

## Tech Note 41: Superiority of Post-Annealed Stainless Steel Tube

**TN.41**

### Overview

Post-annealing is a critical metallurgical process that significantly enhances the corrosion resistance, mechanical stability, and formability of stainless steel tube after it has been welded and shaped. Unlike standard welded stainless tubes that are left in an “as-welded” or unannealed state, AusPress Stainless Steel Tube is fully annealed after fabrication, delivering superior performance across construction, industrial, and fire protection applications.

### Applicable Products:

- AusPress Stainless Press-Fit, diameters 28 – 168.3mm.

### Related Documents:

- Tech Note TN.01 Chlorides, Chlorine & Stainless Steel
- Tech Note TN.07 Underground, Concrete & Press-Fit.
- Tech Note TN.11 Marine Spray Environments & Stainless Steel
- Tech Note TN.14 Warranty AusPress Stainless Press-Fit
- Tech Note TN.24 Fire Services with Press-Fit
- Tech Note TN.30 Flow Rates & Pressure Loss (Press-Fit).
- Tech Note TN.40 Fire Services in Tunnel Applications



### Standard Stainless Press-Fit Product Specification

AusPress Stainless Press-fit system, supplied in 316L stainless steel. Fittings M-Profile with standard LBP (Leak Before Press) EPDM ring seal fitted. Tube to be post annealed, metric sizes to AS 5200.053 Series 2. Installation by a qualified person(s) in accordance to AS 3500 and AusPress recommendations. Installation tool selection to suit M-Profile metric sizes and press a join rated to or exceeding the required system working and test pressures.

### 1. Understanding the Annealing Process

Annealing involves heating the stainless steel tube to a controlled temperature, typically between **1,000–1,100°C**, followed by controlled cooling.

This process:

- Relieves internal stresses created during tube forming and welding.
- Recrystallises the metal's microstructure.
- Restores chromium uniformity across the weld area (eliminating chromium carbide precipitation that causes corrosion).

Post-annealing ensures the tube's microstructure is homogeneous, consistent with the original base material composition.

---

## 2. Corrosion Resistance – The Primary Advantage

In an unannealed tube, the heat-affected zone (HAZ) around the weld seam becomes a weak point, prone to:

- **Pitting and crevice corrosion**, particularly in chloride-rich or humid environments.
- **Intergranular corrosion**, where chromium depletion along the weld boundary reduces resistance to oxidation.

By post-annealing, AusPress eliminates these weaknesses, resulting in:

- A **passivated, chromium-rich surface** that self-protects against corrosion.
- **Superior resistance** in aggressive environments such as tunnels, food processing, marine facilities, and water treatment plants.
- **Extended service life** and reduced maintenance costs compared with unannealed alternatives.

---

## 3. Improved Formability and Mechanical Properties

The annealing process softens the material and improves ductility. Benefits include:

- Ease of bending, flaring, and expansion without risk of cracking or distortion.
- Reduced risk of weld seam brittleness, ensuring **mechanical consistency** along the tube length.
- Enhanced shock and vibration resistance, ideal for dynamic installations such as fire suppression, mechanical services, or transport infrastructure.

---

## 4. Superior Weld Integrity

Annealing **normalises the weld seam**, aligning the grain structure between the weld and the parent metal.

This produces:

- **Consistent strength** across the full cross-section.
- Reduced hardness differentials, which can otherwise cause micro-cracking or fatigue over time.
- **Leak-free reliability** under pressure and thermal cycling.

---

## 5. Surface Finish and Aesthetic Advantages

Post-annealed tubes are typically **bright annealed**, meaning the surface is heat-treated in a controlled atmosphere to prevent oxidation.

This delivers:

- A **clean, smooth internal and external surface**, promoting hygiene and optimal flow.
- **Reduced contamination risk** for food, pharmaceutical, and potable water applications.
- A high-quality finish that requires no post-treatment or pickling.

## 6. Lifecycle and Economic Benefits

While annealing adds a step to manufacturing, it provides measurable long-term advantages:

- **Longer lifespan** in harsh environments.
- **Lower total cost of ownership** through reduced failures and maintenance.
- **Improved reliability**, supporting compliance with international standards such as **EN 10312**, **AS 3688**, and **AS 4041**.

### Conclusion

Post-annealing transforms standard stainless steel tube into a **premium, high-performance material**.

Through stress relief, microstructural refinement, and enhanced corrosion resistance, AusPress post-annealed stainless steel ensures superior longevity, reliability, and installation flexibility — setting a benchmark for press-fit and industrial piping systems in demanding applications.

Comparison: Unannealed vs Annealed Stainless Steel Tube		
Property	Unannealed (Standard) Stainless Tube	Post-Annealed (AusPress)
Manufacturing Process	Tube remains in <i>as-welded</i> condition; no post-fabrication heat treatment.	Tube undergoes controlled heat treatment (annealing) after welding at ~1,050°C and cooled under inert gas.
Microstructure	Heat-affected zone (HAZ) remains stressed with chromium-depleted grain boundaries.	Recrystallised, uniform grain structure; chromium redistributed evenly.
Corrosion Resistance	Lower – prone to intergranular and pitting corrosion, especially at weld seams.	Significantly higher – stress relieved and full passivation restored. Ideal for harsh or chloride environments.
Mechanical Properties	Harder and more brittle; increased risk of cracking during bending or flaring.	Softer and more ductile; excellent for press-fit, bending, and fabrication.
Weld Seam Quality	Inconsistent hardness across weld; may fail under cyclic loads or vibration.	Weld and base metal hardness uniform; improved fatigue resistance.
Surface Finish	Dull and often requires pickling or cleaning post-production.	Bright-annealed finish with smooth, clean surface—no pickling required.
Hygiene & Flow Efficiency	Rougher internal surface may retain residues or cause higher pressure drop.	Smooth internal surface ensures clean flow and lower friction losses.
Service Life	Shorter lifespan in humid, marine, or chemically aggressive environments.	Extended life expectancy with minimal maintenance required.
Compliance	May not meet higher-grade specifications or WaterMark requirements.	Fully compliant with EN 10312, AS 3688, AS 4041, AS5200.053 and WaterMark WMTS-040.

### Further Information

For additional or specific information, please contact [technical@auspress.com.au](mailto:technical@auspress.com.au)