Instruction Manual

Model 271

Extractive Gas Sample Probe

AMETEK®

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

MAN.271.REVE.12222014

Contents

Receiving and Storage

Carefully inspect the sample probe 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.

The sample entry boot and mounting flange gaskets are placed inside the enclosure for shipping. Items should not be removed until immediately before installation at the sampling point to ensure they do not get misplaced.

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.

Product Identification

271 Model Extractive Gas Sample Probe (Part Number Configurator: 271)					
271	316SS Probe With Sanitary Clamp				
	Flange Size (Other Sizes Available, Contact the Factory)				
	F2	2" 150# RF Flange			
	F3	3” 150# RF Flange			
	F4	4” 150# RF Flange			
		Blowback Control			
		24	24VDC Solenoid		
		115	115VAC Solenoid		
		230	230VAC Solenoid		
		BBT115	Blowback Timer With 115VAC SOLENOID*		
		BBT230	Blowback Timer With 230VAC SOLENOID*		
		N	No Blowback Included		
			Enclosure Options		
			FG	Fiberglass Enclosure (Standard)	
			FGI	Fiberglass Enclosure, Insulated	
			FGH115	Fiberglass Enclosure, Insulated & Heated, 115VAC 50/60 Hz	
			FHG230	Fiberglass Enclosure, Insulated & Heated, 230VAC 50/60 Hz	
			SS	Stainless Steel Enclosure	
			SSI	Stainless Steel Enclosure, Insulated	
			SSH115	Stainless Steel Enclosure, Insulated & Heated, 115VAC 50/60 Hz	
			SSH230	Stainless Steel Enclosure, Insulated & Heated, 230VAC 50/60 Hz	
			N		
				Calibration Options	
				CV	1/4” Cal Gas Inlet and Check Valve
				N	No Cal Gas Inlet

271	**-F2**	**-115**	**-FGH115**	**-N**	**Sample Part #**

NOTE: PROBE TIP FILTERS & PROBE TUBES PURCHASED SEPARATELY.
*NOT AVAILABLE WITH HEATED ENCLOSURE OPTION.

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 20 A. 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.

Declaration of Conformity

The product described in this manual complies with the following certifications:

CE

CE – Certification

LVD – Low Voltage Directive (Directive 2006/95/EC)

Second Edition EN 61010-1:2001 - Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements.

SPV – Simple Pressure Vessels Directive (Directive 87/404/EEC)

EN 286-1:1998 – Simple unfired pressure vessels designed to contain air or nitrogen - Part 1: Pressure vessels for general purposes.

EMC – Electromagnetic Compatibility (Directive 2004/108/EC)

EN 61326-1:2006 – Electrical equipment for measurement, control and laboratory use.

Specifications

OPERATING SPECIFICATIONS			
Sample Flow Rate		0 to 20 l/m	
Calibration Gas Requirement		Sample flow rate plus 10%	
Operating Pressure Drop at 10 l/m		12” W.C.	
Maximum Stack Gas Temperature*			
316SS		750°F (398°C)	
Hastelloy C-276		1475°F (801°C)	
Dimensions			
Fiberglass		18” H x 16” W x 10” D (457.2mm H x 406.4mm W x 254mm D)	
Stainless Steel		19” H x 17” W x 14.5” D (482.6mm H x 431.8mm W x 368.3mm D)	
Weight**		25 lbs (11.4 kg)	
Input Power Requirement		Heated Enclosure	Non-Heated Enclosure (with blowback)
Voltage	24VDC	-	23.2 watts
	115VAC	250 watts	24 watts
	230VAC	300 watts	6 watts
Ambient Operating Temperature		200°F Maximum (93°C)	
Blowback Tank Volume		0.7 scf (19.8 l) @ 100 psig (7.4 barg)	
Blowback Duration		2 seconds (recommended)	
Enclosure Heater Type		Electric, finned, controlled with bi-metallic thermal switch	
Available Filter Materials		316SS and Hastelloy C-276	
Chamber Material		316SS	

*DEPENDENT ON PROBE TUBE AND PROBE TIP FILTER MATERIAL (SOLD SEPARATELY).
** WEIGHT OF PROBE TUBE AND PROBE TIP FILTER CONSIDERED SEPARATELY.

Description and Principle of Operation

APPLICATION

The Universal Analyzers Model 271 Extractive Gas Sample Probe Assembly is designed to be installed on sample stacks containing non hazardous gases. It is suitable to install in an unclassified location.

The Model 271 will mount by means of a pipe flange to a mating flange on the stack. The size of the flange can be specified by the user and can include 2”, 3” or 4”. Other flange sizes may be available; contact the factory for more information. A 1/2” NPT female threaded connection is provided for the sample probe tube to mount inside the mounting flange.

GENERAL DESCRIPTION, HEATED FILTER SECTION

The Model 271 is a stack mounted extraction probe supporting a probe tube with probe tip filter. An optional blowback system is provided to allow the blowback to occur on command from a computer, data logger, PLC or external switch.

In colder climates, an additional heater can be supplied for the enclosure. This heater will maintain approximately 140°F (60°C) inside the enclosure.

