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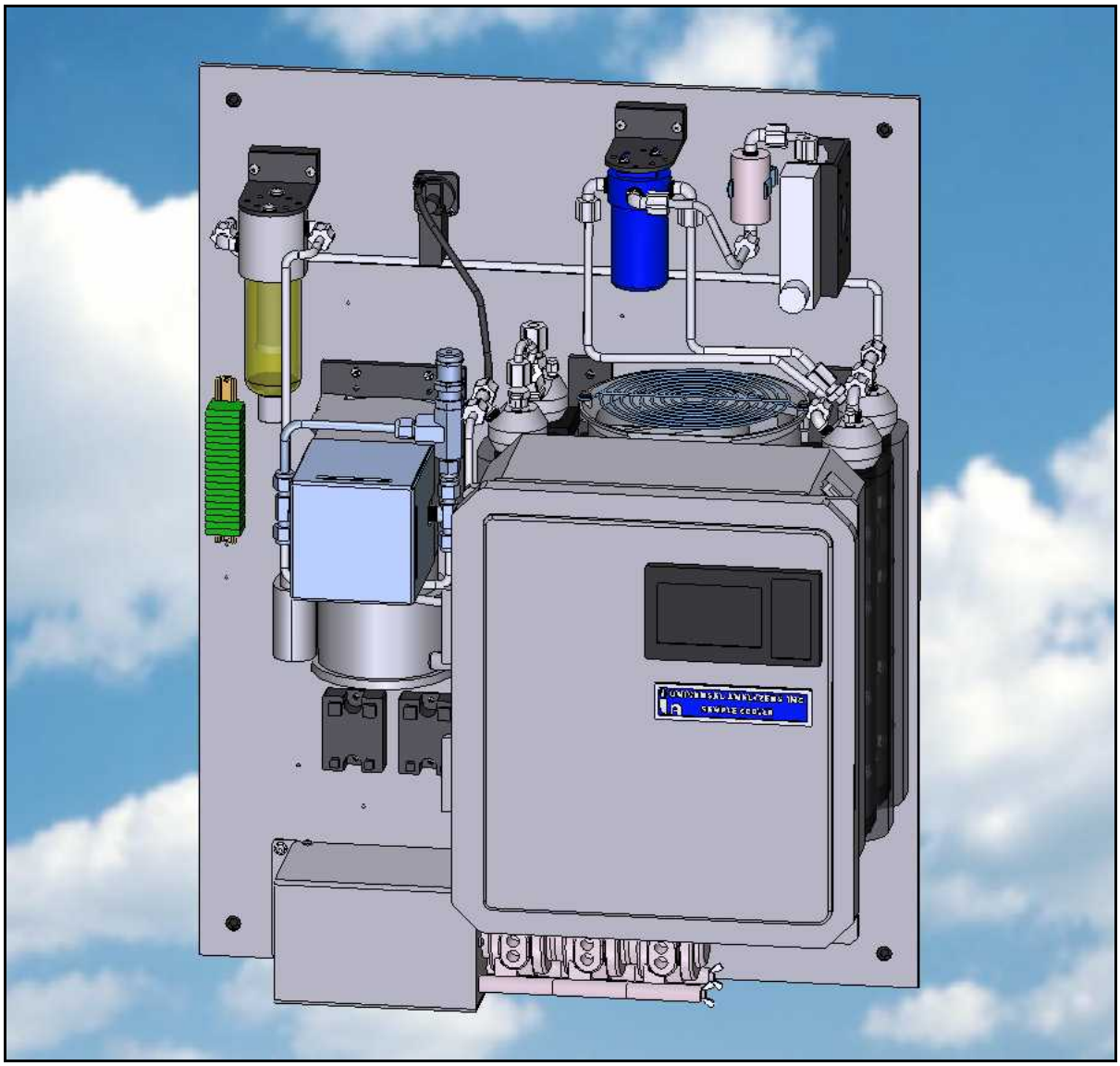
MODEL 1095E

SO^3 AEROSOL FREEZER CHILLER



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MAN1095E Rev A

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LIMITED WARRANTY

ALL PRODUCTS MANUFACTURED BY UNIVERSAL ANALYZERS INC. ARE WARRANTED TO BE FREE OF MANUFACTURING DEFECTS FOR A PERIOD OF ONE YEAR FROM THE DATE OF RECEIPT AT THE CUSTOMER'S RECEIVING AREA AND FOR AN ADDITIONAL PERIOD OF UP TO 90 DAYS IF THE PRODUCT IS PLACED IN SERVICE AFTER BEING IN STORAGE. THIS WARRANTY COVERS MATERIALS AND LABOR TO RESTORE ANY PRODUCTS TO ORIGINAL FACTORY SPECIFICATIONS IF A DEFECT IS FOUND WITHIN THE WARRANTY PERIOD.

THE DEFECTIVE PRODUCT SHOULD BE SENT, FREIGHT PREPAID, TO THE FACTORY IN CARSON CITY, NEVADA. REPAIRS WILL BE PERFORMED AT THE FACTORY AND RETURNED, PREPAID, BY THE SAME SHIPPING METHOD USED TO SEND THE PRODUCT TO THE FACTORY.

THIS WARRANTY DOES NOT APPLY WHERE THE EQUIPMENT HAS SUSTAINED DAMAGE DUE TO NEGLECT, MODIFICATION, CORROSION, OR OTHER REASON BEYOND THE SCOPE OF THE NORMAL DEFINITION OF "MANUFACTURING DEFECT".

FURTHER, THIS WARRANTY IS LIMITED TO REPLACING THE DEFECTIVE COMPONENTS AND RETURNING THE EQUIPMENT MANUFACTURED BY UNIVERSAL ANALYZERS INC. TO THE CUSTOMER IN WORKING CONDITION. ANY OTHER CLAIMS ARE OUTSIDE THE SCOPE OF THIS WARRANTY. NO WARRANTIES ARE MADE AS TO THE SUITABILITY OF THE USE OF THE EQUIPMENT IN ANY PARTICULAR APPLICATION OR LOCATION. THE SUITABILITY OF THE USE OF THE EQUIPMENT IS THE RESPONSIBILITY OF THE CUSTOMER AND THE INSTALLING CONTRACTOR.

MODEL 1095E FREEZER CHILLER	UNIVERSAL Analyzers Inc. 5200 CONVAIR DR CARSON CITY, NV 89706 PHONE: (775) 883-2500 FAX: (775) 883-6388

SPECIFICATIONS

SAMPLE FLOW RATE:	0 TO 5 L/M TOTAL (at STP)
MAXIMUM INLET TEMPERATURE:	
STAINLESS STEEL HEAT EXCHANGER:	700° F. (351° C.)
KYNAR/GLASS HEAT EXCHANGER:	280° F. (138° C.)
MAXIMUM INLET GAS DEWPOINT:	178° F. (81° C.)
MAXIMUM INLET WATER CONCENTRATION:	50%*
MINIMUM AMBIENT TEMPERATURE:	34° F. (1° C.)
MAXIMUM AMBIENT TEMPERATURE:	105° F. (41° C.)*
MAXIMUM COOLING POWER:	540 BTUs PER HOUR (160 Watts/Hr.)
OUTLET SAMPLE DEW POINT:	-22° F. (-30° C.)
GAS SAMPLE INLET FITTINGS:	3/8" TUBING FITTINGS
GAS SAMPLE OUTLET FITTINGS:	1/4" TUBING FITTINGS
BOTTOM WATER DRAIN FITTINGS:	3/8" TUBING FITTINGS
MAXIMUM INPUT POWER:	900 WATTS
VOLTAGE:	115/230VAC, 50/60 Hz
ELECTRICAL CLASSIFICATION:	GENERAL PURPOSE, NEMA 1
DIMENSIONS:	27" HIGH x 21" WIDE x 14 1/4" DEEP
WEIGHT:	75 LBS (34 KG)
SOLUBLE GAS REMOVAL RATES:	NO 0% LOSS NO_2 <10% LOSS SO_2 < 2% LOSS CO 0% LOSS CO_2 < 2% LOSS

* at reduced flow rate above 77° F. (25° C.) ambient.

Standard 1095E Freezer Chiller with 05 PLC and Touch Screen Interface

SYSTEM DESCRIPTION

The Universal Analyzers Model 1095E SO^3 Thermoelectric gas sample cooler contains the special Kynar Pak impinger type heat exchangers. These are mounted within heat transfer blocks, which are cooled by thermoelectric elements utilizing the "Peltier Effect" discovered in France over half a century ago. Where high water contents are encountered, it is efficient to remove the condensate in multiple stages, one at the temperature of the air in the vicinity of the "Ambient Pre-cooler", then by passing the sample into a heat exchanger cooled to 4°C by the thermoelectric elements. The sample gas is then super-cooled by special cascaded peltier elements to minus 30°C freezer alternating Impingers controlled by a PLC.

The gas sample conditioning system should contain additional components to insure that a clean, dry sample is presented to the analyzer panel for minimum analyzer maintenance. A Moisture sensor is provided to sense the presence of condensate, should any exist in the tubing following the chiller. This WCOF (Water Carry-Over/Filter) sensor with a visible coalescing filter is provided with the 1095E Universal Analyzers chiller. The WCOF, which collects particulates on the outside of the cylindrical filter, surrounded by a transparent bowl, will allow the operator to inspect the condition of the heated stack filter. The integral moisture sensor with the sensing elements in the bottom of the filter bowl to provide an early warning if the coalescing filter removes liquid from the sample stream. If water carry-over is sensed, the Alarm Message “Water Carry-Over” is displayed. With Channel 1 Chiller high temperature (>10°C) the Operator Interface displays “Ch1 High Temp”. Either of these stops the Sample Pump and turns off the Channel 2 and Channel 3 Peltier cooling elements turning off the Y4 “Pump Run”, Y2 “Peltier A”, and Y3 “Peltier B” status bits respectively.

A Vacuum switch is provided to monitor and alarm high inlet vacuum. The message “System Vacuum” will appear on the top system status line of the operator interface, if there is high inlet vacuum.

A Flow switch alarms on low flow. The message “Low Sys Flow” will appear on the top system status line of the operator interface, if there is low flow.

The heated head sample pump (oil-less diaphragm pump) is placed in the sample line between the 4°C and minus 30°C heat exchangers. The first chilled heat exchanger takes enough of the water vapor from the sample to protect the pump. The freezer heat exchangers are under a slight pressure because they are on the discharge side of the pump. This will cause the dew point of the sample to be at its minimum. The sample pump location within the sample system is a matter of choice and good engineering.

A Teflon Solenoid is used to alternate the online minus 30°C column and the offline ambient column that is in defrost/blow down mode. The active freezer column flow impedance is monitored by a Flow switch to sense column freeze-up. If a flow restriction is sensed before Online Dwell time out, the Alarm Message “Column Frozen” is displayed and after a time delay of 60 seconds the PLC will sequence to the other Freezer Column.

The offline column is pre-chilled to approximately minus 10^{o}C before the column is brought online. Once the pre-chill column is below minus 10^{o}C, the program automatically advances to that column or after 30 minutes of pre-chill time the pre-chill channel goes online. If the column fails to cool for 15 minutes once it is online, the message "Ch2 or Ch3 Malfunction" will be displayed.

Condensate is removed from the heat exchanger(s) by a continuously running peristaltic tubing pump that can be used with the heat exchanger either under pressure or vacuum. This is an easy solution, which lends itself to leak testing because of the positive displacement nature of the peristaltic pump. It is, however, a device which requires periodic maintenance to replace the tubing. A preventative maintenance program replacing the tubing every 6 months is a good practice.

Finally, a means of controlling the flow of the sample to the analyzers must be considered. This can be as simple as providing a flow meter with a flow control needle valve to regulate the sample flow causing the sample pump to pump higher on the pump curve. One option, which is used, is to provide an adjustable back-pressure regulator between the inlet and outlet of the sample pump. This allows a portion of the gas pumped to be re-circulated back to the inlet if discharge pressure exceeds the back-pressure control point. Some analyzers have their own sample pump which may be sufficient to supply the analyzer but insufficient to pull the sample through the chiller, sample line and heated stack filter. These can be supplied by piping the sample from the external sample pump into an atmospheric tee with a flow meter that registers the flow of excess sample from the branch of the tee to the atmosphere. The internal analyzer sample pump can then withdraw the sample from the opposite run of the tee which is essentially at atmospheric pressure and unaffected by pressure changes within the sample line, due to changes in filter pressure drop or sample pump efficiency.

INSTALLATION INSTRUCTIONS

Thermoelectric Sample Coolers should be installed away from heat sources in a well-ventilated area of an instrument rack or enclosure. Completely enclosing any instrument generating 740 watts of energy will cause the temperature of the interior of the enclosure to rise beyond the capability of the sample cooler to perform reliably. Universal Analyzers can supply NEMA 12, 4 or 4X type enclosures modified to duct outside air directly into the heat sink. The heated air is then exhausted to the outside of the enclosure with fans, thermostatically controlled. The interior of the enclosure can also be insulated to reduce the solar heat loading in case the enclosure is mounted in direct sunlight.

The sample inlet is a 3/8" compression fitting supplied on the top of the first Impinger. The heat insulation on the heated tube bundle should be stripped no more than 3" to avoid plugging the exposed line. The sample outlets are ¼" compressions fittings on the flowmeter or the atmospheric manifold.

A 3/8" tubing fitting is provided as the condensate drain connection at the bottom of each heat exchanger. This can be removed to expose 3/8" NPT female connections. The triple head peristaltic pump is used to withdraw the condensate from each Impinger. Care must be taken to drain the condensate into a safe drain because of the presence of condensed sulfuric acid.

START UP PROCEDURE

Note: It is important that the Heated Probe and Sample should be at operating temperature before starting the chiller and sample pump.

Apply power to the sample cooler. Channel 1 temperature should start to drop immediately. It will be below the over-temperature set points, (10°C), in approximately four minutes and the sample pump should start as the program leaves the start-up mode and enters run mode. Channel 1 will operate @ approximately 4°C.

For Touch-Screen User Interface See Page 8

The bottom line of the Start-up display shows how many minutes are remaining in the current mode. The message "Ch 2 or Ch 3 High Temp" will be displayed until the active column chills below minus 10°C. The active column is indicated by an asterisk (*). The freezer column will reach minus 30°C in approximately 30 minutes.

OPERATION

The Model 1095E SO^3 is manually controlled through the Operator Interface located on the front of the unit, or remotely by the I/O inputs to the PLC. The 4 Line, 16 Character alphanumeric Operator Display/Interface is used to display and manually operate the 1095E Chiller.

Main Display

Line	1	Alarms Displayed and Channel 1 temperature
	2	Channel 2, Status "DWELL" "OFF" "CHILL" and temperature
	3	Channel 3, Status "DWELL" "OFF" "CHILL" and temperature
	Note "*"	Indicates the active column
	4	Minutes remaining on Active Step

Keypad: Local operation Bit control Mode

Bit control is entered by pressing MSG, OPT, ENT, ENT, this enables the following functions:

Key	Function
"MSG"	Clears logged Alarms
"→"	Advances System to next step in Sequence (Pre-Chill, Dwell, Off)
"←"	Displays the message Press "-" Offline Press "+" Online
"-"	Puts the System Offline meaning the sample pump, and Peltier elements for Ch2 and Ch 3 are off.
"+"	Puts the System Online meaning the sample pump, and Peltier elements for Ch2 and/or Ch 3 are on.

System Defaults:

The PLC will have following default values:

Dwell	180 Minutes - Length of time freezer Column is online
Pre-Chill	30 Minutes - Pre-Chill on the Offline Column, prepares the Column to become active.

Procedure to change Dwell Time and Pre-Chill Time:

Press "CLR" Twice. This will cancel Bit Control Mode

1. Press "CHG-PRE"
2. Select Parameter to change with "-" and "+" keys
    a) Dwell/Mn- Amount of time a Channel remains online
    b) Prechill/min- Max amount of preparation time a channel will have before it becomes active. Note a Channel will automatically become active if it is already cool.
3. Press "ENT" to move from title to values
4. Press "-" and "+" to increment values
5. Press "MSG" for Standard Screen
6. Press "OPT" and Select *Bit Control*
7. Press "ENT" Twice – To default into Standard Message Screen

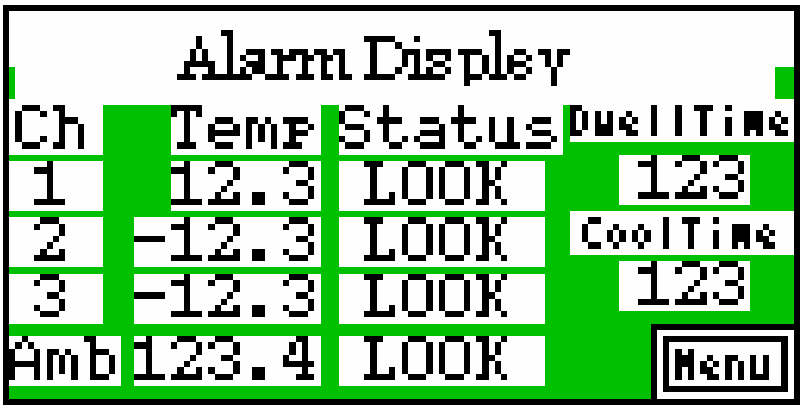
Note - One must exit Bit Control Mode to change preset values. One must be in Bit Control Mode to use local operation keys.

Display & Alarms Messages:

Display	Description	Output Contact
System Normal	System Online, No Alarms	
Pump Offline	Sample Pump Off, Ch 2 and Ch 3 Peltiers off.	
CH 1 High Temp	Channel 1 Temp >10^{o}C, System goes offline	
Column Frozen	FS-1 Clears after Column Switch	
Water Carry-Over	Condensation Detected at Water Slip Sensor	
CH2 Malfunction	Channel 2 fails to reach minus 5^{o}C after 15 minutes in dwell	
CH3 Malfunction	Channel 3 fails to reach minus 5^{o}C after 15 minutes in dwell	
System Vacuum	System Inlet Vacuum $\geq$ 5" HG	
Low Flow	Flow less then <.5 l/m	
Warm	Online Freezer Temp warmer than minus 10^{o}C	
Cold	Online Freezer Temp cooler than minus10^{o}C	
Temp. Senor Failure	One or more of the thermocouples are not connect properly or broken	
Off	The channel is offline	Y2 corresponds to Ch 2 Y3 corresponds to Ch 3
On	The channel is online	
Chill	The Peltiers cool to prepare for the next channel	

Touch-Screen User Interface

Main Display



This is the main display screen of the Touch Screen style user interface:

Line	1	System Status and Alarms displayed
	2	Column Display Headings
	3	Chiller Channel 1 Temperature and Status plus time remaining on active freezer channel
	4	Freezer Channel 2 Temperature and Status
	5	Freezer Channel 3 Temperature and Status
	6	Ambient Temperature (inside the Electronics enclosure) and Status plus Menu Button, lower right corner.

System Status and Alarms Displayed:

System Normal
Water Carry-over
Channel 1 (chiller) Hi Temperature
Channel 2 (freezer) Hi Temperature
Channel 3 (freezer) Hi Temperature
Column 2 Frozen
Column 3 Frozen
Column 2 Malfunction (not cooling)
Column 3 Malfunction (not cooling)
Hi System Vacuum
Low Sample Flow
System Offline
Column Held (from user input during Calibration)
RTD Failure
High Ambient Temperature

Channel 1 Status Displayed

OK
Fault
Warm

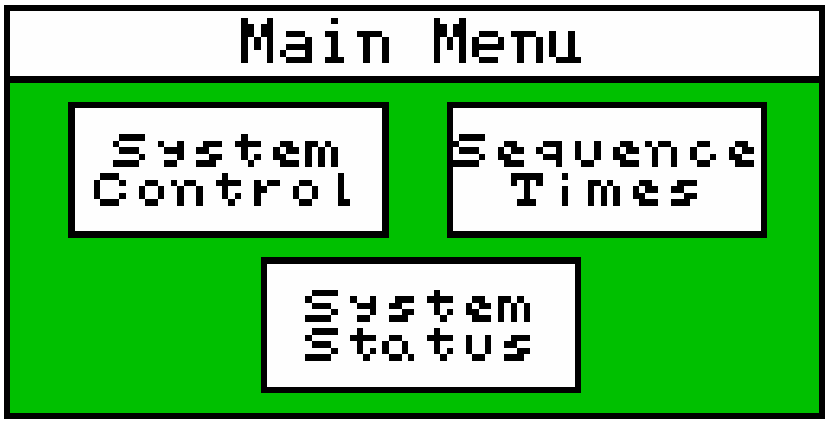
Channel 2,3 Status Displayed

Offline
Dwell (Channel on, normal cycle)
Warm (not at temperature after chill cycle)
Chill (pre-cooling before going online)
Fault (not cooling or RTD failure)

Ambient Status Displayed

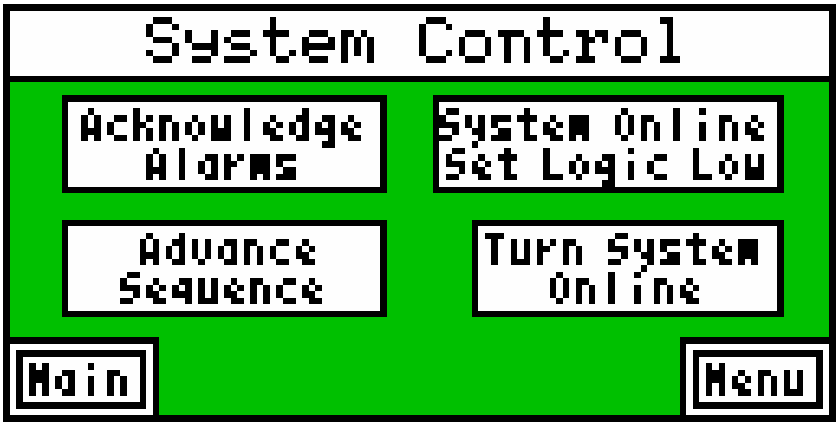
OK
Fault
Warm

Main Menu



This menu provides access to the System Control Menu and the Sequence Times Menu. The System Status button returns the user to the main display screen.

System Control Screen



The Acknowledge Alarms button is used to clear alarms displayed on the Main Display screen once the alarming condition has been corrected.

