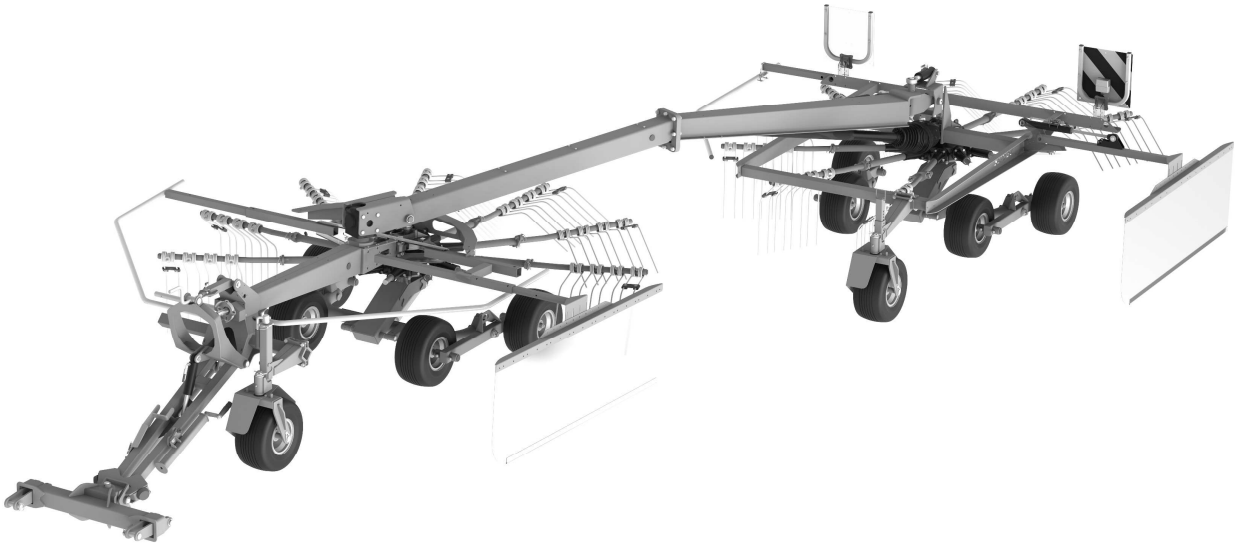
SaMASZ Sp. z o.o.
Poland, 16-060 Zabłudów, ul. Trawiasta 1
Established – 1984

NIP PL-966-159-29-76
tel. (+48) (85) 664 70 31
fax (+48) (85) 664 70 41
e-mail: samasz@samasz.pl
www.samasz.pl

OPERATOR'S MANUAL



TWO-ROTOR IN-LINE RAKE

DUO 680
DUO 740

Serial number

IN306USA002
2017.08.28
EDITION No. 2

Translation of the manual

CAUTION:
It is forbidden to turn on rake drive before moving the machine into its working position.

NOTE:
The manufacturer reserves the right to introduce modifications at any time, and without notice.

NOTE:
Any repairs of the rake's components bent after having been hit by obstacles or stones are done on extra charge.

WARNING:
Do not lift the rake before its working units have come to a complete standstill.

CAUTION:
Do not operate the rake when any person remains in the danger area of 170'.

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 in **Fig. 1.**

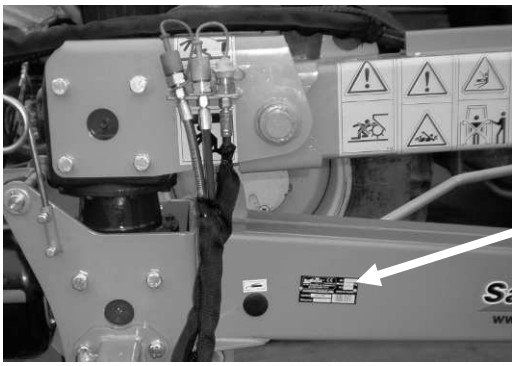


Fig. 1. Data plate location

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.

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.
- 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.
- Please contact your dealer if you have any queries relating to the operation and service of the rake.

3. PROPER AND INTENDED USE

In-line rake **DUO** is designed to rake green forage, dried forage and hay. The 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.

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. Specification of two-rotor rake

Model:	**DUO 680**	**DUO 740**
Working width [ft. in]	17' 1"–20' 1"	18' –21' 1"
Rotor diameter [ft. in]	10' 2"	10' 6"
Transport width (max.) [ft. in]	9' 10"	8' 6"
Transport width (min.) [ft. in]	5' 11"	8' 6"
Admissible transport speed	25 km/h / 15 mph	
Height in working position	4' 9"	
Transport height [ft. in]	8' 6"	8' 6"
Transport length [ft. in]	28' 7"	29' 6"
Tractor's PTO rpm	540 rpm	
Recommended drive's rotating speed	**350-450 rpm**	
Power demand	37kW/50 HP	59kW/80 HP
Working capacity	~ 5 – 6.5 ha/h	~ 8.0 ha/h
Rotor count	2 pcs	2 pcs
Rotor arm count	2 x 11 pcs	2 x 11 pcs
Axis on rotors	Tandem axis	
Tires	18x8,5-8	
Ground following wheels	18x8,5-8	
Tire pressure	2.0 bar	
Weight	1,720 kg / 3,792 lbs	2,060 kg / 4,541 lbs
Noise level L_{pA}	63,8 ± 3,2 dB	
L_{Amax}	64,5 ± 3,2 dB	
L_{Cpeak}	91,5 ± 3,2 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

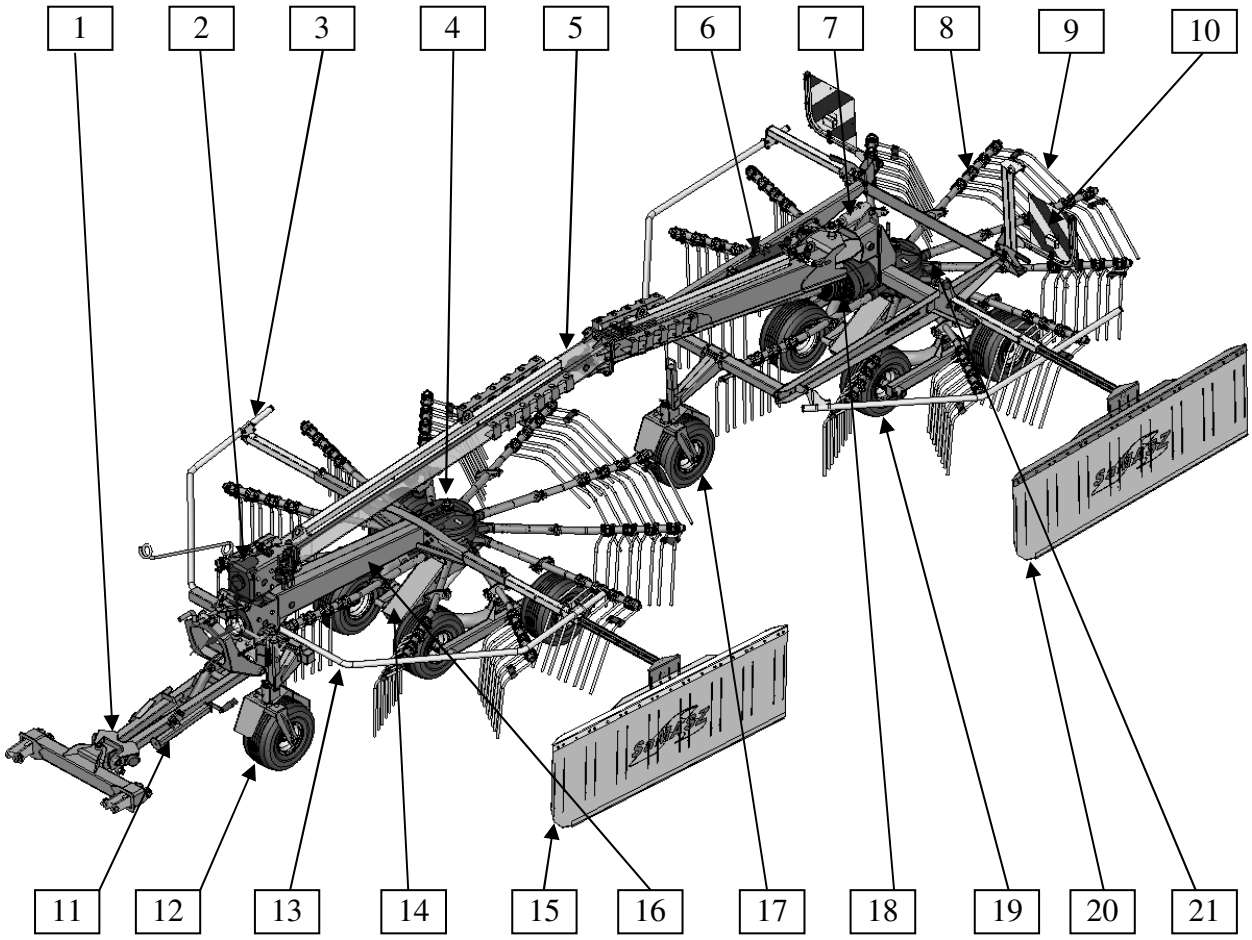


Fig. 3. Parts of **DUO 680** two-rotor rake

1 – Drawbar
2 – Intersecting axis gear
3 – Safety guard
4 – Front rotor gear
5 – Joint linkage
6 – Turning cylinder
7 – Ground following lock cylinder
8 – Rear raking arm
9 – Tine
10 – Warning plate with lighting
11 – Drawbar's support leg
12 – Front support wheel
13 – Front safety guard
14 – Front cart
15 – Front swath guard
16 – Front linkage
17 – Rear support wheel
18 – Wide-angle shaft
19 – Rear cart
20 – Rear swath guard
21 – Rear rotor gear

Drawbar (**1**) enables mounting the rakes on 3-point linkage beam, which is part of each tractor's equipment. Drive from tractor rpm is transmitted through intersecting axis gear (**2**) onto rotary gear with shaft located on rake's front linkage (**16**). Rear rotor gear (**21**) is driven by gear (**2**), roller located inside the linkage (**5**) and roller with homo-kinetic joint (**18**). Both rotors are equipped with numerous raking arms (**8, 3**). Safety guards (**13**) reduce the risk of unwanted objects getting into the area of rotor arms operating. The rake is equipped with adjustable swath guard both on front and rear raking assembly (**20, 15**). Both assemblies are guided onto carts (**14, 19**).

3.3. Standard equipment and spare parts

Rakes are sold with the following standard equipment:

- warranty card,
- operator's manual with spare part list and declaration of conformity,
- PTO shaft,
- spray paint (150 ml).

Optional extra equipment:

- twin wheels - set.

Tab. 2. Recommended PTO shaft for DUO 680 and DUO 740 rakes

Model	Power	Length	Torque	Symbol	Clutch	Manufacturer	Remarks
	HP	mm	Nm				
DUO 680 DUO 740	35	4' 3"- 6' 1"	620	8G7R130CEWR7001	unilateral	Bondioli & Pavesi	

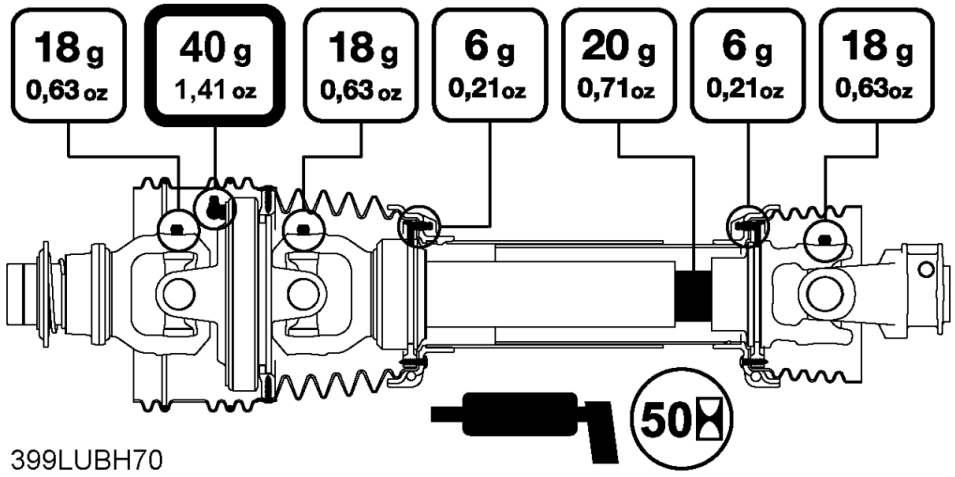


Fig. 4. PTO shaft lubrication points. Mounting directions

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

NOTE:
Optional extra equipment should be ordered separately.

The rake is equipped with optional equipment such as holders and brackets used to mount warning lights and plates. Combined lights and reflectors are mounted on warning plates.

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 working 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. In addition, any damaged protective aprons should be replaced with a new ones.
- 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 standstill (NOTE: raking tines will rotate for several minutes after engine is turned off),

- 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 and holders.
- 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.
- Rotating spring tines and other rotary elements pose danger to health and life of persons remaining within the machine working range. Do not touch any moving machine parts.
- Never start the rake when the rotors are off the ground.
- 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 to 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. 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 working 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 5.3.
- 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.

4.2.1. 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.

