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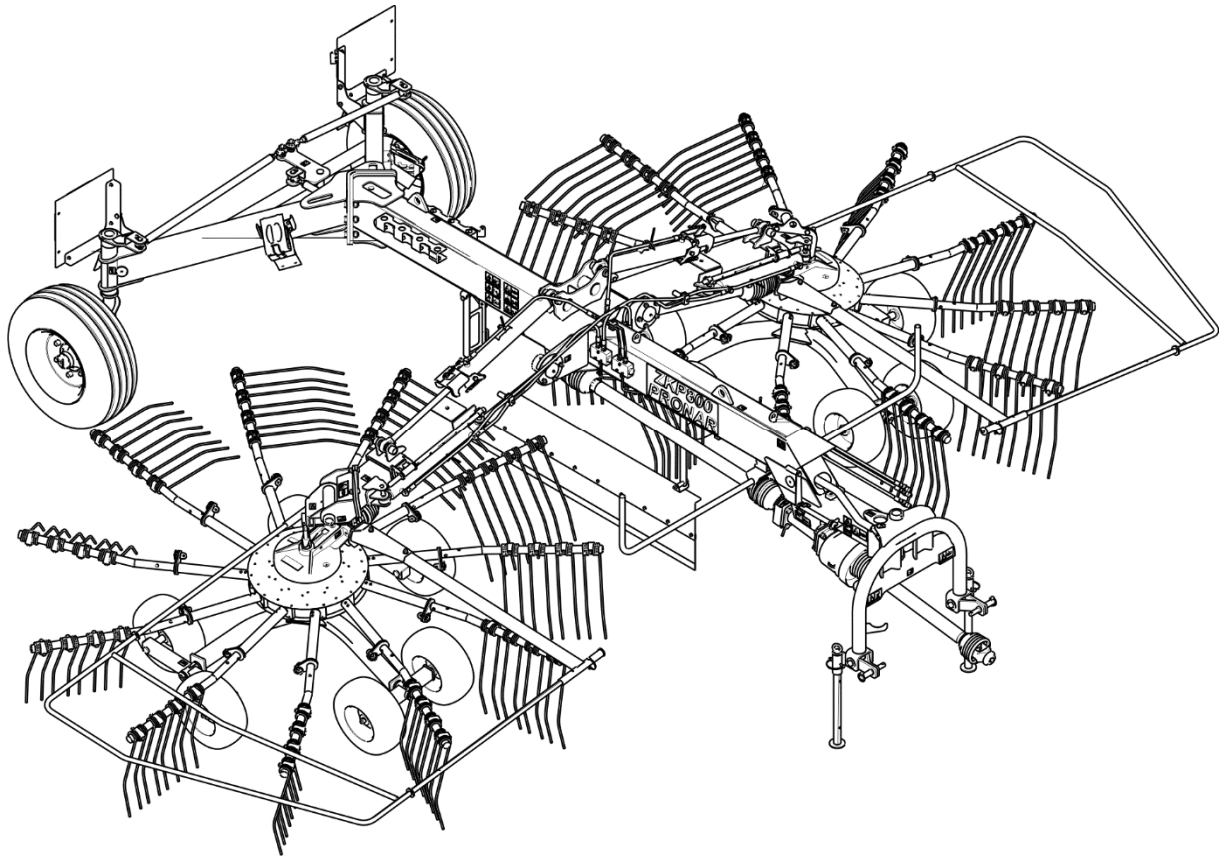
OPERATOR'S MANUAL

ROTARY RAKE

PRONAR ZKP800

TRANSLATION OF THE ORIGINAL INSTRUCTIONS



EDITION 1C-09-2016

PUBLICATION NO 231N-00000000-UM

EN

ROTARY RAKE

PRONAR ZKP800

MACHINE IDENTIFICATION

TYPE: **ZKP800**

SERIAL NUMBER:

INTRODUCTION

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

This Operator's Manual is an integral part of the machine's documentation. Before using the machine, the user must carefully read this Operator's Manual and observe all recommendations. This guarantees safe operation and ensures malfunction 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 safety rules and operation of Pronar ZKP800 Rotary rake. If the information stated in the Operator's Manual needs clarification then the user should refer for assistance to the sale point where the machine was purchased or to the Manufacturer.

MANUFACTURER'S ADDRESS:

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17-210 Narew

CONTACT TELEPHONES

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SYMBOLS APPEARING IN THIS OPERATOR'S 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.

Particularly important information and instructions, the observance of which is essential, are distinguished in the text by the sign:

and also preceded by the word **"ATTENTION".** 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's Manual is marked with the pictogram:

Additional tips and advice for machine operation are marked:

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

DIRECTIONS USED IN THIS OPERATOR'S MANUAL

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

REQUIRED SERVICE ACTIONS

Service actions described in the manual are marked: ➡

Result of service/adjustment actions or comments concerning the performance of actions are marked: ⇨

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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:	**ZKP800**
Model:	–
Serial number:	
Commercial name:	**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.

Narew, the 2011 -03- 24

Place and date

Z-CA DYREKTORA
d/s technicznych
członek zarządu
Romuald Kmiecianiuk

Full name of the empowered person position, signature

CONTENTS

SECTION

1

BASIC INFORMATION

1.1 IDENTIFICATION

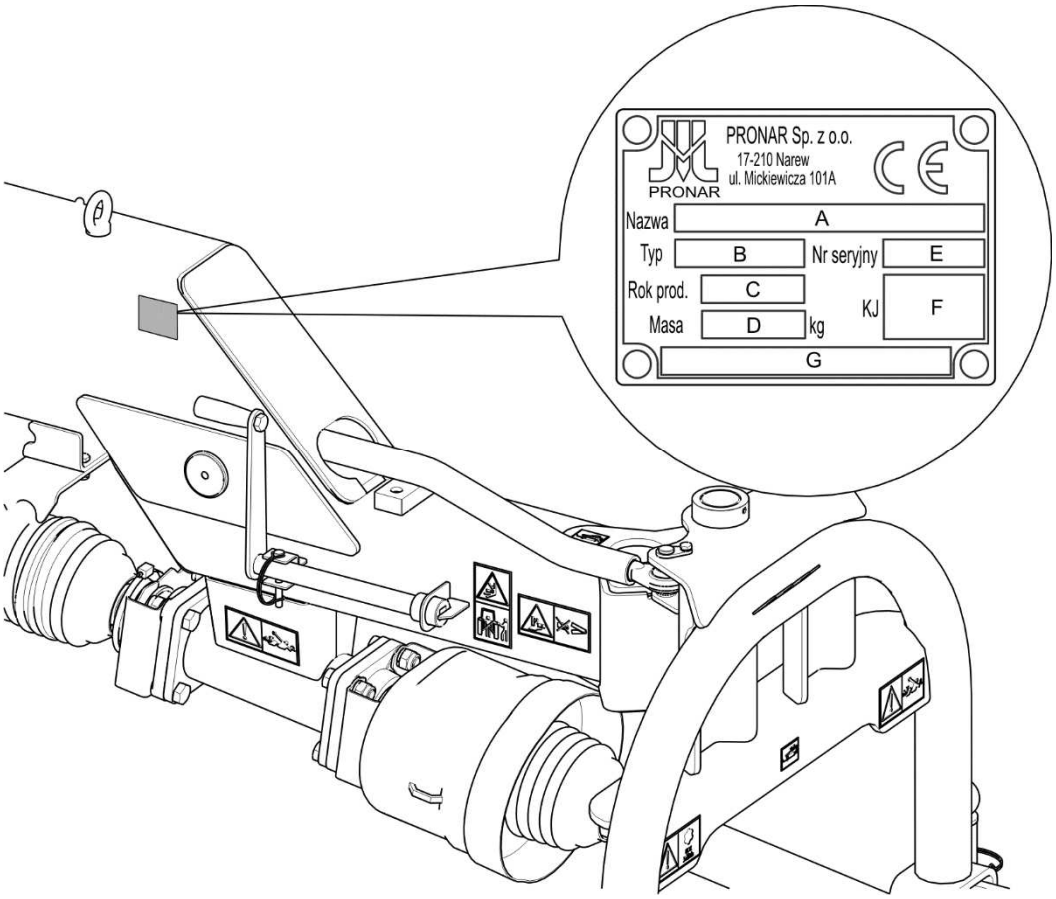


FIG. 1.1 Location of the data plate

(1) data plate

The ZKP800 Rotary rake is marked with a data plate (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'S MANUAL*.

The meanings of the individual fields found on the data plate are presented in the table 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 PROPER USE

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

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

ATTENTION

The rotary rake must not be used for purposes other than those for which it is intended.

Using it as intended also involves all actions connected with the safe and proper operation and maintenance of the machine. In connection with this the user is obliged to:

- carefully read the *OPERATOR'S MANUAL OF THE ROTARY RAKE AND THE* WARRANTY BOOK and conform with the recommendations contained in these documents,
- understand the rotary rake'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 the road traffic regulations and transport regulations in force in a given country, in which the machine is used,
- carefully read the Operator's Manual and comply with its recommendations,
- only hitch the rotary rake to an agricultural tractor, which fulfils all the requirements made by the rotary rake's Manufacturer.

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's 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.

TAB. 1.1 Agricultural tractor's requirements

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)
Hydraulic system	-	One double acting section + one single-acting section with floating position
Hydraulic oil	-	L-HL32 Lotos (1)
Pressure rating of the system	bar / MPa	160 / 16
Electrical system		
Electrical system voltage	V	12
Connection socket	-	7 polar compliant with ISO 1724

CONTENTS	UNIT	REQUIREMENTS
Other requirements The required minimum power	 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 may be found on the product information card.

1.3 EQUIPMENT:

When buying the rotary rake check integrity of the machine.

TAB. 1.2 ZKP800 rotary rake equipment

EQUIPMENT	STANDARD	ADDITIONAL
Operator's Manual	•	
Warranty Book	•	
Connection lead for the electrical system	•	
Wheel chocks	•	
PTO shaft for connection with tractor	•	
Warning reflective triangle		•

Recommended PTO shaft:

- 904-80280 Weasler,

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'S MANUAL*. The repair period is specified in the *WARRANTY BOOK.*

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

- tyres,
- spring tine fingers,
- bearings,
- bulbs.

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

the user will lose the right to warranty service.

TIP

Demand that the seller carefully and precisely fills out the Warranty Book and warranty repair coupons. A missing date of purchase or sale point stamp, may make the user ineligible for any warranty repair or refund.

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

1.5 TRANSPORT

To save space rotary rake is partially dismantled for shipment. By carrying several operations it can be ready for normal operation.

ATTENTION!

When transporting independently, the user must carefully read this operator's manual and observe its recommendations. 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 take particular care while driving.

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

When loading and unloading the rotary rake, comply with the general principles of workplace health and safety 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. It is recommended that during transport of the machine the raking arms are dismantled. In the event that cable or strap of transloading equipment may be caught by protruding rake elements placed in transport position, dismantle them. When lifting the rotary rake take particular care due to the possibility of tipping over the machine and the risk of injuries from protruding parts.

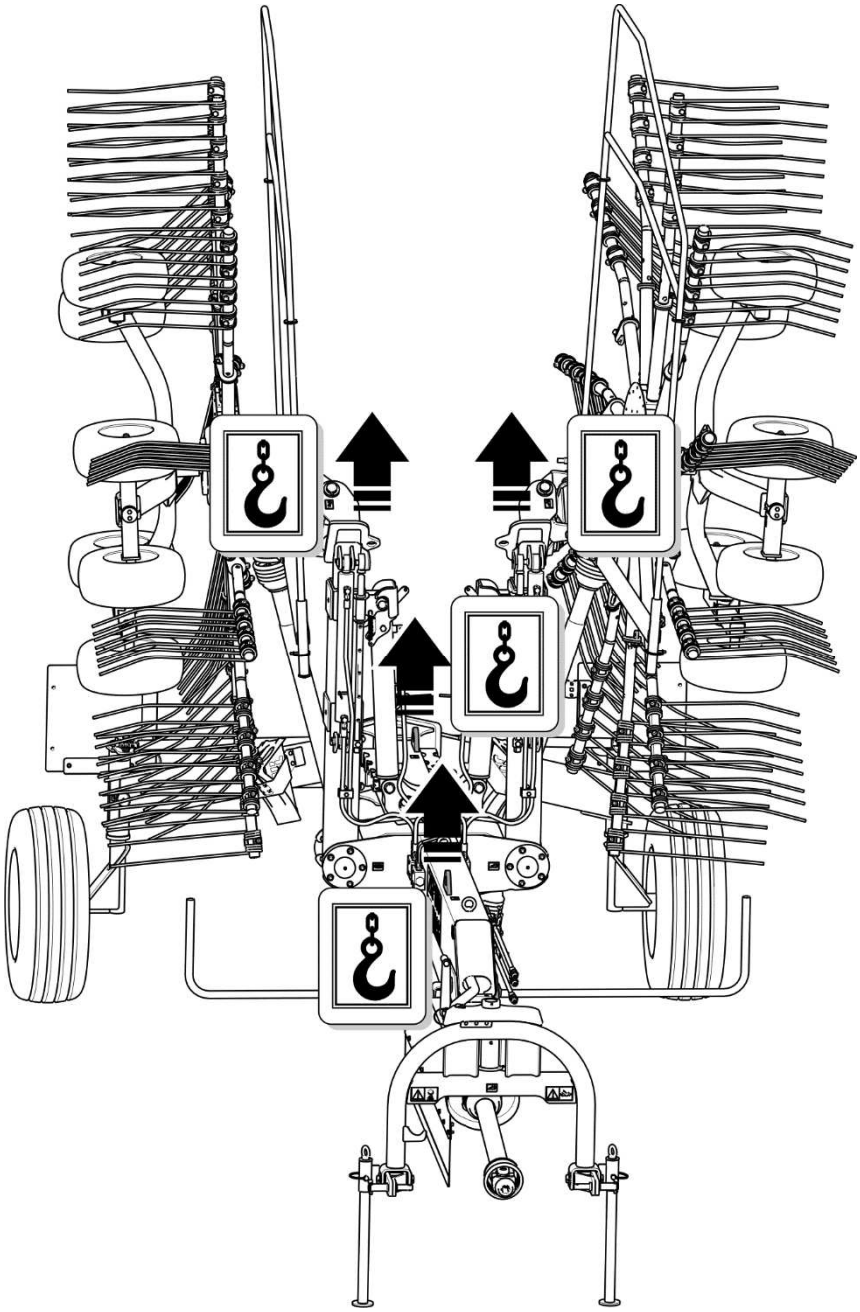


FIG. 1.2 Rotary rake suspension points

DANGER

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

The machine should be attached firmly to the platform of the vehicle using straps or chains fitted with a tightening mechanism. The fastening equipment used must have a valid safety

certificate. Chocks or other objects without sharp edges should be placed under the wheels of the rotary rake to prevent it from rolling. The chocks must be fixed to the platform of the vehicle. During reloading work, particular care should be taken not to damage parts of the rotary rake's fittings or the paint coat.

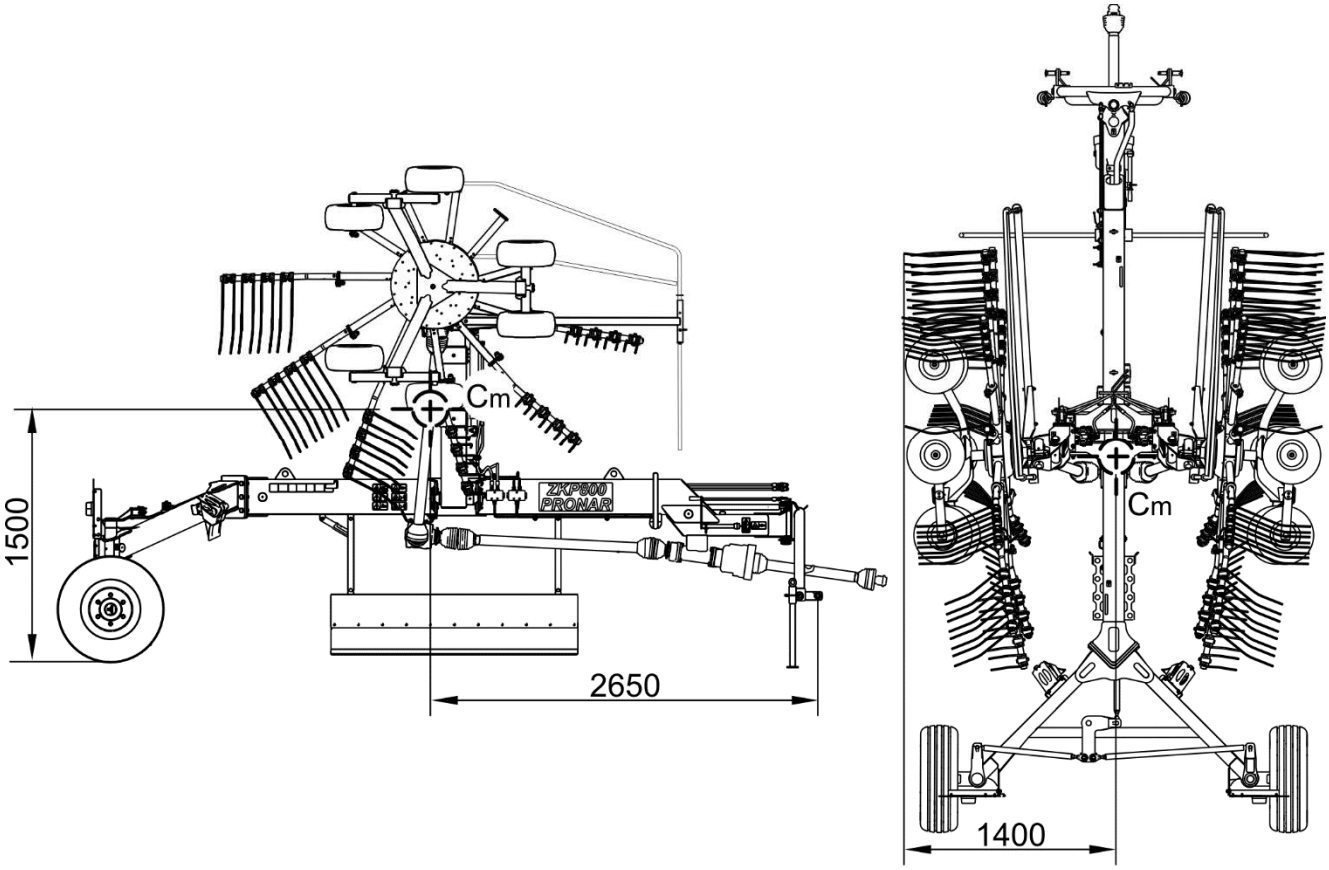


FIG. 1.3 Centre of gravity

ATTENTION

When being road transported on a motor vehicle the rotary rake must be mounted on the vehicle's platform in accordance with the transport safety requirements and the regulations.

