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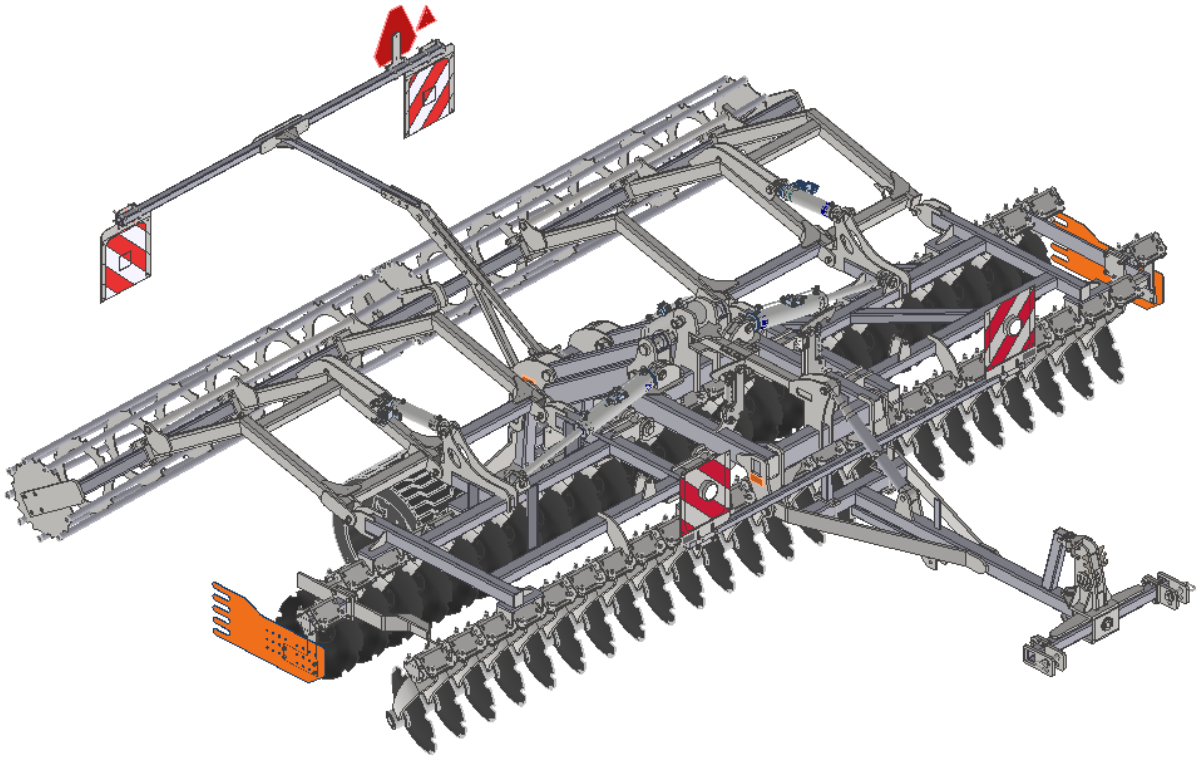
OPERATION MANUAL

Disc harrow GAL-K, GAL-K HD



Revision VI
Gliwice 2025

TŁUMACZENIE INSTRUKCJI ORYGINALNEJ
ENG

EC DECLARATION OF CONFORMITY

FOR THE MACHINE

Pursuant to the Ordinance of the Minister of Economy of 21 October 2008 (Journal of Laws No. 199, item 1228) and the Directive of the European Union 2006/42/EC of 17 May 2006

MANDAM Sp. z o.o.
ul. Toruńska 14
44 -100 Gliwice
declares with full responsibility that the machine:

DISC HARROW GAL-K, GAL-K HD
type/model: .....
year of production: .....
Factory No.: .....

under this declaration, complies with:

Ordinance of the Ministry of Economy of October 21, 2008 on the essential requirements for machines (Journal of Laws No. 199, item 1228) and the Directive of the European Union 2006/42/EC of 17 May 2006

Persons responsible for the technical documentation of the machine: Jarosław Kudlek, Łukasz Jakus
ul. Toruńska 14, 44-100 Gliwice

The following standards were also used to assess compliance:

PN-EN ISO 13857:2010,
PN-EN ISO 4254-1:2016-02,
PN-EN ISO 12100-1:2005/A1:2012
PN-EN ISO 12100-2:2005/A1:2012
PN-EN 982+A1:2008

This EC Declaration of Conformity loses its validity, if the machine is modified or converted without the manufacturer's consent.

Prezes Zarządu
Dyrektor
inż. Bronisław Jakus

V-ce Prezes Zarządu
Dyrektor ds. Techniczno-Organizacyjnych
mgr inż. Józef Seidel

....
Place and date of issue *Surname, first name, position and signature of the authorized person*

Contents

1 Introduction

Congratulations on your purchase of the GAL-K / GAL-K HD disc harrow. This manual provides information on the hazards that may occur when using the roller, technical data and the most important indications and recommendations, the knowledge and application of which are prerequisites for correct operation.

As used in the manual, the terms left, right and rear and front of the unit refer to the orientation of the observer facing the direction of travel. By following the recommendations in the following instructions, you will ensure long-term, trouble-free operation and reduce the cost of exploring the unit. Each of the following chapters discusses the relevant issues in detail. Keep this manual for future use.

If there is incomprehensible information in the instructions, or if the user of the machine has encountered an issue not addressed in the instructions, he/she can obtain comprehensive explanations by writing to the manufacturer's address - in which case the following should be included: the exact address of the purchaser of the machine, the machine symbol, the serial number, the year of manufacture, the year and issue number of the operating instructions.

- Notes that are important for safety reasons are marked with the sign:

With the welfare of our customers in mind, we are constantly improving our products and adapting our offerings to their needs. We therefore reserve the right to make changes to the products without notice.

Machine identification

The identification data of the GAL-K and GAL-K HD disc harrows can be found on a rating plate on the drawbar. The rating plate contains basic information about the manufacturer and the machine, as well as the CE mark.

Figure 1 Rating plate

The guarantee for GAL-K / GAL-K HD is valid for 24 months from the date of sale.

- The warranty card is an integral part of the machine.
- Please always quote the serial number when making enquiries about spare parts.
- Information on spare parts can be found:

http://mandam.com.pl/parts/

+48 668 662 289

parts@mandam.com.pl

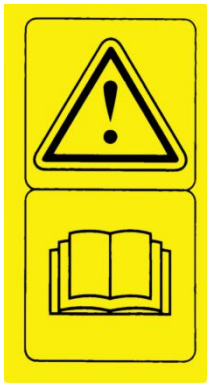
- authorised distributors of machines from Mandam Sp. z o. o.

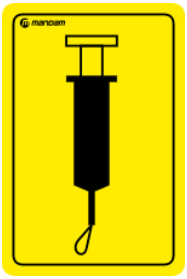
1.1. Information and warning signs

Remember! When using the disc harrow, special care should be taken in areas marked with special information and warning signs (yellow stickers).

- The safety signs and inscriptions on the machine are listed below. They should be protected against loss and loss of legibility, if lost and/or illegible they should be replaced with new ones.

Table 1. Information and warning signs.

Safety signs	*Meaning of the safety sign*
	Read the operating instructions before use.
	Crushing of the toes or foot.

Safety signs	*Meaning of the safety sign*
	Keep a safe distance from foldable and moving parts of the machine
	Do not reach into the crushing area if parts may move
	Pressurised liquid jet - bodily harm
	Fixing point for transport belts
	Lubrication point

Safety signs	*Meaning of the safety sign*
	Designation of hydraulic system couplings
	Note about riding ban on rollers
	Opening sequence of a machine equipped with a hydraulic wing lock
	5-year warranty on maintenance-free bearings

2 General information

2.1. Construction of the GAL-K and GAL-K-HD disc harrows

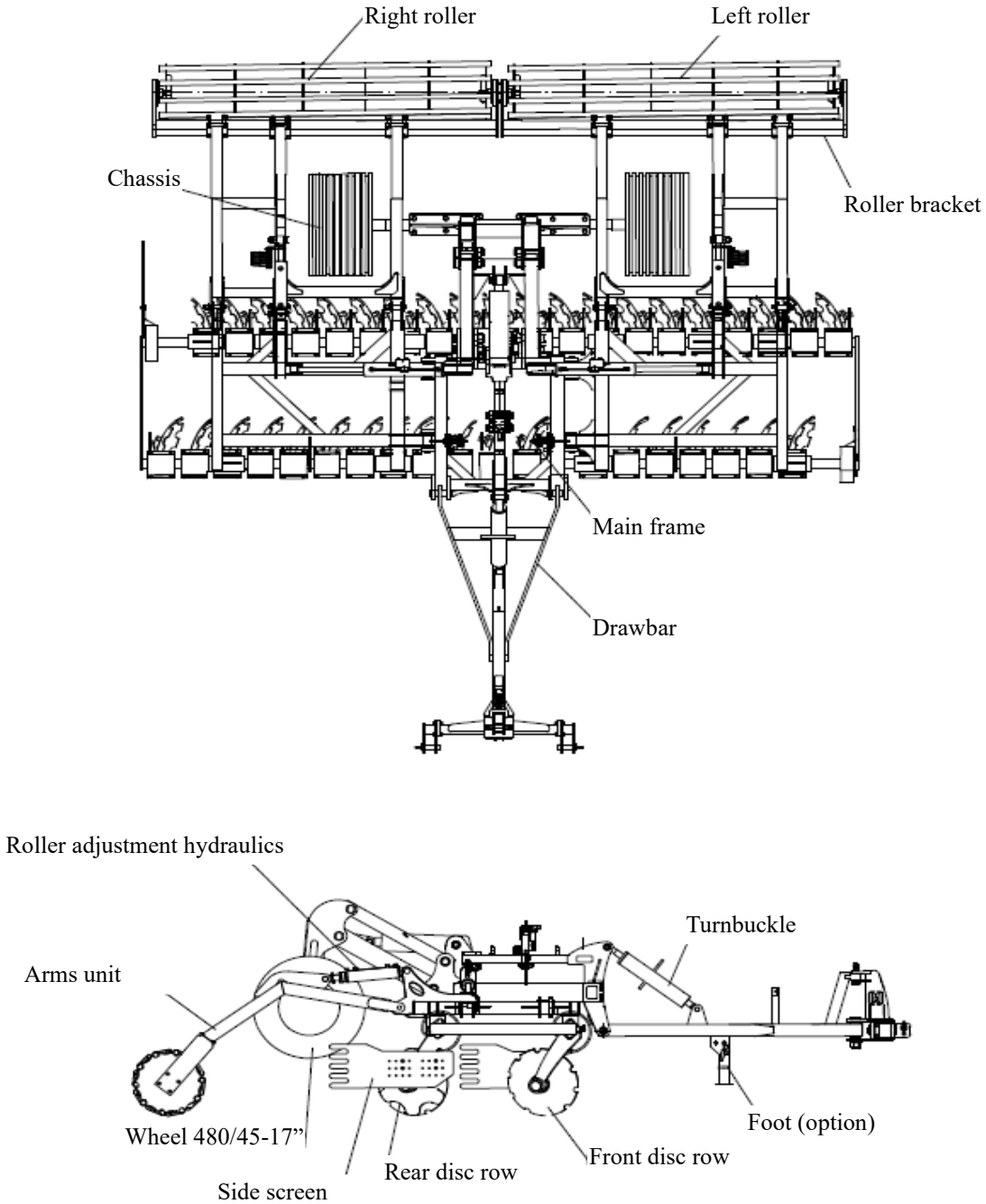


Figure 2 GAL-K disc harrow.

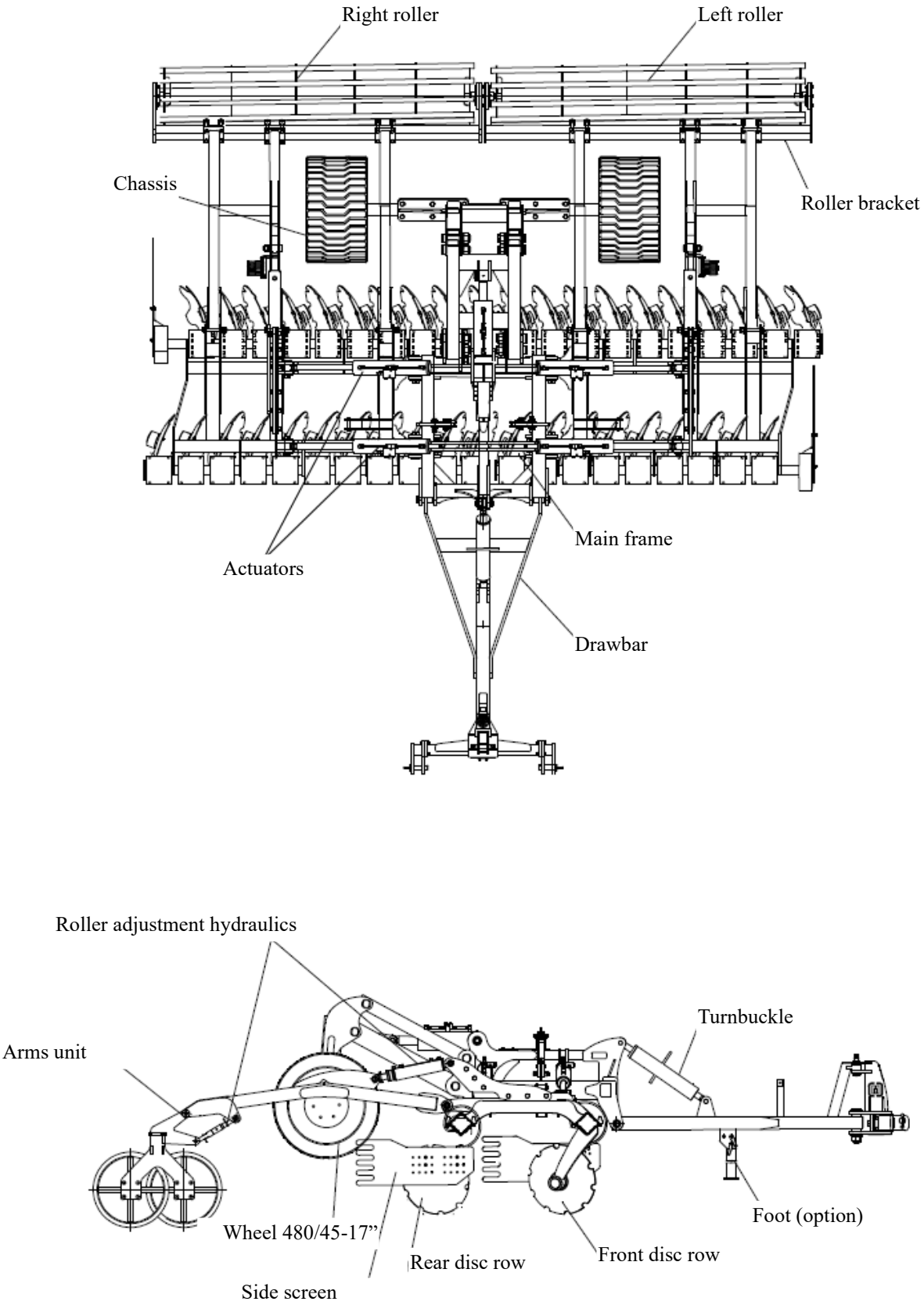


Figure 3 GAL-K HD disc harrow.

Table 2. Types of disc harrow GAL-K

Type of harrow	Working width [m]	Diameter of toothed discs [mm]	Number of discs [pcs.]	Min. tractor power [HP]	Wheel sizes	Weight [kg]
GAL-K 4.0H	4	560	32	150	480/45-17”	3508
GAL-K 5.0H	5	560	40	180	480/45-17”	3963
GAL-K 6.0H	6	560	48	200	480/45-17”	4461
GAL-K 8.0H	8	560	64	220	620/40-22.5”	5576
GAL-K 10.0H	10	560	80	380	620/40-22.5”	8683
GAL-K 12.0H	12	560	96	420	620/40-22.5”	9200

Table 3. Types of disc harrow GAL-K HD

Type of harrow	Working width [m]	Diameter of toothed discs [mm]	Number of discs [pcs.]	Min. tractor power [HP]	Wheel sizes	Weight [kg]
GAL-K 4.0H HD	4	560	32	160	480/45-17”	3699
GAL-K 5.0H HD	5	560	40	180	480/45-17”	4000
GAL-K 6.0H HD	6	560	48	200	480/45-17”	4400

2.2. Intended use of the GAL-K and GAL-K HD disc harrows

The disc harrow is designed for post-harvest cultivation (with chopped straw) and pre-sowing in both ploughing and ploughless technology. The unit can also be used to mix catch crops into the soil.

The working elements are toothed discs of diameter Ø560 mm in two staggered rows mounted on maintenance-free bearings. Equipping each disc with its own bearing allows the disc to be optimally inclined to the direction of travel and the ground. This allows the stubble to be thoroughly undercut, and harvest residues to be evenly mixed and broken up. As a result, soil evaporation is interrupted, plant residues decompose more quickly and there is a reduction in the intensity of phenolic compounds negatively affecting the development of succeeding plants. The toothing of the discs aids penetration. The roller located at the rear of the machine compacts the soil, resulting in faster emergence of weeds and volunteer seeds. The use of a disc harrow before sowing ensures thorough mixing of fertiliser into the soil, levelling of the surface and proper soil structure.

The GAL-K HD version of the disc harrow has a double hydraulic actuator system for folding the machine wings as standard.

An optional drawbar-mounted support foot is available to ensure horizontal positioning of the harrow during storage or maintenance work.

The GAL-K units are equipped with their own chassis with a braked axle. A pneumatic system is used for this purpose.

NOTE! MANDAM sp. z o. o. provides a 5-year guarantee on maintenance-free hubs under the following conditions:
- comply with the rule of replacing the working discs in the event of wear, which must not exceed 490mm in diameter for discs Ø560mm and 550mm for discs Ø610mm,
- use the original MANDAM plates,
- do not exceed the permissible working depth, which is 12cm for discs Ø560mm and 15cm for discs Ø610mm,
- observe the rule prohibiting the turning manoeuvre with the harrow when it is in the working position (working discs buried in the soil).

NOTE! The disc harrow is designed exclusively for agricultural use. Use for any other purpose will be construed as misuse and will void the warranty. Failure to comply with the recommendations in these operating instructions will also be construed as misuse.

NOTE! The manufacturer is not liable for damage resulting from the operation of the machine not in accordance with its intended use.

3 General safety rules

The disc harrow may only be started up, used and repaired by persons who are familiar with its operation and the associated tractor and with the rules of conduct for the safe operation and handling of the disc harrow.

The manufacturer is not responsible for arbitrary changes to the harrow design. During the warranty period, only factory-made "MANDAM" parts must be used.
The disc harrow should be operated with all precautions in mind, in particular:

- before each start-up, check that the disc harrow and the tractor are in safe working order,
- use of the machine by minors, persons who are ill or under the influence of alcohol or other intoxicants is prohibited,
- use work clothes, footwear and gloves when carrying out maintenance work,
- permissible axle loads and transport dimensions must not be exceeded,
- use only original safety and split pins,
- do not approach the disc harrow while it is being raised or lowered,
- it is not permitted to stay between the tractor and the disc harrow when the engine is running,
- when moving the disc harrow, lift and lower it slowly and gently without sudden jerks, taking care not to allow any bystanders to be in the vicinity,
- it is forbidden to reverse the tractor or make a U-turn with the machine lowered into the working position,

- the tractor's independent brakes must not be applied during turning,
- do not stand on the machine or put any additional weight on it during operation or transport,
- during u-turns, special care should be taken if there are bystanders in the vicinity,
- disc harrows must not be operated on gradients greater than 12°,
- carry out any repairs, lubrication or cleaning of working parts only with the engine switched off and the machine lowered and unfolded,
- during maintenance and when replacing parts, going inside or underneath the machine without adequate protection can cause head injuries - a helmet should be used in this case.
- when not in use, lower the machine to the ground and stop the tractor engine,
- harrows with a working width greater than 3.00 m are fitted with a mechanical lock to prevent the wings from opening uncontrolled when stationary and during road transport,
- driving and parking the unit next to a slope with unstable ground may cause a landslide,
- machinery must be stored in such a way as to prevent injury to people and animals,

3.1. Proper coupling and uncoupling with the tractor

- The attachment of the machine to the tractor must be made as specified, remembering to secure the pins and to secure the suspension pins with split pins.
- When coupling the tractor to the disc harrow, it is forbidden for people to stay between the machine and the tractor during this time.
- The tractor working with the disc harrow must be fully operational. It is forbidden to couple the harrow with a tractor with defective pneumatic (if the machine has a braked axle) and hydraulic systems.
- Make sure that the tractor with the attached unit is stable, and the tractor steerability and stopping power can be maintained. The load on the front axle cannot drop below 20% of the total load on the tractor axle – set of front-mounted weights.
- In the resting position, the machine, when uncoupled from the tractor, should maintain a stable equilibrium.
- The support foot should be rested on a stable surface. It is forbidden to use foot pads that may cause instability of the support.

3.2. Tyres

- Tyre pressures must not exceed those recommended by the manufacturer and it is forbidden to transport the machine at too low a pressure. This may damage the machine and cause an accident on large uneven surfaces and when driving too fast.
- Significantly damaged tyres (particularly profile damage) must be replaced immediately.
- When replacing tyres, the machine must be secured against rolling.

- Repair work on wheels or tyres should be carried out by persons trained and authorised for this purpose. This work should be carried out with appropriately selected tools.

Each time the wheels are fitted, the tightness of the nuts should be checked after 50km.

3.3. Hydraulic and pneumatic system

The hydraulic and pneumatic system is under high pressure. All precautions should be taken, in particular:

- do not connect or disconnect the hydraulic lines when the tractor's hydraulic system is under pressure (hydraulics set to neutral),
- regularly check the condition of the connections and the hydraulic and pneumatic hoses.
- the unit must be taken out of service while the hydraulic or pneumatic failure is being rectified.

3.4. Noise and vibrations

- When the machine is in operation, there is no noise hazard to the operator contributing to hearing loss, as it is a passive tool and the operator's workplace is in the tractor cab. It should be added that the noise caused by the unit's operation does not exceed 70dB.

- Operator hazards caused by vibration do not occur during operation of the unit. This is because the operator's workstation is located in the tractor cab and the seat is cushioned.

- In very dry conditions, very heavy dusting can occur. In such cases, it is recommended that the doors and windows of the tractor remain closed. In extreme conditions, a dust mask is recommended.

3.5. Compliance with standards

Our unit has been designed and manufactured in accordance with the safety standards of the engineering industry in force on the day the unit was launched. In particular, the following legislation and standards have been taken into account:

- Machine directive 2006/42/EC,
- EN ISO 13857:2010 'Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs'.
- Standard EN ISO 4254-1:2016-02 "Agricultural machinery -- Safety -- Part 1: General requirements.
- EN ISO 12100-1:2005/A1:2012 "Safety of machinery -- Basic concepts, general principles for design -- Part 1: Basic terminology, methodology"
- Standard PN-EN ISO 12100-2:2005/A1:2012 " Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles "

- EN 982+A1:2008 standard "Safety of machinery -- Safety requirements for hydraulic and pneumatic systems and their components -- Hydraulics".
- EU commission delegated regulation 167/2023

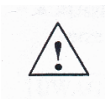
3.6. Safety regarding transport on public roads

For transport, the side sections of the disc harrow must be folded into the transport position using the hydraulic system. Before folding, the machine must be raised to the extent that the side sections do not interfere with the ground during folding. To do this, the wheels of the cultivator must be lowered to the point where the working sections do not interfere with the ground during folding.

The side frames of the disc harrow should be secured against unfolding with a hydraulic HBS folding lock.

- **During transport, the clearance under the machine should be at least 30 cm**

When transporting the unit on public roads, the use of a luminous device, a distinguishing sign and side reflectors is mandatory.



WARNING! It is stipulated that it is against the highway code to drive on public roads without an approval certificate. The travel can take place under the responsibility of the user or with individual approval.

The travelling speed during transport must not be exceeded:
- on roads with a smooth surface (asphalt) up to 15 km/h,
- on dirt or paved roads 6-10 km/h,
- on bumpy roads not more than 5 km/h.

The driving speed must be adapted to the condition of the road and the conditions on the road to ensure that the unit does not jump up on the tractor's linkage and that there are no excessive loads on the frame of the machine and the linkage of the tractor.

Particular care should be taken when passing and overtaking and on bends. The permissible width of the machine running on public roads is 3.0 m.

- It is forbidden to transport the unit where the slope transverse to the unit exceeds 7°.

WARNING! Failure to comply with the above rules may create hazards for the operator and bystanders as well as damage to the machine. Damage resulting from non-compliance with these rules is the responsibility of the user.

3.7. Description of residual risk

MANDAM Sp. z o.o. makes every effort to eliminate the risk of accidents. There is a residual risk that could result in an unfortunate accident. The greatest danger occurs when:

- using the machine for purposes other than those described in the instructions,
- using the machine by minors, persons who are not authorised, who are ill or who are under influence of alcohol or other drugs,
- persons and animals are within the operating range of the machine are present,
- no caution is paid when transporting and manoeuvring the tractor,
- staying on the machine or between the machine and the tractor while the engine is running,
- during operation and failure to comply with operating instructions,
- driving on public roads.

3.8. Assessment of residual risk

Residual risk can be minimised by applying the following recommendations:

- prudent and unhurried operation of the machine,
- careful reading of operating instructions,
- keeping a safe distance from danger zones,
- prohibition on being on the machine and in the operating area of the machine while the tractor engine is running,
- carrying out maintenance work in accordance with safety rules,
- use of protective clothing and, if working under machinery, a helmet,
- prevention of unauthorised access to the machines, especially by children.

4 Information on handling and use

Before starting the machine for the first time:

- refer to the operating instructions,
- make sure the machine is in good working order,
- check the condition of the hydraulic and pneumatic systems (replace components if damaged, e.g. pressure lines),
- make sure that the machine's pressure hose couplings fit into the sockets on the tractor,
- check the tightness of the individual bolts and nuts,
- check the air pressure in the wheels in accordance with the manufacturer's recommendations,
- ensure that all components requiring lubrication are lubricated,
- ensure that the pressure in the tractor wheels is the same on each axle to ensure even operation.

NOTE! The permissible axle loads and tyre load capacities must not be exceeded. The front axle load must not be less than 20%.

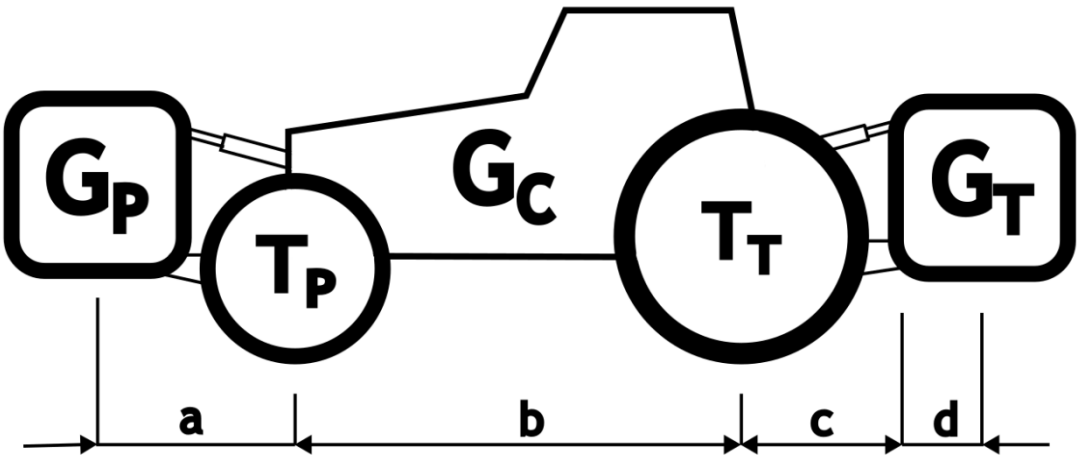


Figure 4 Diagram of tractor load designations

Minimum load at the front for rear-mounted machine:

$$G_{P\,min}=\frac{G_T\cdot(c+d)-T_P\cdot b+0{,}2\cdot G_C\cdot b}{a+b}$$

Actual front axle load

$$T_{P\,cal}=\frac{G_P\cdot(a+b)+T_P\cdot b-G_T\cdot(c+d)}{b}$$

Actual total weight

$$G_{cal}=G_P+G_C+G_T$$

Actual rear axle load

$$T_{T\,cal}=G_{cal}-T_{P\,cal}$$

Designations:

G_C – tractor dead weight,

T_P– front axle load of the empty tractor,

T_T – rear axle load of the empty tractor,

G_P – total weight of front-mounted device,

G_T – total weight of rear-mounted device,

a – distance between the centre of gravity of the front-mounted device and the centre of the axle,

b – tractor wheel track,

c – distance between the centre of the rear axle and the centre of the hitch bolt of the rear device,

d - distance of the machine's centre of gravity from the tractor's hitching pins (suspended machine - assume 1.4 m, semi-mounted machine - assume 3 m and 0.6 weight),

x – distance of the centre of gravity from the rear axle (if the manufacturer does not specify this parameter, enter 0.45).

4.1. Preparing the disc harrow

The disc harrow is usually supplied ready for sale. Due to the limitations of transport facilities, it is also possible to deliver it in a partially dismantled state - this usually involves disconnecting the roller.

When the unit is first prepared for operation, its components (roller) must be assembled. To do this, place the disc harrow on flat paved ground in a position that allows the roller to manoeuvre. A lifting device with a lifting capacity of at least 500 kg w (700 kg in the case of a rubber roller) must be used to transport the roller for reasons of stability during transport. Position the arms in the harrow brackets and connect the arms to the roller bracket with screws (fig 5).

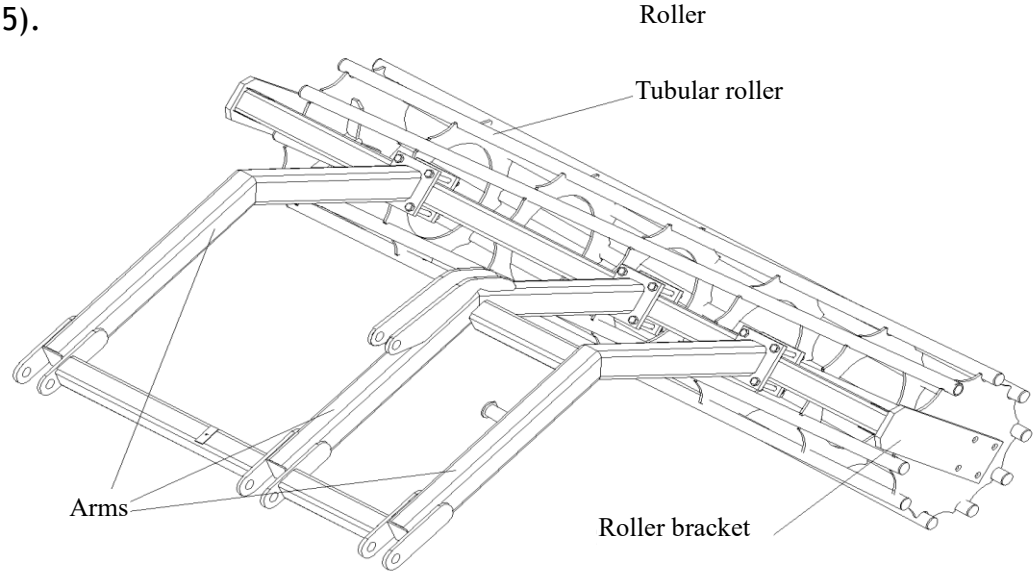


Figure 5 Connection of the arms to the roller bracket.

