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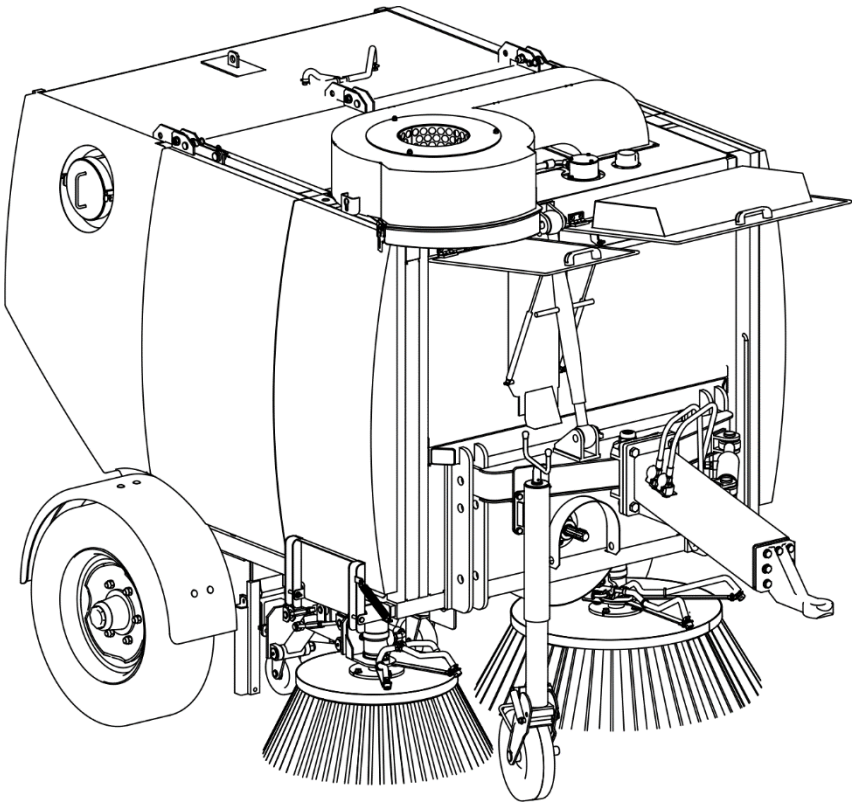
OPERATOR'S MANUAL

TRAILED SWEEPER

PRONAR ZMC2.0

TRANSLATION OF THE ORIGINAL COPY OF THE MANUAL



EDITION 3A-06-2012

PUBLICATION NO 130N-00000000-UM

EN

TRAILED SWEEPER

PRONAR ZMC2.0

MACHINE IDENTIFICATION

TYPE: *ZMC2.0*

SERIAL NUMBER:

INTRODUCTION

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

This Operator's Manual is an integral part of the machine's documentation. Before using the machine, the user must carefully read this Operator's Manual and observe all recommendations. This guarantees safe operation and ensures malfunction free work of the machine. The machine is designed to meet obligatory standards, documents and legal regulations currently in force.

The manual describes the basic safety rules and operation of the machine. If the information stated in the Operator's Manual needs clarification then the user should refer for assistance to the sale point where the machine was purchased or to the Manufacturer.

MANUFACTURER'S ADDRESS:

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CONTACT TELEPHONES

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SYMBOLS APPEARING IN THIS OPERATOR'S MANUAL

Information, descriptions of danger and precautions and also recommendations and prohibitions associated with user safety instructions are marked:

and also preceded by the word **"DANGER”.** Failure to observe the instructions may endanger the machine operator's or other person's health or life.

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

and also preceded by the word **"ATTENTION".** Failure to observe the instructions may lead to damage to the machine as a result of improper operation, adjustment or use.

In order to focus the user's attention on the need to perform maintenance, the relevant section of the Operator's Manual is marked with the pictogram:

Additional tips and advice for machine operation are marked:

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

DIRECTIONS USED IN THIS OPERATOR'S MANUAL

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

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EC DECLARATION OF CONFORMITY OF THE MACHINERY

PRONAR Sp. z o.o. declares with full responsibility, that the machine:

Description and identification of the machinery	
Generic denomination and function:	**Trailed sweeper**
Type:	**ZMC2.0**
Model:	–
Serial number:	
Commercial name:	**Trailed sweeper PRONAR ZMC2.0**

to which this declaration relates, fulfills all the relevant provisions of the Directive **2006/42/EC** of The European Parliament and of The Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (Official Journal of the EU, L 157/24 of 09.06.2006).

The person authorized to compile the technical file is the Head of Research and Development Department at PRONAR Sp. z o.o., 17-210 Narew, ul. Mickiewicza 101A, Poland.

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

Z-CA DYREKTORA
d/s [illegible]
członek zarządu
Roman Omelianiuk

Narew, the 2010 -04- 07

Place and date

Full name of the empowered person position, signature

CONTENS

SECTION

1

BASIC INFORMATION

1.1 IDENTIFICATION

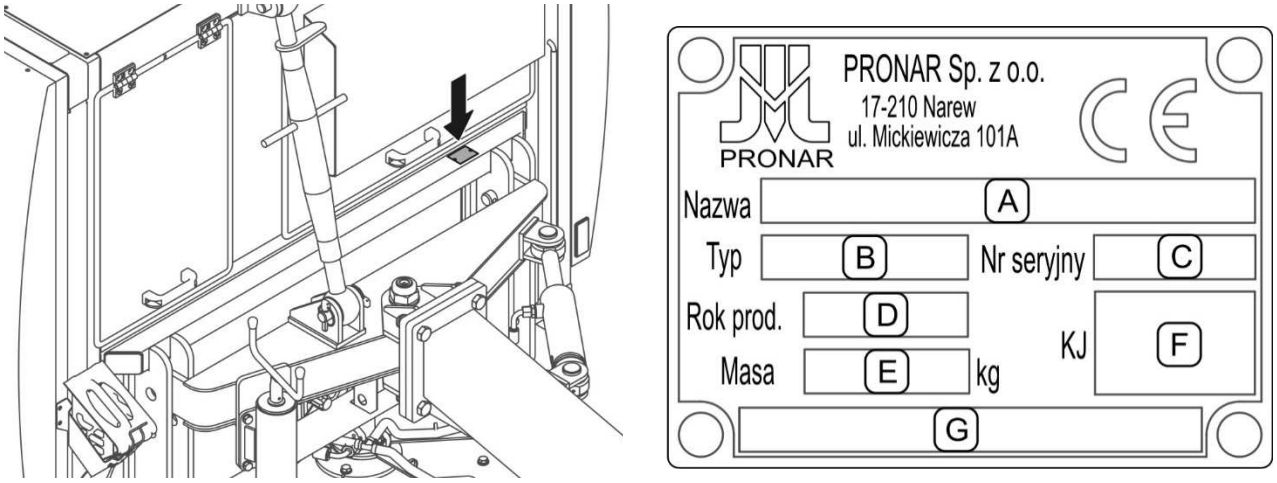


FIG. 1.1 Location of the data plate

Meaning of data plate items (FIG. 1.1):

A - machine name

B – type,

C – serial number

D – year of manufacture

E – machine tare weight [kg]

F – Quality Control stamp

G – maximum carrying capacity [kg]

The factory number is stamped into the data plate and on mounting base beside the data plate. Data plate is located at the front, on the left side of the frame. When buying the machine, check that the serial number corresponds with that indicated in the *WARRANTY BOOK*, in the sales documents and in the *OPERATOR'S MANUAL*.

1.2 PROPER USE

The PRONAR ZMC2.0 sweeper is used for sweeping access roads, squares, parking spaces, extensive warehouse areas, external surroundings of buildings with paved surfaces as asphalt, concrete paving blocks, concrete. Use for other purposes should be regarded as improper.

The sweeper is designed for operation with agricultural tractors and other carrying vehicles that meet the requirements contained in Table 1.1

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

- carefully read the OPERATOR'S MANUAL and comply with its recommendations,
- understand the machine's operating principle and how to operate it safely and correctly,
- comply with general safety regulations while working,
- prevent accidents,
- comply with road traffic regulations.

The machine may only be used by persons, who:

- are familiar with the contents of this publication and with the contents of the tractor Operator's Manual,
- have been trained in machine operation and safe working conditions,
- have the required authorisation to drive the vehicle and are familiar with the road traffic regulations and transport regulations.

IMPORTANT!

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

- **for transporting people and animals**
- **for transporting whatever materials**

TAB. 1.1 Carrying vehicle requirements

	UNIT	REQUIREMENTS
Brake system		
Double line pneumatic system *	-	socket compliant with PN-ISO 1728:2007
Pressure rating of the system	kPa	600
Hydraulic system		
Hydraulic oil	-	HL32
Nominal pressure	MPa	16
Hydraulic sockets	-	2 sockets of one hydraulic section on the rear of the carrying vehicle
Electrical system		
Lighting system socket	-	7 polar compliant with ISO 1724
Control panel power supply socket	-	3-pole socket
Electrical system voltage	V	12
Power take-off shaft		
Rotation speed of PTO shaft	RPM	1,000
PTO rotation direction	-	clockwise *(looking at the shaft front in the carrying vehicle)*
Power demand	kW / Horsepower	above 44.1 / 60
Hitch		
Type of hitch	-	upper transport hitch according to 89/173/EEC Directive (located over PTO shaft)
Drawbar eye diameter	mm	Ø 40
Minimum vertical load capacity of hitch	kN / kg	6,5 / 650
Other requirements		
Beacon light	-	orange light

**- optionally, the sweeper can be equipped with single line pneumatic brake system*

1.3 EQUIPMENT

The sweeper equipment includes:

- Operator's Manual,
- Warranty Book,
- control panel,
- PTO shaft,
- Wheel chocks
- claw joint MU-704 acc. to DIN 3483 *(for filling the water container)*
- 3-pin socket *(for connecting the control panel in tractors without a socket)*

Additional (optional) equipment:

- single line pneumatic break system,
- side adapter for collecting leaves,
- additional water tank, capacity. 200 dm3,
- Hydraulic brake system,
- chute, set

1.4 TERMS & CONDITIONS OF WARRANTY

PRONAR Sp. z o.o., Narew guarantees the reliable operation of the machine when it is used according to its intended purpose as described in the *OPERATOR'S MANUAL*. Defects discovered during the warranty period will be removed by the Warranty Service. The repair period is specified in the *WARRANTY BOOK*.

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

- brushes;
- slides;
- bearings;

- filters,
- bulbs,
- drive belts
- fan,
- suction hoses

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

In the event of damage arising from:

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

the user will lose the right to warranty service.

TIP

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

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

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

1.5 TRANSPORT

DANGER

When transporting independently, the user must carefully read this Operator's Manual and observe all recommendations. When being transported on a motor vehicle the machine must be mounted on the vehicle's platform in accordance with the transport safety requirements. The driver of the vehicle should take particular care while transporting the machine. This is due to the vehicle's centre of gravity shifting upwards when loaded with the machine.

The machine is prepared for sale completely assembled and does not require packing. Packing is only required for the machine operator's manual and electrical system components.

Delivery is either by transport on a vehicle or independently, after being attached to a tractor. Transportation of the machine is connected to a permissible tractor provided the vehicle's driver familiarises himself with the machine's Operator's Manual and particularly with safety information and Concerning the Principles of connection and transportation on public roads.

During road transport the machine should be secured on the carrier platform by certified belts or chains fitted with pulley.

When loading and unloading the machine, comply with the general principles of workplace health and safety for reloading work. Persons operating reloading equipment must have the qualifications required to operate these machines.

During reloading work, particular care should be taken not to damage parts of the fittings or the lacquer coating. Chocks or other objects without sharp edges should be placed under the wheels to prevent it from rolling. The chocks must be fixed to the load platform.

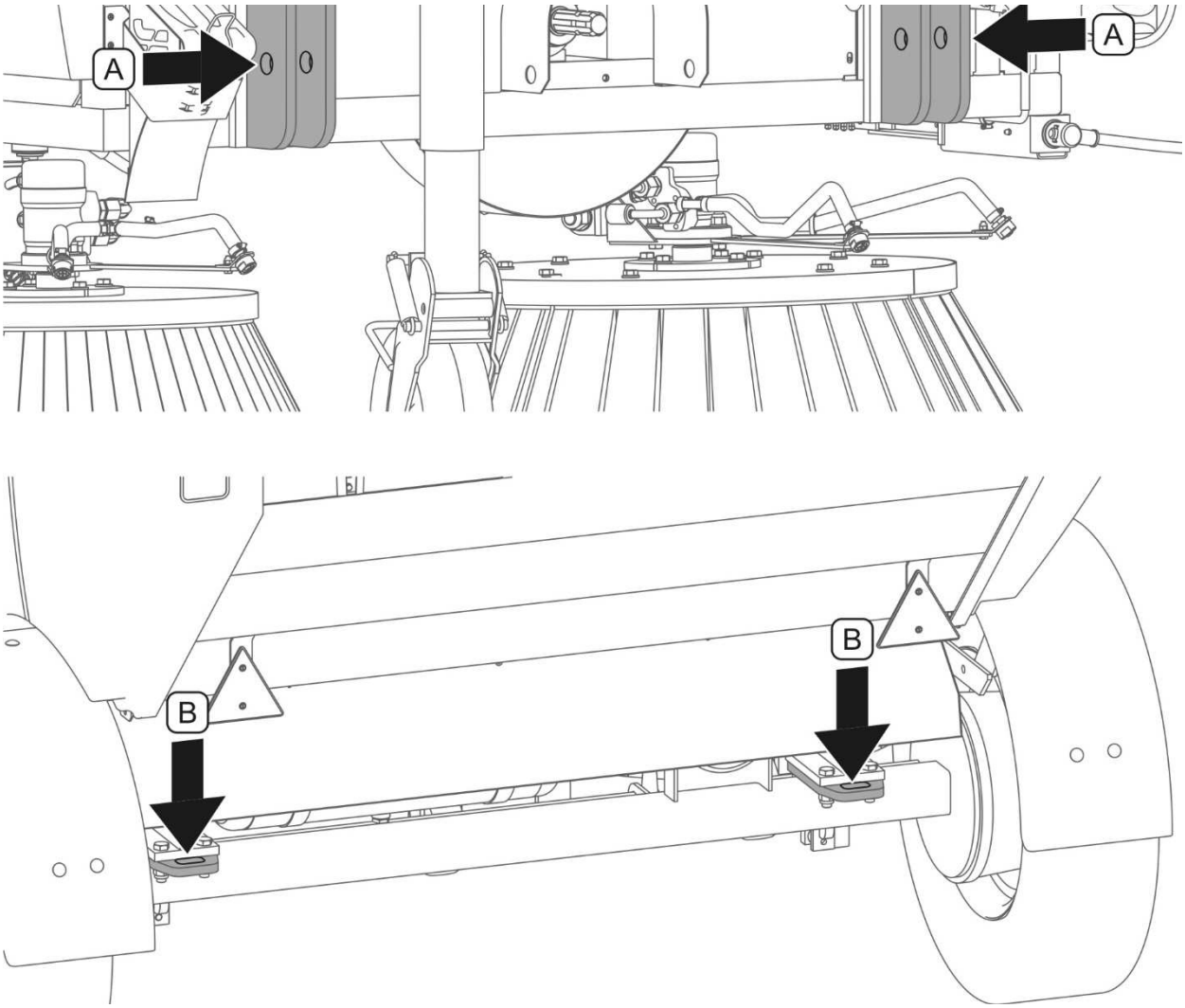


FIG. 1.2 Transport lugs

(A)- lower openings of the hitch bracket; (B)- openings of the axle bracket

The machine should be attached to lifting equipment in places specially designed for this purpose (FIG. 1.2). Sweeper has four points () for fixing it to the load platform.

ATTENTION!

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

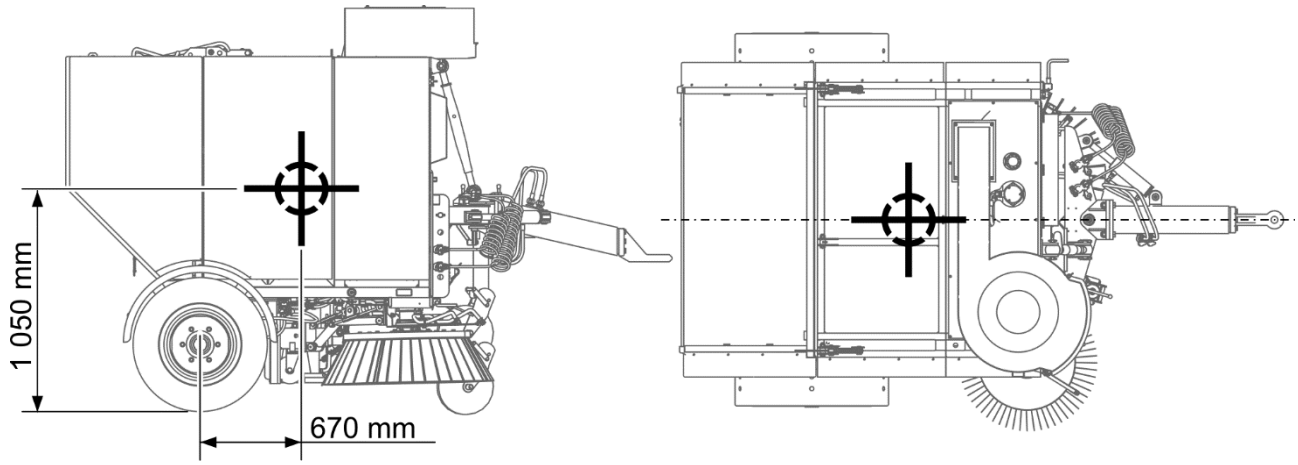


FIG. 1.3 Location of centre of gravity (empty tank)

ATTENTION!

Centre of gravity, depending on the machine version varies in the ±50 mm range.

1.6 ENVIRONMENTAL HAZARDS

A hydraulic oil leak constitutes a direct threat to the natural environment owing to its limited biodegradability. Maintenance and repair work which involves the risk of a leak should be performed in the rooms with oil resistant surface. In the event of lubricant leaking into the environment, first of all contain the source of the leak, and then collect the leaked lubricant using available means. Remaining lubricant should be collected using sorbents, or by mixing the oil with sand, sawdust or other absorbent materials. The lubricant pollution, once gathered up, should be kept in a sealed, marked, hydrocarbon resistant container, and then passed on to the appropriate oil waste recycling centre. The container should be kept away from heat sources, flammable materials and food.

Oil, which has been used up or is unsuitable for further use owing to a loss of its properties should be stored in its original packaging in the conditions described above.

1.7 WITHDRAWAL FROM USE

In the event of decision by the user to withdraw the machine from use, comply with the regulations in force in the given country concerning withdrawal from use and recycling of machines withdrawn from use.

Before proceeding to dismantle machine, oil shall be completely removed from hydraulic system.

When spare parts are changed, worn out or damaged parts should be taken to a collection point for recyclable raw materials. Waste oil, hydraulic lines, electrical system components and plastic elements should be taken to the appropriate facility dealing with the recycling of this type of waste.

IMPORTANT!

During dismantling personal protection equipment shall be used i.e. protective clothing, boots, gloves and protective goggles etc.

Avoid contact of skin with oil. Do not allow used lubricants to spill.

SECTION

2

SAFETY ADVICE

2.1 BASIC SAFETY RULES

2.1.1 USE OF MACHINE

- Before using the machine, the user must carefully read this Operator's Manual and the *WARRANTY BOOK*. When operating the machine, the operator must comply with the recommendations.
- The machine may only be used and operated by persons qualified to drive agricultural tractors and agricultural machines and trained in the use of the machine.
- If the information stated in the Operator's Manual is difficult to understand, contact a seller, who runs an authorised technical service on behalf of the manufacturer, or contact the manufacturer directly.
- Be aware of the existence of a residual risk, and for this reason the fundamental basis for using this machine should be the application of safety rules and sensible behaviour.
- The machine must never be used by persons, who are not authorised to drive agricultural tractors, including children and people under the influence of alcohol or other drugs.
- Non-compliance with the safety rules of this Operator’s Manual can be dangerous to the health and life of the operator and others.
- The machine must not be used for purposes other than those for which it is intended. Anyone who uses the machine other than the way intended takes full responsibility for himself for any consequences of this use. Use of the machine for purposes other than those for which it is intended by the Manufacturer may invalidate the warranty.
- The machine may only be used when all the protective elements (i.e.. safety guards, bolts, cotter pins) are technically sound and correctly positioned. In the event of loss or destruction of the safety guards, they must be replaced with new ones.

- Before hitching the machine to the tractor, always check the technical condition of the hitching system, connection elements of the braking system and electrical system of the tractor and the machine.

2.1.2 HITCHING AND UNHITCHING FROM CARRYING VEHICLE

- Carefully read the tractor Operator's Manual.
- To mount machine on tractor use only genuine pins and safeguard cotter pins.
- The agricultural tractor to which the machine will be coupled must be technically reliable and must fulfil the requirements of machine Manufacturer.
- Be especially careful when hitching the machine to tractor.
- After completion of coupling the machine, check the safeguards.
- Be especially careful when disconnecting the machine from the tractor.
- Do not disconnect the sweeper from the tractor if the waste tank is open or raised.
- The machine unhitched from tractor must be immobilised with parking brake. If the machine is positioned on a slope or elevation it should be additionally secured against moving by placing chocks under the machine's wheels.

2.1.3 TRANSPORTING THE MACHINE

- Before driving on public roads, check operation of indicator lights.
- While driving on public roads the machine shall be marked with a warning triangle distinguishing slow-moving vehicles. The warning triangle should be attached to the rear of the machine.
- When driving on public roads, comply with the road traffic regulations. in force in the country, in which the machine is used.
- Do not exceed the permitted speed arising from road conditions and design limitations. Adjust travel speed to the prevailing road conditions and other limitations arising from road traffic regulations limits.
- Do NOT exceed the maximum transport speed of 25 km/h.
- Do NOT leave machine raised and unsecured while the tractor is parked.
- Do NOT travel with raised or open waste tank.

- The machine must never be used for transport of people, animals and other items.
- Reckless driving and excessive speed may cause accidents.

2.1.4 MAINTENANCE

- During the warranty period, any repairs may only be carried out by Warranty Service authorised by the manufacturer. It is recommended that necessary repairs to machine should be undertaken by specialised workshops.
- In the event of any fault or damage whatsoever, do not use the machine until the fault has been corrected.
- During work, use proper protective clothing, gloves and appropriate tools.
- Any modification to the machine frees PRONAR from any responsibility for damage or detriment to health which may arise as a result.
- Regularly check the technical condition of the safety devices and correct tightening of bolt connections.
- Regularly perform service inspections of machine as recommended by the Manufacturer.
- Do NOT perform service or repair work under raised and unsupported machine.
- Servicing and repair work should be carried out in line with the general principles of workplace health and safety. In the event of injury, the wound must be immediately cleaned and disinfected. In the event of more serious injuries, seek a doctor's advice.
- Repair, maintenance and cleaning work should be carried out with the tractor's engine turned off and the ignition key removed. Immobilise tractor with parking brake. Ensure that unauthorised persons do not have access to the vehicle.
- Switch off the machine and install supports and service safety devices before performing any maintenance, adjustment and repair activities near the raised waste tank.
- Should it be necessary to change individual parts, use only original parts. Non-adherence to these requirements may put the user and other people's health and life at risk, and also damage the machine and invalidate the warranty.

- Do NOT weld, drill holes in, cut or heat the main structural elements, which have a direct impact on the machine operation safety.
- In the event of work requiring the machine to be raised, use properly certified hydraulic or mechanical lifts for this purpose. After lifting the machine, stable and durable supports must also be used. Do NOT carry out work under a machine, which has only been raised with the lift jack.
- Do not modify pressure in hydraulic system on forfeit of warranty rights.
- The machine must not be supported using fragile elements (bricks or concrete blocks).
- After completing work associated with lubrication, remove excess oil or grease.
- In order to reduce the danger of fire the machine must be kept in a clean condition.

2.1.5 MACHINE OPERATION

- Before starting the tractor with the connected machine make sure the PTO drive is not engaged, otherwise it can lead to uncontrolled operation of the machine.
- Before activating the machine, always ensure that all the safety guards are in good condition and in place.
- Before starting the machine make sure that there are no bystanders (especially children) or animals in the danger zone. The machine operator is obliged to ensure proper visibility of the machine and the working area.
- During machine operation do not occupy a different position than that of the operator in the vehicle's cab. Do NOT leave the cab, when the machine is in operation.
- Do NOT stand within the machine's working zone and also between the carrying vehicle and the machine when the carrying vehicle's engine is working.
- Lower the suction unit onto the ground after achieving speed 1,000 rpm by the PTO.
- During operation, do not reduce the PTO speed,
- When finished sweeping turn the PTO off after 10 -20 seconds following lifting the suction unit.

- DO NOT allow persons to stand near the brushes until rotating parts stop completely.
- Do NOT exceed the maximum working speed of 6 km/h
- Before lifting the tank or opening the tank, make sure there are no bystanders near the machine.
- Keep a safe distance from electric power lines while lifting and emptying the waste tank.
- Do NOT leave the waste tank open or raised without supports and service safety devices installed.
- In order to limit occupational risks associated with exposure to noise during sweeper operation use individual protection (ear protectors). In order to reduce the level of noise during work the tractor cab window and door should be closed.

2.1.6 OPERATION OF PTO SHAFT

- The machine may only be connected to the tractor by appropriately selected PTO shaft.
- Never use a damaged PTO drive shaft, it may cause an accident. A damaged shaft must be repaired or replaced.
- Disconnect the drive shaft each time when it is not necessary to drive the machine.
- The chains preventing the shaft cover from turning while the shaft is working, shall be secured to a fixed element of machine structure.
- Do NOT use the securing chains to support the shaft while machine is parked or when transporting the machine.
- Before using the machine, the user should thoroughly acquaint himself with the PTO shaft Operator's Manual and adhere to the recommendations contained in it.
- Do not exceed recommended by the manufacturer shaft working angle.
- The shaft must be equipped with guards. Do NOT use the shaft with damaged or missing guards.

- After connecting shaft ensure that it is correctly and safely connected to the tractor and to the machine.
- Before starting PTO shaft make certain that the PTO rotation direction is correct.
- Before disconnecting the shaft, turn off the tractor engine and remove the key from the ignition.
- Do NOT wear loose clothing, straps or whatever that may become wrapped round the rotating drive shaft. Contact with rotating PTO drive shaft may cause severe injuries.
- Do NOT go over and under the shaft or stand on it equally during work as also when the machine is parked.

2.2 DESCRIPTION OF RESIDUAL RISK

Pronar Sp. z o.o. in Narew has made every effort to eliminate the risk of accidents. There is, however, a certain residual risk, which could lead to an accident, and this is connected mainly with the actions described below:

- using the sweeper for purposes other than those for which it is intended,
- being between the tractor and the machine while the engine is running and when the machine is being attached;
- operation of the machine by persons under the influence of alcohol;
- being on the machine when it operates,
- being near moving elements of the machine;
- operating the machine with removed or faulty safety guards;
- cleaning, maintenance and technical checks when tractor is connected and engine is running;
- making modifications to the machine without the consent of the Manufacturer;
- oil leaks and sudden movement of elements resulting from line cracking;
- possibility of trapping persons or animals inside the waste tank;
- presence of persons or animals in areas invisible from the driver's position;

- transport of persons or animals on or inside the machine;
- exceeding permissible travel speed.

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

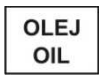
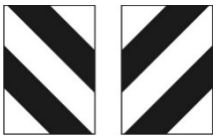
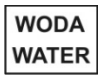
- prudent and unhurried operation of the machine,
- application of the remarks and recommendations stated in the Operator's Manual;
- maintaining safe distance from the danger zone
- assistance of third persons while manoeuvring the machine, due to limited visibility from the driver's position;
- carrying out repair and maintenance work in line with operating safety rules,
- using suitable protective clothing
- ensuring unauthorised persons have no access to the machine, especially children.
- a ban on being on the machine when it is operating.

2.3 INFORMATION AND WARNING DECALS

All signs should always be legible and clean, visible to the operator and also to persons possibly being in the vicinity of the machine in operation. If any safety sign is lost or illegible, it should be replaced with a new one. All elements having safety signs replaced during repairs should be affixed with these signs. Safety signs and decals may be purchased from the Manufacturer or the Seller.

TAB. 2.1 Information and warning decals

ITEM	SYMBOL	DESCRIPTION	ITEM	SYMBOL	DESCRIPTION
1		Before starting work, carefully read the Operator's Manual.	6		Warning "*THE USER MUST NOT! DISCONNECT THE MACHINE WITH THE WASTE TANK RAISED FROM THE TRACTOR. OPERATE THE MACHINE WITH REMOVED SAFETY GUARDS*"
2		Engage service interlocks before entering the danger zone	7		Do not stand under raised or open waste tank
3		Danger caused by materials thrown out by the machine. Keep a safe distance from the operating machine.	8		Do not reach into crushing space if elements may move.
4		Keep a safe distance from electric power lines.	9		Do not reach into the belt transmissions' working area

ITEM	SYMBOL	DESCRIPTION	ITEM	SYMBOL	DESCRIPTION
5		Do NOT approach and do NOT touch rotating brushes	10		Keep a safe distance. Pressurised liquid.
11		Single person operation	17		Oil inlet marking
12		Rotation speed of PTO shaft	18 19		Marking of maximum and minimum water level in the tank
13		Guaranteed level of acoustic power	20		Machine designation
14		Ear protection required	21		Fixing points for the transport
15		Tilting hitch drawbar	22		Outline marking.
16		Water inlet marking	23		Manufacturer's website
			24		Maximum transport speed

Numbers in the item column correspond to marking (FIG. 2.1)

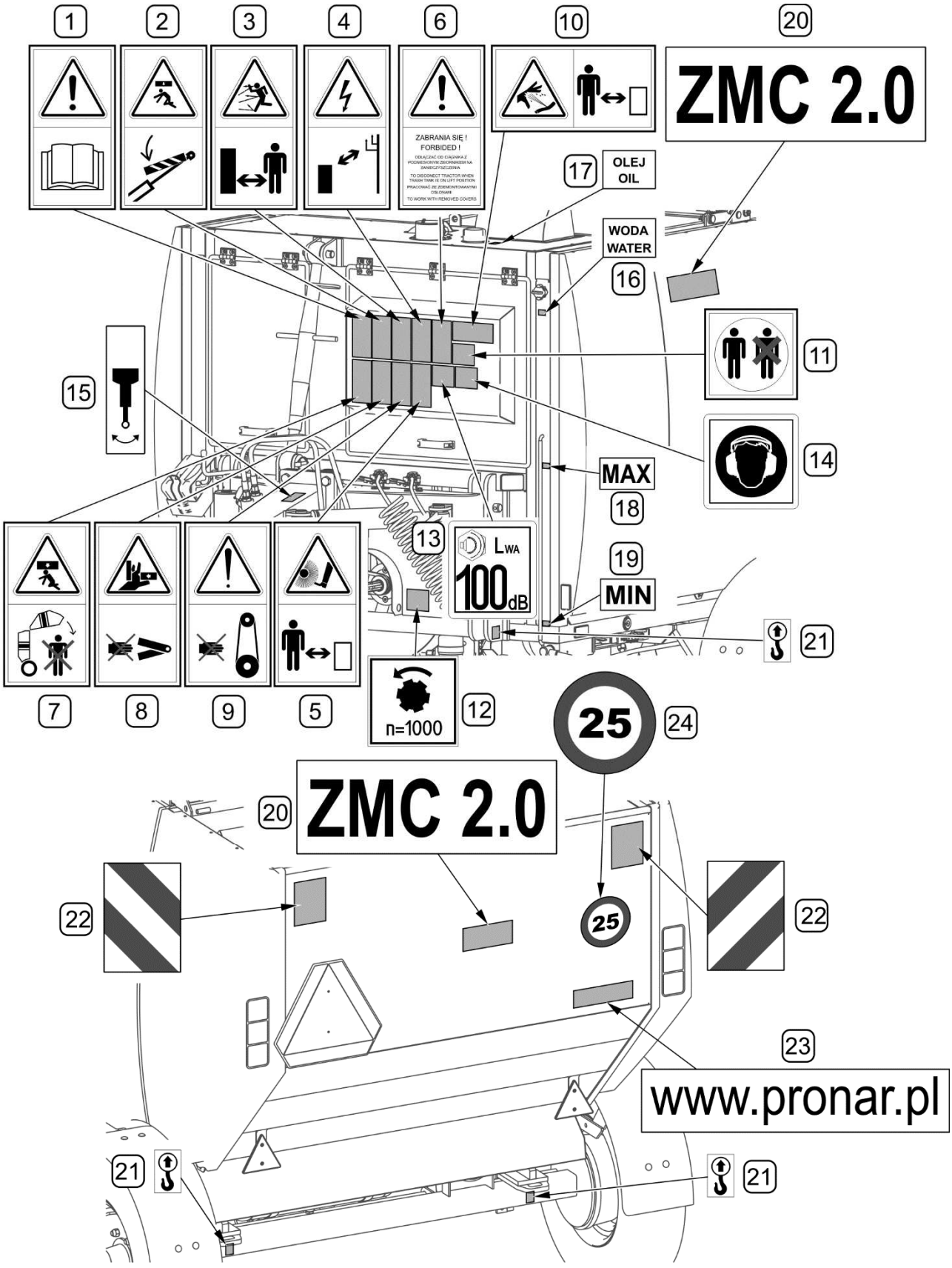


FIG. 2.1 Locations of information and warning decals.

Meaning of symbols (TAB. 2.1)

SECTION

3

DESIGN AND OPERATION

3.1 TECHNICAL SPECIFICATION

TAB. 3.1 BASIC TECHNICAL DATA OF ZMC 2.0 SWEEPER

	Unit	
Technical specification		
Sweeping width	mm	2,000 – 2,300
Capacity *(for maximum working speed)*	m^2/h	13,800
Maximum working speed	km/h	6
Waste tank capacity	m^3	2.1
Tare weight (without water)	kg	2,300
Hydraulic system		
Oil tank capacity	l	40
Nominal pressure in the system	MPa	16
Type of oil	-	hydraulic, HL32
Sweep unit		
Quantity and type of brushes	item	2 disk brushes
Brush diameter	mm	800, 1 000
Rotation speed of brushes	RPM	0 – 130
Sprinkler system		
Water tank capacity Additional water tank capacity *	l	240 200 *
Quantity of sprinkling nozzles	item	11
Maximum water pressure	MPa (bar)	0,3 (3)
Tyres		
Tyre	-	215/75R17,5HT TL 135/133J
Wheel disc	-	6.00x17,5 6xM18x1,5Ø160XØ205 ET=0
Tyre pressure	kPa	850
Other information		
Transport speed	km/h	25
Operation	-	single person operation
Acoustic power level L_{WA}	dB(A)	100
Acoustic pressure level at working position L_{pA}	dB(A)	99

** - option*

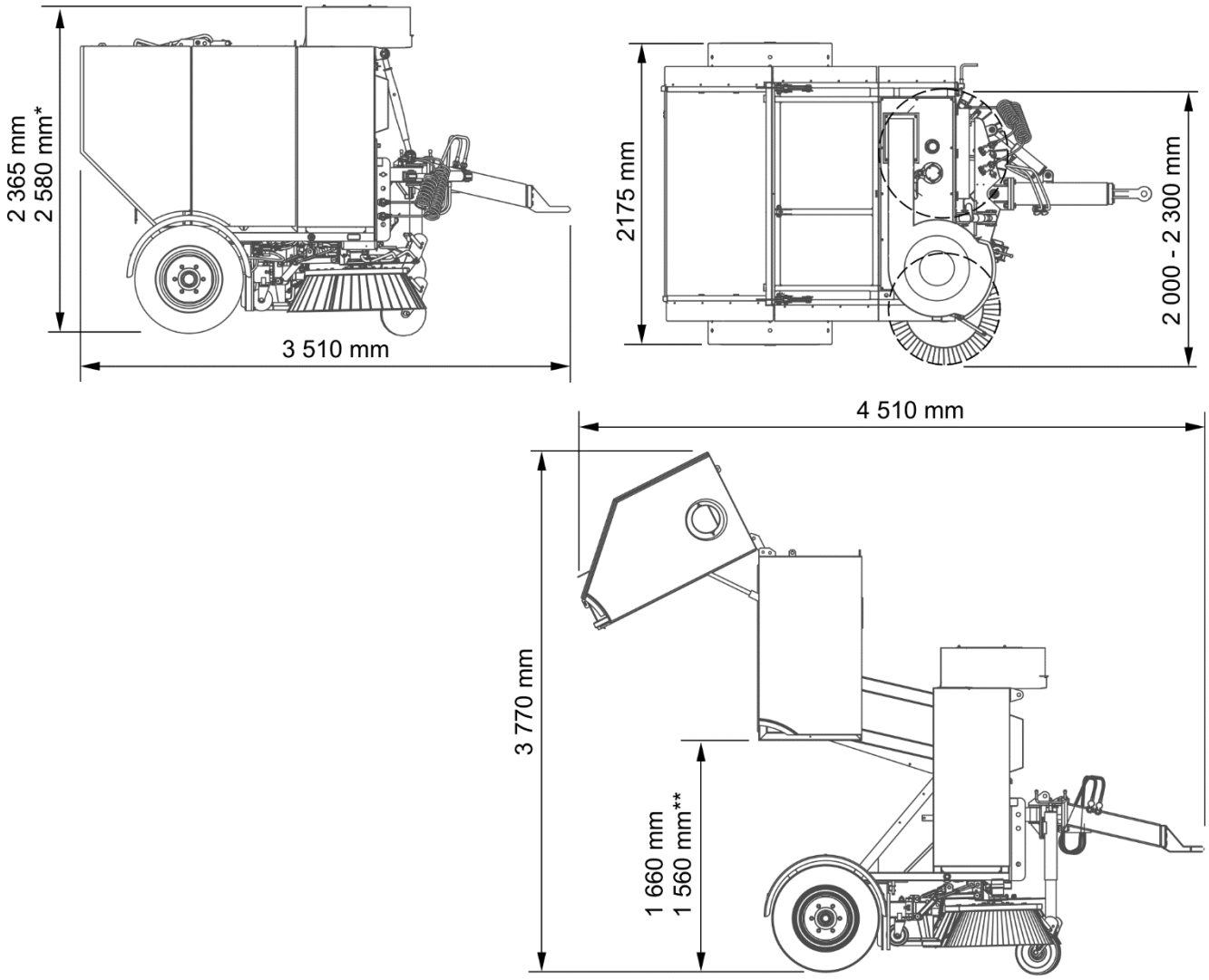


FIG. 3.1 External dimensions of ZMC2.0 sweeper

** - for the machine with an additional water tank (optional)*

*** - for the machine equipped with a chute set. (option)*

3.2 HYDRAULIC SYSTEM

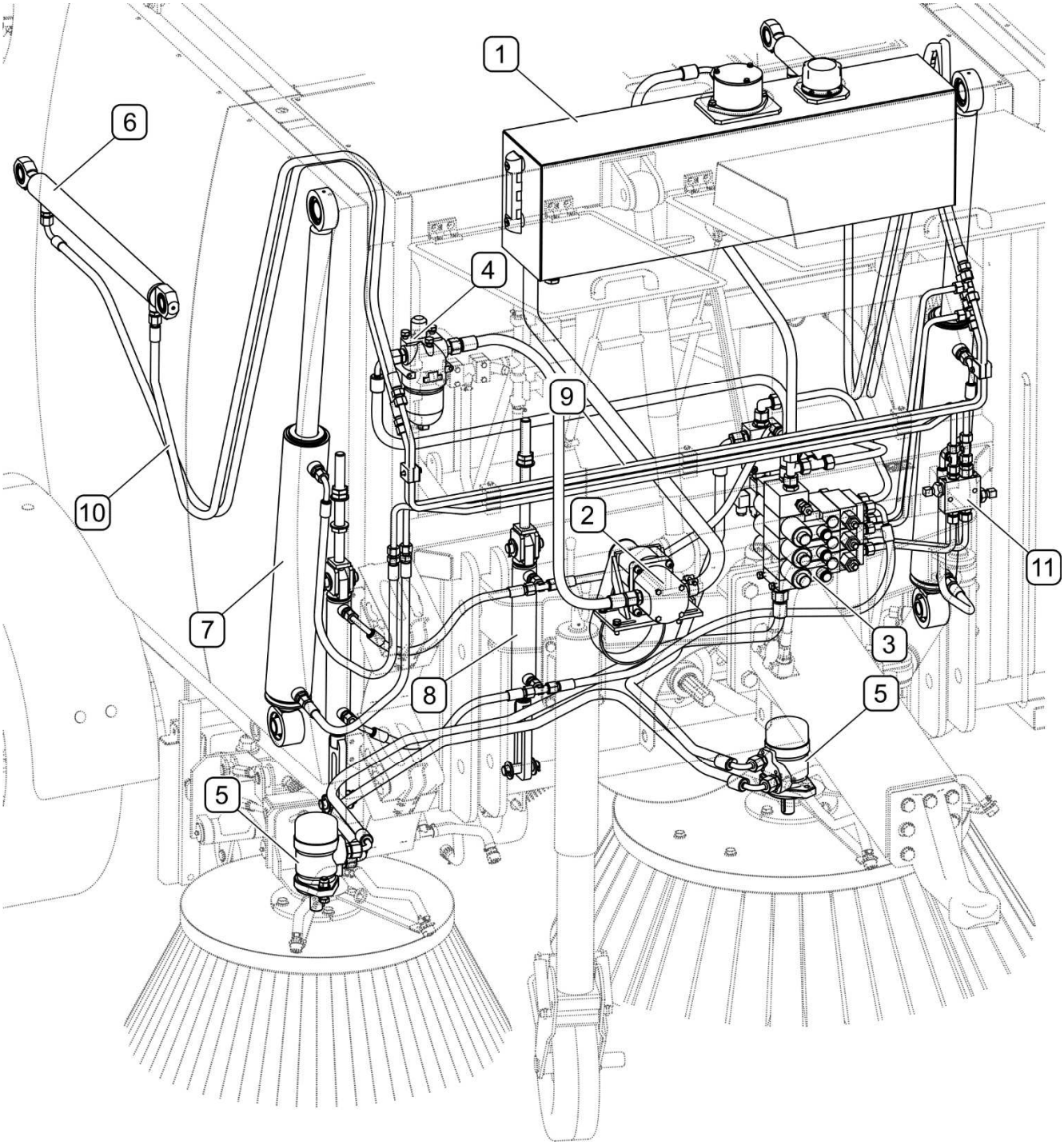


FIG. 3.2 Hydraulic system design

(1) - oil tank; (2) - oil pump; (3) - selective control valve; (4) - oil filter; (5) - hydraulic motor; (6)- hydraulic cylinder for tank opening; (7) - hydraulic cylinder for tank lifting; (8) - hydraulic cylinder for raising brushes; (9) - metal hydraulic conduits; (10) - rubber hydraulic conduits; (11) - cross overflow valve

PRONAR ZMC2.0 sweeper is equipped with a closed hydraulic system (FIG. 3.2). Oil tank (1) is located on the front, in the upper part of the machine and is equipped with filler plug with filter, return filter and oil level indicator with thermometer. Oil pump (2) is driven by the tractor's power take-off shaft (PTO) through the power reception system. The hydraulic circuit is controlled by activating suitable selective control valve (3) sections from the operator cab. Brushes are driven by two hydraulic motors (5).

