Original instructions

Tugger train

Routenzug-10
Routenzug-16

CE

0504 0506 0508 0510

50988012117 EN - 02/2015

first in intralogistics

4 Overviews

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1

Foreword

General

About these operating instructions

These operating instructions describe daily operation of the tugger train in detail and can be used as a source of information by both new and trained operators.

The operating instructions are not intended to be a technical or service manual. For technical or maintenance issues that are not covered in these operating instructions, please contact your authorised service centre.

Manufactured by:

LR Intralogistik GmbH

Siemensstraße 15

84109 Wörth an der Isar

Germany

Distribution and service by:

STILL GmbH

Berzeliusstr. 4

22113 Hamburg

Germany

Issue date and topicality

The issue date of these operating instructions can be found on the title page.

STILL makes continuous efforts to enhance and improve its trucks. These operating instructions are subject to change, and any claims based on the information and/or illustrations contained in them cannot be asserted.

If you require technical support for the vehicle, please contact the authorised service centre.

Have a good trip, your partner

STILL GmbH

Berzeliusstr. 10

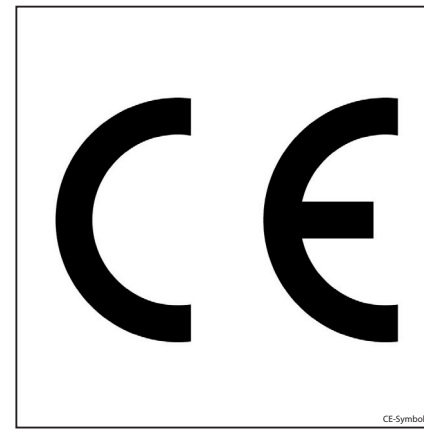
22113 Hamburg, Germany

CE labelling

The manufacturer uses CE labelling to indicate that the frame complies with the standards and regulations valid at the time the frame was placed on the market. Compliance is confirmed by the issue of an EC declaration of conformity. The CE labelling is attached to the nameplate.

An unauthorised structural change or addition to the frame can compromise safety, thus invalidating the EC declaration of conformity.

The EC declaration of conformity must be carefully stored and made available to the relevant authorities.



EC declaration of conformity in accordance with Machinery Directive

Declaration

LR Intralogistik GmbH
Siemensstraße 15
84109 Wörth an der Isar

We declare that the

Device description:	**Corresponding to these operating instructions**
Device type:	**Corresponding to these operating instructions**

conforms to the latest version of the Machinery Directive 2006/42/EC.

Personnel authorised to compile the technical documents:

See EC declaration of conformity

LR Intralogistik GmbH

Information about the documentation

Copyright and trademark rights

Explanation of information symbols used

⚠ DANGER

Indicates procedures that must be strictly adhered to in order to prevent the risk of fatalities.

⚠ WARNING

Indicates procedures that must be strictly adhered to in order to prevent the risk of injuries.

⚠ CAUTION

Indicates procedures that must be strictly adhered to in order to prevent material damage and/or destruction.

NOTE

For technical requirements that require special attention.

ENVIRONMENT NOTE

To prevent environmental damage.

Terms and definitions

Chassis

The chassis is a trailer for picking up loads.

It is suitable for picking up Trolleys of all sizes.

The frame must be lifted to ensure safe, low-noise transportation. Depending on the design, this operation can be carried out using a hydraulic or pneumatic system. The tow tractor for the frames must therefore be fitted

with either a hydraulic power unit or an air compressor.

"Self-sufficient" chassis

When using a "self-sufficient" chassis, neither a hydraulic unit nor an air compressor is required. These chassis can raise and lower their load without the need for a hydraulic or pneumatic supply.

Operating principle: One load wheel on the frame drives one pump with a tank. The generated oil pressure is stored in a spring accumulator. This oil pressure is used to raise the load and is fed back into the tank when the load is lowered.

The "self-sufficient" model is only available for E chassis.

Articulated steering system

An articulated steering system consists of a rigid tiller and a hinged tiller. The articulated steering system allows driving on ramps and stabilises the tugger train in the vertical plane - prevents the frames from rocking.

Hinged tiller

The hinged tiller connects two articulated frame steering rigs and the tow tractor to a tugger train.

Compensating hinge

The compensating hinge is fitted to the first articulated frame steering rig as a holding fixture for the hinged tiller on the second articulated frame steering rig.

Trolley

A rolling platform (Trolley) is pushed into the frame for transportation. Depending on the design of the "Trolleys" and of the frame, a frame can hold one or more trolleys.

Tugger train

The unit consisting of the frames and a tow tractor is known as the "tugger train".

Environmental considerations

Packaging

When the chassis are delivered, certain parts are packaged to provide protection during transportation. This packaging must be removed completely prior to commissioning.

ENVIRONMENT NOTE

The packaging material must be properly disposed of after delivery of the chassis.

Disposal of units and hydraulic oil

It may be necessary to exchange units as part of maintenance work. Exchanged units must then be disposed of.

A chassis is made of different materials. Each of these materials must be

- disposed of,
- treated or
- recycled in accordance with regional and national regulations.

ENVIRONMENT NOTE

We recommend working with a waste management company for disposal of hydraulic oil or other hazardous materials.

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Introduction

Use of the tugger train

Intended use

The frames are intended solely for the following purpose:

- Picking up and transporting Trolleys loaded with equipment in order to transport them to a workplace and exchange them for empty Trolleys.
- A chassis must only be loaded with the Trolleys intended for this purpose.
- A C frame or an E frame may only be pulled by a suitably equipped (pneumatic/hydraulic) tow tractor (not by a truck!).
- An autarkic E frame may only be pulled by an appropriate tow tractor (not by a truck!).

⚠ WARNING

The frames are designed for a maximum speed of 15 km/h.

If a tow tractor is used that can travel faster than 15 km/h, its maximum speed must be limited to 15 km/h in order to guarantee safe operation of the chassis.

The chassis may only be used for its proper purpose as set out and described in these operating instructions!

If the chassis is to be used for purposes other than those specified in the operating instructions, the approval of the manufacturer and, if applicable, the relevant regulatory authorities must be obtained beforehand to prevent hazards.

Improper use

The operating company or driver, and not the manufacturer, is liable for any hazards caused by improper use.

Use for purposes other than those described in these operating instructions is prohibited.

- A chassis may not be operated in areas where there is a risk of fire, explosion or

corrosion, or in areas that are particularly dusty.
- A chassis must not be loaded or unloaded on slopes or ramps.
- Transportation of people is prohibited

Requirements for the tow tractor

General requirements for the tow tractor

The tow tractor must have a steered front axle.

The maximum speed of the tow tractor must be limited to 15 km/h.

The towing jaws of the tow tractor must correspond with the LR standard (bolt ≥ 28.5 mm, vertical play = 70 mm).

It must be ensured that the tow tractor cannot be moved before all frames are fully raised.

Hydraulic C frame

- A suitable hydraulic power unit with the following properties must be fitted to the tow tractor: operating pressure: 180-200 bar; flow rate: approx. 10 l/min; coupling in accordance with ISO 16028
- There must be at least 2 litres of hydraulic oil (HLP46) in the hydraulic system
- The hydraulic connection must be fitted close to the tow coupling of the tow tractor
- The maximum permitted tractive force of the tow tractor must not exceed 16,000 N

Hydraulic E frame

- A suitable hydraulic power unit with the following properties must be fitted to the tow tractor: operating pressure: 180-200 bar; flow rate: approx. 10 l/min; coupling in accordance with ISO 16028
- There must be at least 2 litres of hydraulic oil (HLP46) in the hydraulic system
- The maximum permitted tractive force of the tow tractor must not exceed 2000 N With a reinforced hinged tiller (UPA), the maximum tractive power of the tow tractor must not exceed 5000 N

Pneumatic E frame

- Depending on the design of the E frames, the tow tractor must have a compressor of the corresponding size:

- For frames with a 600 kg load capacity: 7 bar working pressure

- For frames with a 1000 kg load capacity: 10 bar working pressure

Residual risk

Residual risk

Residual dangers, residual risks

Despite careful work and compliance with standards and regulations, the occurrence of other risks when using the chassis cannot be entirely excluded.

The chassis and all other system components comply with current safety requirements. Nevertheless, even when the chassis are used for their proper purpose and all the instructions specified here are followed, some residual risk cannot be excluded.

Even beyond the narrow danger areas of the chassis, a residual risk cannot be excluded. Persons in this area must exercise a heightened degree of awareness towards the chassis and the tugger train as a whole, so that they can react immediately in the event of any malfunction, incident or breakdown etc.

⚠ WARNING

All persons that are in the vicinity of the chassis must be instructed regarding these risks that arise through use of the chassis.

In addition, attention must be drawn to the safety regulations in these operating instructions.

The risks can include:

- Escape of consumables due to leakages, rupture of lines and containers etc.
- Risk of accident when driving over difficult ground such as gradients, smooth or irregular surfaces, or poor visibility etc.
- Falling or tripping when loading or unloading the Trolleys into or out of the chassis.
- Human error - Disregarding safety regulations.
- Risk caused by unrepaired damage.
- Risk caused by insufficient maintenance or testing.
- Risk caused by using the wrong consumables.
- Risk caused by exceeding testing intervals.

The manufacturer is not held responsible for accidents involving a chassis caused by the operating company's intentional or negligent failure to comply with these regulations.

Danger to employees

According to the German workplace safety ordinance (BetrSichVO) and labour protection law (ArbSchG), the operating company

must determine and assess hazards during operation, and establish the occupational health and safety measures required for employees. The operating company must therefore draw up appropriate operating procedures (§ 6 ArbSchG) and make them available to the driver. These operating instructions for the frames do not form the operating procedures. A responsible person must be appointed.

The structure and equipment of the frames correspond to the Machinery Directive 2006/42/EC and are therefore identified with the CE mark. The operating company must, however, select the frame type and frame equipment so as to comply with the local provisions for deployment.

The result must be documented (§ 6 ArbSchG). When deployment of the frames involves similar hazard situations, the results may be summarised. This summary is designed to help to meet the requirements of this regulation. The summary specifies the primary hazards that, in the event of non-compliance, are the most frequent causes of accidents. If other major hazards are present as a result of the specific operating conditions, these hazards must also be taken into consideration.

The conditions of use for the frames are broadly similar in many plants, so the hazards can be summarised in one overview. The information provided on this subject by the relevant employers' liability insurance association or national authorities must be observed.

3

Safety

Definition of terms used for responsible persons

Personnel

All operators must:

- Have read and understood these operating instructions.
- Have completed the appropriate operator training
- Observe the basic regulations governing safety at work and accident prevention.

⚠ DANGER

Taking drugs, alcohol or medications that affect the responses of an individual limits the ability of that individual to drive a tugger train!

Individuals under the influence of the aforementioned substances are not permitted to perform any work on or with a tugger train.

Operating company

The operating company is the natural or legal person or group who uses the chassis or on whose authority the chassis are used.

The operating company must ensure that the chassis are used only for their intended purpose, and that they are used in compliance with the safety regulations set out in these operating instructions.

The operating company must ensure that all operators of the chassis read and understand the safety information.

The operating company is responsible for the scheduling and correct performance of regular safety checks.

We recommend that the national performance specifications are adhered to.

The operating company must make personal protective equipment (protective clothing, safety footwear, safety helmet, industrial goggles, gloves) available to the operators of the chassis in accordance with the application conditions.

Specialist

A qualified person is defined as a service engineer or a person who fulfils the following requirements:

- A completed vocational qualification that demonstrably proves their professional expertise. This proof should consist of a vocational qualification or a similar document.
- Professional experience indicating that the qualified person has gained practical experience of industrial trucks over a proven period during their career During this time, this person has become familiar with a wide range of symptoms that require checks to be carried out, such as based on the results of a hazard assessment or a daily inspection
- Recent professional involvement in the field of the industrial truck test in question and an appropriate further qualification are essential. The qualified person must have experience of carrying out the test in question or of carrying out similar tests. Moreover, this person must be aware of the latest technological developments regarding the industrial truck to be tested and the risk being assessed

Basic principles for safe operation

Warning regarding non-original parts

The original parts and accessories are designed specifically for the chassis. We specifically draw your attention to the fact that parts and accessories not supplied by the manufacturer have also not been tested or approved by the manufacturer.

⚠ CAUTION

Installation and/or use of non-original parts may therefore have a negative impact on the design features of the chassis and thus impair active and/or passive driving safety.

Before installing such parts, we recommend that approval is obtained from the manufacturer. The manufacturer accepts no liability for any damage caused by the use of non-original parts and non-approved accessories.

Changes and retrofitting

Changes to the E frames that will adversely affect stability, load capacity and safety systems, among other things, must not be made without the manufacturer's approval.

The E frames must not be converted without written approval from the manufacturer. Approval from the relevant authority must be obtained where applicable.

Damage and defects to safety systems

The operator must report any damage or other defects to a chassis to the supervisory personnel immediately.

A chassis that is not functional or safe to drive must not be used until it has been properly repaired.

Do not remove or deactivate safety devices and switches.

Safety regulations for handling consumables

Oils

⚠ DANGER

Oils are flammable!

– Follow the statutory regulations.
– Do not allow oils to come into contact with hot engine parts.
– No smoking, fires or naked flames!

⚠ DANGER

Oils are toxic!

– Avoid contact and consumption.
– If vapour or fumes are inhaled, move to fresh air immediately.
– In the event of contact with the eyes, rinse thoroughly (for at least 10 minutes) with water and then consult an eye specialist.
– If swallowed, do not induce vomiting. Seek immediate medical attention.

⚠ WARNING

Prolonged intensive contact with the skin can result in dryness and irritate the skin!

– Avoid contact and consumption.
– Wear protective gloves.
– After any contact, wash the skin with soap and water, and then apply a skin care product.
– Immediately change soaked clothing and shoes.

⚠ WARNING

There is a risk of slipping on spilled oil, particularly when combined with water!

– Spilt oil should be removed immediately with oil-binding agents and disposed of according to the regulations.

ENVIRONMENT NOTE

Oil is a water-polluting substance!

- *Always store oil in containers that comply with the applicable regulations.*
- *Avoid spilling oils.*
- *Spilt oil should be removed immediately with oil-binding agents and disposed of according to the regulations.*
- *Dispose of old oils according to the regulations.*

Hydraulic fluid

The following warnings and environmental notes must be observed if the frames are fitted with a hydraulic lifting system.

WARNING

These fluids are pressurised during operation of the truck and are hazardous to your health.

– Do not spill the fluids.
– Follow the statutory regulations.
– Do not allow the fluids to come into contact with hot motor parts.

WARNING

These fluids are pressurised during operation of the truck and are hazardous to your health.

– Do not allow to come into contact with the skin.
– Avoid inhaling spray.
– Penetration of pressurised fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
– To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, industrial goggles, skin protection and skin care products).

ENVIRONMENT NOTE

Hydraulic fluid is a substance hazardous to water.

- *Always store hydraulic fluid in containers complying with the regulations.*
- *Avoid spilling.*
- *Spilt hydraulic fluid should be removed with oil-binding agents at once and disposed of according to the regulations.*
- *Dispose of old hydraulic fluid according to the regulations.*

Disposal of consumables

ENVIRONMENT NOTE

Materials that accumulate during repair, maintenance and cleaning must be collected properly and disposed of in accordance with the national regulations for the country in which the truck is being used. Work must only be carried out in areas designated for that purpose. Care must be taken to minimise any environmental pollution.

– Soak up any spilt fluids such as hydraulic oil or gearbox oil immediately using an oil-binding agent.

– Neutralise any spilt battery acid immediately.

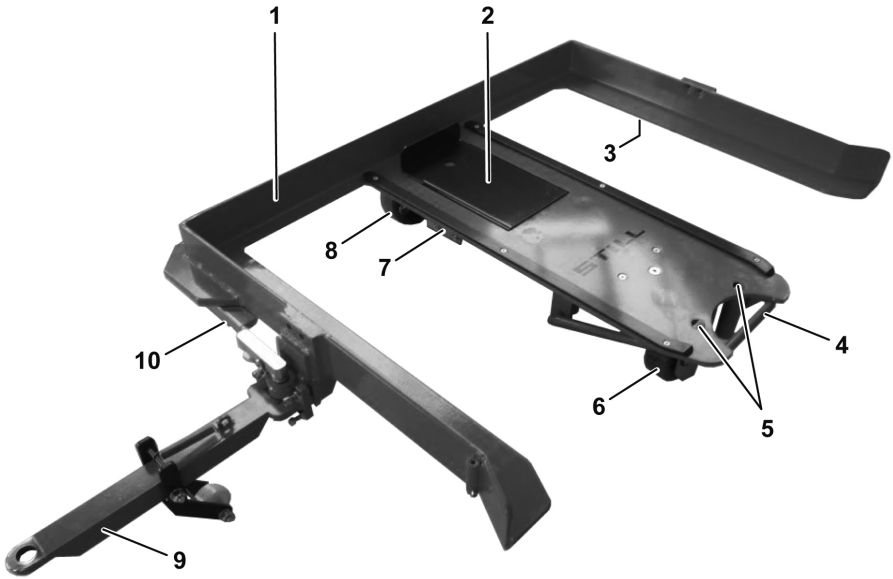
– Always observe national regulations concerning the disposal of used oil.

