

A dark blue world map is centered in the background of the slide. The continents are visible in a slightly lighter shade of blue.

Varec Biogas Digester Gas Safety and Handling Equipment

A world map with a blue-to-purple gradient background. The map is centered on the Atlantic Ocean, showing the continents of North America, South America, Europe, Africa, Asia, and Australia. The title 'Biogas Definitions' is overlaid in the center in a bold, yellow, sans-serif font.

Biogas Definitions

Biogas Systems

Important Design or Sizing Parameters

1. Total gas production or gas flow rate = approx 15 cubic feet of gas/lb of VSS destroyed
2. Biogas composition
3. WEF MOP 8, 1998 edition
 - Maximum velocity = 12 fps
4. NFPA 820, 2012 edition

Biogas Systems

Important Design or Sizing Parameters

5. Local Standards, e.g., 10-State Standard

Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers (GLUMRB)- Recommended Standards for Wastewater Treatment Facilities(10-State Standard).

Member States: ILLINOIS, NEW YORK, INDIANA, OHIO, IOWA, ONTARIO, CANADA, MICHIGAN, PENNSYLVANIA, MINNESOTA, WISCONSIN

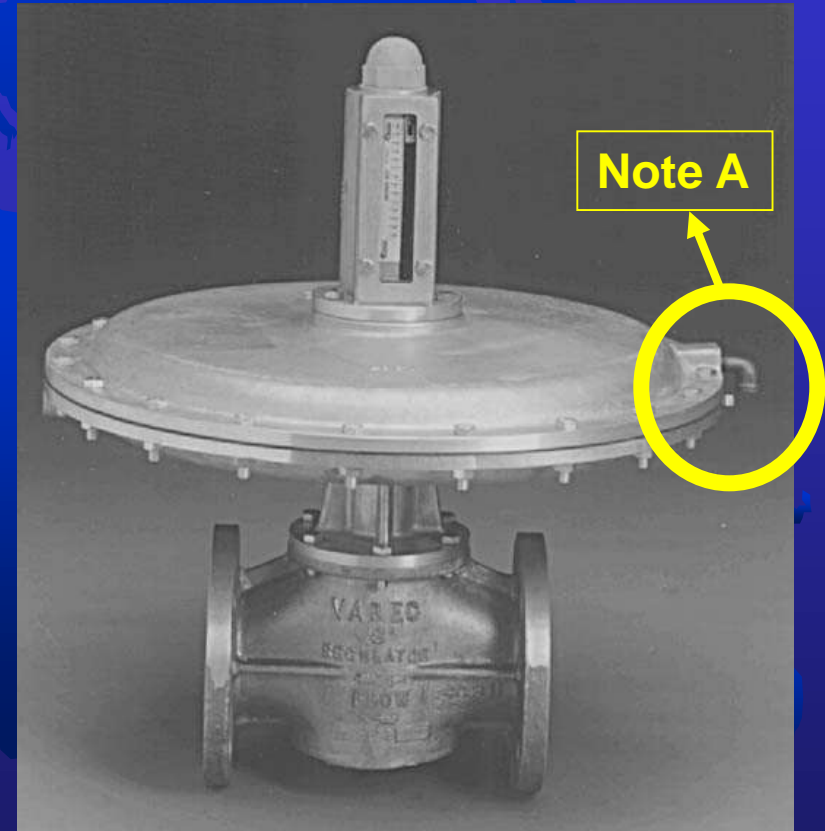
A dark blue world map is centered in the background of the slide. The continents are visible in a slightly lighter shade of blue.

Waste Gas Burner Header

386 Series Back Pressure Regulator

Operation

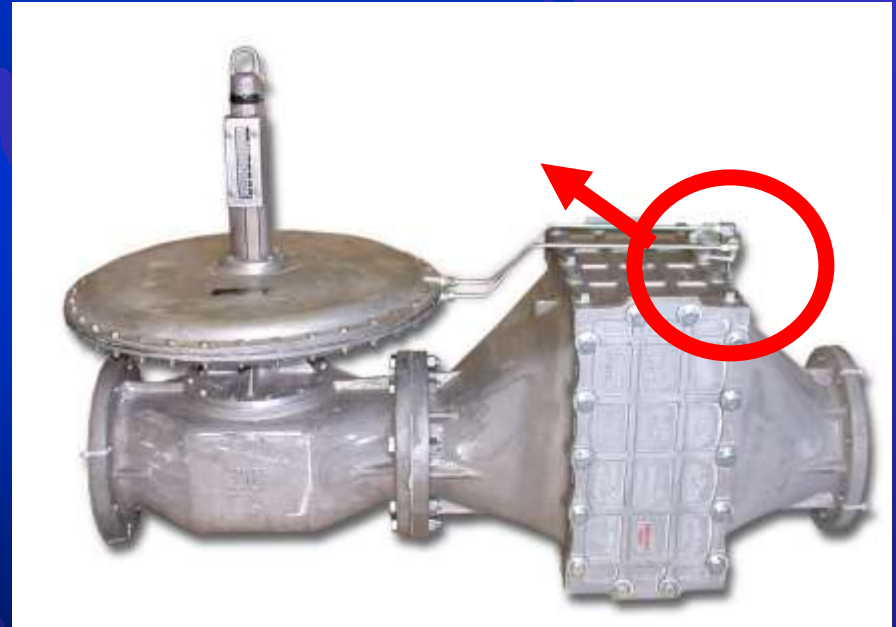
- ❑ Controls upstream pressure.
- ❑ Valve Remains Closed Until Gas Pressure on Diaphragm Overcomes Spring Pressure.
- ❑ Unit Opens on Increasing Pressure.
- ❑ Valve Closes When Pressure Falls 10% Below Set Point
- ❑ Note A - *Fitted with a 3-way solenoid valve connected to burner control panel – ON/OFF Capabilities.*



440 Series Pressure Relief & Flame Trap Assembly

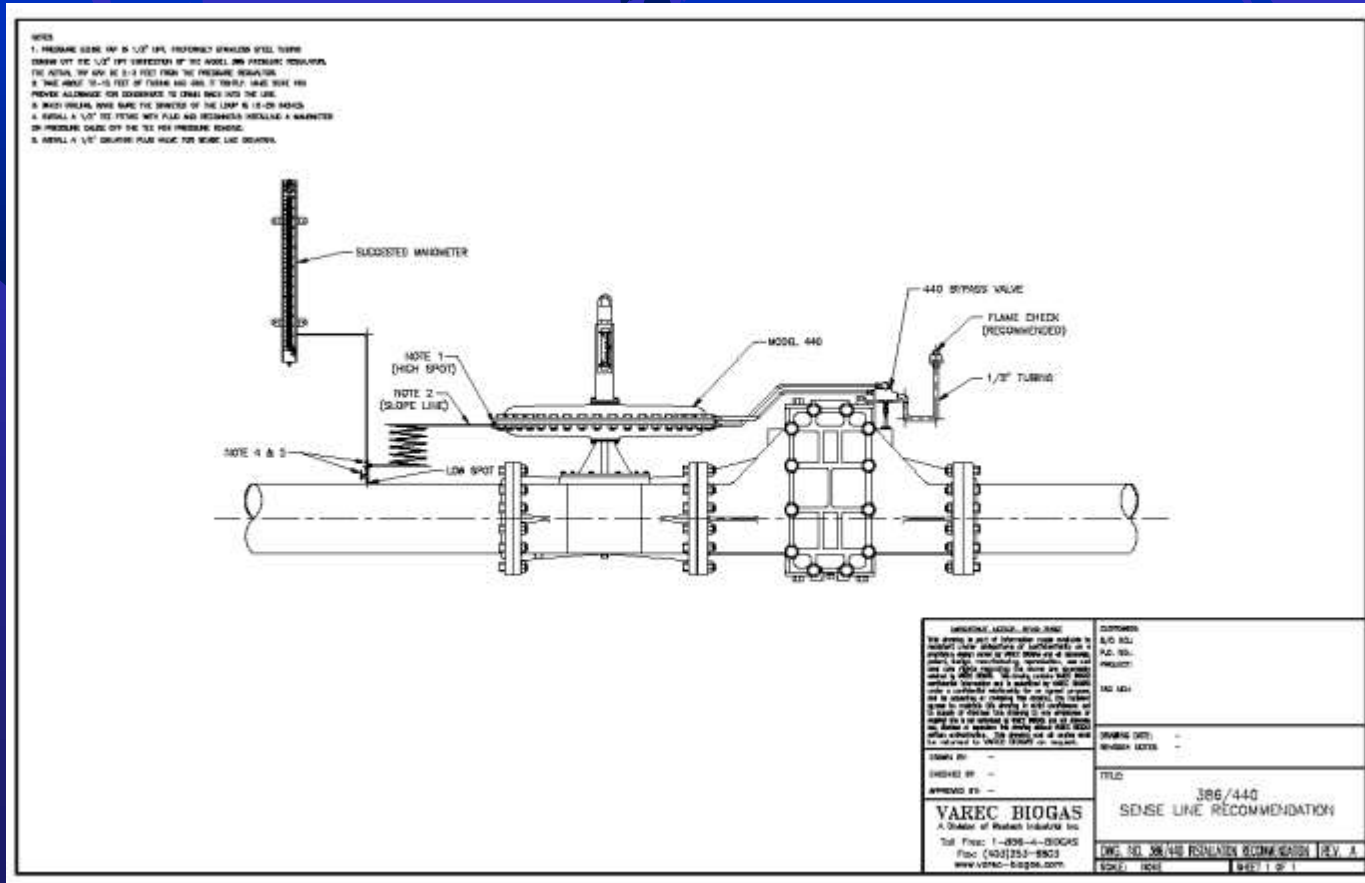
Purpose

- ❑ Regulator is set to divert digester gas to the waste gas burner.
- ❑ Prevent flame propagation in case of flame flashback.
- ❑ **THERMAL BYPASS SHUT-OFF VALVE**
Controls pressure applied on top and bottom portion of diaphragm.
- ❑ Closes regulator when fusible element melts.



386/440 Series Back Pressure Regulator and/or Pressure Relief Regulator and Flame Trap Assembly

Installation Recommendation



440 Series Pressure Relief & Flame Trap Assembly

Installation

1. Within 15 feet of the waste gas burner.
2. Outdoor installation - Insulating jacket (special) for cold weather protection

1/2" NPT
pressure
sense line
(10 feet
upstream).



Drip trap on
1/2" NPT drain
connection
with isolation
plug valve

450 Series Flame Trap Assembly

Purpose

Provides two types of protection from flashback fires

- ❑ Shuts-off Fuel Supply on Flame Flashback-thermal shut-off valve
- ❑ Prevents Propagation of Flame - Flame arrester

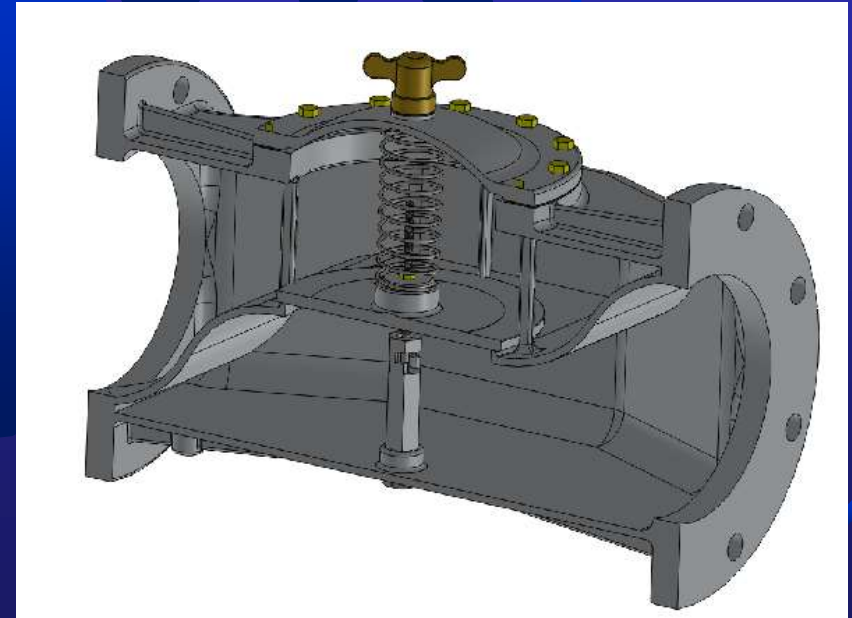
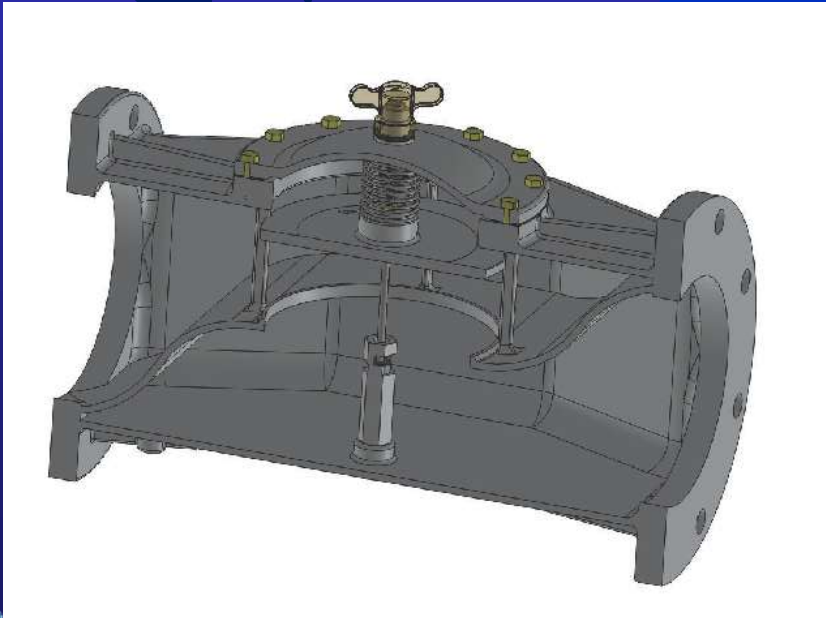


430 Series Thermal Shut-Off Valve

Purpose

Shuts-off Fuel Supply on Flame Flashback

- ❑ Fusible element holds pallet in the open position.
- ❑ Element melts and forces the pallet closed.



450 Series Flame Trap Assembly

Installation

- ❑ Install within 15' of potential flame source, i.e, flares, boilers/heat exchangers, engine-generators.
- ❑ Insulate from cold if installed outdoors



5200 Flame Check

Purpose

- ❑ Prevents flame propagation in case of ashback.



