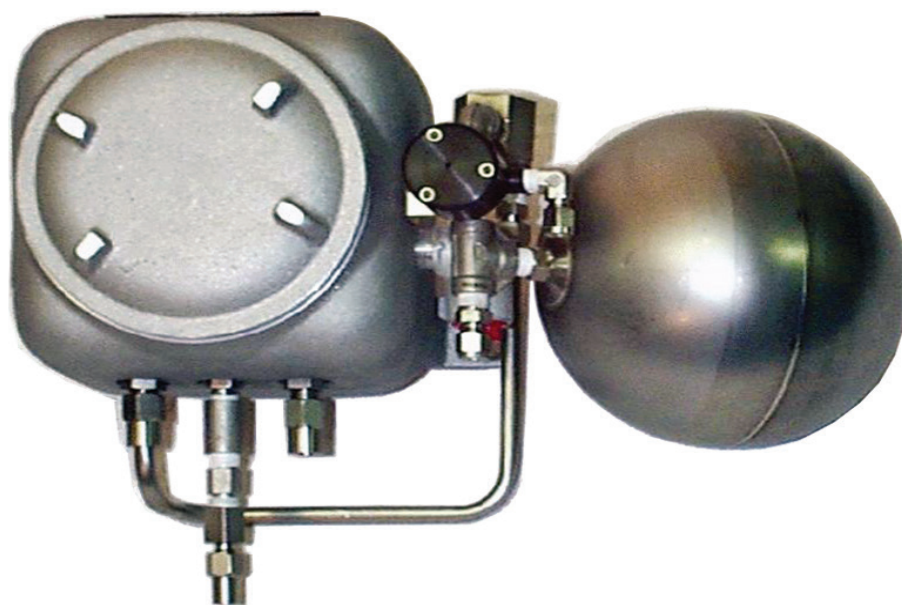




# *Instruction Manual*

## **Model 277S**

### *Stack Filter*



**AMETEK**<sup>®</sup>

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# Receiving and Storage

The UAI Model 277S Gas Sample Probe is 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 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

# Specifications

<b>OPERATING SPECIFICATIONS</b>	
<b>Sample Flow Rate</b>	0 to 20 l/m (0.7 cfm)
<b>Calibration Gas Requirement</b>	Sample flow rate plus 10%
<b>Operating pressure drop at 10 l/m</b>	12" water column (3.0 kPa)
<b>Maximum Stack Gas Temperature</b>	700°F (371°C) (higher with extended probe)
<b>Oven and Vaporizer Temperature</b>	350°F (176°C)
<b>Dimensions</b>	9" H x 9" W x 10" D (230mm H x 230mm W x 250mm D)
<b>Weight</b>	15 lbs (6.8 kg) (plus probe)
<b>Input Power Requirement</b>	150 watts
<b>Input Voltage Requirement</b>	115/230VAC, 50/60 Hz
<b>Blowback Tank Volume</b>	0.1 ft <sup>3</sup> (2.8 l)
<b>Blowback Timer Period</b>	w/o timer card - Ext. control w/ timer card - 15 min to 24 hr
<b>Blowback Solenoid Valve Voltage</b>	w/o timer card - 24VDC or 115/230VAC w/ timer card - 115/230VAC
<b>MATERIAL SPECIFICATIONS</b>	
<b>Filter Chamber Heater Type</b>	Rod heaters in aluminum tube, controlled with thermal switch
<b>Filter Chamber Material</b>	316SS (Hastelloy C-276 available)
<b>Filter Element Types</b>	Ceramic 2 µm (standard) Ceramic with 0.1 µm coating inside (optional) 316SS sintered 2 µm (optional)
<b>Chamber Material</b>	316SS, coated (Hastelloy C-276 optional)

# Description and Principle of Operation

## GENERAL DESCRIPTION

The Model 277S Series Heated Filter is designed to minimize the cooling of the sample at the inlet in order to avoid condensation of the water vapor in the sample. There is a thin cylinder of stainless steel separating the sample tubing from the heavy cast aluminum enclosure to isolate the sample from the cooling effect of the aluminum body. Where desired, the union that is provided to connect the filter to the probe can be eliminated to shorten the connection between the probe and the filter. This will make it easier to insulate the exposed sample tubing.

