



METAL-FACH



**FEEDER WAGON
"OPTIMAL", "BEL-MIX"
T659/1, T659/2, T659/3, T659/4, T659/5
USER MANUAL - PART 2
TRANSLATION OF THE ORIGINAL USER MANUAL
ISSUE 2
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The symbols used in this manual:



DANGER

Hazard warning symbol: indicates a severe hazard that, if not avoided, may result in death or serious injury. This symbol warns against the most dangerous situations.



CAUTION

This symbol points to especially important information and recommendations. Non-compliance can lead to serious damage to the machine, as a result of its incorrect operation.



WARNING

This symbol indicates potential hazards that, if not avoided, can result in death or serious injury. This symbol indicates a lower level of risk of injury than the DANGER symbol.



symbol indicating useful information.



This symbol indicates maintenance activities which should be performed periodically.

4. Instructions for Use

4.1 Feeder wagon preparation for use

4.1.1 Feeder wagon inspection after delivery

The feeder wagon is delivered to the user completely assembled, thus no additional assembly steps are required. The manufacturer ensures that the machine is fully operational and has been checked in accordance with inspection procedures and approved for use. However, this does not exempt the user of the machine from the obligation to check the machine before purchase and commissioning.

When the machine is delivered, the user is obliged to check the technical condition of the feeder wagon:

- check the completeness of the feeder wagon,
- check the components of the balance and the electrical installation,
- check the condition of the covers,
- check the condition of the paint and any mechanical damage to individual components (dents),
- the technical condition of the articulated telescopic shafts and their guards;
- the hydraulic system and gears for leaks.
- check the technical condition and correct installation of the cutting blades on the screw,
- check if the wheel nuts are correctly tightened and the tyre pressure,

If any irregularities are discovered in the received machine, contact your dealer.

4.1.2 Preparing the feeder wagon for the first start-up

Before the first start-up, you should:

- refer to the user manual and instructions for the articulated telescopic shaft,
- after connecting it, make sure that the articulated telescopic shaft (PTO) transmitting drive from the tractor has the adequate length and whether the rotation direction of the PTO shaft is correct,
- check the oil level in the planetary gear and the two-speed gear (if the wagon is equipped with one),
- check the oil level in the expansion tank,



CAUTION

CAUTION!

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 only to the specific type of the tractor which works with the feeder wagon. If the machine is coupled with a different tractor, re-check the correctness of coupling the PTO shaft.

4.1.3 Changing the drawbar position

The factory assembled feeder wagon is designed to be coupled only with the lower hitch of the tractor. The drawbar (2) offers the option of changing the height of the hitching eye (1) in relation to the ground – see Figure 35. This is done by positioning the drawbar on the appropriate mounting holes (3) located in the frame and tightening the bolts (4) with the correct torque. The drawbar is set at the correct height by levelling the feeder wagon, which ensures even distribution of the weight of the feeder wagon along the axle. Once the feeder wagon is connected, make sure that it is properly levelled, both with and without load.

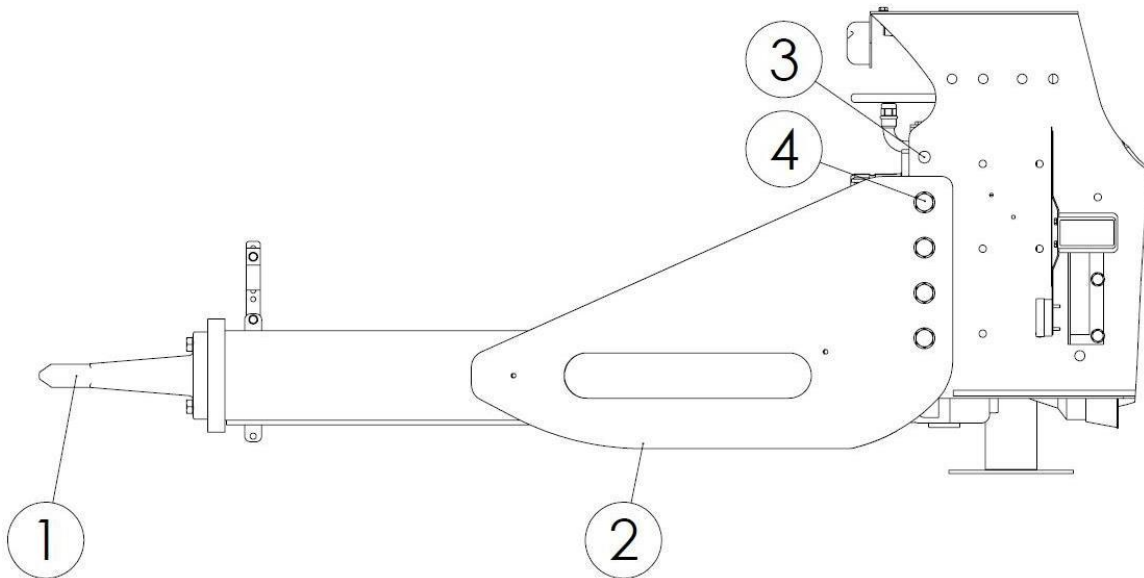


Figure 35. Drawbar position

Indicative values for the level range of the drawbar eye relative to the ground are given in the figure below and in Table 8.

HITCH LEVEL ABOVE THE GROUND - FEEDER WAGONS

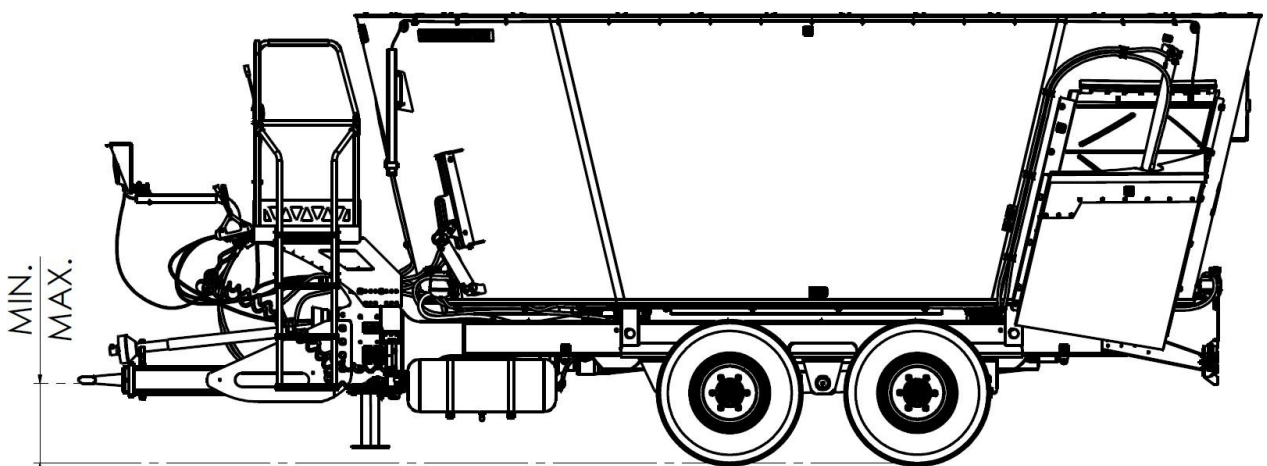


Figure 36. Position of the drawbar in relation to the ground

Table 8. The estimated height values for the position of the drawbar eye in relation to the ground

Product Wheel size	T659/1		T659/2				T659/3		T659/4				T659/5	
			Without hopper		With hopper				Without hopper		With hopper			
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
10.0/75-15.3 or Delcora	420	500	410	490	330	410	200	280	400	480	320	400	250	410
400/60-15.5	510	590	470	550	390	470	-	-	430	510	350	430	280	440

4.1.4 First start-up

Once the preparations are complete and the feeder wagon is operational, it should be connected to the tractor. Next, once the machine is started, check the operation of the individual units in standstill, without load. Follow the sequence of actions discussed below to start the machine for the first time:

- 1) Couple the feeder wagon to the tractor.
- 2) Connect the power take-off shaft and secure it correctly.
- 3) Connect the hoses and wiring of the hydraulic system, brake system, electrical system and connect the power supply to the balance.
- 4) Lift the parking jack.
- 5) Check that the lights on the machine are working correctly.
- 6) Release the parking brake on the feeder wagon.
- 7) Start the tractor.
- 8) Check the operation of the main brake, as soon as starting to drive.
- 9) Check the operation of the hoppers (if the wagon is equipped with them).
- 10) Check the operation of the hydraulic system (correct functioning of the cylinders).
- 11) Check the operation of the balance system.
- 12) Start the PTO drive at the tractor's slow speed (starting the screw drive).
- 13) Leave the screw drive running for a few minutes and check that:
 - there is no knocking sound or any other unusual sounds coming from the drive system,
 - the screw inside the tank rotates smoothly without any blockages,
 - there are no leaks from the hydraulic system,
- 14) Switch off the PTO drive, switch off the tractor engine.

If a malfunction of individual systems or faults is observed during the initial start-up, stop the machine and report the problem to the point of sale or directly to the manufacturer for clarification and possible repair.



CAUTION

CAUTION!

Failure to follow the recommendations specified in the User Manual or incorrect starting up of the machine can lead to damage. Before starting the feeder wagon, make sure that it is in perfect technical condition.

4.2 Connecting and disconnecting the feeder wagon

The machine may only be coupled with a tractor that in good working order, equipped with all the necessary connections (brakes, pneumatic, hydraulic and electric connections) and a tractor hitch meeting the requirements of the feeder wagon manufacturer.

Make sure the machine is immobilised using the parking brake before coupling it to the tractor.



CAUTION

CAUTION!

Before coupling the machine, check the technical condition of the hitching mechanisms of both the tractor and the feeder wagon, as well as the connecting elements of the brake, hydraulic and electrical systems.



CAUTION

CAUTION!

Exercise extreme caution when coupling the feeder wagon. The hydraulic oil in the tractor and feeder wagon must be miscible.

After coupling the feeder wagon to the tractor, secure the braking, hydraulic and electrical lines in such a way that they cannot be broken, worn, bent, crushed or accidentally disconnected while driving.

When driving and working, the parking jack must be raised to its uppermost position.

Coupling the feeder wagon

To couple the feeder wagon, follow the order of activities presented below:

- 1) Ensure that the feeder wagon is immobilised using the parking brake.
- 2) Position the tractor in front of the fodder wagon.
- 3) Position the drawbar eye at a level which allows the machine to be coupled to the tractor.
 - Turn the crank of the parking jack in the correct direction, until the drawbar eye is at the required level.

- if the feeder wagon is equipped with a hydraulic parking jack (Figure 37), connect the hydraulic lines of the jack to the external hydraulic sockets of the tractor; open the hydraulic locking valve of the jack located next to the jack; use the distributor lever in the tractor to raise or lower the drawbar eye to a height which makes it possible to couple it to the tractor's hitch.