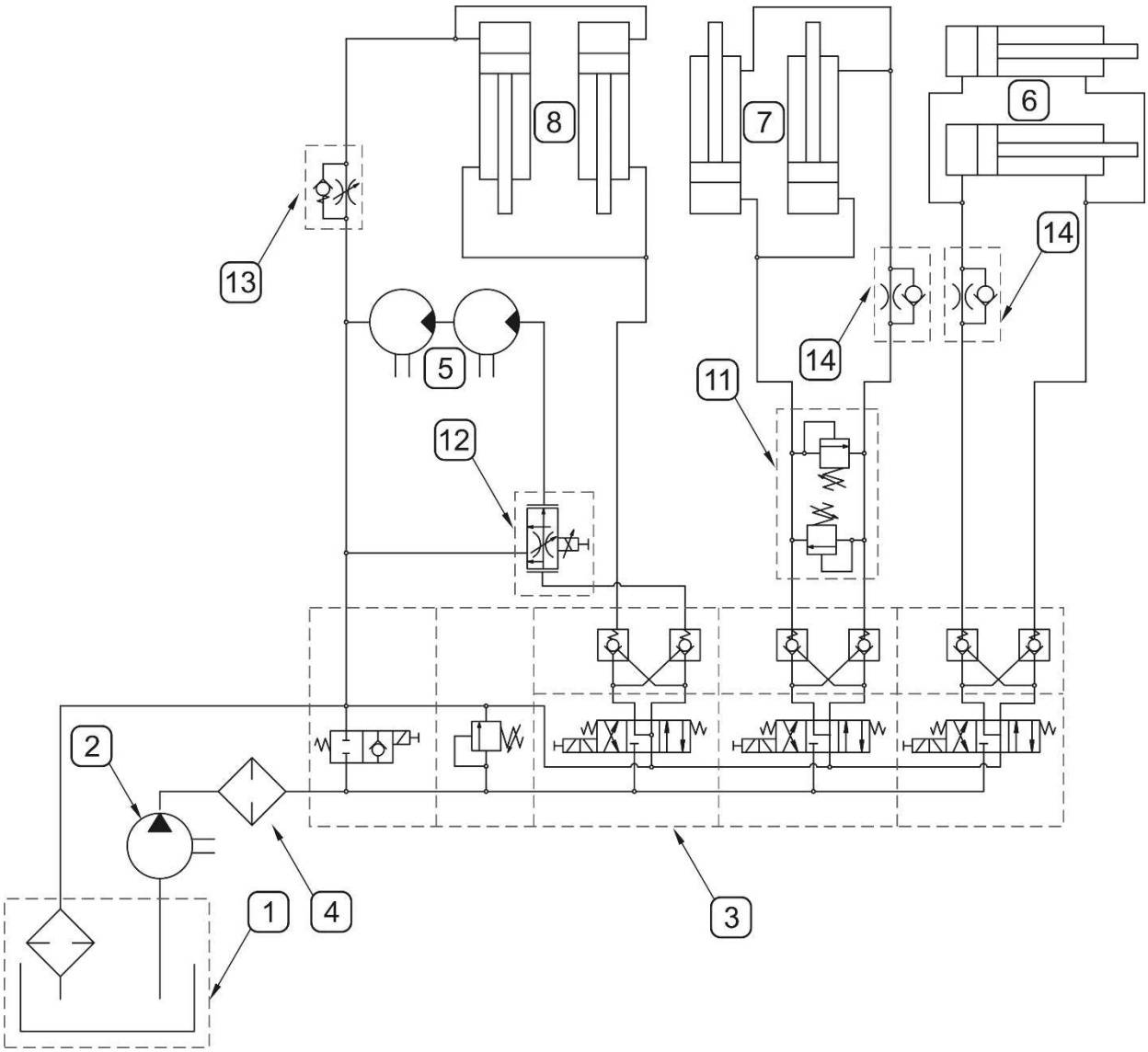


FIG. 3.3 Hydraulic system concept diagram

(1) - oil tank; (2) - oil pump; (3) - selective control valve; (4) - oil filter; (5) - hydraulic motors; (6) - hydraulic cylinders for tank opening; (7) - hydraulic cylinders for tank lifting; (8) - hydraulic cylinders for raising brushes; (11) - cross overflow valve; (12) - proportional valve; (13) - non-return throttle valve with compensation; (14) -gland;

3.3 PNEUMATIC BRAKE SYSTEM

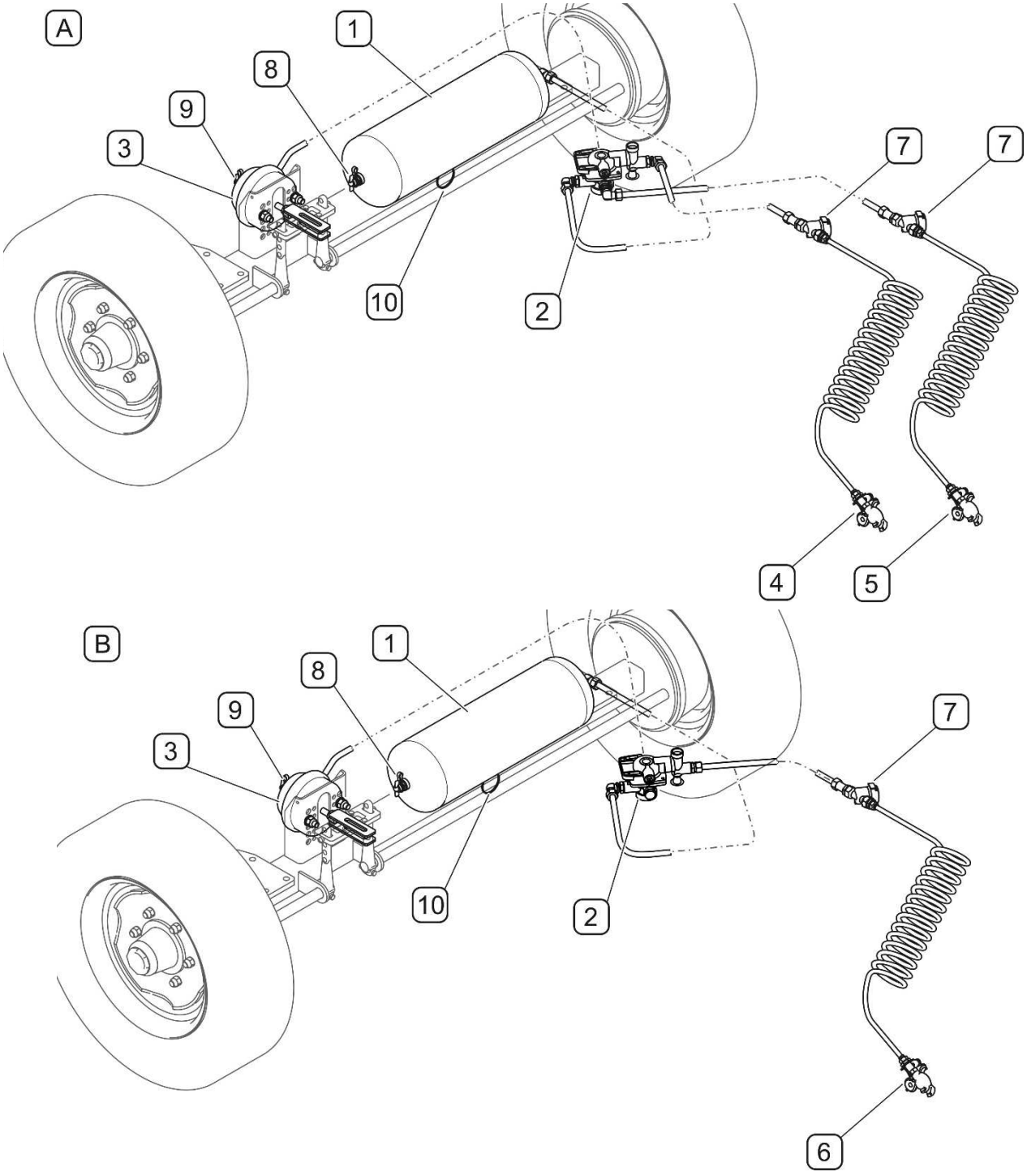


FIG. 3.4 Pneumatic brakes system design

(A) - double conduit system; (B) - single conduit system;(2) - air tank; (2)- control valve; (3) - pneumatic cylinder; (4) - "yellow" control connection; (5) - "red" supply connection; (6) - "black" connection; (7) - air filter; (8) - tank control connection; (9) - cylinder control connection; (10) - drain valve;

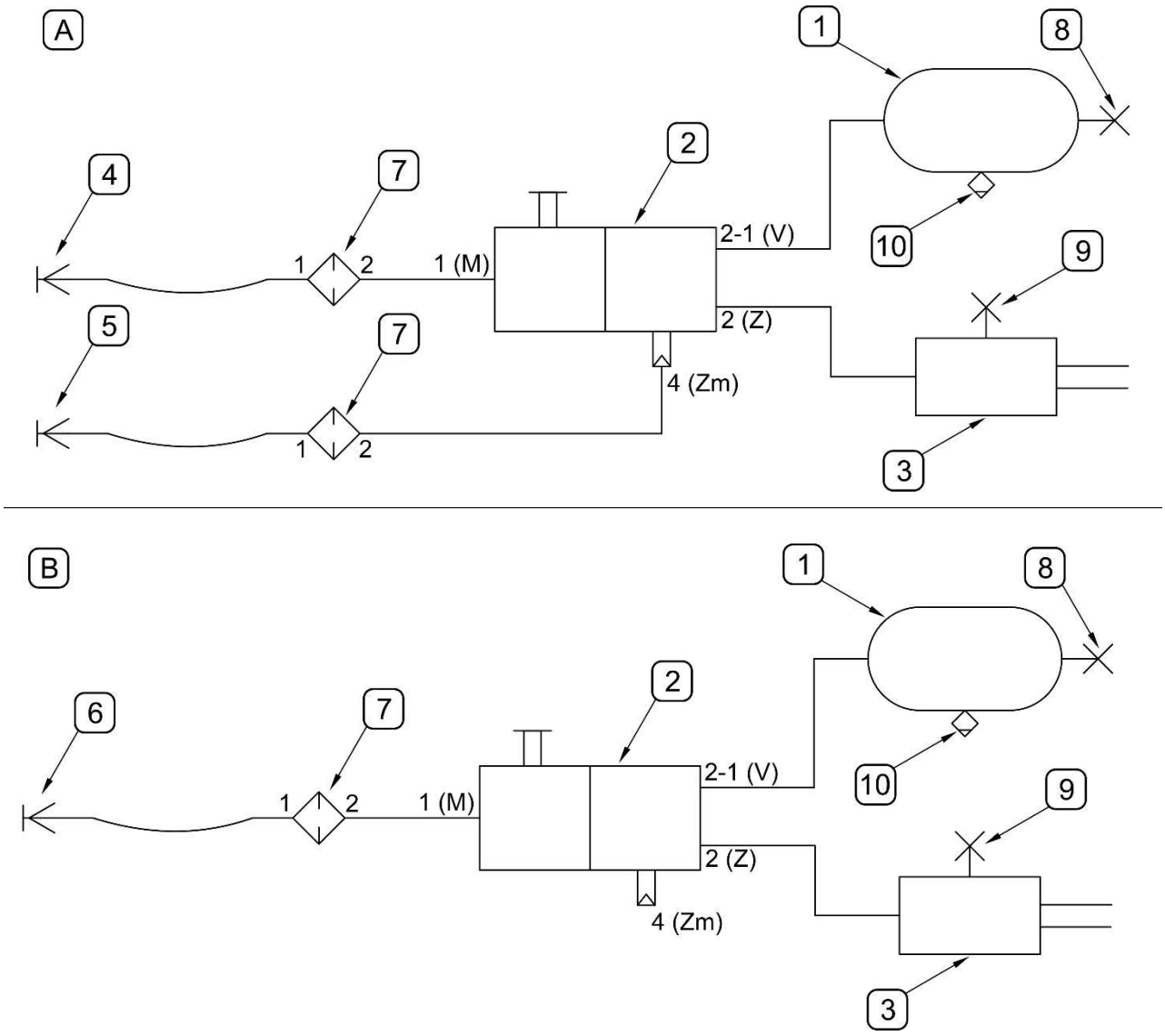


FIG. 3.5 Pneumatic brakes system diagram

(A) - double conduit system; (B) - single conduit system; (1) - air tank; (2) - control valve; (3) - pneumatic cylinder; (4) - "red" supply connection; (5) - "yellow" control connection; (6) - "black" connection; (7) - air filter; (8) - tank control connection; (9) - cylinder control connection; (10) - drain valve

Depending on version, ZMC2.0 sweeper can be equipped with one of the two types of pneumatic brake systems (FIG. 3.5):

- double conduit pneumatic system (A),
- single conduit pneumatic system (B)

The main brake is activated from the tractor driver's position by pressing on the brake pedal. Control valve (2) activates the sweeper's pneumatic brake system when the brake pedal is pressed in the tractor. Additionally, in the event of accidental disconnection of the pneumatic

conduit between the tractor and sweeper, the brake valve will automatically activate the machine brakes. The brake valve is equipped with the brake release system to be used when the sweeper is disconnected from the tractor. In order to switch off pneumatic brakes, pull out the handle next to control valve (2).

When the supply conduit is connected to the tractor, the brake release system automatically changes its position to allow normal brake operation.

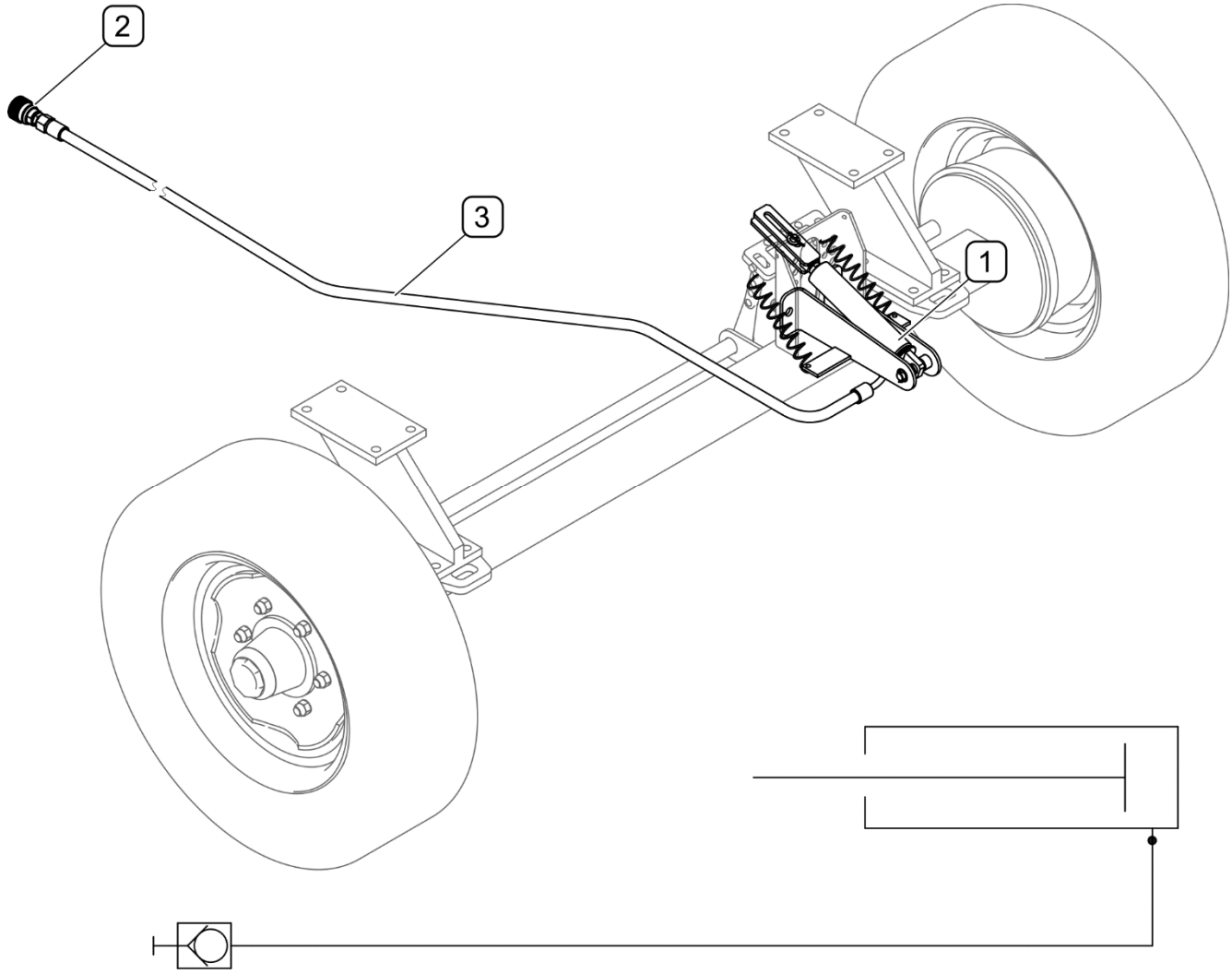


FIG. 3.6 Design of hydraulic brake system (option)

(1) - hydraulic cylinder; (2) - quick coupler; (3) - hydraulic conduit

Optionally, the sweeper can be equipped with hydraulic brake system (FIG. 3.6) that consists of hydraulic cylinder (1), quick coupler (3) and hydraulic conduit (3).

3.4 PARKING BRAKE

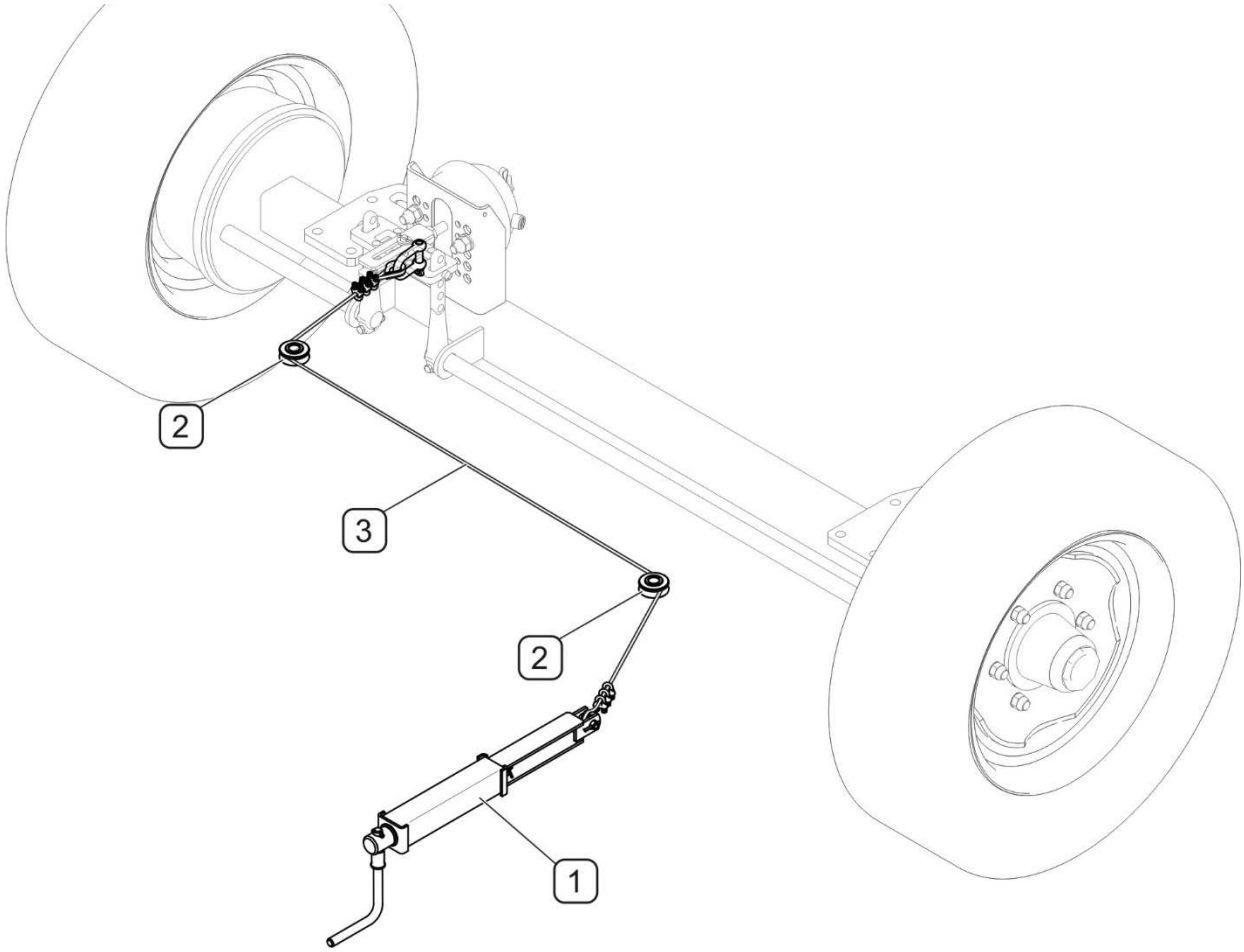


FIG. 3.7 Parking brake

(1) - brake crank mechanism; (2) - guide rollers; (3) - cable;

Parking brake (FIG. 3.7) control mechanism is located at the front, on the left side of the sweeper's frame, and is used for immobilising the machine while standing motionless. The brake is applied by rotating crank mechanism (1) clockwise. The mechanism tightens the steel cable (3) and causes tilting of the expander lever, which parts the jaws of the brake shoes immobilising the machine. In order to release the brake, turn the crank of the brake's mechanism anticlockwise.

3.5 SPRINKLER SYSTEM

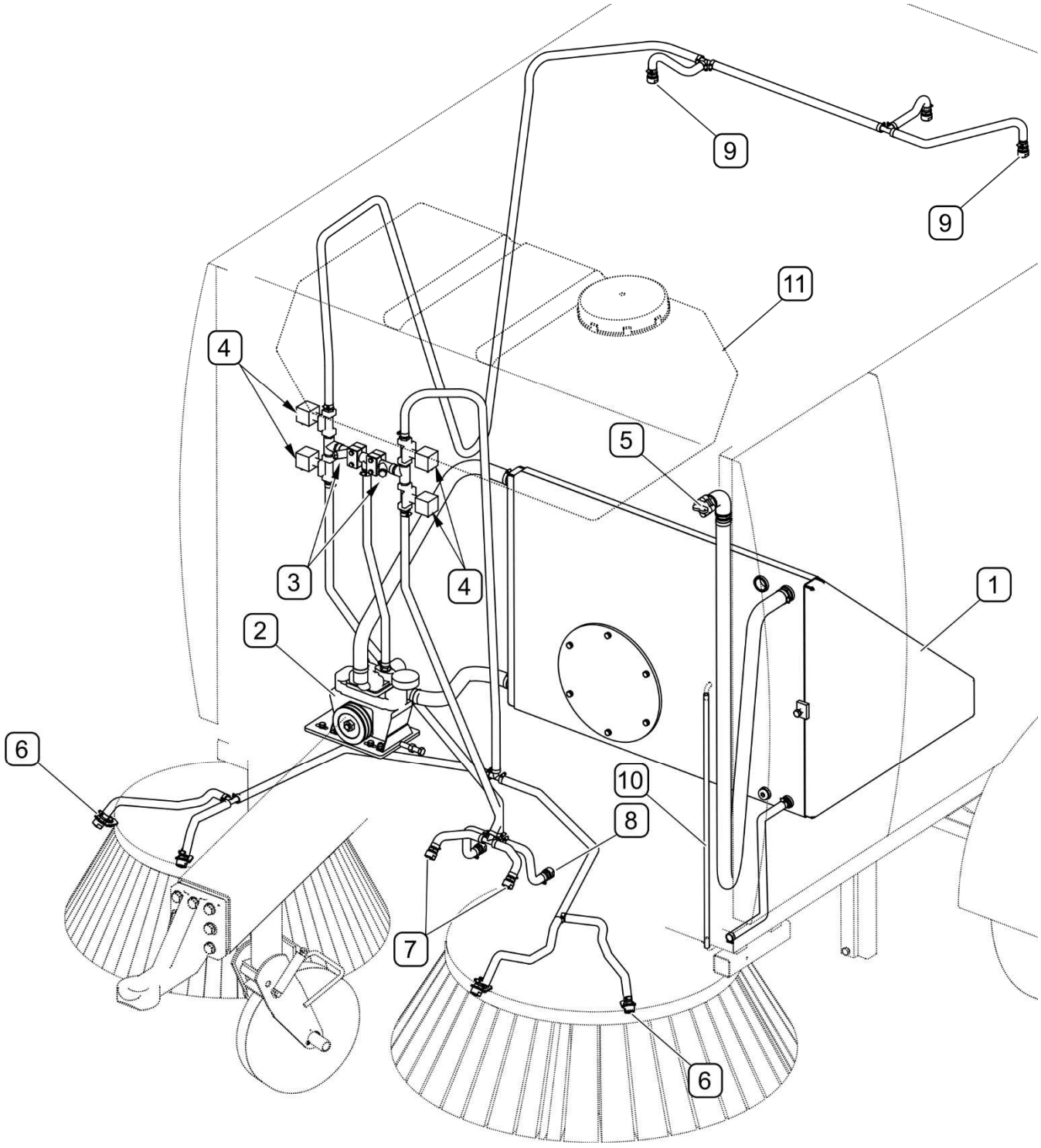


FIG. 3.8 Sprinkler system design

(1) - water tank; (2) - water pump; (3) - filters; (4) - solenoid valve; (5) - filler plug; (6) - slotted nozzles of the sweep system; (7) - slotted nozzles of the suction system; (8) - conical nozzles of the suction system; (9) - conical nozzles of the tank; (10) - water level indicator; (11) - additional water tank (optional)

Water tank (1) and water pump (2) are the main elements of the sprinkler system (FIG. 3.8). Sprinkling nozzles (6),(7),(8) located next to brushes, suction nozzle and inside the waste tank, effectively prevent dusting during machine operation. This system is operated from the control panel by activating suitable solenoid valves (4).

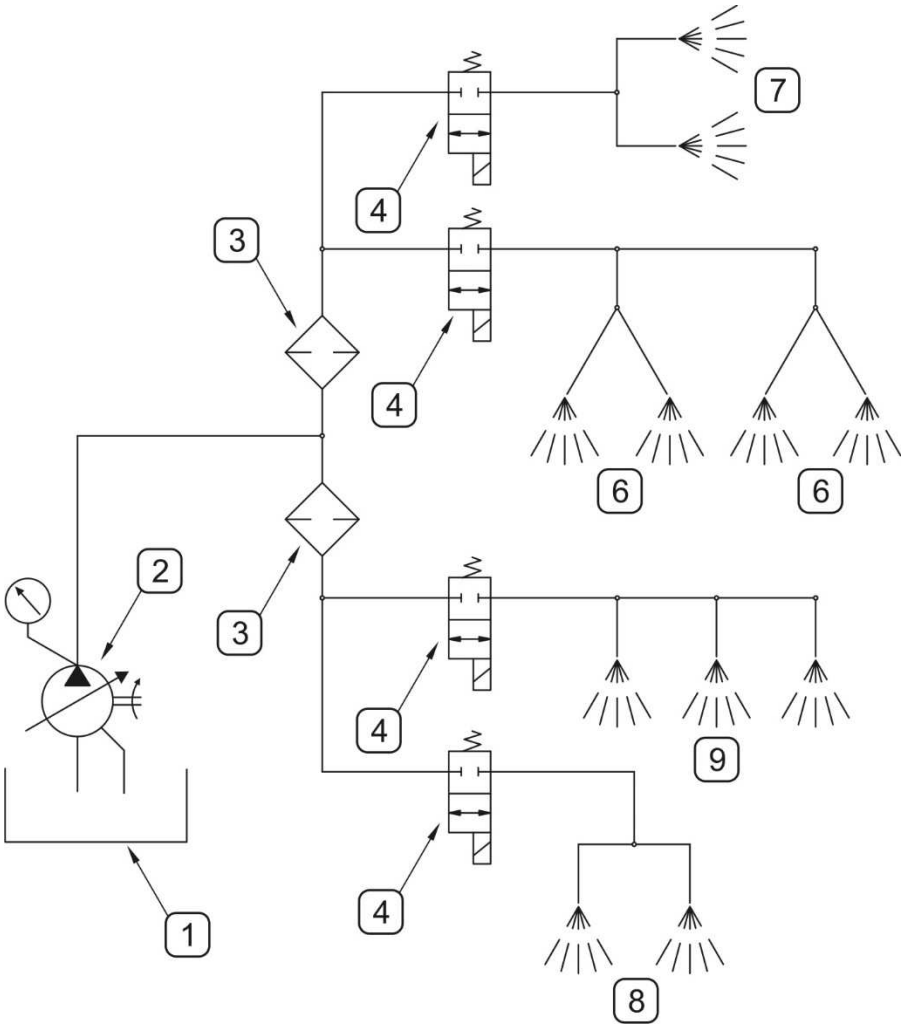


FIG. 3.9 Sprinkler system design

(1) - water tank; (2) - water pump; (3) - filter; (4) - solenoid valve; (6) - slotted nozzles of the sweep system; (7) - slotted nozzles of the suction system; (8) - conical nozzles of the suction system; (9) - conical nozzles of the tank

3.6 ELECTRICAL SYSTEM

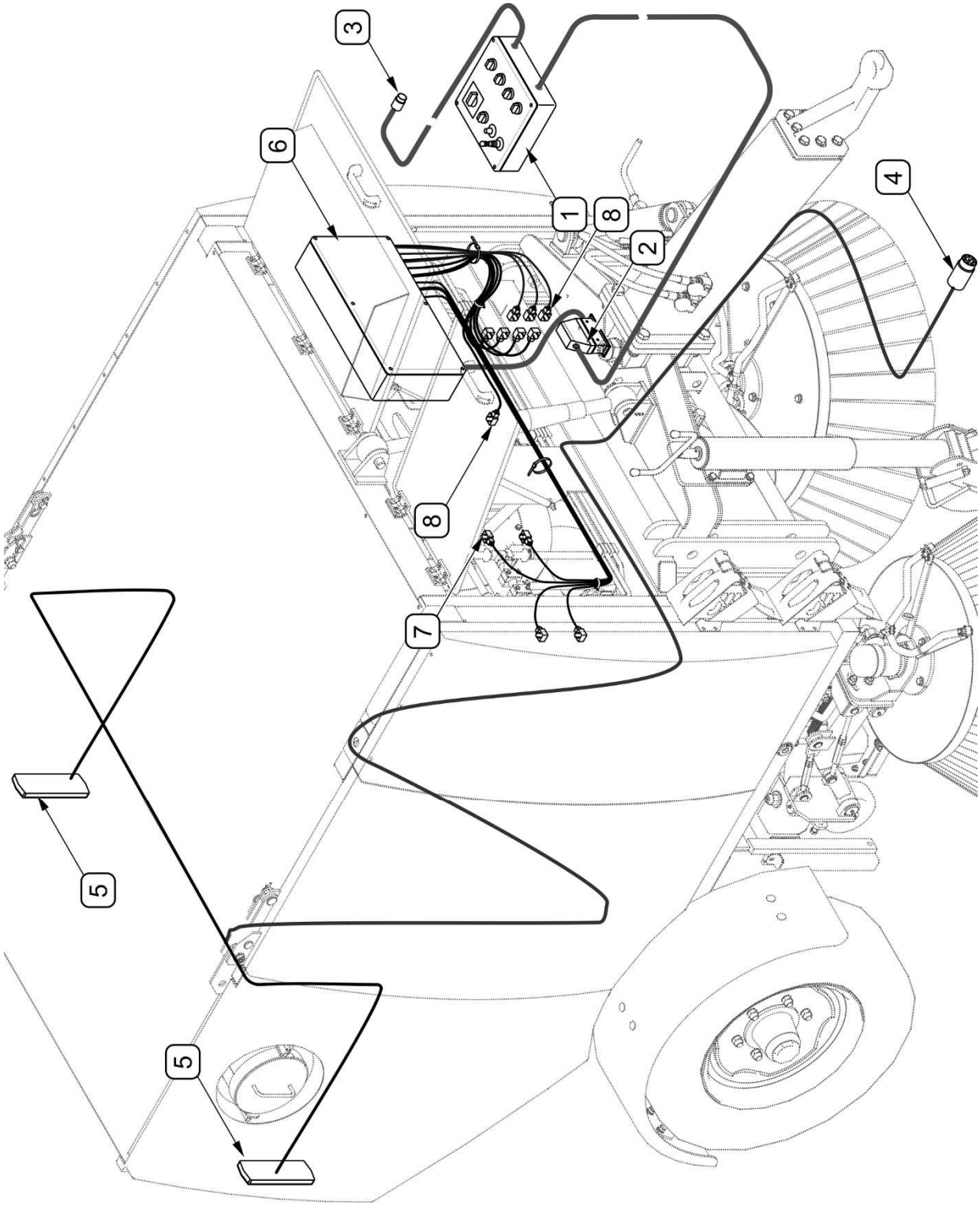


FIG. 3.10 Electrical system design

(1) - control panel; (2) - control connector; (3) - 3-pin plug of the control panel power supply; (4) - 7-pole pin of the lighting system; (5) - lighting system lamps;(6) - wiring compartment; (7) - connectors of the sprinkler system's solenoid valves; (8) - connectors of the hydraulic system's solenoid valves

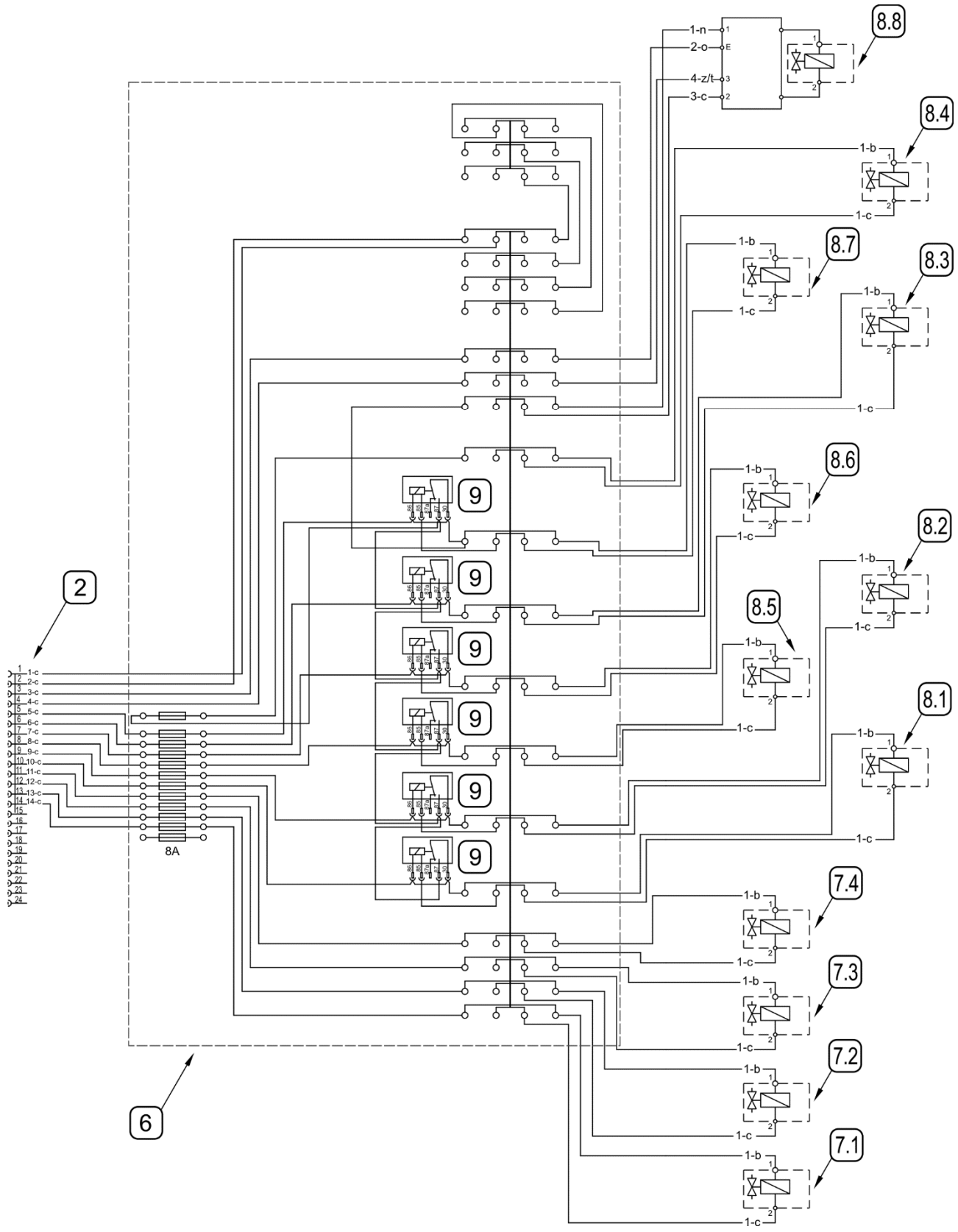


FIG. 3.11 Sweeper electrical system diagram

(2) - control connector; (6) - wiring compartment; (7.1) - solenoid valve of suction nozzle sprinkler system; 7.2)- solenoid valve of brushes sprinkler system; (7.3) - solenoid valve of tank sprinkler system; (7.4) - solenoid valve of tunnel sprinkler system; (8.1) - hydraulic

solenoid valve for tank closing; (8.2) - hydraulic solenoid valve for tank lowering; (8.3) - hydraulic solenoid valve for raising the brushes; (8.4) - hydraulic solenoid valve of main power supply; (8.5) - hydraulic solenoid valve for tank opening; (8.6) - hydraulic solenoid valve for tank lifting; (8.7) - hydraulic solenoid valve for brush activation; (8.8) - hydraulic solenoid valve of proportional valve. (9) - relay

