Liquid petroleum gas (LPG)

Loading- and unloading systems
Welcome to Dipl.-Ing. SCHERZER GmbH

The company’s field of activities includes the planning and turn-key construction of plants for handling and storing liquid and gaseous products. Based on more than 40 years of experience in these sectors, the company offers a high degree of professionalism and is a leader in its field.

Our customers from the petroleum and chemical industries and from a range of other sectors at home and abroad value our groundbreaking technology and our high quality standards as well as our ability to address custom applications while optimizing the economic and environmental aspects of our designs.

Quality - Safety - Service

Social and environmental policy requirements place high demands on our company on a daily basis, as do constantly changing safety guidelines. These standards are our top priority. Consequently, all areas of the company are subject to a quality management system and certified in accordance with DIN EN ISO 9001:2008.

As a specialized company, we do, of course, have all legal permits necessary to operate both in Germany and abroad.

Our subsidiary, Scherzer Umwelttechnik GmbH, will handle our after-sales service, allowing us to be there for you long after a successful start-up. Maintenance, the procurement of spare parts, and other important services will guarantee the continuous operation of your plant.

Range of services

Our comprehensive range of services includes:

- Concept design including essential performance characteristics
- Basic engineering
- Detail engineering
- Delivery of equipment
- Assembly of unit (for turnkey contracts)
- Supervision (for assembly by customer)
- Training
- Commissioning
- Performance check
- Documentation and handover
- Services

Scope of supplies and services

Our portfolio covers a wide range, allowing us to meet almost every requirement. In addition to new construction, it also comprises the retrofit, conversion or expansion of existing plants for the loading and unloading of:

- Railcars
- Tank trucks
- Ships

for transshipment of:

- Light products (petrol/gasoline, diesel, jet fuel, etc.)
- Dark products (crude oil, bitumen, etc.)
- Chemical products (arenes, acids, etc.)
- Stable gas condensate
- Liquid gases (propane, butane, LPG, etc.)
- Biodiesel / Bioethanol

The scope of our services covers also the new construction and reconstruction of tank farms as well as peripheral components and systems such as:

- Vapor recovery units (VRU)
- Vapor pendulum systems
- Fire-fighting systems
- Product and pump systems
- Drainage systems
- Power-supply systems
- Automation technology
- Control and monitoring systems
- Product data logging
- Railroad lines
Loading- and unloading facilities of liquid hydrocarbons into special railcars and tank cars in automated operation

Dipl.-Ing. SCHERZER GmbH plans and designs storage and handling facilities custom-tailored to the individual needs in compliance with the applicable national norms and directives.

The facilities are configured as specified by the customer or based on our long years’ experience.

- Design of loading and rail car positioning systems
- Degree of automation (electrical/instrumentation)
- PC systems (loading computer, visualization computer, tank management systems)
- Data logging systems weighing scale/meter (mass, volume)
- Safety equipment (fire fighting, emergency and signalling systems)
- Storage capacities (tanks, tank equipment)
- Ancillary systems (pumps, recovery systems VRU)
- Construction services (for turn-key plants)
- Supervision of construction (for non-turnkey plants)
- Commissioning of plants
- Training of plant operatives

Dipl.-Ing. SCHERZER GmbH is specialized in loading and unloading systems for special rail cars with its highest requirements to the facilities.
The concept of facilities handling liquid hydrocarbons and mixtures thereof meets the highest requirements in terms of fire protection and operational safety and user-friendliness of the complete automated plant.

- Design pressure: 4.0 MPa PN40
- Design temperature: +40°C / -60°C
- High operational safety: operability guarantee with specified design data
- Plant performance: guarantee of required daily and annual capacities
- Quality assurance: when handling more than one liquid hydrocarbon via product distributor.

**Planning and Documentation**

Dipl.-Ing. SCHERZER GmbH plans and equips loading and unloading plants for liquid hydrocarbon gases in and out of special tank wagons with state-of-the-art technology and in conformity with official national provisions.