The System Online Set Logic button is used to change the logic of the System Online/Offline digital input between Normally Open and Normally Closed

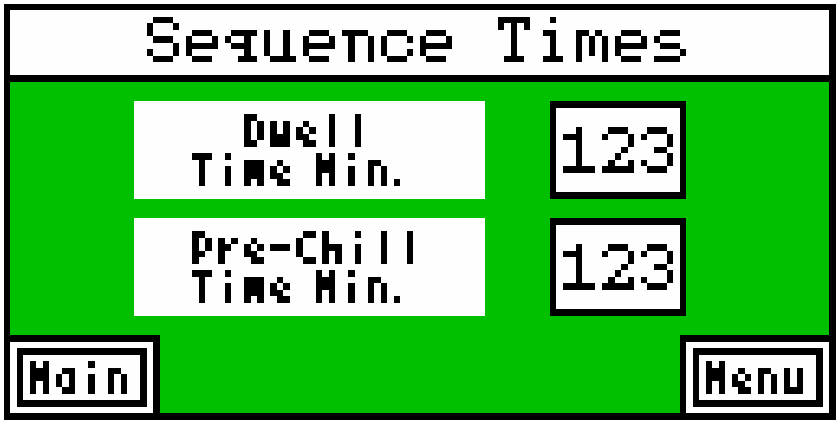
The Advance Sequence button is used to advance the Freezer Channel cycle for troubleshooting.

The Turn System Online/Offline button is used to turn the Sample Pump on or off.

The Main button returns to the Main Display screen.

The Menu button returns to the Main Menu screen.

Sequence Times Screen



The Dwell Time Minutes button allows the user to adjust Freezer Channel sequence time between 100 and 180 minutes.

The Pre-Chill Time Minutes button allows the user to adjust the Next Up Channel pre-chill time between 20 and 40 minutes.

TROUBLE SHOOTING

Caution: **Refer to the Caution Statement at the beginning of this manual**.
Caution: **Troubleshooting should only be done by an Experienced Technician.**

Symptom	Problem	Solution
No Display, no fans	Loss of AC Power	Reestablish AC Power
No Display, no cooling		
Power Supply	15 VDC Supply	Replace Power Supply
	Fuse Blown	Replace Fuse
PLC	Loose connector Cable	Check cable connections
	PLC Failure	Contact Factory for replacement
No Electronics Fan	Electronics Fan Failure	Replace Fan
No Heat Sink Fan	Fan Failure	Replace Fan
Sample Pump Not working	System Offline	Place System Online
	Water Carry-Over Alarm	See Below
	CH1 High Temp Alarm	See Below
	Sample Pump Malfunction	Repair/Replace Pump
"Water Carry-Over"	Liquid in WCO/F	Clean WCO/F Sensor
	Chiller BTU Load high	Reduce Sample Flowrate
	Peristaltic Pump Failure	Replace PeristalticTubing Replace Peristaltic Pump
	High Ambient Temperature	Cool Enclosure < 40^{o}C
"CH 'X' High Temp"	Chiller just Energized	Allow Chiller to Cool
Ch 1 Temp > 10^{o}C	Chiller BTU Load high	Reduce Sample Flowrate
Ch2&3 Temp >-10^{o}C	High Ambient Temperature	Cool Enclosure < 40^{o}C
	Heat Sink Fan Failure	Replace Heat Sink Fan
	Heat Sink Fins Obstructed	Clean Heat Sink Fins
	Peltier Elements Failure	Verify wire connections Replace Elements
Column Frozen	Online Column Frozen	Reduce Dwell Time Check Peristaltic Tubing
Column Malfunction (not cooling)	Peltier devices not functioning	Check cable & wiring connections Replace Peltier devices, Replace Heat sink Assy.
High System Vacuum	System Inlet Vacuum >5"HG	Blowback Heated Filter Replace Heated Filter

		Check Heated Line for Restriction
Low Sample Flow	Pump Failure	Re-build or replace sample pump
RTD Failure	Faulty RTD or Connection	Check Cable and wiring connections. Replace RTD. Replace or exchange Heat sink assy.
High Ambient Temp	Temperature in Electronics Enclosure exceeds 50 Degrees C	Reduce ambient temperature in shelter. Replace Electronics enclosure fan

NOTE:
The presence of water in liquid form after the sample cooler is an indication of a fault in the system. Reasons for the presence of condensate in the system after the sample cooler could be one or more of the following:

1. Overloading of the cooling capacity of the cooler due to too much water vapor in the sample OR too great a sample flow rate.
2. The condensate removal equipment (peristaltic pump, eductor, or drain pot) may be faulty. The heat exchanger(s) may be full of condensate.
3. An air leak may be in the condensate removal system allowing air to enter and blow the condensate back into the heat exchanger. (This assumes the heat exchanger is under a slight vacuum.)
4. The temperature of the air passing through the cooler to cool the heat sink is too high. This could be due to placement of the cooler in a tightly sealed box.

MAINTENANCE SCHEDULE

Daily:

- ✓ Check Alarm Status for normal operation
- ✓ Check Chiller Temperature indication
  CH1 $4^{o}C \pm 1^{o}C$
  Online Freezer - Cold
  Offline Freezer - Warm
- ✓ Check Sample Flowrate through chiller to be normal < 5 Liters/Min

Weekly:

- ✓ Check Sample Pump for Normal Operation – 5-8 Liters/Min @ < 2" Hg @ 10 Psig
  Pump Diaphragm replacement dependent on Load, Ambient Temperature and Sample Composition.
- ✓ Check Sample Filter by observing color and noting any flow restriction.
  Change as required.

Biannually:

- ✓ Replace Tubing on Peristaltic Liquid Pump
- ✓ Replace Diaphragm and Gaskets on Sample Pump
- ✓ Check Pressure setting of Back Pressure Regulator on Sample Pump
- ✓ Leak Check Sample System

MAINTENANCE PROCEDURES

INSTRUCTIONS FOR FIELD REPLACEMENT OF PELTIER ELEMENTS

TOOLS REQUIRED:

1. Razor blade required to remove the old insulation
2. Phillips screwdriver
3. Wire cutter and stripper
4. Vice Grips or crimp tool for installing flag terminals
5. Torque screwdriver with good resolution in 8-inch pound range

MATERIALS REQUIRED:

1. Insulation kit(s) for sample cooler to be repaired
2. Contact cement for reinstalling Insulation
3. Zinc Oxide Heat Transfer Paste
4. Disposable brush for applying Heat Transfer Paste
5. Peltier Element
6. Two flag terminals for each Peltier Element

REMOVAL OF DEFECTIVE PELTIER ELEMENT:

After unplugging and removing the Electronics Enclosure:

1. Remove the Heat Exchanger by pulling it out of the Heat Transfer Block. Clean off the heat transfer paste.
   - Cut off the insulation with a razor blade. Note the location of the five pieces of insulation which cover the Heat Transfer Block. The new insulation will be installed in the same locations.
   - Remove the thermocouple by removing the holding screw and pulling it out of the aluminum Heat Transfer Block. The ground wire will also be removed at this time.
   - Remove the Heat Transfer Block with the screws which hold it to the heat sink. Note that the Peltier Elements are sandwiched between the Heat Transfer Block and the Heat Sink. The inner piece of insulation and locating jig which surround the Peltier Elements will be removed with the Heat Transfer Block. Leave the nylon shoulder washer, the flat washer and the Belleville washers on the No. 6-32 screws which are removed so they will remain in the same order when replaced.

2. Pull off the defective Peltier Elements and clip the wires. Note how the wires on the Peltier Elements are looped under the cable clamps to provide strain relief for the delicate connections at the Peltier Elements. That will be required to be done with the replacement Elements.

3. Disconnect the ends of the Peltier wires where they connect to the Solid State Relays and TB-4 Terminals (Phoenix Connector on 1095E). Note on the connectors and/or wiring diagram where each Peltier Element terminates. This is where the new Peltier Element wires will be connected.

4. Clean the surfaces of the Heat Transfer Block and Heat Sink which come in contact with the Peltier Element. These need to be free of grit to avoid placing stress points on the surface of the Peltier Elements.

RE-ASSEMBLY OF SAMPLE COOLER:

1. Place a thin coating of Zinc oxide heat transfer paste on all surfaces, both sides of the new Peltier Element, the Heat Transfer Block, and the area of the Heat Sink where the Peltier Elements will come in contact.

2. Put the piece of insulation which has the square cut-outs over the Heat Transfer Block. Place the Peltier locating jigs around the pedestals of the heat transfer block. The wide section on one side should be oriented toward the cover of the enclosure. ALSO, THE THERMOCOUPLE HOLE SHOULD BE ORIENTED AT THE TOP ON THE SIDE WITH THE WIDE SECTION OF THE OF THE INSULATION TOWARD THE COVER OF THE ENCLOSURE. Press a mounting screw through each of the mounting holes on the Heat Transfer Block, then through the insulation to make a hole for each screw to pass through when the block is to be mounted. Remove the piece of insulation which the screw pushes out as the hole is created. No glue will be required to hold this piece of insulation in place.

3. Place the Peltier Element in the square opening, pressing them easily onto the block so they will stay. **The red wire is to be oriented at the top for Peltier elements placed on the right hand side of the chiller (facing the display) but at the bottom for Peltier elements placed on the left hand side of the chiller. This insures that the cold side is next to the heat transfer block.**

4. Place the Heat Transfer Block with the single piece of insulation and the Peltier Element against the Heat Sink, sandwiching it with the wires facing the original way, toward the cover of the enclosure**.** TAKE CARE TO AVOID BENDING THE WIRES AT THE EDGE OF THE PELTIER ELEMENT, THEY ARE FRAGILE.

5. Screw the Heat Transfer Block to the Heat Sink using the screws with the washers still in place as they were removed. A torque screwdriver should be used to insure there is the proper amount of pressure on the Peltier Unit. Too little will cause the Peltier unit to burn up because of poor heat transfer to the Heat Sink. Too much pressure will crush the thermocouples within the Peltier Element. The torque screwdriver should be used to tighten the screws diagonally, increasing the torque in one inch pound increments until all are torque to a value of eight inch pounds. In the absence of a torque screwdriver, the finger-tips can be used to screw down the screws a little at a time until the Belleville spring washers are depressed to about one half their relaxed thickness.

6. Carefully route the wires from the Peltier Elements in their original path and place them in the cable clamps to provide strain relief. Tighten the cable clamp screws.

7. Pull the wires from the Peltier Elements through the grommets to the inside of the enclosure (To the Phoenix Connector on 1095E). Cut to the length which will allow connections to the proper terminals. The Red wires will attach to the positive terminals on the Solid State Relays where they originated. The Black wires will be attached to their original terminals on TB-4.

8. Strip the wires about ¼ inch from the end and crimp on the flag terminals using either the proper crimp tool. Press them onto the proper terminals.

9. Replace the cover of the enclosure and tighten the screws at each corner.

10. Find the thermocouple hole in the Heat Transfer Block next to the Peltier Element under the first piece of insulation used. Insert the thermocouple with a little of the heat transfer paste into the hole and fasten it in place with the washer and the ground screw as was done originally.

11. Apply a liberal amount of contact cement to one edge and one face of the 1" x 10" piece of insulation supplied. Contact cement should be also applied to the mating surface on the heat transfer block and the insulation piece mounted to the cooler. Allow ten minutes for the contact cement to set up before placing the 1" x 10" piece of insulation in place. It will be difficult to move the insulation after placing it so make sure it is placed properly before pressing into place.

12. Two end pieces of insulation are provided. They can be identified by the 1" hole in the center. Take one of the pieces and determine how it should be oriented at the top of the heat transfer block. Slip the Heat Exchanger through the hole in the insulation and push it all the way to the top of the Heat Exchanger. Apply zinc oxide heat transfer paste to the outside, 1" diameter surface of the Heat exchanger with the end piece of insulation in place. (This is to avoid smearing the heat transfer paste through the hole in the top piece of insulation. It is done this way in the interest of being neat.) Apply contact cement to the top piece of insulation where it will be in contact with the Heat Transfer Block and to the top of the Heat Transfer Block and wait ten minutes. Insert the Heat Exchanger into the Heat Transfer Block and press the top piece of insulation into place.

13. Glue the bottom piece of insulation on the heat transfer block by applying a liberal amount of contact cement to both surfaces and wait ten minutes before pressing it into place.

14. Determine how the large piece of insulation is to be oriented to fit onto the outside of the Heat Transfer Block. It measures 11" x 6 1/2". The 10" length is the vertical dimension. The 6 1/2" width is required to wrap around the heat transfer block. Apply contact cement to the Heat Transfer Block and to the edges of the insulation around it which will adhere to the large piece of insulation. Apply contact cement to the rough side of the large piece of insulation and to the hidden edges which do not show when it is installed. Wait ten minutes for the adhesive to set up and press into place.

15. The repair is complete. **Do not use the insulated Heat Transfer Block as a handle to pick up the Sample Cooler**. That would apply unusual forces to the Peltier Element. The enclosure, the top and bottom of the Heat Sink, or the wall mounting brackets should be used to move the Sample Cooler.

Dimensional drawings, installation drawings, and schematics are included as part of this manual. If additional information is required, telephone assistance can be obtained by calling (775) 883-2500 or FAX request to (775) 883-6388.

The mailing address of Universal Analyzers is:

5200 Convair Dr.
Carson City, Nevada 89706
USA

MODEL 100A MOISTURE SENSING MODULE
WITH WCO OR WCOF MOISTURE SENSOR

5200 CONVAIR DR
CARSON CITY, NV 89706
PHONE: (775) 883-2500
FAX: (775) 883-6388

SPECIFICATIONS

SAMPLE FLOW RATE:	0 TO 20 L/M
MAXIMUM INLET TEMPERATURE:	212 DEGREES F. (100 C.)
INLET AND OUTLET SAMPLE CONNECTIONS:	1/4" FNPT
INPUT VOLTAGE REQUIREMENT:	90-132, 180-264 VAC 50/60 Hz, Or 12 VDC, USER SELECTABLE
INPUT POWER REQUIREMENT:	5 WATTS MAXIMUM
ELECTRICAL CLASSIFICATION:	GENERAL PURPOSE, NEMA 1
DIMENSIONS OF ELECTRONIC MODULE:	6.3" x 3.2" x 2.2" HWD
WEIGHT OF ELECTRONIC MODULE:	LESS THAN ONE POUND

DESCRIPTION

The Model 100A Moisture Sensor Module is a stand-alone electronics package which powers a moisture sensor or any two electrode element to activate a relay in the presence of water condensate. It can be used to interrupt the power to a gas sample pump if water condensate forms on the contacts of the WCO (Drawing P0006) or WCOF (Drawing P0018) moisture sensors mounted in the gas sample tubing ahead of an analyzer. The contacts of the internal relay are protected with MOV's and have the capacity to start and stop a sample pump having a 1/10 HP motor. A second set of relay contacts are brought out to the Output Terminal Strip to allow connections to an annunciator panel or I/O module for a computer or distributed control system.

The Model 100A can also be installed as a two point level control to control the removal from a condensate pot at the base of a gas sample cooler/dehydrator heat exchanger, ("fill and dump technique"). One type of such pot is illustrated in Drawing P0021 which is appended. Note that there must be a method provided to overcome the vacuum which will exist if the sample pump is located after the sample cooler to remove the condensate from the pot. This can be a peristaltic pump or an eductor or aspirator.

All of the Universal Analyzers Thermoelectric Sample Coolers contain the electronic capability of the Model 100A. The usual deployment of the Model 100A is with other manufacturer's sample coolers or where there is no sample cooler, with sample coolers based on the vortex principle (non electric), or where the fill and dump technique is used to remove the condensate from the heat exchanger.

INSTALLATION INSTRUCTIONS

The terminal strips used in the Model 100A are spring clip type terminals which are easy to operate once one knows how. They can be frustrating if the installer is not familiar with the technique required to open the spring terminal. Inserting a small screwdriver having a blade no wider than 0.010"s into the slot above the wire entry point opens the spring to accept wires up to size 14. Removing the screwdriver allows the spring to capture the wire in a very positive manner. The wires may be removed in a similar manner.

The sensor to be used should be mounted in the gas sample line in a position which will allow moisture to fall on the electrodes if condensation occurs. Ideally, the sensor will be within two feet of the Model 100A Moisture Sensing Module to avoid the necessity of extending the cable from the sensor. If the cable requires extending, a shielded cable should be used. It can be extended up to twenty feet if properly connected as follows. The red wire in the sensor cable should be connected to a conductor within the shielded extension cable. The shield within the sensor cable carries the signal from the second electrode and should be connected to the shield of the extension cable. There is a black wire within the sensor cable which is not connected and does not need to be extended. Be sure that the connections which are made to the sensor input terminals are made with the shield connected to the "COM" terminal and the red wire connected the "PROBE" terminal.

The mounting holes for the Model 100A enclosure are hidden behind the cover of the module. Remove the cover and the mounting holes can be seen at each corner outside the molded cover o-ring seal. Number 8 wood, sheet metal, or machine screws can be slipped into the cavity and used to mount the enclosure to a bulkhead or bracket. Drawing P0001 shows the location and mounting dimensions for the mounting holes.

Power should be brought to the Model 100A and the wires installed according to the power drawing depending on the power source available. Be sure to use the technique described above to open the terminal springs to accept the wires.

The relay contacts should be brought out to perform the desired function by accessing TB2 after referring to the schematic and the Circuit Board Detail section below. The spring terminal strip is used for these connections also.

START UP PROCEDURE

Dry the electrodes by removing the holding pin from the WCO sensor body and withdraw the o-ring sealed sensor. Wipe the electrodes with a dry cloth or absorbent paper. In the case of the WCOF, moisture electrodes are to be accessed inside the bottom of the bowl.

Reinstall the moisture sensor and apply power to the Model 100A. The relay will be powered if the sensor is dry and if the jumper on TB3 (Drawing E0014) is in place. If a manual reset button is used, it will require depressing to initially put the Model 100A in a "dry" state.

CIRCUIT BOARD DETAILS

A schematic and parts layout is provided with this manual as Drawings E0008 and E0014 respectively.

The power supply to the Model 100A circuitry is a dual primary transformer which can accept either 115VAC or 230VAC depending on which primary windings are energized. The full wave rectifier on the secondary provides 12VDC for the circuitry. A terminal is provided to allow the user to supply the 12VDC from an external source, bypassing the power transformer, for battery operation. There is a diode which protects the circuitry from the effect of connecting the 12VDC with the polarity reversed. The Model 100A will not function with the polarity reversed, but it will also not be adversely affected.

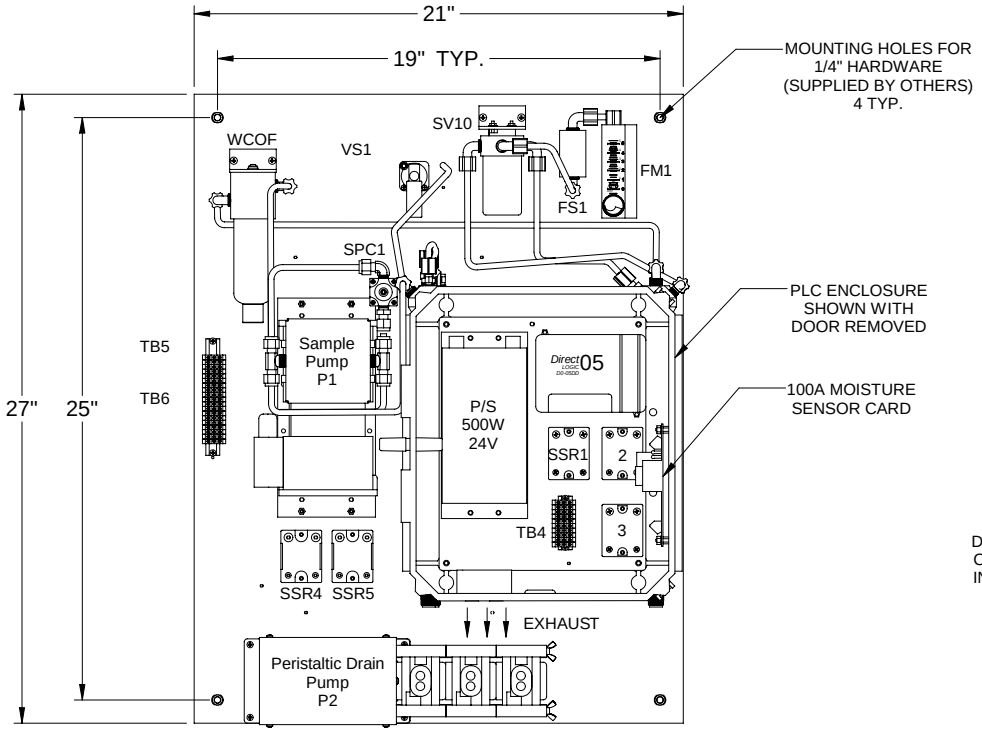
The LM1830N integrated circuit is designed specifically for the application which we have employed in the Model 100A. It provides for the application which we have employed in the Model 100A. It provides a small AC signal to the electrodes in the moisture sensor and delivers a high or low output depending on whether current flows between the electrodes. It is a sensitive device which will detect the smallest amount of slightly conductive liquid present between the electrodes. It will probably be necessary to dry the electrodes with a cloth once liquid is detected to cause the LM1830N to again indicate a dry sample.

The jumper on TB3 is supplied in place and is to be left there for the application where the Model 100A is desired to automatically reset itself when the sensor detects moisture and then dries out. If the installation requirements are for a manual reset to be required to put the Model 100A back into the "dry" state, a reset switch must be supplied and installed according to the appended drawing. In that case the jumper on TB3 is to be removed and one set of the relay contacts used to accomplish the manual reset function.

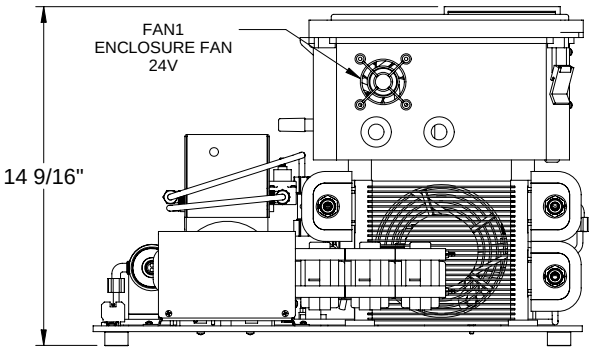
A two color LED is mounted on the circuit board to serve as a visual indication of the state of the moisture sensor. When it is green, the moisture sensor is in a dry state. When it is red, the moisture sensor is wet. The relay may or may not be in that state depending on whether a manual reset switch has been incorporated into the installation. The LED can be green if the sensor is dry but the relay will still be in the "wet" position until the manual reset switch is activated.

