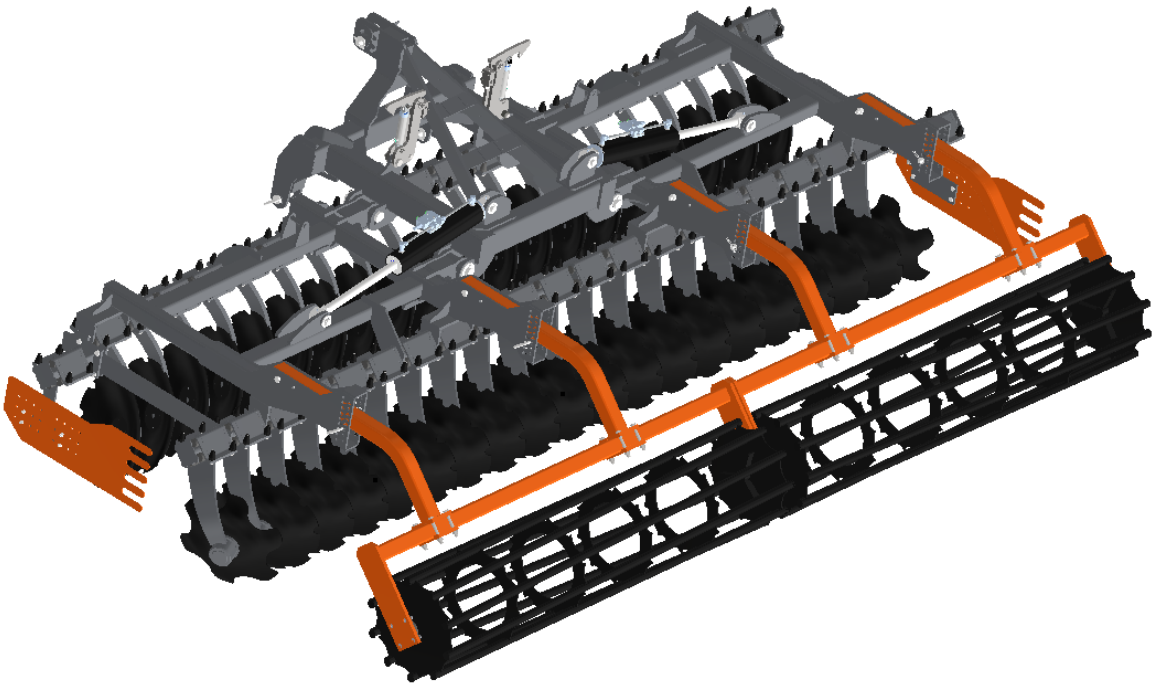
MANDAM Sp. z o.o.
44-100 Gliwice ul. Toruńska 14
e-mail mandam@mandam.com.pl
Phone: 032 232 26 60 Fax: 032 232 58 85
TIN: 648 000 16 74 REGON (*statistical No.*): P – 008173131

OPERATION MANUAL

DISC HARROW GAL-C, GAL-E



TŁUMACZENIE INSTRUKCJI ORYGINALNEJ
ENG

Revision V
Gliwice 2025

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-C / GAL-E
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 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 disc harrow 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 GAL disc harrow guarantee 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:

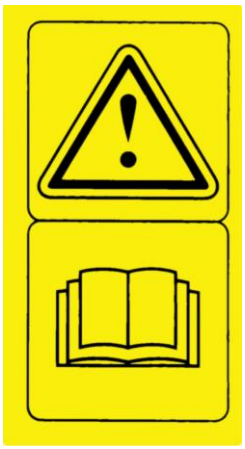
www.parts.mandam.com.pl
+48 668 662 289
parts@mandam.com.pl
- authorised distributors of machines from Mandam Sp. z o. o.

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*
	Contact information for the spare parts department
	Designation of hydraulic system couplings (not available for GAL-E)
	Note about riding ban on rollers
	Opening sequence for machines fitted with hydraulic wing lock (not available for GAL-E)
	5-year warranty on maintenance-free bearings

2 General information

2.1 Construction of the disc harrow GAL-C / GAL-C H

Manufactured GAL-C disc harrows are available in non-folding options in widths: 2.5m, 3.0m, 3.5m, 4.0m, and hydraulically foldable: 4.0m, 4.5m, 5.0m, 6.0m.

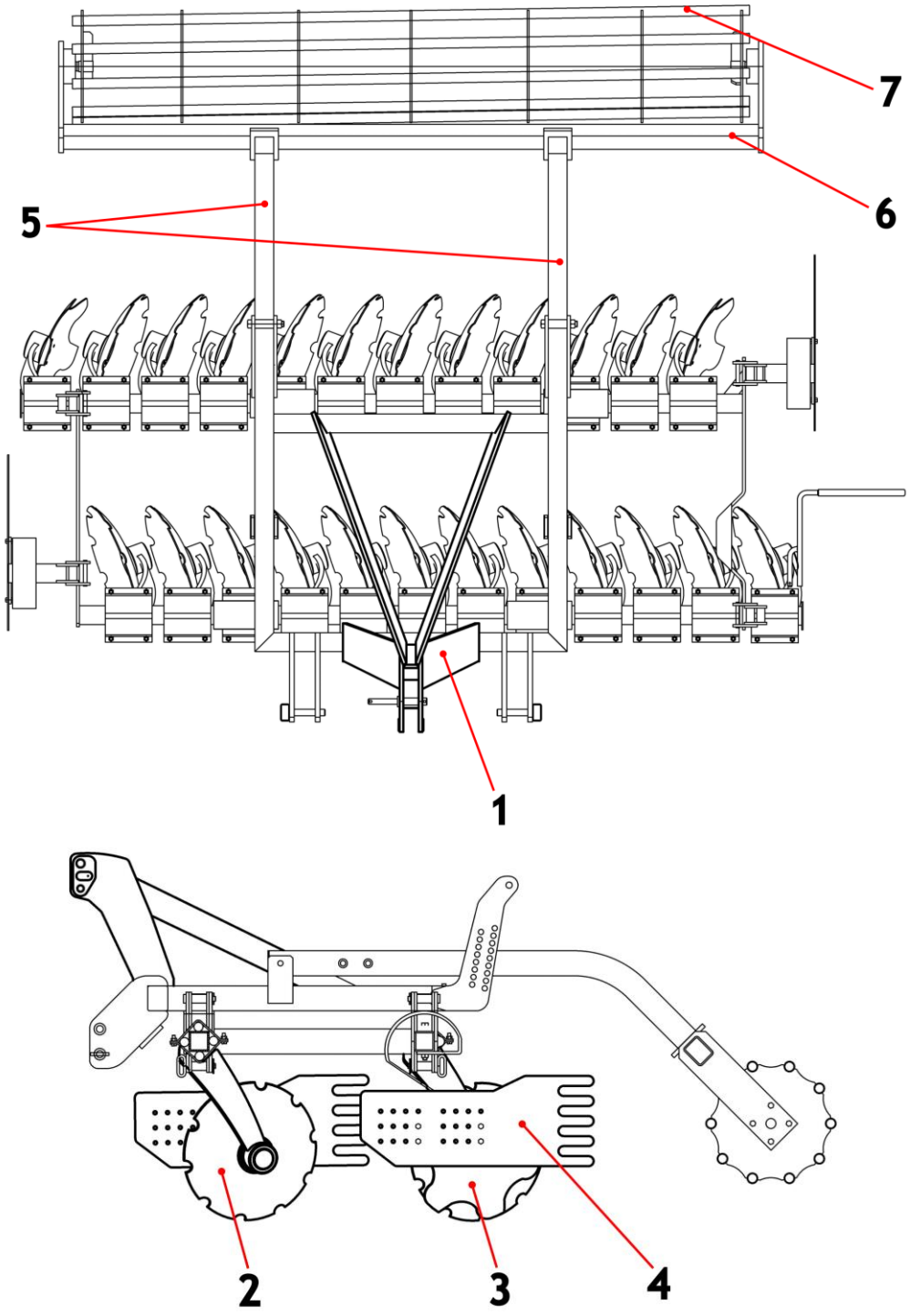


Figure 2 Construction of the GAL-C disc harrow with tubular roller (not hydraulically folded) (1 - frame with drawbar, 2 - front disc row, 3 - rear disc row, 4 - side screen, 5 - arms, 6 - roller bracket, 7 - tubular roller)

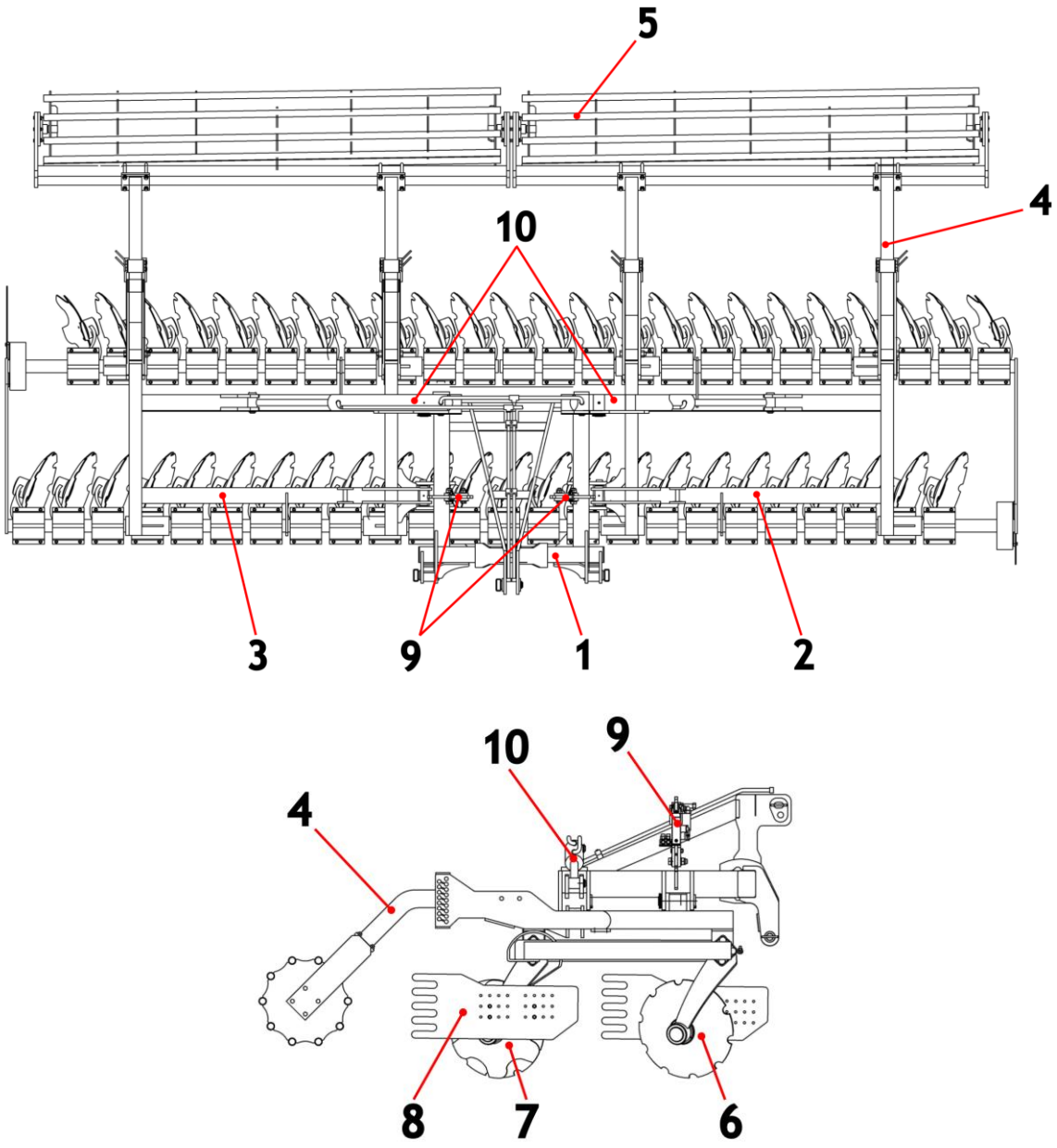


Figure 3 Construction of the disc harrow GAL-C H with tubular roller (hydraulically folded) (1-centre frame with drawbar, 2 - left frame, 3 - right frame, 4 - arms, 5 - tubular rollers, 6 - front disc row, 7 - rear disc row, 8 - side screen, 9 - automatic wing lock, 10 - actuators)

2.2 Intended use of the GAL-C disc harrow

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 for mixing catch crops into the soil or cultivating wasteland overgrown with tall volunteer seeds.

The working elements are toothed discs of standard 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.

GAL-C disc harrows (non-hydraulic folding versions) can be fitted with a transport trolley to facilitate transport by tractor.

NOTE! MANDAM provides a 5-year guarantee on maintenance-free hubs under the following conditions:
- complying 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,
- using the original MANDAM plates,
- not exceeding the permitted working depth, which is 12cm for discs Ø560mm and 15cm for discs Ø610mm,
- observing 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.

2.3 Construction of the GAL-E disc harrow

The GAL-E harrows produced are available in widths: 2.0m; 2,5m; 3.0m.

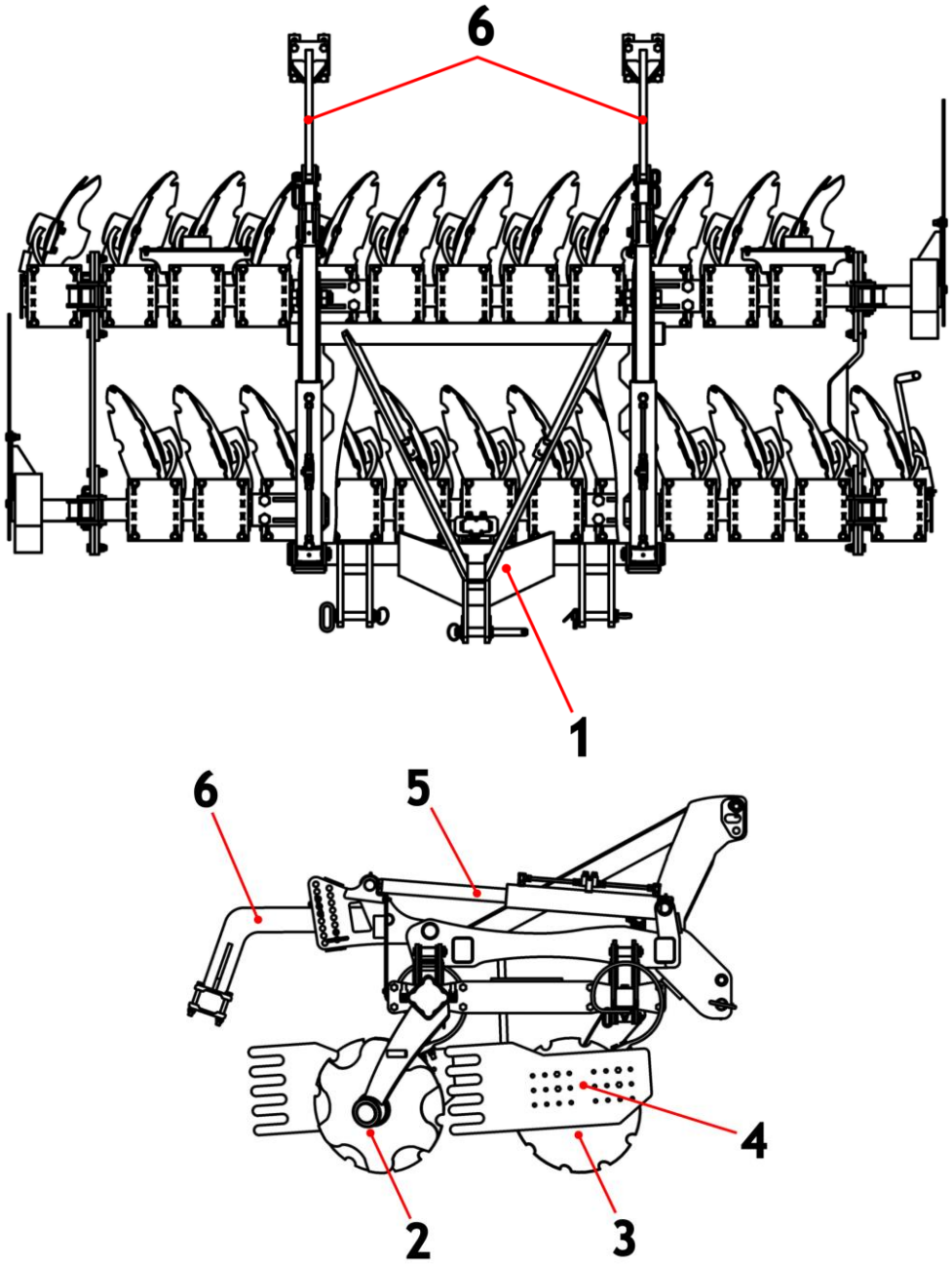


Figure 4 Construction of the GAL-E disc harrow (without working roller) (1 - frame with drawbar, 2 - rear disc row, 3 - front disc row, 4 - side screen, 5 - hydraulic roller lifting unit, 6 - arms)

2.4 Intended use of the GAL-E disc harrow

The GAL-E version of the disc harrow, as opposed to the GAL-C version, uses arms on actuators for hydraulic lifting of the roller during transport. In addition, the centre distance of the disc rows has been reduced to 800 mm, making the whole machine more compact and facilitating transport and the manoeuvrability of the entire set-up.