Before starting the work, check the condition of the disc harrow, especially the condition of the working parts and bolted connections.

NOTE! The correct procedure for mounting the rollers in the arm holders requires that the bolts be evenly tightened diagonally, so that the entire plane of the arm holders is adjacent to the plane of the roller clamp profile. This provides the most secure way of connecting the roller arms to the machine!

4.2. Coupling the harrow to the tractor

The tractor wheel tyre pressure should be in accordance with the manufacturer's recommendations. The lower links of the three-point hitch should be at an equal height, at a spacing corresponding to the spacing of the lower suspension points. When connecting the disc harrow to the tractor, the harrow should stand on firm and level ground.

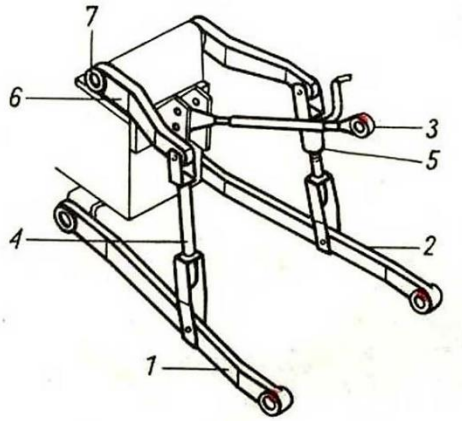


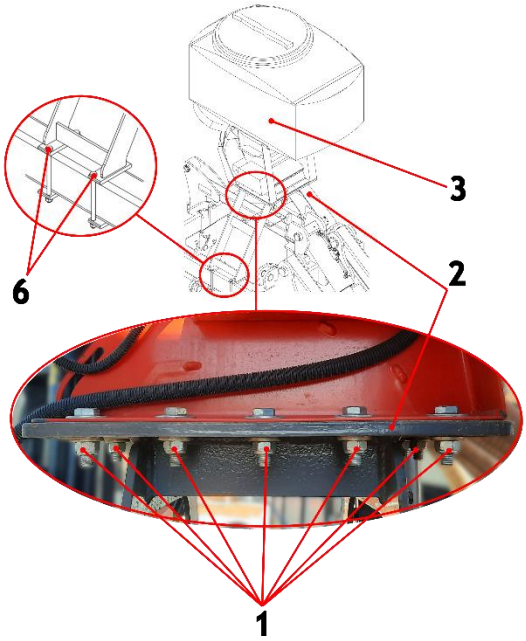
Figure 6 Three-point linkage of the tractor: 1,2 - lower links, 3 - upper fastener, 4 - left suspension, 5 - right suspension with adjustable length, 6 - lift arm, 7 - lift roller

When connecting the semi-mounted unit to the tractor, perform the following steps:

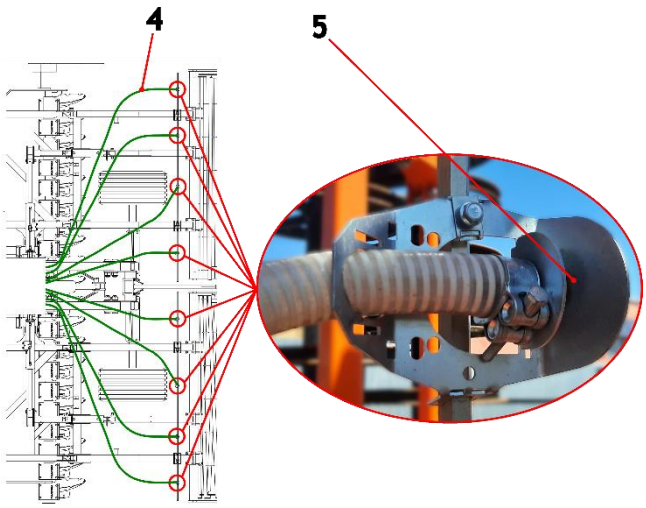
1) Check the pressure in the wheels on one axle of the tractor, it must be the same to ensure an even working depth of the unit
2) Switch the tractor hydraulic system to position control
3) Back the tractor to a distance that allows the connection drawbar with lower links of the tractor
4) Secure the drawbar with pins and cotter pins
5) Connect the electrical cables (if lighting is an option) and check their correct operation
6) Connect the hydraulic cables and check their tightness
7) If the unit has a support foot, it should be raised and secure
8) Raise the unit and check whether the tractor maintains full controllability

Any tractor that is used with the machine must be equipped with a set of weights and must remain steerable during transport, i.e. a minimum of 20% of the tractor's weight must be on the front axle.

4.3. Installation the seed drill to the disc harrow



Seeder installation on the Mandam machie



Dispersion plates (5) and hoses alignment (4)

Figure 7 The left shows the installation of the seeder on the frame, the right shows the hose routing and the location of the dispersion plates (1 - mounting screws, 2 - seeder mounting frame, 3 - APV seeder, 4 - hoses, 5 - dispersion plate, 6 - screws for securing the frame to the frame)

APV seeder installation guide (Fig. 7):

1) Mount the APV seeder mounting frame (item 2) on the machine by screwing it to the frame using flat bars and screws (item 6),
2) using a lifting device position the seeder (item 3) on the seeder mount (item 2)
3) Mount the seeder (item 3) using screws and nuts (item 1) on the machine frame
4) Route the hoses (item 4) from the hopper to dispersion plates
5) Attach the hoses to the dispersion plates (item 5)

4.4. Operation and adjustment

4.4.1 Automatic machine wing lock

On machines with folding sections, an automatic wing lock is available that requires no additional operation. The lock uses a mechanism consisting of an actuator and a hook (Figure 8).

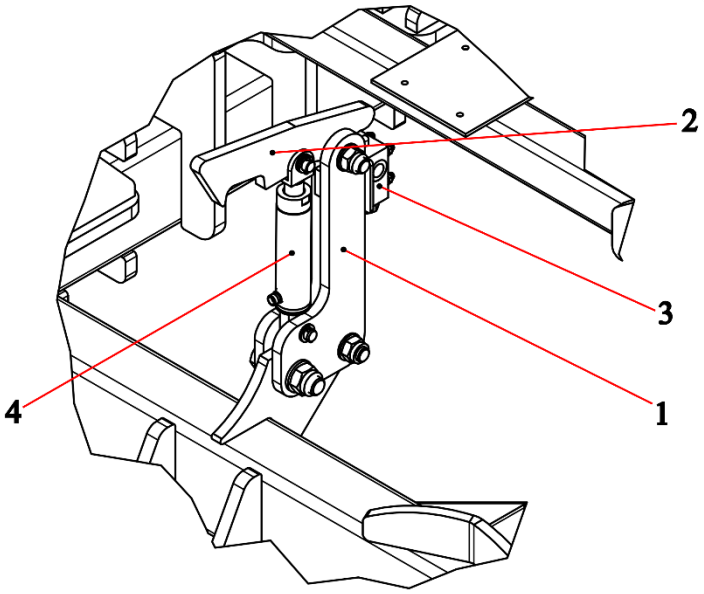


Figure 8 Main frame with automatic wing locking mechanism (1 - sheet metal of automatic locking assembly, 2 - hook of mechanism, 3 - limit valve, 4 - actuator)

4.4.2 Machine opening sequence

Before unfolding the folding wings of the machine, it is important to familiarise yourself with the opening sequence that allows you to do this correctly.

1. The machine must be raised as much as possible to enable it to be folded correctly, avoiding the risk of the folding arms catching on the ground during movement (fig. 9).

2. The next step is to hydraulically fold the wings of the machine into the 'closed' position, the purpose of which is to ensure that the wing lock mechanism unlocks and allows the machine arms to be opened at a later stage. This operation is necessary every time the arms of the unit are opened (fig. 9).

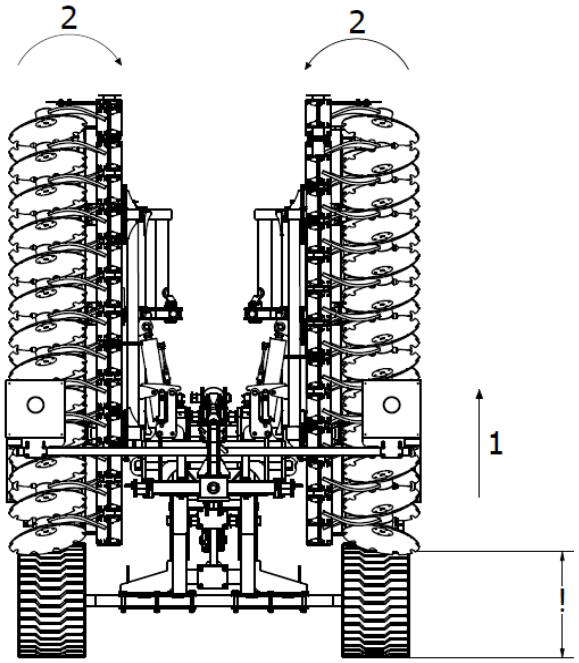


Figure 9 Machine opening sequence: 1- lift the machine up to its maximum, 2- fold the machine wings into the "closed" position.

3. Once you have ensured that the hook of the hydraulic wing lock mechanism will allow the machine wings to be unlocked, you can proceed to open them fully (fig. 10).

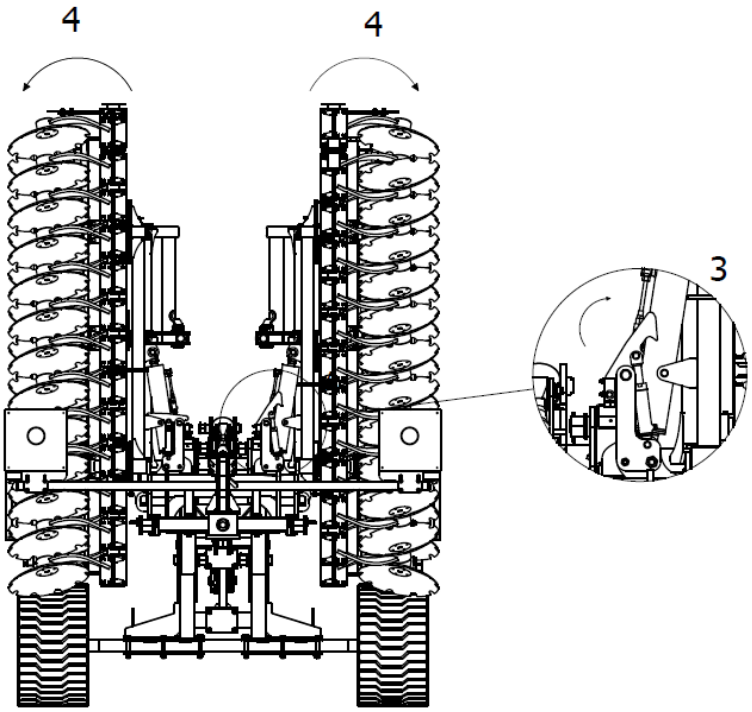


Figure 10 Machine opening sequence: 3- release the hook of the hydraulic wing lock mechanism 4- open the wings of the machine.

4. When opening the machine's wing arms, ensure that the ends of the arms are at a sufficient height to prevent them from snagging on the ground (Fig. 11a).

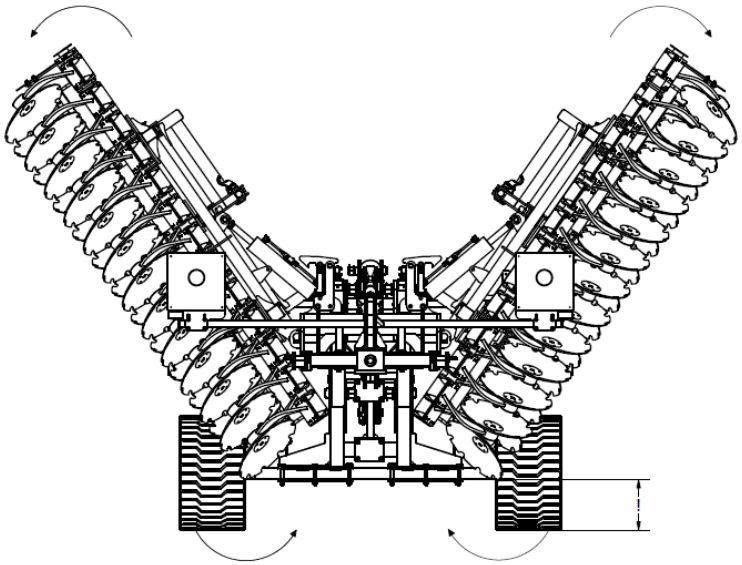


Figure 11a Machine opening sequence: opening the machine with special attention to the height of the arm ends from the ground.

5. To complete the opening sequence of the machine wings, wait until the hydraulic mechanism opens the arms to their final position. Do not interrupt the process of opening the arm wings without ensuring that they are fully open

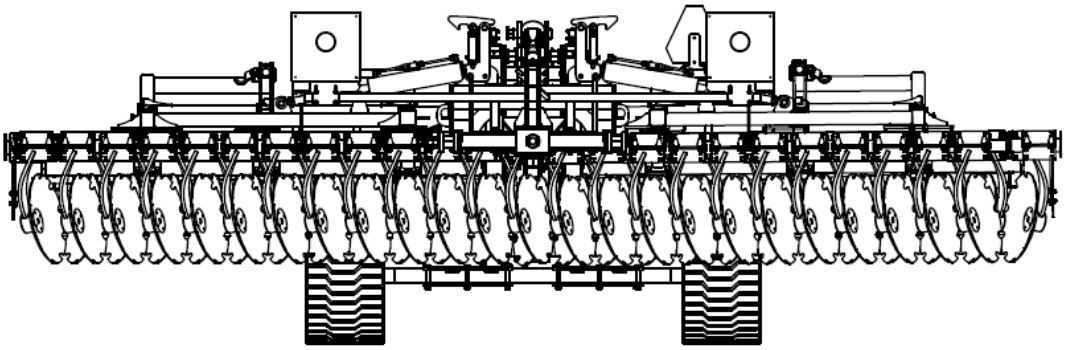


Figure 11b View of the machine at the end of the wing opening sequence. The arms of the machine are fully open.

NOTE! On machines with folding wings, clean the machine thoroughly after use so that excessive soil residues do not put additional strain on the machine wings and thus on the actuators!

4.4.3 Lowering the machine on a trolley

For all machines fitted with trolleys, when lowering the machine on a trolley with the wings folded, the following recommendations must be followed to avoid collisions between the various components that could lead to damage to the individual components.

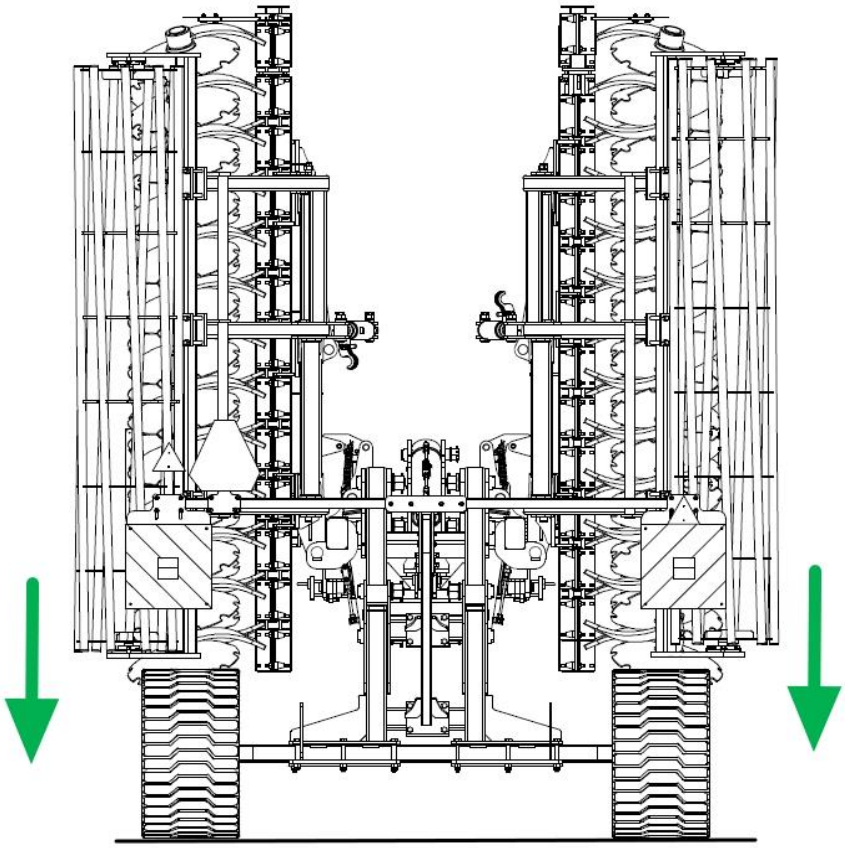


Figure 12a Lowering the machine on the trolley with the wings folded.

When lowering a folded machine on a trolley, collision of the machine arm assemblies with the trolley assembly and the ground is possible. The exposed areas due to the collision are shown in Figure 12b.

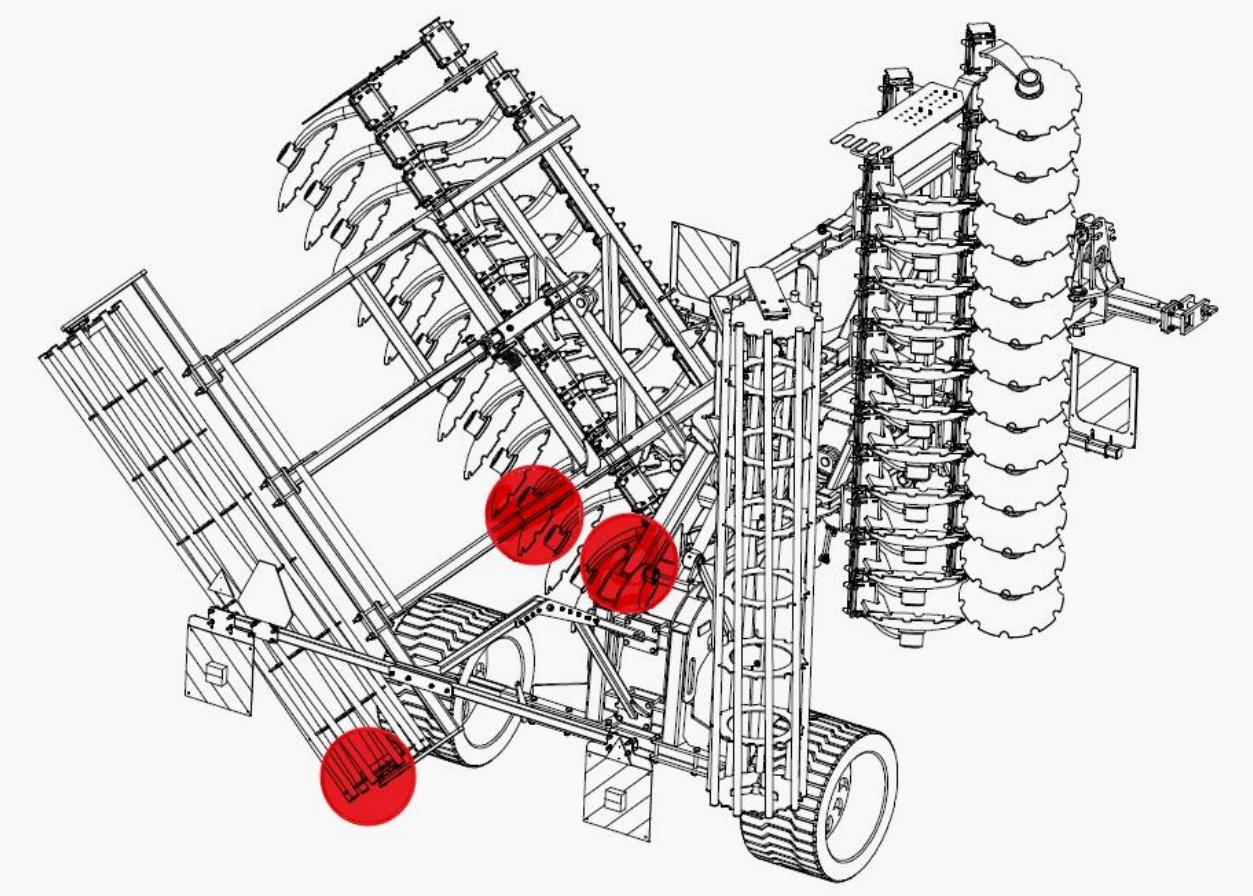
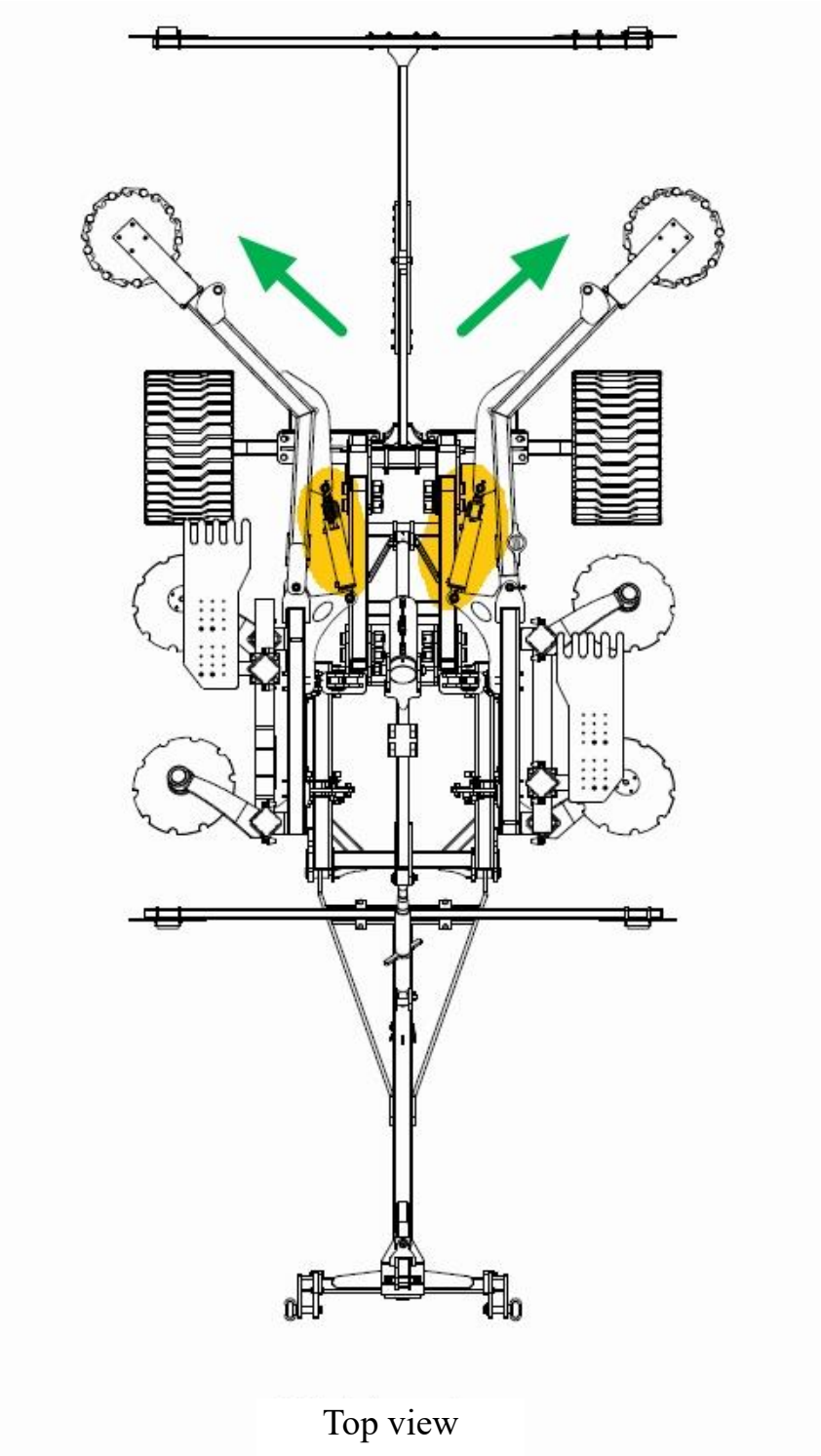


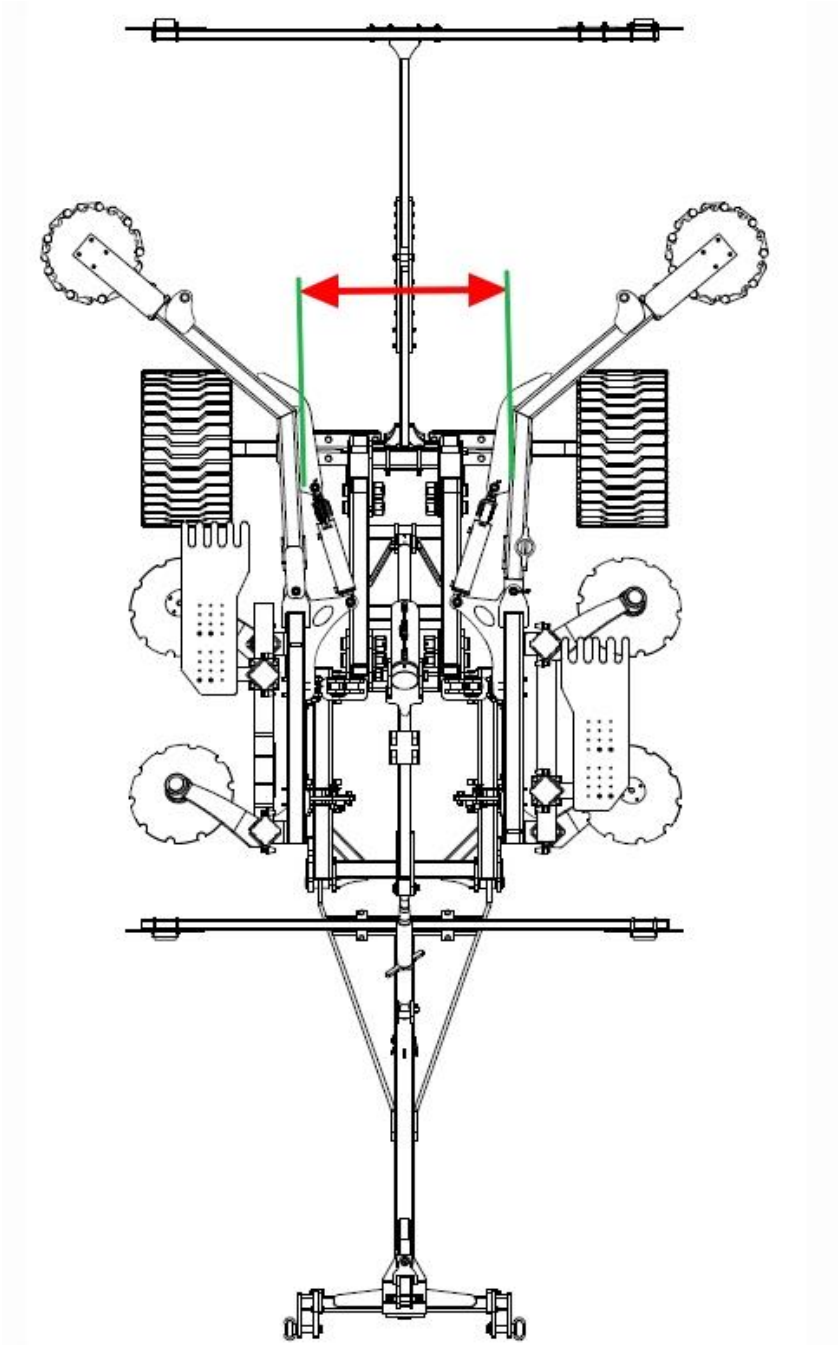
Figure 12b Lowering the machine on the trolley with the wings folded.

In order to avoid collisions between the components shown, a preliminary adjustment of the alignment of the roller arms in relation to the machine wings must be carried out. To do this, the arms with the machine rollers must be lowered by means of the hydraulic depth adjustment actuators of the machine marked in orange (Fig. 12c) until the entire machine can be lowered on the trolley without collision (Fig. 12d).



Top view

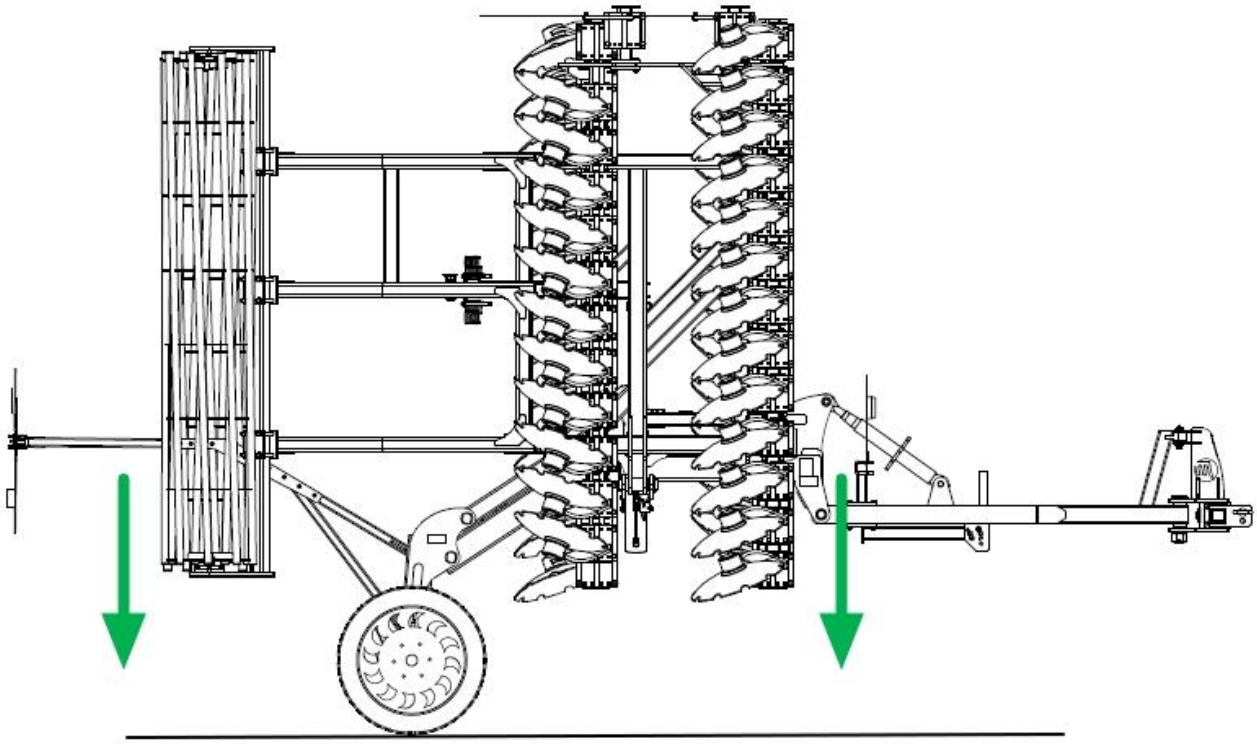
Figure 12c Extending the arms with the machine rollers to allow the machine to be lowered on the trolley without collision.