The project documentation is drawn up in the following planning steps:

**Basic project in conformity with Point 4 SNiP 11-01-95**

The project documentation is drawn up in the following planning steps:

**Basic project in conformity with Point 4 SNiP 11-01-95**

- expert opinion
- the project’s application permit
- project co-ordination (building permit)

**Working project (technical documentation)**

- track building project
- tank building project
- above-ground and underground building projects
- steel building project
- pipeline building project
- ETA/MSR project

**Expert soil opinion (geological soil test)**

**Land survey (project measurement)**

**Expert opinion on supplied equipment (by an expert)**

Application permit for the equipment supplied (Roztechnadzor, Moscow RF)

Final documentation (as-built version)

Operating manual
Design

of the loading and unloading equipment for the tank wagons for transferring the liquid hydrocarbon gases in and out of special tank wagons (KWG)

The loading equipment is planned, configured and built for:

- new tank wagons or
- reconstructing tank wagons

for rebuilding existing systems

Design data:

These systems are designed in conformity with the purchaser’s technical terms of reference for building loading and unloading equipment for tank wagons with the design data:

- climatic conditions (SNiP 23-01-99)
- performance data with daily and annual output
- plant operation with planned operating times
- the number of the products to be loaded and the transfer quantities
- the technical requirements and components of the system to be built
- environmental protection work
- particular requirements

Engineering Design

Dipl.-Ing. SCHERZER GmbH will apply the design data to bring in state-of-the-art innovative engineering solutions for specific operations for the results:

- single- or double-track tank wagon
- installing the special 32 KWG tank wagons /track
- degree of automation with a partially or fully automatic system
- subsidiary systems such as operating units, storage tanks, pump stations, fire extinguishing systems and power supply
- building and assembling operating units with turnkey systems as the general contractor of Dipl.-Ing. SCHERZER GmbH
- start up including performance documentation for systems
Systems for filling tank wagons as per the customer’s terms of reference with design engineering and configuration

Design data for the loading system:

- double-track system to: 2 x 32 KWG
- filling performance: 128 KWG/d
- workers for the tank wagon: 4
- maximum daily capacity: 6,780 m³/d 3,870 T/d
- spare time / day: 6 hours /d
- annual capacity (340 days): 1,315,800 T

Description of the technological operating systems

The following operating systems are specifically engineered for complete loading tank wagons. The double-track loading tank wagon is equipped for a maximum of 32 KWG / track. The tank wagons are inspected with horizontally moveable folding steps for coupling and decoupling the flexible conduit loaders as well as sampling and leading the tank wagons.

Filling systems

Filling systems per filling position essentially consist of:

- flexible conduit loaders with quick-acting coupling for the product side and gas side
  - pressure-relieving systems to the flare
  - nitrogen rinsing for the loading equipment
  - manometer combination
  - monitored parking position for the product loaders and gas loaders
  - controlled product fittings DN80 product sorts
  - controlled gas fittings and detonation guard DN50
- 4-step folding stair with monitored parking position
  - horizontally moveable for safe KWG inspection
  - pneumatic operation
  - equipped with protective basket
- earthing test instrument for monitored forced earthing for the tank wagons during KWG filling

Filling regulation

The filling flow is limited to 45 m³/h per filling position to prevent electrostatic charges when filling the tank wagon in connection with as much as 32 KWG / track.

A DN80 ultrasound flowthrough meter is used for measuring the volume flow. The filling volume is registered and regulated via output impulse [1 impulse = 1 litre of product]

Measuring accuracy: ± 0.6%

The output signal is processed by the PLC control system and controlled by the electro-pneumatic control valve.
The filling regulation is used for:

- presetting quantities of the loading volume / KWG
- keeping the flow rate / KWG at 45 m³/h
- automatic end of loading when reaching the preset quantity, controlled and without pressure surges

**Alternative Solution**

The ultrasound flowthrough meter is replaced with a Coriolis earth meter.

Measuring accuracy: ± 0.15% (measuring certificate) and takes on filling regulation and records the readings

**Data logging**

The data logging of the quantity loaded / KWG are recorded legal-for-trade with a:

- Dynamic weighing – bridge, located in front of the railcar loading unit. With passing of the weighing – bridge with a railcar unit (before and after loading procedure), the quantity loaded per railcar will be recorded legally approved. (Measuring accuracy: ± 50 kg)
- Coriolis - mass meter DN80, certified as a licensed measuring instrument in connection with the appropriate control electronics for calculating:
  - the filled quantity of product per tank wagon [kg]
  - the density of the filled quantity of product [kg/m³] measuring accuracy: ± 0.15%

The quantities loaded are registered and administered in the SCHERZER loading computer and the loading voucher is printed out. The loading data can be exported to the customer’s host system.