4

Overviews

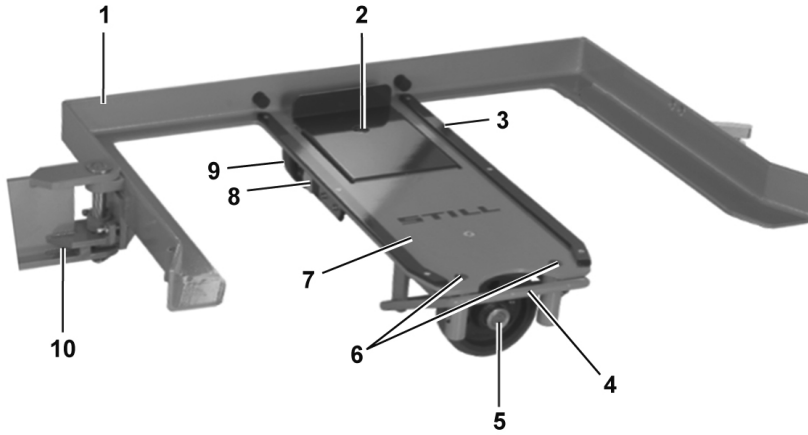
Overall view

E frame



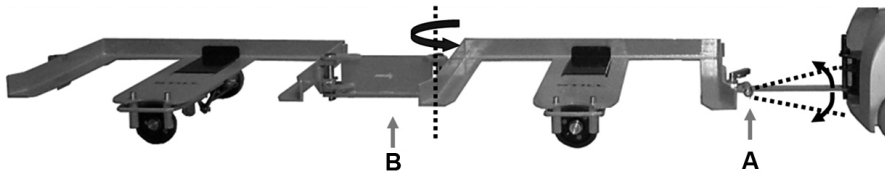
1	Frame	6	Wheel
2	Ejector	7	Lift cylinder
3	Hydraulic/pneumatic connection	8	Wheel
4	Foot pedal	9	Tiller (figure shows standard tiller)
5	Securing bolts	10	Hydraulic/pneumatic connection

Autarkic E frame



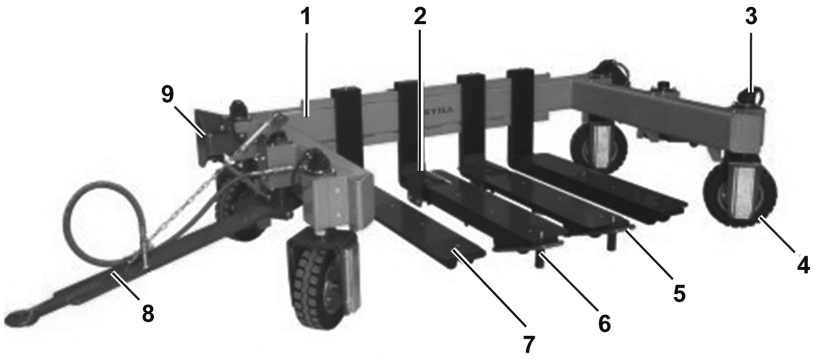
1	Frame	6	Securing bolts
2	Ejector	7	Main load bearer
3	Edge protection	8	Lift cylinder (2x at rear)
4	Foot pedal	9	Drive wheel
5	Load wheel	10	Rigid tiller

Articulated steering system



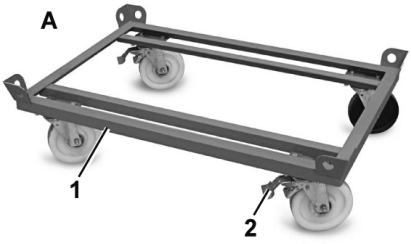
B	Rigid tiller	A	Hinged tiller

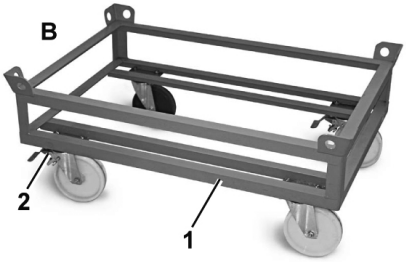
C frame



1	Frame	6	Securing bolts
2	Ejector	7	Fork arms
3	Hydraulic cylinder	8	Tiller
4	Tyre	9	Collision protection
5	Foot pedal		

Trolleys





A	Euro 1/1 trolley – standard design	2	Swivel castors (2 x with wheel brakes, arranged diagonally)
B	Euro 1/1 h trolley		
1	Frame		

The black wheel prevents electrostatic charges.

Description

E frame

The E frame is a device for picking up and transporting roller platforms, known as trolleys.

Two up to a maximum of five E frames (standard) are connected to the tow tractor and can transport trolleys that are loaded with crates, pallets or similar to the desired workplace.

The trolleys are raised by 40 mm for transportation.

The energy required for lifting operations on the E frame is supplied by a unit located in the tow tractor. The frame is lifted by lift cylinders, which are located on the wheel axle, so that the trolley wheels are no longer in contact with the ground.

Loading can performed from the left-hand side or the right-hand side, depending on the alignment of the coupling.

Loads are secured automatically by the securing bolts. These bolts are locked by inserting the trolley.

The E frame has an ejector. This ejector is used to remove the trolleys when changing trolleys.

When the foot pedal is actuated, the ejector is moved forward, the securing bolts retract and the trolley is set in motion by the ejector.

The rubber buffers on the frame (only on the autarkic frame) keep the trolley at the optimum distance from the ejector so that the trolley can be removed more easily.

Autarkic E frame

The autarkic E frame is a device for picking up and transporting roller platforms, known as trolleys.

Two or four E frames are connected to a tow tractor. These E frames can transport trolleys loaded with crates, pallets or similar to the desired workplace.

The E frames are lifted by the integrated hydraulic system on the autarkic E frame. When the accumulator is fully charged, the E frame can be lifted twice by actuating the ejector.

The required energy is supplied by a hydraulic unit that is installed under the E frame. The accumulator on the hydraulic unit is charged during travel. The hydraulic unit therefore has the required energy to lift and lower the autarkic E frame. The accumulator must then be recharged. Driving the tugger train recharges the accumulator. The pressure required to lift the frame is generated over a distance of < 20 m, depending on the ground conditions.

The trolleys are raised by 40 mm for transportation.

When the trolley is inserted, it is automatically secured against rolling out.

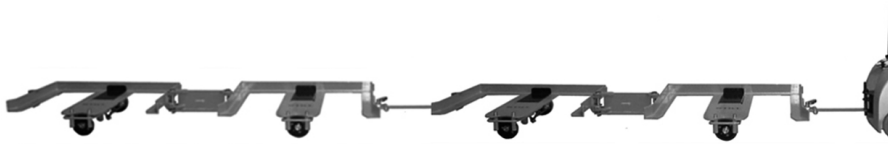
Tugger trains with the autarkic system are always equipped with an articulated steering system (rigid tiller + hinged tiller) for stability reasons. They can consist of two or four E frames (maximum total load of 4 t across the entire train).

NOTE

If trains with four autarkic E frames are used, a compensating hinge must be fitted between the second E frame and the third E frame. The autarkic frames are lowered individually for unloading. If the tugger train drives over a chamfer, it may result in not all frames being raised; the compensating hinge prevents the tugger train from twisting in such cases.

Articulated steering system (driving over ramps)

Function



The articulated steering system allows driving on ramps and stabilises the tugger train in the vertical plane. There is no rocking of the frames.

C frame

The C frame is a device for picking up and transporting roller platforms, known as trolleys.

The tugger train can pull up to four C frames, depending on the tow tractor.

The four-wheel design allows driving on ramps while maintaining a high level of tracking stability thanks to four-wheel steering.

Loading can performed from the left-hand side or the right-hand side, depending on the alignment of the coupling.

The C frame is connected to the wheels by hydraulic cylinders, allowing the trolleys that the frame holds to be lifted up and set down.

The trolleys are hydraulically raised by 80 mm for transportation.

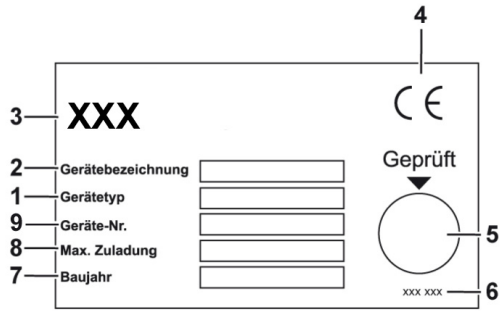
Flexible positioning of the fork arms allows the frame to be adapted for different trolleys.

The C frame has a load securing system. This system is used to secure the trolleys during transport. By depressing the foot pedal, the interlock (securing bolt) of the load securing system on the frame is released and the trolley can be removed. When inserting the trolley, ensure that the securing bolt returns to its locked position.

When the trolley is inserted, it is automatically secured against rolling out.

Labelling points

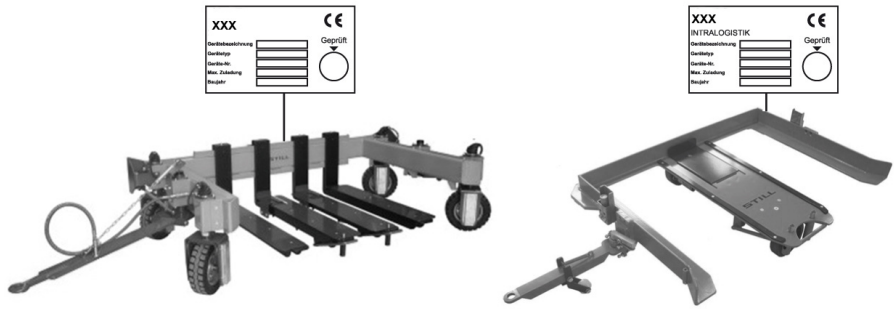
Identification plate



1	Device type	6	Manufacturer contact
2	Device designation	7	Year of manufacture
3	Manufacturer	8	Max. load
4	CE symbol	9	Device number (serial number)
5	Inspection sticker		

The frame can be identified from the information on the nameplate.

Overview



Position of the identification plate

Tugger-train combinations

Overview

Frame	Tiller	Permissible number of frames [3]	Load	Tiller length	Ar-range-ment	Driving over ramps
C frame	Standard	1	See identification plate	–	–	Yes
		2				
		3				
		4				
E frame	Standard	2	See identification plate	[1]	[2]	No
		3				
		4				
		5	See identification plate [4]			
	Rigid + hinged* (optional)	2 (1+1)	See identification plate [4]	[1]	[2]	Yes
		4 (2+2)				
Autarkic E frame	Rigid + hinged*	2 (1+1)				
		4 (2+2)				

* A tugger train with four frames (two articulated frame steering rigs) must have a compensating hinge fitted between the first articulated frame steering rig and the second articulated frame steering rig (only on autarkic frames or as an option). For E frames, the articulated frame steering rig must consist of two frames of the same type (angular frame + angular frame or tubular frame + tubular frame). In general, articulated frame steering rigs must be moved with an even number of trailers (two or a maximum of four trailers).

1) The tiller length for each E frame must be adapted to the preceding frame (when viewed in the drive direction); refer to the chapter entitled "Tiller lengths (standard tiller/articulated steering system)"

2) The frame with the largest dimensions must be placed in the first position in the train, the second-largest frame in the second position, etc. Exception to this rule: As soon as a smaller frame has a higher permissible load capacity, it must be positioned right at the front of the train.

3) Standard frame

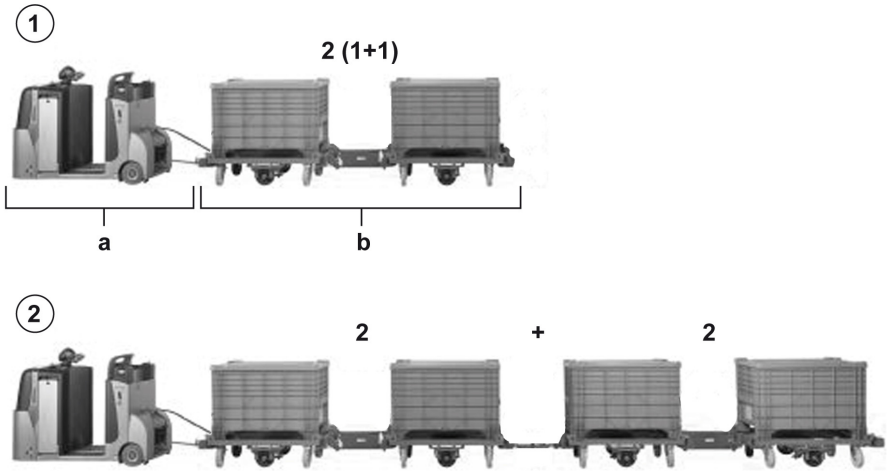
4) Max. total load of 4 t across the whole train

E frames with articulated steering system (driving over ramps)

General

Combinations of the E frame with the articulated steering system

Combinations



a Tow tractor

b Permissible number of frames

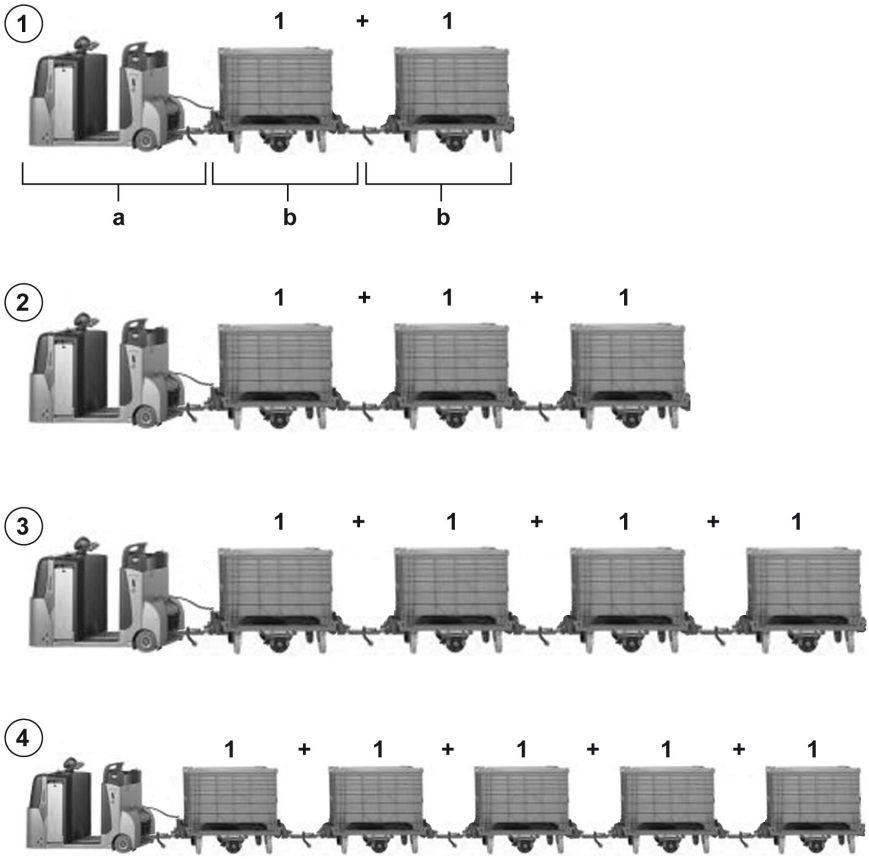
Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

E frames with standard tiller

General

Combinations with standard tiller

Combinations



a Tow tractor
b Permissible number of frames (for combination no. 4, max. weight of load: 4 t)

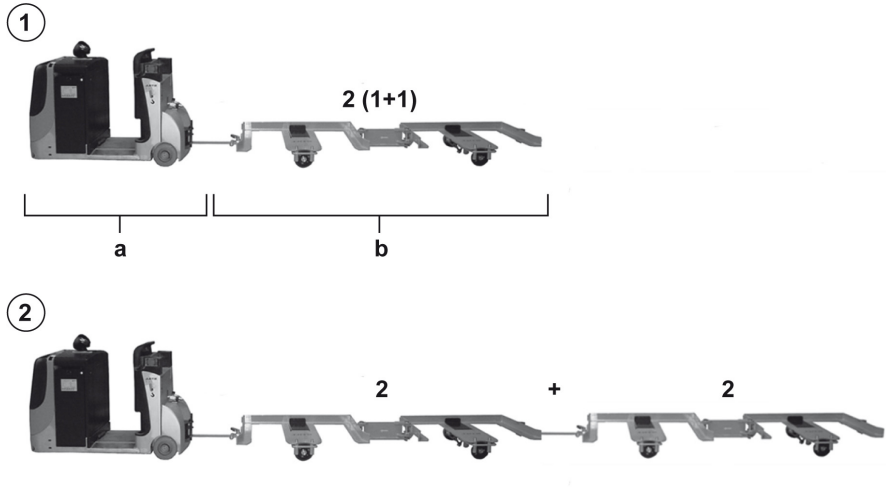
Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

Autarkic E frame

General

Combinations of the autarkic E frame

Combinations



a Tow tractor

b Permissible number of frames

Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

NOTE

Combinations with 2+2 frames require a compensating hinge between the second frame and the third frame.

Mixing E frames and autarkic E frames

Mixing E frames with autarkic E frames

The mixing of E frames and autarkic E frames is permitted in principle, provided that certain conditions are complied with.

The following conditions must be adhered to:

- The autarkic E frames must be positioned behind the hydraulic or pneumatic E frames in the tugger train
- A mixed rig of this type must be operated as an articulated steering system
- All of the general conditions for the train apply (weight, size, length of tillers)

Mixing E frames and C frames

Mixing E frames and C frames

The mixing of E frames and C frames is permitted in principle, provided that certain conditions are complied with.

The following conditions must be adhered to:

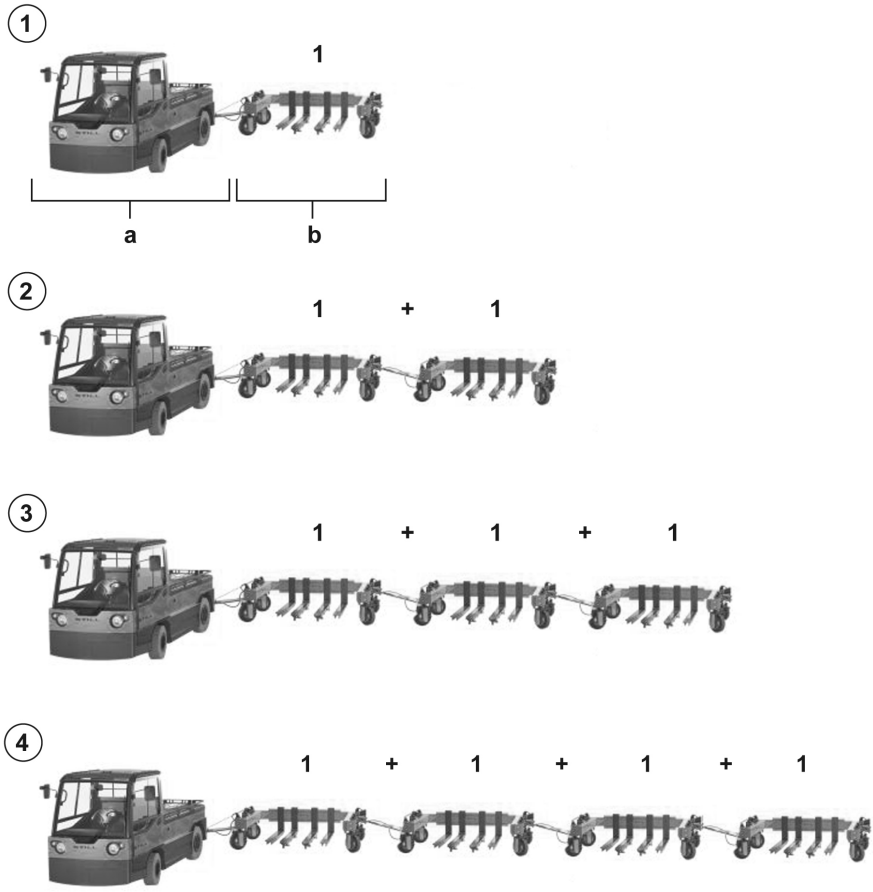
- C frames and E frames can be connected together using a C-E adaptor
- The C frame must always be connected in front of any E frame
- All of the general conditions for the train apply (weight, size, length of tillers)