Top view

Figure 12d Achieving the correct lowering distance of the arms with the machine rollers to enable the machine to be lowered on the trolley without collision.

When adequate lowering of the machine arms with the rollers is achieved, it is possible to safely lower the machine on the roller (Fig. 12e).



Side view

Figure 12e Lowering the machine on the trolley.

4.4.4 Setting up work units

On the GAL disc harrow, the position of the individual working units must be preadjusted before starting work in the field. It is also necessary to level the machine longitudinally with the tractor's top link or drawbar turnbuckle and transversely with the right lower link hanger. The first working run should then be made to set the optimum working speed and correct the adjustment based on an assessment of the correct operation of the individual units.

Setting up the machine correctly for operation
Position the machine parallel to the ground (see fig. 13). The front drawbar must be aligned horizontally. It is forbidden to operate the machine with the drawbar at an angle!

Setting up the machine correctly for operation:

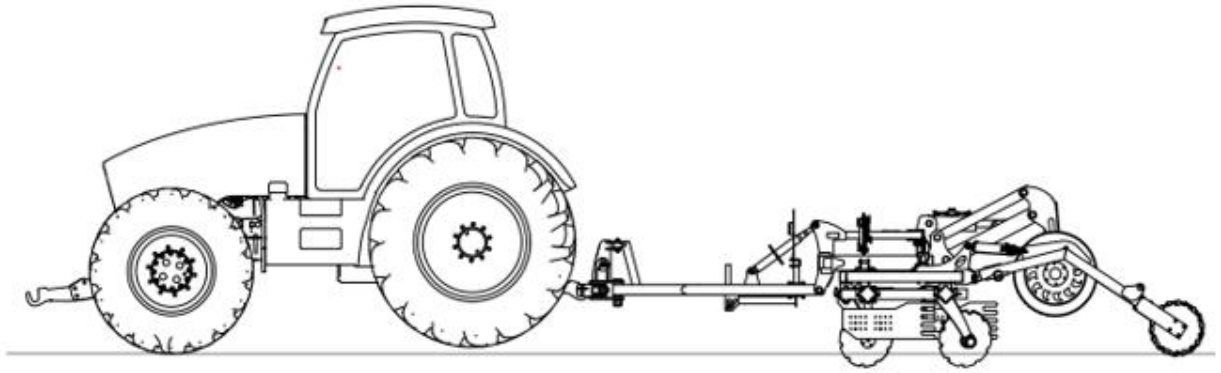


Figure 13 Properly positioned machine parallel to the ground.

Incorrect machine settings:

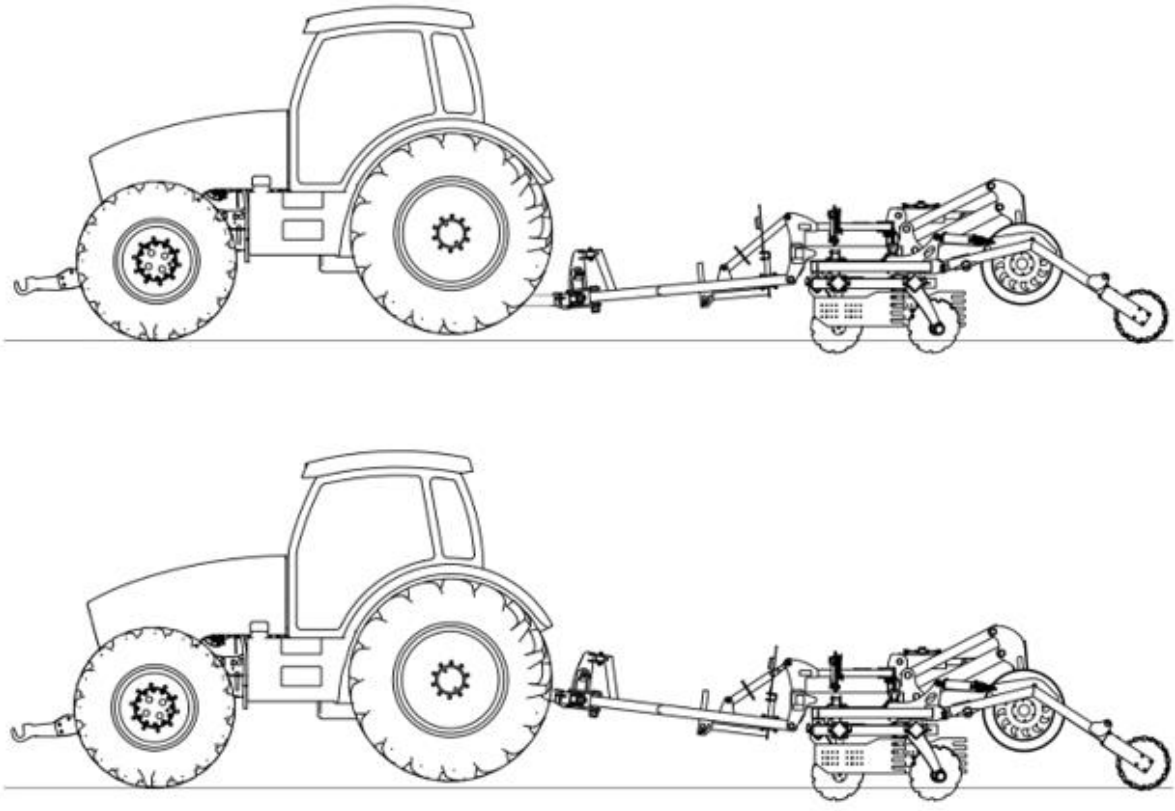


Figure 14 Incorrect settings of the machine.

Turning the machine correctly

Turning at field ends is only permitted with the machine raised on the chassis.

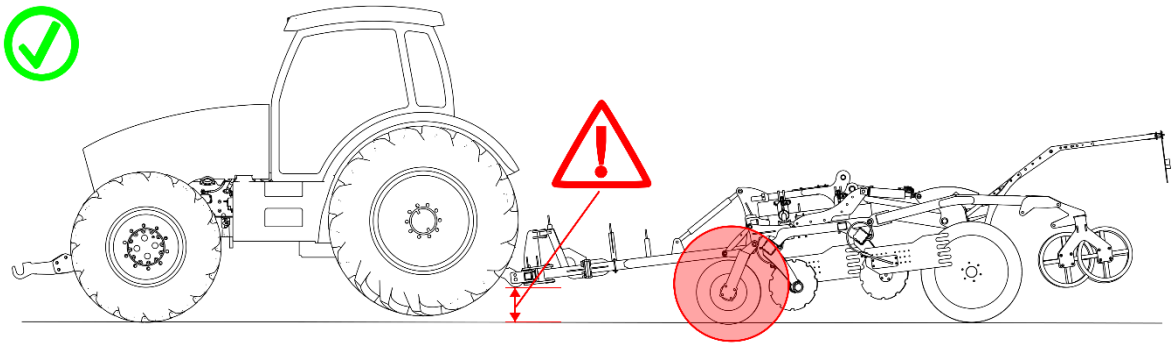


*Figure 15 Turning the machine correctly (look **WARNING !**)*

WARNING! When turning with a machine equipped with front support wheels, pay particular attention to the height of the three-point linkage arms. If the tractor's three-point linkage arms are too low, the front support wheel mount may be damaged.

- Turning with the machine buried in the soil or turning on the rollers is not permitted:

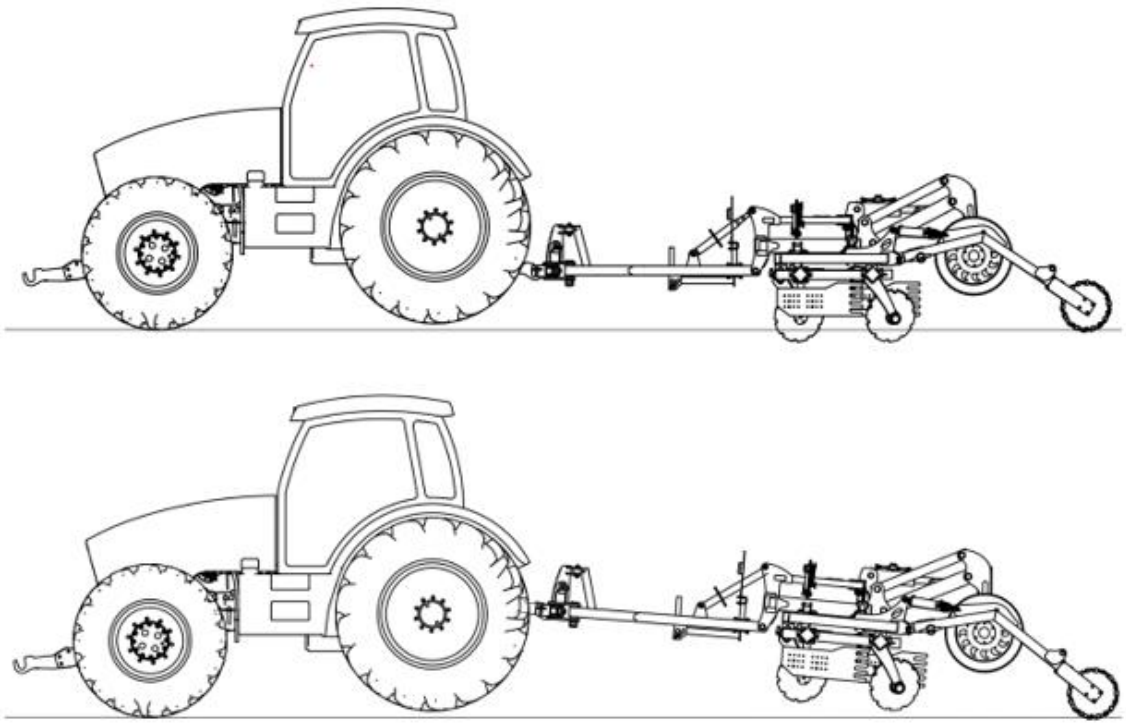


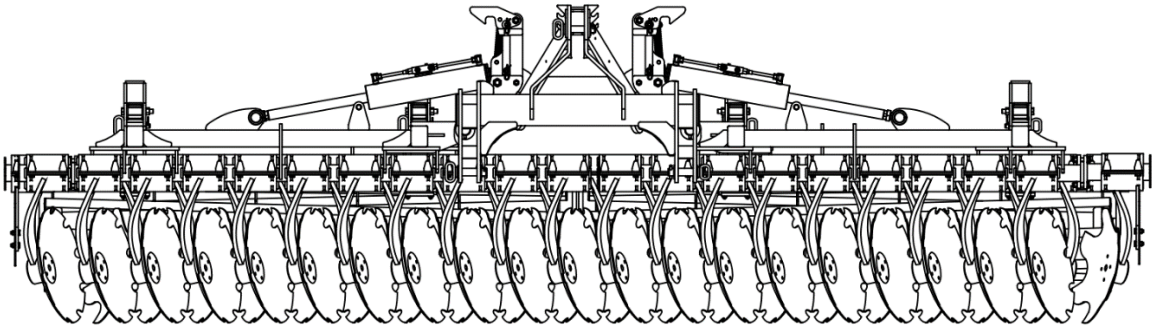
Figure 16 Incorrect turning of the machine.

When working with the machine, it is also advisable to use an additional weight on the front of the tractor to enable more stable and comfortable working.

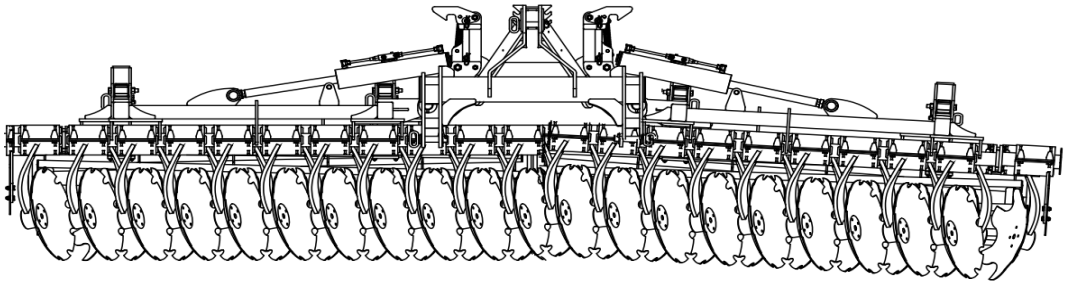
NOTE! It is forbidden to reverse with the machine penetrated in the soil!

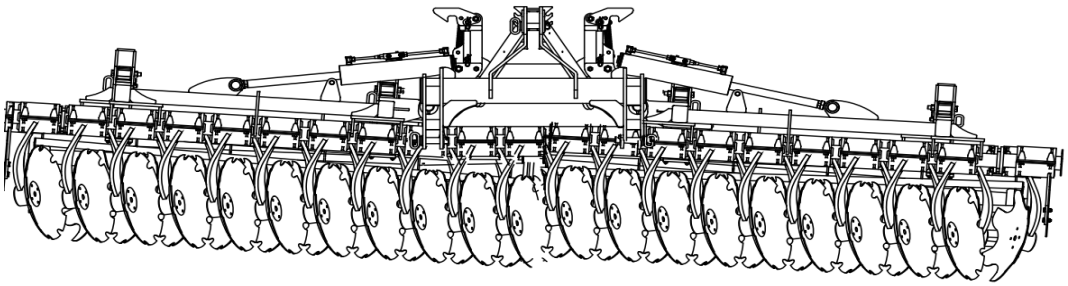
4.4.5 Levelling the machine.

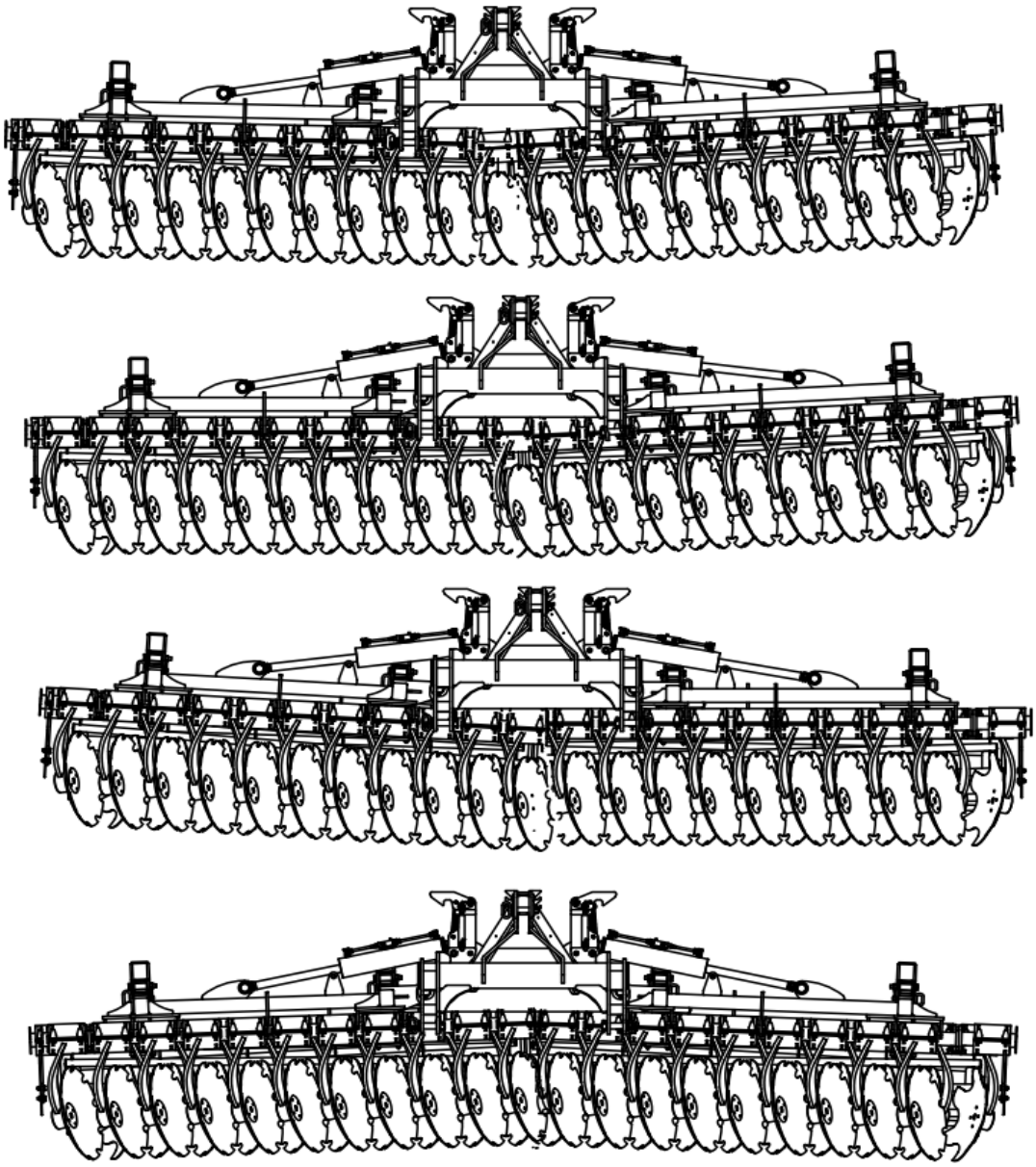
Machine levelled correctly:



Machine levelled incorrectly:







Levelling:
If you notice an abnormality in the machine's level, screw or unscrew the end of the actuator. Firstly, the lock nut is loosened with a size "50" spanner and then the actuator end is adjusted with a size "41" spanner by placing the spanner on the end of the actuator piston rod. If the side frame of the machine is "dropping" the tip should be screwed, while if the side frame is facing "up" the actuator should be unscrewed.

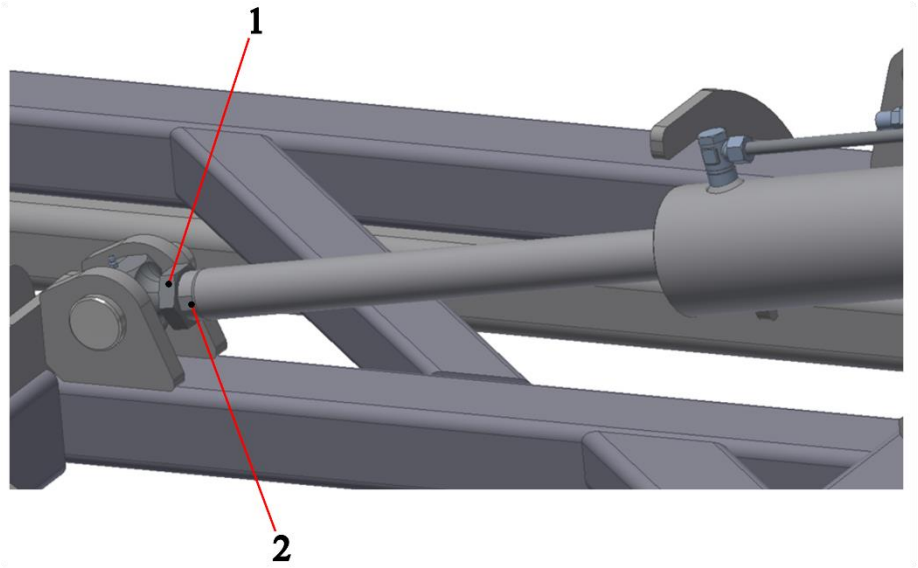


Figure 17 View of actuator with nut for levelling the machine (1 - lock nut; 2 - adjustment spot with spanner 41)

4.4.6 Setting up cultivation rollers

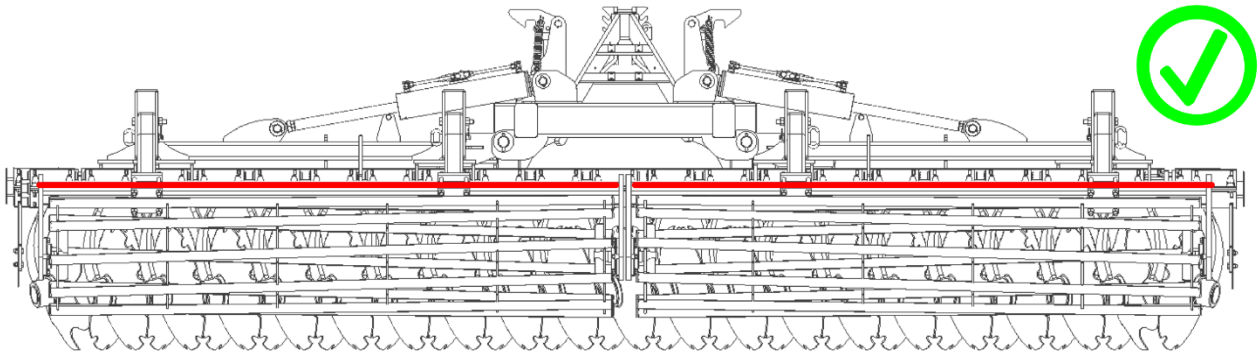


Figure 18 Correctly levelled work rollers - clamps are aligned

Rollers levelling:
Levelling of the rollers is carried out on the depth control actuator in the same way as for adjusting the side frame actuators. Unscrewing the actuator end lowers the roller, screwing in the actuator end raises the roller.

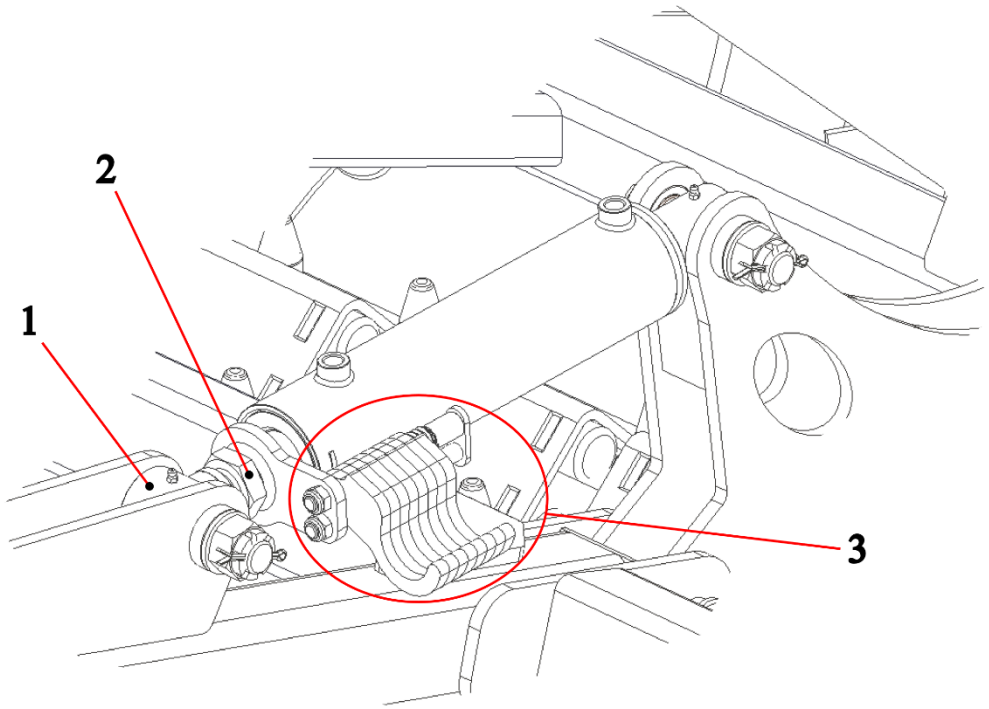


Figure 19 Adjustment of the depth control actuator (1- Actuator end (head), 2- Lock nut, 3- Actuator adjustment ratchet set)

Misalignment of rollers:

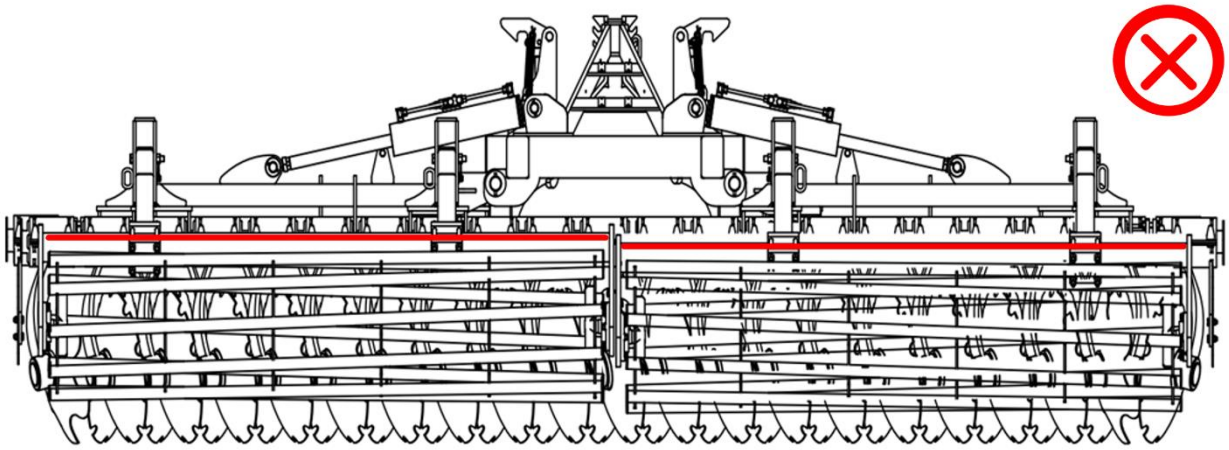
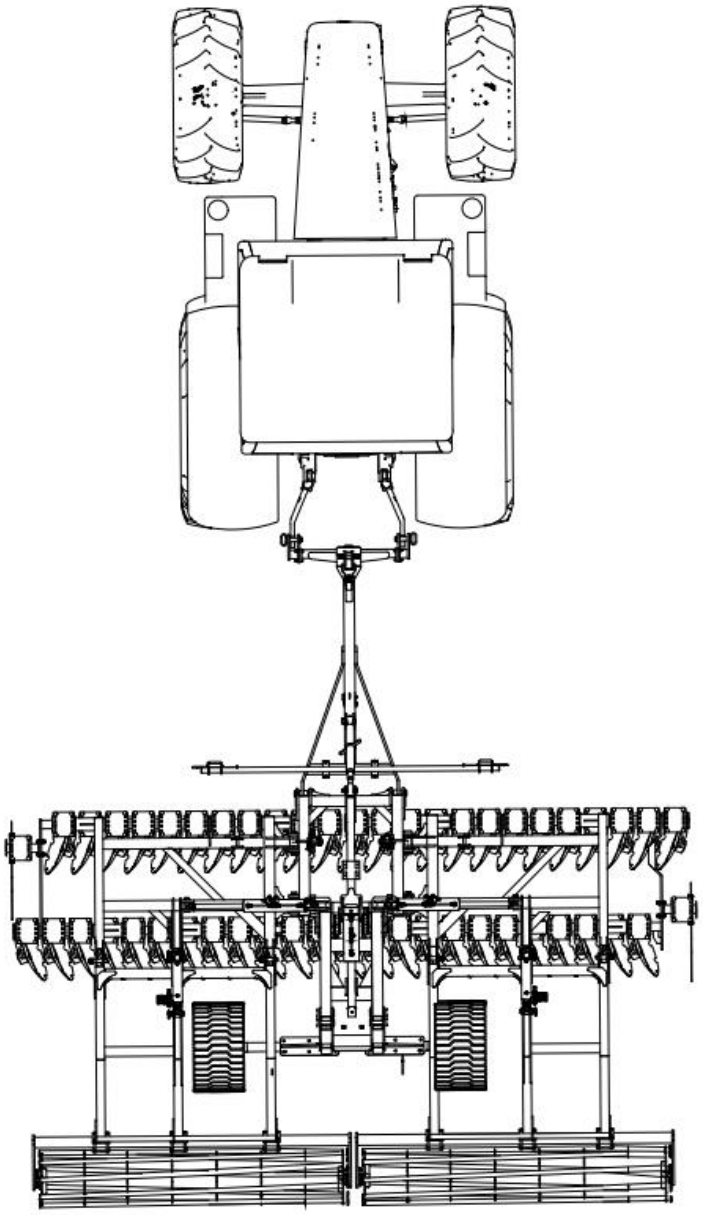


Figure 20 Incorrectly levelled work rollers - clamps not aligned

4.4.7 Irregularities during operation - pulling off the machine

Machine operating correctly:



Left side Right side

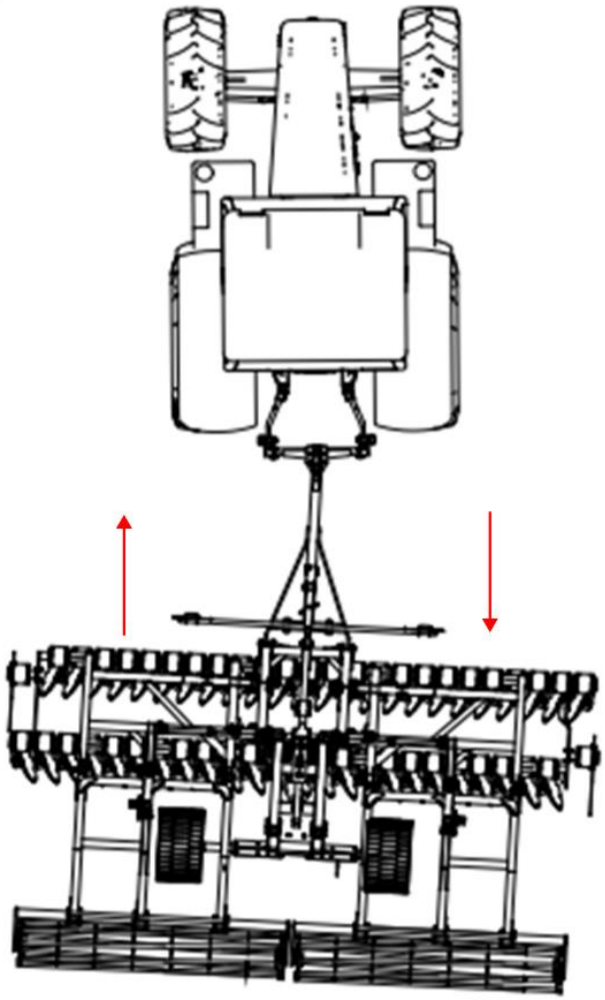
Figure 21 Properly working disc harrow

Pulling the machine to the right side:

- If there is a situation of the machine pulling to the right side, the level of the machine should be checked first. If the machine is not levelled correctly, this can occur when the left side is horizontal and the right side is facing upwards, the actuator on the right side should be rotated.

