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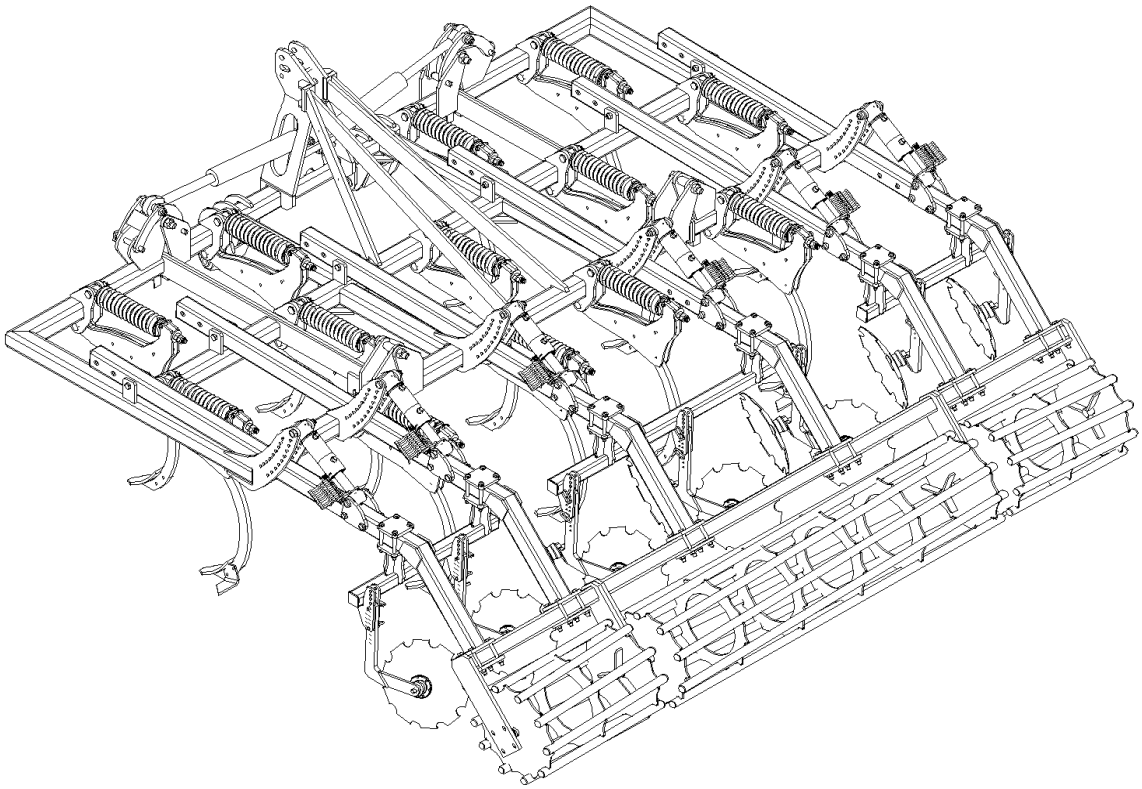
OPERATION MANUAL

SPEC HD CULTIVATOR



Revision III
Gliwice 2023

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:

SPEC HD CULTIVATOR
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

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1 Introduction

We would like to congratulate you on the acquisition of the SPEC HD chisel cultivator. 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 SPEC HD chisel cultivator can be found on a nameplate 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 SPEC 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 SPEC HD cultivator, 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.

Safety signs	Meaning of the safety sign
	Crushing of the toes or foot.
	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

Safety signs	Meaning of the safety sign
	Fixing point for transport belts
	Lubrication point
	Designation of hydraulic system couplings
	Note about riding ban on rollers

2. General information

2.1. Construction of the SPEC HD cultivator

The cultivators produced are available in working widths: 2.5m, 3.0m, 4.0m and 4.8m.

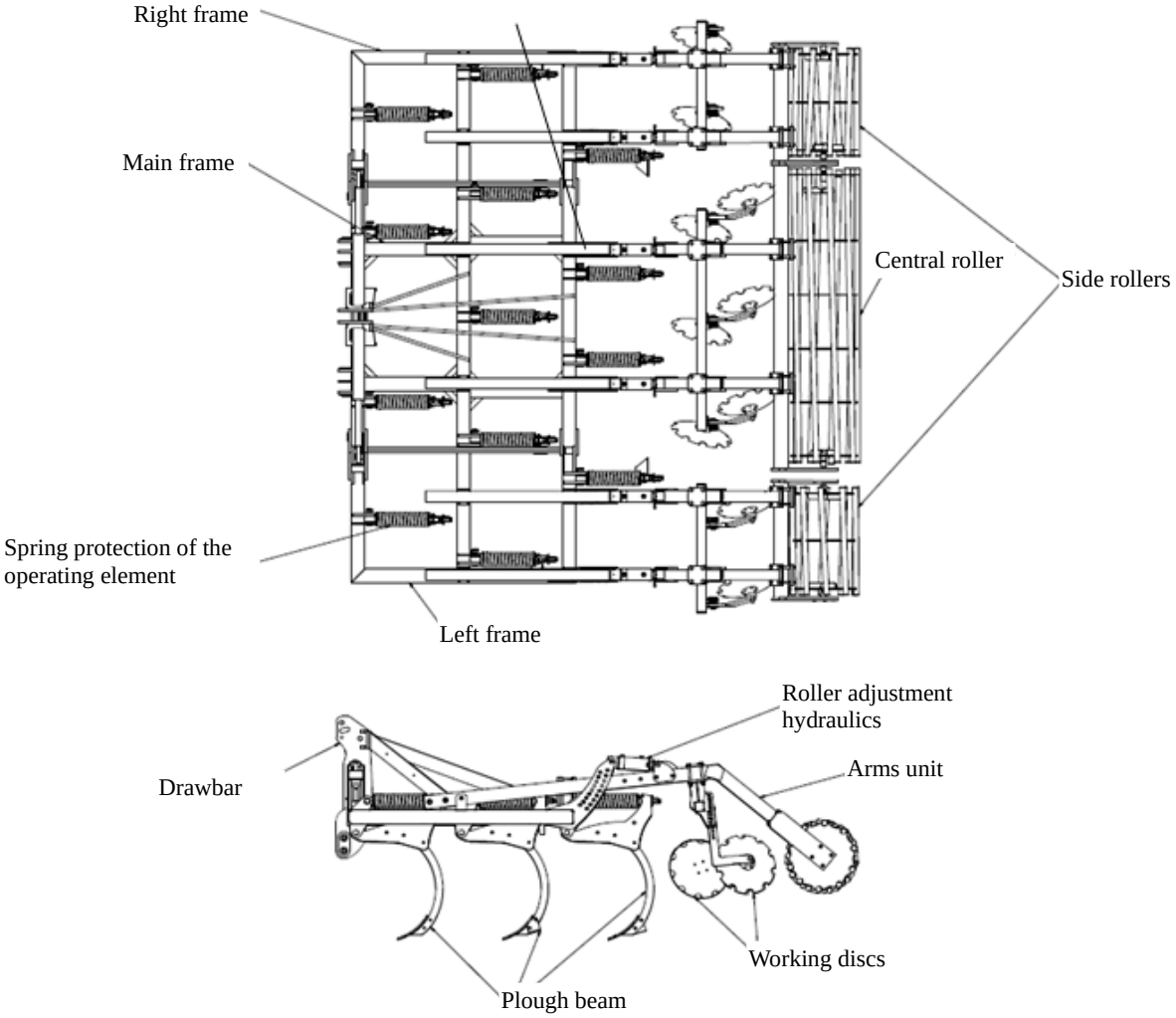


Figure 2 SPEC HD 4.0 H chisel cultivator.

The main frame of the cultivator is the basic load-bearing element of the entire machine. In the version that exceeds a width of 3 m, the cultivator consists of a mid frame and side frames folded hydraulically into the transport position (Fig.2). The plough beams with working components are attached to the frame. Standard cultivators are equipped with a shaft and a disc beam mounted to the shaft arms. Each disc has its own bearing (maintenance-free hubs), allowing the disc to be optimally inclined to the direction of travel and the ground. The task of the discs is to level the soil surface distorted by the last row of working components. The shafts are used to compact opened soil and maintain the working depth of the cultivator.

