METAL-FACH

MANURE SPREADER
“CERBERUS”
N277/6, N277/7

OPERATING INSTRUCTIONS

TRANSLATION OF THE ORIGINAL OPERATING INSTRUCTIONS

REVISION I

MARCH 2020

Operating Instructions No. N277/6_2-01-167/2013

EC DECLARATION OF CONFORMITY

The undersigned,	Jacek Kucharewicz, President of the Board,	
hereby declares, with full responsibility, that the complete machine:		
MANURE SPREADER		
1.1.	Brand (the trading name of the manufacturer)	Metal-Fach
1.2.	Type:	N277/6; N277/7
1.2.1.	Variant:	-
1.2.2.	Version:	-
1.2.3.	Trade name(s) (if any):	Manure Spreader
1.3.	Category, Subcategory, and Vehicle-Speed Indicator	R3a
1.4.	Company name and manufacturer's address:	Metal-Fach Sp. z o.o. ul. Kresowa 62 16-100 Sokółka, Poland
1.4.2.	Name and address of the manufacturer's authorised representative (if applicable)	N/A
1.5.1.	The location of the manufacturer's rating plate	On the front wall of the spreader body
1.5.2.	The method used to fix the rating plate of the manufacturer:	Riveted, glued
1.6.1.	The location of the vehicle-identification number on the chassis	On the front wall of the spreader body
2.	Machine-identification number:	

Complies with all the appropriate regulations of Directive 2006/42/EC and the Regulation of the Minister of the Economy dated 21 October 2008 on the principal requirements for machines (Journal of Laws of 2008, No. 199, item 1228, as amended)

The following harmonised standards were applied to assess the compliance.

PN-EN 690:2014-02, PN-EN ISO 12100:2012, PN-EN ISO 4254-1:2016-02, PN-EN ISO 13857:2010

and the following standards: PN-ISO 3600:2015, PN-ISO 11684:1998 and Regulation of the Minister of Infrastructure dated 31 December 2002 on technical conditions of vehicles and the range of their necessary equipment (Journal of Laws of 2003, No. 32, item 262, as amended).

Safety Testing Report No.:

This EC Declaration of Conformity shall become null and void if the machine is modified or reconstructed without the Manufacturer's consent.

Sokółka
(Place)

05/01/2017
(Date)

Jacek Kucharewicz
(Signature)

President of the Board,
(Position)

Machine data

Type of machine		Manure Spreader
Type designation:		N277/6, N277/7
Serial Number(1):		_____
Machine manufacturer:		METAL-FACH Sp. z o.o. 16-100 Sokółka ul. Kresowa 62 Phone: (0-85) 711 98 40 Fax.: (0-85) 711 90 65
Seller:		_____
	Address:	_____
		_____
	Phone/Fax.:	_____
		_____
Delivery date:		_____
Owner or User:	Last Name:	_____
	Address:	_____
		_____
	Phone/Fax.:	_____

(1) The data is located on the machine's rating plate located on the front part of the machine's main frame

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INTRODUCTION

The information included in the Instructions Manual is valid as of the date of its drawing up. The manufacturer reserves its right to make design changes to machines, and due to this, some values or illustrations might not correspond to the actual state of the machine supplied to the user. The manufacturer reserves its right to make design changes without amending these instructions. The Instructions Manual is part of the basic equipment of the machine. Before using the machine, the User is obliged to read the contents of this Instructions Manual and to comply with its recommendations. It will ensure a safe operation and a trouble-free machine operation.

The machine has been built in compliance with the standards in force and the current legal provisions. This instruction manual describes the basic safety and operation principles of the Manure Spreader made by Metal-Fach, type N277/6 and N277/7.

The significant obligations of the Manufacturer are shown in the Guarantee Certificate, which includes the complete regulations currently in force regarding guarantee services.

If the information included in the Instructions Manual proves to be incomprehensible, you should address the seller from whom the machine was purchased, or the manufacturer directly, for assistance.

The spare parts catalogue constitutes a separate list and is attached in the form of a CD, when the machine is purchased. It is also available on the Manufacturer's website: www.metalfach.com.pl.

The Guarantee Certificate, together with the warranty terms, is attached to this instructions Manual as a separate document.

Manufacturer's address:

Metal-Fach Sp. z o.o.

ul. Kresowa 62

16-100 Sokółka

Contact:

Phone: (0-85) 711 98 40

Fax.: (0-85) 711 90 65

The symbols used in these Instructions:

DANGER!

Hazard-warning symbol. This indicates the occurrence of a serious hazard condition, which, if not avoided, can result in death or serious injury. This symbol warns against the most-dangerous situations.

CAUTION

This symbol highlights very important information and recommendations. Non-compliance with the described recommendations risks serious damage to the machine due to its incorrect operation.

WARNING

This symbol indicates the possibility of the occurrence of a hazard, which, if not avoided, can result in death or serious injury. This symbol indicates a lower level of risk of injury than the symbol including the word “DANGER”.

This symbol indicates useful information.

This symbol indicates maintenance activities that should be performed periodically.

1. General description

1.1 Introduction

THIS INSTRUCTION MANUAL IS PART OF THE BASIC ACCESSORIES OF THE MANURE SPREADER

The machine can only be operated by persons, who have read this Instructions Manual who are familiar with the design and functioning of the Manure Spreader, and with the operation of the tractor unit it works with.

To operate the machine in a safe manner, read and adhere to all the instructions set forth in this Instruction Manual. Abiding by the guidelines provided in the Instructions Manual ensures safe operation for the User, and also prolongs the machine's service.

1.2 Identification of the N277/6 and N277/7 Manure Spreaders

The Manure Spreader must be identified with its nameplate, which is permanently attached to the hopper.

The data printed on the rating plate of the Manure Spreader is shown in Figure 1. The position of the rating plate and serial number is shown in figure 2.

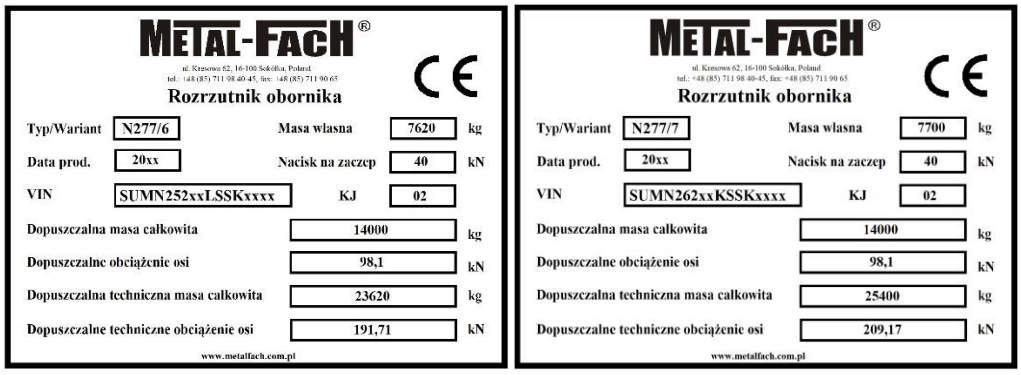


Figure 1. Rating plate

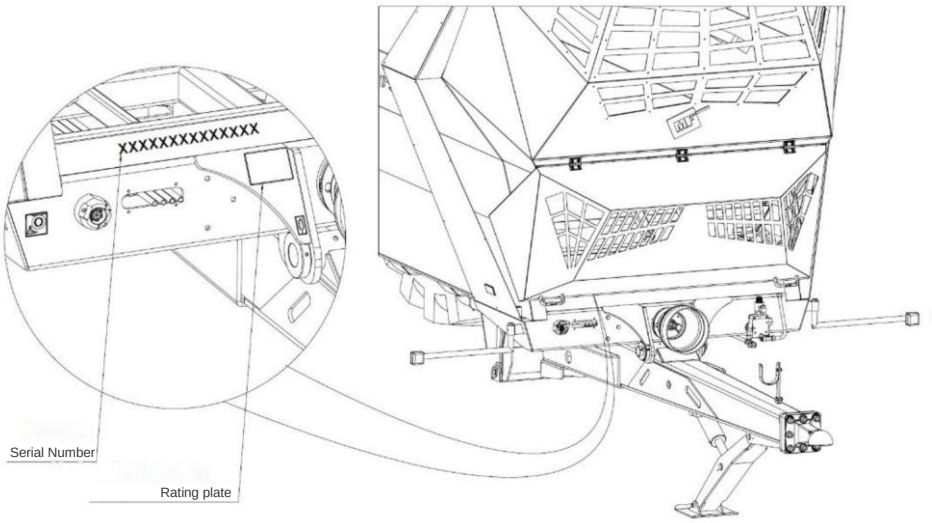


Figure 2. The position of the rating plate and serial number

CAUTION

CAUTION!
Entering public roads without a rating plate or with an illegible rating plate is prohibited.

Upon the purchase, check the compliance of the factory number located on the machine rating plate with the number written in the Instruction Manual and Guarantee Certificate - it is crucial for recognizing the guarantee. When contacting technical service, the seller, or the Manufacturer, the User is obliged to provide the information included on the machine's rating plate.

The Instruction Manual is provided as the basic equipment of each Manure Spreader.

Should the Spreader be sold to a different User, it is obligatory to hand the Instruction Manual to them. It is recommended that the supplier of the Spreader to keep a record of every confirmation of receipt signed by the purchaser, when the Instruction Manual is submitted with the machine to the new User.

Please read the Instruction Manual carefully!

If you follow its recommendations, it will be possible to avoid hazards, operate the machine efficiently and productively, and maintain the warranty for the duration granted by the Manufacturer.

CAUTION

CAUTION!

It is prohibited to use the Spreader by the persons who have not red this instruction manual.

1.3 Intended use of the Manure Spreader

Manure spreader is designed for the even spreading of manure, peat, compost, etc. and for transport of agricultural products on farms and on public roads. It is not permitted to use the spreader in any other way than the one described above.

The operator must use the machine in accordance with its intended use by carrying out activities involving the correct and safe operation and maintenance of the spreader, which will include:

- reading and understanding the spreader's principles of operation
- safe and correct operation of the machine
- timely and regular maintenance of the machine
- compliance with the general safety regulations
- compliance with the provisions of the Road Traffic regulations.

DANGER!

DANGER!

The Spreader must not be used contrary to its intended purpose, in particular to:

- carry people and animals
- operate it with exceeded payloads
- spread and transport toxic and flammable materials
- distribute liquids, sand or fibrous substances
- carry goods, machinery and equipment not secured, which, while driving, may shift their position or affect the stability of the spreader
- carry out transport of building materials, individual objects or any materials which are not included in its intended use

Unauthorised structural changes to the spreader voids the manufacturer's liability for consequential damage.

Table 1. Requirements for agricultural tractors

Description	Requirements	UoM
Braking system 2-line braking system Pressure rating of the system:	 as per PN-ISO-1728:2007 800	kPa
The hydraulic system Hydraulic oil Nominal pressure Oil purity	 HL 46 16 20/18/15 acc. to ISO 4406-1996	MPa
Electrical system Electrical system voltage Connection socket	 12 7-pole acc. to ISO 1724	V
Tractor hitch Minimum vertical load-bearing capacity of the hitch	 4000	kg
Minimum power demand of the tractor	N277/6 – 140 -150 N277/7 – 140 -150	HP
Minimum turning radius	7	m

1.4 Basic components

The basic accessories of each Spreader include:

- Operating instructions;
- Warranty Certificate with warranty terms and conditions;
- A bracket for fixing a slow-vehicle marking plate
- two-line pneumatic brakes with manually adjustable braking force;
- A parking brake;
- Lights.

1.5 Transporting

The Spreader is sold fully assembled and does not require any further assembly. It is delivered to the User by means of motor transport or independently, when coupled with a tractor.

CAUTION

CAUTION!
Observe the general health and safety regulations, regarding handling of cargo, when loading and unloading the Spreader. Those operating the loading and unloading equipment must have the required authorisation to use it.

CAUTION

CAUTION!
It is forbidden to attach slings of lifting devices to the upper mounting brackets of the body and the beater unit to lift, load or unload a complete spreader.

If transported on a platform, secure the Spreader by means of clamping straps or chains with a tensioning mechanism. Such fasteners must have a valid safety certificate. Place chocks or other elements without any sharp edges under the wheels of the Spreader to prevent the machine from rolling. Attach the chocks to the platform of the means of transport applied. Special attention must be paid during loading and unloading, so as not to damage the accessories of the Spreader and its paint coating. Attach the fastening straps or chains to the shipping brackets welded to the frame of the hopper. The longitudinal members or other robust structural elements of the frame can also be used for that purpose.

Before loading the Spreader on the platform, couple it with the tractor's hitch and connect the brake system lines. Use the unfolded ramps to drive the Spreader onto the low-loading platform.

DANGER!

DANGER!
Improper use of fasteners can cause an accident.

CAUTION

CAUTION!
Pay particular attention to the angle of inclination of the ramps on the low loader. It may not exceed 10°. The excessive inclination of the ramps can lead to damage to both the spreader and the transport trailer.

The Spreader may be driven on public roads, as a machine attached to the **lower hitch** of a farm tractor.

Make sure that the tractor is fully manoeuvrable, before driving it on public roads. The front-axle load of the tractor must be at least 20% of the tractor's weight, which also applies when transporting and operating a loaded Spreader. If this condition is not satisfied, the front-axle of the tractor must be additionally loaded.

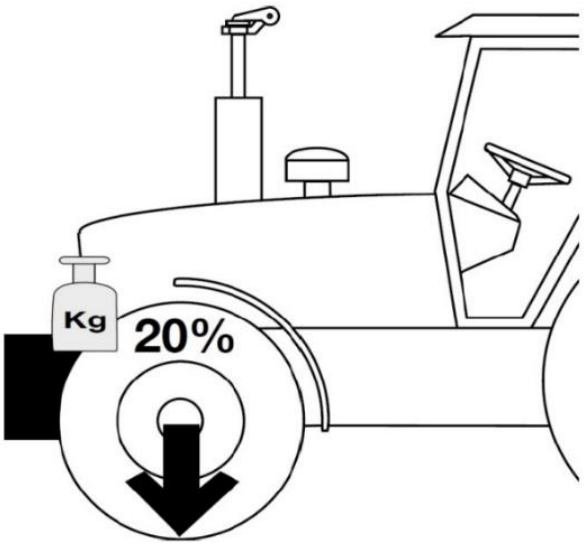


Figure 3. Minimum front-axle load of the tractor

CAUTION

CAUTION!
During the transport of the machine on public roads adapt the speed to the traffic conditions and do not exceed the speed of 40km/h.

Prior to spreader transport make sure that

- the spreader is properly coupled to the tractor and the hitch device is secured against accidental disconnection
- both the spreader and the tractor brake systems function correctly
- both the spreader and the tractor lighting work correctly and the front position lamps of the spreader are in transport setting
- the ladder is folded in the transport position;
- the beater shields are closed
- the body gate is in its lowest position

- the hydraulic and pneumatic hoses are properly arranged and protected against damage in transport;
- the support foot is raised to its uppermost position;
- the parking brake is released.

During transport of the spreader on public roads adhere to the road traffic regulations. During emergency pulling over the tractor with the attached machine the driver must:

- Ensure that any hazard to the safety on the road ensues when stopping the vehicle
- Park the vehicle as close to the edge of the road as possible, parallel to the road centre line
- Stop the tractor engine, take off the key from the key switch, engage the auxiliary brake and place the chocks under a spreader wheel
- Outside a built-up area, place a warning triangle between 30 and 50 metres behind the vehicle and switch on hazard lights
- when in a built-up area, switch on the hazard-warning lights and place a warning triangle behind the vehicle, unless it is installed on a bracket on the rear of the machine; make sure that it is clearly visible to other road Users;
- in the case of a breakdown, undertake relevant steps to secure the area where the breakdown occurred.

1.6 Environmental hazards

Leaking hydraulic and gear oils can pose a direct threat to the natural environment. Carry out all maintenance and repairs in rooms with an oil-resistant surface if there is a risk of oil leakage. If oil leakage occurs, secure the source of leakage and collect the spilled oil. Use absorbent materials to collect oil residues. When collected, all pollutants must be stored in tightly closed, oil-resistant, and marked, containers.

DANGER!

DANGER!

Store used hydraulic and gear oil or any collected residues mixed with absorbent materials in tightly sealed containers. Do not use food containers for this purpose.

CAUTION

CAUTION!

Dispose of all waste oil and used oil, in accordance with the applicable regulations.

It is forbidden to dispose of oil into the sewage system or water reservoirs.

1.7 Scrapping

If the machine is to be withdrawn from use, the User must comply with the national regulations regarding withdrawing from use and recycling of end-of-life machines, applicable in a given country. Before dismantling, remove all oil from the hydraulic system and gearboxes. Reduce air pressure in the braking system to the minimum.

DANGER!

DANGER!

When dismantling, use suitable tools, lifting equipment and personal protective equipment such as gloves, shoes, protective clothing, glasses, etc.

Avoid contact with skin. Prevent any oil leaks.

Dispose of all waste oil and used oil, in accordance with the applicable regulations.

When changing worn, damaged, or unrepairable parts and components, send them to buy-back recycling centres.

2. Safety of use

2.1 Basic safety principles

2.1.1 Obligation to provide information

CAUTION

CAUTION!
If the spreader is sold to further users, attach the Instruction Manual, and the purchaser of the spreader must undergo training as indicated in the Manual.

2.1.2 General safety and use regulations

Before each activation, the Spreader must be checked for safe operation:

- Observe the generally applicable safety and accident-prevention regulations, and follow the information provided in this Instructions Manual;
- The attached symbols, warning and informatory inscriptions provide important guidelines for safe operation – observing them ensures your safety;
- Operate the Spreader only if all required devices are connected and protected against unintentional disconnection or opening (e.g. hitch and drawbar, couplings, PTO shaft)
- Before starting work, get yourself familiar with all control equipment and elements, and their functions. It will be too late to do this during the operation;
- Persons under the influence of alcohol or other stimulants, and those who are not trained and do not hold proper driving licences are forbidden to operate the spreader

2.1.3 Safety of operation

1) Before using the machine, the user must read and understand the content of this Instruction Manual. Observe all the guidelines included in this Instruction Manual, during operation.
2) If any information contained in this Instructions Manual is unclear, please contact the seller running an authorised technical-support service on behalf of the Manufacturer, or contact the Manufacturer directly.
3) Careless and improper use and operation of the Spreader, as well as failure to observe the recommendations contained in this Instructions Manual, are dangerous to health and life.
4) Failure to observe the safety rules poses a threat to the health and life of the operators, and third parties.
5) Please note that during the Spreader's operation some residual risks can occur, so exercising safety rules must be a priority.
6) All safety-related information must also be passed on to all other Users and operators of the Spreader.
7) Any structural and functional modifications of the Spreader release Metal-Fach Sp. z o.o. from liability for damage to property or health impairment.
8) Use only the recommended PTO shafts with the correct parameters to transmit power from the shaft.
9) Do not use of PTO shafts without guards for power transmission.

