

# Dilution Sample System

## User's Manual



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## **1.0 INTRODUCTION**

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### **1.1 About This Manual**

The Dilution User’s Manual should be used in addition to the Model 330S & 331S Hydrogen Sulfide Analyzer User’s Manual.

This manual should be read and referenced by the person who will install, operate, or modify the Dilution sample system. Take time to familiarize yourself with the content of this User’s Manual, reading each section carefully so you can quickly and easily install and operate the analyzer.

The manual includes images and tables that provide a visual understanding of the analyzer and its functions. Take note of all the caution symbols and notes, as they will alert you of potential hazards and important information.

### **1.2 Warranty & 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 36 months from the shipping date or up to 24 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.**



**Caution: hot surface.**



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

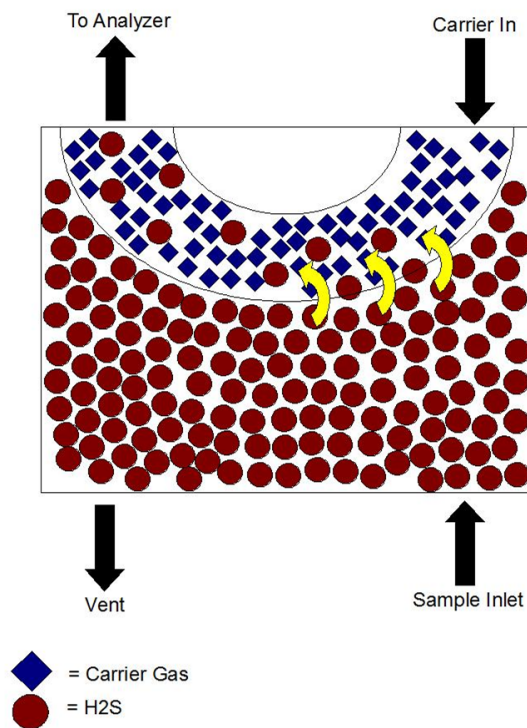
## 2.0 EQUIPMENT OVERVIEW

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### 2.1 Theory of Operation

A standard 330S/331S series hydrogen sulfide (H<sub>2</sub>S) analyzer from Envent Engineering will measure ranges up to 0 to 100 ppm, however, the tape consumption will be excessive if the analyzer is measuring 50-100 ppm on a continuous basis. The dilution sample system option utilizes a permeable membrane which will dilute a high range hydrogen sulfide sample from as high as 30% hydrogen sulfide by volume to a ppm range of 0-20 ppm/v. The system requires an H<sub>2</sub>S free carrier gas such as air, nitrogen, or fuel gas.

The dilution chamber uses a membrane tubing coiled in the dilution chamber. As the gas enters the chamber a small portion of the gas permeates through the membrane. It then mixes with the carrier gas, which is then analyzed by the hydrogen sulfide analyzer.



**Figure 1: Dilution Chamber**



A calibration fitting is provided for introduction of a calibration gas. A three-way valve is also provided to allow the dilution chamber to be purged with carrier gas prior to being serviced.