Blowback air is used to clean the probe tip filter element. Compressed air supplied to the blowback assembly needs to be clean and dry (-40 °F/°C recommended). Instrument quality air is preferred. The pressure should be as high as possible, up to 125 psig (8.6 barg). High pressure air fills two accumulators (each 7” (178 mm) diameter SS sphere) and provides a substantial blast when the high flow solenoid valves open. This loosens the particles on the filter surface and forces them back out from the filter into the stack stream. The period of time between blowback cycles should be set to occur before the pressure drop across the filter begins to increase beyond acceptable limits. By installing and monitoring a vacuum gauge ahead of the sample pump, a maintenance interval can be established. This can be as often as every fifteen minutes but should be no less frequently than once per day. The time period between blowback cycles can be based on calculations to estimate the amount of sample required to deposit from three to five grams of solids in the filter element.

Instrument air usage is minimal and smoothed by the fact that the air accumulator is charged over a period of time through a 1/4” instrument air line. The recharge time could be extended with a restriction in the air line if it were desired to reduce the pressure pulses on the instrument air supply and to consume instrument air more slowly.

The calibration gas may be injected into the probe. This is close to the sample source, as is required by many EPA officers. A back pressure check valve (set at 3 psig (0.2 barg)) is provided in the cal gas injection path to insure that calibration gas does not leak into the sample while the sample is being drawn through the filter.

Installation

The Model 271 probe should only be installed on a shut down system.

Install the probe on the stack nozzle using the studs on the flange. Tighten them in an incremental star pattern to avoid build up of excessive stress on any side of the flange.

Connect the sample out tube of the umbilical to the 3/8” tube connection provided on the probe. Connect instrument air to the 1/4” Instrument air inlet in the probe. Connect calibration gas to the 1/4” Cal Gas Inlet in the probe, if the cal gas option is used.

No provision is provided with the Model 271 probe to support the sample line. The heat shrink boot where the umbilical enters the probe box is for sealing purposes only.

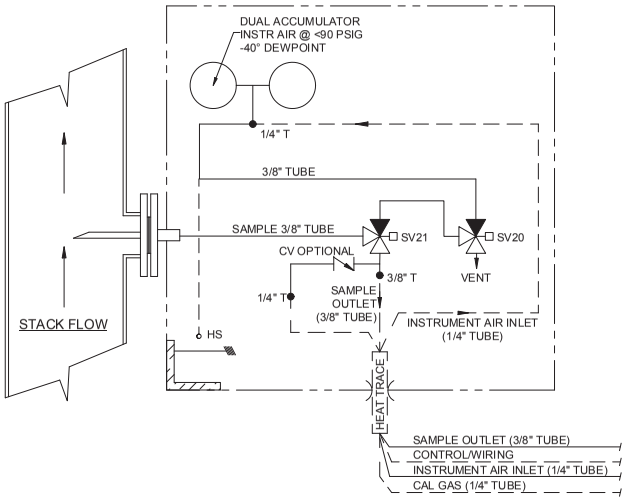
If the heated enclosure option is selected, connect 115VAC or 230VAC power to TB1. If the blowback option is selected, connect 24VDC, 115VAC, or 230VAC to the blowback terminals as appropriate. Do not power the blowback solenoid with the wrong voltage as this may damage the solenoids or prevent them from working properly. Installation shall be in accordance with the manufacturer’s instructions and the National Electrical Code (NFPA 70).

NOTE: 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 Ensure the power supplied to the heater matches the heater voltage requirement shown on the serial number tag. An independent ground wire should be run to the grounding terminal on the terminal strip.

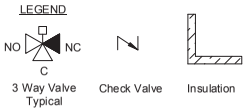
NOTE: Probe tubes and Probe tip filters are sold separately from the Model 271. The probe tube type should be threaded at both ends so it can mate with both the probe enclosure/flange and filter.

Electrical Connections Model 271

P&ID

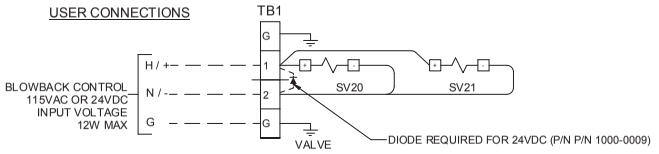


LEGEND

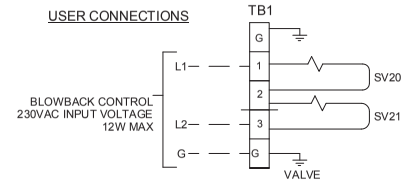


Item	Blowback Voltage	Qty	Description	UAI Part No.
HS	N/A		HEATER SPARGER (HEATED ENCLOSURE ONLY)	5150-2144
SV20,21	24 VDC	2	Solenoid Valve 3-Way SS 150P.S.I. 24VDC	4955-0142
SV20,21	115 OR 230 VAC	2	Solenoid Valve 3-Way SS 150P.S.I 115VAC	4955-0151
CV	N/A	1	Check Valve (Optional)	4955-0148

WIRING SCHEMATIC (NON-HEATED ENCLOSURE) 115VAC or 24VDC



WIRING SCHEMATIC (NON-HEATED ENCLOSURE) 230VAC



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:

	115VAC	230VAC
HOT	- BLACK	L1 - BROWN
NEUTRAL	- WHITE	L2 - BLUE
GROUND	- GREEN	G - 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.

