Maximizing Rail Passenger Safety and Comfort with Advanced Tape Solutions

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It may come as a surprise to learn that as a means of transportation, passenger rail is on the rise. New commuter rail projects or expansions are slated for service in Atlanta, Baltimore, Boston, Washington D.C., Minneapolis and Los Angeles. The European Union saw a 3.4% increase in year-over-year train passengers in 2019. And tourists are increasingly seeing scenic, luxury train routes — where the train is both destination and transportation — as an alternative vacation option.

This is at least in part due to travelers' interest in reducing their carbon footprint. Thanks to its reliance upon fewer fossil fuels and resultant less pollution, rail transportation is advantageous to the planet. Europe has even seen the recent growth of a "flygskam" (translation: flight shame) movement that grew out of Sweden, which encourages choosing trains over planes whenever possible.

At the same time, high urbanization rates in areas such as Latin America have prompted the revitalization of urban rail infrastructure. China already hosts a high-speed rail network that is by far the longest and most extensively used in the world; the Asia/Pacific region is home to the bulk of recently added track. Even in the United States, which has historically gravitated toward a preference for getting everywhere by car, there is reason for optimism, as untenable congestion in the skies and on the roads has given way to a search for different routes.

A common denominator for choosing rail is often the overall travel experience, including safety and comfort. Addressing these factors is a challenge for manufacturers of railway cars, but also an opportunity: ensuring a better travel experience could increase the number of rail passengers, benefitting manufacturers and passengers alike. One highly effective way to bolster safety, comfort and the experience of travel by rail is to integrate advanced tape solutions into the construction of railway cars and components. Being a materials solution provider, we have some recommendations.

Railway Material Safety and Standards

Safety is paramount in any industry. While rail is an incredibly safe mode of travel, the occasional accident tends to get greater media attention than the more commonplace car crash. Trains, after all, carry many more passengers. Making railway cars safer benefits not just passengers, but also overall the industry's credence as a preferable means of travel.

As in the aerospace industry, one critical safety consideration for passenger rail is flame-retardancy. **Saint-Gobain® Norseal®** Foam and Sponge Products are used in transportation applications to form protective gasket seals against intrusion from the elements, such as air and moisture; they are also used to protect against fire and smoke. The flame-retardancy ratings of the materials selected for rail-related construction are key parameters to consider, as they can make the difference between a minor emergency and a major tragedy.

Figure 1. In much of the world, passenger rail is on the rise.

Source: Shutterstock.

Such ratings are based on testing against various standards, which vary by region. Examples include ASTM E162, which measures flame spread; ASTM E662, which measures smoke density; and ASTM C1166, which looks specifically at flame prorogation in elastomeric gaskets. The Bombardier SMP 800-C test measures toxic gas released during combustion of certain materials commonly used in vehicle construction. EN 45545-2 is a European standard that also provides a fire resistance classification.

The igniting of silicones with relatively forgiving ratings can create a dangerous "flaming gasket" situation, with the potential to spread fire to other areas of the vehicle. Advanced tape solutions, such as the **Norseal** Silicone Product Line, by contrast, provide low outgassing and high flame-retardancy. This translates to low-toxicity, cleaner white smoke when ignited, as well as a lower potential for spreading flame.

An additional safety measure to consider is the sealing of electronics, including those found in lighting, access panels and other enclosures. Relevant ratings include those based on UL 94, a standard used to test plastic parts flammability in devices and appliances; and UL 50E, which deals specifically with electrical equipment enclosures. This is another application for our **Norseal** Silicone Products.

Silicone Foams for Rail Comfort

Comfort is a less tangible quality than safety; there are no published standards that can be used to test for the level of pleasure a passenger experiences while aboard a vehicle. But a recent article in the journal *Transportation Research Interdisciplinary Perspectives (TRIP)* is instructive for the rail industry, as it notes that "bus and train riders experience the most negative emotions in comparison with other transport modes such as private car, walking and cycling." The authors go on to suggest that making improvements to comfort and convenience could be a cost-effective way to increase ridership.

Figure 2. Passenger seats in modern railcar.

Source: Shutterstock.

Foam solutions can contribute to comfort in a number of different areas of a railway car cabin, where applications include windows, HVAC seals and intake gaskets. As noted above, foam and sponge tapes are used to form gasket seals that provide a protective barrier to a variety of external elements, including air, dust and light; ultraviolet rays and ozone gas; and all manner of moisture including rain, sleet, snow and frost. Able to withstand wide temperature ranges, they can also be used as thermal insulation.

In addition, tape solutions can be used for internal door seals and other applications to offer acoustic insulation, contributing to the quiet comfort of a cabin via noise damping or soundproofing. Floor panels and seating cushioned by tape can also be used to reduce vibration and maximize seat comfort.

