

The right seals and materials keep chemicals moving

By Thijs Menzel

THE world relies on chemicals to provide the essentials of modern life and they are the basic building blocks of everyday items; from the fertilizers that help grow our food to the beds we lie on, from the shoes on our feet to the cars that we drive. Transporting those chemicals safely to where they are needed, is a major logistical effort that requires advanced sealing technology.

For perspective, the American Chemistry Council's 2021 Guide to the Business of Chemistry estimates 946 million tons of products were transported in 2020, making the business of chemistry one of the country's largest shippers. According to the Association of American Railroads, chemical, petroleum, and petroleum product freight accounted for about 20% of total North American rail carloads in 2019, equating to roughly 68,700 carloads per week on average.

With end users of chemicals spread across five continents, the safe transport of huge volumes of materials to production plants by rail, road, sea, or air is itself a massive industry. In the U.S. alone, ACC says that some 970 million tons of chemicals shipped around the country in 2018. Regardless of the type of chemical, producers and consumers need safe, efficient, and cost-effective methods of transportation.

The solution at the heart of any chemical transport system is a tank. Pumping substances into a tank prior to them being sent to and emptied at their destination involves pumps and valves with a variety of seals. It is crucial to ensure that

chemicals do not leak into the environment; zero-leakage is mandatory to avoid environmental contamination and meet strict regulations. Seals must perform well for a long time, regardless of how destructive chemicals may be.

Ensuring safety

Intrinsically, the type of chemicals transported will cause standard sealing materials to deteriorate prematurely with the most aggressive of media being extremely destructive.

Consequently, chemical transporters worldwide rely on seal manufacturers, like Trelleborg Sealing Solutions, with extensive materials expertise to provide specialized reliable sealing solutions, service, and technical support. This will prevent non-accidental releases (NARs) and ensure the safe and efficient operation of tank cars, tank trucks, ISO containers, and IBC equipment.

Reducing the total cost of ownership

Though the seals themselves are relatively low in value, the labor to bring the tank into the shop and perform maintenance, lost up-time during maintenance, and time spent waiting for an inspector to sign off on work done, can be costly. The key to lowering the total cost of ownership for the tank operator is increasing seal life to extend the mean time between maintenance. In addition, to make transportation as effective and economical as possible for the carrier,

The right seal for the job

A variety of solutions seal the various valves and devices on over-the-road bulk transportation carriers. For example, on a tank car, the vacuum relief valve, top transfer valves, bottom outlet valves, and the pressure relief devices, all require sealing solutions. The seal types used for these applications may be O-Rings, X-Rings, square rings, or custom components.

- **O-Rings** are efficient, easy to use and an economical sealing element for a range of primarily static uses.
- **X-Rings**, double-acting four lip seals, provide higher seal efficiency and lower friction than conventional O-Rings.
- **Elastomer Square Rings** keep their shape and provide high sealing efficiency in static applications, mostly in flanges to SAE standards.
- **Custom Components** solve technically challenging applications and are manufactured using specialty processes and materials.

Know your chemicals (SIDE BAR) Some of the most commonly transported chemicals include:

- **Acetone**—An organic compound that is a commonly used as a solvent
- **Ammonium Hydroxide**—A solution of ammonia in water used as a cleanser and in manufacturing of plastics, rubber, fertilizer, and textiles
- **Butyraldehyde**—An organic compound used in production of plasticizers
- **Diethyl Ether**—An ether used as an inhalation anesthetic, non-polar solvent, and refrigerant
- **Ethanol**—A simple alcohol used in a variety of products and processes
- **Ethyl Acetate**—An acetate used in glues, nail polish removers and in the decaffeination of tea and coffee
- **Ethylenediamine***—An organic compound commonly used as a building block in chemical synthesis
- **Ethylene Glycol**—An organic compound used as a raw material in the manufacture of polyester fibers and antifreeze
- **Glacial Acetic Acid***—A water-free acetic acid and