FIELD TO WIRE

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

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REV	DATE	DESCRIPTION	DWN	APVD
F	10/06/14	UPDATED BLOWBACK WIRING	DR	DR

REVISIONS

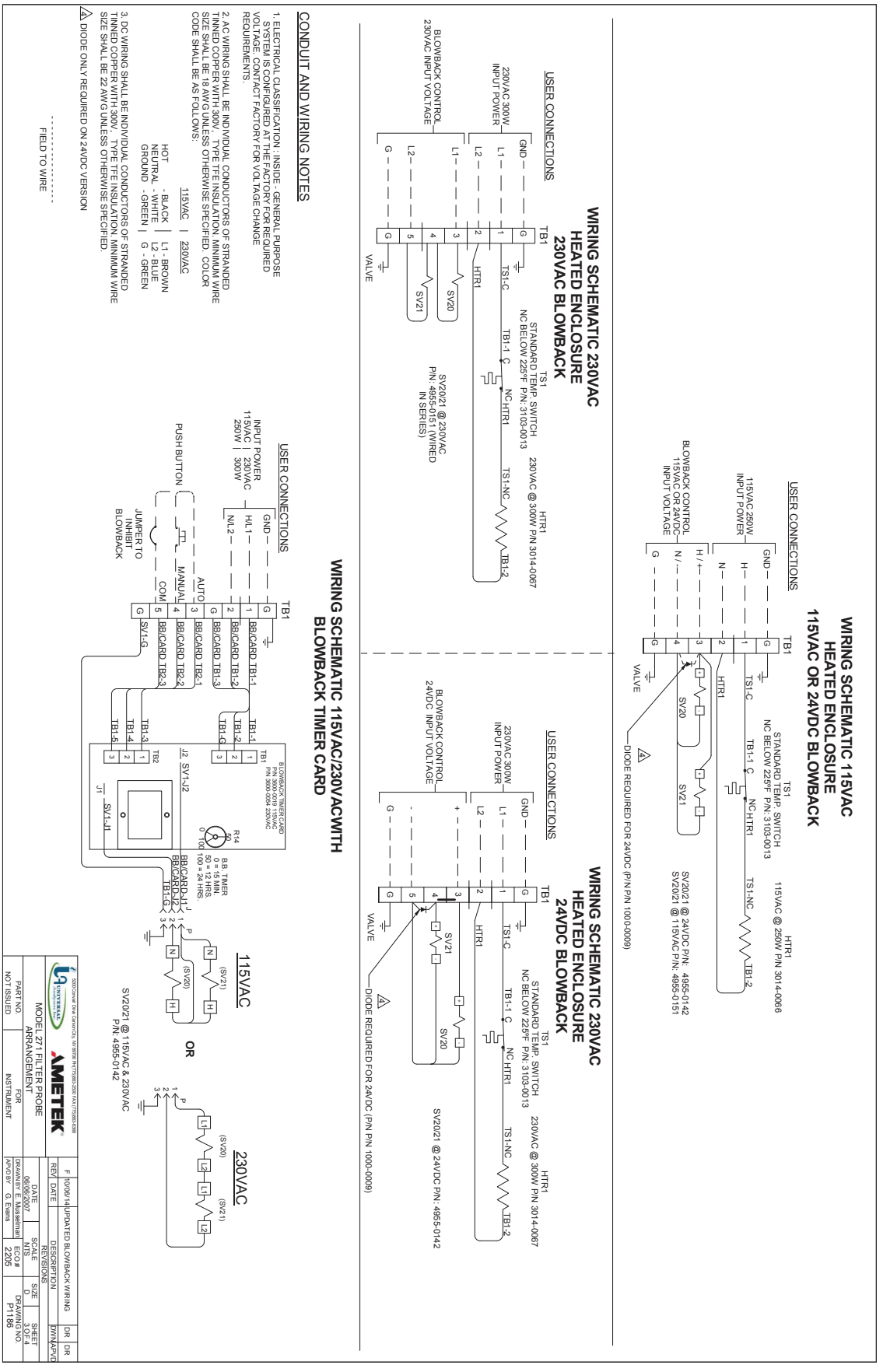
MODEL 271 FILTER PROBE ARRANGEMENT

DATE	SCALE	SIZE	SHEET
06/06/2007	NTS	D	2 OF 4

PART NO.	FOR	DRAWN BY	ECO #	DRAWING NO.
NOT ISSUED	INSTRUMENT	E. Musselman	2205	P1186

APVD BY G. Evans

Electrical Connections Model 271



Start-Up

Apply power to the Model 271 probe. Allow one hour for the enclosure heater to heat the enclosure. If no enclosure heater is used, the probe will be ready to use immediately.

Start the sample pump and determine that the proper amount of sample is being supplied to the instrumentation.

Perform a calibration cycle to insure that the calibration lines are properly installed and sealed. If no calibration option was chosen, this step may be skipped.

Open the instrument air valve to charge the blowback accumulator. Exercise the blowback solenoid valve to insure it is properly wired. During and after a blowback cycle, the presence of a slight pressure pulse on the sample tubing in the analyzer shelter, and the momentary dilution of the sample with instrument air, is normal and signifies that a blowback cycle has occurred. The pressure pulse comes from the vacuum drawn on the sample line while the blowback is in process, which isolates the sample line from the probe for its duration.

The optimum time between blowback cycles is to be determined by experience. Once a day is sufficient in relatively clean applications. The requirement could be as frequent as every fifteen minutes where the dust and soot levels are severe. It is better to blowback too often than not often enough. A vacuum gauge in the sample line can be helpful to indicate if the particulate loading of the filter has started to restrict the flow of sample. The blowback cycle should be initiated before unacceptable pressure drop occurs.