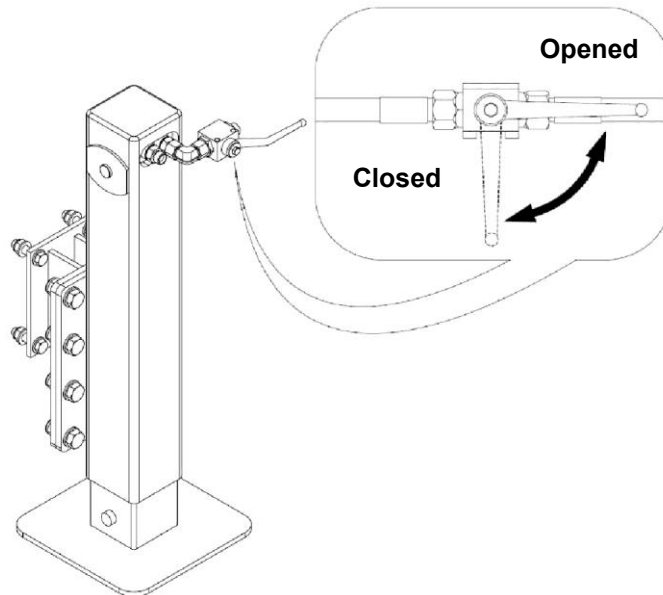


Figure 37. Hydraulic valve to control (shut off) the hydraulic parking jack

- 4) Reverse the tractor, couple the feeder wagon with the hitch of the tractor and check the coupling protection.
 - If the tractor is equipped with an automatic hitch, make sure that machine coupling has been completed and the drawbar eye is secured.
- 5) Apply the parking brake of the tractor, switch off the engine and secure the tractor against unauthorised access.
- 6) Raise the parking jack to its maximum position.
- 7) Connect the lines of the braking system, in the case of (depending on equipment):
 - In the case of a single-line pneumatic system, connect the black pneumatic line to the black socket on the tractor.
 - In the case of a double-line pneumatic system, connect the yellow pneumatic line to the yellow pneumatic socket on the tractor and the red pneumatic line to the red pneumatic socket on the tractor.
 - Hydraulic brake installation Connect the hydraulic brake line to the hydraulic brake socket on the tractor.
- 8) Connect the hydraulic system hoses of the feeder wagon to the tractor.
- 9) Connect the electrical system wiring.
- 10) Connect the PTO shaft and secure the guards.
- 11) Release the parking brake on the feeder wagon.

DANGER!



DANGER

Bystanders are not allowed to stand between the feeder wagon and the tractor during the coupling procedure.

When coupling the machine, the operator of the tractor should exercise particular caution and make sure that no unauthorised persons are in the danger zone.

When connecting the hydraulic lines, make sure that the hydraulic systems of the tractor and of the feeder wagon are not pressurised.



Figure 38. Marking of the hydraulic lines



Figure 39. Indication of the oil flow direction in hydraulic lines



CAUTION

CAUTION!

The use of a faulty fodder wagon is prohibited.

Travel on public roads with faulty lights is prohibited.

The parking jack foot must be raised when the feeder wagon is in transit and in operation.

Feeder wagon uncoupling

To uncouple the feeder wagon, follow the sequence described below:

- 1) Apply the parking brake of the tractor, switch off the engine and secure the tractor against unauthorised access.
- 2) Immobilise the feeder wagon using the parking brake.
- 3) Turn the crank to lower the parking jack, in such a way that the position of the drawbar eye makes it possible to uncouple the tractor safely:
- 4) Disconnect the hydraulic system hoses, secure them with covers and place them in the bracket screwed onto the front of the platform.
- 5) Disconnect the lines of the braking system.
- 6) Connect the electrical system wiring.
- 7) Disconnect the power take-off shaft and secure it correctly.
- 8) Uncouple the hitch of the feeder wagon from the tractor hitch and drive the tractor away.



CAUTION

CAUTION!

Extreme caution is required when uncoupling the feeder wagon from the tractor.

It is prohibited to uncouple a loaded feeder wagon from the tractor.

4.3 Tank loading and feedstock preparation

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

Before loading, always make that there are no persons, objects (stones, pieces of wood, etc.) inside the tank and that the gates of the discharge windows are lowered. For loading, use loaders, tractors equipped with a front loader with a clamshell bucket, loading bucket, etc. Before starting the tank filling, adjust the position of the counterweight, then start the tractor, engage the PTO shaft and operate the balance.



DANGER

DANGER!

Staying on the platform or in the vicinity of a running machine during tank loading is prohibited. Standing on the platform is only permitted in order to check the mixing of the feedstock and to manually load loose feedstock ingredients.

Standing in the vicinity of the running PTO shaft is prohibited.

Reaching inside the tank with limbs or objects while the screw is rotating is prohibited.

An operator present on the platform during work should protect the eyes against the possible dust generated during mixing.

The mixing process should be started at low screw speeds. The roughage components (straw, hay, etc.) should be fed into the tank first, as they require fine chopping. During the loading, use the balance of the feeder wagon to add the correct amounts of ingredients. Mixing can cause the hay or straw to rotate in the tank, which prevents the ingredients from being cut. It is therefore important to correctly adjust the counterblades to ensure proper cutting and mixing of the feedstock and to reduce the mixing time. It is also important to ensure that the cutting knives on the screw are always sharp. Other components of the TMR can only be added after the ingredients of the first portion have been thoroughly cut and mixed. More concentrated feedstocks (cereal grains, meal, industrial mixes, water, etc.) should be added last. The mixing and cutting process must be continued until the feedstock has uniform consistency.

Remember that the maximum PTO shaft speed must not exceed 540 rpm. When starting mixing with light ingredients such as hay/straw, the screw speed should be lower than the maximum speed. The speed can be gradually increased once the ingredients have been pre-cut and mixed.



CAUTION

CAUTION!

It is prohibited to exceed the permitted PTO shaft speed of 540 rpm.

Adjustment of the counterblade must only be carried out with the screw drive switched off.

Strings, foils, nets, etc. must be removed before loading the individual components.

During loading, make sure that no foreign objects enter the tank.

Check the degree of sharpening of the cutting knives - this reduces feedstock preparation time and ensures that the materials are cut thoroughly.

Exceeding the permissible loading capacity of the feeder wagon is prohibited.

Adding another ingredient before mixing and cutting the previous one can result in inaccurate cutting and mixing of the feedstock. During loading, care must be taken to ensure that no foreign objects (e.g. stones) enter the tank, as this can damage the machine and cause cattle diseases.

4.4 Feedstock mix analysis

Check the degree of feedstock mixing and cutting before adding each subsequent ingredient. This check is carried out visually from the position of the platform, during which extreme caution must be observed. If poor cutting and mixing is found, continue the process before adding the next ingredient.



DANGER

DANGER!

Mixing can be controlled from the platform with the machine switched off with extreme caution exercised while on the platform.

4.5 Unloading

The feeder wagon is unloaded using feeders (if the wagon is equipped with them) or the discharge windows. The feeder can be discharged on the right, the left side of the machine or through the front or rear central discharge windows.

To unload the prepared feedstock, drive up to the feeding station, start the feeder wagon drive system (the screw inside the tank must rotate). Open one of the gates and start the hopper drive if it is installed in the machine. The rate at which the feedstock is discharged depends on how far the gate is opened, the speed of the screw and the consistency of the prepared mix. Rotation of the screw causes the feed to circulate through the tank, this then the TMR to spill out onto the feeder table. Close the gates once the unloading is complete.


At the end of unloading, there may be forage remaining on the screw loops, if this is the case, the PTO shaft speed should be increased to 540 rpm. This should cause the feed to drop from the mixer and the tank to be thoroughly emptied during the final unloading stage. Nevertheless, residues of the mix may remain inside and should be removed manually.

4.6 Two-speed gear operation

In the case of a feeder wagon equipped with a two-speed gear, the speed of the mixing motor can be increased or decreased. Changing the speed may be necessary depending on the prepared feedstock mixture, its composition and consistency. The screw speed can be reduced by changing the PTO shaft speed or by changing the gear ratio.

To change the ratio of the two-speed gear, move the lever to one of two positions. This operation can be carried out from the operator's seat using the lever (1) or directly at the gear, by shifting the lever (2). The two levers are connected to each other by a cable of adequate length so that the operator can freely install the lever (1) in the middle of the tractor.

This solution allows easier and faster operation of the machine.



CAUTION!
The ratio of the two-position gear can be changed only with the PTO drive and the screw stopped.

CAUTION

- Position 1 - 1st gear (slow screw speed)
- Position 2 - 2nd gear (fast screw speed)

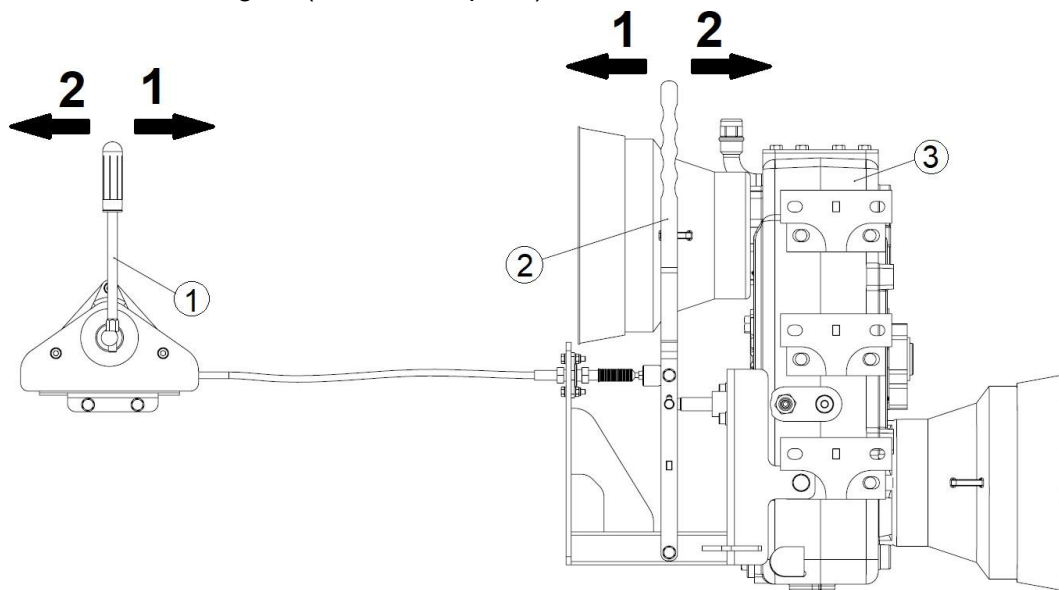


Figure 40. Gear ratio change in a two-speed gear: 1 - gear ratio change lever, 2 - gear ratio change lever at the gear, 3 - two-speed gear

4.7 Counterblade adjustment

When chopping and mixing light ingredients (straw, hay, etc.), the counterblades must be adjusted accordingly. Otherwise, the loaded feedstock may rotate at the same speed as the screw and will not be cut. Sliding the counterblades inside the tank holds the feedstock and causes it to be cut. The counterblades should be adjusted before mixing begins.

The feeder wagon is equipped as standard with two manual counterblades (hydraulic counterblade is available as an option) located on the opposite sides of the tank.

To insert/remove the counterblade, remove the pin (2) secured by the cotter pin (3) and move it to the desired position. The same operation is carried out for both counterblades. If the feeder wagon is equipped with a hydraulic counterblade (Fig. 41), the system is controlled from the platform level using a lever (5). A hydraulic cylinder (4), attached to the tank at the bottom and bolted to the counterblade at the top with fastening elements (2), is responsible for retraction and extension of the blade.



CAUTION

CAUTION!

The counterblade may be adjusted only when the screw is stopped.

