Compressed Gas Tanker Loading

A brief guide to the initial steps for planning and setting up a station (or stations).

The Essential Guide

CARBIS LOADTEC GROUP LTD

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The Essential Guide

What fluids does this guide cover?

This guide aims to highlight the similarities among the following fluids or products, which typically include C2, C3, C4, and C5.

- Propane
- Butane
- Ethane
- Pentane
- Isobutane

Plus

- CO_2
- Ammonia

What are the similarities?

All the fluids mentioned previously will be transferred in a liquid state into or out of a tanker (road or rail).

For the purposes of this guide, we shall assume that they will be in a liquid state and be at:

- -20°C
- 20 barG

With this in mind, the design and functionality become much easier to develop.

At this point, we will take the evidence we have and state that all European transfers are done at Ground Level.

How much space do I need?

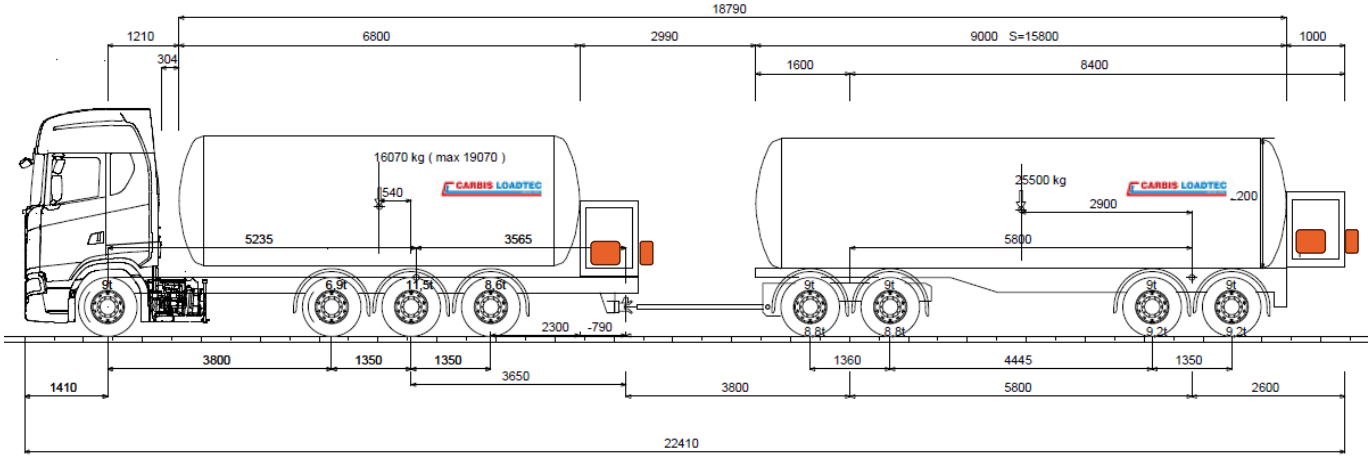
This is quite a simple exercise. A tanker is generally accepted as being 2.4m wide, and if it is an articulated single-barrel vessel, it will be 16m long, including the tractor cab.

There may be slight length variances due to the type of tank (ISO or traditional round barrel).

If the tanker is a “B-type” with a trailer, it will have a length of 22.5 meters, which may cause challenges during loading.

Furthermore, a lot will depend on where the tanker connections are. Rear or Side?

Typical Compressed Gas European B-Type Rig



These boxes indicate the two possible interfaces for the tanker connections.

