

Model 6100 Formation Response Tester w/ Slurry Cart

Part Number CP6100-0050
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S/N _____



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General Information

Introduction

Purpose and Use

The Model 6100 Formation Response Tester (FRT) is designed to accurately measure the permeability changes of a formation sample when exposed to a variety of test fluids. The unique design of the Model 6100 allows fluids to be injected through a prepared core sample in either direction or flowed across either end of the core to simulate the flow of treating fluids or formation fluids.

Description

This fully Automated Core Flow Instrument allows the technologist to sequence numerous fluids (including acids) through a core sample. The system is designed to handle acids and other corrosive fluids at temperatures up to 350°F (177°C). The core can be 1 inch (2.54 cm) or 1.5 inches (3.81 cm) in diameter, depending on the option selected, and up to 6.75 inches (17.1 cm) long. Operating pressure and temperature are limited to 6000 psi (41,344 kPa) and 350°F (177°C). The direction of flow is extremely flexible – top to bottom, across the core face, system flush, etc.

The Model 6100 Formation Response Tester is equipped with a software platform that provides both manual and semi-autonomous operation of the equipment. The Model 6100 software allows a user to perform tests, log data, and generate reports using a comma separated ASCII file format. Tests can be performed manually or according to a schedule.

Eurotherm 2216e temperature control units provide a safe and precise temperature control method. These units are located on the front panel of the Model 6100. A more detailed description of these units can be found in the Eurotherm 2216e manual.

While temperature control parameters are set using the front panel of these instruments, the ISCO precision pump can be programmed via the Model 6100 control software. Software controlled operation allows the pump to operate at multiple flow rates throughout the course of a scheduled test.

Pressure is measured using a pair of 0-6000 PSI (0-41,344 kPa) transducers. One is connected to the top and one is connected to the bottom of the core holder.

Differential pressure is measured across the core sample using a pair of Rosemount precision DP sensors. During the execution of a test, permeability can be measured using the 0-400 PSI (0-2756.3 kPa) differential pressure transducer or the 0-6000 PSI (0-41,344 kPa) transducer, depending on the range and level of precision required. For models equipped with side pressure taps, differential pressure can also be measured along the length of the core sample.

Theory

Permeability Calculation

During execution of a test, the liquid permeability of the core sample is automatically calculated several times a second. The result of this calculation is considered valid once the core is fully saturated and the differential pressure reading stabilizes.

Formulas Used for Permeability

The liquid permeability formula used by the Model 6100 is based on core length, diameter, fluid viscosity, flow rate, and differential pressure. The equation is:

$$\text{Permeability (md)} = \frac{245 * \text{Core Length (cm)} * \text{Flow Rate (ml/min)} * \text{Fluid Viscosity (cP)}}{DP \text{ (PSI)} * \text{Area (cm}^2\text{)}}$$

Core length and diameter are manually entered on the main screen. The viscosity for each sample fluid is entered via the Schedule Management screen. For example, the viscosity entered for sample fluid 1 on the main screen will appear whenever sample fluid 1 is selected.

Features and Benefits

- Unique design allows fluids to be injected in either direction or across either end of a core
- Accurate temperature control to 350°F (177°C)
- Accurate pressure control to 6000 PSI (41,344 kPa)
- Core holder pivots for easy visual inspection of the core
- Ability to pump solid-laden fluids
- Fully automated for ease of use

Specifications

Model 6100

Operating Conditions:	75°F - 350°F (24°C - 177°C)
Maximum Temperature:	350°F (177°C)
Maximum Confining Pressure:	6000 PSI (41,344 kPa)
Maximum Pumping Pressure:	5500 PSI (37,890 kPa)
Input Voltage:	200-240 VAC; 50/60 Hz
Heater Power:	3000 Watts
Dimensions:	67" (170 cm) wide X 64" (163 cm) high X 34" (86 cm) Deep
Net Weight:	560 lbs (254 kg)
Shipping Weight:	760 lbs (345 kg)

Optional Slurry Cart

Operating Conditions:	75°F - 200°F (24°C - 93°C)
Maximum Temperature:	200°F (93°C)
Maximum Pressure:	1000 PSI (6891 kPa)
Input Voltage:	200-240 VAC; 50/60 Hz
Heater Power:	1750 Watts
Dimensions:	36" (91 cm) Wide X 72" (183 cm) High X 25" (64 cm) Deep

Safety Requirements

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

The Chandler Engineering Model 6100 Formation Response Tester is designed for operator safety. Any instrument that is capable of high temperatures and pressures should always be operated with **CAUTION!!**

To ensure safety:

- Locate the instrument in a low traffic area.
- Post signs where the instrument is being operated to warn non-operating personnel.
- Read and understand the instructions before attempting instrument operation.
- Observe caution notes!
- Observe and follow the warning labels on the instrument.
- Never exceed the instrument maximum temperature and pressure ratings.
- Always disconnect main power to the instrument before attempting any repair.
- Turn off the heater at completion of each test.
- Appropriately rated fire extinguishers should be located within close proximity.

Note: All Chandler Engineering equipment is calibrated and tested prior to shipment.

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@chandlereng.com
- Website: www.chandlereng.com

Contact Chandler Engineering with all inquires, orders for spare parts, and technical support.

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. Make sure that the location permits easy access to the nitrogen bottles required to conduct the tests. If the optional slurry cart has been purchased, an additional three feet (one meter) of space beyond and beside the table or bench where the Model 6100 is located will be required.

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

Model 6100 FRT

Electrical Power

- Heater power: 230 VAC \pm 10%, 50/60Hz, 15A
- Instrument power: 230 VAC \pm 10%, 50/60Hz, 10A
- Electronic Mass Balance, 230VAC, 50/60Hz, 1A
- Computer: 115 VAC \pm 10%, 50/60Hz, 10A

Facility Connections

- Instrument air: 80-100 psig, 1/4" Swagelok connection
- Nitrogen: 1000 psig, 1/4" Swagelok connection
- Facility Water, 1/4" Swagelok connection
- Optional waste line for disposal of flushed liquids
- 36" X 72" Bench top space

Slurry Cart (Optional)

Electrical Power

- Heater power: 230 VAC \pm 10%, 50/60Hz, 15A
- Electric Mixer, 230VAC, 50Hz, 3A

Facility Connections

- Nitrogen: 1000 psig, 1/4" Swagelok connection
- Facility Water, 1/4" Swagelok connection

Tools/Equipment Required

Standard hand tools

Setting up the Instrument

The Model 6100 is shipped with a pre-configured PC, including all necessary hardware and software components. No initial software installation or setup is required.

1. Remove the plastic plugs from all fittings in preparation for attachment of utilities.
2. Loosen the black bumper stops on the oven track and place them back in the proper position. Once completed, tighten the bumper stops again.
3. Move the oven up and support it with the wooden oven support as shown in *Figure 1*.
Note: Core holder and accumulator may be different from the ones pictured.

Figure 1: Oven with Support in Place

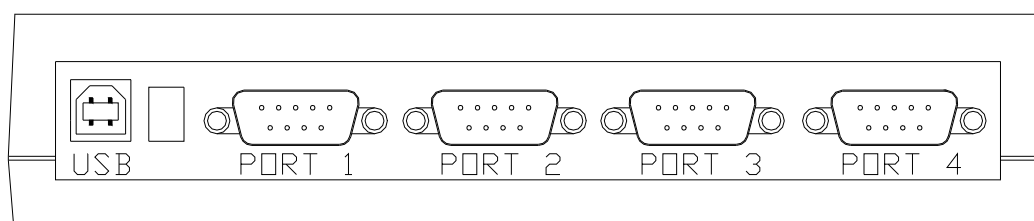


4. Remove the tie wrap from the oven cables and work the cable ends onto the oven cable mounts in the rear of the oven.
5. Remove the oven support. The oven should move freely up and down.
6. Loosen the retaining screws on the top of the Dual Cylinder Head between the accumulator and the core holder. This will allow the core holder and the accumulator to pivot.
7. Attach the water from a tap water source to the Water In bulkhead.
8. Plumb the nitrogen from the source to the bulkhead.
9. Plumb the air from the source to the bulkhead at the rear of the instrument.
10. Plumb the pressure relief valves to a drain or other collection source
11. Fill the oil tank.
12. Connect the pump fluid line to the bulkhead connection at the front of the instrument.

Note: See Figure 2 below as well as drawing SPR097-0117 for illustration of USB connections.

13. Connect the pump computer interface to Port 2 in the USB hub via the cable provided.
14. Connect the balance to Port 1 in the USB hub via the cable provided.
15. Connect the Eurotherm controller to Port 3 in the USB hub. Between the Eurotherm cable and the hub, an RS485 to RS232 converter must be used.
16. Connect the cable from the USB hub to the computer, using USB port 1 on the computer.
17. Connect the Ethernet cable from the control box to the computer in the 3 Com 3C905 card.

Figure 2: USB Ports



Connecting the PC to a Local Area Network

In general, it is possible to connect the 6100-PC to a Local Area Network, provided that Microsoft networking is used. This section of the manual is intended for network administrators and qualified technicians who are familiar with Windows networking. Complete familiarity with Microsoft networking and Windows NT or 2000 is required, depending on the operating system shipped with the unit.

The PC is equipped with dual Ethernet adapters. One adapter is reserved for 6100 I/O communications ONLY. The other can be connected to any Microsoft based TCP/IP LAN.

Ethernet I/O

The PC communicates with the 6100 hardware serially and via Ethernet. The adapter used for Ethernet I/O is pre-configured with an IP address and Subnet Mask. In the event that these values need to be reset, refer to the table below.

IP Address:	10.1.1.1
Subnet mask:	255.0.0.0
Default gateway:	Blank
Preferred DNS server:	Blank
Alternate DNS server:	Blank

The Model 6100 is shipped with a pre-configured PC, including all necessary hardware and software components. No initial software installation or setup is required.

LAN Connection

In most cases, Microsoft networking can be used to communicate with the 6100-PC. A second Ethernet card is pre-installed in the unit for LAN connectivity. The TCP/IP settings in Windows should be configured to match those required by your Local Area Network.

Setting up the Slurry Cart (optional)

1. Position the slurry cart near the side of the FRT containing the core holder for proper installation.
2. Connect the two hoses from the slurry cart to the FRT. The hoses are interchangeable.
3. Connect the data cord from the underside of the control box to the computer. The computer does not control the operations contained on the slurry cart but it does record data from the slurry cart including flow rate, pressure, and temperature.
4. Plumb the slurry cart to the nitrogen and water connections.
5. Plug the slurry cart into a proper 200-240 VAC receptacle.

Section 2 – Operation

Note: The core holder is designed for convenient loading and unloading. The unit can be rotated for easy access. Core sample size must be 0.98-1.0" (2.49 – 2.54 cm) in diameter for a 1.0" (2.54 cm) core holder and 1.48-1.50" (3.76 – 3.81 cm) in diameter for a 1.5" (3.81 cm) core holder and 6.75" (17.1 cm) in length (with spacers). The diameters of the cores used for testing should be as consistent as possible to insure a longer life for the Core holder Sleeve.

Before Operation

The unit is shipped with spacers loaded into the sleeve of the core holder with a slight amount of pressure to maintain the seal. The spacers must be removed before a core can be loaded into the core holder. To remove these spacers, perform the following steps:

1. Release the confining pressure by turning the confining pressure regulator fully counterclockwise and opening the confining pressure relief valve. The confining pressure gauge must read zero before the core holder can be opened.
2. Next, the four stainless steel lines on the top and bottom of the cell must be removed. (See Figures 3 and 4 below under loading the core sample.) The two lines on the bottom of the core holder from the slurry cart must also be removed. The confining oil line as well as the electrical lines (thermocouples), DO NOT need to be removed, as there is sufficient flex in these lines to allow the core holder to pivot. Additionally, if the Model 6100 is equipped with the optional pressure tap feature, these lines do not need to be removed to pivot the core holder.
3. Remove the brass core end plug from the top of the core holder.
4. Remove the plug from the core extraction plug at the bottom of the core holder. Thread the extractor rod onto the core extraction plug at the bottom of the core holder.
5. Carefully push the spacers out the top of the core holder. Do not force the spacers, or damage to the Core holder Sleeve may occur.

Core Preparation

Before loading the core into the core holder, the operator should insure that the core is properly prepared. The following list provides guidelines for core preparation before testing.

1. Insure that both ends of the core have edges that are sharp and not rounded. Any gaps in the ends of the core sample will cause failure of the test.
2. Insure that the diameter of the core meets the requirements of the tester.
3. Insure that the ends of the core are perpendicular to the axis so the core fits flush against the ends of the holder and/or the spacers.
4. It is helpful to have the core fully saturated before loading it into the core holder. This can be achieved by soaking the core in brine under a vacuum.

Loading the Core Sample

1. Insure that plumbing lines are removed from the top and bottom of the core holder (two on each end). Refer to Figures 3 and 4 below. Additionally, remove the plumbing lines from the slurry cart located on the bottom cap of the core holder.
2. Pivot the core holder in order to easily access the core holder.
3. Unscrew the end plug from the top of the core holder. Refer to figure 3 below.
4. Insert the core first and then the spacers to achieve the total length required for the tester.
5. Reinsert the end plug and screw it into the top of the core holder. Be sure the end plug butts firmly against the core (or spacers).

Note: The end plug MUST fit firmly against the core or the Core holder Sleeve will not seal correctly.

6. Pivot the core holder to the upright position and re-attach the plumbing lines on the top and bottom of the core holder.

Note: Forward Flow is from BOTTOM to TOP of the core holder. When spacers are being used at the top of the core, the top face of the core is not actually flushed when flow across that face is selected.

Figure 3: Top of the Core Holder

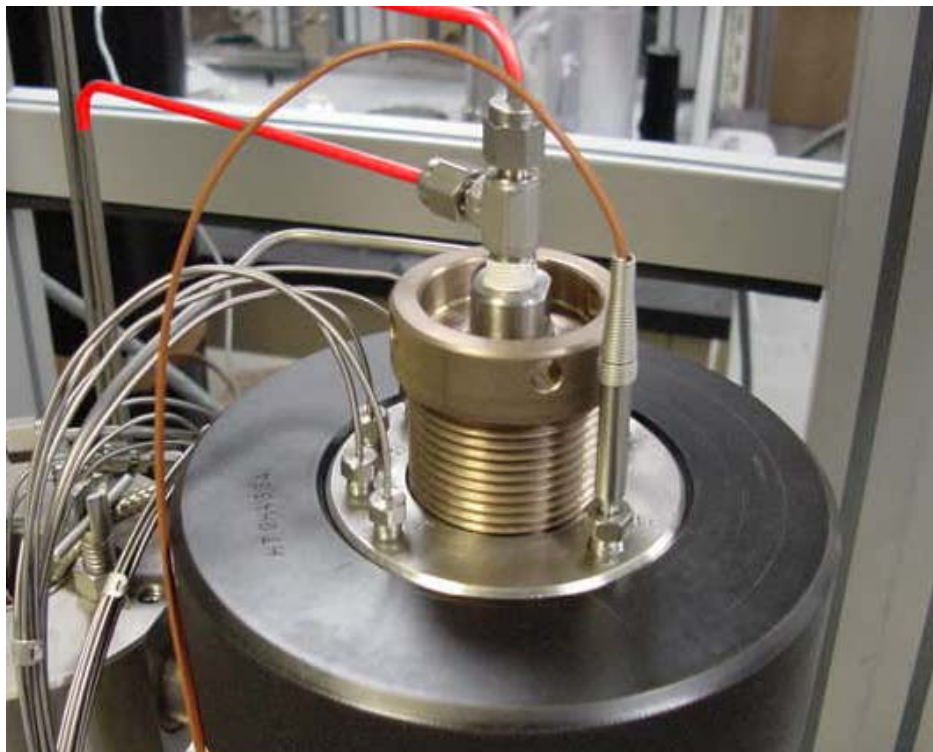
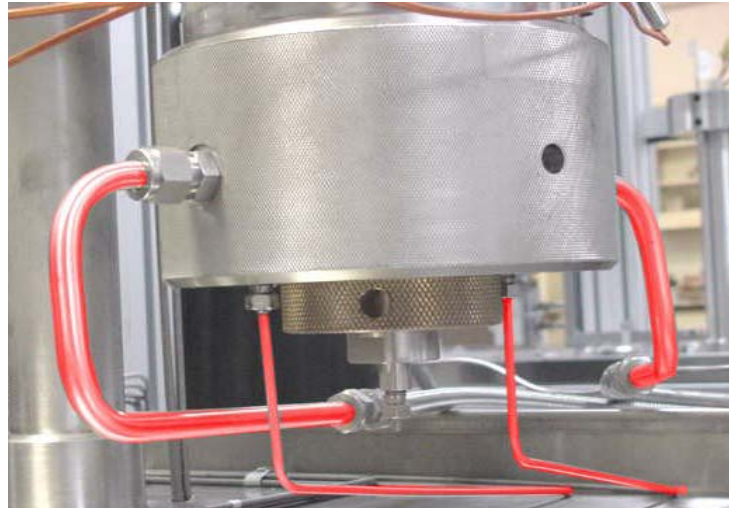


Figure 4: Bottom of Core Holder

Starting a Test

1. After the core is inserted into the core holder with appropriate spacers, verify to see that all plumbing lines are re-connected to the core holder.
2. Fill as many fluid containers as are necessary for the test. Only fluids with low viscosity may be placed in fluid containers 1-4 (i.e. fluids less than 10cP, such as brines or acids). Viscous materials such as muds must be loaded into the accumulator (designated as fluid container #5) in order to be pumped.

Viscous materials may also be pumped using the optional slurry cart. However, the maximum pressure for the slurry cart is 1000 PSI (6891 kPa) and the maximum temperature is 200°F (93°C).

Note: The fluid in container #1 is used to push the piston in the accumulator and pump the viscous fluid. Therefore, sufficient fluid must be placed in fluid container #1 to equal the volume to be used in the test as well as to provide enough fluid volume for pumping up the piston in the accumulator.

3. To fill the accumulator with a desired viscous fluid perform the following steps:
 - a. Disconnect all plumbing lines from the top of the accumulator.
 - b. Disconnect the thermocouple.
 - c. Remove the top of the accumulator.
 - d. Open the valve at the bottom of the accumulator and place a container underneath the outlet to catch the liquid.
 - e. Manually push the piston to the bottom of the accumulator.
 - f. Close the valve.
 - g. Fill the accumulator with the desired fluid.
 - h. Replace the top and re-connect all lines.
4. Prime the pump and set the pressure limits. (For more information, see Notes on Injection Pump Operation below.) The pressure limits must be set on the pump itself. The software does NOT control these limits.