All six contacts from the relay are brought out to the terminal strip, TB2. For use as needed. There are no power connections to any of the contacts from within the Model 100A . They are “dry” and power may be applied from outside sources. The NC and NO notation on the circuit board refer to the condition of the relay in it’s de-energized state. The relay is powered when the sensor is dry and therefore the NC contact is open in the dry state and closed if moisture is present. This is done as a fail-safe technique to insure that the Model 100A only indicates a dry sample when it has power applied to the module. The output relay is in the “wet” position if the module has no power applied.

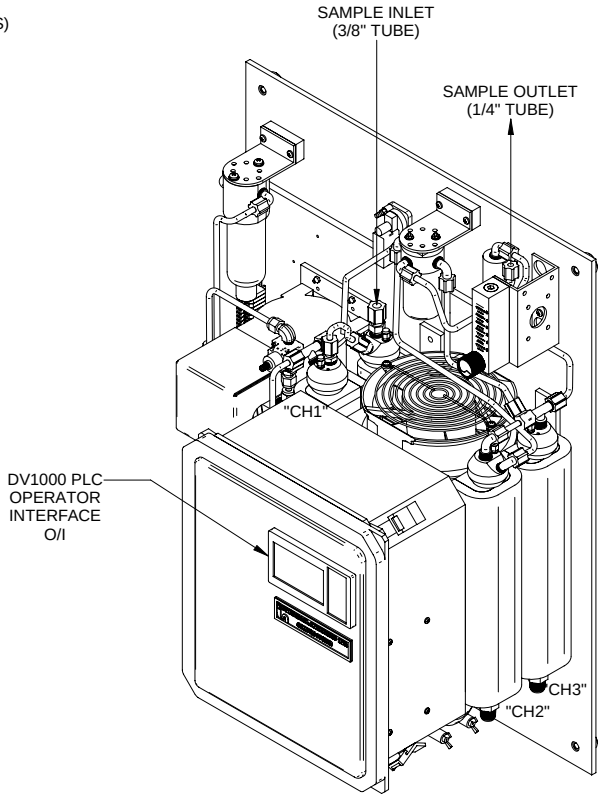
MOV protection for the one set of Form C contacts on the relay allow the relay to absorb the inductive spikes from turning on and off the 1/10 HP motor on a sample pump.



FRONT VIEW



BOTTOM VIEW



Notes:

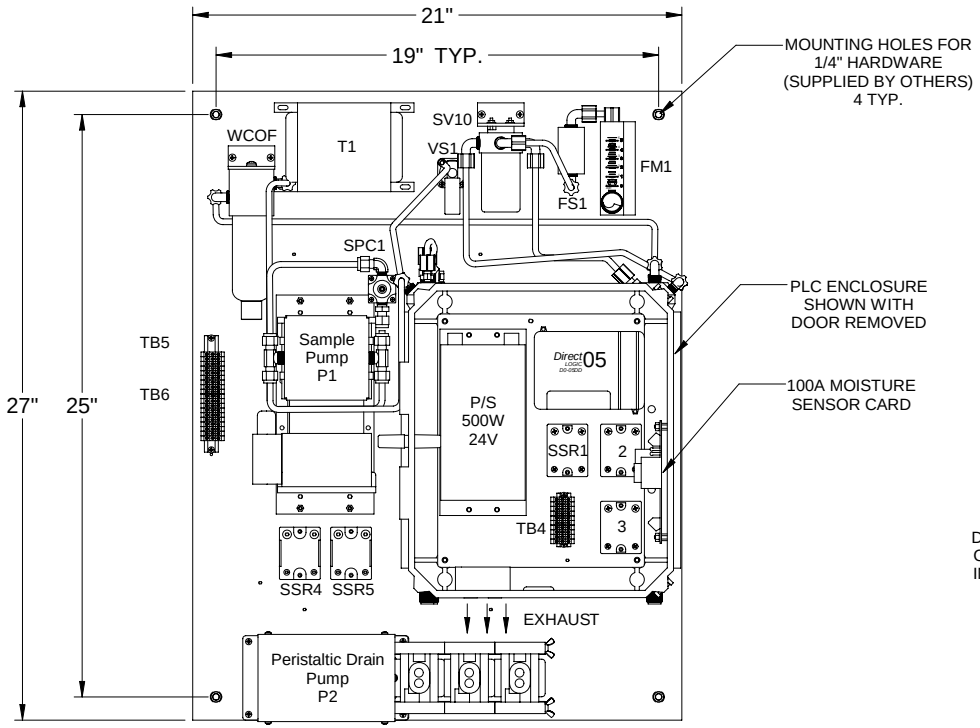
1). Arrangement may vary according to good engineering and assembly practices.

2). See Sheet 3 for P&ID.

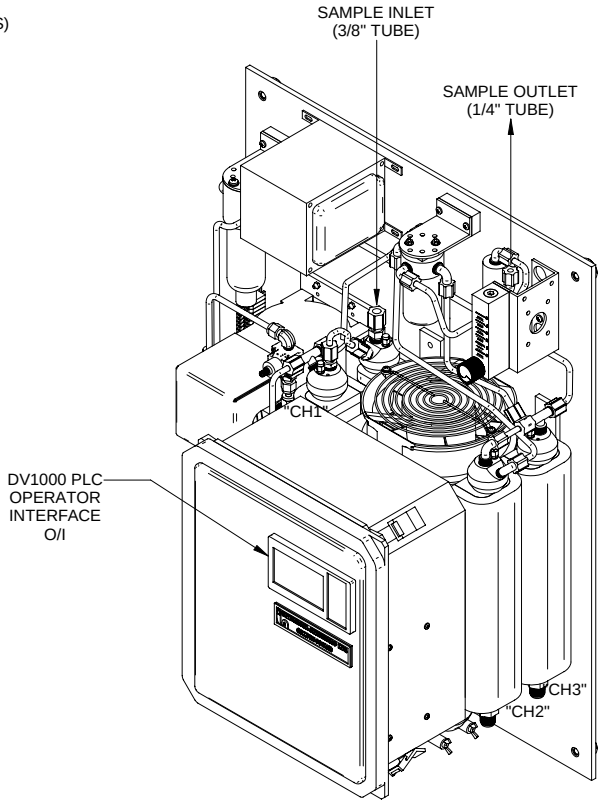
3). See Sheet 4 for 115Vac Wiring Schematic.

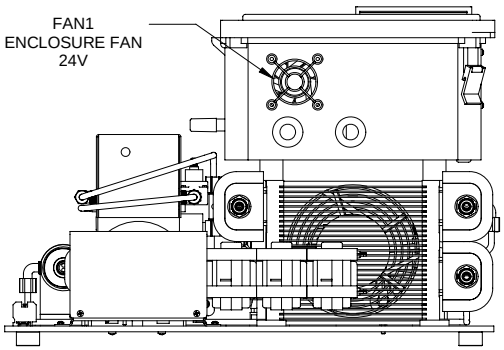
4). See Sheet 5 for 230Vac Wiring Schematic.

UNIVERSAL ANALYZERS INC. 1701 South Sutro Terrace Carson City, Nevada 89706 USA			Y	11/27/06	Revised Per Sheet 5	RW GE
			REV	DATE	DESCRIPTION	DWN APVD
			REVISIONS			
SCP-1095-05-OI LAYOUT & DIMENSIONS			DATE 07/07/2003	SCALE NTS	SIZE D	SHEET 1 OF 5
PART NO.	FOR		DRAWN BY E. Musselman		DRAWING NO. P0728	
Not Issued	Instrument		APVD BY R. Daniel			



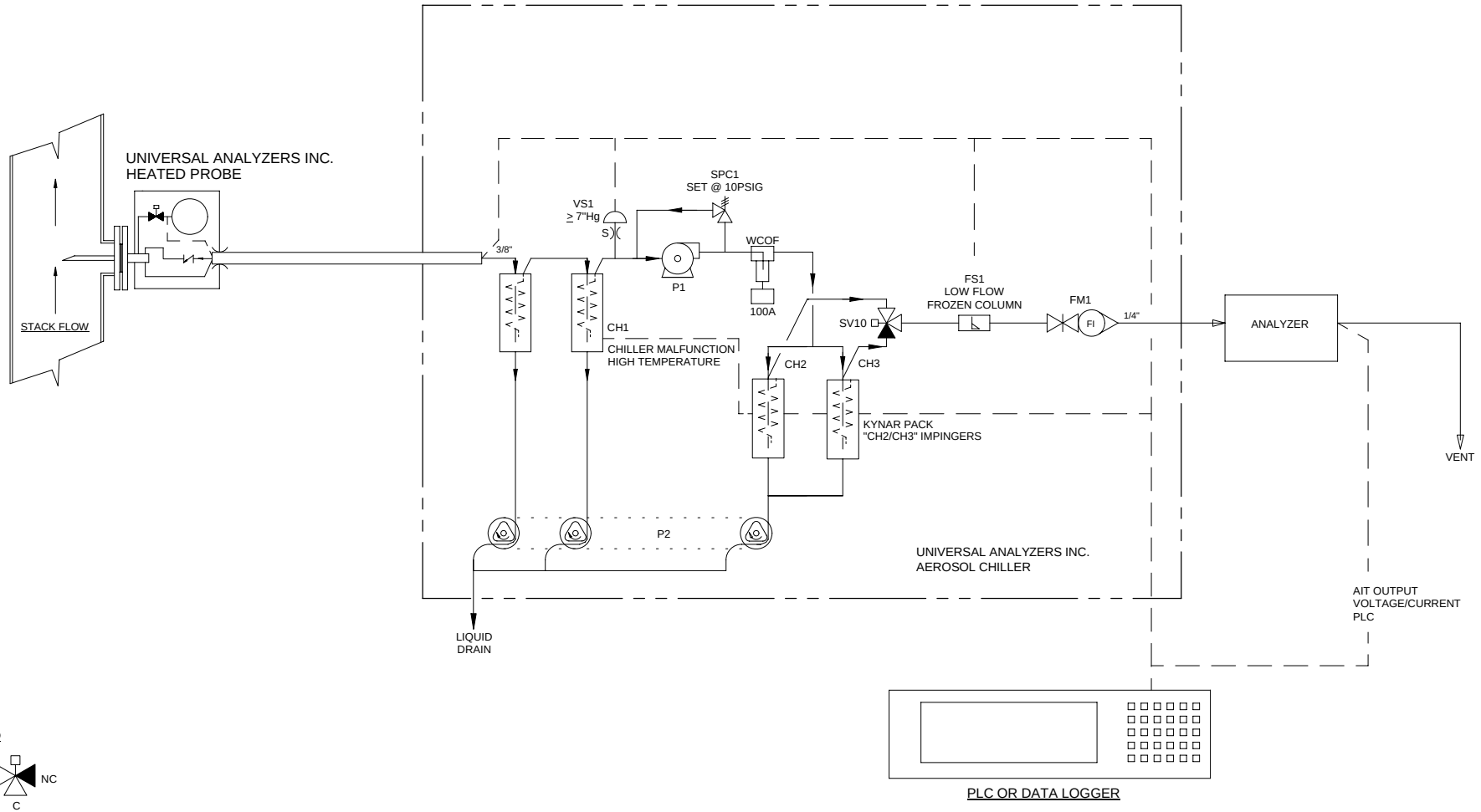
FRONT VIEW





BOTTOM VIEW

UNIVERSAL ANALYZERS INC. 1701 South Sutro Terrace Carson City, Nevada 89706 USA			Y	11/27/06	Revised Per Sheet 5	RW GE
			REV	DATE	DESCRIPTION	DWN APVD
			REVISIONS			
SCP-1095-05-OI-230VAC LAYOUT & DIMENSIONS			DATE 07/07/2003	SCALE NTS	SIZE D	SHEET 2 OF 5
PART NO.	FOR		DRAWN BY E. Musselman		DRAWING NO. P0728	
Not Issued	Instrument		APVD BY R. Daniel			



LEGEND

3 Way Valve Typical

115vac System Components

Item	Qty	Description	UAI Part No.
VS1	1	Switch - Vacuum Air Logic 0-29"Hg	3103-0017
WCOF	1	Water Carry Over Sensor - Filtered 2 Micron	4980-0005
SPC1	1	Sample Pressure Control	4955-0246
P1	1	Sample Pump - 115Vac Single Heated Head Mini Dia Vac	4958-0125
FS1	1	Flow Switch ≈560cc/m	3103-0051
SV10	1	Solenoid Valve - 115Vac 3-Way Teflon	4955-0048
P1	1	Peristaltic Drain Pump - 115Vac Triple Head	4958-0080
FM1	1	Flowmeter w/ Needle Valve 0-5 l/m	4965-0008
S) (	1	Snubber - #6-32	0000-0000
CHILLER	1	Universal Analyzers Model 1095 Aerosol Chiller	1095

230vac System Components

Item	Qty	Description	UAI Part No.
VS1	1	Switch - Vacuum Air Logic 0-29"hg	3103-0017
WCOF	1	Water Carry Over Sensor - Filtered 2 Micron	4980-0005
SPC1	1	Sample Pressure Controller	4955-0246
P1	1	Sample Pump - 115Vac Single Heated Head Mini Dia Vac	4958-0125
FS1	1	Flow Switch ≈560cc/m	3103-0051
SV10	1	Solenoid Valve - 115Vac 3-Way Teflon	4955-0048
P1	1	Peristaltic Drain Pump - 230Vac Triple Head	4958-0081
FM1	1	Flowmeter w/ Needle Valve 0-5 l/m	4965-0008
S) (	1	Snubber - #6-32	0000-0000
CHILLER	1	Universal Analyzers Model 1095 Aerosol Chiller	1095

UNIVERSAL ANALYZERS INC.
1701 South Sutro Terrace
Carson City, Nevada 89706 USA

SCP-1095-05-OI
P & ID

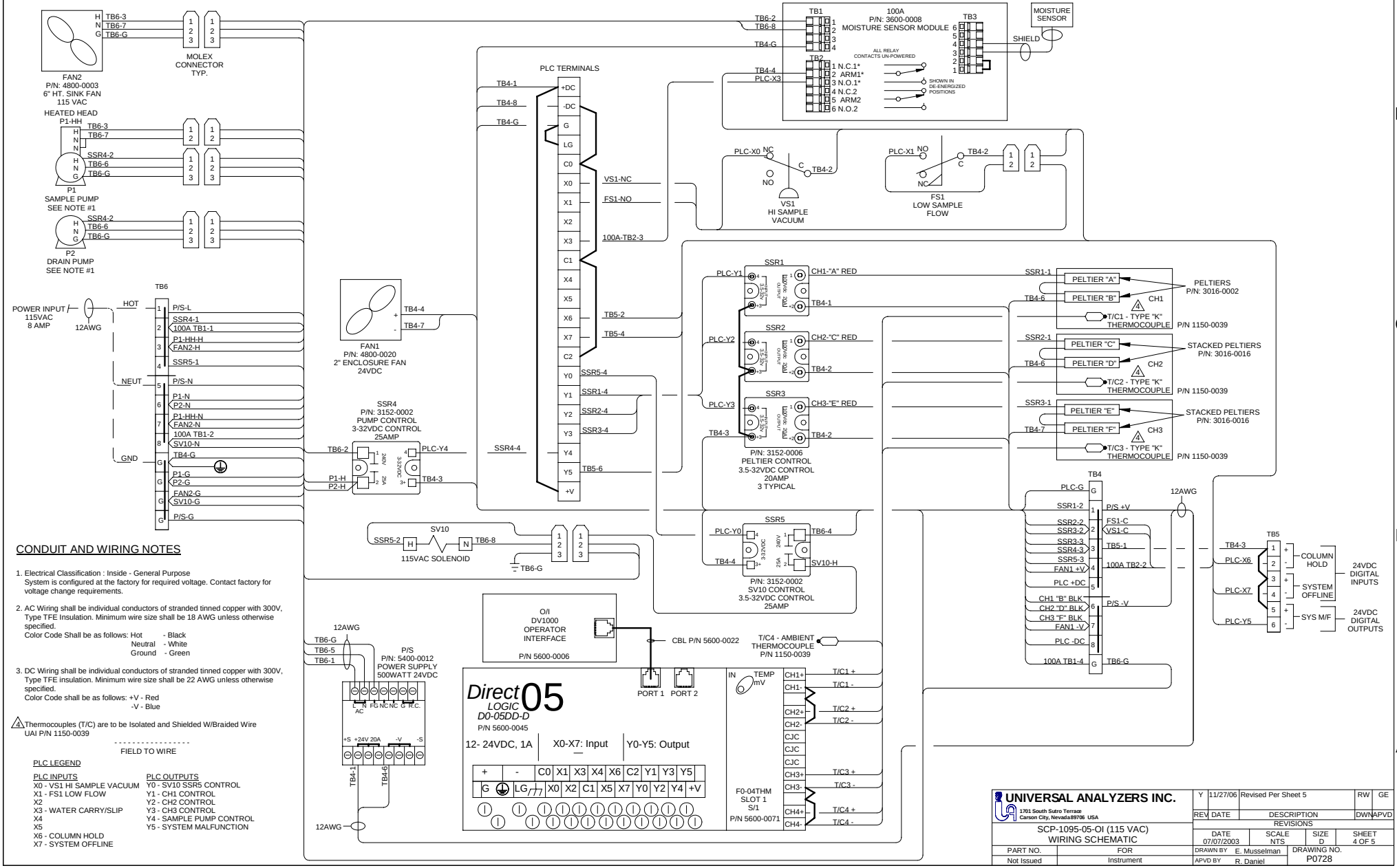
PART NO.	FOR
Not Issued	Instrument

REV	DATE	DESCRIPTION	DWN	APVD
Y	11/27/06	Revised Per Sheet 5	RW	GE

REVISIONS

DATE	SCALE	SIZE	SHEET
07/07/2003	NTS	D	3 OF 5

DRAWN BY E. Musselman
APVD BY R. Daniel
DRAWING NO. P0728



CONDUIT AND WIRING NOTES

1. Electrical Classification : Inside - General Purpose
   System is configured at the factory for required voltage. Contact factory for voltage change requirements.

2. AC Wiring shall be individual conductors of stranded tinned copper with 300V, Type TFE Insulation. Minimum wire size shall be 18 AWG unless otherwise specified.
   Color Code Shall be as follows: Hot - Black
   Neutral - White
   Ground - Green

3. DC Wiring shall be individual conductors of stranded tinned copper with 300V, Type TFE insulation. Minimum wire size shall be 22 AWG unless otherwise specified.
   Color Code shall be as follows: +V - Red
   -V - Blue

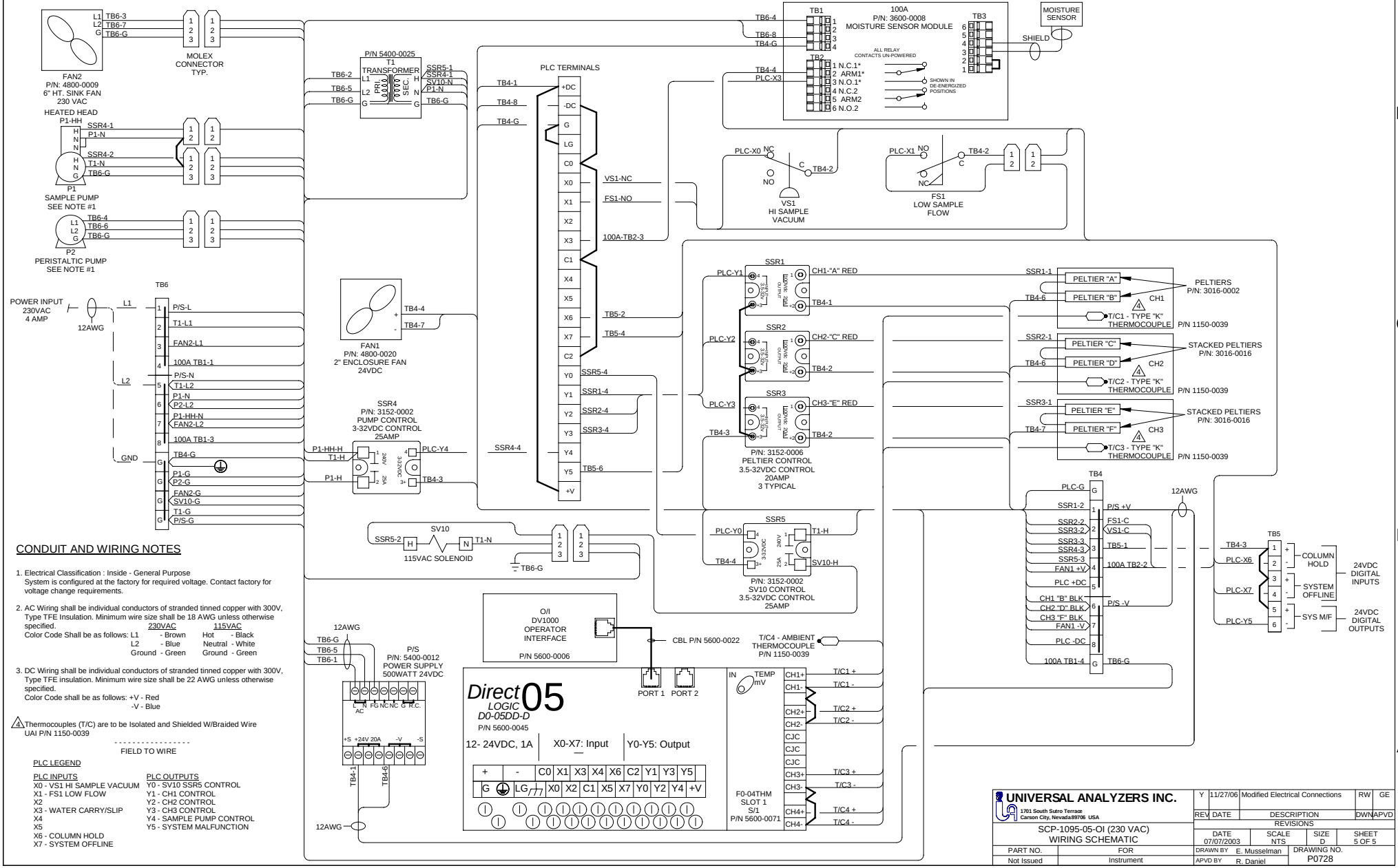
4. Thermocouples (T/C) are to be Isolated and Shielded W/Braided Wire
   UAI P/N 1150-0039

FIELD TO WIRE

PLC LEGEND

PLC INPUTS	PLC OUTPUTS
X0 - VS1 HI SAMPLE VACUUM	Y0 - SV10 SSR5 CONTROL
X1 - FS1 LOW FLOW	Y1 - CH1 CONTROL
X2	Y2 - CH2 CONTROL
X3 - WATER CARRY/SLIP	Y3 - CH3 CONTROL
X4	Y4 - SAMPLE PUMP CONTROL
X5	Y5 - SYSTEM MALFUNCTION
X6 - COLUMN HOLD	
X7 - SYSTEM OFFLINE	

UNIVERSAL ANALYZERS INC. 1701 South Sutro Terrace Carson City, Nevada 89706 USA		Y 11/27/06 Revised Per Sheet 5	RW GE
		REV DATE DESCRIPTION	DWN APVD
SCP-1095-05-OI (115 VAC) WIRING SCHEMATIC		REVISIONS	
		DATE 07/07/2003	SCALE NTS
		SIZE D	SHEET 4 OF 5
PART NO. Not Issued	FOR Instrument	DRAWN BY E. Musselman	DRAWING NO. P0728
		APVD BY R. Daniel	



CONDUIT AND WIRING NOTES

1. Electrical Classification : Inside - General Purpose
   System is configured at the factory for required voltage. Contact factory for voltage change requirements.

