASSEMBLY	1	
3	19-0034	SWIVEL ARM ASSEMBLY, 1910	1	
4	19-0108-CE	PANEL,FRONT	1	
5	19-0095-CE	CYLINDER ASSEMBLY,1910-CE	1	
6	19-0176	RING,CYLINDER DECK	1	
7	P-0006	BRG,BLK,4-BOLT,1.000ID,FLANGED	1	
8	07-0885	MOLD ASSY,EIGHT,DBL COMPR	1	
9	19-0111	INSULATION JACKET	1	
10	P-0408	BOLT,EYE,.25-20X2.0,STL	2	
11	C18320	HANDLE,W/O LOCK,CTE CABINET	2	
12	P-2036	LOCK,CAM,HANDLE	2	
13	07-0018	HEAD, PIVOT	1	
14	35-0005-90	USE C12233 INTERNATIONAL SYMBOL	1	
15	07-0021	PLATE, GUIDE SUPER CONSIS	1	
16	07-0391	BAIL,PLUG	1	
17	H-37-004	SCREW,HHCS,CD,.375-16X1.00	1	
18	1910-0084-CE	NPL,SN,PWR RATING,1910	2	
19	C07817	CLAMP,SINGLE LINE 1/2 OD,316SS	2	
20	C09042	MODULE,E-THERM,RS-422,4-WIRE	1	
21	P-2380	JACK,PNL,TC,1.12,SQ FACE	1	
22	C12161	SWITCH,RCKR,PNL,SPST,10A,250V,0-1	1	
23	C16390	CONTROLLER,LIMIT,EZ-ZONE,1/32	1	
24	19-0115	BARRIER,THERMAL INSULATION	1	
25	C06572	GAGE,100PSI,1.5",1/8NPT,CBM	1	
26	P-1887	REG,PRESS,300/100PSI,1/8 FP	1	
27	19-0120-CE	RESERVOIR ASSEMBLY,OIL	1	
28	P-1462	PUMP,AIR-HYDR,50000X110PSI	1	
29	P-0256	BUSHG,BRS,1/4FPX1/2MP PK	1	
30	P-0518	LUBR,HYDR,.33PT,.25FPX.25FP	1	
31	P-1465	BUSHG,BR,RDCR,1/2FPX1MP	1	
32	P-0674	MUFFLER, 1/2MPT,3.75Dx5.5L	1	
33	P-1285	ELBOW,ST,1/2FPX1/2MP,ST	1	
34	P-0255	NIPPLE,ST,1/4MPX3L,CA	1	
35	P-1255	ELBOW,BR,1/4MPX1/4T	12	
36	P-1400	ELBOW,BRS,0.375MP x 1/4T	1	
37	19-0187	PLATE,FLUID SERVICE	1	
38	C08268	RETAINER,SST,3/4ID,BHD,SW	2	
39	P-1954	CONN,BRS,1/4FPX1/4T,BHD,SW	2	
40	C08963	BASE, OIL FILTER	1	
41	C08964	FILTER,OIL	1	
42	P-0855	COLLAR,SS,1/4-28LHX3/8LGX3/8OD	2	
43	P-2043	GAGE,30000PSI,6",9/16-18FM,PNL	1	
44	P-0193	GLAND,SST,TUBE,1/4TX9/16-18RH	2	
45	C17096	XDCR,PRESSURE,40KPSI,AE F250-C,BENDIX PTIH-10-6P	1	
46	P-2169	COLLAR,SS,3/8-24LHX1/2LG,1/2OD	2	
47	P-0754	TEE,HIP,SS,1/4T,60000PSI	2	
48	P-2168	GLAND,SS,3/4-16RHX3/8HPT	2	
49	P-0269	BUSHG,BRS,RDCG,1/8FPX3/8MP WH	1	
50	P-1246	ELBOW,BR,1/8MPX1/4T	1	
51	P-1244	CONN,BRS,1/4TX1/8MP SW	2	
52	C17278	CONN,BRS,1/2MPX1/4T SW	1	
53	P-1265	TEE,UNION,BR,1/4T	3	
54	P-0249	PLUG,BR,1/8MP,HEX,WH	1	
55	C17289	CONN,BRS,1/2MPT X 3/8T,SW	1	
56	C17293	ADAPTER,SS,3/8HPX3/8HPT,HIP	1	
57	P-3199	CONN,BRS,3/8MPX3/8T,SW	1	
58	C14023	LABEL,WARNING,HAZARD VOLTAGE,1.00" BASE	4	
59	C15746	LABEL,WARNING,HOT SURFACE HAZARD,1.00" BASE	1	
60	C17718	HMI,WINDOWS,10in PANEL	1	
61	07-0887	BUCKET,MOLD,1910 CC	1	
62	P-3517	VALVE,NDL,SS,60KPSI,3/8 HPT	1	
63	C12815	VALVE,SOLENOID,2WAY,24VDC,0.093ORIF	2	
64	C12443	VALVE,SOLENOID,ESM-8302-33-H-HC-D024	2	
65	C08259	VALVE,AIR OPR,30000PSI	1	
66	7222-0051	BRACE, VALVE MOUNTING	1	
67	7500-2208	TUBE ASSEMBLY, HP CAPILLARY	1	
68	19-0183	PLATE,CHANDLER ENGINEERING	1	
69	19-0184	LABEL,PRESSURIZED CC	1	
70	19-0185	NPL,RATING	1	
71	19-0186	LABEL,AMETEK LOGO	1	
72	C18019	BRKT,TUBE SUPPORT,1.25" DIAMETER	1	
73	C10380	VALVE, CHECK, B-4C-1	2	
74	P-1277	CROSS,BR,1/4T,SW	1	
75	P-2165	TEE,HIP,SS,3/8TX1/4TX3/8T,60K	2	
76	69-793	SAFE HEAD .25X.083TBG F/1/4A	1	
77	C11569	FTG,TUBE,RED,1/16-1/4,SST,SW	1	
78	C12677	ADPTR,SS,3/8TX1/4HP,60KPSI	1	
79	C14080	ACTUATOR, STOP SWITCH, EAO	1	
80	C14081	SWITCHING ELEMENT,2NC,10A	1	
81	C18036	DISK,RUPTURE,25500 PSI,.250,IN,CE	1	
82	C12480	CABLE,DIN,SOLENOID	4	
83	1910-TUBESET	TUBESET,MODEL 1910-CE	1	
84	19-0096-CE	TUBING DIAGRAM, 1910-CE	1	
85	19-0097-CE	WIRING DIAGRAM, 1910-CE	1	
86	C18084	SCREW,FHMS,SS,1/4-20X3.00	2	
87	H-25-007	WSHR,FLAT,SS,1/4	2	
88	H-25-001	NUT,HEX,SS,1/4-20	2	
89	C18295	INDICATOR,PANEL,LED,RED,24VDC,75mcd,22mm	1	
90	C18218	SCREW,TORX,SS,8-32x0.375	2	

