Original instructions

Liftrunner

B frames for tugger trains

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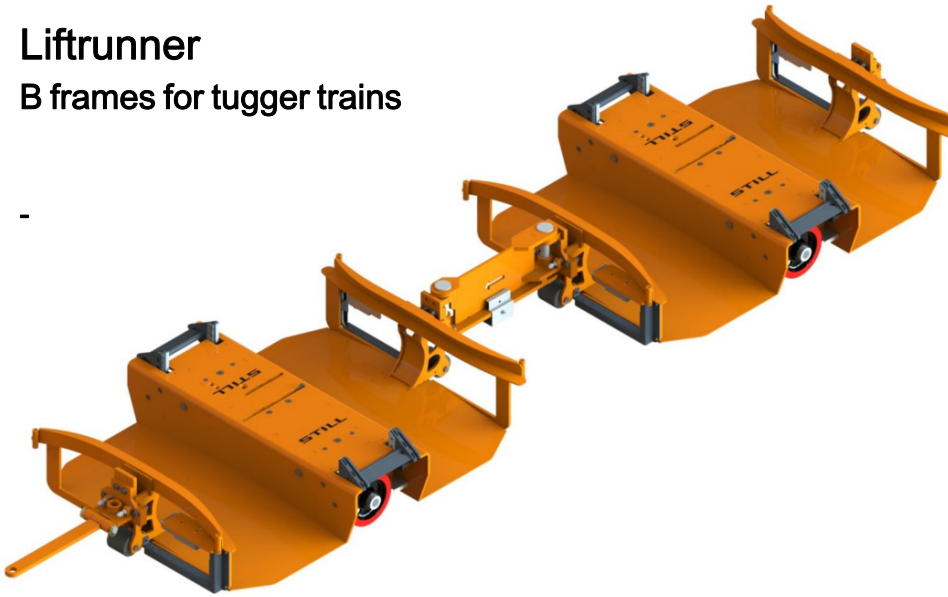

CE

first in intralogistics

50988046101 EN - 02/2017

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

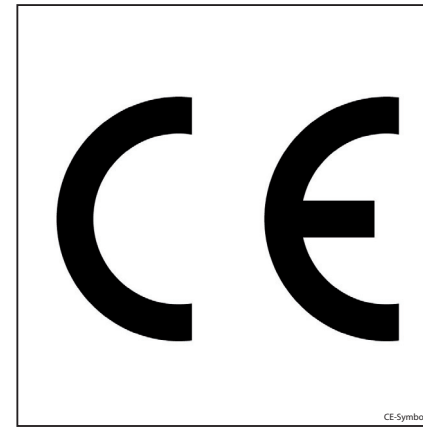
Copyright and trademark rights

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.



CE-Symbol

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 holding 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, pneumatic or electrical system. The tow tractor for the frames must therefore

be fitted either with a suitable hydraulic power unit, air compressor or electrical system.

"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 is pushed into the frame for transportation. Depending on the design of the "trolley" 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.

2

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 replace them with empty trolleys
- A frame must only be loaded with the trolleys intended for this purpose
- A B frame, C frame or E frame may only be pulled by a suitably equipped (pneumatic/hydraulic/electrical) 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

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:

- C frames: Rockinger towing jaws RO244- 2
- B frames and E frames: 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

- The maximum permitted tractive power of the tow tractor must not exceed 16,000 N
- 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

Hydraulic B frames and E frames

- The maximum permitted tractive power of the tow tractor must not exceed 2,000 N With a reinforced hinged tiller (UPA), the maximum tractive power of the tow tractor must not exceed 5000 N
- 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

Pneumatic E frame

- The maximum permitted tractive power of the tow tractor must not exceed 2,000 N With a reinforced hinged tiller (UPA), the maximum tractive power of the tow tractor must not exceed 5000 N
- 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

Electrical B frames and E frames

- The maximum permitted tractive power of the tow tractor must not exceed 2,000 N With a reinforced hinged tiller (UPA), the maximum tractive power of the tow tractor must not exceed 5000 N
- The tow tractor must have suitable interface
- The tow tractor must have a rechargeable battery with a voltage of 24 V
- The rechargeable battery must be able to provide a current of up to 125 A at 24 V for lifting the frames
- For lowering the frames, the rechargeable battery must be able to store up to 35 A at 25.5 V

Autarkic E frame

- The maximum permitted tractive power of the tow tractor must not exceed 2,000 N

With a reinforced hinged tiller (UPA), the maximum tractive power of the tow tractor must not exceed 5000 N

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

The 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.

Protection type of electrical system

When connected, the electrical system corresponds to protection type IP 54.

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.

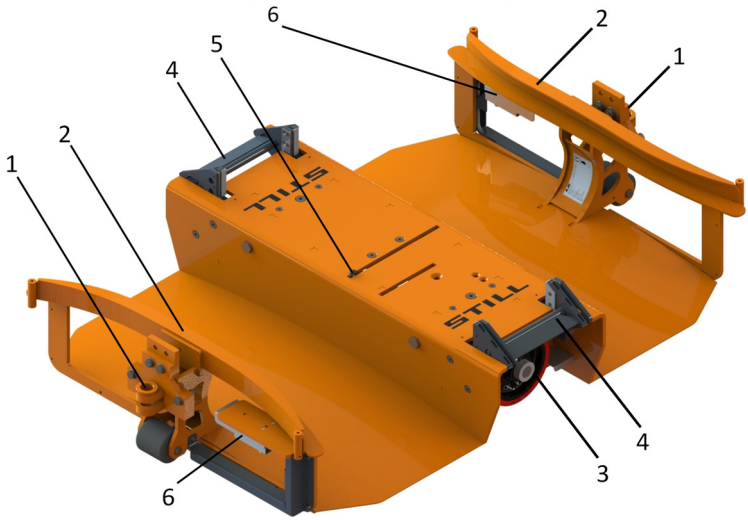
– Always observe national regulations concerning the disposal of used oil.

4

Overviews

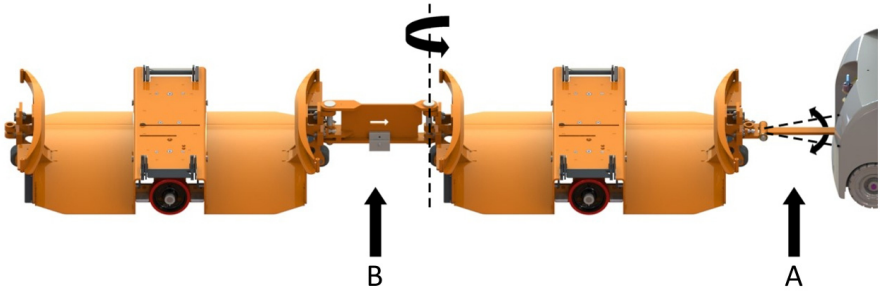
Overall view

B frame



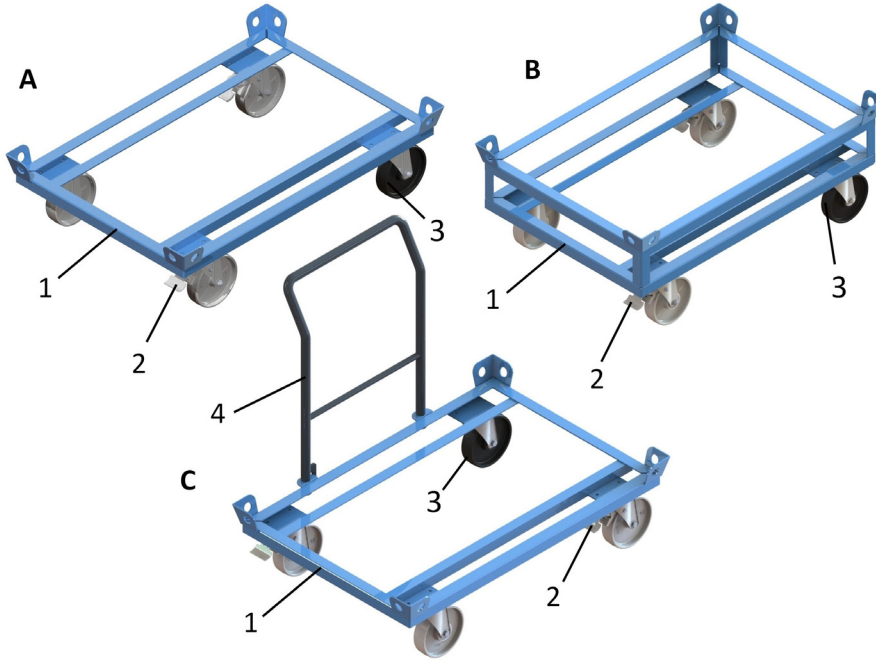
1	Towing jaws	4	Foot pedal for the locking plates
2	Side guides for the trolley	5	Eccentric for manual lift
3	Wheel	6	Hydraulic/electrical connection

Articulated steering system



B	Rigid tiller	A	Hinged tiller

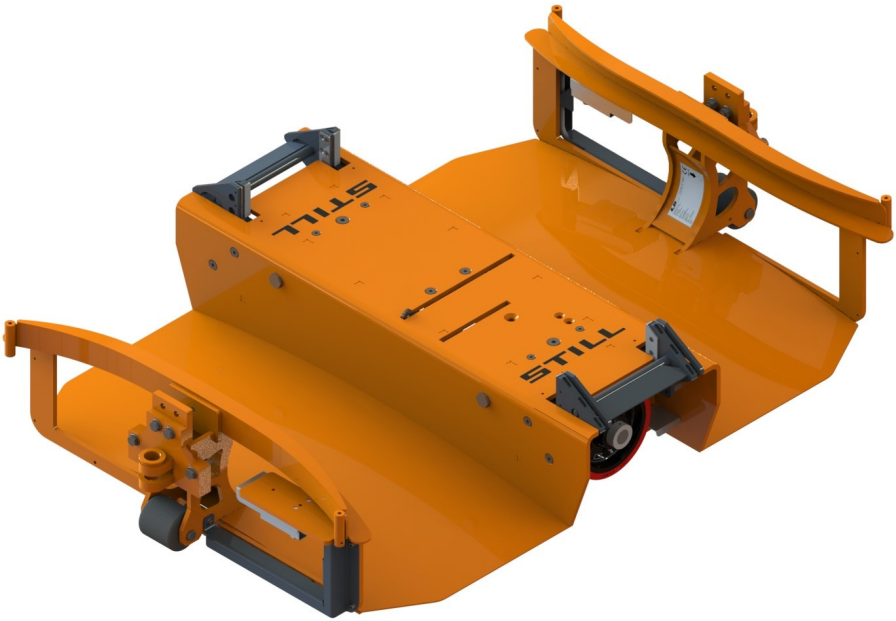
Trolleys



A	Euro 1/1 trolley – standard design	1	Frame
B	Euro 1/1 h trolley - raised version (450 mm)	2	Swivel castors (2 x diagonally braked)
C	Euro 1/1 trolley - standard design with handle	3	ESD-roller (electrically conductive roller)
		4	Handle

Description

B frames



The B frame is a device for picking up and transporting roller platforms (trolleys). The trolleys can be loaded with crates, pallets or similar.

Between two and a maximum of four B frames can be attached to a single tow tractor. Only articulated frame steering rigs are permitted.

B frames and E frames can be combined in a single train.

The energy required for the lifting operation is provided by the tow tractor. The frame is raised via the axle. Depending on the version, the energy is transferred hydraulically or electrically.

NOTE

To ensure that the load is secured efficiently, the dimensions of the trolleys must be compatible with the B frame.