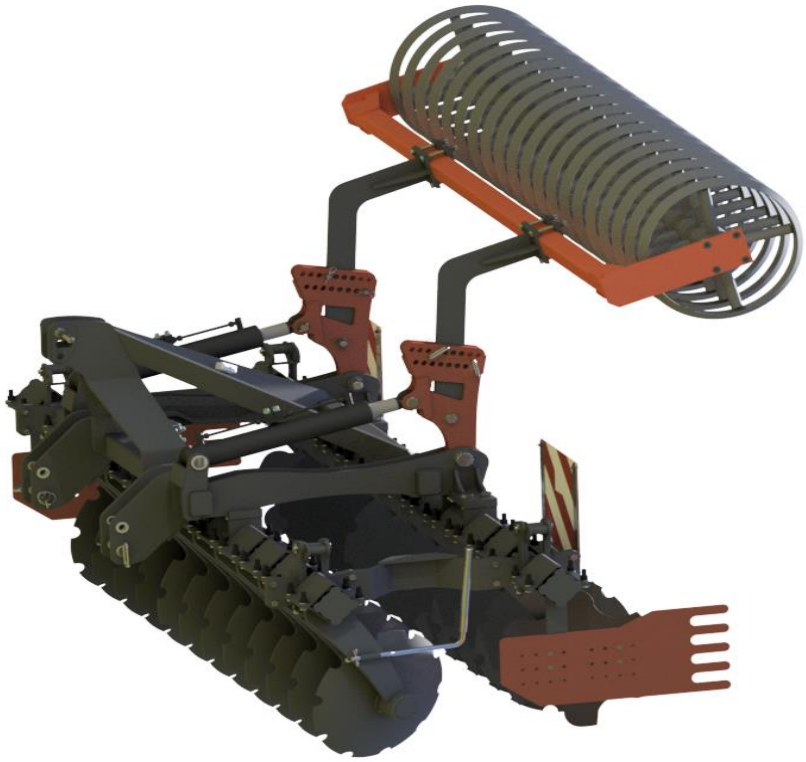


Figure 5 GAL-E disc harrow with raised roller - transport position.

NOTE! MANDAM provides a 5-year guarantee on maintenance-free hubs under the following conditions:
- complying with the principle of replacing the working discs in the event of wear, which must not exceed a diameter of 490mm for discs Ø560mm,
- using the original MANDAM plates,
- not exceeding the permitted working depth, which is 12cm for discs Ø560mm,
- observing 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.

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

3.1 General rules for coupling and uncoupling the harrow to 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. Suspension machines must be raised on the tractor's three-point linkage to such an extent that there is no collision with the ground (minimum 60 cm). On machines fitted with transport trolleys, lower the wheels to the point where collision with the ground during folding does not occur.

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 travelling speed must be adapted to the condition of the road and the conditions on the road so that the disc harrow does not jump up on the tractor's suspension and there are no excessive loads on the machine frame and the tractor's suspension.

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, however, 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 by turning the discs and rollers by hand that rotation is free and without jamming,
- 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%.

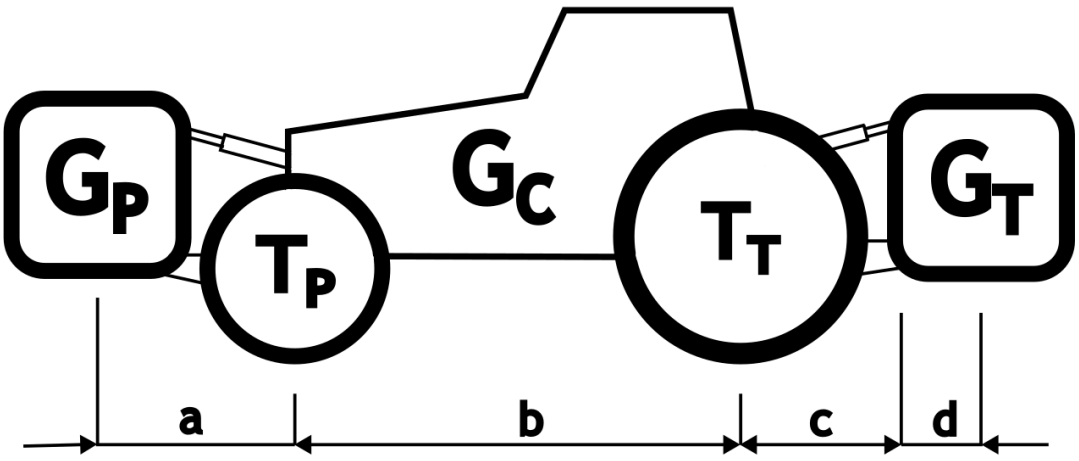


Figure 6 Diagram of tractor load designations

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 for use

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.

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

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 brackets on the machine frame and connect the arms to the roller bracket with screws (fig 5).

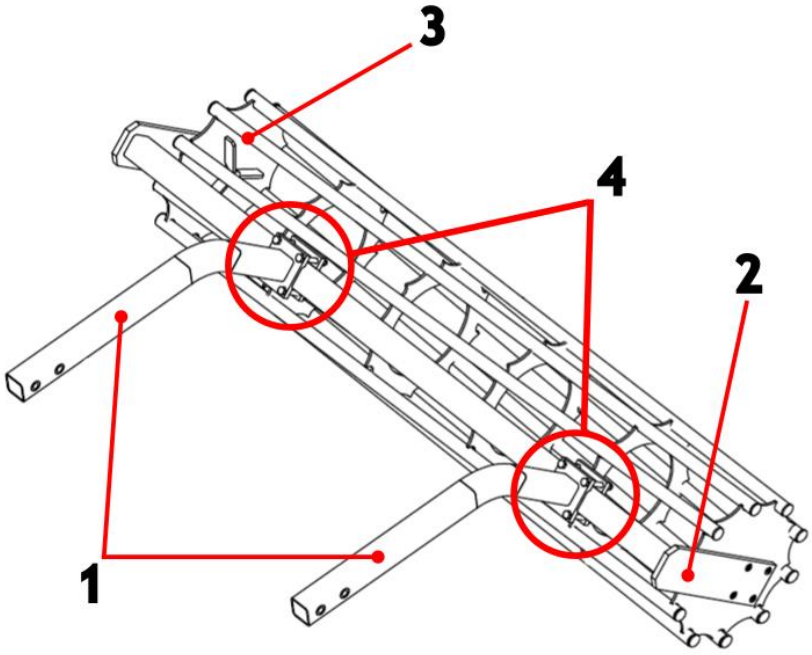


Figure 7 GAL-C arms connected to a tube-roller racket (1 - arms, 2 - tube-roller bracket, 3 - tube-roller, 4 - points of attachment of arms to bracket)

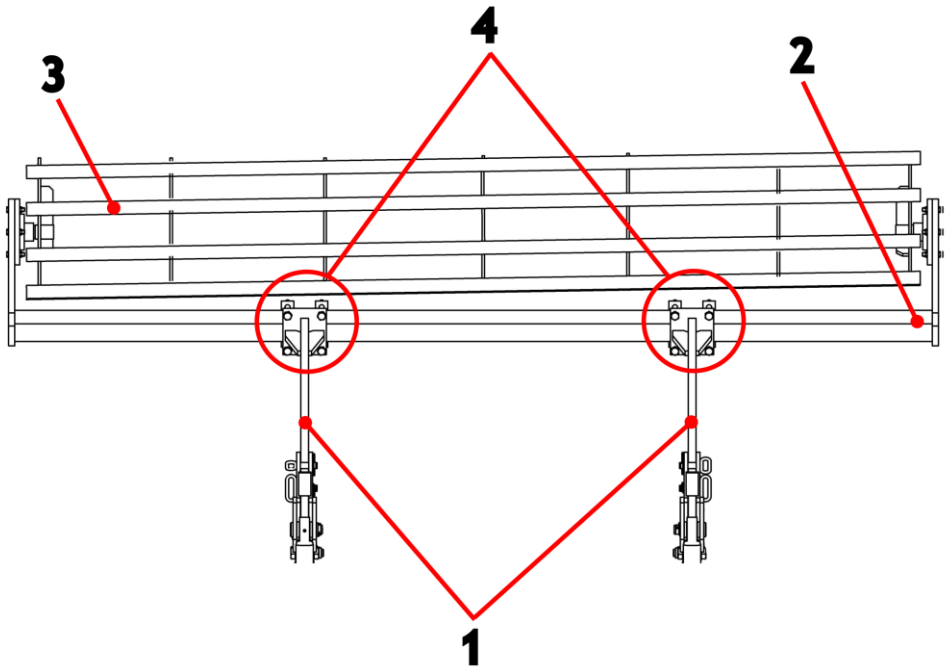


Figure 8 GAL-E arms connected to a tube-roller racket (1 - arms, 2 - tube-roller bracket, 3 - tube-roller, 4 - points of attachment of arms to bracket)

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 disc 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.

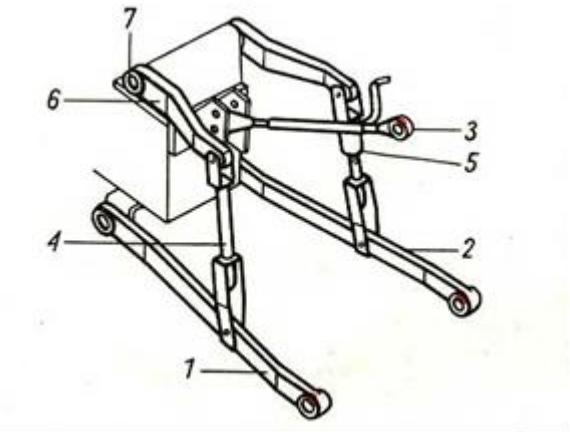


Figure 9 Three-point linkage of the tractor: 1,2 - lower links, 3 - upper fastener, 4 - left suspension, 5 - right suspension with adjustable length, 6 - lift arm, 7 - lift roller

When connecting the 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 even working depth of the unit,
2) Ensure that the category of hitch and tie rod is identical,
3) Switch the tractor hydraulic system to position control,
4) Back the tractor up to a distance that allows the hitch of the unit to be connected to the lower links of the tractor,
5) Align the lower links at an equal distance from the ground,
6) First connect the lower links of the tractor,
7) Secure the connection with pins and locks,
8) Connect the top link of the 3-point hitch and adjust the connection,
9) Connect electrical cables (if lighting is optional) and check for correct operation,
10) Connect the hydraulic lines and check for leaks,
11) If the unit has a support foot, it must be raised and secured,
12) Raise the unit and check that the tractor retains full steering control,

When connecting the semi-mounted unit to the tractor, the following steps must be carried out:

1) Check the pressure in the wheels on one axle of the tractor, it must be the same to ensure even working depth of the unit,
2) Switch the tractor hydraulic system to position control,
3) Back the tractor up to a distance to connect the drawbar to the tractor's lower links,
4) Secure the drawbar with pins and cotter pins,
5) Connect electrical cables (if lighting is optional) and check for correct operation,

6) Connect the hydraulic lines and check for leaks,
7) If the unit has a support foot, it must be raised and secured
8) Raise the unit and check that the tractor retains full steering control

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 Mounting the seed drill on the disc harrow using the APV PS as an example

Only seed drills included in the MANDAM range should be fitted. The installation of other seed drill models is prohibited.

Any arbitrary change to the design of the seed drill mounting by the user of the machine will be regarded as interference with the design. This may result in the guarantee being honoured in the event of structural or seed drill damage.

4.3.1 Installation on GAL-C harrow

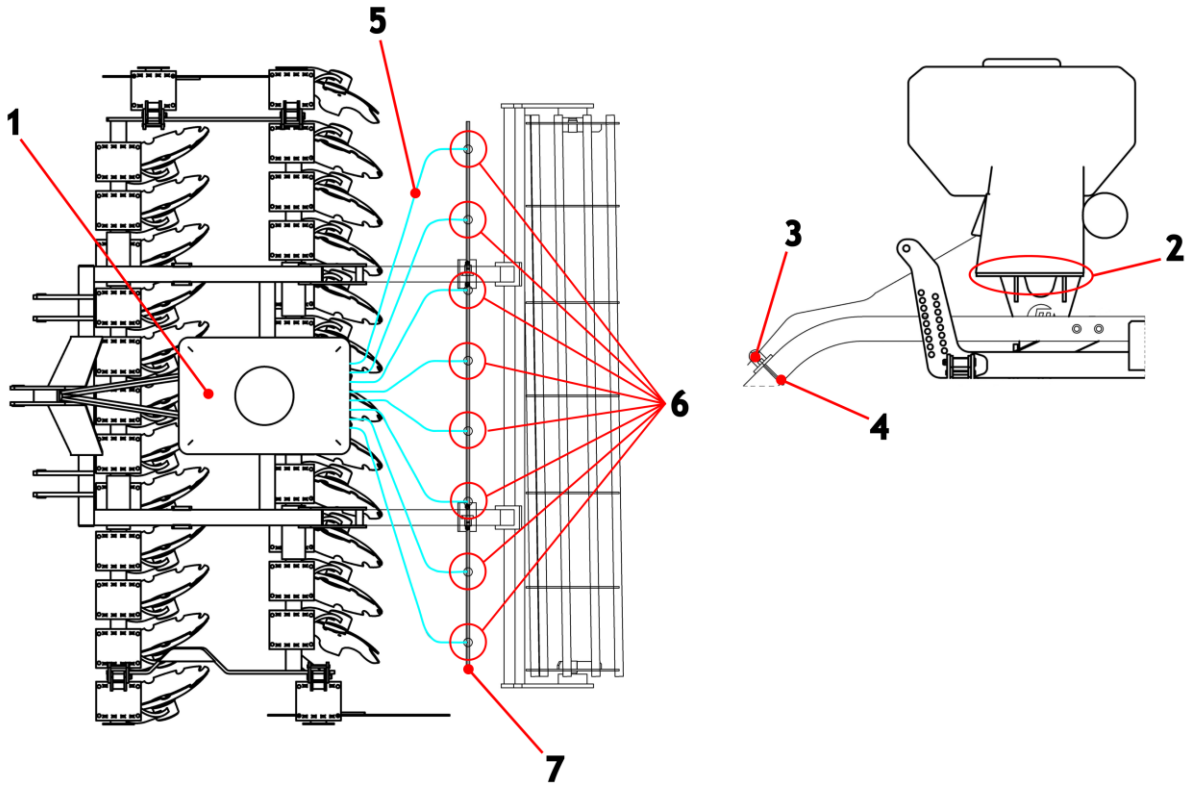


Figure 10 Representation of a mounted APV seed drill on a GAL-C disc harrow (1 - seed drill, 2 - seed drill mounting frame plate, 3 - hexagonal rod holder, 4 - bracket, 5 - supply hoses, 6 - places for attaching hoses to the rod, 7 - hexagonal rod)

To fix (fig. 10) the APV PS seeder, it is necessary to:

1. Screw the seed drill mounting frame (item 1) to the frame structure,
2. Screw the seed drill to the frame with the screws (item 2),
3. Fix the hexagonal rod holders (item 3) to the arms using the clamp (item 4),
4. Route the hoses (item 5) from the seed drill (item 1) to the hexagonal bar (item 7).

4.3.2 Installation on GAL-E harrow

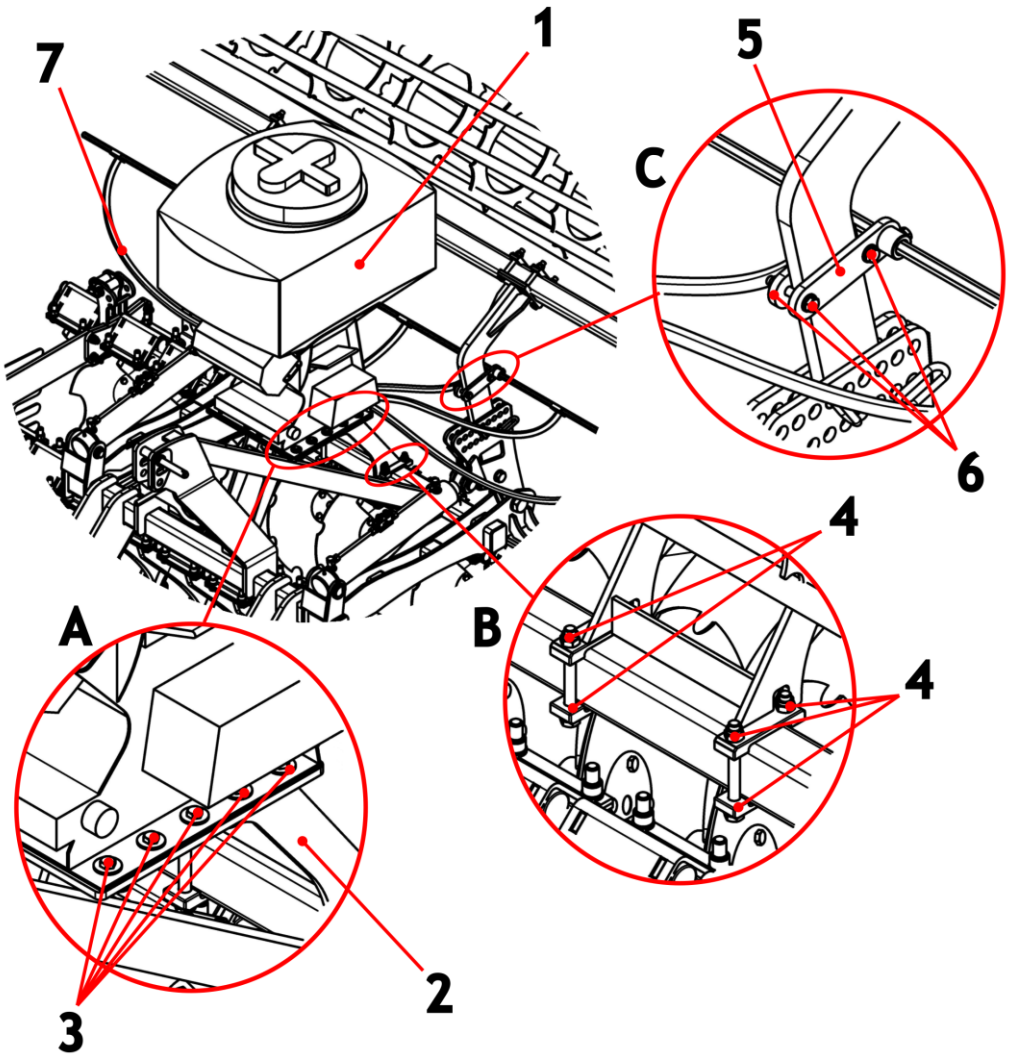


Figure 11 Representation of the mounted APV seed drill on the GAL-E disc harrow (1 - seed drill, 7 - supply hoses):
View A - Seed drill mounting frame (2 - frame, 3 - mounting bolts)
View B - brackets for attaching the frame to the harrow (4 - mounting screws and mounting forging)
View C - hexagonal rod holder for harrow arms (5 - rod holder, 6 - fixing bolts)

To fix (fig. 11) the APV PS seeder, it is necessary to:

1. Screw the seed drill mounting frame (item 2) to the harrow structure,
2. Bolt (item 3) the seed drill to the frame (item 2),
3. Fasten the hexagonal rod holders (item 5) to the harrow arms using the wedge and flat bar (item 6).
4. Route the hoses from the seed drill (item 1) to the hexagonal bar (item 7).