A 125 watt heater tube is mounted on the outside of the filter chamber. The heater holds the temperature of the filter near 350°F (177°C). A bi-metallic thermal switch mounted on the heater keeps the temperature from exceeding 350°F (177°C) by opening the circuit at that temperature. An optional independent thermocouple/RTD can be provided as a means to measure and transmit or record the temperature of the filter. A second thermal switch, set at 225°F (105°C.) is provided to be used as an alarm contact if the temperature drops below the switch temperature.

Several types of filter elements can be supplied with the Model 277S. The 2 µm ceramic filter is supplied as an economical general purpose filter. A similar ceramic filter with an internal 0.1 µm coating is available for finer filtration or to provide a surface to enhance the blowback capability where the fines have a tendency to fill the pores of the 2 µm element. A 2 µm, 316SS filter can be inserted for those applications where the ceramic filter is determined to be unsuitable. Additional filtration materials and pore sizes are available on request.

Compressed air is used to clean the filter element. This air supplied to the blowback assembly needs to be clean and dry. Instrument quality air is preferred. The pressure should be as high as possible, up to 125 psig (862 kPa). High pressure air fills the accumulator and provides a substantial blast when the solenoid valve opens. This loosens the particles on the filter surface and forces them back through the sample probe into the stack. The period of time between blowback cycles should occur before the pressure drop across the filter begins to increase. This should be selected to be as often as every fifteen minutes but no less frequently than once per day. The time period between blowback cycles can be based on a calculation to estimate the amount of sample required to deposit from three to five grams of solids in the filter element.

The blowback accumulator, a 7" diameter stainless steel sphere, is designed to be pressurized to a maximum pressure of 125 psig (862 kPa) using compressed air. At that pressure there is 1.0 standard cubic feet (28L at STP) of air stored to flush the particulate matter out of the filter and through the probe into the stack.

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 is injected into the chamber ahead of the filter. This is close to the sample source as is required by many EPA officers. A back pressure check valve (set at 3 to 5 psig, 21 kPa to 34 kPa) 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

Each stack where the Model 277S Series is to be mounted should have a sample probe installed. The probe should be mounted with the interior end level or pointing slightly downward to allow any entrained liquid to drain back into the stack. The Model 277S should be mounted to the probe and supported by the union which is supplied as part of the assembly. Where a Heated Sample Line (HSL) can place additional weight on the assembly, there should be a structure to support the assembly. The probe is not designed to support the weight of the HSL.

A HSL should be supported close to the Model 277S. Connect the sample line to the 3/8" tubing fitting (See Drawing P0521). The unheated portion of the sample line should be kept short and insulated to avoid condensation within the line between the Model 277S and the HSL. Connect the cal gas line through a back pressure check valve to the 1/4" tubing fitting. If the automatic blowback option is to be installed, remove the 3/8" plug in the blowback tubing fitting and connect the line from the blowback assembly. A service loop can be provided for the cal gas line and the blowback line because they do not need to be kept hot.

Insulate the portion of the sample line between the Model 277S and the heated portion of the sample line.

Provide power to the terminal block within the Model 277S. 150 watts of power, at 115/230VAC is required. A thermal switch in the heater oven will control the temperature at 340°F (171°C). Ensure the power supplied to the heater matches the heater voltage requirement shown on the serial number tag. If needed, the voltage requirement can be changed by moving jumpers on the terminal strip. Where the optional blowback assembly is supplied, the electrical wiring should also include a control line to power the solenoid valve to initiate a blowback cycle. Make sure the control line power matches the voltage requirement on the solenoid valve name plate. An independent ground wire should be run to the grounding terminal on the terminal strip. All electrical connections to the explosion-proof enclosure and the solenoid valve should conform to the requirements of the NEC for the area classification where the Model 277S is located.

If an independent measurement and display of the oven temperature is desired, the Model 277S can be built with a thermocouple or RTD installed into a 1/8" hole in the heater oven.

