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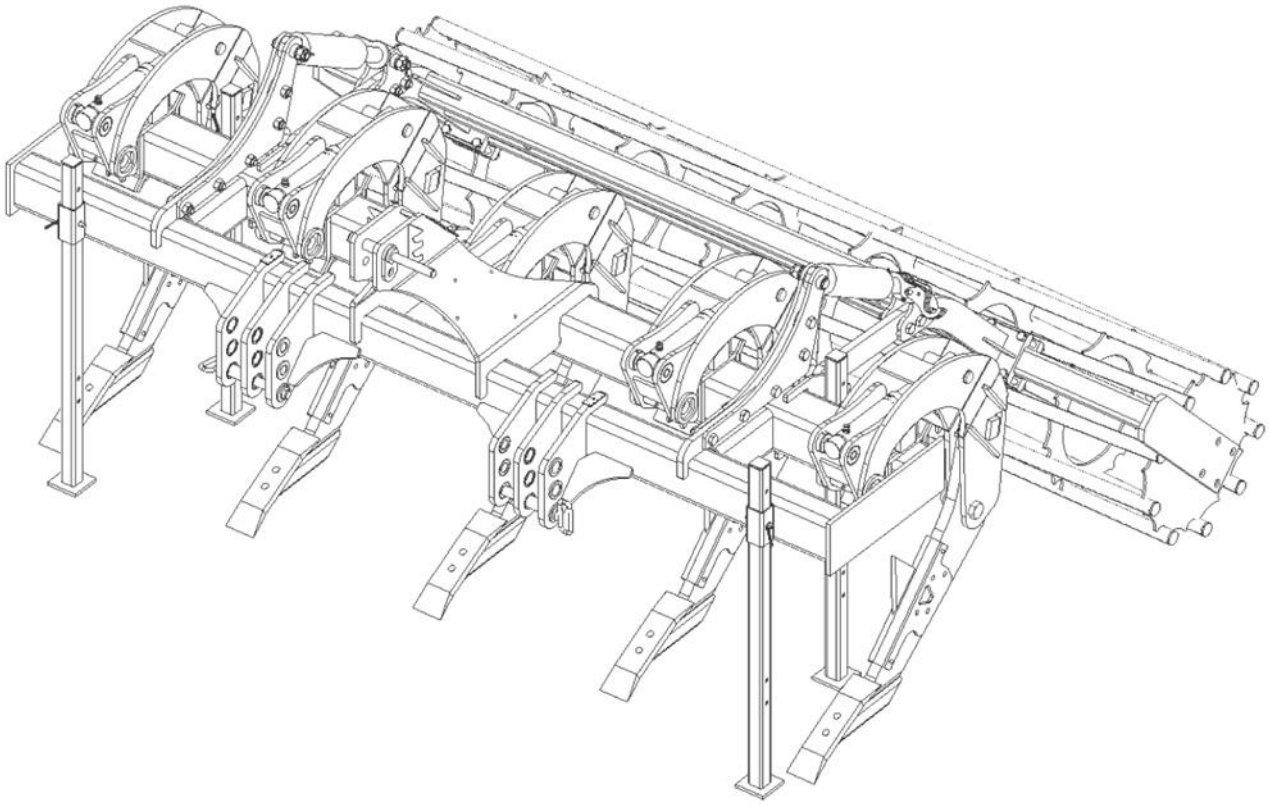
OPERATION MANUAL

CHISEL PLOUGH DIG



TŁUMACZENIE INSTRUKCJI ORYGINALNEJ
ENG

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:

CHISEL PLOUGH DIG

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

We would like to congratulate you on the acquisition of the DIG chisel plough. This manual provides information on the hazards that may occur when using the roller, technical data and the most important indications and recommendations, the knowledge and application of which are prerequisites for correct operation.

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

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

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

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

Machine identification

The identification data of the DIG chisel plough can be found on the rating plate on the drawbar. The rating plate contains basic information about the manufacturer and the machine, as well as the CE mark.

Figure 1 Rating plate

The guarantee for DIG chisel plough is valid for 24 months from the date of sale.

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

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

  +48 668 662 289

  parts@mandam.com.pl

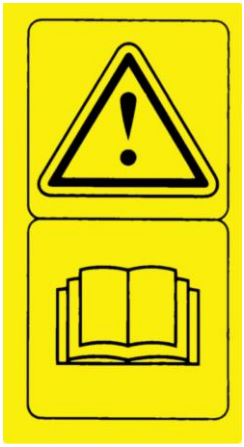
  authorised distributors of machines from Mandam Sp. z o. o.

1.1 Information and warning signs

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

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

Table 1. Information and warning signs.

Safety signs	*Meaning of the safety sign*
	Read the operating instructions before use.

Safety signs	*Meaning of the safety sign*
	Crushing of the toes or foot.
	Keep a safe distance from foldable and moving parts of the machine
	Do not reach into the crushing area if parts may move
	Pressurised liquid jet - bodily harm

Safety signs	*Meaning of the safety sign*
	Fixing point for transport belts
	Lubrication point
	Contact information for the spare parts department

