



# Instruction Manual

## 500 Series *Thermoelectric Gas Coolers*



**AMETEK®**

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# Receiving and Storage

The Universal Analyzers 500 Series Thermoelectric Gas Coolers are complete pre-installed units. No assembly is necessary when received on-site.

Carefully inspect the product and included accessories immediately on arrival by removing them from the packing and checking for missing articles against the packing list.

Check the items for any damage which may have occurred during transit and immediately inform the shipping insurance company of any damage found.

# Definition of Symbols



WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR HAZARDOUS AREA INSTALLATION.

THE SUPPLY POWER CIRCUIT MUST INCLUDE AN OVERPROTECTION DEVICE WITH A MAXIMUM RATING OF 20A. A DISCONNECT SWITCH MUST BE LOCATED IN CLOSE PROXIMITY TO THE PROBE.

IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED PER CLAUSE 5.4.4(i) IN STANDARD EN 61010-1

CAUTION, RISK OF DANGER SYMBOL INDICATES INJURY MAY OCCUR IF MANUFACTURER'S INSTRUCTIONS ARE NOT ADHERED TO. PLEASE READ MANUAL CAREFULLY WHEN SYMBOL IS DISPLAYED

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CAUTION, HOT SURFACE SYMBOL INDICATES EXPOSED SURFACE TEMPERATURE CAN CAUSE BURNS OR PERSONAL INJURY. CARE SHOULD BE TAKEN WHEN CONTACT IS REQUIRED.

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CAUTION, RISK OF ELECTRICAL SHOCK SYMBOL INDICATES ELECTRICAL SHOCK MAY OCCUR. CAUTION SHOULD BE TAKEN BEFORE DISCONNECTING OR CONTACTING ANY ELECTRICAL CONNECTIONS.

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PROTECTIVE CONDUCTOR TERMINAL SYMBOL INDICATES THE TERMINAL LOCATION FOR THE PROTECTIVE CONDUCTOR. FAILURE TO CONNECT TO THE PROTECTIVE CONDUCTOR TERMINAL MAY RESULT IN A SHOCK HAZARD.

# Specifications

OPERATING SPECIFICATIONS	
<b>Sample Flow Rate</b>	
Model 520	0 to 2 1/2 l/m total (at STP)
Model 530	0 to 5 l/m total (at STP)
Model 540	0 to 4 l/m total (at STP)
Model 560	0 to 5 l/m total (at STP)
Model 570	0 to 4 l/m total (at STP)
Model 574	0 to 4 l/m total (at STP)
<b>Maximum Inlet Temperature</b>	
Stainless Steel Heat Exchanger	700°F (351°C)
Kynar/Glass Heat Exchanger	280°F (138°C)
<b>Maximum Inlet Gas Dewpoint</b>	180°F (82°C)*
<b>Maximum Inlet Water Concentration</b>	50%*
<b>Minimum Ambient Temperature</b>	34°F (1°C)
<b>Maximum Ambient Temperature</b>	105°F (41°C)*
<b>Maximum Cooling Power</b>	
Model 520	63 BTUs per hour (60 kJ/hr)
Model 530	63 BTUs per hour (60 kJ/hr)
Model 540	126 BTUs per hour (120 kJ/hr)
Model 560	126 BTUs per hour (120 kJ/hr)
Model 570	126 BTUs per hour (120 kJ/hr)
Model 574	126 BTUs per hour (120 kJ/hr)
<b>Outlet Sample Dew Point</b>	41°F (5°C)
<b>Gas Sample Inlet Fitting</b>	3/8" tubing fitting
<b>Gas Sample Outlet Fitting</b>	1/4" tubing fitting
<b>Bottom Water Drain Fitting</b>	3/8" tubing fitting
<b>Maximum Input Power</b>	
Model 520	250 Watts
Model 530	250 Watts
Model 540	475 Watts
Model 560	475 Watts
Model 570	475 Watts
Model 574	925 Watts
<b>Voltage</b>	
All models	90-132 or 180-264 VAC, 50/60 Hz
<b>Electrical Classification</b>	General Purpose, NEMA 1
<b>Dimensions **</b>	
Model 520	11" high x 9" wide x 9" deep
Model 530	11" high x 11" wide x 9" deep
Model 540	11" high x 11" wide x 10" deep
Model 560	11" high x 9" wide x 9" deep

# Specifications

Model 570	11" high x 11" wide x 10" deep
Model 574	11" high x 11" wide x 11" deep
<b>Weight</b>	
Model 520	19 lbs (8.5 kg)
Model 530	21 lbs (9.5 kg)
Model 540	21 lbs (9.5 kg)
Model 560	21 lbs (9.5 kg)
Model 570	25 lbs (11.5 kg)
Model 574	25 lbs (11.5 kg)
<b>Soluble Gas Removal Rates</b>	
NO            0% loss NO <sub>2</sub> <10% loss SO <sub>2</sub> < 2% loss CO            0% loss CO <sub>2</sub> < 2% loss	
<b>Storage Requirements</b>	
Cool and dry location, -20°F < x < 120°F < 95° relative humidity, non-condensing	

\* AT REDUCED FLOW RATE ABOVE 77°F (25°C) AMBIENT

\*\* DIMENSIONS DO NOT INCLUDE FITTINGS OR MOUNTING HARDWARE

# Description and Principle of Operation

## APPLICATION

In order to accurately analyze combustion gases, moisture must be removed from the sample without removing gas components of interest. The Universal Analyzers Thermoelectric Gas Cooler provides an ideal repeatable, and stable way to decrease the dew point of combustion gasses. This prevents water condensation in sample prefilters, sample pumps, and gas analyzers. Where water vapor is an interferent, a stable and repeatable dew point becomes a part of the gas analyzer's performance specification. The 500 Series Cooler provides this constant, resulting in an accurate analysis of the gas components of interest.

The gas sample is first pulled through a sample probe, which usually contains a heated filter, and then through a heated sample line, which keeps the sample above its dew point. The 500 Series Cooler then condenses water out of the sample, which lowers the dew point to 5°C (41°F).

The 500 Series Thermoelectric Gas Coolers are for general purpose, light duty applications. Several models are available to meet various application conditions. Use the cooler selection chart below to best fit a model to the expected flow rates, water vapor concentrations, and ambient temperature conditions. If none of the models listed meet the needs of the application, contact your Universal Analyzers local sales representative for more options.

### Gas Cooler Selection Chart

Conditions		Model						
Ambient	Water	520	530	540*	560	570	574*	574*
77°F (25°C)	12%	2.5 l/m	4.0 l/m	2.5 l/m	5.0 l/m	4.0 l/m	5.0 l/m	2.5 l/m
	15%	2.0 l/m	4.0 l/m	2.0 l/m	4.0 l/m	4.0 l/m	4.0 l/m	2.0 l/m
	30%	1.0 l/m	4.0 l/m	1.0 l/m	2.0 l/m	4.0 l/m	2.0 l/m	1.0 l/m
	50%	0.6 l/m	4.0 l/m	0.6 l/m	1.0 l/m	4.0 l/m	1.0 l/m	0.6 l/m
90°F (32°C)	12%	2.0 l/m	3.0 l/m	2.0 l/m	4.0 l/m	3.0 l/m	4.0 l/m	2.0 l/m
	15%	1.8 l/m	3.0 l/m	1.8 l/m	3.5 l/m	3.0 l/m	3.5 l/m	1.8 l/m
	30%	0.9 l/m	3.0 l/m	0.9 l/m	1.8 l/m	3.0 l/m	1.8 l/m	0.9 l/m
	50%	0.5 l/m	3.0 l/m	0.5 l/m	0.9 l/m	3.0 l/m	0.9 l/m	0.5 l/m
105°F (41°C)	12%	1.5 l/m	2.0 l/m	1.5 l/m	3.0 l/m	2.0 l/m	3.0 l/m	1.5 l/m
	15%	1.2 l/m	2.0 l/m	1.2 l/m	2.5 l/m	2.0 l/m	2.5 l/m	1.2 l/m
	30%	0.6 l/m	2.0 l/m	0.6 l/m	1.3 l/m	2.0 l/m	1.3 l/m	0.6 l/m
	50%	0.3 l/m	2.0 l/m	0.3 l/m	0.7 l/m	2.0 l/m	0.7 l/m	0.3 l/m
# of Gas Streams		1	1	2	1	2	2	4

\*THE DATA PROVIDED IS FOR EACH STREAM

Various combustion processes can produce high levels of corrosive elements. An array of materials is available for the 500 Series Coolers, where gases come into contact with heat exchangers. 316 Stainless Steel is the most common option, and meets the needs of most general purpose applications. Coatings of Silconert™ 2000, or Teflon® may be added to the stainless steel heat exchanger to enhance chemical resistance. Heat exchangers may also be made of other materials for corrosion resistance, such as Glass/Kynar®, Kynar®/Kynar®, and Hastelloy® C276. Contact your local sales representative for information on which material is best suited for your application.

New Jersey Thermocouple Types K and J are available for external monitoring of heat exchanger temperatures.

# Description and Principle of Operation

## DESCRIPTION

The Universal Analyzers 500 Series Thermoelectric Gas Coolers condition gas sample streams to remove water vapor. The gas sample is cooled thermoelectrically to a controlled temperature, and water vapor is condensed and removed.

The key to success is being able to condense the water from a wet gas sample with a minimal loss of the water soluble gas fraction. The separation occurs in a classical impinger, which has a highly polished cylindrical surface, cooled to the desired dew point temperature. The gas sample is brought to the bottom of the cylinder through an insulated tube and allowed to rise through a narrow annular area at a relatively high Reynolds number to insure the entire sample is influenced by the cold surface. The condensate falls down the cold, polished surface in the form of a sheet (as opposed to droplets or the bubbling of the gas sample through the condensate) which minimizes the surface area in contact with the gas sample.

The temperature of the cylindrical, condensation surface of the heat exchangers is maintained through intimate contact with aluminum heat transfer blocks. The blocks are cooled with thermoelectric elements, controlled to a temperature of 5°C. The temperature sensor is a type "K" thermocouple. The temperature controller is proportional with a band of 1°C.

The fan cooled heat sink is constructed from anodized, pure aluminum fins which transfer heat to the surrounding air. The pure aluminum material is a far better conductor of heat than the aluminum alloys which are normally used for extruded heat sinks. The result is an assembly with superior heat exhausting capabilities under high ambient temperature conditions.

The 500 Series Coolers have a digital display for front panel indication of the operating temperature of each of the heat transfer blocks (switch selectable) in degrees Centigrade. Two internal jumpers at the top of the control circuit board within the enclosure can be moved to change the indicated temperature to read out in degrees Fahrenheit.

Three LED lamps to indicate the status of the cooler. The "COOL" lamp is a green LED which indicates when the operating temperature has fallen below the factory set temperature of 10°C. An "Over-temperature relay" is energized and closed to the cool position when the "COOL" lamp is on. The relay board within the enclosure has dual terminal strip relay contacts for alarm/shutdown purposes. The external gas sample pump may be interlocked with this relay to power off when temperatures become too high (fail safe).

The "DRY" lamp is a green LED which indicates when there is no water in contact with the water carry-over sensor (provided separately or as a system option). If no moisture sensor is used, the lamp should be turned off by installing a jumper on the moisture sensor input terminals on the relay board. Without a moisture sensor installed, the "DRY" lamp serves no purpose and should remain off. The moisture sensor relay, which is energized in the "DRY" condition, provides contacts to an annunciator panel and/or to turn off the sample pump in the "wet" condition.

The "TC" lamp is a red LED which indicates when there is a problem (open connection) in the temperature control thermocouple. The "Over-temperature" relay will also transfer to the high temperature condition if the red "TC" lamp comes on.

The WCO or WCOF, optionally available with the 500 Series Cooler Systems, is a sensor which detects the presence of liquid water. One should be placed in each gas sample stream directly after the cooler to provide an alarm if condensate is detected. The electronics associated with water carry-over sensors are included as a standard part of all Universal Analyzers Thermoelectric Sample Coolers. Dual relay contact sets are provided for each moisture sensor. Relay contacts are energized and closed to the dry position when the WCO sensor is dry and the unit is powered on.

## LED Indicator Chart

LED	Color	Status	Condition	Relay Status
COOL	Green	On	Operating properly, temp below 10°C	Over Temp: Energized, towards COLD
		Off	Temp too high or unit is OFF	Over Temp: De-Energized, towards HOT
DRY	Green	On	WCO sensor connected and sample is dry	Moisture Sensor: Energized, towards DRY
		Off	Moisture detected or jumper installed	Moisture Sensor: De-Energized, towards WET
TC	Red	On	Temp control TC has BAD quality	Over Temp: De-Energized, towards HOT
		Off	Temp control TC was OK quality	Does not affect relays

# Description and Principle of Operation

## DESCRIPTION

A gas sample pump may be provided as part of the sampling system. If the pump is placed ahead of the sample cooler, it should be provided with a heated head to avoid the condensation of water vapor. If the sample pump is placed after the sample cooler, drawing the sample through the cooler, the sample has been dried, and a standard, non-heated pump may be used.

A means to control the flow of the sample through the system should be available and visible to the operator. This could be accomplished through the use of pressure regulators with gauges, flowmeters, and/or flow control needle valves.

Condensate removal from the heat exchanger(s) within the Sample Cooler can be accomplished through one of the following methods:

1. A continuously running peristaltic tubing pump.
2. Installing the heat exchanger as a bypass condenser, pulling excess sample through with an eductor.
3. Using float drain traps similar to a steam trap. This requires the sample within the cooler to be at a positive pressure.
4. Use of drain pots on level control with a removal pump.

# Installation

The 500 Series Thermoelectric Gas Coolers are best suited for air conditioned environments. Each unit dissipates heat, and the surrounding area must be well ventilated to provide adequate cooling. The cooler should be located away from other heat sources. If located inside an enclosure, outside air should be ducted directly onto the heat sink, and thermostatically controlled fans and vents should be utilized. The interior of the enclosure should be insulated, and never mount the unit in direct sunlight to avoid solar heat loading.

Route all sample gas lines directly to the 3/8" inlet tubing fittings located on the top of the cooler heat exchangers. When two gas streams are being cooled, the left side of the unit is considered to be channel 1, and the right side of the unit is channel 2. Sample outlet tubing fittings are reduced to 1/4".

At the bottom of each heat exchanger, a 3/8" tubing fitting is provided for the condensate drain. The condensate fitting may be removed to expose a female 3/8" NPT connection. Equipment must be installed to remove the condensate such as a peristaltic pump, liquid drainer, or aspirated drainer. A single head peristaltic pump is recommended. If an aspirator drain is utilized, the outlet tubing should have a small bore and be no longer than two feet to minimize back pressure. The drain must be run to an appropriate condensate disposal location.

A sample pump is normally required to pull the gas sample through the cooler. A Water Carry-Over Filter (WCOF) sensor is recommended for each sample path. The pump should be located between the cooler and the filter. A clear glass bowl should be installed around the filter to allow checking of the condition of the filter while online.

