California Environmental Protection Agency

Air Resources Board

DRAFT TEST PROTOCOL

Detection and Quantification of Fugitive and Vented Methane, Carbon Dioxide, and Volatile Organic Compounds from Crude Oil and Natural Gas Facilities

Prepared By:
Strategy Evaluation Section
Measures Assessment Branch
Stationary Source Division
California Air Resources Board

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Draft Test Protocol

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1. PURPOSE AND APPLICABILITY

The purpose of this protocol is to detect and quantify flow rates of methane, carbon dioxide, and Volatile Organic Compounds (VOCs) from fugitive and vented sources. This protocol is applicable for detecting and quantifying flow rates of methane, carbon dioxide, and VOCs in all cases where crude oil or natural gas is produced, processed, transmitted, or distributed from onshore and offshore crude oil and natural gas facilities.

2. PRINCIPLE AND SUMMARY OF TEST PROTOCOL

This protocol is designed to detect and quantify flow rates of fugitive or vented methane, carbon dioxide, and VOCs (gases) with the use of various instruments and procedures. The instruments described in this protocol are used in conjunction with a gas analysis to quantify emission rates. The first instrument is a screening device used to locate the presence of fugitive or vented methane. These instruments are used to screen large areas or multiple types of equipment from a distance. The second instrument is a detection device or procedure to identify a specific leak source. The third instrument, or a bagging procedure, is used to quantify the flow rate from a particular source.

First, the testing technician scans a particular area with a screening instrument or a detection device while performing a component count of all components scanned. If the presence of a leak is detected, the technician uses a detection device or procedure to identify the particular source. Finally, the technician quantifies the gaseous flow rate and determines the methane, carbon dioxide, and VOC emission rates using the results of a gas analysis.

This protocol does not preclude the use of a single instrument that can perform all required measurements, nor does this protocol preclude the use of multiple instruments or procedures to quantify gaseous flow rates. In most cases, the sampling technician is required to use a variety of instruments and procedures listed in this protocol to detect and quantify both fugitive and vented flow rates.

3. DEFINITIONS

For the purpose of this protocol, the following terms apply:

Anti-Static Bag refers to a bag made of anti-static material used for isolating a fugitive or vented leak source, and which does not pose a threat of creating an explosive environment or condition.

Bagging refers to the isolation of a specific component or location to determine a fugitive or vented gaseous flow rate. Two different bagging procedures available as specified in Section 8.

Calibrated Anti-Static Bag refers to an anti-static bag calibrated to a specific volume and used to estimate flow rate.

Detection Device refers to a device used to identify a specific fugitive or vented leak source.

Fugitive refers to the unintentional release of gas from processes or equipment such as valves, flanges or fittings to ambient air.

Flow Rate Device refers to a device used to measure flow rates (0 to 8 standard cubic feet per minute) from a fugitive or vented leak source.

Offshore Crude Oil and Natural Gas Facilities means any platform structure, affixed temporarily or permanently to offshore submerged lands, that houses equipment to extract hydrocarbon liquid or vapor from wells on the ocean or lake floor and transfer such hydrocarbons to storage, transport vessels, or onshore facilities. In addition, offshore production includes secondary platform structures and storage tanks associated with the platform structure.

Onshore Crude Oil and Natural Gas Facilities means any structure affixed temporarily or permanently to land that houses equipment to extract hydrocarbon liquid or vapor from wells, gravity separation equipment, and storage tanks, used in the production, extraction, recovery, stabilization, separation, or treatment of hydrocarbon liquid or gas. This includes petroleum and natural gas production facilities located on islands, artificial islands or structures connected by a causeway to land, an island, or artificial island.

Screening Device refers to a device used to screen a wide area and detect the presence of fugitive or vented methane.

Total Organic Gases refers to gaseous organic compounds, including reactive organic gases and the relatively un-reactive organic gases such as methane. A laboratory report that measures total organic gases will include VOCs of the C2+ category.

