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

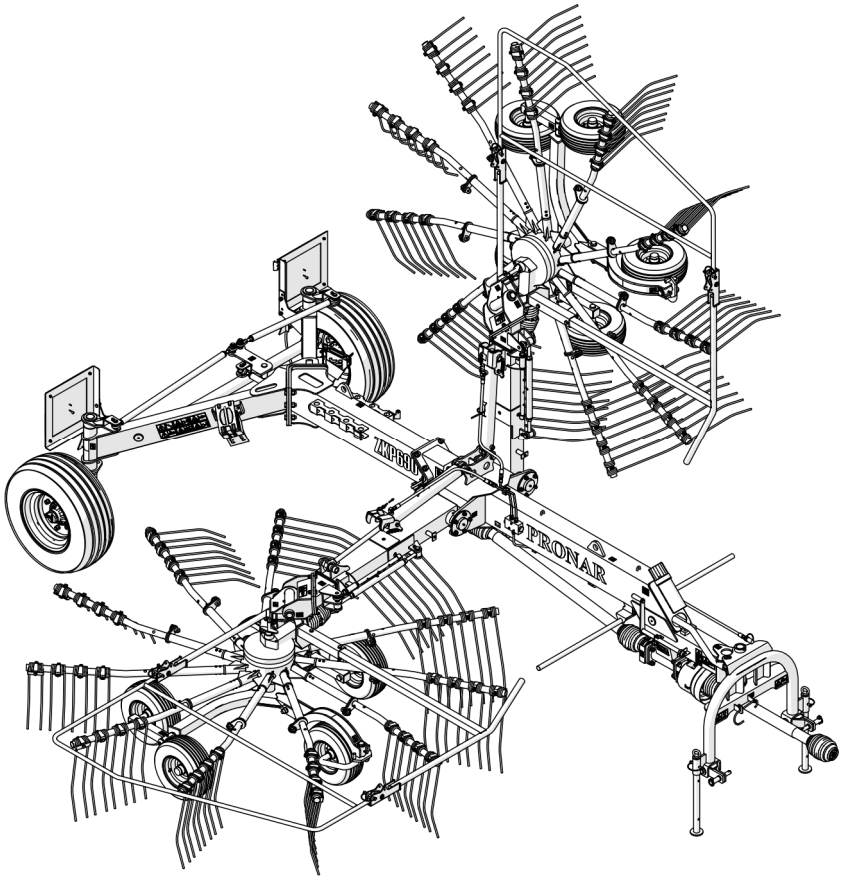
www.pronar.pl

OPERATOR MANUAL

ROTARY RAKE

PRONAR ZKP690, PRONAR ZKP800

TRANSLATION OF THE ORIGINAL COPY OF THE MANUAL



KEEP FOR FUTURE REFERENCE

EDITION 2C-12-2021

PUBLICATION NO. 231N-00000000-UM

EN

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 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

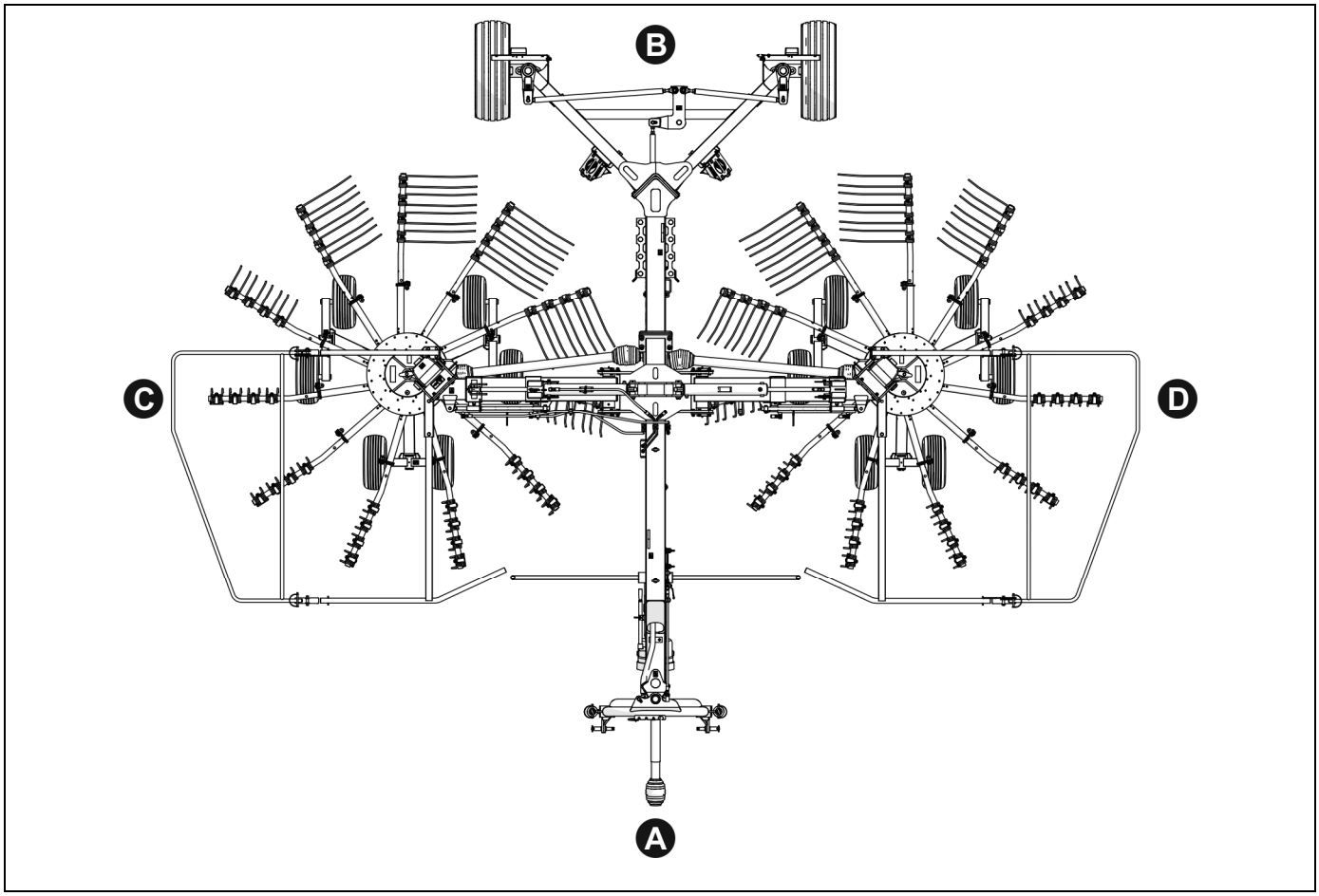


FIGURE 1 Directions used with reference to the machine

(A) front, (B) rear, (C) right side, (D) left side

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:	**ZKP690**	**ZKP800**
Model:	–	–
Serial number:		
Commercial name:	**Rotary Rake PRONAR ZKP690** **Rotary Rake PRONAR ZKP800**	

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.

Z-CA DYREKTORA
d/s techn
czł
Roman

Narew, the 2019-06-12

Place and date

Full name of the empowered person position, signature

CONTENTS

SECTION

1

BASIC INFORMATION

1.1 IDENTIFICATION

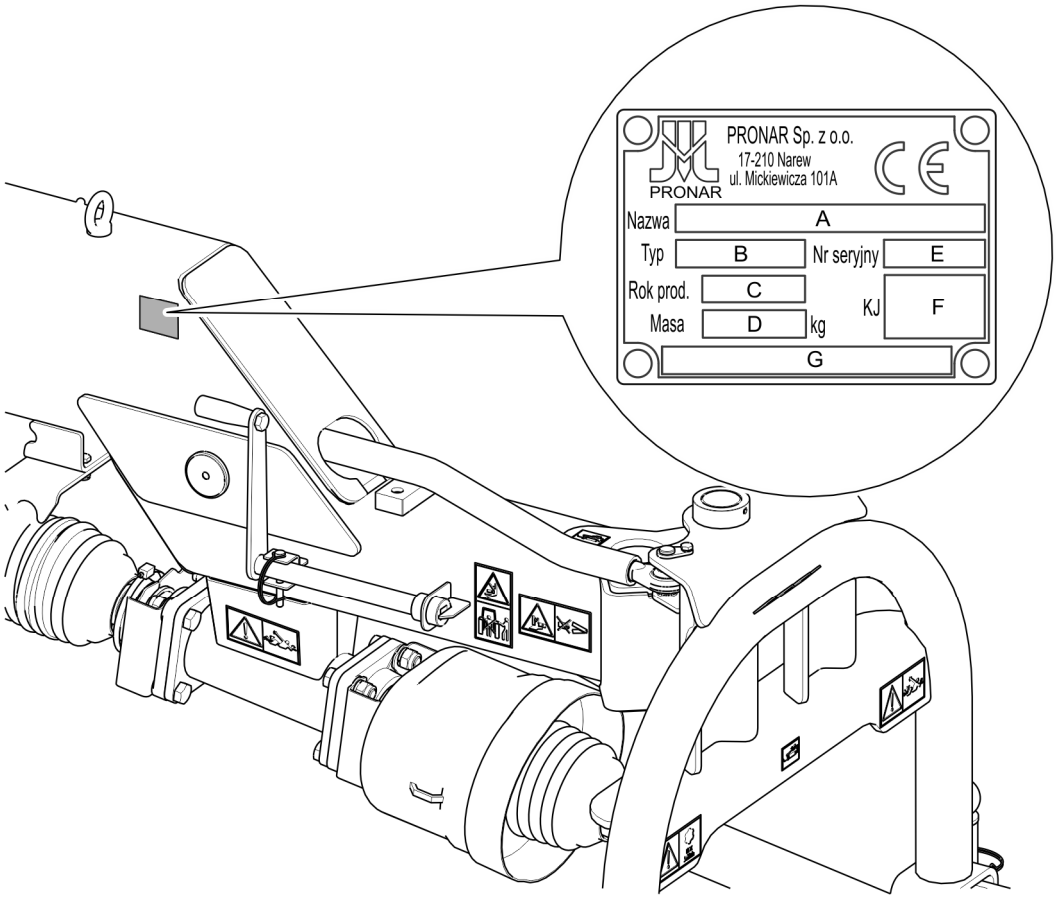


FIGURE 1.1 Location of the nameplate

(1) nameplate

The rotary rake is marked with a nameplate (1), placed on right side of machine's lifting arm. When buying the rotary rake check that the serial numbers on the machine agree with the number written in the *WARRANTY BOOK*, in the sales documents and in the Operator Manual.

The meaning of individual items of the nameplate are presented below:

A - machine name,

B – type

C – year of manufacture,

D – gross weight,

E – serial number,

F – quality Control stamp,

G – machine name, extension of name.

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.

Transporting people, animals or other materials is prohibited and regarded as contrary to the intended purpose. During the use of the machine comply with all road traffic regulations and transport regulations in force in the given country, and any breach of these regulations is regarded by the Manufacturer as use contrary to the intended use of the machine.

IMPORTANT

The rotary rake must not be used for purposes other than those for which it is intended, in particular:

- **for transporting people and animals,**
- **for transporting whatever materials or objects.**

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,
- adhere to the established maintenance and adjustment plans,
- comply with general safety regulations while working,
- prevent accidents,
- comply with road traffic regulations.
- carefully read the *OPERATOR MANUAL* and the *WARRANTY BOOK* and follow instructions in these documents,

- comply with general safety regulations while working,
- comply with the road traffic regulations and transport regulations in force in the given country, in which the machine is used,
- carefully read the Operator Manual and comply with its recommendations,
- only hitch the rotary rake to an agricultural tractor which meets all the Manufacturer's requirements.

The rotary rake may only be used by persons, who:

- are familiar with the contents of this publication and with the contents of the agricultural tractor Operator Manual,
- have been trained in rotary rake operation and safe operation,
- have the required authorisation to drive and are familiar with the road traffic regulations and transport regulations.

TABLE 1.1 Requirements for agricultural tractor

CONTENTS	UNIT	REQUIREMENTS
Rear three-point linkage		
Category	-	I or II according to ISO 730-1
Power take-off shaft		
Rotation speed	rpm	540
PTO type	-	type 1 according to ISO 500 (nominal diameter 35 mm, 6 splines)
ZKP690 hydraulic system		One single acting section with floating position + one double acting section (option for hydraulically adjusted working width).
ZKP800 hydraulic system		One double acting section + one single acting section with floating position
Hydraulic oil	-	AGROL U (1)
System pressure rating	bar / MPa	160 / 16

CONTENTS	UNIT	REQUIREMENTS
Electrical system		
Electrical system voltage	V	12
Connection socket	-	7-pole compliant with ISO 1724
Other requirements		
The required minimum power		
ZKP690	hp / kW	70 / 51
ZKP800	hp / kW	80 / 59

(1) – use of other oil is permitted, on condition that it may be mixed with the oil in the rotary rake. Detailed information can be found on the product information card.

1.3 EQUIPMENT

When buying the rotary rake check integrity of the machine.

ROTARY RAKE EQUIPMENT	STANDARD	ADDITIONAL	OPTIONS
Operator Manual	•		
Warranty Book	•		
Connection wire for the electrical system	•		
Wheel chocks	•		
PTO shaft for connection with tractor	•		
Reflective warning triangle		•	
Document holder		•	
Raking springtines safeguards		•	
Hydraulically adjusted working width (ZKP690)			•

Recommended PTO shaft for connection with tractor:

- 7G4081CE007WR7A B&P (ZKP690, ZKP800)

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.

The warranty service only applies to factory defects and mechanical damage that is not due to the user's fault.

In the event of damage arising from:

- mechanical damage which is the user's fault, damage caused by road accidents,
- inappropriate use, adjustment or maintenance, use of the machine for purposes other than those for which it is intended,
- use of damaged machine,
- repairs carried out by unauthorised persons, repairs carried out improperly,
- making unauthorised alterations to machine design,

the user will lose the right to warranty service.

Do NOT attempt to modify the machine without the written consent of the Manufacturer. In particular, do NOT weld, drill holes in, cut or heat the main structural elements of the machine which have a direct impact on the machine operation safety.

For detailed Terms & Conditions of Warranty, please refer to the *WARRANTY BOOK* attached to each newly purchased machine.

1.5 TRANSPORT

To save space, the rotary rake is partially disassembled for shipment. Before the first start-up, it should be assembled in accordance with appendix A "FIRST ASSEMBLY MANUAL" to prepare it for normal operation.

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. This is due to the vehicle's centre of gravity shifting upwards when the machine is loaded.

The machine is delivered to the user on a transport vehicle. Transport of the rotary rake is permissible connected to a tractor provided the tractor driver familiarises himself with the machine's Operator Manual and particularly with information concerning safety and principles of connection and transport of tedder on public roads. Do NOT drive the tractor with rotary rake connected when visibility is limited.

When loading and unloading ready to work rotary rake, follow the general health and safety regulations for reloading work. Persons operating reloading equipment must have the qualifications required to operate these machines.

The rotary rake should be attached to lifting equipment in places shown on figure (*1.2*), i.e. to transport lugs. Securing point is marked with information decal.

During reloading and transport, the rotary rake should be set in transport position, i.e. right side raking assembly (1) and left side raking assembly (2) must be raised, and parking stand (3) must be lowered - figure (*1.2).* It is recommended that during transport of the machine the raking arms 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.

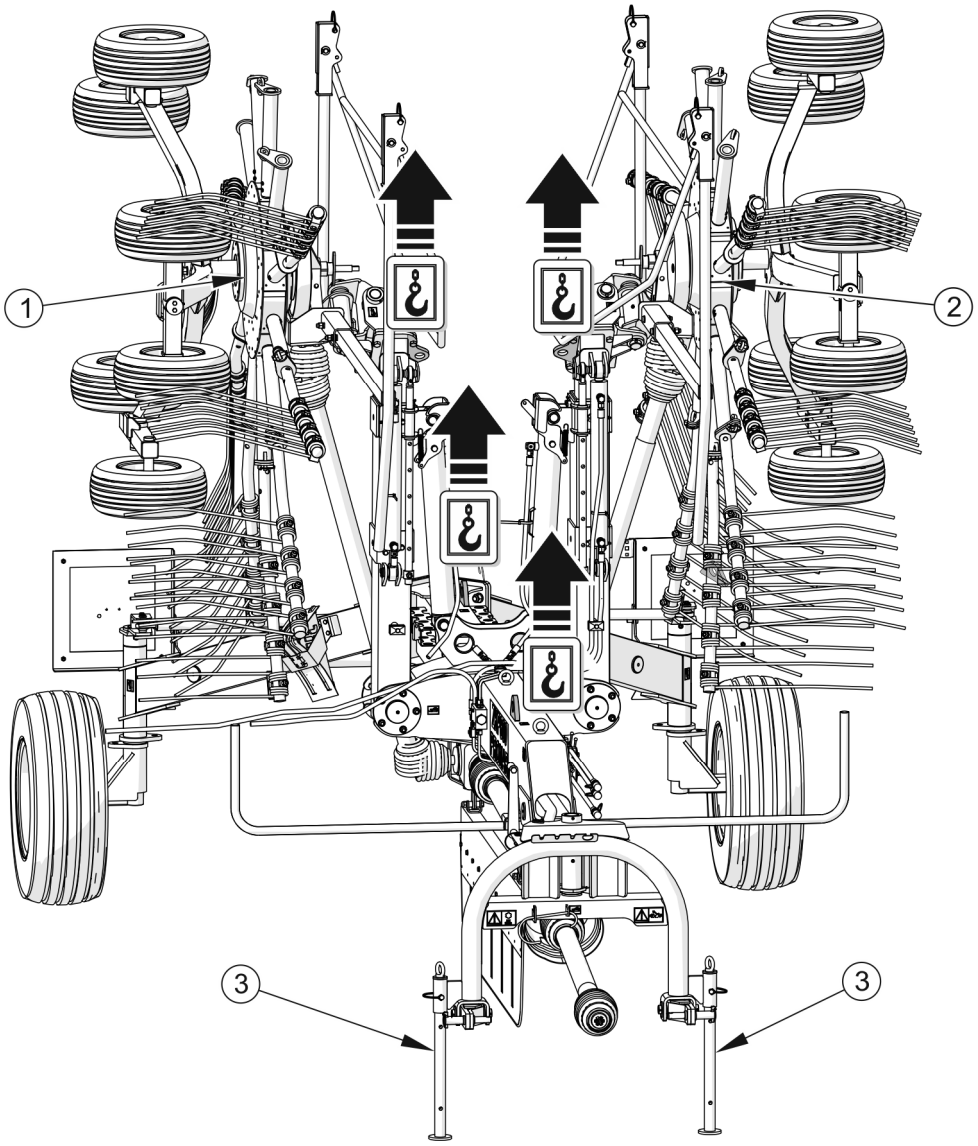


FIGURE 1.2 Rotary rake suspension points

(1) right side raking assembly, (2) left side raking assembly, (3)parking stand

DANGER

During loading, rotary rake should be placed in transport position.

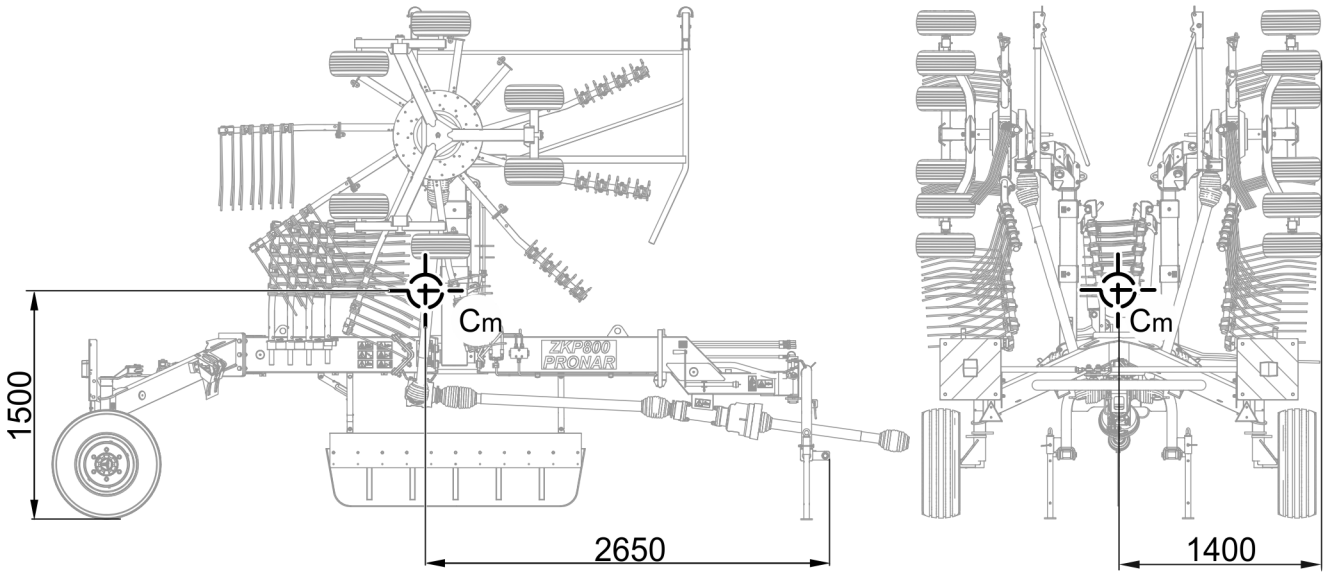


FIGURE 1.3 Location of centre of gravity of the ZKP800 in transport position.

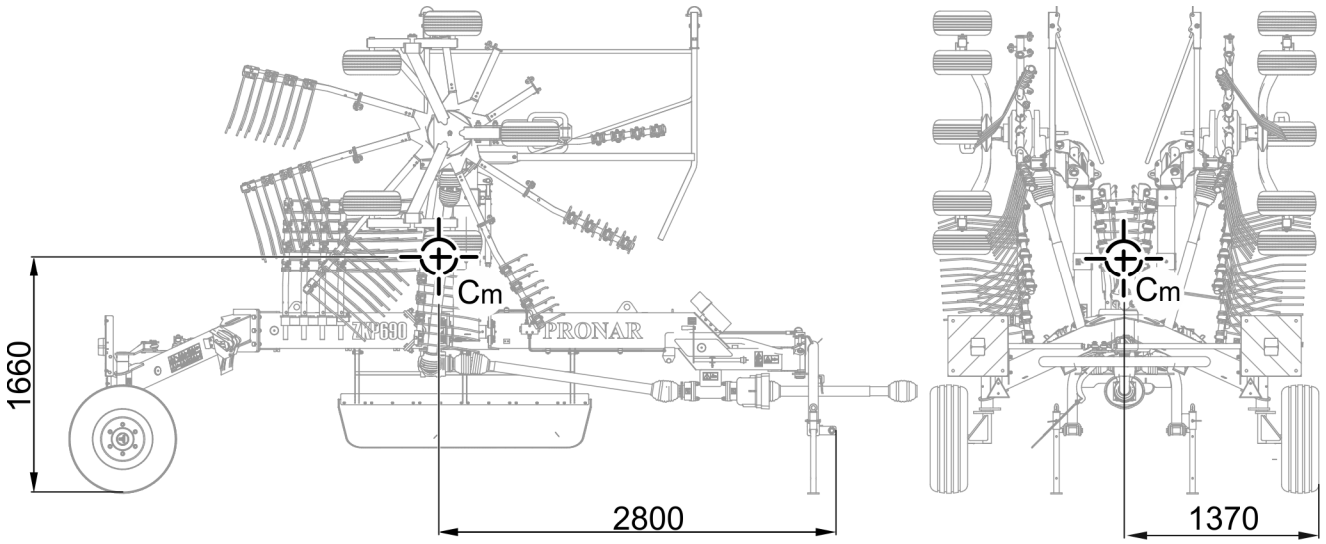


FIGURE 1.4 Location of centre of gravity of the ZKP690 in transport position.

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.

IMPORTANT

When shipped by road on a motor vehicle the machine must be mounted on the vehicle's platform in accordance with the safety requirements and regulations.

Use only certified and technically reliable securing measures. Carefully read the information contained in the Operator Manuals for the given securing measures.

Do NOT secure lifting slings or any types of securing elements to hydraulic cylinders.

During reloading work, take special care not to damage any accessories or paint finish. The tare weight of the rotary rake in condition ready for travel is given in table *(3.1).*

DANGER

Incorrect use of securing measures may cause an accident.

Persons must NOT be present in the manoeuvring zone during transferring the machine to another means of transport.

