

Danfoss Products Onboard Alstom High-Speed Tilting Trains



Alstom high-speed tilting trains are charging across Europe with an empowering lineup of Danfoss products.

Danfoss Italy has supplied Alstom with approximately 500 hydraulic systems that are being used in high-speed railway transit across Europe.

Customer

Alstom Ferroviaria SpA

Markets Served

Government and Private Railways

Background

Railroad passengers across Europe are traveling comfortably at high speeds thanks to the hydraulics expertise of Danfoss. Since 1991, Alstom Ferroviaria SpA of Savigliano, Italy, has been relying on products from Danfoss' hydraulics operations to supply the muscle for its high-speed tilting trains.

Blazing between cities at speeds up to 160 mph (257 kph), Alstom trains feature an empowering lineup of Danfoss hydraulic products. Each railcar was equipped with a Vickers by Danfoss HPU; servo, screw-in cartridge and directional valves; and piston pump; along with Danfoss hoses and threadless connectors.

Operating trains at high speeds prior to the 1980s called for a costly investment in tracks with high-curve radii and moderate relief. To avoid the need for infrastructure investment, Alstom engineers created a tilting technology concept to use existing track, while improving speed and passenger comfort, and reducing travel time. The technology enables trains to be tilted up to a maximum of eight degrees on bends, making increased speeds and a smooth ride possible.

Challenges

With the tilting system technology on the drawing board, Alstom put the system's hydraulic tilting mechanism out for bids to hydraulics equipment manufacturers, including Danfoss in Pessano, Italy.

A contender for the business proposed a hydraulic system that would be strung from front to back on the undercarriage of each railcar. Besides being concerned about the maintenance that would be required for the spaghetti-like system, Alstom engineers had many other valid concerns that they shared with Danfoss' Alessandro Piccolini, industrial application engineering manager.

"I learned that the proposed design called for a servo valve at the front of the railcar and one at the rear, a setup that Alstom feared could cause the railcar to twist while traveling along curves," Piccolini says.

"Alstom was also concerned that the proposed piston pump and valves would not offer long service life, due to the performance and safety demands of the tilting technology, and the fact that the system would be equipped with components from many different suppliers."

Solution

Determined that there must be a better way, Piccolini designed a system that would bring much needed order to each railcar's undercarriage. *"We proposed using a centralized, lightweight Danfoss power unit that would be easy to maintain and feature all Danfoss components,"* Piccolini says.

In order to eliminate the possibility of any twisting movement, Piccolini proposed the use of one servo valve, along with a standby servo valve, for controlling four cylinders in each corner of the railcar for lifting and lowering functions that facilitate tilting.

Piccolini addressed Alstom's need for a long-life pump by proposing Vickers by Danfoss' PVQ piston pump initially. Later the PVM piston pump were configured to operate in high pressure mode during the six second charging accumulator cycle and switch to low pressure mode during the 60-second discharging accumulator cycle, thereby increasing service life. He also recommended equipping the piston control circuit with two Vickers by Danfoss SM4 servo valves. During maintenance or in the event of an emergency, the circuit could be switched easily to the safety backup valve.

Results

Impressed with the stream-lined design of Danfoss' proposed hydraulic tilting system and the attention to detail, Alstom awarded Danfoss with a contract to supply 103 systems for a train it was developing for the Italian market.

During the ensuing 16 years, Danfoss Italy supplied Alstom with approximately 500 hydraulic systems that are being used in high-speed railway transit across Europe.

Danfoss Italy recently worked with Alstom to replace electromechanical controls on the pantograph of its high-speed Pendolino-brand trains with Danfoss servo valves.



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