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How Pneumatics Support Extreme Engineering

by Dave Walker

ENGINEERING YOUR SUCCESS.

How Pneumatics Support Extreme Engineering

Three forces have the greatest impact on the degradation of rail infrastructure, which creates the need for better rail equipment design:

- **The number of vehicles traveling over the line**
  - Rail utilization is growing rapidly in Europe.

- **Vehicle weight**
  - There is a significant drive in Europe to reduce weight within railcars, as reduced vehicle weight increases fuel efficiency in passenger vehicles and lighter freight wagons can carry more payload for the same gross weight.

- **Track degradation**
  - When dust from coal or aggregates falls onto the track and combines with oil or water, it can quickly form a grinding paste that can degrade rail infrastructure.

Rail's need for more speed is combined with the need to carry more freight and passengers. Lighter, more modular controls and components contribute to these goals.

Moving more people and freight

The ability to move more freight in less time over longer distances requires greater efficiency from the entire rail system. That's why parties are looking at increasing freight wagon size and capacity, enabling the movement of more freight per wagon. The same trend is seen on the highways, where 40-ton trucks are being replaced by 44-ton trucks and more. That, too, is having a major impact on transportation infrastructure where bridge loads were designed for lighter capacity.

The European initiative called "Shift2Rail" is trying to shift both passengers and freight from road to rail, recognizing that rail is more environmentally friendly, more efficient and often under-utilized. Although longer trains are being used on some routes to increase efficiency, restrictions such as platform length

factor in. Therefore, greater track utilization is being sought: one method of addressing this is provided by the European Rail Traffic Management System (ERTMS). This, when combined with the vehicle-bound European Train Control System (ETCS), will control vehicle speeds and gradually replace old-style signal systems. The changes will allow vehicles to run at safer speeds, with a reduced but maximized safe operating distance between vehicles, thereby increasing capacity during passenger travel.

Comfort and safety

An intercity high-speed express train operator in the U.K. needed to improve its air conditioning systems with poppet valves for better compartment pressure damping and ventilation. Despite the existing system's proven conventional design, the operator needed to reduce the weight of the module from 8kg to 4kg while accommodating budgetary limits. The module was also required to meet -25°C operation and be shock and vibration tested. Parker provided a valve mounted actuator that reduced the number of parts and resulted in smaller limit sensors and lighter weight.

The growing needs of rail for more speed, capacity and passengers are compounded by the needs for greater comfort and safety. That's why Parker is sharpening its focus on heating and ventilation control systems. Parker's contribution includes fluid control valves and pneumatic control valves for the control and management of fluids within systems. This management includes the filtering of ventilation condensate, the circulation of hot water for heating systems and pneumatic controls for opening and closing vents on air intake distribution systems.

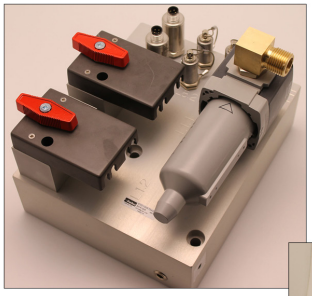
The key drivers within the rail industry for such controls are quality, reliability, safety, total vehicle costs and cost of ownership throughout the life of the vehicles. Parker's engineering expertise rises above providing standard catalog product to meeting customer specifications, particularly in cases involving complex space envelopes.

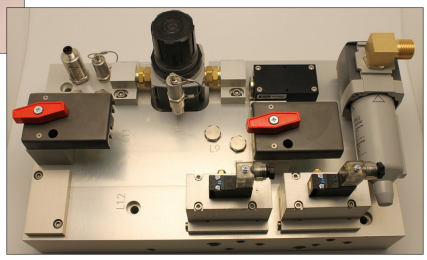
Safety is as important on the freight side as it is on the passenger side. That goes hand-in-hand with increasing the level of automation to reduce the time required for loading/discharge operations. Automation also ensures the vehicle is in-service for longer periods rather than spending time in a depot, being unloaded manually.

Parker supplies systems to automate the discharge doors so that a single operator can control the process. There's also a move toward fully automated systems where the freight wagon door can be operated remotely. That means a vehicle can actually continue traveling, albeit very slowly, through the discharge zone.