2 General information

2.1 Construction and purpose of the DIG chisel plough.

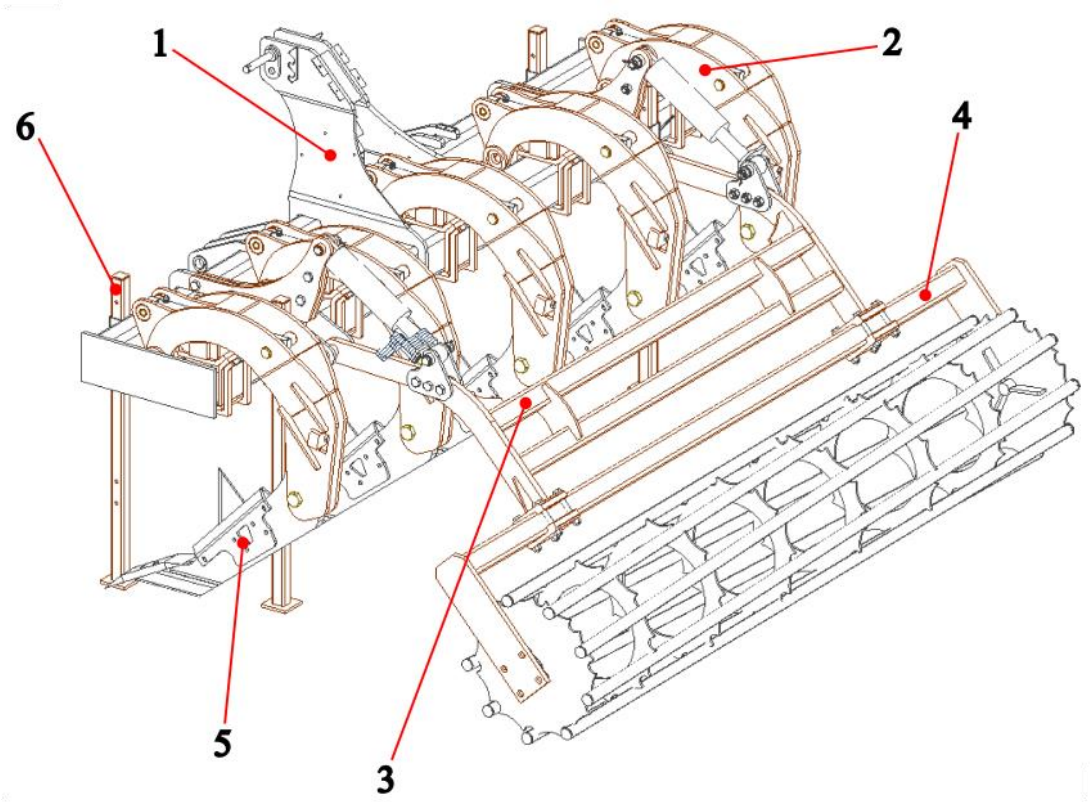


Figure 2 Construction of the DIG chisel plough. (1 - main frame with drawbar, 2 - hydraulic work unit holders, 3 - hydraulically adjustable arms, 4 - roller assembly, 5 - work unit (tine), 6 - support foot

2.2 Intended use of the DIG chisel plough

The chisel plough is designed for crushing, aerating the soil, deep loosening of the subsoil to improve its physical and biological properties and for intensive no-till cultivation.

The working depth oscillates between 15 and 45 cm. Recommended working speed - 6 - 12 km/h depending on conditions. The geometry of the three-fold tine allows it to penetrate even dry soil, pierce the plough pan and stir up plant residues.

The aeration and irrigation of the lower soil layers achieved by using the chisel plough provides an excellent agrotechnical effect and benefits the development of plants that have a deeper root system. The machine can be successfully used for subsoiling, performed mostly on soils for sugar beet, rape and alfalfa.

After using the chisel plough, there is no need for deep ploughing and crops can be sown after seasoning tools.

NOTE! Tractors working with a rear-mounted plough must be fitted with a set of front axle weights.

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

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

3 General safety rules

The chisel plough must only be started up, used and repaired by persons who are familiar with its operation and the mating tractor and with the rules of conduct for the safe operation and handling of the chisel plough. The manufacturer is not responsible for arbitrary changes to the design of the chisel plough. 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 the chisel plough and the tractor to ensure that they are in safe condition for movement and operation,
- 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 pins, cotter pins and split cotters,
- do not approach the chisel plug while it is being raised and lowered,
- do not remain between the tractor and the chisel plough while the engine is running,
- move the chisel plough, lift and lower it slowly and gently without sudden jerks, taking care not to allow any bystanders in the vicinity,
- it is forbidden to reverse the tractor or make a U-turn with the machine lowered into the working position,
- the tractor's independent brake system must not be used when turning or working with the chisel plough,
- do not stand on the machine or put additional weights 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, inspections, maintenance work (greasing etc.), cleaning of working parts and any intervention in the machine only with the engine switched off and the chisel plough lowered,
- during maintenance and replacement of parts, entering or underneath the machine without adequate protection can cause head injuries - in this case a helmet must be used,
- when not in use, lower the machine to the ground and stop the tractor engine,
- driving and parking the chisel plough on a slope with unstable ground may cause a

landslide, therefore the machine should only be unhooked from the tractor on a level surface guaranteeing a stable stand,
- machinery must be stored in such a way as to prevent injury to persons,
- keep agricultural equipment out of the reach of livestock.

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! The marking elements of a chisel plough for use on public roads are not standard equipment. The user can buy them from machinery and agricultural parts dealers.

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

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,
- When coupling the tractor to the chisel plough, it is forbidden for people to be between the machine and the tractor during this time,
- The tractor working with the chisel plug must be fully operational. It is forbidden to couple the machine to a tractor with a defective hydraulic system,
- Ensure that the following are maintained: tractor balance with the chisel plough attached, its steering and braking ability - front axle load must not fall below 20% of the tractor's total axle load - front weight set,
- 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 Hydraulic system

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

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

3.3 Noise and vibrations

- When operating a chisel plough, there is no noise hazard to the operator contributing to hearing loss, as the chisel plough is a passive implement and the operator's seat is in the tractor cab. It should be added that the noise caused by the operation of the chisel plough does not exceed 70dB.

