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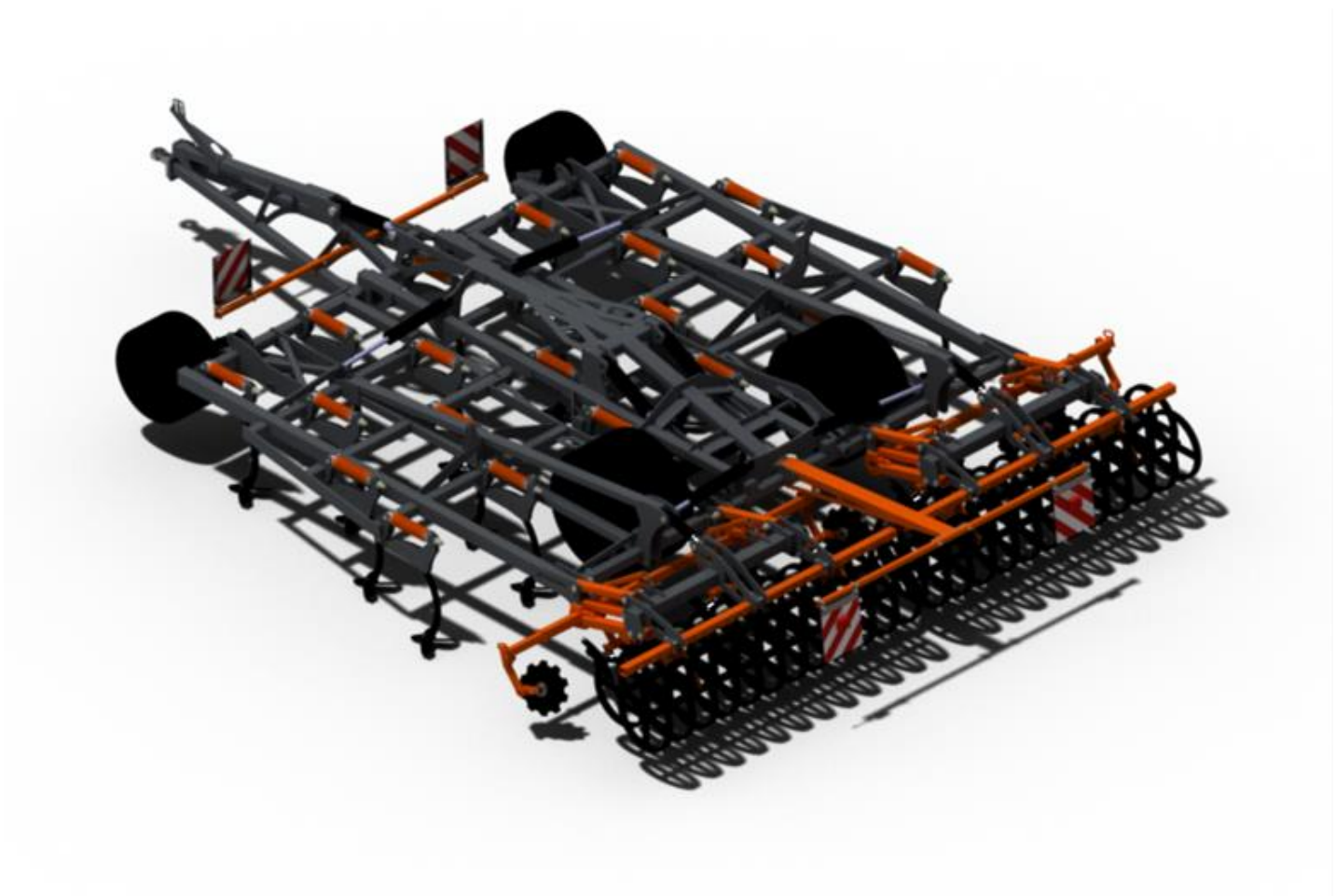
INSTRUCTION MANUAL

RHINO CHISEL CULTIVATOR



Issue II
Gliwice 2022

DECLARATION OF CONFORMITY

FOR A MACHINE

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

MANDAM Sp. z o.o.
ul. Toruńska 14
44-100 Gliwice

hereby declares at its sole responsibility that the following machine:

RHINO CULTIVATOR

type/model:……
serial number:……
year of manufacture:……..

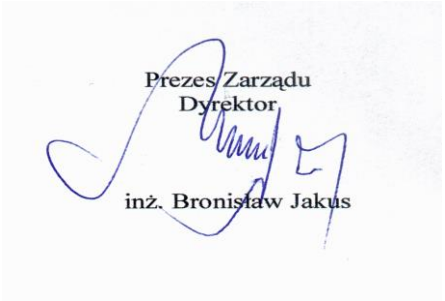
under this declaration, complies with:
the **Ordinance** of the Ministry of Economy of 21 October 2008 on fundamental requirements for machinery (Journal of Laws No. 199, item 1228)
and the **Directive** of the European Union 2006/42/EC of 17 May 2006.

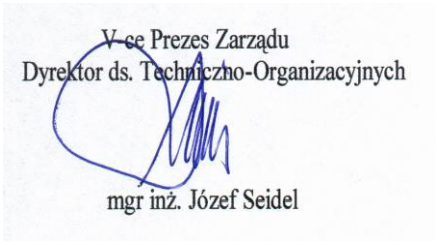
The persons responsible for the technical documentation for the machine: Jarosław Kudlek, Łukasz Jakus
ul. Toruńska 14, 44-100 Gliwice, Poland

For assessment of compliance the following standards have been applied:

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 shall be cancelled
if the machine is modified or redesigned without consent of the manufacturer.





…… *Place and date of issue*

…… *First and last name, position held and signature of the person authorized*

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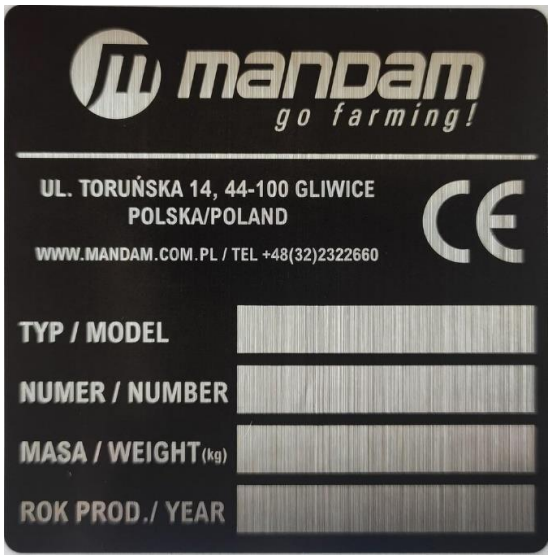
1. Introduction

Congratulations on your purchase of the RHINO cultivator.
This instruction manual provides information on the hazards that may occur during use, cultivator operation, technical data and the most important indications and recommendations, the knowledge and use of which is a prerequisite for proper operation. Keep this manual for future reference. Should you have any problems with understanding any statement in the instruction manual, please contact the manufacturer.
The following mark indicates the guidelines that are important due to safety reasons:

Machine identification
Identification data of the RHINO cultivator, including basic information on the manufacturer and the machine and CE marking, can be found on the rating plate placed on the main frame.



The warranty for the cultivator is valid for 12 months from the date of sale.

The warranty card constitutes an integral part of the machine.

Whenever you request any information on spare parts, provide the serial number.

For more information on spare parts,

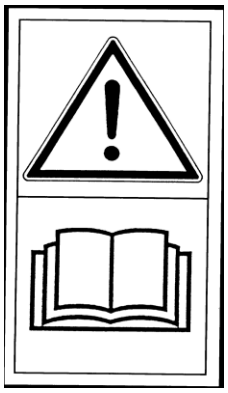
- please visit our website at: http://mandam.com.pl/parts/
- call us at +48 668 662 289
- e-mail us at: czesci@mandam.com

1.1. Safety symbols and inscriptions

Remember! Special care must be taken when using the cultivator in case of areas marked with special information and warning signs (yellow stickers).

The following symbols and inscriptions can be found on the implement. Secure the symbols, signs and inscriptions against loss and make sure they are legible at all times. *If lost or illegible, replace the signs and inscriptions with new ones.*

Table 1. Information and warning signs

Safety sign	Meaning of the safety sign	Location on the implement
	Read the instruction manual prior to operating the implement.	Frame adjacent to the mounting place of the upper fastener
	Danger of toe or foot crush	Frame adjacent to the mounting place of the upper fastener
	Keep clear from lift bars while controlling the lift	Frame adjacent to the mounting place of the upper fastener

Safety sign	Meaning of the safety sign	Location on the implement
	Keep clear from foldable and moving parts of the implement	Front part of the central frame adjacent to side frames
	Do not reach into the crushing zone if the elements can move	Central frame adjacent to side frames
	Pressurized fluid – hazard of bodily injury	Cylinders
	Fixing point for transport belts	Upper part of the drawbar (upper fastener bolt) Rear part of the frame (adjacent to the cylinder bolt on the cetral frame)

2. General information

2.1. Design of the RHINO chisel cultivator

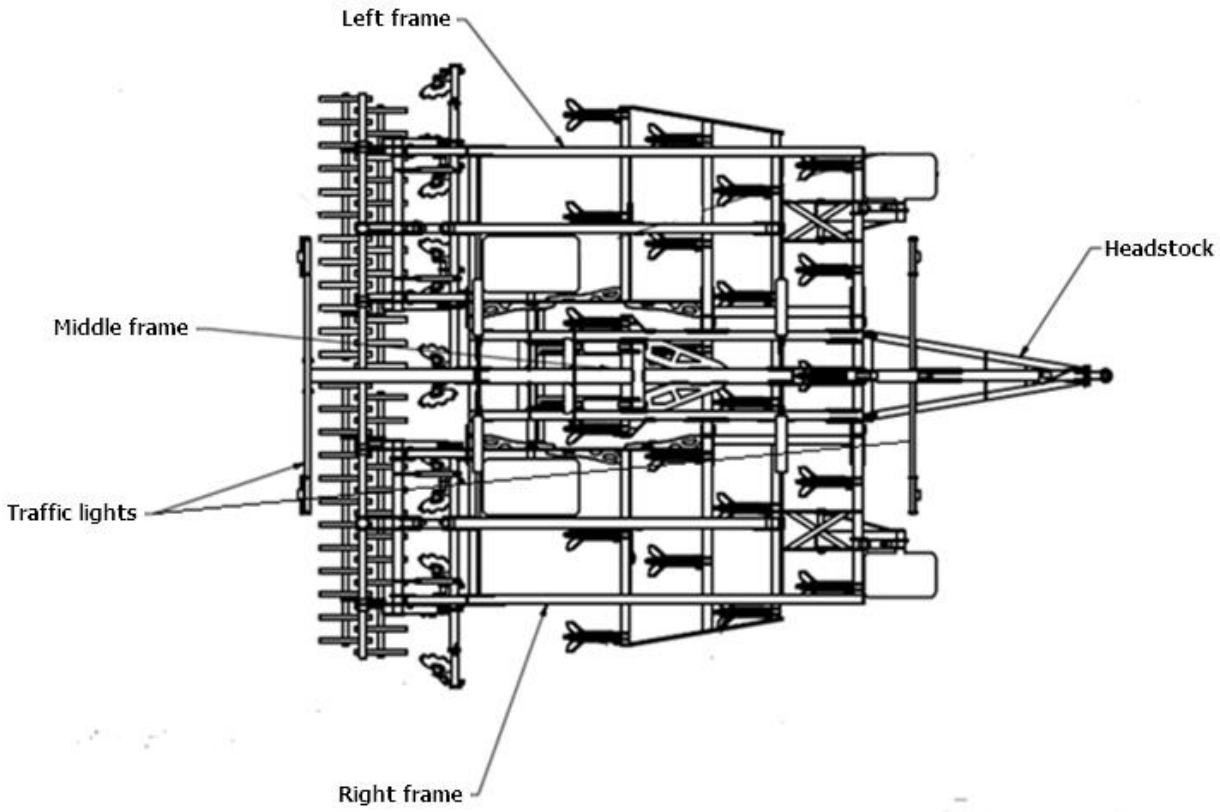


Fig. 1 RHINO 6.0 H chisel cultivator (top view).