2. AC Wiring shall be individual conductors of stranded tinned copper with 300V, Type TFE Insulation. Minimum wire size shall be 18 AWG unless otherwise specified.

Color Code Shall be as follows:	230VAC	115VAC
L1	- Brown	Hot - Black
L2	- Blue	Neutral - White
Ground	- Green	Ground - Green

3. DC Wiring shall be individual conductors of stranded tinned copper with 300V, Type TFE insulation. Minimum wire size shall be 22 AWG unless otherwise specified.
   Color Code shall be as follows: +V - Red
   -V - Blue

4 Thermocouples (T/C) are to be Isolated and Shielded W/Braided Wire
UAI P/N 1150-0039

FIELD TO WIRE

PLC LEGEND

PLC INPUTS	PLC OUTPUTS
X0 - VS1 HI SAMPLE VACUUM	Y0 - SV10 SSR5 CONTROL
X1 - FS1 LOW FLOW	Y1 - CH1 CONTROL
X2	Y2 - CH2 CONTROL
X3 - WATER CARRY/SLIP	Y3 - CH3 CONTROL
X4	Y4 - SAMPLE PUMP CONTROL
X5	Y5 - SYSTEM MALFUNCTION
X6 - COLUMN HOLD	
X7 - SYSTEM OFFLINE	

UNIVERSAL ANALYZERS INC.
1701 South Sutro Terrace
Carson City, Nevada 89706 USA

SCP-1095-05-OI (230 VAC)
WIRING SCHEMATIC

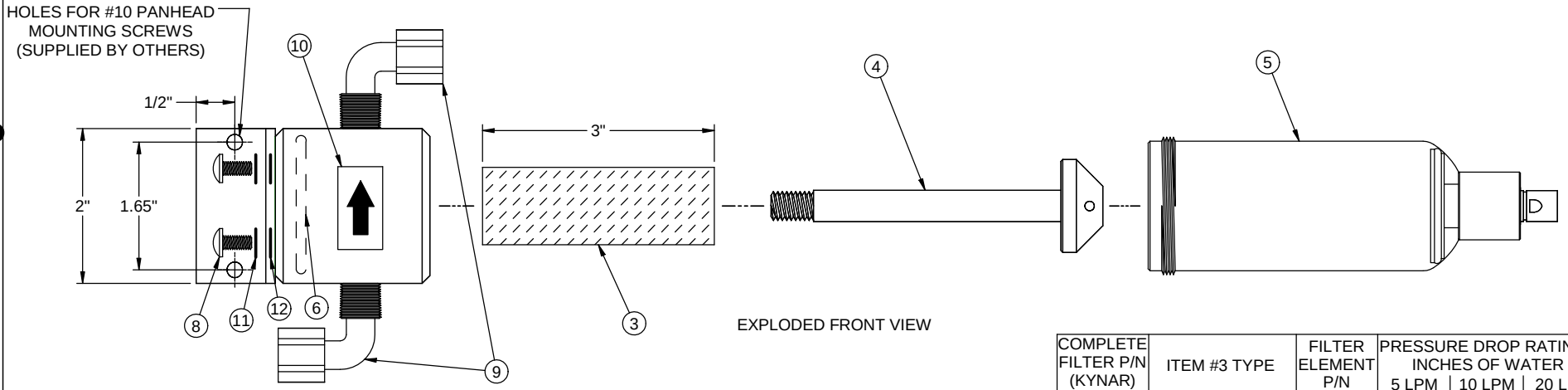
PART NO.	FOR
Not Issued	Instrument

REV	DATE	DESCRIPTION	DWN	APVD
Y	11/27/06	Modified Electrical Connections	RW	GE

REVISIONS

DATE	SCALE	SIZE	SHEET
07/07/2003	NTS	D	5 OF 5

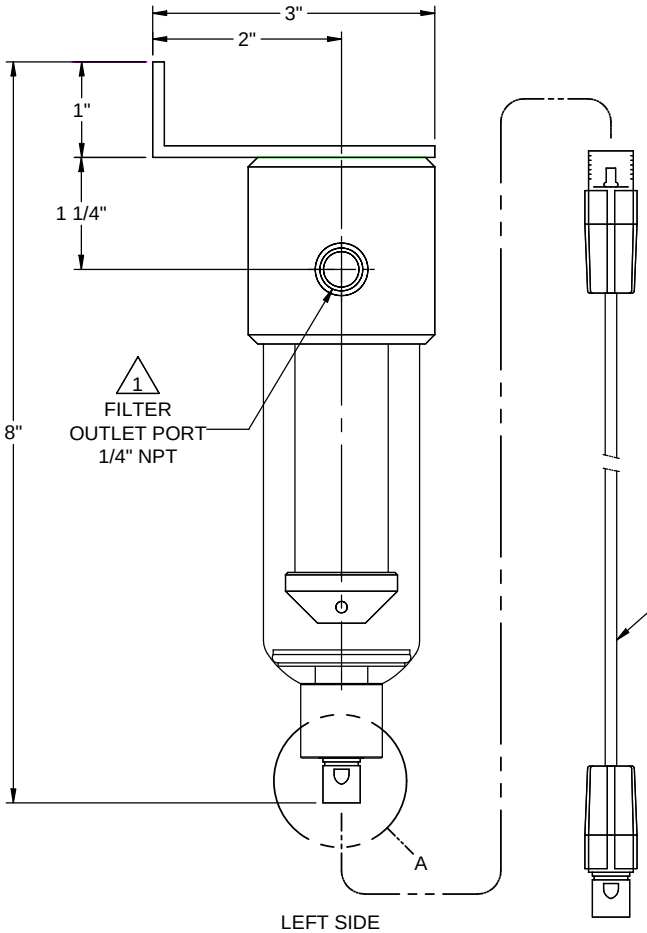
DRAWN BY E. Musselman
APVD BY R. Daniel
DRAWING NO. P0728



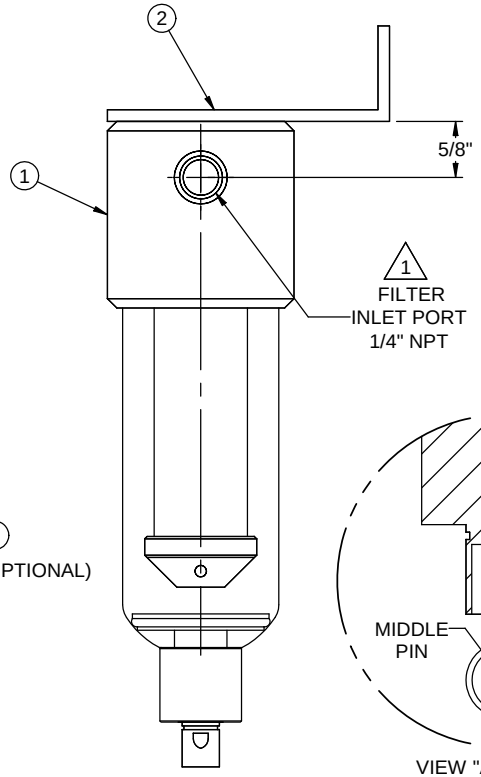
EXPLODED FRONT VIEW

COMPLETE FILTER P/N (KYNAR)	ITEM #3 TYPE	FILTER ELEMENT P/N	PRESSURE DROP RATINGS INCHES OF WATER		
			5 LPM	10 LPM	20 LPM
4980-0039	SINTERED S.S.	4980-0023	10	14	24
4980-0058	PAPER	4980-0022	8	12	20
4980-0005	TEFLON	4980-0006	4	6	10
4980-0009	CERAMIC	4980-0007	4	6	10
4980-0059	COATED CERAMIC	4980-0018	6	8	12

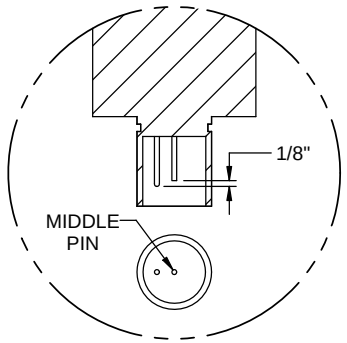
1 FOR COALESCING (COATED CERAMIC WCOF) P/N 4980-0059 SAMPLE INLET & OUTLET PORTS ARE REVERSED.



LEFT SIDE



RIGHT SIDE



VIEW "A" - 2x SCALE
VERIFY BEFORE CONNECTING THAT MIDDLE PIN IS SHORTER THAN OUTSIDE PIN. IF NOT, CUT MIDDLE PIN AS SHOWN

J	09/22/08	UPDATE PART LIST	MW	DA
REV	DATE	DESCRIPTION	DWN	APVD

REVISIONS

ITEM	QTY	DWG NO.	PART NO.	DESCRIPTION
12	2	-	4710-0008	FLAT WASHER
11	2	-	4710-0016	STAR WASHER
10	1	-	5001-0004	RED DIRECTIONAL LABEL
9	2	-	4953-0001	ELBOW 1/4"X1/4" TUBE
8	2	-	4704-0024	10-32X1/2" FLAT HEAD
7	1	-	3907-0052	14" EXT. CABLE
6	1	-	4904-0006	O-RING 2-030
5	1	-	5205-0038	BOWL ASSEMBLY
4	1	-	5110-0012	RETAINER
3	1	-	SEE TABLE	FILTER ELEMENT
2	1	-	5008-0004	BRACKET
1	1	-	5110-0011	KYNAR HEAD

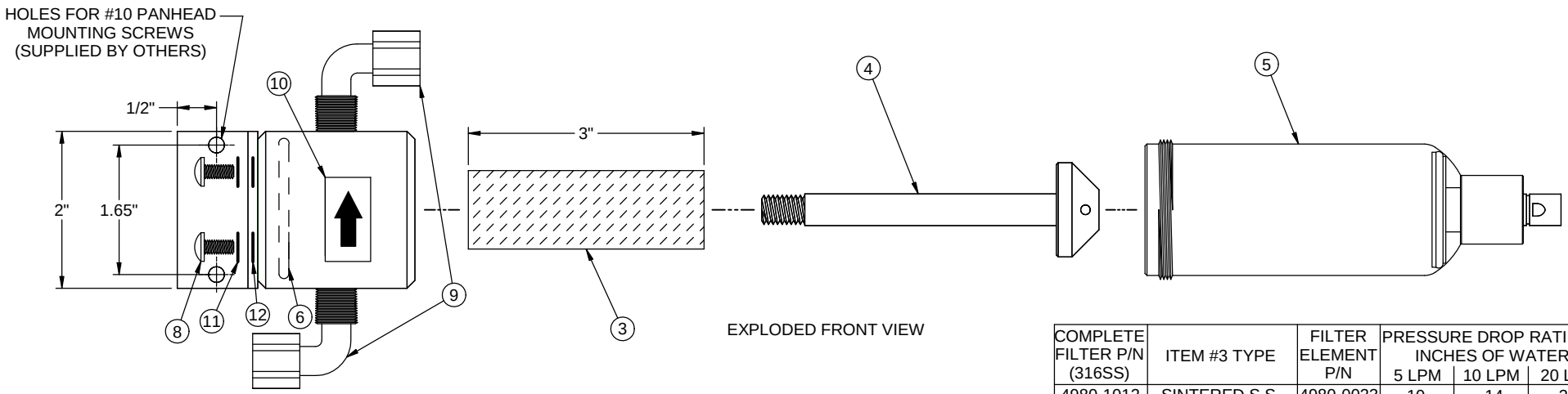
VISIBLE GAS FILTER WITH MOISTURE SENSOR (W.C.O.F.)

PART NO.	FOR
SEE TABLE	INSTRUMENT

UNIVERSAL ANALYZERS INC.
5200 Convair Drive
Carson City, Nevada 89706 USA

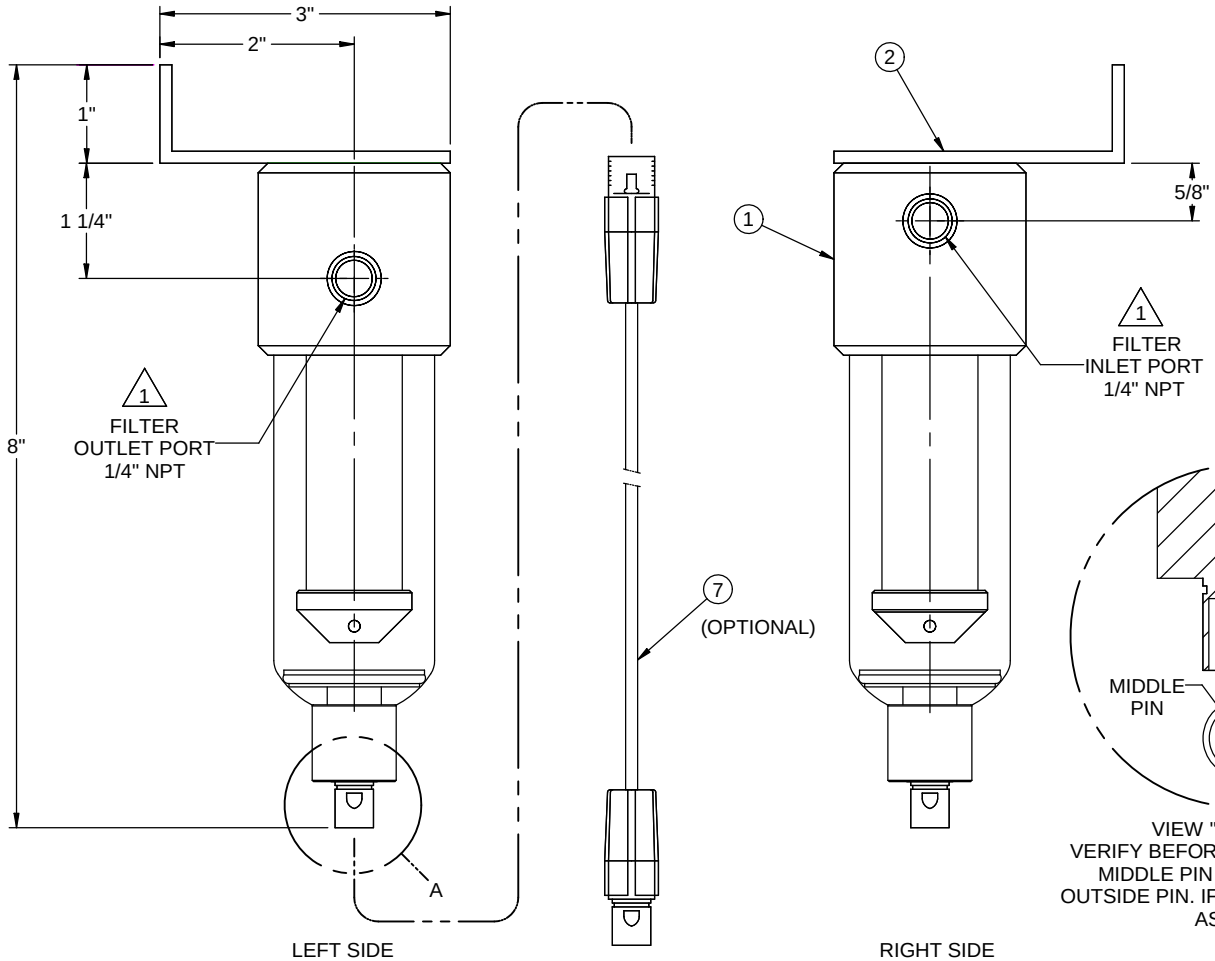
DRAWN BY	HARVEY MITCHELL	DRAWING NO
APVD BY	TED BARBEN II	P0018

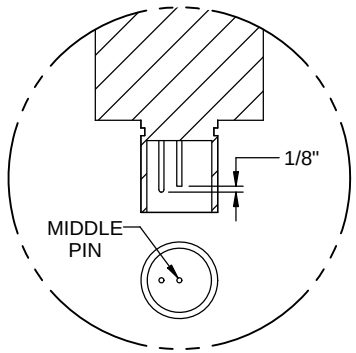
DATE	SCALE	SIZE	SHEET
04/14/92	1 : 1	C	1 OF 2



COMPLETE FILTER P/N (316SS)	ITEM #3 TYPE	FILTER ELEMENT P/N	PRESSURE DROP RATINGS INCHES OF WATER		
			5 LPM	10 LPM	20 LPM
4980-1012	SINTERED S.S.	4980-0023	10	14	24
4980-1013	PAPER	4980-0022	8	12	20
4980-1014	TEFLON	4980-0006	4	6	10
4980-1015	CERAMIC	4980-0007	4	6	10
4980-1016	COATED CERAMIC	4980-0018	6	8	12

△1 FOR COALESCING (COATED CERAMIC WCOF) P/N 4980-0059 SAMPLE INLET & OUTLET PORTS ARE REVERSED.





VIEW "A" - 2x SCALE
VERIFY BEFORE CONNECTING THAT MIDDLE PIN IS SHORTER THAN OUTSIDE PIN. IF NOT, CUT MIDDLE PIN AS SHOWN

REV	DATE	DESCRIPTION	DWN	APVD
J	09/22/08	UPDATE PART LIST	MW	DA

REVISIONS

ITEM	QTY	DWG NO.	PART NO.	DESCRIPTION
12	2	-	4710-0008	FLAT WASHER
11	2	-	4710-0016	STAR WASHER
10	1	-	5001-0004	RED DIRECTIONAL LABEL
9	2	-	4953-0001	ELBOW 1/4"X1/4" TUBE
8	2	-	4704-0024	10-32X1/2" FLAT HEAD
7	1	-	3907-0052	14" EXT. CABLE
6	1	-	4904-0006	O-RING 2-030
5	1	-	5205-0038	BOWL ASSEMBLY
4	1	-	5110-0012	RETAINER
3	1	-	SEE TABLE	FILTER ELEMENT
2	1	-	5008-0005	BRACKET
1	1	-	5150-1015	CHAMBER UPPER 316SS

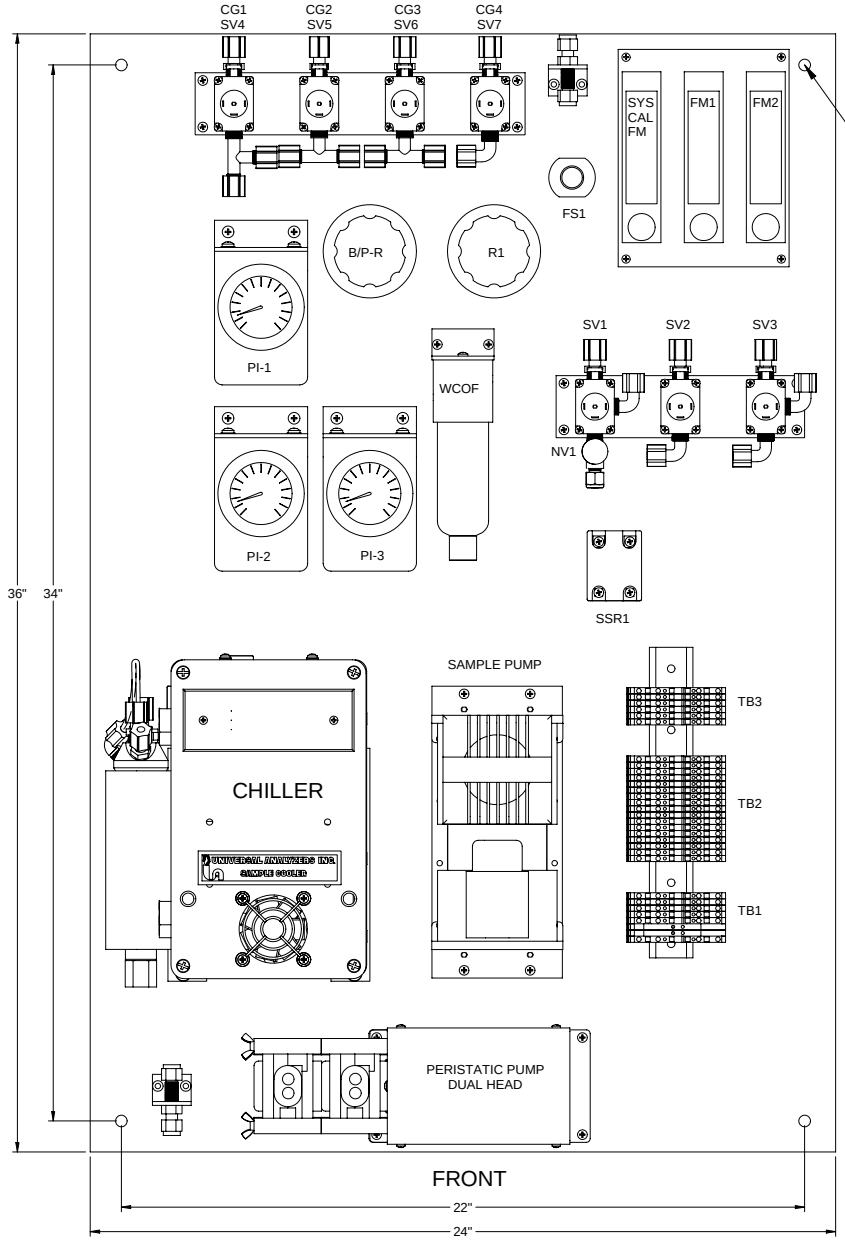
VISIBLE GAS FILTER WITH MOISTURE SENSOR (W.C.O.F.S.S.)