Shutdown

Before removing power from the unit, ensure filter chamber has been purged of any potentially hazardous components.

To purge the chamber, perform the following:

1. If equipped, perform a manual blowback operation.
2. Ensure no sample is being drawn though the filter chamber. If the sample is being drawn using a sample pump, turn off the power to the pump or disconnect the sample line.
3. If not already done, disconnect the sample line.
4. Use instrument air or other inert gas. Flow ~10 l/m for 15-30 minutes through the filter chamber.
   Note: Gas can be routed through the chamber via the heated sample line.
5. After purging is complete, follow the maintenance procedure to change the filter.
6. Cap the sample outlet tube connection and disconnect power from the unit.
   Note: If electrical wires are to be disconnect, follow applicable ‘Lock Out/Tag Out’ requirements

Maintenance

CHANGING THE FILTER

CAUTION: THIS PROCEDURE CAN CAUSE SEVERE BURNS. USE PROPER PROTECTION.

Changing the probe tip filter for the probe tube on a Model 271 probe is extremely easy. Unsecure the door latches and open the door to the unit. Disconnect the PTFE blowback line leading to the probe tube. Depending on stack temperature, the probe tube and probe tube support may be hot. Use heat protection as appropriate. Loosen the quick clamp assembly holding the probe support collar to the subflange. Retract the probe tube and probe tip filter through the subflange. Support the probe tube to prevent excessive contact between the probe tip filter and the subflange. Replace the probe tube support with the cap fitting and reinstall the quick clamp assembly.

Inspect and replace the probe tip filter.

When ready to reinstall the probe tip filter and probe tube, remove the quick clamp assembly from the probe. Inspect the probe tube support gasket and ensure it is flexible and not cracked. Install the probe tip filter, probe tube, and probe tube support. Replace the quick clamp assembly and tighten. Reinstall the blowback PTFE line to the connection on the probe tube support.

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	Probe tip filter element plugged	Check/ replace filter element
	Exit path plugged	Remove probe tube support and check path through to sample out port
Low enclosure temperature	Insufficient warm-up time	Ensure power has been applied to the unit for a minimum of 15 minutes
	Power disconnected	Ensure power is supplied to the unit. Check by measuring for AC voltage on TB1-1 & 2
	Control switch defective	Check for continuity across the control switch. NOTE: the switch is normally closed below 225°F
High oxygen readings/low pollutant readings	Leak	Leaking past the probe tube support gasket. Remove probe tube support and inspect gasket. Ensure it is pliable and seated in its grooves
		Leaking blowback solenoid valve. Block or disconnect the blowback supply
		Loose connection. Verify all fittings are leak free
Low readings during calibration	Insufficient calibration gas flow	Ensure calibration flow is at least 110% of the sample gas flow

Spare Parts

Consumable Spare Parts	
Part	***P/N***
Gasket Sanitary Fitting 2-1/2” Tube Viton	5155-0725

