

Flexible Tanks for Liquid Bulk Cargo

Annex 1

General Risks

As early as 2012, the German Insurance Association (GDV) commissioned Germanischer Lloyd (now part of DNV) to investigate the load limits of a standard ISO container. The results are publicly available¹.

The CTU Code (Code of Practice for Packing of Cargo Transport Units) published jointly by the International Maritime Organization (IMO), United Nations Economic Commission for Europe (UN ECE), and International Labour Organization (ILO) contains the acceleration values which are valid worldwide and which must be taken into account when securing cargo. These acceleration values are the reference for checking the strength of a container, because in the case of liquid cargo, the container must secure the cargo through its lateral structure.

The following is a summary of the results of Germanischer Lloyd's investigation:

The effect of loading below deck, where a container is stowed closer to the rolling axis of the vessel and is therefore subjected to lower accelerations, can be seen in the following graphs (Figure 7). The acceleration forces are shown, taking account of high and low stability, along with the different stowage positions on vessels of different lengths with no transportation restrictions.

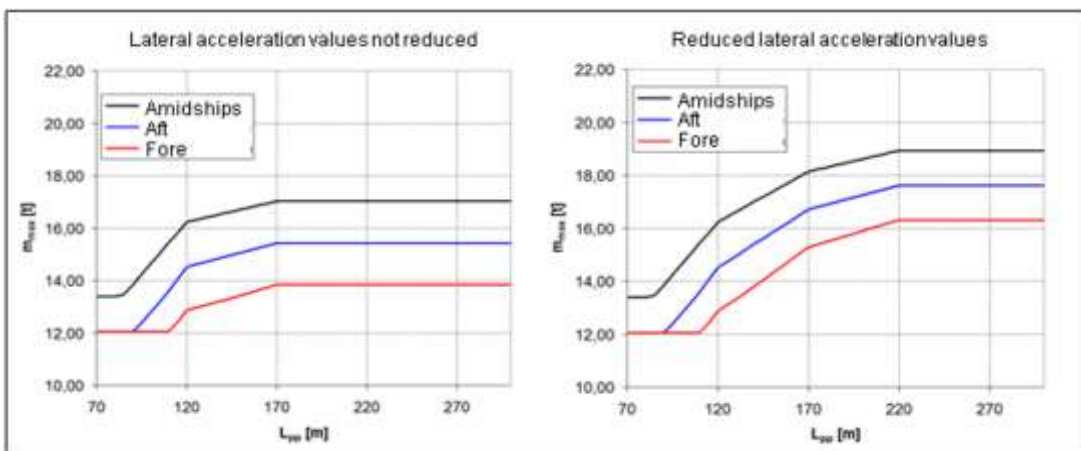


Figure 7: Image source Germanischer Lloyd
Flexitank survey by Germanischer Lloyd for GDV

¹ Report on the investigation into Flexitanks carried out by Germanischer Lloyd and commissioned by the GDV
https://www.tis-gdv.de/tis_e/containe/flexitanks/flexitankuntersuchung.htm/



For container walls that are not fully loaded by the flexible tank, further corrections may have to be made regarding the possible cargo weight. In practice, flexible tanks with volumes of 18K to 24K litres are used. Depending on the specific mass of the liquids, the above limits are far exceeded. If the rules recommended in this IUMI best practice paper for the transport of flexitanks can be adhered to, a mass of 18.00 mt with a specific mass of 1.0^2 is recommended as a limit value.

However, even this recommendation needs to be considered as a compromise as the most favourable conditions were selected in terms of ship size, shipping area and stowage position.

According to Chapter 5, 5.3 of the CTU Code, the maximum expected transverse force in maritime transport in sea areas "C" is $0.8 \times g \times m$ and thus 80% of the mass of the transported goods. In road transport, a maximum expected longitudinal force in the direction of travel of also $0.8 \times g \times m$ is to be taken into account during pre- and on carriage transport.

With regard to the structural limits of a container, the CTU Code in Chapter 6, 6.2.4 further states:

- strength of the side walls equal to 60% of the permitted payload (uniform load)
- strength of the front wall / doors equal to 40% of the permitted payload (for flat load)
- container floor is primarily designed to sustain the total payload homogeneously distributed over the bottom structure

In addition, the CTU specifies as follows with regard to flexitanks:

“However, CTUs used for such purposes should be suitably reinforced and prepared, operational restrictions regarding the permissible payload should be observed (see annex 7, section 5).”

and

“During transport the contents of a flexitank will be subject to dynamic forces without significant retention from friction. These forces will act upon the boundaries of the CTU and may cause damage or complete failure.”

The overloading of containers results in bulging/deformation of the container walls under the influence of normal/expected strains of transport, handling and storage. This in turn are sources of damage for the poly material of the flexible tanks. Repaired areas in a container often have sharp edges and sharply shaped points of contact, as can occur during welding. These lead to mechanical damage to the flexible tanks and thus to leaks which is further illustrated in the following photographs.

² This reference is related to the density since there are different density ratios for different liquids.



Photo 1



Photo 2



Photo 3



Photo 4

Due to the continuing frequency of losses, the Container Owners Association (COA) developed the following regulations in 2010:

- Code of Practice – flexitank (operators)
- Code of Practice – flexitank (manufacturers)

The transport requirements of the COA are as follows:

- Use of a standard 20' container
- Minimum total gross weight 30,480.00 kg
- Maximum flexitank capacity 24,000.00 litres
- Maximum flexitank weight 24,000.00 kg
- Reference to compliance with CTU Code Chapter 5 and specifically Annex 7, Section 5.2.

These maximum values as proposed by the COA lead to an intentional overloading of the container structure. Furthermore, COA certification, as a minimum standard, is not a prerequisite for effecting flexible tank transports. Shipping companies usually accept containers with flexible tanks without further inspection and requirements. As a general rule, the shipper and subsequently the insurer is liable for all damage caused by the transport of flexible tanks.

Based on the limitations of the COA requirements, a mass of 18.00 MT with a specific mass of 1.0 is recommended as a limit value.