INSTRUCTION MANUAL
MODEL 6265
Mechanical Properties Analyzer (MPRO®)
Revision K – July 2024
P/N: 348-1050

S/N: _____

CHANDLER
E N G I N E E R I N G ®

AMETEK®

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General Information
Introduction

Purpose and Use

The 6265 Mechanical Properties Analyzer (MPRO®) is an instrument that continuously measures the elastic mechanical properties (Poisson's ratio, Young's modulus, Bulk Modulus), and compressive strength of API cement under high-temperature and high-pressure conditions.

The instrument measures the compressional and shear sound velocities through the cement sample and uses industry-accepted equations to determine the Poisson's Ratio and Young's Modulus. The data is presented graphically using the 5270 Data Acquisition and Control System (DACS).

Description

Each 6265 MPRO is equipped with a programmable temperature controller that provides the capability to investigate the impact of temperature variations on the cement mechanical properties. With the external Quizix pump system, the user can simulate realistic pressure conditions to evaluate the impact on the mechanical properties of the cement.

Features and Benefits

- Continuous measurement of mechanical properties.
- Single vessel curing to preserve sample conditions and testing integrity, avoiding the need for separate curing and mechanical property measurement procedures.
- Easy to install and use.
- Measures the development of Poisson's ratio, Young's modulus, Bulk Modulus, and compressive strength of API Cement slurries.
- Uses Chandler Model 5270 Data Acquisition and Control System for data retrieval, analysis, and storage.
- Separate pressure control system for accurate sample pressure control.
- Optional external chiller system.

Specifications

Measurements:	Poisson's Ratio, Young's Modulus, Bulk Modulus, Compressive Strength
Operating Conditions:	50°F - 110°F / 10°C - 43°C – non-condensing
Maximum Temperature:	400°F / 204°C
Maximum Pressure:	7500 psi / 52 MPa
Input Voltage:	220 VAC ± 15%; 50/60 Hz ± 10%
Input Power:	750 VA
Dimensions:	16 in. / 41cm high x 18 / 46cm wide x 17 in. / 43cm deep

Safety Requirements

READ BEFORE ATTEMPTING OPERATION OF INSTRUMENT

	If this equipment is not used in a manner consistent with the manufacturer's specifications the protection provided by the equipment may be impaired.
	Warning: Read before attempting operation of this instrument. This instrument is capable of high temperatures and pressures and must always be operated with CAUTION. The instrument is designed for operator safety. To ensure that safety, it is essential the general instructions outlined below are followed. This instrument should only be operated by trained personnel that have completed the appropriate safety training.
	Warning: High Temperatures During a test, the instrument can become hot and cause injury if touched. Allow the cylinder to cool to below 95°F (35°C) prior to touching.

The following safety procedures are advisable:

- Post signs where the instrument is being operated to warn other personnel.

- Read and understand the instructions and caution notes before attempting operation.

- Never exceed the instrument maximum pressure and temperature ratings. The particular 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.

- Use appropriate Personal Protective Equipment such as safety glasses, latex gloves, etc.

- This is a bench top device; place the instrument on a suitable, level, and stable surface.

- Locate the instrument in a low traffic area. Allow a minimum of 12 in. (305mm) unobstructed clearance around side, back and top faces to provide for adequate ventilation. Position the back of the instrument to allow access to disconnect cords in the event of an emergency.

- Always disconnect main power to the instrument before attempting any repair.

- Have the safety officer at your location review the safety aspects of the instrument and this manual and approve the operational and installation procedures.
- Turn off the heater at the completion of a test. Hot water in the open cylinder or drain, when exposed to the atmosphere and heated beyond its boiling point, can cause server burns from steam.

- A fire extinguisher, type 8 BC, should be located within 50 feet (15 meters) of the instrument.

Before attempting to operate the instrument, the operator should read and understand this manual.

Symbols Used on Equipment

Symbol	Meaning
	Protective Conductor Terminal
	Caution, risk of electric shock. Equipment may be powered by multiple sources. Disconnect (Lock-out) all services before servicing.
	Caution, hot surface. Do NOT touch. Allow to cool before servicing.
	Warning, Potential Hazard
	On (Supply)
	Off (Supply)

Symbols Used in this Manual

Symbol	Meaning
	Note, Important Information
	Warning, Potential Hazard

Where to Find Help

In the event of problems, contact your local sales representative or Chandler Engineering:

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

Instrument training classes are also available.

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Section 1 – Installation

Unpacking the Instrument

Remove the instrument from the packing crate carefully. The unit comes fully equipped with all the necessary components and ordered spare parts. Make sure that no parts are lost when discarding the packing materials. Place the instrument on a firm table, close to the water source and required electrical outlets.

After the instrument is removed from the shipping crate, the equipment and spare parts should be checked against the packing list to ensure that all parts have been received and none are damaged.

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

Utilities Required

- Power: 220 ±15% VAC, 50/60 Hz, 750VA
- Water: Clean pressurizing water, 5-150 psi / .34-10.4 bar
- Coolant: Clean water or ethylene glycol and water solution
- Air: Clean, dry compressed air or nitrogen; 75-125 psi / 5.2-8.6 bar
- Drain: Suitable for hot water

Tools/Equipment Required

- 5/8 inch Wrench
- 1/2 inch Wrench
- 1/8 inch drill bits (or 3mm)
- Teflon Tape
- Hex wrenches
- Screwdrivers (flat blade, Phillips head)
- Bench Vise

Installing the Instrument

1. Locate the MPRO® analyzer near power, pressure, water, and drain connections.

2. Connect power to the instrument using the power cord supplied with the analyzer. A 10A fuse or circuit breaker is recommended.   A 1 KVA uninterruptible power supply (UPS) is recommended to protect the data acquisition electronics and test data from brief power failures. The MPRO® is equipped with an internal circuit breaker.

3. The MPRO® has serial, USB and ethernet connections. Only one connection is required. Windows recognizes the USB connection as a serial device and is thus configured the same as the serial connection.

4. Connect the pressure (PRESSURE IN), water (COOLANT IN), and drain (COOLANT OUT and DRAIN) lines to the MPRO® Analyzer. The accessory kit also contains spare nuts and ferrules.

⚠ *Note: The drain system must be capable of handling hot water up to 212°F / 100°C or brief surges of up to 400°F / 204°C steam for short periods during initial cooling of the instrument. If two or more analyzers are connected to a common drain line, it is recommended that the common drain be 3/8 inch / 10mm inside diameter, minimum. It is also recommended to use metal drain lines. Copper tubing with brass fittings is satisfactory.*

⚠ *Note: The ports use 1/4 inch or 1/8 inch female NPT threaded connections. The NPT ports are adapted for use with 1/4 inch and 1/8 inch tubing using Swagelok® fittings. For the high pressure connection (PRESSURE IN), the 1/8 inch stainless steel tubing must have 0.035 inch wall thickness required for use at 7,500 psi. If metric size tubing is required, the port adapters may be changed to adapt the female NPT ports to metric tube connections. In all cases, the high pressure tubing and connections must be rated for 7,500 psi / 52 MPa.*

Software Configuration

The Model 6265 MPRO®.Analyzer is operated remotely via the Chandler Engineering 5270 Data Acquisition and Control Software (5270 DACS or 5270). Version 2.10.3 or later supports reading diagnostic waveform information via Modbus. Configure 5270 as described below.

Generally, the instrument is supplied with a computer that has the instrument pre-configured. If not, 5270 must be installed on the computer involving hardware address definitions for temperature, pressure, compressional wave velocity and shear wave velocity. Each vessel is calibrated and these values must be entered into the calibration section for compressional wave velocity and shear wave velocity.

Note: These instructions assume that the operator has a working knowledge of the 5270 Software. Refer to the 5270 Manual (Chandler P/N 5270-0010) or the in-software Help file for more information.

Modbus Protocol (Serial; use DB9 or USB Connection)

1. Configure a "Modbus" I/O Connection (Tools > Configure > I/O connection) for the instrument. For the purposes of this example, the I/O Connection is named "6265".
   a. Set the Timeout to 500 msec (default is 1000 msec)
   b. Set the Baud Rate (Bits per second) to 19200 (default is 9600)

2. Create a new Instrument (Tools > Configure > Instruments > New). Select the "Model 6265 MPRO" instrument.

3. Enter the desired Name and Test file prefix and click Next.

4. Configure the instrument as shown below.

New Instrument - Step 3

Set the I/O connection and address for each signal, controller, digital output and analog output below. Double-click on an entry to change its settings. If an item does not exist, disable it by clicking the checkbox.

Name	Type	I/O Connection	Address
☑ Transit Time	Input signal	6265	9:0f
☑ Shear Time	Input signal	6265	9:2f
☑ Signal Quality	Input signal	6265	9:4f
☑ Temperature	Input signal	6265	1:1f
☑ Pressure	Input signal	6265	9:18f
☐ Output Pulse	Input signal	6265	9:7512s
☐ Input Waveform	Input signal	6265	9:7000s
☑ Temperature	Controller	6265	1

[< Back] [Next >] [Cancel] [Help]

Note: The "Output Pulse" and "Input Waveform" signals are for diagnostic purposes and are not required for normal operation. Chandler Engineering recommends that these signals be configured but disabled.

ModbusTCP Protocol (Ethernet Connection)

From Chandler Engineering, the 6265 MPRO is configured with the following IP Addresses:

Device	IP Address	Subnet Mask
Electronics Box	10.17.100.200	255.255.0.0
Temperature Controller	10.17.100.201	255.255.0.0

Note: The IP Addresses and Subnet Masks of ALL devices (Electronics Box, Temperature Controller and control PC) must be compatible. Refer to Network Configuration for more information.

