



Robotic Fueling System
Safe, quick and efficient refueling

THE AUTOMATED FUELING SOLUTION FOR MINING TRUCKS, TRAINS, STRADDLE CARRIERS AND AGV'S.

Robotic refueling of heavy industrial vehicles in extreme conditions and dirty environments. Rotec Special Projects developed the system in first instance for the **mining industry**. This modern industry is characterized by its efforts in the field of safety, efficiency and environmental conservation. These are goals that Rotec Special Projects likes to commit.

We show you with pride the first robotic fueling system for heavy industrial applications. The system is applicable for mining trucks, trains, straddle carriers and AGV's



Benefits



SAFE

Because the process is fully automated nobody needs to be near the fueling process or the truck. The result, a safe working environment.



EFFICIENT

The most efficient fueling process available with fueling speeds of **150 GPM up to 300 GPM** and attaching in less than 75 seconds.



ENVIRONMENTAL-FRIENDLY

An environmental-friendly fueling solution is achieved because of an adapter, which encases the receiver, is mounted to the truck and protects the receiver against dirt. The adapter, combined with the dry break connection and our patented system for exact alignment, leads to a reliable and perfect attachment process.



EASY

The RFS is easy to use and operate. The driver controls the proces with an Android app or a radio frequency controller. Also fully automatic is possible for autonomous trucks.



THEFT PROOF

The RFS only fuels vehicles that are equipped with the RFS adapter, and all the fueling data is logged. These safeguards, among others, guarantee that no fuel is ever misplaced or embezzled.



75 seconds
connecting

300 gallons per minute
fuel rate

30 seconds
disconnecting



Technical information

Casing of the RFS

The Robotic Fueling System (RFS) is encased in a 20 ft. sea container. This makes the RFS easy to transport and place. No additional constructional activities are required either. A fuel tank or car only needs to be placed in the vicinity of the RFS. The container also protects the RFS against the influence of changing weather conditions. The container can be fitted with climate control when circumstances demand this. The container opens and closes with an automatic door before and after the automated fuelling process. The original container doors are used during transport.

Interaction between driver and robot

The truck driver positions one's truck in front of the Robotic Fueling System (RFS). The driver receives a live camera image from the RFS on a device in one's cabin. This facilitates the process of moving the adapter within reach of the robot. When the driver has positioned one's truck correctly, one confirms this to the RFS using the same device, after which the connecting and actual fueling begins. During the entire fueling process, the camera image stays active and the driver can monitor the fueling process and abort it when necessary.

Delta robot

The Robotic Fueling System (RFS) consists of a horizontally placed delta robot, which consists of three driving mechanisms, mounted on a sub frame that moves the 6 arms and the tool up and to the side. The sub frame is placed in a main frame. The sub frame and thus the delta robot is moved towards the fueling object by one driving mechanism. The choice for this robotic system stems from the wish to keep the driving mechanisms in the container during the fueling process. The driving mechanisms are kept away from the actual fueling process as well. The mechanical simplicity of the system is also an advantage. Simplicity leads to reliability, low costs and durability.

Self-centering connecting unit

Because the Robotic Fueling System (RFS) knows only three degrees of freedom, a good connecting process is impossible without extra elbow room. To enable a complete movement, one needs six degrees of freedom. These were found in the self-centering system. This system consists of a cone placed on the tool, which has complete freedom of movement because of two or three air bellows. The receiver, which is located on the tank of the truck, is fitted with an adapter that protects the receiver against dirt and also serves as conduction for the cone and the tool. In the moment of connecting, the tool slides into the adapter and an exact alignment between the nozzle and the receiver is achieved. Any deviations of the robot system and the vision system are compensated as well, so that successful connections can be attained repetitively. This would be impossible without the self-centering system, because the nozzle that needs to be placed on the receiver only knows a margin of less than half a millimeter and less than half a degree.

Time of flight camera

Within the margins of the robot, a 3D time of flight camera searches the position of the adapter, which is attached to the fuel tank of the truck. Infrared light sent by the camera is projected on the adapter, reflects back to the camera and is received by the camera. Based on the angle of incidence of the light on the CCD and the time lapse between sending and receiving the light, a 3D image is generated, an extensive vision algorithm is calculated and consequently, the exact position of the adapter and therefore the receiver is determined.

Fast fueling

The Robotic Fueling System (RFS) uses different existing "fast refueling systems" for automated refueling of vehicles. These systems can be pressurized or non-pressurized. They work quick, clean and safe. Because of the hermetical lock fuel spilling is kept to an absolute minimum. The RFS works with the **Wiggins ZZ9A1**, Banlaw BNM800 and the Shaw Development diesel nozzle with a fuel rate up to 150 gallons per minute. Also the **Wiggins VR300** nozzle is supported with a fuel rate up to 300 gallons per minute. Other fueling systems on request.

