High BTU Biogas Projects

Compression, Injection and Odorizing

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Blowers

1
Single Stage

2
Multistage

3
Positive Displacement

Single Stage Blower

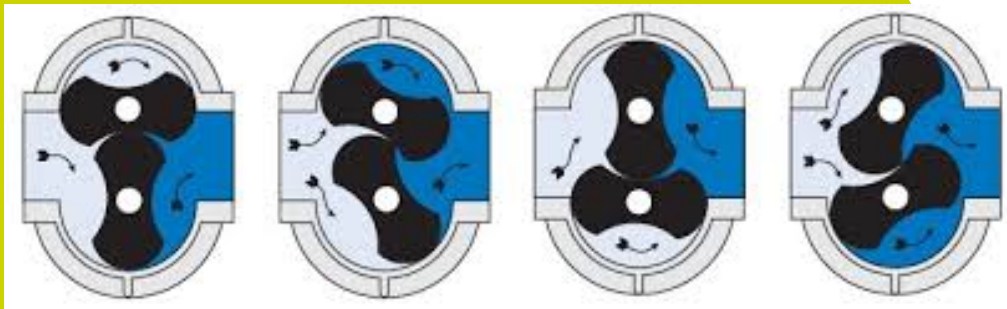
Limited to about 1 PSIG in pressure or vacuum

Multistage Blower

Can produce up to 10 PSIG pressure

Useful for feeding compressors

Positive Displacement Blower



PD blowers

Advantages:

- Cheaper

Disadvantages:

- Less efficient
- Prone to overheating
- Pulsations may damage downstream equipment
- Limited on the amount of pressure delivered

Blower Maintenance

- Grease/ Oil Bearings
- Blowers may be damaged if allowed to surge (low flows and high pressures

Screw Compressors

Pressure Limit generally around 400 PSIG. However there are several vendors than can go to 800 PSIG now.

One or two screws continuously turn and compress gas between the two lobes

Oil is recycled with the gas and provides lubrication and cooling

Screw Compressor

Reciprocating Compressor

Pistons compress gas in multiple stages

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Compressor Comparison

- Reciprocating:
  - Higher Efficiency
  - Piston/Ring/Drive Rebuild requirements (downtime)
  - Better for low volumes/high pressure
- Screw Compressors:
  - Lower efficiency
  - Higher reliability and more uptime

Compressor Maintenance

Compressor rebuilds (more often for recips)

Oil changes/ Oil addition

Filter changes

Compressor Cooling

Recip:

- Requires gas cooling between each stage

Screw Compressor

- Requires oil cooling and gas cooling
- Screw oil heat is convenient for use in other processes

