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ADVANCED
TECHNOLOGIES

High Temperature Thickness Measurements Using HotSense[®] Transducers



High Temperature Thickness Measurements Using HotSense Transducers



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Validation of key performance indicators of deployed transducers for online monitoring

- Transducer high temperature and temperature-cycling stability and resilience
- Coupling efficiency and stability
- High temperature thickness measurement and compensation for changing process conditions

High Temperature Thickness Measurements Using HotSense Transducers

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CONTINUOUS MONITORING TRANSDUCER

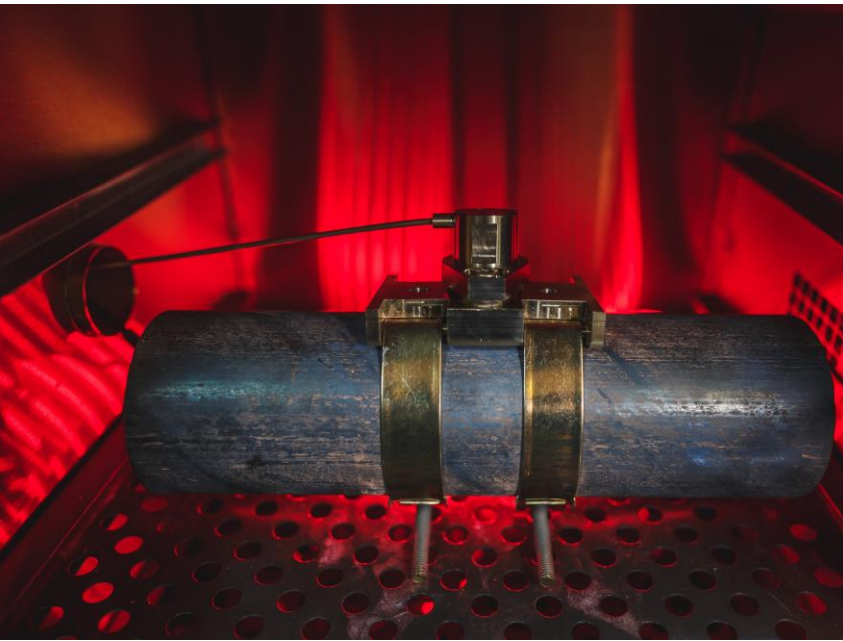
- Continuous measurement between -10°C and 350 °C , and 380°C intermittently
- Mechanical fixturing with solid couplant for efficient and stable installation and operation.
- <50mm total height – can be installed under insulation and weatherproofing
- Integrated in steel delay line – Precise and repeatable thickness measurements with temperature compensation
- Broad compatibility with industry standard instrumentation and software



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TEST SETUP



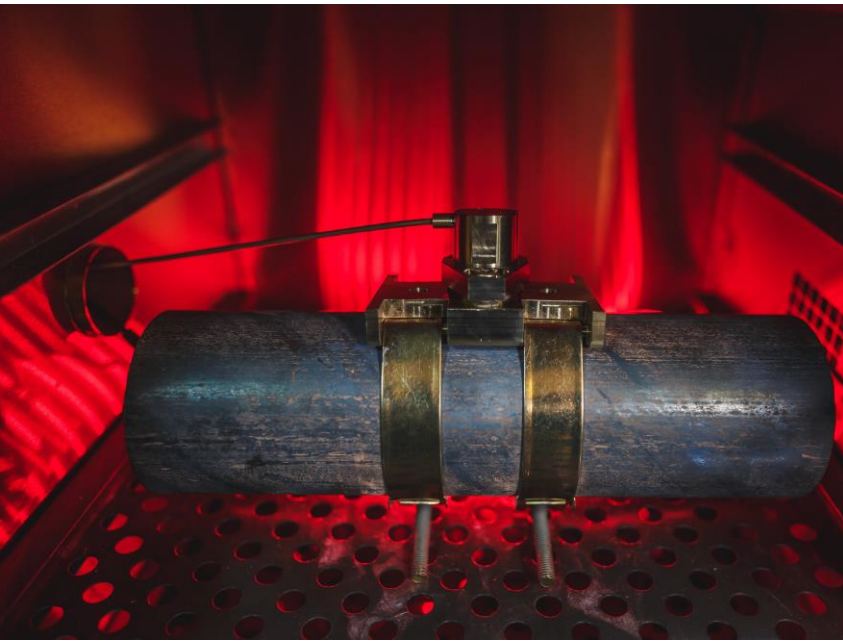
- 5" schedule 40 mild steel pipe (3" setup shown)
- Entire transducer heated in oven with no cooling or duty cycling - replicating installation under insulation
- Simulated 5 years service - 40 cycles with isotherms at 50°C and 350°C and 300°C/hr heating and cooling rate.
- Remote monitoring solution - real-time data acquisition and thickness measurement every 1 minute using proprietary algorithm