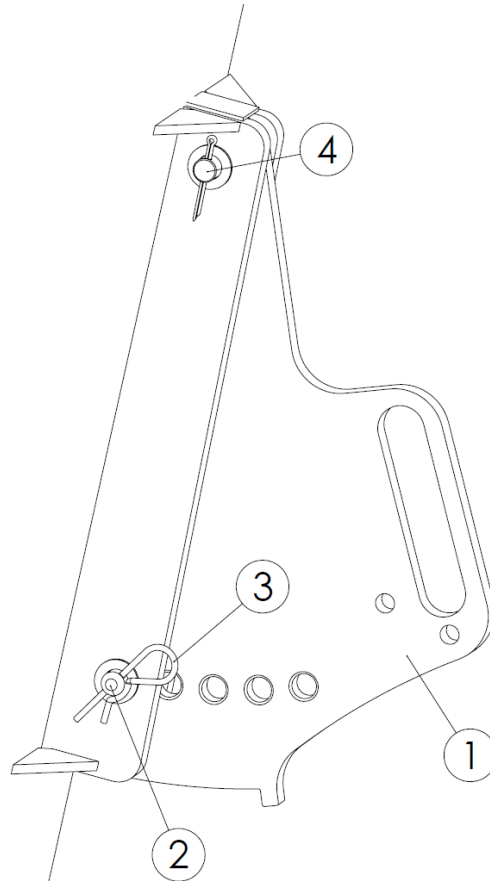


Figure 41. Manual counterblade: 1 - counterblade, 2 - bottom pin, 3 - cotter pin, 4 - top pin

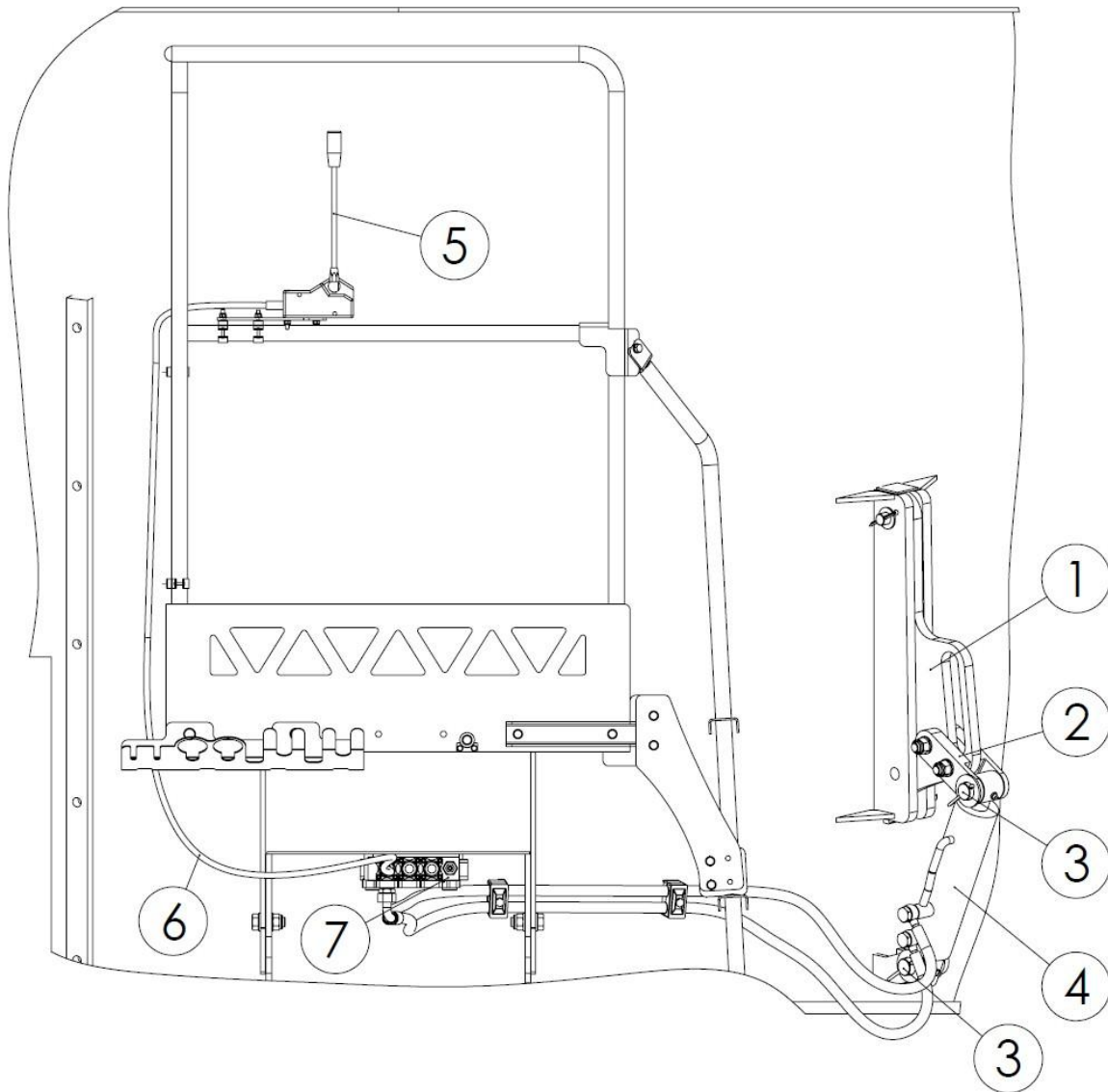


Figure 42. Hydraulic counterblade: 1 - counterblade, 2 - counterblade fastening, 3 - pin, 4 - hydraulic cylinder, 5 - counterblade control lever, 6 - control cable, 7 - hydraulic manifold

5. Technical maintenance

5.1 Maintaining the driving axle and brakes

5.1.1 Driving axle maintenance

It is recommended to check the bearings of the driving axle for play – see Figure 43. Carry out this inspection on a newly purchased machine, after the first 100km. Next, after driving approximately 1,500-2,000km in operation, check again and adjust, if necessary.

To adjust the bearing play, follow the procedure below.

1. Couple the feeder wagon with the tractor and engage the parking brake of the tractor.
2. Lift one side of the feeder wagon, such 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 safety pin that prevents the castellated nut from becoming loose.
4. Turn the wheel while simultaneously tightening the castellated nut, until the wheel has stopped completely.
5. Release the castellated nut by 1/6 to 1/3 of a turn, until the nearest safety pin groove is aligned with the hole on the hub pivot.
6. Secure the nut with a new safety pin; replace and fasten the hub cap.

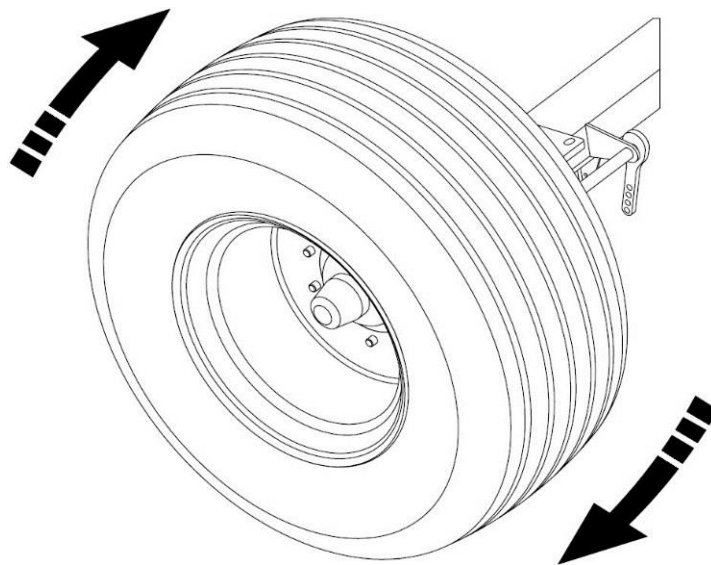


Figure 43. Checking wheel bearing play

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 machine, 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.

5.1.2 Brake maintenance

After purchasing the feeder wagon, the user is obliged to carry out a general inspection of the braking system on the driving axle, and then repeat this check periodically.

Have brake components repaired, changed, and refurbished 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 feeder wagon with the tractor and place chocks under the tractor wheel,
- 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.

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 the work stroke of the brake, and adjust if necessary to keep it within the specified operating range. In a correctly adjusted brake, the angle between the piston rod and the expander lever in the braking position should be 90°.

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

Adjustment includes changing the position of the spreader lever (3) relative to the spreader shaft (4). To change the position of the lever, remove the Seger ring from the shaft, remove the lever from the spreader shaft and move in the appropriate direction. This adjustment must be carried out for each wheel.

- backwards - if the brake response is too slow (A)
- forward - if the brake response is too quick (B)



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

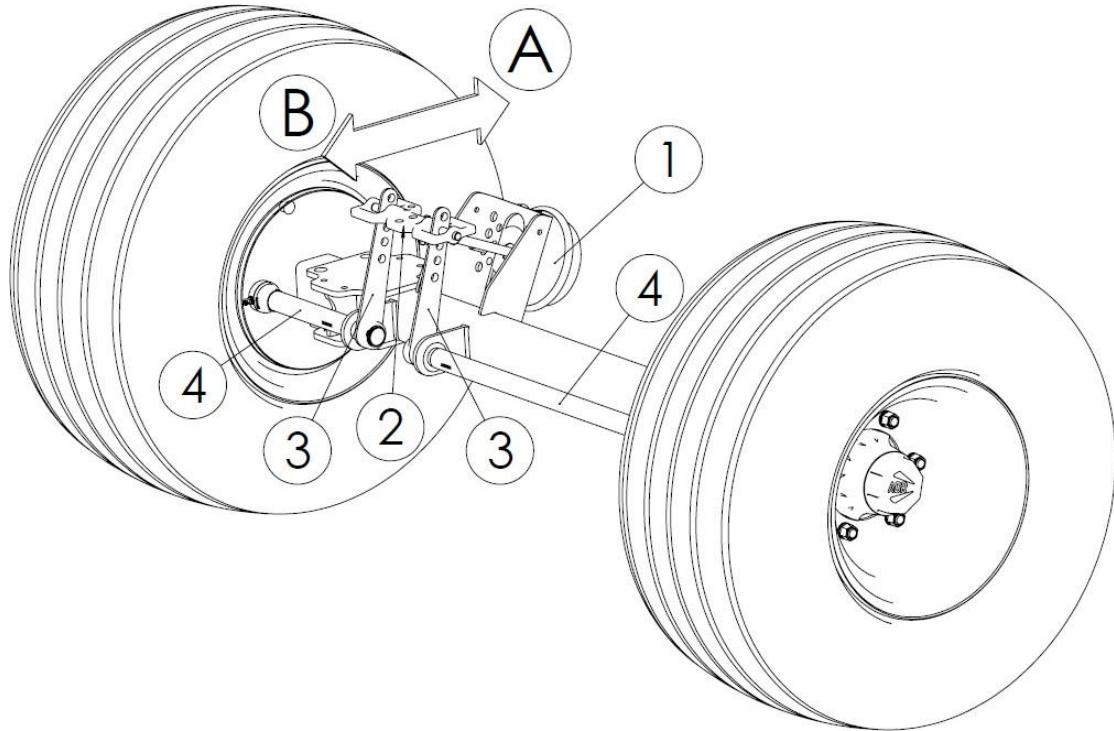


Figure 44. Service brake adjustment

1 - pneumatic cylinder, 2 - yoke, 3 - spreader lever, 4 - spreader shaft



Checking the technical condition of the brake:

- after the first 100 km,
- every 6 months
- after each repair of the brake system
- in the event of uneven braking of the feeder wagon wheels.



CAUTION

CAUTION!

Improperly adjusted brakes 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 of 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.

