



PRONAR Sp. z o.o.

17-210 NAREW, UL. MICKIEWICZA 101A, PODLASKIE PROVINCE

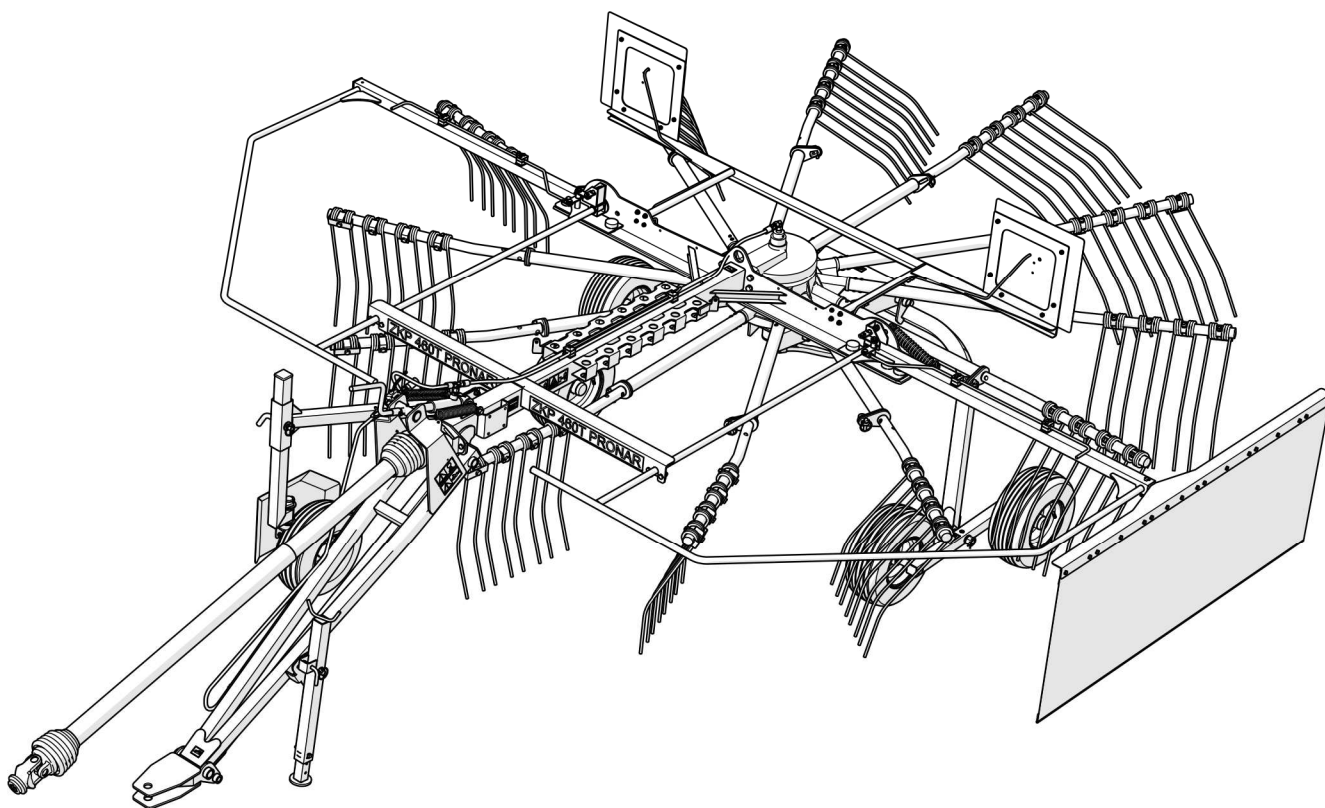
phone:	+48 085 681 63 29	+48 085 681 64 29
	+48 085 681 63 81	+48 085 681 63 82
fax:	+48 085 681 63 83	+48 085 682 71 10

www.pronar.pl

OPERATOR MANUAL

ROTARY RAKE PRONAR ZKP460T

TRANSLATION OF THE ORIGINAL COPY OF THE MANUAL



EDITION 1A-06-2016

PUBLICATION NO 524N-00000000-UM



INTRODUCTION

Information in this document is current at date of publication. As a result of improvements, some numerical values and illustrations in this publication may not correspond to the actual specification of the machine supplied to the user. The manufacturer reserves the right to introduce design changes in machines produced that facilitate and improve the quality of machine operation, without making minor amendments to this Operator Manual.

This Operator Manual is an integral part of the machine documentation. Before using the machine, the user must carefully read this Operator Manual and observe all recommendations.

This guarantees safe operation and ensures failure-free work of the machine. The machine is designed to meet obligatory standards, documents and legal regulations currently in force.

The manual describes the basic principles of safe use and operation of ZKP460T Rotary rake.

If the information in this Operator Manual needs clarification, refer for assistance to the sale point where the machine was purchased or to the Manufacturer.

MANUFACTURER'S ADDRESS:

*PRONAR Sp. z o.o.
ul. Mickiewicza 101A
17-210 Narew*

CONTACT TELEPHONES

+48 085 681 63 29

+48 085 681 64 29

+48 085 681 63 81

+48 085 681 63 82

SYMBOLS APPEARING IN THIS OPERATOR MANUAL

Information, descriptions of danger and precautions and also recommendations and prohibitions associated with user safety instructions are marked:



and also preceded by the word "**DANGER.**" Failure to observe the instructions may endanger the machine operator's or other person's health or life.

Vital information and instructions that must be observed are by the symbol:



and also preceded by the word "**IMPORTANT**". Failure to observe the instructions may lead to damage to the machine as a result of improper operation, adjustment or use.

In order to focus the user's attention on the need to perform maintenance, the relevant section of the Operator Manual is marked with the pictogram:



Additional tips and advice for machine operation are marked with the sign:



and also preceded by the word "**TIP**".

DIRECTIONS USED IN THIS OPERATOR MANUAL

Left side – side to the left hand of the operator facing in the direction of machine's forward travel.

Right side – side to the right hand of the operator facing in the direction of machine's forward travel.

REQUIRED MAINTENANCE

Maintenance actions described in the manual are marked with the sign:

Result of maintenance/adjustment actions or comments concerning the performance of actions are marked with the sign:



PRONAR Sp. z o.o.

ul. Mickiewicza 101 A
17-210 Narew, Polska

tel./fax (+48 85) 681 63 29, 681 63 81, 681 63 82,
681 63 84, 681 64 29

fax (+48 85) 681 63 83

http://www.pronar.pl

e-mail: pronar@pronar.pl

EC DECLARATION OF CONFORMITY OF THE MACHINERY

PRONAR Sp. z o.o. declares with full responsibility, that the machine:

Description and identification of the machinery	
Generic denomination and function:	Rotary Rake
Type:	ZKP460T
Model:	—
Serial number:	
Commercial name:	Rotary Rake PRONAR ZKP460T

to which this declaration relates, fulfills all the relevant provisions of the Directive **2006/42/EC** of The European Parliament and of The Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (Official Journal of the EU, L 157/24 of 09.06.2006).

The person authorized to compile the technical file is the Head of Research and Development Department at PRONAR Sp. z o.o., 17-210 Narew, ul. Mickiewicza 101A, Poland.

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

Narew, the 2016-06-10

Place and date

PRONAR
Spółka z o.o.
17-210 Narew, ul. Mickiewicza 101 A
tel. (85) 681 6329, 681 6429
fax (85) 681 6383

Ł-CIA DYREKTORA
d/s technicznych
członek zarządu

Roman Węclowski

*Full name of the empowered person
position, signature*

CONTENTS

1	BASIC INFORMATION	1.1
1.1	ROTARY RAKE IDENTIFICATION	1.2
1.2	INTENDED USE	1.3
1.3	EQUIPMENT	1.5
1.4	TERMS & CONDITIONS OF WARRANTY	1.5
1.5	TRANSPORT	1.6
1.5.1	INDEPENDENT SHIPPING BY THE USER	1.8
1.6	ENVIRONMENTAL RISK	1.9
1.7	WITHDRAWAL FROM USE	1.10
2	SAFETY ADVICE	2.1
2.1	BASIC SAFETY RULES	2.2
2.1.1	USE OF A ROTARY RAKE	2.2
2.1.2	HITCHING AND DISCONNECTING THE ROTARY RAKE	2.3
2.1.3	TRANSPORTING THE MACHINE	2.4
2.1.4	HYDRAULIC SYSTEM	2.5
2.1.5	OPERATION WITH PTO	2.5
2.1.6	MACHINE OPERATION	2.7
2.1.7	CLEANING, MAINTENANCE AND REPAIRS	2.8
2.2	RESIDUAL RISK	2.9
2.3	INFORMATION AND WARNING DECALS	2.10
3	DESIGN AND OPERATION	3.1
3.1	TECHNICAL SPECIFICATION	3.2
3.2	ROTARY RAKE DESIGN	3.3
3.2.1	ROTARY RAKE DESIGN	3.3
3.2.2	HYDRAULIC SYSTEM	3.5

3.2.3 LIGHTING SYSTEM	3.6
3.3 OPERATING PRINCIPLE	3.8
4 CORRECT USE	4.1
4.1 PREPARING FOR WORK BEFORE THE FIRST USE	4.2
4.1.1 CHECKING THE ROTARY RAKE AFTER DELIVERY	4.2
4.1.2 PREPARING THE ROTARY RAKE FOR THE FIRST USE	4.3
4.1.3 TEST START	4.4
4.2 TECHNICAL CONDITION INSPECTION	4.6
4.3 HITCHING TO TRACTOR	4.7
4.4 TRANSPORTING THE MACHINE	4.9
4.4.1 SETTING THE ROTARY RAKE IN TRANSPORT POSITION	4.10
4.4.2 DISASSEMBLING THE RAKING ARMS	4.12
4.5 ROTARY RAKE OPERATION	4.13
4.5.1 SETTING THE ROTARY RAKE TO WORKING POSITION	4.13
4.5.2 SETTING THE RAKING HEIGHT	4.14
4.5.3 SETTING THE SWATH WIDTH	4.16
4.5.4 SETTING THE SIDE TIPPING OF THE WORKING UNIT	4.17
4.5.5 SETTING THE GAUGE WHEEL (OPTION)	4.18
4.5.6 RAKING	4.19
4.6 UNHITCHING THE ROTARY RAKE	4.20
5 MAINTENANCE	5.1
5.1 PRELIMINARY INFORMATION	5.2
5.2 REDUCTION GEAR MAINTENANCE	5.2
5.3 STORAGE	5.4
5.4 LUBRICATION	5.5
5.5 CHECKING AND REPLACEMENT OF SPRING RAKE TINES	5.8
5.6 GAUGE WHEEL MOUNTING	5.9

5.7 TIGHTENING TORQUE FOR NUT AND BOLT CONNECTIONS	5.11
5.8 TROUBLESHOOTING	5.12

SECTION

1

BASIC INFORMATION

1.1 ROTARY RAKE IDENTIFICATION

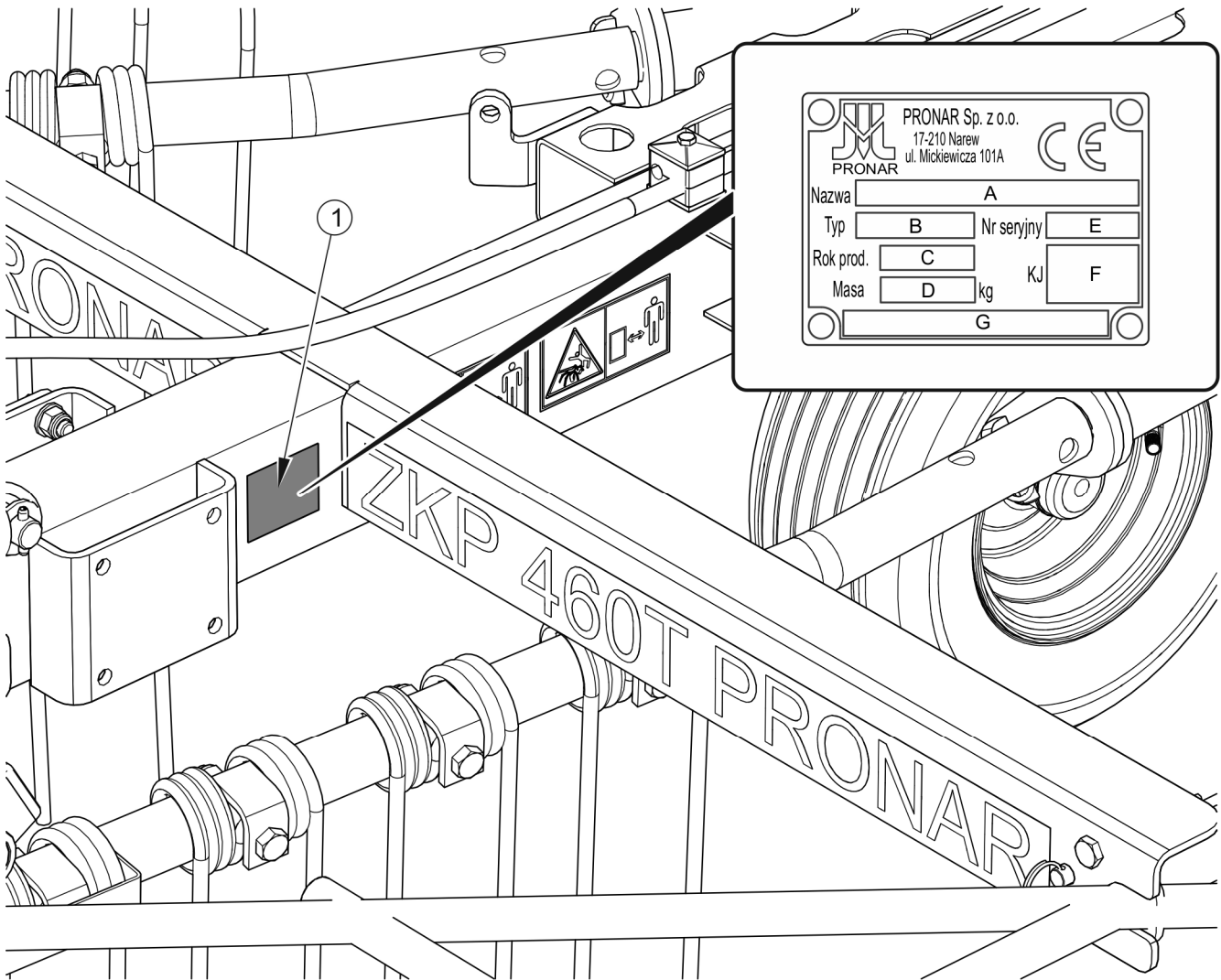


FIGURE 1.1 Location of the nameplate

(1) nameplate

The ZKP460T rotary rake is marked with a nameplate (1), placed on left side of machine's lifting arm.

When purchasing the rotary rake, make sure that the serial numbers on the machine are the same as entered in the *WARRANTY BOOK*, in sales documents and in the *OPERATOR MANUAL*. The meaning of the items on the nameplate is shown in the table below.

TABLE 1.1 Markings on nameplate

ITEM	MARKING
A	Machine name,
B	Serial number,
C	Type,
D	Year of manufacture,
E	Gross weight,
F	Quality Control marking,
G	Machine name, continued.

1.2 INTENDED USE

Rotary rake is designed for agricultural work: raking cut swaths (straw, grass, hays) and gathering it into windrows on stone free grassland with a level surface. Do NOT use the machine for any other purpose. Using it as intended also involves all actions connected with the safe and proper operation and maintenance of the machine. Due to the above, the user is obliged to:


- carefully read this publication and the PTO shaft Operator Manual and adhere to the recommendations contained in these documents,
- understand the machine's operating principle and how to operate it safely and correctly,
- comply with general safety regulations while working,
- prevent accidents,
- comply with road traffic regulations.

TABLE 1.2 Requirements for agricultural tractor

CONTENTS	UNIT	REQUIREMENTS
Fork type hitch or drawbar attached to three-point linkage arms	- -	ISO 6489-4 -
Hydraulic system Maximum system pressure Single acting connection socket	bar / MPa -	200 / 20 according to ISO 7241-1
Power take-off shaft Rotation speed Type / number of PTO splines	rpm -	540 1 3/8" / 6
Other requirements Minimum power demand	kW / hp	22 / 30
Electrical system Electrical system voltage Connection socket	V -	12 7-pole compliant with ISO 1724

Do NOT perform unauthorised repairs and modifications to the rotary rake as this shall be treated by the Manufacturer as misusing the machine.

The machine may only be used by appropriately trained users, who are aware of the dangers, design and operation of the rotary rake. Repairs to the machine shall only be made by qualified personnel (in the warranty period all repairs must be performed in the warranty service, indicated by the Manufacturer). Maintenance and repairs that can be performed by the user, are described in section 5.

	<p>IMPORTANT</p> <p>The rotary rake must not be used for purposes other than those for which it is intended.</p>
---	---

1.3 EQUIPMENT

TABLE 1.3 ZKP460T rotary rake equipment

EQUIPMENT	STANDARD	ADDITIONAL
<i>OPERATOR MANUAL</i>	•	
<i>WARRANTY BOOK</i>	•	
PTO shaft (complete)	•	
Gauge wheels		•
Hitching drawbar		•

Recommended PTO shafts:

- DS4R131CEKR7001

1.4 TERMS & CONDITIONS OF WARRANTY

PRONAR Sp. z o.o. Narew guarantees the reliable operation of the machine when it is used according to its intended purpose as described in the *OPERATOR MANUAL*.

