

Gas Chromatograph

Models: 131S & 132S

User's Manual

Revision 7.1
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**Envent**
Knowledge by Analysis

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1.0 Introduction

1.1 About This Manual

This manual provides all information necessary for the installation, operation, maintenance, and basic troubleshooting of the Envent Engineering 131S and 132S Gas Chromatograph analyzer.

This manual contains information essential to the safe and efficient operation of the 131S & 132S. This manual should be read by all personnel who will be installing, operating, or otherwise interacting with these models.

This manual focuses on the analyzer as a stand-alone unit. However, the sample gas must be conditioned before entering the analyzer to prevent erroneous readings and/or damage to the analyzer. This manual includes a recommended standard sample conditioning system configuration that would ensure proper operation of the analyzer. The exact sample conditioning system used will depend on the customer's requests at time of purchase. Refer to the analyzer's documentation for more information.

1.2 Warranty and Liability Statements

Products produced and supplied by the manufacturer (Envent Engineering Ltd), unless otherwise stated, are warranted against defects in materials and workmanship for up to 18 months from the shipping date or up to 12 months from the start-up date (whichever comes first). During the warranty period the manufacturer can choose to either repair or replace products which prove to be defective. The manufacturer or its representative can provide warranty service at the buyer's facility only upon prior agreement. In all cases, the buyer has the option of returning the product for warranty service to a service facility designated by the manufacturer or its representative. The buyer shall prepay all shipping charges for products returned to a service facility. The manufacturer or its representative shall pay all shipping charges for the return of products to the buyer. The buyer may also be required to pay round-trip travel expenses and labour charges (at prevailing labour rates) if the warranty has been violated. The warranty may be considered violated for any of the reasons listed below.

1.2.1 Limitation of Warranty

The foregoing warranty shall not apply to defects arising from:

- Improper or inadequate maintenance of the product by the user
- Improper unpacking or installation procedures
- Inadequate site preparation

- Unauthorized modification or misuse of the product
- Operation of the product in unfavorable environments such as at high temperatures, high humidity, or in corrosive atmospheres
- Operation of the product outside of the published specifications

Envent Engineering Ltd carries no responsibility for damage caused during transportation or unpacking, unless otherwise specified in the incoterms.

An extended warranty may be available with certified start-up. Contact Envent Engineering Ltd for details.

Envent Engineering Ltd reserves the right to change the product design and specifications at any time without prior notice.

1.2.2 Disclaimer

No other warranty is expressed or implied. The manufacturer specially disclaims the implied warranties of merchantability and fitness for a particular purpose. The sole remedy of the buyer shall in no case exceed the purchase price of the analyzer. The manufacturer shall not be liable for personal injury or property damage suffered in servicing the product. The product should not be modified or repaired in any manner differing from procedures established by the manufacturer.

1.3 Safety Information

The procedures and settings outlined in this manual constitute what is considered proper use of the equipment in question. The equipment was designed and tested under the assumption that these procedures and settings will be adhered to. Applying values outside of the provided ranges (such as permitting excessive pressures) or modifying provided procedures is considered improper use of the equipment. Envent Engineering Ltd is not responsible for any injury or property damage caused by improper use of the equipment. Once in the field, the user is solely responsible for the safe operation of the equipment.

1.3.1 Key Symbols

The following symbols are used throughout the manual to call attention to important information. We recommend familiarizing yourself with them before reading further.



Indicates a potential hazard that, if not properly addressed, could result in damage to the equipment or injury to the operator.



Indicates additional information intended to help clarify an earlier statement or to aid in the reader's understanding of a given topic

2.0 Equipment Overview

2.1 Theory of Operation

2.1.1 Important Definitions

Carrier	A gas which pushes the sample through the columns for analytical separation (also known as the "mobile phase")
Chromatogram	The output of a Chromatograph; a record of the output from the GC Detector and crucial to determining mole percent concentration; typically represented as a graph or chart
Chromatograph	A device designed to separate a mixture into individual components
Column	An analytical device which causes components, in a sample, to separate from one another through physical interaction (also known as the "stationary phase")
Component	Any one of the multiple chemicals which make up the sample, whether of interest to analyze or as a contaminant
Contaminant	A component which is not desired to be analyzed; may or may not cause interference
Elute	The action of a component exiting a column
Integrator	Hardware/Software responsible for computing the output of the detector into a chromatogram
Response Factor	A factor important to determining an analyte's concentration - created during calibration
Retention Time	The time at which the most concentrated part of a component elutes from the column and is detected, usually referenced from the start of analysis or the start of sample injection
Sample	A mixture containing one or more components which the analyzer will measure
TCD	Thermal Conductivity Detector
Thermal Conductivity	A measurement of a material's ability to conduct heat

Thermistor A device which reacts to temperature changes with a change in resistance

Wheatstone Bridge An electrical circuit designed to measure an unknown electrical resistance by balancing two legs of a bridge circuit

2.1.2 Gas Chromatography

Gas Chromatography is achieved by separation of a mixture (a sample) into its individual components so that the concentration of each component can be measured. There are three basic parts to chromatography: (1) The sample; (2) the mobile phase (also known as the “carrier” (typically Helium or Hydrogen)); and (3) the stationary phase (the analytical columns). Separation occurs when the carrier pushes the sample through the columns; the analytical columns are designed such that the components of the mixture move at different rates. In this theory, the components are separated and elute from the column at different times. Detection of the separated components is done using a Thermal Conductivity Detector (TCD). The integrator (electronics) takes the output from the TCD and turns it into a graph (millivolts over time) which has peaks representing the time, and intensity, of each component eluting from the column. This output is called a chromatogram and is the basis of concentration readings and subsequent calculations that need to be performed.

2.1.3 Thermal Conductivity Detector (TCD)

The TCD block consists of two heat-sensitive thermistor beads mounted to individual chambers. Thermistors respond to a change in temperature with a change in resistance. These beads are wired together as part of a balanced wheatstone bridge (see Figure 1), one bead is designated as the “reference” and the other as the “measurement”. As seen in Figure 1, the reference thermistor receives carrier only, while the measurement thermistor receives the carrier as well as the eluted components from the sample.

When both the thermistor beads are receiving carrier gas only, the resistance of the wheatstone bridge system remains unchanged and so the voltage measured by the integrator does not change; this state provides the GC with the baseline measurement. Alternatively, when a component elutes from the analytical column, its individual thermal conductivity will slightly change the temperature in the measurement cell which changes the resistance balance of the bridge – this change causes the integrator to detect a millivolt difference and a peak is generated on the chromatogram.

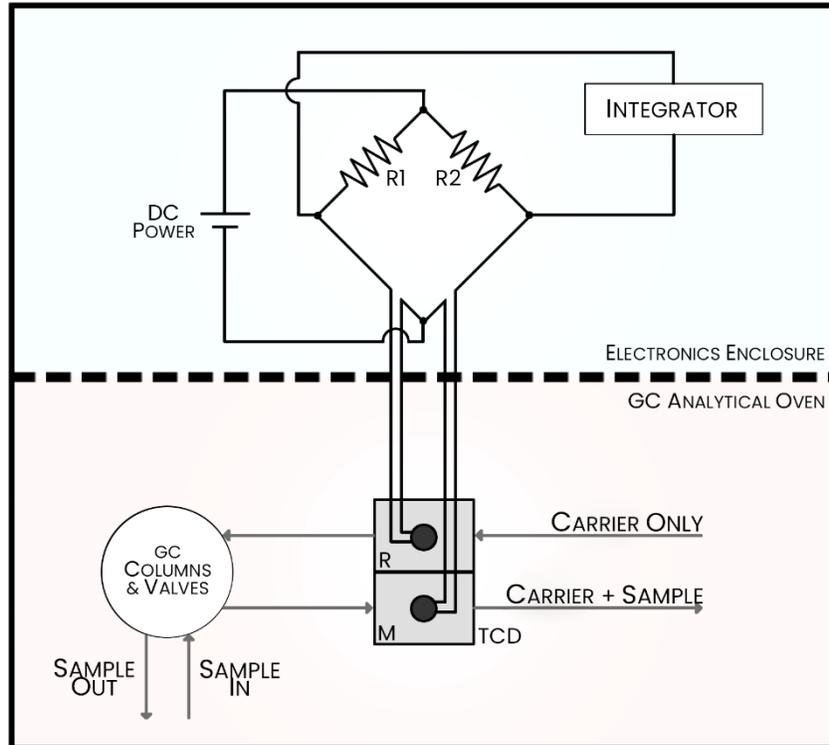


Figure 1. Diagram of the Wheatstone Bridge and TCD

2.1.4 Chromatogram Output

When a resistance change occurs between the two thermistors, and the bridge becomes unbalanced, the millivolt signal is detected, and the integrator interprets this as a peak. The peak is displayed on a chromatogram (see Figure 2), where the peak's relative size (height and width) is correlated to the concentration of the component in the sample.