1. Configure a Modbus TCP I/O Connection (Tools > Configure > I/O connection) for each device. For the purposes of this example, the following I/O Connections were created:

I/O Connection	Device	IP Address
TCP200	Electronics Box	10.17.100.200
TCP201	Temperature Controller	10.17.100.201

Modbus-TCP Protocol Settings
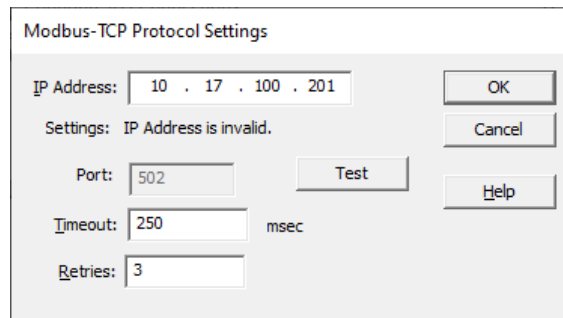
IP Address: 10 . 17 . 100 . 200   [OK]

Settings: IP Address is invalid.   [Cancel]

Port: 502   [Test]   [Help]

Timeout: 250   msec

Retries: 3

Modbus-TCP Protocol Settings

IP Address: 10 . 17 . 100 . 201   OK

Settings: IP Address is invalid.   Cancel

Port: 502   Test   Help
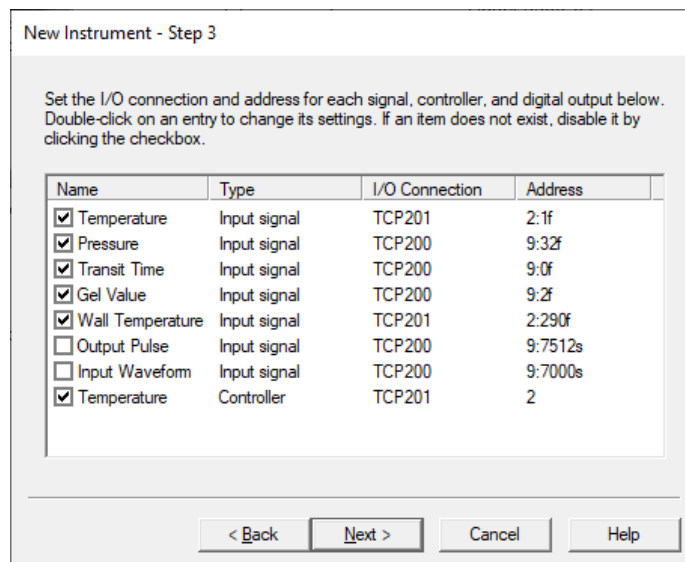
Timeout: 250   msec

Retries: 3

Set the Timeout to 250 msec (default is 1000 msec) and Retries to 3 (default).

2. Create a new instrument (Tools > Configure > Instruments > New). Select the "Model 6265 MPRO" instrument.

3. Enter the desired Name and Test file prefix and click Next.

4. Configure the instrument as shown below:

New Instrument - Step 3

Set the I/O connection and address for each signal, controller, and digital output below.
Double-click on an entry to change its settings. If an item does not exist, disable it by
clicking the checkbox.

Name	Type	I/O Connection	Address
☑ Temperature	Input signal	TCP201	2:1f
☑ Pressure	Input signal	TCP200	9:32f
☑ Transit Time	Input signal	TCP200	9:0f
☑ Gel Value	Input signal	TCP200	9:2f
☑ Wall Temperature	Input signal	TCP201	2:290f
☐ Output Pulse	Input signal	TCP200	9:7512s
☐ Input Waveform	Input signal	TCP200	9:7000s
☑ Temperature	Controller	TCP201	2

< Back   Next >   Cancel   Help

Note: The "Temperature" and "Wall Temperature" Input signal and the "Temperature" Controller use a separate I/O Connection.

Note: The "Output Pulse" and "Input Waveform" signals are for diagnostic purposes and are not required for normal operation. Chandler Engineering recommends that these signals be configured but disabled.

Network Configuration

Changing the Network Configuration of the control PC usually requires Administrator privileges. Chandler Engineering recommends that the user account that is normally used on the control computer have local Administrator privileges.

From Chandler Engineering, the 5265 SGSA is configured with the following IP Configuration:

Device	IP Address	Subnet Mask
Electronics Box	10.17.100.200	255.0.0.0
Temperature Controller	10.17.100.201	255.255.0.0

Understanding The Network Configuration

The **IP Address** is a unique address that identifies a device on the internet or local network. Each device must have its own IP address. In order for devices to communicate with each other, they must both be connected to the network and they must have IP addresses that are on the same subnet. A subnet is a logical division of a larger network. Members of one subnet are generally not able to communicate with members of another. Subnets are defined by the choices of IP addresses and Subnet Masks.

If your PC's Subnet Mask is set to 255.255.255.0 (a common setting known as a Class C Subnet Mask) then your machine can only talk to another network device whose IP address matches yours in the first three octets (the numbers between the dots in an IP address are called octets). For example, if your PC is on a Class C subnet and has an IP address of 10.17.100.100, it can talk to a device at 10.17.100.200 but not one at 10.17.99.200. If you change your Subnet Mask to 255.255.0.0 (Class B) you can talk to any device whose first two octets match yours. Be sure to ask your system administrator before doing this. Your network may be segmented for a reason.

Changing Network Configuration

Computer
To change your Computer Network Configuration on Windows 10. This procedure requires Administrator privileges.

- From the Start Menu, search for "View Network Connections".
- In the window that appears, right-click on the appropriate connection and select Properties.
- In the window that appears, select "Internet Protocol Version 4 (TCP/IP v4)" and click the Properties button.
- In the window that appears, select "Use the following IP address".
- Enter the desired IP address and Subnet mask (refer to the image at right).
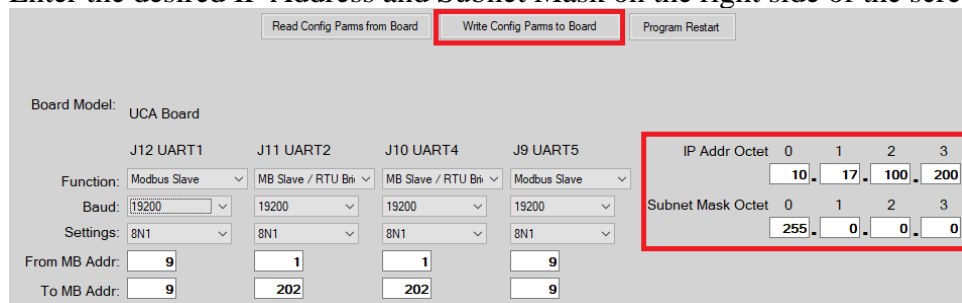
UltraSonic Motherboard

The UltraSonic Motherboard is the red circuit board inside the instrument. This board was designed by Chandler Engineering. The Ultrasonic Configurator software is installed with the 5270 software.

- Connect the instrument to your network (this can be a direct connection to the control computer).
- Power ON the instrument.
- Configure the 5270 instrument (or a new temporary instrument) to use a Modbus (serial) connection to the instrument.
- Open the Ultrasonic Configurator software (click "Configure Device" from the Advanced Tab of the Instrument Configuration dialog).
- Select the "Config File" tab.
- Enter the desired IP Address and Subnet Mask on the right side of the screen.

- Click the "Write Config Params to Board" button.

Note: the new IP address will take affect after the next power cycle.

Note: the Network Configuration of the computer must be compatible with the new IP address.

Temperature Controller

The Temperature Controller can be configured with the Eurotherm iTools software. At the time of this writing, the iTools software was available for download from the following URL: https://www.eurotherm.com/download/eurotherm-itools-v9-84/. The temperature controller uses a special Cascade Control firmware. The IDM (Interface Descriptor Module that tells iTools about the controller) is required; contact Chandler Engineering for the installer.

The Network Configuration of the controller can be read / set from the front panel of the Controller:

Read IP Address
From the Home Screen, press the Scroll button to cycle through the following menu options:
1. Set Point: use this menu to adjust the Set Point as desired prior to switching from Manual to Auto Mode
2. Version: displays the version of the configuration file
3. RTU.Addr: displays the ModbusRTU (Serial) address used by the controller. This parameter is read-only. It can be changed from the Configuration level (see below).
4. IP.A1 – IP.A4 (IP Address Octets): displays the ModbusTCP (ethernet IP address) address used by the controller. These parameters are read-only. They can be changed from the Configuration level (see below).

Set IP Address
- Enter the Configuration Level (see **To enter Level 3 or Configuration** below)
- Use the Page button to scroll to the Comms menu.
- Press Scroll button, the top line of this display shows F.COm
- Press the Up button to change F.COm to O.COm
- Press the Scroll button to enter the Option Comms menu; "mAIN" appears on the top line.
- Press the Up button to change "mAIN" to "Nwrk"
- Press the Scroll button to enter the Network menu.
- Press the Scroll button several times to get to the IP.A1 through IP.A4 menu items. For an IP address of 10.17.100.201:
  - IP.A1 = 10
  - IP.A2 = 17
  - IP.A3 = 100
  - IP.A4 = 201
- Change these values as desired.

Set Subnet Mask
- Enter the Configuration Level (see **To enter Level 3 or Configuration** below)
- Use the Page button to scroll to the Comms menu.
- Press Scroll button, the top line of this display shows F.COm
- Press the Up button to change F.COm to O.COm
- Press the Scroll button to enter the Option Comms menu; "mAIN" appears on the top line.
- Press the Up button to change "mAIN" to "Nwrk"
- Press the Scroll button to enter the Network menu.
- Press the Scroll button several times to get to the IP.S1 through IP.S4 menu items. For a Subnet Mask of 255.255.0.0:
  - ○ IP.S1 = 255
  - ○ IP.S2 = 255
  - ○ IP.S3 = 0
  - ○ IP.S4 = 0
- Change these values as desired.

To enter Level 3 or Configuration
- Press and hold the Page button. Lev 1 and GOTO will appear after approximately 3 seconds. Continue to hold the Page button until Lev 3 and GOTO appear (another 3 seconds).
- Press the Scroll button to enter the password for Level 3 (0003) or press the Raise button to select the Configuration Level (CONF and GOTO appear). The Configuration password is 0004.

Section 2 – Operating Instructions
Front Panel Controls
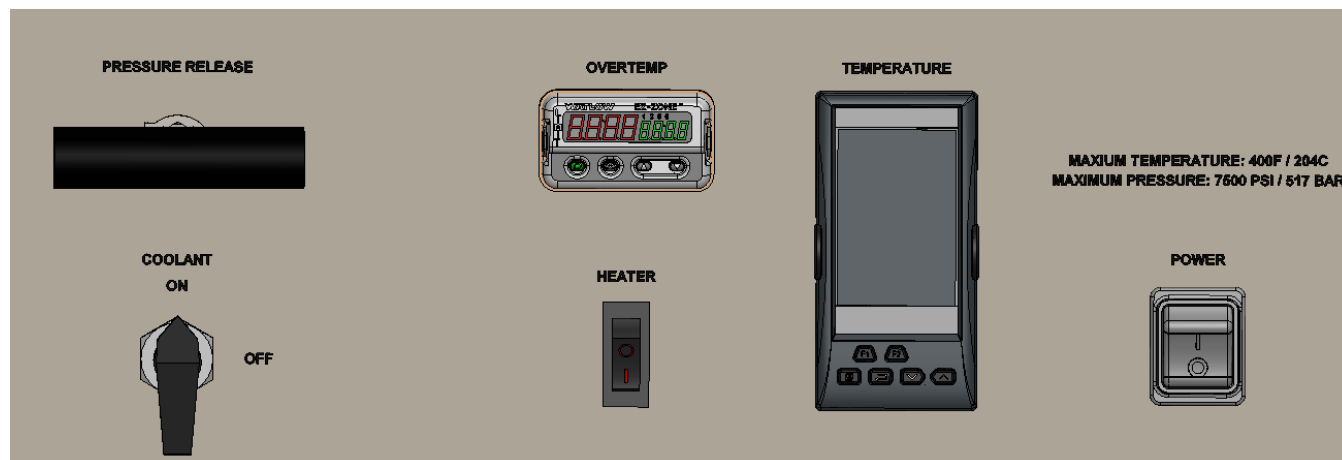
For the following descriptions, refer to the above Figure.