C frame

General

Combinations of the C frame

Combinations



a Tow tractor

b Permissible number of frames

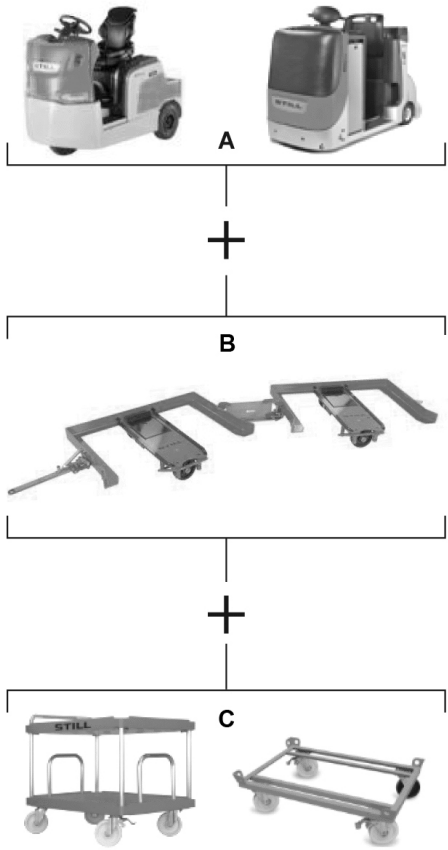
Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

Autarkic system

General

Assembling

Autarkic system



A	Tow tractor	C	Trolleys
B	Autarkic E frame		

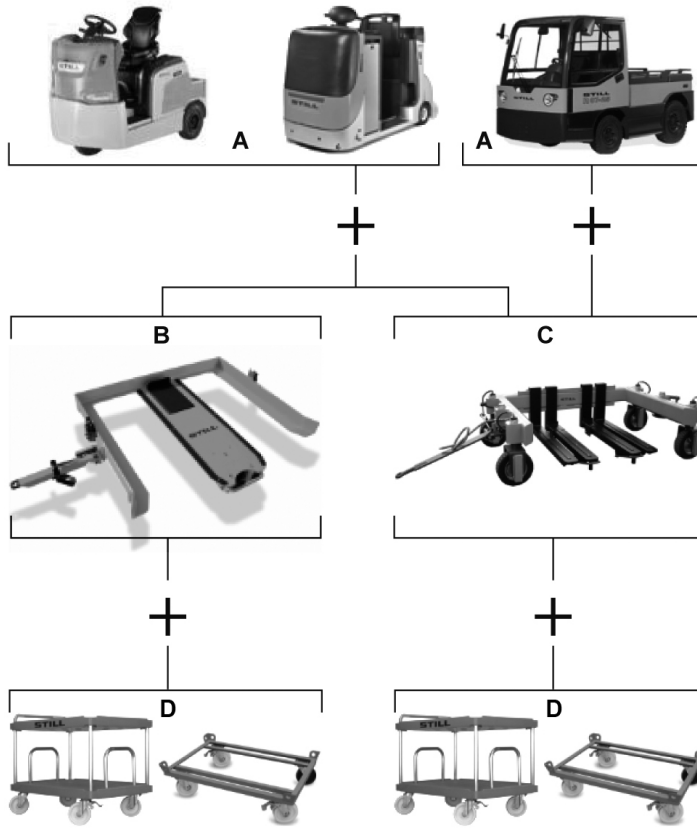
Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

Hydraulic system

General

Assembling

Hydraulic system



A	Tow tractor with hydraulic unit	C	C frame
B	E frame	D	Trolleys

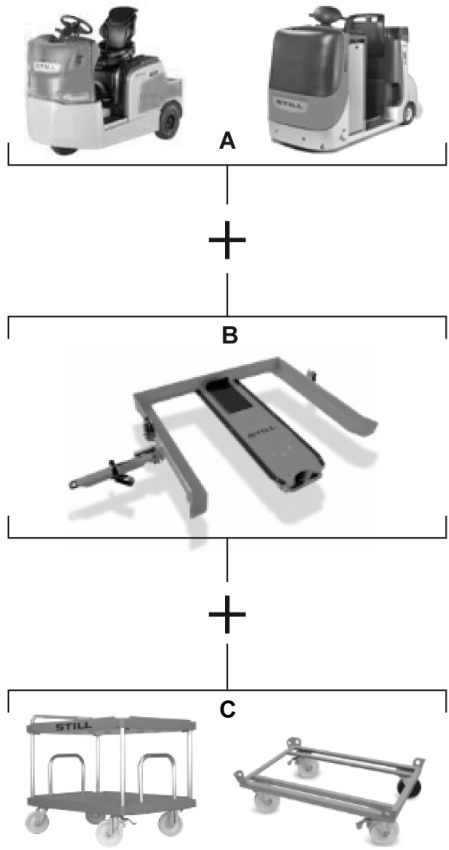
Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

Pneumatic system

General

Assembling

Pneumatic system



A Tow tractor with compressor
B E frame
C Trolleys

Note before assembly; refer to the chapter entitled "Tugger-train combinations/Overview"

Articulated steering system

Design and function

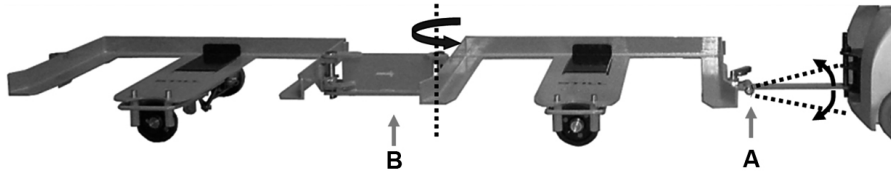
Design and function of the articulated steering system (driving over ramps)

Design

1b Articulated frame steering rig 2

1a Articulated frame steering rig 1

Function



B Articulated steering tiller

A Hinged tiller

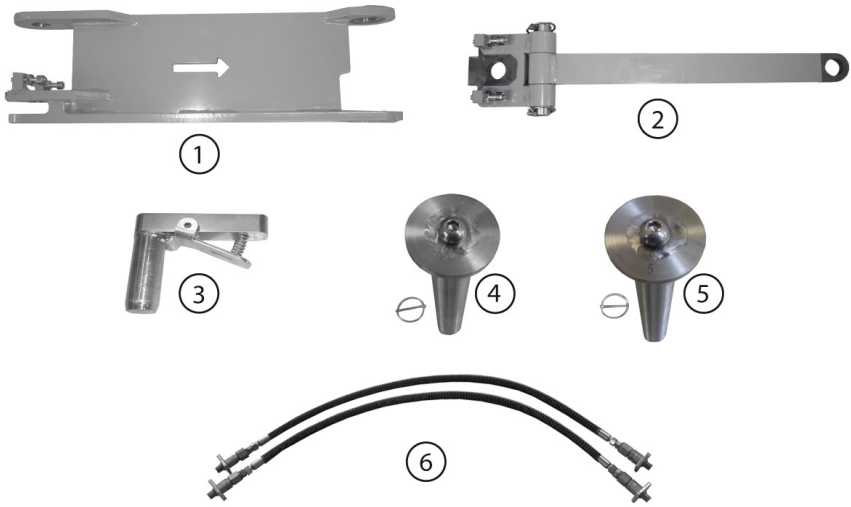
NOTE

The articulated steering system, in combination with the hinged tiller, allows driving on ramps and stabilises the tugger train in the vertical plane. All frames remain in contact with the ground on ramps. The hinged tiller prevents the frames from being lifted into the air by the tillers when transitioning from level surfaces onto gradients.

Components

Components of the articulated steering system

Components for two E frames - Hydraulic

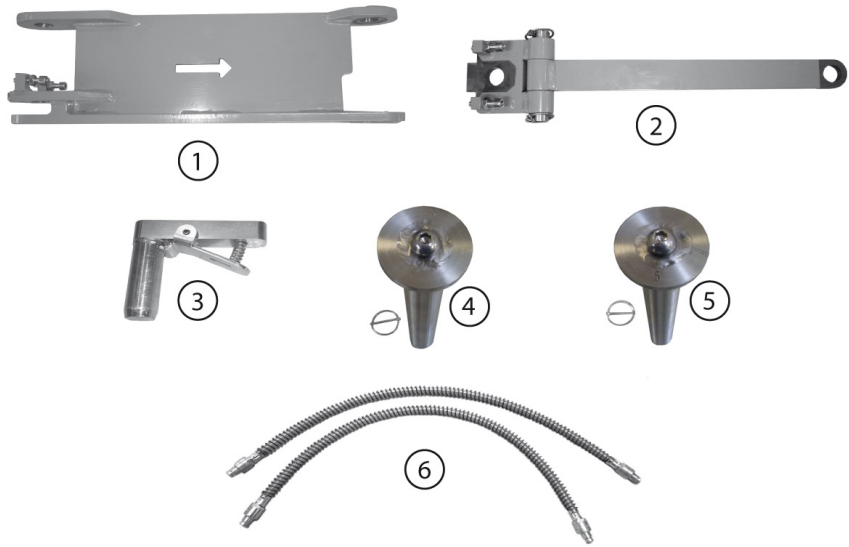


Item	Quantity	Unit	Name
1	1	Piece	Rigid tiller with two pre-assembled clamping bolts
2	1	Piece	Hinged tiller with two pre-assembled clamping bolts
3	2	Piece	Alignment bolt (only one required for assembly)
4	1	Piece	Socket pin with linch pin
5	1	Piece	Socket pin with the marking "5" and linch pin
6	2	Piece	Hydraulic hose with rotation lock

NOTE

The socket pins and the alignment bolts are pre-assembled when delivered.

Components for two E frames - Pneumatic

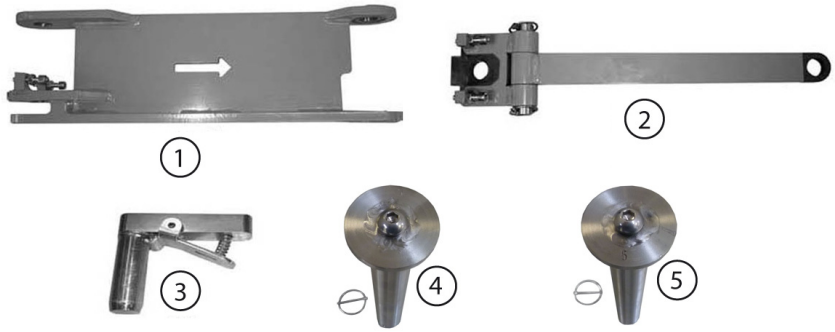


Item	Quantity	Unit	Name
1	1	Piece	Rigid tiller with two pre-assembled clamping bolts
2	1	Piece	Hinged tiller with two pre-assembled clamping bolts
3	2	Piece	Alignment bolt (only one required for assembly)
4	1	Piece	Socket pin with linch pin
5	1	Piece	Socket pin with the marking "5" and linch pin
6	2	Piece	Pneumatic hose

NOTE

The socket pins and the alignment bolts are pre-assembled when delivered.

Components for two autarkic E frames



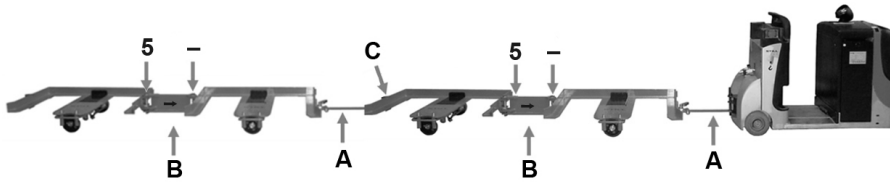
Item	Quantity	Unit	Name
1	1	Piece	Rigid tiller with two pre-assembled clamping bolts
2	1	Piece	Hinged tiller with two pre-assembled clamping bolts
3	2	Piece	Alignment bolt (only one required for assembly)
4	1	Piece	Socket pin with linch pin
5	1	Piece	Socket pin with the marking "5" and linch pin

NOTE

The socket pins and the alignment bolts are pre-assembled when delivered.

Overview of components

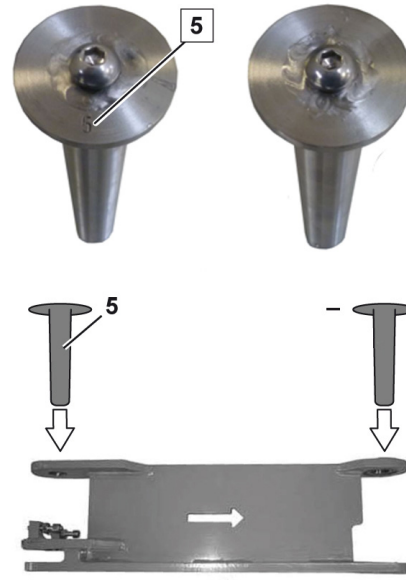
Articulated steering system (2 rigs/2+2 frames)



A	Hinged tiller
B	Rigid tiller
C	Compensating hinge
5	Socket pin with the marking "5"
–	Unmarked socket pin

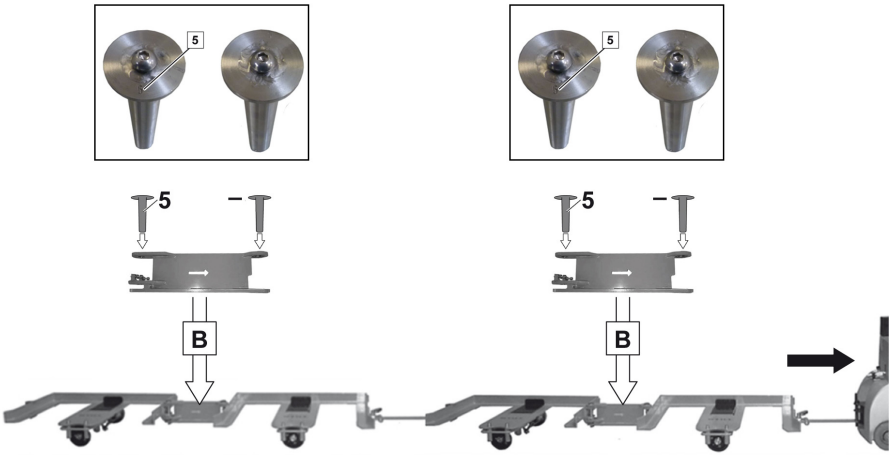
The socket pin with the marking **5** has a smaller diameter. It must always be fitted to the rear bolted end of the rigid tiller.

▷



Position of the socket pins on the rigid tiller

Position of the rigid tiller and the socket pins



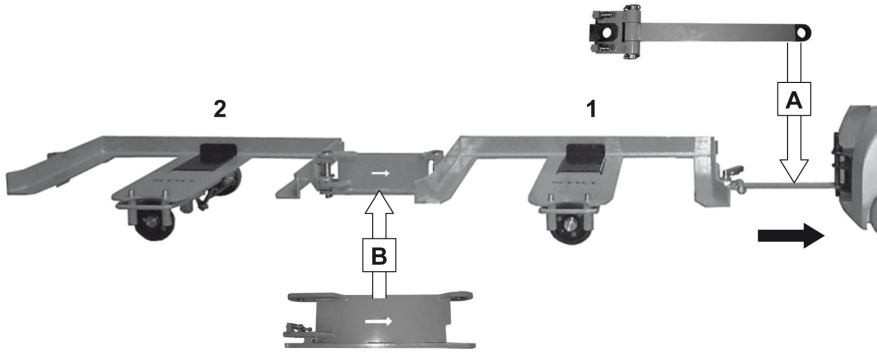
B Rigid tiller
5 Socket pin with the marking **5**
⇨ Drive direction

NOTE

For an overview, also refer to the chapter entitled "Articulated steering system/Components".

Rigid tiller and hinged tiller (two frames)

Position of the rigid tiller and the hinged tiller



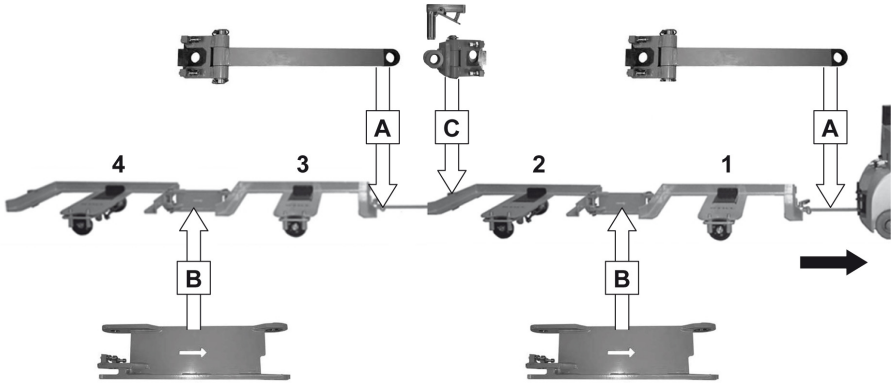
1	First frame
2	Second frame
A	Hinged tiller
B	Rigid tiller
⇨	Drive direction

NOTE

For an overview, also refer to the chapter entitled "Tugger-train combinations/Overview".

Rigid tiller, hinged tiller and compensating hinge (2+2 frames)

Position of the rigid tiller, the hinged tiller and the compensating hinge



1	First frame	B	Rigid tiller
2	Second frame	C	Compensating hinge (only required for autarkic frames)
3	Third frame		
4	Fourth frame	⇨	Drive direction
A	Hinged tiller		

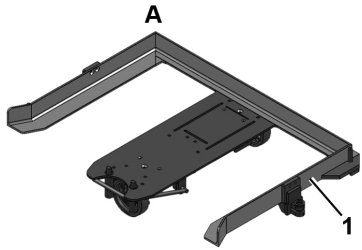
NOTE

For an overview, also refer to the chapter entitled "Tugger-train combinations/Overview".

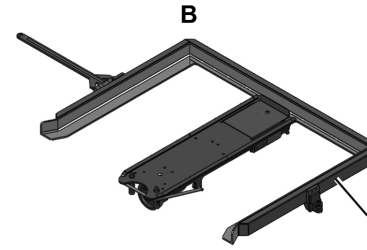
Equipment

Angular frame and tubular frame

Frame designs



A Standard 1200 x 800 mm E frame with angular frame



B Standard 1600 x 1200 mm E frame with tubular frame

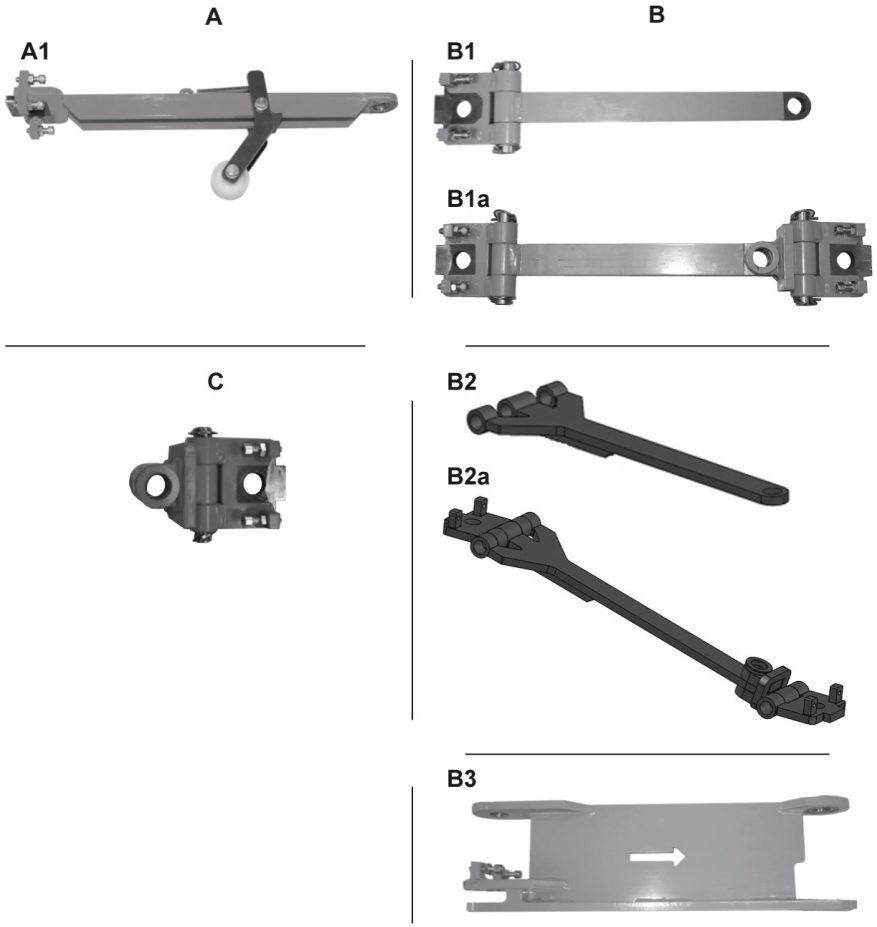
On the 1600 x 1200 mm standard frames, the outer frame (2) is a tubular frame. Smaller frames have angular frames (1).