It could be side or rear or both

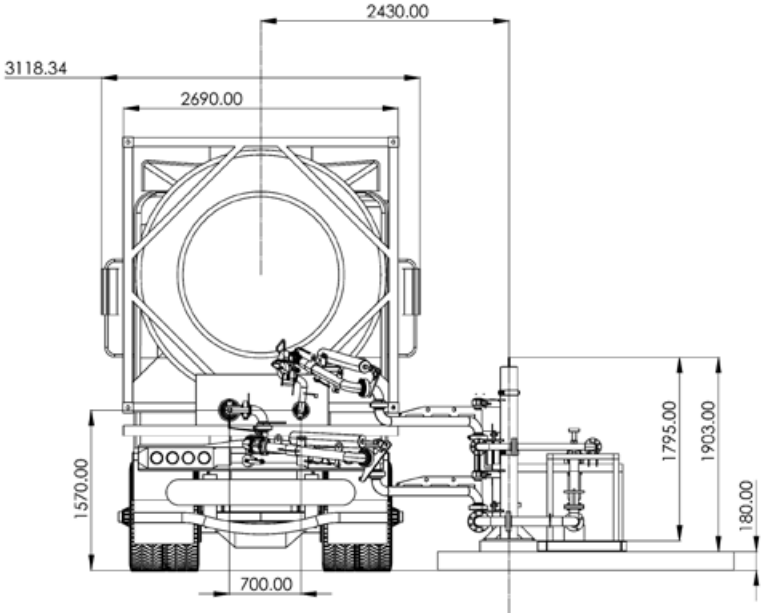
Rear Loading

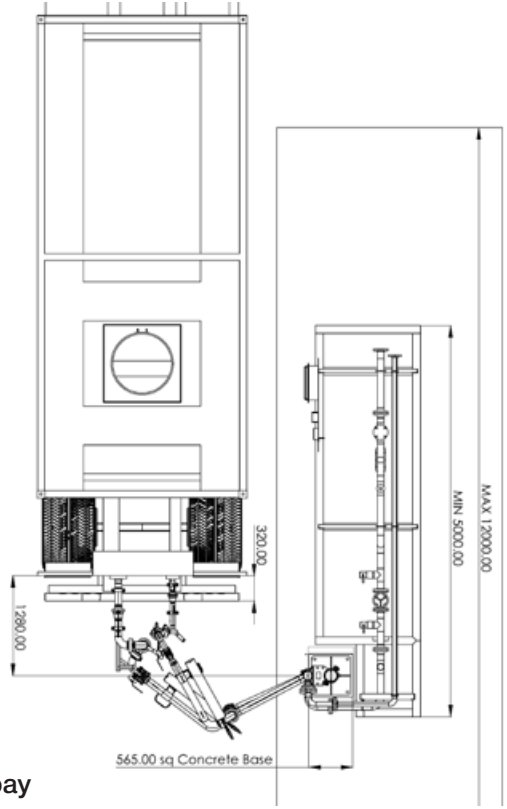
If the tanker connections are at the rear, then there will be two ports* (liquid and vapour) for the arms to connect to. The size of those ports will vary from country to country and media to media, so take nothing for granted.

The loading arms (liquid and vapour) will be designed so that whichever position the ports are in (liquid left, vapour right, or opposite) the arms will cross over to make connection possible Do not underestimate the potential for these variances.

*Unless the gas is being spray loaded and then mixed in the barrel. This will only utilise one connection.

Rear Loading Bay Width





In this scenario, you can see that the distance from the centreline of the tanker to the centreline of the loading arm standpost will be 2430mm

The tanker should be approx. 400/500mm from the kerb. **The loading bay can be 3500mm wide (kerb to kerb).**