Driver of the vehicle should be particularly careful during travel. This is due to the vehicle's centre of gravity shifting upwards when loaded with the machine.

Use only certified and technically reliable securing measures. Carefully read the manufacturer's instructions for the securing measures.

During reloading work, particular care should be taken not to damage parts of the machine's fittings or the lacquer coating. The tare weight of the rotary rake in condition ready for travel is given in table *(3.1).*

DANGER

Incorrect application of securing measures may cause an accident.

ATTENTION

Before transporting independently, the tractor driver must carefully read this operator's manual and observe its recommendations.

1.6 ENVIRONMENTAL HAZARDS

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.

Oil, which has been used up or is unsuitable for further use owing to a 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 L-HL32 Lotos hydraulic oil.

ATTENTION

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

1.7 WITHDRAWAL FROM USE

In the event of decision by the user to withdraw the machine from use, comply with the regulations in force in the given country concerning withdrawal from use and recycling of machines withdrawn from use. Before proceeding to dismantle 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 dismantling, use the appropriate tools, equipment (overhead travelling 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, the user must carefully read this Operator's Manual and the Operator's Manual of the PTO shaft. During use all the recommendations laid down in this Operator's Manual should be observed.
- 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 stated in the Operator's Manual is difficult to understand, contact a seller, who runs an authorised technical service on behalf of the manufacturer, or contact the manufacturer directly.
- Careless and improper use and operation of the rotary rake, and non-compliance with the recommendations given in this operator's 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 existence of a residual risk, and for this reason the fundamental basis for using this machine should be the application of safety rules and sensible behaviour.
- 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 destruction of the safety guards, they must be replaced with new ones.
- The machine must not be used when not in working order.
- 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 to the machine frees the manufacturer 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 an agricultural tractor which fulfils all the requirements of the Manufacturer (minimum tractor power demand, required three-point linkage category etc.) – compare 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.
- To attach the machine to the tractor only the rear three point linkage may be used. After mounting the machine, check the safeguards.
- Be especially careful when hitching the machine to the tractor or truck tractor.
- When reversing the tractor, there must be nobody between the rotary rake and the tractor.
- To mount machine on tractor use only genuine pins and safeguard cotter pins.
- 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.

2.1.3 TRANSPORTING THE MACHINE

- During travel on public roads comply with the road traffic regulations and transport regulations in force in a given 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*).

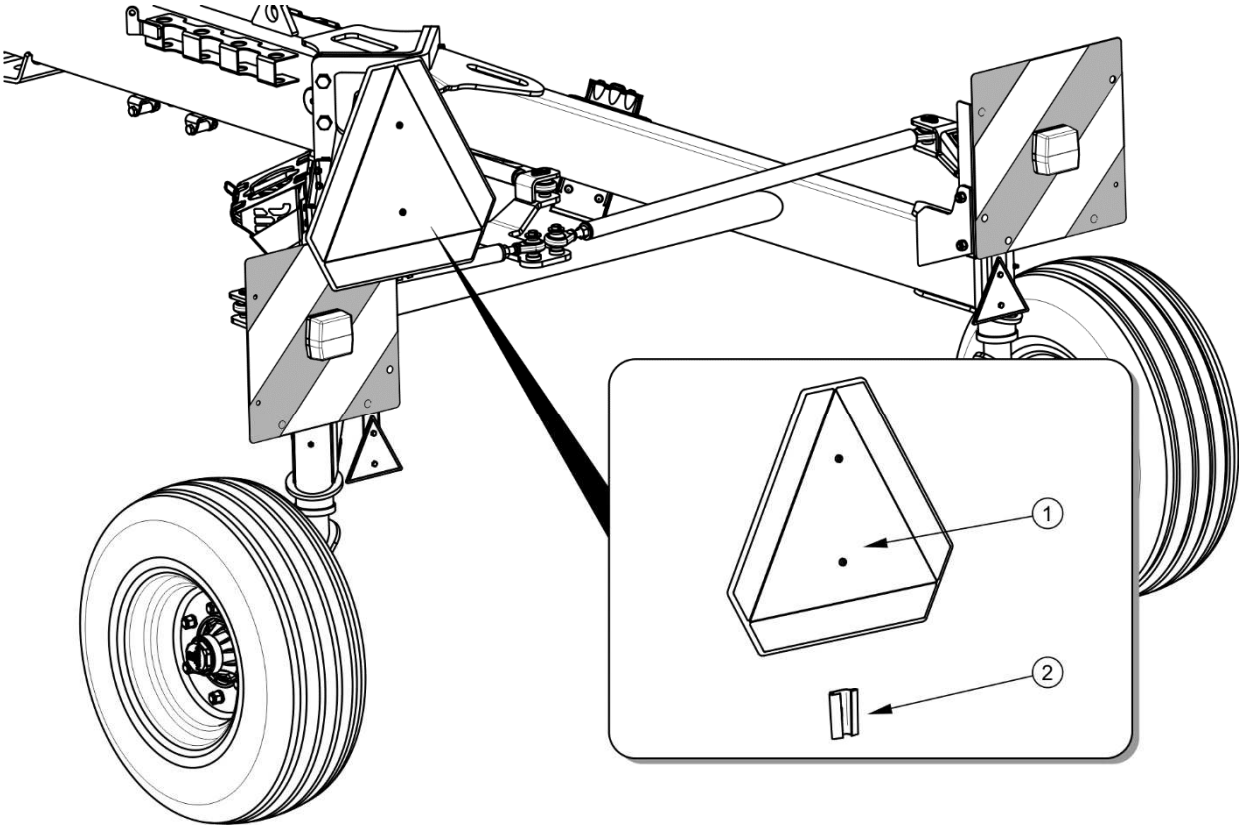


FIG. 2.1 Mounting place for slow-moving vehicle sign

(1) 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 travel speed to the prevailing road conditions and other limitations arising from road traffic regulations limits. 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 connections and the hydraulic lines. There must be no oil leaks.
- In the event of malfunction of the hydraulic system, the machine shall be disconnected from use until the malfunction is corrected.
- Before beginning repair works 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 conduits 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 the user should thoroughly acquaint himself with the PTO shaft Operator's Manual and adhere to the recommendations contained in it.
- PTO shaft may be connected and disconnected only if:

- ⇨ PTO is disengaged,
- ⇨ tractor's 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 PTO shaft Operator's Manual.
- 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's working lights to illuminate the PTO shaft and its vicinity.
- Disconnect the drive shaft each time when it is not necessary to drive the machine, or when the tractor and rotary rake are at an unsuitable angle to each other.
- During transport the shaft must be stored in the horizontal position to avoid damage to safety guards or other protection elements.
- Before starting PTO, make certain that the PTO rotation direction and rotation speed are compliant with allowable rotation speed and rotation direction specified for the machine.

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

2.1.6 MACHINE OPERATION

- 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.
- Before activating the rotary rake, 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.
- Take particular care while 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's 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 whatsoever, do not use the rotary rake until the fault has been fixed.
- During work use the proper, 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.
- Each time a wheel is fitted, always check how firmly the nuts are tightened. Inspection should be carried out each time after the first use, after the first journey, after travelling 1 000 km and then every 6 months of use. The above actions should be repeated individually if 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,
- not maintaining safe distance from the danger zone or being within the zones while the rotary rake is operating,
- operation of the rotary rake by 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's engine is running,

- using unreliable PTO shaft.
- making modifications to the machine without the consent of the Manufacturer,

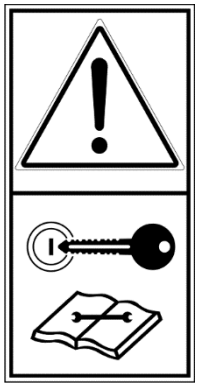
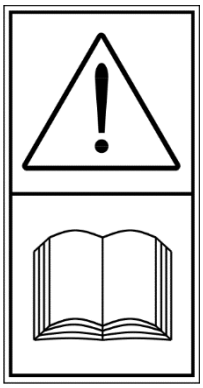
The residual risk may be kept to a minimum by following the recommendations below:

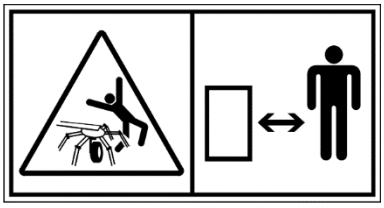
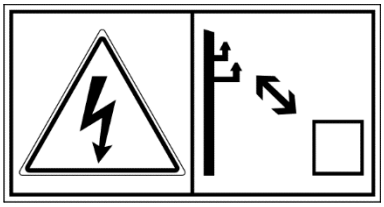
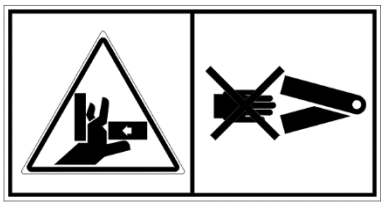
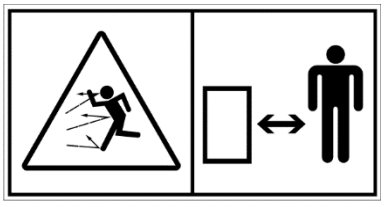
- prudent and unhurried operation of the machine,
- sensible adherence to the remarks and recommendations stated in the Operator's Manual,
- maintaining safe distance from forbidden or dangerous places
- a ban on being on the machine when it is operating,
- carrying out repair and maintenance work in line with operating safety rules,
- carrying out repair and maintenance work by persons trained to do so,
- using close fitting protective clothing,
- ensuring unauthorised persons have no access to the machine, especially children.

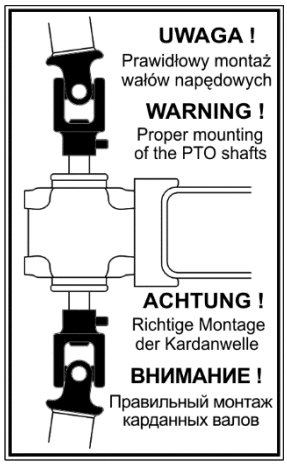
2.3 INFORMATION AND WARNING DECALS

The rotary rake is labelled with the information and warning decals mentioned in table (*2.1*). The symbols are positioned as presented in figure (*2.2*). Throughout the time it is in use, the user of the machine is obliged to take care that notices and warning and information symbols located on the rotary rake are clear and legible. In the event of their destruction, they must be replaced with new ones. 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. During cleaning do not use solvents which may damage the coating of information label stickers and do not subject them to strong water jets.

TAB. 2.1 Information and warning decals

ITEM	SAFETY SYMBOL	DESCRIPTION
1		Danger of inadvertent starting or rolling of the machine. Before beginning servicing or repairs, switch off engine and remove key from ignition
2		Caution! Before starting work, carefully read the Operator's Manual
3		Grease according to the recommendations in the Operator's Manual
4		Transport lug points marking.
5		Caution! Danger associated with the rotating PTO shaft.

ITEM	SAFETY SYMBOL	DESCRIPTION
6		Risk of injury when machine is being arranged in transport or working position
7		Danger of being struck by rotating elements of the machine. Keep a safe distance from raking assembly.
8		Keep a safe distance from electric power lines.
9		Do not reach into crushing space because elements may move. Danger of crushing hands or fingers.
10		Thrown out objects endanger the whole body. Keep a safe distance from the operating machine.
11		Do not stand behind the tractor while lifting arm is operated.

ITEM	SAFETY SYMBOL	DESCRIPTION
12		Caution! Maximum allowable PTO shaft rotation speed is 540 rpm.
13	**PRONAR ZKP800**	Machine type
14	**400 kPa**	Air pressure in the tyres. [1]
15		Proper adjustment of PTO shafts

(1) – pressure value should be adapted to tyres

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

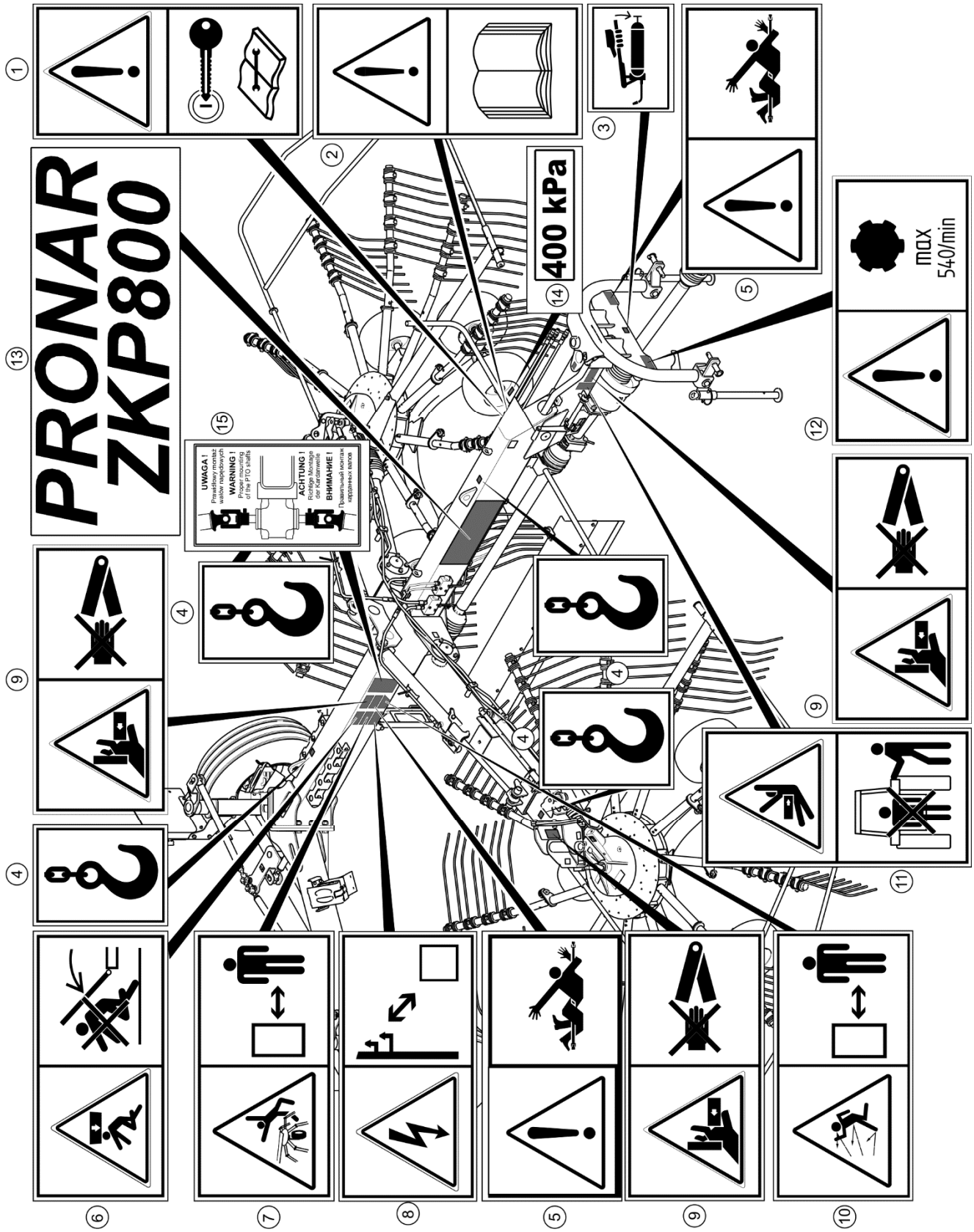


FIG. 2.2 Locations of information and warning decals

SECTION

3

DESIGN AND OPERATION

3.1 TECHNICAL SPECIFICATION

TAB. 3.1 ZKP800 rotary rake basic technical specification

CONTENTS	UNIT	ZKP 800
Dimensions in the transport position		
Total length in transport setting	mm	5,400
Width	mm	2,800
Height		
rakes extended	mm	3,550
rakes withdrawn	mm	4,200
Dimensions in the operating position		
Total length	mm	5,400
Width in working setting		
minimum	mm	7,500
maximum	mm	8,500
Height	mm	1,450
Technical specification		
Working width	mm	7 000 – 8 000
Width between the rotors	mm	900 – 1 900
Minimum tractor power demand	hp / /kW	80 / 59
Maximum PTO speed	RPM	540
Tare weight	kg	1 950
Number of rotors	item	2
Number of rotor working arms	item	11
Number of raking spring tines on a single working arm	item	4
Recommended working speed	km / h	10
Wheel axle tyres		
Tyre	-	10.0 / 75- 15.3
Air pressure in the tyres	kPa	400
Raking assembly tyres		
Tyre	-	16 x 6.5 – 8 (6PR)
Air pressure in the tyres	kPa	160

CONTENTS	UNIT	ZKP 800
Other information		
Electrical system voltage	V	12
Noise emission level	dB(A)	below 70

