

Ultrasonic Thickness Gauge Selection Guide (DMS Go+, MG2-XT, EPOCH, 45MG, 27MG) — Corrosion Mapping & Marine NDT

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Ultrasonic thickness gauge selection reference: dual-element corrosion gauges (Baker Hughes DMS Go+, Evident 45MG, 27MG) versus single-element precision and flaw-detector families (Baker Hughes DMS 2, USM 36; Evident EPOCH 650, EPOCH 6LT), keyed to ISO 16809 measurement principles and ASTM E797 practice. Includes transducer selection by material and thickness range (1 mm through 635 mm), coupling and B-scan corrosion mapping guidance, thru-coating measurement (echo-to-echo) for painted hulls and pipe, temperature range and hot-surface transducer choice for insulated pipework, calibration to steel and non-steel materials (V-block, step wedge, custom), and typical marine, oil & gas, pressure vessel and refractory applications.

Ultrasonic thickness gauge selection & corrosion & precision families

A portable ultrasonic thickness gauge (UTG) is the primary non-destructive tool for measuring the remaining wall of a corroded or eroded steel, alloy, plastic or composite structure. It works by timing the round-trip of a short ultrasonic pulse launched into the material through a coupled transducer, and calculating thickness from the material sound velocity. Correct instrument selection depends on four coupled decisions: (1) the target thickness range and required resolution; (2) whether the surface is corroded, painted or clean; (3) the material sound velocity and attenuation; and (4) whether the measurement is a single wall-thickness reading, a corrosion-mapping B-scan, or a general-purpose flaw-detector duty that happens to include thickness. The selection matrix below covers the two dominant portable UTG families — Baker Hughes (formerly GE) Waygate and Evident (formerly Olympus) — against the ISO 16809 and ASTM E797 practice governing thickness measurement.

Dedicated corrosion thickness gauges (dual-element)

A dual-element (dual crystal) transducer has separate transmit and receive elements mounted in a single housing, side-by-side across a small acoustic barrier. The V-shaped sound path through the wall lets the gauge see the first back-wall echo cleanly even when the couplant film is thick and the front surface is corroded. This is the default architecture for corrosion measurement.

Instrument | Family | Range (steel, mm) | Resolution (mm) | Transducer freq. | B-scan | Thru-coat mode |

Baker Hughes DMS Go+ | Corrosion | 0.5 to 635 | 0.01 | 2 / 5 MHz dual | Yes | Echo-to-echo, TCG |

Baker Hughes DMS 2 | Corrosion + A-scan | 0.5 to 635 | 0.01 | 2 / 5 / 10 MHz dual | Yes | Echo-to-echo, differential |

Baker Hughes DM5E DL | Corrosion (rugged) | 0.5 to 500 | 0.01 | 2 / 5 MHz dual | Optional | Echo-to-echo |

Evident 45MG | Corrosion + precision | 0.08 to 635 | 0.001 | 2 to 20 MHz dual & single | Yes (with option) | Echo-to-echo, TCG |

Evident 27MG | Corrosion | 0.5 to 635 | 0.01 | 2 / 5 MHz dual | Yes (27MG XT) | Echo-to-echo (XT) |

Evident 38DL PLUS | Corrosion + precision | 0.08 to 635 | 0.001 | 2 to 30 MHz dual & single | Yes | Echo-to-echo, TCG |

All the instruments above accept the AWS D1.1 acceptance criterion (± 0.1 mm on a steel plate) and comply with ISO 16809 as portable thickness gauges. The DMS Go+ replaces the older DMS 2 as Baker Hughes' current-generation corrosion gauge and adds a colour touch-screen, on-board B-scan storage of 500,000 readings and PC-Link connectivity for corrosion-mapping datasets. The Evident 45MG covers the same duty cycle and additionally accepts single-element precision transducers for tight-tolerance thin-wall work down to 0.08 mm on a delay-line probe.

Precision thickness (single-element)

A single-element transducer transmits and receives on the same element, giving a cleaner near-surface echo train and higher measurement resolution but requiring a smoother front surface. Precision gauges are the choice for measuring thin wall (

Instrument | Range (steel, mm) | Resolution (mm) | Transducer | Delay-line support |

Baker Hughes DMS Go+ Precision Mode | 0.08 to 500 | 0.001 | Single 10-20 MHz | Yes (DL probe range) |

Evident 45MG Precision Mode | 0.08 to 635 | 0.001 | Single 2-30 MHz | Yes (D790 series delay line) |

Evident 38DL PLUS Precision Mode | 0.08 to 635 | 0.001 | Single 2-30 MHz | Yes |

The two Evident precision-capable gauges (45MG, 38DL PLUS) share the same transducer range and are chosen on cost and B-scan requirement rather than raw performance. Baker Hughes' equivalent precision workflow lives inside the DMS Go+ as a mode-switchable option rather than a separate instrument.