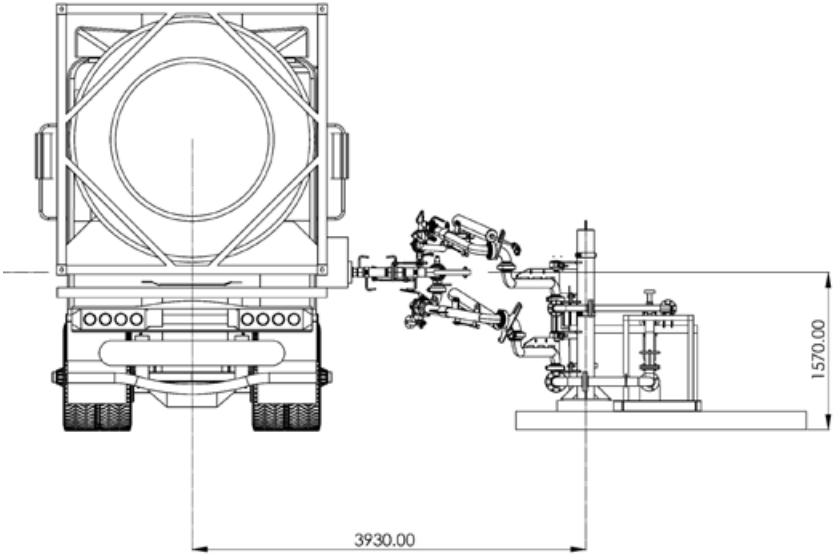
Side Loading

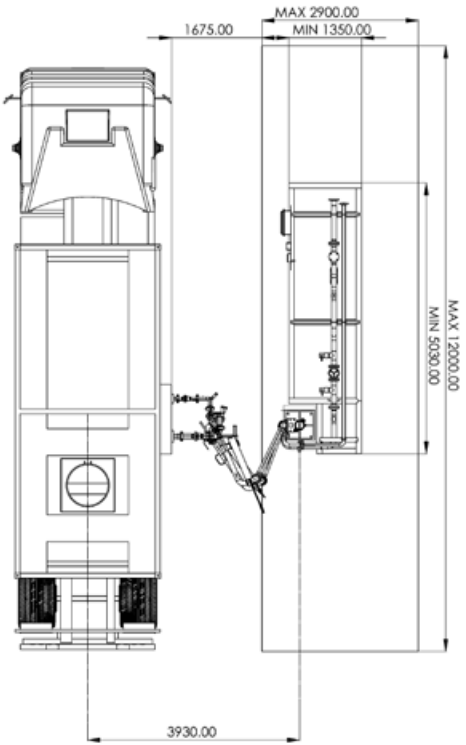
If the tanker connections are at the side, then there will be two ports (liquid and vapour) for the arms to connect to. They are likely to be lower to the ground than the rear connections. The size and linear position of those ports will vary from country to country and media to media, so take nothing for granted.

The loading arms (liquid and vapour) will be designed so that whichever position the ports are in (liquid left, vapour right, or opposite) the arms will cross over to make connection possible. Do not underestimate the potential for these variances.

NOTE! Greater space is required.

Side Loading Bay Width





In this scenario, you can see that the distance from the centreline of the tanker to the centreline of the loading arm standpost will be 3930mm.

The tanker should be approx. 1500mm from the kerb for operator access and safety. **The loading bay needs to be 5630mm wide (kerb to kerb).**

Loading Islands

The island needs to be wide enough to accommodate the metering skid and the loading arms.

The sketches in the subsequent pages show a standard layout whereby the loading arm station is bolted directly onto the meter skid to avoid site run piping and make installation at site much faster.

However, space must be carefully managed to prevent the passing truck from making contact with the loading system.

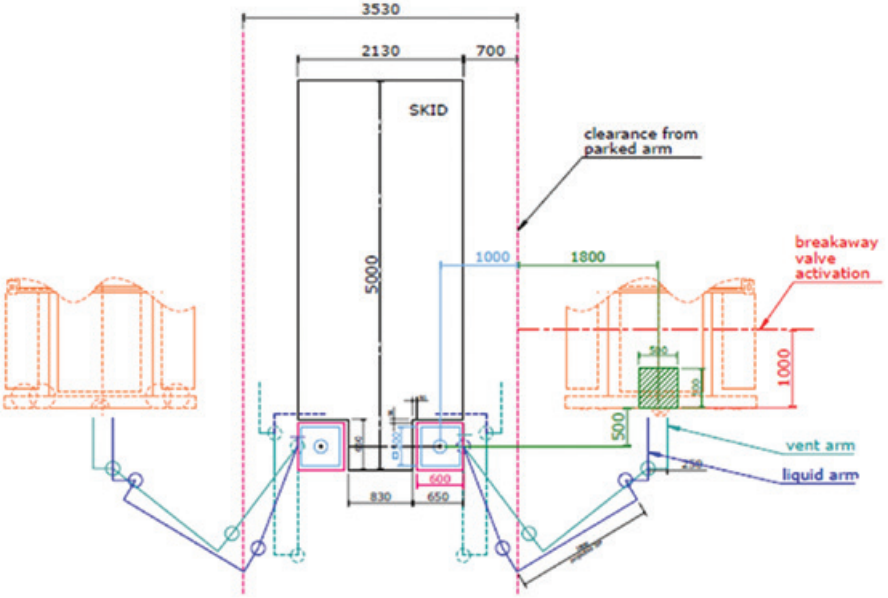
Standard Layout

In this case, a double-sided meter skid is used, with loading arms on each side.

There will be variations, depending on the content of the meter skid, but it shows the arms in the parked position and the pink dotted line indicates the edge of kerb.

Obviously, these are not rules, but as guidance, they will save issues later in the design process.

The length of the island will depend on the content of the meter skid.



Layout Summary

The most compact arrangement is to have rear connections, as this enables the potential for double-sided islands (as shown on the previous page).

However, if side-loaded tankers are used, the connections will most likely be on only one side.