3.2 ROTARY RAKE DESIGN

3.2.1 GENERAL DESIGN

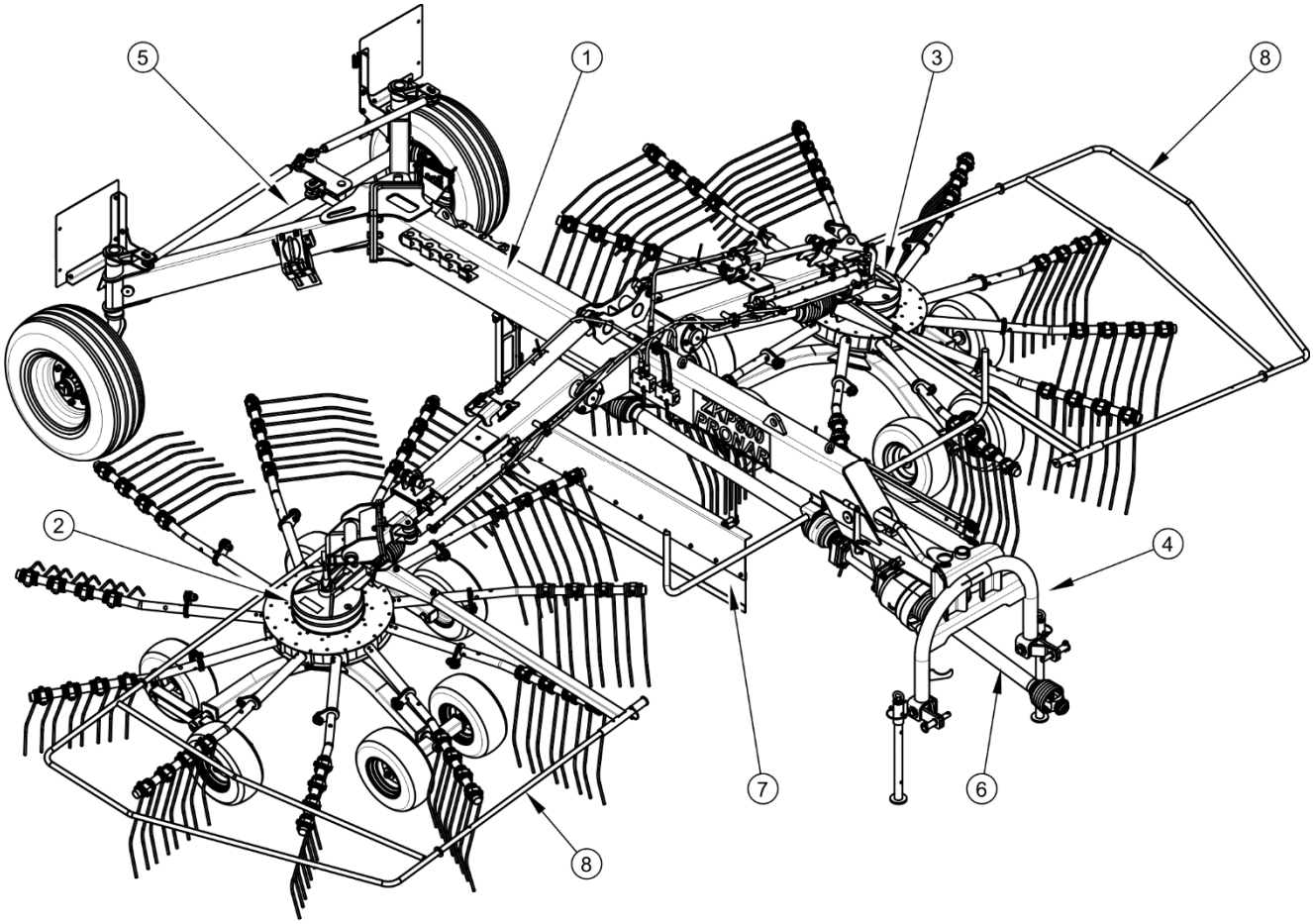


FIG. 3.1 Rotary rake design

(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*). 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).

Raking assembly gears are driven by transmission (6) which consists of intersecting axis 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

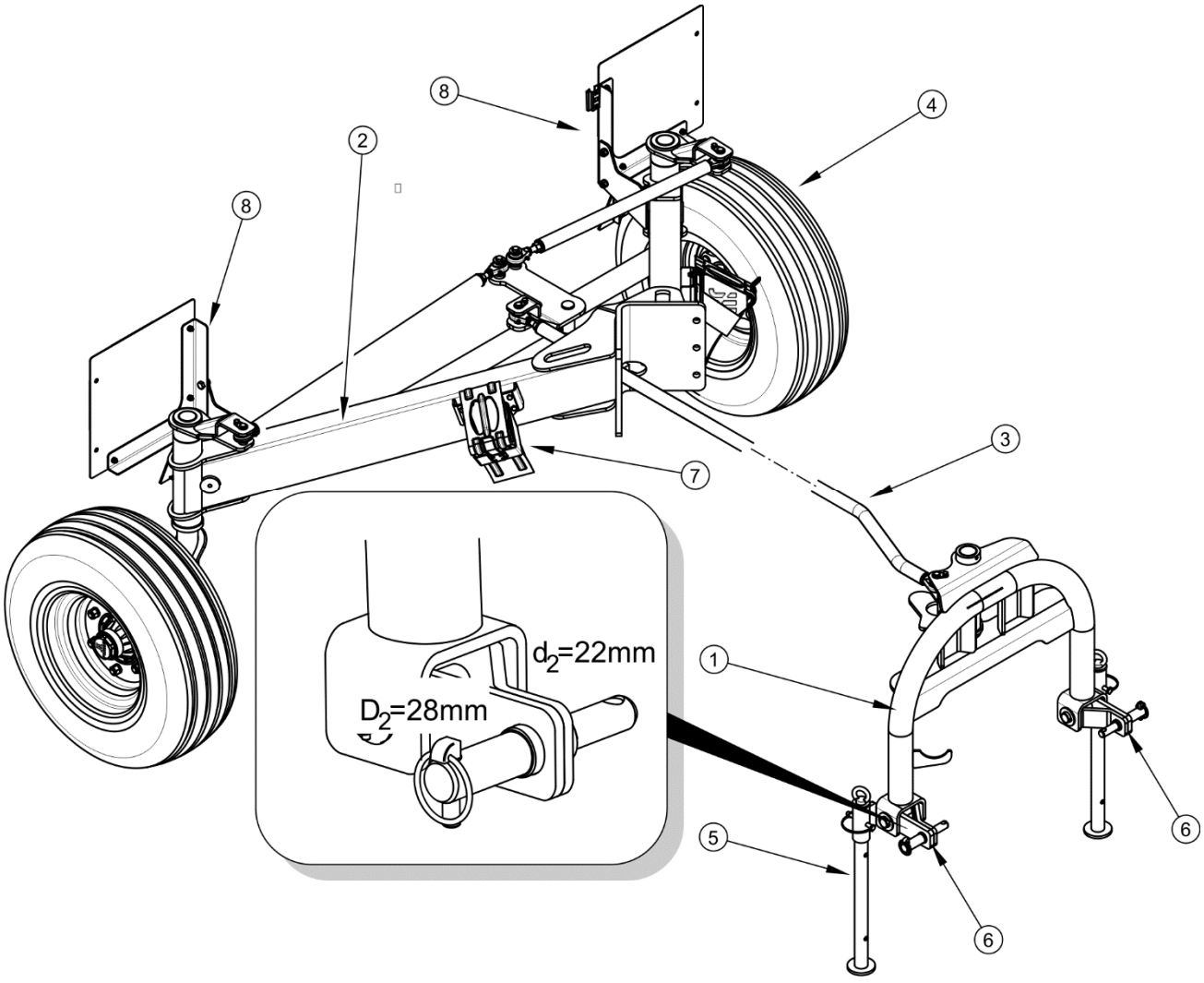


FIG. 3.2 Design of axle system and hitch system

(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's 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's 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)*). Raking assembly design is shown in figure *(3.3)*.

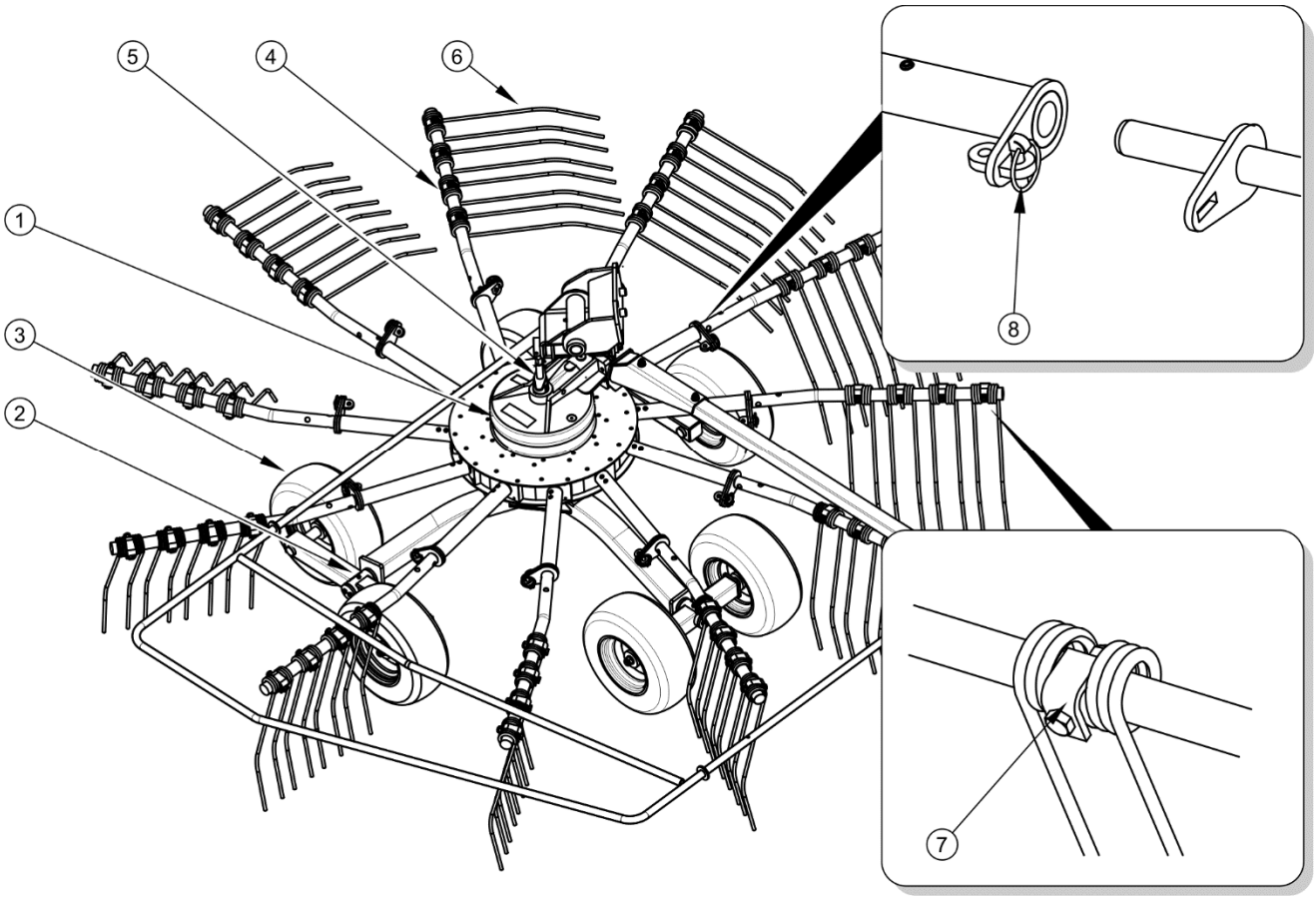


FIG. 3.3 Raking assembly design

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

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 tridem axle system, which guarantees proper raking on wavy surface. Rocker arms (2) with wheels (3) are secured to the axle system wheel frame.

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

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.

3.2.4 DRIVE TRANSMISSION

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 intersecting axis gear (*5)*. Torque is transferred from the intersecting axis 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 *(3.4)*.

ATTENTION

Do NOT use PTO rotation speed other than 540 rpm.

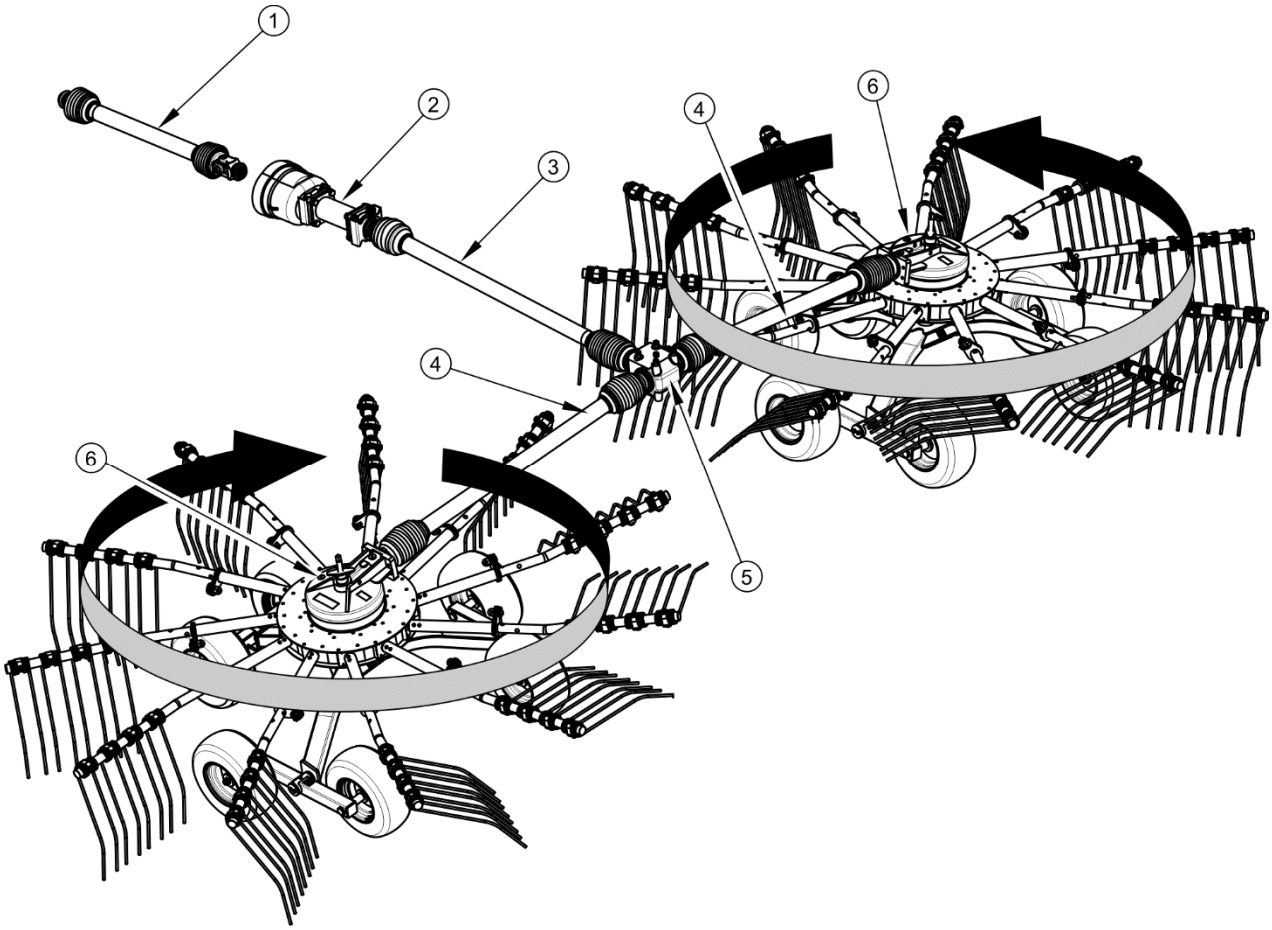


FIG. 3.4 Design of drive transmission system

(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) intersecting axis gear, (6) raking assembly gear

3.2.5 HYDRAULIC SYSTEM

The hydraulic system is used for controlling the raking arms and adjusting the raking width.

The hydraulic system is supplied from the tractor's external hydraulic system through hydraulic quick couplers (6) i (7).

Quick coupler (6) should be connected to the section with floating position. In such configuration the pistons of both lifting/lowering hydraulic cylinders (1) can move freely. Consequently, the raking assemblies can adjust to uneven terrain. Valve (3) is used for locking hydraulic cylinders (1) in transport position.

Working width of the rotary rake 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.

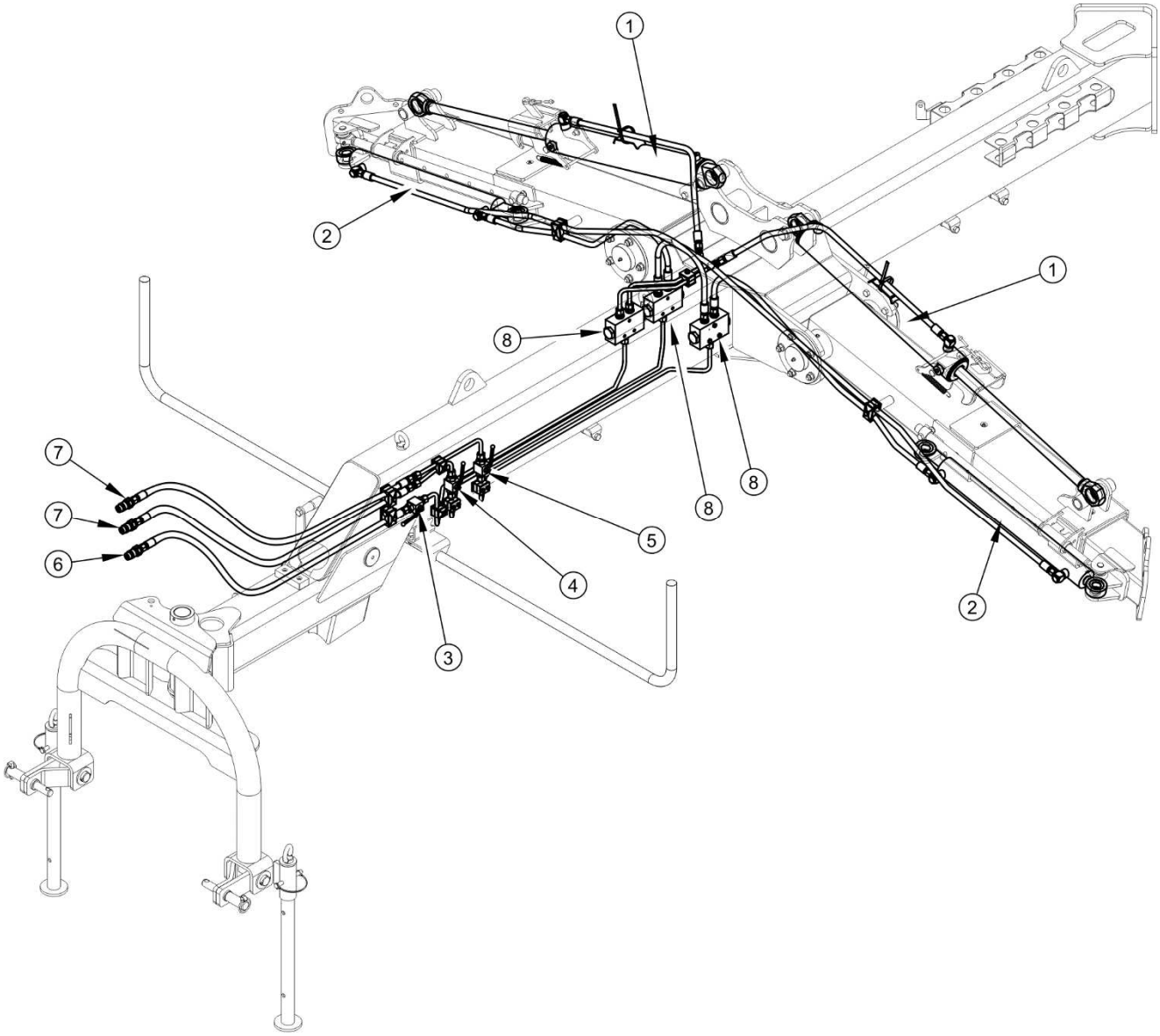


FIG. 3.5 **Hydraulic system design**

(1) lifting/lowering hydraulic cylinder (2) adjusting hydraulic cylinder (3) lifting/lowering hydraulic cylinder 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

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.

