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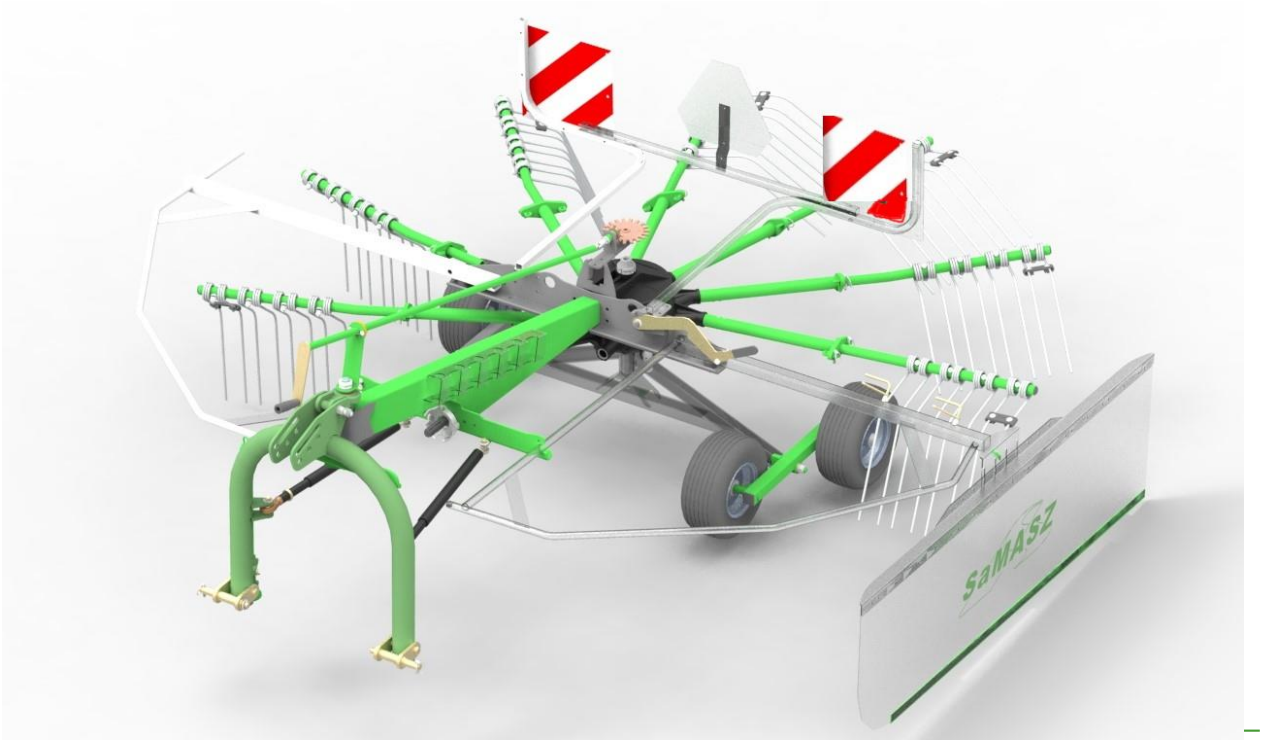
OPERATOR'S MANUAL



ROTARY RAKE

Z-300
Z-301
Z-350
Z-351
Z-300 Slim
Z-301 Slim
Z-350 Slim
Z-351Slim
Z-410
Z-440
Z-470

The original operator's manual
- ENGLISH -

IN300EN013
04.02.2022
EDITION No 13

GENERAL WARNING :

When operating the rake please comply with the warnings and safety regulations shown throughout this manual by this safety alert symbol.

CAUTION:

Operation of the rake before reading the operator's manual carefully as well as operating by the unauthorized staff, especially by children, is strictly forbidden.

CAUTION:

It is forbidden to start the drive of the rake before putting the machine into working position.

CAUTION:

Rake's components bent after coming across an obstacle or stones are done as paid repairs.

CAUTION:

Lifting the rake before the working units have come to a complete standstill is forbidden.

CAUTION:

Operating is forbidden when any person is within the danger area of 50 m.

NOTE:

Keep this manual for future reference.

Well-proven design with thousands of machines in regular use in many countries and quality materials ensure high durability and reliability of SaMASZ rakes.

We congratulate you on the purchase of your new SaMASZ rake and wish you much pleasure and the very best work results through the years to come.

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1. IDENTIFYING THE MACHINE

Data plate is mounted to the rake's main frame in the place shown below **Fig. 1.**

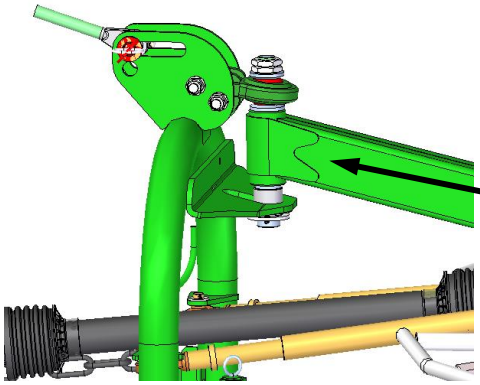


Fig. 1. Data plate placement

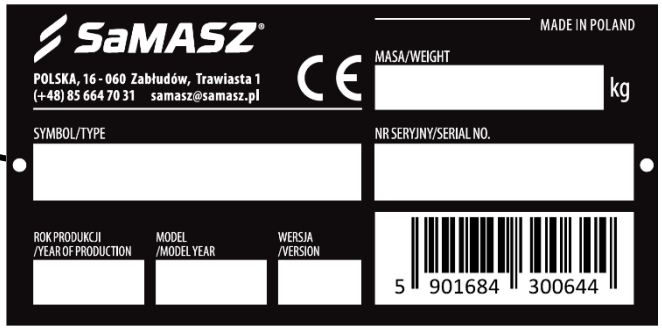


Fig. 2. Data plate

Data plate includes:

- name and adress of the manufacturer,
- CE marking means, that the produce conforms to 2006/42/EC Directive and harmonized standards,
- machine symbol,
- date of manufacture,
- model year,
- version number,
- machine weight,
- id number,
- barcode.

NOTE!

It is forbidden to drive the machine on public roads with damaged, illegible or missing identification plates.

2. INTRODUCTION

- This operator's manual should be considered the rakes' basic equipment. If the rakes is handed over to another operator, it should be in working condition, along with operator's manual, EC declaration of conformity and its basic equipment.
- Prior to operating the rakes its user must familiarize himself with this manual as well as common work safety rules.
- The rake is manufactured in accordance with safety standards requirements.
- Respecting recommendations herein shall ensure operation safety.
- If you have any questions concerning commission and operation of the rake, please contact the manufacturer.
- This operator's manual is an indispensable part of any machine and is intended to familiarize future user with principles of proper operation and use of the machine as well as the risks involved.

3. DESIGNATION

SaMASZ rotary rake is designed for raking forage, dry forage and hay**.** Rotary rake can only be used by people familiar with its technical data, danger situations that may occur during operation and how to avoid them. Rotary rake Z-300, Z-300 Slim, Z-301, Z-301 Slim, Z-350, Z-350 Slim, Z-351 and Z-351 Slim works properly with tractors (power from 20 HP). Rotary Z-410 works properly with tractors (power from 30 HP). Rotary rake Z-440 works properly with tractors (power from 40 HP). Rotary rake Z-470 works properly with tractors (power from 50 HP).

NOTE!

Use of the rake for purposes other than mentioned herein is forbidden. Different use than the above mentioned shall be considered as improper and may lead to revoking of the warranty. The machine should be operated, maintained and repaired only by personnel who are learned with its detailed specifications and safety rules and procedures. Willful modifications to the rake may lead to revoking of the warranty.

3.1. Technical data

Tab. 1. Technical data

Type	**Z-300/ Z-300 Slim**	**Z-301/ Z-301 Slim**	**Z-350/ Z-350 Slim**	**Z-351/ Z-351 Slim**	**Z-410**	**Z-440**	**Z-470**
Working width [m]	3,00	3,00	3,50	3,50	4,10	4,40	4,70
Transport width [m]	2,95	2,95	2,95	2,05	1,80	2,10	2,30
RPM [rpm]	300÷350						
Traktor's power [HP]	20	20	20	20	30	40	50
Working capacity [ha/h]	~ 3,00	~ 3,00	~ 3,50	~ 3,50	~ 4,50	~5,00	~ 5,60
Number of rotors [pcs.]	1	1	1	1	1	1	1
Number of arms [pcs.]	8	8	9	9	11	11	13
Support wheel	15x6,00-6				16x6,50-8	16x6,50-8 / 18x8,5-8	16x6,50-8
Recommended tire pressure [bar]	1,8						
Standard transport wheel	15x6,00-6				16x6,50-8		
Recommended tire pressure [bar]	1,8						
Optional transport wheels	15x6,00-6				-	18x8,5-8	-
Recommended tire pressure [bar]	1,8					1,8	
Weight [kg]	310 / 280	365 / 315	340 / 320	405 / 330	590	750	820
Noise level L_{pA}	74,0 ± 3,0 dB						
L_{Amax}	74,0 ± 3,0 dB						
L_{Cpeak}	93,0 ± 3,0 dB						

LpA – noise level related to 8 hour working time. Averaged in time acoustic pressure level corrected by frequency characteristic A.

LAmax – maximum value corrected by frequency characteristic A of acoustic pressure level.

LCpeak – peak level of acoustic pressure corrected by frequency characteristic C.

3.2. Design and operation

3-point linkage frame (**2**) enables attachment of the rake to tractor's 3-point linkage. The driver from tractors PTO is transmitted by means of PTO shaft placed inside the main frame of the rake on a rotor (**5**). On a rotor there are arms mounted (**7**), to which the arms with tines are attached. On the frame there are safety guards (**13**). During transport outside arms are taken off and placed inside the holders (**12**). The levers (**10**) are used to regulate the height of raking. The rake is equipped with a curtain (**6**), which formulates a windrow.