4.3.3 Mounting on the GAL-C H disc harrow (platform option)

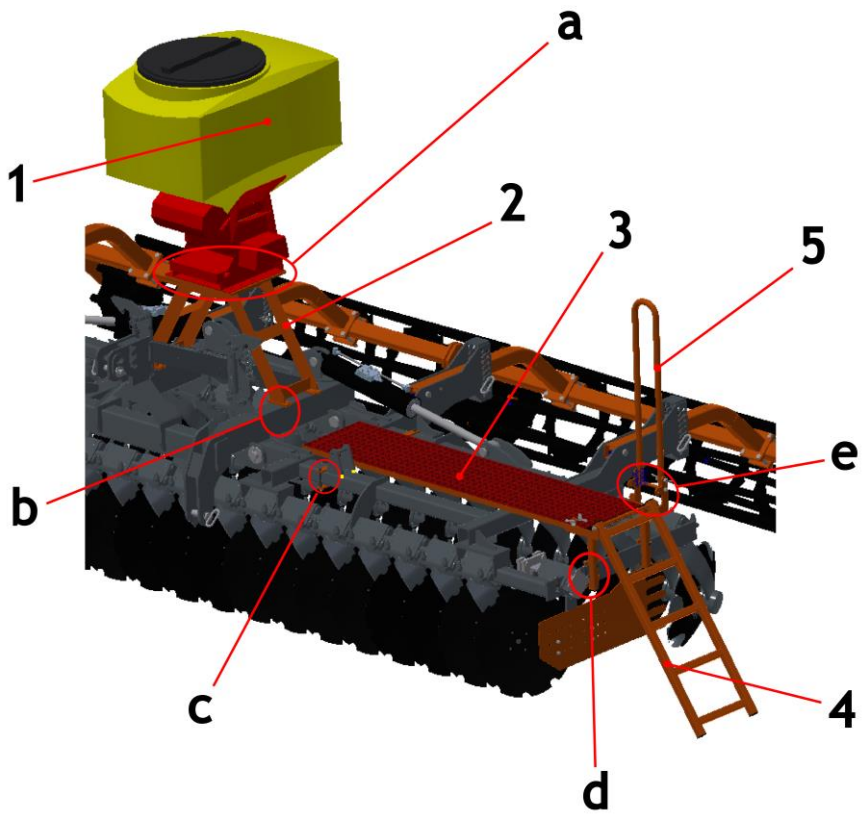
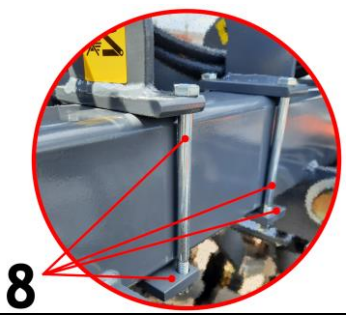
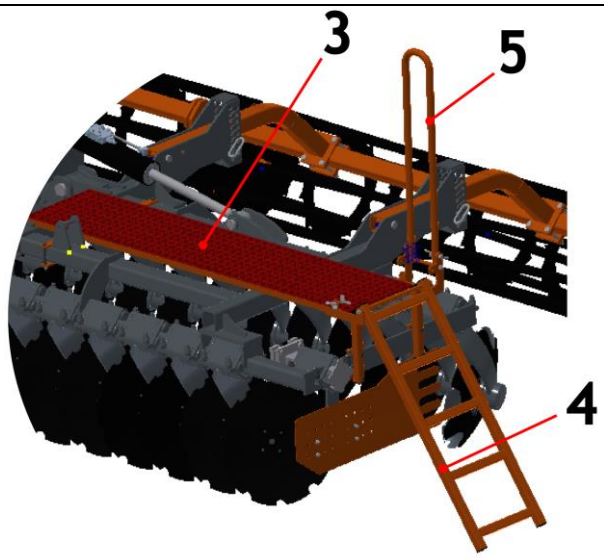


Figure 12 Representation of the mounted APV seed drill with platform on the GAL-C H disc harrow (1 - seed drill, 2 - rack, 3 - platform, 4 - ladder, 5 - handrail)

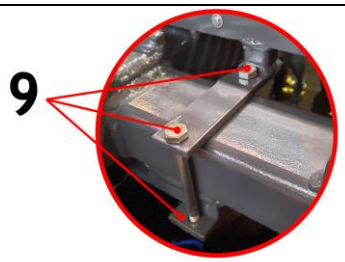
To fix the APV PS seed drill:		
1) Screw the frame (item 2) to the disc harrow frame structure using screws and flat bars (item 8),	Item "b" of fig. 12	

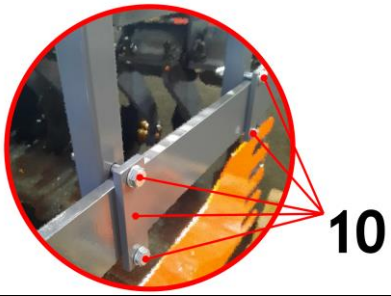
2) Install platform (item 3) with ladder (item 4) and handrail (item 5).



3) Fasten the platform with screws and flat bars (pos. 9 and 10)

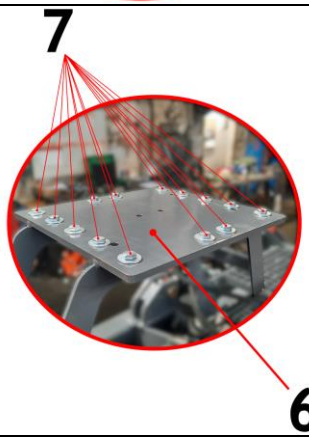
Items "c" and "d" of fig. 12





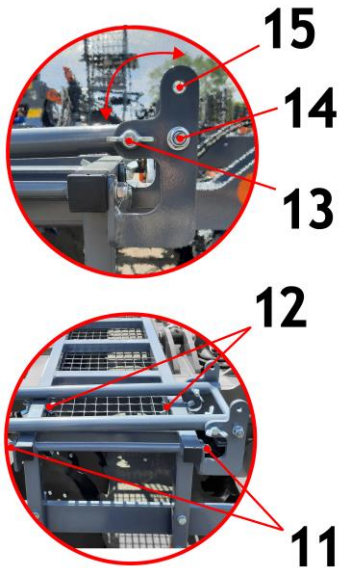
4) Using a lifting device, place the seed drill on the frame plate (item 6) and fasten with screws (item 7).

Item "a" of fig. 12



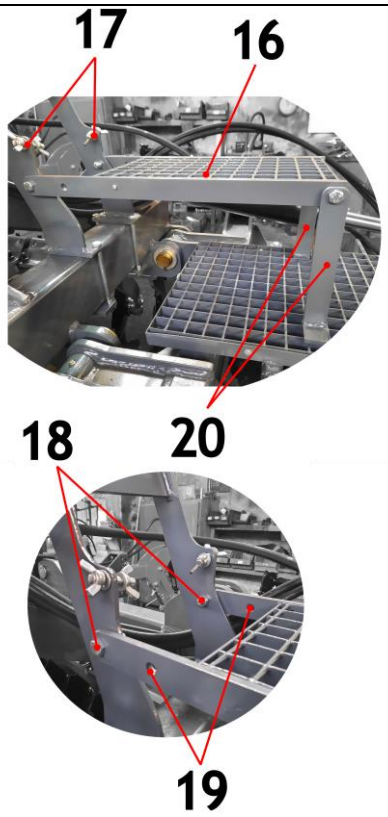
5) Fasten the ladder with screws (item 11) and the handrail with screws (item 14) to the platform structure.

Item "e" of fig. 12



(12 - thumb screws for locking the ladder during transport, 13 - thumb screws for locking the handrail during transport, 15 - hole for locking the handrail in the vertical position)

6) Fasten the step (item 16) with screws (item 18). Secure for transport with thumb screws (item 17)



(19 - holes for locking the step during transport, 20 - step "feet")

The operation of the platform and the order in which the elements are laid out:

1) Unscrew the thumb screws (item 13) and set the handrail upright,
2) Lock the handrail in place by screwing the thumb screws into the holes (item 15),
3) Remove the thumb screws (item 12) holding the ladder during transport,
4) Rotate the platform ladder from the transport position to the working position,
5) Undo the thumb screws (item 17) holding the step during transport,
6) Position the step on the platform so that it rests with its "feet" (item 20) against the platform,
7) To assemble the platform elements, proceed in reverse order

4.4 Assembly of the GAL-C H lighting bracket

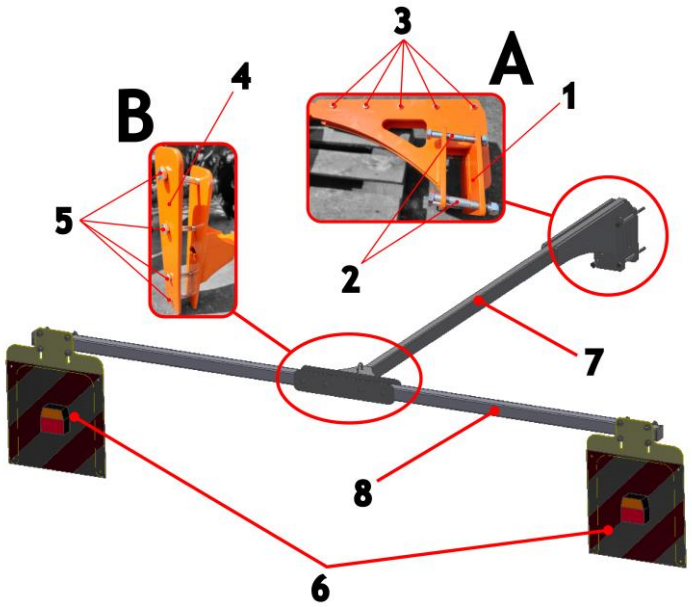


Figure 13 Construction of the lighting support for hydraulically folded disc harrows (1 - fixing plate, 2 - fixing bolts, 3 - bolts connecting the support profile, 4 - fixing plate, 5 - fixing bolts, 6 - lighting boards, 7 - support profile, 8 - lighting bar)

- Place the machine on a level surface before installing the lighting.

The installation of the lighting bracket should be carried out as follows:

1) Start by fitting the bracket holder (fig. 13 view A) to the harrow structure,
2) Fasten the holder with the plate and fastening screws (fig. 13 items 1 and 2)
3) Screw the bracket profile (fig. 13 item 7) to the mount using screws (fig. 13 item 3),
4) Mount at the end of the bracket profile, the light bar (fig. 13 item 8) using the holder (fig. 13 projection B),
5) Screw the beam to the bracket using the plate and fixing screws (fig. 13 item 4 and 5),
6) Fix the light boards (fig. 13 item 6) to the ends of the beam using clamps and nuts,

5 Operation and adjustment

5.1 Automatic machine wing lock

On machines with folding sections, automatic wing locking is available, requiring no additional operation. The lock uses a mechanism consisting of an actuator and a hook (fig. 14).

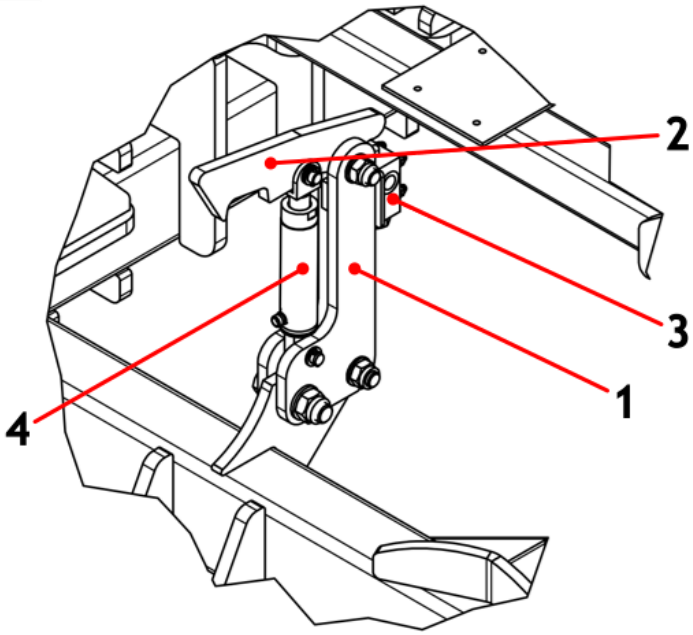


Figure 14 Main frame with automatic wing locking mechanism (1 - sheet metal of automatic locking assembly, 2 - hook of mechanism, 3 - limit valve, 4 - actuator)

5.2 Folding of contour discs and side screens for transport

- When transporting the harrow, place the contour discs in the transport position (fig. 15), secure with pins and cotter pins (fig. 15 item 3). Proceed in the same way when adjusting the side screens to the transport position.

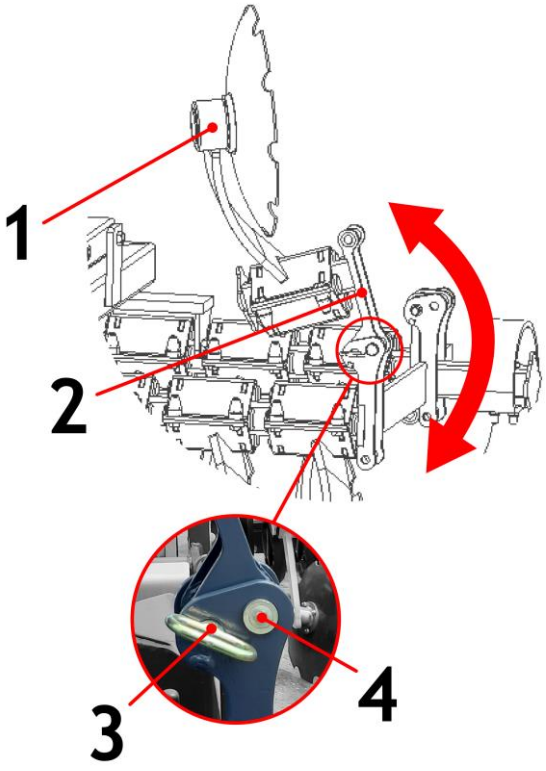


Figure 15 Outline disc in transport position (1 - disc with bearing, 2 - handle / hinge, 3 - position locking pin, 4 - hinge pin)

5.3 Opening sequence of a hydraulically folded machine

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

1) Raise the machine on the tractor's three-point linkage to a height that does not allow the outermost inner wing disc to collide with the ground (fig. 16),

2) Fold the machine wings into the "closed" position to unlock the wing locking mechanism (fig. 16 item 2),

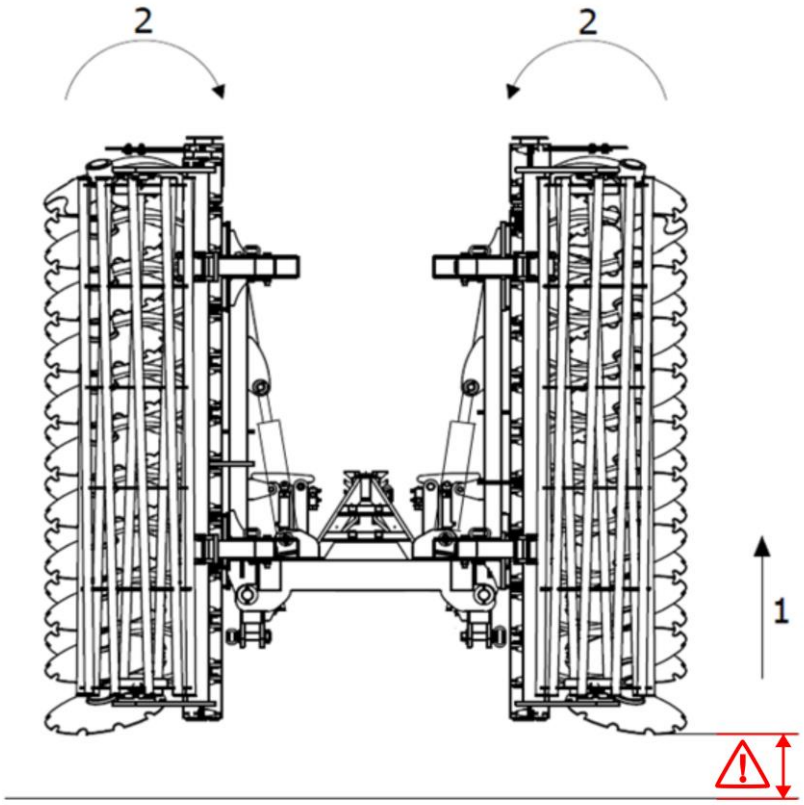


Figure 16 Sequence for opening the machine (1 - lifting the machine up to the maximum (at least 60 cm), 2 - folding the machine wings into the "closed " position).

