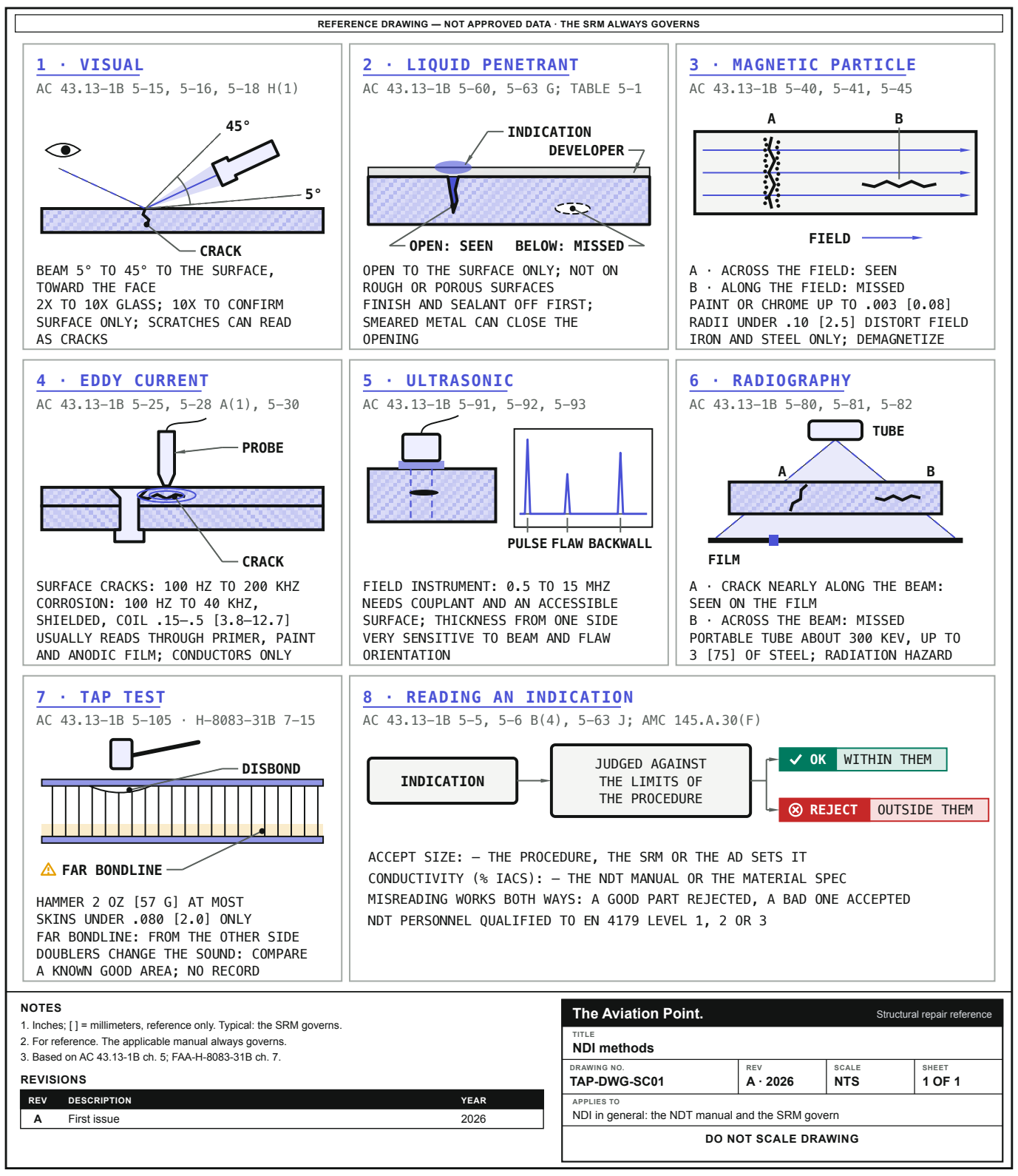
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NDI Methods: What Each One Finds, and What It Misses

Visual · borescope · tap · penetrant · magnetic particle · eddy current · UT · X-ray · thermography

1 Identification



Each method sees only what its physics reaches: orientation decides for magnetic particle and X-ray, the open surface for penetrant, the near skin for the tap test.