10) Before starting to drive, make sure that the parking brake is released and the braking-force regulator is in the correct position corresponding for the load status (it applies to a 2-line pneumatic system with a manual braking-force regulator).
11) Before starting, check the immediate vicinity (for the presence of children or bystanders). Pay particular attention if visibility is reduced.
12) After you finished spreading, lower the slide gate completely, switch off the PTO shaft drive, switch off the floor conveyor's drive, and close the adapter's guards. Never leave the Spreader with the slide gate of the hopper open, if the PTO shaft drive or the floor conveyor drive are switched on, and/or the adapter shields open, without supervision.
13) It is only allowed to enter the hopper, if the Spreader has come to a complete stop, the PTO shaft is disengaged, the tractor's engine switched off, and the machine is protected against unauthorized access.
14) Always activate and deactivate the PTO shaft and hydraulically-controlled components from the driver's seat.
15) Couple the Spreader, according to the applicable regulations. Connect it only to the recommended coupling equipment, and secure the drawbar's eye against uncoupling from the tractor's transport hitch.
16) Special care must be exercised, when coupling and uncoupling the Spreader to and from the tractor.
17) When installing and removing any supporting and safety devices, and ladders, always place them in a position ensuring safe operation.
18) Follow the acceptable axle loads, total weight, and transport dimensions.
19) Check the transporting equipment like the brakes and lights, the marking plate and other protective devices for connection and functioning.
20) Before driving, check the operation of the lights and brakes, and prepare the Spreader, in accordance with the recommendations provided in the "Driving on public roads" section.
21) Ensure that the Spreader is loaded in such a way that the material does not contaminate surfaces, when travelling on public roads.
22) After finishing work and before driving on a public road, remove any residues of the spread material from the external parts of the machine, to prevent it from falling down and contaminating roads.
23) Notice all changes in vehicle behaviour, steering and braking performance due to loaded spreader being coupled to it.
24) When driving with a coupled Spreader, take into account the distribution of the load and/or inertia forces, especially if the load distribution is asymmetrical.
25) Do not stand within range of the material being spread.
26) The spreading of manure can only be carried out, if:

- the Spreader is coupled with the tractor,
- the tractor and Spreader unit is standing on a firm surface,
- the front-axle load of the tractor is at least 20% of the weight of the tractor,
- there are no persons within the spreading area,
- the tractor is aligned with the centre line of the Spreader,
- keeping a safe distance from the power lines,
- no strong gusts of wind occur, which can carry the spreading material away outside the permitted spreading area.

27) If it is necessary to carry out the final stage of spreading on a slope, align the tractor and the Spreader in the direction of thedownslope. When spreading on slopes, make sure that the surface inclination does not exceed 10°.
28) Exercise care when opening the shields, so your fingers and hands are not crushed.
29) When starting the Spreader, observe the signs warning against places, where crushing, dragging, and entangling hazards can occur. When coupling to and uncoupling the Spreader from the tractor, there is a risk of crushing and injuring limbs.
30) No person is allowed to be present between the tractor and the Spreader, unless the vehicle is protected against rolling by the parking brake and/or wheel chocks.
31) Secure the Spreader and the tractor against rolling, when stationary.
32) It is forbidden to transport the Spreader with the hopper's slide gate raised and the adapter's covers removed.
33) Keep a safe distance from power lines, when lifting the slide gate of the hopper.
34) When carrying out repair and maintenance work, which requires entering the hopper, the tractor must be stationary and protected against the risk of starting the engine and the use of the control elements by unauthorised personnel.
35) Always adjust your driving speed to the existing conditions. Avoid sudden up or downhill turns on sloping terrain.
36) Maintain a sufficient safety clearance within the turning area of the unit.
37) When reversing, ensure that you have sufficient visibility (if possible, have another person to assist you).
38) When cornering, take into account the inertia of the Spreader.
39) Observe a minimum turning radius of approx. 6 m when turning and reversing.
40) Remove any functional faults of the attached devices only when the engine is switched off and the ignition key removed.
41) In the event of a failure of the hydraulic or pneumatic systems, the Spreader must be taken out of service, until the failure has been remedied.
42) It is forbidden to carry out maintenance or repair work, when the hopper is loaded.
43) Before carrying out repair work on the hydraulic or pneumatic systems, the oil or air pressure must be reduced.
44) In the event of an injury sustained from a strong hydraulic oil jet, consult a physician immediately. Hydraulic oil can penetrate under the skin or into the eye, and cause infections.
45) Use the hydraulic oil recommended by the Manufacturer. Never mix two different types of oil.
46) Use the gear oil recommended by the Manufacturer. Never mix two different types of oil.
47) Switch off the engine and remove the ignition key, before leaving the tractor. Engage the parking brake and secure the Spreader with a chock.
48) Do not exceed the maximum permissible axle loads of the Spreader.
49) Exceeding the permissible technical load carrying capacity of the Spreader can damage the machine, and cause the loss of its stability while driving, and spillage of the load, and also compromise the safety of other road traffic. The braking system has been adapted to the permissible total weight of the Spreader, which, if exceeded, will considerably reduce the performance of the main brake.
50) It is forbidden to exceed the permissible driving speed.
51) The maximum allowable pressure in the hydraulic system is 16 MPa.

52) The maximum allowable pressure in a double-line pneumatic system is 0.80 MPa, and the minimum is 0.65 MPa.
53) Preparing the spreader for operation (connecting hydraulic hoses, pneumatic system, PTO shaft, etc.) must be made with the tractor engine switched off and the ignition key removed.
54) The Manufacturer delivers the Spreader fully assembled.
55) Change the hydraulic (rubber) lines every 4 years.
56) Noise – the equivalent A-weighted emission sound pressure level (LpA) should not exceed 75dB. The peak C-weighted instantaneous sound pressure value (LCpeak) is 82±1 dB.
57) Keep the spreader clean.

WARNING

WARNING!
If operated during a storm, there is a risk of lightning striking the Spreader.

2.1.4 Working with the machine

- When working with the machine, make sure that no people or animals are present in the vicinity of the spreading area.
- It is forbidden to stand within the spreading area, since the spreading material can contain stones, fragments of wood, or other objects.
- Before commencing work, check the condition of the adapter blades and their fasteners.
- Before loading, check the tension of the chains of the floor conveyor. Regularly check the tension of the conveyor chains.
- When working next to roads, drainage ditches, plot boundaries and water bodies, do not work beyond the designated spreading zone.

2.1.5 Pneumatic and hydraulic systems

CAUTION

CAUTION!
The pneumatic braking system is under high pressure.
Before starting work on the system, switch off the tractor engine, secure the spreader with the parking brake and support chocks and depressurise it.

- When connecting pneumatic lines to the tractor's pneumatic system, ensure that the valves on the tractor and spreader side are not under pressure.
- Check the pneumatic connection on a regular basis and change damaged and ageing parts. The replacement of lines must comply with the manufacturer's

technical requirements. Replace flexible pneumatic lines every 5 years unless damage has been found earlier.

- Air leaks from the pneumatic braking system are not allowed.
- The hydraulic system is under high pressure during operations.
- Use the hydraulic oil recommended by the Manufacturer. Never mix two different types of oil.
- Regularly check the technical condition of the hydraulic connections and hoses.
- When connecting the hydraulic hoses to the tractor, make sure that the hydraulic systems of the tractor and the Spreader are not under pressure. If necessary, reduce the residual pressure of the system.
- In the event of an injury sustained from a strong hydraulic oil jet, consult a physician immediately. Hydraulic oil can penetrate under the skin and cause infections.
- Repair work on the pneumatic or hydraulic systems may only be carried out by an authorised representative of the spreader manufacturer.
- In the event of a failure of the hydraulic or pneumatic system, the spreader must be taken out of service until the failure has been removed.

Change flexible pneumatic lines every 5 years, unless damage is found earlier.

Change rubber hydraulic hoses every 4 years, regardless of their technical condition, unless a fault has been found earlier.

CAUTION

CAUTION!

The required purity of hydraulic oil is 20/18/15, according to ISO 4406-1996.

2.1.6 Working with the PTO shaft

- The Spreader may only be connected to the tractor, by means of an appropriately selected PTO shaft recommended by the Manufacturer.
- Before starting work, read the Instruction Manual of the drive shaft and follow its guidelines.
- Connect and disconnect the PTO shaft only when:
  - the Spreader is coupled with the tractor hitch,
  - the tractor's engine is switched off,
  - the key is removed from the ignition switch,
  - the parking brake is pulled up,
  - and the PTO shaft is switched off.
- Before starting the tractor hitched with the Spreader, make sure that the PTO shaft drive in the tractor is switched off.
- The PTO shaft must be fitted with guards.

- It is forbidden to use the PTO shaft without its guards or with damaged components.
- Install the articulated telescopic shaft, in accordance with the guidelines provided in the Operating Instructions issued by the shaft's Manufacturer.
- Secure the guards of the PTO shaft against rotating, using chains. Fasten the chains of the shaft to the permanent structural components of the Spreader and the tractor.
- The PTO shaft's guard is marked indicating which end of the shaft should be installed on the machine's side and which on the tractor's side. The protective couplings must always be fitted on the machine side.
- After installing the PTO shaft, make sure that it is correctly and safely connected to the tractor and the Spreader.
- Each time you start the Spreader, make sure that the PTO shaft's guards are in good technical condition and correctly positioned. Change any damaged or faulty components for new ones.
- When working with and maintaining the machine, it is forbidden to wear loose clothing, which can be caught by the rotating parts of the PTO shaft. Contact with the rotating PTO shaft can result in serious injury or death.
- When working in conditions of reduced visibility, use the tractor's service lights to ensure adequate sight of the working PTO shaft and its immediate vicinity.
- Transport and store the PTO shaft horizontally with its chains fastened together, to prevent damage to the guards and other components.
- It is forbidden to overload the PTO shaft and the drive system of the Spreader's adapter. It is not allowed to start the PTO shaft of the tractor in a sharp manner. Before starting the PTO shaft, make sure that the direction of rotation is correct.
- **Use a PTO shaft speed of 1000 rpm during operation.** Operating at different speeds can damage the machine or its components.
- Switch off the PTO shaft drive, whenever there is no need to drive the machine, or when the tractor and Spreader are oriented at an unfavourable angle.
- Do not exceed the maximum permissible working length of the PTO shaft.
- When uncoupling the PTO shaft from the tractor, place it in a special holder designed for that purpose.
- It is forbidden to use chains for suspending or supporting the PTO shaft, when the Spreader is parked or transported.

2.2 Residual risk

2.2.1 Residual-risk description

It is inevitable that some risks will occur during the Spreader's operation, although METAL-FACH in Sokółka assumes responsibility for the machine's design and structure, in order to eliminate hazards.

Residual risk can result from incorrect behaviour by the Spreader's operator, e.g. carelessness, ignorance, or improper actions. The following prohibited actions cause the highest level of risk.

1) The operating of the Spreader by minors or persons without authorisation to drive a tractor, as well as by persons who have failed to read the Instruction Manual.

2) The operating of the Spreader by persons, who are sick or under the influence of alcohol or other intoxicating substances.
3) Using the Spreader for purposes other than those described in the Instruction Manual.
4) Standing between the tractor and the Spreader, while the tractor's engine is running.
5) Oil leakage and sudden movement of components caused by rupturing of hydraulic hoses.
6) Standing on the machine while operating or transporting.
7) Bystanders, children in particular, standing close to the running spreader.
8) Presence of persons or animals in areas not visible from the operator's position.
9) Cleaning, maintaining and inspecting the spreader assemblies connected to the PTO shaft while the tractor engine is running.
10) Checking its technical condition, when the Spreader is in operation.
11) Operating a defective power take-off shaft.
12) Exceeding the permitted speed and load carrying capacity.
13) Making changes to the machine without the manufacturer's consent.

When specifying the residual risks, we assume that the spreader is a machine which was designed and manufactured state-of-the-art in the year of its manufacture.

2.2.2 Assessing residual risk

Residual risk can be reduced to the minimum by applying the following recommendations:

1) Adhering to the safety rules described in the Instruction Manual.
2) Using common sense, when operating the machine.
3) Do not hurry, when operating the machine.
4) Maintain a safe distance from the restricted and dangerous places.
5) Do not reach into dangerous and/or restricted places with your hands.
6) Do not stand on the machine, while it is in operation.
7) Have repair and maintenance work performed by trained personnel.
8) Wear the appropriate protective clothing.
9) Prevent unauthorized access, especially children, to the machine.
10) Make sure there is no person present in the blind spot (especially when reversing and coupling).

CAUTION

CAUTION!
Failure to comply with the instructions and guidance provided herein may result in residual risks!

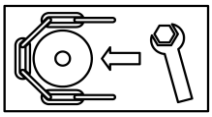
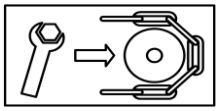
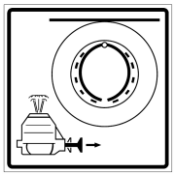
2.3 Warning and information stickers

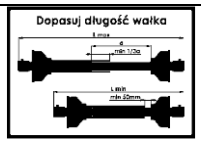
The Manure Spreader is marked with information and warning stickers. The User is obliged to ensure that the inscriptions, warnings and information pictograms provided on the Spreader are legible throughout the working life of the Spreader.

If any information or warning sticker has been damaged or removed, place an order at the manufacturer or at the distributor the machine was purchased from. Re-attach stickers to any new components which have been fitted during repair work. When cleaning, do not point a strong jet of water at the labels and do not use solvents.

Table 2. Information and warning stickers

No.	Safety symbol (sign)	Meaning of the symbol (sign) or content of the inscription	Location on the Spreader
1.		Caution! Before you start operating the machine, read the Instruction Manual.	On the side panel of the hopper.
2.		Caution! Switch off the engine and remove the key before maintenance or repair.	On the side panel of the hopper.
3.		Caution! Risk of electric shock. Keep a safe distance from power lines.	On the side panel of the hopper.
4.		Caution! Torso crushing hazard. Stay clear of the area where the articulated coupling joints rotate, if the engine is running.	On the side panel of the hopper.
5.		Caution! Danger of being dragged in by the drivetrain. Do not reach into the area of rotating parts.	At the hitch and at the rear, on the left-hand side of the hopper.
6.		Caution! Thrown or flying materials. Hazard to the whole body. Keep a safe distance from the machine.	On the adapter frame

7.		Caution! Hand crushing hazard. Keep a safe distance from moving parts.	On the adapter frame
8.		Caution! Danger of hand or upper torso being dragged in by the rotors of the adapter. Do not reach into the area of rotating parts.	On the rear panel of the hopper. Near the adapter.
9.		Caution! Risk of falling. Do not travel on platforms or ladders.	On the left panel of the hopper. On the ladder
10.		Caution! Danger of crushing toes or a foot. Keep a safe distance from the support foot and the drawbar.	At the support foot
11.		Attachment points of the transport tie down straps	At the attachment points
12.		Lubricating points	The front and rear sections of the floor conveyor
13.		Tensioning the floor conveyor chain	On the left panel of the hopper
14.		Tensioning the floor conveyor chain	On the right panel of the hopper
15.		Speed limit of 40 km/h	At the rear, on the adapter's rear guard
16.		Pneumatic brake release mechanism	On the frame

17.		PTO rotational speed	On the front sheath
18.		Jacking point	On the driving axles
19.		Adjust the length of the shaft	On the hitch

	Warning inscriptions	**Meaning of the symbol (sign) or content of the inscription**	**Location on the Spreader**
20.		Check chain tension regularly	On the right and left panels of the hopper
21.		Do not enter the hopper when the drive is enabled	On the left panel of the hopper. On the ladder
22.		Tighten the wheel nuts after a few kilometres and then periodically	Above the road wheels
23.		Beater unit weight 1220 kg	On the adapter frame
24.		Load capacity: 16t – N277/6; 18t – N277/7	On the front wall of the spreader body
25.		Switch off the PTO shaft drive when cornering.	On the side panel of the hopper.
26.		Use a hitch for single-axle trailers to couple the trailer.	On the side panel of the hopper.

CAUTION

CAUTION!

The user of the spreader must maintain legibility of all warning inscriptions and signs attached on the trailer over the whole period of operation. If they are damaged or destroyed, change them to new ones.

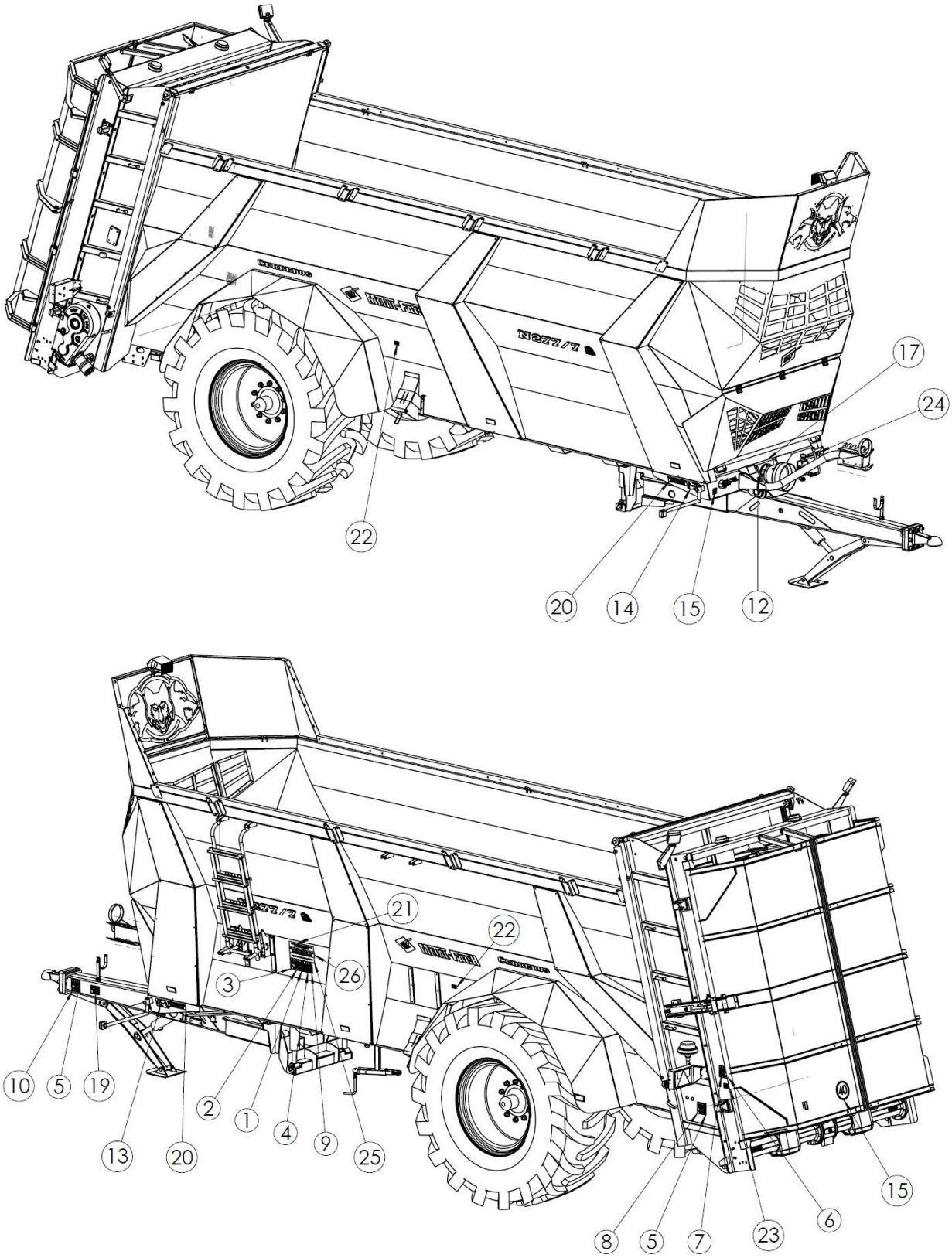


Figure 4. The locations of warning and information stickers

3. The Design and Principles of Operation

3.1 Basic Technical Data

Table 3. Basic technical data

No.	General data					
1.	Type of vehicle			Manure Spreader		
2.	Suspension			Single-axle, rigid		
3.	Type (Model)			N277 (16t / 18t) **CERBERUS**		
4.	Type of bodywork			Shell type hopper		
5.	The point of mounting the rating plate			Front beam of the shell		
Overall dimensions						
				UoM	**N277/6 (16t)**	**N277/7 (18t)**
6.	Length			mm	9490	
7.	Width			mm	2900	
8.	Height (650/6075 R32 wheels)			mm	3450	3600
9.	Wheel track			mm	2150	
Loading height						
10.	Loading height			mm	2800	2950
11.	Loading height with extensions	0.5m		mm	3300	3450
12.	Ground clearance of the hopper floor			mm	1250	
Internal dimensions of the spreader body						
13.	Length			mm	6175	
14.	Width (top/bottom)			mm	1500/2000	
15.	Height			mm	1550	1700
16.	Height with extensions (mesh)	0.5 m		mm	2050	2200
Performance Parameters						
17.	Permissible total weight	Administrative		kg	14000	
		Technical			23620	25400
18.	Load capacity	10 km/h	Administrative	kg	6380	6300
			Technical		16000	17700
		40 km/h	Administrative		6380	6300
			Technical		8980	8900
19.	Permissible axle load	Administrative		kg	10000	10000
		Technical			19620	21400
20.	Kerb weight (max)			kg	7620	7700
21.	Drawbar eye load (max)			kg	4000	
22.	PTO rotational speed			RPM	1000	