The repair period is specified in the *WARRANTY BOOK*.

The warranty does not cover those parts and sub-assemblies of the machine which are subject to wear in normal usage conditions, regardless of the warranty period. Consumables include the following parts/sub-assemblies:

- tyres,
- spring tine fingers,
- bearings.

The warranty service only applies to such cases as: mechanical damage which is not the user's fault, factory defects of parts, etc.

In the event of damage arising from:

- mechanical damage which is the user's fault, caused by road accidents,
- by incorrect use, adjustment or maintenance, use of the rotary rake for purposes other than those for which it is intended,
- use of a damaged rotary rake,
- repairs carried out by unauthorised persons, improperly carried out repairs,
- arbitrary and wilful adjustments to the windrower's structure,

the user will lose the right to warranty service.

The user is obliged to report immediately on noticing any wear in the paint coating or traces of corrosion, and to have the faults rectified whether they are covered by the warranty or not. For detailed Terms & Conditions of Warranty, please refer to the *WARRANTY BOOK* attached to each newly purchased machine.



NOTE

Demand that the seller carefully and accurately fills out the *WARRANTY BOOK* and warranty repair coupons. A missing date of purchase or sale point stamp may make the user ineligible for any warranty repair or refund.

1.5 TRANSPORT

The rotary rake is prepared for sale completely assembled and does not require packing. Packing is only required for the machine's technical documentation.



NOTE

When transporting independently, the user must carefully read this Operator Manual and observe all its instructions. When being transported on a motor vehicle the rotary rake must be mounted on the vehicle's platform in accordance with the transport safety requirements. The driver of the vehicle should use extreme caution while driving.

**DANGER**

Incorrect use of securing measures may cause an accident.

The machine is delivered to the user on a transport vehicle. When loading and unloading the machine, follow the general health and safety regulations for reloading work. Persons operating reloading equipment must have the qualifications required to operate these machines.

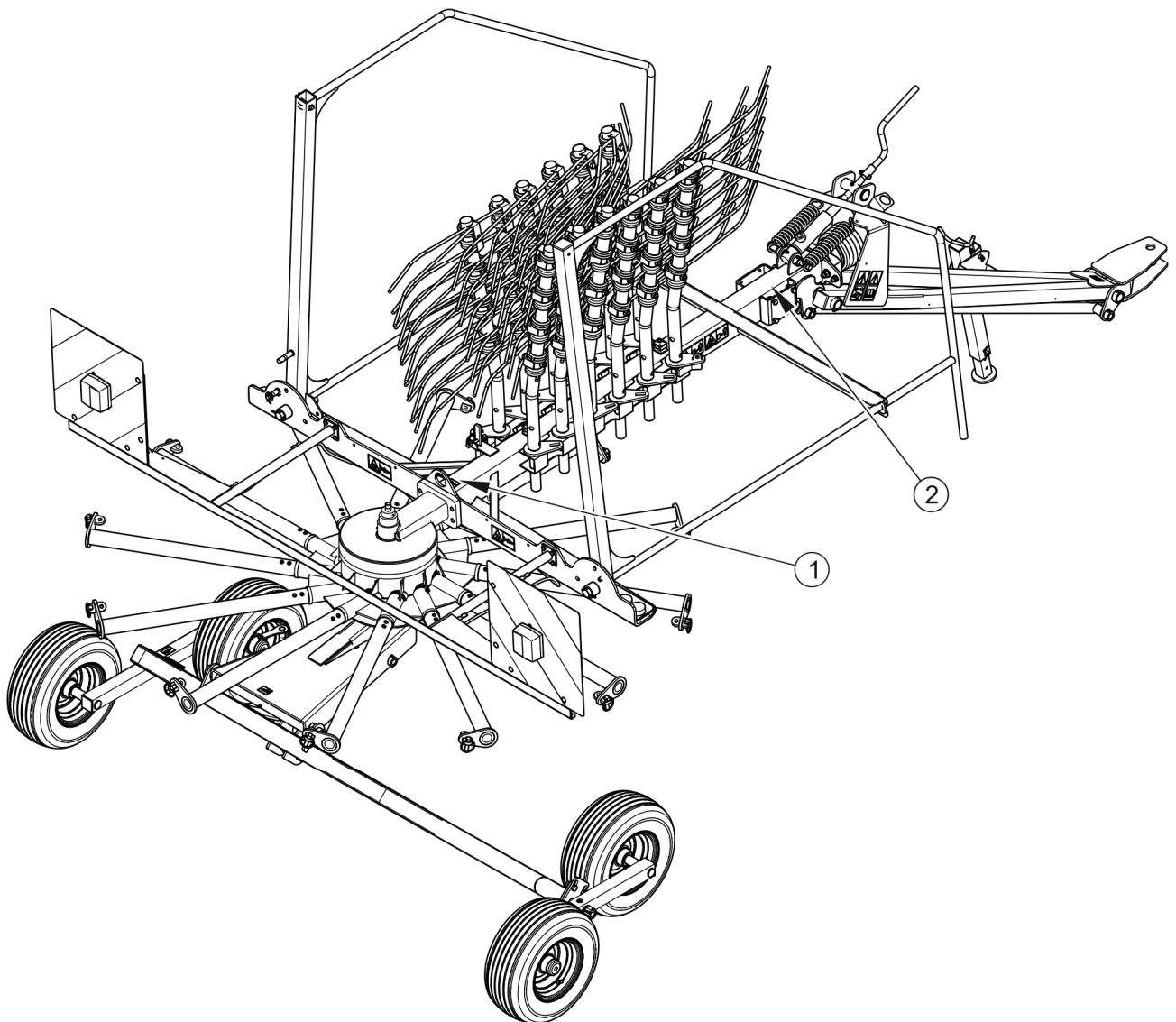


FIGURE 1.2 Rotary rake suspension points

(1) transport lug, (2) support frame element

The rotary rake should be attached to lifting equipment in places shown on figure (1.2), i.e. to transport lug (1) and support frame elements (2). Transport lug is marked with information decal. It is recommended that during transport of the machine the extending arm together with forming shield are dismantled. In the event that cable or belt of transloading equipment may be caught by protruding rake elements placed in transport position, dismantle them. When lifting the machine take special care to avoid tipping over the machine and the risk of injuries from protruding parts.

The machine should be firmly secured on the transport vehicle platform with belts or chains equipped with a tensioning mechanism. The fastening equipment used must have a valid safety certificate. Chocks or other objects without sharp edges should be placed under the wheels of the rotary rake to prevent it from rolling. The chocks must be fixed to the platform of the vehicle. During reloading work, take special care not to damage any accessories or paint finish.

1.5.1 INDEPENDENT SHIPPING BY THE USER

In the event you independently transport the purchased machine, you must read the Operator Manual and adhere to its instructions. Independent transport involves towing the machine with own agricultural tractor to destination. During shipping adjust ground speed to the prevailing road conditions, but do not exceed the maximum design speed.



IMPORTANT

When transporting independently, the user must carefully read this Operator Manual and observe all its instructions.

1.6 ENVIRONMENTAL RISK

A hydraulic oil leak constitutes a direct threat to the natural environment owing to its limited biodegradability. The negligible solubility of hydraulic oil in water does not cause extreme toxicity of organisms living in the aquatic environment. The formation of a film of oil on the water may be the direct cause of physical action on organism, perhaps causing change of oxygen values in the water because of lack of direct contact of air with the water. An oil leak into water reservoirs may however lead to a reduction of the oxygen content.

While carrying out maintenance and repair work, which involves the risk of an oil leak, this work should take place on an oil resistant floor or surface. In the event of oil leaking into the environment, first of all contain the source of the leak, and then collect the leaked oil using available means. Remaining oil should be collected using sorbents, or by mixing the oil with sand, sawdust or other absorbent materials. The oil pollution, once gathered up, should be kept in a sealed, marked, hydrocarbon resistant container. The container should be kept away from heat sources, flammable materials and food.



DANGER

Used hydraulic oil or gathered remains mixed with absorbent material should be stored in a precisely marked container. Do not use food packaging for this purpose.

Used oil or oil unsuitable for further use due to loss of its properties should be stored in its original packaging in the conditions described above. Waste oil should be taken to the appropriate facility dealing with the re-use of this type of waste. Waste code: 13 01 10. Detailed information concerning hydraulic oil may be found on the product's Material Safety Data Sheet.



IMPORTANT

Waste oil should only be taken to the appropriate facility dealing with the re-use of this type of waste. Do NOT dispose of or pour oil into sewerage drains or water reservoirs.

1.7 WITHDRAWAL FROM USE

Should you decide to withdraw the machine from use, comply with the regulations in force in the given country regarding withdrawal from use and recycling of machines withdrawn from use. Before disassembly of the equipment completely remove oil from hydraulic system.

When spare parts are changed, worn out or damaged parts that cannot be reclaimed should be taken to a collection point for recyclable raw materials. Hydraulic oil should be taken to the appropriate facility dealing with the re-use of this type of waste.



DANGER

During disassembly, use the appropriate tools, equipment (overhead crane, crane or hoist etc.) and use personal protection equipment, i.e. protective clothing, footwear, gloves and eye protection etc.

Avoid contact of skin with oil. Do not allow used hydraulic oil to spill.

SECTION

2

SAFETY ADVICE

2.1 BASIC SAFETY RULES

2.1.1 USE OF A ROTARY RAKE

- Before using the rotary rake the user should carefully read this Operator Manual, *WARRANTY BOOK* and the PTO shaft Operator Manual and adhere to the recommendations contained in these documents.
- The rotary rake may only be used and operated by persons qualified to drive agricultural tractors and trained in the use of the machine.
- If the information in this Operator Manual is difficult to understand, contact the seller who runs the authorised technical service on behalf of the Manufacturer, or contact the Manufacturer directly.
- Careless and incorrect use and operation of the rotary rake, and failure to follow instructions in this Operator Manual is dangerous to your health.
- Attention should be paid to the proper use of the covers, as the tarpaulin covers used are flammable.
- The machine must never be used by persons, who are not authorised to drive agricultural tractors, including children and people under the influence of alcohol or other drugs.
- Be aware of the residual risk. Use caution when operating this machine and follow all relevant safety instructions.
- The rotary rake must not be used for purposes other than those for which it is intended. Anyone who uses the machine other than the way intended takes full responsibility for himself for any consequences of this use.
- Any modification of the machine releases the manufacturer (PRONAR Narew) from any responsibility for damage or detriment to health which may arise as a result.
- Before using the rotary rake always check its technical condition. In particular check the technical condition of the hitching system, drive system, mounting of rakes and protective guards.

- Rotary rake uncoupled from tractor must be supported by supports and secured against rolling away by using wheel chocks or other elements without sharp edges.
- Do NOT ride on the rotary rake or transport any materials on it.
- The machine may only be used when all the safety guards and other protective elements are technically sound and correctly positioned. In the event of loss or damage to the protective guards , they must be replaced with new ones.
- Do NOT use an inoperative machine.

2.1.2 HITCHING AND DISCONNECTING THE ROTARY RAKE

- Do NOT hitch the rotary rake to tractor if the tractor does not fulfil the requirements specified by the Manufacturer (minimum tractor power demand, wrong hitch, etc.) – see table (1.2) *REQUIREMENTS FOR AGRICULTURAL TRACTOR*.
- Before hitching the machine make certain that oil in external hydraulic system of tractor may be mixed with the hydraulic oil of the rotary rake.
- Before hitching the machine to the tractor, check the technical condition of the hitching system of the rotary rake and the tractor.
- Before starting the rake for the first time, check that the length of PTO shaft to be coupled with the tractor complies with the recommendations contained in the shaft manufacturer's manual and adjust it if necessary.
- When connecting the machine to the tractor, use the lower fork hitch (according to ISO 6489-3) or the drawbar mounted to the rods of the rear three-point linkage. After hitching the machine, check the safeguards.
- Be especially careful when hitching the machine to the tractor.
- When reversing the tractor, there must be nobody between the rotary rake and the tractor.
- To hitch the machine to tractor use only genuine pins and safeguards.

- Rotary rake uncoupled from tractor must be supported by supports and secured against rolling away by using wheel chocks or other elements without sharp edges.

2.1.3 TRANSPORTING THE MACHINE

- Before driving off make certain that the rotary rake is correctly hitched to the tractor and check lighting system.
- The rotary rake may not be used or transported in conditions of limited visibility.
- When driving on public roads, observe all road traffic regulations in force in the country, in which the rotary rake is used.
- Before beginning travel, rotary rake must be folded to transport position. The working assembly must be lifted to the appropriate height by means of a hydraulic system.
- The shut-off valve must be closed in order to protect against unexpected actuation of the hydraulic system while driving during transport.
- Do NOT ride on the rotary rake or transport any materials on it.
- Adjust speed to the prevailing road conditions and other limitations arising from road traffic regulations. If possible avoid travelling on uneven terrain and unexpected corners.
- Do not exceed the maximum speed when travelling. Adjust driving speed to the road conditions.
- Secure moving parts of the machine so as to eliminate any dangers posed by these parts while the machine is in motion.
- Do NOT leave tractor driver's seat when the tractor is moving.
- The machine must NOT be left unsecured. The rotary rake uncoupled from tractor must be secured against rolling away with wheel chocks placed under the wheels.
- While driving on public roads the rotary rake must be fitted with a certified or authorised reflective warning triangle.
- Lay the hydraulic and electric lines in such a way that they cannot come into contact with the tractor wheels.

2.1.4 HYDRAULIC SYSTEM

- The hydraulic system is under high pressure when operating.
- Regularly check the technical condition of the hydraulic lines and connections. There must be no oil leaks.
- In the event of the hydraulic system malfunction, discontinue using the machine until the malfunction is corrected.
- When connecting the hydraulic lines to the tractor, make sure that the tractor hydraulic system and machine are not under pressure. If necessary, reduce residual pressure in the system.
- In the event of injuries being caused by pressurised hydraulic oil, contact a doctor immediately. Hydraulic oil may penetrate the skin and cause infections. In the event of contact of oil with eye, rinse with large quantity of water and in the event of the occurrence of irritation consult a doctor. In the event of contact of oil with skin wash the area of contact with water and soap. Do NOT apply organic solvents (petrol, kerosene).
- Use the hydraulic oil recommended by the Manufacturer.
- After changing the hydraulic oil, the used oil should be properly disposed of. Used oil or deteriorated oil should be stored in original containers or replacement containers resistant to hydrocarbons. Replacement containers must be clearly marked and appropriately stored.
- Do not store hydraulic oil in packaging designed for storing food or foodstuffs.
- Rubber hydraulic lines must be replaced every 4 years regardless of their technical condition.

2.1.5 OPERATION WITH PTO

- The rotary rake may only be connected to the tractor by appropriately selected PTO shaft recommended by the Manufacturer.
- Before using the machine, carefully read the PTO shaft Operator Manual and follow all instructions.
- PTO shaft may be connected and disconnected only if:

- ⇒ PTO is disengaged,
 - ⇒ tractor engine is switched off,
 - ⇒ parking brake is applied,
 - ⇒ ignition key is removed from ignition switch.
- Before starting the tractor with the coupled rotary rake, make sure that PTO drive in the tractor is disconnected.
 - The drive shaft must be equipped with a cover. Do NOT use the shaft with damaged or missing guards.
 - Install PTO shaft according to guidelines presented in the Operator Manual of PTO shaft.
 - The PTO shaft has markings on the casing, indicating, which end of the shaft shall be connected to the tractor.
 - Protect the PTO shaft covers against turning with the aid of small chains, which should be secured to fixed structural elements of the rotary rake and tractor.
 - After connecting shaft ensure that it is correctly and safely connected to the tractor and to the rotary rake.
 - Do NOT wear loose clothing, straps or whatever that may become wrapped round the rotating drive shaft. Contact with rotating PTO shaft may cause severe injuries.
 - When working in limited visibility conditions, use the tractor working lights to illuminate the PTO shaft and its vicinity.
 - Disconnect the drive shaft each time when it is not necessary to drive the machine, or when the tractor and rotary rake are at an unsuitable angle to each other.
 - During transport the shaft must be stored in the horizontal position to avoid damage to safety guards or other protection elements.
 - Before starting PTO, make certain that the PTO rotation direction and rotation speed are compliant with allowable rotation speed and rotation direction specified for the machine.

- When using the rotary rake and power take-off shaft, do not use PTO rotation speed other than 540 rpm. Do NOT overload shaft and rotary rake and also engage the clutch suddenly.
- Do NOT go over and under the shaft or stand on it equally during work and also when the rotary rake is parked.
- Never use a damaged PTO shaft, it may cause an accident. A damaged shaft must be repaired or replaced.
- Make sure that shaft is covered when travelling on an uneven terrain.
- Disconnected PTO shaft should be placed in the specifically prepared holder.
- Do NOT use the securing chains to support the shaft while machine is parked or when transporting the rotary rake.

2.1.6 MACHINE OPERATION

- Do NOT stand within the windrower's working zone.
- Before starting the rotary rake make sure that there are no bystanders (especially children) or animals in the danger zone. The machine operator is obliged to ensure proper visibility of the machine and the working area.
- Rotary rake must not be operated with folded side protective covers.
- Do not enter the machine rotation and folding zone.
- Each time the machine is used, always ensure that all the safety guards are in good condition and in place. Damaged or incomplete sub-assemblies must be exchanged for original new ones.
- Before starting work, always check condition and correct attachment of springtines on raking arms.
- Use extreme caution when working near people and animals.
- Do NOT leave the tractor cab, when the machine drive is engaged.
- During windrowing use the correct working position.
- While windrowing apply working speed recommendations.
- While reversing and during turns, the rotary rake drive must be disengaged.