Venting refers to the intentional release of gas from equipment or operation processes to ambient air.

4. BIASES AND INTERFERENCES

4.1 Some components must be isolated in order to accommodate the effects of wind or to measure flow rates from large or irregular shaped sources. Components that are not adequately isolated may produce inaccurate results.

4.2 The detection device must have an appropriate range to detect methane. A detection device that cannot detect the range of leaks identified in this protocol may produce inaccurate results.

4.3 The device used to measure flow rate must be appropriately sized for a particular leak source. Flow rate devices that are not appropriately sized for a particular flow rate will produce inaccurate results.

4.4 Instruments that are not calibrated according to the manufacturer's specifications may produce inaccurate readings. All instruments must be calibrated according to the manufacturer's specifications at the recommended calibration intervals.

5. DETECTION LIMIT AND RANGE

5.1 The detection limit of a screening or detection device shall be at least 100 parts per million (ppm), calibrated as methane. The range of the device shall be at least 100 to 10,000 ppm, calibrated as methane.

5.2 The detection limit of a flow rate device shall be at least 0.5 standard cubic feet per minute (scfm), calibrated as methane. The range of a flow rate device shall be at least 0.5 to 8.0 scfm.

5.3 For screening instruments, the *maximum allowable distance* from a leak source shall be as follows:

Infrared Instrument:	30 meters
Thermal Imaging Camera:	12 meters at 100mm focal length

5.4 A temperature measurement device capable of reading temperature to within +/- 2^{o}F and range of at least 32 to 200^{o}F.

5.5 An ambient pressure measurement device with minimum accuracy of 0.04 pounds per square inch (psi) (0.08 inches mercury or 2.8 millibar).

6. GAS ANALYSIS

A laboratory report that lists the total organic gases found in the measured gas stream is required for this test protocol. Some facilities may use real-time monitoring equipment or routinely conduct a gas analysis. A copy of an analysis conducted by the facility is acceptable, provided the analysis includes the total organic gases. In cases where a gas analysis is not available, samples may be gathered using equipment and procedures described in United States Environmental Protection Agency *Method 21, Determination of Volatile Organic Compound Leaks* 40 CFR Part 60 (February 2000) and evaluated in a laboratory for total organic gases and their respective percent concentrations.

7. EQUIPMENT

The following list of equipment specifies the minimum equipment needed to detect and quantify methane flow rate. Additional equipment may be used provided it meets minimum parameters specified in Section 5.

7.1 All instruments used to detect and quantify fugitive or vented gases must be intrinsically safe as defined by applicable California or US standards for operation in any explosive atmosphere that may be encountered in its use. Instruments that are operated in explosive environments shall, at a minimum, be intrinsically safe for Class 1, Division 1 conditions as defined by the US Department of Labor (29 CFR 1910.300 *et. seq*.) All instruments that are not certified as intrinsically safe can only be operated in or at locations that are not considered to be within an explosive environment as determined by the facility operator.

7.2 Screening and detection devices capable of achieving the minimum detection limit and range specified in Section 5.

7.3 A flow rate device capable of achieving the minimum detection limit, range, and distance as specified in Section 5.

7.4 A temperature measurement device capable of achieving the minimum detection limit and range as specified in Section 5.

7.5 A barometric pressure measurement device capable of achieving the minimum detection limit and range as specified in Section 5.

7.6 An Anti-Static Bag used for enclosing or wrapping a leak source and making flow rate measurements.

7.7 A Calibrated Anti-Static Bag calibrated to a specific volume used for measuring flow rate in terms of time.

7.8 Calibration Gas as specified by the instrument manufacturer to calibrate a screening, detection, or flow rate device.

8. PRE-TEST PROTOCOL

8.1 Pre-calibrate or verify all instruments per the manufacturer's instructions prior to conducting field measurements. All instruments must be calibrated or verified at the beginning and end of each test day. Discrepancies greater than 5% between the two calibration or verification readings will invalidate all collected data.

