



Cryogenic Tank Installation Specification

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Introduction

From industrial gases; Nitrogen, Argon, Oxygen, Carbon Dioxide, to medical and specialty gases Air Products has supplied product provision solutions to customers in a wide range of industries since our inception in 1940.

At Air Products we draw on decades of experience to ensure that our customers receive the optimum solution for their requirements.



What We Promise

Air Products engineers listen carefully to what our customers need in order to deliver systems that are specifically designed to provide our gas, or liquid, for their usage requirements through a range of diverse operating conditions.

We are able to provide systems which deliver any of our products; Nitrogen, Oxygen, Argon, Carbon Dioxide, Helium, Hydrogen through a broad range of pressures and flow rates in either a gaseous or liquid state. Our solutions usually take the form of at least one cryogenic storage tank linked to a pressure and flow control system. In a gaseous application a vaporiser is required. We can also provide temperature control if a downstream system is temperature sensitive and we are also able to offer mixing of a number of products at specified ratios through our mixing panels.

In order to ensure that our customer's do not lose supply of our product we monitor usage and aim to provide a delivery well before the cryogenic tank runs empty. We can also respond preemptively to expected future increases in demand by maintaining a close relationship with our customers.

Sizing and Design Criteria

Over the following pages you will see that we offer a wide range selection of tank and vaporiser sizes; the exact combination of these are chosen to reflect the amount, and usage patterns, of product our customers use.

Several criteria must be met in order to comply with regulations during an installation, these vary depending on a number of factors and are intended to ensure the system remains safe. The following pages will explain the criteria required and show the range of equipment we can provide.

Tank Plinth Specifics

Local Planning Authorities shall be consulted for permission to execute the works. The plinth dimensions specified assume a minimum ground bearing pressure of 100KN/m² and a maximum wind speed of 56m/s, different site conditions will require individual review.

The tank and vaporiser plinth should have a minimum fall of 1:200 towards a safe area to prevent pooling of water, which is a hazard. The joints between tank plinth and surrounding area shall be filled with a premixed non-shrink metallic grout.

