PRONAR SP. Z O.O.

17-210 NAREW, UL. MICKIEWICZA 101A, WOJ. PODLASKIE

PHONE: +48 085 681 63 29 +48 085 681 64 29

+48 085 681 63 81 +48 085 681 63 82

FAX: +48 085 681 63 83 +48 085 682 71 10

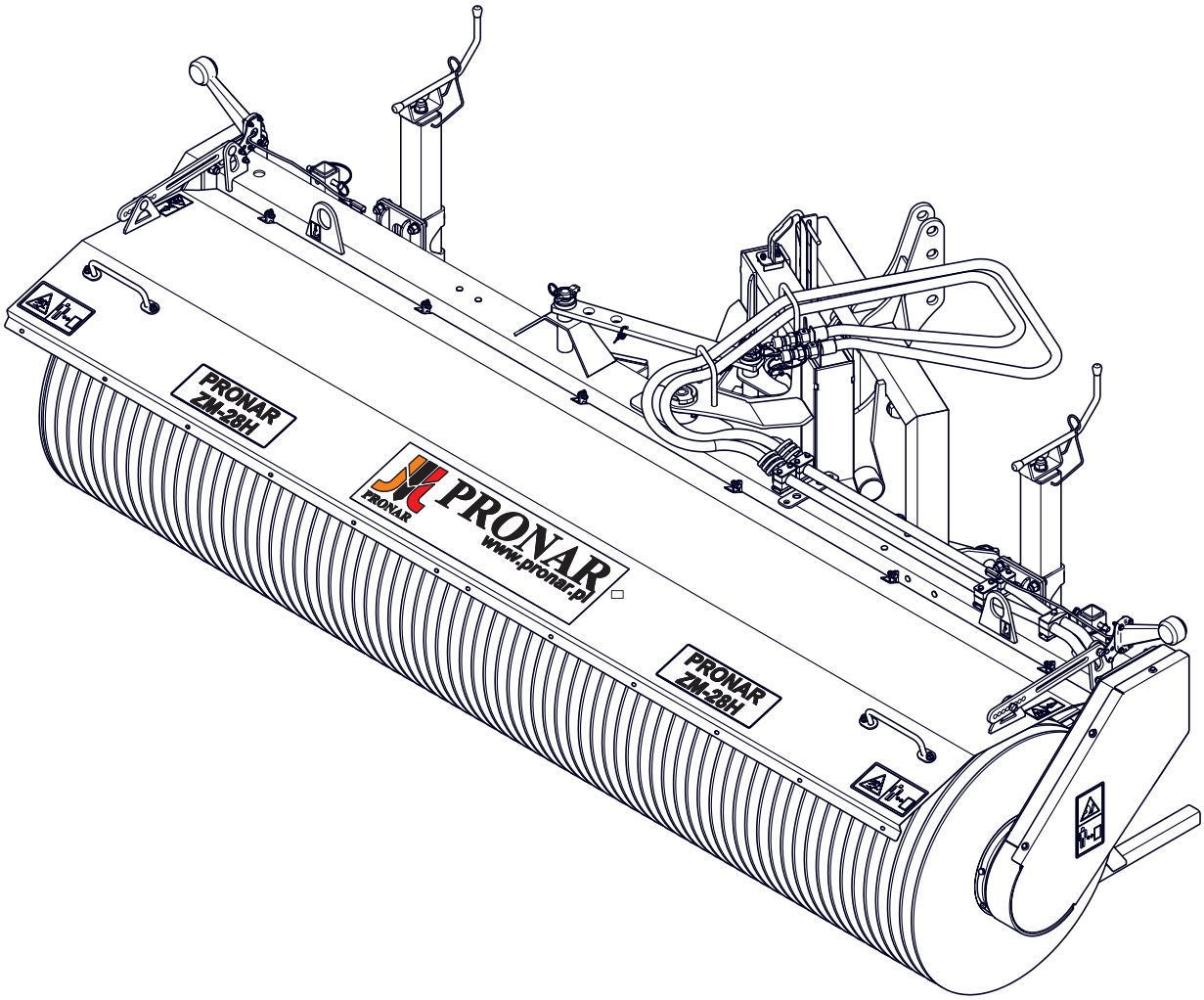
www.pronar.pl

OPERATOR MANUAL

ROLLER BRUSH SWEEPER

PRONAR ZM-28H

TRANSLATION OF THE ORIGINAL COPY OF THE MANUAL



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EN

INTRODUCTION

1.1 INTRODUCTION

Information in this document 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 actual specification of the machine supplied to the user. The manufacturer reserves the right to introduce design changes in machines produced that facilitate and improve the quality of machine operation, without making minor amendments to this Operator Manual.

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

If the information in this Operator Manual needs clarification, refer for assistance to the sale point where the machine was purchased or to the Manufacturer.

It is recommended that the serial number of the machine is inscribed in the spaces below after purchase of the machine.

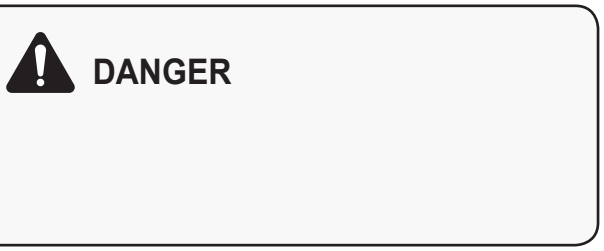
Machine serial number

U.01.1.PL

1.2 SYMBOLS APPEARING IN THIS OPERATOR MANUAL

DANGER

Information, descriptions of danger and precautions as well as recommendations and prohibitions associated with the safety of use are marked in the text with the sign **DANGER**. Failure to observe the instructions may endanger the machine operator's or other person's health or life.



IMPORTANT!

Vital information and instructions that must be observed are highlighted by a border and accompanied by the text: IMPORTANT **IMPORTANT**. Failure to observe the instructions may lead to damage to the machine as a result of improper operation, adjustment or use.

TIP

Additional tips included in the Operator Manual describe useful advice for the machine operation and are marked with the sign **TIP**.

REFERENCES TO PAGES

The machine operating procedures include references to pages on which additional information is given. References to pages are written in bold, underlined text.
Example: **7.13** .

U.21.1.PL

1.3 DIRECTIONS USED IN THIS OPERATOR 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.

Rotation to the right – clockwise rotation of a mechanism (the operator is facing the mechanism).

Rotation to the left – counterclockwise rotation of a mechanism (the operator is facing the mechanism).