5.1.3 Tyre maintenance, disassembly of wheels

Secure the machine with the parking brake and the wheels with chocks when maintaining the tyres. A wheel can be removed only when the feeder wagon tank is empty. Use suitable tools for repairing the wheels. Due to the risks associated with the maintenance and repair works of tyres, the repairer should be trained for this purpose. 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 checks each time after you dismantle the wheels.



The air pressure must be checked regularly. Maintain the recommended tyre inflation pressure. The correct pressure value is indicated on the tyre or as a sticker on the feeder wagon.

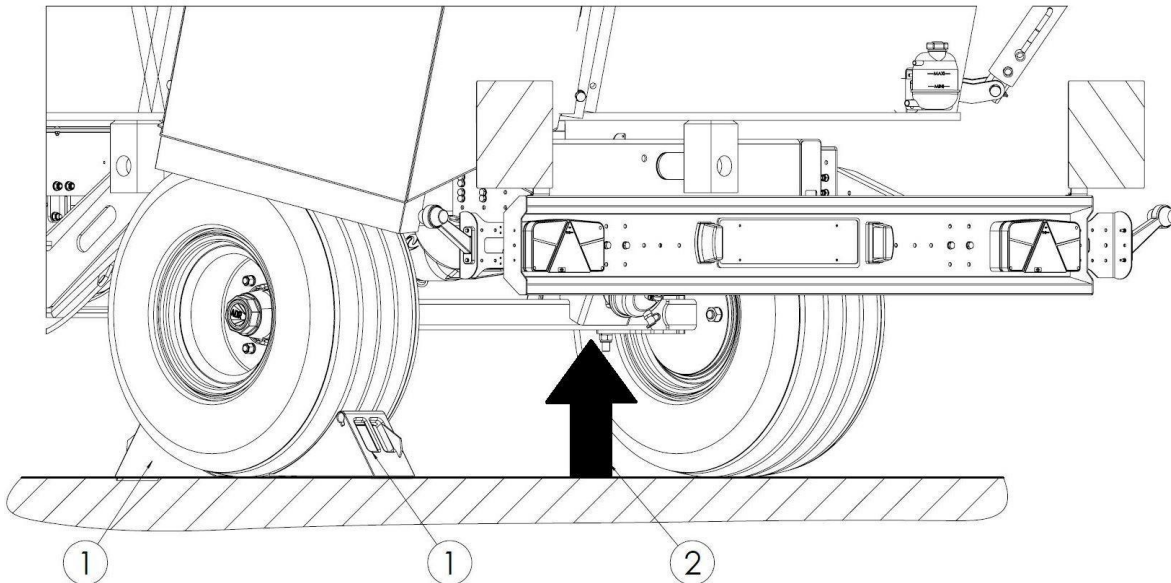


Figure 45. Jacking points: 1 – chocks, 2 – jack

If it is necessary to disassemble the wheel, observe the jacking points (2) under the axle. See Figure 45 for the jacking points. Wheel removal is only permitted when the machine is stationary with the parking brake applied, the wheels are secured with wheel chocks (1) and the fodder wagon tank is empty.



CAUTION

CAUTION!

Regularly check the tightening of the wheel nuts.

- Regularly check and maintain the correct tyre pressure, as recommended in the operating instruction and/or the information provided on the tyre.
- Do not exceed the permissible load capacity of the tyres, according to the operating instruction and/or information provided on the tyre.
- Do not exceed the permissible speed of the feeder wagon, according to the operating instruction and/or information provided on the tyre.
- Secure the 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 minute 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, or the gross and design load capacity of the feeder wagon.

5.2 Pneumatic system maintenance

Have the air braking system components repaired, changed, and regenerated by professional workshops with all the 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 lines.
5. Cleaning and maintaining the connections of pneumatic lines.



CAUTION

CAUTION!

It is prohibited to use the fodder wagon with a faulty braking system.

5.2.1 System tightness and visual inspection of the pneumatic braking system



System tightness and visual inspection:

- At start-up;
- After the first 1,000km;
- And each time system components are repaired or changed annually.

Checking the tightness of the pneumatic system:

- couple the tractor to the feeder wagon,
- immobilise the tractor and the feeder wagon by applying the parking brake, place chocks under the wheel of the feeder wagon,
- start the tractor engine to fill the braking system of the feeder wagon with air,
- 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 leaky, air will escape outside with characteristic hissing at damaged places. Minor leaks can be detected by putting a layer of a foaming agent the on to an inspected part (dish washing liquid, soap).

Replace 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 the 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 lines, the manner of their fastening, as well as their cleanliness and completeness. Lines must not show any signs of wear, 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 refurbished by professional workshops only.

5.2.2 Air filter cleaning



DANGER

DANGER!

Release pressure in the braking system of the feeder wagon before removing the filters.

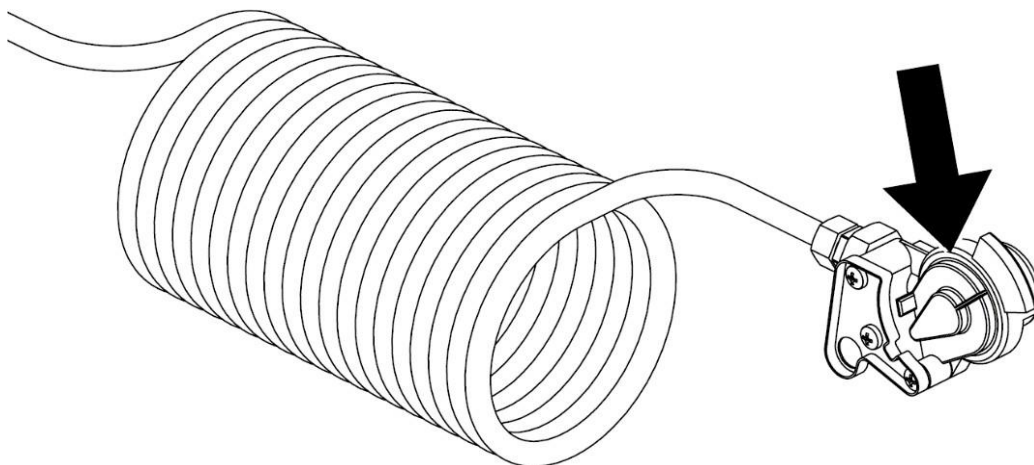


Figure 46. Brake system air filters located on the inside of the connection

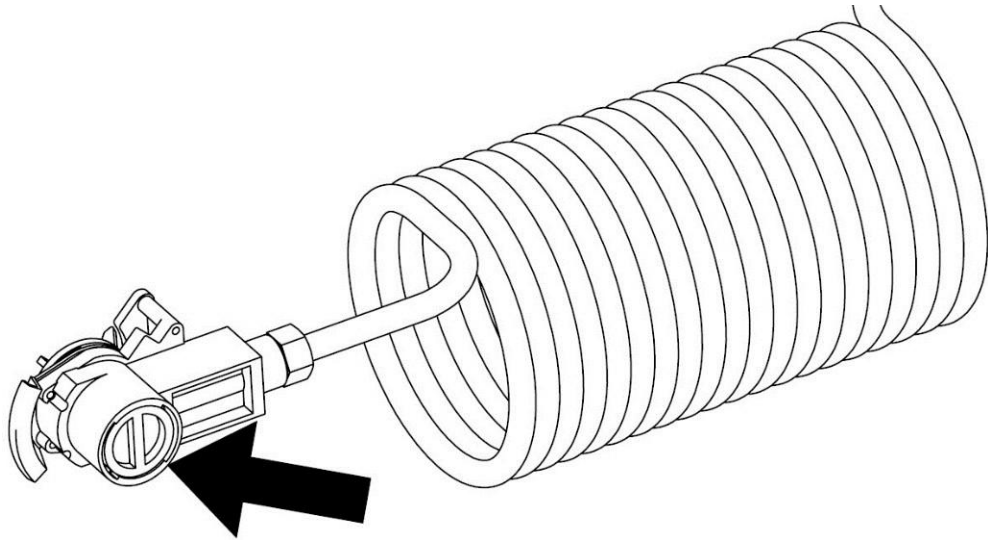


Figure 47. Brake system air filters located on the outside of the connection

Clean the air-filter elements, according to their operating conditions, but at least every 6 months. The filters located in the fittings of the pneumatic lines - see Figures 46 & 47. The air-filter elements are reusable and it is not required to change them, unless damaged.

5.2.3 Draining the air tank

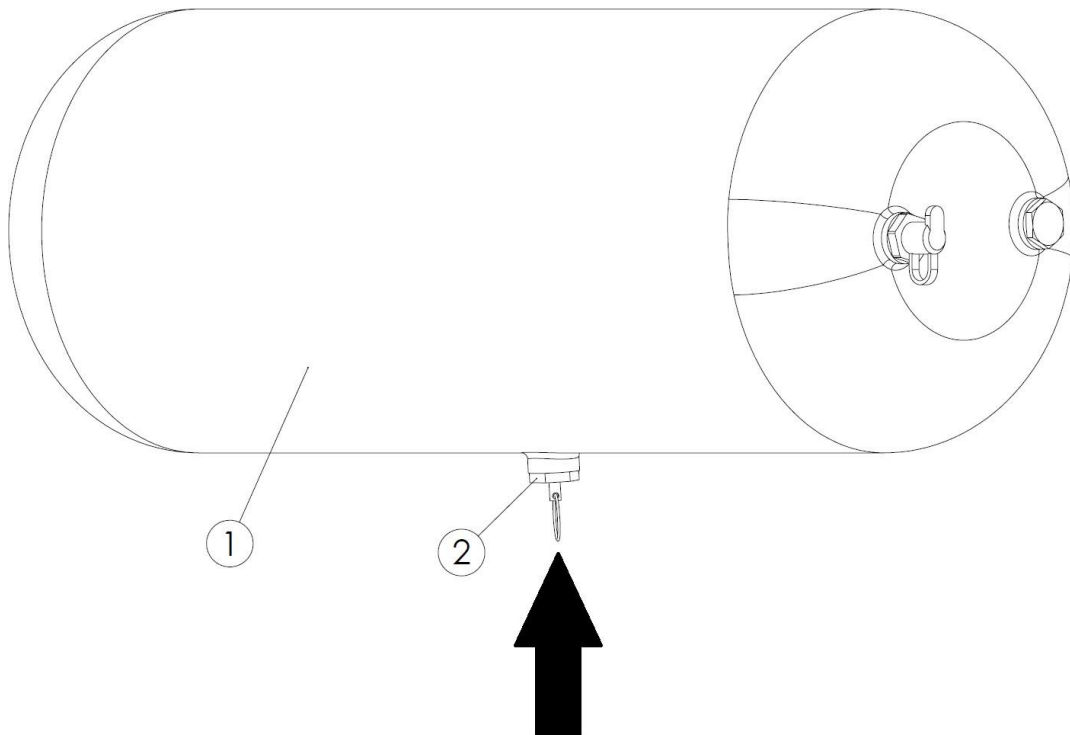


Figure 48. Draining the air tank:
1 - air tank, 2 - drain valve



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 removed and cleaned or changed, if necessary.

5.2.4 Replacement of flexible connection lines

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

To replace the hoses follow the procedure:

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

5.2.5 Cleaning and maintenance of pneumatic line fittings



DANGER

DANGER!

Faulty, damaged or dirty air line fittings can cause malfunction of the brake system.

If elements of the connections of pneumatic lines show any signs of damage, replace them with new and fully efficient parts. If exposed to oils, petrol, greases, etc., the gaskets in the joints can be damaged or age prematurely.