Articulated steering system

Design and function

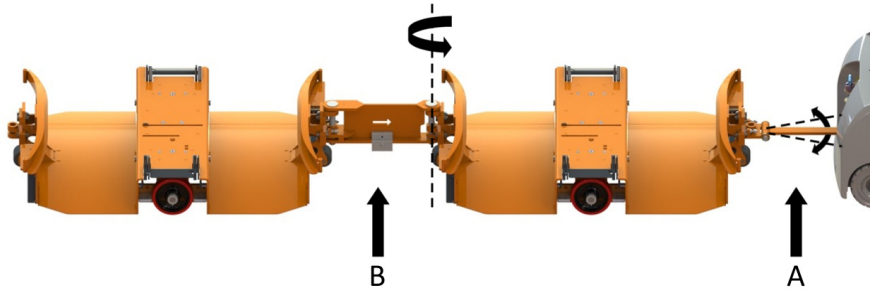
Design and function of the articulated steering system

Design

1b Articulated frame steering rig 2

1a Articulated frame steering rig 1

Function



B Rigid tiller

A Hinged tiller

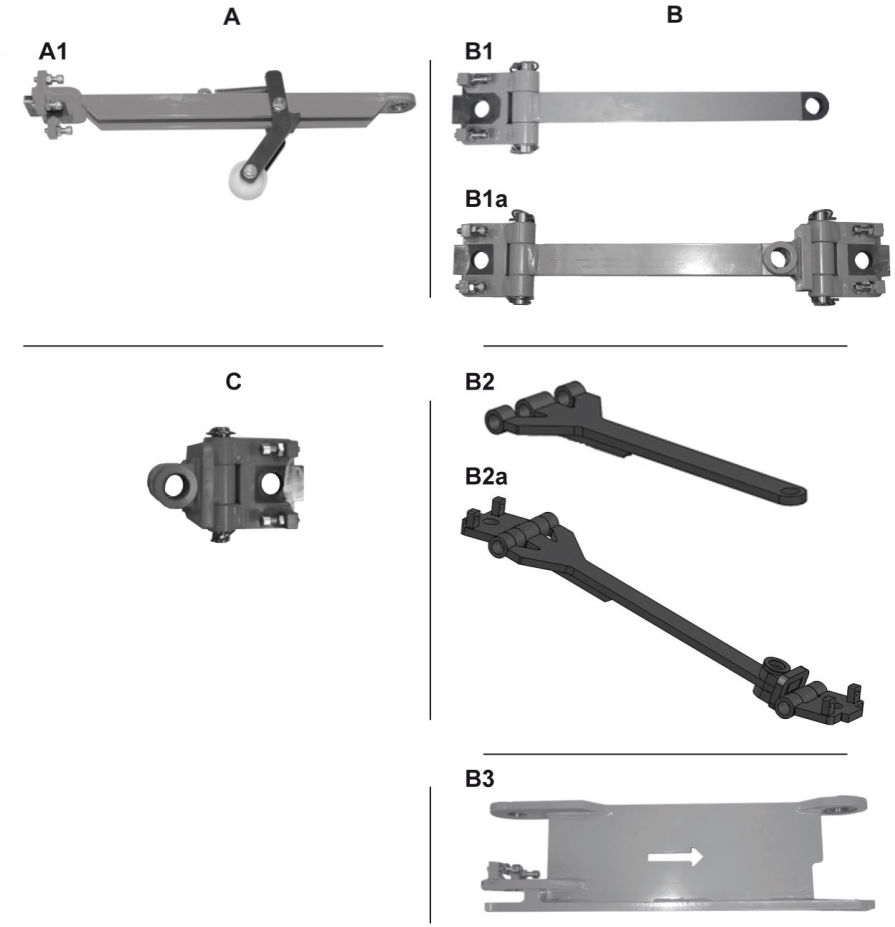
NOTE

The articulated steering system 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. There is no rocking of the frames.

Tiller system

Standard tiller/articulated steering system

Illustration of the tiller systems



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

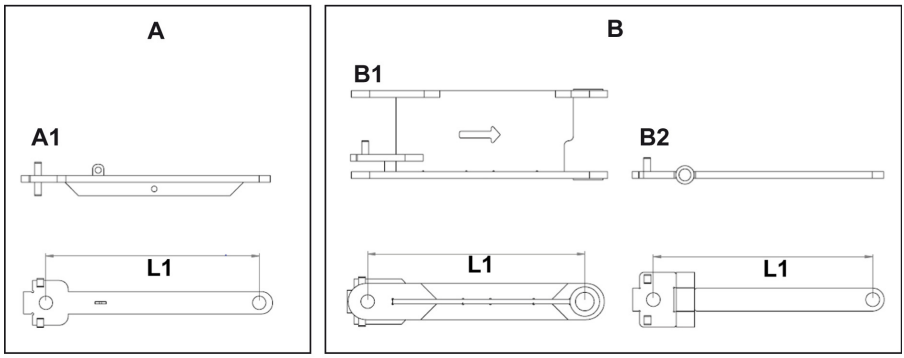
Standard system (A) (no driving over ramps)		
Standard tiller	**(A1)**	For standard E frames, no driving over ramps
		Between the tow tractor and the first E frame
		Between the E frames in the standard tugger train
Articulated steering system (B) (driving over ramps)		
Articulated steering system	**(B)**	Always for B frames and autarkic E frames*
Hinged tiller	**(B1/B2)**	Between the tow tractor and the first 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 B frames or two autarkic E frames of 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		
**Optional for B frames and E frames		

Tiller lengths

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

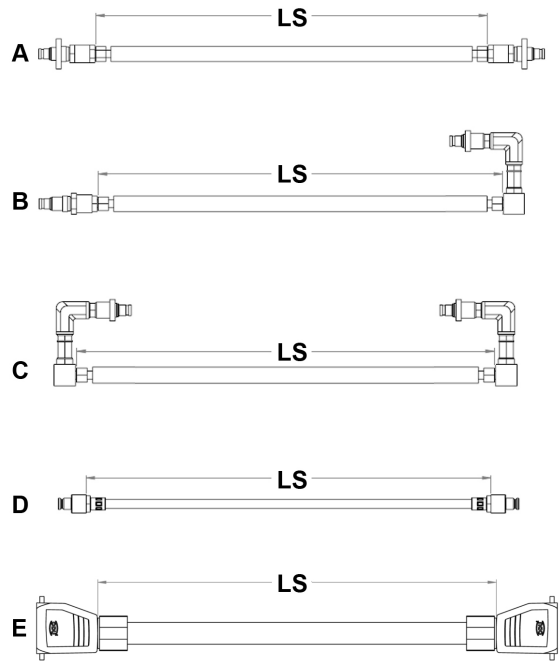
B frames E frames	E frames can hold double loads	B frames can hold triple loads	Tiller length (L1)
1200 x 800	-	800 x 600	478 mm
1200 x 1000	800 x 600	1000 x 600	628 mm
	1000 x 600	-	778 mm
The tiller for each B frame or E frame must be adapted to the width of the preceding frame (when viewed in the 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.			

Hose lengths and cable lengths

Long hydraulic hose, pneumatic hose and connecting cable

The length of the hoses and cables are to be selected depending on the tiller length, as per the table.

Overview

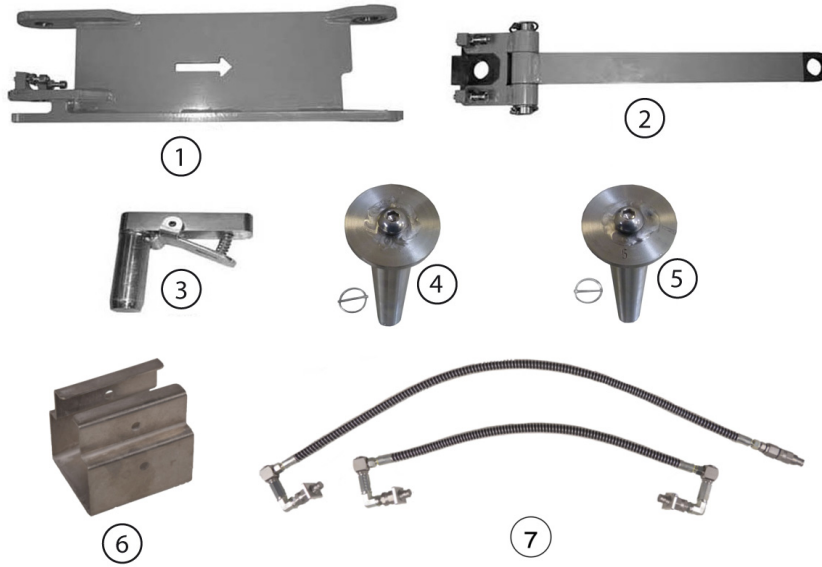


A Connection hose, routed above
B Connection hose to the tow tractor, routed below
C Connection hose between E frames, routed below
D Pneumatic connection hose
D Connecting cable for electrical system

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 (E frame only)	**Hose length LS**	**Tiller length**
D	1030 mm	478 mm
	1150 mm	628 mm
	1500 mm	778 mm
Electrical system, between the tow tractor and a frame	**Cable length LS**	**Tiller length**
D	1170 mm	478 mm
	1320 mm	628 mm
Electrical system, between two frames	**Cable length LS**	**Tiller length**
D	896 mm	478 mm
	1046 mm	628 mm

Articulated steering system

Components for two frames - hydraulic system

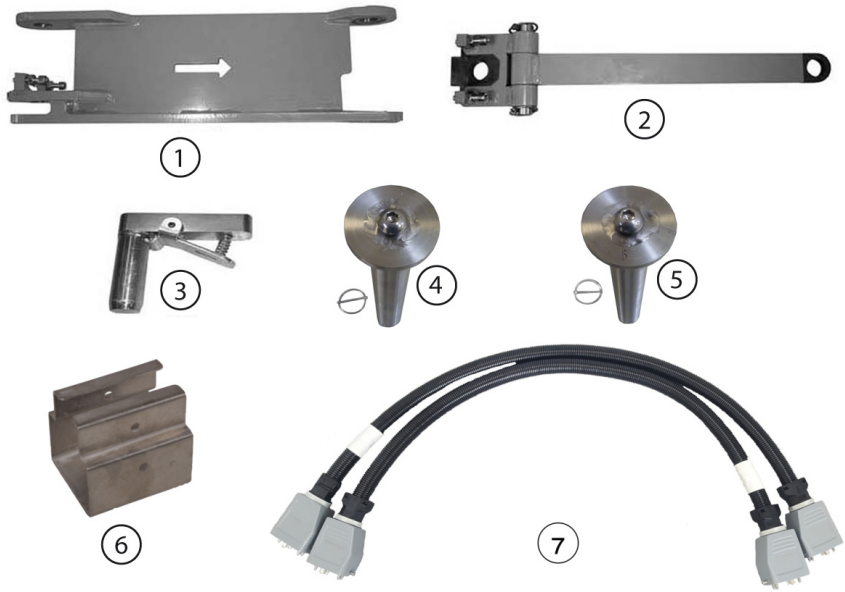


Item	Quantity	Unit	Name
1	1	Piece	Rigid tiller with two pre-assembled clamping bolts
2	1	Piece	Hinged tiller with two pre-assembled clamping bolts
3	2	Piece	Alignment bolt (only one required for assembly)
4	1	Piece	Socket pin with linch pin
5	1	Piece	Socket pin with the marking "5" and linch pin
6	1	Piece	Line holding fixture
7	2	Piece	Hydraulic hose with rotation lock; image shows a hydraulic hose to the tow tractor (top) and a hydraulic hose between frames (bottom)

NOTE

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

Components for two frames - electrical system



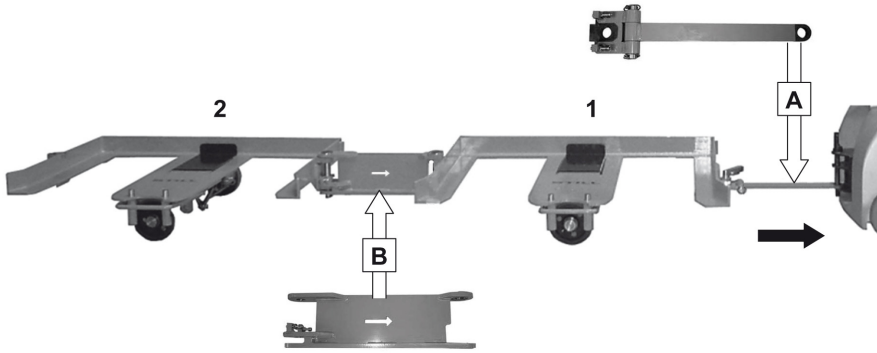
Item	Quantity	Unit	Name
1	1	Piece	Rigid tiller with two pre-assembled clamping bolts
2	1	Piece	Hinged tiller with two pre-assembled clamping bolts
3	2	Piece	Alignment bolt (only one required for assembly)
4	1	Piece	Socket pin with linch pin
5	1	Piece	Socket pin with the marking "5" and linch pin
6	1	Piece	Line holding fixture
7	2	Piece	Electrical connecting cable, image shows a connecting cable between the frames, the connecting cable to the tow tractor is longer

