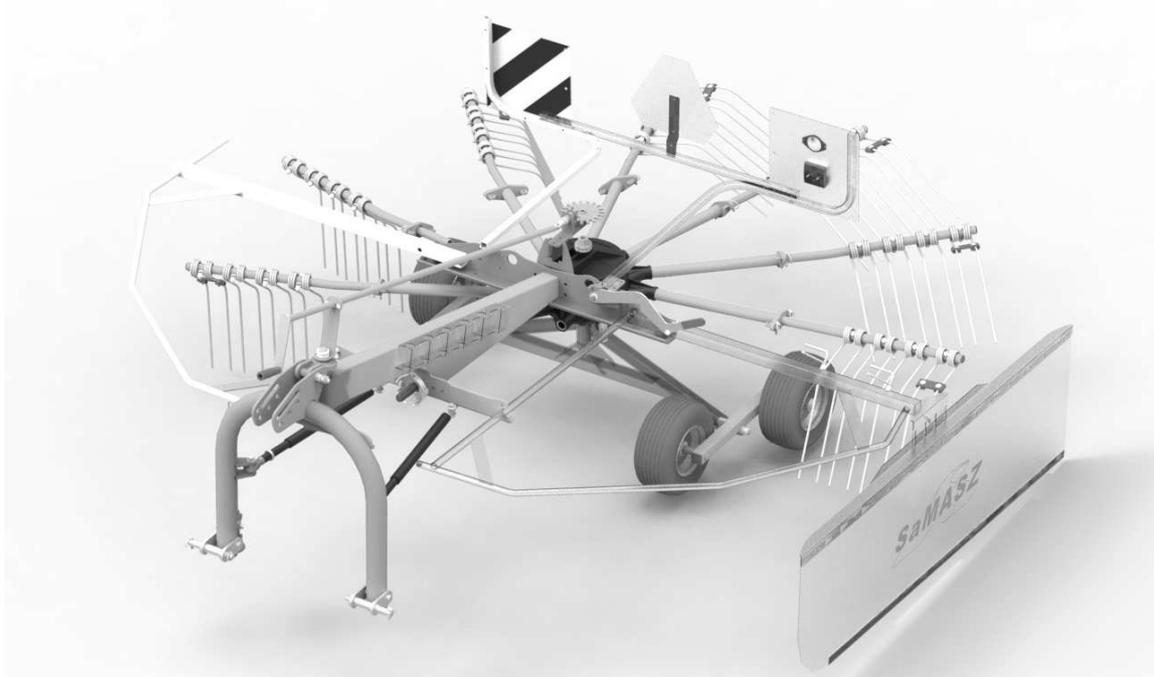




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OPERATOR'S MANUAL



ROTARY RAKE

Z-300 – 9' 10"

Z-300 Slim – 9' 10"

Z-301 – 9' 10"

Z-301 Slim – 9' 10"

Z-350 – 11' 6"

Z-350 Slim – 11' 6"

Z-351 – 11' 6"

Z-351 Slim – 11' 6"

Z-410 – 13' 5"

Z-440 – 14' 9"

Z-470 – 15' 5"

Serial No:

IN300USA011
2017.09.25
EDITION NO 11

Translation of original instructions



CAUTION:

Company SaMASZ is working constantly on development of all types and models. That is why, there is always a possible change of form, equipment and technology of delivered products. Any claims arising from data, drawings and descriptions included in this operator's manual and spare parts list cannot be laid.



CAUTION:

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



CAUTION:

The manufacturer reserves the right to introduce changes in construction.



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.



CAUTION:

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 location



Fig. 2. Data plate

Data plate includes:

- name and address 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.

2. INTRODUCTION

- ❑ This operator's manual is essential for safe and proper use of this rake and should be read before anyone operates this rake. It should be kept near the rake for future use. If the rake is used by another operator, it should be in working condition and include this operator's manual and all other basic equipment.
- ❑ Operator's manual is attached to every machine in order that the operator can familiarize himself with design, working principles, service and adjustment of the rake. The operator should be familiar with common safety rules and procedures.
- ❑ The rake is manufactured according to international safety rules.
- ❑ Compliance with the safety precautions in this operator's manual will help to enable safe operation.
- ❑ Please contact your dealer if you have any queries relating to the operation and service of the rake.

3. PROPER AND INTENDED USE

SaMASZ rotary rake is designed for raking forage, dry forage and hay. Rotary rake can only be used by persons who familiarized themselves 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 rake 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).



WARNING:

Use of the rake for purposes other than described above is forbidden. Improper use can be dangerous and may lead to voiding of the warranty. Rake should be operated and repaired only by people familiar with its detailed specifications and with all applicable safety rules and regulations and with the relative dangers. Unauthorized modifications to the rake will lead to voiding 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	9' 10"	9' 10"	11' 6"	11' 6"	13' 5"	14' 9"	15' 5"
Transport width	4' 11"	4' 11"	4' 11"	4' 11"	5' 3"	6' 11"	7' 7"
RPM [rpm]	300÷350						
Tractor'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
Wheel dunder rotors	15x6,00-6				16x6,50-8		
Recommended tire pressure [bar]	1,8						
Weight [lbs.]	683 / 617	805 / 694	750 / 706	893 / 728	1301	1653	1808
Noise level	L_{pA}						
	74,0 ± 3,0 dB						
	L_{Amax}						
	74,0 ± 3,0 dB						
	L_{Cpeak}						
	93,0 ± 3,0 dB						

L_{pA} – noise level related to 8 hour working time. Averaged in time acoustic pressure level corrected by frequency characteristic A.

L_{Amax} – maximum value corrected by frequency characteristic A of acoustic pressure level.

L_{Cpeak} – peak level of acoustic pressure corrected by frequency characteristic C.

3.2. Design and working principle

3-point linkage frame (7) enables attachment of the rake to tractor's 3-point linkage. Drive from tractor's rpm is transmitted by means of PTO shaft located inside the main frame of the rake on a rotor (2). The rotor has arms mounted (8), to which the tines are attached (9). The frame is equipped with safety guards (4). During transport on public roads arms are taken off and placed inside the holders (9). The levers (3) are used to adjust the raking height. The rake is equipped with a curtain (5) used for windrow forming.

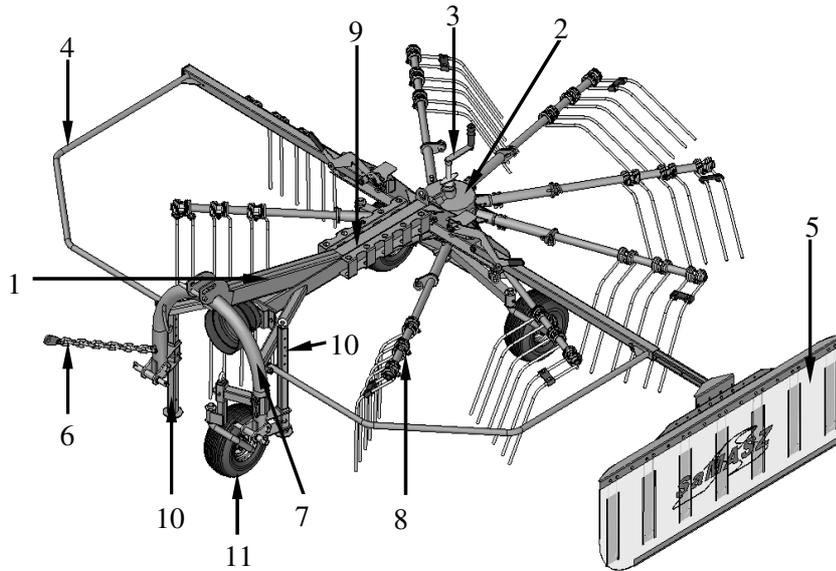


Fig. 3. Rotary rake Z-350

- | | |
|----------------------|--|
| 1 – Main frame | 6 – Support chain |
| 2 – Rotor | 7 – 3-point linkage frame |
| 3 – Adjustment lever | 8 – Arms with tines |
| 4 – Safety guard | 9 – Holder |
| 5 – Windrow curtain | 10 – Support legs |
| | 11 – Ground following wheel (optional) |