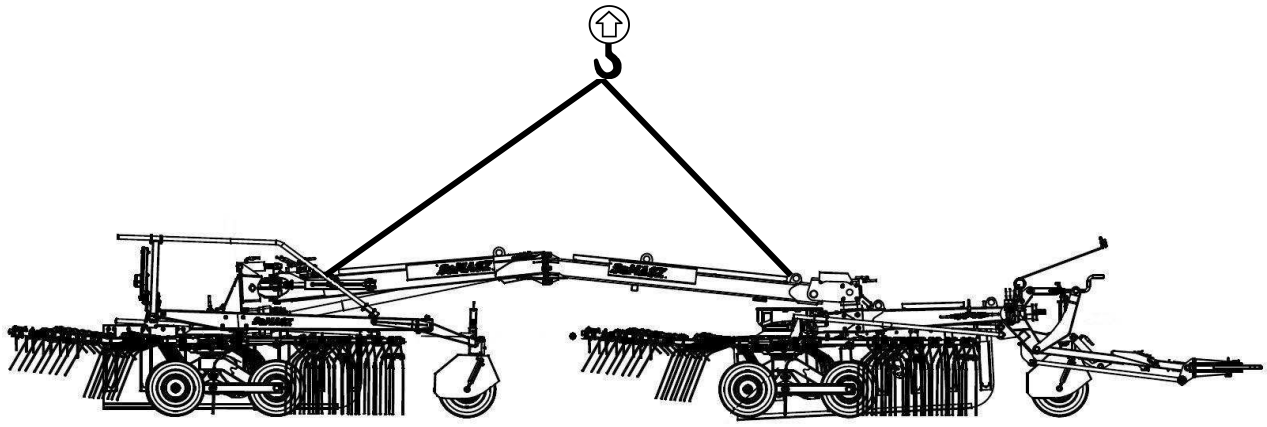


Fig. 5. Moving machine by transport holders

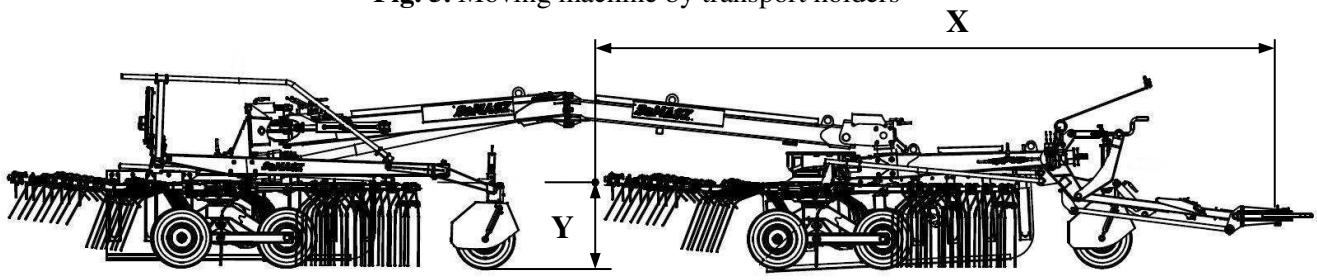


Fig. 6. Location of center of gravity on rakes

Tab. 3. Location of center of gravity

Dimension [ft. in]	Model	
	DUO 680	DUO 740
X	14' 9"	17' 1"
Y	2' 5"	2' 2"

4.3. Working parts

- Before operating the rake check the condition of both the rotor and tines.
- Worn or damaged tines should be replaced immediately with new ones.

NOTE:
When replacing working parts wear protective gloves.

4.4. PTO shaft

- Before operating, read bar manufacturer's manual placed on the shaft. Follow all safety precautions in that manual.
- Use only PTO shafts recommended by rake's manufacturer with guards in good condition.
- 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.

4.5. Hydraulic assembly

- Hydraulic assembly is under high pressure. Hydraulic oil under pressure may penetrate skin and cause serious injury or death. Skin and eyes should be protected when working around this assembly.
- In case of injury caused by a liquid under pressure, call a doctor immediately.
- Hydraulic hoses can be connected to the tractor's hydraulics provided that both the tractor's and the rake's hydraulic assemblies are not under pressure. To remove the pressure from the hoses, start the tractor's hydraulic valves several times with the tractor off.

- When looking for oil leaks, do so safely. Use a cardboard card. Do not touch any potential leaks until the entire hydraulic assembly has been relieved of pressure.
- Use only hydraulic oil featuring oil purity class 9 - 10 in accordance with NAS 1638**.**

When using hydraulic hoses:
- Avoid stretching the hoses when operating.
- Do not allow hydraulic hoses to get deflected.
- Do not expose hydraulic hoses to contact with any sharp edges.
- If damaged or worn, replace the hoses with new ones.
- Useful life for hydraulic hoses is 5 years from their production date.

4.6. Residual risk

Despite the fact that SaMASZ, 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 being cautious during transportation and moving 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 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.

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,

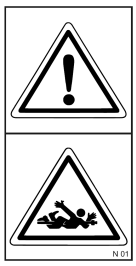
When the risk of exposure to noise cannot be avoided or eliminated by any protective means or organization of work, the employer (farmer) must:

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.

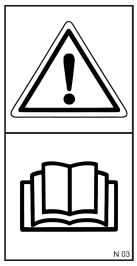
4.7.Safety labels and their meaning

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

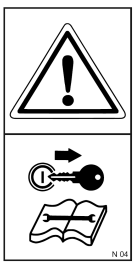
- All warning decals are clean and legible
- All lost or damaged decals are replaced by ordering new decals from your dealer or supplier
- All persons using this rake have read the section of this manual explaining the meanings of these labels
- All spare part used for repair of the rake should have all safety labels provided by the manufacturer.



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



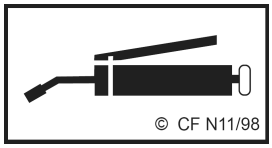
N-03
Caution – read the operator's manual before putting the rake into operation!



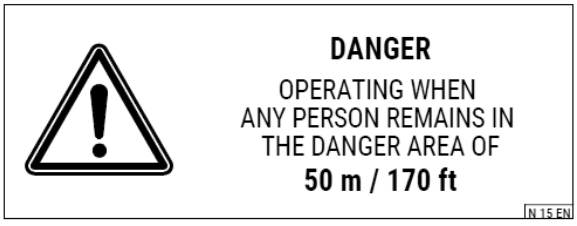
N-04
Caution – while making repairs the machine must be stopped!

N-06
Caution – rotating parts

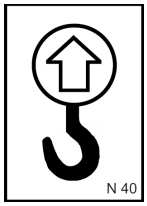
N-07
Operating is forbidden when any person is within the danger area of 50 m / 170 ft



N-11
Lubrication point



N-15



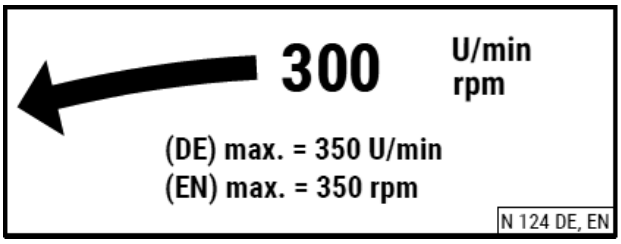
N-40
Transport hook for lifting of the rake

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

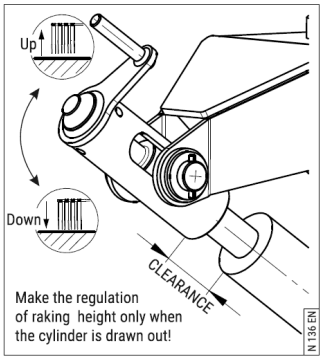
N-50
Do not get under the rake

N-55

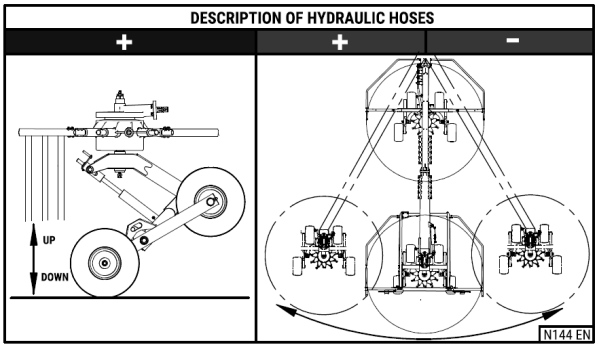
N-117
Avoid fluid escaping under pressure



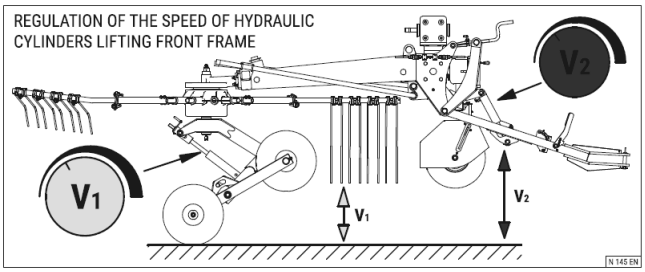
N-124



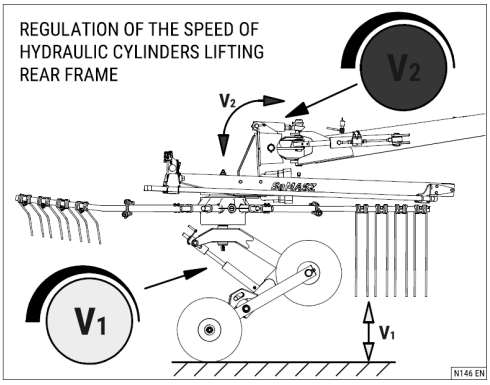
N-136
Raking height adjustment



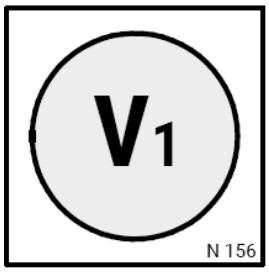
N-144
Description of hydraulic hoses



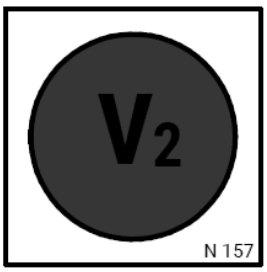
N-145
Regulation of the speed of hydraulic cylinders lifting front frame



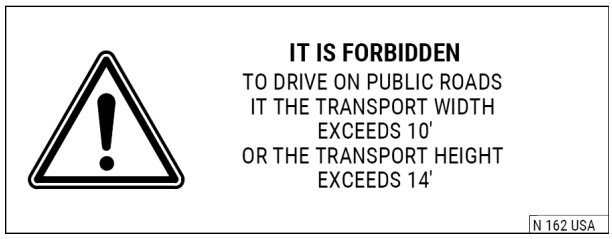
N-146
Regulation of the speed of hydraulic cylinders lifting rear frame



N-156
Valve identifier V1

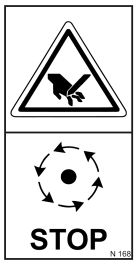


N-157
Valve identifier V2



Z-162

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
Caution: danger of leg drawing

N-196
Recommended tire pressure rakes

N-201
Admissible transport speed

N-204 N-206
Use the required Personal Protective

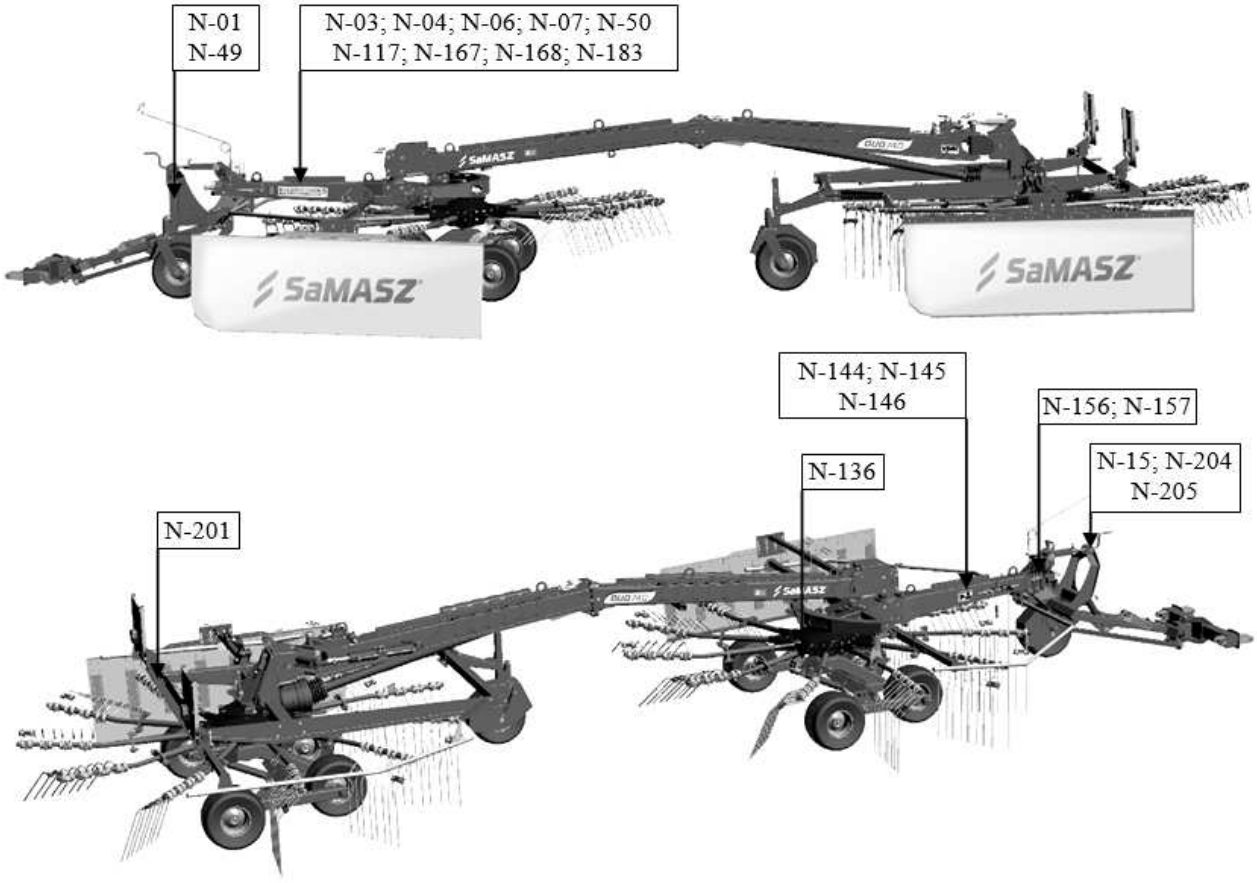


Fig. 7. Warning decals placed on the rake

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

WARNING:
- Only hitch and unhitch machine on a flat surface with compact dirt.
- Keep everyone away from area between rake and tractor.
- Be careful near link road zone of tractor's rear power lift. Contains sharp parts.

Rakes **DUO 680 and 740** are adjusted to be attached to tractors by means of drawbar (**1**). Connect the rake to tractor' links with pins (**3**) and protect them with cotters (**4**) (**Fig. 8**).