The final step in the installation process is to screw the access cover back on the Model 277S and apply power.

## **SMART BLOWBACK MODULE (OPTIONAL)**

The "smart" blowback module includes a timer circuit which will initiate the blowback cycle based on an regular, adjustable time period. The timer can be turned off by adding an external jumper. An external contact closure can be used to initiate a blowback cycle whether the timer is active or not.

On the circuit board for the blowback module is a potentiometer, R14, that controls the blowback cycle time. At the full counter clockwise position, the period of time between blowback cycles is about 15 minutes and at full clockwise position, the period of time between blowback cycles is about 24 hours.

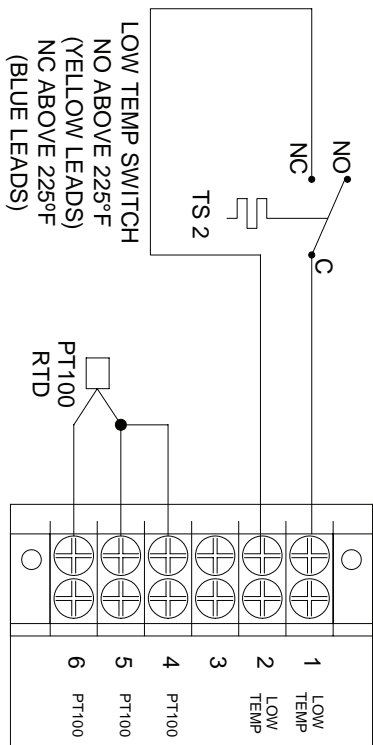
A jumper placed between terminals labeled as "AUTO-OFF" and "COM" will disable the timer. A contact closure between terminals labeled as "MANUAL B.B." and "COM" will initiate a blowback cycle. These terminal labels may be found on the circuit board itself, or in the case where the board is mounted within a large enclosure, the connections are brought out to an external terminal strip which is also labeled as described.

The blowback solenoid valve will be opened for 2 seconds when the blowback cycle is started by either the internal timer or an external contact closure.

Power is provided to the timer circuit when power is applied to the Model 277S.

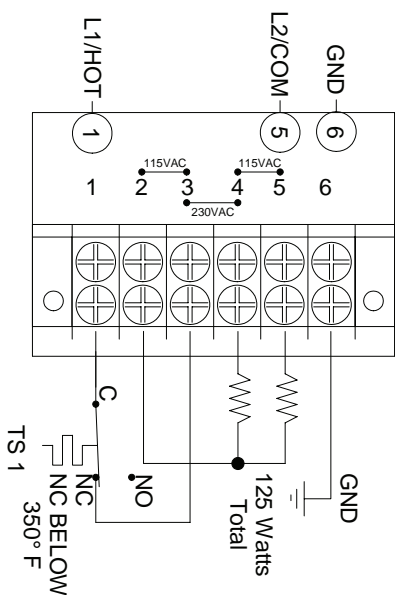
# Electrical Connections Model 277S

FRONT VIEW  
(LID REMOVED FOR  
CLARITY)



ALARM WIRING  
TB2

INPUT POWER  
WIRING  
TB1



REQD	DESCRIPTION	P/N
1	2-216 O-RING VITON	4904-0016
2	2-208 O-RING VITON	4904-0015
1	CHECK VALVE	4955-0003

REV	DESCRIPTION	BY	DATE
3	Revised Alarm Wiring	SPH   K	
2	DESCRIPTION	DOWN	1/10/00
1	REVISIONS		