BREAK EDGES, DEBURR
UON DIMS ARE IN INCHES
1 PLC ±0.030 2 PLC ±0.010
3 PLC ±0.005 ANGL ±1/2°
SURFACE FINISH 63 RMS
THIRD ANGLE PROJECTION

DRAWN: JJM 8/6/2018
MFG: ADMN8/14/2018
ENGR: JJM 8/6/2018
TYPE:
STRUCT:

CHANDLER ENGINEERING
MODEL 1910,CURING CHAMBER,CE
PN: 19-0090-CE
PROJ: 19
REV F
SIZE D
SHEET 1 OF 2
TITLE BLOCK REV 3





BACK PANEL NOT SHOWN

BREAK EDGES, DEBURR
UON DIMS ARE IN INCHES
1 PLC ±0.030 2 PLC ±0.010
3 PLC ±0.005 ANGL ±1/2°
SURFACE FINISH 63 RMS
THIRD ANGLE PROJECTION

DRAWN: JUM 8/6/2018
MFG: ADMN8/14/2018
ENGR: JUM 8/6/2018
TYPE:
STRUCT:

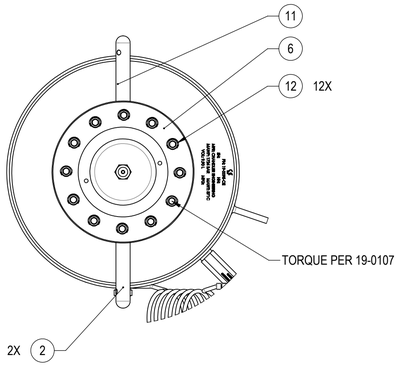
CHANDLER ENGINEERING

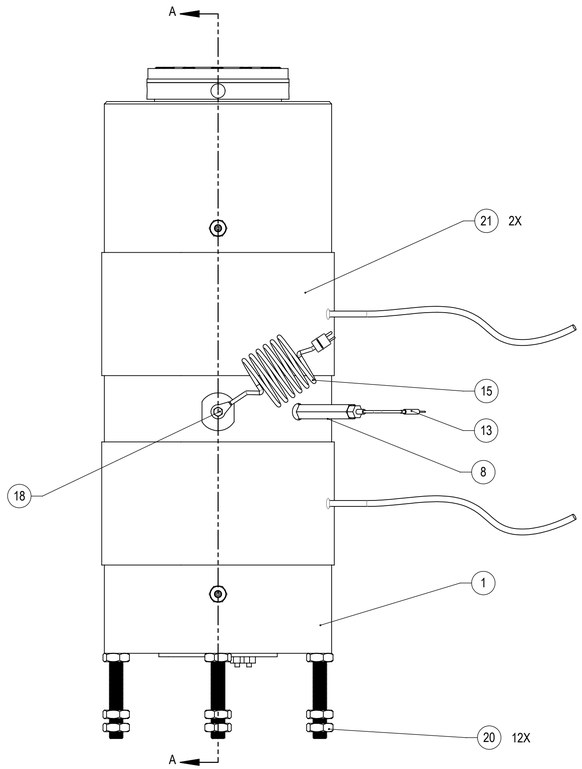
MODEL 1910,CURING CHAMBER,CE

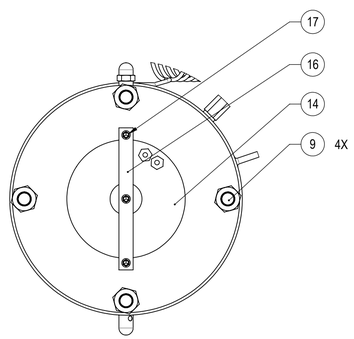
PN: 19-0090-CE | REV F | SIZE D
PROJ: 19 | SHEET 2 OF 2

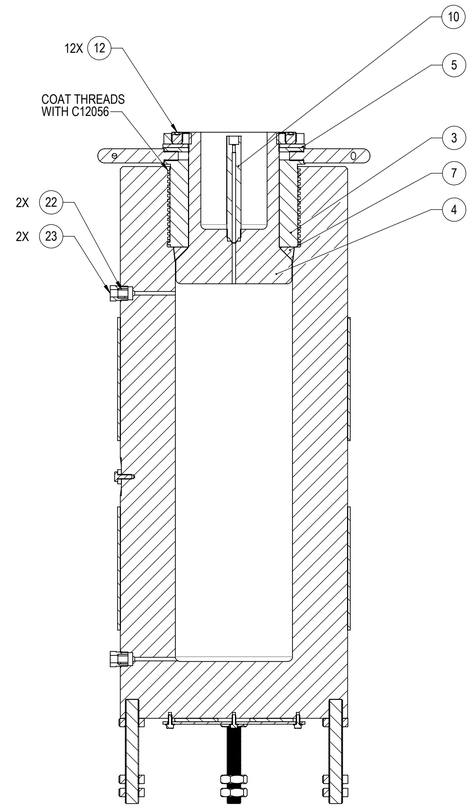
TITLE BLOCK REV 3

REV	DESCRIPTION	DATE	APPROVED
A	ISSUED	07/19/18	JJM
B	ECN T8246; CHANGED 19-0055 AND 19-0078 TO CP525-19-0055 AND CP525-19-0078	8/22/2018	JJM









