Multiphase Gas Compressor
Self-Regulating Multiphase Pump/Compressor for Casing Gas and Vapor Recovery Applications

Fluidstream Energy Inc.
Can the majority of O&G compressor technology meet **ALL** these needs?

- Effective liquids handing / Multiphase pump
- Cost effective
- Low service and maintenance
- Large compression ratio
- Long run life
- Self adjusting (don’t set speed, set targets)
- Simple design and reduced moving parts
- Portable
- Data capture and output
- User functionality and access (mobile phone access)
- Remote monitoring and control

**Fluidstream’s Fluid Pump designed to meet ALL these needs**
# Product Comparison

<table>
<thead>
<tr>
<th></th>
<th>Fluidstream Multiphase Fluid Pump</th>
<th>Beam Casing Gas Compressor</th>
<th>Standard Conventional Compressor</th>
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<tbody>
<tr>
<td>Cost (Equip, Install, &amp; Service)</td>
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Fluidstream’s Fluid Pump Philosophy

- Keep mechanical design simple and robust
  - Promotes long run life and reduced maintenance

- Use sophisticated, proprietary programming to
  - Automate desired outcomes without the need for operator intervention, or mechanical and moving parts
  - Liquids handling
  - Optimize efficiency (ex. optimal use of HP)
  - Reduce user maintenance
  - Extend run life

Simple mechanical design + Sophisticated programming = Fluidstream Fluid Pump
Simple/Robust Mechanical Design

- Double acting positive displacement piston design derived from the proven beam casing gas compressor design
- No gas recirculate, no scrubber, no heat trace, no oil injection

Enhancements (to mechanical component)
- Robust switching mechanism (can last over 10 million cycles)
- Robust seals (no lubrication required)
- Proprietary cushioning system
- Robust sealing to mitigate gas leakage
Hydraulics used as primary driver source
  - Well suited for operational control

Continually/instantaneously updating pump speed and operations to meet these user defined targets

1. Suction Pressure
2. Discharge Pressure
3. System Load
   - Assists in liquids handling and HP optimization
4. System Health
User Interface: Main Screen
User Interface: Suction Pressure Setting

Fluidstream Energy

Overview

Suction Pressure PID

PV 240
SP 240
OP 100

Cooler Setpoint

Press Disch
220 PSI

Motor Load Amp
60

Motor Load %
128

Compressor Ratio
10.0

Press Temp
85 °C

Cooling Fan

Suction

Discharge

Power Pump

Auto Start: OFF

ON

Stroke/min

5.45

Flow

2.72 E3 m³/d

Flow

96.57 MCF/d

PM-100

Pump O/L

Overview

Control Setpoints

Pump Setpoints

Run Data

Trend

Active Alarms

Alarm History

Admin

Alarms Reset

Sleep Mode Timer

600 Sec

Counter

10

Reset Sleep Mode

February 11-14, 2019

2019 Artificial Lift Strategies for Unconventional Wells Workshop

Oklahoma City, OK
User Interface: Discharge Pressure Setting
### User Interface: Control Setpoints

![Image of control setpoints](image-url)

**Alarm & Control Setpoints**

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<th>Value</th>
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<th>Low Low</th>
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</table>

- **S/D**: Shutdown
- **SM**: Sleep Mode
- **ROV**: Restart On Value
User Interface: Multi-user Permissions
Android/iPhone/Tablet/Desktop Access

- Download free app from Google Play or Apple app store
- Download free software for desktop viewing
- Can connect to any Fluid Pump compressors in your network
Case Study: Casing Gas Application

- Discharge Pressure: 120 – 150 psig [827 – 1034 kPag]
- Inlet/Suction Pressure: 15 psig [103 kPag]
- Flow (at inlet pressure): 106 mcf/day [3000 m3/day]

- Operational for more than two (2) years; installed in 2016
- Servicing two (2) wells as casing gas application
- No issues related to wet gas or cold weather operations; no heat trace system used for winter operations
- Infrequently, one (1) well of the two (2) wells would stop production – the Fluid Pump would automatically self-adjust (slowing down) to ensure target inlet/suction pressure is maintained; no operator intervention required
Case Study: Vapour Recovery Application

Discharge Pressure: 150 psig [1034 kPag]
Inlet/Suction Pressure: 0.5 psig [3.4 kPag]
Flow (at inlet pressure): 35 mcf/day [800 m3/day]
H2S: 3000 ppm
Compression Ratio: 11

- Installed on July 3, 2018
- No issues related to wet gas or cold weather operations; no heat trace system used for winter operations
- Customer saved more than 50% in costs versus other conventional VRU technologies
- Operators monitored using iPhone and Android devices; desktop software access also used
- Fluid Pump adjusts speed to maintain target inlet pressure, thus avoiding mechanically derived “recycle loops” to handle changes in tank pressure from truck unloading of oil
- Cost effective enough to add additional unit for increasing gas flow or further increasing compression ratio
Customer requested a customized feature that allows the Fluid Pump to go into “Standby” mode if the inlet pressure gets too low. This happens when a truck is unloading from the tanks. The Fluid Pump starts stroking again once the tank pressure is at a target pressure.
VRU Standby Replaced by ROV

2/7/2019 3:20:22 AM

Alarm & Control Setpoints

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Feb. 11 - 14, 2019 2019 Artificial Lift Strategies for Unconventional Wells Workshop Oklahoma City, OK
As an oil and gas producer with over 13,000 wells in Southern Alberta, 550 being oil wells, and plans to drill 150 more oil wells over the next 12 months, we have interest in Fluidstream’s compressor technology for vapour recovery applications. Their technology has unique advantages over standard vapour recovery compression packages.

1. Very high Turndown Ratio.
2. Very high Compression Ratio.
3. Significantly more cost effective.
4. Ability to handle entrained liquids within gas solution.
5. Automated control system that reduces the need for mechanical and moving parts.
6. Ability to handle a large range of line pressures.
7. Good for Sour Service to 1%.

Douglas Bond, P.Eng, PMP
Senior Staff Facilities Engineer
Torxen Oil & Gas Ltd.
Additional Advanced Features

- Limitless speed reduction (can stroke at 1 stroke per 5 minutes)
- Three stage cold start-up
- Soft start with user defined settings
- Comprehensive data logging and output via USB
- Automatic update of maximum speed setting if in constant motor overload (user defined settings)

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<td>Speed Reduce Rate</td>
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Data output and data logging

- Exports to Excel Spreadsheet
- Trending and Graphing on HMI/display
- Data logging
  - Date/Time
  - Suction Pressure
  - Discharge Pressure
  - Discharge Temperature
  - Pump Stroke Rate
  - Instantaneous Gas Flow (Theoretical)
  - Cumulative Gas Flow (Theoretical)
  - System Warning/Shutdown Messages
Maintenance Requirements

Scheduled Maintenance

- Replace filters => 12-24 months
- Replace hoses => as needed (only 3 high pressure hoses)

Preventative Maintenance

- Replace seals => 24 months
- Inspect cylinder internals => 24 months
- Filter hydraulic oil => 18 months

System monitoring and controls mitigate equipment failure
### Performance (mcf/day)

- Max allowable suction and discharge differential is 380 psig
- Pump flow performance is optimized using patented methodology of variable speed within stroke to optimize maximum motor performance

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Max allowable suction and discharge differential is 380 psig.
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