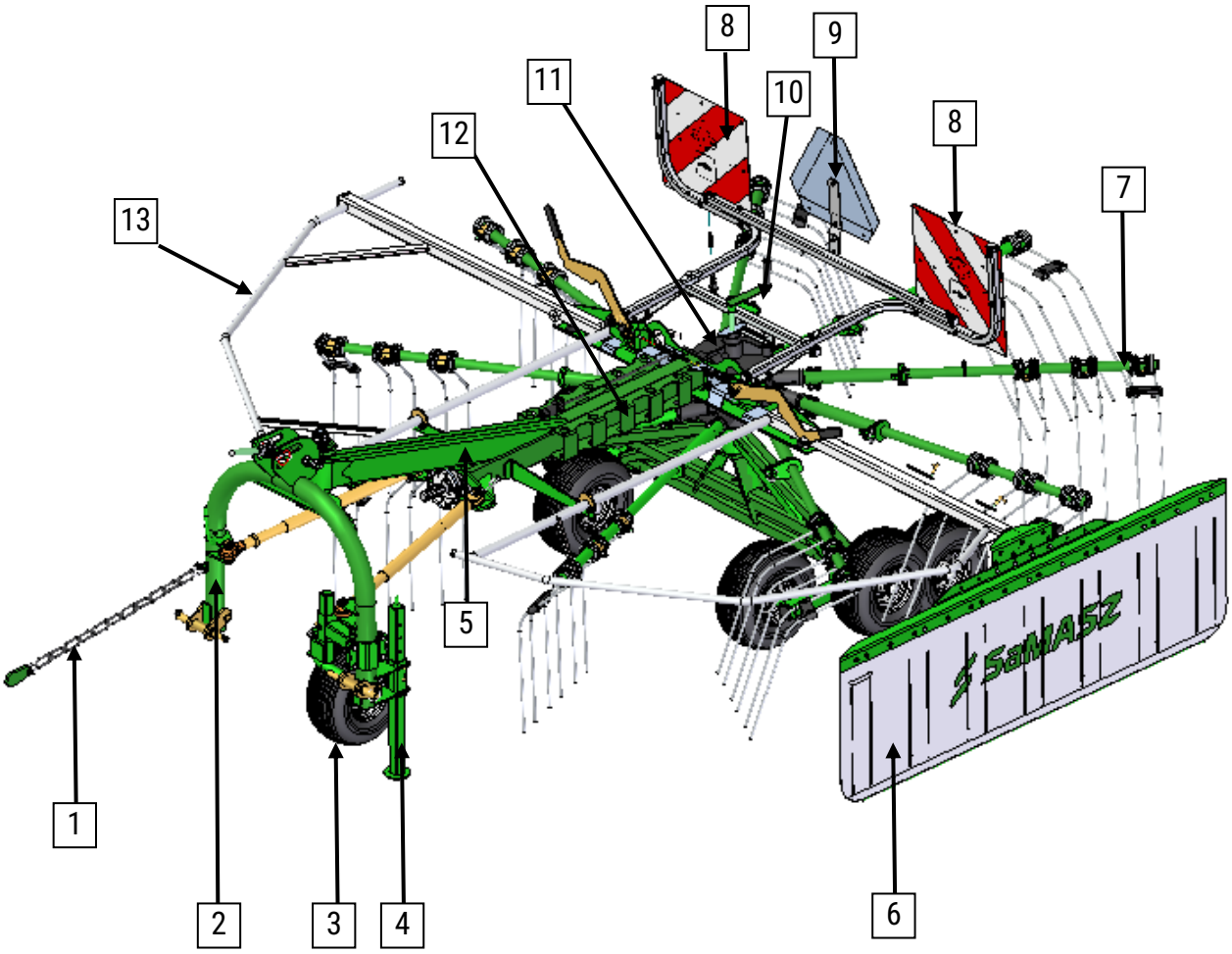


Fig. 3. Overview of rotor rake Z-351

1 – Support chain
2 – 3-point linkage farme
3 – Ground following wheel (optional)
4 – Support leg
5 – Main frame
6 – Windrow curtain
7 – Arms with tines
8 – Warning plates
9 – Warning triangle (optional)
10 – Adjustment lever
11 – Carousel gearbox
12 – Arms holders for transport
13 – Safety guard

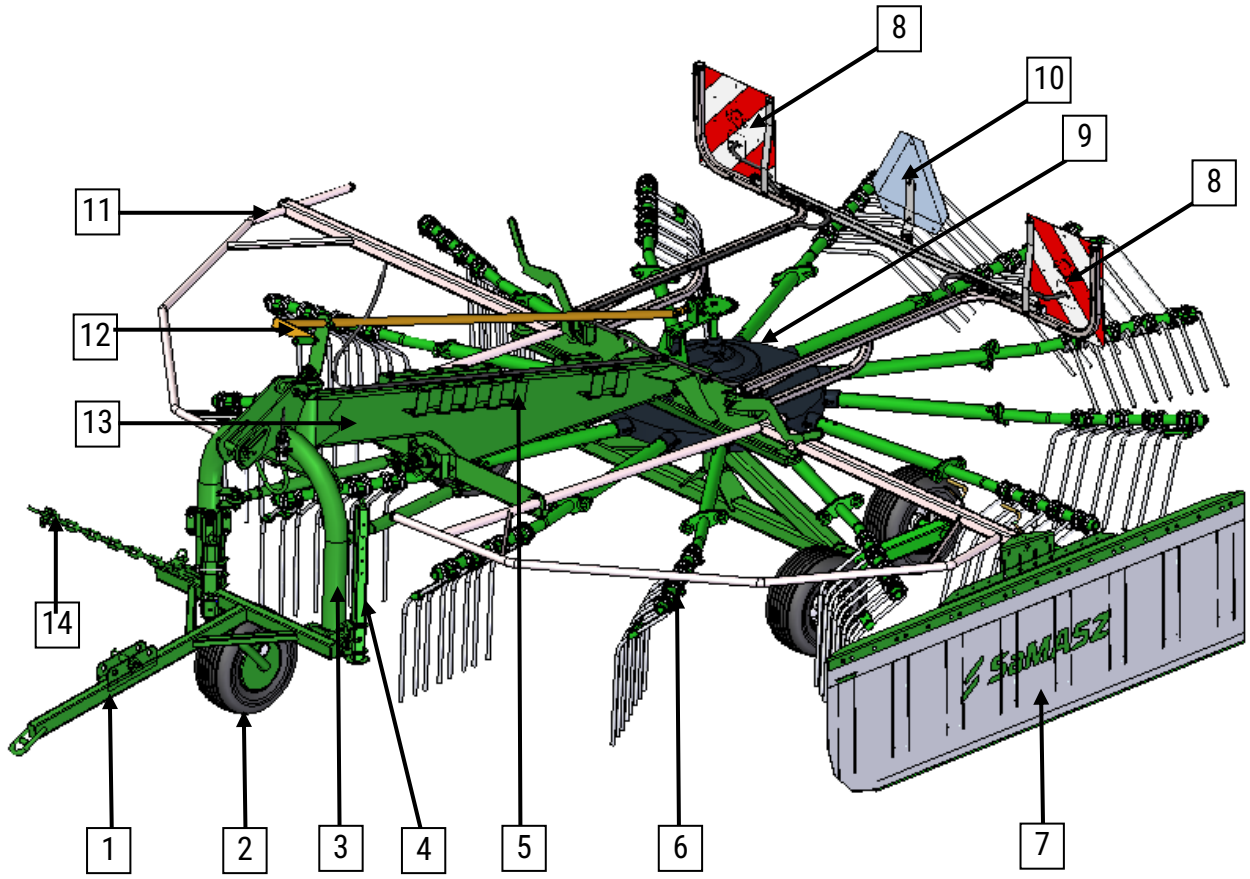


Fig. 4. Overview of rotor rake Z-470

1 – Transport drawbar (optional)
2 – Ground following wheel
3 – 3-point linkage farme
4 – Support legs
5 – Arms holders for transport
6 – Arms with tines
7 – Windrow curtain
8 – Warning plates
9 – Carousel gearbox
10 – Warning triangle (optional)
11 – Safety guard
12 – Adjustment lever
13 – Main frame
14 – Support chain

3.3. Standard equipment and spare parts

The rakes are sold with the following standard equipment:

- operator's manual with spare parts catalogue and the declaration of conformity,
- PTO shaft,
- warning plates with rear road lights (Z-440, Z-470),
- spray paint (150 ml).

Additional equipment:

- drawbar for pulling the rakes on wheels (Z-410, Z-440, Z-470),
- suport wheel for rakes (except Z-470),
- tandem chassis (Z-300, Z-301, Z-350, Z-351),
- warning plates with rear road lights,
- slow-moving vehicles warning plates (Z-410, Z-440, Z-470).

Tab. 2. Recommended PTO shafts for rotary rake

Model	Power	Length	Moment	Symbol	Joint	Notes
	KM	mm	Nm			
Z-300/Z-300 Slim Z-350/Z-350 Slim	21	810-1133	270	7G2N081CE0070E9A	overrunning	-
Z-301/Z-301 Slim Z-351/Z-351 Slim		910-1283		7G2N091CE0070E9TA		
Z-410 Z-440 Z-470	26	960-1350	460	7G3N096CE0070F3YA		

PTO shaft's end without clutch – To be mounted on tractor's side

PTO shaft's end overrunning clutch – To be mounted on rake's side

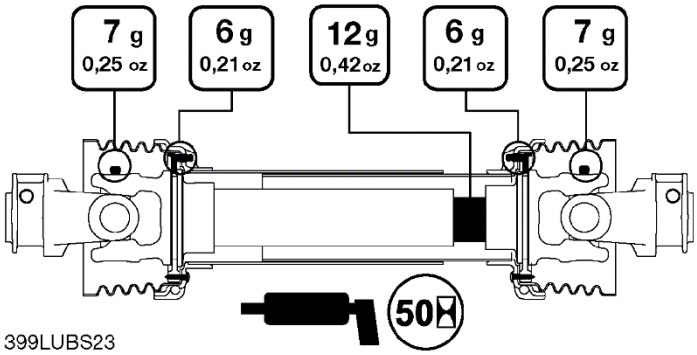


Fig. 5. PTO shaft 7G2N081CE0070E9A and 7G2N091CE0070E9TA lubrication points. Mounting directions

PTO shaft's end without clutch – To be mounted on tractor's side

PTO shaft's end overrunning clutch – To be mounted on rake's side

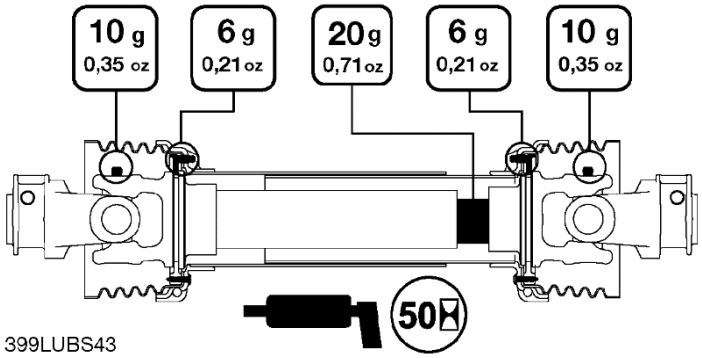


Fig. 6. PTO shaft 7G3N096CE0070F3YA lubrication points. Mounting directions

CAUTION:

Lubricate the PTO shaft with high quality multi - purpose grease every 50 shaft operating hours. If access holes are available, lubricate fittings through access holes. See decal on guard if applicable (**Fig. 5, Fig. 6**).

PTO shafts of other brands with equivalent parameters could be used afetr SaMASZ permission.

4. SAFETY ADVICE

4.1. Safety rules and regulations

- Front axis of the tractor should be weighted to keep the balance. If need be, use front wheel weights.
- Any operation with the hydraulic lift lever should be done from the operator's seat; DO NOT move the lever from outside of the tractor.

  In case of tractors equipped with EHR, operating with hydraulic lift is done by the buttons mounted outside the tractor's cabin. When operating be extremely careful.
- When switching from working to transport position unmount the whole or at least one end (from tractor's PTO) of PTO shaft.
- Operation without safety guards as well as with the damaged or raised guards is not allowed.
- Raking can only be started after the power take-off reaches a nominal PTO speed.
- Nobody is allowed to remain within the danger area. Particular caution is necessary when operating near roads and in stoney areas.
- Any maintenance and adjustment work should only be done after the drive has been disconnected and when the rotors have come to the complete standstill.
- Never lift the rake on tractor's 3-point linkage when the drive is on and the rotors are rotating.
- When driving on public roads always comply with local traffic regulations, especially concerning warning lights.

CAUTION:

Be certain that children and animals are at a safe distance away from the machine. Never allow anyone to ride on a machine or tractor.

- When the rake is lifted for repair on the 3-point linkage, it should be secured against falling by a mechanical support or by chain.
- The bolts and other fasteners should be inspected on regular basis. Operating with damaged or worn fasteners is not admissibl.
- Every maintenance work and regulations can be done only when the rake is on the ground.
- When the parts of the rake need replacement, use only original spare parts according to spare parts list.
- Prior to performing any maintenance works set the machine onto a stable ground and protect against unintentional shifting.
- The change of position cord should be attached with sufficient clearance in the tractor cabin.
- When operating the rake, the tractor should always be equipped with the cabin.
- Rake should not be operated when the tractor-rake set is not balanced.
- Never start the rake when it is lifted.
- Never start the rake, when people or animals are near the machine.
- Always comply with the safety decals describing hazards, and warning signs placed on the machine.
- Before you start the tractor make sure that every other drives are turned off and the levers steering hydraulics are in neutral position.
- Never leave the tractor's engine running without supervision. Before you leave the tractor, turn off the engine and put off the key from tractor's ignition switch.
- It is forbidden to operate the rake when driving backwards.
- Never get on the rake in any case.
- It is forbidden to transport people or any things on the machine.

