



STUDY

TO COMPARE TANK CAR
ON SPOT LOADING SYSTEMS
WITH
SERIAL LOADING SYSTEMS



LOADING YOUR FUEL

Dipl.-Ing. SCHERZER GmbH



Comparison of Tank Car Loading Methods

Automatic On spot loading
vs.
Automatic Serial Loading Systems

For more than 40 years, Dipl. - Ing. Scherzer GmbH has been involved in the **planning and turn-key installation of systems for handling and storing liquid and gaseous products**. Our key customers are primarily in the mineral oil and the chemical industries, as well as a number of other industries.

Scherzer not only plans and delivers the tank car loading system itself, but also designs the complete loading and unloading system, including all aspects of the integrated system; for example automation, loading computers, measuring value recording systems, piping systems, electrical power supply, buildings, etc.

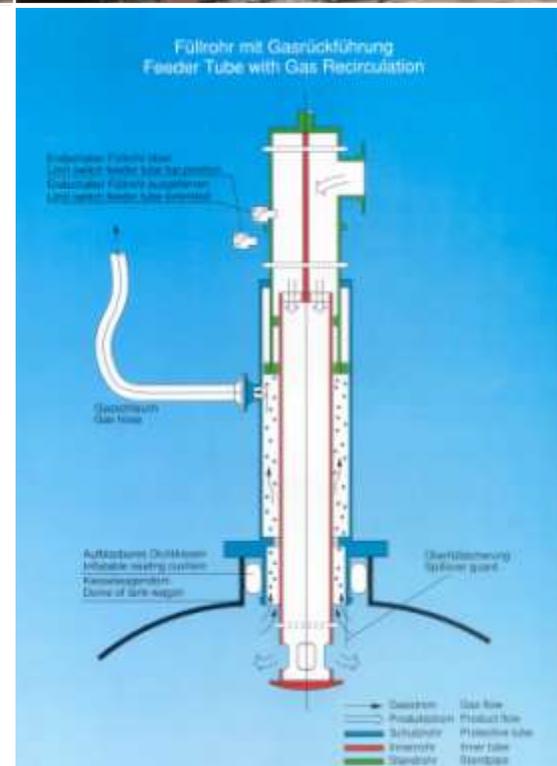
In 1966, Scherzer planned and delivered the first tank car loading system. In the mean time, more than 210 filling tube systems have been planned, delivered and put into operation.

Currently, **state-of-the-art systems operate in a refinery in Lithuania (Mazeikiu Nafta)**, in Poland (PKN Orlen Plock and Grupa LOTOS Gdansk), West Siberia (Novatek) and in Yaroslavl (Slavneft).

Scherzer's scope of supply includes the delivery and installation of individual filling tube systems, extension of existing tank car loading systems and the completion of turn-key on spot loading systems as well as also row loading systems.

For the individual projects, please refer to the list of references for tank car loading systems and tank car filling tubes. This reference list is available on the Scherzer web site at www.scherzer.net

The systems for loading railway tank cars as well as the associated automation equipment will be custom designed according to the prevailing local conditions and the relevant requirements of each customer.



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System comparison

On Spot Loading vs. Serial Loading

Many customer and prospect inquiries raise the subject of serial loading systems for filling railway tank cars.

These serial loading systems are established technology and have been in operation for many years.

For each inquiry, Scherzer prepares a comparison between serial loading systems and on spot loading systems. The decision – what system is to be offered for what facility – results from comparing the many aspects of the loading systems in question.

In any case, the decision depends primarily on the following:

- ◆ Required loading capacity of the system
- ◆ Specification of the tank car types to be filled Degree of automation
- ◆ Specific Safety requirements

Due to the increased requirements of capacity, safety, quality assurance in terms of product mixing as well as flexibility of the loading systems, serial loading systems may have trouble meeting such requirements. Even if – in the mean time – one tries to modernize older serial loading systems and provide them with articulated loading arms, the major disadvantages continue to exist.