3) Unlock the wing locking mechanism (fig. 17)

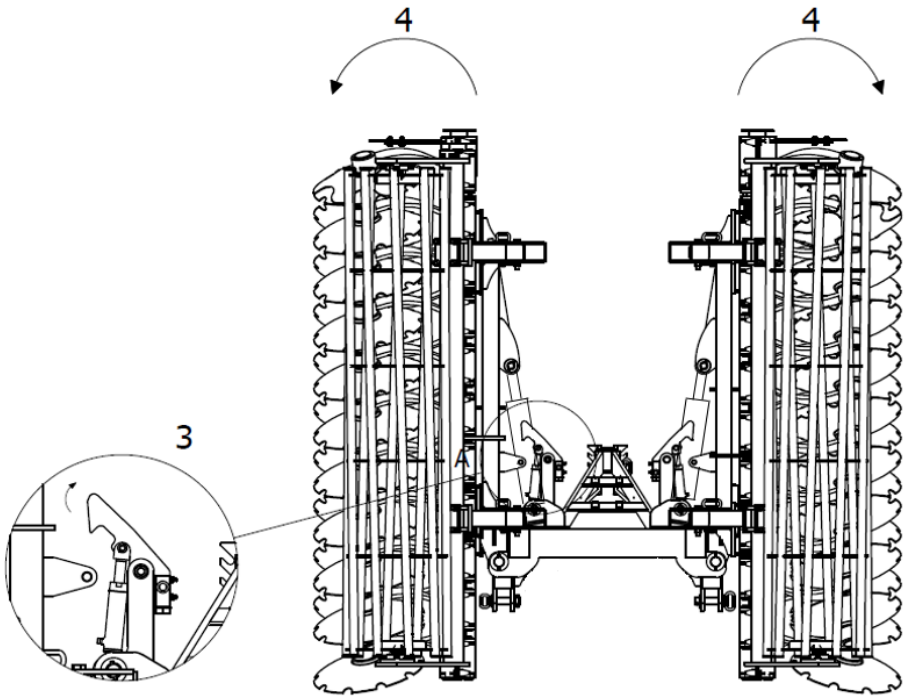


Figure 17 Machine opening sequence (3 - release of the hook of the hydraulic wing lock mechanism, 4 - opening of the machine wings)

4) Start opening the wings of the machine (pay attention to the correct height to prevent snagging on the ground!),

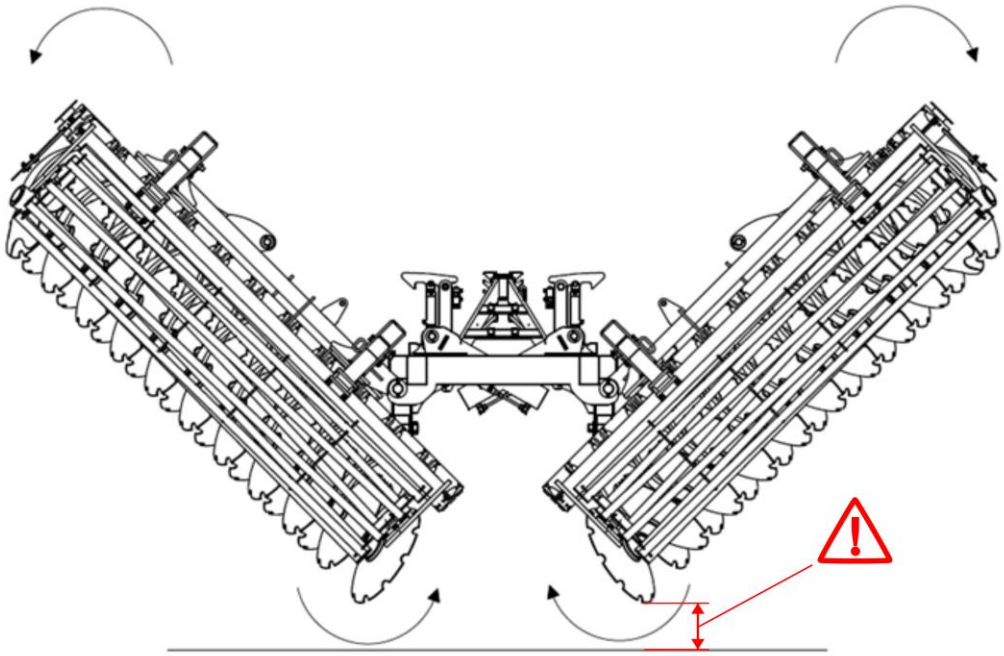


Figure 18 Machine opening sequence: opening the machine with special attention to the height of the arm ends from the ground.

5) Continue and do not interrupt the process of opening the wings until they are fully open (fig. 18),
6) Once the opening sequence is complete, check the levelling of the machine (fig 19),

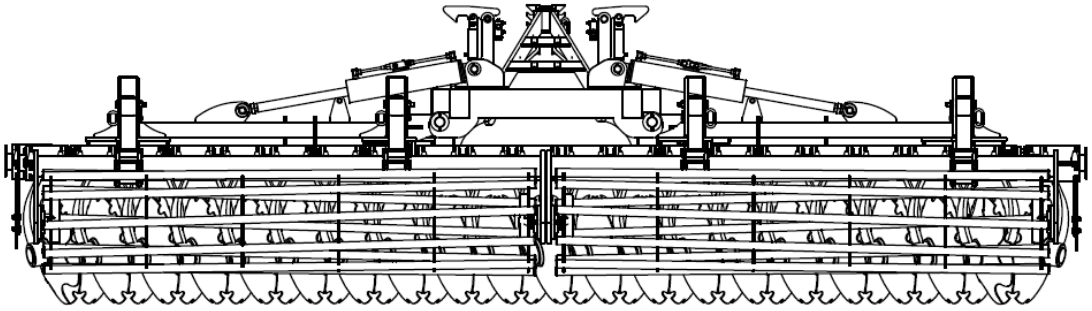


Figure 19 View of the machine at the end of the wing opening sequence. The arms of the machine are fully open.

NOTE! After completion of work, on machines with folding wings, the unit and the rollers must be thoroughly cleaned so that soil residues do not put additional strain on the machine wings and thus on the actuators!

5.4 Side frame levelling (hydraulically foldable harrows)

- **Levelling the machine.**

Machine levelled correctly:

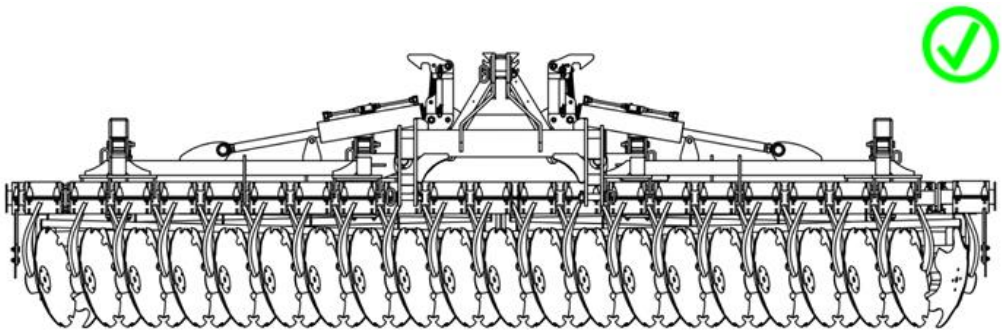


Figure 20 Representation of a correctly levelled disc harrow

Machine levelled incorrectly:

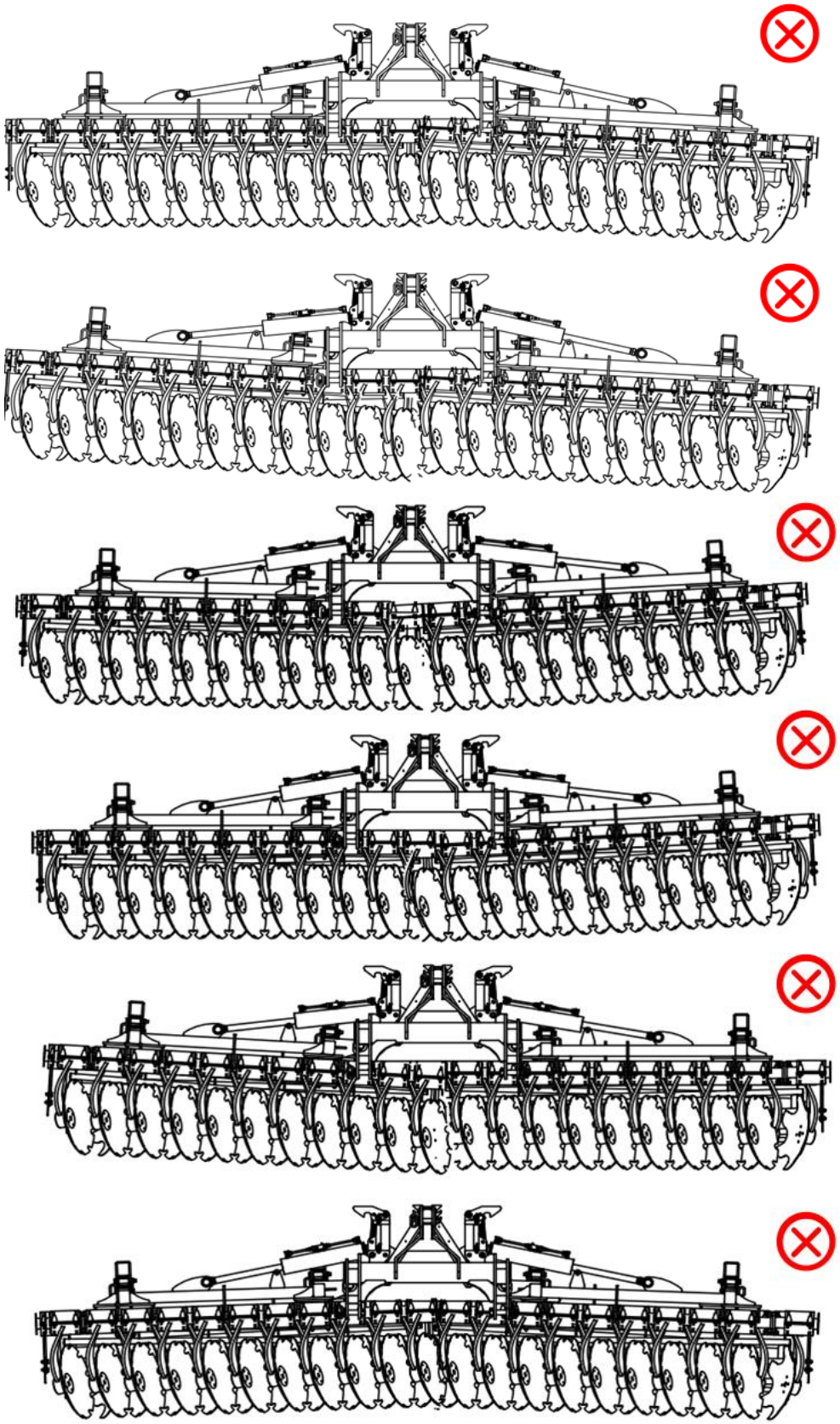


Figure 21 Illustration of variants of *incorrect* levelling of the disc borne

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.

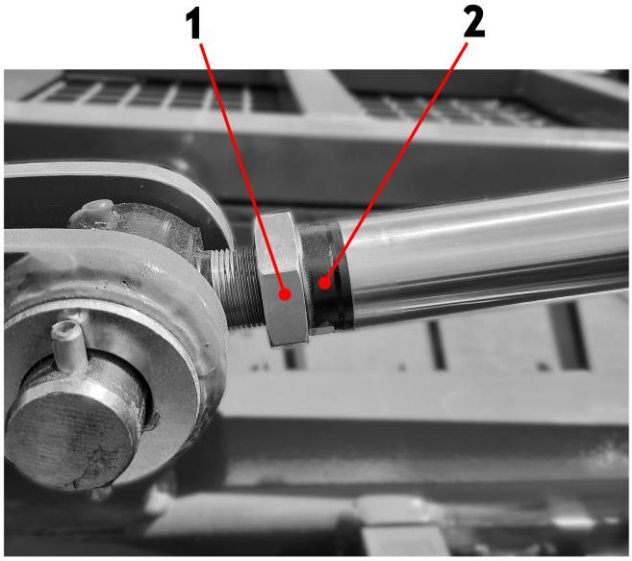


Figure 22 View of actuator with nut for levelling the machine (1 - lock nut; 2 - adjustment spot with spanner 41)

5.5 Correct and incorrect positioning of the harrow for work and when turning

- **Setting up the machine correctly for operation**

The machine must be set up parallel to the ground for operation (see fig. 23). The front drawbar should be aligned horizontally. **It is forbidden to operate the machine with the drawbar at an angle!**

Correct

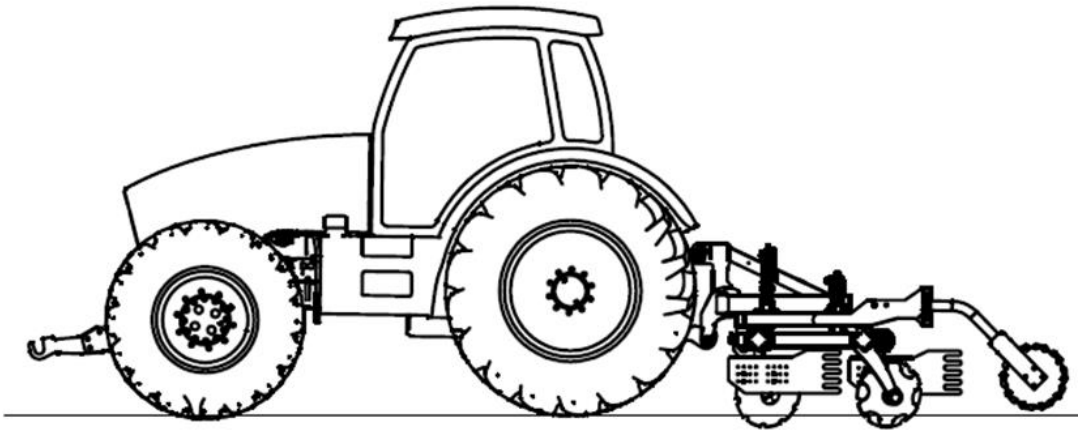


Figure 23 Properly positioned machine parallel to the ground.

- **Incorrect machine positions**

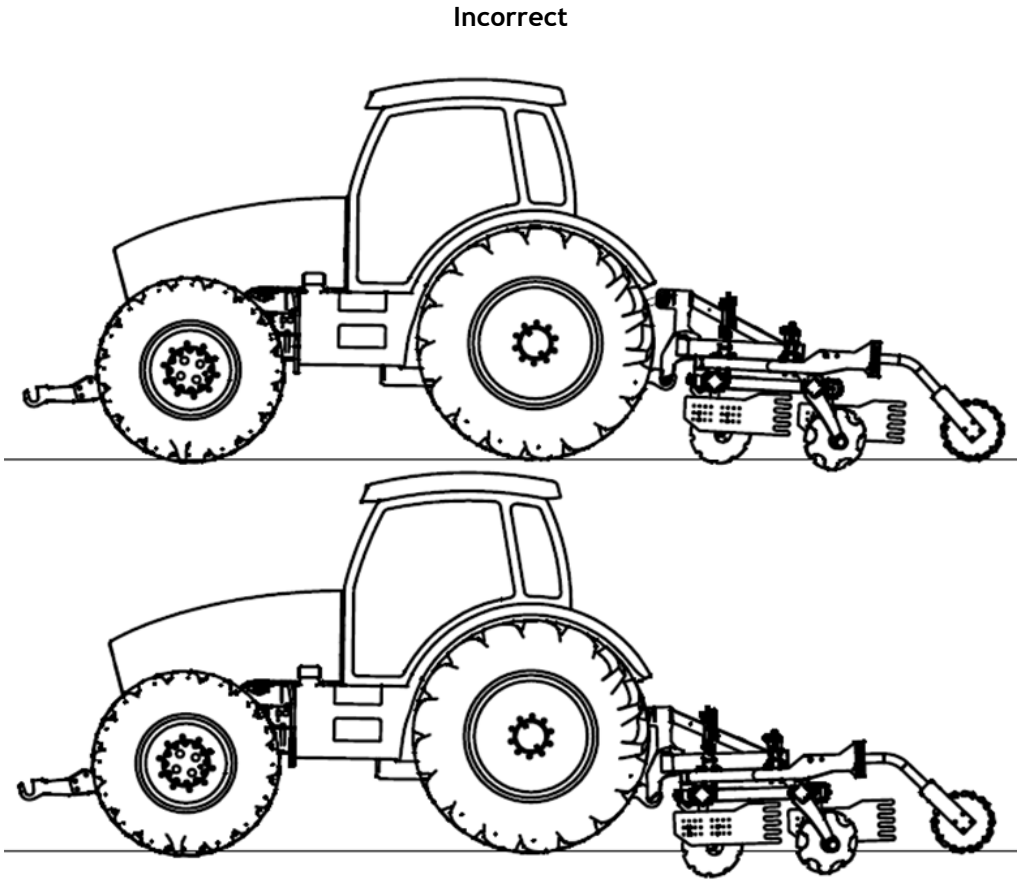


Figure 24 Incorrect settings of the machine.