Table 2. Types of the SPEC HD cultivator

Type	Working width [m]	Number of teeth [pcs.]	Number of discs [pcs.]	Min power res. [KM]	Weight [kg]
SPEC HD 2,5	2.50	8	7	110	1319
SPEC HD 3,0	3.00	10	8	130	1505
SPEC HD 4,0 H	4.00	13	10	180	2520
SPEC HD 4,8 H*	4.80	16	12	220	3365

machine with integrated running gear

2.2. Purpose of the SPEC HD cultivator

The SPEC HD cultivator is an all-purpose machine for shallow ploughing or used instead of ploughing for:

- shallow stubble cultivation (up to 15 cm) to mix post-harvest residues, stop soil water evaporation, increase the growth of weeds and self-seeding plants, and reduce ploughing resistance, or deep cultivation,
- deep tillage (to a maximum of 30 cm) to loosen the soil layer, mix in mineral and organic fertilisers and prevent mineralisation of humus in the arable layer.

The application of right and left side shields improves the degree of stubble mixing. As a result, the concentration of phenol compounds affecting the growth of crops in the following year is reduced. The application of the SPEC HD cultivator for deep cultivation eliminates the need of ploughing, and as such, this allows cost reduction, eliminates the risk of excessively compacted soil, and helps to complete farming work on time.

NOTE! The cultivator 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 cultivator may only be used and repaired by persons who are familiar with its operation and the mating tractor and with the rules of conduct for the safe operation and handling of the cultivator. The manufacturer is not responsible for arbitrary changes to the design of the cultivator. During the warranty period, only factory-made "MANDAM" parts must be used.

The cultivator should be operated with all precautions in mind, in particular:

- before each start-up, check that the cultivator and the tractor are in safe condition when moving and working,
- 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,
- when working with the cultivator, when lifting, lowering and unfolding, there

should be no bystanders in the vicinity, especially children,

- it is forbidden to stay between the tractor and the cultivator while the engine is running,
- move forward, lift and lower the cultivator slowly and smoothly without sudden jerks, making sure that nobody stays in the vicinity,
- 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,
- carry out any repairs, lubrication or cleaning of working parts only with the engine switched off and the machine lowered and unfolded,
- when not in use, the machine must be lowered to the ground and the tractor engine stopped, machines must be stored in such a way as to prevent injury to people and animals,
- It is forbidden to turn or reverse with the machine lowered.

IMPORTANT! In addition to these operating instructions, traffic, health and safety regulations must also be observed. When driving on public roads, the regulations contained in the Highway Code must be observed without exception.

NOTE! SPEC HD are not permitted on public roads as standard.

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

3.1. Proper coupling and uncoupling of the machine to/from 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 cultivator, it is forbidden for persons to stay between the machine and the tractor during this time.
- The tractor working with the cultivator must be fully operational. Coupling to a tractor with a defective hydraulic system is prohibited.
- 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.

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 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.

- If the SPEC HD cultivator is used on stony soils, significant noise may result. In this case, it is advisable to keep the windows and doors of the tractor closed. You can also wear ear protectors.

- 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 SPEC HD cultivator 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.

- **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 chisel cultivator 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, 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 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! It is forbidden to work the chisel cultivator at an angle greater than 5°. For proper operation, all working elements must be in constant contact with the ground.

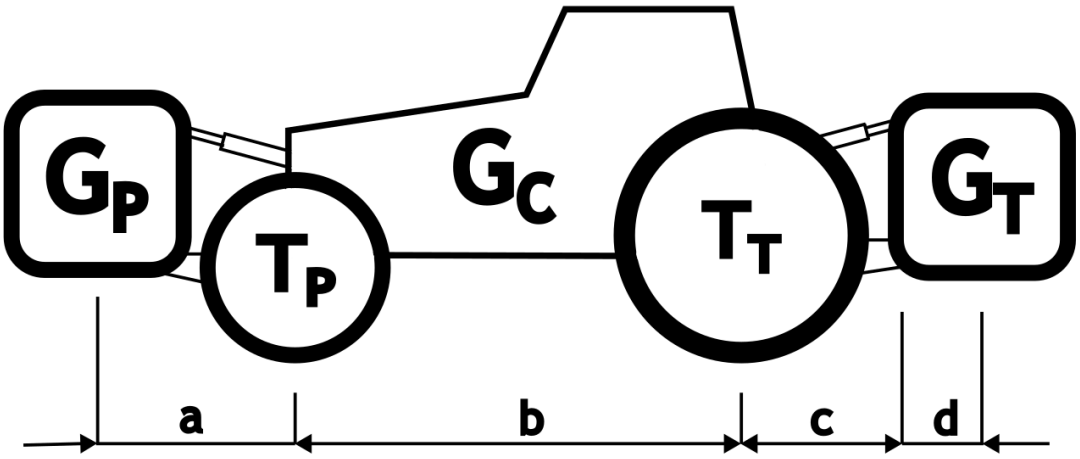


Figure 3 Diagram of tractor load designations

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

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

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

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).

NOTE! The permissible axle loads and tyre load capacities must not be exceeded. The front axle load must not be less than 20% of the total load. The tyre pressure should be in accordance with the manufacturer's recommendations

4.1. Preparing the cultivator for work

The cultivator is usually delivered ready for work. Due to the limitations of transport facilities, it is also possible to deliver it in a partially dismantled state - this usually involves disconnecting the rear shaft, disc beam and discs.

When the unit is first prepared for use, its components must be assembled: cultivator, shaft and discs. To do this, place the cultivator on a flat hard surface in a position that allows the shaft to manoeuvre. Position the shaft arms in the cultivator brackets and connect the arms to the shaft bracket with screws (Fig. 4). Then mount the beam with discs to the shaft arms. The discs should be set so that their work causes the furrows created by the coulters of the last row of the cultivator to be filled in. There is one pair of discs per plough beam in the last row (left and right discs - Fig. 5).

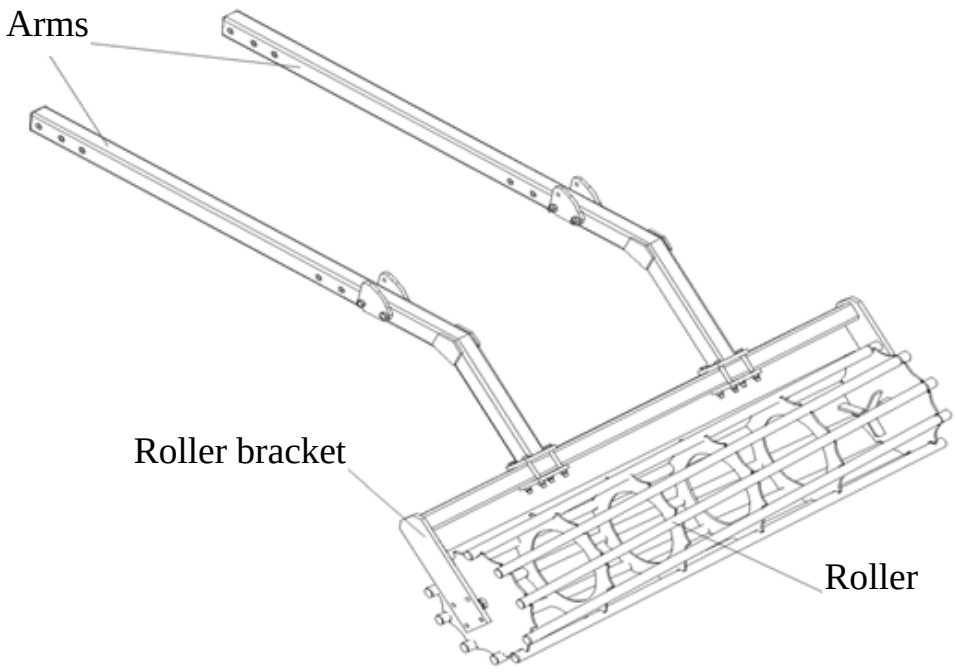


Figure 4 Connection of the arms to the roller bracket.