NOTE

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

Rigid tiller and hinged tiller (two frames)

Positioning the rigid tiller and the hinged tiller on B frames and E frames



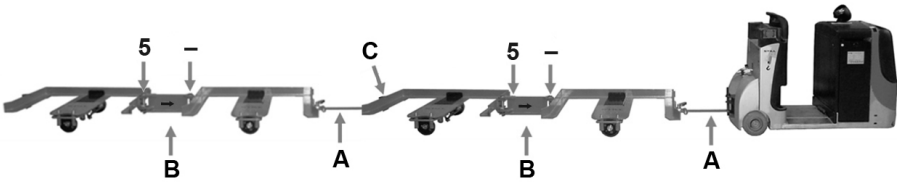
1	First frame
2	Second frame
A	Hinged tiller
B	Rigid tiller
⇨	Drive direction

NOTE

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

Construction overview

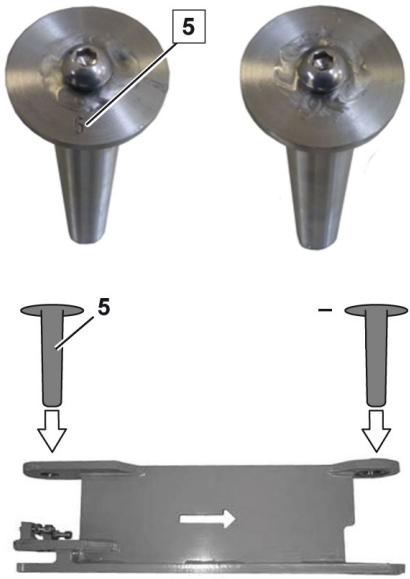
Articulated steering system for B and E frames (2 rigs/2+2 frames)



A	Hinged tiller
B	Rigid tiller
C	Compensating hinge (required for autarkic and reinforced hinged tiller, otherwise optional)
5	Socket pin with the marking "5"
–	Unmarked socket pin

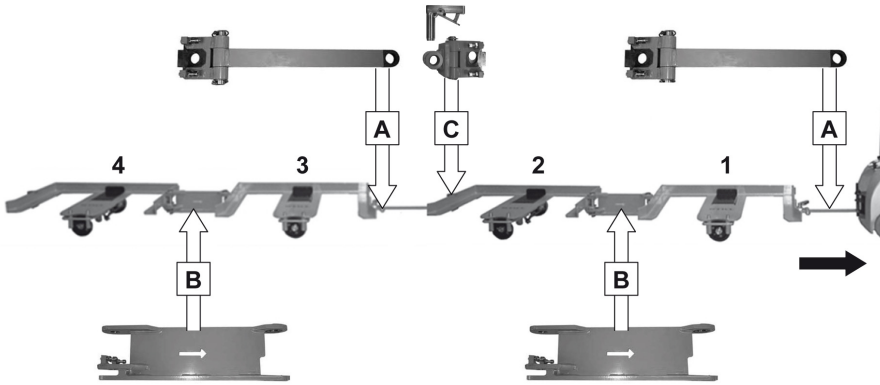
The socket pin with the marking **5** has a smaller diameter. It must always be fitted to the rear bolted end of the rigid tiller.

▷



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

Positioning the rigid tiller, the hinged tiller and the compensating hinge on B and E frames



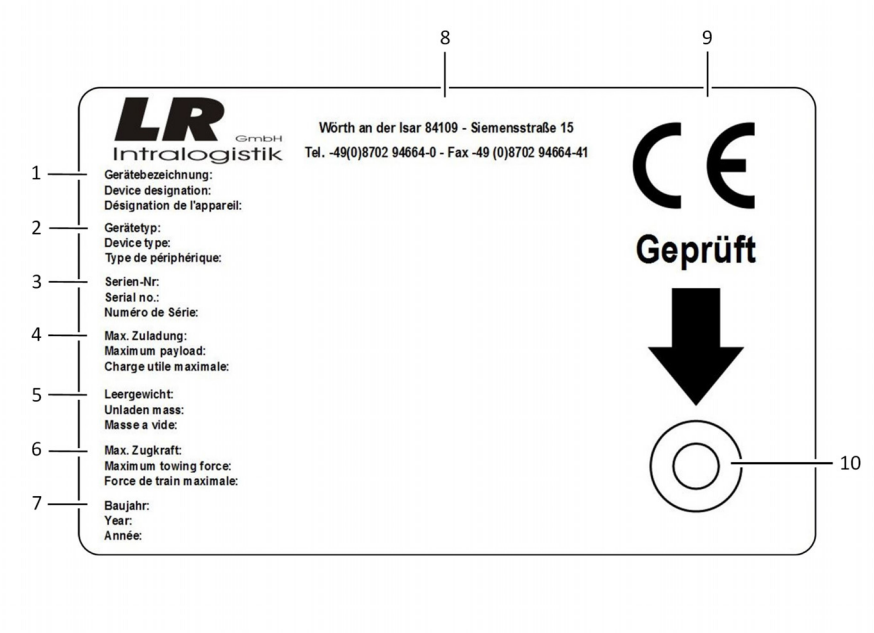
1	First frame	B	Rigid tiller
2	Second frame	C	Compensating hinge (only required for autarkic, otherwise optional)
3	Third frame		
4	Fourth frame	⇨	Drive direction
A	Hinged tiller		

NOTE

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

Labelling points

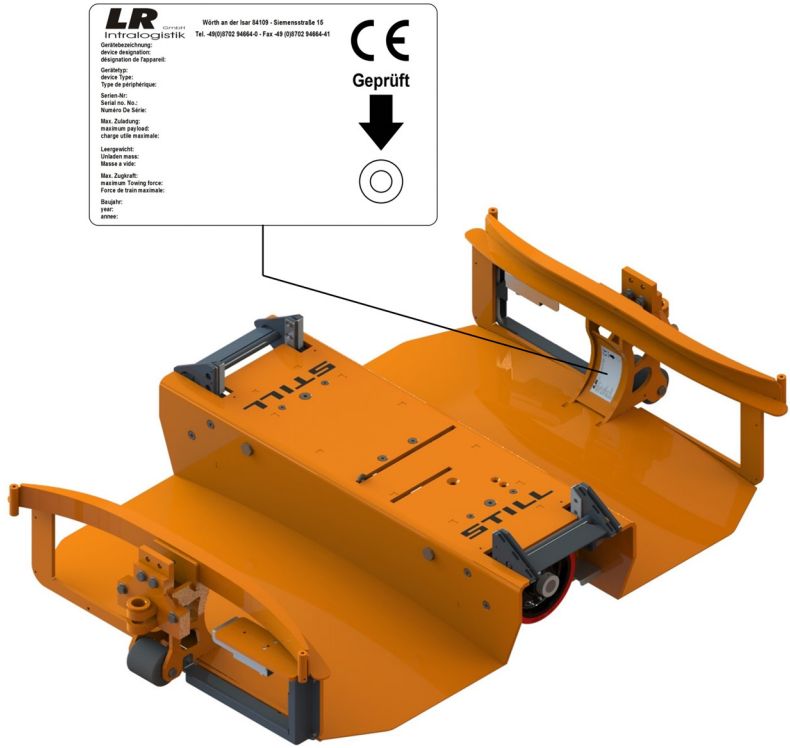
Identification plate



1	Device designation	6	Max. pulling force
2	Device type	7	Year of manufacture
3	Serial no.	8	Manufacturer contact
4	Max. load	9	CE symbol
5	Tare weight	10	Inspection sticker

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

Position



Position of the identification plate

Tugger train combinations

Overview

Frame	Tiller	Permissible number of frames [3]	Load	Tiller length	Arrange-ment	Driving over ramps
B frames	Rigid + hinged*	2 (1+1)	See identification plate [4]	[1]	[2]	Yes
		4 (2+2)				
C frame	Standard	1	See identification plate	[1]	[2]	Yes
		2				
		3				
		4				
E frame	Standard	2	See identification plate [4]	[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 (required for autarkic and reinforced hinge tillers, otherwise optional). 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 frame must be adapted to the preceding frame (when viewed in the drive direction); refer to the chapter entitled "Tiller system".

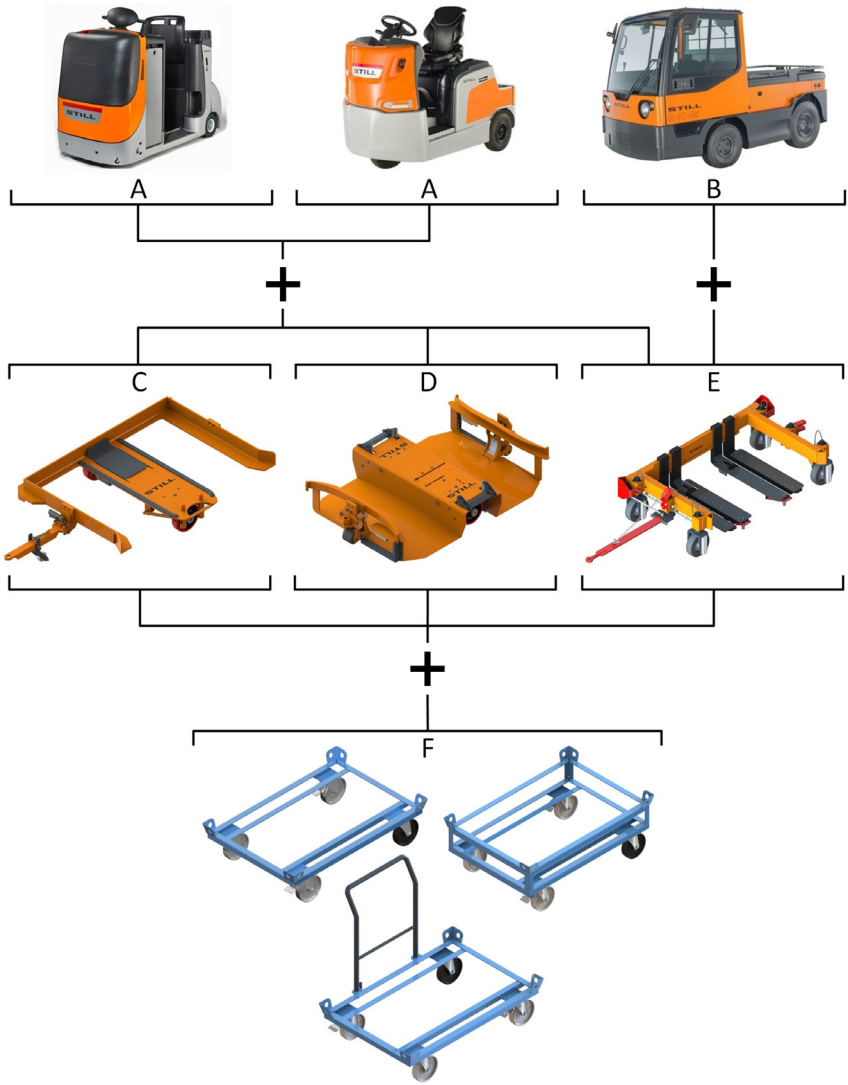
2) The frame with the largest dimensions must be placed in the first position in the train, the second-largest frame in the second position, etc. Exception to this rule: As soon as a smaller frame has a higher permissible load capacity, it must be positioned right at the front of the train.