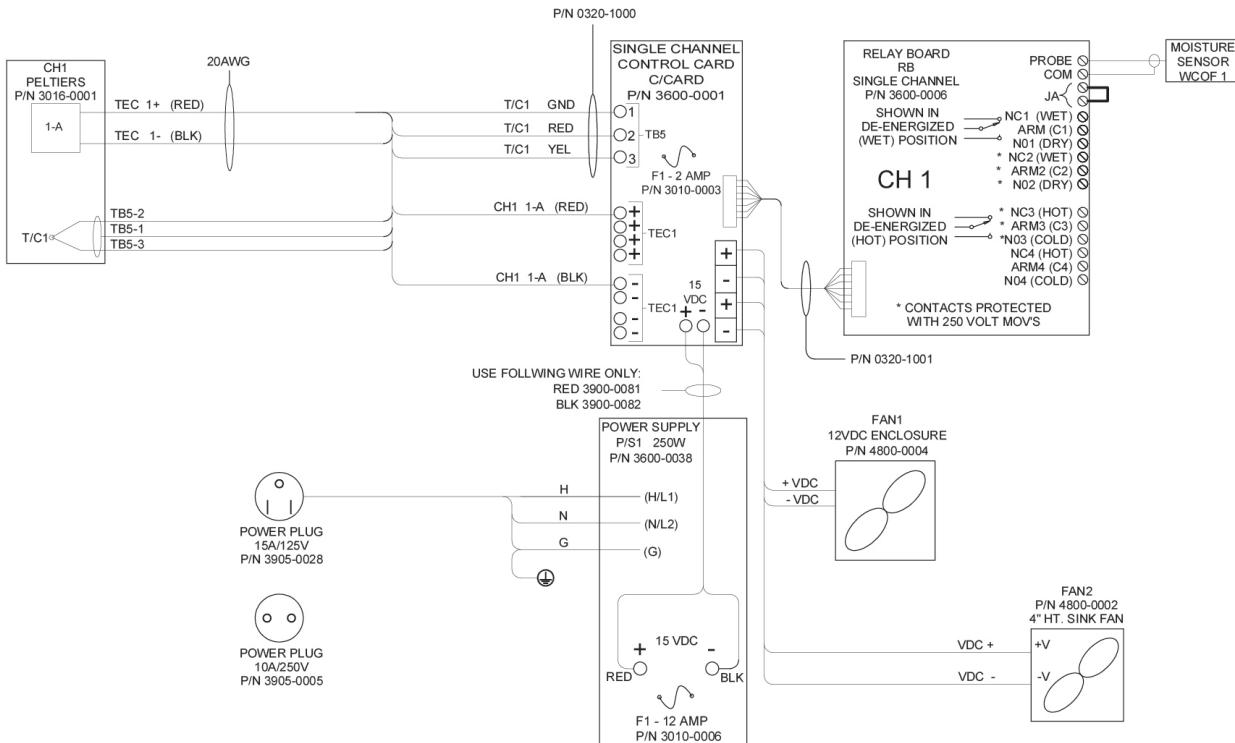
Each cooler consumes about 2 amps (at 115 VAC) per every active heat exchanger. Use minimum wire size of 18 AWG, stranded, tinned copper with a minimum rating of 300 Volts. Dual relays are provided for both the WET/ DRY and HOT/ COLD conditions. One set of relays are MOV protected and designed to interrupt power to the sample pump upon alarm.

The temperature of the heat exchangers may be viewed on the display on the front of the unit. If a multiple channel unit has been provided, a selector switch on the right side of the display lets the user toggle the display from one block to the other. For these same cooler models, a second toggle switch on the left side of the display allows the user to view the settings for the relay and cooler temperatures. Jumpers inside the unit on the control panel allow setting the display for degrees Celsius or degrees Fahrenheit.

Sample pumps, WCOF sensors, drains, flow meters, regulators, and other optional equipment are available from Universal Analyzers. These may be purchased separately or installed on a complete 500 Series Sample Conditioning System.

All installations shall be in accord with the manufacturer's instructions and the National Electric Code (ANSI/NFPA 70).

# Electrical Connections Model 520



## 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:

115V - HOT	- BLACK	230V - HOT	- BROWN
NEUTRAL - WHITE		NEUTRAL - BLUE	
GROUND - GREEN		GROUND - GREEN/YELLOW	

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, UNLESS OTHERWISE SPECIFIED:

115V +V RED	+V RED
-V BLUE	-V BLACK

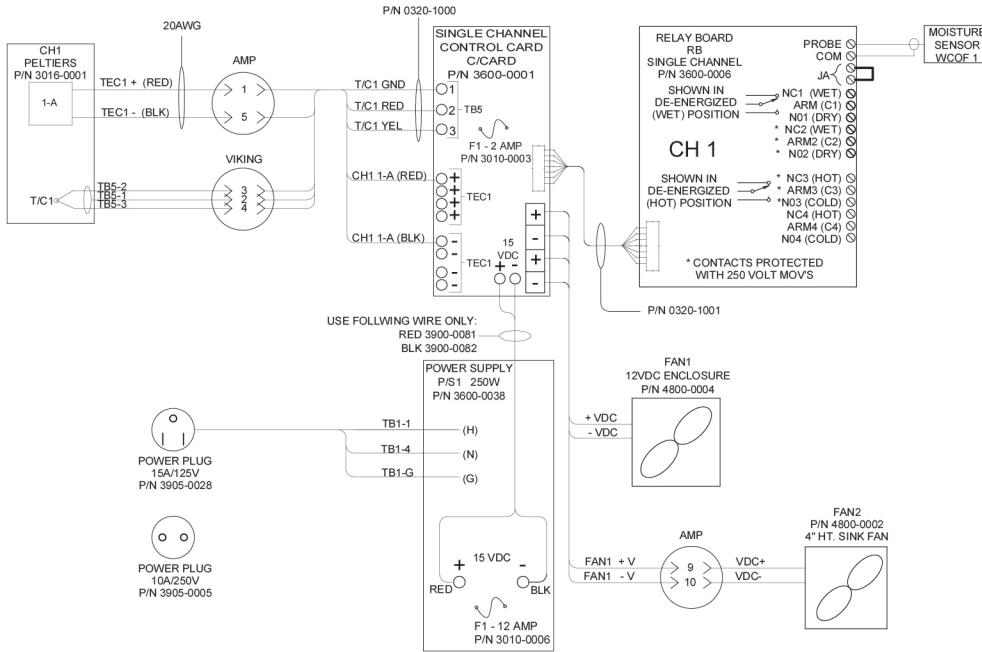
## RELAY BOARD NOTES

4. USER CONNECTIONS TO MOISTURE SENSOR RELAY ENERGIZED WHEN SENSOR IS DRY (DRY LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

5. USER CONNECTIONS TO "AT TEMPERATURE" RELAY ENERGIZED WHEN BELOW SET TEMPERATURE (COOL LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

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FIELD TO WIRE

# Electrical Connections Model 530



## 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:

115V - HOT	- BLACK	230V - HOT	- BROWN
NEUTRAL - WHITE		NEUTRAL - BLUE	
GROUND - GREEN		GROUND - GREEN/YELLOW	

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, UNLESS OTHERWISE SPECIFIED:

115V +V RED	230V +V RED
-V BLUE	-V BLACK

## RELAY BOARD NOTES

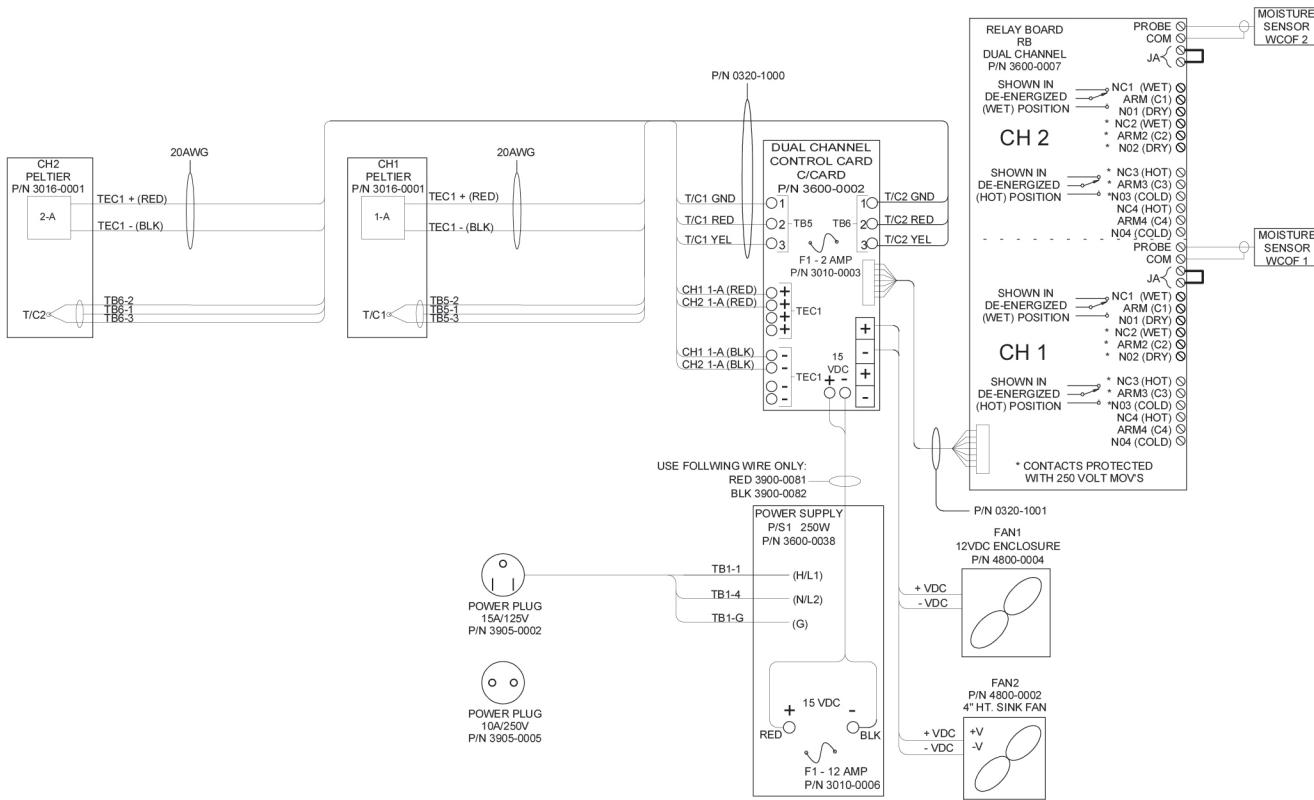
4. USER CONNECTIONS TO MOISTURE SENSOR RELAY ENERGIZED WHEN SENSOR IS DRY (DRY LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

5. USER CONNECTIONS TO "AT TEMPERATURE" RELAY ENERGIZED WHEN BELOW SET TEMPERATURE (COOL LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

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FIELD TO WIRE



# Electrical Connections Model 540



## 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:

115V - HOT	- BLACK	230V - HOT	- BROWN
NEUTRAL - WHITE	- BLUE	NEUTRAL - BLUE	
GROUND - GREEN	- GREEN/YELLOW	GROUND - GREEN/YELLOW	

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, UNLESS OTHERWISE SPECIFIED:

115V +V RED	230V +V RED
-V BLUE	-V BLACK

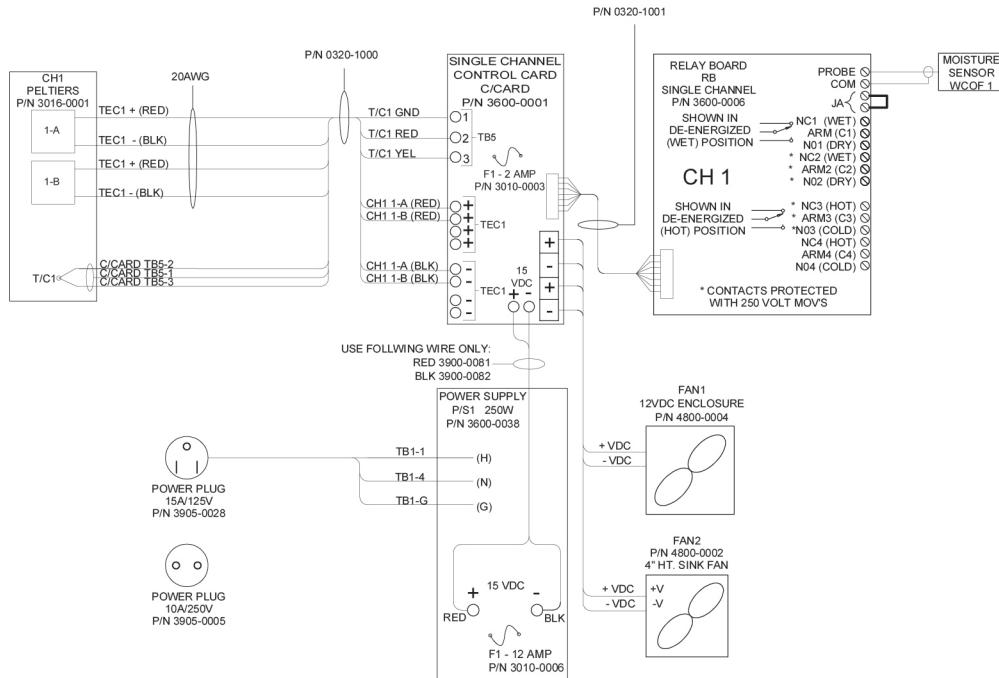
## RELAY BOARD NOTES

4. USER CONNECTIONS TO MOISTURE SENSOR RELAY ENERGIZED WHEN SENSOR IS DRY (DRY LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

5. USER CONNECTIONS TO "AT TEMPERATURE" RELAY ENERGIZED WHEN BELOW SET TEMPERATURE (COOL LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

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FIELD TO WIRE

# Electrical Connections Model 560



## 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:

115V - HOT	- BLACK	230V - HOT	- BROWN
NEUTRAL - WHITE		NEUTRAL - BLUE	
GROUND - GREEN		GROUND - GREEN/YELLOW	

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, UNLESS OTHERWISE SPECIFIED:

115V +V RED	+V RED	230V +V RED	+V RED
-V BLUE	-V BLACK	-V BLACK	-V BLACK

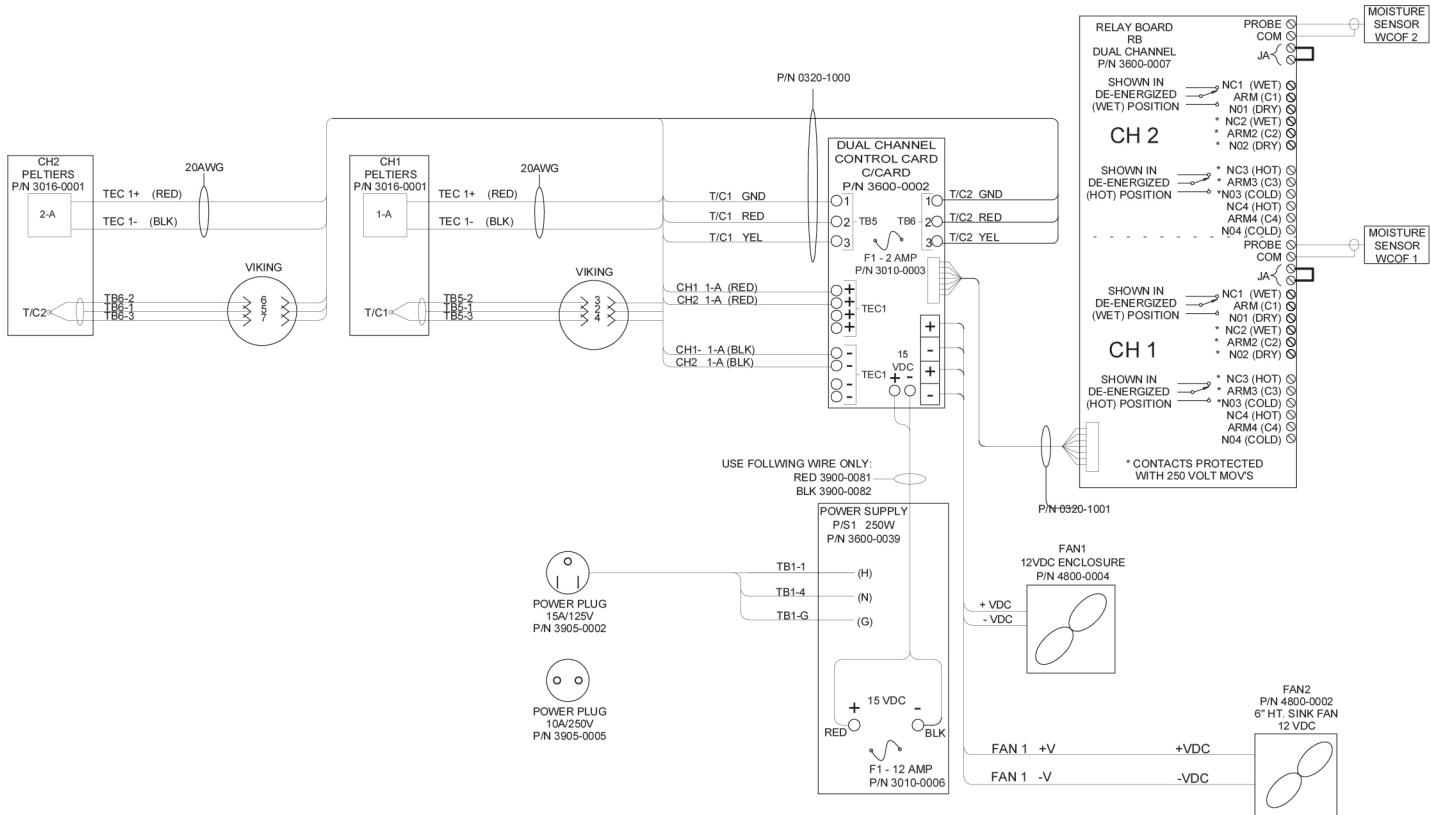
## RELAY BOARD NOTES

4. USER CONNECTIONS TO MOISTURE SENSOR RELAY ENERGIZED WHEN SENSOR IS DRY (DRY LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

5. USER CONNECTIONS TO "AT TEMPERATURE" RELAY ENERGIZED WHEN BELOW SET TEMPERATURE (COOL LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

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FIELD TO WIRE-----

# Electrical Connections Model 570



## 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:

115V - HOT	- BLACK	230V - HOT	- BROWN
NEUTRAL - WHITE		NEUTRAL - BLUE	
GROUND - GREEN		GROUND - GREEN/YELLOW	

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, UNLESS OTHERWISE SPECIFIED:

115V +V RED	+V RED	230V +V RED	+V RED
-V BLUE	-V BLACK	-V BLACK	-V BLACK

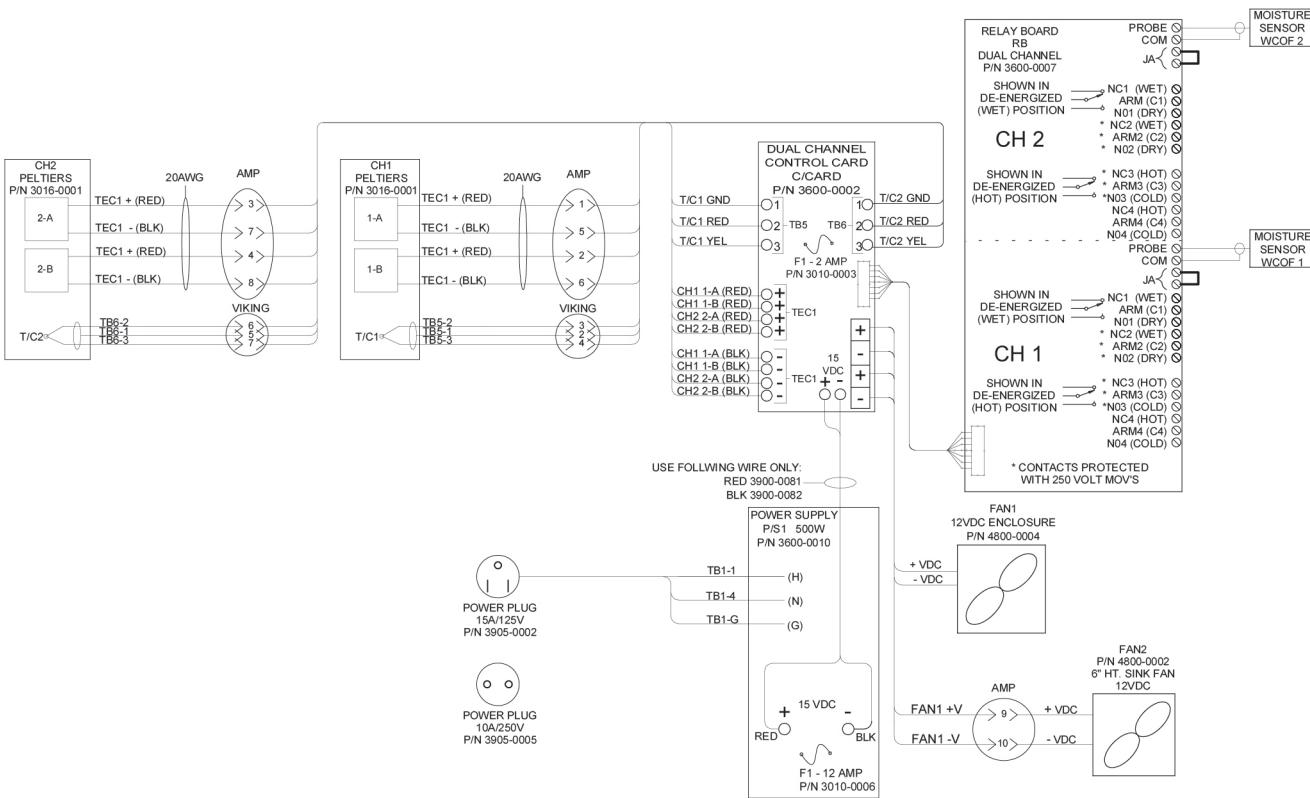
## RELAY BOARD NOTES

4. USER CONNECTIONS TO MOISTURE SENSOR RELAY ENERGIZED WHEN SENSOR IS DRY (DRY LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

5. USER CONNECTIONS TO "AT TEMPERATURE" RELAY ENERGIZED WHEN BELOW SET TEMPERATURE (COOL LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

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FIELD TO WIRE

# Electrical Connections Model 574



## 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:

115V - HOT	- BLACK	230V - HOT	- BROWN
NEUTRAL - WHITE	- BLUE	NEUTRAL - BLUE	- GREEN/YELLOW
GROUND - GREEN		GROUND	

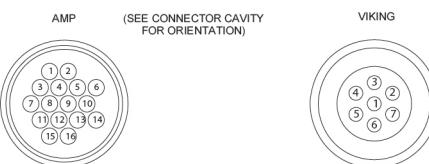
3. DC WIRING SHALL BE INDIVIDUAL CONDUCTORS OF STRANDED TINNED COPPER WITH 300V, TYPE TFE INSULATION. MINIMUM WIRE SIZE SHALL BE 22 AWG UNLESS OTHERWISE SPECIFIED. COLOR CODE SHALL BE AS FOLLOWS, UNLESS OTHERWISE SPECIFIED:

115V +V RED	-V BLUE	230V +V RED	-V BLACK
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## RELAY BOARD NOTES

4. USER CONNECTIONS TO MOISTURE SENSOR RELAY ENERGIZED WHEN SENSOR IS DRY (DRY LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.

5. USER CONNECTIONS TO "AT TEMPERATURE" RELAY ENERGIZED WHEN BELOW SET TEMPERATURE (COOL LED ON). RATING: 1/10HP 120VAC 5A 240VAC/32VDC RESISTIVE.



# **Startup**

Apply power to the Universal Analyzers 500 Series Thermoelectric Gas Cooler. The indicated temperature will start to drop immediately. It should be below the over-temperature set point in approximately four minutes and the “COOL” green LED lamp should light. When the temperature reaches the control point (set at 5°C), the rate at which the temperature drops will be reduced. It will stabilize between 4° and 5°C.

Start the sample gas flow. Water should be observed to be removed from the bottom of the heat exchanger when steady state conditions are established.

If moisture sensors are installed, the (DRY) light should remain on as dry gas is transported to the analyzer(s). Turn on the analyzer(s) and calibrate as required.

# **Shut Down**

Stop sample gas flow to the Universal Analyzers 500 Series Thermoelectric Gas Cooler by turning off the sample pump. Allow the drain pump to run for several minutes to remove any remaining condensate from the heat exchangers. After all condensate has been drained, turn off power to the cooler.

# Maintenance

Before performing any maintenance on the 500 Series Thermoelectric Gas Cooler, ensure that all plant safety procedures are followed.

The 500 Series Cooler is designed for maintenance free operation, but if any is required, ensure power has been removed before maintenance is performed.

For the best performance of the cooler, the following maintenance schedule is recommended:

Maintenance Activity	Frequency
Peristaltic Pump	Replace Tubing every 3 months
Diaphragm Sample Pump	Replace Diaphragm every 6 months
Clean Heat Exchanger	Annually
Inspect Heat Sink Fins	Monthly

# Troubleshooting

The following table should give an overview of possible errors and an instruction to check and to repair them (is not valid for the starting-up period of cooler).

Error	Possible reason	Check/Repair
The presence of water	Overloading of the refrigeration capacity of the cooler due to too much water vapor or too great a sample flow rate  A fault in the condensate removal equipment. The heat exchanger has become full of condensate  An air leak in the condensate removal tubing  The pressure of the compressed air driving the vortex tube has dropped below 60 psig at the inlet of the thermal valve  Failure of the sample cooler  The cooler is not cold enough and needs to be calibrated. See calibration procedure below	
No sample gas flow	Heat exchanger plugged  Alarm shutoff  No power on cooler	Check for an obstruction  Remove heat exchanger from unit and disassemble  Verify Cool & Dry Indicators are illuminated  Ensure cooler has power supplied
Water carry over	Inadequate drain apparatus  Excessive flow rate  High ambient temperature  Defective cooler	Verify drain tubing is unobstructed and equipment is functioning satisfactory  Reduce the flow rate  Reduce the ambient temperature (Increase ventilation or relocate cooler)  Verify air flow across the heat sink  Hold hand in front of heat sink fins and ensure air movement

# Troubleshooting

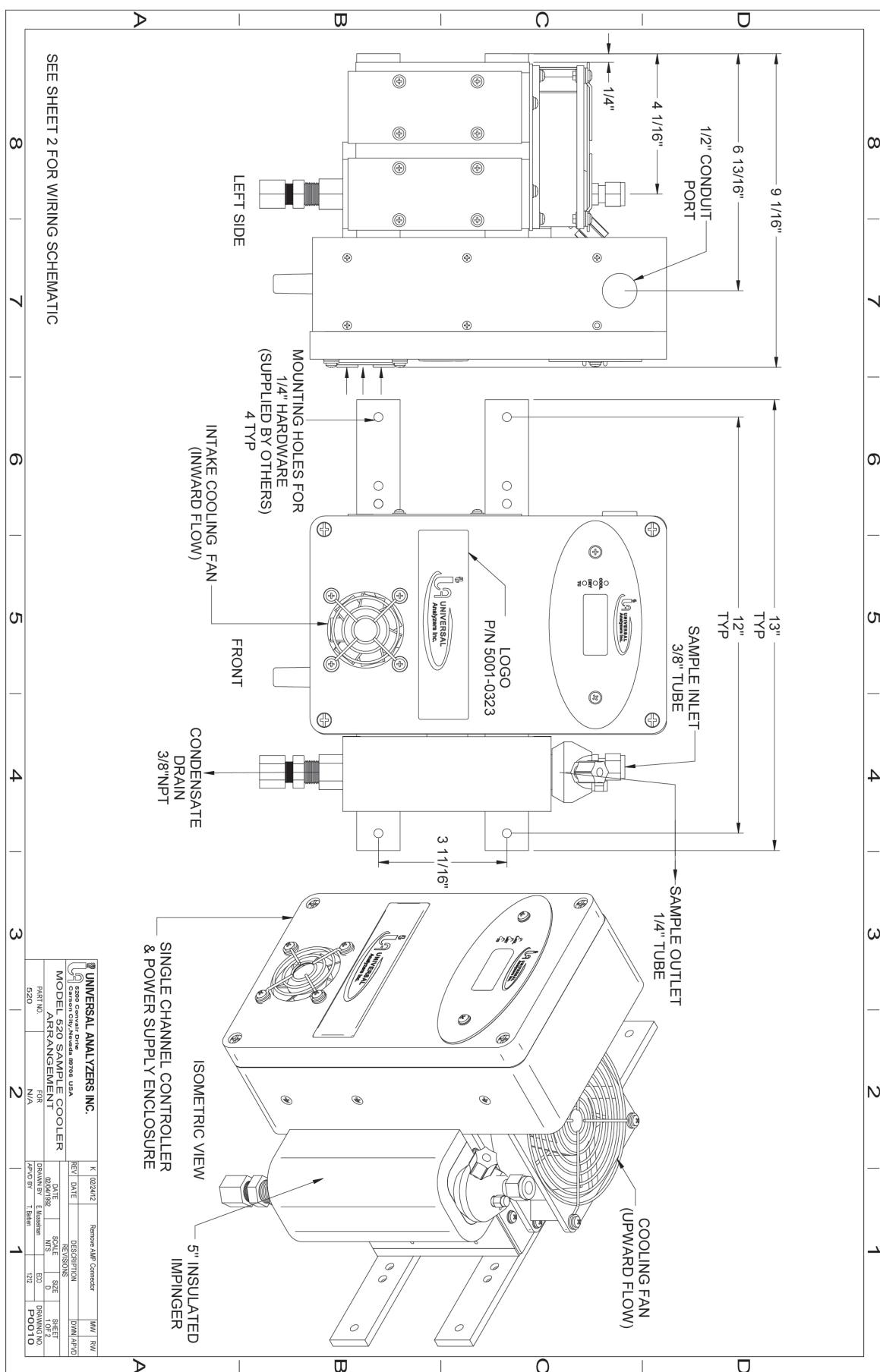
High oxygen readings/ low pollutant readings	Leak	Loose connection Verify all fittings are leak free Defective peristaltic pump tubing Replace tubing Broken or leaking heat exchanger Remove heat exchanger and replace if broken or repair (replace O-Ring) if leaking
'Dry' light is not illuminated	Water carry over  Faulty water carry over IC	See "water carry over" error  Disconnect/Unplug the 2 wire cable from the WCO terminals, located on the power supply board. If the dry light does not illuminate, consult the factory
'Cool' light is not illuminated	Ambient temperature too high  Flow rate/ water content too high  Failed Peltier element	Reduce the ambient temperature (Increase ventilation or relocate cooler)  Lower the flow rate through the cooler and observe the results  If condition corrects itself, consult the factory for further troubleshooting  Measure resistance between the red & black Peltier leads. A failed Peltier element will read high resistance or 'open'. Consult wiring diagram for wire location details
Power only on drain pump	Blown fuse (F1)  Defective transformer (T1)	Replace Fuse  Replace Power Supply Board

