



Precision Steel Tubes

for the Automotive Industry



MANNESMANN
PRECISION TUBES

A Member of the Salzgitter Group

The group

Mannesmann Precision Tubes is internationally active and a successful partner to the automotive industry, the manufacturing industry and the energy sector for high-quality, customized steel tubes and tubular components. Our locations in Germany, France, the Netherlands and Mexico form the basis for high delivery performance and customer satisfaction.



As one of the leading manufacturers of cold-drawn seamless and welded precision steel tubes as well as seamless hot-rolled tubes and tubular components, Mannesmann offers you a wide range of products and processes.

Everything from a single source

From steel production to precision steel tubes and components

Thanks to its integration into the Salzgitter Group, Mannesmann is able to represent the complete value chain for the production of tubes. Customer requirements are taken into account in a targeted manner through the consistent further development of products and processes.



Germany

Sales: Mülheim an der Ruhr, Administration: Hamm
Production: Bielefeld-Brackwede,
Burbach-Holzhausen, Hamm, Wickede, Zeithain



France

Production and Sales: Saint-Florentin,
Vitry-le-François



Netherlands

Production and Sales: Helmond



Mexico

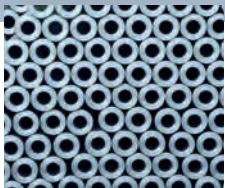
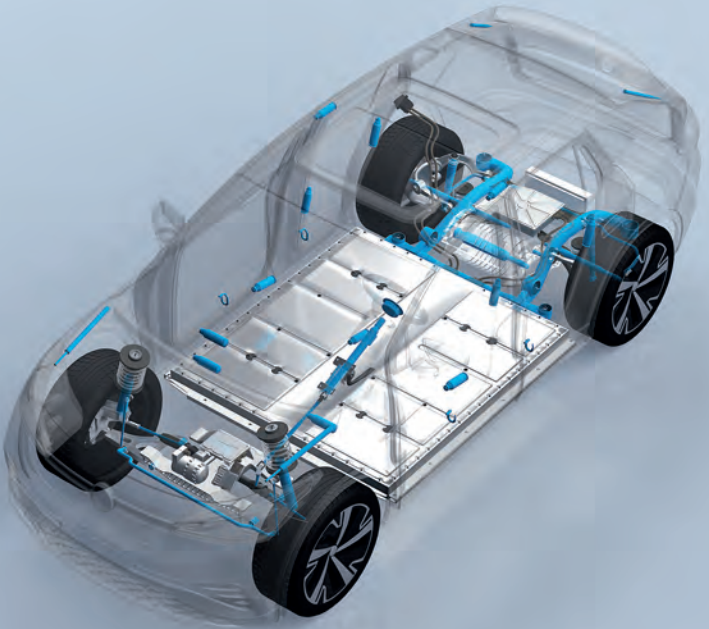
Production and Sales: Guadalajara






The Salzgitter Mannesmann Forschung is the central research company of the Salzgitter Group. It offers the group companies versatile support in: materials technology, forming and surface technology, application processes and nondestructive testing.

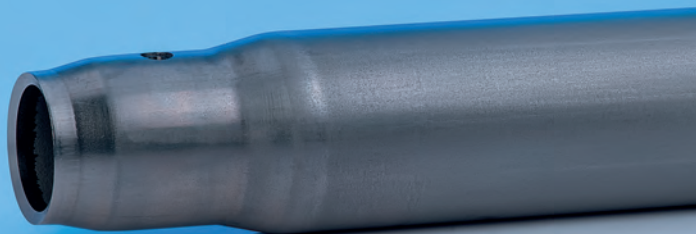
Automotive

Precision steel tubes for the automotive industry

An outstanding strength of Mannesmann is its technical support and consulting service targeting at customized solutions for the automotive industry.