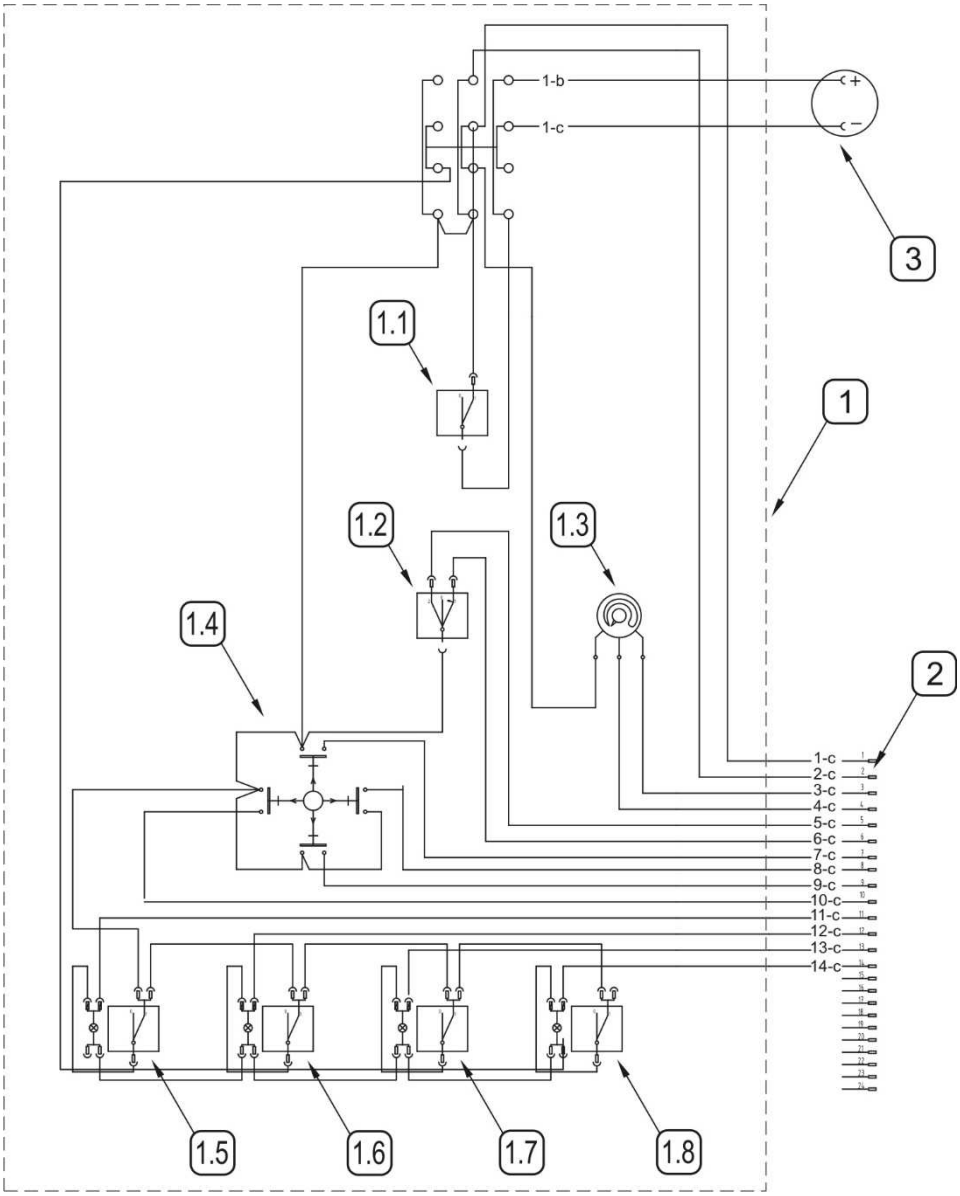


FIG. 3.12 The control panel electrical system diagram

(1) - control panel; (1.1) - breaker switch of control panel power supply; (1.2) - brushes switch;(1.3) - potentiometer for brush speed adjustment; (1.4) - multifunction lever - joystick; (1.5) - switch for the sprinklers in suction tunnel; (1.6) - switch for the sprinklers located before brushes; (1.7) - switch for the sprinklers located inside the waste tank; (1.8) - switch for the sprinklers located before suction tip; (2) - control connector; (3) - 3-pin plug of the control panel power supply;

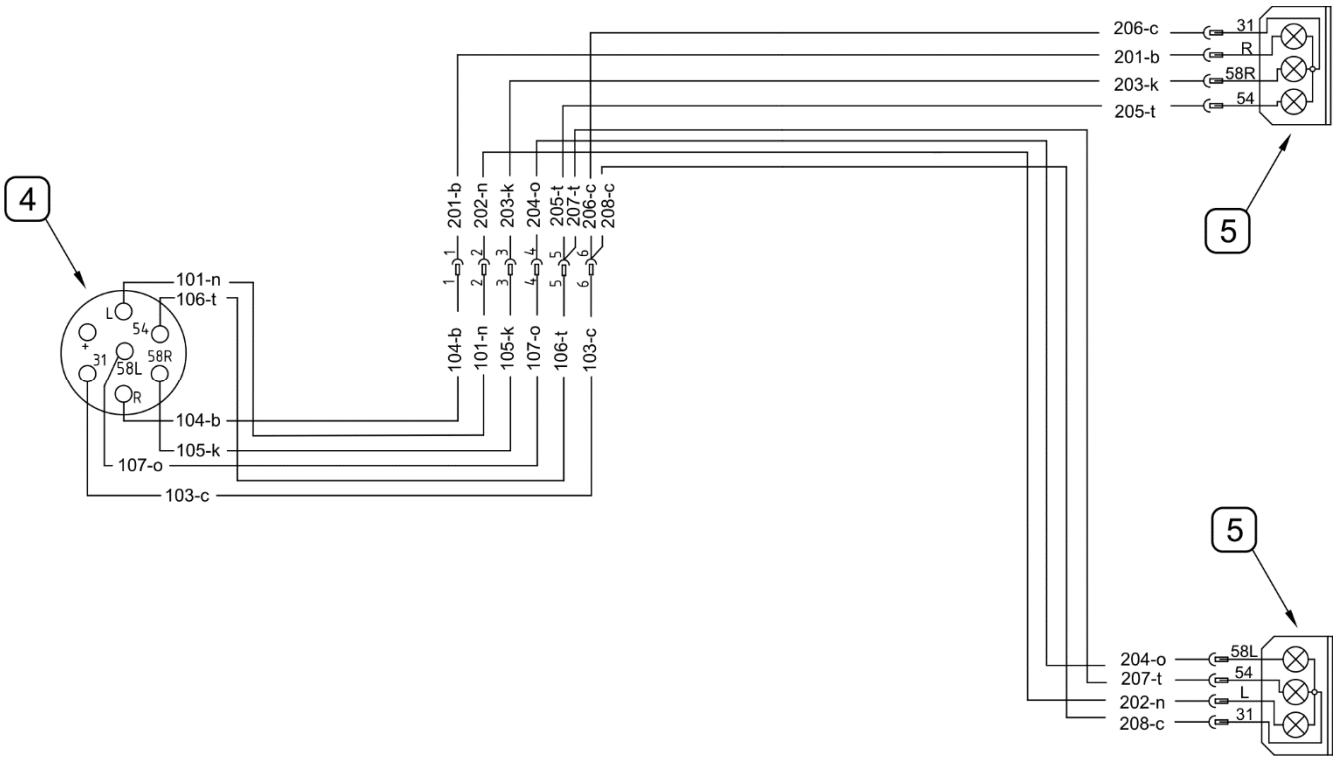


FIG. 3.13 Electrical lighting system diagram

(4) - 7-pole pin of the lighting system; (5) - lighting system lamps;

Colour designations on electrical diagrams:

b- white; **c**- black; **f**- violet; **k**- red; **l**- lazurite; **n**- blue; **o**- brown;

Electrical system diagram of ZMC2.0 sweeper is designed for 12 V DC supply. Connect electrical lighting system (FIG. 3.10) connector (4) to 7-pole socket on the tractor. Connect the sweeper's control panel plug (3) to 3-pin socket on the tractor.

3.7 SWEEP AND SUCTION SYSTEM

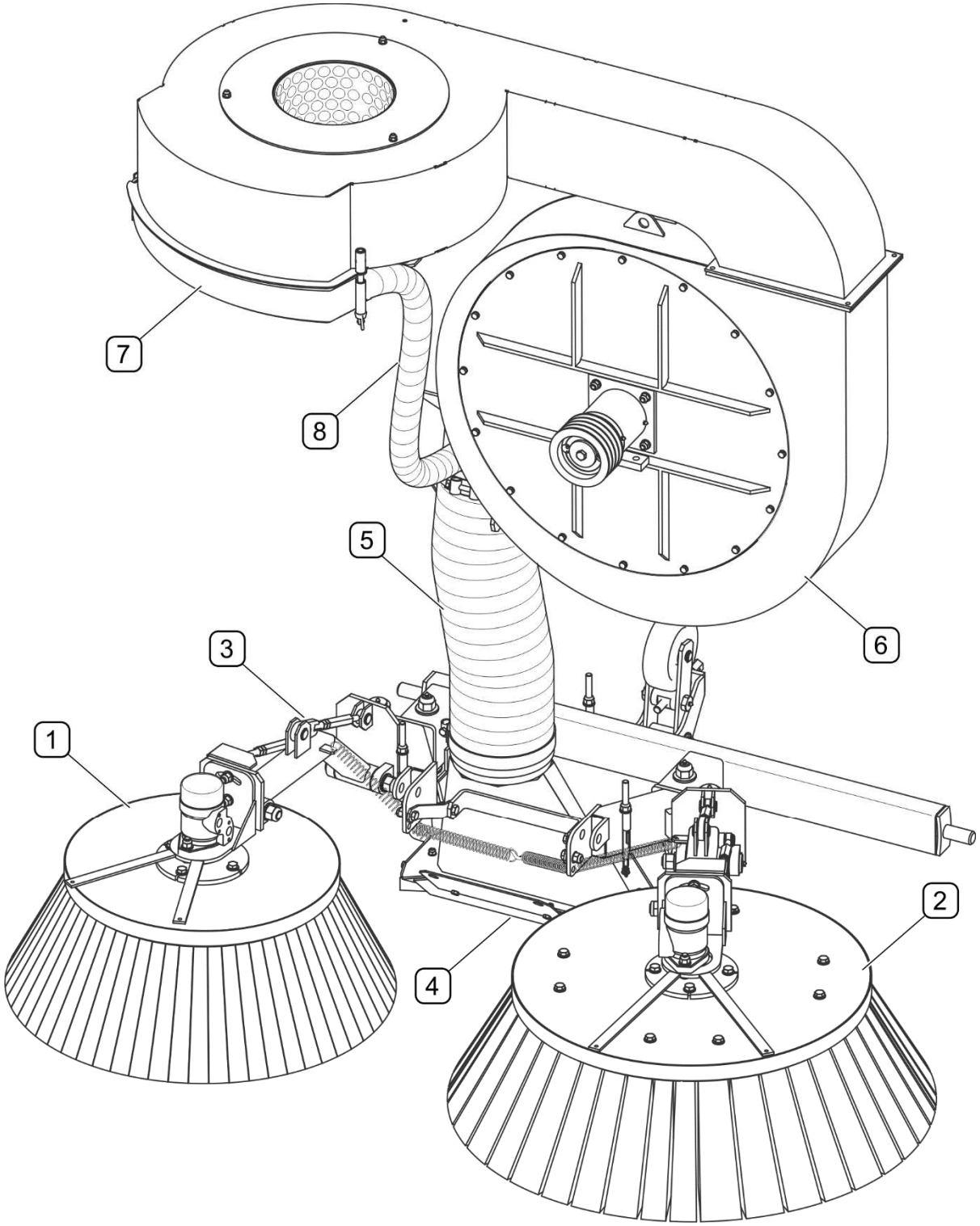


FIG. 3.14 Sweep and suction system

(1) - disk brush I; (2) - disk brush II; (3) - brush arm; (4) - suction tip; (5) - suction pipe; (6) - suction fan; (7) - cyclone separator; (8) - extraction hose

The sweep system consists of two mechanically adjustable disk brushes (1) and (2). The brushes direct waste to the inside of the machine. Thanks to vacuum created by fan (6) the waste is carried to the waste tank, through pipe (5), by the suction system with suction tip (4) run on cleaned surface. Separating cyclone (7) with the discharge of dirt through hose (8) is installed at the outlet of air from the fan.

3.8 DRIVE SYSTEM

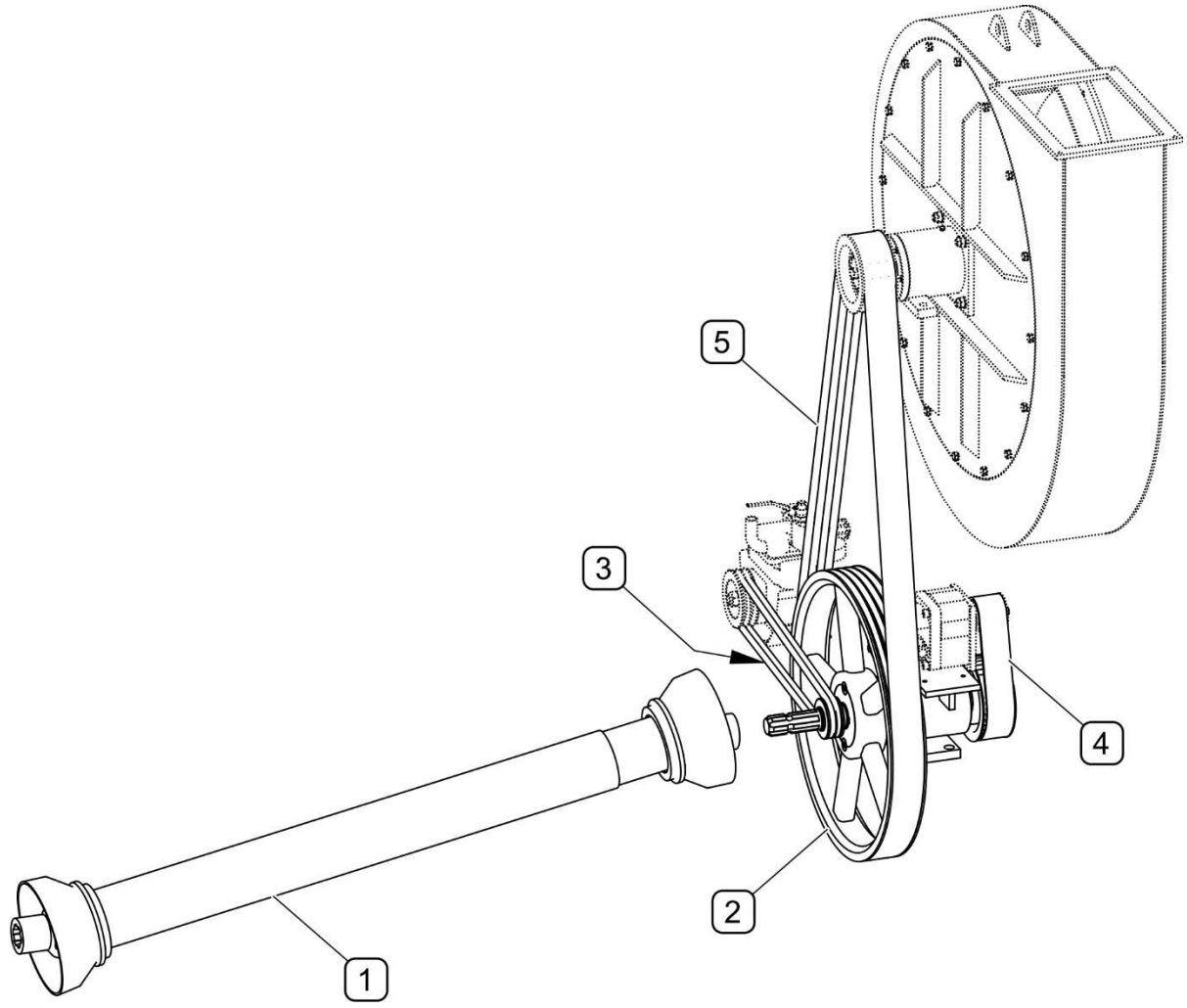


FIG. 3.15 Drive system

(1) - PTO shaft; (2) - power reception system; (3) - vee belts of water pump drive system; (4) - cogbelt of oil pump drive system; (5) - combined belt of fan drive system

During operation, the machine's power reception system (FIG. 3.15) is connected to the tractor's PTO by means of PTO shaft (1). Water pump, oil pump and suction fan are driven by means of belts (3), (4) and (5).

SECTION

4

CORRECT USE

4.1 PREPARING FOR WORK BEFORE FIRST USE

ZMC2.0 sweeper is supplied to the user completely assembled and does not require additional mounting operations of machine sub-assemblies except the control panel that should be connected to the socket on the hitch drawbar. The manufacturer guarantees that the machine is fully operational and has been checked according to quality control procedures and is ready for use. This does not release the user from an obligation to check the machine's condition prior to purchasing and before first use.

Prior to connecting to the tractor, machine operator must verify the sweeper's technical condition. In order to do this:

- read this Operator's Manual and the PTO shaft Operator's Manual and adhere to the recommendations contained in these documents,
- immobilise machine with parking brake
- check technical condition of protective guards and check if they are correctly installed,
- check condition of paint coatings, traces of corrosion or mechanical damage (crushing, piercing, bending or breaking of minor elements),
- check technical condition of PTO shafts and their shields as well as completeness of these elements,
- check technical condition of brushes and adjustment of machine,
- check technical condition of tyres and tyre pressure,
- check and adjust the height of drawbar to the tractor hitch,
- check level of oil in the machine's hydraulic system tank,

ATTENTION!

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

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

DANGER

Before starting the tractor with the connected machine make sure the PTO drive is not engaged, otherwise it can lead to uncontrolled operation of the machine.

If all the above activities have been performed and there is no doubt as to the good technical condition of the sweeper, the machine should be hitched to tractor (see section *HITCHING TO TRACTOR* After connection of control line, brake system lines and hydraulic lines of drawbar control system and starting the machine, the correct operation of individual systems as well as tightness of systems and hydraulic cylinders should be checked. In the event of incorrect operation, immediately disconnect tractor PTO drive and identify a fault. If a fault cannot be rectified or the repair could void the warranty, please contact the Manufacturer for additional clarifications.

4.2 PREPARING FOR NORMAL OPERATION

DANGER

Before using the machine, the user must carefully read this Operator's Manual.

Careless and improper use and operation of the machine, and non-compliance with the recommendations given in this Operator's Manual is dangerous to your health.

The machine must never be used by persons, who are not authorised to drive agricultural tractors, including children and people under the influence of alcohol or other drugs.

Before commencing work check the following:

- technical condition of tyres and tyre pressure,
- tightening of nuts fixing the wheels, drawbar,
- condition of other bolt and nut connections,
- correct operation of lights and indicators.
- operation of brake system
- correct operation of the drawbar hydraulic system,
- level of oil in the hydraulic system tank,
- level of water in the sprinkler system tank,

- technical condition of PTO shaft, its shields and securing chains,
- lubricate elements according to guidelines presented in section "LUBRICATION"

ATTENTION!

Before using the machine always check its technical condition.

Do NOT use a malfunctioning or incomplete machine.

4.3 HITCHING TO TRACTOR

4.3.1 CONNECTING THE MACHINE WITH THE TRACTOR HITCH

DANGER

Prior to attempting to hitch the sweeper to the tractor, make sure that the sweeper is immobilised with parking brake.

ZMC2.0 sweeper may be hitched to agricultural tractor or another carrying vehicle that meets the requirements contained in Table 1.1 REQUIREMENTS FOR CARRYING VEHICLE.

Sweeper is equipped with height adjustable hitch with drawbar. In order to change the height of sweeper drawbar, determine the height of hitch position in the frame's openings taking into account position of the tractor hitch and possibility of its adjustment as well as possibility of PTO shaft connection. If necessary, remove bolts (1) and change the mounting hole to the lower or higher one (FIG. 4.1)

DANGER

When hitching, there must be nobody between the sweeper and the tractor.

In order to attach the sweeper to tractor, proceed as follows

- position drawbar eye at the correct height using knob (3) on the jockey wheel,
- While tractor is in reverse, connect drawbar eye to the tractor's hitch and check if the connection is secure,
- raise jockey wheel upwards using knob (3) and place it in transport position while pressing pedal (4),
- connect electrical leads to the tractor as well as hydraulic and braking system conduits,
- connect PTO shaft to tractor
- release parking brake by turning crank (5) anticlockwise,

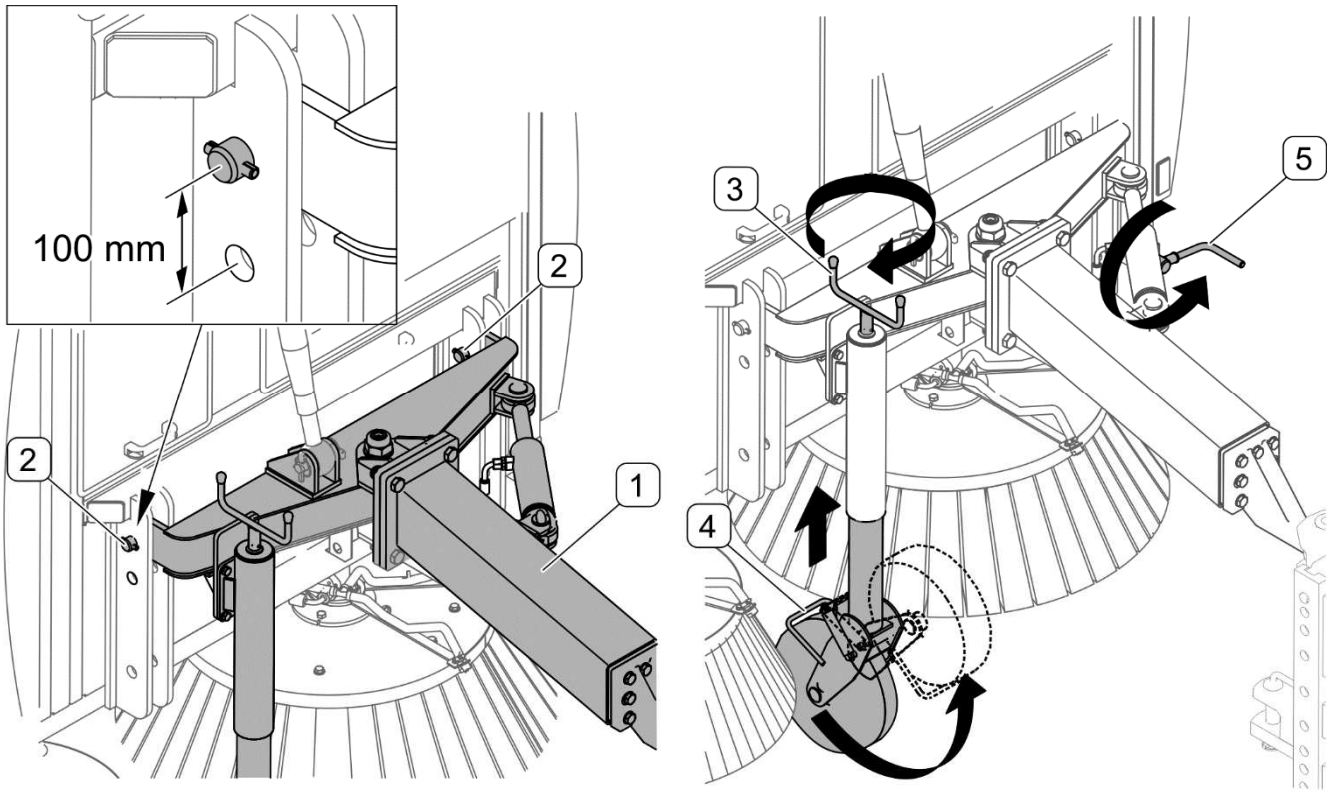


FIG. 4.1 Connecting sweeper hitch to tractor

(1) - hitch; (2) - hitch securing pin; (3) - jockey wheel knob; (4) - jockey wheel pedal; (5) - crank of the parking brake mechanism

DANGER

The sweeper must not be moved when the parking stand is extended and rests on the ground. While the machine is moving there is a risk that the jockey wheel may fold.

For optimum operation, set sweeper body in horizontal position (FIG. 4.2) by loosening counter nut (1) and turning connector lever (2). After adjustment of the connector, tighten counter nut (1).

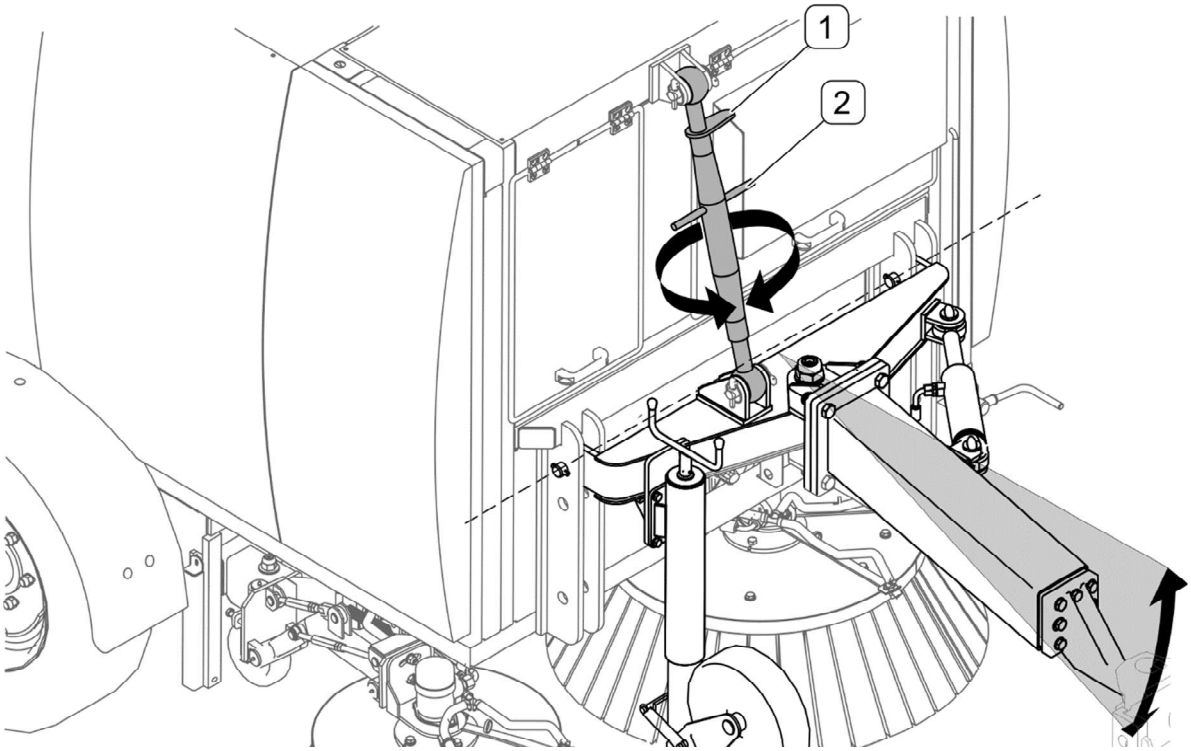


FIG. 4.2 Adjustment of sweeper hitch

(1)- counter nut; (2)- connector adjustment lever;

4.3.2 CONNECTING THE DRAWBAR CONTROL HYDRAULIC SYSTEM

DANGER

When connecting the hydraulic conduits to the tractor, make sure that the tractor hydraulic system is not under pressure.

Hydraulic connections (1) of tilting drawbar control system (FIG. 4.3) should be connected to the section of the tractor's external hydraulic system that makes it possible to change hydraulic oil flow direction.

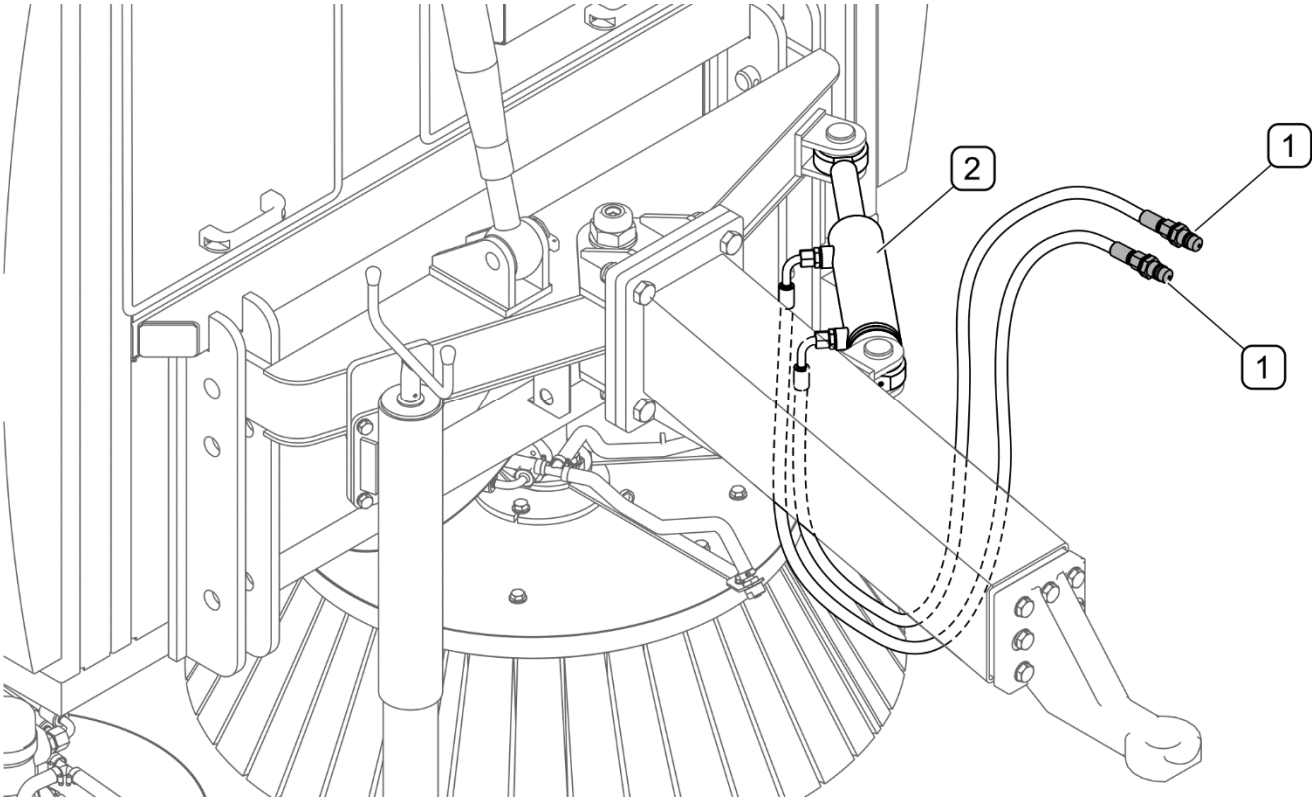


FIG. 4.3 Connecting hydraulic control system of tilting drawbar

(1) - hydraulic quick couplers; (2) - hydraulic cylinder; (3) - "black" connection of single conduit system

4.3.3 CONNECTING BRAKE SYSTEM

DANGER

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

Depending on machine version, the sweeper can be equipped with double-conduit (A) or single-conduit (B) pneumatic brake system (FIG. 4.4). Securing connections are made from coloured plastic. The colours of these elements correspond to the colours of the connection sockets in the tractor:

- The double conduit pneumatic brake system – red supply connection, yellow control connection
- The single conduit pneumatic brake system – black colour connection.

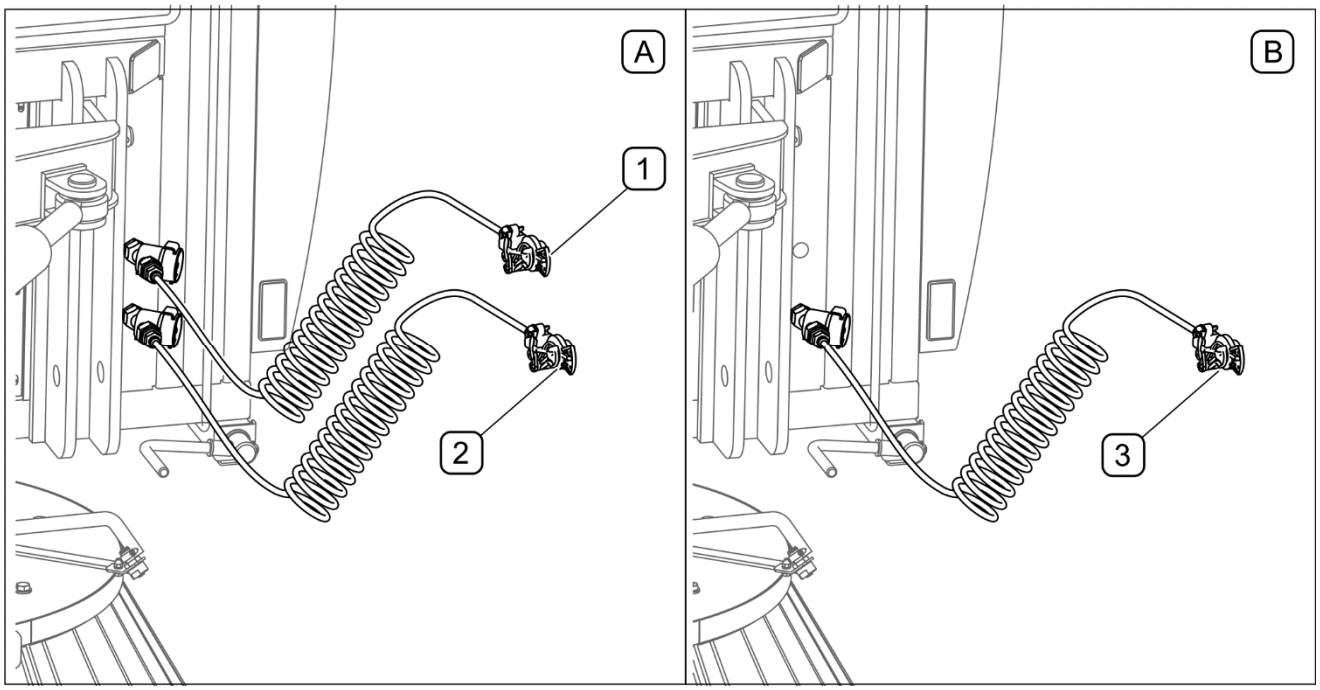


FIG. 4.4 Connection of pneumatic brake system

(A) - double conduit pneumatic brake system; (B) - single conduit pneumatic brake system; (1) - "red" pneumatic supply connection; (2) - "yellow" pneumatic control connection, (3) - "black" connection of single conduit pneumatic brake system

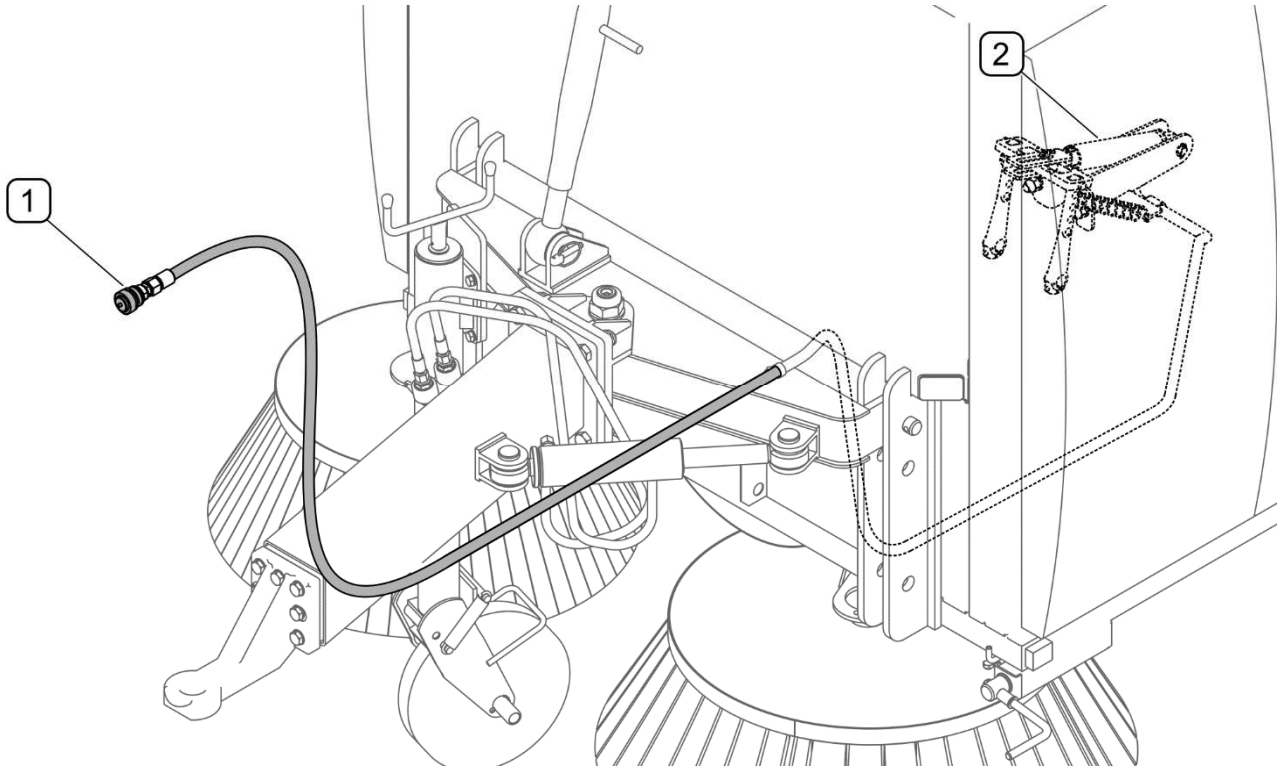


FIG. 4.5 Hydraulic brake system (option)

(1) - quick coupler; (2) - hydraulic cylinder

Optionally, ZMC2.0 sweeper can be equipped with hydraulic brake system.

ATTENTION!

Do NOT travel with machine which has unreliable brake, lighting or signalling system.

When turning, connecting conduits must hang loosely and not become tangled with moving elements of machine and tractor.

Jockey wheel must be maximally raised during machine operation or travel.

4.3.4 CONNECTING PTO SHAFT

DANGER

Before connecting the PTO shaft, the user should read the PTO shaft Operator's Manual provided by the Manufacturer.

Before connecting PTO shaft, turn off the vehicle's engine and remove key from ignition. Ensure that unauthorised persons do not have access to the tractor.

Before connection to the tractor, check technical condition of shaft guards, completeness and condition of protecting chains and general technical condition of PTO shaft.