SECTION A-A

ITEM	PART NUMBER	DESCRIPTION	QTY	UoM
1	19-0093-CE	CYLINDER,1910-CE	1	EA
2	07-0772	HANDLE,PLUG	2	EA
3	19-0087	PLUG, HIGH TEMP	1	EA
4	19-0088	SEAL SHAFT, CURING CHAMBER	1	EA
5	19-0109	THRUST WASHER,MACHINED	1	EA
6	19-0091	NUT,LOCKING,HIGH TEMP	1	EA
7	19-0089	SEAL RING	1	EA
8	CP525-19-0055	ADAPTER, SIDE THERMOCOUPLE	1	EA
9	19-0060	LEG,CYLINDER	4	EA
10	CP525-19-0078	ADAPTER, CENTER THERMOCOUPLE	1	EA
11	70-0023	THERMOCOUPLE	1	EA
12	P-1792	SCREW,SKHSS,BK,5/8-11,FLAT	12	EA
13	19-0057	TC,SPECIAL TYPE J,6.6"L	1	EA
14	C16901	HTR,RING,500W,240V,6.25inOD	1	EA
15	C16981	THERMOCOUPLE, TYPE J, BOLT ON	1	EA
16	07-0387	HEATER STRAP 1910 STD	1	EA
17	C17244	SCREW,HHCS,SS,10-32X0.500,HEX	3	EA
18	H-25-019	SCREW,HHCS,SS,1/4-20X0.750,HEX	1	EA
19	19-0093-CE-STEN	STENCIL,19-0093-CE	REF	EA
20	H-75-001	NUT,HEX,CD,3/4-10	12	EA
21	C18016	HEATER,CIR,4000W,240V,12X6.5 LEADS	2	EA
22	P-2169	COLLAR,SS,3/8-24LHX1/2LG,1/2OD	2	EA
23	P-2168	GLAND,SS,3/4-16RHX3/8HPT	2	EA
24	19-0095-CE-TEST	PROC,TEST,PRESSURE VESSEL	REF	EA

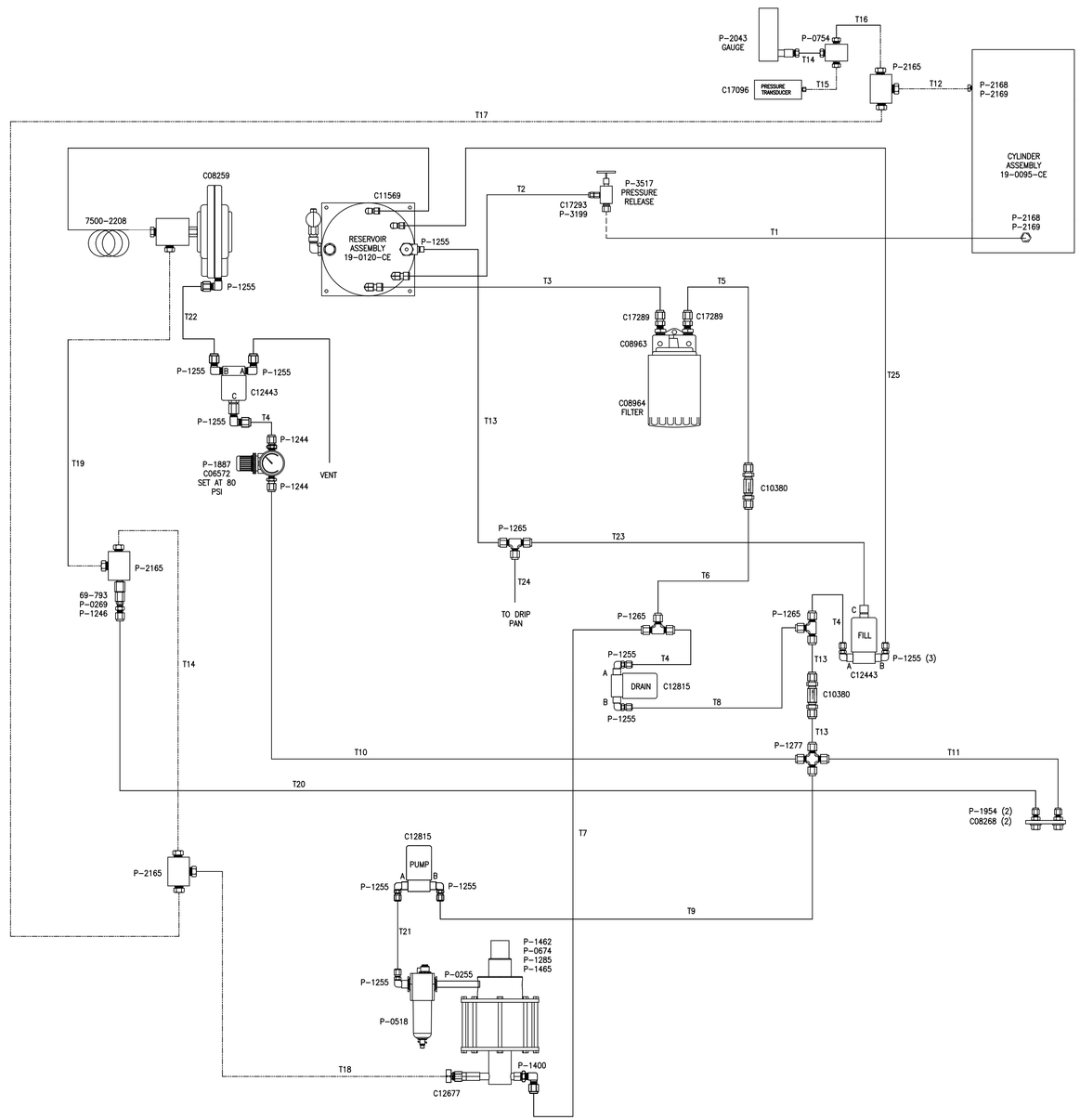
NOTES:
1. TEST VESSEL ASSEMBLY PER 19-0095-TEST
2. ENSURE THAT VESSEL IS MARKED PER 19-0093-CE-STEN

BREAK EDGES, DEBURR
UON DIMS ARE IN INCHES
1 PLC ±0.030 2 PLC ±0.010
3 PLC ±0.005 ANGL ±1/2°
SURFACE FINISH 63 RMS
THIRD ANGLE PROJECTION