2.1.7 CLEANING, MAINTENANCE AND REPAIRS

- Servicing and repair work should be carried out in line with the general principles of workplace health and safety. In the event of injury, the wound must be immediately cleaned and disinfected. In the event of more serious injuries, seek a doctor's advice.
- During the warranty period, any repairs may only be carried out by warranty service authorised by the Manufacturer. After the expiry of the warranty period it is recommended that possible repairs to the trailer be performed by specialised workshops.
- Repair, maintenance and cleaning work should be carried out with the tractor engine turned off and the ignition key removed. Tractor should be immobilized with parking brake and chocks should be placed under the rotary rake wheels. Ensure that unauthorised persons do not have access to the tractor cab.
- In the event of any fault or damage, do not use the rotary rake until the fault has been fixed.
- When servicing, use appropriate, close-fitting protective clothing, gloves, shoes, glasses and the correct tools.
- Any modification of the machine releases the manufacturer (PRONAR Narew) from any responsibility for damage or detriment to health which may arise as a result.
- In order to reduce the danger of fire the machine must be kept in a clean condition.
- Regularly check the condition of nut and bolt connections, in particular connections of drawbar eye with drawbar and wheel nuts.
- Regularly service machine according to schedule defined by Manufacturer.
- Before beginning repair works on hydraulic systems, reduce oil pressure completely.
- Should it be necessary to change individual parts, use only those parts indicated by the Manufacturer. Non-adherence to these requirements may put

the user and other people's health and life at risk, and also damage the machine and invalidate the warranty.

- Before welding or electrical work, the machine should be disconnected from the power supply. The paint coating should be cleaned. Burning paint fumes are poisonous for people and animals. Welding work should be carried out in a well lit and well ventilated space.
- During welding work pay attention to flammable or fusible elements (tarpaulin covers, electrical system part, hydraulic lines). If there is a risk that they will catch fire or be damaged, they should be removed or covered with non-flammable material before commencing welding work. Before beginning work, prepare a CO₂ or foam extinguisher.
- Check the tyre pressure regularly.
- Repair work on the wheels or tyres should be carried out by persons trained and entitled to do so. This work should be carried out using appropriate tools.
- In the event of work requiring the rotary rake to be raised, use properly certified hydraulic or mechanical lifts for this purpose. After lifting the machine, stable and durable supports must also be used. Do NOT carry out work under a machine, which has only been raised with the lift jack.
- The machine must not be supported using fragile elements (bricks or concrete blocks).
- After completing work associated with lubrication, remove excess oil or grease.

2.2 RESIDUAL RISK

Pronar Sp. z o. o. in Narew has made every effort to eliminate the risk of accidents. There is, however, a certain residual risk, which could lead to an accident, and this is connected mainly with the actions described below:

- using the rotary rake for purposes other than those for which it is intended,
- being between the tractor and the rotary rake while the engine is running and when the machine is being attached,
- being on the machine when it operates,

- operating the rotary rake with the safety guards removed, folded or faulty,
- failure to maintain a safe distance from the danger zone or being within the zones while the rotary rake is operating,
- Rotary rake operation by unauthorized persons or persons under the influence of alcohol
- oil leaks and sudden movement of elements resulting from line cracking,
- cleaning, maintenance and technical checks of the rotary rake when the tractor engine is running,
- using unreliable PTO shaft,
- making modifications to the machine without the consent of the Manufacturer,

The residual risk may be kept to a minimum by following the recommendations below:

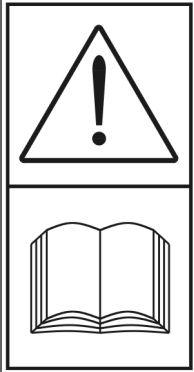
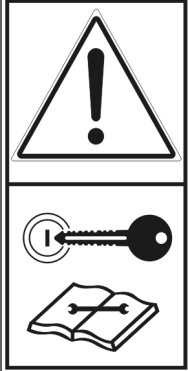


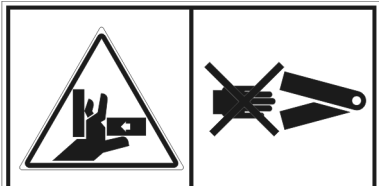
- operate the machine in prudent and unhurried manner,
- sensibly adhere to the remarks and recommendations contained in the Operator Manual,
- maintain a safe distance from prohibited or dangerous places
- a ban on being on the machine when it is operating,
- carry out repairs and maintenance work in line with operating safety rules,
- repair and maintenance work should be carried out by persons trained to do so,
- use close fitting protective clothing and appropriate tools,
- ensure unauthorised persons have no access to the machine, especially children.

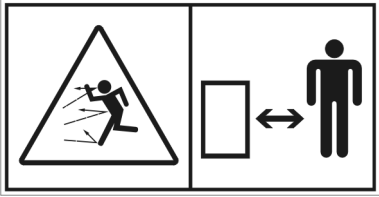
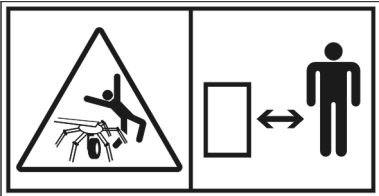

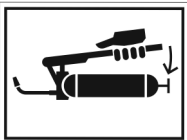
2.3 INFORMATION AND WARNING DECALS

The rotary rake is labelled with the information and warning decals mentioned in table (2.1). The arrangement of symbols is shown in figure (2.3). Throughout the machine use, you must ensure that any warning messages and information decals located on the machine are clear and legible. If any are destroyed or damaged, they must be replaced with new. Safety decals are available from your PRONAR dealer or directly from PRONAR customer service. New

assemblies, changed during repair, must be labelled once again with the appropriate safety signs. When cleaning the rotary rake, do not use solvents that can damage the coating of information decals and do not subject them to strong water jets.

TABLE 2.1 Information and warning decals

ITEM	DECAL	MEANING
1		<p>Before starting work, carefully read the Operator Manual. 178N-00000001</p>
2		<p>Before maintenance or repairs, turn off engine and remove key from ignition. 178N-00000002</p>
3		<p>Danger associated with the rotating PTO shaft. 185N-00000003</p>
4		<p>Maximum allowable PTO shaft rotation speed is 540 rpm. 185N-00000004</p>
5		<p>Danger of crushing or severing of limbs. Be careful while folding and unfolding lateral guards. 178N-00000005</p>

ITEM	DECAL	MEANING
6		<p>Thrown out objects endanger the whole body. Keep a safe distance from machine during work of rotary rake.</p> <p>178N-0000006</p>
7		<p>Danger of being struck by rotating elements of the machine. Keep a safe distance from raking assembly.</p> <p>178N-0000007</p>
8	<p>ZKP 460T PRONAR</p>	<p>Rotary rake type</p> <p>524N-0000004</p>
9		<p>Transport lug points marking.</p> <p>178N-0000009</p>
10		<p>Marking of greasing points.</p> <p>185N-0000011</p>

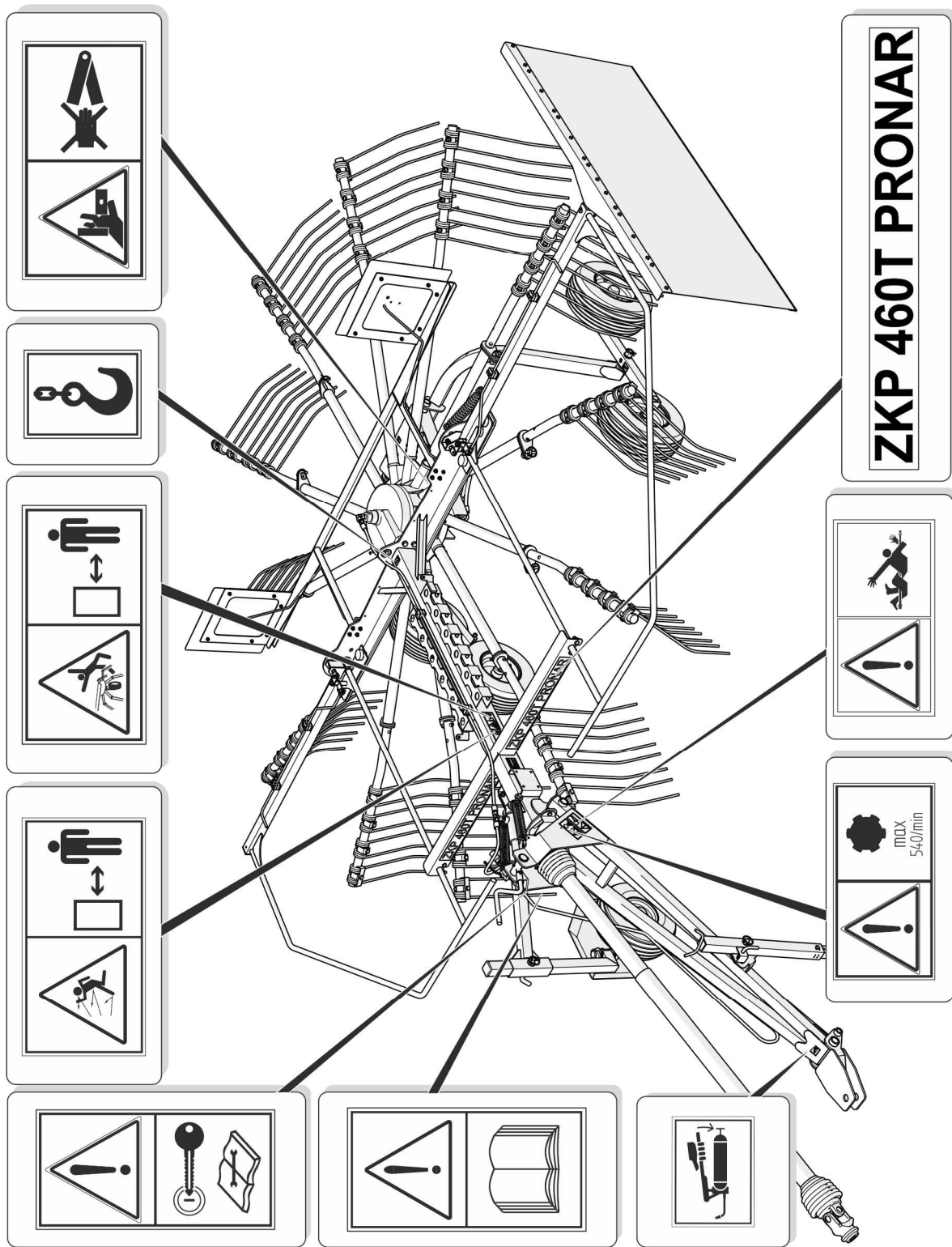


FIGURE 2.1 Locations of information and warning decals

SECTION

3

**DESIGN AND
OPERATION**

3.1 TECHNICAL SPECIFICATION

TABLE 3.1 Rotary rake technical specification

CONTENTS	UNIT	ZKP460T
Dimensions in the transport position		
Total length in transport setting	mm	4,506
Height in transport setting	mm	2,700
Width in transport setting	mm	2,360
Dimensions in the operating position		
Total length in working setting	mm	5,477
Width in working setting		
minimum	mm	4,175
maximum	mm	4,675
Height in working setting	mm	1,242
Technical specification		
Working width	mm	4,600
Number of rotors	item	1
Number of rotor working arms	item	12
Number of spring rake tines on a single working arm	item	4
Minimum tractor power demand	hp / kW	30 / 22
Maximum PTO speed	rpm	540
Tare weight	kg	680
Work output	ha/h	4.6
Recommended working speed	km/h	10
Tyres		
Tyre	-	16x6.5-8 6PR
Air pressure in the tyres	kPa	300
Other information		
Electrical system voltage	V	12
Noise emission level	dB(A)	below 75

3.2 ROTARY RAKE DESIGN

3.2.1 ROTARY RAKE DESIGN

Rotary rake design is shown in figure (3.1). The main subassembly of the machine is the support frame (1). In the front part of the machine there is the articulated drawbar (13) with the parking stand (14) mounted on its left side. The rotary rake drawbar can be connected to the tractor's lower fork hitch or to the flat bar drawbar mounted to the arms of the tractor's 3-point linkage. The rotary rake's height-adjustable parallelogram drawbar control keeps the towing eye in horizontal position during hitching and unhitching to prevent it from jamming.

The main transmission (2) of the working unit is located in the rear part of the rotary rake. The transmission is driven by the tractor's PTO through the PTO shaft (12) and the drive shaft located in the longitudinal member of the support frame (1)

The transmission (2) has 12 output shafts to which raking arms (3) are attached. Each of the arms is equipped with 4 spring rake tines (4) for raking the swath. They are mounted on the arm extension with the aid of securing angles (5), which prevent tines from sliding or rotating. Arms are secured to the transmission with the aid of cotter pins (6). The rotary rake can be additionally equipped with a gauge wheel (16) mounted at the front of the rotor.

The rotary rake has a hydraulic-mechanical adjustment of raking height and lifting the rotor to the transport position. The rotary rake suspension consists of the wheel beam (7) to which the rocker arms (8) are mounted. During operation and transport, the rotary rake moves on four wheels (9) suspended on a tandem. On the left side of the rotary rake there is the extension arm with the forming shield (10) secured to it. During machine operation the shield acts as a barrier for the raked swath, due to which the swath is not scattered but formed into a regular windrow. The extension arm is secured in the wing profile of the left protective shield (11) and locked with a cotter pin.

Protective shields prevent accidental impact by rotating arms. The shields are hinged and can be folded for transport.

At the rear of the machine there are warning plates with lights (15), which improve safety when transporting the machine on the road.

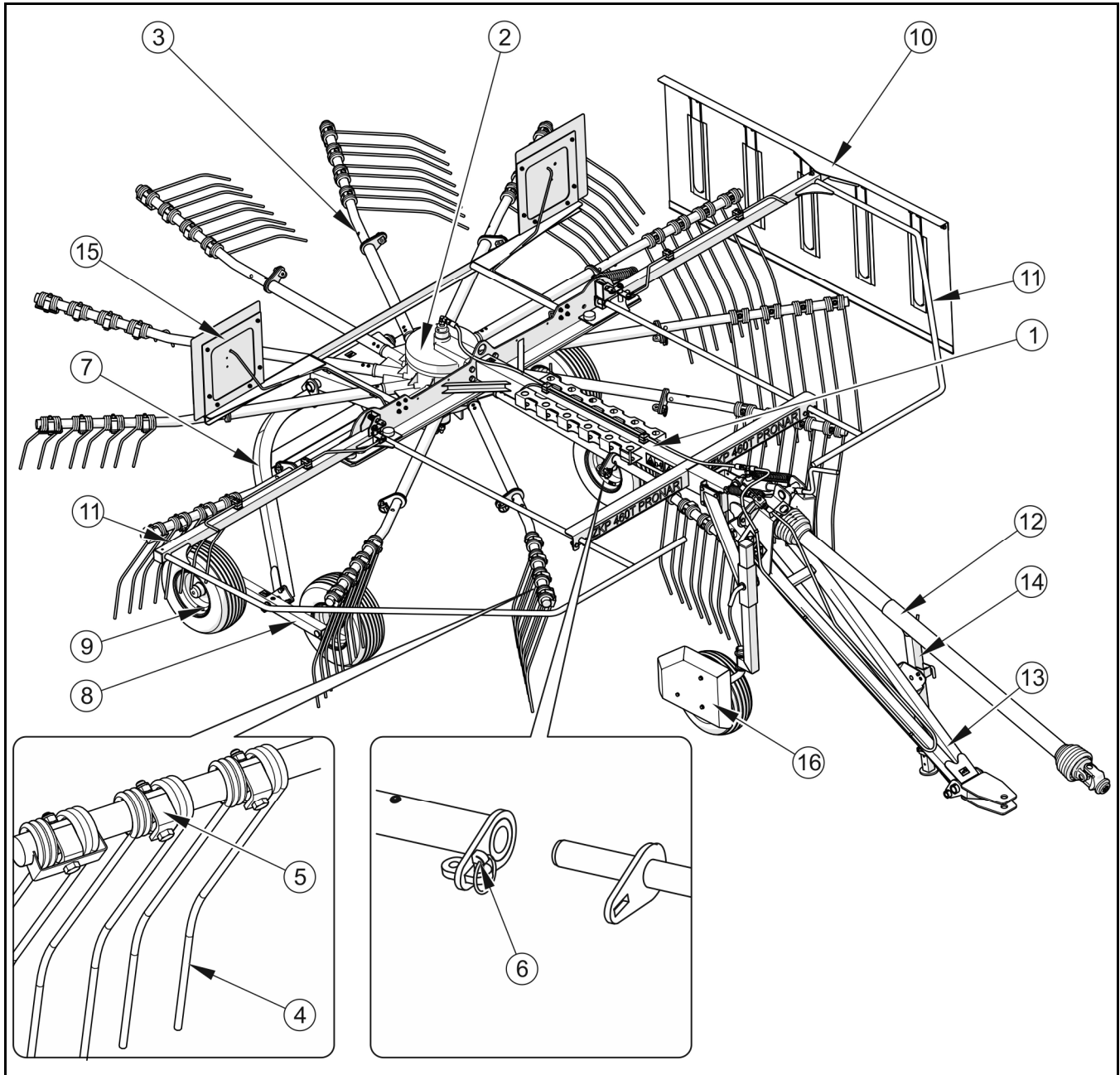


FIGURE 3.1 Rotary rake design

(1) frame, (2) transmission, (3) raking arm, (4) spring tine, (5) securing angle, (6) cotter pin, (7) wheel beam, (8) rocker arm, (9) wheels, (10) shield with extension arm, (11) protective shield, (12) drive shaft, (13) drawbar, (14) support, (15) warning plates with lights, (16) gauge wheel

3.2.2 HYDRAULIC SYSTEM

The rotary rake's hydraulic system is used for raising / lowering the rotary rake's working unit.