	Domains	Application
	Vehicle Safety	Airbag Inflators, Seatbelt Pretensioners
	Engine and Gearbox	Diesel Injection Lines, Camshafts, Gear Shafts
	Driveline	Propshafts, Sideshafts, Constant-Velocity Joints (Ball Cages)
	Alternative Drives	Rotor shafts, Sideshafts for Alternative Drives, Hydrogen High Pressure Tanks and Lines
	Vehicle Chassis	Shock Absorbers, Stabilizers, Steering Columns, Axles, Anti-Vibration Systems



Airbag Inflators

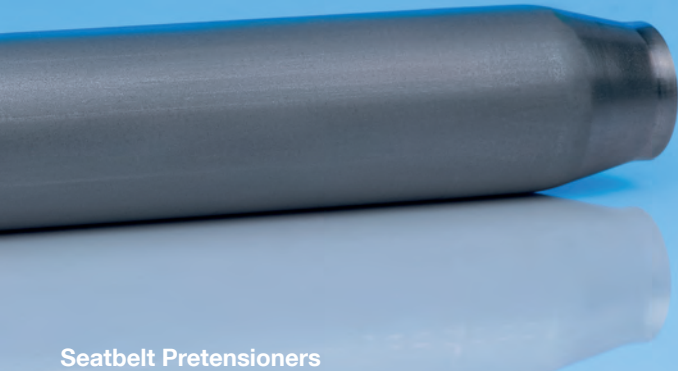


Precision steel tubes for hybrid airbag solutions

Seamless cold-drawn precision steel tubes for airbag inflators feature outstanding toughness properties dedicated even for operating temperatures as low as -60°C . Depending on the specific requirements airbag tubes are delivered either as micro-alloyed engineering steel or quenched and tempered or even air hardening steel. Dedicated burst tests on tube in static as well as dynamic condition confirm excellent close-to-component toughnesses. Mannesmann also offers quenching and tempering on the final tube product.

Customer expectations

- Cold or warm forming capacity
- Weldability
- Excellent component toughness without any indication of fragmentation at low operating temperatures
- Suitability for light-weight concepts



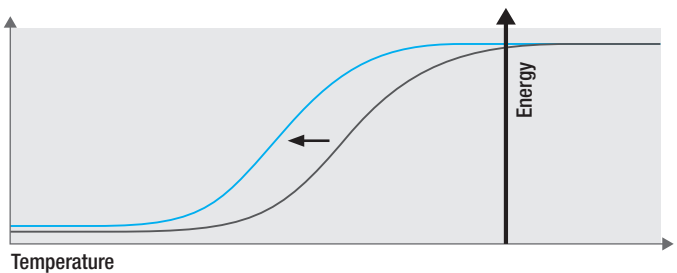
Seatbelt Pretensioners

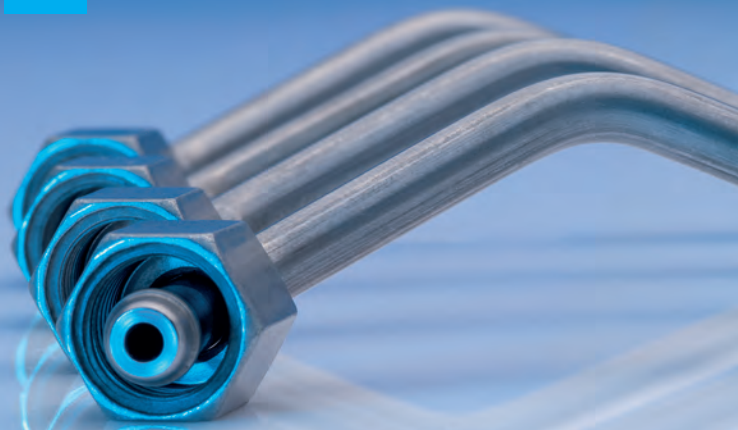


Tube requirements

- Well-defined, finely grained and isotropic microstructures
- Excellent tube toughness properties featuring very low transition temperatures
- Excellent static and dynamic strength properties