Flaw detectors with thickness mode

A general-purpose ultrasonic flaw detector (Baker Hughes USM 36, USM Vision+, Evident EPOCH 650 and 6LT) offers an on-board thickness mode and stores gate-triggered thickness readings alongside its primary A-scan / TOFD / phased-array work. Use a flaw detector as the primary thickness instrument when the same inspection also needs weld-defect sizing, corrosion-under-insulation TOFD or PAUT sector scans — otherwise the dedicated corrosion gauges above are lighter, more battery-efficient and quicker to configure.

Instrument | Primary duty | Thickness range (mm) | PA / TOFD |

Baker Hughes USM 36 | Portable flaw detector | 1 to 9,999 (A-scan gated) | Single-channel; PA optional |

Baker Hughes Mentor UT | Portable UT + thickness | 0.5 to 635 | Single-channel |

Evident EPOCH 650 | Portable flaw detector | 1 to 5,000 | Single-channel |

Evident EPOCH 6LT | Rope-access flaw detector | 1 to 5,000 | Single-channel |

Transducer selection by material and thickness range

Transducer choice drives measurement resolution and acceptable thickness range more than the instrument itself does. Higher-frequency transducers give shorter wavelengths and finer near-surface resolution but attenuate faster in coarse-grained materials. Use the guide below as a starting point:

Material | Thickness | Transducer freq. | Element diameter | Notes |

Carbon steel (rolled plate, pipe) | 1 to 10 mm | 5-10 MHz dual | 6-13 mm | Default corrosion probe |

Carbon steel | 10 to 100 mm | 2-5 MHz dual | 13-25 mm | General corrosion mapping |

Carbon steel | 100 to 635 mm | 2 MHz dual | 19-25 mm | Thick section (vessel wall) |

Stainless steel (austenitic weld) | 3 to 60 mm | 1-2 MHz dual (low-freq) | 25 mm | Coarse grain attenuates > 2 MHz |

Cast iron (grey/ductile) | 3 to 25 mm | 1-2 MHz dual | 25 mm | Very coarse grain; verify with 2nd echo |

Aluminium alloy (5xxx/6xxx) | 0.5 to 200 mm | 5-10 MHz single/dual | 6-13 mm | Higher velocity 6.35 mm/μs |

Copper / brass | 1 to 60 mm | 5 MHz single/dual | 13 mm | Lower velocity 4.7 mm/μs; recalibrate |

Titanium alloy | 0.5 to 60 mm | 10-20 MHz single | 6 mm | Sound velocity 6.10 mm/μs |

Nickel alloy (Inconel 625/718) | 2 to 60 mm | 2-5 MHz dual | 13 mm | Attenuation sensitive to heat treatment |

HDPE / polyethylene pipe | 3 to 60 mm | 2-5 MHz dual delay-line | 13 mm | Low velocity 2.4 mm/μs; needs delay line |

Glass / ceramic | 0.5 to 20 mm | 10-20 MHz single | 6 mm | Precision only; polish surface |

Composite (CFRP/GFRP laminate) | 1 to 30 mm | 2-5 MHz single | 13-25 mm | Multi-layer; verify on step-wedge |

Thru-coating (echo-to-echo) measurement

A painted or coated wall — ship's hull with epoxy topcoat, coated pipe, painted tank — adds an unknown paint thickness to a single-echo reading. Echo-to-echo mode measures the time between successive back-wall echoes and reports the wall thickness directly, without adding the coating thickness. Every corrosion gauge in the tables above supports echo-to-echo; the technique requires:

A dual-element transducer with adequate bandwidth (5 MHz is typical; 2 MHz on thicker walls).

A wall thick enough to resolve the second echo before the first echo has decayed — typically "e 2.5 mm on carbon steel with a 5 MHz probe, "e 5 mm with a 2 MHz probe.

Coating thickness under approximately half the wall thickness (thicker coatings attenuate the second echo).

Echo-to-echo is essential for reliable hull-thickness measurement on any painted marine structure and for pipe-wall measurement without stripping the coating — a major time saving on in-service inspection.