- **Turning at field ends/headlands only permitted with the machine raised on the chassis.**

- **Turning the machine correctly**

Turning correctly

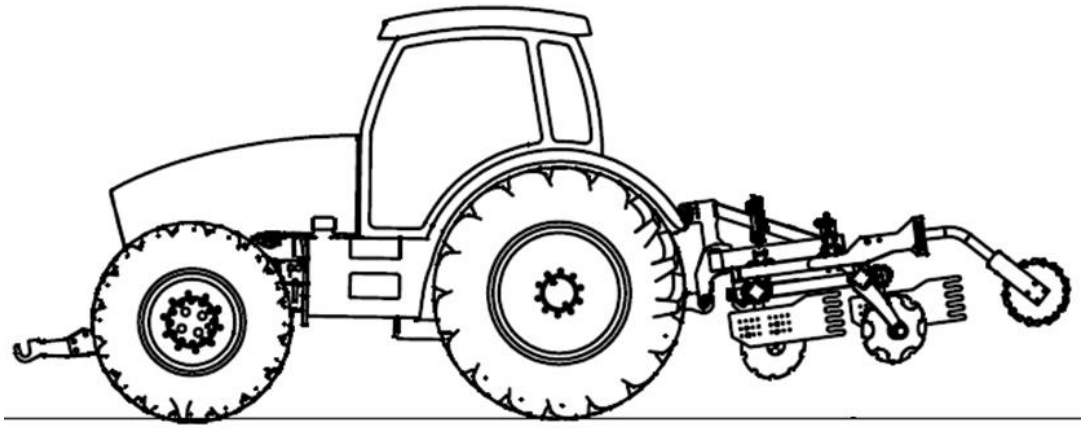


Figure 25 Turning the machine correctly.

- **Incorrectly turning the machine**

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

Turning incorrectly

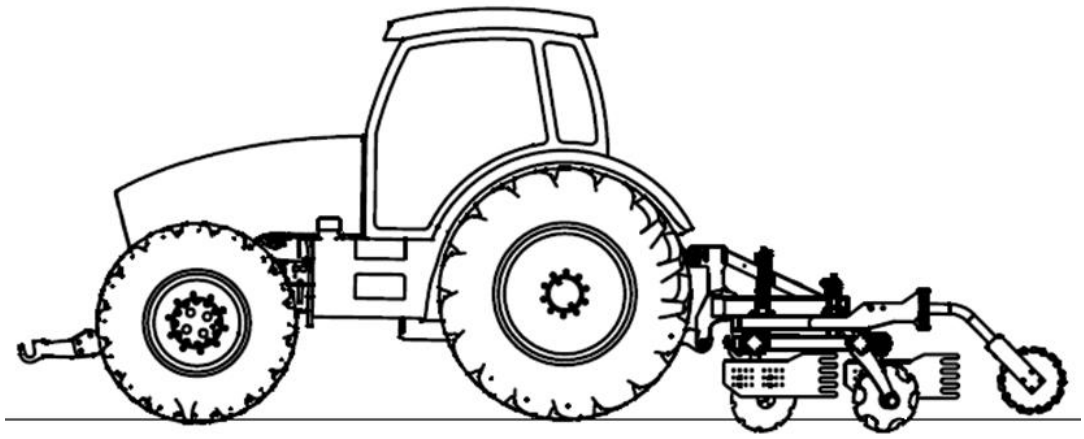


Figure 26 Incorrect turning of the machine.

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.

➢ **Operating the machine with an additional load**

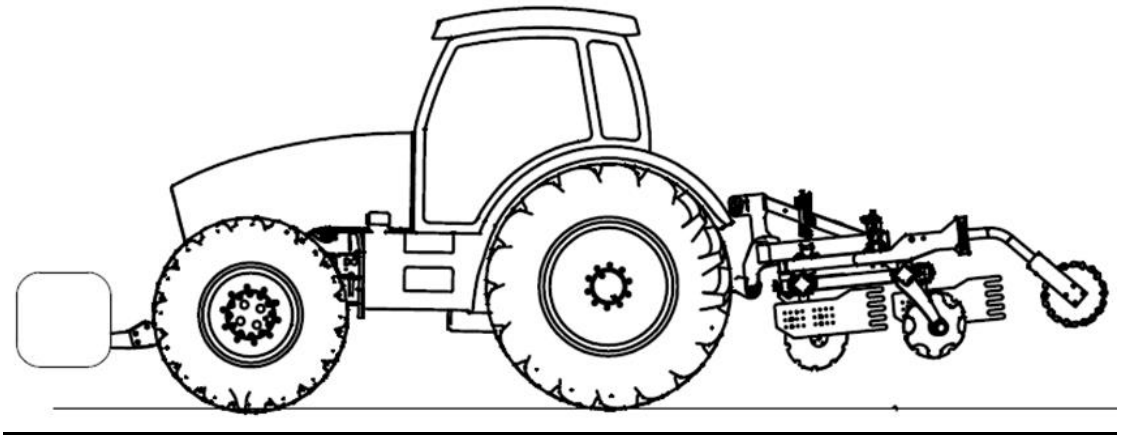


Figure 27 Operation with additional load applied to the front of the tractor.

5.6 Adjusting the working units of the GAL-C disc harrow

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.

The working speed should be between 10 km/h and a maximum of 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 working depth of the disc harrow is determined by the position of the roller, whose arms are locked in the holders with pins (fig. 28, item 1). Initially, the roller 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. To change the position of the roller, install the pins in the appropriate holes after lifting the harrow, ensuring that the pins are installed the same in both holes.

The distance of the roller from the disc harrow depends on the mounting hole of the roller arms (fig. 28 item 2). It should be increased when the soil rejected by the discs overflows the roller. However, it must be remembered that moving the roller backwards causes the machine to lengthen and worsens the longitudinal balance of the tractor. The disc harrow can also operate without a roller. Then, however, the settlement of the discs cannot be reduced and the soil will remain in a loosened state. When using maximum disc depths, the roller can also be unlocked to work under its own weight.

➢ The maximum working depth is 12cm for Ø560mm discs and 15cm for Ø610mm discs.

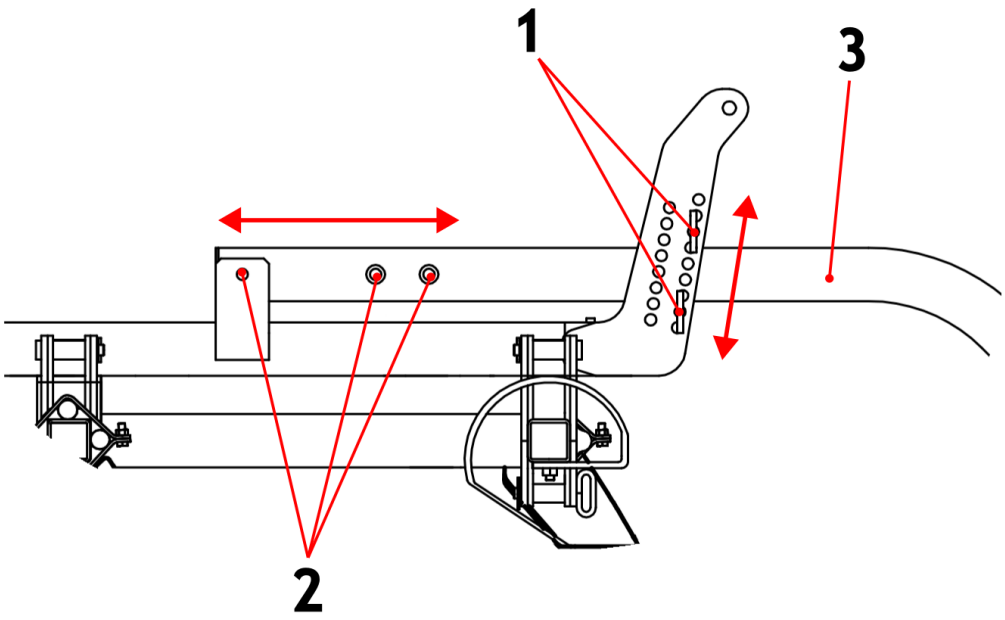


Figure 28 Example of adjustment of the working depth of the roller and the distance of the roller from the second row of discs (1 - pins for adjustment of working depth with stabilising plate, 2 - holes for fixing the roller arms)

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 necessary, it should also be moved forwards or backwards (remounting at the holes (fig. 29, item 1) so that it retains the soil thrown up by the outermost front disc and compacts the furrow behind the outermost rear disc.

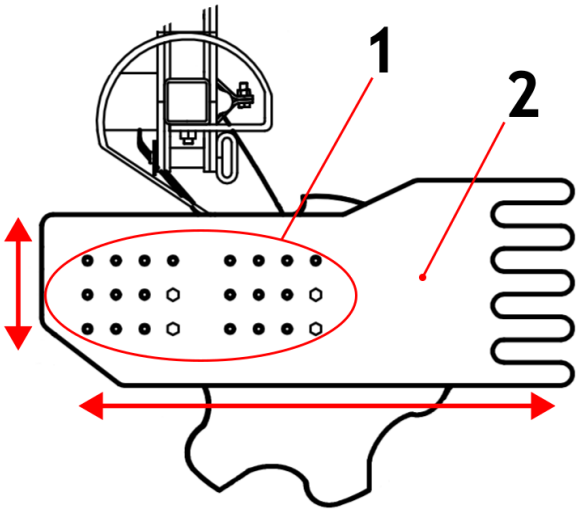


Figure 29 Adjusting the position of the side screen (1 - holes for adjusting the position of the side screen relative to the holder, 2 - side screen)

5.6.1 Hydraulic working depth adjustment - optional

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. Initially, the working roller 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 Ø560mm discs and 15cm for Ø610mm discs.

Once the required working depth has been established, the appropriate number of pawls should be fitted to the piston rod. This ensures a constant working depth during operation. The number of pawls on both actuators must always be equal.

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. 30 and fig. 31, the correct way of installing the subsequent pawl plates on the actuator and the incorrect way of installing them are shown.

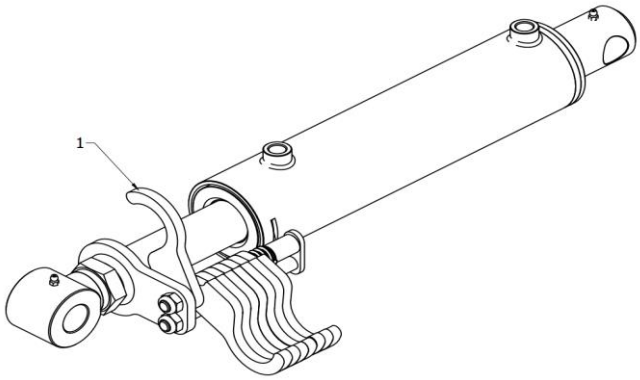


Figure 30 Correct way to put the first (1) ratchet on the piston rod of the actuator to adjust the working depth of the machine.

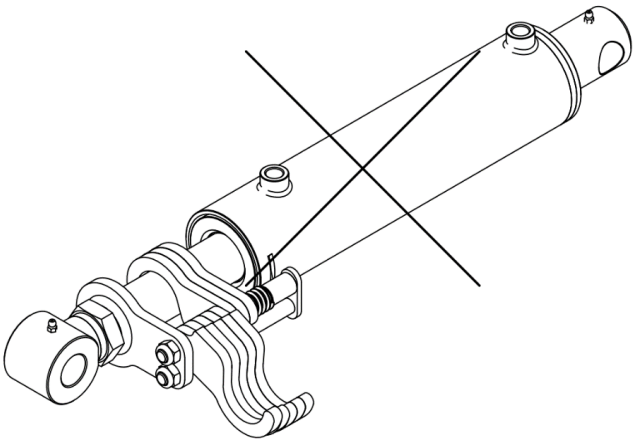


Figure 31 Incorrect way of fitting the ratchets to the piston rod of the actuator. Partial omission of the attachment of the pawls to the actuator results in uneven distribution of the forces acting on the piston rod and can lead to piston rod buckling resulting in damage to the entire actuator assembly. This kind of adjustment is ***unacceptable****!*

5.7 Adjusting the working units of the GAL-E disc harrow

On the GAL-E disc harrow, the position of the various working units must be preset 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.

The working speed should be between 10 km/h and a maximum of 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 **working depth of the GAL-E disc harrow** is determined by the position of the roller, whose arms are locked in the holders with pins (fig. 32, item 2). Initially, the roller 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. A hydraulic lifting system is used to change the position of the roller (fig. 33). To raise the roller, the piston rod of the actuator must be pushed in (fig. 33 item 3), and when the roller needs to be lowered, the piston rod must be pulled out. Any movement of the roller during operation is prevented by pins in the ladders (fig. 32 item 2).

The distance between the roller and the disc harrow is determined by the roller arm. The distance should be increased when the soil rejected by the discs overflows the roller. However, it must be remembered that moving the roller backwards causes the machine to lengthen and worsens the longitudinal balance of the tractor. The disc harrow can also operate without a roller. Then, however, the settlement of the discs cannot be reduced and the soil will remain in a loosened state. When using maximum disc depths, the roller can also be unlocked to work under its own weight.

- The maximum working depth is 12cm for discs Ø560mm.

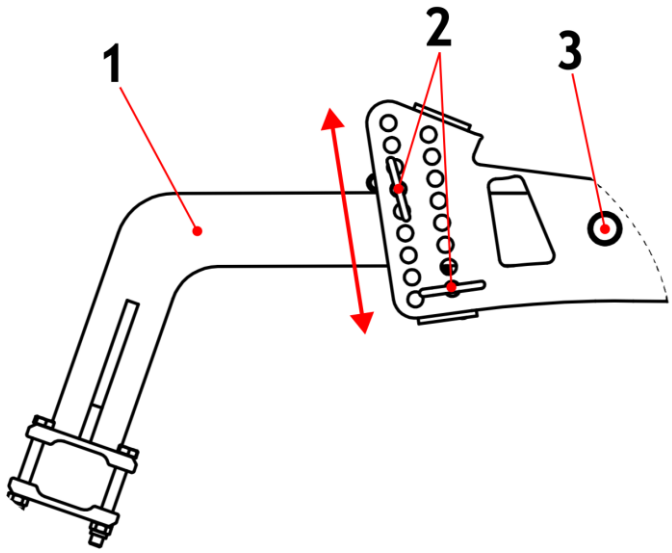


Figure 32 Roller arm attachment (1 - roller arm, 2 - work depth adjustment pins, 3 - hole for pin attaching arm to frame mount)

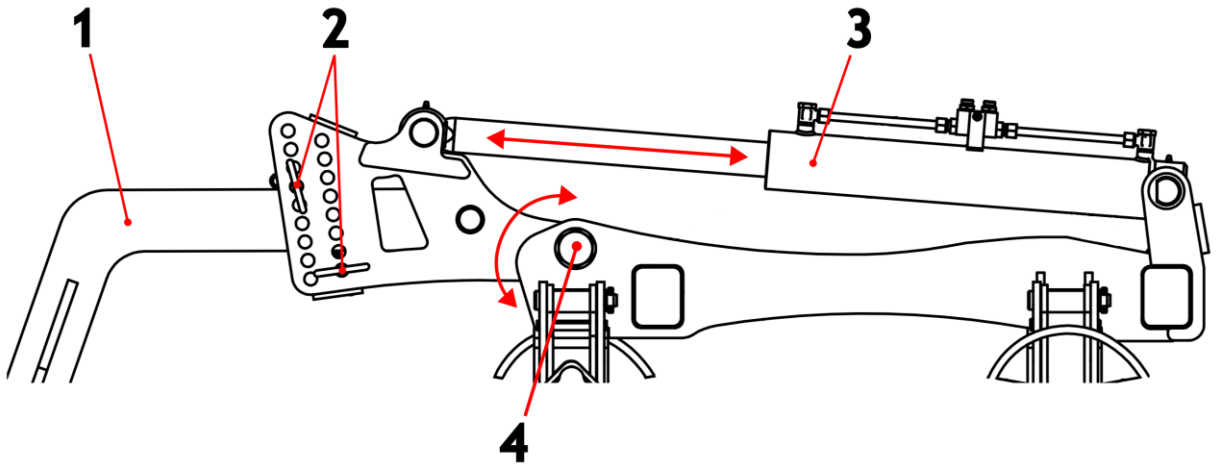


Figure 33 Hydraulic roller lift (1 - roller arm, 2 - working depth adjustment pins, 3 - actuator, 4 - arm pivot pin)

- The hydraulic roller lifting system on the GAL-E disc harrow is designed to lift the roller into the transport position. This makes the set shorter and easier to transport and operate at headlands.

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 necessary, it should also be moved forwards or backwards (remounting at the holes (fig. 34, item 1) so that it retains the soil thrown up by the outermost front disc and compacts the furrow behind the outermost rear disc.

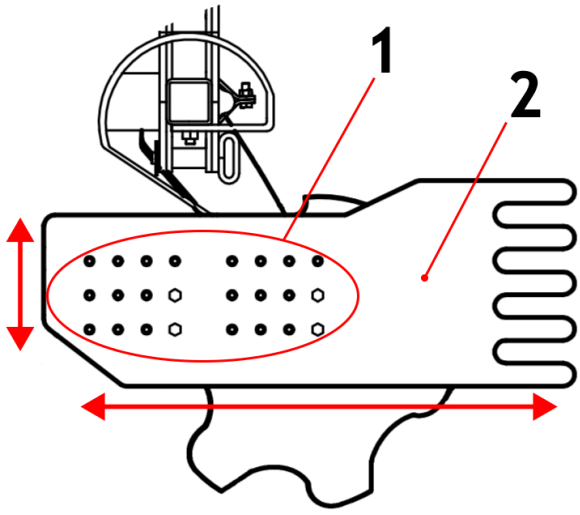


Figure 34 Adjusting the position of the side screen (1 - holes for adjusting the position of the side screen relative to the holder, 2 - side screen)

5.8 Transport trolley for the disc harrow - optional

- If the transport trolley option for the disc harrow is fitted, follow the rules for transport on public roads as described in section 5.8 and maintain safety during transport on public roads as described in section 3.6 of these instructions.