				UoM	N277/6 (16t)	N277/7 (18t)
23.	Tractor power demand (min.)			HP	140-150	
24.	Cargo space	Volume of the hopper to the slide gate		m³	17.1	19
		Height after piling-up			20.8	22.7
25.	Cargo space with extensions	0.5 m		m³	22.9	24.8
26.	Effective spreading width			m	10	
27.	Maximum spreading width			m	10-16	
28.	Permissible transport speed			km/h	40	
29.	Working speed			km/h	4-10	
Other Information						
30.	Pressure in the hydraulic system (max)			MPa	16	
31.	Maximum pressure in the 2-line pneumatic braking system			MPa	0.80	
32.	Electrical system voltage			V	12	
33.	Types of hitch	Type of shock absorption	Standard	-	Longitudinal suspension spring	
			Optional		Hydraulic springs	
		Coupling with the tractor	Lower hitch		YES	
			Upper hitch		NO	
34.	Drawbar eyes (types)	Standard		mm	K80 ball drawbar eye	
35.	Driving axle	Standard		mm	Permanent □150	
		Optional			NONE	
36.	Brakes	Standard		-	Pneumatic, 2-line	
		Optional			Hydraulic	
		Optional			Hydraulic-pneumatic	
37.	Parking brake			-	Mechanical, drum, manually controlled via a worm gear	
38.	Tyre size	Standard		-	650/75 R32	
39.	Adapter type [2m wide]	Vertical 2-rotor 2000x2385, fastened with bolts	Standard	-	- all flat and bent blades made of the HARDOX 450 steel - MOBEX gearbox	
			Optional		- all flat and bent blades made of the HARDOX 450 steel - SISP gearbox with increased strength and lifetime	
40.	Adapter's weight			kg	1220	
41.	Oil in the hydraulic system (HL-46)			L	6	

				UoM	N277/6 (16t)	N277/7 (18t)
42.	Oil in the gearbox of the floor conveyor (gearbox oil 80W90)			L	6	
43.	Oil in the gearbox of the spreading adapter (gearbox oil 80W90)			L	10.7	
44.	Chain of the floor conveyor	Chain link		mm	∅ 20 (VAUCANSON)	
		Number of rows		pcs.	2	
45.	Tensioning the chain of the floor conveyor	Tensioning screws in the front beam		pcs.	2	
46.	Safeguards (overload couplings)	Adapter		-	Articulated telescopic shaft at the front – shear pin	Articulated telescopic shaft at the rear – friction clutch
		The floor-conveyor gear			The cross-directional hydraulic valve	
47.	The slide gate-lifting indicator			-	NONE	
48.	The thickness of the hopper panel (steel grade)			mm	4 (S355)	
49.	The thickness of the hopper floor (steel grade)			mm	3 (S355)	
50.	The wheel chocks included in the delivery			-	YES	
51.	Wheel mudguards	Standard		-	YES	
52.	Deflectors	Vertical adapter	Standard	-	Hydraulically controlled rear flaps	
53.	External ladder			-	Fixed permanently with bolts on the left-hand side of the hopper (foldable)	
54.	Extensions	Optional	0.5 m	-	Net	
The hydraulic system						
55.	Slide gate of the hopper			-	Hydraulically controlled	
56.	Support foot			-	Scissor type	
57.	The drive of the floor conveyor			-	Hydraulically controlled	
58.	Rear flaps				Hydraulically controlled	
59.	Drawbar	Standard		-	Longitudinal suspension spring	
		Optional			Hydraulic springs	
60.	No distributor	Standard		-	4 pairs (4 sections)	
		Optional	Hydraulically sprung drawbar		5 pairs (5 sections)	
61.	Distributor	Optional	With or without a spring drawbar	-	1 pair of conduits	

* - The permissible total weight and payload are given for a pressure of 4,000 kg exerted on the hitch, and depend on the type of tyres applied.

** - The permissible axle load depends on the load capacity of the tyres and their permissible speeds specified in the table (4).

The User must observe the permissible transport speeds commensurate with the maximum load carrying capacity of the Spreader. If using a different brand of tyres, observe the parameters regarding that particular brand.

Table 4. The data regarding the permissible tyre loads, in relation to speed and pressure

MAXI TRACTION 650/75R32 (172AB) (172B)							
Speed [km/h]	Pressure (bar)						
	2.0	2.4	2.8	3.2	3.4	3.6	4.0
	Maximum permitted load [kg]						
10*(**)	7540	8295	8950	9565	9860	10160	10710
10	6725	7370	7960	8505	–	–	–
30	5330	5840	6310	6745	–	–	–
40	4985	5460	5895	6300	–	–	–

* - The maximum transport speed corresponding to the maximum spreader's payload, taking into account the required tyre pressure.

** - Cyclical load:

- Cyclical additional load is allowed for traction wheels, if exposed to cyclical load changes, under minimum torques and significant laden weight's fluctuations;

- Before leaving the field, the vehicle must be unloaded;

- If under the maximum load, the vehicle must be unloaded after travelling for 1.5 km, at the latest;

- The maximum load exerted on the tyre must be determined, taking into account all possible variations regarding the type of terrain and vehicle / application;

- When working on slopes, where inclination is more than 10 degrees (20%), it is not permitted to apply cyclical additional load;

- The basic tyre pressure must be increased, in accordance with the tables.

DANGER!

DANGER!
Failure to adhere to the permissible speed, tyre and axle loads can result in a serious accident.

3.2 The Design and Principles of Operation

The components of the spreader are shown in figure 5. The main structural components include a monocoque body (10) with rigid single-axle wheels and suspension (5). A sprung hitch equipped with a ball drawbar's eye (1) is used for connection with the tractor's lower hitch. A hydraulic support foot (3) is attached to the drawbar to support the spreader when it is not connected to the tractor and to adjust the height of the drawbar during coupling.

The foldable ladder (13) installed on the left-hand side of the hopper is used to inspect the load compartment and to enter the hopper, during cleaning or maintenance work. There is a hydraulically controlled gate (12) at the rear of the body, to separate the loaded material from the beaters and prevent it from falling out during transport. The main operation component is the beater unit (6) with two vertical augers. The loaded material is moved towards the adapter unit by the chain feeder installed on the hopper's floor. The beater unit is fitted with hydraulically controlled protective shields (11) to be used as spreading limiters (deflectors) during operation.

After installing the side extensions and removing the adapter (6), the Spreader can be used as a self-dumping manure conveyor.

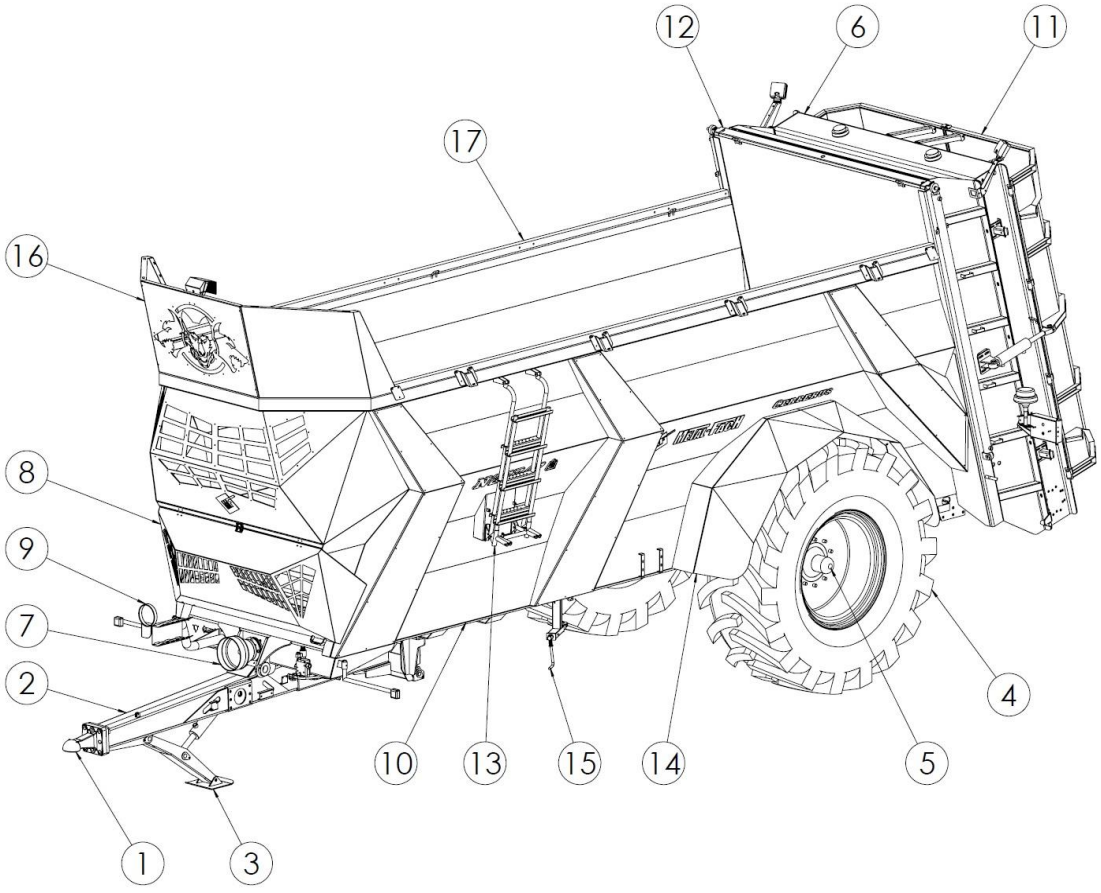


Figure 5. Main components of the manure spreader
1 - drawbar eye, 2 - sprung hitch, 3 - support leg, 4 - wheels, 5 - suspension, 6 - beater unit, 7 - beater unit drive, 8 - front guard, 9 - lighting beam, 10 - spreader body, 11- beater unit shields, 12- body gate, 13 - ladder, 14* - side extensions, 15* - mudguards, 15 - hand brake, 16 - chain feeder, 17 - body wall finishing edge,
* - optional equipment

3.2.1 The feeding mechanism

The feeding unit consists of a floor conveyor, a feeder roller, and a tensioning system. The entire unit driven by the tractor's hydraulic system.

The floor conveyor consists of a pair of chains connected by scraper bars. The chains are driven by sprocket wheels mounted on the feeder roller. The feeder roller is driven by the reduction gear and the hydraulic motor. The front part of the Spreader contains a tensioning system that controls the tensioning of the chains of the feeder.

The floor conveyor is protected against damage by an overload hydraulic valve located at the hydraulic motor. If overloaded or blocked mechanically, the conveyor is paused immediately.

3.2.2 The drive unit of the adapter

The drive unit of the adapters consists of a PTO shaft coupled with the tractor, rotating at the nominal torque of 900Nm with a shear-pin coupling, a split quill shaft that transmits power from the front part to the rear part of the Spreader, and a PTO shaft that transmits power to the adapter.

Table 5. Articulated telescopic shafts

Symbol of the tractor's PTO shaft	**Nominal torque**	**L min.**	**L max**	**Transmitted power**	**Overload coupling**
	Nm	mm	mm	kW	Nm
680005/802.K68-1/5NW	900	1460	2490	51	2700
680060/S802.K68-1/5NW*	900	1530	2220	51	2700
Symbol of the adapter's PTO shaft	**Nominal torque**	**L min.**	**L max**	**Transmitted power**	**Overload coupling**
680440/804.C6803A/5NW	900	710	1110	51	1300

3.2.3 2-auger vertical beater unit

The 2-auger vertical beater unit is used for shredding and scattering the material supplied by the floor conveyor. The beater unit is mounted on the rear of the spreader. The beater unit is supplied by the drive unit and the PTO of the tractor.

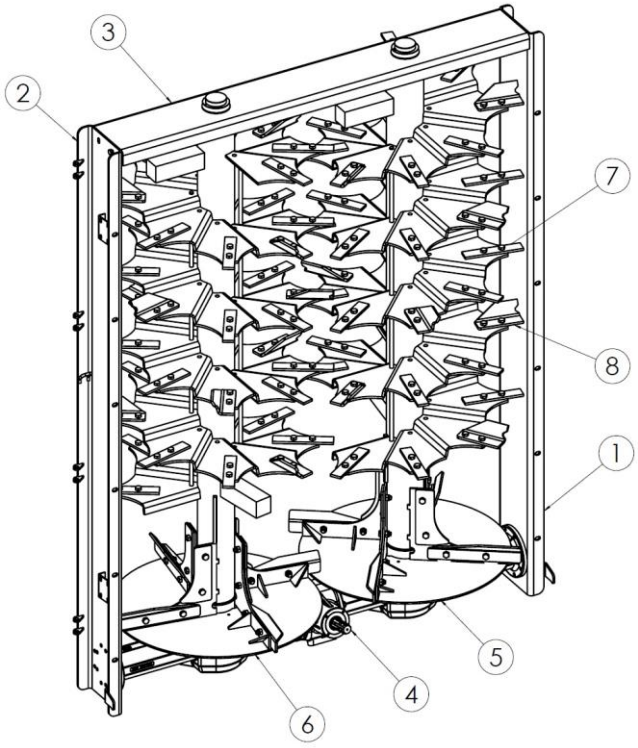


Figure 6. 2-rotor verticaladapter

The beater unit consists of a left beam (1), a right beam (2) and an upper beam (3) to form the beater unit frame. In its lower part, there is a gearbox (4) with the vertical augers (5) and (6) mounted inside it. The main working tools are the replaceable blades (8) screwed to the rotor segments. When revolving, the rotors shred the fed material and eject it backwards and sideways. The bottom section of the rotors features discs with blades, which increase the spreading width of the material.

The beater unit is fixed to the spreader body with M16 bolts. To disassemble the beater unit

- disconnect the PTO shaft from the beater unit gearbox
- remove the adapter covers,
- remove the adapter lower covers,
- undo the bolts connecting the adapter to the hopper,
- use a lifting device with the minimum lifting capacity of 1200 kg to remove the adapter,
- after removing the adapter, place it on a solid surface and secure against tipping over.

3.2.4 Adapter covers

The beater unit shields are attached to the Beater unit by means of pins and are opened or closed by means of hydraulic cylinders. They are controlled directly from the tractor cab via the lever of the external valve block. The right guard is additionally equipped with a shut-off valve, so that it can be locked in any position. A partially opened shield can be used as a deflector to limit the spreading width of the material.

3.2.5 Slide gate of the hopper

The N277/6 and N277/7 spreaders are fitted with a body gate as standard. It separates the transported material from the adapter. It is supported in the side guides which seal and protect the material against penetrating outside the hopper. The bottom section of the slide gate is reinforced, which protects the gate against damage resulting from excess manure pressing on it. At the bottom of the gate (as at the front of the body) a rubber sealing belt is fixed, matching the shape of the conveyor chains.

The gate is opened by hydraulic cylinders, controlled by the tractor's external hydraulic system, to move it upwards.

3.2.6 Main brake system

The Spreader can be equipped with one of the three types of main braking systems:

- two-line pneumatic system (Figure 7)
- single-line hydraulic braking system (Figure 9)
- pneumatic hydraulic braking system (Figure 10)

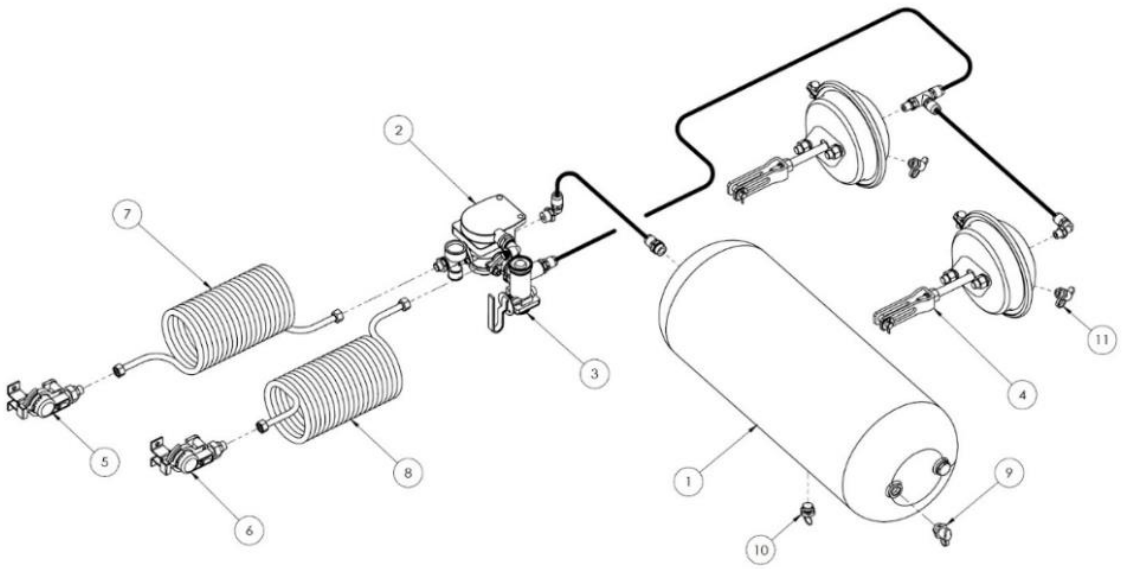


Figure 7. 2-Line pneumatic braking system
1 - air tank, 2 - control valve, 3 - brake force control, 4 - pneumatic cylinder, 5 - hose fitting (red), 6 - hose fitting (yellow), 7 - helical pipe (red), 8 - helical pipe (yellow), 9 - air tank control fitting, 10 - drain valve, 11 - air cylinder’s control fitting

The main brake is activated from the driver's seat by pressing the brake pedal of the tractor. The pneumatic control valve (2) applied in the pneumatic system actuates the brakes of the Spreader simultaneously with the brakes of the tractor.

In the event of an accidental disconnection of the conduits (5) and (6) the control valve will automatically activate the brakes of the machine.

The braking-force regulator (2) – see Figure 8 – applied in the pneumatic braking system adjusts the braking force, according to the hopper load. Switching to the correct working mode is done manually, by shifting the position of the lever (4). This is done by the operator, before starting to drive. The following three working positions are available: (A) “UNLADEN”, (B) “HALF LOAD”, (C) “FULL LOAD”.

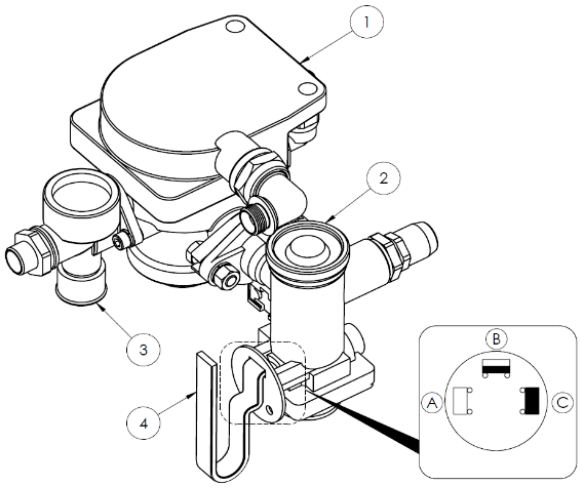


Figure 8. The control valve and brake force control system for 2-line pneumatic brakes 1 - control valve, 2 - brake force control, 3 - brake release key for parked spreader, 4 - control mode selection lever: (A) “UNLADEN”, (B) “HALF LOAD”, (C) “FULL LOAD”.

CAUTION

CAUTION!
The following work modes of the brake force control are not allowed when driving with full load: (A) “UNLADEN”, (B) “HALF LOAD” Failure to follow this guidance may result in an accident.