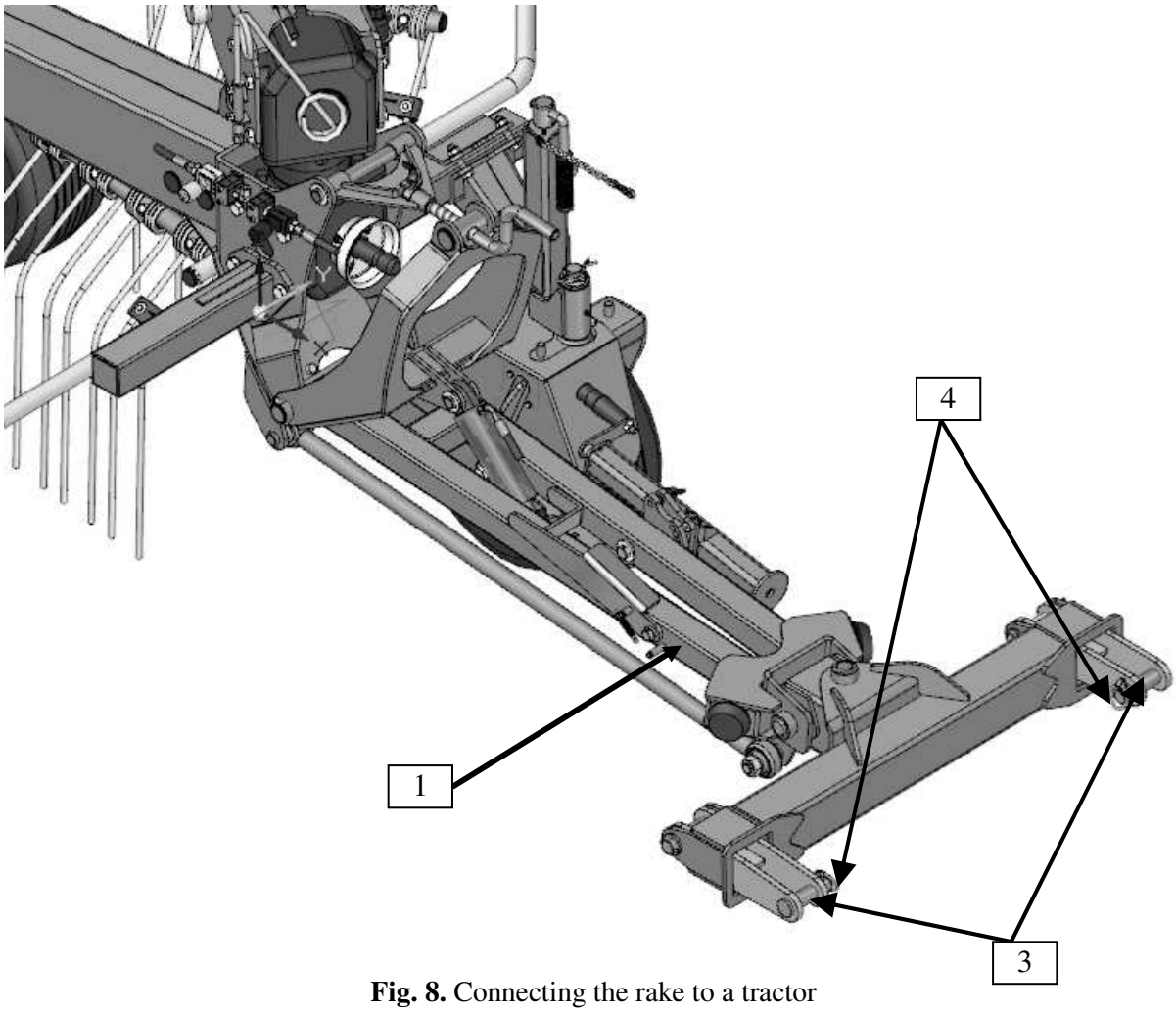


Fig. 8. Connecting the rake to a tractor

As the rake is mounted on the tractor, examine the longitudinal balance and steerability of the tractor-rake aggregate. To do this, calculate to formulas given in the appendix or weigh the set, and then drive on the scales only with front axis of the tractor. If the pressure on the front axis is at least 20% of the whole set's pressure, it means the set is stable. Otherwise, front axis should be balanced.

Due to the fact that rake DUO 740 is equipped with hydraulic rear swath curtain folding assembly it is necessary to additionally connect machine's controller (**1**) (see **Fig. 9**) to tractor's lighter outlet (12V) by means of a plug (**1**) and a three-pin plug (**3**) to the socket (**4**) on the rake's linkage. Fix the controller in tractor's cabin by means of magnetic holder in a visible place. Controller ARDUO enables switching control between two-sided operation of the machine's rear rotor and cylinder for lifting and lowering the rear swath curtain. The selected option is signaled with the corresponding diode (**6**) under the option. To switch the work mode push button (**5**) on the controller until the corresponding diode (**6**) is lit.

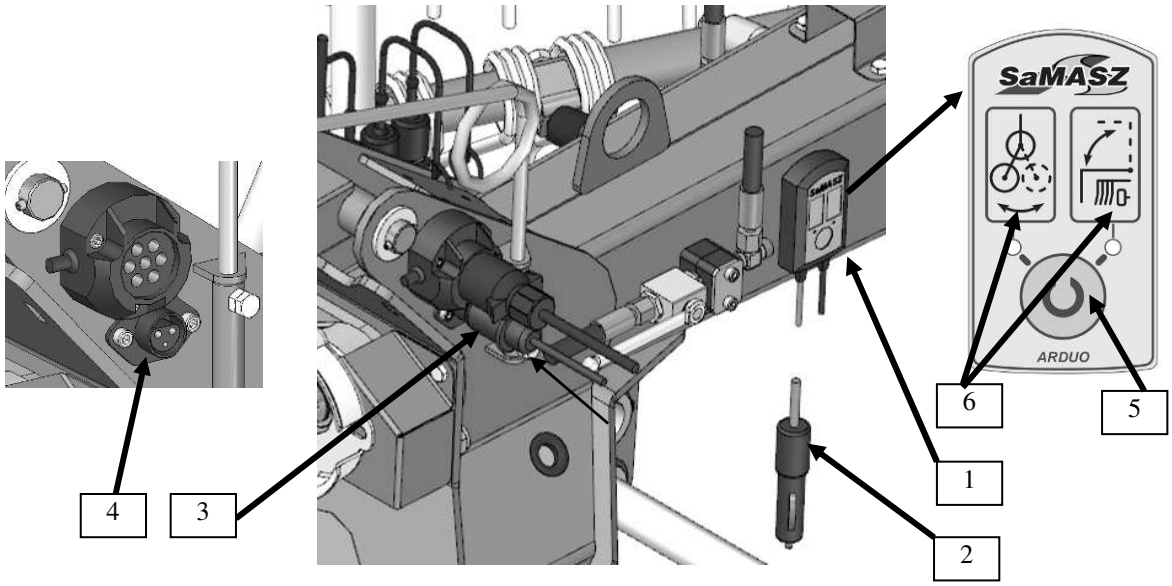


Fig. 9. Control panel ARDUO. **1**- controller ARDUO, **2** - lighter outlet 12V, **3** - controller's three-pin plug, **4** – controller's socket, **5** - work mode switch button, **6** - work mode diodes

NOTE:
When the controller is not plugged to 12V supply or there is no supply while working hydraulic control of one of the cylinders (turning rear rotor or lifting rear swath curtain) will be disabled.

5.2. Preparing the rake for transport

NOTE:
Moving the machine from working position to transport position, and other way round, should only be done on a level and firm ground. Before any operations make sure that nearby the machine there are no unauthorized personnel exposed to the risk of crushing.

In-line rake **DUO 680** can be quickly moved to transport position and thus the transport width of **9' 10"** is obtained. With raking arms dismounted and protective curtains folded it is possible to reduce it to **7' 10"**. To get the admissible rake **DUO 740** width of **9' 10"** at least partially dismount raking arms and fold back the protective curtains according to the below instructions.

In order to prepare the rake lifted on the tractor for transport do the following:

- Set rear rotor so it is perfectly aligned with the front by means of turning cylinder,
- For DUO 740, make sure that the controller ARDUO is set to rear rotor turning mode (**Fig. 10**),

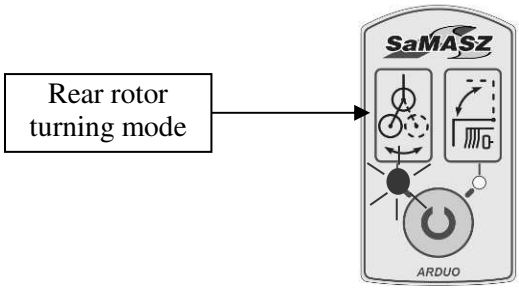


Fig. 10. Controller ARDUO with rake's rear rotor turning mode ON

- After having been switched set the cylinder drive of the tractor until the rear rotor is aligned with the front one (**Fig. 11**),
- If need be, adjust the cylinder by driving the tractor forward,

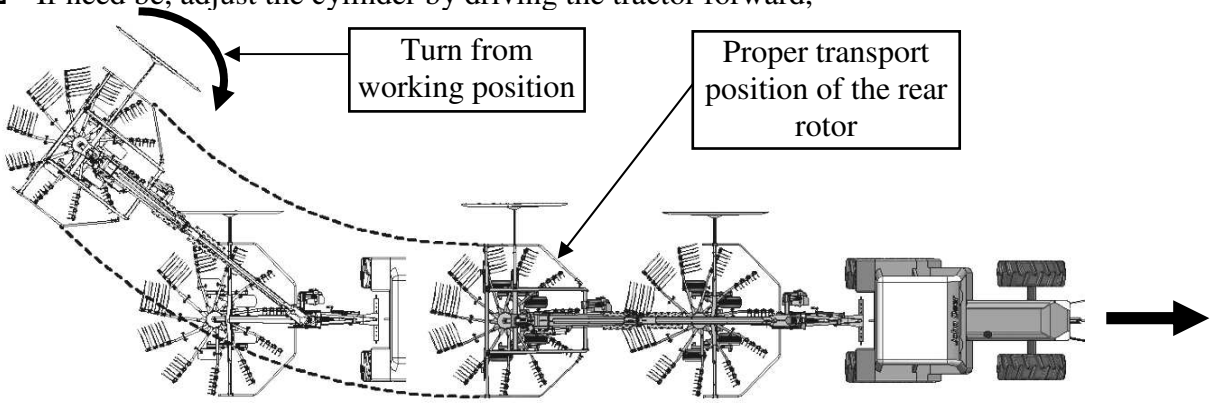


Fig. 11. Setting the proper transport position of the rear rotor

- Lift rear swath guard (
- **Fig.** 12),
- For DUO 680, manually lift the swath guard until it has been locked in vertical position by pneumatic cylinders,
- For DUO 740, select the correct option on the control panel ARDUO by pushing a button until the corresponding diode under the option has been lit up – in this case lifting the rear swath guard. Turn the corresponding lever for two-side operation on the tractor until the rear swath screen has been lifted completely.

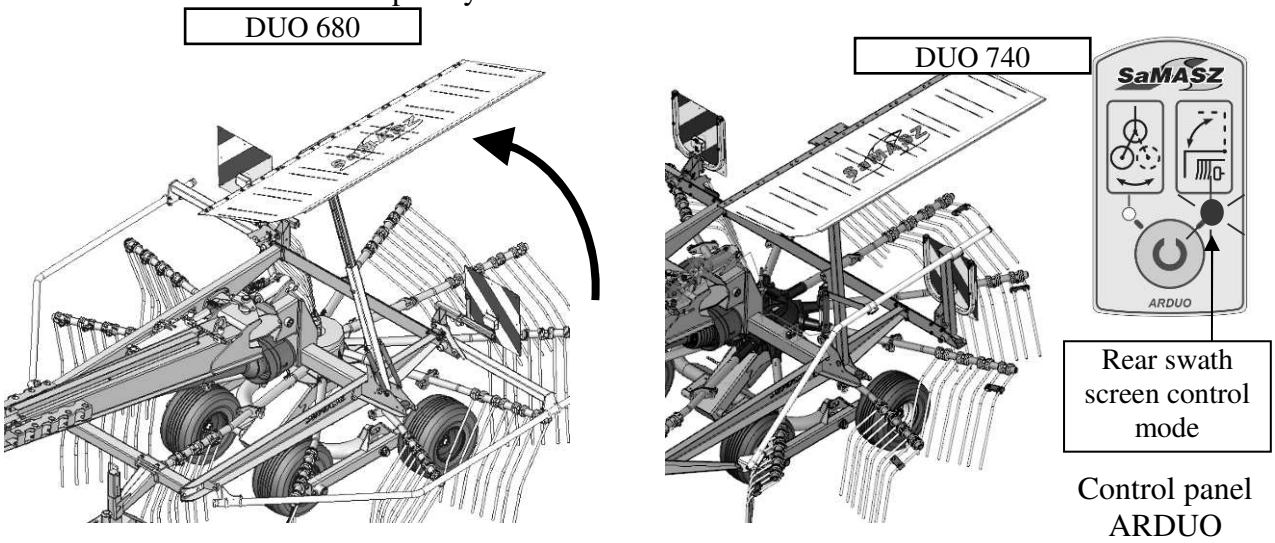


Fig. 12. Lifting rear swath guard a) manually on DUO 680, b) hydraulically on DUO 740

- unlock front swath guard by removing safety linchpin (**Fig. 13**),
- slide the swath guard out,
- place the swath guard in transport housing located under the main frame,
- secure the swath guard with safety linchpin,

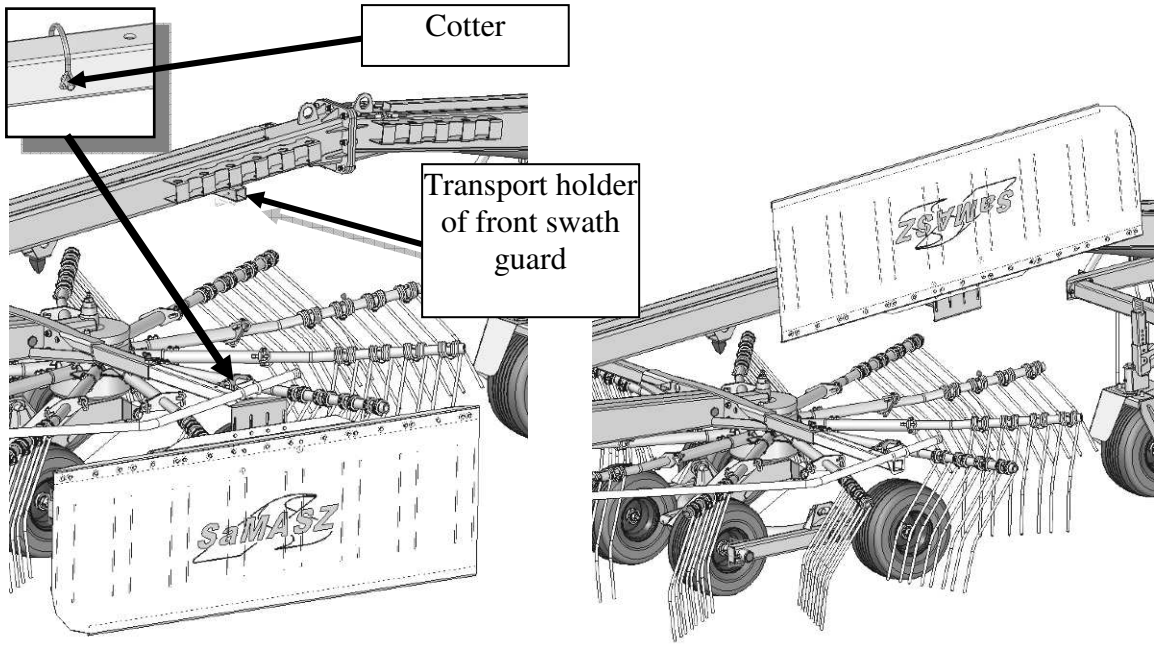


Fig. 13. Transport position of front rotor's guard

- For DUO 740, lock the rotations of the front rotor gear by means of locking assembly located by front rotor according to instructions in **Fig. 14** after firstly having folded the front guard (**Fig. 15**). Dismount the outer-most arms as in **Fig. 18**.

