



Tank Installations for the Supply of Liquefied Gases

Supply of Liquefied Oxygen, Nitrogen and Argon

Whenever large quantities of gas are needed, the economical solution lies in the installation of a tank and evaporator system. The oxygen, nitrogen or argon is delivered in liquefied and refrigerated form by road tanker and then pumped into the customer's heat-insulated tank with the vehicle's pump.

A heat exchanger downstream of the tank evaporates the liquefied gas, which then flows through a pipeline to the user.

Linde leases such tank and evaporator installations to its customers.



Design and Operation of the Tank Installations

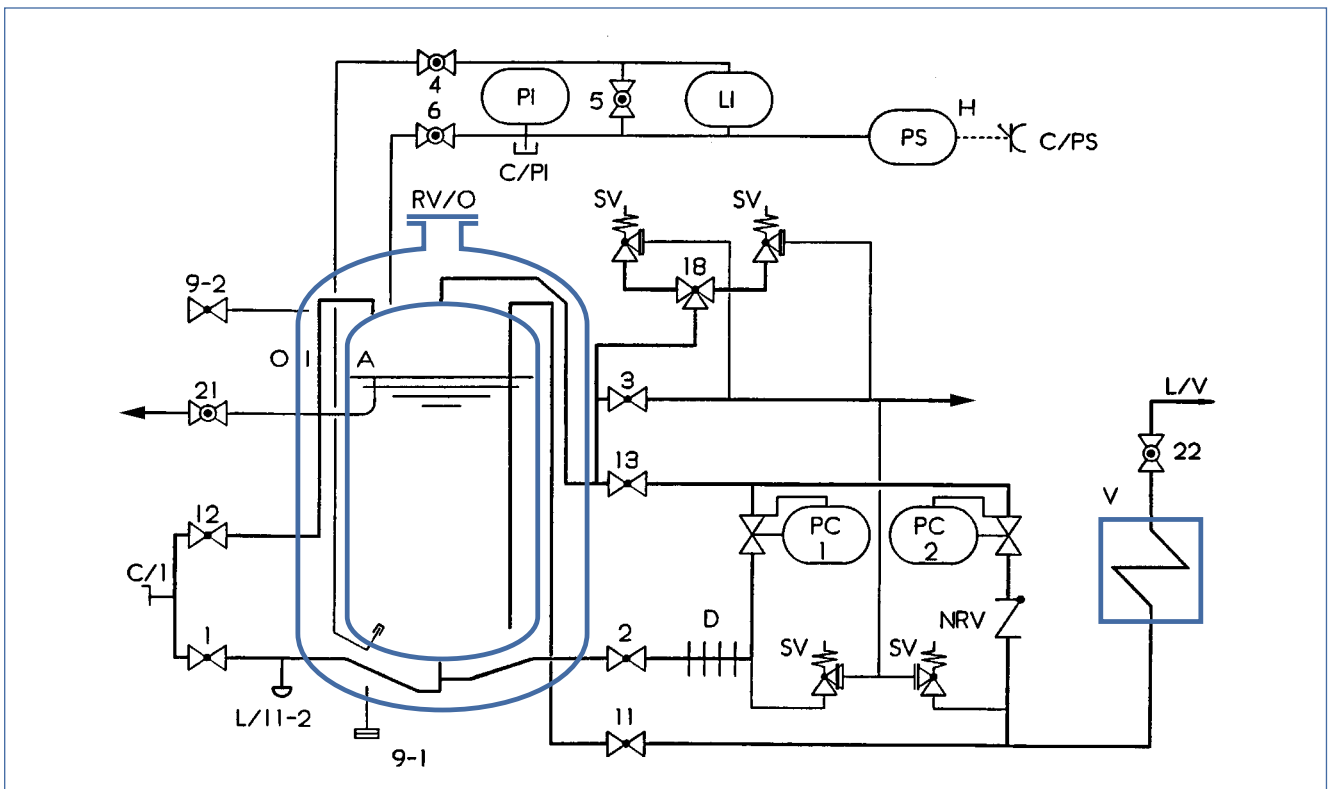
The tanks consist of an inner vessel of cryogenic chromium-nickel steel to hold the liquefied gas and a supporting outer vessel of carbon steel. The space between the inner and outer vessels is air-less and insulated with perlite.