1.6 ENVIRONMENTAL RISK

A hydraulic oil leak constitutes a direct threat to the natural environment owing to its limited biodegradability. Because of the low solubility of oil in water, it is not highly toxic to living organisms. 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. Detailed information concerning hydraulic oil may be found on the product's Material Safety Data Sheet.

TIP

The hydraulic system of the rotary rake is filled with AGROL U hydraulic oil.

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 proceeding to disassemble equipment oil shall be completely removed 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 machine thoroughly read this Operator Manual and the PTO shaft instructions. When operating the machine, follow all instructions in these documents.
- The machine may only be used and operated by persons qualified to drive agricultural tractors and trained in the use of the machine. Rotary rake can be operated by a single person only.
- 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.
- Non-compliance with the safety rules of this Operator's Manual can be dangerous to the health and life of the operator and others.
- Be aware of the residual risk. Use caution when operating this machine and follow all relevant safety instructions.
- 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.
- 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.
- The machine 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.

2.1.2 HITCHING AND DISCONNECTING THE ROTARY RAKE

- The rotary rake should be hitched to and transported with only such a tractor which meets all the manufacturer's requirements (minimum tractor power demand, required tree-point linkage category etc.) – see table *(1.1) AGRICULTURAL TRACTOR REQUIREMENTS.*
- Before hitching the machine to the tractor, check the technical condition of the hitching system of the rotary rake and the 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.
- When connecting the hydraulic lines to the tractor, make sure that the tractor and rotary rake hydraulic system are not under pressure. If necessary, reduce residual pressure in the system.
- Only the rear three point linkage may be used for hitching the machine to the tractor. 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.
- 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.
- The machine disconnected from the tractor must be secured against unauthorized use with a safety device.

2.1.3 TRANSPORTING THE MACHINE

- When driving on public roads, observe all road traffic regulations in force in the country, in which the rotary rake is used.
- Before driving off make certain that the rotary rake is correctly hitched to the tractor and check lighting system.
- Before beginning travel, the rotary rake must be placed in transport position and raised to the appropriate height using the rear three-point linkage system.
- In the rear part of the rotary rake, in attachment point, place slow-moving vehicle warning triangle plate – figure (*2.1*).

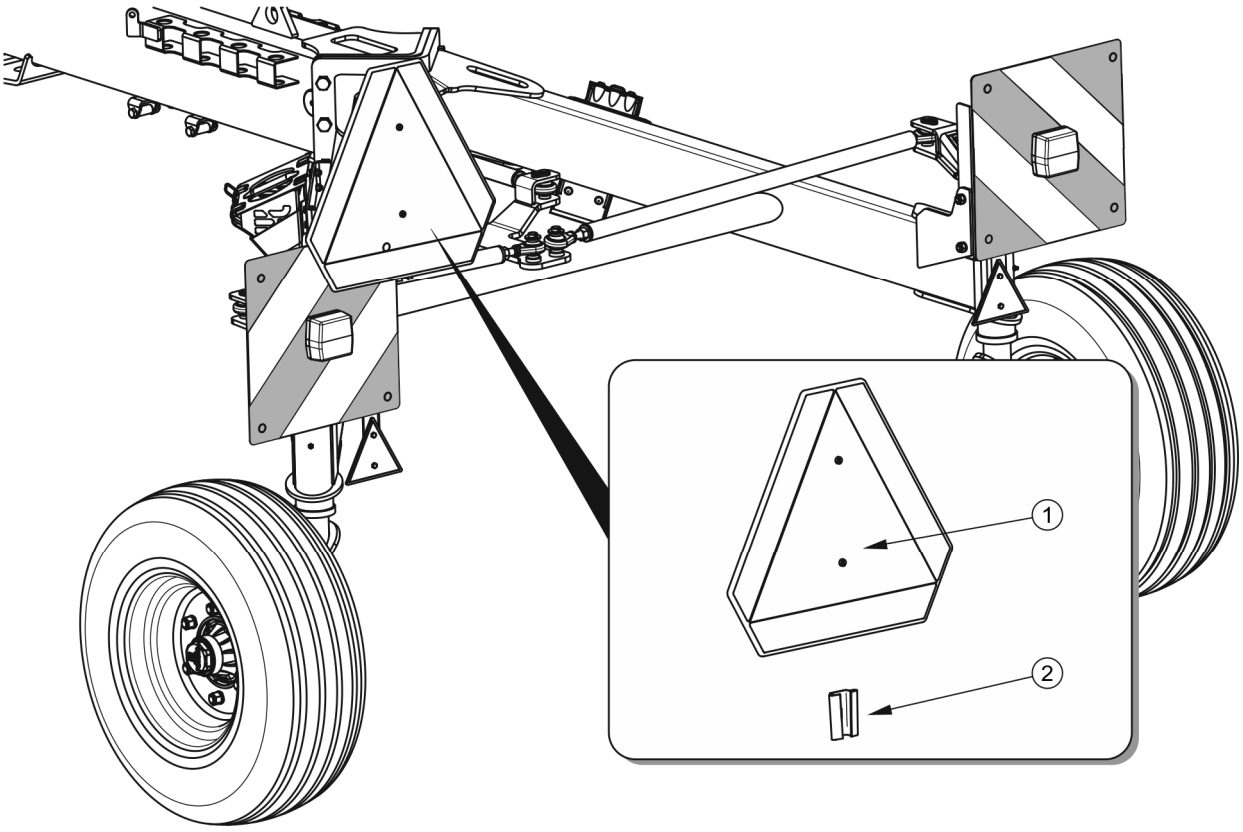


FIGURE 2.1 Mounting place for slow-moving vehicle warning sign

(1) slow-moving vehicle warning sign, (2) attachment point

- In order to prevent inadvertent activation of the hydraulic system, the cut-off valves must be closed while moving the machine during its 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.

2.1.4 HYDRAULIC SYSTEM

- The hydraulic system is under high pressure when operating.
- Use the hydraulic oil recommended by the Manufacturer. Never mix two types of oil.
- 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.
- Before beginning repairs on hydraulic systems, reduce oil pressure.
- In the event of injuries being caused by pressurised hydraulic oil, contact a doctor immediately. Hydraulic oil may find its way under the skin and cause infections.
- 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 greater 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

- 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.
- 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.
- During windrowing use the correct working position.
- While windrowing apply working speed recommendations.

2.1.7 CLEANING, MAINTENANCE AND REPAIRS

- Repair, maintenance and cleaning work should be carried out with the tractor engine turned off and the ignition key removed.
- In order to reduce the danger of fire the machine must be kept in a clean condition.
- 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 machine be performed by specialised workshops.
- In the event of any fault or damage, do not use the rotary rake until the fault has been fixed.
- During work, use appropriate, close-fitting protective clothing, gloves and appropriate tools.
- 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.
- Regularly check the condition of the bolt and nut connections.
- Should it be necessary to change individual parts, use only original parts. Non-adherence to these requirements may put the user and other people's health and life at risk, and also damage the rotary rake and invalidate the warranty.
- Before welding or electrical work, the machine should be disconnected from the power supply.
- The paint coating should be cleaned off before beginning welding work. 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 (parts of the electric and hydraulic systems, plastic parts). If there is a risk that they will catch fire or be damaged, they should be removed before commencing welding work.

- 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 lifted machine must not be supported using fragile elements (bricks, hollow bricks or concrete blocks).
- After completing work associated with lubrication, remove excess oil or grease.
- After changing the hydraulic oil, the used oil should be properly disposed of.
- 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.
- Checking the tightening of axle wheels should be made after the first use, after the first day of work, and then at regular intervals every 50 hours of work. The above actions should be repeated each time a wheel has been removed from the wheel axle.

2.2 DESCRIPTION OF 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 while the engine is running,
- operating the rotary rake with the safety guards removed 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,

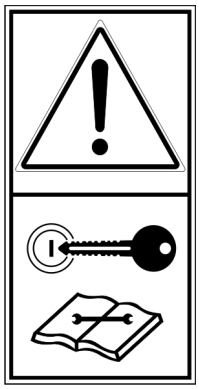
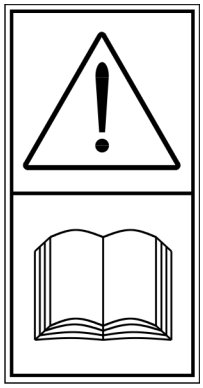
The residual risk may be kept to a minimum by following the recommendations below:

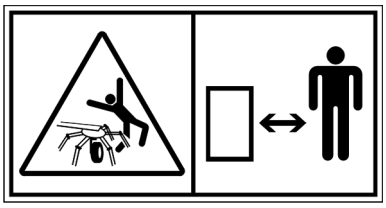
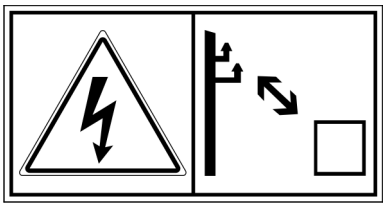
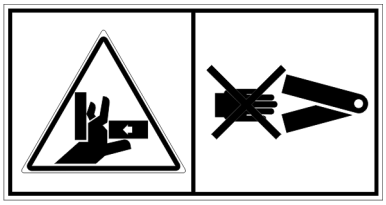
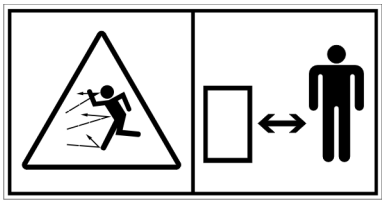
- operate the machine in prudent and unhurried manner,
- sensibly adhere to the remarks and recommendations contained in the Operator Manual,
- maintain a safe distance from prohibited or dangerous places
- a ban on being on the machine when it is operating,
- carry out repairs and maintenance work in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

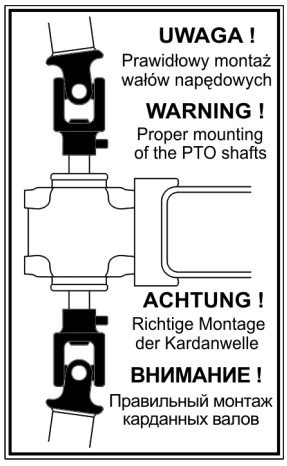
2.3 INFORMATION AND WARNING DECALS

The rotary rake is labelled with the information and warning decals mentioned in table (*2.1*). The arrangement of symbols is shown in figure (*2.2*). 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, 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	SAFETY SYMBOL	DESCRIPTION
1		Danger of inadvertent starting or rolling of the machine. Before maintenance or repairs, turn off engine and remove key from ignition. **178N-00000001**
2		Note Before starting work, carefully read the Operator Manual **178N-00000002**
3		Grease according to the recommendations in the Operator Manual **185N-00000011**
4		Transport lug points marking. **178N-00000009**
5		Note Danger associated with the rotating PTO shaft. **185N-00000003**

ITEM	SAFETY SYMBOL	DESCRIPTION
6		Risk of injury when machine is being arranged in transport or working position. **185N-00000007**
7		Danger of being struck by rotating elements of the machine. Keep a safe distance from raking assembly. **178N-00000007**
8		Keep a safe distance from electric power lines. **185N-00000009**
9		Do not reach into crushing space because elements may move. Danger of crushing hands or fingers. **178N-00000005**
10		Thrown out objects endanger the whole body. Keep a safe distance from the operating machine. **178N-00000006**
11		Do not stand directly behind the tractor while operating the rear hitch. **185N-00000008**

ITEM	SAFETY SYMBOL	DESCRIPTION
12		Note Maximum allowable PTO shaft rotation speed is 540 rpm. **185N-00000004**
13		Machine type ZKP690 **605N-00000001**
13		Machine type ZKP800. **231N-00000001**
14		Air pressure in the tyres. (1) **68N-00000005**
15		Proper adjustment of of PTO shafts **231N-00000002**
16		Company logo. **578N-00000003**

(1) *– pressure value should be adapted to tyres*

Numbers in the item column correspond to labels in figure *(2.2)*

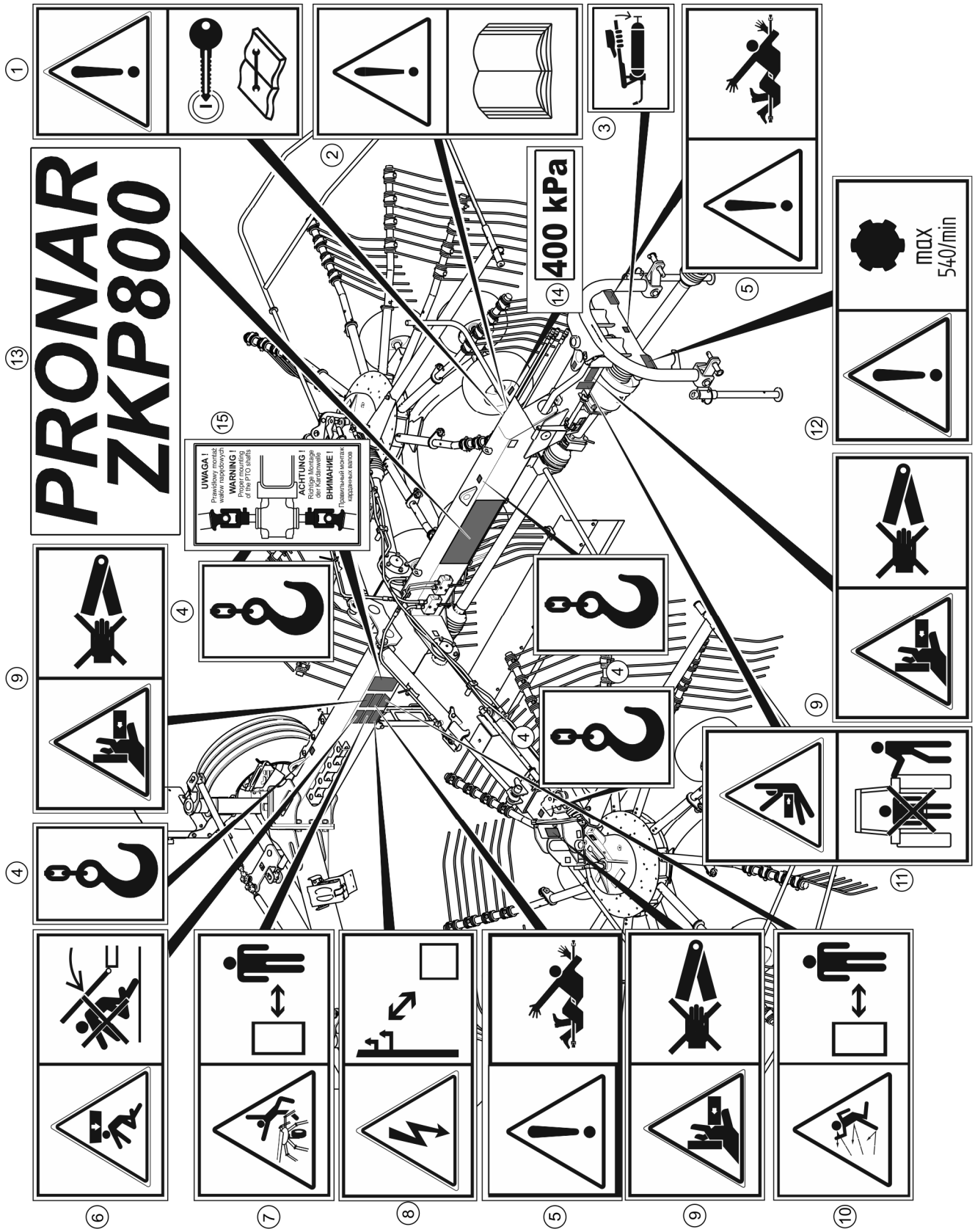


FIGURE 2.2 Locations of ZKP800 information and warning decals.

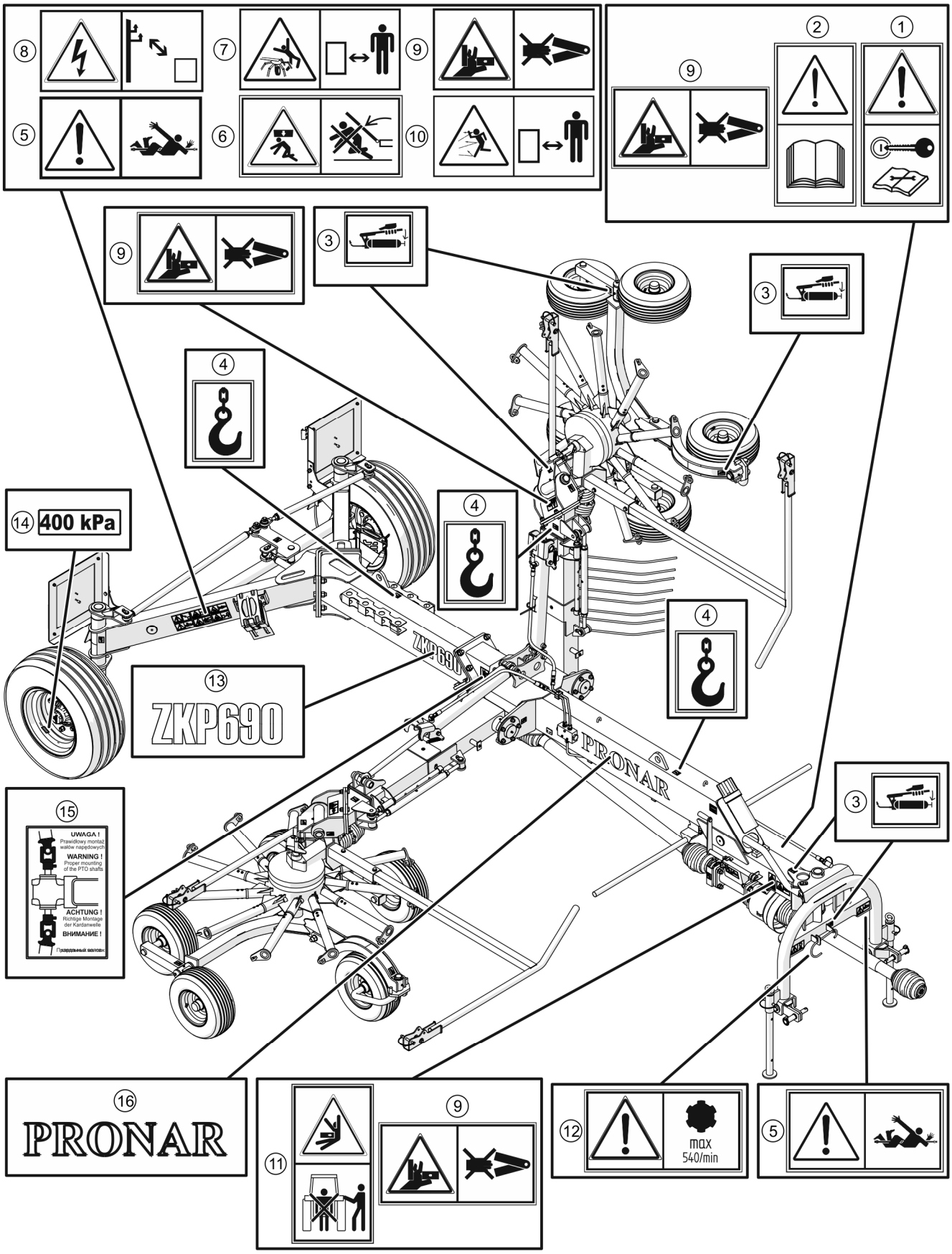


FIGURE 2.3 Locations of ZKP690 information and warning decals.

SECTION

3

DESIGN AND OPERATION

3.1 TECHNICAL SPECIFICATION

TABLE 3.1 Pronar ZKP690 and ZKP800 rotary rake basic technical specification

CONTENTS	UNIT	ZKP690	ZKP800
Dimensions in the transport position			
Total length in transport setting	mm	5,400	5,400
Width	mm	2,800	2,800
Height			
rakes extended	mm	3,450	3,550
rakes withdrawn	mm	4,100	4,200
Dimensions in the operating position			
Total length	mm	5,400	5,400
Width in working setting			
minimum	mm	6,970	7,500
maximum	mm	7,670	8,500
Height	mm	1,450	1,450
Technical specification			
Working width	mm	6,440 – 7,140	7,000 – 8,000
Distance between rotors	mm	350 - 1,050	900 – 1,900
Minimum tractor power demand	hp / kW	51 / 70	80 / 59
Maximum PTO speed	RPM	540	540
Tare weight	kg	1,840	1,940
Number of rotors	item	2	2
Number of rotor working arms	item	11	11
Number of raking spring tines on a single working arm	-item	4	4
Recommended working speed	km / h	10	10
Maximum driving speed	km / h	25	25
Raking assembly wheels and suspension	-	5 wheels	6 wheels
Wheel axle tyres			
Tyre	-	10.0 / 75- 15.3	
Air pressure in the tyres	kPa	400	
Raking assembly tyres			

CONTENTS	UNIT	ZKP690	ZKP800
Tyre	-	16 x 6.5 – 8 (6PR)	
Air pressure in the tyres	kPa	160	
Other information			
Electrical system voltage	V	12	12
Noise emission level	dB(A)	below 70	below 70

3.2 ROTARY RAKE DESIGN

3.2.1 GENERAL DESIGN

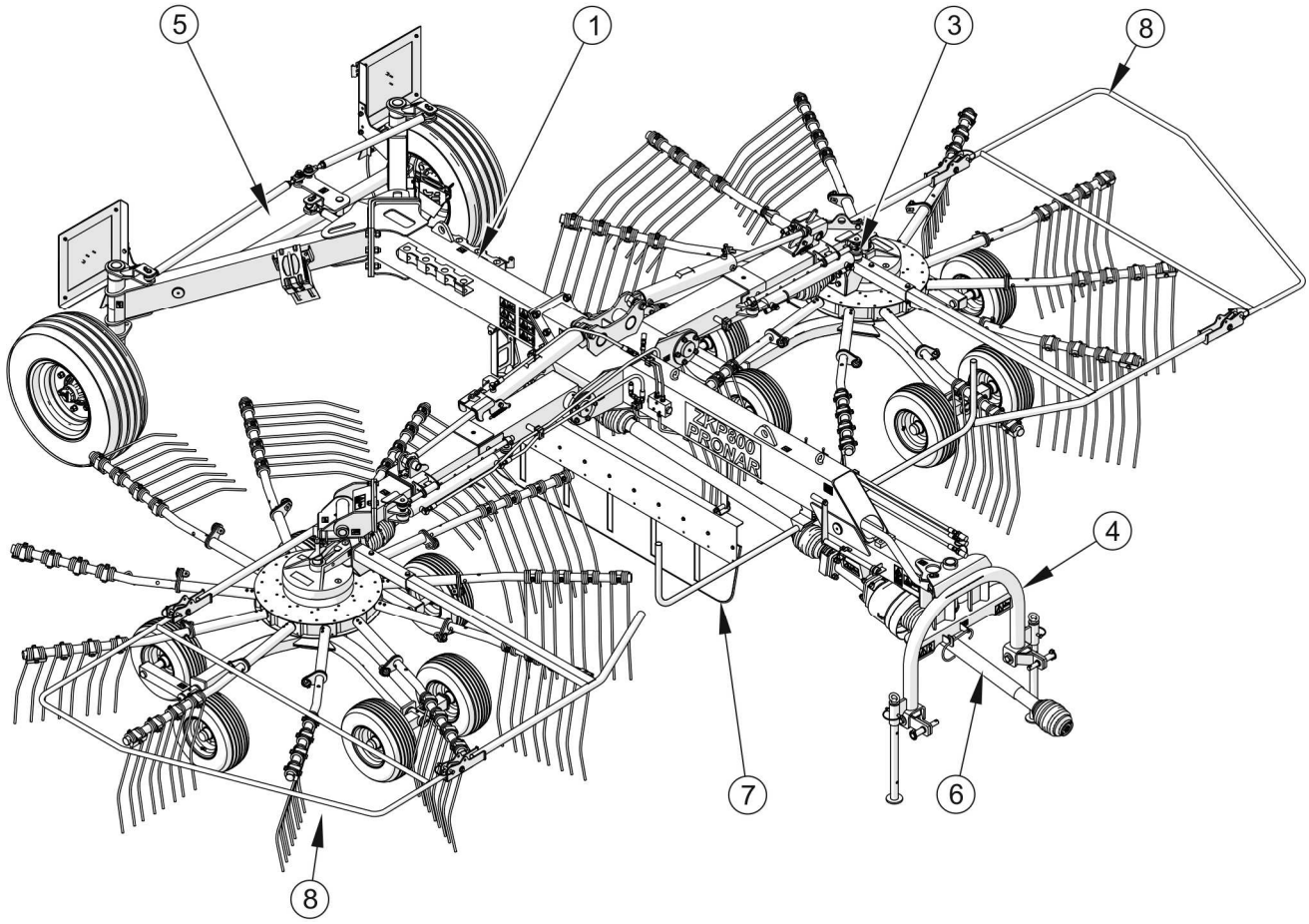


FIGURE 3.1 ZKP800 rotary rake design

(1) main frame, (2) right side raking assembly, (3) left side raking assembly (4) load bearing suspension, (5) axle system, (6) transmission, (7) forming shield, (8) protective shield

Rotary rake design is shown in figure (*3.1*) and (3.2). The machine's main sub-assembly is the main frame (1). In the front part of the frame there is a load bearing suspension (4) for

connection to the tractor three point linkage. On both sides of the main frame there are beams with extendible arms on which two raking assemblies are installed: right side raking assembly (2) and left side raking assembly (3) with protective shields (8).