Norseal Silicone Products

It is no exaggeration to say that we have a product for every conceivable application — if a novel application presents itself, our experts can engineer a custom solution. The **Norseal** Product Line is already well-matched to meet the safety, comfort and travel experience needs of rail passengers.

F-12/F-20

Norseal F-12 and **Norseal** F-20 Silicone Foam Products offer excellent flame resistance, low toxicity and smoke generation, meeting the highest EN 45545-2 hazard classification (HL3). Both types are able to withstand a wide temperature range (-51°C / -60°F to 204°C / 440°F) and offer an excellent compression set value, meaning that a low percent of permanent deformation occurs under pressure (5% for F-12, <5% for F-20).

One difference between the two types is evident in cell structure and density properties. F-12 provides a low-density (192 kg/m^3) modified cell structure, making it lightweight and easy to process. Used as a fire-blocking foam for gaskets, seals and cushioning, it can also be laminated to seat cover fabrics and carpeting to serve as a flame-resistant backing. Its weight savings are so significant that it is used in aircraft and aerospace applications for increased fuel efficiency.

F-20 offers a medium-density (320 kg/m^3) closed cell structure, and is used for flame-retardant performance in gasketing, insulation and dampening applications. It offers excellent resistance to environmental conditions, with a dual-sided smooth surface provides sealing against air, dust, light and moisture.

Applications for both types include window gaskets, door nosing, inter-car diaphragms, lighting seals and access panel seals. We can also apply a film supported adhesive to either type, to create a pressure-sensitive adhesive form that aids in gasket placement. In this scenario, the F-12 becomes SNS 512AF, and the F-20 becomes SNS 520AF.

R10400/R10460

Norseal R10400 and **Norseal** R10460 flame-retardant silicone sponge rubber products offer very good flame resistance, low toxicity and smoke generation, meeting EN 45545-2 classification HL2. Both types are able to withstand an extreme temperature range (-73°C / -99°F to 260°C / 500°F) and offer excellent mechanical properties; respective compression set values are 10% (R10400) and 5% (R10460).

Both are closed cell structure tapes, with respective densities of 560 kg/m^3 (R10400) and 470 kg/m^3 (R10460). Flexible and compressible, they offer excellent weatherability and non-stick properties. Applications for both types include seat frame coverings, thermal/acoustic insulation and HVAC seals.

One difference between the two types is their silicone rubber chemistry. R10400 utilizes high consistency silicone rubber (HCR) chemistry with flame-retardancy meeting UL 94-V0, giving it superior mechanical strength properties over other silicone rubber systems — improved tear strength, tensile strength and abrasion resistance. R10460 is a medium-grade silicone sponge with flame-retardancy meeting UL 94 HB/ V-1 for thicknesses > 11.7 mm that can be used in most gasketing applications.

FS1000 Series

The **Norseal** FS1000 Series is a fire-blocking polyurethane foam tape designed to be airtight, watertight and thermally insulating. It offers the unique property of intumescence: when exposed to heat greater than 200°C / 392°F, it expands to a fire-resistant char, sealing gaps and blocking fire, smoke and hot gases. Meeting EN 45545-2 classification HL2, it is able to withstand a modest temperature range (-40°C / -40°F to 100°C / 212°F). Compression set value is 5%; density is 240 kg/m^3.

Soft and highly conformable to uneven surfaces, the tape can be compressed with minimal force to create air and water seals. Its resilience also confers vibration damping properties. It is used in multiple industries for its protective abilities, including aerospace (seats, freight compartments), automotive (fuel tanks, battery packs) and construction (building joints, HVAC).

Common Norseal features

All **Norseal** Silicone Products are usable for both internal and external seals, with compression set values that provide shape recovery after extended compression; this creates long-life seals that reduce maintenance costs. This has particular relevance in the rail industry, sealing sensitive components and absorbing vibration from travel on the rails and from the frequent cycling of railway car doors.

While the advanced, high-performance nature of the **Norseal** Silicone Products represents a premium solution, it also translates to a high durability and lifespan of 10-plus years, which allows manufacturers to realize cost savings by end-of-product lifecycle.

Available form factors include dry-back gasketing, or pressure-sensitive/strip-n-stick (SNS) tapes for instant gasketing. Sealing abilities can also be modified by altering surface qualities.

On the Right Track

In terms of meeting current opportunities and challenges, there is more than one possible track for railway manufacturers to take. The advanced tape solutions outlined here offer value that becomes clearer over time; while initial expenditures could be reduced by compromising on material quality, this comes at the cost of placing obstacles on the routes to both comfort and safety. We are taking the long view toward building a lasting landscape for the promising future of passenger rail.

Contact us to learn how you can benefit from our solutions for railway applications.

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