Power Switch

The main power switch supplies all of the power to the unit.

Temperature Controller

The Temperature Controller, coupled with the **HEATER** switch, controls the heat-up of the sample in the vessel. The desired temperature schedule is programmed into the controller (ramp and dwell segments). The **HEATER** switch must be in the ON position for heating of the sample to occur.

Heater Switch

The Heater switch controls the power to the heaters and must be placed in the ON position for the heaters to begin heating. Upon completion of a test, the Heater switch should be placed in the OFF position.

Over Temperature Controller

Over Temperature protection. When the Temperature is below 425°F (218°C), "SAFE" is displayed. When the Temperature is higher, "FAIL" is displayed and the Heater is disabled.

Pressure Release Valve

The Pressure Release valve is used to relieve the pressure from the MPRO® unit.

Cooling Valve

The Cooling Water Valves supplies the MPRO® unit with cooling water when in the ON position.

Pressure Vessel Preparation

The pressure vessel consists of a vessel, top plug assembly, bottom plug assembly, and seals. The elastomer seals and backup rings may be replaced as required by the user.

The plug assemblies are not user serviceable. The vessel and the plug assemblies must be used as a matched set of components. Do not attempt to remove the transducer assemblies since they are easily damaged.

To prepare the vessel for use:

1. Remove the top and bottom plugs from the vessel.

2. Replace the o-ring if wear is apparent.

3. Apply lithium grease to the inner tapered surface of the vessel.

4. Apply lithium grease to the surfaces of each plug that contact the cement slurry as illustrated below. DO NOT apply grease to the center transducer element on each plug.

5. Verify that the pressure port passages are free of cement. If plugged, carefully use a 1/8 inch / 3mm drill bit to remove the cement. Note that the passages are drilled at an angle.

Do **NOT** apply grease to these surfaces

Apply grease to this surface

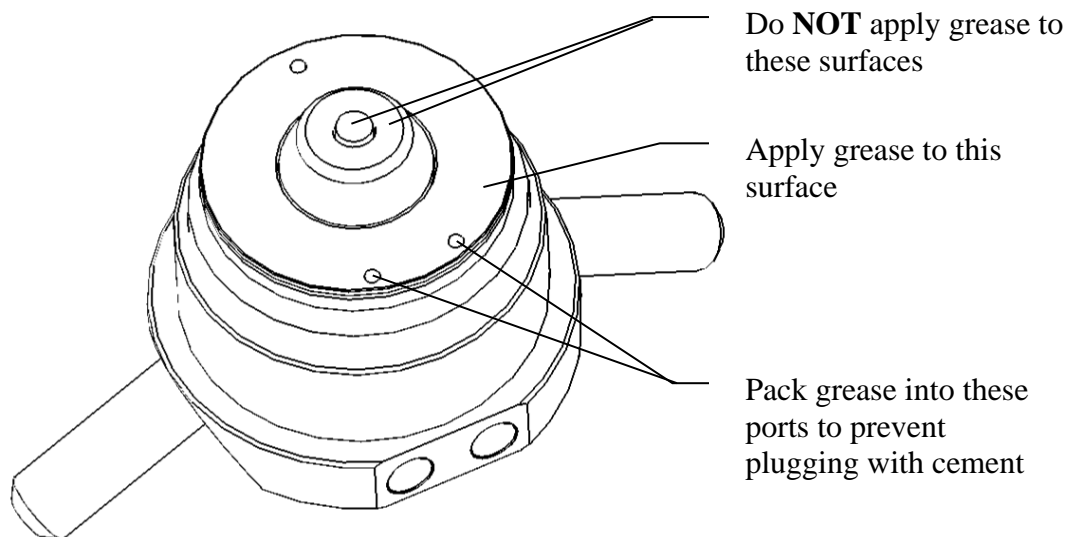Pack grease into these ports to prevent plugging with cement

Figure 1 MPRO® Top Plug

6. Insert the bottom plug assembly into the vessel. The vessel must be oriented with the label TOP upwards. Hand-tighten the plug until the shoulder meets the vessel.

7. Mount the vessel in a bench vise in preparation for filling with prepared cement slurry.

Filling the Pressure Vessel

1. Prepare the vessel using the "Pressure Vessel Preparation" procedures above.

2. Fill the vessel with slurry until level with the slurry level gauge. Do not allow cement to contact the sealing surface or the threads.

3. Insert the top plug assembly into the vessel. Hand-tighten the plug until the shoulder meets the vessel.

4. Insert the high pressure plug into the left port.

5. Apply a thin layer of grease on the thermocouple.

6. Insert the thermocouple in the vessel and hand-tighten the fitting.

5. Carry the vessel to the MPRO®.

7. Slide the vessel into the heating and cooling jacket on the MPRO® instrument with the pressure port oriented vertically.

8. Connect the U-tube and filter assembly between the top pressure ports. Tighten both ports using a ½ inch open-end wrench.

9. Tighten the thermocouple port using a 5/8 inch open-end wrench.

10. Connect the signal cables to the top and bottom connectors on the vessel. The red banana plug is inserted into the center connections, the black banana plug (ground) is inserted into the ground port on each plug.

Starting a Test

Once the vessel is filled and connected to the MPRO® instrument, the temperature and pressure schedules must be defined.

Pressure control is provided using PumpWorks software. Use the following information as a preliminary guide to using Pumpworks and pump. Additional details may be found in the Quizix Pumpworks manual.

Quizix First Start-Up Operations

1. Assure there is an air source connected to the pump, and that the inlet of the pump is plumbed with tubing to a refill reservoir, and that the outlet of the pump is plumbed to an open reservoir or back to the refill vessel; at this time, we do not want to plumb the outlet of the pump to the test apparatus, UNLESS we have a method of diverting the outlet flow of the pump to an open reservoir. Turn the pump(s) on via the switch on the AC inlet. The two digit LED display on the front of the pump (or on the front of the pump controller) will cycle through a start up sequence for about a minute and then flash "d0".

2. Launch PumpWorks on your computer.
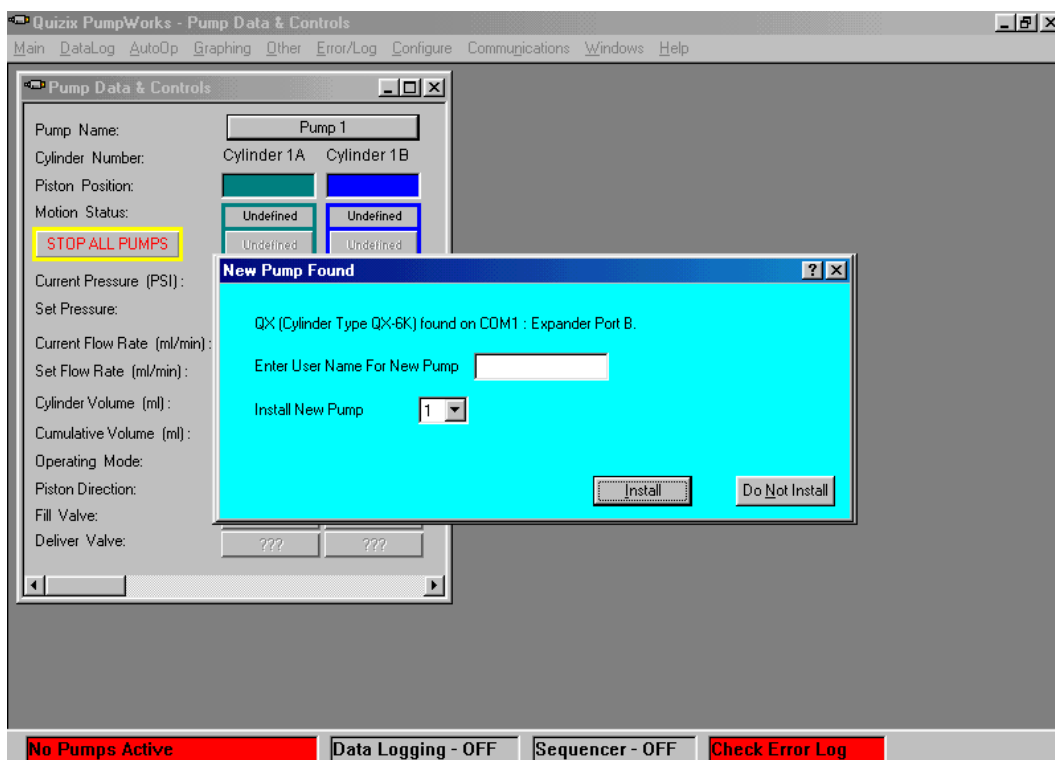
Figure 1 Starting PumpWorks software

PumpWorks will automatically search for the serial expander and then for a connected pump. After about a minute, PumpWorks should inform you that a new pump has been found. Click the "Install" button as shown in Figure 1. The Pump Data and Control window in PumpWorks will fill in with information and the two digit display on the pump controller will change to a flashing "_1" (indicating this is the first pump installed.) The "_1" will continue alternating with "d0" until the safety pressure is set.
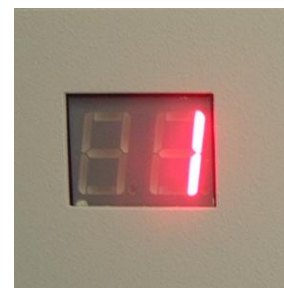
NOTE: If more than one pump is being installed, subsequent pumps will flash "_2", "_3", and so on indicating the position each pump is installed at.