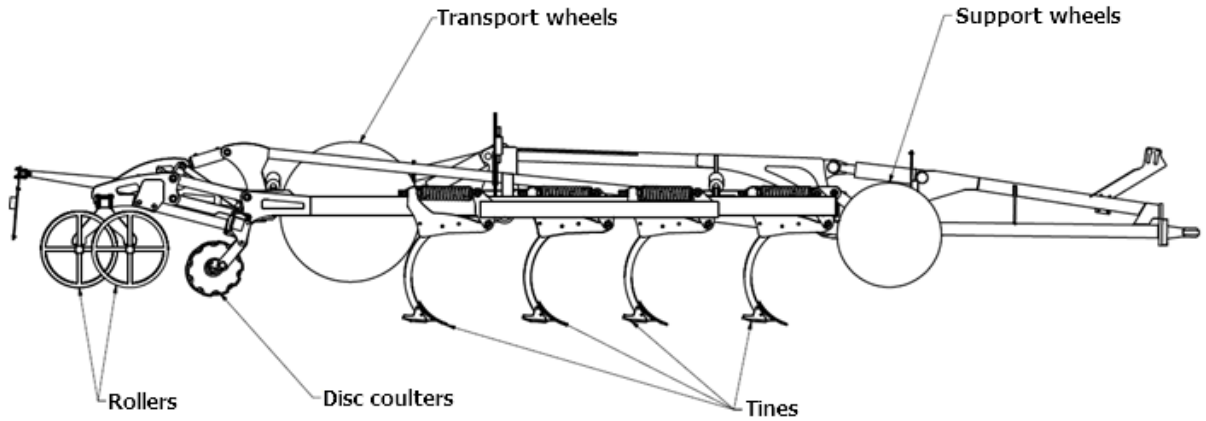


Fig. 2 RHINO 6.0 H chisel cultivator (side view).

Table 2. RHINO cultivator specifications

Type	Working width [m]	Number of tines [pcs]	Number of discs [pcs]	Weight [kg]
RHINO 4.0 H	4.00	15	10	5840
RHINO 6.0 H	6.00	21	12	6352

The cultivator consists of a central frame and side frames which can be folded hydraulically into the transport position (Fig. 1). Beams with workpieces are attached to the frame. As a standard, the cultivators are equipped with C-Ring tandem rollers and a disc beam. Each disc has its own bearing arrangement (maintenance-free hubs), which allows for an optimum inclination of the disc in relation to the direction of travel and the ground. The purpose of the discs is to level out the soil surface deformed by the last row of workpieces. The rollers are used to compact the aerated soil and maintain the working depth of the cultivator.

2.2. RHINO chisel cultivator – intended use

The RHINO chisel cultivator is a universal agricultural stubble cultivation and tillage machine designed for:

- shallow stubble cultivation (up to 15 cm) to mix post-harvest crop residues, stop soil evaporation, accelerate weed and self-sown plant growth and reduce ploughing resistance or deep cultivation,
- deep cultivation (up to 35 cm) to aerate the soil tillage layer, mix mineral and organic fertilisers and prevent the mineralisation of humus in the arable layer.

The use of right- and left-side mouldboards increases the stubble mixing intensity, which results in a decrease in the intensity of phenolic compounds that negatively affect the grain development in the following year. The use of RHINO cultivator for deep cultivation excludes the need for ploughing, which reduces costs, decreases the risk of over-compaction of soil and increases the possibility of timely completion of activities.

CAUTION! The cultivator is designed for agricultural use only. Using the implement for tasks that differ from the intended use shall be regarded as misuse, resulting in loss of warranty. Failure to follow the guidelines included in this instruction manual shall be regarded as misuse.

CAUTION! The manufacturer shall not be liable for any damage arising out of misuse.

3. General safety information

The cultivator can be operated and repaired only by persons familiar with its operation and the attached tractor as well as the rules of safe operation and maintenance of the tillage cultivator. The manufacturer shall not be liable for any unauthorised alternation of the cultivator. Only genuine MANDAM spare parts shall be used during the warranty period.

The cultivator must be operated with all precautionary measures, in particular:

- each time before starting operation check the cultivator and the tractor whether their condition guarantees safety during operation and travel,
- minors, disabled or intoxicated persons (under the influence of alcohol or drugs)

must not operate the machine,
- wear work clothes, shoes and gloves during maintenance,
- do not exceed the maximum axle loads and transport dimensions,
- use only original cotter pins and pins,
- while using the cultivator, no bystanders, in particular children can be present in the vicinity when the machine is being lowered, lifted, unfolded or dismounted,
- do not stay between the tractor and the cultivator when 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,
- during the operation and travel do not stand on the implement and do not put additional loads onto it;
- while making U-turns, pay due caution if anyone is in the vicinity,
- any repairs, lubrication or cleaning of working components may be performed as long as the engine is not running and the implement is lowered and unfolded,
- while taking a break, lower the implement onto the ground and stop the tractor engine, store the implement properly so that no person or animal can be injured,
- no U-turns or reversing is allowed with the lowered implement.

3.1. Proper hitching and unhitching from the tractor

- Make sure that the cultivator is hitched to the tractor in accordance with the instructions, remembering to secure the bolts and that the bolts are secured with cotter pins.
- While hitching the tractor with the cultivator, do not stay between the implement and the tractor;
- The tractor used together with the cultivator must be fully functional and in good working order. Do not attach the implement to a tractor with a defective hydraulic system.
- Remember to observe the following: balance of the tractor and the suspended implement, tractor steerability and braking performance – the front axle load must not drop below 20% of the total tractor load – a kit of front weights;
- When in resting position and disconnected from the tractor, the machine must be stable all the time.
- Place the support leg on a stable ground. Do not use pads under the leg as this may cause instability.

3.2. Tyres

- Tyre pressure cannot exceed the value recommended by the manufacturer. Transporting the implement when the pressure is too low is prohibited. This may cause damage to the implement or an accident when travelling too fast and on very uneven surfaces.
- Considerably damaged tyres (particularly the tyre profile) must be replaced immediately.
- Protect the implement from rolling away when replacing the tyres.
- The repair works on wheels or tyres must be performed by persons trained and authorised for this purpose. Such works must be performed with properly selected tools.

Following every assembly of wheels, check the tightening of nuts after travelling the distance of 50 km.

3.3. Hydraulic system

The hydraulic system operates under high pressure. Take all precautionary

measures, in particular:

- do not connect and disconnect hydraulic hoses when the tractor hydraulic system is pressurised (hydraulics set to neutral),
- check regularly the conditions of connections and hydraulic hoses,
- do not use the implement until the hydraulic system is repaired.

3.4. Transport safety on public roads

Before driving on public roads, fold the side sections of the RHINO cultivator to the travel position using the hydraulic system. Before folding, the machine must be lifted sufficiently high until the folded side sections do not collide with the ground.
Use the hydraulic lock to secure the cultivator against unfolding.
While in transport, the clearance under the machine must be at least 30 cm.
When driving on public roads, it is absolutely mandatory to use lights, a marking plate and side retroreflectors in case the implement is attached to the rear three-point hitch.
Do not exceed the maximum travel speeds:

- up to 20 km/h on smooth (asphalt) roads,
- 6-10 km/h on dirt roads or cobblestones,
- up to 5 km/h on bumpy roads.

Adapt the drive speed to the road conditions to prevent the cultivator jumping on the three-point hitch and to prevent excessive loads on the implement frame and the three-point hitch.
Act with due caution when passing and overtaking or travelling at curves. The maximum implement width on public roads is 3.0 m.

WARNING! Any failure to observe the above rules may pose hazard to the operator and other people. It may also result in damaging the machine. The user shall be liable for any damage caused by failure to observe the rules!

3.5. Residual risk description

Mandam Sp. z o.o. makes every effort to eliminate the risk of accidents. However, there is some residual risk that may result in an accident. The biggest hazard occurs when/during:

- using the implement for purposes other than described in the manual,
- operating the implement by people who are underage and do not have licences, are ill or intoxicated,
- presence of people and animals within the implement operating range,
- precautionary measures are not taken during transport and maneouvering with the tractor,
- staying on the implement or between the tractor and the implement when the engine is running;
- during operation when operation guidelines are not followed,
- driving on public roads.

3.6. Residual risk assessment

The residual risk can be minimised by applying the following recommendations:

- operate the implement carefully and without undue haste,
- read the instruction manual carefully,
- keep a safe distance from hazard zones,
- do not stay on the implement and within the implement operating range when the engine is running,
- perform the maintenance in accordance with safety rules,

- wear safety clothes and a safety helmet while working under the implement;
- prevent the access of unauthorized personnel and especially children to the implement.

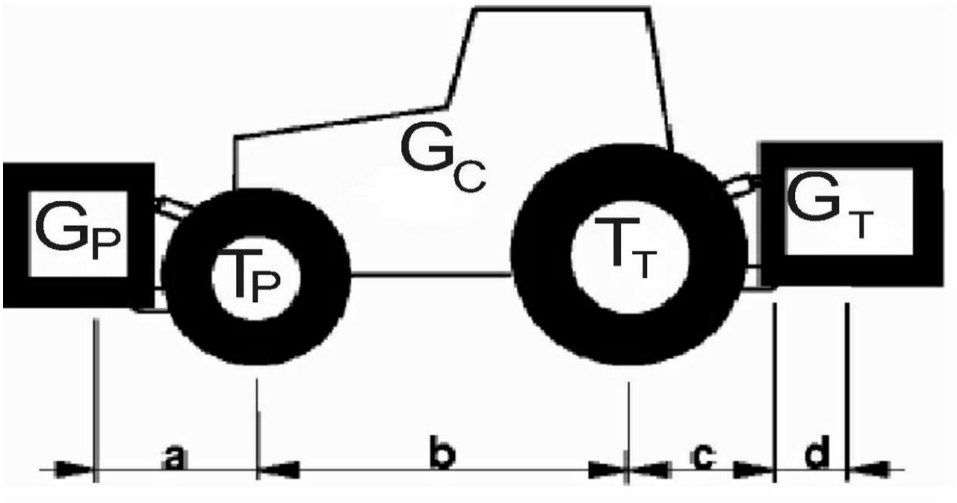
Hazards:
Noise: If the RHINO cultivator is used on stony soils, it can generate a lot of noise. In this case, it is advisable to close the tractor windows and doors. One can also wear hearing protection.
Dust: In very dry conditions, very heavy dusting can occur. In such cases, it is recommended that the doors and windows of the tractor remain closed. The use of a dust mask is recommended under extreme conditions.

4. General information on the use of the implement

Before the machine is put into operation for the first time:

- read the instruction manual,
- make sure that the machine is in proper operating condition,
- check the condition of the hydraulic system (replace damaged components, e.g. pressure hoses),
- make sure that the hydraulic hose quick-connectors of the machine match the tractor sockets,
- check the tightening of bolts and nuts,
- check if the air pressure in tyres is according to the manufacturer's recommendations,
- make sure that all components requiring lubrication are lubricated,
- make sure the tyre pressure in the tractor wheels is equal on both axes to ensure even operation.

CAUTION! The permissible loads on the axles and tyre load capacities must not be exceeded. The front axle load must not be less than 20% of the total load. Tyre pressure must comply with the values recommended by the manufacturer.



Axle load calculations
Key:
GC – tractor weight,
TP – front axle load for the unhitched tractor,
TT – rear axle load for the unhitched tractor,
GT – total weight of the equipment attached at the back,
GP – total weight of the front-mounted machine,
a – distance between the centre of gravity of the front-mounted equipment and the axle centre,
b – tractor wheelbase,
c – distance between the rear axle centre and the centre point of the hitching pin of the rear-mounted implement,
d – distance of the centre of gravity of the agricultural implement from the hitching pins of the tractor,
x – distance of the centre of gravity from the rear axle (assume 0.45 if the manufacturer does not provide this parameter).