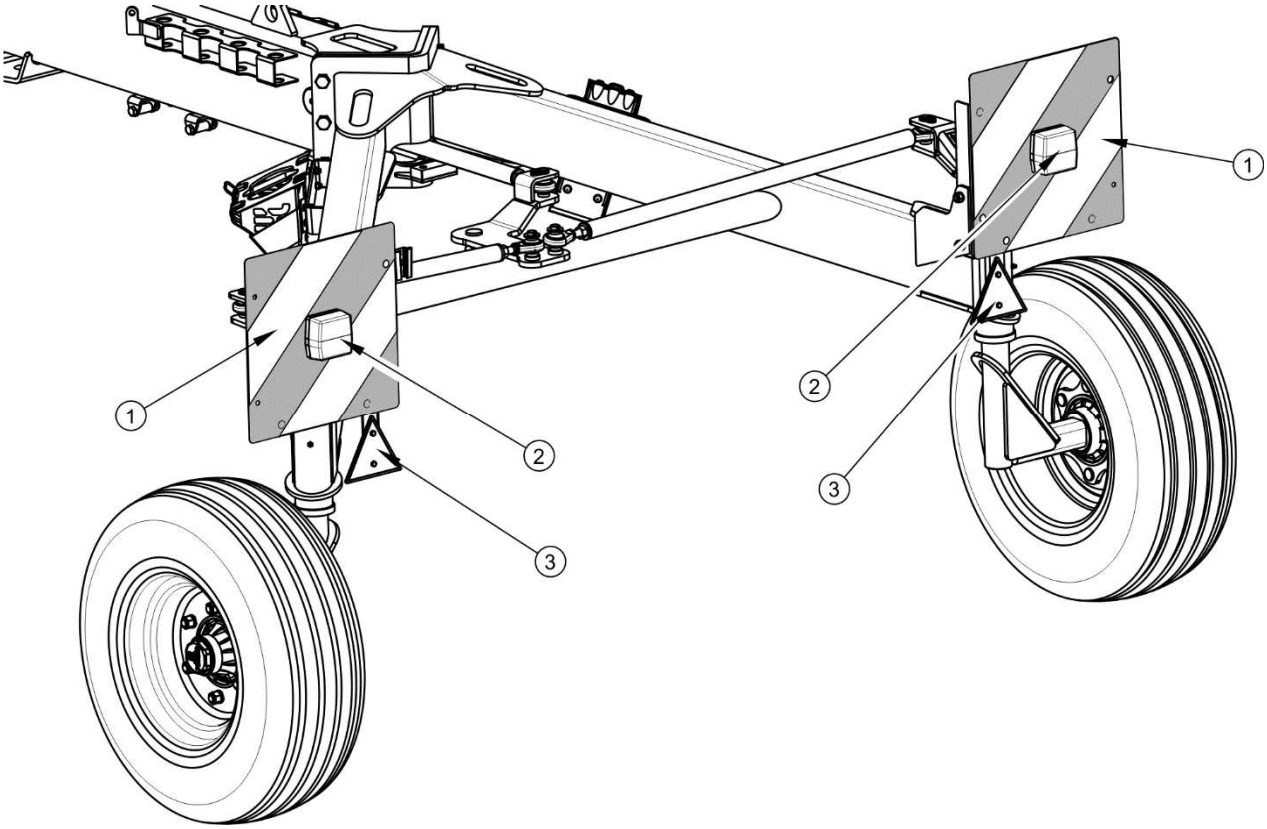


FIG. 3.6 Positioning of electrical system components and reflective elements

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

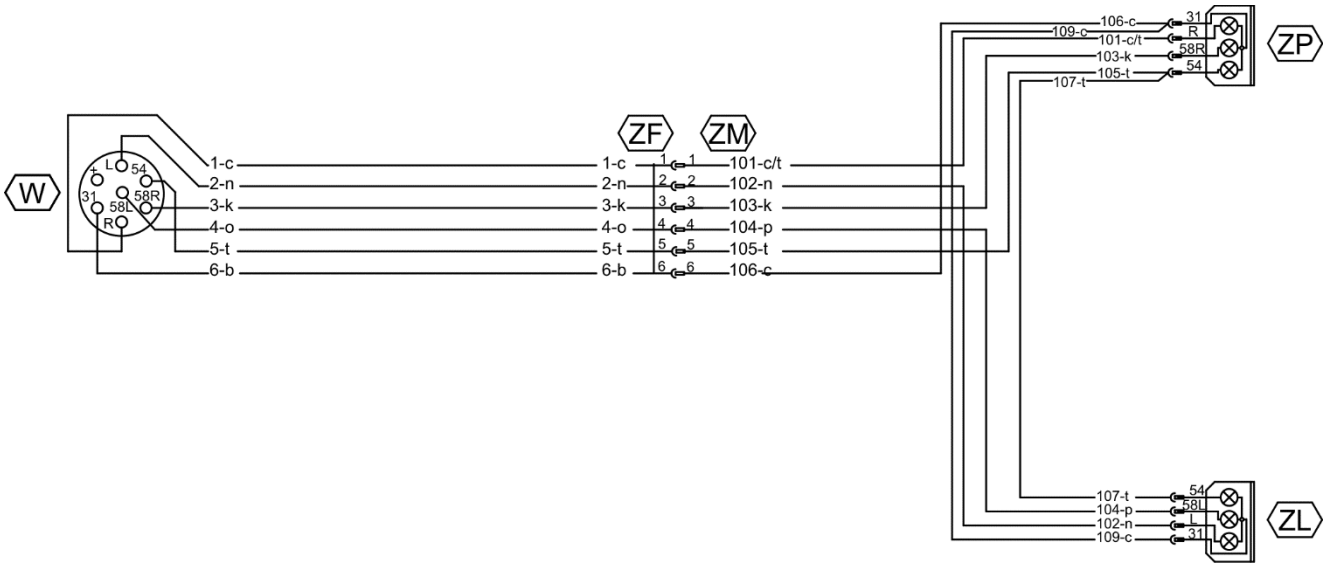


FIG. 3.7 Electrical system diagram

Marking according to table (3.8), (3.9)

FIG. 3.8 List of electrical component markings

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

FIG. 3.9 Line 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 CHECKING 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)*).

ATTENTION!

Before proceeding to hitching to tractor and before first use of the rotary rake the user must carefully read this Operator's Manual and the Operator's 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 intersecting axis 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's 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.

ATTENTION!

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's 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 4.3 „*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.

ATTENTION!

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.

ATTENTION!

Check correctness of hydraulic connections. Replace line plugs possibly.

Non-adherence to the recommendations stated in the Operator's Manual or improper use of the rotary rake may cause damage to the machine.

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

4.2 TECHNICAL CONDITION INSPECTION

When preparing the rotary rake for normal use, check individual elements according to guidelines presented in table (*4.1*).

TAB. 4.1 Technical inspection schedule

DESCRIPTION	SERVICE OPERATION	FREQUENCY
Technical condition of protective shields	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.	Before each use
oil level in intersecting axis gear of drive system,	For details please refer to section *DRIVE SYSTEM OPERATION*	

DESCRIPTION	SERVICE OPERATION	FREQUENCY
Correct operation of lights and indicators of the rotary rake.	Check completeness and technical condition of lights and warning signs and indicators.	
Check technical condition of tyres and tyre pressure,	Check the condition of tyre tread, lateral surfaces, wheel rim and if necessary inflate the tyres up to recommend pressure .	Every month
Tightening of all main nut and bolt connections	Torque values should be according to table (*5.2*)	Every six months
Lubrication	Lubricate elements according to guidelines presented in section "Lubrication".	According to table (*5.4*)

ATTENTION!

The rotary rake must not be used when not in working order.

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 improper use and operation of the rotary rake, and non-compliance with the recommendations given in this operator's manual is dangerous to your health.

Prior to connecting individual system conduits, the user must carefully read the tractor Operator's Manual and observe all Manufacturer's recommendations.

4.3 HITCHING TO TRACTOR

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.
- Switch off tractor engine, secure cab to prevent unauthorised access.
- Connect lower pins (1) with linkage arms (C) and lock with the aid of cotter pins,
- Connect hydraulic lines to the tractor,
    - Plugs of line (6) (see figure *(3.5)*) should be connected to the section with so-called "floating position"
    - Plugs of line (7) (see figure *(3.5)*) should be connected to the double acting section in the tractor. Plugs should be marked in order to exclude the possibility of wrong connection.
- Lift rotary rake using tractor's 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.

ATTENTION!

Prior to attaching the rotary rake, check the technical condition of the rotary rake's and tractor's 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 lines in such a way that they do not become entangled in tractor's moving parts and are not at the risk of breaking or severed when making turns.

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

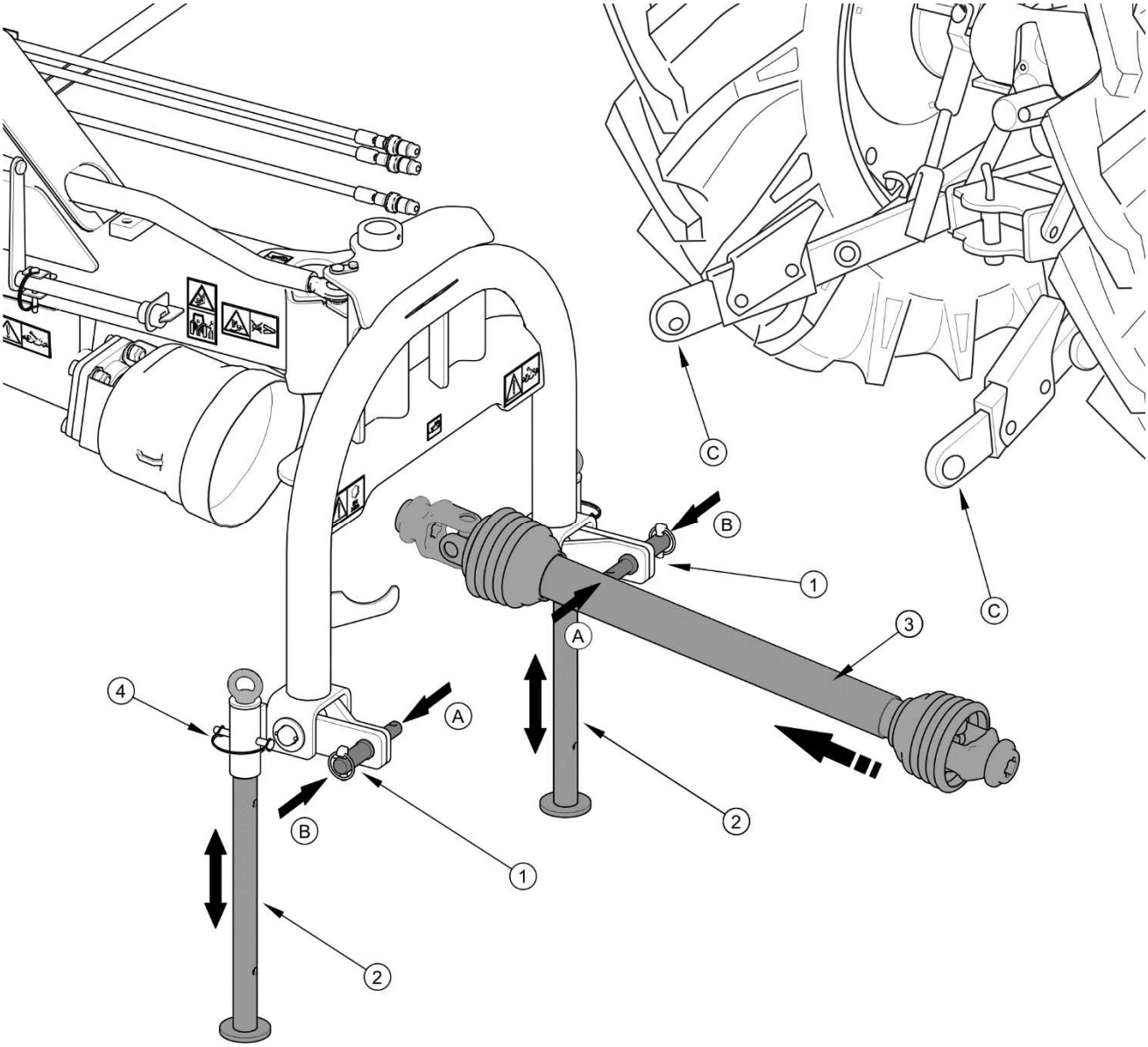


FIG. 4.1 Hitching to tractor

(1) lower linkage pin, (2) support, (3) PTO shaft for connection with tractor, (4) support cotter pin, (A) category I linkage, (B) category II linkage, (C) three point linkage lower arms

- ➡ Connect the main wiring to power the electric lighting.
- ➡ Install PTO shaft (3) according to guidelines specified in the Operator's 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.

Make sure that there is nothing and nobody inside the load box.

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

4.4 TRANSPORTING THE MACHINE

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

Setting the rotary rake in transport position

- 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, take out securing cotter pin (2) and pull the raking arm out of its mount in the raking assembly gear.
  - ⇨ Place the raking arms in the seats on the main frame (3) and secure them with cotter pins (2) - figure *(4.2)*.
- Set the locking valve (3) of lifting/lowering hydraulic cylinders in open position I – figure *(4.3)*.
- Set the locking valves (4) and (5) of the raking width adjusting hydraulic cylinders in closed position 0 – figure *(4.3)*.
  - ⇨ The raking arms and protective shields should be folded in order to reduce total transport height of the machine.

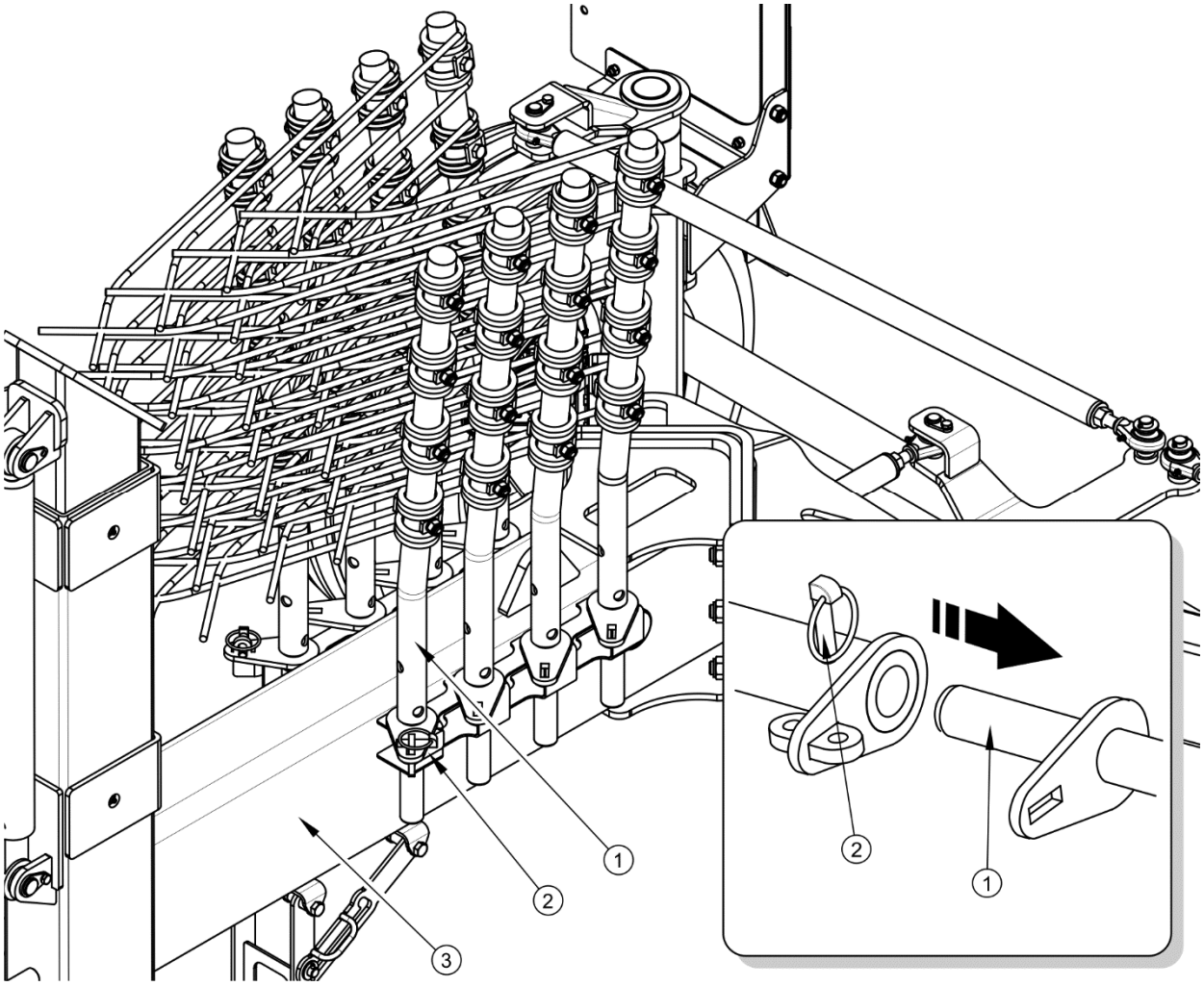


FIG. 4.2 mounting of raking arms

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

- Operating the hydraulic cylinders, lift the lifting arms together with raking assemblies until cylinder lock (2) is engaged– figure *(4.3)*.
  - ⇨ 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.
- Close cylinder valve (3) by switching it to „0” position.
- When setting the rotary rake in transport position, the swath metal plate must be raised.
- Prior to moving off, check the lights.