As far as a technically comparable offer which objectively compares serial loading systems with on spot loading systems, (with the same quality assurance and safety measures), one will see that the serial loading systems are more capital intensive than on spot loading systems. In addition, the increased requirement for inventory of spare and wearing components has not been taken into account here. Thus the capital and operating expenses of serial loading systems will certainly exceed the capital and operating expenses of the On spot loading system.

The following includes some remarks about serial loading systems which are compared with on spot loading systems.





Serial Loading Systems vs. On Spot Loading Systems

Basically, the following arguments highlight the advantages for on spot loading systems and show that serial loading systems do not meet the requirements for the latest state of the art loading systems, worldwide.

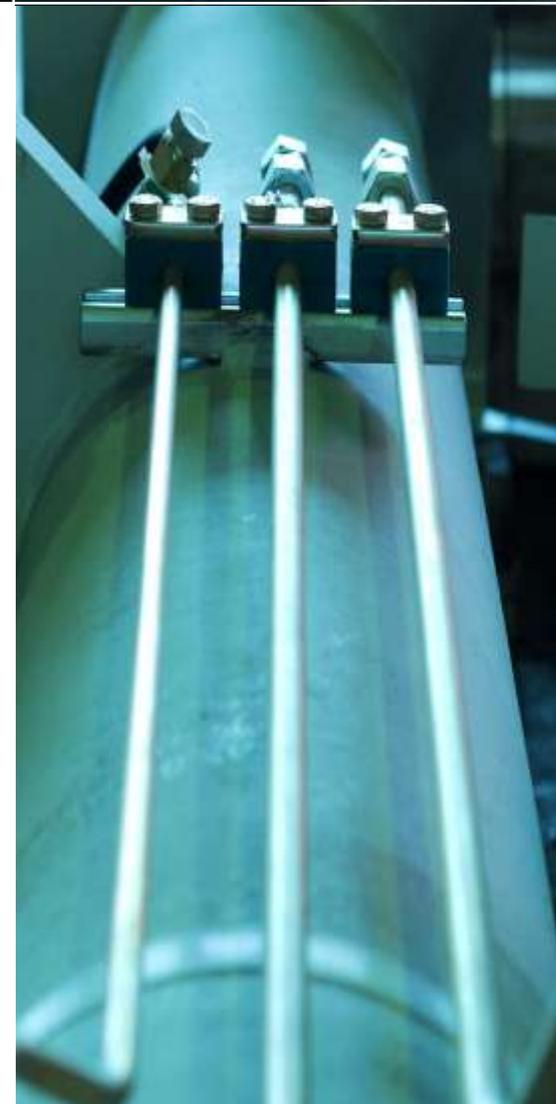
- ◆ Due to the high number of filling points and manual operation, a high potential risk exists with many ignition sources (due to human failure, static charges, etc.).
- ◆ **The on spot system is provided with a lower number of shutting-off and regulation fittings and other associated hardware, fittings and devices.**
- ◆ The loading personnel are not in physical contact with the filling tube, thus a major accident and injury risk of serial loading is avoided.
- ◆ The operating costs for maintenance and repair of the on spot systems are much lower as compared with serial loading systems because significantly less equipment is employed.
- ◆ The large loading area of the serial loading system cannot be adequately controlled and monitored in an appropriate manner. In particular, detection of fire cannot be effectively monitored, contrary to the case with on spot systems. In addition, more fire extinguishing water and foam is required for the serial system, and the risk potential is higher because all tank cars are connected to the filling system at the same time.
- ◆ The installation period of the on spot system is clearly shorter, and therefore the costs associated with installation and construction times are essentially lower.
- ◆ In case of danger (e.g. fire), the loading arms of the spot system move automatically Upwards, and the combined train of cars can be moved by the car pulling system out from the area of risk. No car pulling system is provided for the serial loading system and the filling tubes do not move automatically to an idle position; the filling tubes of the serial loading system are not closed automatically, and it is not possible to pull out the tank cars from the area of danger even when taking into consideration all safety requirements.
- ◆ The metal structure requirements for on spot systems is lower in comparison with that of serial loading systems because the length of the on spot system is much shorter than the length of the serial loading system. For example, the length of an on spot platform with 2 filling points per track is 213 - 246 feet (65 - 75 m) and with one filling point per track approx. 164 feet (50 m). For serial loading systems the length is $N \times l$ tank car, e.g. for 32, 4-axle tank cars the length is $32 \times 12.15 = 1,275$ feet ! (388.8 m)