If the feeder wagon 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, before the winter season.

Each time before coupling the machine, check the condition of the pneumatic connections. 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 feeder wagon with the tractor.

5.3 Hydraulic system maintenance

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

Maintenance of the hydraulic system carried out by the user is narrowed down to:

- 1) Check of the air-tightness of the system and its visual inspection
- 2) Check of the technical condition of the hydraulic connections.



DANGER

DANGER!

The use of the feeder wagon with a faulty hydraulic system is prohibited.



Check for leaks:

- after the first week of use;
- every 12 months;

Checking for leaks in the hydraulic system:

- couple the feeder wagon to the tractor;
- immobilise the tractor and the feeder wagon using the parking brake;
- disconnect the hydraulic hose lines;
- clean the couplings and hydraulic cylinders;
- start the tractor engine and open/close the gate valves several times (if the wagon is equipped with a hopper, start and stop the feeder drive);
- Press the brake pedal several times if the feeder wagon has a hydraulic brake,
- Check the hydraulic lines and cylinders for leaks;

If leaks from the hydraulic couplings are found, the couplings should be tightened. The piston rod of the actuator at maximum extension is covered with a small amount of oil, this is normal and acceptable. If heavy oiling of the piston rod from under the seals is observed, stop operation until the fault has been rectified. If leaks are detected in the hydraulic brake system, such a machine must not be used and driven until the leak has been rectified.

Table 9. The specifications of the HL-46 hydraulic oil

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



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



CAUTION

CAUTION!

The hydraulic system is under high pressure during operation. Check the tightness of the hydraulic system and the technical condition of the lines on a regular basis, and eliminate any leaks on an ongoing basis.

5.3.1 Onboard hydraulic system

If the feeder wagon is equipped with an onboard hydraulic system (Figure 49), its maintenance is limited to checks of the tightness of the hydraulic connections, checking the oil level in the tank using the dipstick (5) and checking the soiling of the hydraulic oil filter via the soiling indicator (3) provided on the filter (2). During machine operation, the oil temperature should be monitored, and it should not exceed 65°C.

The oil level in the tank should be between the MIN and MAX markers, if the oil level is low, it should be topped up via the filler opening (4). The type of oil and operating instructions for the onboard hydraulic system are described in pictograms (Figure 49) provided on the oil tank.

The components of the electrical system should be repaired or refurbished by professional workshops with all the qualifications and tools required to perform this type of work.

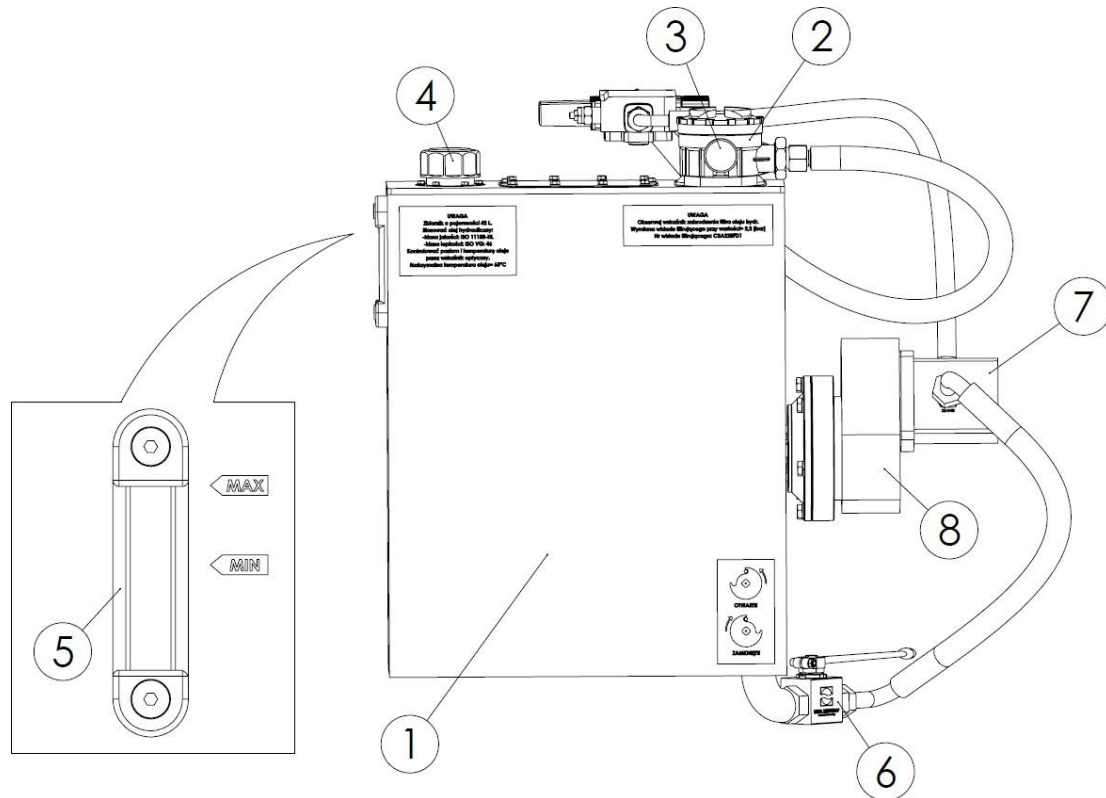


Figure 49. Onboard hydraulic system: 1 - oil tank, 2 - filter, 3 - soiling indicator, 4 - oil filler, 5 - oil level indicator, 6 - ball valve, 7 - hydraulic pump, 8 - multiplier

	Oil tank capacity 42L
	Hydraulic oil: <ul style="list-style-type: none"> • Quality grade: ISO 11158-HL • Viscosity class: ISO VG: 46
	Maximum oil temperature 65°C

<p style="text-align: center;">CAUTION Tank capacity 42L. Use hydraulic oil: -Quality grade: ISO 11158-HL -Viscosity class: ISO VG: 46 Check the oil level and temperature using the visual indicator. Maximum oil temperature = 65°C</p>	 OPEN CLOSED
<p style="text-align: center;">CAUTION Observe the hydr. oil filter soiling indicator. The filter element should be replaced at = 2.2 [bar] Filter element no: CRA220FD1</p>	

Figure 50. Onboard hydraulic system pictograms

Figure 50 shows the pictograms provided on the oil tank of a feeder wagon equipped with an onboard hydraulic system.

5.4 Maintenance of the electrical system and warning components



CAUTION

CAUTION!

The electrical system of the feeder wagon is powered at 12V.

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 refurbished 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 an usable condition. Damaged lamp covers and burnt out 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 dirty.

Maintenance work:

- check the condition of the connecting cable of the electrical installation and the socket in the feeder wagon,
- check the lighting system for completeness, technical condition and correctness,
- check all high-visibility elements for completeness and technical condition,
- check for 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 high-visibility warning triangle,
- before driving on a public road, make sure that the lights and high visibility elements are not dirty.

5.5 Lubrication

Proper lubrication is one of the most crucial factors on which the smooth operation of the individual assemblies and mechanisms of a feeder wagon depends and which extends their service life. Lubrication should be carried out with a hand or foot-operated lubricator, filled with the recommended lubricant.

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.

Lubricate the wheel hub bearings by applying fresh grease after removing the hub and removing used grease. Each time when changing grease, assess the condition of the bearings and replace them, if necessary. After mounting the hub, adjust the bearing play.

Table 10. The lubrication schedule

No.	Name of mechanism	Number of lubricating points	Grease type	Interval
1.	Drawbar eye	1	ŁT	2D
2.	Hub bearings	4/8	ŁT	24M
3.	Mechanical parking jack	2	ŁT	6M
4.	Parking brake assembly	1	ŁT	6M
5.	Discharge window guides	4	ŁT	3M
6.	Gate valve actuator eyes	4	ŁT	1M
7.*	Hydraulic counterblade cylinder eyes	2	ŁT	1M
8.*	Gearbox spline shaft	2	ŁT	1M
9.*	PTO shaft coupler bearings	2	ŁT	24H
10.*	Tandem sprung suspension	6	ŁT	6M
11.	Planetary gear shaft	2	ŁT	1M
12.	Sleeves of the expander shafts	2/4	ŁT	6M
13.*	Feeder bearings	3	ŁT	24H

* - The presence depends on the variant and equipment of the feeder wagon.