PART NO.	FOR
SEE TABLE	INSTRUMENT

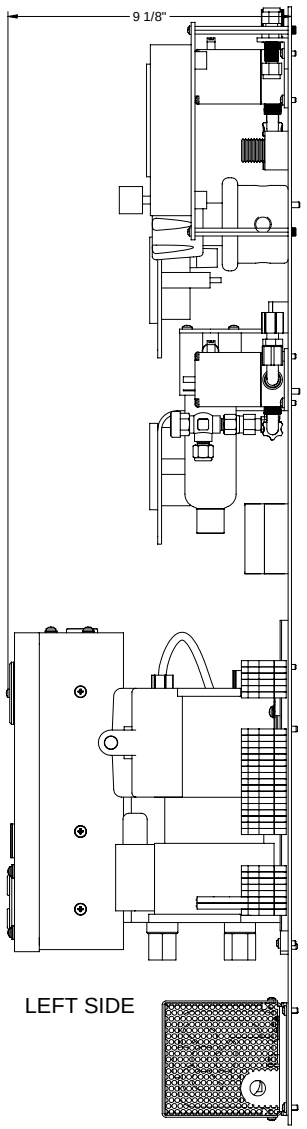
UNIVERSAL ANALYZERS INC.
1701 South Sutro Terrace
Carson City, Nevada 89706 USA

DRAWN BY	HARVEY MITCHELL	DRAWING NO
APVD BY	TED BARBEN II	P0018

DATE	SCALE	SIZE	SHEET
04/14/92	1 : 1	C	2 OF 2



MOUNTING HOLES FOR
3/8" HARDWARE
(BY OTHERS)
4 TYP



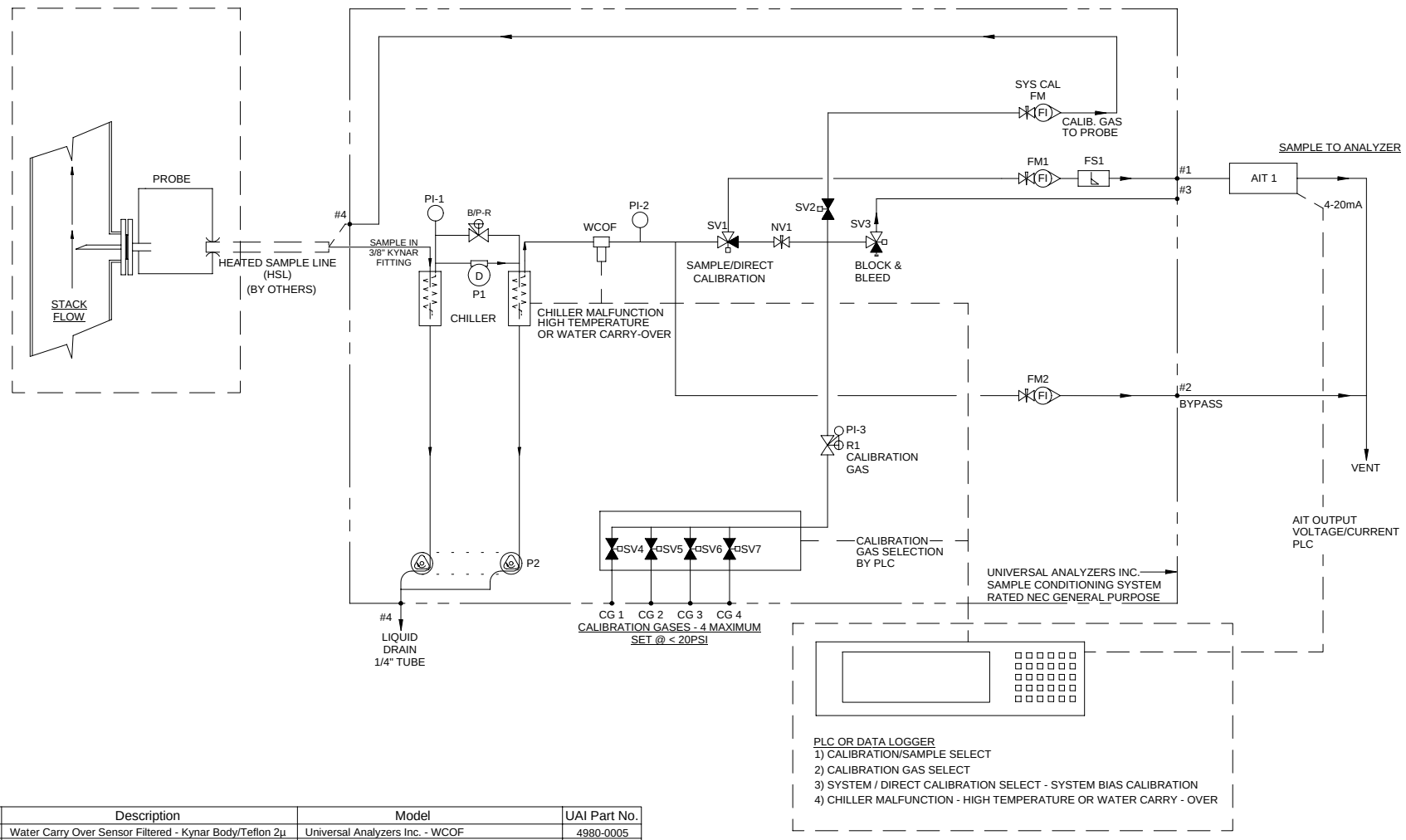
LEFT SIDE

NOTES:
1) ARRANGEMENT MAY VARY ACCORDING TO GOOD ENGINEERING AND ASSEMBLY PRACTICES.

2) SEE SHEET 2 FOR P&ID.

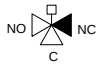
3) SEE SHEET 3 FOR WIRING SCHEMATIC.

UNIVERSAL ANALYZERS INC. 1701 South SutroTerrace Carson City,Nevada 89706 USA		D	03/24/06	REVISE PER SHEET 3	RW	EM
		REV	DATE	DESCRIPTION	DWN	APVD
		REVISIONS				
MODEL SCP66340SS10 P & ID		DATE 10/12/2005	SCALE NTS	SIZE D	SHEET 1 OF 3	
PART NO. 6001-0792	FOR SHELL OIL	DRAWN BY E. Musselman		DRAWING NO. P0994		
		APVD BY				



Item	Qty	Description	Model	UAI Part No.
WCOF	1	Water Carry Over Sensor Filtered - Kynar Body/Teflon 2µ	Universal Analyzers Inc. - WCOF	4980-0005
PI-1	1	Gauge - Vacuum 0-30"Hg Liquid Filled S.S.	Precision Instrumentation - #G425BSG01S	3019-0009
B/P-R	1	Back Pressure Regulator	GO - #BP3-1A11D5D111	8200-0009
P1	1	Sample Pump 120VAC Single Head Teflon / SS	Air Dimensions Inc. - # M161-GT-BA1	4958-0017
SV1 & 3	1	Solenoid Valve - 24VDC 3 Way	Burkert - 330 Series #US03061	4955-0146
SV2, 4-7	1	Solenoid Valve - 24VDC 2 Way	Burkert - 330 Series #457690C	4955-0145
P2	4	Peristaltic Drain Pump - 120VAC Dual Head	Universal Analyzers Inc.	4958-0012
PI-2	5	Gauge - Pressure 0-15psig Liquid Filled S.S.	Precision Instrumentation	3019-0008
PI-3	1	Gauge - Pressure 0-60psig Liquid Filled S.S.	Precision Instrumentation	3019-0024
SYS CAL FM	1	Flowmeter w/ Needle Valve 0-9200 cc/m	King Instrument Co. - #2-14-G-021-2-1-3-7-1	4965-0033
FM1	1	Flowmeter w/ Needle Valve 0-5600 cc/m	King Instrument Co. - #1-23-G-081-4-1-3-7	4965-0035
FM2	1	Flowmeter w/ Needle Valve 0-6200 cc/m	King Instrument Co. - #1-23-G-081-5-1-3-7-1	4965-0036
FS1	1	Flow Switch	Autoflow - Micro Flow # FS6202-C-V-1	3103-0029
CHILLER	1	Universal Analyzers Model 560SS	Universal Analyzers Model 560SS	560SS
R1	1	Regulator 0-50psig	Regulator - GO Model #PR51A11D5D114	8200-0017
NV1	1	Needle Valve - SS	Swagelok - #SS-4LA	4955-0093

LEGEND



3 Way Valve Typical

ALL EXTERNAL TUBE FITTINGS 1/4" SS WITH THE EXCEPTION OF SAMPLE INLET 3/8" KYNAR.

ALL EXTERNAL TUBING CONNECTIONS SHALL BE BULKHEAD UNION FITTINGS.

UNIVERSAL ANALYZERS INC.
1701 South SutroTerrace
Carson City,Nevada 89706 USA

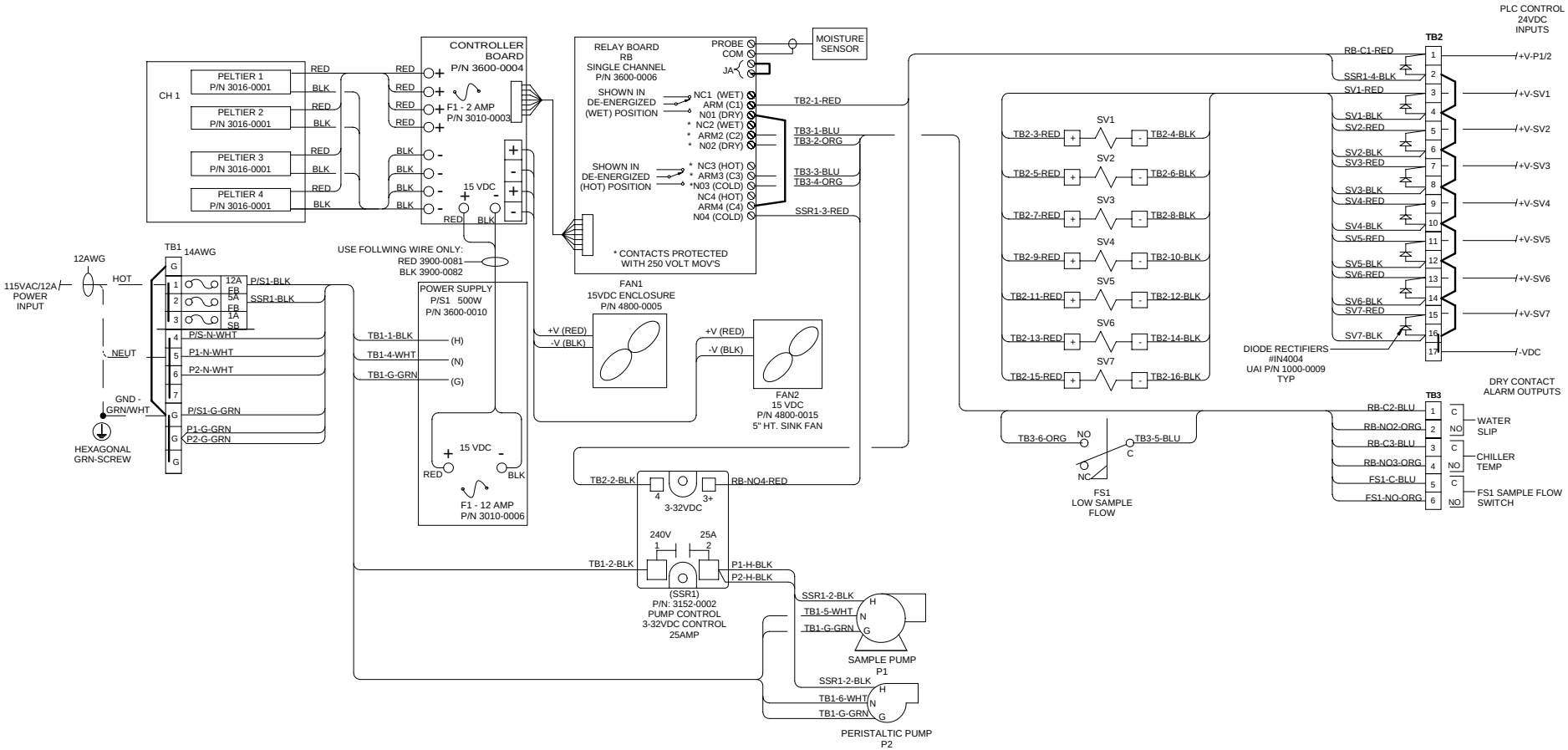
MODEL SCP6340SS10
P & ID

PART NO. 6001-0792
FOR SHELL OIL

REV	DATE	DESCRIPTION	DWN	APVD
D	03/24/06	REVISE PER SHEET 3	RW	EM

REVISIONS

DATE 10/12/2005 | SCALE NTS | SIZE D | SHEET 2 OF 3
DRAWN BY E. Musselman
APVD BY
DRAWING NO. P0994



CONDUIT AND WIRING NOTES

1. Electrical Classification : Inside - General Purpose
2. AC Wiring shall be in accordance with applicable NEC code. Electrical Materials shall be labeled by UL, FM or CSA (Wire & Terminals Only). AC Component wiring, RHH/RHW-2 600-volt insulation will be #14AWG Stranded copper conductor. Instrument wiring/control circuits and or Signal/Alarm less than 120V AC/DC will be #16AWG stranded copper conductor with 300V insulation.
3. All Connectors, sockets and terminals will have Insulating sleeves as applicable.
4. All Terminal Blocks to be mounted a minimum 1" space between the channel and mounting surface. Row seperation between rows up to 24" long will be 4", 6" for longer rows. Terminal strips to plate edge will have a minimum spacing of 4". Terminal BLocks - Use Weidmuller ZDU2.5/4AN Beige #160857, ZDU2.5/4AN White #168348 for Neutral, ZSI2.5/2 # 161649 for Fused Terminals. Maximum 2 Wires per entry.
5. All wires to be individually identified with Purchaser Tag Number, designations both ends, and heatshrink labels.
6. AC/DC, signal & power wiring will be physically seperated. Panduit fill < 40%.
7. Color Code

AC Power		DC Power		Low Voltage Alarm Wiring	
Hot	- Black	Positive	- Red	NC	- Orange
Common	- White	Negative	- Black	Common	- Blue
Ground	- Green				

FIELD TO WIRE

UNIVERSAL ANALYZERS INC.
1701 South SutroTerrace
Carson City,Nevada 89706 USA

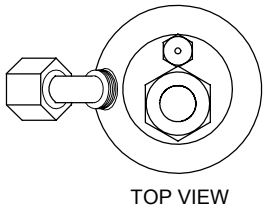
REV	DATE	DESCRIPTION	DWN	APVD
D	03/24/06	Add Jumper to TB1 Ground	RW	EM

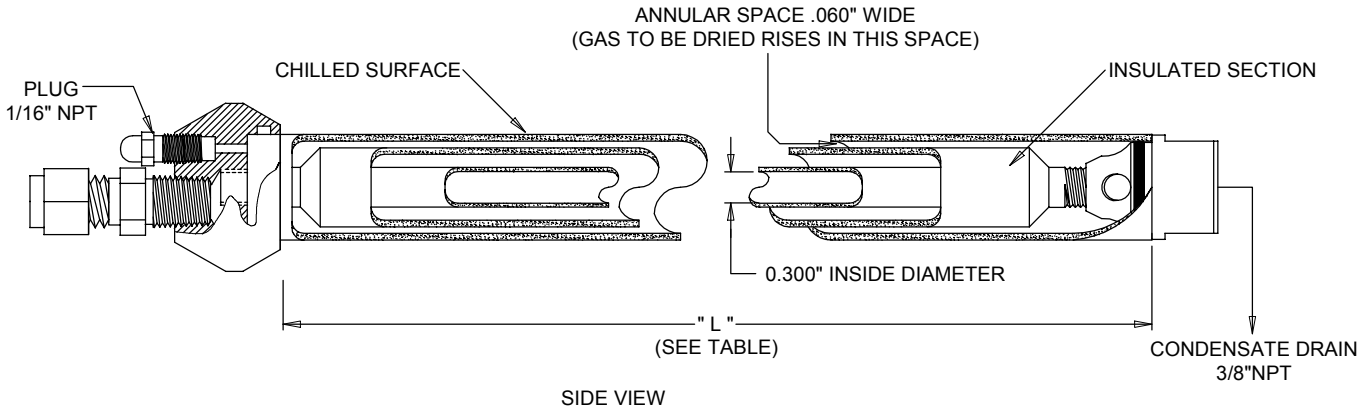
REVISIONS

MODEL SCP66340SS10
P & ID

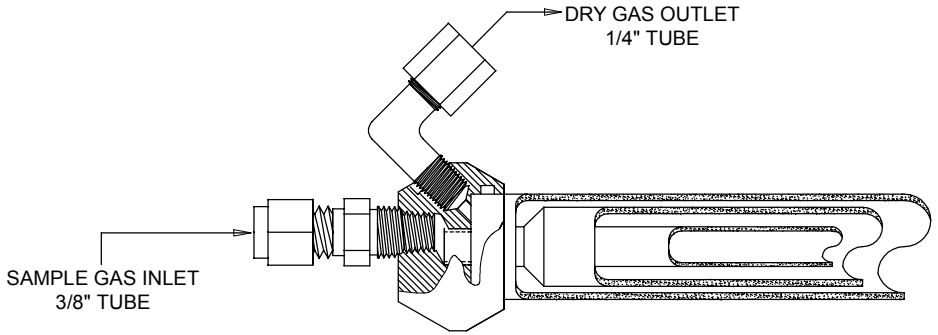
DATE	SCALE	SIZE	SHEET
10/12/2005	NTS	D	3 OF 3

PART NO.	FOR	DRAWN BY	DRAWING NO.
6001-0792	SHELL OIL	E. Musselman	P0994
		APVD BY	





SIDE VIEW



1). SEE SHEET 2 FOR ASSEMBLY INSTRUCTIONS.

LENGTH "L"	GLASS KYNAR HEAT EXCHANGER ASSEMBLY P/N	UNIVERSAL ANALYZERS SAMPLE COOLER MODELS	QTY OF EXCHANGERS PER SAMPLE COOLER
5"	5200-K050	520	1
		530	2
		540	2
		570	4
10"	5200-K010	1040	1
		1050	2
		1060	2
		1080	2
		1090	4
15"	5200-K015	FGA2	1

REV	DATE	DESCRIPTION	DWN	APVD
C	01/19/04	Revision Per Sheet 2	RPH	TB

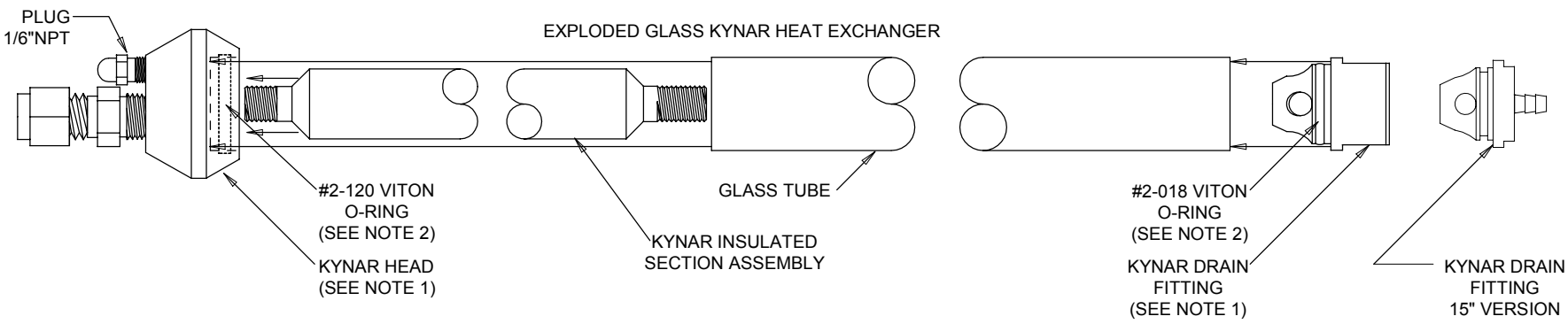
REVISIONS

HEAT EXCHANGER GLASS / KYNAR NON-TEMPERATURE SENSING OUTLINE

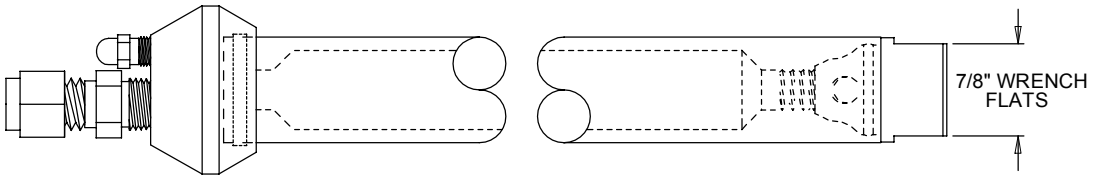
PART NO. SEE TABLE | FOR INSTRUMENT

UNIVERSAL ANALYZERS INC.
1701 South Sutro Terrace
Carson City, Nevada 89706 USA

DRAWN BY	EV MUSSELMAN	DRAWING NO	P0149
APVD BY	H. MITCHELL		
DATE	12/11/95	SCALE 1 : 1	SIZE C	SHEET 1 OF 2



SPARE PARTS LIST								
GLASS KYNAR HEAT EXCHANGER ASSEMBLY		KYNAR INSULATED SECTION ASSY	GLASS TUBE	KYNAR DRAIN FITTING	#2-120 VITON O-RING	#2-018 VITON O-RING	KYNAR HEAD	1/16" NPT PLUG
LENGTH "L"	P/N	P/N	P/N	P/N	P/N	P/N	P/N	P/N
5"	5200-K050	5110-2003	5201-0002	5110-2002	4904-0004	4904-0003	5201-0017	4951-0066
10"	5200-K010	5110-2004	5201-0001	"	"	"	"	"
15"	5200-K015	5110-2006	5201-0078	5201-0066	"	"	"	"



COMPLETE GLASS KYNAR
HEAT EXCHANGER ASSEMBLY

NOTES:

1). O-RINGS ARE FACTORY INSTALLED IN KYNAR HEAD AND KYNAR DRAIN FITTINGS

2). LIGHTLY LUBRICATE O-RINGS WITH SILICONE GREASE BEFORE ASSEMBLY.