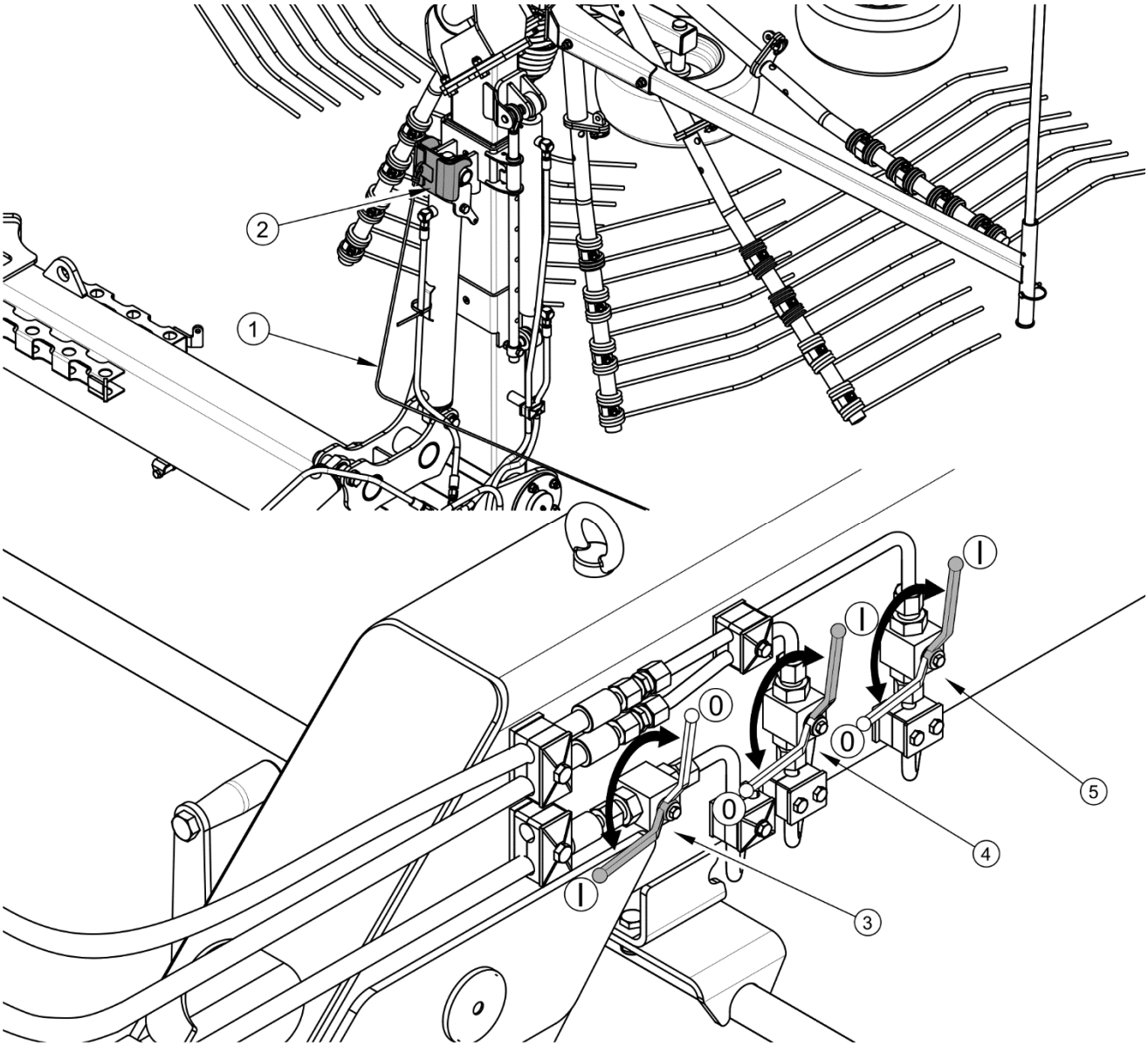


FIG. 4.3 Setting the rotary rake in transport position

(*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*

ATTENTION!

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.

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.

4.5 ROTARY RAKE OPERATION

4.5.1 SETTING ROTARY RAKE IN WORKING POSITION

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 lifting cylinder valve *(3)* in open position I- figure *(4.3)*,
- release lock (2) by pulling cable (1) (figure *(4.3)*) and by operating the tractor's hydraulic circuit, lower lifting arms with raking assemblies so that the wheels touch the ground and set tractor's 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 *(4.4).*

DANGER

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

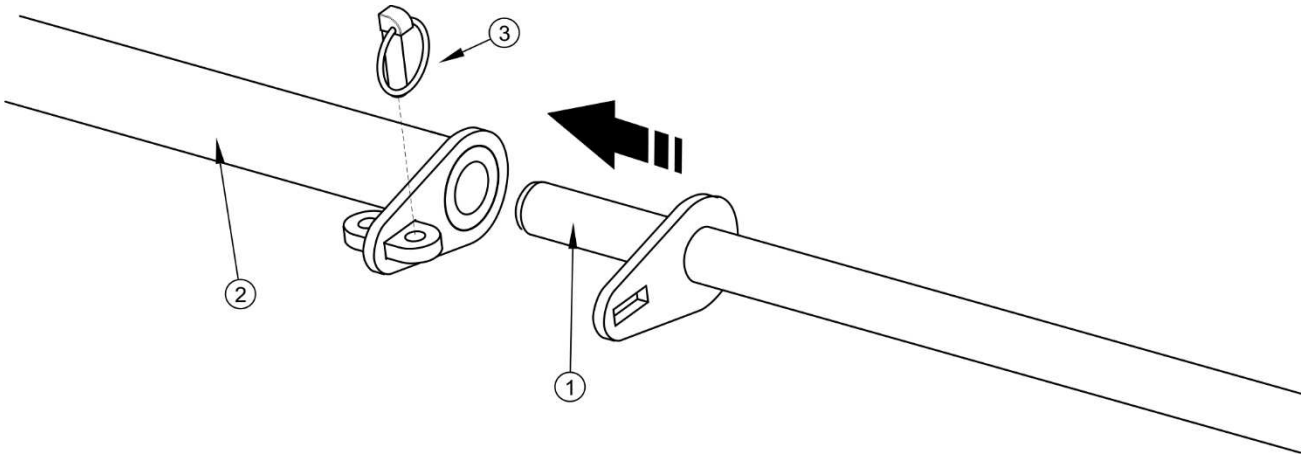


FIG. 4.4 Mounting of raking arms

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

4.5.2 SETTING RAKING WIDTH

Depending on type of hay crop and type of machines working on the field after the rotary rake, working width from 7 m to 8 m can be set. If raking width is increased, the swath width is also increased.

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 (4.3),
- set locking valves (4) and (5) of the raking width adjusting hydraulic cylinders in open position „I" – figure (4.3),
- operating the hydraulic cylinders (1), set proper raking width – figure (4.5),
  - ⇨ maximum raking width can be locked by shifting limiter (3) to proper openings in adjusting bar (2) – figure (4.5),
- 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) can be locked by switching them to 0 position - figure (4.3).

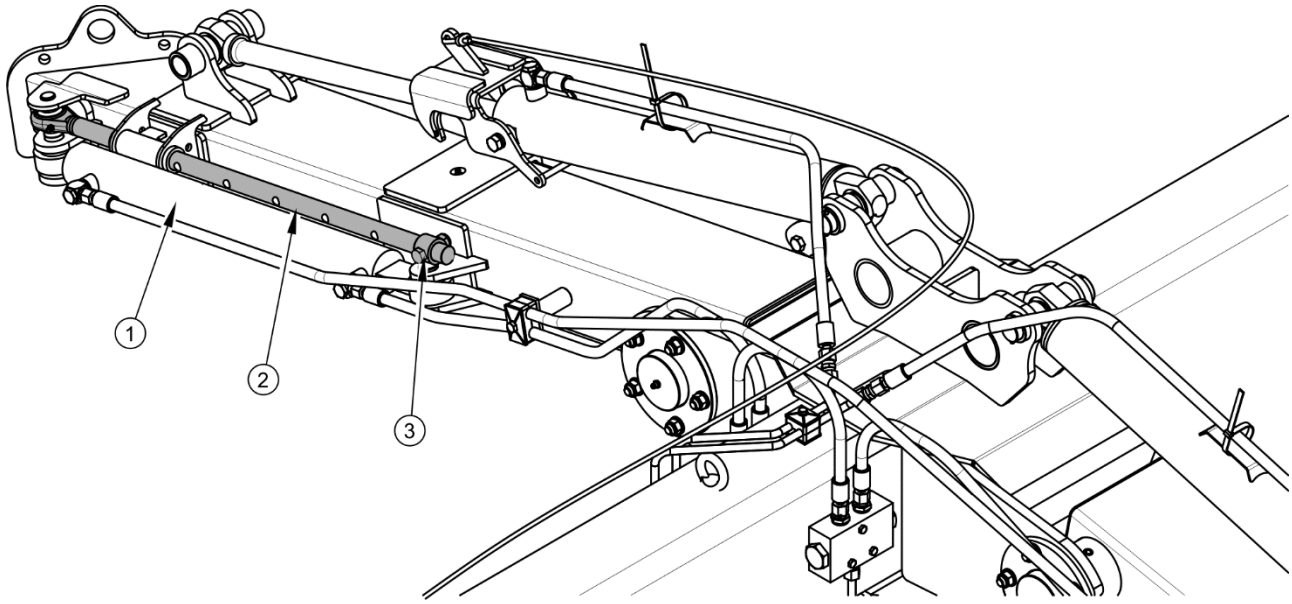


FIG. 4.5 Setting the rotary rake width

(1) setting cylinder, (2) adjusting bar, (3) limiter

4.5.3 SETTING RAKING HEIGHT

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,
- unscrew counter nut (3) anticlockwise - figure (4.6),
- 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 counter nut (3),
- set protective shield (2) and secure it with cotter pin (4).

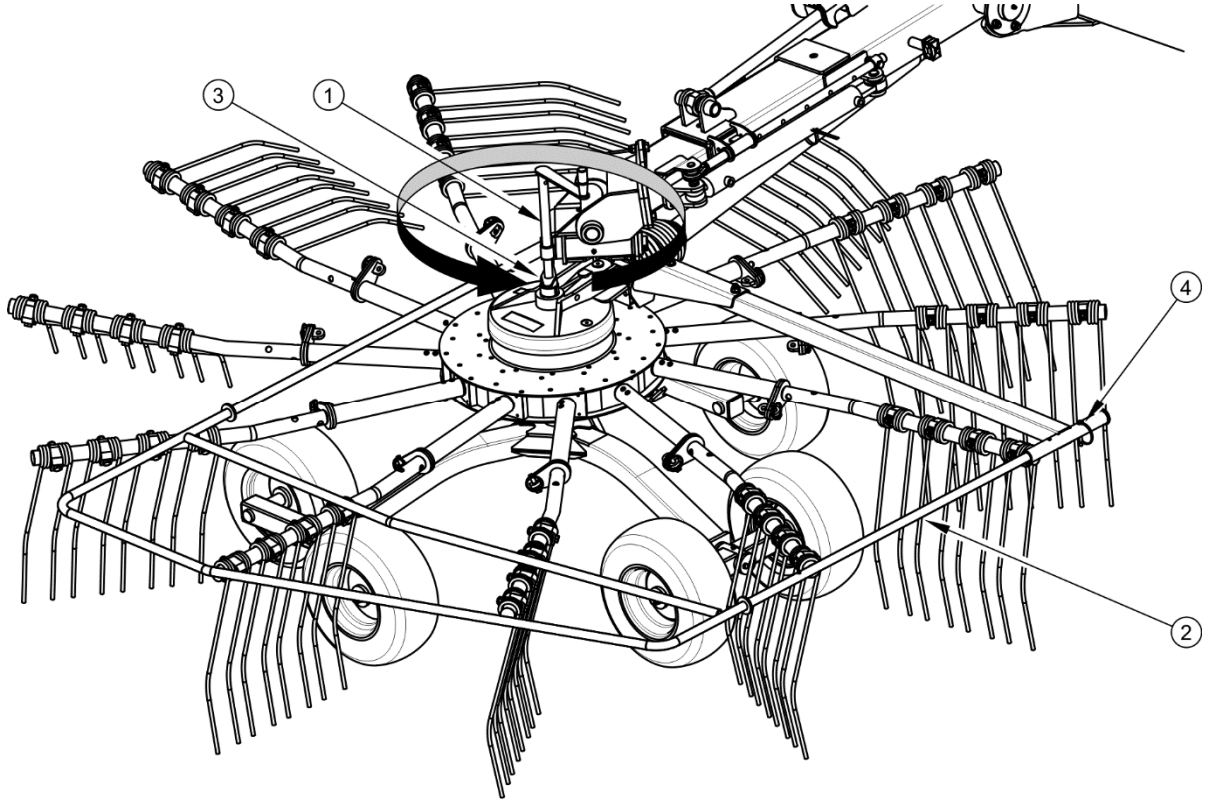


FIG. 4.6 Setting raking height

(1) crank, (2) protective shield, (3) counter nut, (4) cotter pin

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. At a low setting the swath may be contaminated with disturbed earth, turf and stones etc. Furthermore there is increased danger of damage to the rotary rake, mainly for raking fingers and their mounting to the arms. Height selection should be checked frequently during raking and if necessary the setting should be corrected.

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.

4.5.4 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's 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.

Travel speed is adjusted during working. Travel 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.

ATTENTION

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

The revolution speed of the shaft and the speed of travel 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.

4.6 DISCONNECTING THE ROTARY RAKE

Machine disconnected 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 disconnecting the machine from the tractor, turn off the tractor engine, engage the parking brake and secure cab against access of third persons.

Be especially careful when disconnecting the machine from the tractor.

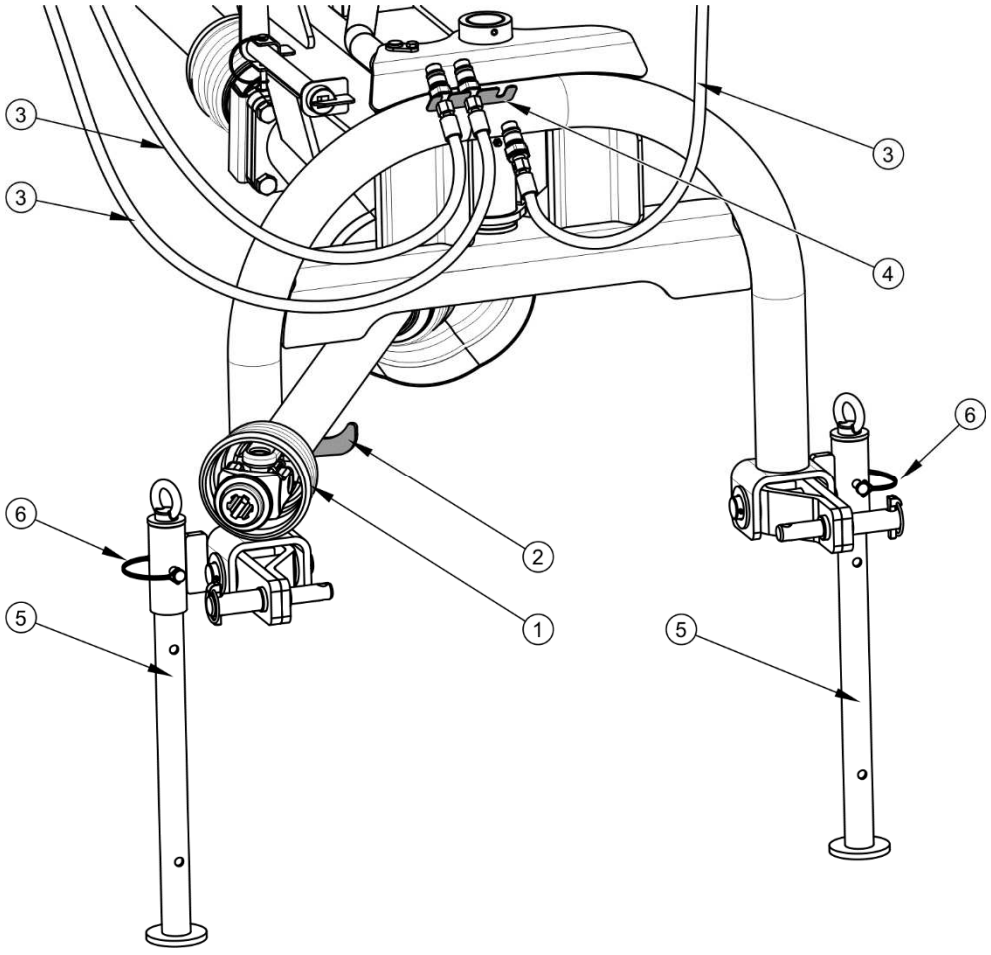


FIG. 4.7 Disconnecting the rotary rake

(1) PTO shaft for connection with tractor, (2) shaft bracket, (3) hydraulic lines, (4) line bracket, (5) support, (6) support cotter pin

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,
- switch off tractor engine and remove key from ignition,
- reduce residual pressure in the hydraulic system by movements of appropriate lever controlling the tractor's hydraulic circuit,
- disconnect hydraulic lines and place them on line bracket (4),
- disconnect PTO shaft and place it on bracket (2),
- disconnect lower pins of the rotary rake and drive tractor away.