The hydraulic system is supplied from the tractor's external hydraulic system through the conduit (3) terminated with the plug (4). The hydraulic system is equipped with the valve (5) for blocking the cylinder (1) in the transport position.



IMPORTANT

In a new rotary rake, the hydraulic system is filled with L-HL32 Lotos hydraulic oil.

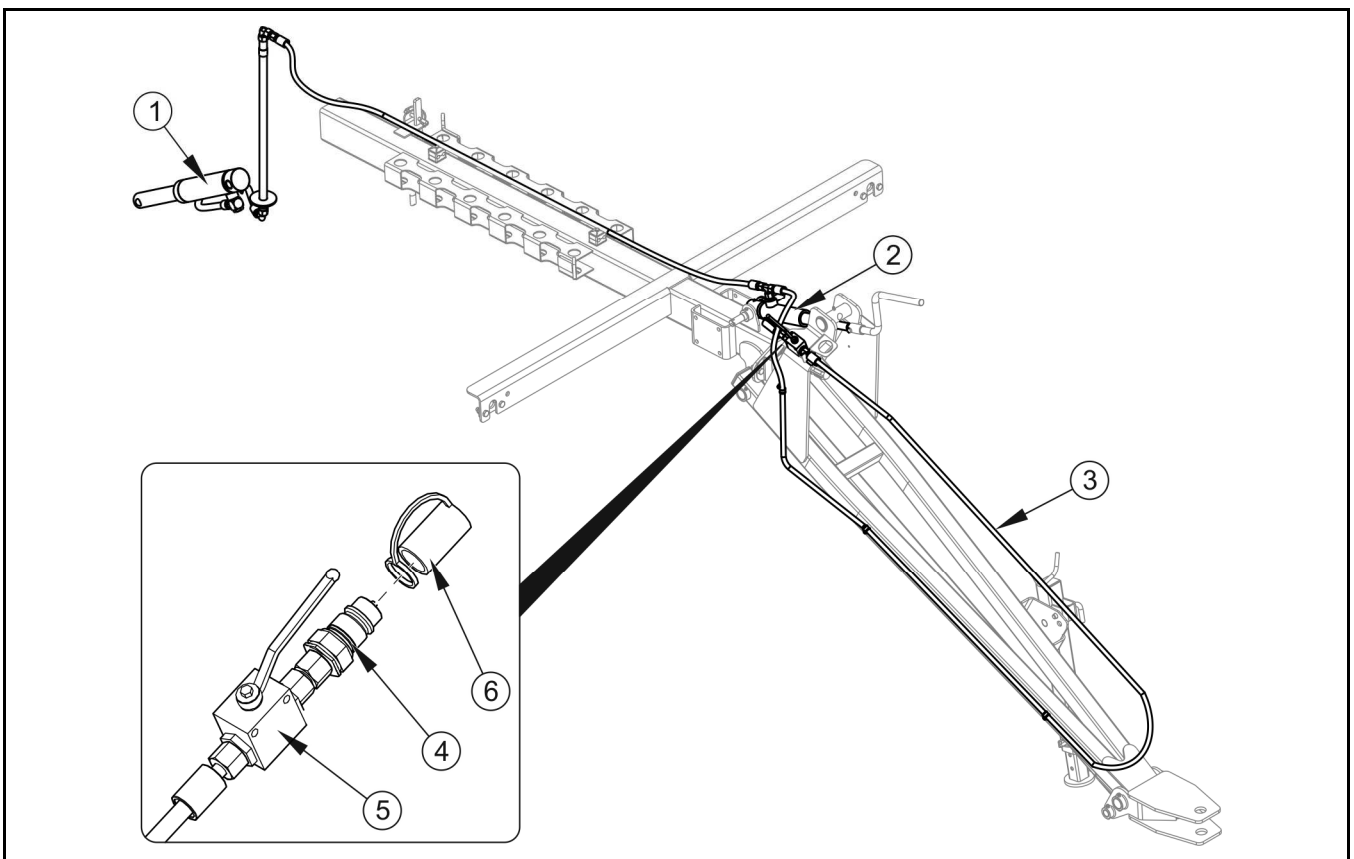


FIGURE 3.2 Hydraulic system

(1) hydraulic cylinder for raising / lowering the working unit, (2) hydraulic cylinder for raising / lowering the drawbar, (3) hydraulic conduit, (4) quick coupler - plug, (5) cut-off valve, (6) plug cap

3.2.3 LIGHTING SYSTEM

The rotary rake's lighting system is designed for supply of 12 V DC. Connect the rotary rake's electrical system with the tractor using an appropriate connection lead with a plug (3).

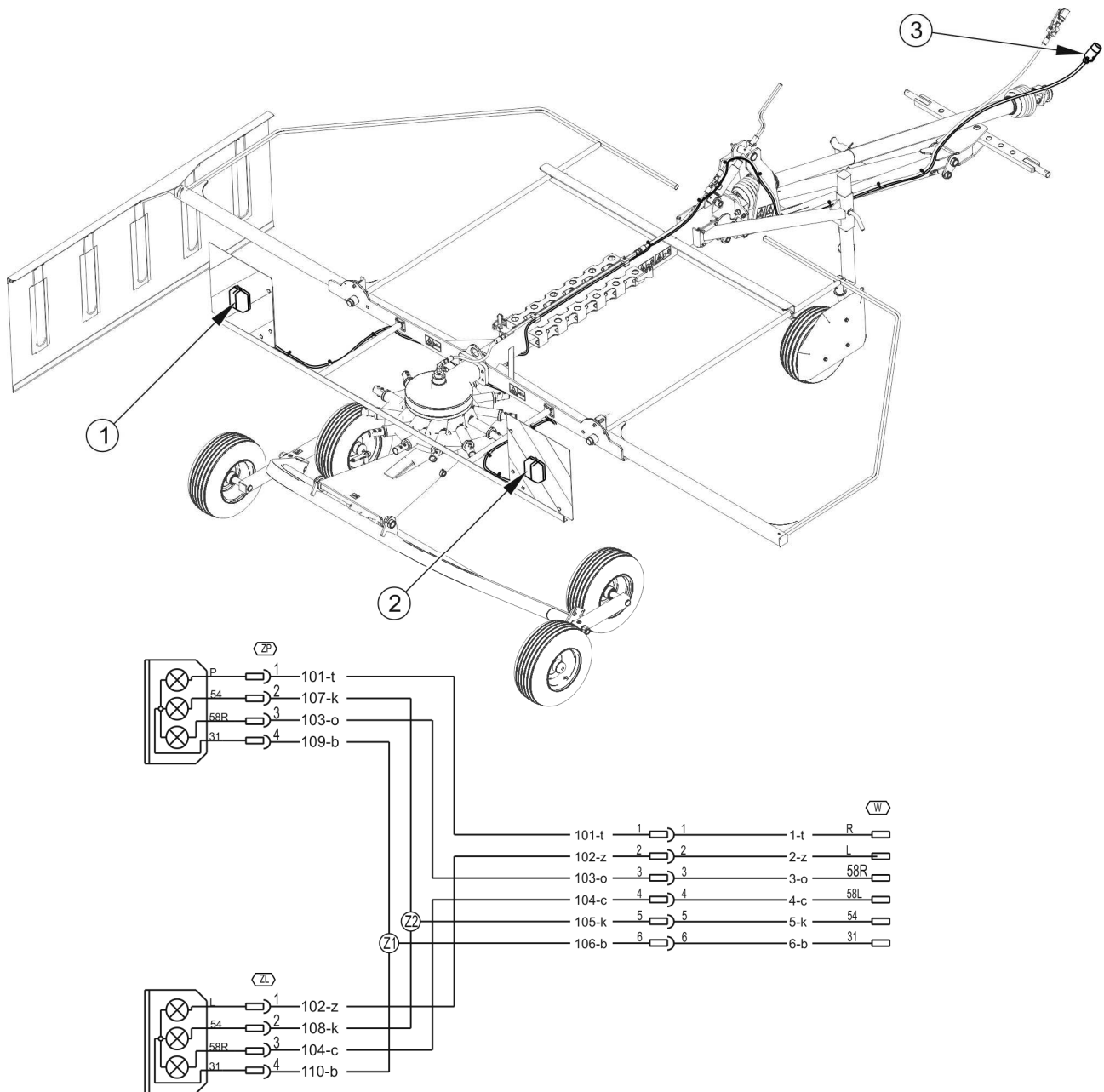


FIGURE 3.3 Electrical system diagram

(1) left rear lamp, (2) right rear lamp, (3) 12V connection plug

Marking according to table (3.2), (3.3) and (3.4)

TABLE 3.2 Lead colour marking

MARKING	COLOUR
b	White
c	Black
k	Red
z	Yellow
t	Green
o	Brown

TABLE 3.3 List of electrical component markings

SYMBOL	NAME
ZP	Rear right lamp assembly
ZL	Rear left lamp assembly
W	Seven-pin plug

TABLE 3.4 Marking of the connectors in the plug

MARKING	FUNCTION
31	Ground
L	Left indicator
54	STOP light
58L	Rear left parking light
58R	Rear right parking light
R	Right indicator

3.3 OPERATING PRINCIPLE

The rotary rake is equipped with the reduction gear driven by the tractor PTO. The torque is transferred through transfer shafts. The reduction gear design ensures that the raking assembly rotates anticlockwise.

The gear's cam mechanism enables the rotation of individual arms, due to which the spring rake tines are lowered or raised according to current setting.

During raking – figure (3.4), area (A) - spring rake tines are lowered almost vertically. The raked swath is retained by the forming shield, due to which it is formed into an even windrow. In other cases, the spring rake tines are raised to the upper position.

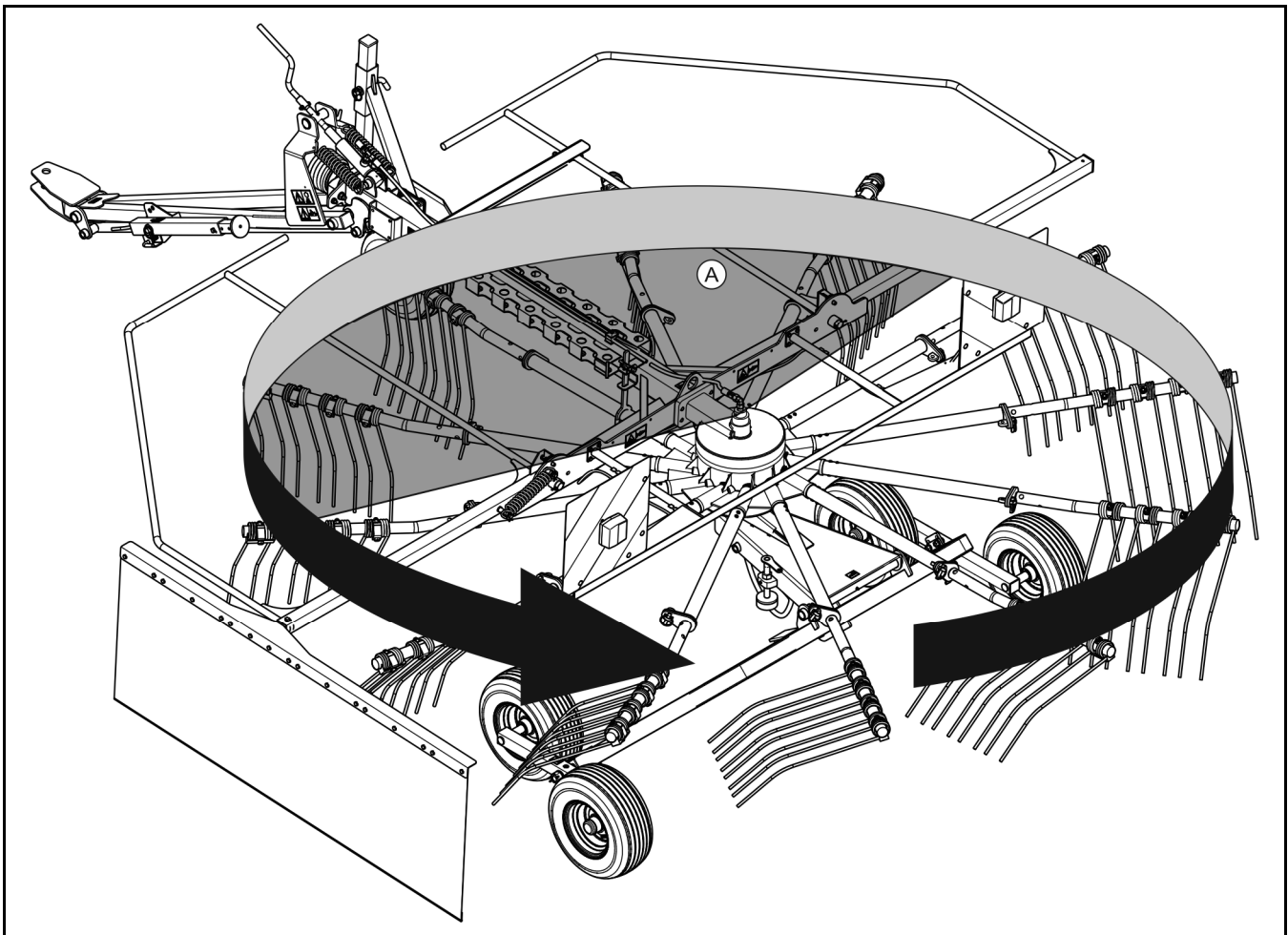


FIGURE 3.4 The rotary rake's operating principle

(A) swath raking phase

SECTION

4

**CORRECT
USE**

4.1 PREPARING FOR WORK BEFORE THE FIRST USE

4.1.1 CHECKING THE ROTARY RAKE AFTER DELIVERY

The manufacturer guarantees that the rotary rake is fully operational and has been checked according to quality control procedures and is ready for use. This does not release the user from an obligation to check the machine's condition after delivery and before first use. The machine is delivered to the user completely assembled.

Before connecting the rotary rake, check whether the tractor meets applicable requirements. The rotary rake may be connected only to such tractors which meet applicable requirements (agricultural tractor requirements are specified in table (1.2)).

Before connecting to tractor, machine operator must inspect the technical condition of the rotary rake and prepare it for test start-up. In order to do this:

- the user must carefully read this Operator Manual and observe all recommendations, understand the design and the principle of machine operation,
- check completeness of machine,
- visually inspect the rotary rake individual components for mechanical damage resulting from incorrect loading, transport or unloading of the machine,
- check condition of paint coatings, traces of corrosion or mechanical damage (crushing, piercing, bending or breaking of minor elements),
- check technical condition of the rotary rake lights and indicators,
- Check all the windrower's lubrication points, lubricate the machine as needed according to recommendations provided in section 5,
- check technical condition of PTO shafts and their shields as well as completeness of these elements,
- check technical condition of tyres and tyre pressure.
- check if wheel, drawbar and rocker mounting is correct,
- check spring rake tines, raking arms and protective shields for correct mounting,
- check lubricating oil level in reduction gear,
- check technical condition of hydraulic lines, that there are no oil leaks.

4.1.2 PREPARING THE ROTARY RAKE FOR THE FIRST USE

When preparing the rotary rake for the first use, check the following:

- ➔ all lubrication points, lubricate the machine elements as needed according to recommendations provided in section 5.4 *LUBRICATION*,
- ➔ check if the nuts fixing the following components are properly tightened: (raking arms, spring rake tines, wheels, protective shields),
- ➔ check lubricating oil level in reduction gear.
- ➔ technical condition of PTO shafts, their shields and securing chains,
- ➔ technical condition of hitching system pins and locking cotter pins,

NOTE



When adjusting the PTO shaft, follow the instructions presented in the Operator Manual of the PTO shaft.

Pipe profiles of the PTO shaft must overlap at least at 1/2 of the length in normal working conditions and at least at 1/3 of the length in all working conditions.

When the tractor with the rotary rake is turning or travelling on an uneven terrain, the PTO shaft may be damaged and/or destroyed if it is squeezed or disconnected as a result of its wrong adjustment.



TIP

Adjustment of the PTO shaft applies only to a specific type of tractor. If the machine is connected to a different type of tractor, the adjustment procedure for this type of tractor should be possibly carried out.

- ➔ make sure that the attached PTO shaft may be connected to the tractor (PTO shaft should be suitable for the tractor – see the Operator Manual of PTO shaft),
 - ⇒ check length of PTO shaft in the most favourable and difficult working conditions,
 - ⇒ check whether the PTO shaft pipes are sufficiently covered when the widest angle is set,
 - ⇒ check whether the PTO shaft can be still slid when the smallest angle is set (while turning),

- ➔ make certain that the PTO rotation direction is correct.