5.8.1 Transport trolley - construction and lubrication

The transport trolley is only designed for non-folding machines with a working width of up to 4.0m. Its purpose is to relieve the load on the tractor's three-point hydraulic system. This makes it easier to transport the machine to fields far from the farm, as well as improving driving comfort during long-distance transports.

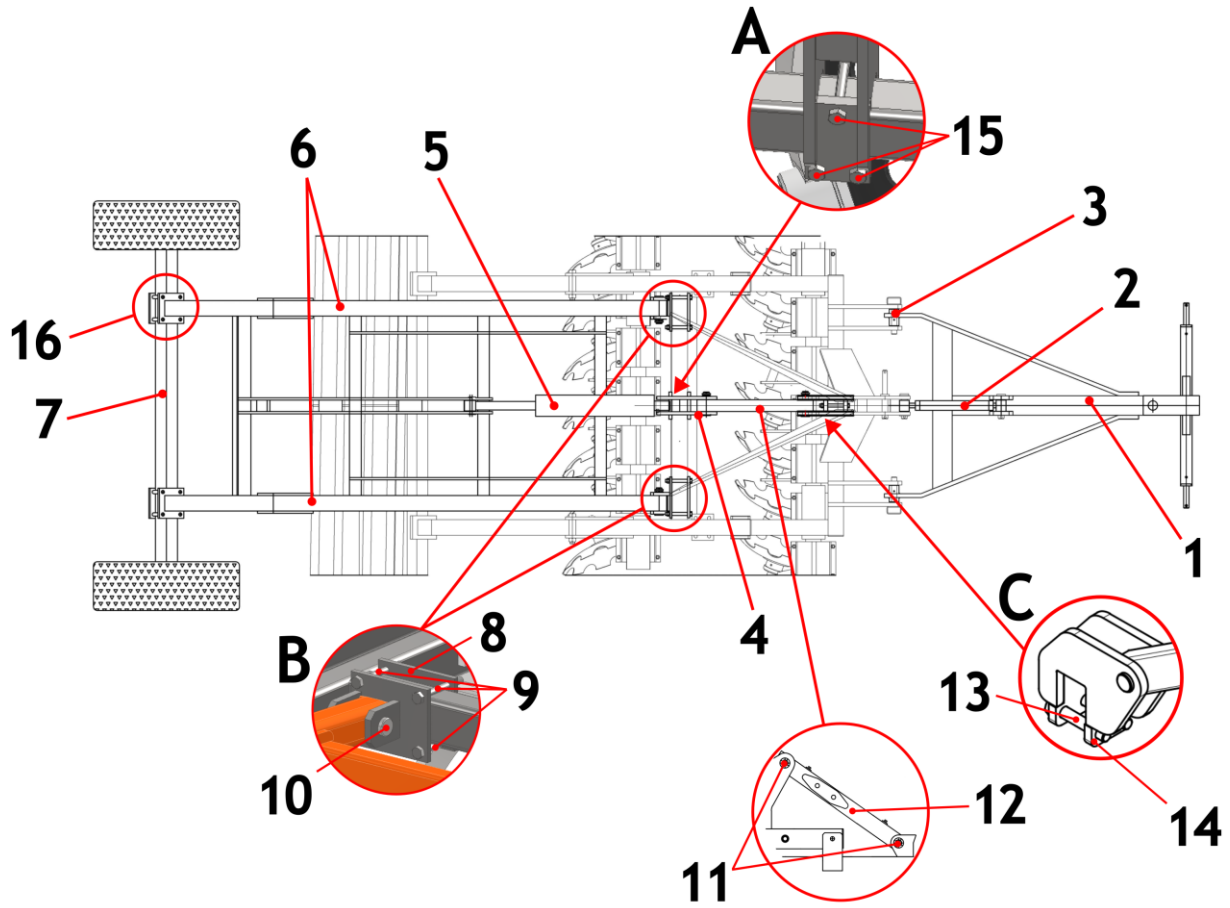


Figure 35 Illustration of the mounting points and construction of the transport trolley to the disc harrow frame. (1 - drawbar with drawbar, 2 - turnbuckle, 3 - mounting points with three-point linkage, 4 - turret, 5 - trolley actuator, 6 - trolley frame, 7 - trolley axle with wheels, 11 - pins, 12 - beam, 16 - mounting points of trolley axle with trolley arms)
A - attachment of the trolley turret to the frame (15 - mounting screws)
B - attachment of the trolley arms to the frame (8 - mounting plate, 9 - mounting screws, 10 - pin)
C - fixing the beam to the harrow frame (13 - mounting screws, 14 - mounting plate)

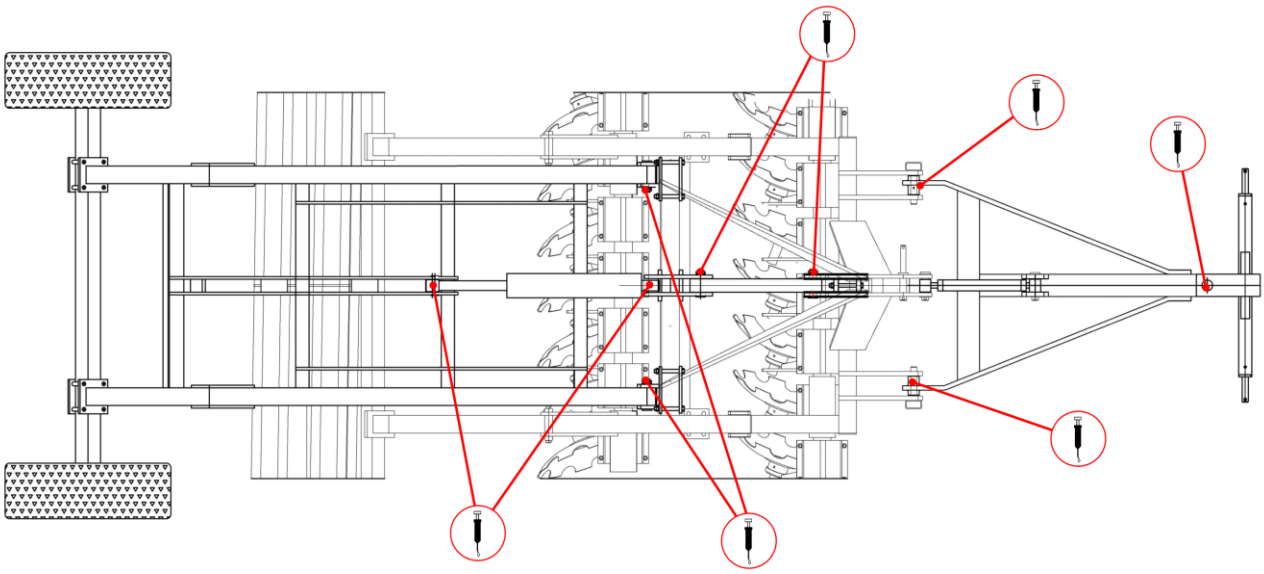


Figure 36 Lubrication points on the trolley.

5.8.2 Transport trolley - installation

- Place the machine on level, unpaved ground before installation.

Order of assembly of the transport trolley assemblies:

1) Attach the trolley turret with trolley arms and actuator to the rear frame beam and fasten with plate and screws (fig. 35 see view A). With the above components supplied separately, bolt the turret itself to the rear beam, followed by the handles and trolley arms (fig. 35 see view B),

2) Secure the connections with dedicated bolts and screws,

3) Screw the bracket bar bracket (fig. 35 view C) to the front frame bar and fasten with fixing plates and screws,

4) Attach the bracket beam (fig.35 item 12) to the bracket and turret using the dedicated pins (fig.35 item 11),

5) Mount the actuator with hydraulics (fig. 35 item 5) (if supplied separately) using the dedicated pins,

6) Insert the drawbar between the lower linkage plates of the three-point attachment (fig. 35 item 3), insert the pins and secure with a cotter pin and wheel,

7) Place the turnbuckle (fig. 35 item 2) in the hole of the upper link and drawbar,

8) Place the axle of the trolley under the mounting plates of the trolley frame (fig. 35 item 6) and centre,

9) Cover the axle with screws and fasten the axle retaining plates (fig. 35 item 16),

NOTE! The trolley actuator must be cycled several times before use!

5.8.3 Transport trolley "Skorpion" - construction and lubrication

The "Skorpion" type transport trolley is designed for non-hydraulic folding machines with a working width of up to 4.0m. The simple design of the hydraulically extendable arm ending in a wheel that rotates 360 degrees provides easier transport of the machine over fields and public roads.

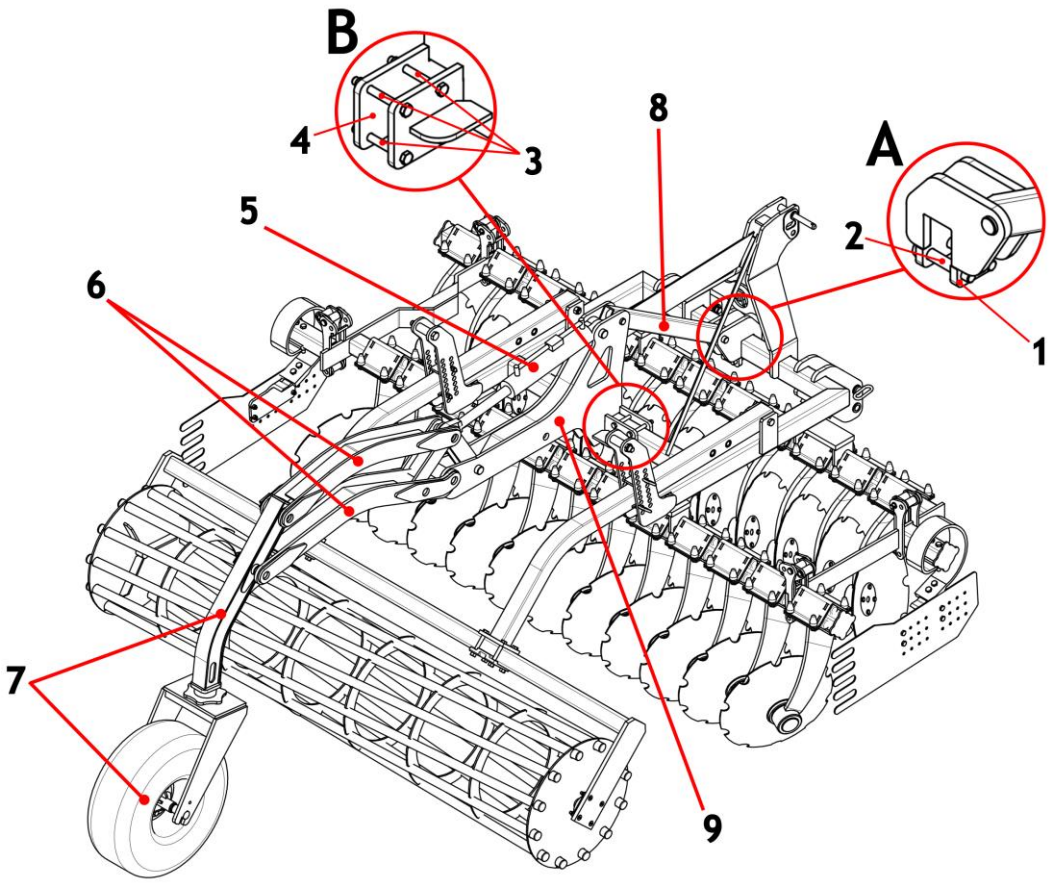


Figure 36 Representation of the attachment points of the 'Skorpion' type trolley to the disc harrow frame (5 - trolley actuator, 6 - trolley arms, 7 - wheel with handle and arm, 8 - beam, 9 - turret)
A - fixing to front beam (1 - fixing plate, 2 - fixing screws)
B - fastening to rear beam (3 - fastening screws, 4 - fastening plate)

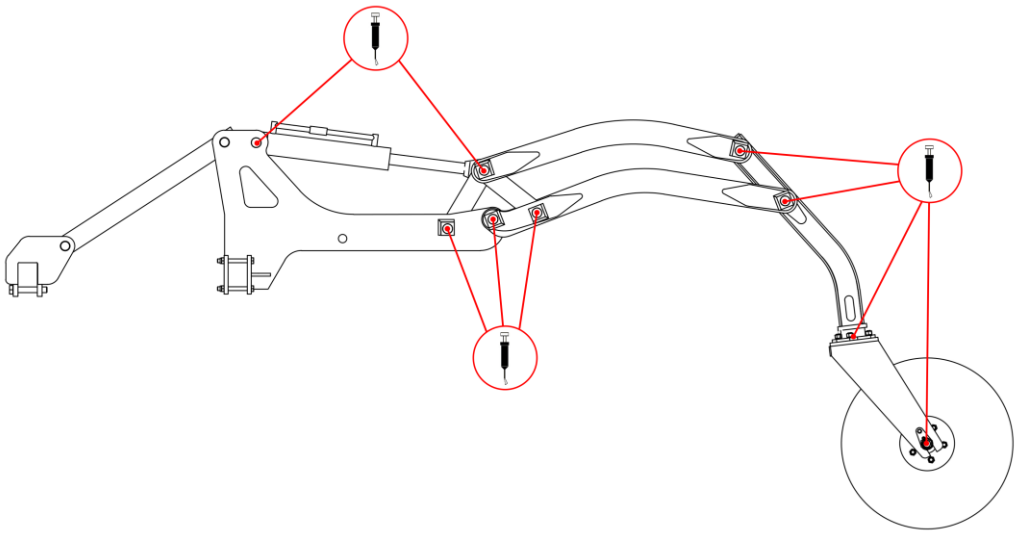


Figure 37 Lubrication points on the "Skorpion" trolley

- Place the machine on level, unpaved ground before installation. The use of lifting equipment is recommended due to the weight of the components.

5.8.4 Transport trolley "Skorpion" - assembly

Order of assembly of the transport trolley assemblies:

1) Attach the trolley turret with trolley arm and actuator to the rear beam of the frame and fasten with plate and screws (fig. 36 see view B). With the above components supplied separately, bolt the turret itself to the rear beam, followed by trolley arm and actuator,

2) Secure the connections with dedicated bolts and screws,

3) Screw the bracket beam bracket (fig. 36 view A) to the front frame beam and fasten with fixing plates and screws (fig. 36 items 1 and 2),

4) Fix the bracket beam (fig. 36 item 8) to the bracket and turret using the dedicated pins,

5) Mount the actuator with hydraulics (fig. 36 item 5) (if supplied separately) using the dedicated pins,

6) Fit the trolley arm with the wheel (fig. 36 item 7) using the pins,

NOTE! The trolley actuator must be cycled several times before use!

5.9 Opening sequence of the machine on the chassis - optional

The chassis is an optional accessory, the procedure for dismantling the machine on the chassis is shown below.

- 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) Set up the machine on a flat surface providing free space,

2) Remember the safety rules described in Section 3 ,

3) Remove the pins that prevent the machine wings from sliding out of the bumpers on their own (fig. 38),

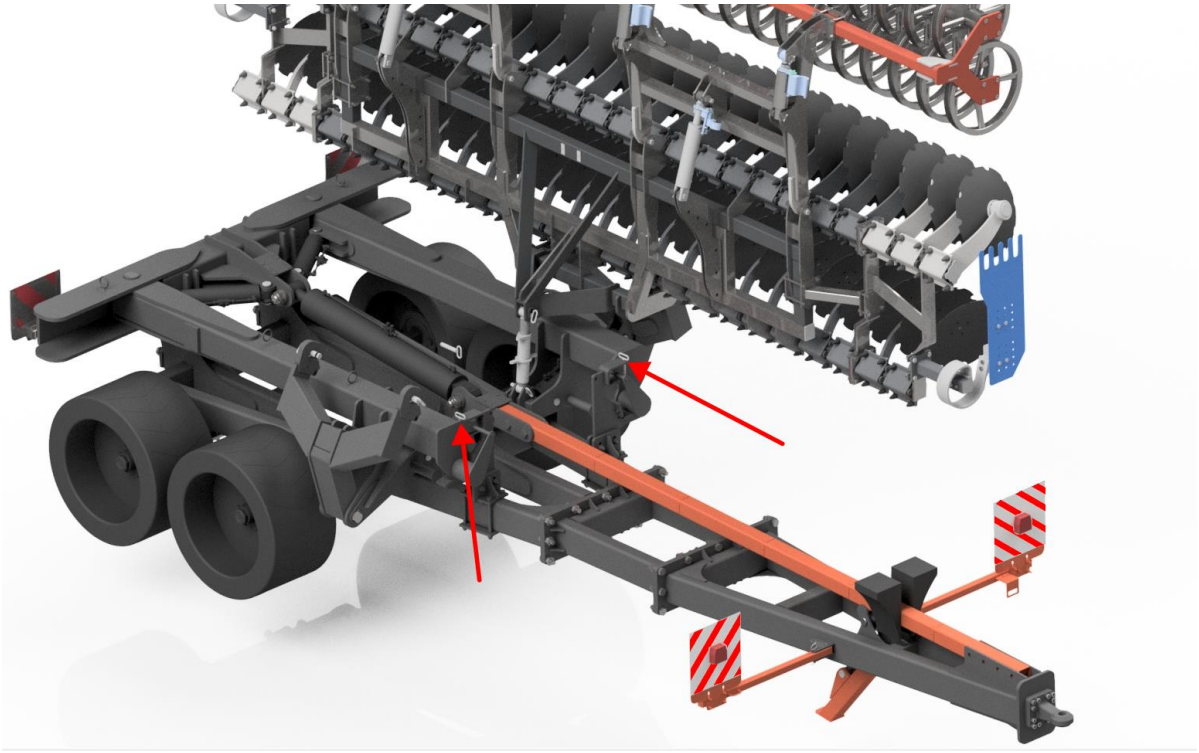


Figure 38 Location of pins preventing the machine wings from unfolding.

