Instruction Manual

Models 512, 513, 514

Portable Sample Systems

AMETEK®

5200 Convair Drive Carson City, NV 89706 • Phone: 775-883-2500 • Fax: 775-883-6388 • www.universalanalyzers.com

MAN.PORT.REVE.06302015

Contents

Receiving and Storage

The UAI Models 512, 513, 514 Portable Sample Systems are a complete pre-installed unit. No assembly is necessary when received on-site.

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

Check the items for any damage in transit and, if required, inform the shipping insurance company immediately of any damage found.

Storage Location should be protected from the elements. Although all components provided are designed to resist corrosion, additional protection from heat (>140°F/ 60°C) and humidity is recommended.

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

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

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

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.

Product Identification

Lead Time	Cooler (Part Number Configurator: 500T)	
2 wks	**512**	One (1) Sample Point - One (1) Active 5” Heat Exchanger
	513	One (1) Sample Point - Two (2) Passive/Active 5” Heat Exchangers
	514	One (1) Sample Point - Two (2) Active/Active 5” Heat Exchangers
	5” Heat Exchanger Material (Price per Heat Exchanger)	
	SS	316SS
	PV	Glass/Kynar
	C	Hastelloy C276
+1 wk	**ST**	Teflon Coated 316SS
+1 wk	**SW**	316 Welded SS (High Pressure)
+1 wk	**SN**	Sulfinert® coated 316SS
	KK	Kynar/Kynar
	Voltage	
	115	115VAC 50/60 Hz; General Purpose (GP) Area
	230	230VAC 50/60 Hz; General Purpose (GP) Area
	Flow Meter with 316SS Needle Valve	
	FM5	5.0 l/m

512	-SS	-115	-FM5	-N	**Sample Part #**

NOTE: LEAD TIMES ARE NOT COMPOUNDED. LEAD TIME IS COOLER + LONGEST OPTION

Flow Capacity l/m									
500 Series	**512**			**513**			**514**		
Ambient Temperature (°F)	77°	90°	105°	77°	90°	105°	77°	90°	105°
12% H_20 Vol.	2.5	2	1.5	4	3	2	5	4	3
15% H_20 Vol.	2	1.8	1.2	4	3	2	4	3.5	2.5
30% H_20 Vol.	1	0.9	0.6	4	3	2	2	1.8	1.3
50% H_20 Vol.	0.6	0.5	0.3	4	3	2	1	0.9	0.7
Exit Dew Point (C°)	4	4	4	4	4	4	4	4	4

Standard Features

- Water Carry-Over Input
- Alarm Contact: Moisture
- LED Status Indicators: Moisture, Cooling

Specifications

OPERATING SPECIFICATIONS	
Sample Flow Rate	
Model 512, 513, 514	See table on previous page
Maximum Inlet Temperature	
Stainless Steel Heat Exchanger	700°F (371°C)
Kynar/Glass Heat Exchanger	280°F (138°C)
Maximum Inlet Gas Dew Point	178°F (81°C)*
Maximum Inlet Water Vapor Content	50%*
Minimum Ambient Temperature	34°F (1°C)
Maximum Ambient Temperature	105°F (41°C)*
Maximum Active Cooling Power	
Model 512, 513	63 BTUs per hour (60 kJ/Hr)
Model 514	126 BTUs per hour (120 kJ/Hr)
Outlet Sample Dew Point	39°F (4°C)
Heat Exchanger (HE) Configuration	
Model 512	1 Active
Model 513	1 Passive, 1 Active
Model 514	2 Active
Gas Sample Inlet (Compression Fitting)	3/8"
Gas Sample Outlet (Compression Fitting)	1/4"
Bottom Condensate Drain (Compression Fitting)	3/8"
Maximum Input Power	
Model 512, 513	175 watts
Model 514	250 watts
Voltage (Not Field Configurable)	
Model 512, 513, 514	120/230VAC, 50/60 Hz
Electrical Classification	General Purpose, NEMA 1
Dimensions	15" H x 10" W x 15" D
Weight	
Model 512	32 lbs (14kg)
Model 513, 514	35 lbs (15kg)
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

Description and Principle of Operation

DESCRIPTION

The 500 series portable sample chiller is a staple to the mobile stack testing and laboratory setting. In order to analyze stack gas or exhaust from any combustion process, a method to remove moisture from the sample without removing gas components of interest is a must. The Universal Analyzers Thermoelectric Sample Cooler, which derives its cooling from the Peltier Effect, is an ideal way to decrease the dew point of combustion gasses to a low dew point. The Universal Analyzer Gas Sample Coolers prevent water condensation in sample pre-filters, sample pumps, and gas analyzers. For gas analyzers where water vapor interferes with the reading, a stable, repeatable, low dew point becomes a part of the gas analyzer's performance specification. The Universal Analyzers sample cooler provides this constant water concentration resulting in an accurate analysis of the components of interest.

The gas sample that is intended for analysis is typically brought to the sample cooler, first 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 Universal Analyzers Sample Cooler then condenses moisture from the sample lowering the dew point to 4°C (39°F) in a controlled fashion.

A diaphragm gas sample pump is integral to the 500 series portable sample chiller. In addition, there is a moisture alarm linked to the sample pump which will cease pump operation if moisture is detected downstream of the sample chiller – this protects equipment downstream of the sample chiller from damage due to excess moisture.
The portable chiller is also equipped with a 0-5 l/m, adjustable sample flow meter. This flow meter is visible to the operator, and can be adjusted via needle valve. Condensate removal from the chiller is also done internally via a continuously running peristaltic pump.