5200 Flame Check

Sample Installation



A world map is shown in the background, rendered in a light blue color against a dark blue gradient background. The map is centered and covers most of the frame.

Burners and Flares

Flare Types



Candle-Stick flares



Enclosed flares

A world map is shown in the background, rendered in a light blue color against a dark blue gradient. The map is centered and covers most of the frame.

Candle-Stick Flares

239A/240 HOA Waste Gas Burner and Manual Cycling Ignition System

Operation

- Combust excess waste gas.
- Pilot Flame Ring
- 240 HOA Manual Cycling Ignition System
 - Igniter Assembly
 - Control Panel
 - Continuous pilot.
 - Spark duration/spark interval.



239A/240 HOA Waste Gas Burner and Manual Cycling Ignition System

Installation

- Burner base pedestal. Make sure its properly supported.
- Secondary stack for 4", 6" and 8".
- Check:
 - Waste gas connection. Pipe slope to drain?
 - Igniter assembly installation. Correct igniter rod position?
 - Pilot gas piping and fitting. Isolation valve and flame check installed?
- Point-to-point wiring check.

244W Series Waste Gas Burner with Automatic Pilot Ignition System

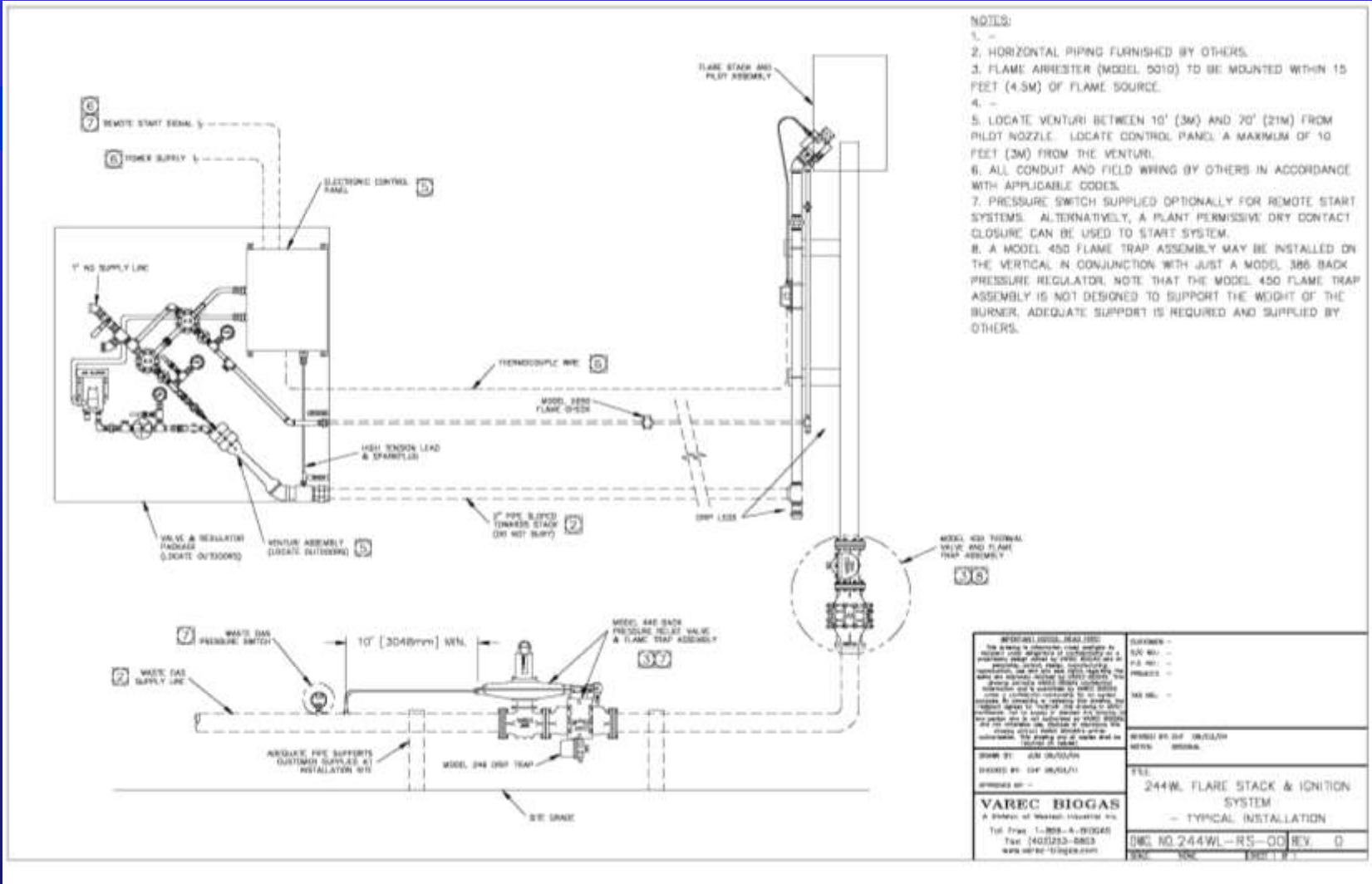
Operation

- ❑ Combust excess waste gas.
- ❑ Flamefront technology
- ❑ Continuous Pilot Nozzle at 30-45 deg. angle.
- ❑ Remote Start Automatic Pilot Ignition System
- ❑ Pilot gas supply pressure 4 in WC (100mm WC) – 14 in WC (350mm WC)
- ❑ Utilizes a low hP blower to pre-mix air and gas
- ❑ Pilot gas control components panel located max 70 feet away and 45-deg elbows allowed.



244WL

244WL Ignition System



Typical Installation for a 244WL with an automatic biogas pilot ignition system

244W Series



Digester Gas

Continuous flame nozzle at a 30-45 deg angle from vertical burner ensures that gas is ignited and burned at all flows (even fluctuating).

244W Series vs. Competition

A look at the burner tip of a pilot nozzle runs parallel to the gas pipe after 9 years of operation.



A look at the burner tip of the 244WS Burner same timeframe.

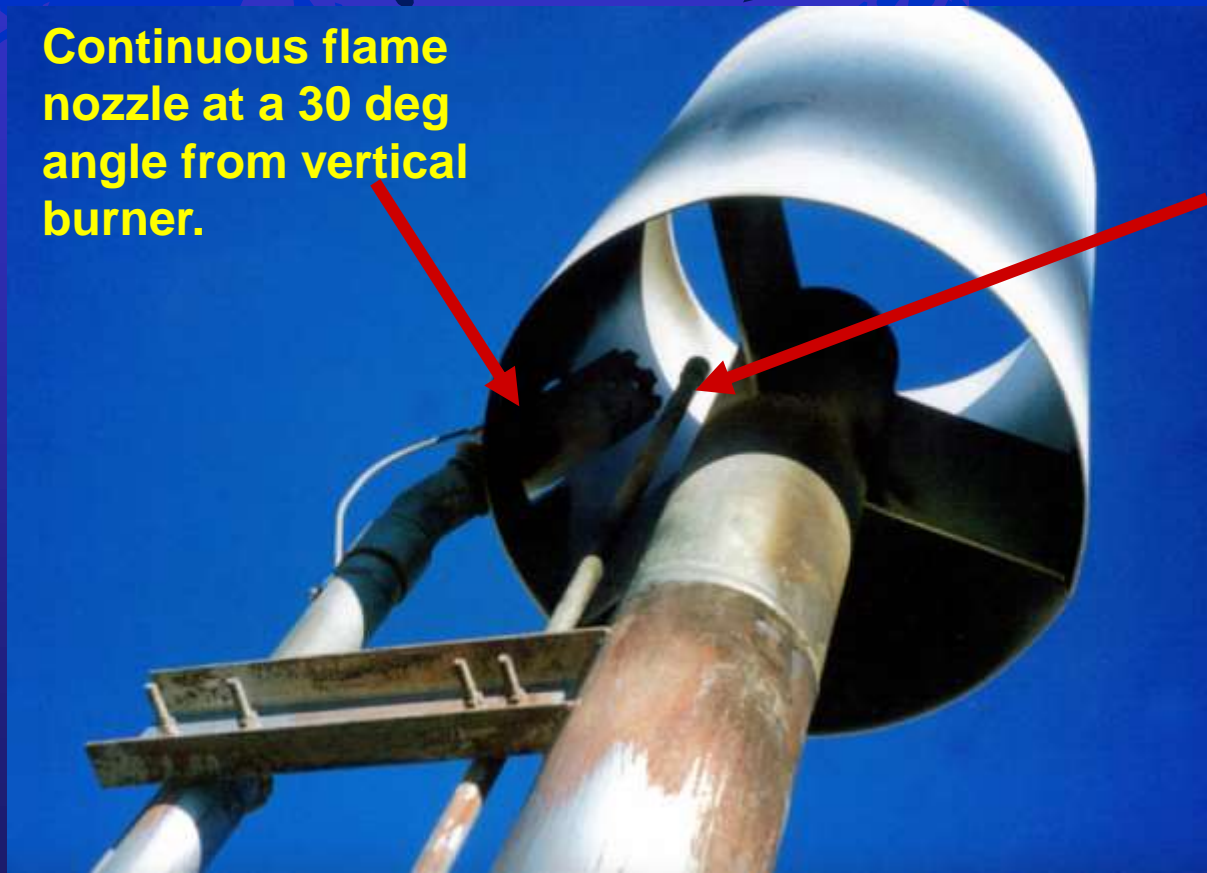


Installation photos at City of Lubbock, TX (1999)

244W Series

Continuous flame nozzle at a 30 deg angle from vertical burner.

Flame retention nozzle – designed to “capture” the flamefront when it exits the continuous nozzle, thus lighting the pilot. Once the pilot is established, pilot gas flow to the retention nozzle is stopped.



A stylized world map in shades of blue and green, centered on the Atlantic Ocean. The continents are outlined in a darker blue, and the oceans are a lighter blue. The map is positioned in the background of the slide.

Enclosed Flares

Enclosed Flares

Differences between Enclosed and Open

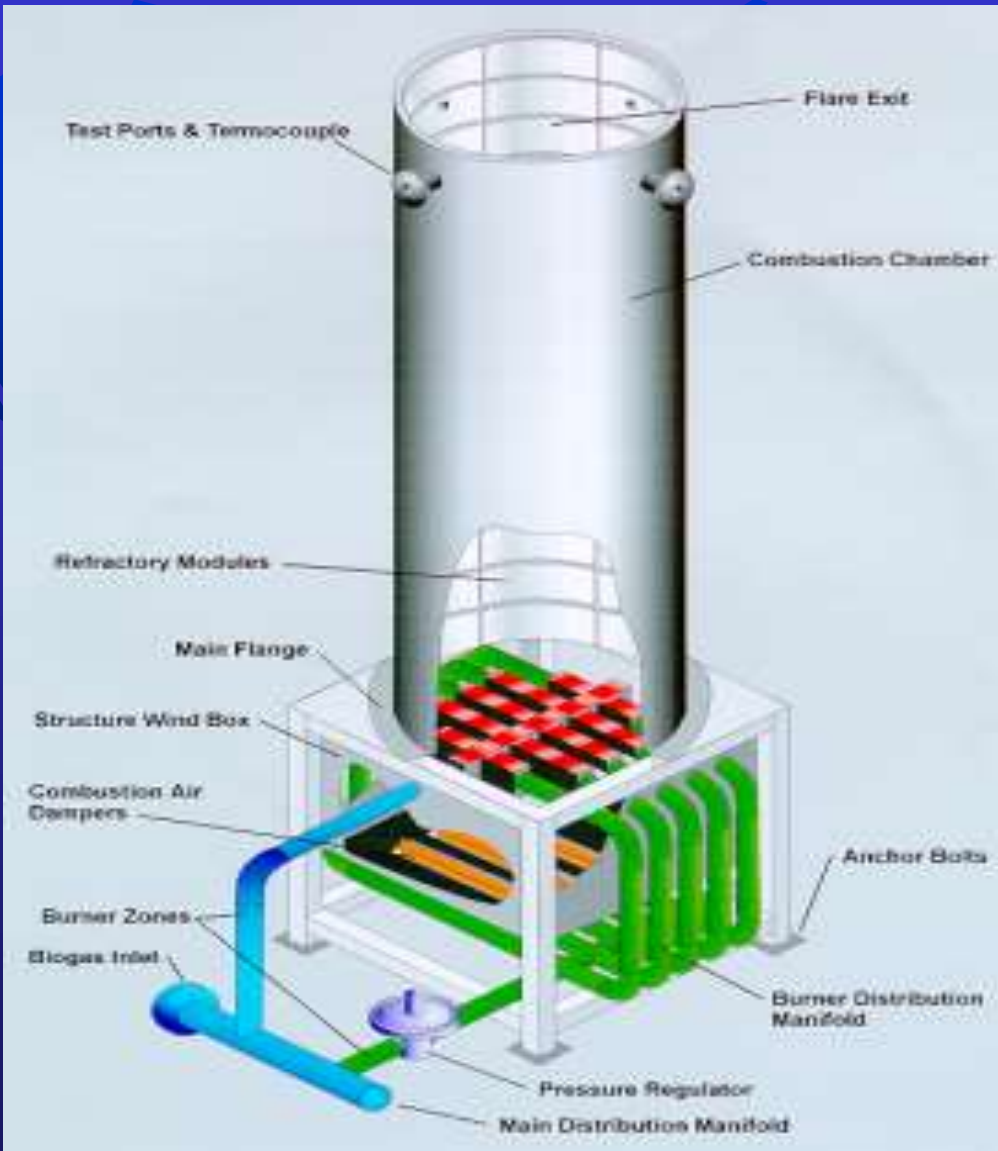
- ❑ No visible flame
- ❑ Guaranteed NO_x, CO, and efficiency
- ❑ Low Radiant Heat

Enclosed Flares

Destruction Removal Efficiency (DRE):

- 99.95% = .05% of the total combustible input to the flare is exiting the flare unburned.

249 Series Enclosed Flare



Operation

- Refractory lined to retain heat and protect stack
- Air dampers modulate based on exit temperature
- Purge cycle and proof of closure valve to insure no gas build up in stack
- Size based on minimum and maximum flow rate.
- Time and temperature based.