U.03.1.PL

1.4 INSPECT THE MACHINE UPON DELIVERY

The manufacturer ensures that the roller brush sweeper is operational, has been checked in accordance with quality control procedures and is ready for use. This does not release the user from an obligation to check the machine's condition after delivery and before first use. Roller brush sweeper is delivered to the user fully assembled.

SCOPE OF INSPECTION ACTIVITIES

- Confirm that the specification of the delivered machine is in conformity with your order.
- Check condition of protective paint coat,
- Visually inspect the machine components for mechanical damage resulting e.g. from improper transport of the machine.
- Check the condition of the gauge wheels and parking stand.
- Check technical condition of elastic hydraulic lines.
- Make certain that there are no hydraulic oil leaks.
- Check the electrical components of the machine.

TIP

Releasing the trailer to the buyer involves a detailed visual inspection and verification of the trailer operation, as well as instructing the buyer on the basic principles of operation. The trailer is operated for the first time in the presence of the Seller.

B.2.6.585.01.1.PL

1.5 START ROLLER BRUSH SWEEPER FOR THE FIRST TIME

- The user must read this Operator Manual and follow all instructions.
- Adjust and check the carrier vehicle linkage and the machine linkage system.
- Carry out a daily inspection according to the guidelines in the schedule.
- Connect the machine to the carrier vehicle.
- Turn on the clearance lights, check the correct operation of the electrical system.
- Perform test drive. While driving, check the operation of the machine sweeping system.

If during test run worrying symptoms occur such as:

- excessive noise and abnormal sounds originating from the rubbing of moving elements,
- leakage and incorrect operation of the hydraulic system,
- other faults,
- the sweeper should be stopped until the failure is remedied. If a fault cannot be rectified or the repair could void the warranty, please contact retailer for additional clarifications or to perform the repair.

IMPORTANT!

During the first use, the machine is checked in the presence of the Seller. The Seller is obliged to conduct the training in safe and correct operation of the trailer.

B.2.6.585.1.PL

PRONAR Sp. z o.o.
ul. Mickiewicza 101 A
17-210 Narew, Polska
tel./fax (+48 85) 681 63 29, 681 63 81, 681 63 82,
681 63 84, 681 64 29
fax (+48 85) 681 63 83
http://www.pronar.pl
e-mail: pronar@pronar.pl

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:	**Snowblower-sweeper**
Type:	**ZM-28H**
Model:	–
Serial number:	
Commercial name:	**Snowblower-sweeper PRONAR ZM-28H**

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 technicznych
Roman [illegible]

Narew, the 2019-06-11

Place and date

Full name of the empowered person position, signature

CONTENTS

BASIC INFORMATION

SECTION 1

1.1 IDENTIFICATION

The roller brush sweeper is marked with a nameplate (1) placed on the rear beam near the left jockey wheel. The meaning of the individual items found on the nameplate are presented in table (1.1).

When purchasing the machine, make sure that the serial numbers on the machine

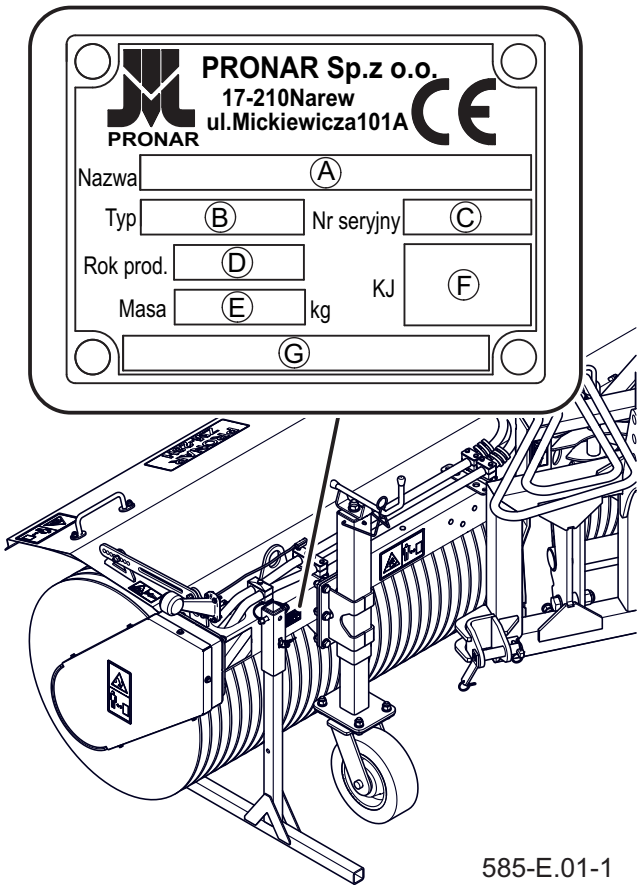


Figure 1.1 Location of the nameplate.

Table 1.1 Markings on nameplate

Item	Meaning
A	Machine name
B	Symbol /Machine type
C	Serial number
D	Year of manufacture
E	Gross weight [kg]
F	Quality Control marking
G	Machine name, continued

are the same as entered in the *Warranty Book*, in sales documents and in the *Operator Manual*.

TIP

When contacting the service department you will need the machine serial number, so we recommend that you write this number down in the manual to have access to it.

E.2.6.585.01.1.EN

1.2 INTENDED USE

The ZM-28H roller brush road sweeper is used to keep clean roads, parking lots, squares, and other areas with a hardened surface such as asphalt, concrete or paving stones. The machine may be used by road maintenance services to clean the roadbed prior to application of asphalt layer on renovated road sections. The ZM-28H machine can be used to sweep debris or a thin, fresh layer of snow to the right or left side without collecting it. Use for purposes other than those described above should be considered as contrary to the intended purpose.

Depending on the accessories, the roller brush sweeper can be mounted on the front of the carrier vehicles that meet the requirements specified in table (1.2).

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

- read the publications and documents delivered with the machine and with the contents of the carrier vehicle Operator Manual,
- have training in the machine operation and work safety,
- have the required authorisation to drive and be familiar with the road traffic regulations and transport regulations.
- adhere to the established maintenance and adjustment plans,

The machine may only be used by persons, who:

- are familiar with this publication and the operating instructions of the implement carrier,
- have been trained in the machine operation and work safety,
- have the required authorisation to drive and are familiar with the road traffic regulations and transport regulations.

NOTE

The machine must not be used for purposes other than those for which it is intended, in particular do NOT:
• for transporting people and animals,
• for transporting whatever materials or objects.