Transition Temperature Curve





Diesel Injection Lines



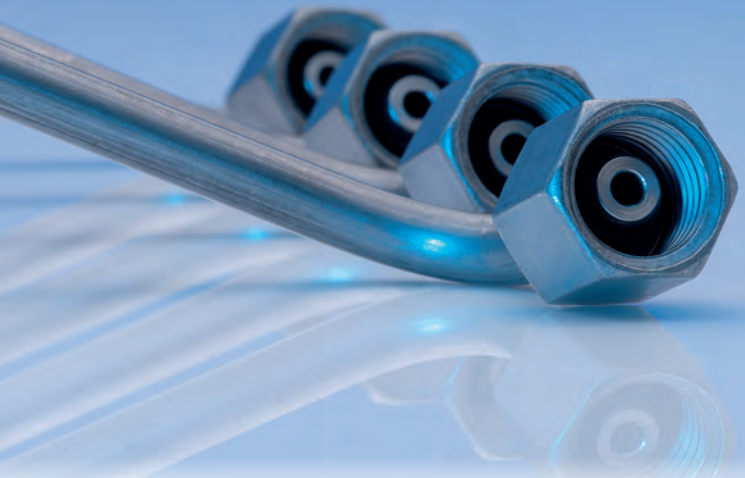
Ready-to-install components for diesel engines

We develop

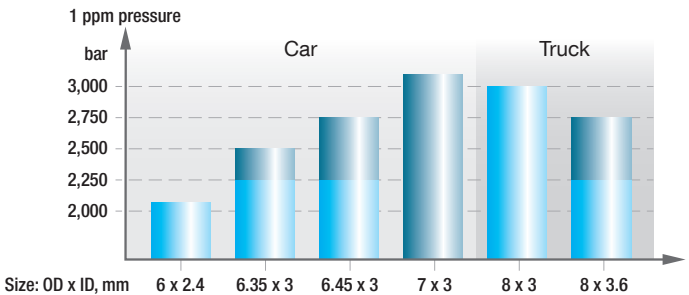
- Ready-to-install components
- According to customer requirements
- For passenger cars, trucks and off-road application
- With analytical, numerical, experimental modeling
- Compliant with IATF 16949
- Using group-wide competencies along the entire value chain

We manufacture

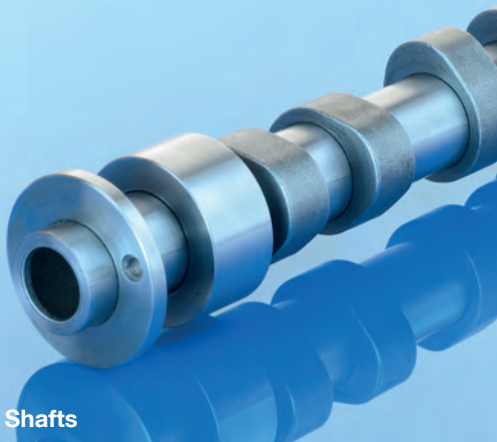
- Small and large series
- With highest precision and efficiency
- Extensive in-process quality checks and analyses
- And highest cleanliness standards



- Material grades: from E355 to Mannesmann special grade (CRG890), depending on the application
- OD x ID: various dimensions available
- High and stable surface quality
- Coating: Zn/ZnNi layer, top coat
- Max operating pressures up to 3,000 bar



Diesel injection lines are manufactured from Mannesmann's broad range of precision steel tubes. Their properties not only meet present-day standards, but also take into account the most stringent requirements to be expected in diesel engine technology.