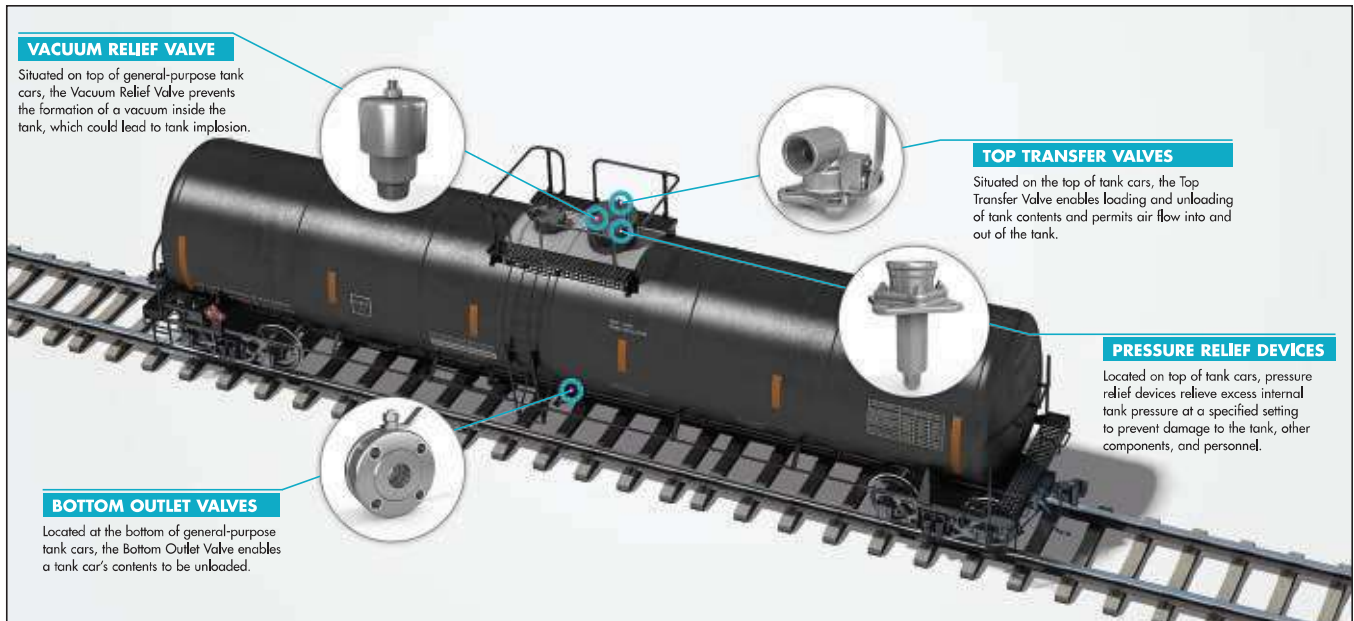


Photo: Trelleborg

it's ideal to use the same pump, valves, and seals regardless of the media transported.

For this to be possible, the seal materials must be resistant to the maximum number of chemicals that are potentially transported, and withstand a wide range of operating temperatures. Consider, for example, the challenging environmental conditions when traveling across deserts in extreme heat or over ice fields at low temperatures. This seemingly makes universal sealing across the full range of chemicals potentially transported an almost unsurmountable task.

Material solutions make their mark

When transporting certain commodities, the only possible type of sealing materials are Perfluoroelastomers (FFKM),

a precursor to polyvinyl acetate and cellulose acetate

- **Mobil Jet 11**—High performance aircraft-type gas turbine lubricant formulated with a combination of a highly stable synthetic base fluid and a unique chemical additive package
- **Methyl tert-butyl ether (MTBE)***—An organic compound used as a blending component to oxygenate and raise the octane of gasoline
- **Nitric Acid**—A mineral acid commonly used as a strong oxidizing agent
- **Sodium Hydroxide**—A caustic base and alkali that is used in many industries
- **Sulfuric Acid**—A mineral acid commonly used in manufacturing and processing
- **Toluene**—An aromatic hydrocarbon used as a solvent in various products, such as paint thinner
- **Urea**—An organic compound that is an important material in chemicals

*These chemicals tend to be the most destructive to sealing materials.

which exhibits the sealing qualities of an elastomer combined with the chemical resistance of a Polytetrafluoroethylene (PTFE). However, not all FFKMs are created equally.

Special properties are needed to stand up to the harshest chemicals likely to be transported. For example, Trelleborg has a proprietary FFKM compound it says effectively endures the rigorous conditions faced in chemical transport over the broadest range of media, proving the effectiveness by subjecting them to an extensive testing program involving the 16 most transported chemicals, including MTBE.

Methyl Tert Butyl Ether (MTBE) is an additive for ethanol that is a denaturant, preventing the consumption of ethanol as an alcohol, which allows it to be de-taxed by the U.S. government. Also, under the Sulphur 2020 initiative, higher-grade diesel is replacing previously prevalent bunker fuel, and this has MTBE in it. These factors are increasing the shipments of ethanol and diesel with added MTBE.

MTBE is destructive to sealing materials and few compounds can provide extended life in this chemical. This makes the use of a single tank pump impossible. Trelleborg says its new sealing materials can stand up to MTBE and other chemicals, which could make them a "game changer" for tank operators in lowering total cost of ownership.

Conclusion

Chemical companies and shippers value component partners who know chemical transportation is not just about the seals themselves and their chemical compatibility. Service also is critical, and avoidance of downtime is vital. When equipment requires repair, commodities aren't moving, and owners and shippers lose money. That's why it's wise to look for solutions and materials that offer the best and broadest resistance to transported media, optimum seal reliability in both extreme hot and cold conditions, and extended service life, all leading to a lower cost of ownership. ■

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