Minimum load at the front in case of a rear-mounted implement:

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

Actual load on the front axle:

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

Actual total weight:

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

Actual load on the rear axle:

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

4.1. Before using the cultivator

The cultivator is usually supplied for sale in a ready-to-operate condition. Due to the limitations of the means of transport, it is also possible to deliver it in a partially disassembled condition – usually by disconnecting the roller assembly, beams with discs, drawbar and lights.

When preparing the unit for operation for the first time, its components must be assembled such as the cultivator, the roller, the discs and the drawbar. To this end, place the cultivator on a flat hard surface and start assembling the components.

4.1.1. Installation of the drawbar

To mount the drawbar to the main frame of the cultivator, first set the lower fasteners (Fig. 3 – No. 1) so that the holes coincide with the mounting holes in the frame. They must then be secured with Ø50 pins, washers and expansion sleeves. Next, tilt the drawbar so that the actuator mounting hole coincides with the mounting hole in the frame (Fig. 3 – No. 2) and secure the connection with the Ø50 pin, washer and expansion sleeve.

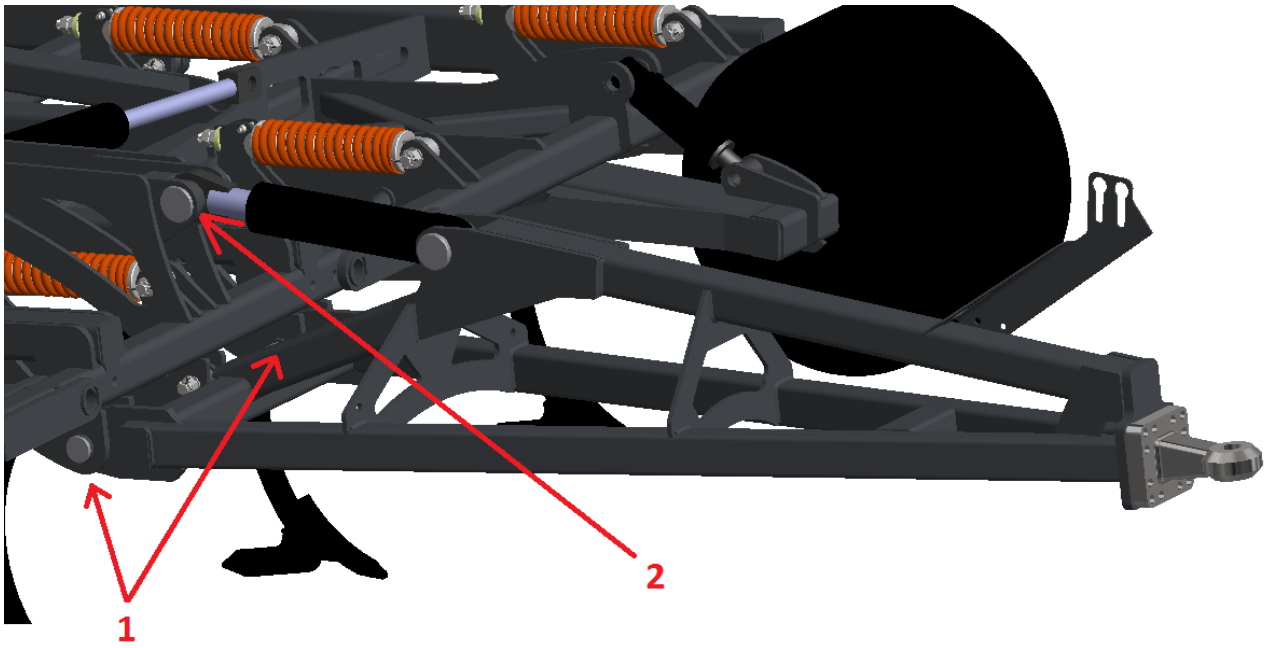


Fig. 3 Installation of the drawbar.

4.1.2. Installation of drawbar lights

To mount the beam with lights on the drawbar, position it so that the mounting holes on the beam and on the drawbar coincide (Fig. 4 – No. 1) and then tighten with M20 bolts and self-locking nuts.

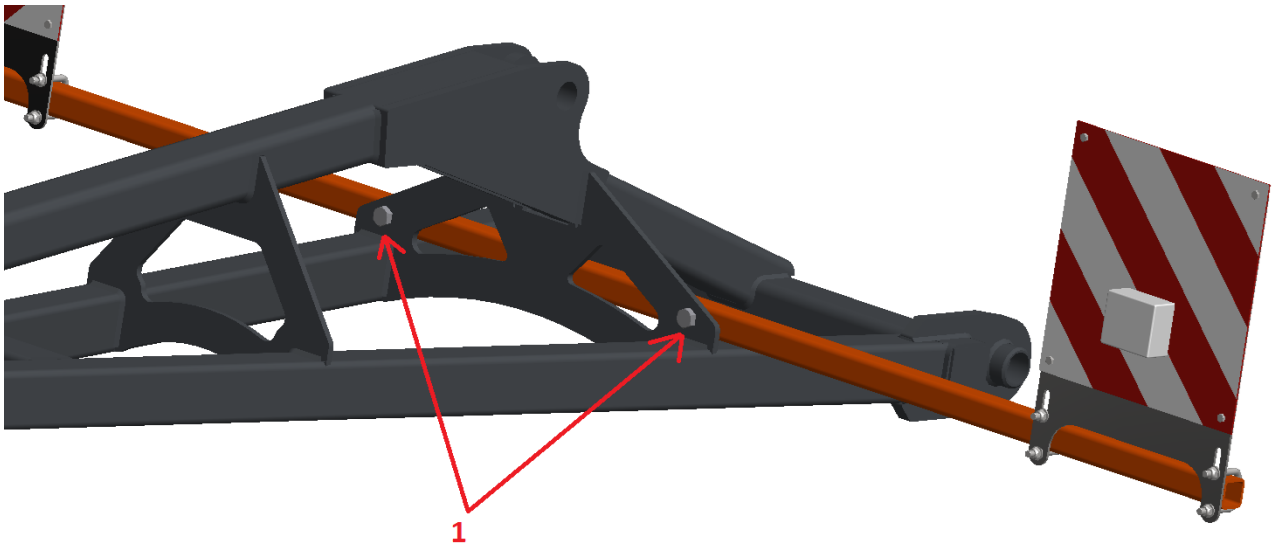


Fig. 4 Installation of drawbar lights.

4.1.3. Installation of rear assemblies

The installation of the roller assembly should be started with the attachment of the arms (8 pieces); the fixing points to the frame are shown in Fig. 5 – No. 1. The mounting holes in the frame and in the arms should be secured by means of Ø40 pins, castle nuts and pins.

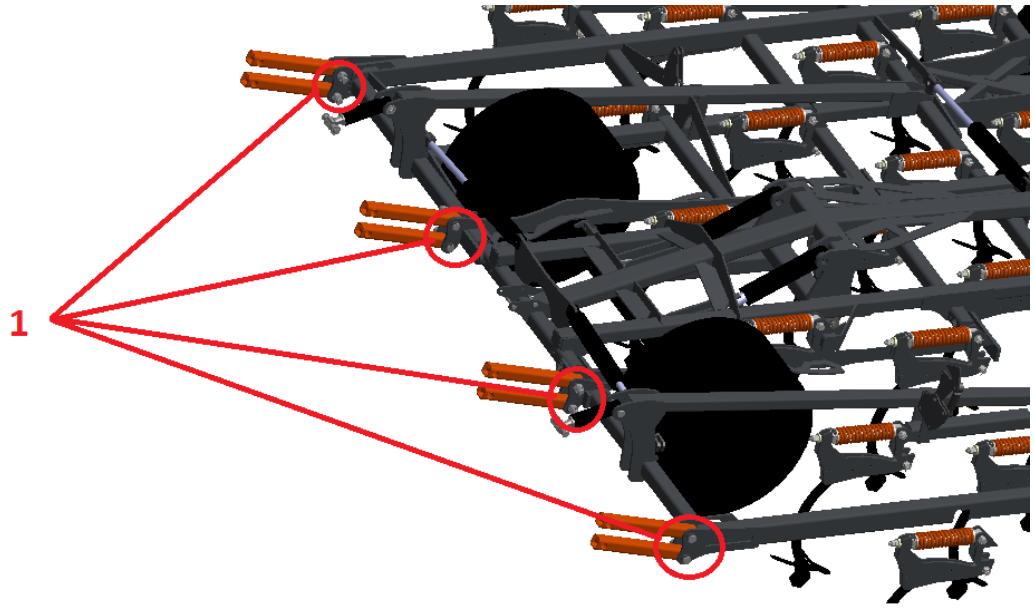


Fig. 5 Arm installation on the drawbar.

Then you can proceed with the assembly of the rear mounting assembly. Start with the attachment to the arms (Fig. 6 – No. 1). When the assembly mounting holes and arm holes overlap, force the Ø40 pin must and secure the elements with castle nuts and pins.

Next, attach the actuators to the assemblies in the places shown in Fig. 6 – No. 2. Use Ø36 pins, washers and expansion sleeves for this purpose.

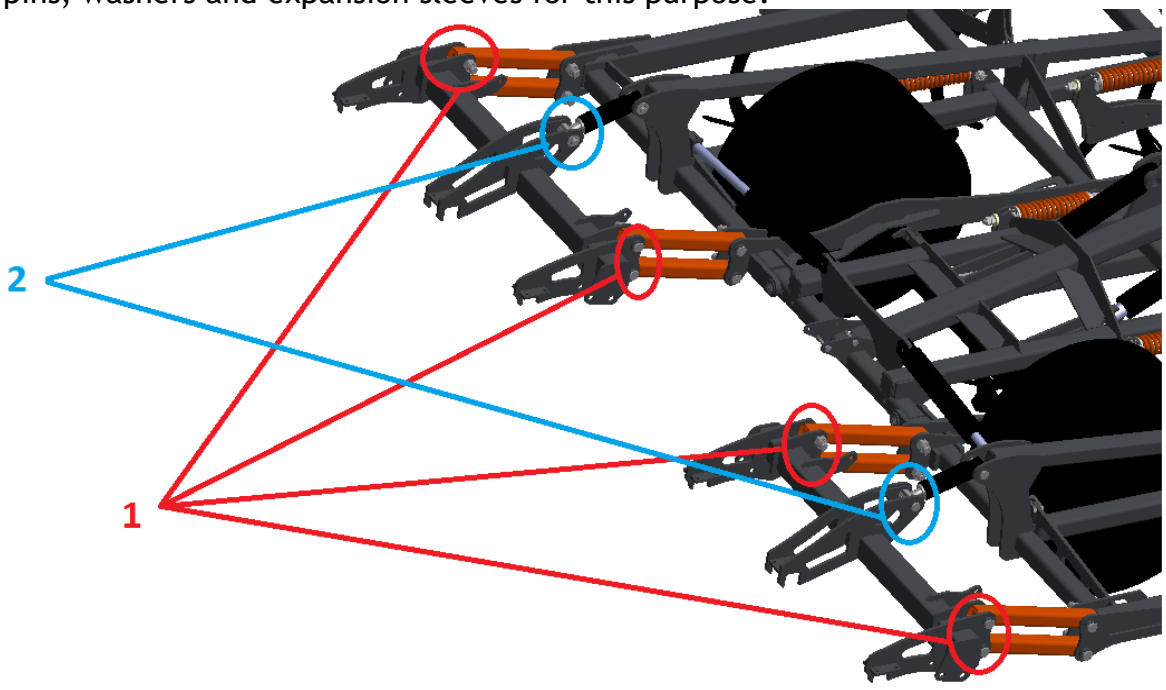


Fig. 6 Installation of the rear mounting assembly.

After installing the rear mounting assembly, proceed with the installation of the disc beam assembly or the roller assembly. The disc beams are mounted on arms which are bolted to the mounting assembly using M30 bolts and nuts with washers. The fixing points are shown in Fig. 7 – No. 1.