The tanks are filled from road tankers through the hose coupling C/1 and valve 1. Valve 12 is used by the tanker driver to inject refrigerated liquid into the top end of the tank to keep the tank

pressure constant during filling. The gas is extracted from valve 11 and then passed through the evaporator V when required in gaseous form and from connection L11-2 when required in liquid form for cooling purposes.

The required tank pressure is set with the pressure controller PC-1. The pressure controller PC-2 ensures that gas flows out of the top end of the tank into the supply line when the tank pressure is

too high. The level indicator LI is a differential pressure gauge showing the tank contents in m³ gas. The tank pressure gauge and level indicator are also available in special versions with limit-switch contacts or analog signals for remote transmission.



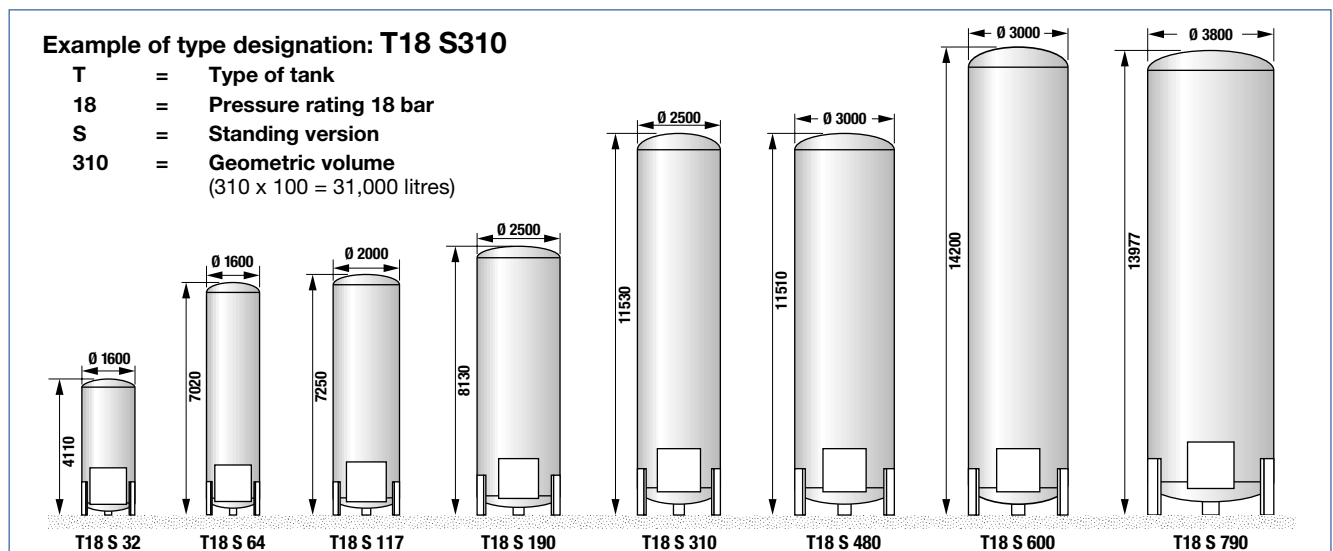
A	Inner vessel	O	Outer vessel	Valve for	11	Extraction
C/1	Filling coupling	PC-1	Pressure controller	1	12	Filling top
C/PS	Pressure switch connector	PC-2	Pressure controller	2	13	Gas shut-off
D	Pressure build-up evaporator	PI	Pressure indicator	3	18	Change-over
I	Insulation	PS	Pressure switch	4	21	Trycock
L/11-2	Line for liquid supply (blind)	RV/O	Pressure relief valve outer vessel	5	22	Gas supply
LI	Level indicator	SV	Safety valve	6		
		V	Evaporator	9-1, 9-2		

Tank Installations

The size of the tank is determined in consultation with the customer taking the factors of reliable supply and economic efficiency into consideration. The following standard tank sizes are available:

Type of tank	T18 S32	T18 S64	T18 S117	T18 S190	T18 S310	T18 S480	T18 S600	T18 S790
Max. operating pressure								
Standard tank (bar)	18	18	18	18	18	18	18	18
High-pressure tank (bar)	36	36	36	36	36	36	36	–
Geometric volume (litre)	3,160	6,400	11,700	19,600	30,800	48,000	60,000	79,400
Capacity (m ³ at 1 bar, 15 °C)								
Oxygen (m ³)	2,560	5,115	9,500	15,865	24,980	39,195	48,620	64,050
Nitrogen (m ³)	2,075	4,155	7,675	12,850	20,180	31,800	39,330	51,850
Argon (m ³)	2,515	5,030	9,290	15,530	24,500	38,575	47,620	62,700
Diameter (mm)	1,600	1,600	2,000	2,500	2,500	3,000	3,000	3,800
Depth across fittings (mm)	2,250	2,250	2,580	3,250	3,250	3,700	3,400	4,400
Height (mm)	4,110	7,020	7,250	8,130	11,530	11,510	14,200	13,977
Foundation plate (minimum size) (mm)	2.2 x 2.2	2.8 x 2.8	2.8 x 2.8	3.5 x 3.5	3.5 x 3.5	3.5 x 3.5	3.5 x 3.5	5 x 5
Weight, empty (kg)	2,200	3,800	5,500	10,200	16,000	21,000	24,500	34,200
Weight, filled								
with oxygen (kg)	5,620	10,640	18,900	31,420	49,400	73,400	89,500	120,000
with nitrogen (kg)	4,630	8,660	15,180	25,250	39,600	58,200	70,500	95,000
with argon (kg)	6,400	12,200	21,710	36,130	56,900	85,400	104,000	139,000
Boil off								
with oxygen (%/24 h)	0.42	0.37	0.29	0.20	0.17	0.13	0.12	0.09
with nitrogen (%/24 h)	0.67	0.56	0.43	0.31	0.27	0.21	0.20	0.15
with argon (%/24 h)	0.46	0.40	0.32	0.21	0.19	0.15	0.14	0.10

Other tank sizes and pressure ratings available on request



Ambient Air Evaporators

Ambient air evaporators consist of aluminium tubes with longitudinal ribs. They work without auxiliary energy by heat exchange with the surrounding air. The liquefied gas is evaporated and heated to virtually ambient temperature. The ambient air evaporators are modular in design and put together according to the desired capacity.

The nominal capacities specified refer to eight hours continuous operation; thereafter the capacity of the evaporators can drop because of ice formation.

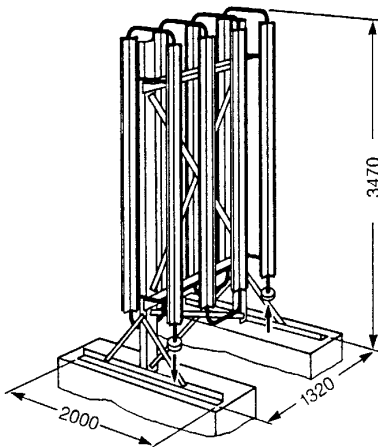
For applications involving longer operating times, therefore, several evaporators are connected in groups. This allows one evaporator group to be used while the other is given time to regenerate.