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.

4.7 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.
- Inspect tightness of nuts after first use of rotary rake, after first travel under load and then every 6 months of use or every 25,000 km. In the event of intensive work, check the nut tightening at least every 100 km. The inspection should be repeated individually if a wheel has been removed from the wheel axle.
- Regularly check and maintain correct pressure in tyres according to Operator's Manual (especially if rotary rake is not used for a longer period).
- Pressure and 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's engine turned off and the ignition key removed. Ensure that unauthorised persons, especially children, do not have access to the tractor.
- The machine must not be used when not in working order.
- 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 HALF AXLE MAINTENANCE

5.2.1 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:

- inspection and adjustment of loose play of half axle bearings,
- mounting and dismounting wheel, inspection of wheel tightening,
- checking air pressure, evaluating technical condition of wheels and tyres.

Procedures connected with:

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

may be performed by specialist workshops.

5.2.2 CHECK WHEEL HALF AXLE BEARINGS FOR LOOSENESS

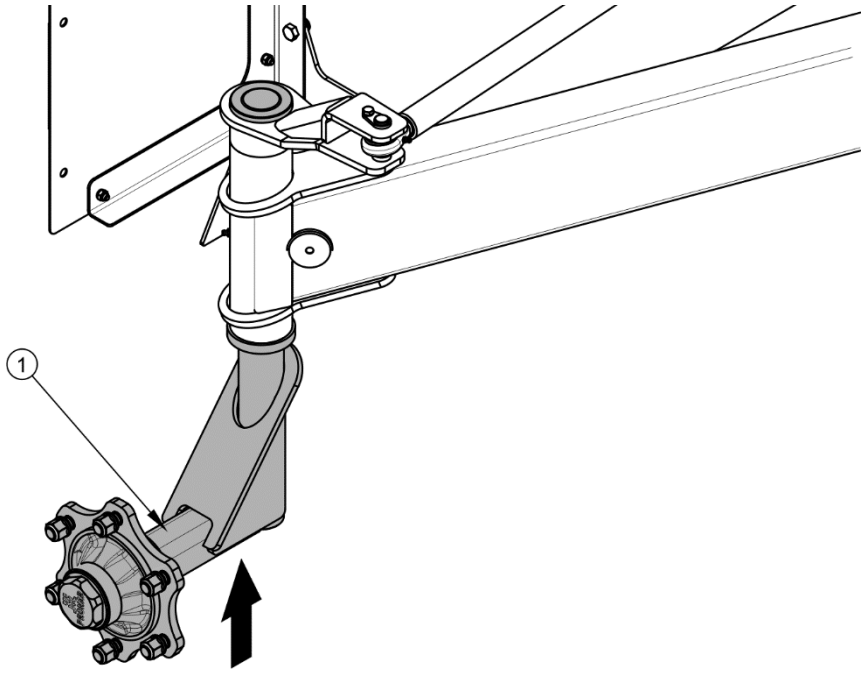


FIG. 5.1 Lifting jack support point

(1) half axle

Preparation 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 shall not move 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.
- ➡ Turning the wheel try to detect looseness.
  - ⇨ You may use a lever placed under the wheel supporting the other end 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 travelling the first 1,000 km,**
- **after intensive use of rotary rake,**
- **every six months use or every 25,000 km.**

If play is felt, adjust bearing. Unusual sounds coming from bearing may be symptoms of excess 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 bearing and hub seals.

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

Check condition of hub cover, if necessary replace with new cover. Inspection of bearing looseness may only be conducted, when the rotary rake is hitched to a tractor.

DANGER

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

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

Ensure that rotary rake shall not move during inspection of bearing looseness of half axle.

5.2.3 ADJUSTING LOOSENESS OF HALF AXLE BEARINGS

Preparation procedures

➡ Prepare tractor and rotary rake for adjustment procedures according to description provided in section 5.2.2.

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 looseness.

⇨ Wheel should rotate with insignificant resistance.

➡ Unscrew nut (not less than1/3 rotation) to cover the nearest thread groove with alignment to opening in wheel stub half axle. Wheel should rotate without excessive resistance.

⇨ Nut may 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 hub cap.

➡ Delicately tap hub cap with rubber or wooden hammer.

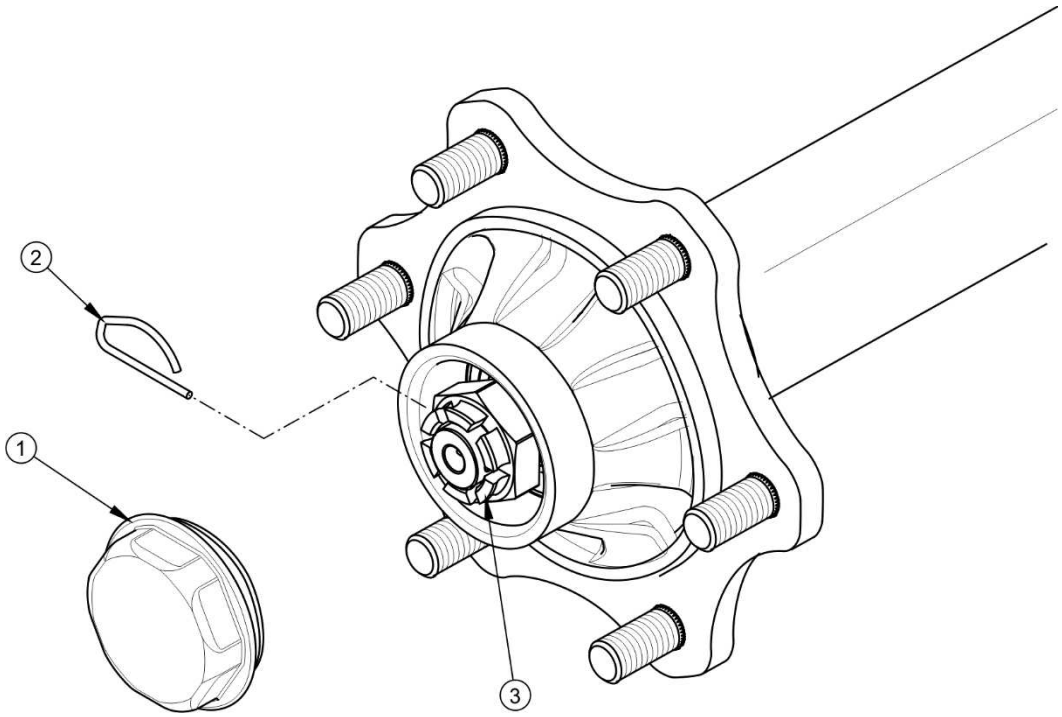


FIG. 5.2 Adjusting half axle bearings

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

The wheel should turn smoothly without stiffness or detectable resistance. Adjustment of bearing looseness may only be conducted, when the rotary rake is hitched to a tractor.

TIP

If the wheel is dismounted, bearing looseness is easy to check and adjust.

5.2.4 MOUNTING AND DISMOUNTING WHEEL, INSPECTION OF WHEEL NUT TIGHTENING

Dismounting wheel

- ➡ Place chocks under wheel that will not be dismounted.
- ➡ Ensure that rotary rake shall not move during wheel dismounting.
- ➡ Loosen wheel nuts according to sequence given in figure (*5.3*).
- ➡ Place lifting jack and lift rotary rake.
- ➡ Dismount wheel.

Wheel mounting

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

Tightening nuts

TIP

Wheel nuts should be tightened using a torque of 270 Nm - nuts M18x1.5.

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.

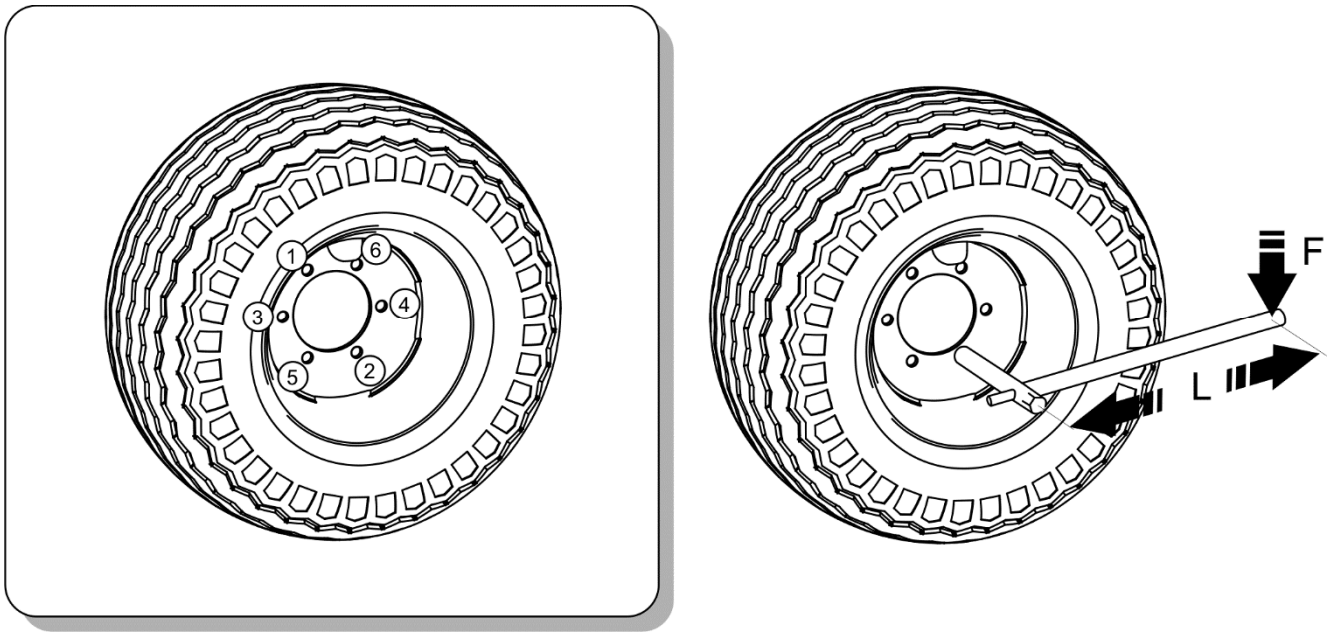


FIG. 5.3 Sequence of nut tightening

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

Checking wheel half axle tightening:

- **after first use,**
- **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.

ATTENTION

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

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

TAB. 5.1 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

5.2.5 CHECK AIR PRESSURE, EVALUATE TECHNICAL CONDITION OF WHEELS AND TYRES

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. Checking should be done before travelling when tyres are not heated, or after an extended period of parking.

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.

Checking tyre pressure and steel rims:

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

5.3 DRIVE SYSTEM MAINTENANCE

Drive system maintenance includes general inspection, change or topping up gear oil in the rotary rake's intersecting axis 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 intersecting axis gear daily.

To check the oil level in intersecting axis 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, supplement oil through inlet 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 intersecting axis 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.

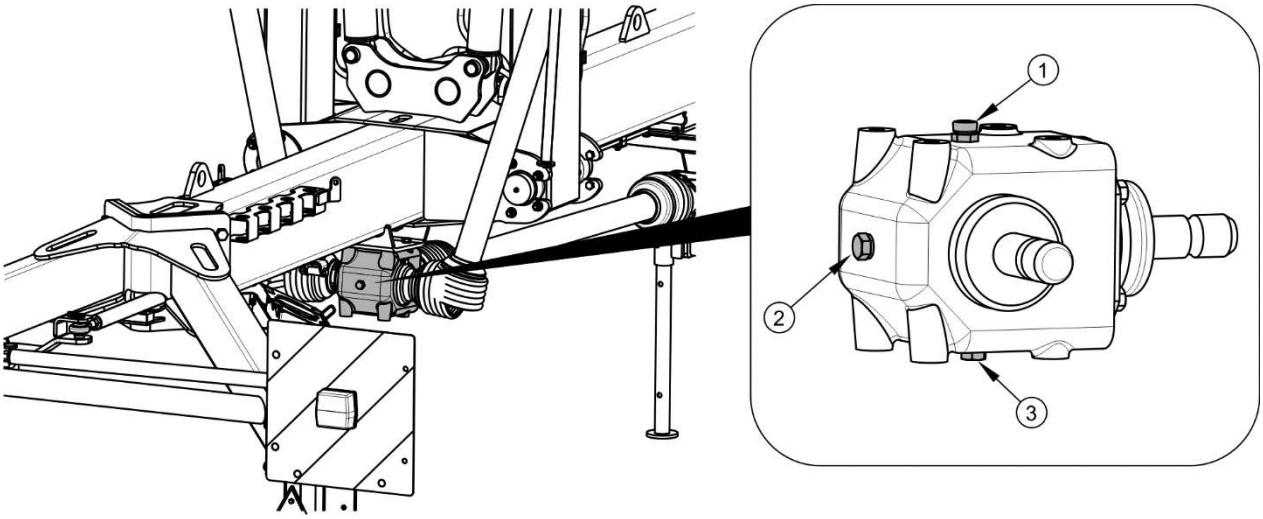


FIG. 5.4 Changing oil in intersecting axis gear

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

To change oil in intersecting axis 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 basin,
- 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 inlet and inspection plugs.

Used oil should be taken to the appropriate facility dealing with the re-use of this type of waste.

To lubricate intersecting axis gears use gear oil 80W90 GL-4 (SE90 EP) in quantity of 1.1 litre.

If a leak is noticed, carefully inspect seals and check oil level. Transmission operation with insufficient oil may cause permanent damage of the mechanism.

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

5.4 HYDRAULIC SYSTEM OPERATION

DANGER

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

DANGER

During work on hydraulic systems 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 L-HL32 Lotos hydraulic oil.

The hydraulic system should be completely tight sealed. Inspect the seals when hydraulic ram cylinders are completely extended. In the event of confirmation of oil on hydraulic ram cylinder bodies ascertain 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.

In the event of confirmation of an oil leak on hydraulic line connections, tighten connections, and if this does not remedy faults then change line or connection elements. Change of sub-assemblies is equally required in each instance of mechanical damage.

ATTENTION!

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 connections and the hydraulic lines.

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

TAB. 5.2 L-HL32 Lotos hydraulic oil characteristics

ITEM	NAME	VALUE
1	ISO 3448VG viscosity classification	32
2	Kinematic viscosity at 40℃	28.8 – 35.2 mm^2/s
3	ISO 6743/99 quality classification	HL
4	DIN 51502 quality classification	HL
5	Flash-point	above 210℃

In the event of necessity of changing 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. Attention should be given, so that chemical substances used for this purpose do not damage 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 extinguisher steam.

5.5 LUBRICATION

Rotary rake lubrication must be carried out in places indicated in figures (*5.5*) & (*5.6*), and also detailed in table (*5.4)*. The machine is equipped with grease nipples facilitating maintenance and marked with yellow labels (pos.3 – table *(2.1)*).

TAB. 5.3 Recommended lubricants

LISTED ON TAB. 5.4	DESCRIPTION
A	machine general-purpose grease (lithium, alkaline),
B	80W90 GL-4 (SE90 EP) gear 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 intersecting axis gears please refer to section 5.3 „*DRIVE SYSTEM MAINTENANCE".*

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

TAB. 5.4 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	Intersecting axis 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
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
16	PTO shafts *	*	*	*

lubrication periods – M month, H – working hour

** For detailed information on maintenance please refer to maintenance instructions attached to the shaft.*

Parts, which should be lubricated with machine oil, should be wiped with dry cleaning cloth and then a small quantity of oil should be applied do surfaces (with 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.