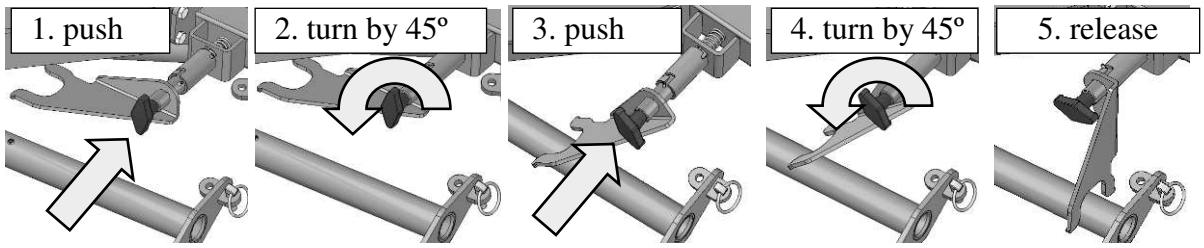


Fig. 14. Transport locking assembly for locking rotations of the front rotor gear (**DUO 740**)

NOTE:
The locking assembly on DUO 740 can be switched to "locked" position only with front rotor protective guard folded (**Fig. 15**).

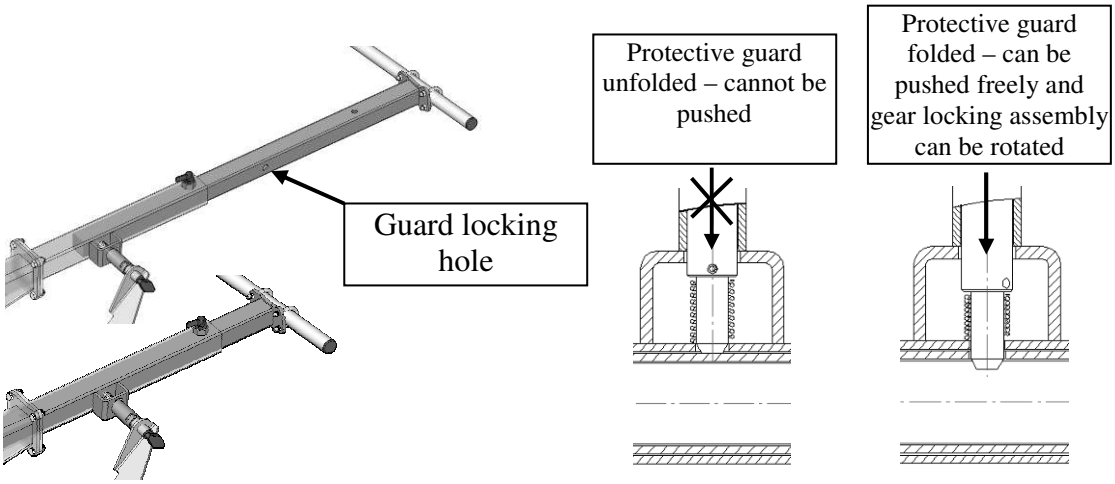


Fig. 15. Front star guard lock (**DUO 740**)

- lift rake up to transport position, close shut-off valve for oil delivery to tractor located on carts' cylinder's hose. Location of valve is provided in **Fig. 16**.

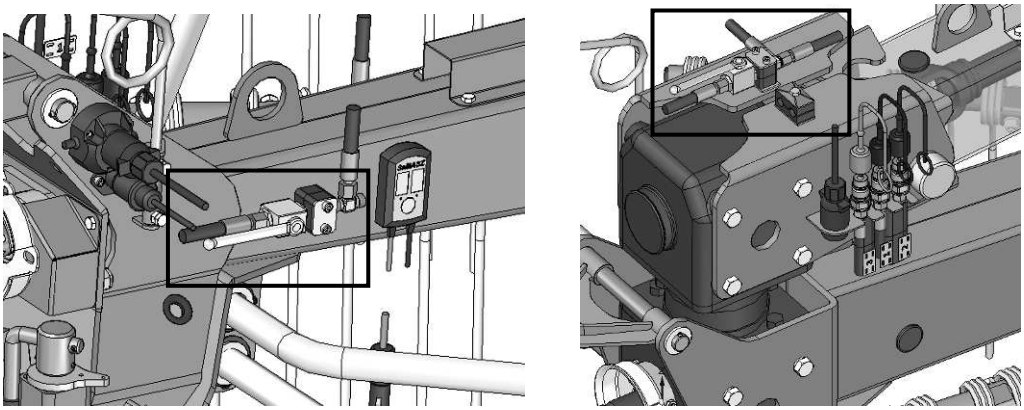


Fig. 16. Location of shut-off valve on rake **DUO 680**

In the above case rake **DUO 680** transport width is **9' 10''** (**Fig. 17**) and rake **DUO 740 — 8' 10''** (**Fig. 18**).

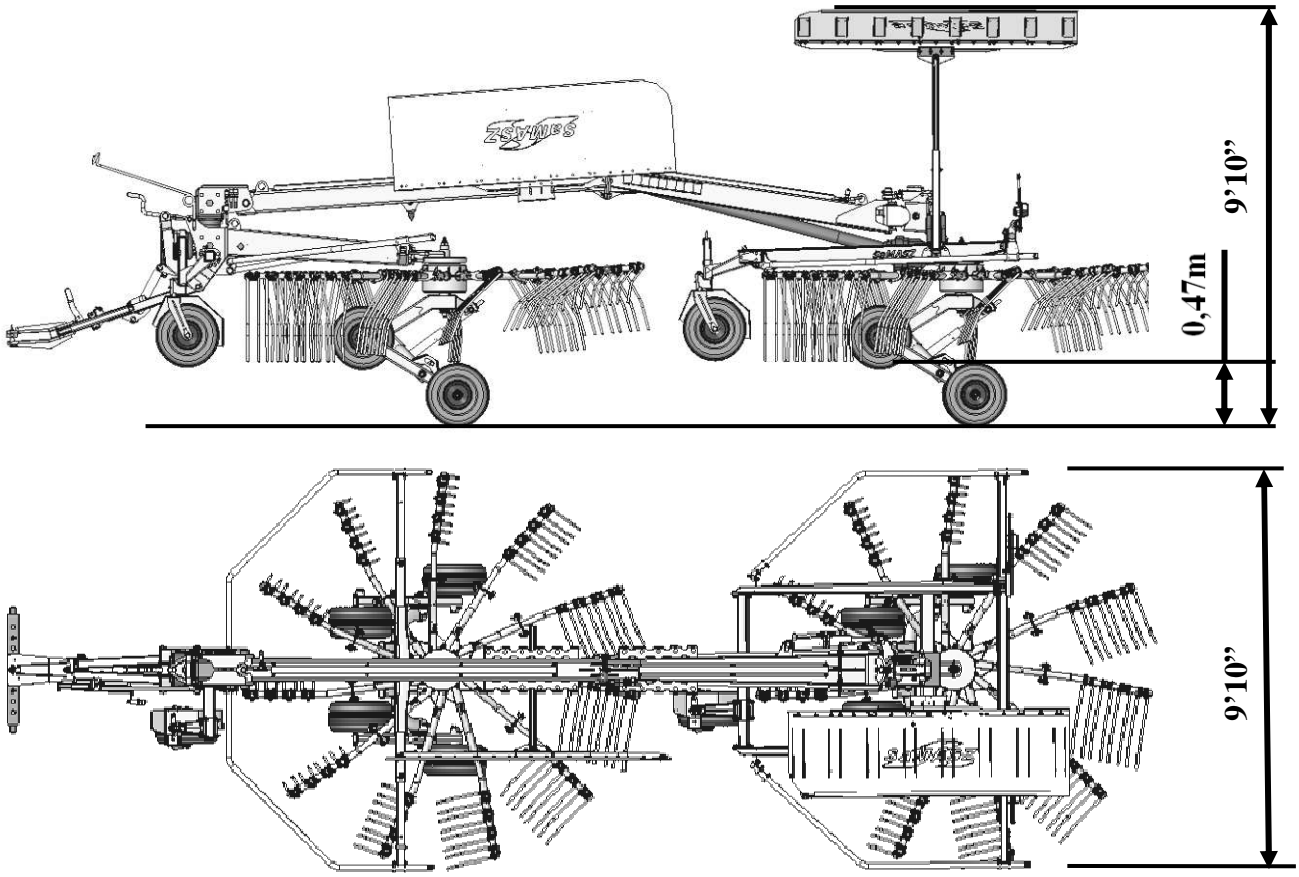


Fig. 17. Transport dimensions of rake DUO 680

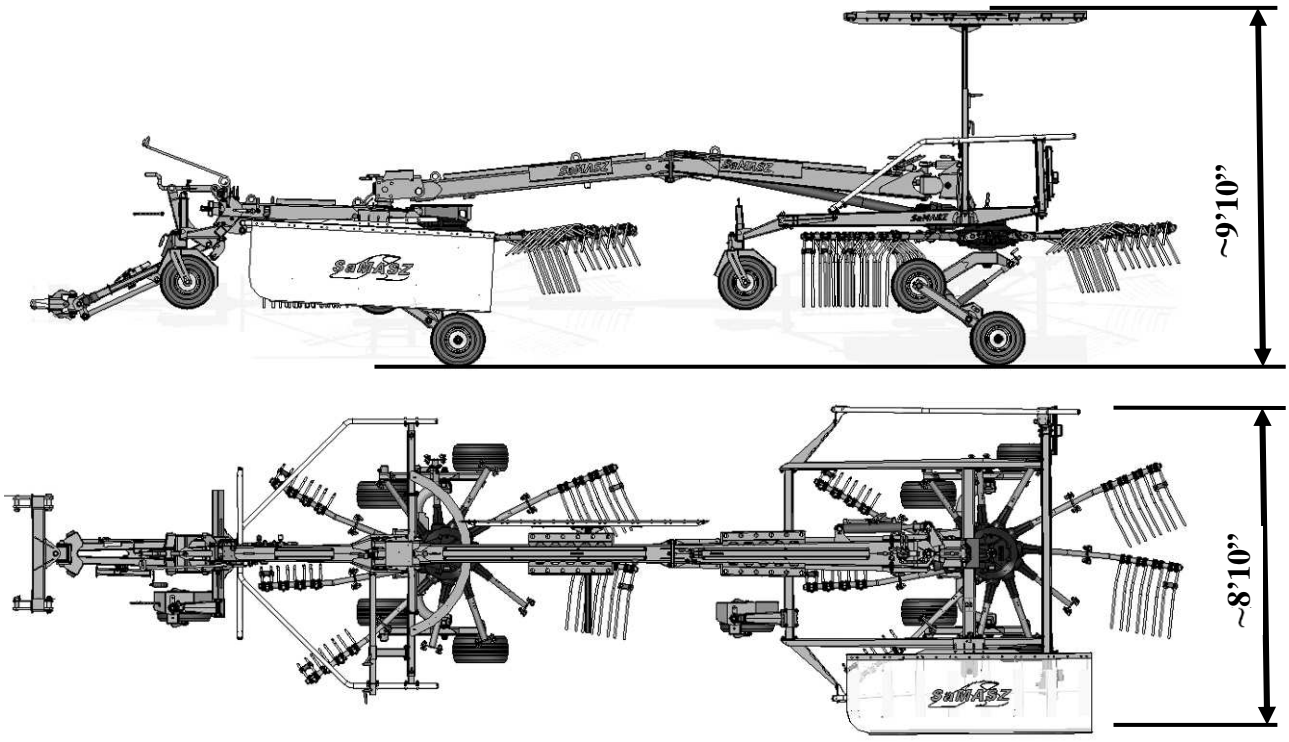


Fig. 18. Transport dimensions of rake DUO 740

Transport width for rake DUO 740

If the operator needs smaller transport width, e.g. for putting the machine in a room or for driving through a narrow access road, it is possible to reduce the transport width to **7' 10"**.Therefore perform the following:

- Unlock, dismount and place raking arms in transport holder (**Fig. 19**),

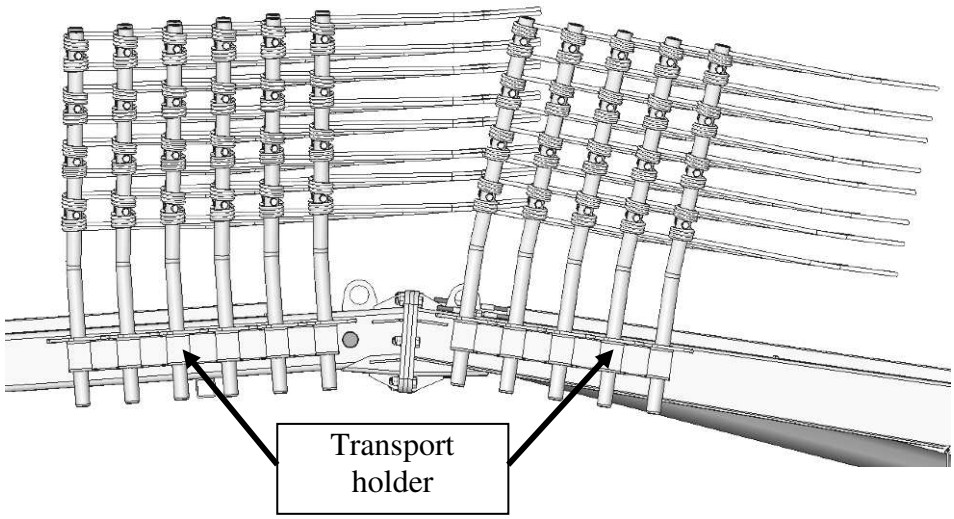


Fig. 19. Raking arms in transport holder

- Unlock, push-in and again lock safety guards of the front rotor (**Fig. 20**),

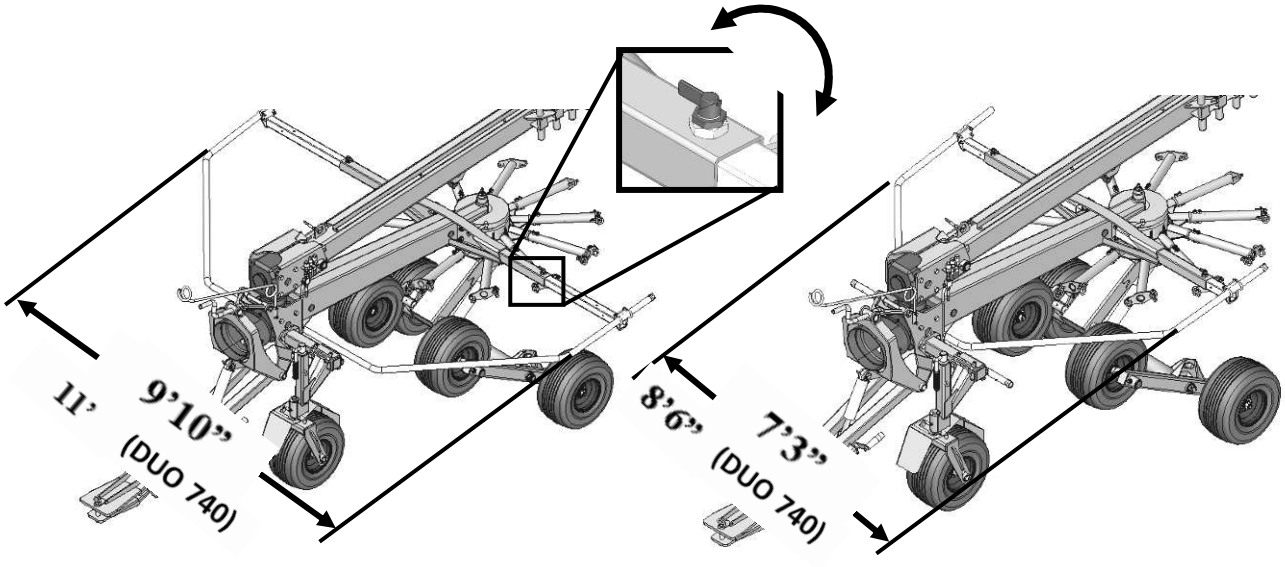


Fig. 20. Transport position of front rotor's guard

- Lift until rear rotor's guard is locked (**Fig. 21**).

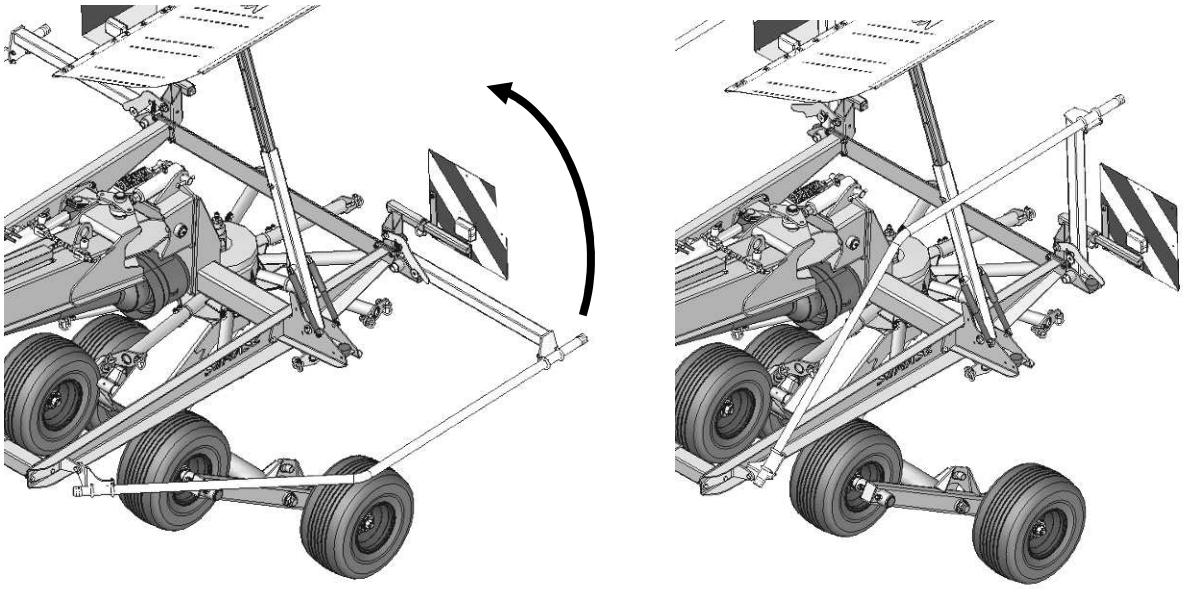


Fig. 21. Transport position of front rotor's guard

The below **Fig. 22** shows dimensions of DUO 680 rake with raking arms dismounted and safety guards installed.

WARNING:
When transporting the rake do not exceed the speed of 25 km/h (15 mph). Otherwise the machine can be damaged.

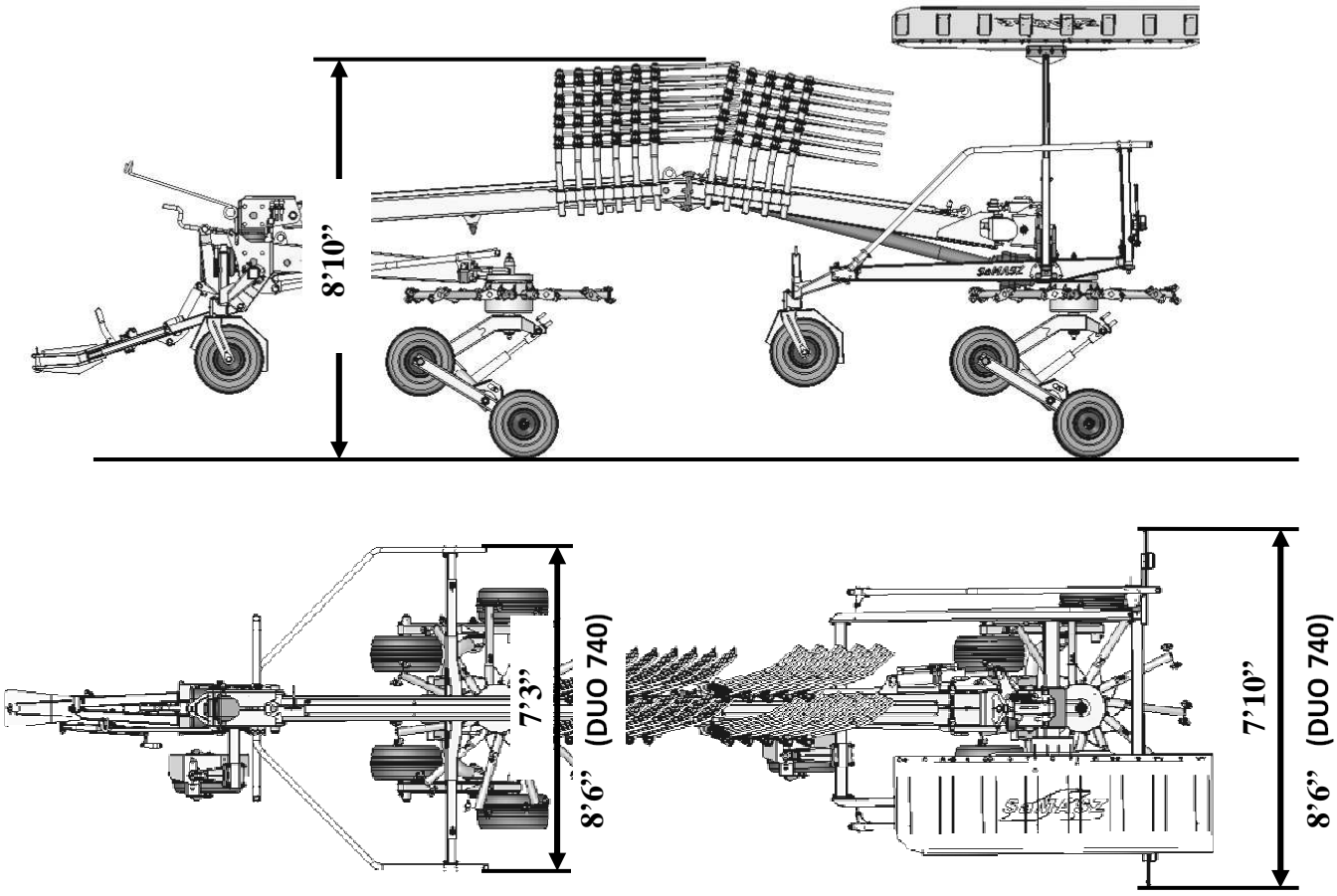


Fig. 22. Transport position of the front rotor's guard (DUO 680)

Fig. 23. Rake in transport position

5.3. 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.

5.4. Preparing rake for transportation on a large truck

In order to reduce the length of DUO 680 rake when being transported on a large truck it is possible to dismount both the front and the rear rotor.

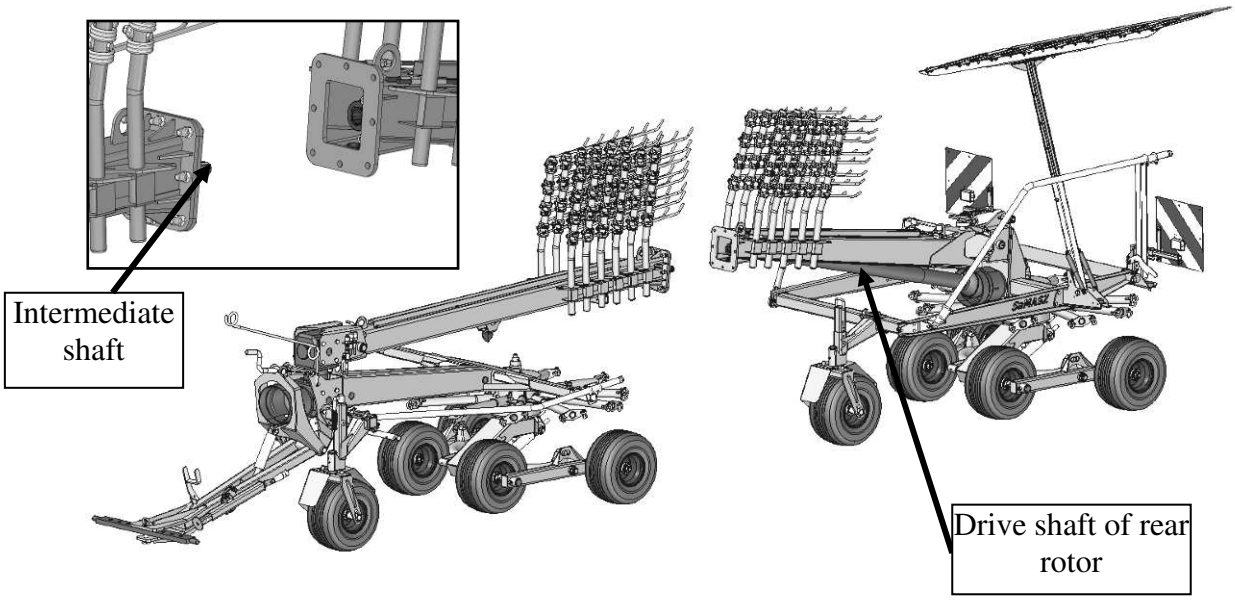


Fig. 24. Dismounting the rake to facilitate its transportation on a large truck

In order to dismount both rotors, perform the following:

- disconnect drive shaft from the rear rotor and intermediate shaft located in the middle section of the linkage (**Fig. 24**),
- disconnect hydraulic hoses in linking point,

NOTICE:
Before disconnecting hydraulic hoses, rake carts must be in lowered position. Disconnecting the hoses in the lifted position may lead to accidental falling of the machine.

- unscrew eight mounting bolts for both linkage segments supporting them with transport holders,

NOTE:
When dismounting the linkage use lifting devices to support both segments with use of transport holders.

- Support rear section of the linkage so ground following locking cylinder of the rear rotor is not tensed (**Fig. 25**),

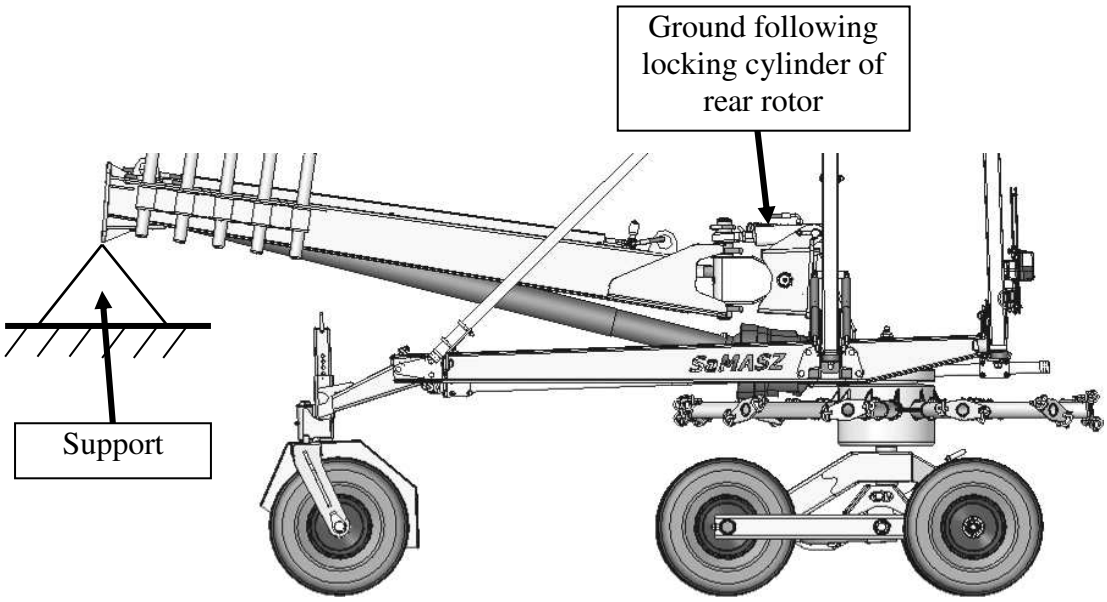


Fig. 25. Supporting rear section of linkage to avoid breaking the ground following mechanism of rear rotor

- store both rake's segments on truck as required,
- secure both segments against shifting during transportation.