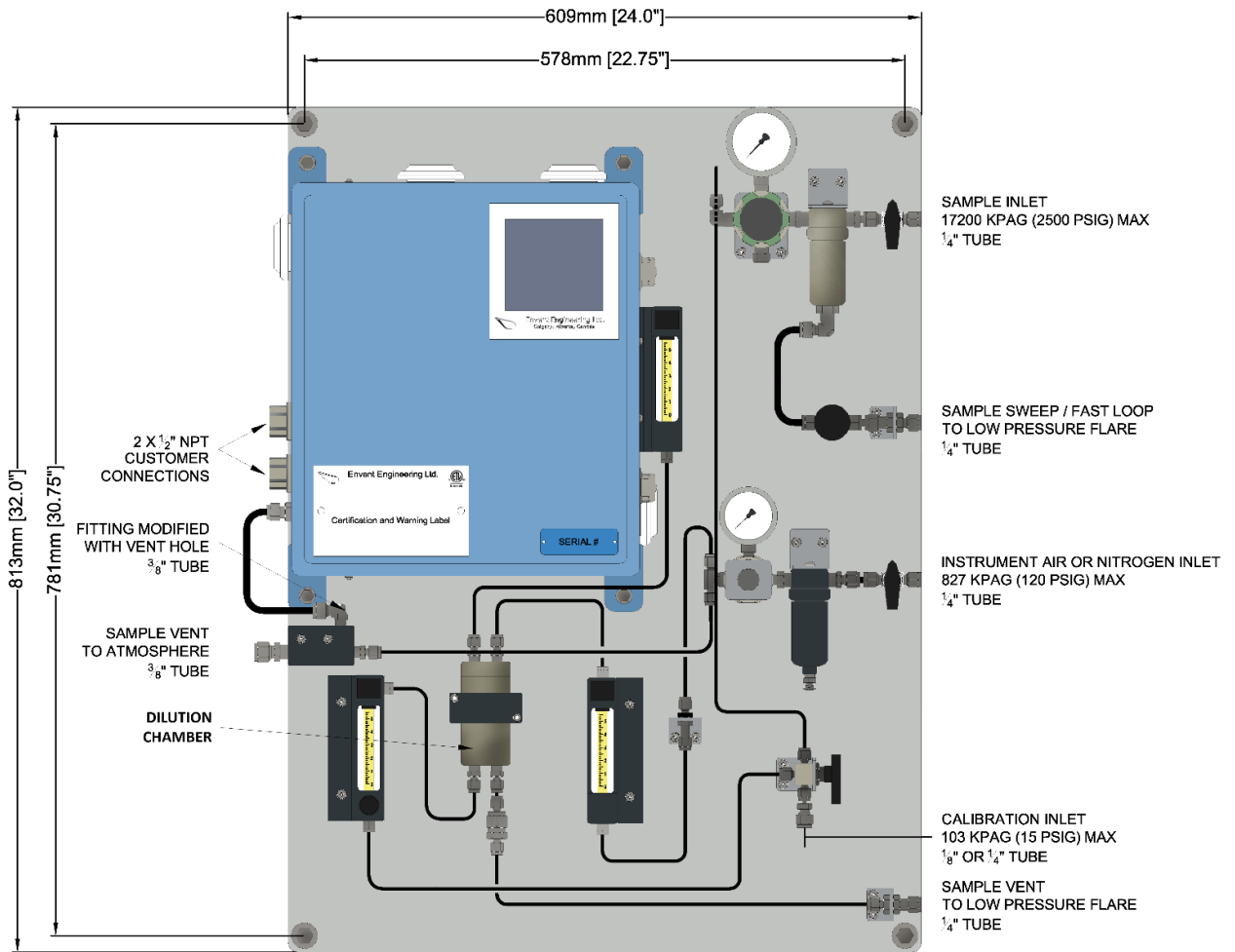
**CAUTION:**

**High levels of hydrogen sulfide are present in the dilution sample system. Ensure you are fully familiar with the operation of the dilution sample system before commencing service.**



