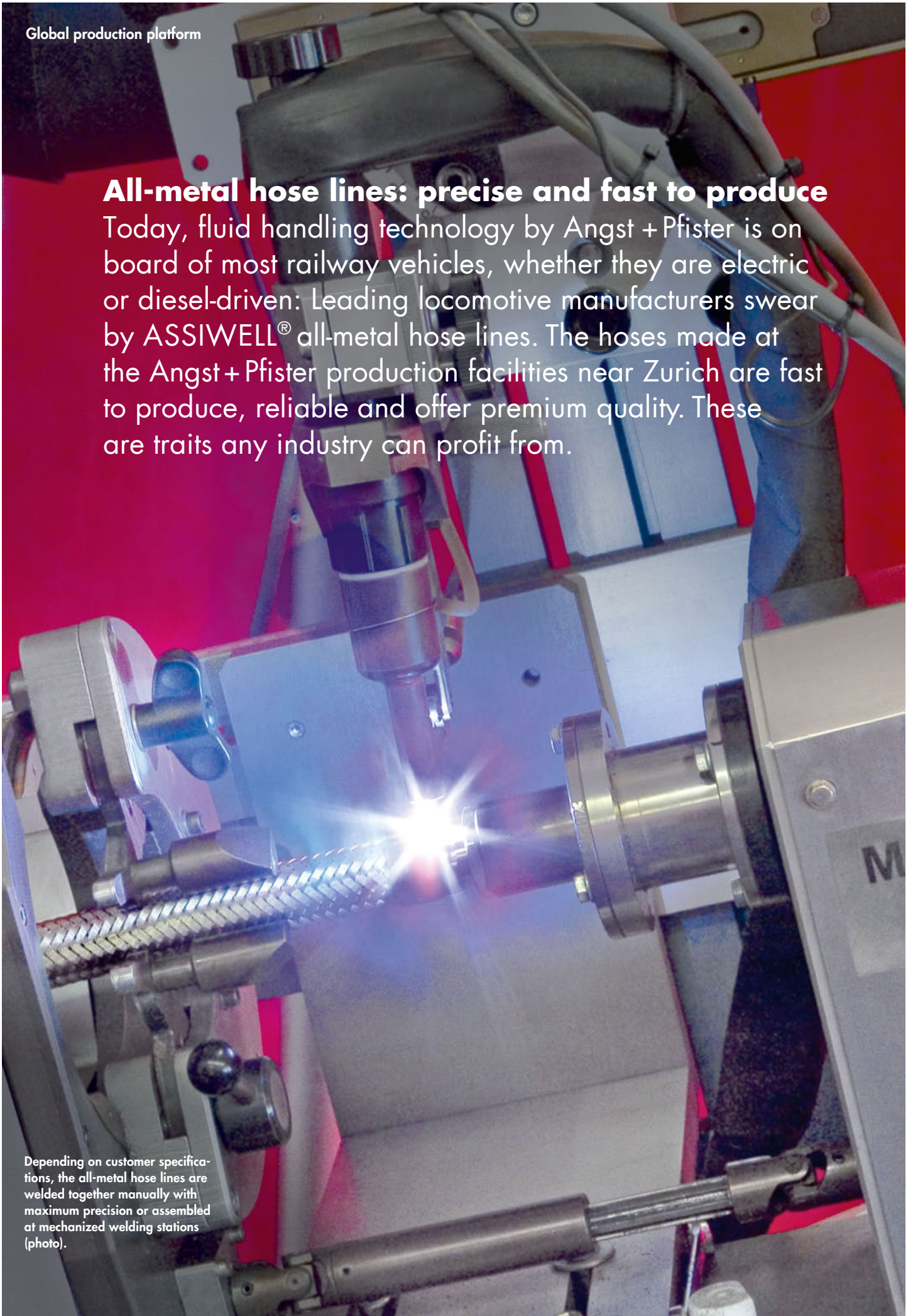


## All-metal hose lines: precise and fast to produce

Today, fluid handling technology by Angst + Pfister is on board of most railway vehicles, whether they are electric or diesel-driven: Leading locomotive manufacturers swear by ASSIWELL® all-metal hose lines. The hoses made at the Angst+Pfister production facilities near Zurich are fast to produce, reliable and offer premium quality. These are traits any industry can profit from.