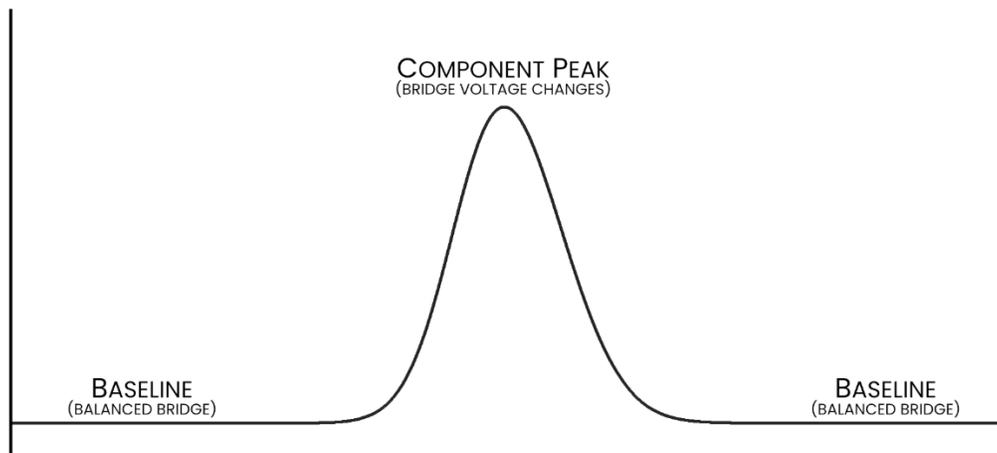


Figure 2. Labeled Diagram Depicting a Chromatogram Peak

2.1.5 Computational Analysis

Integration is performed on the peaks of the chromatogram to determine the area of each peak. The area of a peak is directly correlated to the concentration of the component in the sample, by mole percent. For the integrator to compute the mole percent concentration of a component, two factors are required: the response factor (RF) and the retention time (RT). The retention time is the time at which the peak's apex occurs (usually in seconds), in relation to the start of the chromatogram – this factor is important to identify which component belongs to which peak.

Calibration, of the analyzer, is required to determine the response factor for each component in the sample. The response factor of a component is equal to its peak area divided by the mole percent concentration of the calibration standard.

The response factor is calculated as such:

$$RF_n = \frac{A_n}{Cal \%_n}$$

Where,

- RF_n Response Factor of component “n”
- A_n Area of component “n”
- $Cal \%_n$ The calibration standard's listed mole % of component “n”

During analysis, component concentrations are determined by the following calculation:

$$Mole \%_n = \frac{A_n}{RF_n}$$

Where,

- $Mole \%_n$ Concentration of component “n” by mole percent
- A_n Area of component “n”
- RF_n Response factor of component “n” determined during calibration

After the concentration of each component is determined (by mole percent), the total un-normalized mole percent is calculated with the following calculation, which sums the mole percent concentrations of all the analyzed components:

$$Mole \%_T = \sum_{n=1}^k Mole \%_n$$

Where,

- $Mole \%_T$ Total un-normalized mole percent
- K Number of components included in the total
- $Mole \%_n$ Individual mole percent concentration of component “n”

Normalization is the process by which the results of the chromatogram are adjusted such that the mole percent total equals one hundred percent. This computation is useful when the un-normalized concentration total does not equal one hundred percent – this will almost always be the case as there are always variances which affect the summed total. These variances typically stem from minor changes due to environmental effects (temperature, humidity, pressure), electrical noise differences, and/or minor contaminants or impurities in the sample or carrier. Normalization should not be used as a tool to combat inherently poor chromatography (some examples include inefficient sample conditioning, major contaminants or interference in the readings, and changes in pressure or flow of the sample or carrier). Each component’s concentration is normalized using the following calculation:

$$NMole \%_n = \frac{Mole \%_n}{Mole \%_T} \times 100\%$$

Where,

- NMole %_n* Normalized concentration (by mole percent) of component “n”
- Mole %_n* Un-normalized concentration (by mole percent) of component “n”
- Mole %_T* Total un-normalized mole percent

2.2 External Components & Dimensions/Clearances

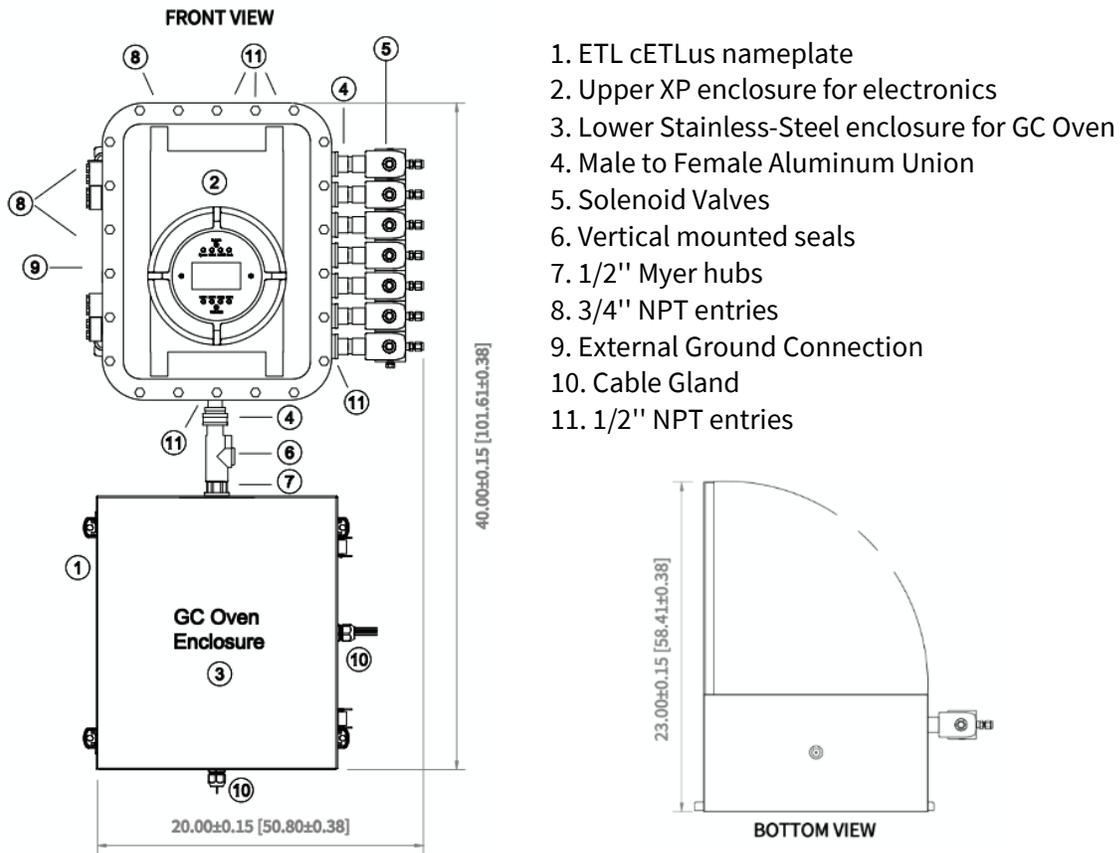
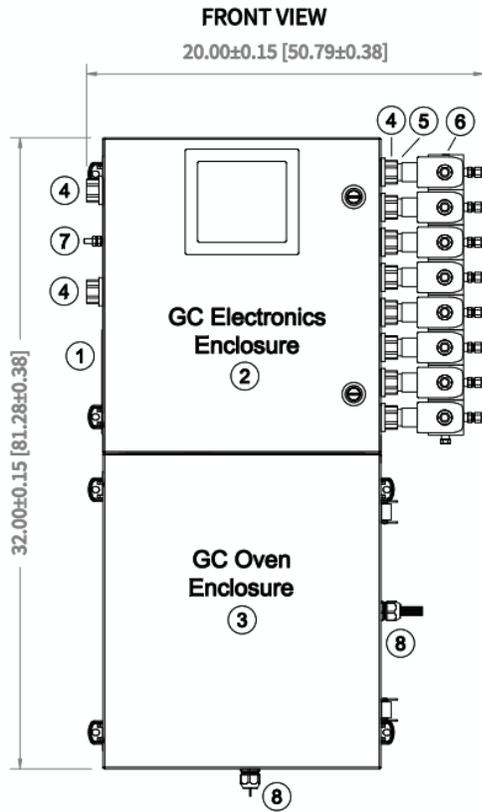


Figure 3. Model 131S External Components & Dimensions/Clearances Inches [cm]



1. ETL cETLus nameplate
2. Upper enclosure for electronics
3. Lower Stainless-Steel enclosure for GC Oven
4. 1/2" Myer hubs
5. Rigid Conduit Nipples
6. Solenoid Valves
7. External Ground Connection
8. Cable Gland

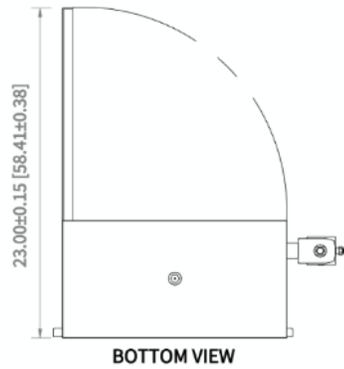


Figure 4. Model 132S External Components & Dimensions/Clearances Inches [cm]

2.3 Technical Specifications

Analyzer Specification	
Mounting	Wall-mount (Standard), Free-standing (Optional)
Supply Voltages	100-240 VAC 50/60 Hz (40 Watts running, 50 Watts Start-up) Fuse Rating: 5 Amps, 250V, Slow blow, Size: 0.201" Dia x 0.787", Package/Case: 5 mm x 20 mm
Certification	Model 131S: cETLus Class I, Division 1, Groups BCD Temp Code T3. Ambient temperature -20 to +55 °C (-4 to +122 °F) – For indoor use only. Model 132S: cETLus Class I, Division 2, Groups BCD Temp Code T3. Ambient temperature -20 to +55 °C (-4 to +122 °F) – For indoor use only.
Oven	Airless heat sink, maximum 84 °C (183.2 °F)
Display	Graphic Liquid Crystal Display; menu is scrolled by internal button or magnetic wand (131 Model)
Valves	6-port and 10-port diaphragm valves
Carrier Gas	Typically UHP helium 7 to 20 cc/min (typical flow rates). Offering 12-14 Months operation in C6+ BTU applications (2 Column App). 6-8 Months operation in C6+ BTU applications (3 Column App).
Detector	Thermal Conductivity Detector (TCD)
Gating Options	Fixed-time, auto-slope detection with automatic gating of peaks on calibration or analysis
Streams	Up to 8 streams (including calibration stream)
Electronics	Envent designed ARM7 CPU based analyzer platform
Analog Inputs	Three sensor inputs filtered with transient protection
Analog Outputs	Dual isolated 4-20 mA (2 wire standard, loop powered)
Communications	RS-232, RS- 485, TCP/IP
Modbus	Enron, Modicon 16, Modicon 32

3.0 Installation

3.1 Unpacking



The 131S Model GC analyzer weighs approximately 68 kg (150 lb) and the 132S Model GC analyzer weighs approximately 36 kg (80 lb) (13.6 kg (30 lb) added with sample conditioning system). Unpacking and transporting requires a minimum of two persons.

