Best Practice Guidelines for Safe tipping of Silo trucks/ Trailers Silo Containers and bag-in-box containers

Issue 1 November 2014

DISCLAIMER

This document is intended for information only and sets out best practice guidelines for the safe tipping of silo trucks/ trailers, silo containers and Bag-In-Box containers, within the chemical logistics supply chain. The information provided in these guidelines is provided in good faith and, while it is accurate as far as the authors are aware, no representations or warranties are made with regards to its completeness. It is not intended to be a comprehensive guide. Each company, based on their individual decision making process, may apply these guidelines, in full or partly or apply any other adapted measures.

No responsibility will be assumed by ECTA/Cefic in relation to the information contained in these Guidelines.

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1 Introduction

In European land transport, silo trucks/ trailers, silo containers and Bag-In-Box containers are frequently used for transport of dry bulk chemicals, either granulates or powders.



The unloading of the above described equipment is undertaken by tipping and this places multiple requirements on the construction of the equipment, on their proper maintenance, on the unloading area conditions and unloading procedures.

Although serious accidents during unloading may be rare, many silo tank trailers and container trailers fall over or containers fall from the trailer, while raised/tipped for unloading.

These accidents constitute a serious safety threat to the personnel, driver and/or site operators surrounding the equipment and always cause additional important material costs.

There are several causes for a fall over e.g. high wind speed, mechanical failure rear support legs, unlocked twist locks, insufficient rigidity or level plane of the unloading area, incorrect way of working, and more…






Serious accidents that have occurred within the industry
In order to limit these safety risks, all interested parties have taken the initiative to revise the existing guidelines summarizing the guidelines on construction, maintenance and usage of this type of equipment.

2 Purpose

The requirements as explained in this guideline are intended to prevent silo trucks/ trailers, silo containers and Bag-In-Box containers falling over or sliding off the chassis during the unloading in raised position, causing injury to people or damage to equipment in the unloading area. It is recognised that adoption of these best practice guidelines will be for each of the parties within the industry to decide how they introduce them, partly or fully, or any other adapted measures. This guideline should be part of an organisations routine risk assessment and risk review process, in how they can be implemented to meet the needs of the industry.

It is strongly recommended to implement these guidelines

- for assessing the unloading practices and driver training
- for assessing the current unloading facilities and equipment
- when building new facilities or taking into service new equipment

3 Scope

The aim of these guidelines is to prevent silo trucks/ trailers, silo containers and Bag-In-Box containers from falling over.

The scope includes:

1. Minimum requirements for unloading Sites in Europe concerning the:
   - The unloading Area
   - The unloading procedures
   - Driver Instructions
   - Checks during the unloading operations

2. Minimum requirements for hauliers concerning
   - The unloading procedures
   - Minimum truck equipment required to allow safe tipping operations

Types of vehicles: silo trucks/ trailers, pressurized and non-pressurized aluminium containers and “Bag in Box” 30’ foot containers and “Lined” 20’ and 40’ foot containers on trailers.

These guidelines do not cover the dry bulk transport equipment that is discharged without tipping (e.g. hopper cars).

3: General safety requirements like
- Roles and Responsibilities,
- Site access, driver instructions, communications,
- PPE,
- Working at Height
- etc…

These are described in the following ECTA guidelines as detailed below:

- **BBS Safe Driving of Road Vehicles**

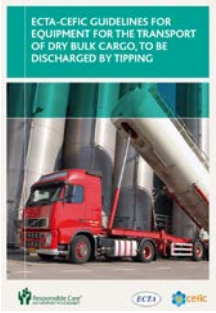
- **Best Practice guidelines for Safe (un)loading of Road Freight vehicles, covering Technical, Behavioural and Organisational aspects.**

- **Best Practice guidelines for the Safe Working at Height in the logistics supply chain and allied sector**

- **Best Practice guidelines for cleanliness of Rotary Valves and unloading equipment for bulk deliveries**

More general information about the technical equipment for the transport of Dry bulk cargo can be found in:

"ECTA/ CEFIC GUIDELINES FOR THE TRANSPORT OF DRY BULK CARGO TO BE DISCHARGED BY TIPPING."



More information on tipping lined Isobox containers:

ECTA "BEST PRACTICE GUIDELINES FOR THE SAFE USE OF "LINED" ISO BOX CONTAINERS FOR MOVEMENT OF DRY BULK PRODUCTS"

All ECTA guidelines can be accessed via www.ecta.com www.cefic.org

4 Risk assessment

4.1 General

The unloading site must perform a **Risk Assessment** (See Annex 1) to assess the potential impact on people and equipment like product lines, silo discharge lines, steam lines, pumps and compressors, buildings, car park, (pedestrian) roads and/or the site border fence, in the event of a silo truck/ trailer, silo container or Bag-In-Box container falls over or slides off the chassis during the unloading in raised position.

The risk assessment should highlight actions that must be taken to mitigate the risk to an acceptable level.

The risks assessment must take into account at least the following:

1. The "impacted area" the so called "danger zone". This is the zone in which the silo truck or container can fall down when it tips over.
2. The unloading area (condition of the floor, other activities in the area, no overhead obstructions etc..)
3. The unloading procedures
4. Training of drivers and operators
5. Degree of supervision (checks)
6. Equipment of the trucks
7. The product to be unloaded. Some products require maximum tipping at the start of the unloading process (see section 6). For other products, tipping at the start is not necessary and therefore not allowed. The risk for a trailer to fall over increases with the increase in tipping height of the silo tank/ container and the weight of the product inside. Unnecessary raising must be prevented at all times.

Container fell on a parked car during tipping

Silo trucks discharging near site pipelines and equipment

Example of a risk assessment: see Annex 1

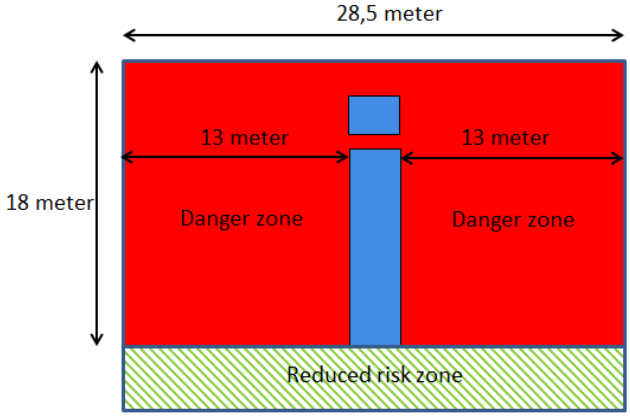
4.2 Danger zones and reduced risk zones for drivers

The “Impacted” area which is shown as the **‘Danger Zone’** is highlighted in **RED** (see schematic below) around the trailer and can be impacted in the event of a silo trailer falling over.

The zone which provides the least risk to the driver during the unloading process is highlighted in **GREEN** and is called the **‘Reduced risk zone’.** This is the area for the driver to operate and observe the unloading process. In this area the driver has the opportunity to step aside into a safe position in case the trailer falls over.

The danger zones are theoretically defined, based on the maximum tipping height of the different trailers (trailer with silo tank, pressurized and non-pressurised containers and 20, 30 and 40 ft. containers).