Depending on customer specifications, the all-metal hose lines are welded together manually with maximum precision or assembled at mechanized welding stations (photo).





The work of the certified welders is accurate down to the millimeter or even the tenth of a millimeter.

A slight smile. The alert eyes squinting in concentration. No, this is no ordinary job. The work done here is an enjoyable challenge. Every day. Because it serves the technological success of the customer. Şahin Tuğlu is one of six certified welders at Angst+Pfister's Global Logistics Center in Embrach. He and his colleagues recently passed the procedure test – they are required to renew their certification every two years. They now have it in black and white: They have met the stringent requirement conditions of the DIN EN 15085-2 CL1 regulation. This top certification level is proof of their skill in welding railway vehicle components.

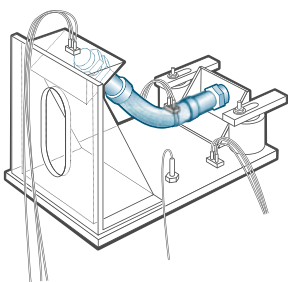
**Highest standards** Angst+Pfister is a leading manufacturer of metal hose lines. Where required, ASSIWELL® all-metal hose lines – made of stainless steel with wire braiding produced by welders at the Global Logistics Center – fulfill further standards: the Pressure Equipment Directive 97/23/EC (PED) in categories I and II, the DIN 3384 standard regarding stainless steel gas hose assemblies, the TPW/W 119-1 standard for the design and testing of corrugated hose connections for water installations up to PN 10 and temperatures up to 95 °C and the TPW 119 standard for the design and testing of flexible connections for water installations.

The work done by Şahin Tuğlu and his colleagues can't be duplicated by just anyone: With maximum concentration and an extremely steady hand, they weld together the corrugated hose, the braiding that encases it and the terminal sleeve, which is

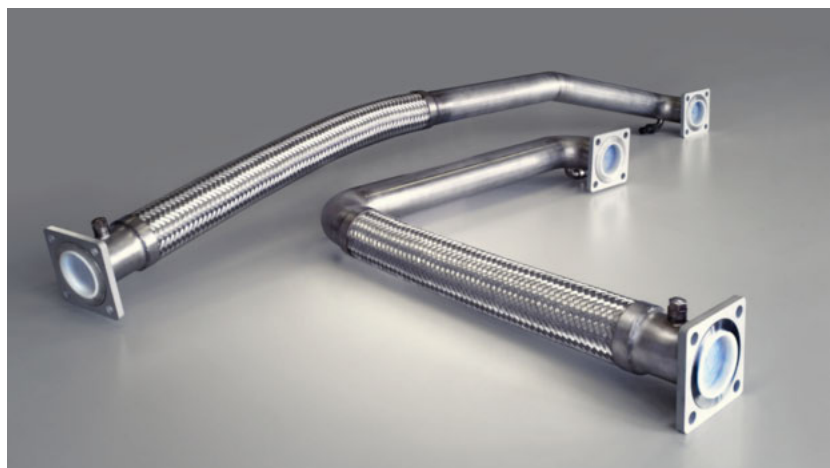
then welded to the fitting. The work they do is precise down to the millimeter or even the tenth of a millimeter.

**Consistent quality** Premium-quality prototypes, custom fittings, small and very small series as well as larger metal hose lines with diameters up to 300mm are welded manually. For the production of higher quantities in the 6 to 100mm diameter range, Angst+Pfister has designed mechanized welding systems. Here, automation results in precise, consistent quality that completely fulfills the "copy exactly" requirement. However, in order to achieve this, the highest level of accuracy must go into the production of the hose elements, terminal sleeves and fittings. Only components that fit together perfectly can be welded together perfectly without developing any residual stress. The mechanized welding systems themselves must also be set up exactly and the individual parts carefully loaded. The Angst+Pfister employees who operate the mechanized welding systems have therefore been certified to perform this specific task.