NOTE! The correct procedure for mounting the shafts 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 shaft clamp profile. This provides the most secure way of connecting the shaft arms to the machine!

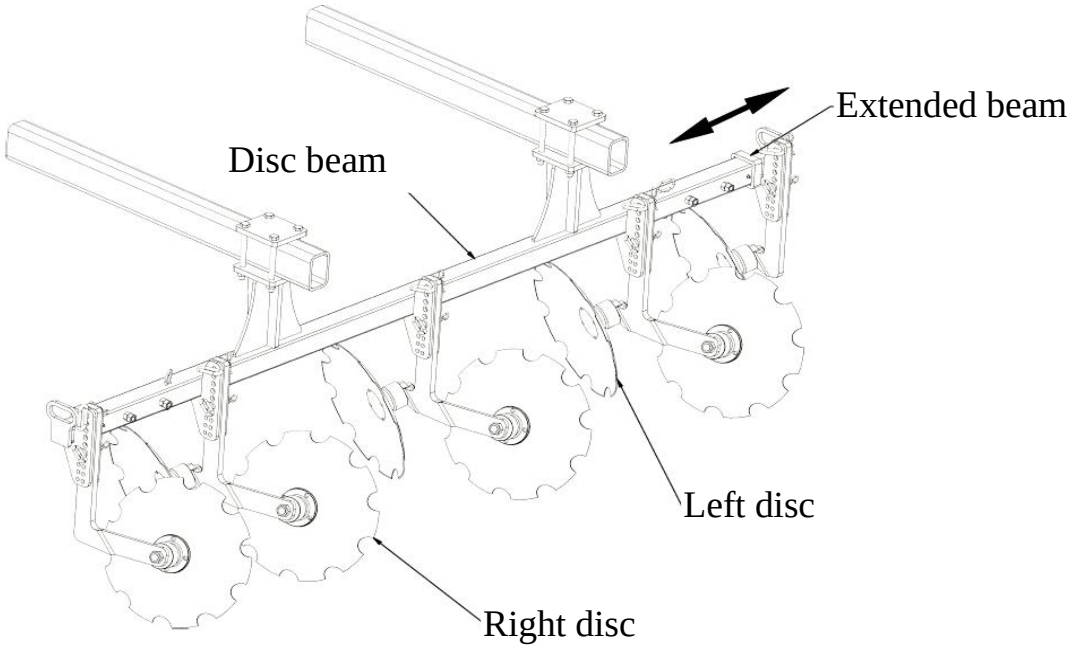


Figure 5 Distribution of discs on the beam.

NOTE! While preparing the machine for deep soil cultivation, dismount all cutting wings asthey may contribute to extensive compaction of the soil, resulting in plough pan effect, and increase the operating resistance.

SPEC HD cultivators are optionally available with a disc beam with disc holders with rubber protection to prevent the holders from twisting excessively during machine operation (Fig. 6).

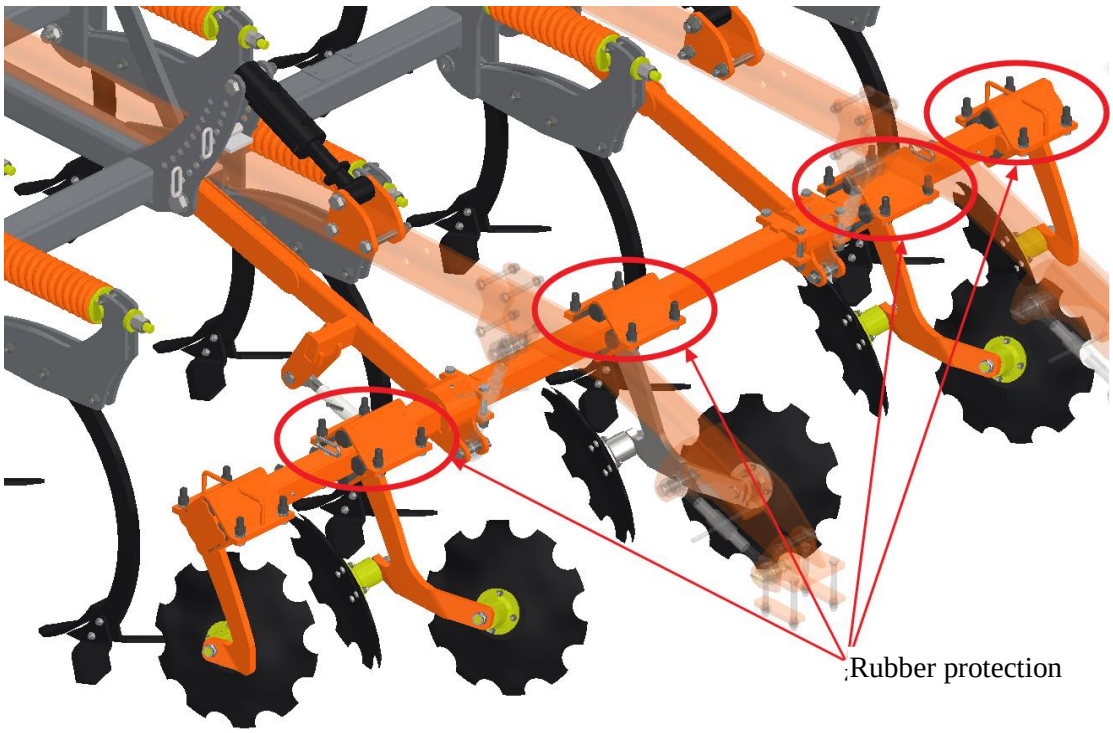


Figure 6 Disc beam with rubber protection.

NOTE! On a machine fitted with a disc beam with rubber-covered handles, mount the arms on the first available hole (Fig. 7 item 1). The distance between the discs and the operating roller is then maintained.

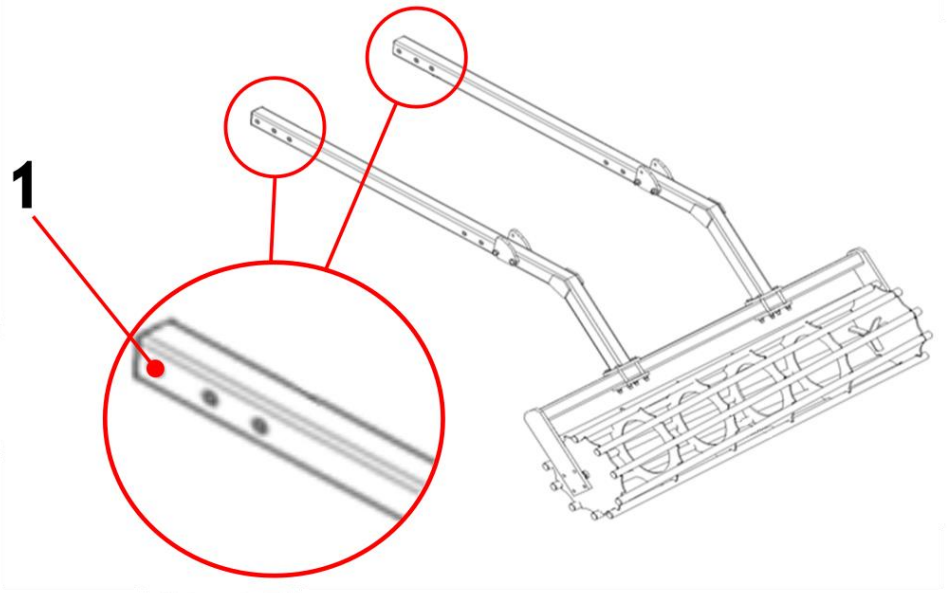


Figure 7 Arm mounting holes (1 - mounting hole - see **NOTE!**)

4.2. Coupling the cultivator 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 cultivator to the tractor, the cultivator should stand on firm and level ground.