**MODEL 277S NEMAY**  
STACK FILTER WITH  
1/2" CONDUIT PORTS & PT100  
PART NO. FOR  
NOT ISSUED INSTRUMENT

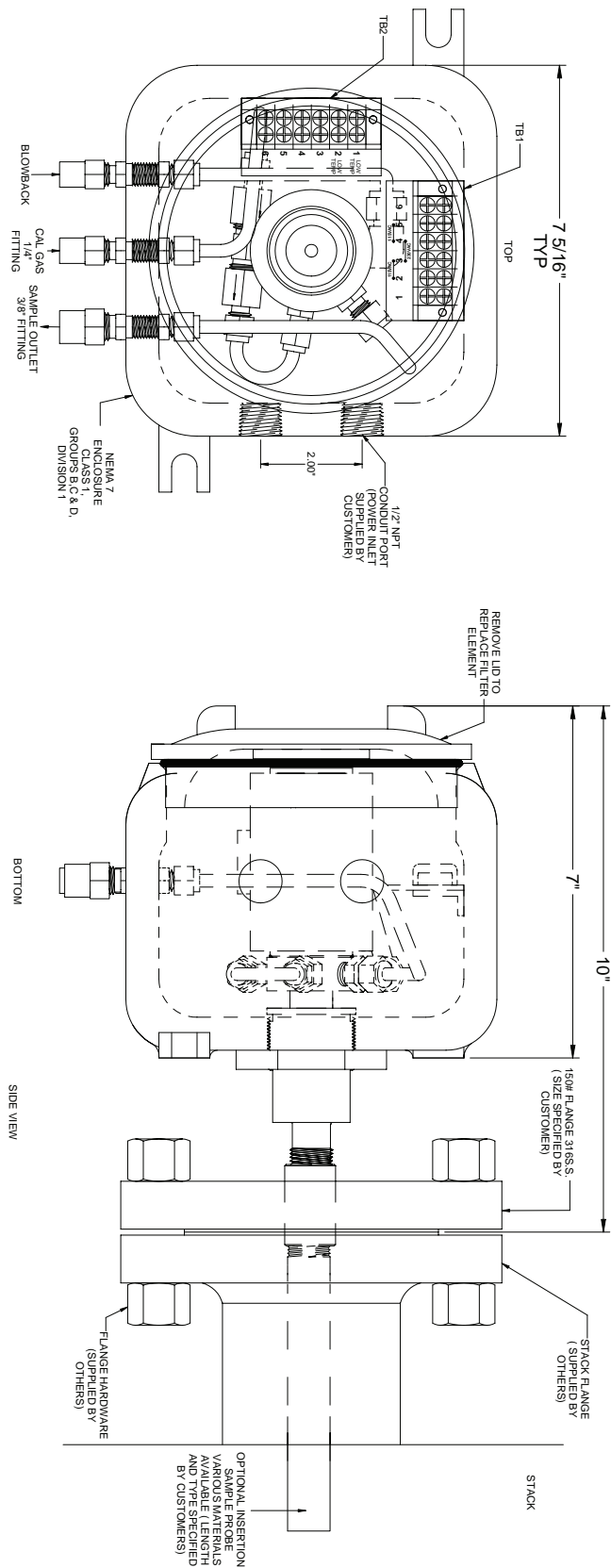
**UNIVERSAL ANALYZERS INC.**  
1701 South Suito Terrace  
Carson, CA, Nevada 89706 USA

DRAWN BY: E. Mueserlin  
DRAWING NO: POS21

DATE: 11/06/00  
SCALE: 1:1  
SIZE: D  
SHEET: 1 OF 1



# Process and Piping Connections Model 277S



# Start-Up

Apply power to the Model 277S. Allow 15-30 minutes for the filter to come to temperature. This warm-up period is extremely important to avoid the presence of condensation within the Model 277S filter which would cement the particulates to the filter surface.

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

Run a calibration cycle to insure that the calibration lines are properly installed and sealed. At least 10 percent more calibration gas should be supplied to the Model 277S than is being withdrawn as sample. That will ensure that the filter and probe are being properly flooded with calibration gas. The excess calibration gas will be discharged through the probe.

Open the instrument air valve to charge the blowback accumulator tank if the blow back option is installed. After the tank is pressurized, exercise the blowback solenoid valve to ensure it is properly wired. After a blowback cycle, the presence of a slight pressure pulse on the sample tubing in the analyzer house and the momentary dilution of the sample with instrument air, is normal, and signifies that a blowback cycle has occurred.