Optionally, the spreader can be equipped with a single-line hydraulic braking system. The components of the system are shown in Figure 9.

The brake is activated from the driver's seat by pressing the brake pedal of the tractor. The Spreader brake is supplied and activated directly from the hydraulic braking system of the tractor. In the event of an accidental disconnection of the Spreader coupled with the tractor, the emergency valve (1) will activate the brakes of the machine by means of the chain (5).

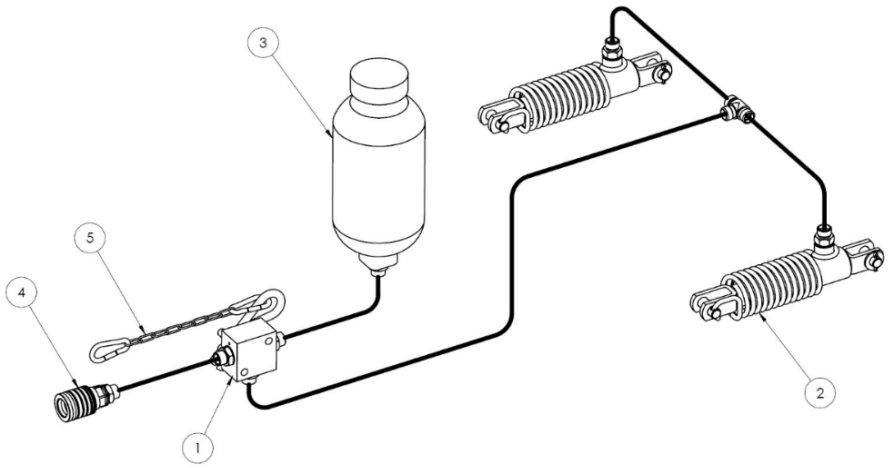


Figure 9. 2-Line pneumatic braking system
1 - air tank, 2 - control valve, 3 - brake force control, 4 - pneumatic cylinder, 5 - hose fitting (red), 6 - hose fitting (yellow), 7 - helical pipe (red), 7 - helical pipe (yellow), 8 - air tank control fitting, 10 - drain valve, 9 - air cylinder control fitting

Another option for the brake system is the hydraulic pneumatic brake system. This system is a combination of the 2-line hydraulic and pneumatic braking systems. Whether you can connect the hydraulic or pneumatic braking system depends on the type of trailer brakes the tractor is equipped – figure 10.

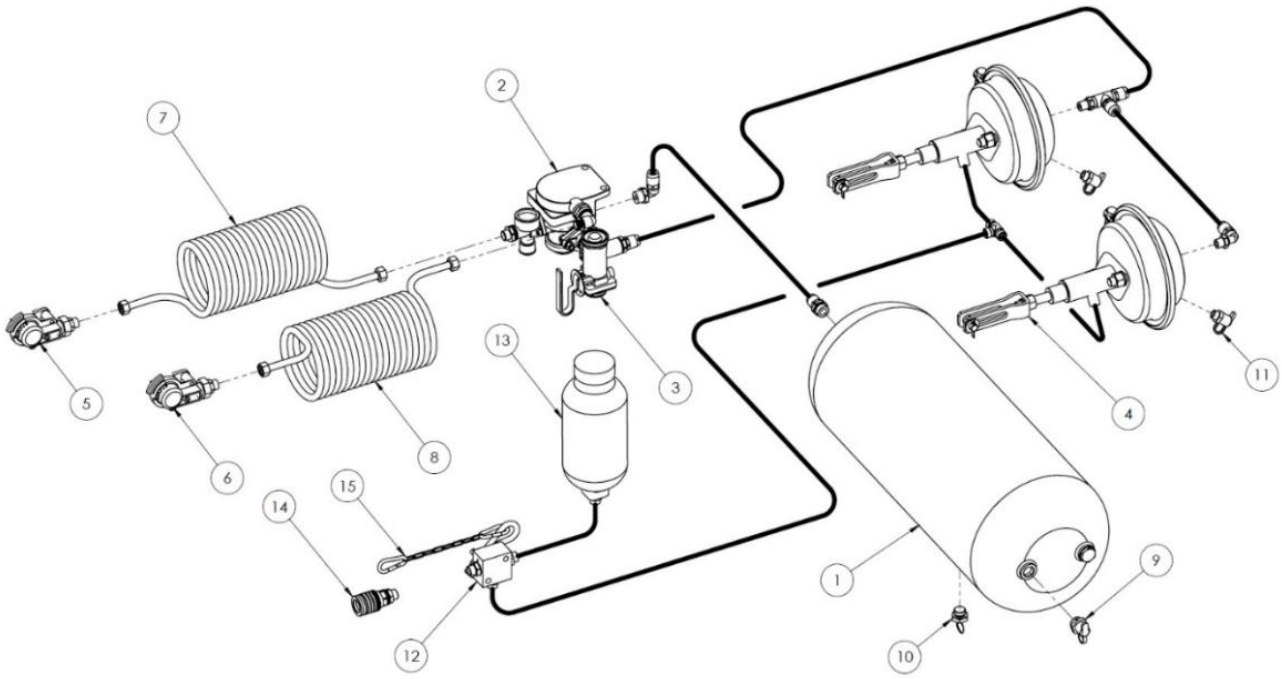


Figure 10. Hydraulic pneumatic braking system
(1) air tank, (2) - control valve, (3) - brake force control, (4) - hydraulic pneumatic cylinder, (5) - hose fitting (red), (6) - hose fitting (yellow), (7) - helical pipe (red), (8) - helical pipe (yellow), (9) - air tank control fitting, (10) - drainage valve, (11) - air cylinder control fitting, (12) - emergency valve, (13) hydraulic accumulator, (14) hydraulic quick coupling (15) emergency valve actuation chain

3.2.7 Parking brake

The parking brake is used to stop the Spreader, while it is parked. The components of the system are shown in Figure 11.

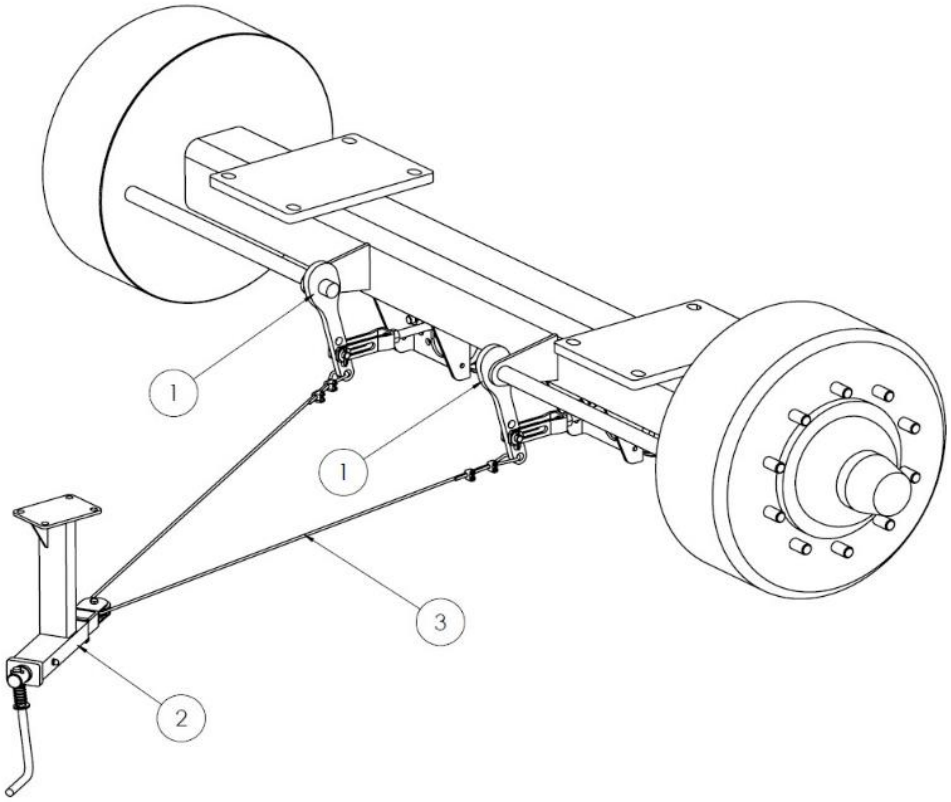


Figure 11. Parking brake:
1 - brake-expander lever, 2 - brake tension, 3 - steel cord

The tension assembly (2) is fixed on the left-hand side of the body. The expander levers (1) of the axle are connected to the crank device by means of a steel cable (3). Turning the crank of the tension assembly pulls the cable (3) and swivels the expander lever to actuate the spreader brakes. The brake is released by turning the crank of the tension assembly to the left.

3.2.8 The electrical and lighting systems

The electrical system of the spreader can supply power from a 12V DC power source from the tractor electrical system. Connect the electrical system of the Spreader to the electrical system of the tractor system by means of a connecting cable supplied with the machine. The wiring diagram is shown in Figure 12 and the arrangement of lights in Figure 13.

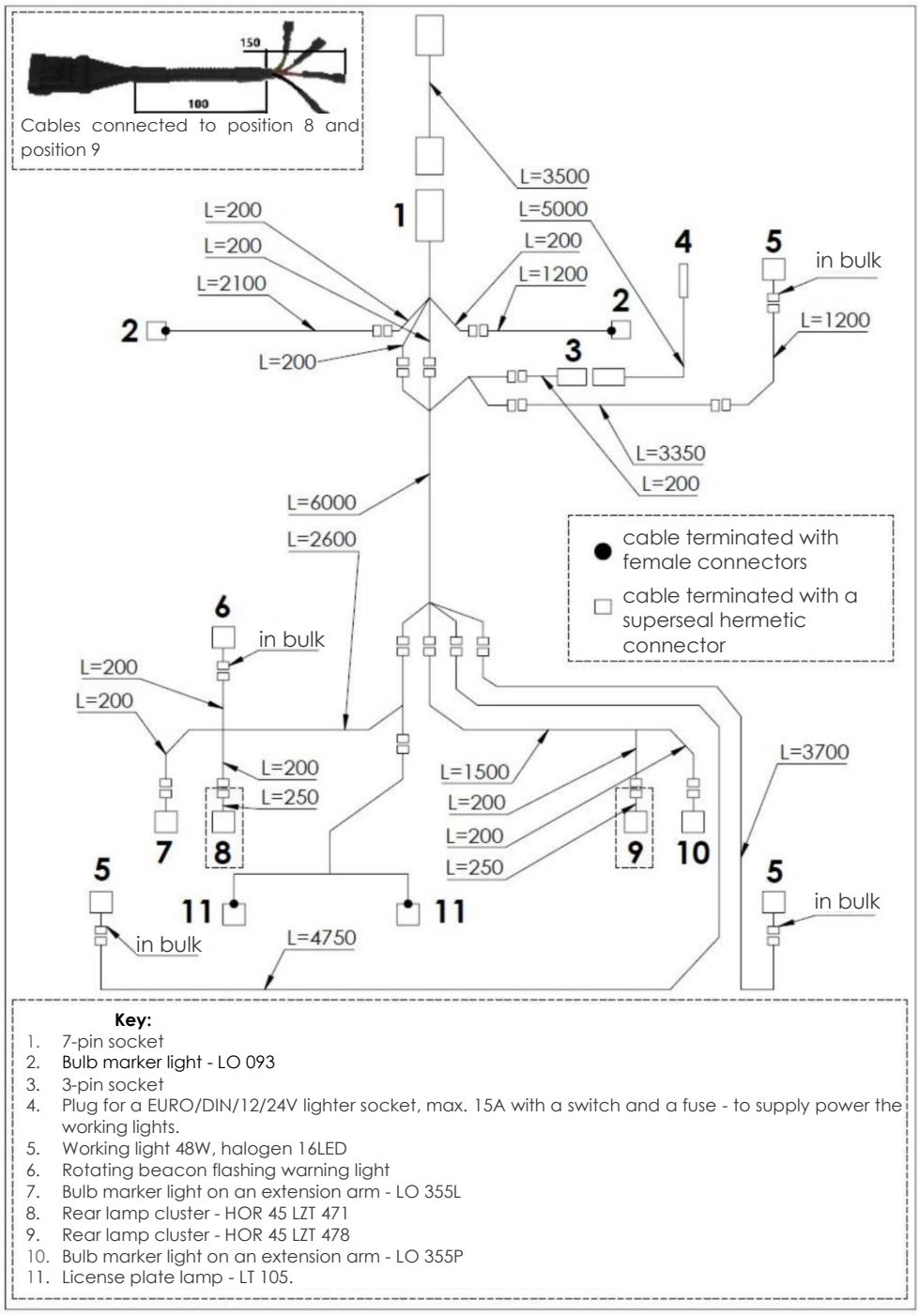


Figure 12. Wiring Diagram

Table 6. GT sockets connection marking

Designation	Function
1 - L	Traffic indicator lamp, left
3 - 31	Earth
4 - R	Traffic indicator lamp, right
5 – 58R	Running lights
6 - 54	Brake light

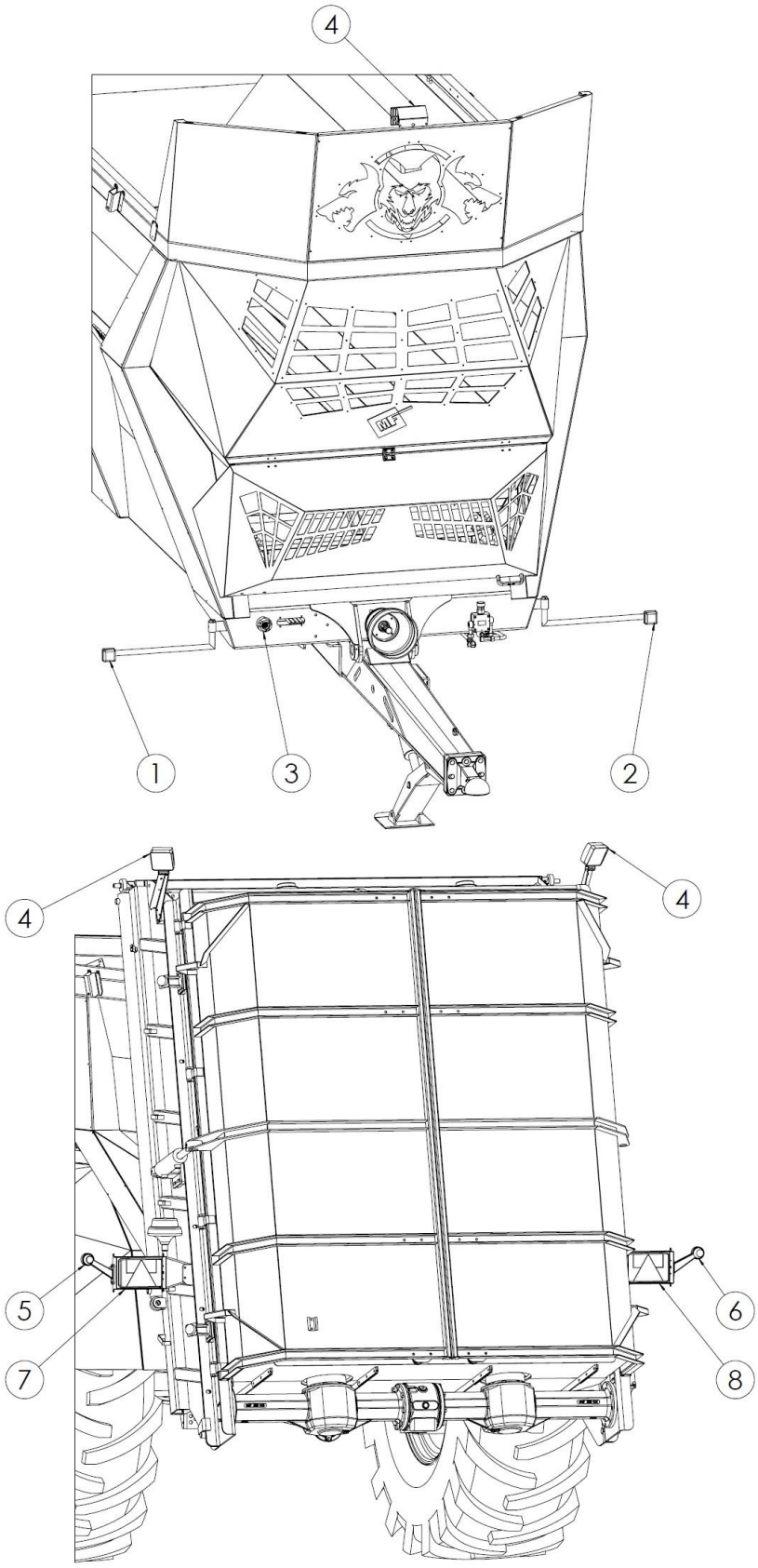


Figure 13. Arrangement of the electrical system components: 1 - front right running light, 2 - front left running light, 3 - connection socket, 4 - working lamp, 5 - left marker lamp, 6 - right marker lamp, 7 - rear left lamp cluster, 8 - rear right lamp cluster

4. Instructions for Use

4.1 Preparing the machine for operation

4.1.1 Checking the Spreader after Delivery

The Spreader is delivered to the User completely assembled and does not require any additional assembly. However, this does not exempt the User from the obligation to check the machine before purchasing and commissioning it.

Before coupling the Spreader, make sure that the tractor is suitable for this purpose. The Spreader can only be coupled with a tractor which meets the requirements listed in Table 1.

CAUTION

CAUTION!

Before coupling and putting the Spreader in operation for the first time, it is mandatory to become familiar with the design of the Spreader, the layout of its individual components, as well as to read and follow the contents of this Operating Instructions and the Operating Instructions dedicated to the articulated telescopic shaft supplied with the machine.

The spreader may only be coupled to an agricultural tractor that has a hitching device suitable for connection to single-axle trailers, as well as suitable sockets for the brake, hydraulic and electrical systems.

The oil in the tractor's external hydraulic system must be compatible or miscible with the spreader oil.

Before connecting the machine to the tractor, the operator must verify the technical condition of the Spreader and prepare it for the initial start-up. To this end, verify the following:

- the completeness of the machine;
- the condition of the paint coating and mechanical damage to individual components;
- the technical condition of the protective guards and the correctness of their assembly;
- the technical condition of the hydraulic and pneumatic conduits;
- the technical condition of the PTO shafts and their guards;
- the hydraulic system and gears for leaks.

4.1.2 Preparing the Spreader for the initial start-up

Before starting the trailer for the first time, check the following:

- lubricating points and, if necessary, lubricate the components;
- the correct tightening of screwed connections (road wheels, drawbar, components of the spreading adapter);
- the oil level in the gears of adapter and the floor conveyor;
- the tensioning of the floor conveyor's chains;
- Make sure that the PTO shaft transmitting power from the tractor has a sufficient length in all possible configurations of the tractor in relation to the machine, when coupled (Figure 14);

- whether the speed of the tractor's PTO shaft matches the required rotational speed of the Spreader drive.

CAUTION

CAUTION!

Under normal operating conditions, the tubular profiles of the PTO shaft should work overlapped by 1/2 of the shaft's length, and by 1/3 of the shaft's length, under extreme operating conditions.

Observe the instructions of the shaft Manufacturer, when fitting the PTO shaft.

If fitted incorrectly, the PTO shaft transmitting power from the tractor can be damaged or destroyed, when driving on an uneven terrain and when cornering.

The PTO shaft can only be adapted to the one type of the tractor which works with the Spreader. If the machine is coupled with a different tractor, re-check the correctness of coupling the PTO shaft.