REV	DATE	DESCRIPTION	DWN	APVD
C	01/19/04	Added Kynar Drain P/N for 15" Length	RPH	TB

REVISIONS

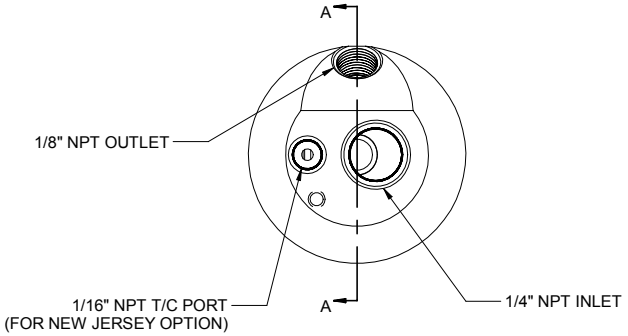
HEAT EXCHANGER GLASS / KYNAR NON-TEMPERATURE SENSING SPARE PART INSTALLATION

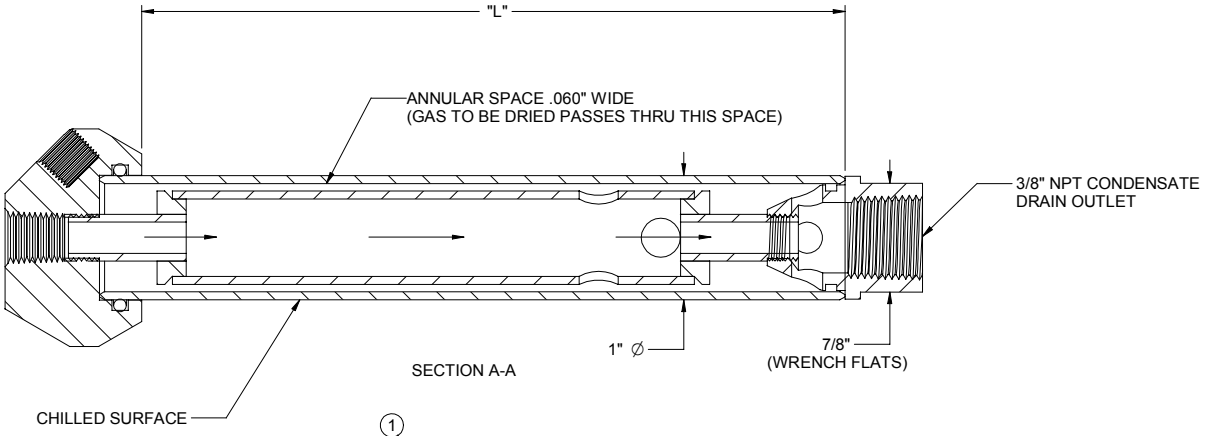
PART NO.	FOR
SEE TABLE	INSTRUMENT

UNIVERSAL ANALYZERS INC.
1701 South Sutro Terrace
Carson City, Nevada 89706 USA

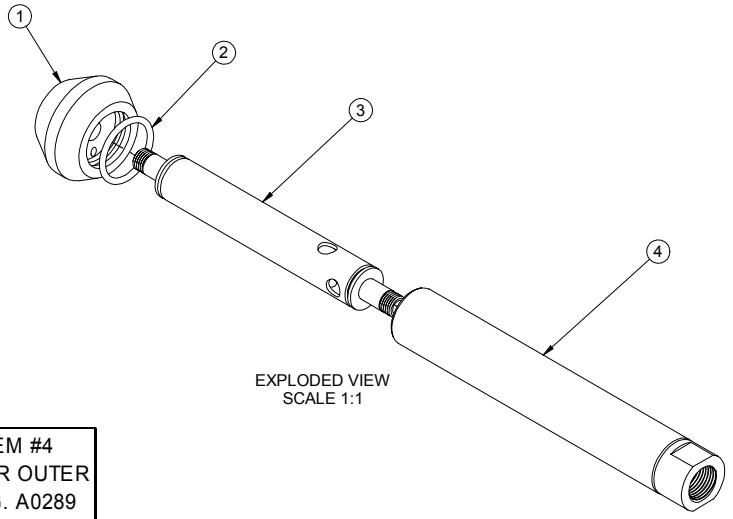
DRAWN BY	EV MUSSELMAN	DRAWING NO
APVD BY	H. MITCHELL	P0149

DATE	SCALE	SIZE	SHEET
12/11/95	1 : 1	C	2 OF 2





SECTION A-A



EXPLODED VIEW
SCALE 1:1

NOTES:

1) FULLY THREAD ITEM #3 INTO ITEM #1 TAKING CARE NOT TO OVERTIGHTEN.

2) LIGHTLY LUBRICATE O-RINGS WITH SILICONE GREASE BEFORE ASSEMBLY.

KYNAR/KYNAR HEAT EXCHANGER ASSEMBLY P/N	"L" LENGTH	U.A.I. FREEZER MODELS	ITEM #1 KYNAR HEAD DWG. M0321	ITEM #2 VITON O-RING SIZE 2-120	ITEM #3 KYNAR INNER DWG. A0285	ITEM #4 KYNAR OUTER DWG. A0289
5200-K05F	5"	595	5201-0017	4904-0004	5201-0113	5201-0117
5200-K01F	10"	1085 1095 2085	5201-0017	4904-0004	5201-0115	5201-0118

UNIVERSAL ANALYZERS INC.
1701 South Sutro Terrace
Carson City, Nevada 89706 USA

HEAT EXCHANGER ASSEMBLY
FOR SAMPLE FREEZERS

PART NO. See Table | FOR INSTRUMENT

REV	DATE	DESCRIPTION	DWN	APVD
A	06/21/05	Item 3 Revised	RPH	GE

REVISIONS

DATE 05/31/2005 | SCALE 2:1 | SIZE D | SHEET 1 OF 1

DRAWN BY R. Harder | APVD BY J. Kreck | DRAWING NO. P0965

Universal Analyzers Inc. **1701 South Sutro Terrace Carson City, NV 89706**
Telephone (775) 883-2500 (800) 993-9309
Fax (775) 883-6388

SPARE PARTS RECOMMENDATIONS FOR MODEL 1095E

Level A, Consumable Parts:		**2 Yr Req**
4980-0006	Porous Teflon Filter Element, 2 Microns (WCOF)	9
9515-0140	ADI Mini Heated Dia-Vac Sample Pump Rebuild Kit	3
9216-0002	Peristaltic Pump Tubing, #15, 5 Ft Length	9
Level B, Basic Spare Parts:		
5200-K010	Glass/Kynar Heat Exchanger/Impingers, 10” Pass. & Ch1	
5200-K01F	Kynar/Kynar Pak Freezer Impinger, 10” Ch2 & 3	1
5201-0001	Glass Outer Tube – Replacement for 10” Heat Exchanger	2
4904-0003	O-ring, 2-018, Viton, Glass Heat Exchanger, bottom	2
4904-0004	O-ring, 2-120, Viton, Glass Heat Exchanger, top	2
8010-0001	Heat Sink Paste, 0.1 ounce container	1
Level C, Critical Parts:		
3016-0002	Peltier Element Pair, Ch1 Only	
3016-0016	Peltier Element Pair, Ch2 & 3 Only	
9515-0002	Insulation Kit for Heat Transfer Block, Ch1 Only	
9515-0058	Insulation Kit for Heat Transfer Block, Ch2 & 3 Only	
1150-0048	RTD, PT100 or	3
1150-0039	Thermocouple, Type K	3
4800-0003	Heat Sink Cooling Fan, 115Vac	
4800-0009	Heat Sink Cooling Fan, 230Vac	
4800-0020	Enclosure Cooling Fan, 24Vdc	
5600-0045	PLC, DL-05DD-D CPU	
5600-0105	PLC, F0-04RTD, 4 Ch RTD Module or	
5600-0071	PLC, F0-04THM, 4 Ch T/C Module	
5600-0006	PLC, Operator Interface DV-1000 or	
5600-0218	PLC EA1-S3Ml C-More Micro Touch Screen	
5600-0022	PLC, Shielded Interconnect Cable, DV-1000	
3600-0008	100A Moisture Sensor Module	

Level D, In Depth Parts:

4958-0125	Sample Pump, 115V Single Heated Head Mini Dia-Vac or	
4958-0168	Sample Pump, 230V Single Heated Head Mini Dia-Vac	
4955-0246	Sample Pressure Control, KNF 1	
5205-0006	WCOF Visible Moisture Sensor Bowl Assembly	
4958-0003	Peristaltic Pump Motor, 6 Rpm 115Vac or	1
4958-0031	Peristaltic Pump Motor, 6 Rpm 230Vac	1
4958-0006	Peristaltic Pump Head, #15 Tubing	
5400-0012	Power Supply, 500Watt 24Vdc	
3152-0002	Relay Solid State, 3-32Vdc Cntrl. 240Vac Drv. 25Amp	
3152-0006	Relay Solid State, DC-DC 3-32Vdc Drv. 20Amp	
3103-0051	Flow Switch, 1300cc/min Air “NO” TFE Piston	1
3103-0017	Vacuum Switch, 0-29” Hg, Sample Inlet Vacuum	
4955-0048	Solenoid Valve - Beco 115Vac 3-Way – Teflon or	1
4955-0057	Solenoid Valve - Beco 230Vac 3-Way – Teflon	1
4965-0008	Flow Meter, 0-5 Liters/Min, SS Needle Valve	
4902-0002	Flow Meter Knob	

UNIVERSAL ANALYZERS INC.

MOISTURE CONVERSION TABLE

DEW POINT, DEGREES C.	% WATER BY VOLUME AT SATURATION	% WATER BY WEIGHT AT SATURATION	WATER VAPOR PRESSURE, mm. Hg
-100	0.00000139	0.00000081	0.0000099
-50	0.00388	0.00241	0.0295
-20	0.102	0.0633	0.776
-10	0.256	0.1596	1.950
-5	0.396	0.229	3.014
-4	0.432	0.268	3.280
-3	0.469	0.291	3.569
-2	0.510	0.317	3.880
1	0.555	0.345	4.223
0	0.602	0.364	4.579
1	0.649	0.404	4.937
2	0.696	0.433	5.294
3	0.750	0.466	5.70
4	0.803	0.499	6.10
5	0.861	0.535	6.54
6	0.922	0.573	7.01
7	0.988	0.614	7.51
8	1.06	0.658	8.05
9	1.13	0.702	8.58
10	1.21	0.753	9.15
11	1.29	0.802	9.8
12	1.38	0.860	10.5
13	1.48	0.920	11.2
14	1.58	0.980	12.0
15	1.68	1.044	12.8
20	2.31	1.433	17.5
25	3.13	2.004	23.8
30	4.19	2.64	
35	5.55	3.54	
40	7.28	4.67	
45	9.46	6.12	
50	12.2	8.0	
55	15.5	10.3	
60	19.7	13.3	
65	24.4	16.8	
70	30.7	21.7	
75	38.0	27.8	
80	46.7	35.6	
85	57.2	45.7	
90	69.2	58.4	

Mini Dia-Vac® Diaphragm Sampling Pumps

Single and Double Stage Diaphragm Pumps and Compressors

Meet ADI's Mini Dia-Vac®, the workhorse pump in our stable. The Mini Dia-Vac® pumps are completely self contained and may be used for either built in or portable applications. They are designed as a combination vacuum/pressure pump so you can mount the Mini Dia-Vac® in mid-stream and push or pull air to either end of your system. The Mini Dia-Vac® pumps are ideal for use in laboratories, industrial plants, process control, environmental and remote sampling as well as an ideal choice for OEM customers requiring customized gaseous vacuum/pressure sampling applications.

With the special capacitor run feature and oversized fan, the durable Mini Dia-Vac® is designed to provide you with cooler operating temperatures than many other pumps of its size on the market. You can count on the Mini Dia-Vac® for continuous operation, even under load conditions. This pump has heavy duty bearings and built in overload protection in the motor. The Mini Dia-Vac® is also available with ATEX certified EExd IIC,T4,IP65 as well as Air Driven motors for explosion proof and non-spark appliactions. The Mini Dia-Vac® general purpose motors are UL Listed , CSA and CE approved.

Choose either the single or dual stage design to meet your specific requirements...and let our Mini Dia-Vac® pump start to pass your gas!

Some of the outstanding quality features of the Mini Dia-Vac® include:

- CE approved
- Complete field serviceability
- Continuous operation
- General Purpose, 12-24 V. Brush and Brushless DC, ATEX certified and Air Driven motor options
- Corrosion resistant options
- Wetted parts made of chemically inert material to system performance requirements
- Capacitor-run feature
- Oversized fan to keep motor cool
- Oversized bearings and motor shaft
- Exceptionally quiet at all pressures
- Low maintenance with minimal vibration
- No risk of damage even when inlet or outlet becomes blocked
- Will customize the Mini Dia-Vac® to your specific application

M161-BT-GB2
Single Head Mini Dia-Vac® with ATEX Certified Motor

M162-BT-AA1
Double Head Teflon® coated 316 Stainless Steel Mini Dia-Vac®

M161-BT-AA1
Single Head Teflon® coated Aluminum Mini Dia-Vac®

1371 West Newport Ctr. Drive
Suite 101
Deerfield Beach , FL
33442

Phone: *954-428-7333*
Fax: *954-360-0987*
Email: *info@airdimensions.com*
web: *www.airdimensions.com*

"We Pass Your Gas"

Specifications:

Connecting Rod Material	Aluminum	**Weight**	8lbs. Single, Aluminum 9lbs. Double Aluminum
Motor	1/15 HP, permanent split with 5 UF capacitor	**Port Connections**	1/4 NPT
Ambient Temperature	40° C	**Electrical**	115V, 50/60HZ 1.7 amps 230V, 50/60HZ 0.8 amps

Mini Dia-Vac® Performance

ADI's Dia-Vac® Pumps can Pass Your Gas at the Speed of Need! Due to an increased interest in reducing the pressure, vacuum, and/or flow on the Dia-Vac® pumps, our engineers designed a modified eccentric. This allows you to customize your Dia-Vac® pump to meet your application requirements while at the same time increasing the diaphragm and bearing life. The standard eccentric size is .160 on the Mini Dia-Vac® pumps.

Flow Average Mini Dia-Vac®

Eccentric Size	PSIG	bar	InHg	mbar	CFM	LPM
.080	6.0	0.41	7.0	237	.44	12.5
.100	17.0	1.17	17.0	575	.47	13.5
.120	21.0	1.43	18.0	600	.64	18
.150	27.0	1.86	20.0	676	.72	20.0
.160 (std)	30.0	2.07	22.0	745	.78	22.0
.160 (dbl.)	33.0	2.27	27.0	913	1.28	36.2

- Test Results are approximate.
- Tests performed with 316 stainless steel head, Teflon®/EPDM diaphragm, 3/8 in. diameter hose x 5 ft. line at 75°F, using a std. 1725 rpm motor at 60Hz.
- These test results are for reference only, and are intended to help provide information to the user when determining which pump to buy. Actual pump performance will depend upon the users application.
- Please visit the ADI website at : www.airdimensions.com for complete performance curves.

How to Specify and Order Pumps from Air Dimensions Incorporated

CAPACITY			-	WETTED MATERIALS		-	POWER			-	OPTIONAL
STYLE	**ECC.**	**HEADS**	-	**HEAD**	**DIAPHRAGM**	-	**TYPE**	**VOLTS**	**Hz**	-	**OPTIONS**
M=Mini	17	1		A=Alum	E=Encapsulated		A=Gen. Pur.	A=115	0=N/A		L=Elevated Head
	16*	2		B=Alum (TFECo)	N=EPDM		D=Air Driven	B=230	1=60 1Ph		M=Heated w/K Thermocouple
	15			F=316ss	P=All Teflon		G=XP/ATEX/IIC	H=12(DC)	2=50 1Ph		M2=Heated 65° Thermostat
	14			G=316ss (TFECo)	*T=Tef/EPDM		H=Brushless DC	J=24(DC)			M3=Heated 100° Thermostat
	12			H=Hast C	V=Viton		J=Brush DC	X=N/A			M4=Heated 140° Thermostat
	10			J=Hast C (TFECo)			U=XP/ATEX/IIB				M5=Heated 163° Thermostat
	08			K=Kynar (PVDF)							M6=Heated 200° Thermostat
				P=Electro Polish							
	*Std. Eccentric				*Std. Diaphragm						

EXAMPLE:
M16I-FT-AAI : SINGLE STAGE MINI DIA-VAC® W/ SS HEADS, .160 ECC., TFE/EPDM DIAPHRAGM, 115V/60HZ MOTOR

Note that ADI will always attempt to accommodate any custom application that you may have. Please contact the factory for more information.

954-428-7333 •800-423-6464

info@airdimensions.com • www.airdimensions.com

"We Pass Your Gas"

AIR DIMENSIONS INCORPORATED

1371 West Newport Center Dr., Suite 101, Deerfield Beach, FL 33442
Phone 954-428-7333 or 800-423-6464 Fax 954-360-0987
http://www.airdimensions.com
e-mail address -Info@AirDimensions.com

MINI DIA-VAC®

MAINTENANCE AND DISASSEMBLY INSTRUCTIONS

A. General Operations Characteristics

1. Normal motor coil temperatures may be 160° - 180° F. Winding insulation is Class B.

2. Surrounding temperatures of the pump should remain between 40°-104° F (5°- 40° C)

3. Match electrical power to motor - Serious damage will occur to the motor if wired to an improper voltage.

4. Do not start pump with load of pressure or vacuum on pump head. Additional motor options are available to start under load conditions. Please contact ADI or your local representative for details.

5. Pumps are intended for gaseous operation, eliminate liquids entering pump. It is recommended that the pump is installed at the highest point within the system to prevent the possibility of condensate entering the pump. Additionally pump should be installed in a location protected from moisture contact.

6. Nominal running amps for General Purpose Mini Dia-Vac® at 115/230 volts are 1.03 / 0.51
   Nominal running amps for ATEX Mini Dia-Vac® at 230 volts are 0.95

7. Ensure that your Mini Dia-Vac® pump environment and sample application do not exceed motor capabilities. Mini Dia-Vac® General Purpose motors cannot be used in explosive or flammable gas applications or be located in a hazardous environment. Please contact ADI customer service for clarification.

   To check pumping efficiency, employ suitably damped gauges connected so as to dead-end either pressure or vacuum.

   NOTE: Check each separately, One or the other port must be open during this test.
   Use 0-60 PSI pressure gauge.
   0-30 inch hg. vacuum gauge, (or mercury manometer.)

   Maximum pressure should be 35 PSIG.
   Maximum vacuum should be 20 inches Hg.

B. Maintenance Procedures

1. For all pump parts refer to parts illustration sheet for specific model type. When reassembling pumps it is recommended that a medium strength thread locker such as Loctite® 242® be used on all screws except A19005 and A19006.

2. Motor oiling - No oiling or other lubrication addition is necessary. All bearings are pre-lubricated and shielded from external contamination.

3. Diaphragm Replacement

a) Teflon® coated EPDM (part #A04301 or kit #11305) - Satisfactory operation can be attained for periods of 12 months or more under conditions of light pressure or vacuum loads.
b) Viton® /Nomex (part #A04303 or kit #11307) - same as ***a*** above.

C. Disassembly of Head Section and Service Diaphragm

1. Remove head section by unscrewing the four large bolts (part #A19005). A flat-bladed screw driver may be needed to gently pry the head free of the service diaphragm. **If you have Teflon® coating on the heads use caution not to scratch the surface.

2. The valve body can then be removed by unscrewing the two smaller screws (also accessible on the top of the head section). This part may be freed by gently tapping on these two screws after they have been loosened about three or four turns.

3. When the valve body is removed, check all internal surfaces for any accumulation of dirt. The two valve discs (part #A04004) can be wiped clean and replaced as long as they appear unaffected by usage. The valve gasket (part #A07001) can be easily removed and should be inspected. As a matter of good practice, the valve discs and valve gasket should be replaced during any routine maintenance check of the head section. A once a year routine procedure is recommended.

4. The service diaphragm is secured by the single screw (part #A19301) in its center. Remove this screw with a 5/32" Allen wrench. The diaphragm and its plate should be easily lifted off. Some slight adherence to the metal may occur if the diaphragm has been in use for a long period.

5. When replacing the service diaphragm, a Teflon washer (part #A23001) should be inserted under the head of the diaphragm cap screw. This is added insurance against small gas leaks through screw heads and may be essential in vacuum applications where outside air contamination cannot be tolerated. After tightening the screw, the excess Teflon should be trimmed away.

NOTE: When replacing the service diaphragm, be sure the four projecting studs of the base casting are properly located in the four outer holes provided in the diaphragm before the part is clamped in place. Be sure the diaphragm plate is firmly replaced with its center screw (refer to part E. for Related Torque Values)

D. Disassembly and Replacement of the Connecting Rod

1. Remove head section and service diaphragm as described in (C) above. When this is done and the front screen has been removed, the connecting rod assembly may be taken out (refer to exploded view drawing). Gently pry up and remove the connecting rod cap (part #3301) which is held in place by the diaphragm screw.

2. Loosen but do not remove the counterweight screw. This is accessible from the top of the pump base casting and will require a 5/32" hex Allen wrench. The connecting rod assembly, including counter-weight and fan, will then slide off the motor shaft.

3. To replace the connecting rod assembly, align the flat section on the motor shaft with the counter-weight screw (part #A19309) before sliding the assembly in place. Slide the assembly onto the shaft without letting the connecting rod and housing come in contact (connecting rod should be approxi-mately 1/16 inch from housing). Be careful to maintain the alignment of the flat on the shaft and the counterweight screw when sliding the assembly in place. Tighten the counterweight screw.

   a) Please pay close attention when disassembling dual stage pumps as front and rear fans are not interchangeable.

   b) After prolonged use, the connecting rod assembly may "freeze up" on the motor shaft. A wheel puller may be needed to free the part. When replacing the eccentric assembly, the motor shaft should be lightly coated with a graphite or MDS based lubricant to facilitate future removal.