Note: Be sure to set the pump upper pressure limit to 300-500 PSI LESS than the confining pressure of the test.

5. It may be desirable to fill the fluid lines of the system with a fluid other than water. Typically, after a test, the lines will be left filled with water from the flushes. However, if the core being used is sensitive to water, then the lines will need to be flushed with another fluid. The following steps will flush only the lines that would potentially come into contact with the core. The objective is to flush the water out of the system but not through the core.
 - a. Place the desired flush fluid in one of the fluid containers.
 - b. Set the computer in Manual Override position.
 - c. Run a Forward Flush with both valves 8 and 9 open.
 - d. Run a Reverse Flush.
 - e. Close all valves.
 - f. Open only valves 8 and 9 and manually open the valve on the top of the accumulator. Pump until flush fluid comes out the open valve.
6. Apply confining pressure to maintain a pressure of 300-500 PSI greater than the chemical injection pressure. (Also see notes on Confining Pressure below)
 - a. Turn Relief Valve counter-clockwise until all pressure is released
 - b. Slowly turn the Confining Pressure Regulator clockwise until the pump begins to stroke (<1 stroke/second).
 - c. Slowly turn the Relief Valve clockwise until pressure begins to show on the gauge.
 - d. Alternately, adjust the Regulator and Relief Valve until the desired Confining Pressure is reached.
 - e. Once the desired pressure is reached, back off the air pressure until the pump strokes only occasionally to maintain pressure.
7. Set the backpressure regulator to the desired pressure (typically 100 PSI).
8. Begin heating, if desired, by entering the set point into the heaters and pressing the green button on the front of the control panel. The red button stops the heaters. (For more information see the Notes on Temperature Control below.)
9. Pull the heating oven down over the cell.
10. Verify that a container is on the balance to receive any leak-off fluids.
11. Tare the balance.
12. Begin flow manually or using the computer control software.

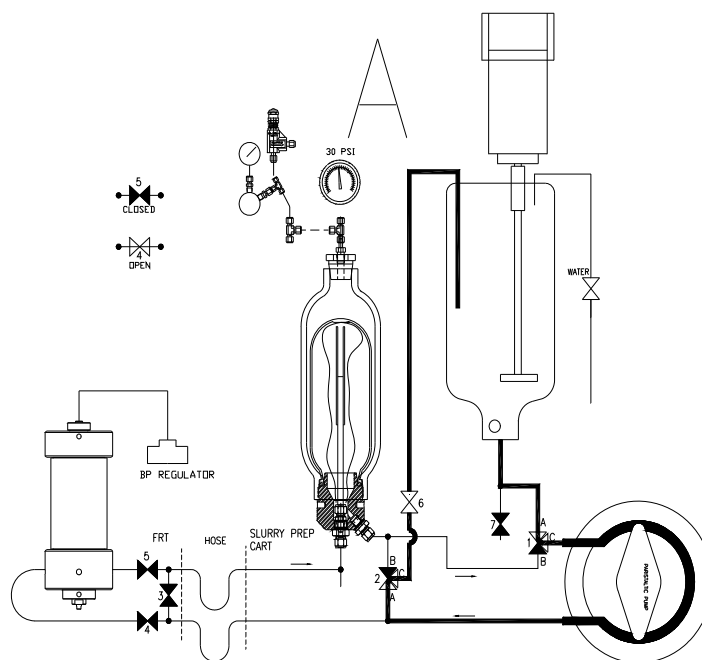
Operation of the Slurry Cart (optional)

Figure 5 below illustrates the control panel for the slurry cart. Refer to Figure 5 while following the operating procedure for the Slurry Cart.

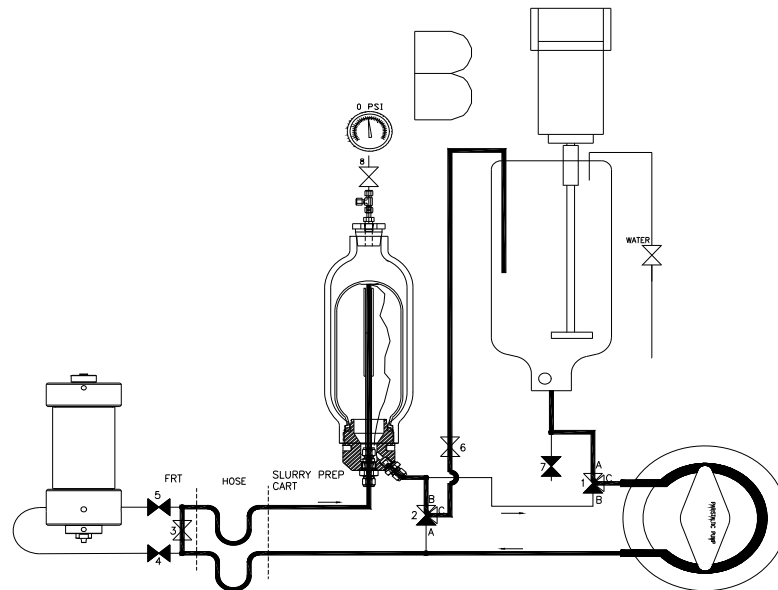
Figure 5: Front Control Panel for the Slurry Cart



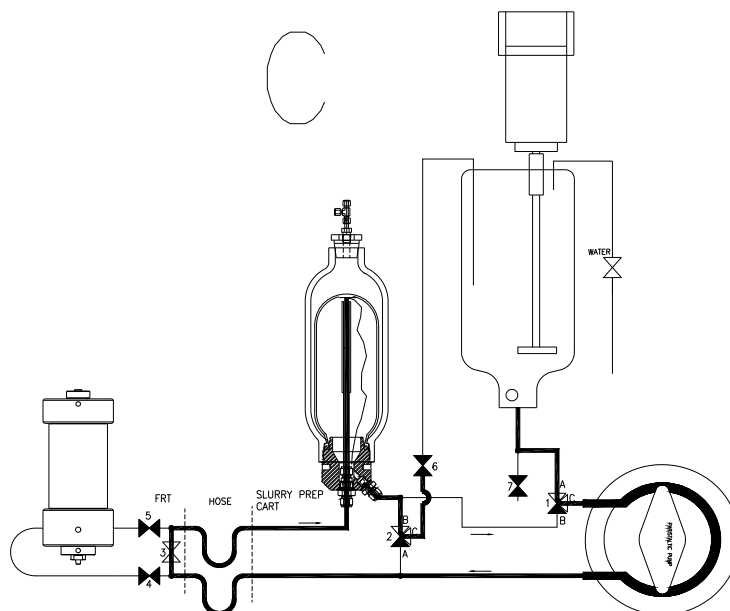
1. Check to see that the confining pressure on the core holder is at least 200 PSI above the desired pumping pressure on the slurry cart.
2. Set the backpressure on the core holder to equal the desired pumping pressure on the slurry cart.
3. Open Valve 2 to the B position.
4. Apply approximately 30 PSI to the slurry cart accumulator.
5. Check to see that Valves 3, 4, 5, and 7 are in the CLOSED position. Valve 6 should be in the OPEN position. Valves 1 and 2 should be turned in the "A" direction.
6. Fill the reservoir to the desired level.
7. Add mix chemicals and stir. To use the reservoir mixer, turn the power switch to the ON position on top of the mixer and adjust the mixing speed with the knob.
8. Run the pump to circulate fluid into the reservoir. To run the pump, turn on the Main Power switch located on the Slurry Cart control panel, place the Pump Switch in RUN position, select FWD or REV with the toggle switch, and adjust the speed until the display indicates the desired pump speed in liters per minute.

Figure 6: Flow Path in Slurry Cart Resulting from Steps 5-8

9. Add proppant to the fluid once it has thoroughly mixed, if desired.
10. Mark the fluid level using the dark gray marker on the tubing beside the reservoir. This marker is 2 liters of volume in the reservoir and is critical when filling the slurry cart accumulator.
11. Open Valve 3 and set Valve 2 to "B" direction.
12. Reduce pressure to 0 PSI using the regulator. Slowly open Valve 8 to bleed off the pressure. Fluid will now circulate into the slurry cart accumulator.

Figure 7: Flow Path in Slurry Cart Resulting from Steps 11-12

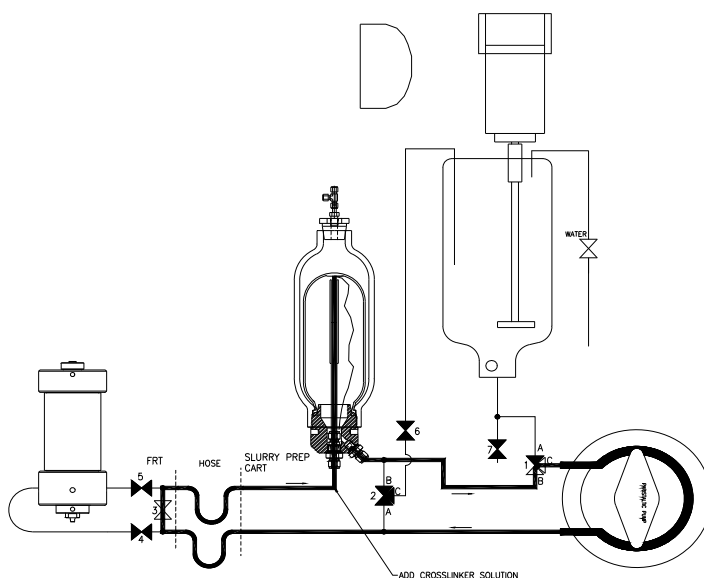
13. Close Valve 6. The bladder inside the slurry cart accumulator will fill.

Figure 8: Flow Path in Slurry Cart Resulting from Step 13

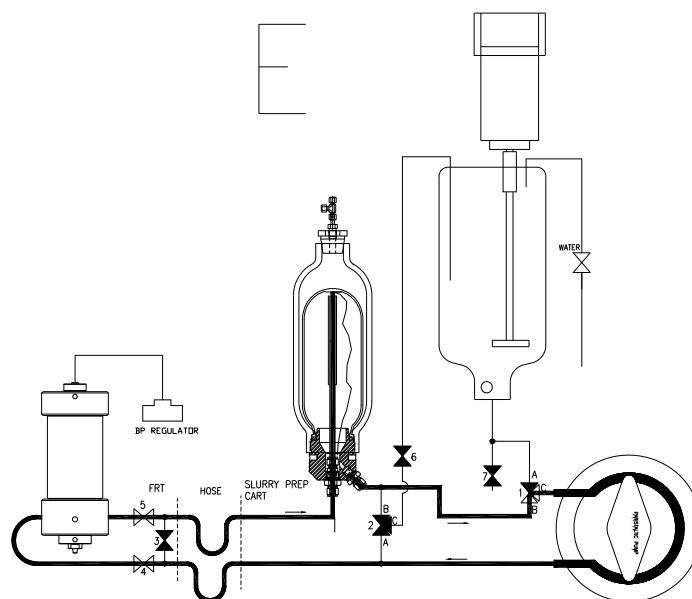
14. The capacity of the bladder is approximately 2 liters. When the fluid reaches the bottom of the marker, immediately place Valve 1 in B position. Place Valve 2 in the C position. Turn off the reservoir mixer.

15. Begin the cross-linker injection through the tee at the bottom of the slurry cart accumulator, if desired.
16. Program the desired temperature into the temperature controllers and press the Heater ON button.

Figure 9: Flow Path in Slurry Cart Resulting from Steps 14-16



17. Apply pressure until the pressure in the slurry cart matches the desired pumping pressure (the back pressure that was set in Step 2 above).
18. Begin circulating to the FRT by opening valves 4 and 5. Close valve 3.
19. To start leak-off through the core, decrease the backpressure until the desired pressure differential across the core is obtained. The minimum backpressure should be 100 PSI.

Figure 10: Flow Path in Slurry Cart Resulting from Steps 17-18

Test Clean-up

Note: Test clean up (steps 1, 2, and 7) can begin immediately after the test is completed if the operator does not wish to preserve the core. If the operator wishes to preserve the core, water flushes should not begin until after the core is removed.

1. Using the control software, turn the fluid pump off.
2. Turn the heaters off by pressing the red button on the front of the control panel.
3. Lift the oven up from the cells.
3. Allow the system to cool to below 200°F (93°C) before continuing.
4. Remove the backpressure by turning the backpressure regulator fully counterclockwise.
5. Remove the confining pressure by turning the confining pressure regulator fully counterclockwise and opening the Confining Pressure Relief valve.
6. Remove core by following procedure below (Unloading the Core Sample).
7. Flush all the lines using the Water valve on the front of the instrument. Using the Water valve on the front of the instrument will allow a more rapid clean up than the 10 mls/min maximum flow rate provided by the pump. Flow water through all the various flow paths to insure each line is flushed. Be sure to flush all lines to minimize the risk of corrosion and clogging due to precipitation.
8. Clean the accumulator thoroughly.
9. Wipe up all spills from the bottom tray.

Slurry Cart Cleanup

1. Turn off the heaters by pressing the red Heater OFF button.
2. Close Valves 4 and 5 to stop circulation through the core. Open Valve 3.
3. Turn the regulator fully counterclockwise to reduce pressure to 0.
4. Slowly open valve 8 to bleed pressure off of the slurry cart accumulator.
5. Open Valve 7 to drain the reservoir of remaining fluid. (Be sure that the plastic tub is on the slurry cart to catch the waste.)
6. Close Valve 7 when it has drained.
7. Open the Water valve to the reservoir to fill it with water.
8. Open Valve 6 to begin fluid circulation back into the reservoir.
9. Place Valve 1 in the A position to feed the pump from the reservoir.
10. Continue circulating while periodically opening Valve 7 to drain the reservoir and fill the reservoir back up with water until all lines are completely flushed with water.

Unloading the Core Sample

1. Insure that there is no fluid pressure on the system and that the confining pressure has been completely removed from the core sample.

Note: Fluid pressure must be removed before the confining pressure is removed.

2. Remove the plumbing lines from the top and bottom of the core holder (two on each end). There are two additional plumbing lines on the bottom of the core holder that must be removed if the instrument is equipped with the optional Slurry Cart.
3. Unscrew the end plug from the top of the core holder. Pivot the core holder for easier access to the end plug.
4. Remove the plug from the bottom core extraction plug. Thread the core extractor rod into the core extraction plug and gently push the core sample out of the core holder.

Note: Do not force core sample out of the core holder. Damage may occur to seals within the core holder.

Notes on Confining Pressure

Confining pressure is applied to the core by applying hydraulic pressure into the cavity around the core holder sleeve surrounding the core. When pressure is applied, the sleeve compresses around the core and effectively seals the outer surface of the core so that fluids injected at the ends of the core must pass through it rather than bypass it.

The Chandler Model 6100 Formation Response Tester uses an air-driven hydraulic pump to apply this confining pressure. There are two controls on the front panel of the instrument, which control the confining pressure. They need to be adjusted in balance to provide the necessary confining pressure and effective over pressure protection. An air pressure regulator located on the front panel controls the amount of air pressure going to the hydraulic pump and its resulting hydraulic pressure. The pressure relief valve located just below the confining pressure gauge limits the maximum amount of pressure contained in the hydraulic system. A properly

adjusted confining oil system is one where the pumping pressure is just less than the relieving pressure of the system. When the Core Holder is heated, expansion of the oil will cause pressure to increase. A properly adjusted relief valve will release fluid to maintain pressure just below its setting. If pressure drops due to cooling, etc., the pump will stroke to bring the pressure back up to its setting.

Note: Generally it is desirable to maintain a confining pressure that is 300-500 PSI greater than the chemical injection pressure.

Notes on Injection Pump Operation

The Quizix pump supplied with the FRT System is very reliable when properly maintained. It is equipped with inert wetted components and is suitable for pumping acids. Fluids must be filtered to insure they are particle free. The pump is capable of 0.001 – 50 ml/min at a maximum pressure of 6000 psi. It is capable of pumping viscous fluids as long as the suction lines and head are adequate for the flow rate.

Precision Pump Control

The Model 6100 is equipped with a 0-50ml/min pump, which may be controlled via the Model 6100 main screen or by specifying flow rates in a schedule. The user must NOT change the units for Pressure, Flow Rate, or Volume that are displayed in the PumpWorks software. The FRT software expects these values to be in PSI, ml/min and ml respectively.

Specifying a Flow Rate

Flow Rate can be entered via the main screen, under “Manual Preset,” or via schedule selection. For manual operation, the specified flow rate will take effect once the “RUN” button is pressed. During scheduled cycle operation, the flow rate is specified using the Schedule Management screen.

Setting the Upper Pressure Limit

The pump safety pressure must be set by the user whenever the pump has been powered off and back on again. This safety pressure should be set to a value 300-500 psi less than the confining pressure of the test. If the pressure exceeds the safety pressure limit, the pump will stop and not start again until the pressure is relieved and the RUN button is depressed on the 6100 main screen.

Warning: The high-pressure limit should be 300-500 PSI less than the confining pressure.

Notes on Temperature Control

Warning: Be sure to turn the heaters off anytime a test is completed or when the unit is to be left unattended.

Eurotherm 2216e temperature control units provide a safe and precise temperature control method. These units are located on the front panel of the Model 6100. A more detailed description of these units can be found in the Component section of this manual.

Defining a Set point

The front panel of each temperature controller normally displays the current temperature above the set point. From within this screen, the up and down arrows control the set point. For more information refer to the Component section of this manual.

Starting and Stopping the Heaters

Pressing the green button on the Model 6100 control panel starts the heaters. When power is applied to the heaters, the green light should remain on. If it does not remain on, then an alarm condition may be present. Pressing the red button on the front of the control panel stops the heaters.