In the ZKP800 model, the extension of the arms to adjust the working width is carried out hydraulically. In the ZKP690 rotary rake, the working width is set manually using the connector (9) (hydraulic control as an option).

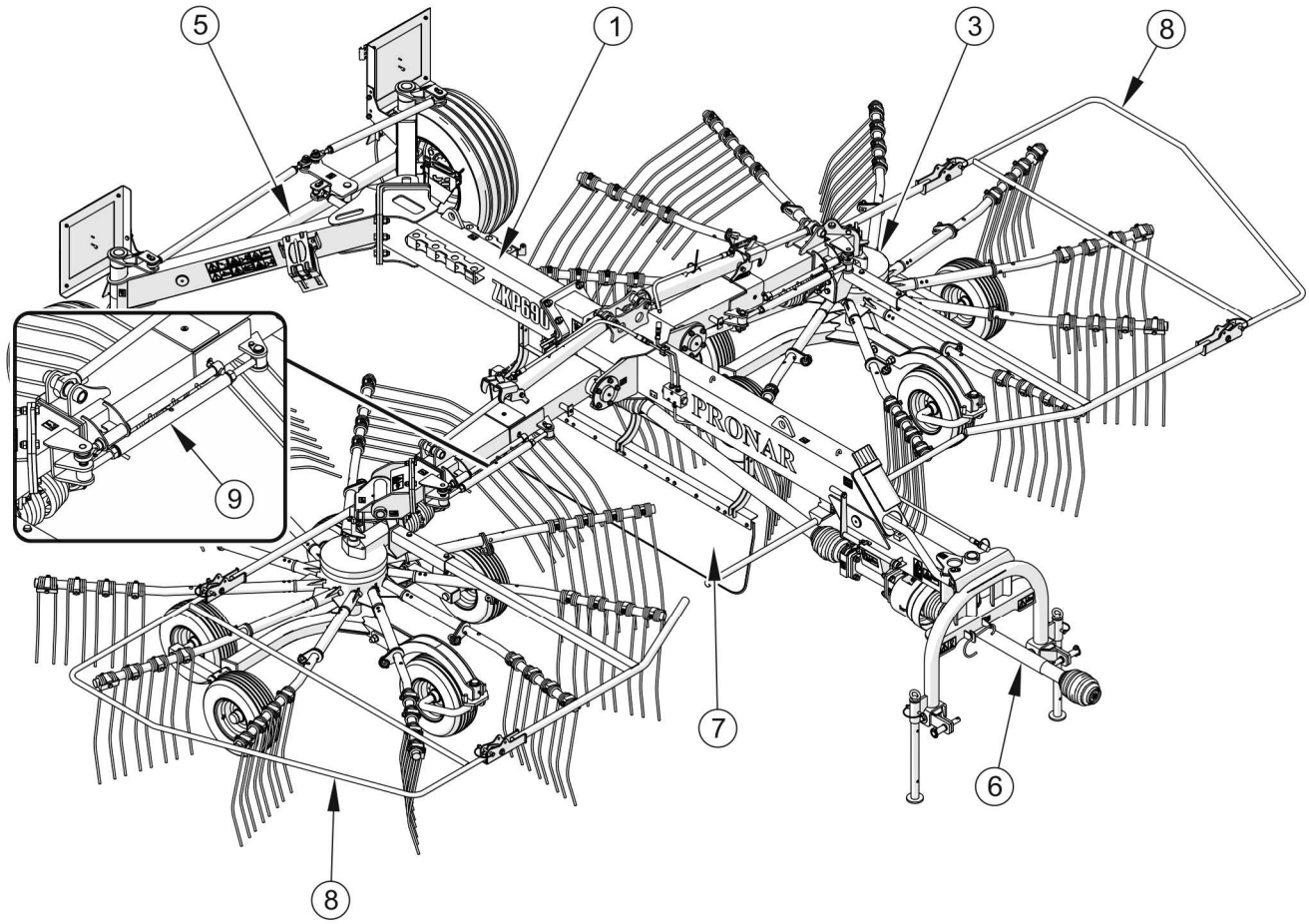


FIGURE 3.2 ZKP690 rotary rake design

(1) main frame, (2) right side raking assembly, (3) left side raking assembly (4) load bearing suspension, (5) axle system, (6) transmission, (7) forming shield, (8) protective shield, (9) connector

Raking assembly gears are driven by transmission (6) which consists of bevel gear and PTO shafts. In the rear part of the rotary rake there is axle system (5), which consists of axle frame and half axle with wheels.

Forming shield (7) is attached in the lower part of the main frame. During machine work the shield constitutes a barrier for the raked swath, due to which it is not scattered but formed into a regular windrow.

3.2.2 HITCH SYSTEM AND AXLE SYSTEM

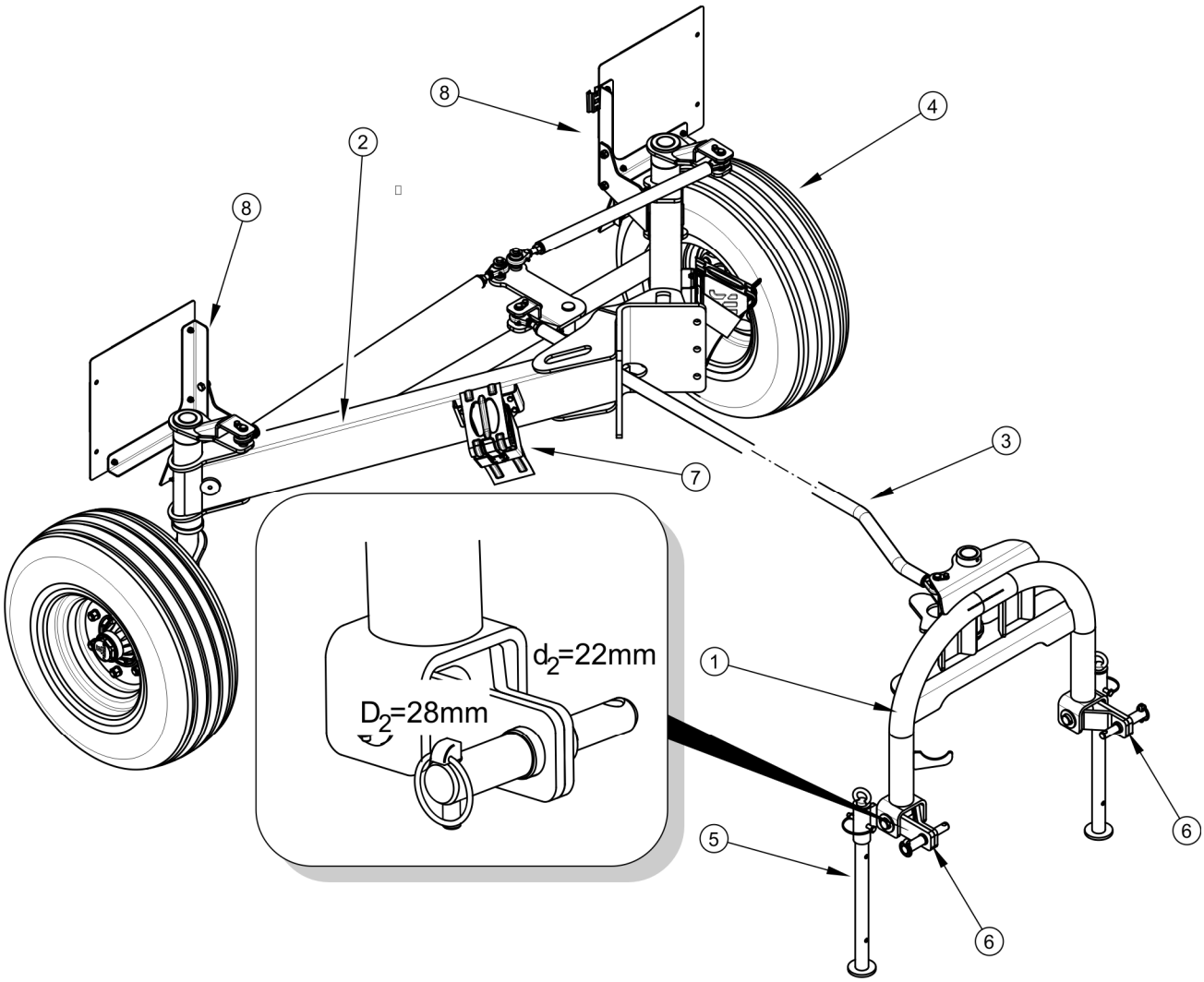


FIGURE 3.3 Design of axle system and hitch system

(1) three-point linkage frame, (2) axle frame, (3) tension rod, (4) wheel, (5) support leg, (6) hitch rocker arm, (7) wheel chock, (8) rear light assembly

The main element of the linkage is the three point linkage frame *(1)*, which is equipped with hitch rocker arms (6) with lower pins for connection to the tractor three point linkage. The three point linkage frame is connected to axle system wheels (2) using tension rod (3). Such steering system enables the rotary rake to accurately follow the tractor track even at high driving speeds.

3.2.3 RAKING ASSEMBLY

The rotary rake is equipped with two raking assemblies (right and left raking assemblies) - compare figure *(3.1)* and *(3.2)*. Raking assembly design is shown in figure *(3.4)* and *(3.5)*.

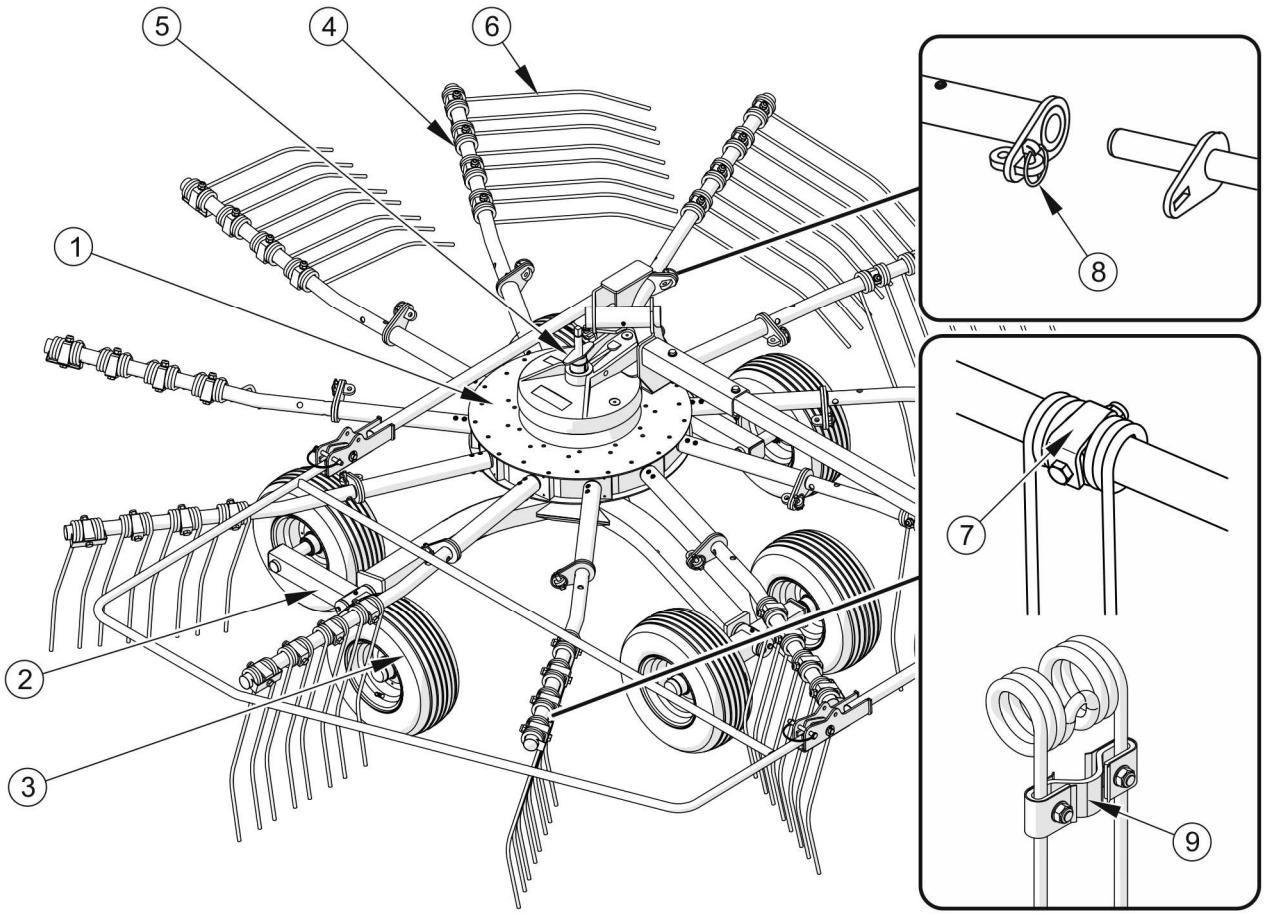


FIGURE 3.4 ZKP800 raking assembly design

(1) transmission gearing, (2) rocker arm, (3) wheel, (4) raking arm, (5) adjustment bolt, (6) springtine, (7) securing angle, (8) cotter pin, (9) springtine safeguard

The transmission gearing (1) has 11 radiating shafts, to which raking arms (4) are secured. Each of the arms is equipped with 4 springtine fingers (6) for raking the swath. They are mounted on the arm extension with the aid of securing angles (7), which prevent fingers from sliding or rotating. Depending on the rotation direction of the raking assembly, there are right and left raking arms. The raking arms are fixed to the gearing transmission (1) and secured with the aid of cotter pins (8). In the lower part of the raking assembly there is axle system, which guarantees proper raking on wavy surface. Rocker arms (2) with wheels (3) are secured to the axle system frame.

The height of raking arm setting above the surface is regulated by the adjustment screw (5) and secured by the interlock.

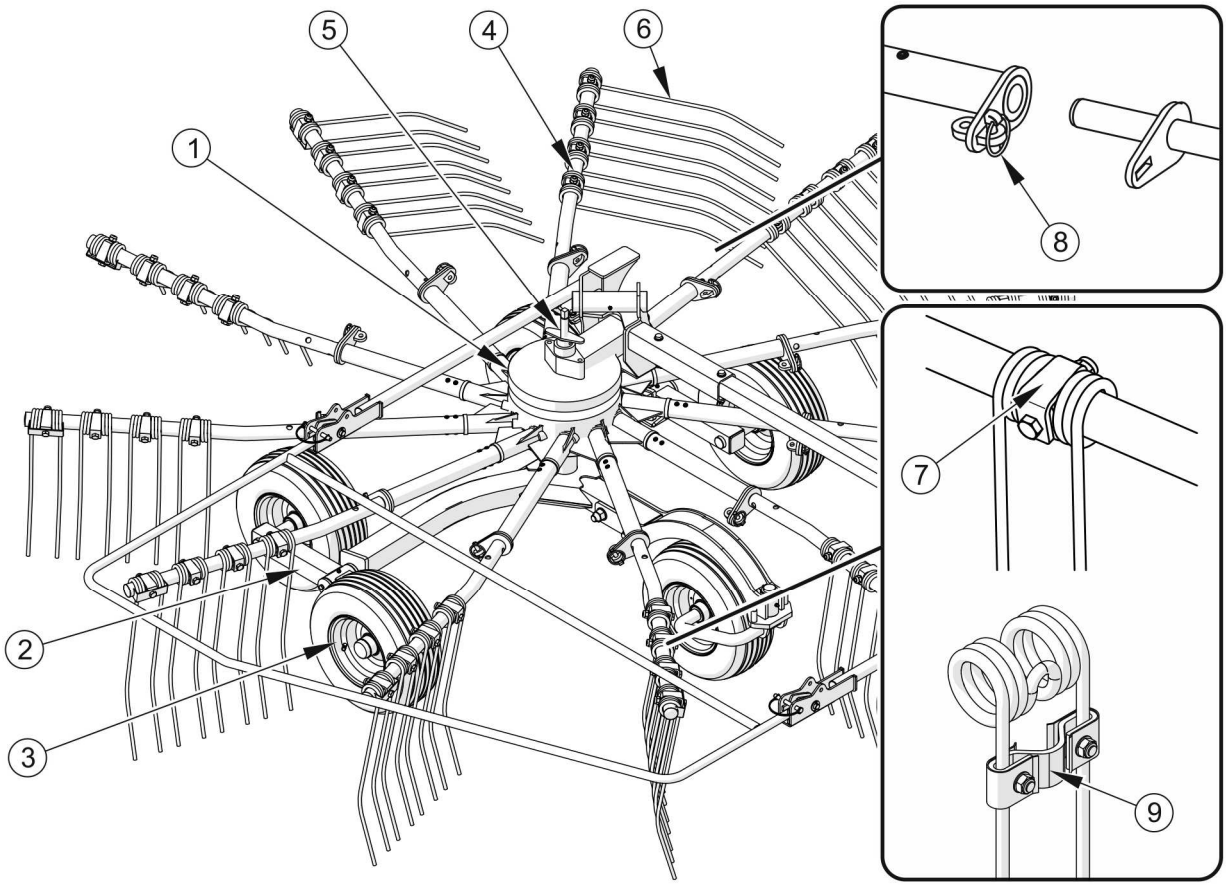


FIGURE 3.5 ZKP690 raking assembly design

(1) transmission gearing, (2) rocker arm, (3) wheel, (4) raking arm, (5) adjustment bolt, (6) springtine, (7) securing angle, (8) cotter pin, (9) springtine safeguard

The gear (1) cam mechanism applied enables the rotation of individual arms, due to which the springtine fingers are lowered or raised according to current setting. During raking springtine fingers are lowered almost vertically. The raked swath is retained by the forming shield, due to which it is formed into an even windrow. In remaining instances the raking springtines are raised to the upper position.

To prevent the loss of a broken springtine part, a springtine safeguard (9) (optional accessory), can be fitted to each springtine. Broken springtine in the swath may damage other agricultural machines operating in the field.

3.2.4 DRIVE TRANSMISSION

IMPORTANT

Do NOT exceed the PTO rotation speed of 540 rpm.

Torque is transmitted from the tractor PTO through a wide-angle PTO shaft (1) to the driving shaft (2). Next, torque is transferred by PTO shaft with backstop clutch (3) to bevel gear (*5)*. Torque is transferred from the bevel gear to the raking assembly gears (6) by two PTO shafts with overload protection clutch (4). The raking assembly gears rotate in the direction indicated by arrows in figure *(3.6)*.

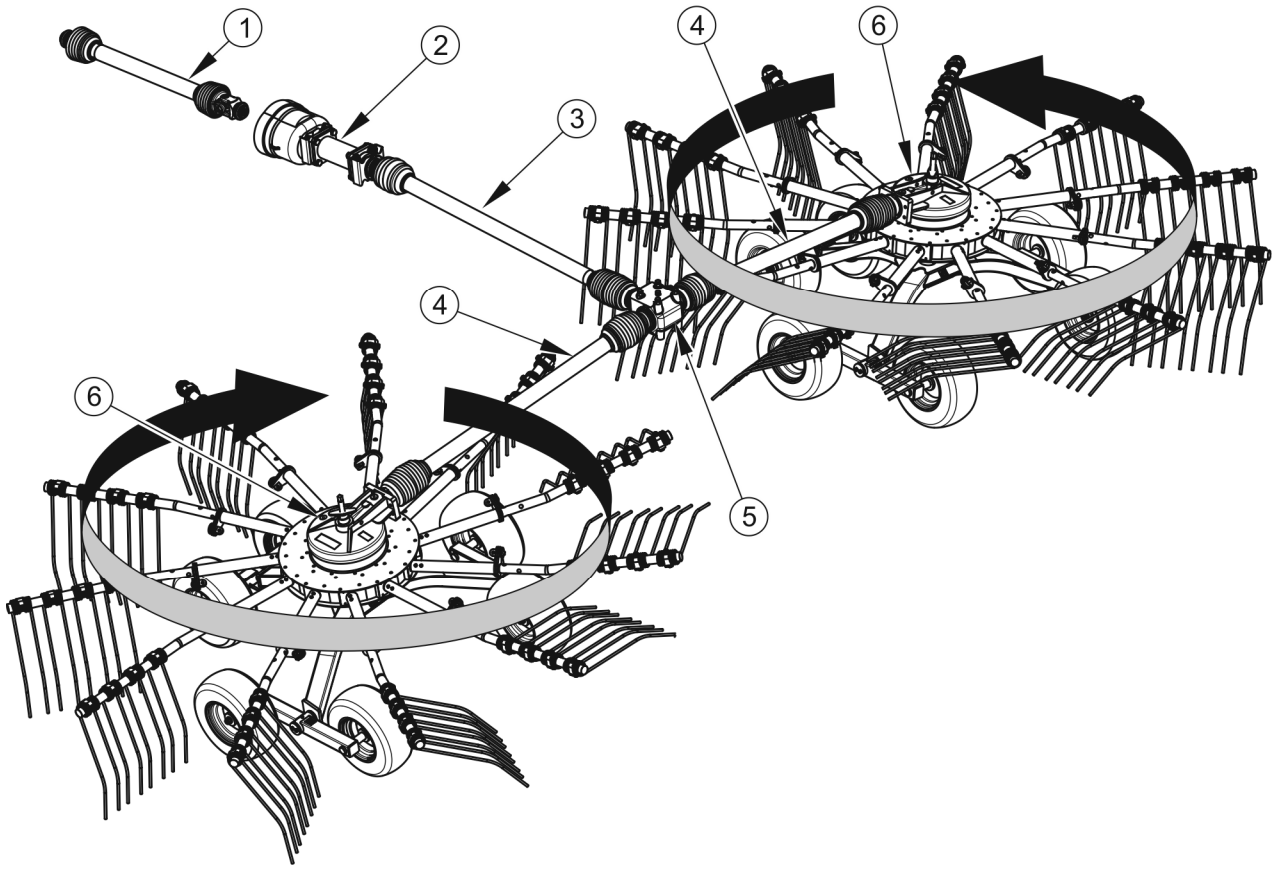


FIGURE 3.6 Design of drive transmission system

(1) wide-angle PTO shaft (50˚) for connection with tractor, (2) driving shaft, (3) PTO shaft with backstop clutch, (4) PTO shaft with overload protection clutch, (5) bevel gear, (6) raking assembly gear

3.2.5 HYDRAULIC SYSTEM

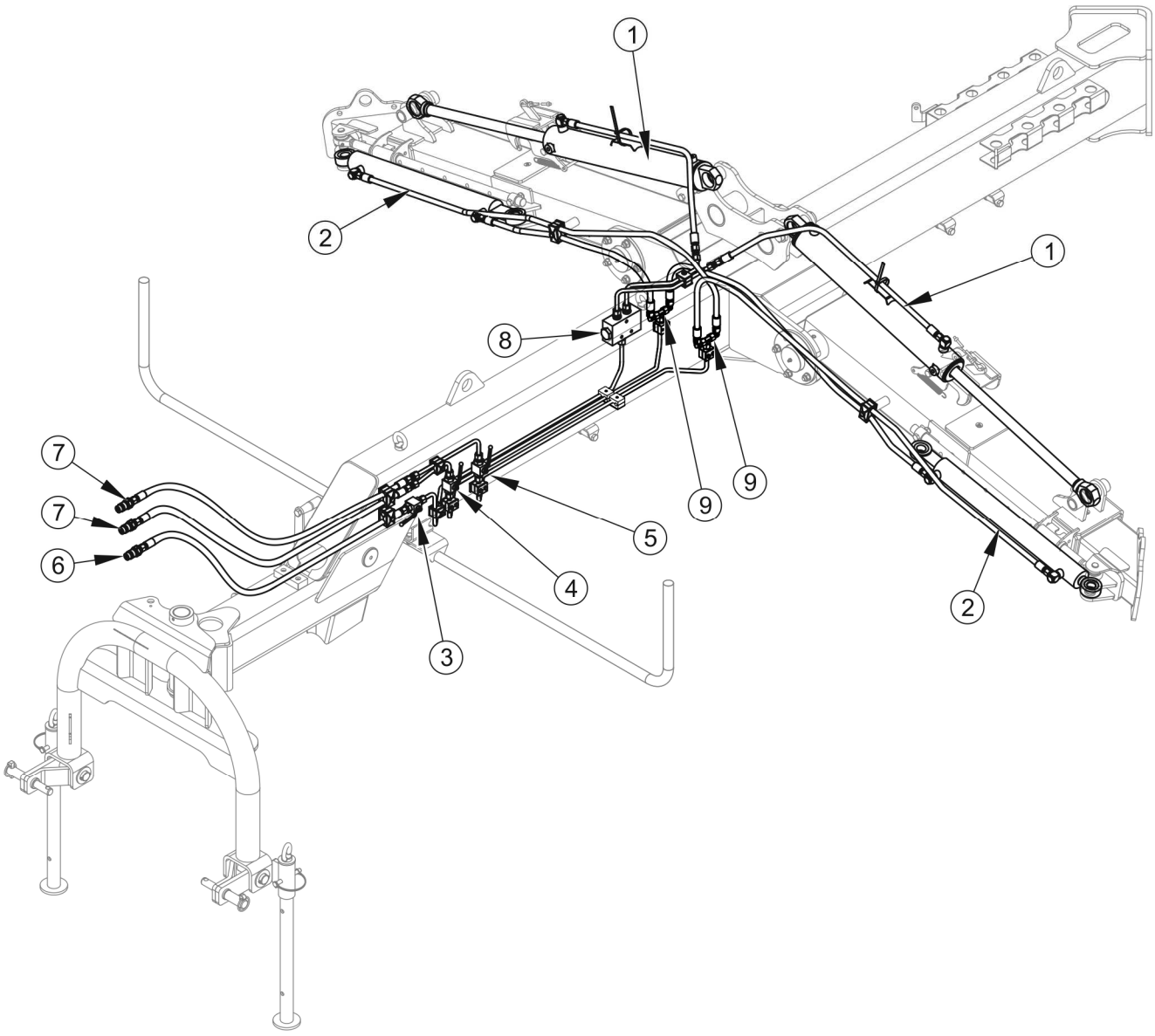


FIGURE 3.7 Hydraulic system design

(1) lifting/lowering hydraulic cylinder (2) adjusting hydraulic cylinder (3) lifting/lowering hydraulic cylinders locking valve, (4), (5) adjusting hydraulic cylinder locking valve, (6) hydraulic quick coupler for controlling lifting/lowering, (7) hydraulic quick coupler for controlling the adjusting hydraulic cylinders, (8) flow divider, (9) tee fitting

The hydraulic system is used for controlling the raking arms and adjusting the raking width. The hydraulic system is supplied from the tractor external hydraulic system through hydraulic quick couplers.