Upon arrival, the packaging should be immediately inspected for any external damage that may have occurred during shipping. If any damage is present, please contact Envent Engineering Ltd and request that the carrier's agent be present when the analyzer is unpacked. If a disagreement arises, the incoterms agreed to by the seller and the customer will overrule any dispute.

Once the integrity of the packaging has been confirmed open the shipping container and remove the packing materials from the shipping box. Remove all provided components from the shipping container and inspect them for any damage that may have been sustained during shipping. Compare the provided components to the shipping manifest to ensure that all parts are present.

3.2 Mounting Requirements



The 131S is designed for cETLus Class 1, Division 1 (132S for Division 2), Groups BCD, Temp Code T3 (Tamb -20°C to +55°C). These models are designed for indoor use only. Ensure that the analyzer received is suitable for the electrical classification of the installation site.

The analyzer should be mounted in an enclosed area in which it is not exposed to vibrations, excessive pressures, temperatures, or environmental variations.

The selected installation site should provide adequate room for maintenance and repair procedures.

The installation site should be as close as possible to the process stream being measured. The sample delivered to the analyzer must be representative of the stream and as such, should be taken from a point as close as possible to the analyzer. This proximity will prevent lag times and sample degradation in the lines.

A bypass sweep is recommended to reduce sample lag time if the sample lines are longer than 4.6 m (15 ft) or if they are being kept at high pressure (2758 kPag (400 psig) and above). If the line pressure is over 2758 kPag (400 psig), a heated regulator is recommended.

All connections must be leak tight to ensure the safety of the user and the operation of the analyzer.

Sample should not exceed 172 kPag (25 psig) in sample system. Damage to sample system may result.

Model 131S only:

- No modifications or repairs to the flame paths are permitted.
- Substitution of components may impair flameproof safety and suitability for Class I, Division 1.
- All NPT thread entries must meet the minimum engagement of 5 threads.
- XP enclosures must have conduit plugs installed for unused conduit entries.
- Conduit seal(s) must be installed at a minimum distance of 18" from any XP enclosure's conduit entries.
- Conduit seals must be poured after wiring is completed and before powering up the unit. Refer to Appendix D for more information on the conduit sealing compound.

3.3 Electrical Connections



For 120 – 240 VAC powered analyzer: A disconnect device rated 240 VAC and 5A max is required and is to be installed in accordance with local electrical codes.

Do not disconnect equipment unless the power has been switched off or the area is known to be non-hazardous.

External ground wiring must be 12-10 AWG (3.31 – 5.26 mm²).

External IS Ground wiring must be 22 AWG (0.33 mm²) green insulated conductor.

Power supply wiring must be rated for a minimum of 90 °C (194 °F) above surrounding ambient temperature.

Relay Outputs on Mainboard (Relay 1 to 4) P7, are limited to 120VAC max, or used as dry contacts.



The 4-20 mA output requires a 24 VDC power loop which can be supplied by the analyzer.

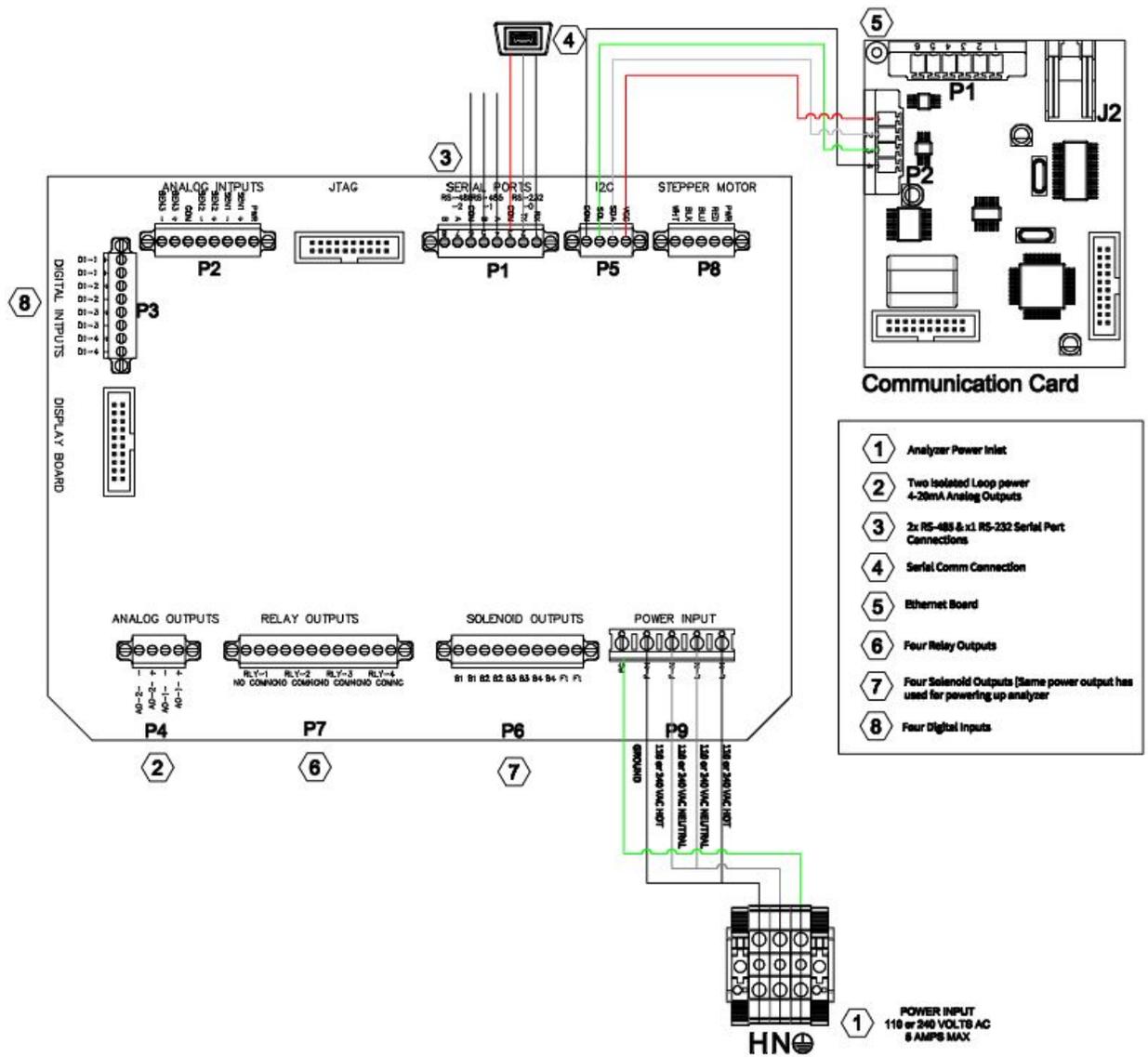


Figure 5. Electrical Customer Connections

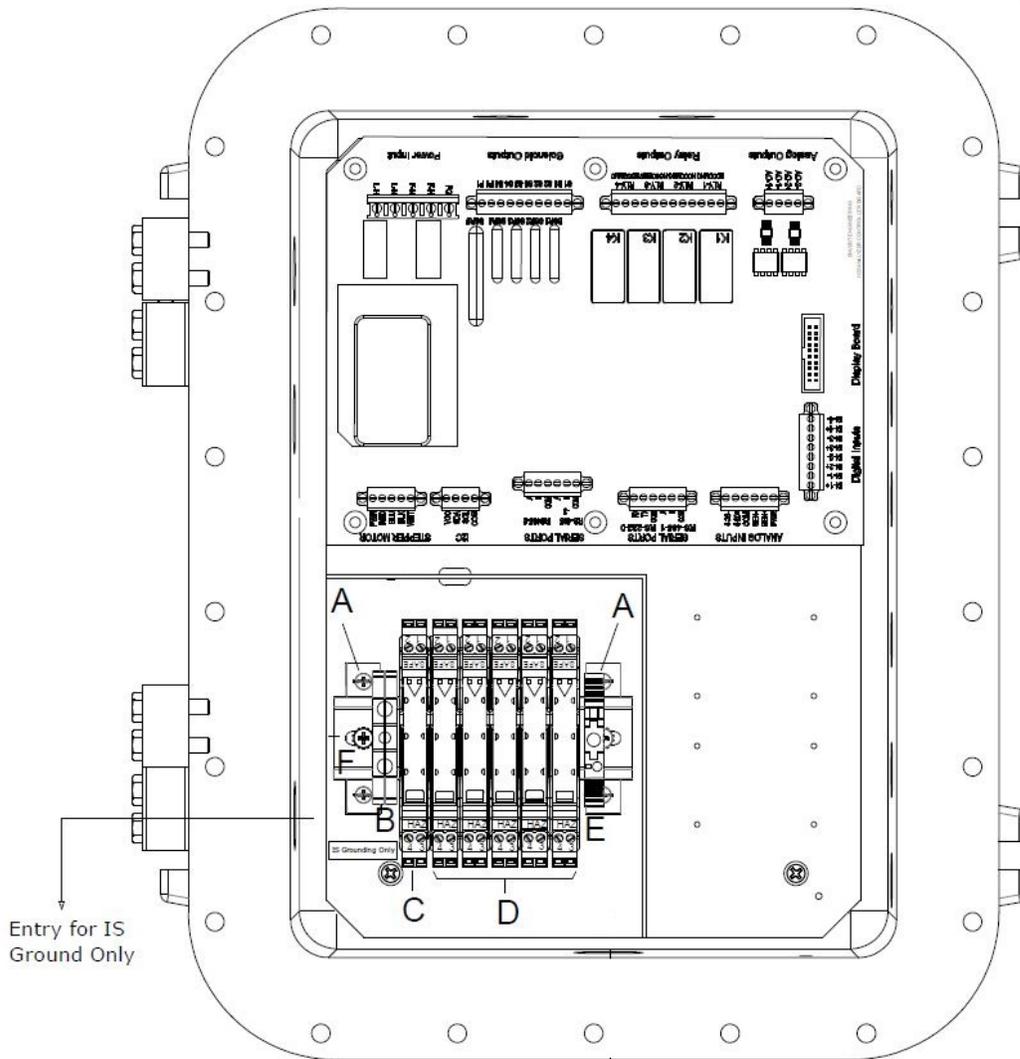


Figure 6. IS Ground Customer Connections

4.0 Operation

4.1 Start-Up Procedure



Oven temperature can exceed 84 °C (183 °F). Caution should be taken when touching the inside surfaces of the GC Oven.