- Never stand between tractor and rake, before tractor-rake set is secured against moving by the tractor's brake.
- The rake should be stored under roofed places and in the way that it will not harm people or animals.
- Rotating spring tines and other rotary elements present a danger to health and life of persons present nearby the machine. Do not touch any moving machine parts.
- When operating over a stony field or nearby roads there exists a risk of throwing out stones or other objects, which may pose a danger for passing-by vehicles on the road or for passers-by. There fore keep the safe distance.
- Prior to approaching operation with the machine, make sure that all safety guards are not damaged and fitted in place. Operating without safety guards is not permitted.
- When cleaning the machine, use personal protective equipment for health protection.
- Do not leave agricultural machinery on slopes or other descents without providing protection against its free runaway.
- When taking turns pay particular attention and consider weight and dimensions of the machine.
- In case of a fatal failure, stop the machine's drive, turn the tractor's engine off and take out the ignition key. Then call for technical service, and if an accident (in this case: road accident) occurs, respect first aid rules and contact responsible authorities.
- Before transporting the rake make sure that the support leg is lifted and protected.
- In the event of any break in the equipment operation, turn off the drive. Shut down the tractor's engine, take the ignition key off, leave the cabin and make sure there are no unauthorized persons in the cabin and the door is closed.
- When the machine is stopped bear in mind that it is necessary to use supports to keep the stability.
- The operator is not allowed to leave the tractor while driving.
- Machine should be kept clean, so as to avoid danger of fire.
- When used in storm, the machine is exposed to lightning.
- During repair and maintenance work it is mandatory to use personal protective equipment (PPE) in the form of protective clothing, protective gloves, safety shoes and safety glasses.

4.2. Qualifications of operator

To provide safe machine operation each person being the machine operator must meet the following requirements:

- Operator should hold driving license, have ability to drive vehicles safely and know road traffic rules.
- Operator must be in proper physical condition to be able to operate the machine.
- Operator must not be under the influence of alcohol, drugs and medicines, which all have influence on vehicle driving and machine operation.
- Operator should be familiarized with this manual and follow its provisions.
- Operator should be familiar with working principles of both the tractor and the machine, and be able to recognize and avoid hazards resulting from operation of the aggregate.

4.3. Conditions of mounting mower on tractor

- Prior to the mounting operation, check whether the tractor's and the mower's hitch categories are compatible and make sure that tractor's hitch load is adequate for the machine aggregated.
- Prior to mounting the machine, examine technical condition of the mower's hitch assembly and tractor's 3-point linkage.
- Use only genuine pins and cotters to mount the mower on a tractor.
- Once the machine is mounted on tractor check stability and manoeuvrability of the latter. Load on the front axle should be approx. 20% of the weight of tractor. Otherwise, ballast front of the tractor.

4.4. Transport

- Any modifications in the rake's position are possible only if no unauthorized personnel is around (children in particular).
- When transported the rake shall have mobile warning light device and warning triangle mounted for slow driving vehicle.
- When transported the rake should always be set in transport position. See chapter 5.2.
- Prior to putting the rake to transport position make sure, that the tractor PTO is disconnected and all the rotating parts in complete standstill.
- Driving speed should always be adjusted to current road conditions.
- Driving speed should always be adjusted to current road conditions and traffic code applicable in your country.
- Before transporting the rake make sure that support legs are lifted and protected.

NOTE:

When transporting the rake on even road, do not drive faster than 25 km/h. Whenever any unevenness is on the way, reduce the speed. Exceeding speed or not adjusting it to road conditions may cause damage to the machine.

4.4.1. Putting machines onto another vehicle for transport

Both the carrier and the driver shall be responsible for the rake transport safety. Any equipment and parts must be secured properly for transport.

In order to have the rakes relocated safely onto another vehicle, please follow these rules:

- The rake should be seized by any lifting device only in places indicated on the machine by the hook sign.
- Transport belts, belt suspensions, ropes cannot be damaged. Whenever damages to these parts are spotted replace these with new ones.
- When mounting slings, chains, handles etc. always pay attention to setting the machine's center of gravity properly.
- To catch machines, pick ropes of adequate length, so that the angle between them is no greater than 120°, and the angle between the strand and the vertical is no greater than 60°.
- To lift the rake, use only lifting devices with hoisting capacity bigger than the rakes weight provided on data plate. It also concerns ropes and chains used for lifting.
- Collapsible elements should be locked in transport position.
- When relocating the rake onto another vehicle, there should be no unauthorized personnel permitted to remain within the danger area.
- The rake should be protected from shifting on the vehicle's trailer.

NOTE:

Securing manouvering area and transport of the mower is the responsibility of a person who does it.

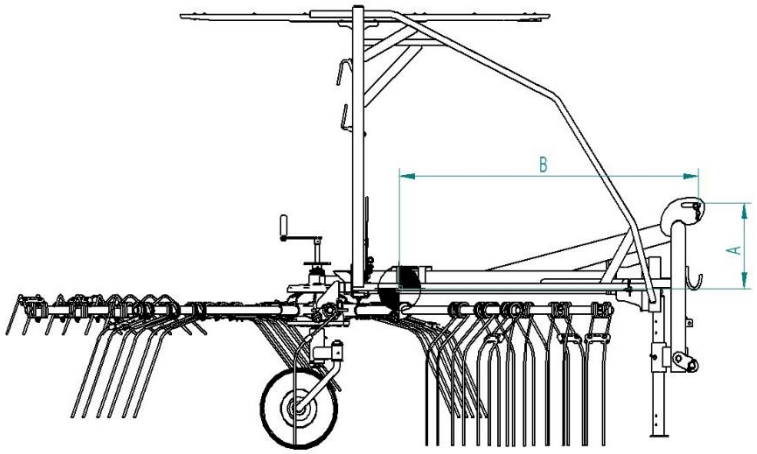


Fig. 7. Location of centre of gravity

Tab. 3. Location of centre of gravity

Dimension [mm]	Model						
	Z-300/ Z-300 Slim	Z-301/ Z-301 Slim	Z-350/ Z-350 Slim	Z-351/ Z-351 Slim	Z-410	Z-440	Z-470
A	320 / 460	570 / 540	310 / 300	540 / 480	480	560	500
B	1330 / 1340	1640 / 1550	1430 / 1410	1620 / 1550	1780	1840	1960

4.5. Operating parts

- Prior to operating the rakes check the rotor and the tine condition.
- Worn or damaged tines should be replaced immediately with new ones.

4.6. PTO shaft

- Prior to operating learn instructions given by the shaft's manufacturer found on the shaft.
- Use only the rake's manufacturer recommended PTO shafts.
- In order to operate safely use only fit, undamaged telescopic articulated shafts. Damaged telescopic articulated shaft shall be repaired or replaced with new one.
- Pay particular attention to PTO shaft's guards and rake's and tractor's spline shaft guards. Never work with damaged guards.
- Before operation, check all guards (in tractor, machine and the shaft), if they are in place and are functional. Any worn or damaged guard must be replaced. Damaged or missing guard of drive shaft may cause serious accident and even death.
- Possible inclination of the shaft depends on shape and size of the guard. Before operation check if guards in any position are not damaged or locked.
- Always pay attention to the recommended overlap of the PTO shafts in working and transport positions.
- Before you start work, you must make sure that the PTO shaft is spinning in the right direction and that the tractor PTO RPM matches the permissible RPM levels of the machine.
- When using the power PTO shaft there must be nobody in the danger zone of the rotating telescopic joint shaft or PTO shaft!

4.7. Tires

- The air pressure in the wheels must be regularly checked and maintained at the appropriate level recommended by the manufacturer.
- Repair work on the machine's tyres and wheels may only be carried out by qualified personnel with the appropriate tools for this type of work.
- When carrying out maintenance and repair work on tyres and wheels, ensure that the machine is properly parked and secured against rolling away (use wedges).
- Disassembly and assembly of the wheels requires appropriate skills and equipment.

4.8. Residual risk

Despite the fact, that SaMASZ company – the manufacturer of the rake takes the responsibility for the rakes design and manufacturing, in order to eliminate hazard, certain risk when operating the machine is unavoidable. When keeping such recommendations as:

- thorough familiarizing with operator's manual,
- no persons remaining on the machine when operating and during drives,
- no persons remaining within the rake operation range,
- adjustment, maintenance and lubrication of the machine with engine off,
- performing repairs of the machine only by skilled persons,
- operation of the machine by persons, which are familiarized with operator's manual,
- in the event of the machine protection against children and unauthorized personnel residual risk when operating the rake may be limited to necessary minimum.

1. Danger of catching

This kind of risk occurs when the rake's position is changed, when operating near rotating parts, operating without safety guards.

When operating, maintenance and regulation works are conducted always wear protective gloves, footwear and clothing with no loose parts, belts, etc. Always comply with safety decals placed on the rak.

2. Danger of wound, abrasion and damage of skin

Present when replacing working parts with sharp edges, cleaning the machine and removal of any clogging and jams. For any repair and maintenance works always wear safety gloves.

NOTE

Residual risk results from incorrect behaviour of the machine's operator.

3. Bans

Bear in mind the following bans when operating the rakes:

- Do not unblock the rake, make any adjustments or repairs when the mower is operating.
- Never change the sequence of operation and maintenance works specified in the operator's manual.
- Never operate the rake when its working condition is poor or has safety guards damaged.
- Never get your limbs close to rake's rotating parts.
- During the rake's repair and maintenance works always comply with the descriptions included in the operator's manual, while conducting them with the tractor drive disconnected.
- Prior to approaching any works, focus your attention solely on the tasks to do.

- Never operate the rakes being under influence of alcohol, drugs, or strong medicines.
- Wear clothing that is not too loose, nor too tight. Too loose clothing elements may be pulled in by the machine's rotating parts.
- The rake cannot be operated by children nor handicapped people.

When describing residual risk, the rake shall be considered a machine, which until the moment of production launching had been designed and manufactured in accordance with top technology level actual as per the machine manufacture date.

NOTE:
There is possibility of residual risk if not complying with specified instructions and bans.

Residual risk assessment

When keeping such recommendations as:

- thorough familiarizing with operator's manual,
- no persons remaining on the machine when operating and during drives,
- no persons remaining within the rake operation range,
- adjustment, maintenance and lubrication of the machine with engine off,
- performing repairs of the machine only by skilled persons,
- operation of the machine by persons, which are familiarized with operator's manual,

in the event of the machine protection against children and unauthorized personnel residual risk when operating the rake may be limited to necessary minimum.

When the risk of exposing to noise cannot be avoided or eliminated by any group protective means or organization of work, employer (farmer) must:

1) provide the operator with individual means of noise protection, if the noise level in work place exceeds 80 dB.
1) 2) provide the operator with individual means of noise protection and supervise the correctness of its usage, if the noise level in work place reaches or exceeds 85 dB.

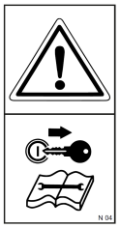
4.9. Safety decals and their meaning

CAUTION:

a) all warning decals should be clean and legible,
b) lost or damaged decals must be replaced,
c) please order new decals from your dealer or supplier.

N-01
Be extremely careful when PTO shaft is rotating!

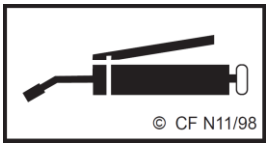
N-03
Caution – read the operator's manual before putting the rake into operation!



N-04
Caution – while making repairs the machine must be stopped!

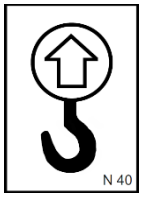
N-06
Caution – rotating parts

N-07
Operating is forbidden when any person is within the danger area of 50 m / 170 ft.



N-11
Lubrication point

N-15
Danger operating when any person remains in the danger area of 50 m/ 170 ft.