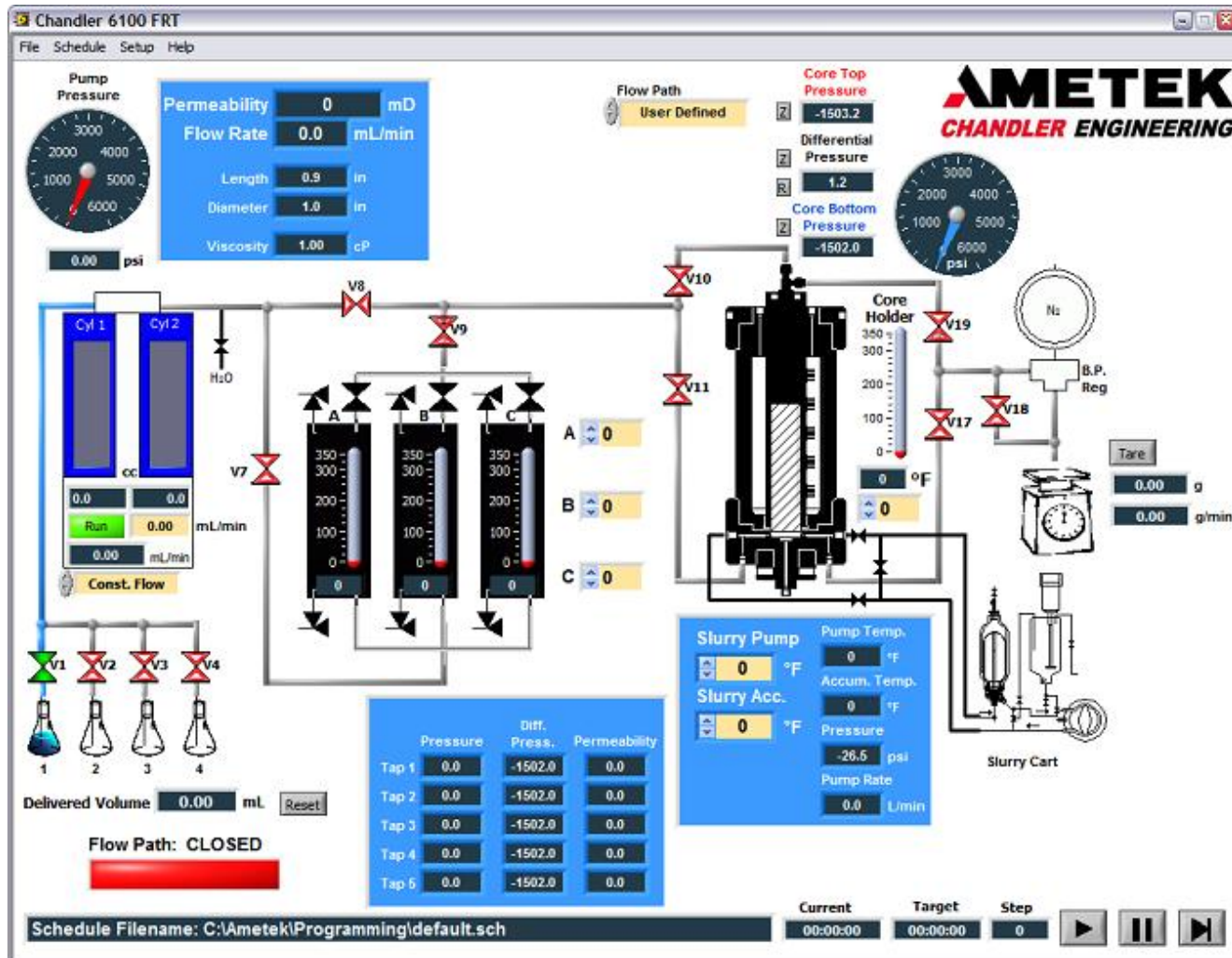
Notes on Startup/Shutdown Sequence

When powering on the FRT, first apply power to the Instrument from the front panel power button. Then startup the 6100 software from the computer.

During shutdown, exit the Quizix Pumpworks software from the computer first, then exit the 6100 software. Turn power off to the FRT Instrument from the front panel power button.

Note: Turning power off to the FRT Instrument while the 6100 software is running will result in lost communication to the computer. When power is reapplied to the Instrument, the 6100 software will require restarting.

Description of Primary Software Functions



The main screen depicts the configuration of the Model 6100 graphically, allowing the user to manually open and close valves and select sample fluids, flow paths, etc. Valves that are shown in red on the screen are closed, and valves that are shown in green are open. Depending on installed options, some controls or indicators may not be visible.

Menus

File

This menu allows the user to exit the application.

Schedule

This menu allows the user load a previously defined schedule or Edit / Create an existing or new schedule file. These menu options are not available while a schedule is running. See also Schedule Editor.

Setup

This menu allows the user to access the various screens used to set up and configure the 6100 Software.

The Calibration window allows the user to calibrate the various pressure transducers and the Slurry Cart Pump Rate feedback.

The Communications window allows the user to set the appropriate serial COM port for the Temperature Controllers and the Flow Meter.

The Core Dimensions window allows the user to set the appropriate dimensions for both Core Holders.

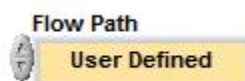
The Units window allows the user to set which units are to be used for Pressure, Temperature and Core Length / Diameter.

The Viscosities window allows the user to set the Viscosity of the fluids in the Sample Containers and Piston Accumulator(s).

Help

This menu allows the user to open the Help File (Index...) and display the About Dialog.

Flow Path Selection



This drop-down list is used to select or indicate standard flow paths for the Core Holder. If the user manually opens / closes individual valves, this drop-list will change to indicate which flow path has been configured (if any). If the configured flow path does not match any standard flow path option, then drop down list will show User Defined as above.

Production

Opens valves 10 and 17; Closes valves 11 and 19. Fluid flows from the top of the core to the bottom (Formation to Well-Bore direction).

Bottom Flush

Opens valves 11 and 17; Closes valves 10 and 19. Fluid sweeps the bottom face of the core.

Injection

Opens valves 11 and 19; Closes valves 10 and 17. Fluid flows from the bottom of the core to the top (Well-Bore to Formation direction).

Top Flush

Opens valves 10 and 19; Closes valves 11 and 17. Fluid sweeps the top face of the core. If spacers are used during the test, the bottom flush will only sweep the spacer.

Close All Valves

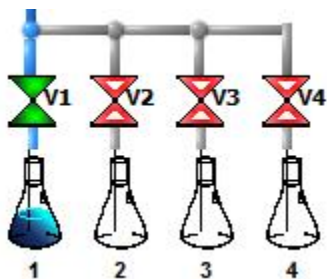
Closes all valves and selects Sample Fluid 1 (opens Valves 1 and 8).

User Defined

This option does not open or close any valves. This option is used to indicate that the currently open valves do not conform to any of the configurations listed above.

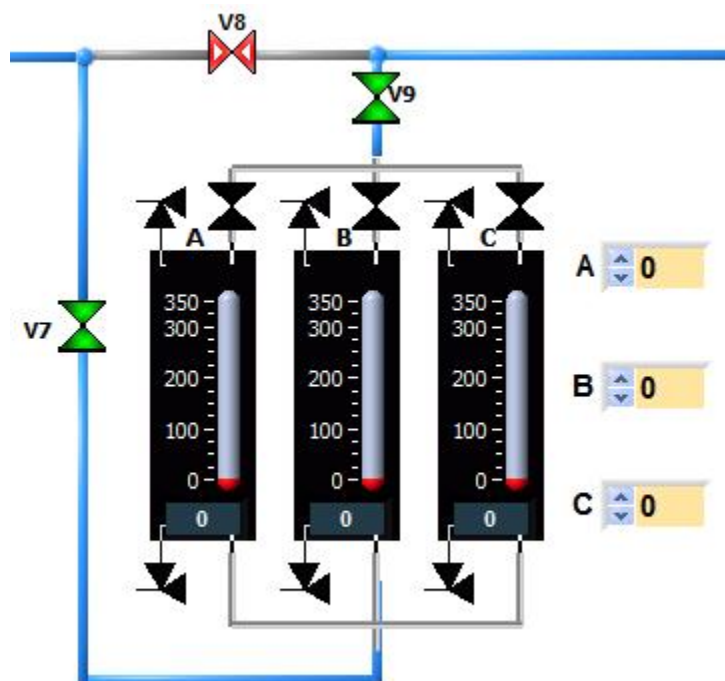
Note: if a valid flow path is detected, the Flow Path indicator (depicted below) is green and displays “OK”. If a closed flow path exists, the Flow Path indicator is red and displays “CLOSED”. If the pump is running in Constant Flow mode at a set point greater than 2 mL/min and a closed flow path is detected, the pump is automatically set to 2 mL/min.

Flow Path: OK

**Fluid Selection**

Sample fluids may be selected on the main screen. Only one sample fluid may be selected at a time. If the Piston Accumulator is selected, valves 7 and 9 are opened, valve 8 is closed, and sample fluid 1 is selected. When sample fluids 2, 3, or 4 are selected then the accumulator will be deselected, valves 7 and 9 are closed and valve 8 is opened.

Piston Accumulators



The Piston Accumulators may be selected as the Fluid Source. For systems equipped with multiple accumulators, manual valves are used to open or close the appropriate accumulator. The number of Piston Accumulators displayed may vary depending upon your configuration. If the user clicks on any Piston Accumulator, Sample Fluid 1 is selected (Valve 1 is opened) and Valves 7 and 9 are opened, Valve 8 is closed. The temperature controls displayed here are described in further detail below.

Permeability Parameters

Permeability	0	mD
Flow Rate	0.0	mL/min
Length	0.9	in
Diameter	1.0	in
Viscosity	1.00	cP

Permeability: These fields display the calculated Permeability of the core.

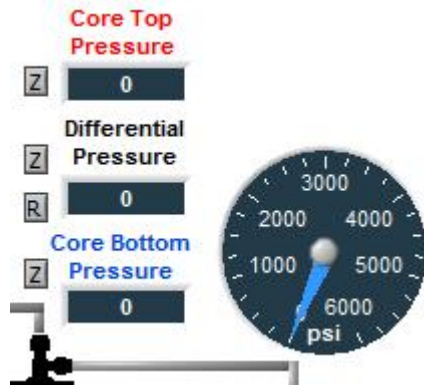
Flow Rate: This fields indicates the Flow Rate to the core.

Length: This field displays the Core Length entered by the user on the Core Holder Dimensions window.

Diameter: This field displays the appropriate Core Diameter entered by the user on the Core Holder Dimensions window.

Viscosity: This field indicates the “Working Viscosity” dependent upon the currently selected Sample Fluid container or the Piston Accumulator (if valves 7 and 9 are open and valve 8 is closed). The individual viscosities for these containers are entered by the user on the Viscosities window.

Pressure Gauge (Core Holder)



The Core Top Pressure and Core Bottom Pressure are displayed on a single Pressure Gauge indicator.

Core Top Pressure: This field indicates the feedback from the pressure transducer located at the top of both Core Holders. This value is the red needle on the gauge and corresponds to the “Cell Inlet” Pressure Gauge located on the front of the Formation Response Tester.

Note: the red needle (Core Top Pressure) on the gauge is under the blue needle (Core Bottom Pressure). If the pressures are similar, the red needle may not be visible.

Core Bottom Pressure: This field indicates the feedback from the pressure transducer located at the bottom of both Core Holders. This value is the blue needle on the gauge and corresponds to the “Cell Outlet” Pressure Gauge located on the front of the Formation Response Tester.

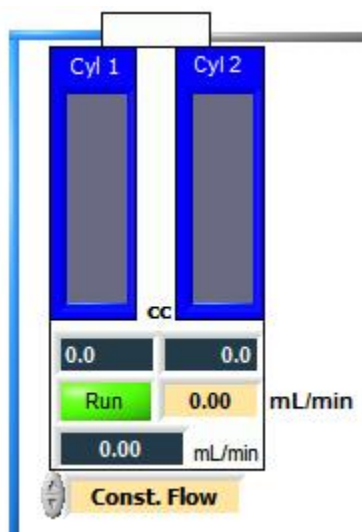
Differential Pressure: This field indicates the absolute value of the difference between the Core Top Pressure and Core Bottom Pressure. This value is not indicated on the pressure gauge.

"Z" Buttons (Zero): These buttons allow the user to zero the appropriate Pressure Transducer. Clicking the Z button located next to either the Cell Top Pressure or Cell Bottom Pressure indicators will adjust the appropriate Offset (located on the Calibration screen) to force the current pressure feedback to read zero. Clicking the Z button located next to the Differential Pressure indicator will set an offset variable (that is added after the difference calculation) such that the current differential pressure feedback will read zero. Before zeroing any pressure transducer, the system must have atmospheric or zero pressure in the

line or errors may result in the calculations.

"R" Button (Reset): Clicking this button will reset the offset variable for the Differential Pressure to zero (no offset). To reset the offsets introduced by clicking the Z buttons for the Core Top and Bottom Pressure indicators, see the Calibration screen.

Pump Control



QX Pump Pressure: Displays the output pressure of the pump.

Cyl1 / Cyl2: Displays the current volume of each pump cylinder.

Run / Stop: Allows the user to Start and Stop the pump. When this button is red and displays “Run”, the pump is currently stopped (click to Run the pump). Likewise, when this button is red and displays “Stop”, the pump is currently running (click to Stop the pump).

Set Point: This field (off-white background, black text) allows the user to enter a set point. The units label next to this field change depending on which state the pump is in. When the pump is in Constant Flow mode, the Set Point units are milliliters per minute. When the pump is in Constant Pressure mode, the Set Point units are pounds per square inch (psi).

Pump Flow Rate: This field displays the current output flow rate of the pump.

Mode Selection: This Drop-List allows the user to set the pump in Constant Flow or Constant Pressure mode. If the pump is running when the mode is changed, the pump is first stopped before changing modes (the pump is NOT restarted).

Delivered Volume:

Delivered Volume **0.00** mL

The Delivered Volume indicator (shown above) displays the amount of volume that has been delivered by the Pump. This value is reset at the beginning of each schedule step. This value may be manually reset by clicking the **Reset** button. **Note:** Clicking the reset button while

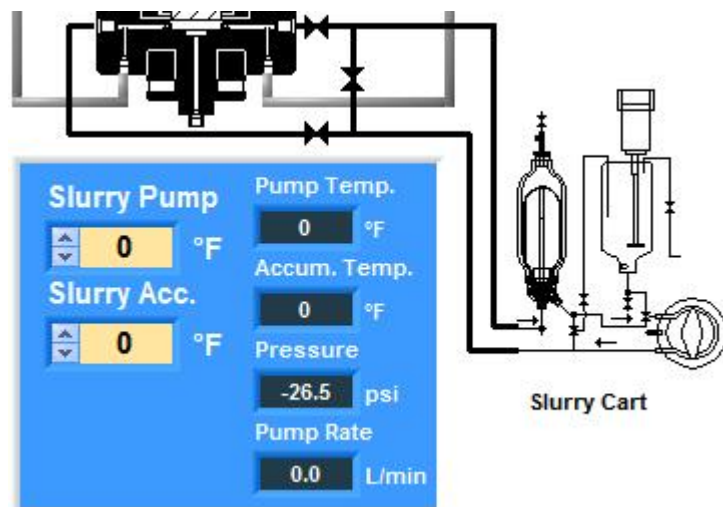
executing a Schedule Step based on Volume (see Schedule Editor) will affect the amount of time that a "Based on Volume" schedule step will execute. For example, if the currently running schedule step is based on volume and is set to advance to the next schedule step when 10mL has been delivered, and the operator clicks this button when the Delivered Volume indicator displays 5mL (and then allows the schedule to advance automatically) the actual amount of volume delivered to the core during this example schedule step will be, approximately, 15mL.

Balance



These indicators display the Effluent (instantaneous feedback from the balance in grams) and the calculated Effluent Rate (the slope of the line created by plotting the Effluent feedback over the past 60 seconds). The **Tare** button allows the user to Tare (or Zero) the balance. The Tare button acts the same as pushing the "Tare" (or "Re-Zero" button depending on model) on the balance.

Slurry Cart



Slurry Pump: This field allows the user to set the “In-Line” temperature controller on the Slurry Cart. This temperature may also be set via the temperature controller interface on the Slurry Cart. All temperature set points are periodically synchronized with the appropriate controller.

Slurry Acc: This field allows the user to set the “Accumulator” temperature controller on the Slurry Cart. This temperature may also be set via the temperature controller interface on the Slurry Cart. All temperature set points are periodically synchronized with the appropriate

controller.

Pump Temp: This field displays the current temperature feedback from the Slurry Cart “In-Line” temperature controller.

Accum. Temp.: This field displays the current temperature feedback from the Slurry Cart “Accumulator” temperature controller.

Pressure: This field displays the current pressure feedback from the Slurry Cart. This signal can be calibrated on the Calibration screen.

Pump Rate: This field displays the current pump rate feedback from the Slurry Cart. This signal can be calibrated on the Calibration screen.

Schedule Controls



File name: This field displays the file name of the currently loaded schedule.

Current: This field displays the current progress of the schedule step. If the step is “Based on Time”, this field displays how much time has passed (in hours : minutes : seconds) since this step started. If the step is “Based on Volume”, this field displays how much volume has been delivered to the core since this step started.

Target: This field displays the target time or target delivered volume at which the schedule will advance to the next step.

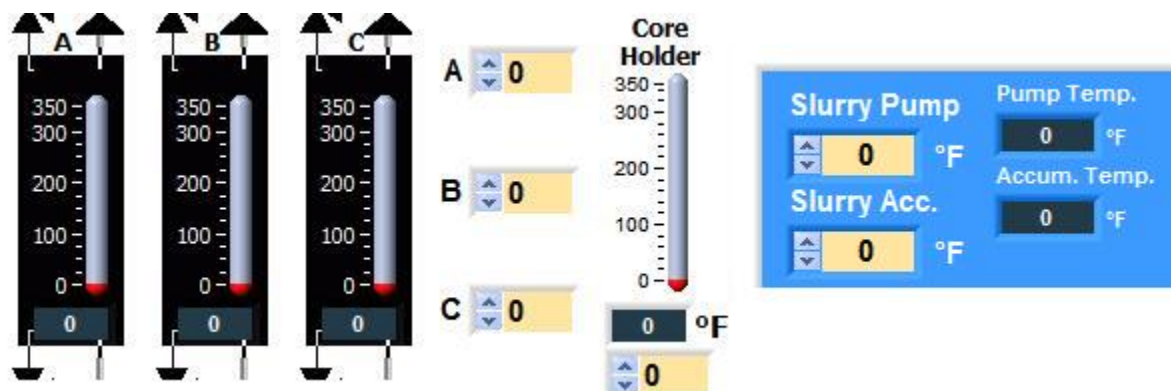
Step: This field indicates which schedule step is currently being executed.

Play/Stop: This button allows the user to start and stop the schedule. Before any schedule settings are applied, the operator is asked if data logging should be started (if it is not already logging - see Data Plotting screen). If the operator answers "Yes", the Setup Data Logging screen will appear. The software waits for the operator to finish with the Setup Data Logging screen before beginning the schedule.

Pause: This button allows the user to “Pause” the schedule. Pausing the schedule does NOT “pause” the pump. The schedule will not automatically advance to the next step when the Pause button is active. If the schedule is paused and the schedule advancement criteria have been met (the “Current” field exceeds the “Target” field) the “Current” field will flash.

