Table of Contents

General Information......................................................................................... P-1
  Introduction ........................................................................................................... P-1
  Purpose and Use ................................................................................................... P-1
  Description ............................................................................................................ P-1
  Theory of Operation .............................................................................................. P-1
  Features and Benefits .......................................................................................... P-2
  Specifications ....................................................................................................... P-3
  Safety Requirements ............................................................................................ P-4
  Symbols Used on Equipment ................................................................................. P-5
  Hydrogen Sulfide Safety Precautions ................................................................... P-6
    H₂S (Hydrogen Sulfide) Properties ...................................................................... P-6
    H₂S Detection ..................................................................................................... P-6
  Operational Procedures ........................................................................................ P-7
  Where to Find Help .............................................................................................. P-7

Section 1 – Installation ..................................................................................... 1-1
  Unpacking the Instrument .................................................................................. 1-1
  Utilities Required ............................................................................................... 1-1
  Tools/Equipment Required ................................................................................ 1-1
  Setting up the Instrument .................................................................................... 1-1

Section 2 – Operating Instructions .................................................................. 2-1
  Description of Valves and Switches ................................................................. 2-1
    Carrying Handles (1) ......................................................................................... 2-2
    Gauge (2 and 4) ............................................................................................... 2-2
    Two-Way Valve (3) ......................................................................................... 2-2
    Vent (5 and 6) ............................................................................................... 2-2
    Three-Way Valve (7 and 8) ............................................................................. 2-2
    Inlet (9 and 10) ............................................................................................. 2-2
    1000cc Jar (11) .............................................................................................. 2-2
    2000cc Jar (12) .............................................................................................. 2-2
    Piston (13 and 14) ......................................................................................... 2-2
    Knob (15 and 16) ......................................................................................... 2-2
    Scale (17 and 18) .......................................................................................... 2-3
    Vernier (19 and 20) ...................................................................................... 2-3
    Safety Relief Valve Port (21) ........................................................................ 2-3
    Digital Temperature Display (22) ................................................................. 2-3
    Digital Volume Display (23) .......................................................................... 2-3
  Operating Procedure .......................................................................................... 2-3
    Measuring Absolute Volume ........................................................................... 2-4
    Operations for Measuring Flow Rate ............................................................ 2-4

Section 3 – Maintenance ............................................................................... 3-1
  Tools Required .................................................................................................... 3-1
Cleaning and Service Tips .................................................................................................. 3-1
Cleaning the Jars and Replacing the O-rings ................................................................. 3-1
Leaks Test .......................................................................................................................... 3-2
Scale Adjustment ............................................................................................................. 3-3

Section 4 – Troubleshooting Guide ................................................................................. 4-1

Section 5 - Replacement Parts ....................................................................................... 5-1
Replacement Parts for Model 2331D Gasometer ................................................................ 5-1

Section 6 - Drawings and Schematics ............................................................................. 6-1
General Information

Introduction

This manual contains installation, operation, and maintenance instructions for the Model 2331D Gasometer.

Purpose and Use

The Model 2331D is designed for the precise volumetric measurement of atmospheric gas. In the past, most gas measurements were made with the wet test meter, gas burette, or a gasometer. Accurate volume measurements of all types of gases are very difficult to obtain, especially those that contain carbon dioxide.

Description

The Model 2331D Gasometer was developed for use in a PVT laboratory where all types of gases are encountered. It has two precision bore glass tubes: 1000 cm³ and 2000 cm³, which can be connected together to produce a total volume of 3000 cm³. Each side of the instrument contains an atmospheric volumetric pump with the piston connected to a measuring device, including a scale, a vernier, a pressure-adjusting knob, a digital temperature and pressure display.

Theory of Operation

When the gas is introduced into the precision bore cylinder through the inlet port, the piston is displaced. This linear displacement of the piston is measured with a scale that is calibrated in volumetric units (cubic centimeters). A vernier is provided to improve the resolution of the measurement. The two parameters of the volumetric measurement of gas are pressure and temperature.

In the gasometer, it is recommended that all the volumetric readings be taken at atmospheric pressure. This can be achieved with the aid of a null gauge and adjusting knob provided on the gasometer. It is also recommended that the volumetric reading be taken at room temperature.

