

ClampOn Subsea Flow Temperature Monitor

SCDU 2022 - Perth

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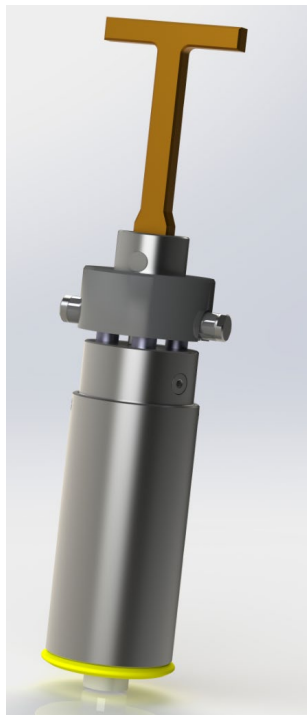


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CLAMPON[®]

ULTRASONIC INTELLIGENT SENSORS

Non-intrusive flow temperature

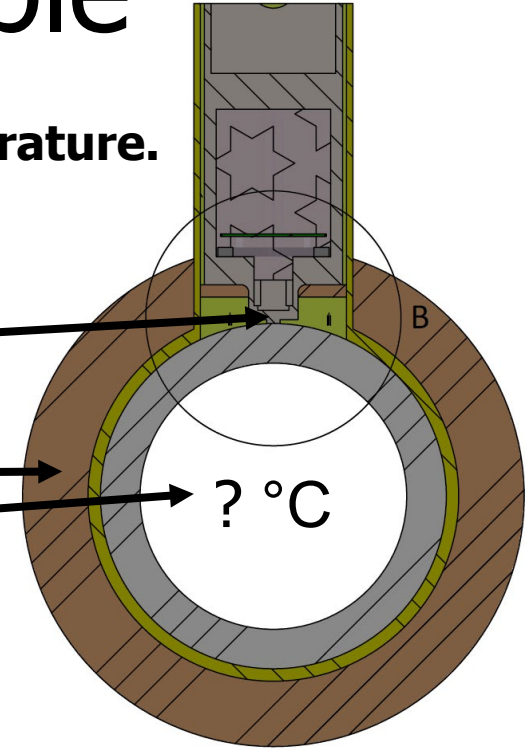


- Where intrusive instruments (TT, PT) have or may have failed.
- Insulated pipework
- Or with insulation sleeve
- Possibly in combination with ASD, APD, Leak, or vibration monitor.

Working principle

Measure skin temperature, calculate flow temperature.

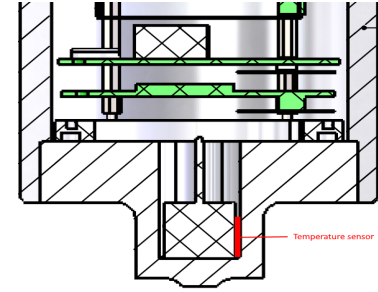
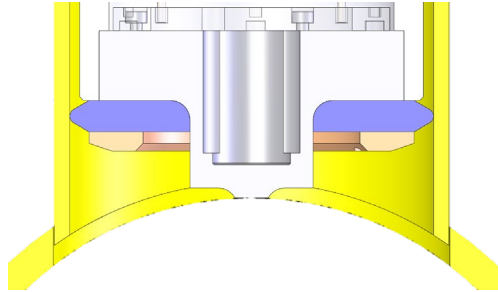
- Measure skin temperature
- Measured or constant ambient
- Factor the insulation
- Calculate Internal flow temperature