4.1.3 TEST START

If all the above actions are completed and if the technical condition of the rotary rake is not a cause of concern then connect it to the tractor 4.3 "*HITCHING TO TRACTOR*". Start the tractor engine, check all systems and test the rotary rake before beginning work. In order to inspect:

- ➔ hitch rotary rake to tractor,
- ➔ connect PTO shaft to tractor and rotary rake
- ➔ connect hydraulic system conduits and electrical system leads,
- ➔ remove the raking arms from the support frame, attach them to the transmission output shafts and secure with pins,
- ➔ unlock and lower the side protective shields until the latch snaps into place,
- ➔ start tractor,
- ➔ check correct operation of lights and indicators,
- ➔ check operation of the raking assembly lifting/lowering system,
 - ⇒ Using the selective control valve lever in the tractor cab, activate hydraulic cylinders of the lifting/lowering system.
- ➔ Start tractor PTO slowly (starting the drive of the raking assembly gear),
- ➔ leave for several minutes working at low RPM and check:
 - ⇒ that there is no knocking or noise in the drive system and in the raking assembly gear arising from rubbing against metal elements,
 - ⇒ proper rotation of raking system,
 - ⇒ proper action of cam mechanism of the raking assembly gear (spring tines should lower and raise according to current arm position),
 - ⇒ the rotary rake operation at no load should be smooth, shaking of raking mechanism and whole machine is not acceptable, nor is abnormal noise and vibrations coming from loose nut and bolt connections,

- ⇒ after stopping rotary rake check fastening of rake fingers and raking arms. Check that the gear oil does not leak from the reduction gear.
- ➔ Disconnect PTO drive, turn off tractor engine and unhitch the rotary rake from tractor.

NOTE

Before using the rotary rake, the user must carefully read this Operator Manual

Before using the rotary rake always check its technical condition. In particular check the technical condition of the raking system, wheel system, all protective guards and correct condition of mounting of raking fingers.

DANGER

Careless and incorrect use and operation of the rotary rake, and failure to follow instructions in this Operator Manual is dangerous to your health.

The rotary rake must never be used by persons, who are not authorised to drive agricultural tractors, including children and people under the influence of alcohol or other drugs.

Non-compliance with the safety rules of this Operator's Manual can be dangerous to the health and life of the operator and others.

DANGER

Before starting the rotary rake, ensure that there are no bystanders in the danger zone.

The rotary rake may be used only when all preparatory activities have been completed satisfactorily. If during test run worrying symptoms occur such as:

- noise and abnormal sounds originating from the abrasion of moving elements of the rotary rake design,
- hydraulic oil leak,
- other suspected faults

immediately cut off oil supply, disconnect tractor PTO drive and identify a fault. If a fault cannot be rectified or the repair could void the warranty, please contact the retailer or directly the manufacturer for additional clarifications or to perform the repair.

4.2 TECHNICAL CONDITION INSPECTION

To get the rotary rake ready for daily use, check components according to guidelines presented in Table 4.1.

TABELA 4.1 Technical inspection schedule

DESCRIPTION	MAINTENANCE ACTIVITIES	FREQUENCY
Technical condition of protective shields	Check the technical condition of safety shields, if complete and correctly mounted.	Before each use
Technical condition of PTO shaft, its shields and securing chains,	Inspect visually and check completeness	
Check mounting of spring rake tines to raking arms	Ensure that spring rake tines are correctly tightened.	
Check technical condition of tyres and tyre pressure,	Visually inspect the tyres and if they are properly inflated.	Before each use
Oil level in the working unit reduction gear	Check according to section " <i>REDUCTION GEAR MAINTENANCE</i> "	
Correct operation of lights and indicators of the rotary rake.	Check completeness and technical condition of lights and warning signs and indicators.	
Check technical condition of tyres and tyre pressure,	Check the condition of tyre tread, lateral surfaces, wheel rim and if necessary inflate the tyres up to recommend pressure .	Every month
Check if all main nut and bolt connections are properly tightened	Tightening torque should be according to table (5.2).	Every six months
Lubrication	Lubricate elements according to guidelines presented in section "LUBRICATION".	According to table (5.1)

NOTE

Do NOT use an inoperative rotary rake.

The rotary rake must never be used by persons, who are not authorised to drive agricultural tractors, including children and people under the influence of alcohol or other drugs.

Careless and incorrect use and operation of the machine, and failure to follow instructions in this Operator Manual is dangerous to your health.

Prior to connecting appropriate system leads, carefully read the Operator Manual of the tractor and observe all manufacturer's recommendations.

4.3 HITCHING TO TRACTOR

NOTE

Prior to attaching the rotary rake, check the technical condition of the rotary rake's and tractor hitch system and connection elements of the hydraulic and electrical systems.

The hydraulic oils in the tractor and the rotary rake must be mixable.

Be especially careful when hitching the machine to tractor.

Before first use, adjust the length of PTO shaft according to Operator Manual of PTO shaft recommendations.

When hitching is completed, secure the electrical leads and hydraulic system lines in such a way that they do not become entangled in tractor moving parts and are not at the risk of breaking or being severed when making turns.

During travel and operation of the machine, the parking stand must be in transport position.

The value of the transferred torque on the shaft is set by the Manufacturer and may not be changed independently. Change of overload protection clutch setting may invalidate the warranty

In order to attach the rotary rake to tractor, proceed as follows:

- ➔ Position agricultural tractor directly in front of drawbar eye.
- ➔ Using the tractor's three-point linkage, set the flat bar drawbar at such a height that it is possible to hitch the machine.
- ➔ Reverse the tractor, connect the drawbar (1) to the centre of the flat bar drawbar (2) or to the tractor's lower fork hitch. Secure the pin (3) with the cotter pin (4).
- ➔ Turn off tractor engine, secure cab to prevent unauthorised access.

- ➔ Connect the hydraulic system conduit ended with a plug (7).
- ➔ Connect the main power supply cable of the electrical lighting system ended with a plug (6).

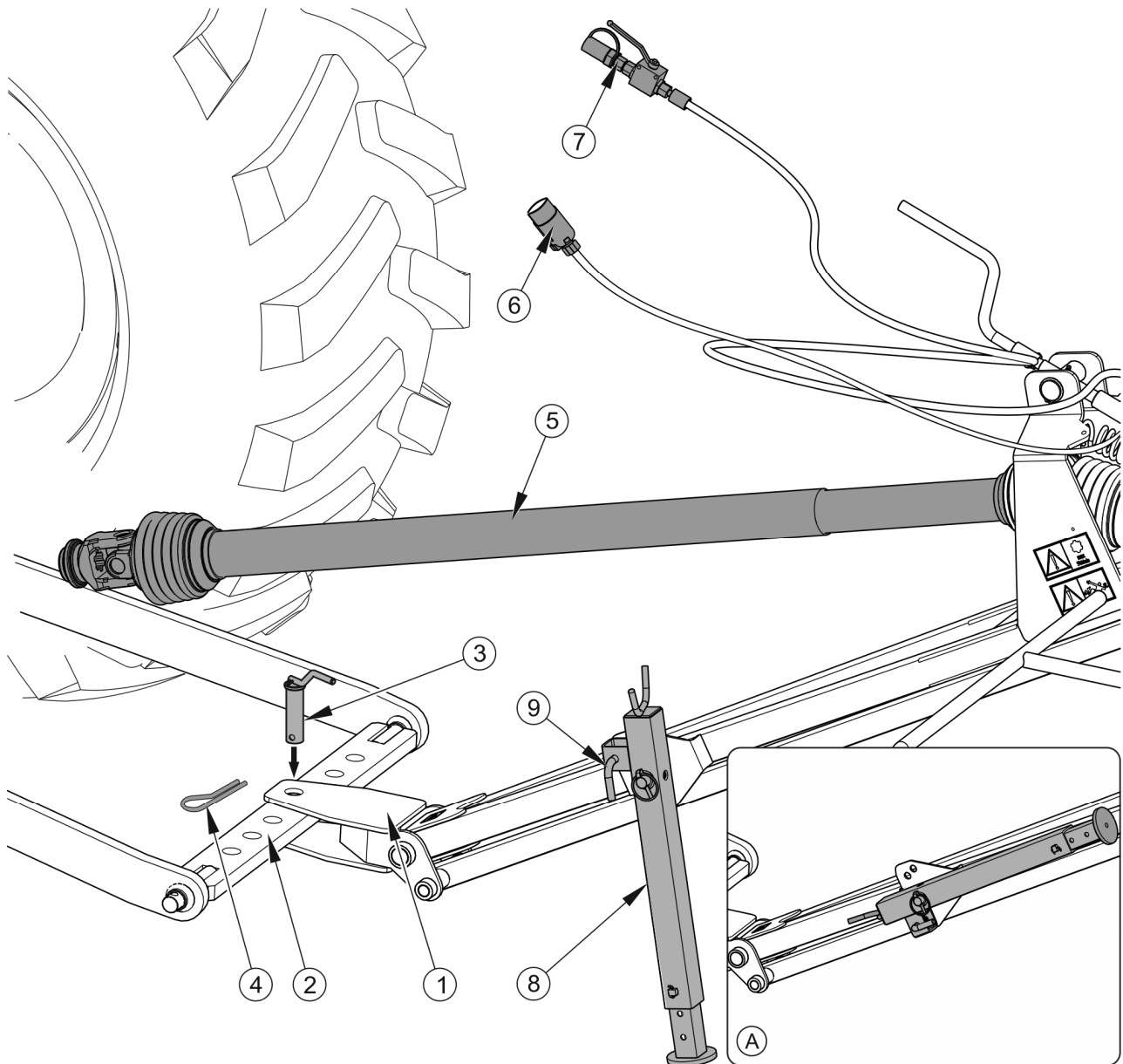


FIGURE 4.1 Hitching to tractor

(1) drawbar, (2) flat bar drawbar, (3) pin, (4) cotter pin's pin, (5) PTO shaft for connection with tractor, (6) electrical system plug, (7) hydraulic system plug, (8) drawbar support, (9) locking pin, (A) support in the transport position

- ➔ Install PTO shaft (5) according to guidelines specified in the Operator Manual of the PTO shaft.

- ⇒ Connect the end of the shaft fitted with the clutch to the rotary rake.
- ➔ Make sure that shaft ends on both the tractor and rotary rake fit well and the linkage is properly secured.
- ⇒ Attach chains securing the PTO shaft covers.

**TIP**

Adjustment of the PTO shaft applies only to a specific type of tractor. If the machine is connected to a different type of tractor, the adjustment procedure for this type of tractor should be possibly carried out.

- ➔ Lift the rotary rake's drawbar using the tractor's three-point linkage arms.
- ➔ Unlock the locking pin (9). Move the parking stand (8) from the support position to the transport position (A) and secure it with the pin (9).

**DANGER**

When hitching, there must be nobody between the rotary rake and the tractor. When hitching the machine, tractor driver must exercise caution and make sure that nobody is present in the hazard zone.

When connecting the hydraulic lines to the tractor, make sure that the tractor and rotary rake hydraulic system are not under pressure.

4.4 TRANSPORTING THE MACHINE

For transport to place of work and back, set the rotary rake in transport position. Travel with rake arms extended in work position is prohibited. During travel they must be placed in sockets on frame and secured with cotter pins. Disconnection of PTO shaft from tractor PTO is recommended.

**DANGER**

Preparing the rotary rake for transport may only be done with tractor engine turned off. Remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor. Immobilise the tractor with parking brake.

When lifting and lowering, no person must be present between the tractor and the rotary rake and under the raised arms.

4.4.1 SETTING THE ROTARY RAKE IN TRANSPORT POSITION



NOTE

When transporting the machine on public roads, parking lights and safety devices required by law must be installed.

Setting from transport position to working position and vice versa should only be conducted on a level and stable surface.

Place the rotary rake on a hard, flat surface. Secure the machine against rolling away by placing chocks or other elements without sharp edges under the wheels.

- ➔ Turn off tractor engine and remove key from ignition. Brake tractor with parking brake and secure tractor cab, ensure that unauthorised persons do not have access to the tractor.
- ➔ Slide in the swath forming shield (1).
 - ⇒ Unlock and remove the securing pin (2).
 - ⇒ Completely slide in the swath forming shield and secure it with the securing pin (2).
- ➔ Raise the protective shields (3) to the vertical position.
 - ⇒ Loosen the lock (4) by pulling the lock arm (5).
 - ⇒ Raise the left shield to the vertical position until it is locked by the lock (4).
 - ⇒ Repeat the procedure for the second shield.
- ➔ Disassemble the raking arms in accordance with section 4.4.2.
- ➔ Raise the working unit using the manifold lever in the tractor.
 - ⇒ The cut-off valve (6) should be in the open position "I".
- ➔ Set the cut-off valve (6) to the closed position "0".
- ➔ Prior to moving off, check the lights.

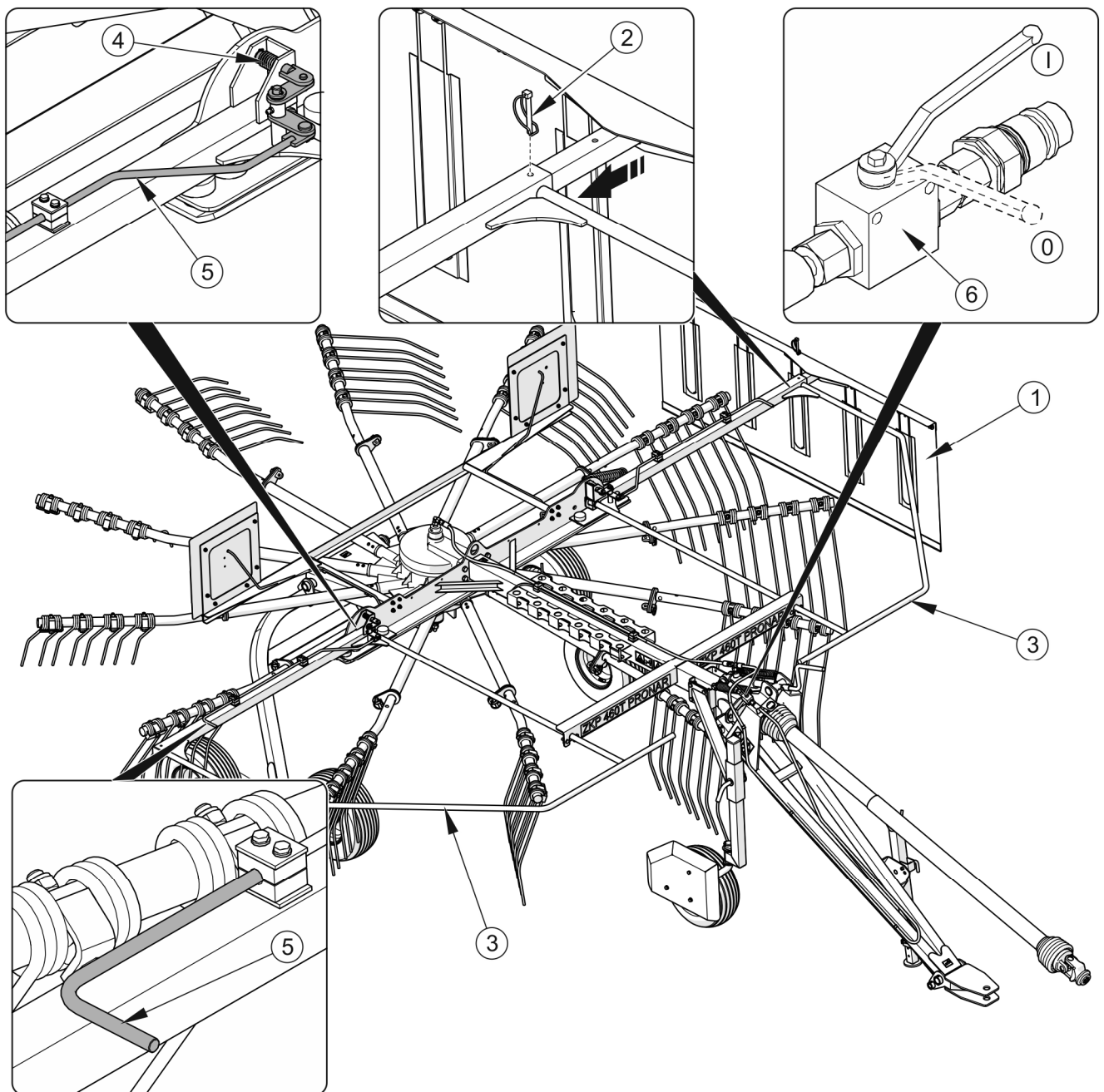


FIGURE 4.2 Setting the rotary rake in transport position

(1) swath forming shield, (2) securing pin, (3) protective shield, (4) shield lock, (5) lock arm, (6) cut-off valve, (I) "open" valve position, (0) "closed" valve position

Disconnection of PTO shaft is not necessary but taking it off is recommended. Turning sharp corners, especially in field conditions may be hindered because of this. If the shaft is not taken off, is essential to remember not to engage the PTO drive of the tractor during transport travel.

4.4.2 DISASSEMBLING THE RAKING ARMS

In order to reduce the machine transport width, the raking arms should be disassembled.

- ➔ In order to disassemble the raking arm, take out securing cotter pin (2) and pull the raking arm out of its mount in the raking assembly gear.
- ➔ Place the raking arms in the seats on the main frame (3) and secure them with cotter pins (2) - figure (4.3).