Advance: This button allows the user to manually advance the schedule to the next schedule step.

Temperature Controls



Set Point: These fields (off-white background, black text) allow the user to set the appropriate temperature controller.

Note: The temperature set point may also be entered at the Eurotherm controller. The software periodically synchronizes the displayed set point with the Eurotherm controller.

Feedback: These fields (dark teal background, white text) display the feedback from the appropriate temperature controller.

Data Plotting and Data Logging

















Data Plotting and Logging are performed in this window. The operator may right-click on the plot to reveal a popup menu which allows the operator to show / hide different data channels. The plot can hold approximately 4 days worth of data.






Log Data: Clicking this button will display the Setup Data Logging screen to allow the user to enter "header information". This button may be automatically actuated depending on the value in the "Log Data?" field of the.

Data Log Interval: This control allows the user to set the rate at which data will be logged. This control may be set automatically depending on the value in the "Log Rate" field of the Schedule.

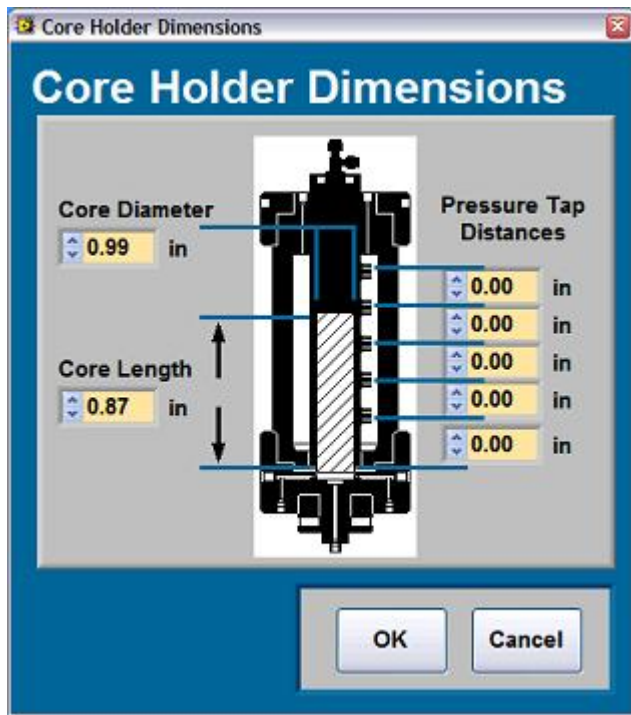
Elapsed Log Time: This indicator displays the amount of time that has passed since data logging was started. This indicator will flash red when a data point is saved.

Plot Toolbar: The Plot Toolbar provides flexibility in manipulating the displayed contents of the plot.

	Enable X-Axis Tracking - Causes the X-Axis to automatically adjust its scale.
	Disable X-Axis Tracking - Causes the X-Axis to stop automatically adjusting its scale.
	Manual Axis Scaling - Pressing this button displays the Manual Axis Scaling Screen.
	Undo - Restores the plot settings, ignoring the last action. A drop-down menu allows multiple undo operations with a single mouse click.
	Redo - Restores the plot settings, ignoring the last undo action. A drop-down menu allows multiple redo operations with a single mouse click.
	Save as Default Setting - Saves the current plot configuration to the instrument file.
	Scroll (Axes) - Selecting this button allows scrolling of the X and Y axes by clicking and dragging the desired axis scale.
	Zoom (Axes) - Selecting this button allows zooming of the X and Y axes by clicking and dragging the desired axis scale.
	Zoom In - Zooms in toward the center of the chart.
	Zoom Out - Zooms out from the center of the chart.
	Zoom Box - Zooms in on the chart around a window that is drawn by clicking and dragging.
	Cursor - Displays or hides the data cursor. Note: Selecting a data cursor effectively disables X-Axis Tracking. To re-enable X-Axis Tracking, press the Enable X-Axis Tracking button.
	Copy to Clipboard - Copies the displayed chart contents to the windows clipboard for pasting into other applications as a bitmap image.
	Save as Image - Allows the displayed chart contents to be saved to a

	bitmap (.bmp), JPEG (.jpg) or enhanced metafile (.emf) file.
	Print - Automatically rescales and prints the displayed chart contents on the default printer.
	Show/Hide Y-Axis Titles - Allows the user to hide Y-Axis titles to reserve more screen space for plot data.
	Show/Hide Legend - Allows the user to hide the legend to reserve more screen space for plot data.
	Show/Hide Y Values in Legend - Allows the user to display or hide current Y Values for each visible plot in the legend (if visible).
	Clear Plot - Allows the user to clear the contents of the plot.

Core Dimensions



The Core Holder Dimensions window allows the user to specify the length and diameter of the core sample and the Pressure Tap spacing.

Note: The values entered do not take effect until the OK button is clicked. Changed values are discarded if the Cancel button is clicked. Clicking either the OK or Cancel buttons will close the window.

Note: Pressure tap dimensions show only when option is installed.

Generating Reports Using Microsoft Excel

When logging data, the 6100 software will write data to a column formatted *.csv file, which can be opened and edited by Microsoft Excel.

Adding Serial Ports to the PC

The Model 6100-PC comes equipped with a USB serial hub for communication with the various instruments of the Model 6100. If additional serial ports are installed, the existing serial ports may be re-assigned. Use the Communication window to set the appropriate serial port.

Note: PumpWorks can only be connected to COM1 through COM8

Section 3 - Maintenance Schedule

Calibration Procedures

Periodically calibrate all components as recommended by the manufacturers (refer to the Component Instructions section of this manual).

Sensor Calibration

The Model 6100 is shipped with all sensors pre-calibrated. This section of the manual describes the procedures for re-calibration, should it become necessary. All parameters for sensor calibration are available from the “Sensor Calibration” screen (shown below as Figure 29). Note: calibration screen shows only installed options.

Figure 29: Sensor Calibration Screen

The screenshot displays the "Calibration" window with tabs for "Permeameter", "Pressure Taps", and "Slurry Cart". The "Pressure Taps" tab is active, showing five sections for "Pressure Tap 1" through "Pressure Tap 5". Each section contains input fields for "Span (psi)" and "Zero (psi)", both set to "0.00", and "Sample" buttons. To the right of each section is a calculation row with the following components: "Raw Value (cts)" (0.000000), "Slope (psi/cnt)" (1.000000), "Intercept (psi)" (0.000000), "Offset (psi)" (0.000000), and "Scaled Value (psi)" (0.00). The calculation is represented as: $0.000000 \times 1.000000 + 0.000000 + 0.000000 = 0.00$. At the bottom right are "OK", "Cancel", and "Apply" buttons.

Calibration Basics

The software calibration procedure for each sensor is based on a linear mapping function. The raw voltage signal from each sensor is applied to the following formula to obtain a process value: $PROCESS_VALUE = (RAW_INPUT * GAIN) + OFFSET$.

In the above formula, GAIN and OFFSET are automatically obtained by sampling two different values from the sensor in question, using the “Zero” and “Span” buttons. However, GAIN and OFFSET may also be entered directly, which can be useful in calibrating sensors with known characteristics.

Note: These methods of calibration are only valid for sensors with a linear relationship between voltage and the quantity to be measured.

Calibrating the Pressure Sensors

The procedure for calibrating each 0-6000 PSI pressure transducer is as follows:

1. Remove pressure from the sensor.
2. Press the “Zero” button on the Sensor Calibration screen.
3. Apply up to 6000 PSI to the sensor using a precision pressure source (dead weight).
4. Enter the exact amount of pressure applied to the sensor in the “Span Value” box on the Sensor Calibration screen.
5. Press the “Span” button on the Sensor Calibration screen.

Slurry Pump Pressure Calibration

The procedure for calibrating the slurry cart pressure transducer is as follows:

1. Connect the slurry cart umbilical cable.
2. Remove pressure from the sensor.
3. Press the “Zero” button on the Sensor Calibration screen.
4. Apply up to 2000 PSI to the sensor using a precision pressure source (dead weight).
5. Enter the exact amount of pressure applied to the sensor in the “Span Value” box on the Sensor Calibration screen.
6. Press the “Span” button on the Sensor Calibration screen.

Slurry Pump Rate Calibration

The procedure for calibrating the slurry pump is as follows:

1. Connect the slurry cart umbilical cable.
2. Turn the pump speed knob fully counterclockwise.
3. Place the pump control switches in the “RUN” and “FORWARD” positions, respectively.
4. Press the “Zero” button on the Sensor Calibration screen.
5. Begin pumping water at full speed (approximately 90 RPM).
6. Measure the pump rate in liters per minute, and enter the rate in the “Span Value” box on the Sensor Calibration screen.
7. Press the “Span” button on the Sensor Calibration screen.

Eurotherm 2216e Temperature Controller Calibration

Calibration of the temperature control modules is covered in the Eurotherm 2216e manual. No user-selectable parameters are available via the Model 6100 control software.

Replacing O-rings and Core holder Sleeve in the Cell

Note: Each o-ring that is replaced should be lubricated. The o-rings in the core holder should be replaced when suspect. The o-rings may need to be replaced more frequently if the tests being run are in a particularly harsh environment. There are a total of 6 o-rings in the core holder.

1. Before changing the o-rings, the confining pressure oil must be drained from the core holder.
2. Remove the plumbing lines from the top and bottom of the core holder.
3. Remove the pressure and confining oil lines from the core holder.
4. Insert the drain tube into the confining oil line.
5. Blow air into the cell through the thermocouple line.
6. Slowly blow the oil out of the cell.
7. Remove the optional pressure tap lines.
8. Pivot the core holder in order to access the bottom.
9. Remove the adjustable end plug from the top of the core holder. (This may already be out if it was left out when removing core.)
10. Remove the top cap of the core holder.
11. Carefully push the sleeve out of the core holder from the bottom to the top, pushing against the flow geometry insert.
12. Remove the sleeve adapter from the top core holder insert.
13. If the sleeve does not need to be changed, it may remain attached to the sleeve adapter. If a new rubber sleeve is needed, remove the sleeve from its adapter using the spanner tools provided.
14. Assemble sleeve to adapter as shown in fig 30.

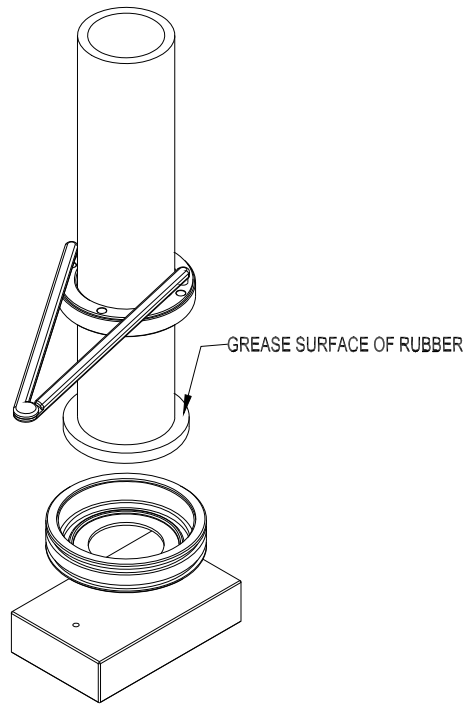


Figure 30: Sleeve to Adapter Assembly

15. Place the aluminum sleeve spacer over the core holder sleeve.
16. Install and lubricate o-rings.
17. Insert sleeve assembly into top cap assembly
18. Slide sleeve and cap assembly into coreholder housing. Inserting a finger into the lower end of coreholder may aid alignment of the adapter.
19. Tighten top collar (hand tight only).. Be sure sleeve adapter is fully seated against shoulder in lower cap.
- 20 After sleeve replacement, the confining oil will need to be replenished in the coreholder. Be sure oil reservoir is full. Also, be sure spacers are properly inserted into sleeve and both end plugs are secure. Loosen the vent plug at top of coreholder and begin pumping confining oil. This will take several minutes to fill the large volume in the coreholder. Check the oil reservoir sight glass to monitor progress and be sure reservoir does not run dry. When air is purged and oil emerges from vent plug, stop pump and tighten the vent plug.
21. Apply confining pressure to test integrity of seals.
22. Coreholder is now ready to use.

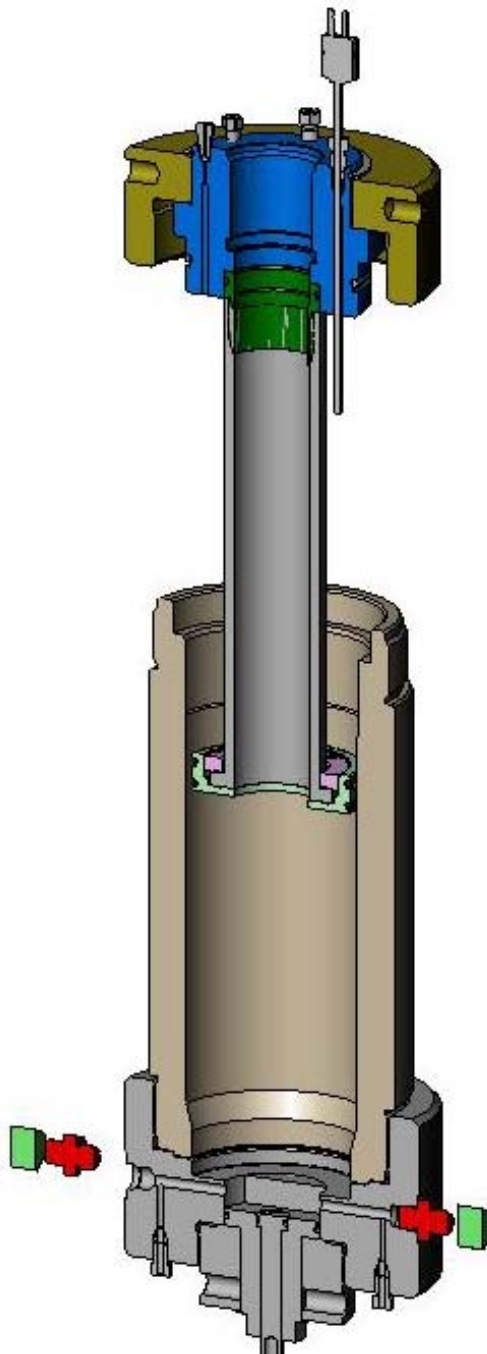


Figure 31: Core Holder Assembly, Steps 15-19

Valve Replacement / Repair

To replace a valve, perform the following steps:

1. Press down on the orange ring and remove the tubing from the valve.
2. Using the thin wrench provided with the Model 6100, remove the valve.
3. If the valve is leaking, the two o-rings and two backup o-rings on the exterior of the valve can be replaced.
4. Replace the valve using the thin wrench and re-attach the tubing.

Maintenance Schedule

The maintenance schedule will vary with each component. Again refer to Component Instructions section of this manual.

MAINTENANCE SCHEDULE Model 6100 Formation Response Tester					
COMPONENT	EACH TEST	MONTHLY	3 MONTHS	6 MONTHS	ANNUAL
Transducers					Calibrate annually
Filters					Check, replace when dirty or if flow is hindered
Pressure Relief Valves					Check annually
This maintenance schedule applies to normal usage of one test per day. Detailed procedures for these operations are contained in your manual. ● Per API Specifications σ Where Applicable					

Section 4 - Troubleshooting Guide

Potential Problems and Solutions

Problem	Solution
Poor Water Supply	Check filters to be sure they are not plugged. Check water supply to be sure it is in the “ON” position.
Valves Not Opening / Shutting	Check to see that sufficient air pressure exists – at least 80 PSI. Check the valve itself to insure that it is functioning. Check that the software is properly communicating with the FRT and the correct flow path is selected. If the above problems are eliminated, the PLC card in the box or the solenoid could be faulty.
Leaks	If the leak exists by the valves, the o-rings in the valves should be changed.
Confining Pressure Bleeding Off	Core holder Sleeve may be ruptured or optional pressure taps may be leaking.
Fluids Not Pumping	Check to insure that all lines are primed. Check inlet filters on fluids to be pumped. Check valves may be fouled. Check the pump for any problems. Check connections from the pump to the USB hub.
No Power	Check, and replace if necessary, the two main fuses in the control box (see electrical schematic).
Communication Lost to Computer	Check all cables to insure that they are properly connected. Check power to the FRT. Check the two fuses in the power supply.
Heaters Not Functioning	Check the alarm boards inside the control box. If a green and red light are both blinking, power down the unit and restart to re-set the boards. Check all thermocouple connections. Check thermocouple wiring.
No Back Pressure	Check to see that nitrogen is on.
Back Pressure fluctuating or Irregular	The diaphragm in the backpressure regulator may be fouled – clean or replace.