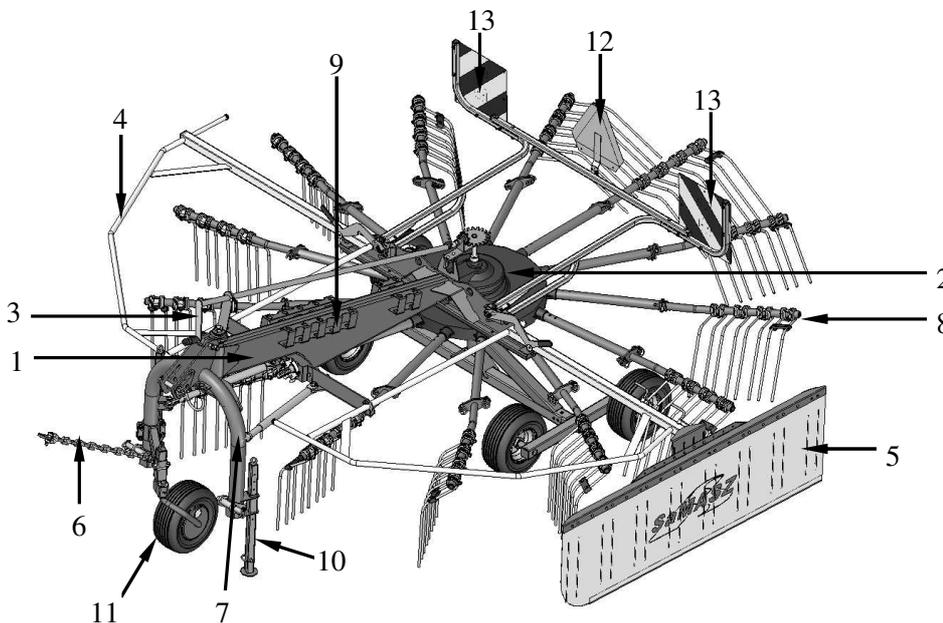


Fig. 4. Rotary rake Z-470

- | | | |
|----------------------|---------------------------|----------------------------------|
| 1 – Main frame | 5 – Windrow curtain | 9 – Holder |
| 2 – Rotor | 6 – Support chain | 10 – Support legs |
| 3 – Adjustment lever | 7 – 3-point linkage frame | 11 – Ground following wheel |
| 4 – Safety guard | 8 – Arms with tines | 12 – Warning triangle (optional) |
| | | 13 – Warning plates |

3.3. Standard equipment and spare parts

The rakes are sold with the following standard equipment:

- ❑ warranty card,
- ❑ operator's manual with spare parts list,
- ❑ PTO shaft,
- ❑ spray paint (150 ml).

Additional extra equipment:

- ❑ suport wheel for rakes (Z-300 – Z-440),
- ❑ drawbar for pulling the rakes on wheels.

Tab. 2. Recommended PTO shafts for rotary rakes

Model	Power	Length	Momentum	Symbol	Coupling	Remarks
	HP	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		910-1133		7G2N091CE0070E9TA		
Z-410 Z-440 Z-470	26	1110-1575	460	7G3N101CE0070F3A		

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

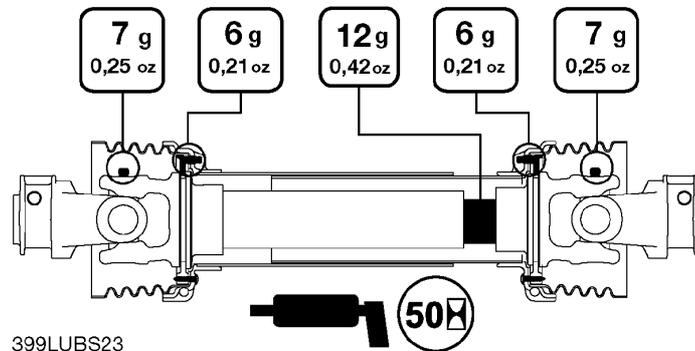


Fig. 5. PTO shaft 7G2N081CE0070E9A and 7G2N091CE0070E9TA lubrication points. Mounting directions

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

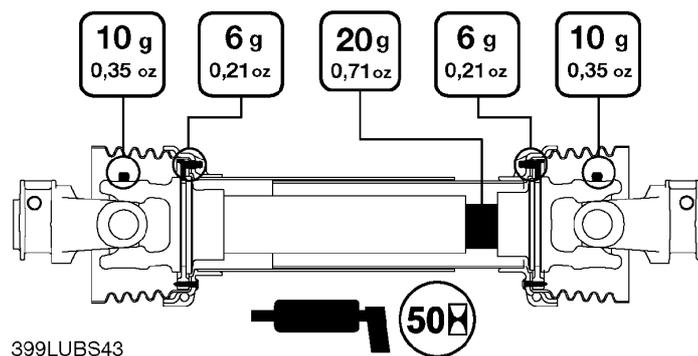


Fig. 6. PTO shaft 7G3N111CE0070F3A lubrication points. Mounting directions

**NOTE:**

Optional extra equipment should be ordered separately.

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

4. SAFETY PRECAUTIONS

**WARNING**

The following precautions are for your safety. They must be read carefully and followed by every person who operates or maintains the machine. Failure to follow these safety precautions could result in serious injury or death to the operator, maintenance person or bystanders and property damage to the machine and surrounding property.

Safety Signal Words

This manual and the safety labels attached to this equipment utilize signal words that signify safety hazards with different levels of severity. Below are the words used and the definitions for these words:

- **DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE** is used to address practices not related to physical injury.

4.1. General safety rules and regulations



The following descriptions are for your safety: They must therefore be read carefully and applied every time you use the machine.

- ❑ The machine has been designed for use by one single operator.
- ❑ When using, servicing, repairing, moving or storing the machine, the operator must wear safety footwear, safety gloves plus ear protection and dusk mask if necessary.
- ❑ During use, the machine may give rise to dust, especially if the soil is dry. You are advised to use a tractor with a cab fitted with filters in the ventilation system. Failing this, wear a dust mask with filter to protect your respiratory tract
- ❑ Front axis of the tractor should be weighted to keep the balance. If need be, use front wheel weights.
- ❑ In order to keep steering conditions, impact on front axis should be at least 20% of the complete tractor.
- ❑ Be extremely careful whenever using hydraulic lift lever or buttons. Any operation with hydraulic lift lever should be done from operator's seat; DO NOT move the lever from outside of a 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 raking to transport position, remove the entire PTO shaft or at least one end of the shaft from the tractor's PTO so it cannot turn.
- ❑ When attaching the rake to a tractor, the operator should wear protective gloves.

- ❑ DO NOT operate the rake unless all safety guards are in place and operational.
 - ❑ No person (except operator) should stand within danger area which is a minimum of 170' from any operating part, especially when operating near roads and in areas with stones and other debris. Be certain that children and animals are at a safe distance away from the machine.
- IMPORTANT:** Maintenance and adjustment should ONLY be done after the following has occurred:
- ❑ tractor's engine has been stopped and ignition key has been taken out,
 - ❑ all rotating parts have come to complete.
- ❑ Never tamper with or remove safety devices on the machine or make them inoperable.
 - ❑ Before starting work and periodically thereafter, replace any damaged, missing and/or worn tines.
 - ❑ When driving on public roads always comply with local traffic regulations, especially those concerning warning lights.
 - ❑ When the rake is lifted for repair on 3-point linkage, it should be secured against falling by mechanical support or by chain.
 - ❑ The bolts and other fasteners have to be periodically checked and, if necessary, tightened or replaced. DO NOT work with damaged or worn fasteners.
 - ❑ Never lift the rake on tractor linkage when the drive is operating and the rotors are in motion.
 - ❑ When operating the rake, the tractor should always be equipped with operator protection that is required by laws and regulations.
 - ❑ Before you start the tractor make sure that all drives are turned off and the levers that turn the hydraulics are in neutral position.
 - ❑ Never leave tractor's engine running without supervision. Before you leave the tractor, turn off the engine and remove the key from tractor's ignition.
 - ❑ DO NOT operate the rake when driving the tractor backwards.
 - ❑ Permissible inclination of the rake on a slope when working and during transport is 8°. Exceeding this incline can result in rake tipover.
 - ❑ Never stand between tractor and rake unless tractor and rake are secured against moving by the tractor's brake.
 - ❑ If any maintenance must be done under an elevated rake, it must be blocked or otherwise secured against falling.
 - ❑ When the parts of the rake need replacement, use only original spare parts as described in the spare parts list. Pay particular attention to PTO shaft's guards and rake's and tractor's spline shaft guards.
- Hydraulic hoses are potentially very dangerous. Do the following to minimize any hazards:
- ❑ Hydraulic hoses should be periodically checked and if any damage to the hoses have occurred or if they have been used more than 5 years, replace with new ones.
 - ❑ Never use scotch tape to repair hydraulic hoses.
 - ❑ When connecting hydraulic hoses to tractor's hydraulic connectors, make sure that the tractor's or rake's hydraulic system is not under pressure.
- ❑ The rake should be stored under a roof and in a way as to not be hazardous both people or animals.
 - ❑ In the event of an accident involving this rake in a field or on a road, follow all applicable first aid procedures and contact SaMASZ technical service.
 - ❑ Rake should be kept clean, so as to avoid danger of fire.
 - ❑ The operator is not allowed to leave the tractor while driving.