NOTE

For E frames, the articulated frame steering rig must consist of two frames of the same type (angular frame-angular frame or tubular frame-tubular frame). Refer to the chapter entitled "Tugger-train combinations/Overview".

Standard tiller/articulated steering system

Illustration of the tiller systems



A	Standard system, no driving over ramps	B1a	Hinged tiller with compensating hinge
A1	Standard tiller	B2	Reinforced hinged tiller
B	Articulated steering system for driving over ramps (always present on autarkic frames, optional on standard E frames)	B2a	Reinforced hinged tiller with compensating hinge
B1	Hinged tiller	B3	Rigid tiller
		C	Compensating hinge

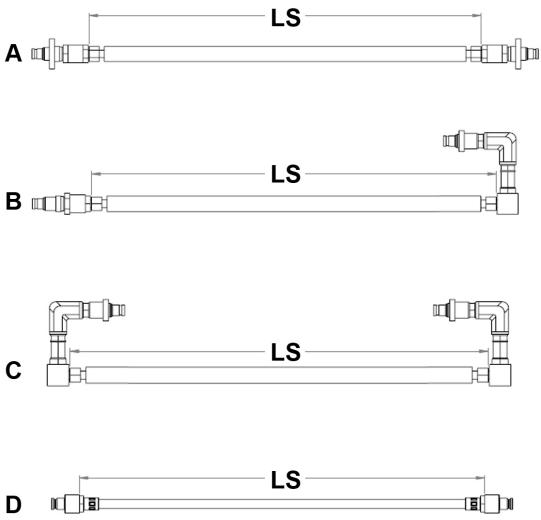
Standard system (A) (no driving over ramps)		
Standard tiller	**(A1)**	For standard E frames, no driving over ramps
		Between the tow tractor and the first E frame
		Between the E frames in the standard tugger train
Articulated steering system (B) (driving over ramps)		
Articulated steering system	**(B)**	For autarkic E frames (always)*
Hinged tiller	**(B1/B2)**	Between the tow tractor and the first autarkic E frame*
Hinged tiller with compensating hinge	**(B1a/B2a)**	Between two articulated frame steering rigs (2 frames = 1 articulated frame steering rig)*
Rigid tiller	**(B3)**	Between two autarkic E frames in the articulated steering system*
Compensating hinge	**(C)**	Between two articulated frame steering rigs for autarkic E frames, required in addition to hinged tiller*
*Optional for standard E frames		

Variants of hydraulic hose and pneumatic hose

Variants of hydraulic hose and pneumatic hose

The lengths of hoses must be adjusted depending on the lengths of the tillers in accordance with the table.

Overview



A	Connection hose, routed above	C	Connection hose between E frames, routed below
B	Connection hose to the tow tractor, routed below	D	Pneumatic connection hose

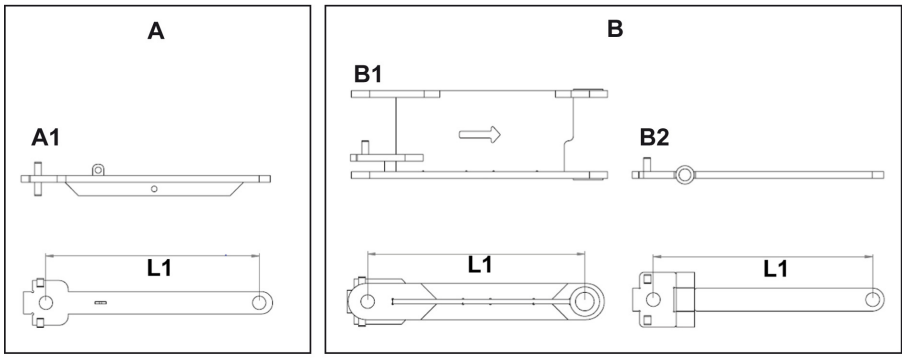
Hydraulics	Hose length LS	Tiller length
A	1250 mm	478 mm
	1500 mm	628 mm
	1500 mm	778 mm
B	1300 mm	478 mm
	1400 mm	628 mm
	1400 mm	778 mm
C	720 mm	478 mm
	840 mm	628 mm
	1050 mm	778 mm
Pneumatics	**Hose length LS**	**Tiller length**
D	1030 mm	478 mm
	1150 mm	628 mm
	1500 mm	778 mm

Tiller lengths (standard tiller/articulated steering system)

General

A tiller of the appropriate length must be attached to the frame in accordance with the table.

Tiller lengths



A Standard system (standard tiller)
A1 Standard tiller
B Articulated steering system (rigid tiller + hinged tiller)
B1 Rigid tiller
B2 Hinged tiller
L1 Tiller length

E frame	Tiller length (L1)
1200 x 800	478 mm
1200 x 1000	628 mm
1600 x 1200	778 mm
The tiller for each E frame must be adapted to the preceding frame (when viewed in the drive direction). The frame with the largest dimensions must be placed in the first position in the tugger train, the second-largest frame in the second position, etc. Exception to this rule: As soon as a smaller frame has a higher permissible load capacity, it must be positioned right at the front of the tugger train.	

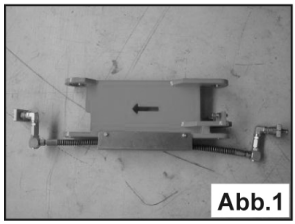
5

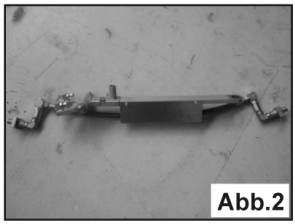
Operation

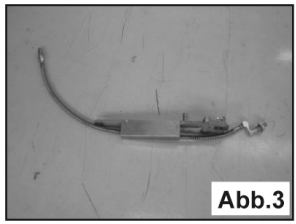
Assembling the articulated steering system (driving over ramps)

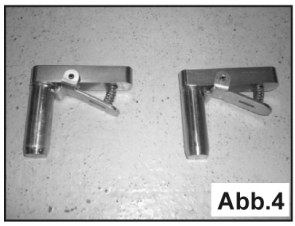
Assembling the hydraulic steering system (hydraulics routed underneath)

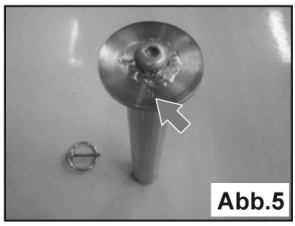
Scope of delivery

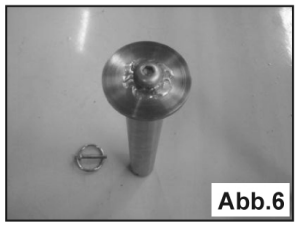












Scope of delivery for 2 x E frames:

- **Figure 1:** 1 x rigid tiller with two pre-assembled clamping bolts. Hydraulic hose routed underneath
- **Figure 2:** 1 x hinged tiller with two pre-assembled clamping bolts. Hydraulic hose routed underneath to connect two E frames
- **Figure 3:** 1 x hinged tiller with two pre-assembled clamping bolts. Hydraulic hose routed underneath to connect the tow tractor and the E frames
- **Figure 4:** 2 x alignment bolts (only one required for assembly)
- **Figure 5:** 1 x socket pin with the marking "5" (see arrow) with linch pin
- **Figure 6:** 1 x socket pin with linch pin
- **7:** 1 x tiller support (not pictured)

Preparation

The following section describes the procedure for a tugger train with two trailers when loading and unloading is performed on the left-hand side in the drive direction.

The socket pins and the alignment bolts are pre-assembled when delivered.

The rigid tiller must (see figure) be fitted between the first E frame and the second E frame. (Arrow in drive direction).

▷

Assembling the rigid tiller

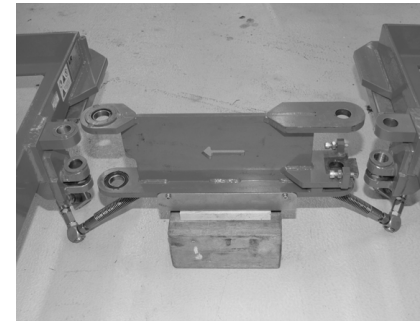
⚠ WARNING

Risk of injury through crushing!

- The frames are heavy. Never place hands or feet underneath the raised frames.
- When raising the frame, always use appropriate devices (wedges, wooden blocks) to prevent rolling or tipping.
- Use only approved hardwood blocks.

– Use appropriate means (wooden blocks) to place the frames and the rigid tiller in a horizontal position.

▷

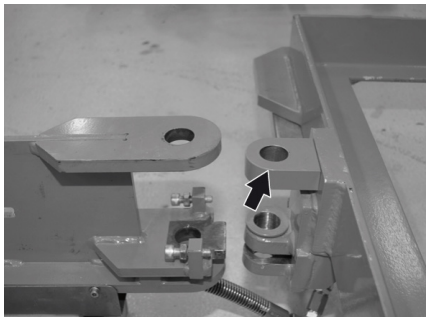


Assembling the articulated steering system (driving over ramps)

The two socket pins (with and without the marking **5**) are pre-installed when delivered. ▷

– Release the linch pins and pull out the socket pins.

– Screw on the tab (see arrow) for the second frame in the drive direction. ▷



– Do not tighten the screws. The tab (see arrow) must be loose.

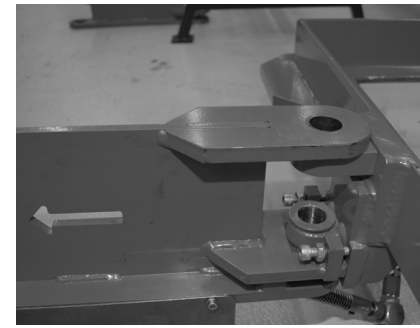
NOTE

The welded-on ring on the tab (see arrow) must be on the underside. Rotate the tab if necessary.

▷

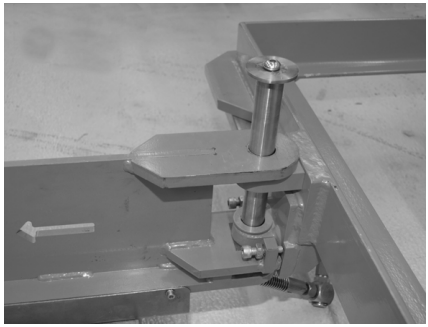
– Insert the rigid tiller into the tabs on the second frame in the drive direction.

▷

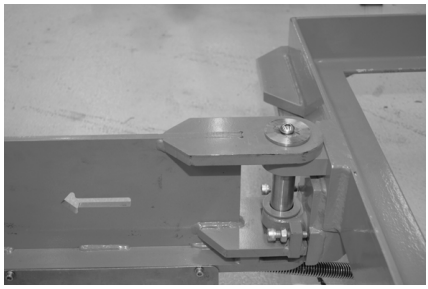


Assembling the articulated steering system (driving over ramps)

– Spray the socket pin with the marking **5** with Teflon spray. ▷



– Insert the socket pin with the marking **5** (tab must be loose). ▷



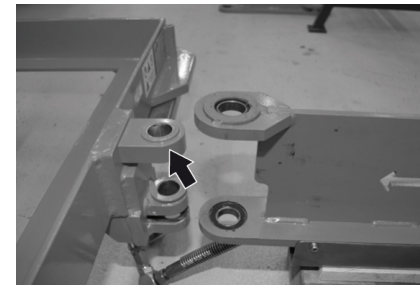
⚠ CAUTION

Component damage due to incorrect socket pin!

– Insert the socket pin with the marking "5" in the second E frame in the drive direction.

– Secure the socket pin using the linch pin. ▷

– Screw on the tab (see arrow) for the first frame in the drive direction. ▷

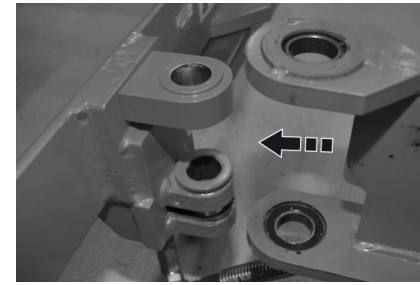


– Do not tighten the screws. The tab must be loose. ▷

NOTE

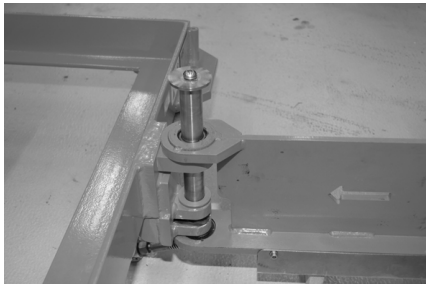
The welded-on ring on the tab (see arrow) must be on the top. Rotate the tab if necessary.

– Insert the rigid tiller into the tabs on the first frame in the drive direction. ▷

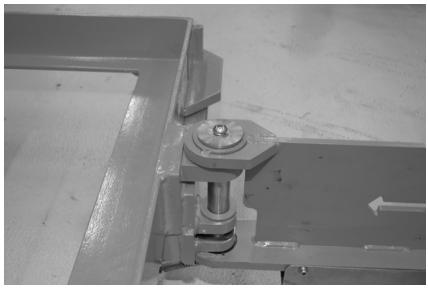


Assembling the articulated steering system (driving over ramps)

– Spray the unmarked socket pin with Teflon spray. ▷

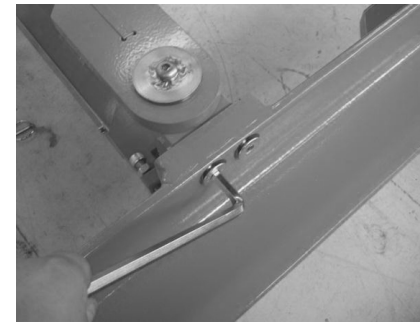


– Insert the unmarked socket pin into the first frame in the drive direction. If necessary, drive in with a Teflon hammer. ▷



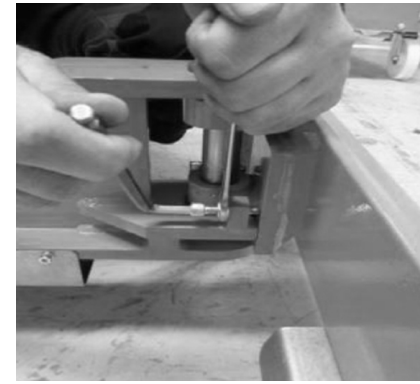
– Secure the socket pin using the linch pin. ▷

– Tighten the screws for the tabs (two screws at both ends of the rigid tiller). ▷



– Tighten the clamping bolts on the rigid tiller **(tightening torque: 30 Nm)**. ▷

– Secure the clamping bolts with nuts **(tightening torque: 50 Nm)**. ▷

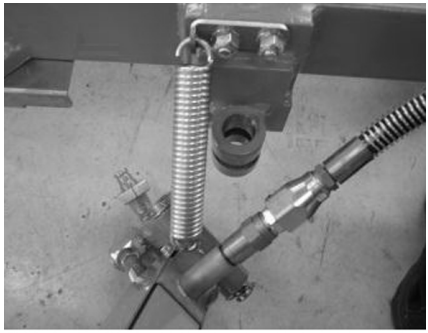


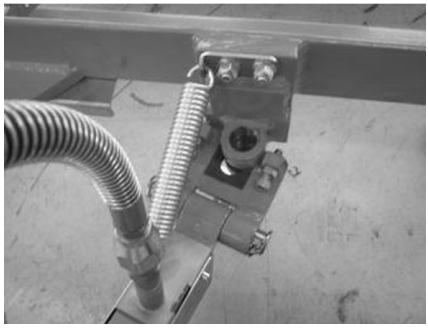
NOTE

The clamping bolts brace the tiller against the E frame and protect the tiller against lateral swivelling movements.

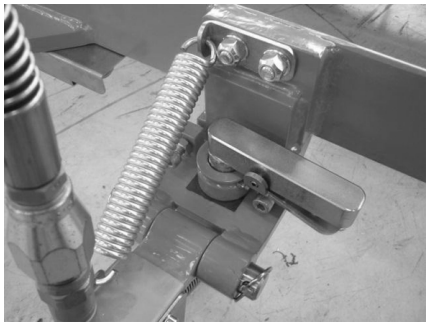
Assembling the hinged tiller

– Before assembly, remove the alignment bolt from the first frame in the drive direction. Then attach the spring and insert the tiller into the towing jaws. ▷





– Insert the alignment bolt and lock it in place. ▷

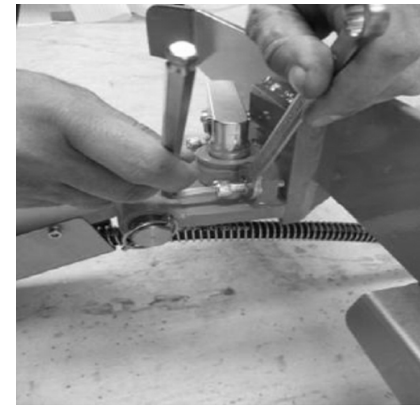


– Tighten the clamping bolts on the hinged tiller **(tightening torque: 30 Nm)**.

▷

– Tighten the nuts on the clamping bolts **(tightening torque: 50 Nm)**.

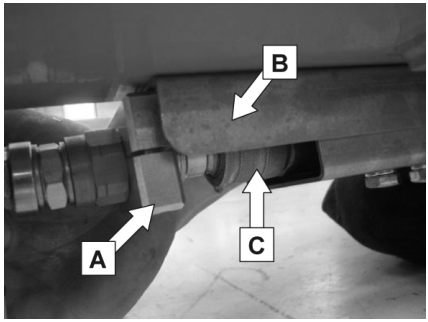
▷



NOTE

The clamping bolts brace the tiller against the E frame and protect the tiller against lateral swivelling movements.