8.2 Warm up all instruments per the manufacturer's instructions. All instruments must be started in an environment that is free from fugitive or vented gases to allow instruments to perform self-diagnostic checks.

9. TEST PROTOCOL

9.1 SCREENING, COMPONENT COUNTING, AND LEAK IDENTIFICATION

(a) ***Screening.*** Use a device with minimum specifications listed in Section 5 to scan a wide area looking for the presence of methane. This will include moving the instrument slowly across numerous components while looking for a response from the instrument. In some cases, a response may require the operator to screen backwards (back-track) due to a delay in instrument readings. In some cases, a screening instrument may not be applicable (e.g., in areas of high wind or inappropriate background).

(b) ***Component Counting.*** Each component screened must be counted. The purpose of component counting is to proportionately quantify the total number of components counted with leaks identified. Section 13 contains definitions of common components that must be quantified on Form 1. The technician performing this procedure must use best judgment when categorizing components due to the large variety of components and configurations that exist. Separate data sheets are required in order to gather relevant equipment information for Centrifugal Compressors, Reciprocating or Rotary Compressors, and Natural Gas Dehydrators.

(c) ***Leak Identification.*** Once a leak has been identified, identify the specific leak source using a detection instrument or the Alternative Leak Detection Procedure listed in Section 9.1 (e). The purpose of leak identification is to identify a specific leak source prior to measuring flow rate. Care must be taken to ensure that all sources are identified, as a single component may have multiple leak sources.

(e) ***Alternative Leak Identification (Water-Soap Solution).*** An alternative procedure based on the formation of bubbles in a water-soap solution may be used provided the solution is approved by the facility operator. Care must be taken to ensure the solution is not corrosive to some materials.

The water-soap solution may only be used for sources that do not have continuously moving parts or surface temperatures that are greater than the boiling point or less than the freezing point of water, that do not have open areas the solution cannot bridge, and that do not exhibit evidence of liquid leakage. Spray the solution on the potential leak source and look for the formation of bubbles within 10 seconds to identify a leak path.

9.2 FLOW RATE QUANTIFICATION

(a) The purpose of flow rate quantification is to determine the flow rate at which gas is escaping from a fugitive or vented leak source. This measurement is combined with the estimated number of days leaking to determine the quantity of emissions over time.

(b) Obtain a gas analysis that includes total organic gases and their respective percent concentrations and attach a copy of the analysis to Form 1.

(c) Once a leak is identified, use a flow rate device that meets or exceeds the minimum specifications listed in Section 5 to measure the leak flow rate.

(d) If a component requires isolation in order to obtain an accurate measurement, use a flow rate device in conjunction with the bagging procedure specified in 9.3 (a), or use the timed bagging procedure specified in 9.3 (b).

(e) If the flow rate exceeds the range of the flow rate device, use the timed bagging procedure specified in 9.3 (b).

9.3 BAGGING PROCEDURES

(a) ***Slip-Fit Bagging.*** Slip-Fit Bagging refers to loosely covering a component or leak source with anti-static material to divert the flow of gas in to a flow rate device that uses a vacuum pump as a means of measuring flow rate. The purpose of slip-fit bagging is only to divert the flow of gas to the instrument. The component should not be completely sealed with bagging material or this will prevent the instrument from drawing in surrounding ambient air.

(b) ***Timed Bagging.*** Timed Bagging refers to measuring the time it takes to fully inflate a calibrated bag made of anti-static material. This procedure does not use a flow rate device, but does require gas temperature and ambient pressure measurements. To conduct the procedure, roll-up the calibrated bag from the bottom to completely evacuate all air or gas. Cover 100% of the leak source and use a stopwatch to measure the amount of time it takes for the bag to fully inflate. Repeat this procedure at least 3 times and report the average flow rate on Form 1.

The temperature of the gas stream and ambient pressure must be measured. Measure the temperature of the gas stream just upstream of where the calibrated bag was installed to take measurements. Correct the flow rate and calculate results as described in Section 10.