# Spare Parts

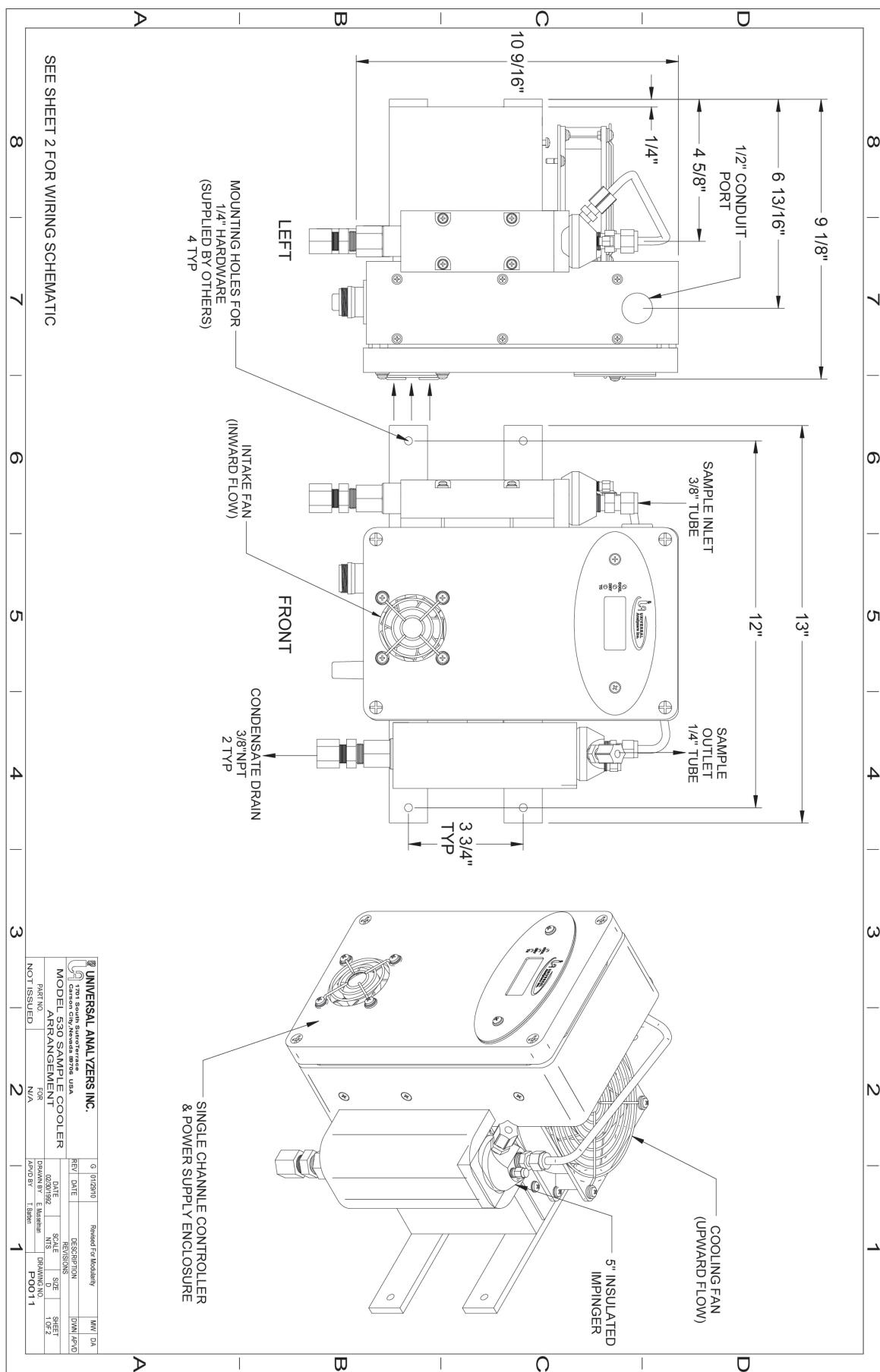
Consumable Parts	
Part	P/N
Fuse, Control Board – 2 Amp Slow Blow	3010-0003
Fuse, Power Supply Board – 6 Amp Slow Blow	3010-0005
Basic Parts	
Part	P/N
Heat Exchanger/Impinger – 316SS 5"	5200-S050
O-Ring for 316SS Heat Exchanger – Viton 2-021	4904-0013
Heat Exchanger/Impinger – Glass/Kynar 5"	5200-K050
O-Ring for Glass/Kynar Heat Exchanger – Viton 2-018 (Bottom)	4904-0003
O-Ring for Glass/Kynar Heat Exchanger – Viton 2-120 (Top)	4904-0004
Glass Tube, Outer – Heat Exchanger Replacement 5"	5201-0002
Paste, Heat Sinking – 0.1 Ounce Container – All Heat Exchangers	8010-0001
Critical Parts	
Part	P/N
Peltier Element – 15 VDC, 8.5 Amp, 40 mm Sq.	3016-0001
Insulation Kit – Heat Transfer Block	9515-0001
Thermocouple, Type "K" – Peltier Control	1150-0016
Fan, Heat Sink Cooling	4800-0002
Fan, Power Supply Cooling	4800-0004
Controller Circuit Board – Single Channel (Models: 520, 530, 560)	3600-0001-SN
Controller Circuit Board – Dual Channel (Models: 540, 570, 575)	3600-0002
Alarm Relay Circuit Board – Single Channel (Models: 520, 530, 560)	3600-0006
Alarm Relay Circuit Board – Dual Channel (Models: 540, 570, 575)	3600-0007
Power Supply Board – 115 VAC, 250 Watt, (15 VDC Output)	3600-0038
Power Supply Board – 230 VAC, 250 Watt, (15 VDC Output)	3600-0038-230
Optional Parts	
Part	P/N
Motor, Peristaltic Pump – 120 VAC, 6 RPM	4958-0003
Motor, Peristaltic Pump – 230 VAC, 12 RPM	4958-0007
Head, Peristaltic Pump – for #15 Tubing	4958-0006
Tube, Peristaltic Pump – 5 Feet Length #15	9216-0002
Sample Pump – 115 VAC, Mini Dia-Vac Aluminum/Teflon Single Head	4958-0025
Sample Pump – 230 VAC, Mini Dia-Vac Aluminum/Teflon Single Head	4958-0015
Sample Pump – 115 VAC, Mini Dia-Vac Aluminum/Teflon Dual Head	4958-0026
Sample Pump – 230 VAC, Mini Dia-Vac Aluminum/Teflon Dual Head	4958-0016
Sample Pump Rebuild Kit – Mini Dia-Vac (one per pump head required)	9515-0018
WCOF Assembly – Visible Moisture Sensor with 2µm Ceramic Filter	WCOF-4980-0007
Filter Element – 2µm Ceramic (for WCOF Assembly)	4980-0007
Bowl, WCOF Filter – Replacement with cable	5205-0038
Thermocouple Kit, Heat Exchanger – New Jersey Type "K"	9515-0046

