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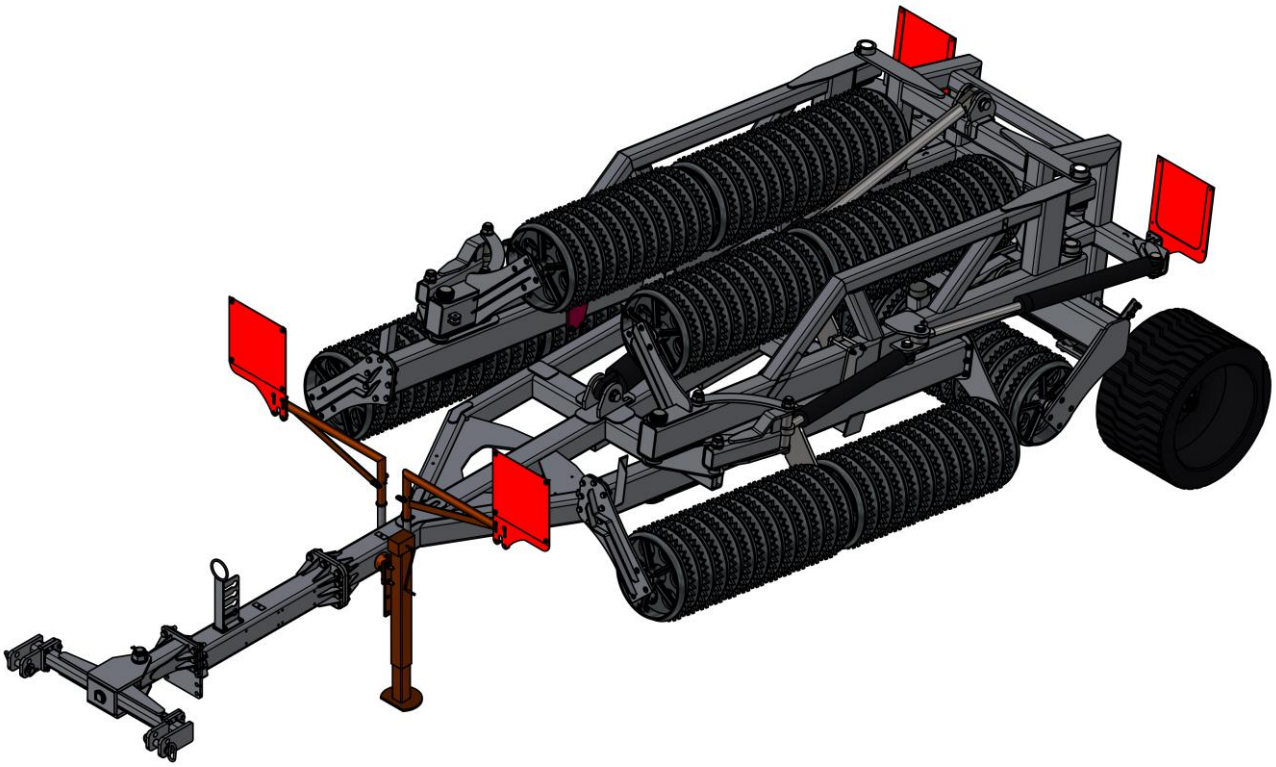
OPERATION MANUAL

CAMBRIDGE MCB 12.3 H CULTIVATION ROLLER



Revision 1
Gliwice 2024

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:

CAMBRIDGE MCB 12.3 H CULTIVATION ROLLER

type/model.....
year of production: .....
Factory No.: .....

under this declaration, complies with:

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

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

The following standards were also used to assess compliance:

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

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

Prezes Zarządu
Dyrektor
inż. Bronisław Jakus

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

.....
Place and date of issue

.....
Surname, first name, position and signature of the authorized person

Contents

1 Introduction

Congratulations on your purchase of the Cambridge cultivation roller. This manual provides information on hazards that may occur when working with the roller, technical data and the most important instructions and recommendations, knowledge and application of which is a condition 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. Following the recommendations in the following instructions will allow for long-term, trouble-free operation and will reduce the cost of exploring the cultivation roller. 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:

Machine identification

The identification data of the cultivation roller can be found on the rating plates on the support frame. The rating plate contains basic information about the manufacturer and the machine, as well as the CE mark.

Figure 1 Rating plate

The Cambridge cultivation roller warranty 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

- Mandam's authorised distributors.

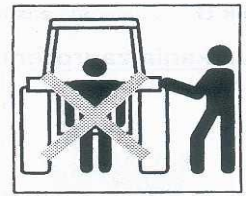
1.1 Information and warning signs

Remember! When using the Cambridge cultivation roller, special care should be taken in areas marked with special information and warning signs.

- 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.

Information and warning signs	*Meaning of the signs*	*Placement on the machine*
	Read the operating instructions before use.	Frame near mounting of the upper fastener.

Information and warning signs	*Meaning of the signs*	*Placement on the machine*
	Crushing of the toes or foot.	Frame near mounting of the upper fastener.
	Keep clear of the lift bars while controlling the lift.	Frame near mounting of the upper fastener.
	Keep a safe distance from foldable and moving parts of the machine	Front part of the mid frame near the side frames
	Pressurised liquid jet - bodily harm.	Actuators.
	Do not reach into the crushing area if the parts may move.	Near work depth control, contour rollers, side screens.

Information and warning signs	*Meaning of the signs*	*Placement on the machine*
	Lubrication point	In the vicinity of areas requiring lubrication
	Fixing point for transport belts	Upper part of drawbar (for non-folding machines) Main frame (for non-folding machines) Drawbar (on folding machines) Centre frame at arm hinges (on folding machines)
	Designation of hydraulic system couplings	On the drawbar of the machine
	Contact information for the spare parts department	Machine frame or drawbar

2 General information

2.1 Construction and purpose of the Cambridge cultivation roller.

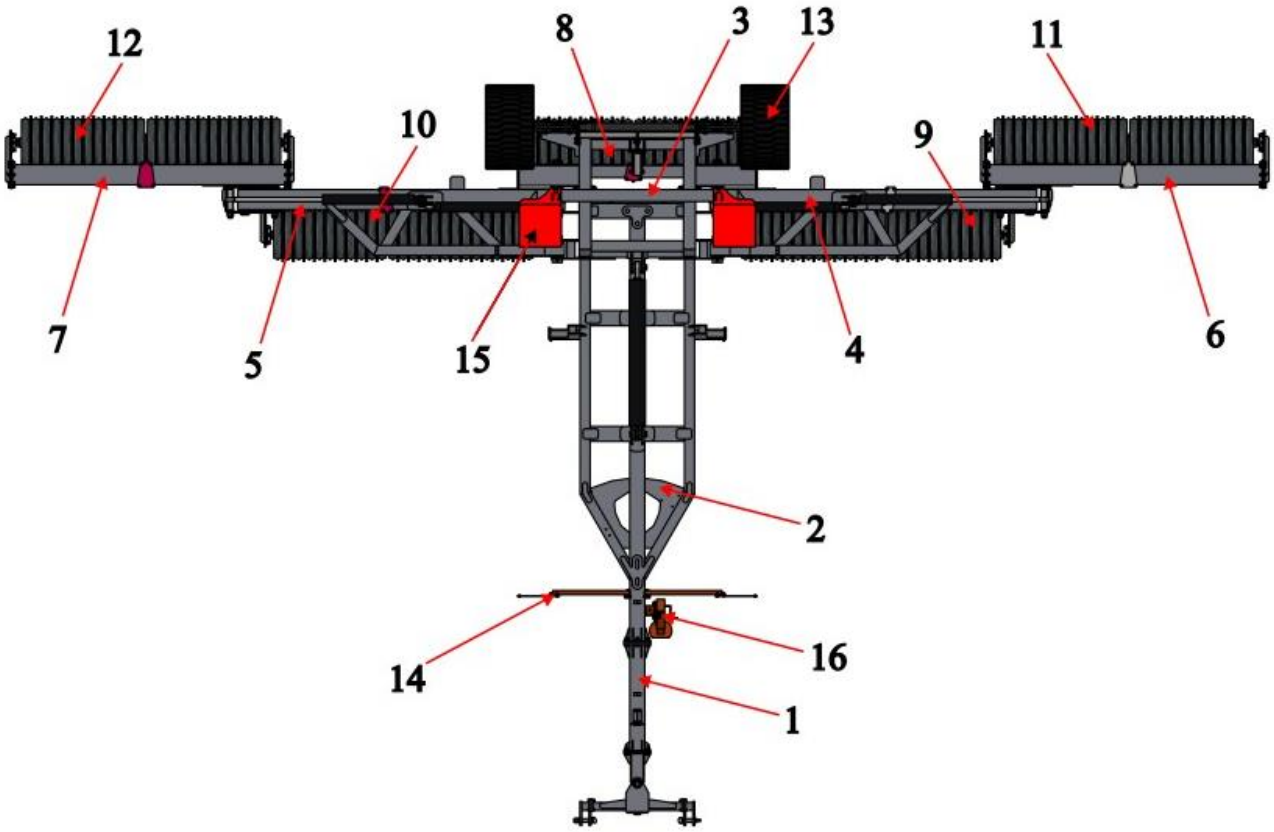


Figure 2 Construction of the Cambridge MCB 12.3 H cultivation roller (1 - front beam, 2 - drawbar, 3 - centre frame, 4 - left frame; 5 - right frame, 6 - left outermost frame, 7 - right outermost frame, 8 - centre roller, 9 - left roller, 10 - right roller, 11 - left outermost roller, 12 - right outermost roller, 13 - running gear, 14 - front lights; 15 - rear lights, 16 - support foot

- The roller **centre frame** is the load-bearing element for the working sections and the roller. With the use of the main actuator, it is possible to change the position of the centre frame in the horizontal plane. This allows the user to change position from working to transport and vice versa. The centre frame comprises the wings (right and left), the centre volok and the running gear. It is made of hollow sections.