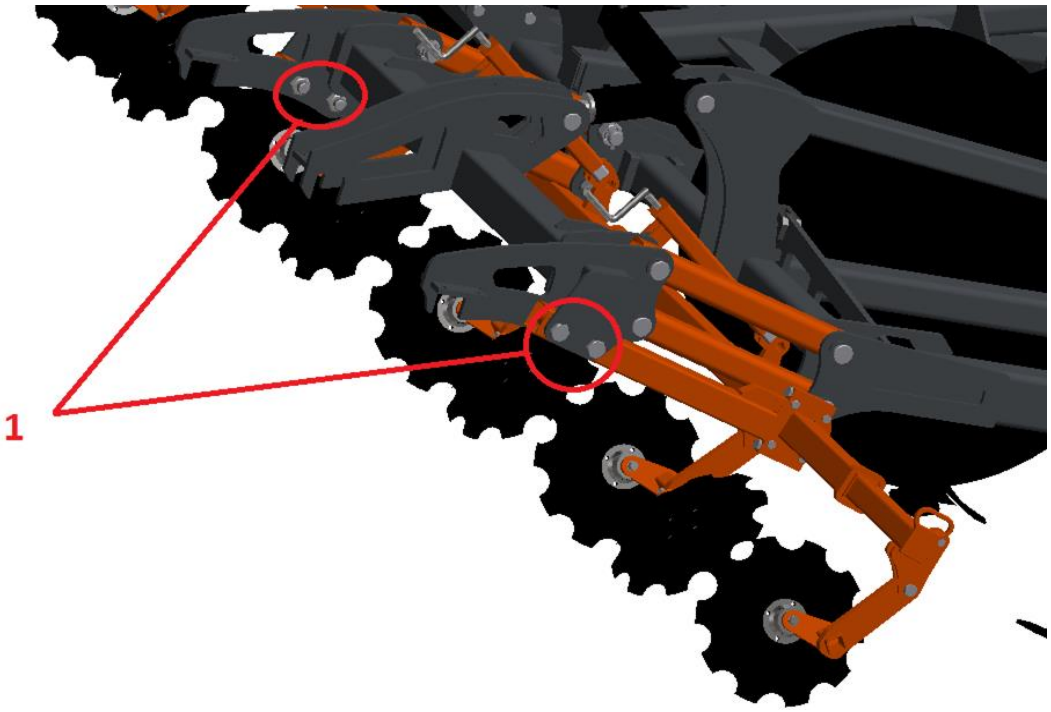


Fig. 7 Installation of disc beams.

After screwing in the disc beams, remember to install adjusting cranks. Their fixing points are shown in Fig. 8 – No. 1.

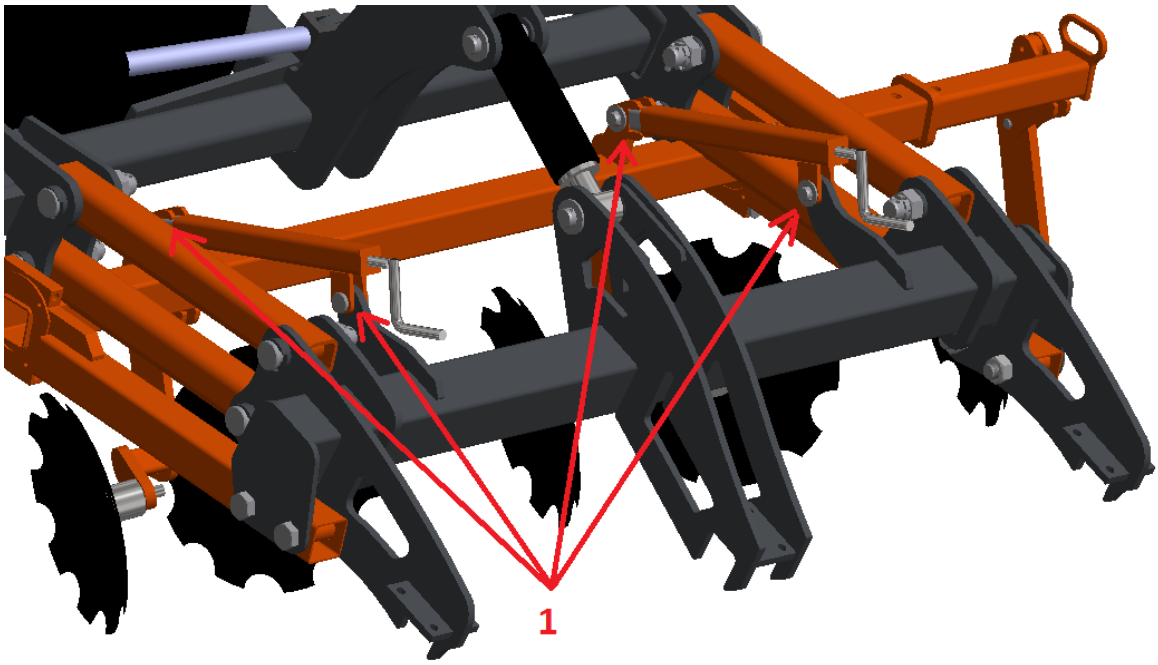


Fig. 8 Fixing point of the disc beam adjusting cranks (No. 1).

Next, bolt the roller assemblies to the mounting assembly. Use flat bars with through-holes, M16 screws and nuts. The figure below shows the locations of the fixing points.

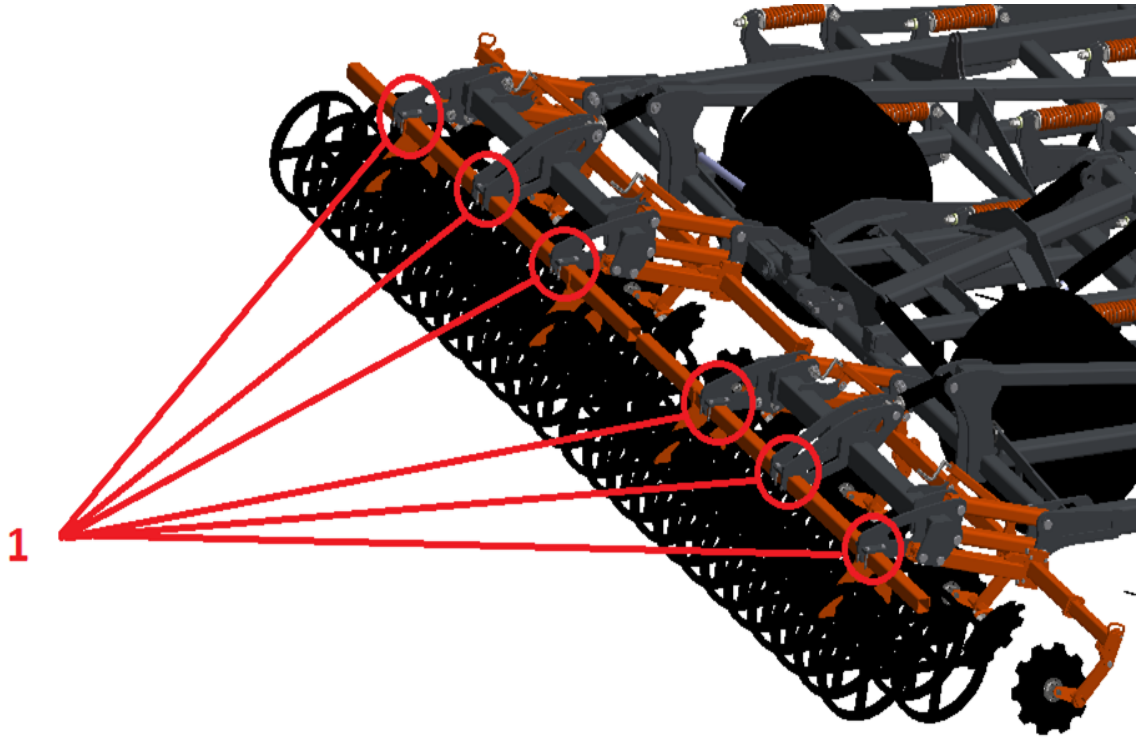


Fig. 9 Fixing points of the roller assembly (No. 1).

Finally, mount the beam with lights. They are attached with two M20 bolts, together with washers and nuts.

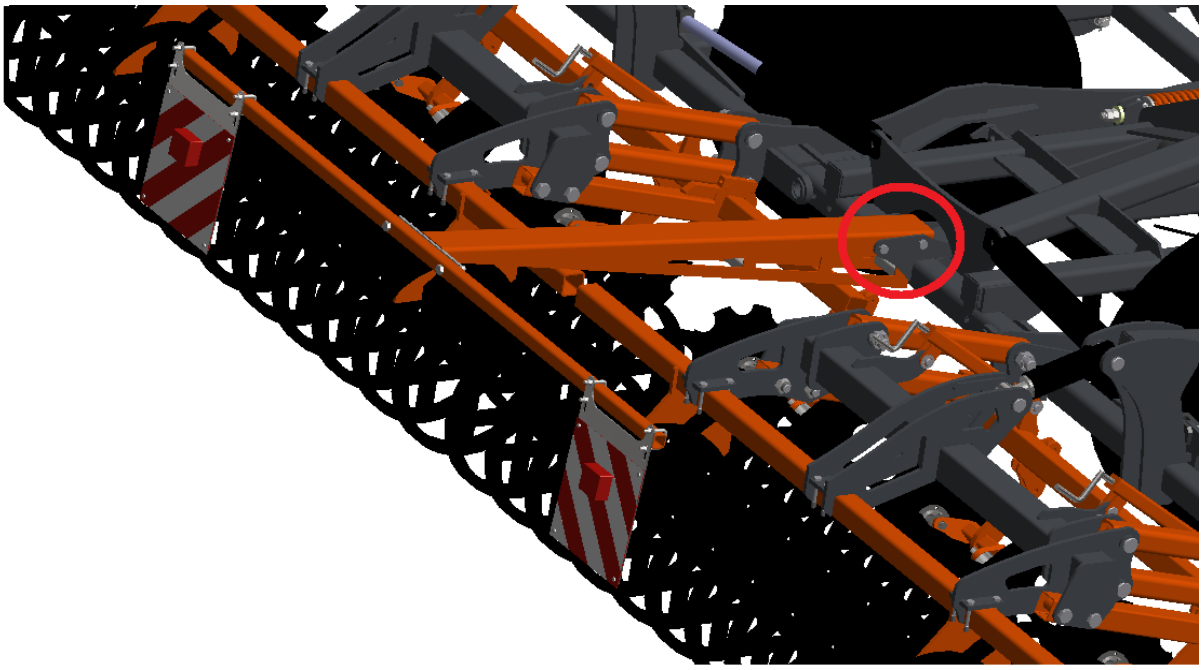


Fig. 10 Light fixing point.

CAUTION! The correct procedure for mounting the rollers in the arm clamps requires that the screws are tightened evenly diagonally so that the entire plane of the arm brackets is flush with the plane of the roller clamp profile. This provides the most secure way of connecting the roller arms to the machine!

4.2. Hitching the cultivator with the tractor

Tyre pressure in the tractor wheels must comply with the values recommended by the manufacturer. The lower bars of the three-point hitch should be at the same height, spaced correspondingly to the spacing of the lower points of hitch. While attaching the cultivator to the tractor, the machine must be placed on hard and even ground.

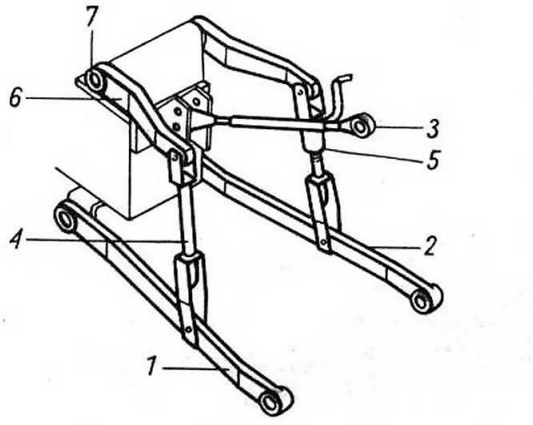


Fig. 11 Three-point hitch of the tractor: 1,2 – lower bars, 3 – upper fastener, 4 – left support rail, 5 – right support rail with adjustable length, 6 – lift arm, 7 – lift shaft.