249 Series Installation



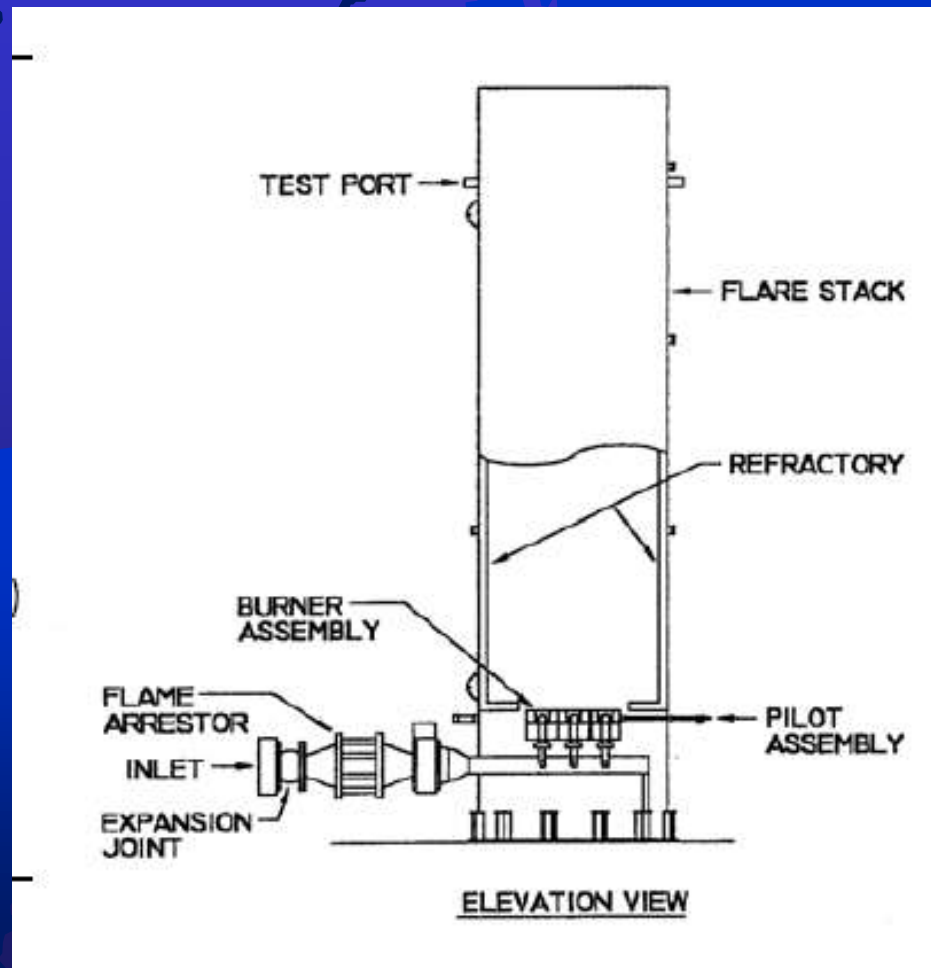
**Boston Harbor Mod 3,
Boston, Massachusetts USA**



**F. Wayne Hill Water
Resources Center, Gwinnett
County, GA**

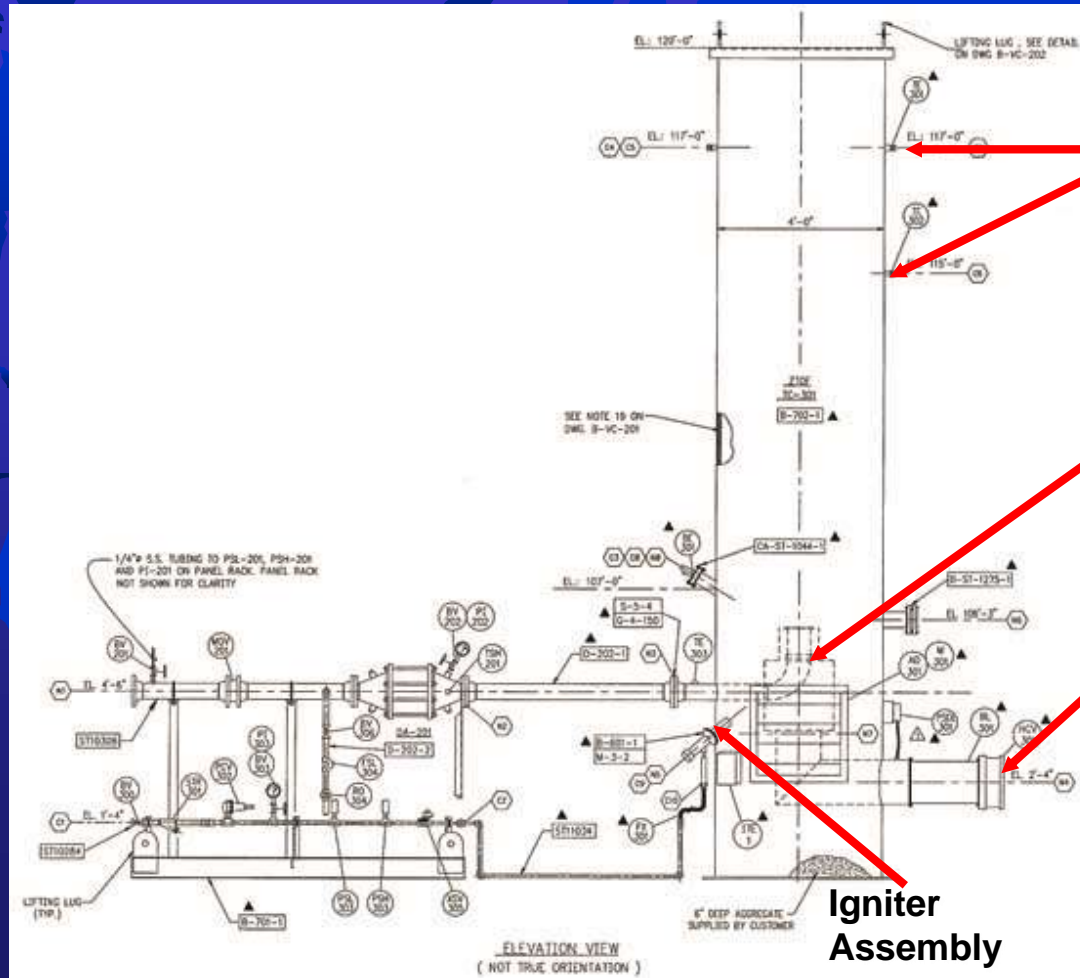
Enclosed Flares

Typical Enclosed Flare - using Natural Draft



Enclosed Flares

Typical Enclosed Flare – Purge Blower



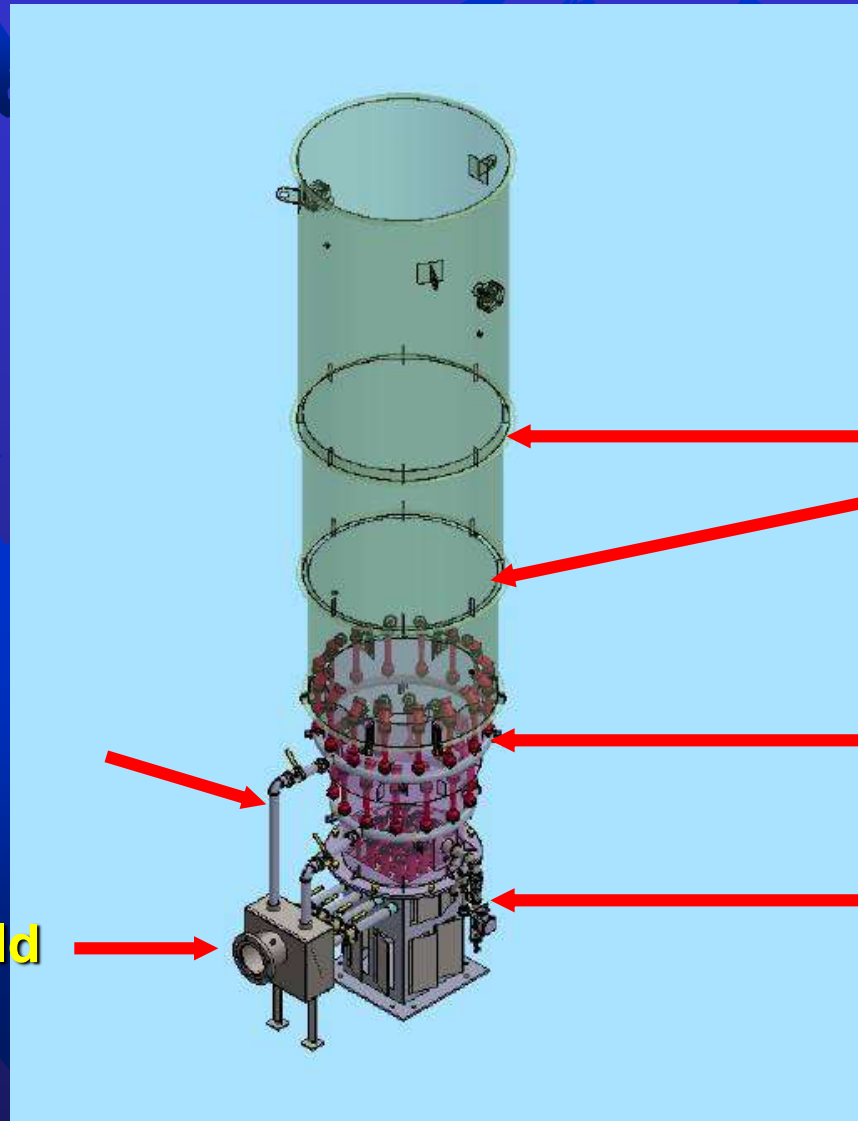
thermocouple

Burner

Air purge blower with flow meter and pressure regulator

Igniter Assembly

244E Enclosed Flare



Burner zones

Burner manifold

Air gaps –
Induces air
naturally

Venturi Nozzle
burners

Pilot gas piping

244E Enclosed Flare with Automatic Pilot Ignition System



Operation

- Combust excess waste gas.
- Guaranteed Destruction Removal Efficiency
- Same Ignition System as 244W. Either "S" , "G" or "L"
- Continuous Pilot Nozzle at 30-45 deg. angle.
- Remote Start Automatic Pilot Ignition System

244E Enclosed Flare

Control Panel

Pilot Gas Valve
and Regulator Panel



Dual Pilot Lines



244E Enclosed Flare



Burner Zones

Venturi-style nozzles



244E Enclosed Flare

❖ Pilot Ignition System:

- ❑ Thermocouple – Pilot flame sensing

- ❑ Flamefront Technology

1. Venturi-Driven System – 10 psig of supply pressure
2. Low pressure pilot gas system, Digester Gas or Natural Gas, 5 psig and lower

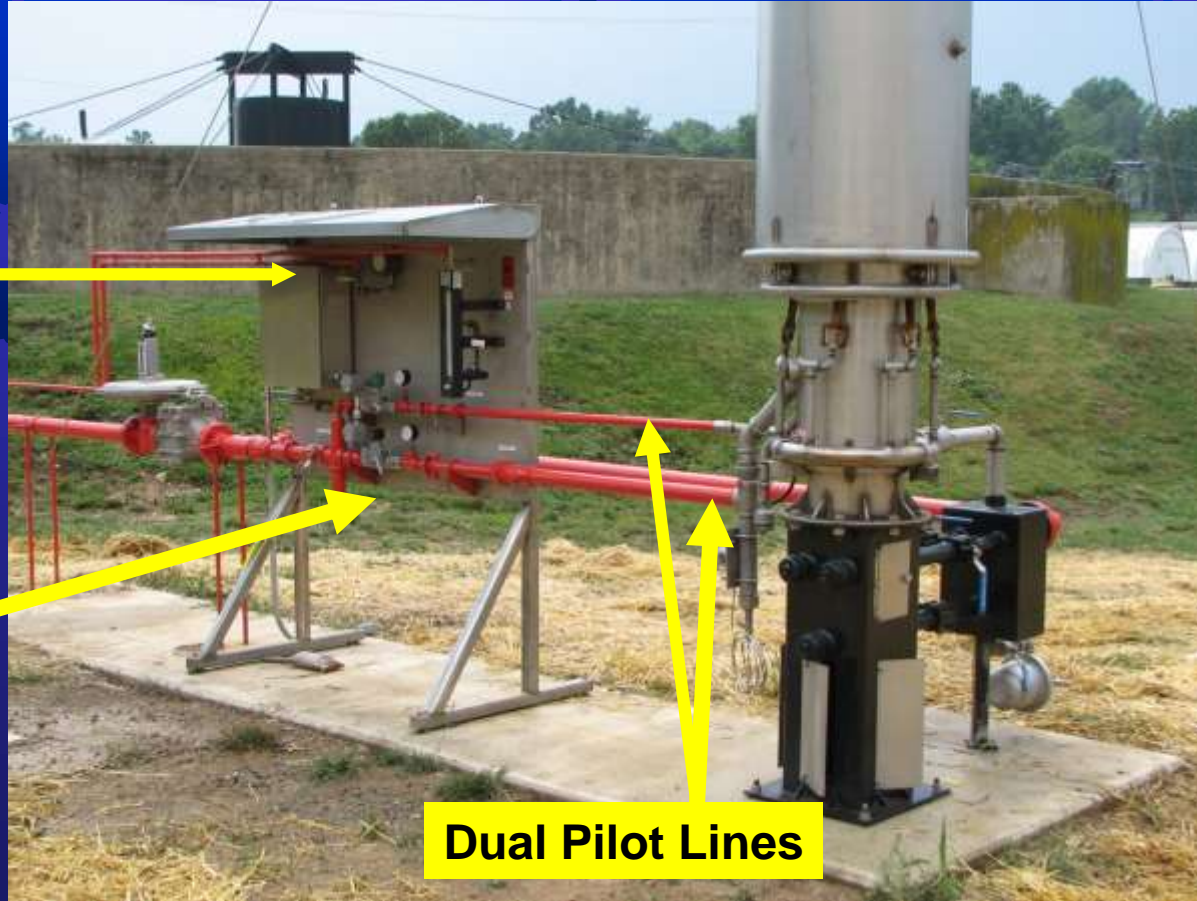
244E Enclosed Flare with Automatic Pilot Ignition System

Installation

Control Panel

Pilot Gas Valve and Regulator Panel with weatherhood and mounting stand

Dual Pilot Lines



A dark blue silhouette of a world map is centered in the background of the slide. The continents are clearly outlined against the lighter blue background.