Changes



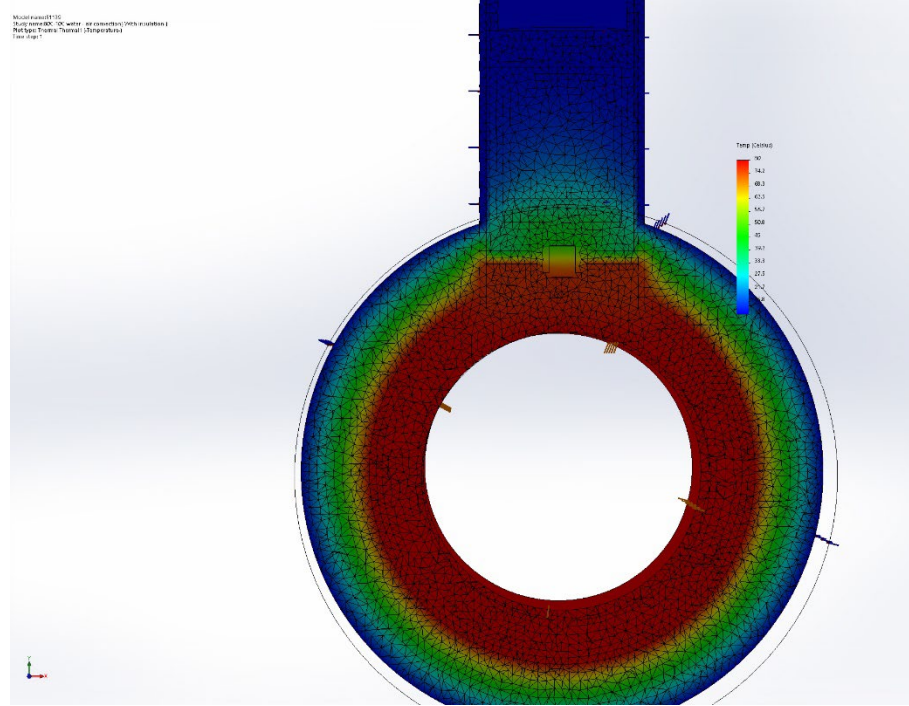
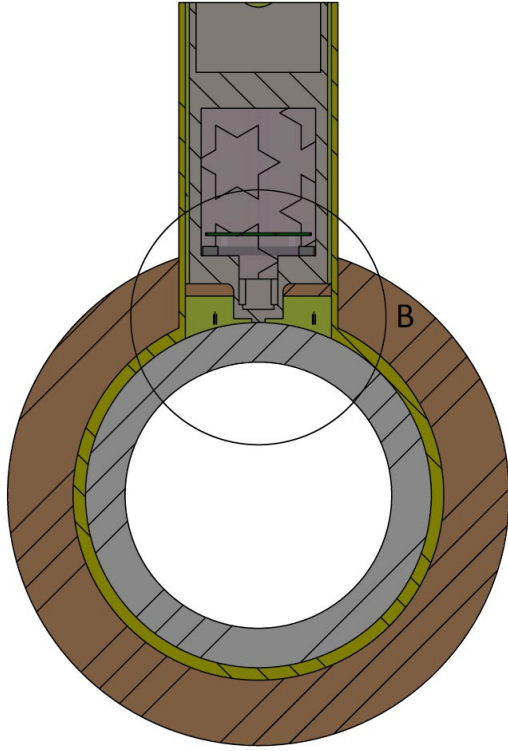
- Standard Compact instrument:
- Synthetic seal between funnel wall and instrument.
- Temperature sensor placed in "nose"/front of the instrument.



Qualification / verification

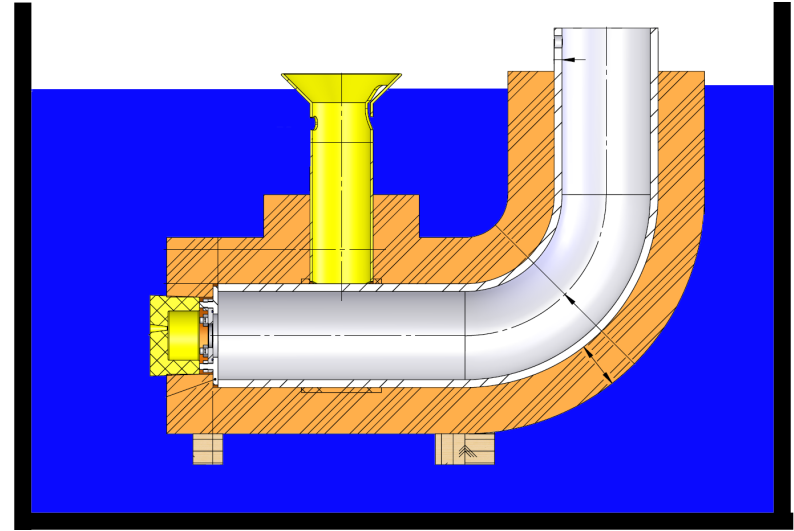
- **Application:**
- Temperature simulation (Solidworks)
 - Find k factor depending on insulation thickness
- Full-scale mock-up testing
 - Proof of concept
 - Actual k factor found based on measurement
- **Hardware:**
- Standard compact ASD
 - API17F 4th ed.