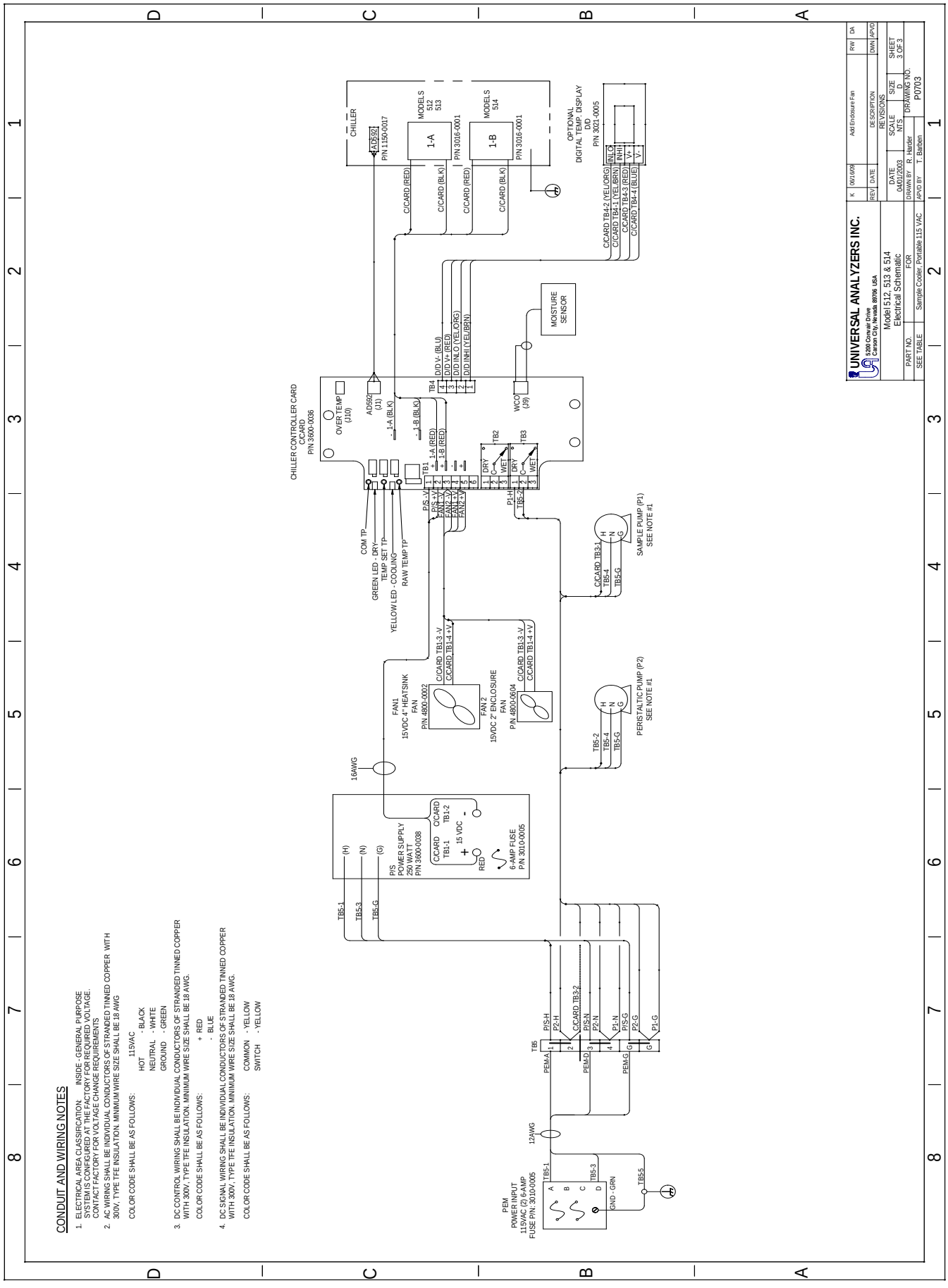
Installation

The UAI Models 512, 513, 514 Portable Sample Systems should be installed away from heat sources in a well ventilated area of an instrument rack or enclosure. Completely enclosing the instrument which generated between 175 and 250 watts of energy will cause the temperature of the interior of the enclosure to rise to a temperature too great for the sample cooler to perform reliably. Universal Analyzers supplies NEMA 1 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 two fans, thermostatically controlled.

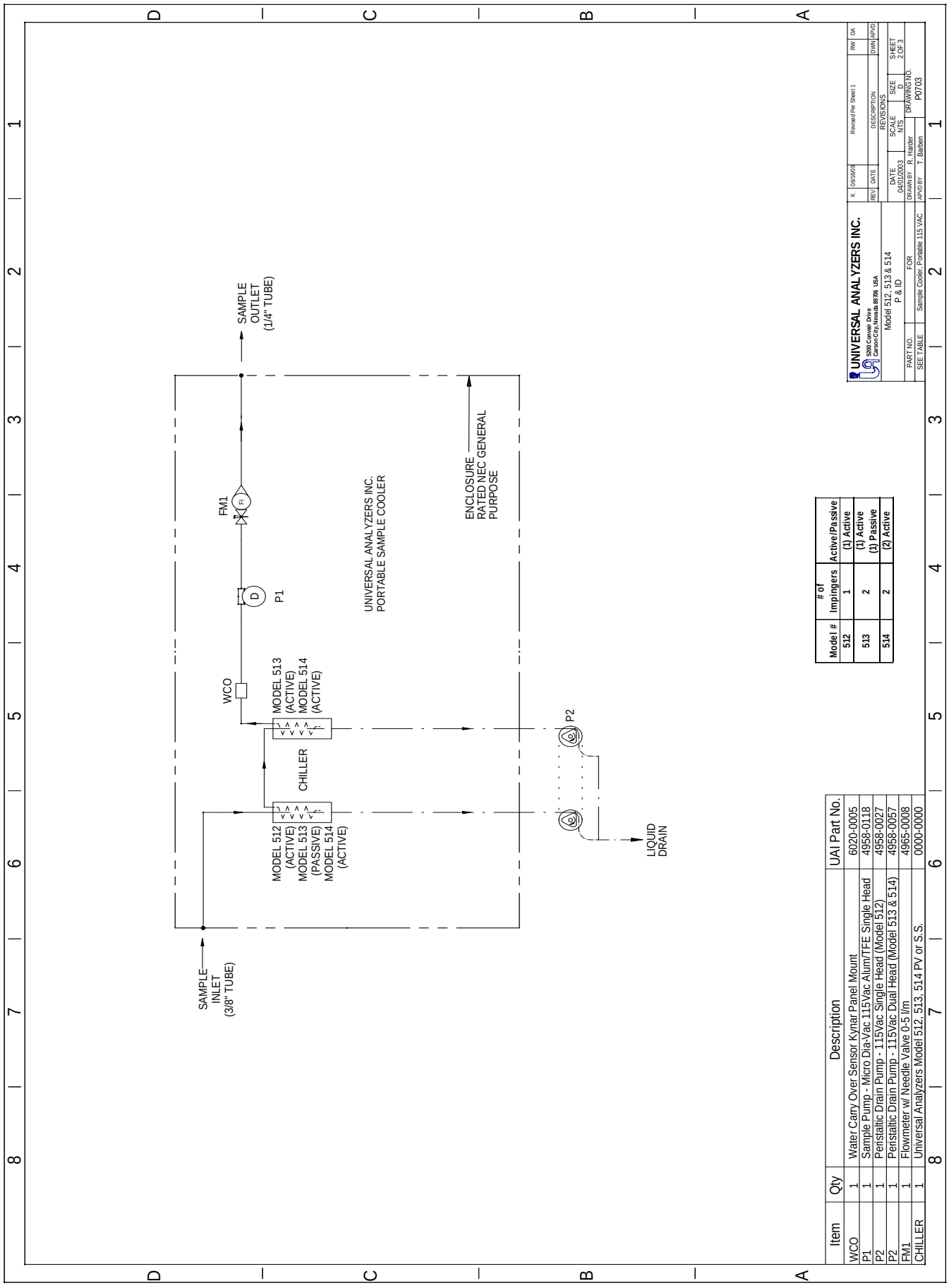
Sample tubing should be brought to the heat exchanger inlet. A 3/8” tubing fitting is provided on the front of the enclosure for the sample inlet to the sample cooler. The dry sample outlet is a 1/4” tubing fitting located next to the sample inlet.