Section 5 – Replacement Parts

FRT Parts

Refer to drawings in *Section 6 – Drawings and Schematics*

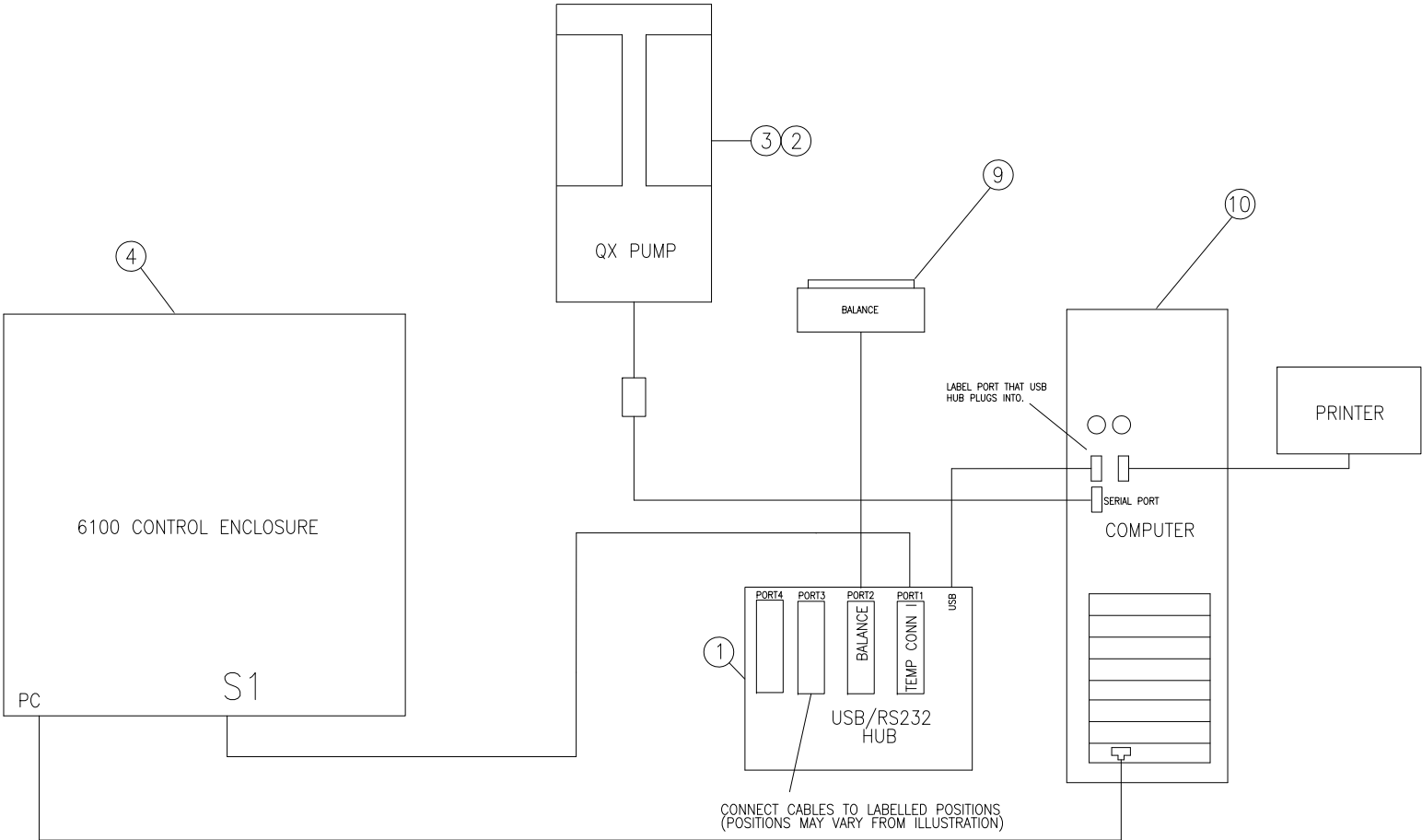
Slurry Cart Parts

Refer to drawings in *Section 6 – Drawings and Schematics*

Section 6 – Drawings and Schematics

Drawing Number	Description
CP6100-6-XX	6100-FRT SYSTEM SCHEMATIC
6100-0021-XX	Piping Schematic
6100-0030	Electrical Schematic
6100-2182-XX	Ass'y, Piston Accumulator
6100-2280-XX	Ass'y, Back Pressure Regulator
6100-2361	Ass'y Coreholder Vessel
6100-2379-XX	Kit, 1" Sleeve Adapter
6100-2381-XX	Kit, 1.5" Sleeve Adapter

REVISIONS					
ZONE	REV	DESCRIPTION OF REVISION	DATE	APPROVALS	
	1	ISSUED	04/18/08	PNN	DBL
	2	PUMP CALLED OUT AS REF.	8/8/08	DBL	PNN
	3	CORRECTED CABLE CONNECTIONS	12/30/08	PNN	PNN
	4	REMOVE ITEM 2	5/4/09	PNN	PNN
	5	ADD ITEM 12	7/14/09	DBL	JF



6100-2554	6100-2554	1	KIT,SC SERVICE PLUMBING		12
6100-ACCESS	6100-ACCESS	1	ACCESSORY KIT		11
6100-1205	6100-1205	1	COMPUTER SYSTEM		10
C11865	C11865	1	BALANCE, A&D GX2000		9
6100-0031	6100-0031	1	CABLING DIAGRAM, 6100 FRT		8
6100-2026	6100-2182-HC	1	ACCUMULATOR, 1000CC		7
6100-2361-SS	6100-2361-HC	1	COREHOLDER, FLUSH-FACE, 6"		6
6100-0021-SS	6100-0021-HC	1	PLUMBING SCHEMATIC, 6100 FRT		5
6100-1100	6100-1100	1	BASE UNIT, 6100 FRT		4
QX6000HC-1-0-A-H-0	QX6000HC-1-0-A-H-0	REF	QUIZIX PUMP, 6000PSI, WASH		3
					2
C09614	C09614	1	USB SERIAL HUB		1
-SS	-HC	QTY	DESCRIPTION	MATERIAL SPEC.	ITEM

PART NUMBER		PARTS LIST							
		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		CHANDLER ENGINEERING					
		TOLERANCES:							
		1 PLACE +0.030 [.76]							
		2 PLACE +0.010 [.25]							
		3 PLACE +0.005 [.127]							
NEXT ASSY	USED ON	ANGLES ±1/2" 63/		TITLE 6100 FRT W/ 6" COREHOLDER					
APPLICATION		SURF. FINISH							
BREAK SHARP EDGES, DEBURR		APPROVALS							
		DATE							
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				CHECKED: DBL	04/18/08	C		CP6100-6-XX	5
				ENGR.: DBL	04/18/08	SCALE: 1 = 1	TITLE BLOCK REV: 1.0	SHEET: 1 of 1	
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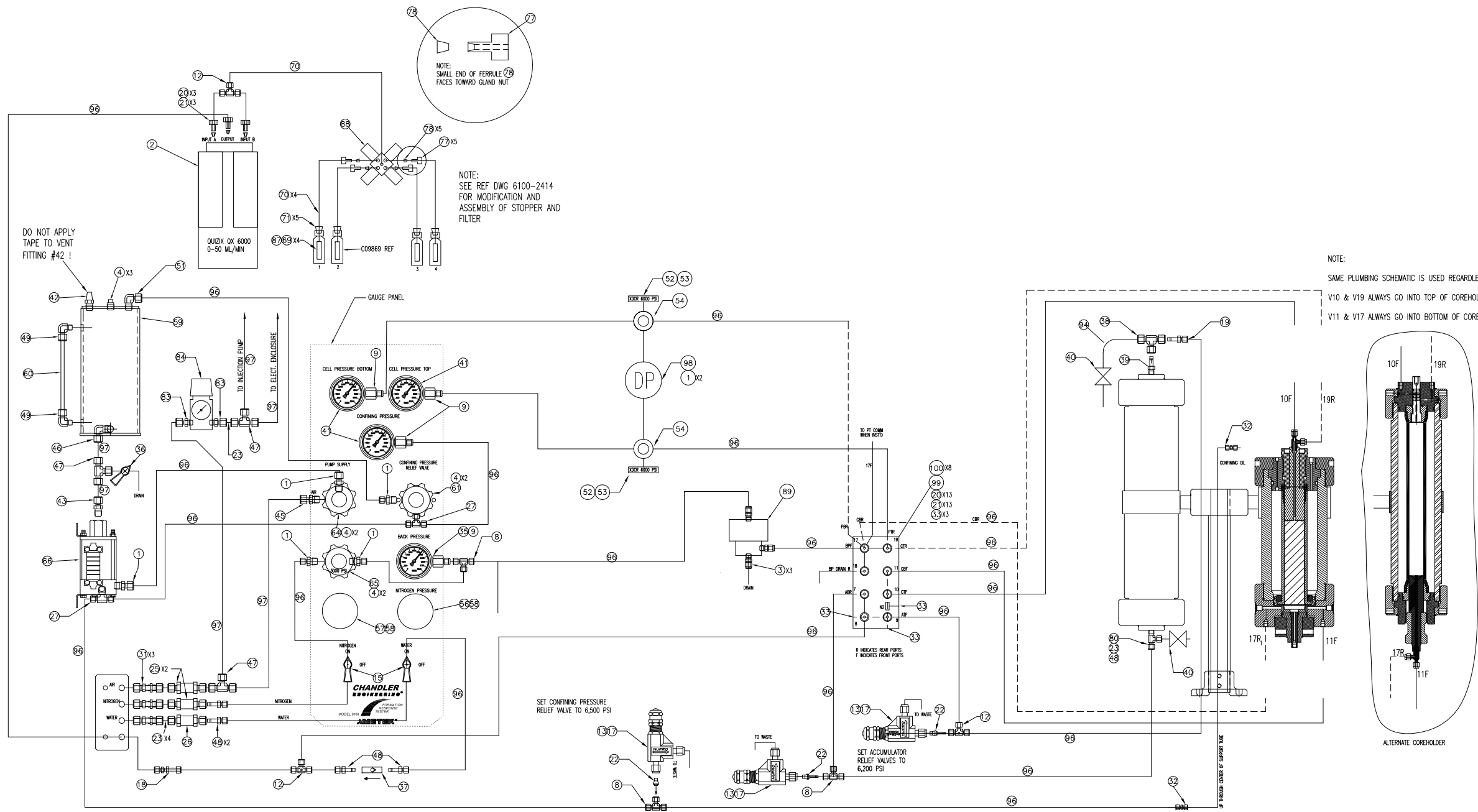
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12	11	10	9	8	7	6	5	4	3	2	1
H											H
G											G
F											F
E											E
D											D
C											C
B											B
A											A
12	11	10	9	8	7	6	5	4	3	2	1

A		REVISIONS		
ZONE	REV	DESCRIPTION	DATE	APPROVED
	1	ISSUED	8/31/07	PNN
	2	ITEM 88 WAS 6100-3145	11/05/07	PNN
	3	ADDED ITEM 2,56-58,REMOVED ITEM 68	1/7/08	PNN
	4	REDRAWN FOR CLARITY	3/10/08	PNN
	5	REVERT TO HISTORIC VLV ASSN, ADD DP XMTR	6/12/08	PNN
	6	REVISE QTY; ITEMS 33 & 54	8/11/08	DBL
	7	ITEM 2, USE HC PUMP ON SS UNITS	12/8/08	DBL
	8	ADD ASSY NOTES AND REF DWGS	3/26/09	DBL

ITEM	-SS	-HC	DESCRIPTION	QTY	ITEM	-SS	-HC	DESCRIPTION	QTY	Item	PN
1	187-20403	187-20403	CONN ,SS,1/4MPX1/8T,SW	7	51	188-08984	188-08984	ELB,SS,1/8T X 1/8MP	1		
2	QX6000HC-1-0-A-H-0	QX6000HC-1-0-A-H-0	QUIZX PUMP,6000PSI,0-50ML/MIN,WASH,	1	52	C11539	C11539	TRANSDUCER,6000 PSIG,ROSEMOUNT	2		
3	188-13044	188-13044	CONN ,SS,1/8MPX1/8T,SW	3	53	C11629	C11629	ADAPTER,HC,1/2MPT,1/8T,VALCO	2		
4	188-13190	188-13190	PLUG ,SS,1/4MP,SQ HD	9	54	C11628	C11628	CROSS,HC,VALCO,1/8T,ZX2L-HC	2		
5	6100-2414	6100-2414	MOD SAMPLE BOTTLE	REF	55						
6					56	6100-2422	6100-2422	PLUG,GUAGE PANEL,PRESS,DELRIN	1		
7					57	6100-2423	6100-2423	PLUG,GUAGE PANEL,REG,DELRIN	1		
8	70607-85	70607-85	TEE,1/8TX1/8TX1/8T,XX-200-3	3	58	6100-2424	6100-2424	NUT,RETAINER,GUAGE PANEL PLUG	2		
9	C08517	C08517	CONN ,SS,1/4FPX1/8T,SW,SS-200-7-4	4	59	7750-0019	7750-0019	TANK	1		
10					60	C07435	C07435	LEXAN,TBG,0.375ODx0.250ID	0.6		
11					61	C09215	C09215	RGLTR,BP,50-6KSI,TESCOM	1		
12	70607-85	C09429	TEE,1/8TX1/8TX1/8T,XX-200-3	3	62						
13	C09434	C09434	V,PRESSURE RELIEF	3	63						
14					64	C09546	C09546	500 PSI REG	1		
15	C09473	C09473	V,BALL,2-WAY,WHITEY,SS-41S2	2	65	C09548	C09548	RGLTR,PRESSURE,0-6000 PSI	1		
16					66	P-3263	P-3263	PUMP	1		
17	C09545	C09545	SPRING,REGULATOR,5000-6000 PSI	3	67						
18	188-13042	C09627	UN,BH,1/8,XX-200-61	1	68						
19	P-1944	C09628	RDCR,1/8,XX-200-R-4	1	69	C09723	C09723	FILTER 20 MICRON, PUMP INLET	4		
20	C09640	C09640	NUT,SST,1/8T,VA	20	70	187-20522	187-20522	TEFLON,TBG,0.125ODx0.030W	20		
21	C09643	C09643	FER,HSTLY,1/8,VA	20	71	C12006	C12006	STOPPER,FISCHER CAT. NO. 14-140B	5		
22	C09703	C09703	CONN,REDUCING PORT,1/4 x 1/8	3	72						
23	C09704	C09704	1/4 PORT CONN,SS-401-PC	6	73						
24					74						
25	C09707	C09707	FLTR, 2 MICRON,INLINE,1/4T,SST,SS-4F-2	2	75						
26	C09708	C09708	FLTR,15 MICRON,INLINE,1/4T,SST,SS-4F2	1	76						
27	C09710	C09710	TEE,SST,MALE BRANCH,SS-200-3-4-TTM	2	77	C10460	C10460	PEEK GLAND NUT, 1/4-28X 1/8T	5		
28					78	C10461	C10461	1/8 PEEK FERRULE	5		
29					79						
30					80	C09328	C09328	TEE,SS,1/4SWX1/4SWX1/8MP	1		
31	C03321	C03321	UN,BLKHD,1/4 SS-400-61	3	81						
32	70601-55	70601-55	UN ,SS,1/8TX1/8T,SW	2	82						
33	C10309	C10309	VALCO PLUG,1/8	4	83	P-1486	P-1486	CONN,SS,1/4T X 1/8MP,SW	2		
34					84	C09524	C09524	FLTR REG, W/GAUGE AND BRKT	1		
35	C10333	C10333	GAUGE 3K	1	85						
36	C10399	C10399	V,PLUG,1/4SW,SS-4P4T	1	86						
37	C10550	C10550	CV 10K HC	1	87	C09724	C09724	FILTER ELEMENT, 20 MICRON,FOR C09723	4 REF		
38	P-1942	C10553	TEE,1/4T,XX-400-3	1	88	6100-3164	6100-3164	ASSY, MIXER VALVE	1		
39	C10268	C10554	TBADPTR,1/8MPX1/4T,XX-4-TA-1-2	1	89	6100-2280-01	6100-2280-HC	ASSY, BP REGULATOR,QC	1		
40	C10555	C10555	V,SVR SERV,1/4SW,6KPSI,SS-NBS4	2	90						
41	C10562	C10562	GAUGE 6K	3	91						
42	ZC11681	ZC11681	PLUG,BRNZ BREATHER,3/8NPT	1	92						
43	P-1389	P-1389	CONN ,SS,3/8MPX1/4T,SW,SS-400-1-6	1	93						
44					94	R-0631	ZC11524	TUBING,0.250DX0.035	0.5		
45	P-1488	P-1488	CONN ,SS,1/4MPX1/4T,SW,SS-400-1-4	1	95						
46	P-1772	P-1772	ELB ,SS,1/4MPX1/4T,SW	1	96	70615-56	70615-56	HSTLY,TBG,0.125ODX0.020W,C276	80		
47	P-1942	P-1942	TEE ,SS,UN,1/4TX1/4TX1/4T,SW,SS-400-3	3	97	R-0631	R-0631	TUBING,SST,.250ODX.035W,316	10		
48	P-1944	P-1944	RDCR,SST,1/8Tx1/4OD SW,SS-200-R-4	5	98	C12481	C12481	XMTR, ROSEMOUNT DP +/-2000 PSI	1		
49	P-3561	P-3561	ELB ,BRS,CPRSN,1/4MPX3/8T	2	99	6100-2411-SS	6100-2411-HC	MANIFOLD, 8PORT, STD MAIN	1		
50					100	6990-0001-HT	6990-0001-HT	VALVE, HC-CARTRIDGE	8		

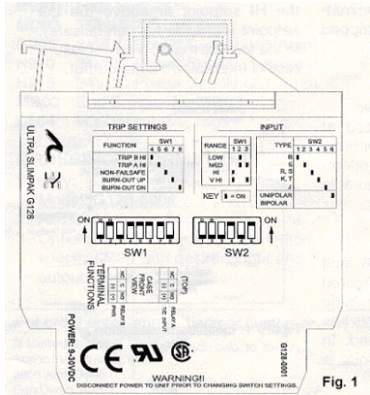
-04	-03	-02	-01	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
QTY. REQD.				PARTS LIST			
				UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		CHANDLER ENGINEERING	
				TOLERANCES:			
				1 PLACE ±0.030			
				2 PLACE ±0.010			
NEXT ASSY				USED ON	3 PLACE ±0.005		TITLE 6100 FRT PLUMBING SCHEMATIC (DETAIL)
					ANGLES ±1/2°		
					SURF. FINISH 63/		
APPLICATION				APPROVALS		DATE	
BREAK SHARP EDGES, DEBURR							
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Copyright by Chandler Engineering Company LLC							
DRAWN: <i>PM</i>		8/30/07		SIZE	S.O. NO.	DWG NO.	REV.
CHECKED: <i>JS</i>		8/31/07		D		6100-0021-XX	8
ENGR.: <i>PM</i>		8/30/07		SCALE:	NA	DO NOT SCALE DRAWING	SHEET: 1 of 2