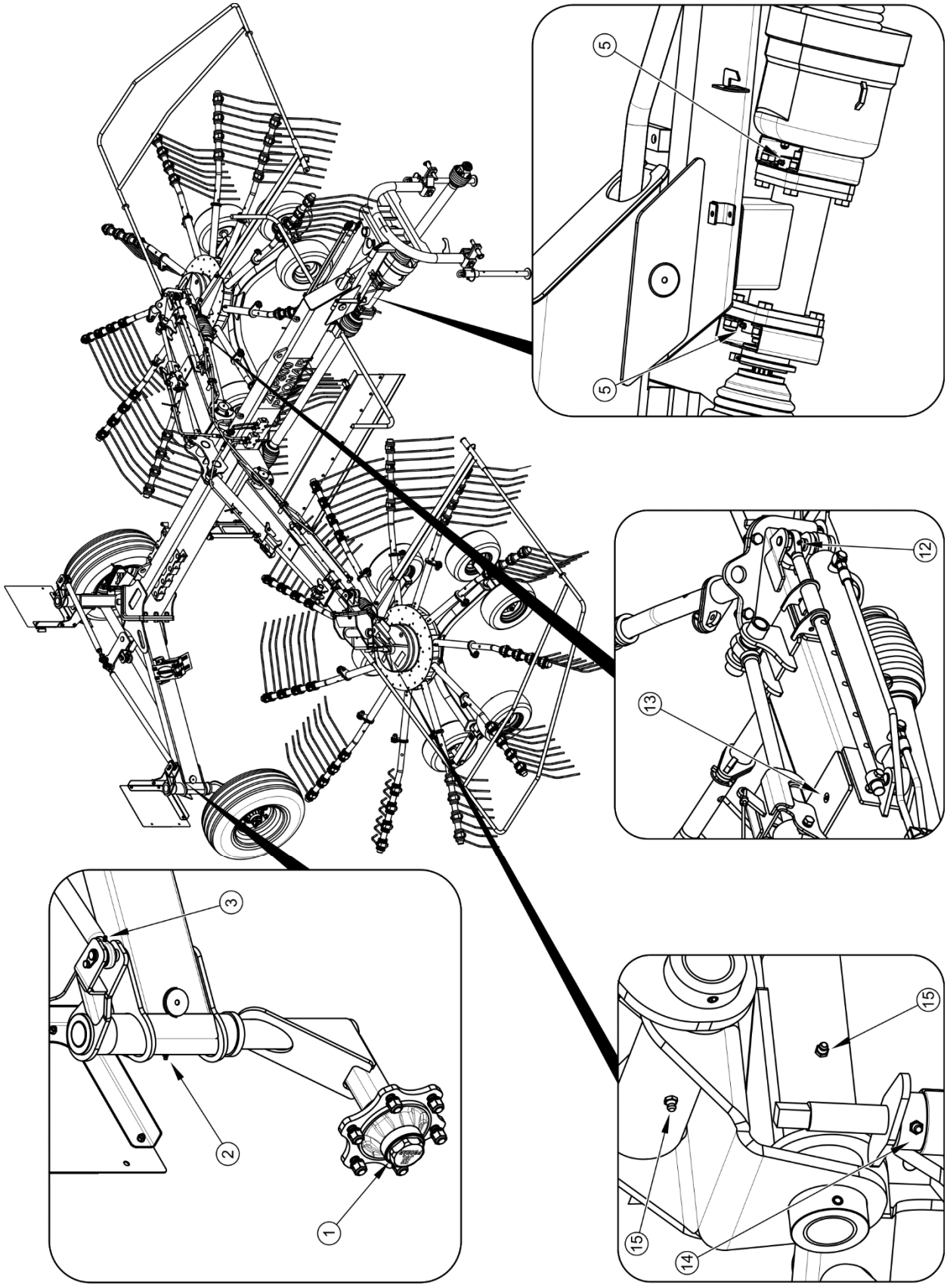


FIG. 5.5 Rotary rake lubrication points

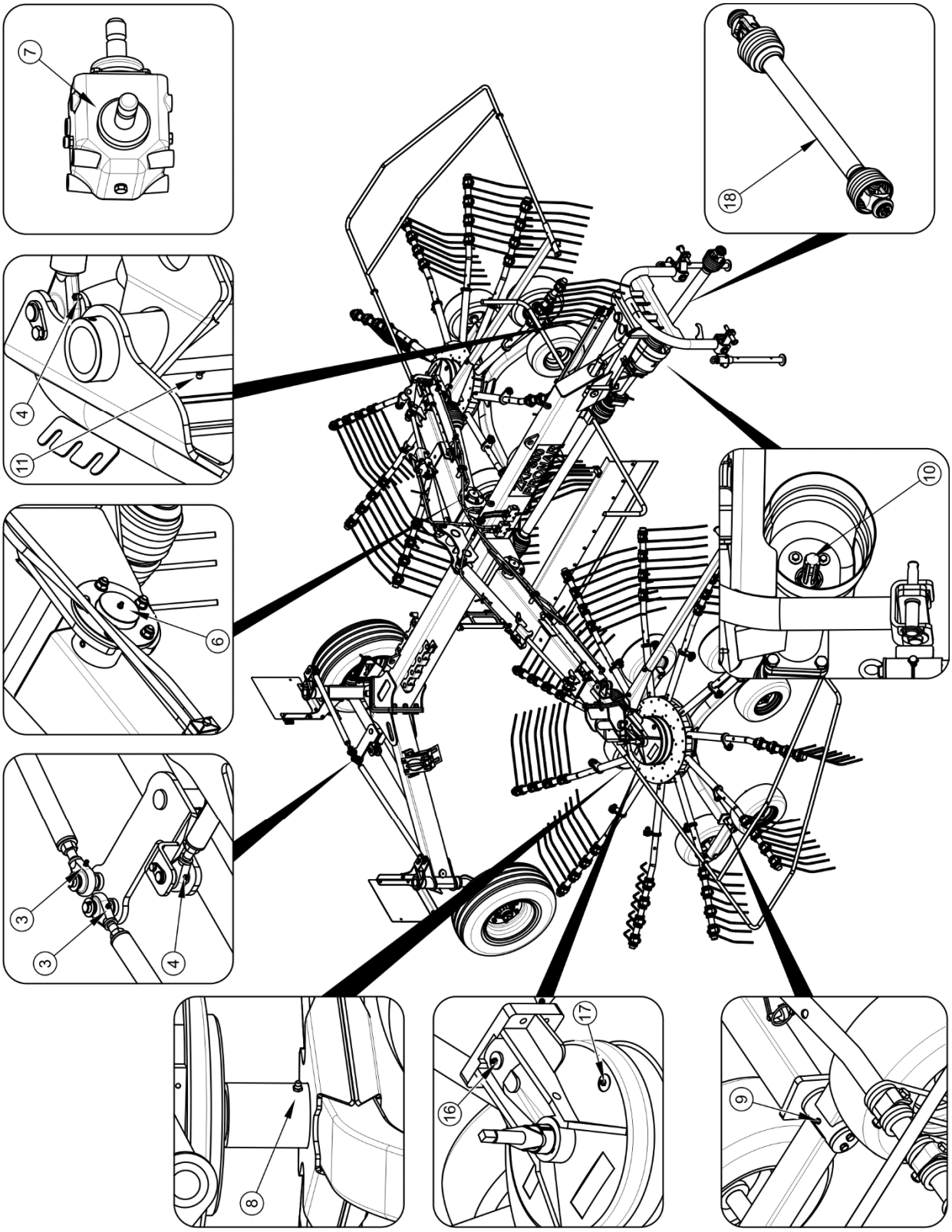


FIG. 5.6 Rotary rake lubrication points

5.6 STORAGE

After finishing work, rotary rake should be thoroughly cleaned and washed with 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. Used or damaged elements should be repaired or replaced.

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 washing 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 rotary rake shall not be used for a long period of time, protect it against adverse weather conditions. Rotary rake should be lubricated according to instructions provided. In the event of prolonged work stoppage, it is essential to lubricate all elements regardless of the period of the last lubrication process. 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 tyre pressure should be inspected from time to time, and if necessary pressure should be increased to appropriate value.

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

5.7 OPERATION OF ELECTRICAL SYSTEM AND WARNING ELEMENTS

The responsibilities of the user are limited to:

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

ATTENTION

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

TIP

Before driving away make certain that all lamps and reflective lights are clean.

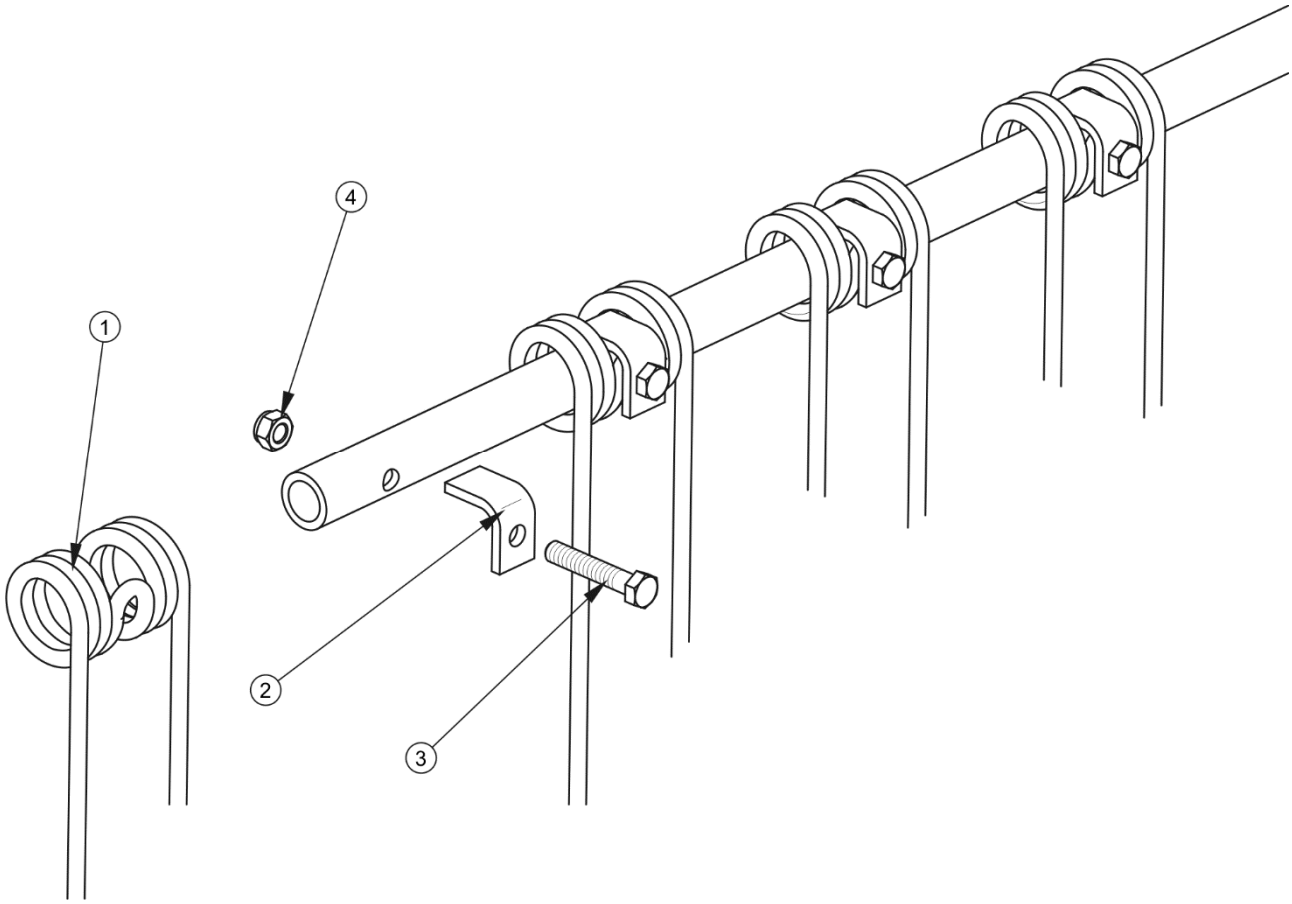
Checking technical condition of electrical system:

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

Required service actions

- Hitch rotary rake to tractor with appropriate connection lead.
  - ⇨ Check if the connection lead 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 triangular slow-moving vehicle sign.
- Before driving on to public road check that the tractor is equipped with warning reflective triangle.

5.8 CHECKING AND REPLACEMENT OF SPRINGTINES



RYSUNEK 1.1A CHANGING RAKING FINGERS

(1) springtine, (2) securing angle, (3) bolt, (4) self-locking nut

In order to dismantle springtines:

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

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

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

DANGER

Before beginning preparation work switch 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.

5.9 TIGHTENING TORQUE FOR NUT AND BOLT CONNECTIONS

Unless other tightening parameters are given, during maintenance repair work apply appropriate torque to tightening nut and bolt connections. Recommended tightening torque of most frequently applied nut and bolt connections are given in table *(5.5).* Given values apply to non-lubricated steel bolts.

TAB. 5.5 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

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

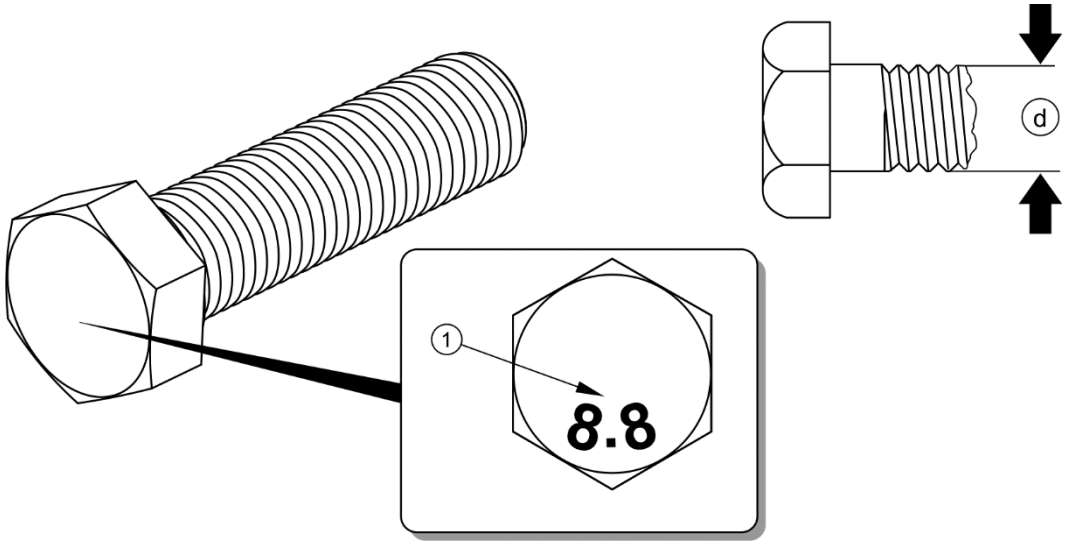


FIG. 5.7 Bolt with metric thread

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

5.10 TROUBLESHOOTING

TAB. 5.6 Troubleshooting

TYPE OF FAULT	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's 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 4.5.3 „SETTING RAKING HEIGHT”
Excessive vibration during work	Damaged PTO shaft	Check shafts, if necessary replace

TYPE OF FAULT	CAUSE	REMEDY
	Damaged raking assembly gear	Repair at authorised service point
Rotary rake drive units stop during raking	Damaged raking assembly gear	Repair at authorised service point
	Damaged intersecting axis gear	Replace or repair at authorised service point

NOTES

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,
- tubular shields - 2 items,
- brackets of tubular shields - 2 items,
- raking arms - 22 items,
- PTO shafts with overload safety clutch - 2 items,
- forming shield - 1 item.

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.

ATTENTION!

Do NOT perform assembly work under raised and unsupported machine.

Exercise particular 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).

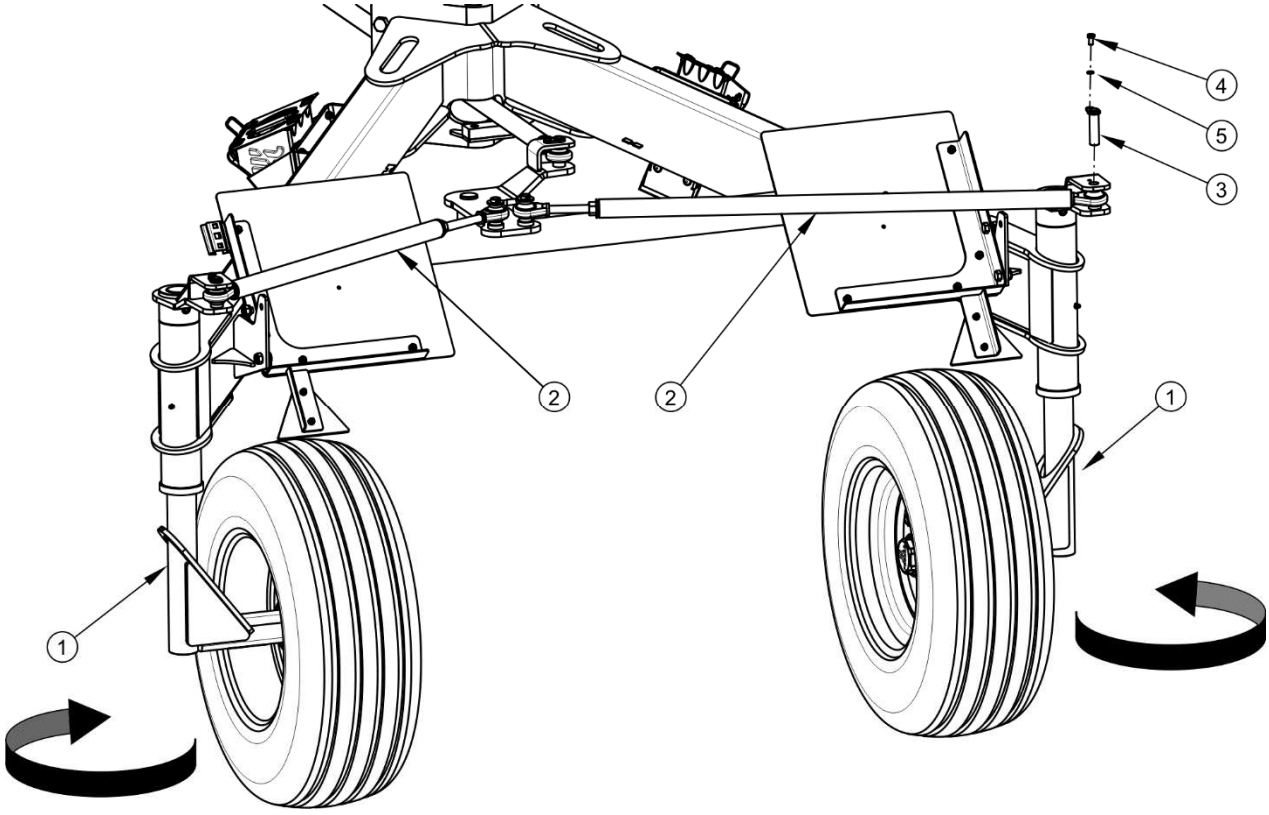


FIG. A.1 Turning the wheels

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

ATTENTION!