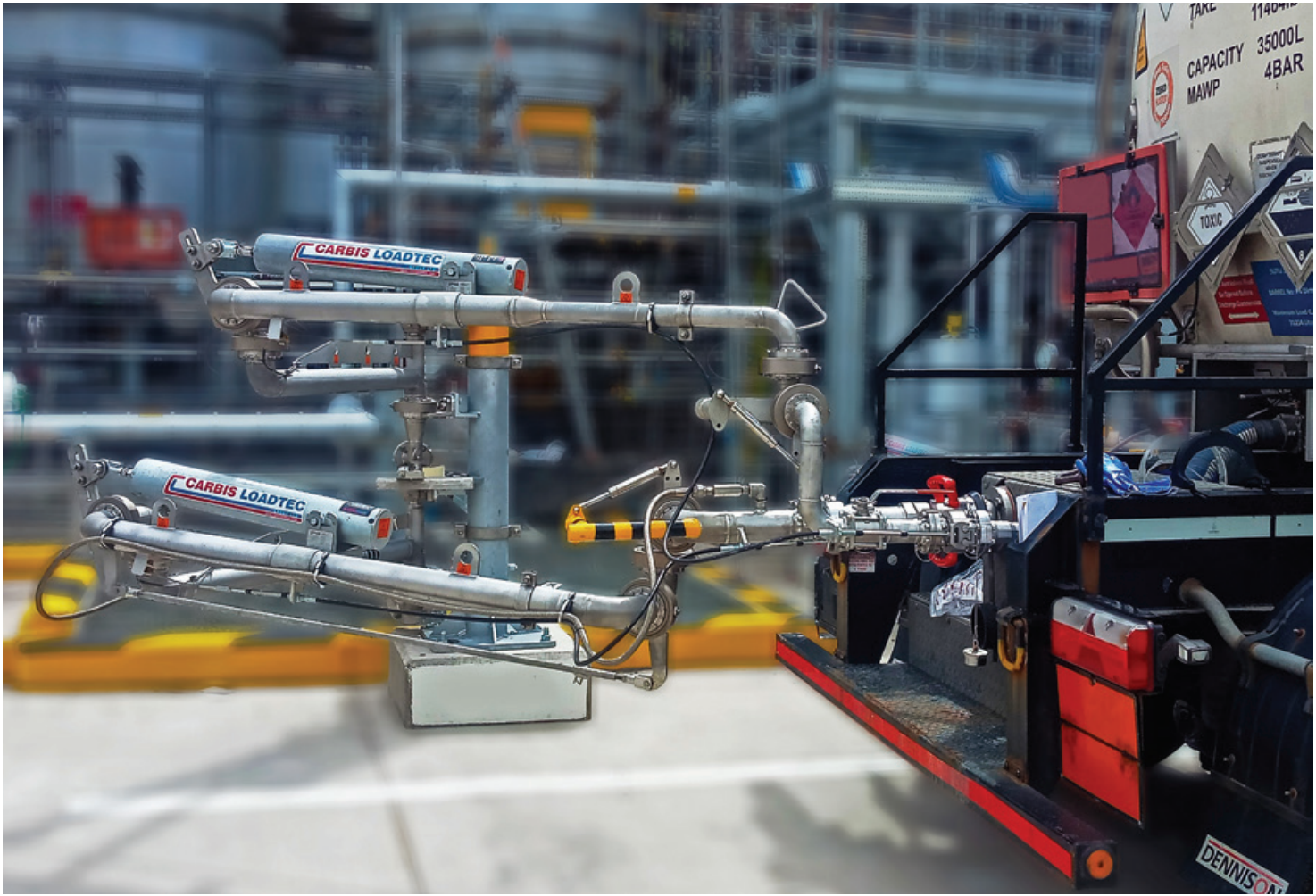
This leaves the B-Type tankers. How do we resolve two loading points?

1. Have two distinct meter skids and arms.
2. Have a one meter skid and two loading arm stations and load in sequence, not simultaneously.

The issue is whether the front and rear tanker connections are the same orientation. If the tanker has to park to suit side connections on the front barrel, the arms will not be able to reach the rear connections on the rear barrel.

It's a question that has answers but needs a detailed discussion.