Digester Cover Equipment

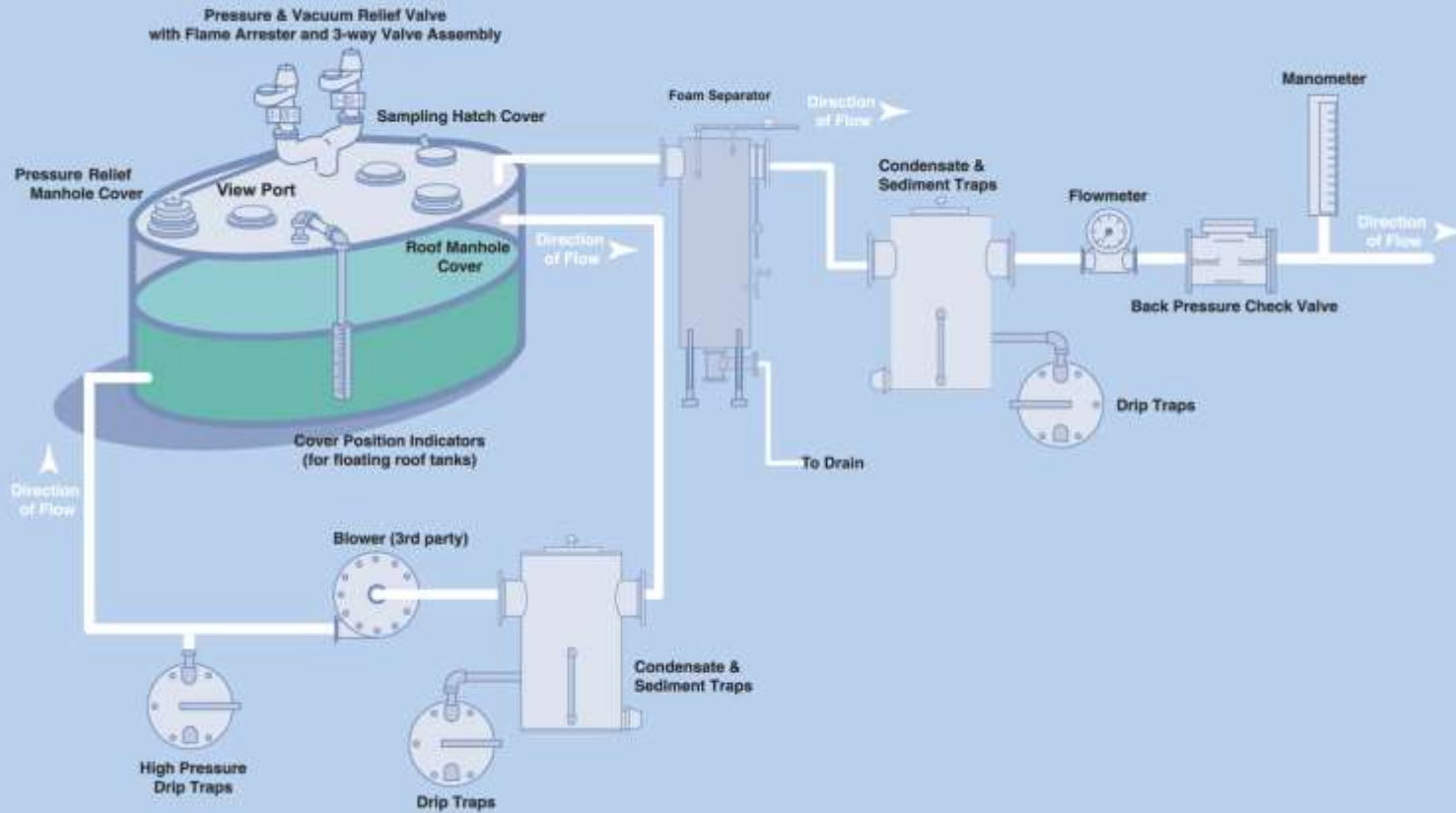
Varec
BIOGAS

Varec

Biogas Systems

HINTS

1. Many digesters generate foam which can clog equipment, therefore it is recommended to place a gas/foam separator downstream of your digester.



Note: This schematic diagram is for general guidance only and does not represent a specific design.

5810B/5820B Relief Valve with Flame Arrester Assembly

1. Varec Model 5810B
-
Vent to Atmosphere
2. Model 5820B -
Pipe Away
3. Model 5811B or
5821B -All-weather
model



5810B/5820B Relief Valve with Flame Arrester Assembly

Purpose

- ❖ PVR Valve - Protects Digester from overpressure and vacuum.
- ❖ Flame Arrester - Protects Digester from flame flashback from outside source.



Pipe-Away



Vent-to-Atmosphere

2010B/2020B Series Pressure & Vacuum Relief Valve



OPERATION

- ❖ Provide over pressure relief as well as Vacuum protection
- ❖ Field adjustable
- ❖ Dead weight loaded pallets
- ❖ Teflon inserts for seating surface
- ❖ Model 2011B/2021B – All weather version
 1. “All Weather” feature protects the valve in temperatures ranging from -25o F to +200 o F (-32 o C to + 93 o C).
 2. Includes special anti-freeze coating applied to seat ring tip, pallet periphery and stem, and guide posts.

2010B/2020B Series Pressure & Vacuum Relief Valve

Sizing and Setting Criteria

Pressure and Vacuum Setting

- ☐ Allowable over- pressure – 20% above set pressure. Minimum is 10%
- ☐ Allowable under-pressure – 50% above set pressure. Minimum is 10%

2010B/2020B Series Pressure & Vacuum Relief Valve

Installation

Calibration

1. **Verify Setting - the actual weight of the pallet assembly (including loading weights). Adjust loading weights as required.**
Weight tolerance: + 5%/- 5%
Setting tolerance: + 0%/- 10%

| PALLET LOADING (INCLUDES WEIGHT OF PALLET) | | |
|--|--|--|
| VALVE SIZE | OUNCES OF WEIGHT REQUIRED PER OUNCE OF SETTING | OUNCES OF WEIGHT REQUIRED PER INCH OF WC SETTING |
| 2" | 8.3 | 4.8 |
| 3" | 16.8 | 9.7 |
| 4" | 22.1 | 12.8 |
| 6" | 43.4 | 25.1 |
| 8" | 72.7 | 42.0 |
| 10" | 120.1 | 69.4 |
| 12" | 179.9 | 104.0 |

2010B/2020B Series Pressure & Vacuum Relief Valve

Maintenance



IMPORTANCE ON PROPER ROUTINE MAINTENANCE AND PREVENTATIVE MAINTENANCE

- ❖ Maintenance is key to operational performance.
- ❖ Leaking valves create odor problems, as well as harmful conditions.
- ❖ Leaking valves will adversely affect flame arrester operation.
- ❖ Improper handling can cause damage to pallets and seats.
- ❖ Simple maintenance can save an expensive Digester.

5000/5010 Flame Arrester

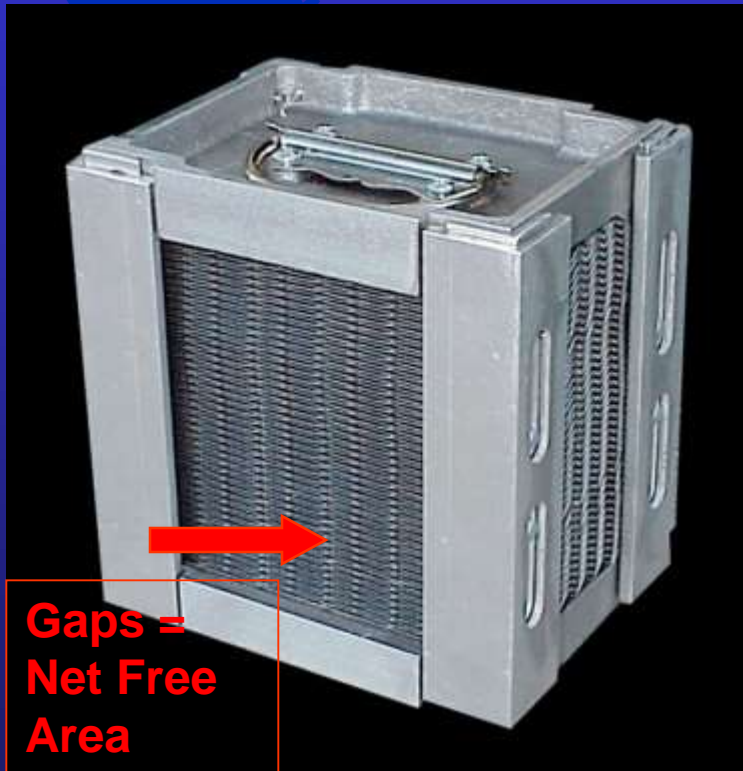
Purpose:

- ❑ Prevents propagation of flame or flame flashback.



5000/5010 Flame Arrester

Operation



- ❖ Work as a heat sink.
- ❖ Dissipate heat through corrugated sheets as well as large surface area.
- ❖ Static, in-line device
 - ❖ Must inspect or undergo routine maintenance to determine if suitable for continued use.
- ❖ Prevent flame propagation in biogas headers.
- ❖ Protect Digesters from flash back.
- ❖ Install within 15' from flame or Oxygen source.

5000/5010 Flame Arrester

Features

- ❖ **Cleaning Procedure:**
 - ❑ Wash bank sheets with a mild solvent.
 - ❑ Rinse sheets with a solvent that does not leave an oily film. This is necessary to avoid collecting foreign matter.
 - ❑ Blow out dry particles with compressed air.
 - ❑ Wash bank sheets with hot water.
 - ❑ Steam bank assembly clean.
 - ❑ Can use spray washing for cleaning.



5000/5010 Flame Arrester

IMPORTANT CONSIDERATIONS:

1. Have spare bank assembly – One per size and type.
2. Horizontal Flame Arresters (5010) –
 - a. Can be installed on vertical or horizontal line.
 - b. Check to make sure that the drain is at the 6 o'clock position.
2. Vertical Flame Arresters (5000)
3. Orient flame arrester so that there is access to the “Removable Cover”.
4. Re-assembly
 - a. Make sure the bank assembly is pushed all the way in.
 - b. Tighten the bolts on the removable cover in a star cross pattern.
5. **DO NOT MATE A FLAT FACE FLANGE TO A RAISED FACE FLANGE** or use proper spacer.

5000/5010 Flame Arrester

Preventative Maintenance



- ❖ Must be maintained because:
 - ❑ Can plug up from debris in gas.
 - ❑ Located in corrosive gas stream.
- ❖ Good Preventative Maintenance saves on equipment and man hours.

5000/5010 Flame Arrester

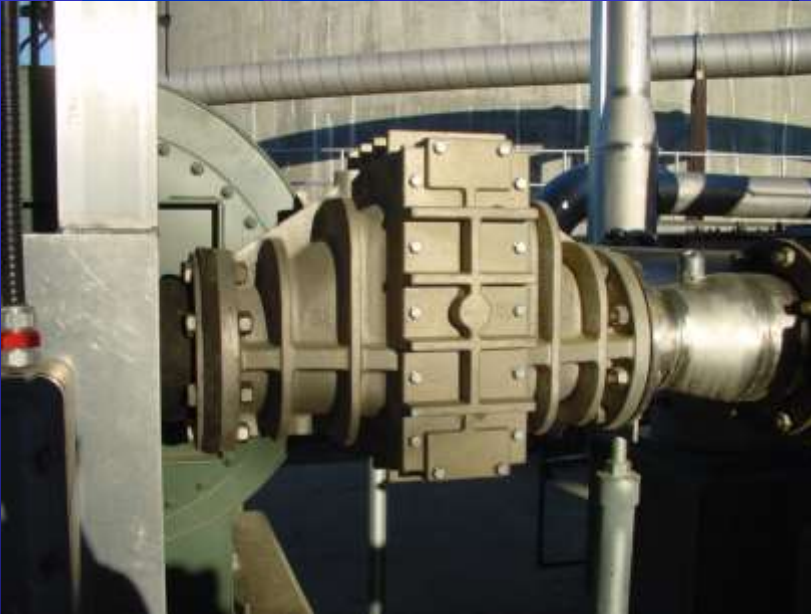
Versus Round Configuration



Core assembly
(sample)

5000/5010 Flame Arrester

Versus Square configuration with Alternating Flat and Crimped Ribbon



5000/5010 Flame Arrester

Alternating flat and crimped plates



Pressure/Vacuum Relief Valve and Flame Arrester with Safety Selector Valve

Typical Installation



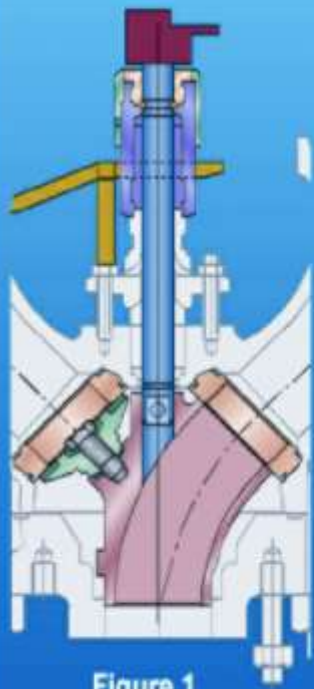
Safety Selector Valve

- Allows for cleaning of one assembly while still protecting digester
- Unique operator design won't stick. Non-lubricating. Teflon seals.
- Easily operated without gears or actuators
- Full port and smooth flow path provides low pressure drop



Safety Selector Valve

OPERATION



220/220W Series Manhole Cover

Uses

- ❑ Light weight, quick-Opening and Gas-tight for easy digester access
- ❑ 1 psig (7 Kpa) Working Pressure Maximum
- ❑ Available sizes:
18", 20", 24", 30", 36", 42", 48"



220W



220

220VP Series View port Inspection Cover

USES

- Easy viewing access of vessel
- 23-3/4" actual viewing area
- Even Load Distribution Design
- Gas-Tight Seal
- Non-Sparking
- Stainless Steel construction
- Weatherhood for glass protection
- Cleaning rod and wiper assembly
- Maximum working pressure up to 1 psig (6.9 kPa)



400W Emergency Pressure and/or Vacuum Relief Manhole Cover



Pressure and Vacuum

USES

- Provide Pressure and/or Vacuum Relief.
- Self-draining
- Hinged pivot design for reseating



Pressure

400W Emergency Pressure/ Vacuum Relief Manways

Installation



Sampling and Gauging Hatch Cover

42 Series

Purpose

- Provide quick access for sludge sampling and temperature measurement.