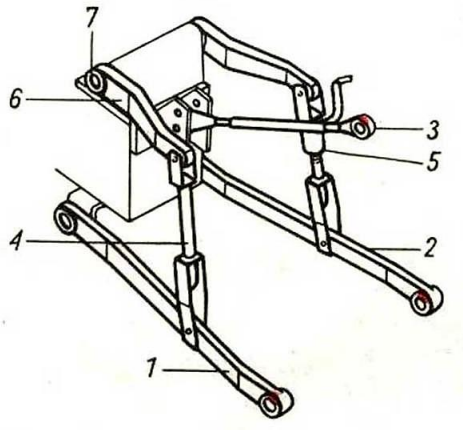


Figure 8 Three-point linkage of the tractor: 1,2 - lower links, 3 - upper fastener, 4 - left suspension, 5 - right suspension with adjustable length, 6 - lift arm, 7 - lift shaft

When connecting the mounted machine to the tractor, perform the following operations:

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) Reverse the tractor to a distance that allows the unit hitch to be connected to the lower links of the tractor,
4) Make sure that the category of the hitch and link are identical
5) Set the lower links at the same distance from the ground
6) First, connect the lower links of the tractor
7) Secure the connection with pins and safety devices
8) Connect the upper link of the 3-point hitch and adjust the connection
9) Connect the electrical cables (if lighting is an option) and check for correct operation
10) Connect the hydraulic lines and check their tightness
11) If the unit has a support foot, raise and secure it
12) Raise the unit and check whether the tractor maintains full controllability

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.

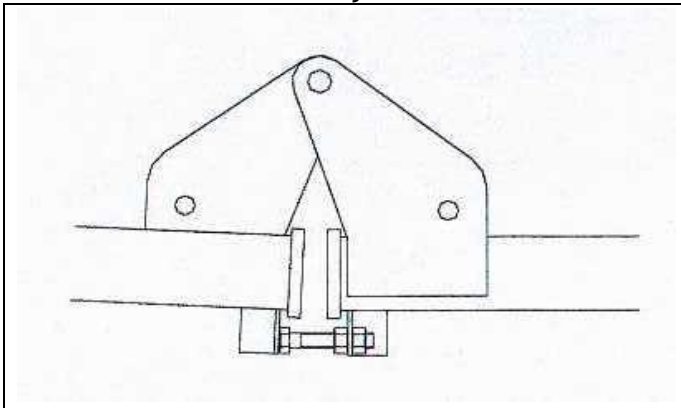
NOTE! Hitching the tractor to the cultivator must be done carefully, at minimum tractor speed! When hitching the machine, make sure there are no bystanders in the vicinity.

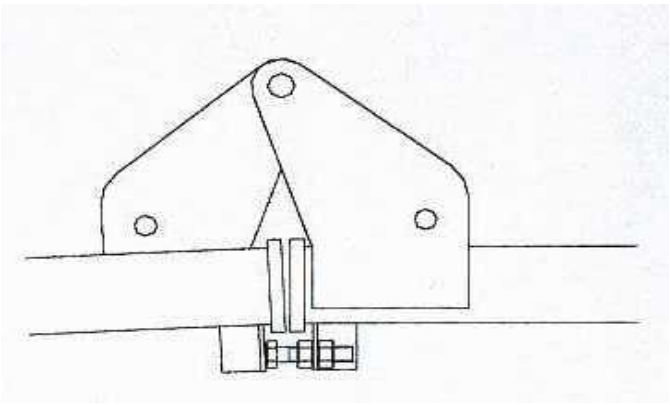
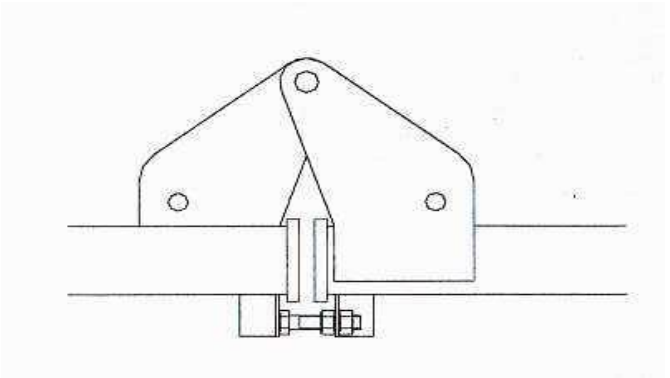
4.3. Operation and adjustment

4.3.1. Side arms adjustment

On cultivators with folding side frames, the level adjustment of these frames must be carried out using the screws built into the front and rear of the mid frame (at each hinge - Table 3). Properly adjusted side arms should be at the same level as the mid frame. Once adjusted, secure the screw with a lock nut.

Table 3. Side frame level adjustment.

	Incorrect adjustment

	Incorrect adjustment
	Correct adjustment

Before carrying out field work with an unit with folding side arms, the hinge lock **must** always be in place and secured with a cotter pin (Fig. 9).

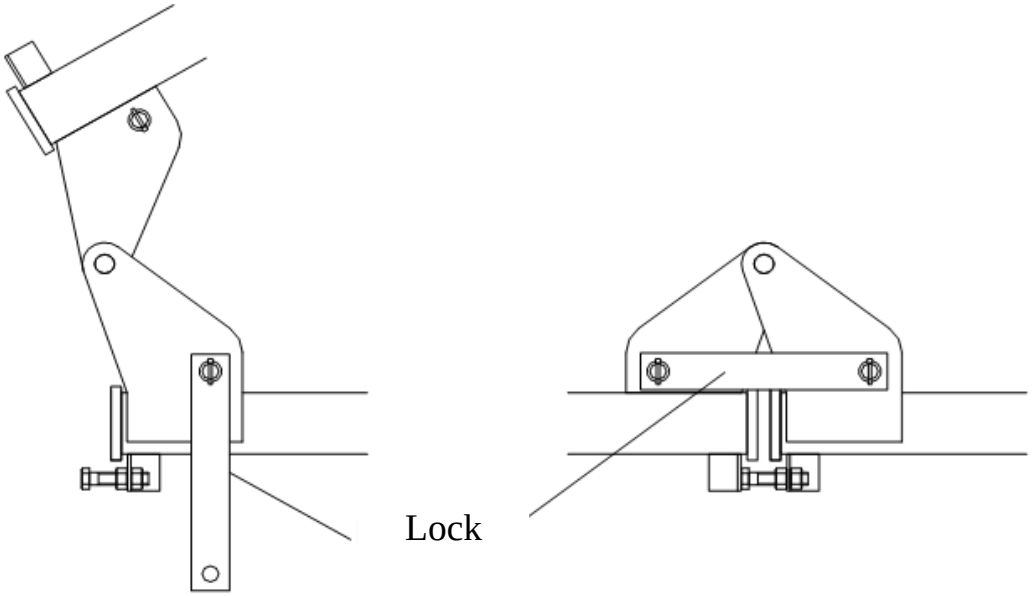


Figure 9 Lock in the transport position (fig. a), lock in the working position (fig. b).

NOTE! It is forbidden to carry out field work with units with folding side arms without the hinge lock in place.

Remember to remove the hinge lock before lifting the side arms into the transport position.
A properly hitched cultivator should follow the tractor evenly during operation and loosen the soil uniformly over the entire working width. For longitudinal levelling, use the tractor's top link (turnbuckle), while for transverse levelling, use the crank on the tractor's right-hand suspension.

4.3.2. Adjusting the working depth of the roller

The working depth is adjusted by changing the height of the roller relative to the cultivator frame using the tractor's hydraulic linkage connected to the hydraulic depth control (Figure 10). It is also possible to change the distance of the shaft from the cultivator frame by moving the arm mounting hole (figure 10 item no. 2) to the next available hole. In this case, the actuator mount on the roller arm must also be moved (Figure 10 position No. 3) to ensure the full range of operation of the actuator. Note that too little distance between the tines and the plates can cause clogging with plant residues.