Technical Specifications

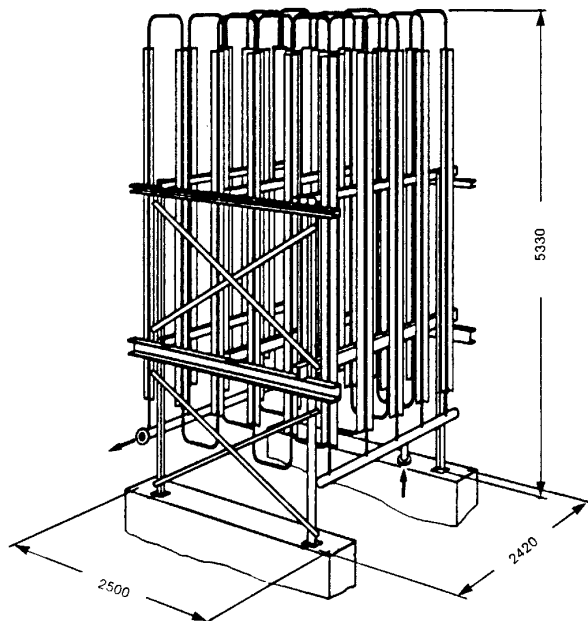
Nominal capacity (m ³ gas/h)	33	66	100	250	600
Type of evaporator	L40-3F2,3	L40-5F2,7	L40-8F2,7	L40-12F4,3	L40-30F4,3
Length (mm)	1150	2000	2000	1500	2500
Width (mm)	383	1320	1320	1620	2420
Height (mm)	2472	3470	3470	5330	5330
Tare weight (kg)	55	102	145	790	1370
Operating weight iced (kg)	220	430	670	2800	4350

Example of type designation: L40-8F2,7

- L = Ambient air evaporator
- 40 = Permissible operating pressure 40 bar
- 8 F 2,7 = 8 finned tubes, each 2.7 m long