A 3/8” tubing fitting is provided as the condensate drain connection towards the bottom of the front side of the enclosure. There is roughly six inches of 3/8" drain tubing. This should be run to the common drain or a container. Proper drainage is imperative in avoiding the accumulation of liquid near electrical equipment. The tubing can be connected via a 3/8" tube fitting or an 8mm barb fitting.

Electrical Connections All Models (512, 513, 514)



Electrical Connections All Models (512, 513, 514)



Item	Qty	Description	UAI Part No.
WCO	1	Water Carry Over Sensor Kynar Panel Mount	6020-0005
P1	1	Sample Pump - Micro Dia-Vac 115Vac Alum/TFE Single Head	4958-0118
P2	1	Peristaltic Drain Pump - 115Vac Single Head (Model 512)	4958-0027
P2	1	Peristaltic Drain Pump - 115Vac Dual Head (Model 513 & 514)	4958-0057
FM1	1	Flowmeter w/ Needle Valve 0-5 l/m	4965-0008
CHILLER	1	Universal Analyzers Model 512, 513, 514 PV or S.S.	0000-0000

Model #	# of Impingers	Active/Passive
512	1	(1) Active
513	2	(1) Active (1) Passive
514	2	(2) Active

Start-Up

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. 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 4°C), the rate at which the temperature drops will be reduced. It will stabilize between 4°C and 5°C.

Start the sample gas flow. Condensate may be observed flowing through the peristaltic pump/drain 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.

Shutdown

If there is excessive condensate that needs to be drained, a moisture alarm can be simulated by bridging the connection on the moisture sensor. This will turn off the sample pump while allowing the peristaltic pump to continue operation. After all condensate has been drained, the power switch on the Power Entry Module can be put in the off position.

Maintenance

HEAT SINK FINS
The cooler heat sink is used to dissipate heat away from the heat transfer block/ Peltier elements. Over time in an industrial environment, dust/ debris can build up between the fins on the back side of the heat sink. This build will reduce the efficiency of the cooler and can cause premature failure of the Peltier elements.

Using a flash light (or other light source), shine a light through the heat sink fins. If the fins are obstructed, or laden with debris, the fins should be cleaned. One simple method is using a computer-safe aerosol cleaner.

PERISTALTIC TUBING
While the standard Phar-Med tubing is resilient to most chemicals, there is a potential for chemical degradation of the tubings integrity. Inspect the tubing for weak points. The tubing can also wear physically where it is in contact with the rollers on the pump heads.

SAMPLE PUMP
If the chiller appears to be lacking in regard to inlet vacuum or outlet pressure, inspect the diaphragm sample pump head. There are rebuild kits available. See the associated chiller spare parts list.

Maintenance

Before performing any maintenance on the cooler, ensure that all plant safety procedures are followed. As with any electrical device, ensure power is removed before performing any procedures.

The cooler is designed for maintenance free operation but if any is required, ensure power has been removed before maintenance or repair 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

REPLACEMENT OF PERISTALTIC TUBING (IF EQUIPPED)

1. Please refer to manufactures website for instructions: http://www.masterflex.com/catalog/product_view.asp?sku=0701520
2. YouTube: http://www.youtube.com/watch?v=zC1INbSnf8o&feature=player_embedded#at=242

REPLACEMENT OF SAMPLE PUMP DIAPHRAGM

1. Please refer to manufactures website for instructions: http://www.airdimensions.com

INSTALLING OR REPLACING HEAT EXCHANGERS

Removing the heat exchanger

1. Remove the inlet and outlet tubes by loosening the compression fittings. Always use a backup wrench on the fitting body to ensure no damage to the heat exchanger occurs.
2. Remove the drain fitting using the same procedure as the inlet/ outlet. Remove the drain fittings from the exchanger. Use a backup wrench on the lower heat exchanger hex to prevent damage to the exchanger.

Replacing the heat exchanger

1. Dry and clean the heat exchanger opening in the heat transfer block using a dry, lint-free cloth (If reusing the heat exchanger, clean the outside as well.) Dried heat transfer paste can be removed by using a very fine abrasive pad wrapped around a drill bit.
2. Smear the outer diameter of the heat exchanger with heat transfer paste.
3. Gently push the heat exchanger into the heat transfer block until the head is fully seated against the insulation on top.
4. Reinstall the drain fitting. Ensure pipe tape is used on the pipe threads before installation. Use a backup wrench on the heat exchanger lower hex to prevent damage to the exchanger.
5. Reconnected the drain, inlet and outlet tubes.