**Gas Return**

The gas is returned with a DN50 gas flexible conduit loader, equipped with DN50 detonation guard and controlled DN50 fittings to the storage tanks. The pressure for the tank wagons is compensated to the storage tanks via gas line before beginning to fill the tank wagons.

**Loading Computer / Visualisation System**

The process control system (visualisation) is combined with the function of the loading computer by keying in all inputs and functions. The loading system is shown on 2 colour monitors including the display of all states having an impact on safety.

The PC system is installed in the combined electrical operating container of the liquid gas tank wagon.

**Control and Monitoring System**

The control and monitoring system (PLC) is installed in the combined electrical operating container of the liquid gas system.

The PLC carries out all locks for the liquid gas loading tank wagon having an impact on safety, issues filling releases on the operating terminals of each of the filling points and controls loading via quantity calculation (filling regulation) and opening/closing pneumatic fittings.
Low-Voltage Switchgear
The low-voltage switchgear uses fused outgoing circuits to supply the field units such as electrical heaters, lighting and switchgears with the voltage levels 380/220 V AC and 24 V DC in the loading tank wagon.

Gas Alarm System
The gas alarm system consists of the gas sensors installed at exposed places in the tank wagon.
The gas alarm system indicates:
- 20% UNG ➔ alarm (horn and flash lamp)
- 50% UNG ➔ system shutdown
The PLC processes and monitors the signals.

Emergency-Off Control
Pressing an emergency-off button interrupts the entire loading operation. The de-energised fittings (spring-energy closing) automatically go into safety position.
An emergency-stop button is built into the operating terminal for each of the filling points to 32 KWG / track that interrupts tank wagon filling when pressed.

Electrical Operating Container
The electrical room is a combined container (L x W x H) 15.42 x 3.00 x 2.84 m with:
- a compressor room (2.42 x 3.0 x 2.84) equipped with a redundant compressor ready for operation for instrument air. (dew point –60°C)
- operating room (6.0 x 3.0 x 2.84) equipped with a computer system, loading computer, WinCC visualisation and intercom
- the operating room is also equipped with heating and air conditioning
- ETA/MSR room (7.0 x 3.0 x 2.84) equipped with control and monitoring system ready for operation, low-voltage switchgear and USV system for supplying voltage to the automation system if there is a power failure
The electrical room is equipped with an automatic CO₂ extinguisher.

CO₂ Extinguisher
The CO₂ extinguisher is mounted in a CO₂ container installed next to the electrical container (L x B x H) 4.12 x 2.5 x 2.8 m completely ready for operation and is automatically triggered by fire alarm box if there is a fire.

Meteorological Cabin
The meteorological cabins (L x B x H) 2.0 x 1.5 x 2.8 are installed on the tank wagon platform.
They provide a place for the operating personnel to stay when monitoring the loading process in the cold seasons.
These cabins are designed, insulated and heated to –60°C.
They are equipped with 2 insulated glazing windows K=1.1 (size 91/121 cm, 1 outside steel door, size 87/200 cm)
Tank wagons - unloading facility
for storing liquid hydrocarbon gases and their mixtures from special tank wagons into storage tanks

The systems for emptying tank wagons are engineered and configured such as tank wagon filling facilities as per the customers specification.

Design data for the unloading system:
- double-track system to: 2 x 32 railcars
- unloading performance / day: 128 railcars
- workers on the tank wagon: 4
- maximum daily capacity to: 6,780 m³/d
  3,870 T/d
- spare time / day*: 1 hour /d
- annual capacity (340 days/year): 1,315,800 T

* The spare time changes at low temperatures since tank wagon pressure relief to 0.7 bar takes less time.

Describing the technological operating systems
The following operating systems are specifically engineered for double-track unloading system for a maximum of 32 KWG / track for all unloading tank wagons. Otherwise, these operating systems should be provided as in one loading tank wagon.