N-40
Transport hook for lifting of the rake

N-41
Point of support of rake

N-49
Do not get too close to the hoist of the tractor during operation of the hoist

N-50
Do not get under the rake

N-52
Use protective gloves

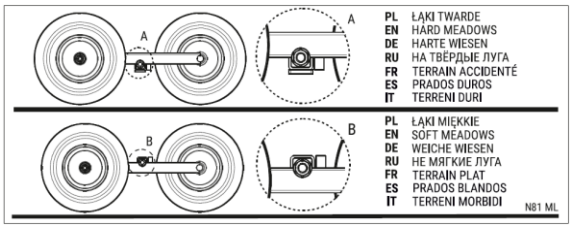
N-100
Use protective glasses

N-101
Use protective clothing

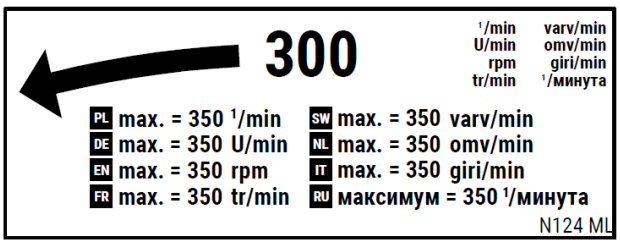
N-102
Use head protection

N-103
Use hearing protection

N-104
Use protective shoes



N-81

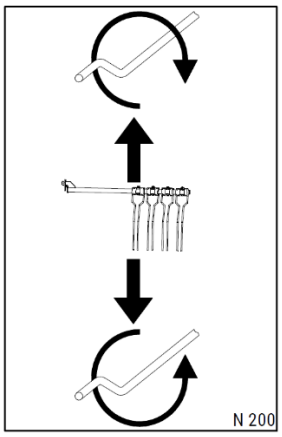


N-124
PTO rotation direction

N-167
Do not remain on the machine while driving

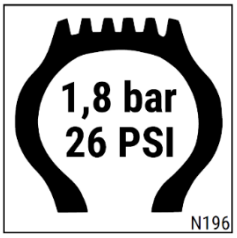
N-168
Do not touch the machine before the rotating parts have not come to a complete standstill

N-162
(for: Z-410, Z-440, Z-470)

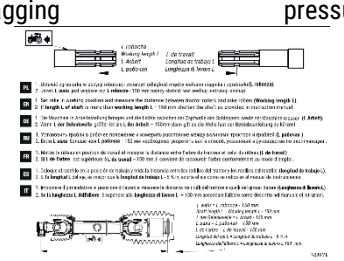


N-200

N-183
Attention: dander of legs dragging



N-196
Recommended tire pressure



N-203
Adjusting shaft articulated telescopic (for: Z-410, Z-440, Z-470)

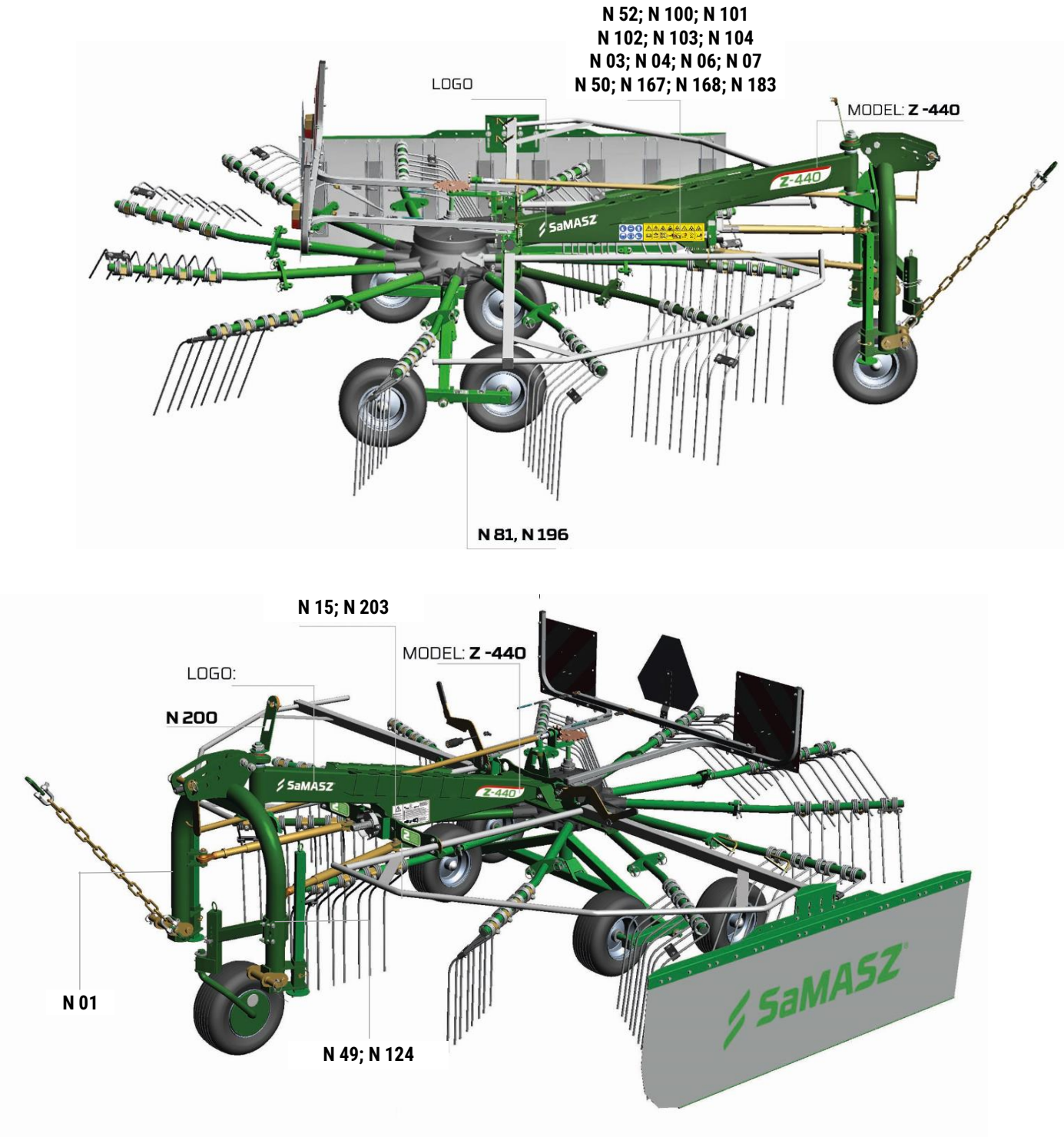


Fig. 8. Warning decals placed on the rake

5. OPERATION

5.1. Attaching the rake to the tractor

NOTE:

When attaching the rake, there should be no persons between the machine and the tractor. Any accidental manoeuvring with the aggregate might cause crushing of unauthorized personnel.

NOTE:

The machine should be mounted on a level ground.

- **For rakes Z-300, Z-300 Slim, Z-350 and Z-350 Slim**

The rake should be mounted on tractor with use of 3-point linkage as provided in **Fig. 9**. Hangers **W** of the tractor's lower links should be placed on pins on the rake's linkage. Once the machine is hanged the setting should be adjusted on an even ground with top link **S** and hangers **W** for tractor's lower links (**Fig. 9**). Chain **L** shall be placed on the top link pin in order to protect the rake from falling of hangers for lower links **W.**

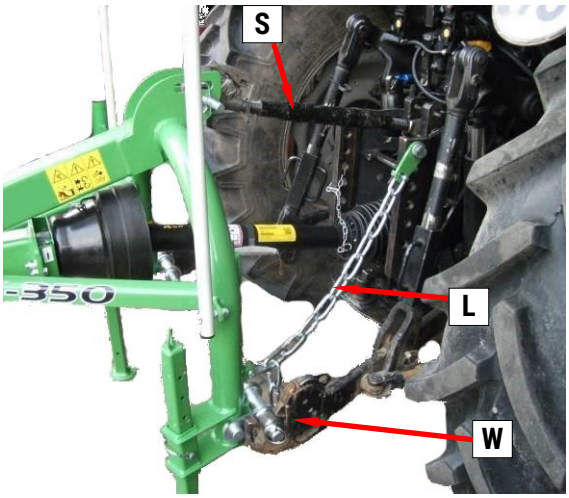


Fig. 9. Connecting the rake Z-350 to the tractor

- **For rakes Z-301, Z-301 Slim, Z-351, Z-410, Z-440 and Z-470**

Rake should be mounted on tractor with use of 3-point linkage frame. Tractor's lower links **C** should be shortened maximally with use of turnbuckles (if links are lowered too much, it will cause the rake to be lifted not high enough during its transport). Upper link **G** should be mounted on pin **S1** in the catch eye (**Fig. 10b**), hangers **W** for tractor's lower links should be placed on pins of rake's linkage frame (**Fig. 10a**).

Chain **L** shall be placed on the top link pin in order to protect the rake from falling of hangers **W.**

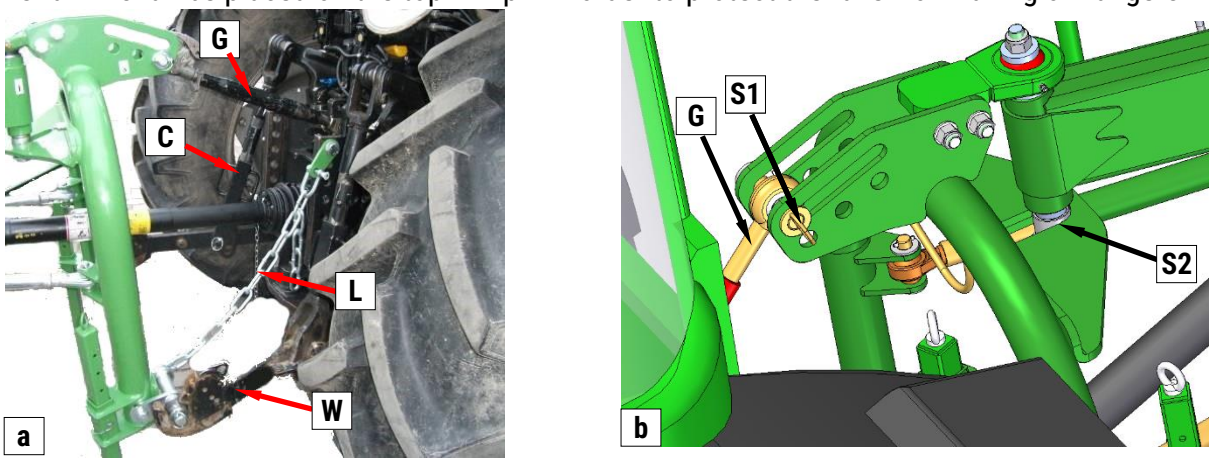


Fig. 10. Connecting the rake to the tractor

After the rake has been attached to tractor, check the balance and steerability of tractor - rake set. To do this, weigh the set, and then drive on the scales only with front axis of the tractor (tedder must be in transport position, so lifted upwards). If the pressure on the front axis is at least 20% of the whole set's pressure, it means the set is stable. If not, the front axis should be balanced.

5.2. Preparing the rake to transport

To prepare the rake to transport and to meet safety precautions, please do the following:

- roll up swath curtain to the maximum and secure it with cotter pin,
- lift safety guards to transport position,
- take off extreme rotors, put them in the transport holes,
- lift the rake with tractor hydraulic lift until the lower lift pins of the rake 3-point linkage frame raise about 50 cm above the ground,
- lift and secure support legs (**10**) (**Fig. 3**).

Fig. 11. Rotary rake in transport position

NOTE:

When lifting the machine for transport pay attention so that the tractor's glass pane is closed. Protective barriers found on the rake may damage the glass.

Rake Z-301, Z-351, Z-410, Z-440 and Z-470 can also be transported upon dismounting outer arms only (**Fig. 12**) (**Note:** transport width cannot be more than 3 m). In order to prevent other arms from moving freely lift guards to lock the gear against any rotation automatically with adequate locking mechanism (**Fig. 13a**).