- Operator hazards due to vibration do not occur when operating a chisel plough. This is because the operator's workstation is located in the tractor cab and the seat is cushioned.

3.4 Compliance with standards

Our chisel plough 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.

3.5 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.

3.6 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

The chisel plough is a relatively simple design that allows for efficient operation. Its main component is the main frame of the chisel plough, which is the basic element of the whole machine. There are tines attached to the chisel plough frame that have hydraulic protection. The machine is equipped with a roller unit with hydraulic adjustment of the working depth. This allows the operator to easily and simply adjust the position of the roller assembly. **The user of the machine, apart from working parts, does not receive spare parts**.

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

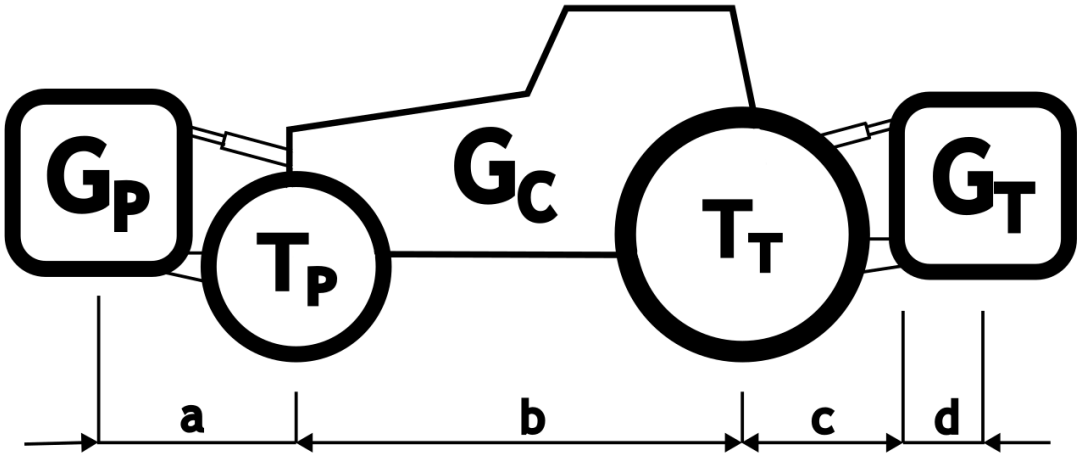


Figure 4 Diagram of tractor load designations

Minimum load at the front for rear-mounted machine:

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

Actual front axle load

Designations:

G_C – tractor dead weight,

T_P– front axle load of the empty tractor,

T_T – rear axle load of the empty tractor,

G_P – total weight of front-mounted device,

G_T – total weight of rear-mounted device,

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

Actual total weight

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

Actual rear axle load

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

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%.

4.1 Coupling the chisel plough 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.

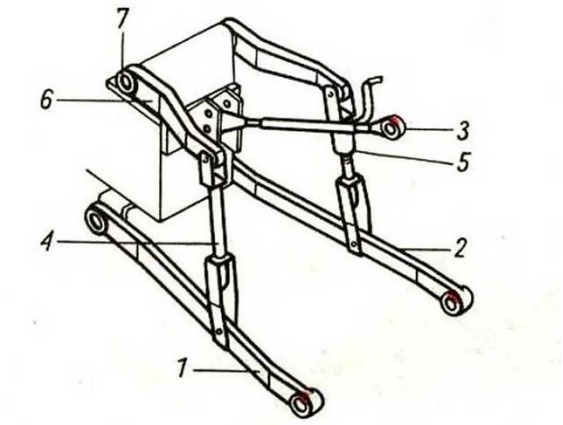


Figure 4 Three-point linkage of the tractor: 1,2 - lower links, 3 - upper fastener, 4 - left suspension, 5 - right suspension with adjustable length, 6 - lift arm, 7 - lift roller

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

1) Check the pressure in the wheels on one axle of the tractor, it must be the same to ensure an even working depth of the unit
2) Switch the tractor hydraulic system to position control
3) Reverse the tractor to a distance that allows the unit hitch to be connected to the lower links of the tractor,

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

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.

4.2 DIG chisel plough adjustment

The chisel plough is usually supplied ready for sale, however, the condition of the unit should be checked before starting work, especially the condition of the working parts and bolted connections. During the inspection, the plough should be secured against overturning by means of properly adjusted support legs (these are standard equipment on the chisel plough).

- Loose screw connections should be tightened.

- If you have purchased a chisel plough supplied without a working roller fitted, the components must be assembled when the unit is first prepared for operation.

For this purpose, the unit must be placed on a flat paved surface in a location that allows the assemblies to be manoeuvred. First install the roller arm in the bracket located on the main frame and then set the work depth adjustment actuators (see Figure 5 for the most important installation points). The next step will be to tighten the clamp assembly and the roller.

- It is important to ensure that the bolts holding the roller arm to the bracket are screwed in diagonally so that the entire plane of the arm forging is flush with the plane of the roller bracket profile.

- A lifting device with a lifting capacity of at least 500 kg must be used to transport the roller for reasons of stability during transport.