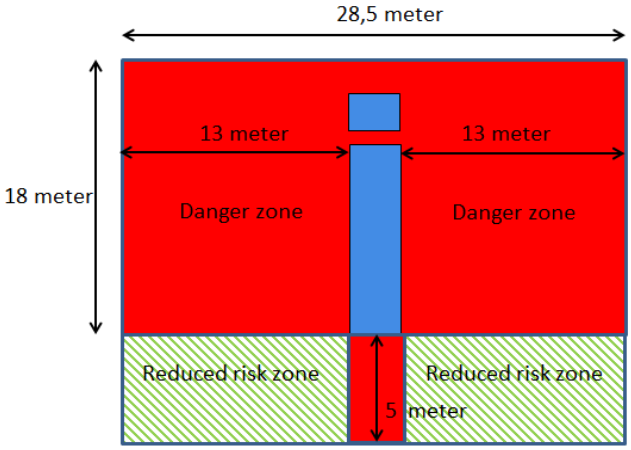
4.2.1 Silo truck/ trailer



Silo truck trailer danger zones and reduced risk zone

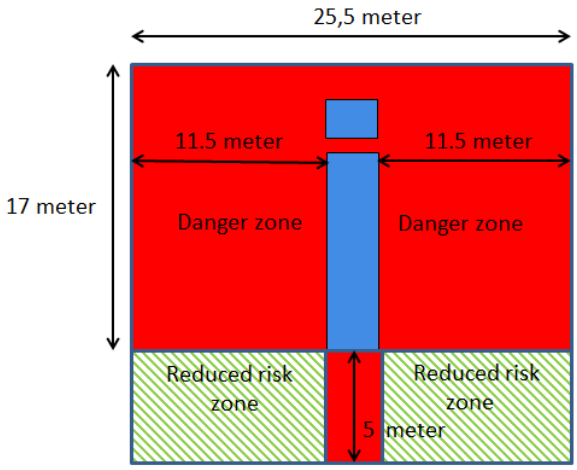
4.2.2 Container on trailer

With respect to **a container on a trailer**, the area behind the trailer can also be impacted if the container slides from the trailer during tipping (see schematic below with danger zone behind the trailer).

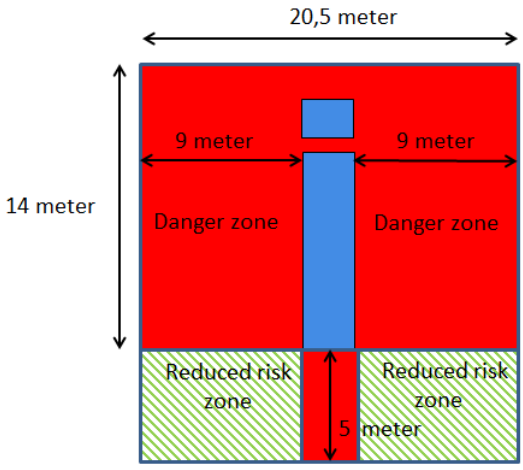


40 ft. Container on trailer with danger zone behind the trailer

In case of a 30 and 20 ft. container the danger zones are smaller (see schematics below)



30 ft. Container on trailer with danger zones

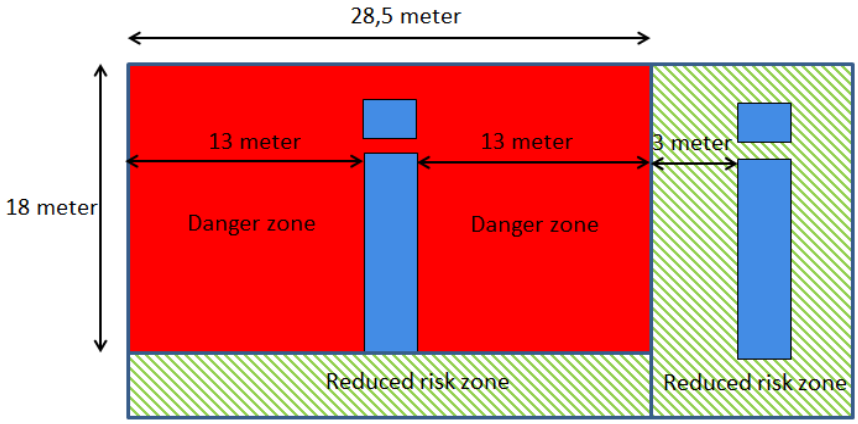


20 ft. Container on trailer with danger zones

4.2.3 Multiple danger zones

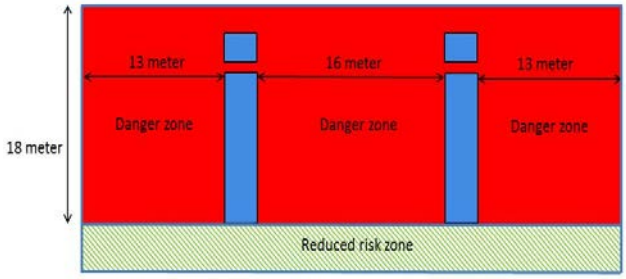
In the event of two or more trailers unloading at the same time, it is possible that the danger zones may overlap. The distance between the trailers should be at least 16 meter. *(In case of container on trailer the danger zone behind the container must also be taken into account and in case of 20'and 30' feet container other danger zone dimensions are applicable).*

With this distance a reduced risk zone of 3 meters around the trailer is created. When preparing the trailer for unloading, the driver must work within the 3 meter area around the trailer to ensure he/she does not enter the danger zone of the adjacent tilted trailer. (see schematics below)



Silo trailer in tipped position (left) with danger zones and a second silo trailer (right) not tipped with a reduced risk zone around the trailer at the right

In the schematic below, 2 trailers tipped at the same time creating an overlapping danger zone . *(In case of a trailer with container the danger zone behind the container must be taken into account and in case of 20'and 30' feet container other danger zone dimensions are applicable).*



Both silo trailers in tipped position with an overlapping danger zone

4.2.4 Danger zones depending on tipping height

The dimensions of the danger zone are based on the maximum tipping height of the different trailers types. However in case of unloading very fluid product there is no need to tip to the maximum and the danger zone would be smaller with the exception that in case of a trailer with container, the danger zone behind the trailer remains.

If a limited tipping height is one of the measures to reduce risks, adequate procedures must be in place to manage the drivers to comply with this limited tipping height, because not tipping to the maximum is for most drivers very unusual and they will always tend to tip to the maximum. Consideration should be given for the installation of physical barriers to prevent exceeding the maximum tipping height.

4.2.5 Reduction of the danger zones by installing a mechanical protection

To protect silo's, buildings, facilities, traffic, site road/public road or other unloading trailers, a construction, strong enough to hold a falling trailer, can be considered as shown in photos below.

Mechanical structure to protect people/ equipment/ vehicles
in the event of a silo truck falling over

4.2.6 Risk of Entrapment

While tipping up or down, besides a risk of falling over, there is also a risk of entrapment because of the movement of the tipping ram and other movable parts on the trailer.
Therefore the danger zone must also be taken into account in all cases during tipping.

5 Requirements of the unloading area

5.1 The unloading area must be located within the site premises and NOT on the public road (See picture below) unless there is a permit from the local authorities and the unloading is done under controlled conditions (e.g. marking, fencing off the unloading area, etc..)

Not OK

Parked on a public highway with the discharge hose trailing across the pedestrian walkway

5.2 The access road to the unloading area is easily accessible (e.g. sufficient width, spacious curves, no obstacles (height) and rigid surface with sufficient load bearing capacities – see 5.4 below), in order to have sufficient space to manoeuvre to and from the unloading point.

Not OK

5.3 In the event that reverse driving is necessary, a competent ‘guide’ is recommended to support the driver and to avoid damaging (e.g. construction, building, facility or trailer). At the unloading place, a “reverse stop” either through signage or a physical barrier on the ground is recommended.