Camshafts and Gear Shafts

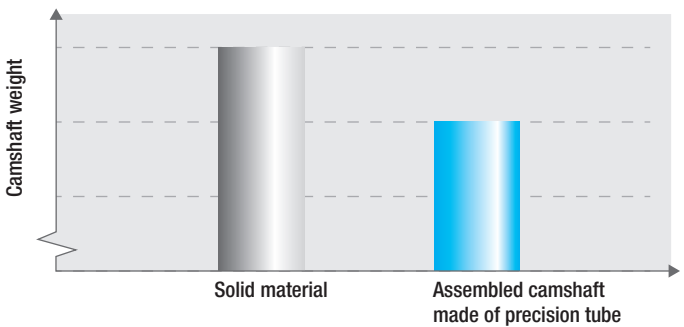
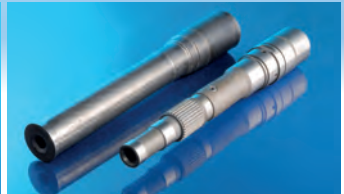


Assembled Camshafts made of precision steel tubes – Light-Weight Solution for the automotive industry

By using precision steel tubes as hollow shafts for assembled camshafts, a significant weight saving can be obtained compared to forged solid components. Mannesmann has long-term knowledge in production of such specialized tubes.

Customer expectations

- Tight tolerances
- Suitability for machining
- Weight reduction



Tube requirements

- Optimized mechanical properties
- Suitability for customized local properties
- Demanding requirements on micro-cleanliness
- Special machining for customized tube end designs



Propshafts and Sideshafts

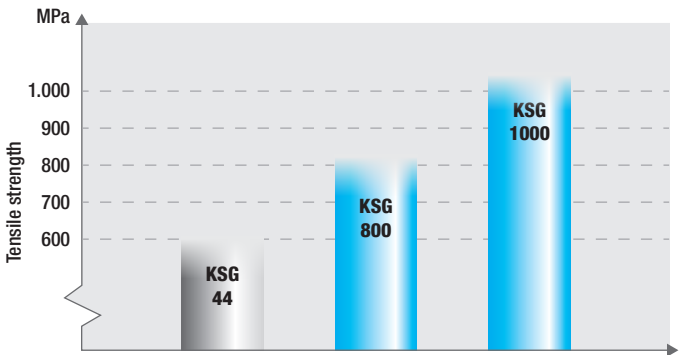
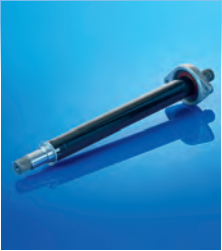
Precision steel tubes for propshafts are endowed with outstanding surface and geometrical properties. The steel material solutions of the well-established Mannesmann special steel grade **KSG** series are finely grained and feature excellent static as well as fatigue strength properties.

Customer expectations

- Weldability
- Excellent dynamic response
- Excellent strength properties (static strength and fatigue strength) within narrow scatter spread bands

Tube requirements

- Geometrical characteristics within narrow scatter bands (wall thickness, diameter, eccentricity amongst others)
- Well-defined, homogeneous microstructure
- Narrow scatter band of strength properties



Technological trend steel grade development



Side Shafts and Constant-Velocity Joints (Ball Cages)

Monobloc tubular shafts (MTS) and welded tubular shafts (WTS)

Precision steel tubes for welded tubular shafts are endowed with outstanding geometrical properties and delivered as high-quality carbon, manganese-boron or air hardening steel. Dedicated wall thickness and eccentricity tolerances give way for excellent dynamic response as well as fatigue properties. Precision steel tubes for monobloc tubular shafts are designed either for quenching and tempering (C and CrMo-grades) or hardening processes (MnB-grades). Our steel material shows a well-defined microstructure and large deformation capacities perfectly suitable for any forming process carried out at low temperature, just as needed for tapering and splining.

Customer expectations

- Cold forming capacity (MTS)
- Weldability (WTS)
- Excellent dynamic response
- Appropriate static and fatigue properties

Tube requirements

- Geometrical characteristics within narrow scatter bands (wall thickness, diameter, eccentricity among others)
- Well-defined, homogeneous microstructure
- Narrow scatter band of strength properties



Ball Cages

Precision steel tubes for ball cage tubes or blanks are endowed with outstanding surface and geometrical properties and well-defined microstructure.