The optimum time between blowback cycles is to be determined by experience. Once a day is usually 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 conduct a blowback too often than not enough. A vacuum gage in the sample line can be helpful to indicate if the particulate loading of the filter has started to restrict the flow of sample. That condition should not be allowed to occur. The blowback should be initiated before the change in pressure drop becomes noticeable.

# 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. Close the filter stack isolation valve(s), if applicable.
3. Ensure no sample is being drawn through 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.
4. If not already done, disconnect the sample line.
5. Using instrument air or other inert gas, flow ~10 l/m (0.4 cfm) for 15-30 minutes through the filter chamber.  
Note: Inert gas can be routed through the chamber via the calibration gas line.
6. After purging is complete, follow the maintenance procedure to change the filter.
7. Cap the sample outlet tube connection and disconnect power from the unit.  
Note: If electrical wires are to be disconnected, follow applicable 'Lock Out/ Tag Out' requirements.

# Maintenance

## CHANGING THE FILTER



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

Changing the filter in the Model 277S Heated Filter Assembly is extremely easy. Using gloves to protect the hand, grasp the cap of the enclosure and turn it counter clockwise. The cover may be hot to the touch and may cause burns to the hand if not protected. Removing the cover exposes the filter. Reach into the heated oven with pliers to pull out the old filter. If using a new style cap, the filter comes out with the cap.

Inspect the O-Rings which are at each end of the filter to ensure they are still elastic and will seal the filter. Replace them if they are charred or deformed.

Replace the filter with a new one, again handling it with pliers. Ensure it is pushed in the center of the oven so that it is in contact with the O-Ring on the far end of the filter.

Screw the cap back on the filter body. The filter replacement procedure is complete.

# 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).

<b>Error</b>	<b>Possible reason</b>	<b>Check/Repair</b>
No sample gas flow	Filter element plugged	Check/replace filter element
	Filter chamber exit port plugged	Remove filter element and inspect exit port
Low temperature alarm	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	Verify by measuring for a closed circuit between TB1-1 & 4
High oxygen readings/ low pollutant readings	Leak Leaking past the filter element O-Rings.	Remove filter element and inspect -rings. There are two O-Rings, one located at the base of the filter element and the other in the cap. Ensure both are pliable and seated in their respective 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