\* COMMISSIONING SPARE PART

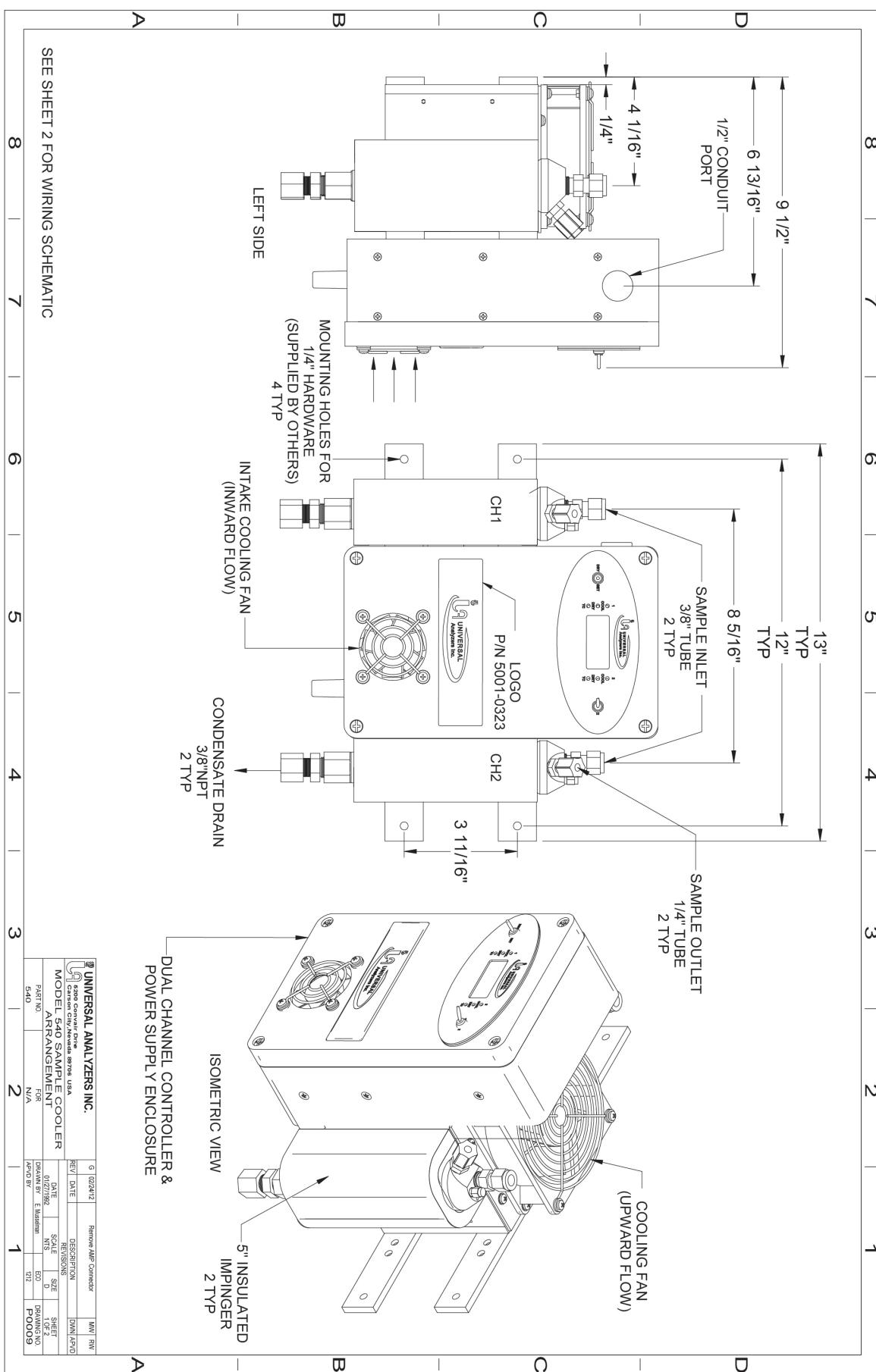
# Drawings Model 520



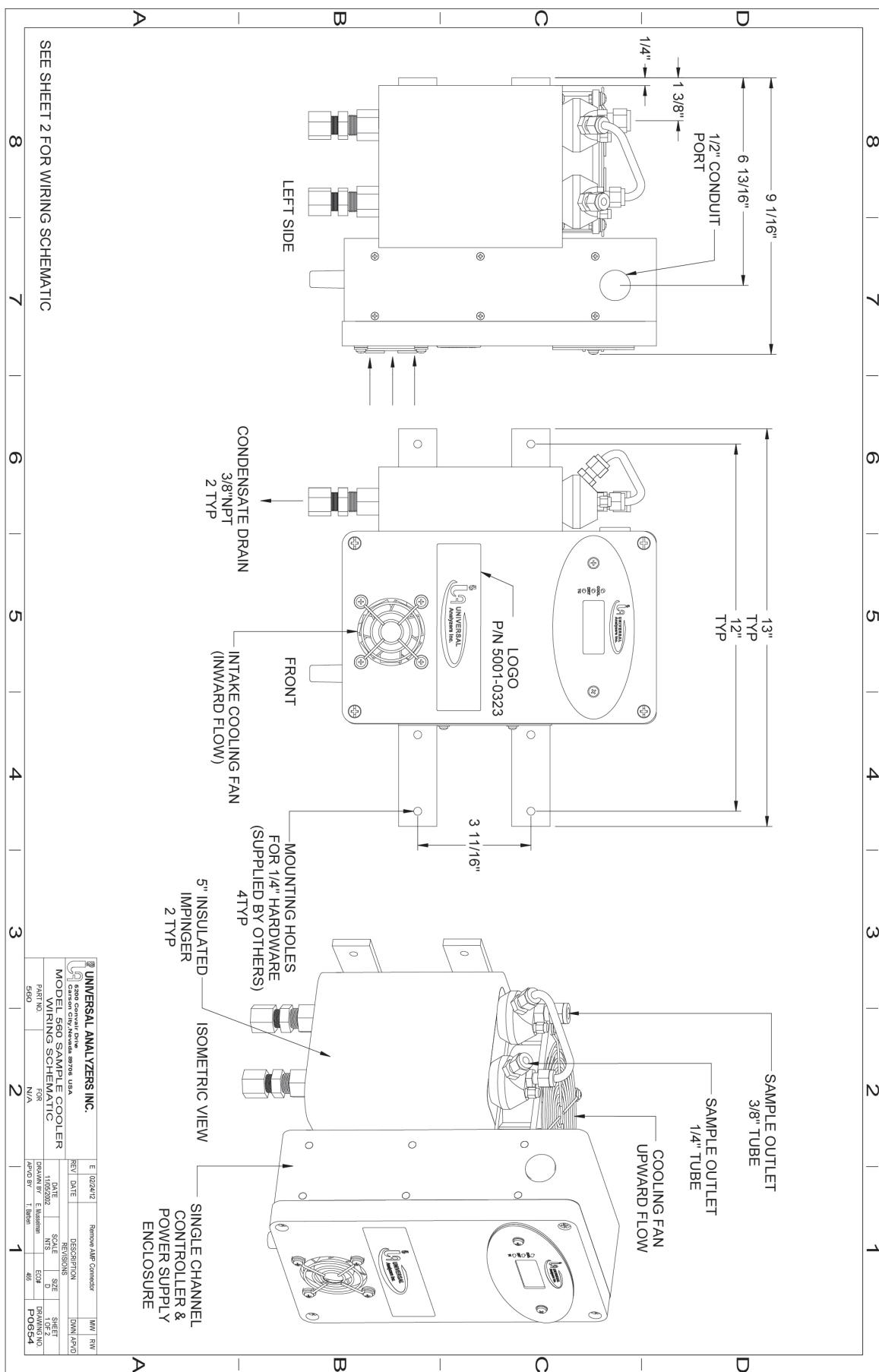
# Drawings Model 530



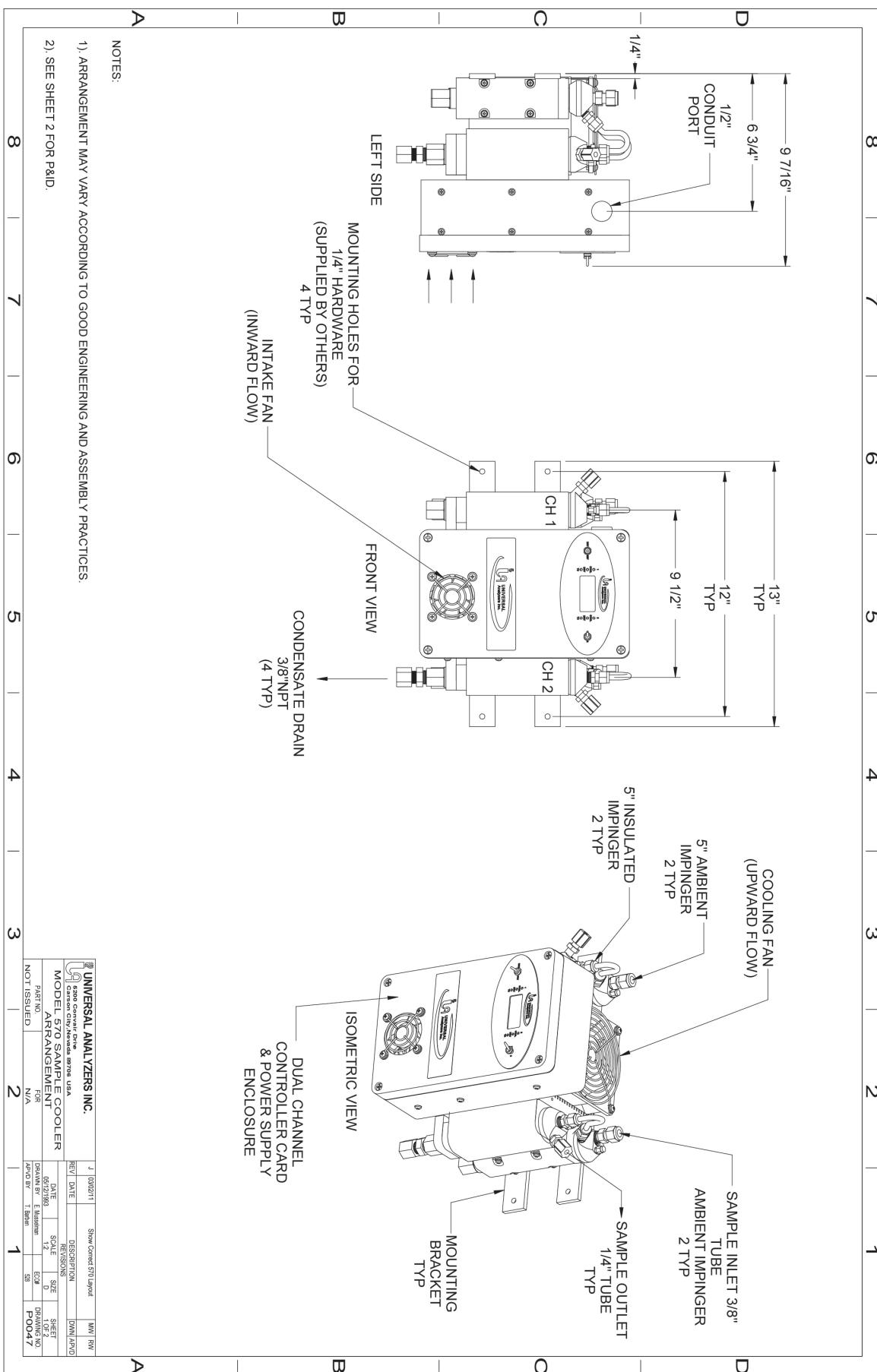
# Drawings Model 540



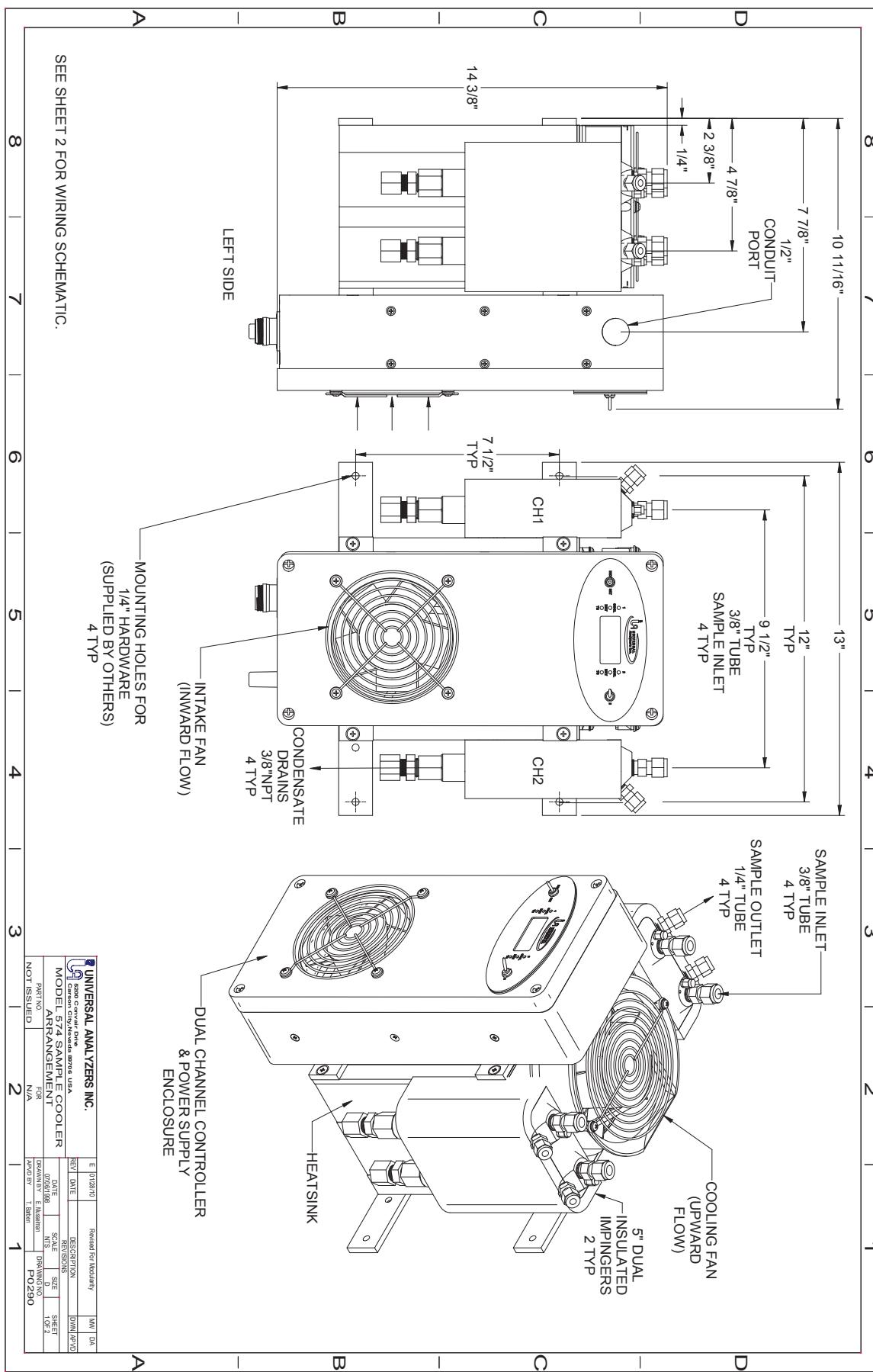
# Drawings Model 560



# Drawings Model 570



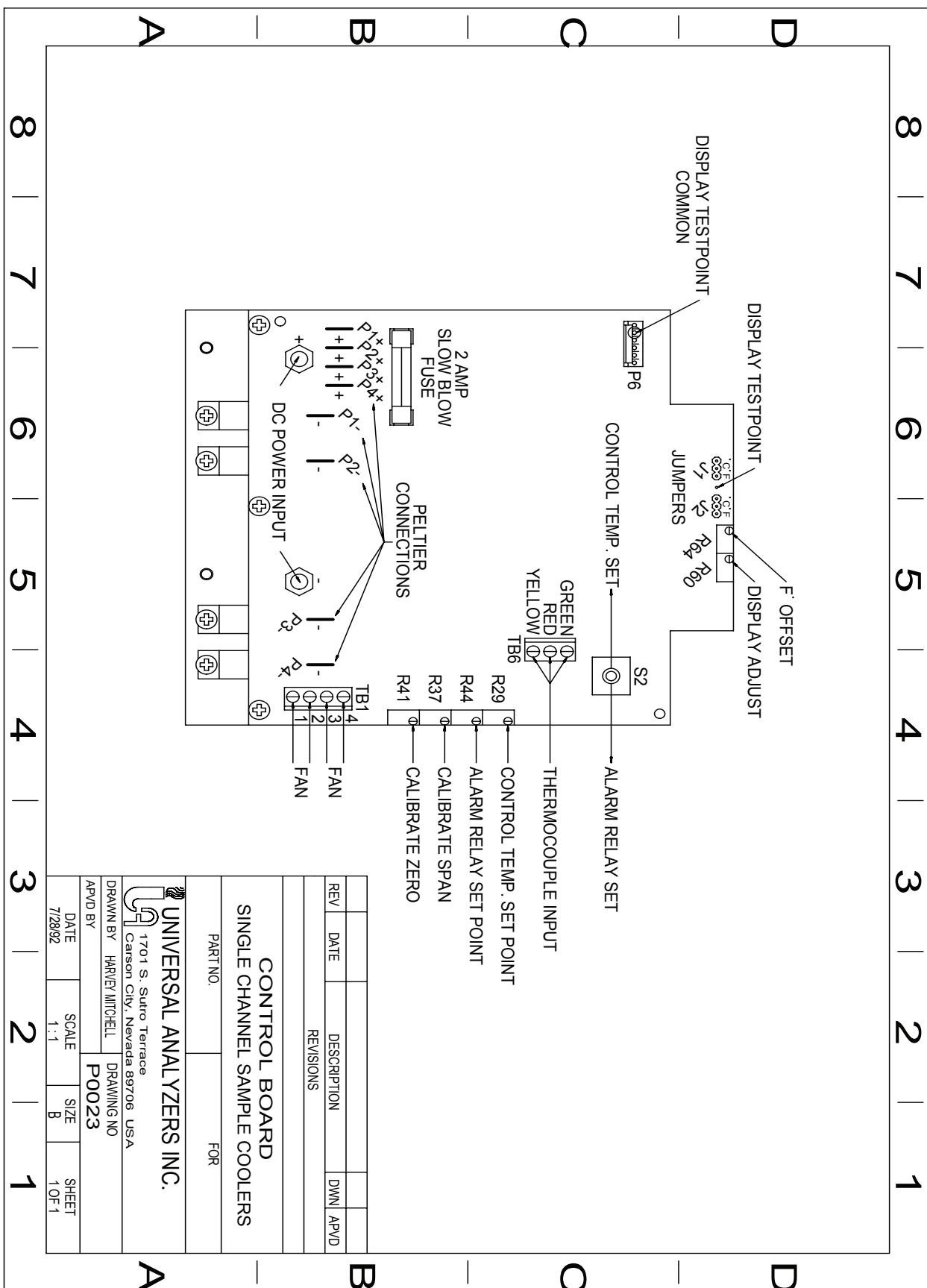
# Drawings Model 574



# Drawings - Controller Boards

Display Board

Models 520, 530, 560



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

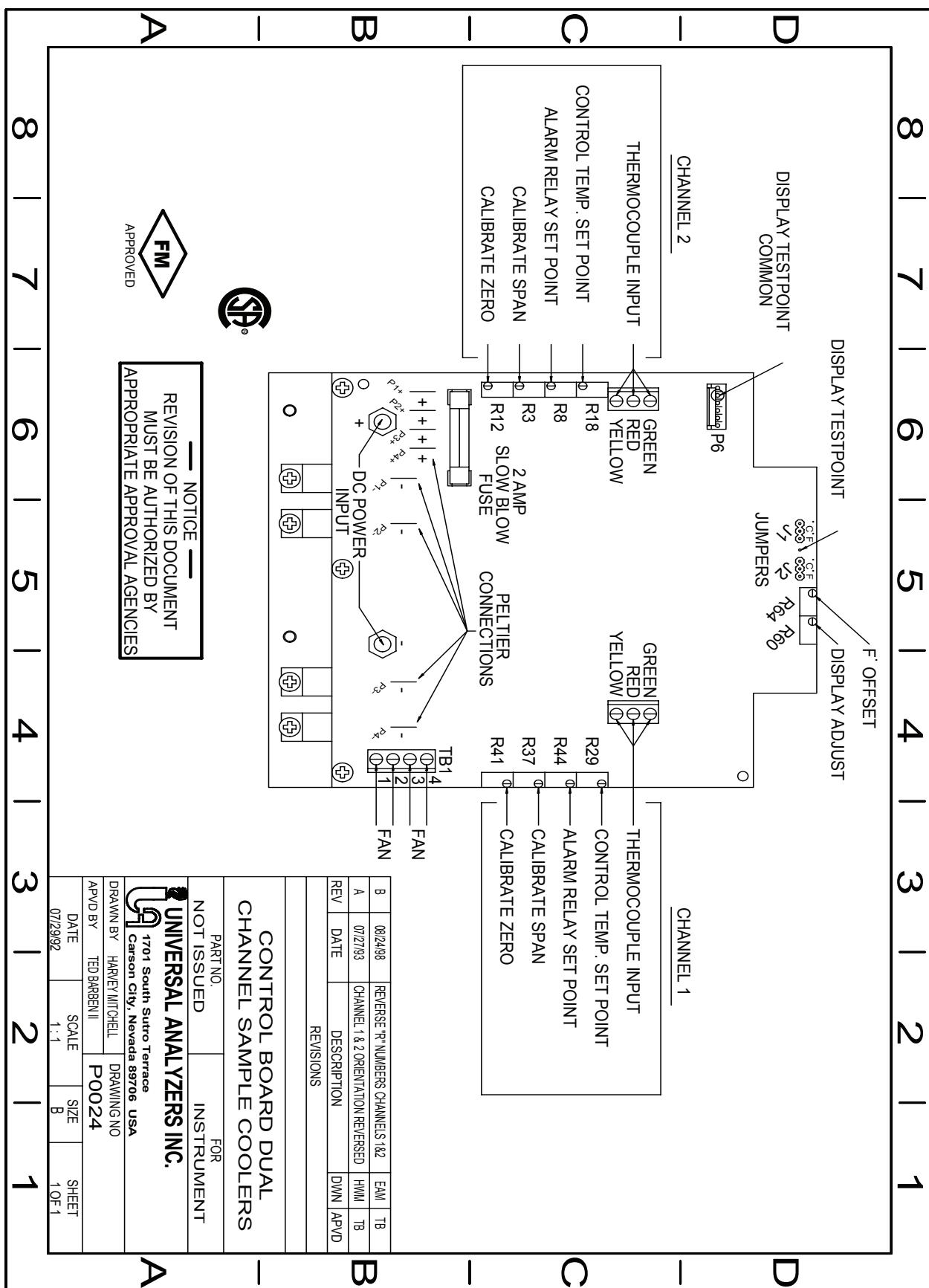
DRAWN BY HARVEY MITCHELL DRAWING NO.  
APV'D BY P0023