DRAWN: JJM 8/6/2018
MFG: ADMN8/13/2018
ENGR: JJM 8/6/2018
TYPE:
STRUCT:

CHANDLER ENGINEERING
CYLINDER ASSEMBLY,1910-CE
PN: 19-0095-CE
PROJ: 19
REV B
SIZE D
SHEET 1 OF 1
TITLE BLOCK REV 5

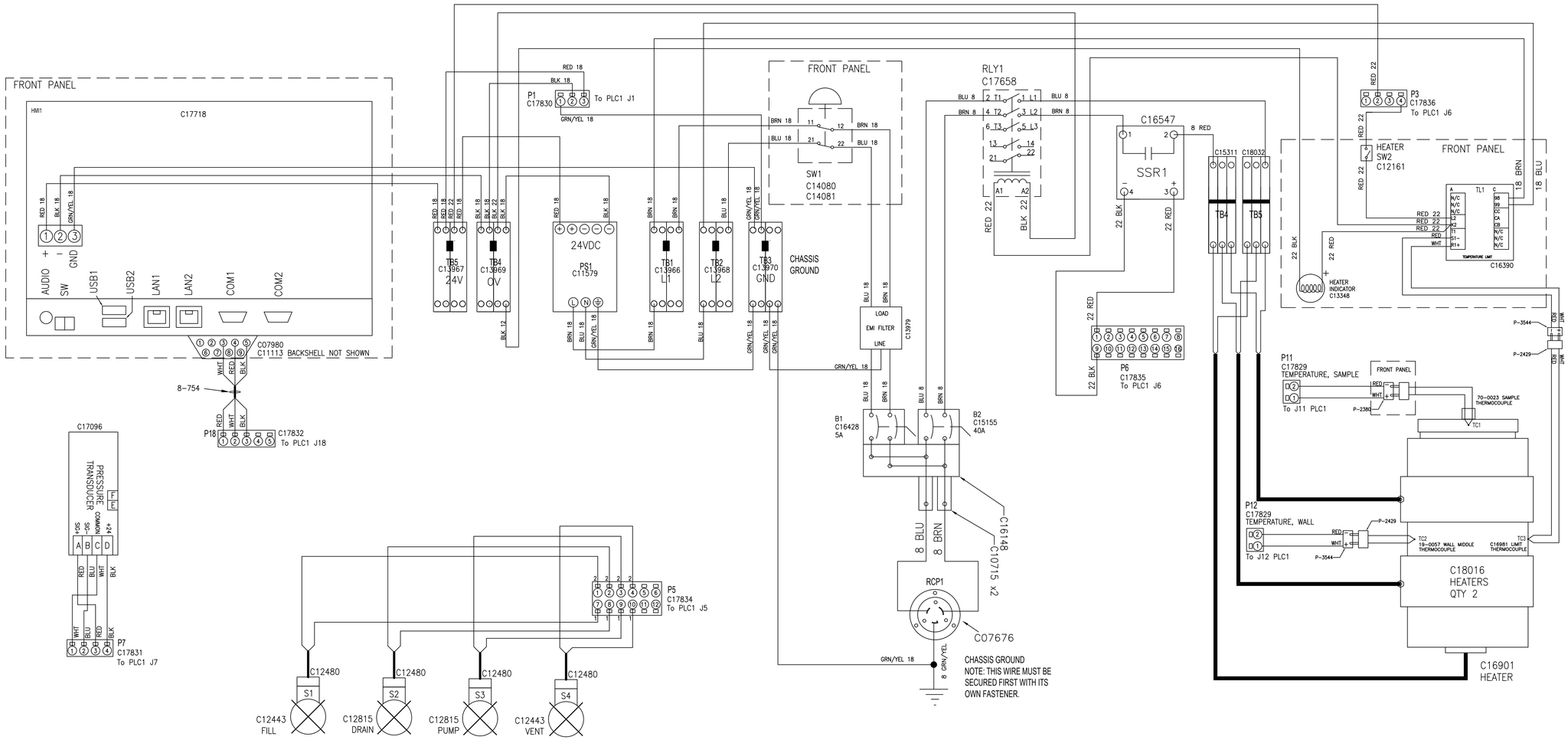
REVISIONS				
ZONE	REV	DESCRIPTION OF REVISION	DATE	APPROVALS
	A	ISSUED	07/31/18	JJM



		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		CHANDLER ENGINEERING			
		TOLERANCES:					
		1 PLACE ±0.030 [.76]					
		2 PLACE ±0.010 [.25]					
NEXT ASSY	USED ON	3 PLACE ±0.005 [.127]					
		ANGLES ±1/2°		TITLE			
APPLICATION		SURF. FINISH 32		TUBING DIAGRAM			
BREAK SHARP EDGES, DEBURR		APPROVALS	DATE				
		DRAWN: JJM	07/31/18	SIZE C	S.O. NO.	DWG NO. 19-0096-CE	REV. A
		CHECKED:					
		ENGR.: JJM	07/31/18	SCALE: 1 = 1	TITLE BLOCK REV: 1.0	SHEET: NTS	

NOTE: ALL PART NUMBERS ON THIS DRAWING ARE FOR REFEREMCE ONLY.
TO FIND THE PART NUMBER FOR A COMPONENT ON THE SOLID MODEL
MATCH THE REFERENCE DESIGNATOR FOUND ON BOTH DRAWINGS.