3) Standard frame

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

Hydraulic system

Assembling



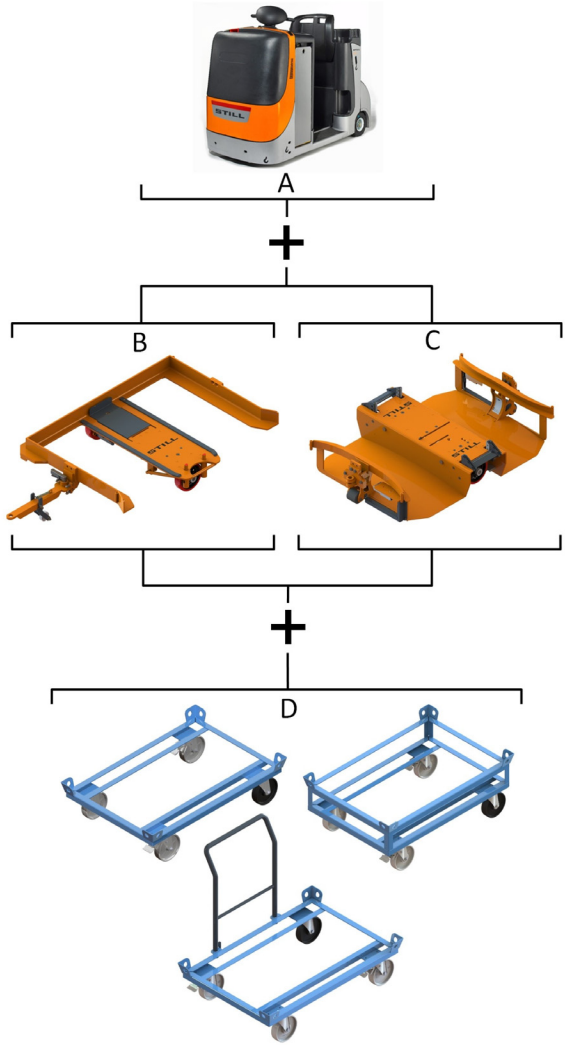
A	Tow tractor with a hydraulic power unit and a maximum tractive power of up to 2000 N (5000 N with reinforced hinged tiller)	B	Tow tractor with a hydraulic power unit and a maximum tractive power of up to 16,000 N
		C	E frame

D B frame
D C frame
F Trolleys

Before assembly, refer to the chapters entitled "Tugger train combinations/Overview" and "Requirements for the tow tractor".

Electrical system

Assembling



A	Tow tractor with a suitable interface and a maximum tractive power of up to 2000 N (5000 N with reinforced hinged tiller)	B	E frame
		C	B frame
		D	Trolleys

Tugger train combinations

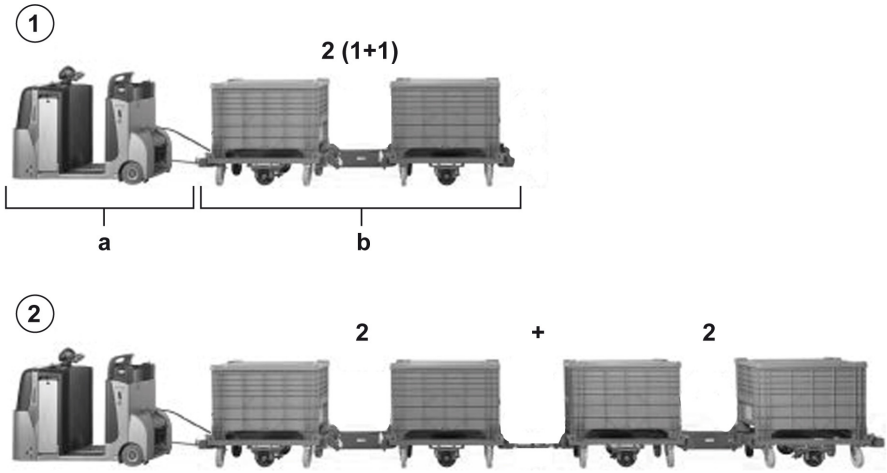
Before assembly, refer to the chapters entitled "Tugger train combinations/Overview" and "Requirements for the tow tractor".

B frames and E frames with articulated steering system

General

Combinations of the B frame or 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"

Mixing B or E frames with autarkic E frames

Conditions

The mixing of B or 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, pneumatic or electrical B and 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 B, C and E frames

Conditions

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

The following conditions must be adhered to:

- B frames, C frames and E frames can be connected together using a C-E-B adaptor
- The C-frames must be positioned in front of the B frames and E frames
- The type of lift must be consistent (hydraulic)
- All of the general conditions for the train apply (weight, size, length of tillers)

5

Operation

Commissioning the B frames

Testing before initial commissioning

Before initial commissioning, check the tugger train components for any damage that might have occurred during transport. The operating instructions, in particular the safety information, must be read and understood before commissioning.

Before commencing driving, check:

- Frames: visual inspection for damage
- Tillers: visual inspection for damage
- Supply lines: visual inspection for damage
- Secure fit and condition of the hydraulic, pneumatic and electrical connection assemblies

If parts of the tugger train are damaged, bent or not working, they must be repaired.

Roadways

Before initial commissioning, the roadways must be checked for aisle widths, room for manoeuvring, obstacles, safety distances, space for pedestrian footpaths, curve radii, gradients etc.

⚠ DANGER

Danger of collisions with persons which can result in fatal injuries!

If roadways and walkways are not marked, particular caution is important.

The driver must have the whole tugger train in view.

– Define roadways and walkways clearly.
– Drive carefully.
– If a collision is imminent, safely bring the tugger train to a standstill.

Checks before commissioning

⚠ WARNING

Risk of accident due to damage or other defects on the frame. Damage to the frame can lead to unpredictable and dangerous situations.

If damage or other defects are identified on the frame during the following inspections, the frame must not be used until it has been properly repaired.

Prior to commissioning, ensure that the frame is safe for operation:

- Check whether a trolley can roll out of the lowered frame despite the locking plates being extended.
- Perform a functional test on the locking plates and on the lifting function.

Safety regulations for commissioning

Driving

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

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

Loading the B frames

WARNING

Risk of injury from becoming trapped!

- Loading and unloading must be performed only 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.
- The foot pedal may be actuated only when the frame is lowered.
- Make sure that the trolleys are correctly inserted into the frames. Ensure that the locking plates are fully visible.

⚠ CAUTION

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

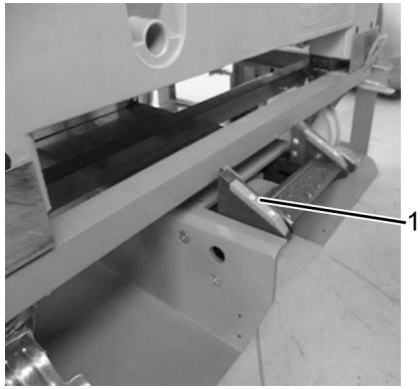
– Lash the load to the trolleys if necessary.
– Place the load on the trolleys in a way that ensures that the centre of gravity as low as possible.

– Apply the parking brake on the tow tractor.

NOTE

The maximum permissible load can be found on the identification plate.

– Before loading, fully lower all frames.
– Push the trolley into the B frame from the left-hand or right-hand side up to the stop. The locking plates (1) must be fully raised on both sides of the frame. The operator must visually check that this is the case immediately after the loading process. ▷



Unloading the B frames

⚠ DANGER

Risk of crushing when unloading the trolleys!

– Never unload on chamfers or gradients.
– When unloading the trolleys, there must be sufficient space to unload the trolleys safely and to manoeuvre the trolleys safely.
– If a trolley is heavily loaded, the driver must be prepared to exert a greater amount of force to brake or steer the trolley.
– The foot pedal may be actuated only when the frame is lowered.

⚠ WARNING

Risk of injury from becoming trapped!

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

⚠ WARNING

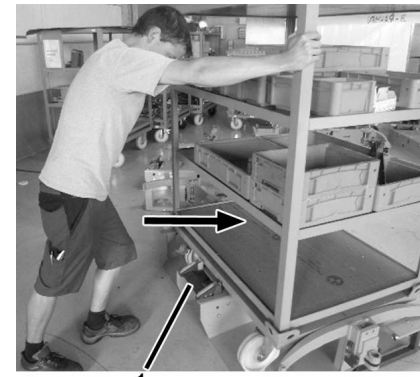
Risk of injury! When actuating the foot pedal to unload the trolley, the trolley may roll towards the driver!

– Keep a firm hold of the trolley while actuating the foot pedal.

– Apply the parking brake on the tow tractor.

– As soon as the driver leaves the tow tractor, the frames are lowered automatically.

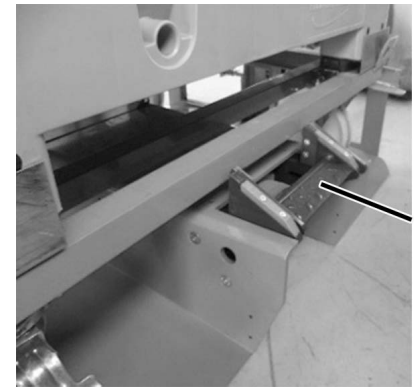
– Push the trolley away from the locking plate (1). ▷



– Press the foot pedal (1) to lower the locking plates and hold the pedal down. ▷

– Pull the trolley out of the frame by approx. 15 mm. The foot pedal and the locking plates are now locked in the lowest position.

– The trolley can now be pulled out of the frame completely.



Manually lifting the B frames

The B frames can be moved only once they have been lifted. For this reason, you can also manually lift the frames if the hydraulic system or the electrical system of the tow tractor is not working or if the frame is not coupled to the tow tractor.

NOTE

If a train comprising several B frames is to be manually lifted, always begin with the rearmost frame when viewed in the drive direction.

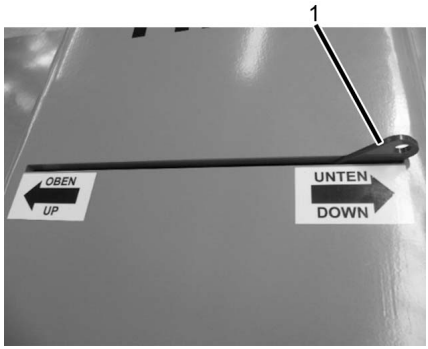
⚠ WARNING

Risk of injury!

Always keep a firm grip on the Lift-Tool during operation.

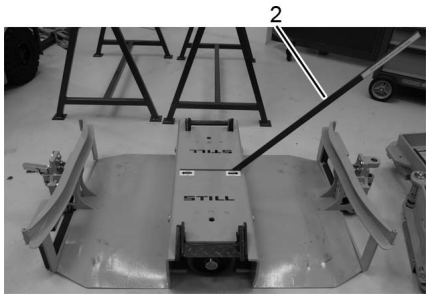
The Lift-Tool must be removed again immediately after lifting and lowering.

– Push the Lift-Tool, which is available as an option, as far as it will go onto the lever (1) located on the central tunnel of the frame. ▷



– Push the Lift-Tool(2) as far as it will go in the direction of the oben/up label. The frame is lifted. ▷

– To lower the frame again, push the Lift-Tool(2) as far as it will go in the direction of the unten/down label. The frame is lowered.



Hydraulic system

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).

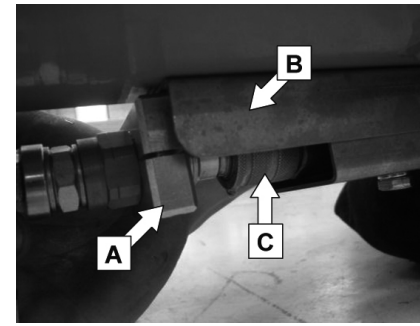
Releasing the pressure from the hydraulic system

- 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

▷



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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).

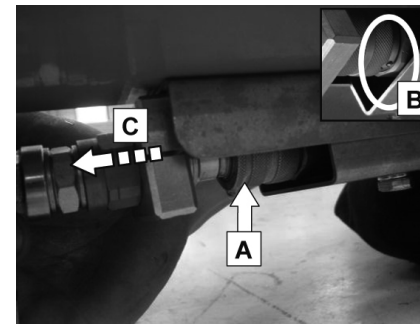
⚠ CAUTION

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

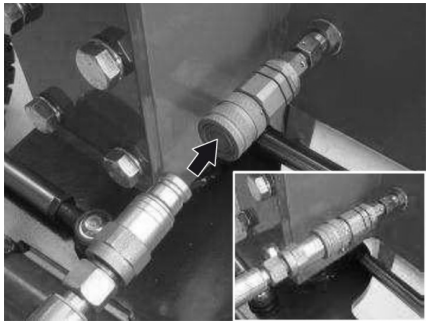
The ball on the coupling must lie in the groove on the connector sleeve!

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 (hydraulic system only).

The coupling can only be disconnected in the correct position (in accordance with the image) (hydraulic system only).