What each method finds and misses

Method	Finds	Misses, or limits	Materials
Visual, with light, mirror and magnifier	Surface cracks, corrosion, contamination, finish damage; buckled, bulging or dented skin; overheating marks; composite delamination signs	Surface only; generally only large flaws; scratches can be misread as cracks	All
Borescope	Inside closed structure and engines: pitting, scoring, cracks, seal and part fit, foreign objects	Surface only, and only what the tip can see	All
Tap test	Delamination or disbond near the surface; thin skin to stiffener bondlines; honeycomb with thin face sheets	Skins under 0.080 in [2.0 mm] only; the far bondline of a honeycomb panel needs access from the other side; no record; design details change the sound	Composite and bonded metal
Liquid penetrant	Discontinuities open to the surface	Nothing below the surface; rough or porous surfaces; finish and sealant must come off; smeared metal can close the opening	Nonporous metals and non-metals, steel included
Magnetic particle	Cracks, laps, seams, voids, pits at or slightly below the surface	Only iron and steel; a flaw parallel to the field; paint or chrome over 0.003 in [0.08 mm]; the part must be demagnetized after	Ferromagnetic only
Eddy current	Surface and subsurface cracks, pits, metal loss from corrosion on inner surfaces; usually through primer, paint and anodic film	Conductive material only; the probe must reach the surface; rough surfaces; slow over large areas; best on small local areas	Electrically conductive
Eddy current, conductivity	Alloy and heat-treat condition; heat damage after grinding, fire or overheating	Acceptance values: the NDT manual or the material specification sets them	Conductive metals
Ultrasonic	Cracks, porosity, delaminations, bond voids; thickness from one side	Needs couplant and an accessible surface; very sensitive to beam and flaw orientation; high skill to set up and read	Wide range of materials and thicknesses
Radiography (X-ray)	Internal flaws, hidden areas, water in honeycomb core, crushed core; gives a permanent record	Cracks only when nearly along the beam; tight cracks in thick sections; delaminations almost never; no depth; radiation hazard	Most; composites need low energy
Thermography	Debonds, cracks, impact damage, panel thinning, water in composites and honeycomb	Works best on thin laminates and near-surface flaws	Composite and bonded structure

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2 Allowable damage

The numbers the public documents give

Item	Value [mm]	Source
Flashlight angle for surface cracks	5° to 45° to the surface, toward the face	AC 43.13-1B par. 5-18 h(1)
Magnifier to carry / to confirm a crack	2 to 10 power / 10 power	AC 43.13-1B pars. 5-16, 5-18 h(1)
Magnification of a simple lens	M = 10 / f, f in inches: f = 5 in [127 mm] gives 2 power	AC 43.13-1B par. 5-16 c
Eddy current, surface cracks	100 Hz to 200 kHz	AC 43.13-1B par. 5-28 a(1)
Eddy current, corrosion	100 Hz to 40 kHz; shielded probe, coil 0.15 to 0.5 in [3.8 to 12.7 mm]	AC 43.13-1B par. 5-30
Ultrasonic field instrument	0.5 to 15 MHz	AC 43.13-1B par. 5-93
Tap hammer / skin it works on	2 oz [57 g] at most / under 0.080 in [2.0 mm]	AC 43.13-1B par. 5-105
Coatings left on for magnetic particle	Paint or chrome up to 0.003 in [0.08 mm]; electroplated nickel up to 0.001 in [0.025 mm]	AC 43.13-1B par. 5-45 a
Portable X-ray tube	About 300 keV; up to the absorption of 3 in [75 mm] of steel	AC 43.13-1B par. 5-82
Accept size of an indication	—	The procedure, the SRM or the AD (AC 43.13-1B par. 5-6 b(4))
Conductivity acceptance (% IACS)	—	The NDT manual or the material specification

3 Repair

1. Get the procedure.
2. Look first.
3. Prepare for the method.
4. Calibrate on the standard.
5. Inspect the whole area.
6. Confirm, size, clean, record.

Key points

- **The manual names the method:** NDT manual, SB, AD or SSID.
- **Penetrant:** open to the surface only. **Magnetic particle:** iron and steel only.
- **Eddy current:** conductive metal, usually through paint.
- **X-ray** almost never shows a delamination; **tap** only skins under 0.080 in.
- **Qualified staff** read the indication; the limit is the manual's.

MAIN SOURCES · AC 43.13-1B with Change 1, Acceptable Methods, Techniques, and Practices — Aircraft Inspection and Repair · FAA-H-8083-31B, Aviation Maintenance Technician Handbook — Airframe · TO 1-1A-1 / NAVAIR 01-1A-1, General Manual for Structural Repair · AMC 145.A.30 to Regulation No 1321/2014, Annex II · AC 43-3, Nondestructive Testing in Aircraft · EASA Part-66 Appendix I 2023/989) and FAA-S-ACS-1

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