10. CALCULATING RESULTS

The following calculations are performed using the field results and gas analysis to calculate the emission rates of CH_4, CO_2, and VOCs (C2 through C20).

10.1 Flow Rate. Calculate the standard cubic feet per day CH_4, CO_2, and VOC flow rates using the field results and gas analysis. If the gas flow rate was not measured in standard cubic feet per minute (scfm), convert the flow rate to standard conditions using Equation 4.

$$Q_{\text{CH4, CO2, VOC}_{\text{Day}}} = (Q_{\text{Gas}})(P_{\text{CH4, CO2, VOC}})(1440)$$ **Equation 1**

Where:
$Q_{\text{CH4, CO2, VOC Day}}$ = flow rate of compound (cubic feet/day)
Q_{Gas} = flow rate of gas from field results (scfm)
$P_{\text{CH4, CO2, VOC}}$ = percentage of compound from gas analysis
1440 = number of minutes per day

10.2 Emission Rate. Calculate the CH_4, CO_2, and VOC emission rates per day using the results of Equation 1 and the standard compound densities listed in Table 10 below.

$$E_{\text{CH4, CO2, VOC}} = (Q_{\text{CH4, CO2, VOC}})(Density_{\text{CH4, CO2, VOC}})$$ **Equation 2**

Where:
$E_{\text{CH4, CO2, VOC}}$ = emission rate of compound (pounds/day)
$Q_{\text{CH4, CO2, VOC}}$ = flow rate of compound from Equation 1 (cubic feet/day)
$\text{Density}_{\text{CH4, CO2, VOC}}$ = density of the compound (pounds/cubic feet)

10.3 Timed Bagging and SCFM Flow Rate Conversion. Calculate the flow rate of the timed bagging procedure using Equation 3 as follows:

$$Q_{Gas} = \left(\frac{Volume}{Time}\right)(60)$$ **Equation 3**

Where:
Q_{Gas} = flow rate of gas (cfm)
Volume = the volume of the calibrated bag (cubic feet)
Time = the time to fully inflate the bag measured in (seconds)
60 = number of seconds per minute

Correct the flow rate to Standard Temperature and Pressure of 68^{o}F and 14.969 psi using the measured gas temperature and ambient pressure with Equation 4 as shown. Use the result with Equations 1 and 2 to calculate the CH_4, CO_2, and VOC emission rates.

$$Q_{Gas_{SCFM}} = Q_{Gas}\left(\frac{T_{STP}}{T_{Actual}}\right)\left(\frac{P_{Actual}}{P_{STP}}\right)$$ **Equation 4**

Where:
$Q_{Gas\ SCFM}$ = standard cubic feet per minute flow rate (scfm)
Q_{Gas} = measured cubic feet per minute flow rate (cfm)
T_{Actual} = measured gas temperature (converted to ^{o}R)
T_{STP} = standard ambient temperature (528^{o}R)
P_{Actual} = measured ambient pressure (psi)
P_{STP} = standard ambient pressure (14.969 psi)

Table 10
Gaseous Compounds and Densities

Compound	Common Name	Density (lb/ft^3)*
CO_2	Carbon Dioxide	0.1150
C1	Methane	0.0417
C2	Ethane	0.0789
C3	Propane	0.1175
i-C4	Isobutane	0.1508
n-C4	n-butane	0.1508
i-C5	Isopentane	0.1872
n-C5	n-pentane	0.1872
Cyclo-C6	Cyclohexane	0.2184
C6	Benzene	0.2027
n-C6	n-hexane	0.2236
C7 thru C20	Heptane +	0.4972

*****Densities calculated at 68^{o}F and 14.969 psi.

11. REPORTING RESULTS

11.1 Report all results in electronic spreadsheet format as shown on Form 1 and the forms specific to Natural Gas Compressors and Glycol

Dehydrators. Alternative spreadsheet formats are acceptable provided they contain the same minimum information specified.

11.2 Natural Gas Compressors and Glycol Dehydrators require additional information to be reported. Report the additional information for individual units on the appropriate forms. Use one form for each piece of equipment inspected and tested.