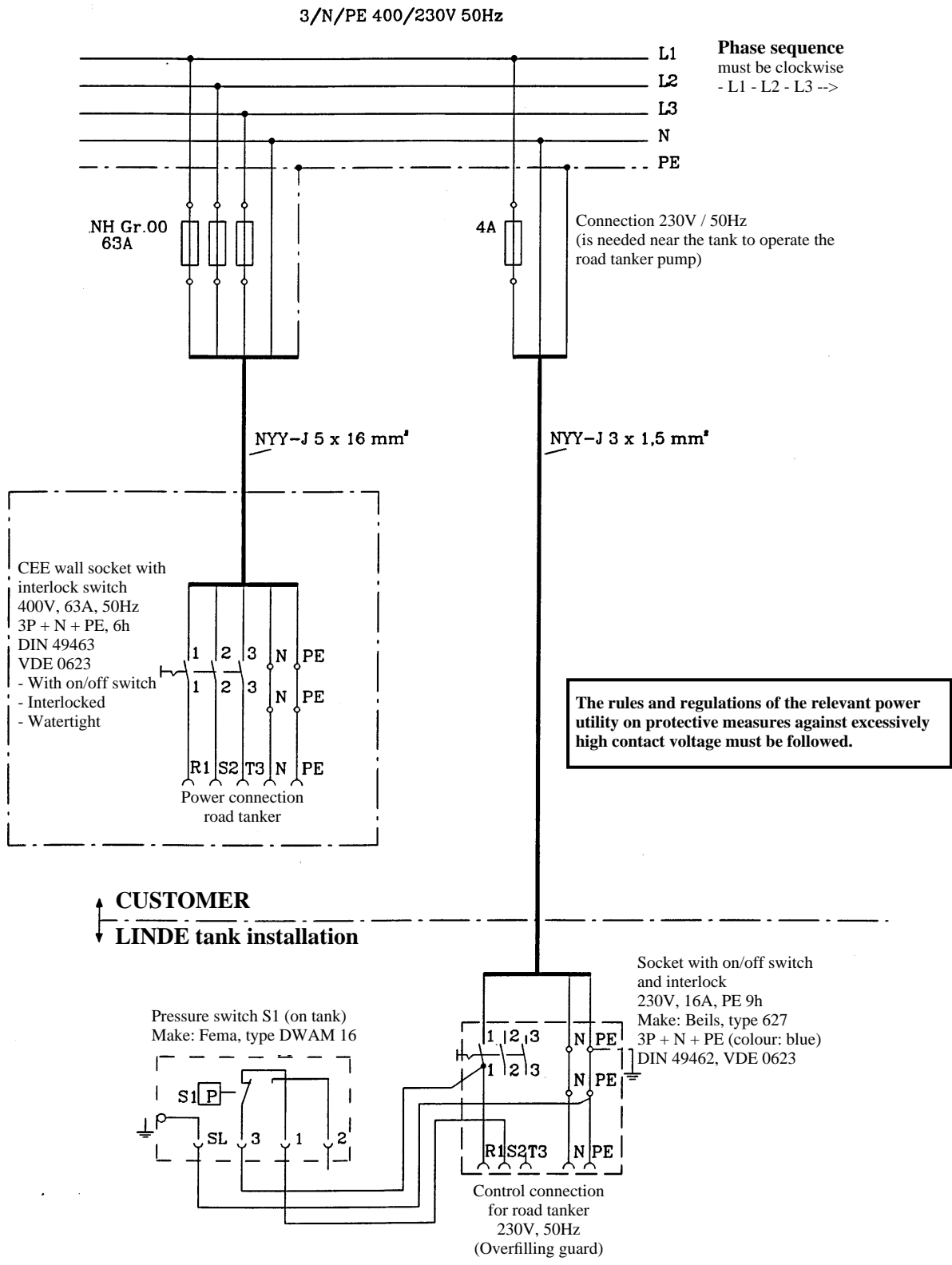


Evaporator type L40-8F2,7
Capacity 100 m³/h



Evaporator type L40-30F4,3
Capacity 600 m³/h

Customer-supplied power point located near the tank foundation for operation of the road tanker pump



Codes and Tests

The storage tanks and evaporators are constructed in accordance with the requirements of German pressure vessel regulations. The prescribed test at the installation site is arranged by Linde AG at the end of installation. The operator need not carry out or arrange for regular

internal and pressure tests. In Germany the requirements of German pressure vessel regulations and especially the Technical Rules for Pressure Vessels (TRB) as well as state building regulations, if applicable, must be followed in the installation and operation of the

tanks and evaporators. Further, storage of inflammable gases is subject to the German Federal Immissions Control Act upwards of certain quantities.

Installation

For safety reasons tank installations should be erected outdoors. If indoor installation is unavoidable, the special conditions applicable in such a case must be met (TRB 610 No. 3.2.2).

When erecting tank installations (tank and evaporator) in the open, the following points must, among others, be observed:

1. Tank installations must be erected so that there is adequate air circulation around the tank (TRB 610 No. 3.2.1).
2. Tank installations must be erected so that access to them is assured (TRB 610 No. 3.2.1.2).
3. Tank installations may not be erected on pedestrian walkways or roads or near open-air installations (TRB 610 No. 3.2.1.3).
4. The ground area under the connections of tank installations with refrigerated liquid oxygen must consist of fire-resistant materials and be free of oil, grease and other combustible materials (TRB 610 No. 3.2.1.5).
5. There may not be any open ducts, duct inlets without liquid seals, openings to lower-lying rooms or air extraction openings 5 m around openings in tank installations for refrigerated liquefied gases (TRB 610 No. 3.2.3.1.1).
6. Tank installations must be protected against mechanical damage (TRB 610 No. 3.2.3.2).
7. Tank installations must be protected against fire (TRB 610 No. 3.2.3.3).
This requirement can be realised with a safety distance, a protective wall, earth cover, fire protection insulation or sprinkler system.

Use

Various accident prevention regulations (e.g. VBG 61 "Gases", VBG 62 "Oxygen", VBG 15 "Welding and Cutting") and, if applicable, German pressure vessel regulations must be observed for the construction, fitting and operation of equipment downstream of the tank installation (pipeline, control station, consumer).

Competence Where You Need It – With Linde Gases

Service

Service on the spot

Advice

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Supply

ECOVAR®

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Tanks

Application

Metallurgy and chemistry

Glass

Medicine

Environmental technology

Power engineering

Food processing

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Industrial cleaning

Microelectronics

Pipeline

Application and supply equipment

Printed on chlorine-free bleached paper

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Linde industrial gases are used for welding, freezing or driving purposes, and where heating, industrial cleaning, artificial respiration or testing is required. They improve the quality of life, helping you to produce more economically and thus safeguarding your future.

We offer advice, know-how, customer-specific hardware, and carry out tests for our customers and do all the gas-related handling.

It goes without saying that we tailor-make an economic supply-concept according to customer specifications: Gas cylinders and cylinder bundles, tank supply of cryogenic liquid gases, the ECOVAR® supply concept and pipeline supply.

Linde

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