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***
No sample gas flow	Heat exchanger plugged	Check for an obstruction Remove heat exchanger from unit and disassemble
	Alarm shutoff	Verify cool & dry indicators are illuminated
	No power on cooler	Ensure cooler has power supplied
Water carry over	Inadequate drain apparatus	Verify drain tubing is unobstructed and equipment is functioning satisfactory
	Excessive flow rate	Reduce the flow rate
	High ambient temperature	Reduce the ambient temperature (Increase ventilation or relocate cooler)
	Defective cooler	Verify air flow across the heat sink
		Hold hand in front of heat sink fins and ensure air movement
High oxygen readings/low pollutant readings from analyzer	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	See "Water Carry Over' error
	Faulty water carry over circuit	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

Troubleshooting

'Cool' light is not illuminated	Ambient temperature too high	Reduce the ambient temperature (Increase ventilation or relocate cooler)
	Flow rate/water content too high	Lower the flow rate through the cooler and observe the results. If condition corrects itself, consult the factory for further trouble-shooting
	Failed peltier element	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)	Replace fuse
	Defective transformer (T1)	Replace power supply board

Spare Parts

Level A, Consumable Parts (All Models)	
Part	***P/N***
Tube, 5' Peri Phar-Med #15 for Master-Flex Peristaltic Pump 5'	9216-0002

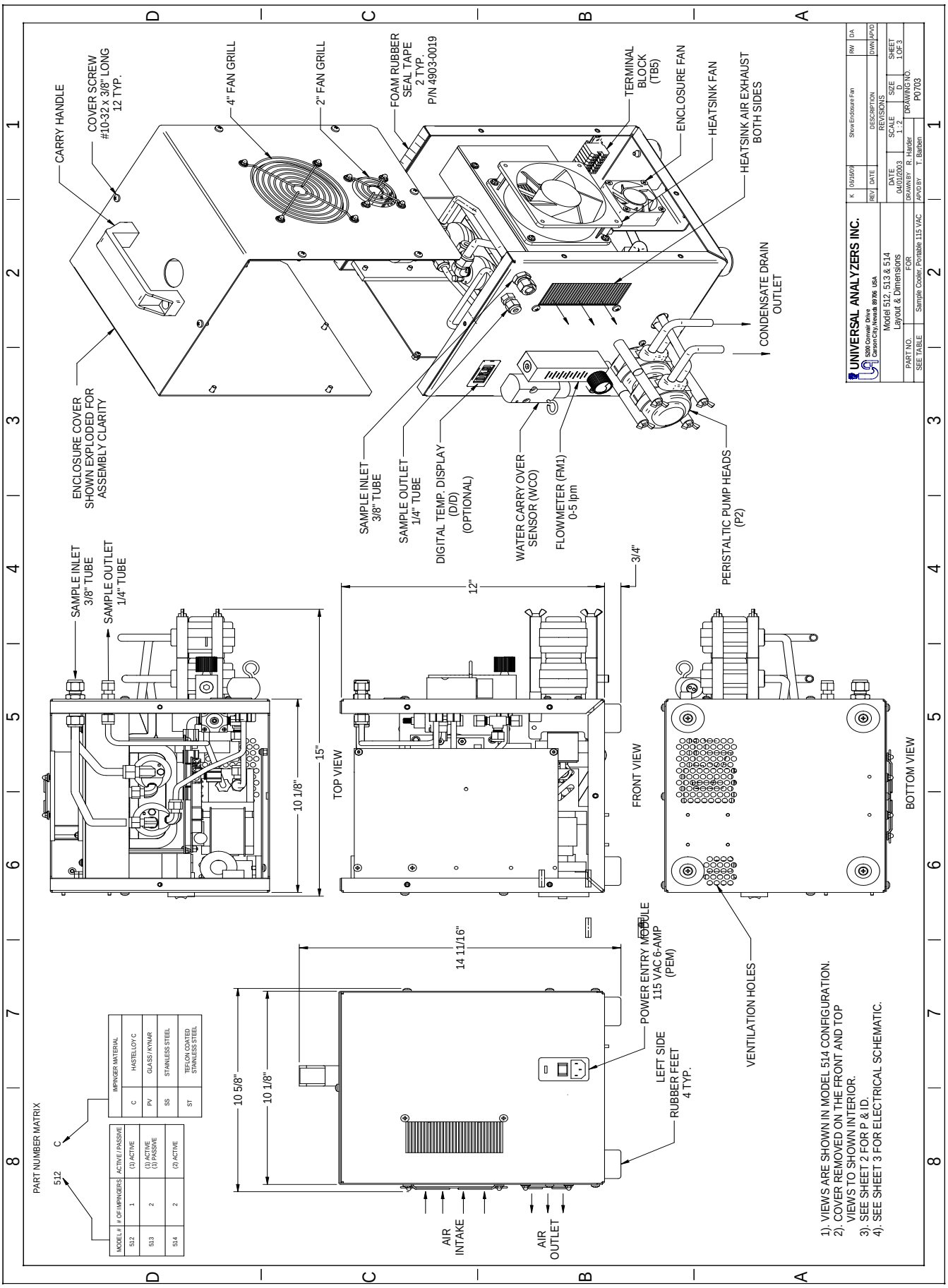
Level B, Basic Parts (512SS, 513SS, 514SS)	
Part	***P/N***
Heat Exchanger 5" SS	5200-S050
O-Ring 2-021 Viton for Separable Heat Exchangers & Panel Mount Filters	4904-0013
Compound Zinc Heat Transfer Paste, 1 oz Container for Kit	8010-0001
Fuse, 6 Amp 250V Time Delay	3010-0005

Level B, Basic Parts (Models 512PV, 513PV, 514PV)	
Part	***P/N***
Heat Exchanger 5" Kynar/Glass	5200-K050
Tube Glass - 1" Diameter x 6" for 5" PV Heat Exchanger	5201-0002
O-Ring, 018 Viton For PV Exchanger Drain	4904-0003
O-Ring, 120 Viton	4904-0004
Compound Zinc Heat Transfer Paste, 1 oz Container for Kit	8010-0001