4.2. Conditions of mounting rake on tractor

- ❑ Prior to the mounting operation, be sure that the tractor and rake hitches are compatible and that the tractor's hitch load is adequate for the machine which is to be mounted or attached.
- ❑ Prior to mounting the machine, examine the technical condition of the rake's hitch assembly and tractor's 3-point linkage.
Use only genuine cotter pins to mount the rake on a tractor.

4.3. Transport

The lifting, handling and transporting operations can be very dangerous unless they are carried out with the utmost caution. Have all persons not involved in the actual work move away from the area and limit the zone where the operations are to be carried out. Also make sure that the area in which the operations take place is clear and that there is a sufficient escape route, i.e. a free, safe zone to which the operators can quickly move if the load should fall.

The safety hooks and ropes used to lift the machine must be of an adequate carrying capacity

To minimize the risk of serious injury or death, do the following:

- ❑ When the machine is converted from the transport position to the work position and vice versa, you could be pinched or crushed by some of its parts. Take extra care when carrying out these maneuvers and have all persons keep well clear of the danger zone.
- ❑ Do not change position of the rake until there are no people or animals around (pay particular attention to children).
- ❑ While transporting the rake, put a warning plate with combined lights and reflectors and warning triangle on the rake.
- ❑ During transport, always put the rake in its proper and safe transport position. See section 5.2.
- ❑ Before putting the rake in transport position, make sure that the tractor's PTO is turned off and all rotating parts have come to a complete stop.
- ❑ Do not drive over 25 km/h (15 mph). Drive slower if road conditions are poor, especially on irregular surfaces or steep slopes.
- ❑ The behavior of the tractor on the road, such as its turning and braking capacities, are affected by the implements mounted.
- ❑ When driving on the road after work, check to make sure that the tires and soil working tools are clean to prevent the road surface from becoming dirty.
- ❑ Make sure that the machine is not damaged during transport.

4.3.1. Putting the rake onto another vehicle for transport

The driver and the carrier are responsible for the rake's transport safety. Equipment and parts must be secured during transport. To put the rake onto another vehicle in a safe way, please obey the following rules.

- ❑ Transport should be done by qualified and specifically trained personnel,
- ❑ Grab the rake by any lifting devices only in places indicated by hook sign,
- ❑ For rake lifting, use only lifting devices with hoisting capacity larger than rake's weight shown in data plate. This also applies to ropes and chains used for lifting,
- ❑ Do not lift if transport belts, belt suspensions, ropes are damaged. Whenever damage to these parts occurs, replace with new ones,
- ❑ When mounting slings, chains, handles etc., always set the machine's center of gravity properly,
- ❑ To safely support the machine, use 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°,
- ❑ Lift the machine with the utmost caution and move it slowly
- ❑ No one should be within the range of action of the lifting equipment when any transporting operations are being carried out,

- ❑ Collapsible parts should be blocked in transport position,
- ❑ When the rake is on the vehicle's trailer, the machine should be secured against moving.

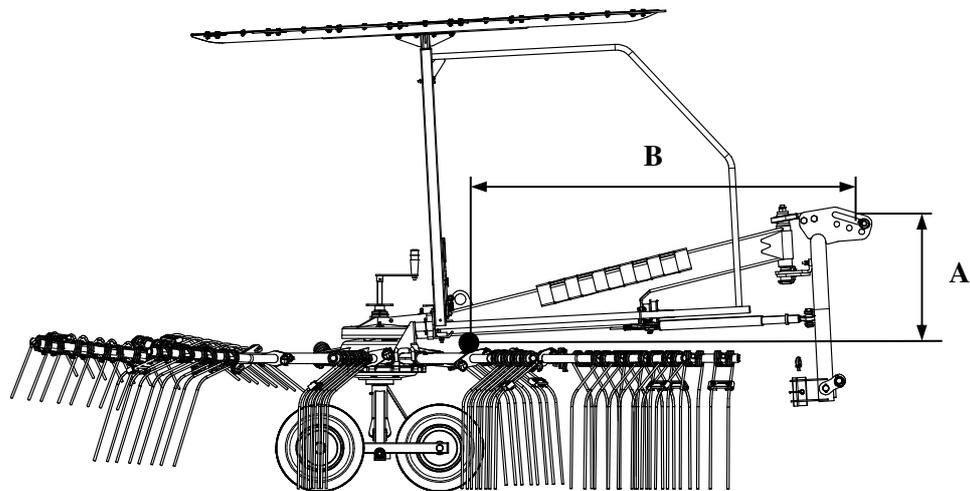


Fig. 7. Location of center of gravity

Tab. 3. Location of center of gravity on rakes

Dimension [ft, in]	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	1' 1" / 1' 6"	1' 10" / 1' 9"	1' / 1"	1' 9" / 1' 7"	1' 7"	1' 10"	1' 8"
B	4' 4" / 4' 5"	5' 5" / 5' 1"	4' 8" / 4' 7"	5' 4" / 5' 1"	5' 10"	6'	6' 5"

4.4. Working parts

- ❑ Before operating the rake check tine's condition.
- ❑ Worn or damaged tines should be immediately replaced with new ones.

4.5. PTO shaft

- ❑ Before operating, read bar manufacturer's manual placed on the bar. Follow all safety precautions in that manual.
- ❑ Use only PTO shafts recommended by rake's manufacturer.
- ❑ In order to operate safely, use only undamaged PTO shafts and shields. Damaged PTO shafts and shields must be repaired or replaced with new ones before use.

4.6. Residual risk

Despite the fact that SaMASZ Białystok, the manufacturer of the rake, has taken great care in the design and manufacturing of the rake, certain risks during rake operation and maintenance are unavoidable. A major source of risk that could result in serious injury or death can occur during the performance of these operations.

Major source of risk follows performance of these operations:

- ❑ operation of rake by minors
- ❑ operation by individuals who have not read the operator's manual and safety labels,
- ❑ operation of rake by persons under influence of alcohol or other substances,
- ❑ not keeping caution while transportation and shifting of rake during operation,
- ❑ transport of persons who are on the machine,
- ❑ presence of persons and animals within the rake operation range,
- ❑ performing servicing and machine adjustments with the engine on.

4.6.1. Danger of machine entanglement

This risk occurs when (1) changing position of a rake, (2) operating near rotating parts, and (3) working without safety guards. During operation, maintenance and adjustment, always wear protective gloves, shoes and clothes without loose parts, belts and so on. Always comply with safety labels placed on the rake.

4.6.2. Danger of cutting injury

This risk occurs during replacement of working parts with sharp edges. During any maintenance work, always use safety gloves.

4.6.3. Forbidden actions

During rake's operation, do not do the following:

- never unblock the rake, make any regulations or repairs of the rake while it is in motion,
- never change order of operation and maintenance activities described in operator's manual,
- never operate the rake when it is not in working order or has damaged safety guards,
- never get your hands and legs close to rotating parts of the rake,
- during repair and maintenance of the rake, always comply with descriptions included in operator's manual. Always do these activities when the tractor's drive is off,
- never operate the rake under influence of alcohol, drugs, or strong medicine that impair your attention,
- do not wear clothes or jewelry that are too loose or too tight. Too loose clothing or jewelry may be pulled in by the rotating parts of the rake,
- the rake should not be operated by children or by handicapped people.