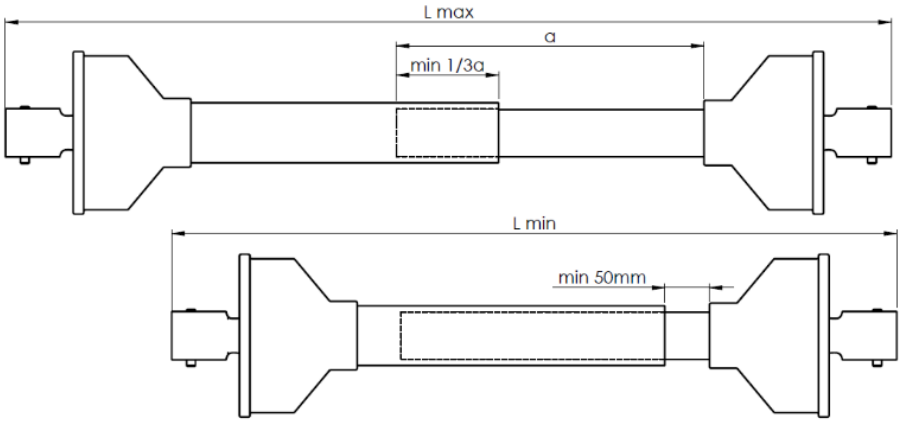


Figure 14. Adjusting the length of the PTO shaft when the Spreader is coupled with the tractor

4.1.3 Changing the Position of the Hitch

The pre-assembled Spreader is designed to be coupled only with the lower hitch of the tractor. The hitch (2) features the function of changing the height of the drawbar eye (1) in relation to the ground - see Figure 15. This is done by the hydraulic cylinder (3). The drawbar is set at the right height by levelling the Spreader, which ensures an even distribution of the Spreader's weight on the axle. After coupling the Spreader, make sure that it is properly levelled, both with and without load.

See Table 7 for the estimated height ranges between the drawbar eye and the ground.

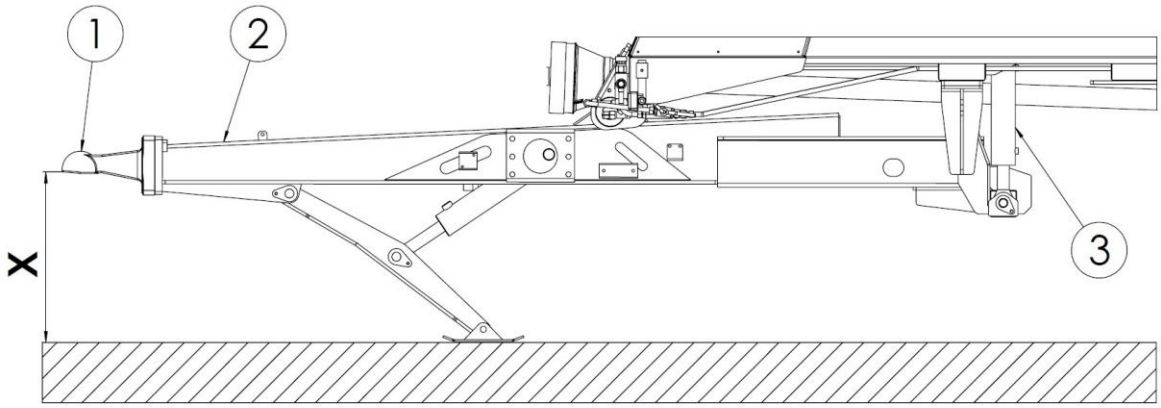


Figure 15. Position of the drawbar in relation to the ground

Table 7. The estimated range of heights of the drawbar in relation to the ground

Extension of the cylinders / Wheel sizes	min	max
	N277, N277/7 spreader	
	X [mm]	
650/75 R32	473	811

4.1.4 Start-up

If the preparatory work has been completed and the Spreader is in a good working order, couple it with the tractor. After starting the tractor, check the function of each individual system, when parked and unladen. Follow the sequence of actions discussed below to start the machine for the first time:

1) Couple the Spreader with a compatible tractor hitch.
2) Connect the power take-off shaft and secure it correctly.
3) Connect the braking, hydraulic, and electrical conduits/lines.
4) Lift the support foot.
5) Check the proper operation of the lighting system.
6) Release the parking brake of the Spreader.
7) Start the tractor.
8) Check the operation of the main brake, as soon as starting to drive.
9) Check the operation of the floor conveyor:
   - set the feed rate in the range from “3” to “10” on the flow controller mounted on the right panel of the hopper,
   - use the appropriate distributor lever of the tractor to start the floor conveyor,
   - use the holes in the front guard to observe the movement of the conveyor bars, making sure that its direction of movement is correct; the direction of the conveyor’s movement can be changed by changing the position of the distributor’s lever in the tractor, with the locking valve lever previously set to “open” - see Figure 18.
10) check the proper operation of the beater unit shields
   - open and close the adapter unit’s guards using the corresponding distributor lever in the tractor (if the guards are installed).
11) Start the PTO shaft drive at low engine speed (start the drive of the adapter rotors).

12) Allow the adapter run at low engine speed for a few minutes and check, whether:
    - there in no knocking sound or any other disturbing sounds coming from the drive system and the adapter,
    - the adapter rotors rotate smoothly without jamming.
13) Switch off the PTO shaft drive and the tractor engine, and uncouple the Spreader from the tractor.


CAUTION

CAUTION!
The PTO shaft speeds must correspond to those specified in Table 3.

If all preparatory work has been completed successfully, the Spreader can be approved for operation. If any malfunction or faults of individual systems are found during the initial start-up, report them to the point of sale or directly to the Manufacturer to have the problem solved or to carry out repairs.


CAUTION

CAUTION!
Failure to follow the recommendations in the Instruction Manual or starting up the machine incorrectly can result in damage.
Ensure that there are no reservations as to the technical condition of the spreader before it is put into operation.

4.2 Coupling and decoupling the spreader

The machine may only be coupled with a farming tractor which is in good working order, fitted with all the necessary connections (braking, pneumatic, hydraulic and electric) and a tractor hitch according to the requirements of the spreader manufacturer.

Before coupling the spreader to the tractor, use the parking brake to make sure that the spreader is not moving.


CAUTION

CAUTION!
Before coupling the machine, check the technical condition of the tractor and spreader hitch as well as the connection parts of the braking, hydraulic and electrical systems.


CAUTION

CAUTION!
Use particular caution when coupling the spreader.
The hydraulic oil in the tractor and spreader must be miscible.
After coupling the Spreader to the tractor, secure the braking, hydraulic, and electrical lines in such a way that they will not break, wear, bend, crush, or accidentally disconnect, while driving.
For travel and operation, raise the support foot to its uppermost position, and close the hydraulic valve retaining the foot.

Coupling the Spreader

To couple the Spreader, follow the sequence of actions described below:

1) Use the parking brake to immobilise the Spreader and put the protective chocks under the wheels.
2) Align the position of the tractor straight in front of the Spreader's hitch.
3) Set the drawbar eye to the height that enables coupling the machine:
   - if the Spreader is equipped with a mechanical support foot, turn the crank in the appropriate direction, until the drawbar eye reaches the required height,
   - if the Spreader is equipped with a hydraulic scissor support foot, connect the foot's hydraulic lines to the tractor's external hydraulic sockets; open the foot's hydraulic locking valve on the drawbar; use the distributor lever in the tractor to raise or lower the drawbar eye to a height, which makes it possible to connect it to the tractor's hitch.
4) reverse the tractor and couple the Spreader to the tractor's hitch. Check the securing pin of the coupling preventing the machine against accidental disconnecting:
   - if the tractor is fitted with an automatic hitch, make sure that the coupling is completed and the drawbar eye is secured.

DANGER!

DANGER!
Bystanders are not allowed to stand between the spreader and the tractor during coupling procedure.
When coupling the machine, the operator of the tractor should exercise particular caution and make sure that no unauthorized persons are in the danger zone.
When connecting the hydraulic lines, make sure that the hydraulic systems of the tractor and Spreader are not pressurised.

5) Use the distributor lever to lift the support foot to its uppermost position.
6) Activate the parking brake in the tractor, switch off the tractor's engine, remove the key from the ignition switch, and secure the tractor against unauthorised access.
7) Connect the lines of the 2-line pneumatic braking system; connect the yellow pneumatic conduit to the yellow pneumatic socket in the tractor, and the red pneumatic conduit to the red pneumatic socket in the tractor:
   - if the Spreader is fitted with hydraulic brakes, connect the hydraulic conduit of the Spreader's brakes to the plug of the hydraulic braking system in the tractor. Then, connect the activating chain of the emergency braking valve to the permanent element on the tractor;
   - if the Spreader is equipped with hydraulic-pneumatic brakes, connect the pneumatic or hydraulic braking system, respectively, depending on the type of the braking control mechanism installed in a particular tractor.
8) Connect the hydraulic conduits of the driving system of the floor conveyor.
9) Connect the hydraulic conduits of the slide gate system.
10) connect the hydraulic hoses of the control system controlling the adapter's guards (if present).
11) Install the PTO shaft and secure the shields against rotating.

12) Release the parking brake of the Spreader.

Uncoupling the Spreader

To uncouple the Spreader, follow the sequence of actions described below:

1) Position the Spreader on its support foot, in such a way that the position of the drawbar eye makes it possible to uncouple the tractor safely:
   - if the Spreader is equipped with a mechanical support foot, turn the crank in the appropriate direction, until the drawbar eye reaches the required height,
   - if the Spreader is equipped with a scissor support foot, use the tractor's distributor lever to raise the drawbar, so that the drawbar eye makes it possible to uncouple the tractor safely.
2) Activate the parking brake in the tractor, switch off the tractor's engine, remove the key from the ignition switch, and secure the tractor against unauthorised access.
3) Stop the Spreader using the parking brake and place chocks under the wheels.
4) Close the locking valve of the hydraulic support foot (located directly at the drawbar).
5) Release pressure in each of the hydraulic systems in the tractor.
6) Uncouple the hydraulic hoses from the floor conveyor, the slide gate, the adapter's guards of the support foot, and secure them with covers, and the hang the plugs from the holder located on the bracket for cables.
7) Disconnect the conduits of the braking system.
8) Disassemble the power takeoff shaft and secure it correctly
9) Uncouple the Spreader's hitch from the tractor hitch and move the tractor away.


CAUTION

CAUTION!
Use particular caution when uncoupling the spreader from the tractor.
Uncoupling the loaded machine from the tractor or leaving the loaded spreader parked and supported on the support leg is not allowed.
Dismantling the support leg and supporting the machine on provisional stands is not allowed.

4.3 Loading the Trailer body

Before loading, drive and park the correctly coupled tractor and Spreader on a stable, horizontal ground. Park both machines in a straight-ahead position and secure them both with the parking brake.

Before loading, make sure that there are no persons, objects (stones, pieces of wood, etc.) inside the spreader body, that the body gate is fully lowered and that the floor conveyor is not damaged.


CAUTION

CAUTION!
For transport and operation of the laden spreader, the front axle load of the tractor must be at least 20% of the tractor weight.

Use suitable loaders, front end loaders or conveyors for loading. Start manure loading at the rear of the spreader body and keep loading in layers. During the loading, empty the bucket smoothly from the lowest possible height. Do not try compacting the manure.

Ensure even distribution of the load to achieve optimum spreading conditions. Due to the differences in the density of the spreading material, using the entire hopper capacity can result in the exceeding of the permissible design load bearing capacity of the Spreader. Therefore, observe the permissible gross weight. See Table 10 for the estimated densities of selected materials.

Table 8. The estimated densities of selected materials

Type of Material	**Density [kg/m^3]**
Fermented manure	700-800
Composted manure	800-950
Fresh manure	700-750
Compost	950-1100
Peat	330-650
Agricultural lime	2700-3400

Regardless of the type of material carried, the user is obliged to secure it in such a way that it cannot move freely and pollute the road. If this condition cannot be met, carrying such materials is prohibited.

CAUTION

CAUTION!
It is forbidden to exceed the gross weight.
Unevenly distributed load causes uneven spreading of the material in the field.

4.3.1 Loading and Spreading of Lime

It is allowed to spread loose agricultural lime and its derivatives. Failure to observe the following guidance can result in damage to the Spreader.

The general recommendations for spreading agricultural lime:

The maximum weight of loaded lime must not exceed: 8.5 t for the N277/6 and N277/7 spreaders, i.e: 1/2 of the height of the spreader body (0.45m from the spreader body floor)

1) Spread lime immediately after loading, as it can set permanently on the floor of the Spreader after a long period of time, which could stop the movement of chains and bars.
2) Once loaded with lime, the Spreader cannot have any contact with moisture. It is not allowed to start the floor conveyor's drive unit, during precipitation of any kind (unload it manually, if water gets inside the Spreader loaded with lime).

3) Due to its compaction properties, lime can accumulate in chain links and sprockets. Therefore, regularly inspect the technical condition of all components of the floor conveyor (preferably, after each pass).
4) Thoroughly clean the chains, feeder bars, and sprockets, after each spreading of lime (it is recommended to use a pressure washer with clean water or appropriate agents). Washing and drying must be carried out at temperatures above zero.
5) Degrease all greasy or oily surfaces with extraction naphtha or degreasing agents, and then wash them with clean water mixed with a detergent.

Manure Spreaders are not typically designed for spreading lime and its derivatives. When spreading lime with Spreaders, it is not possible to achieve the optimum spreading parameters, when compared to lime spreading using machines specifically designed for that purpose.

CAUTION

CAUTION!
Strictly adhere to the recommendations provided for lime spreading.
Failure to adhere to the rules for lime spreading with the spreader can result in damage to the machine.
When spreading lime or derived fertilisers, use suitable protective clothing and PPE, and observe the general regulations for fertiliser application.

4.4 Fertiliser application rate control and manure spreading

4.4.1 Adjusting Fertiliser Doses

Dosage of the material spread over a certain area of the field depends on the following factors:

1) The speed of the floor conveyor.
2) The driving speed.
3) The loading height of the hopper.
4) The effective spreading width, depending on the type of spreading material.

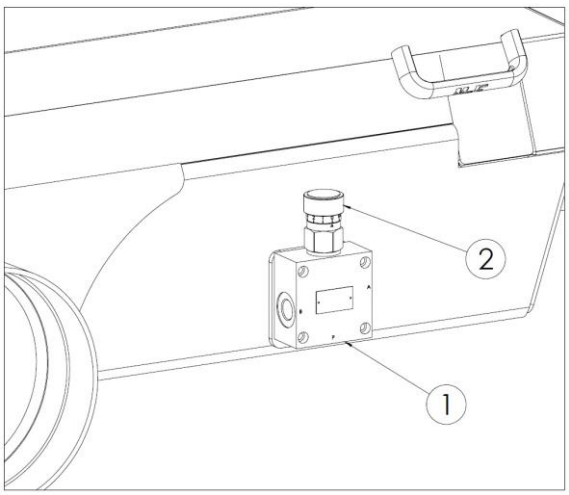


Figure 16. Adjusting the feeding speed of the floor conveyor
1 - oil flow controller, 2 - controller knob

Select the feeding speed of the floor conveyor by trial and adjust it with a knob (2) on the flow controller (1) located on the front beam of the hopper – see Figure 16.

Adjusting the Speed of the Floor Conveyor:

- reducing the travel speed of the floor conveyor – turn the knob of the controller clockwise, towards “0”.
- To increase the speed of the floor conveyor: turn the knob of the controller anticlockwise towards “10”.

Low driving speeds and high speeds of feeding the load result in high dosages of fertilisation.
High driving speeds and low speeds of feeding the load result in low dosages of fertilisation.

Table 9. Dosage of manure (the density of 950kg/m^3), depending on the feeding speed of the floor conveyor and the actual working speed.

Setting No.	Conveyor Capacity [kg/s]	The Working Speed of the Spreader [km/h]						
		4	5	6	7	8	9	10
		Dose of manure [t/ha]						
2	4.2	5.5	4.9	4.1	3.6	2.8	2.3	1.8
3	6.4	7.2	5.8	4.8	4.1	3.6	3.2	2.9
4	14.3	16.1	12.9	10.7	9.2	8.0	7.2	6.5
5	25.7	29.0	23.2	19.3	16.5	14.5	12.9	11.6
6	38.4	43.2	34.6	28.8	24.7	21.6	19.2	17.3
7	50.1	56.4	45.1	37.6	32.2	28.2	25.1	22.6
8	64.7	72.8	58.2	48.5	41.6	36.4	32.3	29.1
9	76.8	86.4	69.2	57.6	49.4	43.2	38.4	34.6
10	99.5	112.0	89.6	74.6	64.0	56.0	49.8	44.8

4.4.2 Spreading of manure

Before starting to spread manure, re-check the condition of the hydraulic connections and safety guards.

DANGER!

DANGER!

Operating the Spreader with safety guards removed or with a damaged articulated telescopic shaft poses a direct risk to the life and health of the operators.

Bystanders or animals are not allowed to stand in the spreading zone.

Keep a safe distance from power lines, especially when working with the slide gate of the hopper raised.

Do not operate the PTO shaft at other rotational speeds than the those specified in Table 3. Using different PTO speeds can damage the adapter or its drive.

To limit the spreading action and achieve precise fertilisation of the field at the boundaries, set and lock the right-hand shield of the beater unit in a desired position. Close the hydraulic valve to lock the right-side guard – see Figure 17. The degree of opening the adapter's left-side guard can be adjusted from the driver's position, using the distributor lever, after locking the right-side guard.

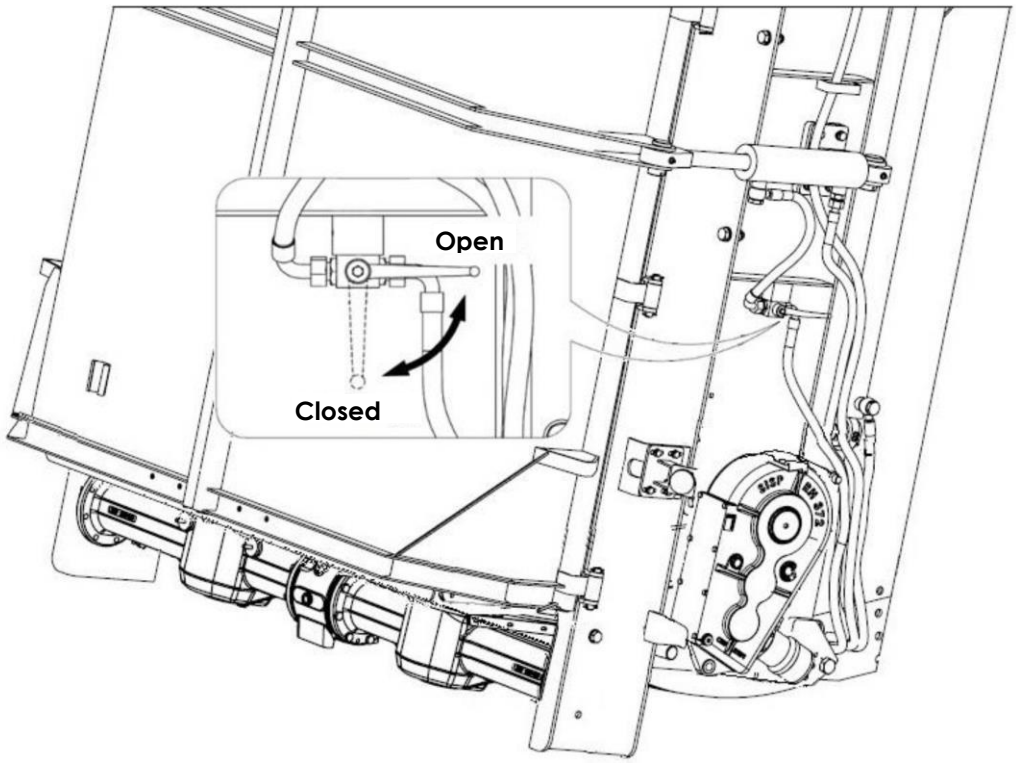


Figure 17. Hydraulic valve for locking the beater unit shield

The Procedure for Starting Manure Spreading

1) Set the tractor coupled with the spreader to drive straight ahead at the location where fertilisation starts.
2) Remove the adapter's mesh guard or, if hydraulic guards are installed, open them using the appropriate distributor lever in the tractor.
   •If the lock valve of the right-side adapter’s guard is closed, only the left-side guard will open.
   •To limit the spread, open the right-side adapter’s guard to the required position, and then lock it with the hydraulic valve. Open the left shield fully or move it other required position

3) Make sure that the PTO shaft of the tractor is adjusted to the correct range of rotational speed.
4) Start the PTO shaft at a low engine speed and increase the engine speed, until the adapter rotors have reached the correct speed, and keep it within this range.
5) Fully raise the slide gate of the hopper.
6) Use the correct distributor lever to start the drive of the floor conveyor, and verify the correct direction of feeding.
7) Engage the tractor gear and start working as soon as the sufficient amount of manure has been fed onto the rotors of the adapter.