3. When "d0" is being displayed, PumpWorks will require you to enter safety pressures for the pump and a dialog box will appear. Enter appropriate safety pressures for all cylinders and click on the "Send Safety Pressures to Pumps" button.
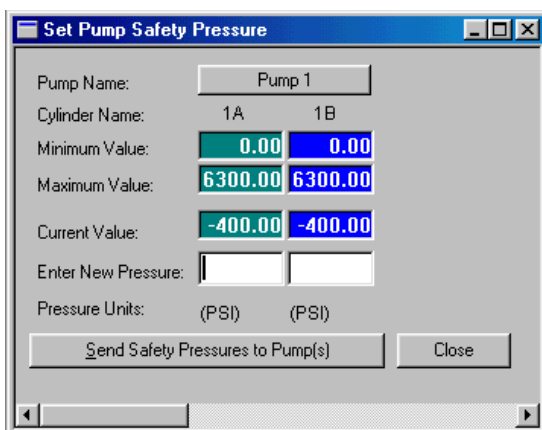
Figure 2- Safety pressure settings window

Each pump type has a maximum pressure it will support, but the user should set a lower safety pressure if other components in the flow system cannot support the pump's maximum pressure rating. Generally, safety pressures should be set according to one or more of the following criteria:

    a. Maximum pressure capability of the test apparatus.
    b. Maximum pressure the sample should be exposed to

NOTE: When installing multiple pumps, occasionally pumps will install in wrong positions, i.e. Pump 1 should really be Pump 2 or 3, and so on. To change the pump position within PumpWorks software, go to the CONFIGURE tab, select "Reassign Pump Number", and move the pump to the correct position.

PRIMING THE PUMP

4. Before starting the pump, you need to prime the pump (i.e., get fluid into the pump's cylinders.) On the main Pump Data and Control window, click on the "Operating Mode" button for Pump 1 Cylinder A; this will bring up the dialog box with the pump operating modes. Select Mode 1C "Individual Constant Rate-Cycled". Click on the "Set Flow Rate" button and set any desired flow rate up to the maximum indicated.
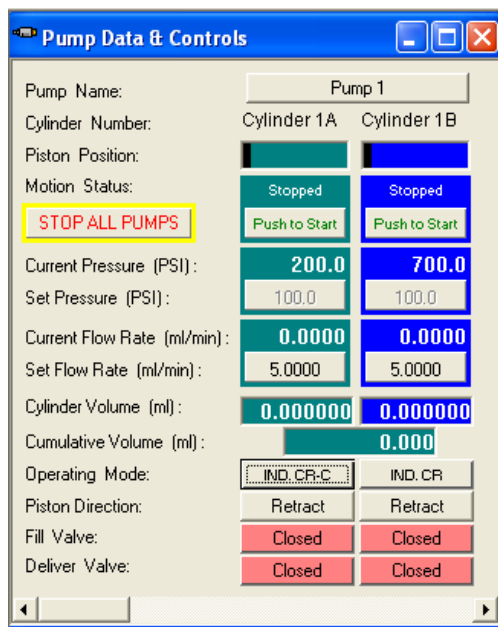
Figure 3 Pump Data and Control Window

5. Assure all valves for both cylinders are CLOSED. You can click on the Fill Valve and Deliver Valve buttons located on the bottom of the Pump Data and Control window to toggle the valves open or closed.

6. Now you can start Cylinder 1A in motion by clicking the button marked "Push to Start".   The pump will automatically open/close the deliver and fill valves for Cylinder 1A as appropriate and

2-6   SECTION 2 – OPERATING INSTRUCTIONS

begin to automatically fill itself. Allow the pump to run for two to ten piston strokes to remove the air from the cylinder. Once you can no longer see air bubbles exiting the outlet line, the cylinder is full of fluid. Stop the cylinder with piston in the fully retracted position.

7.   Now you need do the same steps to Cylinder 1B. It is recommended that we fill/purge only one cylinder at a time. If multiple pumps are connected, you can fill/purge multiple pumps at the same time, as long as we only fill one cylinder from each pump at a time.   .

ZERO PRESSURE TRANSDUCERS AND SET COFIGURATIONS

8. After filling both cylinders, leave the fill valves open. If the fill valves are closed, you can open them by clicking on the Fill Valve button located on the Pump Data and Control Window near the bottom of the window. The pressure transducers are calibrated at the factory, but the initial value for ambient pressure may be different. You can set the initial value of the pressure transducers at this time by clicking on the "Other" item on the main menu and then selecting "Software Pressure Transducer Calibration". The dialog box shown in Figure 4 will show the current pressure value for each transducer, as well as the Current Offset gain (zero gain) and Current Gain (high span gain). Since the Fill Valves are open, the Current Pressure value should be at or near ambient, and can be set to zero by clicking the "Current Offset" button and selecting "Auto Zeroing" button. If you have a version of PumpWorks software greater than 6.02, you can click the check-boxes for "cylinders to change", and then click the "Auto-Zero All Checked Cylinders". Do not change Current Gain, as this is the factory span calibration factor.
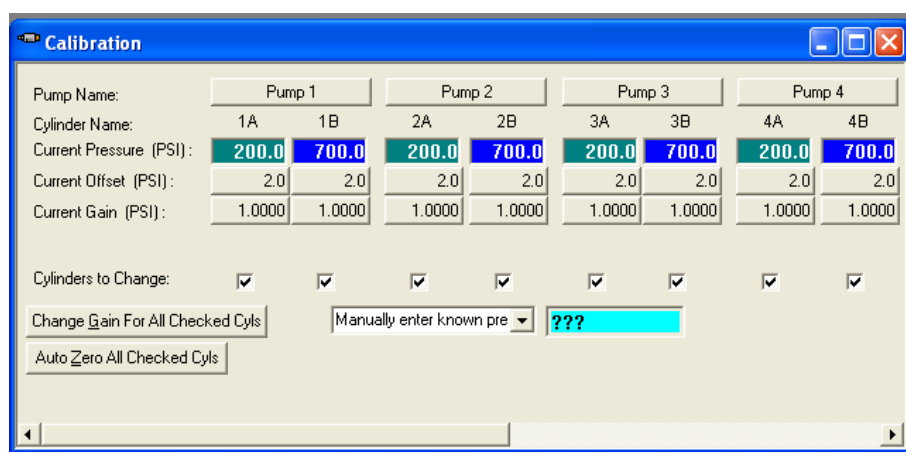
Figure 4 Pressure Transducer Auto Zero Calibration

9. Now go to the CONFIGURE tab, and select "Pump Operating Parameters". A window should open as in Figure 5. Criteria for setting the configuration parameters are as follows:
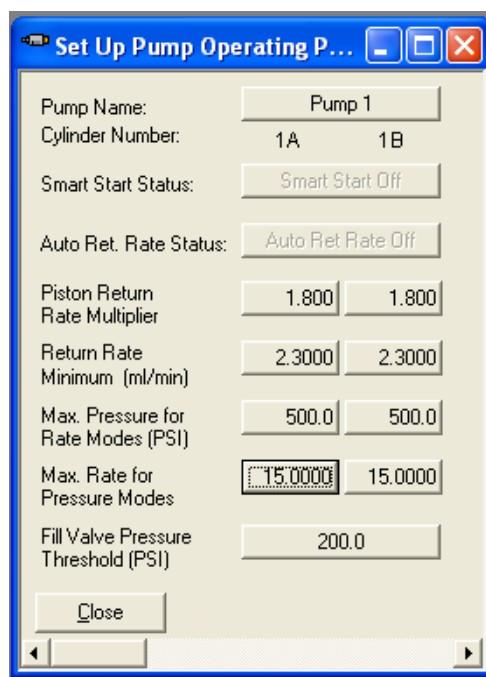
Figure 5 example of operating parameter window

*Note: Settings shown in Figure 5 are specific to a QX-5000 pump module; settings for Max
Pressure for Rate Mode and Max Rate for Pressure Mode will be different than shown
for other Quizix pump models.*

PUMP PRESSURE SERVO CONTROL GAINS

10. PumpWorks allows the user to set proportional and differential pressure servo gains. Of most
importance is correct Closed Valve gain settings; this assures the pump correctly matches
cylinder pressures before switchover without excessive overshoot or undershoot. Open Valve
gains are provided to assure the pump reacts correctly to larger system volumes when operated in
pressure control modes. Essentially, proportional gain is like stepping on the gas in your car; a
higher value will cause the pump to react quicker to reach a pressure. Differential gain is like
stepping on the brake; this will dampen (or reduce the rate of change) once the pressure is close
to the target. See the PumpWorks manual for complete discussion on this feature. Typical
values for Closed Valve gains are 2000 and 2000. Check these values before operating the pump
is assure
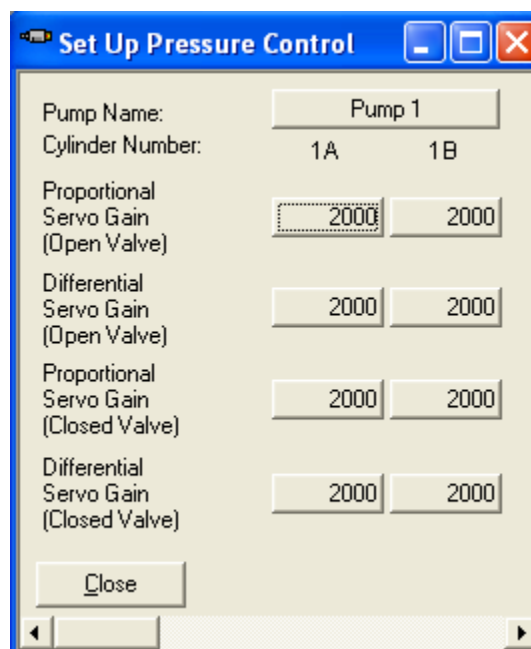
Figure 6 Pressure Servo control Window

RESETTING CYLINDER VOLUMES TO ZERO

11. Now we need to reset our cylinder volumes to zero. Click the MAIN tab, and select "Reset Volumes to Zero". You can select individual cylinder volumes or cumulative volume, or click "Reset All Volumes to Zero". Resetting the cylinder and cumulative volumes to zero provides the user with a distinct starting point for volume calculations, and is typically done once the pump is primed and both cylinders are in the correct position for running the necessary mode of operation.
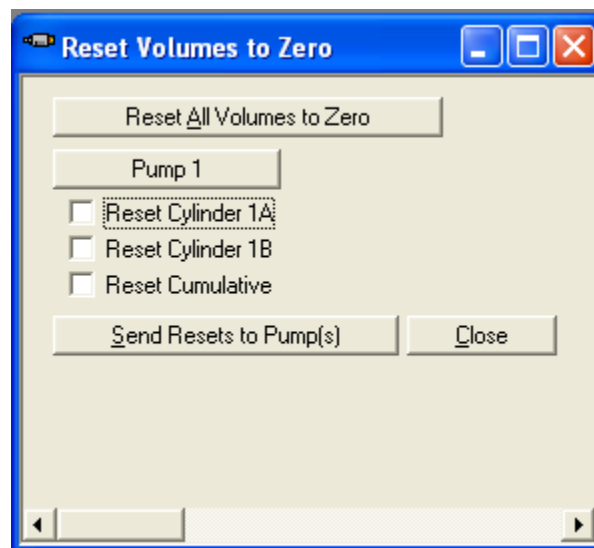
Figure 7 Reset Volumes to Zero window

PUMP SET UP FOR DUAL CYLINDER BI-DIRECTIONAL MODE (pressure)

12. Bi-directional mode is used when the application requires that the pump be capable of delivering AND receiving fluids at a pressure set point. Pumps operated in Bi-Directional Pressure Mode should have their pistons set at 50% extended position for correct start-up. See Figure 6C, and

look at the graphical piston position bar located at the top of the Pump Data and Control window for pump 4 (Bi-Directional Mode) for an example of proper piston position for this mode.

    a.   To manipulate pistons into the correct position, click on the Operating Mode button, and select Mode 1, Independent Constant Rate mode.

    b.   Enter a flow rate of 50% of pump maximum.

    c.   Open the FILL valve by clicking the FILL VALVE button located under each cylinder.

    d.   Click the Push to Start button for each cylinder, and allow the piston to extend until it reaches approximately 50% of its travel, and stop the cylinder.