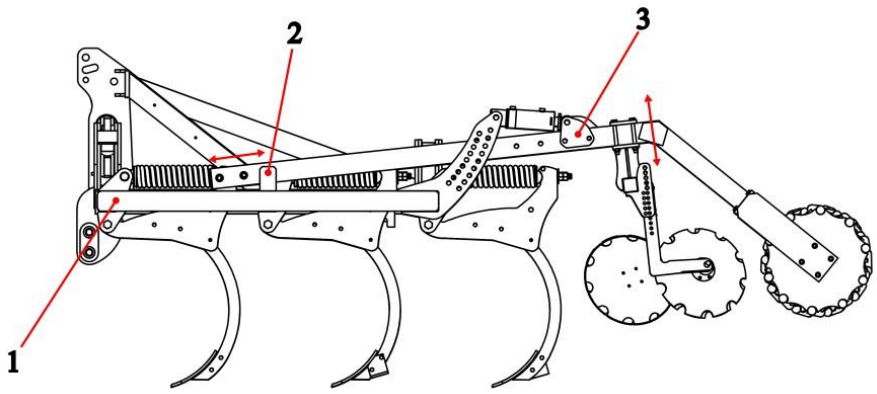


Figure 10 Adjusting the depth and working distance of the roller (1 - cultivator frame, 2 - roller arm attachment screw, 3 - actuator attachment to roller arm)

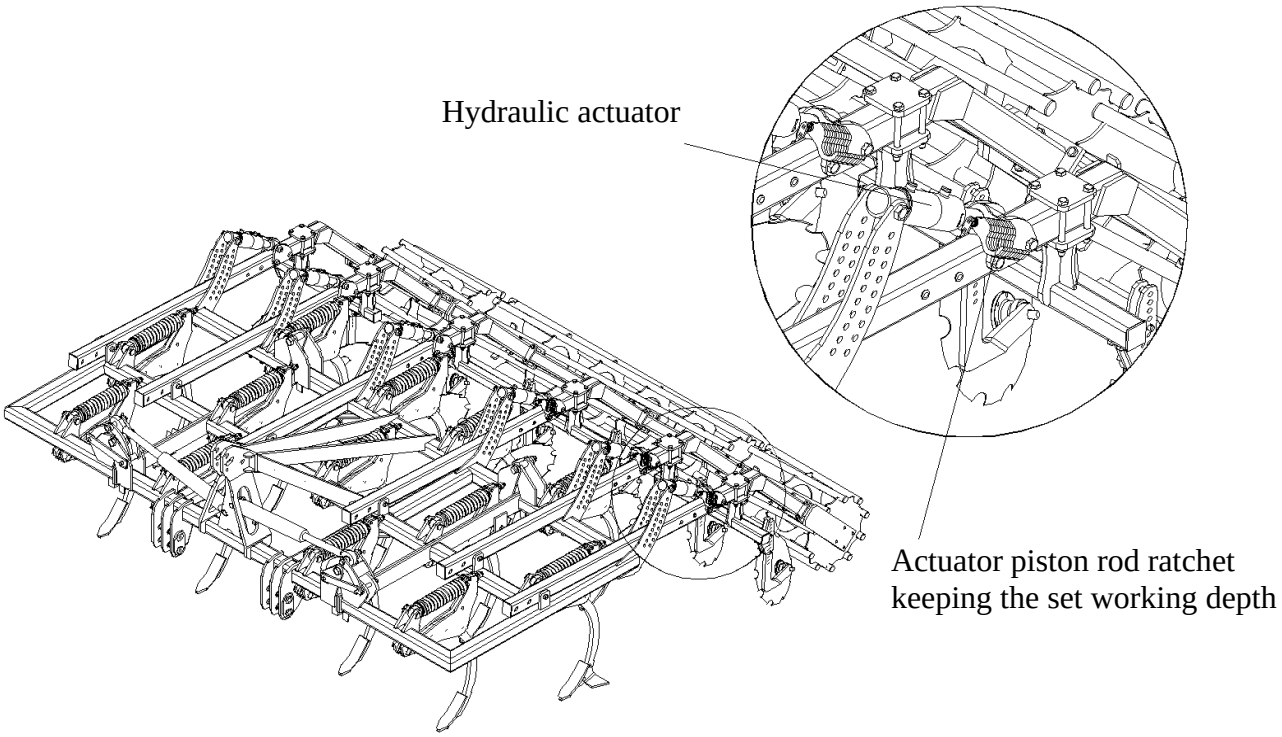


Figure 11 Hydraulic adjustment of tube roller depth.

For machines with hydraulic depth control, the working depth of the machine is set using ratchets 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. 12 and Fig. 13), the correct way of installing the subsequent pawl plates on the actuator and the incorrect way of installing them are shown.

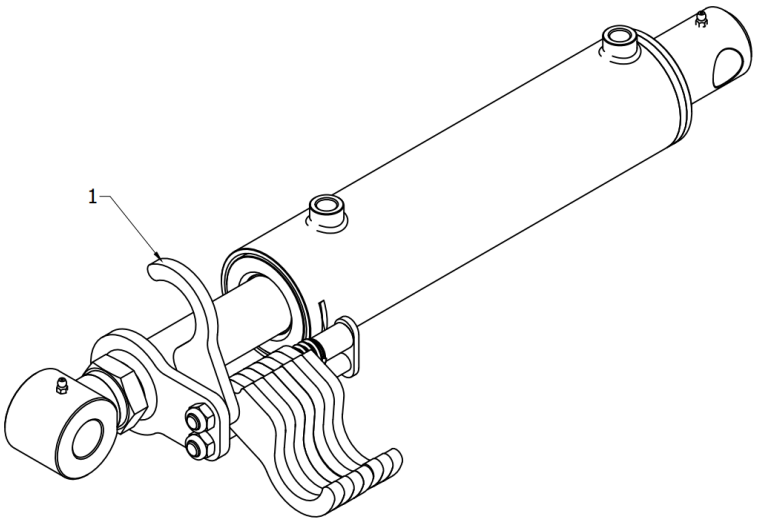


Figure 12 Correct way to put the first (1) ratchet on the piston rod of the actuator to adjust the working depth of the machine.

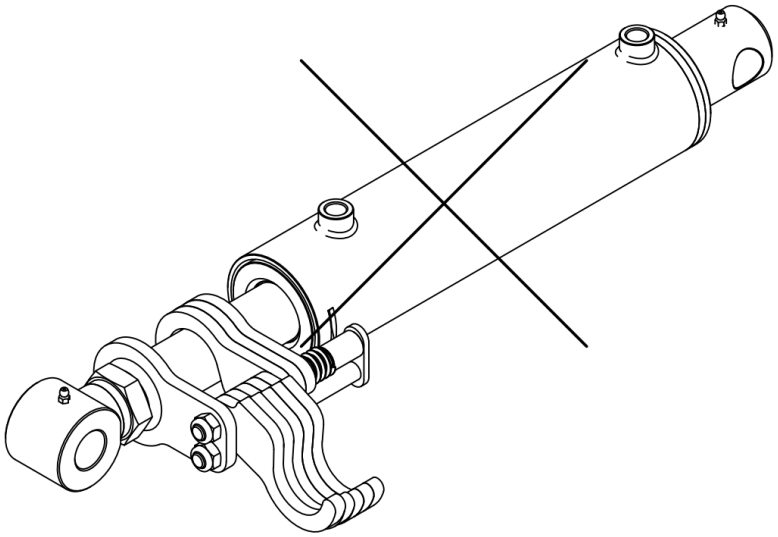


Figure 13 Incorrect way of fitting the ratchets to the piston rod of the actuator. Partial omission of the attachment of the pawls to the cylinder results in uneven distribution of the forces acting on the piston rod and can lead to piston rod buckling resulting in damage to the entire cylinder assembly. This kind of adjustment is **unacceptable**!

The number of pawls on all shaft arm cylinders must always be equal!

The working depth of the discs is set according to the depth of the cultivator. The discs must work on the surface to evenly level the soil behind the plough beams.
The SPEC HD cultivator elements can be adjusted in terms of angle of attack. The more horizontal position of the coulters reduces working resistance and undercuts the stubble with low loosening - recommended for compact soils with optimum moisture content and soils of medium and low compactness (nut on the spring screw). The steeper position of the coulter facilitates penetration and loosens the soil to a greater extent - recommended for hard and dry soils. Note that as the screw twist changes, so does the strength of the protection induction.

WARNING! It is forbidden to make adjustments to the machine while the tractor engine is running. The working speed of the SPEC HD cultivator under normal operating conditions should be 8 - 12 km/h.

The machine must be raised before turning and during reverse travel.