- It is also important to check that the front and back rows of discs are evenly aligned. If the front row is set too deep, the high soil resistance causes the machine to pull. The machine should then be raised on the lifting arms and the front row of discs slightly lifted.

- Check the setting up cultivation rollers: Cultivation rollers should be horizontally aligned. If the right side runs deeper and the left side runs shallower there is a pulling down of the machine.



Left side Right side

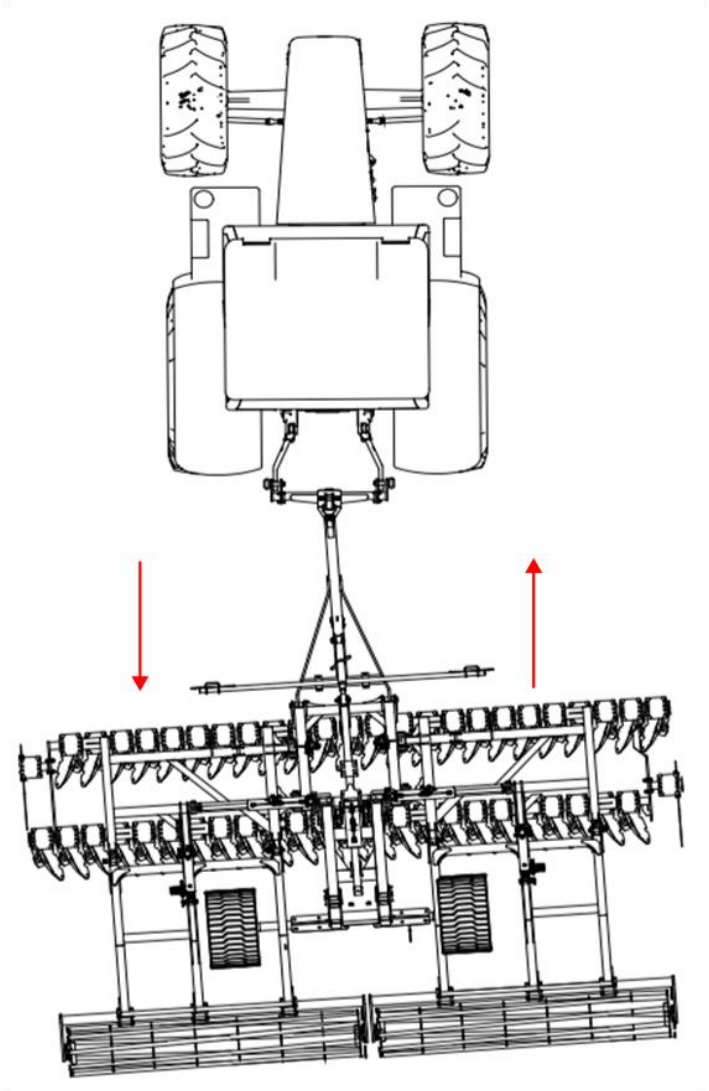
Figure 22 Pulling the incorrectly adjusted disc harrow to the right-hand side

Pulling the machine to the left side:

- If there is a situation of the machine pulling to the left side, the level of the machine should be checked first. If the machine is not levelled correctly, this can occur when the right side is horizontal and the left side is facing upwards, the actuator on the left side should be rotated.

- It is also important to check that the front and back rows of discs are evenly aligned. If the front row is set too deep, the high soil resistance causes the machine to pull. The machine should then be raised on the lifting arms and the front row of discs slightly lifted.

- Check the alignment of the operating rollers. The operating rollers should be horizontally aligned. If the left side runs deeper and the right side runs shallower there is a pulling down of the machine.



Left side Right side

Figure 23 Pulling the incorrectly adjusted disc harrow to the left

The working speed should be 10 - 15 km/h. In a well-adjusted machine, the frame must be parallel to the ground and all working units should penetrate the soil equally across the entire working width.

The **side screen** should be set and locked with a screw at such a height that it is above the soil surface and not exposed to the impact of stones and the hanging of crop residues. If required, it should also be moved forwards or backwards (remounting on the holes) so that it retains the soil rejected by the outermost front disc and rakes the furrow behind the outermost rear disc.

4.4.8 Working depth of the disc harrow GAL-K and GAL-K-HD

The working depth is determined by the position of the roller, whose arms are adjustable by actuators. To maintain a constant roller position (working depth) during operation, clamps are fitted to the actuator piston rods (fig. 24). Initially, the roller and wheels should be set above the lower edge of the discs at a height that roughly corresponds to the anticipated working depth, and the setting should be adjusted during the work once the roller's settlement has been taken into account. The maximum permissible working depth is 12cm for discs Ø560mm.

Once the required working depth has been established, the appropriate number of clamps must be taken from the holder on the roller arm and then fitted to the piston rod of the actuators. This ensures a constant working depth during operation. The number of clamps on both actuators must always be equal.

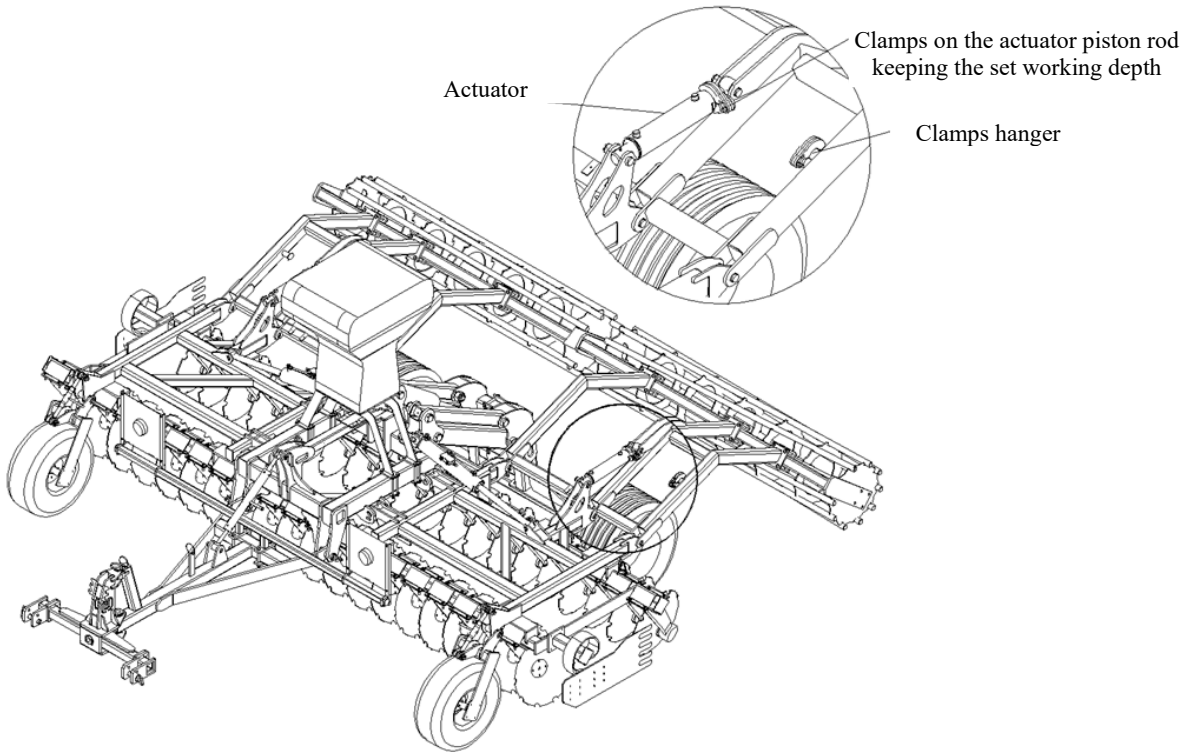


Figure 24 Hydraulic adjustment of roller depth.

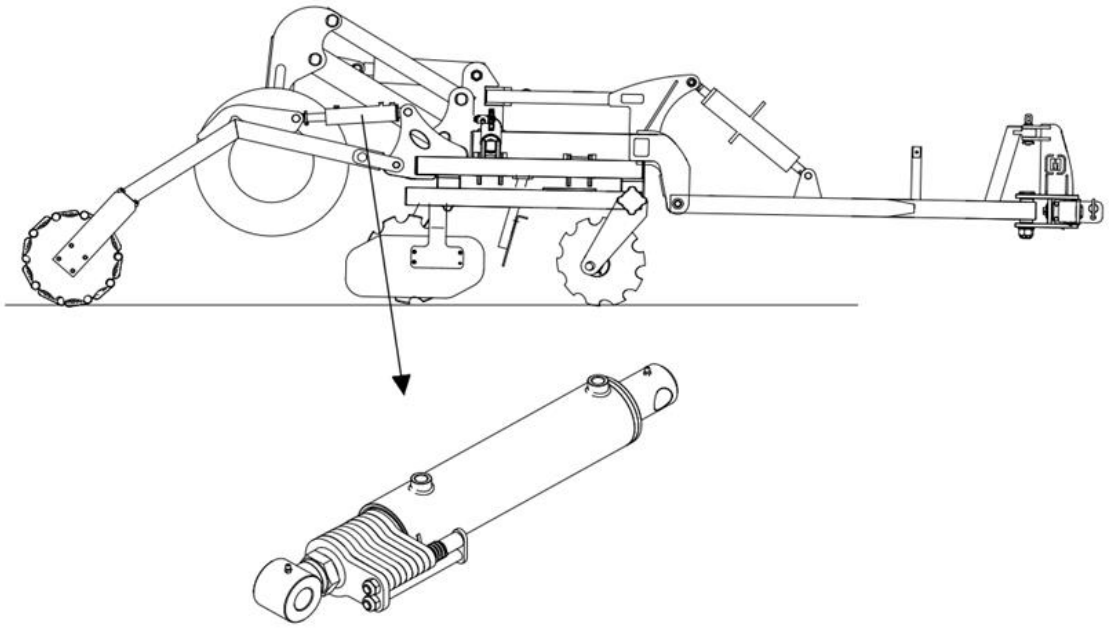


Figure 25 Actuator with ratchet attached to the piston rod to adjust the working depth.

The working depth of the machine is set using pawls located at the piston rod of the actuator. As more pawls are folded, the operation of the machine becomes shallower. In a configuration where none of the pawls are installed, the machine is in its greatest working depth configuration. In fig. 26 and fig. 27, the correct way of installing the subsequent pawl plates on the actuator and the incorrect way of installing them are shown.

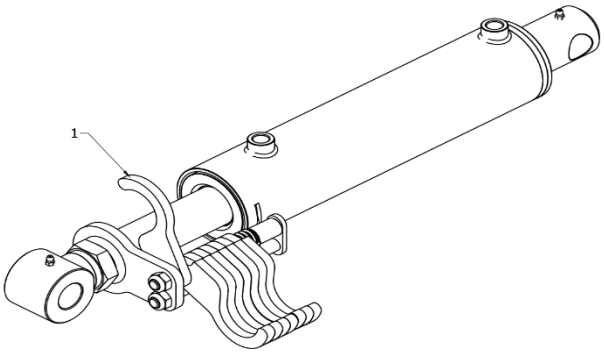


Figure 26 Correct way to put the first (1) ratchet on the piston rod of the actuator to adjust the working depth of the machine.

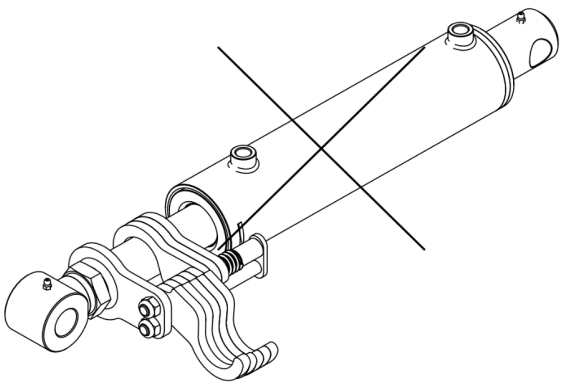
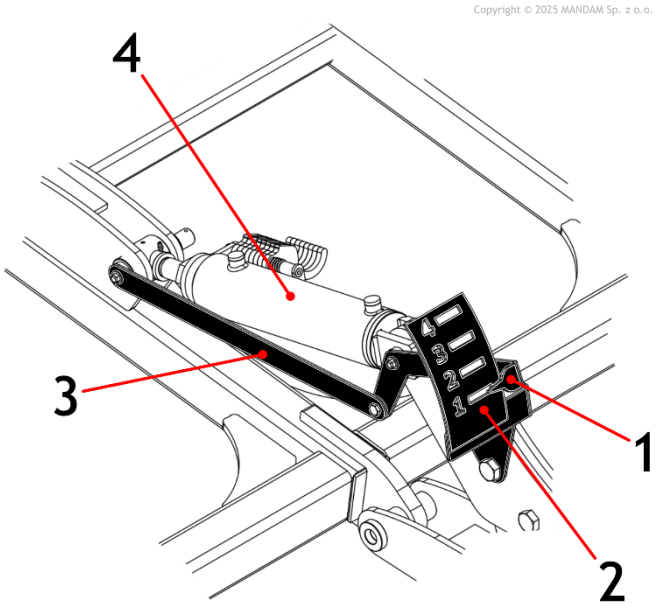


Figure 27 Incorrect way of fitting the ratchets to the piston rod of the actuator. Partial omission of the attachment of the pawls to the actuator results in uneven distribution of the forces acting on the piston rod

and can lead to piston rod buckling resulting in damage to the entire actuator assembly. This kind of adjustment is **unacceptable**!

4.4.9 Measure of work depth

The disc harrow is equipped with an indicator allowing the tractor operator to visually control the working depth.



Side view (Indicator mounting points)

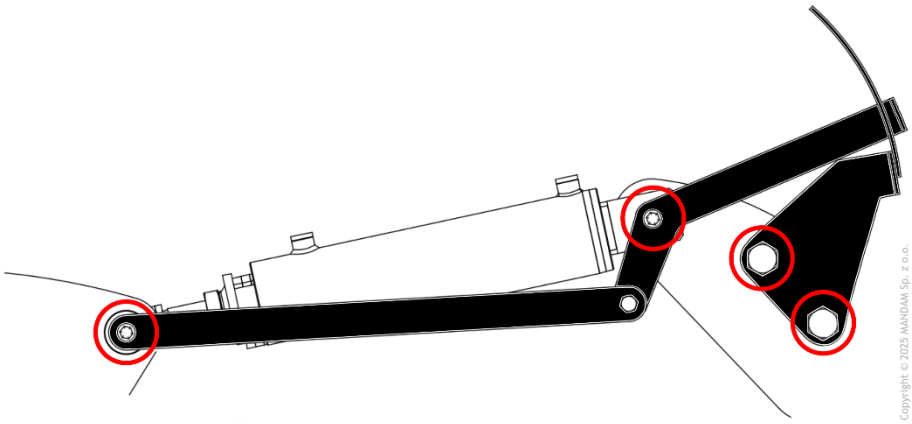
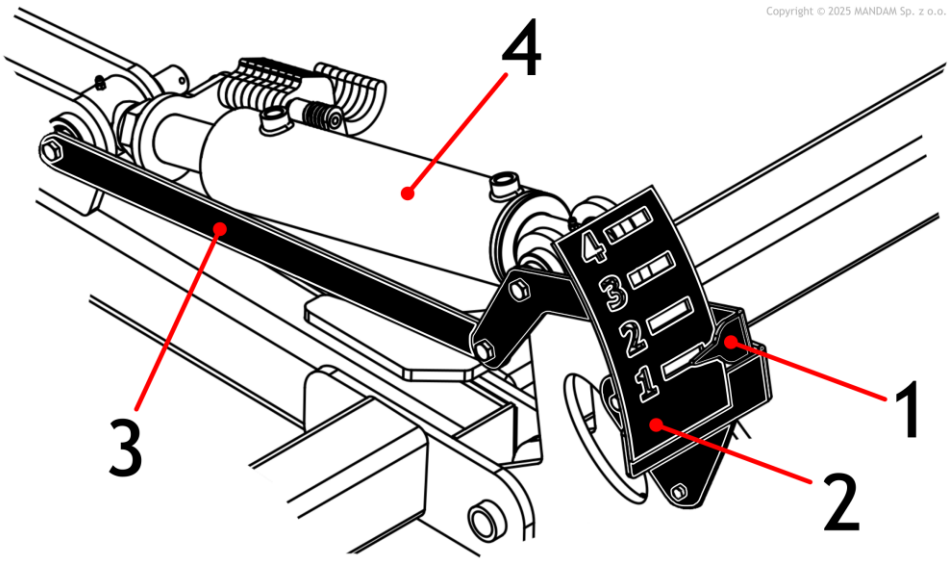


Figure 28 Working depth indicator of the disc harrow GAL-K HD (1 – Indicator, 2 – Scale, 3 – Indicator arm, 4 – Actuator)



Side view (Indicator mounting points)

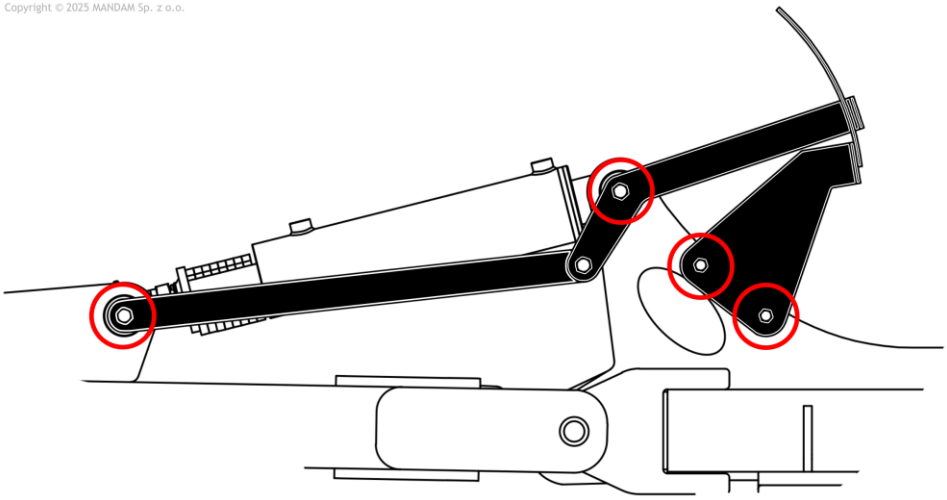


Figure 29 Working depth indicator of the disc harrow GAL-K (1 – Indicator, 2 – Scale, 3 – Indicator arm, 4 – Actuator)

4.4.10 Side screen adjustment

The side screen should be positioned and locked with a screw at a height so that it is above the soil surface and not exposed to impacts from stones or the accumulation of crop residues. If necessary, it should also be adjusted forward or backward by mounting it on the available adjustment holes (Fig. 28, item 1) so that it prevents the soil thrown by the outer front disc from falling off and collects the furrow behind the outer rear disc.

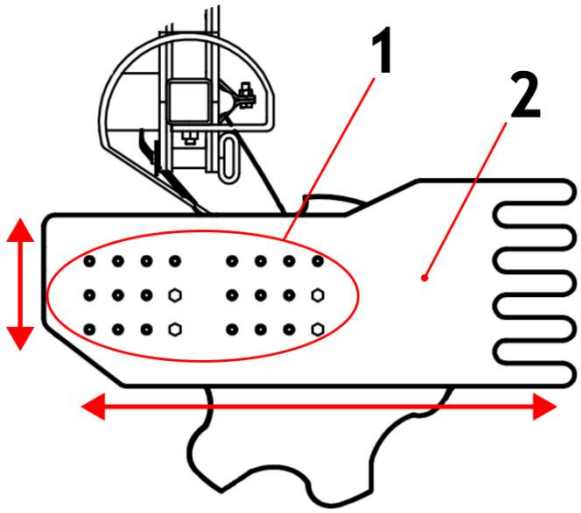


Figure 30 Adjustment of the side screen position (1 – adjustment holes for the side screen position relative to the bracket, 2 – side screen)

4.4.11 Center screen adjustment - optional

The main task of the screen in to stop the soil thrown by the front row of discs. The screen should by positioned and locked with clamps at a height so that it is above the soil surface. The screen can be adjusted as described below, to adapt its height to the prevailing conditions.

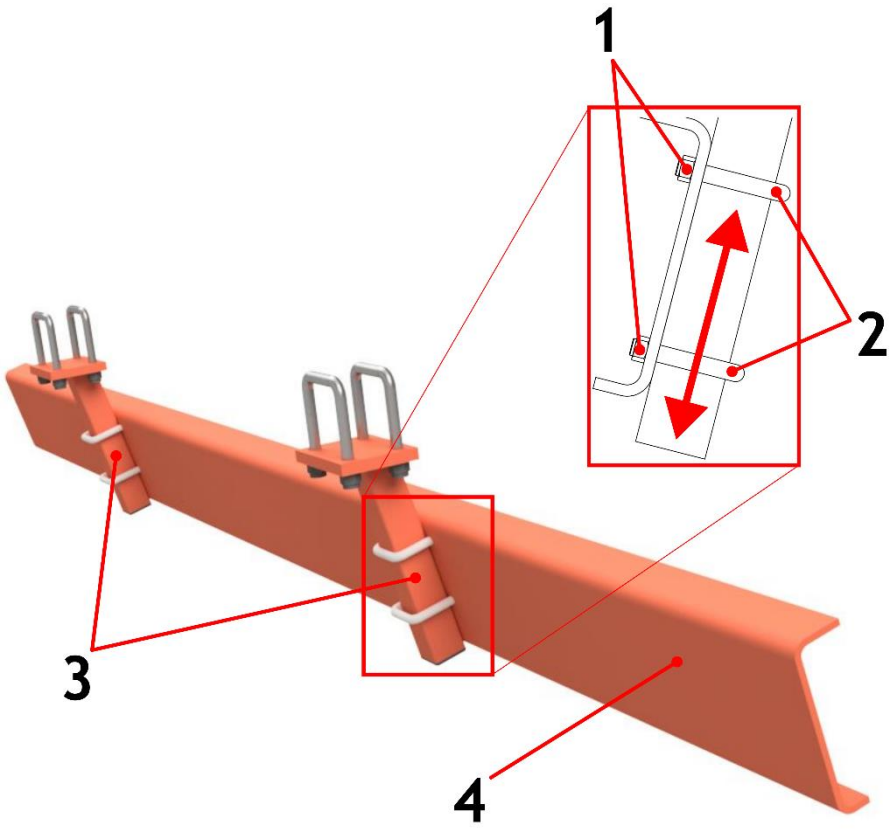


Figure 31 Adjustment of the central screen position and its construction (1 – fastening nuts, 2 – fastening clamps, 3 – screen brackets (mounted to the frame structure), 4 – central screen)

Method of adjusting the central screen:

1. Loosen the nuts (Fig. 31, item 1) of the clamps (Fig. 31, item 2) holding the screen,
2. Move the screen (Fig. 31, item 4) on the brackets (Fig. 31, item 3) up or down to the desired position and level it,
3. Tighten the nuts (Fig. 31, item 1) diagonally,
4. Check the correctness of the assembly.

4.4.12 Adjustment of the spring screen - optional

The spring screen can be adjusted by extending or retracting the claws. This allows the working height of the screen to be adapted to the machine's working depth.

To change the working height, proceed as follows:

1. Loosen the nuts (Fig. 32, item 3) and the plate (Fig. 32, item 1),
2. Extend upwards or retract downwards the claw (Fig. 32, item 2),
3. Tighten the nuts to secure the claw in the desired position,
4. Perform the adjustment sequentially on each element to ensure uniform operation,
5. Check the correctness of the assembly.

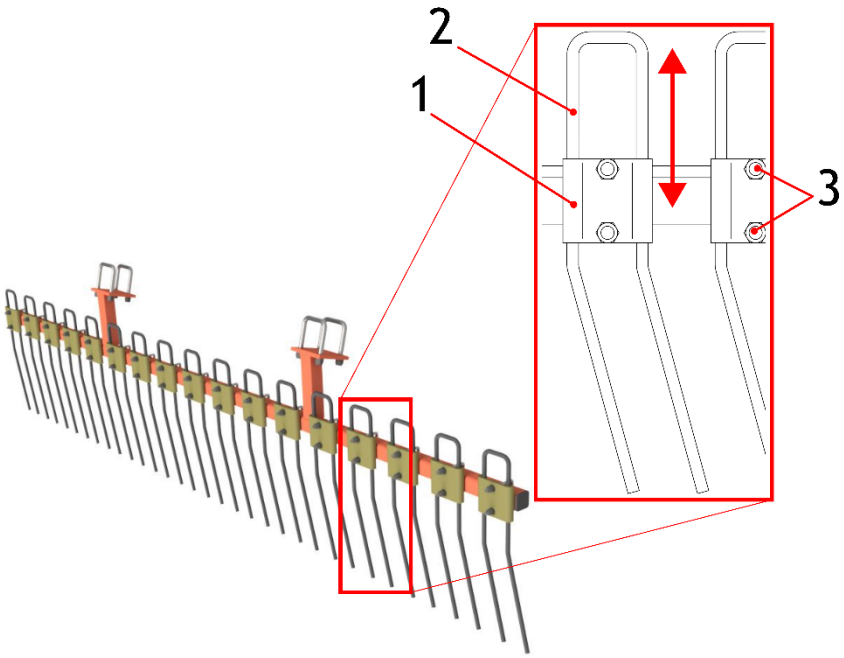


Figure 32 Adjustment of the position of the spring screen claws (1 – mounting plate, 2 – spring claw, 3 – fastening nuts)

4.4.13 Opening sequence of the machine on the chassis

Before unfolding the machine on the chassis, it is important to familiarise yourself with the opening sequence to allow you to do this correctly.

1. Position the machine on a flat surface in a place that provides free space to allow the machine to unfold correctly avoiding the risk of the folding wings of the machine catching on other obstacles during movement.

2. Pull out the pins securing the machine wings against self-extension from the buffers (fig. 33).

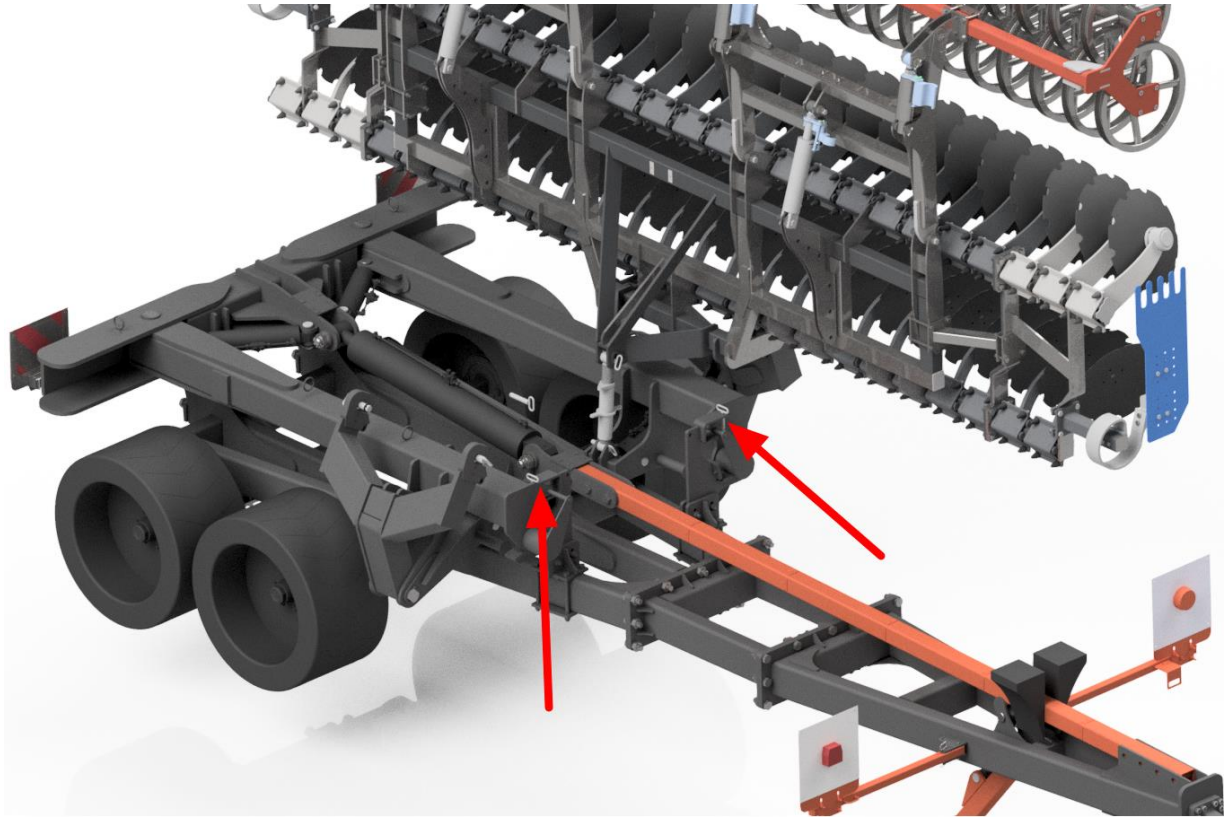


Figure 33 Location of pins preventing the machine wings from unfolding.

NOTE! Remember to secure the machine wings against self-opening by means of safety pins each time the unit is folded.