5.4 The surface of the unloading area must be firm and even

When tipping the trailer, please take into account that forces up to 25 ton can be exerted on each stabilizing leg.

The surface should be capable to accommodate this without deformation and should preferably be constructed of concrete.

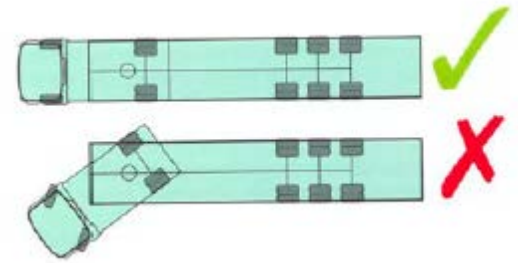
Take care in case of asphalt, because hot weather can make it too soft. Also the potential for sewer systems or underground pipes, close to the rear legs position must be taken into account.

The design/ strength of the concrete floor (the rear legs support area) should be based on calculation.

OK

Not OK

5.5 The lay out of the unloading area must be such that the traction unit and trailer can be positioned in a straight line.



5.6 A slight slope of the unloading place is acceptable in longitudinal line, e.g. in the same plane as the tipping of the container/ silo.

Lateral angles of slope e.g. left to right across the chassis <u>are not acceptable</u>.

The angle of the slope will affect the maximum tipping height.

These cases must be considered in the risk assessment.

OK

Not OK

Unloading on a lateral incline

5.7 The surface of the unloading area should be made of suitable material minimizing dust and other material (e.g. gravel) in order to avoid contamination of the product. The working area should be adequate anti-slip, properly drained, frequently cleaned, be kept snow and ice free and free from tripping hazards.

5.8 There should be NO overhead obstruction in case the trailer is tipped to the maximum height (e.g. overhead lines, gantries or electric power cables).

Not OK

5.9 The unloading area must have lighting that is suitable for unloading activities during hours of darkness and that must cover the complete area and trailer.

5.10 The unloading area must have a fit for purpose, and properly marked earthing connection, and preferably, with a positive earth prove indicator (see picture)

5.11 A spill kit must be available in case of leakage of hydraulic oil, diesel or cooling water at the unloading location or site.

5.12 The average unloading time is between 1 and 2 hours. During the unloading the driver must stay in the vicinity of the trailer in the reduced risk zone (see diagrams) to observe the unloading process. To protect the driver against heavy rain, snow, ice, cold, heat and/or sun a shelter should be provided. The shelter must be located outside the danger zone behind the trailer or a short distance and with a free view to the rear of the trailer. Also a restroom within walking distance should be made available.

5.13 The unloading site must be equipped with a wind speed meter (anemometer) and alarm system/ procedure in order to stop and/or adjust the unloading activity in case of strong wind. Average wind speed above 4 beaufort scale (6,5 m/sec) will increase the risk of tipping over. The risk assessment needs to consider wind speeds, wind directions and physical layout of the unloading place.(see also 9.5)

5.14 In case the unloading site requires a sample from the top of the silo tank or container, provisions to work safely at height must be implemented (e.g. stairs, fall arrest system in combination with safety harness). More guidance on this subject can be found in ECTA/Cefic guidelines

Best Practice guidelines for the Safe Working at Height in the logistics supply chain and allied sectors www.ecta.com, www.cefic.org

6 Tipping taking into account the product characteristics

6.1 Different types of products

The flow characteristics of the product to be loaded, transported and unloaded play a significant part in the selection of the transport solution. Once it is established what transport solution is to be used, then the producer of the product, along with the haulier, needs to determine the fluidity of the product and the way of discharging.

The driver must be informed/trained and take into account the difference of products, the risk of avalanching and the way a particular product must be discharged

6.2 Tipping Free flowing products

For Polypropylene, Polyethylene, PVC granules or other free flowing products no tipping is needed at the start of the unloading process. (Some products do need a little tipping from the start).

During unloading, step-by-step tipping is allowed as required to assist with unloading the product.

For some products maximum tipping to the first ram is sufficient, for other products tipping to the second, third or to the maximum is needed in order to fully empty the trailer.

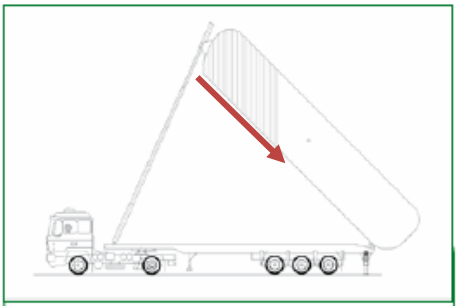
In all cases, tipping higher than needed should be prevented.

Note. Product trials can establish the agreed maximum tipping heights and the delivery requirements. These can then be used in the original risk assessment and controls

6.3 Tipping products with avalanche risk.

Some products (e.g. powders like chalk) can cause ‘bridges’ causing product to stick to the top of the silo tank or container trailer. This mass can suddenly fall down, resulting in an avalanche of the product. This causes a violent and sudden drop of product mass onto the rear stabilizing legs, with risk of damaging the legs and and/or the trailer falling over.

For silo trucks and silo containers, products with avalanche risk should be **tipped to the maximum** before unloading starts to make sure that the product is able to flow.



>> “avalanche” effect about to happen

The risk of avalanche can be reduced by using specialised equipment (e.g. fluidizing equipment)

6.4 30’ BIB Containers

As mentioned earlier in the document silo trucks, silo container and bag in box are very different transport solutions for dry bulk products. The equipment and the safe way to discharge is also different.

With BIB the additional variable is the type of liner which can be used in the Bag in Box solution.

Products with avalanche risk may need special fluidisation to aid in the flow and tipping process. Under certain strict conditions (free flowing product, no lateral inclination of unloading place, pivot point of tipping chassis at, or very close to the rear axle etc..) and subject to a separate risk assessment, tipping of 20' and 30' BIB containers can be done without stabilizing legs. The use of rear stabilizing legs, even under those strict conditions should be considered & assessed. Also see Section 7.1.6.4

7 Technical equipment

7.1 Minimum Equipment Requirements

7.1.1 Introduction

The tipping equipment on a trailer is a “Machine” as defined in the EC Machine Directive. The aim of the directive is to harmonise the design and construction of machinery to protect the safety of persons using such machinery. The letters 'CE' (CE mark) on a machine is the manufacturer's claim that the machine meets the essential health and safety requirements taking into account potential dangers to operators and other persons using or affected by the machine.

For trailers without a CE mark a CE Risk Assessment is mandatory and based on the risks a retro–fitting must be considered taking the technical and economic feasibility into account.

7.1.2 Tipping mechanism

The tipping mechanism must be equipped with a Dead Man’s Switch

In order to operate the tipping of a trailer, the driver has to keep pushing the switch/button/handle. When the driver stops, the trailer will stop tipping. In this way the driver is forced to stay at his/her position and able to react immediately in case something goes wrong.

These buttons should be placed at the rear corner this allows the driver to move out of the danger zone if an incident occurs.

7.1.3 Remote control on silo trucks

A remote control (see picture) can prevent the risk of entering the danger zone.

It is NOT recommended that Remote Control systems are used on a container tipping chassis as it would allow a driver to step into the danger zone behind the tipping container.

Currently only a limited number of trailers are equipped with remote controls. However a remote control system is considered to be best practice.

7.1.4 Twist locks

7.1.4.1 General

Tipping of containers places strenuous conditions on the twist locks therefore only twist locks recommended by the manufacturer for tipping applications must be used. A high tensile stem is recommended.
The shear block should be a one-piece casting in cast steel or welded steel construction.