⚠ WARNING

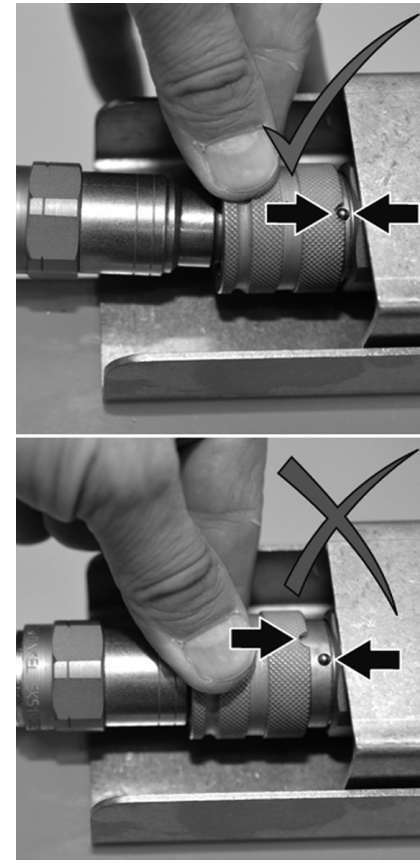
Hydraulic fluid is pressurised during operation and is hazardous to your health.

- 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 (hydraulic system only).
- Push the ring in the direction of the connector sleeve and pull out the plug.

NOTE

The ball on the coupling must lie in the groove on the connector sleeve (hydraulic system only)!



Electrical system

Connection assembly for the electrical system

Lower the system

– Leave the tow tractor or actuate the lift/lower switch on the tow tractor.

Connecting the connection assembly

⚠ CAUTION

Risk of damage!

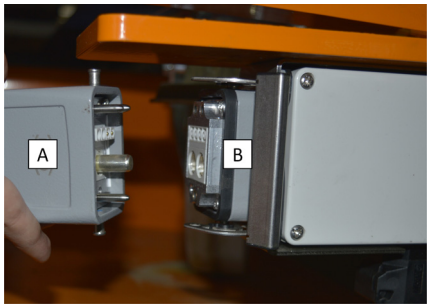
– Protect the plug against contamination and water.

– Lower the system

– Connect the plug (A) to the bush (B).

– Close the locking bracket (C) and ensure that it has properly engaged.

– Fit the end plug (D) on the bush for the last frame or for the tow tractor (when driving without a frame)



Releasing the connection assembly

⚠ CAUTION

Risk of damage!

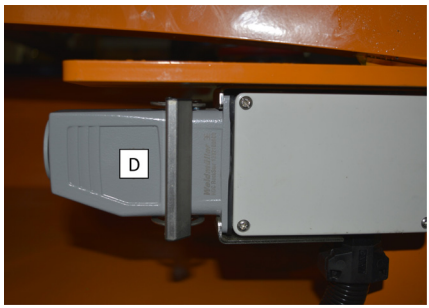
– Protect the plug against contamination and water.

– Lower the system

– Open the locking bracket (C).

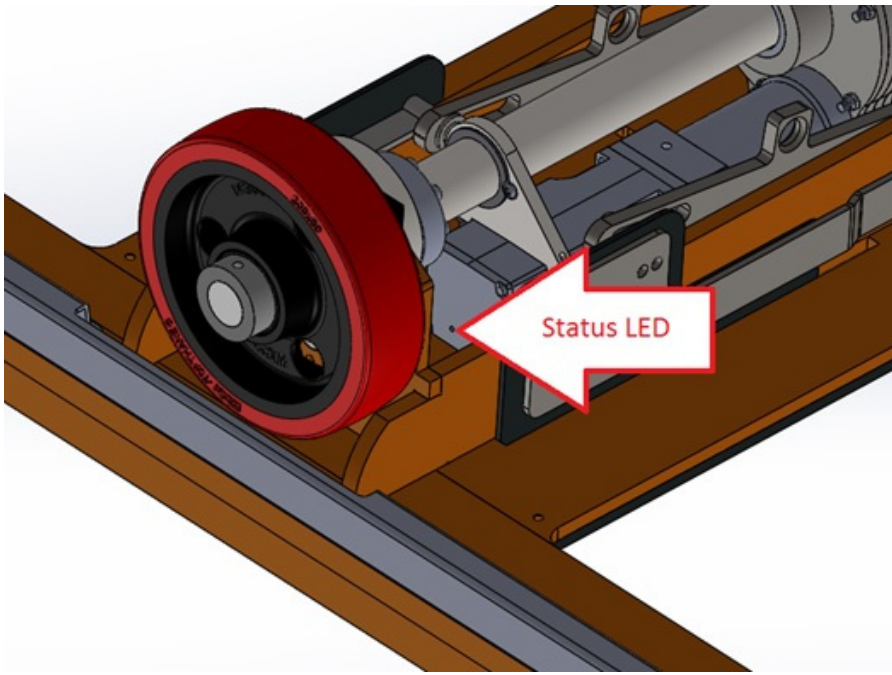
– Disconnect the connection assembly (A / B).

– Fit the end plug (D) on the bush for the last frame or for the tow tractor (when driving without a frame)



Before assembly, refer to the chapters entitled "Hose lengths and cable lengths" and "Requirements for the tow tractor".

Electrical system error codes



The status LED provides information about the operating status of the motor.

⚠ DANGER

Risk of injury from electrical voltage.

Repair work on the electrical system must only be carried out by an authorised STILL technician.

Green LED	Red LED	Operating status
ON	OFF	Motor ready
OFF	Flashing	Error status, contact STILL technician
OFF	OFF	Device not working, contact STILL technician

Assembling the articulated steering system

Assembling the articulated steering system

(using the example of an E frame - hydraulics routed underneath)

Scope of delivery

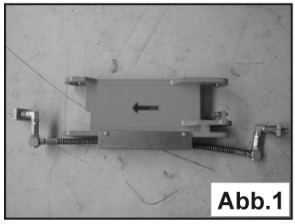


Abb.1

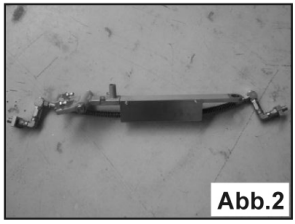


Abb.2

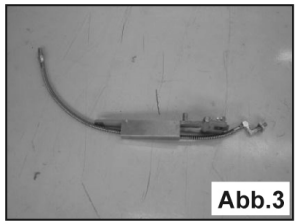


Abb.3

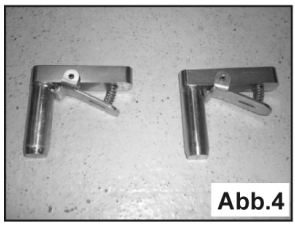


Abb.4

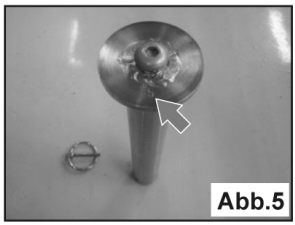


Abb.5

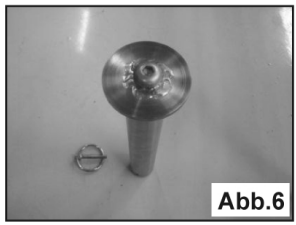


Abb.6

Scope of delivery for two 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 frames
- **Figure 3:** 1 x hinged tiller with two pre-assembled clamping bolts. Hydraulic hose routed underneath to connect the tow tractor and a frame
- **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 frames 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 be fitted between the first frame and the second frame (see figure). (Arrow in drive direction). ▷

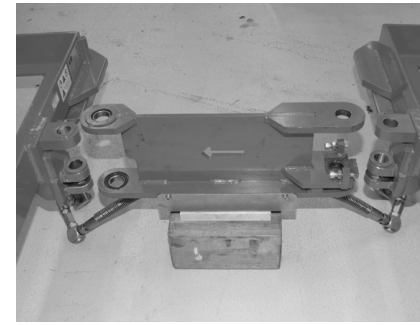
Assembling the rigid tiller

⚠ 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. ▷

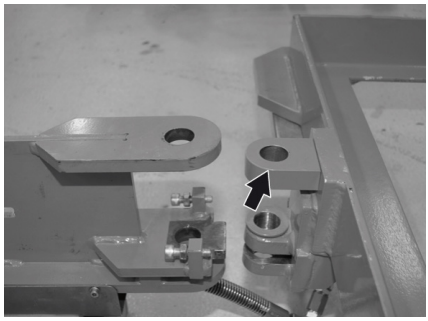


Assembling the articulated steering system

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.

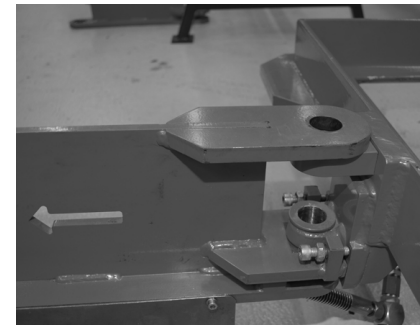
NOTE

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

▷

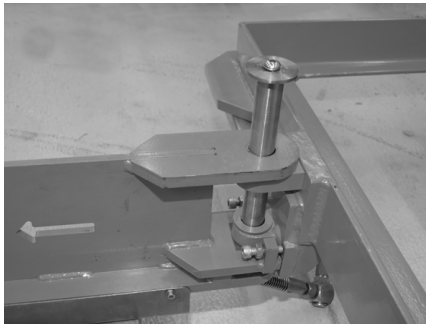
– Insert the rigid tiller into the tabs on the second frame in the drive direction.

▷

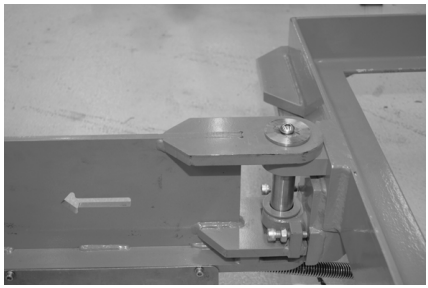


Assembling the articulated steering system

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



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



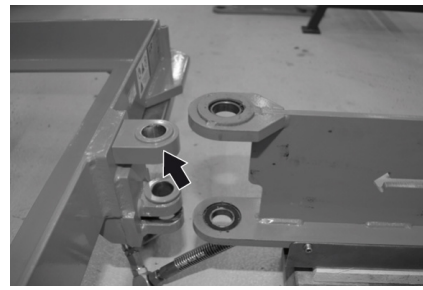
⚠ CAUTION

Component damage due to incorrect socket pin!

– Insert the socket pin with the marking "5" into the second 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. ▷

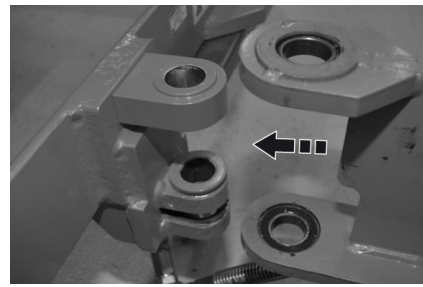


– Do not tighten the screws. The tab must be loose. ▷

NOTE

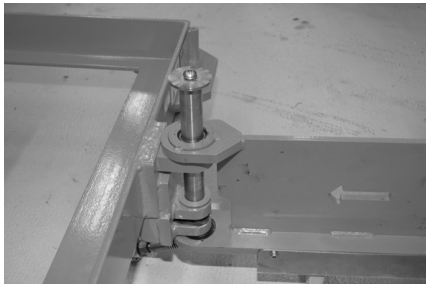
The welded-on ring on the tab (see arrow) must be on the top. Rotate the tab if necessary.