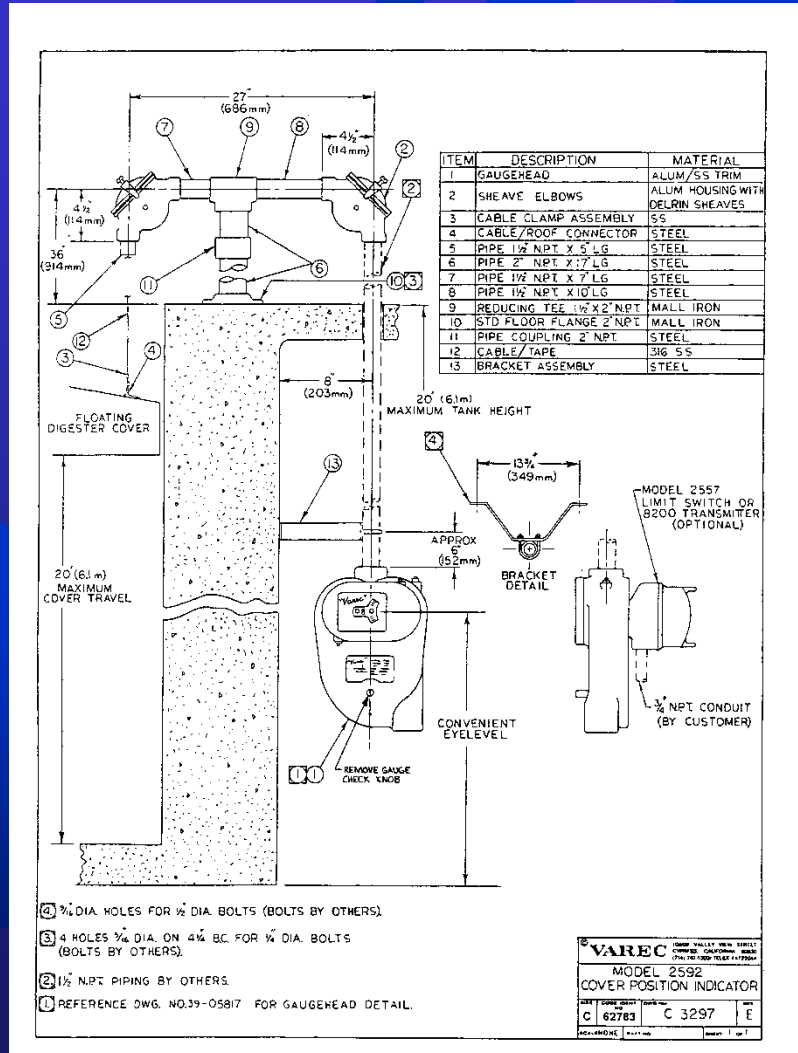
2592 Series Cover Position Indicator

Purpose

- ❑ Measure the cover travel for floating roof Digesters
- ❑ Used on Gas Holders



2592 Series Cover Position Indicator



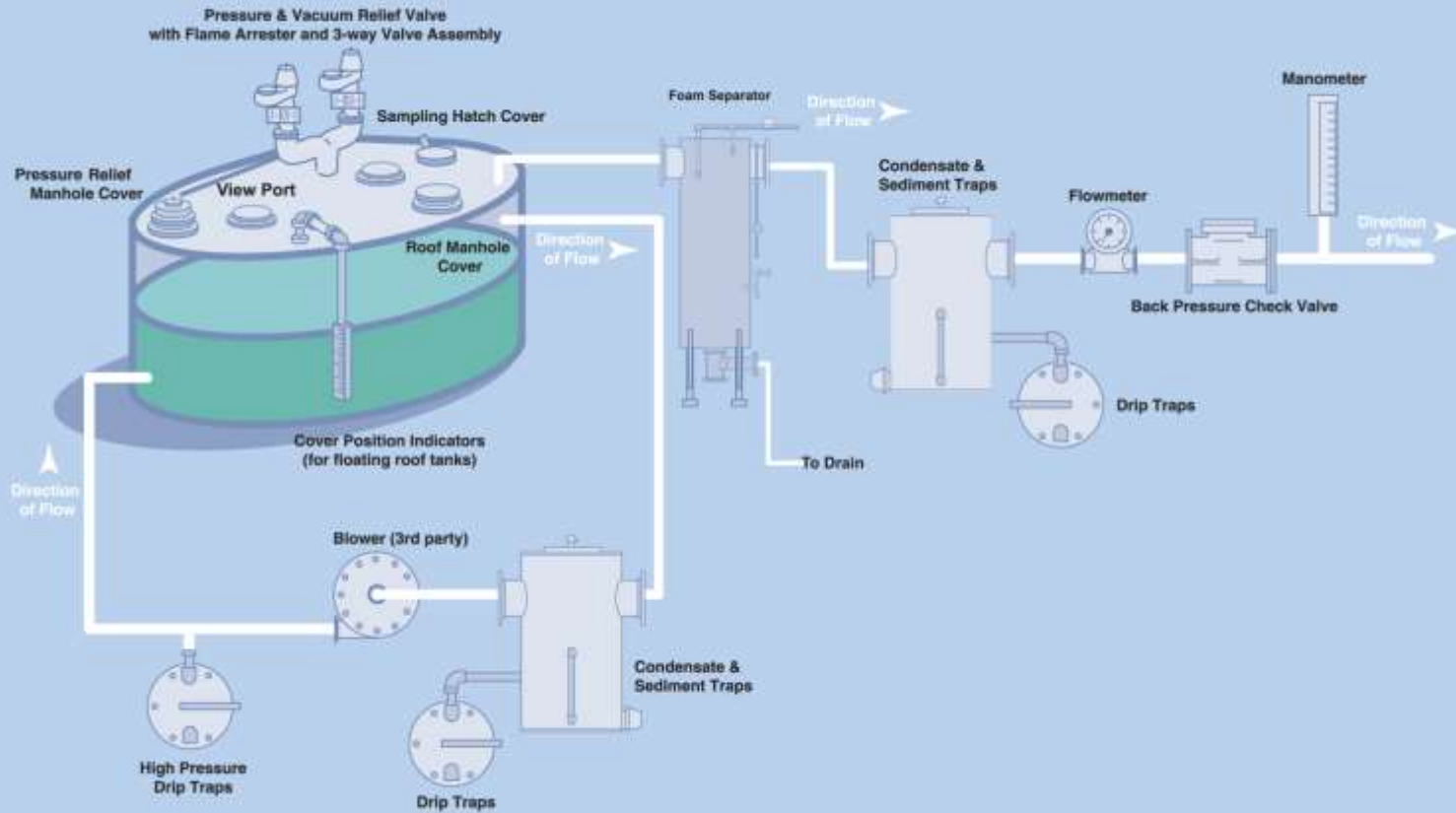
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Biogas Systems – Digester Gas Take-Off Line

Biogas Systems

HINTS

1. Many digesters generate foam which can clog equipment, therefore it is recommended to place a gas/foam separator downstream of your digester.



Note: This schematic diagram is for general guidance only and does not represent a specific design.

231 Series Foam Separator

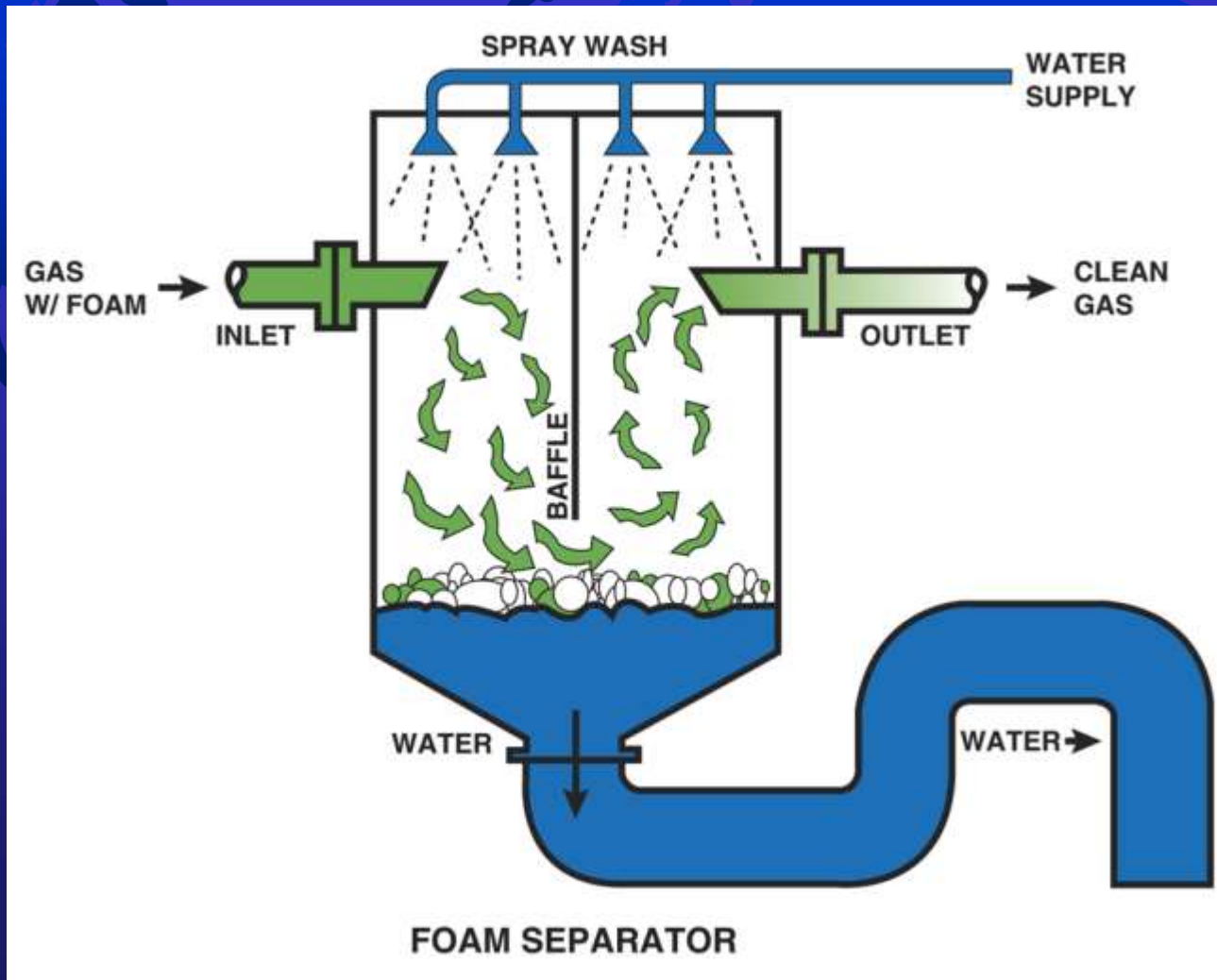
Uses

- ❖ Prevents Digester Generated Foam From Going Into the Gas Line.



231 Series Foam Separator

Operation:



231 Series Foam Separator

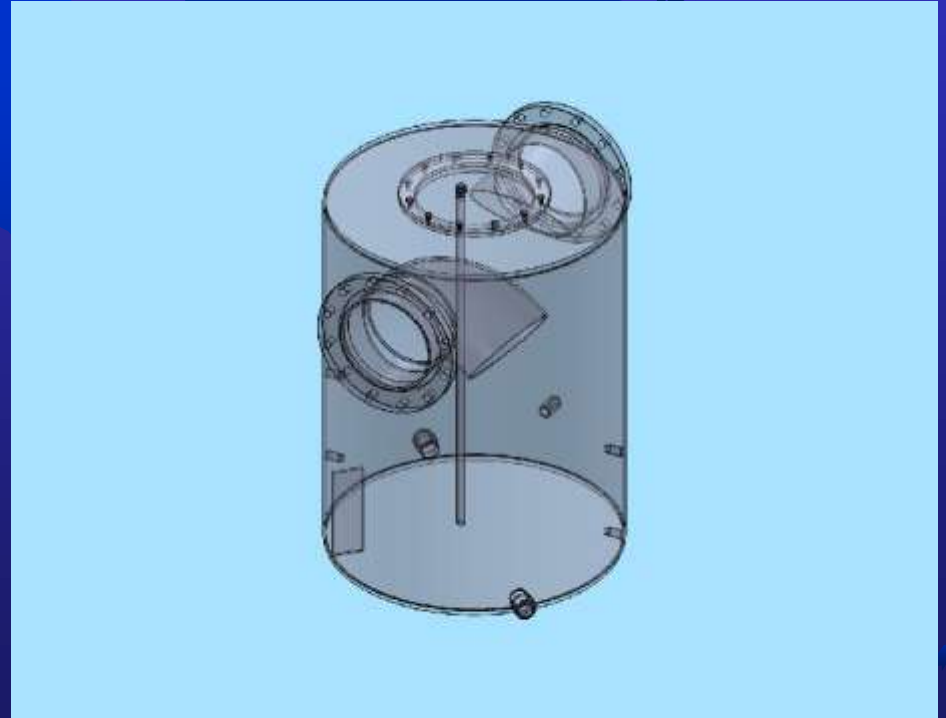
Installation



233 Series Condensate & Sediment Trap

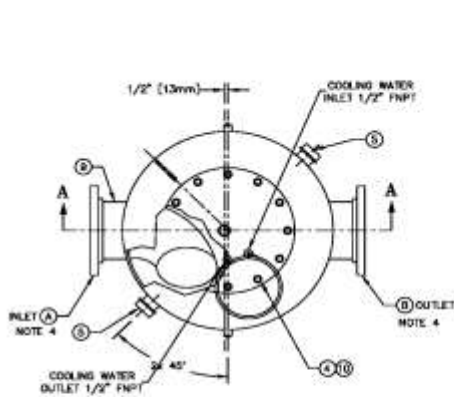
Purpose:

- ❑ Removes Liquids and Solids From Biogas Stream as biogas exits digester.



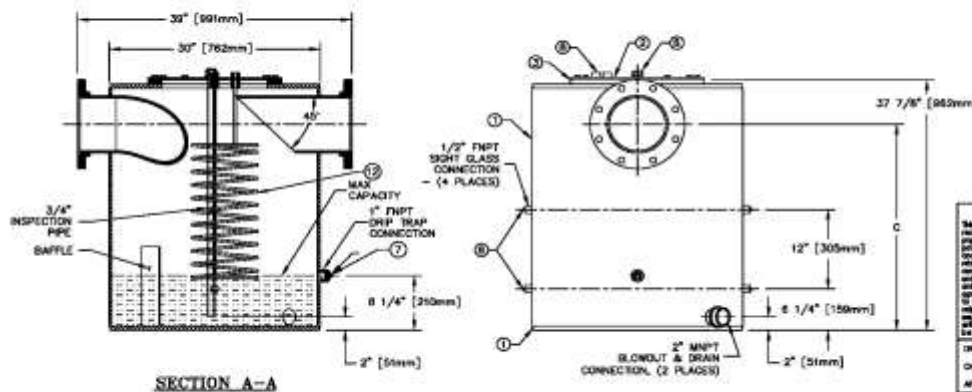
233 Series Condensate & Sediment Trap

Cooling Coil Option - To assist in additional condensate removal with the use of cooling water running through the coil.