Quick coupler for controlling the lifting / lowering cylinders (1) should be connected to the section with floating position. In such configuration the pistons of both lifting/lowering

hydraulic cylinders can move freely. Consequently, the raking assemblies can adjust to uneven terrain. The valve (3) - figure *(3.7)* (ZKP800) or the valve (2) - figure *(3.8)* (ZKP690) is used to lock the cylinders in the transport position.

Working width of the ZKP800 rotary rake (ZKP690 as an option) is controlled with the use of hydraulic cylinders (2) and locking valves (4) and (5). Quick couplers (7) should be connected to one double acting section in the tractor - figure *(3.7)*.

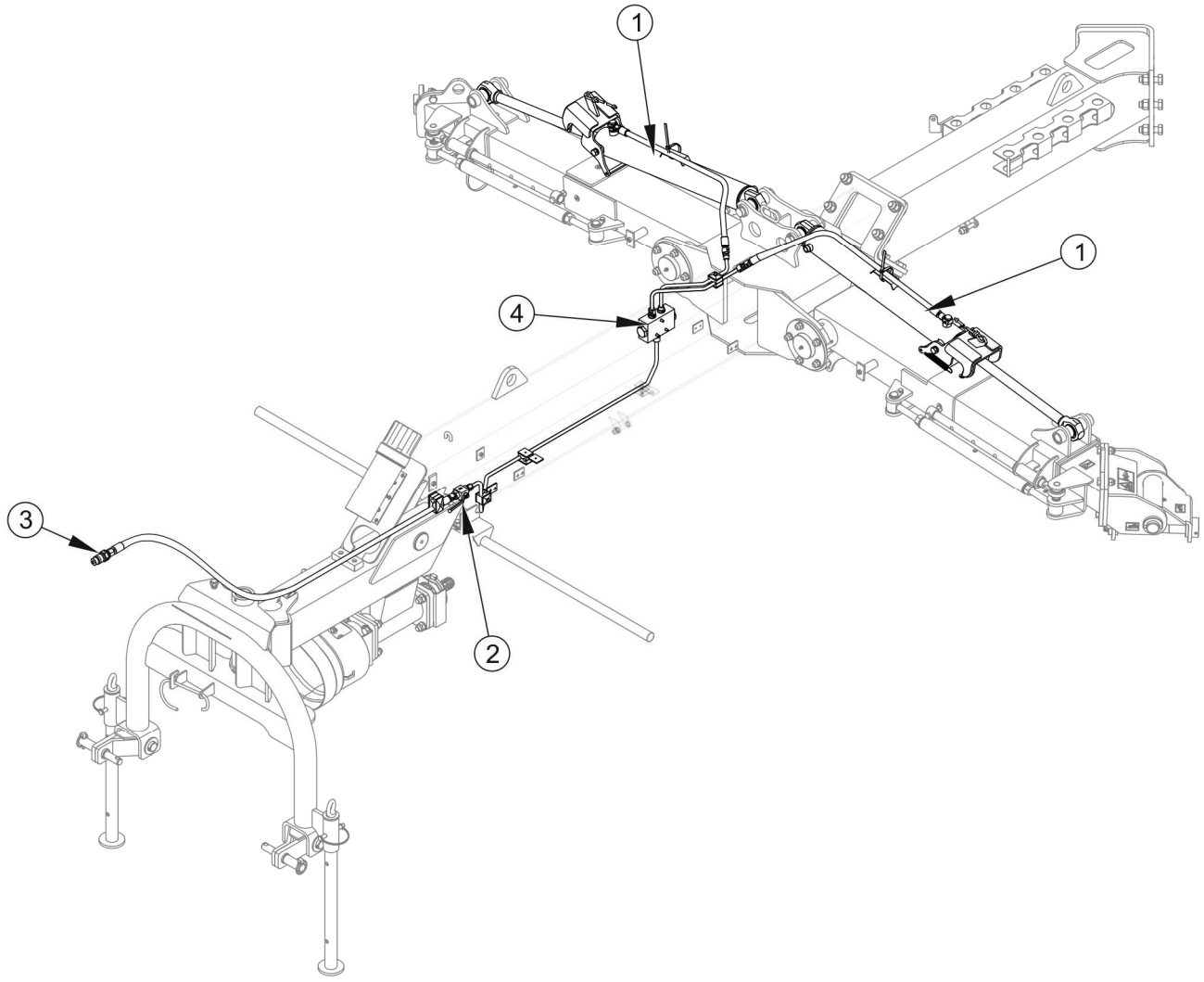


FIGURE 3.8 ZKP690 Hydraulic system design (standard)

(1) lifting / lowering hydraulic cylinder, (2) lifting / lowering cylinder locking valve, (3) lifting / lowering hydraulic quick coupler, (4) flow divider

3.2.6 LIGHTING SYSTEM

The rotary rake electrical system is designed for supply of 12 V DC. Connection of the electrical system with the tractor should be made through an appropriate connection lead that is part of the machine's standard equipment.

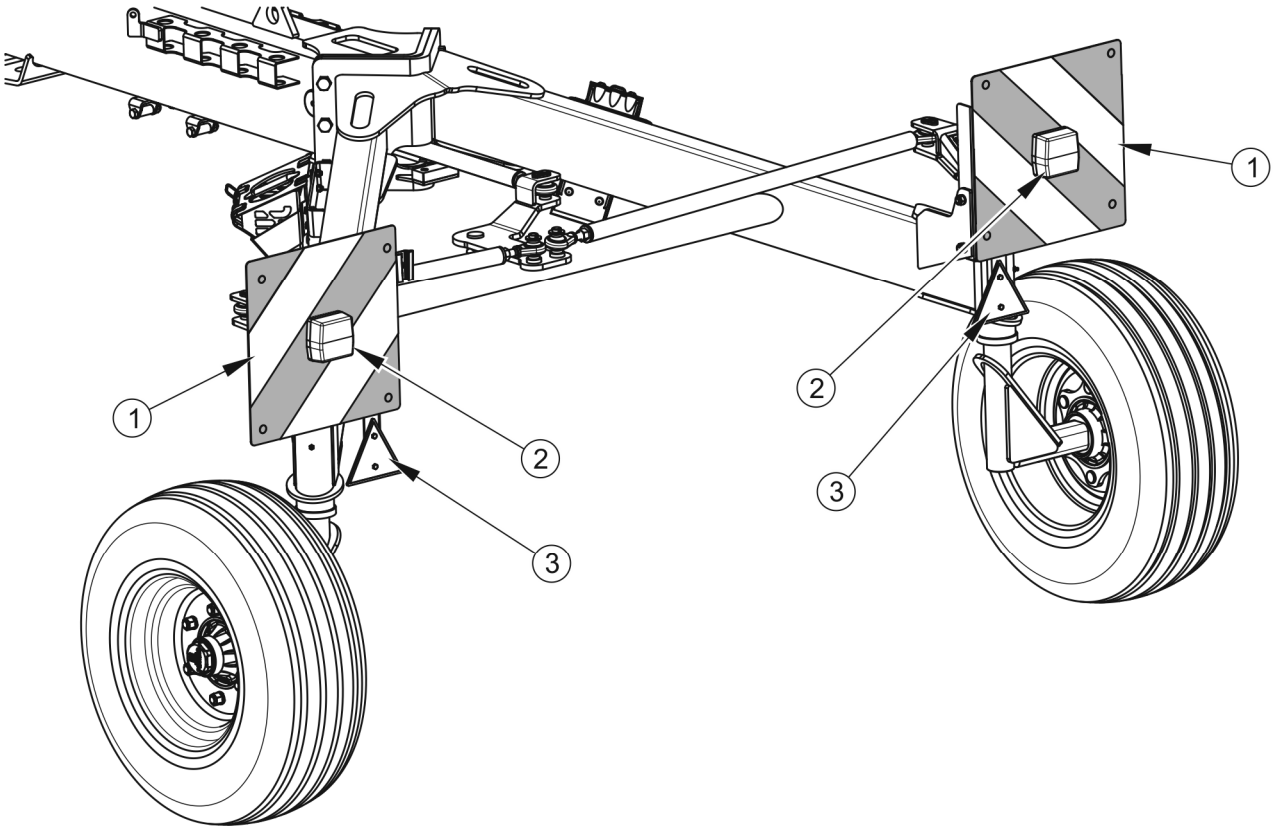


FIGURE 3.9 Positioning of electrical system components and reflective elements

(1) warning sign, (2) rear lamp, (3) warning reflective triangle

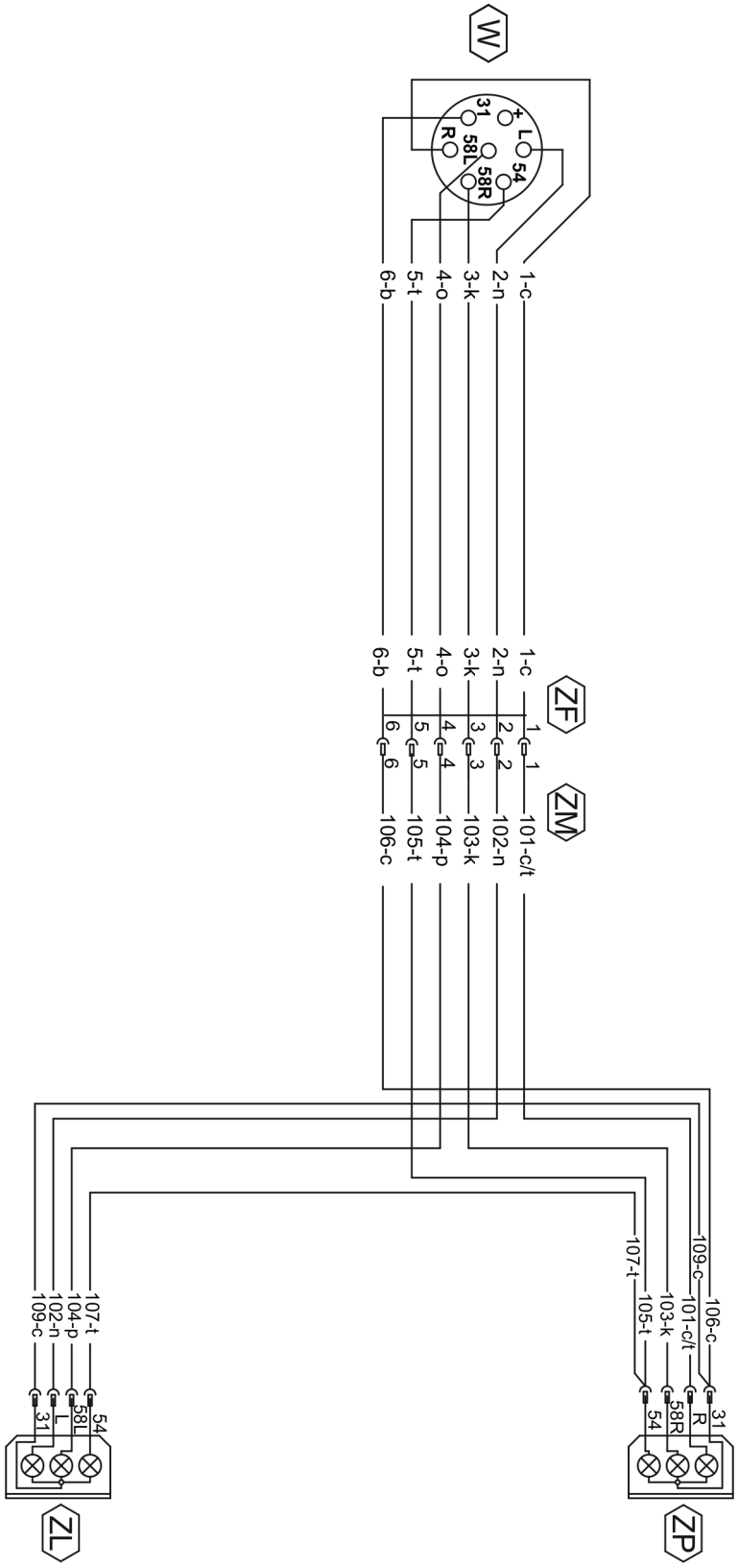


FIGURE 3.10 Electrical system diagram

Marking according to table (3.2), (3.3)

TABLE 3.2 List of electrical component markings

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

TABLE 3.3 Lead colour marking

MARKING	COLOUR
B	White
C	Black
K	Red
N	Blue
P	Orange
T	Green
C/T	Black and green
R	Pink
O	Brown

SECTION

4

CORRECT USE

4.1 PREPARING FOR WORK BEFORE FIRST USE

4.1.1 CHECK THE ROTARY RAKE AFTER DELIVERY

The rotary rake is partially dismantled for shipment to the user. 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 prior to purchasing and before first use.

ANNEX A to this manual includes *INITIAL SET-UP* instructions describing the first installation steps after delivery.

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 *(1.1)*).

NOTE

Before proceeding to hitching to tractor and before first use of the rotary rake the user must carefully read this Operator Manual and the Operator Manual of PTO shaft attached to the machine and observe all recommendations.

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.

The rotary rake may only be hitched to an agricultural tractor which has the rear three point linkage of category I or II and the required electrical system connection sockets. Oil in the tractor external hydraulic system must have appropriate characteristics or must be mixable with the oil in the hydraulic system of the rotary rake.

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

- check completeness of machine,
- check condition of paint coatings, traces of corrosion or mechanical damage (crushing, piercing, bending or breaking of minor elements),
- check technical condition of protective shields and check if they are correctly installed,

- visually inspect the rotary rake individual components for mechanical damage resulting from incorrect loading, transport or unloading of the machine,
- check technical condition of the rotary rake lights and indicators,
- check technical condition of PTO shafts and their shields as well as completeness of these elements,
- check technical condition of hydraulic lines,
- check that there are no hydraulic 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 5.5 *LUBRICATION*,
- check if the nuts fixing the following components are properly tightened: (raking arms, springtines, wheels, protective shields),
- oil level in bevel gear of drive system,
- technical condition of PTO shafts, their shields and securing chains,
- technical condition of hitching system pins and locking cotter pins,
- 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),
- check correct PTO shaft rotation speed.

NOTE

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

When the tractor with the manure spreader are 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.

4.1.3 TEST START

If all the above activities have been performed and there is no doubt as to the good technical condition of the rotary rake, the machine should be hitched to tractor according to instructions specified in section 4.2 „*HITCHING TO TRACTOR".* Start tractor engine, check all systems and perform a test run of the rotary rake without load before beginning work. It is recommended that the inspection is conducted by two people, one of which should always remain in the tractor cab. Test start should be conducted according to the sequence shown below.

- Hitch rotary rake to tractor.
- Connect PTO shaft and secure it in a proper manner.
- Connect hydraulic system and electrical system lines.
- Set raking arms, raise raking assemblies upwards maximally using the crank, so that springtines do not touch surface.
- Check correct operation of lights and indicators.
- Start tractor.
- Check operation of the raking assembly lifting/lowering system.
    - ⇨ Using the selective control valve lever in the tractor cab, activate hydraulic cylinders of the raking assembly

lifting/lowering system. Check whether lines are connected in a correct manner.

➡ Check operation of the raking width adjusting system.

⇨ Using the selective control valve lever in the tractor cab, activate hydraulic cylinders of the raking width adjusting system. Check whether lines are connected in a correct manner.

➡ Start tractor PTO slowly (starting the drive of the raking assembly gears).

➡ Leave for several minutes working at low RPM, during which check:

⇨ that there is no knocking or noise in the drive system and in the raking assembly gears arising from scraping or grinding of metal elements,

⇨ proper rotation of raking system,

⇨ proper action of cam mechanism of the raking assembly gears (springtines should be lowered and raised according to current arm position).

➡ Disconnect PTO drive, turn off tractor engine and unhitch the rotary rake from tractor.

NOTE

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.

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.

NOTE

Check correctness of hydraulic connections. Replace conduit plugs possibly.

Failure to follow instructions in this Operator Manual or starting the machine incorrectly may cause damage to the machine.

The technical condition before starting the machine must be no cause for concern.

4.2 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.

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.

Parking supports must be maximally raised during machine operation or travel.

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

- Reversing the tractor bring the lower three point linkage connection points (C) of the tractor close to pins (1) of the rotary rake.
- Set links (C) of tractor at appropriate height.
- Remove the safety device (6).
- Turn off tractor engine, secure cab to prevent unauthorised access.

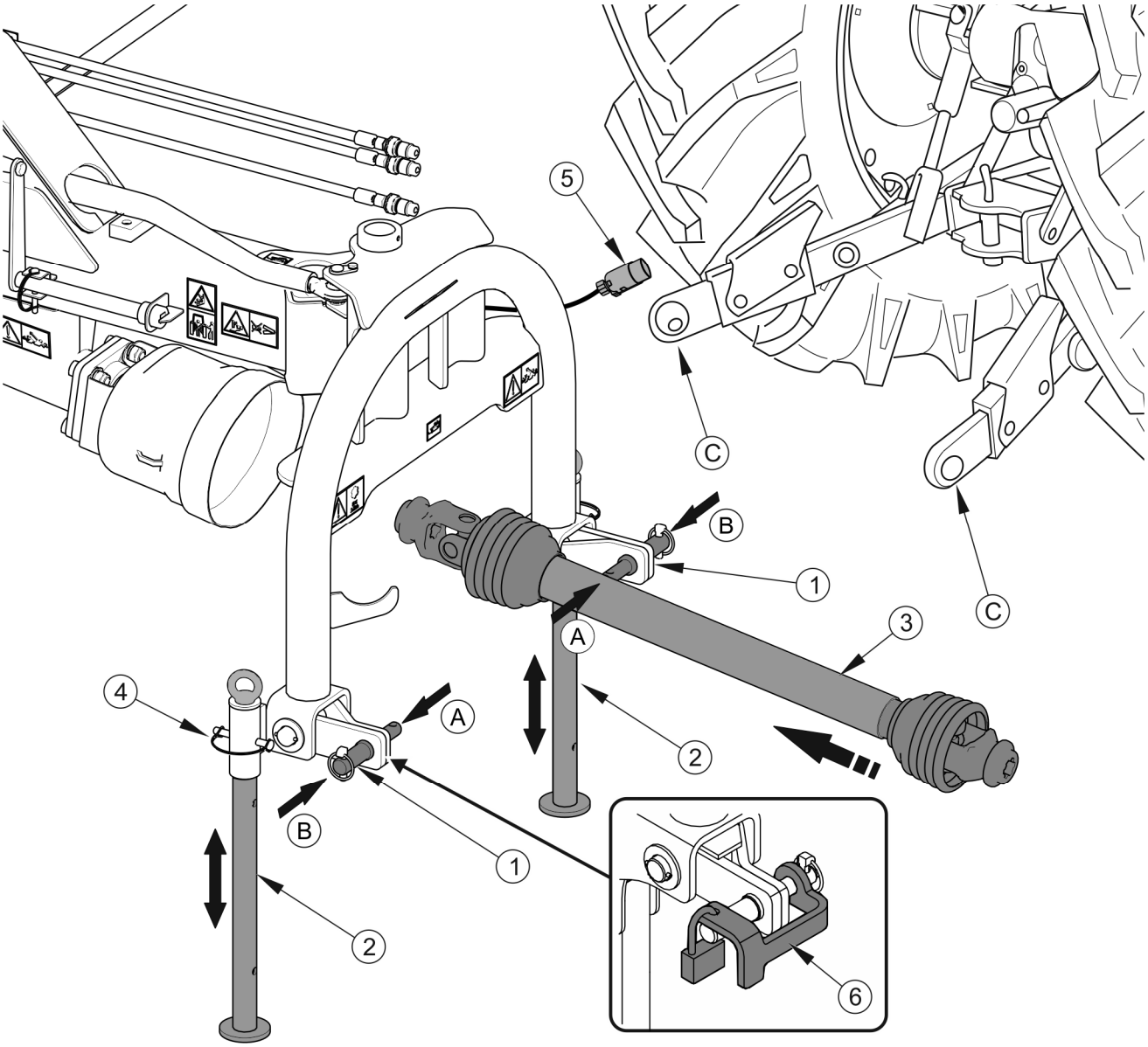


FIGURE 4.1 Hitching to tractor

(1) lower linkage pin, (2) support, (3) PTO shaft for connection with tractor, (4) support cotter pin, (5) lighting system line plug, (6) safety device, (A) category I linkage, (B) category II linkage, (C) three point linkage lower arms

- ➡ Connect lower pins (1) with linkage arms (C) and lock with the aid of cotter pins,
- ➡ Connect hydraulic lines to the tractor.
  - ⇨ Plug of line (6) (see figure *(3.7)*) should be connected to the section with so-called "floating position" (ZKP800).

⇨ Plugs of line (7) (see figure *(3.7)*) should be connected to the double acting section in the tractor. Plugs should be marked in order to exclude the possibility of wrong connection. (ZKP800)

⇨ Plug of line (3) (see figure *(3.8)*) should be connected to the section with so-called "floating position" (ZKP690).

➡ Lift rotary rake using tractor three point linkage.

➡ Raise the left and right support (2) and secure with cotter pins (4).

⇨ Set both tractor lower linkage arms at the same height.

➡ Connect the plug (5) of the electric lighting system power cable.