**Purge the dilution chamber with carrier gas before opening.**

**A leak check of the dilution chamber should be performed after service**



**Figure 2: Dilution Sample System Layout**

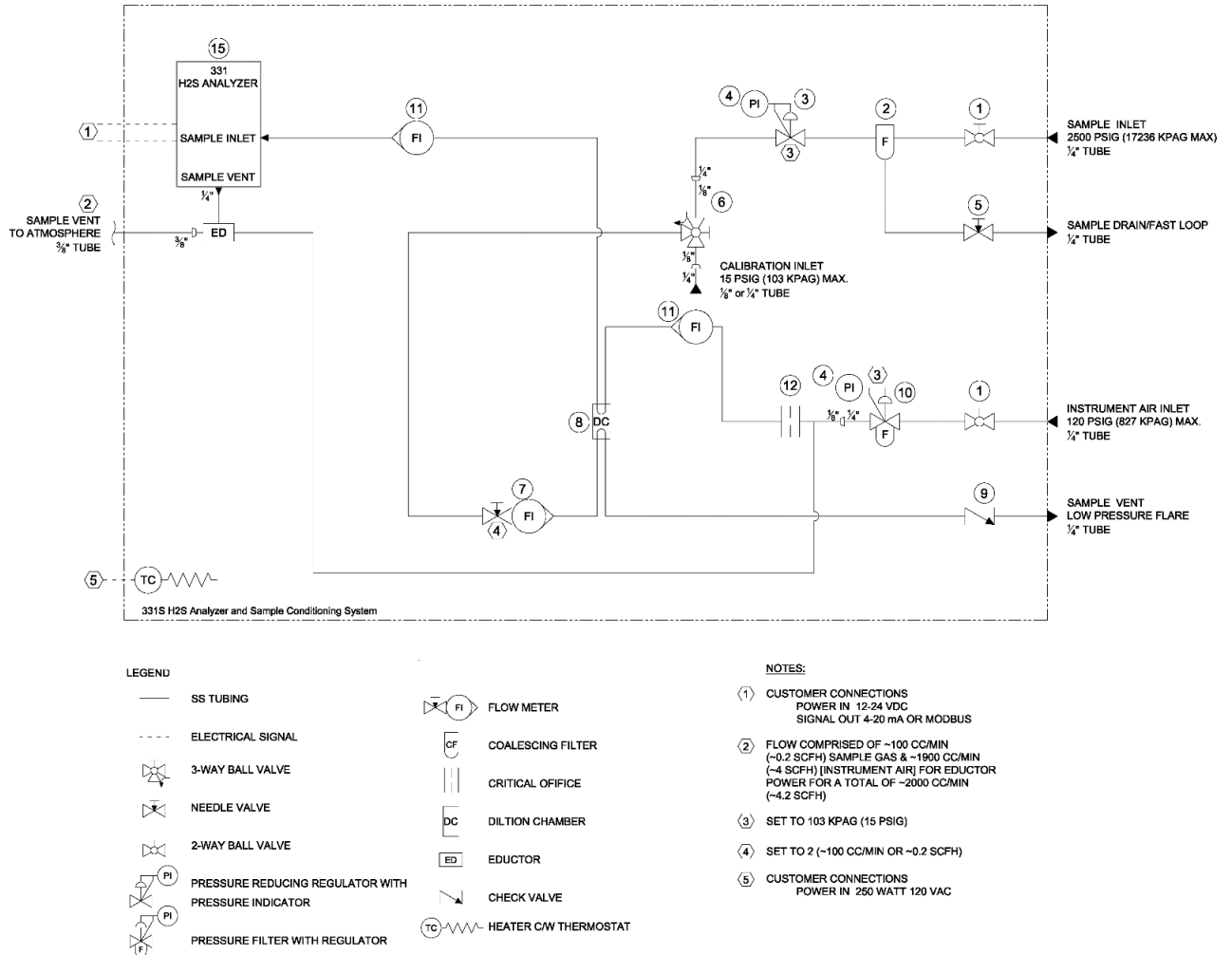


Figure 3: Dilution Sample System Flow Diagram

## 3.0 MAINTENANCE

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**As an overall practice when doing maintenance on an H2S analyzer, 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 of the H2S analyzer, an appropriate breathing device might be required such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus).**

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The dilution sample system will generally operate for up to one year with no service required. It will also protect the analyzer from liquid or particulate contamination in the sample. If the dilution sample system is flooded with hydrocarbon liquids, water or compressor oil, the dilution membrane tubing may require replacement.

### 3.1 Tubing Replacement Procedure

- Step 1**            Connect sweet carrier gas or instrument air to the calibration three-way valve.
- Step 2**            Turn calibration three-way valve to calibration position.
- Step 3**            Allow the dilution chamber to purge with carrier gas for 60 minutes.
- Step 4**            Disconnect the 1/8” Swagelok tube fittings from the top and bottom of the dilution housing.
- Step 5**            Remove the bracket holding the dilution housing to the panel.
- Step 6**            Remove the top of the dilution canister.
- Step 7**            Inspect the dilution tubing, looking for damage or discoloration.
- Step 8**            Replace the dilution tubing if necessary. Refer to the factory calibration sheet for the specified length of tubing or measure the original length and duplicate it. Contact Envent Engineering Ltd. For replacement membrane tubing.
- Step 9**            Reverse the steps 1-6 to restore the dilution chamber to service.
- Step 10**           Re-calibrate the analyzer after replacing the dilution membrane tubing.

