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Tguqwtegu

Application Notes

Measuring Metal Thickness Through Paint

Application: Accurately measuring remaining wall thickness of metal pipes, tanks, beams, ship hulls, and other structures through paint and similar coatings.

Background: In many industrial and petrochemical maintenance situations it is necessary to measure the remaining thickness of metal that is subject to corrosion through one or more coats of paint or similar non-metallic coatings. With conventional ultrasonic thickness gages, the presence of paint or similar coatings will cause measurement errors, typically increasing the apparent metal thickness by more than twice the thickness of the paint, due to the paint's much slower sound velocity. Two solutions to this problem are available: Echo-to-Echo measurement and THRU-COAT measurement.

Equipment: Echo-to-echo and THRU-COAT capability is available on two Olympus corrosion gages: models **38DL PLUS**, and **45MG .** Echo-to-Echo measurement is usually performed with one of the following dual element transducers: **D790, D791, D797, or D798**. THRU-COAT measurement requires one of two specialized dual element transducers, a **D7906-SM or a D7908**.

Dual element transducers have long been the industry standard for corrosion survey applications, due to their superior response to rough surfaces and pitting conditions. Thus, they are normally recommended for all common corrosion gaging applications. Single element delay line transducers may be recommended in certain applications involving smooth painted metal where higher measurement precision is required.

Theory of Operation: Longitudinal wave sound velocity in steel is typically around 5,900 m/s (0.2320 in/us), while sound velocity in paint and similar coatings is normally less than 2,500 m/s (0.1000 in/us). A conventional ultrasonic gage that measures the total thickness of painted metal will erroneously measure the paint layer at the velocity of steel, meaning that the paint will appear to be at least 2.35 times thicker (the ratio of the two sound velocities) than it actually is. In situations involving thick coatings and close tolerances, the error introduced by the paint layer can be a significant part of the total measurement. The solution to this problem is to measure or calculate thickness in such a way that the paint component is removed from the measurement.

Echo-to-Echo thickness measurement simply involves the well-established technique of timing the interval between two successive back wall echoes that represent successive round trips of the sound wave through the test material. In situations involving painted metal, these multiple back wall echoes occur only within the metal, not in the coating, so the interval between any pair of them (back wall echo 1 to 2, back wall echo 2 to 3, etc.) represents metal thickness only with the coating thickness cancelled out.

Echo-To-Echo Measurements
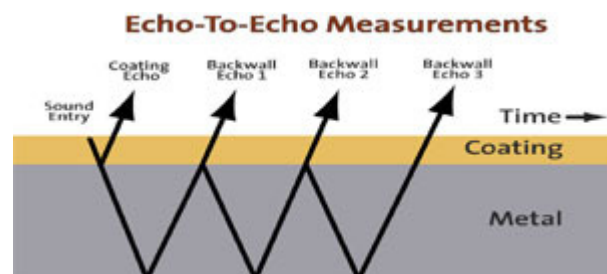
THRU-COAT measurement involves the use of a patented software approach to identify the time interval represented by one round trip in the coating. That time interval is used to calculate and display the coating thickness, and by subtracting that interval from the total measurement the gage can also calculate and display the metal substrate thickness.

Each of these techniques has advantages and disadvantages that should be considered in selecting which is best for a given application:

Echo-to-Echo advantages:
• Works with a variety of common transducers.
• Often works through rough-surfaced coatings.
• Can be performed at high temperatures up to approximately 500 C or 930 F with appropriate transducers.

Echo-to Echo disadvantages:
• Requires multiple back wall echoes, which may not exist in severely corroded metals.
• Thickness range may be more limited than with Thru-Coat.

THRU-COAT advantages:
• Works over a wide range of metal thicknesses, typically from 1 mm (0.040 in.) to greater than 50 mm (2 in.) in steel.
• Requires only one back wall echo.
• May measure minimum remaining metal thickness more accurately in pitting situations.