While attaching the cultivator to the three-point hitch of the tractor, complete the following steps:

- switch the tractor hydraulic system into adjustment position,
- remove lower hitch bolts (if the tractor lift is not equipped with hooks),
- drive forwards carefully, suspend the implement on the lower bars and secure,
- check the operation of cultivator lifting, lowering and the hydraulic system.

CAUTION! Hitching the tractor with the cultivator must be performed carefully, at the tractor's minimum speed! When hitching the implement, make sure that no bystanders are present in the vicinity.

4.3. Operation and adjustment

In order for the cultivator to work effectively – as the owner wishes – it is necessary to carry out the implement adjustments before starting work. It is possible to determine the working depth of the beams, rollers and discs. Remember to adjust the implement symmetrically to maintain sufficient stability during operation.

4.3.1. Hydraulic lock of side extensions

RHINO cultivators are equipped with a hydraulic lock of side extensions, requiring no additional maintenance. The lock uses a mechanism consisting of an actuator and hook, as well as a handle assembly with a locking bar.

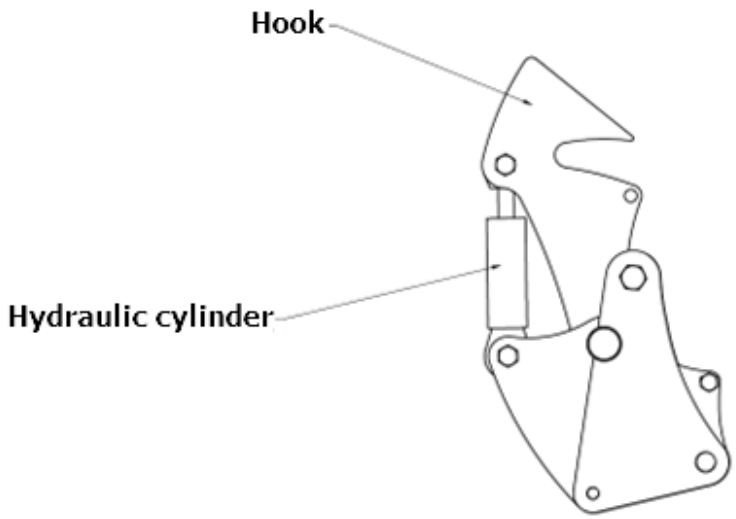


Fig. 12 Hydraulic lock of side extensions.

4.3.2. Implement opening sequence

Before unfolding the folding side the extensions of the machine, learn the opening sequence to perform this operation correctly.

1. First, properly lower the chassis and raise the machine as much as possible to allow the machine to be folded properly avoiding the risk of the folding arms snagging on the ground during movement (Fig. 13).
2. Next, fold the implement side extensions hydraulically into the “closed” position to ensure that the side extension lock mechanism will unlock and allow the implement arms to be opened at a later stage. This operation is necessary each time the arms are opened (Fig. 13).

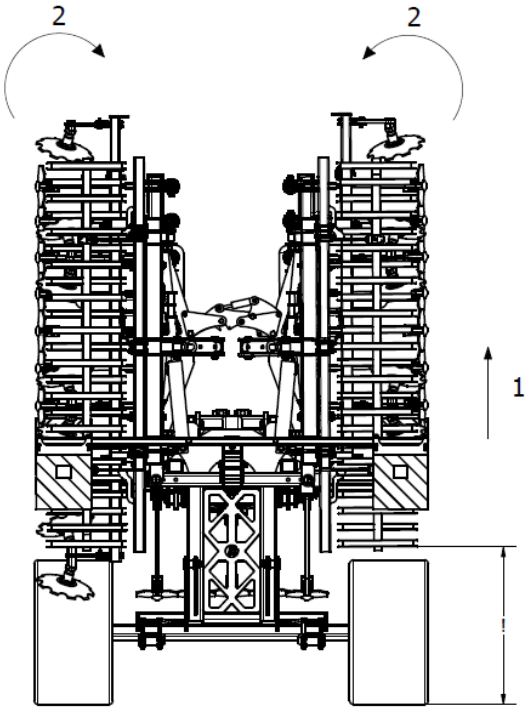


Fig. 13 Implement opening sequence: 1- raise the implement up to the maximum, 2- fold the side extensions into the “closed” position.

3. Then, after making sure that the hook of the hydraulic side extension lock mechanism allows the machine side extensions to be unlocked, proceed to open them fully (Fig. 14).

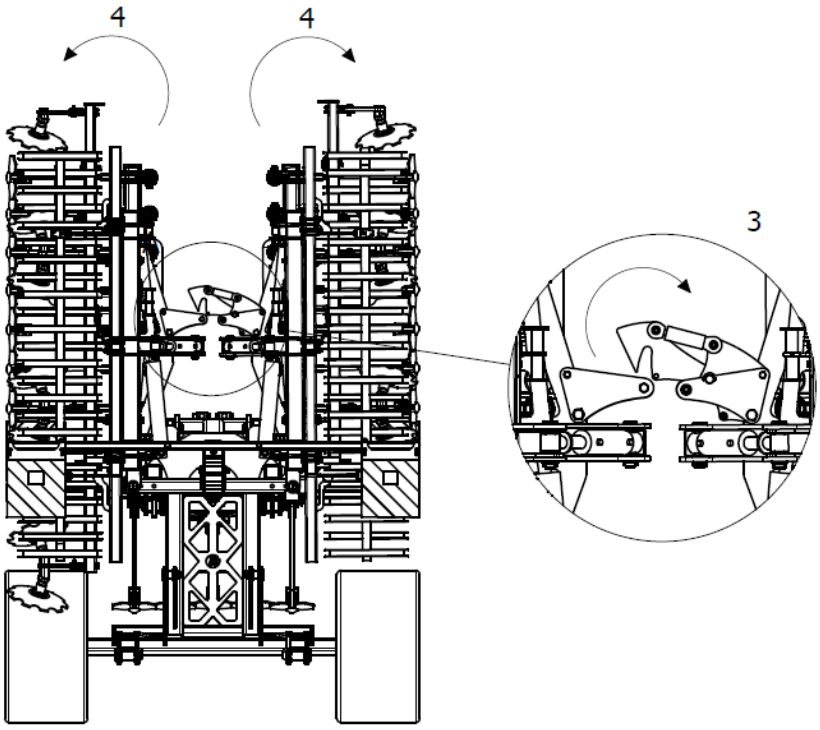


Fig. 14 Implement opening sequence: 3- release the hook of the hydraulic side extension lock mechanism, 4- open the implement side extensions.

4. When opening the implement's side extension arms, make sure that the ends of the arms are at the correct height to prevent them from snagging on the ground (Fig. 15).

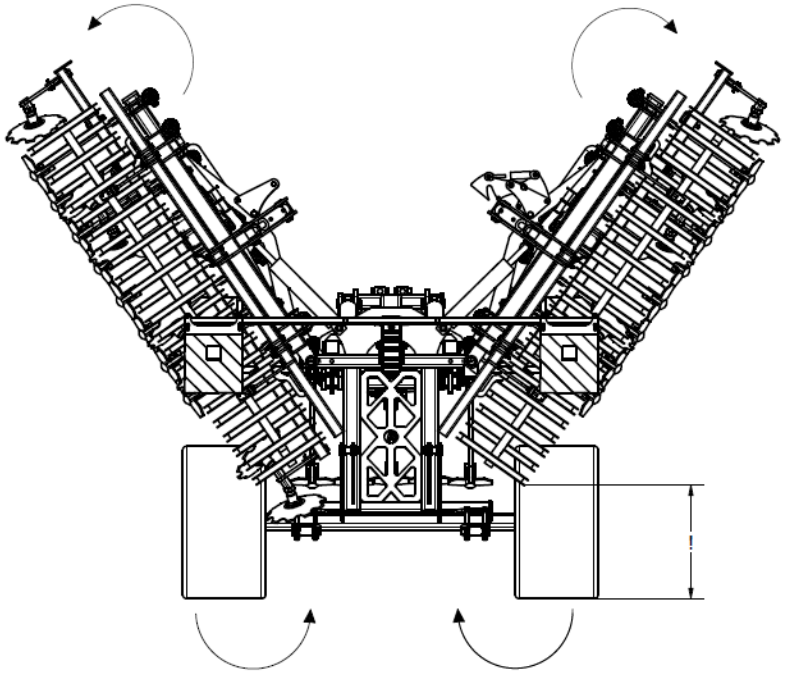


Fig. 15 Implement opening sequence: open the implement paying particular attention to the height of the arm ends from the ground.

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

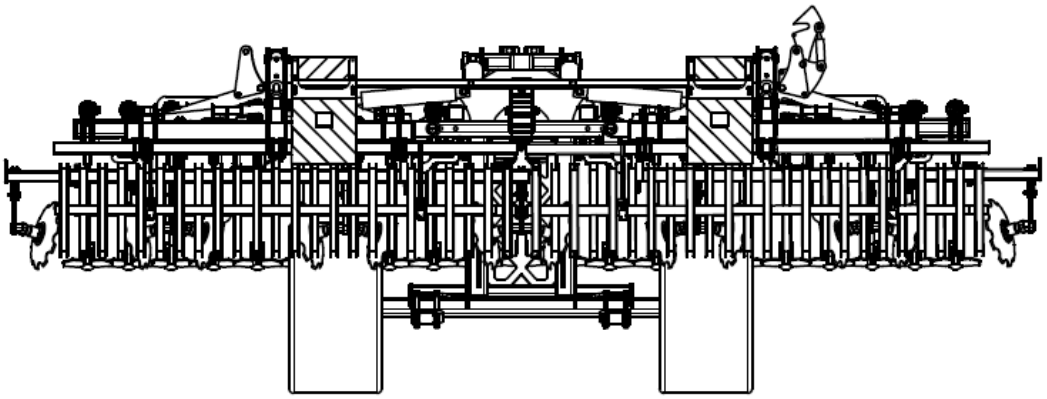


Fig. 16 View of the implement at the completion of the side extension opening sequence. The implement arms are fully open.

CAUTION! On implements with folding side extensions, clean the machine thoroughly after use so that excessive soil residues do not put additional strain on the machine side extensions and thus on the cylinders!

4.3.3. Beam position adjustment

The operation of the beams can be adjusted by changing their working angle and depth. The depth of the beams is adjusted by changing the height of the support wheels and the working angle by the nut on the spring bolt.

Support wheel position adjustment

The position of the support wheels is adjusted by means of an actuator – by increasing its extension the working depth of working tools is reduced.

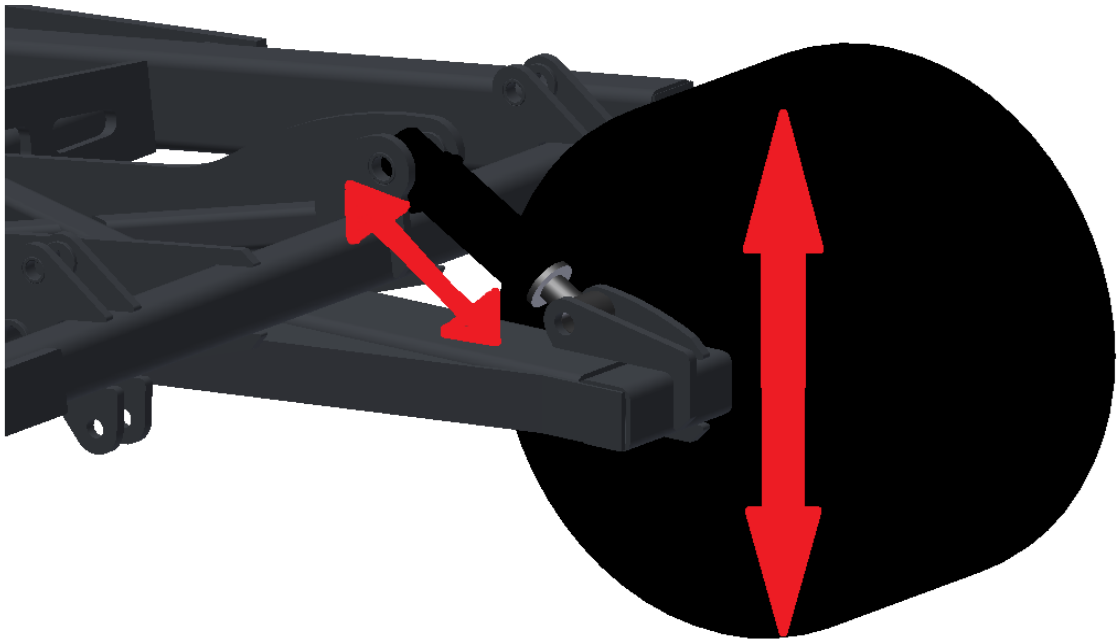


Fig. 17 Adjusting the position of the support wheels.