3. Using the hydraulics, spread the arms of the machine horizontally until they are fully extended (fig. 34).

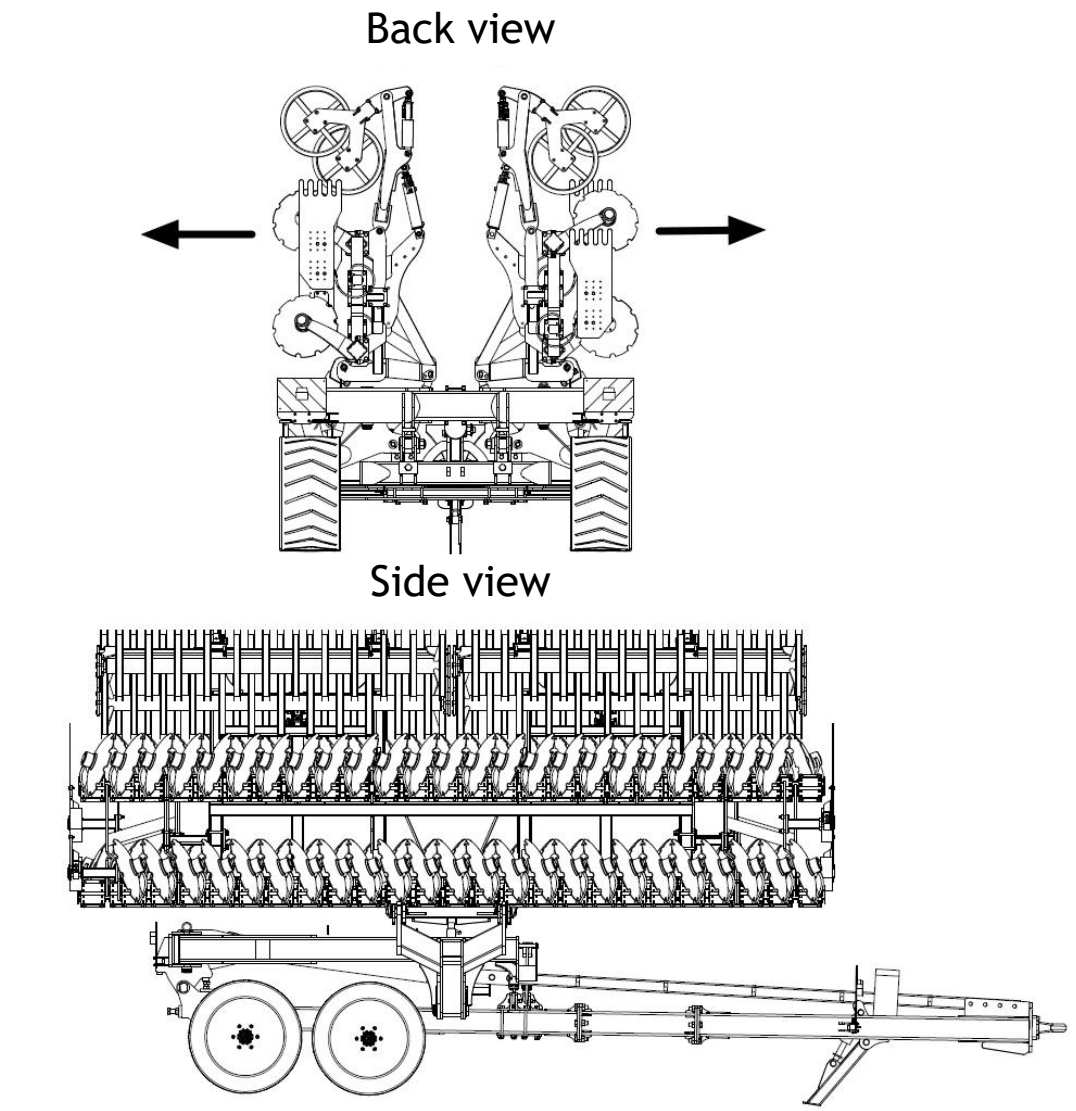


Figure 34 Unfolding the machine wing.

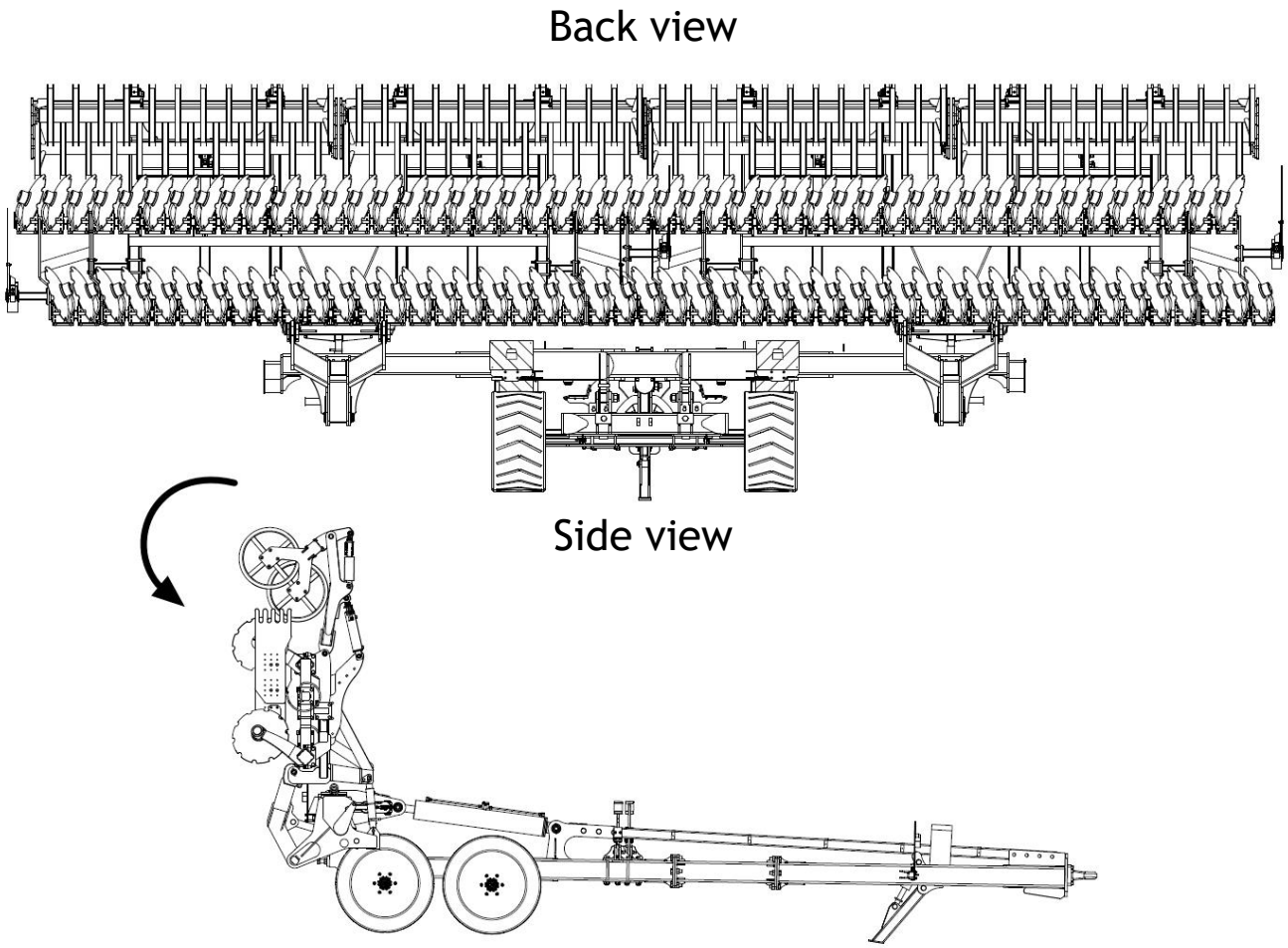
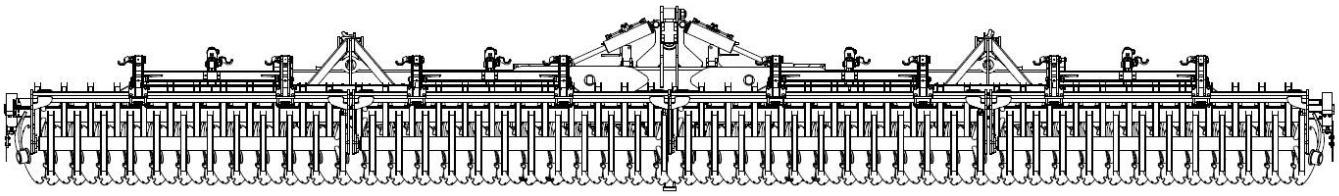


Figure 35 Unfolding the machine wings to a horizontal position.

4. The next step is to hydraulically unfold the open arms of the machine to a horizontal position (fig. 34, 35).

Back view



Side view

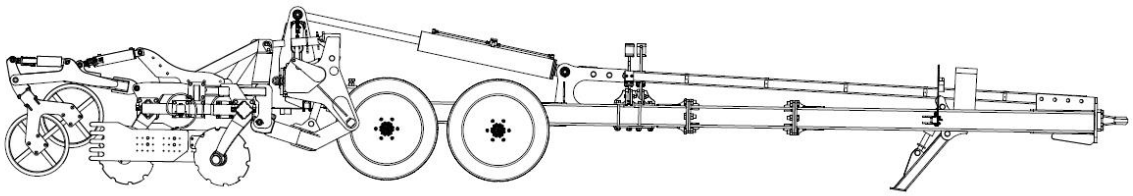
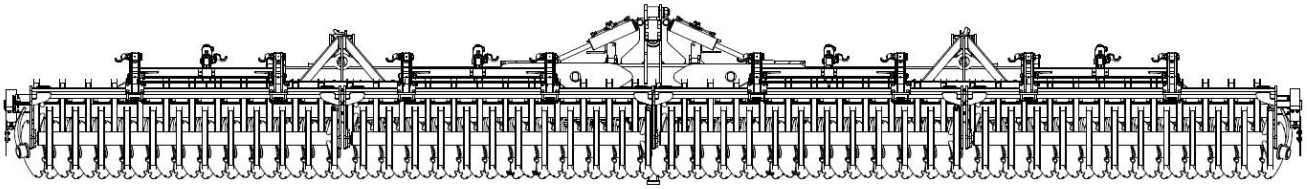


Figure 36 View of the machine after disassembly.

5. Once the machine has been unfolded on the chassis, the alignment of the working rollers with respect to the machine must be carried out using hydraulic actuators. The entire process is carried out using hydraulic actuators that determine the height of the rollers and their angle of attack relative to the ground, and turnbuckles fitted to the machine's wing drawbars (fig. 37).

Back view



Side view

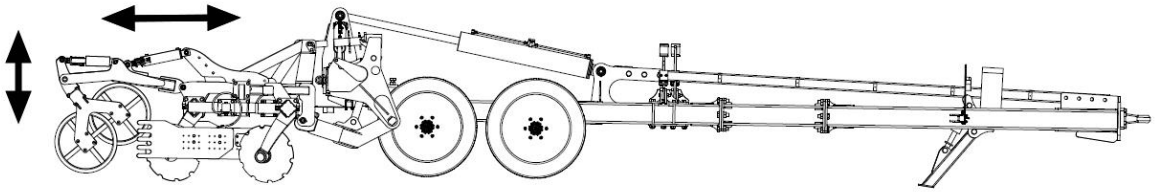


Figure 37 Adjusting the height and angle of attack of the operating rollers.

4.4.14 Adjusting the working depth and setting the correct position for machines with chassis

Once the machine has been unfolded, proceed with setting the working depth and levelling.
First of all, the appropriate working depth must be determined using the hydraulic actuators of the three-point linkage on which the disc harrows are suspended (item 1, fig. 38). There are special clips on the three-point frame designed to be fitted to the piston rod of the actuator to maintain the desired extension (item 2, fig. 38). As the actuator's extension is increased, its working depth is increased, and a decrease in extension results in a decrease in working depth. Clips (item 2, fig. 38), which are fitted to the piston rod of the actuator, are used to maintain the preset actuator extension.

NOTE! Make sure the machine is standing on level ground before carrying out the levelling operation.

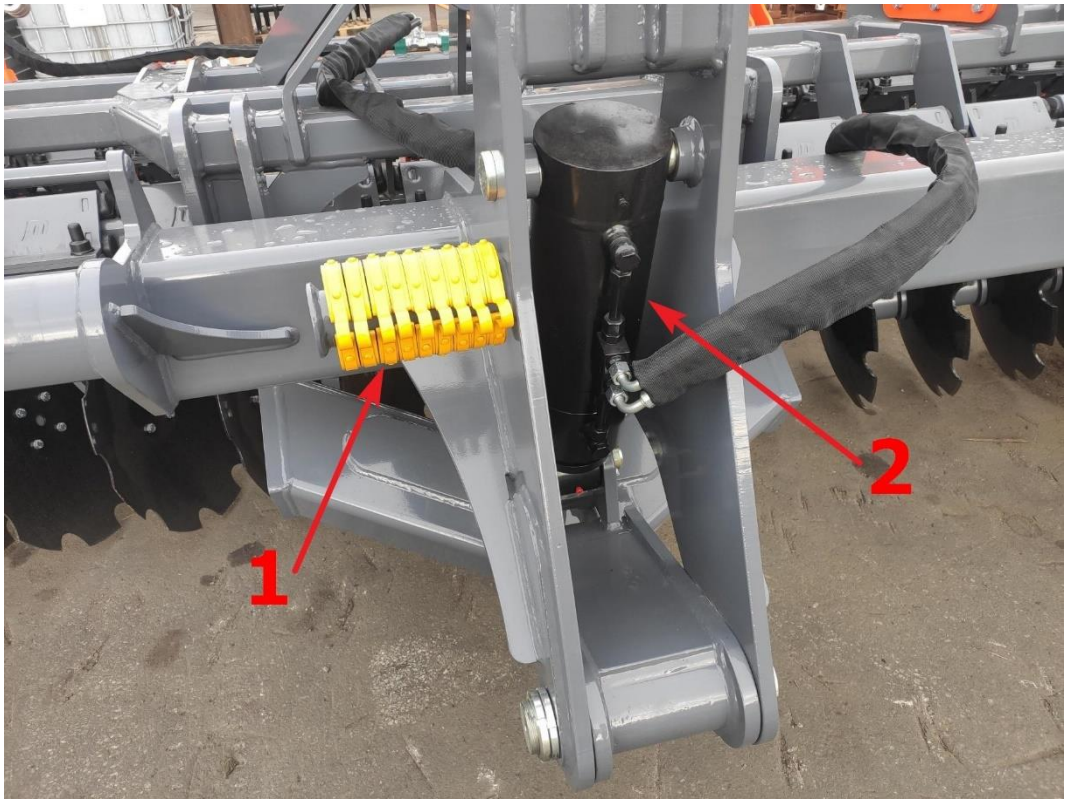


Figure 38 View of the machine wing hydraulic assembly; 1-safety clips, 2-actuator.

Once the working depth of the machine has been established, it is necessary to level the machine by adjusting the turnbuckle on which the disc harrow is mounted on the three-point linkage arms (fig. 39).

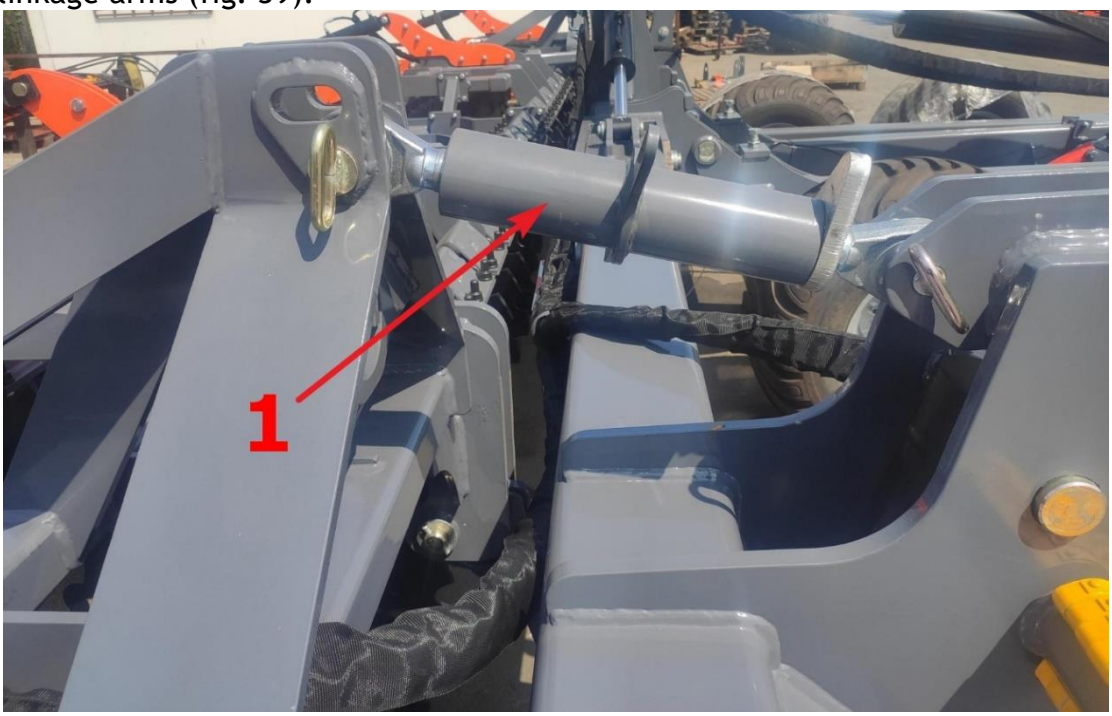


Figure 39 Placing the turnbuckle on the drawbar assembly; 1- turnbuckle.

Levelling the machine is also possible thanks to the adjustment screws at the rear of the chassis. The vertical bolts (item 1, fig. 40) adjust the position of the disc harrow when

the machine is folded. The horizontal screws (item 2, fig. 40) adjust the level of the disc harrow when the machine is unfolded.

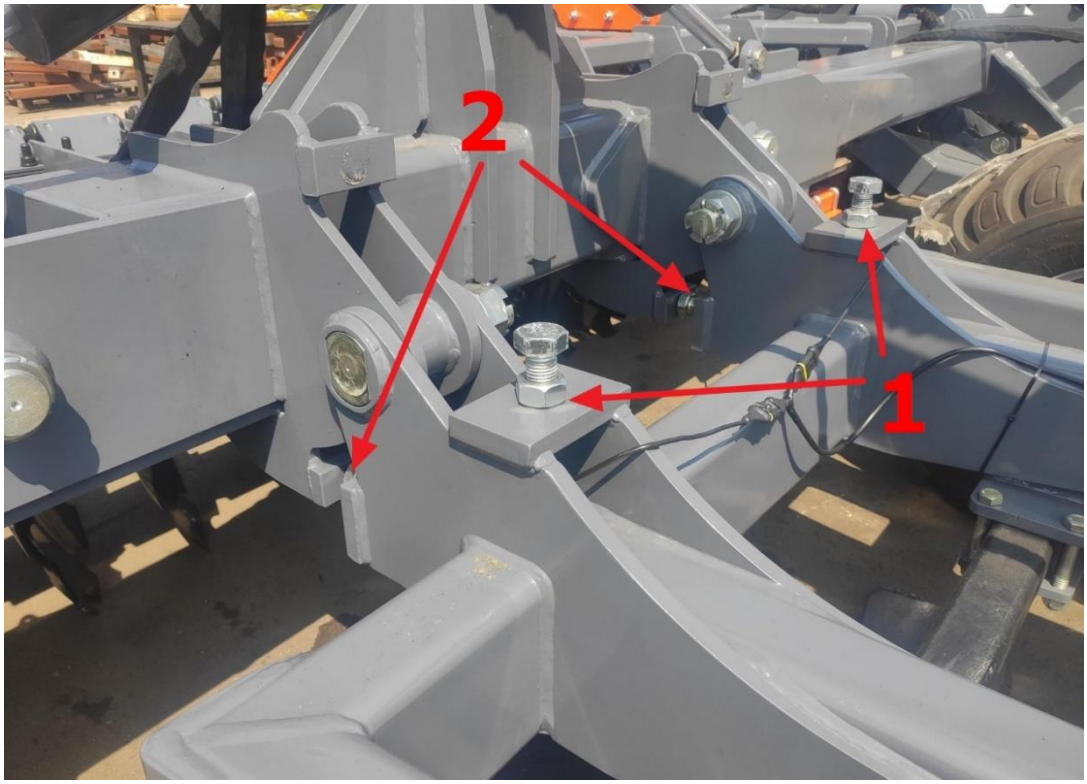


Figure 40 Placement of machine wing adjustment screws in position when: 1-Machine wings are folded, 2-Machine wings are unfolded.

After levelling and adjusting the working depth, adjust the working depth of the machine on the rollers at the rear of the machine. Height adjustment of the rollers is carried out by hydraulic actuators connecting the roller arms to the disc harrow frame. To maintain a constant roller position (working depth) during operation, clamps are fitted to the actuator piston rods. The maximum permissible working depth is 12cm for discs Ø560mm.
Once the required working depth has been established, the appropriate number of clamps must be taken from the holder on the roller arm and then fitted to the piston rod of the actuators. This ensures a constant working depth during operation. The number of clamps on both actuators must always be equal.

In fig. 41 and fig. 42, the correct way of installing the subsequent pawl plates on the actuator and the incorrect way of installing them are shown.

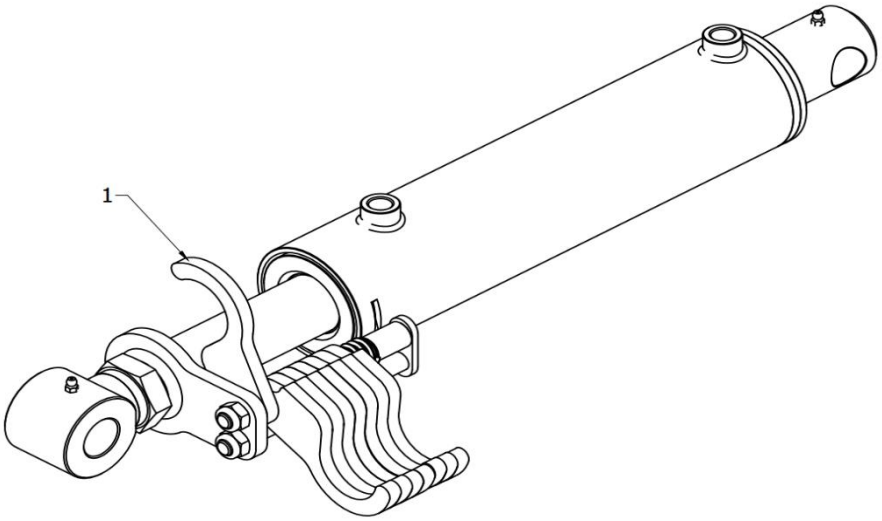


Figure 41 Correct way to put the first (1) ratchet on the piston rod of the actuator to adjust the working depth of the machine.

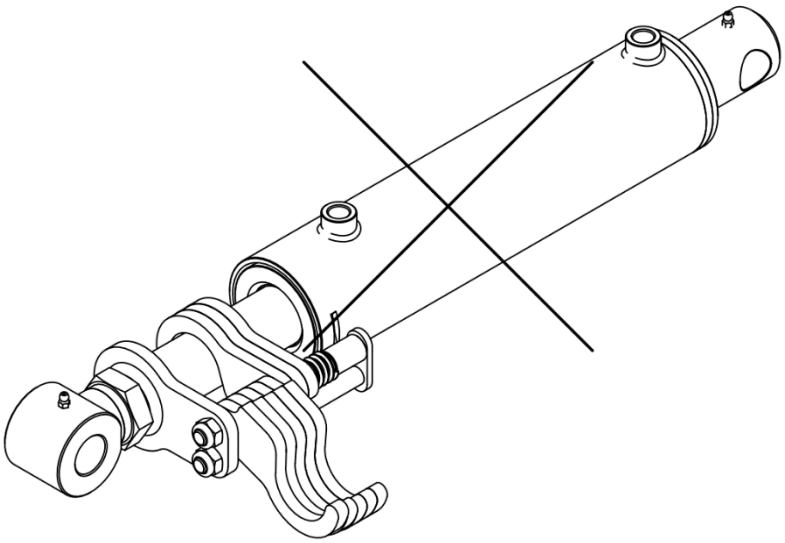


Figure 42 Incorrect way of fitting the ratchets to the piston rod of the actuator. Partial omission of the attachment of the pawls to the actuator results in uneven distribution of the forces acting on the piston rod and can lead to piston rod buckling resulting in damage to the entire actuator assembly. This kind of adjustment is **unacceptable**!

NOTE! Before turning with the machine unfolded, retract the chassis actuator (approx. 100mm) so as to raise the front row of discs by at least 15cm in order to avoid undesirable hitting of the machine on the ground (fig. 43). After the manoeuvre, lower the machine back to the operating position.

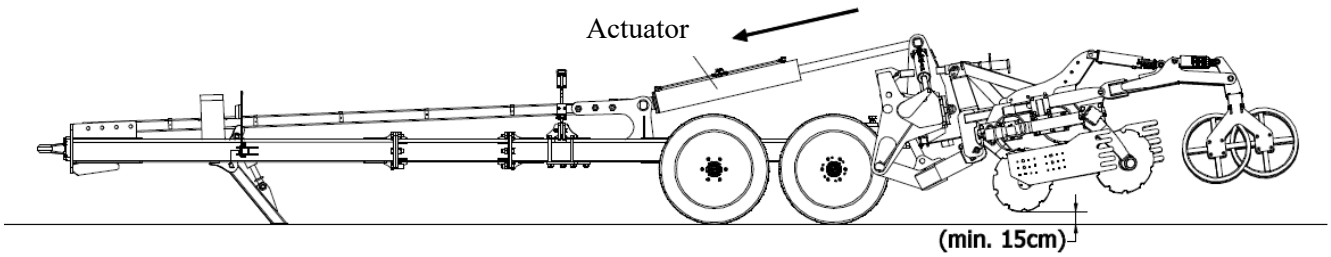


Figure 43 The correct way to lift the machine when carrying out a turning manoeuvre.

5 Braking systems (option)

Chassis-mounted machines can be equipped with three types of braking systems - single-circuit hydraulic brake, dual-circuit hydraulic brake or air brake (standard on 8.0m; 10.0m; 12.0m machines), a diagram of which, along with the principle of operation, is shown below.

5.1. Air brake

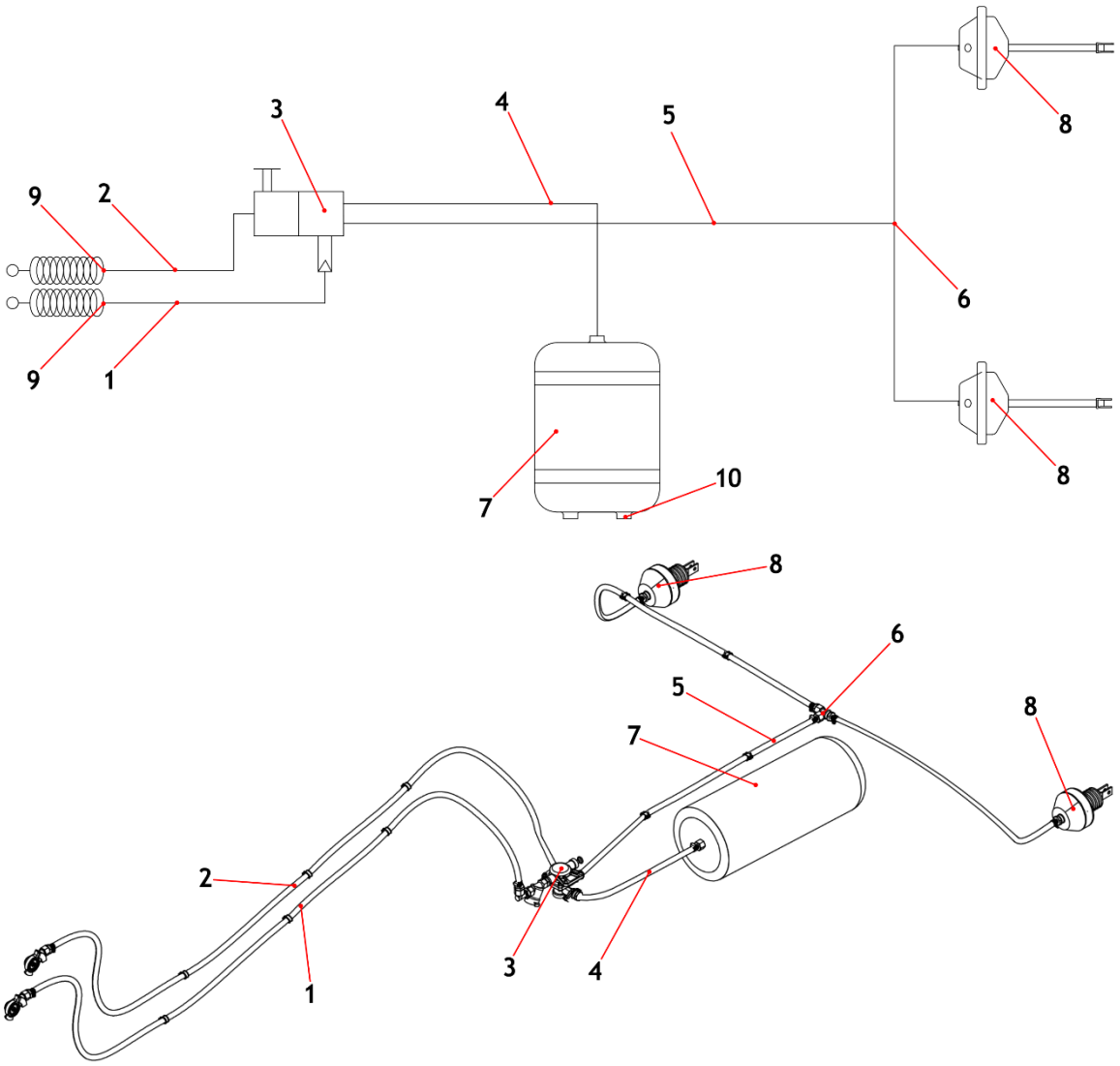
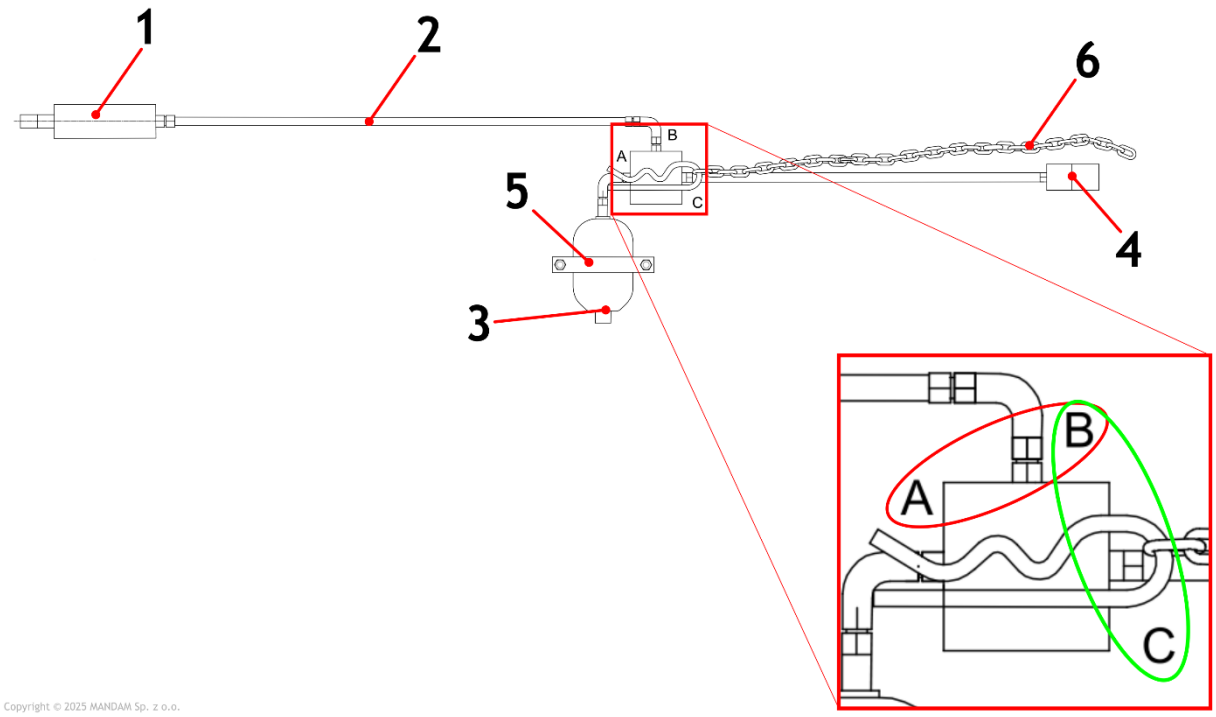
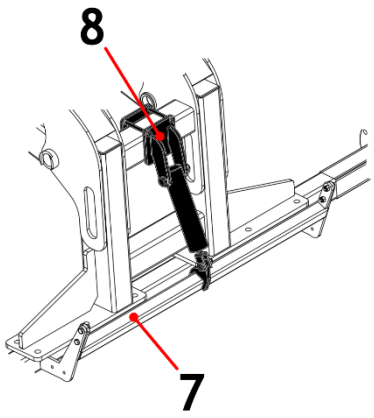


Figure 44 Air brake diagram (1 - spiral hose coupling (yellow), 2 - spiral hose coupling (red - power), 3 - trailer control valve, 4 and 5 - rubber air line, 6 - M22 T-piece, 7 - 40L air tank, 8 - 24" diaphragm actuator, 9 - reduction, 10 - tank plug)

5.2. Hydraulic single-circuit brake



Installation on the chassis



Installation on the drawbar

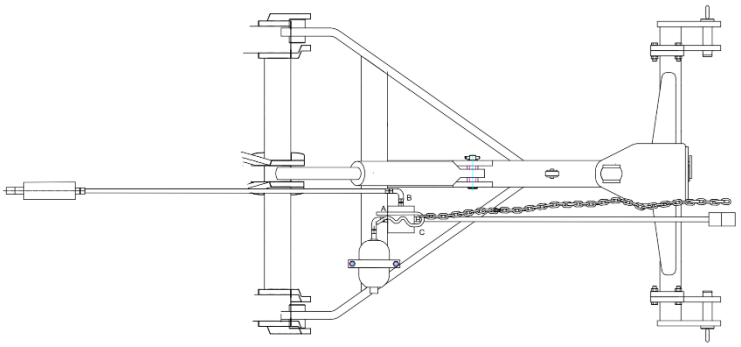


Figure 45 Diagram of a single-circuit hydraulic brake with most important operating components (1 - 301349/P2 actuator, 2 - hydraulic hose, 3 - accumulator 0,75l 100 bar(SIAP WA), 4 - SAFIM quick-release coupling, 5 - accumulator bracket, 6 - safety valve actuating chain, 7 - brake beam, 8 - brake actuator holder.