4) Start unfolding the arms in a horizontal position until they are fully extended (fig. 39),

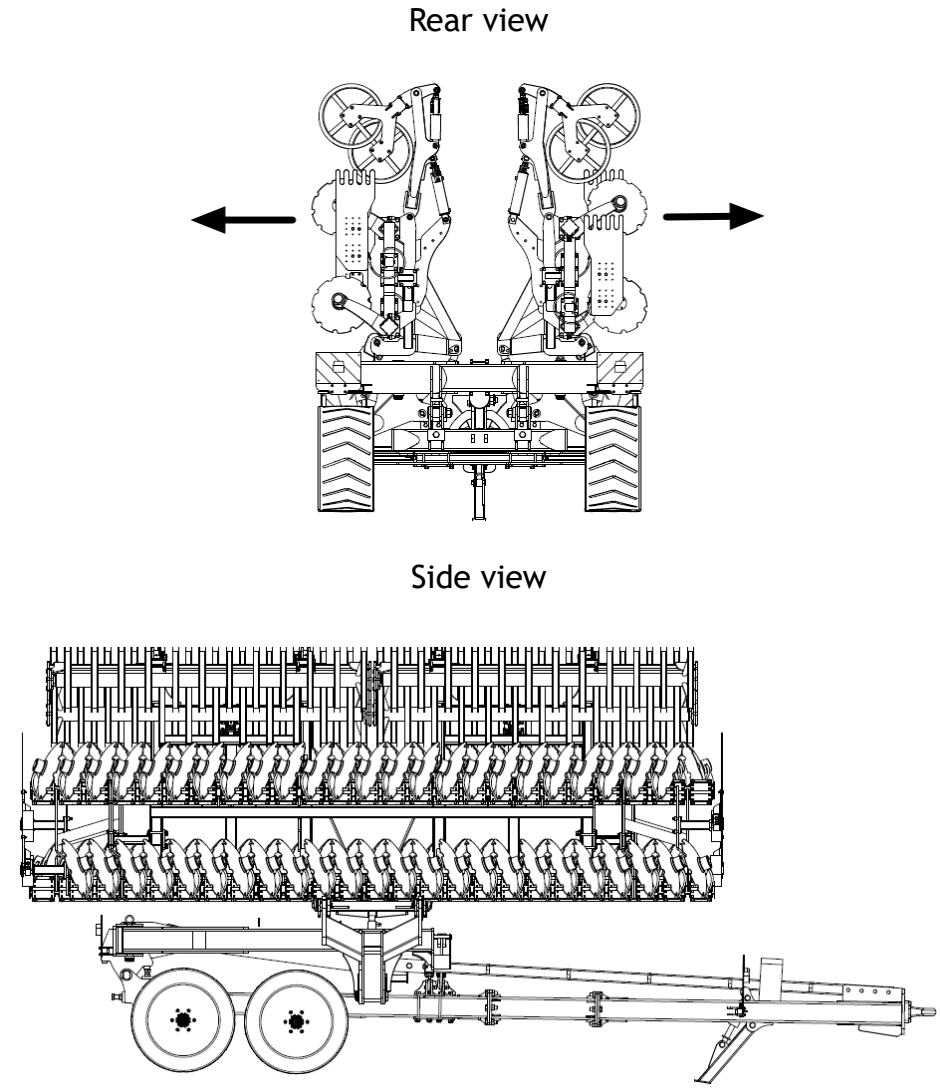
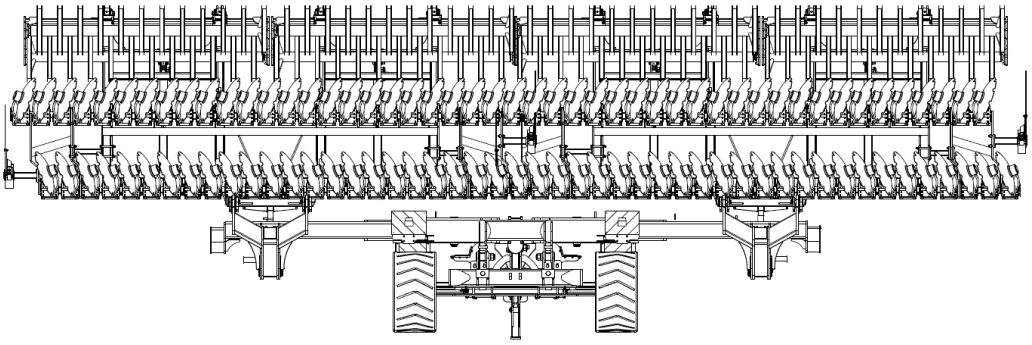


Figure 39 Unfolding the machine wing.

5) Continue unfolding the machine arms to the horizontal position (fig. 40 and 41),

Rear view



Side view

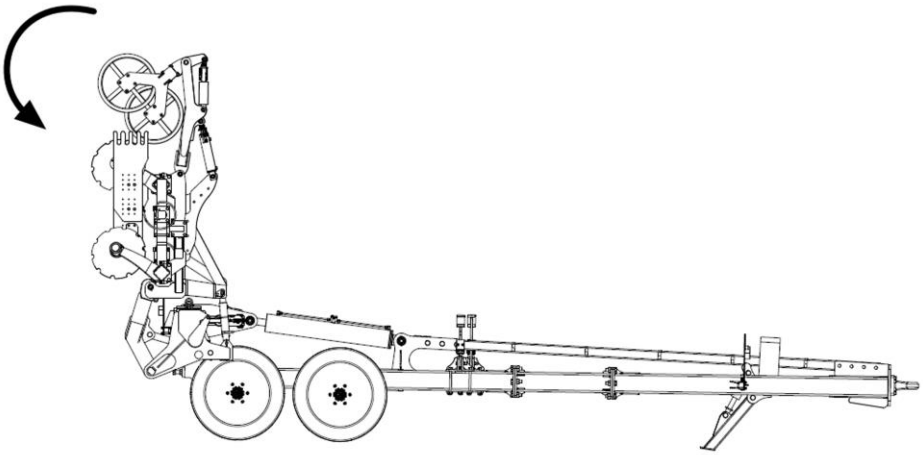
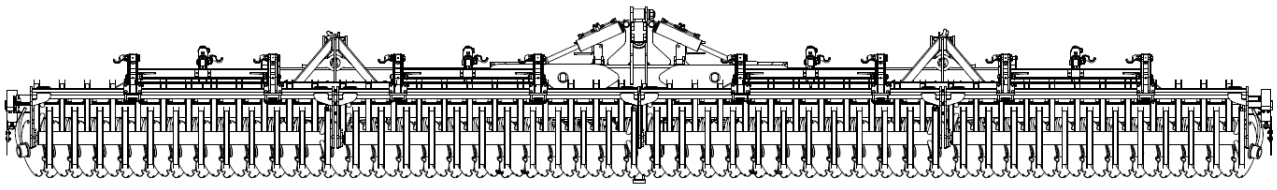


Figure 40 Unfolding the machine wings to a horizontal position.

Rear view



Side view

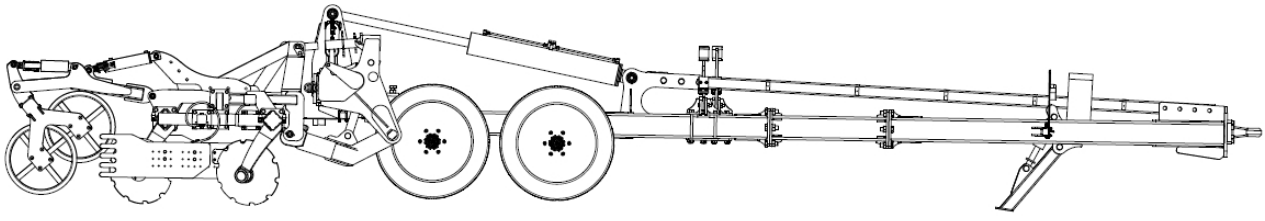
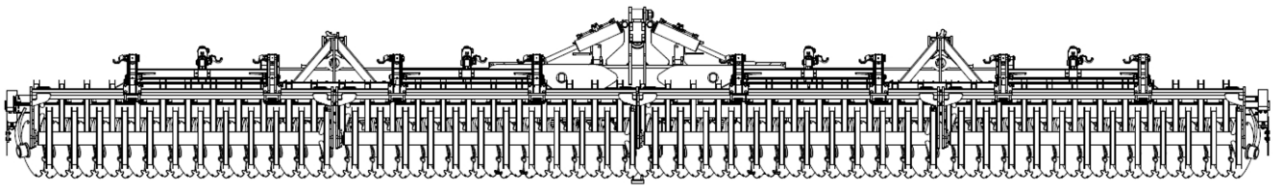


Figure 41 View of the machine after disassembly.

6) Carry out adjustment of the working rollers using the hydraulic roller adjustment actuators (fig. 42),
7) Set the correct height and angle of attack of the working rollers in relation to the ground (fig. 42)

Rear view



Side view

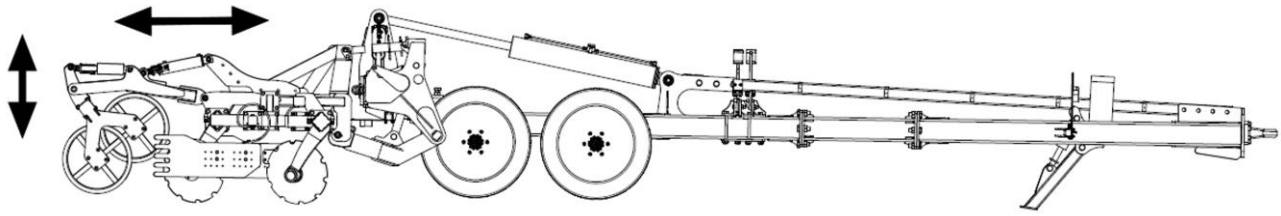


Figure 42 Adjusting the height and angle of attack of the operating rollers.

- **For detailed instructions on how to adjust the height of the working rollers, see the section 5.6 and section 5.7.**

5.10 Rules for transporting the harrow on public roads and lighting the machine

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.

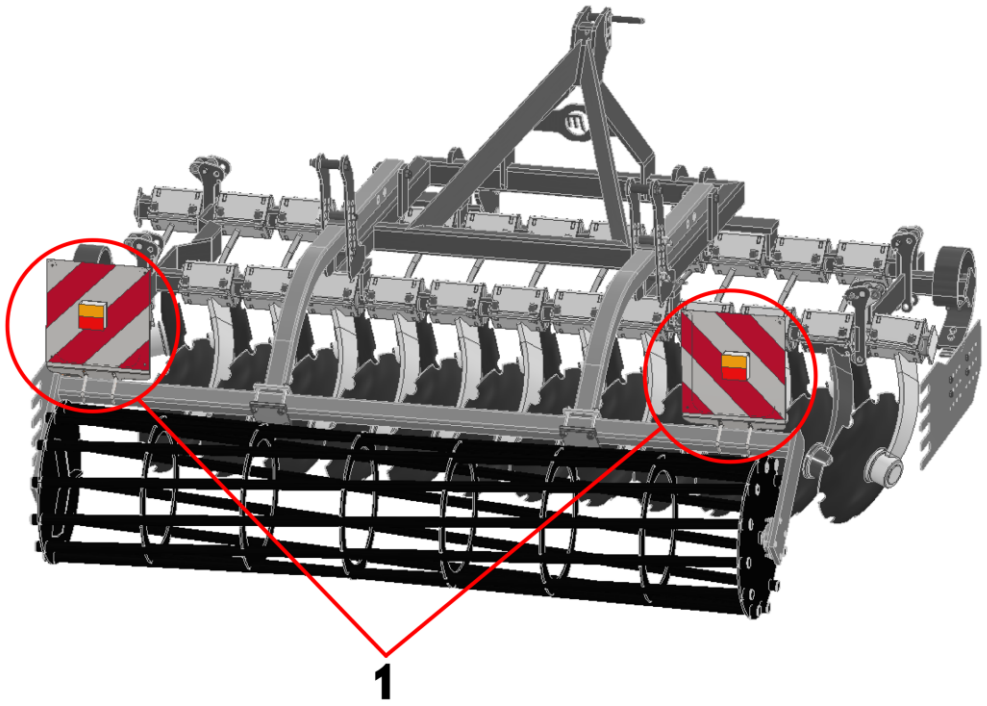


Figure 43 Light arrays on the GAL-C and GAL-E disc harrows on the roller bracket. (1 - lighting boards mounted on the roller bracket)

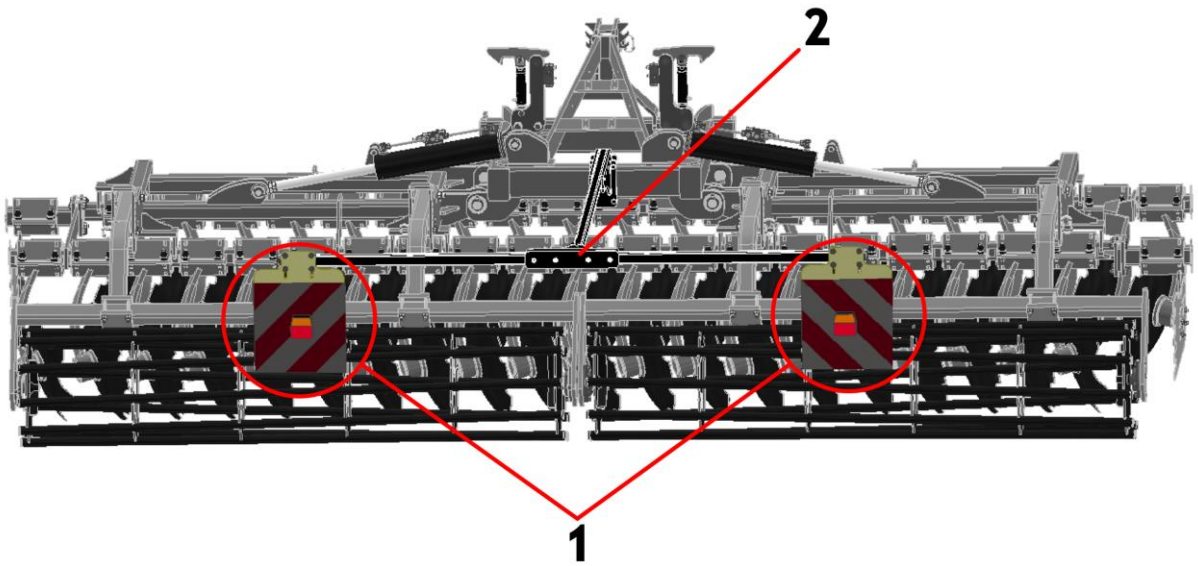


Figure 44 Illumination support assembly for the GAL-C H disc harrow (1 - illumination boards mounted on support, 2 - illumination support mounted on harrow structure)

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 disc harrow equipment. 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.

5.11 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.