– To prevent the coupling (C) from rotating, lock the rotation lock (A) on the hydraulic connection into the guard plate (B).



⚠ WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

– Do not allow the fluid to come into contact with the skin.
– Avoid inhaling spray.
– If highly pressurised hydraulic fluid escapes from the hydraulic system due to leaks, penetration of hydraulic fluids into the skin is particularly dangerous. In case of such injury, immediate medical assistance is required.
– To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

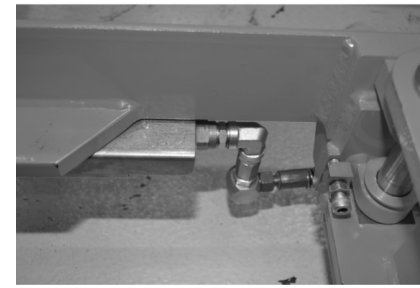
⚠ CAUTION

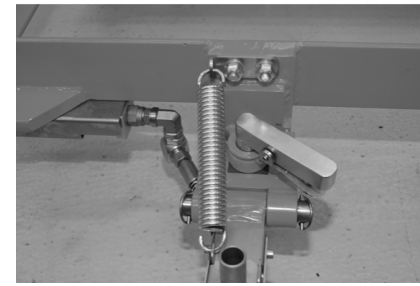
Risk of component damage!

In the event of incorrect assembly, the coupling will become damaged during operation.

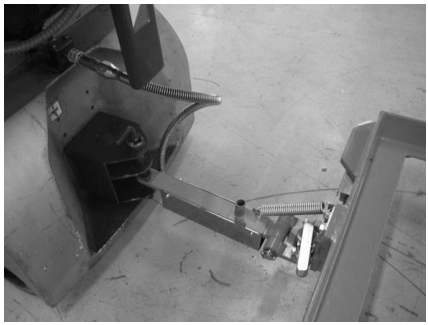
Before assembly, release the pressure from the hydraulic system; refer to the chapter entitled "Hydraulic/pneumatic coupling".

– Attach the pressure line. To do this, push the plug firmly into the coupling. ▷





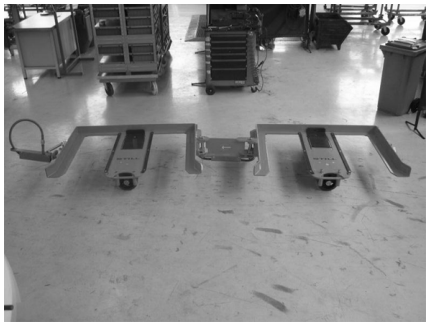
– Couple the hinged tiller with the tow tractor. Connect the hydraulic line to the tow tractor. ▷



NOTE

To release the hydraulic coupling, refer to the chapter entitled "Hydraulic/pneumatic coupling".

– The tugger train is ready for use. Additional E frames can be fitted to the tugger train by following the same procedure as previously described. Always install the hinged tiller and the rigid tiller alternately; refer to the relevant chapters relating to the position of the components. ▷



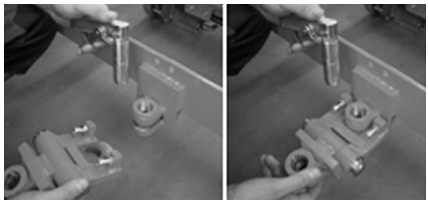
Installing and removing the compensating hinge

The following section describes the procedure when loading and unloading is performed on the left-hand side in the drive direction.

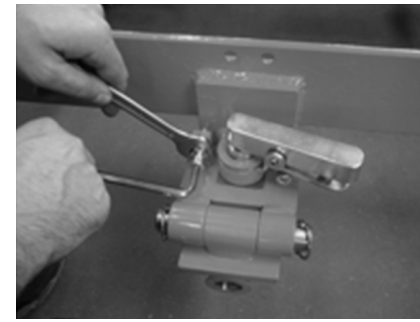
Optional (for attaching a second articulated frame steering rig).

Installing

– Insert the compensating hinge into the rear towing jaws of the first articulated frame steering rig and attach the coupling pin. ▷



– Tighten the clamping bolts evenly **(tightening torque: 30 Nm)** and secure the clamping bolts with nuts **(tightening torque: 50 Nm)**. ▷

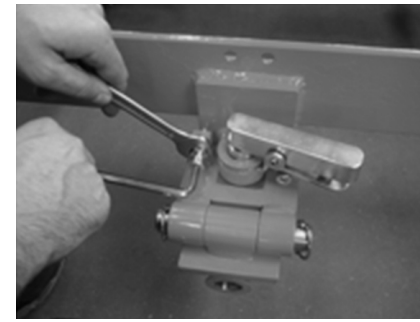


NOTE

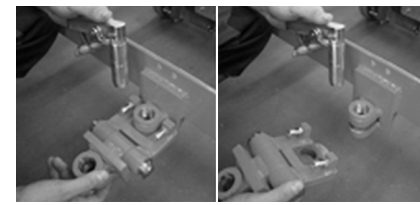
This tightening braces the tiller against the E frame and provides protection against lateral swivelling movements.

Removing

– Loosen the nuts and the clamping bolts. ▷



– Release the coupling pin and remove the compensating hinge from the towing jaws. ▷



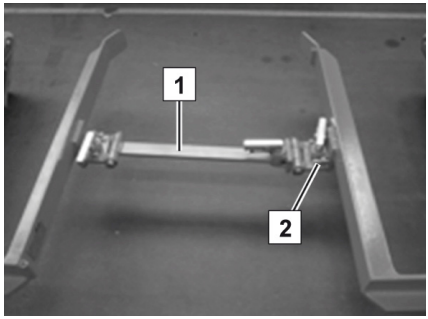
Installing and removing the hinged tiller

Installing

The following section describes the procedure when loading and unloading is performed on the left-hand side in the drive direction.

Assembling the articulated steering system (driving over ramps)

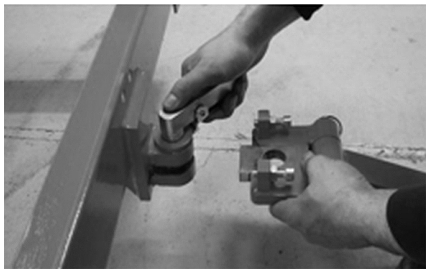
The illustration shows the hinged tiller (1) with the compensating hinge (2) between two articulated frame steering rigs (only for autarkic frames and special frames).



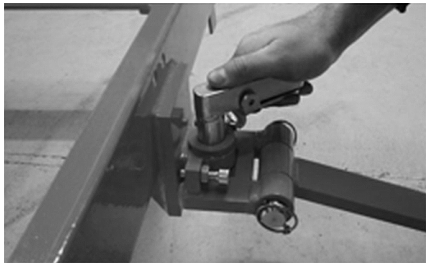
NOTE

For tiller variants, refer to the chapter entitled "Tiller lengths (standard tiller/articulated steering system)".

– Insert the hinged tiller into the front towing jaws of the second articulated frame steering rig.



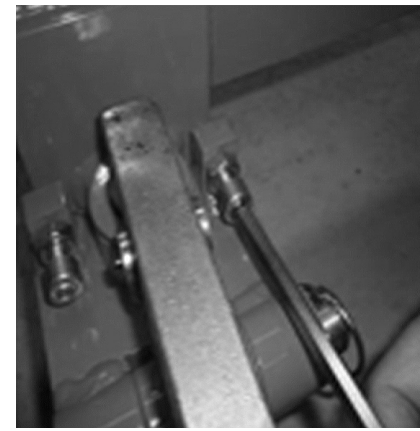
– Insert the coupling pin and lock it in place.



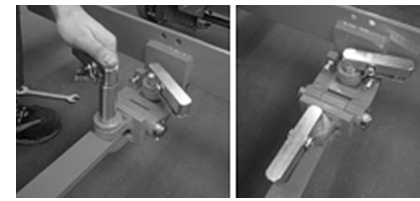
– Evenly tighten the clamping bolts on the hinged tiller **(tightening torque: 30 Nm)** and secure the clamping bolts with nuts **(tightening torque: 50 Nm)**.

NOTE

This tightening braces the tiller against the E frame and provides protection against lateral swivelling movements.

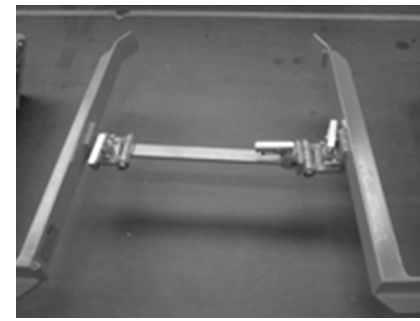


– Insert the hinged tiller on the second articulated frame steering rig into the towing jaws of the compensating hinge.
– Insert the coupling pin and lock it in place.



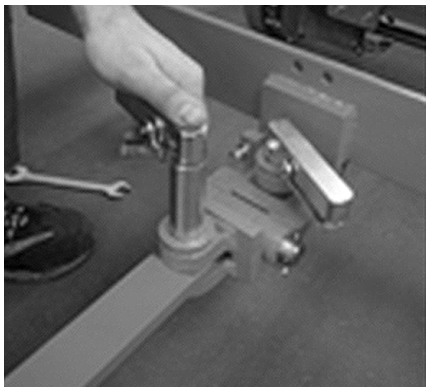
The illustration shows the hinged tiller with the compensating hinge between two articulated frame steering rigs.

The figure shows the hinged tiller when loading and unloading is performed on the left-hand side in the drive direction.



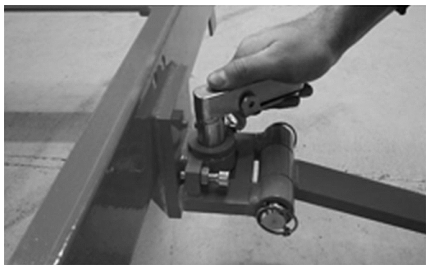
Removing

– Unlock the coupling pin for the compensating hinge and pull out the hinged tiller of the rear articulated frame steering rig from the towing jaws of the compensating hinge. ▷



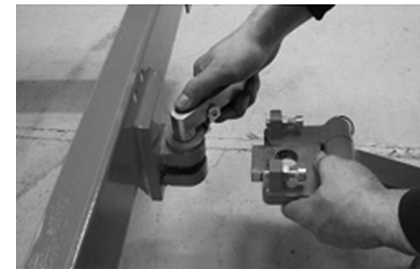
– Loosen the nuts and the clamping bolts on the hinged tiller. ▷

– Pull out the coupling pin. ▷



– Pull out the hinged tiller.

▷



Commissioning the E frames

Safety regulations for commissioning the E frame

Driving

⚠ DANGER

Risk of accident from crushing!

– Before moving off, make sure that there are no people on or between the individual E frames.
– Observe markings for pedestrian paths and roadways.

⚠ CAUTION

Components can be damaged by incorrect driving!

Reverse travel with the tugger train is prohibited.

Tugger trains may only drive over ramps when articulated frame steering rigs are used.

Coupling together

⚠ CAUTION

Components can be damaged if coupled together incorrectly!

The E frames, which cannot be lowered, may only be driven as an articulated steering system.

The articulated frame steering rig must contain an even number of frames (two or four trailers).

For E frames, the articulated steering system must consist of two frames of the same type (angular frame-angular frame or tubular frame-tubular frame).

At the maximum permitted steering angle, the tillers must not make contact with either the frames or the hydraulic components.

Loading

⚠ CAUTION

Components can be damaged by incorrect loading!

The E frames must not be loaded or unloaded on gradients.

Make sure that the trolleys are correctly inserted in the E frames. The securing bolts must be fully visible.

We recommend attaching four E frames to the tow tractor. If the maximum possible number of five E frames is used, the total load of 4 t across the whole train must not be exceeded.

Checking the securing bolts for correct function

⚠ WARNING

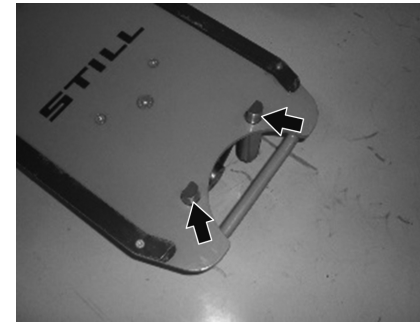
Damage or other defects to the tow tractor or the attached frames can result in accidents.

– If damage or other defects are identified on the frames during the following inspections, do not use these frames until they have been repaired properly.
– Do not remove or deactivate safety systems or switches.

Checking the securing bolts for correct function

– Move the ejector into the rear end position. ▷

– The securing bolts (see arrow) must extend at least 26 mm (locking position). ▷



– When the foot pedal is actuated (no interlock), the securing bolts must retract again. ▷

Checking the securing system for correct function

– Check if the trolley can roll out of the lowered E frame despite the securing bolt being extended.

Coupling and uncoupling the E frames

Aligning chassis in drive direction

The chassis are aligned according to the side on which the Trolleys are to be loaded and unloaded.

Loading and unloading the trolleys from the left:

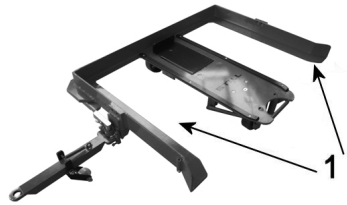
– Set up the chassis in the drive direction with the opening (1) to the left.

Loading and unloading the trolleys from the right:

– Position the frames so that the opening is on the right-hand side in the drive direction.

E chassis

▷



NOTE

The tiller's orientation when it is mounted on the chassis depends on whether the trolleys are to be loaded into the chassis from the left or right.

NOTE

Appearance of the frame and tiller may vary slightly from the figure.

Coupling the E frames

⚠ WARNING

Risk of trapping or crushing!

– Do not reach into the open coupling.
– The tow tractor and the trailer must be on level ground and must be secured so they cannot roll away.

⚠ CAUTION

A tugger train with E frames must always consist of at least two frames and a tow tractor.

⚠ CAUTION

Risk of damage!

Before coupling and uncoupling the frames, always disconnect the pressure line between multiple frames or the pressure line from the tow tractor.

– The system must be depressurised when uncoupling.
– Only use tillers/hoses in accordance with the table.

NOTE

The length of the tiller depends on the size of the frame; refer to the chapter entitled "Tiller lengths (standard tiller/articulated steering system)".

– Insert the wide end of the standard tiller into the holding fixture on the side of the frame facing in the drive direction.
– Tighten the clamping bolts on the standard tiller (tightening torque: 30 Nm).
– Tighten the nuts on the clamping bolts (tightening torque: 50 Nm).

NOTE

This tightening braces the tiller against the E frame and provides protection against lateral swivelling movements.

– Fasten the standard tiller to the frame using an alignment bolt.
– Insert the towing eye of the standard tiller into either the towing jaws of the tow tractor or into the holding fixture of a preceding frame.
– Fasten the towing eye using an alignment bolt.

NOTE

The alignment bolt prevents the frames becoming uncoupled accidentally. It uses spring force to press the handle of the alignment bolt into the groove in the bolt mounting on the frame to prevent the bolt from slipping out.

NOTE

In the hydraulics version, both the chassis and the pressure lines are already filled with hydraulic fluid at the factory.

– Connect the pressure lines on the individual frames together or to the pressure lines on the tow tractor. Depending on the design of the tugger train, these lines are either hydraulic lines or pneumatic lines; refer to the chapter entitled "Connecting the plug connector".

WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

– Do not allow to come into contact with the skin.
– Avoid inhaling spray.
– Penetration of hydraulic fluids into the skin is particularly dangerous if they escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
– To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, industrial goggles, skin protection and skin care products).

– All other chassis must be attached to chassis in front of them and must be connected to the pressure lines. To do this, proceed as described above.

Uncoupling the E frames

WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

– Do not allow to come into contact with the skin.
– Avoid inhaling spray.
– Penetration of hydraulic fluids into the skin is particularly dangerous if they escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
– To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, industrial goggles, skin protection and skin care products).

⚠ WARNING

Risk of trapping or crushing!

– Do not reach into the open coupling.

– The tow tractor and the trailer must be on level ground and must be secured so they cannot roll away.

⚠ CAUTION

Risk of damage!

Before coupling and uncoupling the frames, always disconnect the pressure line between multiple frames or the pressure line from the tow tractor.

– The system must be depressurised when coupling or uncoupling.

– Disconnect the pressure line; refer to the chapter entitled "Disconnecting the plug connector".

– Release then pull out the alignment bolt for the towing eye.

– Remove the standard tiller from either the towing jaws of the tow tractor or from the holding fixture of a preceding frame.

– Re-insert the alignment bolt and secure it in place.

NOTE

The alignment bolt prevents the frames becoming uncoupled accidentally. It uses spring force to press the handle of the alignment bolt into the groove in the bolt mounting on the frame to prevent the bolt from slipping out.

NOTE

In the hydraulics version, both the chassis and the pressure lines are already filled with hydraulic fluid at the factory.

Loading the E frames

⚠ WARNING

Risk of injury from becoming trapped!

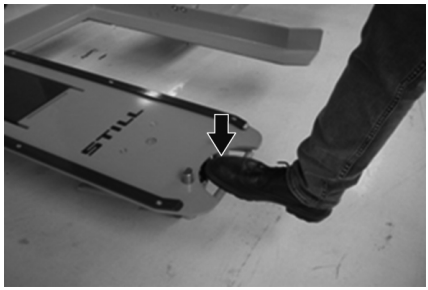
- Loading and unloading must only be performed by the driver. Make sure that no other persons are in the vicinity of the frames.
- Do not load or unload the frames on gradients.
- Make sure that the trolleys are correctly inserted into the frames. The securing bolts must be fully visible.

⚠ CAUTION

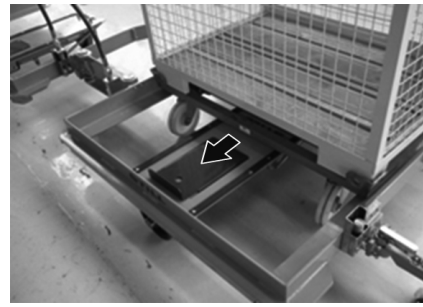
Trolleys with heavy and tall loads may tip over when cornering.

- Lash the load to the trolleys if necessary.
- Place the load on the trolleys with the centre of gravity as low as possible.

- Apply the parking brake on the tow tractor to secure it against rolling away.
- The driver must leave the tow tractor to lower the frames. This deactivates the driver detection system and the frames are lowered automatically. The frames can now be unloaded.
- Actuate the foot pedal until the securing bolts are fully retracted. ▷



– Push the trolley into the open side of the E frame until it reaches the stop. ▷



– When doing so, ensure that the securing bolts (see arrow) are fully extended (locking position) once the trolley has been inserted. ▷
– The trolley is now secured against rolling out.

Unloading the E frames

⚠ DANGER

Risk of crushing when unloading the trolleys!

– Never unload on chamfers or gradients.
– When unloading the trolleys, ensure that there is sufficient space to unload the trolleys safely and to manoeuvre the trolleys safely.
– Depending on how heavily a trolley is loaded, the driver must be prepared to exert a greater amount of force to brake or steer the trolley, if necessary.

