



UT and MT Level II formula sheet

Dated to ASNT's UT General topic list for exams prior to 5 Feb 2027 and its MT General topic list for exams prior to 15 Dec 2026, read 21 Oct 2026 on ASNT's NDT Level II examinations page.

certification.asnt.org/certification/examinations/asnt-ndt-level-ii

ASNT publishes no formula list for either exam and does not say whether a formula sheet is supplied. The MT list for exams after 15 Dec 2026 still names coil, prod and direct contact techniques.

Our own one-page summary of the formulas worked in the UT formulas guide. Work each example by hand, then check it with the calculator named beside it.

- Velocity in mm/μs and frequency in MHz give lengths in mm. Angles are measured from the normal.
- Flat, parallel surfaces and an isotropic material. Round answers at the end, not between steps.
- MT values are in inches and amperes. Your written procedure and the standard it follows control.

Ultrasonic testing (UT)

Wavelength

$$\text{wavelength} = c / f$$

Check: 3.10 mm/μs at 4 MHz: 0.775 mm

[Open in calculator: anglebeam.com/tools/ut-beam-calculator](https://anglebeam.com/tools/ut-beam-calculator)

Near field (circular element, diameter D)

$$N = D^2 \times f / (4c), \text{ or } N = D^2 / (4 \times \text{wavelength})$$

$$\text{fuller form: } N = D^2 / (4 \times \text{wavelength}) \times [1 - (\text{wavelength} / D)^2]$$

Check: 12 mm, 4 MHz, 6.00 mm/μs: 24.0 mm (fuller form 23.6 mm)

[Open in calculator: anglebeam.com/tools/ut-beam-calculator](https://anglebeam.com/tools/ut-beam-calculator)

Beam spread (half-angle from the beam axis)

$$\sin a = k \times c / (f \times D)$$

k = 0.514 at the -6 dB edge; 1.08 at -20 dB; 1.22 at the extreme edge

Check: 12 mm, 4 MHz, 6.00 mm/μs, k = 0.514: 3.7°

[Open in calculator: anglebeam.com/tools/ut-beam-calculator](https://anglebeam.com/tools/ut-beam-calculator)

Snell's law and critical angles

$$\sin(\text{incident}) / c_1 = \sin(\text{refracted}) / c_2$$

1st critical: $\sin = c(\text{wedge}) / c(\text{longitudinal in part})$; 2nd: $\sin = c(\text{wedge}) / c(\text{shear in part})$

Check: wedge 2.60, shear 3.10, longitudinal 6.00 mm/μs: 60° shear needs 46.6°; critical angles 25.7° and 57.0°

[Open in calculator: anglebeam.com/tools/snells-law-calculator](https://anglebeam.com/tools/snells-law-calculator)

Angle beam geometry (thickness T, refracted angle a)

leg = $T / \cos a$; V path = $2T / \cos a$; skip distance = $2T \times \tan a$; half skip = $T \times \tan a$

surface distance = sound path $\times \sin a$

depth, first leg = sound path $\times \cos a$; depth, second leg = $2T - \text{sound path} \times \cos a$

Check: 20 mm plate, 60°, 55 mm sound path: skip 69.3 mm, second leg, depth 12.5 mm, surface distance 47.6 mm

[Open in calculator: anglebeam.com/tools/skip-distance-calculator](https://anglebeam.com/tools/skip-distance-calculator)

Decibels

$$\text{dB} = 20 \log_{10} (A_2 / A_1); \text{ratio} = 10^{(\text{dB} / 20)}$$

about 6 dB doubles amplitude; 20 dB is 10 times

Check: 80% to 32% screen height: -8.0 dB

[Open in calculator: anglebeam.com/tools/decibel-calculator](https://anglebeam.com/tools/decibel-calculator)

Acoustic impedance and reflection

$$Z = \text{density} \times \text{velocity}; \text{amplitude ratio } R = (Z_2 - Z_1) / (Z_2 + Z_1)$$

$$\text{reflected energy} = R^2; \text{transmitted energy} = 4 \times Z_1 \times Z_2 / (Z_1 + Z_2)^2$$

Check: $Z_1 = 35.0$, $Z_2 = 1.92$: $R = -0.896$, reflected energy 0.803, transmitted 0.197

Magnetic particle testing (MT)

Coil shot, ampere-turns (part length L, diameter D)

$NI = 45,000 / (L/D)$; amperes = NI / number of coil turns

the part should have an L/D of 3 or greater

Check: 10 in by 2 in part, 5-turn coil: L/D 5, 9,000 ampere-turns, 1,800 A

[Open in calculator: anglebeam.com/tools/mt-amperage-calculator](https://anglebeam.com/tools/mt-amperage-calculator)

Prods (amperes per inch of prod spacing)

90 to 110 A per inch below 3/4 in thick; 100 to 125 A per inch at 3/4 in or more

keep prod spacing from 3 to 8 in

Check: 6 in spacing on 1/2 in plate: 540 to 660 A

[Open in calculator: anglebeam.com/tools/mt-amperage-calculator](https://anglebeam.com/tools/mt-amperage-calculator)

Sources

UT: Evident's ultrasonic flaw detection tutorial and transducer technical notes, and TWI's beam spread FAQ.

MT: Portland Community College, WLD 204 Magnetic Testing packet, printed pp. 9 and 10. Coil fill-factor and direct contact rules differ between sources; the MT amperage calculator shows the ones it uses.

Read next

[UT formulas guide, with every example worked: anglebeam.com/guides/ut-level-2-formulas](https://anglebeam.com/guides/ut-level-2-formulas)

[MT outline change \(exams after 15 Dec 2026\): anglebeam.com/guides/mt-level-2-outline-change-2026](https://anglebeam.com/guides/mt-level-2-outline-change-2026)

[UT outline change \(exams after 5 Feb 2027\): anglebeam.com/guides/ut-outline-change-2027](https://anglebeam.com/guides/ut-outline-change-2027)

Find your weakest topic with the free 10-question check, explained as you answer it, no signup:

anglebeam.com/ndt-level-2