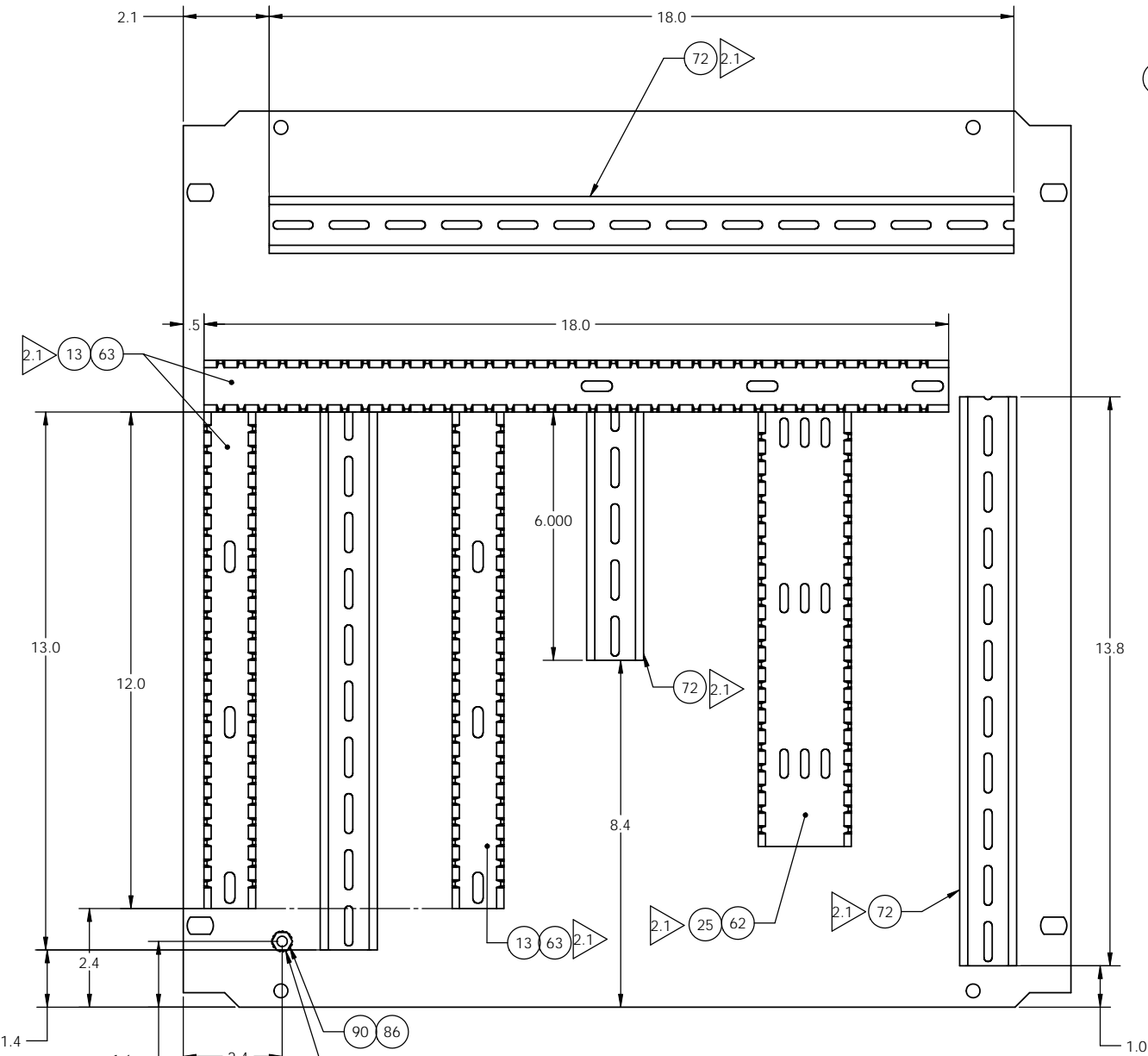
- NOTES:
1. DO NOT APPLY TEFLON TAPE TO FITTING #42.
 2. APPLY TEFLON TAPE AND ANTI-SEIZE LUBRICANT TO ALL OTHER NPT FITTINGS.
 3. APPLY ANTI-SEIZE LUBRICANT TO ALL VALCO GLAND NUTS #20
 4. FOLLOW FITTING MANUFACTURER'S RECOMMENDED ASSEMBLY PROCEDURES.

		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]		<div>CHANDLER ENGINEERING</div> <div>TITLE</div> <div>6100 FRT PLUMBING SCHEMATIC (DETAIL)</div>							
		TOLERANCES:									
		1 PLACE +0.030									
		2 PLACE +0.010									
		3 PLACE +0.005									
NEXT ASSY		USED ON									
APPLICATION		SURF. FINISH		63✓							
BREAK SHARP EDGES, DEBURR		APPROVALS		DATE							
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				CHECKED: <i>JS</i>		8/31/07					
				ENGR.: <i>PM</i>		8/30/07					
SCALE:		NA		DO NOT SCALE DRAWING		SHEET:		2 of 2			

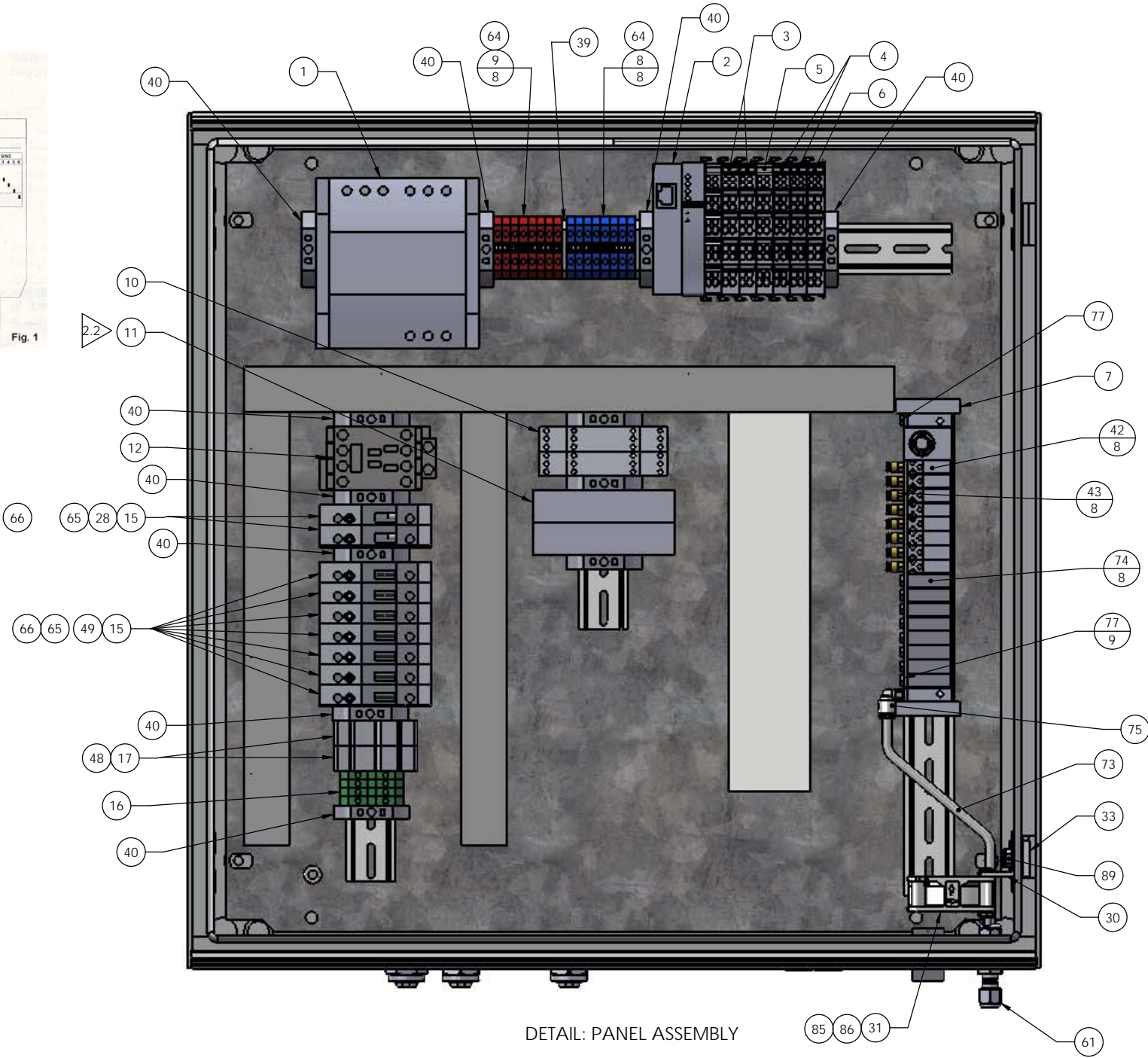
NOTES:
2.1 MATCH DRILL AND ATTACH ITEM 13 AND 73 USING #8-32 SCRES AND NUTS
2.2 CONFIGURE ITEM 10 AS SHOWN PRIOR TO INSTALLATION



DETAIL: ITEM 10



DETAIL: PANEL LAYOUT



DETAIL: PANEL ASSEMBLY

										1							
-04	-03	-02	-01	PART NUMBER		DESCRIPTION			MATERIAL SPEC.		ITEM						
QTY. REQD.				PARTS LIST													
<div>CP105</div>				<div>UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES</div> <div>TOLERANCES: 1 PLACE ±0.030 2 PLACE ±0.010 3 PLACE ±0.005 ANGLES ±1/2° SURF. FINISH</div>		<div>CHANDLER ENGINEERING</div>											
NEXT ASSY		USED ON				TITLE		ELECTRICAL ASSEMBLY, 6100									
APPLICATION																	
BREAK SHARP EDGES, DEBURR				APPROVALS		DATE											
<div>AND THE DRAWINGS AND TECHNICAL DATA CONTAINED HEREIN ARE THE PROPERTY OF CHANDLER ENGINEERING COMPANY, LLC OR DISSEMINATION IN ANY FORM EXCEPT AS EXPRESSLY AUTHORIZED BY CHANDLER ENGINEERING COMPANY, LLC. THE OWNER IS FORBIDDEN THE HOLDER AGREES TO RETURN THIS DRAWING TO THE OWNER ON DEMAND. COPYRIGHT BY CHANDLER ENGINEERING COMPANY, LLC</div>						DRAWN: PN		03/24/09		SIZE		DWG NO.		REV.			
						CHECKED: TC		4/9/09		D		6100-0030		-1.10			
						ENGR.: PN		03/24/09		SCALE: 1:4		TITLE BLOCK REV: 2.0				SHEET: 2 of 5	

1

3.2 PROVIDE SERVICE LOOP FOR WIRES ROUTED TO DOOR PANEL



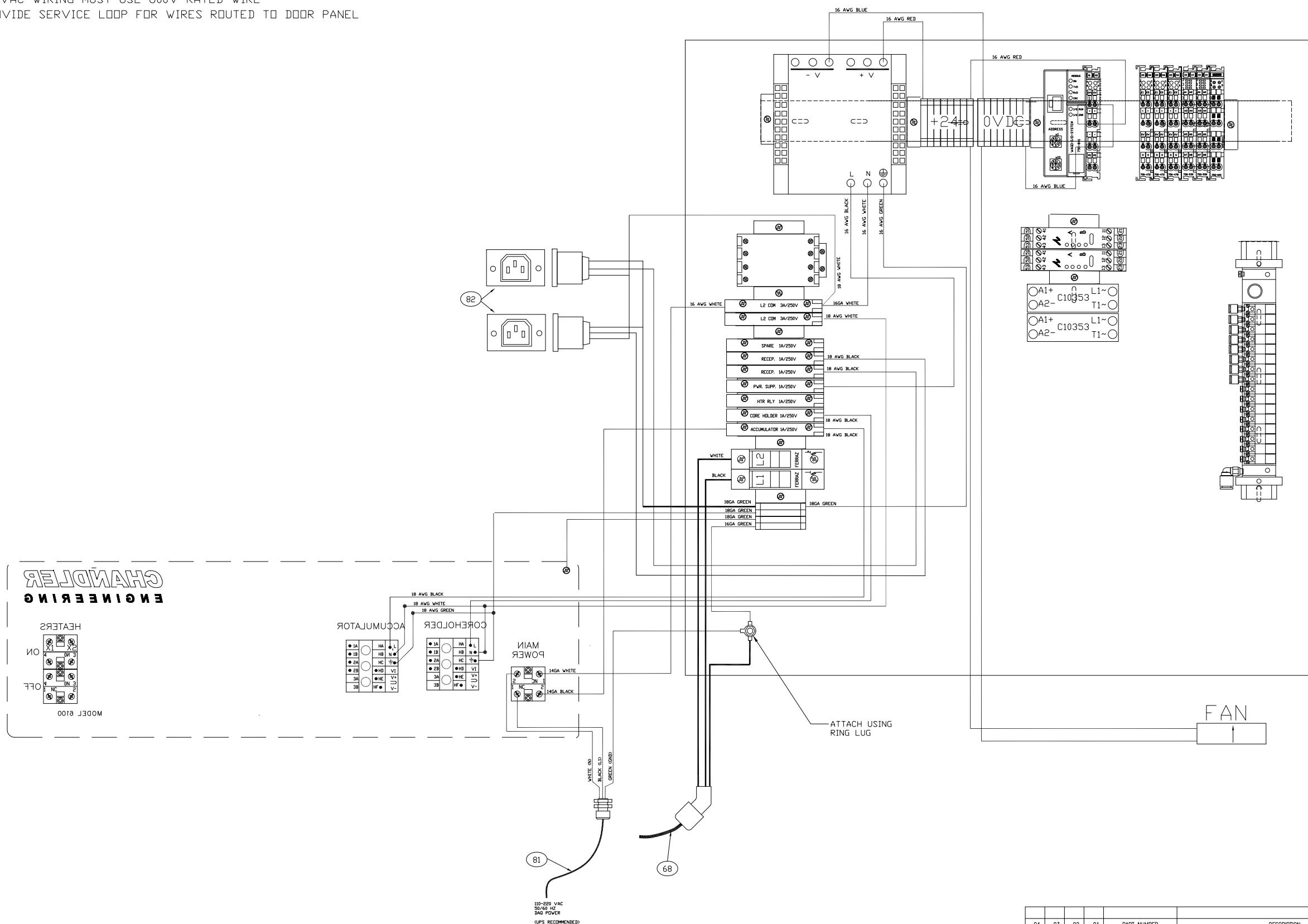
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QTY. REQD.				PARTS LIST							
NEXT ASSY				UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (mm) TOLERANCES: 1 PLACE +0.030 2 PLACE +0.010 3 PLACE +0.005 ANGLES 1/2" SURF. FINISH 63/				CHANDLER ENGINEERING ELECTRICAL ENCLOSURE HP FRT			
USED ON				TITLE							
APPLICATION											
BREAK SHARP EDGES, DEBURR											
APPROVALS				DATE							
DRAWN: PM				3/24/09							
CHECKED: JC				4/09/09							
ENGR: PM				3/24/09							
SCALE: 1 = 1				DO NOT SCALE DRAWING SHEET: 3 of 5							

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4.1 220VAC WIRING MUST USE 600V RATED WIRE

4.2 PROVIDE SERVICE LOOP FOR WIRES ROUTED TO DOOR PANEL



DETAIL SUPPLY POWER WIRING

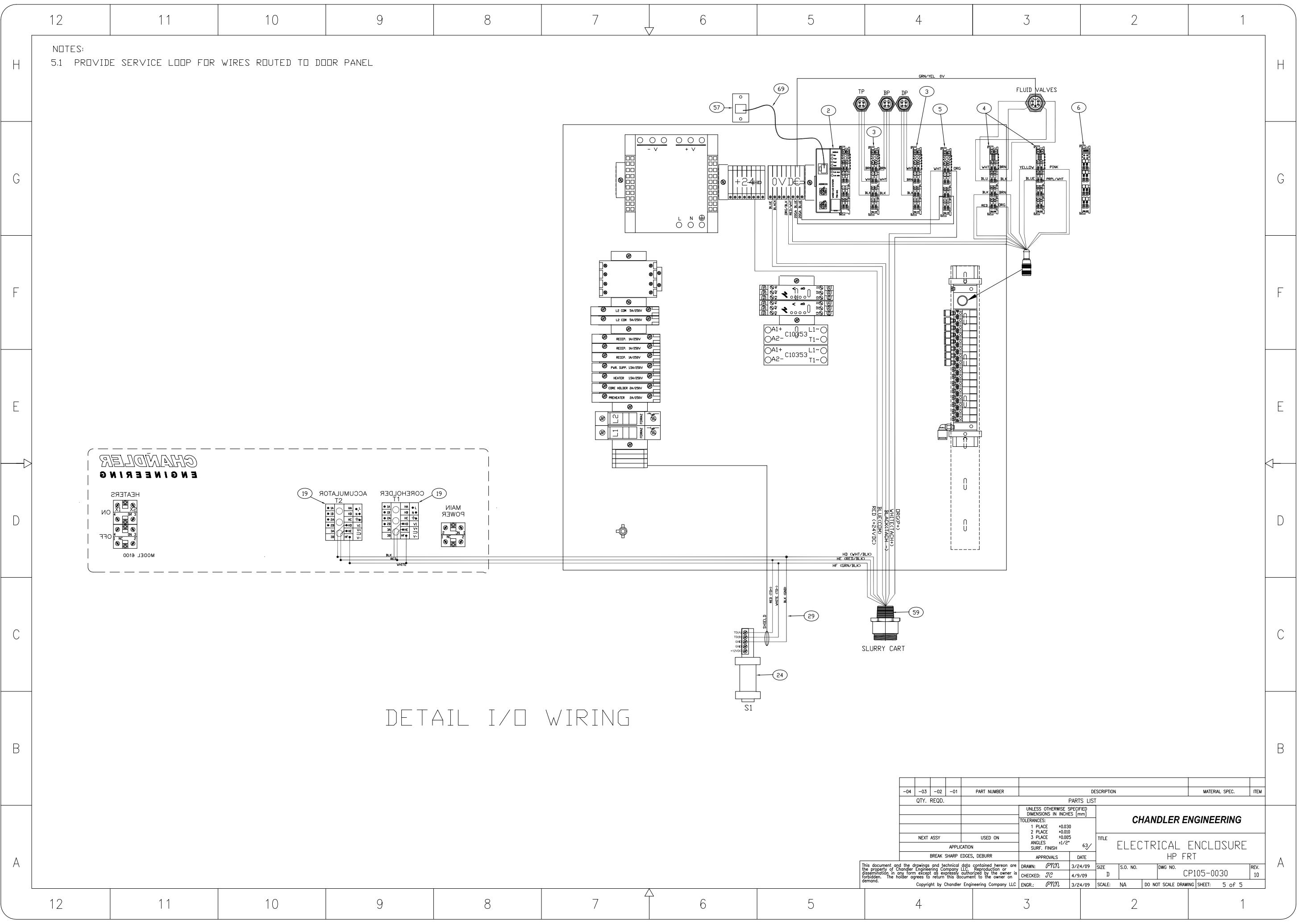
-04	-03	-02	-01	PART NUMBER	DESCRIPTION			MATERIAL SPEC.	ITEM
QTY. REQD.				PARTS LIST					
NEXT ASSY				UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]			CHANDLER ENGINEERING		
									TOLERANCES:
APPLICATION				63/		ELECTRICAL ENCLOSURE HP RT			
BREAK SHARP EDGES, DEBURR				APPROVALS					DATE
DRAWN: <i>PTM</i>				3/24/09		SIZE	S.O. NO.	DWG NO.	REV.
CHECKED: <i>JC</i>				4/9/09		D		CP105-0030	10
ENGR: <i>JC</i>				3/24/09		SCALE: 1 = 1	DO NOT SCALE DRAWING SHEET: 4 of 5		