The interface between the container corner casting and the twist lock should be kept clean and not greased to maintain friction.

NB – If the twist locks are semi-automatic, the drivers must always be instructed that the hand nuts still need to be manually tightened. There is a danger that semi-automatic twist locks can give a false sense of security and that drivers might feel that they do not have to check them

7.1.4.2 Twist Lock Indicator

Each twist lock should be equipped with an indicator, minimum length ±20 cm and painted yellow (safety warning colour RAL-1023) this indicates the open / closed position. The driver should be able to check the position of the indicator from inside his cabin via the rear view mirrors.

Indicator at the front

Indicator at the back

7.1.5 Level indicator

Trailers should be equipped with a level indicator, this enables the driver to check if the chassis position is level before commencing tipping.

The level indicators should be at the rear end of the chassis.

7.1.6 Rear Stabilizing Legs

7.1.6.1 General

Rear stabilizing legs are used to create a level tipping platform; to reduce the potentially damaging effect from product avalanche; twist and torsion on the trailer and to reduce the risk of falling over. Rear stabilizing legs generate a “stable point” on the trailer.

The trailer manufacturers should incorporate the know-how of the manufacturers of the rear stabilizing legs, especially in relation to the attachment process of these legs and to the angles to the chassis and trailer.

Rear stabilizing legs must be fitted with a footplate, no wheels. The stabilizing leg footplate must be minimum 252 mm sq.

7.1.6.2 Technical Evolution

Most stabilizing legs are mechanically operated, consisting of an inner mechanism of a spindle and a nut, which is being moved up and down by a mechanical screwing action by the driver.

Over recent years there have been specific technical developments relating to tipping of products where rear support is required. Rear stabilizing legs have a construction and design different to standard landing legs and can be considered state of the art..

The incorporation of specific safety devices can limit the consequences of rear stabilizing leg failure.

The design should allow reliable maintenance and check of operability. These evolutions in design aim to prevent and reduce the impact of tipping incidents.

7.1.6.3 In-use checks and maintenance

A check is essential when the stabilizing leg does not operate as designed e.g. during winding down/up.

When the equipment has suffered the occurrence of an avalanche a detailed examination of the stabilizing legs must be done.

Maintenance must be done in accordance with the manufacturer's requirements.

A system must be in place to record the maintenance cycles of the rear stabilizing legs as recommended by the manufacturer.

7.1.6.4 Trailers not fitted with rear stabilizing legs

Under certain strict conditions (free flowing product, no lateral inclination of unloading place, pivot point of tipping chassis at, or very close to the rear axle etc..) and subject to a separate risk assessment, tipping of 20' and 30' BIB containers can be done without stabilizing legs. . The use of rear stabilizing legs, even under those strict conditions should be considered & assessed.

The centre of gravity changes in relation to the most rear axle position. See photo below which shows the pivot point at the rear most position,

30‘ Container

With EU regulations related to gross weight and axle loading of transport units, the rear axle position can vary.

7.1.7 Safety Clamps/ Locking pins

Various connections/safety clamps, some with locking pins are used to prevent hoses becoming disconnected during the unloading operation. See below the various types and the Guillemin coupling (Pic 6), sometimes called Symmetric or French coupling. The Guillemin is connected by putting the two halves together and turning the locking rings so that they tighten up behind the claws. The use of clamps (as below) is important, when a unit is elevated there is natural rotational twisting effect which could cause the couplings to become disconnected.

Photo 1

Photo 2

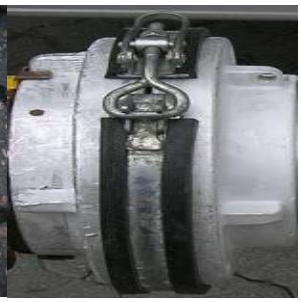


Photo 3

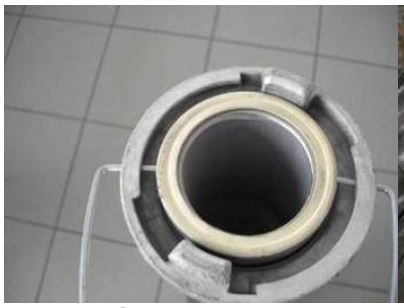


Photo 4

Photo 5

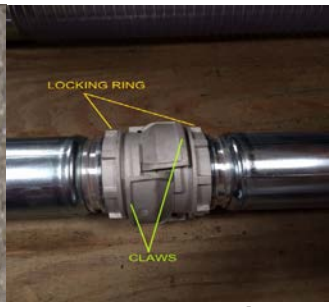


Photo 6

7.2 Additional Safety Equipment

Many new developments in trailer design and equipment take place, some developments are more or less in a test phase and others are close to become a best practice.

When ordering a new trailer consideration should be given to include the new technology and developments as presented in this document as well as future developments.

7.2.1. Sensors on stabilizing legs

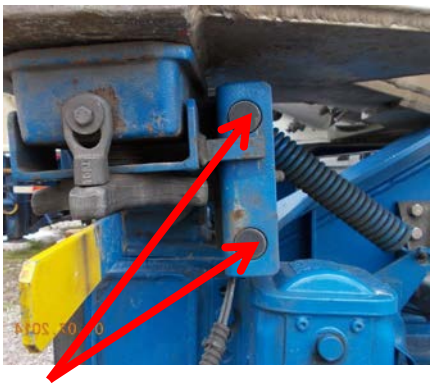
In order to prevent tipping when the rear stabilizing legs are not lowered and before tipping starts, sensors that detect the position of the stabilizing legs or the weight on the stabilizing legs are installed. These can be interlocked with the tipping mechanism.

7.2.2 Interlocked sensors to ensure twist locks are correctly locked.

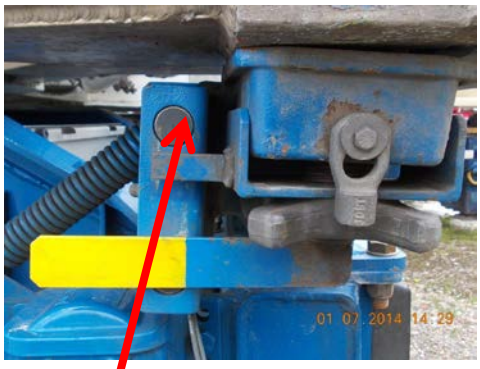
The industry has had numerous accidents involving twist locks that have not been properly locked.

There are systems developed which incorporate safety sensors to ensure twist locks are properly locked. If the sensor senses that the twist lock is not properly locked, this will prevent the trailer from driving and from tipping.

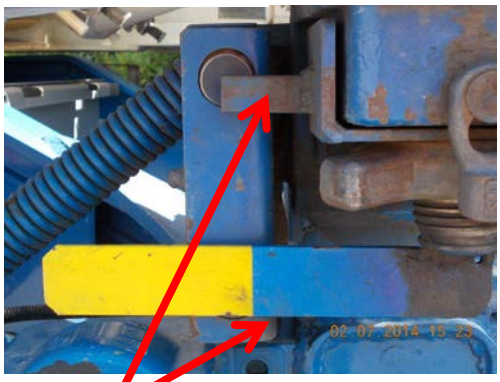
e.g. The below pictures explain the process.



Both parts of this twist lock are not closed, therefore the system will not make contact and it is not possible to tip the chassis



One part of this twist lock is not closed properly, therefore the system will not make contact and tipping is not possible



This twist lock is correctly closed and is picked up by both sensors, allowing for the system to tip the chassis.