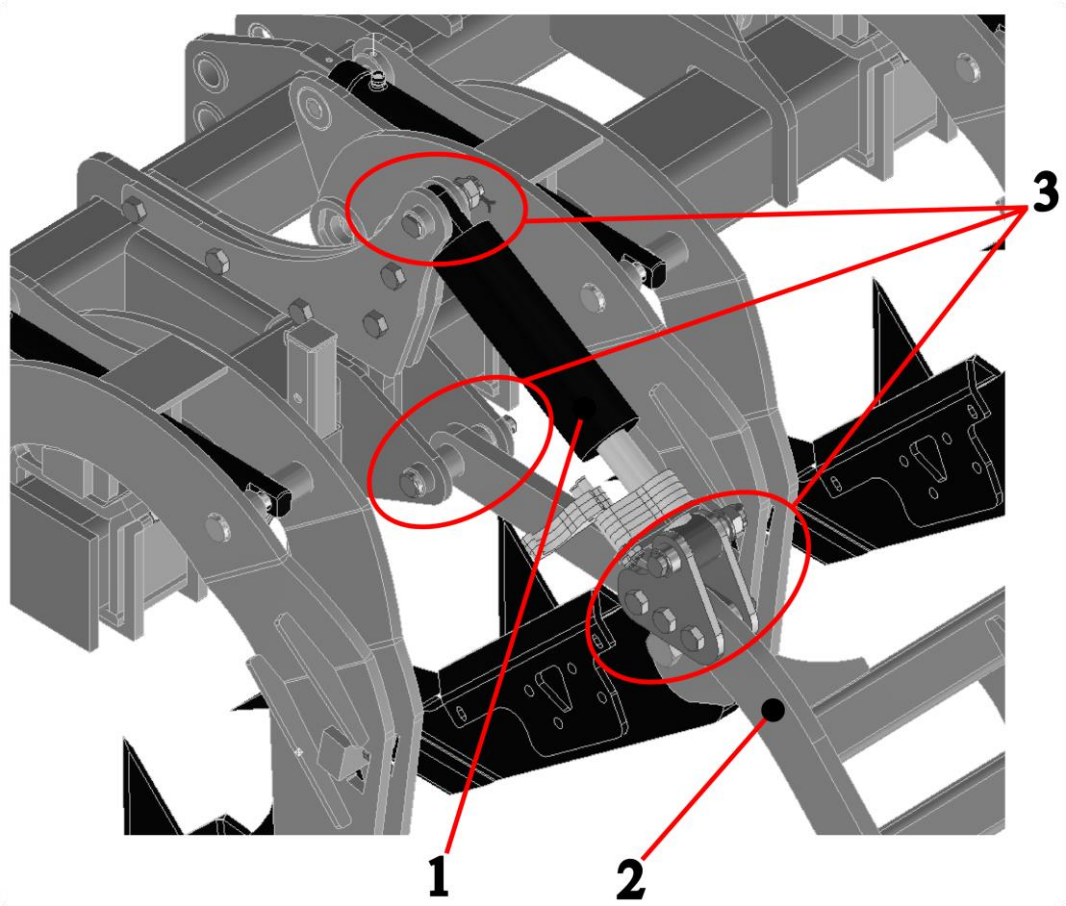


Figure 5 Connection of the arms to the roller bracket (1 - ratchet actuator, 2 - roller arm, 3 - attachment points for the roller arm and the hydraulic depth control actuator)

Behind the working section is the roller assembly. Its job is to maintain working depth, level the field surface and crush soil aggregates into smaller pieces. The working depth is set by actuators controlled by the tractor's external hydraulics.

- During machine operation, the working depth of the tines is adjusted - this is done by changing the position of the roller using a hydraulic working depth.

The working depth of the machine is set using pawls located at the piston rod of the actuator. As more pawls are folded, the operation of the machine becomes shallower. In a configuration where none of the pawls are installed, the machine is in its greatest working depth configuration.

- In fig. 6 and fig. 7, the correct way of installing the subsequent pawl plates on the actuator and the incorrect way of installing them are shown.

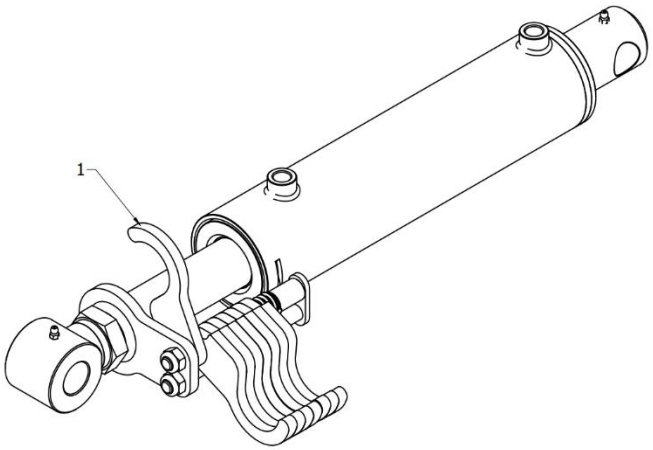


Figure 6 Correct way to put the first (1) ratchet on the piston rod of the actuator to adjust the working depth of the machine.

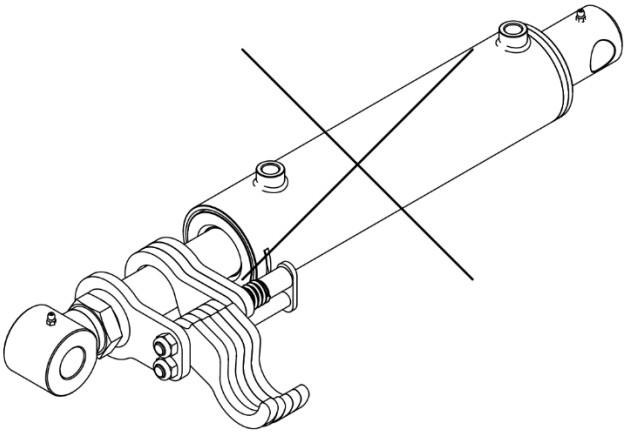


Figure 7 Incorrect way of fitting the ratchets to the piston rod of the actuator. Partial omission of the attachment of the pawls to the actuator results in uneven distribution of the forces acting on the piston rod and can lead to piston rod buckling resulting in damage to the entire actuator assembly. This kind of adjustment is **unacceptable**!