- The **drawbar** is a structure that allows the roller to be hitched to the tractor. The drawbar is fitted with a handle on which the working sections rest during transport. It is made of hollow sections.

- The **working section (roller)** is a component consisting of a series of iron castings positioned on the axis of the working shaft (Figure 3). The shaft is bearing-mounted at the ends of the axle. The plain wheel is seated on the shaft axle, while the larger diameter gear is seated on the protruding part of the hub of the plain wheel and can rotate independently on it. The difference in speed of the rotating wheels clears the roller with sticky soil.

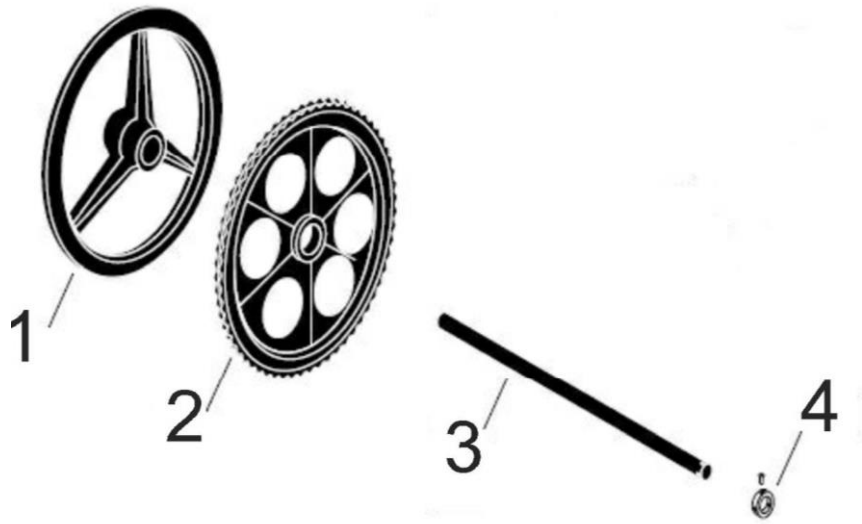


Figure 3 Elements of the MCB/MCW roller working section: 1- plain wheel, 2- gear wheel, 3- roller axle, 4- retaining ring.

- The **volok** is a section of tines working in front of the shaft fixed by an arm and a turnbuckle to adjust the angle of attack, thus the depth of work relative to the roller. It crumbles cloddy furrow slices and levels the surface, resulting in an evenly worked roller.

2.2 Purpose of the Cambridge roller

Cultivation rollers are used to compact the topsoil immediately after ploughing, before sowing or after sowing, and to create a tubular structure. They crumble the clods and compact the soil while leaving the surface slightly loosened.

Cultivation rollers are particularly useful on compact, clayey soils where they are excellent at breaking up ploughed furrow slices and clods. Cultivation provides compaction and levelling of the topsoil. The high weight per metre width results in good hardening and levelling of the arable layer, so that deep ruts do not form during subsequent passes and, due to the improved capillarity of the soil, a much higher emergence capacity is achieved.

NOTE! Tractors working with a roller suspended on the rear three-point linkage must be equipped with a set of front axle weights.

NOTE! The rollers are designed exclusively for agricultural use. The use of the rollers for other purposes will be understood as a misuse. Cultivation rollers must not be used on soils with stones of significant size lying on the surface.

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

The machine should only be handled and operated by adults who are familiar with the operating instructions, taking all precautions and in particular:

- before each start-up, check that the cultivation roller and tractor are in safe working order,
- use of the machine by minors, persons who are ill or under the influence of alcohol or other intoxicants is prohibited,
- use work clothes, footwear and gloves when carrying out maintenance work,
- permissible axle loads and transport dimensions must not be exceeded,
- use only original safety and split pins,
- when working with the roller, when lifting, lowering and unfolding the roller, children should not be in the vicinity,
- it is forbidden to approach the cultivation roller while it is being raised and lowered,
- it is forbidden to be between the tractor and the roller when the engine is running,
- starting off with the roller, lifting and lowering slowly and gently without any sudden jerks, taking care not to allow any bystanders in the vicinity,
- observe traffic regulations when using public roads and install transport equipment such as lighting, reflective and warning devices,
- 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 shaft 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.

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! Roller markings for travelling on public roads are not standard equipment. The user can buy them from machinery and agricultural parts dealers.

3.1 Proper coupling and uncoupling with the tractor

The following points must be followed when coupling and uncoupling :

- The connection of the machine to the tractor must be carried out as prescribed, remembering to secure the pins and to secure the suspension pins with cotter pins,
- It is forbidden for people to be between the machine and the tractor when coupling the tractor and the roller,
- The tractor working with the cultivating roller must be fully operational. It is forbidden to couple the machine to a tractor with a defective hydraulic system,
- It must be ensured that: the tractor's balance with the mounted roller, its manoeuvrability and its braking ability are maintained - the front axle load must not fall below 20% of the tractor's total axle load - a set of front weights,
- In the resting position, the machine, when uncoupled from the tractor, should maintain a stable equilibrium.
- The support foot should be rested on a stable surface. It is forbidden to use foot pads that may cause instability of the support.

3.2 Tyres

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

- When replacing tyres, the machine must be secured against rolling.

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

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

3.3 Hydraulic and pneumatic system

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

- do not connect or disconnect the hydraulic lines when the tractor's hydraulic system is under pressure (hydraulics set to neutral),

- regularly check the condition of the connections and the hydraulic and pneumatic hoses.
- the unit must be taken out of service while the hydraulic or pneumatic failure is being rectified.

3.4 Noise and vibrations

➢ When using the roller, there is no noise hazard to the operator contributing to hearing loss, as the roller is a passive tool and the operator's seat is in the tractor cab. It should be added that the noise caused by the operation of the cultivation roller does not exceed 70dB.

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

3.5 Compliance with standards

Our cultivation roller 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 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,
- handling and failure to comply with operating instructions,
- driving on public roads.

3.7 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

➢ Cultivation rollers are supplied fully assembled by the manufacturer. An optional accessory is a volok mounted in front of the roller. **The user of the machine, apart from working parts, does not receive spare parts**.

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

4.1 Axle load calculations

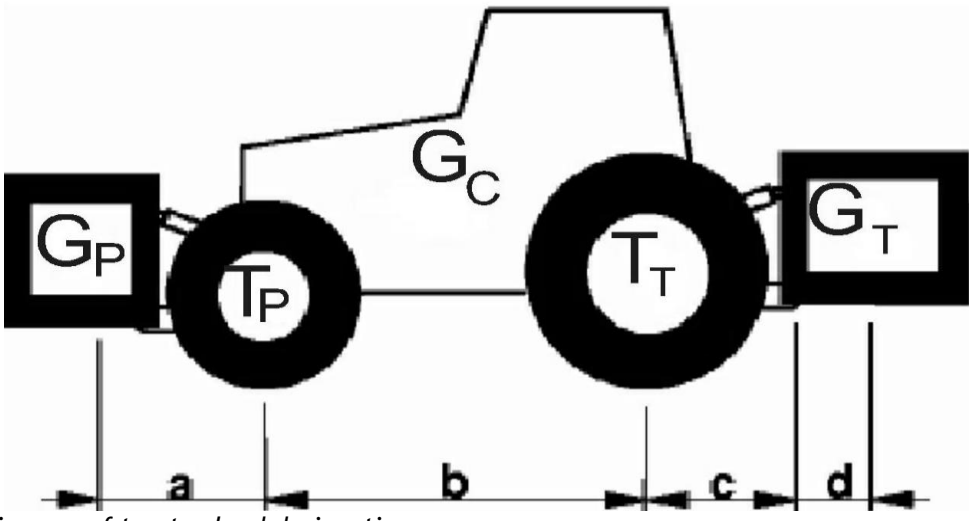


Figure 8 Diagram of tractor load designations

Minimum load at the front for rear-mounted machine:

Designations:

G_C – tractor dead weight,

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

Actual front axle load

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

Actual total weight

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

Actual rear axle load

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

T_P– front axle load of the empty tractor,

T_T – rear axle load of the empty tractor,

G_P – total weight of front-mounted device,

G_T – total weight of rear-mounted device,

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

b – tractor wheel track,

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

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

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

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

4.2 *Coupling the cultivation roller to the tractor*

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

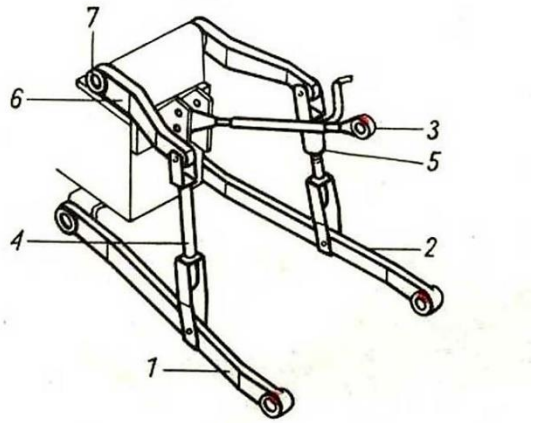


Figure 9 Three-point linkage of the tractor: 1,2 - lower links, 3 - upper fastener, 4 - left suspension, 5 - right suspension with adjustable length, 6 - lift arm, 7 - lift shaft

When attaching a three-point linkage mounted cultivation roller to a tractor, perform the following steps:

1) switch the tractor's hydraulic system to position control,
2) remove the lower hitch bolts (in case the tractor linkage is not equipped with hooks),
3) carefully back up, suspend the machine from the lower links, then secure,
4) connect the top upper fastener on the tractor. During operation of the unit, the hitch point of the upper fastener at the unit must be higher than the attachment point of this fastener at the tractor,
5) check the lifting and lowering of the disc harrow and the operation of the hydraulic system.