## **3.2 Leak Check Procedure**

After putting the dilution chamber back into service after opening, it should be checked for leaks. The steps are as follows:

- Step 1**            Connect sweet carrier gas or instrument air to the calibration three-way valve.
- Step 2**            Turn calibration three-way valve to calibration position.
- Step 3**            Set the carrier gas pressure to 15 psig.
- Step 4**            Pinch the latex tube inside the analyzer corresponding to the dilution stream.
- Step 5**            Observe the carrier flowmeter and ensure it drops to zero flow.
- Step 6**            Open high range H<sub>2</sub>S Sample flowmeter to 6.
- Step 7**            Plug the high range H<sub>2</sub>S Sample Vent.
- Step 8**            Observe the sample flowmeter and ensure it drops to zero flow.

## 6.0 TROUBLESHOOTING

| Problems                                     | Possible Reasons  | Possible Solutions   |
|--|---|--|
| Unexpected high readings                     | Dilution tubing was replaced with a longer piece than was originally in the canister.         | Replace tubing with appropriate length.<br>Consult Envent for clarification. |
|  | Back pressure on dilution canister causing higher H <sub>2</sub> S concentration in canister. | Carrier flow rate or pressure is too high.                                   |
|  |   | Carrier vent is blocked.   |
| Unexpectedly high H <sub>2</sub> S in sample |   | Confirm by other methods acceptable on site.                                 |
| Unexpected low readings                      | Dilution tubing was replaced with a shorter piece than was originally in the canister.        | Replace tubing with appropriate length.<br>Consult Envent for clarification. |
|  | Flooded dilution sample system.   | Clean and replace tubing and components. Re calibrate.                       |
|  | Carrier flow rate is too high   | Return pressure to specified level.  |
|  | Blocked or obstructed vent line from carrier supply   | Clean or unblock vent line.  |

**Table 1: Troubleshooting**

## APPENDIX A – RECOMMENDED SPARE PARTS

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| Part Number | Quantity                     | Description                     |
|-------------|------------------------------|---------------------------------|
| 2000119     | Length is dependent or range | Silicone Dilution Tubing        |
| 1000014     | 1                            | Critical Orifice                |
| 3100037     | 1                            | Small Dilution Canister         |
| 3100038     | 1                            | Large Dilution Canister         |
| 1100029     | 1                            | Dilution Chamber Bracket        |
| 1100116     | 2                            | Long Dilution Canister Prong    |
| 1000103     | 1                            | 1/4” 1/3 psi Check Valve        |
| 1000051     | 1                            | 1/8” 1/3 psi Check Valve        |
| 1100054     | 1                            | A-157-1 Flow Meter (no valve)   |
| 1100063     | 1                            | A-157-1 Flow Meter (with valve) |
| 3000011     | 1                            | Cleaning Kit                    |
| 1100228     | 1                            | Carrier Regulator / Filter      |
| 12-32-50C   | 1                            | Instrument Air Filter           |