4.3.3. Adjustment and initiation force of the SPEC spring system

The user can vary the initiation force of the spring system by adjusting the length of the spring in the system. To do this, adjust the length of the spring with the M24 nuts (Figure 14 item 2) by tightening or unscrewing them. Tightening shortens the spring and consequently increases the force required to excite the system. Once the nut is unscrewed, the situation is reversed.

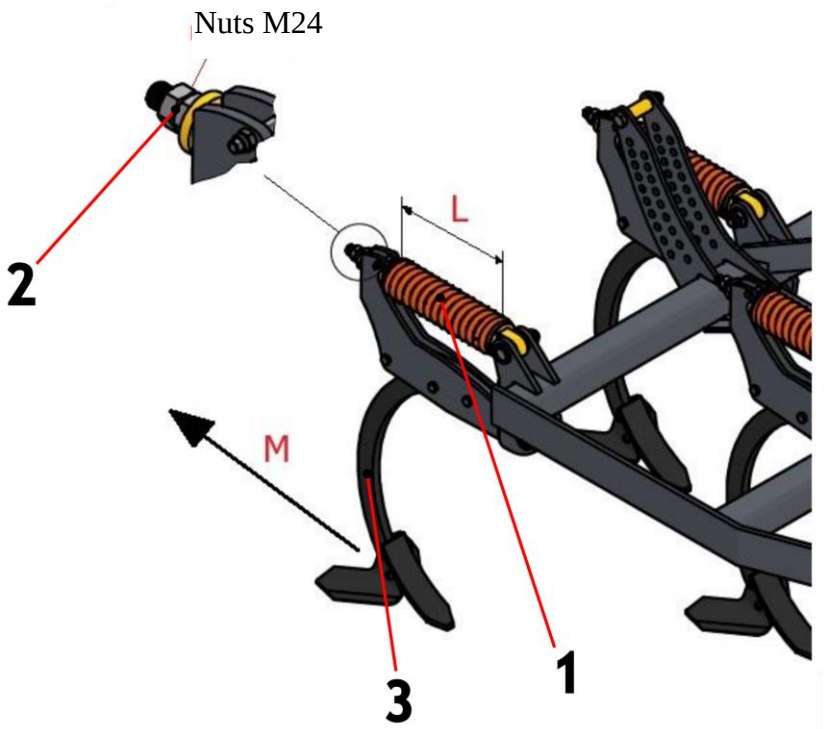


Figure 14 Spring system (1 - system spring, 2 - M24 nuts, 3 - plough beam; L - spring length; M - force and direction of system initiation)

- Initially, all spring systems are set to a spring length of 380 mm.

The table below shows the suggested spring length settings and the initiation force of the system at the set lengths.

Table 4 Spring system length and system excitation force

No.	Spring length L [mm]	Initiation force [kg]
1	380	550
2	375	600
3	370	650

Adjustment of the position of the plough beam

In order to change the angle of attack of the plough beam - the lock nut must first be loosened and then adjustments made with the nut on the spring bolt.

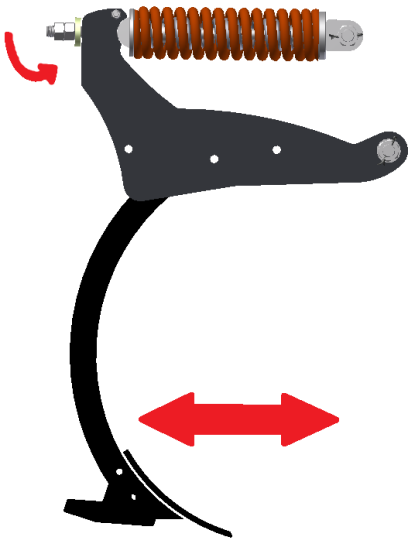


Figure 15 Adjusting the angle of incidence of the plough beam.

The more horizontal position of the coulters reduces working resistance and undercuts the stubble with low loosening - recommended for compact soils with optimum moisture content and soils of medium and low compactness (nut on the spring screw). The steeper position of the coulter facilitates penetration and loosens the soil to a greater extent - recommended for hard and dry soils. Note that as the screw twist changes, so does the strength of the protection induction.

4.4. Rules for transporting the cultivator 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 chisel cultivator. 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.

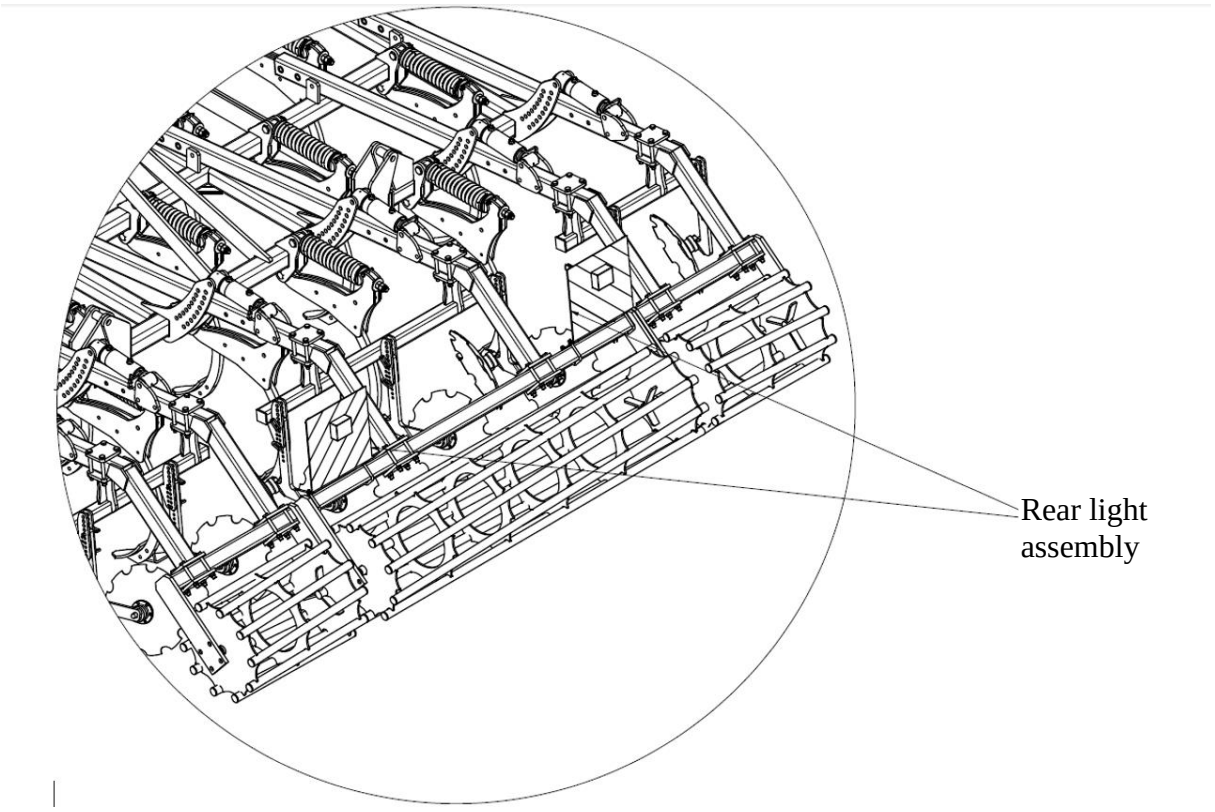


Figure 16 Lighting and rear light assemblies and their location.

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.
- 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 SPEC HD chisel cultivator 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.

4.5. Maintenance and lubrication

- Each time the cultivator is finished working, the soil must be cleaned, 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,**
- The blade tips can be used almost until they are worn down, until the working surface is equal to the initial blade foot surface. However, it is advisable to replace the tips early enough before there is a possibility of wear and damage to the blade foot.
- Lubricate the grease points on the hinge pins daily during the life of the machine. Lubricate the bearings of the shaft and the levelling discs every 25 operating hours

(does not apply to maintenance-free disc bearings - these bearings do not need to be serviced and lubricated).

- When replacing worn components, use thread glue, original bolts and nuts.
- For screwing the working elements, use M12 screws, class 10.9 and tighten them with a torque of 135Nm.
- Damaged or worn parts must be replaced with new or reconditioned parts.
- 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, shaft or other assembly of the machine!