Calibration — steel and non-steel materials

Every UTG defaults to a nominal steel sound velocity of 5.90 mm/μs (longitudinal wave in mild steel). Real material velocity varies with alloy, heat treatment and temperature, and every measurement is only as accurate as the velocity setting.

Calibrate before each session using one of:

Two-point step wedge — a machined block with two known thicknesses in the range of interest. Records both velocity and probe zero-offset. Preferred method for corrosion mapping.

Custom-material sample — a known-thickness coupon of the actual material under inspection. Necessary for non-standard alloys and any composite.

V1 / V2 IIW block — for flaw detectors doing thickness as a secondary duty. Not accurate to 0.01 mm.

ASTM E797 practice — two-point calibration on a step wedge covering "e 80 % of the expected wall range. Verify against a mid-range check point after every 20-30 readings.

Hot-surface measurement (up to 500 °C)

In-service pipe and vessel inspection often demands thickness measurement on a hot surface without shutting the plant down. Standard transducer housings tolerate 60 °C continuous. Above that, choose a dedicated hot-surface probe:

To 200 °C — high-temperature dual-element with silicone-based couplant. Limited dwell time (5-10 s per reading, then let the probe cool).

To 400 °C — delay-line transducer with a ceramic wear-face. Use high-temperature couplant (Ultragel HT, Sonogel HT or equivalent). Dwell 3-5 s per reading.

To 500 °C — specialised delay-line transducer with active water cooling or a heat-sink shoe. Requires a solid-state or EMAT alternative on structural inspection; every reading is a short-duration measurement.

EMAT (electromagnetic acoustic transducer) instruments — Innerspec, Innerspec temate PowerBox, MacTech HTB — couple ultrasound electromagnetically into the wall without contact and are the practical choice above 500 °C and on non-couplable surfaces (heavy scale, refractory-lined vessels).

Application matrix

Application | Recommended family | Notes |

Ship hull corrosion survey (painted) | DMS Go+ or 45MG, echo-to-echo | Class-society compliant record via B-scan export |

Pipeline corrosion mapping (in-service) | DMS Go+ or 45MG with B-scan option | API 570 in-service inspection | Pressure vessel wall (API 510) | DMS 2 or DMS Go+, 2 MHz dual | Grid-pattern data with reading pattern in the report | Boiler tube (retube inspection) | 45MG or 27MG, high-temperature probe | Small OD (25-75 mm); use miniature dual transducer | Refinery furnace tube | DMS Go+ + hot-surface probe or EMAT | Hot service; verify calibration at operating temperature | Refractory-lined vessel | EMAT | Non-contact; scale/refractory too thick for conventional UT | Aerospace composite panel | 45MG precision + composite transducer | Verify on step-wedge of same layup | Weld inspection + thickness | USM 36 or EPOCH 650 | Combine flaw detection and gated thickness | Rope-access hull / offshore structural | EPOCH 6LT | Purpose-built for one-handed use at height |

Standards, records and reporting

ISO 16809:2019 — Non-destructive testing — Ultrasonic thickness measurement. Defines the measurement method, calibration, uncertainty budget and reporting shape for portable UTG readings.

ASTM E797/E797M-15 — Standard practice for measuring thickness by manual ultrasonic pulse-echo contact method. The North American reference practice.

API 570 — piping inspection code; specifies thickness measurement frequency, corrosion monitoring locations (CMLs) and reporting for in-service piping.

API 510 — pressure vessel inspection code; same for pressure vessels.

API 653 — above-ground storage tank inspection; specifies floor and shell thickness survey requirements.

ASME Boiler & Pressure Vessel Code (Section V, Article 23 SE-797) — equivalent to ASTM E797 for boiler and pressure vessel work.

Related products and references

Baker Hughes DMS Go+ ultrasonic thickness gauge on cBallast

All DMS Go+ variants and accessories

Baker Hughes USM 36 flaw detector

Evident (Olympus) EPOCH portable flaw detectors

Evident 45MG thickness gauges

Evident 27MG corrosion gauges

Baker Hughes Waygate on cBallast

Evident (formerly Olympus) NDT on cBallast

Measurement and inspection tools category

Instrument specifications and transducer ranges are compiled from the current published data sheets of Baker Hughes Waygate and Evident (formerly Olympus). Confirm the specific model configuration, transducer part number and calibration coupon against the OEM catalogue for the intended application. cBallast supplies OEM and equivalent transducers and calibration coupons; contact us for a matched-transducer quote against the instrument you already operate.

Part numbers and designations are those of the original manufacturers and are given for identification. cBallast is an independent supplier. © cBallast 2026 · cballast.com