When attaching a cultivation roller with a working width of more than 3m, the following steps must be taken:

1) adjust the hitch of the roller to the height of the tractor hitch by means of the crank on the support foot (note the longitudinal level of the machine)
2) Carefully reverse the tractor under the machine and insert the pin and secure,
3) connect the hydraulic hoses to the tractor and check function (set the tractor hydraulics to neutral when connecting the hoses).

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

4.3 Braking system

The MCB 12.3H cultivation roller can be equipped with three types of braking systems - single-circuit hydraulic brake, dual-circuit hydraulic brake or air brake (standard equipment), the diagrams of which are shown below.

4.3.1 Air brake

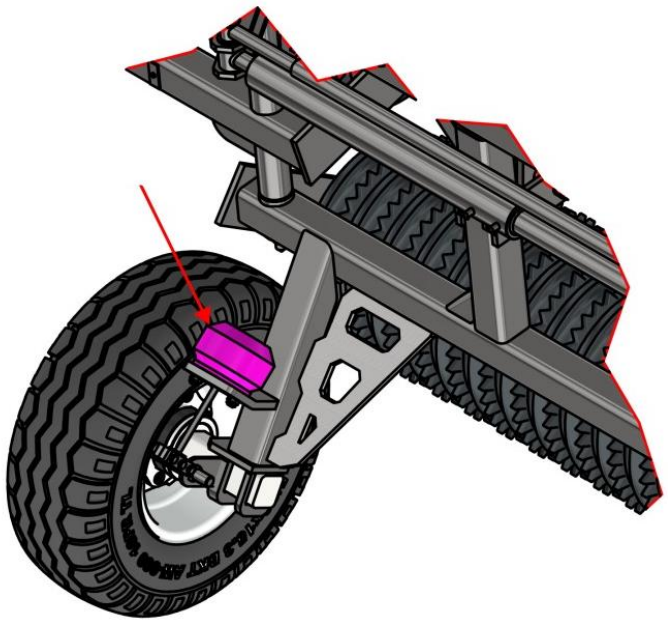


Fig. 6. Location of diaphragm actuators

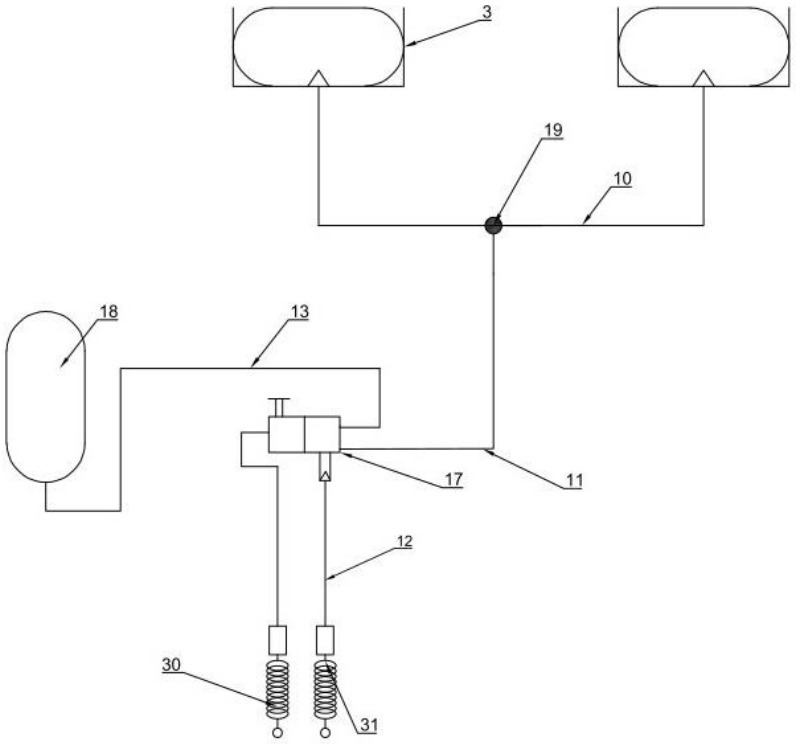


Fig. 7. Diagram of Cambridge 12.3H cultivation roller air brake (3 - 24" diaphragm cylinder; 10,11,12,13 - air line; 17 - trailer control valve; 18 - 20L air tank; 19 - M22 tee; 30 - red spiral hose connector; 31- yellow spiral hose connector)

4.3.2 Hydraulic single-circuit brake

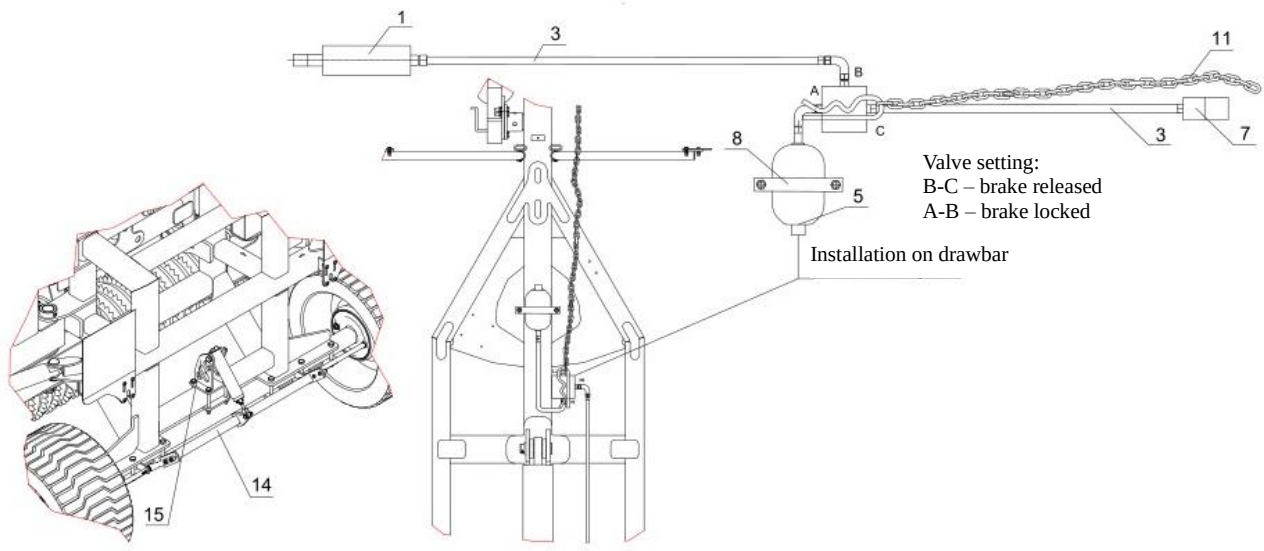


Figure X. Diagram of single-circuit hydraulic brake (1 - Actuator 301349/P2; 3 - Hydraulic line; 5 - Accumulator 0.75l 100bar SIAP WA; 7 - SAFIM quick coupler; 8 - Battery bracket CR 114; 11 - Chain L-2000; 14 - Brake bar; 15 - Actuator bracket).

4.3.3 Hydraulic double-circuit brake

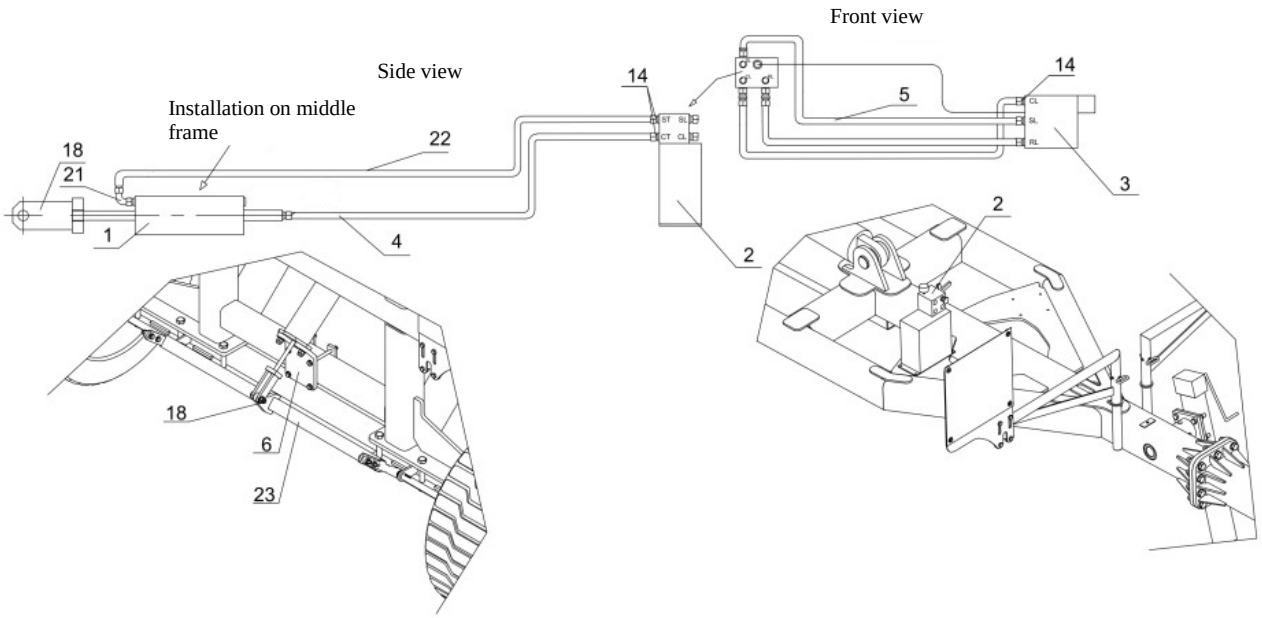


Figure X. Diagram of a dual-circuit hydraulic brake (1 - combination brake cylinder; 2 - valve with pump reservoir; 3 - DLC dual-circuit quick coupler with cable; 4 - hydraulic line; 5 - hydraulic line; 6 - hydraulic cylinder mounting plate; 14 - adapter / nipple; 18 - beam bracket; 21 - elbow fitting; 22 - hydraulic line; 23 - brake beam).

