A Deep Drawn Housing Has One Leak Path Fewer Than A Welded One

Why a drawn housing removes three leak paths a welded assembly carries - and why the leak is nearly always decided upstream of the leak test.



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When a housing leaks, the argument usually starts at the leak test. It should start at the drawing, because on a drawn part the two things that decide tightness are settled long before anyone fills it with air.

The first is structural, and it is a genuine advantage: a drawn housing is one piece of metal. A welded assembly built from tube and end caps carries three leak paths a drawn part does not have - the weld itself, which can be porous or incompletely fused and can weep only after thermal cycling; the heat-affected zone beside it, where the microstructure differs from the parent metal and fatigue cracks begin; and the filler metal, which is a third material in the joint and matters when the medium attacks the filler but not the base. Drawing removes all three, and the grain follows the contour of the part instead of being cut by a fusion line.

That advantage only holds if the wall survives the forming. Material thins where it is stretched hardest, at the punch nose and the die radius. A wall that thins unevenly is not automatically a leaker, but it is where a leaker will show up once pressure or thermal cycling arrives. Four things decide it: how much reduction each stage takes, what the material's elongation and temper are, whether grain size and inclusions are clean, and whether a pre-form defect - casting porosity, a forging lap - was carried into the finished wall by a route that machining cannot clean up.

Draw ratio is the one that gets missed most often. Pushing too much reduction into a single stage thins the wall and can tear it; splitting the same reduction across two or three stages with an anneal between them keeps the wall more even. And a harder temper of the right grade can form without cracking and still leave a thinner, less even wall than the draw-quality strip the process actually wants.

The wall is only half of it. A housing can have a perfect wall and still leak at the joint, because the sealing face is a separate requirement. Face-to-face seals need flatness; radial seals need roundness and a diameter tolerance; both need a finish the elastomer can bite into without tearing. A scratch, a rolled edge, a trim burr, or a surface polished so smooth that the seal slides will all leak where the wall itself would have passed. On a drawn housing that is machined afterwards, the sealing face is usually one of the features made by machining rather than left as formed - and that should be called out on the drawing rather than left to the general tolerance block.

So what belongs on the drawing before it goes out? The requirement rather than the test - a leak rate at a defined pressure and medium, not a note saying the part is leak tested. The wall thickness that actually matters, with its own minimum if it carries pressure. The sealing faces named and toleranced separately from the rest of the part. And a statement of whether the part is machined after drawing, because a turned sealing face behaves differently from an as-drawn one and the choice should not be left open.

When a drawn housing leaks, the cause is nearly always upstream of the leak. Ask three questions in order: was the wall thickness uniform after forming, was the material the right grade and temper for the reduction, and was the sealing face made as a controlled feature? A supplier who only answers the third one has not looked at the part.

The longer version, with the full list of wall failure modes and the drawing checklist, is here: https://balford.net/deep-drawn-housing-leak-tightness/

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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