➡ Install PTO shaft (3) according to guidelines specified in the Operator Manual of the PTO shaft.

⇨ Make sure that shaft ends on both the tractor and rotary rakes fit well and the linkage is properly secured.

⇨ Attach chains securing the PTO shaft cover.

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.

Check that no one or anything is on the machine.

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

4.3 TRANSPORTING THE MACHINE

DANGER

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

For transport to place of work and back, set the rotary rake in transport position. Disconnection of PTO shaft from tractor PTO is recommended.

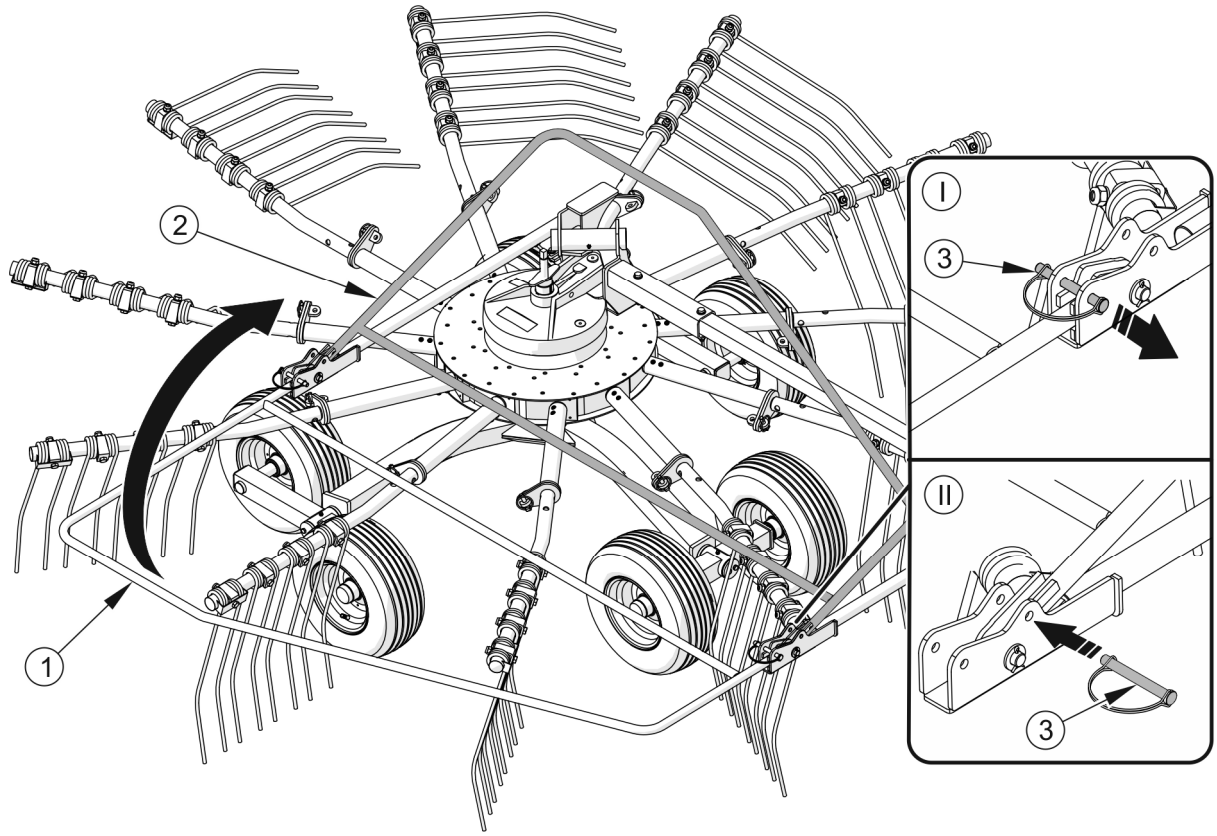


FIGURE 4.2 Operation of the protective covers

(1) cover in the working position, (2) cover in the transport position, (3) cotter pin

Setting the rotary rake in transport position

➡ Change protective covers from working position (1) to transport position (2) - figure *(4.2)*. In order to do this:

⇨ (I) take the cotter pin out (3), then fold protective cover to (2) position,

⇨ (II) secure protective cover in transport position using cotter pin (3) - figure *(4.2)*.

➡ Four raking arms located on the outside of the raking assemblies can be dismantled in order to reduce transport width and height of the machine.

⇨ In order to dismantle the raking arm (1), take out securing cotter pin (2) - figure *(4.3)* 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)*.

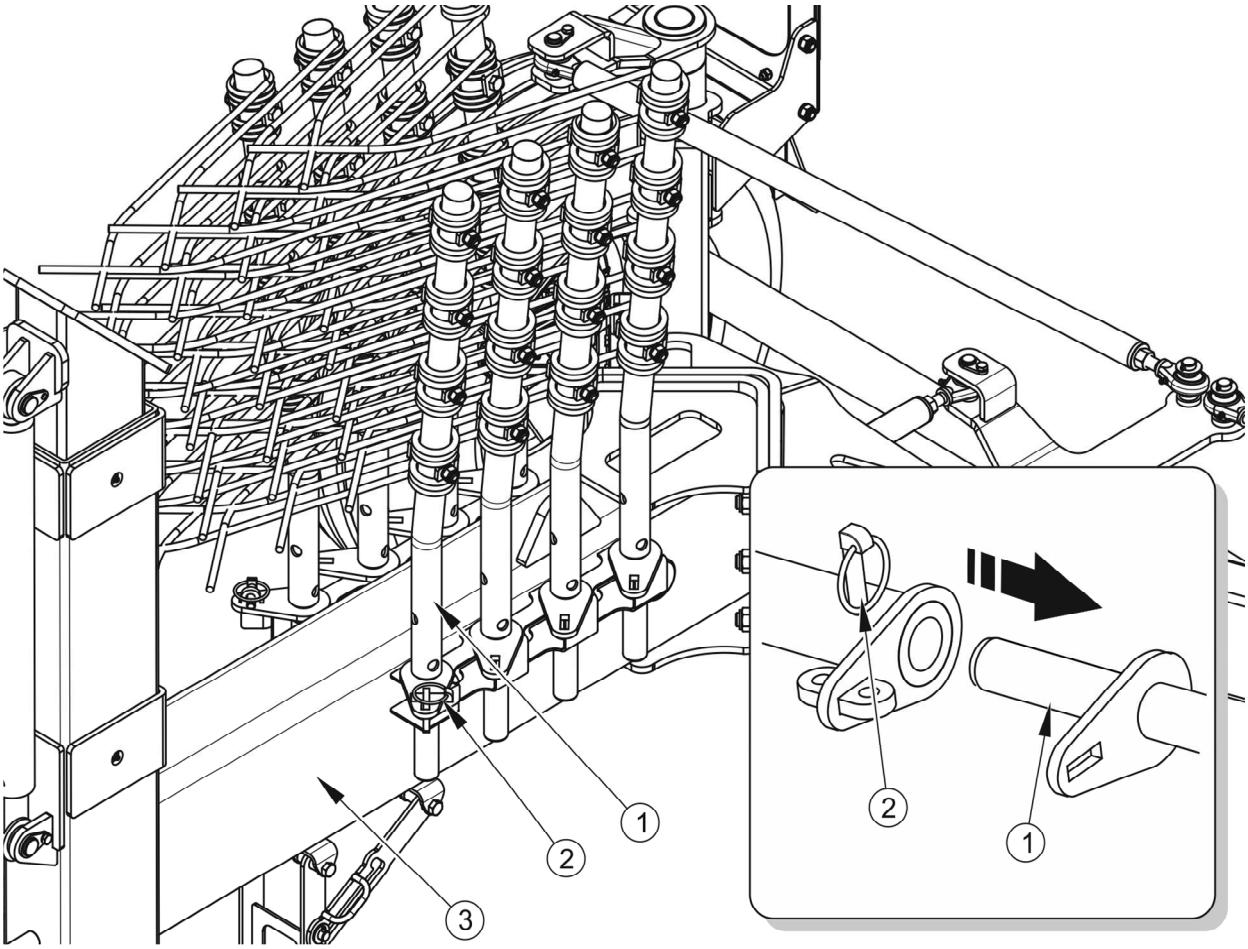


FIGURE 4.3 mounting of raking arms

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

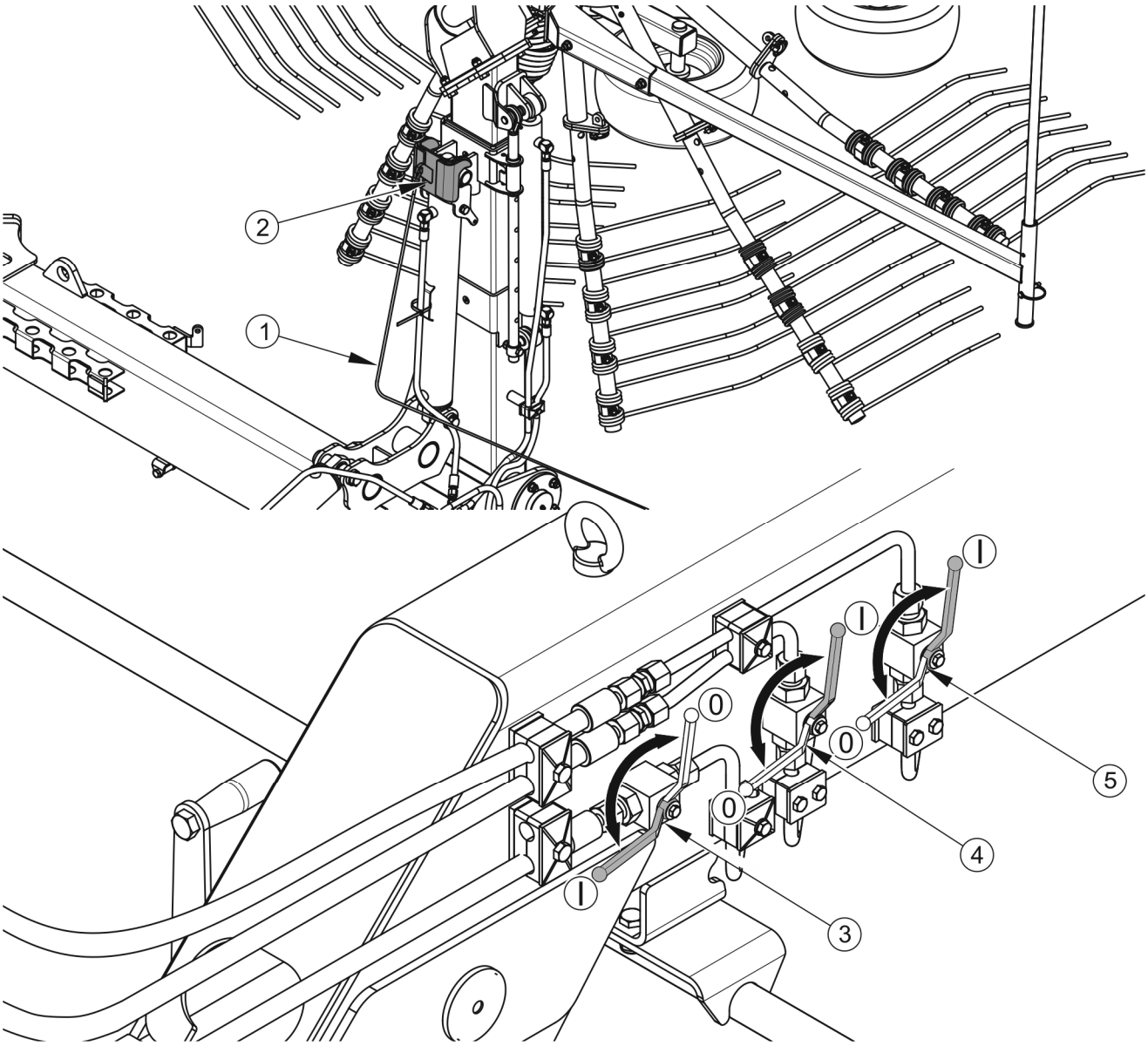


FIGURE 4.4 Setting the rotary rake in transport position

(1) cylinder lock cable, (2) cylinder lock, (3) locking valve of lifting/lowering hydraulic cylinders, (4), (5) locking valves of the working width adjusting hydraulic cylinders (ZKP690 - option)

DANGER

Raking arms should be dismantled and mounted with tractor engine turned off. Remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor. Tractor shall be immobilised with parking brake.

➡ Set the locking valve (3) of lifting/lowering hydraulic cylinders in open position I – figure *(4.4)*.

➡ Set the locking valves (4) and (5) of the raking width adjusting hydraulic cylinders in closed position 0 – figure *(4.4)*.

⇨ The raking arms and protective shields should be folded in order to reduce total transport height of the machine.

➡ Operating the hydraulic cylinders, lift the lifting arms together with raking assemblies until cylinder lock (2) is engaged– figure *(4.4)*.

⇨ The raking assemblies will be automatically locked when they are in vertical position.

➡ Make sure that lock (2) keeps the raking assembly in vertical position - figure *(4.4)*.

➡ Close valve (3) by switching it to „0” position.

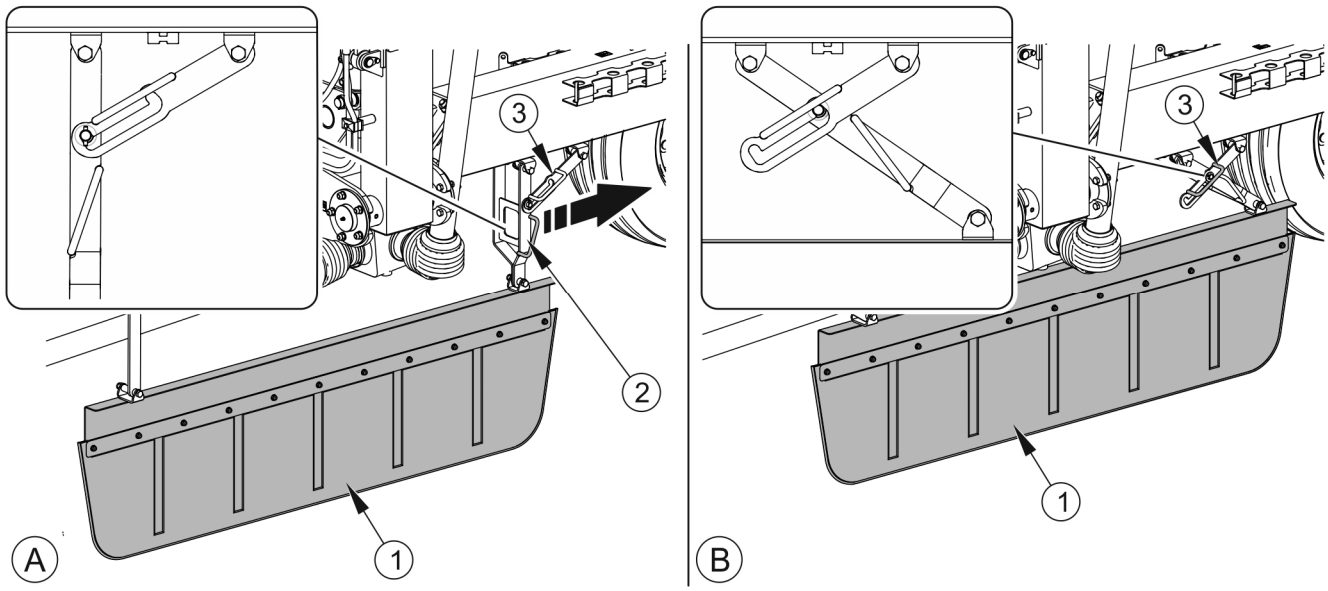


FIGURE 4.5 Operation of ZKP800 forming shield

(A) working position, (B) transport position, (1) forming shield, (2) shield catch, (3) latch

➡ Set the forming shield to the transport position - lift it up (ZKP800).

⇨ Lift the latch (3), then hold the handle and move the shield catch (2) to the back (in the direction of the arrow) - figure *(4.5)*.

⇨ Lock the shield in raised position by lowering the latch (3) – figure *(4.5)*.

➡ In the ZKP690 rotary rake, the forming shield is lifted to the transport position automatically when folding the raking assemblies.

➡ Prior to moving off, check the lights.

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.

4.4 ROTARY RAKE OPERATION

4.4.1 SETTING ROTARY RAKE IN WORKING POSITION

DANGER

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

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 tractor with parking brake,

➡ Set forming shield to the working position (ZKP800)

⇨ Lift the latch (3), then hold the handle and move the shield catch (2) to the front - figure *(4.5)*.

⇨ Lock the shield in working position by lowering the latch (3) – figure *(4.5)*.

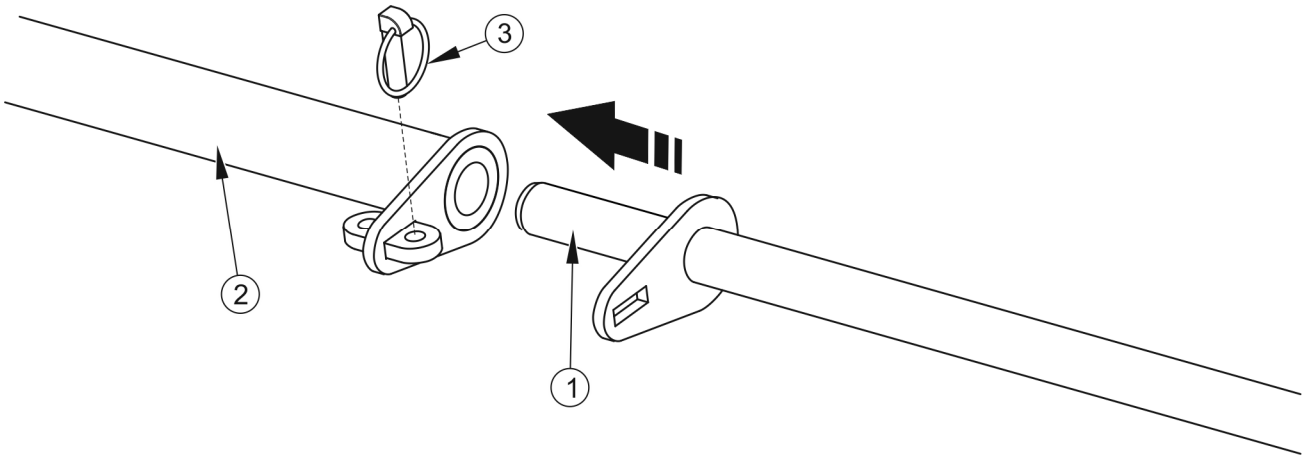


FIGURE 4.6 Assembly of raking arms

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

- In the ZKP690 rotary rake, the forming shield is lifted to the working position automatically when unfolding the raking assemblies.
- Set lifting cylinders loking valve *(3)* in open position I- figure *(4.4)*,
- Release locks (2) by pulling cable (1) (figure *(4.4)*) and by operating the tractor hydraulic circuit, lower lifting arms with raking assemblies so that the wheels touch the ground and set tractor hydraulic circuit in float position,
- If the raking arms (1) were dismantled, remount them by sliding them into arm mount (2) and secure with cotter pin (3) – figure *(4.6)*.
- Change protective covers from transport position (2) to working position (1) - figure *(4.2)*.

4.4.2 HYDRAULIC ADJUSTMENT OF RAKING WIDTH (ZKP690-OPTION; ZKP800-STANDARD)

Depending on type of hay crop and type of machines working on the field after the rotary rake, appropriate working width can be set. Increasing the raking width increases the swath width.

Perform the following actions in order to change working width:

- operating the hydraulic cylinders, lift the lifting arms together with raking assemblies slightly above the ground,

⇨ valve (3) should be set in „I” position - figure (4.4),

➡ set locking valves (4) and (5) of the raking width adjusting hydraulic cylinders in open position „I” – figure (4.4),

➡ operating the hydraulic cylinders (1), set proper raking width – figure (4.7),

⇨ maximum raking width is locked by shifting limiter (3) to proper openings in adjusting bar (2) – figure (4.7),

➡ lower lifting arms so that the wheels of the raking assemblies touch the ground,

➡ when a proper working width is set, valves (4) and (5) is locked by switching them to 0 position - figure (4.4),

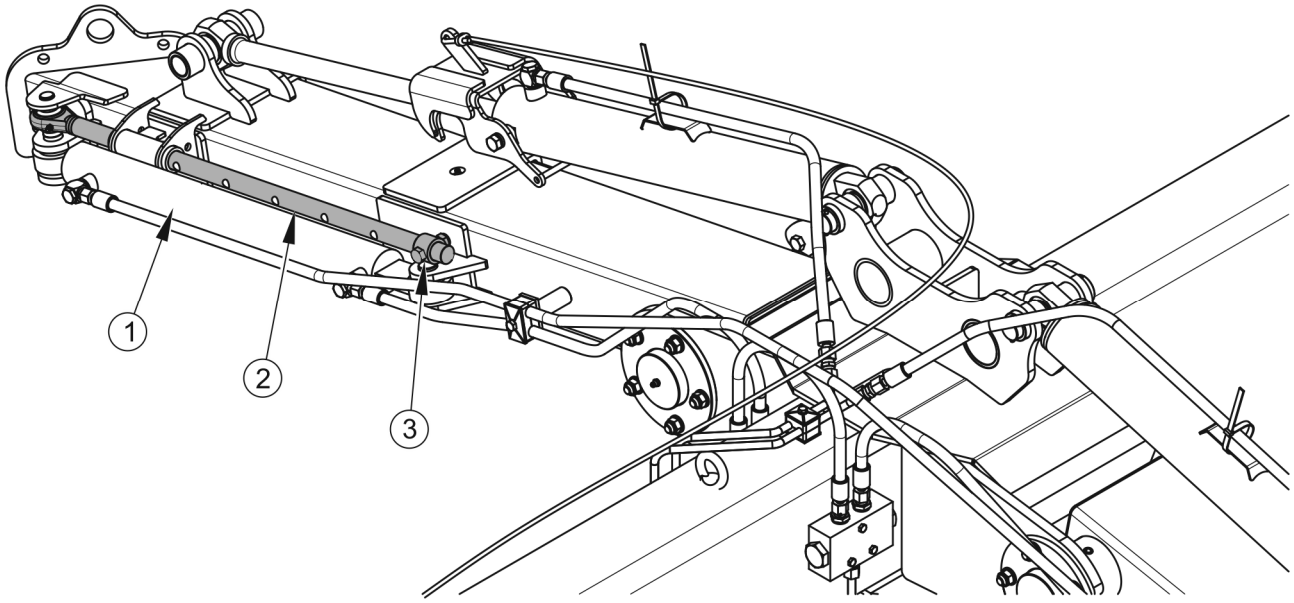


FIGURE 4.7 Setting the rotary rake width (hydraulic adjustment)

(1) connector, (3) adjusting bar, (3) limiter

4.4.3 MANUAL SETTING OF THE ROTARY RAKE WIDTH (ZKP690-STANDARD)

Perform the following actions in order to change working width:

➡ operating the hydraulic cylinders, lift the lifting arms together with raking assemblies slightly above the ground,

⇨ valve (3) should be set in „I” position - figure (4.4),

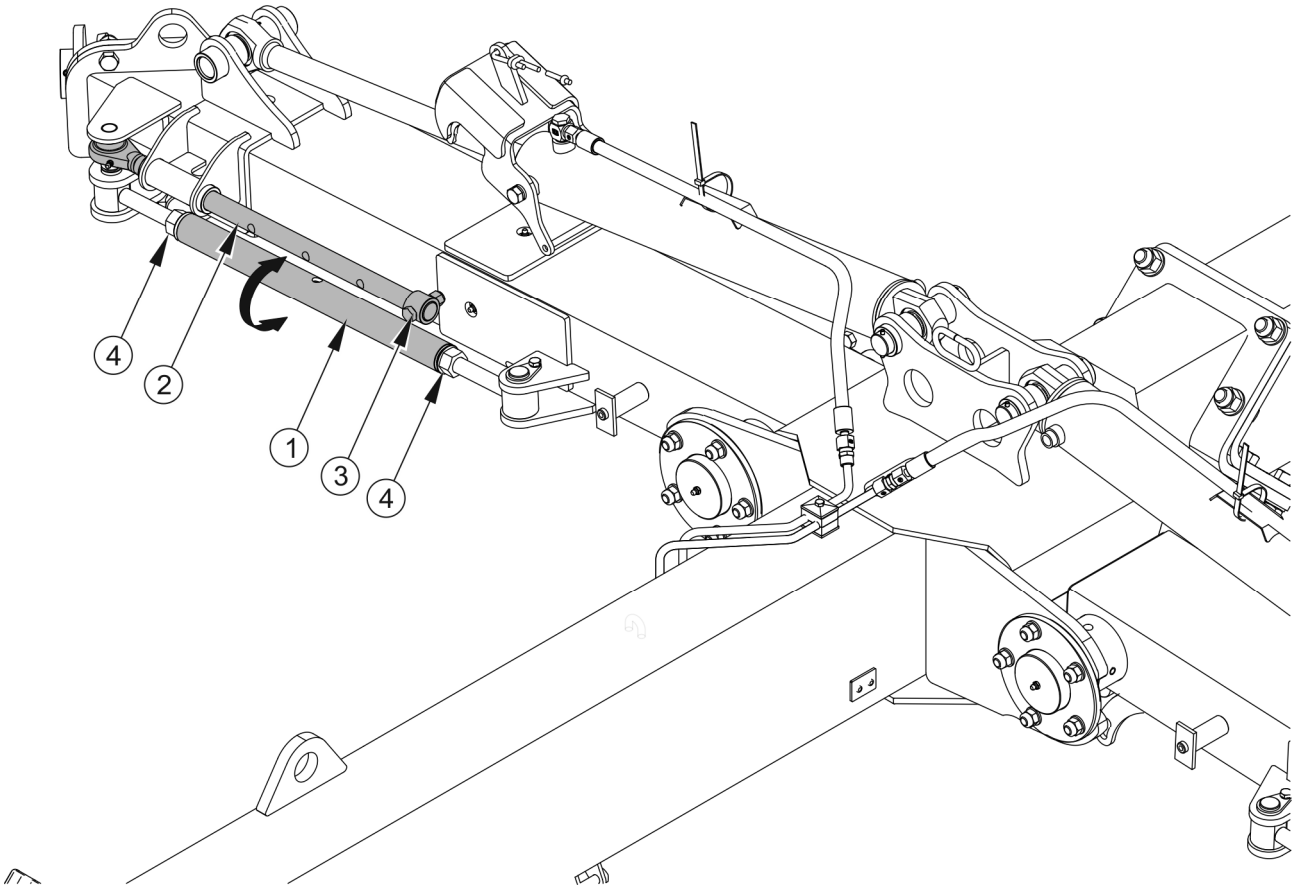


FIGURE 4.8 Setting the rotary rake width (mechanical adjustment)

(1) connector, (2) adjusting bar, (3) limiter, (4) nut

- set raking width – figure (4.8),
  - maximum raking width is locked by shifting limiter (3) to proper openings in adjusting bar (2) – figure (4.8),
  - in order to change the width, loosen the nuts (4), make the adjustment by turning the connector in the appropriate direction and lock the position of the connector by tightening the nuts (4).
- lower lifting arms so that the wheels of the raking assemblies touch the ground.