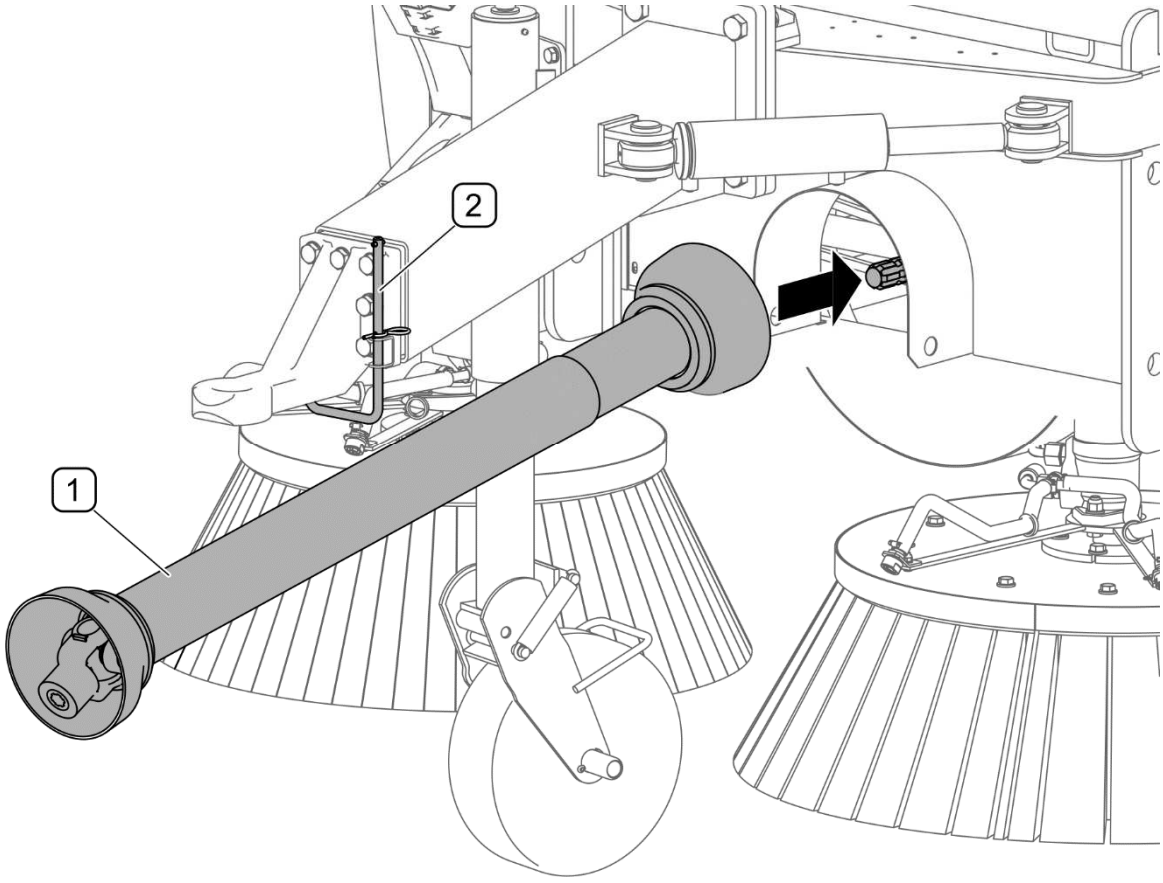


FIG. 4.6 Connecting PTO shaft

(1) - PTO shaft; (2) - PTO shaft bracket

The sweeper may only be connected to the tractor by means of an appropriately selected PTO shaft. Use PTO shaft (with single direction clutch) recommended by the Manufacturer.

If PTO shaft is connected to sweeper and not connected to tractor, it should be installed on PTO shaft bracket (2). During sweeper operation, PTO shaft bracket (2) should be slid upwards and locked in that position (FIG. 4.6A)

DANGER

Do NOT wear loose clothing, straps or whatever that may become wrapped round the rotating drive shaft. Contact with rotating PTO shaft may cause severe injuries.

4.4 SWEEPER OPERATION

4.4.1 FILLING THE SPRINKLER SYSTEM WITH WATER

ATTENTION!

During sweeper operation, the tractor must be equipped with the orange beacon light.

The sprinkler system's water tank of capacity 240 litres is equipped with water level indicator (4) located on the front left-side post of the frame (FIG. 4.7). The tank is filled with water through inlet opening (1) which is protected with plug (2) and located in the upper part of the left-side post of the frame. The tank may be filled directly from water supply system using special claw joint (3) (machine equipment) or using a common hose placed in the inlet opening pipe (1). Drain plug (3) of water tank is located in the lower right-side section of the tank's front wall. Level of water in the tank should be checked during machine operation.

IMPORTANT!

Do not start sweeper without water in the sprinkler system tank.

IMPORTANT!

If there is a risk that temperatures drop below 0°C, drain water from the sprinkler system.

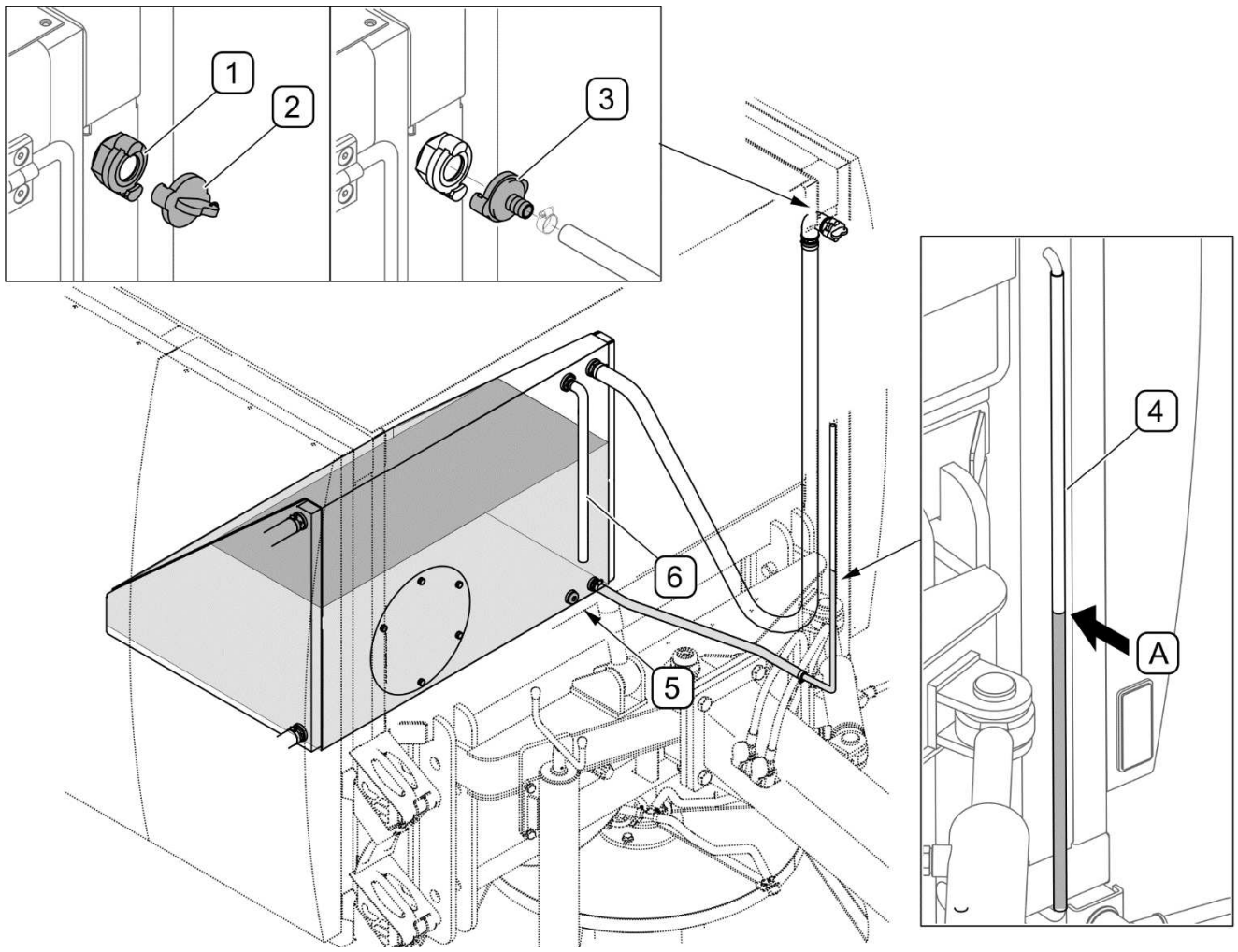


FIG. 4.7 Water tank of sprinkler system

(A) - water level in the tank; (1) - water inlet opening; (2) - filler plug; (3) - claw joint; (4) - water level indicator; (5) - drain plug; (6) - overflow

4.4.2 CONTROL PANEL

The sweeper's control panel should be connected to the 3-pin socket located at the rear of tractor and placed in an easily accessible place in the operator cab. The socket supplied with standard equipment of the sweeper should be installed in tractors which are not equipped with a 3-pin socket.

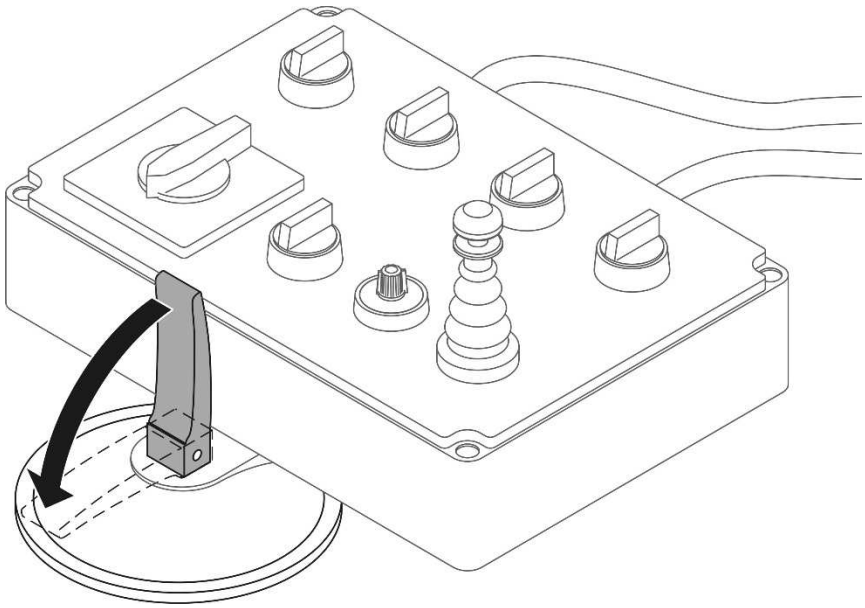


FIG. 4.8 Control panel mounting

Control panel is equipped with a vacuum cup (FIG. 4.8) for attaching the panel to the operator cab's windscreen.

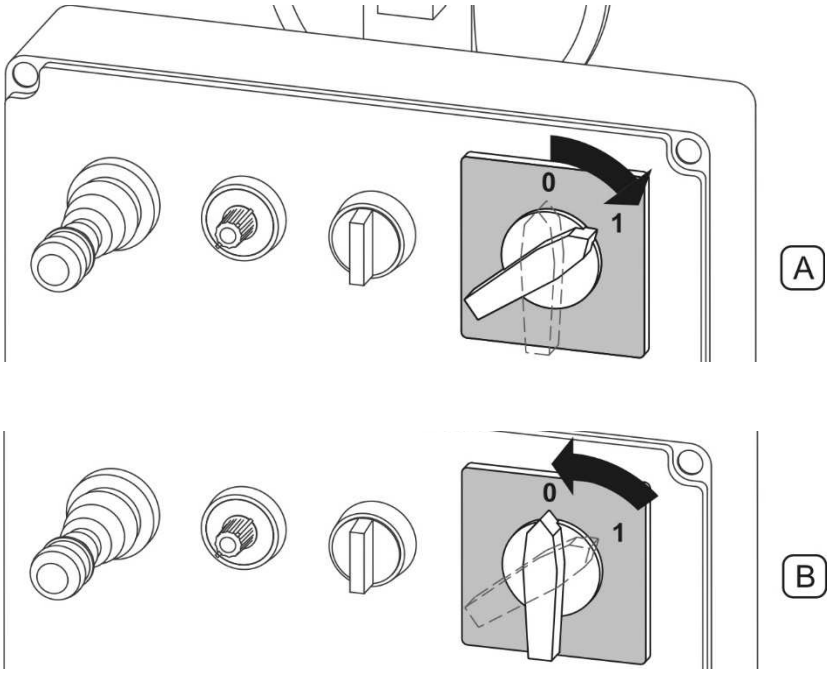


FIG. 4.9 Main switch of control panel

(A) - control panel is switched on „1”; (B) - control panel is switched off „0”

Control panel is protected against accidental use by the main switch (FIG. 4.9). In order to activate the control panel, shift the switch from position „0” (off) to position „1” (on).

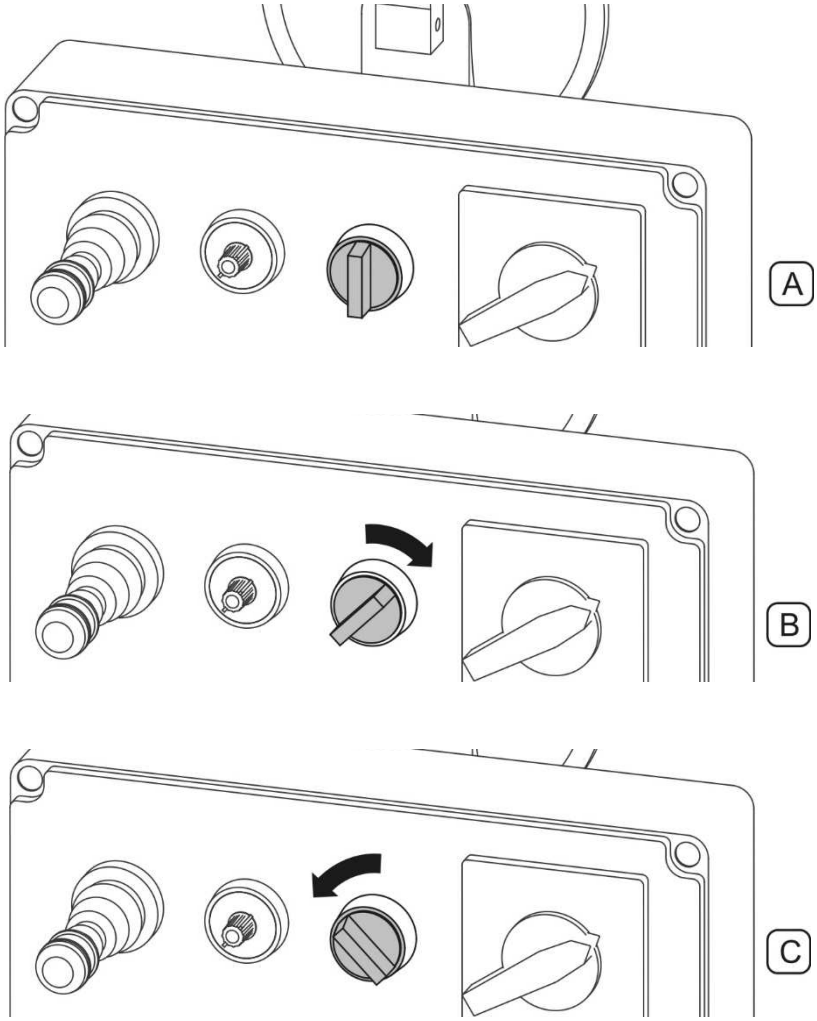


FIG. 4.10 Sweep unit switch

(A)- sweep unit is switched off; (B)- raising the sweep unit; (C)- lowering and switching on the sweep unit

The sweep unit is switched on, switched off and raised using three-range switch (FIG. 4.10). When the switch is shifted to the left (C) ("sweeping"), the sweep unit is lowered to working position and the brush drive is switched on. To switch the brush drive off, shift the switch back to position (A). To raise the sweep unit, shift the switch to the right to position (B) ("raising") and hold it in this position. The switch does not have a lock in position (B) ("raising"). When released, the switch returns to position (A) ("switched off").

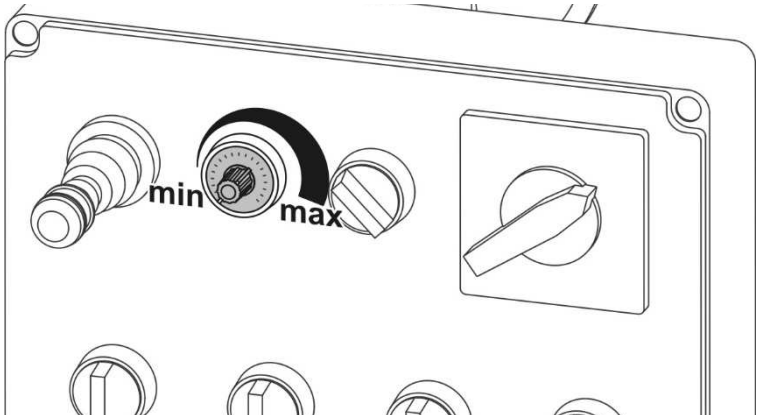


FIG. 4.11 Adjustment of rotation speed of brushes

Rotation speed of brushes is adjusted steplessly using knob (FIG. 4.11) within the range from 0 to 130 rpm for PTO rotation speed of 1,000 rpm. Rotation speed of brushes is increased when the knob is turned clockwise. Rotation speed of brushes is decreased when the knob is turned anticlockwise. When lowering the sweep unit, the knob for adjusting rotation speed of brushes should be set in the maximum position (turned maximally to the right).

IMPORTANT!

Too long operation of the sweeper with reduced rotation speed of brushes may lead to overheating of oil in the hydraulic system.

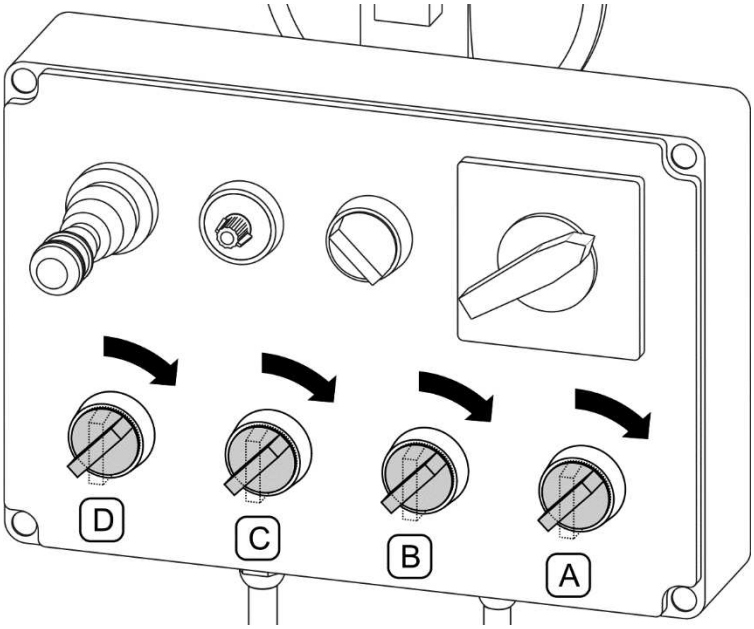


FIG. 4.12 Sprinkler system switches

(A) - switch for sprinklers located before suction nozzle of the suction system; (B) - switch for sprinklers located inside the waste tank; (C) - switch for sprinklers located before brushes; (D) - switch for sprinklers in suction tunnel.

To switch corresponding sprinklers on, shift the switches (FIG. 4.12) to the right. Quantity of activated sprinklers depends on type and humidity of surface cleaned. If humidity of surface cleaned is high, the sprinklers located before suction nozzle, inside the waste tank and before brushes can be switched off. However, the sprinkler in suction tunnel is recommended to be switched on. To switch the sprinklers off, set the switches in "switched off" position.

TIP

Travel speed during sweeping should be adjusted to degree of surface contamination. Reduce sweeping speed if amount of waste to be swept increases. If necessary, use so-called creep gears.

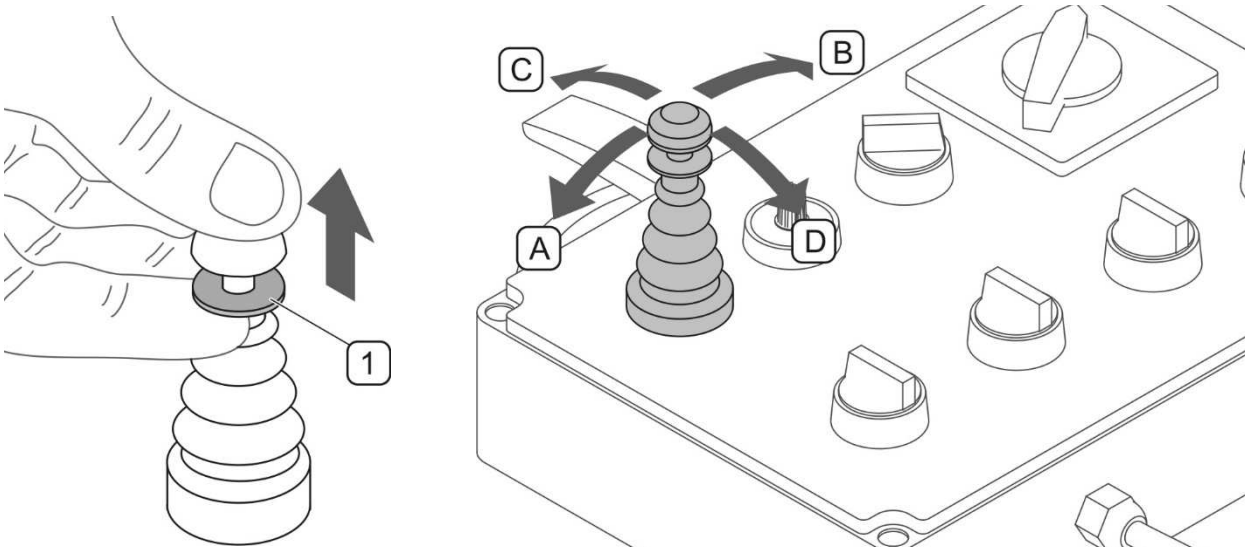


FIG. 4.13 Control of waste tank raising and emptying

(1) - lock ring of the multifunction lever; (A) - closing the waste tank; (B) - opening the waste tank; (C) - raising the tank; (D) - lowering the tank;

Raising and lowering as well as opening and closing of the waste tank should be performed when the sweep function is off (FIG. 4.10). Opening, closing, raising and lowering of the waste tank is controlled from the driver's position by means of multifunction lever (FIG. 4.13). In its neutral position, the lever is locked in order to prevent accidental activation. To release the lock, pull up the ring (1) located under the handle on the lever shank.

Tank opening is controlled by shifting the multifunction lever to the right (B). To close the tank, shift the lever to the left (A) and hold it in this position until the tank is closed completely and then, release the lever. When released, the lever returns automatically to its neutral position.

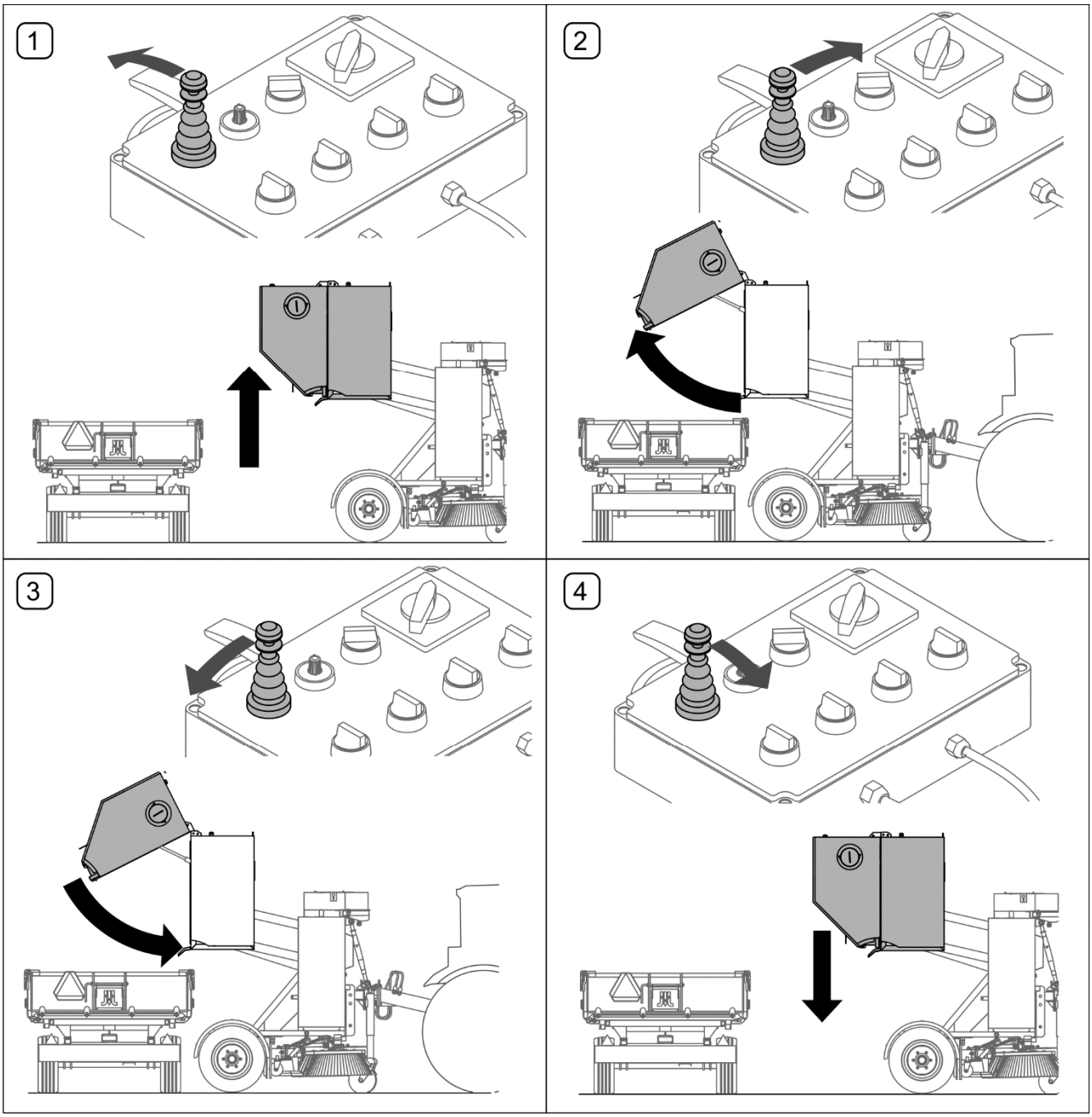


FIG. 4.14 Emptying the waste tank onto a trailer

(1), (2), (3), (4) - successive stages of the waste tank emptying

DANGER

Do NOT stand under raised or open waste tank during machine operation.

When the waste tank is raised, waste can be unloaded directly onto trailer's load box. To unload waste from the tank onto a trailer (FIG. 4.14) proceed as follows:

1) Raise the waste tank to a required height by shifting the multifunction lever forwards.
2) Manoeuvre the tractor and position the tank above unloading point and open the tank by shifting the lever backwards.
3) Close the waste tank after emptying
4) Drive the tractor away from the trailer and lower the waste tank.

ATTENTION!

Clean the seals and check if suction pipe is not blocked each time after emptying the waste tank.

DANGER

Switch off the machine and install supports and service safety devices before cleaning or inspecting the raised waste tank.

DANGER

Keep a safe distance from overhead electric power lines during waste tank raising and unloading.

The sweeper's tilting drawbar is controlled from the operator's position by means of the external hydraulics manifold lever. The hitch is set in tilted position (FIG. 4.15) if sweeping has to be performed near building walls, kerbs and obstacles located along the right side of the sweeper. Thanks to such hitch position, the sweeper's route can be shifted to the right with regard to the tractor's route by approximately 400 mm. Thanks to adjustable sweeper's tilting drawbar, the sweeper can accurately follow the tractor, particularly when sweeping on turns, around columns, posts and benches.

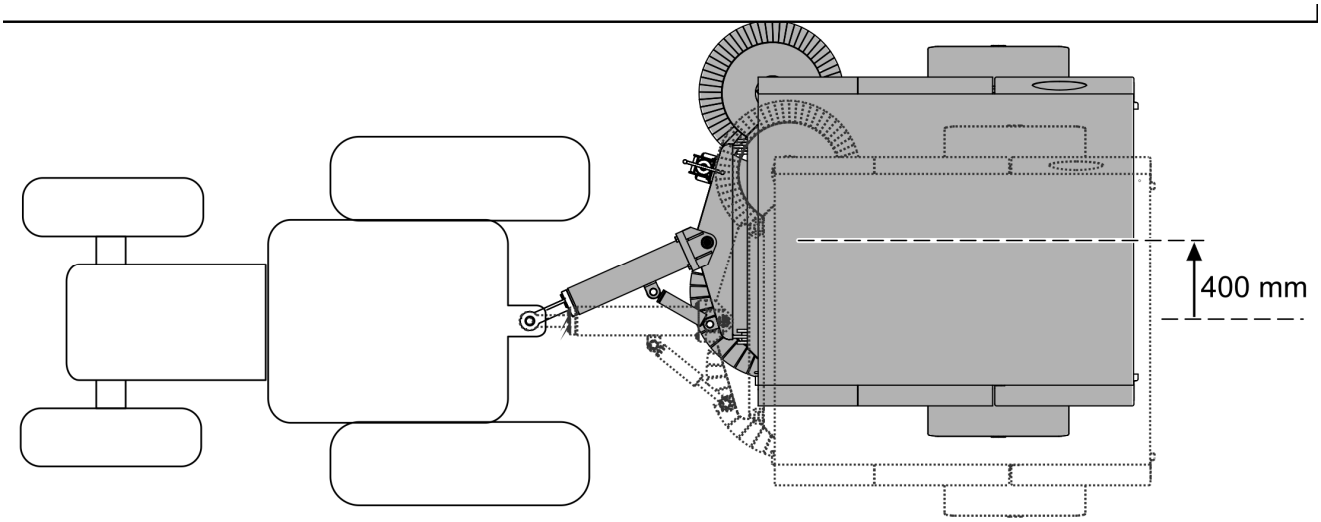


FIG. 4.15 Sweeper's tilting drawbar

4.5 DRIVING ON PUBLIC ROADS

When driving on public roads, respect the road traffic regulations, exercise caution and prudence. If sweeping with the sweeper is done near pavements special attention should be paid to the bystanders likely to be near the working machine. Listed below are the key guidelines for driving the tractor and sweeper combination.

- Before moving off make sure that there are no bystanders, especially children, near the machine or the tractor. Take care that the driver has sufficient visibility.
- Make sure that the sweeper is correctly attached to the tractor and tractor's hitch is properly secured.
- Permissible design speed and maximum speed allowed by road traffic law must not be exceeded. The towing speed should be adapted to the current road conditions, load carried by the machine, road surface conditions and other relevant conditions.
- When not connected to the tractor, the sweeper must be immobilised using parking brake and possibly also with chocks or other objects without sharp edges placed under the front and back wheels. Do NOT leave unsecured machine. In the event of machine malfunction, pull over on the hard shoulder avoiding any risk to other road users and position reflective warning triangle according to traffic regulations.

- While driving on public roads the sweeper must be fitted with a certified or authorised reflective warning triangle. When driving, comply with all road traffic regulations, indicate an intention to turn using indicator lamps, keep all road lights and indicator lights clean at all times and ensure they are in good condition. Any damaged or lost lamps or indicator lights must be immediately repaired or replaced.
- While operating the sweeper, turn on the orange beacon light in the tractor.
- Avoid ruts, depressions, ditches or driving on roadside slopes. Driving across such obstacles could cause the machine or the tractor to suddenly tilt. This is of special importance because loaded machine's centre of gravity is higher, which reduces safety. Driving near ditches or canals is dangerous as there is a risk of the wheels sliding down the slope or the slope collapsing.
- When driving on public roads the machine must be marked with a slow-moving vehicle warning sign attached to the rear wall of load box.
- When driving, avoid sharp turns especially on slopes.
- Please note that the braking distance of tractor and sweeper combination is substantially increased at higher speeds and loads carried in the sweeper.
- Speed must be sufficiently reduced before making a turn or driving on an uneven road or a slope.
- Pay attention to overhead electric power lines when raising and opening the waste tank.
- Lower and close the waste tank after emptying. Do NOT travel with open or raised waste tank.
- Remember not to disconnect the machine from the tractor hitch if the waste tank is open or raised.

4.6 DISCONNECTING FROM TRACTOR

DANGER

Do not open and raise the waste tank if the sweeper is disconnected from the tractor's hitch.

Do not disconnect the sweeper from the tractor if the waste tank is open or raised!

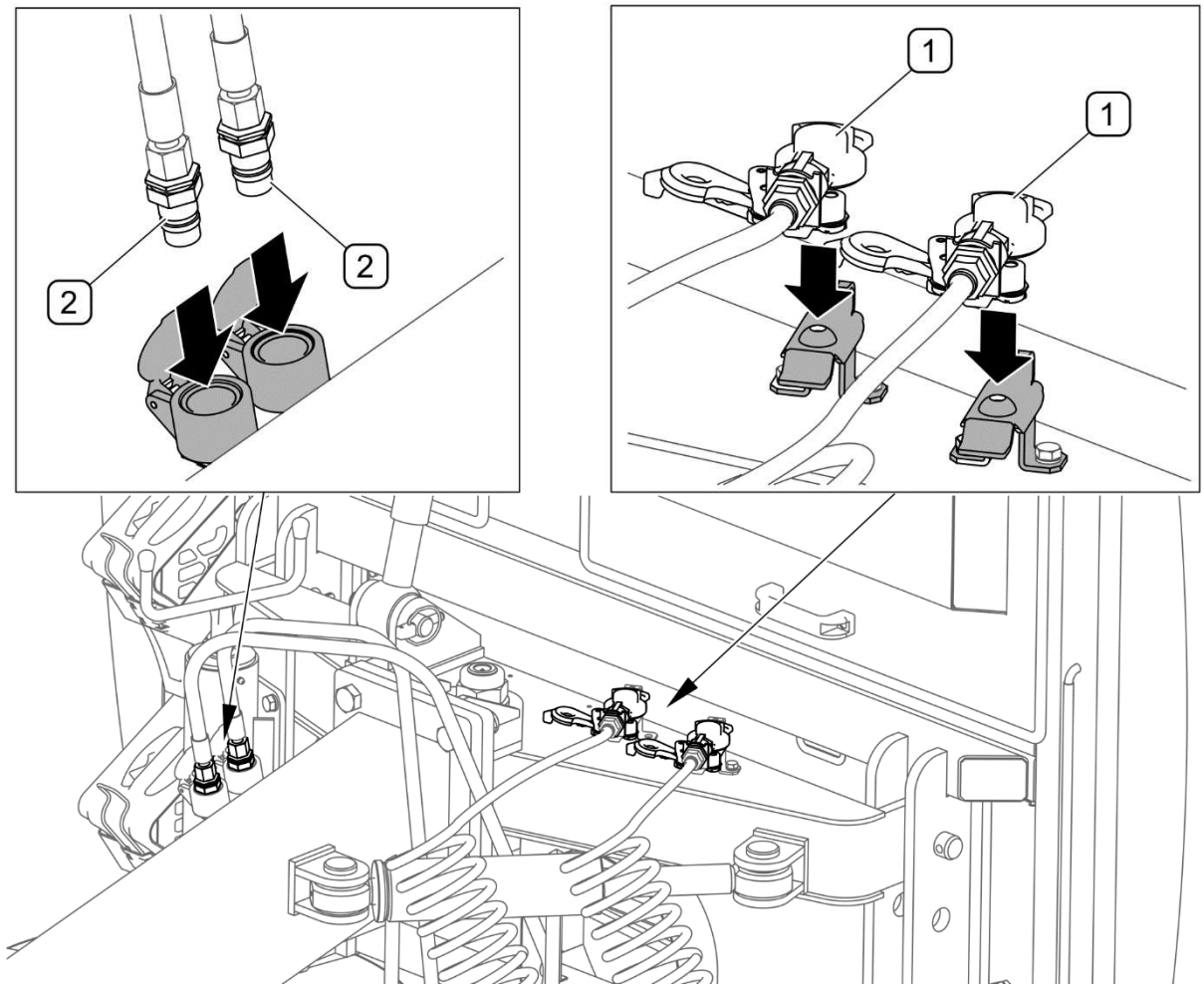


FIG. 4.16 Protection of plugs after disconnection from the tractor

(1) - pneumatic socket plugs; (2) - hydraulic socket plugs

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

- Raise the sweep unit in such a manner as to ensure that brushes do not rest on the surface.
- Once tractor is stopped, immobilise the sweeper using parking brake.
- Lower jockey wheel and set at the appropriate height.

- Disconnect from the tractor electrical system leads (control panel leads, lighting system leads), conduits of hydraulic system for controlling tilting drawbar and brake system conduits.
- Insert hydraulic socket plugs of the hydraulic system for controlling tilting drawbar into securing sockets (FIG. 4.16)
- Place pneumatic socket plugs on the drawbar brackets (FIG. 4.16)
- Disconnect PTO shaft and install it on PTO shaft bracket (FIG. 4.17)
- Disconnect the sweeper's drawbar from the tractor hitch and move the tractor forwards.

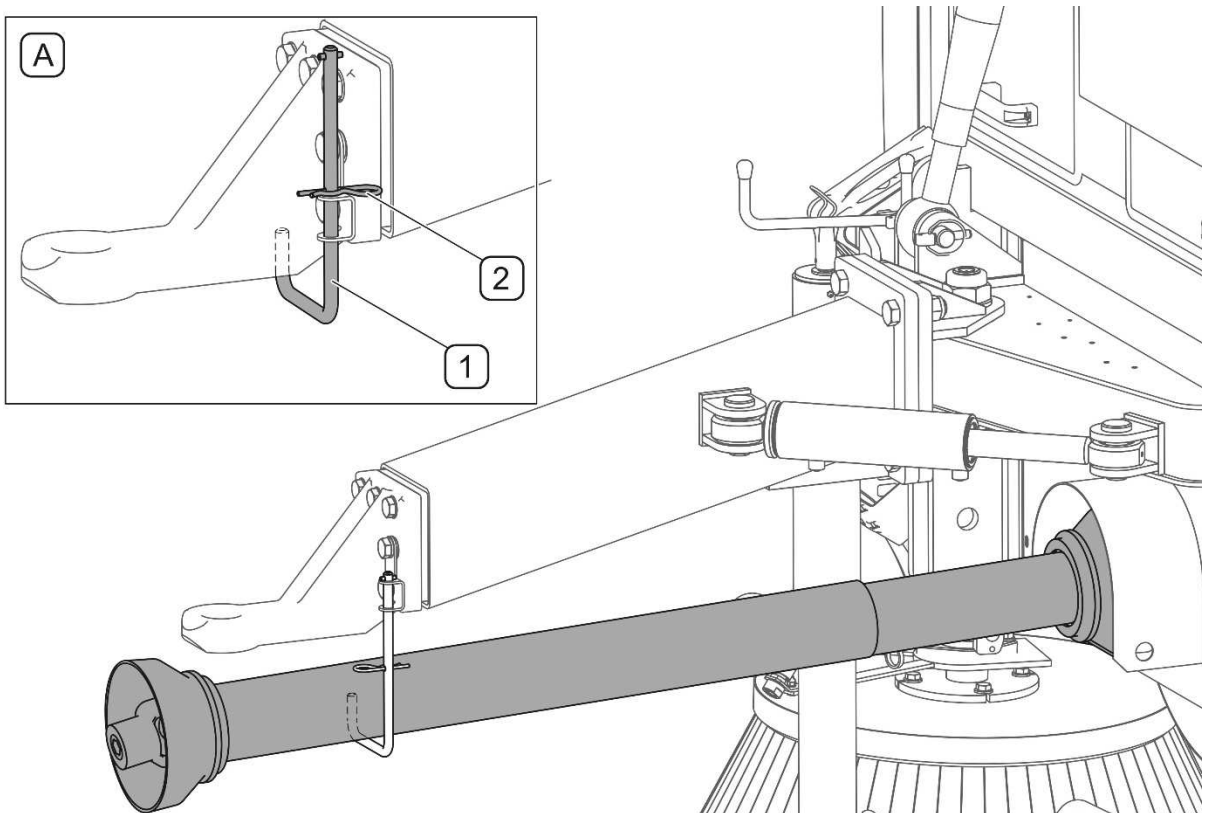


FIG. 4.17 PTO shaft bracket

(A) - position of bracket during machine operation; (1) - bracket; (2) - securing cotter pin

ATTENTION!