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1.3 EQUIPMENT

Table 1.2 Carrier vehicle requirement

Contents	Unit	Requirements
Hydraulic system Maximum oil pressure Type of oil Number and location of hydraulic connectors Hydraulic system performance: - for standard hydraulic system - for hydraulic systems with increased flow rate Type of hydraulic couplings*:	 MPa l/min l/min	 21 hydraulic, HL32 two sockets of one hydraulic section with the function of continuous operation, located at the front of the carrier vehicle 25-55 l/min 55-140 l/min
- 1 pair of quick coupler sockets 12.5 ISO 7241-1 series A		flow rate 25-55 l/min with manual or hydraulic independent steering
- 1 pair of quick coupler sockets 12.5 ISO 7241-1 series A		flow rate 25-55 l/min with hydraulic steering (from the second pair of quick couplers)
- 1 pair of quick couplers sockets 12.5 ISO 7241-1 series A and 1 pair quick coupler sockets 20 ISO 7241-1 series A		flow rate 55-140 l/min with hydraulic steering (from the second pair of quick couplers)
- 1 pair of quick coupler sockets 20 ISO 7241-1 series A		flow rate 55-140 l/min with manual or hydraulic independent steering
Electrical system Power supply of solenoid valve and clearance lights Electrical system voltage	 - V	 3-pole socket 12
Linkage Front three-point linkage - standard other attachment methods on request Lift capacity: (at a distance of 610 mm)	 - - kg	 cat. II according to ISO 7301 - 600

** -depending on the machine version*

The standard equipment of the ZM-28H roller brush sweeper includes:

- Operator Manual
- Warranty Book
- Steering mechanism
- medium hard roller brush (PPN 2x3),
- Category II three-point linkage II, swivel type
- hydraulic system up to 55 l/min,
- clearance lamps
- jockey wheels,
- parking stands
- brush cover.

Equipment versions:

- hydraulic steering mechanism from the second pair of quick couplers,
- hydraulic system for flow rates in excess of 55 l/min,
- rubber apron
- independent hydraulic steering mechanism (without an additional pair of quick couplers) for a maximum flow rate of 55 l/min,
- independent hydraulic steering mechanism (without an additional pair of quick couplers) for a flow rate in excess of 55 l/min,
- suspension system for a forklift or other,
- Category II three-point linkage, rigid,
- soft brush (PPN 1.6),
- hard brush (PPN 2x3 + wire 0.7),
- very hard brush (wire 0.7),
- “honeycomb” type brush, soft (PPN 1.6),
- “honeycomb” type brush, medium (PPN 2x3),
- “honeycomb” type brush, hard (PPN 2x3 + wire 0.7),
- “honeycomb” type brush, very hard (wire 0.7),
- without clearance lights.

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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 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 cover 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:

- cylindrical brush working parts ,
- jockey wheels,
- protective coatings in contact with contaminations, brush bristle and hitching points,
- rubber shield
- fenders
- bearings , filters, fuses.

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, damage caused by road accidents,
- 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 by unauthorized persons, incorrect repair or without the consent of the Manufacturer,
- making unauthorised alterations to machine design,

the user will lose the right to warranty service.

TIP

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

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

Modification of the machine without the written consent of the Manufacturer is prohibited. In particular, do NOT weld, drill holes in, cut or heat the main structural

elements of the machine, which have a direct impact on the machine operation safety.

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1.5 TRANSPORT

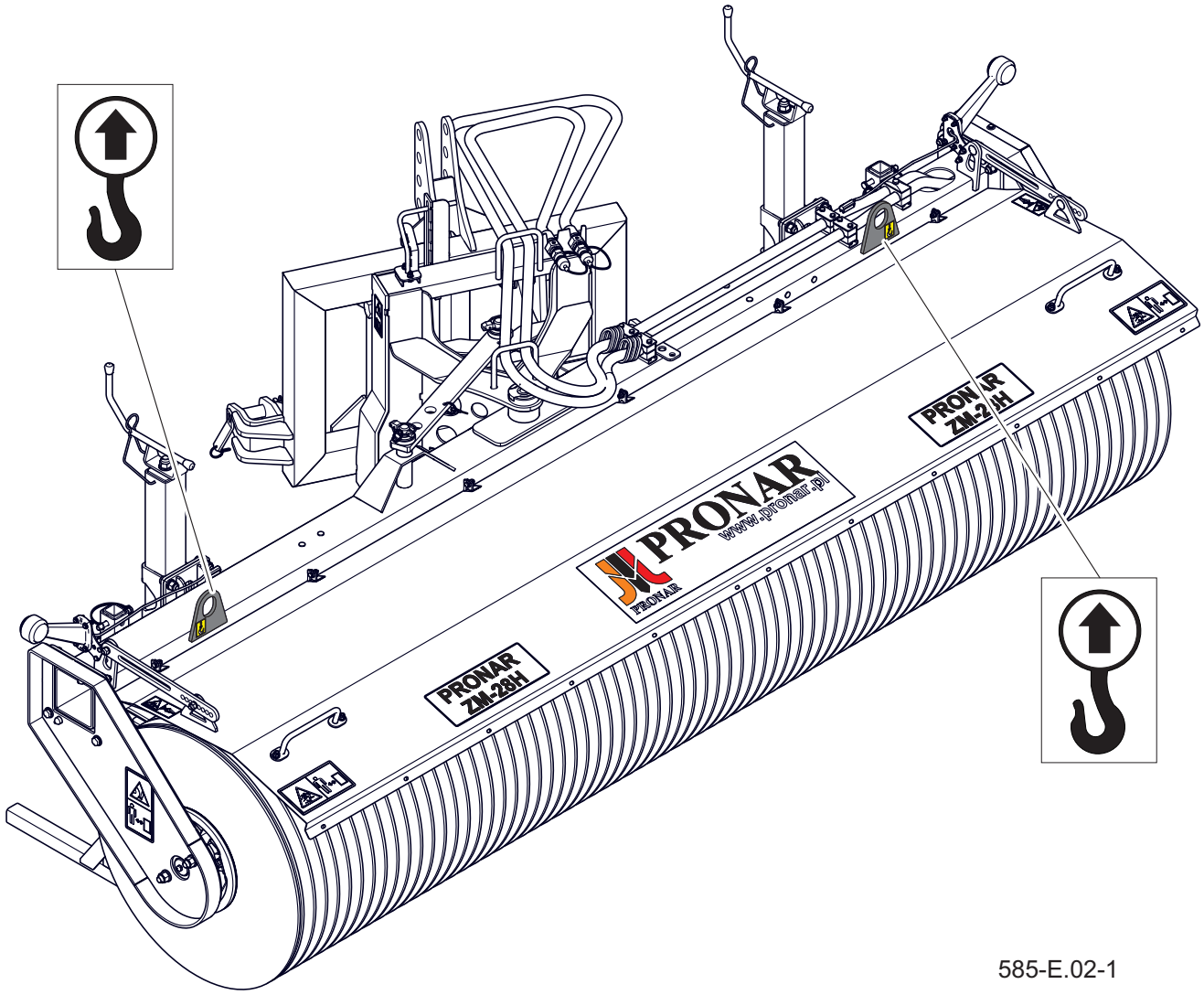

Figure 1.2 Transport lugs

The machine is prepared for sale completely assembled and does not require packing. Packing is only required for the machine Operator Manual and electrical system components.