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

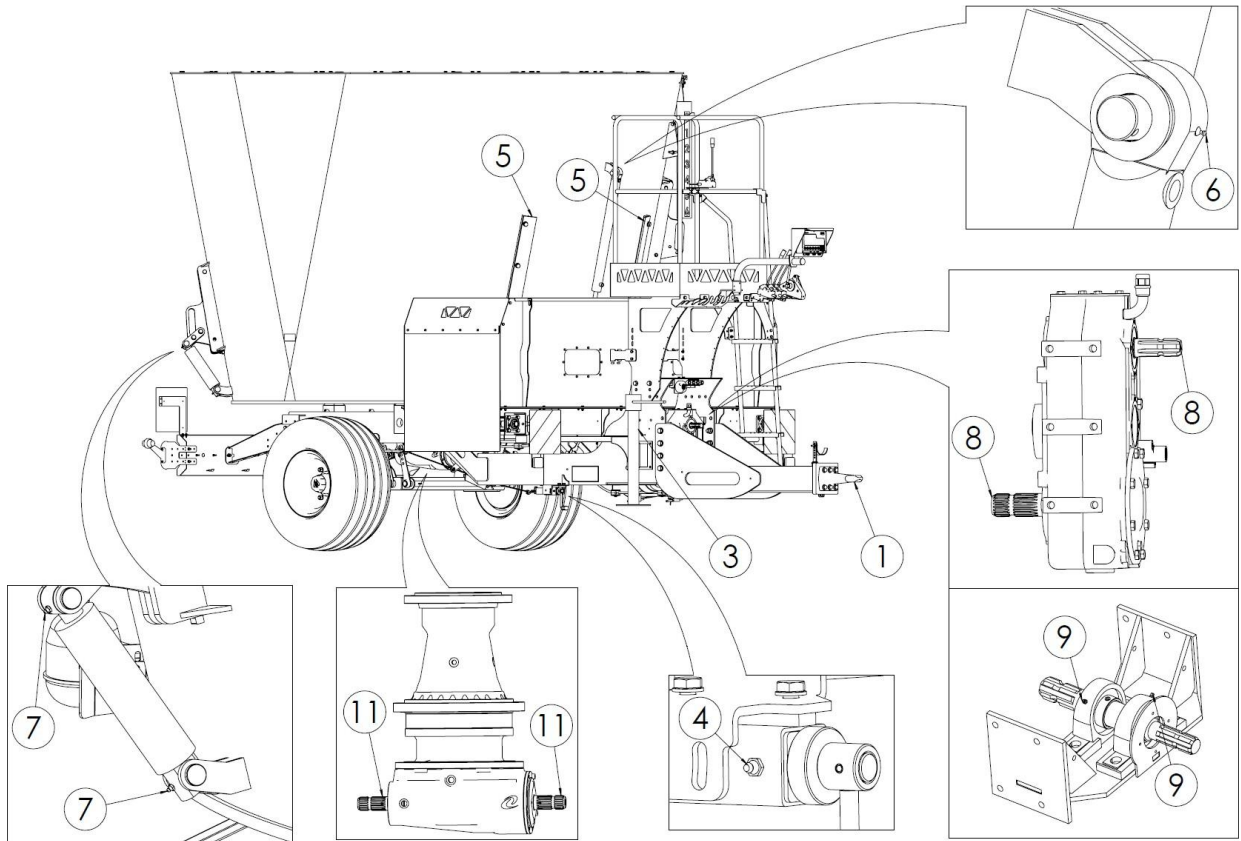


Figure 51. Lubrication points on the feeder wagon

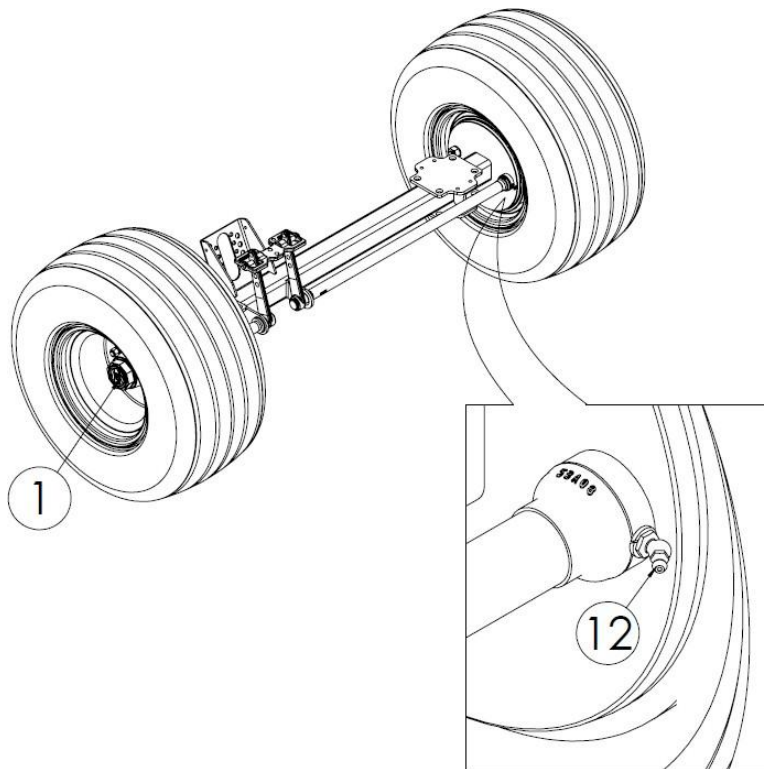


Figure 52. Axle lubrication

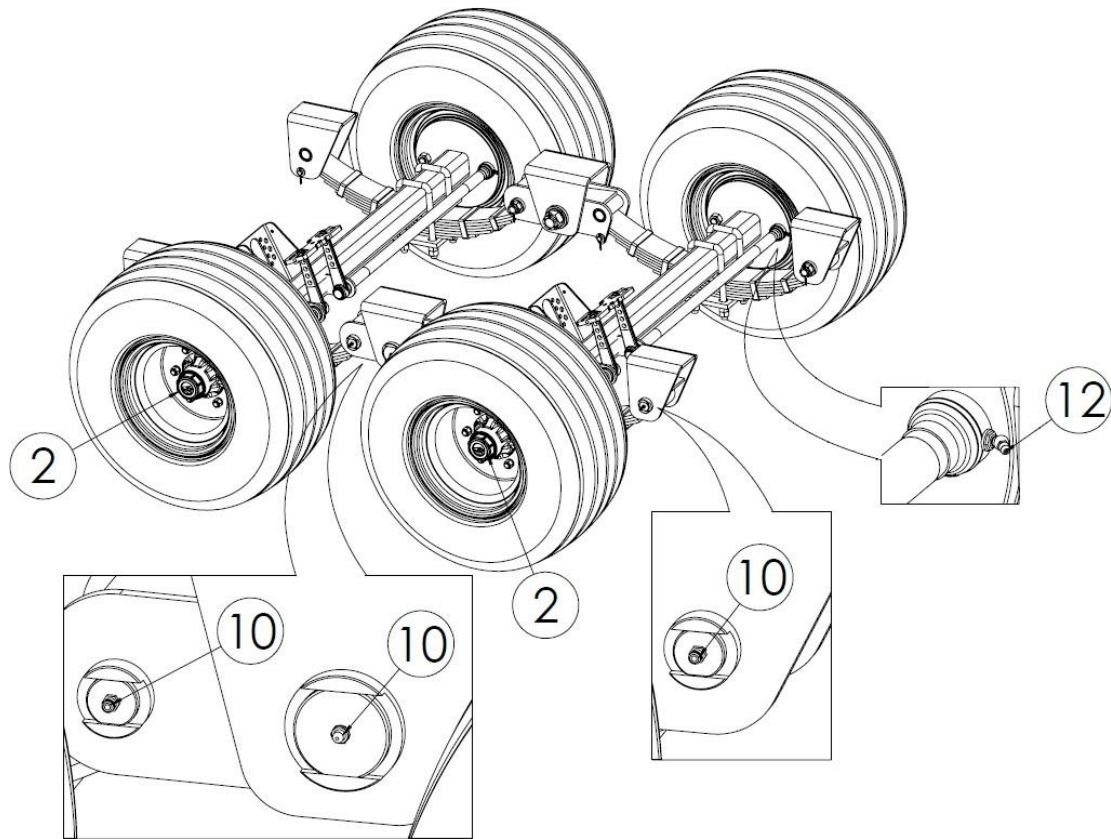


Figure 53. Lubrication points on the tandem suspension for the BEL-MIX T659/4 feeder wagon

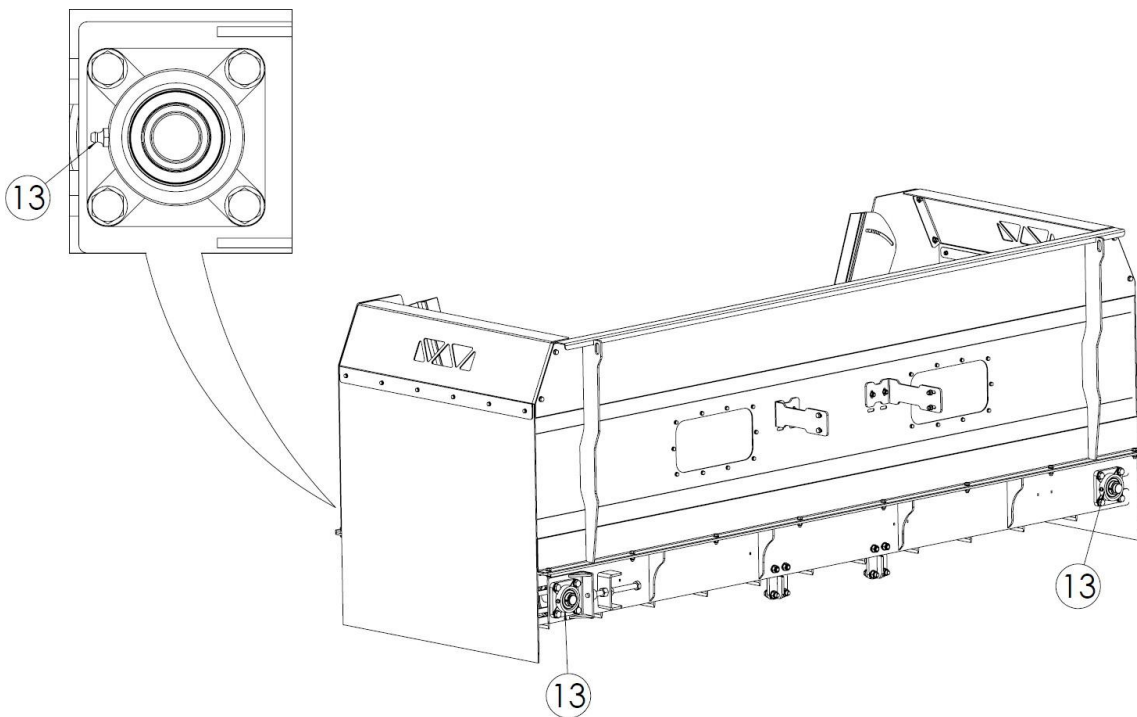


Figure 54. Lubrication points of the hopper

Lubrication should begin with the following steps:

- Clean each grease nipple before injecting grease.
- Pump in the grease until fresh grease starts coming out from the slots (through which the used grease is squeezed out when changing the grease).
- After lubrication, leave some grease on the grease nipple head
- Oil should be used to lubricate threaded connections, lever connections, pins, etc., components of the feeder wagon.

The PTO shafts must also be lubricated in accordance with the manufacturer's recommendations specified in the user manual.

Table 11. Lubricants

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



CAUTION

CAUTION!

It is prohibited to drive without hub caps as dirt entering the wheel bearings will damage them.

5.6 Gear maintenance

Maintenance of the feeder wagon's gear includes checks of the level of, topping up, and changing the gear oil. If gear components have become damaged, contact a service centre for repair.

The first oil change in the gear should be carried out after the first 100 hours of operation and subsequent oil changes should be carried out after 1,500 hours of operation or once a year.

The work should be carried out with the feeder wagon parked on a hard, level surface. When changing oil, use suitable protective clothing, tools and tanks. Store waste oil in appropriately marked containers and dispose of it, in accordance with the applicable regulations.

Oil change in the planetary gear

The oil change should be carried out in accordance with the following instructions:

- Remove the expansion tank cap (2).
- Remove the planetary gear drain plug (1) and drain the oil into a container.
- Remove debris from the drain plug and replace the seal, then screw the plug back into the planetary gear.
- Remove the vent line (4) from the expansion tank (2) and place it below the bottom of the tank in an oil-resistant container, so that the oil in it can be drained.

- Fill the new oil via the expansion tank, until the oil flows out of the vent line (the vent line must be in the oil container when filling the tank).
- Attach the vent line (4) onto the end of the expansion tank.
- Add oil to a level between the Min and Max marks.
- Screw on the expansion tank cap (2).

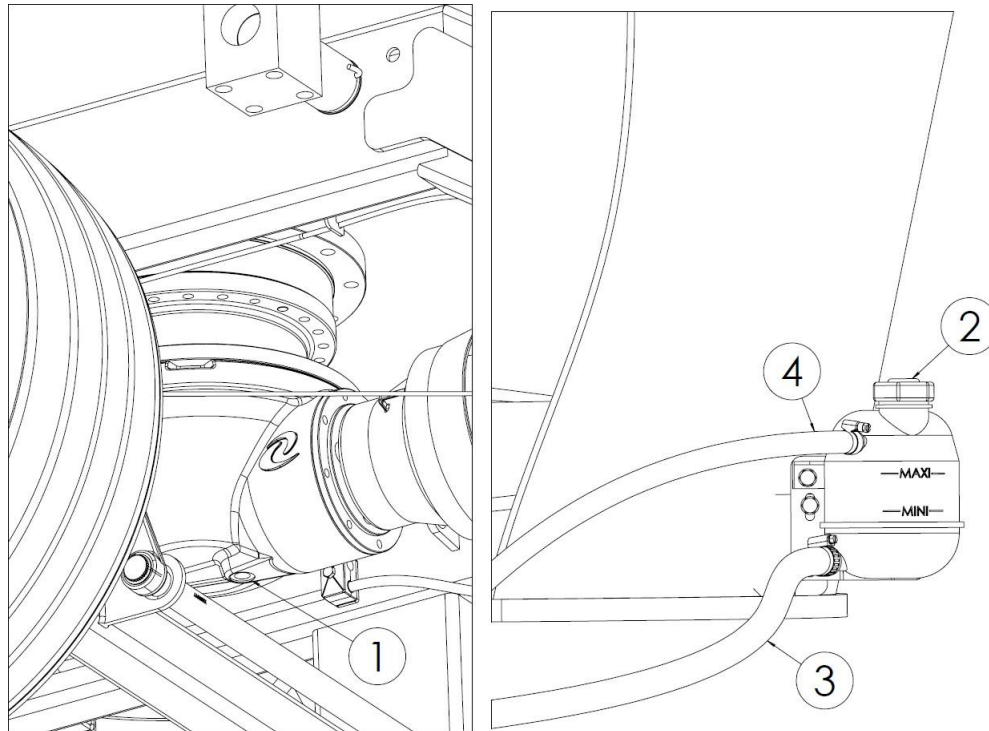


Figure 55. Oil change in the planetary gear: 1 - drain plug, 2 - expansion tank plug, 3 - supply line, 4 - vent line



The oil capacity of the planetary gear is 19.7 litres.