The Loading Station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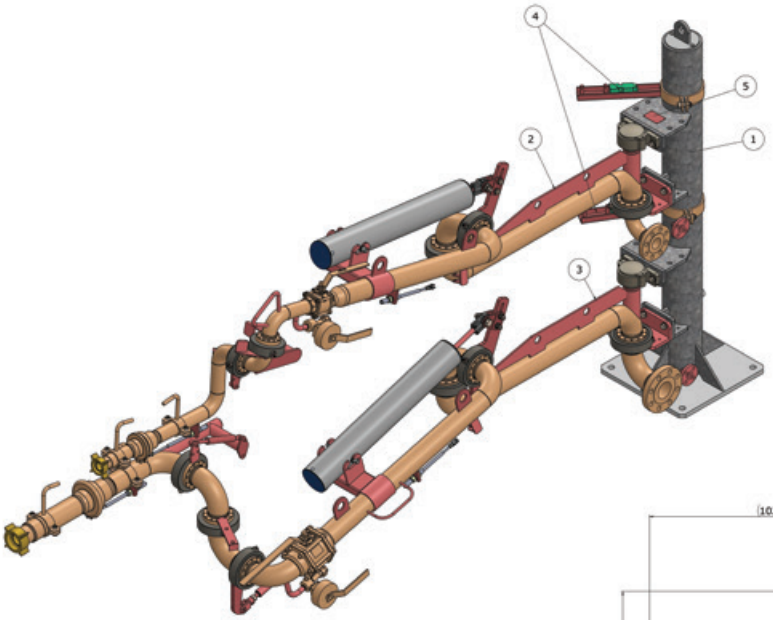
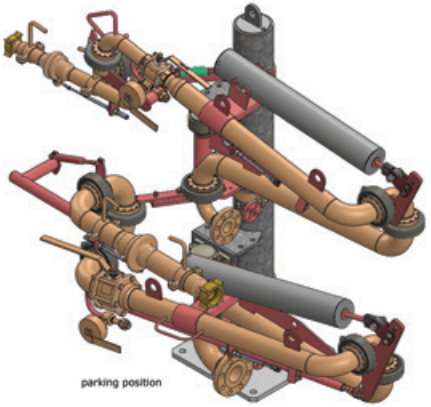
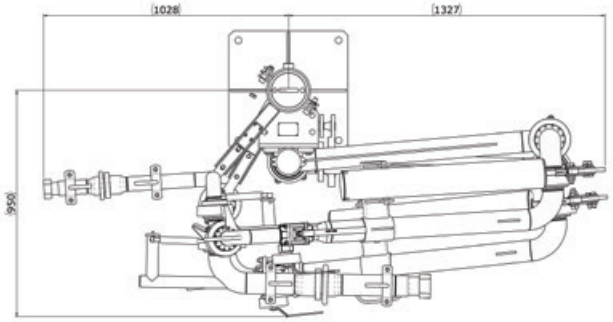
CAPACITY 35000L
MAWP 4BAR
TOXIC
DENNISON