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

During road transport the machine should

IMPORTANT!

Do NOT secure lifting slings or any types of load securing elements to any fragile machine components (e.g. covers, lines) Do NOT attach the slings to the hydraulic cylinder, electrical system components, etc.

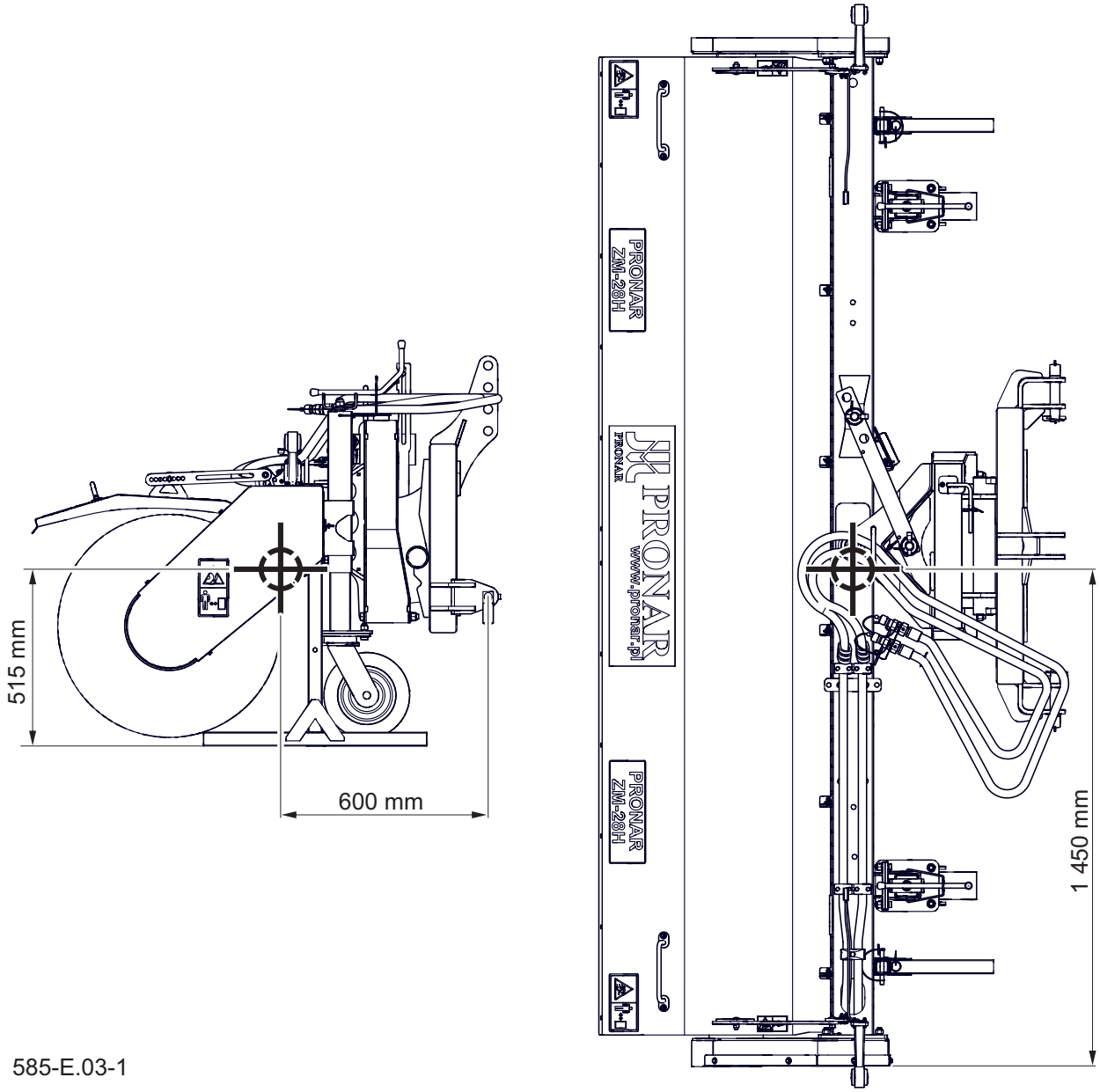

Figure 1.3 Position of the centre of gravity for the category II swivel type three-point linkage.

be firmly secured on the load box by means of certified belts or chains fitted with a tightening mechanism. Special attention should be paid so that the force pressing the machine against the platform does not damage its components. It is recommended to use spacers for fixed sweeper components, i.e. lateral supports and the linkage system.

When loading and unloading the machine, follow the general health and safety regulations for reloading work. Persons operating reloading equipment must have the qualifications required to operate these machines.

The machine should be attached to lifting

equipment in places specially designed for this purpose (figure (1.2)), ie. to the transport handles on the sweeper frame and to the linkage.

Suspension points are identified with information decals. When lifting the machine take special care to avoid tipping over the machine and the risk of injuries from protruding parts. To keep lifted machine in the correct direction it is recommended to apply additional guy cables. During reloading work, special care should be taken not to damage the paint coating.

DANGER

When transporting independently, the user must carefully read this Operator Manual and observe all its instructions. 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 use extreme caution while transporting the machine. This is due to the vehicle's centre of gravity shifting upwards when the machine is loaded.

IMPORTANT!

The position of the centre of gravity may change depending on the machine version.

E.2.6.585.05.1.EN

1.6 ENVIRONMENTAL RISK

DANGER

Do not store waste oil in food containers.
Store used oil in hydrocarbon-resistant containers.

NOTE

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

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 an oil leak should be performed in the rooms with oil resistant surface. In the event of oil leaking into the environment, first of all contain the source of the leak, and then collect the leaked oil using available means. Remaining oil should be collected using sorbents, or by mixing the oil with sand, sawdust or other absorbent materials. The oil contaminations, 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 loss of its properties should be stored in its original packaging in the conditions described above. Waste code: 13 01 10 (hydraulic oil). Detailed information on hydraulic oils can be found in the Material Safety Data Sheets.