Fig. 26 shows example setting of both raking mechanisms to reduce dimensions.

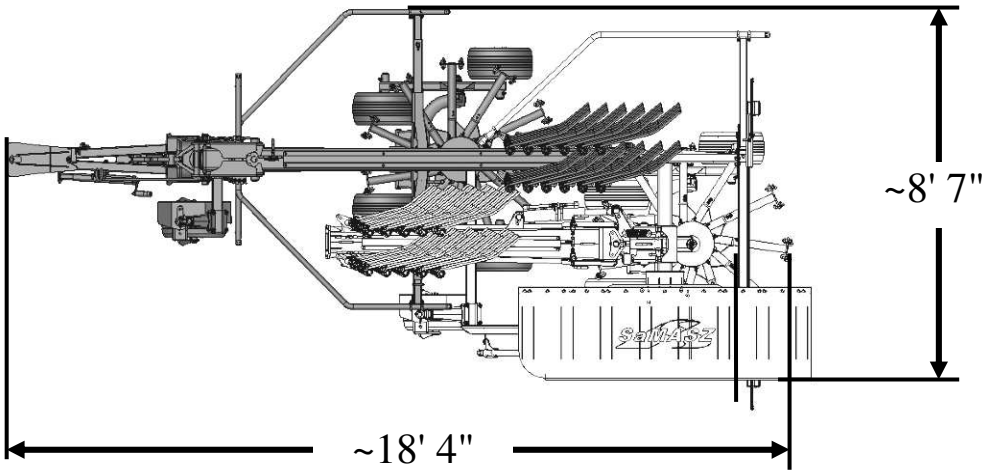


Fig. 26. Example setting of both rake's segments

5.5. Mounting PTO shaft

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

When connecting PTO shaft between tractor and rake make sure that external guard tube of the shaft is on the tractor's side. The PTO shaft plastic guards have to be secured by fastening their small chains to immovable parts of tractor and rake. The PTO shaft must operate at the lowest possible angle. This will ensure that both shaft and the machine last as long as possible.

CAUTION:
If need be, shorten the PTO haft according to its operator's manual given by the shaft's manufacturer (**Fig. 27**).

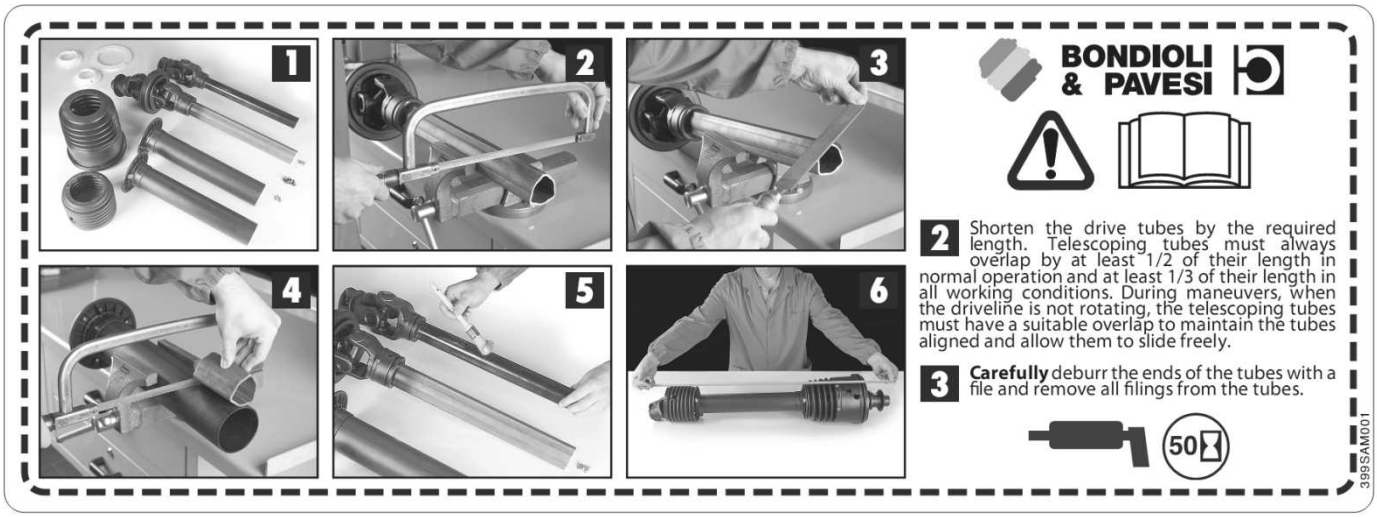


Fig. 27. Instruction of PTO shaft shortening

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 standstill and the cutterbar is on the ground. 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 no person around the danger area,
- Turn on shut-off valve on the tractor,
- Lower carts with hydraulic lifting device as slow as possible to cushion its contact with the ground,
- Take out raking arms from transport holders, put them into the rotor and lock with cotters,
- Lower safety guards,
- Extend the swath guard to required length.

5.7. Preparing the rake for operation

NOTICE:
Before sale SaMASZ protects the cylinders with special grease against weather which may cause premature wear. Before operating the rake, remove the excess grease from the cylinders.

On operation site:

- Turn off the tractor's engine and remove the key,

- Protect the tractor against rolling down,
- Connect PTO shaft extension of the tractor rpm (if only one extension was taken out or connect the complete PTO shaft),
- Pre-adjust the raking height with knobs on both the rear and the front rotor as provided in **Fig. 28, Fig. 29**,
- Turn on the hydraulic valve on driving cylinders of carts,

NOTE:
There exists a risk of accidental falling of the machine from transport position. Any service works should be performed with valve off on driving cylinders of carts.

NOTE:
Accidental falling of the machine may occur if the rake's lifting assembly is not tight. When operating the rake being in transport position it is forbidden to walk under the machine parts.

- Lower the rotors by means of tractor's single-side operation controller,

NOTE:
Before lowering of the machine's rotors make sure that no unauthorized personnel is around.

- Check drawbars for height and leveling,
- If need be, lift the rake once again to transport position, turn off safety valve on cart cylinders powering and readjust raking height,
- Adjust the height of ground following wheels in order to set the gear to working position,

NOTE:
Only adjust the raking height when carts are lifted.

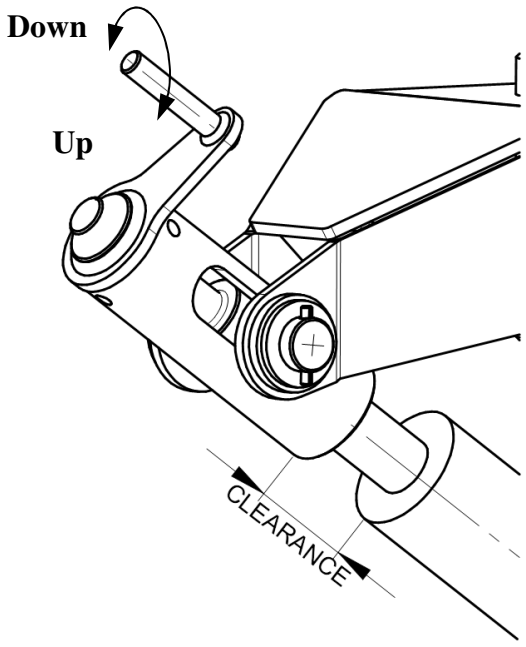


Fig. 28. Cart adjustment clearance

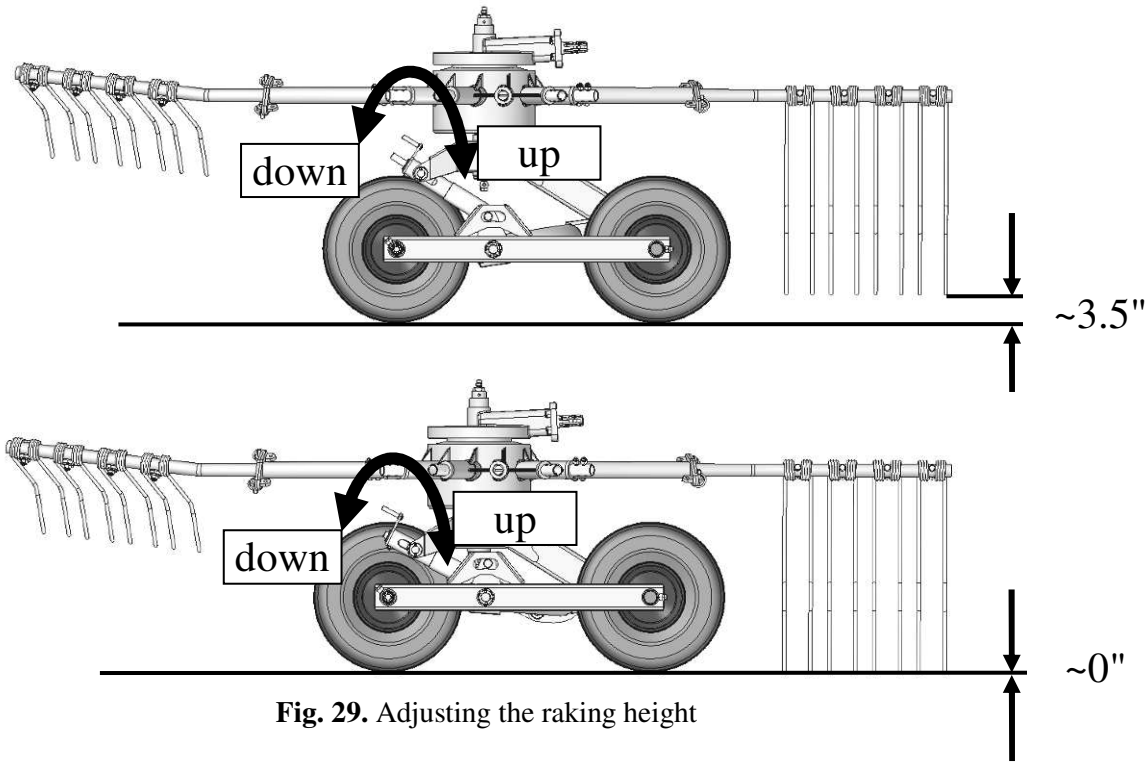


Fig. 29. Adjusting the raking height

- Lower the rake once again,
- Unlock and lower safety guards of the rear rotor by performing actions as in **Fig. 21**,
- Unlock and retract safety guards of the front rotor by performing the opposite as given in **Fig. 20**,
- To set the machine in position for raking one or two rows tilt the raking assembly either left or right with double-action cylinder for rear rotor position control.

Single windrow option

- Lower rear swath guard by pulling it downwards,
- If need be, set the distance between the rear guard and the rear rotor depending on the forage quantity,

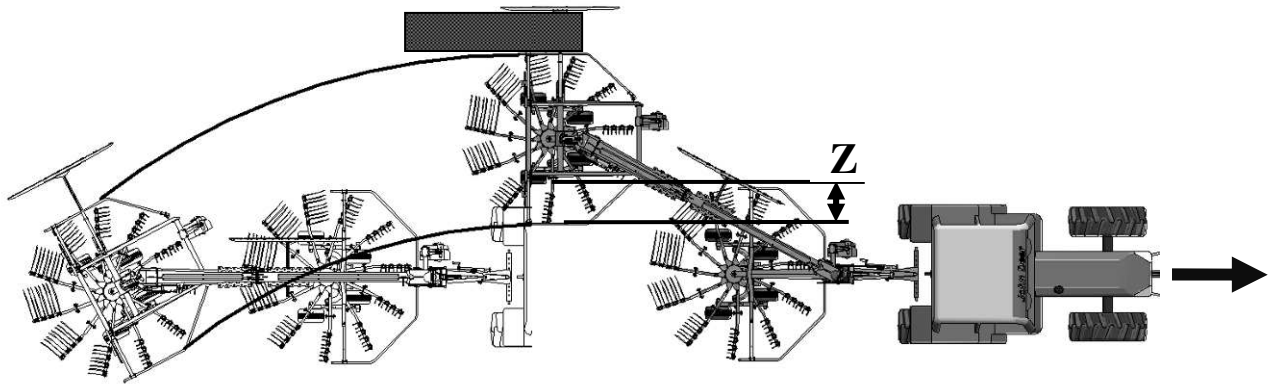


Fig. 30. Position of rear rotor in working position with single windrow option

- Dismount double-action cylinder of the rear rotor, so that the rotor is turned leftwards,
- Drive the tractor until the rear rotor has been turned left to its maximum,
- If need be, adjust the rear rotor position so that optimum overlapping of the rear and the front rotor (**Z**) is achieved depending on the type of material being raked. Overlapping (**Z**) should be adjusted in such way that between the rotors there is no material left on the ground.

Double windrow option

- Lower the rear swath guard by pulling it down,

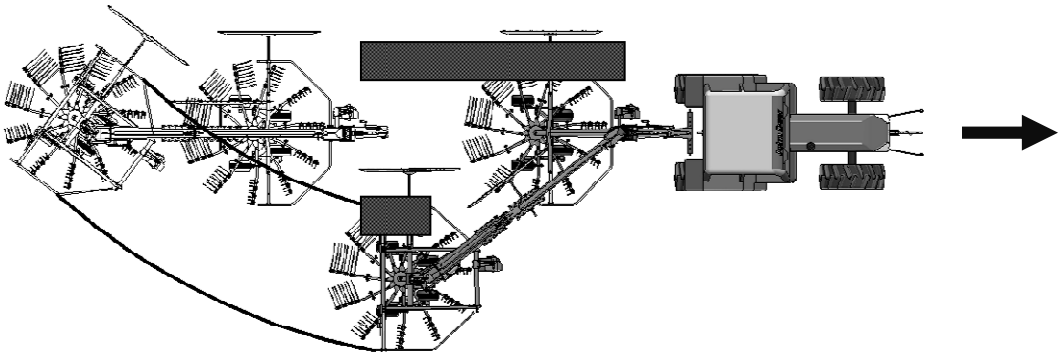


Fig. 31. Position of rear rotor in working position with double windrow option

- Remove the rear rotor guard from the transport holder and mount it in working holder by retracting it for a proper distance,
- Lock it with the front rotor cotter,
- Retract cylinder of the rear rotor to its maximum, so that the rotor is turned rightwards,
- Drive the tractor until the rear rotor has been turned right to its maximum,
- Set rear 3-point linkage links at such height **H** so that the front ground following wheel is on the ground and on the front drawbar cylinder there is a clearance which enables the front ground following function,
- If need be (while keeping a constant hitch height on the tractor), adjust the clearance with knob **P**.