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

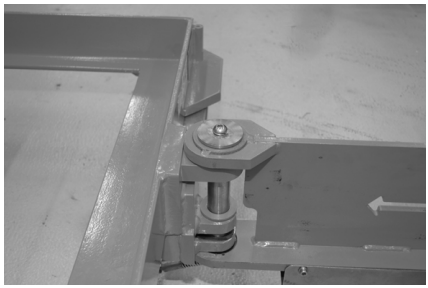


Assembling the articulated steering system

– Spray the unmarked socket pin with Teflon spray. ▷

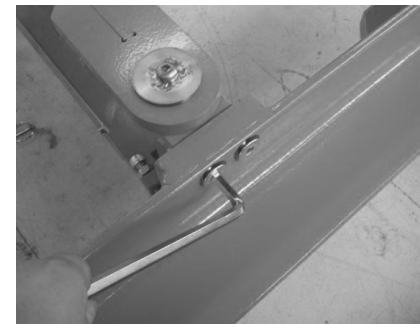


– Insert the unmarked socket pin into the first frame in the drive direction. If necessary, drive in with a Teflon hammer. ▷

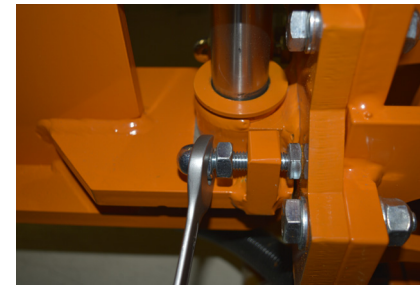


– Secure the socket pin using the linch pin. ▷

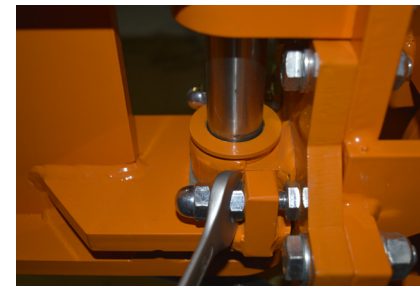
– Tighten the screws for the tabs (two screws at both ends of the rigid tiller). ▷



– Tighten the clamping bolts of the rigid tiller using the dome nuts **(tightening torque 30 Nm)**. ▷



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

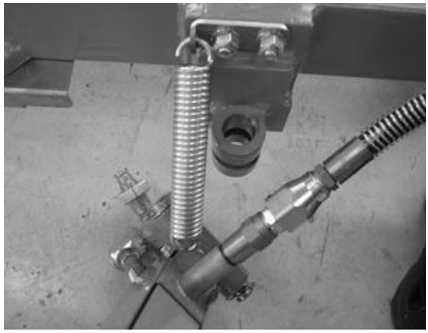


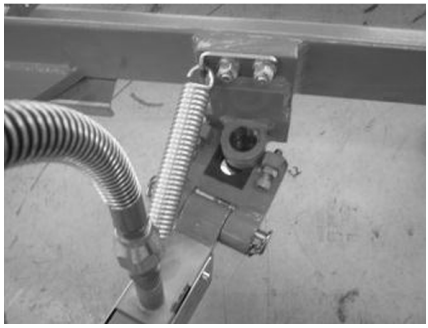
NOTE

The clamping bolt braces the tiller against the frame and protects the tiller against lateral swivel-shift movements.

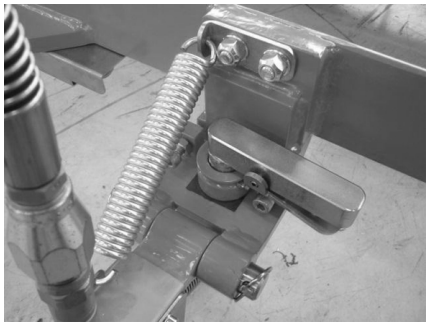
Assembling the hinged tiller

– 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. ▷

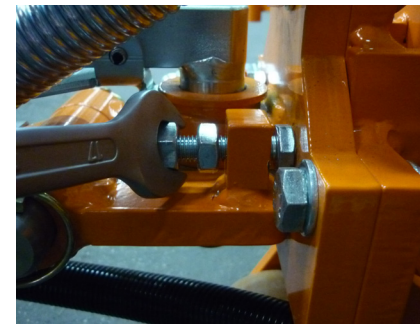




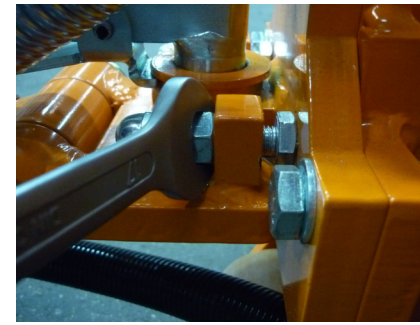
– Insert the alignment bolt and lock it in place. ▷



– Tighten the clamping bolts of the hinged tiller using the dome nuts **(tightening torque 30 Nm)**. ▷



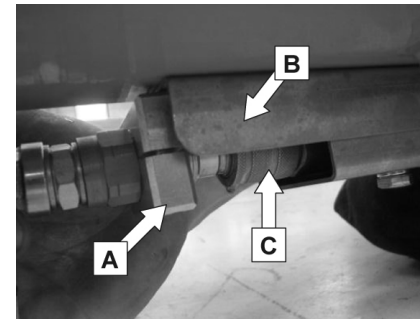
– Secure the clamping bolts with nuts **(tightening torque: 50 Nm)**. ▷



NOTE

The clamping bolts brace the tiller against the frame and protect the tiller against lateral swivel-shift movements.

– In order to the prevent the coupling (C) from turning, securely insert the rotation lock (A) on the hydraulic/pneumatic connection into the guard plate (B) (only with hydraulic and pneumatic systems). ▷



⚠ 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).

Assembling the articulated steering system

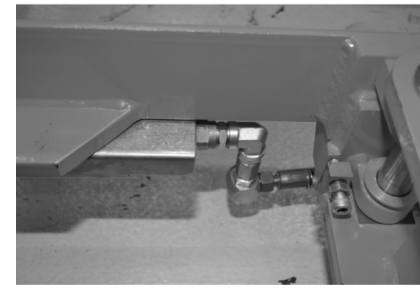
⚠ CAUTION

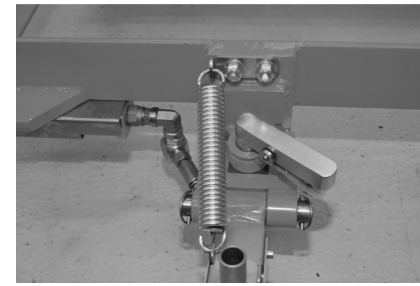
Risk of component damage!

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

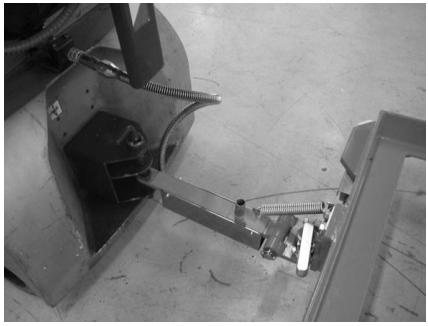
Before assembly, release the pressure from the hydraulic system; refer to the chapter entitled "Hydraulic/pneumatic coupling".

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





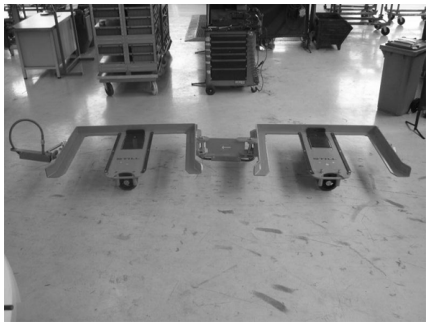
– Couple the hinged tiller with the tow tractor. Connect the wire to the tow tractor. ▷



NOTE

To release the hydraulic coupling, refer to the chapter entitled "Plug connector".

– The tugger train is ready for use. Additional 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. ▷



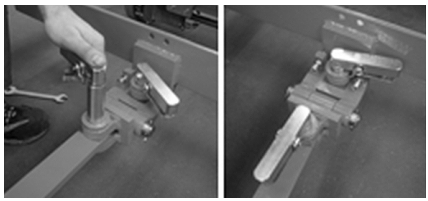
Installing and removing the compensating hinge

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

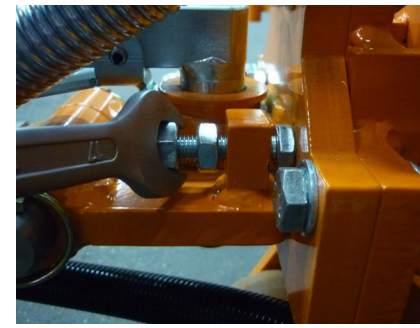
Optional (for attaching a second articulated frame steering rig).

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)**. ▷

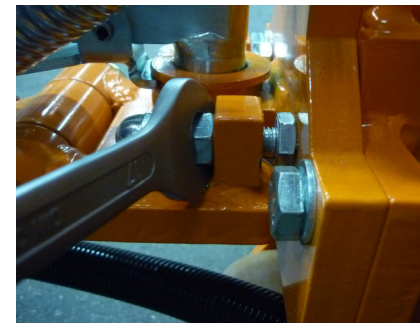


NOTE

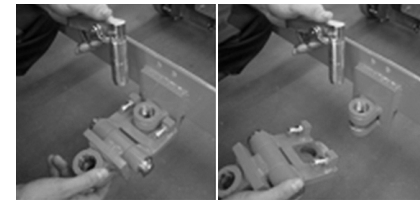
This tightening braces the tiller against the frame and provides protection against lateral swivelling movements.

Removing

– Loosen the nuts and the clamping bolts. ▷



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



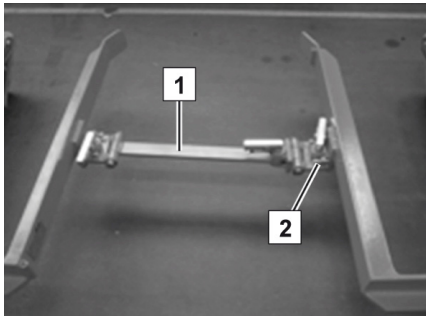
Installing and removing the hinged tiller

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

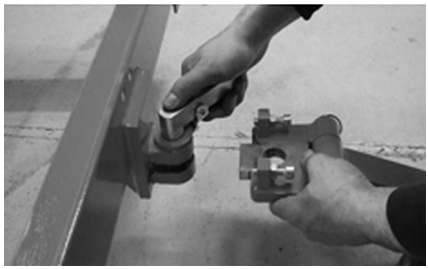
The image shows the hinged tiller (1) with the compensating hinge (2) between two articulated frame steering rigs (required for autarkic E frames and reinforced hinge tillers, otherwise optional). ▷



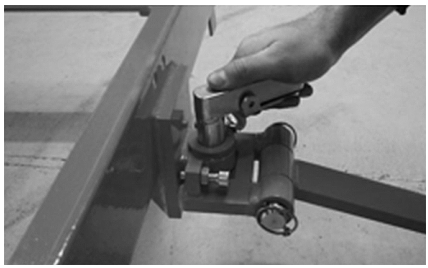
NOTE

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

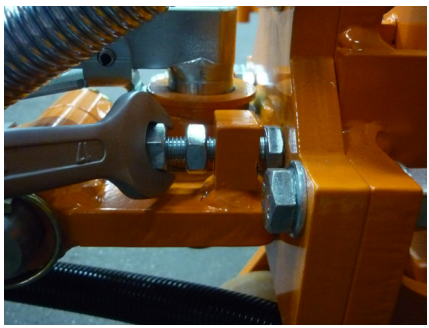
– Insert the hinged tiller into the front towing jaws of the second articulated frame steering rig. ▷



– Insert the coupling pin and lock it in place. ▷



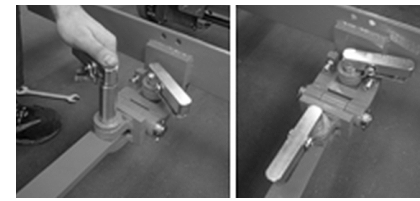
– Evenly tighten the clamping bolts on the hinged tiller **(tightening torque: 30 Nm)** and secure the clamping bolts with nuts **(tightening torque: 50 Nm)**. ▷



NOTE

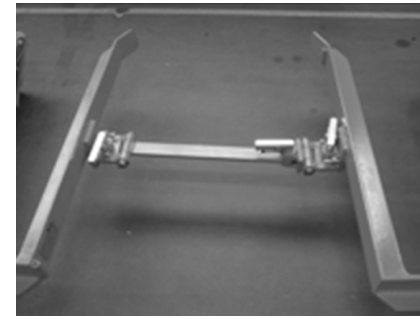
This tightening braces the tiller against the E frame and provides protection against lateral swivelling movements.

– 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.



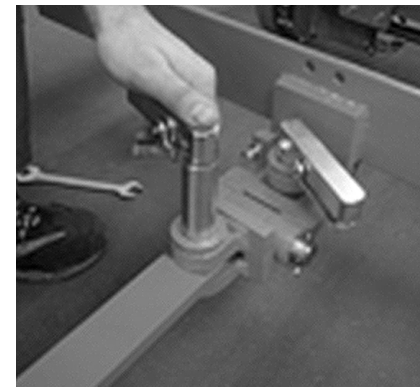
The illustration shows the hinged tiller with the compensating hinge between two articulated frame steering rigs.

