Customer Success Story:
Global rolling stock manufacturer

Market segment
Rail

Eaton Heinemann hydraulic-magnetic circuit breakers significantly increase electrical protection system stability for global transport solutions provider

Location:
France

Challenge:
Eliminate circuit breaker nuisance tripping due to ambient temperature variations on trains

Solution:
Eaton Heinemann Hydraulic-magnetic circuit breakers

Results:
Electrical protection system stability has been improved across 90% of the company train power protection systems and, with rationalisation of circuit breaker technology, 50% reduction in purchasing costs

"Eaton circuit breakers eliminate ambient temperature related nuisance tripping on passenger train electrical systems"

Alexandre Zint, Product Manager Eaton.

Background

The company is a global transport solutions provider and a leading promoter of sustainable mobility. In its view, transport means more than just carrying customers and freight; providing a transportation system requires a comprehensive approach, from the customers' needs to the delivery of efficient, harmonious services. The company's integrated strategy encompasses developing and marketing the most comprehensive range of systems, equipment and services in the railway sector. Rolling stock, signaling, services and infrastructure are available separately, bundled or supplied as fully integrated solutions.

This railway OEM strives for operational and environmental excellence. As part of its quest for ever-improving service efficiency and quality, the company is continually researching for any technology that can reduce train downtime or delays, and increase customer satisfaction.

Challenge

Within its passenger trains, subways, locomotives and trams, this global train manufacturer uses circuit breakers across the low voltage power circuits, to protect both DC and AC electrical loads. The circuit breakers also protect the cables and conductors that deliver energy to these various loads from different distribution points. On-board DC loads include wash-wipers, head and tail lights, passenger lights, horn, the DC part of the climate control and pneumatic systems, relay panels and driver announcement systems. Examples of AC loads are air compressors, sockets for vacuum cleaners, passenger heating, fans and air dryer motors.

The circuit breakers are grouped together and installed in either the control or low-voltage cabinet. In general, the DC circuit breakers are located in the passenger compartment or driver compartment control cabinets, whereas the AC circuit breakers are installed in the low-voltage cabinet or in the roof, depending on the vehicle type.

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Early implementations of these DC and AC low voltage systems used miniature circuit breakers (MCBs) that relied on thermal-magnetic tripping technology.

These MCBs were found to cause problems on rolling stock used on the Caracas subway project in Venezuela; their design includes a bimetallic element that heats up and deforms to create an open circuit when subjected to a non-transient overload current. However this thermally-based operation is significantly affected by variations in ambient temperature, which can change the tripping point by up to 50%. Accordingly, the majority of the subway's MCBs suffered nuisance tripping because of rapid temperature changes characteristic of Caracas's climate.

This caused train downtime and delays, leading to considerable customer dissatisfaction.

Solution

The company's search for a reliable circuit breaker solution that would be temperature-insensitive led them to Eaton Heinemann hydraulic-magnetic products. These circuit breakers are proven as reliable. Use of this technology has been implemented for over 30 years and their operating principle make them ideal for rail applications. They depend on magnetic flux rather than thermal effects; increases in flux due to elevated load currents move an iron core immersed in a sealed tube filled with silicone oil and coiled with a copper wire. If the current is of sufficient duration and value, the core will move enough to trip the breaker. Nuisance tripping due to ambient temperature changes is eliminated. Nuisance tripping caused by transient current surges can also be eliminated with precision, and without reducing overload protection.

The construction of hydraulic-magnetic circuit breakers and more especially the current sensor that makes the mechanism trip also absorbs shock and vibration from the body of the train, even if subjected to these frequencies continuously.

Accordingly, a few test samples were installed on the Caracas system, and proved to offer the temperature insensitivity required, as well as an improved resistance to shock and vibration. Eaton customized the products and technology, adapting connection terminals to provide a better fit. Eaton also designed and manufactured peripheral items including signalling and anti-tamper caps to facilitate and improve retrofit activities. Additionally, the power management company designed a preferred parts number list of replacement products to reduce the number of references within the customer's system.

Results

The client was fully satisfied with the results. After a thorough product qualification process, the organisation authorised a comprehensive rollout of the Eaton HMCBs to all its vehicles. The HMCBs significantly increased electrical protection system stability, and played a major role in eliminating train downtime caused by nuisance tripping. As a result, Eaton HMCBs are now being used in more than 90% of the train manufacturer's electrical protection applications.

Following this success, this public transport operator who runs one of the largest underground systems in Europe, requested the same Eaton solution for its rolling stock.
The HMCBs are now being taken up by rail authorities and users in Singapore, China and other locations around the world. The HMCBs are also largely used on rolling stock application by other major global rail players.

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