When describing residual risk, the rake complies with the state of the art in technology on the date it was manufactured.

4.6.4. Residual risk assessment

Residual risk occurs from not complying with the instructions and safety precautions. Such risk can be minimized by doing the following:

- thorough familiarizing yourself with operator's manual,
- allow no persons on the machine when operating,
- allow no persons within the rake operation range,
- adjust, maintain and lubricate the machine with the engine off,
- only skilled persons should perform repairs of the machine,
- children and strangers must keep away when the machine is operating,



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

- 1) provide the operator with individual means of noise protection if the noise level in work place exceeds 80 dB.
- 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.

4.7. Safety decals and their meaning

Safety labels are critical to safe use of this rake. They must be read, understood and followed. Also, be sure that:

All warning decals are clean and legible

All lost or damaged decals are replaced by ordering new decals from your dealer or supplier

All persons using this rake have read the section of this manual explaining the meanings of these labels

All spare part used for repair of the rake should have all safety labels provided by the manufacturer.



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!



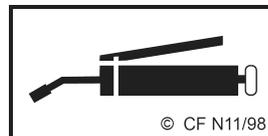
N-06

Caution – rotating parts



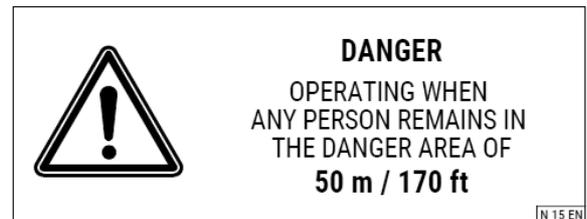
N-07

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



N-11

Lubrication point



N-15



N-40

Transport hook for lifting of the rake



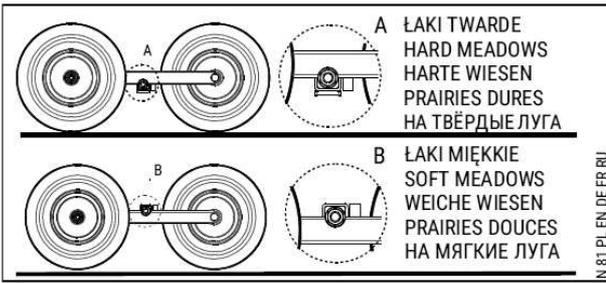
N-49

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



N-50

Do not get under the rake



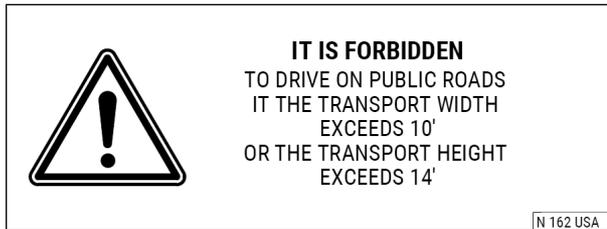
N-81

(For: Z-351, Z-410, Z-440, Z-470)



N-124

PTO rotation direction



Z-162

(For: Z-410, Z-440, Z-470)



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



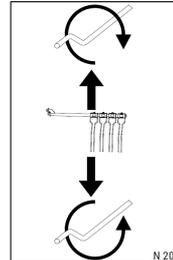
N-183

Attention: danger of legs dragging



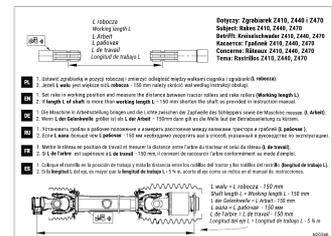
N-196

Recommended tire pressure



N-200

Raking height adjustment
(For: Z-410, Z-440, Z-470)



N-203

(For: Z-410, Z-440, Z-470)



N-204



N-206

Use the required Personal Protective Equipment

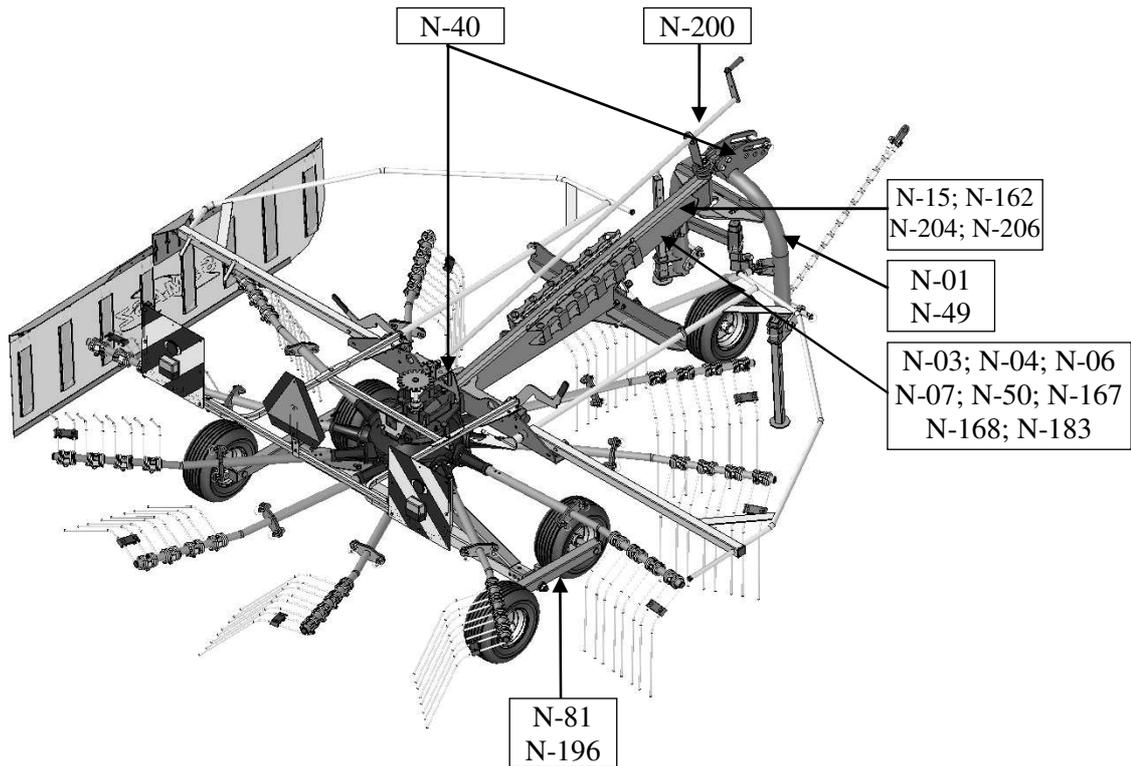


Fig. 8. Warning decals placed on the rake

5. OPERATION

WARNING:



Before beginning to use this machine, do the following:

- Read manual, especially safety precautions in section 4.
- Make sure you are familiar with all controls and functions.
- Make sure all safety devices are in place and working. Fix or replace if not working or damaged.
- Replace protective cover if damaged.

5.1. Attaching the rake to the tractor

a) 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 on **Fig. 9**. Hangers **W** of the tractor's lower links should be placed on pins (**Fig. 9**) 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**.

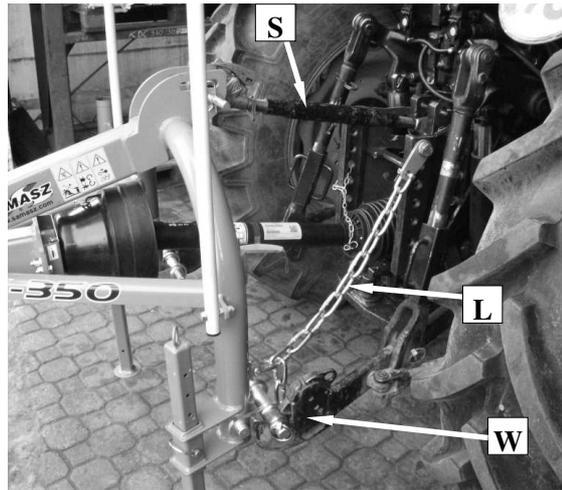


Fig. 9. Connecting the rake Z-350 to the tractor

b) For rakes Z-301, 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**.