4.3 DIG chisel plough working unit

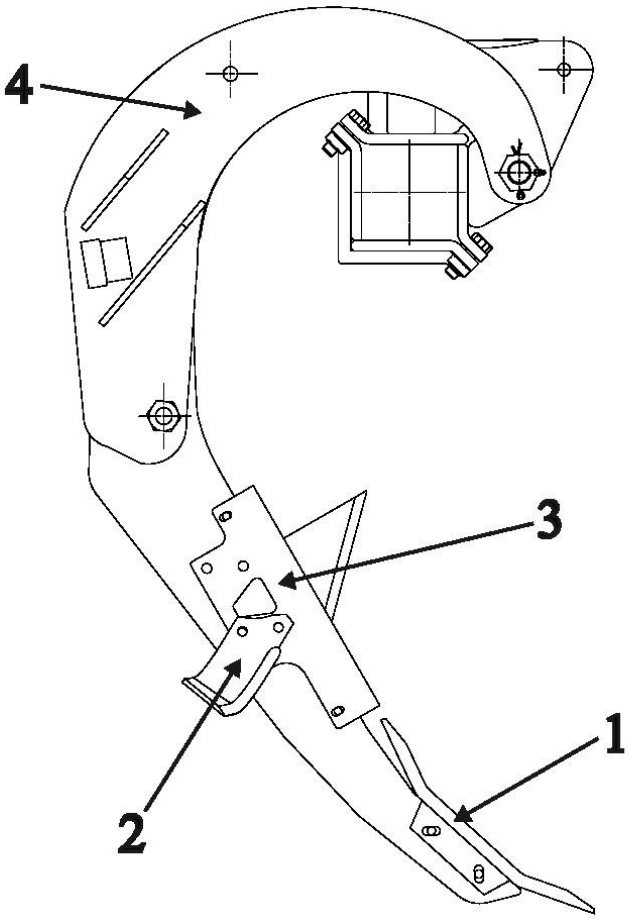


Figure 8 Operating element of the DIG chisel plough

The operating element of the DIG chisel plough (Figure 8) consists of:

1) chisels - double-sided design allows 180° rotation when one end is worn,
2) wing - create a 'soil explosion' effect by loosening, aerating the soil and mixing in crop residues. Setting in 2 positions is possible,
3) blade with guard - dedicated to heavy soils. A bladeless guard is optionally available,
4) hydraulic adjustment system,

The wing is a removable component. On compacted soils, it is advisable to work shallowly with the wings so as not to bring large soil aggregates to the surface. For deep loosening, it is advisable to remove the wings completely on compacted soils.

To remove the wings you need to:

1) at first, knock out the security,
2) remove the tine guard,
3) then unscrew the wings from the tine cover,
4) reinstall the cover on the tine,

4.4 Operation of the chisel plough

The chisel plough should be used for the first test run, during which the plough setting and behaviour should be checked. If necessary, adjust the length of the tractor linkage so that the plough frame is horizontal.

A properly hitched chisel plough should follow the tractor evenly during operation and loosen the soil uniformly over the entire working width. The correct working depth of the chisel plough is set using a roller unit with hydraulic depth control.

The machine must be cleaned of soil and plant debris before being driven on a public road. A warning light for road transport for slow-moving oversize vehicles (rear lighting and marker lights according to traffic regulations) must be mounted on the chisel plough frame.

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

NOTE! The maximum working depth is 450 mm. If this parameter is exceeded, there is a risk of failure or accident.

NOTE! Operation of the chisel plough on heavily stony soil is not permitted, as there is a risk of damaging the machine's working parts or causing an accident. It is unacceptable to work the chisel plough on soil that is too wet.

- The tractor hydraulics should be set to position control, but force or mixed control can be used in adverse conditions.

4.5 Setting the hydraulic body protection

During operation, the hydraulic body protection hoses must be permanently connected to the tractor's external hydraulics via the "P" input and "T" output.

The pressure on the pressure gauge should indicate **140 bar**. Pressurisation to the required pressure is carried out by topping up oil under pressure from the tractor's external hydraulics via the "P" input. A lower pressure than recommended will reduce the excitation force of the body protection system. The pressure increase in the system during operation is taken over by the hydroaccumulator used. When the limit values are exceeded, the excess oil is fed back to the tractor via output "T" and then automatically topped up via input "P".

The appropriate operating pressure can be achieved by adjusting the "BP", with which we set the appropriate operating pressure, and the "AP", with which we adjust the safety pressure. The valve is factory-adapted for the corresponding operation.

NOTE! The ball valve must be in the open position (free flow through the valve) during use. The ball valve must be closed when carrying out service work with the hydraulic system between the tractor and the ball valve.