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re	DRAWN: <i>PNN</i>
is	CHECKED: <i>IC</i>
	<i>0000</i>

DATE	TIME			
3/24/09	SIZE	S.O. NO.	DWG NO.	REV.
4/9/09	D		CP105-0030	10

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NOTES:
5.1 PROVIDE SERVICE LOOP FOR WIRES ROUTED TO DOOR PANEL

DETAIL I/O WIRING

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1. COMPLETE PRESSURE TEST PROCEDURE PRIOR TO FINAL ASSEMBLY
2. LUBRICATE O-RINGS WITH LITHIUM GREASE, PART P-3217, DURING ASSEMBLY
3. INVERT RETAINER FOR CCW ROTATION
4. INSTALL THERMOCOUPLE AND BEND UP TO 90° FOR WIRE ROUTING

SERVICE SPECIFICATIONS		
-01	-HC	
4000	6000 PSI	DESIGN PRESSURE
6000	9000 PSI	TEST PRESSURE
400	500 °F	MAX OPERATING TEMPERATURE
1362	1362 ML	VOLUME W/O PISTON
1000	1000 ML	VOLUME W/PISTON

1.1 ASSEMBLE PRESSURE TEST CONFIGURATION AS SHOWN
1.2 RECORD HEAT NUMBERS

6100-2186 HOUSING
6100-2024 TOP END PLUG
6100-2024 BOTTOM END PLUG
6100-2025 TOP THREADED COLLAR
6100-2025 BOTTOM THREADED COLLAR

1.4 FILL WITH WATER AND PRESSURE TEST AS FOLLOWS:

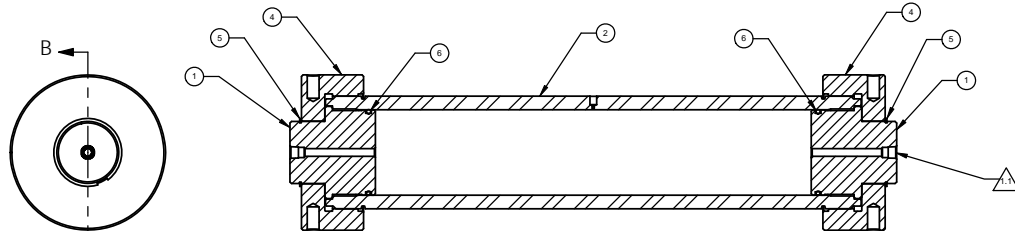
2000 PSI, 5 MINUTES
4000 PSI, 5 MINUTES
6000 PSI, 5 MINUTES
8000 PSI, 5 MINUTES
10,000 PSI, 10 MINUTES

1.5 DISASSEMBLE AND CLEAN. INSPECT O-RINGS FOR DAMAGE.

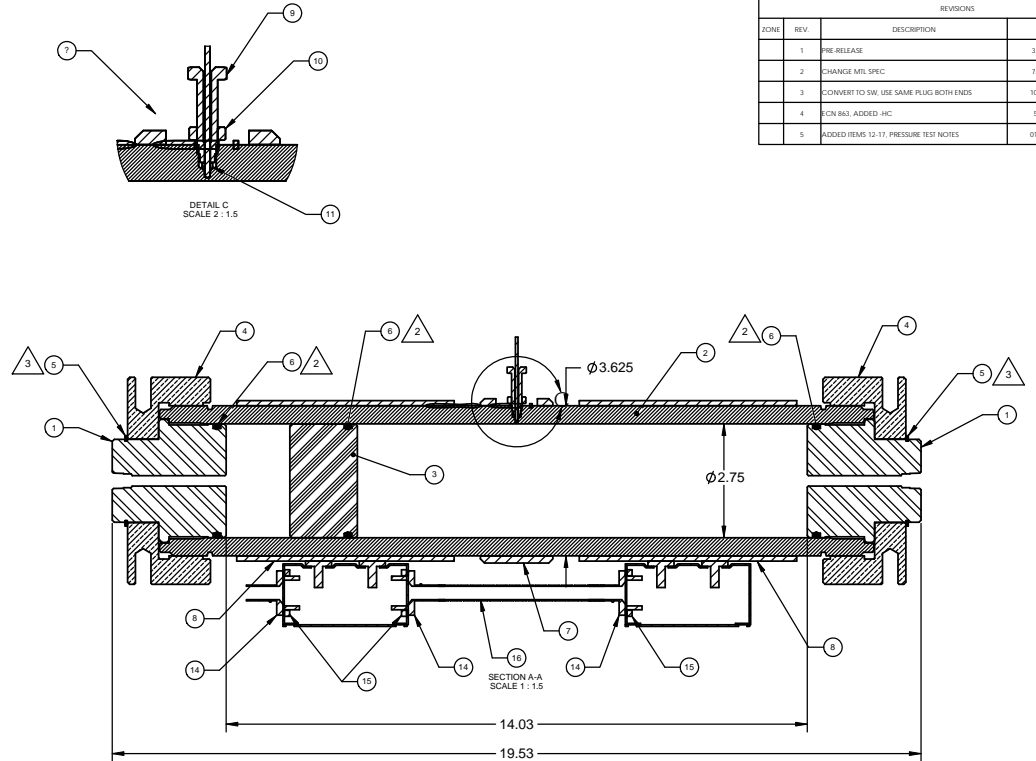
PASS_____ **FAIL**_____

TECHNICIAN

P.E. ENGINEER

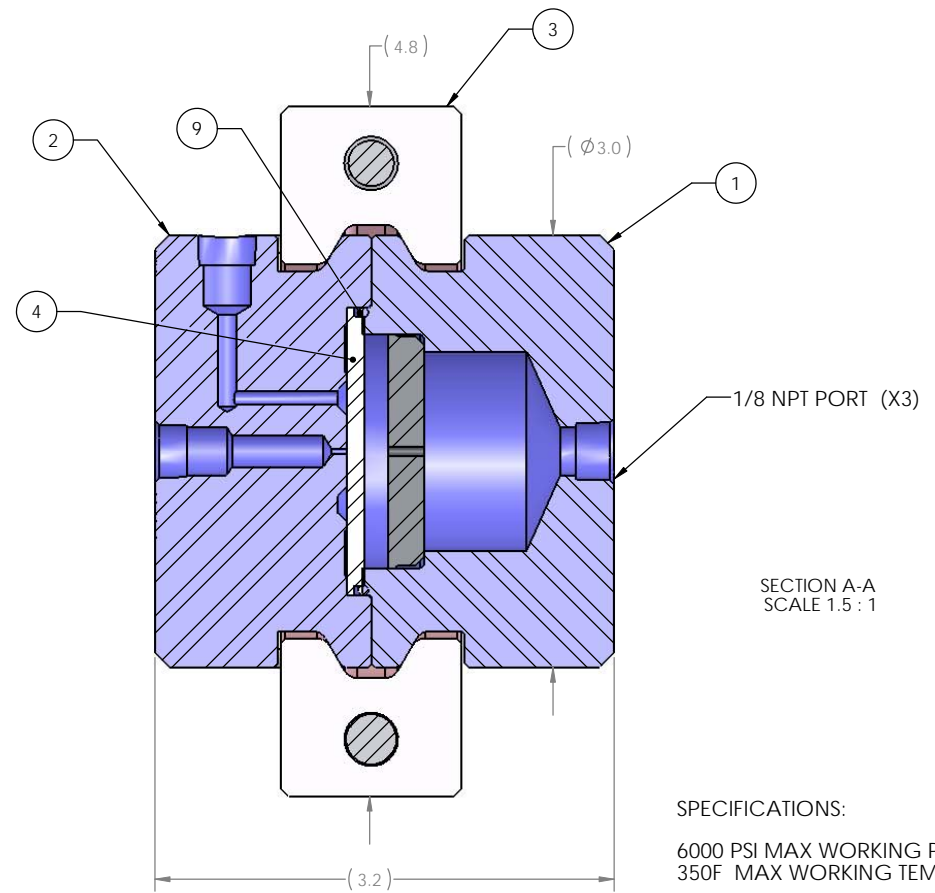
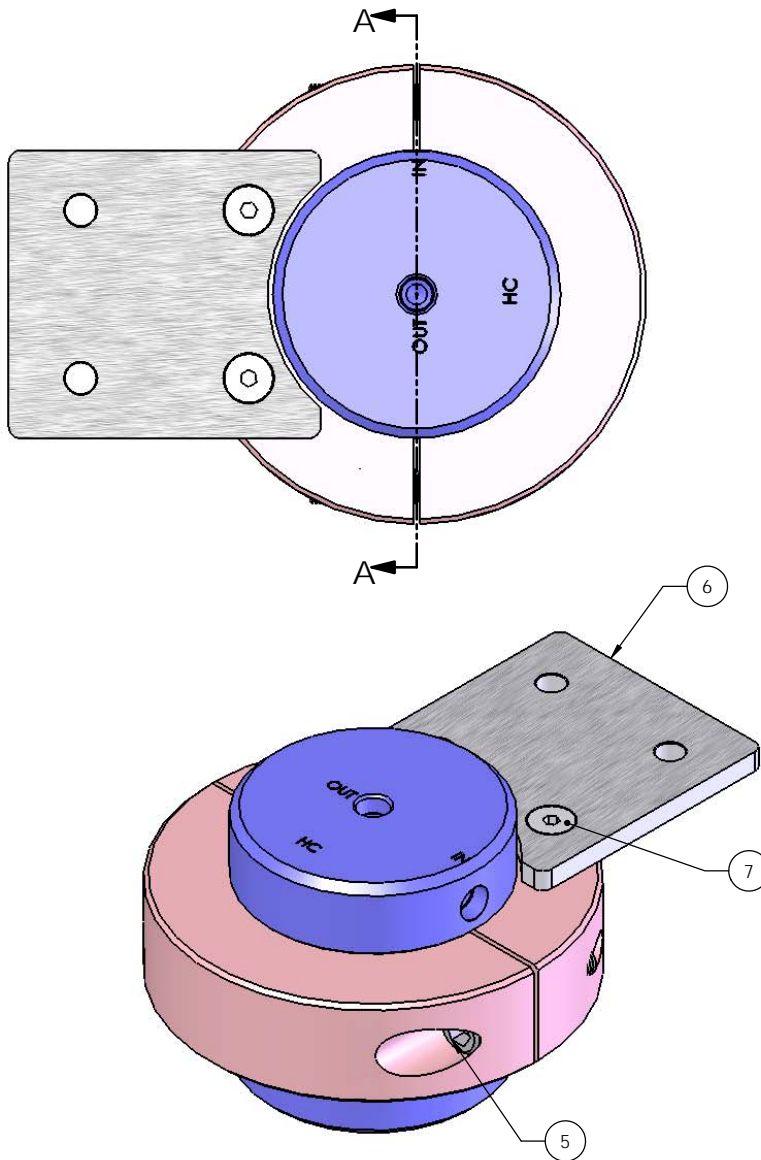


1 PRESSURE TEST CONFIGURATION



1	6100-2182-ACCESS	6100-2182-ACCESS	CONDUIT KIT, ACCUMULATOR	17
1		C11360	ACCUMUL FLEX,3/8,SS	16
3	C10967	C10967	NUT,CONDUIT,1/2"	15
3	6100-2389	6100-2389	MOD. FERRULE, 3/8 FLEX CONDUIT	14
1	C11005	C11005	TC,3.5" X 0.062",TYPE K	13
1	C10034		TC,TYPE-K,WASHER,UNGROUND	12
1	C08814	C08814	FERRULE, 1/16 HP	HC
1	H-25-002	H-25-002	NUT, SST, HK, 10-32	SS
1	6100-2219	6100-2219	GLAND, NUT, HP 1/16, LONG	18-SS
2	6100-2194	6100-2194	HEATER, 3.63ID X 5.25,750W	SS
1	6100-2188	6100-2188	WELDMENT PIVOT RING 3.63	316SS
3	C08565	C08565	ORING, VITON, AS-230-V75	VITON
2	C09699	C09699	RETAINER,EXT,SMALLEY WS200	302SS
2	6100-2025	6100-2025	COLLAR THREADED, 3.6625-8 ACME	C63000
1	6100-2023	6100-2023	PISTON, FLOATING, 2.75	PEEK
1	6100-2186-HC	6100-2186	HOUSING,ACCUMULATOR,1000CC	2
2	6100-2024-HC	6100-2024	PLUG, ACCUM, 2.75	1
QTY	-HC	-SS	DESCRIPTION	MATERIAL
				ITEM

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES		<h1>CHANDLER ENGINEERING</h1>			
TOLERANCES: 1 PLACE .0030 2 PLACE .0050 3 PLACE .0050 ANGLES 1/2° SURF. FIN.					
NEXT ASSY	USED ON	TITLE <h2>ACCUMULATOR, 1000CC</h2>			
APPLICATION		APPROVALS		DATE	
BREAK SHARP EDGES & DEBURR		DRWNG. DBL CHECKED: JF ENGR. DBL		SIZE D SIZE D SIZE D SCALE: 1:1	REV. 5 6100-2182-X SHEET: 1 of 1
PART AND ASSY DRAWINGS AND TECHNICAL DATA CONTAINED HEREIN ARE THE PROPERTY OF CHANDLER ENGINEERING CO. NO REPRODUCTION OR DISSEMINATION IN ANY FORM EXCEPT AS EXPRESSLY AUTHORIZED BY CHANDLER ENGINEERING CO. IS TO BE PERMITTED. THE COMPANY IS FOREWARNED THE HOLDER OF THIS DRAWING TO RETURN IT TO THE COMPANY ON DEMAND.					
COPYRIGHT © CHANDLER ENGINEERING COMPANY, LLC					



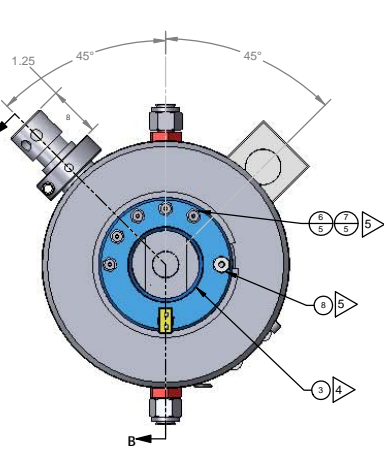
SPECIFICATIONS:
6000 PSI MAX WORKING PRESSURE
350F MAX WORKING TEMPERATURE

				1	1	C11190	ORING,VITON,AS032-V75	SEE PARTS DWG.	9				
				2	2	H-25-034	SCREW,SST,FHSC,1/4-20 X 3/4	SEE PARTS DWG.	8				
				1	1	6100-2334	BRACKET: BP REGULATOR MOUNTING	SEE PARTS DWG.	7				
				2	2	H-37-105	SOCKET HEAD CAP SCREW .375 X 1.5, XYLAN COATED	SEE PARTS DWG.	6				
				1	1	6100-2392	DIAPHRAM, TEFLON,NOTCHED FOR ORING	SEE PARTS DWG.	5				
				1	1	6100-2284	CLAMP, BACK PRESSURE REGULATOR	SEE PARTS DWG.	4				
				1		6100-2282-HC	SEAT, BACK PRESSURE REGULATOR	SEE PARTS DWG.	3				
					1	6100-2282-01	SEAT, BACK PRESSURE REGULATOR	SEE PARTS DWG.	2				
				1	1	6100-2281	DOME ASSY, BACK PRESSURE REGULATOR	SEE PARTS DWG.	1				
-04	-03	-HC	-01	PART NUMBER		DESCRIPTION			MATERIAL SPEC.	ITEM			
QTY. REQD.				PARTS LIST									
		.		.		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES TOLERANCES: 1 PLACE ±0.030 2 PLACE ±0.010 3 PLACE ±0.005 ANGLES ±1/2° SURF. FINISH 63							
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		.		.									
NEXT ASSY				USED ON		TITLE ASSY BACK PRESSURE REGULATOR							
APPLICATION						APPROVALS		DATE					
NT AND THE DRAWINGS AND TECHNICAL DATA CONTAINED THE PROPERTY OF CHANDLER ENGINEERING COMPANY, L.L.C. OR DISSEMINATION IN ANY FORM EXCEPT AS EXPRESSLY THE OWNER IS FORBIDDEN. THE HOLDER AGREES TO RETURN NT TO THE OWNER ON DEMAND.						DRAWN: DAB		09/15/06		SIZE	S.O. NO.	DWG NO.	REV.
						CHECKED: DBL		11/21/06		C		6100-2280-XX	3
						ENGR.: DBL		09/15/06					
						SCALE: 1:2				SHEET: 1 of 1			

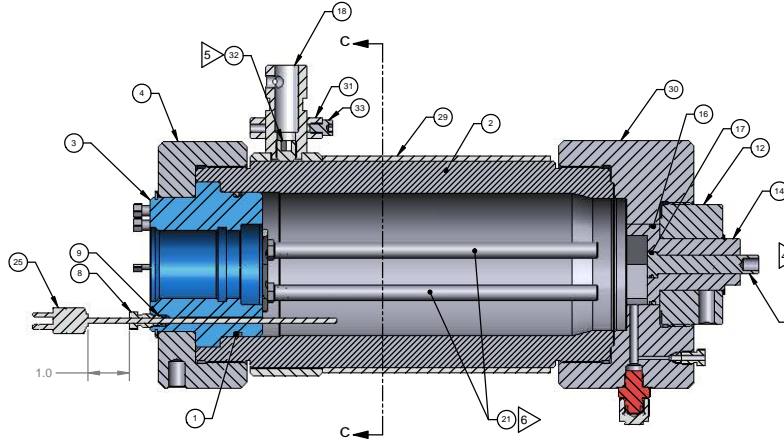
THIS DOCUMENT AND THE DRAWINGS AND TECHNICAL DATA CONTAINED HEREON ARE THE PROPERTY OF CHANDLER ENGINEERING COMPANY, L.L.C. REPRODUCTION OR DISSEMINATION IN ANY FORM EXCEPT AS EXPRESSLY AUTHORIZED BY THE OWNER IS FORBIDDEN. THE HOLDER AGREES TO RETURN THIS DOCUMENT TO THE OWNER ON DEMAND.

- NOTES:
1. ASSEMBLE TEST CONFIGURATION AS SHOWN AND COMPLETE PRESSURE TEST PRIOR TO FINAL ASSEMBLY.
 2. LUBRICATE O-RINGS DURING ASSEMBLY.
 3. RECORD HEAT NUMBERS AS INDICATED AND PLACE ALL MATERIAL CERTIFICATIONS IN SERIAL NO FILE.
 4. INVERT RETAINING RINGS DURING INSTALLATION.
 5. APPLY ANTI-SEIZE COMPOUND TO THREADS DURING INSTALLATION.
 6. APPLY MEDIUM STRENGTH THREADLOCKER (LOCTITE 222) TO THREADS.
 7. INSTALL 6100-2189 FROM 6100-2379 KIT OR 6100-2175 FROM 6100-2381. USE O-RINGS C09589.