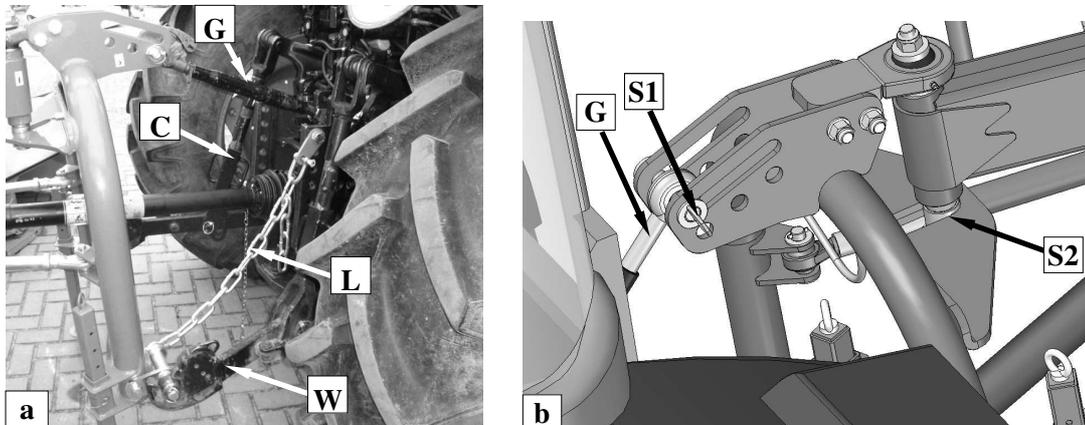


Fig. 10. Connecting the rake to the tractor

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 (rake 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 for transport

To prepare the rake for 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-most 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 1' 8" above the ground,
- lift and secure support legs (10) (Fig. 3).



Fig. 11. Rotary rake in transport position

CAUTION:

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-301 Slim, Z-351, Z-351 Slim, Z-410, Z-440 and Z-470 can also be transported upon dismantling 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 dismantled only)



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



NOTICE:

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



NOTICE:

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

5.3. Transporting rakes aggregated with tractor by means of tiller (option) (for: Z-410, Z-440 and Z-470)

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



NOTICE:

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



WARNING:

Legal requirements for transport on public roads may differ from state to state. Check your location's requirements and comply.

To comply with safety precautions concerning transport on the public roads the rake should be equipped with the following devices:

- portable warning light plates to be mounted on both sides of rake top guard in their holders. The panel consists of warning plate with combined lamp mounted (parking, stop lights and driving direction) and with red reflectors facing the rear and white light on the front.

5.5. Mounting PTO shaft

Prior to operating, 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.

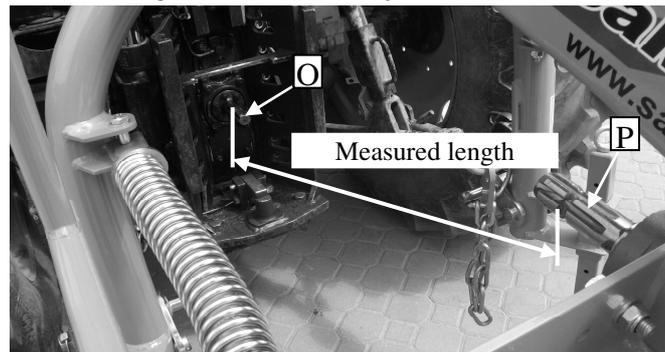


Fig. 16. Distance between tractor's PTO shaft and machine's drive shaft

In order to determine minimal shaft length:

- set aggregated rake 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 5.9" 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.

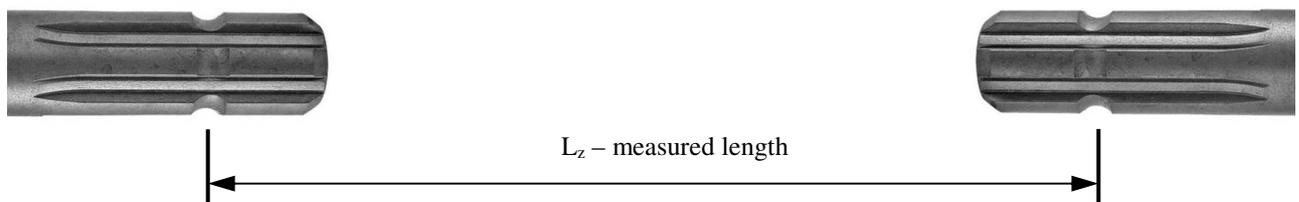


Fig. 17. Properly measured length

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

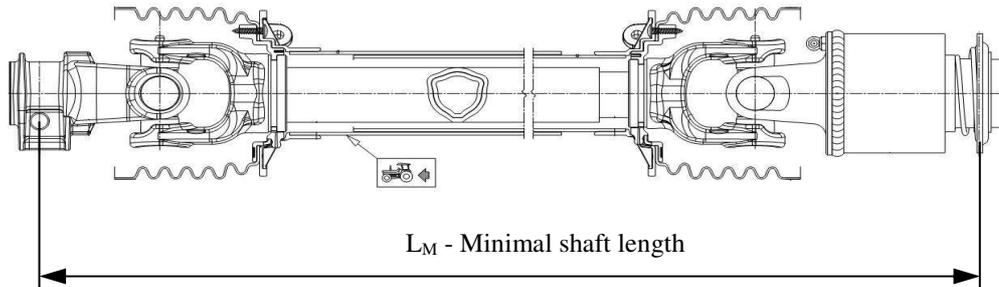


Fig. 18. Properly measured shaft length
 $L_M = L_Z - 5.9''$



CAUTION:

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°.



CAUTION:

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.



NOTICE:

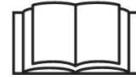
If need be, shorten the PTO shaft according to its operator's manual given by the shaft's manufacturer (**Fig. 19**).









2 Shorten the drive tubes by the required length. Telescoping tubes must always overlap by at least 1/2 of their length in normal operation and at least 1/3 of their length in all working conditions. During maneuvers, when the driveline is not rotating, the telescoping tubes must have a suitable overlap to maintain the tubes aligned and allow them to slide freely.

3 Carefully deburr the ends of the tubes with a file and remove all filings from the tubes.



Fig. 19. Instruction of PTO shaft shortening



CAUTION:

Handle all parts with utmost care. Never place your hands or fingers between one part and the other. Wear safety clothes such as gloves, protective footwear and goggles. The operation of shortening must be carried out with the utmost care as the PTO shaft will have to be replaced if the telescopic shafts are shortened to an excessive extent.

**CAUTION:**

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

**NOTICE:**

The manufacturer declines all liability for damage caused by an incorrectly fitted or used PTO shaft.

**CAUTION:**

Use the machines with PTO shafts designed to drive them. Before the work begins, check the safety guards (in tractor, rake and PTO shaft), if they are placed correctly and are not damaged. Damaged or lost parts must be replaced with genuine ones. Make sure the PTO shaft is properly mounted. It is forbidden to approach the rotating parts, because it may lead to serious injuries or even death. All service and repair operations must be done only after the tractor engine has been stopped and ignition key off, all rotating parts have come to the complete stop. Before the operation begins, read operator's manuals of both the machine and PTO shaft.

5.6. Moving from transport to working position

**WARNING:**

Moving the rake to and from operating position from the transport position should only take place on even and stable ground. Prior to making the moves make sure whether there are no unauthorized persons exposed to any hazardous moving parts.