Level C, Critical Parts (All Models)	
Part	***P/N***
Transducer Temperature Assembly - 19 Inch AD592 in Brass Housing	1150-0017

Level D, In-Depth Parts (All Models)	
Part	***P/N***
Motor Only 6RPM 115V Motor	4958-0028
PCB Assembly 600 Series 15-24VDC Controller	3600-0036
PCB Assembly Power Supply 250W Short Bar 500 Series	3600-0038
Pump Sample 1 Head Teflon Coated Alum 115VAC Micro Dia-VAC	4958-0118
Pump Sample 1 Head Teflon Coated Alum 230VAC Micro Dia-VAC	4958-1067
Sensor Replacement Assembly with O-Ring "Sensor Only" for WCO	5101-0001
Fan, 12VDC 102CFM	4800-0002
Fan, 12VDC 14CFM 2" x 1" For 520530 540 Power Supply, 2800RPM	4800-0004
Flowmeter 0-5 lpm with SS Valve	4965-0008

Drawings All Models (512, 513, 514)



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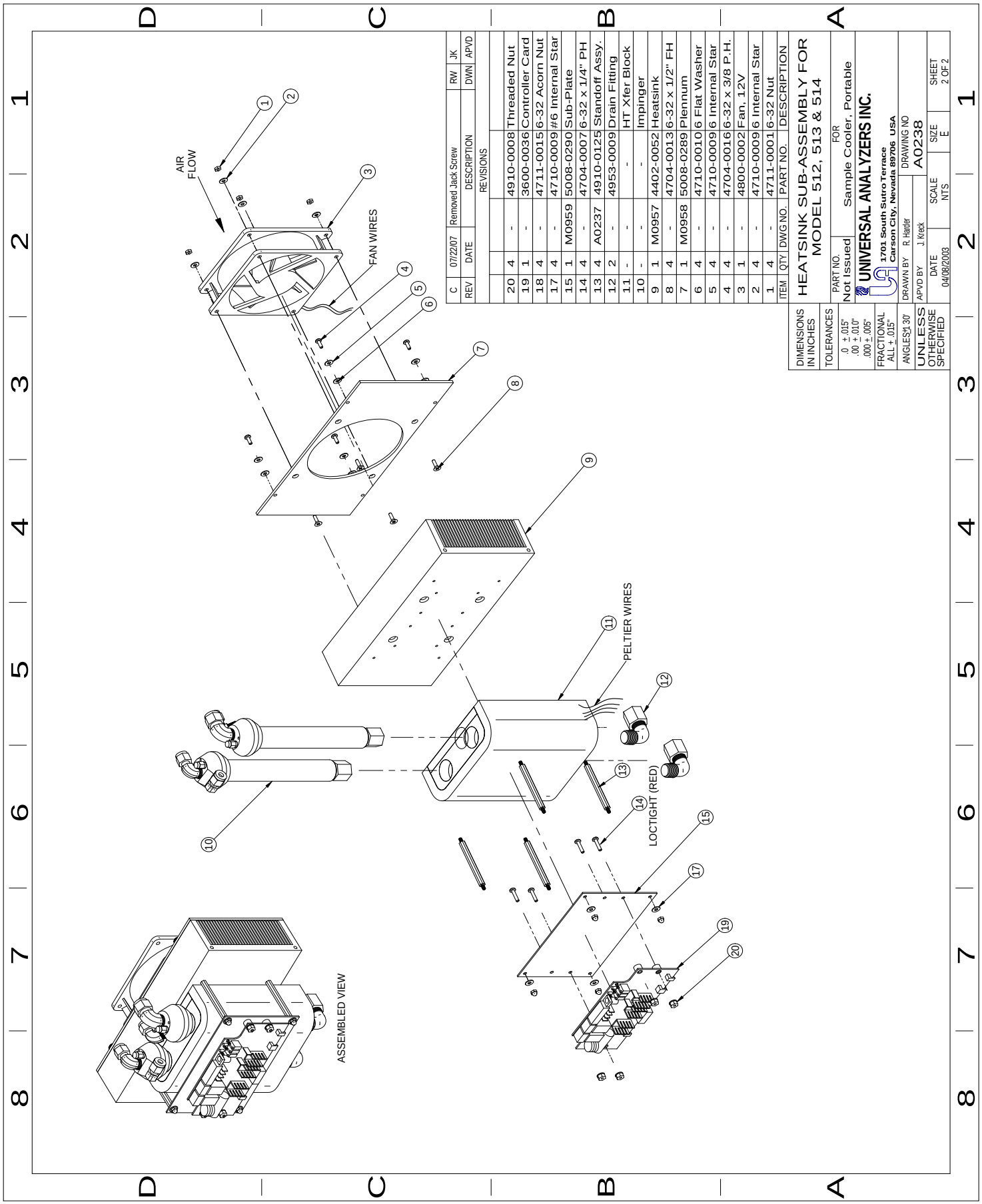