13. Click the Operating Mode button, and select Mode 12, Paired Constant Pressure   Bi-Directional Mode. Enter a pressure set point, and click the Push to Start button.
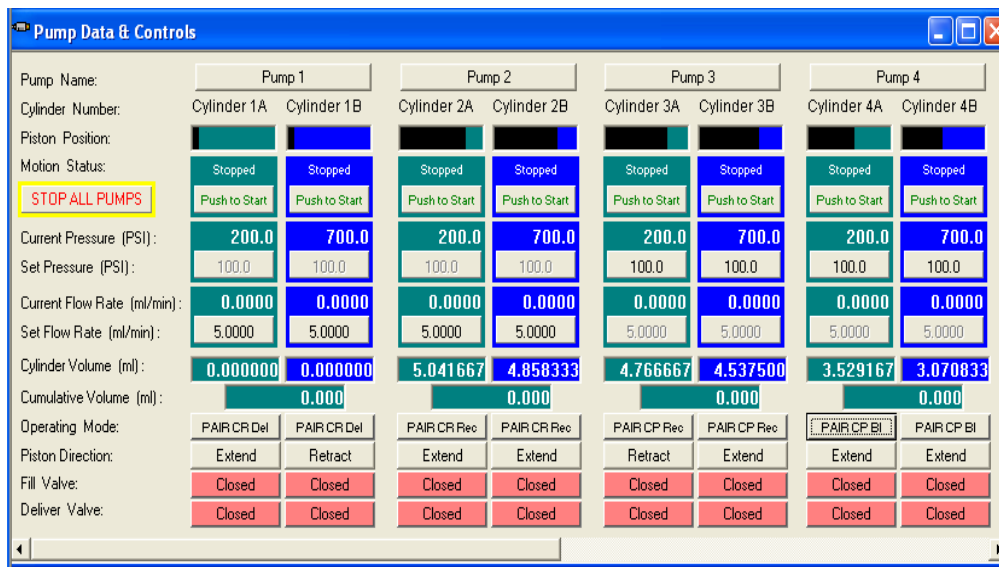
Figure 6C, Pump 4 Piston Position for Bi-Directional Mode

Note: In Constant Pressure Bi-Directional mode, the pump will first extend the cylinders to reach the pressure set point; this is normal. Once the pressure set point is reached, the pump will automatically begin receiving fluids at the desired pressure set point.

Temperature Controller

The controller may be programmed to heat the sample using ramp and soak segments. There is a maximum of 8 segments.

Configuring the controller involves defining the time to ramp to a new temperature from the current temperature and the final stable temperature. This process is commonly referred to as the *ramp time* and the *dwell.* The time to ramp to a new set point may be defined as the time between two set points (*minutes*).

Once the program exists, the program is executed by pressing the *F1* button to enter

Automatic mode (the "hand" icon will turn **OFF**) and then the *F2* button to start the program (the appropriate Program Status indicator will turn on). To terminate the program, press the *F2* button to stop the program (the current Temperature Set Point is maintained) and then press the *F1* button to return to Manual mode.

Note: Always turn OFF the heater switch when the heater is not used.

Controller Panel

Alarm Beacon: Flashes when any new alarm occurs (e.g. Over Temperature or Sensor Break). The beacon will stay illuminated when an alarm is acknowledged (press Page + Scroll) but still active.

Upper Readout: Displays the current Temperature. This value is green when the controller or display is not in an Alarm state.

Middle Readout: Displays the target Temperature Set Point if the controller is in Automatic mode or the Manual Output Power when in Manual mode.

Lower Readout: Displays the current output power demanded by the controller. This line may also display a scrolling message.

Bar Graph: A graphical representation of the current output power.

Alarm Beacon

Upper Readout

Middle Readout

Lower Readout

Bar Graph

Program Status

Manual Mode

Output Indicators

Figure 2 9051 Controller Panel

Program Status: Indicates the current Program Step:

Indicates Ramp / Step Up

Indicates Dwell (Flashing indicates Dwell End)

Indicates Ramp / Step Down.

Manual Mode: Indicates Manual Mode has been selected. In Manual Mode, the Raise and Lower buttons operate on the Output Power. In Automatic Mode (this icon is off), the Raise and Lower buttons operate on the Set Point.

Output Indicators: Illuminate when the appropriate output is activated. Output 1 is used to heat. Other outputs may be activated during an alarm or error condition.

F1: Toggles between Automatic and Manual mode. When in Manual Mode the "hand" icon is illuminated.

F2: Program Run / Reset. Press once to Start the program. Press again to Reset the program.

Page: Used to page through the various menus in the controller.

Scroll: Used to scroll through the parameter settings within a menu page.

Note: Press Page + Scroll to return to the "Home" Display. When at the Home Display, Page + Scroll will acknowledge any alarm.

Lower / Raise: Used to change the value of a parameter. Press and hold the button for rapid changes.

Schedule

The following example describes a ramp and dwell program. Each parameter may be changed using the *Raise* and *Lower* buttons. A program may also be defined using the 5270 software.

1. Repeatedly press the "Page" button until P.SET is displayed

2. Press "Scroll"; Observe P.NUM (Program Number) 1 is indicated

3. Press "Scroll"; Verify that HB.STY (Holdback Style) is set to PROG.

4. Press "Scroll"; Verify that HB.TYP (Holdback Type) is set to OFF.

5. Press "Scroll"; Verify that RAMP.U (Ramp Units) is set to P.mIN (Per Minute).

6. Press "Scroll"; Verify that DWEL.U (Dwell Units) is set to mINS (minutes).

7. Press "Scroll"; Verify that P.CYC (Program Cycles) is set to 1.

8. Press "Scroll"; Change P.END (Program End Type) as desired. For this example, dwEL (Dwell) is used.

    a. dwEL (Dwell): Dwell at the last set point.

    b. rSEt (Reset): Reset to the set point used prior to starting the program.
        Note: it is not recommended to set Program End Type to Reset when programming Pressure Controllers. This can cause a sudden decrease in pressure at the end of the program.

    c. tRAk (Track): same effect as Dwell

9. Press "Scroll"; Observe that S.NUM (Segment Number) 1 appears.

10. Press "Scroll"; Change S.TYPE (Segment Type) as desired. For this example, tImE (Time to Target) is used.

    a. rAtE (Ramp at Rate to Target): Ramp the set point at a given Rate (°/min) for a given Time.

    b. tImE (Time to Target): Ramp to a given Target over a given Time.

    c. dwEL (Dwell): Dwell at the last set point for a given Time.

    d. StEP (Step to Target): Instantaneously change to the given Set Point.

    e. CALL (Call Program Number): Execute another program as a subroutine (this is not common).

    f. ENd (End Program): The very last segment of a program. Behavior is defined by the Program End Type (see above).

11. Press "Scroll"; Change TSP (Target Setpoint) to the desired sample temperature using the "Lower" or "Raise" buttons (temperature or pressure at the end of the ramp).

12. Press "Scroll"; Change R.TIME (Ramp Time) to the desired ramp time in hh:mm (Duration of Ramp).

13. Press "Scroll"; Verify that EV.OP (Event Output) is set to 0.

14. Press "Scroll"; Observe that S.NUM (Segment Number) is now 2.

15. Press "Scroll"; Change S.TYPE (Segment Type) to ENd (End).

16. Press "Scroll"; Verify that EV.OP (Event Output) is set to 0.

17. Press "Scroll"; Observe P.NUM (Program Number) 1 is indicated.

18. Press the "Page" button twice to return to the Home display.

To Run the program, press the *F1* button to set to Automatic Mode (the "hand" icon is off). Press the *F2* button to start the program (the Program Status indicator turns on).

Note: Once a program has been defined within the controller, it may be reused.

Section 3 – Maintenance

Tools Required

- 5/8 inch Wrench
- 1/2 inch Wrench
- Teflon Tape
- Hex wrenches
- Screwdrivers (flat blade, Phillips head)
- Bench Vise

Cleaning and Service Tips

- Keep the test cell surfaces exposed to cement coated with a thin layer of grease. The tips of the MPRO® transducers must be free from grease. This reduces the chance of corrosion and prevents cement from adhering to the metal.
- Keep cement off threads and out of the high-pressure ports on the top plug of the test cell.
- Lubricate the threads on the test cell plugs periodically with anti-seize lubricant.
- Thoroughly clean test cell of all cement immediately after each test.
- Keep the sensor faces and cavities inside each test cell plug clean and flat.

Calibration Procedure

The temperature controller requires periodic calibration. The procedures related to calibrating the controller are found in the controller manual.

The instrument does not require calibration for the measurement of Poisson's ratio and Young's modulus. These measurements are absolute provided the compressional and shear velocity calibrations are verified.

The procedure to gather performance data is listed as follows:

1. Remove the cell from the instrument.

2. Thoroughly clean the vessel assembly.

3. Fill the cell with distilled water.

4. Install the cylinder assembly into the instrument. Connect the top and bottom transducer cables, pressure line, and thermocouple.