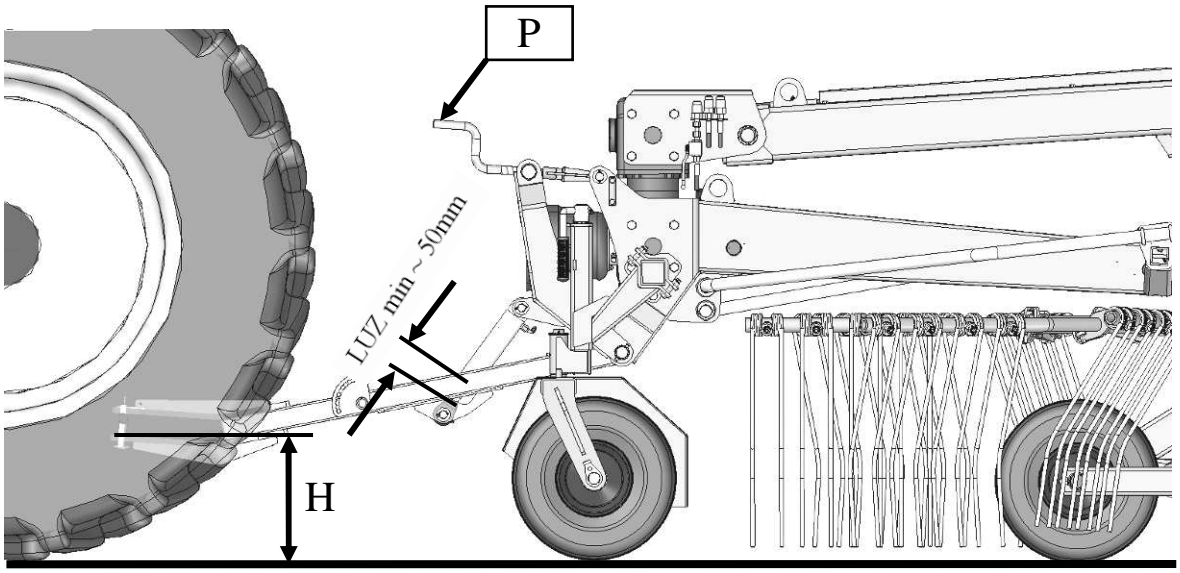


Fig. 32. Setting front drawbar for operation

5.8. Raking width adjustment

DUO in-line rake has smooth adjustment of raking width ranging from 11' 2" (12' 10" DUO 740) up to 22' 4" (24' 3" DUO 740) by means of a double-side cylinder for adjusting the position of the rake's rear working assembly. Bear in mind, that the maximum raking width for the single-row option is the difference of 22' 4" reduced by overlapping **Z** (**Fig. 30**) value for rear and front rotor's tracks.

5.9. Operation

Rotary rake is intended to rake swath or grass after having been treated with tedders. Driving speed should be based on ground configuration, harvest size and raking smoothness.

To achieve much better ground following the rake has transverse and length-wise options (**Fig. 33** and **Fig. 34**).

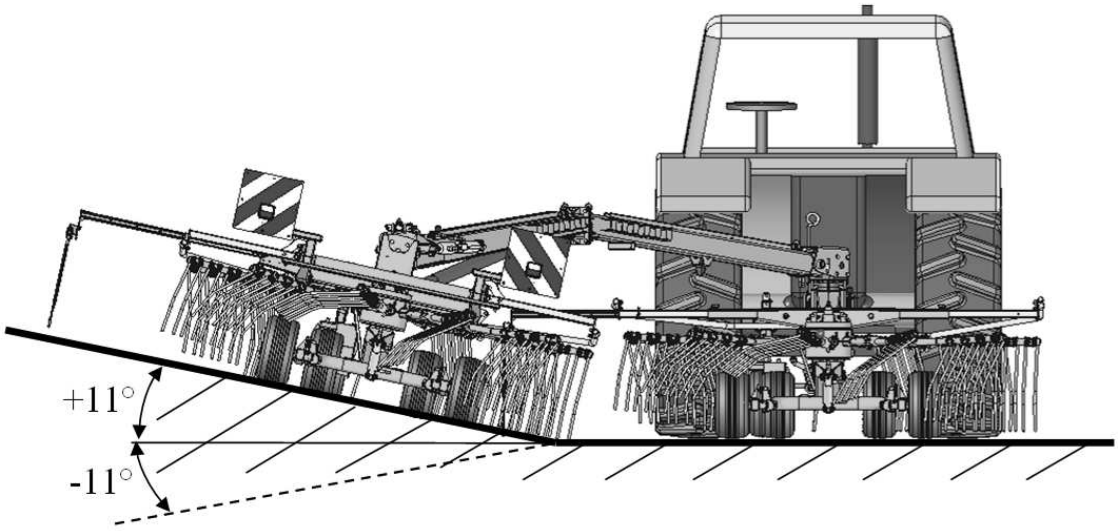


Fig. 33. Transverse ground following

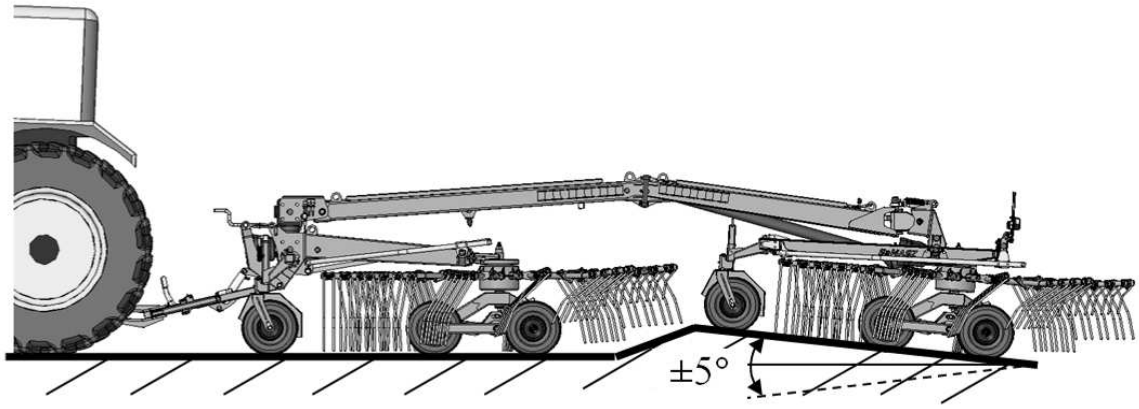


Fig. 34. Length-wise round following

WARNING:
When operating the machine do not try to overcome short and steep uneven grounds, otherwise it may be damaged.

Application of 4-wheeled carts with wide tires as standard enables reducing the rake's pressure on the ground, which is particularly important on loose ground, e.g. turf meadows. Smaller uneven grounds (e.g. stones) are leveled with remote, tandem wheels of the cart (**Fig. 35**).

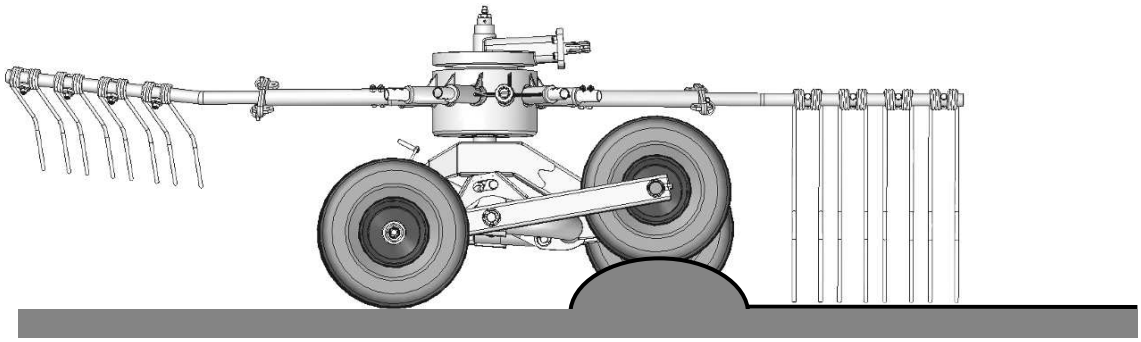


Fig. 35. Tandem suspension cushioning short uneven ground sections

5.10. Lifting the rake on turns

When driving back through already formed rows, lift the rake to its transport position. Perform the following:

- Operate single-side controller for lifting until the machine has been fully lifted,
- Drive back or drive over the formed rows,
- Operate single-side controller for lowering until the machine has been fully lowered,
- Set the controller in zero position.

WARNING:
Due to the specific in-line design of the machine it is forbidden to take sharp turns with the rotors lifted. Taking too sharp a turn may cause a fall or a damage to the machine. The risk is analyzed in **Fig. 36**.

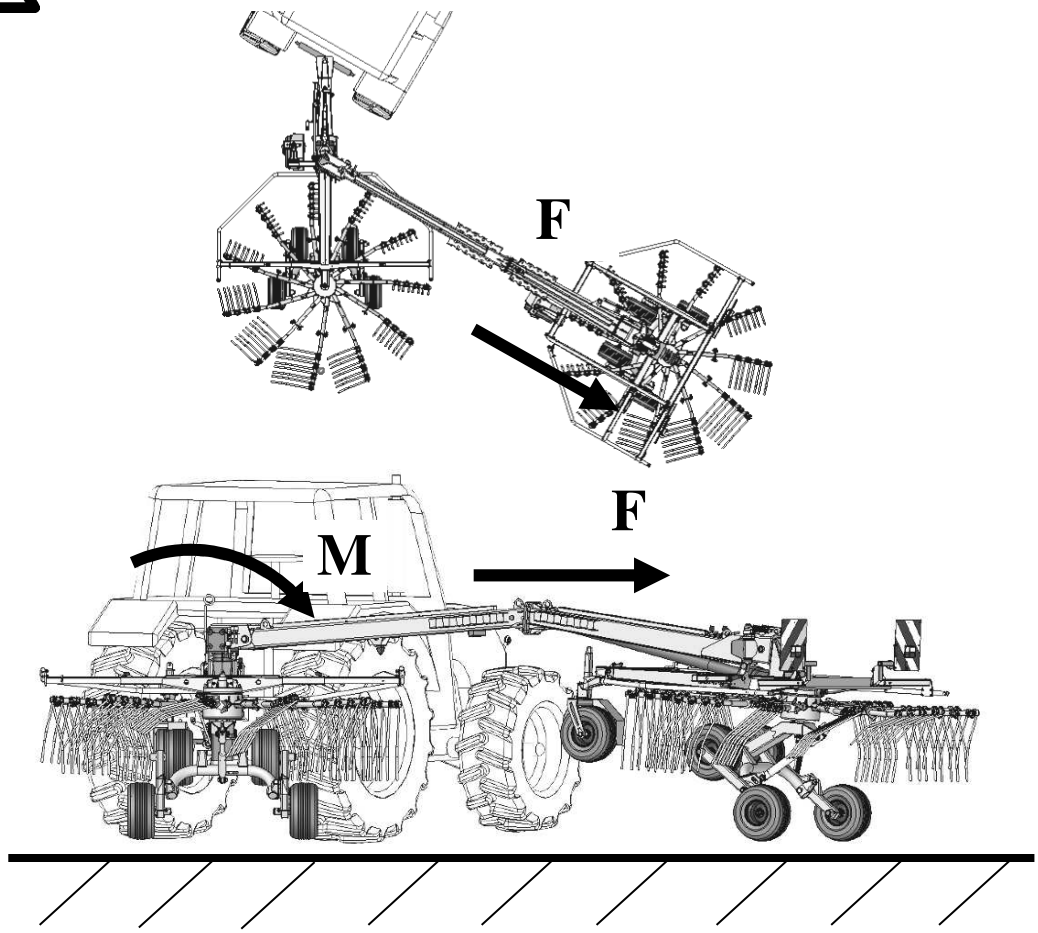


Fig. 36. Risk of falling due to torque **M** when taking a tight turn with rotors lifted

NOTE:
To avoid a potential falling of the machine reduce its lifting height on tight turns or increase turning radius.

WARNING:
The machine may fall when operating on a slope (**Fig. 37**).

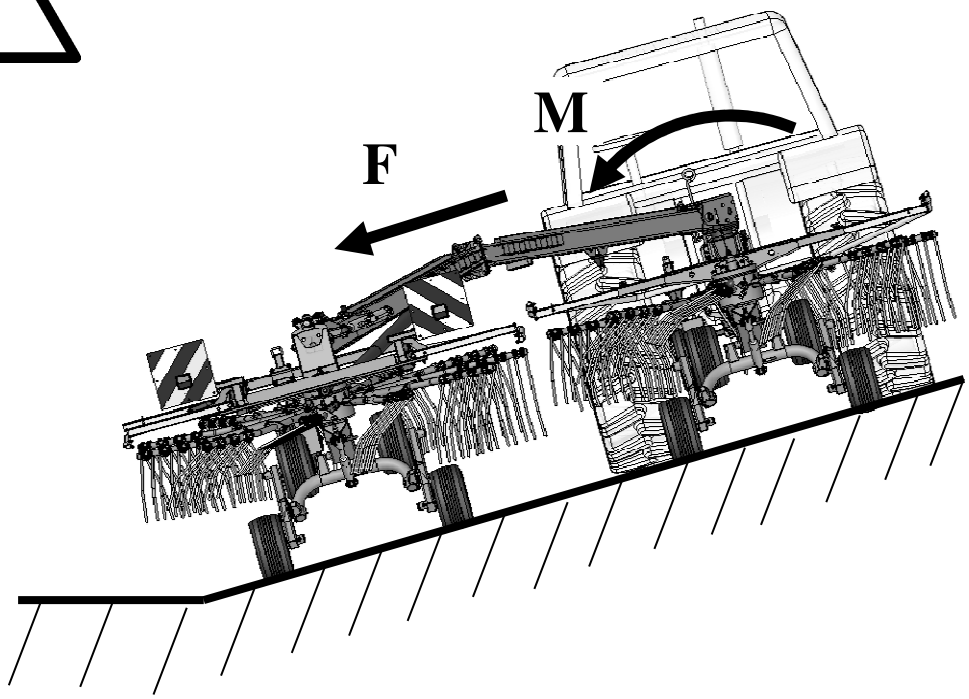


Fig. 37. Risk of machine falling due to torque **M** when operating on a slope

5.11. Removing clogging and jams

When operating the mower pay attention to variable conditions on field, which may influence the mower clogging and jams, such as: terrain unevenness, height and density of grass as well as other objects in the grass (stones, branches, piles of soil). In order to avoid clogging and jams, operating speed should be adjusted to the mentioned conditions.

