

Railcar Loading “ON SPOT”

Loading tube mechanism, General Specification



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_ 1 System design

_ 1.1 Loading products

- petrol
- Diesel fuel

_ 1.2 Operating requirements

- dry, oil-free control air
- control air pressure min. 4.0 (op) to max. 6.5 bar (op)
- 400/230V, 50Hz power
- 380/220V, 50 Hz power (Eastern Europe)
- 24 V DC voltage

_ 1.3 Steel construction

The steel construction must be designed to take up all components required for the operation of the loading tube mechanism. The filling platform is designed as a frame construction and is arranged over the loading track. It serves to take up the track frame (which is part of the steel construction) in which the longitudinally travelling carriage with the installed feed pipe can move.

_ 2 Hydraulic control unit

_ 2.1 General

The hydraulic control unit is comprised of an oil tank with installed motor-driven hydraulic pump and control block mounting. The required throttle valves, over-pressure valves and control spools are flanged onto the control block.

The displacement counter measures the amount of oil displaced during the filling process, and thus the distance covered. The values are transmitted via a pulse encoder to the system control. This makes it possible to drive to different positions (e.g. the draining position) with the loading tube.

In order to be able to automatically drive a loading tube out of the tank truck in the event of a loss of power, each hydraulic control unit is equipped with a pressure reservoir bottle.

The control spools can be switched on-site by way of emergency manual actuation devices (simplifying servicing).

The hydraulic control unit is equipped with a pressure switch "instrument air present", with two pressure switches "storage pressure min./max.", with a differential pressure transmitter "loading tube installed", with a level switch "low hydraulic oil level", and with a temperature switch "high oil temperature", connected to the system control.

The control unit is installed in a protective cabinet and mounted on the longitudinally travelling carriage. From here, all consuming devices (loading tube cylinder and travelling cylinder) are connected by hydraulic piping.

The control unit is provided with internal piping and is ready for connection.

_ 2.2 Hydraulic pump

Type:..... Axial reciprocating pump
Capacity: V = 27 cm³/h
Flow rate:..... Q = 40 l/min
Operating pressure: P = 40 bar and P = 160 bar
Motor speed: n = 1,500 rpm
Motor manufacturer: Siemens
Voltage: U = 400 V 50 Hz
Power: P = 11 KW
Explosion protection: EExe II T1-T3
Heat class: F
Degree of protection: IP 55

_ 2.3 Oil tank

Volume: c. 160 litres
Equipment: The tank is equipped with a service opening, oil level indicator, return screen for return flow, air feed filter with demister, oil filler neck with screen and locking fixture, oil drip-off, and all required holding fixtures for the attached parts and terminal boxes.

_ 2.4 Pressure reservoir

Design: Bubble-type
Storage capacity: c. 35 litres
Initial pressure:..... 160 bar
Final pressure: 90 bar

_ 2.5 Control valves

Distributing valves:..... electro-pneumatic distribution valves
Control valves: pneumatically actuated
Control air pressure:min. 3.5 bar
Pilot valves: with emergency manual actuation, solenoid 24 VDC, degree of protection EExe, with 3 m cable length

_ 2.6 Safety devices

_ 2.6.1 Safety devices for protecting the hydraulic control unit against over loading

The hydraulic control unit is equipped on the pump pressure side with a pressure control valve (P = 190 bar) that prevents an unacceptable rise in the pump pressure. For the protection of the hydraulic pump, the control unit has a level switch for triggering the alarm and switching off in the case of "low hydraulic oil level". For the monitoring of the oil temperature and the protection of all hydraulic components, the control unit is also equipped with a temperature switch for triggering the alarm and switching off in the case of "high hydraulic oil temperature". When the level switch or the temperature switch responds, the control unit is switched off, and it is necessary to locate the cause of the problem.

_ 3 Technical data for the loading tube

_ 3.1 Loading tube with vapour return

Design:

Telescopic pipe with internal hydraulic drive cylinder.

The inner pipe of the telescope can be driven downwards into the tank car.

The outer pipe is permanently mounted with brackets on the longitudinally travelling carriage. On the casing of the guide pipe is an upper pipe which, due to its own weight is driven to the edge of the tank car dome, where it is anchored by seating brackets. An inflatable dome seal is mounted on the upper pipe. Following inflation of seal in the tank car dome, the gap between the loading tube and the edge of the dome is closed off, so that hydrocarbon vapours arising during the filling of the tank car are led off by the vapour telescope pipe mounted on the upper pipe. The upper pipe is equipped with a filler neck for this purpose, on which the vapour telescope pipe, which is also driven downwards when the loading tube is lowered, is mounted.

The loading tube is firmly held in its upper end position by an internal mechanical locking (hydraulic cylinder). The hydraulic oil needed for travelling movements is also used for the locking (during upwards travel) or unlocking (during downwards travel). The loading tube is sealed off liquid-tight against the continued flow of products from the product system. Following sealing off of the loading tube, during upwards travel, only an outer surface on the lower side of the buffer remains slightly moistened by the product (thinly adhering product film). The residual amounts drip into the tank car when the loading tube is briefly held over the tank car dome in the drip-off position following completion of the filling process.