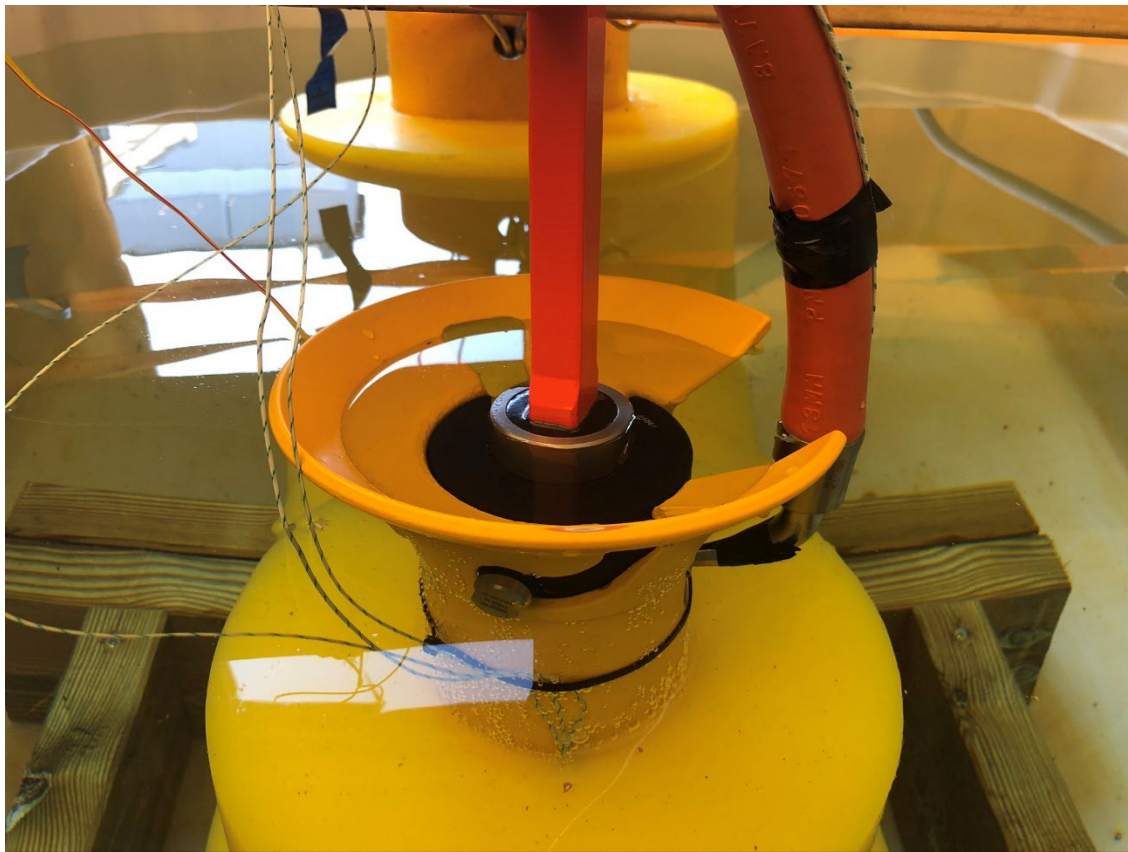
Simulation

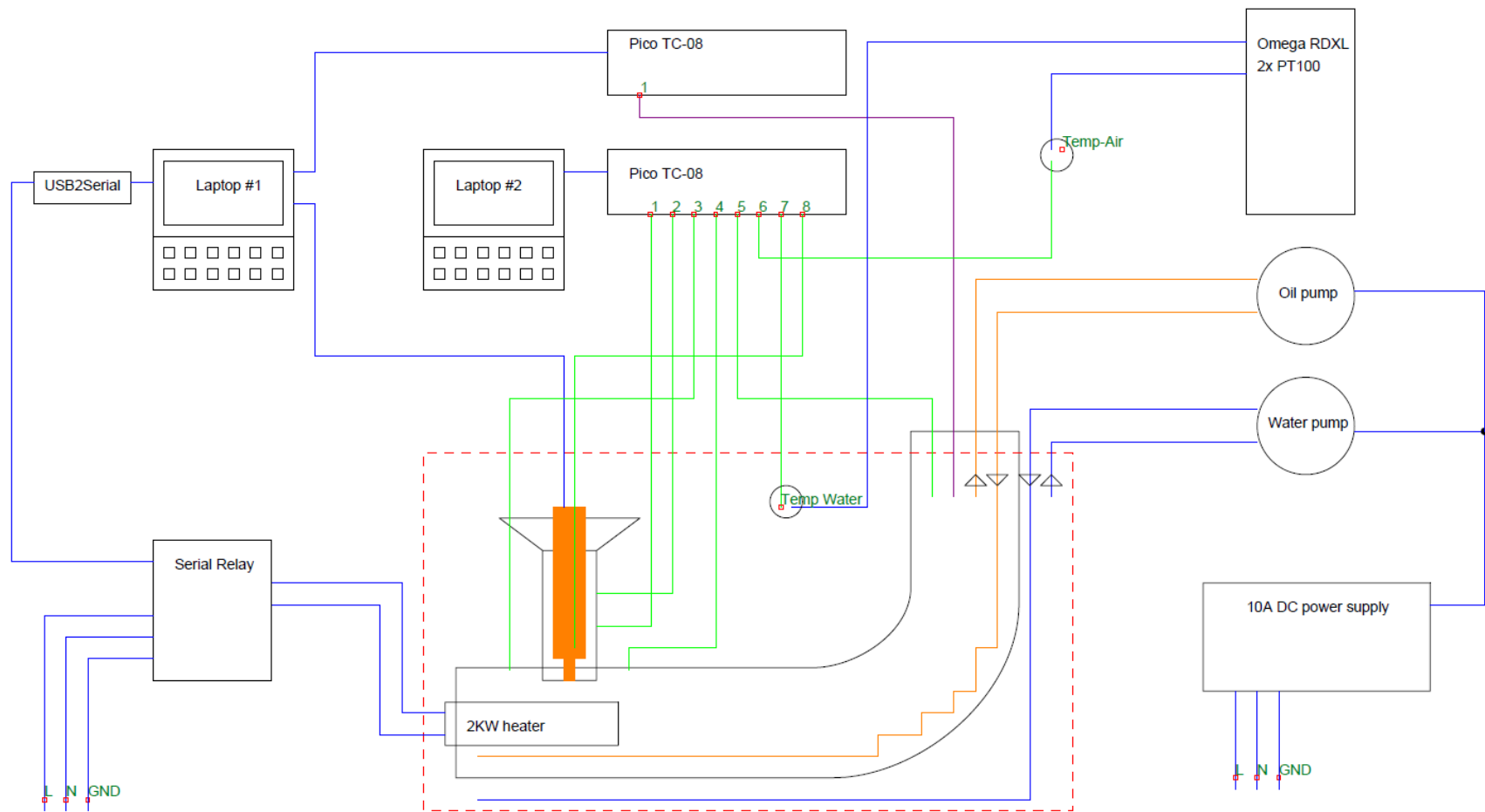


Full scale, mock-up test

- Oil-filled 6" pipework.
- 1 kW electric heating element.
- 75mm insulation.
- Standard compact funnel.
- Surrounded by circulating water.