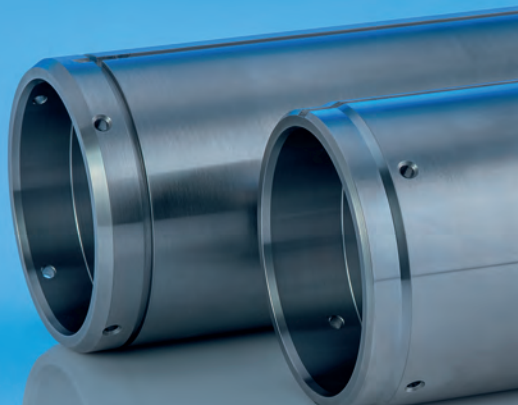
Customer expectations

- Formability, machinability
- High surface quality
- Adequacy for (case) hardening
- Cross sectional volume constancy

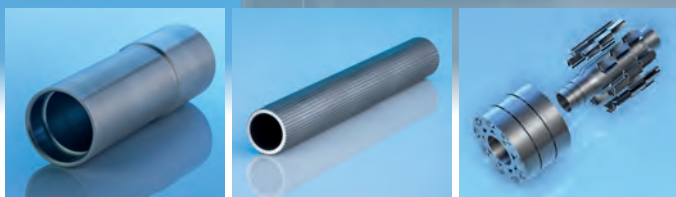
Tube requirements

- Geometrical characteristics within narrow scatter bands (wall thickness, diameter, eccentricity amongst others)
- Well-defined, homogeneous microstructure
- Customized chemical analysis
- Demanding requirements on micro-cleanliness

Mannesmann has long-term experiences and technology know-how to produce customized precision steel tubes for ball cages. Moreover, a large steel grade portfolio for C-steels, quenched and tempered steels or case hardening steels can be chosen for dedicated solutions.



Rotor shafts and Sideshafts for Alternative Drives



Mannesmann Precision Tubes manufactures seamless and welded cold-drawn precision steel tubes as well as hot-rolled tubes in accordance with standards including EN 10305-1, EN 10305-2 and EN 10297-1.

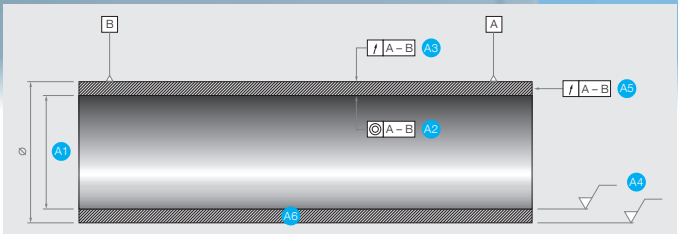
The materials and tube properties can be specifically adapted to the requirements of subsequent customer-specific manufacturing processes and optimized for the rotor shaft product.

Product properties

- Tight geometry, shape and position tolerances
- Minimal imbalance and excellent dynamic properties
- High strength and low weight
- High fatigue strength

Processability

- Homogeneous microstructure
- Machinability
- Formability
- Hardenability
- Weldability



- A1** Precise diameter tolerance
- A2** Minimal coaxiality tolerance
- A3** Exact circular run-out tolerance – radial
- A4** Finest surface roughness
- A5** Optimum circular run-out tolerance – axial
- A6** Suitable material selection/heat treatment

Rotor shafts for electrically driven vehicles are components with highest requirements for tolerances of form, orientation, location and run-out. To maximize customer benefit, we offer specially machined tubes with very tight tolerances and special tube shapes with integrated product features (e.g. plug-in splines, grooves or cooling channels).

Customer benefits

- Minimized imbalance for very high revolutions per minute
- Reduction of air gap between rotor and stator
- High efficiency and reduced noise emission of the electric motor



Hydrogen High Pressure Tanks and Lines



Precision Steel Tubes for Hydrogen high pressure tanks and lines

Hydrogen as an energy storage medium is another important step towards lower CO₂ mobility. Mannesmann works with partners on tank systems to store hydrogen safely and cost-effectively in vehicles. The hydrogen stored in the tank system can be used in two ways: either in combination with a fuel cell to generate electricity for powering an electric motor, or the hydrogen is combusted in a combustion engine.