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

4.7 PROPER USE AND MAINTENANCE OF TYRES

- When working on the tyres, chocks or other objects without sharp edges should be placed under the wheels of the machine to prevent it from rolling. Wheels can be taken off the sweeper axle only when the sweeper's waste tank is empty.
- Repair work on the wheels or tyres should be carried out by persons trained and entitled to do so. This work should be carried out using appropriate tools.
- Each time a wheel is fitted, always check how firmly the nuts are tightened. Individual checks should be made after the first use, after the first journey with a load and then every 6 months. The above actions should be repeated individually if a wheel has been removed from the wheel axle.
- Regularly check and maintain correct pressure in tyres according to Operator's Manual (especially if machine is not used for a longer period).
- Pressure and tyres should be also checked during the whole day of intensive work. Please note that higher temperatures could raise tyre pressure by as much as 1 bar. At high temperatures and pressure, reduce load or speed.
- Do not release air from warm tyres to adjust the pressure or the tyres will be underinflated when temperatures return to normal.
- Protect tyre valves using suitable caps to avoid soiling.
- Do not exceed maximum working speed and maximum transport speed.
- When sweeper is operated all day, stop working for a minimum of one hour in the afternoon.
- Adhere to 30 minutes rest for cooling tyres after driving 75 km or after 150 minutes continuous travel depending on which occurs first.
- Avoid potholes, sudden manoeuvres or high speeds when turning.

4.8 ADDITIONAL FITTINGS AND OPTIONAL EQUIPMENT

4.8.1 SIDE ATTACHMENT FOR COLLECTING LEAVES

DANGER

Switch off the machine and install supports and service safety devices before performing any activities near the opened or raised waste tank (see: *5.1 SHIELDS, SUPPORTS AND SERVICE SAFETY DEVICES*)

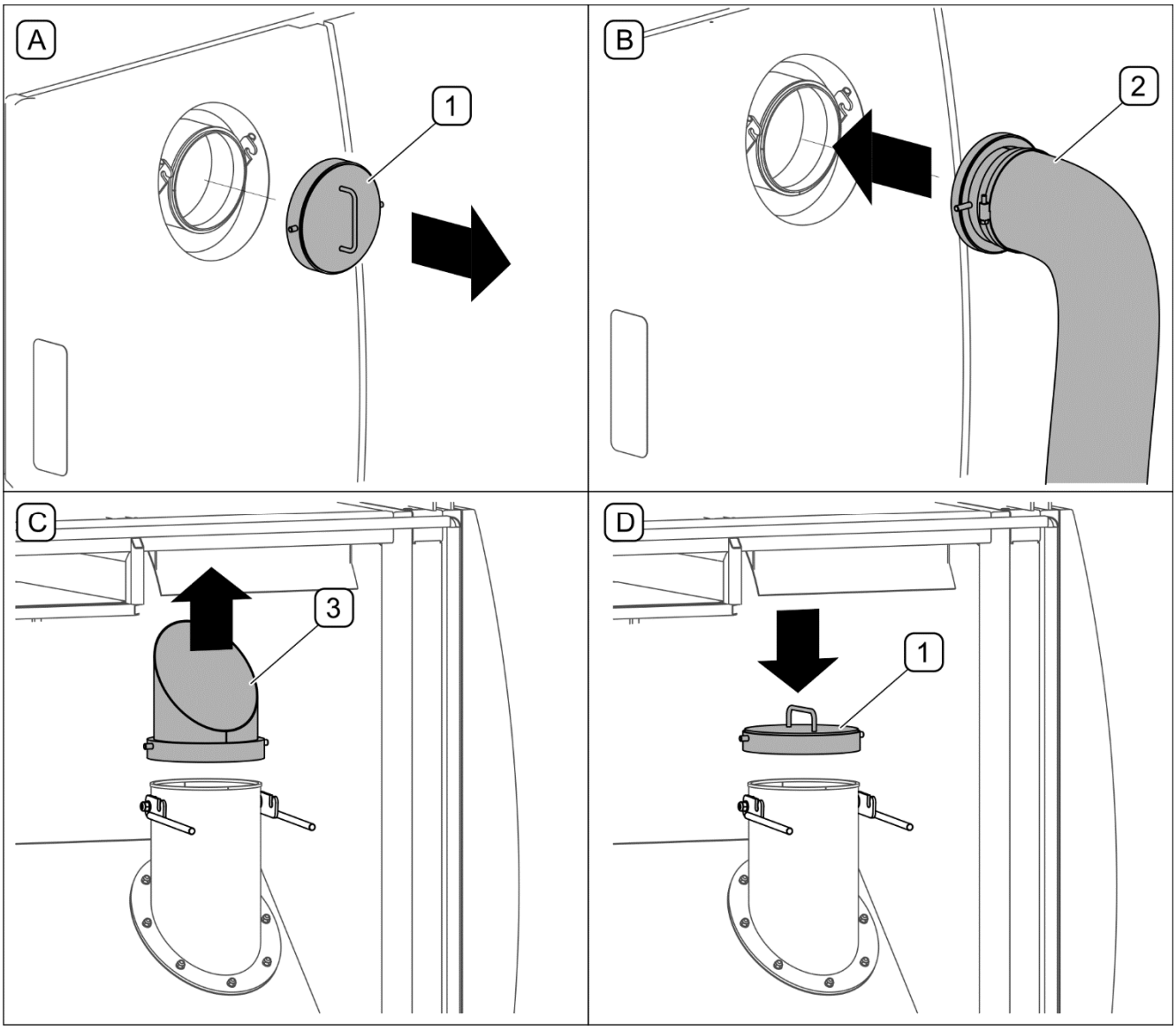


FIG. 4.18 Installing the attachment for collecting leaves

(A),(B),(C),(D) - installation sequence; (1) - closing cover; (2) - suction pipe; (3) - outlet stub pipe inside the tank

Optionally, ZMC2.0 sweeper can be equipped with side attachment for collecting leaves. Connect the attachment to the opening in the side wall of the tank after dismounting the closing cover (1). In order to increase suction force during operation of the sweeper with the attachment for collecting leaves, close the suction of the suction system by installing the closing cover (1) in place of stub pipe (3) inside the waste tank (FIG. 4.18)

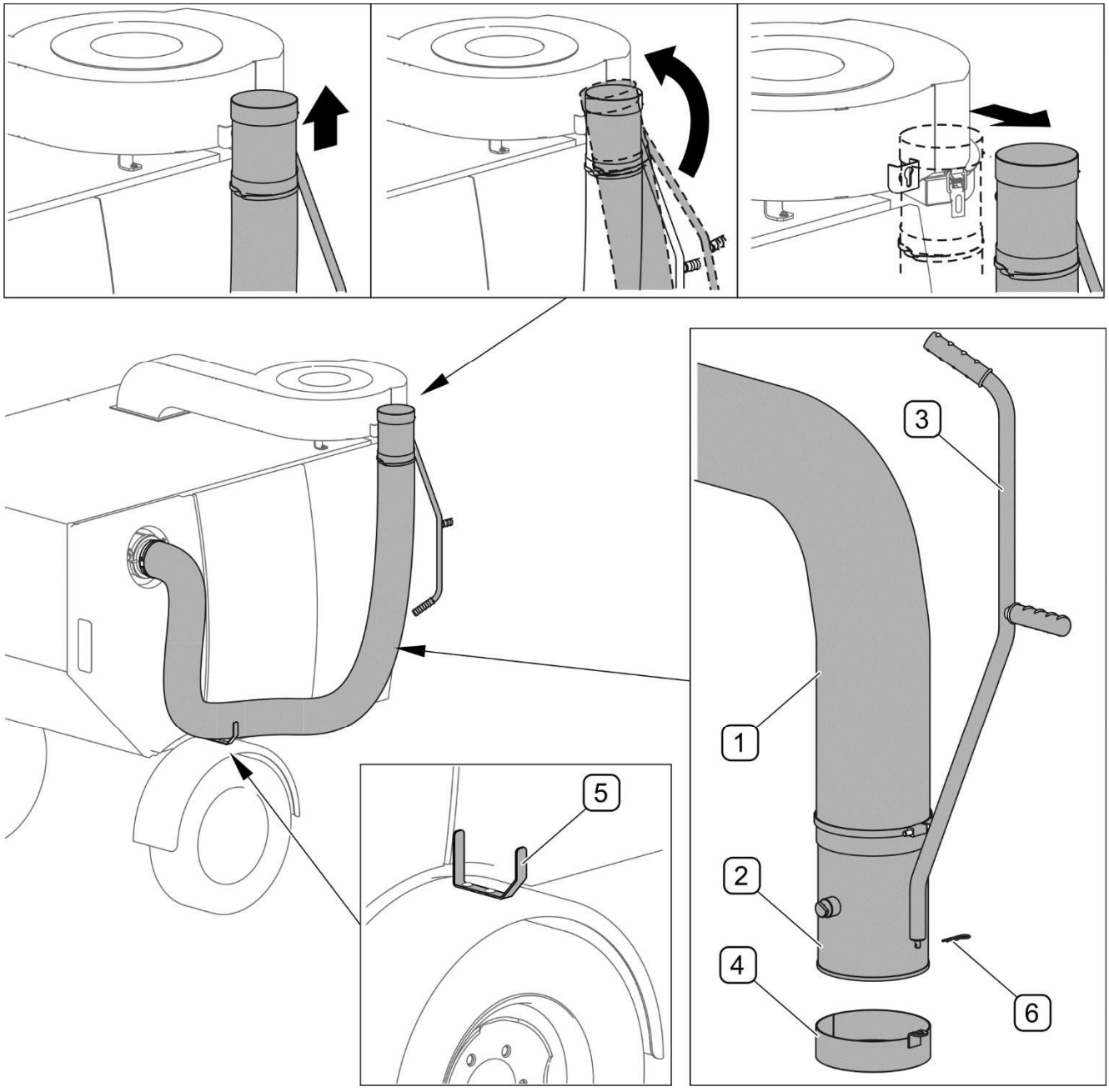


FIG. 4.19 Attachment for collecting leaves

(1) - suction pipe; (2) - suction tip; (3) - grip; (4) - cover; (5) - bracket; (6) - securing cotter pin

The side attachment for collecting leaves (FIG. 4.19) consists of suction pipe (1), suction tip (2) with grip (3) and cover (4) secured with cotter pin (6). Suction tip (2) is attached on the

right side on the enclosure of the separating cyclone. Bracket (5) installed on the right mudguard is used for supporting the suction pipe (1).

4.8.2 ADDITIONAL WATER TANK

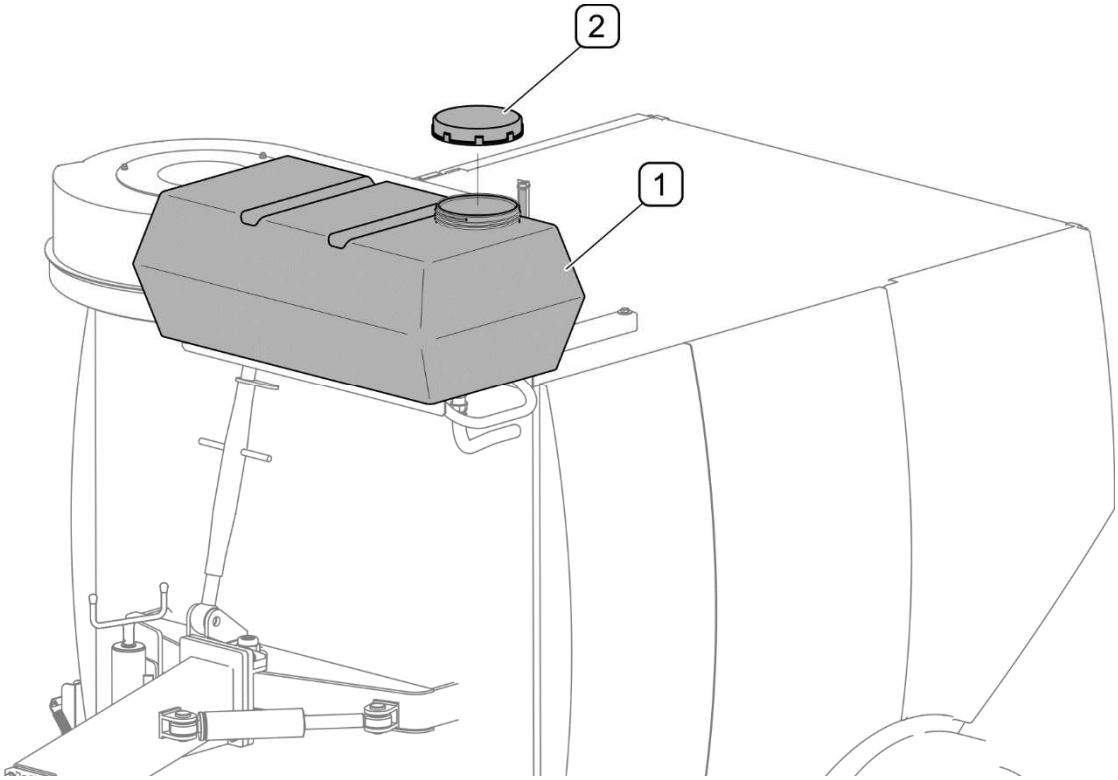


FIG. 4.20 Additional water tank

(1) - tank; (2) - plug

Optionally, the sweeper can be equipped with additional water tank (1) with capacity of 200 dm^3 (litres) which is connected to the main filler of the sprinkler system tank. The tank is mounted by means of the bracket to the upper part of the frame at the front of the machine. In such a case, the sprinkler system is filled after unscrewing the plug (2). Total capacity of both water tanks is 440 dm^3 (litres).

SECTION

5

MAINTENANCE

5.1 SHIELDS, SUPPORTS AND SERVICE SAFETY DEVICES

DANGER

Do not open shields during machine operation!

The sweeper must not be started without shields installed or if shields are damaged or incomplete!

ZMC2.0 sweeper is equipped with movable guards (FIG. 5.1A) which facilitate machine servicing.

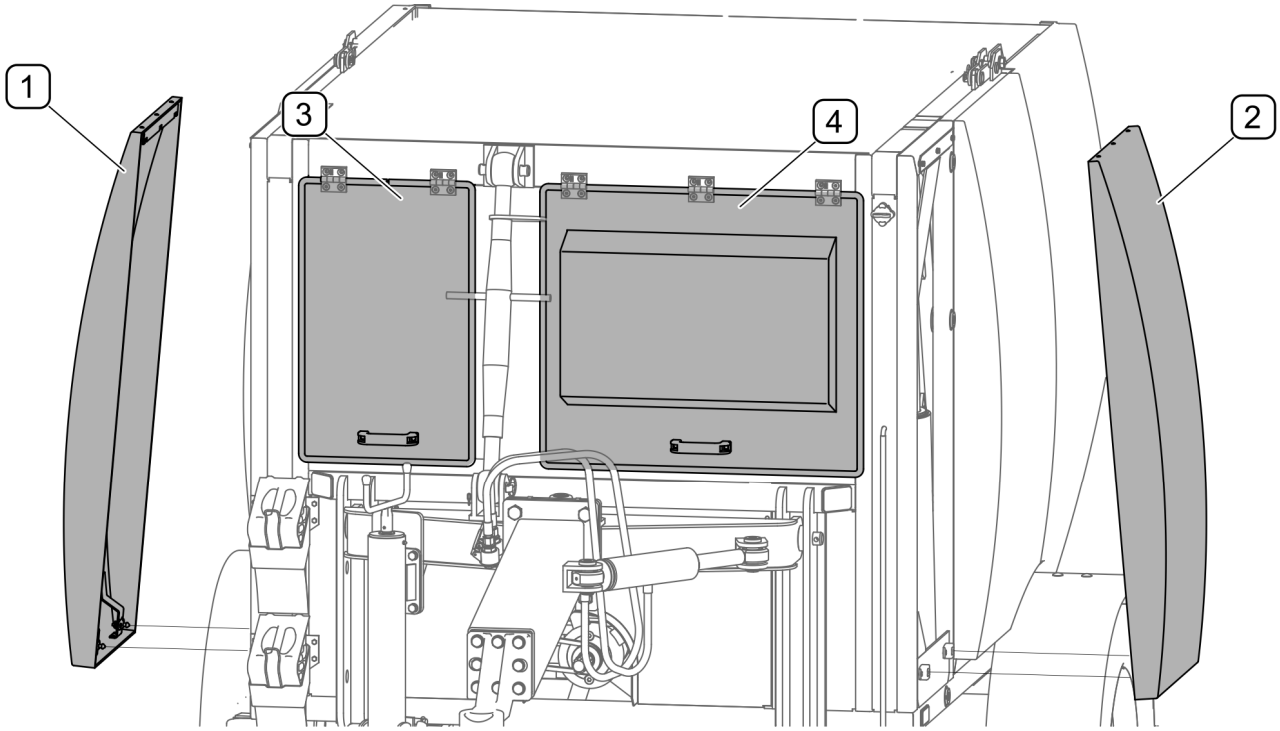


FIG. 5.1 Movable guards

(1) - side guard, right; (2) - side guard, left; (3) - front guard, right; (4) - front guard, left.

Side shields, right one (1) and left one (2), are disassembled for the time of maintenance (FIG. 5.1). Front shields (3) and (4) open upwards. They are kept in upper position by two gas springs.

To remove the side guards (1) and (2):

- pull out the lower part of the shield in order to disconnect latches;
- raise the guard and dismount catches from brackets

TIP

To allow the opening and closing of the right side guard (FIG. 5.1) lover the folding platform (FIG. 5.33) (only machines equipped with a folding side platform)

To install side shields (FIG. 5.1):

- install the shield's upper catch on bracket;
- insert latch pins into locks and press both sides of the shield;
- check if correctly installed

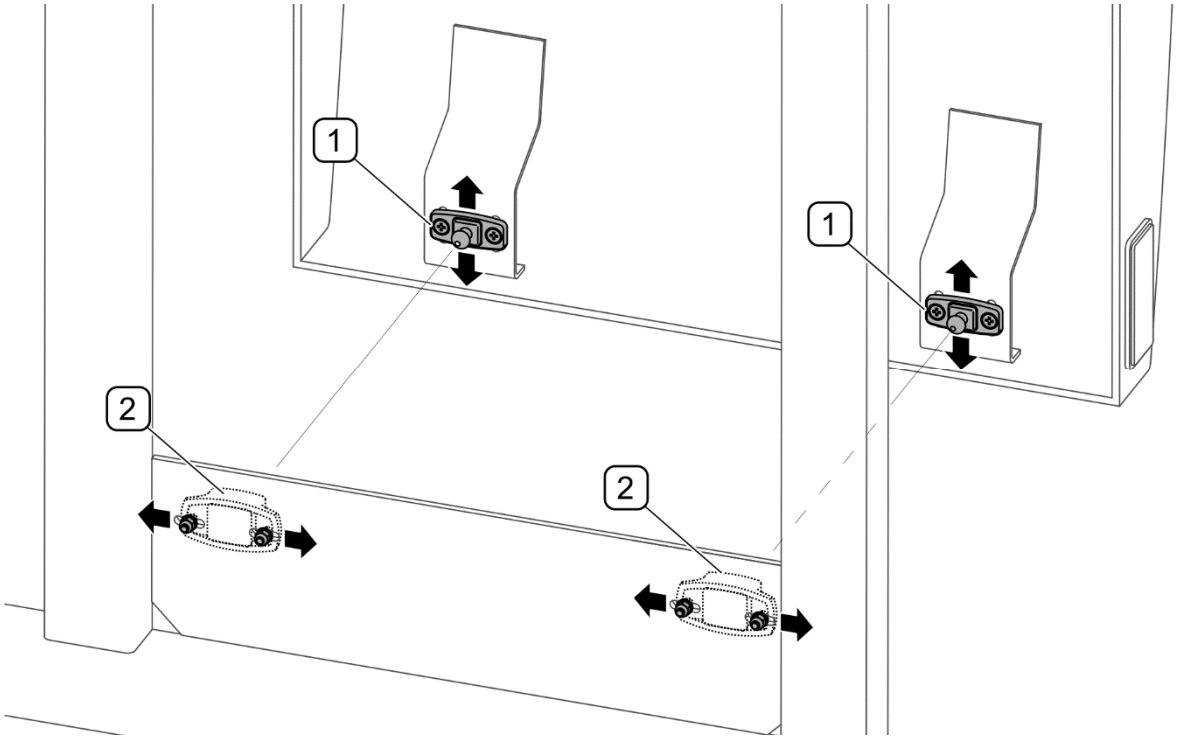


FIG. 5.2 Adjustment of side shields

(1) - latch pins on guards; (2) - latch seat on support frame

Side shield latches consist of two elements. The latch seat is attached to the sweeper's support frame and the pin is located on the bracket in the lower part of shield. Adjustment of side shields (FIG. 5.2) involves proper setting of latch pins on the shield and proper setting of latch seats on support frame. After loosening of securing bolts, the latch pins can be shifted in vertical plane and the latch seats can be shifted in horizontal plane. Tighten securing bolts after completed adjustment.

DANGER

Do not open or raise the waste tank if the sweeper is disconnected from the tractor's hitch!

Do not disconnect the sweeper from the tractor's hitch if the waste tank is open or raised!

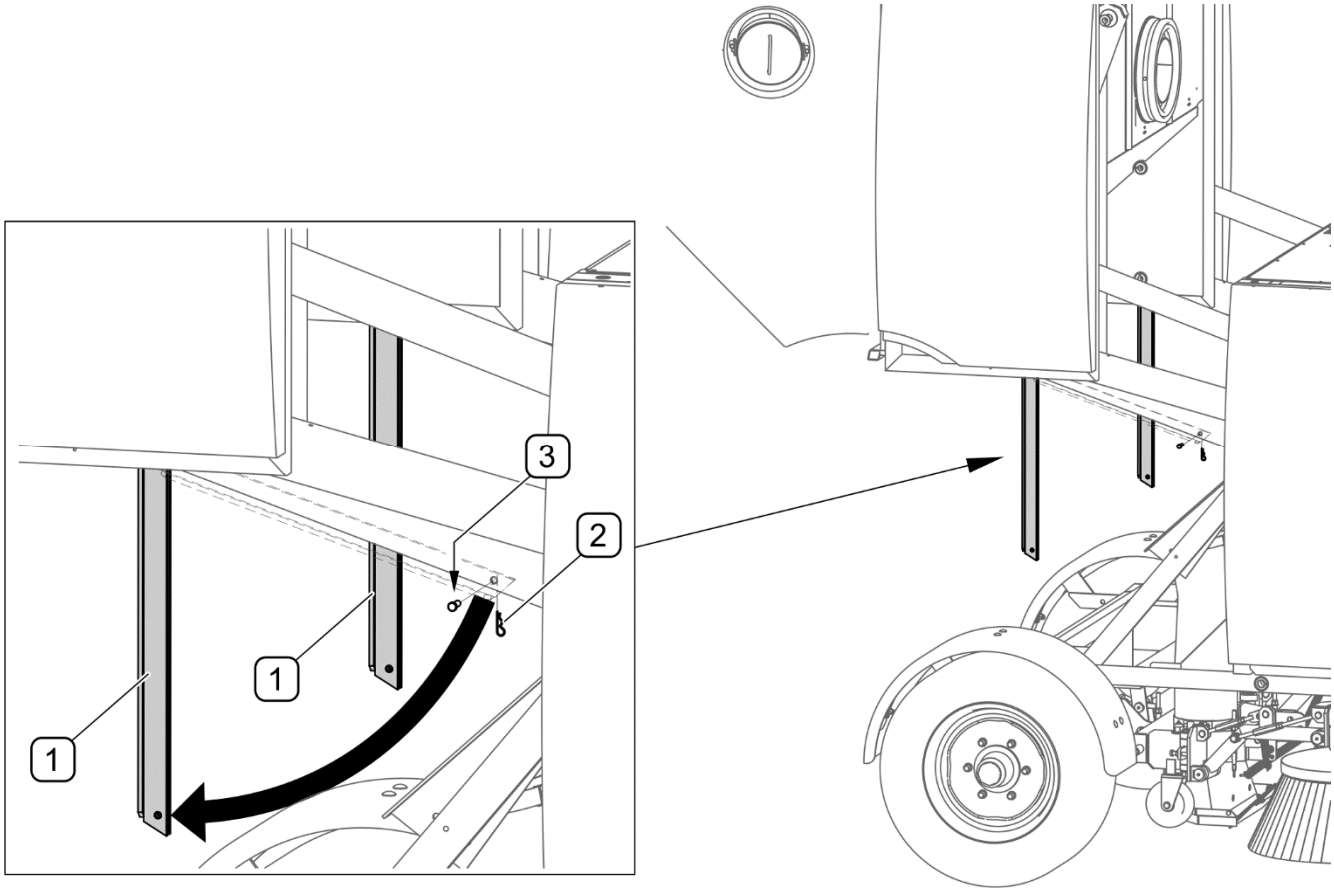


FIG. 5.3 Service supports

(1) - service supports; (2) - cotter pin; (3) - pin;

Service supports (1) are used to block the waste tank in raised position (FIG. 5.3).

In order to use service supports:

- raise the waste tank,
- take out securing cotter pins (2) and slide out pins (3),
- lower the service supports vertically,
- lower the tank slowly until service supports rest on the sweeper's frame,
- switch off sweeper, switch off tractor engine and remove key from ignition, engage parking brake,

In order to remove service supports:

- raise the waste tank,
- fold the supports, secure them with pins and cotter pins,

DANGER

Service supports and locks may be used only when the waste tank is empty.

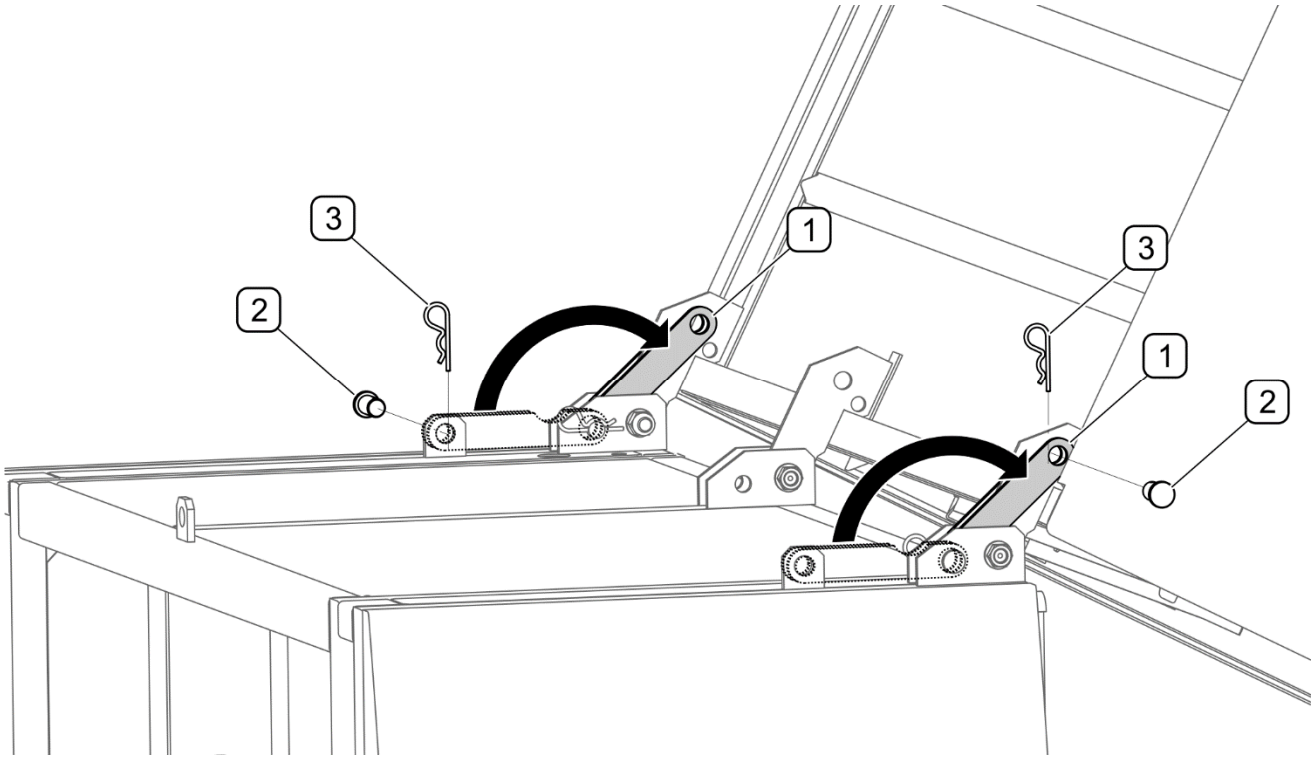


FIG. 5.4 Locking tank in open position

(1) - safety protection; (2) - pin; (3) - cotter pin

The waste tank has additional protections (FIG. 5.4) which enable blocking the tank in open position. In order to do this:

- open the waste tank gate,
- take out cotter pins (3) and slide out pins (2),
- relocate protection (1) from bracket's opening to gate's opening,
- install pins (2) and secure with cotter pins (3),

DANGER

Switch off the machine and install supports and service safety devices before performing any maintenance, adjustment and repair activities near the raised waste tank.

Failure to use proper supports may lead to falling down of the tank onto the operator or bystanders.

5.2 ADJUSTMENT OF SWEEP UNIT

DANGER

Prior to adjustment work, switch off the sweeper completely, switch off the tractor engine, remove key from ignition and engage parking brake in order to ensure safety.

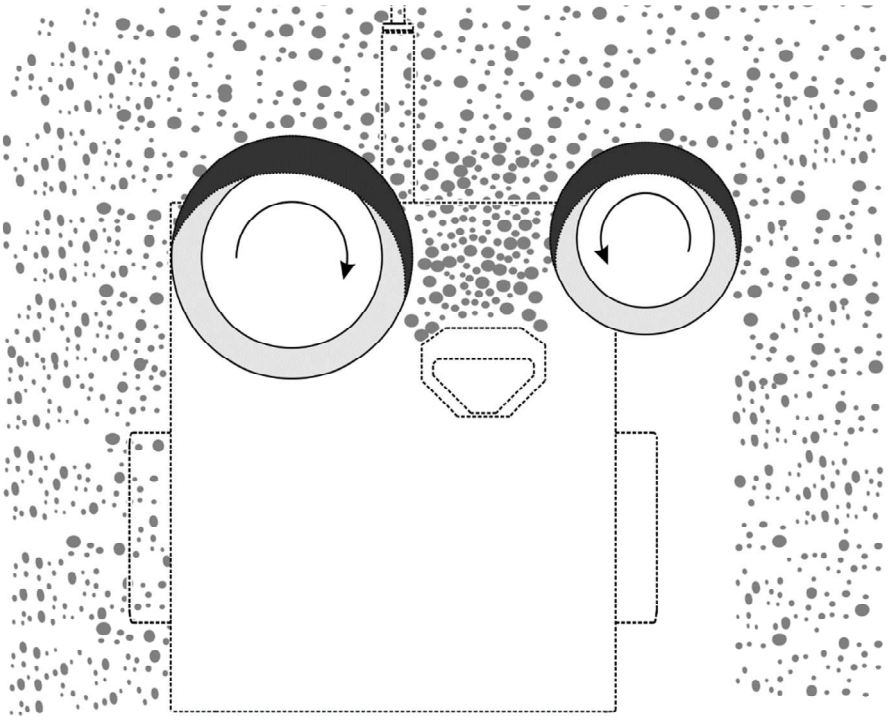


FIG. 5.5 Diagram showing brush arrangement ensuring that correct brush

Correctly positioned brush should touch the surface only with a section of its circumference in such a manner as to ensure that waste is directed to the inside of the sweeper and then to the suction unit. Shaded areas on diagram (FIG. 5.5) indicate sections of correctly set brushes which touch the surface. Adjustment of arm height and adjustment of longitudinal and lateral inclination have influence on proper brush setting.

Make certain that waste is not swept outside the machine. If necessary, adjust the sweep unit in the following manner:

1) Levelling of the sweep unit (FIG. 5.6)
2) Adjustment of brush arms (FIG. 5.7)
3) Adjustment of lateral inclination of brushes (FIG. 5.8)
4) Adjustment of brush side tipping (FIG. 5.9)
5) Adjustment of ground surface tracking (FIG. 5.10)

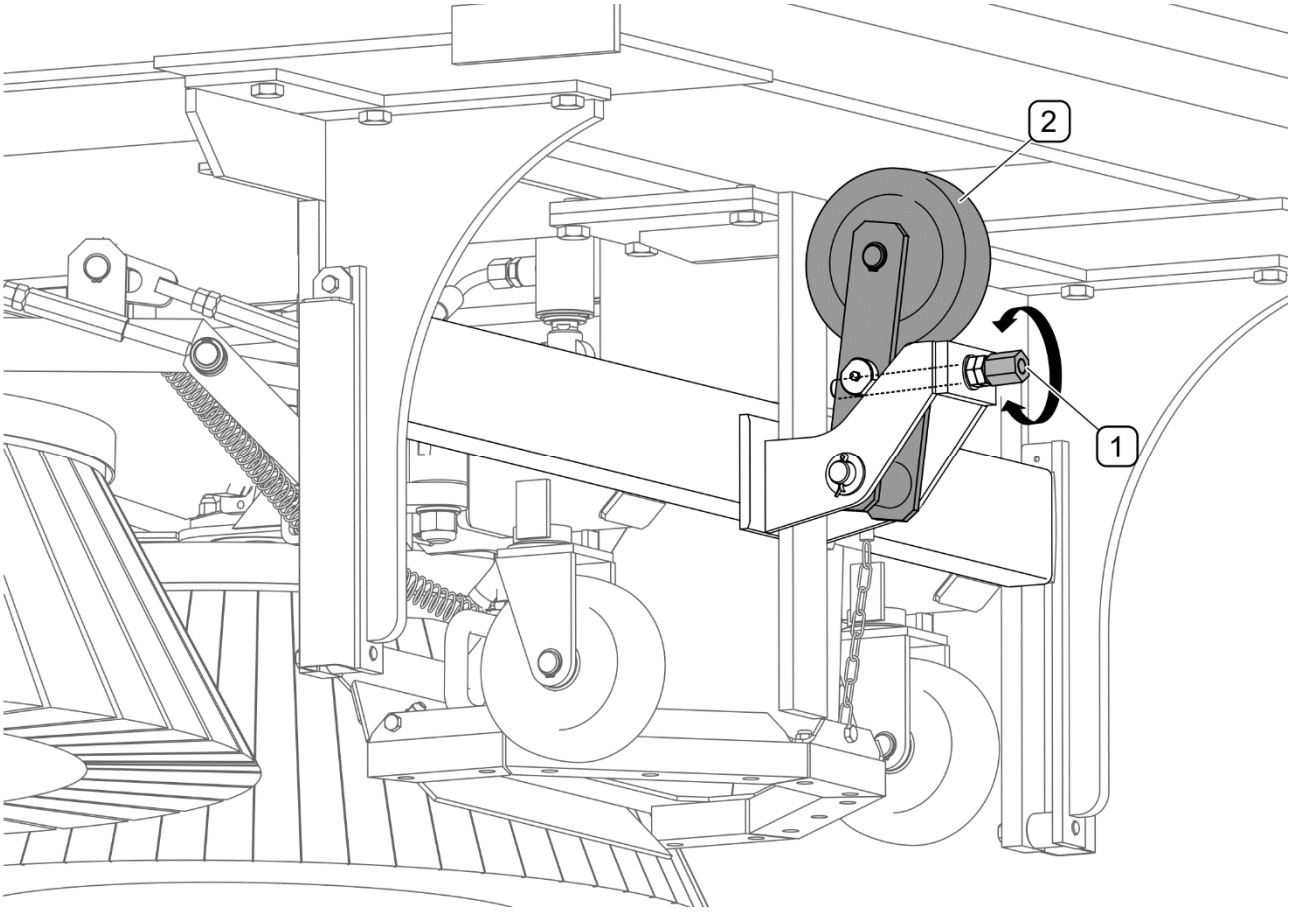


FIG. 5.6 Levelling of the sweep unit (view from the bottom of the machine)
(1) - adjustment bolt; (2) - resistance wheel

At the start of operation sweep unit should be levelled (FIG. 5.6) by adjusting resistance wheel (2). The adjustment is done by screwing or unscrewing the adjustment screw (1).

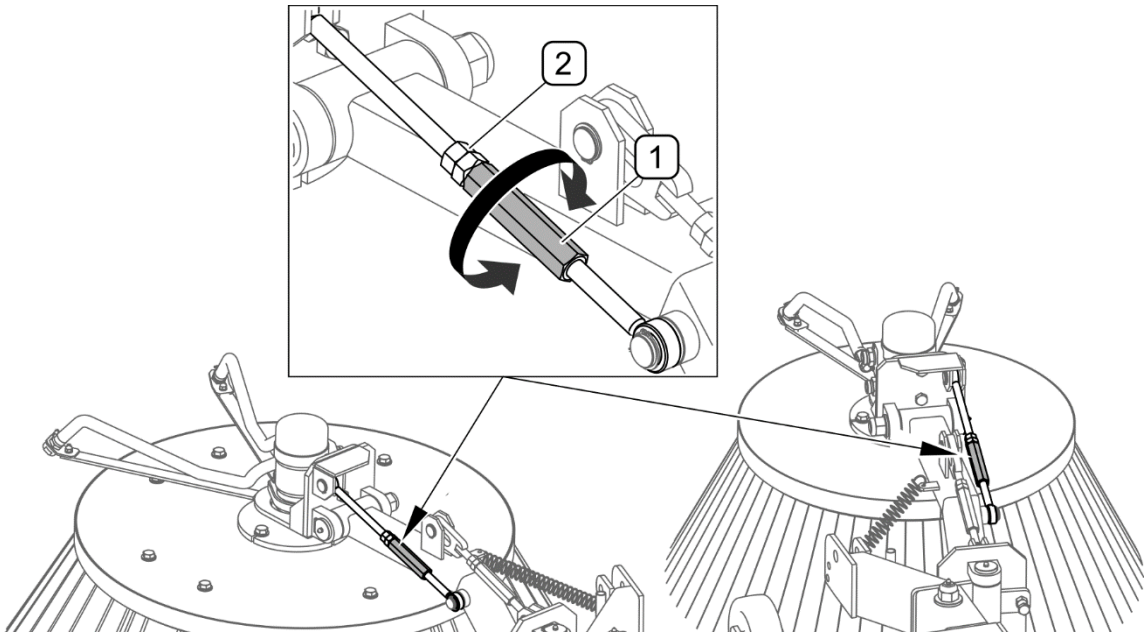


FIG. 5.7 Adjustment of brush arms

(1)- tensioner; (2)- securing nut

Height of brush arms (FIG. 5.7) is adjusted by means of tensioners (1). Loosen securing nuts (2) before adjustment and then turn tensioner (1) in order to set a required height of individual arms. After adjustment, tighten securing nuts (2). The adjustment is carried out independently for the right and left brush.

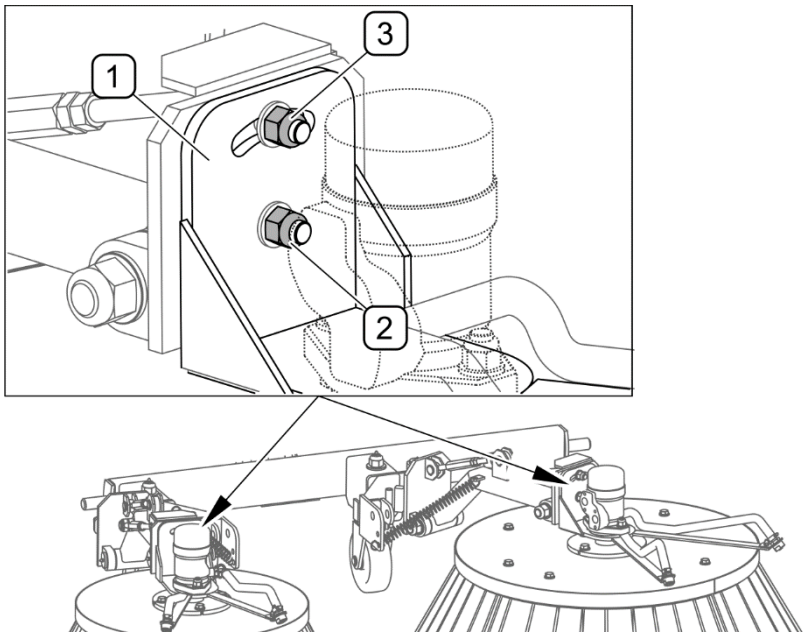


FIG. 5.8 Adjustment of lateral inclination of brushes

(1) - bracket securing hydraulic motor; (2) - rotation axis of bracket; (3) - locking nut.