- NOTES
1. DIMENSIONS IN [] ARE MILLIMETER EQUIVALENTS.
2. MAXIMUM WORKING PRESSURE: 25 PSIG (172 kPa).
3. FACTORY PRESSURE TEST AT 38 PSIG AIR.
4. 150# ASME FLAT FACE FLANGE DRILLING.
5. OPTIONAL AVAILABLE WITH EPOXY COATED INTERIOR.

| QTY | DESCRIPTION | UNIT | MATERIAL | FINISH | STANDARD |
|-----|-----------------------|------|--------------------------|---------------|----------|
| 1 | BODY ASSY | | CARBON STEEL | GALVANIZED CS | 316SS |
| 2 | COVER ASSY | | CARBON STEEL | GALVANIZED CS | 316SS |
| 3 | GASKET | | | NEOPRENE | |
| 4 | HEX HD CAP SCR | | ZINC PLATED CARBON STEEL | | 316SS |
| 5 | PPFE CAP 2" NPT | | GALVANIZED CARBON STEEL | | 316SS |
| 6 | PPFE CAP 3/4" NPT | | GALVANIZED CARBON STEEL | | 316SS |
| 7 | PPFE PLUG 1" NPT | | CAO PLATED CARBON STEEL | | |
| 8 | PPFE PLUG 1/2" NPT | | CAO PLATED CARBON STEEL | | |
| 9 | NAMEPLATE | | ALUMINUM | | |
| 10 | WASHER | | ZINC PLATED CARBON STEEL | | 316SS |
| 11 | COOLING COIL ASSEMBLY | | | | 316SS |



| SIZE | A | B | UNIT | C | CAPACITY |
|------|-----|-----|------|--------|-------------|
| 8" | 8" | 8" | IN | 31 3/8 | 22 GAL (US) |
| | | | MM | 797 | |
| 10" | 10" | 10" | IN | 30 1/2 | 22 GAL (US) |
| | | | MM | 775 | |

| | |
|---|---|
| MINORITY AGES, FEMA (1991) This drawing is part of information made available to the public under authority of the President John F. Kennedy Assassination Records Collection. It is released in accordance with Executive Order 13526, dated 8/17/2001, and is subject to the provisions of that order. It is not to be disseminated outside the limits of the public release of information. This drawing and all other information contained herein are the property of VAREC BIOGAS and its subsidiaries. No part of this drawing or its contents may be reproduced or transmitted in any form or by any means electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without the written permission of VAREC BIOGAS, Inc. 1-800-4-9200. | CUSTOMER: S/D NO.: P.O. NO.: PROJECT: TAB NO.: |
| DESIGN BY: HIG 07/01/98 CHECKED BY: C. SHER 07/13/99 APPROVED BY: HIG 07/02/99 | DRAWING DATE: 6/19/02 REVISION NOTES: COOLING COIL ADDED |
| VAREC BIOGAS A Division of Westek Industries Inc. 1-800-4-9200 www.varec-biogas.com | TITLE: VAREC 8-10" 233 FLANGED SEDIMENT TRAP w/COOLING COIL - GENERAL LAYOUT DWG. NO. C2556 REV. 1 SCALE: NONE SHEET 1 OF 1 |

233 Series Condensate & Sediment Trap

Installation



245 Series Automatic Drip Trap

Purpose

- ❑ Provides automatic drainage of liquid with the use of a float-operated needle valve.
- ❑ Maximum working pressure of 25 psig (173 kPa).



245 Series Automatic Drip Trap

Rule

When can you use a 245?

1. MOP 8 – permits float operated drip traps outdoors. If installed indoors, recommend installing gas detection units.
2. 10-State Standard (IL, NY, IN, OH, IA, MI, PA, WI, Ontario Canada) – does not allow float operated drip traps.

245 Series Automatic Drip Trap

Installation



246 Series Low Pressure MANUAL Drip Trap

Operation

- ❑ Drain condensate without allowing gas to escape.
- ❑ Open and close handle to drain.

handle



Connect to condensate and sediment trap or low point in gas piping.



Connect to drain.



246 Series Low Pressure Manual Drip Trap

Rule - When can you use a 246?

- 1. Where the operating pressure is less than 5 psig.**
- 2. Can be installed indoors and outdoors.**
- 3. Indoor installation:
NFPA 820 requirement - 10 feet radius**

246 Series Low Pressure Manual Drip Trap

Rule - When can you use a 246?

4. Outdoor installation:

- the line be heat traced and insulated
- Sample Locations:

- 1. Burner Header - Off ½" NPT Drain Connection of Flame arrester portion of Pressure Relief Regulator and Flame Trap Assembly.**
- 2. Gas Purifiers installed outdoors.**

246 Series Low Pressure MANUAL Drip Trap

Installation



246AT Series Low Pressure Automatic Drip Trap

Purpose

- ❑ Automatically provides drainage of liquid in gas via electric actuation.



246AT Series Low Pressure Automatic Drip Trap

Rule - When can you use a 246AT?

1. When the operating pressure is less than 5 psig
2. When the engineer wants automatic drainage and installation site is one of the States comprising 10-State Standard.
3. Same rules apply for indoor and outdoor installation as 246 Series. Indoor installation, actuator and timer in NEMA 7 enclosure is rated for Class 1, Divs. 1 and 2 so NFPA 820, 2008 edition is met.

246AT Series Low Pressure Automatic Drip Trap

Installation



247 Series High Pressure MANUAL Drip Trap

Operation

- ❖ Provides Drainage of Liquid Without Allowing Gas to Escape at operating pressures greater than 5 psig and maximum 100 psig.
- ❖ Body has two valves controlling FILL and DRAIN lines.
- ❖ Interlocking handle.



247D Series High Pressure Low Profile Dual Chamber Drip Trap

Operation

- ❖ Provides Drainage of Liquid Without Allowing Gas to Escape at operating pressures greater than 5 psig and maximum 100 psig.
- ❖ Ideal for booster or compressor skids.
- ❖ Multi-stage compressors - condensate must be drained from two chambers with different pressures.



247 and 247D Series High Pressure Manual Drip Trap

Rule - When can you use a 247 or 247D ?

- 1. When the operating pressure is greater than 5 psig. Maximum rating is 100 psig (688 kPa).**
- 2. Same rules apply for indoor and outdoor installation as 246 Series.**

247AT Series High Pressure AUTOMATIC Drip Trap

Purpose

- ❑ Automatically provides drainage of liquid via interlocked electric actuation.



247AT Series High Pressure Automatic Drip Trap

Rule - When can you use a 247AT?

1. When the operating pressure is greater than 5 psig. Maximum rating is 100 psig (688 kPa).
2. When the engineer wants automatic drainage and installation site is one of the States comprising 10-State Standard.
3. Same rules apply for indoor and outdoor installation as 246 Series. Indoor installation, actuator and timer in NEMA 7 enclosure is rated for Class 1, Divs. 1 and 2 so NFPA 820, 2008 edition is met.

246AT or 247AT Series Drip Trap LOCAL CONTROL PANEL

- Can operate and monitor up to 5 maximum 246AT or 247AT



Drip Trap Control Panels



Installation

- ❖ Automatic operation and monitoring
- ❖ Explosion proof applications
- ❖ Confined space usability
- ❖ Adjustable timers
- ❖ Remote operation
- ❖ Full display available



246AT or 247AT Series Drip Trap LOCAL CONTROL PANEL



Multiple Station

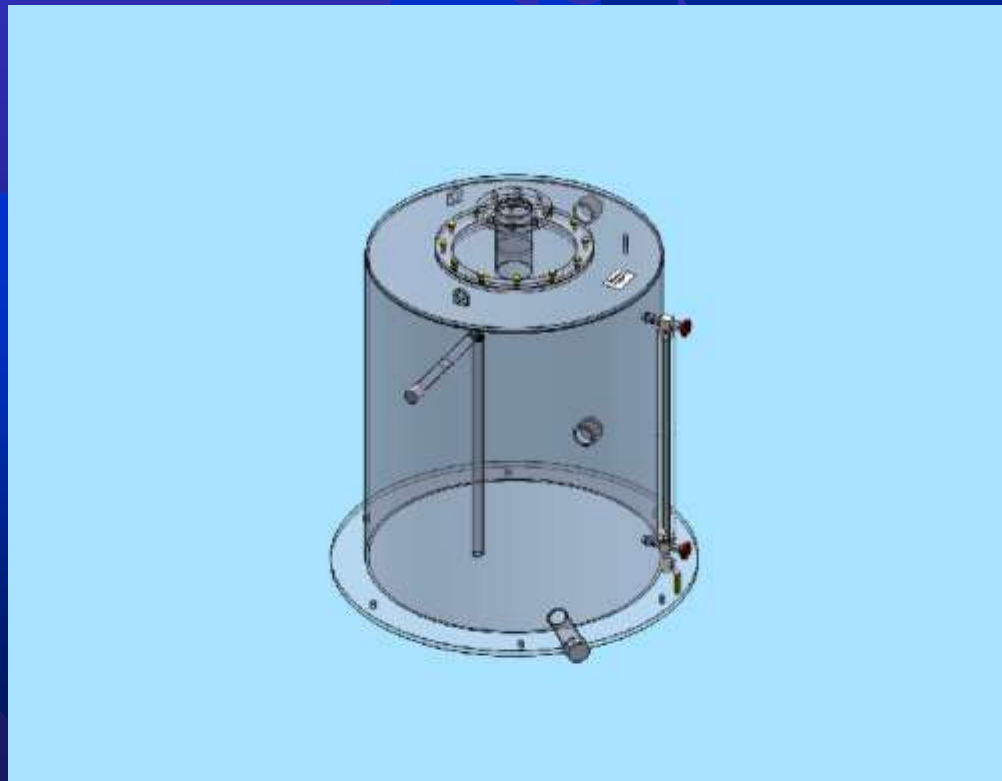


Inside lay-out

248 Series Condensate Accumulator

Purpose

- ❖ Stores large volumes of liquid condensed from Digester Gas
- ❖ Protects piping and equipment from possible damage due to corrosion.



248 Series Condensate Accumulator

Installation



211 Series Check Valve

Purpose

- ❑ Prevents Reversal of Flow



211 Series Check Valve

Installation

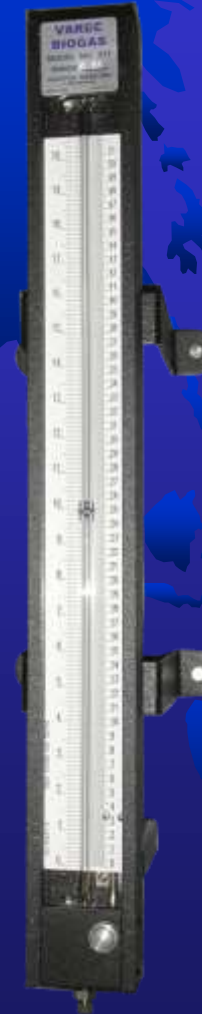
- ❖ Follow flow direction on body when orienting in pipe.
- ❖ Don't install on vertical run.



217 Series Manometers

Operation

- ❑ Measure the Gas System Pressure by direct reading.
- ❑ As Pressure Rises, Fluid Rises in Graduated Tube



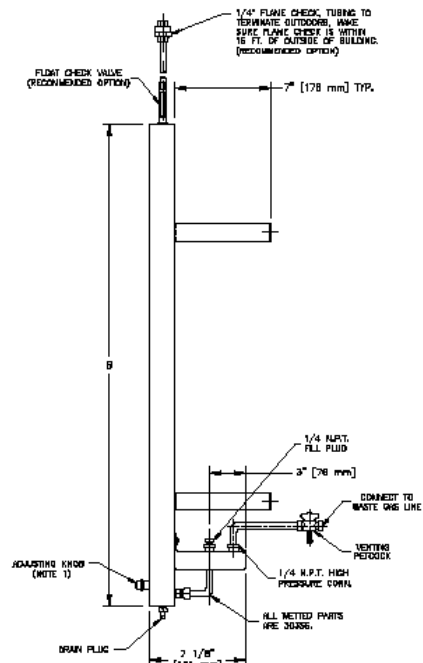
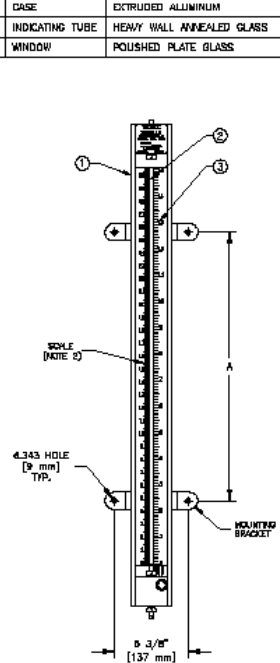
217 Series Manometers

Installation

- NOTES:
1. FRONT-OF-CASE EXTERNAL SCALE ADJUSTMENT.
 2. SCALE GRADUATED IN ENGLISH UNITS AND METRIC UNITS.
 3. CASE FINISH: BLACK CRACKLE.
 4. METRIC DIMENSIONS ARE CONVERTED EQUIVALENTS.

| REVISION RECORD | | | | | |
|-----------------|-------|---|----------|------|--------|
| REV. | EDD | DESCRIPTION | DATE | CHKD | APPVD |
| A | 92101 | PRODUCTION RELEASE | 02/06/19 | J.G. | R.D.S. |
| B | 92170 | REDRAWN FOR MKTD. | | | |
| C | - | MERCURY OPTION REMOVED | 07/03/28 | DAR | |
| D | - | 30" REPLACES 24" MODEL | 06/06/06 | W-H | |
| E | - | EXTRUDED AL. REPLACES RIGID STEEL CHANNEL | 06/06/05 | PW | |

| ITEM | DESCRIPTION | MATERIAL |
|------|-----------------|---------------------------|
| 1 | CASE | EXTRUDED ALUMINUM |
| 2 | INDICATING TUBE | HEAVY WALL ANNEALED GLASS |
| 3 | WINDOW | POUSHED PLATE GLASS |



| SIZE | VAREC PART NO. | | A | B |
|------|----------------|---------|----------|-------|
| 12" | 217121 | ENGLISH | IN 5.50 | 16.75 |
| | 217122 | METRIC | MM [140] | [476] |
| 20" | 217201 | ENGLISH | IN 10.50 | 28.75 |
| | 217202 | METRIC | MM [287] | [879] |
| 30" | 217301 | ENGLISH | IN 20.50 | 38.75 |
| | 217302 | METRIC | MM [521] | [833] |

GENERAL SAFETY INSTRUCTIONS
 This device is used for measuring gas pressure. It is not to be used for measuring liquid pressure. It is not to be used for measuring pressure in a system containing a flammable or explosive gas. It is not to be used for measuring pressure in a system containing a toxic or corrosive gas. It is not to be used for measuring pressure in a system containing a gas at a pressure higher than the maximum rated pressure. It is not to be used for measuring pressure in a system containing a gas at a pressure lower than the minimum rated pressure. It is not to be used for measuring pressure in a system containing a gas at a pressure higher than the maximum rated pressure. It is not to be used for measuring pressure in a system containing a gas at a pressure lower than the minimum rated pressure.