4.4.4 SETTING RAKING HEIGHT

DANGER

Adjustment of rotary rake's working height must be done with the tractor engine turned off. Remove the key from the ignition, ensure that unauthorised persons do not have access to the tractor. Tractor shall be immobilised with parking brake.

Adjustment of raking height should be performed after lowering the machine to the ground. Perform the following actions in order to adjust raking height:

- park tractor and rotary rake on flat level ground,
- set rear three point linkage in position adjustment mode,
  - ⇨ set the height of the tractor lower three-point linkage forks in such a manner as to ensure that the raking assemblies are set horizontally or slightly inclined forward,

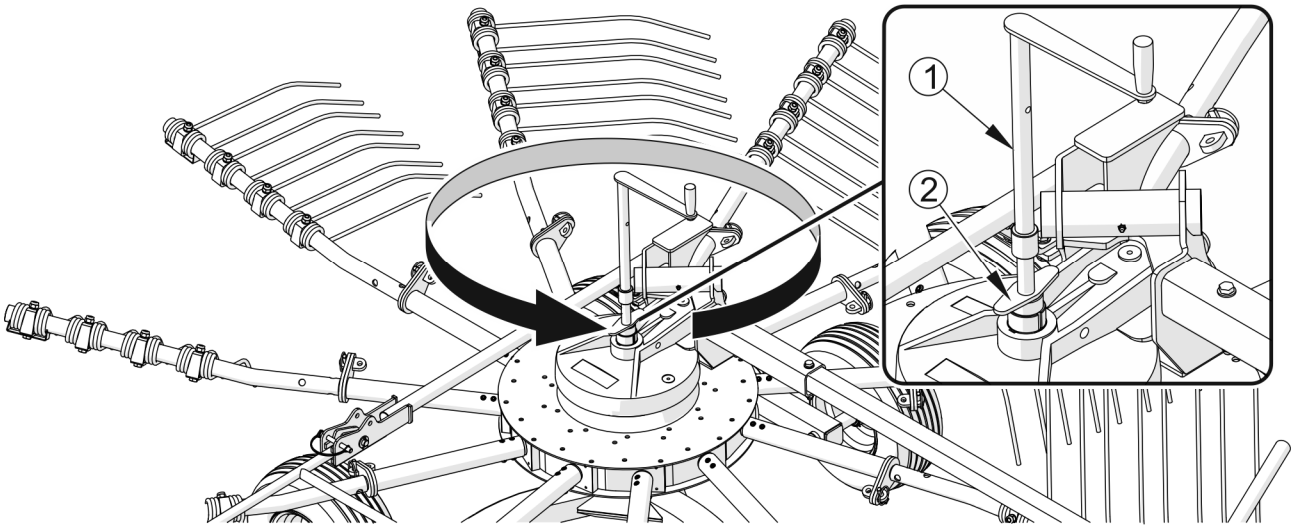


FIGURE 4.9 setting raking height

(1) crank, (2) lock nut

- unscrew lock nut (2) anticlockwise - figure (4.9),
- set the height of springtines in such a manner as to ensure that they delicately touch the ground (lower the raking assembly by turning crank (1) anticlockwise; turning crank (1) clockwise raises the raking assembly),
- tighten lock nut (2),

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. If springtines are too high from the ground there is a risk that not all of the swath will be raked. If the spring 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 tines and their mounting to the arms. Height selection should be checked frequently during raking and if necessary the setting should be corrected

4.4.5 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.

Selective control valve lever of the tractor external hydraulic system used for controlling operation of the lifting/lowering hydraulic cylinders should be set in "floating" position. Consequently, the raking assemblies can adjust to uneven terrain.

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 arm setting should be checked frequently during working.

During turning or reversing, PTO shaft drive should be disengaged and the lifting arms of raking assemblies should be raised slightly above the ground.

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 springtines.

4.5 DISCONNECTING THE ROTARY RAKE

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

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

- lower the left and right support (5) and secure them with cotter pins (6),
- set the rotary rake using three-point linkage until supports (5) fully rest on the ground,
- place chocks under rotary rake wheel.
    - ⇨ wheel chocks shall be so placed that one is in front of the wheel and the second is behind it,

➡ turn off the tractor engine and remove the key from the ignition,

➡ Reduce residual pressure in the hydraulic system by moving the appropriate control lever of the hydraulic circuit in the tractor,

➡ disconnect the hydraulic conduits (3) and the electric lighting system supply line (7) and place them on the line bracket (4),

➡ disconnect PTO shaft (1) and place it on bracket (2),

➡ disconnect lower pins of the rotary rake and drive tractor away.

➡ Install the safety device (8).

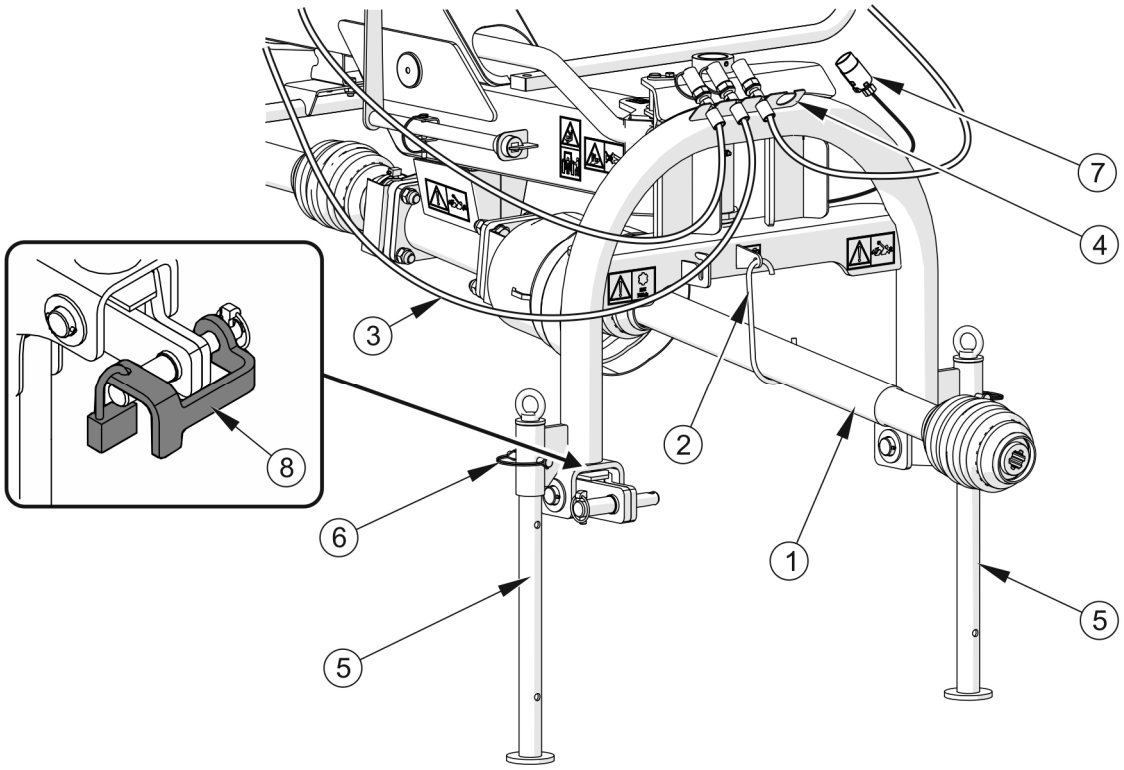


FIGURE 4.10 Disconnecting the rotary rake

(1) PTO shaft for connection with tractor, (2) shaft bracket, (3) hydraulic lines, (4) line bracket, (5) support, (6) support cotter pin, (7) electric wire, (8) safety device,

DANGER

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

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.

4.6 PROPER USE AND MAINTENANCE OF TYRES

- When working on tyres, the rotary rake should be secured against rolling by placing chocks under the wheels.
- 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.
- Checking the tightening of nuts should be made after the first use, after the first day of work, and then at regular intervals every 50 hours of work. The inspection should be repeated individually if a wheel has been removed from the wheel axle. Wheel nuts should be tightened according to recommendations provided in the section *5. MAINTENANCE*.
- Regularly check and maintain the correct pressure in tires in accordance with the instructions (especially if not used for an extended).
- Air pressure in tyres should be also checked during the whole day of intensive work. Please note that higher temperatures could raise tyre pressure by as much as 1 bar. At high temperatures and pressure, reduce speed.
- Do not release air from warm tyres to adjust the pressure or the tyres will be underinflated when temperatures return to normal.
- Tyre valves should be protected with the appropriate caps to avoid soiling.
- Do not exceed the rotary rake's maximum design speed.
- When machine is operated all day, check temperature of tyres.
- Avoid potholes, sudden manoeuvres or high speeds when turning.

SECTION

5

MAINTENANCE

5.1 SAFE MAINTENANCE PRINCIPLES

- Repair, maintenance and cleaning work should be carried out with the tractor engine turned off and the ignition key removed. Ensure that unauthorised persons, especially children, do not have access to the tractor.
- Do NOT use an inoperative machine.
- Repairs during the warranty period may only be performed by authorised service points.
- 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).
- When operating the machine wear protective gloves and use the appropriate tools.
- 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.

5.2 PERIODIC MAINTENANCE SCHEDULE

To get the rotary rake ready for daily use, check components according to guidelines presented in Table *5.1*.

TABLE 5.1 Technical inspection schedule

DESCRIPTION	MAINTENANCE ACTIVITIES	FREQUENCY
Technical condition of protective covers	Check the technical condition of safety guards, 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 springtines to raking arms	Ensure that springtines are correctly tightened.	
Check technical condition of tyres and tyre pressure,	Visually inspect the tyres and if they are properly inflated. In case of doubt, carefully check tyre pressure.	
oil level in bevel gear of drive system,	For details please refer to section *DRIVE SYSTEM OPERATION*	
Oil level in reduction gear of the working assembly	For details please refer to section *"REDUCTION GEAR MAINTENANCE"*	
Correct operation of lights and indicators of the rotary rake.	Check completeness and technical condition of electrical system, lights and warning signs and indicators.	
Check if the wheels are properly tightened	According to the chapter “Install and remove wheel, inspect wheel nut tightness.”	50 working hours
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

DESCRIPTION	MAINTENANCE ACTIVITIES	FREQUENCY
Changing oil in the raking assembly gear	In accordance with the guidelines in the chapter “RAKING ASSEMBLY GEAR MAINTENANCE”.	500 working hours or once a year, depending on which comes earlier
Changing oil in bevel gear	In accordance with the guidelines in the chapter “DRIVE TRANSMISSION MAINTENANCE”.	
Check if all main nut and bolt connections are properly tightened	Tightening torque should be according to table (*5.7*).	Every six months
Checking axle shaft bearings for slackness	In accordance with the chapter “Check wheel half axle bearings for looseness.”	
Lubrication	Lubricate elements according to guidelines presented in section "LUBRICATION".	According to table (*5.5*)

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.

5.3 HALF AXLE MAINTENANCE

5.3.1 PRELIMINARY INFORMATION

Work connected with the repair, change or regeneration of half axle components should be entrusted to specialist establishments, having the appropriate technology and qualifications for this type of work.

The responsibilities of the user are limited to:

- inspect and adjust loose play of half axle bearings,
- Install and remove wheel, inspect wheel nut tightness.
- check air pressure, evaluating technical condition of wheels and tyres.

Procedure relating to:

- changing grease in half axle bearings,
- changing bearings, hub seals,

may be performed by specialist workshops.

5.3.2 CHECKING AXLE SHAFT BEARINGS FOR SLACKNESS

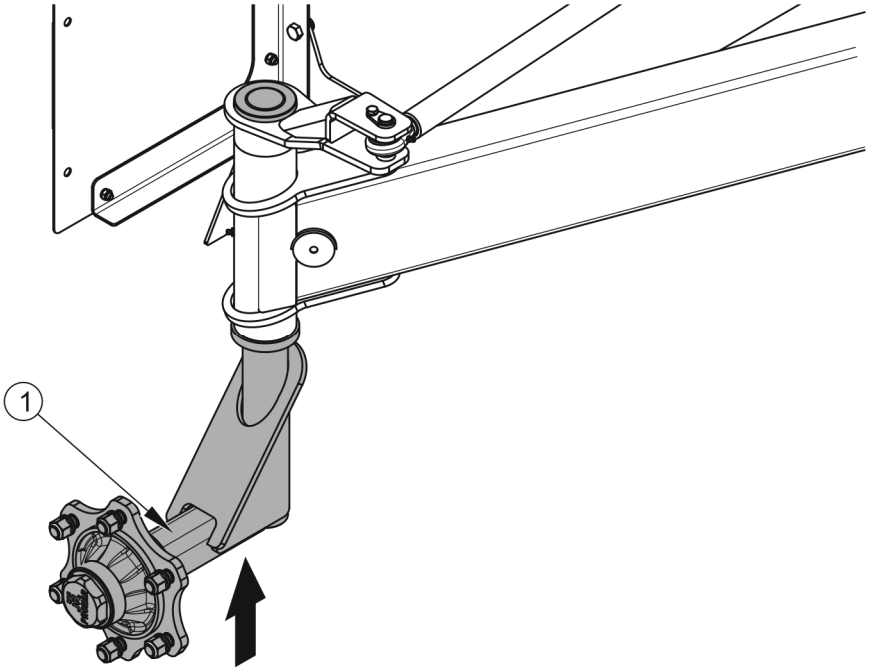


FIGURE 5.1 Lifting jack support point

(1) half axle

Preparatory procedures

- Hitch rotary rake to tractor, immobilise tractor with parking brake.
- Park tractor and rotary rake on hard level ground.
  - ⇨ Tractor must be placed to drive forward.
- Place securing chocks under the rotary rake's wheel opposite to wheel to be raised. Ensure that rotary rake is immobilised during inspection.
- Raise the wheel (opposite to the side where chocks are placed).
  - ⇨ Lifting jack should be positioned in the place indicated by the arrow in figure (*5.1*). Lifting jack must be suited to weight of rotary rake.

Check wheel half axle bearings looseness

- Turning the wheel slowly in both directions check that movement is smooth and that the wheel rotates without excessive resistance.
- Turn the wheel so that it rotates very quickly, check that the bearing does not make any unusual sounds.
- Moving the wheel try to detect slackness.
  - ⇨ You may use a lever placed under the wheel supporting the other end of the lever on the floor.
- Repeat the procedure for the other wheel, remembering that the lifting jack must be on the side opposite to the chocks.

Check wheel half axle bearings for looseness:

- **after the first month of use,**
- **every 6 months of use.**

If slackness is felt, adjust bearings. Unusual noise made by the bearing may be a symptom of excessive wear, dirt or damage. In such an event the bearing, together with sealing ring, should be replaced with new parts, or cleaned and greased again During inspection of bearings ensure that possibly detected looseness comes from the bearing and not from the suspension system

TIP

If hub cover is damaged or missing, contamination and dampness enter the hub, which causes significantly faster wear of bearings and hub seals.

Bearing life is dependent on working conditions of rotary rake, loading, ground speed and lubrication conditions.

Check condition of hub cover, if necessary replace with a new cover. Only inspect bearings for looseness, when the machine is hitched to a tractor.

DANGER

Before commencing work the user must read the user's manual for the lifting jack and adhere to the manufacturer's instructions.

The lifting jack must be stably supported by the ground and so must the half axle.

Make sure that the machine does not roll when checking the wheel axle bearings slackness.

5.3.3 ADJUST SLACKNESS OF HALF-AXLE SHAFT BEARINGS

Preparatory procedures

➡ Prepare tractor and rotary rake for adjustment procedures according to description provided in section 5.3.2.

Adjusting looseness of half axle bearing

➡ Take off hub cover (1) – figure (5.2).

➡ Take out split cotter pin (2) securing castellated nut (3).

➡ Tighten castellated nut in order to eliminate slackness.

⇨ Wheel should rotate with insignificant resistance.

➡ Undo nut (not less than ⅓ of a turn) to align the nearest thread groove with the opening in wheel half axle pin. Wheel should rotate without excessive resistance.

⇨ The nut must not be excessively tightened. Do not apply excessive pressure because working conditions of the bearings may deteriorate.

➡ Secure castellated nut with cotter pin and mount the hub cap.

➡ Delicately tap the hub cap with rubber or wooden mallet.

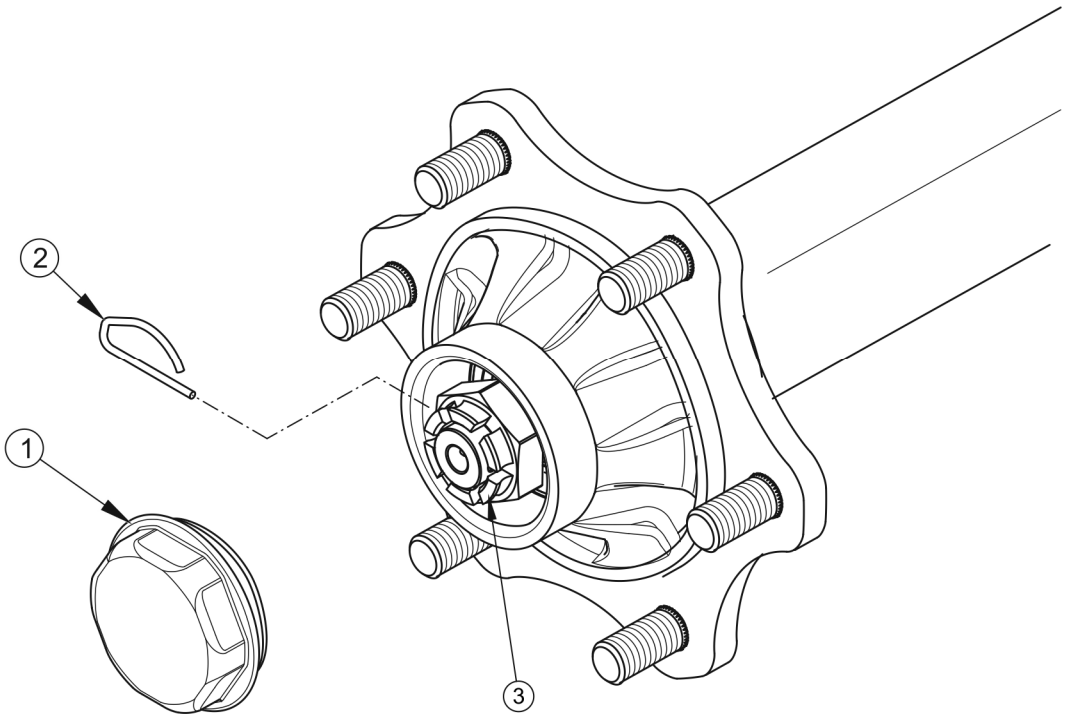


FIGURE 5.2 Adjusting half axle bearings

(1) hub cover, (2) castellated nut, (3) cotter pin

The wheel should turn smoothly without jamming and detectable resistance. Only adjust bearings, when the machine is hitched to a tractor.

TIP

If the wheel are removed, bearing play is easy to check and adjust.

5.3.4 INSTALL AND REMOVE WHEEL, INSPECT WHEEL NUT TIGHTNESS.

Remove wheel

- Place chocks under the wheel that will not be dismounted.
- Ensure that rotary rake is immobilised when wheel is being removed.
- Loosen wheel nuts according to sequence given in figure (*5.3*).
- Place lifting jack and lift rotary rake.
- Dismount wheel.

Install wheel

- Clean half axle pins and nuts of contamination.
  - ⇨ Do not grease thread of nuts and pins.
- Check condition of pins and nuts, if necessary replace them.
- Place wheel on hub, tighten nuts so that wheel rim tightly fits the hub.
- Lower rotary rake, tighten nuts according to recommended torque and given sequence.

Tightening nuts

TIP

Wheel nuts should be tightened using the torque of 270 Nm – M18x1.5 nuts.

Nuts should be tightened gradually diagonally, (in several stages, until obtaining the required tightening torque) using a torque spanner. If a torque spanner is not available, one may use an ordinary spanner. The arm of the spanner (L), figure (*5.3*), should be selected according to the weight of the person (F) tightening the nut. Remember that this method of tightening is not as accurate as the use of a torque spanner.