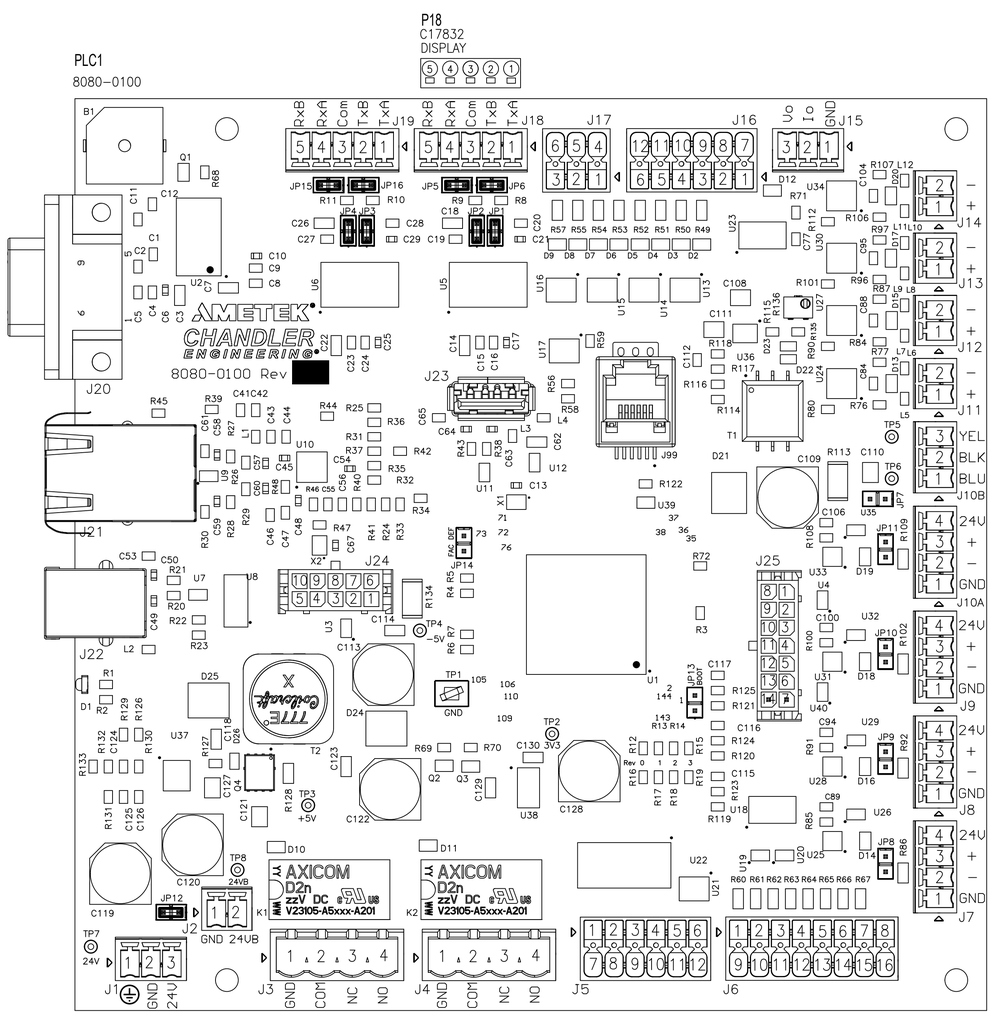
REVISIONS					
ZONE	REV	DESCRIPTION OF REVISION	DATE	APPROVALS	
	A	ISSUED	27SEP18	TAS	DLR
	B	ECN T8623; AS BUILT CHANGES	05AUG19	TAS	JS



		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		CHANDLER ENGINEERING			
		TOLERANCES:					
		1 PLACE ±0.030					
		2 PLACE ±0.010					
NEXT ASSY	USED ON	3 PLACE ±0.005		TITLE	DIAGRAM,WIRING		
		ANGLES ±1/2°			1910-CE CURING CHAMBER		
APPLICATION		SURF. FINISH 63					
BREAK SHARP EDGES, DEBURR		APPROVALS	DATE				
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		DRAWN: TAS	27SEP18	SIZE	S.O. NO.	DWG NO.	REV.
		CHECKED: JS	27SEP18	D		19-0097-CE	B
		ENGR.: TAS	27SEP18	SCALE: 1 = 1	TITLE BLOCK REV: 1.0	SHEET: 1 of 2	