Fig. 12. Rakes in transport position (outer arms dismounted only)

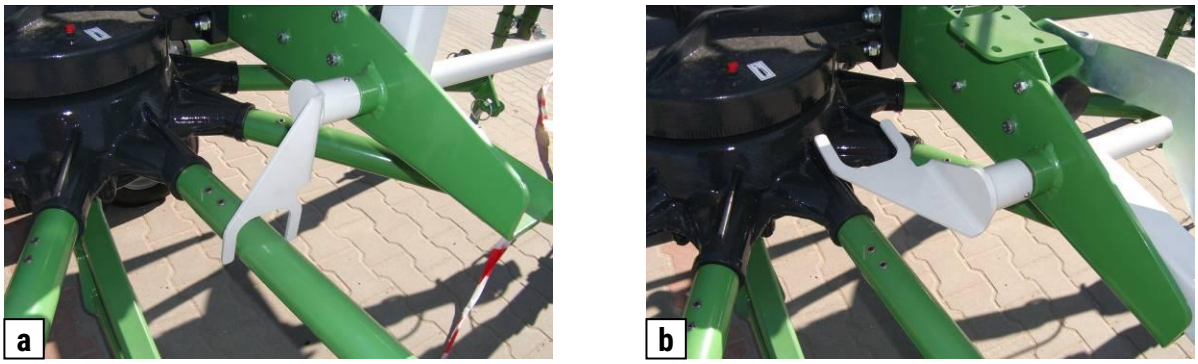


Fig. 13. a) Locking the gear for transport (guard lifted vertically), b) Locking the gear for operation (guard lowered horizontally)

NOTE:

Once the machine is set to transport position, check whether mechanical locking pawls are properly locked on pins.

NOTE:

Prior to operating with the machine unlock the gear by lowering the guard. Otherwise it may damage the rake.

5.3. Transportinh rakes aggregated with tractor by means of tiller (option) (dotyczy Z-410, Z-440 i Z-470)

In case of smaller tractors, transporting rakes is possible by means of tiller (optional equipment) as provided on **Fig. 14.**

Fig. 14. Rakes aggregated with tractor by means of tiller

Mount tiller on pins (**R**) of rakes' linkage and upper tractor's hitch (**Z**) (**Fig. 15**). Couple rakes' upper hitch with tiller by means of tractor's upper link (**C**).

Fig. 15. Aggregation of rakes with tractor by means of tiller

NOTE:

When transporting rakes aggregated with tractor by means of tiller, adjust driving speed to conditions ahead on the road and pay particular attention on turns.

5.4. Preparing the rake for transport on public roads

To meet safety precautions concerning transport on the public roads in Poland the rake should be equipped with portable warning-light plates, to be mounted on both sides of rake.

CAUTION:

Warning devices can be ordered from the rake's manufacturer.

When transporting on public roads respect provisions valid in the country of use.

5.5. Mounting and shortening PTO shaft (WPT)

The machine is delivered with a separate instruction manual for PTO shafts.

Prior to commencing operation, examine and adjust length of PTO shaft, which is designed to mount machine on tractor. In some cases it is possible, that the shaft is too long and therefore needs to be shortened, so that there is adequate tolerance for the shortest possible distance between tractor's shaft **O** and machine's shaft **P**.

Shaft length should be adjusted individually for tractor, on which the machine is mounted.

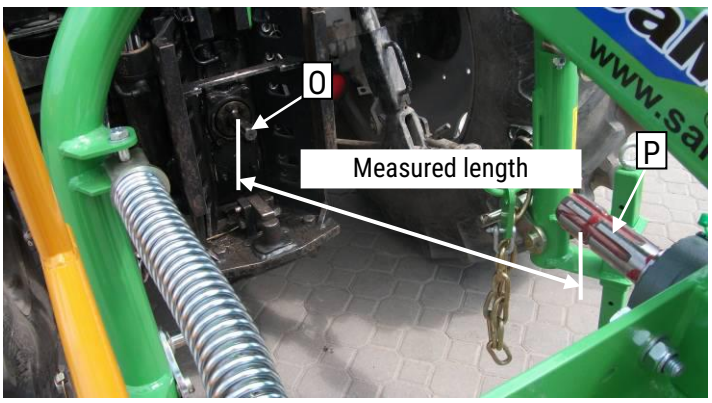


Fig. 16. Distance between tractor's PTO shaft and machine's drive shaft

In order to determine minimal shaft length:

- set aggregated rakes in working position, / (by means of 3-point linkage, adjust connector end of machine's PTO **P** on the most approximate height, on which tractor's PTO is mounted,
- take measurement of distance between two shafts as provided on **Fig. 16** and **Fig. 17,**
- next additionally distract 150 mm from the resulting measurement in order to keep tolerance and shorten the shaft for this particular length (**Fig. 18**). Information on proper shortening of shafts is provided in item **5.5** herein, on decal N-149 placed on the machine and also found in shaft's manual provided by its manufacturer.

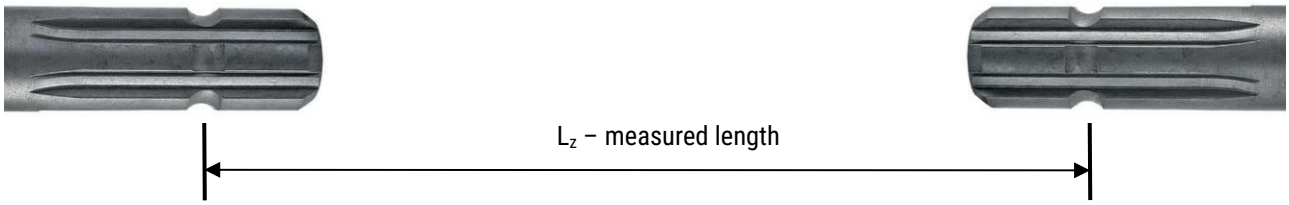


Fig. 17. Properly measured length

As a result of following the abovementioned instructions, length of PTO shaft is obtained, and then it can be used safely to mount the machine on the tractor.

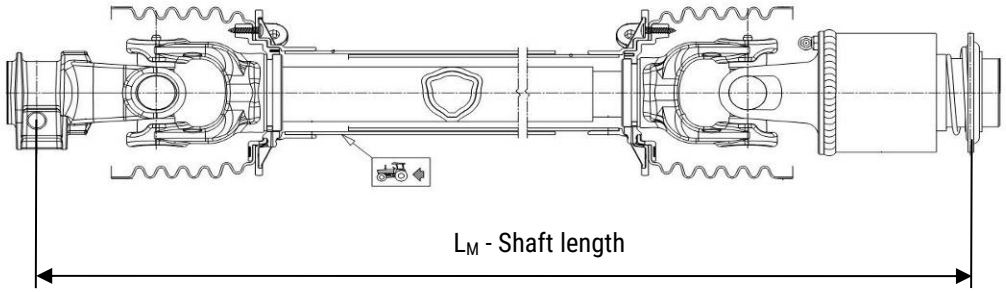


Fig. 18. Properly measured shaft length
$L_M = L_Z$ – 150 mm

NOTE:
When using links to lift the machine suspended on 3-point linkage, PTO speed should be reduced or absolutely it off at the angle of shaft work more than 25°.

NOTE:
Before approaching any operation adjust length of PTO shaft for tractor-machine aggregate by shortening it (see Section 5.5. or instructions of PTO shaft shortening); next check if the shaft's length in transport position (when should be the shortest) is properly adjusted, and if need be re-shorten the PTO shaft.

PTO shaft's end with overrunning clutch should be mounted on rakes's side. The PTO shaft plastic guards have to be secured by fastening their small chains to immovable parts of tractor and rake.

CAUTION:
If need be, shorten the PTO haft according to its operator's manual given by the shaft's manufacturer (**Fig. 19**).

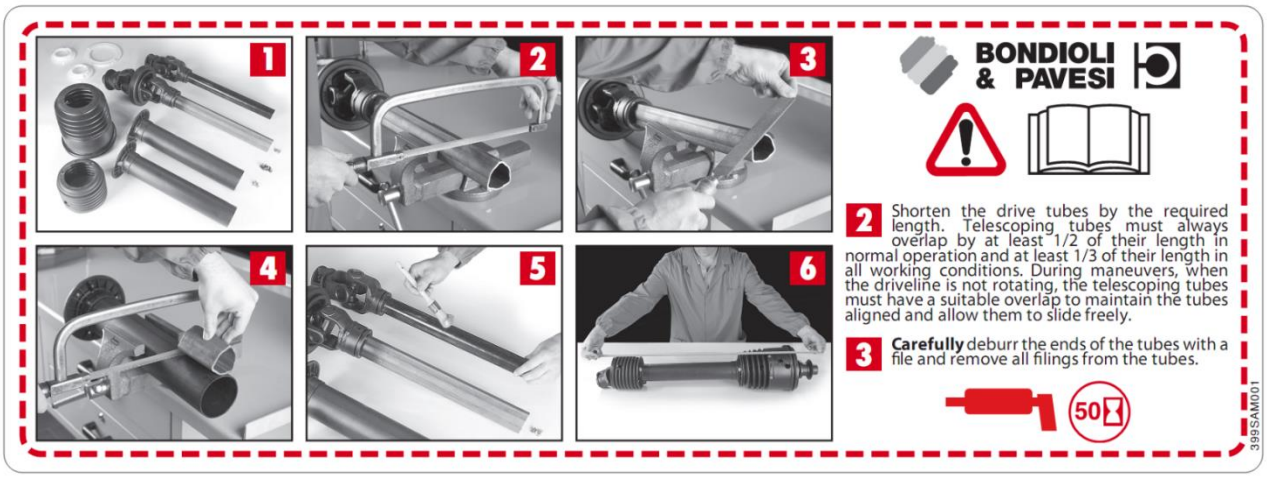


Fig. 19. Instruction of PTO shaft shortening

CAUTION:
The PTO shaft should be mounted only during operation time and disconnected from tractor PTO for transport and service.

CAUTION:
PTO shaft's end with overrunning clutch should be mounted on rake's side.

CAUTION:
Use machines with correspondingly designed driving PTO shafts. For any service and repair works of the shaft and the machine, the tractor engine and its drive must be disconnected.
Prior to the work commencement, safety guards should be inspected whether they (in the tractor, the mower and the PTO shaft) are placed correctly and are not damaged. Damaged or missing parts must be replaced with genuine ones. Make sure that the PTO shaft is mounted properly. Approaching the rotating parts is strictly forbidden, as it may lead to serious injuries or even cause death. For any service and repair works of the shaft and the machine, the tractor engine and its drive must be disconnected.

5.6. Switching from transport to working position

To shift rake to working position:

- make sure there is no person around the danger area,
- by means of hydraulic lifting lower arms of the rake in the slowliest way in order to cushion contact with the ground,
- take off arms from transport holders, put them into the rotors and secure them with cotter pins,
- lower the protective guards, while automatically unlocking the gear,
- unfold swath curtain on demanded length.