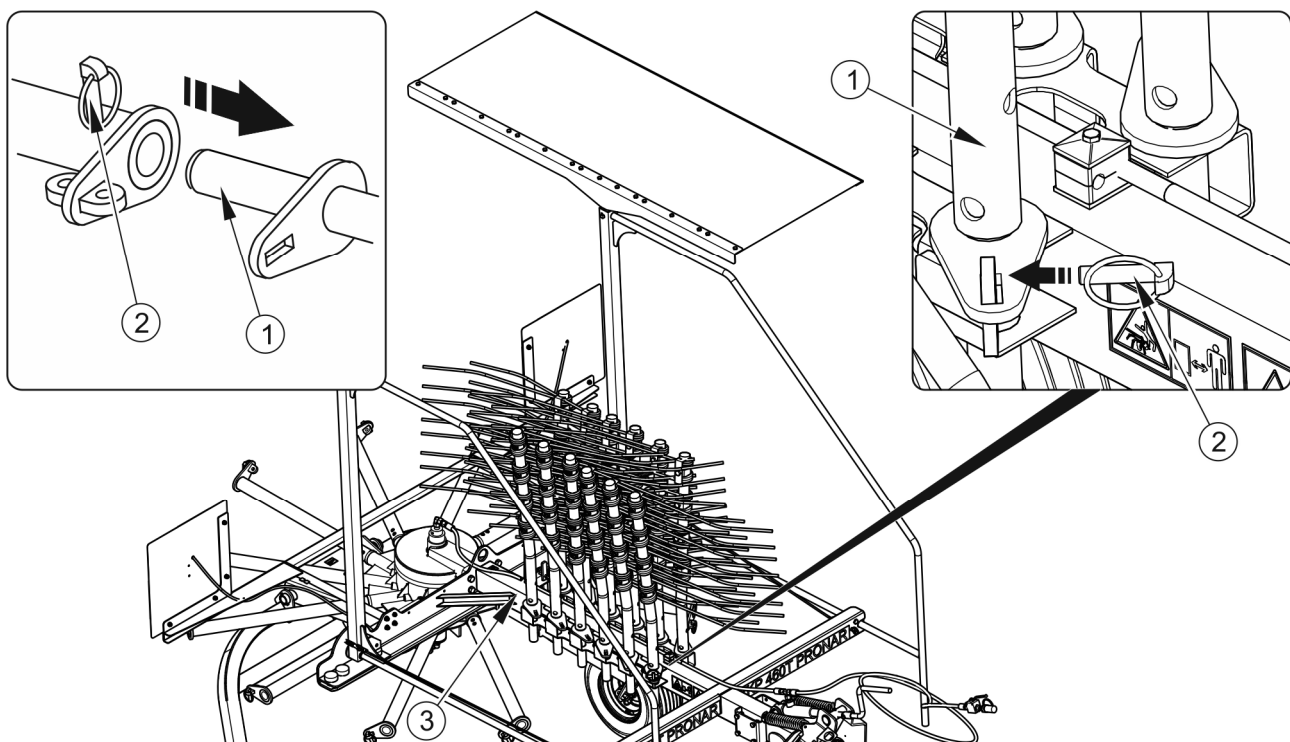


FIGURE 4.3 Disassembling the raking arms

(1) raking arm, (2) locking cotter pin, (3) main frame



NOTE

Raking arms in transport position secured with the aid of 2 cotter pins (1 cotter pin for each side). These cotter pins are used to secure raking arms in working position.

4.5 ROTARY RAKE OPERATION

4.5.1 SETTING THE ROTARY RAKE TO WORKING POSITION



DANGER

Setting the rotary rake to working position may only take place when the tractor engine is turned off. Remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor. Immobilise the tractor with parking brake.

Rotary rake transported to the field must be set in appropriate working position. Preparing of the machine for work must only take place exclusively on level and stable surface. Perform the following actions in order to set the rotary rake in working position:

- ➔ stop tractor and remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor.
- ➔ Immobilise the tractor with parking brake.
- ➔ Set the cut-off valve (6) to the open position “I”- figure (4.2).
- ➔ Lower the rotary rake slowly using the manifold lever in the tractor.
 - ⇒ The rubber bumper (1) must rest on the plate (2) of the wheel beam - figure (4.5).
 - ⇒ Set the tractor hydraulic circuit in the “floating” position.

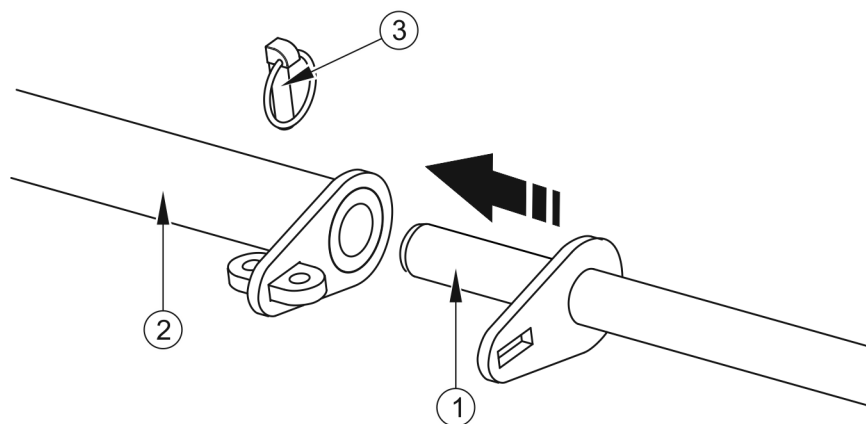


FIGURE 4.4 Assembling the raking arms

(1) raking arm, (2) arm mount, (3) securing cotter pin

- ➔ If the raking arms (1) were disassembled, assemble them by sliding them into arm mount (2) and secure with cotter pin (3) – figure (4.4).
- ➔ Turn the side protective shields (3) to working position - figure (4.2).
- ➔ Using the adjustment handle (3), set the working unit horizontally, slightly tilted forward - figure (4.5).

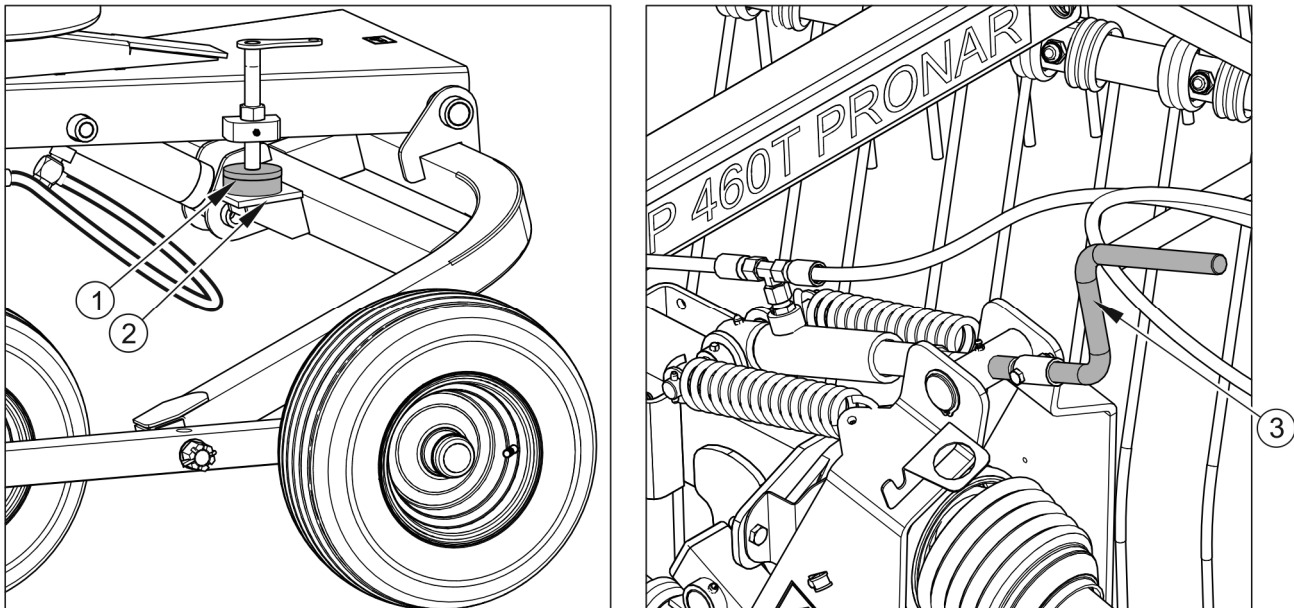


FIGURE 4.5 Setting the rotary rake

(1) rubber bumper, (2) wheel beam plate, (3) adjustment handle



DANGER

Before setting the rotary rake in working position or transport position make sure that there are no bystanders in the danger zone.



NOTE

Setting from transport position to working position and vice versa should only be conducted on a level and stable surface.

4.5.2 SETTING THE RAKING HEIGHT

Raking height selection depends on the amount of cut hay crop, degree of dampness, raking speed and the ground over which the rotary rake is moving.

TIP

If spring rake tines are too high from the ground there is a risk that not all of the swath will be raked. If the spring rake tines are too low from the ground, the swath may be contaminated with earth, turf, stones etc. Furthermore, there is an increased risk of damage to the rotary rake, mainly to the spring rake tines and their mounting to the arms. Height selection should be checked frequently during raking and if necessary the setting should be corrected

DANGER

Setting the raking height may only take place when the tractor engine is turned off. Remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor. Immobilise the tractor with parking brake.

In order to change the raking height:

- ➔ immobilise tractor with parking brake,
- ➔ set the cut-off valve (6) to the open position “I”- figure (4.2).
- ➔ raise the rotary rake slowly using the manifold lever in the tractor,
- ➔ stop tractor and remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor,
- ➔ use the adjustment screw (1) to set the rubber bumper (2) in the required position - figure (4.6).
 - ⇒ Unscrew the screw (1) counterclockwise to raise the bumper (2) and lower the raking assembly. Screw in the screw (1) to raise the raking assembly.
 - ⇒ After setting the bumper position, tighten the lock nut (3).
- ➔ Use the lever in the tractor to slowly lower the rotary rake and check the raking height. If necessary, correct the setting again by repeating the above procedure.
 - ⇒ Set the raking height so that the spring rake tines gently touch the ground.

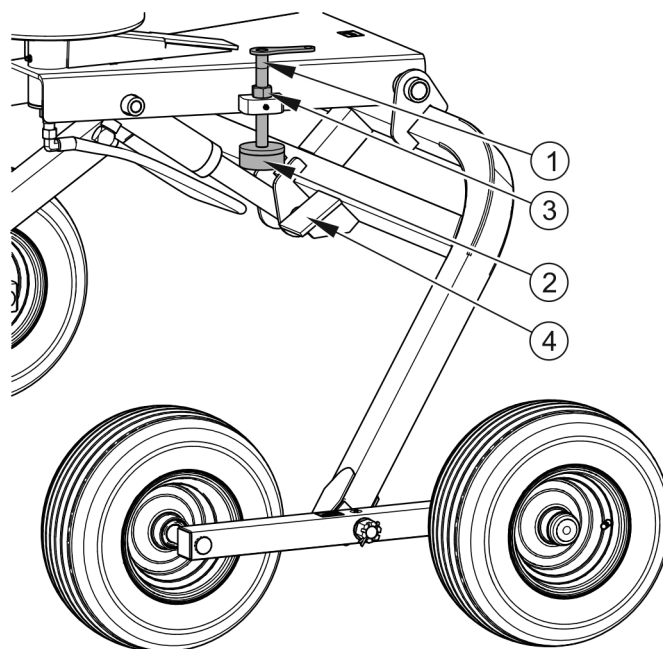


FIGURE 4.6 Setting the raking height

(1) adjustment crank, (2) rubber bumper, (3) lock nut, (4) wheel beam plate

4.5.3 SETTING THE SWATH WIDTH

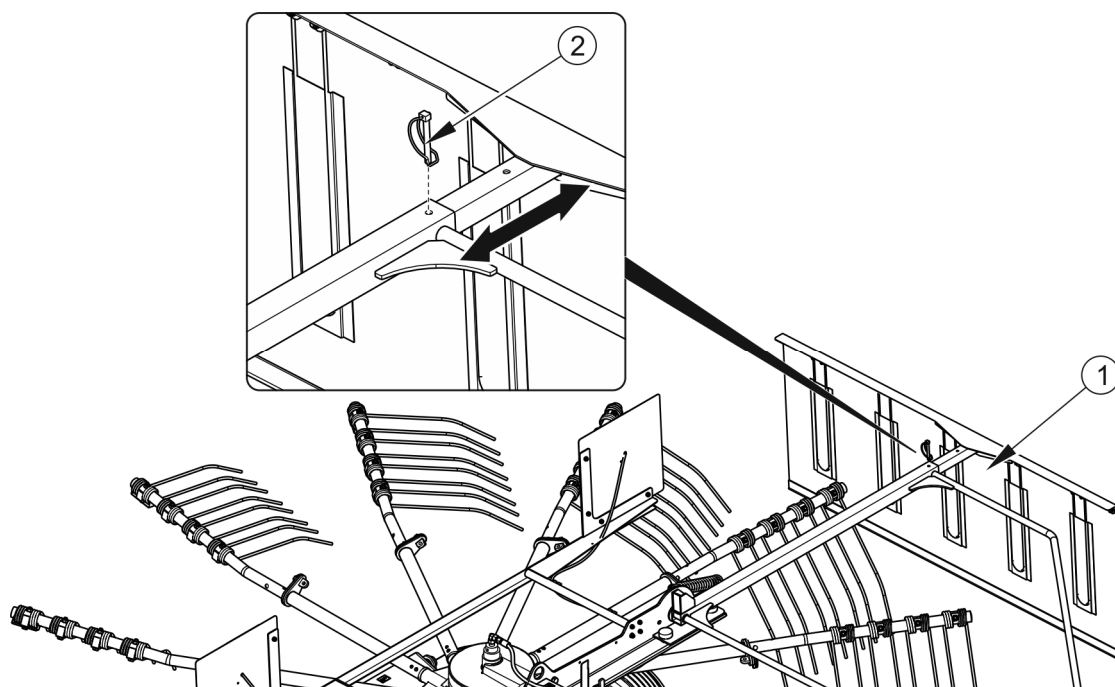


FIGURE 4.7 Setting the swath width

(1) swath forming shield, (2) securing pin

Depending on the amount of hay crop and type of machines which will be working on the field after the rotary rake, the required swath width can be set within the range from 0.5 m to 1.2 m. To set the swath width, adjust the distance of the swath forming shield (1) from the rotor. In order to do this:

- ➔ Unlock and remove the securing pin (2).
- ➔ Move the swath forming shield to the desired position and secure it with the pin (2).
 - ⇒ If there is a large amount of hay crop, the distance between the swath forming shield and the rotor should be large.
 - ⇒ If there is a small amount of hay crop, the distance between the swath forming shield and the rotor should be small.

4.5.4 SETTING THE SIDE TIPPING OF THE WORKING UNIT

The side tipping of the working unit is used when raking heavy wet hay crop.

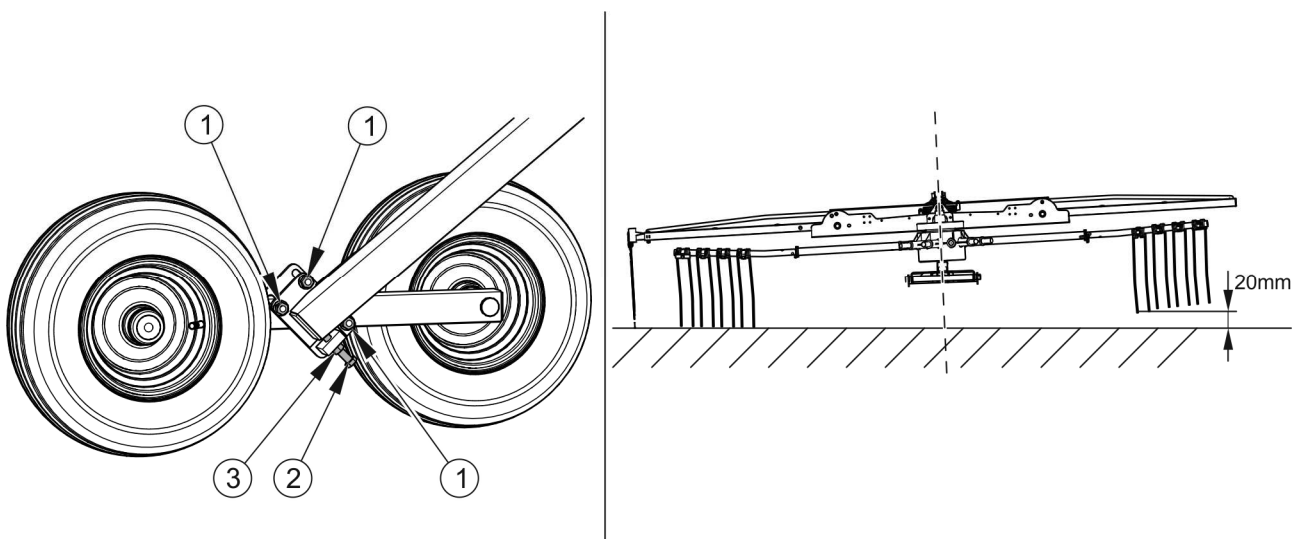


FIGURE 4.8 Setting the side tipping of the working unit

(1) fixing screw, (2) adjustment screw, (3) lock nut

To change the side tipping:

- ➔ immobilise tractor with parking brake,
- ➔ stop tractor and remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor,

- ➔ loosen fixing screws (1) and lock nut (3),
- ➔ use the screw (2) to set the chassis inclination angle and tighten the lock nut (3),
- ➔ After the adjustment, retighten the fixing screws (1).