NOTES:
1. JP1,JP2,JP3,JP4,JP5,JP6,JP7,JP12,JP15.JP16 INSTALLED
2. JP8,JP9,JP10,JP11,JP13,JP14 NOT INSTALLED

CHAN 80



P12
C17829
TEMPERATURE, WALL

P11
C17829
TEMPERATURE, SAMPLE

PRESSURE
ANALOG1

P7
C17831

P1
C17830
POWER

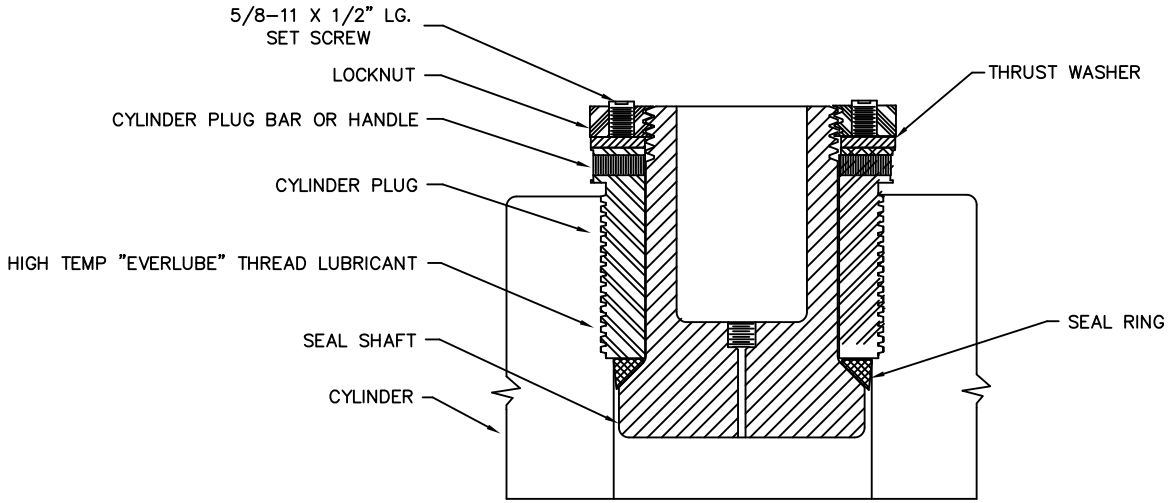
P3
C17836
HEATER ENABLE

P5
C17834
VAVLE CONTROL

P6
C17835
SSR HEATER CONTROL

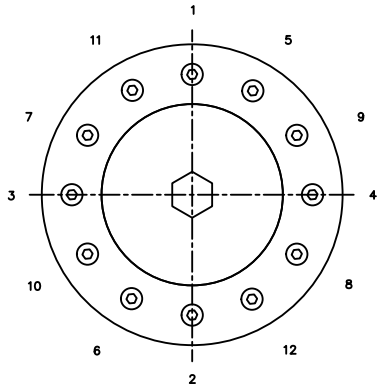
		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		CHANDLER ENGINEERING			
		TOLERANCES: 1 PLACE ±0.030; 2 PLACE ±0.010; 3 PLACE ±0.005; ANGLES ±1/2°		TITLE: DIAGRAM,WIRING 1910-CE CURING CHAMBER			
NEXT ASSY	USED ON	SURF. FINISH 63					
APPLICATION		BREAK SHARP EDGES, DEBURR					
		APPROVALS	DATE				
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		DRAWN: TAS	27SEP18	SIZE: D	S.O. NO.	DWG NO. 19-0097-CE	REV. B
		CHECKED: JS	27SEP18				
		ENGR.: TAS	27SEP18	SCALE: 1 = 1	TITLE BLOCK REV: 1.0	SHEET: 2 OF 2	

REVISIONS					
ZONE	REV	DESCRIPTION OF REVISION	DATE	APPROVALS	
	C	ECN 6931	08/07/00	AEB	BD
	D	ECN T8706; COMBINED SHEETS 1 AND 2	09/26/19	JJM	JS



NOTES

1. KEEP SEAL SURFACES CLEAN.
2. TORQUE SCREWS AS PATTERN INDICATES.
3. TORQUE SCREWS TO 20 ft–lbs (27 N–m) DURING FIRST ROTATION.
4. TORQUE SCREWS TO 35 ft–lbs (47 N–M) DURING SECOND ROTATION.
5. ONLY CYLINDER PLUG SHOULD ROTATE WHEN SEAL RING CONTACTS CYLINDER TAPER.



OPERATIONS

1. THREADED PLUG IS SCREWED INTO CYLINDER UNTIL CONTACT IS MADE BETWEEN SEAL RING AND CYLINDER. BAR IS USED TO GENTLY TIGHTEN PLUG.
2. SET SCREWS ARE TIGHTENED ACCORDING TO PATTERN SHOWN ON SHEET 2 OF 2, PULLING SEAL SHAFT AGAINST SEAL RING AND MAKING INITIAL SEAL.
3. INTERNAL PRESSURE THEN FORMS A TIGHTER JOINT.

–04	–03	–02	–01	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
QTY. REQD.				PARTS LIST			
56–170–0				5617			
				1910			
NEXT ASSY				USED ON			
APPLICATION							

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]

TOLERANCES:
1 PLACE ±0.030
2 PLACE ±0.010
3 PLACE ±0.005
ANGLES ±1/2°
SURF. FINISH 63

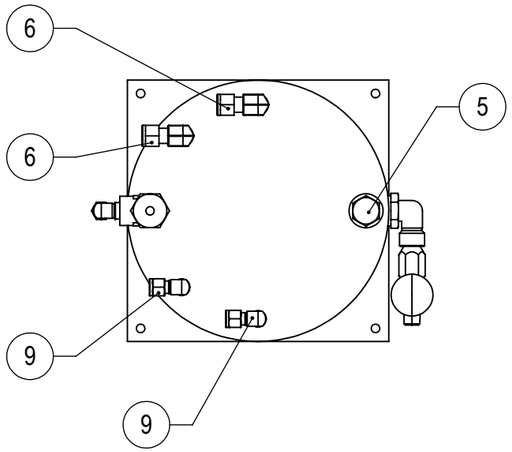
APPROVALS		DATE
DRAWN:	WES	06/14/77
CHECKED:	CEL	06/14/77
ENGR.:	ARK	06/14/77