⚠ WARNING

Risk of injury from becoming trapped!

– Loading and unloading must only be performed by the driver. The driver must ensure that no other persons are in the vicinity of the frames.

⚠ WARNING

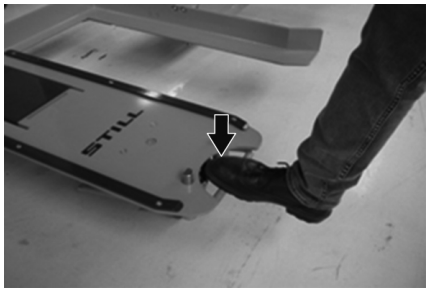
Risk of injury! If you press the foot pedal to unload the trolley, this action will push the trolley out towards you.

– Remove your foot from the foot pedal immediately after actuating the foot pedal.

– Apply the parking brake on the tow tractor to secure it against rolling away.

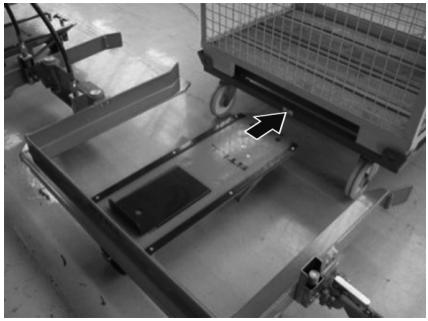
– The driver must leave the tow tractor to lower the frames. The frames can now be unloaded.

– Actuate the foot pedal of the frame to be unloaded until the securing bolts are fully retracted (unlocked). ▷



– The ejector automatically knocks the trolley to make the trolley roll out of the frame. ▷

– Pull the trolley straight out of the frame.



Commissioning the autarkic E frames

Safety regulations for commissioning

Safety regulations for commissioning the autarkic E frame

Coupling

⚠ CAUTION

Components can be damaged by incorrect coupling!

- Tugger trains with the autarkic system are only permitted with an articulated steering system.
- If trains with four autarkic E frames are used, a compensating hinge must be fitted between the second E frame and the third E frame.
- At the maximum permitted steering angle, the tillers must not make contact with either the frames or the hydraulic components.

Coupling and uncoupling the autarkic E frames

Aligning frames in the drive direction

The frames are aligned according to the side on which the Trolleys are to be loaded and unloaded.

Loading and unloading trolleys from left:

- Position the frames so that the opening is on the left-hand side in the drive direction.

Loading and unloading trolleys from right:

- Position the frames so that the opening is on the right-hand side in the drive direction.

NOTE

The tiller's orientation when it is mounted on the frame depends on whether the trolleys are to be loaded into the frame from the left or right.

Coupling the autarkic E frames

⚠ WARNING

Risk of trapping or crushing!

- Observe the maximum number of frames and the maximum weight of the load.
- Do not reach into the open coupling.
- The tow tractor and the frames must be on level ground and must be secured so they cannot roll away.

⚠ CAUTION

Components can be damaged by incorrect coupling!

Tugger trains with the autarkic system are always equipped with an articulated steering system (rigid tiller + hinged tiller) for stability reasons. These tugger trains can be operated with two or four E frames (articulated frame steering rig).

– Insert the wide end of the hinged tiller into the holding fixture on the side of the frame facing in the drive direction.

– Tighten the clamping bolts on the hinged tiller (tightening torque: 30 Nm).

– Tighten the nuts on the clamping bolts (tightening torque: 50 Nm).

NOTE

The clamping bolts brace the tiller against the E frame and protect the tiller against lateral swivelling movements.

– Fasten the hinged tiller to the frame using an alignment bolt.

– Insert the towing eye of the standard tiller into either the towing jaws of the tow tractor or into the compensating hinge of a preceding articulated frame steering rig.

– Fasten the towing eye using an alignment bolt.

NOTE

The alignment bolt prevents the frames becoming uncoupled accidentally. Using spring force, the handle of the alignment bolt is pressed into the groove in the bolt mounting on the frame. The alignment bolt is thus prevented from slipping out.

NOTE

In the hydraulic version, both the frames and the pressure lines are pre-filled with hydraulic fluid ex works.

Uncoupling the autarkic E frames

– Release the alignment bolt for the towing eye.
– Remove the hinged tiller from either the towing jaws of the tow tractor or from the compensating hinge of a preceding articulated frame steering rig.
– Re-insert the alignment bolt and secure it in place.

Loading the autarkic E frames

⚠ WARNING

Risk of injury from becoming trapped!

Loading and unloading must only be performed by the driver. The driver must ensure that no other persons are in the vicinity of the frames.

The frames must not be loaded or unloaded on gradients.

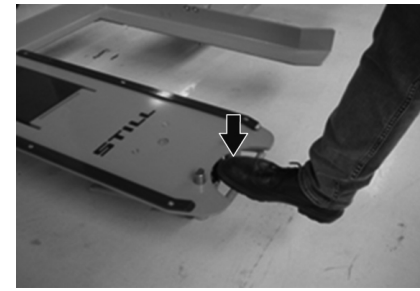
Make sure that the trolleys are correctly inserted into the frames. The securing bolts must be fully visible.

⚠ CAUTION

Trolleys with heavy and tall loads may tip over when cornering.

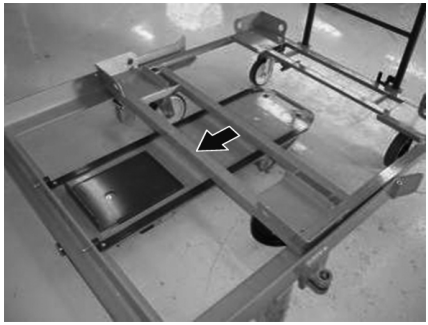
– Lash the load to the trolleys if necessary.
– Place the load with the centre of gravity as low as possible.

– Apply the parking brake on the tow tractor to secure it against rolling away.
– Actuate the foot pedal until resistance is felt. ▷ The frame is lowered.



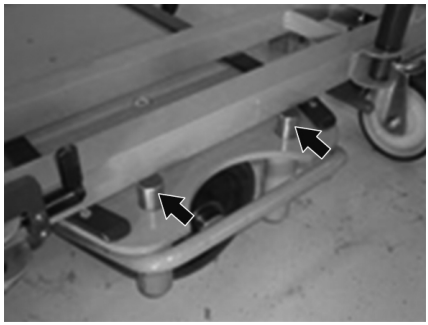
– Push the trolley into the open side of the E frame until it reaches the stop. The E frame is raised by 40 mm and the trolley wheels turn freely. A prerequisite for this is sufficient pressure in the accumulator.

▷



– When doing so, ensure that the securing bolts (see arrow) are fully extended (locking position) once the trolley has been inserted.
– The trolley is now secured against rolling out.

▷



Unloading the autarkic E frames

Unloading the autarkic E frames

⚠ DANGER

Risk of crushing when unloading the trolleys!

– Never unload on chamfers or gradients.
– When unloading the trolleys, ensure that there is sufficient space to unload the trolleys safely and to manoeuvre the trolleys safely.
– Depending on how heavily a trolley is loaded, the driver must be prepared to exert an appropriate amount of force to brake or steer the trolley, if necessary.

⚠ WARNING

Risk of injury from becoming trapped!

– Loading and unloading must only be performed by the driver. The driver must ensure that no other persons are in the vicinity of the frames.

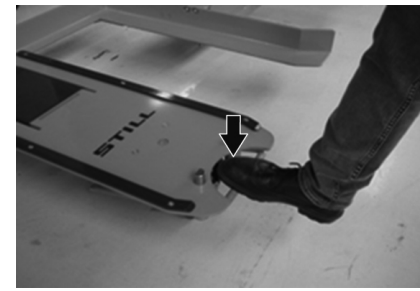
⚠ WARNING

Risk of injury! If you press the foot pedal to unload the trolley, this action will push the trolley out towards you.

– Remove your foot from the foot pedal immediately after actuating the foot pedal.

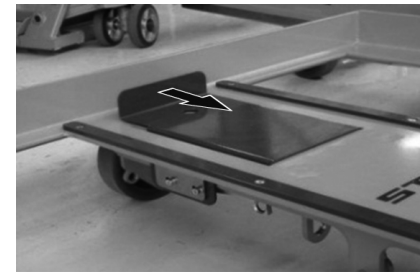
– Apply the parking brake on the tow tractor to secure it against rolling away.

– Actuate the foot pedal until resistance is felt - the frame is lowered. ▷



– The ejector automatically knocks the trolley to make the trolley roll out of the frame. ▷

– Pull the trolley straight out of the frame.



Commissioning the C frames

Safety regulations for commissioning

⚠ DANGER

Risk of accident from crushing!

– Before moving off, make sure that there are no people on or between the individual frames.

– Observe markings for pedestrian paths and roadways.

⚠ CAUTION

Components can be damaged by incorrect operation!

– Reverse travel with the tugger train is prohibited.

Checking the securing bolts for correct function

⚠ WARNING

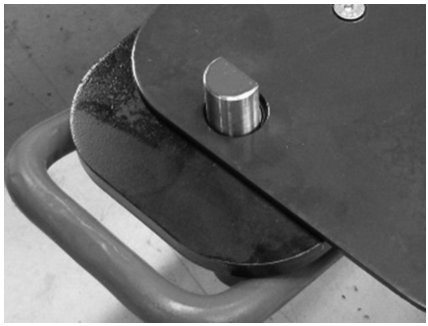
Damage or other defects to the tow tractor or the attached frames can result in accidents.

– If damage or other defects are identified on the frames during the following inspections, do not use these frames until they have been repaired properly.
– Do not remove or deactivate safety systems or switches.

Checking the securing bolts for correct function

– Move the ejector into the rear end position. ▷

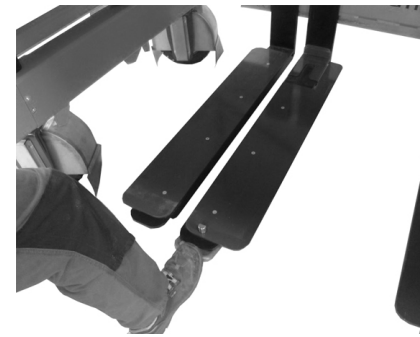
– The securing bolt must extend at least 26 mm (locking position). ▷



– Actuating the foot pedal must cause the securing bolt to retract (no interlock).

Checking the securing system for correct function

– Check if the trolley can roll out of the lowered C frame despite the securing bolt being extended.



Changing the loading side of the C frames

The C frame can be loaded from the left-hand side or the right-hand side as seen in the drive direction. Care must be taken to ensure that the tiller and the towing jaws are correctly fitted.

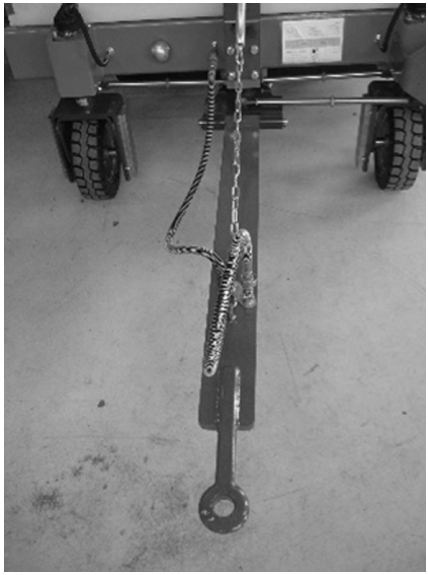
⚠ CAUTION

Risk of damage!

– When uncoupling the C frames, disconnect the hydraulic line between multiple frames or the hydraulic line from the tow tractor. The system must be depressurised when uncoupling.

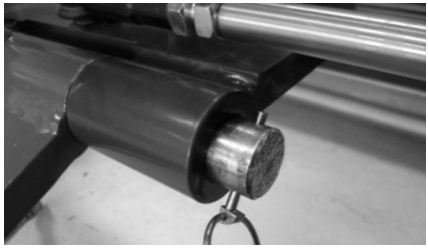
– Disconnect the hydraulic line from the tow tractor or from a preceding frame.

– Coil the hydraulic line into a loose loop and insert into the holding device. ▷

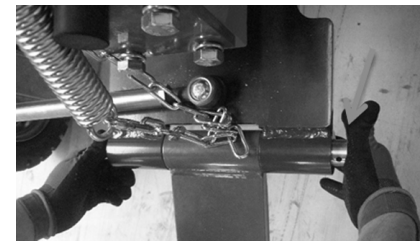


– Detach the chain on the tiller. ▷

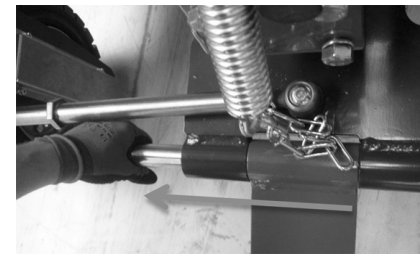
– Remove the linch pin from the pin. ▷



– Push the bolt out of the tiller support. ▷

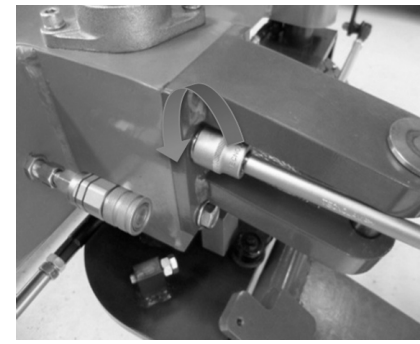


– Pull out the bolt from the tiller support. ▷



– Carefully set down the tiller. ▷

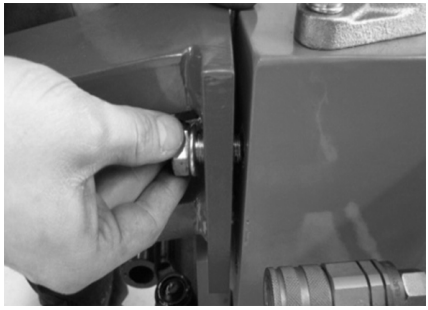
– Remove the towing jaws. ▷



– Remove the tiller support. ▷

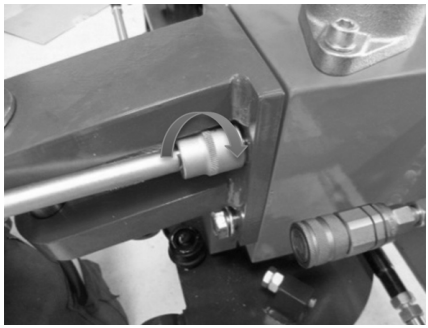
– Fix the towing jaws in a new position. To do this, tighten the mounting screws of the towing jaws by hand.

▷



– Tighten the mounting screws of the towing jaws **(tightening torque: 200 Nm)**.

▷



– Fix the tiller support in a new position. To do this, tighten the mounting screws of the towing jaws by hand.

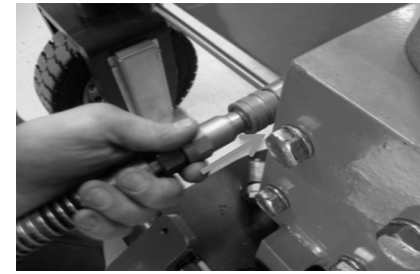
▷

– Tighten the mounting screws of the tiller support **(tightening torque: 200 Nm)**.

– Insert the tiller into the support mounting and push in the bolt. Secure the bolt using the linch pin.

– Attach the chain to the eyelet.

– Connect the hydraulic hose line to the C frame.



– Attach the tiller to the tow tractor or a preceding frame.

– Connect the hydraulic hose line to the tow tractor.
– Perform a functional test.

Coupling and uncoupling the C frames

Aligning the C frames

– Align the frames in the drive direction.

The frames are aligned according to the side on which the trolleys are to be loaded and unloaded.

Loading and unloading trolleys from left:

– Position the frames so that the opening is on the left-hand side in the drive direction.

Loading and unloading trolleys from right:

– Position the frames so that the opening is on the right-hand side in the drive direction.

Coupling the C frames

⚠ WARNING

Risk of trapping or crushing!

– Do not reach into the open coupling.
– The tow tractor and the trailer must be on level ground and must be secured so they cannot roll away.

⚠ WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

– Do not allow the fluid to come into contact with the skin.
– Avoid inhaling spray.
– Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
– To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

⚠ CAUTION

Risk of damage!

The system must be depressurised when uncoupling.

– When coupling and uncoupling the frames, always disconnect the pressure line between multiple frames or the pressure line from the tow tractor.

⚠ CAUTION

Risk of component damage!

– Observe the max. number of frames and the max. weight/load.
– Only use tillers/hoses in accordance with the table.

NOTE

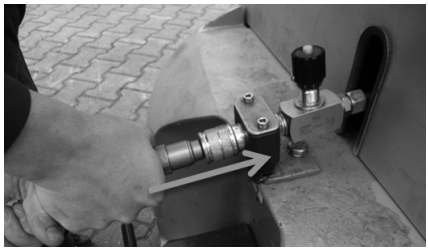
The tiller's orientation when it is mounted on the frame depends on whether the trolleys are to be loaded into the frame from the left or right.

– Release and remove the towing pin from the tow tractor or a preceding frame. To do this, depending on the version, press down the towing pin in the tow coupling on the tow tractor, turn the towing pin 90° and pull it out, or release the towing jaw bolt on the frame and pull it out.

– Insert the trailer tiller into either the coupling jaw of the tow coupling on the tow tractor or into the holding fixture of a preceding frame and secure the tiller in place. To do this, depending on the version, insert the towing pin into the coupling jaw, push down against the pressure of the safety spring, rotate the towing pin by 90° and lock it in place, or insert the coupling jaw bolt from the frame and secure the bolt in place.

– Attach the safety chain to the eyelet on the tiller.

– Attach the pressure line to the tow tractor or a preceding frame. Depending on the design of the tugger train, these lines are either hydraulic lines or pneumatic lines; refer to the chapter entitled "Connecting the plug connector".



– Check whether the C frame is properly connected to the tow tractor or a preceding frame.

- The pressure line must lie freely and must NOT be wrapped around the tiller
- The safety chain must be attached to the eyelet on the tiller

– Remove the equipment used to prevent the coupled load from rolling away.

– All other frames must be attached to frames in front of them and must be connected to the pressure lines. To do this, proceed as described above.

Uncoupling the C frames

⚠ WARNING

Risk of trapping or crushing!

– Do not reach into the open coupling.

– The tow tractor and the frames must be on level ground and must be secured so they cannot roll away.

⚠ CAUTION

Risk of damage!

The system must be depressurised when coupling or uncoupling.

– When coupling and uncoupling the frames, always disconnect the pressure line between multiple frames or the pressure line from the tow tractor.

– Disconnect the pressure line; refer to the chapter entitled "Disconnecting the plug connector".

– Make sure that the safety chain on the tiller is attached to the eyelet on the tiller.

– Release and remove the towing pin from the tow tractor or a preceding frame. To do this, depending on the version, press down the towing pin in the tow coupling on the tow tractor, turn the towing pin 90° and pull it out, or release the towing jaw bolt on the frame and pull it out.