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1.7 WITHDRAWAL FROM USE

Should you decide to withdraw the machine from use, comply with the regulations in force in the given country regarding 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.

DANGER

During dismantling, use the appropriate tools, equipment (overhead crane, crane or hoist etc.) and use personal protection equipment, i.e. protective clothing, footwear, gloves and eye protection etc.

Used oil and also rubber and plastic elements should be taken to the appropriate facilities dealing with the recycling of this type of waste.

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SECTION 2

SAFETY ADVICE

2.1 SAFE USE USING THE MACHINE

2.1.1 MACHINE USE

- Before use, the user must carefully read this Operator Manual and the Warranty Book. When operating the machine, follow all instructions in these documents.
- The machine may only be used and operated by persons qualified to drive carrier vehicle and trained in the use of the machine.
- If the information in this Operator Manual is difficult to understand, contact the seller who runs the authorised technical service on behalf of the Manufacturer, or contact the Manufacturer directly.
- Careless and improper use and operation of the trailer, and non-compliance with the instructions of this operator manual is dangerous to your health.
- Be aware of the residual risk. Use caution when operating this machine and follow all relevant safety instructions.
- The machine must never be used by persons, who are not authorised to drive carrier vehicle, including children and people under the influence of alcohol or other drugs.
- 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 guarantee.
- The machine may only be used when all the protective elements and warning markings are technically sound and correctly positioned. In the event of loss or damage to the protective features, they must be replaced with new ones.

2.1.2 HITCHING AND UNHITCHING THE MACHINE

- Do NOT hitch the machine to a carrier vehicle, if the linkage system of the machine is not compatible with the linkage system of the carrier vehicle.
- After completed hitching of the machine, check the safeguards. Carefully read the carrier vehicle Operator Manual.
- To hitch the machine to the carrier

vehicle use only the linking elements recommended by the machine and carrying vehicle Manufacturer.

- The carrier vehicle to which the machine will be coupled must be technically reliable and must meet all manufacturer's requirements.
- Be especially careful when hitching the machine to carrier vehicle.
- When hitching, there must be nobody between the machine and the carrier vehicle.
- Be especially careful when unhitching the machine from the carrier vehicle.
- The machine disconnected from the carrier vehicle must be supported on the parking stands and placed on level, sufficiently hard surface in such a manner as to ensure that it is possible to connect it again.

2.1.3 HYDRAULIC SYSTEM

- The hydraulic system is under high pressure when operating.
- Regularly check the technical condition of the hydraulic lines and connections. There must be no oil leaks.
- In the event of the hydraulic system malfunction, discontinue using the machine until the malfunction is corrected.
- When connecting or disconnecting the hydraulic lines, make sure that carrier vehicle and machine hydraulic system is not under pressure. If necessary, reduce residual pressure in the system.
- Use the hydraulic oil recommended by the Manufacturer. Never mix two types of oil.
- In the event of injuries being caused by pressurised hydraulic oil, contact a doctor immediately. Hydraulic oil may find its way under the skin and cause infections. In the event of contact of oil with eyes, rinse eyes with a large quantity of water and in the event of the occurrence of irritation consult a doctor. In the event of contact of oil with skin wash the area of contact with water and soap. Do NOT apply organic solvents (petrol, kerosene).
- Used oil or deteriorated oil should be stored in original containers or replacement containers resistant to hydrocarbons. Replacement containers must be clearly marked and appropriately stored.
- Do not store hydraulic oil in packaging designed for storing food or foodstuffs.
- Rubber hydraulic lines must be changed every 4 years regardless of technical condition.

- Repair and replacement of hydraulic system elements should be entrusted to the appropriately qualified persons.

2.1.4 TRANSPORTING THE MACHINE

- Before driving on public roads, check operation of indicator lights.
- When driving on public roads, observe all road traffic regulations in force in the country, in which the machine is used.
- Do not exceed the maximum speed resulting from road conditions and design restrictions. Adjust speed to the prevailing road conditions and other limitations arising from road traffic regulations.
- Do NOT leave the machine raised and unsecured while the carrier vehicle is parked. When parked, the machine should be lowered.
- Do NOT ride on the machine or transport any materials on it.
- Before using the machine always check its technical condition, especially in terms of safety. In particular, check the technical condition of the hitch system and elements connecting the hydraulic system.
- When driving with raised machine, the carrier vehicle's linkage should be locked in the up position to prevent accidental lowering.
- Reckless driving and excessive speed may cause accidents.

2.1.5 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, do not use the machine until the fault has been corrected.
- During work, use proper, close fitting protective clothing, gloves and appropriate tools. When working on hydraulic systems it is recommended to use oil resistant gloves and protective goggles.
- Any unauthorized modifications to the machine by the user release PRONAR from liability for any 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.
- 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 carrier vehicle's engine turned off and the ignition key removed. Immobilise the carrier vehicle with parking brake and ensure that unauthorised persons do not have access to the vehicle's cab. Secure the raised machine against falling.
- 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.
- Regularly check technical condition and correct mounting of safety guards and protective elements.
- 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 hoists or lifting devices. After lifting the machine, stable and durable supports must also be used. Do NOT perform maintenance or repair work under raised and unsupported machine.
- 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.

2.1.6 MACHINE OPERATION

- Before starting the carrier vehicle with the hitched machine, make sure that the control levers of the external hydraulic system are not engaged, otherwise, the machine may be started in an uncontrolled manner.
- Each time the machine is used, always ensure that all the safety guards are in good condition and in place.
- Before lifting or lowering the machine mounted on the carrier vehicle, make sure that there are no bystanders near the machine.
- Before starting the machine make sure that there are no bystanders (especially children) or animals in the

danger zone. The 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.
- Keep a safe distance from rotating parts of the machine.

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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 machine for purposes other than those for which it is intended,
- being between the carrier vehicle and the machine while the engine is running and when the machine is being attached,
- being on the machine while the engine is running,
- operating the machine with removed or faulty safety guards,
- not maintaining a safe distance from the danger zone or being within the zones while the machine is operating,
- machine operation by unauthorized persons or persons under the influence of alcohol
- cleaning, maintenance and technical checks when carrier vehicle is connected and engine is running.
- rupture of the hydraulic lines.