To safely move to the operating position, do the following:

- ❑ make sure there is nobody in the place where you are going to lower the rake,
- ❑ using hydraulic lifting lower arms of the rake as slow as possible 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 to required 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** on the other one (**Fig. 20a**),
- ❑ it is allowable to set the machine as shown on **Fig. 20b** on an even ground. When operating 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,

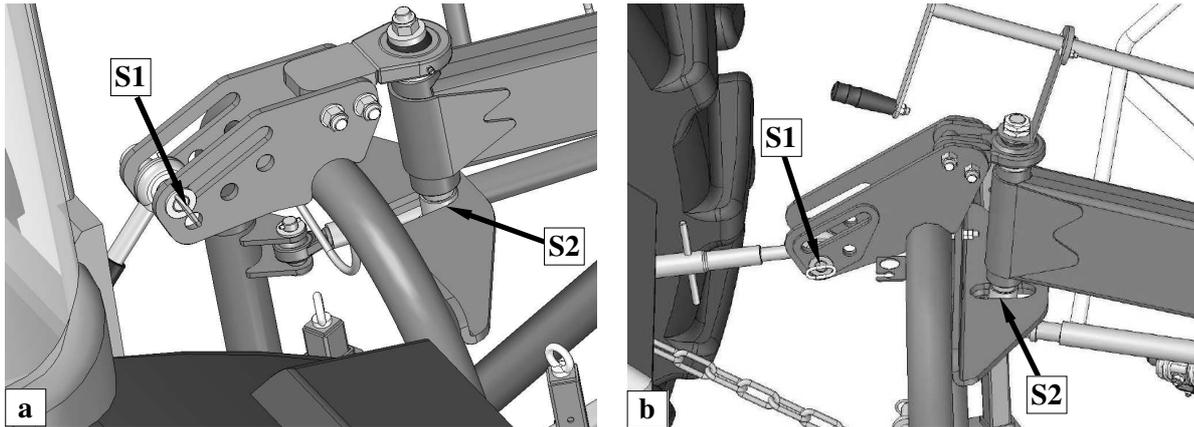


Fig. 20. Recommended rake setting – a) under normal operating conditions, b) when operating on an even ground

- 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).

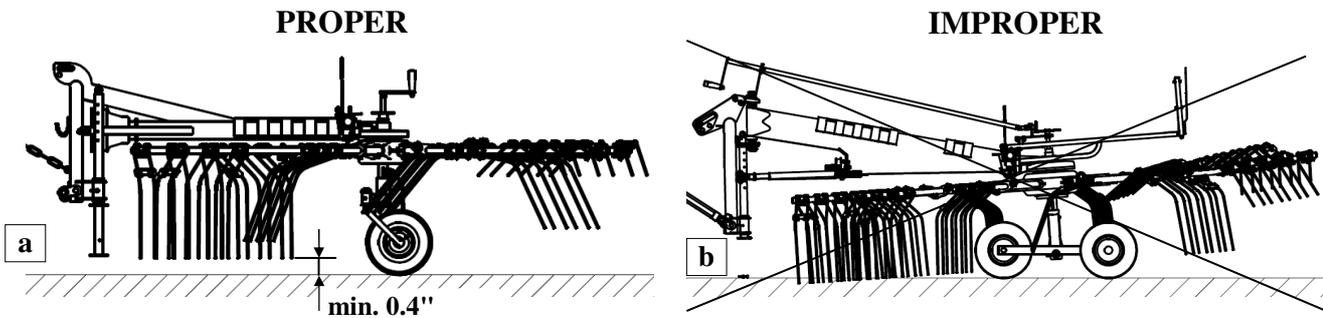


Fig. 21. Rakes in working position – a) proper; b) improper

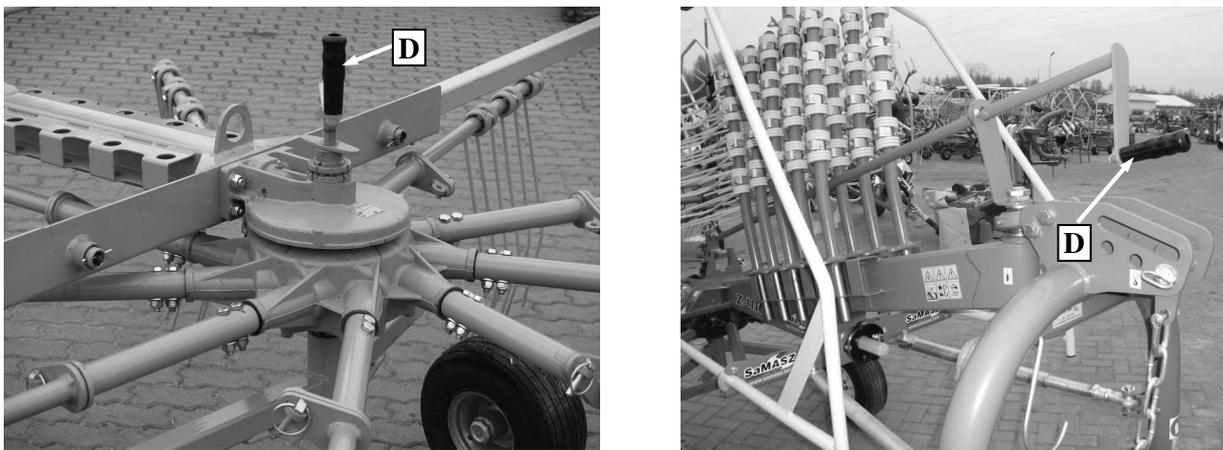


Fig. 22. Working height adjustment lever



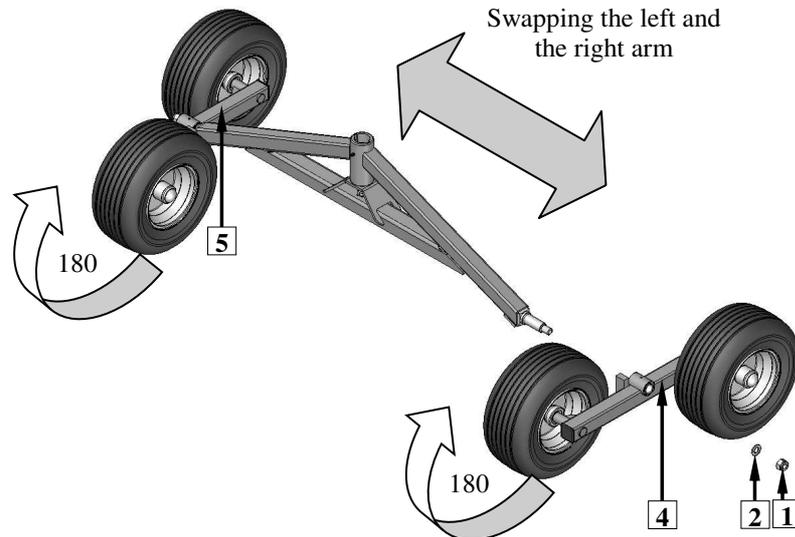
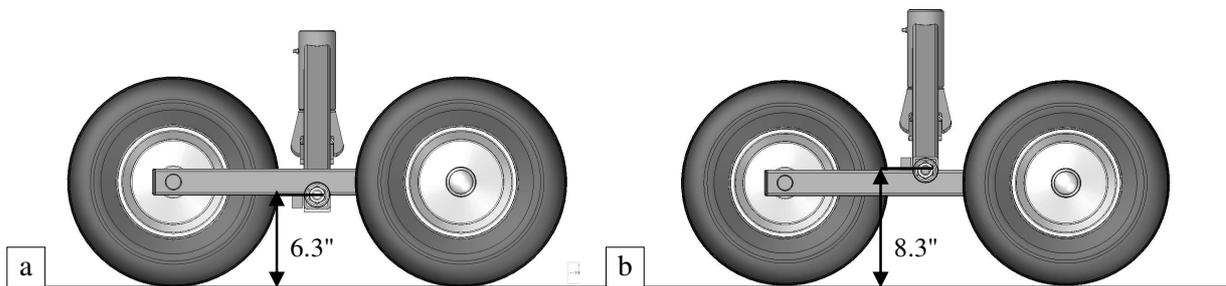
CAUTION!

It is forbidden to lower raking arms below the level of 0.4" 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!