To change the measured volume of gas to any standard pressure and temperature, the following relationship should be used:

\[ V_2 = V_1 \times \left[ \frac{P_1}{P_2} \right] \times \left[ \frac{T_2}{T_1} \right] \]
Where:  
\[ V_1 = \text{measured volume} \]
\[ P_1 = \text{Atmospheric Pressure (gas pressure in the jar at the time of the volumetric reading)} \]
\[ T_1 = \text{Room Temperature (temperature of gas at the time of volumetric reading)} \]
\[ V_2 = \text{Volume at desired standard conditions} \]
\[ P_2 = \text{desired standard pressure} \]
\[ T_2 = \text{desired standard temperature} \]

**Features and Benefits**

- Cylinders are made of precision-bore Pyrex tubing
- Piston seals are spring-loaded fluorocarbon
- Scales are provided with verniers to read volume with resolution of 0.1% of full scale
- Overall accuracy of the gasometer is 0.2% or better depending on environmental temperature
- Compound gauges for pressure
- Three gasometers in one. The 1000 cc and 2000 cc cylinders can be used individually or combined to allow for a total displacement of 3000 cc
- Integral safety considerations in the form of pressure relief valves and shielding of the viewing slots
Specifications

Operating Conditions:
- Input Voltage: 100 - 240 VAC
- Input Current: 2A
- Frequency: 50 / 60 HZ, 1 Phase
- Total Capacity: 3000 cc
  - Left Side Capacity: 2000 cc
  - Right Side Capacity: 1000 cc
- Accuracy: 0.2% of Reading
- Maximum Pressure: 50 inches of water (~2 psi)
- Scale Resolution: 0.1% of Full Scale

Environmental Conditions:
- Environment: Indoor Use
- Altitude: 6561.6 ft (2000m)
- Temperature: 41°F - 104°F (5°C - 40°C)
- Relative Humidity: 80% for temperatures up to 31°C decreasing linearly to 50% at 40°C

Weights and Dimensions:
- Dimensions: 40.31” (102.4 cm) high x 13.31” (33.81 cm) wide x 7.69” (19.53 cm) deep (including 3/8” thick rubber feet)
- Weight: 50.5 lbs. (20.9 kg)
Safety Requirements

Before attempting to operate the instrument, the operator should read and understand this manual.

NOTE: Remove the cotton from the gauge, by accessing the gauge face with the two screws on the side and then replace the face of the gauge. (Cotton should be replaced if shipment is required.)

Pressurized vessels and associated equipment are potentially dangerous. The Model 2331D Gasometer described in this manual should be operated only by personnel trained in procedures that will assure safety to themselves, to others, and to the equipment.

Use this instrument only in a well-ventilated room. Improper use with hydrogen sulfide or other hazardous fluids may result in personal injury or death from breaks, leaks, or explosions. Keep oxygen close and take all the safety precautions described in this operating manual.

To ensure safety:
- Locate the instrument in a low traffic area.
- Post signs where the instrument is being operated to warn non-operating personnel.
- Read and understand instructions before attempting instrument operation.
- Observe caution notes!
- Observe and follow the warning labels on the instrument.
- Never exceed the instrument maximum pressure ratings.
- Appropriately rated fire extinguishers should be located within close proximity.
- Never connect a pressure source to the gasometer or create a pressure in the cylinders of more than about 50 inches of water (~2 psi). Higher pressure will activate the pressure relief valve and the gas sample will be lost.
- Never cap the downstream port for the relief valves (in the right panel of the instrument). One quarter tubing should be connected from this port to a safety ventilation hood or other safe discharge area.
- Do NOT turn the knobs beyond top dead and bottom dead positions of the piston. Overloading the knobs may cause damage to the pinion and gear mechanism.
- Refer to the H₂S Safety section below when working with sour gas.
- Always position the instrument in such a manner that allows easy access to the power cord.
- Always wear the appropriate PPE and take the cautionary measures based on the type of gas used.
- Always wear eye protection when operating or servicing the instrument.
- In case of fire, use the appropriate rated fire extinguisher based on the type of gas used.
## Symbols Used on Equipment