4.3.4 Automatic brake valve with spring brake - 206613

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

Figure 35 Overview view of the two-line hydraulic brake system.

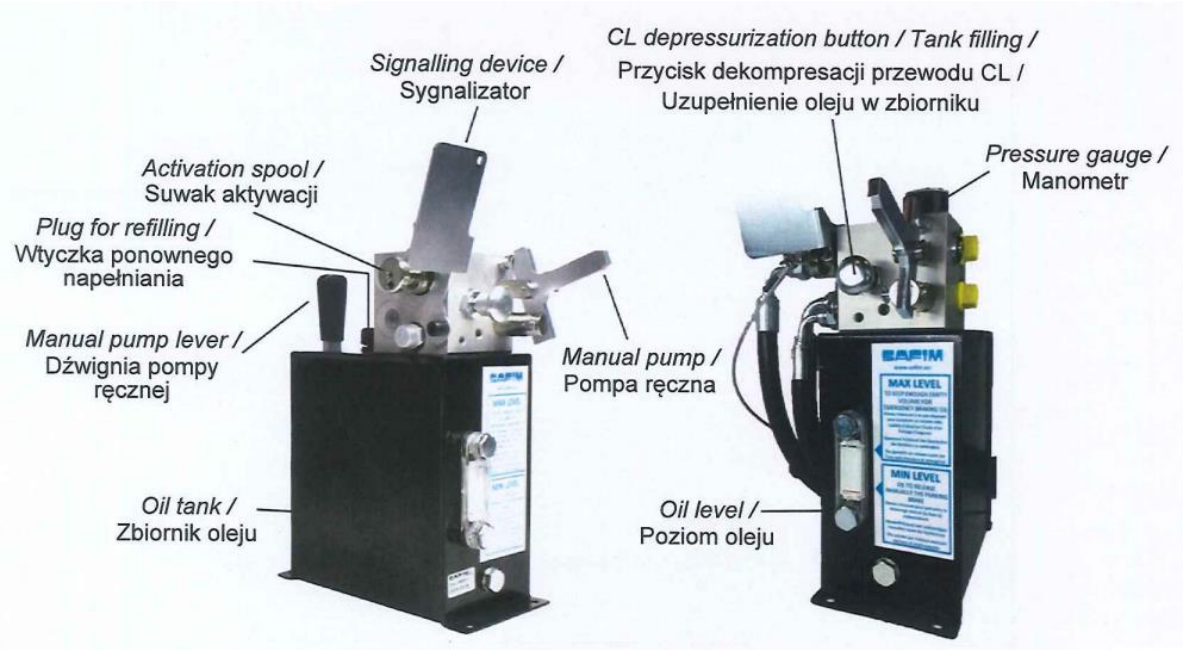


Figure 36 Valve with marked components.

Figures 7 and 8 show the respective valve plans with the designations of the most important wires and connectors, where they denote in sequence:

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

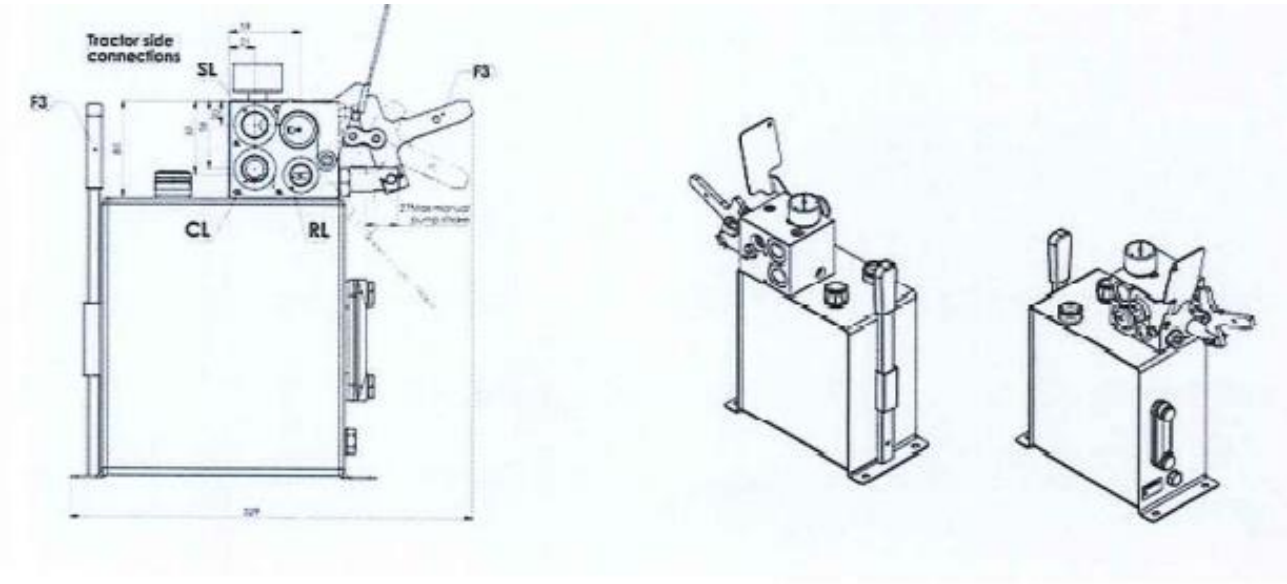


Figure 37 Plan showing the connectors on the tractor side.

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

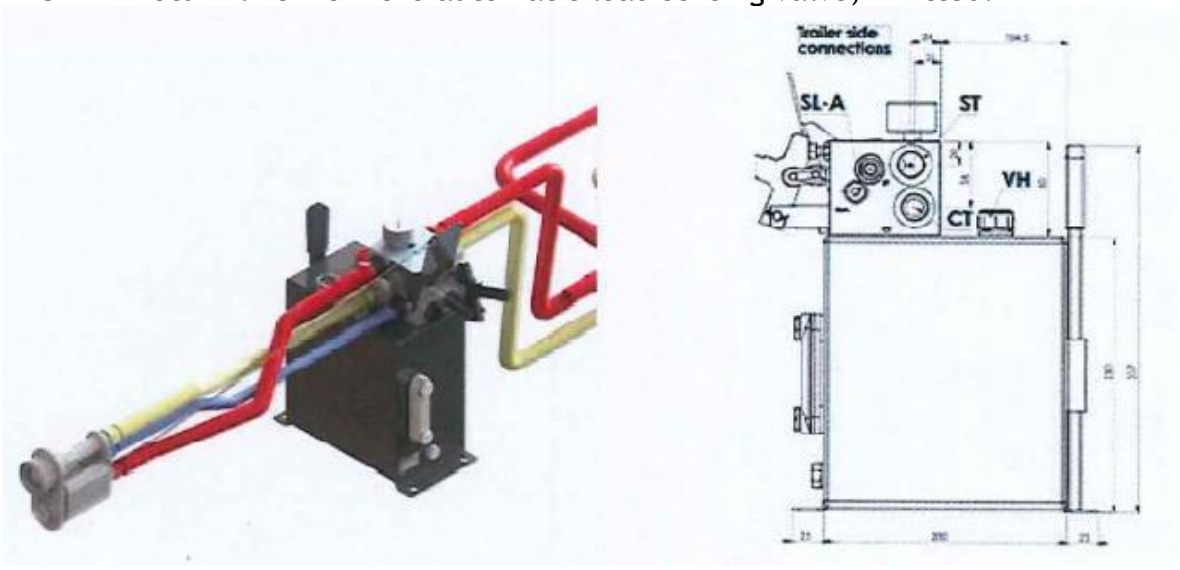


Figure 38 Plan showing the joints on the side of the disc harrow.

