

A simplified lighter metal hose that reduces total life-cycle costs

The new double-decker trains from Bombardier traveling on Switzerland's rail network have cutting-edge technology from Angst+Pfister installed in their railcars: charged with the task of cooling the transformers, the all-metal ASSIWELL® hose lines transport the heat-transfer oil between the transformer and the cooler. This solution minimizes weight while maximizing both efficiency in production and operations while maintaining durability.



Image: Rendering Bombardier, © SBB CFF FFS

The new Bombardier double-decker long-distance train.

Wednesday, May 12, 2010, was a historic day for the Swiss Federal Railways (SBB). It will be remembered as the date on which SBB issued its biggest ever rolling stock order, calling on Bombardier Transportation (Switzerland) AG to build 59 new double-decker trains for long-distance transport. The order was worth around 1.9 billion Swiss francs. The bid submitted by Bombardier made the best impression – in terms of both comfort for passengers and economic efficiency for the company. In its evaluation, SBB considered not only investment costs but also total life-cycle costs, and here Bombardier offered the most favorable conditions overall.

Complementary expertise Economic efficiency goes hand in hand with technical efficiency – which in turn depends not least on weight, and this, is where Angst+Pfister came in. Bombardier, one of the world's largest manufacturers of innovative transportation solutions and a global leader in rail transportation equipment, did not have far to go in its search for the necessary competence in fluid technology – the Zurich offices of Angst+Pfister and Bombardier are within walking distance of each other. Angst+Pfister with its DIN EN 15085-2 CL1

certification offers the highest-level welding quality approval for rolling stock applications. The know-how brought by both sides of this relationship is highly complementary – giving rise to the needed innovation necessary for the railcars of these new double-decker trains.

Highly flexible hose lines The excess heat from the transformers that convert electricity for propulsion must be channeled away. The engineers from Bombardier defined rigid pipes with compensators for the necessary connection between the transformer and the cooler, for both the flow and the return. The fluid handling technology specialists at

Angst+Pfister then suggested ASSIWELL® pipelines with integrated all-metal hose, which performs the role of the compensators – thereby making them superfluous. The flexibility of the corrugated hose, which is covered with braided stainless steel, compensates for both the thermal expansion and the relative movements as well as installation tolerances between the cooler and the transformer.

Flawless durability over 40-year lifespan

Another critical point is that SBB demands a lifespan of 40 years for these train compositions, in order to minimize repair and maintenance costs and maximize operational efficiency. The requirements placed on these materials are extremely high. And ASSIWELL® meets all necessary temperature, pressure and vibration requirements, as the hose lines must perform their services flawlessly for a period of 40 years.

Around 50% lighter This elegant but long-lasting solution offers even more benefits: The continuous ASSIWELL® all-metal hose eliminates the need for the heavy flange connections used in the technical solution initially proposed. One single part takes the place of two separate parts per line, and the all-metal hose weighs just half as much as the original solution. Less weight means lower electricity consumption, lowering the life-cycle costs through greater operational efficiency.

Simplified assembly The assembly process at Bombardier is also more efficient, with the flexibility of the integrated metal hose and the reduced number of parts significantly simplifying assembly. Each of the rigid pipes originally intended for use in this application, would have had to be adjusted manually in order to achieve the specified measurements. In terms of tolerances, the ASSIWELL® all-metal hose line is clearly more “yielding” and flexible, also speeding up this step in production to provide further savings.

“We have found a simple and long-lasting solution. Less maintenance means greater availability of the railcars.”

Markus Heimberg, Bombardier Transportation (Switzerland) AG, Zurich, Switzerland



Rigid hose line end attached to the radiator.

Fully tested and certified An accredited external laboratory near Berlin carried out the rigorous shock and vibration tests on the all-metal hose lines from Angst+Pfister in accordance with DIN EN 61373. The three five-hour vibration tests also included simulation of the load placed on the line by the transformer, which is mounted on rubber buffers. Bombardier itself runs a test laboratory in Zurich with the aim of testing its newly developed drive systems and thereby ensuring the safe and reliable operation of its rolling stock. The company inspects every conceivable detail, anticipating every eventuality with the strictest quality tests. The ASSIWELL® all-metal hose lines from Angst+Pfister proved to be ideally suited thanks to their sturdiness, flexibility, extremely long lifespan, and durability.