**Table 2: Spare Parts List**

**APPENDIX B – RISKS & SAFETY INFORMATION**

| <b>Hydrogen Sulfide Properties</b>    |  |
|---------------------------------------|--|
| <b>Gas Properties</b>                 | <b>Description</b>   |
| Physical State                        | Gaseous above 60 °C  |
| Color                                 | Colorless - No visible sign of H <sub>2</sub> S to warn you of its presence  |
| Odor                                  | Characteristic smell of rotten eggs at 0.5 ppm; paralyzes the olfactory nerve around 100 ppm   |
| Vapor Density                         | <p>Heavier than air (1.19 compared to 1.0 for air)</p> <ul style="list-style-type: none"> <li>&gt; In gas mixtures, it will be present wherever the gas mixture is found.</li> <li>&gt; Gas mixtures may be heavier or lighter than air, depending upon their vapor density and temperature compared to the ambient atmosphere (usually air)</li> <li>&gt; In its pure state, or in a high proportion of a gas mixture, it may flow or settle into low-lying areas, such as pits, trenches, and natural depressions</li> </ul> |
| Flammability                          | <p>Flammable at 4.3 - 46 percent vapor concentration in air, by volume</p> <p>Burns with a blue flame and gives off Sulphur dioxide (SO<sub>2</sub>) gas SO<sub>2</sub> is also hazardous and irritates the eyes and the respiratory system</p>  |
| Solubility                            | Soluble in water and oil, solubility is inversely proportional to fluid temperature  |
| Common Locations for H <sub>2</sub> 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.  |

**Table 3. Hydrogen Sulfide Properties**

| <b>Hydrogen Sulfide Quantities and it’s Health Effects</b> |  |
|--|--|
| <b>H2S Exposure</b>  | <b>Possible health Effects</b>   |
| <1ppm  | <ul style="list-style-type: none"> <li>- No known health effects</li> <li>- Can be smelled</li> </ul>  |
| 10-20 ppm  | <ul style="list-style-type: none"> <li>&gt; No known health effects for most people</li> <li>&gt; For 10 ppm or less, the exposure limit is 8 hours - Check your local legislation as they vary.</li> <li>&gt; For 15 ppm, the exposure limit is 15 min with 60 minutes breaks. Check your local legislation as they vary.</li> </ul>            |
| 20-200 ppm   | <ul style="list-style-type: none"> <li>&gt; Eye and respiratory tract irritation and loss of smell</li> <li>&gt; Headache and nausea - loss of smell after 2 - 5 min</li> <li>&gt; Respiratory Protection is required beyond this level such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)</li> </ul> |
| 200 - 500 ppm  | <ul style="list-style-type: none"> <li>&gt; Above effects, but sooner and more severe</li> <li>&gt; Loss of breathing and death in 30 min to 1 hour</li> </ul>   |
| 500 - 700 ppm  | <ul style="list-style-type: none"> <li>&gt; Affects the central nervous system.</li> <li>&gt; Rapid unconsciousness, cessation of breathing, and death</li> </ul>  |
| >700ppm  | <ul style="list-style-type: none"> <li>&gt; Immediate loss of consciousness</li> <li>&gt; Permanent brain damage and death in a few minutes even if removed to fresh air at once</li> </ul>  |

**Table 4. Hydrogen Sulfide Quantities & Health Effects**



## CONTACT US

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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.enventengineering.com](http://www.enventengineering.com).



### Canada (Main)

**Toll Free:** +1 (877) 365 8408

2721 Hopewell Place NE

**Tel:** (403) 253 4012

Calgary, Alberta, Canada T1Y 7J7

**Info:** [info@enventengineering.com](mailto:info@enventengineering.com)

**Parts:** [parts@enventengineering.com](mailto:parts@enventengineering.com)

**Service:** [servicecanada@enventengineering.com](mailto:servicecanada@enventengineering.com)



### USA

**Tel:** 1 (713) 567 4421

13219 B Stafford Road

**Info:** [usasales@enventengineering.com](mailto:usasales@enventengineering.com)

Missouri City, Texas, USA 77489

**Parts:** [ordersusa@enventengineering.com](mailto:ordersusa@enventengineering.com)

**Service:** [serviceusa@enventengineering.com](mailto:serviceusa@enventengineering.com)



## **Mexico**

**Tel:** +52 (833) 247 8260

**Email:** [international@enventengineering.com](mailto:international@enventengineering.com)

Avenida Revolución No. 1267, Piso  
19, Col. Los Alpes. Álvaro Obregón  
01040 Ciudad de México, México



## **International Sales**

**Tel:** +1 (877) 365 8408

**Email:** [international@enventengineering.com](mailto:international@enventengineering.com)

 **Envent**