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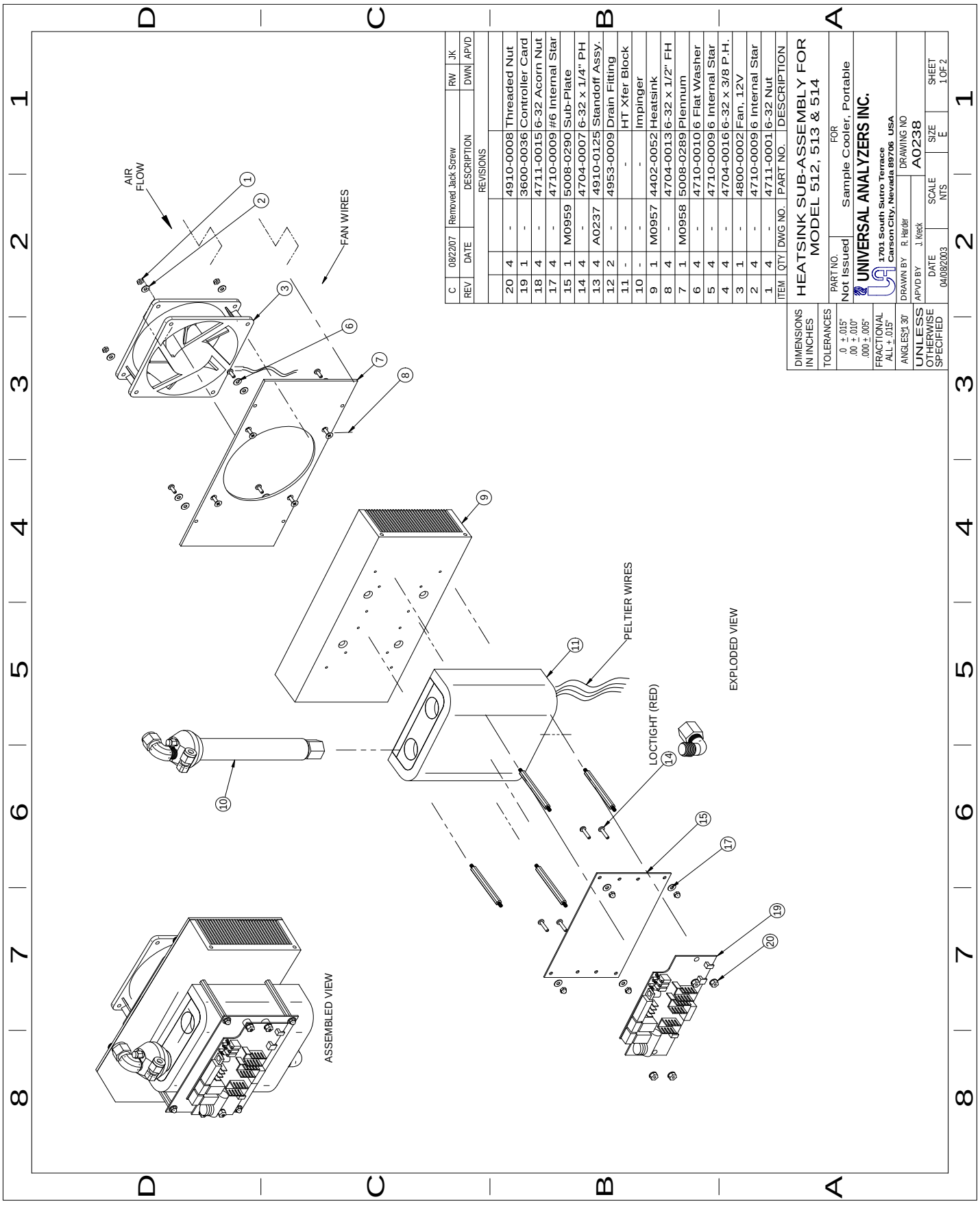

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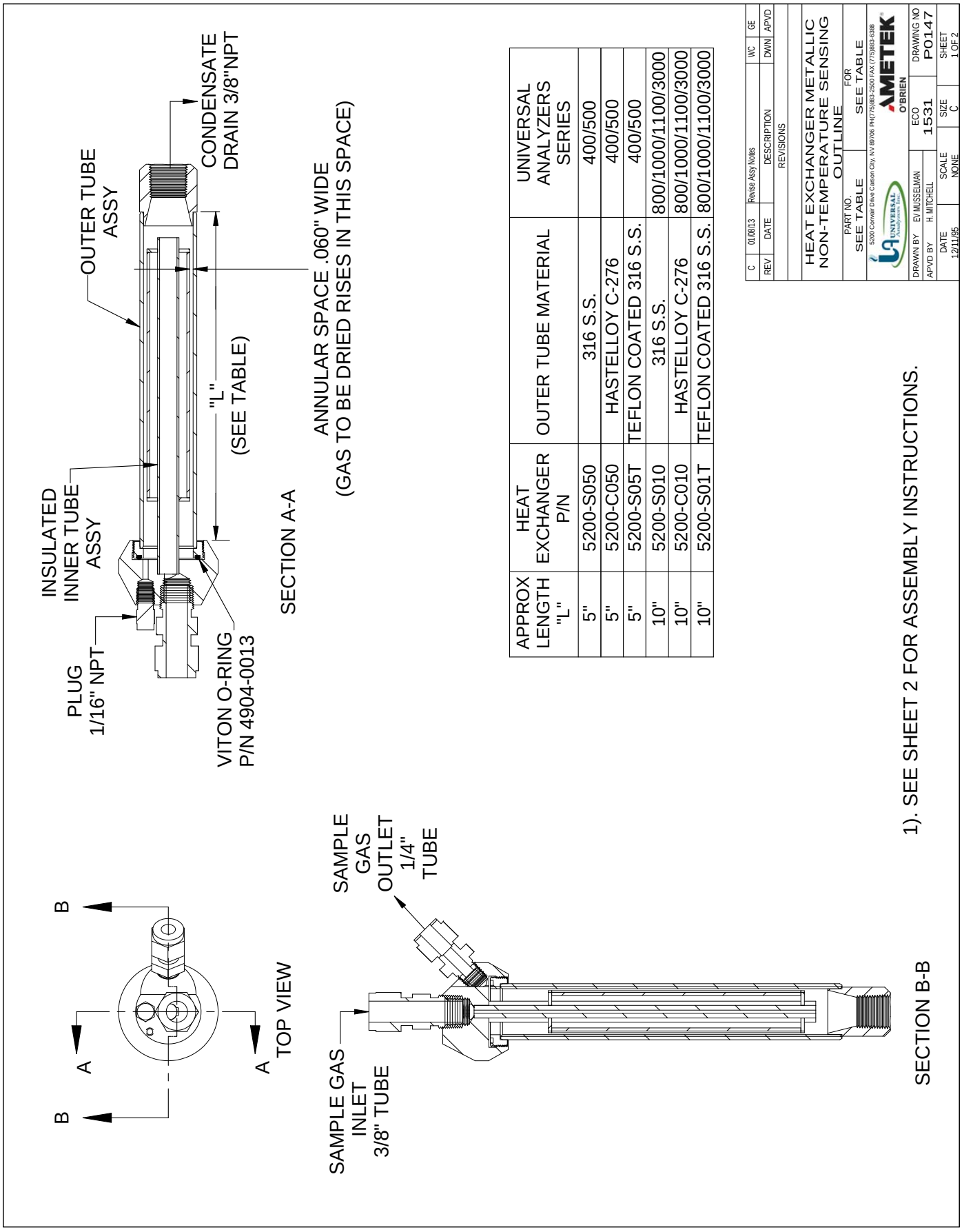