Before commencing the start-up procedure for the analyzer, please ensure that all sections within “Installation” (Section 3.0) have been understood and addressed. Do not proceed until this is done as significant safety hazards can arise if the analyzer is not properly set-up prior to start-up.

During start-up, it is possible that the analyzer and/or the SCS will be contaminated with undesired liquids/solids (such as a scavenger solution). The flow meter should be inspected for liquids to ensure that the ball moves freely. Check all filters to ensure no contaminants will be forced into the analyzer after introduction of pressurized product.

Excessive temperature and environmental variations may affect the integrity of the calibration gas. Should heavier components condense into the liquid phase, the composition of the bottles could change. Calibration cylinders should be installed with a cylinder riser to keep the bottle off the floor. For high heating value cylinders, a heated bottle blanket may be required to ensure the contents do not condense.

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- Step 1.** Ensure that the analyzer power supply and range are suitable for the application.
 - Step 2.** Check that the hazardous location rating is suitable for the installation location.
 - Step 3.** Select an installation location that is close to the sample point.
 - i** ·Ensure that the selected installation site provides adequate room for maintenance and repair.
 - Step 4.** Bolt the analyzer to the wall or secure Unistrut to a solid surface. 3/8” x 1” bolts are recommended for installation.
 - Step 5.** Wire power, analog outputs, discrete inputs & outputs, and communications to the GC
 - Step 6.** Check to ensure all bottles are securely fastened to wall mount brackets and

regulators are installed on each bottle, and leak tested.



Dual stage regulators must be installed on the carrier gas, usually Helium. Single stage regulators can be installed on the calibration gas and process gas streams.

Step 7. Tube the sample inlet(s), calibration inlet(s), sample sweep(s), sample vent and carrier vent lines to the GC.



- 1/4" 316 stainless steel tubing is recommended for the sample tubing.
- 1/8" 316 stainless steel tubing can also be used if the response time of the analyzer is of particular concern.
- All fittings in the sample and vent lines must be 316 stainless steel.
- The sample vent line should be tubed in 3/8" stainless steel tubing to a maximum of 6'
- 1/2" 316 stainless steel tubing should be used for vent lines exceeding 6'
- The tubing should be installed with a slight downward slope and should be as short as possible.
- The sample vent line can be tubed to atmosphere, low pressure flare or returned to process. If returning to process or low pressure flare a 1/3 psi check valve should be used.
- The carrier vent line must be tubed to atmospheric pressure only.
- The ARV (Atmospheric Reference Valve) vent line must be tubed to atmospheric pressure only.
- For systems with stream selectors installed, double-block-and-bleed vent must be tubed to atmospheric pressure only.

Step 8. With the sample pressure turned off (sample inlet valve closed). Apply power to the GC. The display will illuminate.

Step 9. Turn on carrier pressure from bottle. Perform a Helium Leak Test. Factory plugs are installed on the carrier inlet/outlet lines to protect the columns from contaminants during shipping – remove these plugs when carrier gas is ready for the analyzer.

Step 10. Turn on carrier pressure from bottle and verify GC carrier pressure regulator is set to the desired pressure as outlined in the Factory Calibration Certificate provided with the GC.

Step 11. Once the GC oven is at the set point (approximately 1-2 hours), turn on calibration gas and sample gas to all stream inlets. Set flows and pressures according to the requirements of the system (typically a label on the back-pan or refer to drawings).

Step 12. Connect serial cable to the GC from Laptop or a PC.

Step 13. Load Envent ICE onto a laptop or PC.

Step 14. Log onto the GC and validate communications.

Step 15. Check the certified component concentrations (not target mixtures) on the calibration bottle and configure the component table (Configuration > Components) in ICE. The values on the calibration bottle must be entered into the GC component table EXACTLY as printed on the calibration bottle in Mole % (if a component lists “balance”, then it must be calculated (100% minus the sum of all other components)) (if a component lists ppm, calculate the mole percent (100% x ppm / 1000000)).

Step 16. Run the calibration gas as an unknown through the GC for startup.



Navigate to the Control Screen (Operations > GC Control) and select the check-box for the calibration gas stream.

- This will analyze the calibration gas without performing the calibration functions (This operation will not update the RF & RT values for each component)

Step 17. Navigate to Operations > Chromatogram and open a new chart file, or retrieve archived calibration runs from the analyzer

Step 18. Gate all peak Retention Time values in the Calibration Table.



- Continue to analyze calibration gas as an unknown while observing the chromatograms displayed in the diagnostics menu.
- Note the time at the top of each peak - This is referred to as the Retention Time (RT)
- Write down all RT values for each component and compare them to the RT values in the factory calibration sheet provided.
- If the values have all increased or decreased the user can either:
 - Edit the component table with the correct values.
 - Adjust carrier pressure slightly to line up values and edit from that point.
- If they are randomly above or below the values in the factory calibration data, then the user must configure the component data to match the values on the Chromatogram without changing the carrier gas pressure.

Step 19. Once all RT values are correct and the chromatogram compares favorably with the factory original, the user can calibrate to the calibration stream. To MANUALLY calibrate the GC: See section 4.2 (Calibration Procedure).

Step 20. Compare final calibration results to factory calibration and ensure that all RF and RT values are within the Deviation limits and that the calibration was noted as successful in the final calibration report.

Step 21. Repeat steps 15-20 for each calibration table as required.

Step 22. Edit the stream sequencing as required to ensure the desired stream sequencing is configured into the GC.



- Go to Configuration > Components.
- Click the desired Stream tab (bottom-half of this screen).
- In the Activation section, select the desired activation intervals.
 - Check-box – Checked items allow the stream to run.
 - Run numbers – Number next to check box runs this stream for “n” cycles
 - Event – Event type is defined here (ex. “Continuous (Always Set)”)

Step 23. Note the chromatogram, raw data, and analysis reports for each stream for approximately 2 hours.



- It may be advisable to enter the calibration gas into the stream sequencing as a check on the stream-to-stream purge efficiency.
- Each stream should be completely purged from the sample loop prior to injection and subsequent analysis of the next stream in sequence.
 - To check this stream-to-stream purge, enter the cal. gas into the stream sequence and configure the stream sequence for two consecutive analyses of each stream prior to switching to the next stream in sequence (i.e. 1,1,2,2,3,3,4,4 etc.)
 - With two analyses of each stream, note the repeatability for each analysis on a given stream, pay particular attention to the reported results of N2 and the back flush peak (usually C6+)
 - If all streams are being analyzed correctly with repeatable results the stream sequencing and stream to stream purging is set up correctly. If not, then increase the sample rotameter flow rate from 2 to 3 or 4 and repeat the procedure until results are repeatable for each stream.

Step 24. Confirm manual calibration using the calibration reports.

Step 25. Remove the second analysis and calibration gas from the stream sequencing and configure as desired for online operations.

Step 26. Save all device files and chart files to an appropriate location on the hard drive-in addition to factory calibration data for future reference.

4.2 Calibration Procedure

The number of calibrations required by the analyzer will depend on the application in question. It is recommended that a calibration is performed every 3 – 4 months (at minimum) to ensure accuracy and functionality. A calibration is performed at the factory prior to shipping.



Incorrect configuration of the analyzer may cause errant operation. Injury to the operator and/or damage to the facilities may occur. The analyzer's functionality should be verified if any configuration changes have been made. Consult Envent Engineering Ltd.

When performing maintenance on the Gas Chromatograph the operator should carry a personal H₂S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, and steel toed boots. Depending on the location, a breathing device may be required. Examples of such devices include SCBAs (Self-contained Breathing Apparatus) and SABAs (Supplied Air Breathing Apparatus).

All connections must be leak tight to ensure the safety of the user and the operation of the analyzer.

To access the display menu, the display XP enclosure lid must be removed while the analyzer is powered on. Do so only when the area is known to be non-hazardous. Alternatively, a magnetic pen is included to access the menus while the enclosure lid is attached.

The calibration functions are under the operations menu in ICE. There are three types of calibrations available:

Automatic Calibration - Based on time to initiate calibration to update RF & RT values for each component, provided that all new values fall within the limits identified in the component table.

Manual Calibration - Same as automatic calibration except initiated by operations personnel logged onto the GC with ICE PC based software. Manual calibration is not time based. To start a manual calibration, navigate to Operations > GC Control > Analysis Sequence and click the box for the calibration stream that requires calibration. Do not click the “continuous” check-box, only the gray button which surrounds the continuous check box.