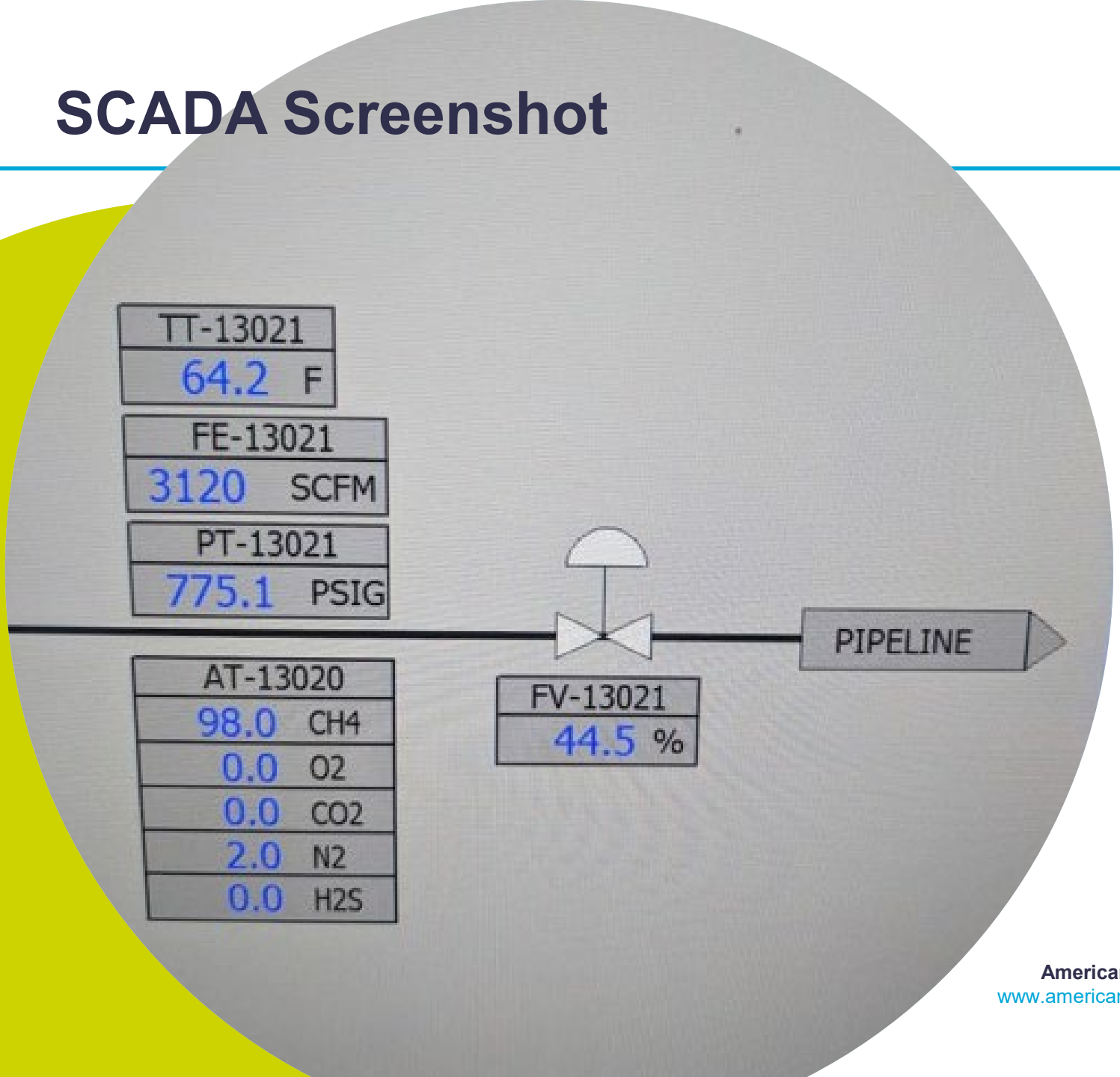
Compressor Cooling

Final Metering

Design requirements:

- Pigging station to clean pipeline
- Check valve to prevent back flow
- Bypass valve to send off spec gas to flare
- Metering valve to control flow of gas down the pipeline
- Gas Chromatograph to measure gas going in pipeline
- Flow meter
- Bypass valve to allow pipeline gas to be burned in flare

SCADA Screenshot



Final Metering

Final Metering

Pigging Station

Pig Launcher/ Receiver (allows pipe to be cleaned)

Custody Transfer Meters

Coriolis Meter

Orifice Plate

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Gas Chromotagraph

Measures CH_4, CO_2, N_2, O_2, H_2S

May need a separate meter for moisture

Ordorizer

Purpose:

- Safety: Help detect gas leaks

Types:

- Wick
- Metering

Pipeline companies may prefer that you do not odorize the gas

Wick Odorizer

Thermal Oxidizer

Purpose:

- Combust gases when RNG equipment is not operating
- Combust out of spec gas that would go down the pipeline

Utility Flare

- Very fast to turn on
- Can combust Medium and Hi-BTU Gases
- Propane or NG instant pilot
- Cannot do emission test

Utility Flare

Ground Flare

- Takes medium and Hi-BTU gases
- More complicated
- Slow starts (purging)
- Will need a standing pilot to take gases quickly
- Reacts slowly to changes in flow

Regenerative/ Recuperative TOX

- Regenerative
  - Bed of typically ceramic media that keeps the bed hot
  - Typically better with low BTUs (0-5% methane)
- Recuperative
  - Post combustion heat exchanger conserves heat in the process
  - Typically better with higher BTUs (5% to 10% methane)
- Low BTU gases only (1% to 10% methane)
- Starts can be slow and energy intensive while heating up the oxidizers
- Designed to combust off gases from RNG processes that may contain VOCs

Recuperative Thermal Oxidizer

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