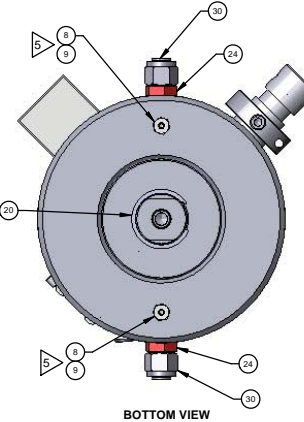
SPECIFICATIONS
MAX PRESSURE: 6000 PSI
MAX TEMPERATURE: 350 °F



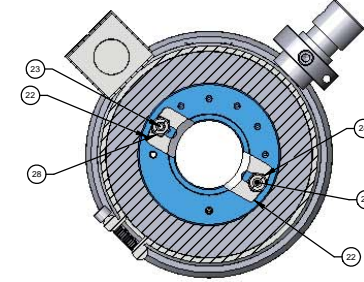
TOP VIEW



SECTION B-B
SCALE 1 : 1.5



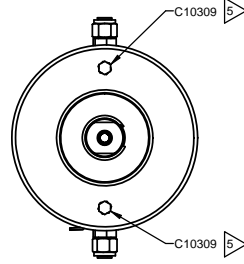
BOTTOM VIEW



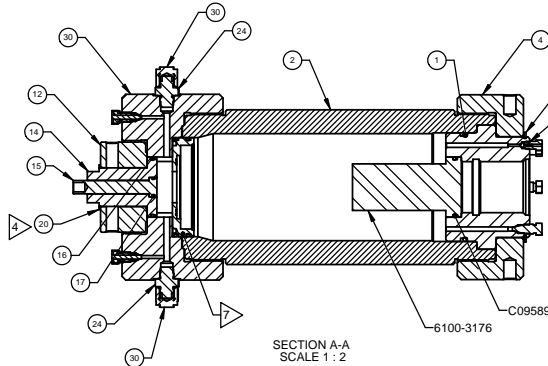
SECTION C-C
SCALE 1 : 1.5

RECORD HEAT NOS

6100-2048 _____
6100-2047 _____
6100-2046 _____
6100-2030 _____

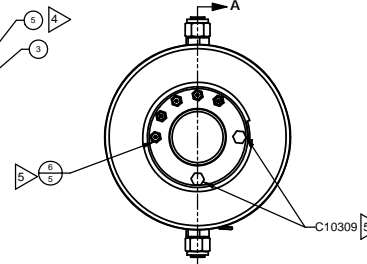


BOTTOM VIEW



SECTION A-A
SCALE 1 : 2

1 PRESSURE TEST CONFIGURATION



TOP VIEW

PRESSURE TEST PROCEDURE

1. ASSEMBLE TEST CONFIGURATION AS SHOWN
2. LUBRICATE O-RINGS DURING ASSEMBLY
3. PRESSURE TEST TO 9000 PSI. HOLD FOR 5 MIN
4. DISASSEMBLE AND CLEAN. VERIFY THREAD PERFORMANCE DURING DISASSEMBLY
5. INSPECT O-RINGS FOR DAMAGE.

PASS _____ FAIL _____

DATE: _____ TECHNICIAN: _____

ENGINEER: _____

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	1	ISSUED	2/6/07	DBL
	2	ECN 11116: ADD HIR, MOUNT AND FITTINGS	8/3/2007	DBL
	3	NEW PN FOR ITEM 24: REVISED NOTES	8/22/2008	DBL
	4	ADDED PRESSURE TEST CONFG. NOTES	10/12/09	PN
	5	ADDED ITEMS 31-33: ADDED VIEW C-C	10/22/09	PN

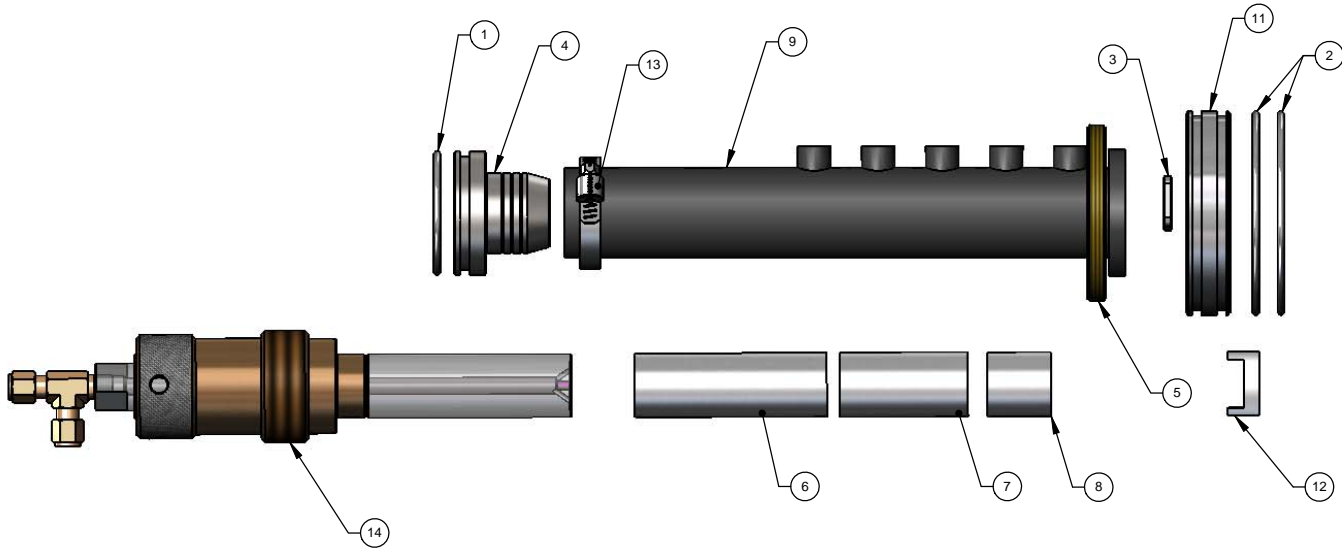
ITEM NO.	PART NUMBER	DESCRIPTION	-HC	-SS
1	C10338	ORING, VITON, AS568-236-V75	1	1
2	6100-2048	HOUSING- COREHOLDER	1	1
3	6100-2047	PLUG, COREHOLDER, ADJ END	1	1
4	6100-2048	COLLAR, 4.75-STUB ACME-B	1	1
5	C09701	RING, RTNG, EXT, WS-325	1	1
6	C09815	GLAND NUT, HIP, 1/16	5	5
7	C10084	PLUG, 1/16 HIP, 15-7AM1	5	5
8	C09640	FTG, NUT, 3/8T, 1/8T, VA	4	4
9	C09643	FERRULE, HC, 1/8 VALCO	4	4
10	6100-2030-HC	CAP, BOTTOM COREHOLDER HC	1	1
11	6100-2030-SS	CAP, BOTTOM COREHOLDER-SS	1	1
12	6100-2049	RET NUT, CORE INSPECTION	1	1
13	6100-2361-ACCESS	ACCESS KIT FOR 6100-2361	1	1
14	6100-2051	PLUS, FLOW GEOMETRY	1	1
15	6100-2052	PLUS, CORE EXTRACTION	1	1
16	C09589	ORING, VITON, AS568-132-V75	1	1
17	C09586	ORING, VITON, AS568-014-V75	1	1
18	6100-2067	WELDMENT, PIVOT	1	1
19	C09410	RING, RETAINING, WST-125-S16	1	1
20	6100-2408	SPREADER ROD, 3/8 X 7.81	2	2
21	6100-2407	RETAINING DOG	2	2
22	H-24-113	SCREW, SKHSS, SS, 1/4-28X1, CUP	2	2
23	C12567	CONN, 7/16-20X3/8T, SS-600-1-4ST	2	2
24	C10278	TC, TYPE-K, 0.126 X 6	1	1
25	P-2676	ORING, VITON, AS012-V75	2	2
26	H-25-101	NUT, HEX, SS, 1/4-28	2	2
27	6100-2092	BAND HEATER, 1500W	1	1
28	C09825	CAP, 3/8T, SS-600-P	2	2
29	6100-2277	PIVOT STOP COLLAR	1	1
30	C10015	SCREW, SKHSS, SS, 1/2-20 X .50	1	1
31	H-25-038	SCREW, SKHSS, SS, 1/4-20X0.312, ALN	1	1

QTY. REQD.	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES		
		TOLERANCES		
		1 PLACE .0030		
		2 PLACE .0010		
		3 PLACE .0005		
		ANGLES .125"		
		SURF. FINISH		
		BREAK SHARP EDGES, DEBURR		
		APPROVALS	DATE	
		DRAWN: DBL	8/3/07	
		CHECKED: PN	8/3/07	
		ENGR: DBL	8/3/07	
		TITLE		
		CORE HOLDER, 6" FLUSH FACE		
		SIZE	DWG NO.	REV.
		1:4	6100-2361	-05
		SCALE	TITLE BLOCK REV. 2.0	SHEET: 1 of 1

NOTES:

1. ASSEMBLE SLEEVE, ITEMS 1,2,3,6,7,9,11,13. USE FLANGE FIXTURE 6100-2184 FROM COREHOLDER ACCESSORY KIT TO HOLD SLEEVE FLANGE 6100-2189. TIGHTEN SLEEVE RETAINER 6100-2335 USING SPANNER WRENCH FROM COREHOLDER ACCESSORY KIT.
2. ITEMS 4,5,8,10,14 ARE LOOSE

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	1	ISSUED	6/8/07	PNN
	2	ITEM 16 WAS 6100-2175	9/15/07	PNN
	3	ADDED ITEM 17, ITEM 14 WAS 6100-2231 ITEM 3 WAS 6100-2029	10/3/07	PNN
	4	ECN T1371, ADDED C10588 TO BOM	12/18/2007	JB/TC
	5	REPLACE ITEM 8, REMOVE ITEM 2,3,5,6, ADD NOTES	8/05/09	PN



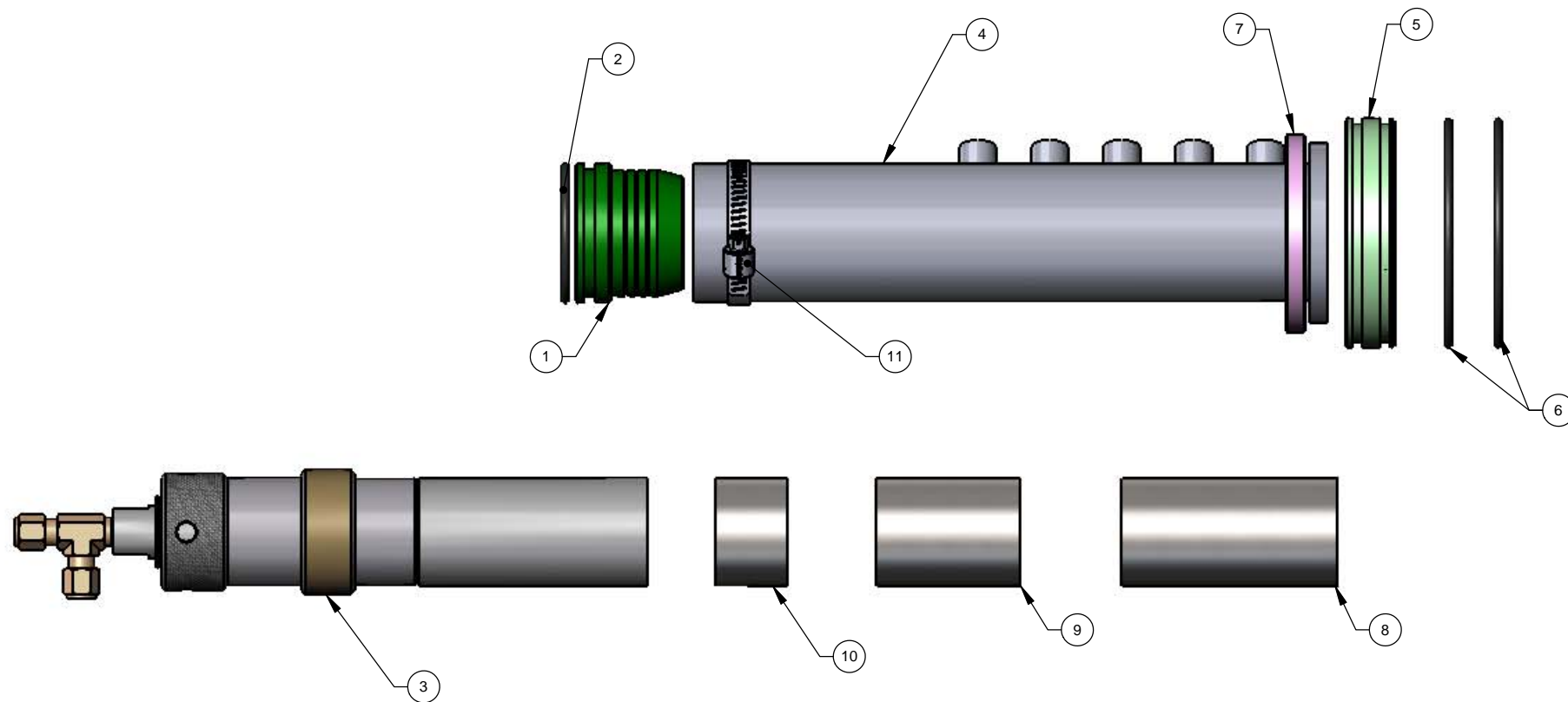
14	6100-3168-SS	6100-3168-HC	PLUG ASSEM, ADJ END, 1.0" COREHOLDER	1
13	C10588	C10588	#28 Hose Clamp	1
12	6100-2093	6100-2093	INSERT, 0.75 x 0.25 GEOMETRY	1
11	6100-2189	6100-2189	ADAPTER, TUBE, 1.0" CORE	1
10	6100-2379-ACCESS	6100-2379-ACCESS	ACCESSORY KIT	1
9	6100-2311	6100-2311	SLEEVE, FLANGED 1 X 8.77 MOLDED TAPS	1
8	6100-2088-01	6100-2088-HC	SPACER, CORE, 1.0 DIA X 1	1
7	6100-2087-01	6100-2087-HC	SPACER, CORE, 1.0 DIA X 2	1
6	6100-2086-01	6100-2086-HC	SPACER, CORE 1.0 DIA X 3	1
5	6100-2335	6100-2335	RING, NOTCHED FLANGE RETAINER, 1"	1
4	6100-2084	6100-2084	ADAPTER, SLIP, 1" SLEEVE	1
3	6100-2337	6100-2337	INSERT, 1" NOTCHED RING	1
2	C09587	C09587	ORING, VITON, AS568-151-V75	2
1	C09589	C09589	ORING, VITON, AS568-132-V75	1
ITEM NO.	6100-2379-SS	6100-2379-HC	DESCRIPTION	QTY

NEXT ASSY		USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES		CHANDLER ENGINEERING			
APPLICATION			TOLERANCES:					
BREAK SHARP EDGES, DEBURR			1 PLACE ±0.030					
			2 PLACE ±0.010					
			3 PLACE ±0.005		TITLE			
			ANGLES ±1/2°		KIT, 1" CORE ADAPTER			
			SURF. FINISH		SIZE			
			APPROVALS		C			
			DATE		S.O. NO.			
			DRAWN: PNN 6/8/07		DWG NO.			
			CHECKED: JS 6/11/07		6100-2379-XX			
			ENGR.: PNN 6/8/07		REV. -05			
			SCALE: 1:4		TITLE BLOCK REV: 1.0			
					SHEET: 1 of 1			

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1. ASSEMBLE SLEEVE, ITEMS 1,2,4,5,6,7,11. HOLD FLANGE 6100-2175 WITH FIXTURE 6100-2184 FROM 6100-2381 ACCESSORY KIT. USE SPANNER WRENCH TO TIGHTEN RETAINER 6100-2177.
2. ITEMS 3, 8, 9 , AND 10 ARE LOOSE

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	1	ISSUED	6/10/07	PNN
	2	ITEM 5 WAS 6100-2232	10/4/07	PNN
	3	ECN T1371, ADDED C12109 TO BOM	12/18/2007	JB/TC
	4	MOVE ITEMS 4,7,13,14 TO DWG 6100-3169	08/06/09	PN



THIS 1.5" ADAPTER KIT IS DESIGNED TO FIT
6100-2361 COREHOLDER HOUSING

1	6100-2381-ACCESS	6100-2381-ACCESS	KIT,ACCESSORY	12
1	C12109	C12109	#20 Hose Clamp	11
1	6100-2091	6100-2091-HC	SPACER, CORE,1.5 X 1.0,SS	10
1	6100-2090	6100-2090-HC	SPACER,CORE,1.5 X 2.0	9
1	6100-2089	6100-2089-HC	SPACER,CORE 1.5 X 3	8
1	6100-2177	6100-2177	RETAINER, 1.5 FLANGED SLEEVE	7
2	C09587	C09587	ORING,VITON,AS568-151-V75	6
1	6100-2175	6100-2175	ADAPTER, 1.5" FLANGED SLEEVE	5
1	6100-2312	6100-2312	SLEEVE,VITON,1.5 X 8.81 FLANGED	4
1	6100-3169-SS	6100-3169-HC	PLUG ASSEM,1.5" CORE	3
1	C09589	C09589	ORING,VITON,AS568-132-V75	2
1	6100-2060	6100-2060	SLEEVE ADAPTER, 1.5"	1
QTY	PART NUMBER	PART NUMBER	DESCRIPTION	ITEM

PART NUMBER		UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES		CHANDLER ENGINEERING				ITEM							
		TOLERANCES:						TITLE							
		1 PLACE ±0.030		KIT,1.5" CORE ADPTR											
		2 PLACE ±0.010													
NEXT ASSY		3 PLACE ±0.005													
USED ON		ANGLES ±1/2"													
APPLICATION		SURF. FINISH													
BREAK SHARP EDGES, DEBURR		APPROVALS		DATE											
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				CHECKED: JB		6/11/07									
				ENGR.: PNN		6/10/07		SCALE: 1:4				TITLE BLOCK REV: 1.0		SHEET: 1 of 1	
4		3		2		1									