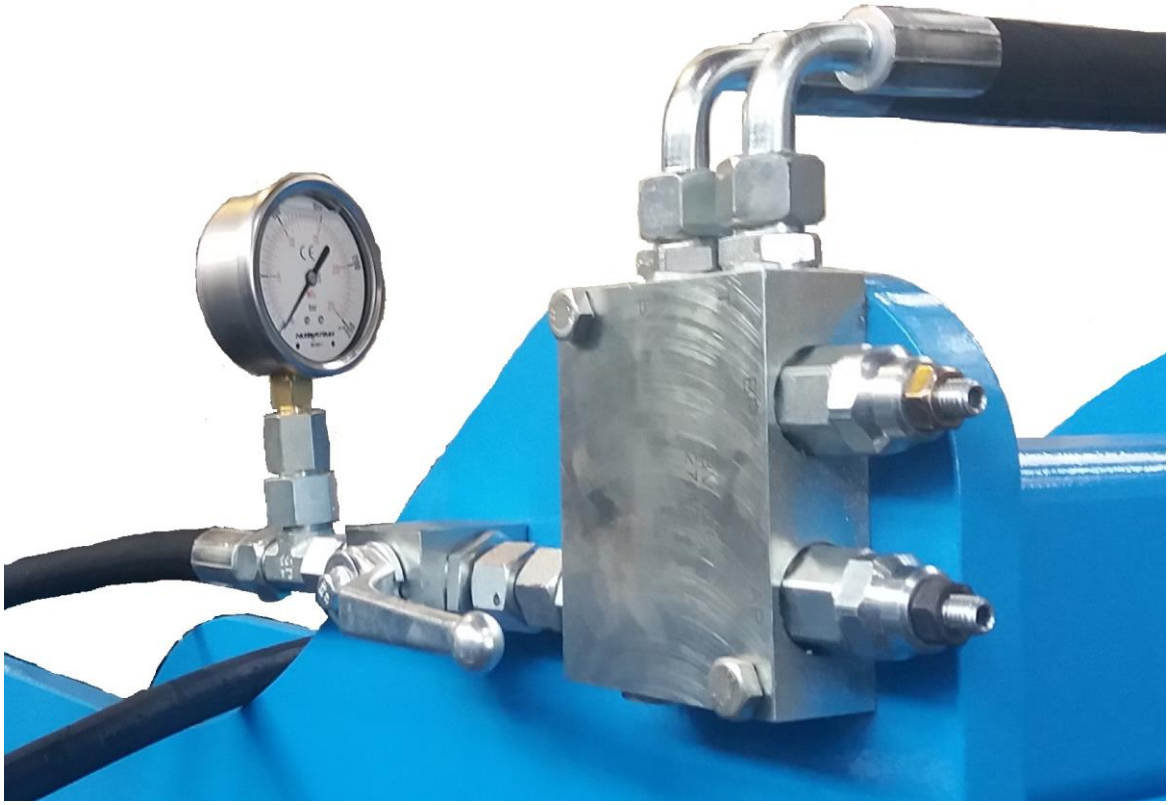


Figure 9a Hydraulic protection control unit.

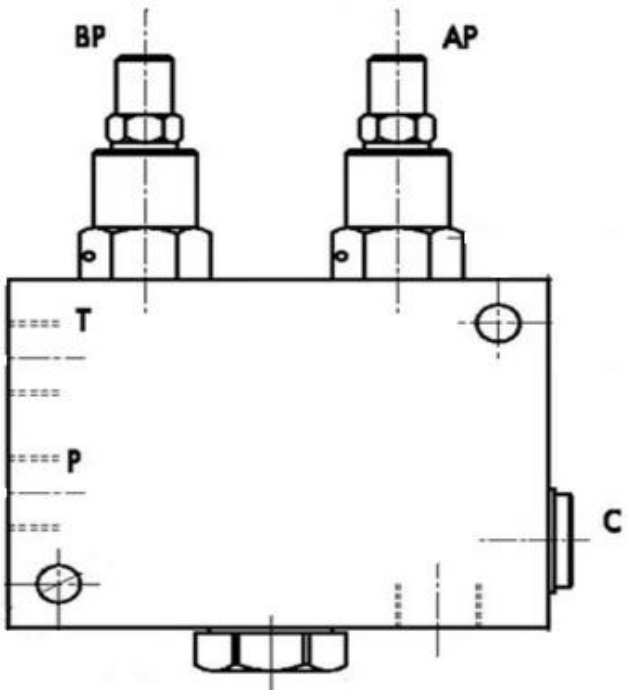


Figure 9b NON-STOP valve; P- input (tractor supply), T- return, C- machine system, BP- system load control, AP- safety trigger.

4.6 Adjusting the chisel plough while working / Turning the chisel plough

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

The machine must be set up parallel to the ground to be used. The front drawbar should be aligned horizontally. **It is forbidden to operate the machine with the drawbar at an angle!**