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

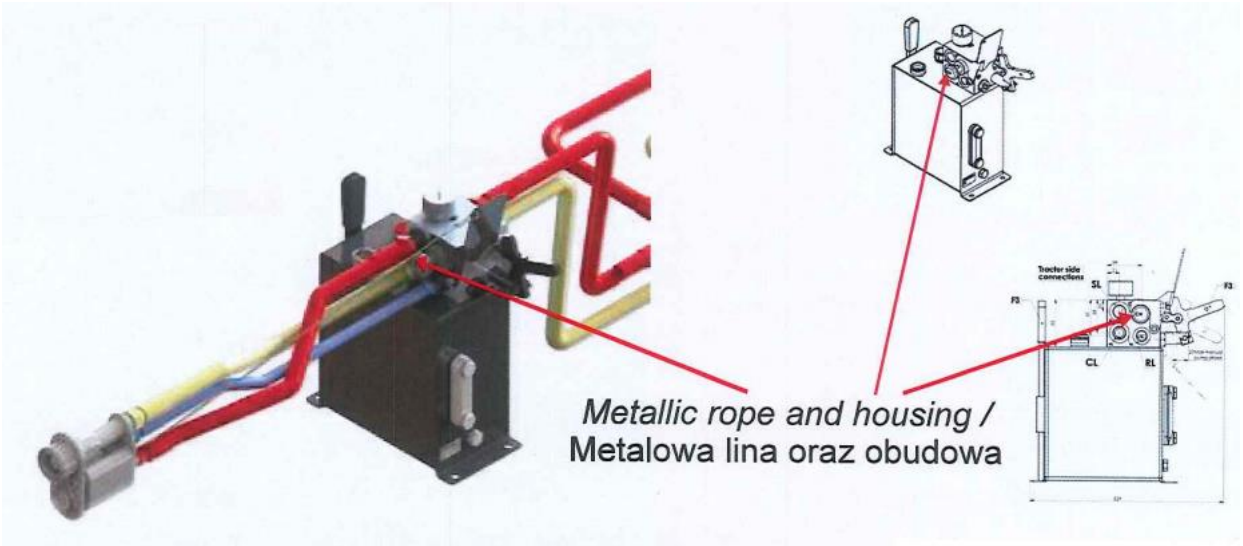


Figure 39 Marking where the metal cable is connected to its dedicated housing.

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

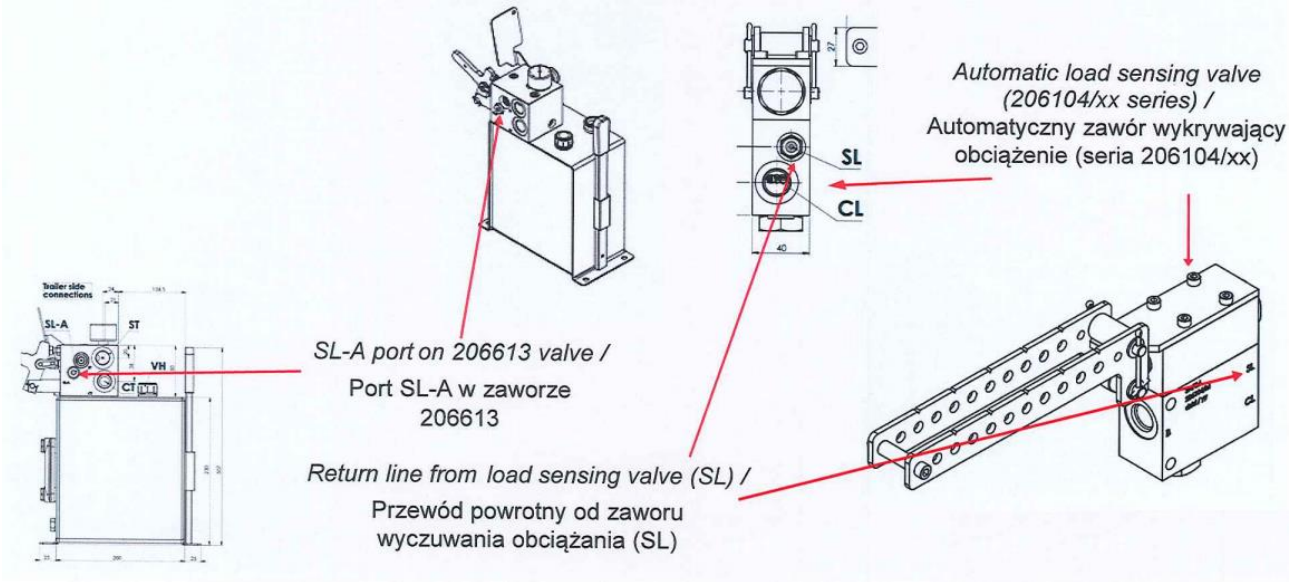


Figure 40 Marking of the connection point when using automatic load sensing valve type 206104/xx.

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

Mode 1 – Drive mode:

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

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

The valve's normal function mode is engaged each time the operator connects the two-

line connector, starts the tractor engine and releases the parking brake.
The device provides all standard trailer braking functions when the driver brakes. If the trailer is disconnected from the tractor, the automatic brake valve activates the automatic emergency braking function.

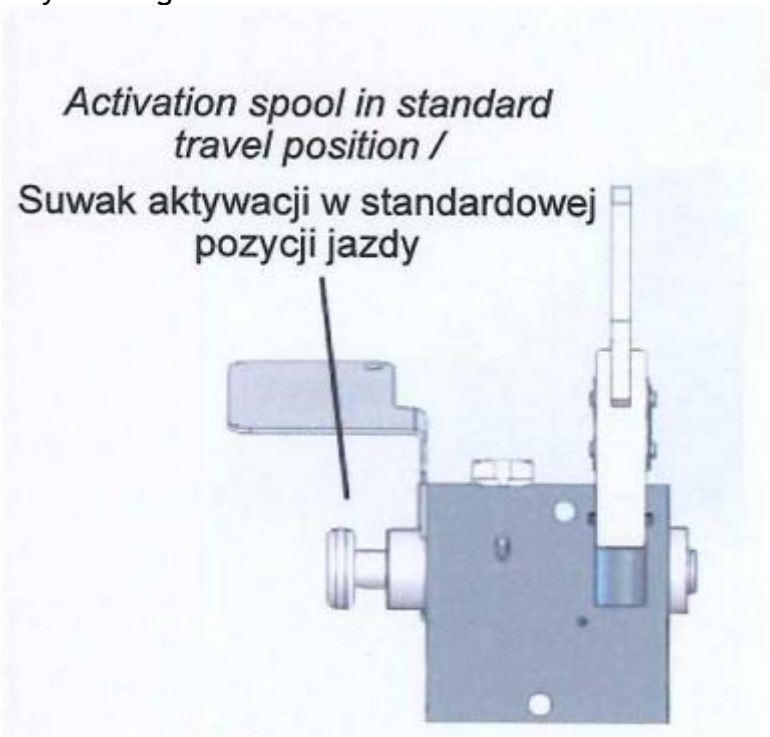


Figure 41 Standard position of the activation slider in the driving position.

Mode 2 – Emergency mode:

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

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

Mode 2a – Parking mode:

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

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

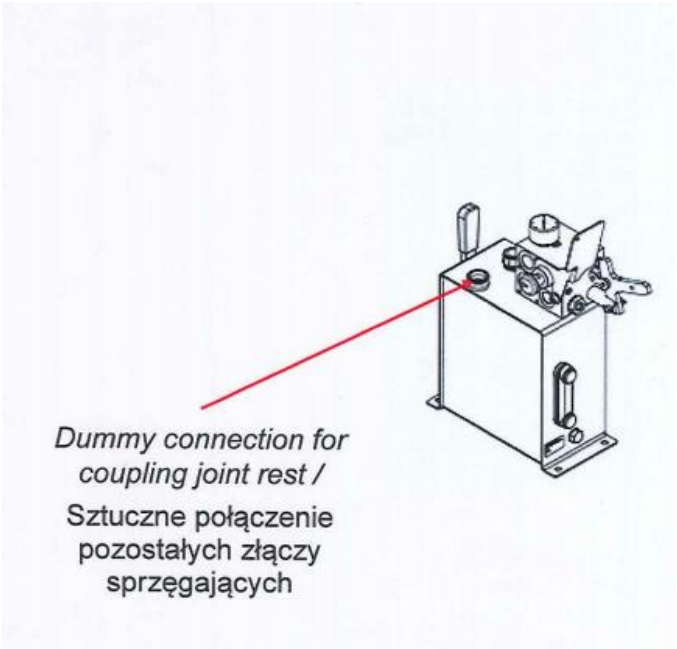


Figure 42 Port of artificial connection of the remaining coupling connectors.

Mode 3 - Deactivation of automatic brake function:

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

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

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

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

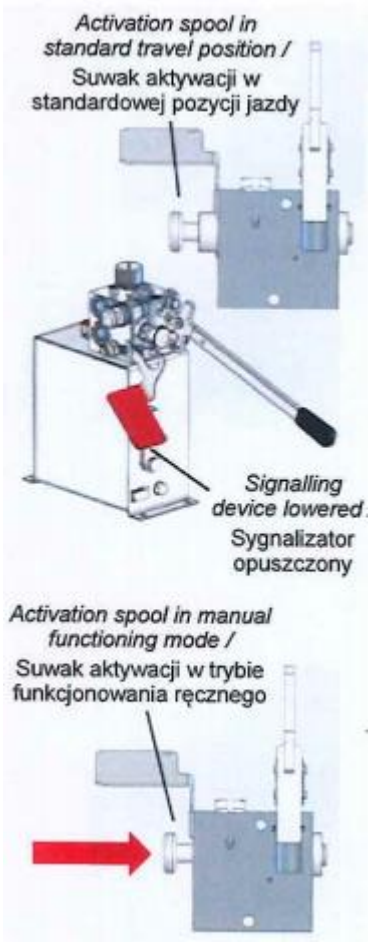


Figure 43 Activation slider positions in manual operation position

Mode 4 - Reconnecting to the tractor:

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

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

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

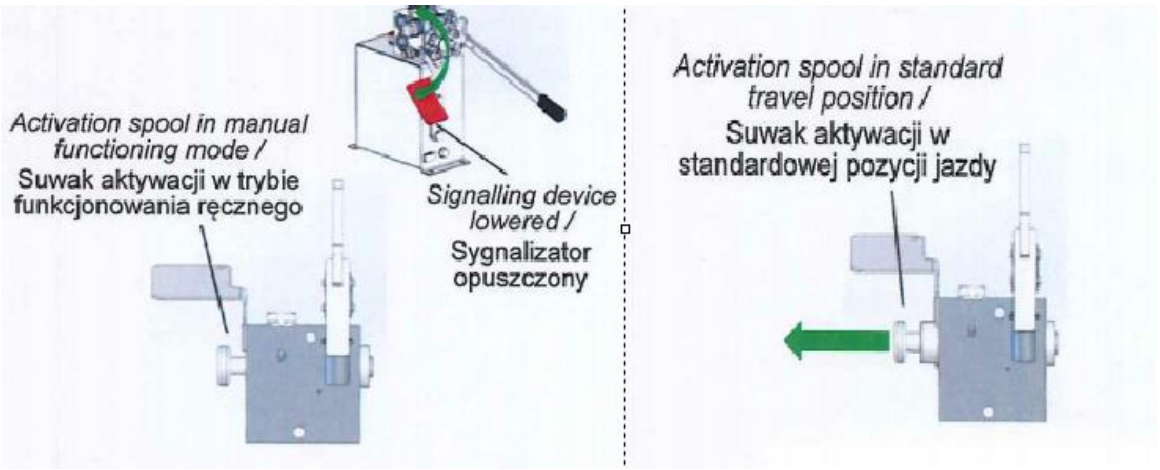


Figure 43 Activation slider positions in manual operation and standard driving position.

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

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

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

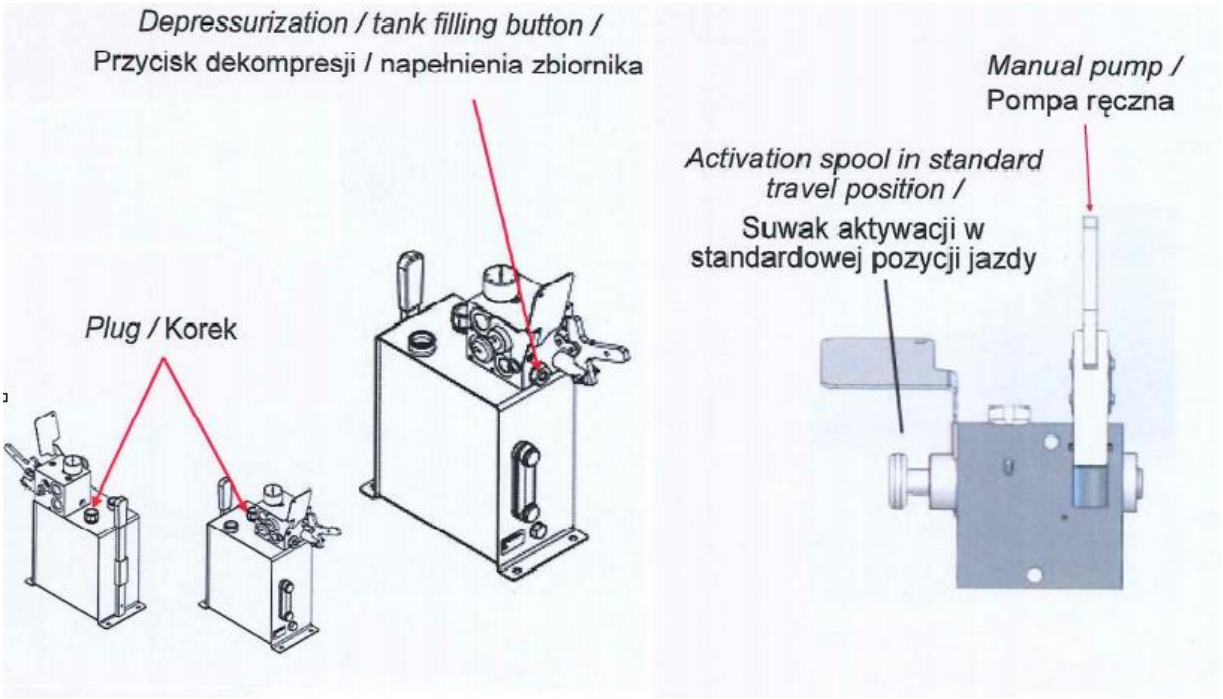


Figure 44 Location of tank cap, decompression button and hand pump

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

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

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

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

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

4.4 Cultivation roller operation

Start with an initial test run to check the alignment and behaviour of the roller. If necessary, adjust the length of the tractor coupling so that the shaft frame is horizontal. Travel speed with the cultivating roller during work should not exceed 8 km/h.

NOTE! Coupling of the tractor and the roller must be carried out carefully, at minimum tractor speed! When hitching the machine, make sure there are no bystanders in the vicinity.

A properly hitched and adjusted roller should move evenly behind or in front of the tractor during operation and compact the soil uniformly over the entire working width. The frame of the roller should take a horizontal position in relation to the field surface (adjust with the tractor's top link).

NOTE! Do not work the roller on soil that is too wet, as this causes the roller to become coated with soil.

NOTE! Do not work the roller on stony soil, as this risks cracking the roller's working elements.

4.5 Adjustment of the cultivation roller during operation / Turning the roller during operation

<u>Setting up the machine correctly for operation</u>

Position the machine for work so that the rollers are parallel to the ground. The front drawbar should be aligned horizontally.

- **It is forbidden to operate the machine with the drawbar at an angle!**

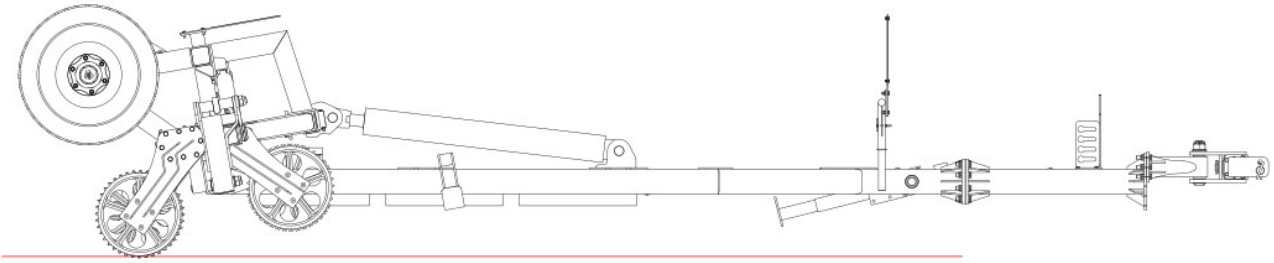


Figure 13 Incorrect working position of the roller

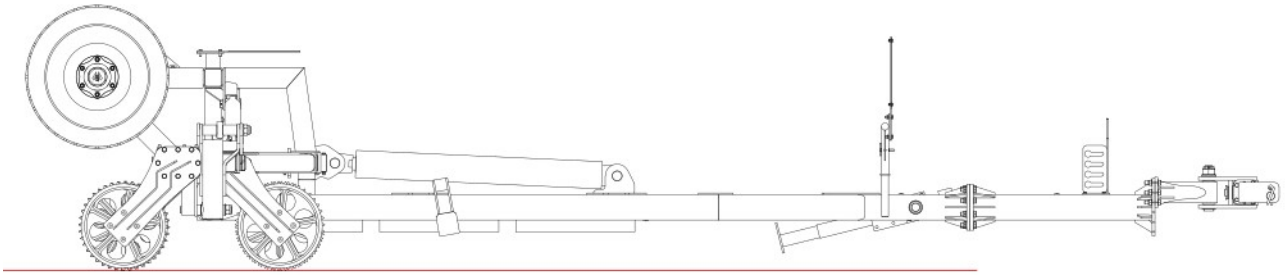


Figure 14 Correct working position for the cultivator

Turning the roller correctly

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

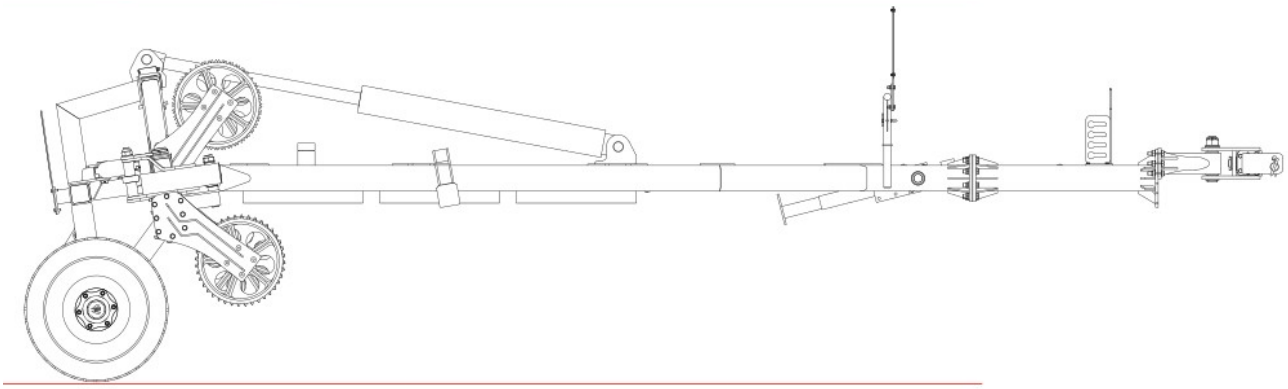


Figure 15 Correct turning of the cultivation roller

Turning at the ends of the field/headlands is only permitted when the machine is raised. When working with the machine, it is also advisable to use an additional weight on the front of the tractor to enable more stable and comfortable working.