DATE 7/28/92 SCALE 1:1 SIZE B SHEET 1 OF 1

# Drawings - Controller Boards

Display Board

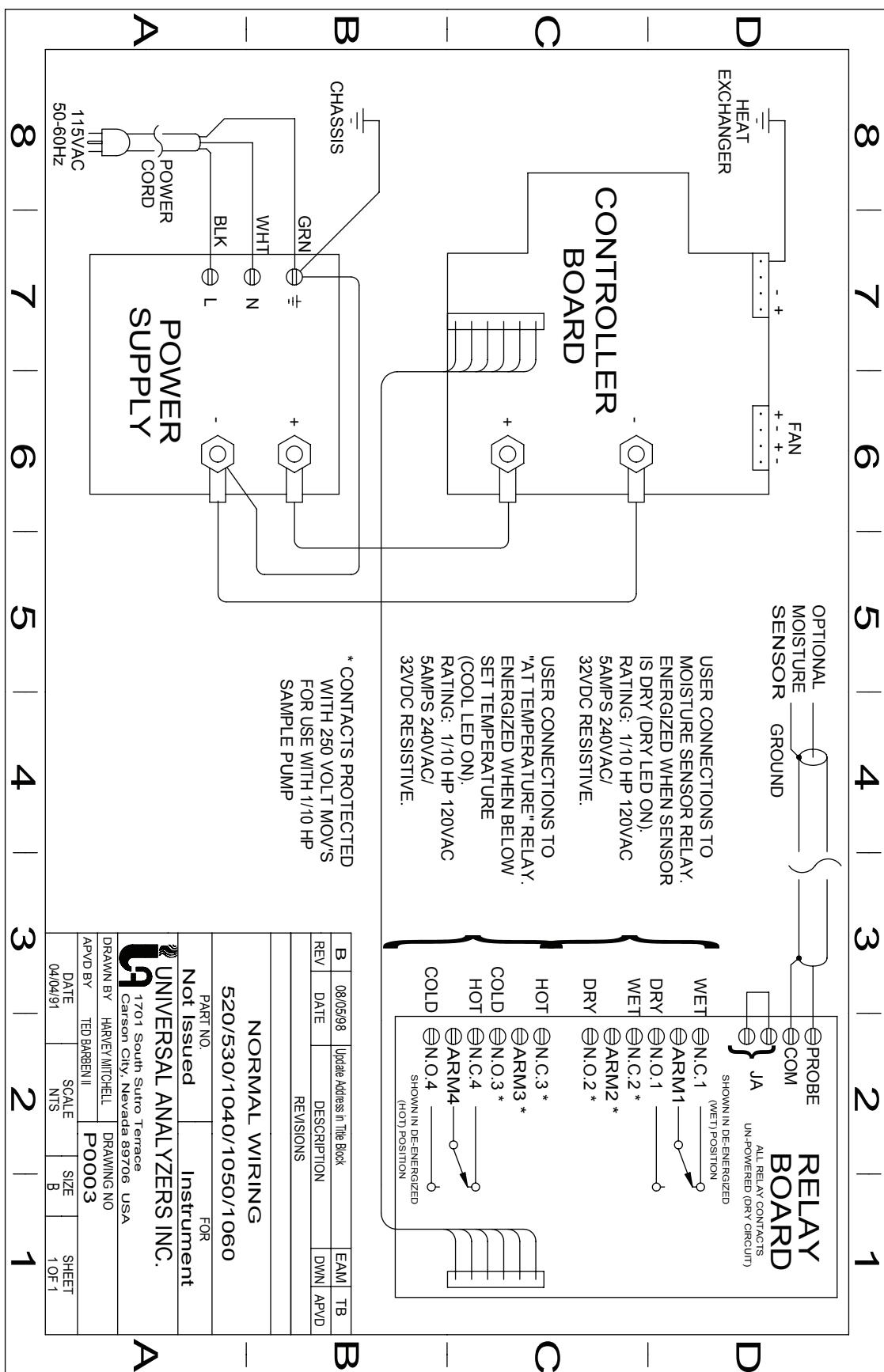
Models 540, 570, 574



# Drawings - Controller Boards

Relay Board

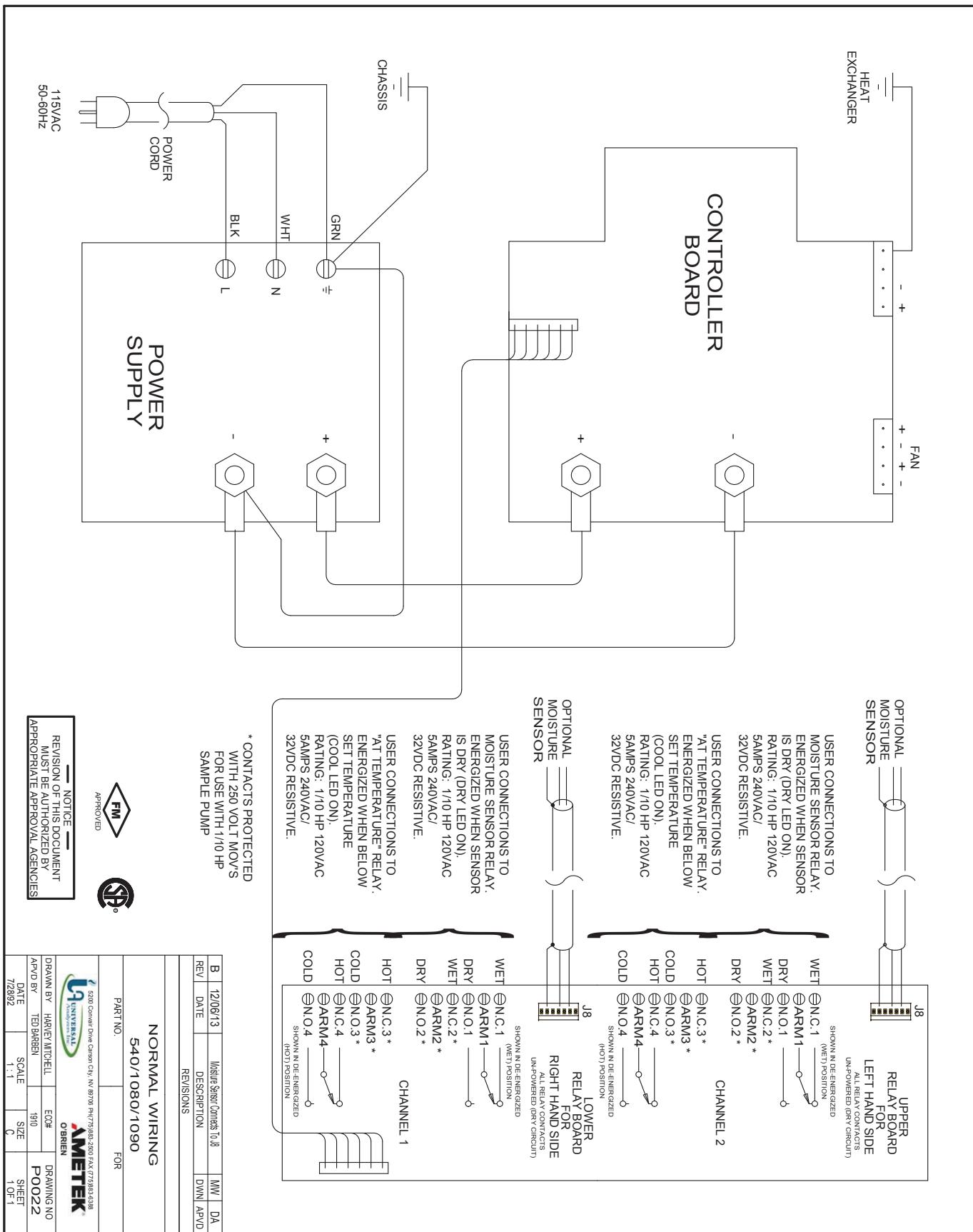
Models 520, 530, 560



# Drawings - Controller Boards

## Relay Board

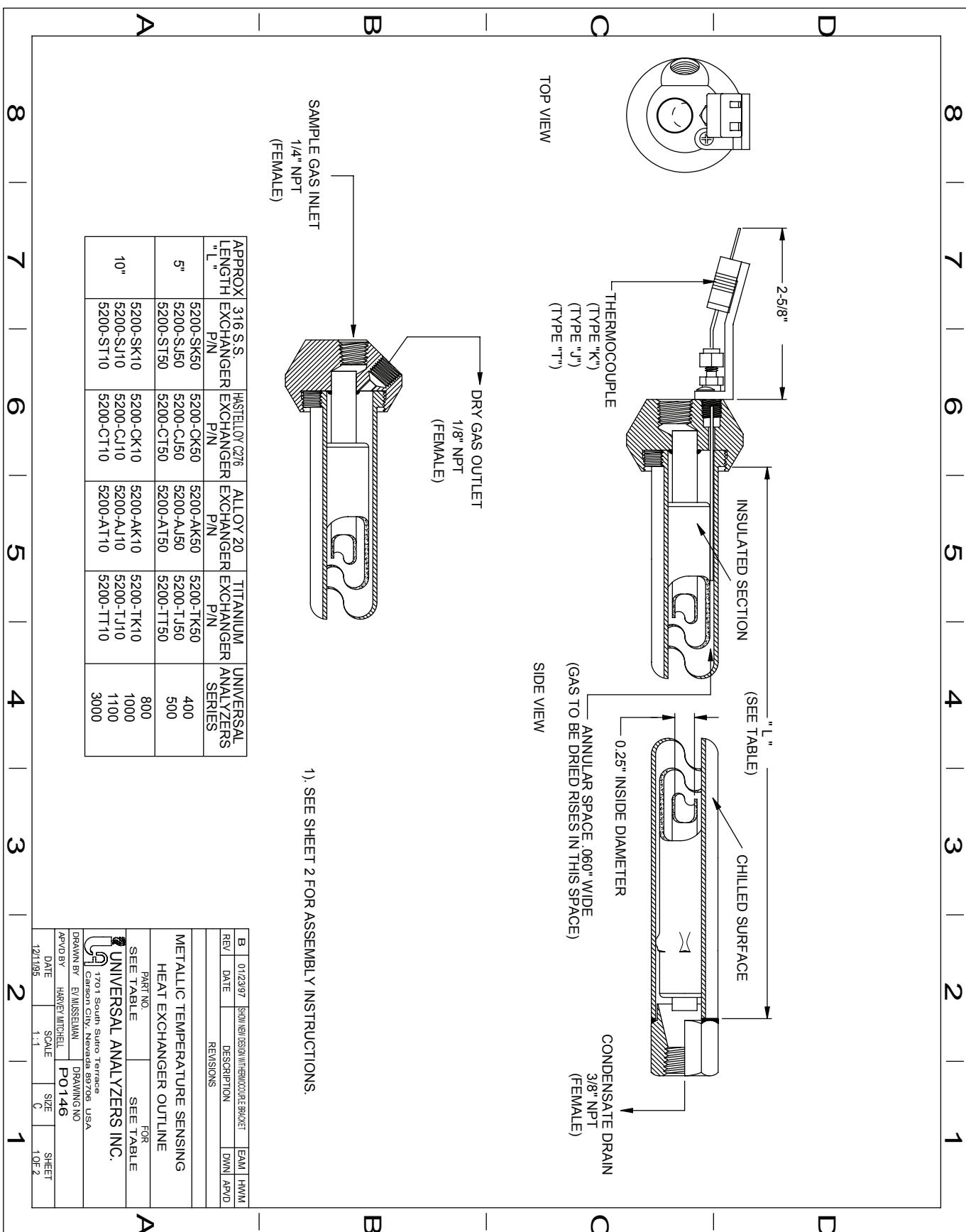
Models 540, 570, 574



# Drawings - Heat Exchangers

Metallic Heat Exchangers (Temperature Sensing)

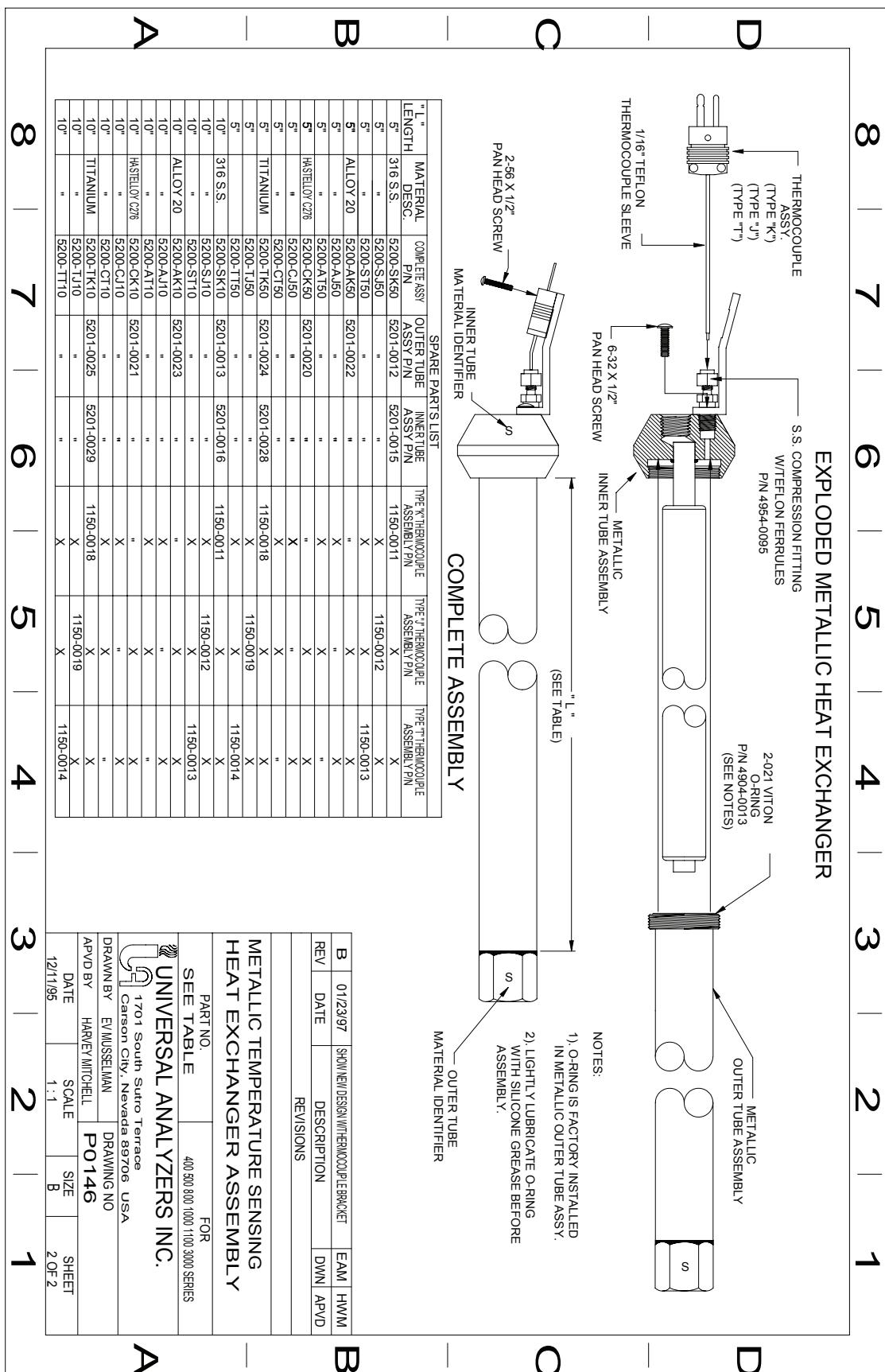
Models 520, 530, 540, 560, 570, 574



# Drawings - Heat Exchangers

Metallic Heat Exchangers (Temperature Sensing)