7.2.3

De-pressure valve at working height.

After unloading a silo tank trailer has to be de-pressurized. In most cases the valve is positioned on top of the silo tank at the back and the driver has to climb the stairs to open the valve. In some cases the de-pressure valve is located at a lower position. It is also possible to retro fit a hose with a valve at the de-pressure valve on the top of the tank in order to give the driver the opportunity to de-pressure from ground level. (see picture below)

8.0 Tipping Trailers for Containers

8.1 Chassis body

The chassis body is the structure on which the lifting forces are placed to enable the lifting and tipping of the container. The chassis by its very nature is also the running gear of the transport unit. The equipment must therefore be under service regimes that examine not only the “road worthiness” of the chassis but also the lifting, securing and loading (unloading) equipment of the chassis.

The materials of construction used in the chassis body must be type approved for the design purpose of the equipment. This is predominantly “steel” construction, although aluminium is also used in this application.

8.2 Heel Plates

These provide no safety feature in prevention of container detachment, should twist locks have not been properly locked and closed. They are predominantly used as a locating guide when placing the container on the chassis bed.

Twist locks with indicators and heel plates

8.3 Toe Plates.

These are a progression from the heel plate, with a short horizontal beam running under the container when positioned on the twist lock. One of the uses of these arrangements is the short horizontal beam acts as a counter weight to ensure the twist lock is the “right way round” when the chassis is empty ahead of the container being positioned on the twist locks.

Heel and Toe plate.

8.4 Front bolster bar.

The tipping ram will connect to the container via the front bolster bar through the twist locks. This section or frame means that when in tip, the mass is spread across the full bottom rail of the container on the lifting section. It is recommended that the bar is over the full width of the container.

This is compared to a silo tank in lift where the lift is through one point on the barrel.



8.5 Rear Bolster Bar :

This is the rear pivot section of the chassis; the point on which the container / twist locks rotate.

This is an important feature of the tipping equipment and therefore needs to be serviced regularly including a preventative maintenance regime.

It is possible that the rear bolster bar section consists of two separate sections or one, across the full width of the chassis. If the rear bolster consists of two separate rotating bolsters there is the potential risk that the rotating movement is giving an unequal speed during elevation operations. This leads to twisting and potential tip over as the ram lifts the box. This would be greatly enhanced if one of the bolsters failed to rotate whilst the other is rotating.

Full width bolster bars or split bolster bars which are linked by means of a torsion bar (see picture) prevent this unequal rotation and ensure smooth movement of the container when pivoting in the tipping activity, therefore this is recommended for all new tipping equipment.

The picture below shows a rear bolster bar with a 40’ tilting chassis. With 20’ and 30’ chassis this requirement can be met with a permanent (full width) bolster bar.


40’ Connected bolster bars

8.6 Side Beams

Within the BIB sector it is know that some suppliers operate chassis with ‘side beams’ fitted to them. The side beams structurally link the front and rear bolsters on the chassis unit. These side beams operate as an additional safety feature in the unloading of BIB and delivery of free flowing products (See section 6.2).

These provide a rigid platform or bed on which the container sits and is therefore lifted as a single component. These side beams also reduce the likelihood of catastrophic failure and tip over, should a twist lock fail or not be locked closed

With the side beams, the tipping ram is lifting and rotating the “bed” on which the container is sat and not independently lifting the front bolster bar and the container.
The lifting forces are pushed “up” through the front bolster, transmitted through the side beams to the rear bolster to the pivot. Compared to those systems without side beams, where the container is being pushed ‘backwards’ and ‘forced’ to rotate through the twist lock and rear bolster bar.
Here the movement forces are transmitted through the container itself. These side beams transfer the torsion forces that can be present when the container is lifted, from passing through the box to through the rigid beam platform.

These side beams do however add weight to the chassis bed and therefore can be seen as a negative impact on the payload.

8.7 Tipping ram.

The tipping ram is designed to be used as the lifting mechanism and must be prevented from suffering sideways loading.

The most common version of this is a single tipping ram situated at the front centre of the chassis / box tipped to “5 rams high”.

Drivers must be educated in the proper usage of the tipping ram. This is particularly important, if there is a need to lower a loaded box, rather than an empty unit.

The tipping ram, as a mechanical device must be included in an inspection regime and serviced in line with the manufacturers guidelines by an appropriately trained person.

The tipping ram & system should be visually checked in use and as part of the service regimes, to prevent oil leaks and system failures.
It is recommended that oil spill kits are part of the equipment on the chassis, just in case there is failure of the system in use. If these occur on sites then there is a clear expectation the driver reports this to site operative.

Tipping rams are designed with fail safe mechanisms in mind. Should the system fail, then the tipping ram would lower slowly under its own pressure. In most cases these failures are fitted with alarms etc.

9 Requirements for the unloading site/ operator

The majority of incidents that occur during tipping are due to inadequate operational discipline and supervision. Therefore a dual check system (site operator/ driver) must be in place to ensure that some critical checks are done before and during the unloading

9.1 The unloading site should develop a clear instruction on checks to be performed at the site when receiving a trailer with container for unloading. This check should take place before commencing unloading, by a second person (not the driver), in order to make sure e.g. that the **Twist Locks** are properly engaged and secured with the locking pin in place, a so called "Dual Check" sheet has been developed.

SEE ANNEX 1 AND 2 AT REAR OF DOCUMENT

9.2 The degree of supervision of the unloading operations (full time/ spot checks) is the responsibility of the Unloading Site Management and must be based on the Risk Assessment.

9.3 In the absence or part absence of supervision, the driver must receive clear instructions in writing, in a language that he understands.

9.4 Unloading operators must understand the unloading process, therefore they must receive training in unloading of silo trucks/ trailers, silo containers and Bag-In-Box containers.

9.5 During the unloading process the site operator should be aware of the site instructions regarding weather conditions, if in doubt (e.g. high wind, lightening etc) the driver must be informed to stop the unloading. The tipped trailer shall be lowered to a safe or horizontal position. Therefore the unloading site has a duty to develop a clear instruction to stop or adjust the unloading with regard to weather conditions, taking into account the local situation (e.g. unloading location and the wind impact, wind direction and direction of the tilted trailer and the risk of thunder and lightning). The instruction must also indicate the responsible person for monitoring the weather conditions, who is taking the decision to stop the unloading and the method of informing the driver. (see also 5.13).

9.6 More details about responsibilities during unloading: See ECTA

"Best Practice guidelines for Safe (un)loading of Road Freight vehicles, covering Technical, Behavioural and Organisational aspects."

www/ecta.com **www.cefic.org**

10 Requirements for the driver

10.1 Driver training

Drivers must understand the unloading process, therefore they must receive training in unloading of silo trucks/ trailers, silo containers and Bag-In-Box containers.

10.2 General preparations before commencing the unloading

The driver must comply with all site specific requirements and rules (e.g. Personal Protective Equipment).

The truck must be positioned at the unloading area as instructed by site personnel.

The vehicle must be properly immobilized.

See Annex 1 and 2 for adherence to site instructions.

NB The driver should agree with site instructions or raise his concerns.