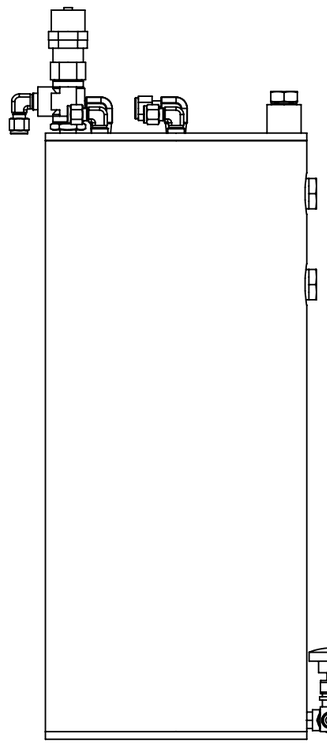
CHANDLER ENGINEERING

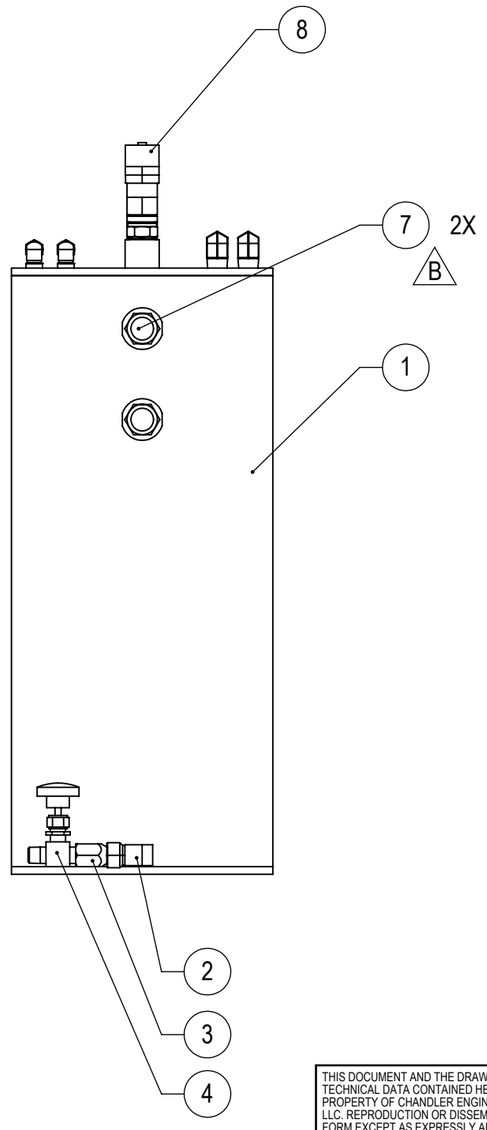
TITLE
MODIFIED BRIDGEMAN SEAL

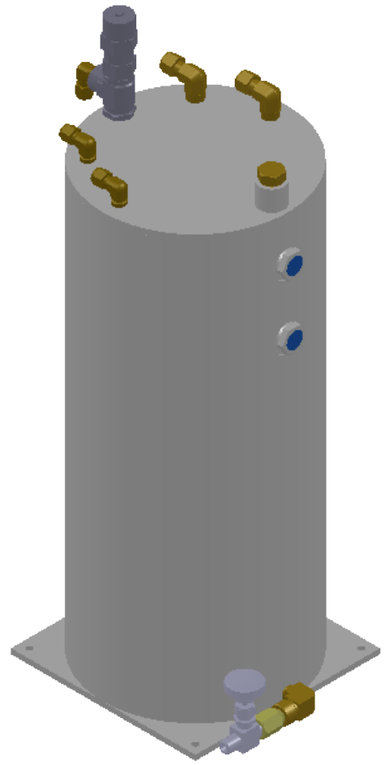
SIZE	S.O. NO.	DWG NO.	REV.
A4		19–0107	D
SCALE:	DO NOT SCALE DRAWING	SHEET: 1 OF 1	

REV	DESCRIPTION	DATE	APPROVED
A	ISSUED	07/23/18	JJM
B	ECN T8255; CHANGED QTY OF C18018 TO 2	8/28/2018	JJM









ITEM	PART NUMBER	DESCRIPTION	QTY	UoM
1	19-0113-CE	RESERVOIR ASSEMBLY	1	EA
2	P-1496	ELBOW,BR,1/4FPX1/4MP,STREET,90DEG	1	EA
3	36-0040	ADAPTER, GAUGE	1	EA
4	P-1500	VALVE,NDL,BR,1/4MX1/4M,2WY-STR	1	EA
5	P-0275	PLUG,BR,1/2MP,HEX	1	EA
6	19-0119	DIP TUBE,RESERVOIR,3/8	2	EA
7	C18018	PLUG,SIGHT GLASS,3/4-IN NPT	2	EA
8	C18020	VALVE,RELIEF,SS,81-150 PSI	1	EA
9	P-1255	ELBOW,BRS,1/4MPX1/4T,SW	3	EA

BREAK EDGES, DEBURR
UON DIMS ARE IN INCHES
1 PLC ±0.030 2 PLC ±0.010
3 PLC ±0.005 ANGL ±1/2°
SURFACE FINISH 63 RMS
THIRD ANGLE PROJECTION

DRAWN: JJM 8/3/2018
MFG: ADMN8/13/2018
ENGR: JJM 8/3/2018
TYPE:
STRUCT:

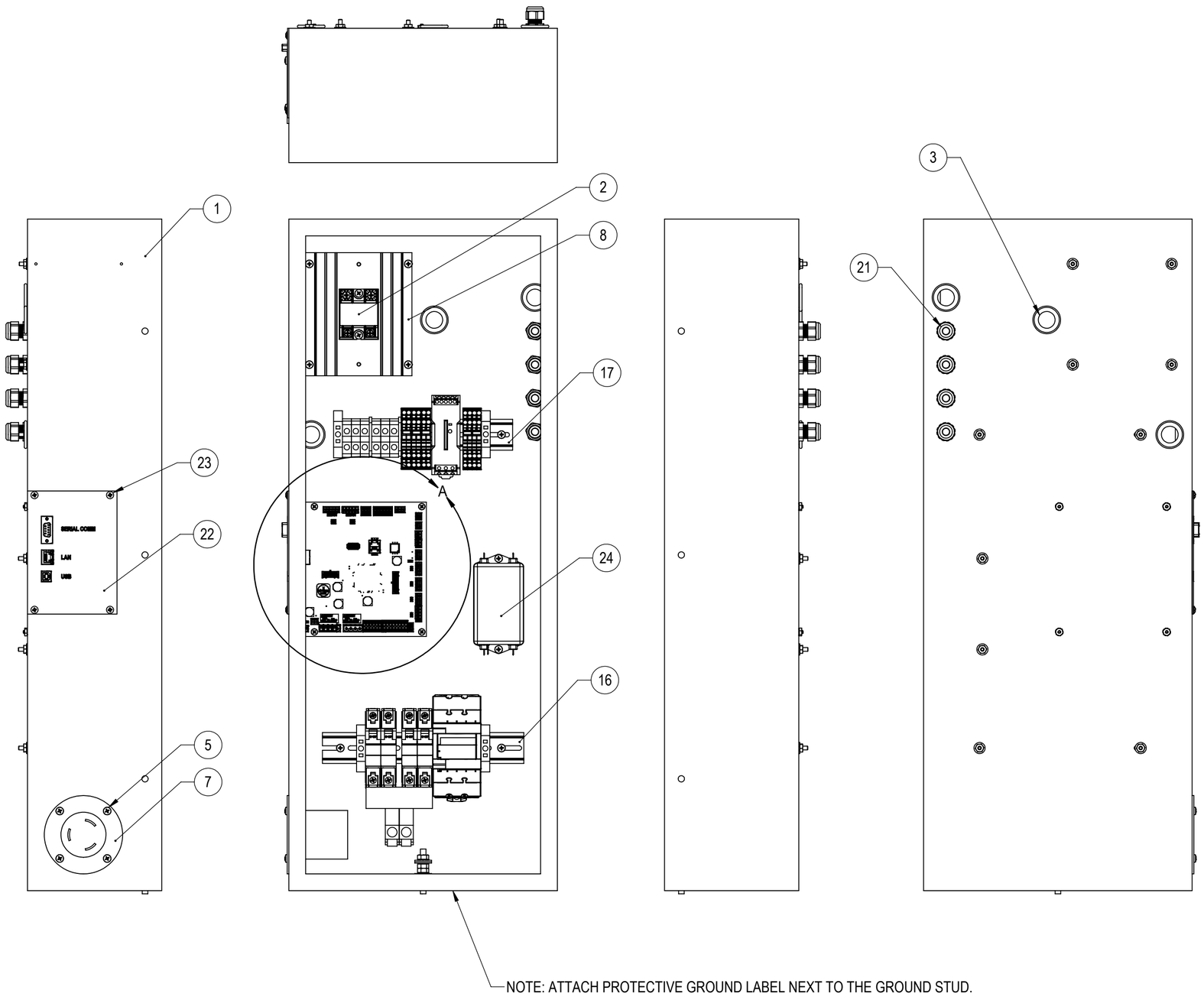
CHANDLER ENGINEERING

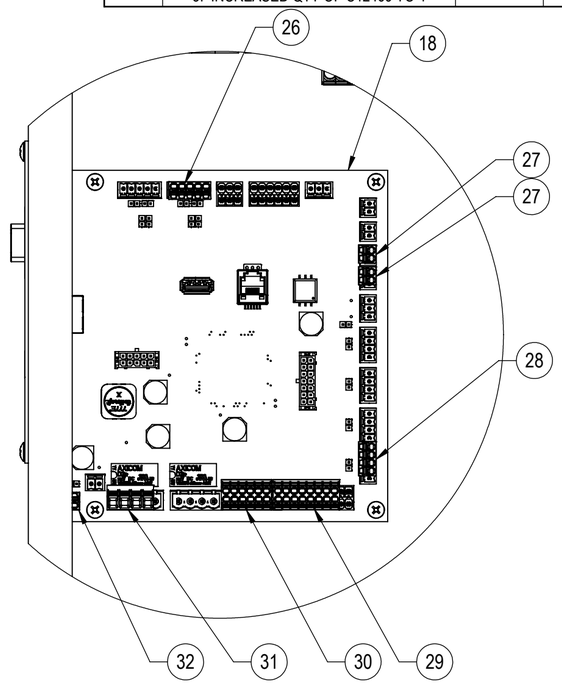
RESERVOIR ASSEMBLY,OIL

PN: 19-0120-CE | REV B | SIZE B
PROJ: 19 | SHEET 1 OF 1

TITLE BLOCK REV 3

REV	DESCRIPTION	DATE	APPROVED
B	ECN T8302	10/8/2018	DLR
C	ECN T8347; INCREASED QTY OF P-1562 TO 3. INCREASED QTY OF C12469 TO 4	10/29/2018	JJM





DETAIL A

NOTE: ATTACH PROTECTIVE GROUND LABEL NEXT TO THE GROUND STUD.

ITEM	PART NUMBER	DESCRIPTION	QTY	UoM
1	19-0755-ENCL	ENCLOSURE,ELECTRONICS	1	
2	C16547	SSR,240VAC,75A,CHASSIS	1	
3	P-1562	GROMMET,RBR,.625X1.125X.0625	3	
4	H-8002	WSHR,FLAT,SS,#8	10	
5	H-8014	SCREW,BHMS,SS,8-32X0.500,PHIL	16	
6	H-8004	NUT,HEX,SS,8-32	14	
7	C07676	INLET,250V,50A,HUBBELL CS8275	1	
8	C09685	HEAT SINK,SSR,50A	1	
9	C16550	THERMAL PAD FOR SSR, C16547	1	
10	H-25-026	SCREW,SKHSS,SS,1/4-20X2.00,CUP	1	
11	H-25-003	NUT,HEX,SS,1/4-20,KEPS	5	
12	C12233	LABEL,PROTECTIVE EARTH GROUND	1	
13	H-25-007	WSHR,FLAT,SS,1/4	4	
14	07-1586	CABLE,COMM,WAGO,4-WIRE	1	
15	C09911	CABLE,4 COND,22AWG,SHIELDED	1	
16	19-0750-01	DIN RAIL ASSY,1910-STD	1	
17	19-0750-03-CE	DIN RAIL ASSEMBLY,POWER	1	
18	8080-0100	PCA ASSY,CHANTRONICS-80	1	
19	C17843	STDF,HEX,SS,0.50x0.25,6-32,M/F	4	
20	H-6009	SCREW,BHMS,SS,6-32X0.250,PHIL	4	
21	C12469	STRAIN RELIEF,CABLE	4	
22	8080-0103	PANEL,LABEL,CHAN80	1	
23	H-6015	SCREW,THMS,SS,6-32X0.375,PHIL	4	
24	C13979	FILTER, POWER LINE,10A,250VAC	1	
25	H-6041	NUT,KEPS,SS,6-32	8	
26	C17832	PLUG,TERM BLOCK, 5 POS 3.5MM,MATES W C17825	1	
27	C17829	PLUG,TERM BLOCK, 2 POS 3.5MM,MATES W C17822	2	
28	C17831	PLUG,TERM BLOCK, 4 POS 3.5MM,MATES W C17824	1	
29	C17835	PLUG,TERM BLOCK,16 POS,DUAL,3.5MM,MATES W C17828	1	
30	C17834	PLUG,TERM BLOCK 12 POS,DUAL,3.5MM,MATES W C17827	1	
31	C17836	PLUG,TERM BLOCK,4 POS,5.08MM,MATES W C08949	1	
32	C17830	PLUG,TERM BLOCK, 3 POS 3.5MM,MATES W C17823	1	
33	C07980	CONN,9 PIN,DSUB,FEMALE	1	
34	C11113	HOOD,DB9,BACK,SIDE ENTRY	1	

BREAK EDGES, DEBURR
UON DIMS ARE IN INCHES
1 PLC ±0.030 2 PLC ±0.010
3 PLC ±0.005 ANGL ±1/2°
SURFACE FINISH 63 RMS
THIRD ANGLE PROJECTION

DRAWN: JJM 8/3/2018
MFG: ADMN8/14/2018
ENGR: JJM 8/3/2018
TYPE:
STRUCT:

CHANDLER ENGINEERING
ELECTRONICS ASSEMBLY
PN: 19-0750-CE | REV C | SIZE C
PROJ: 19 | SHEET 1 OF 1

TITLE BLOCK REV 3