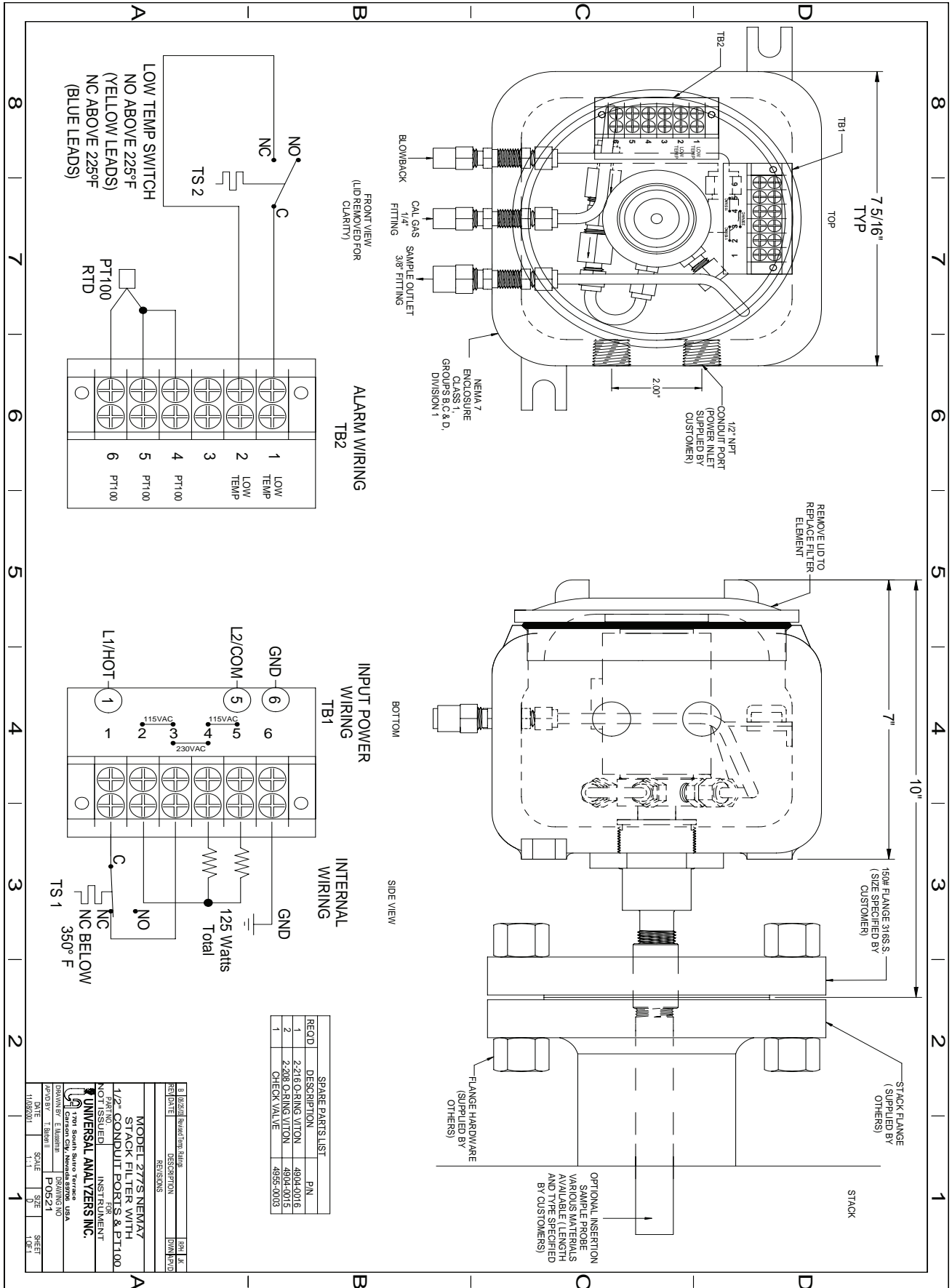
# Spare Parts

<b>Consumable Spare Parts</b>	
<b>Part</b>	<b>P/N</b>
Filter, 2 µm Ceramic 3" Lg. (other options available)	4980-0007
O-Ring, Viton 2-208, Filter Element	4904-0015
O-Ring, Viton 2-216, Knob Assembly	4904-0016
O-Ring, Viton 1	4804-0004
Heater Element Paste	8010-0001
Filter Element Ceramic Alumina, 1 µm (optional)	4980-0127

<b>Basic Spare Parts</b>	
<b>Part</b>	<b>P/N</b>
Heater Element, 1-1/2" Lg. 63 Watt @ 120VAC	3014-0046
Temperature Switch Heater Control, Normally Closed Below 340°F	3103-0014
Low Temperature Switch, Normally Open Below 225°F (fail safe)	3103-0012
Low Temperature Switch, Normally Closed Below 225°F	3103-0013
Gasket, 2" Flange	4903-1002
O-Ring, Kalrez, 2-117, Triple O-Ring Seal	4904-2021
O-Ring, Kalrez, 2-132, Tertiary Subflange	4904-2031
O-Ring, Kalrez, 2-125, Probe Tube Support	4904-2030