Loading Station Design Features

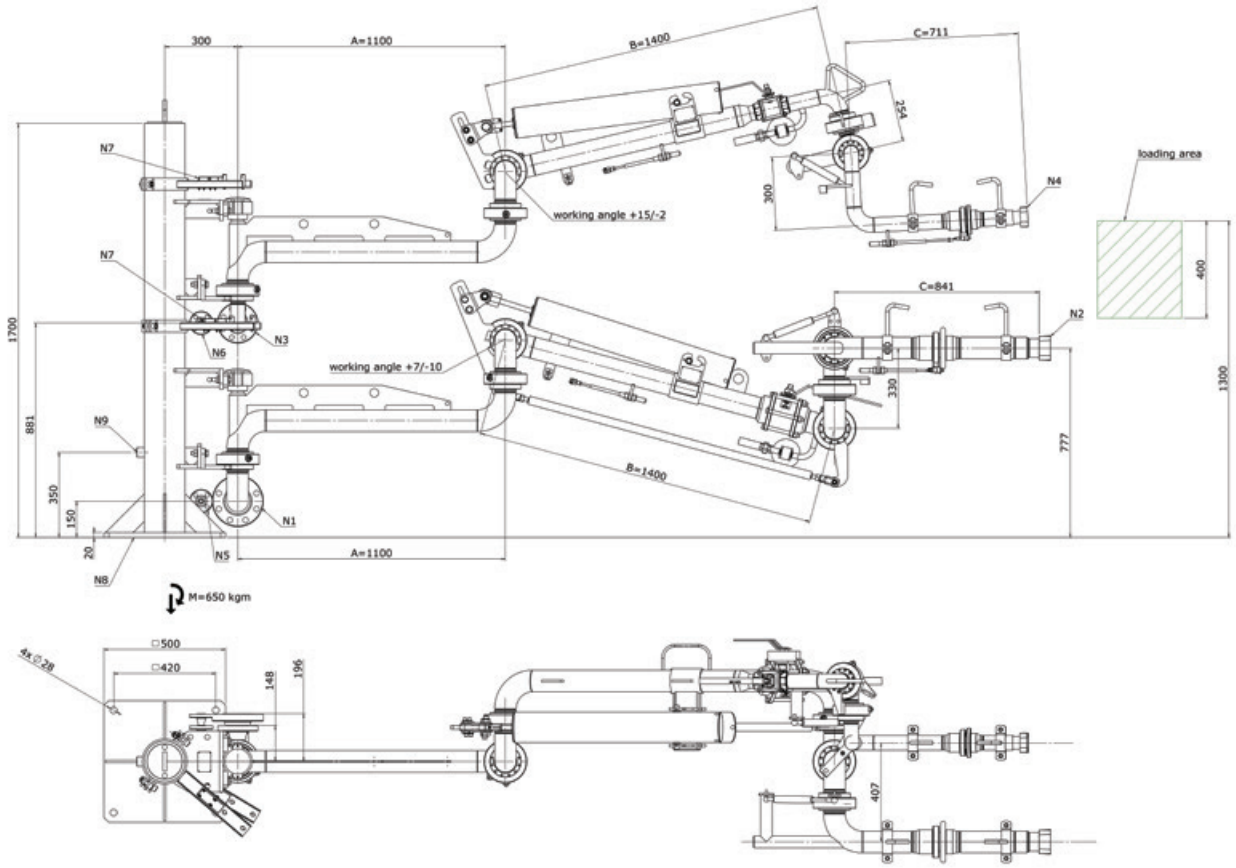






See page 19 for explanation.

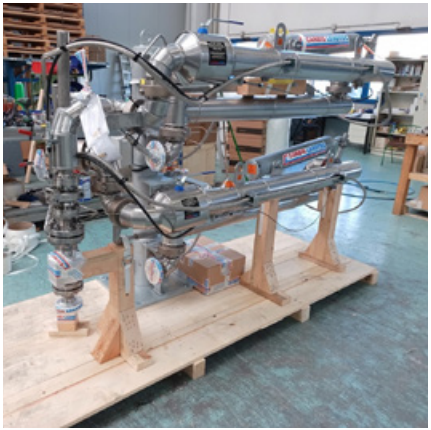
Loading Station Design Features



Loading Station Explained

Let's do a walk-through of pages 17 and 18. This is a typical LPG Station.

1. Both arms are mounted on a common standpost. This is galvanised steel and will have an earthing boss.
2. The client will decide whether they want parking switches for the arms or simple latches. The switches can be linked to a traffic barrier or Stop/Go lights.
3. The lower arm is a 3" liquid line with six swivel joints for easier articulation.
4. The upper is the vapour return. It is also 3" for strength, reduced down to 2" for the tanker connection.
5. These arms can be 2", 3" or 4".
6. Both arms carry the same hardware:
    - Spring balance cylinder
    - Manual Ball Valve
    - Vent valve with DN15 hose linking back to a standpost mounted flange outlet
    - Emergency Release Coupler
    - Tanker connection - in this case, a Weco type screw coupling



Loading Station Explained

In reality, the only real variation occurs if Dry-Disconnect couplers are fitted to the arms to match the road or rail tanker. In that case, the manual ball valve and vent line can be deleted because the dry-disconnect will take care of the isolation when disconnecting and avoid the need to vent. But this will be dictated by the country you are working in and the working practice applied to that industry.

Arms can be in 316L stainless steel which avoids the needs for maintenance (painting) or epoxy coated low temperature carbon steel.

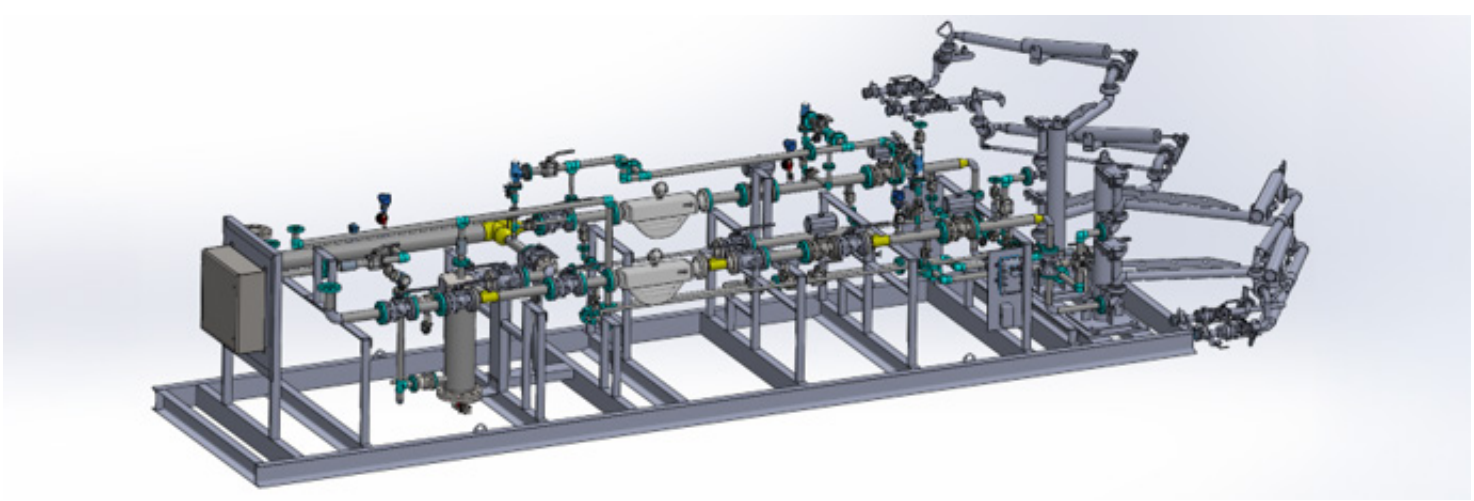
There are instances whereby the client only requires a loading arm and does not take away the vapour.

