Parker Hannifin Corporation
Automation Group
55 Maylands Ave
Hemel Hempstead
HP2 4SJ – UK
rail.parker.com

All-Weather Pneumatic Solutions for Rail

By Dave Walker

ENGINEERING YOUR SUCCESS.

All-Weather Pneumatics Solutions for Rail

As road congestion becomes a bigger challenge for the movement of both people and freight, rail services are becoming a more popular transportation alternative around the world. That makes infrastructure development a high priority among transportation providers. Global routes that were previously only dreamed of (i.e., the Trans-Siberian Railway and the much anticipated China-U.S. line) are now keeping many planners awake. Among those losing sleep are railroad technicians wondering how they will keep the trains running under extreme weather conditions. Rail conditions are challenging enough, but how do you keep electromechanical and pneumatic controls functional at minus 40°C and beyond?

The opening of rail markets in the extreme northern and southern hemispheres will require more and more technology providers to help clients in the rail industry deal with extreme heat and cold. Sealing and shielding are key to dealing with that entire climatic spectrum.

Effects of global weather extremes on train functionality

With weather extremes come challenges from ice forming on rail vehicles and vehicle equipment, increasing the friction and power required to move anything needing motion control (including door systems or the valves that operate almost anything). Maintenance technicians must also be ready to deal with what happens when freezing conditions occur —or when extreme pressure or temperature differentials create the potential for condensation, humidity and moisture within control systems.

On the equipment supplier side, vehicle manufacturers need to provide vehicles designed to operate within these extremes. One approach is to put systems or elements of systems within cabinets that can then be preheated to create their own environments. Equally important is getting the train on power to enable that preheating. That may mean turning on preheating systems an hour before the systems and components come up to their operating temperature. That introduces a potential delay into the vehicle schedule. Managers in those growth markets are reluctant to do that. They want solutions enabling them to operate a train whenever they want, and wherever they want, immediately. And that's the real challenge.

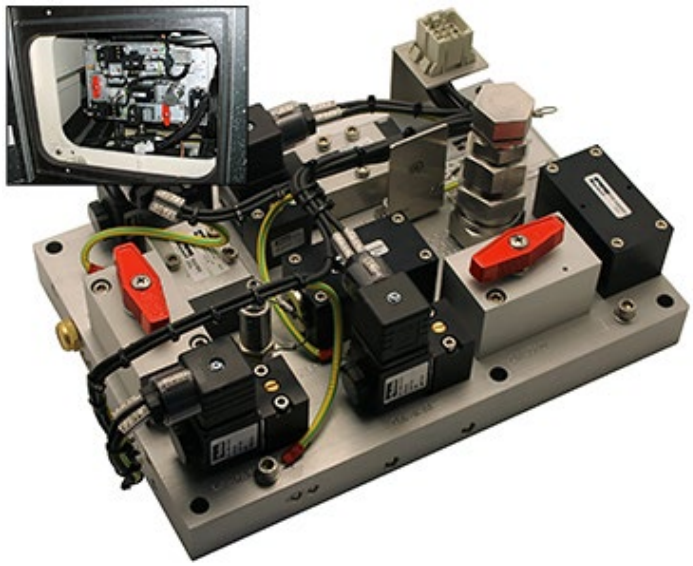
It starts with system suppliers building to specifications requiring components to withstand -40°C and beyond. This requirement is moving the temperature range beyond the present industry standard of -40°C towards temperatures in excess of -50°C, driven by GOST standard 15150-69 for equipment to be used in certain geographic areas with extreme environments, notably Russia and Canada . These specifications are driving operating temperature ranges as low as -60°C with storage temperatures of -70°C.

Role of pneumatic controls

The customer's drive is not to increase cost, but to use standard products as much as possible. Unfortunately, a train system incorporates different technologies operating under different standards.

Parker is designing its products to international standards as much as possible and its Viking Xtreme range of pneumatic valves is a good example—designed for extreme operating conditions down to -40°C as standard and initial testing indicates operation capabilities of current standard product in excess of -50°C. These valves have also successfully passed "winterisation" testing by a major customer to prove operation at extreme temperature with rapid temperature changes applied to simulate thermal shocks from entering and leaving tunnels in cold environments.

Where pneumatic cylinders are concerned, the current Parker ISO standard transportation product is approved to -40°C, and these components, along with the necessary valves, are available as standard production units for various applications. That makes these parts readily available for maintenance or for direct replacement of existing components. With the population of skilled maintenance technicians declining, those remaining need componentry that is easy to understand and easily available. Having straight-forward and modular solenoid valves and air cylinders makes replacement an easy plug-in replacement process.



Three technologies provide effective motion and control: electromechanical, pneumatic and hydraulic—and Parker provides all three.

Hydraulic is typically high pressure, and therefore normally related to high-load applications typically found on the infrastructure and track maintenance side of the industry. Pneumatic technology however is low pressure and ideally suited to more human interfaced control applications, making them the preferred solution where control accuracy and greater safety is required within the passenger and freight segments of the market.