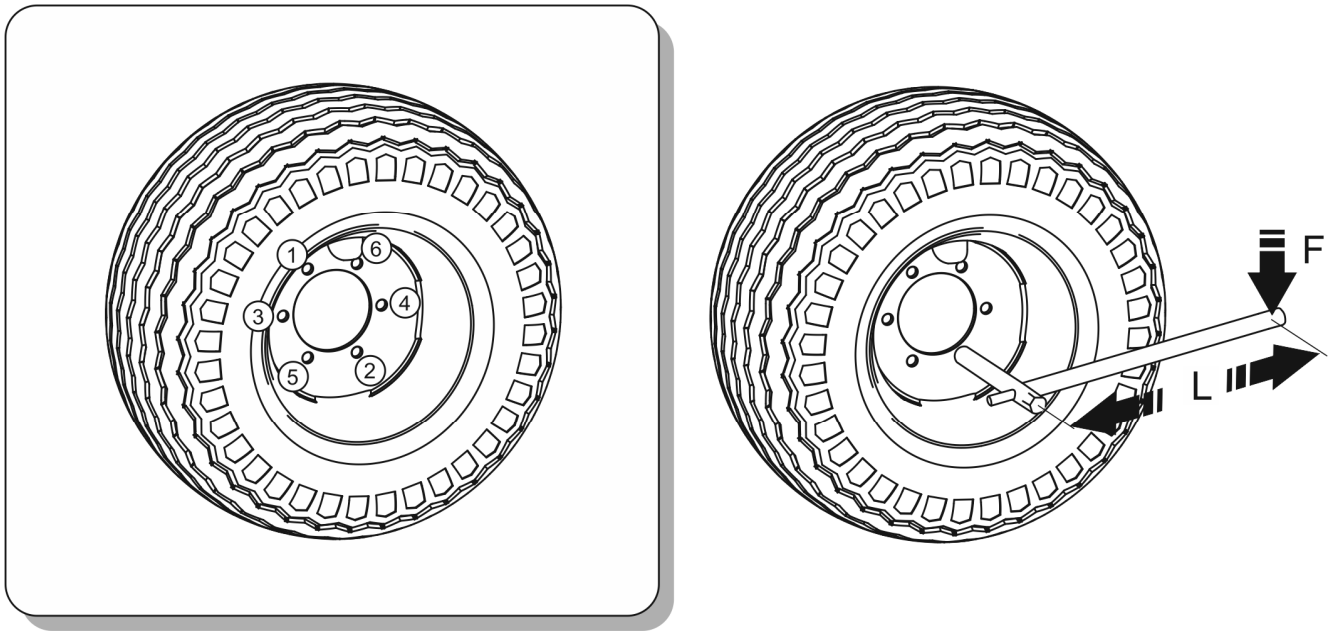


FIGURE 5.3 Sequence of nut tightening

(1) - (6) sequence of nut tightening, (L) spanner length, (F) user weight

Check tightening of half axle wheel nuts:

- **after first use of the rotary rake,**
- **after first day of work,**
- **at regular intervals (50 h).**

The inspection should be repeated individually if a wheel has been removed from the wheel axle.

IMPORTANT

Wheel nuts must not be tightened with impact wrench because of danger of exceeding permissible tightening torque, the consequence of which may be breaking the connection thread or breaking off the hub pin.

The greatest precision is achieved using a torque spanner. Before commencing work, ensure that correct tightening torque value is set.

TABLE 5.2 Spanner arm

WHEEL TIGHTENING TORQUE	BODY WEIGHT (F)	ARM LENGTH (L)
[Nm]	[kg]	[m]
270	90	0.30
	77	0.35
	67	0.40
	60	0.45

5.3.5 CHECK AIR PRESSURE IN TYRES, TECHNICAL CONDITION OF TYRES AND STEEL RIMS

Tyre pressure should be checked each time after changing spare wheel and not less than every month. In the event of intensive use, air pressure in tyres should be checked more frequently. Check tyres before you drive off when tyres are not warm, or after the machine has been parked for an extended period.

TIP

Tyre pressure values are specified in information decal, placed on wheel.

DANGER

Damaged tyres or wheels may be the cause of a serious accident.

While checking pressure pay attention to technical condition of wheels and tyres. Look carefully at tyre sides and check the condition of tread.

In case of mechanical damage consult the nearest tyre service and check whether the tyre defect requires tyre replacement.

Wheels should be inspected with regard to distortion, breaking of material, breaking of welds, corrosion, especially in the area of welds and contact with tyre.

Proper technical condition and appropriate maintenance of wheels significantly extends the life of these components and ensures appropriate level of safety to machine users.

Check air pressure in tyres and visual inspection of steel wheels:

- **at regular intervals (100 h),**
- **if needed.**

5.4 DRIVE SYSTEM MAINTENANCE

Drive system maintenance includes general inspection, change or topping up gear oil in the rotary rake's bevel gear. In the event of damage to transmission, contact authorised service point in order to perform repairs.

DANGER

Do NOT perform service or repair work under raised and unsupported machine.

Check oil level in bevel gear daily.

To check the oil level in bevel gears:

- set the rotary rake horizontally,
- unscrew inspection plug (2),
- oil level should reach the lower edge of the inspection plug opening (2),
- if necessary, add oil through filler opening (1) to the required level.

DANGER

When checking oil level and changing oil, use appropriate personal protection equipment i.e. protective clothing, safety shoes, gloves, safety goggles. Avoid contact of skin with oil.

Oil in bevel gear must be changed after the first 50 hours of work. The next oil change should be made after 500 hours of rotary rake work or once a year, whichever occurs first.

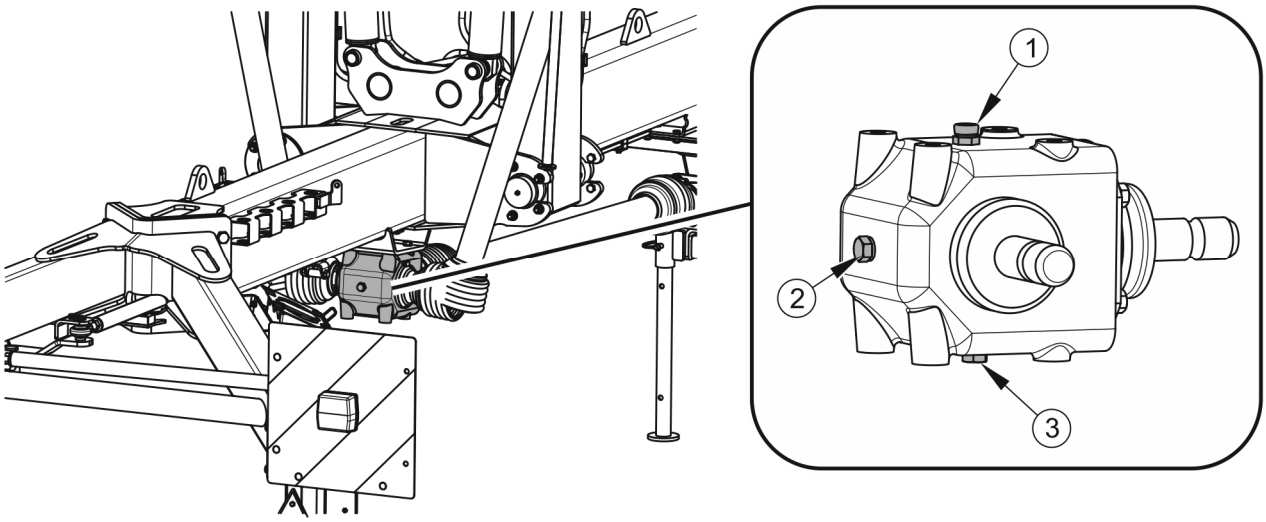


FIGURE 5.4 Changing oil in bevel gear

(1) filler plug, (2) inspection plug, (3) drain plug

To change oil in bevel gear:

- set rotary rake on a hard and level surface
- unscrew filler plug (1) and inspection plug (2),
- unscrew drain plug (3) and drain oil to previously prepared container,
- if oil Manufacturer recommends flushing transmission, that operation should be performed according to the guidelines of the oil Manufacturer (guidelines may be detailed on packaging),
- tighten drain plug (3),
- add oil until oil flows out of inspection opening (2),
- tighten filler plug (1) and inspection plug (2).

NOTE

To lubricate bevel gears use gear oil 80W90 GL-4 (SAE90 EP) in quantity of 1.1 litre.

Used oil should be taken to the appropriate facility dealing with recycling or regeneration of oils.

If a leak is noticed, carefully inspect seals and check oil level. Operating the transmission with insufficient amount of oil may cause permanent damage.

Repairs of the transmission during warranty period may only be performed at authorised mechanical workshops.

5.5 MAINTENANCE OF RAKING ASSEMBLY GEAR

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

Check oil level in the gear daily before beginning work, add oil 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 box amounts to 6.2 litres. Transmission oil required: SAE90EP.

Oil change should be conducted at working temperature, if the machine has worked for several minutes, then possible contamination, in the transmission is mixed with the oil and then is drained out with it.

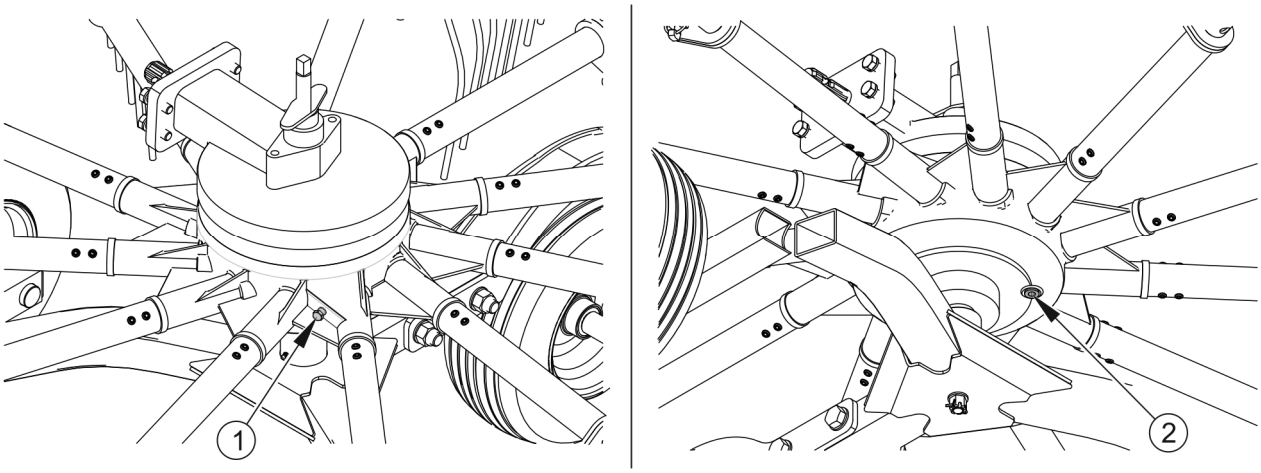


FIGURE 5.5 Changing gear oil

(1) inspection and filling plug, (2) drain plug

In order to change oil in gear transmission:

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

During normal operation lubrication of the gear bearing is also required – see section "Lubrication".

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

5.6 HYDRAULIC SYSTEM MAINTENANCE

DANGER

Before commencing whatever work on hydraulic system reduce the pressure in the system.

DANGER

During work on hydraulic system, use the appropriate personal protection equipment i.e. protective clothing, footwear, gloves and eye protection. Avoid contact of skin with oil.

Always adhere to the principle that the oil in the rotary rake hydraulic system and in the tractor hydraulic system are of the same type. Application of different types of oil is not permitted. In a new rotary rake, the hydraulic system is filled with AGROL U hydraulic oil.

The hydraulic system must be tight. Inspect the seals when the hydraulic cylinders are completely extended. If oil is found on hydraulic cylinder body, check origin of leak. Minimum leaks are permissible with symptoms of "sweating", however in the event of noticing leaks in the form of "droplets" stop using the machine until faults are remedied.

If an oil leak is found on hydraulic connections, tighten the connections. If this does not remedy the problem, replace the lines and connection components. Always exchange each mechanically damaged component.

TABLE 5.3 Characteristics of Agrol U oil

ITEM	NAME	UNIT	VALUE
1	Kinematic viscosity at 100ºC	-	10.0- 11.5
2	Viscosity index, min.		>95
3	Pour point, max.	ºC	<-24
4	Base number mgKOH/g	-	9.9
5	Flash-point	ºC	>230

If it is necessary to change hydraulic oil for another oil, check the recommendations of the oil Manufacturer very carefully. If it is recommended to flush the system with the appropriate preparation, then comply with these recommendations. It should be ensured that the chemicals used for this purpose do not compromise the materials of the hydraulic system.

Hydraulic lines should be replaced after 4 years of rotary rake use.

Detailed tightness and technical condition inspection of hydraulic system should be made at least annually.

The oil used in the hydraulic system is not classified as a dangerous substance, however long-term action on the skin or eyes may cause irritation. In the event of contact of oil with skin wash the place of contact with water and soap. Do NOT apply organic solvents (petrol, kerosene). Contaminated clothing should be changed to prevent access of oil to skin. 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. Hydraulic oil in normal conditions is not harmful to the respiratory tract. A hazard only occurs when oil is strongly atomised (oil vapour), or in the case of fire during which toxic compounds may be released. Oil fires should be quenched with the use of carbon dioxide, foam or steam extinguishers.

NOTE

The machine with a leaking hydraulic system must NOT be used.

The condition of hydraulic systems should be inspected regularly while using rotary rake.

The hydraulic system is under high pressure when operating.

Regularly check the technical condition of the hydraulic lines and connections.

Use the hydraulic oil recommended by the Manufacturer. Never mix two types of oil.

5.7 LUBRICATION

Rotary rake lubrication must be carried out in places indicated in figures (*5.6*) & (*5.7*), and also detailed in table (*5.5)*. The machine is equipped with grease nipples facilitating maintenance and marked with yellow labels (pos.3 – table *(2.1)*).

TABLE 5.4 Recommended lubricants

MARKING ACCORDING TO TAB. (5.5)	DESCRIPTION
A	machine general-purpose grease (lithium, alkaline),
B	80W90 GL-4 (SAE90 EP) transmission oil

Rotary rake lubrication should be performed with the aid of a manually or foot operated grease gun, filled recommended grease. Before commencing work insofar as is possible remove old grease and other contamination. Remove and wipe off excess oil or grease.

For detailed instructions on how to change oil in bevel gears please refer to section „*DRIVE SYSTEM MAINTENANCE".*

TABLE 5.5 Lubrication schedule

ITEM	LUBRICATION POINT	NUMBER OF LUBRICATION POINTS	TYPE OF GREASE	FREQUENCY
1	Hub bearings in half axle	2	A	24M
2	Wheel half axle	2	A	60H
3	Axle system tension rod joint	4	A	60H
4	Tension rod joint	2	A	60H
5	Bearing assembly	2	A	20H
6	Arm pin	4	A	60H
7	Bevel gear **	1	B	500H
8	Adjustment bolt (connection with axle system)	2	A	60H
9	Axle system rocker arm in raking assembly	6	A	60H
10	Multi-splined drive shaft	1	A	20H
11	Three-point linkage frame suspension pin	1	A	8H
12	Joint of tension rod for arm extension adjustment	2	A	60H

ITEM	LUBRICATION POINT	NUMBER OF LUBRICATION POINTS	TYPE OF GREASE	FREQUENCY
13	Extendible arms slide surface	16	A	60H
14	Adjustment bolt (threaded)	2	A	60H
15	Raking assembly suspension pins	4	A	60H
16	Bearings of raking assembly gears	2	A	60H
17	Toothed ring	2	A	60H
18	PTO shafts *	*	*	*
19	Raking assembly gear **	2	B	500H

lubrication periods – M month, H – working hour (1)

** For detailed information on operation and maintenance please refer to Operator Manual enclosed with the shaft.*

*** First change after 50 working hours*

Parts to be lubricated with machine oil should be wiped with dry clean cloth and then a small quantity of oil should be applied to their surfaces (using oil can or brush). Wipe off excess oil.

Change of grease in half axle hub bearings should be entrusted to specialised service points, equipped with the appropriate tools. According to the recommendations of the half axle Manufacturer, dismantle the entire hub, remove the bearing and individual sealing rings. After careful washing and inspection, mount lubricated elements. If necessary, bearing and seals should be replaced with new parts. Lubrication of half axle bearings shall be performed at least once in 2 years or every 50,000 km. In the event of intensive use, lubrication should be performed more frequently.

Empty grease or oil containers should be disposed of according to the recommendations of the lubricant Manufacturer.

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

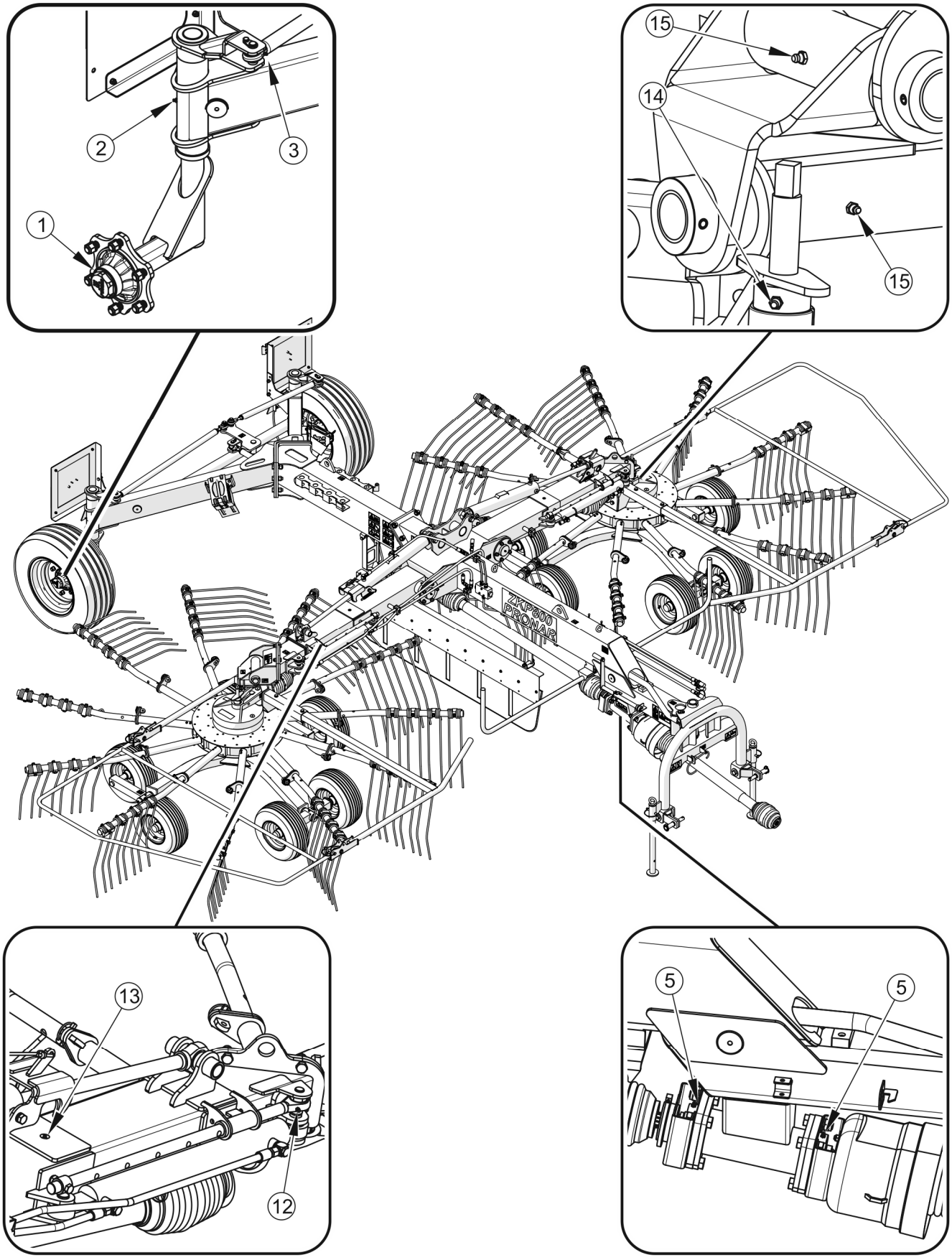


FIGURE 5.6 Rotary rake lubrication points

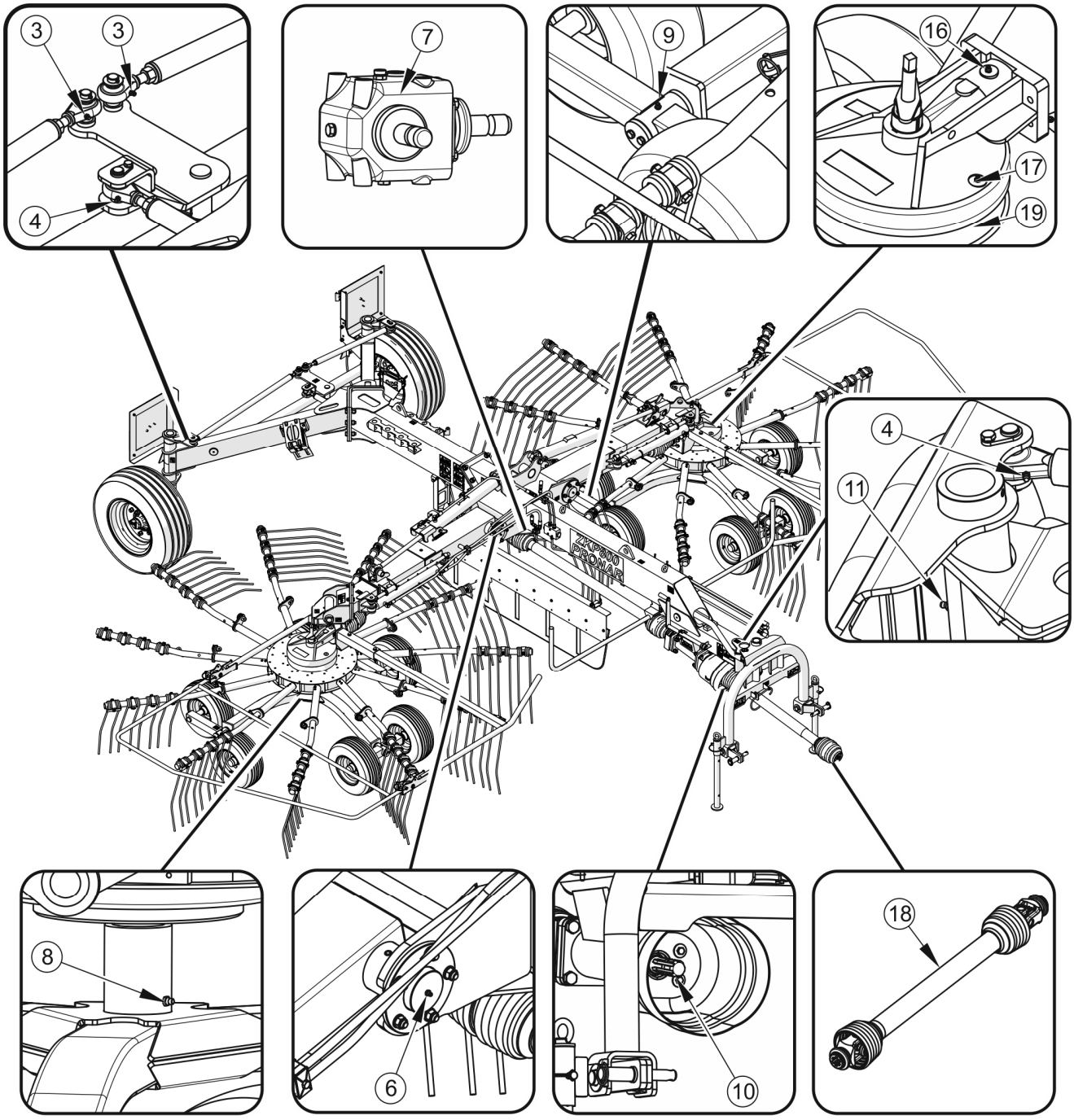


FIGURE 5.7 Rotary rake lubrication points

5.8 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, bearings or hydraulic lines. Nozzle of pressure or steam washer should be kept at a distance of not less than 30 cm from cleaned surface.

After cleaning, 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.

DANGER

Carefully read the instructions for application of detergents and maintenance preparations.

While washing with detergents wear appropriate protective clothing and goggles protecting against splashing.

Switch tractor engine off and disengage PTO shaft before cleaning the machine.

If the machine will not be used for an extended period of time, protect it against adverse weather conditions. 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.

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.

Observe the rules of environmental protection and wash the machine in a place designed for this purpose. Washing and drying the rotary rake must take place at temperatures above 0°C because, in winter, freezing water may cause damage to paint coating or machine elements.

5.9 MAINTENANCE OF ELECTRICAL SYSTEM AND WARNING ELEMENTS

The responsibilities of the user are limited to:

- technical inspection of electrical system and reflectors,
- changing bulbs

IMPORTANT

Do NOT travel with out of order lighting system. Damaged lamp lenses, and burned-out bulbs must be replaced immediately before travelling. Lost or damaged reflectors must be replaced.

Required maintenance

- Hitch rotary rake to tractor with appropriate connection lead.
  - ⇨ Check if the connection wire is reliable. Check connection sockets in tractor and rotary rake.
- Check completeness and technical condition of machine lights.
- Check completeness of all reflectors.
- Check correct mounting of the slow-moving vehicle warning sign holder.
- Before driving on to public road, check that the tractor is equipped with a warning reflective triangle.

Check technical condition of electrical system:

- **each time while connecting rotary rake.**

TIP

Before driving off, make certain that all lamps and reflectors are clean.