Models 520, 530, 540, 560, 570, 574

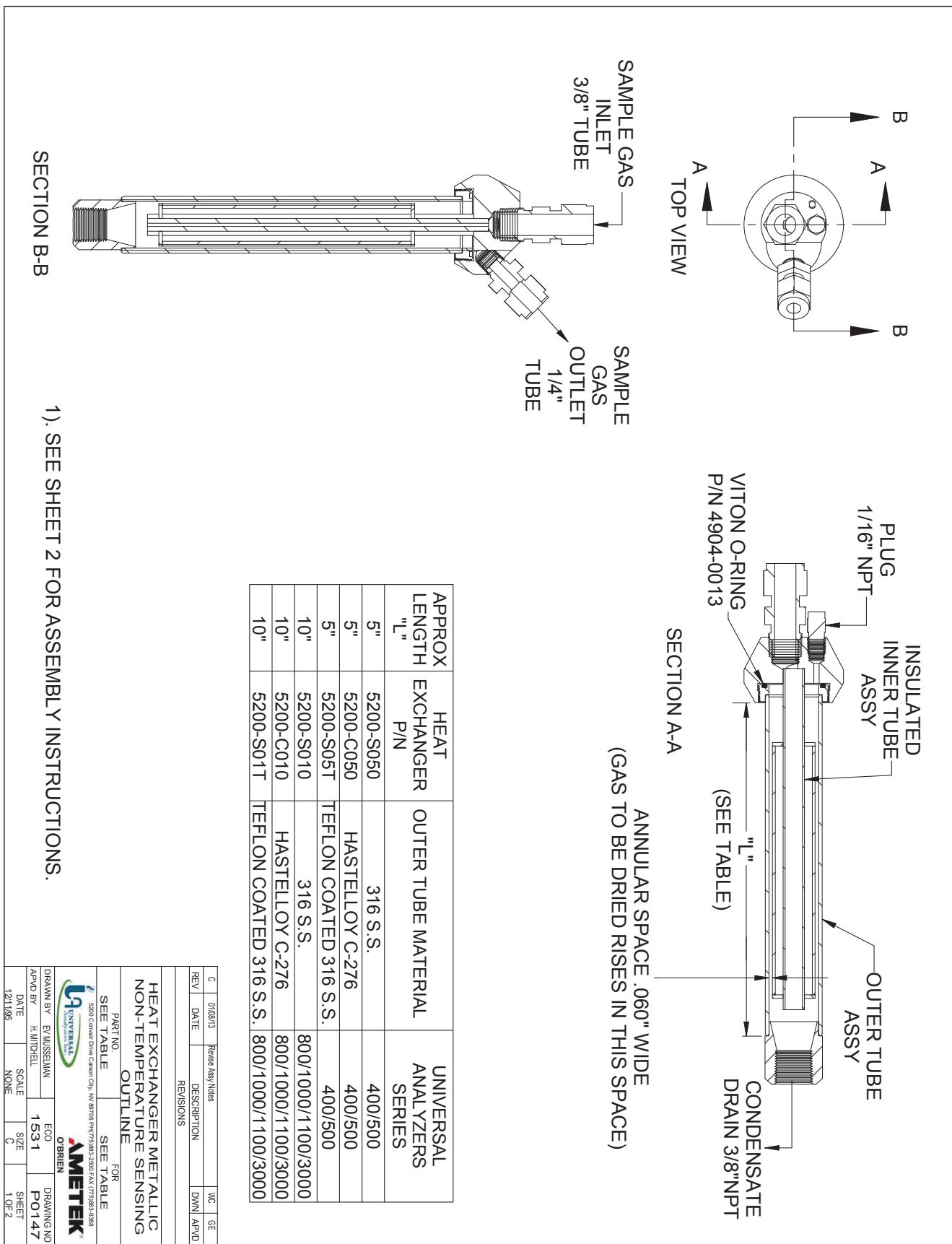


8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

# Drawings - Heat Exchangers

Metallic Heat Exchangers (Non-Temperature Sensing)

Models 520, 530, 540, 560, 570, 574



# Drawings - Heat Exchangers

Metallic Heat Exchangers (Non-Temperature Sensing)

Models 520, 530, 540, 560, 570, 574

HEAT EXCHANGER SPARE PARTS LIST						
APPROX SEPERABLE LENGTH	P/N	INNER TUBE ASSY P/N	OUTER TUBE ASSY P/N	VITON O-RING #2-021 P/N	PLUG 1/16"NPT P/N	
5"	5200-S050	5201-0015	5201-0012	4904-0013	4951-0058	
5"	5200-C050	"	5201-0020	"	"	
5"	5200-S05T	5201-0041	5201-0043	"	"	
10"	5200-S010	5201-0016	5201-0013	4904-0013	4951-0058	
10"	5200-C010	"	5201-0021	"	"	
10"	5200-S01T	5201-0042	5201-0044	"	"	
15"	5200-S015	5201-0107	5201-0055	"	"	

**NOTES:**

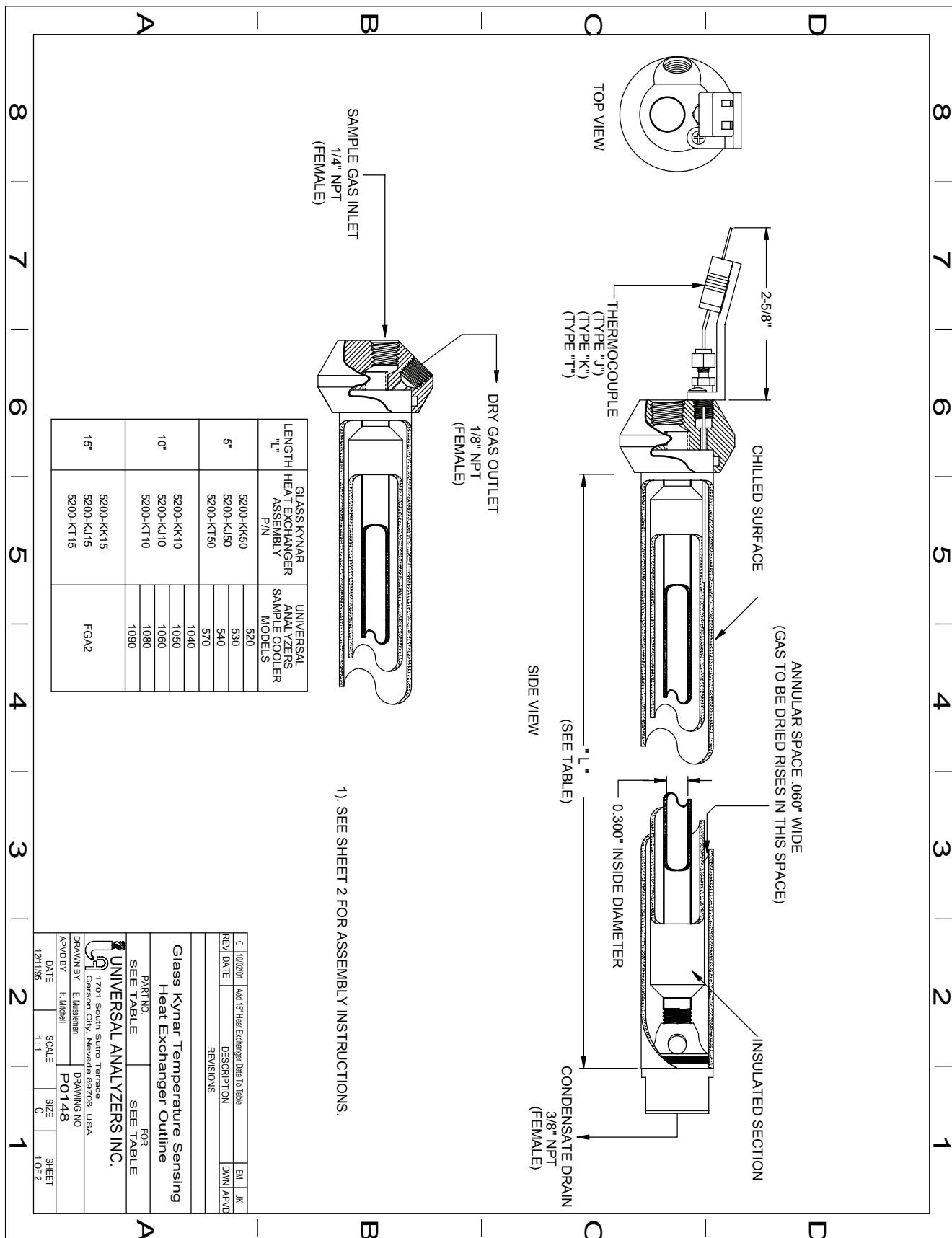
1. O-RING IS FACTORY INSTALLED IN METALLIC OUTER TUBE.
2. LIGHTLY LUBRICATE O-RING WITH SILICONE GREASE BEFORE ASSEMBLY.
3. ANTI-SEIZE ON OUTER TUBE THREADS.

HEAT EXCHANGER ASSEMBLY  
NON-TEMPERATURE SENSING  
METALLIC

C	01/03/03	Release Assy Notes	WC	GE
REV	DATE	DESCRIPTION	DWN	APVD
REVISIONS				
PART NO. FOR INSTRUMENT				
SEE TABLE				
3290 Commercial Drive, Carson City, NV 89706 (775) 882-2600 FAX (775) 882-2499				
<b>AMETEK</b> UNIVERSAL				
DRAWN BY	EV MUSSELMAN	ECD	DRAWING NO	
APVD BY	H. MITCHELL	1531	PO147	
DATE	12/1/95	SCALE	SIZE	SHEET
	NONE	C	2 OF 2	