Where trains are concerned, air systems are typically already in place on vehicles thanks to the requirements of air brake and suspension systems. That means compressed air is a readily available energy source on passenger, locomotive and freight vehicles, which is not usually the case for hydraulics. That, and the lower pressures for control and system safety, tends to make pneumatics a more suitable technology and provides a cost effective solution for both passenger and freight rail vehicles.

Although electromechanical solutions are developing in this market, their greater sensitivity to temperature and shock extremes provide certain challenges, but are an area of development and innovation for Parker in all transportation markets.

Why system solutions are important

From an energy consumption perspective, research is aimed at reducing energy requirements for the solenoid, enabling low power variants. One of the reasons electromechanical solutions are still desired is their self-diagnostic capabilities with the potential to feed data direct to train management systems or remote systems via wireless technologies. Alternatively technicians with laptops can plug in and download data into their maintenance management programs.

But lower cost weighs heavily in the balance on the pneumatic side. From a systems perspective it is becoming easier to build in diagnostic feedback signals offering information to the driver's desk or the guard's vehicle so they can be made aware of certain fault conditions. And with integrated modular pneumatics systems the user benefits from a fully tested plug-and-play module that doesn't require a highly skilled maintenance staff to install. When maintenance is required that module can be unplugged and replaced with a new one while offline diagnostics identify what happened with the old module. In the meantime, that train is back on track and in service.

Making sure vehicle downtime is minimized is the most cost effective solution of all.

The use of an integrated system minimizes the number of interconnections required to form the control circuit. Using many separate components means many separate connection points but with an integrated system the number of connections are reduced—as are the leak points. A pre-assembled system's manufacturing method with the pneumatic circuit machined into the module block, along with its standard componentry and connections, ensures repeatable, reliable performance and energy consistency throughout its operating life.

Total life cycle costs

When a vehicle builder supplies new trains, they're also supplying a maintenance contract that can last as long as 30 years. The cost of that maintenance is a significant contributor to the total life cycle cost of the vehicle. Parker's global reputation for quality and reliability is well known, and the ability to respond and support in establishing life cycle cost data for its equipment is a key capability of the total offer to the customer. Being able to keep vehicles on track by minimizing vehicle down time is key for vehicle builders and operators. The plug-and-play nature of both the integrated pneumatic solutions and standard components from Parker can contribute to this improved vehicle availability with the plug out, plug in nature of the solutions maximizing vehicle uptime whilst maintenance is done off vehicle.

With regard to integrated systems, dealing with one supplier instead of 20 means dealing with one part number and one order. The cost to raise one instead of 20 orders represents a significant cost savings at the outset. Add to that the savings coming from logistics, delivery charges and the cost of handling material through their warehouses, and procurement of a completely integrated solution makes economic sense. On the installation side, technicians draw one item from stock, take one item to the vehicle, plug one module in, and the job is done with reduced assembly time. The training investment required to accomplish that is much less than what was required when the OEM was building everything themselves from individual components.

Case Studies

Valve's cold comfort yields hot savings in China

One of the largest manufacturers of locomotives and rolling stock in China needed in-line pneumatic valves. The huge distances covered by rolling stock in China, in extremes of weather, means that all components used on express trains must be able to operate at very low temperatures with high reliability.

Viking Xtreme valves, designed to operate from +60°C down to an extreme -40°C, were subjected to exhaustive testing to Chinese transportation standards and passed. These valves were also specified in braking and coupling control. The low temperature capability of these valves gave the customer freedom to position the control cabinet without restrictions defined by the weather. This simplified installation and easier maintenance resulted in a 30% savings in the overall installation costs.

Actuator opens doors to Russia

A major European rail industry first-tier supplier won a 12-month contract to supply complete door actuation systems to Moscow Metro for use on new rolling stock. All cylinders and valve products had to be capable of operating at -40°C, be approved for use in the rail industry, and be compliant with shock and vibration, IEC 61373:1999 Cat 1 Class B (Shock & Vibration).

An actuator and control system using rail approved products from Parker met the required specifications. The actuator has extended cushioning and its construction ensured the unit would fit into the existing door structure design.

About the Author:

Dave Walker is Parker's Automation Group market development manager for the rail industry across Europe, Middle East and Africa. He has been with Parker for approximately 15 years within the pneumatics sector of the business, principally within the transportation markets, previously with the Parker Fluidic Solutions (PFS) division based out of Milton Keynes in the U.K. as transportation systems manager for customer bespoke system solutions. He received early training in the rail industry, completing a mechanical engineering apprenticeship with what was then Westinghouse Brake and Signal Company in the U.K. (now part of Knorr Bremse).

Parker Hannifin

Parker provides and develops technologies that are rail-certified for proven reliability. Our high performance products include pneumatic and electrically operated actuators, air preparation, control valves and customized control systems, electric motors, hose and fittings and rail accessories. These solutions help reduce engineering and assembly times by up to 70% on compressed air, braking, coupling systems, and ancillary devices. Visit our Solutions section for more information about Parker rail applications.

Parker Hannifin Corporation
Automation Group
55 Maylands Ave
Hemel Hempstead
HP2 4SJ – UK
rail.parker.com