This is mostly found on regional LPG depots whereby the tankers are being used for industrial and domestic supply and not delivering a specific gas/liquid, whereby returned vapour can be recompressed and delivered to originating storage bullet.

Aerosol LPG (which is a propane and butane blend) is loaded into the tanker in a strict sequence and then mixed internally using the tank truck pump.

In these cases, all the above rules for dimensions apply, but the vapour arm is not included.

The Meter Skid



The Meter Skid Explained

The meter skid is an open book. It can vary in length, width, complexity and functionality.

Essentially, it is there to measure the mass (we prefer mass when measuring the C family) and control the functionality of the loading system to prevent overfilling. This is where it can get a little complex.

Every meter skid should comprise the following features for good practice.

- Manual valve isolation at each end of the skid for each line
- A Mass Meter per line
- A Control Valve per line
- An Emergency Valve per line
- Meter Proving connections
- Temperature and Pressure instruments
- Pressure relief valves
- Batch controller
- Electrical distribution panel
- Tanker Earthing system
- Drain down facilities

Furthermore, if a vapour return is present, the vapour line may have a back pressure control valve to maintain the tanker pressure at a certain level while being filled.

Beyond this, it depends on the client's preferences, and we can adjust to any situation.

Insulation

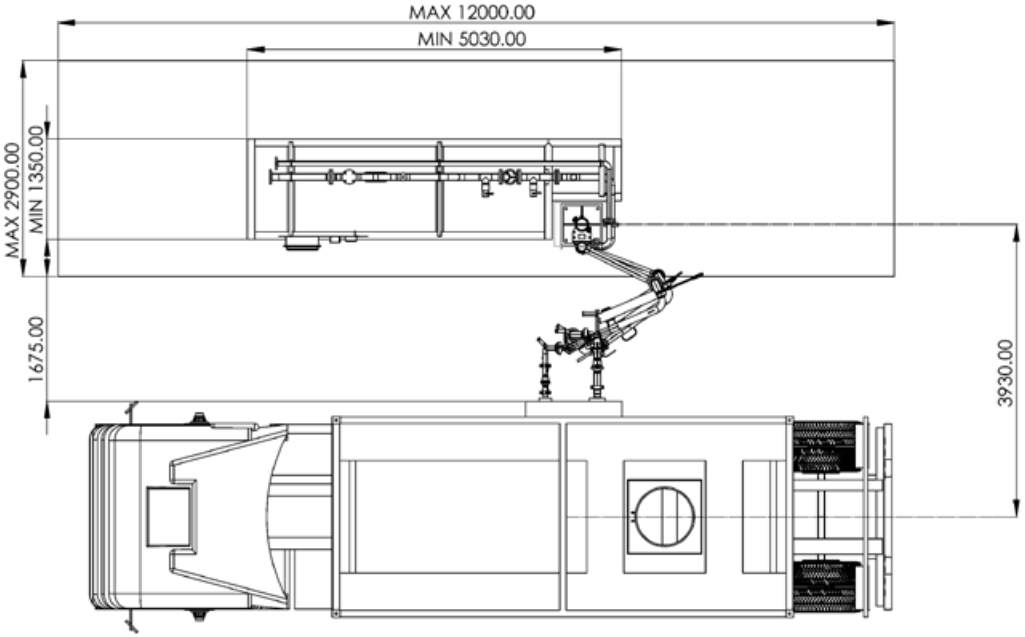
It is not normally required for LPG stations.