Forced Calibration -The forced calibration function is available only under the right click mouse functions in the analyzer Chromatogram menu for use when viewing chromatograms. Because a calibration should only make minor adjustments to response factors and retention times there are limits that are set in the component table to allow for minor adjustments only. If major adjustments are required, it is likely that other factors are causing problems that need to be remedied before a calibration is performed. Forced calibration allows users to bypass these safeguards. Other than the RF and RT deviation limits forced Calibration is the same as same as manual/automatic calibration.

- Users should use CAUTION when using forced calibration and accept new values only after careful review of the relevant chromatograms and raw data to ensure all peaks are properly identified based on RT and concentrations reported are reasonable based on peak areas reported in raw data reports and the calibration concentrations used in the calibration standard.

The primary purpose of a calibration is to update response factors for each component listed in the component table. Responses factors determine the concentration of each component. Retention times identify each component by name. Mole % concentrations are determined with the following calculation:

$$RF = A/CalGas\%$$

$$Mole\% = A/RF$$

Where:

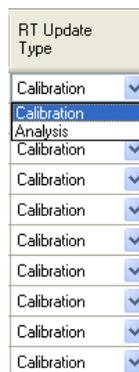
RF = Response Factor

A = Peak integrated Area

CalGas% = Calibration Gas Mole %

Mole% = Measured Mole % of component

A secondary purpose of calibration is to update the retention time for each component listed in the component table. The user can update RT based on analysis or calibration. This is configured in the component table shown below under RT Update.



All calibrations will generate a calibration report and update response factors for each component at the completion of the final calibration. Calibration runs (consecutive analysis of calibration gas) can be configured for numerous runs with the final calibration calculations and reporting resulting in the average RF and RT values for each calibration run. These averaged values are then checked against the deviation limits for each component listed in the component table to determine if they will be accepted in manual or auto calibration mode. If any single component has a deviation beyond the defined limits for RF or RT the calibration results will not be updated, and the previous values will be retained. Forced calibration will allow these new values to be accepted independent of the deviations between updated and previous factors.

Ensure a suitable calibration gas and a single stage stainless steel regulator with the correct CGA fitting is available. Ensure the regulator is rated for calibration cylinder pressure.

Recommended calibration gas for calibration purposes should specify Primary or (certified) mixtures with all components representative of the stream compositions. The Application Data Sheet contains “Target” mixtures for calibration gas based on the individual application (for trace components it is recommended that the calibration concentration be higher than the typical concentrations found during normal operations).

Validating the Calibration

As mentioned in above the GC calibration is performed either manually automatically or by forced calibration under the Chromatogram menu. Once the calibration has been completed, the user needs to review the calibration’s status (“PASS” or “FAIL”). If calibration is unsuccessful, a secondary review of the following is recommended:

- Review sample flow and carrier gas pressures relative to original factory calibration data.
- Review RT Dev. and RT Dev. for each component
- Use Chromatogram overlay functions to compare new calibration chromatograms to factory original OR user-saved “Good Chromatograms” from the same GC from previous calibrations.
- Analyze cal. gas or additional reference gas as an unknown to compare with certified “as found” OR “as analyzed” results on the bottle
- Contact Envent Engineering Ltd. if problems persist

5.0 Maintenance

The Gas Chromatograph was configured, functionally tested, and calibrated at the factory prior to shipping. All test and calibration data can be found in the Factory Calibration Report.



When performing maintenance on the Gas Chromatograph the operator should carry a personal H₂S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, and steel toed boots. Depending on the location, a breathing device may be required. Examples of such devices include SCBAs (Self-contained Breathing Apparatus) and SABAs (Supplied Air Breathing Apparatus).

Do not disconnect equipment or open XP enclosures unless the power has been switched off or the area is known to be non-hazardous.

Field disassembly of any component of the analyzer or sample conditioning system is not advised. Consult the factory if disassembly is required.

Turn off the power before servicing. Ensure that the circuit breakers are off before connecting or disconnecting supply power.

No modifications or repairs to the flame paths are permitted.

Substitution of components may impair flameproof safety and suitability for Class I, Division 1 on model 131S.

Substitution of components may impair safety and suitability for Class I, Division 2 on model 132S.

XP enclosures must have conduit plugs installed for unused conduit entries.

The XP enclosures' covers must remain installed and fully engaged to maintain area classification. They must be secured with the provided 6/32 x 1/2 set screw. A 1/16 hex key is required for removal.

All connections must be leak tight to ensure the safety of the user and the operation of the analyzer.

The following maintenance procedures are required to validate proper GC operations and maintain performance:

- Step 1.** During start up store and maintain all factory calibration reports and operational parameters shipped with the GC for future reference.

- Step 2.** Check Helium Pressure to ensure minimum pressure of 100 psig is maintained at the regulator attached to the helium bottle(s).
- Step 3.** Check Calibration Gas to ensure minimum pressure of 10 psig is maintained.
- Also check to ensure Calibration gas is kept warm enough to ensure the heaviest components listed on the certification tab will not condense in the calibration bottle due to cold ambient temperatures.
 - As a rule of thumb for Natural Gas Applications, the minimum ambient temperature that needs to be maintained on the calibration gas is -10 °C (8 °F) with C6+ at 300 ppm or less and Pentanes (C5) at 0.2 mole % or less.
- Step 4.** Check Calibration reports to ensure all RF and RT values do not exceed the deviation limits in the component table.
- Pay particular attention to back flush peaks like C6+
- Step 5.** Also note which component have the greatest deviations in final calibration reports. Check against original factory reports.
- Step 6.** Check Raw Data reports to confirm that the component with the largest deviation amounts is a valid peak with peak areas or heights similar to original factory parameters.
- Step 7.** Check carrier gas pressure (usually Helium) on the third-stage carrier pressure regulator and pressure gauge and compare it to the factory calibration certificate.
WARNING: Do not make any adjustments to the third-stage carrier pressure regulator(s); consult Envent Engineering Ltd. if the pressure setting is different compared to the factory calibration certificate
- Step 8.** Check Chromatograms against original chromatograms from factory calibration using overlay functions.
- Ensure all peaks are eluting at similar retention times and that baseline separation is maintained between peaks relative to original factory chromatograms.
 - Note back flush peak relative to factory originals.
 - Save “ *.chart” files with chromatograms from valid calibrations and with comments at least once per year.

5.1 Monthly Check-Up



Incorrect configuration of the analyzer may cause errant operation. Injury to the operator and/or damage to the facilities may occur. The analyzer's functionality should be verified if any configuration changes have been made. Consult Envent Engineering Ltd for assistance.

When performing maintenance on the Gas Chromatograph the operator should carry a personal H2S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, and steel toed boots. Depending on the location, a breathing device may be required. Examples of such devices include SCBAs (Self-contained Breathing Apparatus) and SABAs (Supplied Air Breathing Apparatus).

All connections must be leak tight to ensure the safety of the user and the functionality of the analyzer.

While the Gas Chromatograph requires little in the way of regular maintenance, a monthly check-up is still recommended to ensure that the system is performing to specifications. The recommended steps for a monthly check-up are as follows:

- Check that the analyzer's display is on and displaying the live oven temperature (default configuration), or displaying the values which were requested to be displayed during configuration.
- Check the sample inlet gas flow by inspecting the flow meter(s) and pressure gauge(s).
- Check the filter(s) in the sample conditioning system. Depending on the application and sample gas quality, the inlet filter will last between one and four months.
- It is recommended that a calibration is performed every 3 – 4 months. More frequent calibration may be necessary depending on operating conditions.

5.2 Spare Parts and Consumables

Part Name	Part Number	Description
SCS Filters	330406*	Box of 10 Filters, 12/19-57-50CSK (For 122 housing)
Filter Membranes	330405*	Set of 5 membranes for inlet filter
GC Column Set	CONTACT ENVENT	Column sets are application specific and come pre-calibrated with a calibration certificate
10 Port Diaphragm Valve	400018	10 port diaphragm GC valve
10 Port Diaphragm Replacement Kit	400029	Diaphragm replacement for 10 port GC valve
6 Port Diaphragm Valve	400015	6 port diaphragm GC valve
6 Port Diaphragm Replacement Kit	400028	Diaphragm replacement for 6 port GC valve
Diaphragm Replacement Tool Kit	400019	Tool kit required to work on, or replace, diaphragms for GC valves

* NOTE: Contact Envent Engineering Ltd. to confirm that these part numbers are correct for the installed system

5.3 Filter Replacement Procedure

- Step 1.** Ensure that the field site bypass is enabled. No local bypass is available on the analyzer.
- Step 2.** Halt the analyzer (Navigate to Operations/GC Control/Analysis Sequence and click “halt”, or use the top-button on the display)
- Step 3.** Shut off the sample gas inlet.
- Step 4.** Ensure there is no pressure in the filter housing by checking the pressure gauge. Open sample sweep needle valve to release any remaining pressure.



Once the pressure has been released, close the sample sweep needle valve to protect the operator from gas releases caused by backpressure from the sample sweep line.

- Step 5.** Dismantle the ¼” tube piece by loosening both ¼” nut fittings using a 9/16” wrench.
- Step 6.** Remove the filter housing by using a 3/4” wrench. Go counterclockwise to loosen filter housing.
- Step 7.** Rotate the element retainer counterclockwise to gain access to the microfiber coalescing filter element.