5. Pressurize the cell to 3000 psi using the Quizix pressure control system to maintain a highly accurate pressure.

6. Stabilize the temperature to within ±0.20°C.

7. Enable the Ultrasonic Waveform Input Signals in the Instrument Configuration in 5270.

8. Start a 5270 test and capture at least 10 minutes of data using the distilled water as the sample. Save the file as SNxxx Data.TST. Note that a file SNxxx Data.CAP is also created in the same folder.

9. The MPROCAL utility may be used to view the contents of the SNxxx Data.CAP file. This utility does <u>not</u> provide a means to calibrate the vessel.

10. Use procedure 348-2101 to evaluate the vessel performance characteristics using water. This procedure provides a means to verify the compressional wave velocity through water at a known temperature and pressure.

Replacing the O-rings

1. Disconnect the signal cables from the top and bottom of the cell.

2. Disconnect the thermocouple cable; do not remove the thermocouple to avoid spilling water.

3. Disconnect the pressure line and filter assembly from the top of the cell.

4. Remove the cell from the MPRO® unit as shown below.

5. Unscrew the top and bottom plugs from the test cell as shown on the following page.

6. The O-ring and back-up ring should be changed on both the top and bottom plugs if there is any evidence of wear. Grease replacement O-rings thoroughly before installing.

Top Plug
Assembly

Seals

Vessel (large end
of internal taper is
down)

Bottom Plug
Assembly
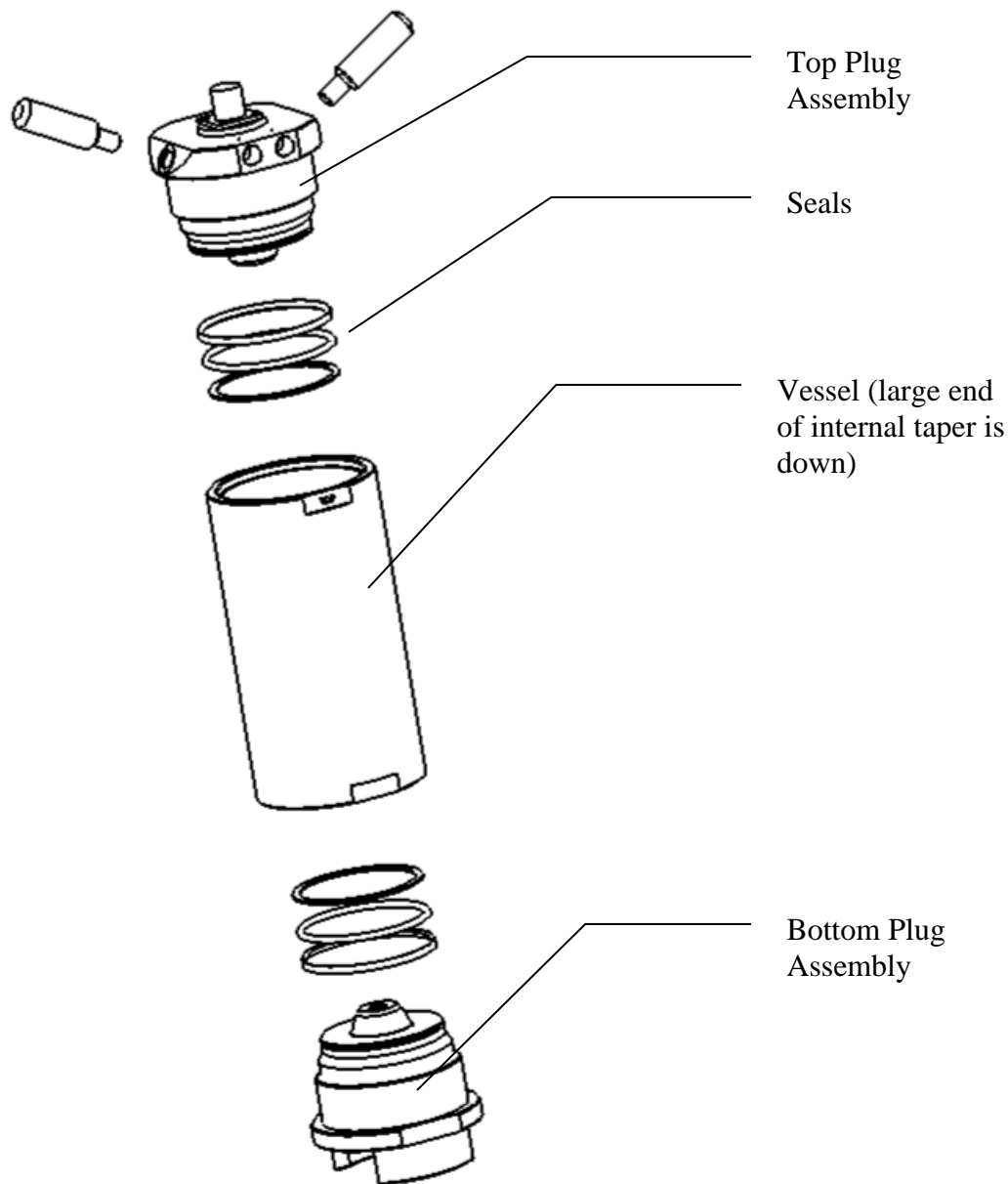
Figure 3 - MPRO® Pressure Vessel Exploded Assembly

Maintenance Schedule

<table>
<tr><td colspan="6">MAINTENANCE SCHEDULE
Model 6265 Mechanical Properties Analyzer (MPRO®)</td></tr>
<tr><td>COMPONENT</td><td>EACH TEST</td><td>MONTHLY</td><td>3 MONTHS</td><td>6 MONTHS</td><td>ANNUAL</td></tr>
<tr><td>Vessel Seals</td><td>Inspect & replace as required</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Vessel Assembly</td><td>Clean</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rupture disc</td><td></td><td></td><td></td><td></td><td>Replace</td></tr>
<tr><td>Signal Cables</td><td></td><td></td><td></td><td></td><td>Inspect & replace as required</td></tr>
<tr><td>Temperature Controller</td><td></td><td></td><td></td><td>● Calibrate</td><td></td></tr>
<tr><td>Pressure Controller</td><td></td><td></td><td></td><td>● Calibrate</td><td></td></tr>
<tr><td colspan="6">This maintenance schedule applies to normal usage of two tests per day. Detailed procedures for these operations are contained in your manual.
● Per API Specifications
σ Where Applicable</td></tr>
</table>

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Section 4 – Troubleshooting Guide

Problem	Solution
No Compression Transit Time signal	1. Connect signal cables to vessel. 2. Apply pressure to sample. 3. Inspect end plugs to verify that cement has not invaded the annular groove surrounding the transducers. 4. Load vessel with water and pressurize. 5. Start a test using 5270. If no signal exists, contact Chandler Engineering.
No Shear Transit Time signal	1. Verify that the sample is solid. 2. Connect signal cables to vessel. 3. Apply pressure to sample. 4. Inspect end plugs to verify that cement has not invaded the annular groove surrounding the transducers.
System will not pressurize	1. Verify that the water supply is present and turned ON. 2. Verify that the air supply is present. 3. Verify that air is not present in the lines by flowing water to drain. 4. Check for water leaks.
System will not heat	1. Verify that the heater switch is ON. 2. Verify that the thermocouple is plugged into the port on the back panel of the instrument. 3. Check the temperature controller program. 4. Verify that the over-temperature limit switch is not open (vessel temperature exceeds 450˚F.

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Section 5 – Replacement Parts

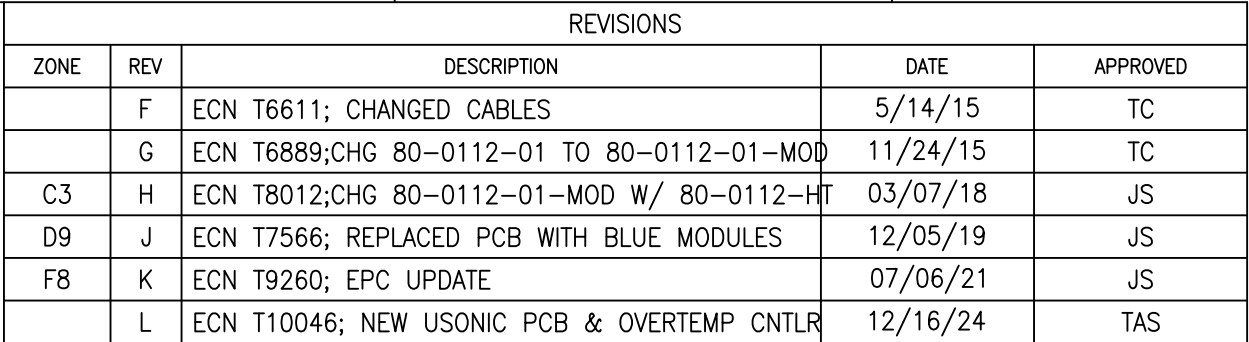| Part Number	Description
C08588	CABLE,COAXIAL,20 AWG
348-1015	Heater Assembly
348-1104	Ring, Plug Sealing
348-1107	Tube, High Pressure
348-1108	Tube, High Pressure
348-1116	Gasket, Heater Flange
348-1157	Gauge, Slurry Level
348-2010	Vessel Assembly (must be tested and calibrated prior to use)
7750-0115	Plug Top Handle
80-0021	Thermocouple, Plug
80-0050	CABLE,ASSY 36" LG
80-0051	CABLE,COAXIAL ASSY 12"
80-0369	TRANSDUCER CONNECTOR ASSEMBLY
83-0202-6265	PCA, ASSEMBLY, CONFIGURED, 6265
9051-6265	Controller, Temperature
C08564	Seal Retaining Ring
C08565	Plug Oring Seal
C10127	CABLE,DB9 M/F 25FT MOLDED
C10382	Gauge, 4 inch
C10385	Union, Bulkhead, High Pressure
C10388	Nut, High Pressure
C10402	Plug, High Pressure
C10770	Disc, Rupture, 8750 psi
C11011	Filter, High Pressure
C11271	VALVE,BALL,SS,1/4T,2WY-STR
C15142	ADPTR,BNC,BANANA W/GND LD
C19075	CABLE,ETHERNET,25FT,BLACK
C19413	XDCR,PRESSURE,20K,17-4SS,F250C,4-20MA
C19420	VALVE,NDL,SS,20-13LF4
P-2334	Foot, Support

To ensure correct part replacement, always specify model and serial number of instrument when ordering or corresponding.