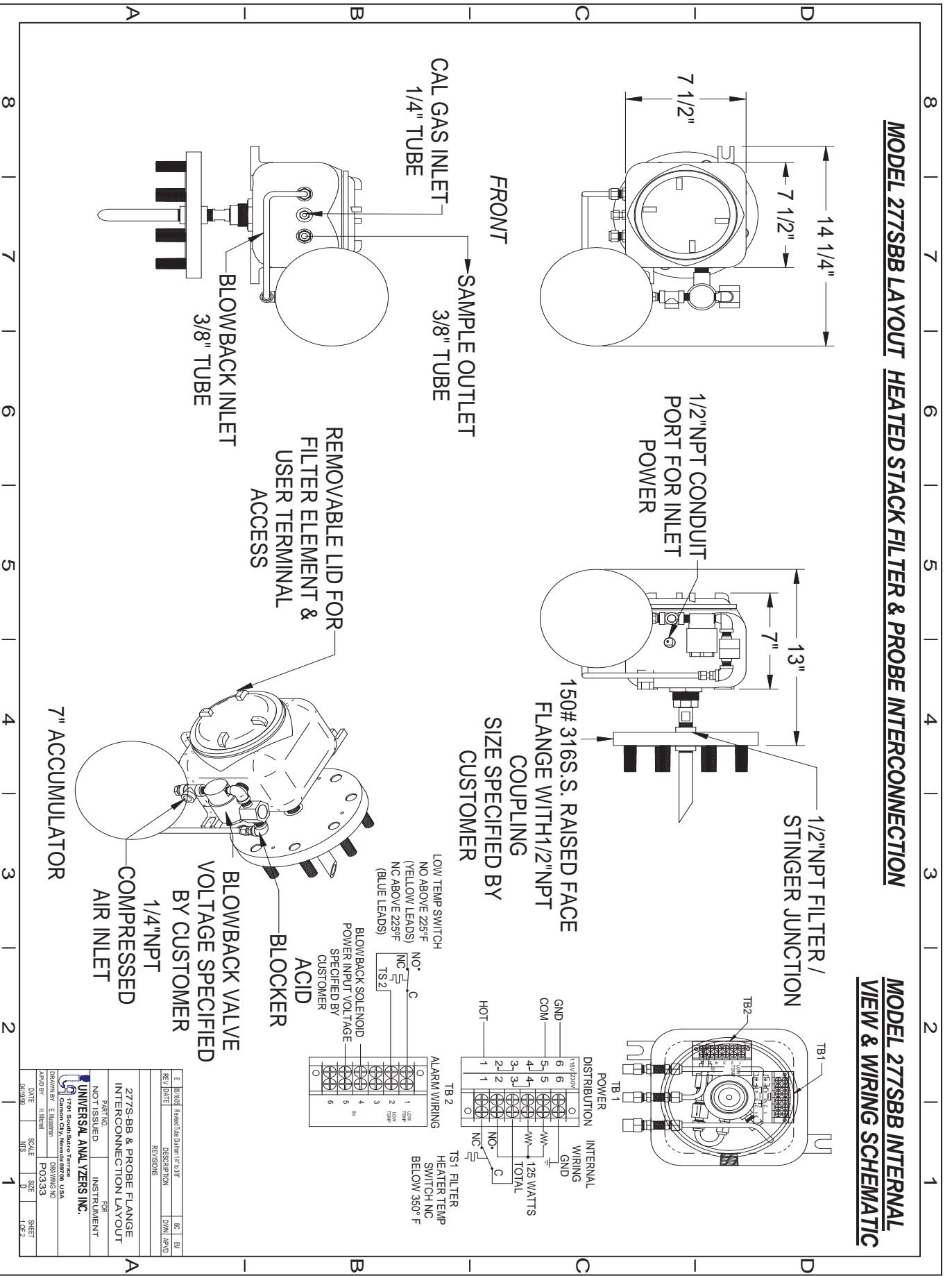
<b>Optional Parts</b>	
<b>Part</b>	<b>P/N</b>
Solenoid Valve Blowback, 2-Way 24VDC Explosion Proof	4955-0037
Solenoid Valve Blowback, 2-Way 120VAC Explosion Proof	4955-0046
Solenoid Valve Blowback, 2-Way 240VAC Explosion Proof	4955-0088
Accumulator Sphere Blowback, Unheated	4956-0001
Timer Card Blowback, 120VAC	3600-0019
Timer Card Blowback, 240VAC	3600-0054
Check Valve Calib. Gas, Adjustable Pressure	5150-0014
Acid Blocker Assembly, Blowback	5110-0015