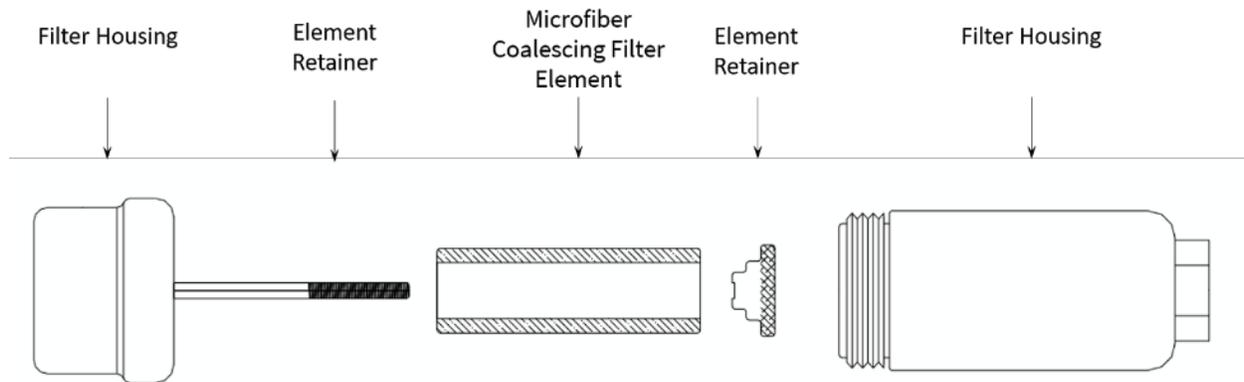


Figure 7. Microfibre Coalescing Filter Element Diagram

- Step 8.** Discard the microfibre coalescing filter element and replace it with a new one. Refer to Section 5.2 for more information.
- Step 9.** Tighten the element retainer to between a quarter and a full turn after it first contacts the microfibre coalescing filter element. This will securely seal the filter tube. A mark on the end of the retainer can be used as a guide.
- Step 10.** Before replacing the filter housing ensure that the mating threads and sealing surfaces are clean and damage free. It is recommended that the threads and sealing faces be lubricated with a small amount of silicone grease before assembly. Stainless steel housings fitting contains a solid PTFE gasket.
- Step 11.** Install the filter housing back to its top base by using a torque wrench. It should be tightened to a torque of 30 – 40 Nm.
- Step 12.** Reassemble the ¼” tube piece using a 9/16” wrench.
- Step 13.** Open the sample gas inlet.
- Step 14.** Open the sample sweep needle valve and adjust based on the desired analyzer response time.
- Step 15.** Set flows and pressures according to the requirements of the system (typically a label on the back-pan or refer to drawings).
- Step 16.** Wait 3-4 analysis cycles for the analyzer's readings to stabilize.
- Step 17.** Disable the field site bypass.



All connections must be leak tight to ensure the safety of the user and the functionality of the analyzer.

5.4 Sample Conditioning System Cleaning Procedure

During start-up or plant upset situations, the analyzer and sample conditioning system may become contaminated with amine or a hydrogen sulfide scavenger solution. This in turn may cause the analyzer to read incorrectly. The scavenger solution is water soluble and therefore is relatively easy to clean. Should it become necessary to clean the sample conditioning system and the CH₄ sensor, follow the steps below.

i If the analyzer requires cleaning on a regular basis, the sample point may have to be relocated or additional sample conditioning may be required. Please consult Envent Engineering Ltd.



Electrostatic Hazard – The aluminum back-pan must be cleaned exclusively with a damp cloth to prevent a static charging hazard.

Do not use solvents, brake cleaners, soaps, detergents, or rubbing alcohol to clean the analyzer or the sample conditioning system.

The materials required to clean the sample conditioning system are:

- A residue free cleaning agent (such as Alconox Laboratory Cleaner)
- Clean fresh water
- 100% isopropyl alcohol
- A rinse bottle

Step 1. Mix the residue cleaning agent and warm water to produce a cleaning solution. The solution should have a concentration of approximately 1% (2.5tbsp/gal).

Step 2. Shut off the sample flow at the sample point prior to the sample system.

i The sweep valve on the sample filter should be left slightly open at all times. This will decrease the likelihood of contamination.

Step 3. Disassemble the sample conditioning system components and tubing.

i It is recommended to take pictures before disassembling the components of the sample conditioning system as this will aid in reassembly. Alternatively, refer to the provided customer drawing package

Step 4. Throw away the microfiber coalescing filter element.

Step 5. Place all disassembled components in a bucket and add the cleaning solution prepared in Step 1. The required soaking time required will depend on how contaminated the components are. Ensure that the components and tubing are clean before proceeding to the next step.



Ensure that all valves are completely open when cleaning. 3-way valves should be cleaned with the handle in all possible positions

Step 6. Rinse the components with fresh water.

Step 7. Flush the tubing and components with isopropyl alcohol.

Step 8. Dry the tubing and components with clean instrument air.

Step 9. Re-assemble the sample conditioning system and replace the microfiber coalescing filter element according to the drawing package or pictures taken prior to disassembly.



Refer to Section 5.3 for more detailed instructions when installing the new microfiber coalescing filter element into the filter housing.

Step 10. Recalibrate the analyzer. Refer to Section 4.2 for the calibration procedure.

6.0 Troubleshooting

Symptom	Possible Causes	Recommended Solutions
Lower than expected readings and/or slow readings	Leak in Analytical GC Oven	Check for leaks and seal as needed.
	Insufficient sample flow rate	Ensure that the flow rate is appropriate for the analyzer in question.
	Contaminant or liquid carry over in SCS	The sample conditioning system cleaning procedure.
	Blocked sample vent line	Check for blocks and clear as needed.
	Closed sweep valve	Adjust the sweep valve to a level where the analyzer response time increases to the desired rate.
Erratic readings	Changing flow rate due to a faulty regulator	A replacement regulator is required. Contact Envent Engineering Ltd.
Different from expected readings	Analyzer out of calibration	Re-calibrate analyzer and refer to factory chromatogram. If necessary, perform a gas calibration. Refer to Section 4.2 for the calibration procedure.
	Excessive sample flow rate	Ensure that the flow rate is appropriate for the analyzer in question.
	Calibration and Stream pressure are different	Ensure that the pressure is balanced between calibration and stream runs
Analyzer not turning on	Blown fuse	A replacement Mainboard and/or AC-DC converter is required. Contact Envent Engineering Ltd.
	Inappropriate voltage rating	Refer to the ETL Certification Nameplate on the analyzer or the Factory Calibration Certificate for more information on the analyzer voltage rating
	Mainboard malfunction	A replacement Mainboard is required. Contact Envent Engineering Ltd.
Analog outputs (4-20 mA) not working	Improper wiring	Verify wiring.
	System variable for the AO output has been modified	Analog output 4-20mA is configured based on the specified range.
Pressure gauge not working	Pressure gauge has been over pressurized	A replacement pressure gauge is required. Contact Envent Engineering Ltd.

Appendix A – Risk Assessment

Risk Assessment Matrix

	Severity of Impact and/or Consequences					
		Negligible	Minor	Moderate	Serious	Critical
Likelihood Of Event	Very Likely	Medium	Medium	High	High	High
	Likely	Low	Medium	High	High	High
	Possible	Low	Low	Medium	High	High
	Unlikely	Low	Low	Low	Medium	High
	Very Unlikely	Low	Low	Low	Medium	Medium

Situational Risk Assessment

Hazardous Situation	At Risk Personnel	Safety Hazards	Initial Risk Assessment	Residual Risk Assessment
Changing filter in SCS	Operator(s)	The release of high pressure gases can cause serious injuries	Possible – Serious (High)	Very Unlikely – Serious (Medium)
The filter is located before the pressure regulator. As such, pressures up to 3600PSI can be present. The operator must isolate the sample system before changing the filter.				
Leakage or rupture due to high pressure	Operator(s)	The release of high pressure gases can cause serious injuries	Unlikely – Serious (High)	Very Unlikely – Serious (Medium)
Depending on the sample conditioning system, the inlet maximum pressure varies. Please consult document package for the maximum pressure for the sample system. Do not apply more pressure than specified as this can cause damage to the analyzer and create safety risks.				
H2S Exposure (Atmosphere)	Operator(s)	H2S exposure is a potentially lethal health/safety risk. Consult Table B4 for more information.	Unlikely – Serious (Medium)	Very Unlikely – Serious (Medium)
For atmospheres where there is H2S, depending on the levels and company policy, the operator must wear the appropriate equipment before servicing a Gas Chromatograph analyzer				

Hazardous Situation	At Risk Personnel	Safety Hazards	Initial Risk Assessment	Residual Risk Assessment
H2S Exposure (Leakage / Overpressure)	Operator(s)	H2S exposure is a potentially lethal health/safety risk. Consult Table B4 for more information.	Unlikely – Critical (High)	Very Unlikely – Critical (Medium)
In case of leakage, follow the company's health and safety policies on how to deal with an H2S leak. Depending on the application and location of the Gas Chromatograph analyzer, the operator might require breathing equipment.				
Exposure to other gases	Operator(s)	Potentially lethal health/safety risk. Explosion, O ₂ deprivation	Unlikely – Critical (High)	Very Unlikely – Critical (Medium)
In case of a leak, follow the company's health and safety policies on how to deal with gas leak. Depending on the application and location of the Gas Chromatograph analyzer, the operator might require breathing equipment.				
Flooding the sample system and analyzer	Operator(s)	No immediate health/safety concern	Possible – Minor (Low)	Unlikely – Minor (Low)
If the analyzer is flooded, the analyzer needs to be immediately isolated, turned off, and cleaned.				
Voltage hazards	Operator(s)	Immediate health/safety risk.	Unlikely – Serious (Medium)	Very Unlikely – Serious (Medium)
It is important that the operator is trained on handling the analyzer when it is on. The analyzer does not need to be off when it goes into maintenance. However, it is very important that the operator is aware of the danger of an electric shock				
Electrostatic hazard - explosion hazard	Operator(s)	Immediate health/safety risk.	Unlikely – Critical (High)	Very Unlikely – Critical (Medium)
The backpan and certification nameplate may be cleaned only with a damp cloth to prevent static charging hazards which could result in an explosion.				
Analyzer weight	Operator(s)	Body Injury	Unlikely – Moderate (Low)	Very Unlikely – Moderate (Low)
In some cases, unpacking and transporting the analyzer will require a minimum of two persons.				