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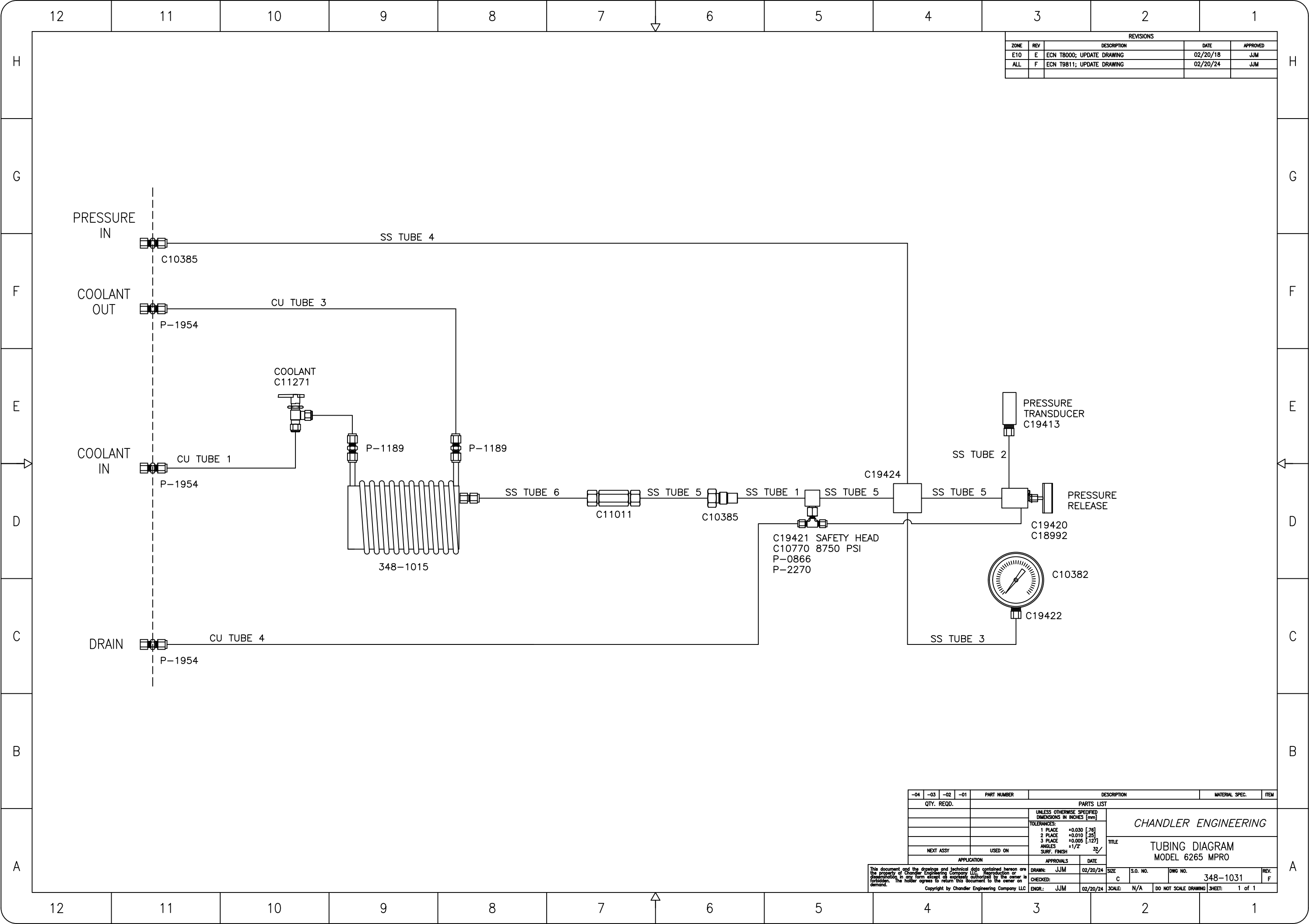
Section 6 - Drawings and Schematics

Drawing Number	Description
348-1030	Diagram, Wiring, MPRO
348-1031	Diagram, Tubing, MPRO
348-2010	Assembly, Vessel, MPRO®

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INPUT POWER FILTER

MAIN POWER CIRCUIT BREAKER SWITCH -10A

L
G
N
RCP1

BRN-18
G/Y-18
BLU-18

BRN-18
BLU-18

TB1 L1
TB2 L2
TB3 GND

C13966 X2 / C13972 X1
C13968 X2 / C13972 X1
C13970 X2 / C13972 X1

BRN-18
BLU-18
G/Y-18

C17671
REORDER 9051-6265

BLK-18
RED-18

1A +
1B −
1C
1D
2A
2B
2C
2D
E
HD GRN
HE BLK
HF RED
L
N
TC+ WHT
TC− RED

G/Y-18

TWIST

TEMPERATURE LIMIT
REORDER 9051-4262

BRN-18
BLU-18

9B 99 CC CA CB
C
N/C
N/C
N/C

A
N/C
N/C
N/C
L2 K2 T1 S1 R1

C16390

BRN-18

HEATER SWITCH
C12161

WHT-18
WHT-18
RED
WHT

RLY
C19067

BRN-18
BLU-18

21 22
24
16 BLU
11 12 18 BLU TEFLON
14
A1 A2

WHT-18
BLU-18

BLK-18
RED-18

4 3

C08262

1 2

18 BRN TEFLON

PRESSURE TRANSDUCER 20KPSIG [P06DK]

C19413

C18437;BRN MB3,24V
C18437;BLU MB3,A3,+

G/Y-18
BRN-18
BLU-18

APPLY A RED COLORED LABEL TO CABLE AND BOARD TO INDICATE CORRECT PORT CONNECTION

C09911

C08587

80-0051
80-0050

C19418
LEFT HEATER
350W
(P-2707/348-1015-HEATER)

RED-18 TEFLON
18 BRN TEFLON

CYLINDER ASSY

80-0021

RED-18 TEFLON
18 BLU TEFLON
RIGHT HEATER
350W
G/Y-18

APPLY A BLUE COLORED LABEL TO CABLE AND BOARD TO INDICATE CORRECT PORT CONNECTION

AMETEK CHANDLER ENGINEERING

83-0202-4265

80-0050
80-0051

C08587

NOTES:
1. USE THE WIRE PART NUMBERS AS INDICATED IN THIS DRAWING – NO SUBSTITUTIONS ARE ALLOWED.
2. ROUTE AC AND DC WIRING SEPARATELY.
3. CLEARLY MARK CHASSIS GROUND CONNECTIONS WITH C12232 LABEL (GROUND SYMBOL): ⏚ SECURE THE INLET POWER GROUND WIRE (GREEN/YELLOW) UNDER ITS OWN NUT (ALL OTHER GROUND WIRES CAN BE HELD UNDER A SINGLE NUT).
4. APPLY SAFETY COVERS TO ALL HEATER POWER CONNECTION TERMINALS.

-04	-03	-02	-01	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
				QTY. REQD.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]
TOLERANCES:
1 PLACE +0.030 [.76]
2 PLACE +0.010 [.25]
3 PLACE +0.005 [.127]
ANGLES ±1/2°
SURF. FINISH 32/

CHANDLER ENGINEERING

NEXT ASSY | USED ON
HPHT RHEOMETER

APPLICATION

TITLE
WIRING DIAGRAM
MODEL 6265 MPRO

APPROVALS	DATE
DRAWN: JJM	01/31/02
CHECKED: BA	03/01/03
ENGR.: JJM	01/31/02

SIZE C | S.O. NO. | DWG NO. 348-1030 | REV. L

SCALE: N/A | DO NOT SCALE DRAWING | SHEET: 1 of 1

PRESSURE IN
C10385

SS TUBE 4

COOLANT OUT
P−1954

CU TUBE 3

COOLANT
C11271

P−1189

P−1189

PRESSURE TRANSDUCER
C19413

SS TUBE 2

C19424

COOLANT IN
P−1954

CU TUBE 1

SS TUBE 6

C11011

SS TUBE 5

C10385

SS TUBE 1

SS TUBE 5

SS TUBE 5

PRESSURE RELEASE

C19420
C18992

348−1015

C19421 SAFETY HEAD
C10770 8750 PSI
P−0866
P−2270

C10382

C19422

DRAIN
P−1954

CU TUBE 4

SS TUBE 3

TRANSDUCER ALIGNMENT PROCEDURE:
1. VERIFY THAT PIEZO FLAT IS ALIGNED WITH ONE OF THE
   WRENCH FLATS. MARK THE WRENCH FLAT WITH A CHARPY PEN.
2. INSTALL TRANSDUCER ASSEMBLY IN TOP PLUG, TIGHTEN
   TO 25 FT-LBF.
3. MARK THE ORIENTATION OF THE MARKED FLAT ON THE TOP PLUG OD.
4. ASSEMBLE THE BOTTOM PLUG IN THE VESSEL WITHOUT THE
   TRASDUCER ASSEMBLY.
5. TRANSFER THE INDEX MARK ON THE TOP PLUG TO THE BOTTOM PLUG.
6. INSTALL TRANSDUCER ASSEMBLY IN BOTTOM PLUG, TIGHTEN
   TO 25 FT-LBF.
7. TRANSFER INDEX MARK TO THE TRANSDUCER ASSEMBLY.
8. REMOVE BOTTOM TRANSDUCER ASSEMBLY AND ALIGN THE FLAT ON THE
   PIEZO ELEMENT TO ALIGN WITH THE INDEX MARK.
9. REINSTALL THE BOTTOM TRANSDUCER ASSEMBLY AND TORQUE TO 25 FT-LBF.
10. ONCE COMPLETED, THE FLATS ON THE PIEZO ELEMENTS MUST BE COPLANAR AND
    THE LOCATION OF THE TRANSDUCER ASSEMBLIES MAY NOT CHANGE
    BETWEEN TOP AND BOTTOM PLUGS.