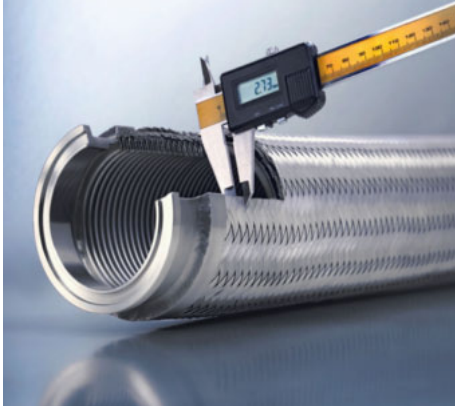
**No tempering colors** The highly qualified welding experts at Angst+Pfister possess another unique skill: Depending on customer requirements, the welded area will have only minimal tempering colors or no tempering colors at all. Tempering colors change the structure and affect the chemical resistance of metal. For that reason, depending on the intended use, Angst+Pfister runs argon noble gas through the interior of the hose line or



Ensuring the exact fit of the welded metal hose lines: Installation and application diagrams illustrate the level of precision required.



Depending on customer requirements, the welded area has no tempering colors.



The welding done at the Angst+Pfister Global Logistics Center can withstand every test.



Prototypes, custom fittings, small and very small series and metal hose lines with diameters up to 300 mm are welded manually. High quantities with diameters between 6 and 100 mm are welded mechanically.

employs a box with argon atmosphere to ensure that no tempering colors develop, neither inside nor outside.

**Tested through and through** At Angst+Pfister, the impermeability of every welded hose line is checked in a water bath at a pressure of 5 bar. This is standard procedure at Angst+Pfister, as are the helium leak test and additional pressure tests. Furthermore, during preparations staff can trace the parts they have ordered back to automated storage at any time in order to determine their origin. Parts can be traced all the way back to the steel mill and smelter number, so that the customer receives a complete inspection certificate according to EN 10204.

**Speed and flexibility** As thorough and reliable as production is, speed and flexibility are also important. "We can even handle large quantities of 400 or 500 hoses in just a few days," says Ines Busse, who manages the Angst+Pfister's Global Logistics Center. The annual production volume of 150,000 all-metal hose lines is very impressive.

**From expert design of the hose lines to their premium-quality production right through to specifically defined delivery – Angst+Pfister provides the customer with everything from a single source.**

**Engineering, production and logistics from a single source** Furthermore – and this is something that distinguishes Angst+Pfister from other suppliers – our service package starts with the design and engineering of the metal hose line. Application-oriented engineers advise and support the customer in the developmental phase and can do so on-site upon request. This level of service gives the customer the comfort of knowing he is getting the ideal product through a cost-optimized process.

Angst+Pfister service even goes a step further and also takes into account the customer's individual logistics requirements. From the professional design of the hose lines to their high-quality production right through to delivery in accordance with specifically defined conditions – at Angst+Pfister, customers get everything they need from a single source.



**One for all**

ASSIWELL® all-metal hose lines combine a number of extraordinary qualities: Depending on the design, they can withstand the highest pressures and temperatures up to at least 500 °C. They are completely diffusion-resistant, vacuum-resistant, also suitable for tight bending radii, dynamic high pressure-resistant, extremely non-aging and premium-welded. Depending on customer requirements and the specific application, Angst+Pfister produces the hoses with up to three layers of steel braiding, multiple insulation layers and wear protection around the entire hose line as well as in between the all-metal hose and the braiding.

The rail industry has long since discovered ASSIWELL®. As time goes on, more and more ASSIWELL® all-metal hose lines are also being used to transport fluid and gaseous substances in power generating facilities, in turbines and generators, in mechanical engineering and equipment construction, in the food industry and in laboratories. They are equally in demand in the field of thermal solar technology, for wind farms and in the high vacuum sector.