11.3 Report the total number of components inspected, the results of field measurements, and the results of calibrations on Form 1. Use the comments and notes section to further describe components tested.

11.4 For leaks that are detectable with a screening or detection device, but below the detectable flow rate required of a flow rate device, or found in a location that is inaccessible, report the detection concentration only**.**

11.5 Report the results of a gas analysis of the gas stream measured by attaching an electronic copy of the gas analysis to Form 1.

12. REFERENCES

US EPA, 2000. United States Environmental Protection Agency. *Method 21, Determination of Volatile Organic Compound Leaks.* 40 CFR Part 60. February 2000.

United States Department of Labor. *29 CFR 1910.300 et. seq., Hazardous (Classified) Locations*. (n.d.).

13. DATA SHEET DEFINITIONS

For the purpose of screening, measuring, and reporting components, the following terms are to be used in conjunction with Form 1 and the data sheets for Natural Gas Compressors and Glycol Dehydrators.

Compressor Blow-Down Vent refers to a dedicated outlet used to divert gas away from a natural gas compressor when relieving pressure for shut-down or maintenance purposes. A blow-down vent may combine two or more compressors, also known as a combined blow down vent.

Compressor ID refers to a unique ID number that identifies the compressor. This number may be available or any unique number may be assigned.

Compressor PRV refers to a pressure relief valve used to prevent the over-pressurization of a natural gas compressor. The term refers to the area where gas is allowed to exit. The valve does not include a flange or a threaded connection used to attach the device to the compressor piping.

Compressor Seal refers to a mechanism used to contain pressure within a natural gas compressor. The seal includes all associated leak paths. Reciprocating compressors may use a rod packing while centrifugal compressors may include an inboard, outboard, wet or dry gas seal. Care must be taken not to double-count the associated flanges or threaded connections located immediately adjacent a compressor seal.

Compressor Starter Vent refers to a dedicated outlet used to divert starter gas away from a natural gas compressor during startup operations. A starter vent may combine two or more compressors, also known as a combined compressor starter vent.

Compressor Vent refers to a dedicated outlet used to divert seal gas or other gas away from a natural gas compressor.

Contactor Pressure refers to the pressure inside of a vessel where gas and the Glycol interact.

Dehydrator Gas-Assist Pump refers to a natural gas powered pump used to direct natural gas through a natural gas dehydration vessel. Care must be taken to count the associated connections or leak paths located immediately adjacent to the pump as a Dehydrator Pump.

Dehydrator Vent refers to an outlet used to divert dehydrator gas away from a natural gas dehydrator or may be used to blow-down the dehydrator for shut-down or maintenance.

Detection Concentration refers to the percent methane concentration as observed by a screening or detection device measured in parts per million calibrated as methane.

Dry Gas Water Content refers to the percentage of water found in the gas stream.

Flange refers to a projecting rim on a pipe or object used to attach another flanged component with bolts. During a survey, each flange is counted regardless of whether it is connected to a valve or other component.

Flash Tank refers to a vessel used to degas the Glycol solution and remove natural gas and other hydrocarbons.

Flash Tank Pressure refers to the pressure inside of the Flash Tank while the unit is in operation.

Flash Tank Temperature refers to the temperature inside the Flash Tank while the dehydrator is in operation.

Gas Treater refers to a vessel that is specific to natural gas treatment such as an Amine, Sulfa-Treat, or Lo-Cat unit. Care must be taken to distinguish a gas treater from other *Vessels* that are not used to sweeten or perform acid gas removal.

Glycol Dehydrator refers to a unit used to remove water from natural gas. A Glycol Dehydrator is usually composed of a Contactor and Reboiler.

Glycol Flow Rate refers to the flow rate of Glycol flowing through the dehydrator system.

Hatch refers to any access door or cover that can be manually opened in order to access a tank or vessel.

