



MAGNA ENERGY STORAGE SYSTEMS

How to optimize the functionality of your fuel caps and filler necks

Whitepaper

Table of Content

Abstract	3
Major challenges to the truck industry	4
The role of fuel caps and filler necks	4
• Dirt in the locking mechanism	5
• Contamination of the tank and fuel leaks	6
• Spitback and overfilling while refueling	7
Conclusion	8

Abstract

Legal regulations to achieve emission reduction, increased product complexity and the trend towards alternative propulsion systems are challenging the truck industry.

Clever improvements to fuel caps and filler necks can contribute to environmental protection, lower maintenance costs, higher reliability as well as convenience and time saving for the driver.

Major challenges to the truck industry

Following greater consciousness of environmental impact, sustainable action is becoming more and more important. Changing legal frameworks, such as the Paris treaty, are fostering this trend. As a consequence, the truck industry faces stricter requirements on emissions, with the latest emission norms such as *China 6b* or *Euro 7* leading the way. At the same time, many companies worldwide see the benefits of common sourcing across countries and continents. For truck OEMs, this results in a focus on platform strategies with the objective of developing components that can be used across many vehicle models. Another trend is towards individualism, as many customers desire tailor-made solutions instead of standard components.

Consequently, development cycles are getting shorter as manufacturers need to meet shifting demands on the market and keep up with the latest standards in emissions, innovations and newest technologies. However, despite a quick-paced development environment, reliable production and supply chain are essential.

The role of fuel caps and filler necks

Fuel caps and filler necks are more than just a precondition for a fully operational truck. They make a significant contribution to complying with environmental standards – such as preventing fuel spills and leaks – or passive safety regulations – for example certain behavior of the truck tank system upon impact.

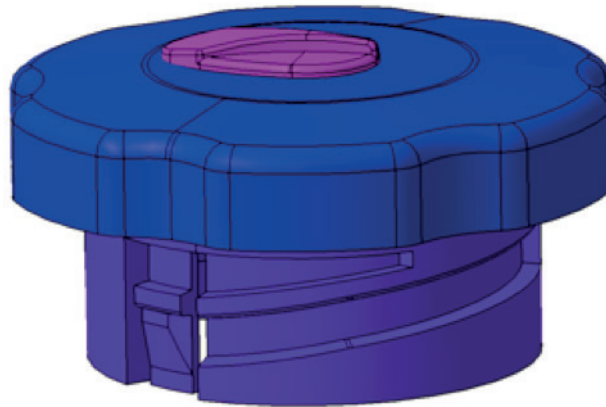
Fuel caps and filler necks are also subject to customers' demands on functionality. A key concern is ease of use and comfort for the driver. As one of the interfaces between truck and driver, a well-designed fuel cap and filler neck can help the driver to focus on simply driving the truck and working productively.

To fulfill customer demands and legal requirements, there are three key topics where fuel caps and filler necks for truck tanks can help to tackle the key challenges in the industry:

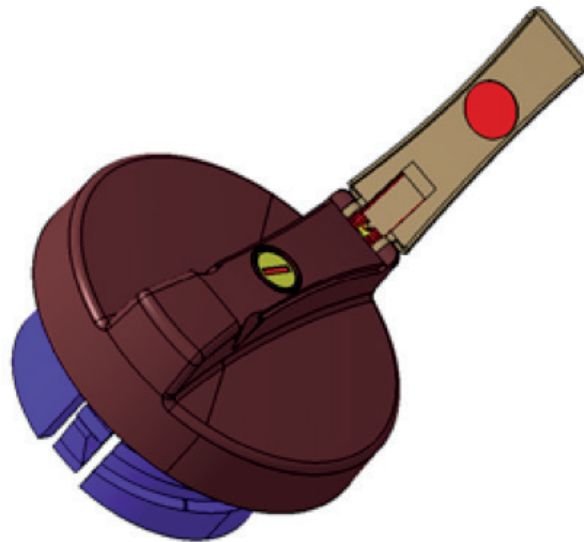
- **Dirt in the locking mechanism**
- **Contamination of the tank and fuel leaks**
- **Spitback and overfilling while refueling**

- Dirt in the locking mechanism

As truck tanks are usually mounted directly on the chassis without any extra cladding, protection against dirt and moisture – usually in combination – as well as fuel theft are always issues. In many cases it makes sense to include a lock in the fuel cap to offer some protection against fuel theft. As for dirt, all commercial vehicles with a similar layout are negatively affected, but trucks in construction and related industries even more so. Malfunction of the fuel cap locking mechanism due to dirt is an unnecessary annoyance and can potentially cause delays when refueling or even drive up maintenance costs and time. To prevent this problem, there are two possible solutions for protecting the lock. The first is a lock cap with an eccentric bushing – a simple, yet effective way to ensure a well-functioning lock under all circumstances (figure 1). The second version has optimized ergonomics, in this case a flipping lock cap integrated into the handle for extra comfort and quick operation (figure 2). Both solutions also feature a 90° bayonet instead of a conventional 360° thread and thus ensure a quick and hassle-free fuel stop.