10.3 Check stabilizing legs.

Visually check the rear stabilizing legs for wear, cracks, deformation and damage. Extend the rear stabilizing legs to touch the ground. In case a leg does not operate easily, the unloading process must be stopped and the legs must be inspected by a qualified person

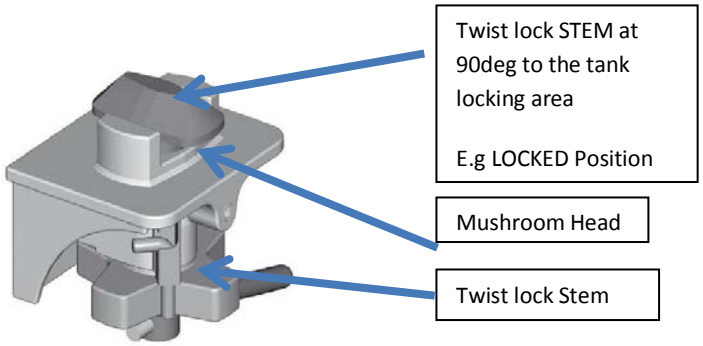
Use the rear stabilizing legs to level the trailer by lowering one of them. Make sure that the legs are at approximately 90° to the ground and free of torsion/ twisting tension. If this is not the case, raise the legs to release torsion/ twisting action and re-adjust using the brakes, before lowering legs again as stated above.

Brakes on the truck and trailer must be applied, the rear stabilizing legs positioned and the trailer levelled and air dumped from the air suspension of the trailer. If braking is done after the stabilizing legs are on the ground, the wheels may shift slightly, thus moving the stabilizing legs to an angle, which is dangerous and can damage them.

Bent stabilizing legs and should be changed

10.4 Check twist locks (for containers only)

The mushroom head of the bolt should be completely embedded (at 90deg – see below)in the twist lock when the twist lock is closed properly. This means that the bolt is properly inserted, also check and ensure that the Twist Locks are engaged and secured, with locking pin in place



Before unloading the driver must screw down the hand nut of all twist locks tightly (no spanner needed)

10.5 Set up the delivery equipment.

The driver will then set up his delivery equipment in line with his driver manual and following the site rules.

10.6 Sample Taking

Samples (if required) need to be taken from ground level whenever possible e.g. at unloading valve. In the event that samples are required from the top, the "Working at Height at Site Safety Instructions" must be followed (e.g. stairs, fall arrest system and safety harness).

10.7 Connect the unloading hoses to the silo.

The driver will have been instructed by or the site operator will have connected the discharge hose to the correct silo and both signed off on the delivery check list (if in use).

Make sure that the hose is connected to the right silo.

Put the safety clamps on the couplings.

10.8 Tipping

The tipping must be done according to instructions based on the risk assessment which is determined by the fluidity of the product

10.9 Position of the driver

The 'Danger Zone' is the area around a tipped trailer and the Reduced risk zone is the zone where the driver has to stand during the unloading process trailer (see 4.2).

While tipping the trailer up or down or when the trailer is in a raised/ tipping position, the driver must stay in the reduced risk zone. It is **NOT** allowed to enter the danger zone. There are three exceptions:

- to operate the tipping switch
- to re- adjust the pressure of the air compressor (in cabin)
- to check the tipping equipment e.g. hydraulic system, pressure

After these activities have been carried out, the driver must immediately step back into the reduced risk zone.

In all other cases, when there is a requirement for the driver or another person to enter the danger zone and the trailer is in the tipped position, the unloading must be stopped.

10.10 Weather conditions

During the unloading process the driver should be aware of the weather conditions, if in doubt (e.g. high wind, lightening etc) the unloading should stop and the site operator informed. The tipped trailer should be lowered to a safe or horizontal position. (see also 5.13)

10.11 Overhead obstructions

Sufficient free overhead space should be available above the truck so that tipping is not obstructed e.g. no overhead electricity lines, no piping or any other obstacles.
During tipping, the driver must check if the overhead space is sufficient and not obstructed

10.12 Completion of unloading.

After completion of the unloading, the unloading valve must be closed, the compressor switched off and the tilted trailer/ container lowered to its horizontal position. After this, the hoses and earthing cable are to be disconnected and the silo truck/ trailer, silo container must be depressurized before driving away.

10.13 Spills

Any spilled product must be cleaned up immediately and disposed of according to the applicable laws. Spills may never be allowed to enter drains of sewer systems.

10.14 Reporting problems

Drivers must report any incident or deviation (including spillage) during the unloading process to the receiving operator and his transport company.

11 Requirements for Inspectors/ Observers

11.1 Unloading operations must be supervised.
Therefore, regular checks must be done to ensure that the operations are done safely.
Checks can be done by representatives of the haulier, the supplier, or the unloading site.
Inspectors/ observers must receive proper training in the unloading process.

11.2 The inspector/ observer must be 'the example' and set the standard.
The inspector/ observer must wear the prescribed PPE and must never enter a danger zone when the trailer is in the raised position. The inspector/ observer must be familiar with the minimum safety requirements concerning the: See Annex 3

- Unloading Area
- Unloading Procedure Driver
- Site Instructions

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Annex 1 Example Risk Assessment unloading place

Requirement	Yes No N/A	Risk in case of non compliance	P	E	S	R	Possible Mitigation/ control measures
The unloading area is located within the site premises NOT on the public road		A raised silo/ container can topple sideways when it is hit by another vehicle causing injury or death to people passing by or damage equipment, vehicles etc. Evaluate amount of traffic passing by, pedestrians etc.	**1**	**6**	**15**	**90**	Change unloading location. If not possible consider the following options. Close the street during unloading activities or implement high visibility cones around the discharging vehicle, encouraging passing vehicles to slow down and to pass with a greater distance. Implement physical barriers at either end of the discharging vehicle, forcing pedestrians to use the walkway on either side of the road. Allow only unloading outside rush hours, at quieter times of the day. Also check whether there is a permit from the local authorities to unload from the public road and if yes, what the conditions in this permit are.
Trucks have an easy access to the unloading area with no obstructions		Collision risk	**6**	**6**	**5**	**108**	Make sure that there is a clear, safe access with sufficient room for the vehicle to manoeuvre.
The driver receives assistance in case reversing to the unloading point is necessary in an area where pedestrians or vehicles are moving or where there is a risk of hitting obstructions.		Collision risk	**6**	**6**	**3**	**108**	Look for an alternative way to access the unloading place. If not possible: provide assistance by an operator, improve signage (e.g. 'reverse STOP')
The surface of the unloading area is firm and even and not on an incline.		Toppling sideways of silo/ container in case of unstable underground or if on an incline	**3**	**6**	**15**	**270**	Establish whether discharging equipment is designed to discharge on an incline. A slight slope in longitudinal line of the vehicle could be accepted. In that case, discharge with the tractor facing down the incline thereby moving the centre of gravity closer to the centre of the vehicle/ trailer is recommended. Lateral angles of slope (e.g. left to right across the chassis) are not acceptable.