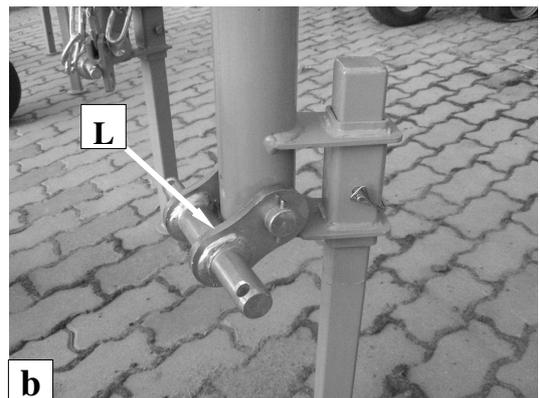
The raking arms' height should be controlled on an on-going basis while operating the machine, and if need be, adjusted. Adjustments are performed with tractor's drive off.

- for peat meadows it is possible 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 swap them (Fig. 23),


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

Fig. 24. Trolley's height with a) normal setting, 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 rake

5.8. Operation

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

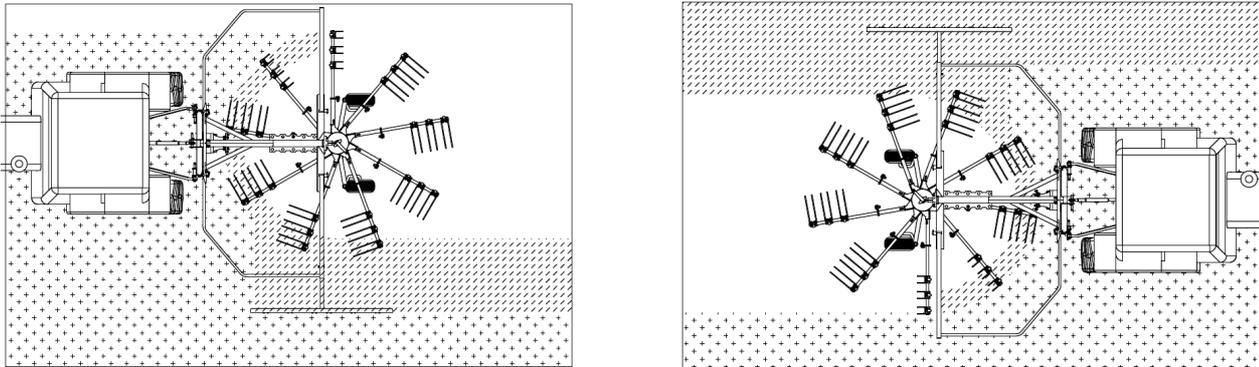


Fig. 26. Proper operation rotary rake



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 of the rake

In order to avoid clogging, raking speed should be adjusted so as to match the mentioned conditions. In order to remove the machine clogging, lower the rotor onto the ground, disconnect the drive, take ignition key off and pay particular attention. When eliminating the machine clogging, the operator should use protective gloves and tight wear.

5.10. Unmounting machine from tractor



CAUTION:

When unmounting, make sure there is no person in between the rake and the tractor.

To unmount the rake from the tractor:

- Set the machine onto an even, stable ground,
- Support the machine with the support legs and protect with safety pin,
- Turn the tractor's ignition off and take the key out,
- Protect the tractor against free runaway,
- Dismount the PTO shaft and place it on a PTO shaft holder, which is standard-delivered with the machine,
- Detach the machine from the tractor.

6. MOUNTING AND ADJUSTMENTS

6.1. Mounting and timing of the tines

The tines should be mounted as shown in **Fig. 27**.

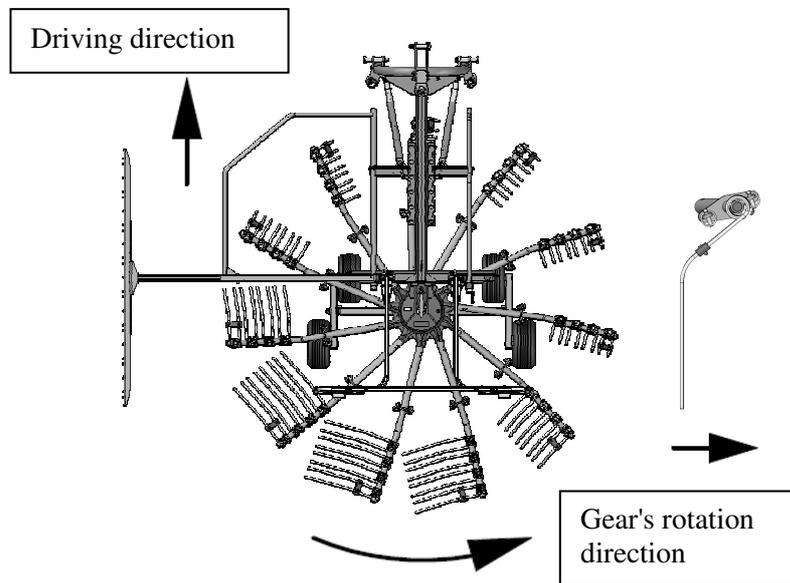


Fig. 27. Mounting of rake's tines



WARNING:

Use only the tines recommended by the manufacturer. Check condition of tines before each operation. Worn or damaged tines should be replaced immediately.



CAUTION:

Mount and dismount rake tines only if the drive is off and engine shut down and ignition key out.

6.2. 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 raking 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.

6.3. Daily maintenance

Everyday after work please do the following:

- check all visible parts and components and their connections; tighten all loose bolts and nuts and replace all damaged and/or worn parts with new genuine ones,
- clean the rake,
- remove grass and mud,
- check rotor's condition,
- grease PTO shaft tubes with STP grease,
- if necessary, lubricate the parts and units according to lubrication instructions (chapter 7).

Parts which may cause risk to operator's health and safety are as follows: missing or damaged safety covers, PTO shaft guides, worn or missing tines.

**WARNING!**

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

6.4. After-season maintenance and storing

At the end of the season the following shall be performed:

- clean, wash and dry the rake,
- 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 are present, remove them immediately,
- periodically check the rake and secure the moving parts with grease to prevent the rake from corrosion of internal mechanisms such as gear wheels, bearings, or shafts, and cause breakdowns.

Rake should be stored in standstill position so it is supported onto protected support legs. It is recommended to store the set on paved ground, preferably in roofed places, inaccessible to unauthorized personnel or animals. If the machine is exposed to weather conditions, apply lubrication regularly.

If the machine is stored for a long period of time before first operation, its technical condition should be examined. Paint the area where the paint is missing.

**NOTICE:**

It is recommended for the operator to wear protective gloves when performing maintenance works.

**CAUTION!**

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

**CAUTION!**

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

6.4.1. Restarting the machine after longer storing periods

After longer storing period do the following:

- Make sure that all nuts and screws are tightened with correct torque,
- Make sure that all guards are installed in place,
- Lubricate the whole machine,
- Check pressure in tires.

Tab. 4. Torque values for bolts

A	6.8		8.8		10.9		12.9		
	Maximum torque								
	Ib-ft	Nm	Ib-ft	Nm	Ib-ft	Nm	Ib-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	

In the absence of specific torque values, the following chart can be used as a guide to the maximum safe torque for a particular size and grade of fastener. There is no torque difference for fine or coarse threads. Torque values are based on clean, dry threads. Reduce value by 10% if threads are oiled before assembly.

7. LUBRICATION

7.1. Gearbox

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

Oil level is inspected when the gear is situated horizontally by check opening **B**. If the oil level is too low refill the oil until it is visible in hole **A** (Błąd! Nie można odnaleźć źródła odwołania.). To drain the oil use plug underneath the gear.

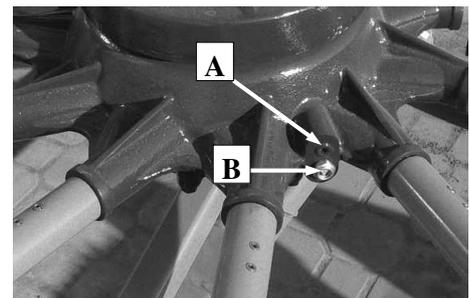


Fig. 28. Oil inspection points in gear

- For Z-470

Every 50 hours of rake's operation, pay attention to lubricating points **C** of the gear (**Fig. 29**).