4.5.5 SETTING THE GAUGE WHEEL (OPTION)

The rotary rake can be additionally equipped with a gauge wheel. The gauge wheel, which always runs in front of the rotor, ensures good following of uneven terrain. The spring rake tines are thus optimally guided over uneven meadow, have a very limited contact with the ground and do not contaminate hay crop.

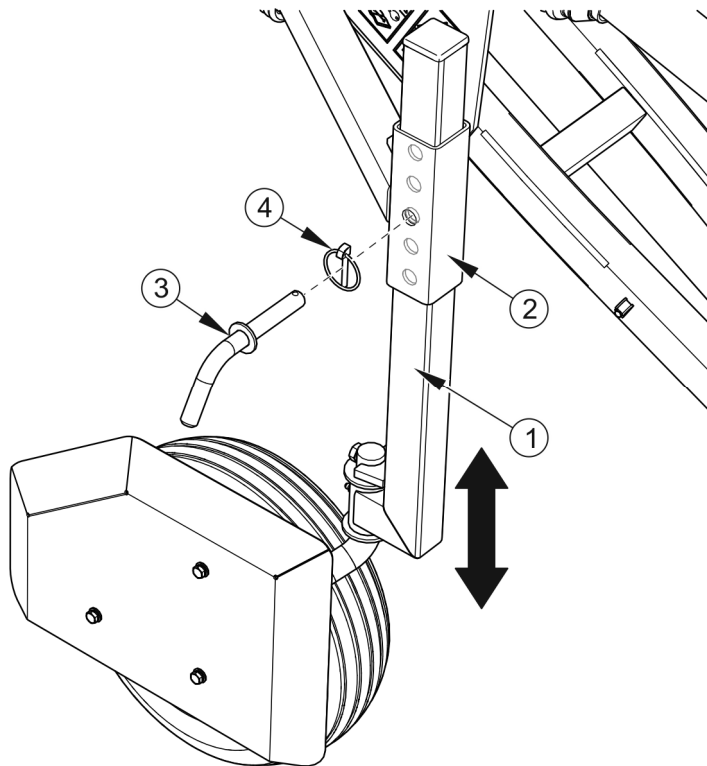


FIGURE 4.9 Setting the gauge wheel

(1) wheel arm, (2) gauge wheel, (3) pin, (4) cotter pin

The gauge wheel position is set in order to adjust the working depth of raking.

In order to do this:

- ➔ immobilise tractor with parking brake,

- ➔ stop tractor and remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor,
- ➔ unlock the cotter pin (4) and pull out the pin (3),
- ➔ set the required position of the support wheel (1) in the wheel arm holder (2),
- ➔ after the adjustment, secure the wheel position using the pin (3) and the cotter pin (4).

**NOTE**

When the rotary rake is operated with a gauge wheel, ensure a 10 mm stroke of the drawbar cylinder.

The gauge wheel must be always fitted so that it is free steering.

4.5.6 RAKING

If the rotary rake is correctly set for working in the field, is totally serviceable and its technical condition causes no concerns one may commence work.

**DANGER**

Before engaging drive to PTO shaft make sure that there are no bystanders, especially children, near the rotary rake. Maintain proper visibility of machine during work

Other persons should be at a safe distance from the rotary rake during work because of the danger that objects may be thrown (stones, branches from beneath spring rake tines.

Selective control valve lever of the tractor's external hydraulic system used for controlling the operation of the hydraulic cylinders for lifting/lowering the suspension should be set in "floating" position.

Ground speed is adjusted during working. Ground speed should be adjusted in such a way as to ensure that hay crop is completely raked and the swath is properly formed. Allowable revolution speed of PTO shaft is 540 rpm. However, one should set such a revolution speed as to prevent unnecessary spreading of hay crop. Revolution speed of PTO shaft should be reduced when a drier swath is raked.

**IMPORTANT**

Do NOT start the rotary rake with PTO revolution speed higher than 540 rpm.

The revolution speed of the shaft and the ground speed depend on several factors, including size of swath, degree of moisture, length of swath, type of ground, therefore the selection of appropriate working parameters rests on the person operating the rotary rake. During machine operation the linkage system shall be set in position adjustment work mode.

**TIP**

The height of raking arms should be checked frequently during working.

Raking the swath in order to form it into windrows should be conducted in a system of smaller areas. When turning or reversing, raise the raking assembly above the ground and disengage the PTO shaft drive. Hydraulic cylinders located on the chassis and on the drawbar ensure 40 cm clearance between the raking arms and the ground. In this position, the rotors are raised so high that the swaths that the machine runs over are not spread. When turning, keep the manifold lever in the tractor in the "Lifting" position.

4.6 UNHITCHING THE ROTARY RAKE

Machine unhitched from the tractor must be placed on a level, sufficiently hard surface in such a manner as to ensure that it is possible to hitch it again.

**DANGER**

Before unhitching the machine from the tractor, turn off the tractor engine, engage the parking brake and secure cab against access of unauthorised persons.

Be especially careful when unhitching the machine from the tractor.

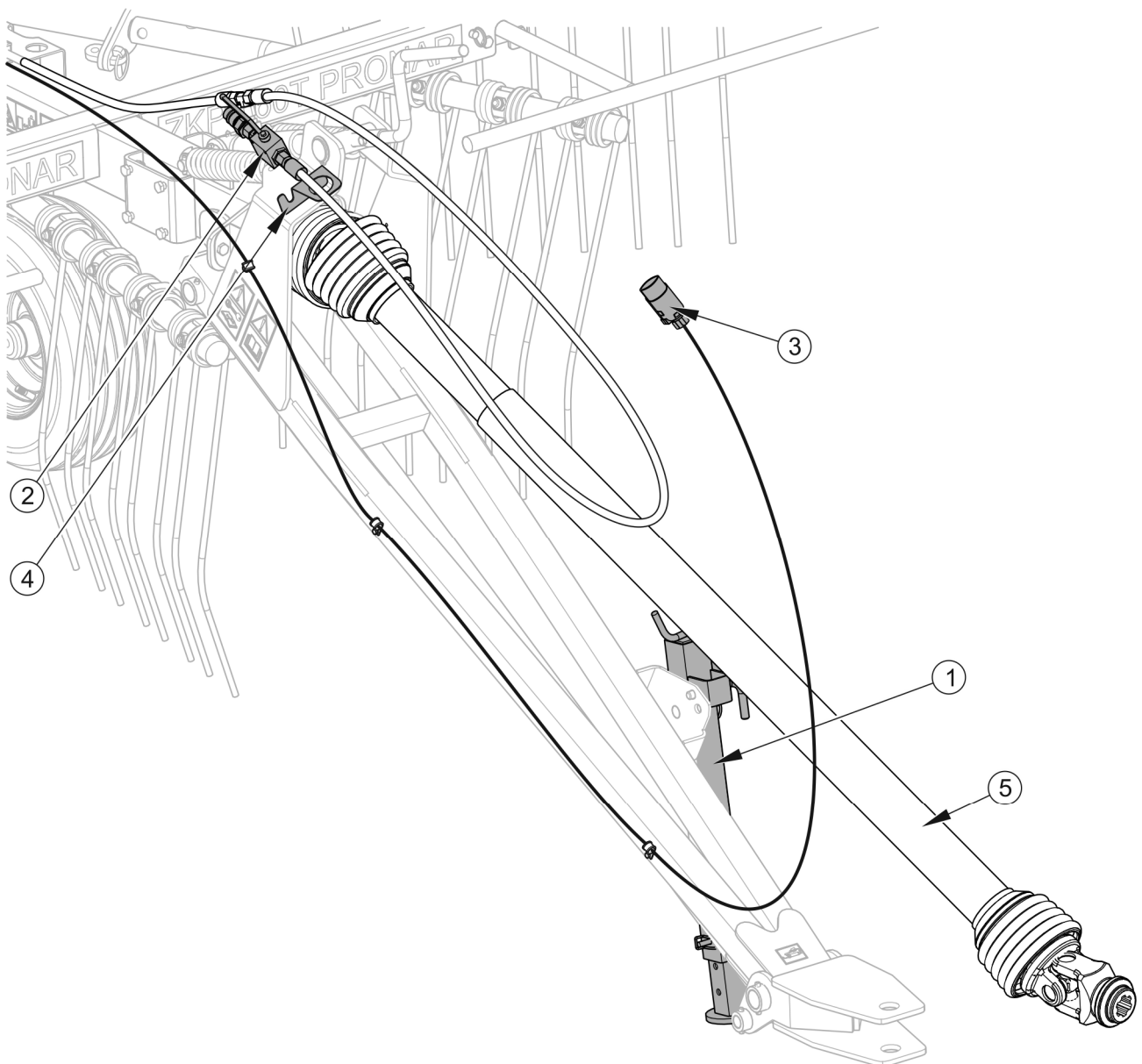


FIGURE 4.10 Unhitching the rotary rake

(1) parking stand, (2) hydraulic conduit, (3) electrical lead, (4) conduit bracket, (5) PTO shaft for connection with tractor

In order to disconnect the rotary rake from the tractor, proceed as follows:

- Place the rotary rake on a hard, flat surface.
- Lift the rotary rake's drawbar using the tractor's three-point linkage arms.
- Move the parking stand (1) from the transport position to the supporting position.

- Turn off tractor engine and remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor.
- Secure the machine against rolling away by placing chocks or other elements without sharp edges under the wheels.
- Reduce residual pressure in the hydraulic system by moving the appropriate control lever of the hydraulic circuit in the tractor.
- Disconnect hydraulic conduit (2) and electrical lead (3) and place them on the conduit bracket (4).
- Disconnect the PTO shaft (5) and place it in the holder in the parking stand.
- Disconnect the rotary rake drawbar and drive the tractor away.

**DANGER**

Do NOT use the securing chains to support the shaft while machine is parked or when transporting the machine.

SECTION

5

MAINTENANCE

5.1 PRELIMINARY INFORMATION

When using the machine, regular inspections of its technical condition and the performance of maintenance procedures are essential, which keep the machine in good technical condition. In connection with this the user of the rotary rake is obliged to perform all the maintenance and adjustment procedures defined by the Manufacturer.

Repairs during the warranty period may only be performed by authorised service points.

Detailed procedures and extent of activities which the user may perform by himself are described in this section. In the event of unauthorized repairs, changes to factory settings or activities which the machine operator is not allowed to perform, the warranty will be invalidated.

5.2 REDUCTION GEAR MAINTENANCE

Maintenance of the reduction gear is conducted during general inspection, change or topping up gear oil. In the event of damage to the reducer, contact authorised service point in order perform repairs.



Check the reduction gear oil level every day before starting work and top up if necessary.

First oil change must be made after the first 50 hours worked. The next oil change should be made after 500 hours of rotary rake work or once a year. Most suitable time for changing gear oil is when preparing for first fieldwork.



NOTE

The quantity of oil necessary to fill the reduction gear is 6.2 litres. Gear oil required: SAE90EP.

Oil change should be conducted at working temperature, if the machine has worked for several minutes, then any contaminations in the reduction gear are mixed with the oil and then drained out with it.

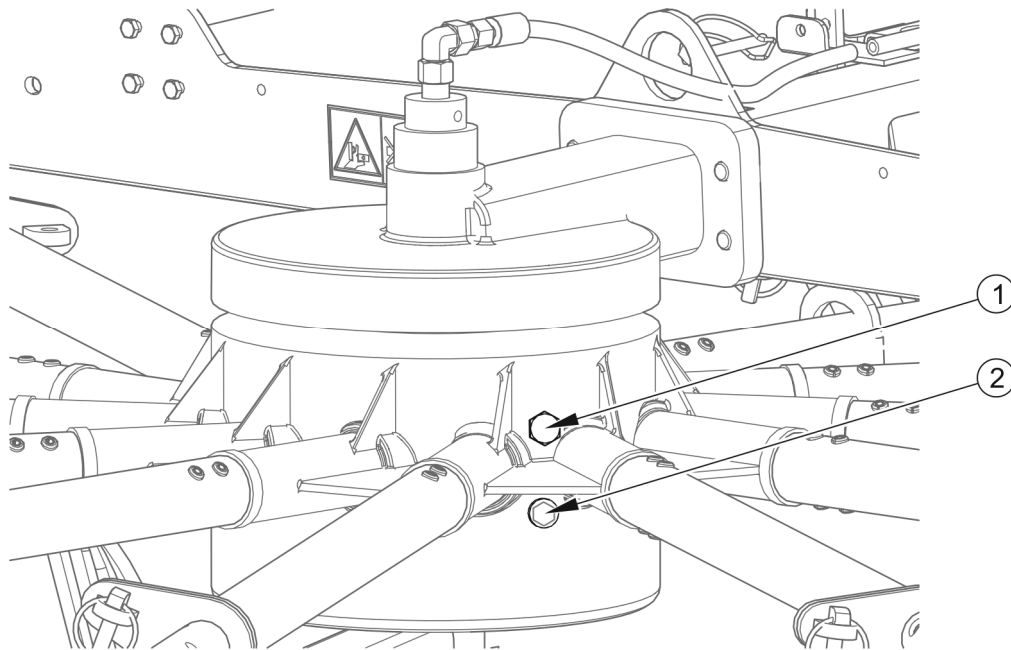


FIGURE 5.1 Gear oil change

(1) filler-overflow plug, (2) drain plug

In order to change oil in reducer:

- set rotary rake on a hard surface and level the machine
- unscrew the filler-overflow plug (1)
- unscrew drain plug (2) on the lower part of the reducer,
- drain oil into oil-resistant tight container, container capacity should be about 8 litres,
- if oil Manufacturer recommends flushing the reduction gear, that operation should be performed according to the guidelines of the oil Manufacturer (guidelines may be detailed on packaging),
- tighten drain plug,
- add oil until oil flows out of inlet opening (1), tighten plug.



The first oil change should be made after 50 hours of rotary rake work and the next change should be after 500 hours or once a year.

Lubrication of the reduction gear bearing is also required during normal operation - see section "Lubrication".

If a leak is noticed, carefully inspect seals and check oil level. Operating the reduction gear with insufficient amount of oil may cause its permanent damage. Repairs of the reduction gear during warranty period may only be performed at authorised mechanical workshops.

5.3 STORAGE

After finishing work, clean and wash the rotary rake thoroughly with a water jet. While washing do not direct a strong water or steam jet at information and warning decals or bearings. Nozzle of pressure or steam washer should be kept at a distance of not less than 30 cm from cleaned surface.

After cleaning rotary rake inspect the whole machine, inspect technical condition of individual elements. Repair or replace any used or damaged components.

In the event of damage to the paint coat, clean rust and dust from damaged area, degrease and then paint with undercoat and after it is dry paint with surface coat paint retaining colour uniformity and even thickness of protective coating. Until the time of touch-up painting, the damaged place may be covered with a thin layer of grease or anticorrosion preparation. Rotary rake should be kept in closed or roofed building.

If the rotary rake will not be used for a long time, it is essential to protect it from adverse weather, especially rust and accelerated tyre deterioration.

Rotary rake should be lubricated according to instructions provided. In the event of a prolonged storage, it is essential to lubricate all components regardless of the date of the last lubrication. Additionally before the winter period apply grease to hitching system pins. The ends of the raking arms and rake mounting sleeves should be cleaned from any contamination and protected with any widely available anticorrosion agent.

Tyres should undergo conservation maintenance at least twice a year using the appropriate preparations designed for this purpose. Complete wheels and tyres should be previously carefully washed and dried. During longer storage of unused rotary rake it is recommended that every 2 to 3 weeks the machine may be moved a bit so that the place of contact of tyres with ground is changed. The tyres will not be deformed and maintain proper geometry. Also, air pressure in tyres should be inspected from time to time and, if necessary, pressure should be increased to appropriate value.

5.4 LUBRICATION

Rotary rake lubrication shall be performed where indicated in figure (5.2) and as detailed in table (5.1). This procedure should be performed using a hand or foot operated grease gun filled with generally available permanent grease. Before commencing lubrication insofar as is possible remove old grease and other contamination. Remove excess oil or grease

Oil in reduction gearing shall be changed after the first 50 hours, and then after 500 hours or once a year of use. Detailed description of oil change and reduction gear maintenance is given in section 5.1 "Reduction gear maintenance"



During rotary rake use the user is obliged to observe lubrication instructions according to the attached schedule. Excess lubricant causes depositing of additional contaminants in places requiring lubrication, therefore it is essential to keep individual machine components clean.