– Pull out the trailer tiller from the coupling jaw of the tow coupling on the tow tractor or out of the coupling jaw of a preceding frame.

– Insert the towing pin and secure it in place.

Loading the C frames

⚠ WARNING

Risk of injury from becoming trapped!

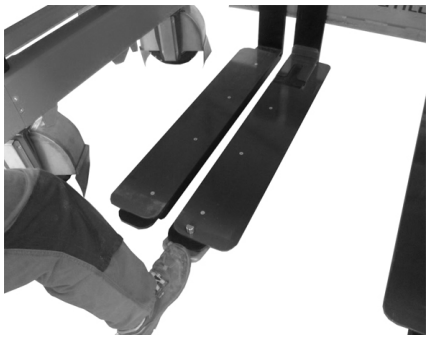
- Loading and unloading must only be performed by the driver. The driver must ensure that no other persons are in the vicinity of the frames.
- The frames must not be loaded or unloaded on gradients.
- It must be ensured that the trolleys are correctly inserted into the frames so that the securing bolts are fully visible.

⚠ CAUTION

Trolleys with tall, heavy loads may tip over when cornering.

- Lash the load to the trolleys if necessary.
- Place the load on the trolleys with the centre of gravity as low as possible.

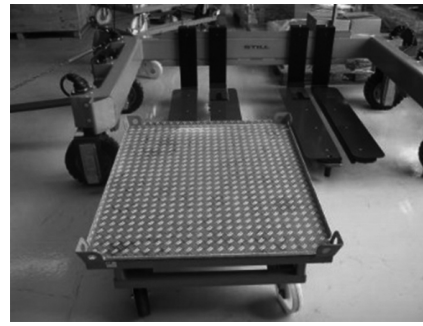
- Apply the parking brake on the tow tractor to secure it against rolling away.
- Lower the frame by actuating the lowering switch on the tow tractor.
- Adjust the position of the fork arms so that the trolleys to be transported can be held safely; refer to the chapter entitled "Adjusting the fork arms".
- Unlock the securing bolt by actuating the foot pedal. ▷



– Push the trolley into the open side of the C frame until the trolley reaches the stop. When doing so, ensure that the securing bolts are fully extended (locking position) once the trolley has been inserted.

The trolley is now secured against rolling out.

▷



Unloading the C frames

⚠ DANGER

Risk of crushing when unloading the trolleys!

– Never unload on chamfers or gradients.
– When unloading the trolleys, ensure that there is sufficient space to unload the trolleys safely and to manoeuvre the trolleys safely.
– Depending on how heavily a trolley is loaded, the driver must be prepared to exert a greater amount of force to brake or steer the trolley, if necessary.

⚠ WARNING

Risk of injury from becoming trapped!

– Loading and unloading must only be performed by the driver.
– Before lowering the frames, the driver must ensure that there are no other persons near the trolleys.

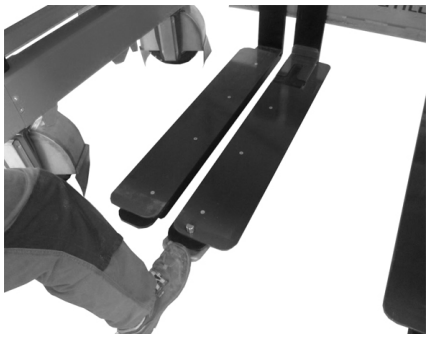
⚠ WARNING

Risk of injury! If you press the foot pedal to unload the trolley, this action will push the trolley out towards you.

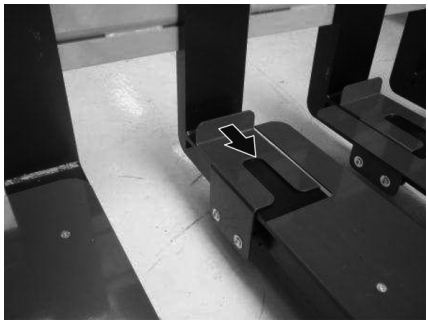
– Remove your foot from the foot pedal immediately after actuating the foot pedal.

– Apply the parking brake on the tow tractor to secure it against rolling away.
– Lower the frame by actuating the lowering switch on the tow tractor.

– Actuate the foot pedal until the securing bolts are fully retracted (unlocked). ▷



– The ejector automatically knocks the trolley to make the trolley roll out of the frame. ▷
– Pull the trolley straight out of the frame and take to the required unloading site.

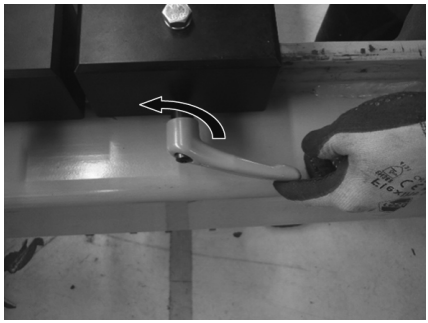


Adjusting the fork arms

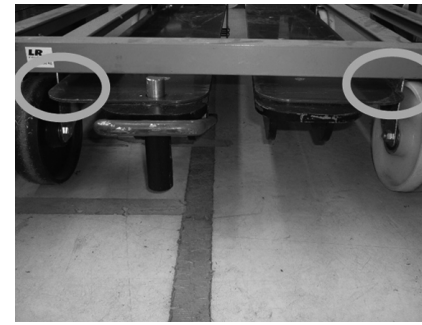
⚠ WARNING

Risk of trapping or crushing!
- Do not reach between the frame and the fork arms.

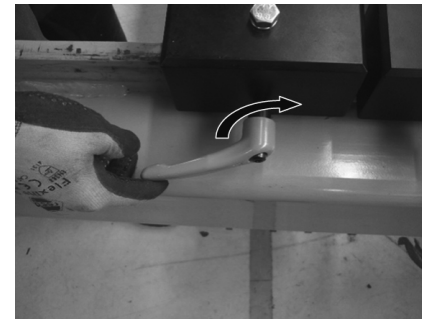
– To release the interlock, turn the locking lever in an anti-clockwise direction. ▷



– Align the fork arms on the frame so there is a 30-mm gap between the trolley and the frame after insertion. ▷



– To lock the fork arm in place, turn the locking lever in a clockwise direction. ▷



NOTE

If the locking lever hits the frames so that it cannot be turned sufficiently to release or secure the lock, it can be reset. To do this, pull out the locking lever towards the retaining spring and turn against the desired direction of rotation. Then re-engage the locking lever and turn in the desired direction of rotation again. Repeat this procedure as required until the interlock on the fork arm is fully released or secured.

Hydraulic/pneumatic coupling

Releasing the pressure from the hydraulic system

⚠ WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

- Do not allow the fluid to come into contact with the skin.
- Avoid inhaling spray.
- Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
- To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

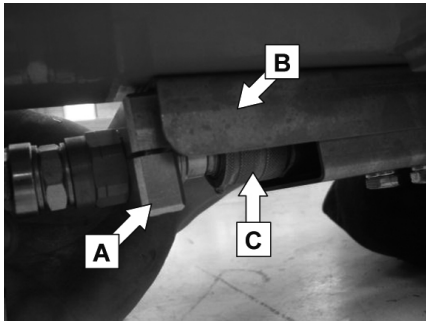
Releasing the pressure from the hydraulic system

- Leave the tow tractor and/or actuate the lift/lower switch on the tow tractor.
- Lift and lower the frame repeatedly until the frame no longer lifts (only on autarkic version).

Hydraulic connection to the trailer

Connecting the rotation lock

▷



⚠ WARNING

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- Do not allow the fluid to come into contact with the skin.
- Avoid inhaling spray.
- Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
- To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

⚠ CAUTION

Risk of component damage!

- In the event of incorrect assembly, the coupling will become damaged during operation.
- The plug connector and the coupling must always be clean.
- Only use hoses in accordance with the table.

- Couple the frames.
- Release the pressure from the system.
- To prevent the coupling (C) from rotating, lock the rotation lock (A) on the hydraulic connection into the guard plate (B).
- Attach the pressure line. To do this, push the plug firmly into the coupling.

Releasing the rotation lock

⚠ WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

- Do not allow the fluid to come into contact with the skin.
- Avoid inhaling spray.
- Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
- To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

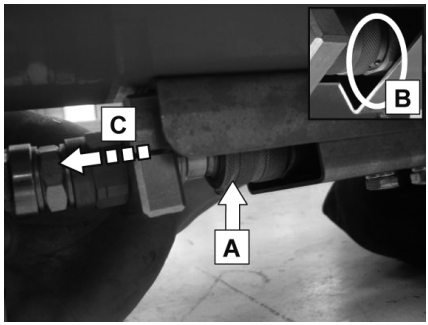
⚠ CAUTION

Risk of component damage!

In the event of incorrect assembly, the coupling will become damaged during operation.

- Release the pressure from the system.

– Turn the ring on the connector sleeve (A) until the two markings on the coupling are aligned (B).
– Press the ring on the connector sleeve in the direction of the ball (B) and disconnect the plug connector (C).



NOTE

The ball on the coupling must lie in the groove on the connector sleeve!

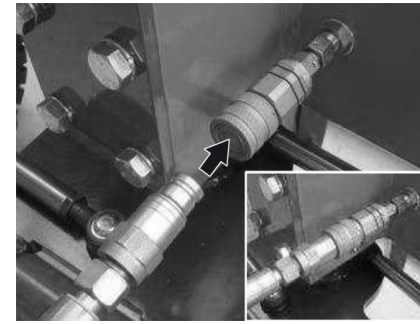
NOTE

Appearance of the guard plate on the hydraulic coupling may vary slightly from the figure.

Connecting the plug connector

Connecting

▷



⚠ WARNING

Hydraulic fluid is pressurised during operation and is hazardous to your health.

- Do not allow the fluid to come into contact with the skin.
- Avoid inhaling spray.
- Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
- To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

⚠ CAUTION

Risk of damage!

- The plug connector and the coupling must always be clean.
- Only use hoses in accordance with the table.

- Couple the frames.
- Release the pressure from the system.
- Attach the pressure line. To do this, push the plug firmly into the coupling.

Disconnecting the plug connector

Uncoupling

The coupling is secured against being released unintentionally.

The coupling can only be disconnected in the correct position (in accordance with the figure).

Hydraulic/pneumatic coupling

⚠ WARNING

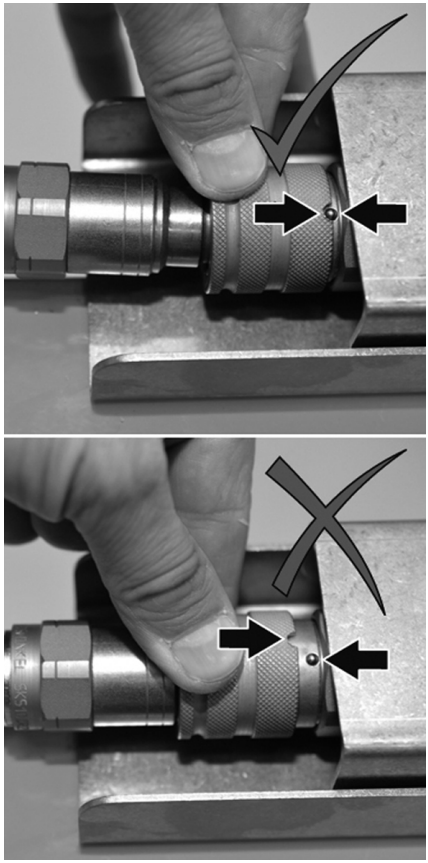
Hydraulic fluid is pressurised during operation and is hazardous to your health.

- Do not allow the fluid to come into contact with the skin.
- Avoid inhaling spray.
- Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.
- To avoid injury, use appropriate personal protective equipment (e.g. protective gloves, protection goggles, skin protection and skin care products).

- Release the pressure from the system.
- Turn the ring on the connector sleeve until the two markings on the coupling are aligned.
- Gently press the ring on the connector sleeve in the direction of the ball and disconnect the plug connector.

NOTE

The ball on the coupling must lie in the groove on the connector sleeve!



Driving

Safety regulations when driving

Driving conduct

⚠ DANGER

Risk of accident from crushing!

- Before moving off, make sure that there are no people on or between the individual frames.
- Observe markings for pedestrian paths and roadways.

⚠ WARNING

The driver's attention is adversely affected by operating multimedia and communication devices or listening to these devices at an excessive volume during travel or when handling loads. Risk of accident!

- Do not use devices during travel or when handling loads.
- Set the volume so that warning signals can still be heard.

⚠ WARNING

In areas where the use of mobile phones is prohibited, it is absolutely not permitted to use a mobile phone or radio telephone.

- Switch off the devices.

⚠ CAUTION

Components can be damaged by incorrect driving!

- Reverse travel with the tugger train is prohibited.
- Tugger trains with the autarkic system must always be equipped with an articulated steering system for stability reasons.
- At the maximum permitted steering angle, the tillers must not make contact with either the frames or the hydraulic components.

⚠ CAUTION

Components can be damaged by incorrect operation!

- The driver may only move off if all frames are completely raised.

The driver must comply with the highway code when driving within the plant.

The driver must use an appropriate turning circle depending on the train to be towed and must not corner at more acute angles than this.

The speed must be appropriate to the local conditions.

For example, the driver must drive slowly around corners, in tight passageways, when driving through swing-doors, at blind spots or on uneven roadways.

The driver must always maintain a safe braking distance from vehicles and persons in front, and must always have the tugger train under control. He must avoid stopping suddenly, turning at speed and overtaking in dangerous places or in blind spots.

– Initial driving practice must be carried out in an empty space or on a clear roadway.

The following are forbidden when driving:

- Carrying passengers on the frames or the fork arms
- Walking between the tow tractor and the frame
- Leaning the body over the outer contour of the tow tractor
- Using electronic devices, for example radios, mobile phones etc.

Driving over ramps with the E frames

E frame

NOTE

Articulated steering system required for driving over ramps!

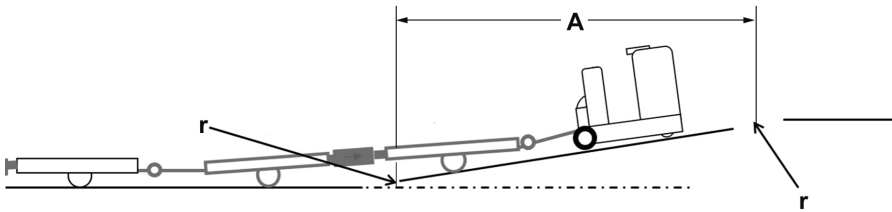
WARNING

Risk of accident from failing to adjust speed!

– Max. speed when driving over ramps: 6 km/h.

Gradient on the ramp	Comment
Up to 7%	The ends of the ramp do not have to be rounded
7% to 18%	Between the start of the ramp and the middle section (section A) and between the middle section and the end of the ramp, see figure (not to scale)

Diagram



A Distance between the start of the ramp and the end of the ramp

r Radius min. 40 m

E frames (standard tiller)

CAUTION

Components can be damaged by driving on upward or downward gradients!

It is forbidden to drive on ramps.

Driving over ramps with the C frames

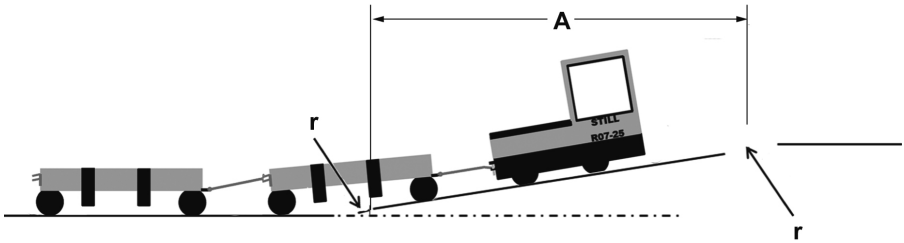
⚠ WARNING

Risk of accident from failing to adjust speed!

– Max. speed when driving over ramps: 6 km/h.

Gradient on the ramp	Comment
Up to 7%	The ends of the ramp do not have to be rounded
7% to 18%	Between the start of the ramp and the middle section (section A) and between the middle section and the end of the ramp, see figure (not to scale)

Diagram



A Distance between the start of the ramp and the end of the ramp
r Radius min. 40 m

Reverse travel

Reverse travel

Frames, tillers and hydraulic components are severely damaged by reverse travel. The operational safety is then no longer guaranteed!

⚠ CAUTION

Components can be damaged by incorrect driving!

– Reverse travel with the tugger train is prohibited.

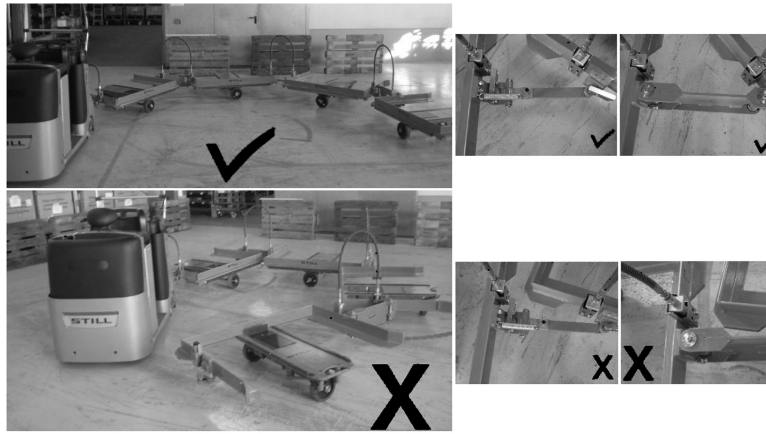
Steering angle

⚠ CAUTION

Components can be damaged by incorrect driving!

– At the maximum permitted steering angle, the tillers must not make contact with either the frames or the hydraulic components.

Steering angle



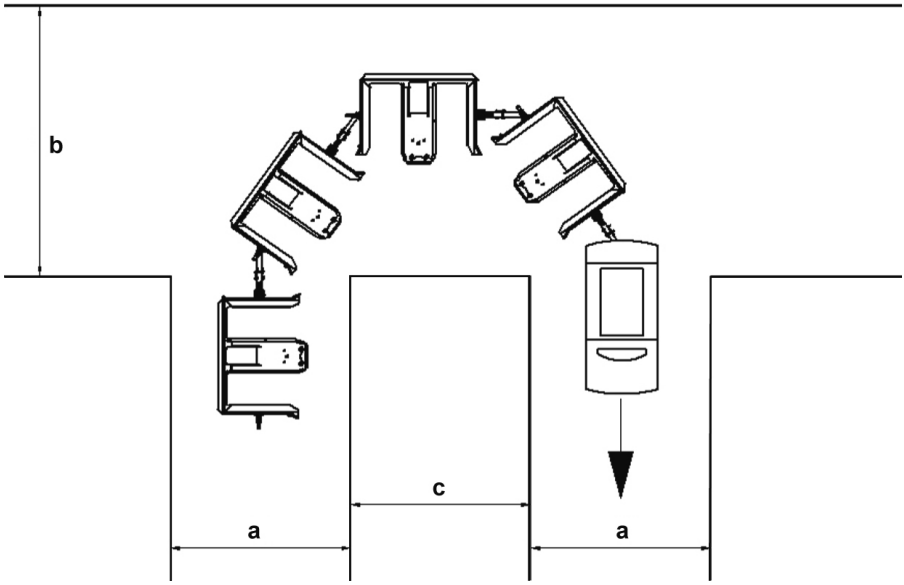
NOTE

Recommendation: Perform a test drive to check the steering angle.