APPROX LENGTH "L"	HEAT EXCHANGER P/N	OUTER TUBE MATERIAL	UNIVERSAL ANALYZERS SERIES
5"	5200-S050	316 S.S.	400/500
5"	5200-C050	HASTELLOY C-276	400/500
5"	5200-S05T	TEFLON COATED 316 S.S.	400/500
10"	5200-S010	316 S.S.	800/1000/1100/3000
10"	5200-C010	HASTELLOY C-276	800/1000/1100/3000
10"	5200-S01T	TEFLON COATED 316 S.S.	800/1000/1100/3000

REV	DATE	DESCRIPTION	DWN	APVD
C	01/08/13	Revise Assy Notes	WC	GE
		REVISIONS		

HEAT EXCHANGER METALLIC NON-TEMPERATURE SENSING OUTLINE

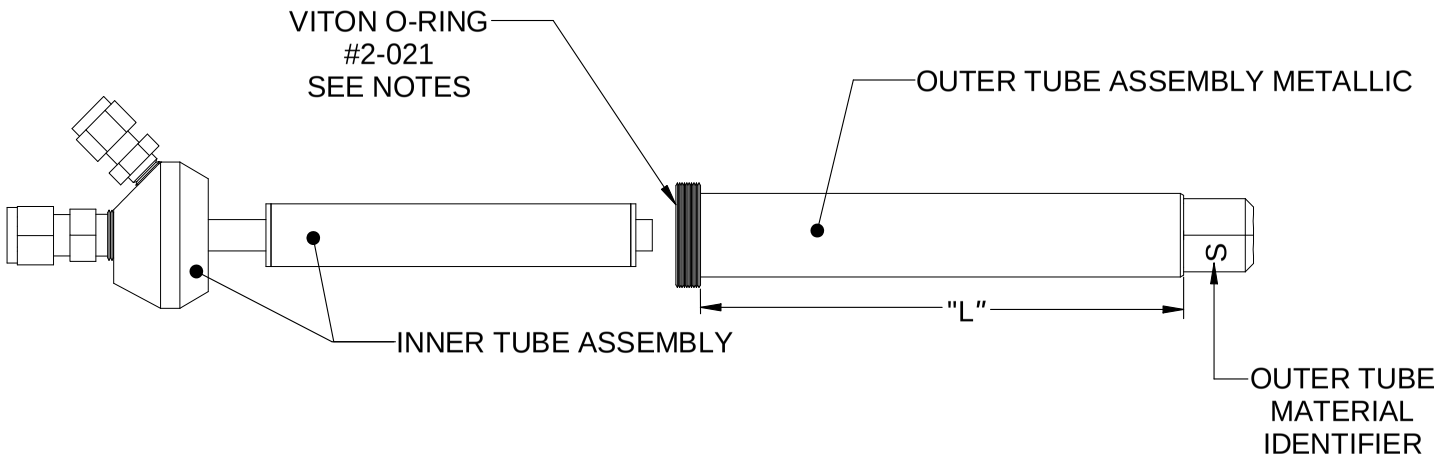
PART NO. SEE TABLE | FOR SEE TABLE

5200 Convair Drive Carson City, NV 89706 PH:(775)883-2500 FAX:(775)883-6388

DRAWN BY EV.MUSSELMAN | ECO 1531 | DRAWING NO P0147

APV'D BY H. MITCHELL | SCALE NONE | SIZE C | SHEET 1 OF 2

DATE 12/11/95



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 SEPERABLE		SPARE PARTS LIST			
APPROX "L" 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	"	"

C	01/08/13	Revise Assy Notes	WC	GE
REV	DATE	DESCRIPTION	DWN	APVD
REVISIONS				

HEAT EXCHANGER ASSEMBLY
NON-TEMPERATURE SENSING
METALLIC

PART NO.	FOR
SEE TABLE	INSTRUMENT

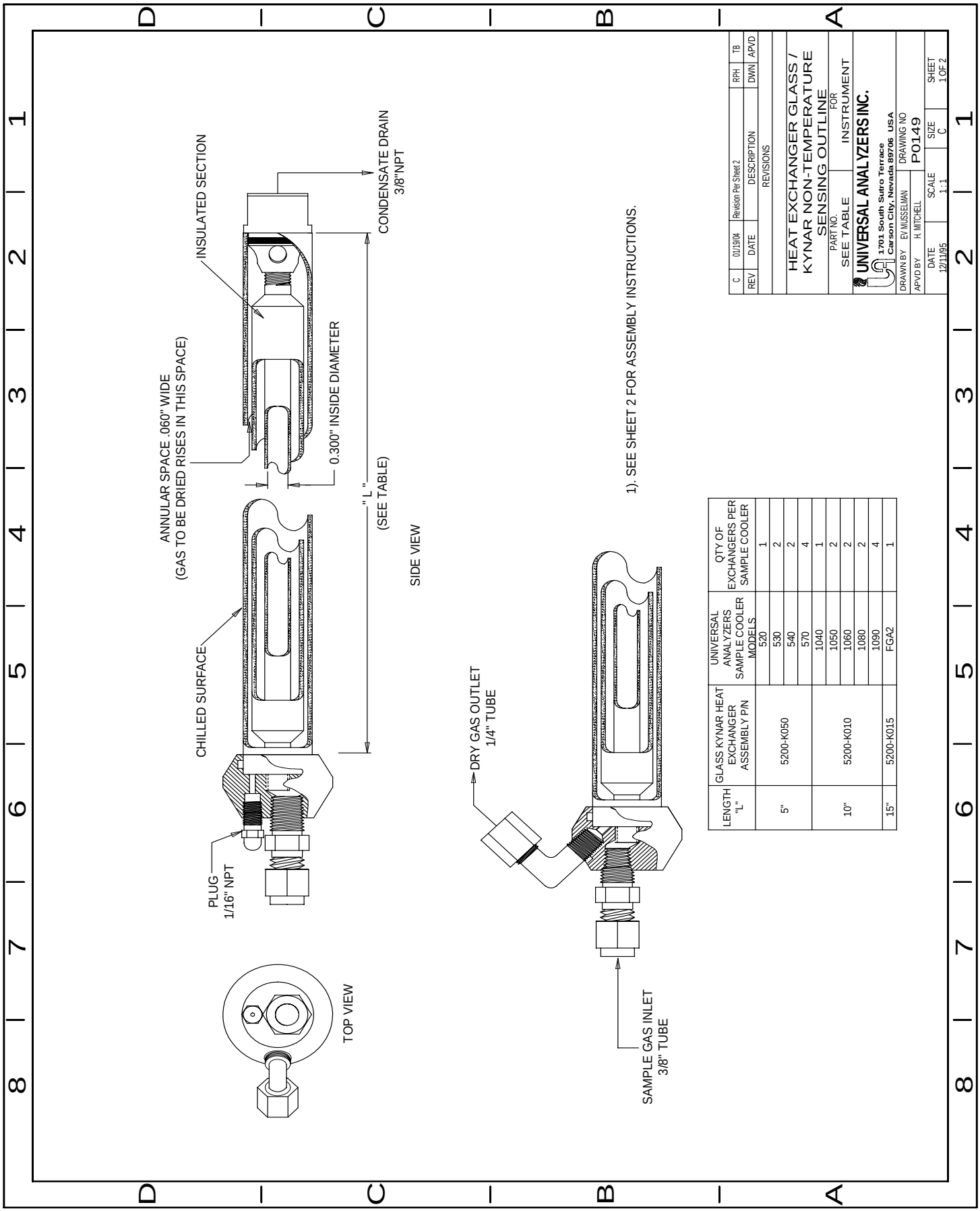
5200 Convair Drive Carson City, NV 89706 PH(775)883-2500 FAX (775)883-6388