Practical quick couplings

Deep fluid handling know-how, complemented by a partner with extensive application experience gives rise to impressively simple solutions. The design team with engineers from Angst+Pfister also

went on to suggest replacing the screw connections originally intended for use on the pipeline for filling, discharge, and oil sampling with quick couplings. The company Walther-Präzision offers suitable, low-weight quick couplings with clean-break technology – using high performance sealing components from Angst+Pfister. Thanks to these quick couplings, the transformer oil that serves as the heat-transfer medium cannot drip out of the line during filling, bleeding, and oil sampling. The quick couplings are mounted at a low point to enable the heat-transfer oil to flow in gently making the filling process easier and safer.



Flexible flow and return hose sections attached to the transformer.

Bombardier’s engineers are convinced by the integral solution with the ASSIWELL® all-metal hose line between the transformer and the cooler. “Thanks to Angst+Pfister, we have found an extremely simple, long-lasting, and cost-effective solution,” comments Markus Heimberg of Bombardier System Engineering. And the essential issue of “efficiency” is relevant both to Bombardier and to SBB: “Less maintenance means lower costs and greater availability of the railcars.”

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Certificate TÜV Class CL1 in DIN EN 15085-2

What the experts say

Selecting critical components? Coordinate it with our technician.



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Extreme conditions, challenging mediums and limited space frequently present us with fascinating technical situations. In high-temperature, -vibration and -pressure environments, it is crucial to define suitable materials and to develop flexible connectors that meet the harshest application requirements. Compensating for installation inaccuracies and ensuring tension-free lines also have a tremendous impact on both production and maintenance costs. This challenging "playing field" is where I, as a sales engineer, feel most at home. The ability to analyze all application requirements and to propose the best possible solution is a core strength of Angst + Pfister.

Choose from a large portfolio From high-performance PVC hoses, chemical hoses with inner layers made of NBR, EPDM or PEX, and silicone and Teflon® hoses to high-alloy Assiwell® all-metal hose lines: all of these can be found in our broad portfolio and are available from stock for specific solutions. Whether for 600 bars of pressure, for +300 °C or -272 °C, we select the best-suited hose lines and related connection systems for the respective application. Finding the right combination of materials for a highly demanding application and designing a hose line that also simplifies installation

and reduces maintenance costs are what I find the most rewarding aspect of being an Angst + Pfister technician.

Certified at the highest level The vast array of compliance regulations is diverse as compared to an even wider range of possible applications. From the outset of each project, we take into account the necessary product approvals, from the Pressure Equipment Directive to standards and guidelines for specific applications – particularly in the food, drinking water, pharmaceutical and chemical industries.

Angst + Pfister holds the highest-level certification (CL1) in the manufacturing of all-metal hose lines as per the Pressure Equipment Directive, for gas applications as per DIN 3384 and for railway applications as per DIN EN 15085. Being involved in the obtaining of approvals is always stimulating. I help raise the bar by putting together the necessary documentation in cooperation with the certification authorities. Every additional certificate increases our market competitiveness and enhances the value we can bring to our customers.

Amazing innovations New production techniques and the market's constantly increasing quality requirements result in innovations in our products. For me, the close coordination with our global production platform is highly rewarding and often leads to amazing results. The role as intermediary between the market and manufacturing never fails to fascinate me.

Collaboration with laboratories We work as a team with colleagues from Angst + Pfister's various product lines whenever expert opinions are required. We regularly collaborate with specialist laboratories when special testing is required. This collaboration con-

sistently enables us to reach new findings that are added to our wealth of experience and enable us to further increase the value we offer to our customers. Naturally, customer-specific findings for highly specific applications are treated with the utmost confidentiality.

Satisfaction is our goal Finding the most suitable solution that meets our customers' high expectations together with my colleagues is my passion. I enjoy the design and development phases, and love most to view the

applications on site – to touch the hose lines in action when possible and to feel the pulse of this "living" technology. In the end it's simple: If the customer is happy, then so am I.

The user mostly sees nothing of the complex engineering work we have done in the back-

ground or of the careful coordination required to make the best possible hose lines and end-product. Our hose lines make travel convenient by train, bus and tram. Enjoying a coffee, fruit juice, pasta or pizza? It likely came in contact with one of our hoses. At home with comfortable warm or refreshing cold air, drinking water from the tap or cooking with a pot over a gas flame? Then our hose lines may be in use. In all of these applications we provide our customers with valuable engineering and production expertise. Our products can be found almost everywhere – and always with our technical, production and logistical know-how inside.

"Finding the most suitable solution that meets our customers' high expectations is my passion."

Francesco Brunone, Sales Application Engineer,
Angst + Pfister Switzerland