Ending the Spreading Procedure:

1) It is recommended to lower the hopper's slide gate to the height of the fed material, in the final phase of spreading.
2) Reduce the speed of travel or use the knob on the flow controller to increase the feeding speed of the floor conveyor, in order to obtain a uniform dose of spreading material in the final stage of spreading.
3) Switch off the floor conveyor's drive, when the hopper is completely empty.
4) Fully lower the slide gate in the hopper.
5) Reduce the rotational speed of the engine and switch off the PTO shaft drive.
6) Fit the adapter's guards or close them, if hydraulically-controlled guards are used.
7) Clean the Spreader after finishing each spreading, if you intend to drive on public roads, to avoid their contamination.

CAUTION

CAUTION!

Strictly observe the sequence provided for starting the spreader. Following any different sequence can damage the spreader and endanger the health or life of the operator.

When driving on headlands, first switch off the drive of the floor conveyor, and the PTO shaft of the tractor.

The direction of movement of the floor conveyor can only be reversed, if the rotors of the adapter are locked. It is not allowed for the load to come into contact with the front panel of the hopper, when the load is moving forward.

4.4.3 Clogging the Spreading Adapter

When spreading manure, the spreading adapter can get clogged, which stops the rotors of the adapter, resulting from the shearing of the safety pin in the PTO shaft transmitting power from the tractor to the Spreader. If the rotors of the adapter come to a stop during spreading, immediately switch off the drives of both the floor conveyor and the PTO shaft drive in the tractor.

Causes of the adapter's clogging:

- objects such as stones, wood, etc. get into the adapter together with manure,
- the feeding speed of the floor conveyor is too high,
- the rotational speed of the PTO shaft is kept too low,
- inadequate speed of the PTO shaft,
- the load is too dense.

Unclogging the spreading adapter:

1) Switch off the PTO shaft drive and uncouple the PTO shaft from the tractor.
2) Shift the position of the rocker of the blocking valve that prevents reversing of the conveyor to the “Open” position - see Figure 18.
3) Reduce the tension on the conveyor's chains.
4) Reverse the floor conveyor by switching the distributor lever in the tractor in the direction opposite to the normal working position of the feeder.
   - Perform this action in phases.
   - Reverse the conveyor only as much as required for the load not to press on the rotors of the adapter.
   - It is not permitted to move the conveyor forward, when the load is in contact with the front panel of the hopper.
5) Switch off the tractor's engine, activate the parking brake to stop the tractor and the Spreader, remove the key from the ignition switch, and secure the tractor against unauthorised access
6) Use suitable tools to remove any objects blocking the rotors of the adapter.
7) Install the bolt in the coupling of the articulated telescopic shaft and connect it to the tractor.
8) Start the tractor's engine and activate the PTO shaft to clean the adapter’s rotors of any residual material.
9) Tension the chains of the conveyor.
10) Move the lever on the shut-off valve to the "OPEN" position,

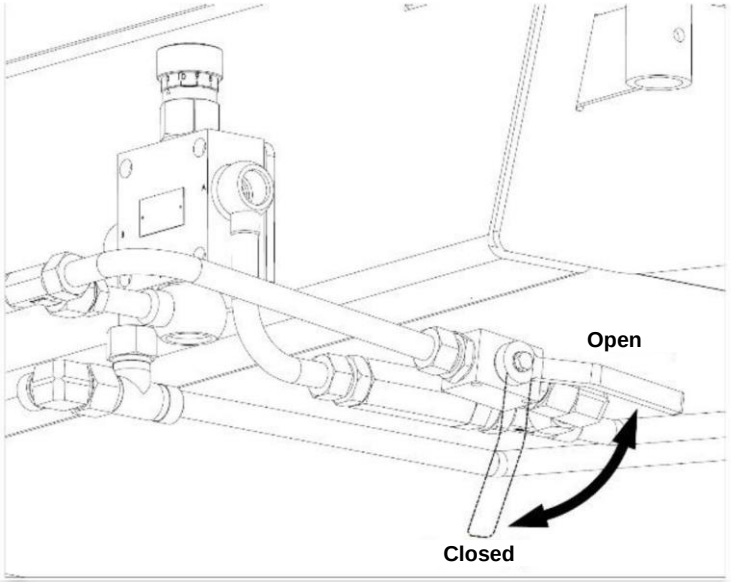


Figure 18. The blocking valve which prevents reversing of the conveyor

CAUTION

CAUTION!

During normal operation, the locking valve should be set to the “closed” position. This setting forces the conveyor to move backwards and prevents it from going the opposite direction.

The “Open” position should only be used, if the direction of the forward movement of the conveyor is changed in a controlled way.

5. Technical maintenance

5.1 Checking and Adjusting the Tension of the Floor Conveyor Chains

Check the tensioning of the floor conveyor chains during operation daily, especially during the initial period of operation. Carry out the tensioning of the conveyor chains by adjusting screws (1) at the front of the spreader body - Figure 19. To increase the chain tension, loosen the nut (5) and then tighten the adjusting screws (2) so that the tensioner slider (1) and the pulley (3) move forward. Follow the tensioning procedure for both chains (4), ensuring that their tension is equal. The locking nut (5) should be tightened after tensioning.

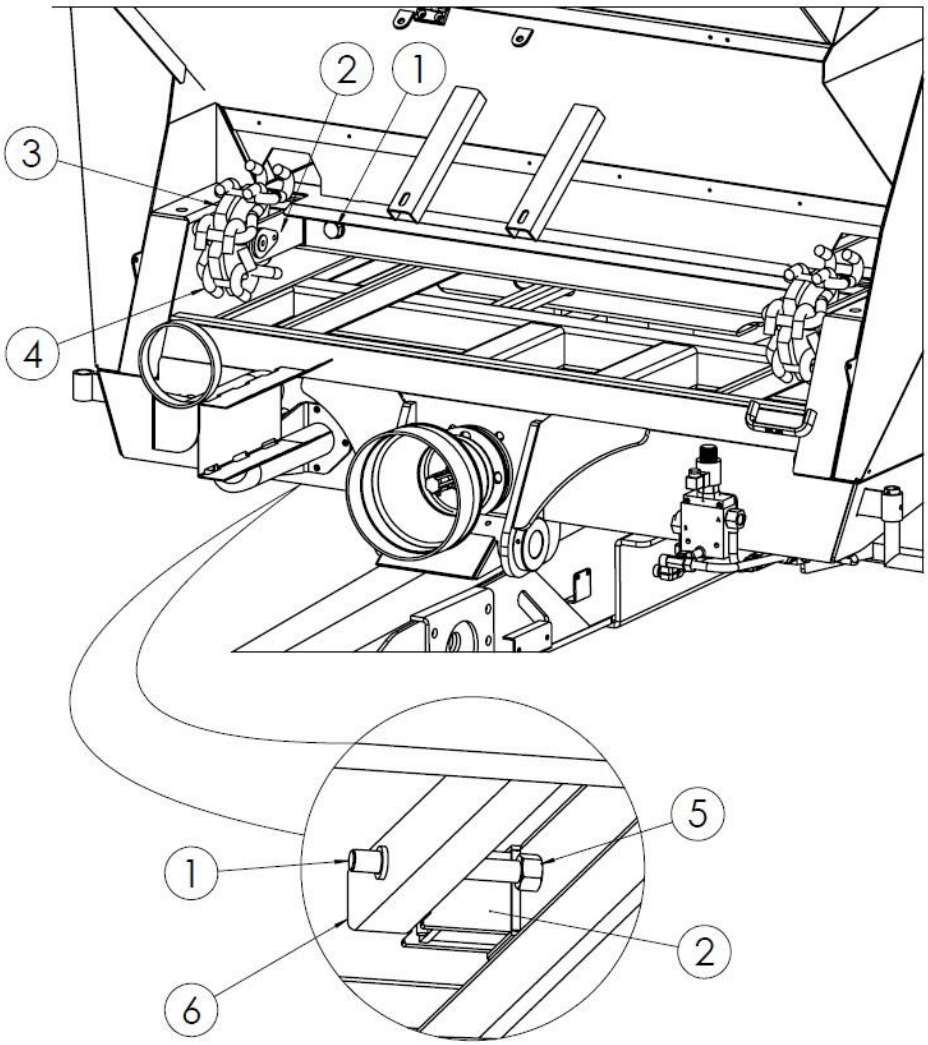


Figure 19. 1 - adjustment screw, 2 - tensioner slider 3 - pulley, 4 - conveyor chain, 5 - locking nut, 6 - tension bar

If tensioned correctly, the chain can be raised to a height of 40-80mm, when applying a force of 60kg to the chain in the middle of the length of the hopper.

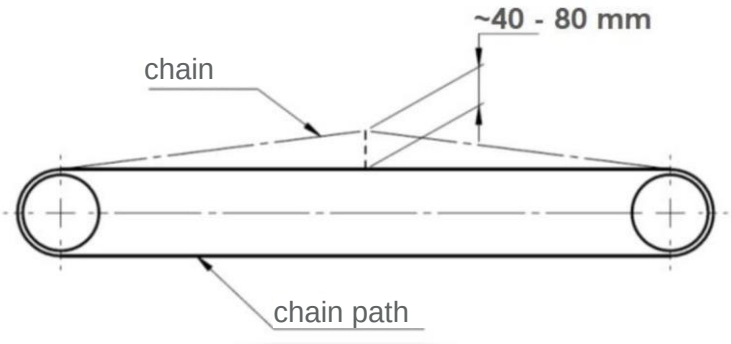


Figure 20. Checking the tensioning of the spreader chains

If the entire range of adjusting chain tensioning is used up, it is possible to shorten the chain of the conveyor by removing 1 links of the chain at the point of their connecting. The reason for an excessive chain stretching may be an incorrect adjustment of the chain's tension.

CAUTION

CAUTION!
All conveyor chains must be adjusted to equal tension.
If too loose, the chains can damage the Spreader and pose a direct risk to bystanders or operators.

5.2 Maintaining the Hydraulic System

The hydraulic system of the Spreader must be leak-proof. It is not allowed to operate the Spreader with a leaking hydraulic system. To check the tightness of the system, activate each individual circuit of the hydraulic system several times. If oil leakage is found, seal the connection or change the leaking line.

Table 10. The specifications of the HL-46 hydraulic oil

No.	Name	Value
1	Viscosity grade as per ISO 34448VG	46
2	Kinematic viscosity	41.4 - 50.6mm²/s (40°C)
3	Quality class as per ISO 11158	HL

Each new Spreader has its hydraulic system factory-filled with the HL-46 oil. The oil in the hydraulic system of the tractor should be of the same grade as the oil used in the hydraulic system of the Spreader. It is permitted to mix oils of the same grade, provided that it is approved by the oil Manufacturer. The hydraulic system of the Spreader is not equipped with a filter, which means that the cleanliness of the oil in the system depends on the condition of the filters in the hydraulic system of the tractor. The correct and trouble-free operation of the hydraulic system depends on the cleanliness of the hydraulic oil.

Keep both the hydraulic quick couplings of the Spreader and the hydraulic sockets of the tractor clean. After disconnecting the conduits from the tractor, wipe the plugs of quick couplings with a clean and dry cloth, and then secure them with protective caps.

Change rubber hydraulic conduits every 4 years, regardless of their technical condition, unless a fault has been found earlier.

Change the filters and oil in the hydraulic system of the tractor on a regular basis to ensure reliable and stable operation of the hydraulic system of the Spreader.

CAUTION

CAUTION!

The hydraulic system is under high pressure during operations.

Check the tightness of the hydraulic system and the technical condition of the conduits on a regular basis, and eliminate any leaks on an ongoing basis.

Use the hydraulic oil recommended by the Manufacturer.

Never mix two different types of oil.

Contaminated oil can cause the failure of hydraulic components.

The oil used in the hydraulic system is not listed as a hazardous substance, but prolonged skin exposure can cause irritation. Use soap and water to wash the skin that has come into contact with oil.

5.3 Gear maintenance

Maintenance of the Spreader's transmission consists in checking the level of, topping up, and changing the gear oil.

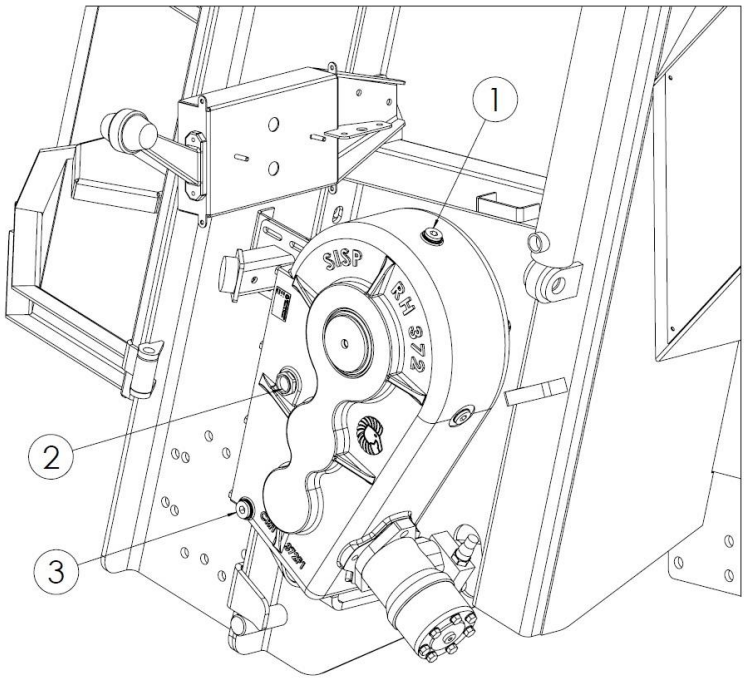


Figure 21. Oil level control points in the floor conveyor's transmission:
1 - oil filler (vent), 2 - oil-level sight glass, 3 - drain plug

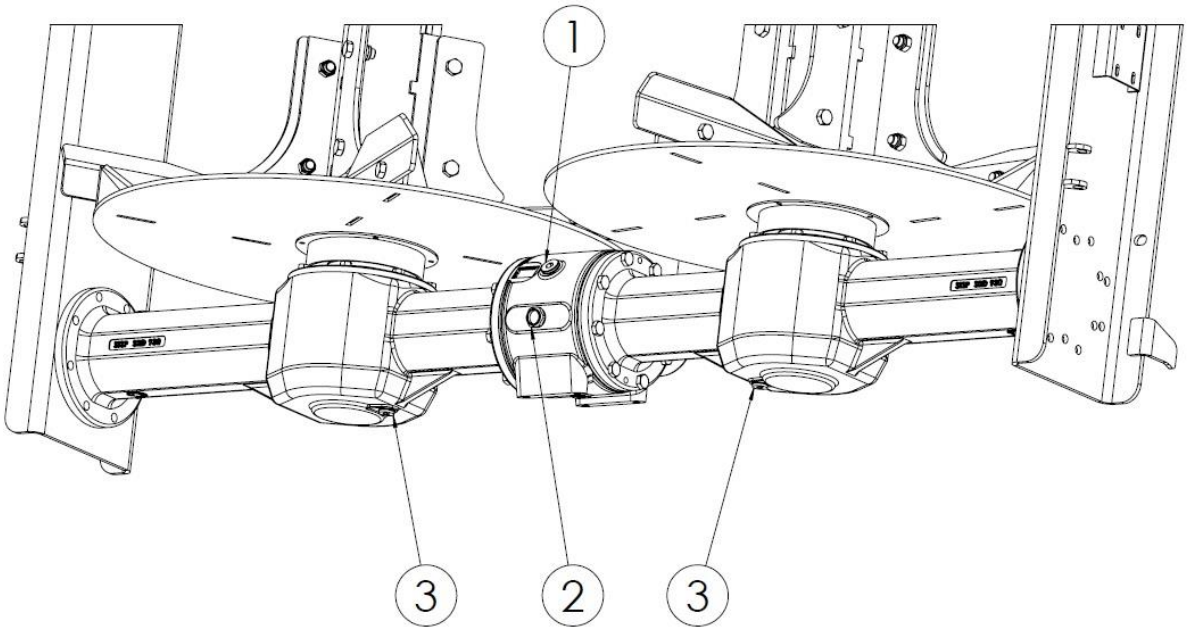


Figure 22. Oil level control points in the adapter's transmission:
1 - oil filler (vent), 2 - oil-level sight glass, 3 - drain plugs

Change oil at the operating temperature, immediately after work is completed, when the oil is still hot. Carry out the work by driving the Spreader on hardened, level ground. When changing oil, wear suitable protective clothing, tools, and tanks. Store waste oil in appropriately marked containers and dispose of it, in accordance with the applicable regulations.

To drain the oil from the gear unit (Fig. 21, 22), unscrew the drain plugs (3). Fill the gearboxes with new oil via the oil filler (1) until oil becomes visible in a sight glass (2). The correct oil level is reached when the oil is visible in the middle of the sight glass.

All elements of the adapter's transmission body are interconnected, so it only requires using the filler plug and level sight glass in the central body to top up and check oil level in the entire unit.

Check the oil level in the beater unit gearbox and the floor conveyor gearbox via a sight glass each time before you start the machine.

Change the oil in the beater unit gearbox and the floor conveyor gearbox after the first 50 operating hours and then every 700 operating hours.

Table 11. Quantity of oil in the gear

Name	Type of oil	Volume
The adapter gear	Hipol GL 4 80/W90	12 L
The floor-conveyor gear	Hipol GL 4 80/W90	4.3 L

DANGER!

DANGER!
During oil change, use appropriate personal protective equipment such as safety clothing, gloves, glasses and footwear.
Avoid contact with skin.
Oil may cause an allergic skin reaction.
The oil has a harmful long-term effect on aquatic species.

5.4 Lubrication

Proper lubrication is one of the most important factors which determine the efficient operation of each individual unit and the mechanisms of the Spreader.

Complying with the lubrication recommendations of the Manufacturer will significantly reduce the possibility of damage or premature wear and tear to individual parts. Lubrication points are indicated in Figures 22, 23, and 24, while the lubrication schedule is defined in Table 12.