Valve settings:
B-C - brake released
A-B - brake locked

5.3. Hydraulic double-circuit brake

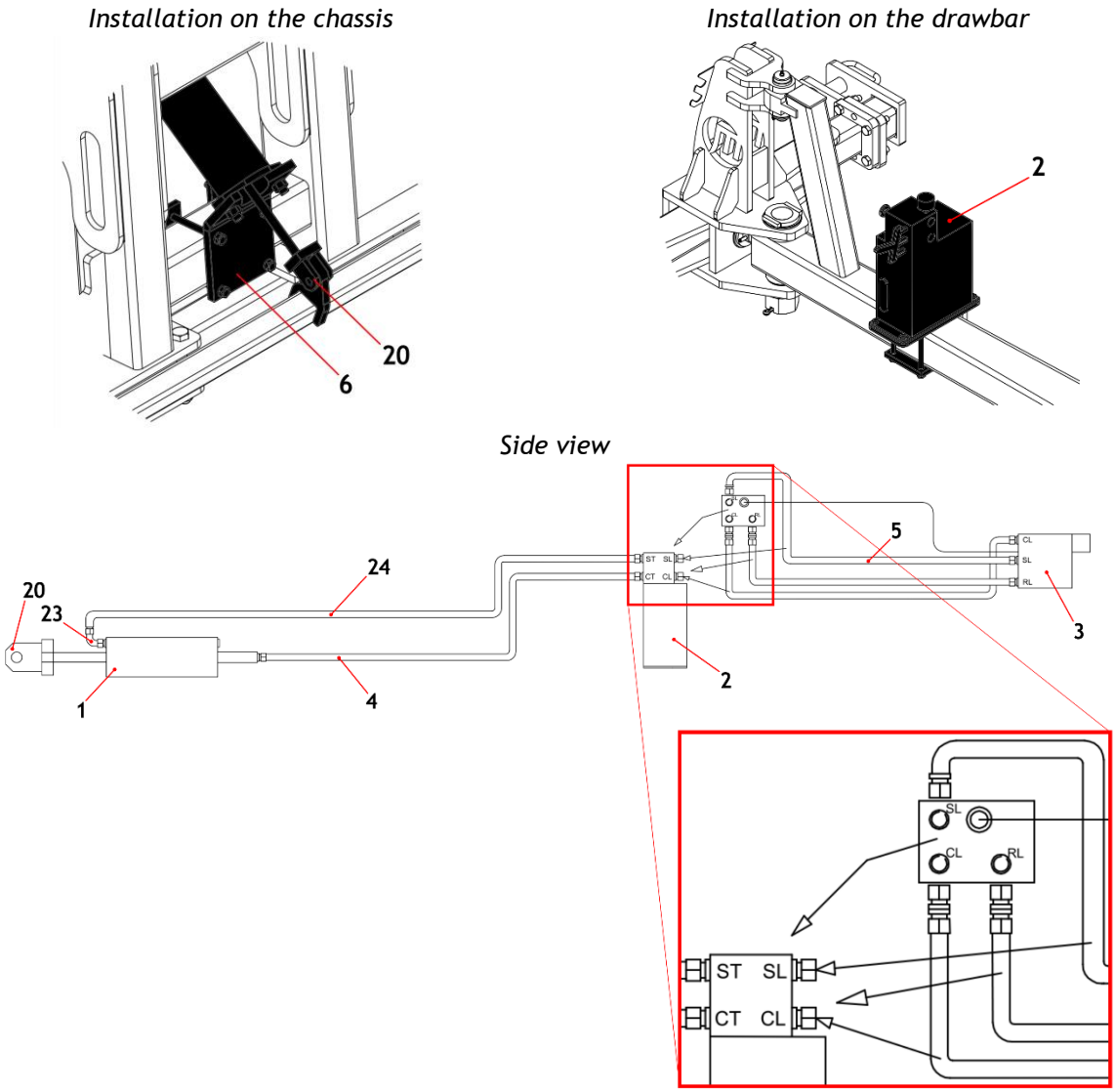


Figure 46 Diagram of a double-circuit hydraulic brake with the most important operating components(1 - combination brake actuator, 2 - valve with pump reservoir, 3 - DLC-double-circuit coupling with cable, 4-5 - hydraulic line, 6 hydraulic actuator mounting plate, 20 - beam bracket, 23 - elbow connector, 24 - hydraulic line)

5.4. Automatic brake valve with spring brake - 206613

The SAFIM valve on the machine is designed to manage the service and emergency braking functions of the two-circuit hydraulic braking system. If the trailer is disconnected from the tractor, the automatic brake valve activates the emergency braking function. This function is achieved by using the energy previously stored on the compressed spring of the SAHR actuators, which become active when the oil of the spring brake section is discharged into the reservoir.

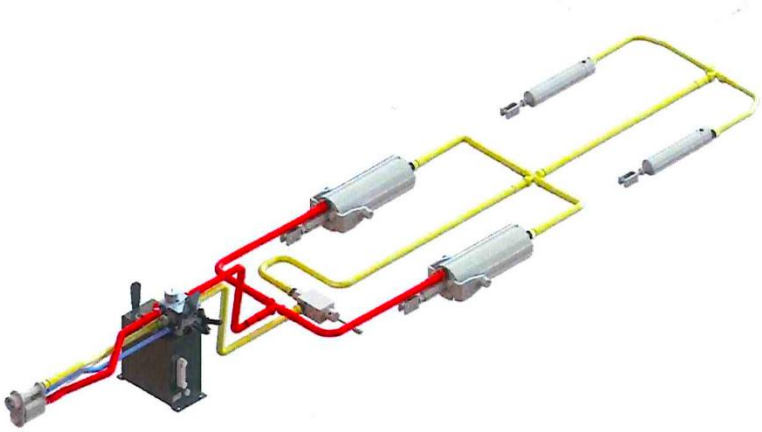


Figure 47 Overview view of the two-line hydraulic brake system.

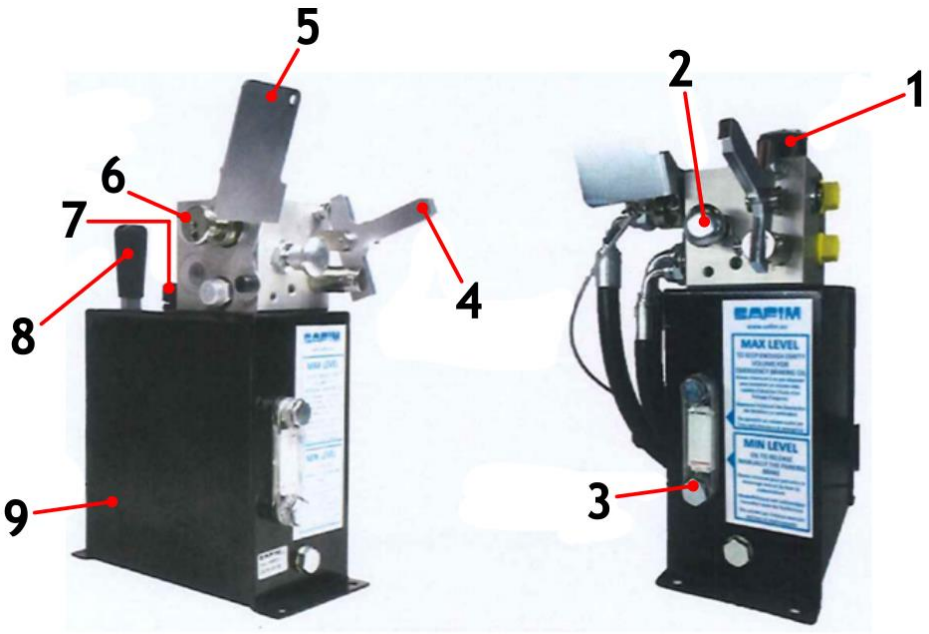


Figure 48 Valve with marked components (1 – Pressure gauge, 2 – CL depressurization buton / Tank filling, 3 – Oil level, 4 – Manual pump, 5 –Signalling device, 6 – Activation spool, 7 – Plug for refilling, 8 – Manual pump lever, 9 – Oil tank)

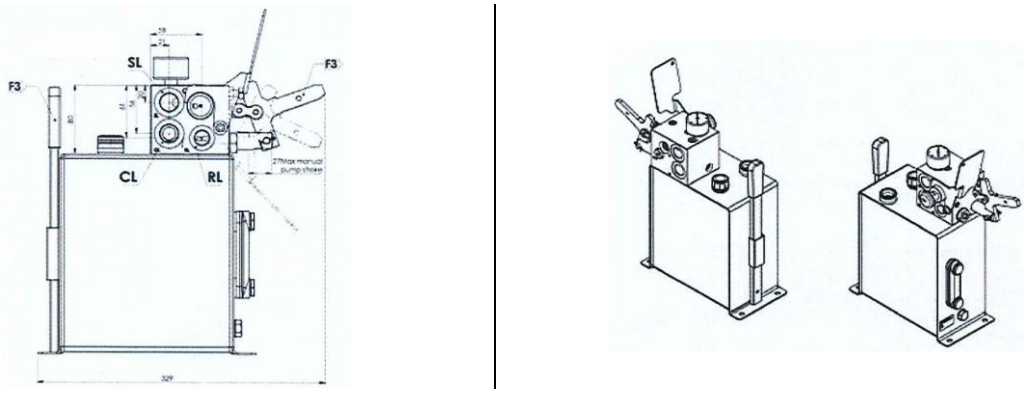


Figure 49 Plan showing the connectors on the tractor side (on the left), isometric view (on the right)

Figures 49 show the respective valve plans with the designations of the most important wires and connectors, where they denote in sequence:

- **CL** – control cable (from coupling joint),
- **SL** – auxiliary line (from the coupling joint),
- **RL** – return line (from the coupling joint),

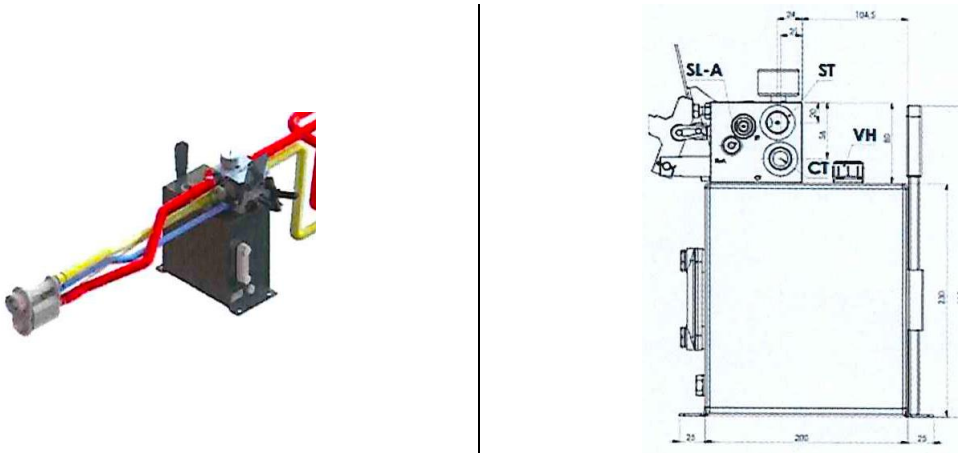


Figure 50 Plan showing the joins on the side of the disc harrow (on the right) and illustrative view (on the left)

Figures 50 show the respective valve plans with the designations of the most important wires and connectors, where they denote in sequence:

- **CT** – output port (of brake actuators or load sensing valve, if fitted),
- **ST** – output port (spring brake sections of the combined SAHR actuators - SL port),
- **SL-A** – return line from the automatic load sensing valve, if fitted.

It is important to note that during installation, the metal cable (pre-mounted on the coupling joint) must be connected to its dedicated housing on the valve. Also ensure that the length of the cables is 20-30 cm shorter than the length of the hydraulic lines.

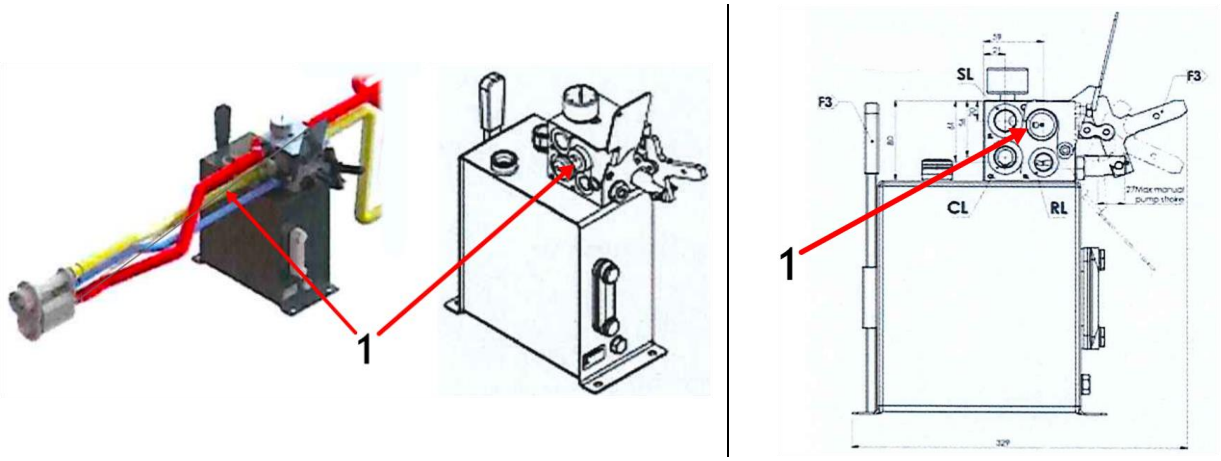


Figure 51 Marking where the metal cable is connected to its dedicated housing (1 – metal cable and housing (illustrative view on the left, view from the disc harrow side on the right)

If the braking system contains an automatic load detection valve of type 206104/xx, connect the SL-A port of the automatic brake valve to the SL port of the load detection valve.

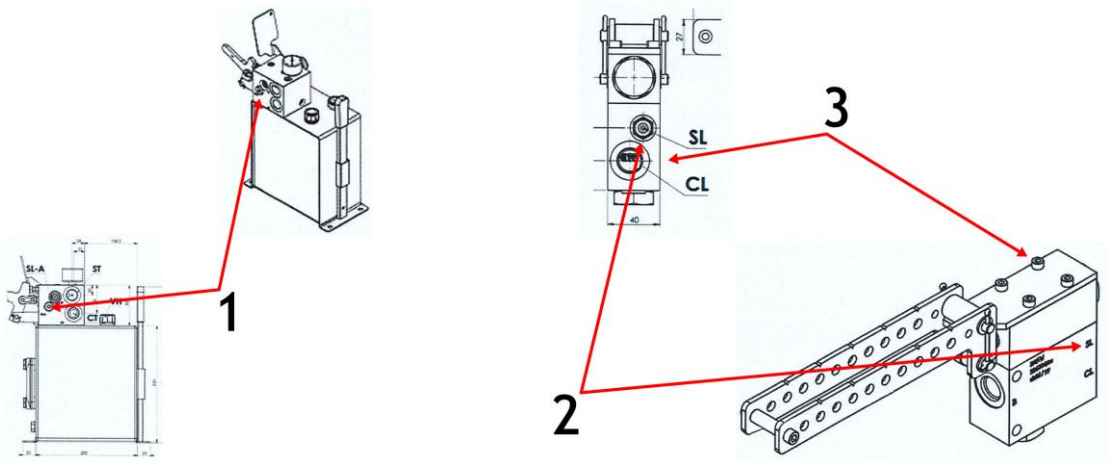


Figure 52 Marking of the connection point when using automatic load sensing valve type 206104/xx (1 – SL-A port on 206613 valve, 2 – Return line from load sensing valve (SL), 3 – Automatic load sensing valve (206104/xx series)

The brake valve has several modes of operation. All modes are listed in sequence below with their descriptions:

Mode 1 – Drive mode:

- Two-line connector: connection to the tractor
- Tractor engine: on
- Parking brake: released

The activation slider automatically returns to the drive mode position when the pressure in the secondary line (SL) increases to its normal value.

The valve's normal function mode is engaged each time the operator connects the two-line connector, starts the tractor engine and releases the parking brake.
The device provides all standard trailer braking functions when the driver brakes. If the trailer is disconnected from the tractor, the automatic brake valve activates the automatic emergency braking function.

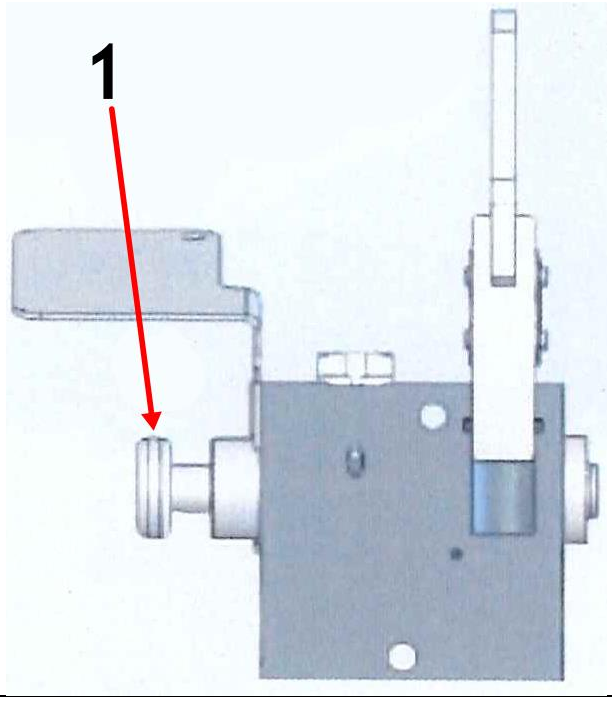


Figure 53 Standard position of the activation slider in the driving position (1 – Activation spool in standard travel position)

Mode 2 – Emergency mode:

When the trailer is disconnected from the tractor, an automatic brake valve connects the spring brake section of the SAHR actuators to the reservoir. The oil holding the springs under tension is discharged into the reservoir, the spring action activates the emergency brake function.

The automatic emergency brake function is activated even if the pressure in the auxiliary line (SL) drops while the DLC connector is still connected to the tractor. The activation slider remains in its normal function position when the automatic brake function is activated.

Mode 2a – Parking mode:

In a spring brake trailer braking system, the application of the automatic emergency braking function overlaps with that of the parking brake, as spring brakes generate both functions. Therefore, disconnecting the DLC connector ensures that the vehicle is parked correctly.

If the operator disconnects the two-line joint from the tractor, it is recommended to connect it to the dummy connection of the valve housing to avoid contamination.

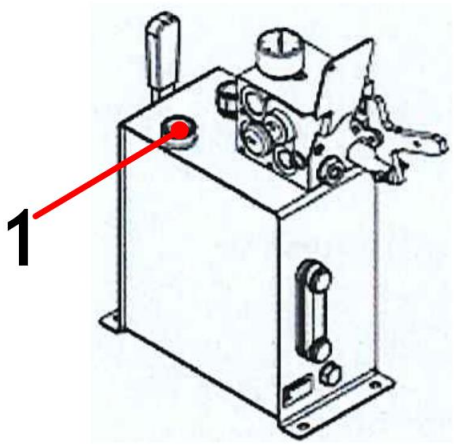


Figure 54 Port of artificial connection of the remaining coupling connectors (1 – Dummy connection for coupling joint rest)

Mode 3 - Deactivation of automatic brake function:

To deactivate the automatic brake function (if towing a trailer by a non-two-wheel tractor or other type of vehicle):

- Press the activation slider (as in the image on the right) until it is fully extended. The signalling device will move downwards generating a switch on manual mode operation;
- Pump oil from the reservoir into the spring brakes using a hand pump. The automatic/parking brake function will be deactivated.

NOTE! the brakes will be released when the pressure in SL towards the spring section of the SAHR actuators is over 15 bar. When pumping, check the pressure gauge to ensure that it indicates the correct pressure not exceeding 35 bar.

NOTE: Whenever the activation slider is in "manual operation mode", automatic application of the parking brake is not ensured. If the vehicle has to park again, check that the activation slider is in the "standard driving position".

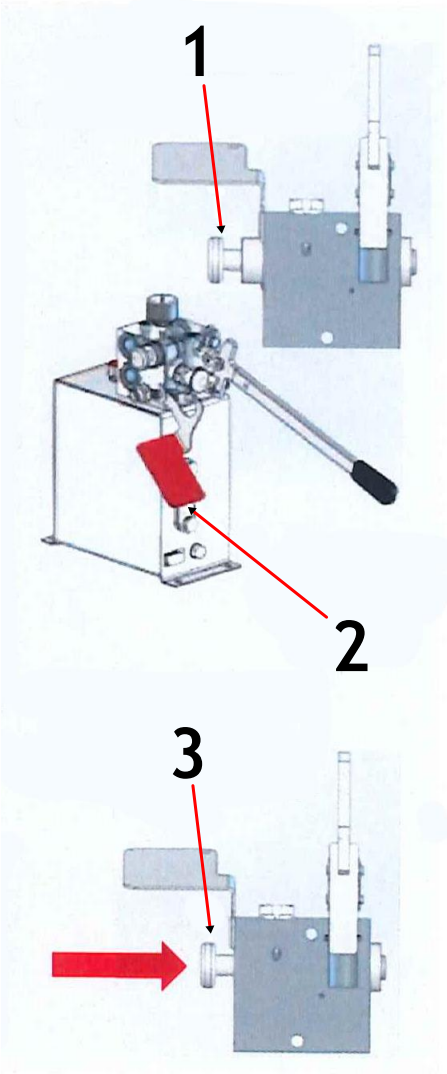


Figure 55 Removal of automatic brake function (1 - Activation spool in standard travel position, 2 - Signalling device lowered, 3 - Activation spoil in manual functioning mode)

Mode 4 - Reconnecting to the tractor:

The activation slider automatically returns to its normal function position every time the pressure in the secondary line (SL) increases to its normal value.

The valve's normal function mode is engaged each time the operator connects the two-line joint, starts the tractor engine and releases the parking brake. In this situation, all emergency functions are switched on.

Place the signal box back into its running position before switching on the tractor engine and before releasing the tractor parking brake. If the slider is already in the driving position, it will be impossible to reset the signalling device.

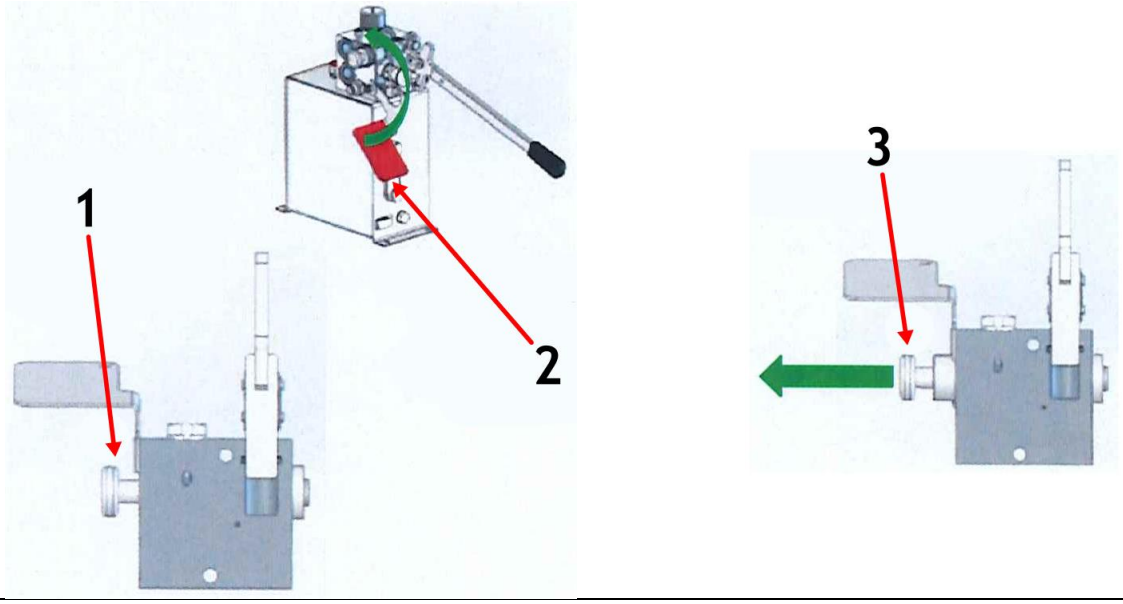


Figure 56 Activation slider positions in manual operation and standard driving position (1 -Activation spool in manual functioning mode, 2 - Signalling device lowered, 3 - Activation spool in standard travel position)

Two alternative procedures are allowed for filling the installation's oil tank after installation. To do that:

- Unscrew the oil plug from the top and fill the tank with the correct amount of oil*;
- Press the "**decompression/reservoir fill**" button on the front side of the valve and, keeping it in the same position, slightly depress the tractor brake pedal (this procedure requires two operators, one to operate the tractor and one to operate the valve). The oil coming from the tractor via the control line (CL) will be directed to the tank. When the oil has reached the correct level, let go of the „**decompression/tank fill**" button.

***Use oil complying with SAE 10W30 standard or that used to fill the tractor's oil tank.**

Check the oil level in the tank regularly: the level must always be between the **„max"** and **„min"** positions on the oil level indicator.

If the oil level is below the minimum, follow one of the previously described procedures to refill the tank.

If the oil level is above the maximum, use the hand pump when the trailer is connected to the tractor (the activation slide is in the „**normal function position**"). The oil will flow from the tank to the tractor tank via an additional line (SL).

If it is difficult to reconnect the tractor's two-line joint due to residual pressure inside the lines, it is possible to relieve the pressure by pressing the decompression button for a few seconds. This can happen if the vehicle is left parked in the sun for some time. Excess oil will be drained into the reservoir and the DLC connector can be reconnected.

You can push the decompression button with tools such as a screwdriver, spanner or lever to the hand pump supplied with the valve assembly kit.

6 Optional equipment for the GAL-K and GAL-K HD disc harrows

The GAL-K and GAL-K HD disc harrows can be equipped with a number of additional options. Below are descriptions and operating instructions for selected options.

6.1. Structure and function of a valve block with electric control (optional)

For machines with running gear, the option is available to purchase a valve block with electric control, which allows all hydraulic sections to be connected directly to the control panel with joystick, which allows more convenient control of the machine's hydraulics and relieves the load on the tractor's external hydraulics (one pair of hydraulic lines is connected to the tractor) (fig. 57).

- ***Principle of operation***

The valve block is connected by one pair of wires to the tractor, the joystick is connected to the electrical system. All control of the hydraulic systems is via a joystick.

- ***Control***

Start section slider in two positions (0 - 1), on a spring, i.e. it returns to the neutral position by itself when the power supply is cut. While the slider is in the neutral position, the oil goes to the overflow, the pump is then relieved.