Roadways

Minimum aisle widths for E frames

Minimum aisle widths depending on the length of the tugger train

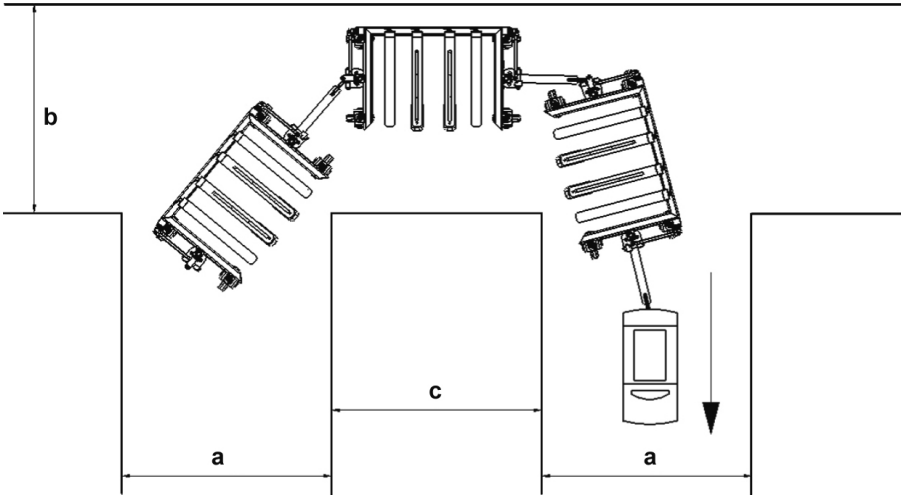


E frame	Number of trailers	Length without tow tractor in cm	a	b	c	a
			a in cm (without oncoming traffic) with CX-T or R 06	b in cm (without oncoming traffic) with CX-T or R 06	c in cm with CX-T or R 06	In loading and unloading zone, a in cm with CX-T or R 06
1210 x 810	2	374	200	220/240	200	290
	3	561	200	260/280	200	290
	4	748	200	300/320	200	290
	5	935	200	340/360	200	290
1210 x 1010	2	402	230	250/270	200	330
	3	603	230	290/310	200	330
	4	804	230	330/350	200	330
	5	1005	230	370/390	200	330

1610 x 1210	2	502	250	280/300	200	370
	3	753	250	340/360	200	370
	4	1004	250	400/420	200	370
	5	1255	250	460/480	200	370
This table shows only the technical values for a standard frame. Different dimensions, additional units etc. may produce different values.						

Minimum aisle widths for C frames

Minimum aisle widths depending on the length of the tugger train



C frame	Number of trailers	Length without tow tractor in cm	a a in cm (without oncoming traffic) with CX-T or R 06	b b in cm (without oncoming traffic) with CX-T or R 06	c c in cm with CX-T or R 06	a In loading and unloading zone, a in cm with CX-T or R 06
2000 x 1200	1	384	275	275	80	390
	2	768	300	300	80	390
	3	1152	325	325	80	390
	4	1536	350	350	80	390
This table shows only the technical values for a standard frame. Different dimensions, additional units etc. may produce different values.						

6

Servicing

Safety regulations for maintenance

General information

General information

To prevent accidents during service work and inspections, all necessary safety measures must be taken, e.g.:

- Place the frames on which service work or repair work is to be performed on a level surface in a cordoned-off, safe location.
- Secure the frames to prevent them from rolling away during all service work and repair work.
- Place the frames on which service work or repair work is to be performed on a solid, level surface.
- Jack up the frames in a horizontal position so that both wheels rotate freely and it is possible to work while maintaining an ergonomic posture.

Safety devices

After service work and repair work, all safety devices must be reinstalled and checked to ensure that they are in working order.

Maintenance instructions

Maintenance work must be carried out in accordance with the following maintenance intervals. The intervals are defined for standard use. Shorter maintenance intervals can be defined in consultation with the operating company, depending on the application conditions of the tow tractor/frame.

The following factors may necessitate shorter maintenance intervals:

- Dirty, poor-quality roadways
- Dusty or salty air
- High levels of air humidity
- Extremely high or low ambient temperatures, or extreme changes in temperature
- Multi-shift operation with a long operating time

- Specific national regulations for the frame or individual components
- Outdoor use

For maintenance tasks, only use original spare parts, and only use consumables that have been prescribed in the overview of consumables.

Personnel qualifications

Qualifications of personnel

Service work and inspections must be performed correctly by qualified and authorised personnel using suitable tools. The annual testing must be conducted by a specialist. The specialist's evaluation must be unaffected by operational and economic conditions and be conducted solely from a safety standpoint. The specialist must have the sufficient knowledge and experience to be able to assess the condition of the frames and the effectiveness of the protective devices according to technical conventions and the principles for testing industrial trucks.

Working on the hydraulic equipment

The hydraulic system must be depressurised prior to all work on the system.

Service work (C frames)

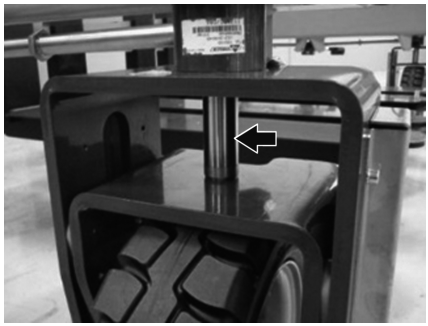
Checking the gasket for leaks

Check the gasket on the hydraulic cylinders for leaks

– Lift the C frames hydraulically.

– The cylinder rod (see arrow) must be moistened with only a thin film of oil.

– Check the gasket for leaks (traces of oil).



Checking the hydraulic system for wear points

Checking the hydraulic system for wear points

⚠ WARNING

Hydraulic oil under pressure can escape from leaking lines and cause injuries to the skin.

– Wear suitable protective gloves, protection goggles etc.

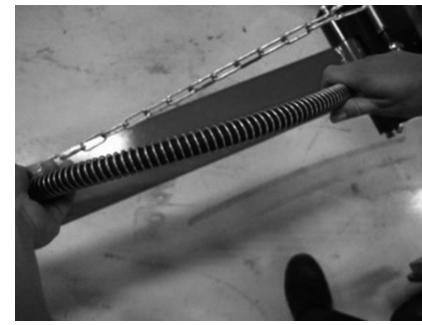
⚠ WARNING

Hydraulic hoses become brittle over time!

– Hydraulic hoses must not be used for a period longer than six years.

– The BGR 237 specifications must be complied with. Differing national laws must be taken into account.

– Perform a visual inspection of the hydraulic hoses on the C frame in order to identify wear points or porous areas. ▷



– If damaged, replace the hydraulic hoses and gaskets. ▷

Hose lines must be replaced if:

- The outer layer is damaged or becomes brittle and cracks begin to form
- They are leaking
- There are any unnatural deformations (e.g. bubble formation or buckling)
- A fitting is detached from the hose
- A fitting is heavily damaged or corroded

Pipes must be replaced if:

- There is abrasion and a loss of material
- There are any unnatural deformations and bending stress is detected
- They are leaking

Checking the lifting function

Checking the lifting function

⚠ WARNING

Hydraulic fluid is pressurised during operation. It is hazardous to your health.

– Do not allow the fluid to come into contact with the skin.

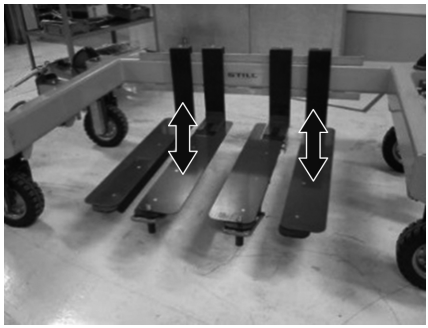
– Avoid inhaling spray.

– Penetration of hydraulic fluids into the skin is particularly dangerous if these fluids escape at high pressure due to leaks in the hydraulic system. In case of such injury, immediate medical assistance is required.

Service work (C frames)

– Couple the C frame to the tow tractor and connect the hydraulic connection hose. ▷

– Enter the tow tractor and actuate the lifting/lowering switch on the tractor. All frames must lift or lower. ▷



Maintenance intervals for the E frames

Summary table of maintenance tasks for the E frames.

Unit	Task	Daily	Quarterly
Chassis	Check if the trolley can roll out of the lowered E frame despite the securing bolt being extended	x	
	Carry out a functional test on the securing bolts and the lifting function (of the E frames)	x	
	Clean the securing bolts on the E frame, check the bolts for damage and correct operation, spray the bolts		x
	Check the bearings on the securing bolts (ease of movement)		x
	Clean the mechanism on the E frame		x
	Check the mechanism for general ease of movement		x
	Check that all bolts and nuts are present and that they are securely fitted		x
	Check for the red warning colour on the securing bolts		x
	Check that the springs are operating correctly		x
Hydraulics/pneumatics	Check the pressure lines and pressure connections for leaks		x
	Check the hoses for wear points (leaks)		x
	Check the gasket on the hydraulic cylinders for leaks		x
Wheels	Check the wheels for wear and ease of movement		x

Maintenance intervals for the autarkic E frames

Summary table of maintenance tasks for the autarkic E frames.

NOTE

Before performing maintenance, enter the tow tractor and drive approx. 25 m. The hydraulic accumulators in the frames are now charged.

Unit	Task	Daily	Quarterly
Chassis	Check if the trolley can roll out of the frame despite the securing bolts being in the securing position	x	
	Carry out a functional test on the securing bolts and the lifting function (of the E frames)	x	
	Clean the securing bolts on the E frame, check the bolts for damage and correct operation, spray the bolts		x
	Check the bearings on the securing bolts (ease of movement)		x
	Clean the mechanism on the E frame		x
	Check the mechanism for general ease of movement		x
	Check that all bolts and nuts are present and that they are securely fitted		x
	Check for the red warning colour on the securing bolts		x
	Check that the springs are operating correctly		x
	Check the lines and the connections for leaks		x
	Check the oil level and top up if necessary		x
Hydraulics/pneumatics	Check the pressure lines and pressure connections for leaks		x
	Check the gasket on the hydraulic cylinders for leaks		x
	Check the hoses for wear points (leaks)		x

Wheels	Check the wheels for wear and ease of movement		x
Drive	Check the drive belt for wear and replace if necessary		x

Maintenance intervals for C frames

Maintenance in accordance with the maintenance schedule

Unit	Task	Daily	Quarterly	Annually
Chassis	Carry out a functional test on the securing bolts and the lifting function (of the C frames)	x		
	Check if the trolley can roll out of the lowered C frame despite the securing bolt being extended	x		
	Clean the securing bolts on the C frame, check the securing bolts for damage and correct operation and spray the securing bolts		x	
	Check the bearings on the securing bolts (for ease of movement)		x	
	Clean the mechanism on the C frame		x	
	Check the mechanism for general ease of movement		x	
	Check that all bolts and nuts are present and that they are securely fitted		x	
	Check for the red warning colour on the securing bolts		x	
	Check that the springs are operating correctly		x	
Hydraulics/pneumatics	Check the pressure lines and pressure connections for leaks		x	
	Check the hoses for wear points (leaks)		x	
	Check the gasket on the hydraulic cylinders for leaks		x	
Wheels	Check the wheels for wear and ease of movement		x	
	Check the bearings and rod end bearings at the wheel guides (for ease of movement)		x	
Fork arms	Check the fork arms for wear and deformation Check the fork arms and welding seams using a dye penetration test			x

Consumables

Consumables for service work on the standard frames

C frame		
Unit	**Consumable**	**Specification**
Lubricating nipple bearing wheel guides	Grease	Lubricating grease KP 2 K-30 DIN 51825
Securing bolts	Lubricant	PTFE Longlife Teflon spray
Ejector tread	Lubricant	PTFE Longlife Teflon spray
Moving parts of the fork arms	Lubricant	PTFE Longlife Teflon spray
Securing bolts	Colour	Red warning colour
Lubricating nipple for the wheels	Grease	Lubricating grease KP 2 K-30 DIN 51825

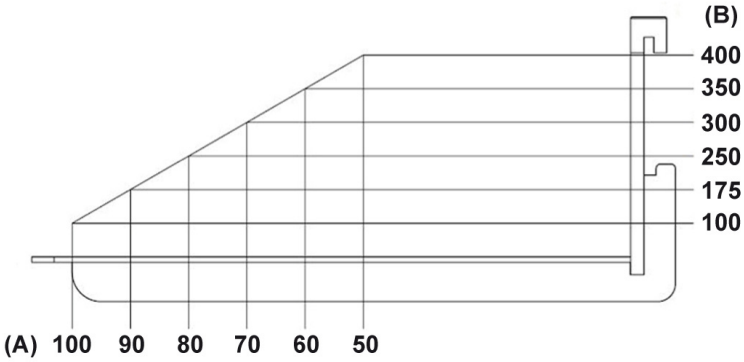
E frame		
Unit	**Consumables**	**Specification**
Securing bolts	Lubricant	PTFE Longlife Teflon spray
E chassis mechanism	Lubricant	PTFE Longlife Teflon spray
Lubricating nipple for the wheels	Grease	Lubricating grease KP 2 K-30 DIN 51825
Securing bolts	Colour	Red warning colour

"Autarkic" E frame		
Unit	**Consumables**	**Specification**
Securing bolts	Lubricant	PTFE Longlife Teflon spray
E chassis mechanism	Lubricant	PTFE Longlife Teflon spray
Lubricating nipple for the wheels	Grease	Lubricating grease KP 2 K-30 DIN 51825
Oil tank	Oil	HLP 46
Securing bolts	Colour	Red warning colour

7

Technical data

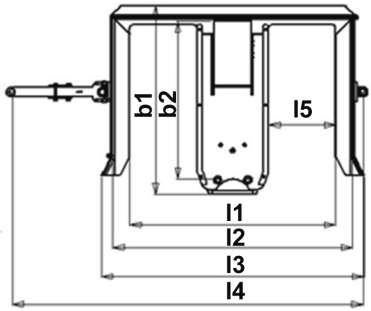
Load diagram for the C frames



(A) Load centre of gravity distance (%)

(B) Load (kg)

Technical data for E frames

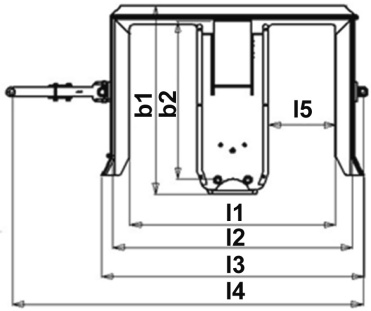


Technical data and equipment for the E frames				600 kg (1210/810) 1000 kg (1210/810)	600 kg (1210/1010) 1000 kg (1210/1010)	1000 kg (1610/1210)
Load capacity		Q	kg	600/1000	600/1000	1000
Net weight			kg	158/170	188/200	274
Dimensions	Length	l1	mm	1090	1090	1490
	Length	l2	mm	1270	1270	1666
	Length	l3	mm	1390	1390	1790
	Length	l4	mm	1900	2040	2650
	Length	l5	mm	355	355	555
	Width	b1	mm	1007	1207	1417
	Width	b2	mm	837*	1037**	1240***
	Height	h1	mm	228	228	228
	Height	h2	mm	310	310	310
Max. driving speed (depending on the tow tractor)			km/h	15	15	15
Turning circle (CX-T/R 06 tow tractor)		2 x Wa	mm	3900/4200	4200/4500	5500/5800
Turning radius (CX-T/R 06 tow tractor)		Wa	mm	1950/2100	2100/2250	2750/2900
Recommended number of trailers			Piece	4	4	4
Load-carrier dimensions			mm	1200/800	1200/1000	1600/1200

Technical data for E frames

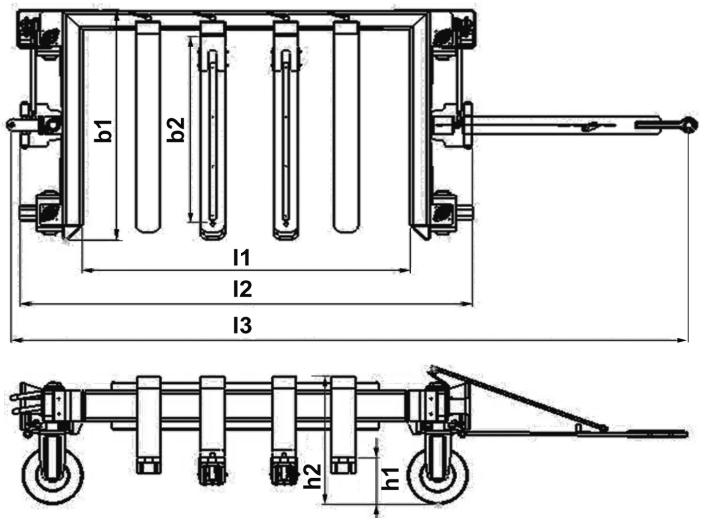
* For load carriers up to a maximum width of 810 mm		
** For load carriers up to a maximum width of 1010 mm		
*** For load carriers up to a maximum width of 1210 mm		

Technical data for autarkic E frames



Technical data and equipment for the autarkic E frames				1210/810	1210/1010	1610/1210
Load capacity		Q	kg	600/1000	600/1000	1000
Net weight			kg	158/170	188/200	274
Dimensions	Length	l1	mm	1090	1090	1490
	Length	l2	mm	1270	1270	1666
	Length	l3	mm	1390	1390	1790
	Length	l4	mm	1900	2040	2650
	Length	l5	mm	355	355	555
	Width	b1	mm	1007	1207	1417
	Width	b2	mm	837*	1037**	1240***
	Height	h1	mm	228	228	228
	Height	h2	mm	310	310	310
Max. driving speed (depending on the tow tractor)			km/h	15	15	15
* For load carriers up to a maximum width of 810 mm						
** For load carriers up to a maximum width of 1010 mm						
*** For load carriers up to a maximum width of 1210 mm						

Technical data for C frames



Technical data and equipment for the C frames				
Load capacity		Q	kg	1600
Net weight			kg	960
Dimensions	Length	l1	mm	2000
	Length	l2	mm	2760
	Length	l3	mm	4140
	Width	b1	mm	1540
	Width	b2	mm	1250*
	Height	h1	mm	228
	Height	h2	mm	755
Max. driving speed (depending on the tow tractor)			km/h	15
Turning circle**		2xWa	mm	6200
Turning radius**		Wa	mm	3100
Maximum dimensions of load carrier			mm	1900 x 1200
*For load carriers up to 1210 mm wide				
**CX-T or R 06 tow tractor				

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