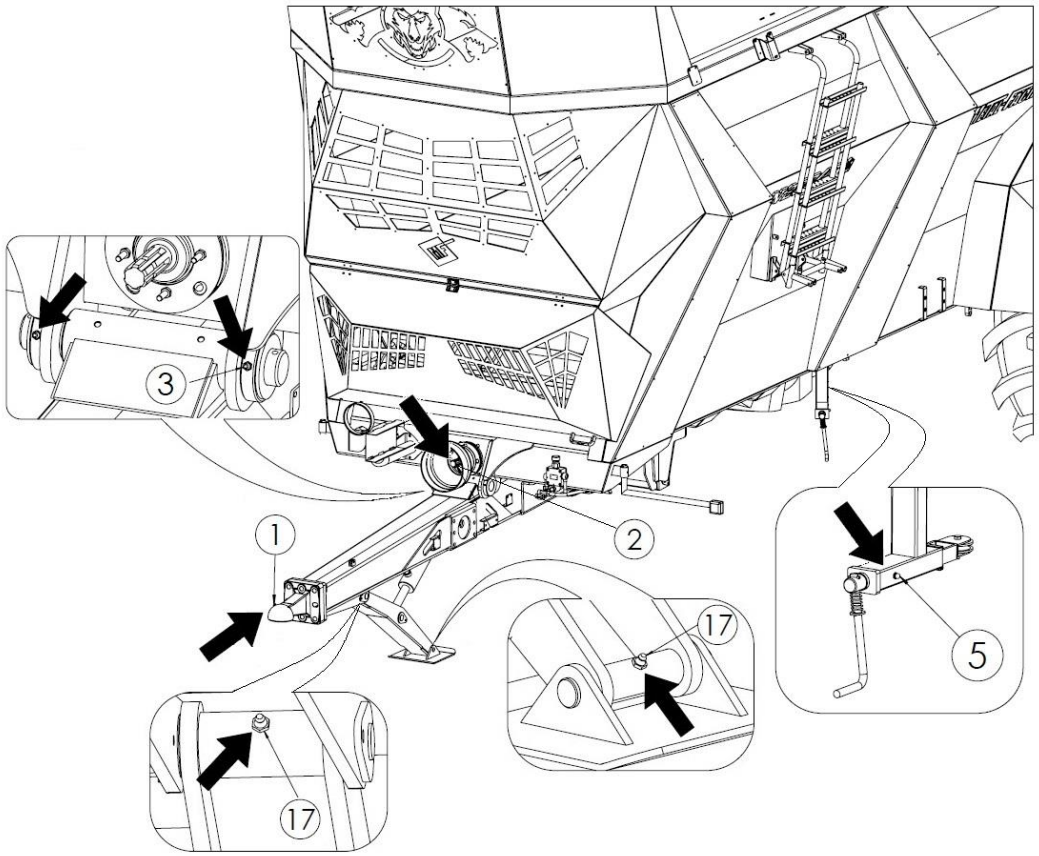


Figure 23. Lubricating points

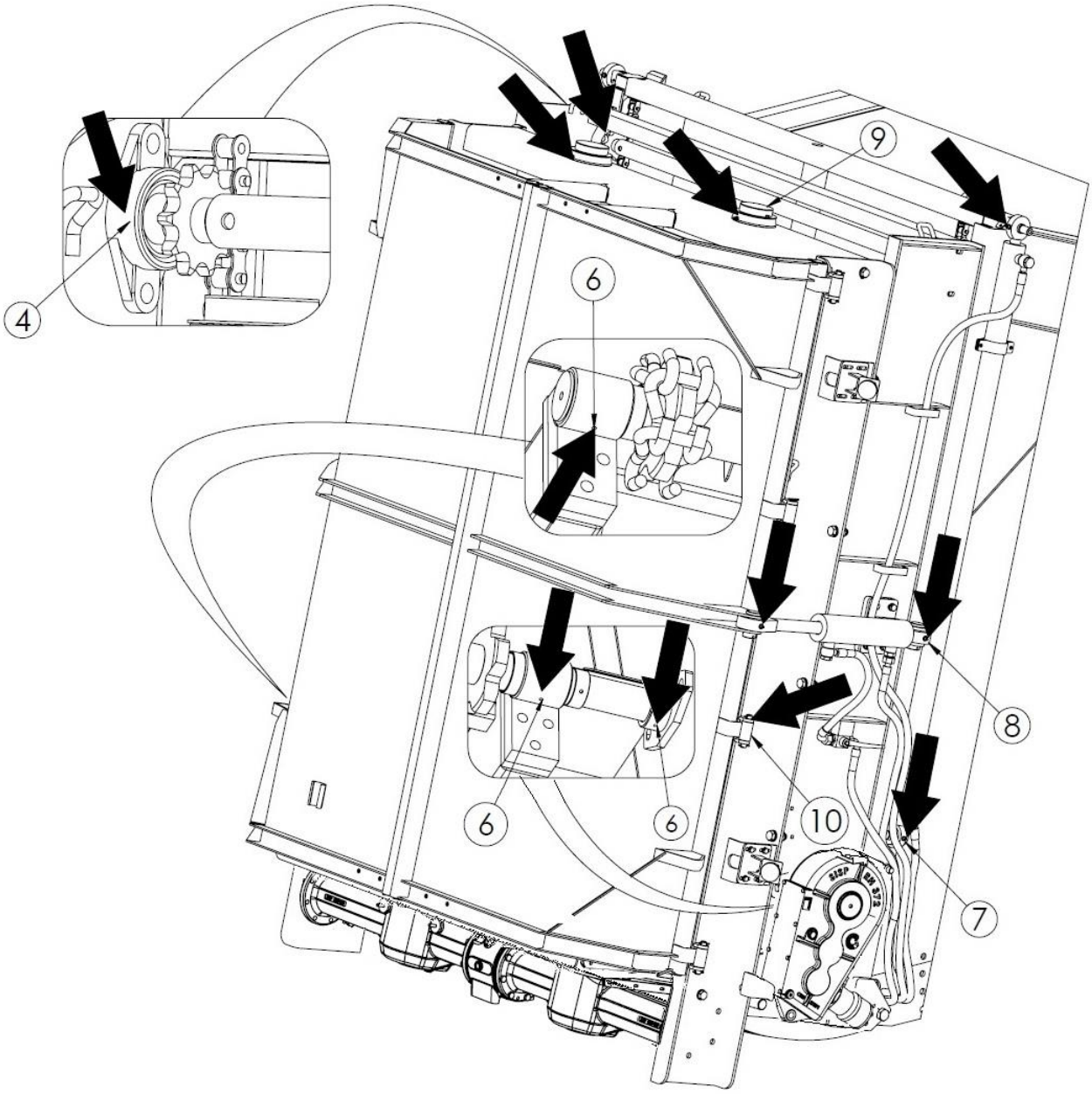
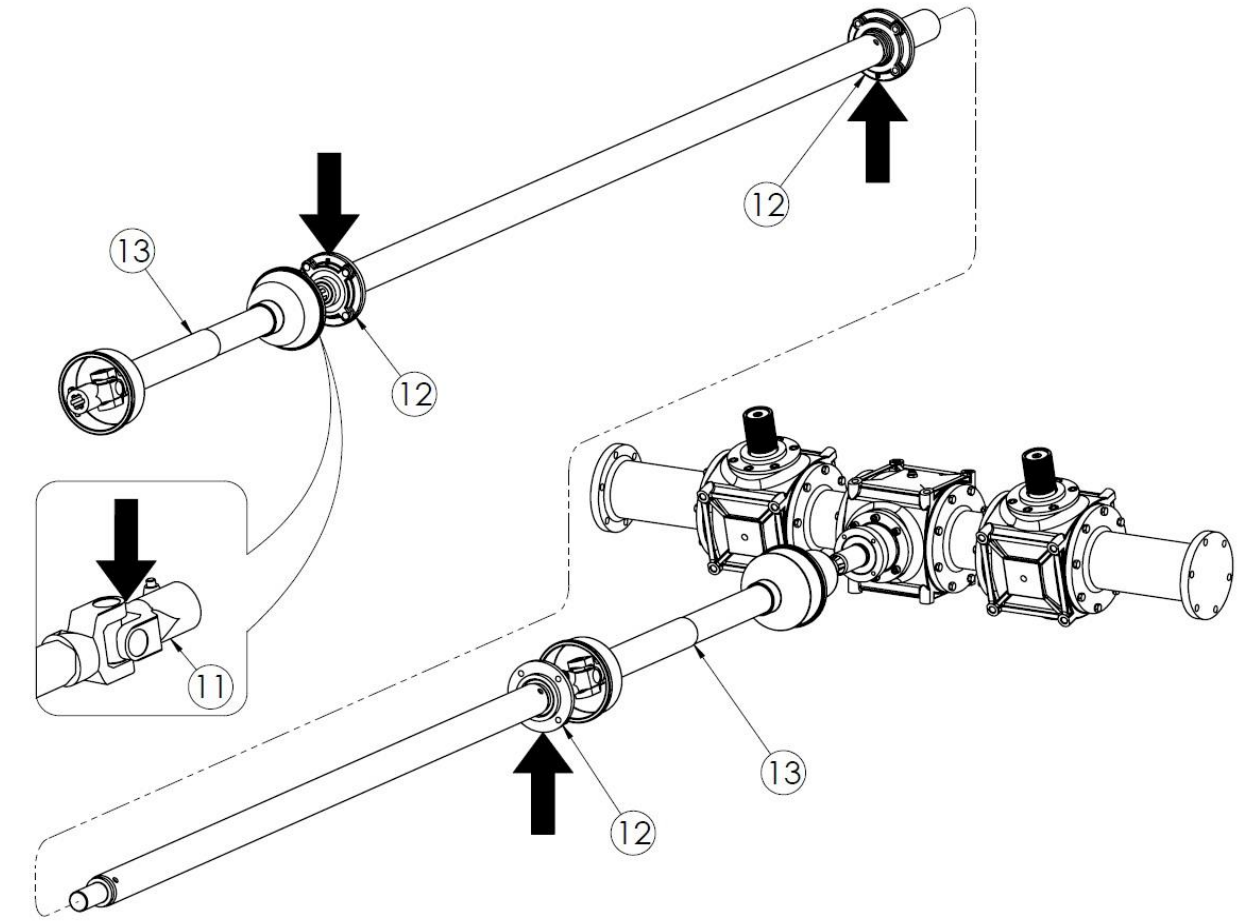
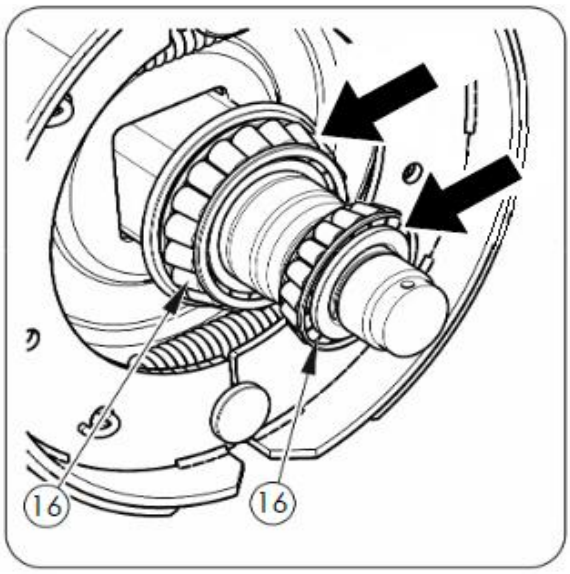


Figure 24. Lubricating points





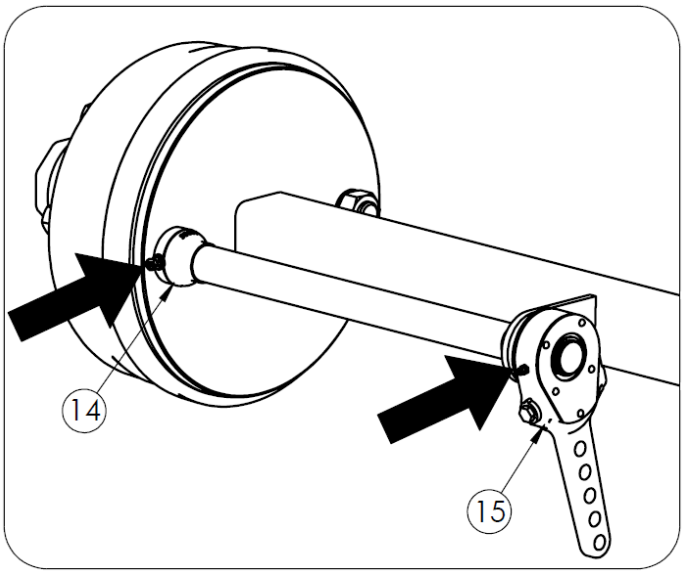


Figure 25. Lubricating points

Table 12. The lubrication schedule

No.	Name of mechanism	Number of lubricating points	Grease type	Interval
1.	Drawbar eye	1	ŁT	2D
2.	The splines of the shaft of the drive system	1	ŁT	6M
3.	Drawbar's pin	2	ŁT	24H
4.	Sowing shaft bearing	3	ŁT	6M
5.	Parking brake assembly	1	ŁT	6M
6.	Feeder shaft sleeves	3	ŁT	8H
7.	Spherical plain bearings of the gate cylinder	4	ŁT	6M
8.	Spherical plain bearings of the beater unit shield cylinder	4	ŁT	6M
9.	Upper bearings of the adapter	2	ŁT	8H
10.	Beater shield hinges	8	OM	6M
11.	Shaft universal joints	4	ŁT	24H
12.	Bearings of the drive unit	3	ŁT	6M
13.	Articulated telescopic shafts	*	*	*
14.	Sleeves of the expander shafts	2	ŁT	6M
15.	Lever of the brake expander	2	ŁT	6M
16.	Bearings of the wheel hub	4	ŁT	24M
17.	Pins of the scissor support foot	2	ŁT	6M

***** - Observe the guidelines provided in the Instruction Manual supplied with the PTO shaft

Lubrication interval codes: H - working hour, D - working day, M - month

When lubricating, follow the guidelines below:

- Clean the grease nipple before you start pumping the grease
- pump grease, until fresh grease appears in the slots (through which used grease is squeezed out during pumping); after finishing lubrication, leave a little grease on the nipple head.

Table 13. Lubricants

Codes from Table 10	Description
ŁT	ŁT-42, ŁT-43 General purpose grease
OM	Machine oil

Use a clean cloth to wipe the parts to be lubricated with machine oil, and then apply a small amount of oil to the lubricated parts. Wipe off excess oil.

To lubricate the bearings of the wheel hubs, disassemble the hub, remove used grease, and apply fresh grease. Each time when changing grease, assess the condition of the bearings and change them, if necessary. After mounting the hub, adjust the bearing play.

CAUTION

CAUTION!
Driving the spreader without hub caps is not allowed. Dirt entering the wheel bearings causes damage to the wheel bearings.

5.5 Pneumatic system maintenance

Have the pneumatic braking system components repaired, changed, and regenerated by professional workshops having all appropriate qualifications and tools to perform this type of work.

Maintaining the pneumatic system carried out by the User is narrowed down to:

1. Checking the air-tightness of the system and its visual inspection
2. Cleaning the air filters.
3. Draining the air tank and cleaning the drain valve.
4. Changing the flexible connection conduits.
5. Cleaning and maintaining the connections of pneumatic conduits.

CAUTION

CAUTION!
It is not allowed to operate the spreader if the brake system is faulty.

5.5.1 System tightness and visual inspection of the pneumatic braking system

System tightness and visual inspection:

- At start-up
- after the first 1,000 km
- each time system components are repaired or replaced
- annually

Checking the tightness of the pneumatic system:

- Couple the tractor with the spreader
- use the parking brake to immobilise the tractor and the Spreader, and put chocks under the wheel of the Spreader,

- start the tractor's engine to supply air to the braking system of the Spreader,
- switch off the tractor's engine,
- check the air-tightness of the pneumatic components after releasing the brake pedal in the tractor,
- check the air-tightness of the pneumatic components, when the brake pedal in the tractor is pressed (it is required to have another person to assist you).

If the system is leaky, air will escape through points of damage producing a distinctive hissing sound. Minor leaks can be detected by applying a layer of foaming agent to the inspected parts (washing-up liquid or soap).

Change the damaged parts or have them repaired. Eliminate any leaks in the joints by tightening the joint or changing the fitting or sealing.

When checking air-tightness of the system, carry out a simultaneous visual inspection of the pneumatic braking system. Pay particular attention to the condition of the pneumatic conduits, the manner of their fastening, and the cleanliness and completeness of the components. Conduits must not show any signs of wearing, permanent deformation, partial splitting, or bending. It is not allowed for the system's components to be contaminated with oil and grease.

CAUTION

CAUTION!
Have the pneumatic system components repaired, replaced and regenerated by professional workshops only.

5.5.2 Cleaning air filters

DANGER!

DANGER!
Depressurise the spreader's brake system before dismantling the filters.

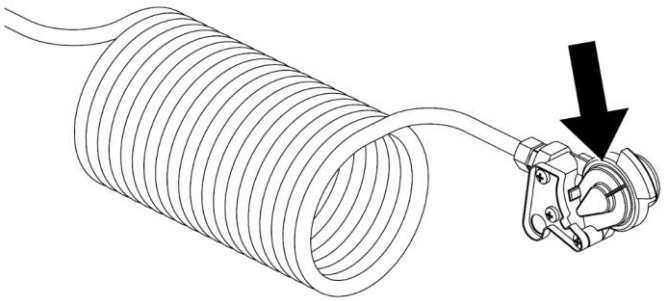


Figure 26. Haldex brake system air filters

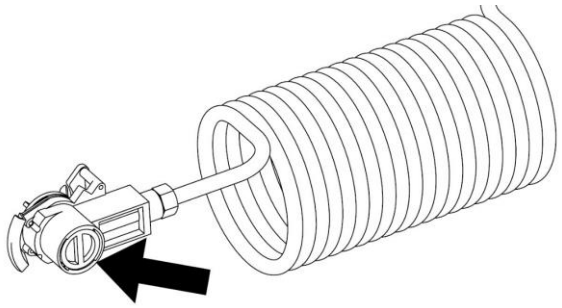


Figure 27. Knorr-Bremse brake system air filters

Clean the air-filter elements,according to their operating conditions, but at least every 6 months. The filters located in the fittings of pneumatic conduits - see Figures 25 & 26. The air filter elements are reusable and it is not required to change them, unless damaged.

5.5.3 Draining the air tank

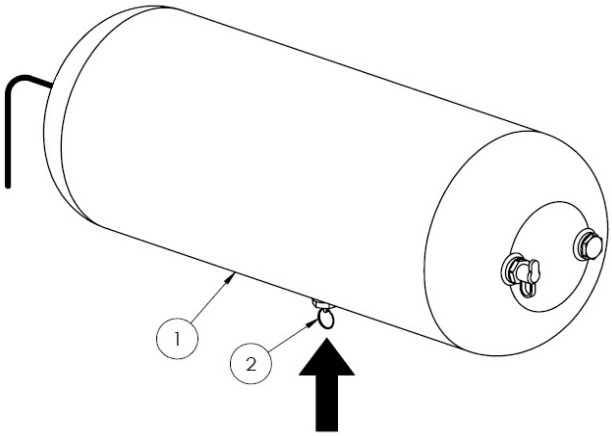


Figure 28. Draining the air tank:
1 - air tank, 2 - drain valve

Drain the air tank, after every 7 days of use.

Draining the air tank:

- Pull the drain valve (2) to let water escape (compressed air will make water escape outside)
- release the stem of the drain valve (the valve will close automatically and cut off the airflow).

If the drain valve is leaking, it must be dismantled and cleaned or changed, if necessary.

5.5.4 Changing the flexible connection conduits

Change all flexible connection conduits every 5 years, unless damage (permanent deformation, wearing, or cutting) has been found earlier.

To change the conduits, do the following:

- purge the system completely,
- unscrew the pneumatic fittings from the conduits,
- unscrew the flexible conduits from the brake valve,
- fit new conduits,
- check the air-tightness of any new connections.

5.5.5 Cleaning and maintenance of pneumatic hose fittings

DANGER!

DANGER!
Faulty, damaged or dirty air hose fittings can cause malfunction of the brake system.

If the connections of pneumatic conduits show any signs of damage, change them for new ones and fully efficient parts. If exposed to oils, petrol, greases, etc., gaskets in the connections can be damaged or age prematurely.

If the Spreader is uncoupled from the tractor, the connections must always be protected with caps and placed in the appropriate holders. It is recommended to preserve the gaskets in the connections with a suitable agent, e.g. silicone spray for rubber parts, after the season is over.

Before each coupling of the machine, check the technical condition of the pneumatic connections in the Spreader and the tractor. Keeping the connections clean extends their service life and ensures the correct operation of the entire braking system.

Always check the technical condition of the pneumatic connections, before coupling the Spreader with the tractor.

5.6 Maintaining the driving axle and brakes

5.6.1 Maintaining the driving axle

It is recommended to check the bearings of the driving axle for play - see Figure 29. Carry out this inspection on a newly purchased machine, after the first 100km. Then, after driving about 1,500-2,000km, carry out the same inspection again and adjust, if necessary.

To adjust the bearing play, follow the procedure below.

1. couple the Spreader with the tractor and engage the parking brake in the tractor.
2. Lift one side of the Spreader, so that the wheel does not touch the ground, and secure it against falling.