Accessories (per loading tube):

- 1 inflatable dome seal
- The immersion and reference probes are arranged on the seal part of the loading tube. Both probes are part of the pneumatic-electric overflow prevention device.
- 1 limit switch for signalling the upper rest position
- 1 filling level switch for monitoring the upper pipe with respect to accumulation of the product This switch monitors the upper pipe, so that no product can collect there, e.g. when the inner pipe is filled with product due to a leaking fixture and the product then runs into the upper pipe.
- 1 power track train for guiding all pneumatic and electric lines from the upper pipe to the loading tube carriage
- 1 power track train for guiding all pneumatic and electric lines from the loading tube carriage to the operating building
- 2 block ball valves in the hydraulic lines on the loading tube
- 2 oil tanks (oil tank on loading tube = for lubricating outer pipe, as well as a compensator reservoir for lock-in = while driving the bolt in and out an exchange of air takes place between the locking and the oil tank)

_ 3.1.1 Technical data:

Outer diameter of inner pipe:..... 250 mm
Equivalent nominal width: 220 mm
Outer diameter of vapour pipe:..... 219 mm
Inner diameter of vapour pipe: 145 mm
Vapour connection - vapour telescope pipe: .. DN 150 PN 16
Product connection: DN 250 PN 16
Inner pipe: Steel, chrome-plated running surface
Outer pipe: Steel, outer surface coated with primer
running surface for outer pipe and chrome
plated
Upper pipe:..... Steel, outer surface coated with primer
Guide rod: Steel, running surface chrome-plated
Guide rings:..... PTFE
Sealing parts: NBR quality down to minus 40°C
Cylindrical pipe:..... Steel
Piston rod: Steel, running surface chrome-plated

_ 4 Longitudinally travelling carriage

The longitudinally travelling carriage is comprised of a welded profile steel frame mounted on castors with ball bearing elements. For taking up the transversally travelling unit of the hydraulic control unit, the carriage is equipped with all required holding fixtures and attachment consoles.

_ 5 Longitudinally travelling cylinder

For the exact positioning of the loading tube over the tank car dome, the longitudinally travelling carriage can be driven along the axis of the track. A synchronous hydraulic cylinder mounted on the longitudinally travelling cylinder serves as the drive.

_ 6 Transversally travelling carriage

For loading tube travel transversally to the axis of the track, i.e. exact positioning of the loading tube over the open tank car dome, the longitudinally travelling carriage is equipped with an additional transversally travelling carriage mounted on castors with ball bearing elements. The transversally travelling carriage is comprised of a welded profile steel frame mounted on castors with ball bearing elements. For taking up the cylinder and the loading tube, the carriage is equipped with all required holding fixtures and attachment consoles. A loading tube can be attached to the transversally travelling carriage.

_ 7 Transversally travelling cylinder

The transversally travelling cylinder has the dimensions 80/40-200 and a travel path of ± 100 mm (total travel 120 mm). The cylinder is mounted on the transversally travelling carriage, which is connected to the loading tube. The cylinder is designed as a synchronising cylinder.

_ 8 Articulated piping

The connection between the fixed system parts, i.e. the product pipelines, the vapour system, and the travelling filling mechanism, is established by articulated piping. Each articulated pipe has three joints with a vertical axis of rotation. The articulated piping can also be electrically heated and isolated.

_ 9 Vapour connection line

The vapour connection line, running along the loading tube carriage, is the connecting link between the loading tube with vapour return and the articulated vapour piping. The line can also be electrically heated and isolated. A filling level switch serves the monitoring of the pipelines with regard to accumulation of product or condensation.

_ 10 Overflow prevention system

The overflow prevention system for the loading tube is installed together with other pneumatic systems on a control board and located in the protective cabinet for the hydraulic control system.

The electro-pneumatic overflow prevention device serves to stop the filling process when the permissible filling level in the tank car is exceeded. The overflow prevention system functions according to the bubbling-through principle. With the aid of a transmitter, the filling level in the tank car is monitored. For the monitoring of the filling level, it is necessary to distinguish between tank cars with a low dome and tank cars with a high dome. The overflow prevention has a two-phase design, with an immersion probe and a reference probe. The immersion probe is immersed in the product as soon as the liquid level approaches the upper limit, while the reference probe is located in the gas space of the tank car.

For the loading tube with vapour return, a pressure transmitter, for the monitoring of the pressure in the gas space of the tank car, is integrated in the overflow prevention system. The pressure transmitter is connected to the measurement lead of the reference probe. When the pressure rises above a certain limit value, the filling process is interrupted.

_ 11 Power track train

All supply lines required for the filling mechanism, such as the power cable, control cable and signalling cable and the pressurised air supply, are fed from the fixed part of the system through a mobile power track train to the loading tube carriage.