Minimum Bend Radius Chart for Sheet Metal

Use this sheet metal minimum bend radius chart to select recommended starting inside bend radii for steel, aluminum, and stainless steel parts.

Before You Use This Chart

The minimum bend radius is the smallest **inside bend radius** that can be formed without unacceptable cracking, severe thinning, distortion, or surface damage.

The values on this page are recommended starting points for design and DFM review. They are not universal production guarantees or the smallest radius achievable by every press-brake process.

Actual bendability depends on the material grade, temper, thickness, rolling direction, bend angle, die opening, punch radius, press-brake method, cosmetic requirements, and factory tooling.

> **Rule of thumb:** When material details are unknown, start with an inside bend radius of at least **1 × material thickness**: R = 1 × T. Use a larger radius for stainless steel, thick sheet, high-strength material, and heat-treated aluminum.

Recommended Starting Inside Bend Radius

MATERIAL	SHEET THICKNESS	RECOMMENDED STARTING INSIDE RADIUS
Mild steel / cold-rolled steel	1–6 mm	1 × T
Mild steel / cold-rolled steel	6–12 mm	1–1.5 × T
Stainless steel 304	1–6 mm	1.5–2 × T
Stainless steel 304	6–12 mm	2–3 × T
Aluminum 5052-H32	1–6 mm	1 × T
Aluminum 5052-H32	6–12 mm	1.5 × T or more
Aluminum 6061-T6	1–6 mm	3–4 × T
Aluminum 6061-T6	6–12 mm	4 × T or more

T = material thickness | **R** = inside bend radius

> **Important:** “Minimum” in this page title means a practical DFM guideline. It does not mean every press brake, die set, material condition, or fabricator can produce the listed radius in every situation.

Material-Specific Bend Radius Guidelines

MATERIAL	RECOMMENDED STARTING RADIUS	DESIGN NOTES
Cold-rolled steel	1 × T	Suitable starting point for standard brackets, covers, and enclosures
Galvanized steel	1–1.5 × T	Use a larger radius if zinc-coating cracking or cosmetic damage is unacceptable
Stainless steel 304	1.5–2 × T	Higher springback; increase radius for thicker sheet, hard tempers, or cosmetic surfaces
Aluminum 5052-H32	1 × T	Good formability; commonly used for bent enclosures and fabricated parts
Aluminum 6061-T6	3–4 × T	Higher crack risk; avoid sharp bends unless validated by material condition and process
Aluminum 6061-O	1–1.5 × T	Annealed aluminum bends more easily than T6 material
Copper C110	1 × T	Ductile, but confirm surface-finish and cosmetic requirements
Brass	1–2 × T	Depends strongly on alloy, temper, and bend direction

Note: Do not specify only “aluminum” when bend radius is important. Aluminum 5052-H32 and 6061-T6 have very different forming behavior: 5052-H32 is generally more suitable for formed parts, while 6061-T6 usually needs a larger radius and closer process review.

Rounded Starting Examples by Thickness

Use these as early design references. Final bend radius should be confirmed against the selected material condition, bending method, available tooling, and cosmetic requirements.

SHEET THICKNESS	CRS / MILD STEEL	304 STAINLESS STEEL	ALUMINUM 5052-H32	ALUMINUM 6061-T6
0.8 mm	R0.8 mm	R1.5 mm	R0.8 mm	R2.5–3.0 mm
1.0 mm	R1.0 mm	R1.5–2.0 mm	R1.0 mm	R3.0–4.0 mm
1.2 mm	R1.2 mm	R2.0–2.5 mm	R1.2 mm	R4.0–5.0 mm
1.5 mm	R1.5 mm	R2.5–3.0 mm	R1.5 mm	R4.5–6.0 mm
2.0 mm	R2.0 mm	R3.0–4.0 mm	R2.0 mm	R6.0–8.0 mm
2.5 mm	R2.5 mm	R4.0–5.0 mm	R2.5 mm	R8.0–10.0 mm
3.0 mm	R3.0 mm	R4.5–6.0 mm	R3.0 mm	R9.0–12.0 mm
4.0 mm	R4.0–6.0 mm	R6.0–8.0 mm	R4.0 mm	R12.0–16.0 mm
5.0 mm	R5.0–7.5 mm	R7.5–10.0 mm	R5.0 mm	R15.0–20.0 mm
6.0 mm	R6.0–9.0 mm	R9.0–12.0 mm	R9.0 mm	R24.0 mm or more

Why Bend Radius Matters

A radius that is too small stretches the outside surface of a bend beyond what the material can safely accommodate. This can cause:

- Cracks along the outside bend surface
- Coating damage or zinc-layer cracking
- Visible whitening, crazing, or fracture in aluminum
- Reduced fatigue life in the bend area
- Inconsistent bend angles and springback
- Higher forming force and possible tooling damage

A larger bend radius reduces strain and crack risk, but it also affects bend allowance, flat-pattern dimensions, enclosure clearances, and final formed geometry.

Why Tooling Changes the Radius

In air bending, the finished inside radius is not controlled only by the punch tip. Material properties, thickness, V-die opening, bend angle, and press-brake setup all influence the final formed radius.

TOOLING FACTOR	EFFECT ON THE BEND
Larger V-die opening	Usually produces a larger inside bend radius
Smaller V-die opening	Can produce a tighter radius but requires more forming force
Larger punch nose radius	Can reduce sharp-bend strain when compatible with the die opening and forming method
Material hardness	Increases springback and may require a larger radius
Material thickness	Usually requires a larger die opening and bend radius
Bottoming or coining	Can form tighter radii but needs higher tonnage and suitable tooling

Do not assume that a radius shown on a drawing can be achieved exactly with standard air-bending tools. Confirm available punch and die combinations when radius affects fit, sealing, appearance, or a mating interface.

Checks Before Releasing a Drawing

- Match bend radius to the exact material grade and temper, not only the material family
- Use at least 1 × T when material details are unknown
- Use larger radii for stainless steel, high-strength steel, and heat-treated aluminum
- Place tight bend lines perpendicular to rolling direction whenever practical
- Keep holes, slots, cutouts, and self-clinching hardware outside the bend deformation zone
- Avoid locating cosmetic surfaces on the outside of tight bends where cracking or marks are unacceptable
- Specify material grade, temper, thickness, bend direction, and inside radius when they are functionally critical
- Request a first-article sample for tight-radius, cosmetic, structural, or high-load bends

When a Small Radius Is Required

If the design needs a radius below the normal recommendation, consider the following options.

OPTION	WHEN IT HELPS	TRADE-OFF
Use a more ductile material	Tight bends in aluminum or stainless parts	May change strength, corrosion resistance, availability, or cost
Specify annealed material	Tight bends in aluminum or copper	May reduce strength or hardness
Increase bend radius	Cracking or cosmetic damage is a concern	Changes formed geometry and flat-pattern dimensions
Bend perpendicular to rolling direction	Material grain direction is known	May affect nesting efficiency and material use
Add bend reliefs	Bend ends near an edge, slot, or cutout	Adds features and may affect appearance
Use a forming tool or staged operation	Tight local geometry is essential	Increases setup, tooling, and cost
Machine a relief groove before forming	Very tight or controlled bends are required	Reduces local section strength and adds processing

Caution: Do not specify a very small bend radius without identifying the actual material and temper. A bend that works in 5052-H32 may crack in 6061-T6 even when thickness and nominal radius are the same.