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Protective Conductor Terminal</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Documentation must be consulted in all cases where this caution symbol is marked.</td>
</tr>
</tbody>
</table>
Hydrogen Sulfide Safety Precautions

\( H_2S \) (Hydrogen Sulfide) Properties

- **Color:** Colorless
- **Odor:** Very offensive; odor of rotten eggs.
- **Vapor Density:** 1.5399 g/l. \( H_2S \) is heavier than air.
- **Boiling Point:** -76 °F (-60 °C)
- **Explosive Limits:** 4.3 to 46% by volume in air
- **Ignition Temperature:** 500 °F (260 °C)
- **Water Solubility:** 4 volumes gas in 1 volume water at 32 °F.
- **Flammability:** Forms explosive mixtures with air or oxygen.

\( H_2S \) (Hydrogen Sulfide) Toxicity Table

<table>
<thead>
<tr>
<th>Concentration of ( H_2S )</th>
<th>Symptoms of Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ppm (1/10,000 of 1%)</td>
<td>• Can Smell</td>
</tr>
<tr>
<td>10 ppm</td>
<td>• Allowable for 8 hour’s exposure</td>
</tr>
<tr>
<td>100 ppm</td>
<td>• Kills sense of smell in 3 to 15 minutes</td>
</tr>
<tr>
<td></td>
<td>• May burn eyes and throat</td>
</tr>
<tr>
<td>200 ppm</td>
<td>• Kills sense of smell rapidly</td>
</tr>
<tr>
<td></td>
<td>• Burns eyes and throat</td>
</tr>
<tr>
<td>500 ppm</td>
<td>• Loss of reasoning and balance</td>
</tr>
<tr>
<td></td>
<td>• Respiratory disturbances in 2 to 15 minutes</td>
</tr>
<tr>
<td></td>
<td>• Needs prompt artificial resuscitation</td>
</tr>
<tr>
<td>700 ppm</td>
<td>• Will become unconscious quickly</td>
</tr>
<tr>
<td></td>
<td>• Breathing will stop and death will result if not rescued promptly</td>
</tr>
<tr>
<td></td>
<td>• Immediate artificial resuscitation</td>
</tr>
<tr>
<td>1000 ppm</td>
<td>• Unconscious at once</td>
</tr>
<tr>
<td></td>
<td>• Permanent brain damage may result unless rescued promptly</td>
</tr>
</tbody>
</table>

*Note: ppm = parts of \( H_2S \) per million parts of air by volume*

\( H_2S \) Detection

Hydrogen sulfide is generally recognized by a characteristic, foul odor. Prolonged exposure to low concentrations has a tendency to act upon the olfactory nerves, thereby dulling the sense of smell. This is important, especially to those who think they can detect dangerous concentrations by the sense of smell. Additionally, it acts on the eyes and respiratory system resulting in irritation. Irritation to the eyes often causes severe pain and may incapacitate the worker. When high concentrations are present, death may occur before the odor is detected due to lung paralysis.
Laboratory monitoring units are available from a number of suppliers. A few are listed below:

<table>
<thead>
<tr>
<th>General Monitors</th>
<th>National Draeger Inc.</th>
<th>Delphian Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costa Mesa, CA 92626</td>
<td>P.O. Box 120-T Northvale, NJ 07647-1977</td>
<td></td>
</tr>
<tr>
<td>(714) 540-4895</td>
<td>Pittsburgh, PA 15230</td>
<td>(201) 767-7300</td>
</tr>
</tbody>
</table>

**Operational Procedures**

- A safety breathing apparatus is required. Each operator must wear an "escape" mask around the neck and in-waiting position. This should be used for escape only. An independent breathing apparatus, with compressed air bottles, should be available in the event personnel must enter a contaminated area, e.g., for a rescue operation.

- Escape routes and containment procedures must be planned before operation.

- Use this equipment only in a well-ventilated room and ensure that the air is ventilated to a safe location.

- Consider the consequences of an operator's immediate escape and the additional equipment operating in the room. A "kill" switch located near the exit may be required.

- Do not place other equipment, such as air compressors, in a room that could become contaminated.