5.7. Preparing the rake for work

When the rake is in working position, please do the following:

- connect PTO shaft between tractor and rake,
- set the tractor and rake aggregate on an even, level ground,
- level the rake with upper link and tractor's lower links' hangers,

- when operating catch pin **S1** with upper link should get leaned on the edge of one eye, and vertical pin **S2** must get leaned on the edge of the other eye (**Fig. 20a**),
- it is allowable to set the machine as shown on **Fig. 20b** when operating on an even ground catch pin **S1** with upper link should be in opening **O**, and catch pin **S2** must be in the middle of the eye. Such setting provides for reduction in ground following range,

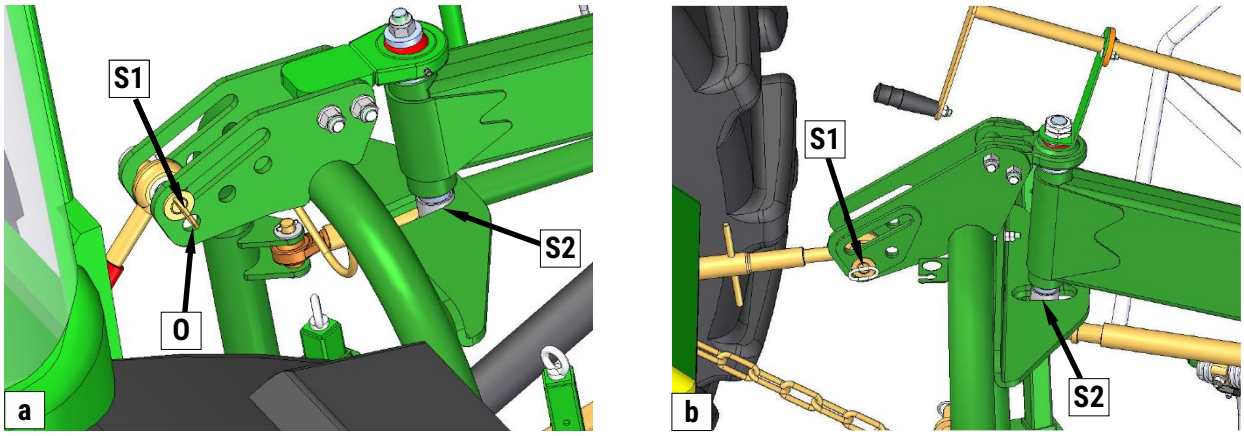


Fig. 20. Recommended rake setting – a) under normal operating conditions, b) when operating on an even ground

- using lever (**D**) (**Fig. 22**) either lower or lift it to set a required raking height; raking tines should be set vertically in relation to the ground, not touching the ground however (**Fig. 21**),

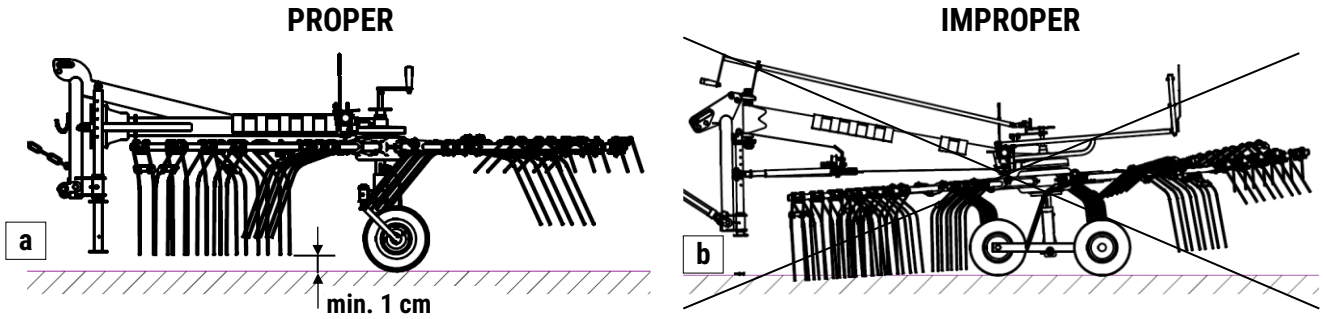


Fig. 21. Rakes in working position – a) proper; b) improper

Fig. 22. Working height regulation lever

CAUTION!

It is forbidden to lower raking arms below the level of 1 cm above the ground, for this may cause damages to the machine such as: bending the raking arms, breaking the linkage, etc., faster wearing of raking tines, damaging sward and contamination of the raked feed. Too high a setting of the raking unit may lead to a risk of not being able to rake up the whole swath.

CAUTION!

The raking arms' height should be controlled on an on-going basis while operating the machine, and if need be, adjusted. Adjustments are performed with tractor's drive off.

- on peat meadows there is a possibility to increase the distance of tines from the ground by shifting arms of wheels' trolley. Unscrew the nut (**1**) and take off washer (**2**), pull out front arm. (**3**) and rotate it 180°. Rotate left (**4**) and right arm (**5**) 180° and switch their places (**Fig. 23**),

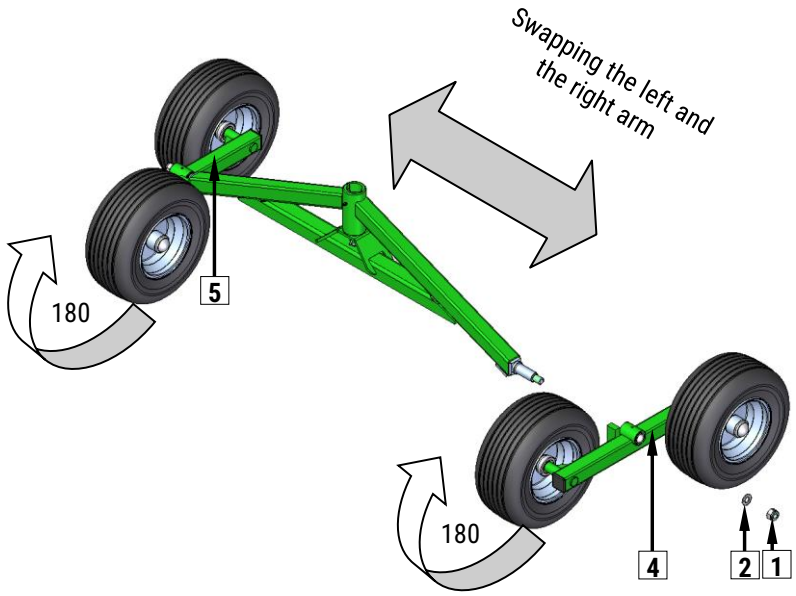


Fig. 23. Increasing working width by means of wheel trolley

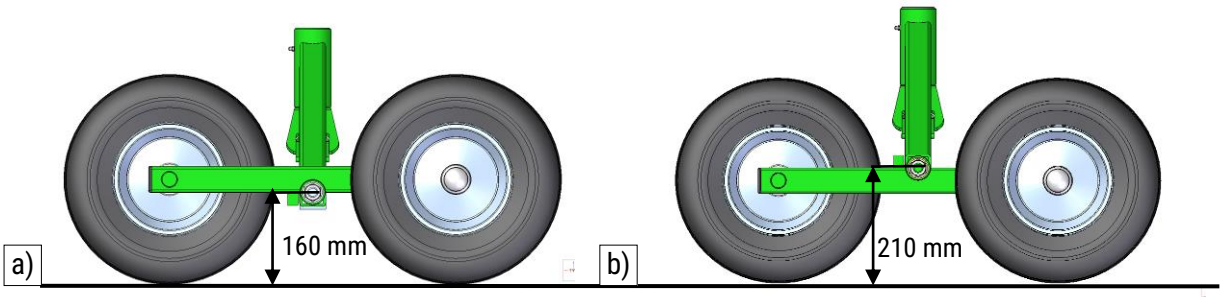


Fig. 24. Trolley's height with a) normal regulation, b) increased height

- slowly engage PTO clutch and wait until the rake reaches its speed 300÷350 rpm. Adjust working speed so that the machine rakes clearly,
- engage tractor gear and drive slowly into the swath.

Movable linkage adjustment **Fig. 25b L** and movable upper link **Fig. 25a G** enable perfect ground following.

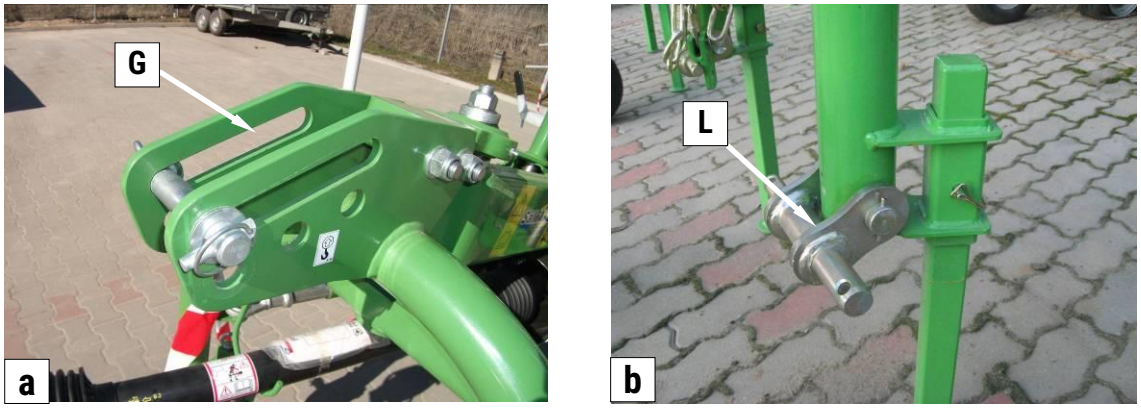


Fig. 25. Linkage of Z-410, Z-440, Z-470 rake

5.8. Operation

Rotary rake is designed for raking forage, dry forage and hay after rotary tedder treatment. Speed should be adjusted to terrain conditions, swath size and cleanliness of raking and cleanliness of raking.

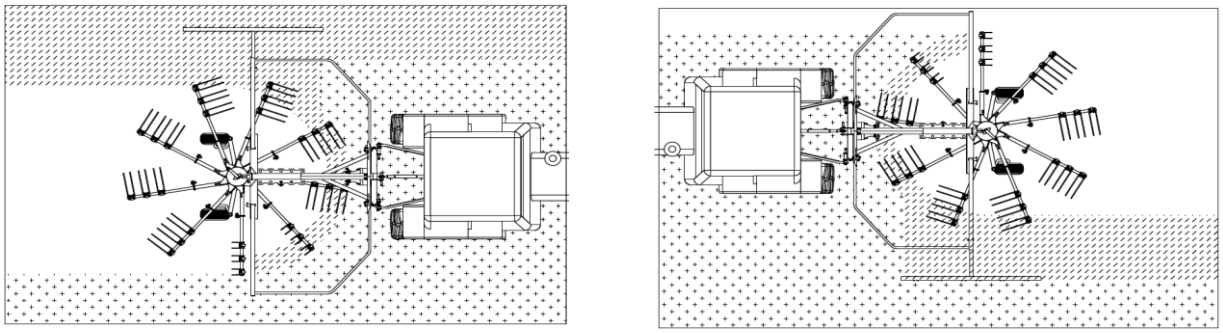


Fig. 26. Proper operation of rotary rake

CAUTION:
Prolonged operation at 540 rpm may lead to premature wear of the gear. It is recommended to apply 300 ÷ 350 rpm.

5.9. Clogging

In order to avoid clogging, mowing speed should be adjusted to the mentioned conditions. In order to remove the machine clogging, lower the cutterbar onto the ground, disconnect the drive, take ignition key off and pay particular attention. When eliminating the machine clogging, use also safety means for operator, so protective gloves and tight wear.

5.10. Dismounting machine from tractor

CAUTION:
When dismounting, make sure there is no person in between the rake and the tractor.

To dismount the rake from the tractor:

- Set the machine onto an even, stable ground,
- Turn the tractor's ignition off and take the key out,
- Secure the machine against moving by placing wedges at wheels,
- Support the machine with the support legs and protect with safety pin,

- Dismount the PTO shaft and place it on a PTO shaft holder, which is standard-delivered with the machine, PTO shaft and power input ends should be protected with guards,
- Detach the machine from the tractor,
- Carefully drive the tractor away.

6. MOUNTING AND ADJUSTMENT

6.1. Tine mounting

Tines should be mounted as provided on scheme on **Fig. 27.**

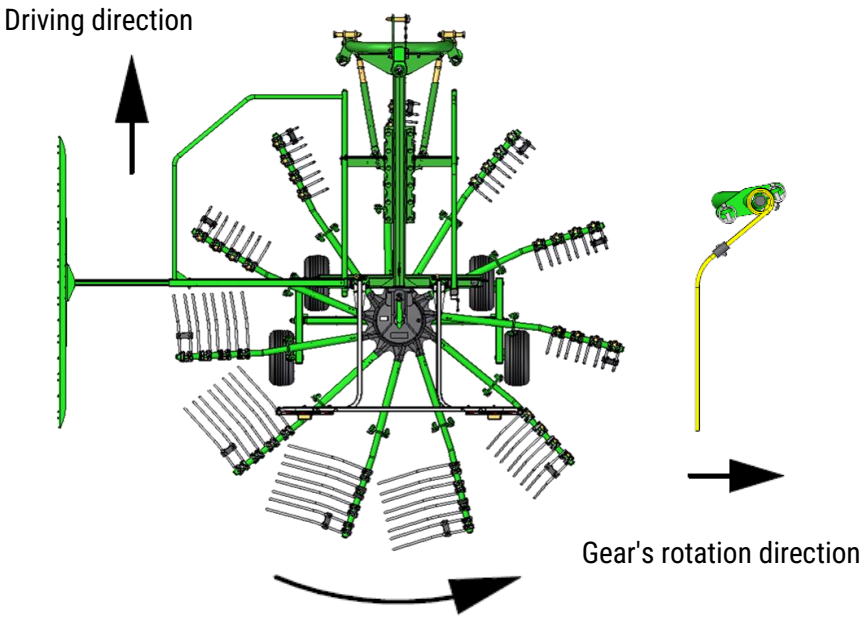


Fig. 27. Mounting of rake's tines

CAUTION:
Use only the tines recommended by the manufacturer.