Oil change in a two-speed gear

- Remove the oil filler plug (1) of the gear and the oil level plug (2) - see Figure 55.
- Remove the drain plug (3), drain the oil from the two-speed gear into a container for used oil.
- After draining the oil, clean the plug and screw it back in.
- Next, fill the two-speed gear with fresh oil. Continue filling until oil leaks through the oil level hole.
- Screw in the oil level plug and close the oil filler inlet.



DANGER

DANGER!

During the oil change, use appropriate personal protective equipment such as safety clothing, gloves, glasses and footwear. Avoid contact of oil with skin and eyes.

Oil may cause an allergic skin reaction.

The oil has a harmful long-term effect on aquatic species.



The oil level in gears should be checked before each machine start-up and topped up if necessary.

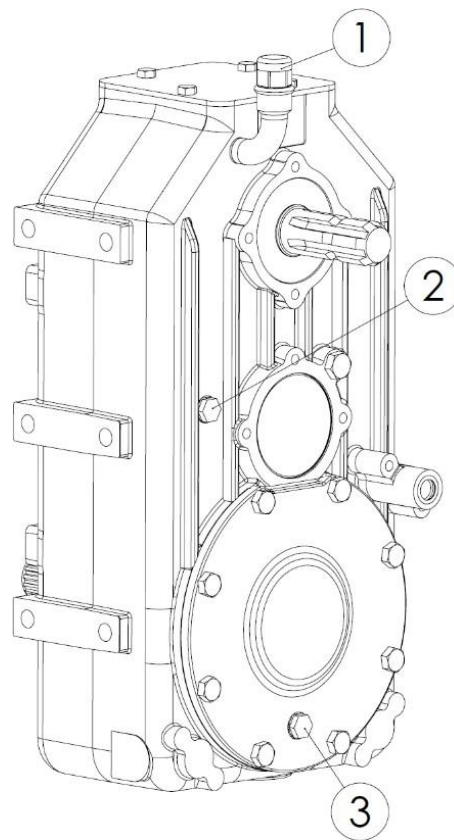


Figure 56. Oil change in a two-speed gear: 1 - oil filler plug, 2 - oil level plug, 3 - oil drain plug

Table 12. Oil quantity in gears

Name	Type of oil	Volume
Planetary gear	Hipol GL 4 80/W90	19.7 L
Two-speed gear	Hipol GL 4 80/W90	5.6 L

5.7 Belt conveyor operation

Before each use of the conveyor, check the belt tension and make sure that the bearings are lubricated. Belt tensioning is carried out using tensioning devices (1) located on the front and rear beams of the conveyor floor (side beams of folding conveyors).

To tension the conveyor belt, loosen the screws (5) securing the shaft bearings and the nut (4). Next, holding the nut (3) with a wrench, turn the screw (2), thus tensioning the belt. The tensioning operation should be carried out on both sides of the conveyor, taking special care to ensure that the tension is identical on both sides. Failure to do so may result in the conveyor malfunctioning (belt skewing during conveyor start-up). Once the belt is correctly tensioned, tighten the screws (5) holding the bearing and the nut (4) to lock the tension.

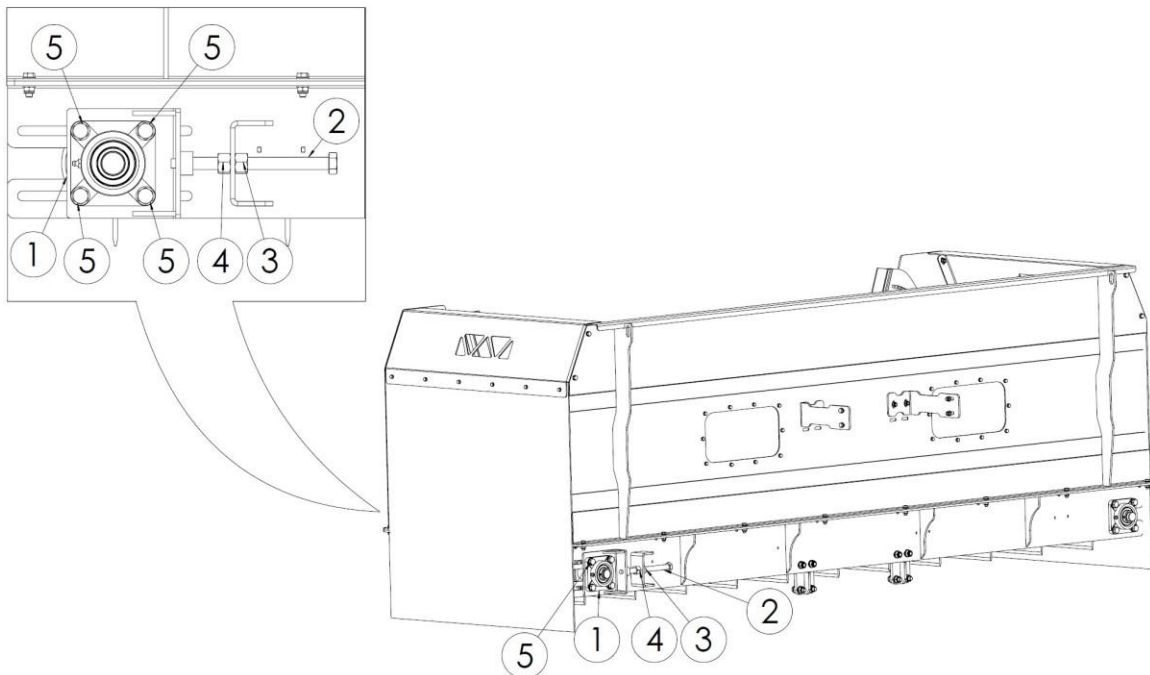


Figure 57. Conveyor belt tensioning: 1 - tensioning element, 2 - tensioning screw, 3 - tensioning nut, 4 - nut, 5 - screw connection of the conveyor shaft bearing

Belt tension should be measured in the middle of the conveyor by measuring the distance between the top and bottom surfaces of the belt. At the correct tension, the measured value should be between 140 and 170 mm - see Figure 58.

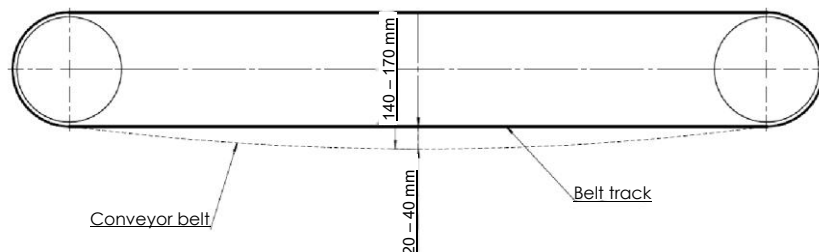


Figure 58. Belt tension check

**CAUTION****CAUTION!**

The conveyor belt must be tensioned equally on both sides.
Inadequate belt tension can result in the belt not rotating during unloading.

Uneven belt tension can cause it to malfunction (skewing during operation) or even damage to it.

In the case of a mobile belt conveyor (optional equipment), the tension of the sliding bearings should be additionally checked (Figure 59). If the bearing pressure onto the floor is inadequate, both the slide and the bearings themselves may become damaged. To avoid this, the pressure of the bearings on the conveyor floor should be checked periodically.

To verify the clearance between the bearing and the floor, check if the bearing (1) spins freely when attempting to rotate the bearing race by hand. If the bearing rotates freely, this means that a clearance adjustment is required. To do this, loosen the nut (2), then tighten the screw (3) clockwise until the bearing race stops rotating freely. Once the play is eliminated, tighten the nut (2). This operation must be carried out for all four bearings with which the conveyor is equipped. If conveyor bearings are pressed too tightly against the conveyor floor, i.e. the bearing axis is not in parallel with the slide or the conveyor floor moves with apparent resistance, readjust by loosening the screw (3) until the correct pressure is reached.

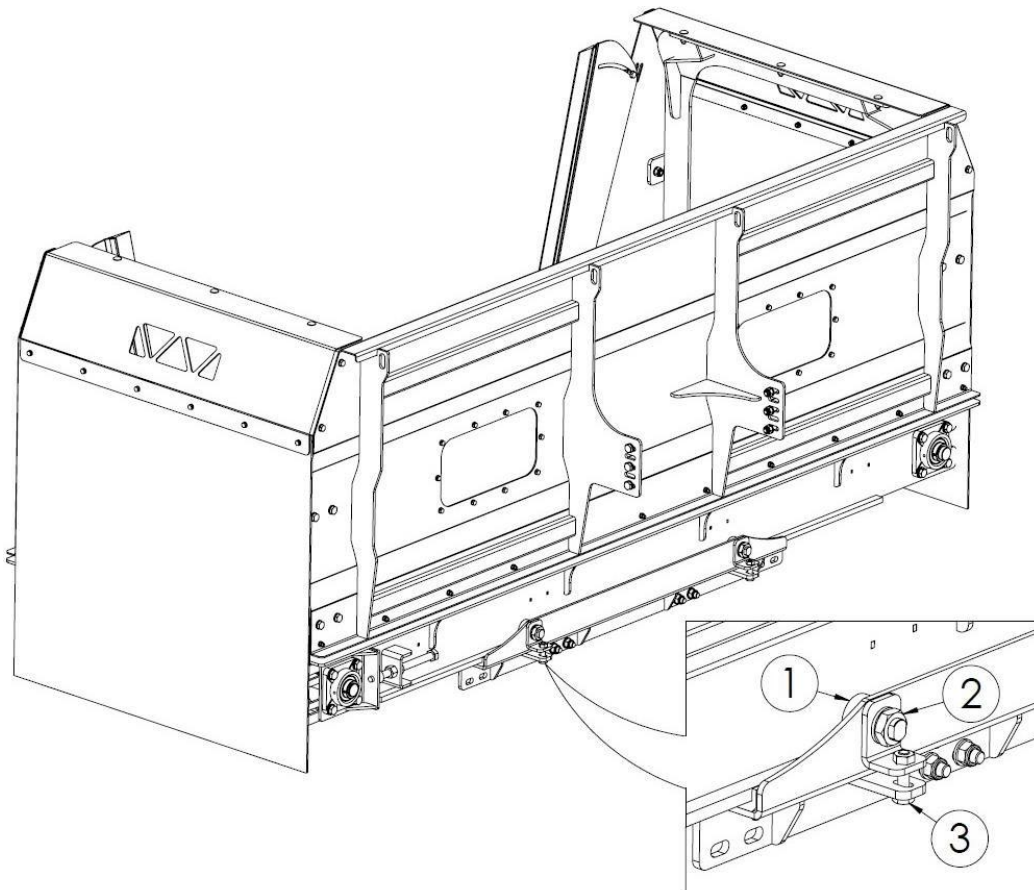


Figure 59. Sliding bearing tension: 1- bearing, 2 - nut, 3 - tensioning screw

5.8 Entering the tank

The use of the feeder wagon often involves entering the tank in order to inspect, sharpen and adjust the cutting knives or clean the tank. This work must be carried out with extreme caution due to the very high risk of accidents. To enter the tank:

- Park the feeder wagon and tractor by applying the parking brake.
- Open the discharge window gates for emergency exit.
- Switch the tractor engine off and protect from unauthorised access.
- Disconnect the PTO shaft connecting the tractor to the feeder wagon, as well as the hydraulic and pneumatic lines.
- Prepare two ladders of an appropriate height.
- Place one ladder against the edge of the tank and insert the other ladder into the tank. Ensure that the ladders stand firmly and can not shift during the ascent/descent.
- Enter the tank with extreme caution.