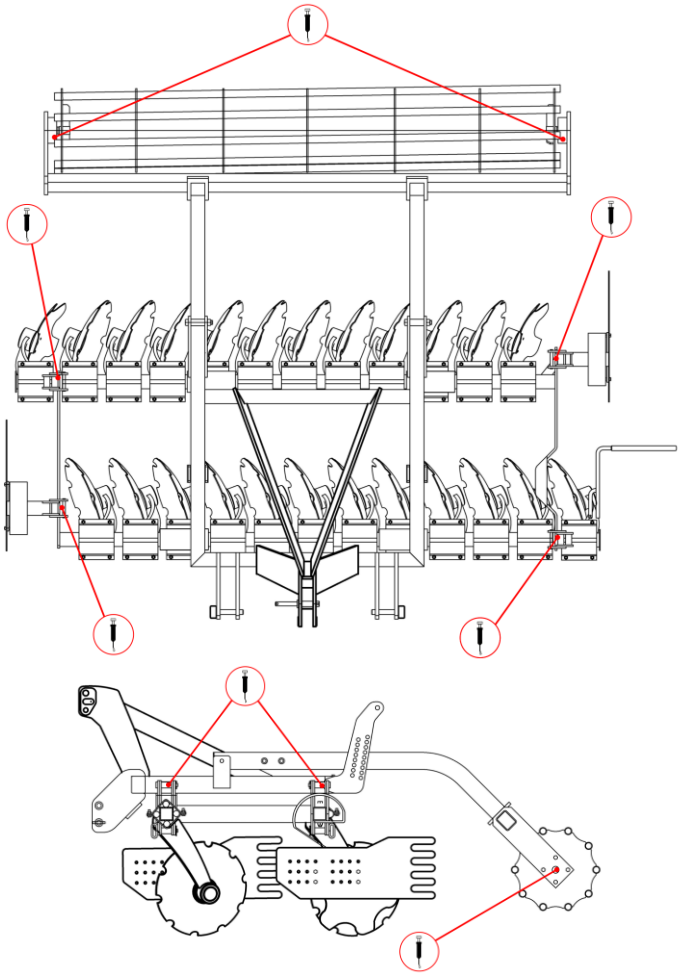


Figure 45 Lubrication points for the GAL-C disc harrow (tubular roller version)

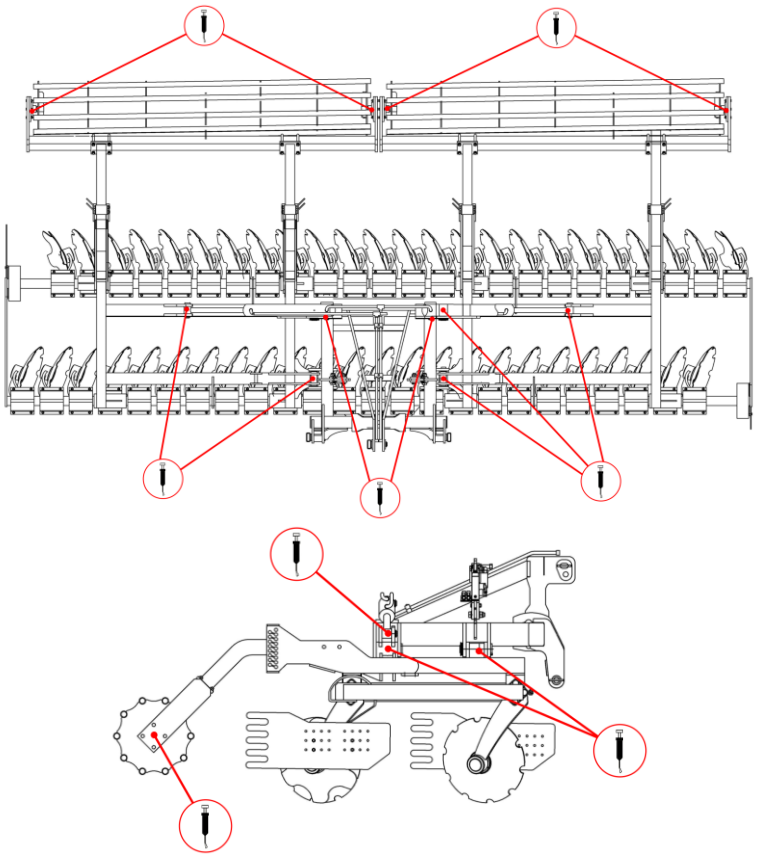


Figure 46 Lubrication points for the disc harrow GAL-C H (tubular roller version)

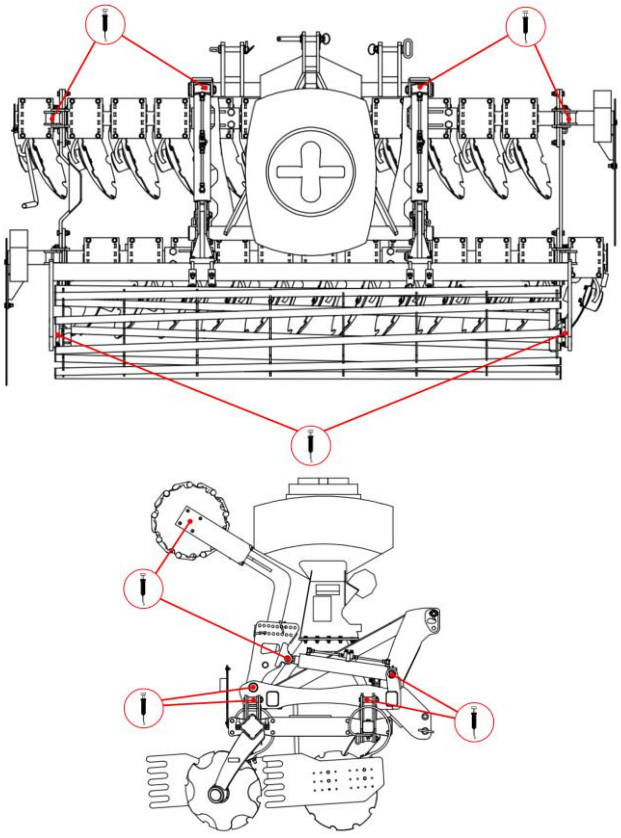


Figure 47 Lubrication points for the GAL-E disc harrow (roller and seed drill version)

5.12 Tightening torque for nuts and bolts

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 2.

Table 2. 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!

6 Operation

- **Everyday service**

Each time you finish working with the unit, thoroughly clean the soil and plant debris and inspect the bolt and pin connections and the condition of the working elements and other parts. 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.

- **Post-season service**

At the end of the operating season, the unit must be thoroughly cleaned, any damage to the paintwork repaired, and the stripped working surfaces of the tines, discs and roller, as well as the threads of the adjusting screws, must be washed with "Antykor" paraffin and protected against corrosion with "Antykor 1" grease; in addition, full lubrication must be carried out. 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.

6.1 Operating the chassis of the GAL-C disc harrow

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 30º 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**

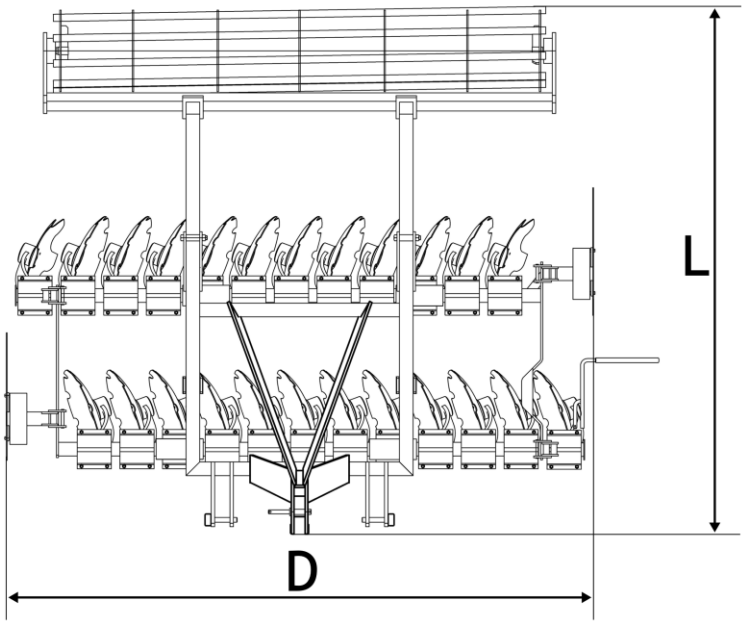
Maintenance of the hydraulic system consists of a visual inspection for leaks. Remember to put plugs on the quick-release couplings. Oil leakage at the connections of the hydraulic lines should be tightened. If this does not rectify the fault, the component or hose must be replaced with a new one. Leakage 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).

6.2 Main transport dimensions of the disc harrow

Top view



Side view

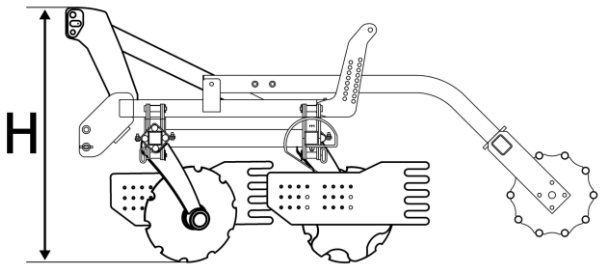
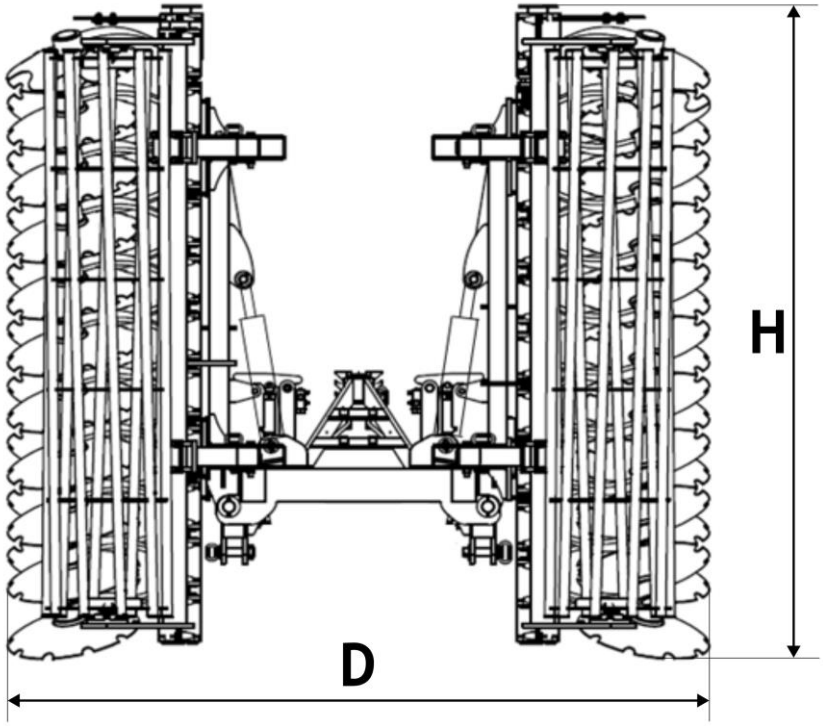


Figure 48 Transport dimensions of the GAL-C disc harrow with tubular roller (D - width, L - length, H - height) (see Table 3)

Rear view



Side view

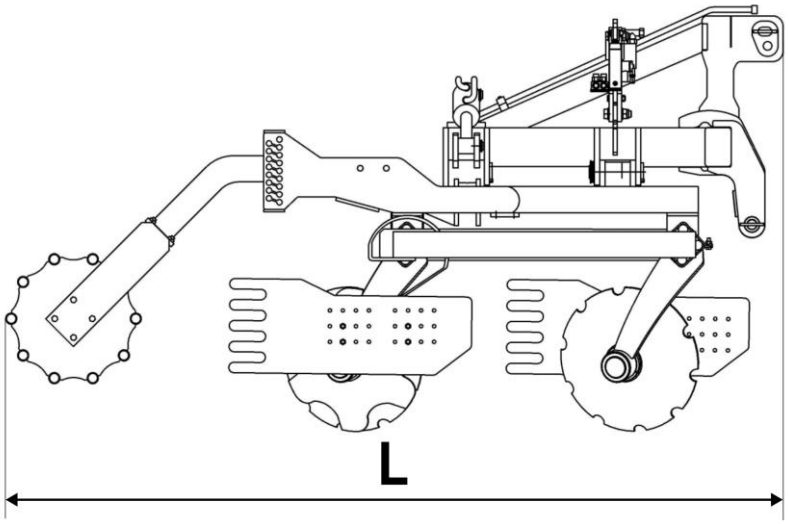
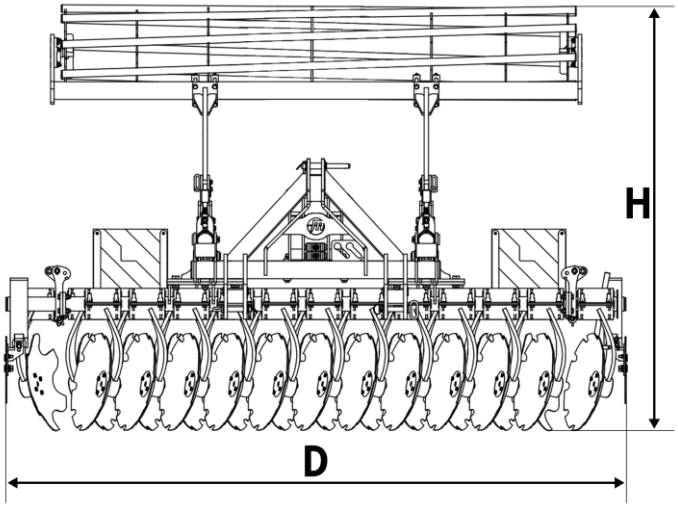


Figure 49 Transport dimensions of the GAL-C H disc harrow with tubular roller (D - width, L - length, H - height) (see table 4)

Front view



Side view

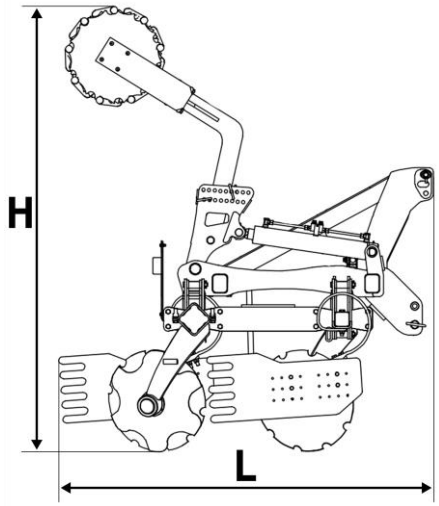


Figure 50 Transport dimensions of the GAL-E disc harrow with tubular roller (D - width, L - length, H - height) (see Table 5)

6.3 Specifications

Table 3 Technical characteristics of the GAL-C disc harrow

No.	Parameters	Unit				
1	Machine type		GAL-C 2.5	GAL-C 3.0	GAL-C 3.5	GAL-C 4.0
2	Working width	m	2.50	3.00	3.50	4.00
3	Hydraulically foldable	-	NO	NO	NO	NO
4	No. of discs	pcs.	20	24	28	32
5	Distance between disc rows	mm	900	900	900	900
6	Diameter of discs	ø	560 or 610	560 or 610	560 or 610	560 or 610
7	Unit dimensions in transport position	Length [L]	3100**	3100**	3100**	3100**
		Height [H]	1465 / 1780***	1465 / 1780***	1465 / 1780***	1540
		Width [D]	2840 / 2340***	3500 / 3000***	3450***	4400
8	Power requirement	KM	80	100	120	140

9	Total unit weight*	kg	1208*	1314*	1495*	1849*
10	Transport trolley option	-	YES	YES	YES	YES
11	Tyres	-	Wheel 11.5/80-15.3	Wheel 11.5/80-15.3	Wheel 11.5/80-15.3	Wheel 11.5/80-15.3
12	Transport speed	km/h	15	15	15	15

* weight of disc harrow without work roller with discs ø560 and arms
** length of disc harrow with tubular roller
*** with raised contour discs and side screens

Table 4 Technical characteristics of the GAL-C H disc harrow

No.	Parameters	Unit				
1	Machine type		GAL-C 4.0 H	GAL-C 4.5 H	GAL-C 5.0 H	GAL-C 6.0 H
2	Working width	m	4.00	4.50	5.00	6.00
3	Hydraulically foldable	-	YES	YES	YES	YES
4	No. of discs	pcs.	32	36	40	48
5	Distance between disc rows	mm	1000	1000	1000	1000
6	Diameter of discs	ø	560 or 610	560 or 610	560 or 610	560 or 610
7	Unit dimensions in transport position**	Length [L]	2980**	2980**	2980**	2980**
		Height [H]	2200	2545	2775	3275
		Width [D]	3000	3000	3000	3000
8	Power requirement	KM	160	170	180	200
9	Total unit weight*	kg	2215*	2395*	2586*	2923*
10	Transport trolley option	-	NO	NO	NO	NO
11	Support wheel option	-	YES	YES	YES	YES
12	Tyres	-	Wheel 10.0/80x12	Wheel 10.0/80x12	Wheel 10.0/80x12	Wheel 10.0/80x12
13	Transport speed	km/h	15	15	15	15
14	Braking system	-	-	-	-	-

* weight of disc harrow without work roller with discs ø560 and arms
** length of disc harrow with tubular roller

Table 5 Technical characteristics of the GAL-E disc harrow

No.	Parameters	Unit			
1	Machine type		GAL-E 2.0	GAL-E 2.5	GAL-E 3.0
2	Working width	m	2.00	2.50	3.00
3	Hydraulically foldable	-	NO	NO	NO
4	No. of discs	pcs.	16	20	24
5	Distance between disc rows	mm	800	800	800
6	Diameter of discs	ø	560	560	560
7	Unit dimensions in transport position**	Length [L]	2500	2500	2500
		Height [H]	2440	2440	2440
		Width [D]	2545	2890	3500
8	Power requirement	KM	75	80	100

9	Total unit weight*	kg	1200*	1301*	1480*
10	Transport trolley option	-	NO	NO	NO
11	Transport speed	km/h	15	15	15

* weight of disc harrow without work roller with discs ø560 and arms
** dimensions of disc harrow with tubular roller in transport position

7 Replacement procedures

If the roller bearings (V-ring, T-ring, C-ring) are damaged, they must be replaced as follows:

- Place the machine on a horizontal surface,
- Remove the two screws between the rings on each side,
- Move the roller away,
- First, remove the retaining ring at the end of the roller secured by headless screws and pull off the roller wheels,
- Pull the bearings using an extractor.
- Fit the new bearings loosely onto the roller, fit the wheels and retaining rings; screw in the headless screws using glue to prevent loosening),
- Roll the roller between the bearing plates and screw the bearings to them.

If the roller bearings (tubular, rubber, disc) 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.

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 when their diameter reduces to 490mm for Ø560mm discs and 550mm for Ø610mm discs.

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

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 of defects and malfunctions of the GAL disc harrow.

Fault, malfunction	Reason	Repair method
- uneven penetration of working elements	- poor levelling of the machine	- level the machine longitudinally and transversely
- poor penetration of the discs	- discs excessively worn - roller too low - disc pressure too low on compacted soil	- replace the discs - lift the roller
- lack of complete stubble undercutting	- disc working depth too shallow	- increase the working depth of the discs
- deep furrow at the junction of the working passages	- misaligned side screen	- improve the positioning of the side screen
- spreading the soil over the roller	- no rear screen - roller too close to the discs	- mount the rear screen - move the roller away from the discs
- clogging the discs	- working depth too deep - too much humidity	- reduce the depth
- clogging up the side screen	- too much crop residue	- remove the side screen
- poor soil compression by the roller	- wrongly levelled harrow - roller too high	- lengthen the top link - lower the roller

8 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.

9 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

10 Spare parts for the disc harrow GAL-C / GAL-E

- 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/en/, 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.