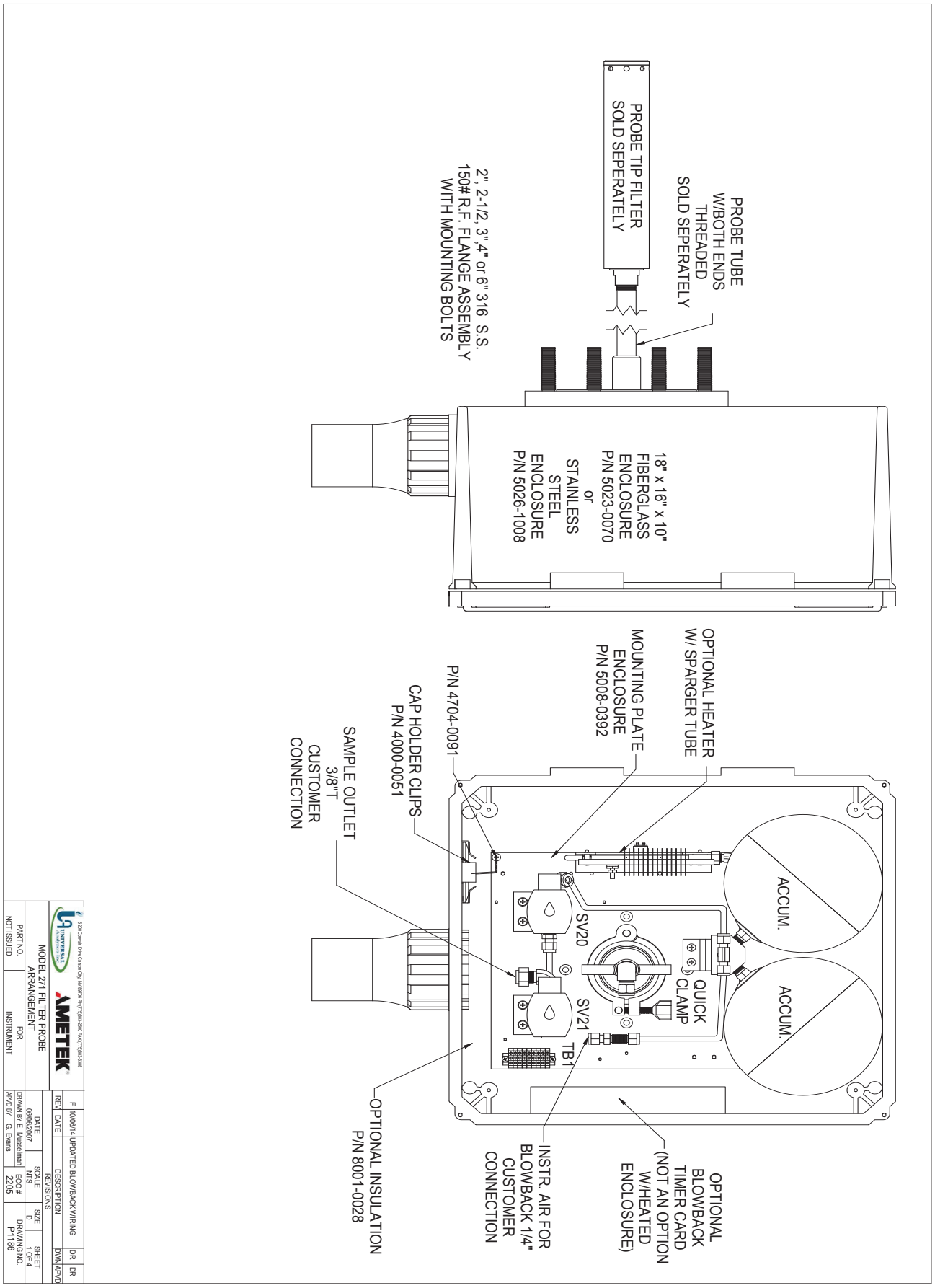
Basic Spare Parts	
Part	***P/N***
Heater, Finned, 250 watt @ 115VAC	3014-0066
Heater, Finned, 300 watt @ 230VAC	3014-0067
Switch, temperature, open on rise at 225°F	3103-0013
PCB Assy, 115VAC Blowback Timer Board	3600-0019
PCB Assy. 230VAC Blowback Timer Board	3600-0054
Gasket, Silicon Foam Closed Cell HT-800 1/4" Thick For 275 Enclosure	4903-1000
Tee Handle 271 for Quick Sanitary Clamp	4900-0011
Valve Solenoid 3 Way Hi-Flow 24VDC	4955-0142
Valve, Check 3 psig Crack, 316SS	4955-0148
Valve Solenoid 3 Way Hi-Flow 115VAC (Also used for 230VAC blowback)	4955-0151
Clamp Sanitary Fitting 2-1/2” Tube 304SS	5155-0723
Cap Assembly for 271 Sanitary Clamp Design	5209-0367
Accumulator Sphere, 7” SS	4956-0001
Probe Support and Mount for 271 Sanitary Clamp Design	5155-0237

Probe Tip Filters

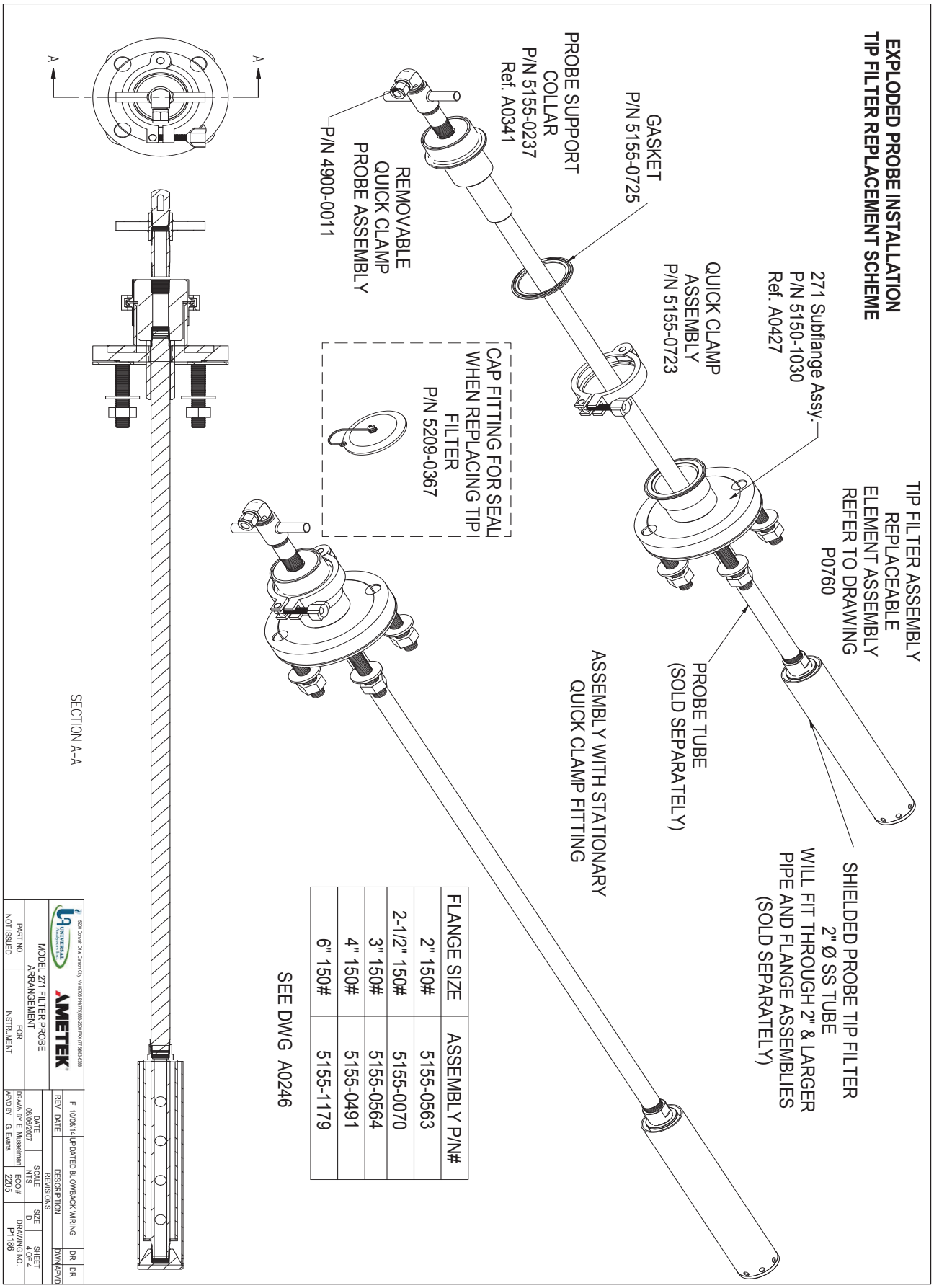
The Probe Tip Filter is available in 316SS and C-276 Hastelloy. A large 24” filter is available for high dust load or if a high flow rate is needed. Volume Reducers are available to increase the sample response time. (Recommended for Dilution Probes) Shields are available to protect the filter area from impacted dust, abrasion and debris. See Probe Tube Price Sheet for pricing and selection (use Probe Tubes with threads on both ends).