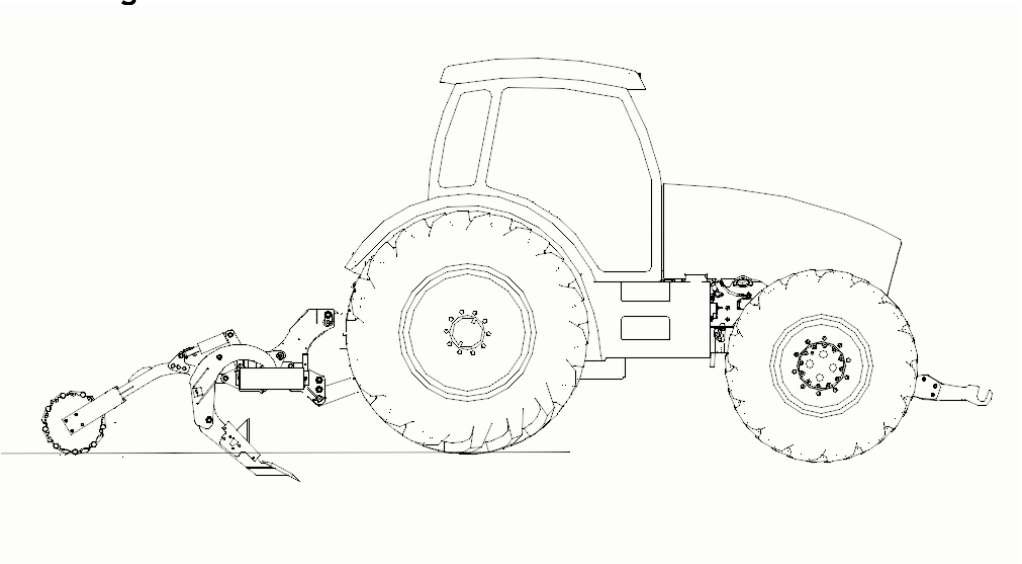


Figure 10 Correct working position for a chisel plough

- **Proper turning with a chisel plough**

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

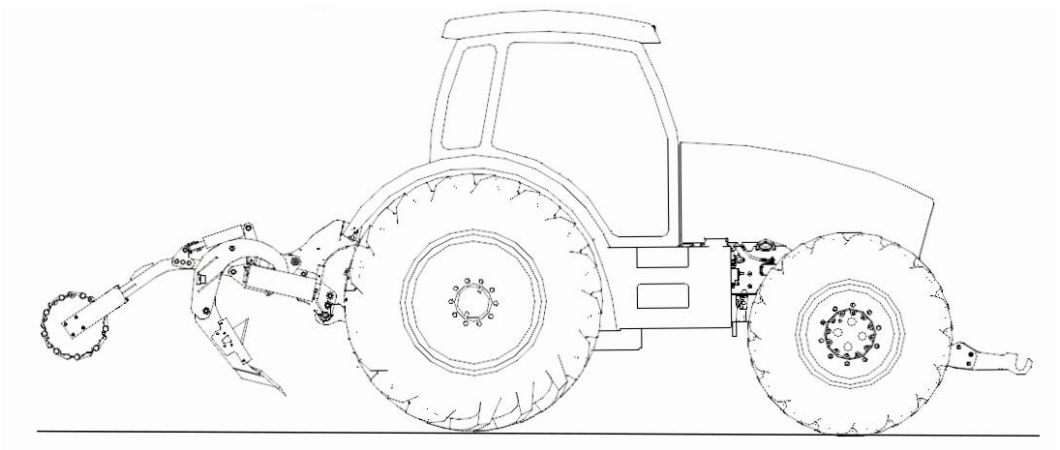


Figure 11 Turning the machine correctly.

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.

4.7 Rules for transporting the chisel plough on public roads and lighting the machine

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

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

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

The permissible transport speed for the tractor with the machine on smooth roads is up to **25 km/h**. On roads with poorer surfaces (dirt or cobblestones) it should be lowered to a maximum of **10 km/h**, and on bumpy roads to **5 km/h**. Extreme caution should be exercised when passing and overtaking other vehicles, avoiding obstacles and crossing large irregularities in fields and dirt roads.

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

The machine must be thoroughly cleaned of adhering plant debris and soil before being driven on the public road. Portable warning-light devices and a distinguishing sign for slow-moving vehicles (according to current traffic regulations) should be attached to the

ends of the unit frame. The machine must be fitted with rear lights and front contour lights (according to current traffic regulations) and side reflectors.

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

NOTE! The unit as a part of the vehicle protruding beyond the rear side contour of the tractor obscuring the rear lights of the tractor poses a danger to other vehicles on the road. It is forbidden to travel on public roads without appropriate markings.

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

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

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

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

- When work is complete (in the case of hydraulically foldable units for which the width of the machine in the working position exceeds 3.0 m), fold the machine into the transport position. **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 chisel plough 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 Technical maintenance.

5.1 Everyday maintenance.

- Each time a chisel plough operation is completed, the machine should be thoroughly cleaned of soil and plant debris, the bolted and pin connections should be inspected and the condition of the working elements and other parts should be checked. When cleaning, plant debris and strings winding up at the bearing points of the roller should be removed.

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

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

5.2 Replacement of working components.

- Excessive wear on the working elements makes it difficult for the machine to sink into the ground and increases 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 roller) must be provided. After lowering the chisel plough, switching off the tractor engine and applying the handbrake, check the stability of the tractor-machine combination. Only suitable screws should be used to fix new components.

5.3 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).**

5.4 Faults and malfunctions of the chisel plough

The DIG chisel plough is distinguished by its very low failure rate due to the simplicity of its design and the materials used. In order to extend the service life of the machine, all the recommendations of this manual regarding operation, adjustment, lubrication, transport and storage must be followed. When operating the machine on soils in the presence of stones, it is recommended to equip the machine with the optional hydraulic protection of the working elements.

Table 2 Causes and remedies of faults and malfunctions of the DIG chisel plough.

Fault, malfunction	Reason	Repair method
- uneven penetration of tines	- poor levelling of the machine - misaligned roller	- level the machine longitudinally and transversely - level and correct the roller
- poor tine penetration	- excessively worn tines - roller too low	- replace the tines - lift the roller
- clogging of tines	- working depth too deep	- reduce the depth
- poor soil compression by the roller	- poorly levelled machine - roller too high	- lengthen the top link - lower the roller