THRU-COAT disadvantages:

• Coating must be non-metallic and at least 0.125 mm (0.005 in.) thick.

• Coating surface must be relatively smooth.

• Requires use of one of two specialized transducers.

• Maximum surface temperature is approximately 50 C or 125 F.

Procedure: The procedures for activating and performing Echo-to-Echo and THRU-COAT measurements with the 38DL and 45MG gages and appropriate transducers are described in detail in the respective gage operating manuals. Please refer to the gage manuals for that information, as well as details on the recommended procedure for velocity calibration, and for gain and blanking optimization where necessary.

Rangeof Measurement Thru-Coat: The THRU-COAT feature using D7906-SM or D7908 transducers can measure only non-metallic coatings such as paint or epoxy that are 0.005" (0.12mm) or greater in thickness. If you are measuring coated steel and a value for the coating is not displayed, the coating thickness is below the minimum thickness reading capability of the THRU-COAT feature or cannot be otherwise resolved by the feature. However in many cases, the thickness of the coating will still be subtracted from measurement and the thickness of the steel will be displayed. You may also attempt the measurement using the Echo-to-Echo feature, or it may be necessary to remove the coating.

The measurable metal thickness in THRU-COAT mode typically ranges from approximately 1 mm (0.040 in.) to greater than 50 mm (2 in.), depending on the acoustic properties of the metal and the interior surface condition.

Rangeof Measurement Echo-to-Echo: In echo-to-echo mode, the range of thickness depends on transducer selection and the type of gage being used, as well as the acoustic properties of the metal being measured and the surface condition. Because by definition Echo-to-Echo measurement requires the presence of at least two backwall echoes, it will not work in certain extreme situations involving severely corroded, very rough, highly scattering, or highly attenuating materials that do not support a second multiple backwall echo. In such cases, THRU-COAT measurement should be used if possible.

With the Model 38DL and 45MG gages, typical echo-to-echo thickness ranges are as follows:

Transducer Type	Thickness Range*
D798	0.060 in. to 0.300 in. (1.5 mm to 7.50 mm)
D790/D791	0.100 in. to 2.00 in. (2.0 mm to 50 mm)
D797	0.500 in. to 5.00 in. (12.5 mm to 125 mm)
M201	0.050 in. to 0.500 in. (1.25 mm to 12.5 mm)

Thickness ranges are dependent on material, surface condition and temperature.

Products used for this application

38DL PLUS »

The 38DL PLUS is an advanced ultrasonic thickness gage. Uses dual element transducer for internally corroded applications, features include THRU-COAT and Echo-to-Echo. Uses single element transducers for very precise thickness measurements of thin, very thick, or multilayer materials.

45MG »

The handheld 45MG is an ultrasonic thickness gage packed with measurement features and software options. This unique instrument is compatible with the complete range of Olympus dual element and single element transducers, making this innovative instrument an all-in-one solution for virtually every thickness gage application.

Uwduetkdg   vq ›
Pgy urgwgtu

Jgvc Swqvg   ›

FqpvcevWu   ›

NDT Instruments

Flaw Detectors/Phased Array Flaw Detectors
Thickness Gages
Transducers and Probes
Bar Inspection Solutions
Tube Inspection Solutions
NDT Systems Instrumentation
Industrial Scanners

Videoscopes, Borescopes

Videoscopes
Fiberscopes
Rigid Borescopes
Light Sources
Inspection Assist Software
Turning Tools

Industrial Microscopes

Laser Confocal Microscopes
Digital Microscopes
Measuring Microscopes
Cleanliness Inspector
Light Microscopes
Semiconductor & Flat Panel Display Inspection Microscopes
Stereo Microscopes
Digital Cameras
Image Analysis Software
Objective Lenses
OEM Microscope Components for Integration

XRF and XRD Analyzers

Handheld XRF Analyzers
Compact and Portable XRF Analyzers
Process XRF Analyzers
XRD Analyzers
OEM Solutions
Applications Solutions Key

Support

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