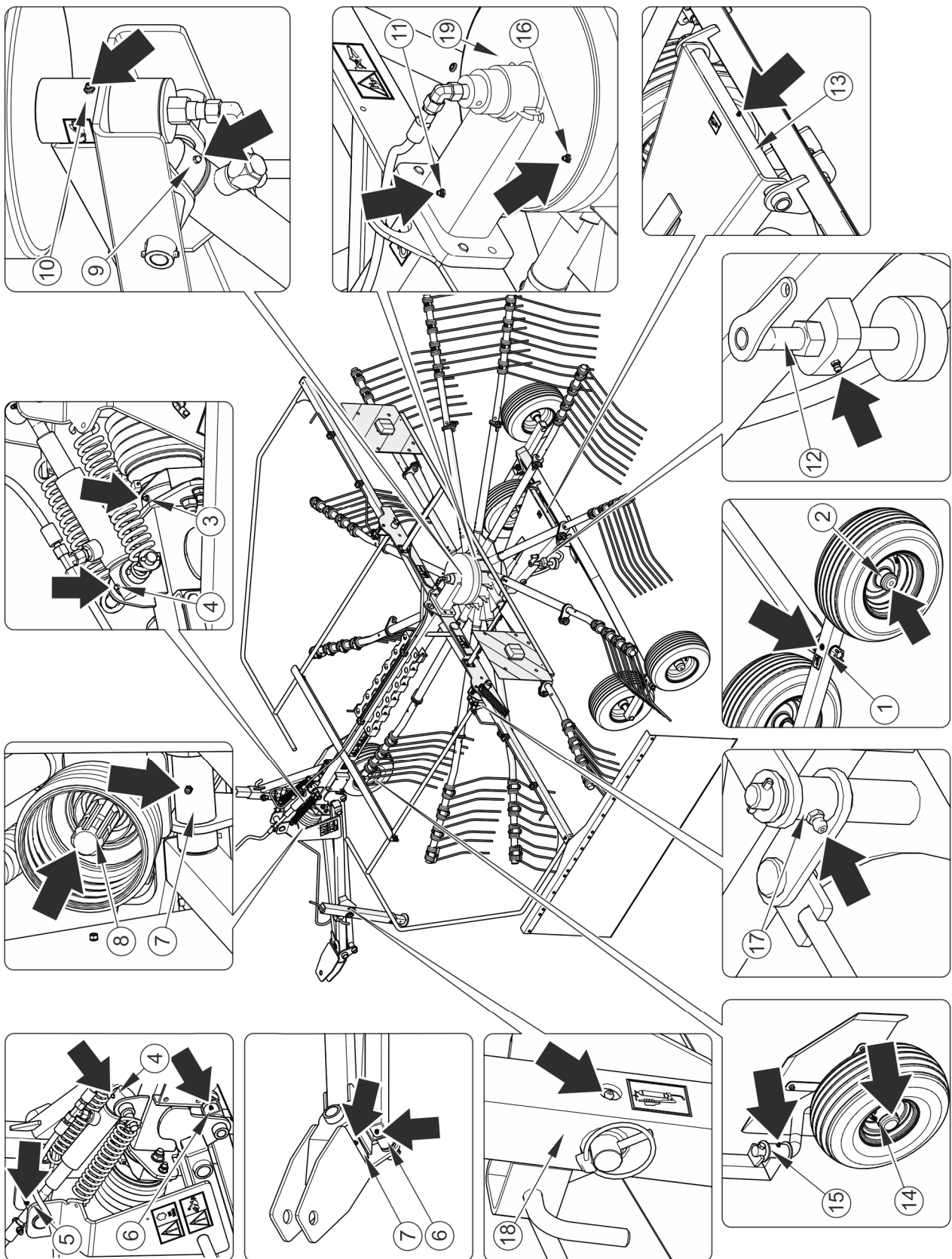


FIGURE 5.2 Rotary rake lubrication points

TABLE 5.1 Lubrication points

ITEM	NAME	NUMBER OF LUBRICATION POINTS	TYPE OF GREASE	LUBRICATION FREQUENCY
1	Suspension rocker arm pin	2	PERMANENT	60 hours
2	Wheel axle	4	PERMANENT	60 hours
3	Shaft self-aligning bearing	1	PERMANENT	20 hours
4	Drawbar cylinder lower pin	1	PERMANENT	50 hours
5	Adjustment sleeve	1	PERMANENT	50 hours
6	Guide rod pin	2	PERMANENT	20 hours
7	Upper drawbar pin	2	PERMANENT	20 hours
8	Drive shaft spline	1	PERMANENT	20 hours
9	Suspension cylinder pin	1	PERMANENT	50 hours
10	Guide sleeve	1	PERMANENT	20 hours
11	Reduction gear bearing	1	PERMANENT	20 hours
12	Bumper height adjustment screw	1	PERMANENT	20 hours
13	Suspension pin	1	PERMANENT	20 hours
14	Gauge wheel axle	1	PERMANENT	60 hours
15	Guide wheel axle	1	PERMANENT	20 hours
16	Transmission toothed ring	1	PERMANENT	20 hours

ITEM	NAME	NUMBER OF LUBRICATION POINTS	TYPE OF GREASE	LUBRICATION FREQUENCY
17	Shield locking mechanism sleeve	2	PERMANENT	20 hours
18	Parking stand rotation sleeve	1	PERMANENT	20 hours
19	Gear	1	OIL	every 500 hours or once a year
	PTO shaft	★	★	★


IMPORTANT. Description of markings in Item column in Table (5.1) conforms with numbering shown in Figure (5.1).

★ PTO shaft lubrication should be performed according to the instructions of the PTO shaft Manufacturer. For detailed information on maintenance please refer to maintenance instructions attached to the shaft.

5.5 CHECKING AND REPLACEMENT OF SPRING RAKE TINES



Each day check condition of spring tines connections to arms and locking cotter pins on raking arms frame in case they have fallen out



DANGER

Before beginning preparation work turn off tractor engine and remove the key from the ignition and engage tractor parking brake. Ensure that unauthorised persons do not have access to the tractor.

In order to dismantle spring rake tines:

- unscrew nut (4),
- disassemble securing angle (2) and bolt (3),
- remove damaged spring rake tine (1) and mount a new one,
- place angle and insert bolt, tighten nut to appropriate moment.

Spring rake tines and their mounting should be checked while working with rotary rake. Damaged elements should be replaced. It is not possible to repair spring rake tines.

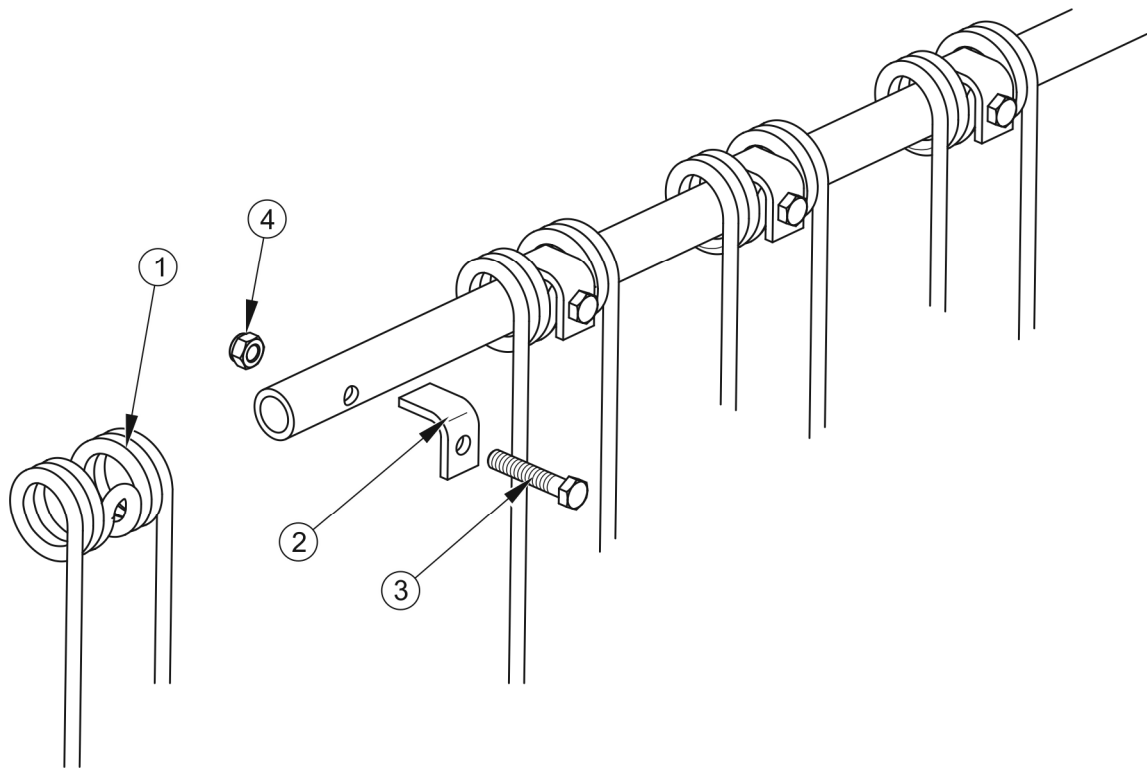


FIGURE 5.3 Changing spring rake tines

(1) spring rake tine, (2) securing angle, (3) bolt, (4) self-locking nut

5.6 GAUGE WHEEL MOUNTING

The rotary rake can be equipped with an additional gauge wheel mounted at the front of the working unit.

Gauge wheel mounting:

- ➔ Mount the wheel arm (1) with screws (3) to the plate (6) on the machine frame.
 - ⇒ The plates (6) are located on both sides of the rotary rake, so the wheel can be mounted on the left or right side of the machine.
- ➔ Place the gauge wheel (2) in the arm holder (1) and then secure it with pin (4) and cotter pin (5).
 - ⇒ The wheel must be fitted so that it is free steering – Figure (5.4).

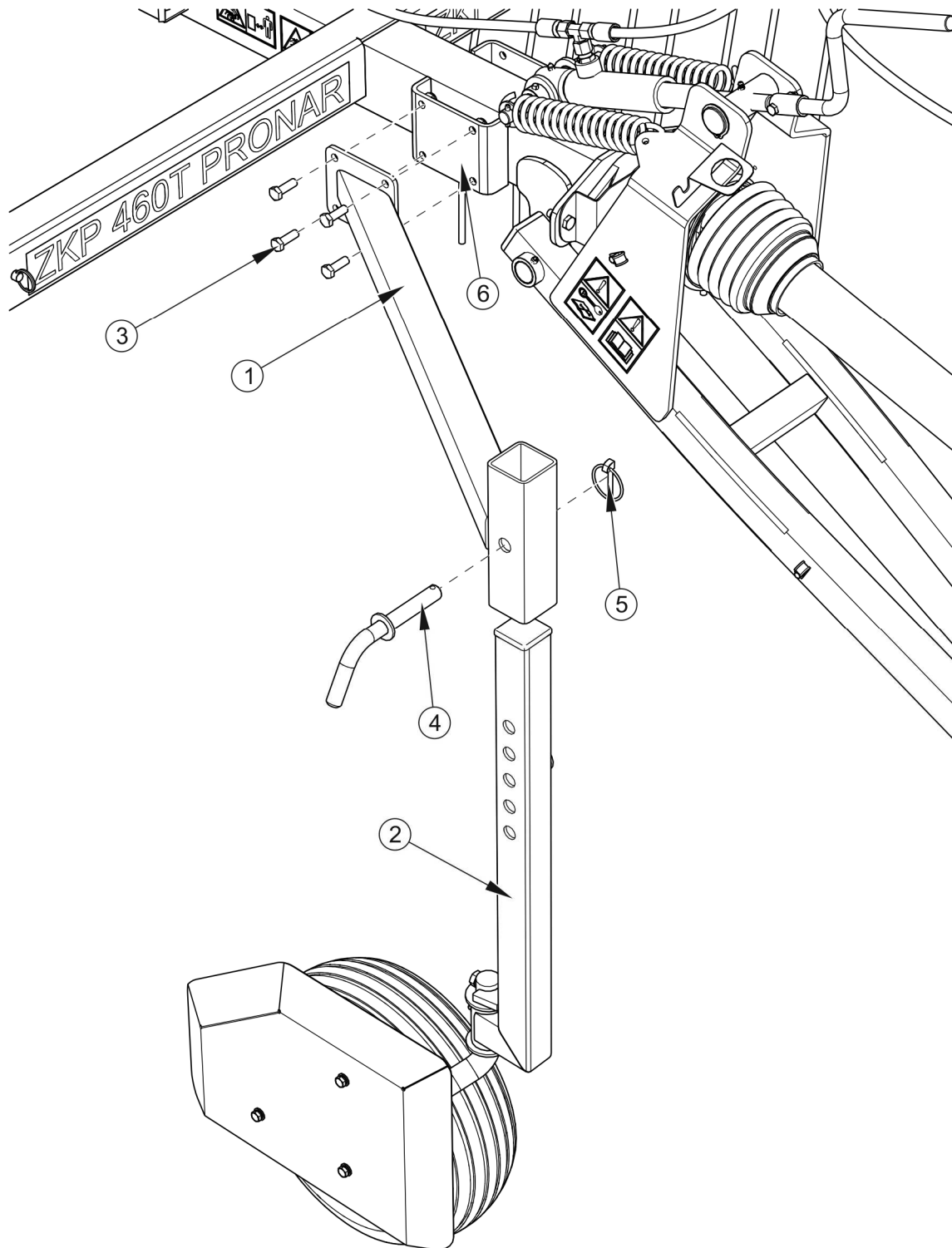


FIGURE 5.4 Gauge wheel mounting

(1) wheel arm, (2) gauge wheel, (3) screw, (4) pin, (5) cotter pin, (6) wheel mounting plate

5.7 TIGHTENING TORQUE FOR NUT AND BOLT CONNECTIONS

During maintenance or repair work, apply appropriate torque when tightening bolt and nut connections, unless other tightening torque values are given. Recommended tightening torque of most frequently applied nut and bolt connections are given in table (5.2). Given values apply to non-lubricated steel bolts.

Detailed inspection of tightness of nut and bolt connections should be made after the first 10 hours of work, and then each time at the end of working year of rotary rake.

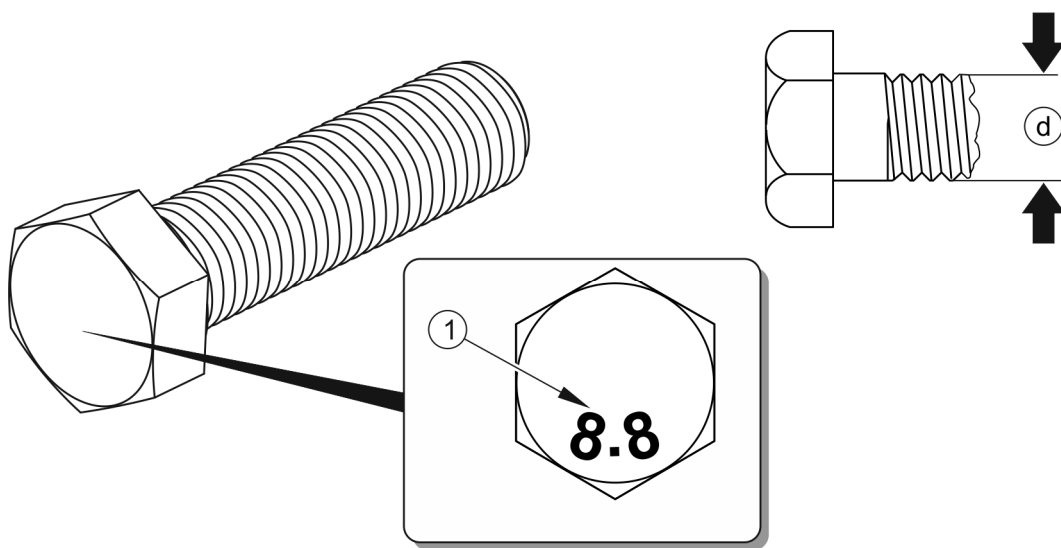


FIGURE 5.5 Bolt with metric thread

(1) bolt strength class, (d) thread diameter

TABLE 5.2 Tightening torque for nut and bolt connections

METRIC THREAD	5.8 ⁽¹⁾	8.8 ⁽¹⁾	10.9 ⁽¹⁾
	Md [Nm]		
M8	18	25	36
M10	37	49	72
M12	64	85	125
M14	100	135	200
M16	160	210	310

METRIC THREAD	5.8 ⁽¹⁾	8.8 ⁽¹⁾	10.9 ⁽¹⁾
	Md [Nm]		
M20	300	425	610
M24	530	730	1,050
M27	820	1,150	1,650
M30	1,050	1,450	2,100

⁽¹⁾ – strength class according to DIN ISO 898 standard



TIP

Hydraulic lines should be tightened using torque of 50 – 70 Nm.

5.8 TROUBLESHOOTING

TABLE 5.3 Troubleshooting

TYPE OF FAULT	POSSIBLE CAUSE	REMEDY
Rotary rake suspension cannot be lifted or lowered	Incorrectly connected or damaged quick coupler	Check quick couplers and manner of their connection
	The tractor hydraulic system is out of order	Check condition of tractor hydraulic system
Some hay crop is left unraked (inaccurate raking)	Raking height too high	Set the raking height lower according to section 4.5.2 "SETTING THE RAKING HEIGHT"
	Tractor PTO rotation speed too low	Maintain correct, constant PTO speed
	Working speed too fast	Reduce the working speed to approx. 8-10km/h. Adapt the speed to the ground conditions and the amount of forage.
	Incorrect inclination of raking assembly	Set raking assembly horizontally or slightly inclined forward

TYPE OF FAULT	POSSIBLE CAUSE	REMEDY
	Incorrect lateral tipping	Change the lateral tipping according to section 4.5.4.
	Spring tines damaged or missing	Install spring tines or replace worn spring tines.
Contaminated forage	Raking height too low	Set the raking height higher according to section 4.5.2 "SETTING THE RAKING HEIGHT"
Excessive vibration during work	Damaged PTO shaft	Check shaft, if necessary replace
	Damaged raking assembly gear	Repair at an authorised service point
Rotary rake drive units stop during raking	Damaged raking assembly gear	Repair at an authorised service point

NOTES

A series of horizontal dotted lines for writing notes.