5.10 CHECK AND REPLACEMENT OF SPRINGTINES

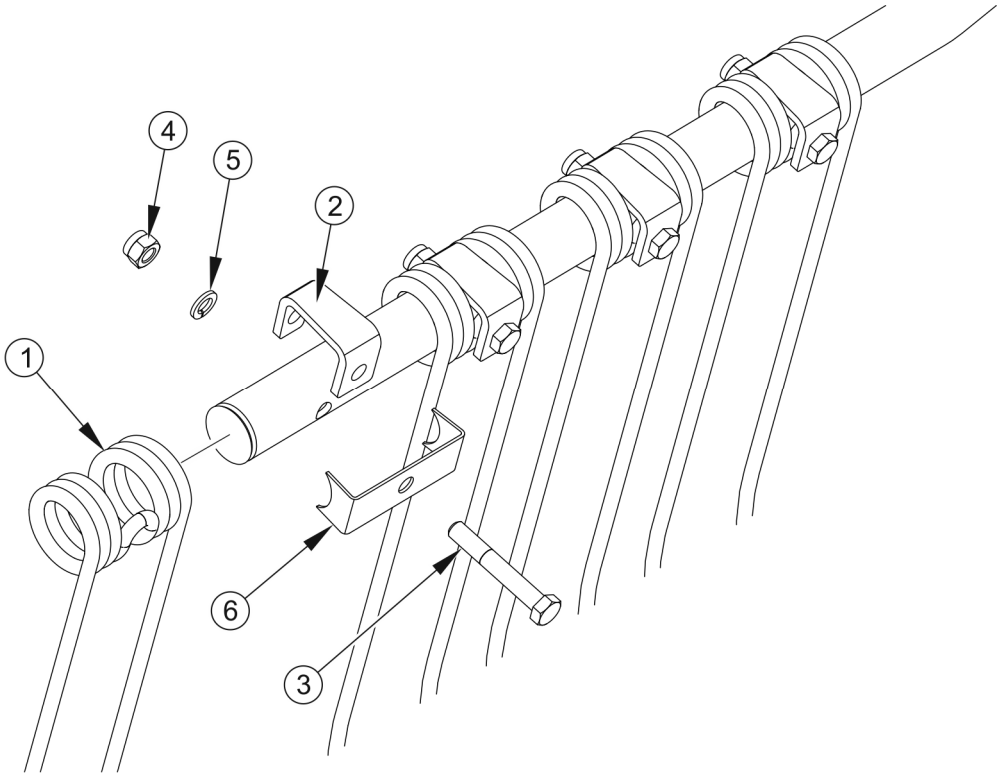


FIGURE 5.8 Changing springtines

(1) springtine, (2) mounting angle section, (3) M12x80 bolt, (4) M12 self locking nut, (5) 12 washer, (6) raking springtines safeguard

In order to dismantle springtines:

- unscrew nut (4)

- Dismantle raking springtine safeguard (6), mounting angle section (2) and bolt (3)
- remove damaged springtine (1) and install a new one,
- insert bolt and angle section. Tighten the nut using appropriate tightening torque according to table (*5.7*).

TABLE 5.6 Springtine

Name	Part number	Quantity
Springtine	178N-02010300	88

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

Each day check condition of springtines 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.

5.11 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 values for the most frequently used bolt and nut connections are given in table *(5.7).* Given values apply to non-lubricated steel bolts.

TABLE 5.7 Tightening torque for nut and bolt connections

THREAD METRIC	5.8(1)	8.8(1)	10.9(1)
	Md [Nm]		
M10	37	49	72
M12	64	85	125
M14	100	135	200
M16	160	210	310
M20	300	425	610
M24	530	730	1,050
M27	820	1,150	1,650
M30	1,050	1,450	2,100

(1) – resistance class according to DIN ISO 898 standard, (M_D) – tightening torque, (d) thread diameter

TIP

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

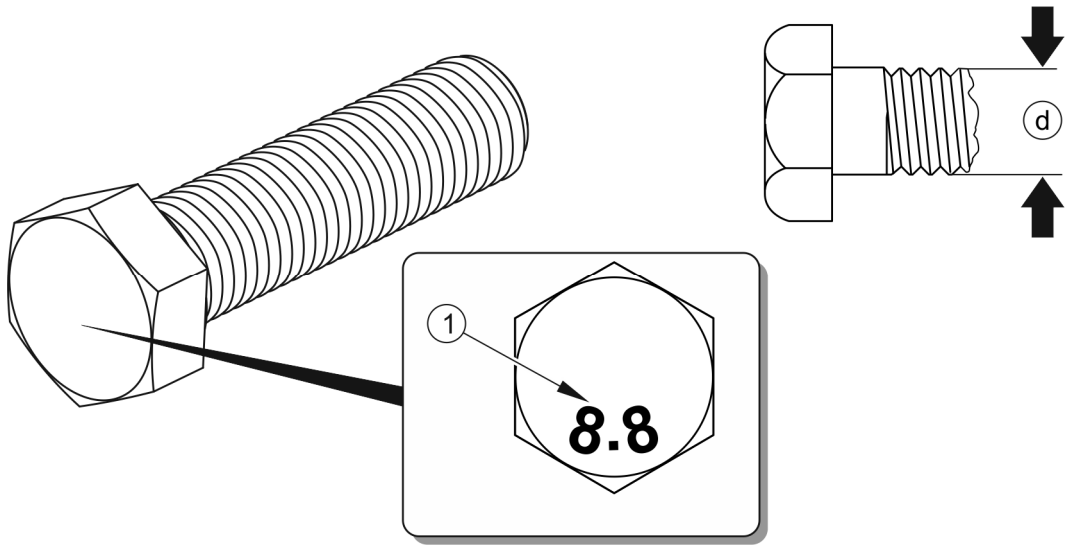


FIGURE 5.9 Bolt with metric thread

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

5.12 TROUBLESHOOTING

TABLE 5.8 Troubleshooting

TYPE OF FAULT	POSSIBLE CAUSE	REMEDY
Rotary rake arm cannot be lifted or lowered	Incorrectly connected or damaged quick coupler	Check quick couplers and manner of their connection
	Blocked cylinder lock	To unblock lock pull cable
	The tractor hydraulic system is out of order	Check condition of tractor hydraulic system
Some hay crop is left unraked (inaccurate raking)	Tractor PTO rotation speed too low	Maintain correct, constant PTO speed
	Incorrect inclination of raking assembly	Set raking assemblies horizontally or slightly inclined forward
	Worn or missing springtines	Install springtines or replace worn springtines
	Incorrect raking height	Set raking height according to section 4.4.4 „SETTING RAKING HEIGHT”
Damaged springtines	Raking assemblies arms hight set to low	Set appropriate raking assemblies hight according to section 4.4.4 “SETTING RAKING HEIGHT”
Excessive vibration during work	Damaged PTO shaft	Check shafts, 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
	Damaged bevel gear	Replace or repair at authorised service point
Oil leak in the raking assembly gear	System leaking	Check sealing, oil level.

ANNEX

A

FIRST ASSEMBLY MANUAL

A.1 PREPARATION

Due to its large overall dimensions, Pronar ZKP800 rotary rake is partially dismantled for shipment and transport on a motor vehicle. Before the first start, the rotary rake has to be assembled in order to be prepared for normal operation. It is absolutely necessary to carefully read this manual before assembling the rotary rake. The persons who assemble the rotary rake should have sufficient know-how, appropriate technology and qualifications for this type of work.

The following parts of the rotary rake are disassembled before transport:

- complete raking assemblies with chassis - 2 items,
- raking arms - 22 items,
- PTO shafts with overload safety clutch - 2 items,

Warning boards with lights are turned by 180° and bolted to axle system bracket. Single items and fasteners necessary for assembling the rotary rake are delivered in special bags.

After preliminary assembly, operation of the machine must be tested. All bolt and nut connections must be checked and retightened after 50 hours of work.

NOTE

Do NOT perform assembly work under raised and unsupported machine.

Exercise due caution while assembling the machine. Make certain that all safety conditions are adhered to.

During assembly work, the tractor and rotary rake must be protected against rolling.

A.2 TURNING THE WHEELS

Wheels of the rotary rake are turned inwards and locked in that position for shipment and transport on a motor vehicle. In order to turn the wheels to normal operating position:

- ➡ disconnect steering rods (2) by removing pins (3),
- ➡ turn the axle steering knuckles (1) outwards by 180°,

➡ attach steering rods (2) to axle steering knuckles by inserting pins (3) and secure by means of bolt (4) and washer (5).

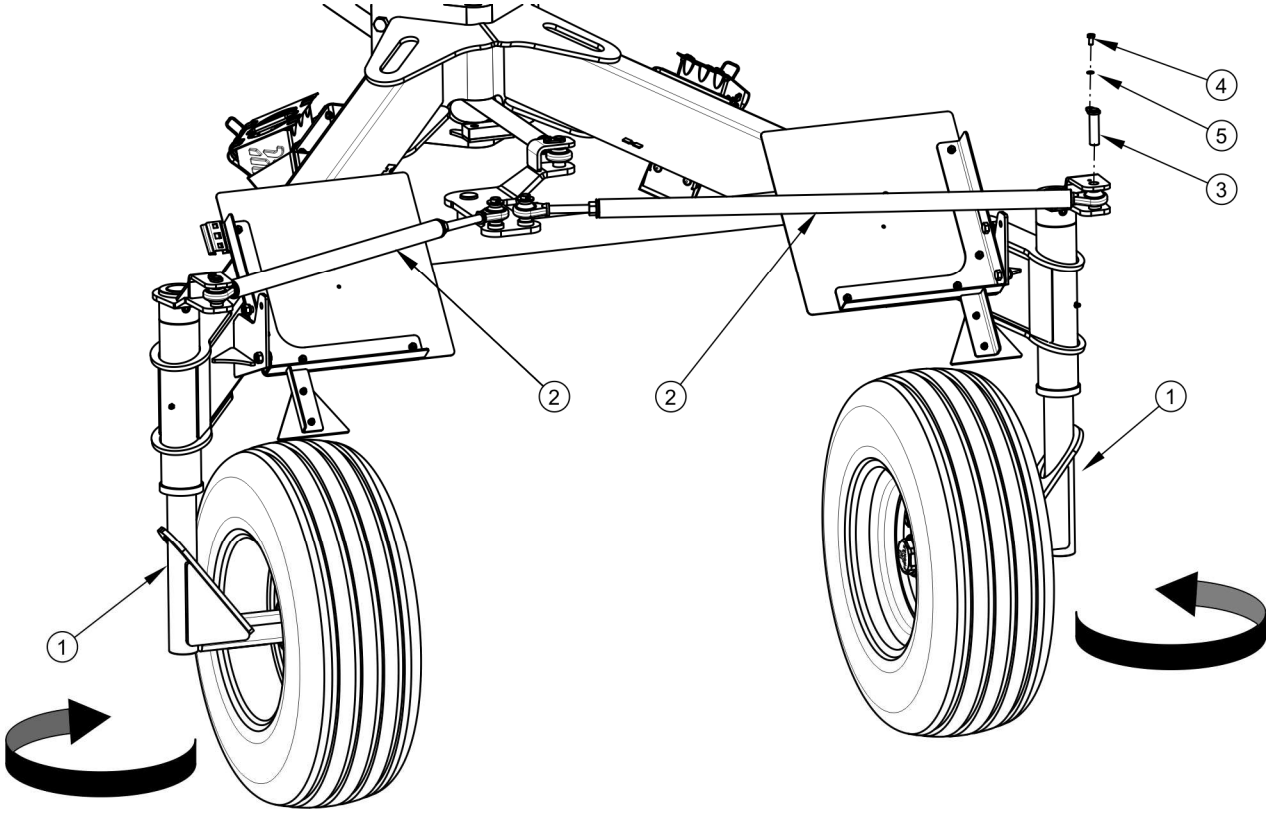


FIGURE A.1 Turning the wheels

(1) axle steering knuckle, (2) steering rod, (3) link pin, (4) M8x16 bolt, (5) Z8,2 spring washer

NOTE

Do NOT use or tow the rotary rake on public roads in shipment configuration because it may tip over.

A.3 INSTALLING THE WARNING BOARDS

For shipment and transport on a motor vehicle, the warning boards are turned and bolted to axle system bracket. Disassemble the boards, turn them outwards by 180° and attach according to figure *(A.2).*

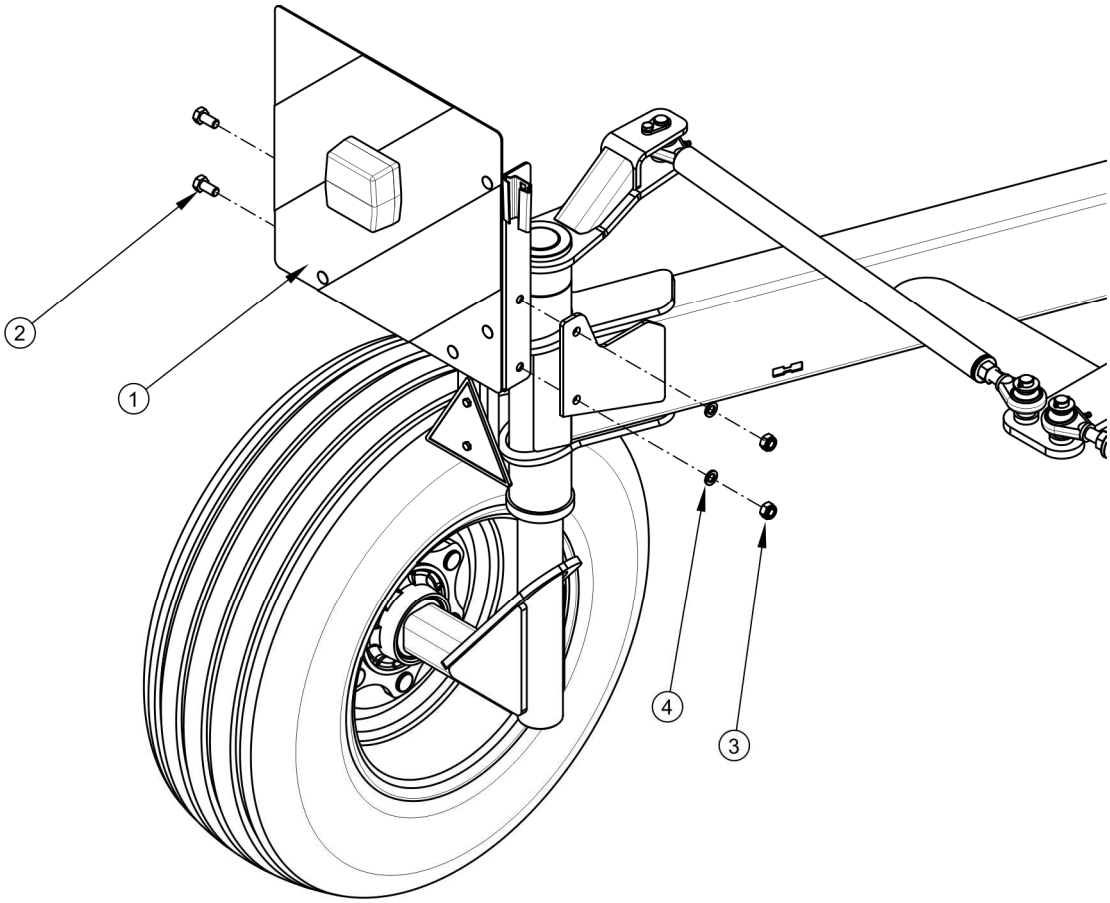


FIGURE A.2 Installing the warning boards

(1) warning board, (2) M12x25 bolt, (3) M12 self locking nut, (4) Z12,2 spring washer

A.4 INSTALLING THE RAKING ASSEMBLIES

Raking assembly should be bolted to the rotary rake arm by means of four bolts (1) – figure *(A.3).*

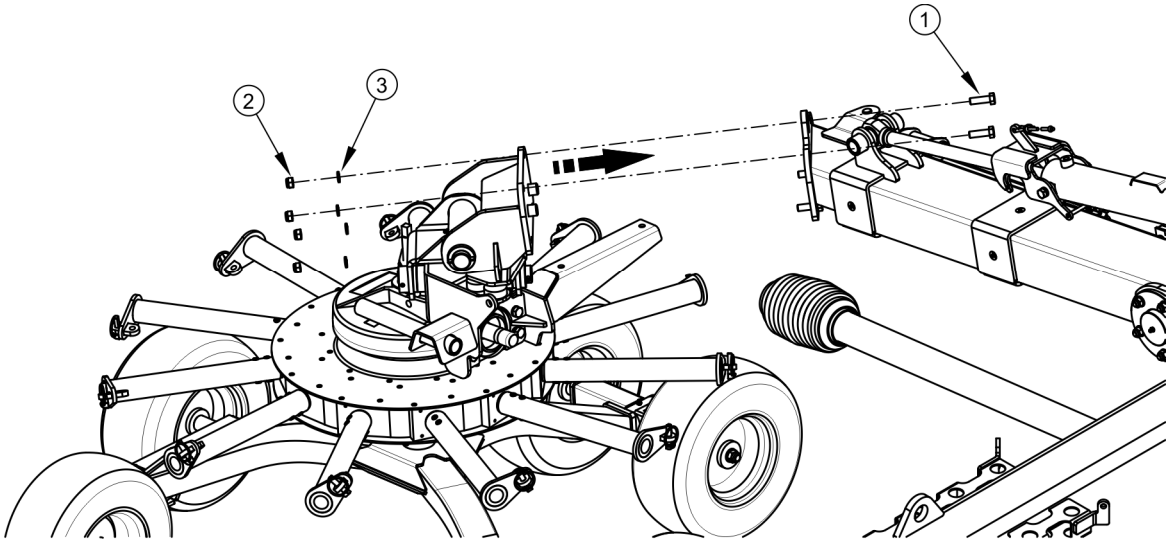


FIGURE A.3 Installing the raking assembly

(1) M14x45 bolt, (2) M14 self locking nut, (3) Z14,2 spring washer

After installing the first raking assembly, connect PTO shaft (1) to transmission shaft (2) so that overload safety clutch (4) is located on the raking assembly side – figure *(A.4)*.

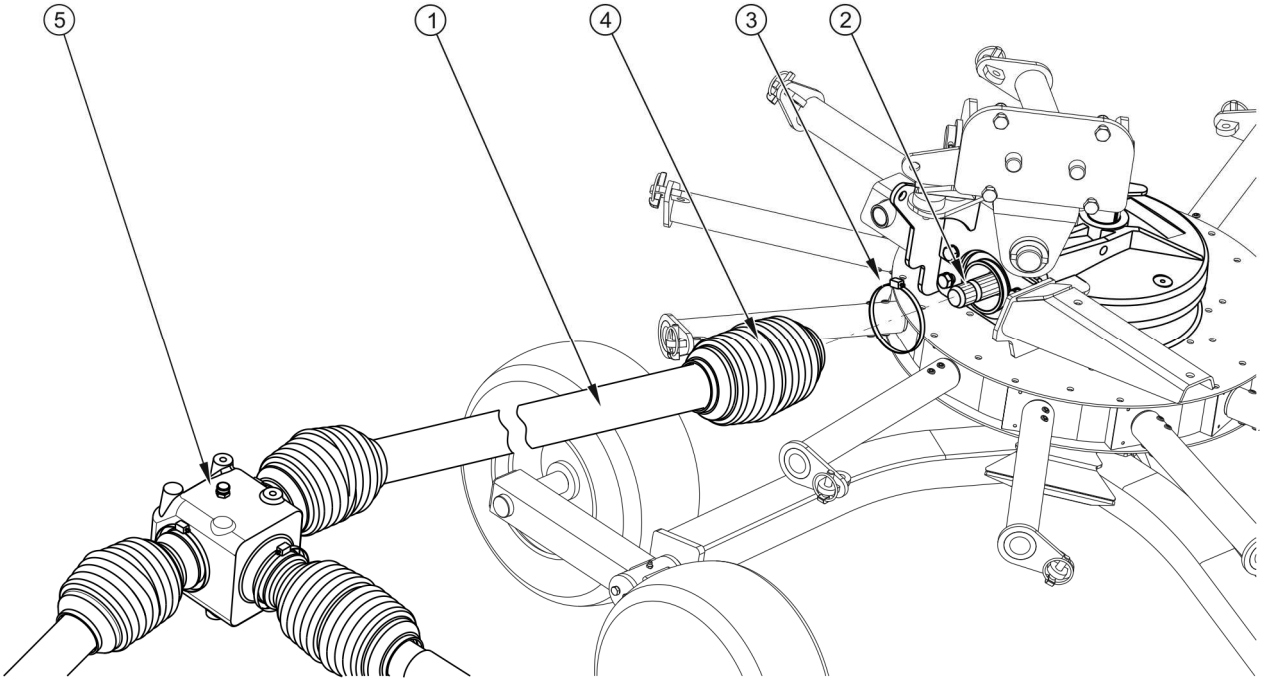


FIGURE A.4 Mounting PTO shaft

(1) PTO shaft with overload safety clutch, (2) raking assembly transmission shaft, (3) jubilee clip, (4) overload safety clutch, (5) central transmission

In order to ensure synchronous operation of PTO shafts, connect them to the central transmission shafts so that articulated joints of shafts are located in one plane, symmetrically with regard to the central transmission – figure *(A.5)*.

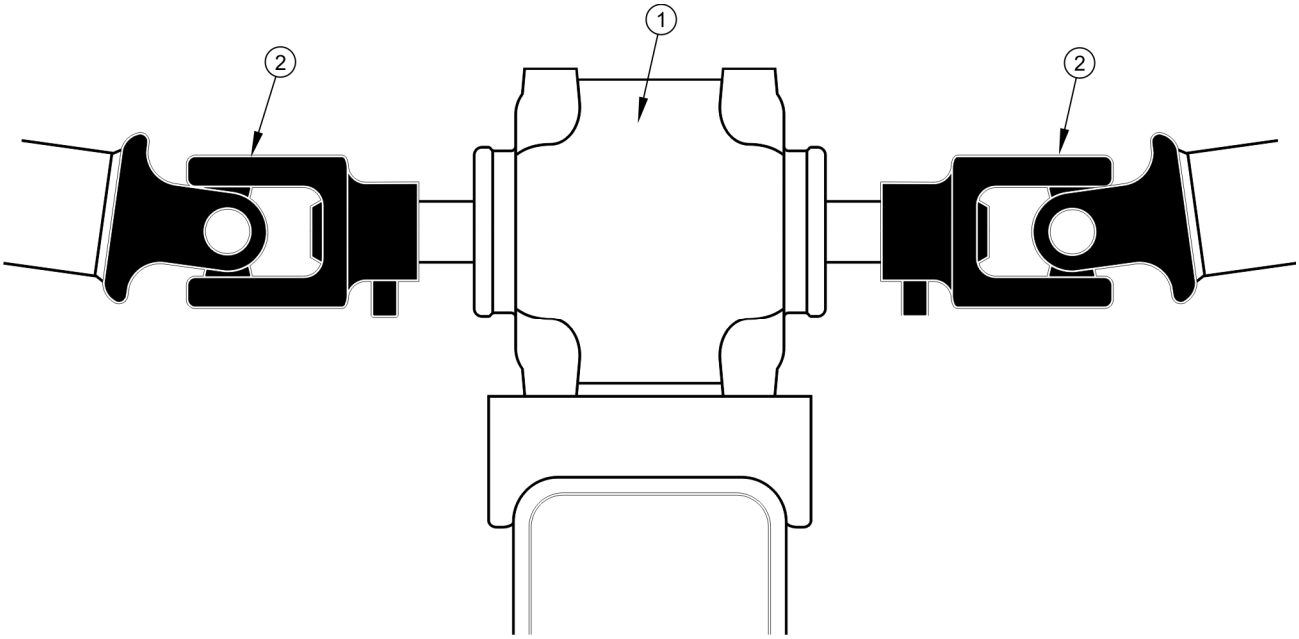


FIGURE A.5 Proper adjustment of PTO shafts

(1) central transmission, (2) articulated joint of shaft

IMPORTANT

Overload safety clutch of PTO shaft must be located on the raking assembly transmission side.

When connecting PTO shafts, make certain that the ends of PTO shaft hitch are securely snapped.

DANGER

Articulated joints of shafts on the central transmission side should be positioned in one plane (symmetrically with regard to the transmission). Incorrectly positioned shafts may get damaged while the raking assemblies are being lifted.

After connecting the PTO shaft, the rubber shield on the overload safety clutch side should be secured with a jubilee clip (3) – figure *(A.4)*.

Repeat the procedure for the second raking assembly.

NOTES