4.6 Rules for transporting the roller on public roads and lighting the machine

NOTE! Special care must be taken when transporting the cultivator roller. 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 25 cm. The permissible transport speed of the tractor with the machine is 15 km/h. It should be reduced to 10 km/h on roads with poorer surfaces and 5 km/h on dirt roads. Extreme caution should be exercised when passing and overtaking other vehicles, avoiding obstacles and crossing large irregularities in fields and dirt roads.

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.

For transport, the side sections of the cultivation roller 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. The cultivation roller should be secured against unfolding by a mechanical lock.

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.

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.

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 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.

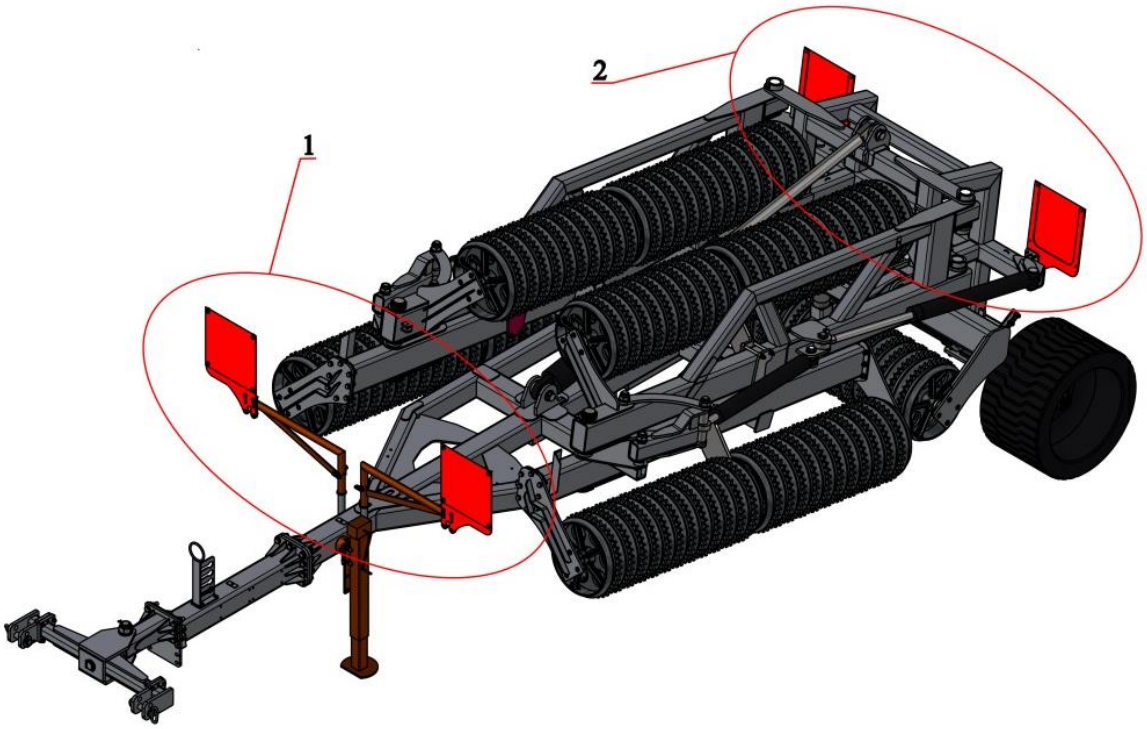


Figure 16 Location of light-warning boards in the MCB 12.3 H cultivation roller (1 - front lighting; 2 - rear lighting)

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. **Be sure to secure the lock!**

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

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

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

- It is forbidden to transport the roller when the slope transverse to the machine exceeds 7°.

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

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

5 Maintenance of the cultivation roller

5.1 Everyday service

- Whenever you have finished working with the cultivation roller, clean the machine thoroughly of soil and crop residue, inspect the bolt and pin connections and the condition of the working elements and other parts. When cleaning, plant debris and strings winding up at the bearing points of the roller should be removed.

- If parts are found to be damaged or worn, they should be replaced. All loose screw connections must be tightened and damaged cotter pins and pins must be replaced.

- After operation, lubricate the shaft bearings, hinges and actuator pins **(not less frequently than every 25 operating hours).** ŁT-43 grease can be used for lubrication.

- The working elements of the volok can be used almost until they are worn down, until the working surface is equal to the initial surface of the handle. However, it is advisable to replace the tine coulter and working elements of the volok early enough before there is a possibility of wear and damage to the blade holder. Damaged or worn parts must be replaced with new or reconditioned parts.

5.2 Operation of the hydraulic system

- A malfunctioning actuator (presence of leaks, etc.) must be dismantled and taken to a specialist workshop. The replacement actuator, once connected to the system, should cycle through its operation several times in order to fill the actuator completely with oil.

- The system pressure must be reduced before servicing the actuators, hoses and the accumulator. To do this, connect the system to the tractor and reduce the spring tension on the valve with a screw until the pointer points to zero.

- The ball valve should be in the open (operating) position. There may be residual pressure in the system which will cause oil to suddenly flow out under pressure.

- **When handling, take special care and work in full body protection (gloves to protect the hands, mask to protect the face).**

5.3 Hydraulic system quick couplings

- The machine's hydraulic system has quick couplings for quick and easy connection of the hoses and other hydraulic installation. Each quick coupling has its own designation (fig. 17):

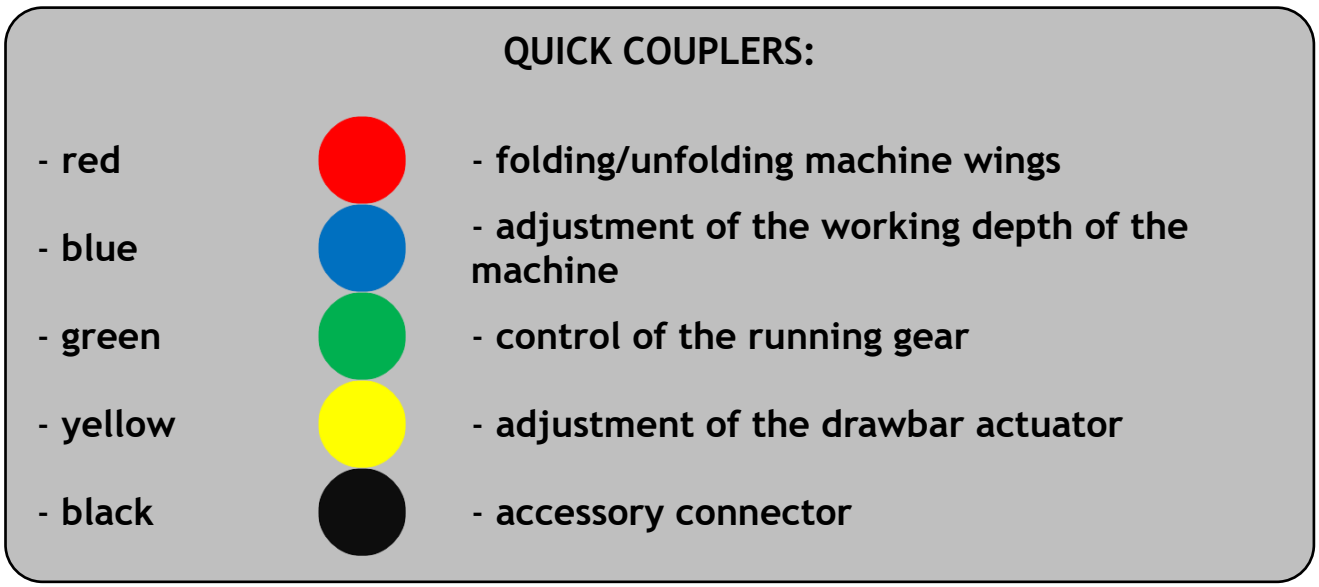


Figure 17 Colour coding of the hydraulic system's quick couplings.