Emptying systems
- 2 DN40 flexible conduit loaders for the product side are used to drain the liquid hydrocarbon gases and their mixtures (unloading).
- 1 DN40 flexible conduit loader for the steaming side is used for impinging the tank wagons with excess pressure Δp ≥ 1 bar.
Additional Emptying Systems

in opposite to the railcar filling systems are:

- **Compressor systems**
  The compressor system in a specific design for generating the differential pressure between the tank wagon and storage tank to transport the product from the tank wagon into the storage tank. It is planned for unloading tank wagons so that it automatically switches from pressure operation to suction operation in the tank wagon by switching over to KWG pressure relief. This compressor system has the following functions:
  - returning the hydrocarbon vapours remaining when emptying the tank wagon by draining them into the storage tanks
  - reducing the excess pressure to 0.07 MPa in the emptied tank wagons in conformity with WUP SNE-87 2.15.

- **SUG evaporator**
  The SUG evaporator supports the compressor system in cold seasons. This ensures that there is enough gas on the suction side of the compressors to compress the needed differential pressure $\Delta p$. This is necessary with butane fractions where the steaming pressure (absolute) at $-20°C p = 0.47$ bar $(kg/cm^2)$. The evaporating energy can be generated by:
  - the energy medium of steam
  - electrical energy 380 V AC; 50 Hz

Emptying Regulation

The product flow / KWG should be limited to an unloading rate of 26 $m^3/h$ due to the product corner valves of the tank wagons. This is done with an eddy current measuring instrument installed in each emptying position (± 0.6% accuracy) that triggers the control valve to 26 $m^3/h$.

If a tank wagon in the group to be emptied is empty, a sensor mounted in the product distributor indicates the end of unloading and the control valve is automatically closed. Then the tank wagon is separated from the emptying group.

Recording readings

The readings of the quantity of hydrocarbon gas unloaded / KWG are only recorded legal-for-trade via dynamic rail weighbridge.

The other emptying systems are a component of the unloading tank wagons.
Training, supervision and commissioning

Training, supervision and commissioning is performed by high qualified specialists of Dipl.-Ing. SCHERZER GmbH.

In-house training is generally combined with the function – test of the facility. Therefore it is secured that training activities are performed directly at control systems of the facility. During training substantial functions are explained as well as the complete engineering system such as tag number system, circuit diagram etc.

Our specialists of supervision are sub-classified regarding Mechanic, earth work and foundations, electric and MSR. Further a Chief supervisor for coordination and as the contact person for the customer is foreseen. Detailed schedules and organization sheets and plans for supervision and commissioning are worked out.

After Sales Service

Our After Sales Service are performed by the specialists of our subsidiary company SCHERZER Umwelttechnik GmbH.

Maintenance contracts can be settled directly and will be split between mechanical section and EMSR. Short term fault analyses are carried out by a remote diagnosis with VPN or modem connection for a quick solution of problems.

Various references:

AO Novatek (Westsibirien / Russia)
1. 2003 LPG railcar loading facility with 10 filling systems for 2 tracks incl. control system, measuring and dynamic weighing system
2. 2006 Two track serial railcar loading facility for filling of LPG in automated operation incl. 20 filling systems, operating- and electric container, fire fighting system, video system, control- and measuring system.

Lurgi Life Science / Russia (2003)
LPG railcar loading facility with 6 filling systems, complete control- and automation system in container, measuring at filling point, automatic emptying system, dynamic weighing system.

Orlen / Poland (1997)
Supply of equipment for a LPG railcar loading station, including railcar scale, shunting unit, complete control system, metering system, engineering.
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Other brochures of Dipl.-Ing. SCHERZER GmbH
- Company profile
- Railcar loading systems
- Railcar unloading systems
- Railcar filling tube systems
- Study to compare tank car on spot loading systems with serial loading systems
- LPG loading and unloading systems
- Tank truck loading and unloading systems
- Ship loading and unloading systems
- Tankfarms, handling plants and Vapor Recovery Units (VRU)
- Detailed reference list

We are pleased to send you a brochure on request.

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