CAUTION:
Mounting and dismounting rake tines can only be performed with drive off and engine shut down and also ignition key out.

6.2. Replacing connecting rods

In case of connecting rod damage, a simple replacement is possible by removing the damaged part. Replace as follows:

- Secure raking arm with support,
- Remove expansion pins (**K**) from arm mount,
- Once pins are removed slide down arm mount from connecting rod,
- Loosen four screws (**S**) that fix connecting rod to gearbox body,
- Remove damaged connecting rod module,
- Install new connecting rod,
- Re-tighten the screws (**S**) with adequate torque,

- Use support again when installing arm mount, securing it with expansion pins.

  When replacing connecting rod it is not necessary to drain oil from the gear.

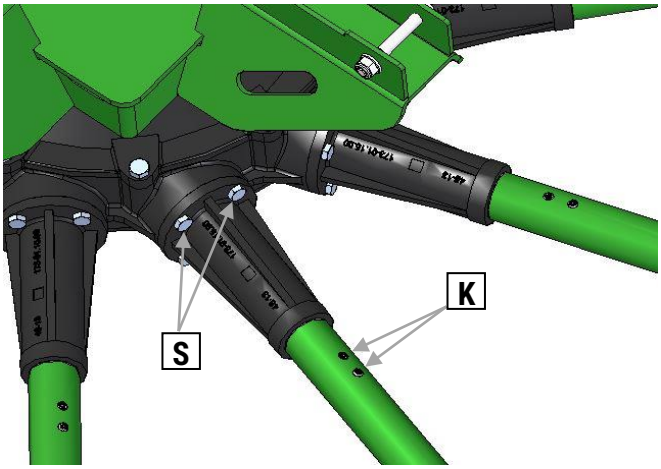


Fig. 28. Replacing connecting rod

6.3. 3-point linkage support chain

Support chain is used to ensure 3-point linkage frame of the rake is always at the same height, to set the mowing unit parallel to the ground and to relieve the hydraulic lift of the tractor.

When connecting rake to the tractor the end of the chain should be put on upper linkage.

6.4. Wheel replacement

NOTE!

The condition of the tyres, the pressure and the tightness of the wheel fixing bolts must be checked regularly (the tightening torque of the nuts should be in accordance with **Tab. 4**).

Make sure to gave inspections, in particular:

- after first use of the rake, and then once a month,
- after wheel replacement,
- in case of intensive use.

NOTE!

Operation with damaged wheel may cause a serious accident.

When found damaged, replace the wheel as follows:

- set the machine on a stable ground and protect it against uncontrolled moving,
- loosen wheel nut,
- mount lifter in points as shown in **Fig. 29** and lift the machine,
- remove the wheel,
- clean nut and check their technical condition,
- reinstall the wheel, tighten the nut and mount the protective cap,
- lower the machine.

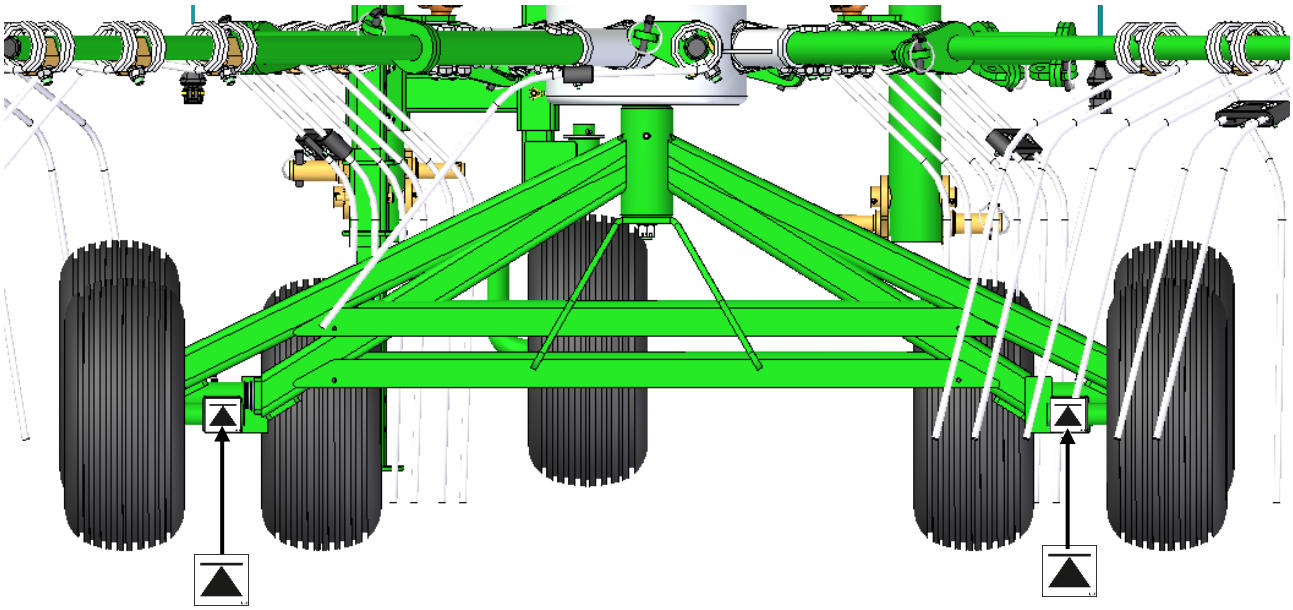


Fig. 29. Points of mounting of lifter

6.5. Daily maintenance

Upon daily completion of operation the following should be performed:

- inspect all visible external parts and assemblies with their connection; all loosen screws shall be tighten and worn or damaged parts replaced,
- wash the rake with water under pressure after each operation,
- remove grass and mud from the machine,
- examine condition of rotors,
- check the condition of the road wheels tyres and the air pressure in the tyres,
- lubricate the PTO shaft tubes with STP grease,
- if necessary, lubricate the other parts and assemblies in accordance with the lubrication instructions (**punkt 7**).

NOTE!

Be extremely careful when cleaning the machine with a pressure washer. Do not direct the water jet directly onto the bearings.

6.6. After-season maintenance and storing

NOTE!

Be extremely careful when performing service, repair and maintenance works. Avoid any contact of grease and oil with the skin.

NOTE!

Service, repair and maintenance works can only be performed with drive off, engine shut down and ignition key out.

During repair and maintenance work it is mandatory to use personal protective equipment (PPE) in the form of protective clothing, protective gloves, safety shoes and safety glasses.

At the end of the season:

- the rake should be cleaned, washed and dried. Carefully grease unpainted surfaces and 3-point linkage pins
- remove any traces of rust and paint the area affected,
- check lubrication of intersecting axis gears. If leaks occur, remove them immediately,
- periodically check the rake and secure the moving parts with grease to prevent the rake from rust, which affects proper functioning of the rake.
- the dismounted machine should be stored in a standstill position (unfolded tine arms together with rotors, drive chassis set on the ground like in position to work, main frame rest on secured support stand).
- it is recommended to store the set on a paved ground, preferably in dry, roofed places, inaccessible to unauthorized personnel (mainly children).
- if the machine is exposed to weather conditions, apply lubrication regularly.

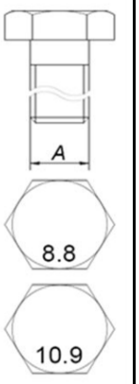
The dismounted machine should be stored in a standstill position, so it is supported onto protected support legs. It is recommended to store the set on a paved ground, preferably in dry, roofed places, inaccessible to unauthorized personnel (mainly children). If the machine is exposed to weather conditions, apply lubrication regularly.

6.6.1. Restarting the machine after longer storing periods

- Make sure that all nuts and screws are tightened with correct torque (**Tab. 4**).
- Make sure that all guards are installed in place.
- As the storing period is over lubricate the whole machine.
- Check the condition of the road wheels tyres and the air pressure in the tyres.
- once all the guards are installed, perform a warm-up start in order to make sure the repaired machine operates properly.

Tab. 4. Torque values for bolts

A	6.8		8.8		10.9		12.9	
	Maximum torque							
	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm
M4	1.5	2.2	2	3.0	3	4.4	4	5.1
M5	3.5	4.5	4.5	5.9	6.5	8.7	7.5	10
M6	5.5	7.6	7.5	10	11	15	13	18
M8	13	18	18	25	26	36	33	43
M10	27	37	37	49	55	72	63	84
M12	47	64	63	85	97	125	111	145
M14	74	100	103	135	151	200	177	235
M16	118	160	159	210	232	310	273	365
M18	162	220	225	300	321	430	376	500
M20	229	310	321	425	457	610	535	710
M22	314	425	435	580	620	820	726	960
M24	395	535	553	730	789	1050	926	1220



7. LUBRICATION

7.1. Risks present when lubricating

- If risk of splashing is present, make sure to wear protective eyewear with side guards.
- When lubricating protect eyes and skin against contact with the substance. Therefore use adequate protective wear with long sleeves and protective footwear. Also use protective gloves. In case of a contact with skin, immediately wash the infected area with plenty of water with soap.
- Do not allow the product to contaminate water outlets, water courses and soils.
- In case of an unintentional release to the environment plug the leak, limit the spillage, and then collect the oil with non-flammable absorbent material (e.g. sand).
- The product is flammable. In case of fire, use adequate fire-extinguishing means (e.g. foam, water mist, extinguishing powders). Do not use water jets.
- Disposal of the used product must be made according to official regulations. Improper disposal of the used oil poses danger to the environment.

7.2. Gears

- **For Z-300(Slim); Z-301(Slim); Z-350(Slim); Z-351(Slim); Z-410; Z-440**

During daily maintenance, check the gearbox for oil leaks and stains that may indicate oil loss from the gearbox. In this situation, check the oil level and if it is low, top it up by removing plug **A** (**Fig. 30**) in the upper part of the gearbox (pouring it until it appears in point **B**). Plug **C** is used for draining the oil.

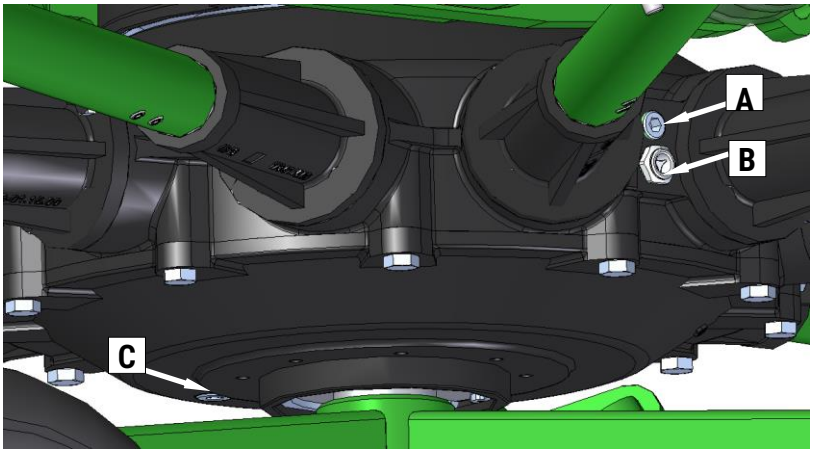


Fig. 30. Oil inspection points in gear

❑ **For Z-470**

Every 50 hours of rake's operation, pay attention to lubricating points **C** of the gear (**Fig. 31** operation with **ŁT43** (or other equivalent designed for lubricating bearings in temp. between -30°C and + 130°C).