3. If the wheel shows excessive play, remove the hub cap and the securing pin to prevent the castellated nut from spontaneous unscrewing
4. Turn the wheel while simultaneously tightening the castellated nut, until the wheel has stopped completely.
5. Loosen the nut by 1/6÷1/3 of a turn, until the nearest pin groove overlaps with the hole on the hub spigot
6. Secure the nut with a new pin, replace, and fasten the hub cap

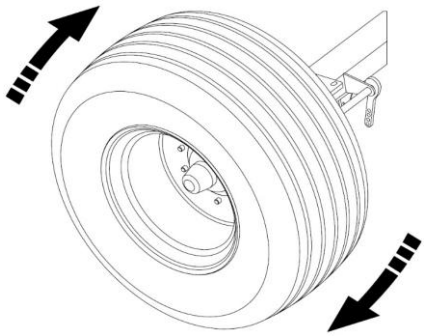


Figure 29. Checking wheel bearing play

If the bearing play is adjusted correctly, the wheel should rotate smoothly, without stopping or apparent resistance (other than friction of the brake shoes against the drum). Slight friction of the shoes against the drum, particularly in a new Trailer, or after their replacement, is a typical occurrence. After driving for a few kilometres observe how the wheel hubs heat up, to check finally if the bearing-play adjustment is correct. In addition to the improper adjustment of the bearing play, considerable resistance to wheel rotation and hub heating can be caused by impurities in the lubricant or bearing damage. The afore-mentioned symptoms make it necessary to disassemble the wheel hub to eliminate the malfunction.

5.6.2 Maintaining the brakes

After purchasing the Spreader, the User must carry out a general inspection of the braking system on the driving axle, and then repeat it periodically.

Have brake components repaired, changed, and regenerated by professional workshops with all the appropriate and tools to perform this type of work.

The User is responsible for carrying out the following maintenance of the driving axle brake:

- functional checks of the brakes,
- inspections of the brake-linings for wear,
- adjusting the service brake,
- functional check of the parking brake,
- changing the parking-brake cable and adjusting its tension.

Functional checks of the brakes:

- couple the Spreader with the tractor and place chocks under the tractor wheels,

- check the manner of fastening the pneumatic cylinder and its forks on the brake lever arm,
- check the axle brake components (pins, cotter pins, nuts, etc.) for completeness,
- activate and release the main brake, and repeat the same with the parking brake (the action of the brakes should be smooth and they should retract without resistance or jamming),
- check the stroke of the cylinder piston rod,
- check the pneumatic cylinders for air-tightness,
- carry out a test run, when unladen, by activating the main brake several times to check its functioning.

Inspections of the brake linings for wear

Look through the inspection windows in the brake drum cover to check the brake linings for wear - Figure 30. Change brake shoes, when the thickness of brake lining has exceeded the minimum value specified by the Manufacturer.

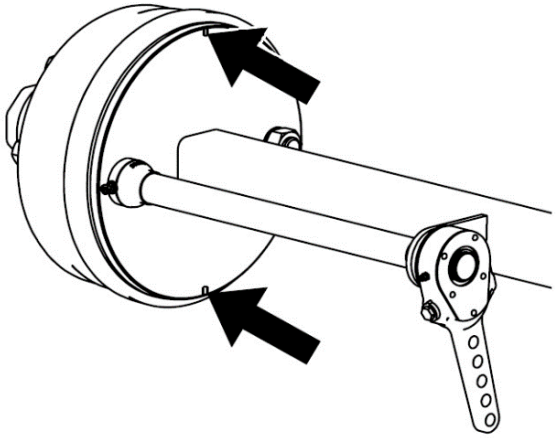


Figure 30. Inspections of the brake linings for wear

The minimum thickness of brake lining is 5mm.

Inspections of the brake linings for wear:

- every 3 months of operation,
- if the stroke of the cylinder piston rod takes significantly longer than normal,
- or if any strange noises are coming from around the brake drum.

Adjusting the service brake

As the brake linings wear, the work stroke of the pneumatic cylinder piston rod increases. Excessive stroke may reduce the effectiveness of the brakes, therefore check, and adjust if necessary, the work stroke of the brake to keep it within the specified operating range. In a brake which is adjusted correctly, the angle between the piston rod and the expander lever in the braking position shall be 90˚ - Figure 31.

To check the functioning of the brake, measure the stroke length of the piston rod in each pneumatic cylinder. If stroke of the piston rod is longer than the maximum value (45mm), the system must be adjusted.

Adjust the stroke of the cylinder piston rod and the angle of the expander lever, by correctly setting the cylinder forks (3) and adjusting the stroke with the adjusting screw (7). Carry out this adjustment for both the cylinder and the expander lever, maintaining the same set values.

The correct stroke of the piston rod should be in the range of 25-45 mm.

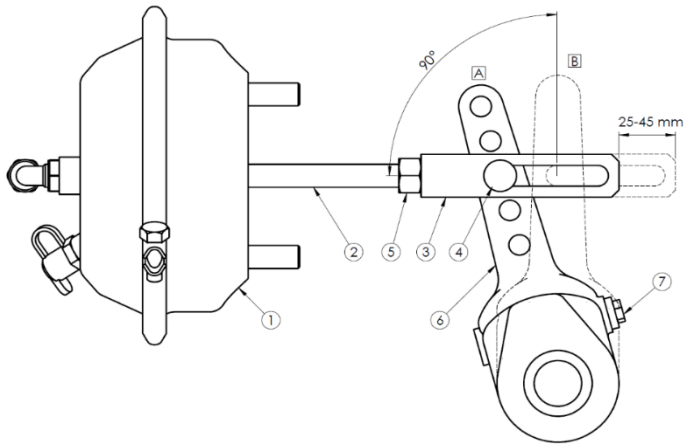


Figure 31. Adjusting the main brake
1 - pneumatic cylinder, 2 - cylinder's piston rod, 3 - cylinder's forks, 4 - fork's pin, 5 - fork's lock nut, 6 - expander lever, 7 - adjusting screw: (A) The lever position when releasing the brake, (B) The lever position when activating the brake

Checking the technical condition of the brake:

- after the first 100km,
- every 6 months
- after each repair of the brake system
- if braking action of the spreader wheels is uneven

CAUTION

CAUTION!

Improperly adjusted brake can cause the brake shoes to rub against the drum, which can result in faster wear of the brake linings and/or overheating of the brake.

CAUTION

CAUTION!

Mounting positions of the pneumatic brake cylinder in the holes of the bracket and fork pin of the cylinder in the holes of the expander lever are set by the Manufacturer and any change of their position is prohibited.

Parking brake adjustment

The correct functioning of the parking brake depends on the effectiveness of the driving axle brakes and the correct tensioning of the brake cables.

Check and/or adjust the parking brake:

- every 12 months,
- if required.

Adjust the cable of the hand-brake, if:

- the cable is stretched,
- the cable is damaged,
- the cable clamps are loose,
- the driving axle brake has been adjusted,
- after repairing the mechanism of the driving axle brake,
- after repairing the mechanism of the parking brake.

If the parking brake requires adjusting, make sure that the brake on the driving axle is adjusted correctly and works efficiently.

Adjust the tension of the parking brake cable by its pre-tensioning, which consists in setting the correct length of the loops at its ends. Carry out this adjustment, when the brake of the driving axle is released, and the crank mechanism of the parking brake is fully loosened.

5.6.3 Tyre Maintenance, Disassembly of the Wheels

Secure the machine with the parking brake and the wheels with chocks, when maintaining the tyres. Changing the wheel is only permitted, if the hopper is empty. Use suitable tools to repair the wheels. The person carrying out the repairs should be trained in such operations, as maintaining and repairing of tyres involves some risk. It is recommended to check the tightness of the nuts, before the initial start-up, after the first laden drive, and then after each intensive use of the machine, after every 100 kilometres. Repeat these inspection activities after each disassembling of the wheels.

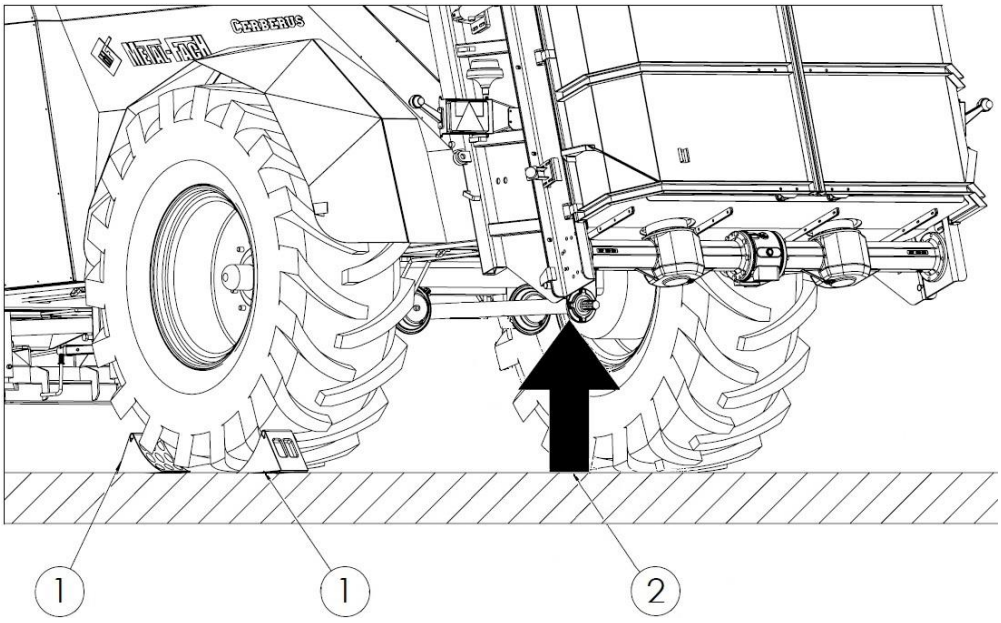


Figure 32. Jacking points:
1 - chocks, 2 - jack

If it is necessary to disassemble the wheel, observe the jacking points (2) under the axle. See Figure 32 for the jacking points. Place the protective chocks (1) under one wheel only.

Regularly check the air pressure. Maintain the recommended air pressure. The correct pressure value is indicated on the tyre or as a sticker on the Spreader.

CAUTION

CAUTION!
Inspect the tightening of the wheel nuts regularly.
M18x1.5 = 270Nm, M20x1.5 = 350Nm, M22x1.5 = 475Nm.

- Regularly check and maintain the correct tyre pressure, as recommended in the Instruction Manual and/or the information provided on the tyre.
- Do not exceed the permissible load capacity of the tyres, according to the Instruction Manual and/or information provided on the tyre.
- Do not exceed the permissible speed of the Spreader, according to the Instruction Manual and/or information provided on the tyre.
- Secure tyre valves with protective caps.
- During the whole day's work, regularly check the temperature of the tyres and, if they heat up, take 30 minutes breaks to cool them down.
- Avoid excessive bumps, inconsistent manoeuvres and high speeds when cornering.

- Regularly check the condition of the tyres and replace them if cut or damaged.

CAUTION

CAUTION!
Do not exceed the permitted transport speed, working speed, and load capacity of the Spreader.

5.7 Maintaining the Electrical System and Warning Symbols

CAUTION

CAUTION!
The electric system of the spreader is supplied with 12V voltage.

The user's responsibilities related to maintaining the electric system include:

- technical inspection of the electrical system and retro-reflectors
- replacement of light bulbs

Have the components of the electrical system repaired or regenerated by professional workshops having all appropriate qualifications and tools to perform this type of work.

CAUTION

CAUTION!
It is not allowed to drive when the lighting system is in usable condition. Damaged lamp covers and burnt bulbs must be immediately replaced before starting to drive. Replace damaged or lost retro-reflectors.
Before driving on a public road, make sure that the lighting and retro-reflectors are not blurred.

Maintenance work:

- check the condition of the electrical connecting cable and the socket in the Spreader,
- check the lighting system for completeness, technical condition, and correctness,
- check all retro-reflectors for completeness and technical condition,
- check for the correct installation of the indicating plate for slow moving vehicles installed in the bracket,
- before driving on a public road, make sure that the tractor is equipped with a retro-reflective warning triangle,
- before driving on a public road, make sure that the lights and retro-reflectors are not dirty.

Table 14. Light bulb list

Lamp	Type of lamp	Bulb identification/ number	Number of lamps
Rear-light cluster, right	HOR45-LZT 478	C5W / 1 item P21W / 2 items	1
Rear-light cluster, left	HOR45-LZT 471	C5W / 1 item P21W / 2 items	1
Marker lamp, right	LO 355	C5W / 1 item	1
Marker lamp, left	LO 355	C5W / 1 item	1
Front running light, right	LO 093	W5W / 1 item	1
Front running light, left	LO 093	W5W / 1 item	1
LED working light (searchlight)	16 LED, 48W	3 items	3

Check the electrical system:

- each time the spreader is coupled

The Spreader lights are equipped with replaceable bulbs. If it is required to change the bulbs, remove the lens and change the bulbs to new ones with the same power rating and marking as the original ones. See Table 14 for a list of bulbs used in the Spreader lights.

5.8 Cleaning, Maintenance, and Storage

The spreader is recommended to be thoroughly cleaned of any residual manure every day after completion of work.

After each “seasonal” manure spreading, thoroughly wash the Spreader with clean water, dry it, and carry out maintenance work. It is recommended to use pressure washers for cleaning. When cleaning, exercise particular caution.

Cleaning guidelines:

- Do not hold the water jet closer than 40cm from the surface to be cleaned. Washing surfaces with a strong jet of water from a short distance can damage lacquered surfaces,
- The water temperature must not exceed 50^{O}C,
- Do not point the water jet directly at the following: electrical components, hydraulic and pneumatic components (cylinders, valves, connections), warning and information stickers, rating plate, lubricating points, etc.,
- If it is necessary to use cleaning agents, carry out a trial washing of the surface on an inconspicuous spot,

- Use petroleum ether or a degreasing agent to clean greasy parts, and then clean them with clean water,
- Do not use organic solvents or substances of unknown origin,
- Use suitable cleaning products to clean plastic or rubber surfaces,
- Wash the Spreader at locations designated for such purposes, according to the environmental protection regulations,
- Clean and dry the Spreader at a temperature above 0°C.

DANGER!

DANGER!
Clean with the drive off, the PTO shaft disconnected and the tractor engine stopped. Remove the key from the ignition. Secure the tractor against unauthorized access.
Entering the spreader body is only permitted when the machine is stationary.

CAUTION

CAUTION!
Wash with appropriate safety clothing on and use personal protective equipment.
Refer to the instructions for use, regarding cleaning products and the pressure washer.

After the thorough cleaning and drying of the Spreader, carry out proper maintenance work, replace missing paint coating, and lubricate the machine. After lubricating using the appropriate lubricating points, activate all mechanisms of the Spreader to distribute the grease.

Apply a small amount of oil or anti-corrosive products in the locations where the lacquered surface has rubbed off naturally as a result of friction of moving material or friction between the parts rubbing against one another.

Store the Spreader in a roofed area, adequately protected against unauthorised access. If stored outdoors, the Spreader will be exposed to corrosive agents and UV radiation, which cause ageing of the lacquer coating.

5.9 Tightening torques of screw connections

The optimum tightening torques for screws with metric threads are shown in Table 15.

Table 15. Tightening torques for screws with metric threads

Screw		Tightening torques for screws with metric threads [Nm]					
Diameter d [mm]	Pitch of thread [mm]	Screw strength classes					Wheel nuts, wheel screws
		4.8	5.8	8.8	10.9	12.9	
3	0.50	0.9	1.1	1.8	2.6	3.0	
4	0.70	1.6	2.0	3.1	4.5	5.3	
5	0.80	3.2	4.0	6.1	8.9	10.4	
6	1.00	5.5	6.8	10.4	15.3	17.9	
7	1.00	9.3	11.5	17.2	25	30	
8	1.25	13.6	16.8	25	37	44	
8	1.00	14.5	18	27	40	47	
10	1.50	26.6	33	50	73	86	45
10	1.25	28	35	53	78	91	
12	1.75	46	56	86	127	148	
12	1.50						80
12	1.25	50	62	95	139	163	
14	2.00	73	90	137	201	235	
14	1.50	79	96	150	220	257	140
16	2.00	113	141	214	314	369	
16	1.50	121	150	229	336	393	220
18	2.50	157	194	306	435	509	
18	1.50	178	220	345	491	575	300
20	2.50	222	275	432	615	719	
20	1.50	248	307	482	687	804	400
22	2.50	305	376	502	843	987	
22	2.00						450
22	1.50	337	416	654	932	1090	500
24	3.00	383	474	744	1080	1240	
24	2.00	420	519	814	1160	1360	
24	1.50						550
27	3.00	568	703	100	1570	1840	
27	2.00	615	760	1200	1700	1990	
30	3.50	772	995	1500	2130	2500	
30	2.00	850	1060	1670	2370	2380	

5.10 Defects and Methods of Elimination

Table 16. Defects and Methods of Elimination

Defect	Cause	Method of rectification
Impacts on the conveyor during operation	Incorrect adjustment of the conveyor chain tension. Excessive extension of conveyor chains.	Check and adjust the tensioning of the chains.
Blocking the spreading adapter	The feeding speed of the floor conveyor is too high.	Reverse the floor conveyor to unblock the beater unit and reduce the feeding speed
	The blocking objects entered the spreading assembly together with the manure	Remove the cause of stopping the augers in the beater unit
	Rotational speed of tractor's PTO not correct	Change the rotational speed of tractor's PTO
	The PTO shaft operates at low speed.	Maintain an adequate tractor engine speed
Floor feeder does not distribute the loaded material towards the beater unit	The knob on the flow controller is set to "0-1"	Increase the setting value on the flow controller
	Excessive load weight results in overload floor feeder	Unload part of the load
	Low pressure in the tractor hydraulic system	Check the pressure in the tractor hydraulic system The minimum required hydraulic pressure of the tractor, measured with hot oil: 14 MPa, (140 bar)
	The engine overload valve of the hydraulic floor conveyor dirty and non-functional	Replace the overload valve Check the condition of the hydraulic filters on the tractor - replace both filters and oil if necessary
	Interrupted oil supply to the hydraulic motor of the conveyor	Check the connection and tightness of the hydraulic system
Spread width too small	Rotational speed of tractor's PTO not correctly selected	Change the rotational speed of tractor's PTO
	The PTO shaft operates at low speed.	Maintain the correct rotational speed of the tractor's engine.

INDEX OF NAMES AND ABBREVIATIONS

dB (A) – scale A decibel, sound pressure unit;

HP – horse power, power unit;

kg – kilogram, weight unit;

km – kilometre, a commonly used multiple measure of the metre, the basic unit of length in the SI system;

kPa – kilopascal, pressure unit

m – metre, length unit;

mm – millimetre, an auxiliary length unit equal to 0.001m;

MPa – Megapascal, a pressure unit;

N – Newton **–** a force unit in the SI system;

Nm - Newton-metre, a unit for the moment of force in the SI system;

Pictogram – an information plate;

PTO – Power take-off shaft;

Rating plate – a manufacturer's plate unambiguously identifying the machine;

t – tonne, a mass unit;

Transport hitch – hitching components of a farm tractor (see the Instruction Manual of the tractor);

V – Volt, a voltage unit;

UV - Ultraviolet radiation; It is an invisible electromagnetic radiation with a negative impact on human health; UV radiation has a negative effect on rubber parts.

ALPHABETICAL INDEX

NOTES

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The pictures do not necessarily show standard accessories.

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TECHNICAL SERVICE

16-100 Sokółka, ul. Kresowa 62

phone: +48 85 711 07 80; fax: +48 85 711 07 93

serwis@metalfach.com.pl

SALES

16-100 Sokółka, ul. Kresowa 62

phone: +48 85 711 07 78; fax: +48 85 711 07 89

handel@metalfach.com.pl

SPARE PARTS WHOLESALE STORE

16-100 Sokółka, ul. Kresowa 62

Wholesale:

phone: +48 85 711 07 81; fax: +48 85 711 07 93

serwis@metalfach.com.pl

Retail:

PHONE SERVICES 24h/7 days +48 533 111 477

Phone: +48 85 711 07 90

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