Fuel cap with lock cap



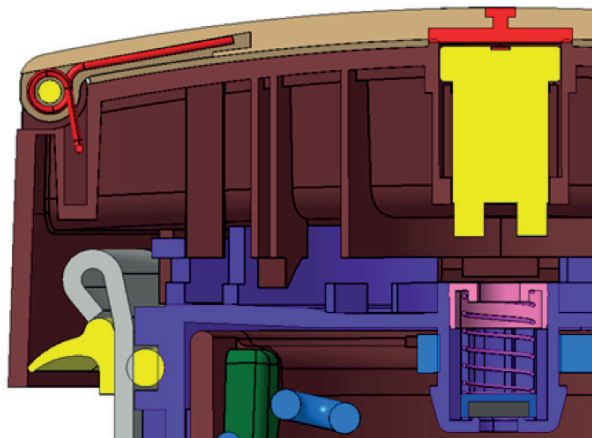
Fuel cap with the lock cap integrated into the handle

- Contamination of the tank and fuel leaks

Dirt and moisture from the environment not only compromise the function of a locking mechanism, they can also cause contamination of the diesel tank itself, potentially creating problems with contaminated fuel and thus higher maintenance costs. At the same time, fuel leaking from the diesel tank through an improperly sealing fuel cap contributes to pollution and a dirty truck. These two issues can be tackled by a set of optimizations to the fuel cap and the filler neck.

First, the conventional flat seal on top of the filler neck is replaced by a radial O-ring seal inside the filler neck. Whereas the conventional seal is easily hit by the fuel nozzle, the O-ring is protected against damage by its somewhat recessed position. Furthermore, while the metal spring in the fuel cap compressing a conventional flat seal might give way over time, the O-ring always remains in the seal zone, even when the bayonet is not screwed on completely. Retaining cams at the end of the bayonet grooves provide extra security against loss of the fuel cap, as a defined force is necessary to break the bayonet mechanism.

Second, some dirt may still creep into the fuel cap and bayonet under severe conditions, leading to eventual contamination of the tank. An additional dust cover sealing the entire fuel cap and filler neck assembly prevents this scenario.



Fuel cap and filler neck with radial O-ring seal and additional dust cover

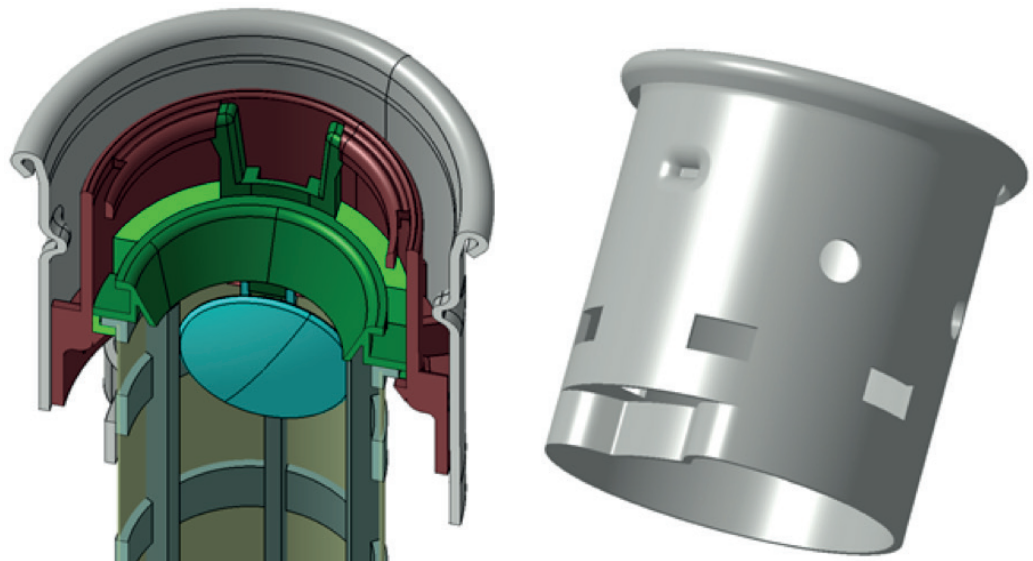
Third, a filter for the filler neck offers even more protection against dirt getting into the tank during refueling. This can be done with an all-plastic solution that is installed via clips or a bayonet, thus making maintenance and regular cleaning of the filter much easier than with a conventional screw-in metal filter. In combination, these three measures add up to maximum protection against contamination of the diesel tank and fuel leaks even under severe use conditions.

- Spitback and overfilling while refueling

Refueling the truck's diesel tank should be as quick and convenient as possible for the driver. A major inconvenience as well as unnecessary pollution and contamination during a tank stop is the so-called "spitback" phenomenon, caused by diesel fuel rising back up the filler neck when the nozzle is retracted. Fortunately, though, there is a simple and effective solution.

A spring-loaded flap gives way when the nozzle is inserted and closes off the filler neck when the nozzle is removed. By integrating the mounting into the bayonet, the overall dimensions remain as compact as possible. This solution can even be retrofitted to existing trucks with compatible tank systems.

Similar to spitback, overfilling the diesel tank can cause inconvenience, pollution and a dirty truck – especially when the tank stop happens in a rush. The key is to include holes in the filler neck to trigger the automatic shutoff of the diesel dispenser. In this example, venting holes, bayonet groove and nozzle support are integrated for a compact, yet robust and functional piece.



A spring-loaded flap against fuel spitback (turquoise), the filter (grey) protects against dust

Venting holes integrated into bayonet groove and nozzle support

Conclusion

It's all in the details. Clever improvements to fuel caps and filler necks can contribute to environmental protection, lower maintenance costs, higher reliability as well as convenience and time saving for the driver.

As a leading partner for energy storage systems, Magna supports OEMs with a comprehensive product portfolio for conventional and alternative propulsion. With development, production and testing concentrated in one location, Magna can take the overall responsibility from development to manufacturing of storage systems. With many decades of experience with automotive development and manufacturing, Magna is ready to respond to rising demands and to help OEMs tackle the challenges the industry is facing.



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