In order to adjust lateral inclination (FIG. 5.8), loosen rotation axis nuts (2) and locking nuts (3) and set bracket (1) securing hydraulic motor in a correct manner. Adjust inclination angle of each brush independently.

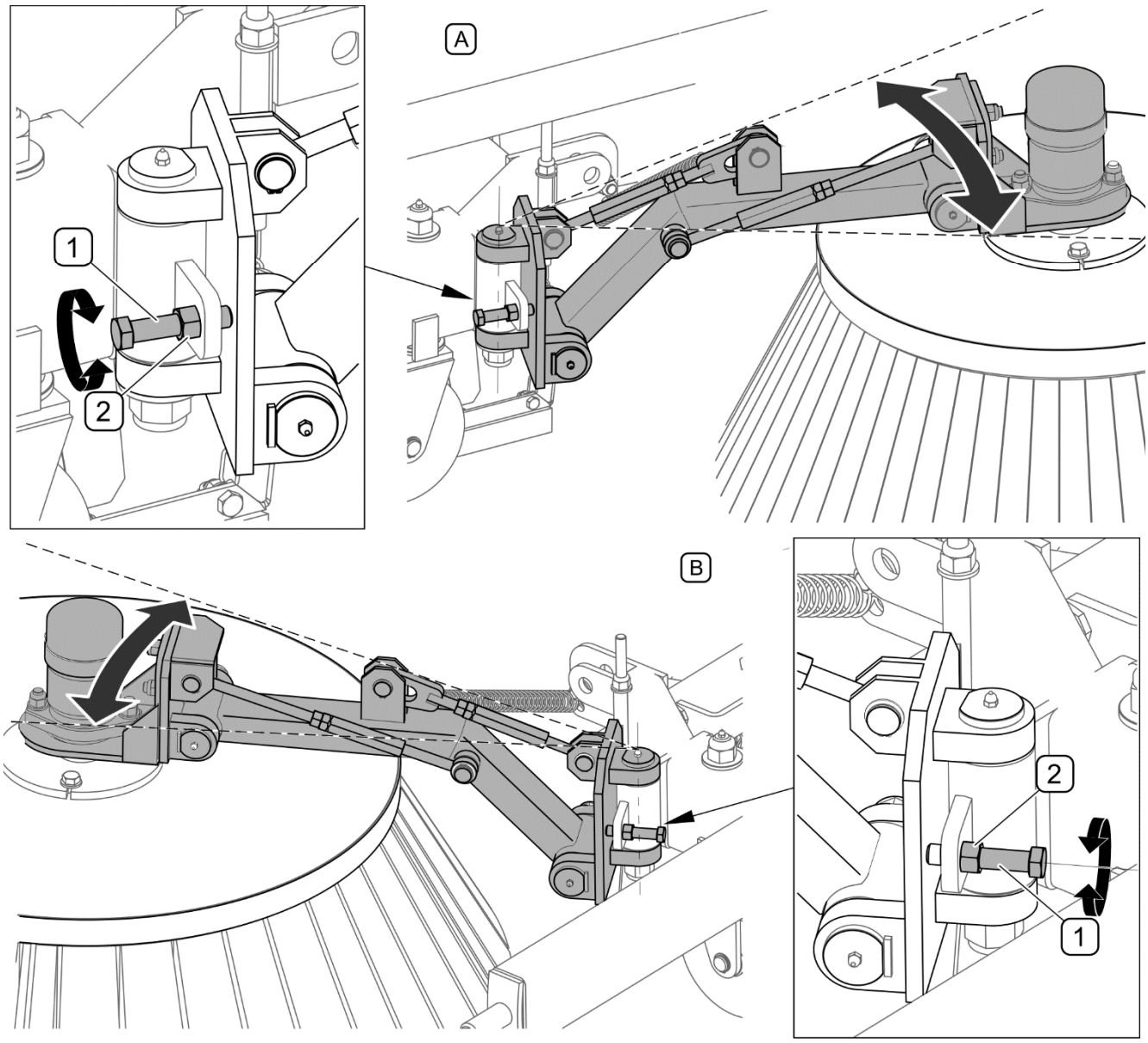


FIG. 5.9 Adjustment of brush side tipping

(A) - right brush; (B) - left brush; (1) - limiting bolts; (2) - counter nuts

During sweeper operation, right (A) and left (B) brush moves to the outside of the machine (FIG. 5.9). When the sweep unit is lifted, tensioning springs move brush arms back towards the machine centre. Range of horizontal movement of brushes is limited with bolts (2). Right brush (A) and left brush (B) can be set freely depending on a required sweeping width.

In order to adjust brush side tipping (FIG. 5.9):

- loosen counter nuts (1),
- set allowable tipping by means of limiting bolt (2),
- after adjustment, tighten counter nut (1).

Side tipping of the right (A) and left (B) brush is adjusted in the same manner.

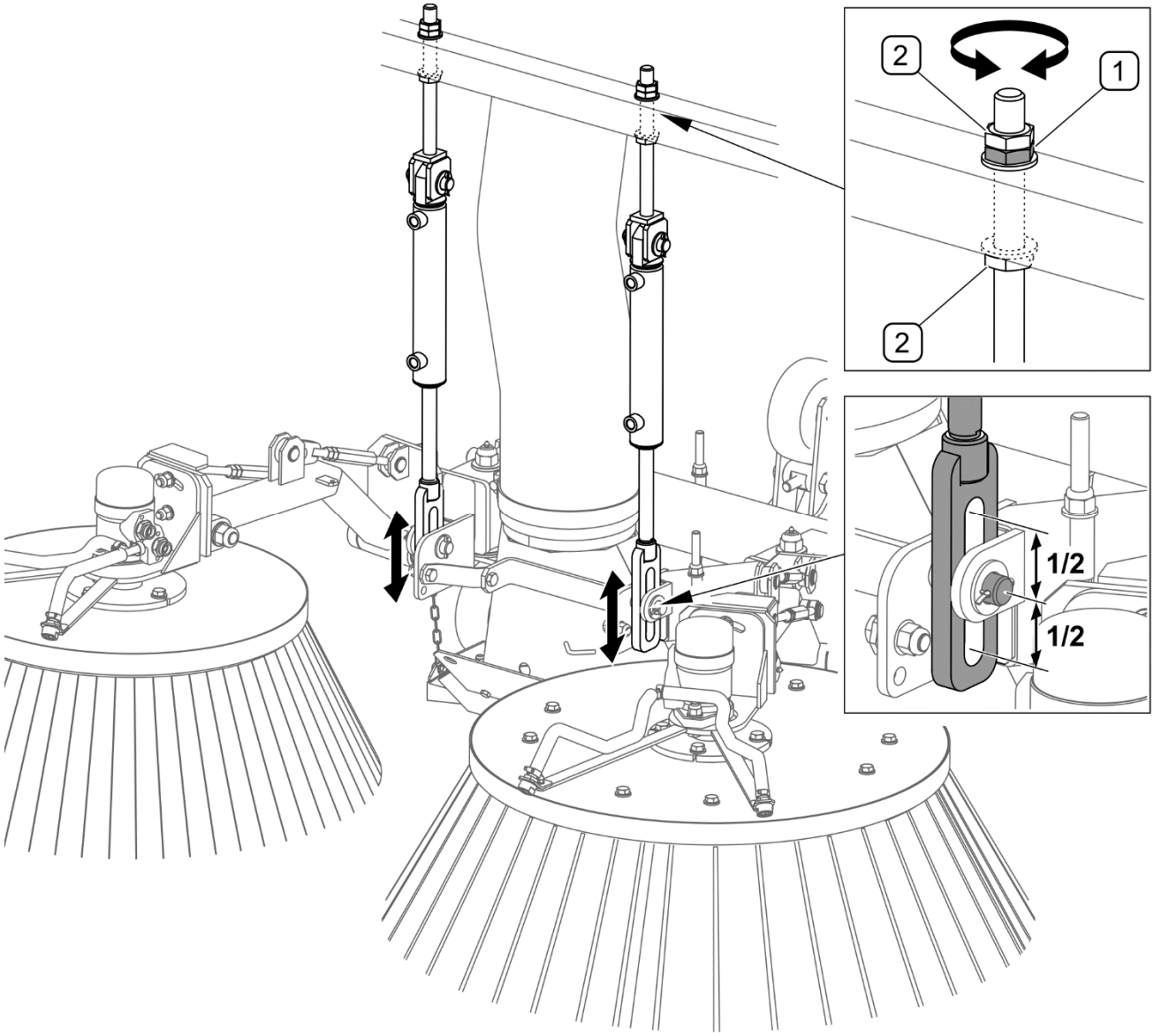


FIG. 5.10 Adjustment of ground surface tracking

(1) - adjustment nut; (2) - counter nut

When the sweep unit is lowered, the fixing pin should be located at the mid-height of the oblong recess (FIG. 5.10). Proper setting of sweep unit suspension enables movement in vertical plane and tracking small unevenness of ground. If necessary, loosen counter nuts (2) and set properly the suspension of right cylinder and left cylinder by means of nut (1).

5.3 BRUSH REPLACEMENT

DANGER

Before inspection and replacement of brushes, turn off the machine drive, switch off the tractor's engine and ensure that unauthorised persons have no access to the vehicle cab.

Technical condition of disk brushes should be checked periodically. Excessively worn brushes of sweep unit must be replaced with new ones.

In order to replace disk brush (FIG. 5.11):

- undo nuts (3) of brush fixing bolts,
- replace worn brush (1), install distance nuts (5),
- tighten nuts (3).

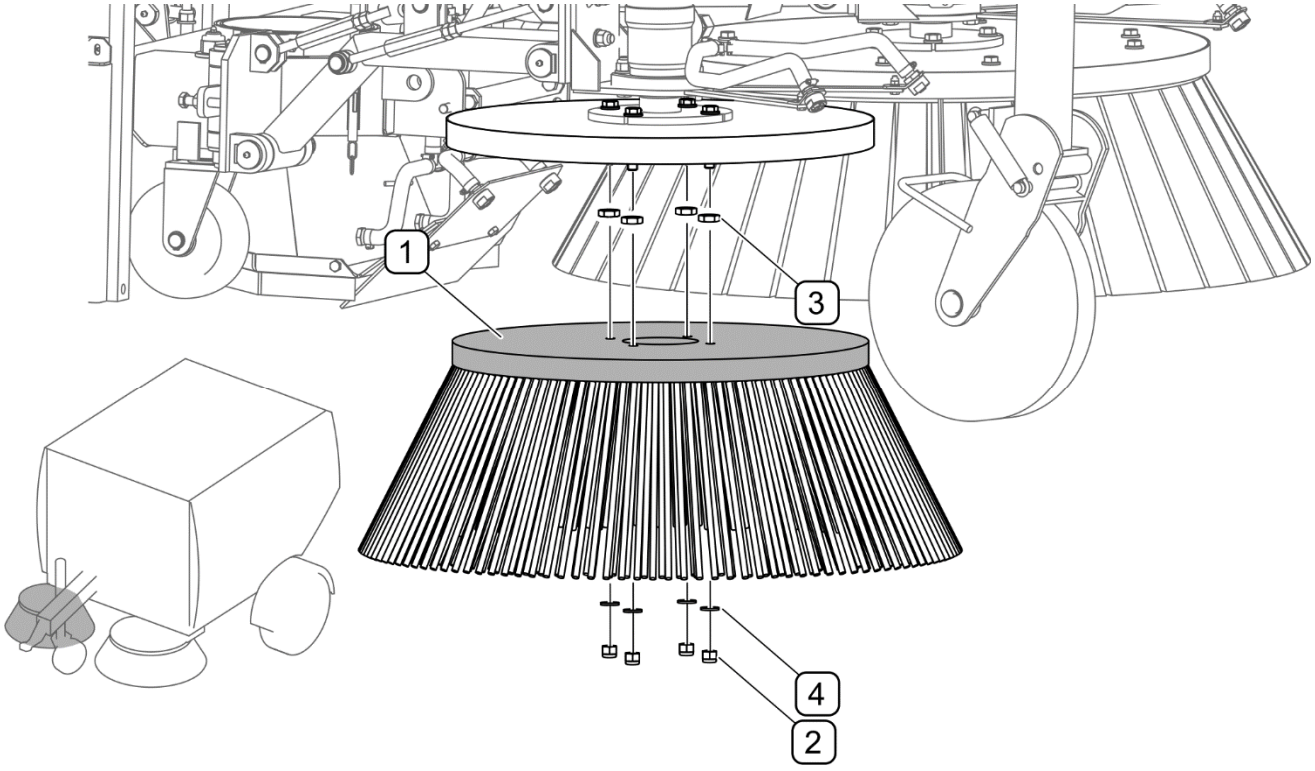


FIG. 5.11 Replacement of disk brush I (right)

(1) - disk brush I (right); (2) - nut M12; (3) - short distance nut M16; (4) - washer 12-100HV

Disk brush II (left) consist of four segments (FIG. 5.12).

In order to replace segments of disk brush II:

- undo nuts (2) of bolts fixing individual segments,
- remove washers (4) and distance nuts (3),
- dismantle worn out segments (4 segments),
- install and fix new brush segments.

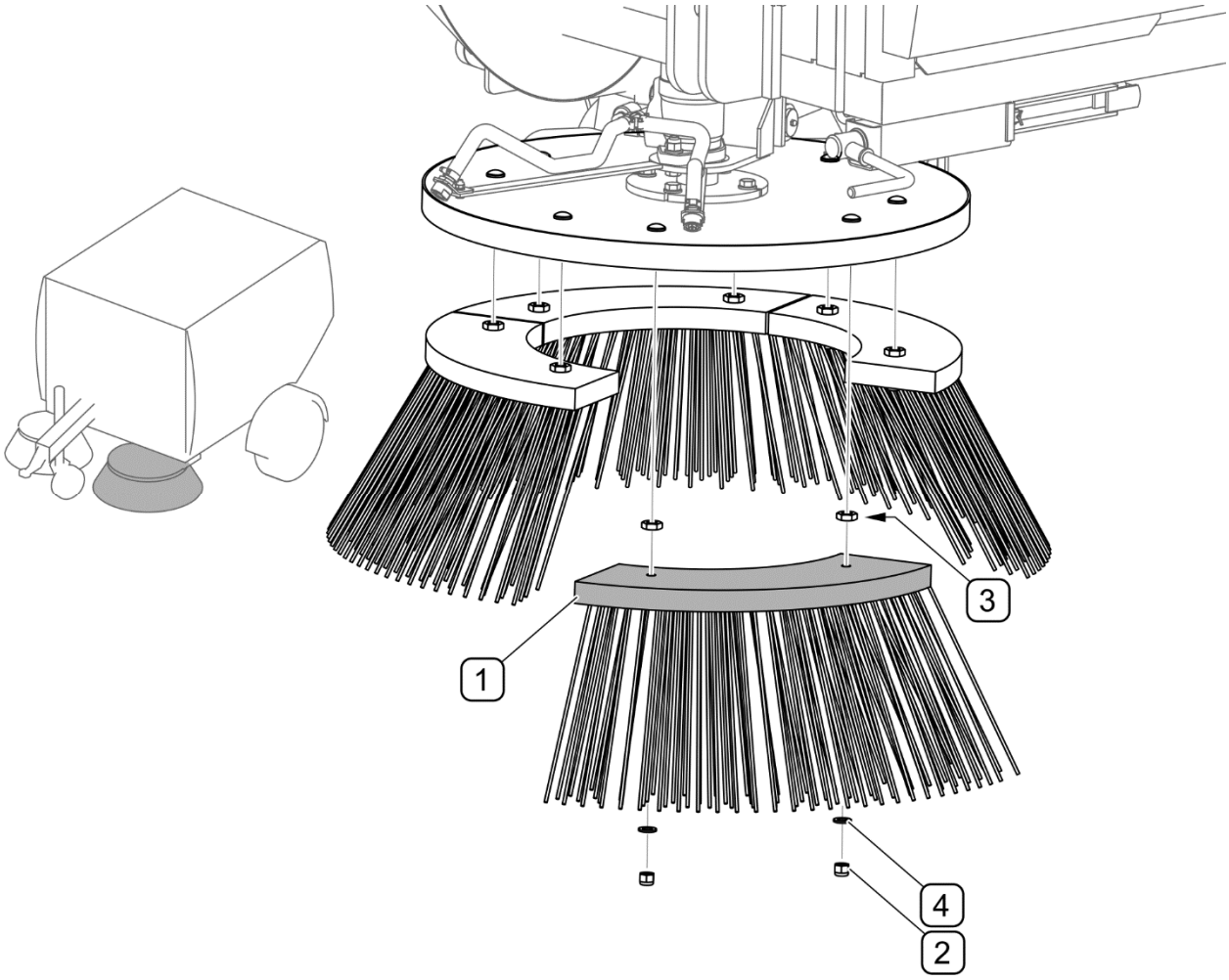


FIG. 5.12 Replacement of disk brush II (left)

(1) - disk brush II segment (left); (2) - nut M10; (3) - short distance nut M16; (4) - washer 10-100HV

TAB. 5.1 TYPES OF DISK BRUSHES

ITEM	SPECIFICATION	PART NUMBER
Disk brush I (right)		
1	Medium brush (wire+plastic)	260305.900600
2	Soft brush (plastic)	260305.000600
3	Hard brush (wire)	260305.900600
Disk brush II (left)		
1	Segment of medium brush (wire+plastic)	260300.900600
2	Segment of soft brush (plastic)	260300.000600
3	Segment of hard brush (wire)	260300.900000

5.4 ADJUSTMENT OF SUCTION UNIT

Adjustment of suction unit should be carried out after adjustment of sweep unit (see *5.2. adjustment of sweep* unit)

Carry out the adjustment when the sweep unit is lowered to working position. Turn adjustment nuts (1) and set suction tip suspension in such a manner as to ensure that the distance between the suction tip's plane and ground is equal and is within the range of 5÷10mm. Slides of suction tip wear off during operation. Consequently, the height of suction tip above cleaned surface should be readjusted. Periodical inspection and necessary adjustment enable efficient operation of suction unit.

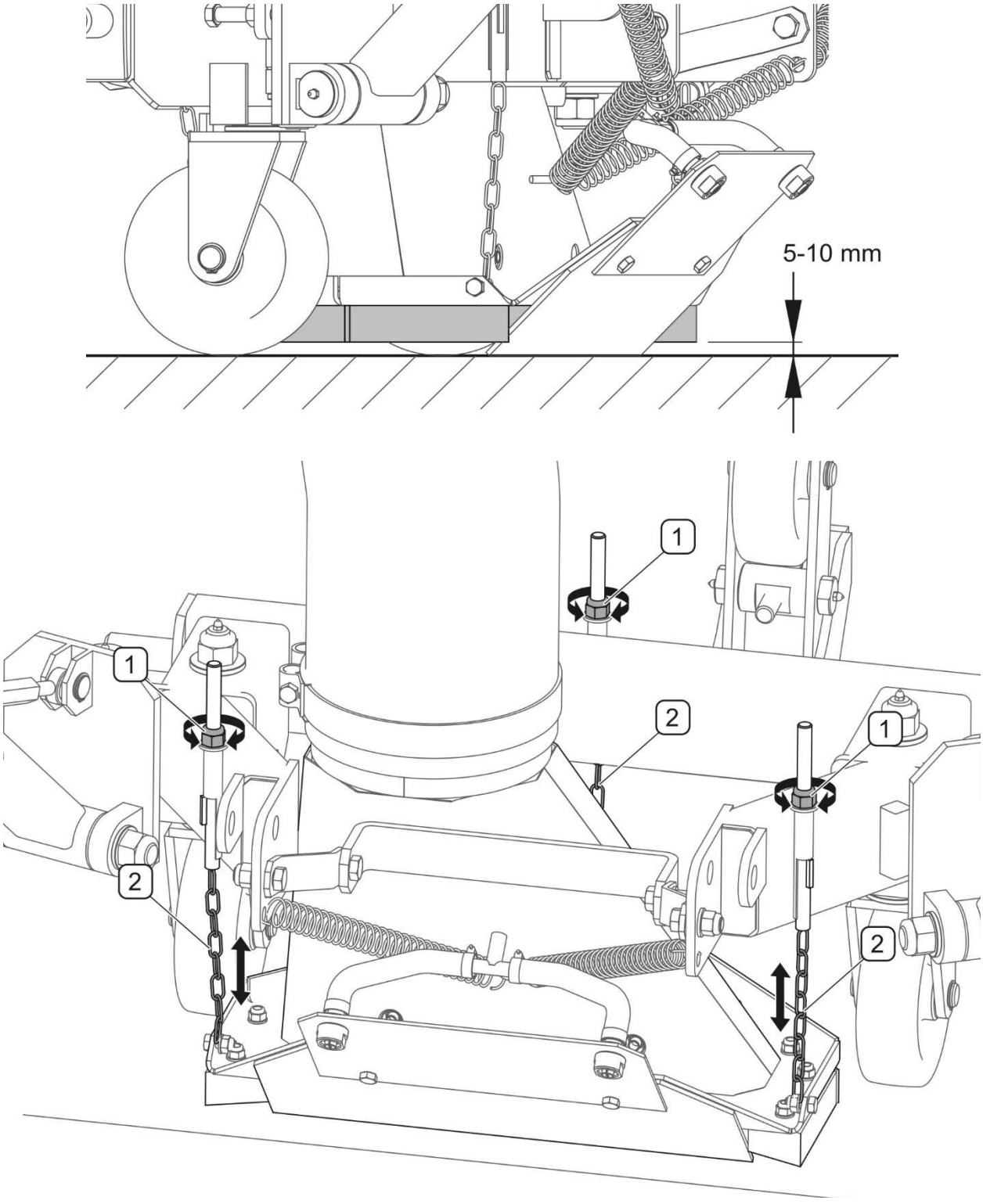


FIG. 5.13 Adjustment of suction tip height

(1) - adjustment nuts; (2) - suction tip suspension chains

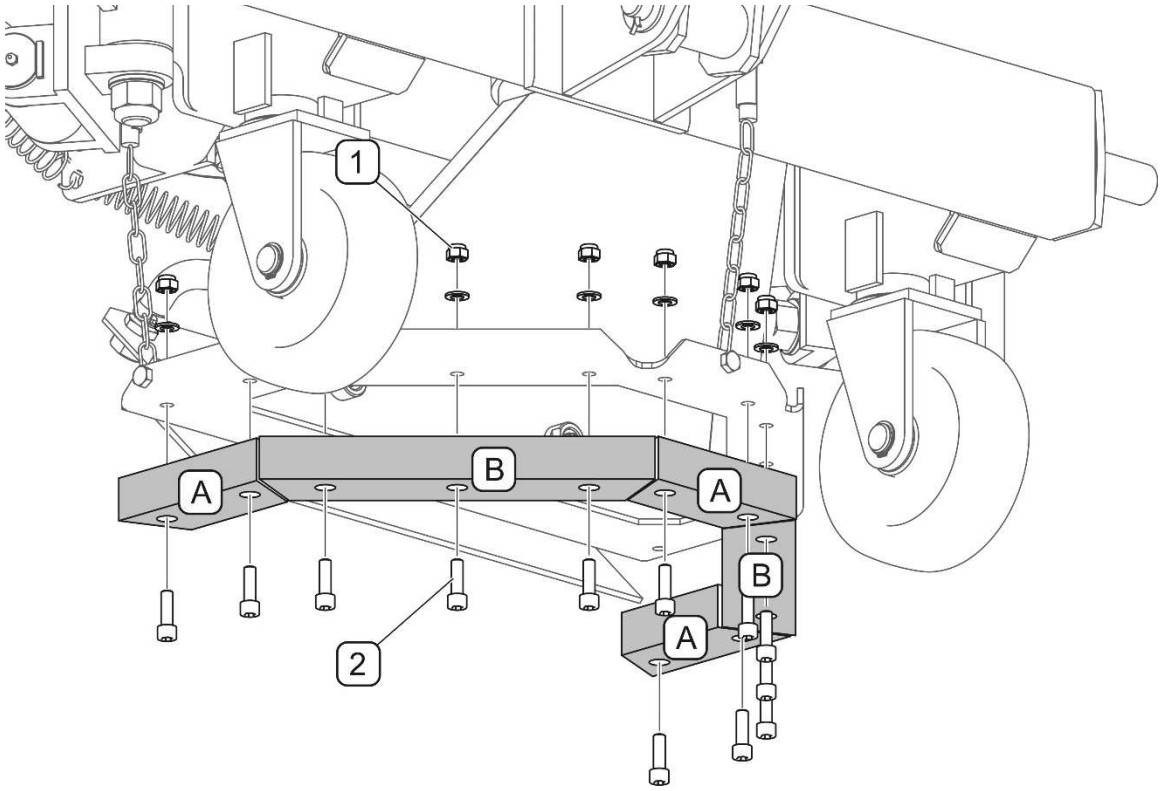


FIG. 5.14 Replacement of suction tip slides

(A) - slide I; (B) - slide II; (1) - nut; (2) - bolt

Excessively or unevenly worn slides of suction tip (FIG. 5.14) should be replaced with new ones. In order to do this:

- undo proper nuts (1) of bolts (2),
- replace worn or damaged slides,
- install bolts (2) and tighten nuts (1).

TAB. 5.2 LIST OF SUCTION TIP SLIDES

MARKING (FIG. 5.14)	**NAME**	**QUANTITY OF SLIDES PER SET**	**PART NUMBER**
A	Slide I	3	130N-05010001
B	Slide II	2	130N-05010002

After replacement of slides, check and adjust, if necessary, suction unit (FIG. 5.14)

5.5 ADJUSTMENT OF DRIVE UNIT

Adjustment of drive unit involves only checking and, if necessary, adjusting tension of vee-belts of fan drive and pump drive.

Tension of vee-belts of fan drive (FIG. 5.15) is measured by belt deflection midway between rotation axis of driving belt pulley and rotation axis of fan belt pulley. When a force of F=200 N is applied, belt deflection should amount to 25 mm.

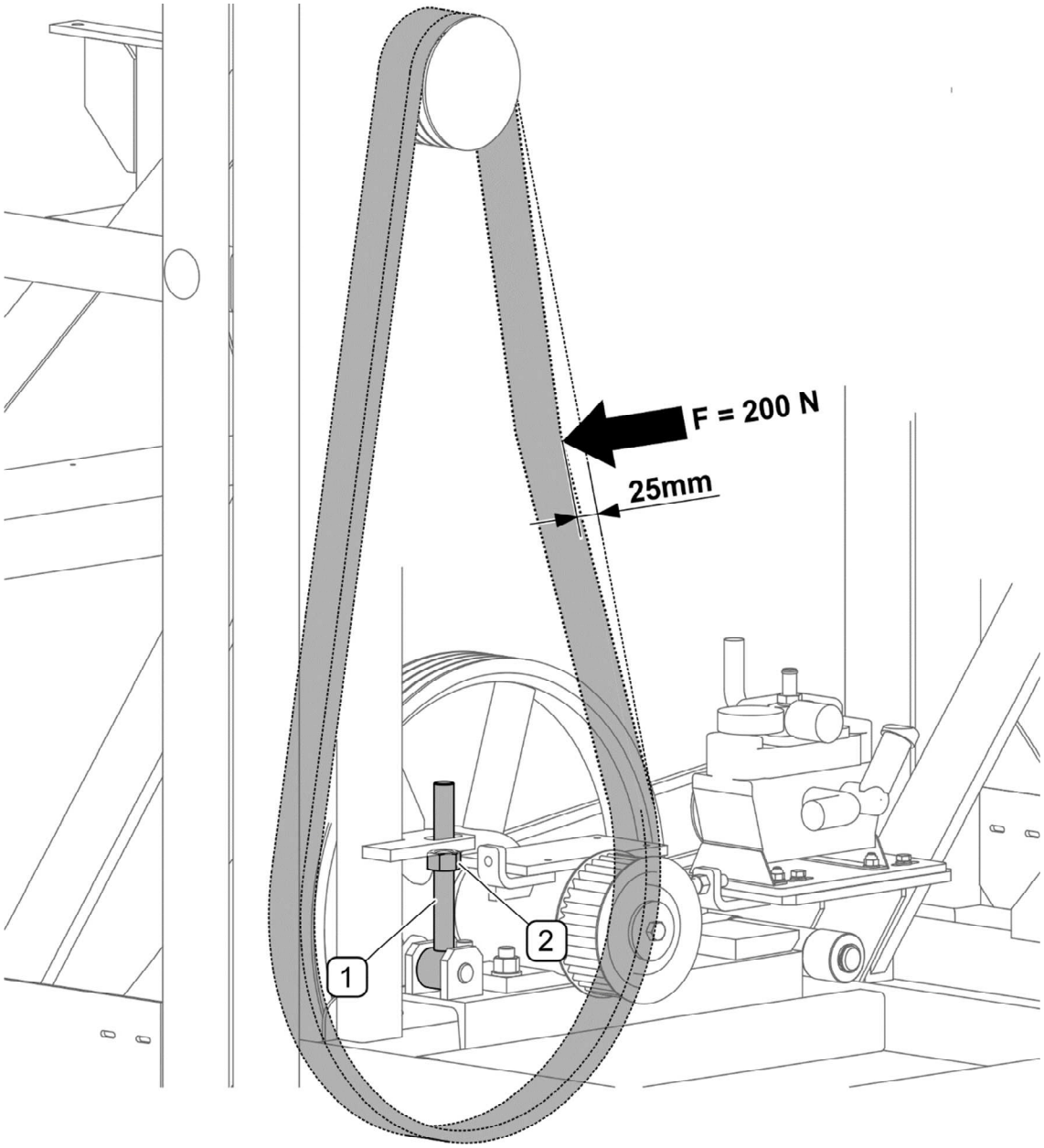


FIG. 5.15 Adjustment of fan drive belt tension

(1) - tensioner; (2) - adjustment nut

Before adjustment of fan belt tension, loosen tension of water pump drive belt (FIG. 5.17)

After the first hour of work, adjust tension of vee-belt of fan drive. After the first 8 hours of work, check other belts tension. Technical condition and tension of belts should be checked periodically.

Tension of fan drive belts (FIG. 5.15) is adjusted with tensioner's nut (2).

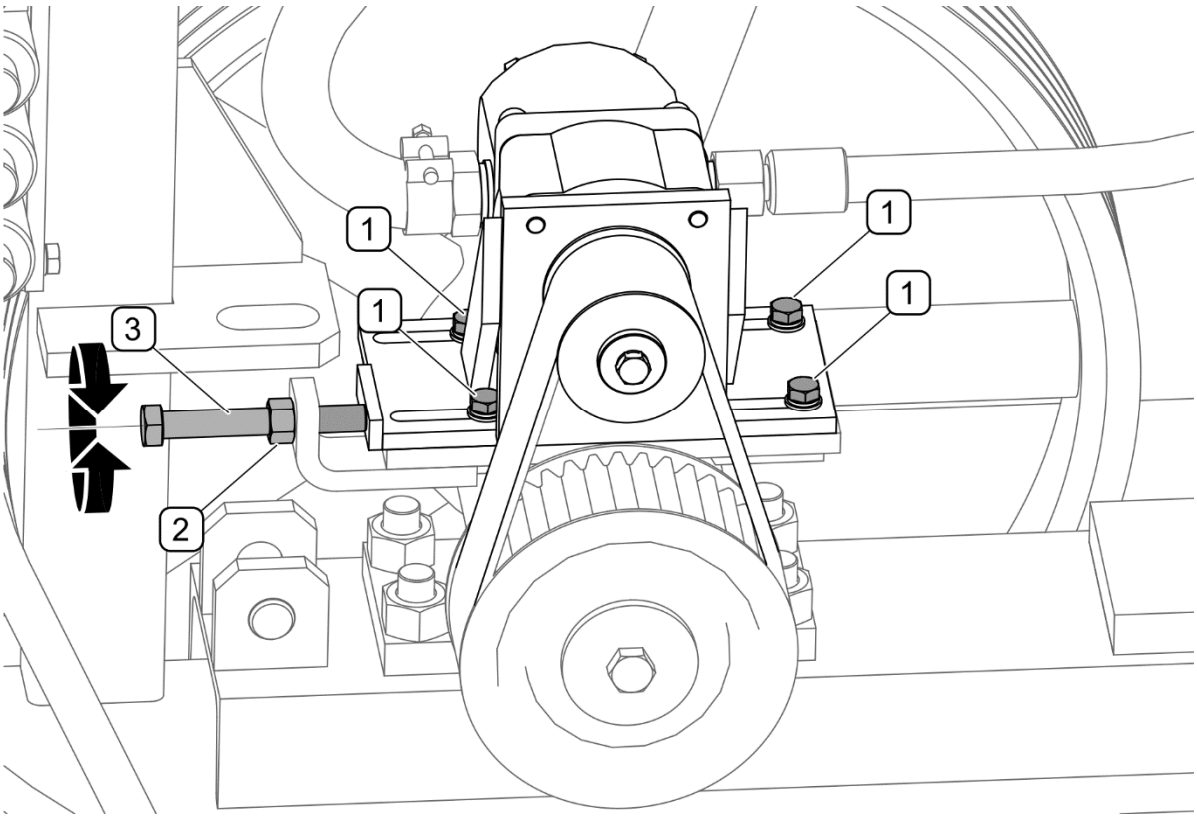


FIG. 5.16 Adjustment of oil pump drive belt tension

(1) - bolts fixing the pump; (2) - counter nut; (3) - adjustment bolt

In order to adjust tension of oil pump drive belt (FIG. 5.16):

- loosen bolts (1) (4 bolts) that fix the pump to its base;
- loosen counter nut (2),
- turn bolt (3) with a wrench and tension the belt by shifting the pump base,
- tighten counter nut (2),
- tighten bolts (1) that fix the pump base,

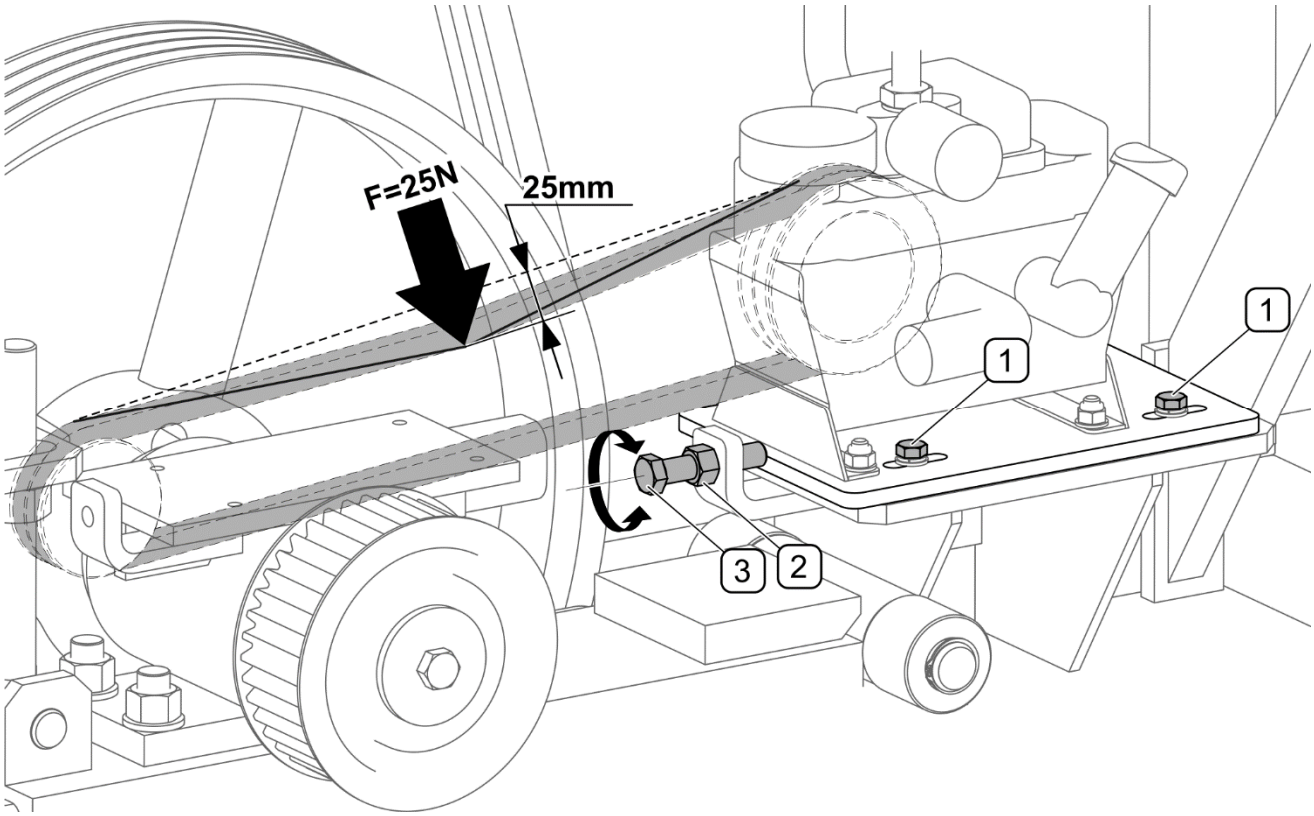


FIG. 5.17 Adjustment of water pump drive belt tension

(1) - bolts fixing the pump; (2) - counter nut; (3) - adjustment bolt

Proper deflection of water pump drive vee-belts should amount to 25 mm, when a force of F=25N is applied. Tension is checked individually for each belt midway between the axes of the pulleys. If belts have slightly different lengths, tension should be adjusted for the shortest belt. Allowable difference in lengths of water pump drive belts is 2 mm.

In order to adjust tension of water pump drive belts (FIG. 5.17):

- loosen bolts (1) (4 bolts) that fix the pump to its base;
- loosen counter nut (2),
- turn bolt (3) with a wrench, shift the pump base and set proper tension of the belts,
- tighten counter nut (3),
- tighten bolts (1) that fix the pump to its base.

TIP

Tension of water pump drive belts should be adjusted after adjustment of fan drive belts because these belts are driven by the same belt pulley.

After the first hour of work, adjust tension of water pump drive vee-belts. After the first 8 hours of work, check other belts tension. Technical condition and tension of belts should be checked periodically.

TAB. 5.3 LIST OF BELTS USED IN THE DRIVE SYSTEM OF ZMC2.0 SWEEPER

ITEM	NAME	MARKING	NUMBER OF ITEMS
1	Fan drive narrow poly-v belt	4SPA 2650	1
2	Vee belt of water pump drive system	SPZ 1120	2
3	Cogbelt of oil pump drive system	HDT 640 8M 50	1

Broken or excessively worn belt must be immediately replaced with a new one.

5.6 HYDRAULIC SYSTEM MAINTENANCE

DANGER

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

DANGER

Do not repair hydraulic system on your own. All hydraulic system repairs must be performed only by suitably qualified personnel.

The duties of the operator connected with the hydraulic system include:

- checking oil level in the hydraulic system tank,
- checking tightness of cylinders hydraulic connections,
- checking technical condition of lines,
- periodical replacement and cleaning of filter cartridges,
- periodical changing of oil in the hydraulic system tank

ATTENTION!

The condition of hydraulic system should be inspected regularly while using the machine.

Hydraulic lines should be replaced after 4 years of machine use.

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

TAB. 5.4 List of filter cartridges used in the hydraulic system

ITEM	NAME	PART NUMBER
1	Filter cartridge of pressure oil filter	CCH 301 FD1
2	Filter cartridge of return oil filter	CDE 020 CD1

The sweeper's hydraulic system should be completely tight. Checking tightness of the hydraulic system involves connecting the sweeper with the tractor, activating the waste tank lifting/opening hydraulic cylinders and holding them in position of maximum extension for 30 seconds. Hold the hydraulic cylinders in position of maximum extension for 30 seconds. In the event of confirmation of an oil leak on hydraulic line connections, tighten connections, and if this does not remedy faults then change line or connection elements. If oil leak occurs beyond connection, the leaking line system should be changed. Change of sub-assemblies is equally required in each instance of mechanical damage. In the event of confirmation of damage of hydraulic ram cylinders they must be replaced or repaired. In such an event the whole set of seals must be changed. Work connected with the repair of hydraulic system should be entrusted to the appropriately qualified persons.

The hydraulic system of new machine is factory filled with HL32 hydraulic oil.