DANGER

DANGER!

Before entering the tank, disconnect the PTO shaft and the lines of the hydraulic and pneumatic systems and secure the tractor against unauthorised access.

Entering the tank using the discharge windows and the platform is prohibited, as they are not designed for this purpose.

The tank may be entered only when the machine is completely stationary.

5.9 Removal and adjustment of the cutting blades

The cutting knives in the feeder wagon are a consumable item and after a certain period of use, they require sharpening, adjustment or should be replaced. The service life of the cutting blades depends on how they are used. Care must be taken to ensure that unwanted foreign bodies (stones, sand) do not enter the tank with the distributed feedstock, as this can have negative impact on the service life of the knives or even result in knife damage. Bent, broken or cracked cutting knives are unsuitable for use and must be replaced immediately for mixing and cutting to proceed properly.

The installation or removal of cutting blades requires access to the inside of the tank, so great care must be taken during such work. Blade replacement involves unscrewing the cutting blades (2 and 3) from the base (1), screwed in place using a screw connection consisting of a nut (9), washer (8) and bolt (7).

Replacement of the two-part cutting blades does not require removing the base (1) from the screw.

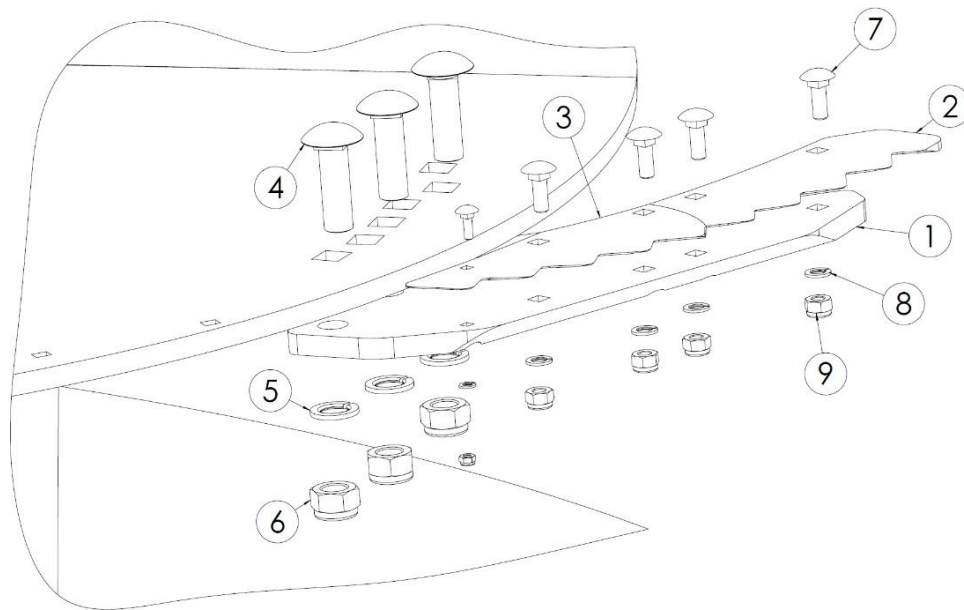



Figure 60. Cutting blade replacement: 1 - blade base, 2 - cutting knife I, 3- cutting knife II, 4 and 7 - jack screw, 5 and 8 - washer, 6 and 9 - self-locking nut



DANGER

DANGER!
 Special care must be taken when replacing/tightening the knives - there is a risk of cutting or crushing the body of the operator between the knife or agitator and the tank wall.
 Cutting blade replacement through the open discharge window is

The cutting blades can be set in two positions A and B - see Figure 60. To do this, remove the base (1), which is bolted using a screw (4), a washer (5) and a nut (6) - see Figure 62. Next, screw the base together with the knives onto the corresponding holes (A - cutting blades extended, B - cutting blades retracted).

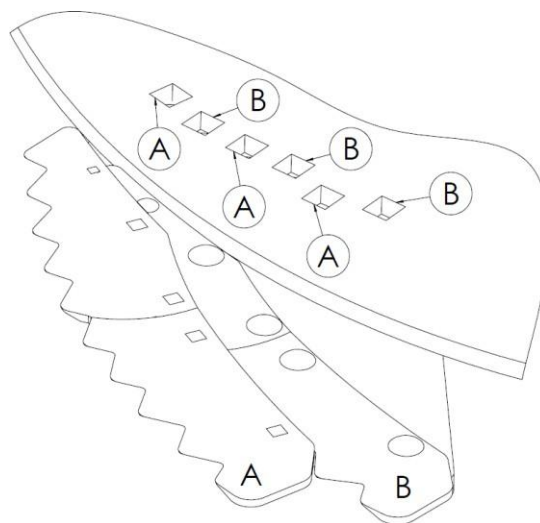


Figure 61. Changing the position of the cutting blades: A - cutting blades extended, B - cutting blades retracted

5.10 Cutting blade sharpening

Cutting blade sharpening should be entrusted to companies specialising in this type of service, which have the appropriate tools.

The user can also sharpen the blades with an angle grinder inside the tank, without the need to remove them. Be careful not to hold the grinding stone in one place for too long during sharpening, as this can lead to blade overheating. Brakes should be taken during work, as this allows the blade to cool down.

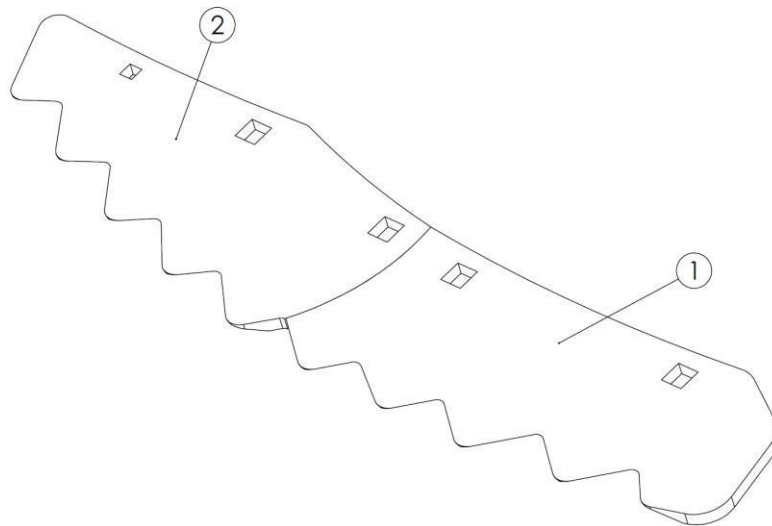


Figure 62. Blade sharpening: 1 - cutting knife I, 2 - cutting knife II



DANGER

DANGER!

Special care must be taken when sharpening the knives due to the sharp edge of the blade.

Use protective goggles and gloves when working due to the swarf generated when the grinding wheel contacts the blade surface.

5.11 Cleaning and maintenance

Every day after work and in case of prolonged stoppage, the conveyor of the feeder wagon should be thoroughly cleaned, including the covers and the screw. Residues of nets or strings should be removed during the maintenance. Pressure washers are recommended for cleaning the machine, with special care taken while using them.

Cleaning guidelines:

- The screw, covers and the inside of the tank should only be washed with clean water.
- Do not hold the water jet closer than 40 cm from the cleaned surface. Washing surfaces with a strong jet of water at a short distance can damage the painted surfaces,

- Water temperature must not exceed 50°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 in an inconspicuous place,
- Use petroleum ether or a degreasing agent to clean greasy parts, followed by rinsing 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 feeder wagon at locations designated for such purposes, according to the environmental protection regulations,
- Clean and dry the feeder wagon at temperatures 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 for cleaning products and the instructions for use for the pressure washer.

A washed and dried feeder wagon should be properly preserved. Corroded areas should be cleaned of rust, degreased and protected with paint. Storage of the feeder wagon indoor or under a roof is recommended. If the machine is not used for an extended period of time, all lubrication points should be greased, followed by brief operation of all mechanisms to distribute the grease.

5.12 Tightening torques of screw connections

The optimum tightening torques for bolts with metric threads are shown in Table 13.

Table 13. Tightening torques for screws with metric threads

Bolt		Tightening torques for bolts with metric threads [Nm] [Nm]					Wheel nuts, wheel screws
Diameter D [mm]	Pitch of thread [mm]	Screw strength classes					
		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	1,200	1,700	1,990	
30	3.50	772	995	1,500	2,130	2,500	
30	2.00	850	1,060	1,670	2,370	2,380	

5.13 Troubleshooting

Table 14. Troubleshooting

Defect	Cause	Remedy
Conveyor belt does not rotate	Inadequate belt tensioning.	Tension the belt.
	No oil supply to the engine.	Check the connection and tightness of the hydraulic system.
Excessive gear heating	Oil level in the gear is too low.	Check the oil level and top up. Check for leaks and seal if necessary.
	Excessive load on the mixing screw.	Load less feedstock into the tank.
	Mechanical damage to the gear.	Repair the gear.
Mixing screw speed is too low	Incorrect ratio setting in the two-speed gear.	Change the gear ratio.
	Defective planetary or two-speed gear.	Repair the planetary or two-speed gear.
Hydraulic system malfunction.	Damaged hydraulic lines.	Check the condition of the hydraulic lines and their tightening. Replace or tighten if necessary.
	Damaged or contaminated actuator.	Check the condition of the piston rod (for corrosion and mechanical damage) and for leaks and repair or replace the actuator if necessary.
	Hydraulic manifold damage.	Check the condition of the manifold connections. Tighten or replace the manifold, if necessary.
The balance is not working properly	Defective balance sensors.	Check the sensors and their connection and replace the defective sensor if necessary.
	The wire harness is damaged.	Check the harness and all connections, clean the contacts.

NAME AND ABBREVIATION INDEX

BHP - occupational safety and health

dB (A) – scale A decibel, a sound power unit;

kg – kilogram, a unit of weight;

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

kPa – kilopascal, a unit of pressure;

m – meter, a unit of length;

mm – millimetre, a secondary unit of length equal to 0.001 m;

MPa – megapascal, a unit of pressure;

N – newton, a SI unit of force;

Nm – newton-metre, an SI unit for the moment of force;

Pictogram – a notice plate;

T – tonne, a unit of weight;

Rating plate – a manufacturer's nameplate for the explicit identification of the machine;

V – volt, a unit of electrical tension (voltage);

Transport hitch– the hitching elements of a farming tractor (see the tractor's user manual).

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NOTES

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