Probe Tip Ordering Matrix					
PTF = Probe Tip Filter					
	S = 316SS 750°F				
	C = C-276 Hastelloy 1475°F				
		9 = 9” Length			
		24 = 24” Length			
			VR = with Volume Reducer		
			0 = without Volume Reducer		
				SH = with Shield	
				0 = without Shield	
PTF	**-C**	**-24**	**-0**	**-SH**	**Sample Part #**

Drawings Model 271



Drawings Model 271



FLANGE SIZE	ASSEMBLY P/N#
2" 150#	5155-0563
2-1/2" 150#	5155-0070
3" 150#	5155-0564
4" 150#	5155-0491
6" 150#	5155-1179

5300 Comal Drive Canon City, NV 89706 PH (775)885-2200 FAX (775)885-2088

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MODEL 271 FILTER PROBE ARRANGEMENT FOR INSTRUMENT

PART NO. NOT ISSUED

REV	DATE	DESCRIPTION	DWN	APV'D	DR
F	10/06/14	UPDATED BLOWBACK WIRING			DR

REVISIONS

DATE 09/06/2007
DRAWN BY E. Masselman
APV'D BY G. Evans

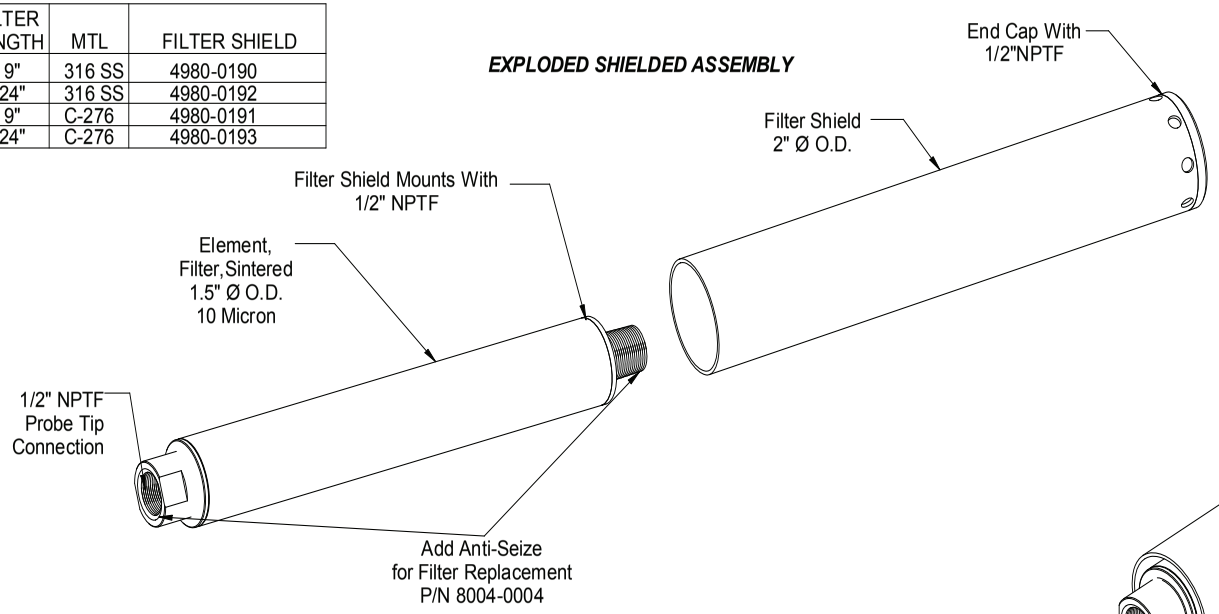
SCALE NTS
ECO # 2205

SIZE D
SHEET 4 OF 4
DRAWING NO. P1186

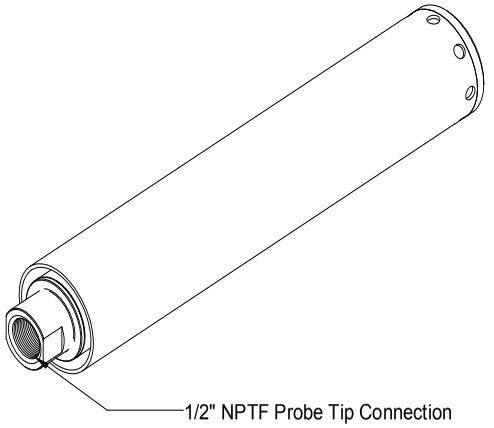
Drawings Model 271

FILTER LENGTH	MTL	FILTER SHIELD