Re-configuring the configuration file. Physical configuration of the analyzer and/or sample conditioning system	Operator(s)	Potential safety risk	Unlikely – Serious (Medium)	Unlikely – Serious (Medium)
Do not physically modify the Gas Chromatograph analyzer or sample conditioning system as this voids the hazardous location certification.				

Physical Properties of Hydrogen Sulfide (H₂S)

Physical State	- Gaseous above -60°C
Appearance	- Invisible
Odor	- Smell of rotten eggs at 0.5ppb - Olfactory paralysis at ~100ppm
Vapor Density	- Heavier than air (relative density of 1.19 compared to air) - In gas mixtures, it will be present wherever the gas mixture is found - Gas mixtures may be heavier or lighter than air, depending upon their vapor density and temperature compared to the ambient atmosphere (i.e. usually air) - In its pure state, or as a high proportion of a gas mixture, it may flow or settle into low-lying areas, such as pits, trenches and natural depressions
Flammability	- Flammable at 4.3% – 46% vapor concentration in air, by volume - Burns with a blue flame and creates gaseous sulphur dioxide (SO ₂). SO ₂ can irritate the eyes and respiratory system
Solubility	- Soluble in water and oil - Solubility of ~4g/L in water @ 20°C - Solubility is inversely proportional to fluid temperature
Common Locations for H ₂ S	- Piping systems, pipelines, wellheads or wellbores, vessels, production facilities, tanks, pits and low spots, confined or enclosure spaces, shacks or buildings, bermed or diked area, sour spills.

Health Effects of Hydrogen Sulfide (H₂S) at Varying concentrations

H ₂ S Concentration	Possible Health Effects
<1ppm	- No known health effects - Can be smelled

1ppm – 10ppm	<ul style="list-style-type: none"> - No known health effects - Up to 10ppm the exposure limit is 8 hours*
10ppm – 15ppm	<ul style="list-style-type: none"> - Up to 15ppm the exposure limit is 15 minutes between 60 minute breaks*
20ppm – 200ppm	<ul style="list-style-type: none"> - Eye and respiratory tract irritation and loss of smell - Headache and nausea - loss of smell after 2 - 5 min - Respiratory protection is required beyond this level
200ppm – 500ppm	<ul style="list-style-type: none"> - Above effects, but sooner and more severe - Loss of breathing and death in 30 min to 1 hour
500ppm – 700ppm	<ul style="list-style-type: none"> - Affects the central nervous system - Rapid unconsciousness, cessation of breathing, and death
>700ppm	<ul style="list-style-type: none"> - Immediate loss of consciousness - Permanent brain damage and death in a few minutes even if removed to fresh air at once

*Check local legislations as these values may vary between locations

Appendix B – Certifications

Go to the Envent website www.enventengineering.com to see the latest certificates for the 131S and 132S.

Appendix C – Sealing Compound Information

KILLARK FITTINGS

EY SERIES
KILLARK

SEALING FITTINGS



ENY
(For Vertical or Horizontal Conduit)



ENY with Nipple
(For Vertical or Horizontal Conduit)



EYS
(For Vertical or Horizontal Conduit)



EYS with Nipple
(For Vertical or Horizontal Conduit)



EY
(For Vertical Conduit)



EY with Nipple
(For Vertical Conduit)



EYD
(Drain/Seal for Vertical Conduit)



EYD with Nipple
(Drain/Seal for Vertical Conduit)



ENY-2
(Fixture Hanger)
(See Page L146)

Class I, Div. 1 & 2, Groups A, B, C, D
Class I, Zone 1, Groups IIC, IIB, IIA
Class II, Div. 1 & 2, Groups E, F, G
Class III

FEATURES-SPECIFICATIONS

Application & Installation

Class I, Divisions 1 and 2

The purpose of seals in a Class I hazardous location is to minimize the passage of gases and vapors and prevent the passage of flames from one electrical installation to another through the conduit system. Seals are required to be installed within 18 inches on any conduit run entering an enclosure which contains devices that may produce arcs, sparks, or high temperature. Where two enclosures are connected by a run of conduit not over 3 ft. long, a single seal located at the center of the run is considered satisfactory. Only explosionproof unions, couplings, elbows, and conduit bodies similar to "L", "T", and "X" type shall be permitted between the sealing fitting and the enclosure.

Seals shall be located within 18 inches of the enclosure or fitting on each conduit run of 2 inch size or larger entering an enclosure or fitting that contains terminals, splices, or taps.

Each run of conduit from a hazardous location to a nonhazardous location should be sealed to minimize the amount of gases and vapors communicated beyond the seal.

Class II, Divisions 1 and 2

Where a raceway provides communication between an enclosure which is required to be dust-ignitionproof and one which is not, suitable means shall be provided to prevent the entrance of dust into the dust-ignitionproof enclosure through the raceway.

Consideration for selection seals:

Select the proper sealing fitting for the hazardous gas/vapor involved; i.e., Class I Groups A, B, C, or D. Zone 1, Groups IIC, IIB, IIC.

Select a sealing fitting for the proper use in respect to mounting position. This is particularly critical when the conduit runs between hazardous and nonhazardous areas. Some seals are designed to be mounted in any position; others are restricted to vertical mounting.

Drains

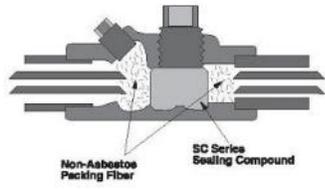
Where there is a probability that liquid or other condensed vapor may be trapped within enclosures for control equipment or at any point in the raceway system, approved means – such as installation of drain seals – shall be provided to prevent moisture accumulation.

For more complete data or special applications, consult the code or your local inspector.

Sealing compounds shall be approved for the purpose and shall not be affected by the surrounding atmosphere or liquids, and shall not have a melting point of less than 93°C. (200°F).

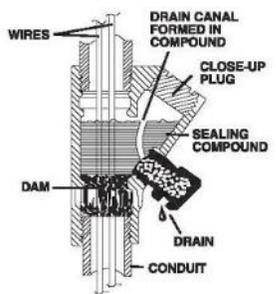
In the complete seal, the minimum thickness of the sealing compound shall not be less than the trade size of the conduit, and in no case less than 5/8 inch.

NOTE: The amount of Killark sealing compound and packing fiber required for any seal is determined by volume, hub size and mounting position of the seal. Refer to installation data table on page F50 for specific amounts required.



Non-Asbestos Packing Fiber SC Series Sealing Compound

Schematic drawings illustrate the application of sealing compound, fiber dams, and installed seal with drain.



WIRES DRAIN CANAL FORMED IN COMPOUND CLOSE-UP PLUG SEALING COMPOUND DAM DRAIN CONDUIT

Splices and taps shall not be made in fittings intended only for sealing with compound, nor shall other fittings in which splices or taps are made be filled with compound.

Killark sealing fittings are produced with utmost care to insure a substantial margin of safety. Threads are clean, deep, and snug. When properly installed with Killark sealing compound (SC Type) and Killark non-asbestos fiber (PF Type) for the dams, you can be sure your installation will provide more than adequate safety.

F46

WWW.HUBBELL-KILLARK.COM

Harsh & Hazardous

FITTINGS

ENY/EYS SERIES



SEALING FITTINGS



ENY-1, 2, 3, 4, 5, 6
Class I, Div. 1 & 2, Groups A, B, C, D
Class I, Zone 1, Groups IC, IIB, IIA
Class II, Div. 1 & 2, Groups E, F, G
Class III

EYS Series
Class I, Div. 1 & 2, Groups C, D
Class I, Zone 1, Groups IB, IIA
Class II, Div. 1 & 2, Groups E, F, G
Class III

File No. E10514
Certified File No. LR11716
See files for details or call Killark.

FEATURES-SPECIFICATIONS

Material/Finish

Copper-free Aluminum
(less than 4/10 of 1%)

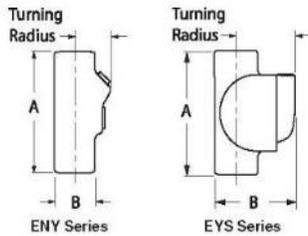
- Electrostatically applied powder coating

Duraloy Iron

- Tri-Coat Finish of electrozinc, chromate sealant, and electrostatically applied powder coating

HUB SIZE	ENY SEALING FITTINGS				TURNING RADIUS	ENY WITH NIPPLE	
	CATALOG NUMBER		DIMENSIONS			CATALOG NUMBER	
	KILLARK ALUMINUM	DURALOY IRON	A	B		KILLARK ALUMINUM	DURALOY IRON
1/2"	ENY-1	ENY-1M	4-1/16" (103)	1-9/32" (33)	1-3/32" (30)	ENY-1-T	ENY-1TM
3/4"	ENY-2	ENY-2M	4-3/16" (106)	1-1/2" (38)	1-9/32" (33)	ENY-2-T	ENY-2TM
1"	ENY-3	ENY-3M	5" (127)	1-3/4" (45)	1-13/32" (36)	ENY-3-T	ENY-3TM
1-1/4"	ENY-4	ENY-4M	5-3/8" (137)	2-3/16" (56)	1-25/32" (45)	ENY-4-T	ENY-4TM
1-1/2"	ENY-5	ENY-5M	5-11/16" (144)	2-3/8" (60)	1-29/32" (48)	ENY-5-T	ENY-5TM
2"	ENY-6	ENY-6M	6-3/8" (162)	2-3/8" (60)	2-5/16" (59)	ENY-6-T	ENY-6TM