Years ago, if a freight vehicle was unloading, it would have to stop periodically. Today, the industry is trending toward vehicles that never have to stop completely. The hopper underneath the discharge may be twice the length of the carriage, but the vehicle will start discharging once it's over it and then continue to discharge as it passes along. Increased safety stems from the ability to remove the operator from the immediate site of discharge and the ability to provide interlocks, so that the wagon can only be discharged from one side.

Equipment maintenance





Providers of a light rail service platform needed a standard solution for auxiliary pneumatic control systems. It had to be modular for adapting to vehicle layout variations and to fit in difficult space envelopes behind profiled seating. Parker provided three separate auxiliary valve modules to cover all space flexibility requirements.

Modular technology answers the desires of OEMs and customers alike, especially where extreme environments raise the cost of service and maintenance. Modular pneumatic components reduce leak paths and energy waste, minimize the envelope, footprint and weight of systems and extend maintenance intervals, even for equipment that has to withstand extreme temperatures, shock and vibration.

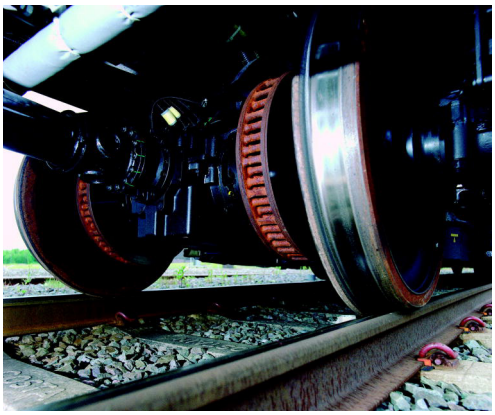
For example, a compact modular regulator assembly designed by Parker eliminated the need for an OEM to interconnect pipework between units on an air supply frame, which considerably reduced the weight of the system. The assembly simply comprised a ball valve, regulator, two manifold blocks and integral mounting brackets. It regulated air pressure effectively from the main reservoir to the required system level. Furthermore, the ball valve isolated the main reservoir supply for simpler, faster maintenance, while test point connections and a safety valve were incorporated into the manifold blocks.

Integrated systems enable the maintenance team to unplug one control system, plug another one in and then do remote diagnostics on a faulty system. This integrated approach saves man hours, relieving the customer of having to install a product physically or do any testing of it on a vehicle. Modules are provided fully assembled and tested, ready to plug and play. That also addresses the need to minimize maintenance costs.

With passenger vehicles, typically the vehicle manufacturer is typically entering into long-term contracts where they not only supply the vehicle, but they have a maintenance contract for the vehicle life. So, when they're designing their vehicle and doing the vehicle build, they need to be sure of the quality and reliability of the componentry inside it over the vehicle life. This certainty enables them to plan maintenance activities and budget for those maintenance costs when they tender their contract bid.

Fuel efficiency

Parker considers system weight when designing a solution to ensure that we keep weight to a minimum. Componentry contributes to the total vehicle weight and, therefore, the vehicle fuel efficiency. It has been estimated that saving a kilo of weight could save 15 Euros a year in vehicle operating costs from a fuel perspective.



Parker's offerings include:

- **Pneumatic and electromechanical pantograph control systems**
- **Cab door controls**
- **External door controls**
- **Traction controls**
- **Brake controls and components**
- **Seat controls**
- **Ancillary air distribution**
- **Air conditioning actuation controls**
- **Toilet system controls**
- **Sanitation control systems and components**

On the freight side, Parker helps with fuel efficiency by offering cover systems for freight wagons. An open freight wagon in movement generates more drag and air turbulence within the vehicle, creating a heavier load on the locomotive. Also, if it's uncovered and it's raining, the load becomes heavier from waterlogging. Both of those factors affect the fuel efficiency of vehicles.

Parker has also helped freight wagon builders automate their cars using valves, actuators and plumbing that withstand extreme temperature environments, contamination, shock and vibration.

A case for extreme engineering

In October 2014, *The Canadian Press* announced that Montreal will continue to operate its current subway cars rather than replace them as planned. This decision, made because of budget cuts by the Montreal government, involves more than 400 second-generation cars dating back to the 1970s.

The Societe de transport de Montreal (STM) said it will extend the life of the Bombardier-built subway cars to 60 years. The transit agency has earmarked $108 million over 20 years to maintain 423 cars, more than half their fleet total, instead of spending $1.9 billion for 558 new cars by 2020.

This documents the importance of extreme engineering at every level of the rail transportation industry—especially at the equipment sub-component and system levels, where Parker Hannifin specializes.

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.

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