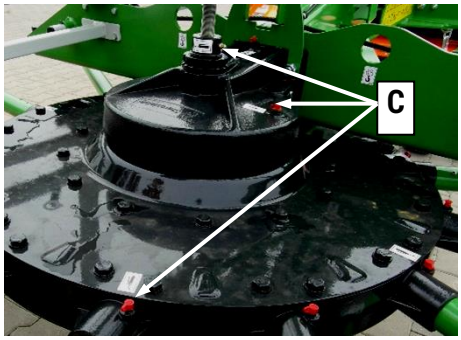


Fig. 31. Lubricating points of gear (for Z-470

Tab. 5. Oil capacities in gears

Model	Oil capacity[1]	Oil type
Z-300; Z-300 Slim	3,2	SAE80W/90 API GL-4
Z-301		
Z-350; Z-350 Slim		
Z-351; Z-351 Slim		
Z-410	5,7	
Z-440	8,3	
Z-470	–	–

7.3. Bearings and joints

Every 50 hours of operation, the bearings (**Fig. 32**) and the transport chassis (**Fig. 33**) must be lubricated with **LT43** grease (or other lubricant designed for lubricating rolling and sliding bearings, which are exposed to operating in temperatures between -30°C and +130°C).

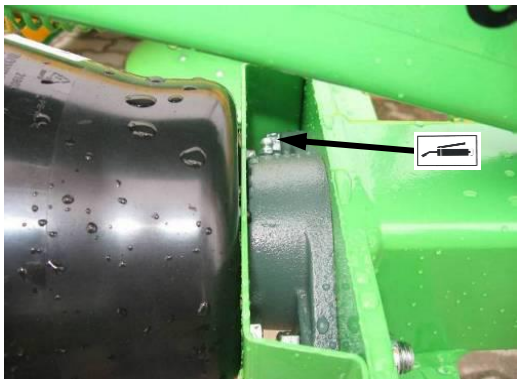


Fig. 32. Lubricating points of bearing

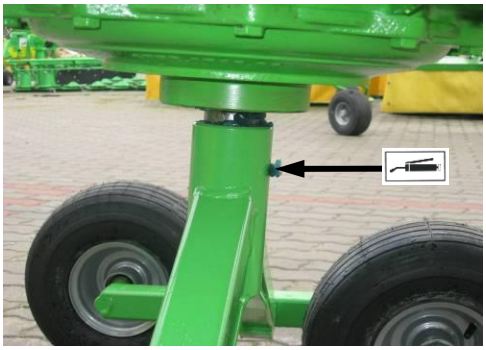


Fig. 33. Lubricating points of trolley

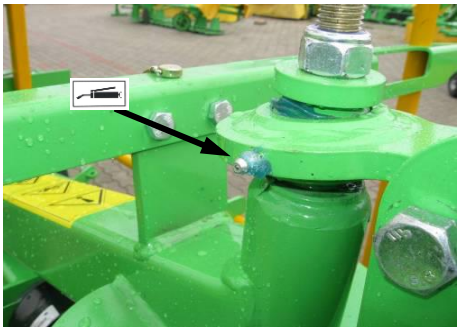


Fig. 34. Lubricating point of ball joint

8. DEFECT AND THEIR REPAIRS

Defect	Reason	Repair
The rake leaves most most part of the swath	Bent tines of the rake or lack of them	Exchange tines
	Too low rotation speed	Increase rpm
	Wrong height of operation	Regulate operation height according to point „Preparing the rake to work"
Excesive vibration during work	Damaged PTO shaft	Check the condition of PTO shaft and if need be replace
	Incomplete number of raking arms	Replace missing raking arms
Damaged raking tines	Raking arms set too low	Set raking height properly with adjusting crank or with trolley (Z-410, Z-470)
Oil leak in gear	Not tight assembly	Examine tightness and check oil level
The carousel gearbox jams / loud gearbox operation	Defective input shaft, damaged disc wheel in the gearbox	Replace damaged parts
	Damaged bearings	
	Improper oil quantity	Check the oil level
The gearbox does not rotate despite the transmission from the tractor	Damaged splined sleeve or drive shaft inside the frame	Replace damaged parts
	Defective input shaft, damaged disc wheel in the gearbox	
Unevenly worn tyres of the working unit wheels	Bent wheel axle	Replace damaged part
	Maneuvering on headlands with lowered rake	Lift the rake on headlands
Problem with raking height adjustment	Dirty or damaged special bolt	Clean the special bolt, replace it with a new one if damaged
	Blocked or unlubricated main pin of the gearbox	Remove the remaining dirt and then press in fresh grease
	Sheared safety pin of the special bolt plate	Fit a new pin and check for smooth adjustment
	It is recommended to lower the gearbox as much as possible at the end of the season	

9. DISASSEMBLY AND WITHDRAWAL FROM USE

9.1. Disassembly

CAUTION:
Before disassembly the rake should be disconnected from the tractor.

Before starting any repair or service the rake should be cleaned and any grass or dirt removed. Carefully check nuts and bolts for correct tension and the pins for wear. Replace as necessary.

The following operations are to be made once the machine is repaired:

- make sure that all elements are installed properly,
- install the dismounted guards,
- check whether screws and nuts are tightened,
- once all the guards are installed, perform a warm-up start in order to make sure the repaired machine operates properly.

9.2. Demontage and withgrawal from use

If the rake cannot be repaired anymore, it should be withdrawn from use.

For this purpose oil from intersecting axis gears should be drained and delivered to a proper waste treatment company. Clean rake's parts, dismantle and dispose properly of all plastic parts. After that, the rake could be sold to breaker's yard.

CAUTION:
When unhitching the machine pay particular attention to additional threat such as crush or cut. Special protective equipment must be used: gloves, protective clothing, glasses etc. Pay attention not to allow the machine lose its stability and therefore protect it with supports.

10. GUARANTEE TERMS AND CONDITIONS

10.1. Information on guarantee terms and conditions

SaMASZ Sp. z o.o. provides a manufacturer's guarantee on new machines in line with the rules described herein. The Guarantee starts on the day of purchase of the machine by final customer. The Guarantee consists in repair or replacement of a defective element or assembly of the machine free-of-charge.
If any negligence on the part of user is found during a repair, the Guarantor shall be entitled to apply to the Customer to cover part of the costs. SaMASZ Sp. z o.o. excludes a replacement of the machine as a whole under implementation of guarantee commitments.

10.2. General guarantee terms for new machines

1. The product has been checked, and found to comply with Technical Acceptance Conditions and is admitted for use.
2. The Manufacturer guarantees good quality and functionality of the product covered by this Guarantee.
3. The Guarantee for SaMASZ hay handling equipment is provided for a period of 24 months, and 12 months for other machinery.
4. The Guarantee for original SaMASZ spare parts is provided for a period of 12 months.
5. Parts, which the machine consists of, but are not manufactured by SaMASZ Sp. z o.o., i.e. tyres, PTO shafts, clutches, gears, engines, hydraulic cylinders, etc. are not covered by the Guarantee provided by SaMASZ Sp. z o.o., while guarantee of respective manufacturers of the above parts.
6. Any guarantee claims in regard of these parts shall be resolved following the same proceedings as those concerning parts produced by SaMASZ Sp. z o.o.. However, the decision will depend on guarantee terms and conditions of a respective manufacturer, and whether the latter finds such complaint reasonable.

7. Defects or damages of the machine found in the Guarantee period shall be removed free-of-charge at the Customer's site, or in a local Guarantor's Service Centre.
8. Guarantee period for the machine starts on the day of sale of the machine to the user.
9. Any revealed defects or damages shall be reported personally, by e-mail or phone or dealer's application. Complaints are considered within 14 days.
10. In the case of major damages of structural parts the Guarantor reserves the right to perform a repair in a longer period, which the Customer shall be notified on within 14 days.
11. The Purchaser shall bear the cost of technical evaluation if the Manufacturer finds that a complained about product is free of defects, damages or such damages occurred as a result of misuse and this is confirmed in expertise.
12. The Guarantor is entitled to render the guarantee null and void if the following are found:
    a. making changes in structure of the machine or intentional causing of damages,
    b. occurrence of extensive damages caused by random event or other occurrences for which the Guarantor cannot be held responsible,
    c. misuse of the machine or use of the machine not in accordance with instruction manual,
    d. the Manufacturer reserves the right to cancel the Guarantee Agreement due to gross negligence on the part of user of the equipment.
13. SaMASZ Sp. z o.o. cannot be held liable in case of lodging a complaint or in case of bodily damage by the owner of the equipment or a third party and therefore shall not be responsible for either case.
14. SaMASZ Sp. z o.o. declines all responsibility for damages related to loss of profits on business, loss of harvest, incomes due to loss of reputation, loss due to delay in works, expenses or losses incurred for labour, delivery of replacement machines or their rental; or other types of property losses or economic losses arising directly or indirectly from product.
15. The Company cannot be held responsible for damages of the machine and its equipment which occurred during transportation and reloading carried out by any carrier.
16. The Customer is obliged to deliver materials necessary to consider the complaint (photos, videos, machine characteristics, description, etc.) to the Manufacturer or distributor. In case no sufficient material can be delivered, the Guarantor is entitled to reject a guarantee claim.

10.3. Guarantee and post-guarantee repairs

1. Any inspections are chargeable, and the cost is incurred by the Purchaser.
2. Guarantee repairs do not include repairs caused by:
    a. misuse of the machine or use of the machine not in accordance with instruction manual,
    b. random events or other occurrences for which the Guarantor cannot be held responsible,
    c. destruction, flooding, damage or devastation caused as a result of intentional and unintentional action or ignorance of the user,
    d. damage of elements of the machine as a result of hydraulic system overload,
    e. damage of elements as a result of making own changes in structure of the machine,
    f. any mechanical damages, including: scratches, bends, deflections, cracks, cuts, rips, meltings, burns, blows, floods, etc. and defects caused by occurrence thereof,
    g. improper maintenance and storage of the machine,

h. failures and damages of machines caused by tampering with by third parties unauthorised to carry out repairs and modifications,

i. breakdowns caused by defective operation of cooperating or adjacent parts, which defectiveness the Customer was aware of or could have learned of easily,

j. wear parts subject to wear and tear with normal use in accordance with instruction manual, such as bearings, drive belts, conveyor belts, tyres, cutting blades with bolts, flail shafts, knives, blades, clutches, clutch disks, rake and harvester tines, skids, sliding sleeves, rubber cleaning bars, safety devices, safety curtains, safety guards, brake shoes, hydraulic hoses, electrical wires, working elements of conditioner, caps, seals, plugs, etc. are not covered by the Guarantee.

3. The Guarantee excludes oils, filters, lubricants.
4. Breakdowns or inspections should be notified by phone, e-mail or dealer's notification panel.
5. In order for a complaint to be considered as subject to Guarantee, it is required to provide serial number of the machine, photos, videos and detailed description of defect. If the description is supported by photo documentation, this will accelerate the complaint process.
6. If the complaint is not deemed legible, the Customer is entitled to request, within a period of up to 15 days counting from the date of the receipt of the decision, to have the damaged parts returned. Following this period parts are systematically disposed of.

NOTICES:

The Manufacturer reserves the right to make changes to structure of the machine. The Company reserves the right to make changes to own machines without prior notification and due to this fact the Company is not obliged to make such changes to machines already sold or in use.

SaMASZ Sp. z o.o. is working on further development of all machine types and models. Thus, at all times form, equipment and technology of the delivered products can change. No claims will be accepted based on data, images and descriptions contained in instruction manuals, website and catalogue of spare parts.

SaMASZ Sp. z o.o. is not responsible for printing errors.

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