Slider operation principle:

- Position 0 - neutral (solenoid supply cut off) no pressure available on the operating sections.
- Position 1 and 2 - operating (solenoid supply on) pressure available on the operating sections.

Three position working section slider (1 - 0 - 2), on a spring, i.e. it returns to the neutral position by itself when the power supply is cut off.

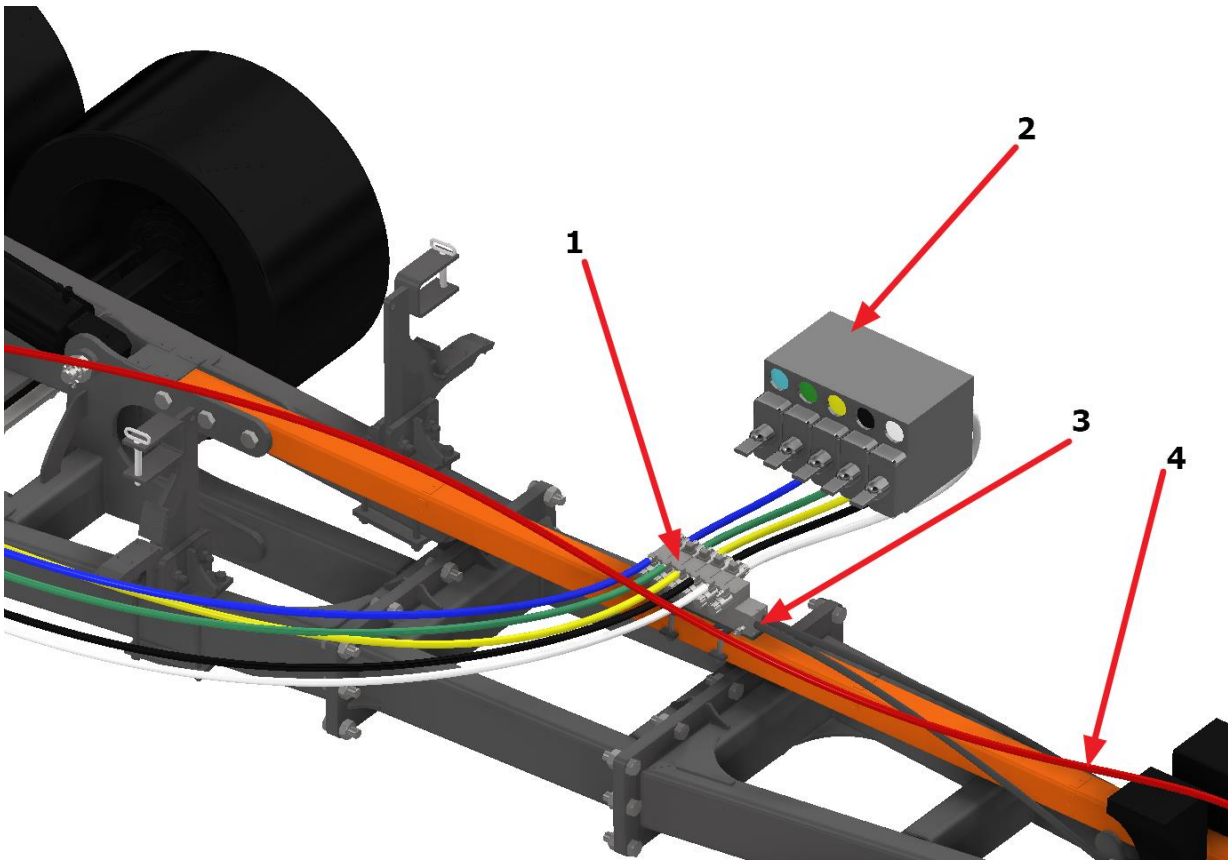


Figure 57 Machine chassis with valve block installed (1 - valve block with electric control, 2 - control panel with joystick, 3 - supply output of valve block, 4 - supply output of machine wing folding/unfolding hydraulics)

Options for valve block operation and equipment in the case of:

1) Tractor equipped with a lever that automatically returns to the starting position

If, during actuation of the valve block system, the control lever on the tractor returns to its initial position after being swung, section sliders without a spring should be used.

2) Tractor equipped with LS (LOAD SENSING) system

A valve block with LS connection can be used in the system. This means that hydraulic distributors with LOAD SENSING ensure smooth control of the hydraulic system. A change in the hydraulic pump delivery rate is made in proportion to the angle of the distributor lever.

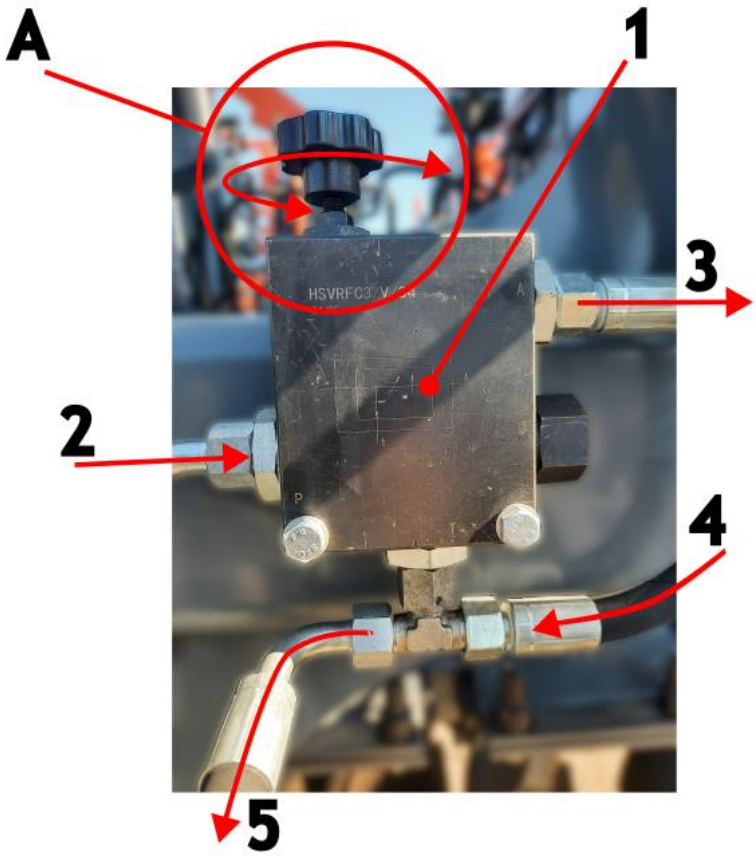


Figure 58 Flow regulator (1 - flow regulator, 2 - supply connection P, 3 - connection to valve block A, 4 - return line, 5 - output to tractor; A - flow control knob)

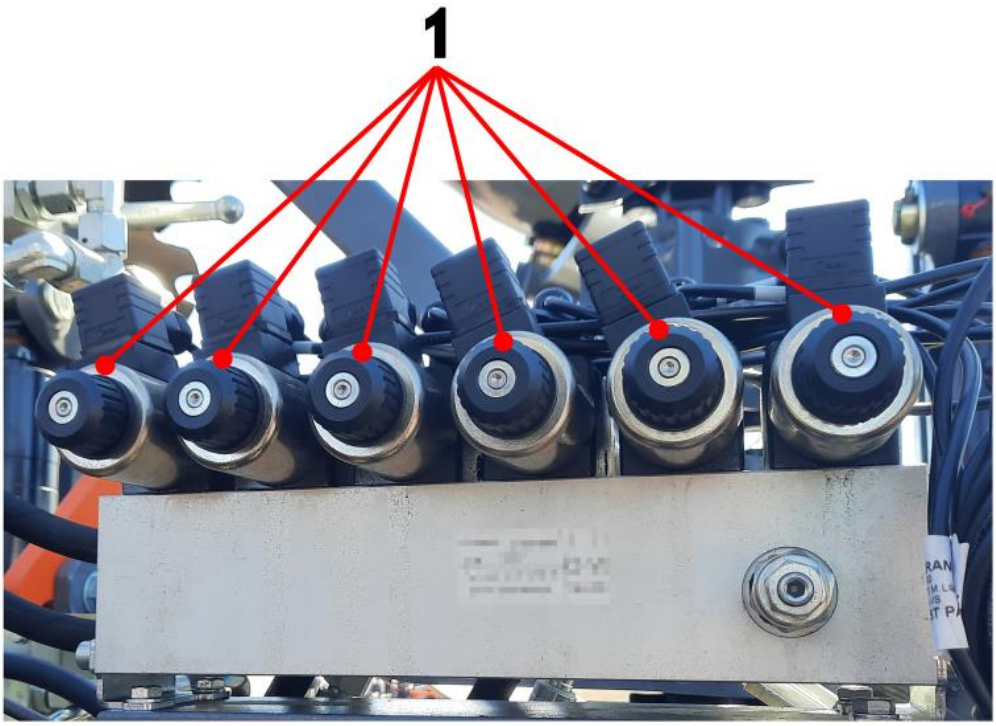


Figure 59 Valve block - side view (1 - electrically operated directional control valves)

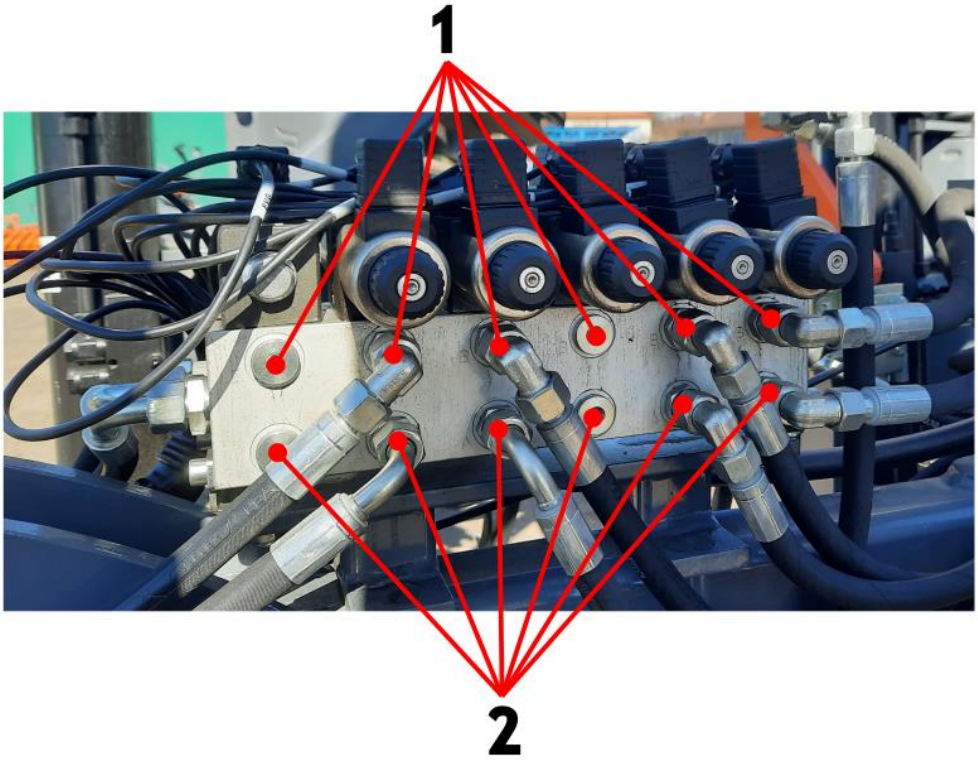


Figure 60 Valve block - side view (1 - A inlet connections , 2 - B outlet connections)

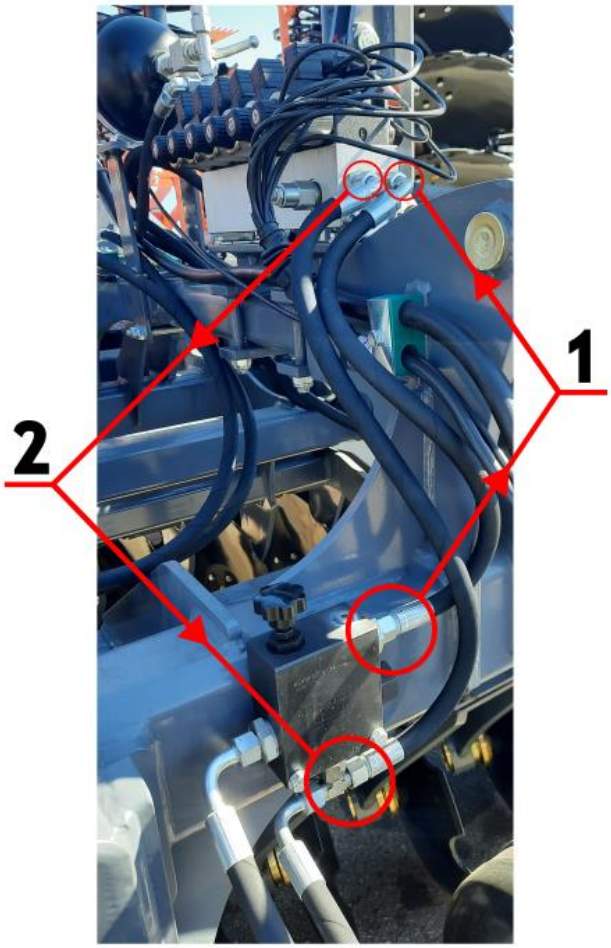


Figure 61 Connection of flow regulator to valve block (1 - supply line, 2 - return line)

Table 4 Technical data of the flow controller

Technical data of the flow controller	
Fluid viscosity	ISO 3448
Filtration	ISO 4406, 25 µm
Maximum flow at port P	120 L/min
Maximum flow at port A	70 L/min
Setting range	2 - 70 L/min
Oil temperature	-15°C ÷ +80°C
Ambient temperature	-20°C ÷ +80°C
Maximum operating pressure	250 bar
External covering	Galvanised steel

Description of the flow controller

The flow controller allows the specific amount of oil flowing through the hydraulic system to be set. This allows you to set the speed of the actuators. Adjustment is by means of a knob located on the controller, and it is possible to secure the settings with a lock nut. The controller has the option of mounting a pressure gauge.

Figure 62 shows a diagram of the machine's hydraulics using a valve block with electric control.

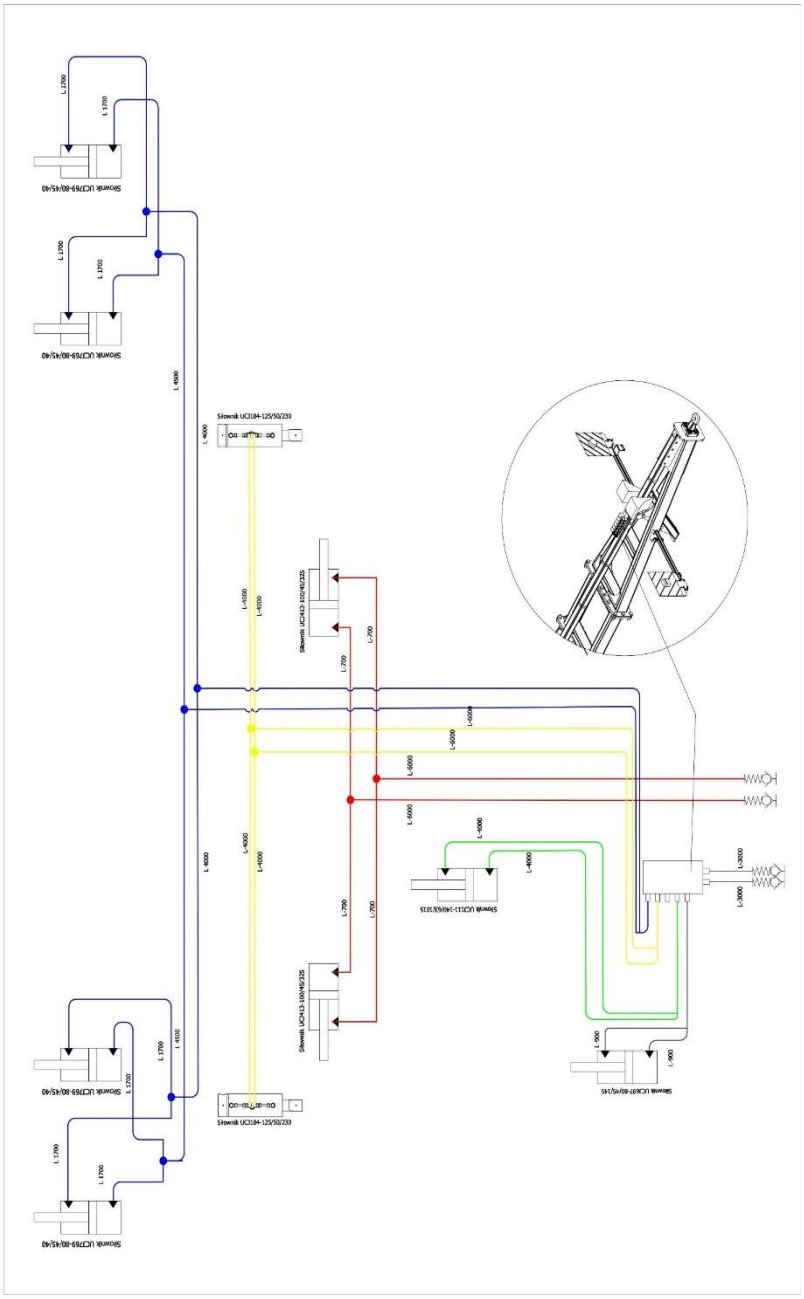


Figure 62 Diagram of the machine's hydraulic system with valve block fitted.

6.2. Construction and operation of the vibration compensation system and of the chassis suspension system (option)

On the GAL-K and GAL-K HD disc harrows, a vibration compensation system can be fitted as an option. The vibration compensation system consists of: double-acting actuator, hydro-pneumatic accumulator, pressure gauge, shut-off valve, hose assembly and fittings.

The system is designed to compensate for vibrations passing from the tractor to the machine, which introduce vibrations into the unit. As a result of the resonance created during operation, there is a 'jumping' between the machine and the tractor, which makes work more difficult, leaves bumps on the field surface and, in extreme cases, can damage the machine. By absorbing vibrations and drawbar oscillations caused by the tractor hitting a bump, the hydro-accumulator reduces the machine's resonance.

6.3. Installation of the vibration compensation system

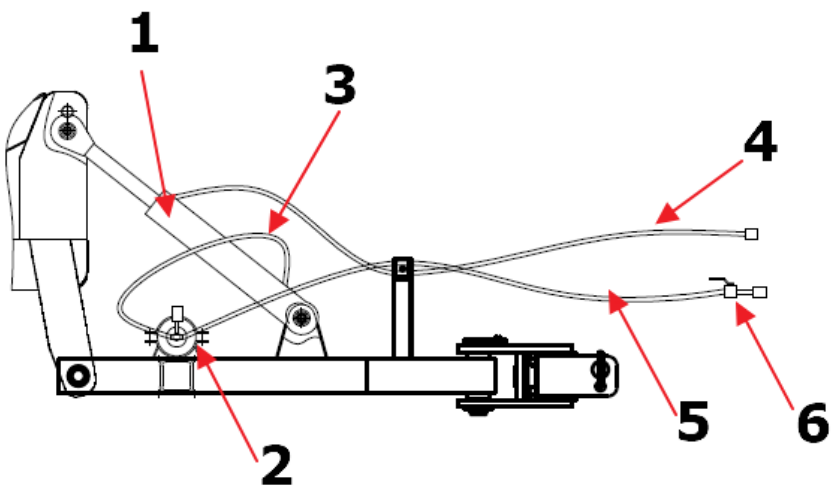


Figure 63 Drawbar with vibration compensation actuator (1-hydraulic actuator, 2-hydropneumatic accumulator system, 3-hose straight elbow 0.9 m, 4-hose straight elbow 2 m, 5-hose straight elbow 2 m, 6-ball valve M18)

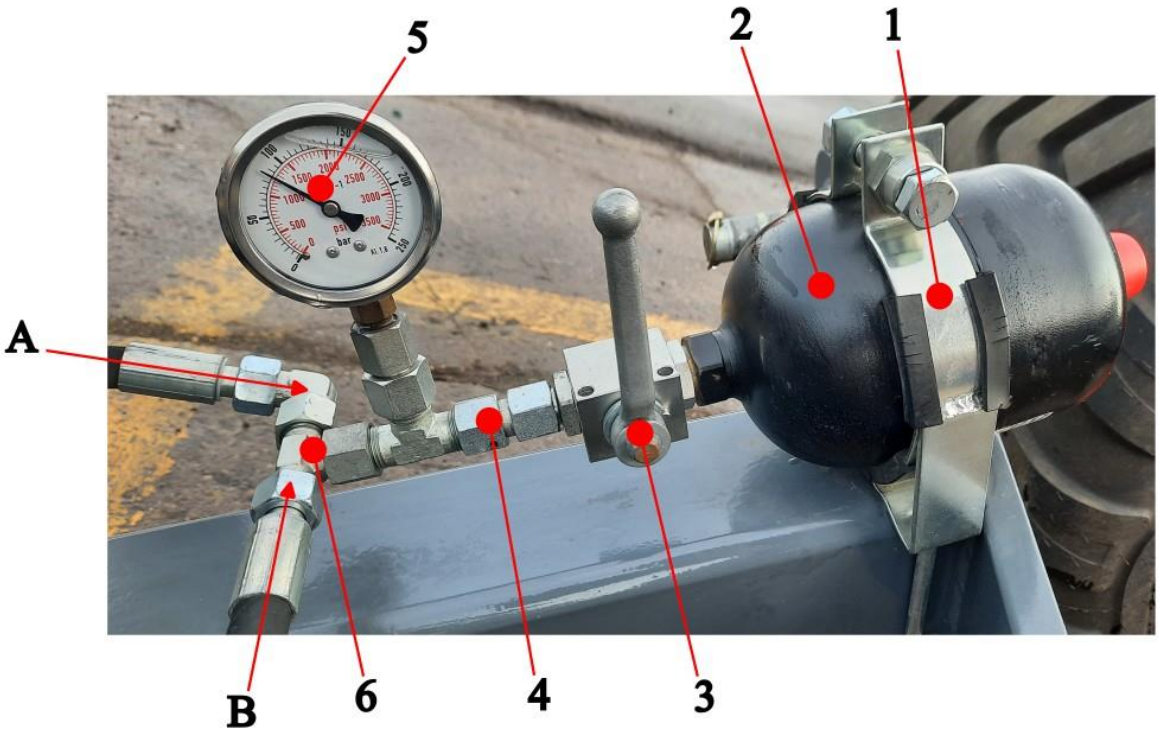


Figure 64 Diagram of the vibration compensation system (1- accumulator clamp, 2- hydro-pneumatic accumulator tank, 3- ball valve with copper / steel-rubber washer, 4- adapter, 5- pressure gauge, 6- tee)
A - output to actuator
B - output to the tractor

Note! Partially assembled components do not provide a connection that enables operation. Before commissioning, check all connections and tighten them!

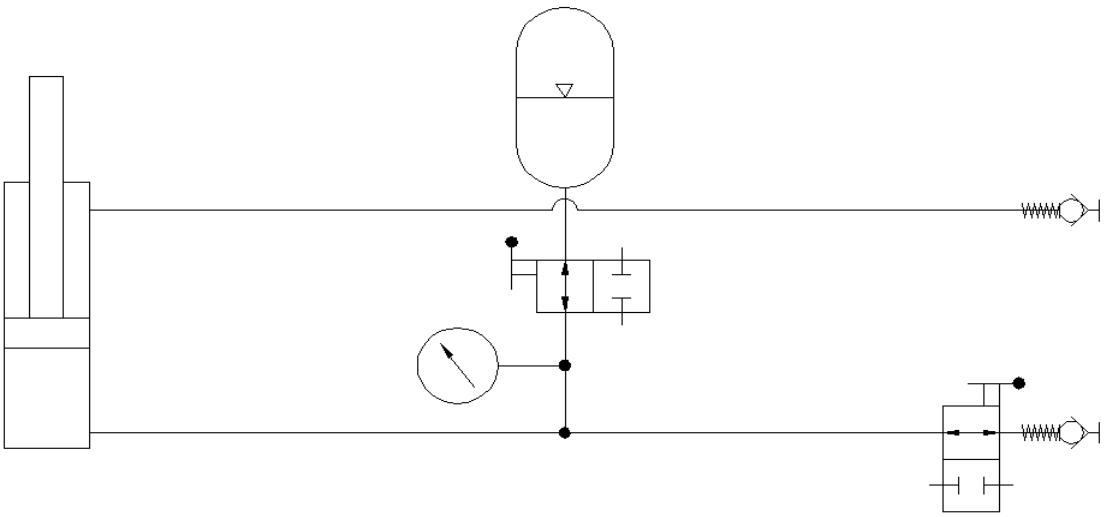


Figure 65 Hydraulic diagram of the vibration compensation system.

6.4. Operation of the vibration compensation system

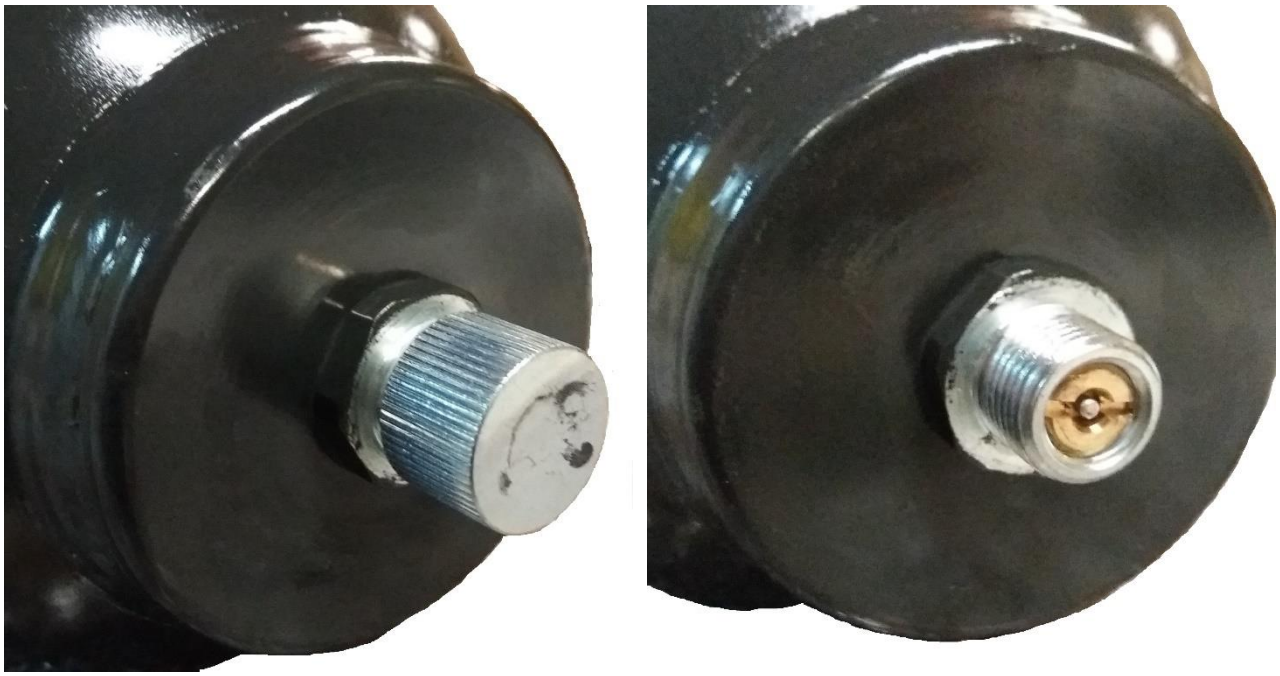
The vibration compensation system is switched on and off using a ball valve (No. 3, Figure 64). When transporting over large unevenness, the hydraulic system should be open - ball valve open (position of lever parallel to oil flow direction). The flow of oil to the accumulator is then allowed, allowing the centre frame to be cushioned when the machine is moving on public roads. Once the system has been pressurised, it is possible to close the hydraulic system using a ball valve (No. 6, Figure 63), allowing the unit to continue operating..

Note! The tractor linkages should be raised to such a height that, in the event of a actuator failure, the machine will not hit the ground when falling.

Initial system start-up

- Before starting work in the field, lift the machine as high as possible on the chassis and only then start to unfold the machine.
- Once the machine has been unfolded and lowered into the working position (trolley raised as far as possible), the machine must be levelled on the actuator and the tractor's suspension system.
- The lever of the pair of tractor hydraulic outputs operating the vibration compensation system should be in a position that prevents the free flow of oil.
- The pressure on the pressure gauge should be around 90 bar to ensure that the system works properly.
- Then raise the machine on the three-point hitch and check the actuator stroke. The stroke value should vary between 30-60 mm depending on the operating conditions of the machine. The amount of pressure in the system will vary depending on the type of machine and actuator.
- If the factory settings prevent adequate stroke, the gas pressure in the hydro-pneumatic accumulator should be reduced. To do this, unscrew the nut on the back of the accumulator (Fig. 66), press the flat screwdriver against the valve (Fig. 66) and then tap it in pulses to reduce the pressure in the accumulator. Check the actuator stroke after each reduction.
- If the actuator stroke is selected appropriately, work can begin.
- When driving, monitor the behaviour of the machine on the road and always adapt your speed to the road conditions (potholes, surface condition, traffic volume, road width).
- During operation, the shock absorber valve may be in the open position (fig. 64 item 3).

Note! The accumulator is charged with nitrogen (N2) at 90 bar. The depressurisation must take place in the open air. Pressurisation must be carried out with specialised tools by a trained worker.



View of valve plug nut

View of the pressure control valve

Figure 66 Accumulator nitrogen pressure control valve.

➢ **Daily operation**

- Once the machine has been unfolded and lowered into the working position (trolley raised as far as possible), the machine must be levelled on the actuator and the tractor's suspension system.
- Then adjust the pressure in the shock absorber system to 90bar.
- The lever of the pair of tractor hydraulic outputs operating the vibration compensation system should be in a position that prevents the free flow of oil.
- The hydro-accumulator valve should be in the open position (lever parallel to the oil flow direction) (fig. 64 item 3).
- Start operation.
- After finishing work, it is advisable to drive with the drawbar suspension engaged when driving over large bumps (e.g. gravel roads).
- The drawbar damping valve must only be closed when driving with the machine on level asphalt roads.

6.5. Operation of the chassis suspension system

The GAL-K disc harrows are fitted with a suspension system for the running gear as standard. The vibration compensation system consists of: actuator system, hydro-pneumatic accumulator, pressure gauge, shut-off valve, hose assembly and fittings.

The system is designed to compensate for vibrations passing from the roadway to the

machine, which subject the machine to additional stress during transport. By absorbing the vibrations caused by the machine hitting a bump, the hydro-accumulator reduces the stress to which the machine is subjected during transport on the road.