DANGER

Oil fires should be quenched with carbon dioxide (CO_2), foam or extinguisher steam. Do NOT use water for fire extinguishing!

TAB. 5.5 HL32 HYDRAULIC OIL CHARACTERISTICS

ITEM	NAME	VALUE
1	ISO 3448VG viscosity classification	32
2	Kinematic viscosity at 40°C	28.8 – 35.2 mm^2/s
3	ISO 6743/99 quality classification	HL
4	DIN 51502 quality classification	HL
5	Flash point, ^0C	Above 210°C

Because of its composition the oil applied is not classified as a dangerous substance, however long-term action on the skin or eyes may cause irritation. In the event of contact of oil with skin wash the place of contact with water and soap. Do NOT apply organic solvents (petrol, kerosene). Contaminated clothing should be changed to prevent access of oil to skin. In the event of contact of oil with eye, rinse with large quantity of water and in the event of the occurrence of irritation consult a doctor. Hydraulic oil in normal conditions is not harmful to the respiratory tract. A hazard only occurs when oil is strongly atomised (oil vapour), or in the case of fire during which toxic compounds may be released.

Spilt oil should be immediately collected and placed in marked tight container. Used oil should be taken to the appropriate facility dealing with the re-use of this type of waste.

ATTENTION!

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

The condition of hydraulic systems should be inspected regularly while using the machine.

The hydraulic system is under high pressure when operating.

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

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

Should it be necessary to change hydraulic oil for another oil, check the recommendations of the oil Manufacturer. If it is recommended to flush the system with the appropriate preparation, then comply with these recommendations. Attention should be given, so that chemical substances used for this purpose do not damage the materials of the hydraulic system.

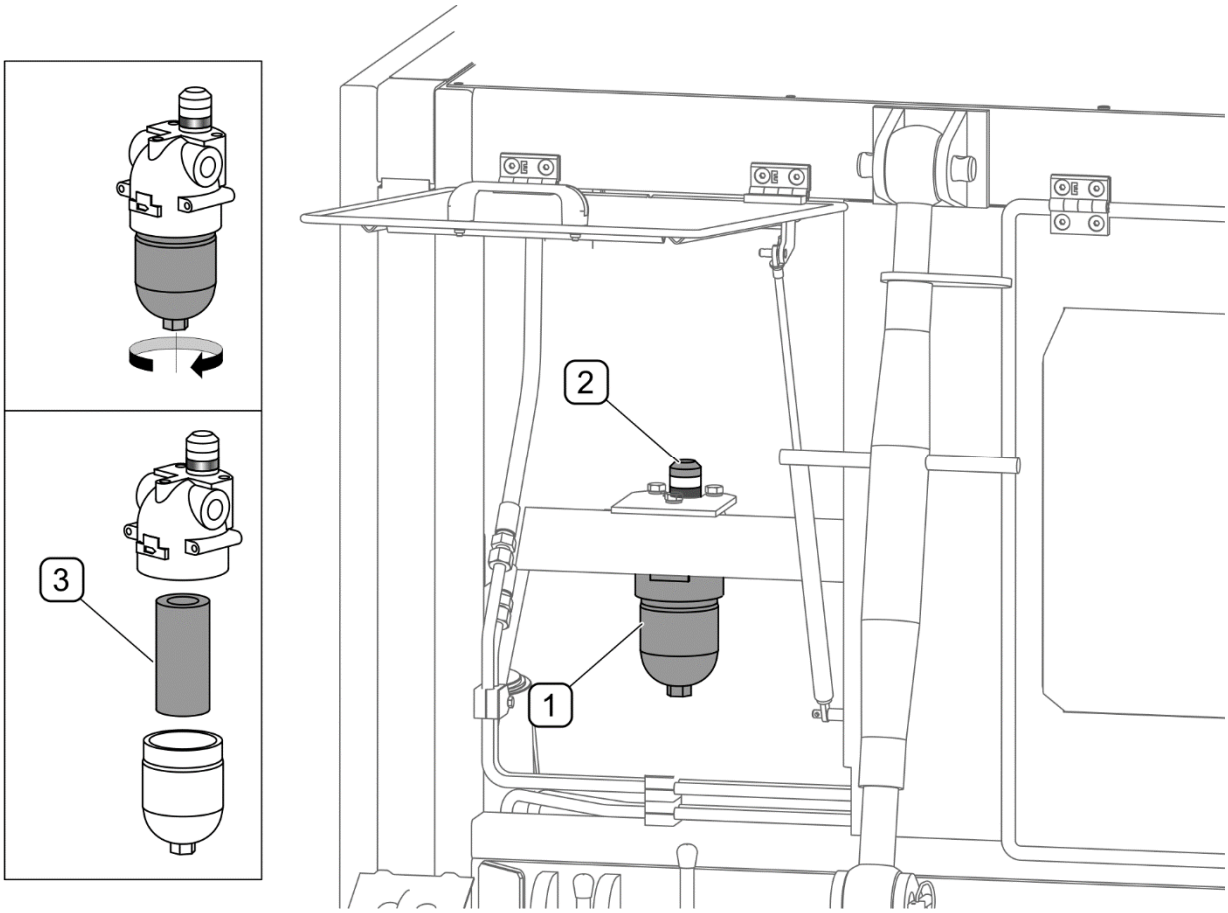


FIG. 5.18 Pressure oil filter with contamination indicator

(1) - pressure oil filter; (2) - indicator of filter cartridge contamination; (3) - pressure filter cartridge;

Pressure filter (FIG. 5.18) is located below the oil tank. Pressure oil filter (1) is equipped with contamination indicator (2). If filter cartridge is contaminated, the indicator changes its colour from white to red. Within the scope of hydraulic system maintenance, check filter condition and replace filter cartridge, if necessary.

In order to replace pressure filter cartridge:

- unscrew lower part of filter housing,
- replace filter cartridge with a new one,
- tighten lower part of filter housing.

The hydraulic system is vented automatically during machine operation.

Filter cartridge of pressure oil filter should be replaced when the indicator located on the filter indicates filter contamination.

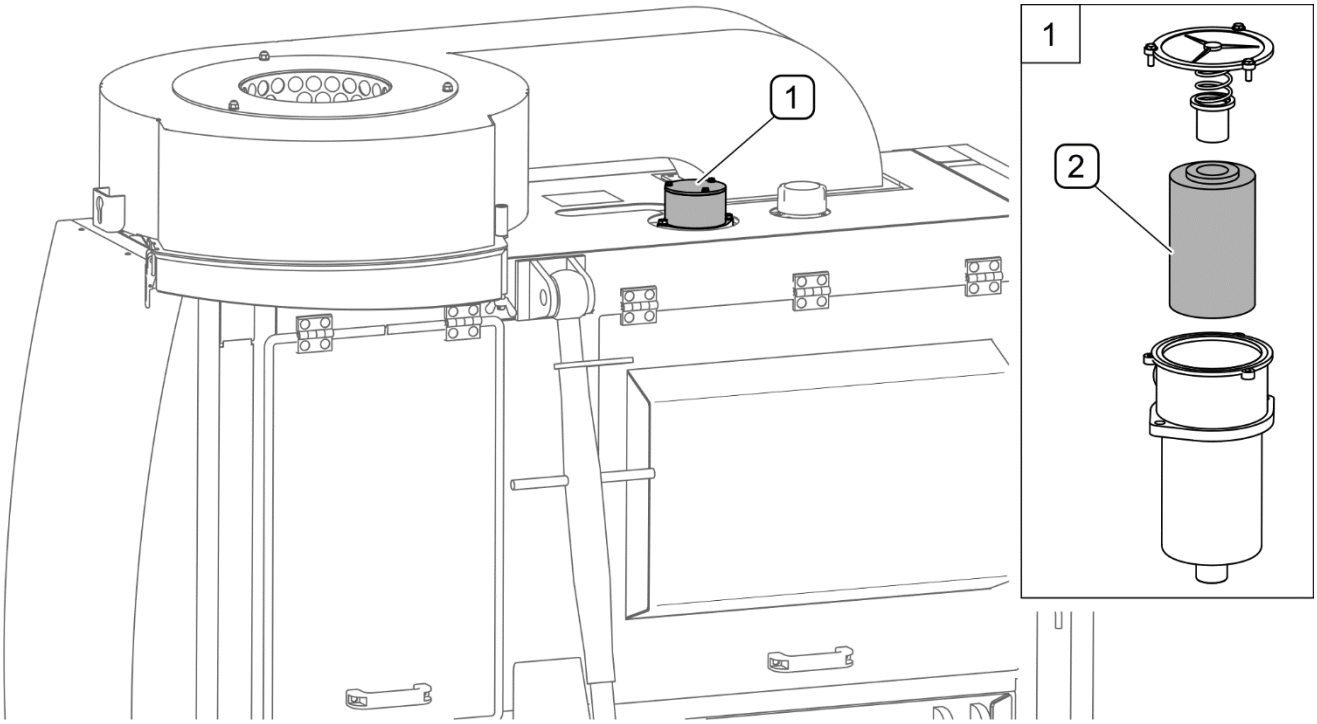


FIG. 5.19 Replacement of return oil filter cartridge

(1) - return oil filter; (2) - return oil filter cartridge;

Return oil filter (FIG. 5.19) is located in the upper part of oil tank. Return oil filter is equipped with filter cartridge which should be periodically replaced.

In order to replace return oil filter cartridge:

- unscrew bolts (3 bolts) that secure filter cover;
- replace filter cartridge with a new one;
- install filter cover and tighten bolts;

The hydraulic system is vented automatically during machine operation.

Return oil filter cartridge should be replaced every 500 engine working hours or once a year, whichever occurs first.

Inlet filter (FIG. 5.20) is located inside inlet opening and should be inspected and cleaned periodically. Unscrew cap (1), take out mesh filter cartridge (2) and clean in washing agent.

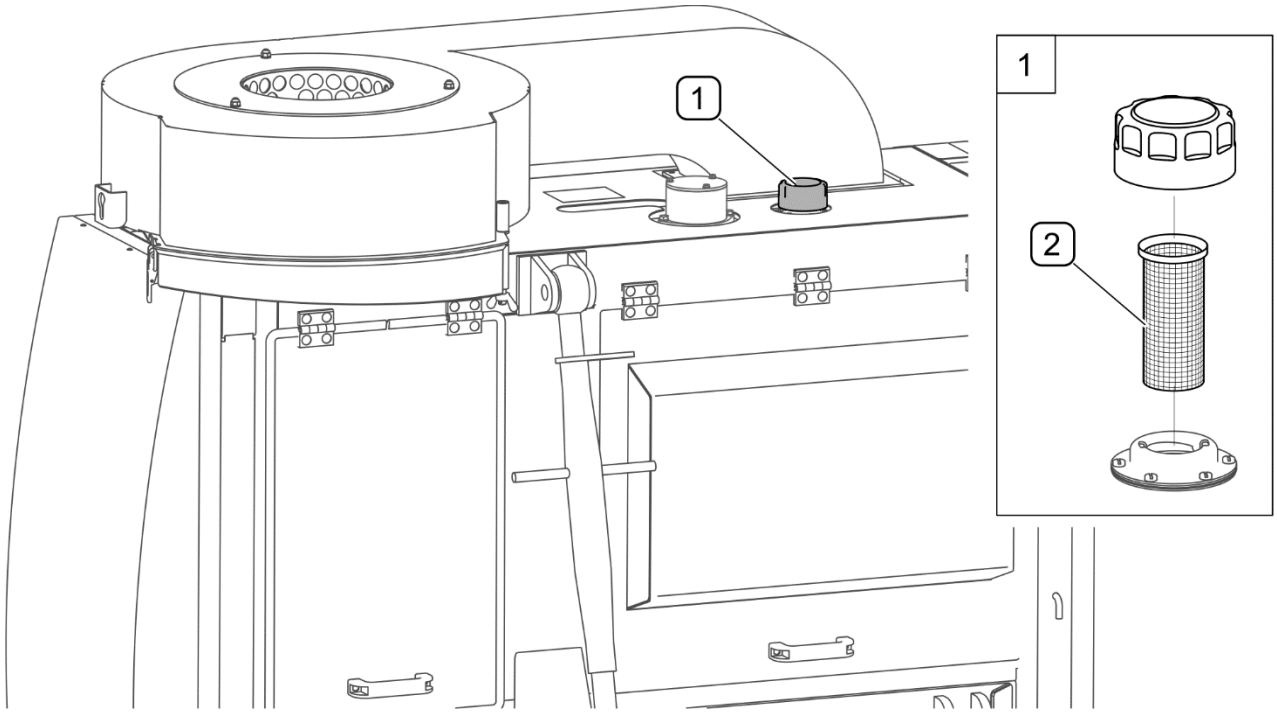


FIG. 5.20 Inlet filter

(1) - oil inlet cap; (2) - inlet filter (strainer)

Inlet filter should be cleaned at every oil change.

Oil tank (1) of hydraulic system contains 40 litres of HL-32 hydraulic oil. Check periodically the oil level on the oil level dipstick (4) (FIG. 5.21). When changing the oil, replace the return oil filter cartridge (FIG. 5.19) and clean the inlet strainer (FIG. 5.20). The hydraulic system is vented automatically during machine operation.

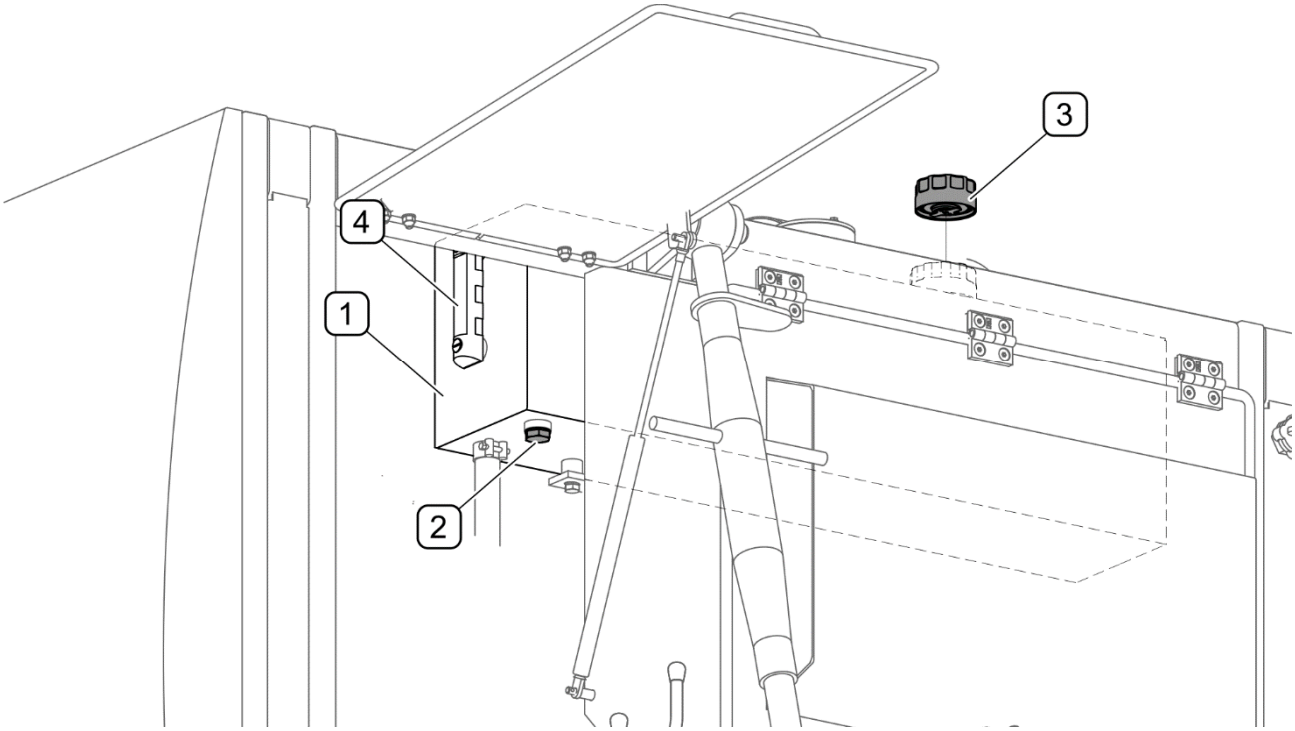


FIG. 5.21 Changing oil in hydraulic system tank

(1) - hydraulic oil tank; (2) - drain plug; (3) - filler plug; (4) - oil level indicator with thermometer.

Oil in the hydraulic system tank should be replaced every 500 engine working hours or once a year, whichever occurs first.

In order to change oil (FIG. 5.21):

- unscrew filler plug (3);
- unscrew drain plug (2) and drain oil to previously prepared basin;
- tighten drain plug (2) and fill tank (1) with oil, tighten filler plug (3).

The hydraulic system is vented automatically during machine operation.

Spilt oil should be immediately collected and placed in marked tight container. Used oil should be taken to the appropriate facility dealing with the re-use of this type of waste.

The hydraulic system should be completely tight sealed. Minimum leaks are permissible with symptoms of "sweating", however in the event of noticing leaks in the form of "droplets" stop using the machine until faults are remedied.

The hydraulic system is vented automatically during machine operation.

DANGER

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

5.7 SPRINKLER SYSTEM MAINTENANCE

Sprinkler system maintenance involves periodical inspection of water system, cleaning of water filters and checking oil level in water pump.

Before first use, check operation of sprinklers, in particular, check adjustment of sprinkling nozzles in front of brushes. Water nozzles should be set in such a manner as to ensure water spraying within the brushes' working area during sweeper operation. Water spraying direction is adjusted after loosening nuts of bolts that secure sprinkler brackets to sweep system brackets.

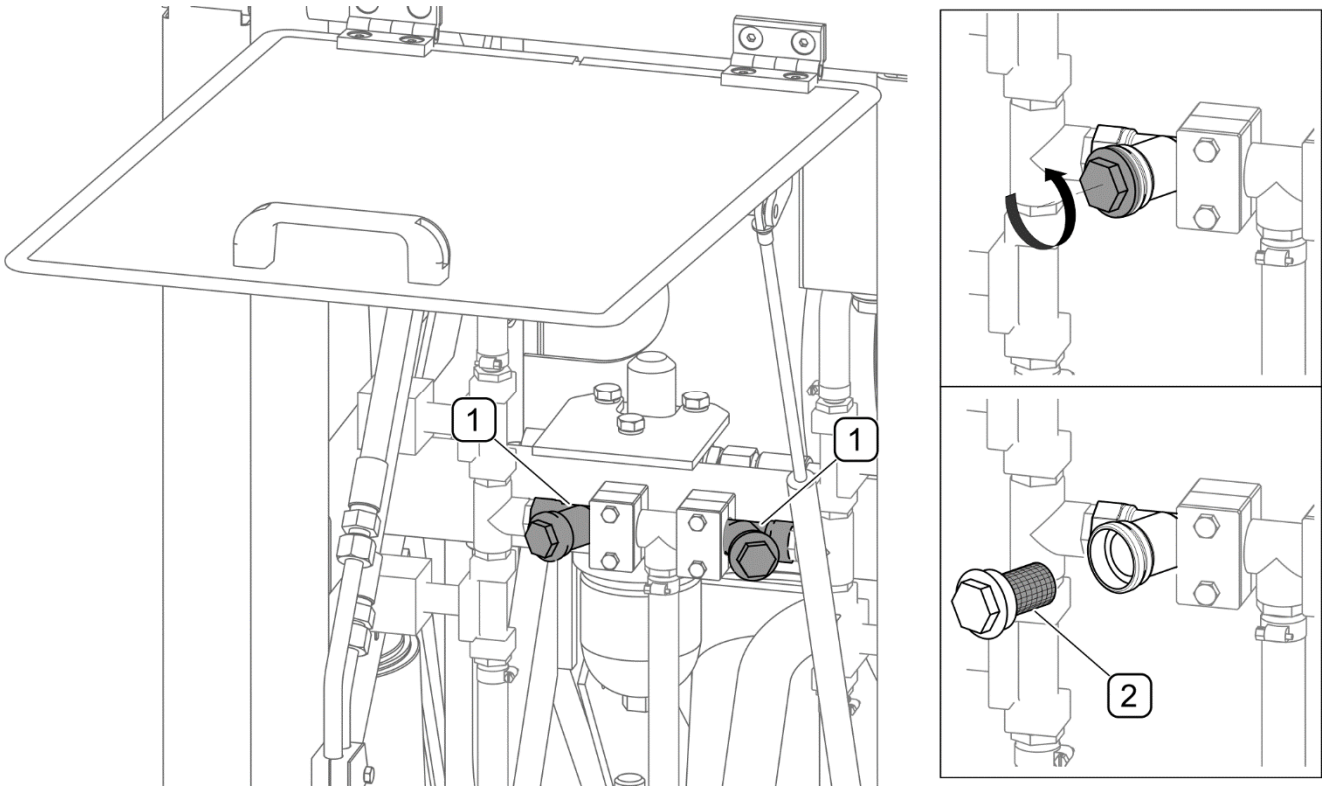


FIG. 5.22 Cleaning of water filters

(1) - water filters; (2) - mesh cartridge of water filter

In the sprinkler system there are two water filters (FIG. 5.22) which catch mechanical contaminants. In order to clean filters (1), unscrew plug and take out mesh cartridge (2) and

wash it with water under pressure or clean with compressed air. Install cartridge, tighten plug and check tightness of connection.

Water filters are recommended to be cleaned at least once a year. Frequency of filter cleaning depends on amount and size of water contamination.

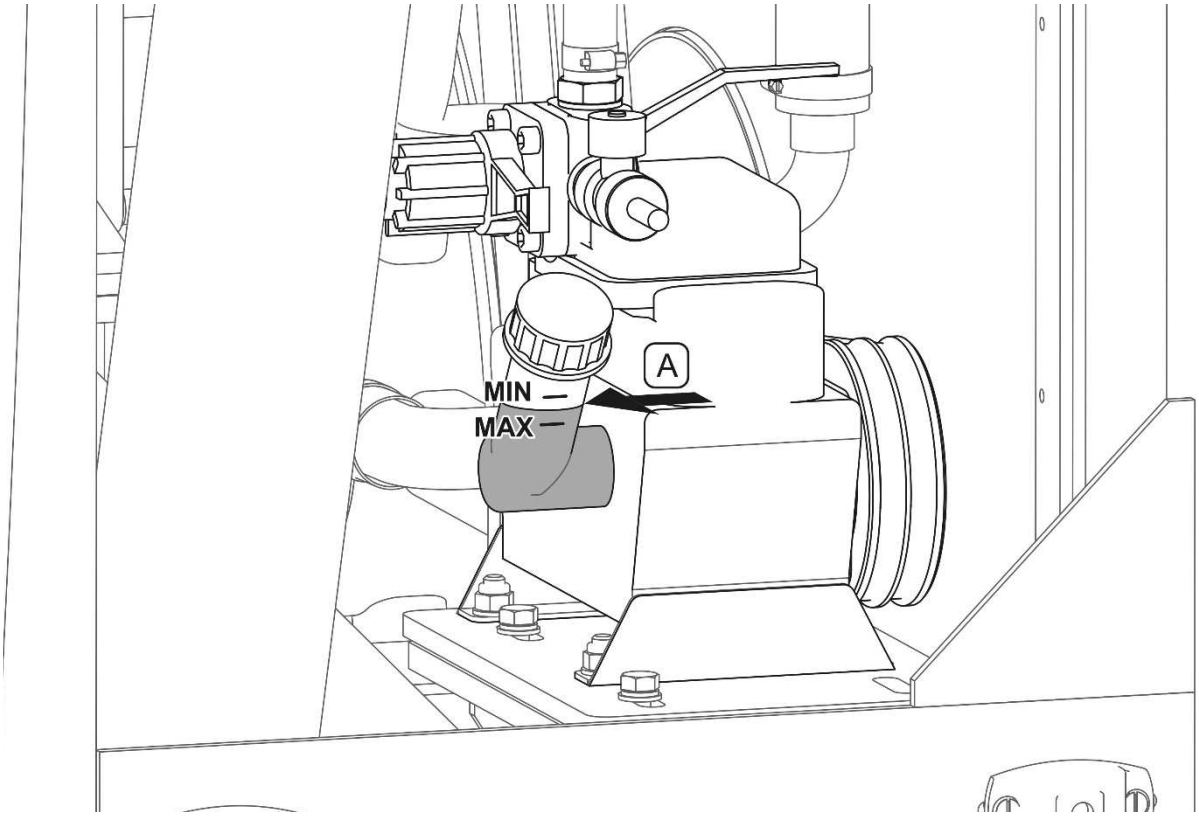


FIG. 5.23 Oil tank of water pump

(A) - oil level in oil tank of water pump

The sprinkler system contains water pump equipped with its own lubrication system. Remove front right-hand shield in order to gain access to the water pump

DANGER

Switch off the machine before checking oil level in the lubrication system and changing water pump's settings.

Level of oil in the water pump lubrication system should be checked periodically. When the machine is switched off, oil level (A) in the water pump lubrication system should be between „min" and „max" marks visible on the inlet tube (FIG. 5.23).

TIP

Water pump lubrication system contains 0.25 litre of non-foaming oil of SAE 40 class.

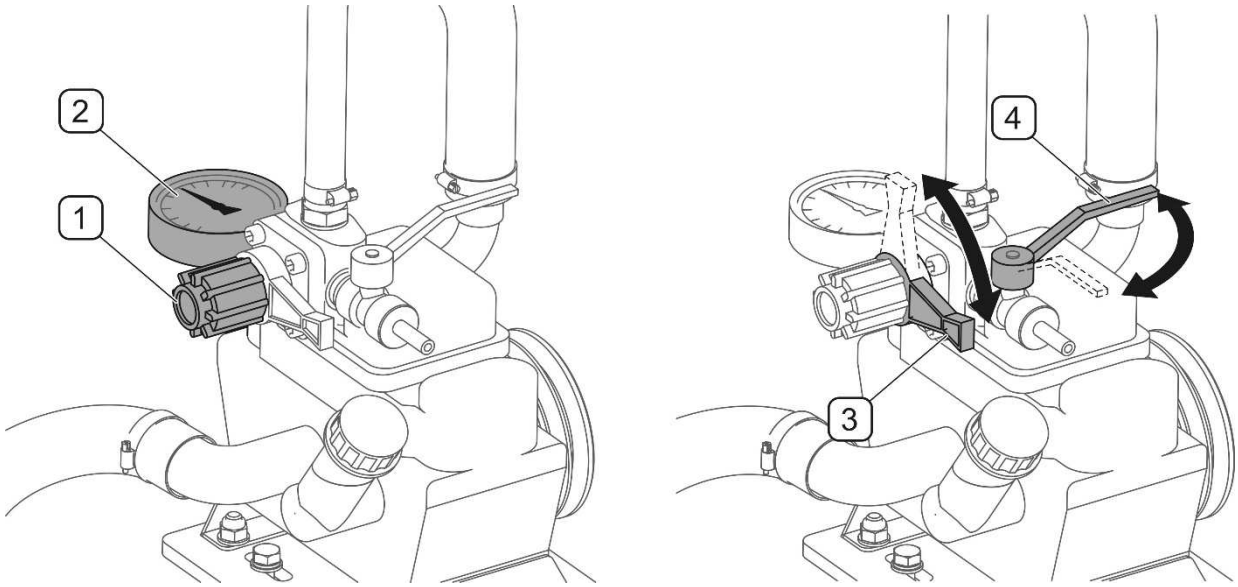


FIG. 5.24 Adjustment of water pressure

(1) - water pressure adjustment knob; (2) - pressure indicator; (3) - water circulation change lever; (4) - water valve lever;

Water pump is equipped with indicator (2) which shows water pressure during machine operation. Maximum water pressure during machine operation must not exceed 0.3 MPa (3 bar). Water pressure is adjusted by knob (1) located on pump body. Lever (3) changes water circulation from the pump to the direct flow to the tank (bypassing solenoid valves and sprinklers). Water valve lever (4) directs water stream to the outside of pump.

IMPORTANT!

Maximum water pressure during sprinkler system operation must not exceed 0.3 MPa (3 bar).

5.8 BRAKES ADJUSTMENT

5.8.1 ADJUSTMENT OF MAIN BRAKES

Brakes adjustment is necessary when:

- as a result of wear of brake shoe linings between lining and drum there is excessive slack and reduced braking effectiveness,
- wheel brakes do not brake evenly or simultaneously.

If brakes are correctly adjusted, braking of machine road wheel takes place simultaneously.

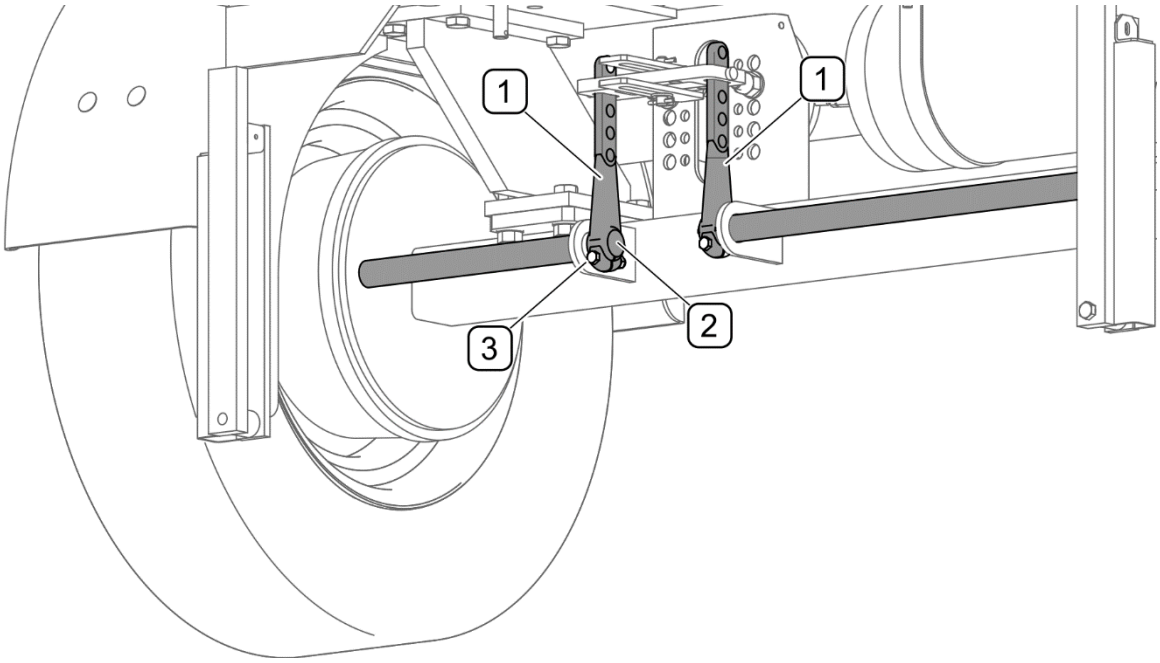


FIG. 5.25 Adjustment of main brakes

(1) - expander arm; (2) - expander shaft; (3) - clamp bolt

Brakes adjustment (FIG. 5.25) involves changing setting of axle shaft expander arm (1) in relation to expander shaft (2). To do this, loosen nut of bolt (3), and then move expander arm (1) on the multisplined end of shaft (2) in the appropriate direction, that is:

- in direction of hydraulic cylinder - if brake brakes too late,
- In direction from hydraulic cylinder - brake brakes too early.

Adjustment should be conducted separately for each wheel. After proper brake adjustment, at full braking the expanders' arms should create the angle of 90° with the pneumatic cylinder piston.

The main brake system should be inspected annually and in case of need should be adjusted.

5.8.2 PARKING BRAKE ADJUSTMENT

Adjustment of parking brake should be conducted in the event of:

- stretching of cable,
- loosening of parking brake cable clamps
- after adjustment of main brake,
- after repairs in main brake system,
- after repairs in parking brake system.

Before commencing adjustment make certain that the main break is functioning properly. Length of parking brake cable should be so selected that at total release of working and parking brake the cable would be loose and hanging by 1 ÷ 2 cm.

5.9 PNEUMATIC SYSTEM MAINTENANCE

The duties of the operator connected with the pneumatic system include:

- air filter cleaning;
- cleaning and maintaining pneumatic line connections
- draining water from a tank, cleaning drain valve;
- checking air tightness of pneumatic system.

Work connected with the repair, change or regeneration of system elements (cylinder, lines, control valve etc.) should be entrusted to specialist establishments, having the appropriate technology and qualifications for this type of work.

As a part of sweeper maintenance, conduct inspection of pneumatic system leaktightness, paying particular attention to all places of connection. Tightness of the system should be checked at nominal pressure in the system.

If lines, seals or other system elements are damaged, compressed air will escape in these damaged places with a characteristic hiss, or for a minor leak, small air bubbles will show up.

Small leaks can be detected by applying a solution of washing-up liquid. Damaged seals or lines, causing leaks should be replaced. If the source of the leak is a pneumatic cylinder, it must be replaced for a new one.

Condensation collecting as water should be removed from air tank periodically. In order to do this open out drain valve (FIG. 5.26) placed in lower part of tank. The compressed air in the tank causes the removal of water to the exterior. After release of the valve stem, the valve should automatically close and stop airflow from the tank.

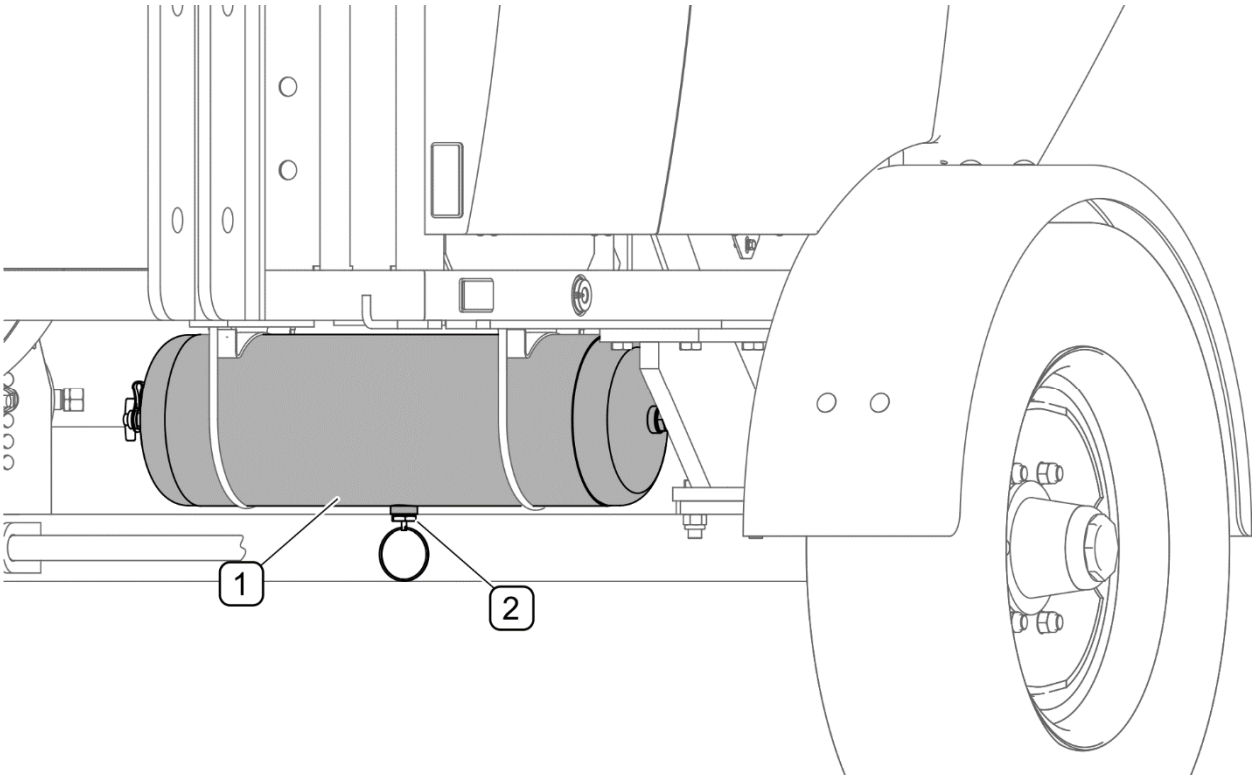


FIG. 5.26 Air tank with water release valve

(1) - air tank; (2) - drain valve

Annually before the winter period unscrew drain valve and clean off accumulated dirt. Replace copper seal.

Annually before the winter period unscrew and clean drain valve.

Inspection of tightness and inspection of pneumatic braking systems in detail should be conducted at least annually and after repairs associated with this system.

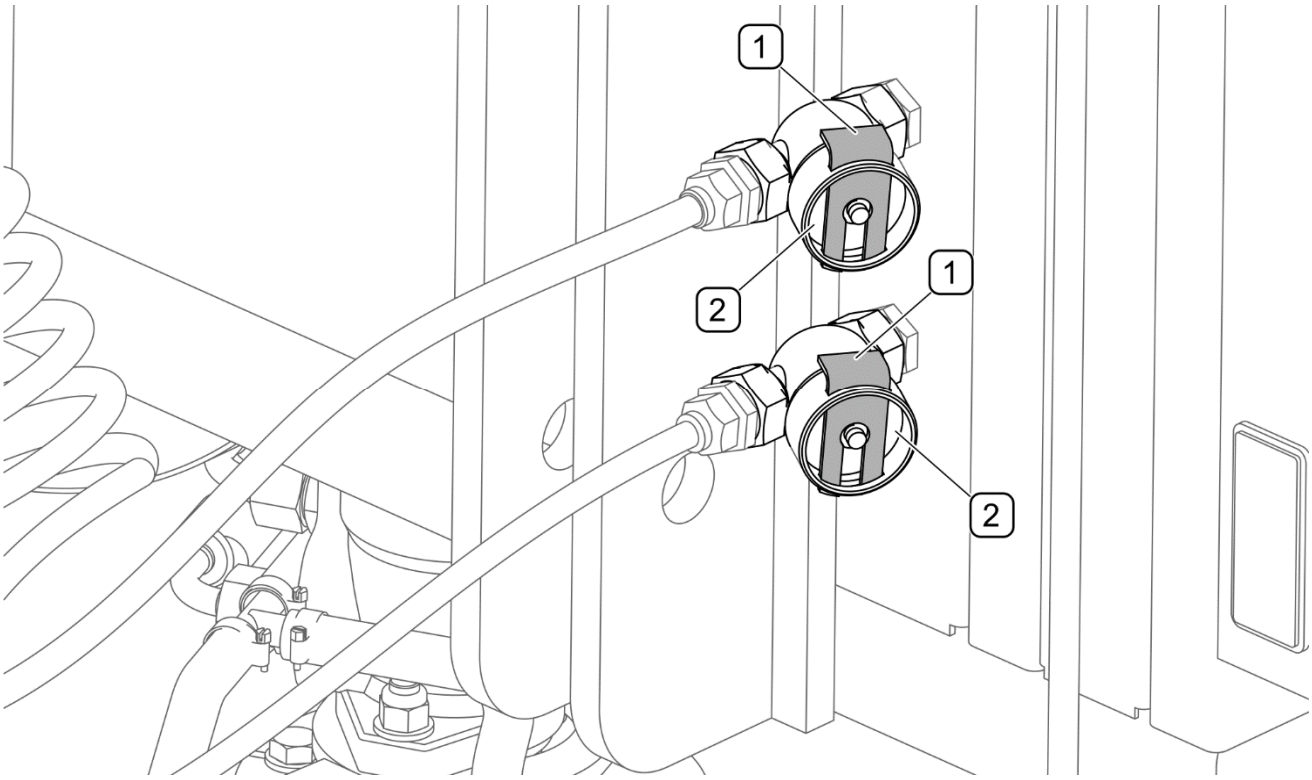


FIG. 5.27 Air filters

(1)- securing slide lock; (2)- air filter cover

Depending on machine working conditions, but not less than once in three months, take out and clean air filter (FIG. 5.27) cartridges, which are located in pneumatic system connection lines. Inserts are used many times and are not subject to changing unless they are mechanically damaged. In order to clean cartridge first reduce pressure in supply line. Next, remove securing slide (1); hold the filter cover with the other hand. After removing slide lock (1), the cover is pushed off by the spring, in the filter housing. The insert and the filter body should be carefully washed out and blown through with compressed air. Install in reverse order.

The insert and the air filter body should be cleaned at least every 3 months of machine use.