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



Removing

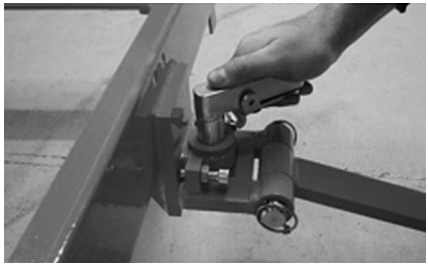
– Unlock the coupling pin for the compensating hinge and pull out the hinged tiller of the rear articulated frame steering rig from the towing jaws of the compensating hinge.



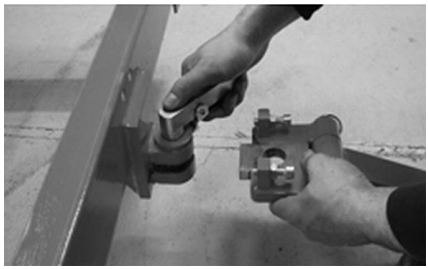
Assembling the articulated steering system

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

– Pull out the coupling pin. ▷



– Pull out the hinged tiller. ▷



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

NOTE

Articulated steering system required for driving over ramps!

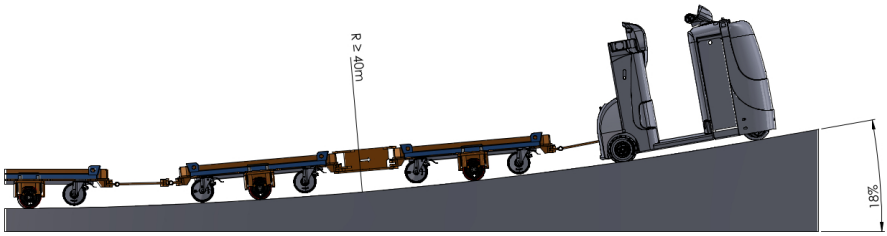
WARNING

Risk of accident from failing to adjust speed!

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

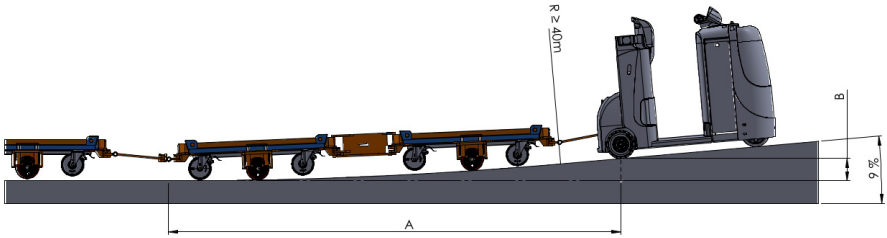
Gradient on the ramp	Comment
Up to 7%	The ends of the ramp do not have to be rounded
7% to 18%	Radius between the horizontal and the chamfer, see diagram

Representation of driving over ramps with gradients from 7% to 18%



The transition from horizontal surfaces onto gradients must have at least a radius of R > 40 m at the entry and exit.

Representation of guide values for driving over ramps using an example of a ramp with a 9% gradient



A approx. 4 m length of the round

B approx. 0.2 m height of the round

E frames (standard tiller)

⚠ CAUTION

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

It is forbidden to drive on ramps.

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.

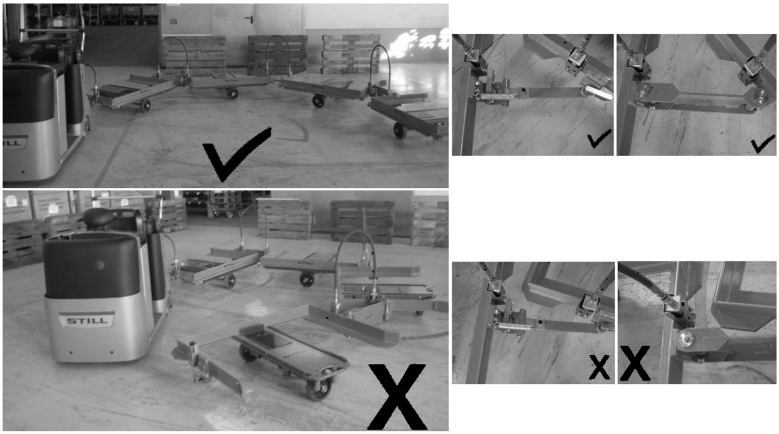
Steering angle

⚠ 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.

For illustrative purposes



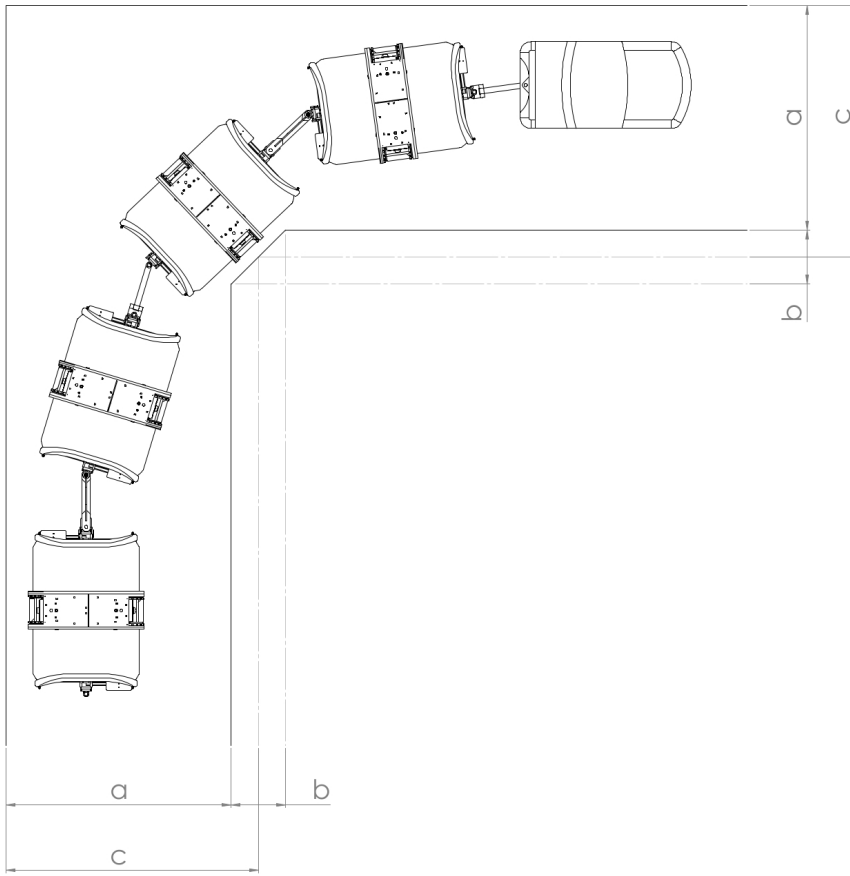
NOTE

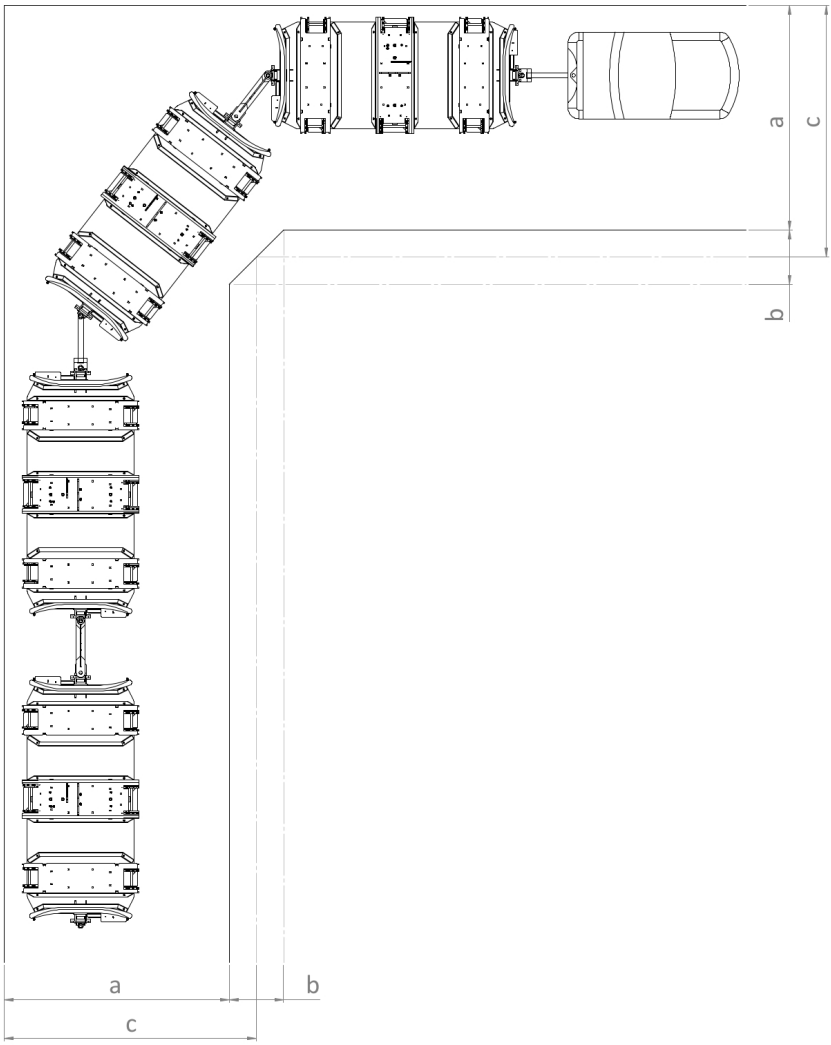
Recommendation: Perform a test drive to check the steering angle.

Roadways

Minimum aisle widths for B frames

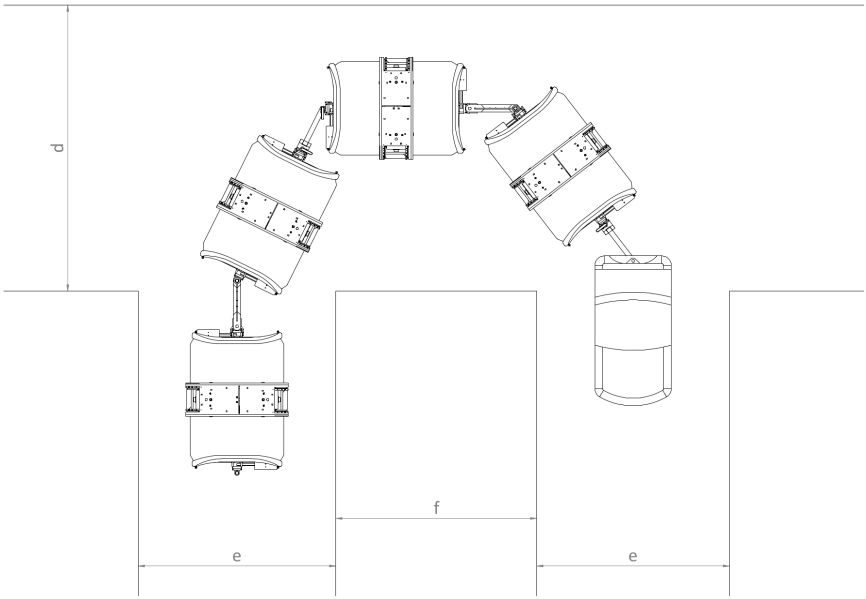
For 90° curves, depending on the length of the train

