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Roll Forming Tooling Design Guide

7 parameters · flower pattern workflow · 3 real cases · design review checklist

The numbers an engineer must set before cutting steel - collected from 15+ years of custom machine builds for customers in 60+ countries.

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1. The 7 Parameters That Decide the Design

Set these seven numbers before any roller steel is cut. Each one locks a cost or a quality outcome; changing one late reopens all of them.

Parameter	What it sets	Rule of thumb
1. Flower pattern	Per-station bend distribution	A few degrees of bend per pass
2. Number of stands	Forming length and cost	6-10 simple; 14-20 deep profiles
3. Shaft diameter	Torque capacity	60-90 mm, sized by yield x thickness
4. Roller material	Wear life	Cr12MoV or D2, hardened
5. Side roll angle	Lateral forming	Set per station for lips and legs
6. Springback overbend	Dimensional accuracy	Compensates stronger metals
7. Strip gap	Thickness window	Max thickness plus tolerance

How shape and material move the numbers

• Part depth: a 70 mm deep part needs 2-3 more stands than a 60 mm part. A standard 50-80 mm top-hat needs 14 stands.

• Wide flat areas: metal can go wavy. Bottom grooves stop the waviness and add strength - but cost 4 extra stands and a bigger motor.

• Sharp or complex drawings: expect 3-4 more forming steps than a simple drawing.

• Tolerances: tighter product rules raise tooling cost and pass count.

• Bending radius: confirm the metal can reach the requested curve without cracking.

2. The Flower Pattern Workflow

The flower pattern is the drawing of the profile as it opens from finished shape back to flat strip. Every stand takes one small step of that opening. Build it in this order:

Step 1 - Freeze the inputs. Profile drawing with tolerances, material grade, yield strength and thickness range. Nothing downstream is stable until these are fixed.

Step 2 - Locate the neutral line. Keep it near the strip centre. It decides the blank width and where the bends grow from.

Step 3 - Distribute the bends. Move a few degrees per pass. Pushing more bend into one station warps edges and work-hardens the corner.

Step 4 - Plan the pass sequence. Form the centre bends first, finish the edge legs last so the strip stays guided as long as possible.

Step 5 - Compensate springback. Stronger metals bounce back more. Add overbend per material: G550 needs more than mild steel.

Step 6 - Assign side rolls. Return lips and legs that top rolls cannot reach are formed with side roll angles, set per station.

Step 7 - Verify in simulation. Run the flower in Copra RF (or equivalent) before cutting steel. Fix interference and flare on screen, not on the mill.

Station count quick guide

Profile type	Typical stands	Notes
Simple open profiles	6-10	Shallow bends, few features
C purlin, 1.5-3.0 mm	10-12	Lip return formed by side rolls
Cable tray, 1.0-1.5 mm	9-11	Return lip, lighter shafts
Racking upright / top hat 50-80 mm	14-20	Deep profile, side rolls + grooves

3. Three Real Cases

The same seven parameters, three very different machines. These are the reference points our engineers start from when a customer drawing arrives.

Case 1 - Racking upright and top hat (50-80 mm deep)

Steel G350-G550. 14 stands. Shaft 70-80 mm. Side rolls form the lips. D2 roller material. Deep sections drive everything: more stands, thicker shafts, and side rolls where top rolls cannot reach.

Case 2 - C purlin (1.5-3.0 mm, G550)

10-12 stands. Shaft 60-70 mm. The lip return is formed by side rolls. High-strength G550 forces a clear springback overbend on the web and flanges.

Case 3 - Cable tray (1.0-1.5 mm)

9-11 stands. Shaft 50-60 mm. Return lip profile at moderate depth. Thin strip keeps torque low, so the design wins on pass efficiency rather than brute force.

Material effects every design must absorb

- Springback: the metal tries to bounce back flat after each bend. Stronger metals bounce back more.
- Flare: the ends of deep or very strong parts bend outward. Control it with pass sequence and side rolls.
- Thickness rule: the roller gap equals the thickest possible strip plus tolerance.
- Width rule: extra strip width usually adds to the outside lip of the final part.
- Flat strip assumption: the design assumes no camber, bow or twist in the incoming coil.

Choosing the machine base

- Cantilever mill - small, light parts.
- Duplex mill - parts with changing widths.
- Side-by-side mill - two different profiles on one machine.
- Standard double-high mill - the heavy-duty default.
- Rafted mill - removable cassettes for quick roller swaps.

4. Design Review Checklist

Run every new tooling design through this list before the steel order goes out.

[ ] Profile drawing confirmed with tolerances

[ ] Material grade, yield strength and thickness range fixed

[ ] Neutral line and blank width calculated

[ ] Bend distribution set to a few degrees per pass

[ ] Springback overbend assigned per material

[ ] Side roll angles assigned for lips and legs

[ ] Shaft diameter checked against torque demand

[ ] Roller steel selected (Cr12MoV / D2) with hardening spec

[ ] Stand count validated in a flower pattern simulation

[ ] Cutoff, punching and stacker integrated in the line layout

Send us your part drawing.
We run the flower pattern free and confirm stand count, motor size and tooling budget within 24 hours.

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External references: Roll-Kraft · The Fabricator · Roll Forming Handbook (G. T. Halmos) · DATA M Copra RF