CONTAINER PRESSURE CHECKS
 S.O.S. ME. -
 P.S. ME. -
 PRESSION -
 24 ME. -

WARNING DATA
 REASON NOTICE -

DATE
 05/06/19

APPROVED BY
 P. L. BETH 05/06/19

TITLED
 MODEL 217
 INSTALLATION RECOMMENDATION

VAREC BIOGAS
 A Division of Inland Industrial Inc.
 Toll Free: 1-800-4-EDGAR
 Fax: (408)263-8801
 www.varec-biogaz.com

DATE
 05/06/19

REV
 E

219 U-tube Series Manometers

Operation

- ❑ Measure the Gas System Pressure, vacuum or differential pressure reading.
- ❑ Height of the fluid is the pressure in the system.



A stylized world map in shades of blue and green, centered on the Atlantic Ocean, serving as a background for the title.

Gas Utilization Train

7100B Series Pressure (Explosion) Relief Valve

Operation

- ❖ weight loaded pallet lifts upon rising pressure, relieving excess pressure to atmosphere.
- ❖ Installed on boiler/heat exchanger headers.



- ✓ Relieves overpressure on line caused by flame flashback.
- ✓ Prevents explosion/detonation.

7100B Series Pressure (Explosion) Relief Valve

Installation



Terminate outside of a building off the main gas line. Should install with isolation valve.

180 Series Double Port Regulator

Operation:

- ❑ Controls upstream (180/186) or downstream (181/187) pressure.
- ❑ Constantly throttling to maintain set pressure.



180 Series Double Port Regulator

Installation

- ❖ Don't install on vertical run.
- ❖ Sense line – 10 feet upstream or downstream of valve (minimum). If not, see next slide.
- ❖ Install so there is access to diaphragm and weights.

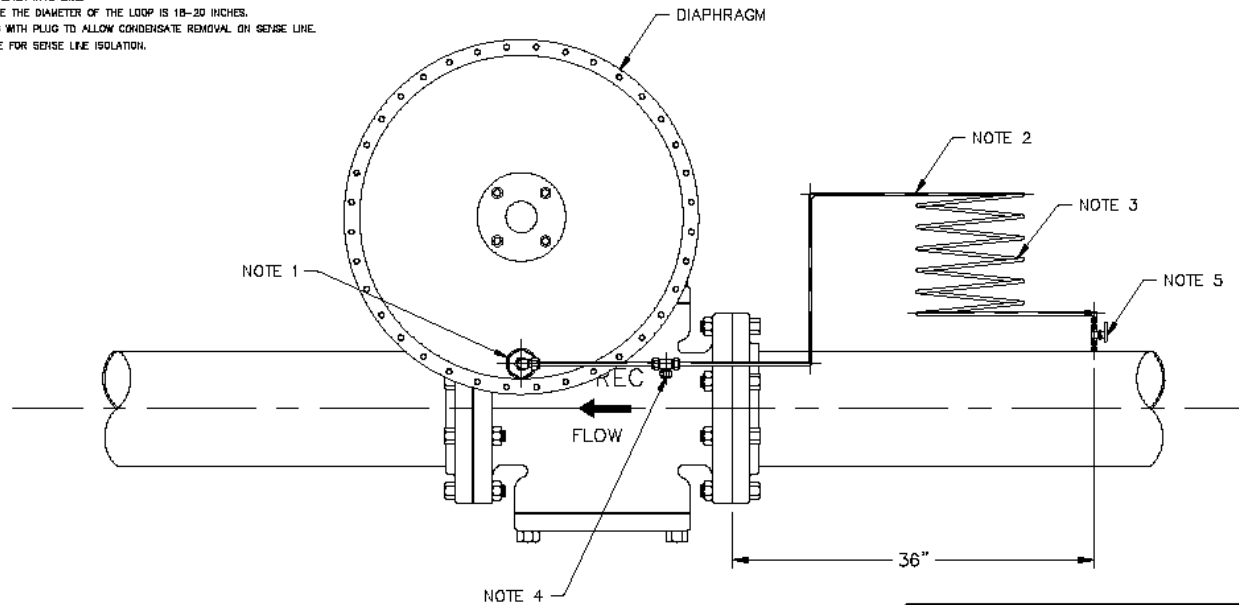


180 Series Double Port Regulator

Installation

NOTES:

1. PRESSURE SENSE TAP IS 1" NPT AT THE TOP PORTION OF THE DIAPHRAGM. BOTTOM PORTION OF DIAPHRAGM (CLOSEST TO VALVE BODY) IS A 2" DRAIN SO DO NOT CONNECT ANY TUBING HERE.
2. TAKE ABOUT 12-15 FEET OF TUBING AND COIL IT. MAKE SURE YOU MAKE ALLOWANCE FOR CONDENSATE TO DRAIN BACK INTO LINE.
3. WHEN COILING, MAKE SURE THE DIAMETER OF THE LOOP IS 18-20 INCHES.
4. INSTALL A 1" TEE FITTING WITH PLUG TO ALLOW CONDENSATE REMOVAL ON SENSE LINE.
5. INSTALL A 1" PLUG VALVE FOR SENSE LINE ISOLATION.

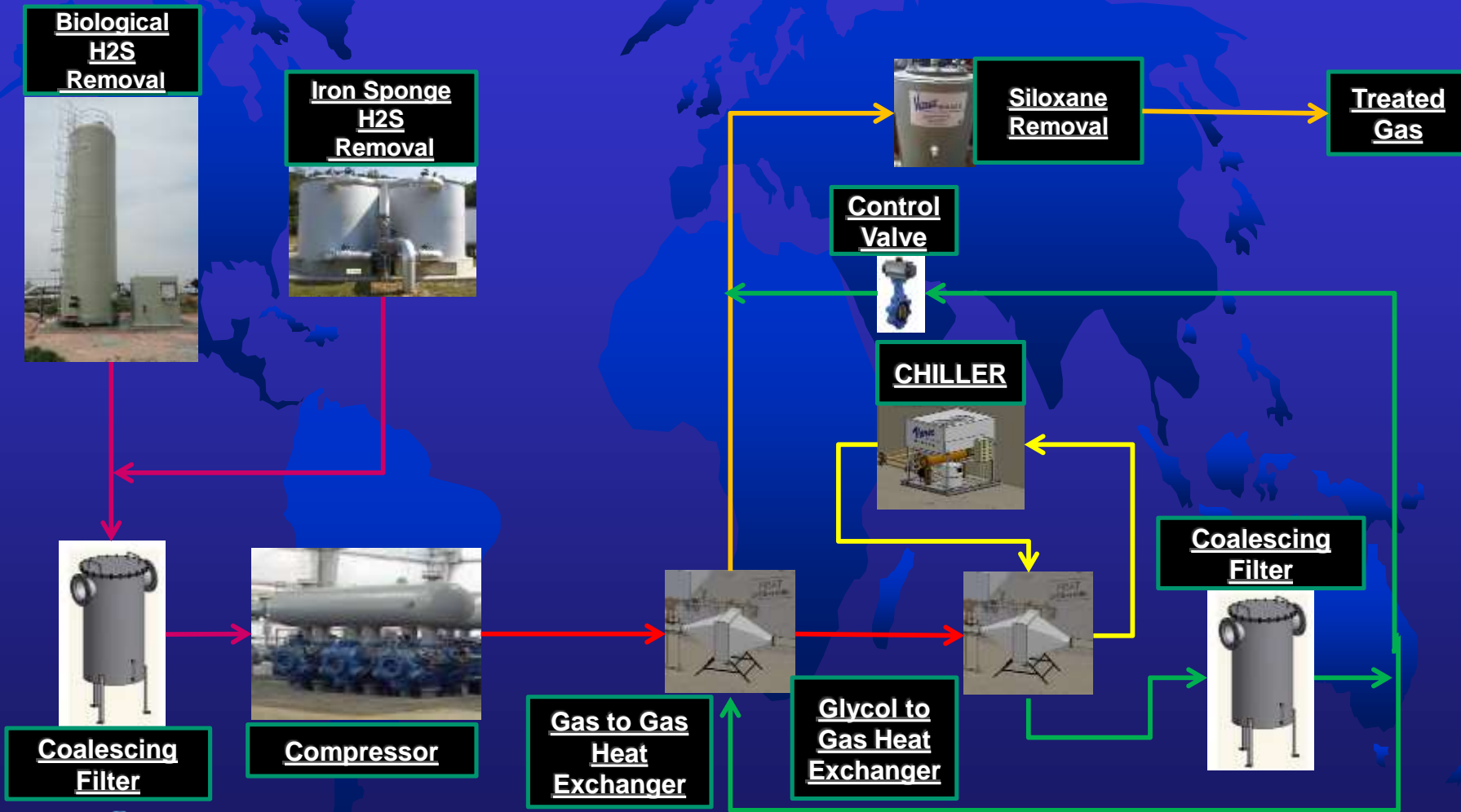


| | | |
|--|---|--|
| <p>UNSWERABLE LIABILITY - BIDDING FIRM:</p> <p>This drawing is part of information made available to facilitate under-subject work of construction on a proprietary design owned by VAREC BIOGAS and all associated product, design, manufacturing, reproduction, use and other data rights including the same are expressly retained by VAREC BIOGAS. This drawing contains VAREC BIOGAS confidential information and is approved by VAREC BIOGAS under a confidential relationship for an agreed system, and by accepting or making this drawing, the recipient agrees to maintain the drawing in strict confidence, not to apply or disclose this drawing to any employee or contractor and is not authorized by VAREC BIOGAS to make any alterations. This drawing and its copies shall be returned to VAREC BIOGAS on request.</p> | | <p>CUSTOMER: -</p> <p>S/D NO.: -</p> <p>P.D. NO.: -</p> <p>PROJECT: -</p> <p>TAC INCL: -</p> |
| <p>DRAWN BY: D. MILTON 11/04/04</p> <p>CHECKED BY: -</p> <p>APPROVED BY: -</p> | <p>DRAWING DATE: C. MILTON 11/04/04</p> <p>REVISION NOTES: ORIGINAL</p> | |
| <p>VAREC BIOGAS A Division of Westech Industrial Inc. Toll Free: 1-888-4-BIOGAS Fax: (403)253-6803 www.varec-biogas.com</p> | | <p>TITLE:</p> <p style="text-align: center;">187 INSTALLATION RECOMMENDATION</p> |
| <p>DWG. NO. 187 INSTALLATION RECOMMENDATION</p> | | <p>REV. A</p> |
| <p>SCALE: NONE</p> | | <p>SHEET 1 OF 1</p> |

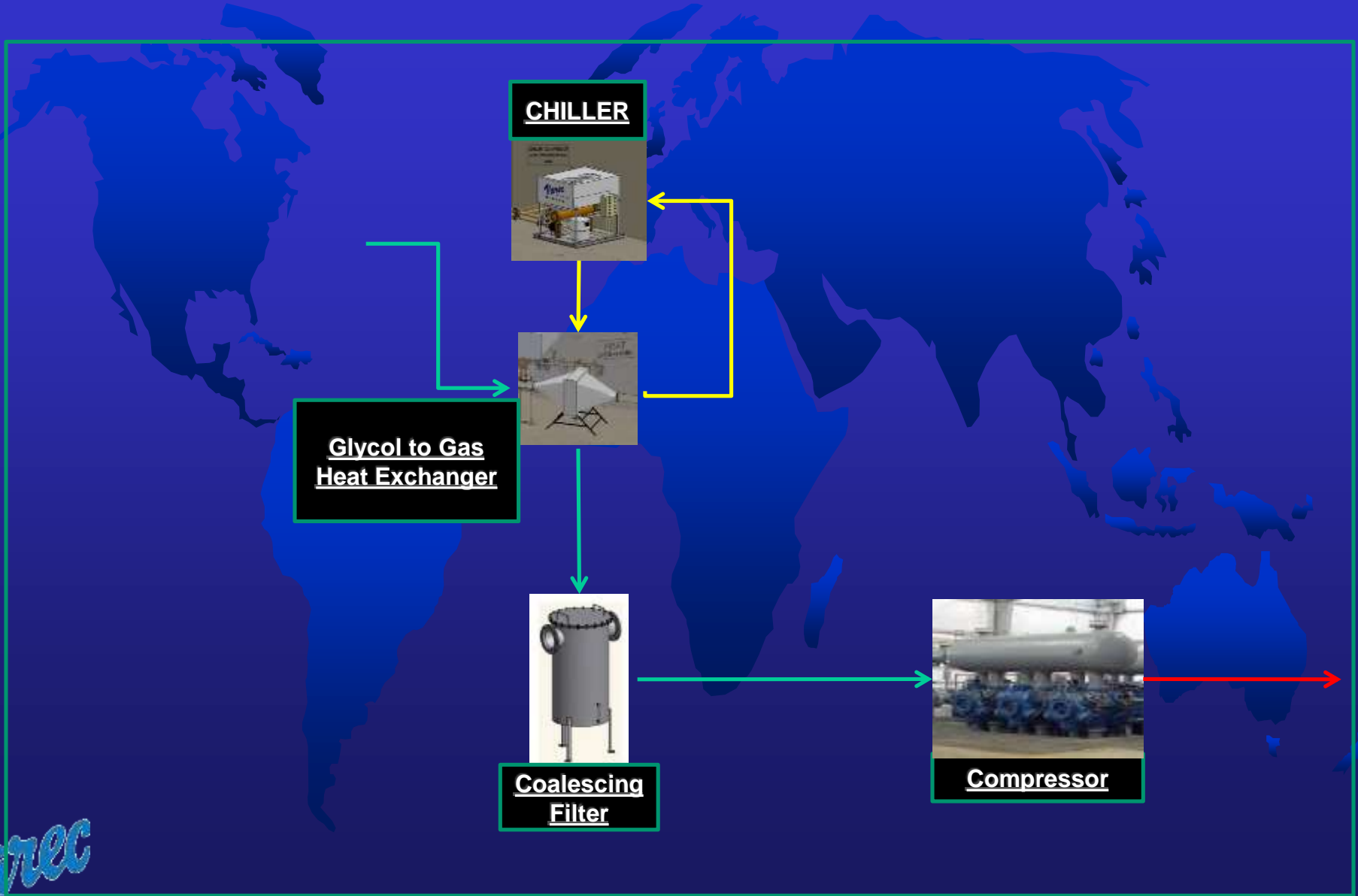
A dark blue world map is centered in the background of the slide. The continents are rendered in a slightly lighter shade of blue, creating a subtle silhouette effect against the darker background.