Beam position adjustment

To change the working angle of the beam – first loosen the counter nut and then make adjustments using the nut on the spring bolt.

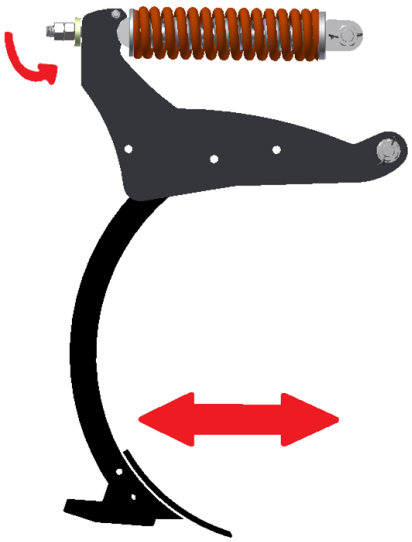


Fig. 18 Beam working angle adjustment.

A more horizontal arrangement of the coulters reduces working resistance and slightly undercuts the stubble aerating the same – recommended for compact soils with optimum moisture content and medium and low compaction soil (nut on the spring bolt). The steep coulter arrangement facilitates penetration and aerates the soil to a greater extent – recommended for hard and dry soils. Note that the lock excitation force also changes with the change of the bolt rotation.

4.3.4. Roller position adjustment

The roller assembly features a system of hydraulic depth control, so the operation height is adjusted by means of cylinders. Larger extension of the actuator means greater depth of the rollers.

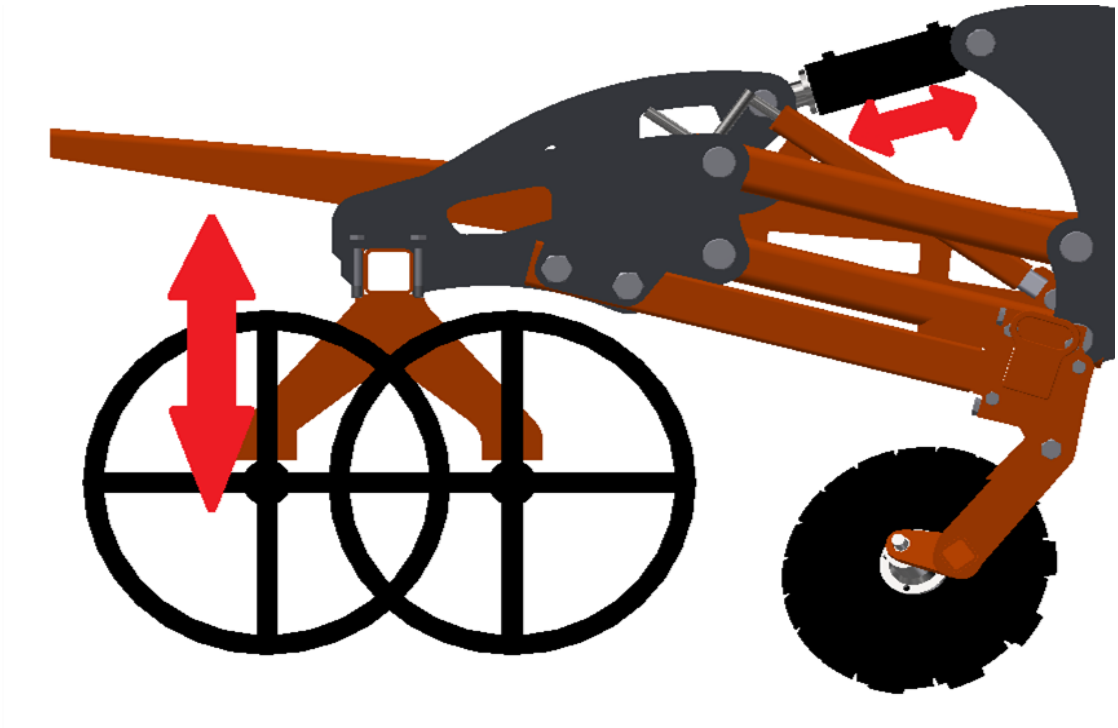


Fig. 19 Roller position adjustment.

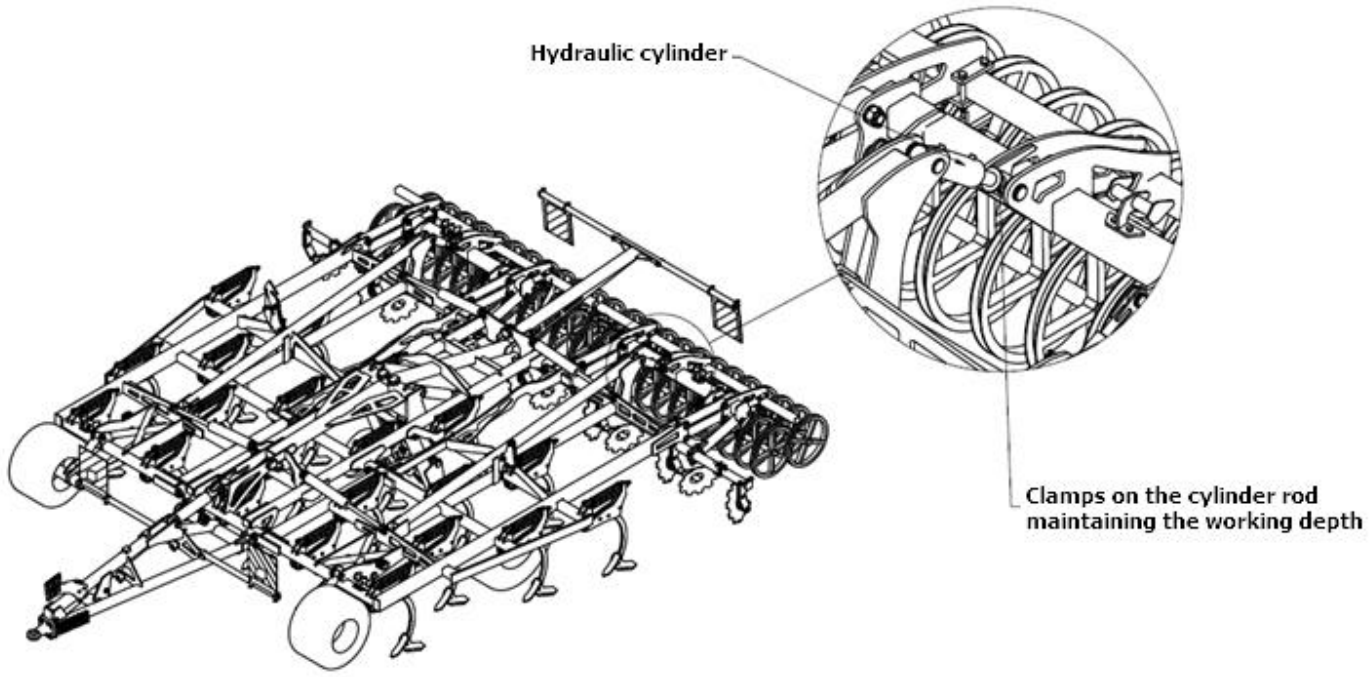


Fig. 20 Hydraulic adjustment of the roller depth.

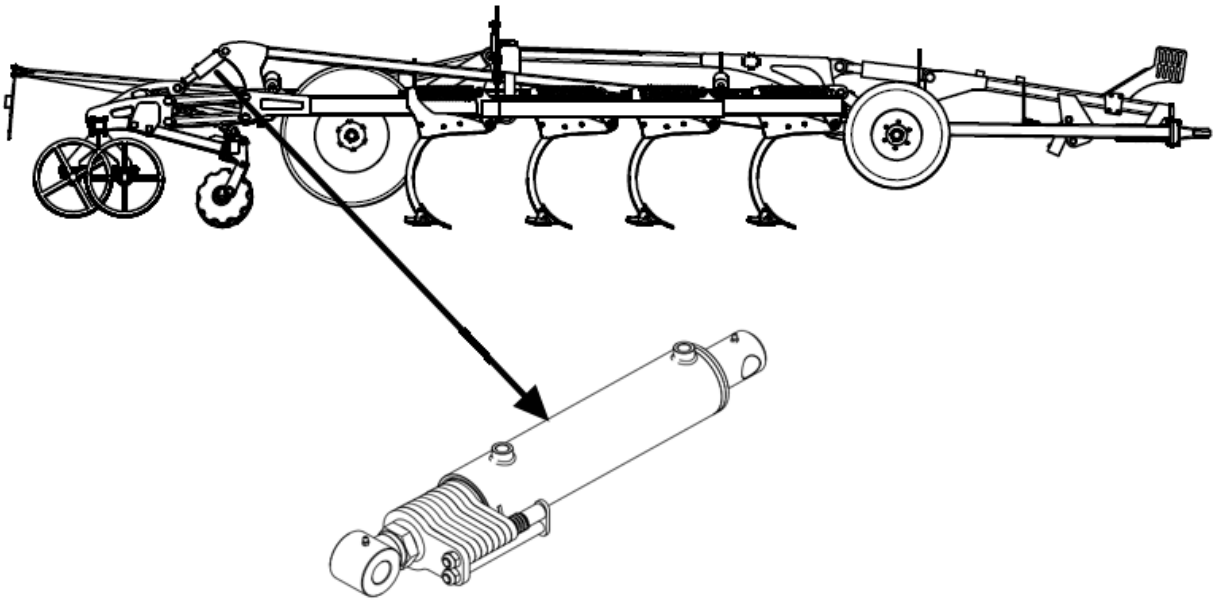


Fig. 21 Cylinder with latches attached to the piston rod to adjust the working depth.

The working depth of the implement is set using latches at the piston rod. As more latches are folded, the operation of the implement becomes shallower. In case none of the latches are installed, the implement operates at maximum working depth. Fig. 22 and Fig. 23 show the correct and incorrect way of installing consecutive latch plates on the cylinder.

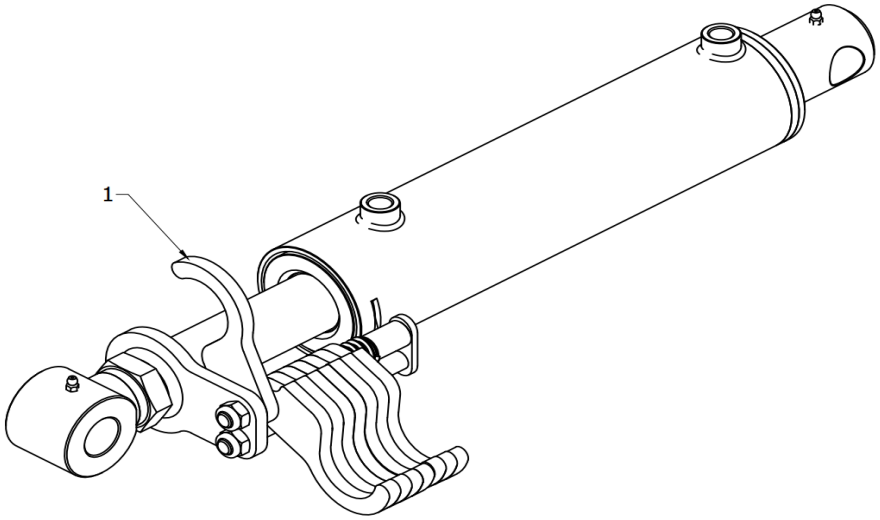


Fig. 22 Correct way to place the first (1) latch on the cylinder piston rod to adjust the implement working depth.