9"	316 SS	4980-0190
24"	316 SS	4980-0192
9"	C-276	4980-0191
24"	C-276	4980-0193

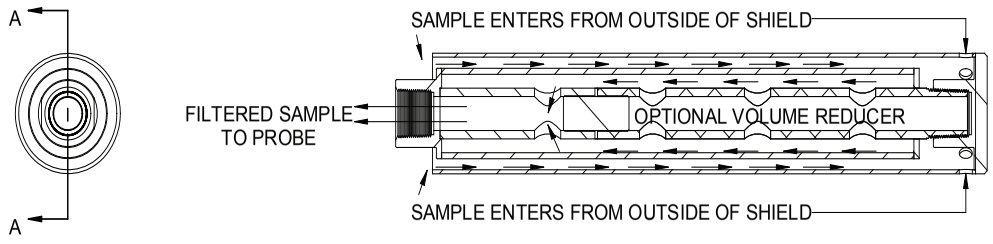
EXPLODED SHIELDED ASSEMBLY



COMPLETE SHIELDED ASSEMBLY

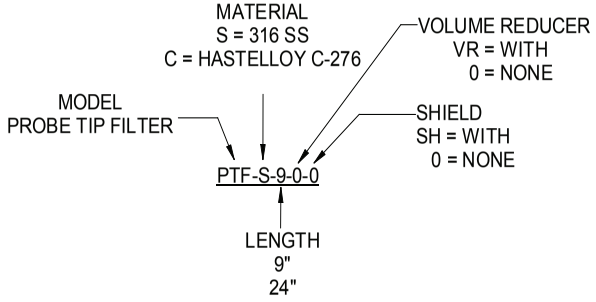


FILTER LENGTH	MATERIAL	FILTER ELEMENT W/ VOLUME REDUCER	FILTER ELEMENT W/O VOLUME REDUCER
9"	316 SS	4980-0184	4980-0182
24"	316 SS	4980-0188	4980-0186
9"	C-276	4980-0185	4980-0183
24"	C-276	4980-0189	4980-0187



SECTION A-A

MODEL PTF SERIES NOMENCLATURE

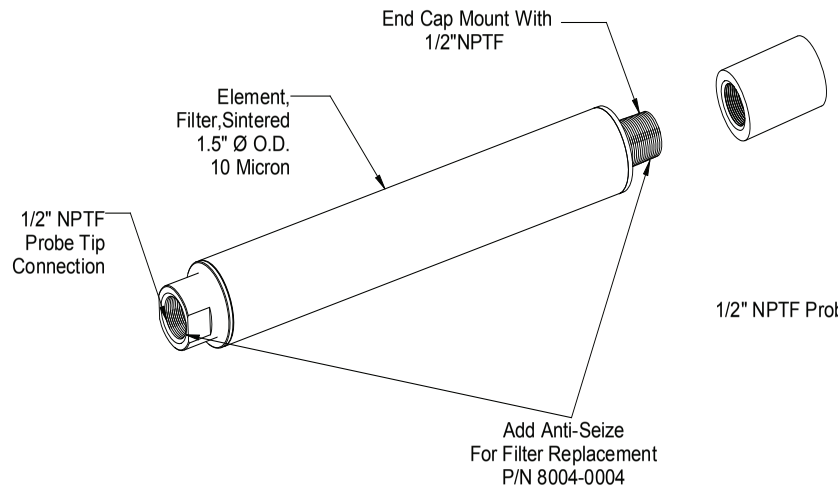


UNIVERSAL ANALYZERS INC. 5200 ConvairDrive Carson City,Nevada 89706 USA	F	03/02/09	Change End Caps	MW	DA
	REV	DATE	DESCRIPTION	DWN	APVD
	REVISIONS				
PROBE TIP FILTER W/SHIELD PTF SERIES	DATE 10/09/2003	SCALE 1 : 1	SIZE D	SHEET 1 OF 2	
PART NO. SEE DWG / FOR INSTRUMENT	DRAWN BY E.Musselman	DRAWING NO. P0760			
	APVD BY T.Barben				

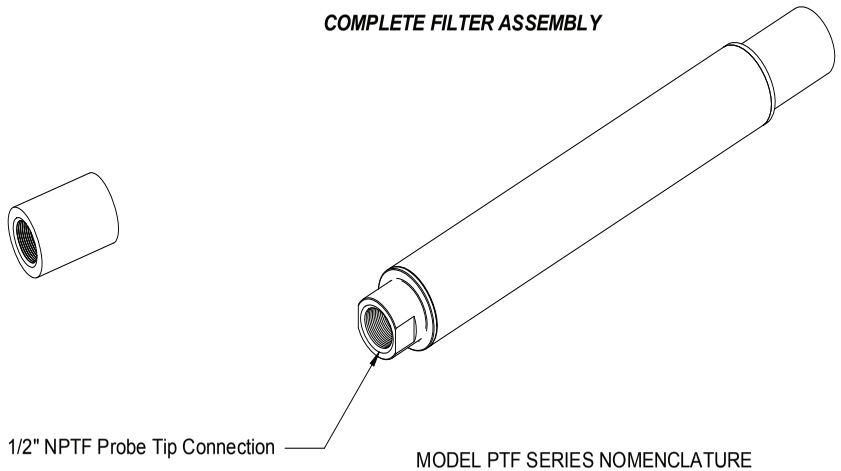
PART NO.	DESCRIPTION
4951-1037	PIPE CAP - FILTER ELEMENT 316 SS
5150-1038	END CAP - FILTER ELEMENT C-276