**Where to Find Help**

In the event of problems, contact your local sales representative or Chandler Engineering L.L.C.®

- Telephone: 918-250-7200
- Fax: 918-459-0165
- E-mail: chandler.sales@ametek.com
- Website: www.chandlereng.com

Instrument training classes are also available.
Section 1 – Installation

Unpacking the Instrument

Carefully unpack the Model 2331D and all of its accessories. Visually inspect the equipment for any damage that may have occurred during shipping. After the instrument is removed from the shipping crate, the equipment and spare parts should be checked against the packing list to insure that all parts have been received and none are damaged.

Note: File an insurance claim with your freight carrier if damage has occurred during shipping. Verify all parts shown on the enclosed packing list have been received. If items are missing, please notify Chandler Engineering immediately.

1. Remove the gasometer from the box and place it on a table in an upright position.
2. Remove all of the packing material from the gasometer and store it for future use.
3. Wipe off all dust and dirt with a clean cloth.
4. Inspect the gasometer for any damage. Any damage should be reported immediately to Chandler Engineering with full details.

Utilities Required

110/220 VAC ± 15%, 50/60 Hz

Tools/Equipment Required

Basic hand tools.

Setting up the Instrument

The gasometer is shipped fully assembled and tested at the factory and should require no adjustments.
Section 2 – Operating Instructions

Description of Valves and Switches

Figure 1 below provides an illustration of the gasometer. Following the illustration is a complete description of each component.

Figure 1: Gasometer
Carrying Handles (1)

Recessed handles are provided on the sides for transporting the gasometer.

Gauge (2 and 4)

A compound gauge, 60 in. water, 0-60 in. water is provided to find the null pressure. For best results, the gauge should be dithered (tapped) before taking a reading. The gauge has a setscrew on the front face for setting the initial null value.

Two-Way Valve (3)

This valve opens and closes the line connecting the 1000cc and 2000cc jars. When in its CLOSED position, the 1000cc and 2000cc jars are separated and can be used individually. In the OPEN position, the jars are connected and the total volume is 3000cc.

Vent (5 and 6)

These ports are connected to the 1000cc and 2000cc jars through individual three-way valves. The ports are used to vent their respective jars to atmosphere or to transfer the collected gas to other instruments. The ports have a Swagelok fitting for ¼” OD tubing.

Three-Way Valve (7 and 8)

These valves connect the 1000cc jar or 2000cc jar to either the inlet port or the vent port. When in its closed position, the jar is disconnected from both inlet and vent ports.

Inlet (9 and 10)

These ports are connected to the 1000cc and 2000cc jars through individual three-way valves. The gas source is connected to these ports. The ports have a Swagelok fitting for ¼” OD tubing.

1000cc Jar (11)

This is a 1000cc jar made of precision bore Pyrex tubing with an I.D. of 2.7340”. A Lexan shield protects it.

2000cc Jar (12)

This is a 2000cc jar made of precision bore Pyrex tubing with an I.D. of 4.0000”. A Lexan shield protects it.

Piston (13 and 14)

Both the 1000cc and the 2000cc pistons are made of aluminum. Both pistons have a spring-loaded fluorocarbon seal on each end.

Knob (15 and 16)

These are pressure-adjusting knobs for the 1000cc and 2000cc jars. The knobs are connected to the pistons through a rack-and-pinion. The knobs are used for adjusting null pressure in the jars.
Section 2 – Operating Instructions

Scale (17 and 18)

These scales are for the 1000cc and 2000cc jars, respectively. For the 1000cc jar, each secondary division represents 10cc. For the 2000cc jar, each secondary division represents 20cc.

Vernier (19 and 20)

The verniers provided for each jar have a total of ten divisions. Using the vernier, the total volume of the 1000cc jar can be resolved to one cubic centimeter and the 2000cc jar can be resolved to two cubic centimeters.

Safety Relief Valve Port (21)

This port is connected to the downstream side of the safety relief valve. When either inlet pressure exceeds 2 psi, the safety relief valve opens and vents the gas to this port. It should be connected through ¼” tubing to a safe discharge area.

Digital Temperature Display (22)

This monitor displays the cylinder temperature in °F.