Manual Valve refers to a hand-operated device used to regulate the flow of gas or fluid. The term manual valve refers to the stem protruding out of the valve packing. Flanges or threaded connections used to attach the valve should be counted in their respective categories. Record valves with one side that is open to atmosphere as *Open Ended Lines*.

Mode refers to the operational state when tested. When identifying mode, use the term *Standby* to describe a compressor that is not running but ready to operate or *Run* to describe a compressor that was running when tested.

Number Days Leaking refers to the estimated number of days a component has been leaking, which is required to determine a volumetric leak rate. Obtain the number of days leaking from the facility operator based on the last time the component was inspected or known to have been found in a non-leaking state.

Open-Ended Line refers to any line that is open to atmosphere including pipes or the open end of a valve.

Other refers to components that are not described by any of the other definitions contained in this protocol. When classifying a component as *Other* on Form 1, describe each component counted as *Other*.

Percent CH4, CO2, and VOC refers to the percentage of methane, carbon dioxide, and volatile organic compounds found in the natural gas stream measured.

Pneumatic Actuator (gas) refers to a natural gas powered device used to control a Pneumatic Valve used to control the flow of liquids or gases.

Pneumatic Valve refers to a valve controlled by a pneumatic actuator to control the flow of liquids or gases. A pneumatic valve does not include the flanges or threaded connections used to install the device.

Pressure Relief Valve refers to a device that is used to prevent the over-pressurization of a piping system, vessel, or other system. This term refers to the area where pressure is allowed to exit. The valve does not include a flange or a threaded connection used to attach the device. Care must be taken to separate compressor PRVs from other pressure relief valves.

Reboiler refers to a heating unit used to remove water from a Glycol.

Regulator refers to a device used to reduce the pressure of natural gas within a natural gas system. Regulators are found throughout natural gas production, transmission, and distribution systems.

Seal refers to any mechanism used to contain liquid or gas within a line or vessel. The term *Seal* is intended to include those sealing mechanisms that are not described by other definitions contained in this protocol.

Starter Type refers to the type of starter motor used to start natural gas compressors. The Starter options are: *gas, electric, air-pneumatic, and hydraulic*.

Stripping Gas refers to a compound used to enhance the water removal from the Glycol and reduce the load on the Reboiler.

Threaded Connection refers to any juncture of two or more components that uses a thread to secure the components together. Threaded connections include all connections regardless of size or use.

Vessel refers to separation or storage tanks associated with crude oil or natural gas production, processing, or storage. Report the total number of vessels inspected and report individual component counts under the appropriate categories.

Volume Between Block Valves refers to volume between the block valves (isolation valves) plumbed to a natural gas compressor. This volume is to be provided by the facility operator.

Welded Connection refers to any junction of two or more components that uses welding or soldering to secure the components together.

Wet Gas Flow Rate refers to the inlet gas flow rate feeding into the Glycol Dehydrator.

Wet Gas Pressure refers to the pressure of the inlet gas going into the Glycol Dehydrator.

Wet Gas Temperature refers to the inlet gas temperature going into the Glycol Dehydrator.

Wet Gas Water Content refers to the percentage of water found in the inlet gas stream into the Glycol Dehydrator.

FORM 1 (Page 1)

Date:	
Facility Name:	
Address:	
City:	
State:	
Zip Code:	
Phone Number:	

Inspection Company Name:	
Inspector Name:	

Instrument Make & Model	**Sample Rate**	**Detectable Compounds**

Detection Instrument Calibration:

	Start (% CH4)	End (% CH4)	Difference (%)
Calibration at 2.5% Methane (CH4):			
Calibration at 100% Methane (CH4):			

Flow Rate Instrument Calibration:

	Start (scfm)	End (scfm)	Difference (%)
Flow @ 10% Max Reading:			
Flow @ 90% Max Reading:			

Total Components Screened:

Compressor Blow-Down Vents ________
Compressor PRVs ________
Compressor Seals ________
Compressor Starter Vents ________
Compressor Vents ________
Dehydrator Gas-Assit Pump ________
Dehydrator Vent ________
Flanges ________
Gas Treaters ________
Hatches ________
Manual Valves ________
Open-Ended Lines ________
Other ________
Pneumatic Actuators (gas) ________
Pneumatic Valves ________
Pressure Relief Valves ________
Regulators ________
Seals ________
Threaded Connections ________
Vessels ________
Welded Connections ________

Notes:

FORM 1 (Page 2)

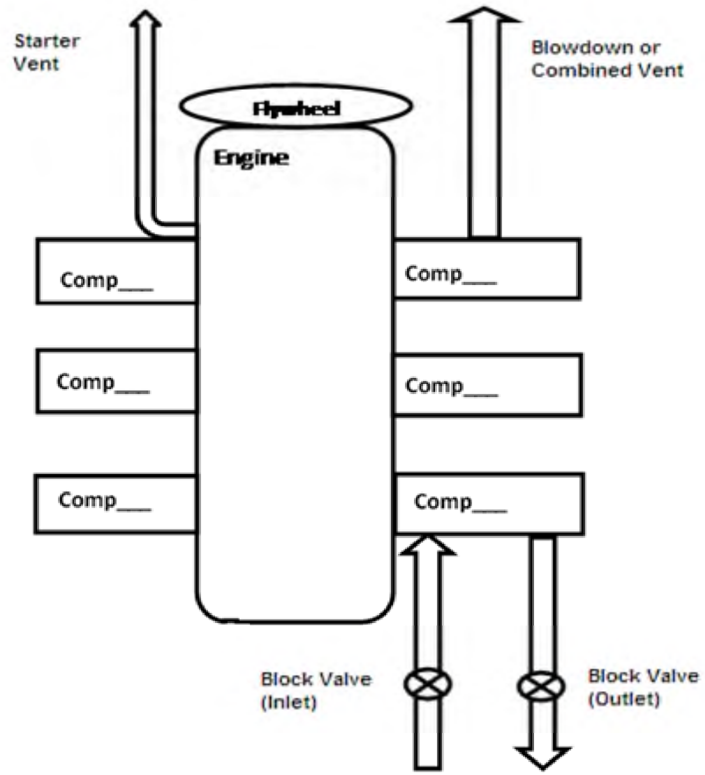
Leak Rate Measurements (attach a copy of the gas analysis):

Component Type	Detect Concentration (ppm)	Measured Flow Rate (scfm)	# Days Leaking	%CH4	%CO2	%VOC	Ambient Temp.	Ambient Pressure	Notes

Reciprocating or Rotary Compressor Field Data Sheet

Compressor ID: ____________________

Reciprocating Compressor Parameters:



Manufacturer: ____________________

Horsepower: ____________________

Age: ____________________

Annual Hours Use: ____________________

Number Startups: ____________________

Number Blow-Downs: ____________________

Discharge Temperature (F): ____________________

Packing Material Type: ____________________

Starter Type: ____________________

Number of Stages: ____________________

	psig
Suction Pressure:	
Discharge Pressure:	
Idle Pressure:	

	Cubic Feet
Estimated Startup Volume:	
Estimated Blow-Down Volume:	
Volume Between Block Valves:	

Additional Paramters and Leak Measurement Readings:

	Y or N	Combined (Y or N)	Mode	Concentration (ppm)	Flow Rate (scfm)	Days Leaking	Comp Number	Notes
Crankcase Vent								
Starter Vent								
Vent								
Blow-Down Vent								
PRV								
Comp Seal								