# Drawings Model 277S

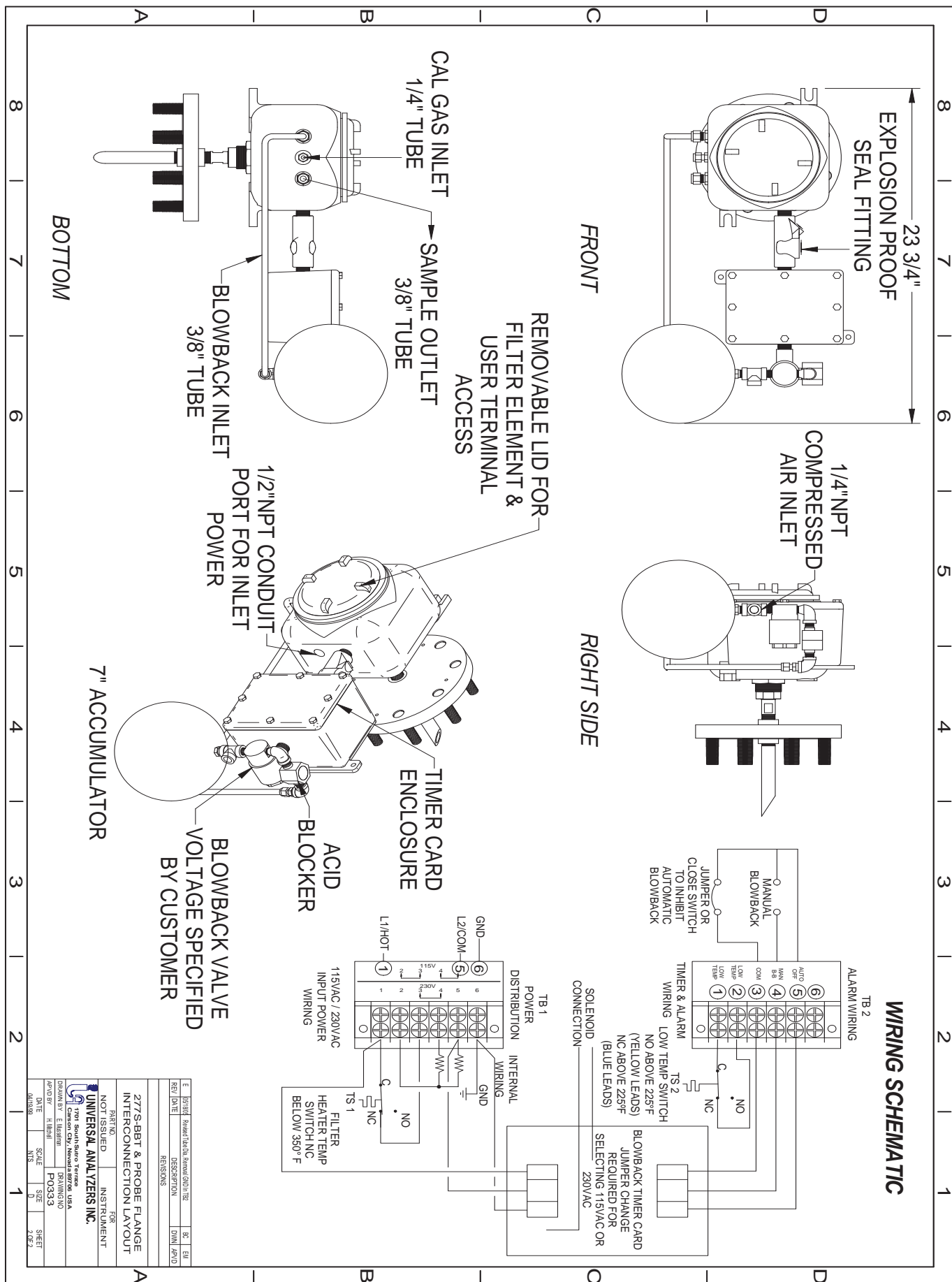


## MODEL 277SBB LAYOUT HEATED STACK FILTER & PROBE INTERCONNECTION

## MODEL 277SBB INTERNAL VIEW & WIRING SCHEMATIC



# Drawings Model 277S





# 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