Digital Volume Display (23)

This monitor displays the volume displacement in cc’s. It may be used for improved accuracy and repeatability over the mechanical scale and vernier.

Operating Procedure

The gasometer may be used either for measuring the absolute volume or for measuring the gas flow rate. Operations for both methods are described below.

In either of the methods, it is important to maintain the room temperature, where the tests are conducted, close to 72 °F (22 °C) so that the error due to thermal expansion is minimized. The zero of the vernier and the scale should be checked to assure that they coincide and the error due to thermal expansion does not interfere. Any adjustment should be made according to the “Scale Adjustment” described in the Installation Section of this manual. Expansion is minimized. If your unit is equipped with digital temperature monitors, they must be allowed to stabilize and warm up for 30 minutes.

If one or both of the pistons are not at the top (0) position in the cylinder and the power is turned off or interrupted, the digital indicator(s) will require resetting as follows: move the piston to the top of the cylinder and simultaneously press the menu and reset buttons. The monitor will reset and indicate a (0) position.
**Measuring Absolute Volume**

1. Turn both of the three-way valves to the VENT position.
2. Bring both of the pistons to the top dead positions.
3. Turn both three-way valves to the CLOSED position.
4. Turn the two-way valve to the CLOSED position. If the gas volume to be collected is larger than the capacity of one jar, turn the two-way valve to the OPEN position, connecting the two jars.
5. Connect the gas source(s) to the inlet port(s), making sure that the larger source is connected to the 2000cc jar in a two-source test.
6. Gas is admitted into the jar by turning the three-way valve to the INLET position.
7. Let the gas in the jars come to room temperature.
8. Bring the gas to null pressure by adjusting the knobs. The gauges should be tapped while adjusting null pressure.
9. Observe the volumetric reading using the vernier and scale, or the digital volume display. Note the room temperature.
10. The collected gas can be transferred to another apparatus for further tests through the vent port by turning to the appropriate valve position.

**Operations for Measuring Flow Rate**

1. Turn the 2000cc three-way valve to its inlet position and the 1000cc three-way valve to its vent position.
2. Turn the two-way valve to its open position connecting both jars.
3. Bring both pistons to their top dead position. (If equipped with digital monitors: before you start the test, simultaneously press the menu and reset buttons and the monitor will reset and indicate a (0) position.)
4. Connect the gas source to the inlet port of the 2000cc jar.
5. Allow the gas to flow through the gasometer until a constant flow is established, holding the pistons to the top dead positions.
6. Simultaneously turn the three-way valve to the 1000cc side to close position and start a stopwatch.
7. Gas will be collected in both jars.
8. After a pre-determined time, turn the three-way valve of the 2000cc side to its closed position and simultaneously start a stopwatch.
9. Disconnect the gas source.
10. Let the gas in the jars come to room temperature.
11. Bring the gas to its null pressure by adjusting the knobs. The gauges should be tapped while adjusting the null pressure.
12. Take the volumetric reading, using the vernier and scale, or digital monitor, on both the jars. These readings are added to get the total volume. Note the room temperature and the time in “seconds” from the stopwatch.

Flow rate is calculated using the following relationship:

\[
\text{Flow rate in cc/minute} = \frac{\text{Total Volume}}{\text{Time in Seconds}} \times 60 \text{ cc/minute}
\]
Section 3 – Maintenance

Tools Required

Basic Hand Tools

Cleaning and Service Tips

- The gasometer should require little or no maintenance. However, as a preventive measure, regularly clean the inside of the glass jars. A dirty jar can retard the smooth movement of the piston.
- The bearings on the shaft hangers and bottom caps should be lubricated with oil at least once per year.
- Never replace the power cord with an inadequately rated power cord (see Section 5 – Replacement Parts for the Chandler Engineering part number).
- Maintenance should only be performed by qualified personnel.

Cleaning the Jars and Replacing the O-rings

As another part of the preventive maintenance, the O-rings on the end caps and seals should be checked regularly and, if required, the worn out or damaged seals should be replaced.

To replace the O-rings and seals and to clean the inside of the jars, the following steps should be taken to disassemble these fixtures.