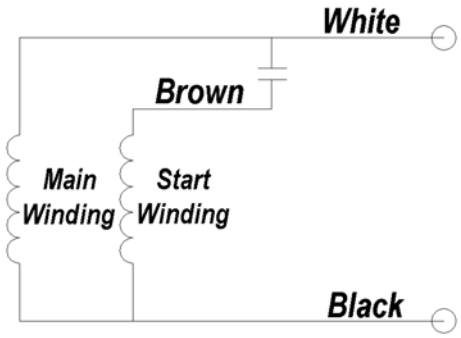
E. Related Torque Values

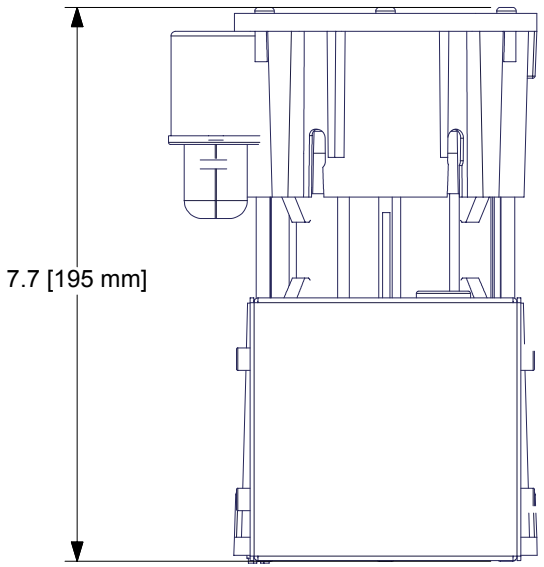
1. Head bolts (A19005) - 110 inch pounds.
2. Valve body screws (A19006)- 70 inch pounds
3. Diaphragm plate screws (A19301) - 70 inch pounds

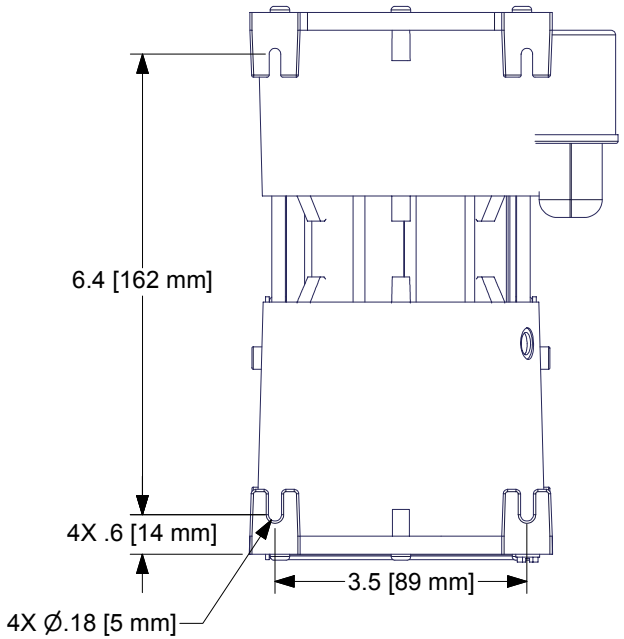
F. Mini General Purpose Motor Amps

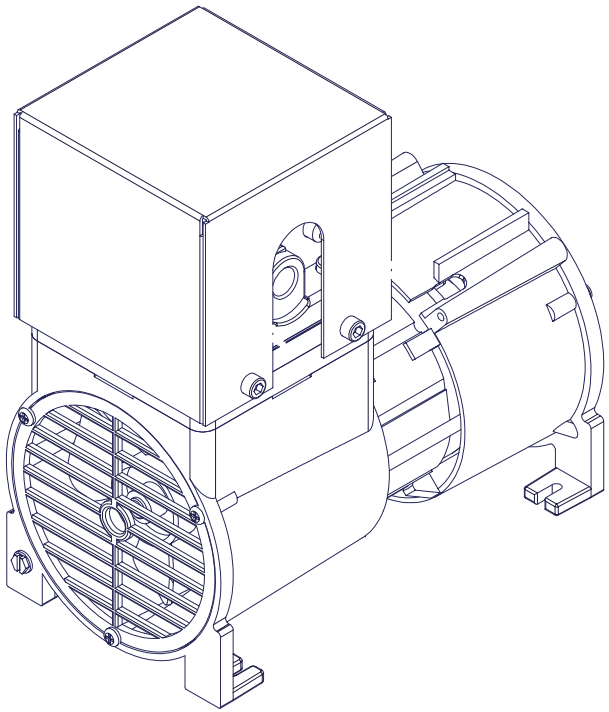
Run. Amps	115v	230v
	1.03	.51

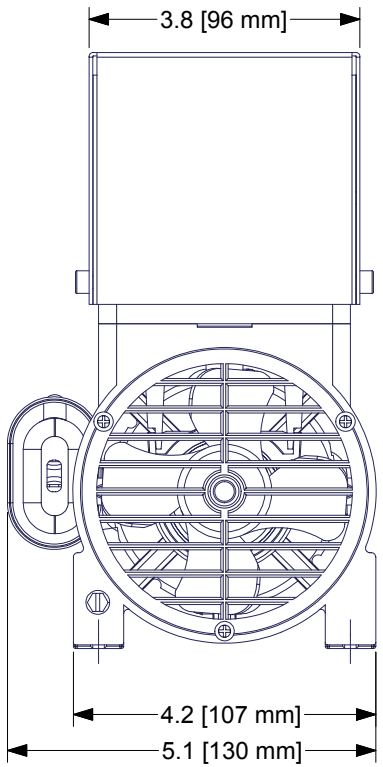
G. Wiring Diagram (General Purpose Motor)

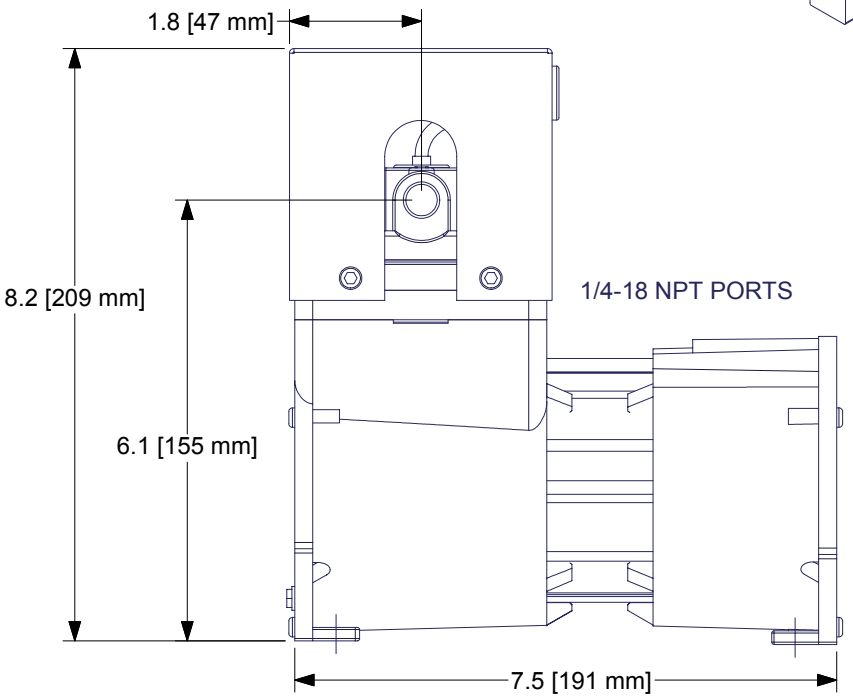












04/04 (0305)

AIR DIMENSIONS INC.
DEERFIELD BEACH, FL. USA 33442
WWW.AIRDIMENSIONS.COM

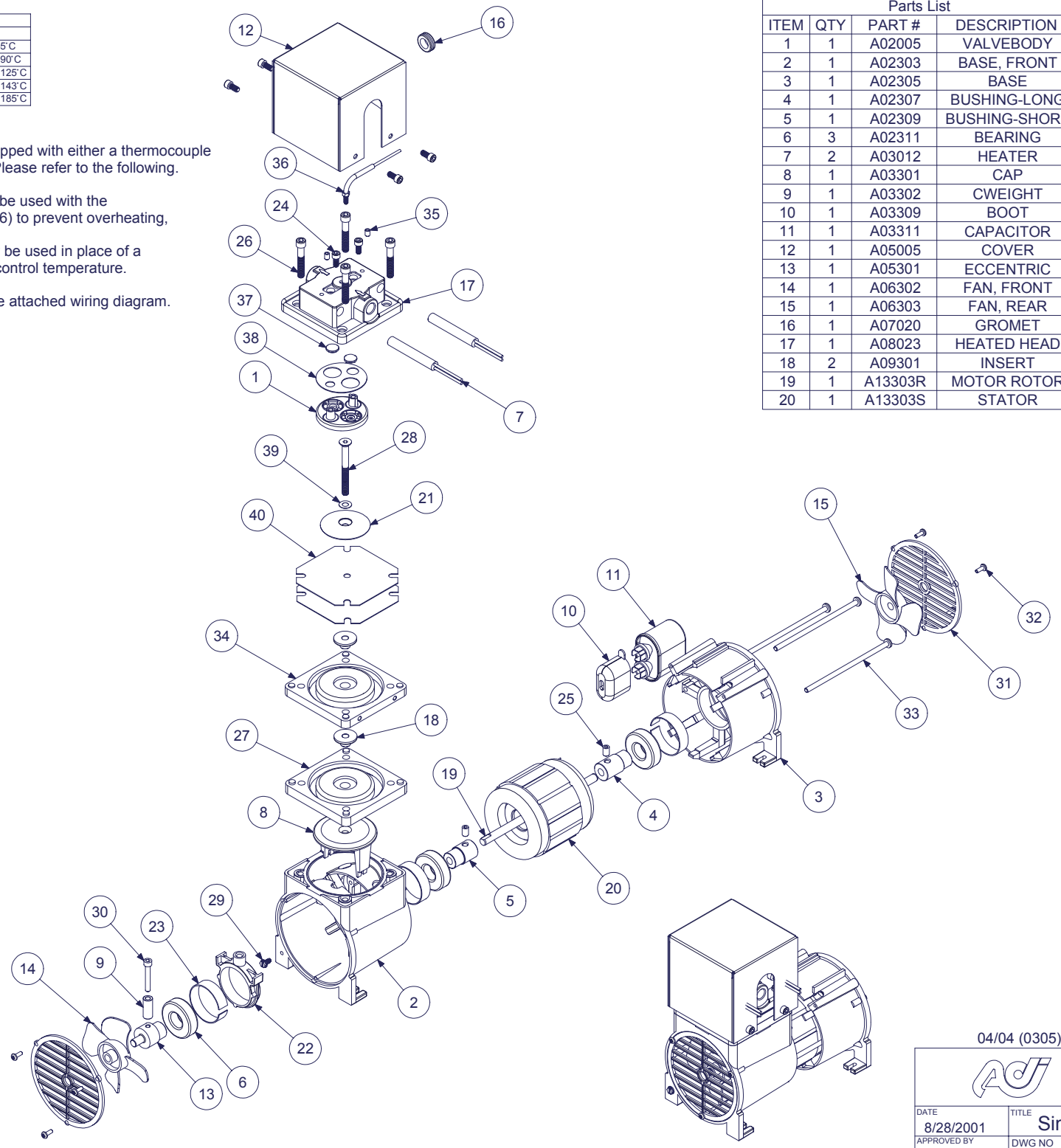
DATE	TITLE		
8/28/2001	Single Heated Head Mini Pump		
APPROVED BY	DWG NO	MODEL #	
FDM	Mxx1-xx-AAx-M	Mxx1-xx-AAx-M	SHEET 1 OF 2

THERMOSTAT UNITS	
PART #	DESCRIPTION
A20065	OFF 65˚C / ON 55˚C
A20100	OFF 100˚C / ON 90˚C
A20140	OFF 140˚C / ON 125˚C
A20163	OFF 163˚C / ON 143˚C
A20200	OFF 200˚C / ON 185˚C

NOTES:
This pump is equipped with either a thermocouple or a thermostat. Please refer to the following.

A controller must be used with the thermocouple (#36) to prevent overheating,
or
A thermostat may be used in place of a thermocouple to control temperature.

Please refer to the attached wiring diagram.



Parts List				Parts List			
ITEM	QTY	PART #	DESCRIPTION	ITEM	QTY	PART #	DESCRIPTION
1	1	A02005	VALVEBODY	21	1	A16001	PLATE-DIAPH.
2	1	A02303	BASE, FRONT	22	1	A18301	CONN. ROD
3	1	A02305	BASE	23	3	A18302	TOL. RING
4	1	A02307	BUSHING-LONG	24	6	A19006	SCREW-VALVE
5	1	A02309	BUSHING-SHORT	25	2	A19008	SET SCREW
6	3	A02311	BEARING	26	4	A19017A	HEAD BOLT
7	2	A03012	HEATER	27	1	A19044	HI-TEMP SPACER
8	1	A03301	CAP	28	1	A19301A	PLATE SCREW
9	1	A03302	CWEIGHT	29	1	A19303	GROUND SCREW
10	1	A03309	BOOT	30	1	A19309	SCREW
11	1	A03311	CAPACITOR	31	2	A19321	SCREEN
12	1	A05005	COVER	32	6	A19322	SCREW
13	1	A05301	ECCENTRIC	33	3	A19324	HOUSING SCREW
14	1	A06302	FAN, FRONT	34	1	A19344A	MINI SPACER
15	1	A06303	FAN, REAR	35	2	A19428	SET SCREW
16	1	A07020	GROMET	36	1	A20018	THERMOCOUPLE
17	1	A08023	HEATED HEAD	37	2	*A04004	DISC-VALVE
18	2	A09301	INSERT	38	1	*A07001	GASKET
19	1	A13303R	MOTOR ROTOR	39	1	*A23001	WASHER
20	1	A13303S	STATOR	40	2	*A04312	DIAPHRAGM

***RECOMMENDED SPARE PART KITS**

DIAPHRAGM KITS	
11312	2-PLY TEFLON
11313	TEFLON/EPDM
11317	2-PLY VITON

INCLUDES ITEMS 37-40.

Alternate Motor
A13304 220v 50/60

	ALTERNATE PARTS
PART #	DESCRIPTION
A02005	VALVEBODY - 316ss
A02006	VALVEBODY - ALUM
A02007	VALVEBODY - CARP 20
A02009	VALVEBODY - 316ss TFE CO
A02010	VALVEBODY - ALUM TFE CO
A02019	VALVEBODY - CARP 20 TFE CO
A02023	VALVEBODY - HAST C
A02024	VALVEBODY - HAST C TFE CO
A04308	DIAPHRAGM - TELFON/EPDM
A04331	DIAPHRAGM - VITON 2 PLY
A04312	DIAPHRAGM - 2 PLY TEFLON
A08003	HEAD - 316ss
A08004	HEAD - ALUM
A08005	HEAD - CARP 20
A08007	HEAD - 316ss TFE CO
A08008	HEAD - ALUM TFE CO
A08009	HEAD - CARP 20 TFE CO
A08020	HEAD - HAST C
A08021	HEAD - HAST C TFE CO
A16001	PLATE - 316ss
A16002	PLATE - ALUM
A16003	PLATE - CARP 20
A16005	PLATE - 316ss TFE CO
A16006	PLATE - ALUM TFE CO
A16019	PLATE - CARP 20 TFE CO
A16020	PLATE - HAST C
A16021	PLATE - HAST C TFE CO

04/04 (0305)

AIR DIMENSIONS INC.
DEERFIELD BEACH, FL. USA 33442
WWW.AIRDIMENSIONS.COM

DATE	TITLE		
8/28/2001	Single Heated Head Mini Pump		
APPROVED BY	DWG NO	MODEL #	
FDM	Mxx1-xx-AAx-M	Mxx1-xx-AAx-M	SHEET 2 OF 2

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131001

1. Single Pump Head Loading

⚠ WARNING: PRODUCT USE LIMITATION

These products are not designed for, nor intended for use in patient connected applications; including, but not limited to, medical and dental use, and accordingly have not been submitted for FDA approval.

Note: *Use only MASTERFLEX precision tubing with MASTERFLEX pumps to ensure optimum performance. Use of other tubing may void applicable warranties.*

Contents: One pump head, one 15 in (38-cm) length of silicone tubing, one mounting hardware package, manual and tubing loading key.

Supplied tubing loading key required for assembly.

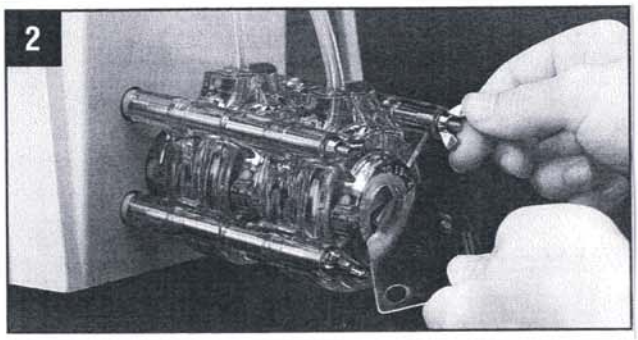
a) Separate the end bells (the pump head halves). Hold the end bell containing the rotor as shown with the tubing retainer grooves pointing down.

b) Place tubing in the right groove and against the first two rollers. Hold tubing with thumb. Near groove, insert smaller prong of loading key between the top of the rotor and tubing. Push key in as far as possible.

c) Push down and turn key counterclockwise (ccw) completely around the rotor. The key will push the tubing uniformly into the end bell assembly. Hold the second end of tubing. Remove the key.

d) Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If end bells do not snap tightly together, reload tubing. If necessary, turn key in slot on rotor shaft to adjust tubing (as in Step e).

e) With key in slot on rotor shaft, turn key to align tang on rotor shaft with slot in motor drive shaft. Point tubing retainer grooves up. Shift the pump head slightly until it snaps on the alignment pins (if present). Secure with four provided screws. Tighten with fingers only.



2. Multi-channel Mounting

Flat bladed Screwdriver required for mounting.

Tubing loading key required for mounting.

Note: Order special mounting hardware for multi-channel pumping, see "3. Replacement Parts and Accessories".

a) Load the pump heads with tubing.

b) Install the four correct length mounting screws into the drive.

c) Slide the first pump head onto the mounting screws.

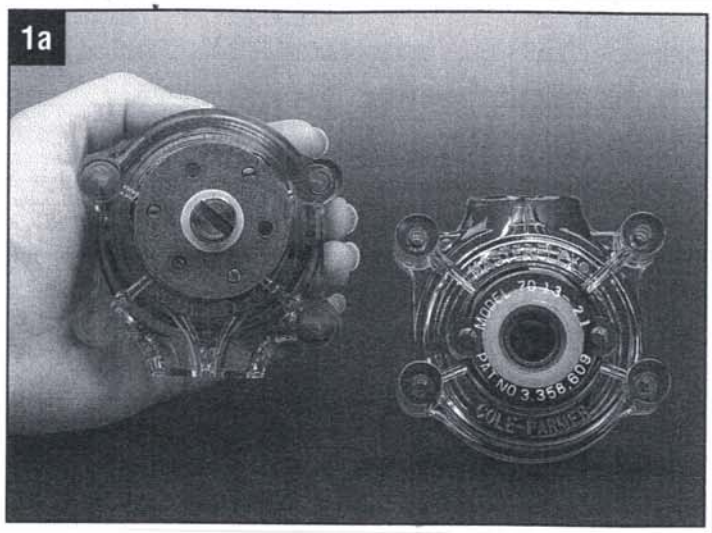
d) Place key in slot on rotor shaft. Twist to align tang on rotor shaft with slot in motor drive shaft. Shift the pump housing around until it drops over the alignment pins (if present).

e) Repeat for each additional pump head, aligning pump head tang with slot on previously mounted pump head.

f) Slide the four flat washers onto screws and secure with the four wing nuts. Tighten with fingers only.

g) A support bracket is supplied with 3- and 4-channel mounting hardware for additional support. Mount over bottom two screws. Insert one of three different adjustment screws depending upon drive height.

1a


MODEL 70 13 2 1
PAT NO 3,358,609
COLE-PARMER

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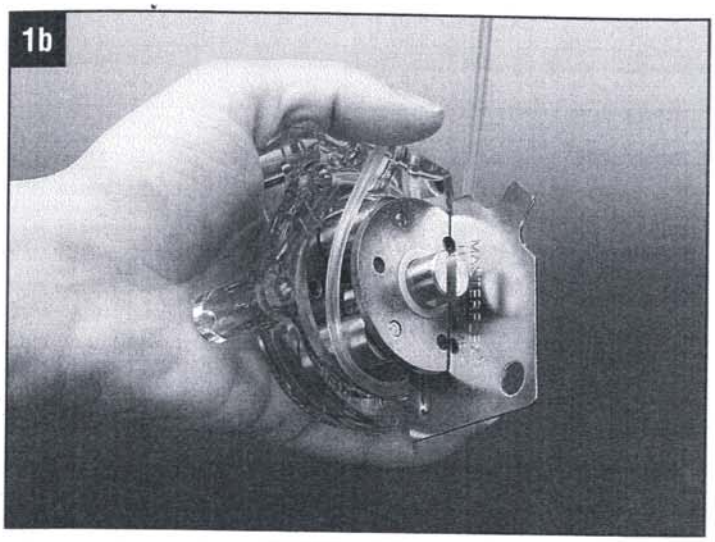
MODEL 70 13 2 1
PAT NO 3,358,609
MASTERFLEX

1b



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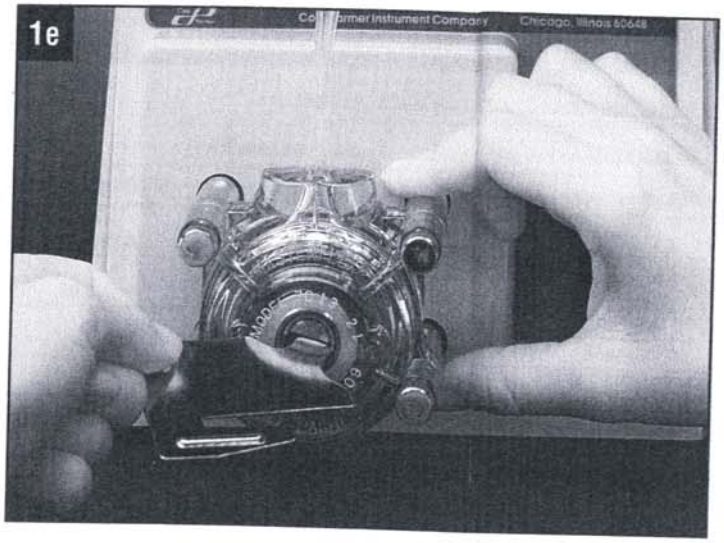
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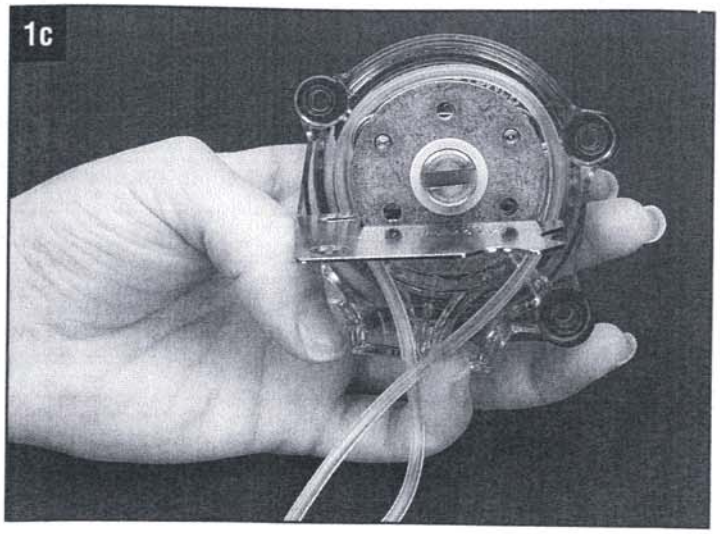
Chicago, Illinois 60648