NOTES:
1. FINAL ASSEMBLY MUST BE PRESSURE TESTED IN ACCORDANCE WITH
   PROCEDURE 348-2063.
2. VERIFY THAT HEAT NUMBERS ARE MARKED ON VESSEL, TOP PLUG, BOTTOM PLUG.
3. VERIFY THAT INSTRUMENT SERIAL NUMBER IS STAMPED ON TOP PLUG,
   BOTTOM PLUG, VESSEL.
4. PLACE C15142 AND CABLES IN A BAG
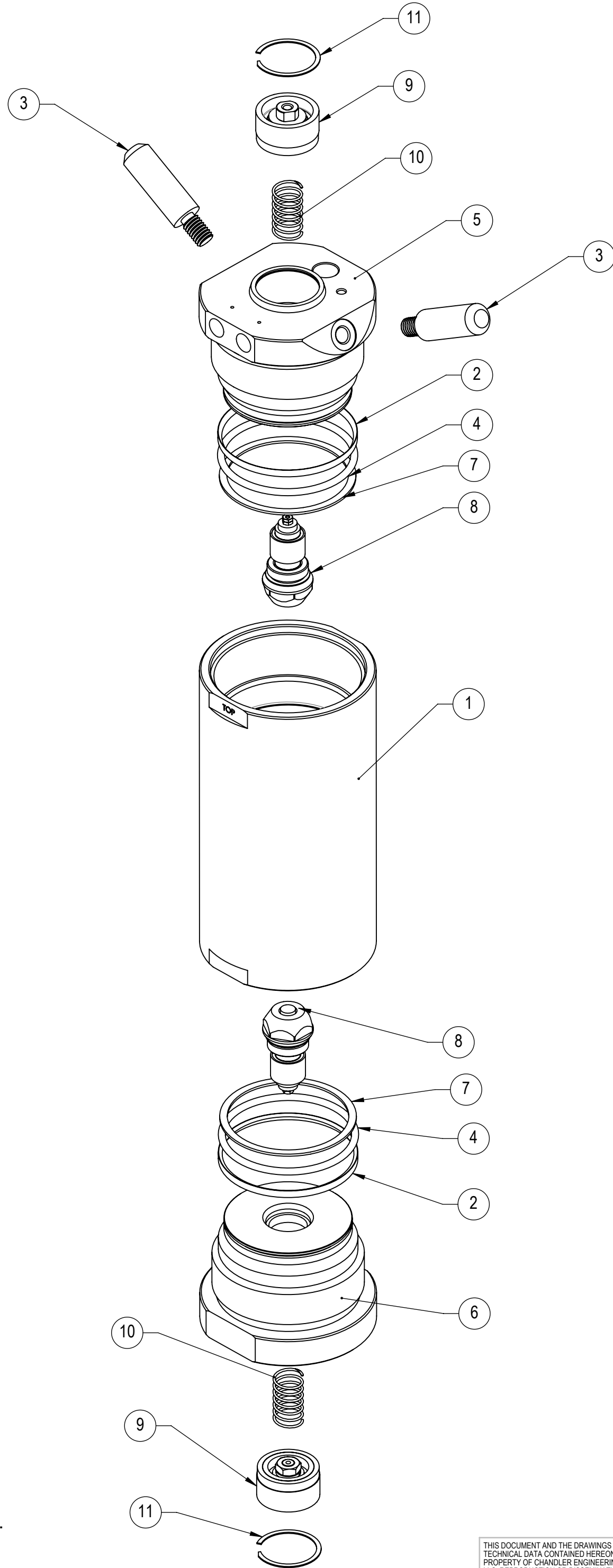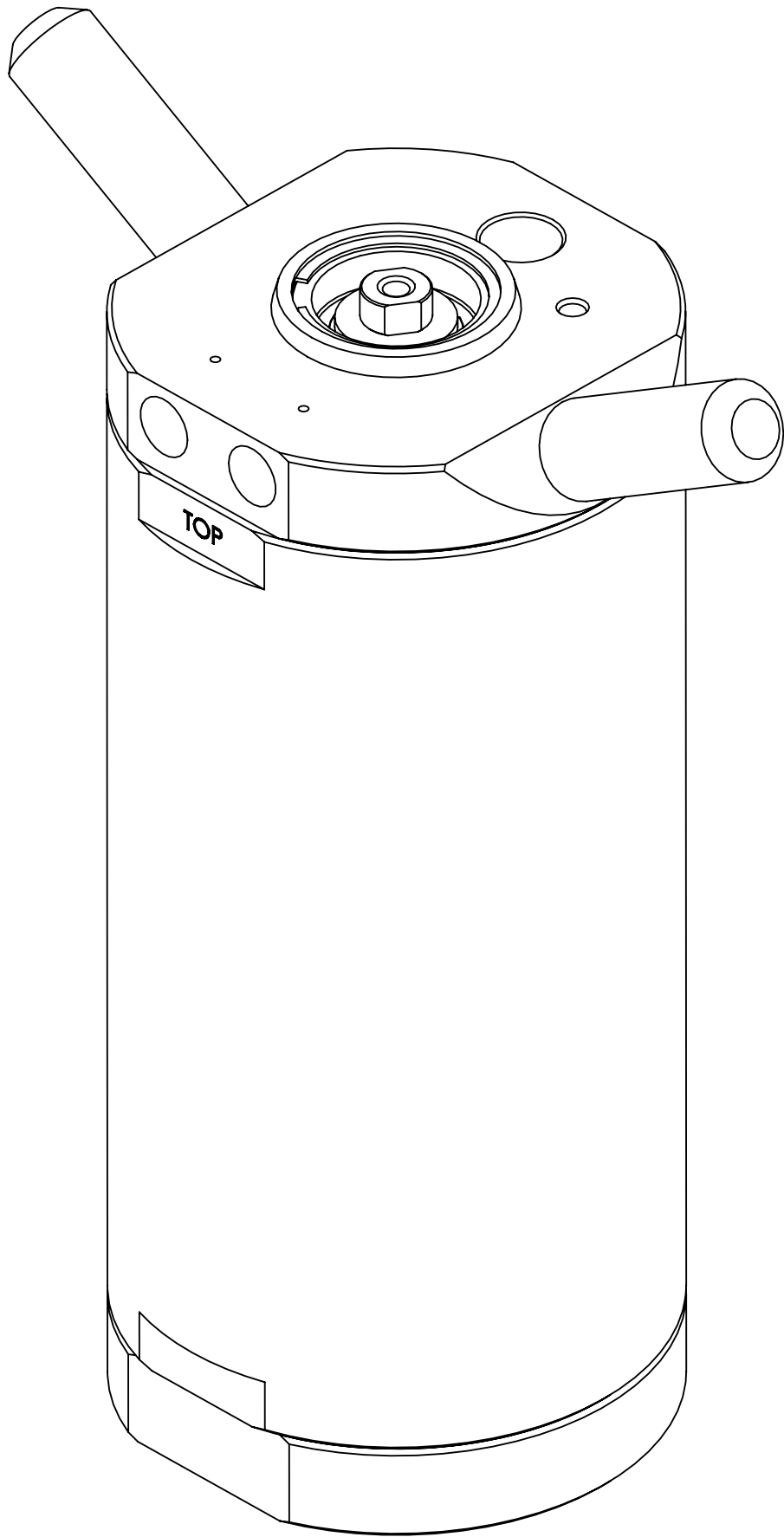
ITEM	PART NUMBER	DESCRIPTION	QTY	UoM
1	348-1101-A286	CYLINDER - MPRO	1	
2	348-1104	RING,SEAL,MPRO PLUG	2	
3	7750-0115	HANDLE,PLUG,CYLINDER	2	
4	C08565	ORING,VITON,AS230-90	2	
5	348-2103	PLUG,TOP	1	
6	348-2102	PLUG, BOTTOM	1	
7	C08564	RING,RTG,SS,2.50"	2	
8	348-2027	ASSEMBLY, TRANSDUCER, CENTER MOUNT	2	
9	80-0369	CONNECTOR ASSEMBLY, TRANSDUCER	2	
10	C11320	SPRING,COMPR,SS,0.600ODX2.000L	2	
11	C10917	RING,RET,INT,1.250,BASIC	2	
12	C15142	ADPTR,BNC,BANANA W/GND LD	2	
13	80-0050	CABLE, ASSY 36" LG	1	
14	80-0051	CABLE,COAXIAL ASSEMBLY,BNC,12"	1	

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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 03/21/10
MFG:
ENGR: JJM 03/21/10
TYPE:
STRUCT:

CHANDLER ENGINEERING
VESSEL ASSEMBLY,MPRO

PN: 348-2010
PROJ: 6265

REV E   SIZE C
SHEET 1 OF 1

TITLE BLOCK REV 3

Please Send Us Your Comments on This Manual

Model Number _____ Serial Number _____

Printing Date of this manual (from the Title Page) _____

Please circle a response for each of the following statements. Use:

(1)= Strongly agree (2) =Agree (3) =Neutral, no opinion (4) =Disagree (5) =Strongly disagree

a) The manual is well organized.   1   2   3   4   5

b) I can find the information I want.   1   2   3   4   5

c) The information in the manual is accurate.   1   2   3   4   5

d) I can easily understand the instructions. 1   2   3   4   5

e) The manual contains enough examples.   1   2   3   4   5

f) The examples are appropriate and helpful.   1   2   3   4   5

g) The manual layout is attractive and useful.   1   2   3   4   5

h) The figures are clear and helpful.   1   2   3   4   5

i) The sections I refer to most often are _____
_____

Other comments _____
_____

Contact us at our website: www.chandlereng.com

Email: chandler@chandlereng.com

Please add me to your mailing list-

for Product Updates and New Product Releases, Information,

Technical Articles, and General Announcements of interest to users of this instrument.

Name _____

Company _____

Address _____

Email address _____

My instrument is Chandler Model _____

Serial Number _____

REGISTERED

ISO 9001

MANAGEMENT SYSTEM

cut out postcards on dotted lines

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 2303 TULSA, OK

POSTAGE WILL BE PAID BY ADDRESSEE

CHANDLER ENGINEERING
P.O. BOX 470710
TULSA, OKLAHOMA 74147-9801 - U.S.A.

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 2303 TULSA, OK

POSTAGE WILL BE PAID BY ADDRESSEE

CHANDLER ENGINEERING
P.O. BOX 470710
TULSA, OKLAHOMA 74147-9801 - U.S.A.

CHANDLER ENGINEERING

All products of Chandler Engineering are warranted for a period of one year from date of shipment to be free from defective workmanship and material. Providing written notice is made and authorization by us is given, any of our products claimed to be defective may be returned freight prepaid to our factory. If found to be defective and after examination by us, our obligation will be limited to repairing or replacing the product, at our option, free of charge, F.O.B. our factory.

COMMERCIAL INSTRUMENTATION
MANUFACTURED BY OTHERS

Commercial instrumentation manufactured by others is covered by separate manufacturer warranty, generally for one year. Contact Chandler Engineering for instructions on obtaining service directly from the manufacturer.

Our warranty does not cover damage or failure caused by abuse, misuse, abnormal usage, faulty installation, improper maintenance, or any repairs other than those provided by authorized Chandler Engineering personnel.

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NO WARRANTY OF MERCHANTABILITY OR FITNESS
FOR A PARTICULAR PURPOSE SHALL APPLY.

Our total liability on any claim shall not exceed the price allocable to the product or service or part thereof that gives rise to the claim.

AMETEK®

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