1. Purge the Gasometer before performing maintenance.
2. Disconnect the power cord.
3. Remove the knobs from the front by loosening the set screws.
4. Remove the rear cover by removing the six screws.
5. Remove both vernier brackets by loosening the Allen screw.
6. Disconnect the piping at the top of the jars, thermocouple(s), and electronic scale connector, shown in figure 4.
7. Remove the four screws that connect the lower plate of the jar assembly and the bracket of the chassis.
8. Pull out the whole jar assembly and set aside.
9. Unscrew the six tie-rods holding together the top and bottom plate of the jar assembly. This will separate the two individual jar assemblies.
10. Unscrew three tie-rods that hold together top and bottom end caps and the piston assembly.
11. Now the O-ring and/or seals can be changed and the jars cleaned.
12. The seals should be installed so that the lip of the seals are facing opposite each other, as shown in Figure 2.
13. Insert the piston assembly into the Pyrex tubing.

Each piston in the top dead center position with valves closed is required to hold 20 inches water/air pressure without leaking. See the following Leak Test procedure to verify that the seals are operating properly.
Each piston should move when 10-20 inches water/air pressure is applied. If the seal on the piston is too loose, remove the light load spring and replace with a medium or heavy load spring.

The lower seal is used to guide the piston and is not required to seal. The spring can be left out of this seal if the friction is too great.

To reassemble, follow these steps in reverse order.

**Figure 2: Seal Placement**

### Leak Test

1. Fill the 1000cc jar with air (approximately 700cc).
2. Adjust the 2000cc piston to its top dead position.
3. Turn both three-way valves to the closed position.
4. Connect both jars by opening the two-way valves.
5. Transfer the air from the 1000cc jar into the 2000cc jar.
6. Adjust the gauges to read “0” by moving the piston positions slightly in order to relieve any pressure or vacuum, and read the scale on the 2000cc jar. This reading should be between 700cc and 690cc, indicating that there are no leaks in the fitting.
7. Transfer the air back into the 1000cc jar and repeat the above process. Take another reading on the 1000cc scale.
8. Repeat this process five times, by returning to step five.
9. After five transfers, the volume should still be between 700cc and 690cc.
10. If there is any leak, the tightness of the fittings should be checked. If the leak still persists after checking the fittings, the leak is probably at the seals. To replace the seals, refer to the maintenance section of this manual.

11. Connect the vent ports and the safety relief valve port to a safe discharge area.

**Scale Adjustment**

Turn both three-way valves to Vent. Bring both pistons to the top dead positions. At this position, the zero of the main scale and the zero of the vernier should coincide to give zero readings. If the zeros do not coincide, the following steps should be taken to adjust the scale:

1. Disconnect the power cord.
2. Remove the rear cover of the gasometer by removing six screws.
3. Loosen the Allen screw shown in Figure 3, so that the vernier bracket can move up and down the rack (or piston rod).
4. Adjust the vernier so that its zero coincides with the zero of the scale. During the adjustment, make sure that the piston is at its top dead position. Hold the vernier scale in this position and tighten the Allen screw.
5. Replace the rear cover.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>EACH TEST</th>
<th>MONTHLY</th>
<th>3 MONTHS</th>
<th>6 MONTHS</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrex Jars</td>
<td>Clean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-rings</td>
<td>Check for wear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lubricate</td>
</tr>
</tbody>
</table>

MAINTENANCE SCHEDULE
Model 2331 Gasometer
Section 4 – Troubleshooting Guide

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas is leaking from the cylinders.</td>
<td>1. Be sure the vent valve is closed.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the piston seals.</td>
</tr>
</tbody>
</table>
## Section 5 - Replacement Parts