Centrifugal and Rotary Compressor Field Data Sheet

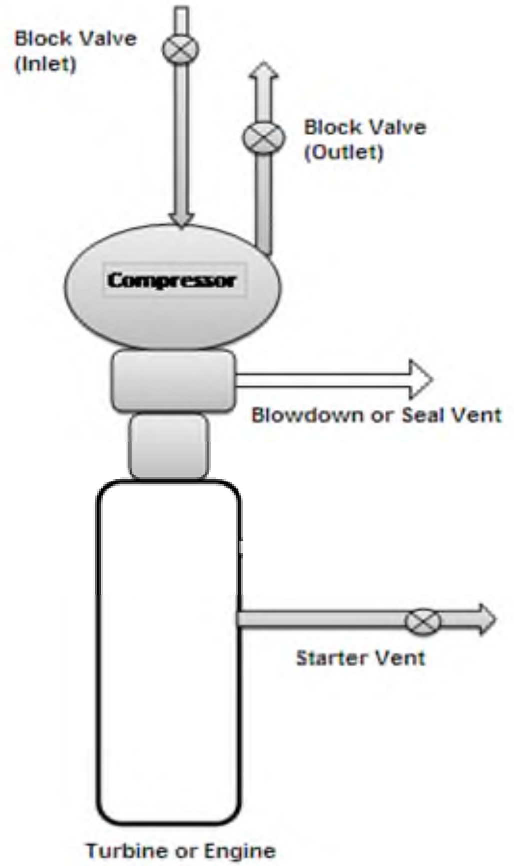
Compressor ID: ____________________

Compressor Parameters:

Manufacturer: ____________________
Horsepower: ____________________
Age: ____________________
Annual Hours Use: ____________________
Number Startups: ____________________
Number Blow-Downs: ____________________
Discharge Temperature (F): ____________________
Seal Type: ____________________
Starter Type: ____________________
Number of Stages: ____________________

	psig
Suction Pressure:	
Discharge Pressure:	
Idle Pressure:	

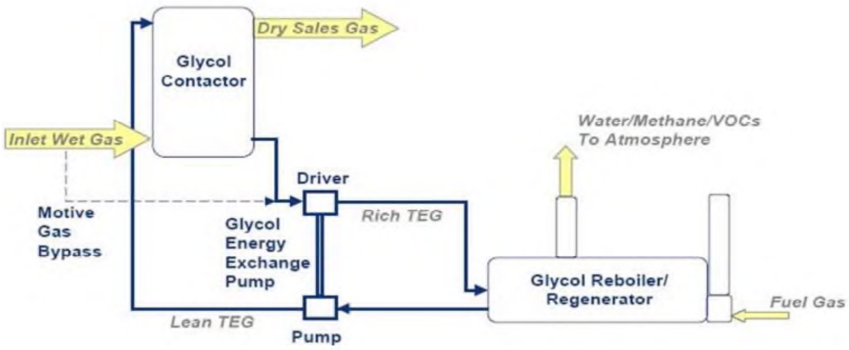
	Cubic Feet
Estimated Startup Volume:	
Estimated Blow-Down Volume:	
Volume Between Block Valves:	



Additional Paramters and Leak Measurement Readings:

	Y or N	Combined (Y or N)	Mode	Concentration (ppm)	Flow Rate (scfm)	Days Leaking	Notes
Crankcase Vent							
Starter Vent							
Blow-Down Vent							
Pressure Relief Valve							
Inboard Seal							
Outboard Seal							
Vent Seal							

Glycol Dehydrator Field Data Sheet



Dehydrator ID: _________

Dehydrator Description

Make: ______________

Model Year: ______________

Glycol Unit Parameters:

Wet Gas Flow Rate: ______________ (mcf/day)

Wet Gas Temperature: ______________ (degrees F)

Wet Gas Pressure: ______________ (psi)

Wet Gas Water Content: ______________ (percent)

Dry Gas Water Content: ______________ (percent)

Dry Gas Flow Rate: ______________ (mcf/day)

Contactor Pressure: ______________ (psi)

Gas Assisted Pump: ______________ (yes / no)

Stripping Gas: ______________ (yes / no)

Glycol Flow Rate: ______________ (gallons/hour)

Flash Tank Temperature: ______________ (degrees F)

Flash Tank Pressure: ______________ (psi)

Flash Tank Vapor Recovery: ______________ (yes / no)

Notes: ____

____

____