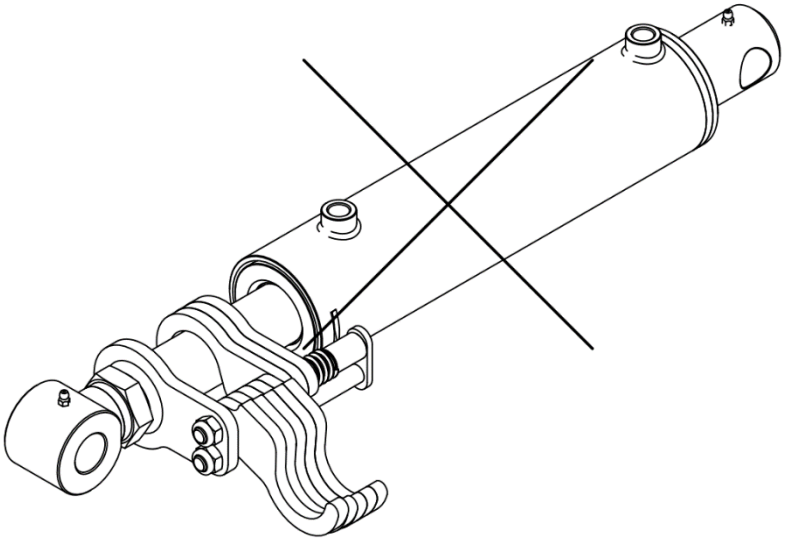


Fig. 23 Latches fitted incorrectly on the cylinder piston rod. If the latches are partially omitted from the cylinder, the forces acting on the piston rod are not evenly distributed and may cause the piston rod to buckle, resulting in damage to the entire piston assembly. This type of adjustment is **unacceptable!**

4.3.5. Levelling disc position adjustment

The depth of the discs is adjusted by means of turnbuckles (marked in white in Fig. 24). The turnbuckles are set with a shank on the bolt and an M30 nut. The working depth of the discs is adjusted according to the working depth of the cultivator. The discs must work on the surface to evenly level the soil behind the beams. **Excessive working depth of the discs may result in their damage.**

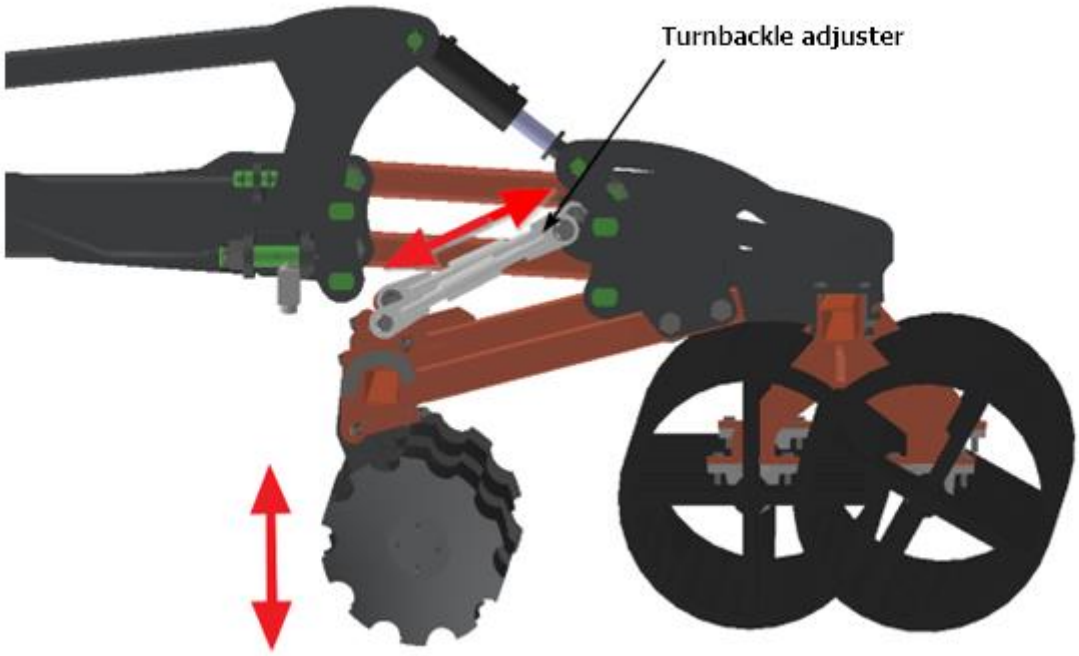


Fig. 24 Disc position adjustment.

WARNING! Do not adjust the implement while the tractor engine is running.

The working speed of the RHINO cultivator should be 8 - 12 km/h under normal operating conditions.
The implement must be raised before making U-turns and during reverse travel.

4.4. Rules for transporting the cultivator on public roads and lighting the implement

According to the road traffic safety regulations (Regulation of the Minister of Infrastructure of 31 December 2002, Journal of Laws No. 32 of 2002, item 262) – an implement consisting of an agricultural tractor and an agricultural implement hitched with the same must meet the requirements identical to those applying to the tractor.

CAUTION! The implement protruding outside the rear side outline of the tractor and obscuring tractor rear lights is a hazard for other vehicles driving on the roads. Be sure to observe the transport instructions specified in chapter 3 "General safety information". Driving on public roads without adequate marking if forbidden.

The implements must be equipped with:

- triangular board for slow vehicles;
- two boards facing front with a white parking light and a white retroreflector;
- two boards facing rear with composite lamp and a red retroreflector. The plates should be painted in diagonal white and red stripes.

After fixing the plates, connect the electrical cables of the light and signalling device to the tractor's electrical socket.

The manufacturer does not supply warning plates as standard equipment for the machine. Warning plates are commercially available.

Always adapt your driving style to the road conditions to avoid accidents and damage to the driving system. Take into account your own skills and traffic intensity, visibility and weather conditions.

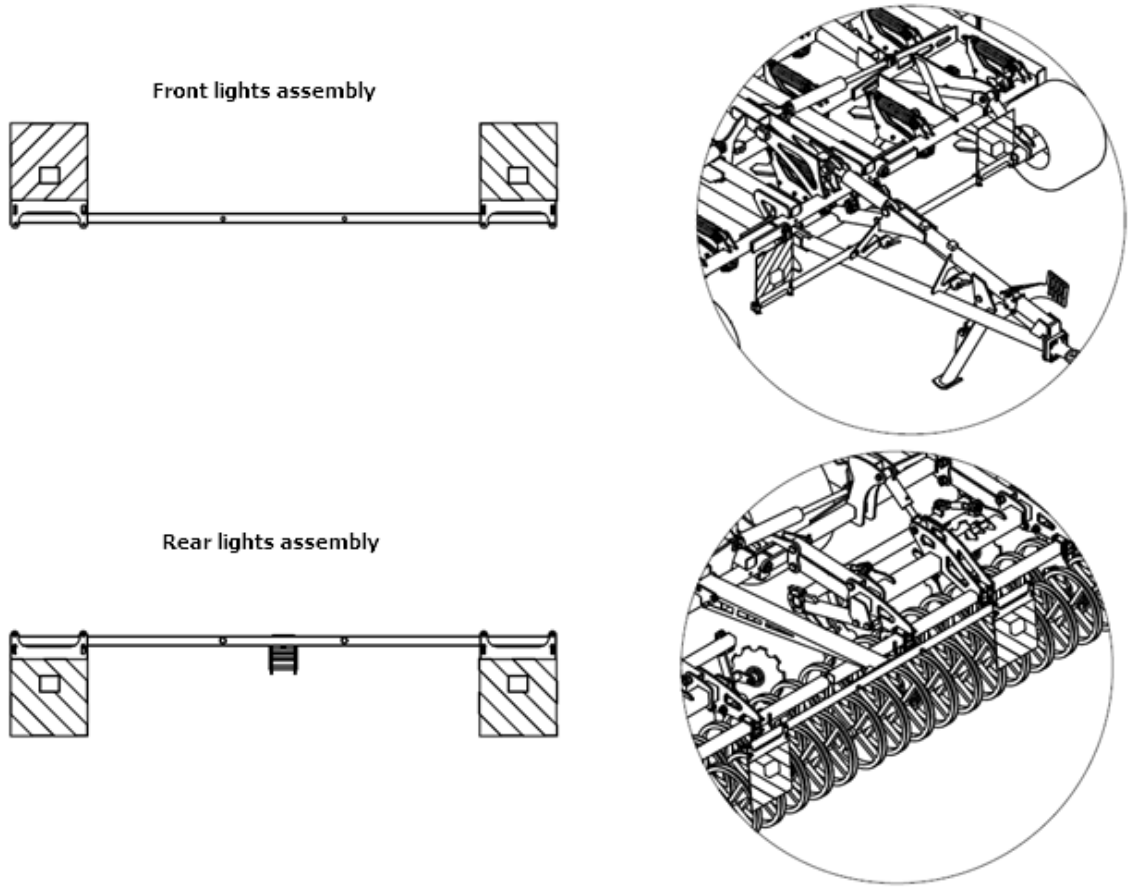


Fig. 25 Front and rear light systems and their position.

Clean the implement from soil residues and check the lights before transporting it. Lift the implement and check the clearance between the lowermost part of the implement and the ground which should be minimum 30 cm. Special care must be taken when passing and overtaking other vehicles, bypassing obstacles and crossing large areas of uneven ground and dirt roads.

4.5. Maintenance and lubrication

- Clean the disc harrow from soil after each use and inspect 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!**
- After the first 4 hours of operation, re-tighten all bolts and periodically check them for tightness. **Failure to do so will exacerbate play and backlash and result in damage to the implement.**
- Clean the cultivator from soil after each use and inspect the connection of parts and assemblies.
- During the service life of the implement, lubricate the connection lubrication points (sleeves at the hinges) every 10 operating hours. Lubricate roller bearings and moving parts of spring protections every 25 operating hours.
- The ploughshare points can be used until they are almost completely worn out, until the working surface is level with the initial surface of the ploughshare foot. However, it is recommended to replace the points in good time before there is a possibility of wear and tear and damage to the ploughshare foot.
- Use only original screws and nuts when replacing worn parts.
- Always remember to tighten the screwed joints properly.
- Replace or refurbish any damaged or worn parts.

CAUTION! Periodic lubrication guarantees the long service life of the machine.

The long service life and efficiency of a machine depends to a large extent on regular lubrication. Use mineral greases for lubrication. Clean the lubrication points thoroughly before pressing or applying grease.

4.6. Screw tightening torque

Screws, bolts and nuts should be tightened in the machine with the appropriate torque depending on the strength class of the bolt and its thread size and pitch. The corresponding torque values for tightening them are shown in Table 3.

Table 3. Screw, bolt and nut tightening torque.

Nuts & bolts torque [Nm]					
			Nuts & bolts strenght grade		
		Thread pitch	8.8	10.9	12.9
Size	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	196	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

CAUTION! 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!

5. RHINO cultivator maintenance

Daily maintenance

Thoroughly clean the cultivator removing soil and plant residues after each use; inspect the screw, pin and bolt connections and the condition of the operating elements and other parts. When cleaning, remove plant residues and ropes wound at the disc and roller bearing points. Replace any damaged or worn parts. Tighten any loose screw connections and replace damaged cotter pins and pins.

Post-season maintenance

After the end of the working season, thoroughly clean the cultivator, repair the damaged paint coating and the worn working surfaces of the tines, discs, strings and roller rings as well as the threads of the adjusting screws must be cleaned with “Antykor” kerosene and protected against corrosion with “Antykor 1” grease; moreover, a full lubrication must be carried out. It is recommended to store the machine under a roof during the operational break. However, if this is not possible, check the condition of the protection from time to time and supplement the grease washed away by the rain, if necessary.

