



# SETTING NEW STANDARDS FOR PINHOLE METAL LOSS DETECTION.

Conventional wisdom has challenged the ability of Magnetic Flux Leakage (MFL) technologies and analysis to accurately detect pinhole anomalies, asserting that traditional non-destructive methods are more reliable. No longer. ENTEGRA's Ultra-High-Resolution (UHR) system accurately detects and identifies pinholes caused by microbially induced corrosion (MIC), AC induced corrosion, illegal taps, and a wide range of manufacturing anomalies.

### Pinhole characterization, redefined.

Extensive pull testing on a series of machined defects confirms ENTEGRA's ability to detect and characterize a pinhole metal loss feature as small as 3mm x 3mm. This was substantiated with field correlation which compared hundreds of internal and external pinhole anomalies with actual field observations. This field correlation testing is considered to be the most reliable and stringent in the industry based on API 1163 qualification standards.

### Taking the complexity out of complex corrosion.

Operators tell us that pinholes within larger areas of metal loss, or pits-in-pits, are their number one concern.

As you'll see, our Ultra-High-Resolution ILI system is uniquely capable of going beyond POD and POI to more accurately size and characterize a wider range of metal loss anomalies. Pinholes. Corrosion in puddle-welded pipe. Hard spots. Pilferage. Manufacturing defects. Corrosion in the long seam. Pits-in-pits. These are but a few of the pipeline corrosion challenges ENTEGRA helps operators to overcome.

### Benefits

- POD, POI, & Sizing 3mm (1/8") Metal Loss
- Internal & External
- Pinhole capability applies in areas of complex metal loss

UHR MFL/CAL/IMU Tool



CASE STUDY: MFL PINHOLE DETECTION

## ENTEGRA® CHARACTERIZES A RANGE OF PINHOLE AND OTHER ANOMALIES FOR GERMAN OPERATOR.

### Overview

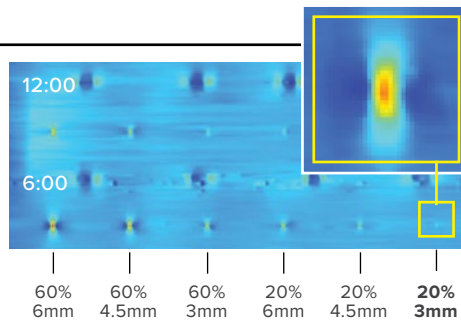
- 17 km, 16" gas pipeline
- Short launcher and receiver barrels, bore restrictions, multiple back-to-back 1.5D bends, wall thickness variations and obstructions.
- 16" UHR MFL/CAL tool with IMU

### Technical Details

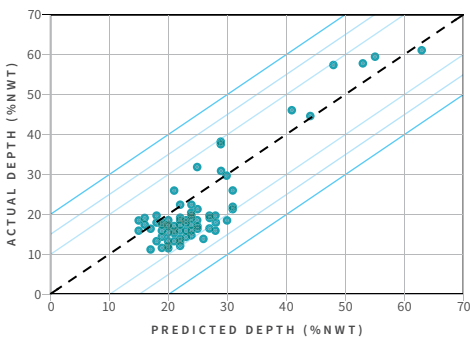
A German pipeline operator needed an accurate, efficient, and cost effective Ultra-High-Resolution (UHR) assessment of a 17.5 km line of 16" gas pipeline. As the operator's sole contractor for In-Line Inspection on this job, ENTEGRA was charged with providing the tools and data analysis expertise to inspect the gas pipeline containing multiple back-to-back 1.5D bends, multiple wall thickness changes, and a host of expected features, including casings, sleeves, valves, taps, and external close/touching metal objects.

### Key Performance Specification for Pinholes

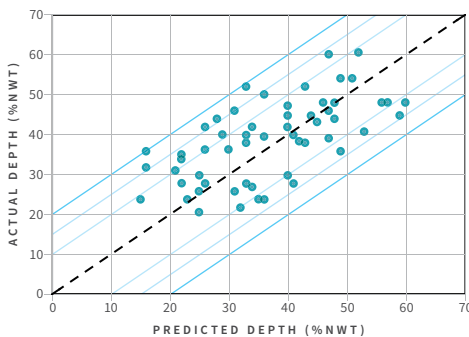
Pinhole Dimension	Minimum Depth Reported	
	INTERNAL	EXTERNAL
3mm x 3mm	18%	20%