DANGER

Before proceeding to dismantle filter, reduce pressure in supply line.

While disengaging filter slide gate, hold cover with other hand. Stand away from filter cover vertical direction.

Pneumatic system connection must be inspected on regularly during use of machine and if necessary cleaned of all contamination.

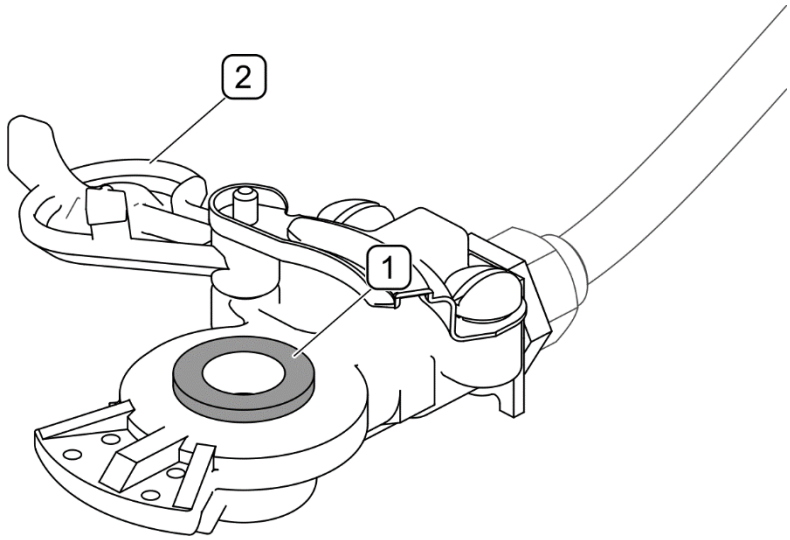


FIG. 5.28 Line connections

(1) - rubber seal; (2) - security cover

Particular attention should be paid to the technical condition of security covers and rubber seals (FIG. 5.28). If these elements are damaged they should be replaced. Seals are recommended to be preserved every six months with silicon preparations designed for rubber elements. Contact of the seals with fuel, lubricants being petroleum derivatives, paints etc., causes rapid ageing of the material from which they are made.

Connection should be inspected every time before connecting machine to the tractor. During connection make sure that tractor socket is not damaged and is maintained in the due cleanliness.

5.10 ELECTRICAL SYSTEM MAINTENANCE

Electrical system maintenance is conducted during the periodical checking the operation of control and lighting system.

After connecting to 7-pole socket on the tractor, check operation of the lighting system. In case of bulb burnout, unscrew screws (5) that secure lamp lens (4) and replace appropriate bulb (FIG. 5.29).

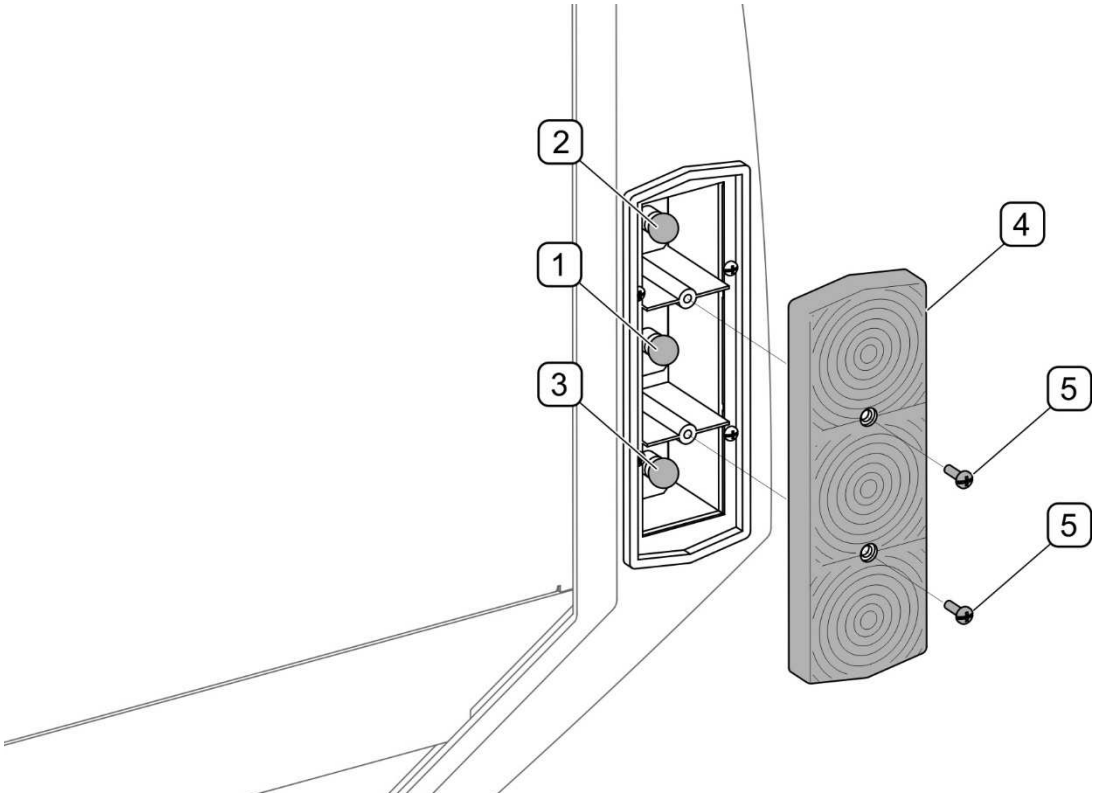


FIG. 5.29 Replacing bulbs in the lamp

(1) - indicator light bulb; (2) - brake light bulb; (3) - parking light bulb; (4) - lamp lens; (5) - screws

TAB. 5.6 LIST OF BULBS

MARKING (FIG. 5.29)	**BULB**	**TYPE OF LIGHT**	**TYPE OF LAMP**
1	P21W	indicator light	Lamp assembly 2SD 001 693-011
2	P21W	brake light	
3	R10W	parking light	

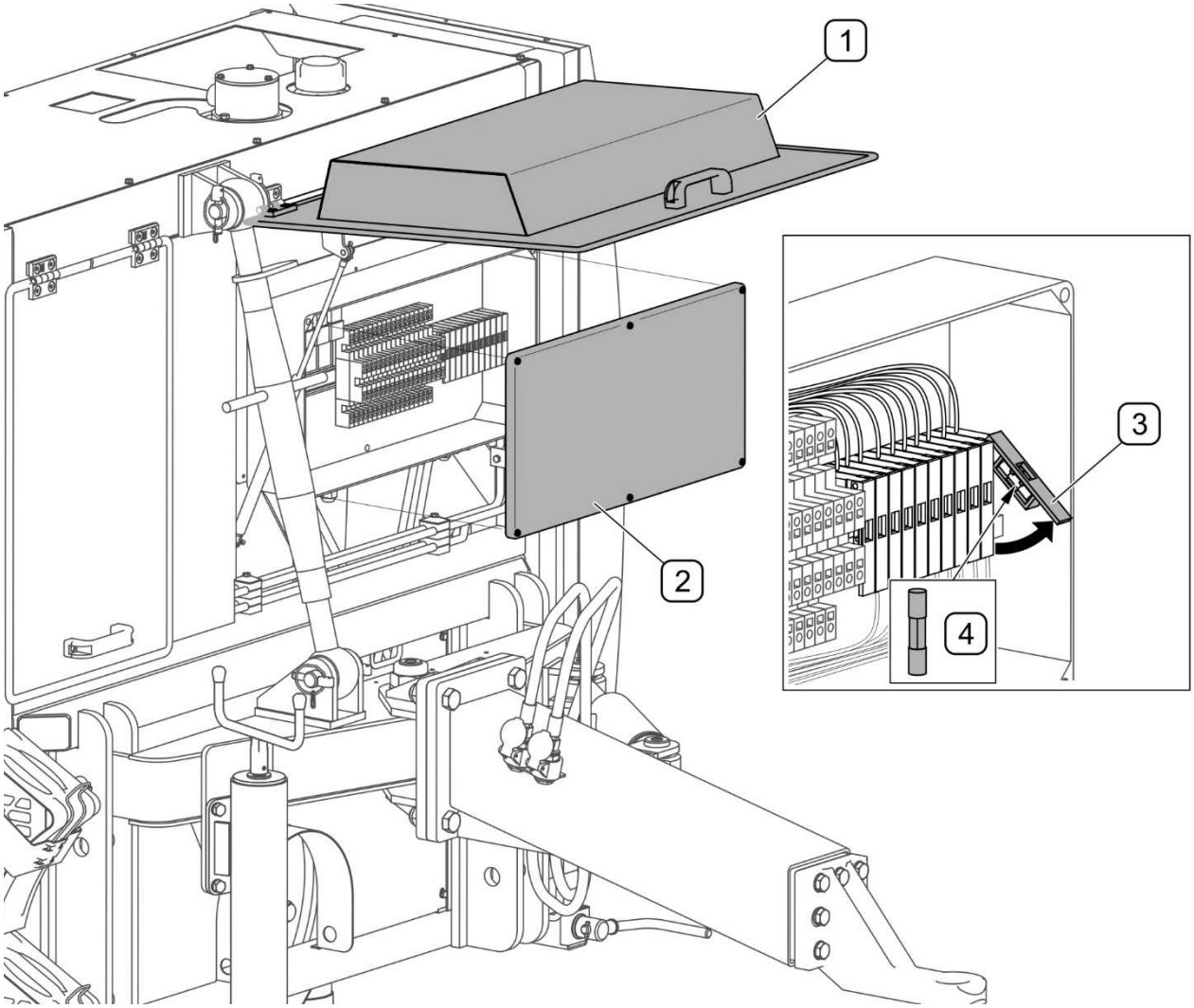


FIG. 5.30 Fuse replacement

(1) - hinged cover; (2) - wiring compartment cover; (3) - fuse housing; (4) - glass tube fuse 8A;

5.11 INSPECTION AND ADJUSTMENT OF WHEEL AXLE BEARINGS

In newly purchased machine, after covering a distance of 100 km, while during further use – after 6 months of vehicle use check and adjust wheel axle bearings when needed. Worn or damaged bearing should be replaced. Inspection of these elements should be conducted according to instructions below.

Hitch sweeper to tractor, immobilise the tractor, place blocking chocks under sweeper wheels and raise wheels in succession using the appropriate lifting jack. The lifting jack should be placed under the axle on one side of the machine, alternately for each wheel. Check if there is any bearing radial play. Adjustment of wheel axle bearings is conducted as follows:

- In the event of excessive play, disassemble hub cap (1*),* and remove cotter pin (A, FIG. 5.31);
- Turning the wheel simultaneously tighten castellated nut (3) until the wheel comes to a stop. Unscrew nut by 1/3 rotation until the nearest cotter pin groove (2) aligns with opening in wheel stub axle (B, FIG. 5.31)
- Secure castellated nut with cotter pin (2) and mount hub cover (1) (C, FIG. 5.31). The wheel should turn smoothly without faltering or detectable resistance not originating from abrasion of brake shoes in brake drum.

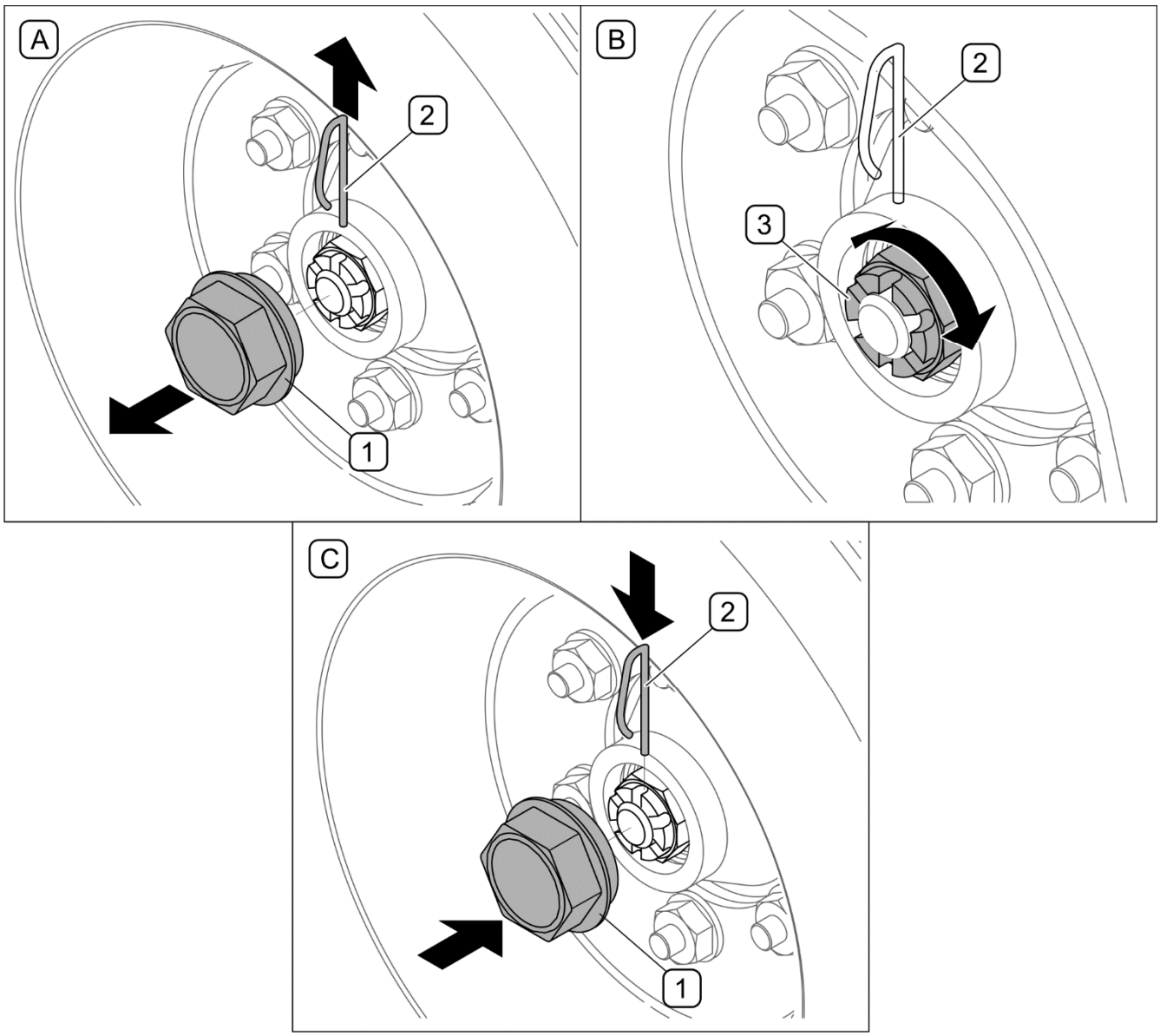


FIG. 5.31 Adjustment of wheel axle bearings

(A), (B), (C) - successive steps of adjustment; (1) - hub cover, (2) - cotter pin, (3) - castellated nut;

Inspection and adjustment of wheel axle bearings may be carried out only when the waste tank is empty.

Bearings replacement, lubrication and repairs connected with brake system and wheel axle should be entrusted to specialist service provider.

Inspection of slack and technical condition of wheel axle bearings must be performed after the first 100km of travel, and then every 6 months of machine use.

5.12 CLEANING

5.12.1 CLEANING THE MESHES OF WASTE TANK

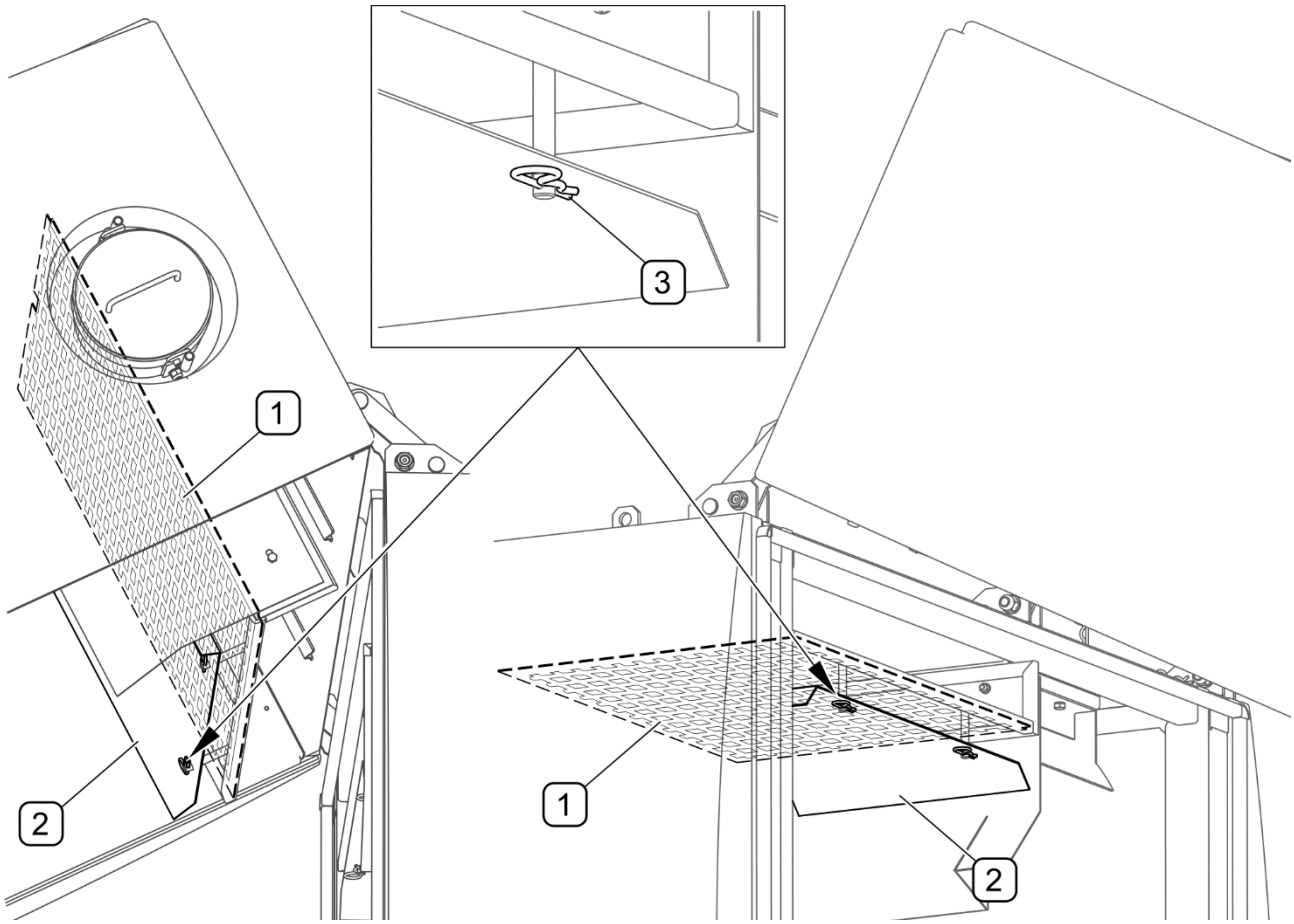


FIG. 5.32 Meshes in the waste tank

(1) - meshes; (2) - shields; (3) - cotter pins that secure shield

Cleanness of meshes in the waste tank (FIG. 5.32) should be checked periodically. Access to the meshes is possible after opening the waste tank. The waste tank in open position should

be secured with the supports (FIG. 5.3). In order to assist access to meshes (FIG. 5.32) it is recommended that shields (2) should be dismounted after removal of securing cotter pins (3). Clean meshes with water jet under pressure. After cleaning, install shields (2) and secure them with cotter pins (3). Make certain that the bows of shields installed are facing downwards. The waste tank seals are recommended to be cleaned each time after emptying the waste tank. Before closing the waste tank remove supports installed earlier (FIG. 5.3).

DANGER

During maintenance work conducted under raised or open tank, secure the tank against closing or falling down using proper supports and service safety devices.

Failure to use proper supports and service safety devices may lead to falling down of the tank onto the operator or bystanders.

5.12.2 CLEANING THE CYCLONE

DANGER

Repair, maintenance and cleaning work should be carried out with the tractor's engine turned off and the ignition key removed.

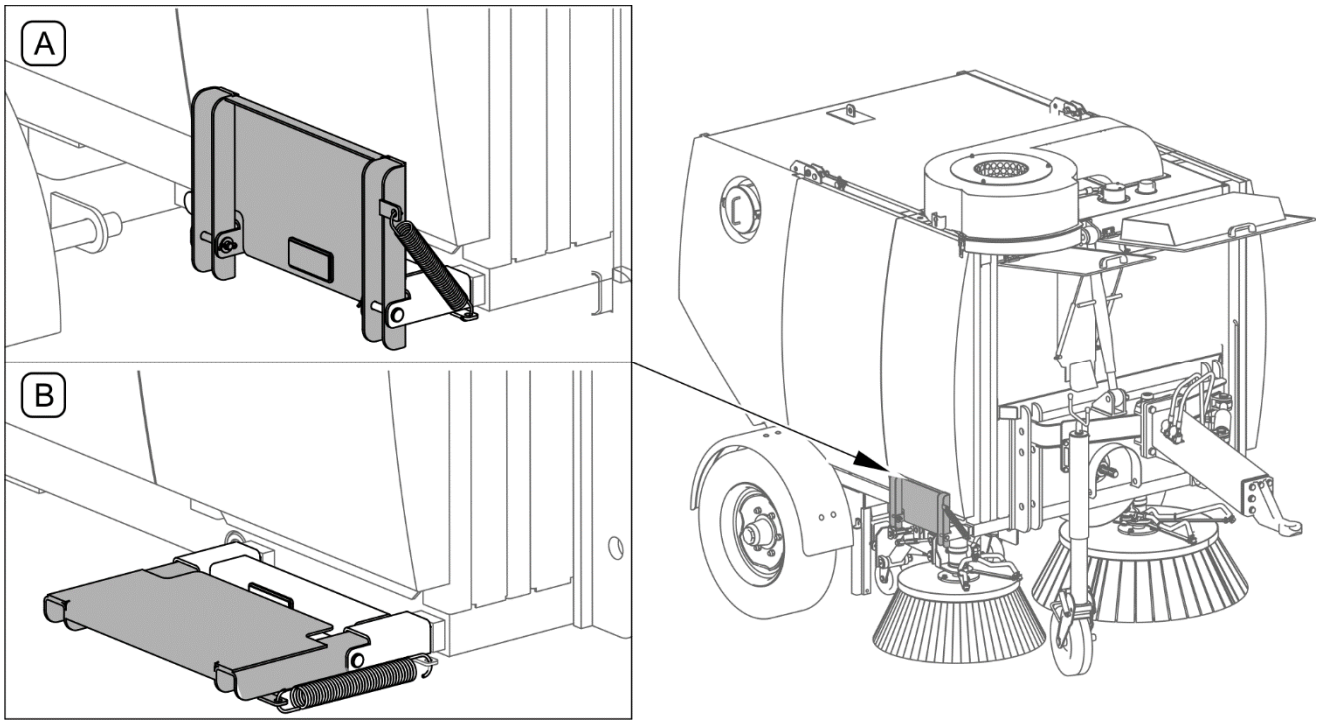


FIG. 5.33 Folding platform

(A) - folded platform; (B) - extended platform

Periodically check the condition of the separating cyclone located on the air outlet of the waste tank (FIG. 5.34). In order to facilitate maintenance of the cyclone extend folding platform (FIG. 5.33) secured on the right side to the machine frame.

After maintenance is completed platform (FIG. 5.33) should be folded to (A) position.

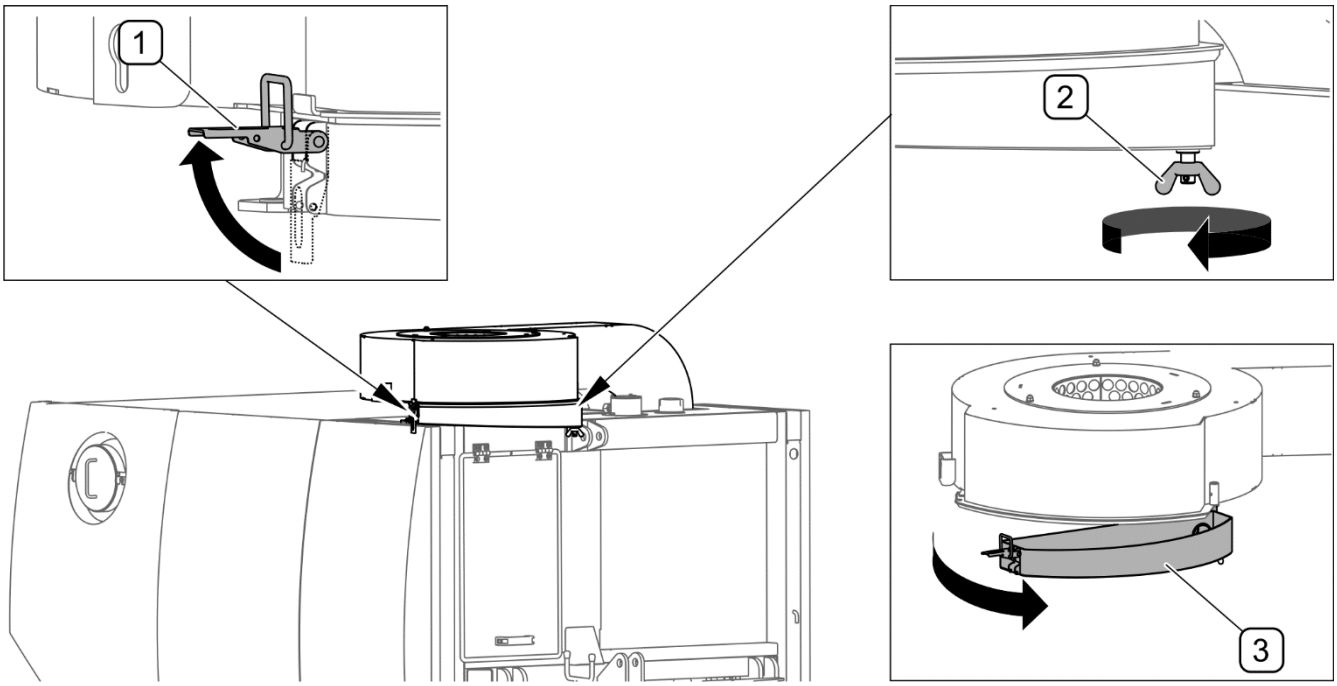


FIG. 5.34 Cleaning the cyclone

(1) - lock; (2) - hinge nut; (3) - bottom cover

To clean the cyclone (FIG. 5.34) unhook the lock (1) of the bottom cover, loosen the hinge nut (2) and then tilt the cover (3) forward on the hinge. Clean the inside of the bottom cover (3) and check that suction hose is not blocked. After cleaning, close the cover (3), tighten the hinge nut (2) and secure the lock (1).

5.13 LUBRICATION

Machine lubrication should be performed with the aid of a manually or foot operated grease gun, filled with ŁT-43-PN/C-96134 grease.

After lubricating according to instructions, wipe off excess grease. Changing grease in wheel hub axle bearings should be entrusted to professional service.

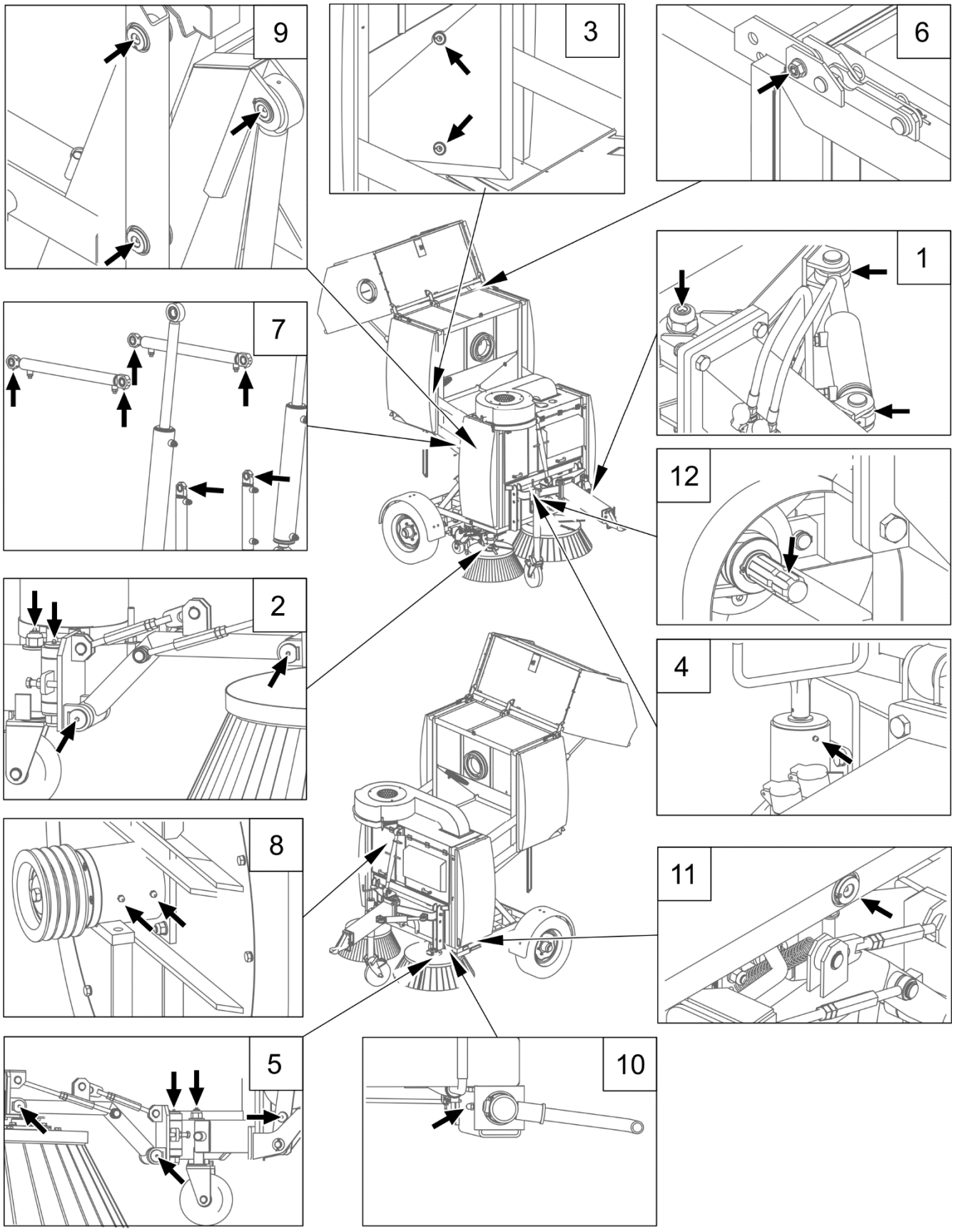


FIG. 5.35 Lubrication points

Figure description (TAB. 5.7)

TAB. 5.7 Lubrication points and lubrication frequency

ITEM	NAME	NUMBER OF LUBRICATION POINTS	TYPE OF GREASE	LUBRICATION FREQUENCY
1	Pin of hitch drawbar, cylinder eye and rams	2+2	Grease	25 hours
2	Pins of right brush arm, pin of right wheel of sweep unit	4	Grease	25 hours
3	Pins of waste tank rising mechanism, inside the frame	4	Grease	25 hours
4	Support column	1	Grease	3 months
5	Pins of left brush arm, pin of left wheel of sweep unit, pin of upper wheel	5	Grease	25 hours
6	Pins of waste tank cover	2	Grease	25 hours
7	Cylinder ram eye and hydraulic cylinder eye	10	Grease	6 months
8	Bearings of fan drive shaft	2	Grease, 9 cm^3 for each bearing	25 hours
9	Pins of waste tank rising mechanism, from the outside of the frame	6	Grease	25 hours
10	Parking brake mechanism	1	Grease	3 months
11	Lower pins of hydraulic cylinder of waste tank rising mechanism	2	Grease	25 hours
12	Surface of multi-splined drive shaft	1	Grease	6 months
	Wheel bearings*	2	Grease	replace every 2 years

Marking description in Item column (TAB. 5.7) conforms with numbering shown (FIG. 5.35)

**- not shown in figure*

When using the machine the user is obliged to observe lubrication instructions according to attached schedule. Excess lubrication substance causes depositing additional contaminants in places requiring lubrication, therefore it is essential to keep individual machine elements clean.

5.14 STORAGE

After finishing work, machine should be thoroughly cleaned and washed with water jet. While washing do not direct a strong water jet at information and warning decals, hydraulic or pneumatic cylinders, electrical equipment. In the event of damage to the lacquer coating clean those places from rust and dirt, degrease and then paint with paint maintaining uniform colour and even thickness of protective coating. Until the time of touch-up painting, the damaged place may be covered with a thin layer of grease or anti-corrosion preparation. Tyres should undergo conservation maintenance at least twice a year using the appropriate preparations designed for this purpose. Wheels and tyres should be previously carefully washed and dried. During longer storage of unused machine it is recommended that every 2 to 3 weeks the machine may be moved a bit so that the place of contact of tyres with ground is changed.

It is recommended to keep the machine in a closed or roofed building.

If there is a risk that temperatures drop below 0°C, drain water from the sprinkler system.

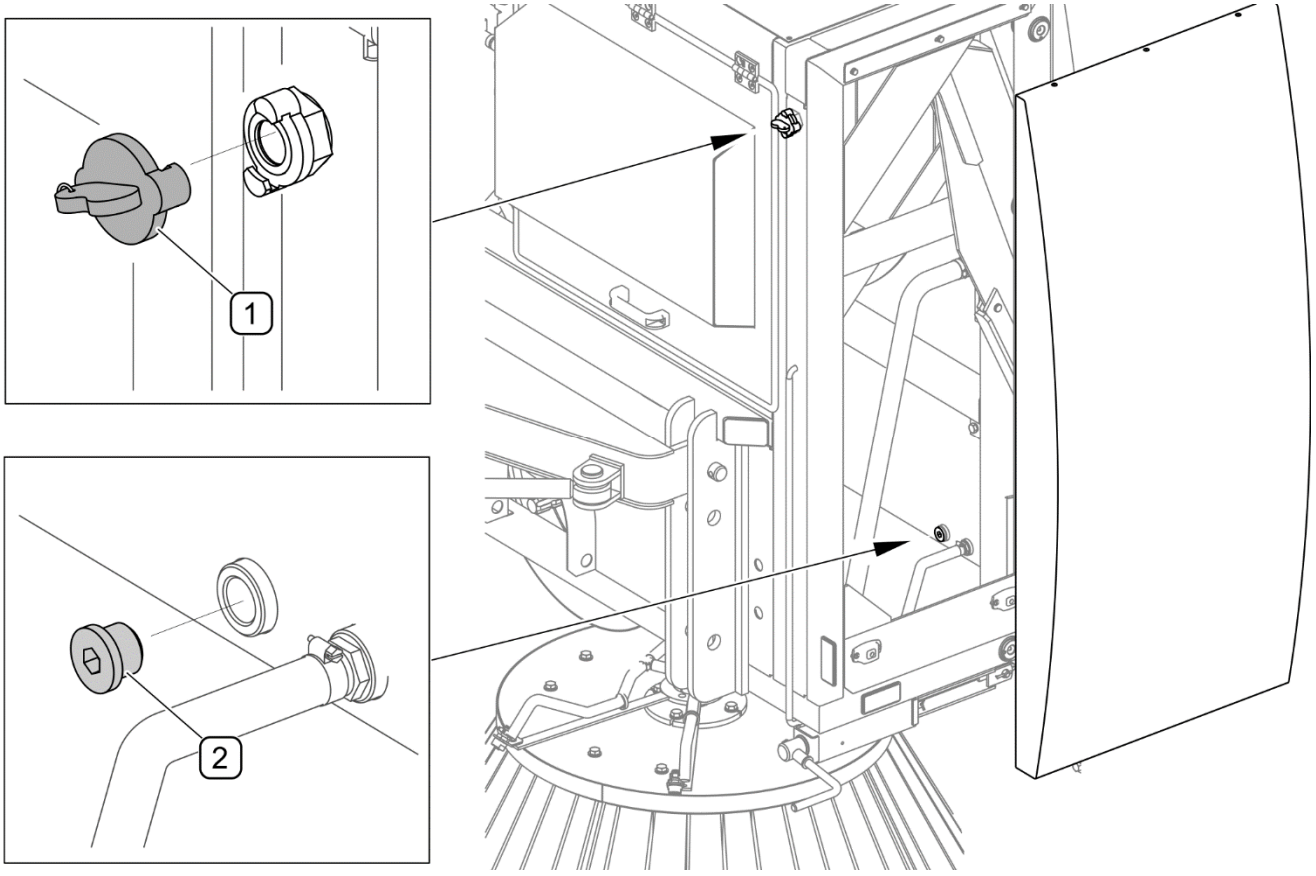


FIG. 5.36 Draining water from the sprinkler system

(1) - water filler plug; (2) - drain plug;

In order to drain water from the sprinkler system tank (FIG. 5.36):

- remove front left movable guard,
- unscrew filler plug (1),
- unscrew drain plug (2) and drain water from the sprinkler system tank,
- start the sprinkler system in order to remove water from lines,
- switch off the machine, tighten drain plug and filler plug,
- Replace the front left movable guard.

5.15 TIGHTENING TORQUE FOR NUT AND BOLT CONNECTIONS

Unless other tightening parameters are given, during maintenance repair work apply appropriate torque to tightening nut and bolt connections. Recommended torque values (TAB. 5.8) apply to non-greased steel bolts.

TAB. 5.8 TIGHTENING TORQUE FOR NUT AND BOLT CONNECTIONS

THREAD DIAMETER [mm]	**5.8**	**8.8**	**10.9**
	TIGHTENING TORQUE [Nm]		
M6	8	10	15
M8	18	25	36
M10	37	49	72
M12	64	85	125
M14	100	135	200
M16	160	210	310
M20	300	425	610
M24	530	730	1050
M27	820	1,150	1,650
M32	1050	1450	2100

5.16 TROUBLESHOOTING

TAB. 5.9 Troubleshooting

TYPE OF FAULT	CAUSE	REMEDY
Control panel does not work	Main switch of control panel is off	Set main switch of control panel in „I" position
	The sweeper's control panel plug is not connected to 3-pin socket on the tractor.	Check connection
	Burnt out fuse of 3-pin socket on the tractor	Change fuse
Sweep unit cannot be lowered	Knob for adjusting rotation speed of brushes is set at the minimum value	Increase rotation speed of brushes using the knob
	Excessive flow choking in the valve	Reduce flow choking in the valve that adjusts sweep unit lowering speed
	Sweep unit is stuck in guides	Clean the guides
Waste tank can not be lowered or closed	Safeguards or service interlocks are installed	Remove interlocks and safeguards before lowering or closing the tank
	Sweeper is switched off	Switch the machine on
	Damaged control system	Notify service point
Sweeper does not collect waste precisely	Fan rotation speed is too low	Increase rotation speed of tractor PTO
	Waste tank is full	Empty the waste tank
	Suction pipe is clogged	Clean
	Excessive travel speed during sweeping	Reduce travel speed
	Suction nozzle is raised too high	Adjust height according to operator's manual
	Waste tank is leaky	Check tank closing. Check seal at the waste tank closure, replace if necessary.
	Leaky connection between tank and suction pipe	Check seals. Check setting of adjustable bracket, adjust according to operator's manual if necessary.
	Leaky connection between tank and fan inlet	Check tank closing. Check seal, change if necessary.
	Incorrectly positioned sweep unit	Adjust according to operator's manual
	Worn fan blades	Notify service point
Overheating of hydraulic oil	Oil level in tank is too low	Check oil level, add oil if necessary
	Sweeper works too long with limited rotation speed of brushes.	Increase rotation speed of brushes
	Main switch is on	Switch off main switch if brushes are not working or the tank is not being emptied.
Too rapid wear of brushes	Incorrect setting of sweep unit and brushes	Adjust according to operator's manual
Too rapid or uneven wear of suction nozzle slides	Incorrect setting of suction nozzle	Adjust according to operator's manual
Excessive dustiness during machine operation	Sprinkler system is not switched on	Switch on proper sprinklers
	No water in the sprinkler system tank	Add water, check water level during operation
	Sprinkling nozzles are clogged	Clean
	Too low pressure at water pump	Set the pressure at the pump