Gas Conditioning System

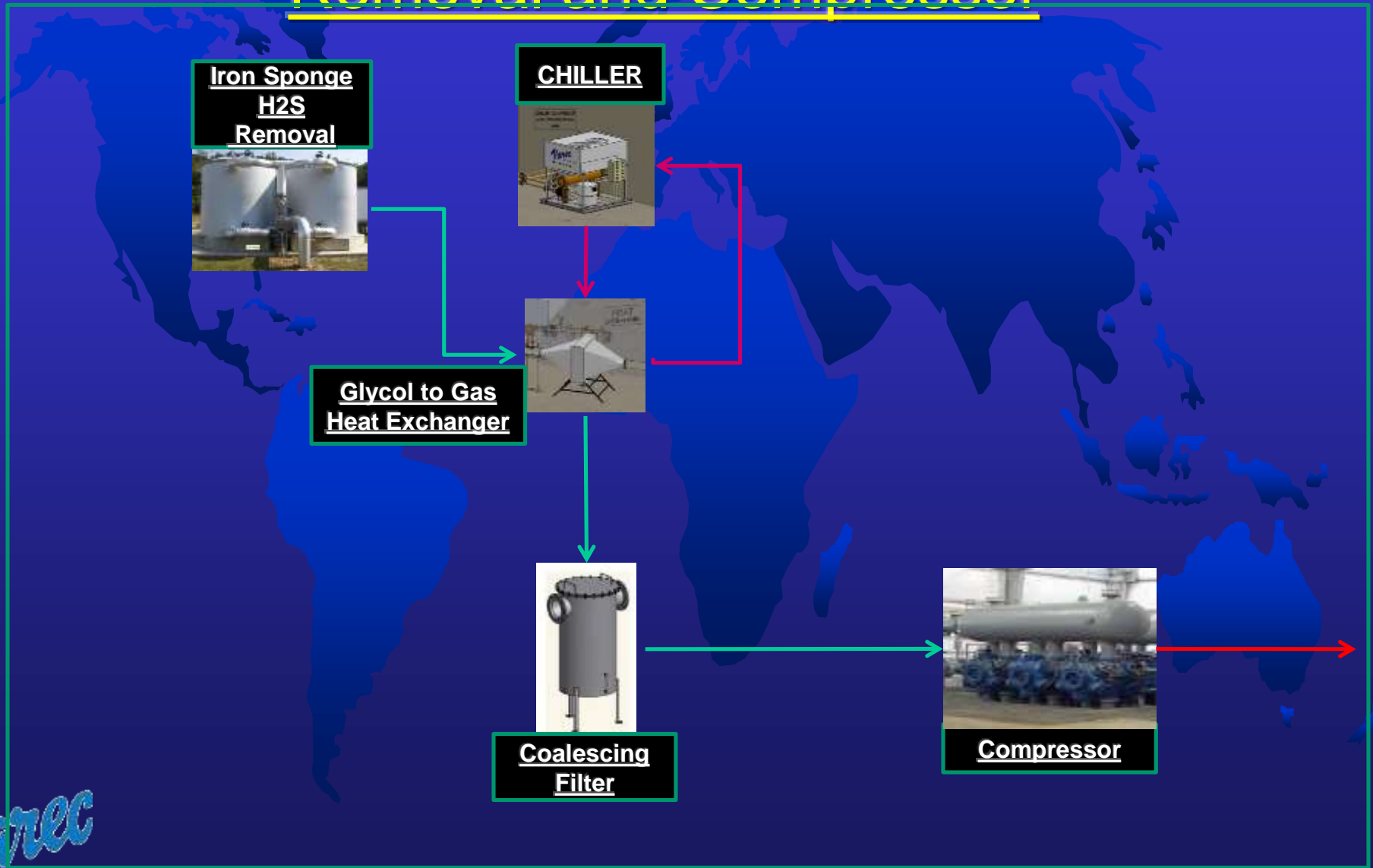
Complete System



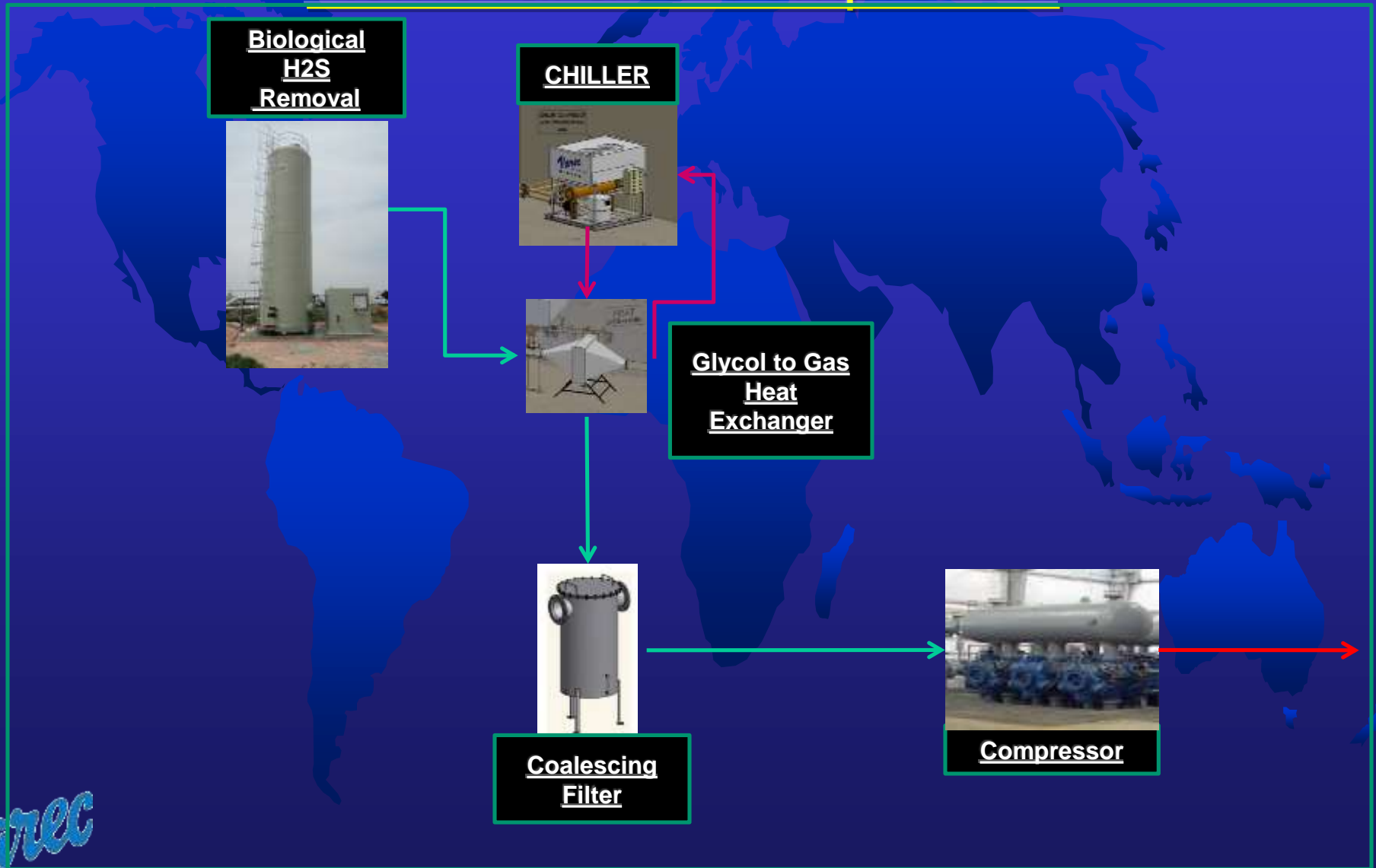
Moisture Removal and Compressor Only



Moisture Removal with Iron Sponge H₂S Removal and Compressor



Moisture Removal with Biological H₂S Removal and Compressor



Hydrogen Sulfide Removal – Iron Sponge Media



→ Model 235 Gas Purifier – Steel or SS construction



Model 236 Gas Purifier –
Fiberglass construction

Gas Purifier

Principle

H₂S removal from biogas using iron sponge



Iron sponge regenerated:



Gas Purifier

Sizing Criteria

Sizing dependent on the following parameters:

- Inlet Flow Rate
- Inlet and Outlet Pressure
- Inlet H₂S Concentration
- Expected H₂S outlet concentration

Model 235 Gas Purifier

Epoxy Coated Carbon Steel or optional
Stainless Steel



Model 236 Gas Purifier



Model 236 Gas Purifier –
Fiberglass construction

Model 236 Purifier

FIBERGLASS CONSTRUCTION

- ✓ Lightweight
- ✓ High Grade
- ✓ Spark-Resistant
- ✓ NFPA 820 Fire Retardant

Corrosion Resistant

1. Factor of 4 or more compared to Epoxy Coated Steel
2. Hetrion 992 – ASTM E84, Class 1 Flame spread Rating of 25 or less

Cylindrical design

1. Allows for proper gas distribution
2. Avoid gas channeling
3. No. of vessels still depend on Inlet H₂S concentration and flow rate, but:
 - ✓ Smaller footprint dimension
 - ✓ Maintain cost effectiveness

Model 235/236 – Continuous Regeneration Kit



Media Removal System



Installation

- Nets are properly labeled. “TOP”, MIDDLE (if applicable) and BOTTOM.
- Drape straps on vessel side.
- Separate iron sponge from vessel wall



Media Removal System



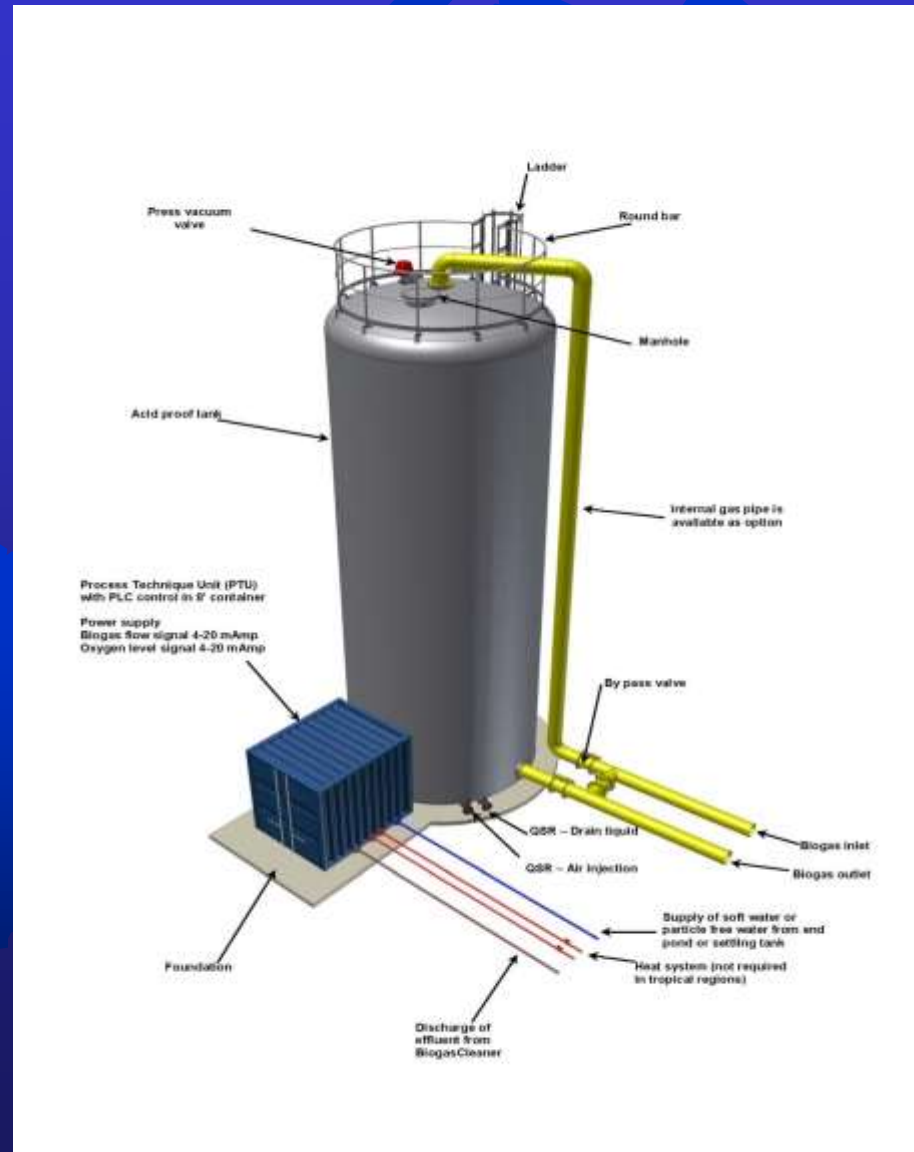
Removal

- Lift strap vertically upward.
- Repeat each step for remaining MIDDLE and BOTTOM straps.



- Lay spent iron sponge on ground in cloth.
- Pull straps off the side for re-use.
- Use vacuum truck to remove residual iron sponge off vessel.

Hydrogen Sulfide Removal – Biological Media



Model 237 Gas Chilling and Drying System



Coalescing Filter
removes liquids and
particulates

Model 237 Gas Chilling and Drying System

Chiller and Heat Exchanger drop dew point of the gas



Model 237 Gas Chilling and Drying System



Chiller drop dew point of the gas

Compressor heats gas providing dew point barrier