Dimensions



HUB SIZE	EYS SEALING FITTINGS				TURNING RADIUS	EYS WITH NIPPLE	
	CATALOG NUMBER		DIMENSIONS			CATALOG NUMBER	
	KILLARK ALUMINUM	DURALOY IRON	A	B		KILLARK ALUMINUM	DURALOY IRON
1/2"	EYS-1	—	2-15/16" (75)	1-13/16" (46)	1-3/16" (30)	EYS-1-T	—
3/4"	EYS-2	—	4-1/16" (103)	2-1/16" (52)	1-9/32" (33)	EYS-2-T	—
1"	EYS-3	—	4-25/32" (121)	2-11/32" (60)	1-13/32" (36)	EYS-3-T	—
1-1/4"	EYS-4	—	5-3/8" (137)	3" (76)	1-25/32" (45)	EYS-4-T	—
1-1/2"	EYS-5	—	5-11/16" (144)	3-1/4" (83)	1-29/32" (48)	EYS-5-T	—
2"	EYS-6	—	6-3/8" (162)	3-15/16" (100)	2-5/16" (59)	EYS-6-T	—
2-1/2"	EYS-7	EYS-7M	7-5/8" (194)	4-1/2" (114)	4-1/8" (105)	EYS-7-T	EYS-7TM
3"	EYS-8	EYS-8M	7-5/8" (194)	4-1/2" (114)	4-3/8" (111)	EYS-8-T	EYS-8TM
3-1/2"	EYS-9	EYS-9M	7-1/8" (181)	5-3/16" (132)	4-3/4" (121)	EYS-9-T	EYS-9TM
4"	EYS-0	EYS-0M	7-1/8" (181)	5-3/16" (132)	4-3/4" (121)	EYS-0-T	EYS-0TM

FITTINGS

EY SERIES



25% FILL VERTICAL SEALING FITTINGS



EY-75M



EY-75TM

EY Series
 Class I, Div. 1 & 2, Groups B, C, D
 Class I, Zone 1, Groups IIB, IIA
 Class II, Div. 1 & 2, Groups E, F, G
 Class III



FEATURES-SPECIFICATIONS

Applications

To seal conduits in vertical runs. To minimize the passage of gases and vapors and prevent the passage of flames from one portion of the electrical system to another through the conduit.

Features

- Large opening for easy packing of fiber dam and pouring of compound
- Integral bushings in conduit hubs to protect conductor insulation from damage
- Npt tapped hubs to ensure ground continuity
- Design provides minimum turning radius
- 25% conductor fill
- EY-T style supplied with removeable close nipples

Material/Finish

Copper-free Aluminum
 (less than 4/10 of 1%)

- Electrostatically applied powder coating

Duraloy Iron

- Tri-Coat Finish of electrozinc, chromate sealant, and electrostatically applied powder coating

EY VERTICAL SEALING FITTINGS						
HUB SIZE	CATALOG NUMBER	DIMENSIONS		TURNING RADIUS*	SEALING COMPOUND REQUIRED	PER HUB (PF)
	KILLARK ALUMINUM	A	B			
1/2"	EY-50	3-5/16" (84)	1-1/8" (29)	1-11/16" (37)	3/4 oz.	1/32 oz.
3/4"	EY-75	3-11/16" (94)	1-5/16" (33)	2" (51)	1-3/4 oz.	1/16 oz.
1"	EY-100	4-3/8" (111)	1-5/8" (41)	2-7/16" (62)	3-3/4 oz.	1/8 oz.

*Turning radius with plug removed.

EY VERTICAL SEALING FITTINGS WITH NIPPLE						
HUB SIZE	CATALOG NUMBER	DIMENSIONS		TURNING RADIUS*	SEALING COMPOUND REQUIRED	PER HUB (PF)
	KILLARK ALUMINUM	A	B			
1/2"	EY-50-T	4-3/16" (106)	1-1/8" (29)	1-11/16" (37)	3/4 oz.	1/32 oz.
3/4"	EY-75-T	4-9/16" (116)	1-5/16" (33)	2" (51)	1-3/4 oz.	1/16 oz.
1"	EY-100-T	5-1/2" (140)	1-5/8" (41)	2-7/16" (62)	3-3/4 oz.	1/8 oz.

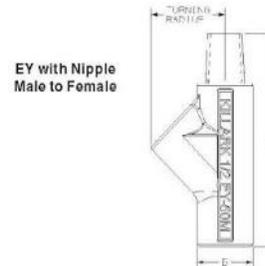
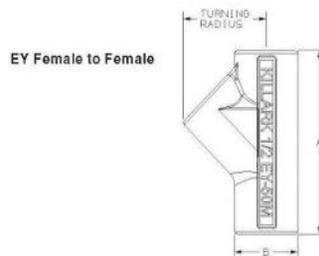
*Turning radius with plug removed.

EY VERTICAL SEALING FITTINGS						
HUB SIZE	CATALOG NUMBER	DIMENSIONS		TURNING RADIUS*	SEALING COMPOUND REQUIRED	PER HUB (PF)
	KILLARK IRON	A	B			
1/2"	EY-50M	3-5/16" (84)	1-1/8" (29)	1-11/16" (37)	3/4 oz.	1/32 oz.
3/4"	EY-75M	3-11/16" (94)	1-5/16" (33)	2" (51)	1-3/4 oz.	1/16 oz.
1"	EY-100M	4-3/8" (111)	1-5/8" (41)	2-7/16" (62)	3-3/4 oz.	1/8 oz.

*Turning radius with plug removed.

EY VERTICAL SEALING FITTINGS WITH NIPPLE						
HUB SIZE	CATALOG NUMBER	DIMENSIONS		TURNING RADIUS*	SEALING COMPOUND REQUIRED	PER HUB (PF)
	KILLARK IRON	A	B			
1/2"	EY-50TM	4-3/16" (106)	1-1/8" (29)	1-11/16" (37)	3/4 oz.	1/32 oz.
3/4"	EY-75TM	4-9/16" (116)	1-5/16" (33)	2" (51)	1-3/4 oz.	1/16 oz.
1"	EY-100TM	5-1/2" (140)	1-5/8" (41)	2-7/16" (62)	3-3/4 oz.	1/8 oz.

*Turning radius with plug removed.



FITTINGS

SC/PF SERIES



SEALING MATERIALS



Sealing Compound



Packing Fiber



SC11W

FEATURES-SPECIFICATIONS

Series SC/PF

Sealing Materials

SC Series Sealing compound is a cement used extensively for sealing conduit to prevent the spread of explosive gases. It is non-shrinking and a secure seal is formed. SC Series resists acids, water, oil, etc. It is UL Listed for use with Killark ENY, EY, and EYS Series. Also CSA certified for use with any CSA certified sealing fitting.

Packing Fiber

Killark's Packing Fiber is made from an environmentally safe, non-asbestos material. It is easy to use and forms a positive dam to hold compound (Killark SC Type) in ENY, EY, and EYS Series fittings.

Features of SC with Water

- Exact amount of compound and water are packaged together into a two-compartment plastic pouch.
- The precise amount of compound and water are available for mixing. No mixing or measure implements are required.
- Squeezing the inner water container forces the water into the compartment containing the sealing compound. Complete mixing takes place inside the plastic pouch.
- The mixed sealing compound can be poured directly into the sealing fitting. A tubular straw is provided for those difficult seals to reach.
- The package label indicates the size and quantity of sealing fittings each pouch will properly fill.

OUNCES REQUIRED PER FITTING				
HUB SIZE	SEALING COMPOUND			PACKING FIBER
	ENY [Ⓞ]	EYS [Ⓞ]	EY/EYD	
1/2"	1.5 oz.	3.0 oz.	1.0 oz.	1/16 oz.
3/4"	2.0 oz.	3.0 oz.	2.0 oz.	1/8 oz.
1"	3.0 oz.	8.0 oz.	4.5 oz.	1/4 oz.
1-1/4"	6.5 oz.	8.5 oz.	7.5 oz.	1/2 oz.
1 1/2"	8.5 oz.	17.5 oz.	12.0 oz.	1 oz.
2"	15.0 oz.	27.0 oz.	24.0 oz.	2 oz.
2-1/2"	—	42.0 oz.	44.0 oz.	3 oz.
3"	—	47.0 oz.	44.0 oz.	4 oz.
3-1/2"	—	56.0 oz.	75.0 oz.	6 oz.
4"	—	56.0 oz.	75.0 oz.	9 oz.

[Ⓞ] ENYEYS suitable for both horizontal or vertical applications.

SEALING COMPOUND	
CATALOG NUMBER	SIZE PACKAGE
SC-4 OZ	4 oz.
SC-8 OZ	8 oz.
SC-1 LB	1 lb.
SC-5 LB	5 lbs.

PACKING FIBER	
CATALOG NUMBER	SIZE PACKAGE
PF-2	2 oz.
PF-4	4 oz.
PF-16	1 lb.

CATALOG NUMBER	HUB SIZE	WILL FILL THE FOLLOWING SEALS:			CU. IN. FILL PER POUCH	NO. OF POUCHES PER CARTON
		ENY	EYS	EY/EYD		
SC5W [Ⓞ]	1/2"	3	1	5	5	5
	3/4"	2	1	2		
	1"	1	—	1		
SC11W [Ⓞ]	1/2"	7	3	11	11	5
	3/4"	5	3	5		
	1"	3	1	2		

[Ⓞ] Appropriate amount of Packing Fiber is included in carton. Additional Packing Fiber maybe purchased separately.

KILLARK

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Contact Us

In the event that a situation arises that is not covered by this manual, we encourage you to contact us so that we can help you resolve any issues you may have. Please have this manual readily available when calling for assistance.

For further information on our products or to access our most recently updated manuals and product catalogues, please visit our website at www.envent-eng.com.

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