### Replacement Parts for Model 2331D Gasometer

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>54-700-230</td>
<td>O-ring</td>
</tr>
<tr>
<td>54-700-240</td>
<td>O-ring</td>
</tr>
<tr>
<td>72-20</td>
<td>Seal Bal 305-240</td>
</tr>
<tr>
<td>72-21</td>
<td>Seal Bal 304-145</td>
</tr>
<tr>
<td>72-23</td>
<td>Medium Load Spring</td>
</tr>
<tr>
<td>72-24</td>
<td>Heavy Load Spring</td>
</tr>
<tr>
<td>72-25</td>
<td>Medium Load Spring</td>
</tr>
<tr>
<td>72-26</td>
<td>Heavy Load Spring</td>
</tr>
<tr>
<td>C09889</td>
<td>Fuse, 2.000A, 250V, 5x20, Fast Blow</td>
</tr>
<tr>
<td>QX-C-1266</td>
<td>Power cord, 230V, 10A, 2.5m</td>
</tr>
<tr>
<td>P-2441</td>
<td>Power cord, 110V, 10A, 3.0m</td>
</tr>
</tbody>
</table>

*Note: This gasometer is built with 72-20 and 72-21 seals. This standard seal/spring is the recommended replacement part. Use the medium and heavy springs only for conditions noted in Section 3 - Maintenance.*

To ensure correct part replacement, always specify model and serial number of instrument when ordering or corresponding.
# Section 6 - Drawings and Schematics

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2331-11</td>
<td>Wiring Schematic</td>
</tr>
<tr>
<td>2331-19</td>
<td>Electronics Enclosure</td>
</tr>
<tr>
<td>2331-21</td>
<td>Gasometer Cylinder and Drive Assembly</td>
</tr>
<tr>
<td>2331-22</td>
<td>Front Panel Assembly</td>
</tr>
<tr>
<td>2331D</td>
<td>Gasometer Assembly</td>
</tr>
<tr>
<td></td>
<td>Declaration of Conformity</td>
</tr>
</tbody>
</table>
INTERNAL JUMPER SETTINGS ON
QUADRATURE SIGNAL CONDITIONER PCB
FOR REFERENCE ONLY

C16318 3X

J1

J5

WHITE 18 GA.

WHITE/YEL 18 GA.

10" 10"

10"

26-821 TEMP GAUGE

79-922 TERMINAL STRIP

C16318 8"

C09578

B 9 8 7 6 5 4 3 2 1

CHANDLER ENGINEERING

SCHEMATIC, WIRING
DIGITAL GASOMETER

C15723

GROUND LUG

C16312 3X
NOTES:
1. SEE 2331-11 FOR WIRING SCHEMATIC.
2. PART # P-0421 NOT SHOWN. SEE 2331-11.
NOTES:
1. FOR SEAL ADJUSTMENTS AND REPLACEMENTS SEE 2331-0004P.
2. TEST CYLINDERS PER 2331-0005P.
SET VALVE TO 55 IN H2O (APPROX 2.0PSI) AND ENGRAVE OR STAMP
Declaration of Conformity

Manufacturer’s Name: Chandler Instruments Company L.L.C.
Manufacturer’s Address: 2001 North Indianwood Avenue
Broken Arrow, Oklahoma 74012

Declares that the product:
Product Name: Gasometer
Model Number: 2331D

Conform to the following standards:
EMC Directive 2004/108/EC

EN 61326-1:2006 Conducted Emissions, Group1 Class A
EN 61326-1:2006 Radiated Emissions, Group1 Class A
EN 61000-4-2:2001 Electrical Discharge, Criteria A
EN 61000-4-3:2002 Radiated Electromagnetic Field, Criteria A
EN 61000-4-4:2004 Electrical Fast Transients / Burst, Criteria A
EN 61000-4-5:2001 Surge Immunity, Criteria A
EN 61000-4-6:2003 RF Conducted Immunity, Criteria A
EN 61000-4-8:1993 Magnetic Immunity, Criteria A
EN 61000-4-11:2004 Voltage Dips, Criteria A
EN 61000-4-11:2004 Voltage Short Interruptions, Criteria B

Low Voltage Directive 2006/95/EC

EN 61010-1:2010 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Machinery Directive 98/37/EC

[Signature]
Dean Dorris
Director of Engineering
Ametek, Chandler Engineering

[Date]
Model 2331D

DIGITAL GASOMETER

An Important Tool for Reservoir Analysis

The Model 2331D Gasometer accurately measures atmospheric gas in the PVT laboratory. It allows precise measurements with a minimum of technique, as required by wet test meters, gas burettes and mercury displacement gasometers.