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. Dismantle the boards, turn them outwards by 180° and attach according to figure *(A.2).*

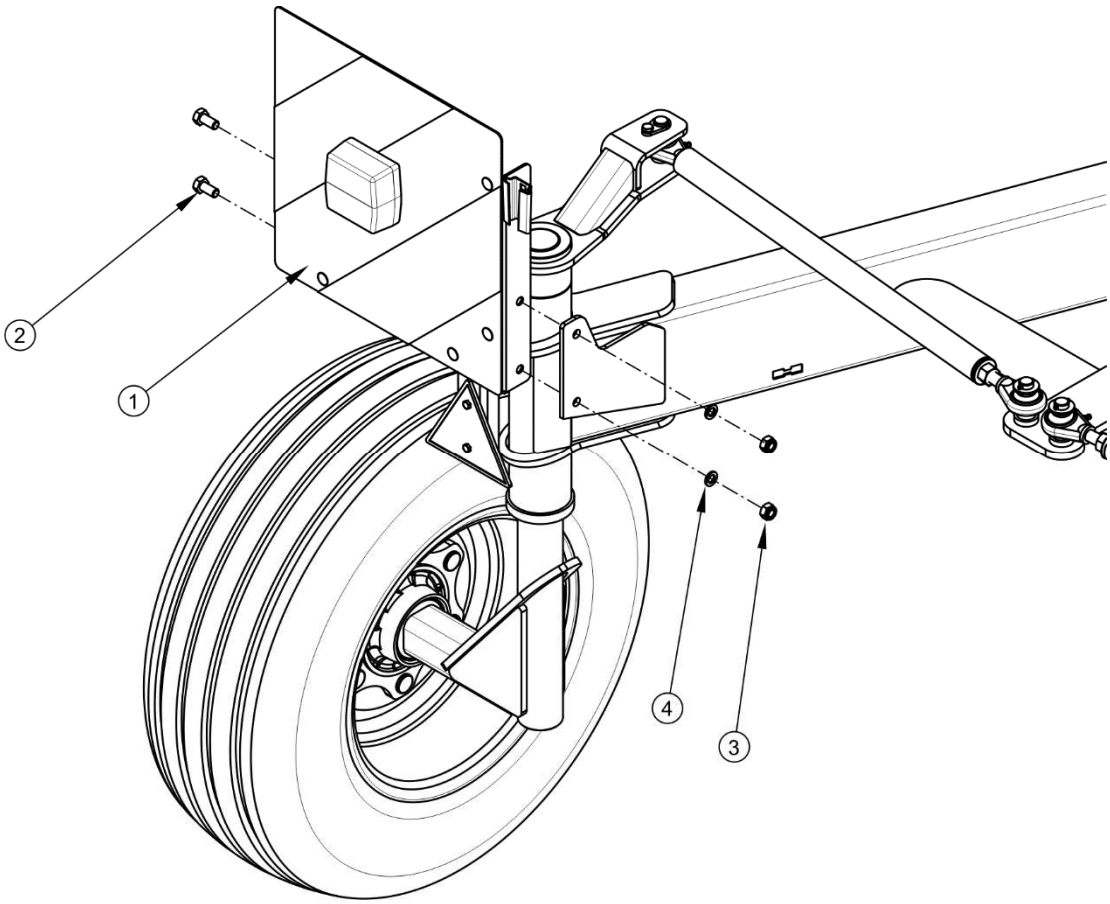


FIG. A.2 Installing the warning boards

(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).*

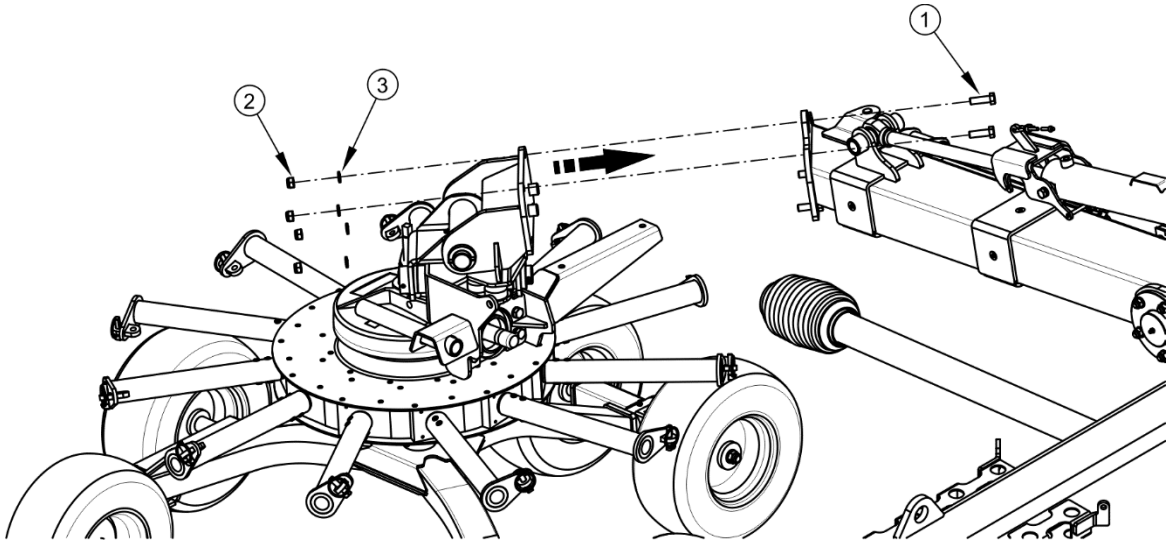


FIG. A.3 Installing the raking assembly

(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)*.

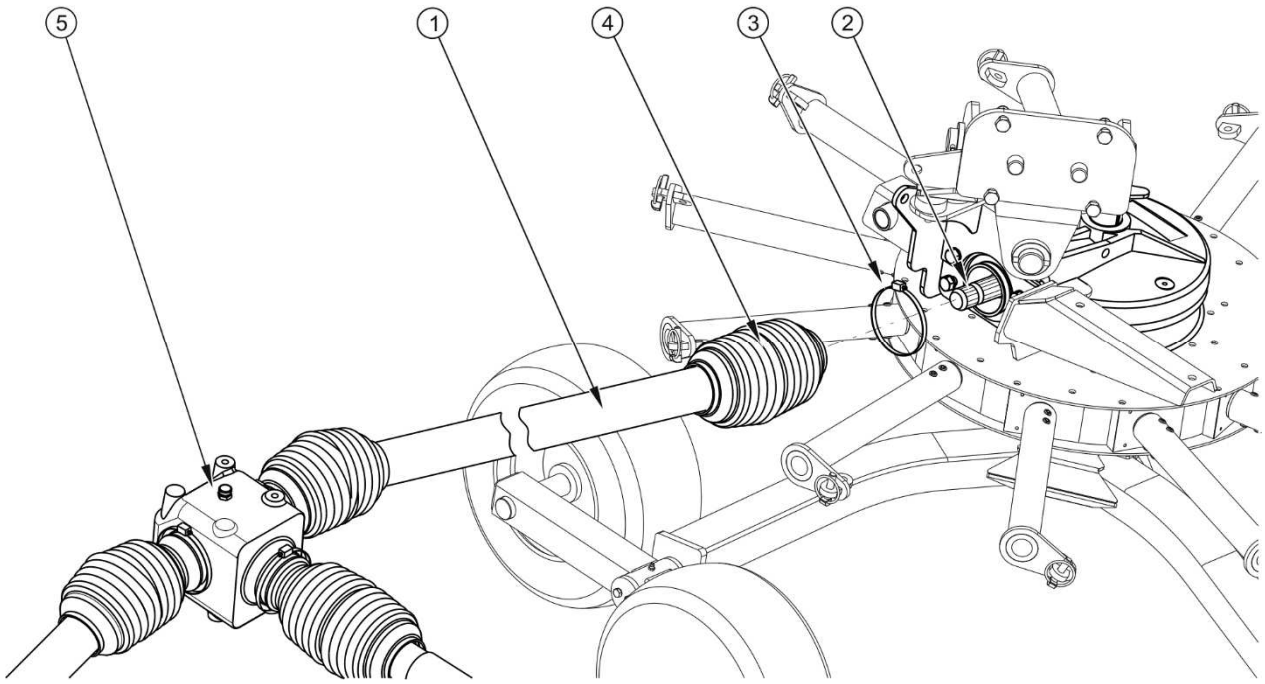


FIG. A.4 Mounting PTO shaft

(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)*.

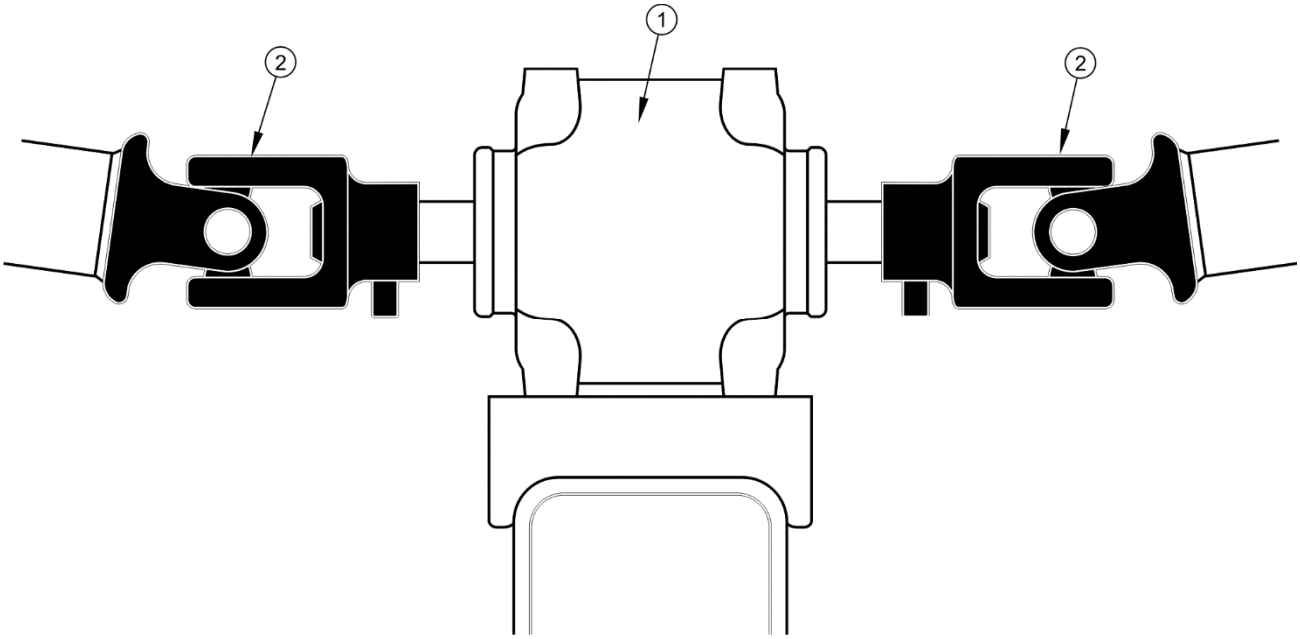


FIG. A.5 Proper arrangement of PTO shafts

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

ATTENTION

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.

A.5 INSTALLING THE TUBULAR SHIELDS

Tubular shields (1) and tubular shields brackets (2) are disassembled for shipment and they should be attached to raking assemblies according to figure *(A.6).*

First install shield bracket (2) and slide shield (1) in. Install locks (4) at the ends of shield (1). Secure the shield with cotter pin (3). Repeat the installation procedure for the second shield.

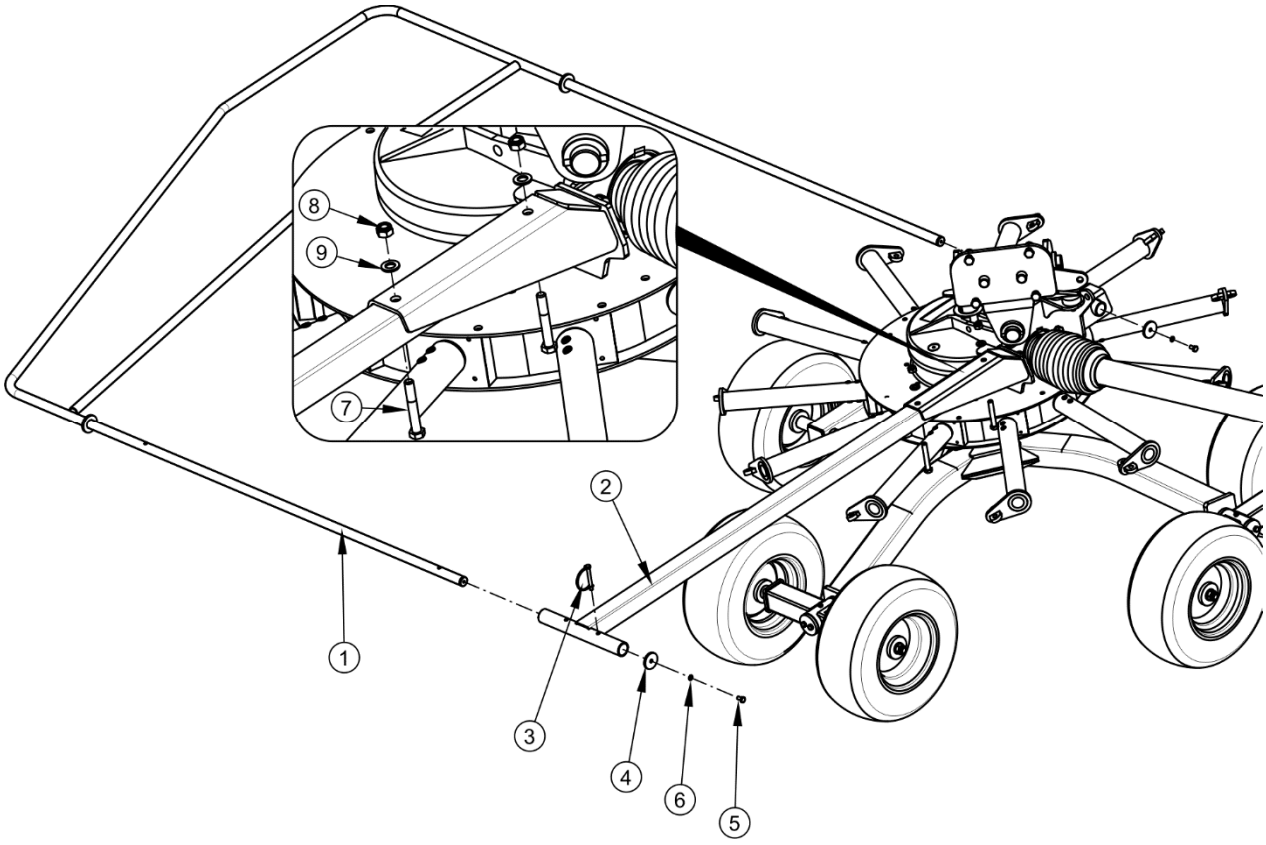


FIG. A.6 Installing the tubular shields

(1) shield, (2) shield bracket, (3) cotter pin for pipes, (4) shield lock, (5) M8x16 bolt, (6) Z8,2 spring washer, (7) M12x80 bolt, (8) M12 self locking nut, (9) 12-100 HV washer

A.6 INSTALLING THE FORMING SHIELD

Swath forming shield (1) should be installed between the raking assemblies under the rotary rake main frame. The shield with catches (2), (3), and latch (4) should be bolted to hinges (5) - figure *(A.7).*

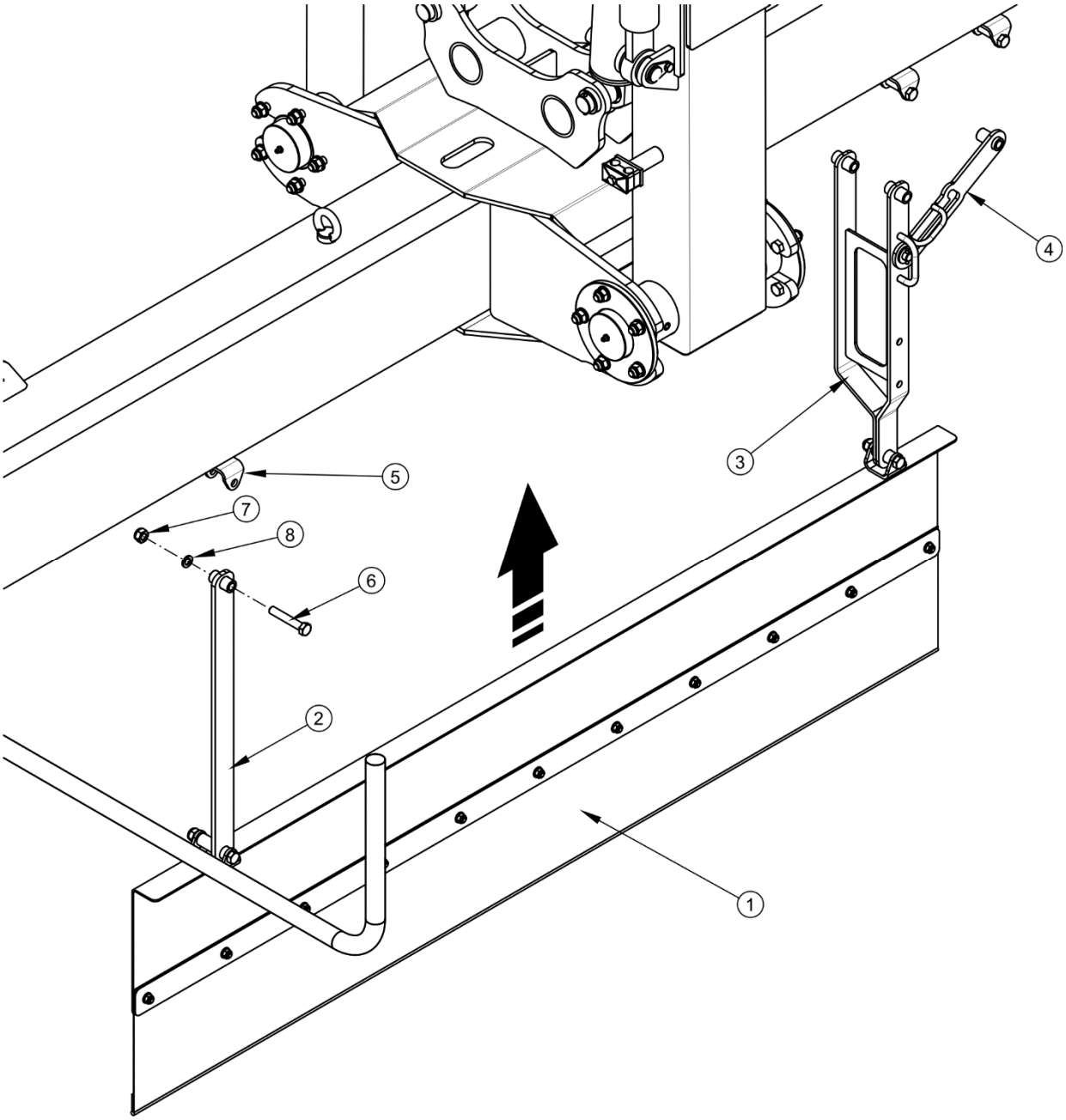


FIG. A.7 Installing the forming shield

(1) forming shield, (2) shield catch I, (3) shield catch II, (4) latch, (5) hinge, (6) M12x70 bolt, (7) M12 self locking nut, (8) Z12,2 spring washer