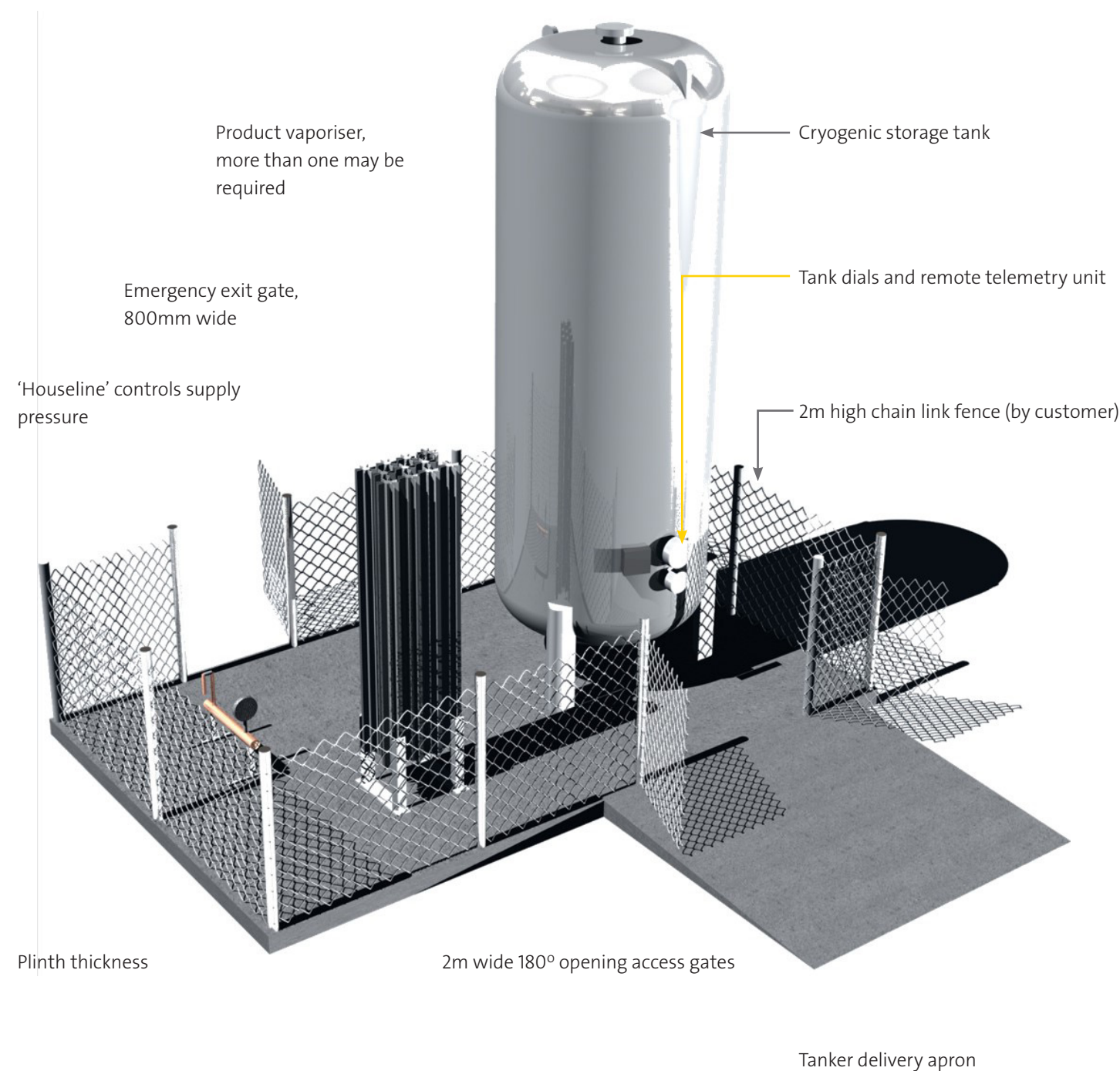
The concrete is required to be a minimum grade of C35 to EN 1992-1 with an air entrainment admixture. If the base is to be sited in an area of very severe exposure, the concrete specification should be verified by a Civil Engineer. Reinforcement is required to be compliant with BS 4449:2005 and mesh reinforcement required to be compliant with BS 4483:2005. Concrete cover to all reinforcement shall be 50mm. The vaporiser plinth, as a minimum, should be reinforced with one layer of A193 mesh top and bottom.

Sufficient lighting of the plinth area must be provided, so that deliveries and repairs can be performed at night. The lighting must provide lumination to a level of 100 lux, in accordance with BS EN 12464.

To avoid trip hazards, tanker delivery apron to be level with front of tank plinth. Otherwise a pedestrian access ramp or step is required in front of the tank/gates. Refer to BS5395-1 for step specification.

For oxygen installations, concrete tanker apron shall be 3500mm by 4500mm, 250mm thick, mesh reinforced. The long dimension being perpendicular to the centre line of the vehicle axis. Tanker apron shall drain surface water to one side.

Generic Tank Plinth Diagram



Air Product's Tanks

Tank sizing depends on a number of factors; flowrate of product required, type of usage – continuous or batch, the size and frequency of deliveries which Air Products can provide to our customer's site. The optimum tank size is chosen through strict procedure, checked by experienced engineers and salespersons to ensure our customers receive the best solution. The common range of tank sizes Air Products' offers are shown below:

Tank Model Number	Dimensions		Weight Unladen kg	Gas Capacity				Weight of Liquid						
	Height mm	Diameter mm		Oxygen m³	Nitrogen m³	Argon m³	CO² m³	Oxygen Kg	Nitrogen Kg	Argon Kg	CO² Kg			
Mini Tanks														
200 litre	1330	610	104	116	144	141	111	205	145	251	182	Flat area capable of withstanding tank Weight, with 600mm of free space around all sides		
250 litre	1330	660	154	181	224	219	172	319	226	390	283			
350 litre	1650	750	208	233	288	281	221	411	291	501	364			
700 litre	1913	1200	702	601	743	726	571	1061	751	1295	939			
1,000 litre	2335	1420	960	614	759	742	583	1084	768	1323	960			
1,800 litre	2240	1450	1630	1228	1518	1484	1167	2168	1535	2647	1919			
Bulk Tanks, up to 14.9 bar tank operating pressure														
3,000 litre	3990	1800	2700	1793	1534	1854	1457	2567	1818	3134	2273	3750	4150	250
6,000 litre	5826	1800	4200	4702	4017	4860	3803	6749	4750	8208	5984			
10,000 litre	6150	2200	7050	8448	7228	8954	6865	12095	8565	14766	10706	4300	4700	350
20,000 litre	9810	2200	10730	15816	13532	16351	12852	22643	16035	27644	20043			
30,000 litre	11770	2500	17290	23979	20515	24790	19485	34328	24309	41910	30387			
44,000 litre	15429	2500	22110	32891	28139	34003	26726	47087	33345	57486	41681	4700	5100	450
50,000 litre	9350	3450	22890	39582	33864	40921	32164	56667	40129	69182	50161			
60,000 litre	13925	3000	28000	48095	41003	50056	38894	68854	48773	84809	61216	5500	5500	
Bulk Tanks, up to 30 bar tank operating pressure														
3,000 litre	3990	1800	2700	2630	2250	2719	2137	3765	2666	4597	3333	3750	4150	250
6,000 litre	5826	1800	4200	4742	4057	4903	3853	6789	4808	8288	6010			
10,000 litre	6150	2200	6900	8640	7410	8734	7038	12399	8781	15138	10976	4300	4700	350
20,000 litre	9810	2200	11900	16402	14033	16957	13328	23482	16629	28668	20786			
30,000 litre	11790	2780	16000	23472	20081	24266	19073	33602	23796	41024	29745			
44,000 litre	15429	2500	26820	35092	30023	36279	28515	50238	35576	61334	44470	4700	5100	450
50,000 litre	12040	3000	28380	40615	34748	41989	33003	58145	41176	70987	51470			
60,000 litre	13925	3000	28000	49095	42003	50756	39894	70286	49773	85809	62216	5500	5500	

The tank chosen for your solution will be optimised for the installation and may differ in size from the size shown.
* Size of plinth for tank only. Additional plinths required for vaporisation

Air Product’s Product Vaporisers

Product vaporisers are used to turn cryogenic liquid into gas, most commonly by using ambient air temperature, and are needed for all gaseous use installations. In an ambient vaporiser, the cryogenic liquid flows through a series of parallel pipes which are exposed to atmosphere. The pipes have five to eight fins extruded along their length to increase the surface area of the pipe, and thus increase the heat transfer rate between the liquid and atmosphere.

The cold temperatures of the vaporisers combined with atmospheric moisture can cause them to “ice-up”; excessive water freezing onto their surface, reducing their operating performance. Therefore, in a continuous use application we supply two or more vaporisers, where one only is used whilst the other(s) de-ice.

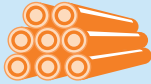
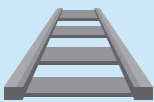
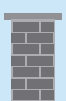
The range of product vaporiser sizes Air Products’ offers are shown below, the actual model provided will be decided by the Air Products Engineering team:

Vaporiser Model Number				Maximum Flowrate before Ice-up		
	Surface Area m²	Approx weight kg	Dimensions WxDxH mm	(8hr) Nm³/hr	(16hr) Nm³/hr	(Continuous) Nm³/hr
Ambient Vaporisers						
AV3M	25.6	100	419 x 1042 x 4143	86	68	28
VAI 806 FL 12	33	200	580 x 860 x 4500	105	84	35
AV6M	51	204	524 x 1096 x 3999	165	114	45
VAI 812 FL 12	67	295	1170 x 860 x 4500	205	164	69
VAI 836 FL 12	201	950	1750 x 1750 x 4800	605	484	203
AV24M	204	782	1140 x 1140 x 7141	754	546	301
AV36M	306	1098	1422 x 1705 x 5617	986	684	389
AV48M	408	1465	1422 x 1705 x 7141	1313	1060	439
VAI 864 FL 15	446	2180	2300 x 2300 x 5715	1420	1136	477
VAI 864 FL 23	669	3180	2300 x 2590 x 7230	1675	1290	552
Vaporiser Model Number				Maximum Recommended		
	Surface Area m²	Approx weight kg	Dimensions WxDxH mm	(8hr) Nm³/hr	(16hr) Nm³/hr	(Continuous) Nm³/hr
Electrical Vaporisers, Predominantly CO ₂						
HP3	3	41	272 x 415 x 420		13	
HP6	6	52	536 x 508 x 492		27	
HP12	12	97	536 x 508 x 764		55	
HP18	18	143	536 x 508 x 1037		82	
HP24	24	188	536 x 508 x 1310		109	
HP30	30	225	560 x 868 x 967		136	

Larger flowrates can be achieved with multiple vaporisers. Two or more vaporisers may be installed and switched between to reduce ice-up; this process can be manual or automated.

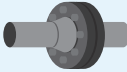
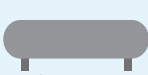
Safety distances

Safety distances are measured from possible release points, and are shown below in meters:

Hazard	Oxygen			Nitrogen		CO ₂	
	Up to 2,000L	2,000L to 20,000L	20,000L to 60,000L	Up to 2,000L	2,0001 to 60,0001	Up to 2,0001	2,0001 to 60,0001
 Large wooden structures	5	15	15	1	3	1	3
 Public Roads	3	5	8	1	5	1	5
 Railway Lines	3	10	15	3	5	3	5
 Flammable Gas Cylinders	5	8	8	1	1	1	1
 Non-flammable Gas Cylinders	1	1	1	1	1	1	1
 Continuous Piping Containing flammable fluids	1	5	6	1	1	1	1
 Untrapped Surface Water Drains	4	5	8	1	3	1	3
 Flue Gas Vent Pipes	5	5	8	1	3	1	3
 MV and HV Substations	4	5	8	1	3	1	3
 Places of Public Assembly	5	10	15	3	3	3	3
 Property Boundaries	3	5	8	1	3	1	3
 Areas Where Open Flames, Smoking, are Permitted	3	5	8	1	3	1	3

Safety distances

The safety distances are in accordance with BCGA Codes of Practice. Distances are measured from potential points of product release on the storage system. Where the safety distances cannot be met certain options can be reviewed to provide a solution to fit the space allocated for the installation. Most commonly this will require a partitioning wall be constructed, or relocation of the tank combined with an extended fill line.

Hazard	Oxygen			Argon, Nitrogen		CO ₂	
	Up to 2,000L	2,000L to 20,000L	20,000L to 60,000L	Up to 2,000L	2,000L to 60,000L	Up to 2,000L	2,000L to 60,000L
 Equipment and Machinery	4	5	8	1	3	1	3
 Flanges, Unions, Containing Flammable Fluids	6	6	6	1	3	1	3
 Openings, Windows, Into Building	5	7	8	3	3	3	3
 Small Stocks of Combustible Materials	3	5	8	1	3	1	3
 Vehicle Parking Areas	3	5	8	1	3	1	3
 LPG/Bulk Flammable Liquid Storage (<4T)	7.5	7.5	7.5	3	3	3	3
 Compressor, Ventilator, Air Conditioning Intakes	5	7	8	1	3	1	3

Service Plus

We also offer a range of solutions as part of our Service Plus program:

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- Dangerous Substances and Explosive Atmospheres Regulations (2002) Compliance Surveys