Compressor Seals
Vent Gas
Measurement
20 Years of Designing Measurement and Controls in Alberta

- Differential Flow Computer
- Gas Turbine Flow Computer
- Thermal Casing Vent Measurement
- Portable Measurement Skids
- Zero Emission Separators
- Solar Powered Linear Actuator
- Electric 1/4 Turn Actuator With Fail Detection
- Hawk Vent Gas Meter Development Started in 2011
Back Pressure Affects Flow

Vent gas measurement is difficult.

Any differential pressure caused by the flow measurement equipment can be significant percentage of the static pressure depending on the measurement solution.

This back pressure will reduce the normal vent flow rate, so minimizing the backpressure is critical for accurate vent gas tests.
Back Pressure - How much is okay?

Atmospheric Pressure varies by 7kPa normally so you are always going to have some natural flow variation due to high and low weather systems.

If you keep the backpressure of your measurement system < 2kPa it’s a reasonable percentage of the error due normal atmospheric pressure changes, which would be costly and time consuming to average out anyways.
Piping is a Surprising Source of Backpressure

The back pressure from piping is often the dominate source of back pressure

Methane gas flowing at 2 m³/hr in 10 meters of:

<table>
<thead>
<tr>
<th>Stainless Tubing</th>
<th>Steel Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼” (0.180)</td>
<td>6.9 kPa</td>
</tr>
<tr>
<td>3/8” (0.305)</td>
<td>0.9 kPa</td>
</tr>
<tr>
<td>1/2” (0.402)</td>
<td>0.2 kPa</td>
</tr>
</tbody>
</table>

Methane gas flowing at 14 m³/hr 10 meters of:

<table>
<thead>
<tr>
<th>Stainless Tubing</th>
<th>Steel Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼” (0.180)</td>
<td>320 kPa</td>
</tr>
<tr>
<td>3/8” (0.305)</td>
<td>33 kPa</td>
</tr>
<tr>
<td>1/2” (0.402)</td>
<td>8 kPa</td>
</tr>
</tbody>
</table>

Use 1 inch ID Pipe or Rubber Hose for your connections
If you have to use a smaller diameter Keep it Short
Primary Measurement - So many choices

Differential

Coriolis

Positive Displacement

Thermal Mass

Ultrasonic

All sensors have their good and bad points
Primary Measurement — Things to consider for low flow measurement

Back Pressure

Range Ability
Can it measure my low and high flow rates?

Accuracy Required

Power Consumption
Will you need a car battery?

Outdoor Rated

Logging

Hazardous Location Approval

Easy of servicing and installation

Operator Friendly
Hose Connections ??
Weight
Size

Reporting Software

Your going to need to log and graph the data

Can it be used in a building where its Div1/Zone1(0)?
A lot of compressor sites are decades old. A lot are still around from the 1960’s.

A variety of exhaust vents are not easy to connect too.

Often the only way to connect is with “jury rigged” connections.

Since the pressure is so low you can get away with “non standard” connections.
Hose Connections - The 5th Strategy

¼” ½” 3/4” 1” 2” NPT Nipples, Bushings, Couplings

Gas Rated Teflon Tape & Thread Sealant

Tube connections ¼” 3/8” ½”

Quick Connects to easily attach hoses

Rubber Hoses 1” Long
Rubber Hoses ¼” ½” 3/4” 1” 2” Short

Hose Clamps and adapters all Sizes

100K$ FLIR Camera and/or Soap and Water

Duct Tape (Gorilla is the Best!)

Binder Twine

The Veteran
Brings Everything
Verify Questionable Seals

All of these connection strategies seen in these pictures,

Supplied by: The AER and Greenpath Energy (Thank you!)

Are okay because they used a FLIR camera or a Bubble Test to

Verify the Connections Are Not Leaking
Connections - Height and Poor Locations

Safety
Extra Time
Retrofitting Vent Locations Connections

Difficult to access exhaust vents are costly to test and can be a safety hazard.

Retrofitting the vent lines so it's easier to measure will save a lot of money in the long run.
Contamination and Verification

A lot of sources of vent gas often burp out liquids, rust, oil and other material. It is a very good idea to have **upstream filter**. If these particles get into your measurement system it can ruin the instrument.

What is worse is if it damaged in a way that is difficult to detect, resulting in many inaccurate flow tests afterwards.

To prevent this **Periodic Verification** with a source of low flow gas, such as using shop air running through a mass flow controller, should be used to verify the accuracy of your flow measurement equipment.
Questions?