- The installation costs for on spot systems are reduced because – due to the reduction in the system length – shorter lengths of pipelines and manifolds are used for the supply of bulk products as well as reduced length requirements for control and power cables. A reduced platform length also requires a lower number of product flowrate, temperature, and pressure sensors and data logging hardware.
- Due to the large area and the high number of filling points, the serial loading system has a high potential for causing groundwater and soil pollution from product spills caused by overfilling/tank car emergencies and leaky collection areas. In addition, excessive fire extinguishing water can also lead to contamination problems.
- If several types of bulk products are filled at the platform, the use of track scales are recommended. The track scale for static weighing is placed below the filling point; automatic measuring value data recording and the printing of delivery documents is carried out in the control room during the filling process.
- Both for the On spot filling and serial loading, weighing can be carried out by dynamic scales (tank car train moves over the scale platform prior to and after filling). However, this will result in major deviations and uncomfortable preparation of loading documents.
- In order to avoid high amounts of contaminated rainwater, serial loading systems should be provided with roofs and thus a large number of metal structures will be necessary.
- The filling points of the spot system are viewed and monitored from a safe position (control room); this is ensured because one filling point only has to be monitored. Simultaneous monitoring of the serial loading system is not possible manually and also not adequately monitored by remote sensors.
- The On Spot systems can be operated with very few personnel and therefore associated labor costs are low.
- The On Spot system has a higher level of automation than that which is possible for serial loading systems.
- The pump station is more compact. A serial loading system will require a higher number of pumps with a higher total capacity. This additional hardware also translates into increased capital and operating expense.





- Pollution from the tank cars is practically eliminated due to a specific filling tube sealing mechanism. (the filling tube is closed tightly and automatically before the loading process can begin).
- The measuring values of the on spot loading system can be recorded at lower costs by a scale or a counter located at each filling point during loading (maximum 4 points as compared with 64 points in a serial loading system). One measuring line each must be installed for each filling point of a serial loading system.
- **The on spot system is very flexible in terms of product changes. In 4-filling point systems (2 filling points per track) it is even possible to fill different products at one track at the same time. This capability will likely be required more often in the future due to the specific requirements of the end customer. It is also possible to load different products into one train of tank cars.**
- There are no problems with different tank car dimensions with the on spot system used in-conjunction with a car pulling system. Even 8-axle tank cars or also different tank car lengths in one train can be loaded without difficulty.
- Tilting stairs are used to open and close the tank cars upstream from and downstream of the filling point; here too personnel protection is higher than with serial loading systems.
- Displaced vapors during the loading process can be exhausted more efficiently at one point. On spot systems achieve higher reduction of toxic emissions into the atmosphere (by providing the loading platforms with Vapor Recovery Units (VRU's)) and also a reduction in the contamination of groundwater. Use of an integrated, closed filling system, (by directing the displaced vapors to a VRU) is necessary to meet the applicable requirements and environmental regulations of modern systems used in the transfer of volatile organic compounds. The economic advantage of recovering the displaced vapors is significant since approx. 0.5 to 1.0 gallon (0.5 to 1 liters) of product are recovered from 1,000 gallons (1 m³) of product loaded.(0.05% to .10 % of throughput; Depending on the vapor pressure and temperature of the product being loaded, the savings for some products such as gasoline are typically 0.1% to 0.3% of throughput; 1-3 gallons per 1,000 gallons loaded (1-3 liters per 1,000 liters loaded) according to the calculations of the specialists Atchinski NPZ NK "JUKOS" (after commissioning of a two-side on spot system for filling light natural oil products and recovery of additional products from the displaced vapors), a reduction of toxic emission and product recovery in an amount of 2,400 tons per year can be achieved. Groundwater contamination pollution is reduced to 1,000 m³/year. Savings in payments for environmental pollution amount to \$ 600,000 annually (journal „Natural Oil and Capital“ No. 1 of 2002, sheet 49).