1c



3. Replacement Parts and Accessories

A. End Bells (order two end bells for a complete head assembly).

Pump Head number	PC Order number	Pump Head number	PPS Order number
07013-00, -20 07013-10, -21	**07013-81** **07013-91**	— 07013-50, -52	— **07013-92**
07014-00, -20 07014-10, -21	**07014-81** **07014-91**	— 07014-50, -52	— **07014-92**
07015-00, -20 07015-10, -21	**07015-81** **07015-91**	— 07015-50, -52	— **07015-92**
07016-00, -20 07016-10, -21	**07016-81** **07016-91**	— 07016-50, -52	— **07016-92**
07017-00, -20 07017-10, -21	**07017-81** **07017-91**	— 07017-50, -52	— **07017-92**
07018-00, -20 07018-10, -21	**07018-81** **07018-91**	— 07018-50, -52	— **07018-92**
07024-00, -20 07024-10, -21	**07024-81** **07024-91**	— 07024-50, -52	— **07024-92**
07035-02, -20 07035-12, -21	**07035-81** **07035-91**	— —	— —

B. Rotor assemblies

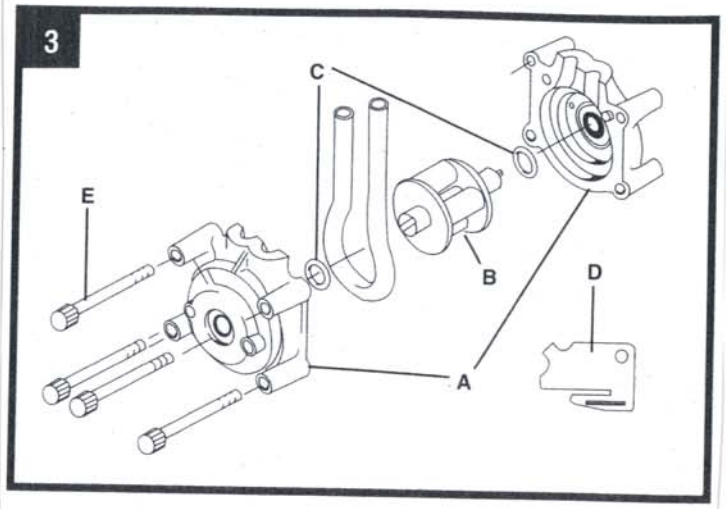
Pump Head number	Pump Head suffix	Order number
07013, 07014, 07016, 07017, 07018	-00 -10, -50 -20 -21, -52	**07013-75** **07013-76** **07013-80** **07013-95**
07015, 07024, 07035	-00, -02 -10, -50, -12 -20 -21, -52	**07015-75** **07015-76** **07015-80** **07015-90**

C. 07021-04 Thrust washers. Pack of 10.

D. 07013-90 Tubing loading key.

E. Mounting hardware for standard pump heads.
Set contains four #8-32 screws, four washers, and four wing nuts.

Number of heads to be mounted	Cold-rolled steel order number	Stainless steel order number
1	**07013-02**	**07013-04**
2	**07013-03**	**07013-05**
3	**07013-06**	**07013-08**
4	**07013-07**	**07013-09**



4. Specifications

	Thin wall*	Thick wall*
Maximum continuous discharge pressure—psi (bar):	20 (1.4)	25 (1.7)
Maximum intermittent discharge pressure—psi (bar):	35 (2.4)	40 (2.7)
Maximum vacuum:	660 (510†) mm Hg; 26 (20†) in Hg	
Maximum suction lift:	8.8 (6.7†) m H_2O; 29 (22†) ft H_2O	
Number of rollers:	3	
Occlusion:	Standard fixed	
Maximum pump speed (rpm):	600	
Nominal torque load:	6.5 kg-cm (90 oz-in)	
Housing materials:	Polycarbonate (PC) all models, or Polyphenylene sulfide (PPS) all models except 07035	
Roller/rotor materials:	Cold-rolled steel (CRS) or Stainless steel (SS)	
Operating temperature‡:	0 to 40°C (32 to 104°F)	

* Thin wall: tubing 13, 14, 16, 17, 18. Thick-wall: tubing 15, 24, 35.
† With tubing 17 & 18.
‡ Use in this temperature range for continuous duty operation with no decrease in performance or product life. Pump heads will work outside this range with some possible reductions in performance or product life.

5. Warranty and Return of Items

Warranty

Use only MASTERFLEX precision tubing with MASTERFLEX pumps to ensure optimum performance. Use of other tubing may void applicable warranties.

The Manufacturer warrants this product to be free from significant deviations from published specifications. If repair or adjustment is necessary within the warranty period, the problem will be corrected at no charge if it is not due to misuse or abuse on your part, as determined by the Manufacturer. Repair costs outside the warranty period, or those resulting from product misuse or abuse, may be invoiced to you.

The warranty period for this product is noted on the Warranty Card.

Product Return

To limit charges and delays, contact the seller or Manufacturer for authorization and shipping instructions before returning the product, either within or outside of the warranty period. When returning the product, please state the reason for the return. For your protection, pack the product carefully and insure it against possible damage or loss. Any damages resulting from improper packaging are your responsibility.

Technical Assistance

If you have any questions about the use of this product, contact the Manufacturer or authorized seller.

Masterflex® Tubing Formulation Descriptions

Silicone Tubing

While our silicone tubing formulations share many characteristics, listed are some basic differences.

Platinum-Cured Silicone Tubing

- Slightly greater clarity
- Smooth surface; low protein binding levels
- Ideal for pharmaceutical and biotechnology use
- Fewer potential leachables

Peroxide-Cured Silicone Tubing

- Greater physical compression capability
- Potential outgassing of peroxide products
- Economical
- Longer tubing life

BioPharm Silicone Tubing

- Platinum-cured; ultra-smooth inner surface minimizes particle entrapment
- Fewer extractables
- Lab, biotech, and pharmaceutical applications

BioPharm Plus Silicone Tubing

- Platinum-cured
- Lower spallation than regular silicone
- Enhanced pressure capabilities
- Longest tubing life
- Ultra-smooth inner surface and fewer extractables
- Documented biocompatibility for sensitive applications

C-FLEX® Tubing

- Long tubing life
- Ultra-smooth inner surface; fewer extractables

To Sterilize Silicone Tubing

• High-speed instrument (flash) autoclave

- Place tubing on non-linting cloth or sterilizing paper in a clean, open tray for 10 minutes at 132°C (270°F) at 2 kg/cm² (30 psi).

• Standard gravity autoclave

- Wrap tubing in non-linting cloth or sterilizing paper and place in a clean, open tray for 30 minutes at 121°C (250°F) at 1 kg/cm² (15 psi).

• Pre-vacuum high-temperature autoclave

- Wrap tubing in non-linting cloth or sterilizing paper and place in a clean, open tray for normal cycle of 30-35 minutes at 121°C (250°F).

• Gamma radiation

- 2.5 Mrad.

Formulation	Silicone (platinum-cured)	Silicone (peroxide-cured)	BioPharm Silicone (platinum-cured)	BioPharm Plus Silicone (platinum-cured)	C-FLEX® (50 A)
Series number	96410	96400	96420	96440	06424
Tubing photo					
Advantages	Excellent biocompatibility. No leachable additives, DOP, or plasticizers; phthalate and latex-free; odorless and nontoxic, fungus-resistant. No taste imparted to transported fluids. Extremely good over a wide temperature range. Weather, ozone, corona, and radiation resistant. Minimal tendency to take a set. See information above on the differences between silicone formulations.	Excellent biocompatibility. No additives, plasticizers or DOP; odorless and nontoxic, fungus-resistant. No taste imparted to transported fluids. Extremely good at low temps. Weather, ozone, corona, and radiation resistant. Minimal tendency to take a set. See information above on the differences between silicone formulations.	Shorter life Ultra-smooth inner surface. Minimizes particle entrapment. Lower absorption; excellent biocompatibility; no leachable additive, DOP, or plasticizers. Odorless and nontoxic, fungus-resistant. No taste imparted to transported fluids. Weather, ozone, corona, and radiation resistant. Platinum-cured.	Platinum-cured silicone tubing with long life and ultra-smooth inner surface. Minimizes particle entrapment; lower absorption. Excellent biocompatibility. No leachable additives, DOP, or plasticizers; odorless, nontoxic. Fungus-resistant. No taste imparted to transported fluids. Weather, ozone, corona, and radiation resistant.	Physical properties similar to silicone with chemical compatibility of Tygon®. Inexpensive. Excellent biocompatibility. Smooth bore. Nontoxic, no leachable plasticizers. Lower gas permeability than silicone. Use with many acids and alkalies.
Limitations	Do not use with concentrated acids and bases, organic solvents, or oils.	Do not use with concentrated solvents, oils, acids. Relatively high gas permeability. See additional notes above.	Do not use with concentrated solvents, oils, or acids. Relatively high gas permeability.	Do not use with concentrated solvents, oils, or acids. Relatively high gas permeability.	Not recommended for use with oils. Moderate pumping life.
Application suitability:					
Acids	Poor	Poor	Poor	Poor	Good
Alkalies	Poor	Poor	Poor	Poor	Good
Organic solvents	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
Pressure	Fair	Fair	Fair	Fair	Fair
Vacuum	Good	Good	Good	Good	Good
Viscous fluids	Fair	Fair	Fair	Fair	Fair
Sterile fluids	Excellent	Excellent	Excellent	Excellent	Excellent
Physical characteristics and composition	Thermal set rubber. Siloxane polymers and amorphous silica. Excellent compression strength. Soft material; flexible. Translucent, clear to light amber	Thermal set rubber. Siloxane polymers and amorphous silica. Excellent compression strength. Soft material. Translucent, clear to light amber.	Thermal set rubber. Siloxane polymers and amorphous silica. Excellent compression strength. Soft material. Translucent, clear to light amber.	Thermal set rubber. Siloxane polymers and amorphous silica. Excellent compression strength. Soft material. Translucent, clear to light amber.	Thermoplastic elastomer. Styrene-ethylene-butylene modified block copolymer with silicone oil. Excellent tensile and tear strength Soft material. Opaque, white.
Temperature range	–50 to 230°C (–58 to 446°F)	–50 to 230°C (–58 to 446°F)	–60 to 232°C (–75 to 450°F)	–60 to 232°C (–75 to 450°F)	–73 to 135°C (–100 to 275°F)
Meets classifications	USP Class V Extractables; exceeds Class VI Implant; EP, FDA 21 CFR 177.2600; Exceeds 3A Sanitary Standards; Produced to Bulk Pharm. cGMPs (FDA 21 CFR 210 and 211).	USP Class VI FDA 21 CFR 177.2600	USP Class VI, EP FDA 21 CFR 175.300 Exceeds 3A sanitary standards	USP Class VI, EP, and FDA 21 CFR Part 177.2600 criteria Exceeds 3A sanitary standards	USP Class VI FDA 21 CFR 177.2600
Gas permeability $\frac{cc \times mm}{cm^2 \times sec. \times cm\ Hg} \times 10^{-10}$	CO_2: 20,132 H_2: 6579 O_2: 7961 N_2: 2763	CO_2: 20,132 H_2: 6579 O_2: 7961 N_2: 2763	CO_2: 25,147 H_2: — O_2: 4715 N_2: 2284	CO_2: 25,147 H_2: — O_2: 4715 N_2: 2284	CO_2: — H_2: — O_2: 150 N_2: —
Cleaning/sterilization	Clean with hot water/soap solution; use a non-oily soap such as Ivory®. Do not use synthetic detergent or oil-based soap as they may be absorbed by the tubing and may leach into fluid. Rinse well with distilled water. ETO sterilization is not recommended—sufficient data is not available regarding complete outgassing of residual ETO and other ETO products.	Clean with isopropyl alcohol or hot water/soap solution. Use non-oily soap such as Ivory®. Do not use synthetic detergent or oil-based soap as they may be absorbed by the tubing and may leach out into the fluid. Rinse thoroughly with distilled water. May use ethylene oxide (ETO) sterilization. Autoclavable.	To autoclave: coil loosely in non-linting cloth or paper; autoclave at 121°C (250°F), 1 bar (15 psi) for 30 minutes. Sterilize by ethylene oxide (ETO), autoclave, or gamma irradiation up to 2.5 Mrad.	To autoclave: coil loosely in non-linting cloth or paper; autoclave at 121°C (250°F), 1 bar (15 psi) for 30 minutes. Sterilize by ethylene oxide (ETO), autoclave, or gamma irradiation up to 2.5 Mrad	Sterilize by ethylene oxide (ETO) gamma radiation, or autoclave

(Continued on next page)

Masterflex® Tubing Formulation Descriptions (Continued)

Tygon® Tubing

Our Tygon® tubing comes in four separate formulations that share common characteristics but differ in tubing life and other specifications. See descriptions below for details about each formulation.

Tygon® LFL Tubing

- Longest tubing life
- Broad chemical compatibility
- Low gas permeability
- USP Class VI and FDA

Tygon® Food Tubing

- Meets various food and sanitary regulations
- Unaffected by all commercial sanitizers
- Non-wetting properties enable flush-cleaning and complete drainage
- Smooth inner surface

Tygon® Lab Tubing

- Ideal for general transfer applications
- Economical
- Nontoxic, nonaging, and nonoxidizing

Tygon® Fuel & Lubricant Tubing

- Ideal for transporting hydrocarbons, gasoline, kerosene, heating oils, cutting compounds, and glycol-based coolants
- Not for use with concentrated strong acids or alkalies

Sterilization Notes

• Standard gravity autoclave:

- Coil loosely in non-linting cloth or sterilizing paper and place in a clean, open tray for 30 minutes at 121°C (250°F) at 1 kg/cm² (15 psi); air dry at max 66°C (150°F) for 2 to 2½ hours until clear.

• Ethylene oxide (ETO):

- Coil loosely in non-linting cloth or sterilizing paper. Follow the sterilization equipment manufacturers directions as to gas type, concentration, times, and temperatures; maintain humidity within the prescribed limits, generally between 30 to 65%.

• Radiation:

- Cap ends of tubing if required. Radiation should be product specific and according to GMP.

Formulation	Tygon® LFL	Tygon® food (B-44-4X)	Tygon® lab (R-3603)	Tygon® fuel & lubricant (F-4040-A)
Series number	06429	06419	06409	06401
Photo				
Advantages	Longest life of all Tygon® peristaltic tubing (1000 hrs) Nonaging, nonoxidizing Clear for easy flow monitoring Broad chemical resistance Low gas permeability Smooth bore Good for viscous fluids High dielectric constant	Designed especially for handling food products; bore is extremely smooth (better than most stainless steels), nontoxic, will not affect taste or odor, and clear for CIP and flow verification. Excellent non wetting properties permit flush cleaning and complete drainage. High dielectric constant	Inexpensive tubing for general laboratory applications Non aging, non oxidizing Clear for easy flow monitoring Handles virtually all inorganic chemicals. Low gas permeability Smooth bore Good for viscous fluids High dielectric constant	Specially formulated to transport hydrocarbons, petroleum products and distillates. Suitable for gasoline, kerosene, heating oils, cutting fluids, and glycol-based coolants Minimum extractability Low gas permeability High dielectric constant
Limitations	Potential leaching of plasticizer	Limited pumping life	Limited pumping life Potential leaching of plasticizer	Don't use with strong acids and alkalies. Potential leaching
Application suitability: Acids Alkalies Organic solvents Pressure Vacuum Viscous fluids Sterile fluids	 Good Good Not recommended Good Good Excellent Good	 Good Good Not recommended Good Good Excellent Good	 Good Good Not recommended Good Good Excellent Poor	 Good Good Not recommended Good Good Excellent Poor
Physical characteristics and composition	Thermoplastic PVC-based material with plasticizer Firm (stiff) material Transparent, clear	Thermoplastic PVC-based material with plasticizer Firm (stiff) material Transparent, clear	Thermoplastic PVC-based material with plasticizer Firm (stiff) material Transparent, clear	Thermoplastic PVC-based material with plasticizer Firm (stiff) material Transparent, yellow
Temperature range	–50 to 74°C (–58 to 165°F)	–44 to 74°C (–47 to 165°F)	–50 to 74°C (–58 to 165°F)	–37 to 74°C (–35 to 165°F)
Meets classifications	USP Class VI FDA 21 CFR 175.300	FDA 21 CFR 175.300 NSF-listed (Standard 51) All 3A Sanitary Plastics Products Various USDA standards	FDA 21 CFR 175.300	None
Gas permeability $\frac{cc \times mm}{(cm^2 \times sec. \times cm\ Hg)} \times 10^{-10}$	CO_2: 563 H_2: — O_2: 124 N_2: 67	CO_2: 270 H_2: 97 O_2: 60 N_2: 30	CO_2: 360 H_2: 97 O_2: 80 N_2: 40	CO_2: 100 H_2: 97 O_2: 22 N_2: 12
Cleaning/sterilization	Sterilize with ethylene oxide (ETO) or autoclave. To autoclave: Coil loosely in non linting cloth or paper; autoclave at 121°C (250°F),1 kg/cm² (15 psi) for 30 mins. (tubing will appear milky); air dry at max 66°C (150°F) for 2 to 2½ hours until clear.	Unaffected by all commercially available sanitizers (when using recommended procedures) Sterilize with ethylene oxide (ETO) or autoclave. To autoclave: Coil loosely in non linting cloth or paper; autoclave at 121°C (250°F), 1 kg/cm² (15 psi) for 30 minutes (tubing will appear milky); air dry at max 66°C (150°F) for 2 to 2½ hours until clear.	Sterilize with ethylene oxide (ETO) or autoclave. To autoclave: Coil loosely in non linting cloth or paper, autoclave at 121°C (250°F), 1 kg/cm2 (15 psi) for 30 minutes (tubing will appear milky); air dry at max 66°C (150°F) for 2 to 2½ hours until clear.	Sterilization is not recommended.

PharMed® Tubing
- Over 10,000 hours of tubing life
- Resists ozone and UV radiation
- Non-cytotoxic and non-hemolytic
- Ideal for tissue and cell culture work
- Heat sealable and bondable

Norprene® Tubing
- Up to 10,000 hours of tubing life
- Best choice for pressure/vacuum applications
- Resists heat, ozone, acids, and alkalies
- Heat sealable and bondable
- Nonaging, nonoxidizing

Norprene® Food Tubing
- Ideal for high-temperature food and beverage applications
- Similar characteristics as Norprene® tubing
- Meets FDA and NSF standards

Viton® Tubing
- Excellent chemical resistance
- Resists corrosives, solvents, and oils at elevated temperatures.
- Low gas permeability
- FDA formulation available

WHERE TO ORDER TUBING

Continuous pressures **up to 100 psi!**

L/S® High-Pressure Pump System

See page 1339 for details and to order our L/S® high-pressure tubing.

Need FDA Viton® Tubing?

For chemical resistance & FDA approval, we offer FDA Viton® tubing.

See details below.

FDA

New

Formulation	PharMed® (65)	Norprene® (A 60 G)	Norprene® food (A 60 F)	Viton®	FDA Viton®
Series number	06485	06404	06402	06412	96412
Photo					
Advantages	Great for tissue and cell work—nontoxic and non-hemolytic Long service life minimizes risk of fluid exposure; reduces tubing costs and pump downtime. Opaque to UV and visible light to protect light-sensitive fluids. Heat sealable, bondable, and formable Extremely low gas permeability	Best choice for vacuum/pressure applications. Offers longest life with good flow consistency. Heat and ambient ozone resistant Good resistance to acids/alkalies Black color hides dirt and dust Heat sealable, nonaging, and nonoxidizing High dielectric constant	Similar to Norprene® (06404) but with FDA approval. Excellent for food/dairy applications Longest life, good flow consistency Heat and ozone resistant Good resistance to acids/alkalies Heat sealable, nonaging, and nonoxidizing High dielectric constant	Our most chemical resistant tubing Resistant to corrosives, solvents, and oils at elevated temperatures Low gas permeability.	Perfect for food and lab applications where FDA compliance is required. Good chemical resistance. Resistant to corrosives. High temperature properties.
Limitations	Potential leaching of USP mineral oil or blend material	Potential leaching of USP mineral oil or blend material	Potential leaching of USP mineral oil or blend material	Limited pumping life	Limited pumping life
Application suitability: Acids Alkalies Organic solvents Pressure Vacuum Viscous fluids Sterile fluids	 Good Good Not recommended Good Excellent Good Excellent	 Good Good Not recommended Excellent Excellent Excellent Not recommended	 Good Good Not recommended Excellent Excellent Excellent Good	 Excellent Excellent Variable—test before using Good Good Good Fair	 Excellent Excellent Variable—test before using Good Good Good Fair
Physical characteristics and composition	Thermoplastic elastomer Polypropylene-based material with USP mineral oil Excellent tensile strength Firm (stiff) material Opaque, beige	Thermoplastic elastomer Polypropylene-based material with USP mineral oil Excellent tensile strength Firm (stiff) material Opaque, black	Thermoplastic elastomer Polypropylene-based material with USP mineral oil Excellent tensile strength Firm (stiff) material Opaque, beige	Thermal set rubber Viton B (67% fluorine) Firm (stiff) material Opaque, black	Thermal set rubber Viton B (67% fluorine) Firm (stiff) material Opaque, black
Temperature range	–59 to 135°C (–60 to 270°F)	–59 to 135°C (–60 to 270°F)	–59 to 135°C (–60 to 270°F)	–32 to 205°C (–25 to 400°F)	–32 to 205°C (–25 to 400°F)
Meets classifications	USP Class VI FDA 21 CFR 177.2600 NSF-listed (Standard 51)	None	FDA 21 CFR 177.2600 NSF-listed (Standard 51)	None	FDA 21 CFR 177.2600
Gas permeability $\frac{cc \times mm}{(cm^2 \times sec. \times cm\ Hg)} \times 10^{-10}$	CO_2: 1200 H_2: — O_2: 200 N_2: 80	CO_2: 1200 H_2: — O_2: 200 N_2: 80	CO_2: 1200 H_2: — O_2: 200 N_2: 80	CO_2: 76 to 79 H_2: — O_2: 13 to 15 N_2: 4.3	CO_2: 76 to 79 H_2: — O_2: 13 to 15 N_2: 4.3
Cleaning/sterilization	Sterilize with ethylene oxide (ETO), autoclave or gamma irradiation up to 2.5 Mrad. Repeated autoclaving will not affect overall life.	Sterilize by autoclave only.	Sterilize by autoclave. Repeated autoclaving will not affect overall life.	Sterilization is not recommended.	Sterilize with circulating hot air oven at 249°C (480°F) for 16 hours.