The system is assembled on the centre frame of the machine and comprises the following components (Figure 67).

- Side view:

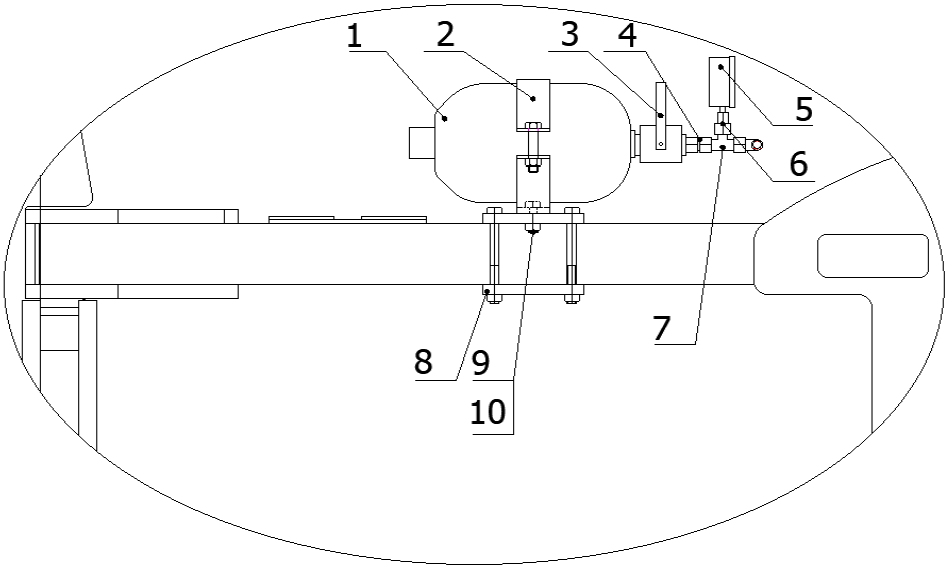
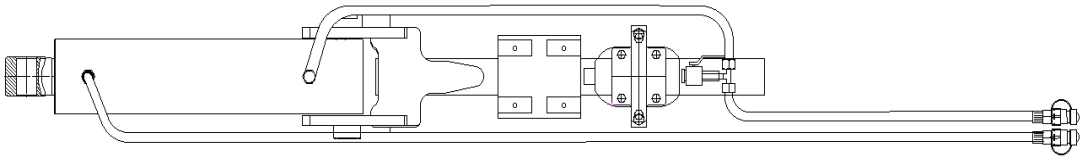


Figure 67 Diagram of the running gear suspension system. (1- hydro-accumulator, 2- clamp, 3- ball valve, 4- M18 GW adapter. W-w, 5- pressure gauge, 6- M18 GW adapter. W-w, 7- tee, 8- accumulator bracket, 9- screw M10x30, 10- lock-nut M10)

- Top view:



Note! Partially assembled components do not provide a connection that enables operation. Before commissioning, check all connections and tighten them!

The vibration compensation system is switched on and off using a ball valve (No. 3, Figure 64). When transporting the machine over large unevenness, the hydraulic system should be open - ball valve open (position of lever parallel to oil flow direction). The flow of oil to the accumulator is then allowed, allowing the machine to be cushioned when the machine is moving on public roads.

➢ **Initial system start-up and operation**

- Lift the machine as far as possible on the chassis, only then fold it into the transport position.
- The arm actuators (hydraulic working depth) must be extended so that when the machine is lowered, the arms are not damaged by colliding with the chassis.
- Once the machine has been lifted onto the chassis, the pressure in the system should be stabilised so that it is 90 bar. During lifting, the pressure gauge can indicate up to 160 bar. To lower the pressure in the system, the chassis should be lowered slightly, which will improve the handling characteristics as the machine's centre of gravity will also be lowered.
- If the pressure gauge reads 90 bar, the machine can be transported with confidence.
- When driving, monitor the behaviour of the machine on the road and always adapt your speed to the road conditions (potholes, surface condition, traffic volume, road width).
- Before starting work in the field, lift the machine as high as possible on the chassis and only then start to unfold the machine.
- During operation, the damper valve may be in the open position.

Note! The accumulator is charged with nitrogen (N2) at 90 bar. The depressurisation must take place in the open air. Pressurisation must be carried out with specialised tools by a trained worker.

6.6. Construction of a Support Wheel (Optional)

The support wheel is designed to help maintain the specified working depth during the operation of the disc harrow and to keep the machine balanced both during operation and transport. It is mounted on the arm of the side frame on both the right and left sides. By using the installed screw jack (Fig. 68, item 2), we can adjust the position of the wheel relative to the machine, raising or lowering it. The higher the support wheel is raised, the shallower the working depth of the unit. To ensure proper operation of the wheel, the tire pressure must be monitored.

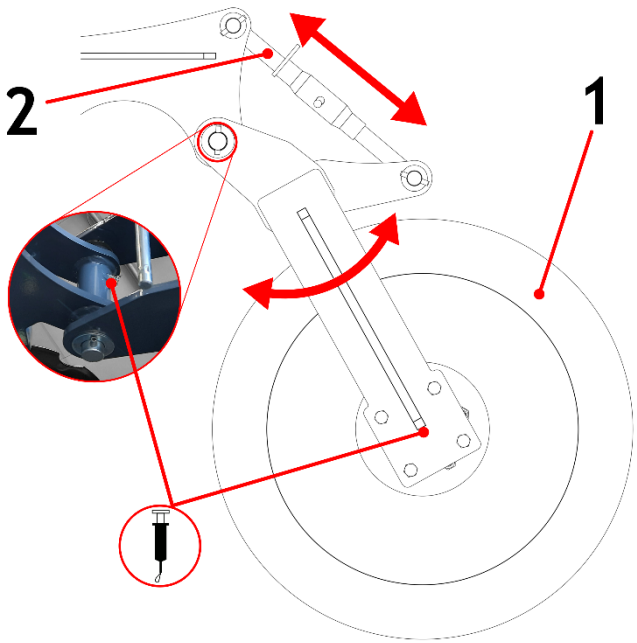


Figure 68 General construction of the support wheel with lubrication points (1 - wheel with hub, 2 - turnbuckle)

Caution! It is prohibited to adjust the machine while the tractor engine is running.

7 Hydraulic system quick couplings

The machine's hydraulic system has quick couplings for quick and easy connection of the hoses and other hydraulic installation. Each quick coupling has its own designation (fig. 69):

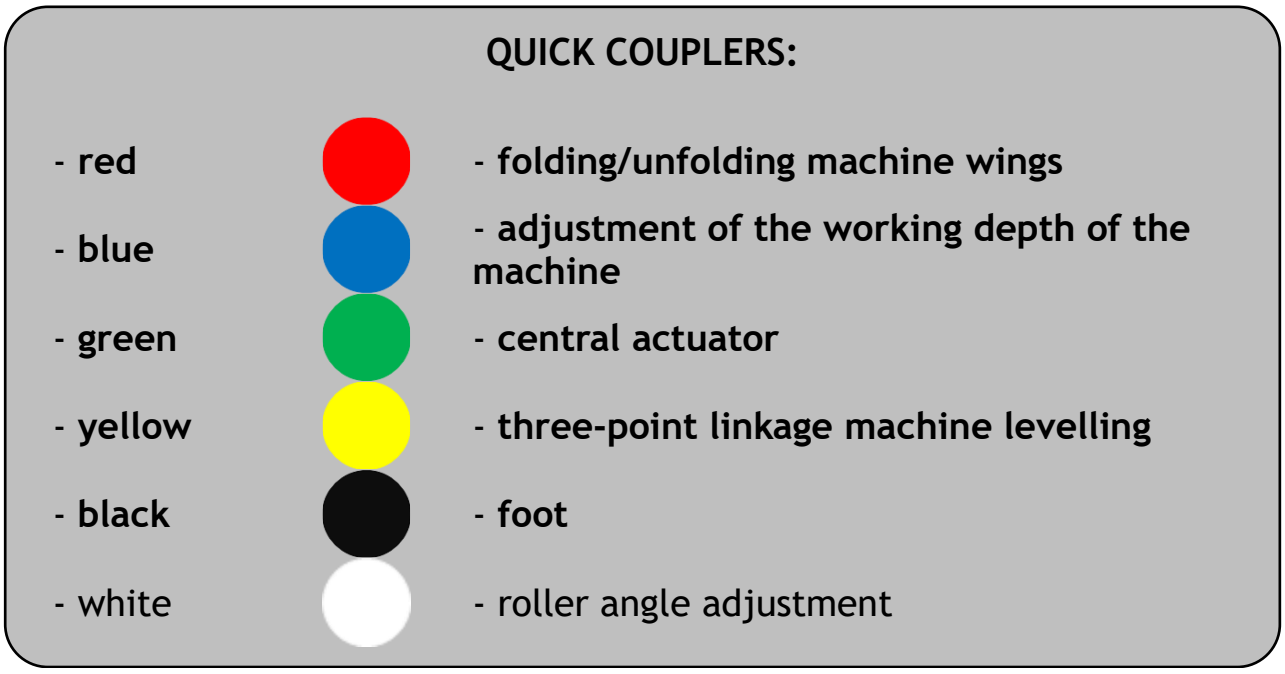


Fig. 69. Designation and purpose of individual quick couplings on the machine.

8 Rules for transporting the harrow on public roads and lighting

In accordance with the road safety regulations (Regulation of the Minister of Infrastructure of 31.12.2002. Journal of Laws No. 32 of 2002 item 262) - unit consisting of an agricultural tractor and the agricultural machine coupled with it must meet the same requirements as the tractor itself.

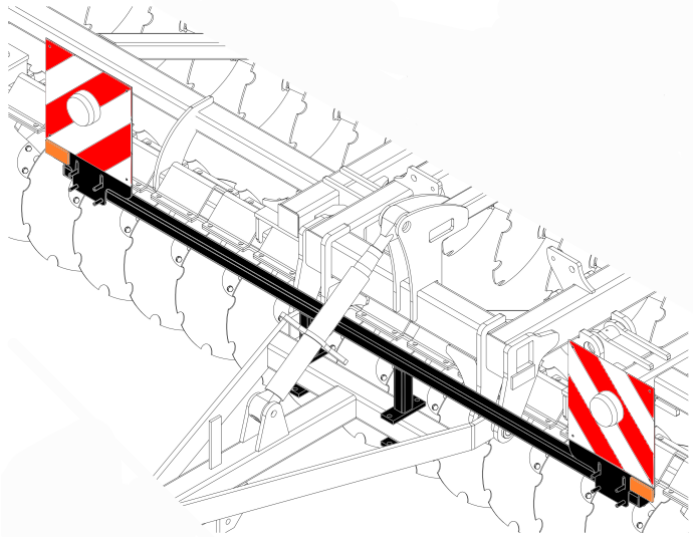
NOTE! Special care must be taken when transporting the disc harrow. It is forbidden to drive on public roads without appropriate additional warning signage.

Before transporting, the machine should be cleaned from the soil and the operation of the lights checked.

- **After lifting the machine, check the clearance under the lowest working elements, which should be at least 30 cm.**

The permissible transport speed for the tractor with the machine on smooth roads is up to **15 km/h**. On roads with poorer surfaces (dirt or cobblestones) it should be lowered to a maximum of **10 km/h**, and on bumpy roads to **5 km/h**. Extreme caution should be exercised when passing and overtaking other vehicles, avoiding obstacles and crossing large irregularities in fields and dirt roads.

Front lights assembly



Rear lights assembly

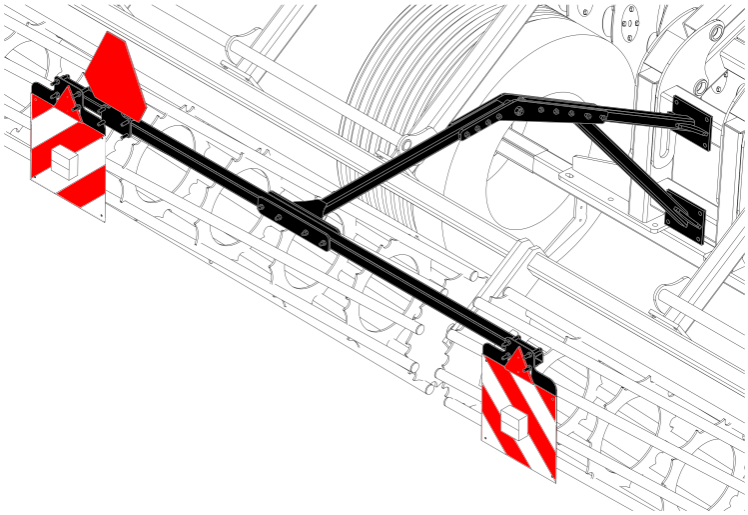


Figure 70 Front and rear light systems and their position.

NOTE! If the tractor's lighting is obscured by a suspended machine, such lighting should be duplicated on the machine (using dedicated lighting boards) to improve the team's visibility on the road.

The machine must be thoroughly cleaned of adhering plant debris and soil before being driven on the public road. Portable light and warning devices and a marking sign for slow-moving vehicles (in accordance with applicable road traffic regulations) should be attached to the ends of the roller frame. The machine must be fitted with rear lights and front contour lights (according to current traffic regulations) and side reflectors.

NOTE! The unit as a part of the vehicle protruding beyond the rear side contour of the tractor obscuring the rear lights of the tractor poses a danger to other vehicles on the road. It is forbidden to travel on public

roads without appropriate markings.

Once the plates have been fixed, the electrical wires of the warning-light device should be connected to the socket of the tractor's electrical installation.

- **The manufacturer does not supply warning signs as standard equipment on the machine.**

WARNING! It is stipulated that it is against the highway code to drive on public roads without an approval certificate. The travel can take place under the responsibility of the user or with individual approval.

Warning signs are available commercially. Driving style should always be adapted to the road conditions - this will help avoid accidents and damage to the chassis. Consider your own skills and the intensity of the movement, the prevailing visibility and the weather.

NOTE! Lighting and warning devices are not part of the equipment of the cultivation roller. The user can purchase them at agricultural machinery dealers.

- When work is complete (in the case of hydraulically foldable units for which the width of the machine in the working position exceeds 3.0 m), fold the machine into the transport position. **Do not forget to secure the automatic wing lock!**

- The driving speed must be adapted to the condition of the road and the conditions on the road, so that the agricultural equipment does not jump on the tractor's suspension system and there are no excessive loads on the machine's frame and the tractor's suspension system.

- Particular care should be taken when passing and overtaking and on bends. On sharp turns, the machine swings in the opposite direction to the direction of the turn. This can lead to collisions with obstacles or other road users. Be aware of the length of the machine.

- The permissible width of the machine running on public roads is 3.0 m.

- It is forbidden to transport the disc harrow if the slope transverse to the machine exceeds 7°.

WARNING! Failure to comply with the above rules may create hazards for the operator and bystanders as well as damage to the machine. Damage resulting from non-compliance with these rules is the responsibility of the user.

NOTE! The unit must be brought into line with the road traffic laws of the country in which it will be on the road.

9 Maintenance and lubrication

- The disc harrow must be cleaned of soil after each operation, followed by an inspection of the parts and assemblies. **Otherwise, there may be a problem with the folding of the machine if the rollers are clogged with soil and there is an additional load!**
- Re-tighten all screws after the first 4 hours of operation and periodically check the tightness. **Failure to do so will exacerbate backlash and cause damage to the machine as a result,**
- Lubricate the grease points on the hinge pins daily during the life of the machine. Lubricate the bearings of the tubular roller and the levelling discs every 25 operating hours (this does not apply to the maintenance-free bearings of the discs - these bearings do not require maintenance and lubrication).
- When replacing worn components, use thread glue, original bolts and nuts.
- Always ensure that screw connections are properly tightened.

NOTE! Periodic lubrication is a guarantee of the durability of the machine.

The service life and efficiency of the machine depend to a large extent on regular lubrication. Mineral lubricants should be used for lubrication. Lubrication points must be thoroughly cleaned before pressing in or applying grease.

NOTE! It is forbidden to work on a damaged machine caused by any event resulting in a broken, or deformed frame, roller or other assembly of the machine!

10 Screw tightening torque

Bolts and nuts should be tightened in the machine with the correct torque depending on the strength class of the bolt and its thread size and pitch. Their respective tightening torque values are shown in Table 5.

Table 5. Tightening torque values for nuts and bolts.

Tightening torques for nuts and bolts [Nm].

Dimension	Thread pitch	Bolt strength class 8.8	10.9	12.9
M4	0.7	3.2	4.5	5.2
M5	0.8	6	8.4	10
M6	1.0	11	15	17
M8	1.3	27	34	40
	1.0	21	30	35
M10	1.5	46	65	76
	1.3	41	75	67
	1.0	36	50	59
M12	1.8	79	111	129
	1.3	65	91	107
M14	2.0	124	174	203
	1.5	104	143	167
M16	2.0	170	237	277
	1.5	139	169	228
M18	2.0	258	363	422
	1.5	180	254	296
M20	2.5	332	469	546
	1.5	229	322	375
M22	2.5	415	584	682
	1.5	282	397	463
M24	3.0	576	809	942
	2.0	430	603	706
M27	3.0	740	1050	1250
	2.0	552	783	933
M30	3.5	1000	1450	1700
	2.0	745	1080	1270
M36	4.0	1290	1790	2020
	2.0	960	1340	1500

NOTE! It is forbidden to work on a damaged machine caused by any event resulting in a broken, or deformed frame, roller or other assembly of the machine!

11 Operation of the GAL-K and GAL-K-HD disc harrows

Everyday service

Each time after work, the harrow should be thoroughly cleaned of soil and plant debris and the condition of the bolt and pin connections and the condition of the working

elements and other parts should be inspected. When cleaning, plant debris and strings winding up at the bearing points of the discs and roller should be removed. If parts are found to be damaged or worn, they should be replaced. All loose screw connections must be tightened and damaged cotter pins and pins must be replaced.

NOTE! When the machine equipped with a chassis is stationary, secure it by placing locking wedges under the wheels of the chassis to prevent unwanted rolling down. The safety wedges with which these machines are equipped as standard are located on the front of the chassis.

Post-season service

After the working season, the disc harrow must be thoroughly cleaned, any damage to the paintwork repaired and the worn working surfaces of the teeth, discs, strings and roller rings, as well as the threads of the adjusting screws, washed with "Antykor" paraffin and protected against corrosion with "Antykor 1" grease, in addition to a full lubrication. It is advisable to store the machine under a canopy when not in use. However, if this is not possible, the condition of the protection should be checked from time to time and, if necessary, the rain-washed grease should be replenished.

Operation of the GAL-K/GAL-K-HD running gear

Regular control of wheel pressure. If there is a significant loss of air from the tyres, check the air valve for leaks. Next, take the wheel to a specialised workshop to locate and repair the damage. Significantly damaged tyres (particularly profile damage) must be replaced immediately.

Setting of wheel bearing axial clearance.
It is recommended that this operation is carried out by a specialised company. Performed by tightening the nut on the wheel hub after the wheels have been removed. Recommended play is 0.12-0.15 mm. Inspection and adjustment should take place every 2 years.

Procedure :

- Removal of the hub cover and the spring pin securing the spring nut.
- At the same time, while turning the hub, press down and tighten the crown nut.
- Tightening is complete when no more than half a turn of the hub is caused by vigorous hand rotation.
- Partially loosen the nut until the hub rotates freely and repeat the tightening.
- After repeated rotation locking, loosen the nut by 30° max. until the immediate nut locking with the pin is possible. Mark the position with a line.
- From the marked position, unscrew the nut by half a turn and, with a gentle tap, press the hub against the nut as far as it will go.
- Tighten the nut to the position marked with the line.
- Fit the hub cover.

NOTE! During maintenance work, the unit should be secured against rolling (it should be connected to the tractor with the parking brake on) and unfolded.

Operation of the hydraulic system

Maintenance of the hydraulic system consists of a visual inspection for leaks. Remember to put plugs on the quick-release couplings. Oil leakage at the connections of the hydraulic lines should be tightened. If this does not rectify the fault, the component or hose must be replaced with a new one. Leakage occurring outside the connector - the leaking hose must be replaced with a new one. Mechanical damage also requires replacement of the component. It is recommended to replace the hydraulic hoses every 5 years.
Appearance of oil on the piston rod of the hydraulic actuator - check the nature of the leak. When the piston rod is fully extended, check the sealing points. Minor leaks characterised by wetting of the piston rod with an "oil film" are permissible (defective sealing ring). In the event of heavier sweating or the appearance of drops, the unit should be switched off while the fault is being rectified (defective seal).

Operation of the pneumatic system

The three-range brake force regulator is not adjustable under normal use. It should be in a central position. If the braking force deviates from that of the tractor, the regulator can be adjusted to avoid incorrect road behaviour. When making any change, be sure not to cause an accident or damage to the machine.
The removal of condensed water in the tank is carried out by means of a valve located underneath the tank. The stem must be pressed, which will cause the compressed air to displace the water. Releasing the stem will automatically close the valve. Once a year (before winter) the drainage valve should be unscrewed and cleaned.
Checking the pneumatic system involves visually inspecting for leaks, especially at the connection points (when checking the system, the pressure should not be less than 6 atmospheres). If hoses, seals and other system components are damaged, this will manifest itself as hissing. Bubbles will appear at small leaks (check by applying wash liquid). **Damaged components should be replaced with new ones.**

Headstock *Braked transport chassis*

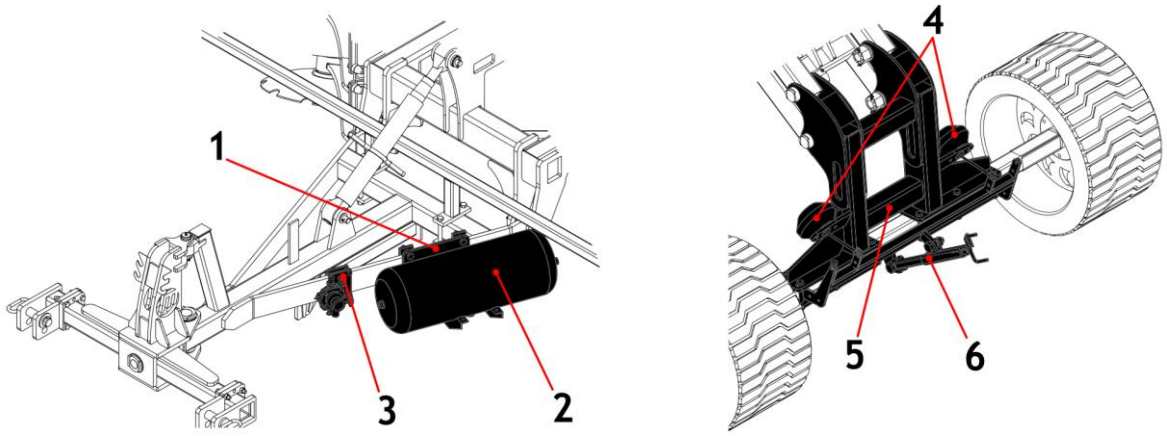


Figure 71 Pneumatic installation of the brake axle (1 - Air bin bracket, 2 - Air bin, 3 - Air valve bracket, 4 - diaphragm actuator, 5 - frame with pneumatic cylinder bracket, 6 - parking brake)

Braking adjustment – braking deceleration levelling, should be carried out when:

- As the lining jaws wear during use and as a result of the resulting clearance, the braking force decreases,
- the wheel brakes brake unevenly and inconsistently.

To do this, it is necessary to change the position of the spreader arm on which the piston rod of the pneumatic actuator acts by changing the starting angle of the spreader roller at the end of the multi-roller and to correct the length of the linkage on the bolt. Adjustments should be carried out for each wheel separately.

Replacement procedures

Replacement of tube roller bearings

If the bearings are damaged, they must be replaced as follows:

- place the machine on a horizontal surface,
- unscrew the four screws holding the ball bearings on each side,
- move the tubular roller away,
- loosen the two headless screws on each bearing and pull off the bearings using an extractor,
- fit the new bearings loosely onto the roller,
- roll the roller between the bearing plates and screw the bearings to them. Screw in headless screws using adhesive to prevent loosening.
- do not replace the ball bearings on the disc holders,
- In the event of damage, replace the entire disc holder.

Replacement of working components

Excessively worn working element make it difficult for tools to penetrate and cause an increase in working resistance. The discs should be replaced with new ones when their diameter reduces to 510 mm.

The working components must be changed on the machine lowered to the ground after

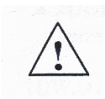
the tractor engine has been switched off. To ensure that the elements to be replaced do not come into contact with the ground, sturdy shims (e.g. wooden blocks approx. 20 cm thick underneath adjacent elements or the roller) must be provided. In the case of a trolley, the maximum lowered wheels can also be used as supports. After lowering the harrow, switching off the tractor engine and applying the handbrake, check the stability of the tractor-machine combination. Only typical screws should be used to fix new components.

If machine components are disassembled several times, it is necessary to inspect and possibly replace connecting elements such as bolts, washers or nuts, excessive wear of which may lead to uncontrolled loosening of the connecting elements and subsequent damage.

When working on extremely worn work tools, such work can cause, for example, bearing damage in the case of a small disc diameter. Tools should be replaced when their wear and tear exceeds the limits allowed by the manual. Failure to follow the recommendations may result in damage, for which the manufacturer is NOT RESPONSIBLE!

Replacement of actuators

A malfunctioning actuator, leakage, etc. must be replaced by dismantling and returning it to a specialist workshop. Replacement of the actuator must be carried out on an unfolded machine. Connect the actuator to the system and, mounted on one side, it should cycle a few times to fill the actuator completely with oil. Failure to do so may result in a sudden fall of the drop section.



NOTE! When carrying out repairs and maintenance, the machine should be lowered to the ground and supported on supports to ensure full stability and the tractor engine switched off. Use proper spanners and protective gloves during maintenance and repairs.

Table 6. Causes and remedies for faults and malfunctions of the GAL-K/GAL-K-HD disc harrow.

Malfunction, defect	Cause	Solution
• Uneven penetration of the workpieces,	○ Improper levelling of the implement,	✓ Level and align the implement lengthwise and crosswise,
• Poor disc penetration,	○ Excessively worn discs, ○ Roller lowered too low, ○ Too low disc pressure on compact soil,	✓ Replace the discs, ✓ Lift the roller,
• The stubble not accurately cut,	○ Too low working depth of the discs,	✓ Increase the working depth of the discs,
• Deep groove at the contact point of the work	○ Incorrectly adjusted side plate,	✓ Adjust the position of the side plate,

Malfunction, defect	Cause	Solution
passages,		
• Soil flowing above the roller,	○ Rear plate not present, ○ Roller placed too close to the discs,	✓ Mount the rear plate, ✓ Move the roller away from the discs,
• Clogging of discs,	○ Excessive working depth, ○ Too much humidity,	✓ Reduce the depth,
• Clogging of the side plate,	○ Too much post-harvest residue,	✓ Dismount the side plate,
• Soil poorly pressed by the roller,	○ Harrow poorly levelled, ○ Roller raised too high,	✓ Extend the upper fastener, ✓ Lower the roller,

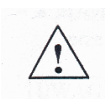
11.1. Storage of the disc harrow

- At the end of the working season with the unit, the roller should be thoroughly cleaned of soil and plant residues, the bolted and pin connections should be inspected and the condition of the working elements and other parts should be checked. When cleaning, plant debris and strings winding up at the bearing points of the roller should be removed.

- If parts are found to be damaged or worn, they should be replaced. All loose screw connections must be tightened and damaged cotter pins and pins must be replaced. The unit should be stored in covered premises. In the absence of a covered area, outdoor storage of the machine is permitted.

- **The unit should be stored in a place that does not pose a threat to people and the surroundings.** If the machine is stored outdoors for a long period of time, the maintenance of the working parts should be repeated when the preservative layer is rinsed off.

Clean the piston rods of the hydraulic actuators during winter and when the machine is not in use for a long period of time, and protect them with vaseline or acid-free grease to protect them from corrosion.



NOTE! The unit must rest on the support feet during storage. The machine should only be placed on hardened ground with a slope of no more than 8.5°. Wedges should be placed under the roller.

- The machine, when uncoupled from the tractor, should support itself on firm and level ground, maintaining a firm balance. All work units should rest on the ground. The machine should be lowered gently so as not to expose the working parts to impact on hard ground.

- Once the machine is down, disconnect the suspension system and drive the tractor

away. Also, components dismantled from the machine must be stored securely supported on the ground, excluding the possibility of uncontrolled movement. It is advisable to store the machine in a paved and covered area that is inaccessible to bystanders and animals.

Store the machine securely supported on a hard surface to prevent injury to people or animals.

- For safety reasons, the unit with a working width of more than 3.00 m should be stored unfolded with the discs facing downwards.

12 Disassembly and disposal

- A machine used in accordance with the rules in the operating instructions will last for many years, but worn or damaged components must be replaced with new ones. In the event of emergency damage (cracks and deformation of the frames) impairing the quality of the machine's work and posing a danger to further operation, the machine must be scrapped.

- The disassembly of the machine should be carried out by persons previously familiar with its construction. These operations should be carried out after the machine has been set up on a level and stable surface. Disassembled metal parts should be scrapped and rubber parts should be taken to a recycling facility. The oil should be poured into a sealed container and taken to a recycling facility.

- The dismantling and disposal of the used machine poses little risk to the environment. Start dismantling the machine by removing small components (pins, bolts, etc.) before moving on to larger ones. The dismantled machine should be taken to a steel scrap collection point as secondary material.

NOTE! When dismantling the machine, every precaution must be taken using operable tools and personal protective equipment. Disassembled parts must be disposed of in accordance with environmental protection requirements.

NOTE! Before dismantling, the unit must be disconnected from the tractor

13 Spare parts for the disc harrow GAL-K and GAL-K-HD

- To search for, price and order original spare parts for MANDAM Sp. z o.o. machinery, please visit our website at:
www.mandam.com.pl, tab “parts”.

- On this page, we provide catalogues and spare parts sheets in PDF format, containing up-to-date parts diagrams for each machine, together with their numbers and prices. The ordering regulations can also be found there.

Parts orders, or enquiries regarding them, can be made directly from this page (tab: “contact/order”) or via e-mail:

@ parts@mandam.com.pl

- The order should include the part numbers and quantities, as well as the purchaser/payer's details including a contact telephone number.

The parts are dispatched directly to the address given, and payment is made by bank transfer or by collection on delivery. In case of doubt, please contact the Mandam Sp. z o.o. spare parts department on the following telephone numbers:

+48 32-232-26-60 ext. 35, 39

+48 797 518 831 (Mateusz)

+48 668 662 289 (Jerzy)

Original spare parts are also available from all authorised distributors of MANDAM Sp z o o machines.