Lubricants in the Manufacturing of Expansion Tubes

Introduction

Expansion tubes are critical components used in automotive exhaust systems, HVAC assemblies, and heat exchangers, designed to connect or adjust pipe diameters through precise forming or expansion processes.
Manufacturing these tubes involves tube expansion, hydroforming, trimming, and welding, all of which generate high levels of friction, pressure, and heat.
To achieve dimensional accuracy, surface integrity, and corrosion resistance, specialized lubricants are essential throughout each production stage.

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1. Importance of Lubrication in Expansion Tube Manufacturing

The expansion process — whether mechanical or hydraulic — subjects metal tubes (often stainless steel or aluminized steel) to significant deformation. Proper lubrication ensures:

- **Reduced Friction and Galling: Prevents seizing or scoring between the tube and mandrel.**
- **Enhanced Metal Flow: Allows smooth and uniform wall expansion without cracking or thinning.**
- **Extended Tool and Die Life: Reduces wear on expansion tools, mandrels, and forming dies.**
- **Improved Dimensional Accuracy: Maintains tight tolerances and consistent tube diameters.**
- **Simplified Cleaning: Low-residue or vanishing lubricants minimize post-expansion cleaning before welding or coating.**
- **Corrosion Protection: Temporary protective films prevent rust during storage and handling.**

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2. Types of Lubricants Used in Tube Expansion

Process Stage	Lubricant Type	Key Benefits

Tube Forming & Expansion	**Polymer-based or semi-synthetic forming lubricants**	**Ensures smooth expansion, prevents metal tearing and galling.**
Hydroforming	**Water-based hydroforming fluids with corrosion inhibitors**	**Clean operation, precise wall control, excellent tool life.**
Cutting & Trimming	**Water-miscible coolants / semi-synthetic cutting oils**	**Burr-free edges and improved cutting tool performance.**
Welding & Assembly	**Low-residue lubricants / anti-spatter fluids**	**Prevents weld defects and contamination.**
Surface Finishing	**Vanishing lubricants / micro-coatings**	**Leaves no residue; supports clean weld and coating adhesion.**
Storage & Corrosion Control	**Solvent-based or dry-film rust preventives**	**Protects parts during logistics and pre-assembly storage.**

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3. Benefits to Manufacturers

- **Reduced Tool Wear: Mandrels and dies last longer, lowering maintenance costs.**
- **Improved Tube Quality: Smoother inner and outer surfaces for better sealing and flow performance.**
- **Higher Production Efficiency: Less downtime due to tool changes or part cleaning.**
- **Cleaner Operations: Water-based lubricants reduce oil mist and VOC emissions.**
- **Enhanced Weld Strength: Cleaner tube surfaces ensure strong, defect-free weld joints.**
- **Corrosion-Free Handling: Temporary protective coatings safeguard tubes before final assembly or coating.**

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4. Industry Trends in Tube Expansion Lubrication

- **Dry-Film Lubricants: Pre-applied coatings that eliminate the need for liquid lubrication and post-cleaning.**

- **Biodegradable and Non-Chlorinated Lubricants: Environmentally friendly solutions replacing traditional oils.**

- **Precision Application Systems: Automated spray or roller systems ensure uniform lubricant distribution.**

- **Hybrid Lubricants: Combine forming lubrication with rust prevention for multi-stage manufacturing.**

- **Smart Monitoring Systems: Real-time control of lubricant flow and concentration for consistent forming performance.**

Expansion Tube

Description:	Frank, I did find this picture from 2003. The part number is PC70187. 080-B10 is used at 4:1. It's 409 SS. Tubing wall thickness is 0.071&#65533;. Initial tubing diameter is 3&#65533; OD. WO. Ramformed.		
Product:	080-B10	Company:	Pridgeon & Clay
Industry:	Automotive Tier One	Material:	Stainless Steel
Thickness:	1.803	Concentration:	20
Author:		Tags:	409
Date:	Jan 1, 2003