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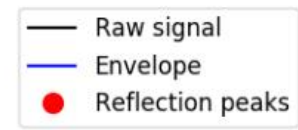
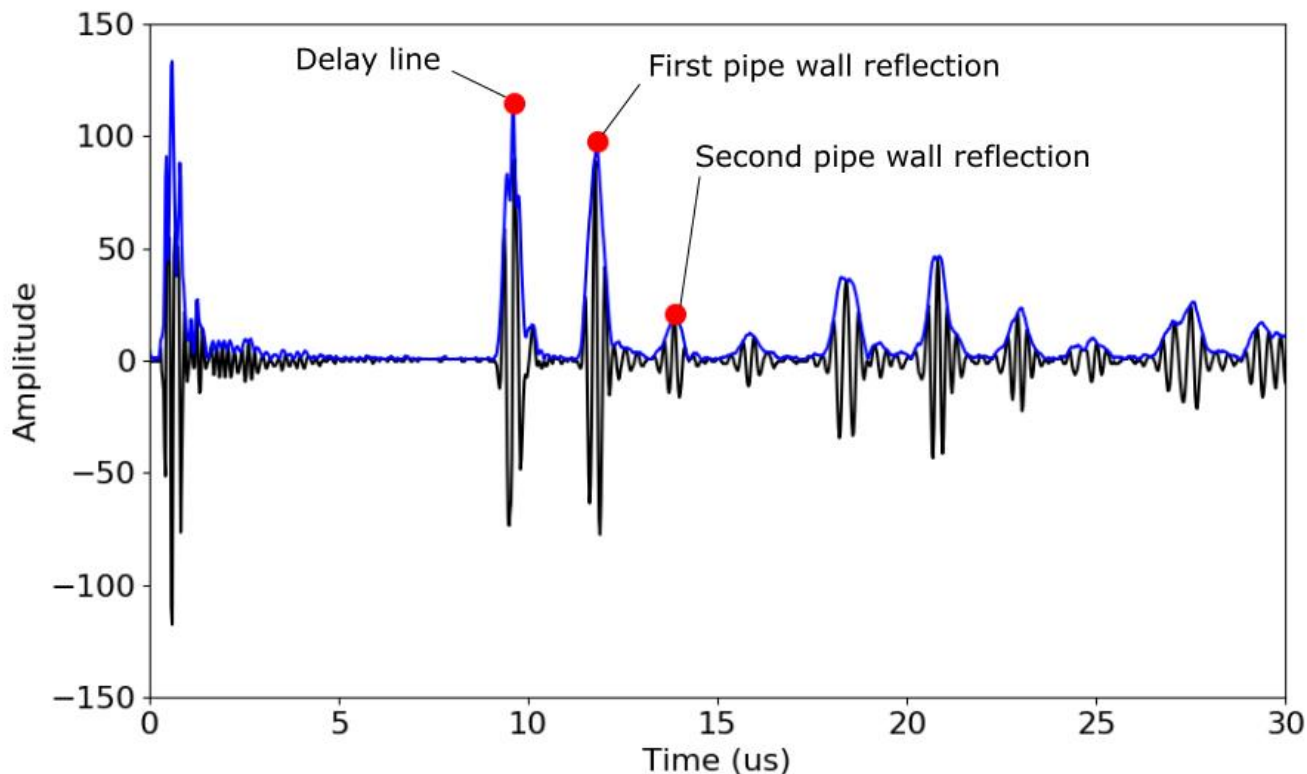


TEST SETUP

- Dynamic temperature compensation - Integrated delay line used as calibration block
- Temperature compensation based on change in speed of sound of the delay line as a function of temperature
- Assumed speed of sound of the pipe at room temperature is 5890m/s
- Temperature compensated thickness measurement allows for determination of rate of wall thickness change in dynamic environment

