FracHeight™ Downhole Micro-deformation Instrument
(for Hybrid-array downhole fracture monitoring)

The FracHeight hybrid tool array combines downhole tiltmeter sensors with downhole microseismic receivers. This array, conveyed on a fiber-optic wireline, will measure microdeformation in addition to monitoring microseismic events during fracture operations.

The raw measurement is the gradient of displacement measured by two orthogonal tiltmeter sensors.

**Performance**
- Sensor and acquisition hardware is capable of resolving tilt changes down to +/- 1 nanoRadians (nR).
- The current generation sensor platform can re-establish zero through +/- 6 degrees while the sensor itself has a range of +/- 0.25 degrees.
- Wellbore environment noise causes the practical recorded survey resolution to be approximately +/- 100 nR.
- A near-future revision sensor platform will be capable of re-establishing zero through +/- 40 degrees.

**Hardware**
- Round cylinder 2.5 in. OD and 3.94 ft in length
- Typically deployed in an array of 12 units or more spanning the depth range of interest

**Software and Communications**
- Communication is via a proprietary fiber-optic based telemetry running at 115,200 baud. Telemetry hardware is capable of supporting up to 126 devices and more than 1,000 ft of array length.

**Dimensions and Ratings**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Temperature</td>
<td>125 °C (350 hrs)</td>
</tr>
<tr>
<td>Maximum Diameter</td>
<td>2.5 in. (6.35 cm)</td>
</tr>
<tr>
<td>Length</td>
<td>3.94 ft (1.2 m)</td>
</tr>
<tr>
<td>Maximum Pressure</td>
<td>20,000 psi (137,895 Kpa)</td>
</tr>
<tr>
<td>Minimum Diameter</td>
<td>3.5 in. (9.0 cm)</td>
</tr>
<tr>
<td>Maximum Hole</td>
<td>Dependent on anchor system</td>
</tr>
<tr>
<td>Weight</td>
<td>35 lb (15.9 kg)</td>
</tr>
</tbody>
</table>

**Borehole Conditions**

- Wellbore type: Vertical or near vertical
- Borehole Fluids: Salt □ Fresh □ Oil □ Air □
- Recommended Maximum Logging Speed: Stationary only
- Tool Positioning: Centralized □ Decentralized □

**Hardware Characteristics**

- Tilt:
  - Sensor Type: Electrolytic cell
  - Sensor Range: +/- 0.25 ° (4,400 µR)

**Physical Strengths**

- Hardware: Tool Joints
  - Tension: 60,000 lb (27,200 kg)
  - Compression: 30,000 lb (13,600 kg)
  - Torque: n/a

**Measure Points**

- Measurement: X & Y
- Measure Point (referenced from bottom of tool): 8.5 in. (21.5 cm)

**Limitations**

- No anchoring device included in this design
- This tool can only be combined with specific microseismic tools running on a fiber-optic wireline.

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