2-in. Horizontal Well Experimental Facility

This facility operates with gas/water and has been designed to study the effects of well trajectory on flow behavior for horizontal gas and condensate wells. Several well configurations can be simulated in this facility such as toe-down, toe-up, hilly terrain-sump and hilly terrain-hill.

Key Specifications

Fluids

Gas: Air
Water: Tap Water

Operating Conditions\(^1\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Pressure</td>
<td>30 psig</td>
</tr>
<tr>
<td>Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>Gas Flow Rate</td>
<td>0 to 0.16 MMSCFD (Superficial Gas Velocity – 0 to 85.3 ft/s)</td>
</tr>
<tr>
<td>Water Flow Rate</td>
<td>0 to 77 BPD (Superficial Liquid Velocity – 0 to 0.25 ft/s)</td>
</tr>
</tbody>
</table>

\(^1\)Operating conditions are given and are subject to change depending upon the project

Test Section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Material</td>
<td>Acrylic</td>
</tr>
<tr>
<td>Diameter of Pipe</td>
<td>2-in.</td>
</tr>
<tr>
<td>Total pipe length</td>
<td>103.6 ft (622 D)</td>
</tr>
<tr>
<td>Test Section</td>
<td>62.6 ft (376 D), lateral section and curvature</td>
</tr>
<tr>
<td></td>
<td>41 ft (246 D), vertical section</td>
</tr>
<tr>
<td>Developing Region</td>
<td>23.8 ft (143 D) at the toe of the well</td>
</tr>
<tr>
<td>Inclination Angles</td>
<td>-3 to 3 degree</td>
</tr>
<tr>
<td>Maximum number</td>
<td></td>
</tr>
<tr>
<td>of undulations</td>
<td>2</td>
</tr>
</tbody>
</table>

Instrumentation and Flow Characteristics

<table>
<thead>
<tr>
<th>Measured Parameters</th>
<th>Instrumentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Holdup</td>
<td>• Quick Closing Valves</td>
</tr>
<tr>
<td></td>
<td>• Conductivity Probes</td>
</tr>
<tr>
<td></td>
<td>• Wire Mesh Sensor</td>
</tr>
</tbody>
</table>

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### Fluid Flow Projects

- **Surveillance Camera**
- **High speed Camera**
- **Wire Mesh Sensor**

### Pressure Gradient

- **Differential Pressure Transducer**

### Liquid Film Reversal Detection

- **High speed Camera**
- **Salt Injection and Dye** + **Conductivity Probes**

### Slug Flow Characterization (translational velocity, slug length and frequency)

- **Conductivity probes**

### Severe Slugging Characterization (Cycle duration, slug frequency and maximum expected pressure)

- **Pressure transducers**

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**Detailed Specifications on Liquid and Gas Supply Systems**

**Air Compressor**

- **Model:** (Single stage) Sundyne BMC-343 EF
- **Power:** 298 kW (400 HP) supplied by Kohler power generator
- **Flow Rate:** 19 MMSCFD
- **Discharge Pressure:** 500 psig
- **Suction Pressure:** 400 psig

**Gas Flow Meter**

- **Model:** Promass 83 (83F08)
- **Max. Mass Flow Rate:** 42.3 kg/h
  - (calculated using gas density at standard conditions)
- **Measurement Uncertainty:** ±0.35% of Flow Rate

**Water Pump**

- **Model:** Leroy Somer Centrifugal Pump
- **Suction Diameter:** 1-1/2 inches
- **Discharge Diameter:** 2 inches
- **Max. Discharge Pressure:** 100 psi
- **Min. Discharge Pressure:** 10 psi

**Water Flow Meter**

- **Model:** Promass 83 (83F25)
- **Max. Mass Flow Rate:** 18000 kg/h
- **Measurement Uncertainty:** ±0.15% of Flow Rate
Figure 1. Schematic of 2-in. Horizontal Well Facility
Figure 2. Schematic of 2-in. Horizontal Well Facility – Lateral
Figure 3. Schematic of 2-in. Horizontal Well Facility – Vertical Section
Figure 4. 2-in. Horizontal Well Experimental Facility

Figure 5. Curvature Section
Figure 6. 2-in. Horizontal Well Experimental Facility