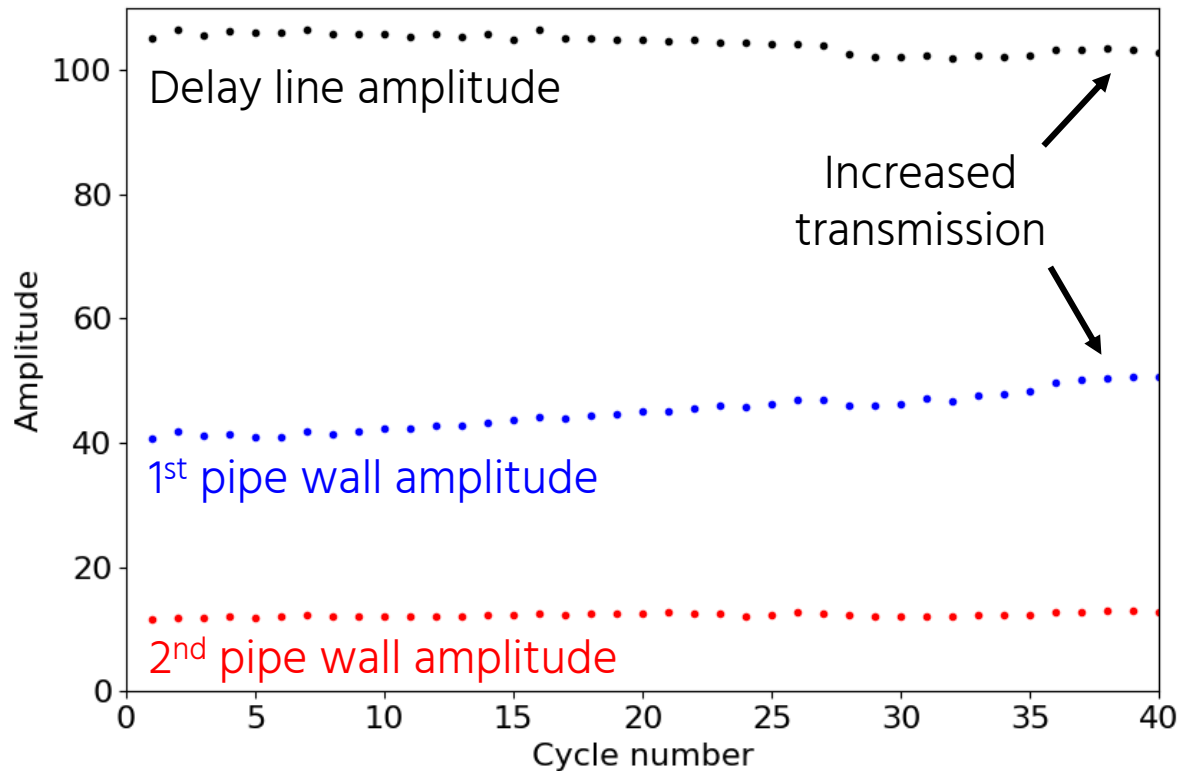


Coupled Transducer A-Scan



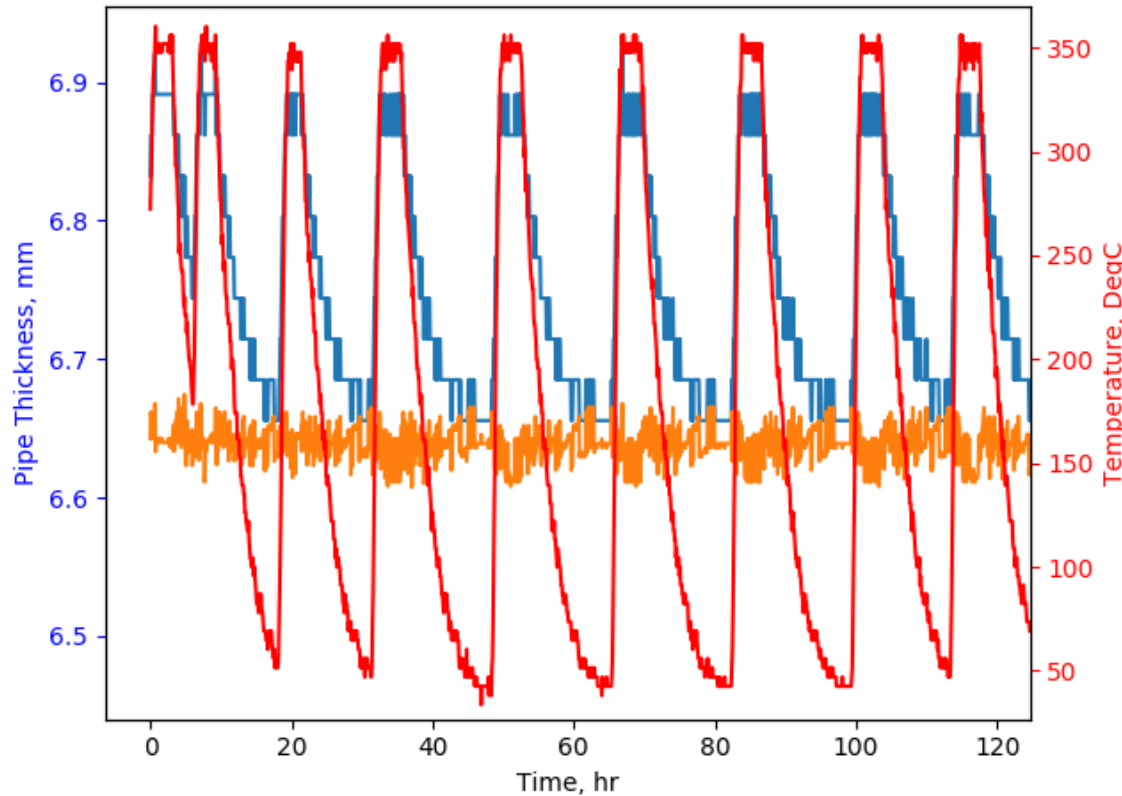
- Standard compression wave thickness measurement method
- Clear and repeatable signal
- Well defined peaks for automatic detection by thickness measurement algorithm