UNIVERSAL Analyzers Inc. AMETEK O'BRIEN

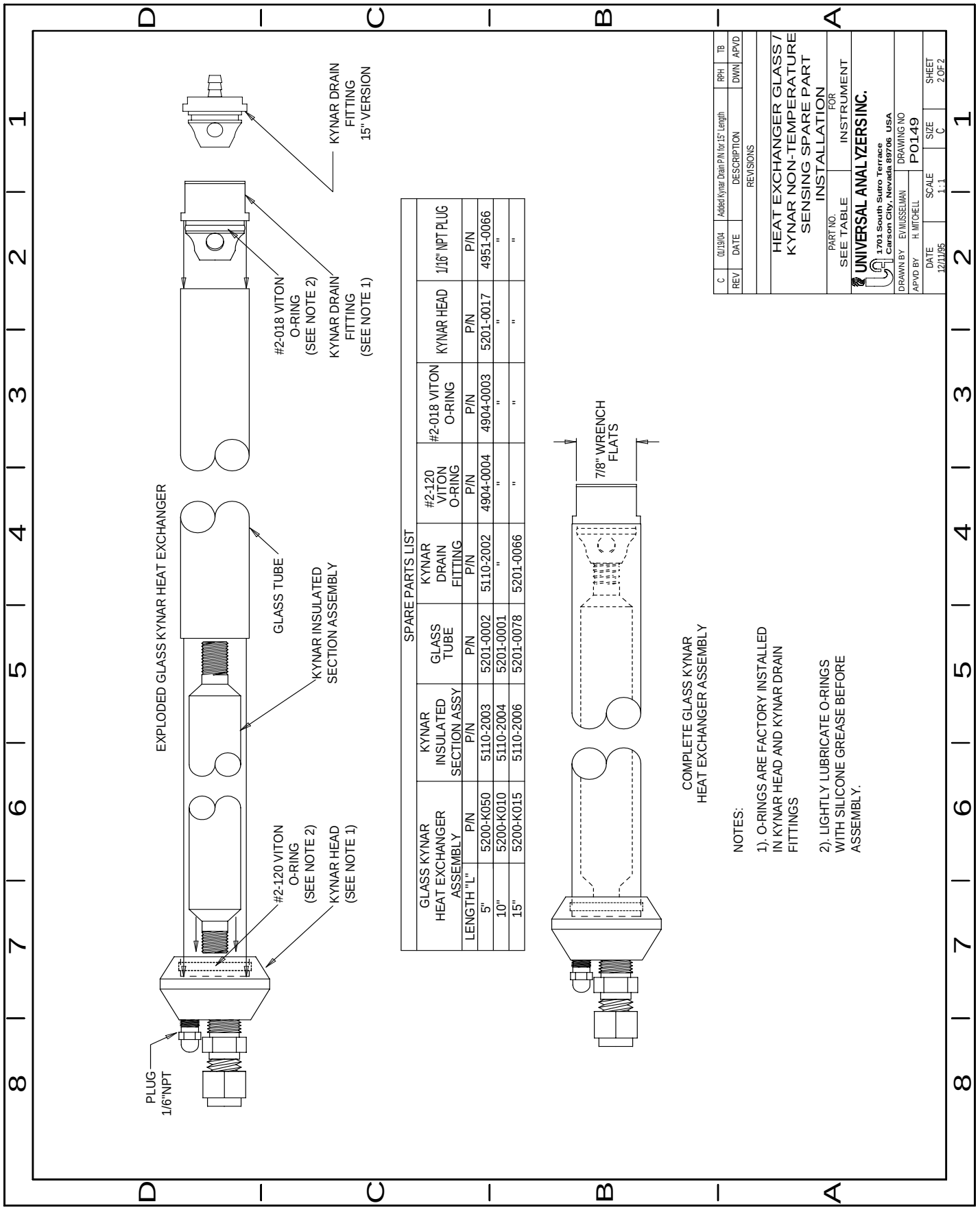
DRAWN BY	EV MUSSELMAN	ECO	DRAWING NO
APVD BY	H. MITCHELL	1531	P0147

DATE	SCALE	SIZE	SHEET
12/11/95	NONE	C	2 OF 2

Drawings All Models (512, 513, 514)



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



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	"	"	"	"

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. SEE TABLE FOR INSTRUMENT

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

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

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.

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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