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

- operate the machine in prudent and unhurried manner,
- reasonably apply all the remarks and recommendations stated in the Operator Manual,
- carry out repairs and maintenance work in line with operating safety rules,
- repair and maintenance work should be carried out by persons trained to do so,
- use close fitting protective clothing,
- ensure unauthorised persons have no access to the machine, especially children,
- maintain a safe distance from forbidden or dangerous places
- do not climb on the machine when it is operating

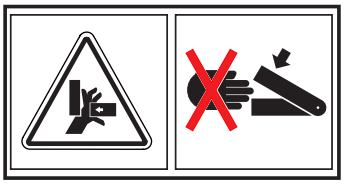
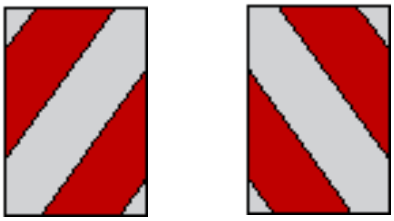
F.2.6.585.02.1.EN

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.

Table 2.1 Information and warning decals

Item	Decal	Meaning
1		Before starting work, carefully read the Operator Manual. *12N-15000006*
2		When implement is in use there must be no bystanders in designated areas. If any work is required in these areas, make sure the carrier vehicle is stationary, and whether the implement is disconnected from the power source. *17N-12000004*
3		Pressurised liquid. Keep a safe distance. *12N-15000009*
4		Risk of injury caused by thrown objects. Keep a safe distance from the operating machine. *12N-15000008*

Item	Decal	Meaning
5		Do NOT approach and do NOT touch rotating brushes. *12N-15000007*
6		Do not reach into crushing space because elements may move. Danger of crushing hands or fingers. *17N-12000006*
7	PRONAR ZM-28H	Machine model. *585N-95000001*
8		Rear clearance marking (left / right). *12N-15000001L* *12N-15000001P*
9		Lifting equipment attachment points for loading the machine *178N-00000009*
10	PRONAR www.pronar.pl PRONAR	PRONAR decal. *187N-00000033*
11		Indicator decal *585N-02000001*

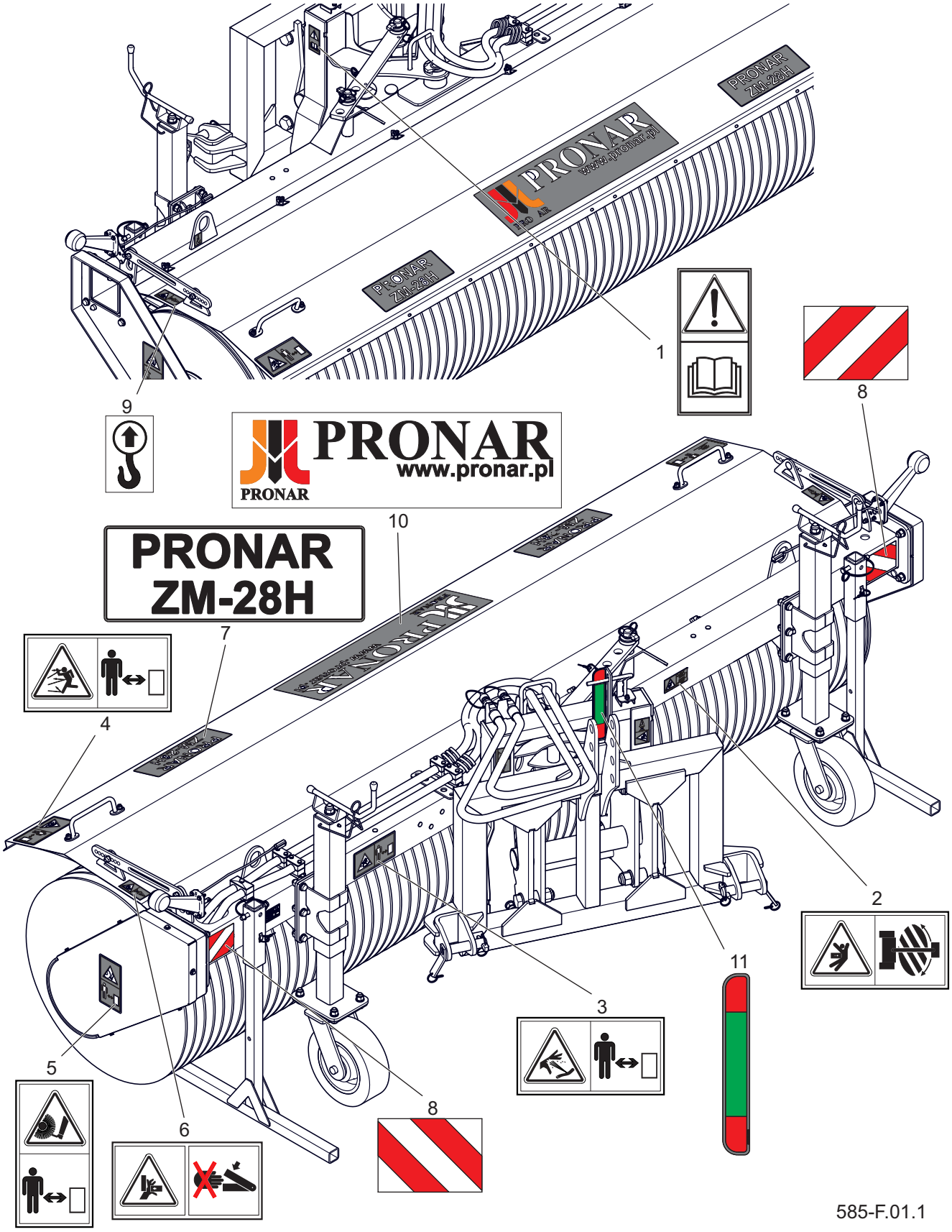


Figure 2.1 Locations of information and warning decals.