CO2 and Ammonia, however, require the arms to be cold-insulated, which is common industry practice for cryogenic temperature lines where heat conservation and freeze protection are needed.

It is recommended that the loading arms be insulated at the factory. The need to accommodate swivel joint arcs of movement and maintenance requirements makes this operation quite a specialist operation.

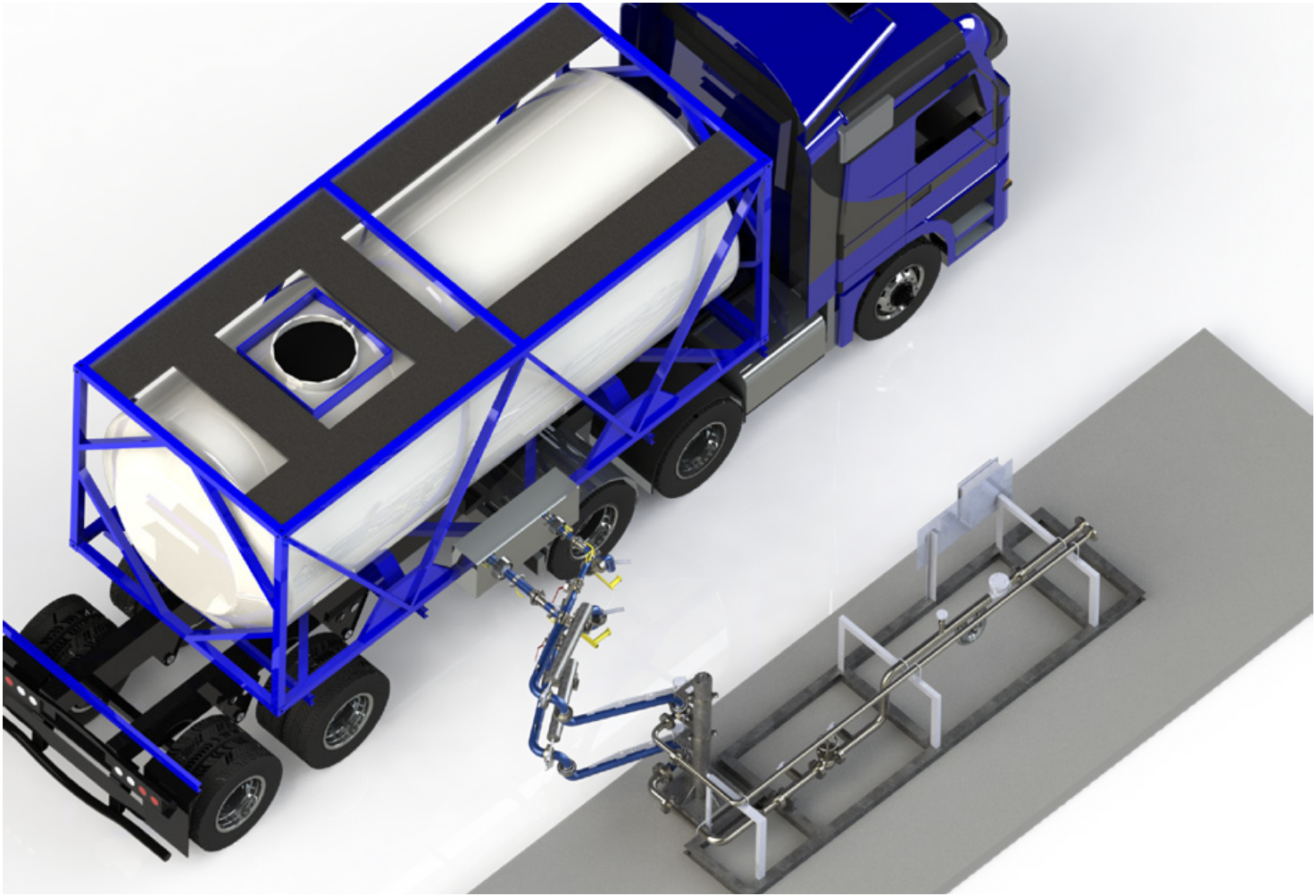
However, it is **not recommended** to insulate the skids until after arrival at the site. The presence of multiple flange joints and the handling of a heavy, large structure require a site pressure test for safety. Once the test is successfully completed, insulation can proceed.

Meter Skid Dimensions



Irrespective of the tanker, the length and width of the meter skid will vary depending on the content.

The drawing indicates that a length between 5,000mm and 12,000mm can be considered.



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