Formula

$$T_f = kT_m - (k - 1)T_a$$

T_f = Flow temperature

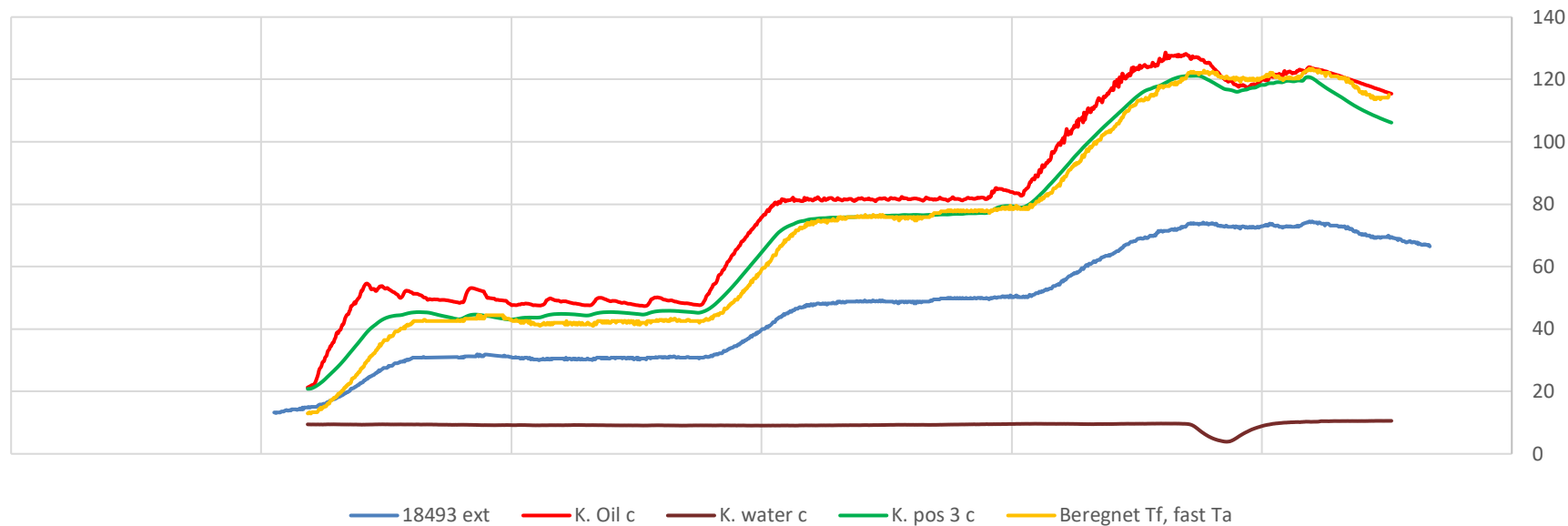
T_a = Ambient temperature

T_m = Measured skin temperature

k = Temperature coefficient

Result

50, 80 & 120 c

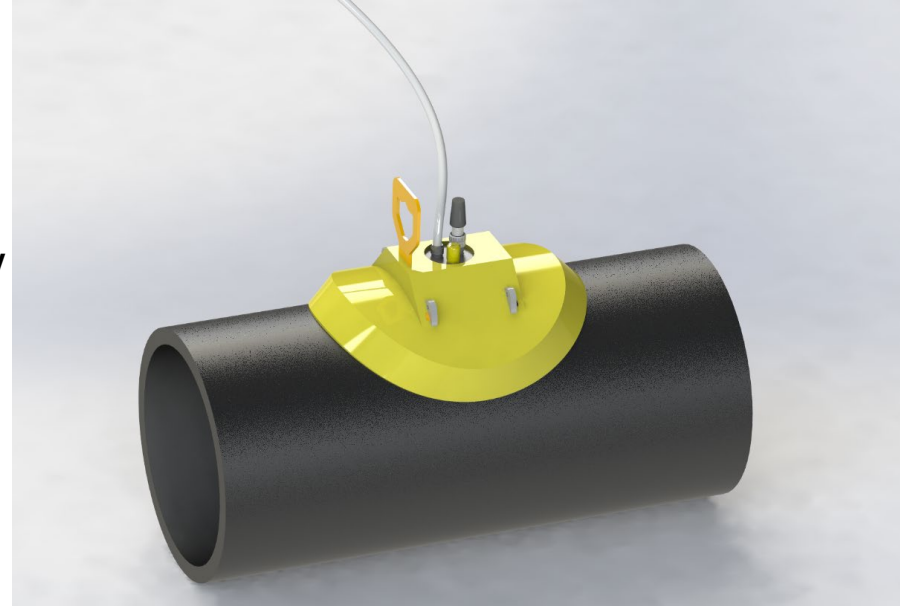


Conclusion

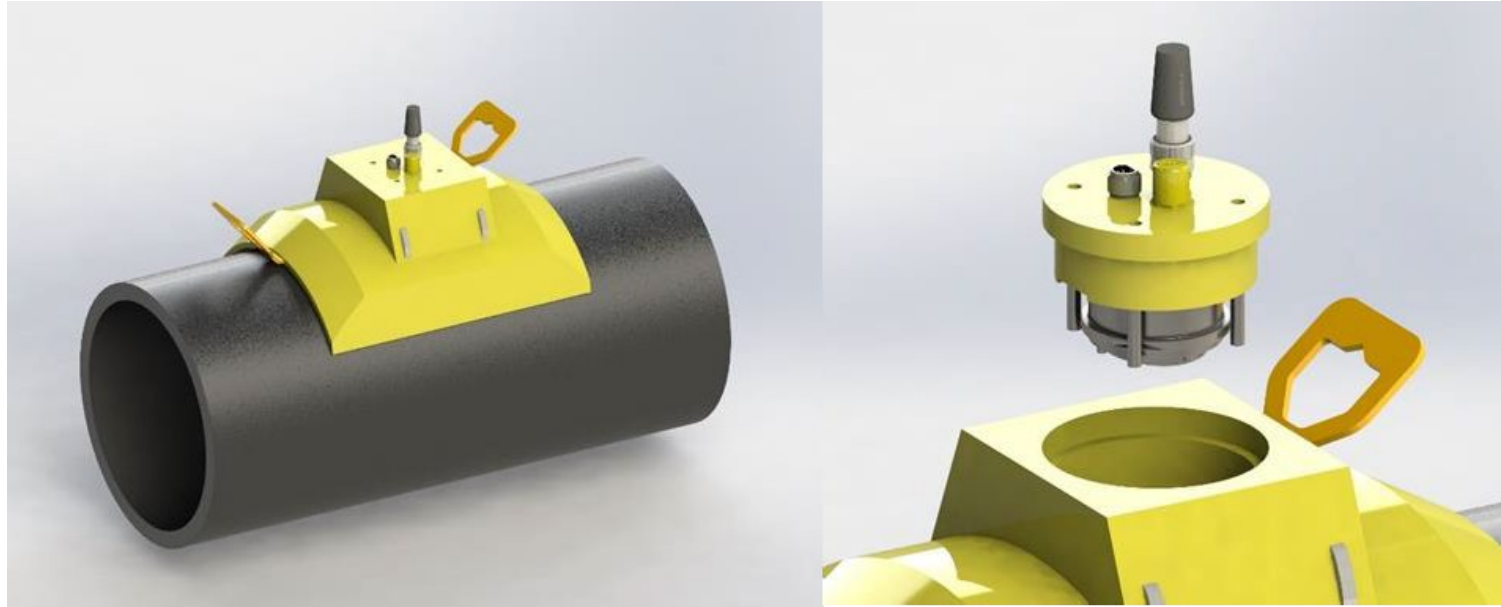
- Qualification/verification provided good accuracy and repeatability with insulated pipework.
- Actual testing reveals a higher k than the initial simulation.
- Simulation factors improved by actual testing.
- Ambient temperature must be known, measured, or constant.
- More insulation, better accuracy.

Non-permanent version

- Magnetic clamp
- Insulated temperature sensor
- Insulated "patch"
- Battery powered
- Internal memory or Communication to ROV
- From installation typical 5 minutes to achieve stable readings
- Custom design for actual pipe size
- Illustration installation on 16" pipe



Non-permanent version





Thank you!



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