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SECTION 3

DESIGN AND OPERATION

3.1 TECHNICAL SPECIFICATION

Table 3.1 Basic technical specification

	Unit	ZM-28H
Method of hitching to carrier vehicle - front three point linkage - other	 - -	 cat. II according to ISO 7301 individual order
Sweeping width setting +25°; -25°	mm	2,600
Performance for the recommended operating speed of 6 km/h	m^2/h	15,600
Recommended sweeping speed	km/h	6
Transport speed (maximum)	km/h	25
Brush drive	-	external hydraulic system of the carrier vehicle
Hydraulic oil requirement - for the standard hydraulic system - for hydraulic systems with increased flow rate	 l/min l/min	 25 - 55 55 - 140
Maximum hydraulic supply pressure	MPa	21
Control	-	external hydraulic system of the carrier vehicle control panel
Brush rotation speed (recommended / maximum)	rpm	100 - 150 / 200
Weight for medium hardness brushes	kg	478
Dimensions: - width - length - height	 mm mm mm	 2,998 1,360 1,180
Power supply for clearance lighting and spray system	-	12V electrical system of the carrier vehicle
Other information	-	single person operation

Level of noise emitted by the sweeper does not exceed 70 dB(A)

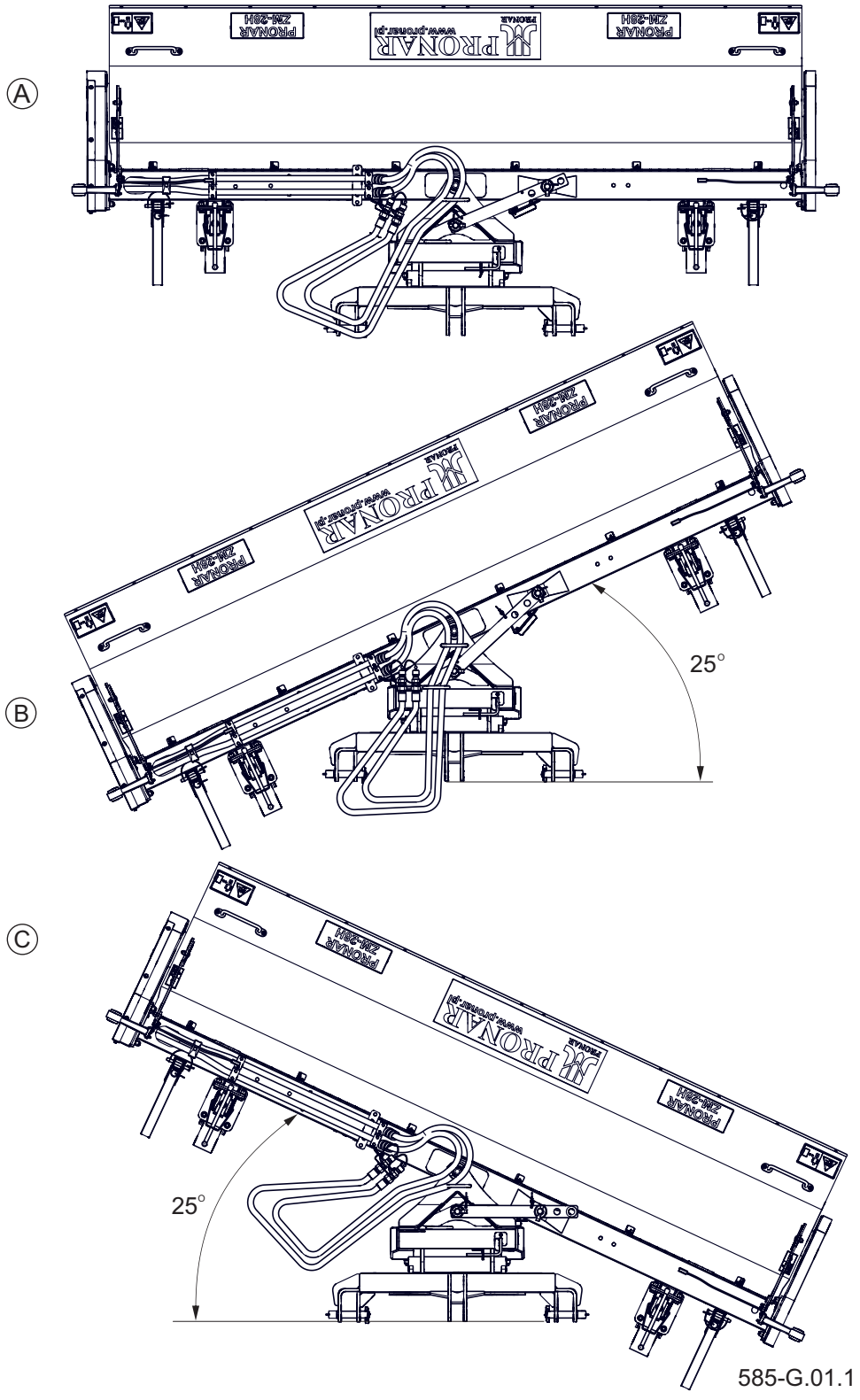

Figure 3.1 Working positions of the ZM-28H roller brush sweeper
(A) work straight ahead, (B) work to the left (C) work to the right

