Patented Hydrocarbon Leak Detector

Environmental monitoring
Contents

• Phaze Technologies
• Capacitance
  – Measuring principle
  – Instrument sensor
• Hydrocarbon Leak Detector
  – How does it work?
Phaze Technologies

- Benestad & Phaze
  - 70% owned by AkerSolutions
- Established in 1973
- Located @ Lierskogen, Norway
- Markets
  - Oil & Gas
  - Defense
- ISO 9000 and ATEX 94/9/EC
- 32 employees
Market – Oil & Gas

- **Oil & Gas**
  - 95% subsea
  - 5% Surface/topside

- **Customers**
  - EPIC contractors
  - Subsea boosting companies
  - Subsea instrumentation
  - Operators
Oil & Gas Products - Phaze

Subsea Boosting & Separation
Pump / Trafo / Compressor / Switch gear / VSD

Subsea Control
Hydrocarbon Leak Detector
Water Leak Detector
Pressure & Temperature Transmitter
Water Cut Meter
In-house Competence - instruments

- **Sensor Technology**
  - Glass/Ceramic-to-metal sealing
  - Thin film technology

- **Electronics**
  - Advanced circuit design

- **Barriers**
  - Penetrator systems
  - Boot seal design

- **Product Design**
  - Extensive electro-mechanical design experience

- **Test & Calibration**
  - 20 years of empirical data

- **Assembly**
  - Industrialized processes
A capacitor consists of two electrodes separated by a medium.

Capacitance describes how two electrodes responds to voltage difference applied to them.

The capacitance is proportional to the dielectric constant of the media.

### Capacitive Sensor

**Electrode A**

**Electrode B**

<table>
<thead>
<tr>
<th>Material</th>
<th>Permittivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>80</td>
</tr>
<tr>
<td>glass</td>
<td>5</td>
</tr>
<tr>
<td>silicon</td>
<td>2.8</td>
</tr>
<tr>
<td>rubber</td>
<td>2.5</td>
</tr>
<tr>
<td>oil</td>
<td>2.2</td>
</tr>
<tr>
<td>teflon</td>
<td>2</td>
</tr>
<tr>
<td>air</td>
<td>1</td>
</tr>
<tr>
<td>vacuum</td>
<td>1</td>
</tr>
</tbody>
</table>
Phaze Capacitive Sensor Design

Sea water

Electrical field

Sensing range

"A few mm"

Hydrocarbon Leak Detector
Hydrocarbon Leak Detector

- Monitors hydrocarbon leakages to the subsea environment
- Field proven since 1995
- More than 400 units supplied
- Most used system on the NCS
- Typical Applications
  - X-mas trees
  - Manifolds
  - Subsea flanges
- Patented technology
Hydrocarbon Detection Principle

HLD

Control Module
Installation on single X-mas Trees

- The collector is formed by the roof of the XMT and additional welded on “skirts”
- The HLD is mounted in the ceiling of the XMT or on the Flow Module
**Installation on templates or manifold**

- The Collector is formed by the hatches of the protective structure.
- The HLD is mounted directly in the ceiling close to the latches.
Design considerations

Collector traps the leakage

Gas leakage

Seawater
Design considerations

Exhaust port to avoid “false alarms”

Gas leakage
System sensitivity

- Depends on:
  - Collector volume
    - The sensor is activated when the gas/oil build-up reach 25% of the sensor window
  - Exhaust port size
Design considerations

• Sensing range
  – The leaking media needs to be in direct contact with the sensor window
Field feedback - instrument

• Correct assembly:
  – Perfectly operational and accurate after >10 yrs in service subsea (NCS)

• In-correct assembly:
  – Corrosion issues
    • Missing earth strap
  – Protective cap not removed

• New instrument
  • 10 years old
Field feedback - collector

- Missing skirts on the collector
  - Collector will not be filled with leaking media
- False alarms
  - Tight exhaust ports (marine growth)
  - Too small exhaust ports
Product Developments

• Instrument
  – Designed to meet ISO 13628-6
  – Software upgrade
    • CAN 443 SIIS level 2
  – Improved corrosion resistance
    • Grounding through jumper
    • Titanium housing

• Collector design
  – Part of the instrument supply
    • Concept studies ongoing
Collector design

- **System**
  - Instrument & collector
- **Smaller collector**
- **Exhaust port**
  - actuated valve
- **Enables systems verification subsea**
- **Part of instrument supply**
Installed base

- Widely used on subsea installations

**Customers**
- FMC
  - Statoil
  - ENI
- GE Vetco
  - BP
- Poseidon
- Bennex
- Aker Solutions
  - ENI

Totally >400 units
New markets

• First award outside the NCS!
Thank you for the attention