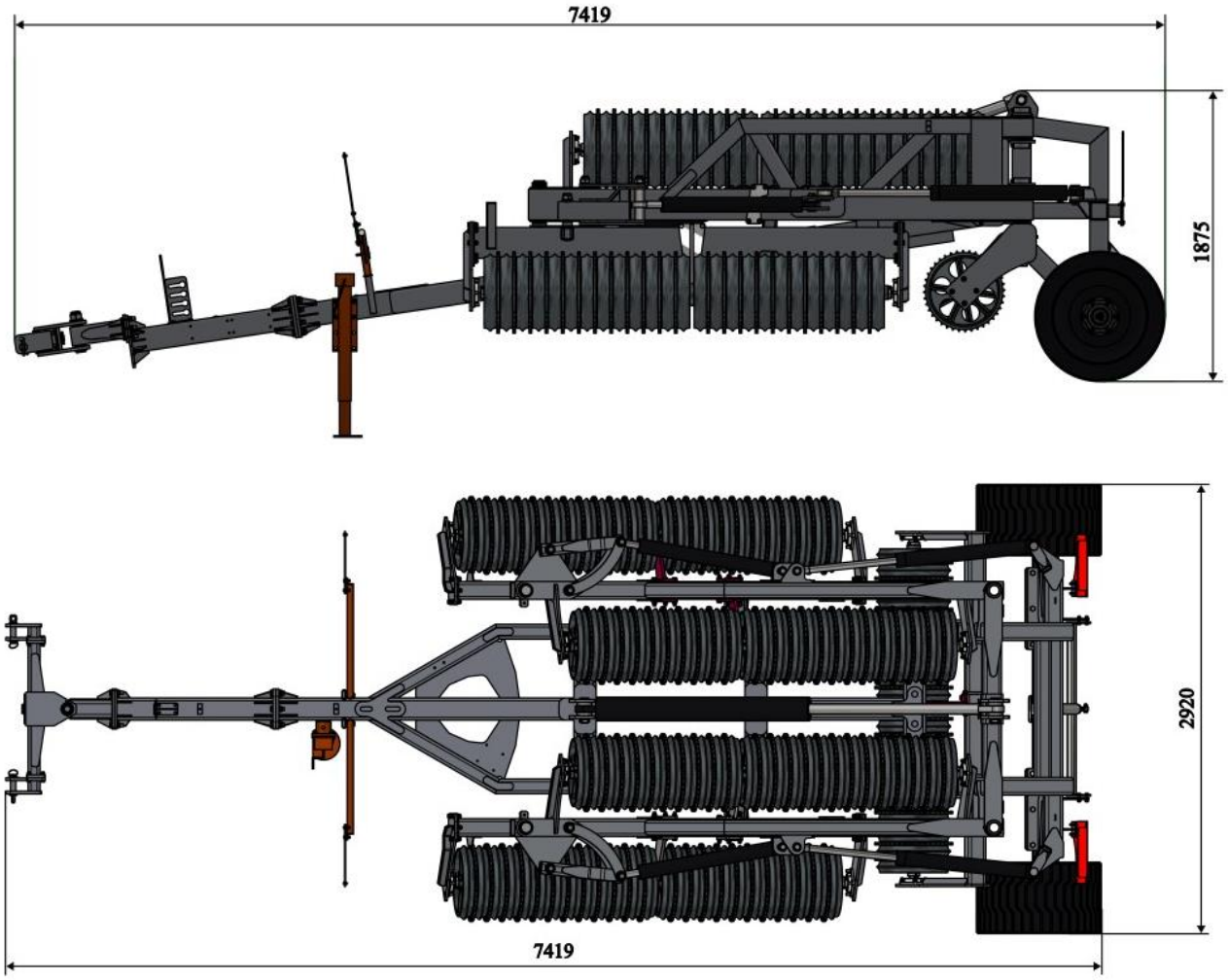
5.4 Faults and malfunctions of the cultivation roller

- The simple construction of the rollers and the materials used make the cultivation rollers extremely failure-free. The use of higher-strength GG20 cast iron for the ring castings has increased the durability of the rings.

- Please note that following all the recommendations of this manual with regard to operation, adjustment, lubrication, transport and storage of the shaft, considerably increases the service life of this machine.

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.

5.5 Main machine dimensions



5.6 Specifications

No.	Parameters	Unit	
1	Machine type		MCB 12,3 H
2	Working width	m	12.30
3	Unit dimensions in transport position: - length - width - height	 mm mm mm	 7419 2920 1875
4	Power requirement	KM	180
5	Total unit weight	kg	7140
6	Number of cast iron wheels	pcs.	247

7	Diameter of cast iron wheels	ø	525
8	Tyres	-	480/45-17
9	Number of transport wheels	pcs.	2
10	Wheel base of transport wheels	mm	2920
11	Transport speed	km/h	Max. 15
12	Braking system		Air brake (standard) Single-circuit hydraulic brake (optional) Dual-circuit hydraulic brake (optional)

5.7 Maintenance and lubrication of the machine

- Lubricators should be well cleaned before lubrication. The points should be lubricated according to the intensity of use:

- Each time the work with cultivation roller is completed, 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 result in damage to the machine.**

- When replacing worn components, use thread glue, original bolts and nuts.

- Always ensure that screw connections are properly tightened.

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

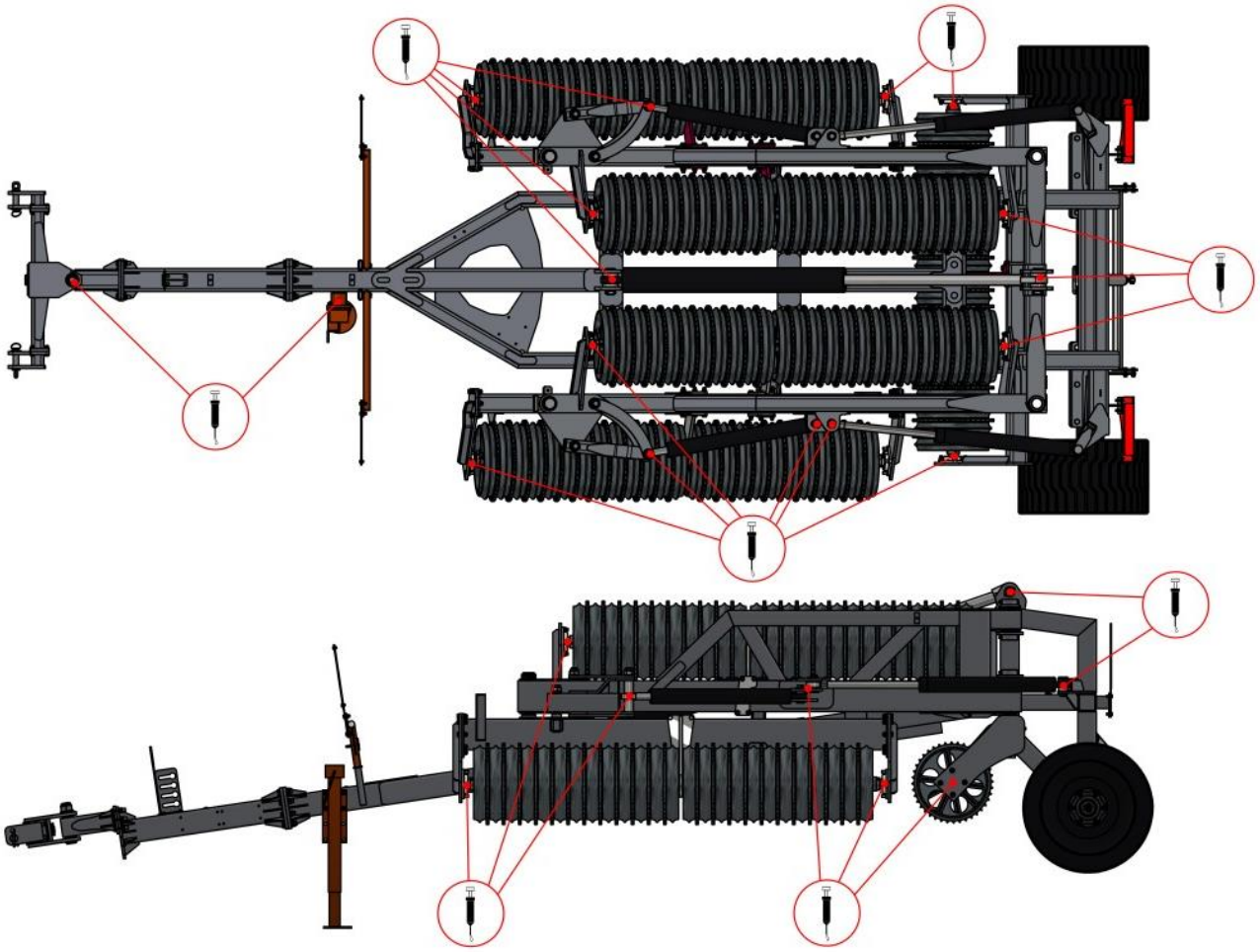


Figure 19 Lubrication points on the Cambridge MCB 12.3 H cultivation roller

- Lubricate all lubrication points until the friction surfaces are completely filled. Remove any residual grease. Too much grease causes dust and soil particles to stick together.

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

5.8 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 3 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!

6 Replacement procedures

Bearing replacement

If the bearings are damaged, they must be replaced:

1) place the machine on a horizontal surface,
2) unscrew the four screws holding the ball bearings on each side,

3) move the roller away,
4) loosen the two headless screws on each bearing and pull off the bearings using an extractor,
5) fit the new bearings loosely onto the shaft,
6) roll the shaft between the bearing plates and screw the bearings to them. Screw in the screws using adhesive to prevent loosening,

Replacement of cylinders

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

Replacement of working components

- Excessively worn working element make it difficult for tools to penetrate and cause an increase in working resistance.

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

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

- **When working on extremely worn work tools, such work can cause damage to other machine components, for example. Tools should be replaced when their wear and tear exceeds the limits allowed by the manual. If the recommendations are not followed, damage may occur for which the manufacturer is NOT RESPONSIBLE!**

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 Storage of the Cambridge cultivation roller

- After the cultivation season is over, the roller should be thoroughly cleaned of soil and crop residues, the bolt and pin connections should be inspected and the condition of the working elements and other parts should be checked. When cleaning, plant debris and strings winding up at the bearing points of the roller should be removed.

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

- **The roller should be stored in a place where it does not pose danger to people and the environment stably supported on support feet.** If the machine is stored outdoors for a long period of time, the maintenance of the working parts should be repeated when the preservative layer is rinsed off.

Clean the piston rods of the hydraulic 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.

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

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

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

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

8 Disassembly and disposal

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

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

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

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

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

9 Spare parts for the Cambridge cultivation roller

To search for, price and order genuine spare parts for MANDAM machines, please visit our website at: www.mandam.com.pl, under the "parts" tab.

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. 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.

Parts are shipped directly to the address provided and payment is made on delivery. If you are not sure, please contact the Mandam spare parts department on the following telephone numbers : +48 32-232-2660 ext. 39 or 45 or on the mobile number +48 668-66-22-89.

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