The surface of the unloading area can withstand an axle load of 12 ton		Toppling sideways of silo/ container in case of unstable underground	**3**	**6**	**15**	**270**	No unloading at this location
The surface of the unloading area is properly drained and free from trip hazards		Personal injury (slipping, tripping)	**6**	**6**	**3**	**108**	Remove water, trip hazards etc..
The rear stabilizing leg support area is preferably made of concrete. It can withstand a weight of 25 ton per rear leg foot (20x30 cm) without deformation (asphalt becomes soft under high ambient temperatures). The design/ strength of the rear leg support area must be based on calculation and must take into account sewer systems and underground pipelines.		Toppling sideways of silo/ container in case of unstable underground	**3**	**6**	**15**	**270**	Suitably designed blocks or metal plates which are at least twice the size of the stabilizing leg feet can be used under the legs to distribute the load.. Do not use wooden planks.
There is no overhead obstruction (pipelines, gantries, power cables..) which may be hit by the silo/ container if it is tipped in its highest position. (up to 13 m vertical clearance depending on silo/ container size)		Damage to equipment, product release etc.. when silo/container hits pipelines cables in raised position	**6**	**6**	**3**	**108**	Move the unloading area away from the obstructions
The lay out of the unloading area must be such that the traction unit and trailer can be positioned in a straight line		Toppling sideways of silo/ container	**3**	**6**	**15**	**270**	
Within an area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the truck (and in addition 5 m behind a container truck) , there is no vulnerable equipment (pipelines with dangerous goods, steam lines, power cables, pumps etc..) that can be damaged in case the trailer would topple over sideways.		Damage to equipment, product spillage, unit outage in case of unit toppling sideways	**3**	**6**	**15**	**270**	Take into account all other identified risks. Depending on this, consider to move all vulnerable equipment out of the danger zone or provide proper protection (e.g. by means of a steel structure)
Within an area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the truck (and in addition 5 m behind a container truck), there are no vehicle movements (e.g. cranes, forklifts, cars..)		Injury, damage to equipment, product spillage, case of unit toppling sideways	**3**	**6**	**15**	**270**	Fence off the area during unloading operations. If not possible, carry out a specific risk assessment
Within an area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the truck (and in addition 5 m behind a container truck), there are no other silo/ container trucks being unloaded		Injury, damage to equipment, product spillage, case of unit toppling sideways	**3**	**6**	**15**	**270**	Take into account all risks related to the unloading of these trucks in order to decide whether or not this is acceptable.

People, apart from the driver, are not allowed to enter the area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the tipping trailer (and in addition 5 m behind a container truck).		Personal injury when silo/ container topples sideways. Risk of entrapment (movable parts silo truck/ tipping chassis)	**3**	**6**	**15**	**270**	Fence off the area during unloading operations. If not possible, keep the presence of people in the danger zone to an absolute minimum.
The danger zone of 13 m (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the tipping trailer (and in addition 5 m behind a container truck).left and right of the truck (and in addition 5 m behind a container truck) is well marked/ signposted.		People moving into the danger zone.					Use mobile sign posts, retractable barrier tape etc..
The intake point to the silo is readily accessible to connect the hose to.		Personal injury (tripping, fall from height etc..)	**3**	**6**	**1**	**18**	Move intake point to a better location.
The intake point is marked with the silo nr and is locked . The driver receives a document with the silo nr on it. The operator indicates where to connect to.		Unloading into wrong silo (Quality risk)					The connection of the hose to the inlet line is done by the operator.
A shelter, outside the danger zone and with a free view to the back of the truck, is available for the driver, from this location he can observe the unloading process.		Driver exposed to extreme weather conditions. Driver could go into his cabin to take shelter.					
At the unloading site there is an anemometer to measure the wind speed. The system gives an alarm in case of high wind speeds or strong gust of wind in which case the unloading must be stopped. (recommended settings: average wind speed 4 beaufort).		Toppling sideways of silo/ container.	**3**	**6**	**15**	**270**	Install anemometer and procedure to stop unloading above a minimum value
In case the unloading site requires a sample from the top of the silo/ container, adequate Working at Height facilities (e.g. life line system with safety harness, mobile safety stairs etc..) are available.		Fall from truck	**6**	**6**	**7**	**252**	No sampling, and if required take bottom sample. If top sample is required, provide proper WAH facilities (platform life line system etc..)
The product characteristics are known (free flowing or not). In case product is not free flowing:		Avalanche risk and more risk of vehicle tipping over	**3**	**6**	**15**	**270**	Fence off the area during unloading operations. If not possible, keep the presence of people in the danger zone to an absolute minimum……

P= Probability that the risk occurs							
0		Theoretically impossible					
0,1		Virtually impossible					
0,2		Practically impossible					
0,5		Thinkable but unlikely					
1		Only borderline possible					
3		unusual but possible					
6		occurrence very well possible					
10		occurrence to be expected					

E= exposure to the risk							
0		No exposure					
0,5		Very rarely -once a year					
1		rarely - a few times per year					
2		Unusual - monthly					
3		Occasional - weekly					
6		Frequently - daily					
10		continuously					

S = Severity : possible damage and consequences when the risk occurs							
0		No damage					
1	Minor	First aid					< 250 €
3	Important	adapted work					< 2500 €
7	Serious	Days away from work					< 25.000 €
15	Very serious	1 fatality					< 250.000 €
40	Disaster	multiple fatalities					> 250.000 €

R = Risk index = P x E x S		
0		No Risk
1	<= 20	Probably acceptable risk
2	20 < R <= 70	requires attention
3	70 < R <=200	requires improvement
4	200 <R <= 400	immediate measures required
5	R > 400	consider to stop activities

Annex 2 Example Checklist to Risk Assess unloading site

Checklist to assess risks of unloading silo trucks/ silo containers and Bag in Box containers by tipping

Nr	UNLOADING AREA and EQUIPMENT	Yes, No, N/A	Comments
1	The unloading area is located within the site premises and NOT on the public road		
2	Trucks have an easy access to the unloading area with no obstructions		
3	The driver receives assistance in the event that reversing to the unloading point is necessary in an area where pedestrians or vehicles are moving or where there is a risk of hitting obstructions.		
4	The surface of the unloading area is firm and even and not on an incline		
5	The surface of the unloading area can withstand an axle load of 12 ton		
6	The surface of the unloading area is properly drained and free from trip hazards		
7	The rear stabilizing leg support area is preferably made of concrete. It can withstand a weight of 25 ton per rear leg foot (252 mm sq) without deformation (asphalt becomes soft under high ambient temperatures). The design/ strength of the rear leg support area must be based on calculation and must take into account sewer systems and underground pipelines.		
8	There is no overhead obstruction (pipelines, gantries, power cables..) which may be hit by the silo/ container if it is tipped in its highest position. (up to 13 m vertical clearance depending on silo/ container size)		

9	The unloading area has lighting adequate for discharge operations during the hours of darkness which covers the complete unloading area		
10	The lay out of the unloading area must be such that the traction unit and trailer can be positioned in a straight line		
11	The surface of the unloading area should be made of suitable material minimizing dust and other material (e.g. gravel) in order to avoid contamination of the product. The working area should be adequate anti-slip, properly drained, frequently cleaned, be kept snow and ice free and free from tripping hazards.		
12	The unloading area has a well marked earthing connection		
13	A spill kit is available in case of leakage of hydraulic oil, diesel or cooling water.		
14	Within an area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the truck (and in addition 5 m behind a container truck) , there is no vulnerable equipment (pipelines with dangerous goods, steam lines, power cables, pumps etc..) that can be damaged in case the trailer would topple over sideways.		
15	Within an area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the truck (and in addition 5 m behind a container truck), there are no vehicle movements (e.g. cranes, forklifts, cars..)		
16	Within an area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the truck (and in addition 5 m behind a container truck), there are no other silo/ container trucks being unloaded		
17	People, apart from the driver, are not allowed to enter the area of 13 meter (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the tipping trailer (and in addition 5 m behind a container truck).		

18	The danger zone of 13 m (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of the tipping trailer (and in addition 5 m behind a container truck).left and right of the truck (and in addition 5 m behind a container truck) is well marked/ signposted		
19	The intake point to the silo is readily accessible to connect the hose to.		
20	The intake point is marked with the silo nr and is locked. The driver receives a document with the silo nr on it. The operator indicates where to connect to		
21	A shelter, outside the danger zone and with a free view to the back of the truck, is available for the driver, from this location he can observe the unloading process		
22	At the unloading site there is an anemometer to measure the wind speed. The system gives an alarm in case of high wind speeds or strong gust of wind in which case the unloading must be stopped. (recommended settings: average wind speed 4 Beaufort scale)		
23	In case the unloading site requires a sample from the top of the silo/ container, adequate working at height facilities (e.g. life line system with safety harness, mobile safety stairs etc..) are available.		