Designed For Flexibility and Simplicity

The design of the Model 2331D consists of two chambers which can be used separately or in series to provide a wide range of volume-resolution combinations. Each chamber contains an atmospheric volumetric pump with the piston connected to a measuring device, including a scale, a vernier, a pressure-adjusting knob and digital temperature and pressure displays.

The chambers each contain a floating piston connected to a rack and pinion that can be positioned through panel control knobs. The movement and position of the pistons can be monitored by the dual digital volume meters which are calibrated in cubic centimeters. The measured gas remains in its separated condition, non-contaminated to guarantee that further true gas analysis is possible.

Materials in contact with the gas will resist the corrosive effects of hydrogen sulfide. Safety shields and relief valves are provided for protection.

FEATURES

✓ Two Volume Chambers
   Allow Operation as Three Gasometers: 1000 cm³, 2000 cm³, 3000 cm³
✓ Digital Meters Display Gas Volumes
✓ Mercury-Free, Design
✓ Sour Gas Compatibility
✓ Verniers for Precise Volume Measurement
Model 2331D

Specifications

Total Capacity
3000 cm³

Left Side Capacity
2000 cm³

Right Side Capacity
1000 cm³

Accuracy
0.2% of Reading

Maximum Pressure
50 inches of water / ~2 psi / 14 kPa

Scale Resolution
0.1% of Full Scale

Utilities
Power
100-240 VAC 50/60 Hz, 2A

Typical Weights and Dimensions*
Dimensions (w x d x h)
13.31 in. x 7.69 in. x 40.31 in. / 33.81 x 19.53 x 102.4 cm

Weight
35 lb / 16 kg

Manufacturer’s specifications subject to change without notice
All products of Chandler Engineering are warranted for a period of one year from date of shipment to be free from defective workmanship and material. Providing written notice is made and authorization by us is given, any of our products claimed to be defective may be returned freight prepaid to our factory. If found to be defective and after examination by us, our obligation will be limited to repairing or replacing the product, at our option, free of charge, F.O.B. our factory.

COMMERCIAL INSTRUMENTATION
MANUFACTURED BY OTHERS

Commercial instrumentation manufactured by others is covered by separate manufacturer warranty, generally for one year. Contact Chandler Engineering for instructions on obtaining service directly from the manufacturer.

Our warranty does not cover damage or failure caused by abuse, misuse, abnormal usage, faulty installation, improper maintenance, or any repairs other than those provided by authorized Chandler Engineering personnel.

This warranty is in lieu of all other warranties, expressed or implied, and of all obligations or liabilities on its part for damages including but not limited to consequential damages, following the use or misuse of instruments manufactured by Chandler Engineering Company L.L.C.

NO WARRANTY OF MERCHANTABILITY OR FITNESS
FOR A PARTICULAR PURPOSE SHALL APPLY.

Our total liability on any claim shall not exceed the price allocable to the product or service or part thereof that gives rise to the claim.
Please Send Us Your Comments on This Manual

Model Number ____________________ Serial Number ____________________

Printing Date of this manual (from the Title Page) ____________________

Please circle a response for each of the following statements. Use:
(1)= Strongly agree  (2) =Agree  (3) =Neutral, no opinion  (4) =Disagree  (5) =Strongly disagree

a) The manual is well organized. 1  2  3  4  5
b) I can find the information I want. 1  2  3  4  5
c) The information in the manual is accurate. 1  2  3  4  5
d) I can easily understand the instructions. 1  2  3  4  5
e) The manual contains enough examples. 1  2  3  4  5
f) The examples are appropriate and helpful. 1  2  3  4  5
g) The manual layout is attractive and useful. 1  2  3  4  5
h) The figures are clear and helpful. 1  2  3  4  5
i) The sections I refer to most often are __________________________________________________

Other comments ______________________________________________________________

Contact us at our website: www.chandlereng.com
Email: chandler@chandlereng.com

Please add me to your mailing list-
for Product Updates and New Product Releases, Information,
Technical Articles, and General Announcements of interest to users of this instrument.

Name __________________________________________
Company _________________________________________
Address _________________________________________
Email address ____________________________________

My instrument is Chandler Model ____________________
Serial Number ____________________