4.6. 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, shaft or other assembly of the machine!

5. Everyday service

Each time the cultivator is finished working, it should be cleaned of soil, plant residues and the condition of the screws and pin connections and the condition of the working elements and other parts should be inspected. During cleaning, plant debris and strings winding up on the bearing points of the shaft 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.

5.1. Out-of-season handling and storage

At the end of the working season, the cultivator should be thoroughly cleaned and any damage to the paintwork repaired. The stripped working surfaces of the teeth, discs, strings and shaft rings, as well as the threads of the adjusting screws, must be washed, dried and preserved. In addition, full lubrication should be carried out. It is advisable to store the machine under a canopy when not in use. If this is not possible, the condition of the protection should be checked from time to time and rain-washed grease should be replenished if necessary. **The cultivator should be stored in a place that poses no danger to persons or the environment.** The machine, when uncoupled from the tractor, should be supported on firm and level ground. Also, components dismantled from the machine should be stored securely supported on the ground, excluding possible uncontrolled movement.

Clean the piston rods of the hydraulic cylinders 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.

5.1.1. Operation of the hydraulic system

Maintenance of the hydraulic system (Figure 17) consists of a visual inspection for leaks. Remember to put plugs on the quick-release couplings. If there is any oil leakage at the connections of the hydraulic lines, the coupling must 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. If there is oil on the piston rod of the hydraulic cylinder, the nature of the leak should be checked. When the piston rod is fully extended, check the sealing points. Minor leaks characterised by wetting of the piston rod (so-called oil film) are acceptable. In the event of stronger "sweating" or the appearance of droplets, the unit should be switched off for the duration of the fault rectification (defective unit ring).

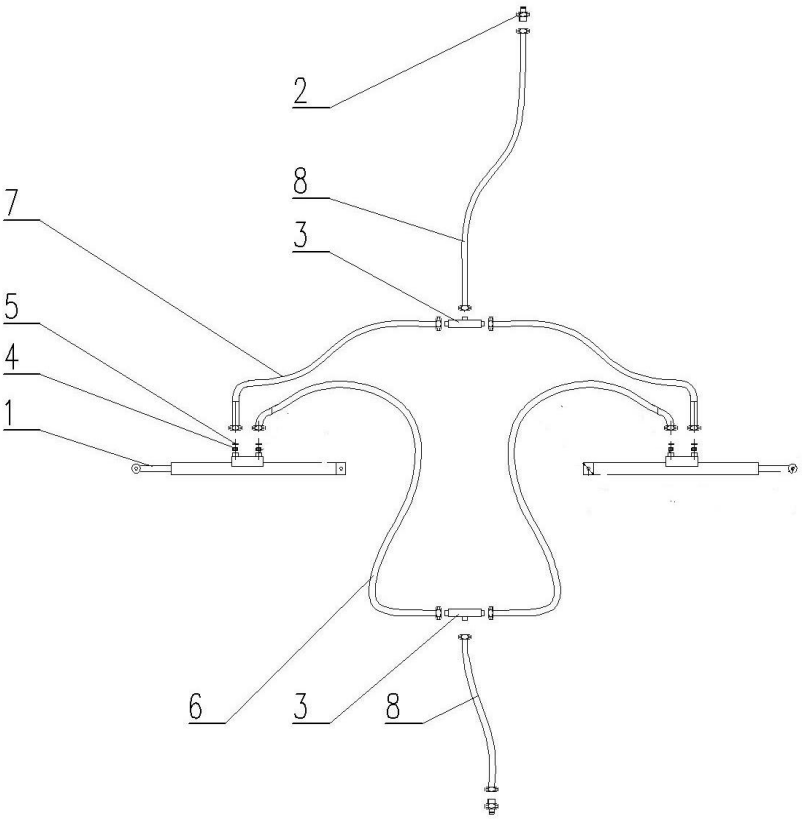


Figure 17 Diagram of the SPEC HD hydraulic system: 1- actuator, 2- quick coupling, 3- tee, 4- orifice, 5- copper washer, 6- hydraulic hose 1m, 7- hydraulic hose 0.7m, 8- hydraulic hose 2.2m.

5.1.2. SPEC HD running system handling (optional)

As an option, the SPEC HD cultivator can be equipped with a transport trolley (fig. 18). This trolley can also have its own brake axle (pneumatic system).

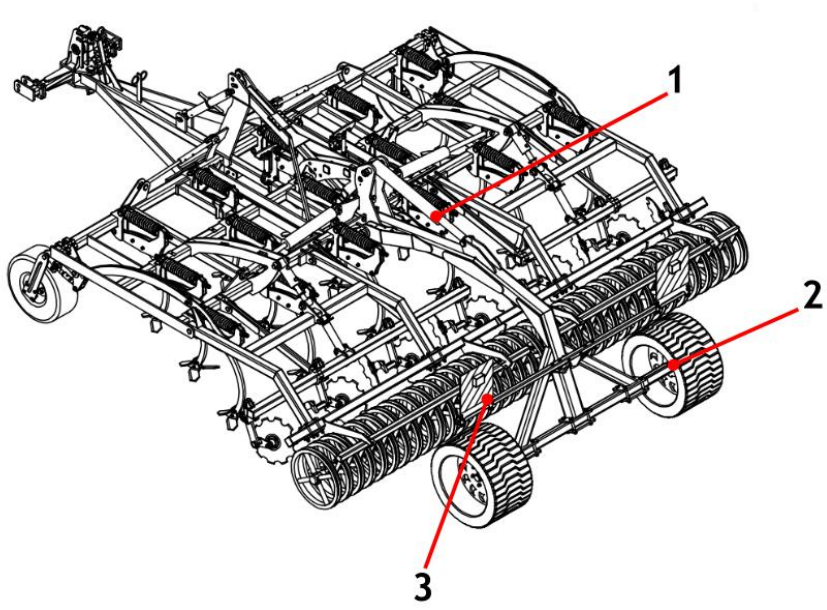
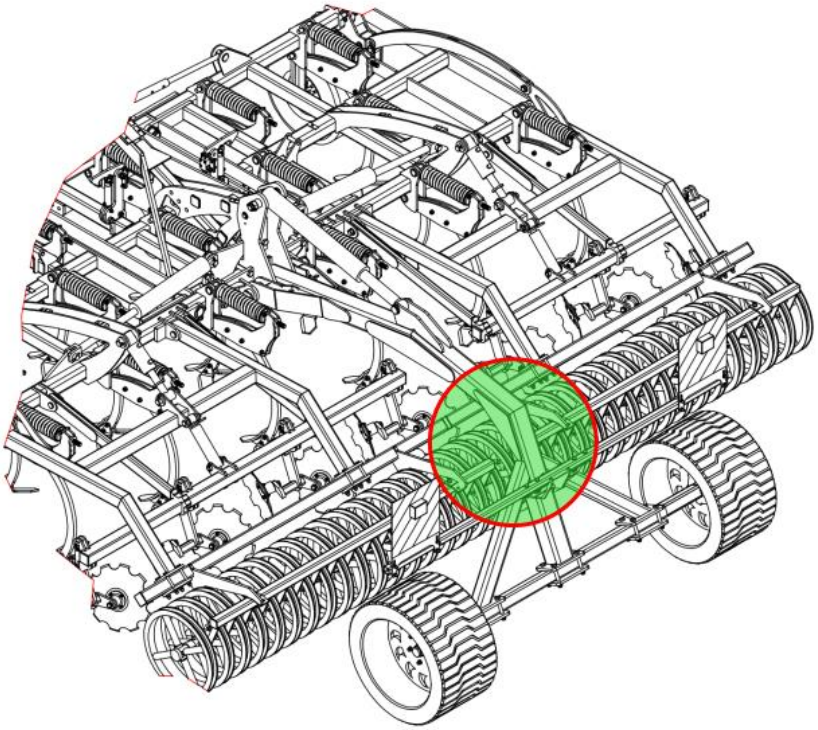


Figure 18 SPEC HD cultivator equipped with transport trolley (optional) (1 - transport trolley adjustable hydraulics, 2 - transport trolley, 3 - rear light bar).

