CHANDAN STEEL LIMITED
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SEAMLESS STAINLESS STEEL TUBES · TECHNICAL COMPARISON

# Hot Piercing vs Hot Extrusion: How Seamless Stainless Tubes Are Made

Hot rotary piercing and hot extrusion are the two routes used to turn a solid stainless steel bar into a seamless hollow. After the hollow is made, both routes go through the same cold pilgering, solution annealing, pickling and testing to become a finished pipe or tube. This page compares the two routes feature by feature, with measured data and the standards that apply.

## Key points

1. **Fewer steps** — piercing makes the hollow in 3 steps (heat, pierce, quench); extrusion takes 8 (drill, heat, press-pierce, reheat, glass coat, extrude, strip glass, cut butt end).
2. **One heating instead of two** — piercing heats the bar once; extrusion heats it twice.
3. **Uniform through-heating** — a controlled furnace soak brings the whole bar, core included, to temperature; rapid induction heats the surface first and needs equalising time.
4. **The whole bar becomes the tube** — extrusion drills out only 1–3% of the bar; the other 97–99% becomes the tube, so bore quality depends on bar quality in both routes.
5. **No lubricant between rolls and bar** — roll grip drives piercing by design; extrusion needs glass, which must be stripped from the tube, including the bore.
6. **Finer grain, defect-free bores** — measured: grain size ASTM 6–7 in the bar → 7–8 in the hollow, 99.6% of 500 pierced hollows defect-free, no radial cracks.
7. **Marginally lower overall cost** — when every process and quality control is done diligently.
8. **Same standards and tests** — ASTM A312, A790, A269, A789 and EN 10216-5 apply to both routes; none of them requires extrusion.

### Hot piercing vs hot extrusion — comparison table

| Feature | Hot piercing | Hot extrusion |
|---|---|---|
| **Starting material** | Solid round bar | Bar drilled through the centre (pilot hole) |
| **Steps to a hollow** | 3 — heat, pierce, quench | 8 — drill, heat, press-pierce, reheat, glass coat, extrude, strip glass, cut butt end |
| **Heatings** | One | Two (often a gas pre-heat, then induction) |
| **Soaking / through-heating** | Controlled furnace soak — uniform temperature through the bar | Rapid induction heating; needs equalising time for a uniform core temperature |
| **Bar centre** | Formed into the bore; 99.6% of 500 hollows defect-free in a published case study | 1–3% of the cross-section drilled out; the remaining 97–99% becomes the tube |
| **Lubricant** | None between rolls and bar — roll grip drives the process | Glass, required; stripped after extrusion |
| **Hot surface** | Oxide scale | Glass film plus oxide scale |
| **Deformation** | Shear and compression; grain refined from ASTM 6–7 to 7–8, no radial cracks | Axial compression through a die over a mandrel |
| **Forming time** | About 20 s per pass, then quenched | About 4 s stroke, within an 8-step route |
| **Material yield** | Whole bar becomes the hollow | Drilled core and butt end scrapped |
| **Tooling** | Rolls, plug and guides | Dies, mandrels, container and a large press |
| **Overall cost** | Marginally lower, with every process and quality control done diligently | Marginally higher — drilling, second heating, glass, scrapped core and butt end |
| **Grades** | Austenitic stainless, duplex and nickel alloys | Austenitic stainless, duplex and nickel alloys |
| **Finished structure and surface** | Cold pilgered, solution annealed ≥ 1040 °C, pickled | Cold pilgered, solution annealed ≥ 1040 °C, pickled |
| **Standards and testing** | ASTM A312, A790, A269, A789; EN 10216-5; every pipe NDT or hydrotested | Same |

**Sources:** Dr K. Elayaperumal, *Stainless Steel Seamless Pipe Manufacturing through Hot Rotary Piercing Process* (2015) · Prasad & Sasidhara, *Hot Working Guide*, ASM International (1997) · Hayashi, Akiyama & Yamakawa, *Advancements in cone-type rotary piercing technology*, J. Manuf. Sci. Eng. 121(3) (1999) · ASTM A312, A790, A269, A789 · EN 10216-5 · Inco patent EP0128682 (1984).

Published by **Chandan Steel Limited**, Umbergaon, Gujarat, India — manufacturer of seamless stainless steel pipes and tubes on rotary hot piercing mills. www.chandansteel.net