The Same Grade, Two Coils, And Only One Of Them Will Draw

Temper and grain decide whether a draw-quality strip forms cleanly. Why the grade alone is not a specification for a deep drawn part.



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A grade fixes the chemistry. It does not fix the state the strip is in when it lands on the press. That state is the temper, and I have watched it decide whether a part runs or cracks.

Two coils can carry the same grade, the same thickness and the same certificate, and still behave completely differently. One forms a deep cup; the other tears at the punch nose. Nothing in the part of the certificate most buyers check will tell you which one you have.

What the grade actually fixes is narrow: the chemistry, whether the steel is aluminium-killed and drawable at all, and the broad formability family. What it leaves open is everything a die cares about - where yield strength sits inside the permitted band, elongation, the r-value, the n-value, grain size, and whether the surface will show stretcher strains after forming. Temper comes from the cold reduction after annealing, and it is an ordered parameter, not a default.

Four numbers predict the draw better than the grade does. Yield strength sets how much force it takes to start the material moving and how much margin is left before the wall thins - on a small housing, soft versus quarter-hard can be the difference between a two-stage and a three-stage draw. Elongation is the headline ductility figure, and a low-elongation coil is where tearing at the punch nose starts. The r-value describes how well the material resists thinning in the plane of the sheet, which is exactly what a pressure-carrying wall needs; it comes from crystallographic texture, so it is shaped by alloying and annealing practice more than by temper alone. And the n-value sets how quickly the material work-hardens, which decides how much reduction one stage can survive.

Temper is visible, too. A strip that is too soft, or annealed with the wrong yield-point elongation, forms parallel bands across the part - stretcher strains - where the material yielded unevenly before work hardening caught up. On a hidden bracket that is cosmetic. On a visible housing it is a defect. The usual fixes are a skin-pass, a slightly harder temper, or running the blank through a roller leveller. The opposite problem is just as real: a temper hard enough to form a shallow part beautifully can be too hard to form a deep one at all, so choose the temper against the deepest feature of the part rather than its average.

So put it on the order, not just in your head. Name the grade and the standard - DC04 to EN 10130, not "mild steel". Name the temper, or the yield and elongation range that works in your tool. Where the part is deep drawn and the wall has to stay uniform, state the r-value or n-value; if nobody knows the number, asking the supplier for forming data on the grade they are proposing is a reasonable substitute. Call out stretcher strain on visible parts. And say whether the material is customer-fixed - where an OEM names the exact grade and mill, the freedom to adjust temper is gone and the die has to be built around what you can actually get.

The test is not whether the certificate matches the grade. It is whether the coil carries the temper the die was set up for. When a part that has run for two years starts cracking, ask for the incoming material report before anyone starts talking about a new die.

The longer version, with the four numbers and the drawing checklist, is here: https://balford.net/drawn-part-temper-selection/

I am the founder of Balford, a deep drawing and metal stamping manufacturer in Zhuji, China. We deep draw and stamp metal housings on presses from 25 t to 350 t, to a maximum draw diameter of 250 mm, and quote from the drawing.

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