Nr	**Safe unloading procedure: DRIVER**		
1	Drivers must be trained in safe unloading of bulk silo's/ containers and must be informed about the risks		
2	Driver wears required PPE		
3	If the driver is requested to take a top sample, he uses the working at height facilities which are provided to do this safely (e.g. life line system, mobile safety stairs etc..)		
4	Brakes on tractor and trailer are applied (before lowering the rear landing legs)		
5	Wheel chocks are placed		

6	In case of a container delivery: it is checked that the 4 twist locks are fully engaged in the corner castings, the hand nuts are well tightened and fully locked with a locker system. Also semi-automatic twist locks must be manually tightened !!		
7	The rear legs are checked for wear, cracks, deformation and damage		
8	The rear legs are extended to the ground. (In case a leg does not run smoothly up and down, the unloading process is stopped and a check by an expert is done)		
9	The air in the air suspension is dumped so that the trailer completely rests on the stabilizing legs		
10	The stabilizing legs are used to level the trailer (see level indicator). The stabilizing legs are approximately 90° to the ground and have to be free of tension.		
11	To avoid tension of the stabilizing legs the brakes on tractor and trailer have to be applied again after dumping air pressure of the air suspension		
12	The earthing cable is connected		
13	The unloading hose is connected to the correct silo - safety clamps are installed on all (reducing) couplings		
14	The silo/ container is tipped in several stages (to keep the centre of gravity as low as possible). No tipping at the start of the unloading. Tipping in several stages until 2/3 of full tipping capability. Tipping to max height only for last 2 tons. **Exception**: powders which may cause avalanche risk require immediate tipping to the max height.		
15	The driver stays in the reduced risk zone of the truck, but outside the danger zone 13 m (silo truck), 11,5 meter (30' container) or 9 meter (20' container) left and right of truck. in addition 5 m behind the truck for containers). Exceptions: - to operate the tipping switch - to re-adjust the pressure of the air compressor - to check the tipping equipment		

16	In case of changing conditions which may create a dangerous situation (people entering the danger zone?, high wind speeds..) the unloading is stopped and the silo/ container is lowered		
17	Lowering a loaded silo/container should be done with great caution regarding the forces that are present in the tipping ram.		
18	After discharge: valves are closed, the compressor is switched off and the silo/container is lowered to its horizontal position. Earthing cable and hoses are disconnected. Rear legs are retracted..		
19	There is No unloading into small receptacles in case of insufficient capacity in the silo (Octabins, Big Bags..)		
20	All incidents are reported		
21	All unsafe conditions (e.g. uneven ground for tipping), near misses (people moving in danger zone), technical problems (e.g. unwinding rear legs) etc are reported		
22	Spilled product is cleaned up immediately		

	Safe unloading procedure: UNLOADING SITE		
1	It is checked that there is enough capacity in the silo. (No unloading into small receptacles !)		
2	The driver receives clear instructions in a language that he understands (or visual instructions): These must comprise as a minimum - the exact unloading location, route and silo nr - the site safety requirements (PPE, emergency rules..) - the unloading instructions (e.g. max unloading pressure)		
3	The unloading operator gives the OK to unload and indicates the inlet connection. He supervises that the connection to the right inlet line is made.		

4	In case of a container delivery: it is checked by the operator (in addition to the driver) that the 4 twist locks are fully engaged in the corner castings, the hand nuts are well tightened and fully locked with a locker system. Also semi-automatic twist locks must be manually tightened !!		
5	There is a clear procedure to stop the unloading at high wind speed conditions. The procedure indicates and who is responsible to take this decision.		
6	There is supervision of the unloading operations (based on a risk assessment)		
7	Spilled product is cleaned up immediately		
8	Unloading operators must be trained in safe unloading of bulk silo's/ containers		

	Safe transport equipment (extra requirements)		
1	Twist locks on tipping chassis are fitted with twist lock indicators with a minimum length of 20 cm and are painted in yellow (Safety warning colour RAL-1023)		
2	The rear landing legs are fitted with flat bottom plates, NO wheels. They must be equipped with devices to limit the consequences of a sudden drop though the spindle and allow easy maintenance and checks.		
3	The haulier has a yearly inspection and maintenance program for the rear landing legs		
4	The dead man switch, to tip the silo/ container, requires the driver to push the button during raising the silo/ container. (this function may never be by-passed !!)		
5	The dead man switch must be located at the back of the trailer (close to the safe zone). (Remote control systems to allow the driver to remain outside the danger zone will become mandatory) N B No remote control in the case of a container.		
6	The trailer is fitted with a level indicator located close to the rear legs allowing to level the trailer correctly		

7	Safety clamps are used to prevent unwanted disconnection of the hoses		
8	Recommended: Interlocked sensors on stabilizing legs		
9	Container chassis :- ➢ Required: full width rear bolster bars or split bolster bars which are linked by means of a torsion bar ➢ Recommended: Interlocked sensors to secure fastened twist locks ➢ Recommended heel plates ➢ Recommended toes plates ➢ Recommended that the front bolster bar is over the full width of the container ➢ Recommended: side beams		

Annex 3 Inspector / Observer Checklist for unloading place

Nr	Inspector/Observer Checklist to assess risks	Yes, No, N/A	Comments
1	The measures as identified in the risk assessment of the unloading place have been taken.		
2	It is checked that the receiving silo has sufficient capacity to accept the consignment		
3	Tipping operations are clear of overhead obstructions		
4	All unnecessary personnel are excluded from the danger zone.		
5	There are no other operations (dangerous activities) going on in the danger zone		
6	The driver is wearing the right PPE (Personal Protective Equipment)		
7	The unloading area is clean (e.g. free from granules, ice and snow), free from obstacles		
8	The site requirements regarding weather conditions are met		
9	The Brakes of the truck have been applied		
10	The truck is well positioned according to the site instructions		
11	The tractor unit and semi-trailer are in line		
12	In case of a container, the twist locks are in locked position and the hand nut is well secured and locked with a locking pin or alternative system		
13	The driver could easily operate the rear stabilizing legs, there was no extra power needed to lower the legs.		
14	The rear stabilizing legs touch the road surface		
15	The road surface is stable, even, firm and is not damaged		
16	The stabilizing legs are free from cracks, deformation and damage		
17	The trailer is equipped with a level indicator and levelled with the rear stabilizing legs.		
18	Hoses are fitted with a restraint system (safety clamps/ collars/ locking pins..) to prevent that they become inadvertently detached under pressure		

19	The product characteristics (free flowing or not) are known and the driver follows the right unloading procedure: this means i. For non-free flowing products (e.g. sticky powders): tilting to the maximum ii. For free-flowing products (e.g. PE/PP/PVC granules): no elevation until the full height at the beginning of unloading and then progressive raising at appropriate intervals.		
20	The driver is in the reduced risk zone and only enters the danger zone for the following activities. iii. to manipulate the tipping switch iv. to re- adjust the pressure of the air compressor v. to check the tipping equipment (e.g. hydraulic piston and pressure).		
21	The driver is supervised during the unloading process		
22	The silo/ container is slowly lowered to the horizontal position immediately after completing of the unloading.		
23	All spilled product has been cleaned up according to site requirements		