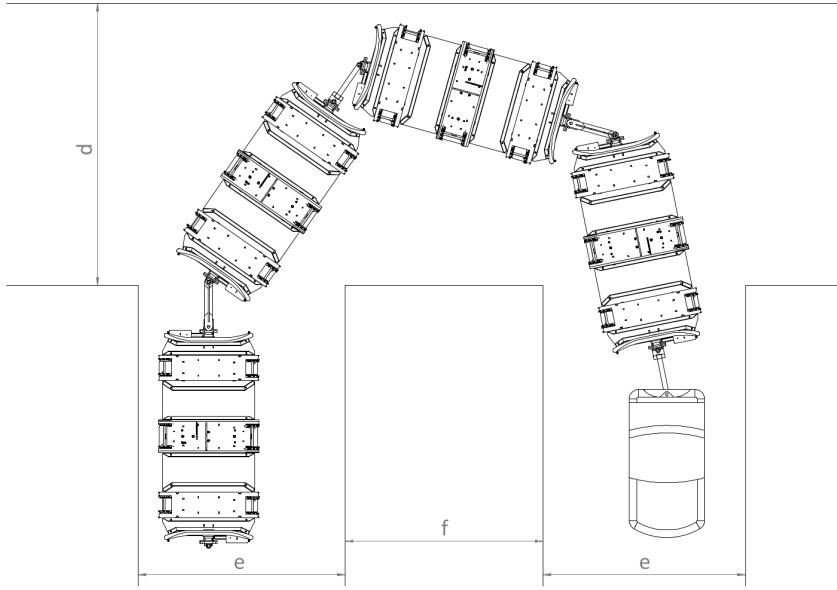



a
c
b
a
c
b

Minimum aisle widths for B frames in 90° curves*	Quantity B frame	Length of train [mm] without a tow tractor	Aisle width "a" with corner chamfer [mm]	Corner chamfer "b" [mm]	Aisle width "c" without corner chamfer [mm]
			(without oncoming traffic) with CX-T / LTX 70		
LiftRunner B frame 1200 x 800 mm	2	4038	2070/2070	0/0	2070/2070
	4	8076	2070/2070	500/500	2320/2320
LiftRunner B frame 1200 x 1000 mm	2	4338	2270/2270	0/0	2270/2270
	4	8676	2270/2270	500/500	2520/2770
LiftRunner B frame 800 x 600 mm triple loadable	2	5668	2070/2070	1000/1000	2570/2570
	4	11286	2070/2070	2000/2000	3070/3070
LiftRunner B frame 1000 x 600 mm triple loadable	2	5968	2270/2270	1000/1000	2770/2770
	4	11886	2270/2270	2000/2000	3270/3270
This table shows only the technical values for a standard frame. Different dimensions, additional units etc. may produce different values.					
* Depending on country-specific and company-specific safety regulations					

For 180° curves, depending on the length of the train




d
e
f
e

Minimum aisle widths for B frames in 180° curves*	Number of B frames	Length of train [mm] without a tow tractor	Aisle width "d" [mm]	Aisle width "e" [mm]	Distance between the aisles "f" [mm]	Aisle width [mm] in loading and unloading zones
			(without oncoming traffic) with CX-T / LTX 70			with CX-T / LTX 70
LiftRunner B frame 1200 x 800 mm	2	4038	2200/2400	2000/2000	2000/2000	2900/2900
	4	8076	3000/3200	2000/2000	2000/2000	2900/2900
LiftRunner B frame 1200 x 1000 mm	2	4338	2500/2700	2000/2000	2000/2000	3300/3300
	4	8676	3300/3500	2000/2000	2000/2000	3300/3300
LiftRunner B frame 800 x 600 mm triple loadable	2	5668	2700/2800	2700/2700	2000/2000	2900/2900
	4	11286	3700/3800	2700/2700	2000/2000	2900/2900
LiftRunner B frame 1000 x 600 mm triple loadable	2	5968	2700/2800	3200/3200	2000/2000	3300/3300
	4	11886	3700/3800	3200/3200	2000/2000	3300/3300
This table shows only the technical values for a standard frame. Different dimensions, additional units etc. may produce different values.						
* Depending on country-specific and company-specific safety regulations						

6

Maintenance

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.

Checking the hydraulic system for leaks

⚠ WARNING

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

Wear suitable protective gloves, industrial goggles etc.

⚠ WARNING

Hydraulic hoses become brittle!

Hydraulic hoses should not be used longer than 6 years.

The specifications of BGR 237 should be complied with. Deviating national laws are to be taken into account.

– Check pipe and hose connection screw joints for leaks (traces of oil).

Hose lines must be changed if:

- The outer layer has been breached or becomes brittle with tears
- They are leaking
- There are unnatural deformations (e.g. bubble formation or buckling)
- A fitting is detached from the hose
- A fitting is badly damaged or corroded

Pipes must be changed if:

- There is abrasion with the loss of material
- There are unnatural deformations and detectable bending stress
- They are leaking

Maintenance intervals for B frames

Unit	Task	Daily	Quarterly
Chassis	Functional test of the locking mechanism	x	
	Check if the trolley can roll out of the B frame despite the locking plates being raised	x	
	Functional check of the manual lifting function of the frames; refer to the chapter entitled "Manually lifting the B frames"		x
	Clean and check the locking plates for damage, and lubricate the fulcrum		x
	Clean the mechanism on the 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 that the springs are operating correctly		x
	Check that all moving parts are present and check for signs of wear		x
	Check the tillers for wear		Annually
Hydraulics	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
	Grease the wheel bearings via the lubricating nipples on the wheels		x
Electrics	Check cables for defects		x
	Check that the connecting plug is secure and check loose parts		x
	Clean the antistatic belt and check it for wear		x

Consumables

Consumables for service work

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
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
Gearbox lubricating nipple (electrical version only)	Grease	Lubricating grease KP 2 K-30 DIN 51825

"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

B frame		
Unit	**Consumable**	**Specification**
B frame mechanism	Lubricant	PTFE Longlife Teflon spray
Lubricating nipple for the wheels	Grease	Lubricating grease KP 2 K-30 DIN 51825
Gearbox lubricating nipple (electrical version only)	Grease	Lubricating grease KP 2 K-30 DIN 51825

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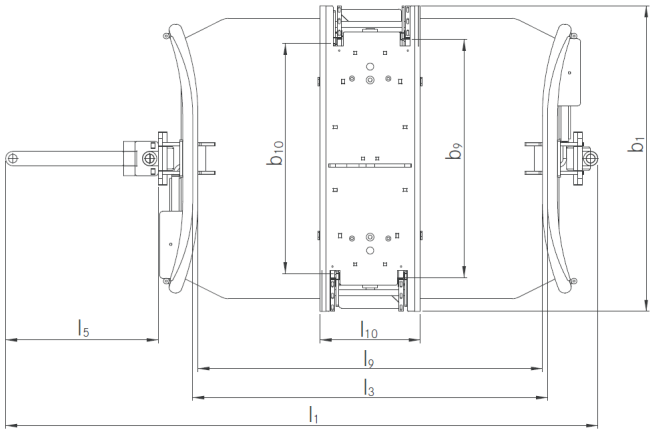
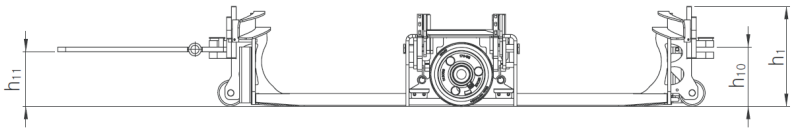
Technical data

B frames - single loadable



Top view



Side view

	Manufacturer			STILL	STILL
Key data	Manufacturer's type designation			**LiftRunner B frame 1200 x 800 mm**	**LiftRunner B frame 1200 x 1000 mm**
	Load dimension (length x width)		mm	1210 x 810	1210 x 1010
	Load capacity [1]	Q	kg	1000	1000
Weight	Net weight		kg	204	237
Wheels/chassis frame	Tyres			Polyurethane	Polyurethane
	Tyre size		mm	∅ 200	∅ 200
	Number of wheels			2 (axle beam)	2 (axle beam)
	Track width	b_{10}	mm	810	1010

Basic dimensions	Total height lowered/raised	h_1	mm	313/353	313/353
	Lift	h_3	mm	40	40
	Coupling height lowered/raised	h_{10}	mm	185/225	185/225
	Length of loading surface/max. length of the trolley [2]	l_3	mm	1240	1240
	Tiller length	l_5	mm	533	683
	Width of loading surface	b_9	mm	834	1034
	Overall length	l_1	mm	2069	2219
	Overall width	b_1	mm	1070	1270
	Ground clearance at the centre of the wheelbase lowered/raised	m_2	mm	0/40	0/40
	Turning radius CX-T / LTX 70	W_a	mm	1950/2100	2100/2250
	Length of opening in the frame (internal dimension of the frame)	l_9	mm	1204	1204
	Length of the centre plate	l_{10}	mm	350	350
	Height of the tiller lowered/raised	h_{11}	mm	170/210	170/210
Performance data	Max. driving speed [3]		km/h	15	15
Other	Coupling			Articulated steering system	Articulated steering system

1 For multiple trailers, the maximum towing load across the entire tugger train is 4 t (depending on the maximum towing load of the tow tractor).

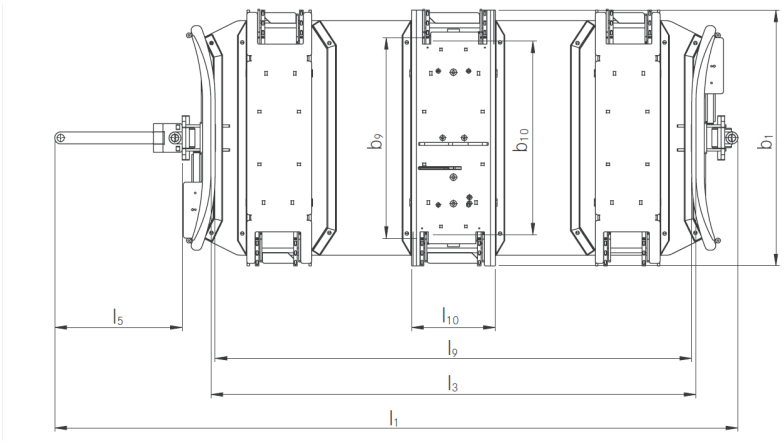
2 Applies only when using STILL LiftRunner-trolleys.

3 Depending on the tow tractor.

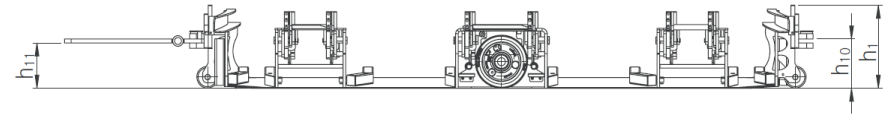
NOTE

This type sheet, based on VDI directive 2198, states only the technical values of the standard device. Different tyres, lift masts, additional units etc. may produce different values.

B frames - triple loadable



Top view



Side view

	Manufacturer			STILL	STILL
Key data	Manufacturer's type designation			**LiftRunner B frame triple loadable 800 x 600 mm**	**LiftRunner B frame triple loadable 1000 x 600 mm**
	Load dimension (length x width)		mm	1210 x 810/ 820 x 630	1210 x 1010/ 1010 x 630
	Load capacity [1]	Q	kg	1 trolley: 1000 2 trolleys: 2 x 500 3 trolleys: 3 x 330	1 trolley: 1000 2 trolleys: 2 x 500 3 trolleys: 3 x 330
Weight	Net weight		kg	408	490
Wheels/chassis frame	Tyres			Polyurethane	Polyurethane
	Tyre size		mm	∅ 200	∅ 200
	Number of wheels			2 (axle beam)	2 (axle beam)
	Track width	b_{10}	mm	810	1010

Basic dimensions	Total height lowered/raised	h_1	mm	313/353	313/353
	Lift	h_3	mm	40	40
	Coupling height lowered/raised	h_{10}	mm	185/225	185/225
	Length of loading surface/max. length of the trolley [2]	l_3	mm	2030	2030
	Tiller length	l_5	mm	533	683
	Width of loading surface	b_9	mm	834	1034
	Overall length	l_1	mm	2859	3009
	Overall width	b_1	mm	1070	1270
Basic dimensions	Ground clearance at the centre of the wheelbase lowered/raised	m_2	mm	0/40	0/40
	Turning radius CX-T / LTX 70	W_a	mm	3350/3450	3500/3600
	Length of opening in the frame (internal dimension of the frame)	l_9	mm	1994	1994
	Length of the centre plate	l_{10}	mm	350	350
	Height of the tiller lowered/raised	h_{11}	mm	170/210	170/210
Performance data	Max. driving speed [3]		km/h	15	15
Other	Coupling			Articulated steering system	Articulated steering system

1 For multiple trailers, the maximum towing load across the entire tugger train is 4 t (depending on the maximum towing load of the tow tractor).

2 Applies only when using STILL LiftRunner-trolleys.

3 Depending on the tow tractor.

NOTE

This type sheet, based on VDI directive 2198, states only the technical values of the standard device. Different tyres, lift masts, additional units etc. may produce different values.

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STILL GmbH

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