Peak Amplitude



- Excellent signal stability and repeatability over 40 cycles / 600 hrs
- Increased transmission with time as coupling efficiency improves
- Transducer and deployment system suitable for long term installation

Measured Pipe Thickness



— Before compensation
— After compensation

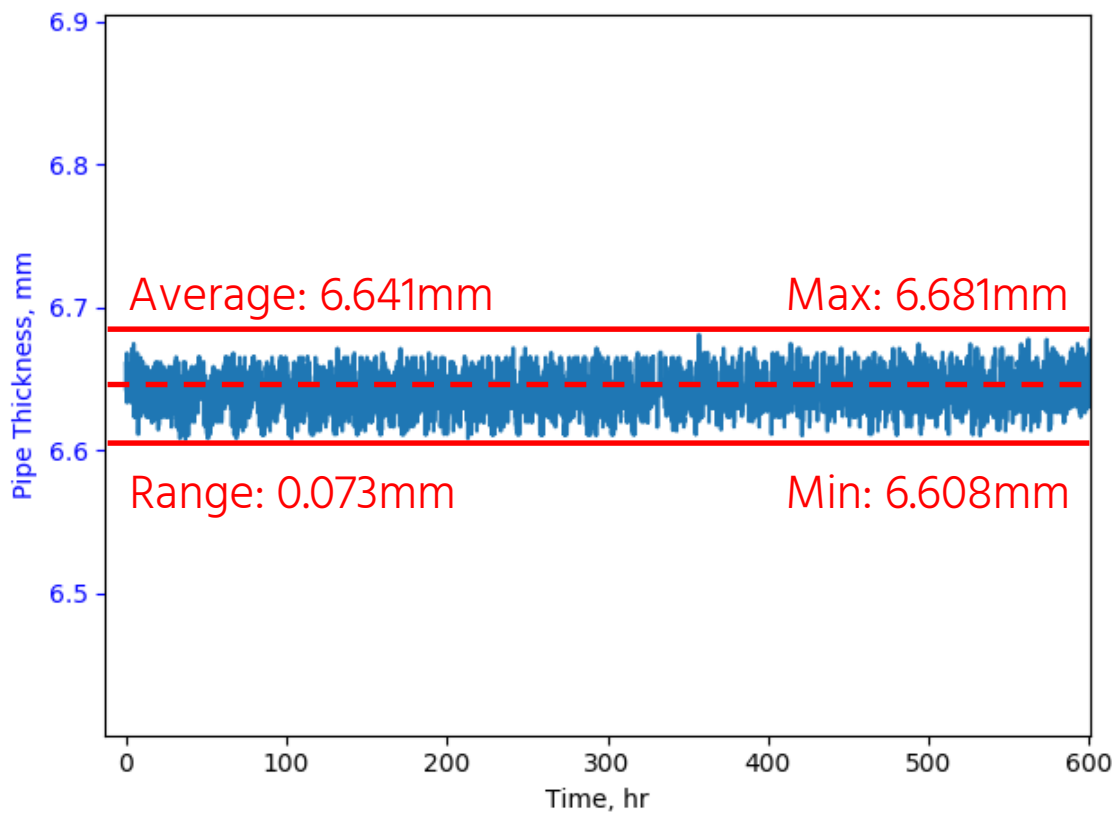
— Temperature

Large variation in non-compensated measurement due to speed of sound change with temperature

Compensation results in stable measurement during thermal cycling

Repeatable high temperature thickness measurements for determination of rate of wall loss

Measured Pipe Thickness



Only 73µm variation in thickness measurement across the whole test period

Absolute measurements can be made with assumed pipe wall speed of sound

Corrosion rates can be quickly determined to monitor the effect of corrosion management interventions and process changes

Suitable for use in dynamic thermal environment such as refinery, power station or plant

- Easy to use transducer and deployment system
- Reliable measurements across a wide temperature range up to 350°C
- Excellent ultrasonic coupling with extreme temperature cycling
- Integrated delay line for temperature compensation
- High measurement stability in a thermally dynamic environment
- Ready to fit to new or existing measurement systems