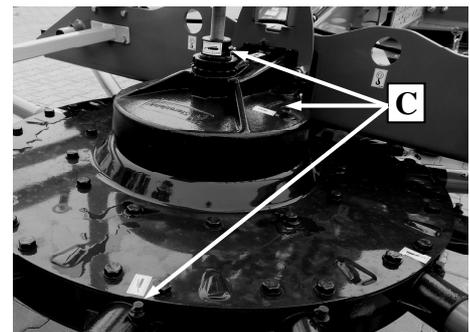


Fig. 29. Lubricating points of gear for Z-470)

Tab. 5. Oil capacities

Model	Oil capacity[l]	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	6,3	
Z 440	8,3	
Z 470	–	–

7.2. Joints

Every 50 hours of rake's operation, make sure to lubricate bearing beds (**Fig. 30a**), points **D** and **E** of the gear (**Fig. 30b**) and trolley (**Fig. 31**) with grease **LT43** (or other lubricant designed for lubricating rolling and sliding bearings, which are exposed to operating in temperatures between -30°C and +130°C).

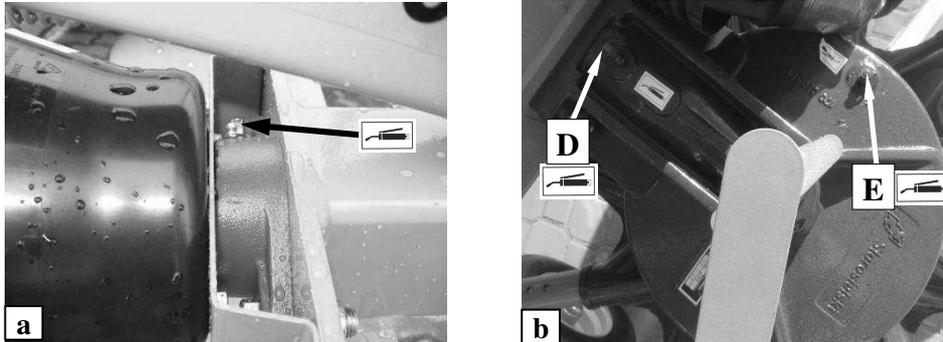


Fig. 30. Lubricating points of a) bearing and b) gear

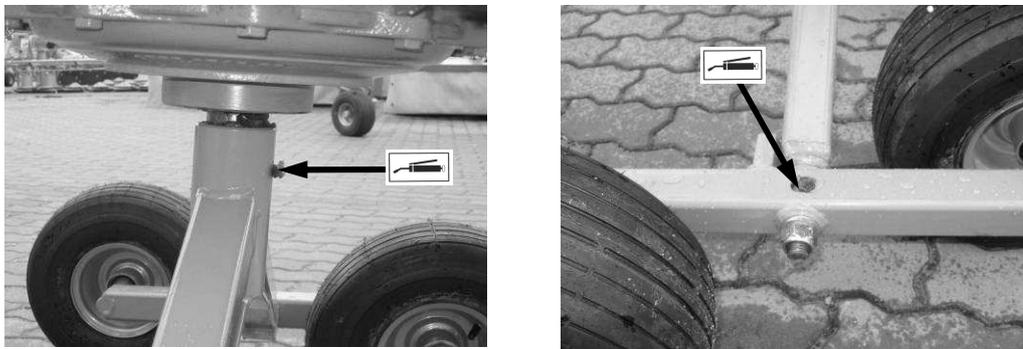


Fig. 31. Lubricating points of trolley

Every 50 hours of rake's operation, make sure to lubricate joint (**Fig. 32**) with STP lubricant.

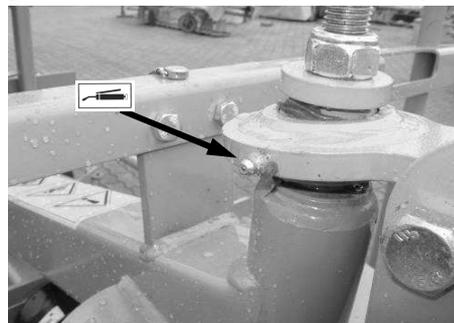


Fig. 32. Lubricating point of ball joint

7.3. 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 soap water.
- ❑ 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.

8. MALFUNCTIONS AND THEIR REPAIRS

Defect	Reason	Repair
The rake leaves major part of the swath	Lack or bent raking tines	Replace tines
	Too low rotation speed	Increase rpm
	Improper working height	Adjust operation height according to section 5.7. „Preparing the rake for work”
Excessive vibrations during work	Damaged PTO shaft	Check the condition of PTO shaft and if need be replace
Damaged raking tines	Raking arms set too low	Set the raking height properly with adjustment lever or trolley (Z-410, Z-470)
Contamination of raked swath	Raking tines immersed too deep	Set larger distance between raking arms and the ground
	Twisted raking tines	Replace with new ones
Oil leak in gear	Gear is not tight	Examine tightness and check oil level.

9. DISASSEMBLY AND WITHDRAWAL FROM USE

9.1. Scrapping

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

To do so, oil from intersecting axis gear and cutterbar should be drained and delivered to a proper waste treatment company. Clean the rake parts, dismantle and dispose properly of all plastic parts. After that, the rake can be scrapped.

10. WARRANTY CARD

ROTARY RAKE

Serial number
 Date of manufacture
 Manufacturer's stamp
 QC signature

Date of purchase
 Dealer's stamp
 Dealer's signature

The product quality has been checked and meets required standards and regulations and is permitted for use.

NOTE: A warranty card without the required information or with corrected or illegible information – **is invalid.**

11. WARRANTY TERMS

11.1. Warranty claims procedures

1. The manufacturer guarantees its products against faults in materials or production.
2. The warranty period is for two years from the date of sale to the purchaser, stated above.
3. Any repair which is subject to warranty should be carried out by an authorised SaMASZ dealer. Upon completion of the repair the dealer must submit a warranty claim within 14 days.
4. Warranty claims regarding replacing of the product or repayment are considered within 14 days by the manufacturer.
5. The following cases are not covered by warranty:
 - a) **wearing parts: cutting plates, sliding skids, intersecting axis gears and parts inside the gearboxes, bushings and sliding elements, clutches, joints, knife holder, cutting knives, V-belts, sprockets, drive chain, conditioner's tines and rollers, roller conditioner's rubbers, bearings, rubber-metal fenders, safety curtains, conveyor's belts, swath guides rubbers, connective elements, etc.**
 - b) **use for any other purpose than those described in the operator's manual,**
 - c) **operation on stoney fields and results such as: damage of tines,**
 - d) **running into any obstacle,**
 - e) **too fast lowering of the machine to the ground,**
 - f) **transport and accidental damage,**
 - g) **setting raking tines lower than 0.4" above the ground,**
 - h) **using PTO shaft featuring parameters other than provided by the shaft's manufacturer, or length not adjusted to operating tractor,**
 - i) **bending or breaking transmission connecting rod,**
 - j) **wearing parts: intersecting axis gears and parts inside the gearboxes, bushings and sliding elements, arms with tines, rubber-metal fenders, safety curtains, tires, connective elements, cogs and gear pinion etc.**
6. The Purchaser bears the costs of technical evaluation - when the manufacturer finds that a claimed product is free of defects and a technical report confirms that.
7. The manufacturer has the right to cancel a warranty in the following cases:
 - a) **interference inside the rake, changes of its mechanical design or intentional damages, bending parts of the rake and so on,**
 - b) **damage caused by accidents, running into obstacles or other events, for which the warrantor is not responsible,**
 - c) **negligent maintenance,**
 - d) **use of non-genuine spare or replacement parts that are not specifically designed for the model in question**
 - e) **lack of needed records in the warranty card or filling in the warranty card independently,**
 - f) **use of the rake not in accordance with operator's manual or for incorrect purpose, or use of the machine by untrained persons.**
8. Manufacturer can break the service agreement with immediate effect when the user do not pay receivables according to that agreement in a timely manner and the delay in payment is longer than 30 days from maturity date. Breaking the service agreement caused by the user makes simultaneous breaching of the warranty.

NOTE:

Please ask your dealer to complete and return the warranty card, otherwise you may lose your warranty rights.

The warranty card is valid only when it contains the following information: address, date and place of purchase, rake type and invoice number.

11.2. Warranty repairs record

Repairs description and changed spare parts:

Date, stamp and signature of repair shop.

Date, stamp and signature of repair shop.

Date, stamp and signature of repair shop.