FILTER LENGTH	MATERIAL	FILTER ELEMENT W/ VOLUME REDUCER	FILTER ELEMENT W/O VOLUME REDUCER
9"	316 SS	4980-0184	4980-0182
24"	316 SS	4980-0188	4980-0186
9"	C-276	4980-0185	4980-0183
24"	C-276	4980-0189	4980-0187

EXPLODED FILTER ASSEMBLY



COMPLETE FILTER ASSEMBLY



MODEL PTF SERIES NOMENCLATURE

MATERIAL
S = 316 SS
C = HASTELLOY C-276

VOLUME REDUCER
VR = WITH
0 = NONE

MODEL
PROBE TIP FILTER

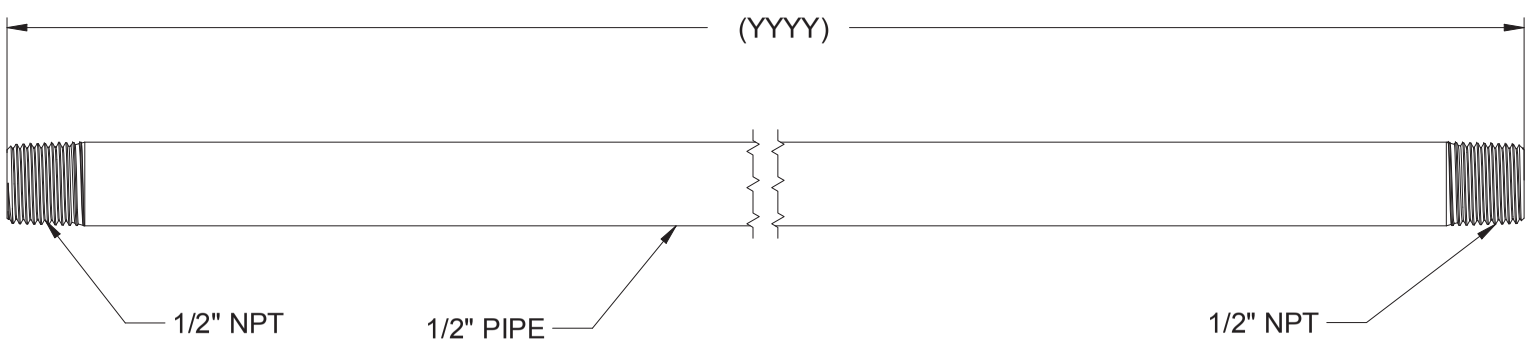
SHIELD
SH = WITH
0 = NONE

PTF-S-9-0-0

LENGTH
9"
24"

UNIVERSAL ANALYZERS INC. 5200 Convair Drive Carson City, Nevada 89706 USA		F	03/02/09	Change End Caps	MW	RS
		REV	DATE	DESCRIPTION	DWN	APVD
PROBE TIP FILTER W/O SHIELD PTF SERIES		REVISIONS				
		DATE 10/09/2003		SCALE 1 : 1	SIZE D	SHEET 2 OF 2
PART NO. SEE DWG	FOR INSTRUMENT	DRAWN BY E. Musselman		DRAWING NO. P0760		
		APVD BY T. Batten				

Drawings Model 271



PART NUMBER: 5*VWX-YYYY*

V = MATERIAL
S = STAINLESS STEEL
C = HASTELLOY C

W = NUMBER OF THREADED ENDS
2 = FOR DOUBLE ENDED PROBE

X = UNITS OF MEASURE
S = IMPERIAL UNITS
M = METRIC UNITS

YYYY = LENGTH
IF X = "S" LENGTH OF PROBE IN INCHES (0036 = 36")
IF X = "M" , LENGTH OF PROBE IN MILLIMETERS (1000 = 1000mm OR 1m)

EXAMPLE PART NUMBER: 5C2S-0048

PART DESCRIPTION: PROBE TUBE, THREADED AT BOTH ENDS, ½" SCHD 40, HASTELLOY C-276, LENGTH 48"

REV	DATE	DESCRIPTION	DWN	APVD
REVISIONS				

MATERIAL/DESCRIPTION | PART NO.

DIMENSIONS IN INCHES
TOLERANCES
.0 ± .015"
.00 ± .010"
.000 ± .005"
FRACTIONAL ALL ± .015"
ANGLES ± 1° 30'
UNLESS OTHERWISE SPECIFIED

PROBE TUBES FOR MODEL 271

PART No. | FOR

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

UNIVERSAL Analyzers Inc. | AMETEK

DRAWN BY		ECO#	DRAWING NO
APVD BY			N/A
DATE 10/07/2014	SCALE 1:1	SIZE D	SHEET 1 OF 1

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