Hydraulic system maintenance

Maintenance of the hydraulic system consists in visual inspections for leak tightness. Remember to insert pins into quick-fit connectors. In case of oil leakage from connections of hydraulic hoses, the connector must be tightened. If the oil leakage is not remedied, replace the element or the hose with a new one. If the leakage occurs outside the connector, replace the leaking hose with a new one. Mechanical damage also requires replacement of the subassembly. It is recommended that the hydraulic hoses be replaced every 5 years. If oil appears on the piston rod of the hydraulic cylinder, check for the nature of the leakage. Check the sealing once the piston rod is fully moved out. Small leakage which results in covering the piston rod with an oil film is acceptable. If the amount of oil is greater or there are oil drops, shut down the unit for the period required to repair the malfunction (defective wiper seal).

5.1. Maintenance of the RHINO driving system

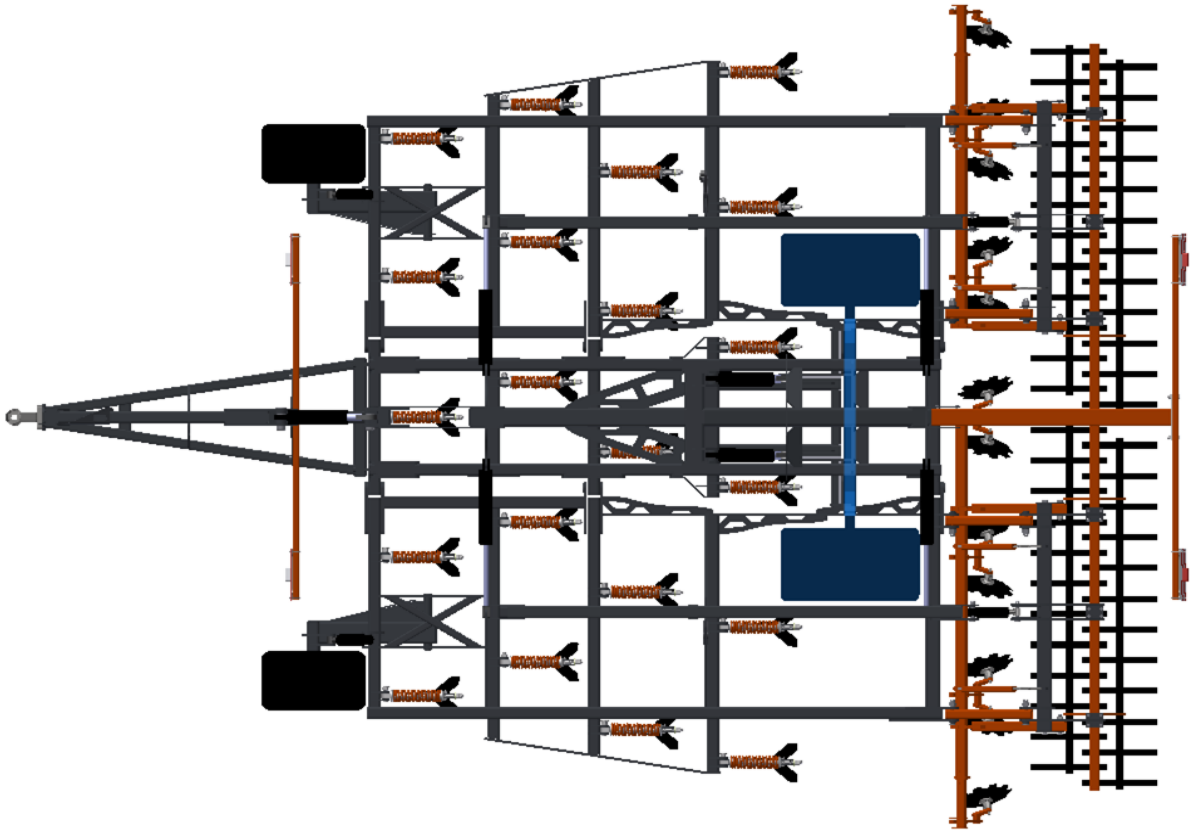


Fig. 26 Drive axle – top view.

The RHINO cultivator is equipped with a drive axle. Its position is adjusted by means of a hydraulic system. For field work, the axle should be raised to the maximum. For transport, however, it should be set in the lower position (with the actuator extended).

Fig. 27 Drive axle – side view.

Regular checks of tyre pressure.

If air leakage in the tyres is considerable, check tightness of the air valve. Next, have the wheel inspected by a specialised company to locate and repair the damage. Considerably damaged tyres (particularly the tyre profile) must be replaced immediately.

Setting the axle clearance of wheel bearings.

It is recommended that this task be carried out by a specialised company. This is done by tightening the nut on the wheel hub once the wheels are dismounted. A clearance of 0.12-0.15 mm is recommended. The inspection and adjustment must be performed every 2 years.

Procedure:

- Dismount the hub cover and the spring pin securing the spring nut.
- At the same time as spinning the hub, press and tighten the crown nut.
- Stop tightening when with a vigorous manual rotation there is no more than a half-turn of the hub.
- Loosen the nut partially until the hub can rotate freely and repeat the tightening step.
- After repeated rotation locking, loosen the nut by max. 30° until the immediate nut locking with a pin is possible. Mark the position with a line.
- From the marked position unscrew the nut a half turn, and slightly tapping on the hub press the hub onto the nut as far as possible.
- Keep tightening the nut until it reaches the position marked with the line.
- Mount the hub cover.

CAUTION! During maintenance, the unit must be secured against rolling away (it must be connected to a tractor with the parking brake on) and unfolded.

Brake system (pneumatic system) maintenance

The three-range braking force distribution system is not adjustable in normal use. It should be in the middle position. If the braking force differs from that of the tractor's braking force, the braking force distribution system may be adjusted to avoid incorrect behaviour of the coupled set on the road. When making any alterations, be sure not to cause an accident or damage to the implement.

The water condensed in the tank is drained using a valve located below the tank. Press the pin down and water will be displaced by compressed air. When the pin is released, the valve will automatically close. Unscrew the drain valve once a year (before winter) and clean it.

The test of the pneumatic system consists in checking for leaks, especially at the connection points (during the test the pressure in the system should not be lower than 6 atmospheres). Any hissing indicates the damage of hoses, gaskets and other components of the system. In the case of small leaks, bubbles will appear (check with a washing liquid). **Damaged components must be replaced.**

Brake control – compensation of the braking deceleration that has to be carried out when:

- the braking force decreases during wear and tear of the brake pad lining during operation and as a result of the resulting play,
- wheel brakes brake unevenly and non-simultaneously.

To this end, change the position of the spreader arm to which the piston of the pneumatic cylinder is acting by changing the initial angle of the spreader shaft at the multi-row end of the shaft and adjust the length of the bar on the screw. Adjustments must be made for each wheel separately.

5.2. Defects and malfunctions in the cultivator operation

Replace the damaged roller bearings following the steps below:

- Place the machine on a horizontal surface;
- Unscrew the four bolts securing ball bearings (two screws between the rings in the case of the ring roller and T-ring roller) on each side;
- Move the roller away;
- For the ring roller and T-ring roller, first remove the retaining ring at the end of the roller, secured with pins, and remove the roller wheels;

- Remove the bearings using a puller;
- Loosely place new bearings on the roller (place the wheels and retaining rings in the ring rollers and T-ring rollers; screw in the pins using a thread locking adhesive),
- Roll the roller between the bearing plates and screw the bearings to the plates.

Do not replace the bearings on the levelling disc holders. In case of damage, replace the entire disc holder.

Damaged cylinders should be delivered to a specialized regeneration company, or replaced. To re-assemble the cylinder, proceed as follows:

- connect the hoses correctly (as they are connected in the adjacent cylinder);
- first, install and secure the cylinder in the central frame,
- support the cylinder so that its piston does not collide with any part when it is pulled out,
- perform several working cycles to vent the cylinder (otherwise, the side frame will suddenly collapse, which may result in an accident or machine damage),
- place the cylinder in the frame's lug and secure it with a pin.

CAUTION! During repairs and maintenance, the implement must be lowered on the ground and be resting on supports ensuring full stability. The tractor engine must be stopped. During repairs and maintenance, use proper spanners and safety gloves.

Replacement of workpieces

Excessively worn workpieces hinder soil penetration by the tools and increase the working resistance. Replace the discs when the diameter has been reduced to 510 mm.

Replace the workpieces on the implement when it is lowered to the ground with the tractor engine stopped. Put sturdy and robust supports (e.g. approx. 20 cm thick wooden blocks under the adjacent workpieces or the roller) to prevent contact between the component to be replaced and the ground. In case of the chassis, the wheels lowered to the maximum position may also be used as supports. Upon lowering the harrow, switching off the tractor engine and applying the hand brake, check the stability of the tractor-implement unit. Use only standard screws to fix new parts or workpieces.

If the components of the machine are disassembled several times, it is necessary to inspect and replace (if required) connecting components such as bolts, washers or nuts, excessive wear of which can lead to uncontrolled loosening of the connected components, and consequent damage to the same.

Work with extremely worn work tools 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. Otherwise damage may occur, for which the manufacturer SHALL NOT BE HELD RESPONSIBLE!

6. Cultivator storage

After the end of the work season, check the parts and assemblies. If any part is found damaged or considerably worn, replace it with a new one. Areas of damaged paint must be cleaned out of dirt and rust. Apply anti-corrosive paint, and then apply a topcoat paint. Protect the working surfaces of the cultivator tines and the roller from corrosion. It is recommended to store the machine under a roof during the operational break. However, if this is not possible, check the condition of the protection from time to time and supplement the grease washed away by the rain, if necessary.

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 from corrosion with vaseline or acid-free grease.

When unhitched from the tractor, the implement must be supported on a firm, level surface with a stable balance. All work units should rest on the ground. Lower the implement gently so that it does not come into contact with hard surfaces. When lowering the implement, unhitch the suspension system and drive away the tractor. Also, the parts that have been disassembled and removed from the implement must be stored securely supported on the ground to prevent uncontrolled movement. It is advisable to store the implement on a hardened firm surface in roofed areas, inaccessible to unauthorised persons, bystanders and animals.

CAUTION! The cultivator must be stored in a place which does not pose any hazard to persons or the environment.

For safety reasons, the cultivator with the working width of 6.00 m should be stored folded out, with the discs and undercutters facing downwards.

7. Disassembly and withdrawal from service and scrapping

When operated in accordance with the guidelines in the instruction manual, the implement will have a long service life, however worn or damaged parts must be replaced. In the event of emergency damage (cracks and deformation of the frames) impairing the quality of the machine operation and posing a risk to its further operation, the machine must be withdrawn from service. Disassembly of the implement should be carried out by persons who are familiar with its design. These operations must be performed when the machine is placed on level, firm ground. Start by removing the small parts (bolts, screws, etc.) and proceed to the bigger ones. The implement should be scrapped after complete disassembly and verification of the machine components. During disassembly, sort the parts by their material. Waste ferrous metal parts should be grouped together at the collection points for ferrous metals. Dispose of worked oil, rubber pads and hoses as waste and hand them over to the disposal companies.

CAUTION Take all precautions during the disassembly: use appropriate tools and personal protective equipment. Dispose of the disassembled parts in accordance with the environmental protection requirements.

8. RHINO cultivator – spare parts

In order to search, find prices and order original spare parts visit our website at www.mandam.com.pl , “parts” tab.
There you can find catalogues and spare part sheets in PDF format, containing current part drawings and diagrams for each machine or implement, together with part numbers and prices.
Purchase orders for parts can be placed or enquiries related to the same can be sent directly from this website (tab: “contact/order”), or sent to the following e-mail address: czesci@mandam.com.pl
A purchase order should contain part numbers and quantities, as well as details of the ordering party/payer together with a contact phone number.

The parts are sent directly to the specified address on the COD basis.
If in doubt, please contact Mandam Spare Parts Department at: +48 32-232-2660 extension 39 or 45 or at + 48 668-66-22-89 (mobile).
Original MANDAM spare parts are also available from all authorised MANDAM distributors.