H₂ high pressure tanks

- Capable of storing pressures of up to 700 bar
- Modular design allows integration into existing vehicle platforms
- High cost advantage compared to CFRP tanks

H₂ pressure lines

- Connection of tanks and tanks with energy converter
- Suitable for hydrogen combustion engines and fuel cells
- Cost-effective and processable in a variety of ways



Axles, Shock Absorbers, Steering Columns

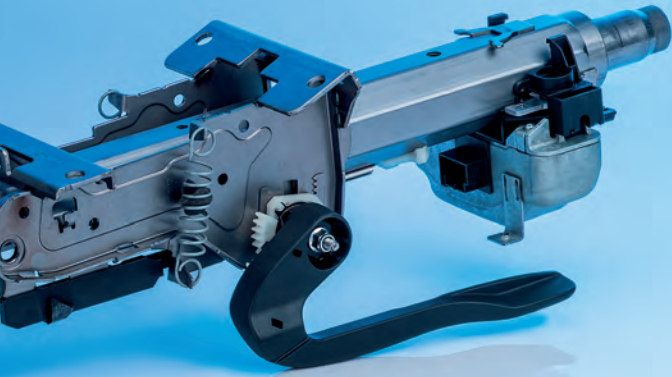


Customer expectations

- High surface quality (ready to use surface)
- Suitability for subsequent processing
- Formability

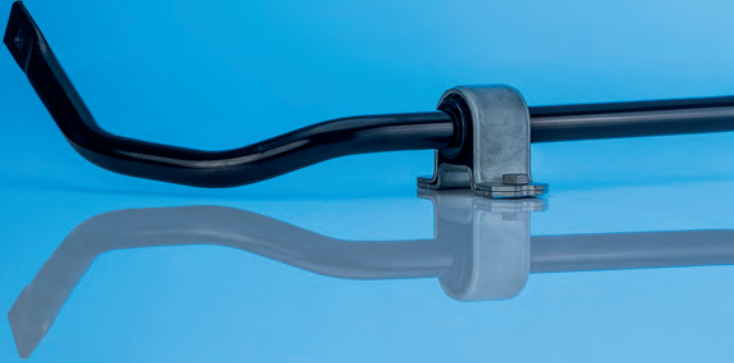
Tube requirements

- Constant mechanical properties
- Tight allowance
- Cleanliness and high surface quality

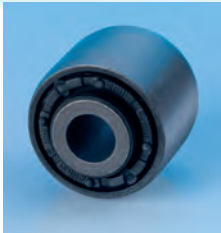


Shock Absorbers

Manufacturers of shock absorbers are increasingly looking for solutions to optimize their own processes. Furthermore, solutions to reduce weight in the vehicle are in the focus. Precision steel tubes with higher strength combined with a steady good process behavior are needed. Mannesmann stands for high quality precision steel tubes for shock absorber.



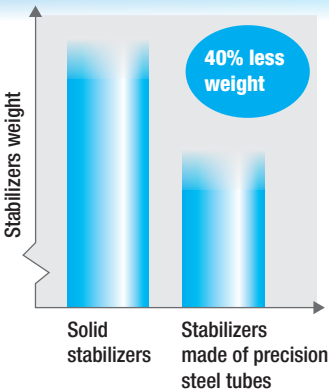
Light-weight concept – Stabilizers, Anti-Vibration Systems



One of the key trends in the Automotive industry is the continuously increasing demand for weight reduction for next generation vehicle platforms. Due to emission taxes weight reduction develops into a more and more indispensable condition.

Customer expectations

- High strength
- High surface integrity to fulfill dynamic load and fatigue life requirements
- Suitability for subsequent processing
- Weight reduction



Mannesmann has many years of experience in the production of such kind of precision steel tubes in a consistently high quality. Mannesmann can offer tubes for all dimensions in desired delivery conditions or desired materials such as manganese-boron steel grades.

Tube requirements

- Bending ability and torsional requirements
- Demanding requirements on micro-cleanliness
- Microstructural requirements

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