UNITY GRAPHS: Internal Pinhole Defect on 6" DNS150 Pipe Cut-outs



Internal Pinhole Defect on 16" DNS400 Pipe Cut-outs

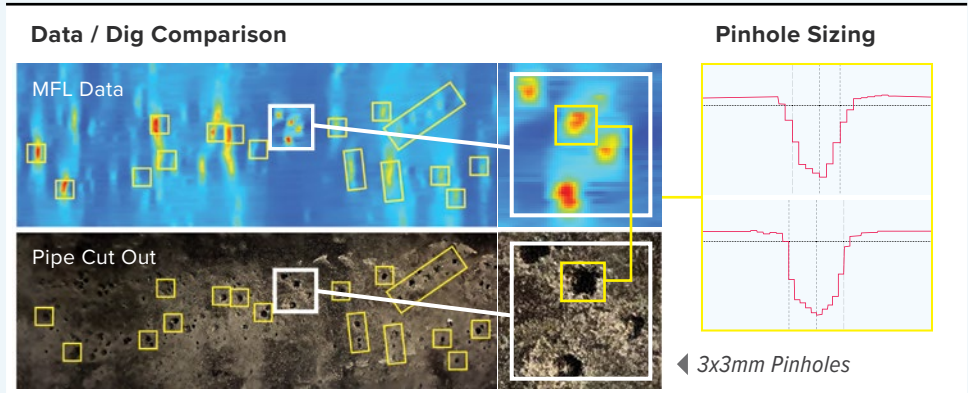


**The System at Work**

The ENTEGRA team deployed its UHR MFL/CAL/IMU combo tools to inspect and assess the 17-km line, which included back-to-back 1.5D bends, a minimum bore restriction of 20% of O.D. and varying wall thicknesses. ILI data is powered by proprietary ENTEGRA software and an experienced dedicated Level III Data Analyst providing immediate and final assessment of pinholes. Assessment of pinholes takes into consideration pits-in-pits, interaction with seam or weld, and internal/external discrimination. ENTEGRA strives to achieve a high POD and POI for all true pinhole type anomalies.

**Outcome**

First run success, as is reflective of ENTEGRA's 98.6% global first run success record. Specific focus on very small (3mm x 3mm) pinhole corrosion and hard spots. The pipeline operator was pleased to discover previously unidentified pinhole corrosion and detect suspected hard spots.



**TIMELINE**

One run, with immediates reported in 10 days and a full ILI report delivered in 50 days.



**VALUE**

UHR data accuracy resulted in identifying previously unidentified pinhole anomalies and zero false digs equating to a total savings of over \$170k USD compared to previous years ILI efforts with a competing ILI vendor.



**EFFICIENCIES**

UHR MFL/CAL/IMU data all in one run.



**The ENTEGRA UHR ILI System: A fusion of technology and people.**

It starts with the technology – a fleet of innovative UHR tools boasting double the number of MFL sensors, double the number of caliper (CAL) sensors, and double the sampling rate delivering four times the resolution of other top-level, high-res tools.

A range of UHR MFL/CAL/IMU in-line inspection tools, from 3" to 36" in diameter, are the workhorses of a technology platform that far exceeds the demands of pipeline operators and traditional MFL deliverables. They're lighter. Compact. More collapsible. And more capable. Our latest technology release is an array of Cathodic Protection Current Mapping (CPCM) ILI tools which collect both AC



and DC voltage data in a single run and can be correlated into our UHR MFL/CAL/IMU data, telling a more complete corrosion story.

What's behind that technology? Industry-leading experience laser focused on customer service. At ENTEGRA, project managers, engineers, subject matter experts, data scientists, Level III Analysts, and former pipeline operators work together to form the heart of our UHR ILI System.

**Bottom Line**

When compared to the impact and cost of a pipeline failure, the cost of an ILI run is insignificant. ENTEGRA's UHR ILI System - paradigm shifting ILI technology backed by the insight of our experienced team - helps operators to see more, know more, and do more when it comes to managing metal loss. We're setting the bar, worldwide, for first run success, increased throughput, reduced run costs, risk mitigation and ROI. That's the ENTEGRA difference.

**For More Information**

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For our latest API 1163 spec, talk to your ENTEGRA rep.