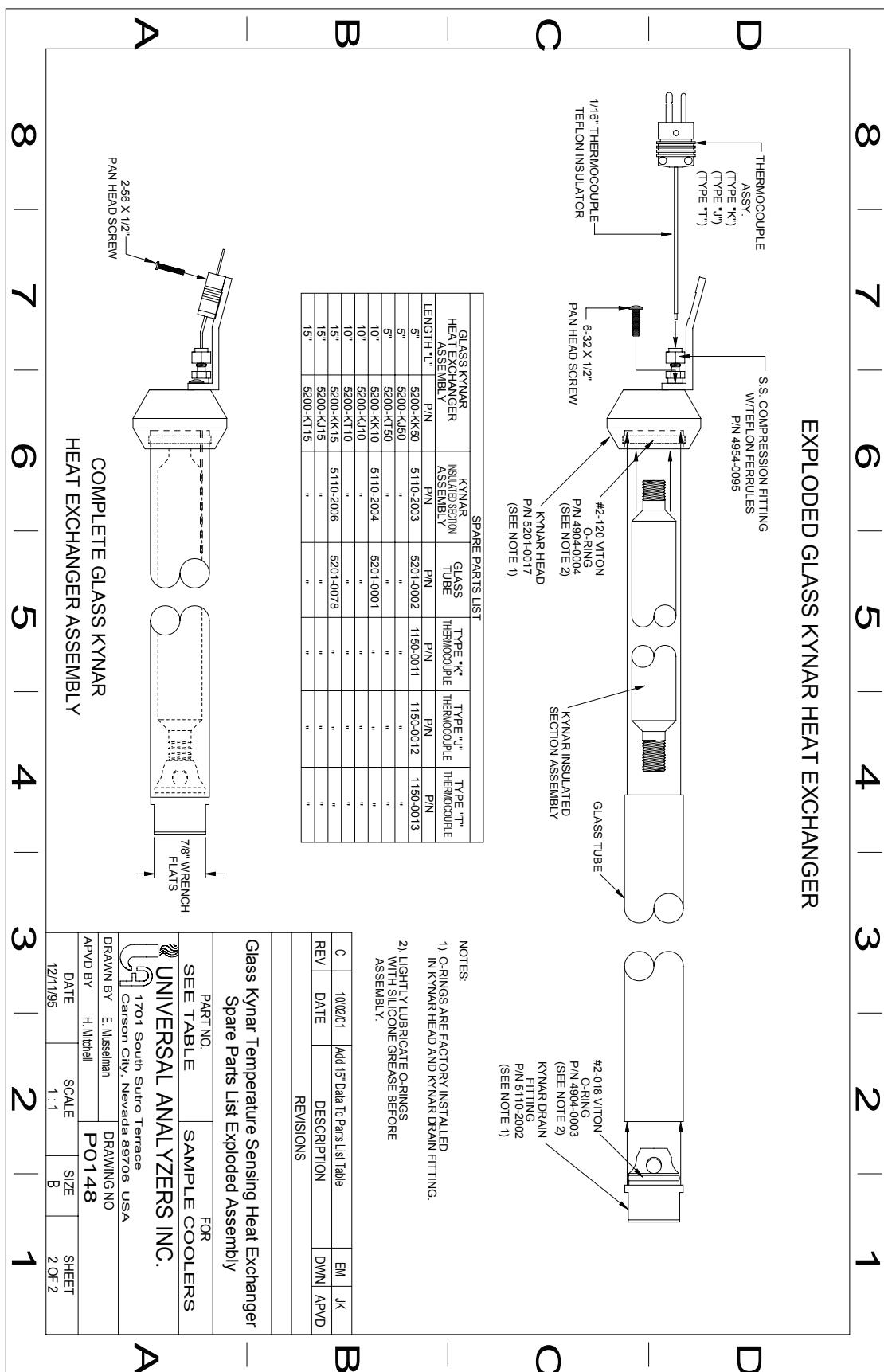
# Drawings - Heat Exchangers

Glass Kynar (Temperature Sensing)  
Models 520, 530, 540, 560, 570, 574



# Drawings - Heat Exchangers

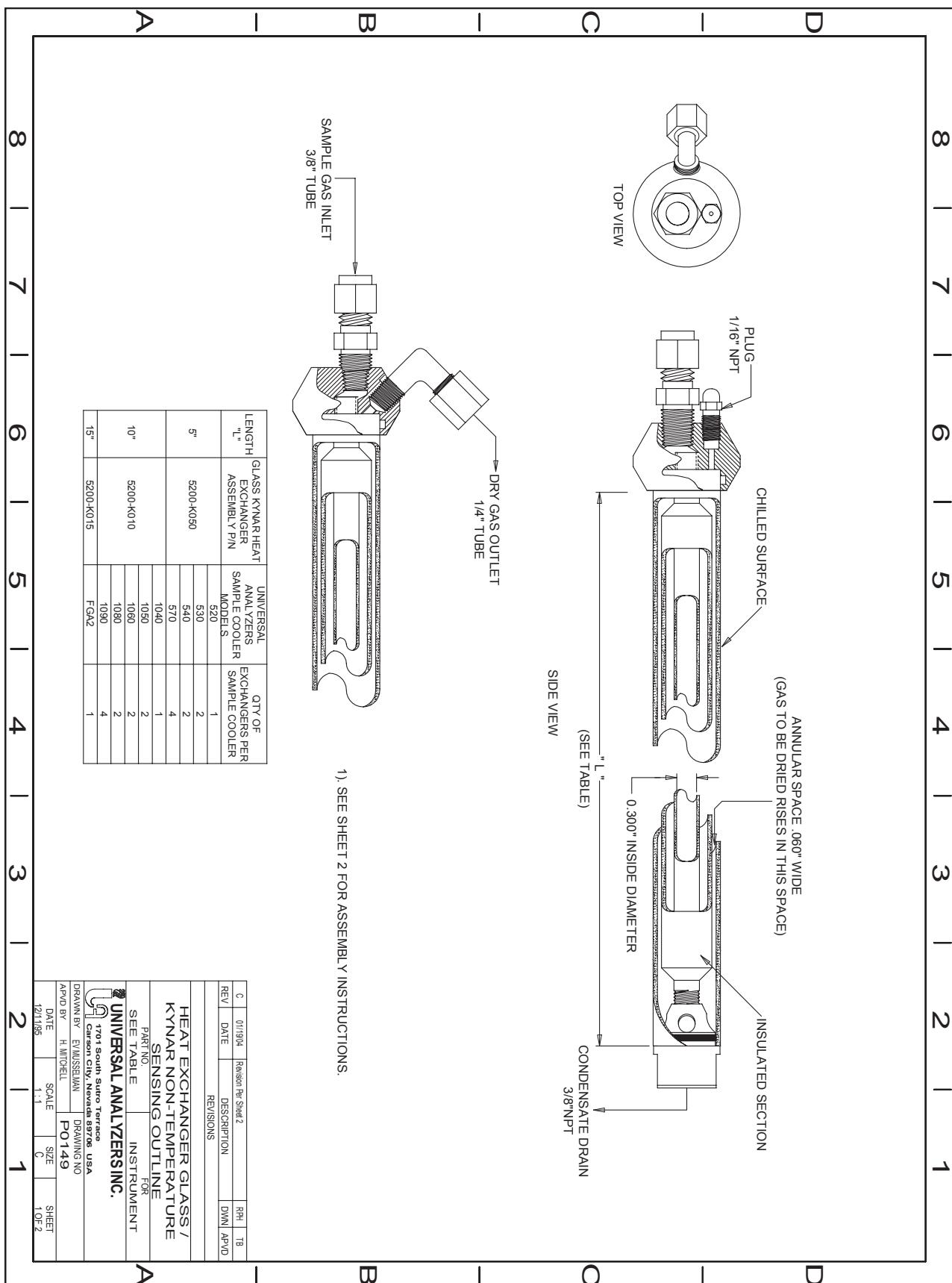
Glass Kynar (Temperature Sensing)  
Models 520, 530, 540, 560, 570, 574



# Drawings - Heat Exchangers

Glass Kynar (Non-Temperature Sensing)

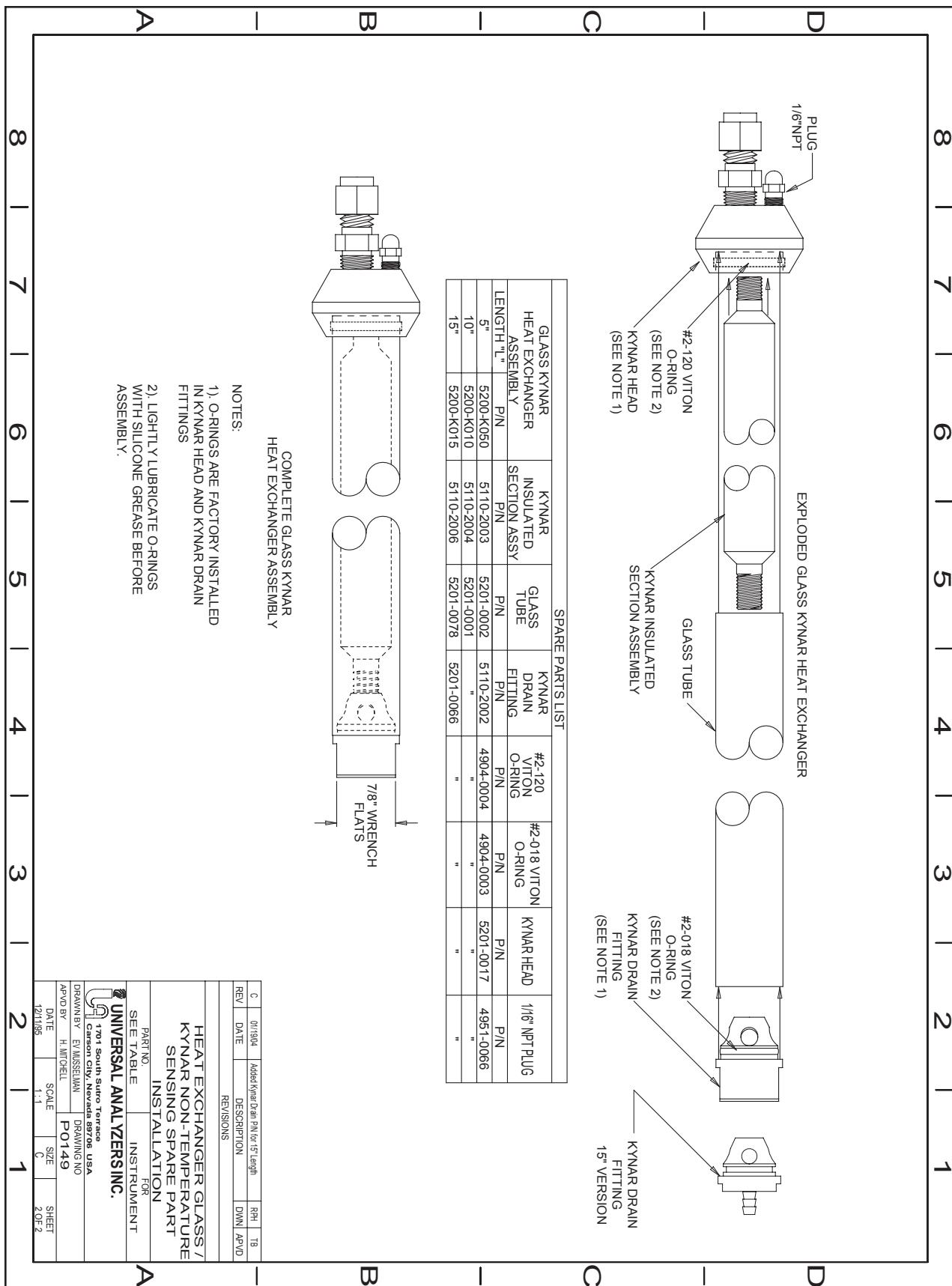
Models 520, 530, 540, 560, 570, 574



# Drawings - Heat Exchangers

Glass Kynar (Non-Temperature Sensing)

Models 520, 530, 540, 560, 570, 574



# Limited Warranty

## I. Limited Warranty

1. Limited Warranty. Universal Analyzers, Inc (UAI) offers a limited warranty on each of its products against failure due to defects in material and workmanship for a period ending the earlier of (i) fifteen (15) months from the date of the invoice relating to the sale of the product and (ii) twelve (12) months from the date of installation of the product (collectively, the "Initial Warranty"). During the Initial Warranty, UAI offers a limited warranty against failure due to defects in material and workmanship on each part of a product repaired or replaced by an authorized service person for a period ending the later of (a) the remaining term of the Initial Warranty of the product and (b) ninety (90) days from the date of such repair or replacement. After expiration of the Initial Warranty, UAI offers a limited warranty against failure due to defects in material and workmanship on each part of a product repaired or replaced by an authorized service person for a period ending ninety (90) days from the date of such repair or replacement. UAI further offers a limited warranty that the products and parts it sells will conform to UAI's written specifications therefor. The foregoing limited warranties cover parts and labor only and UAI does not warrant and will not reimburse the buyer of its products ("Buyer") for any costs relating to the access by service persons of UAI to the product at issue. The foregoing limited warranties cover only the repair or replacement of defective parts and such determination will be in the sole discretion of UAI. In its sole discretion, UAI may make repairs or replacements under these limited warranties with either new or refurbished parts. To the extent Buyer's product cannot be remedied under these limited warranties through repair or replacement of parts, Buyer may return the product for a refund of the purchase price, less a reasonable reduction in such purchase price equal to the depreciation expense incurred by Buyer relating to such product. The limited warranties of this Section I.1. are further subject to those warranty exclusions set forth below in Section I.2.
2. Limited Warranty Exclusions. Excluding the warranties provided for in Section I.1., UAI provides all products to Buyer "as-is," without any other warranty of any kind. UAI disclaims any and all express or implied warranties of merchantability, fitness for a particular purpose and non-infringement of the intellectual property of others. UAI makes no warranty, express or implied, as to the design, sale, installation or use of its products. UAI's warranties will not be enlarged by, nor will any obligation or liability of UAI arise due to UAI providing technical advice, facilities or service in connection with any product. There is no warranty by UAI with respect to any product's: (i) uninterrupted or error-free operation; (ii) actual performance, other than the product's capability to meet UAI's specifications therefor; (iii) removal or installation from a worksite or process; (iv) electronic components or associated accessories (including without limitation circuit boards and integrated circuits); (v) maintenance (including without limitation gasket and seal replacements, adjustments, minor repairs and other inspection requirements, preventative or otherwise); (vi) use under inappropriate conditions or not in accordance with operating instructions; or (vii) use in connection with the operation of a nuclear facility. There is no warranty for labor expenses associated with field repairs or the repair or replacement of defective parts in the engine or power unit of any product if such product has been in the possession of the owner or operator for greater than twelve (12) months. There is no warranty for products determined to be, in UAI's sole discretion, damaged as a result of (a) misuse, neglect or accident; (b) improper application, installation, storage or use; (c) improper or inadequate maintenance or calibration; (d) operation outside of the published environmental specification; (e) improper site preparation or maintenance; (f) unauthorized repairs or replacements; (g) modifications negligently or otherwise improperly made or performed by persons other than UAI; (h) Buyer-supplied software or supplies; (i) use in conjunction with or interfacing with unapproved accessory equipment; (j) use of ABC-style or dry powder fire suppression agents; or (k) leaked sample materials. To the extent a UAI product is used in connection with the operation of a nuclear power facility, Buyer agrees to indemnify and hold UAI harmless from any and all actions, claims, suits, damages and expenses arising from such use. UAI provides no warranty on the oral representations made by its personnel while they are attempting to assist Buyer in the operation of a product. This Standard Limited Warranty does not apply to items consumed by the products during their ordinary use, including but not limited to fuses, batteries, paper, septa, fittings, screws, fuses, pyrolysis, dryer or scrubber tubes, sample boats, furnaces or UV lamps.
3. Non-UAI Products. UAI does not in any way warrant products it does not manufacture except to the extent the warranty of the manufacturer of the product at issue passes through or is otherwise assigned to UAI. If a manufacturer warranty is so assigned to UAI, UAI will only be bound to comply with the length of time associated with such warranty. All other terms of such warranty will be governed by this Standard Limited Warranty and UAI's General Terms and Conditions incorporated herein by reference.

# **Limited Warranty**

4. Expenses on Non-Warranty Work. All repairs or replacements by UAI after the expiration of any applicable limited warranty period will be performed in accordance with UAI's standard rate for parts and labor. Further, if upon UAI's inspection and review, UAI determines the condition of the products is not caused by a defect in UAI's material and workmanship, but is the result of some other condition, including but not limited to damage caused by any of the events or conditions set forth in Section I.2., Buyer shall be liable for all direct expenses incurred by UAI to conduct the inspection and review of the product.
5. Exclusive Remedy. The foregoing limited warranty constitutes Buyer's exclusive remedy with respect to products sold by UAI and UAI's liability shall be exclusively limited to the written limited warranty specified herein. No employee, representative or agent of UAI is authorized to either expressly or impliedly modify, extend, alter or change any of the limited warranties expressed herein to Buyer.
6. Procedure and Costs. All limited warranty claims must be made in writing promptly following discovery of any defect. Buyer must hold defective products for inspection by UAI. If requested by UAI, Buyer must send the product to UAI for inspection. Any such returns by Buyer will be at Buyer's expense and Buyer will remain liable for any loss of or damage to the product during such product's transportation to UAI. No products will be sent to UAI for inspection unless UAI has authorized Buyer to do so.
7. Terms and Conditions. UAI's General Terms and Conditions are incorporated herein by reference and Buyer accordingly agrees to be bound by the terms thereof.

## **II. Limitations on UAI Liability**

1. In General. Buyer agrees UAI shall not be liable for any direct, indirect, incidental, punitive or consequential damages, including lost profits, lost savings or loss of use, whether Buyer's claim is based in contract, tort, warranty, strict liability or otherwise, which Buyer may suffer for any reason, including reasons attributable to UAI. Buyer agrees these limitations on UAI's liability are reasonable and reflected in the amounts charged by UAI for its products.
2. Force Majeure. This Standard Limited Warranty does not cover and UAI shall not be liable for either direct or consequential damage caused, either directly or indirectly, as a result of: (i) any act of God, including but not limited to natural disaster, such as floods, earthquakes, or tornadoes; (ii) damages resulting from or under the conditions of strikes or riots, war, damages or improper operation due to intermittent power line voltage, frequency, electrical spikes or surges, unusual shock or electrical damage; or (iii) accident, fire or water damage, neglect, corrosive atmosphere or causes other than ordinary use.
3. Limitation on Warranty Claims. Prior to any obligation of UAI to perform any limited warranty service as set forth herein, Buyer must have: (i) paid all invoices to UAI in full, whether or not they are specifically related to the product at issue; and (ii) notified UAI of the limited warranty claim within sixty (60) days from the date Buyer knew or had reason to know of the defect



**AMETEK**<sup>®</sup>

5200 Convair Drive Carson City, NV 89706 • Phone: 775-883-2500 • Fax: 775-883-6388 • [www.universalanalyzers.com](http://www.universalanalyzers.com)