- **Folding sequence of the machine with trolley**

1) Lower the roller assemblies to ground level (raised rollers will cause a collision with the lowered trolley!)
2) Lower the trolley to raise the machine above ground level
3) Maintain a minimum distance of 60 cm between the lowest part of the machine and ground level.
4) Close the cultivator wings

Drawings of the correct and incorrect position of the roller assembly relative to the trolley are shown below.



No collision

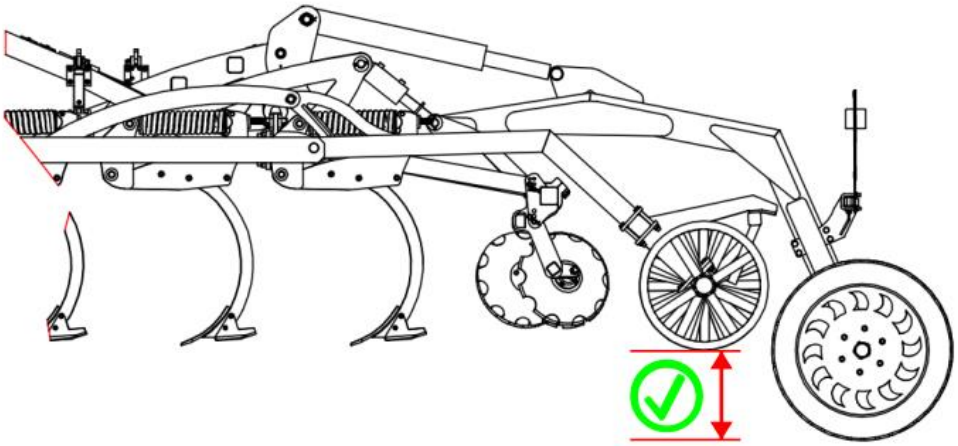


Figure 19 Correct height of roller assembly / no collision when folding wings with the trolley

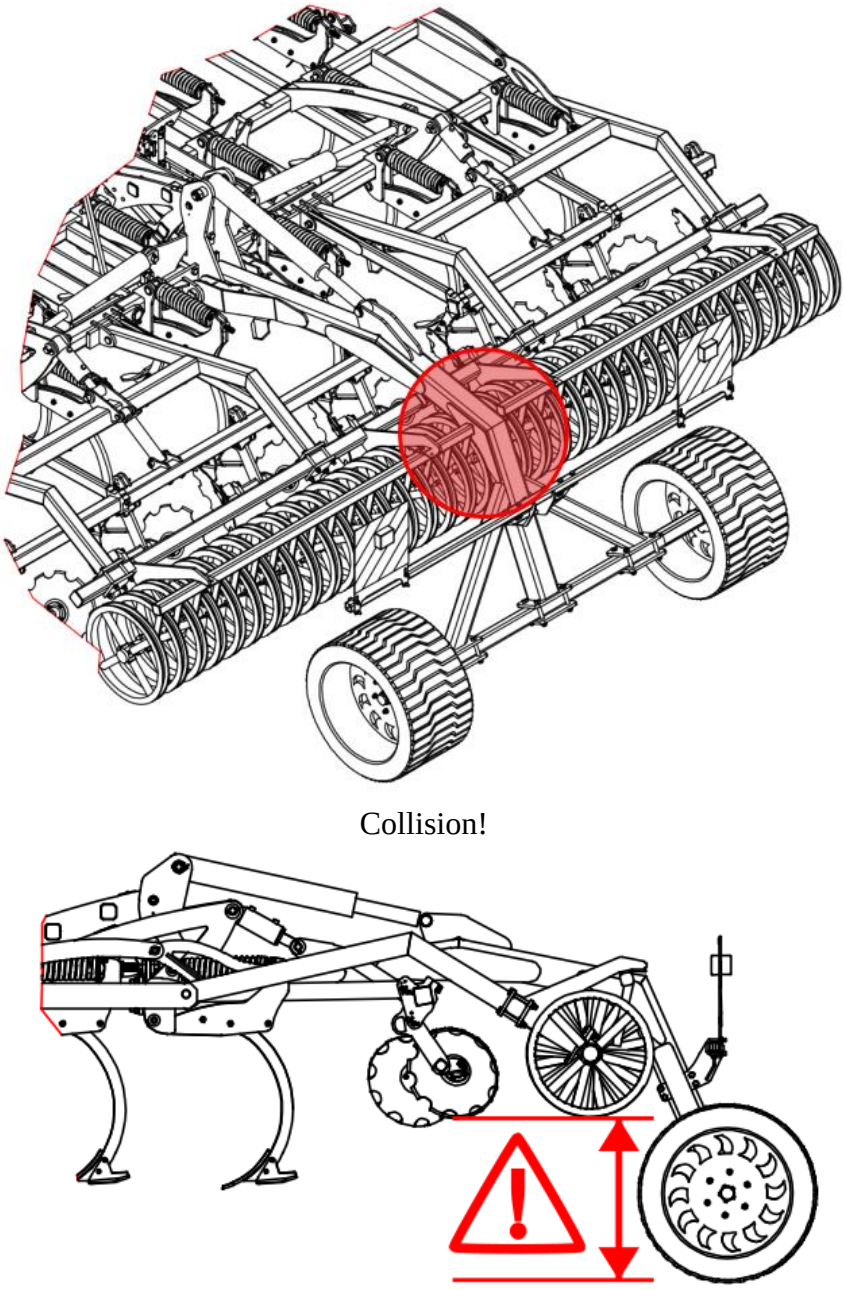


Figure 20 Incorrect height of roller assembly / collision when folding wings with the trolley

NOTE! Turning at field ends/headlands only permitted with the machine raised on the chassis.

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. The recommended clearance 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 brake system (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.**

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, the position of the spreader arm on which the piston rod of the pneumatic cylinder acts must be changed. Change the starting angle of the spreader shaft on the multi-shaft end and correct the length of the linkage on the bolt. Adjustments should be carried out for each wheel separately.

6. Replacement procedures

Tubular shaft bearing replacement
If the bearings are damaged, they must be replaced:

- place the machine on a horizontal surface,
- unscrew the four screws holding the ball bearings on each side,
- move the tubular shaft away,
- loosen the two headless screws on each bearing and pull off the bearings using an extractor,
- fit the new bearings loosely onto the shaft,
- roll the shaft 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 components make it difficult for the tools to sink in, increase working resistance and insufficiently mix harvest residues. 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 components to be replaced do not rest on the ground, sturdy shims should be placed under the shaft. After lowering the cultivator, switching off the engine and applying the handbrake, check the stability of the tractor-machine unit. 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 cylinders
A malfunctioning cylinder, leakage, etc. should be dismantled and taken to a specialist workshop. Replacement of the cylinder must be carried out on an unfolded machine. Connect the cylinder to the system and, when mounted on one side, run through the entire cycle a couple of times to fill the cylinder completely with oil. Failure to do so may result in a sudden fall of the drop section.

The bearings of the levelling discs are not demountable. If damaged, they should be replaced in their entirety.

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.

7. Disassembly and disposal

A machine used in accordance with the instructions in this manual will last for many years, but worn or damaged parts must be replaced. In the event of emergency damage (cracks or deformation of the frames) impairing the quality of the machine and posing a danger to further operation, the machine must be disposed of.

The disassembly of the machine should be carried out by persons previously gotten familiar with its construction. These operations should be carried out after the machine has been set up on a level and stable surface. Sequence of activities:

- Disconnect the shaft bracket from the arms. Remove the bearing mounting bolts and roll the shaft to one side.
- Disconnect the shaft arms from the frame.
- Remove the three-point hitch turret arms connecting to the main frame (for non-welded three-point hitch).
- Remove the three-point hitch turret.
- Place the frame on stable stands. For units with folding side arms, additional stands must be prepared.
- Remove the working components of the unit.
- Detach the side arm supports from the mid frame.
- Disassembly of hydraulic components should be carried out wearing gloves and protective goggles. Wrap the connectors with oil cloth before unscrewing the bent wires. Drain the used oil into a container (bucket).

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

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.

8. Spare parts for SPEC HD cultivator

- 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.