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

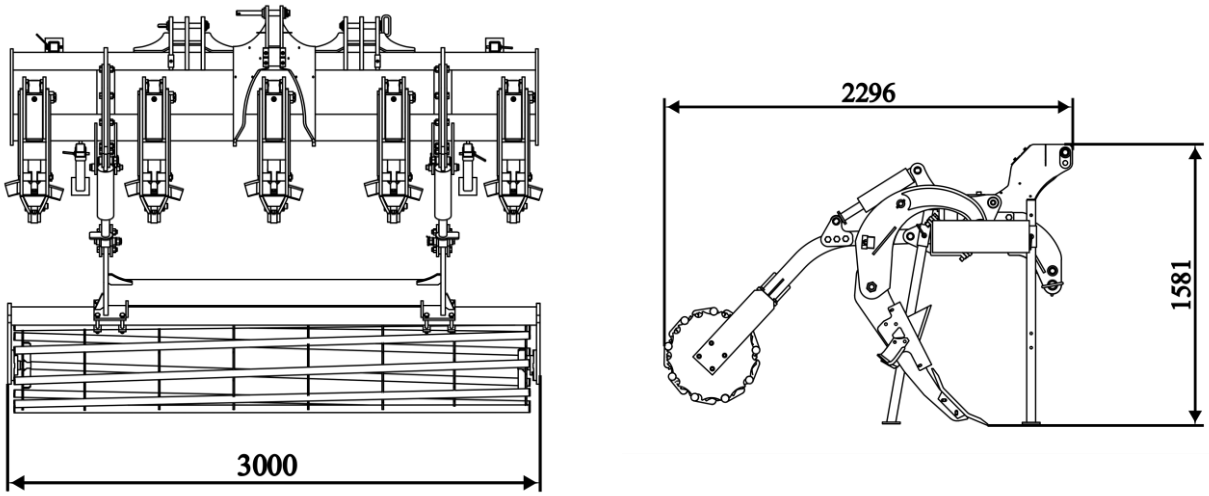


Figure 12 Transport and working dimensions of the DIG chisel plough

5.6 Specifications

Table 3 Technical characteristics of the DIG chisel plough

No.	Parameters	Unit	Chisel plough		
1	Machine type		DIG 3.0 / 3	DIG 3.0 / 4	DIG 3.0 / 5
2	Working width	m	3.00	3.00	3.00
3	Unit dimensions in transport position: - length - width - height	 mm mm mm	 2296 3000 1581	 2296 3000 1581	 2296 3000 1581
4	Power requirement	KM	120	160	200
5	Total unit weight	kg	988	1168	1452
6	Number of tines	pcs.	3	4	5
7	Working tine spacing	[mm]	1350	900	675
8	Transport speed	km/h	max. 25	max. 25	max. 25

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,
- The chisel plough must be cleaned from the ground each time after work, followed by an inspection of the parts and assemblies. **Otherwise, there may be**

a problem with the height adjustment of the rollers if there is soil clogging them and the resulting 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 and pins,
- Always ensure that screw connections are properly tightened.

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

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

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

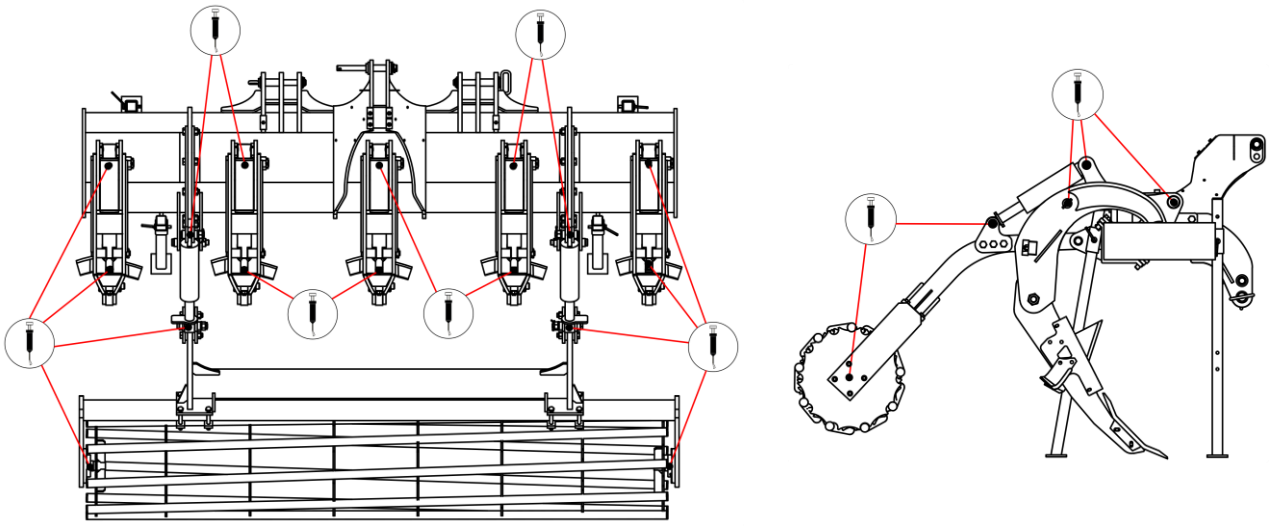


Figure 13 Lubrication points on the DIG chisel plough.

- 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.

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 below (Table 4).

Table 4 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

6 Replacement procedures

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 roller) must be provided. In the case of a trolley, the maximum lowered wheels can also be used as supports. After lowering the chisel plough, 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!**

Replacement of actuators

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

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 roller,
6) roll the roller between the bearing plates and screw the bearings to them. Screw in the screws using adhesive to prevent loosening,

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 DIG chisel plough

- After the chisel plough season is over, the roller should be thoroughly cleaned of soil and crop residue, 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 unit should be stored in covered premises. In the absence of a covered area, outdoor storage of the machine is permitted.

- **The chisel plough should be stored in a place where it does not pose a danger to persons 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 actuators during winter and when the machine is not in use for a long period of time and protect them with vaseline or acid-free grease to protect them from corrosion.

NOTE! The plough must rest on the support feet during storage. The chisel plough 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.

The dismantling and disposal of a used chisel plough 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 Replacement parts for DIG chisel plough

- To search for, price and order original spare parts for MANDAM Sp. z o.o. machinery, please visit our website at: www.mandam.com.pl, tab “parts”.
- On this page, we provide catalogues and spare parts sheets in PDF format, containing up-to-date parts diagrams for each machine, together with their numbers and prices. The ordering regulations can also be found there.

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

@ parts@mandam.com.pl

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

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

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

+48 797 518 831 (Mateusz)

+48 668 662 289 (Jerzy)

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