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- In the event that it is necessary to install a fire extinguishing system, it is much easier to continuously monitor and automatically protect the on spot system.
- Reconstruction and/or installation of the on spot system is possible – depending on the available track length – by connection to the existing system or retrofitting the existing serial loading system. The existing serial loading system can remain completely intact or can be used for parts as emergency reserve, if necessary.
- The on spot system is less expensive than a technically comparable automatic serial loading system. For quality reasons, a product distributor with 2 fittings and leakage monitoring system must be installed for each filling point. This means for 60 filling points and, for instance, 10 different products a total of 1200 automatic shut-off valves and 120 leakage monitoring systems must be installed. In contrast, forty automatic shut-off valves and 20 leakage monitoring systems are used for on spot filling.

The above items represent a summary of some essential arguments and/or examples for the superiority of the On spot system as compared with serial loading systems.

So far, Dipl.-Ing. Scherzer GmbH has been using more than 214 filling tubes in approx. 50 spot systems. The systems are designed for high flowrate and continuous operation due to their high stability and low susceptibility to failure as well as minimum failure times.

Non-availability of the equipment can be limited to a few hours per year when inventorying some of the spare parts recommended by us (e.g. ventilator for monitoring system, electronic control components and 1 spare filling tube as protection against emergencies). Because the factory production capacity of the systems exceeds the typical specified annual demand by far, sufficient reserves for maintenance and repairs, if any, are available on very short notice from our Works.

We recommend on spot loading systems for the above reasons, in particular due to the increased risks for personnel safety and potential environment hazards of the equipment used in serial loading systems.

With reference to recent international state of the art metrics for railcar loading, the serial loading system is obsolete and no longer competitive with other alternatives such as the On Spot Loading System.



Advantages of Scherzer filling tube equipment for on spot loading systems

- ◆ The Scherzer filling tube is made by very sturdy machine equipment. (The weight of a filling tube is approx. 1,800 kg). Many of the filling tubes supplied by us have been in operation for more than 40 years. The wall thicknesses of the tubes range from 10 to 20 mm. The guide faces of the tubes are ground and hard-chromium plates. The components in contact with the tank car are made of brass or red brass and the sealing plate is of NBR.
- ◆ **Longitudinal and transverse movements** of the filling pint for exact positioning are hydraulically remotely controlled.
- ◆ The sealing plate between filling tube and tank car dome is supported by springs. The cut edges are protected by sturdy brass strips. The sealing plate is vulcanized onto a brass plate and screwed to the spring-supported carrying plate, thus the sealing can be replaced difficulty and at low cost.
- ◆ Gas return is via a separate high-quality telescopic tube with multi-sealing. Thus it is ensured – as compared with the formerly usual hose return line – that no condensate can collect in the system.
- ◆ Sealing of the filling tube after moving out of the tank car is by 2 (two) O rings and is absolutely leak-proof. Residual amounts which drip from the tube walls are collected in the tube (approx. 8 – 10 liters). These residual amounts are drained into the tank car during the next loading process. If this mixing (during product change only) is not accepted in special cases, it is possible to automatically drain the residues (option).
- ◆ The PLC controlled loading process meets all safety requirements. Each filling position can be displayed visually on request and the lifting height of the filling tube can be limited depending on the relevant type of tank car.
- ◆ High safety in operation is achieved by the overfill safeguard, the overpressure safeguard and the continuous loading state indicator.
- ◆ During the last 40 years, more than 210 filling tubes have been installed and commissioned in Bulgaria, the Federal Republic of Germany, Great Britain, Iran, Austria, Poland, Russia, the Switzerland, Slovakia, the Czech Republic, Lithuania, Romania and Belgium. Based on continuous further development we can offer a sophisticated system according to the latest state of the art.
- ◆ More than 170 Scherzer filling tubes with gas return equipment have been supplied and installed since 1988. All filling tubes supplied so far have been adapted individually according to the relevant local conditions, customer requirements or the products to be filled. Based on the experience gained, of course it is possible for us to offer the optimum solution for your requirements.
- ◆ We should like to provide contacts to our customers or to arrange a visit to the system. We trust that the high quality standard of our systems will convince you.