In case of machine blockage caused by wrapped material, set the machine on a flat surface, remove excess material using sharp tool. After clearing the machine check if nothing has been damaged.

To remove any clogging it is obligatory to disconnect the drive and the motor, take out the ignition key. When eliminating any clogging on the machine, use also safety means for operator, so protective gloves and tight wear.

NOTE!
Removing clogs and jams while the machine is in operation can lead to the accident!

5.12. Unmounting the rake from the tractor

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

To unmount the rake from tractor perform the following:

- Set the rake on an even, stable ground,
- Support the rake with support leg and protect with cotter pin,
- Turn off the tractor's ignition and remove the key,
- Secure the tractor against free runaway,
- Disconnect the rake's hydraulics from the tractor,
- Dismount PTO shaft and place it on the shaft holder, being the rake's standard equipment,
- Detach the rake from the tractor.

6. MOUNTING AND ADJUSTMENTS

6.1. Mounting tines

Tines should be mounted as shown in **Fig. 38.**

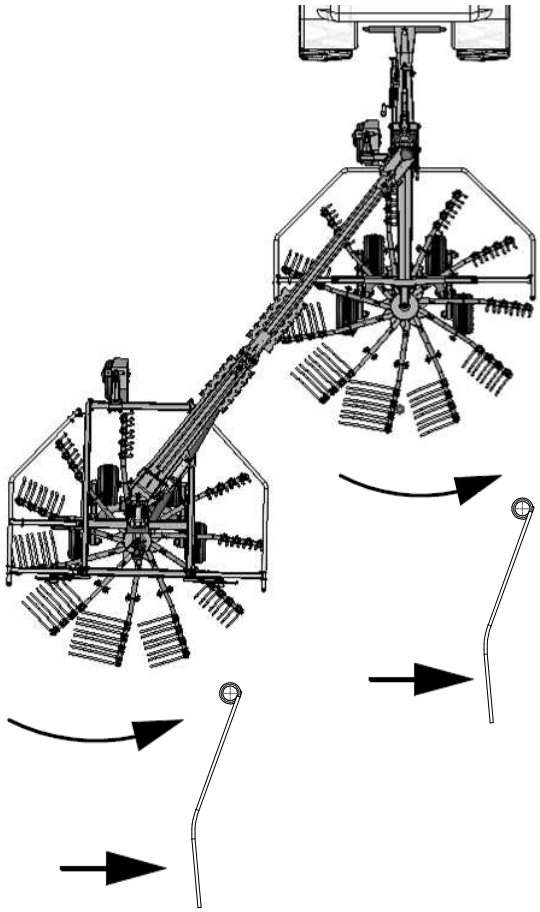


Fig. 38. Mounting of raking tines

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

6.2. Adjusting the sequence of rotor lifting

DUO in-line rake's rotors can be adjusted for proper lifting sequence. This is performed with adjustable chokes located on the rake's linkage. Chokes are part of the rake's hydraulics and are used to control oil flow for powering each of four rake cylinders. Winding down the choke knob results in reducing oil flow rate and therefore slowing down the operation of the corresponding choke.

NOTICE:
Be careful when adjusting the chokes as even subtle modifications of choke settings will cause significant difference in rotor lifting speed.

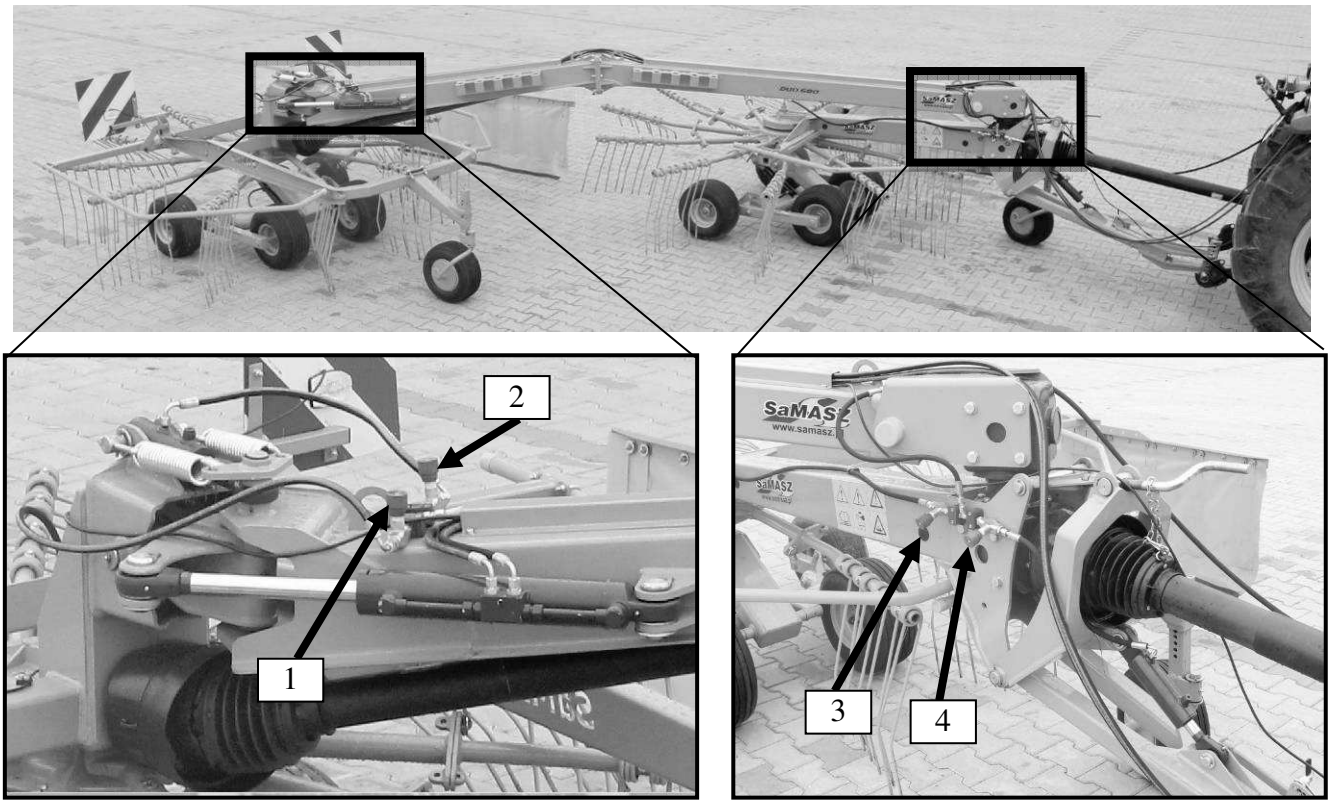


Fig. 39. Location of adjustable chokes

Choke 1
Used to control the rear rotor lifting and lowering speed. Winding down results in reducing the speed of rear rotor lifting and lowering. Winding up results in increasing the speed.

Choke 2
Used to control the rear rotor locking speed in horizontal position. Winding down results in reducing the rear rotor following locking mechanism speed. Winding up results in increasing the speed.

Choke 3
Used to control the front rotor lifting speed. Winding down results in reducing the front rotor lifting and lowering speed. Winding up results in increasing the speed.

Choke 4
Used to control the front lifted drawbar speed. Winding down results in reducing the drawbar lifting and lowering speed. Winding up results in increasing the speed.

The most optimum setting of chokes should firstly result in parallel lifting of front rotor which is particularly important at field's edge and causes the front rotor to stop operating earlier. Then rear rotor ground following locking mechanism should be turned on to prevent tines from driving into the ground while operating. In the closing stage rear rotor lifting occurs.

6.3. Daily maintenance

When you finish each day of operation carry out the following maintenance:

- 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, because grass with mud may damage the bearings,
- remove grass and mud,
- check rotors,
- grease PTO shaft tubes with STP grease,
- if necessary, lubricate the parts and components according to lubrication instructions (**Chapter 7**).

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

6.4. After-season maintenance and storing

At the end of season the following shall be performed:

- lower the rake on the ground,
- remove the PTO shaft extension from the tractor rpm or unmount the complete PTO shaft and install it into corresponding holder at the 3-point linkage frame,
- disconnect hydraulic hoses and electrical cables from the tractor and hang them onto corresponding holders on the 3-point linkage frame,
- detach the rake from the tractor (reverse procedure as in case of attaching the rake to the tractor, see section 5.1), and then drive the tractor away.

Rake should be stored in standstill position, so it is supported onto supporting leg. It is recommended to store the set on a paved ground, preferably under roof, in places inaccessible to unauthorized personnel or animals.

If the machine is stored for a long period of time before first operation, examine its technical condition and pay special attention to the hydraulics and the drive. Paint the areas where the paint is missing. Check hydraulic hoses and lubricate the machine.

Additionally:

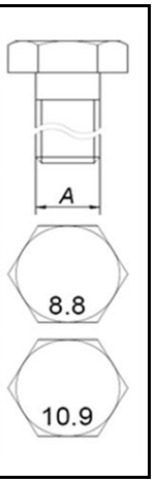
- remove any traces of rust and paint the area,
- check the oil level in gears (Chapter 7). If leaks are found, remove them immediately and refill oil. If water in oil is found, change the oil immediately as it could cause corrosion of internal mechanisms such as gear wheels, bearings, or shafts, and cause breakdowns,
- periodically inspect the rake and lubricate operating parts in order to protect them from corrosion which adversely affects the proper operation of the rake,
- check hydraulic hoses regularly; replace any damaged or old hoses; in any case, replace hoses that have been in use more than 5 years from the date of their manufacture printed on the hose.

6.4.1. Starting the rake after longer storing periods

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

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



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. Gear

Every day before starting work check the oil level and, if needed, refill after having removed the vent **A** (**Fig. 40 a**) on the top of the gear. The oil level can be checked through check opening **A** on the side of the gear. Please refill the oil until it is visible in the check opening **A**. Removing the old oil from the gearbox is done through opening **B**.

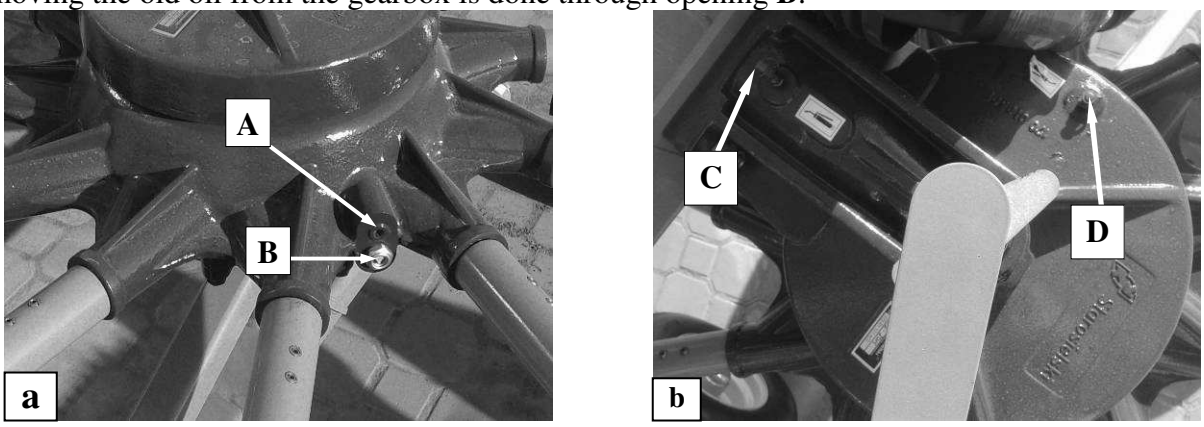


Fig. 40. Lubrication points on the gear

Tab. 5. Oil capacity

Model	Oil capacity	Oil type
DUO 680	1.7 Gal US-Liquid for each one	SAE80W/90 API GL-4
DUO 740	2.2 Gal US-Liquid for each one	

Lubricate bearings (**C** and **D**) once every 50 gear operation hours with **ŁT43** grease (**Fig. 40b**) (or other equivalent grease designed for lubricating bearings in temp. between -30°C and + 130°C).

7.2. Joints

Lubricate joints once every 50 rake operation hours with **STP** lubricant.

Fig. 41. Lubrication points on joints

7.3. Risks present when lubricating the machine

- To avoid being splashed with pressurized liquid 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 shoes. Use protective gloves, too. 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 direct 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

Tab. 6. Defects and their repairs

Defect	Reason	Repair
The rake is not lifted/lowered hydraulically	Damaged or dirty components of hydraulics	Replace or clean connecting components of the hydraulics
	Damaged hydraulics of the tractor	Check condition of hydraulic unit of the tractor
Cylinder is not tight	Contaminated oil in the tractor's hydraulics	Replace oil in the tractor's hydraulics (recommended oil purity class according to NAS 1638 is minimum 9-10). Order cylinder repair kit and replace damaged gaskets
The rake leaves most part of the swath	Bent or missing tines	Replace tines
	Too low rotation speed	Increase rpm
	Incorrect working height	Adjust working height according to section 5.6. "Preparing the rake for work"
Excessive vibration during operation	Damaged PTO shaft	Check the condition of PTO shaft and if need be replace

9. REPAIR AND WITHDRAWAL FROM USE

9.1. Scrapping

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

To do so, drain oil from intersecting axis gear and working unit and deliver it 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

TWO-ROTOR IN-LINE 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 the 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. 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 are considered if received within 14 days after it is completed by the manufacturer.
5. The following parts and situations are not covered by warranty:
   a) **wearing parts: rotors, intersecting axis gears and parts inside the gearboxes, bushings and sliding elements, clutches, joints, tine holders, raking tines, bearings, rubber-metal fenders, safety curtains, swath guides rubbers, connective elements, etc. These repairs may be done only at purchaser's cost.**
   b) **use for any other purpose than those described in the operator's manual,**
   c) **operation on rocky fields and results such as: damaging and bending of tines**
   d) **running into any obstacle,**
   e) **too fast lowering of the machine to the ground,**
   f) **setting raking tines lower than 0.4" above the ground,**
   g) **using PTO shaft featuring parameters other than provided by the shaft's manufacturer, or length not adjusted to operating tractor,**
   h) **transport and accidental damage.**
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 of the interior of 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) **use of different tines - not original SaMASZ tines,**
   d) **negligent maintenance,**
   e) **use of non-genuine spare or replacement parts that are not specifically designed for the model in question,**
   f) **lack of needed records in the warranty card or filling in the warranty card independently,**
   g) **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 does not pay the invoice 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 also invalidates the warranty.

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

NOTE:
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 scope and spare parts replaced:

Date, stamp and signature of repair shop.

Date, stamp and signature of repair shop.

Date, stamp and signature of repair shop.