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3.2 GENERAL DESIGN

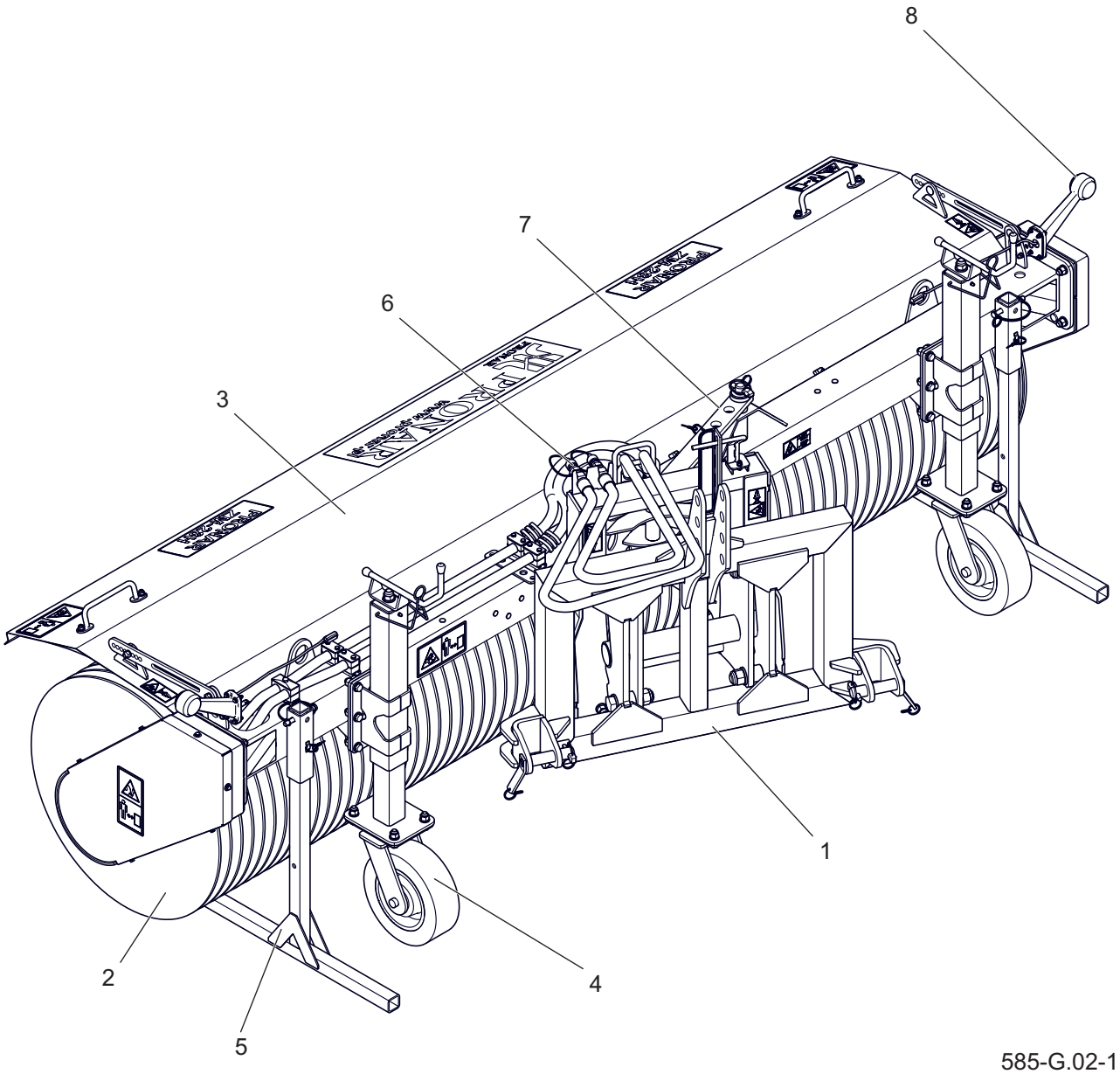

Figure 3.2 General design

(1) linkage *(2) roller brush* *(3) adjustable guard*
(4) jockey wheel *(5) parking stand* *(6) hydraulic system*
(7) turning lock *(8) electrical system*

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3.3 HYDRAULIC SYSTEM

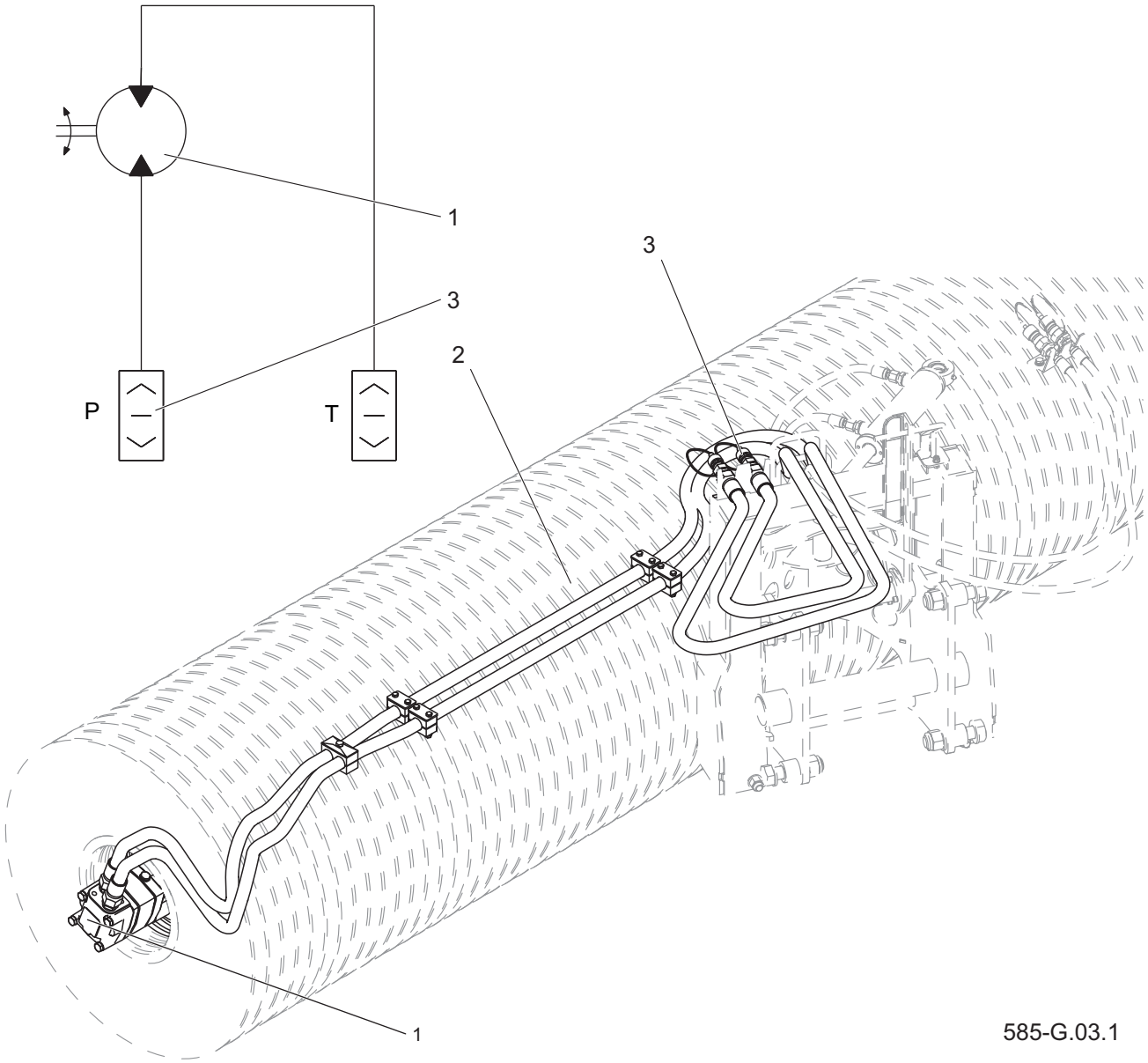

Figure 3.3 Hydraulic system (standard version for flow rate 25-55 l/min)
(1) hydraulic motor (2) hydraulic line (3) plug

The roller brush sweeper can be equipped with different hydraulic system setup versions. In each version, the brush is driven by a hydraulic motor (1) powered from the carrier's external hydraulic system. Detailed requirements for the carrier vehicle are presented in table (1.2). The machine requirements and basic specification are presented in table (3.1).

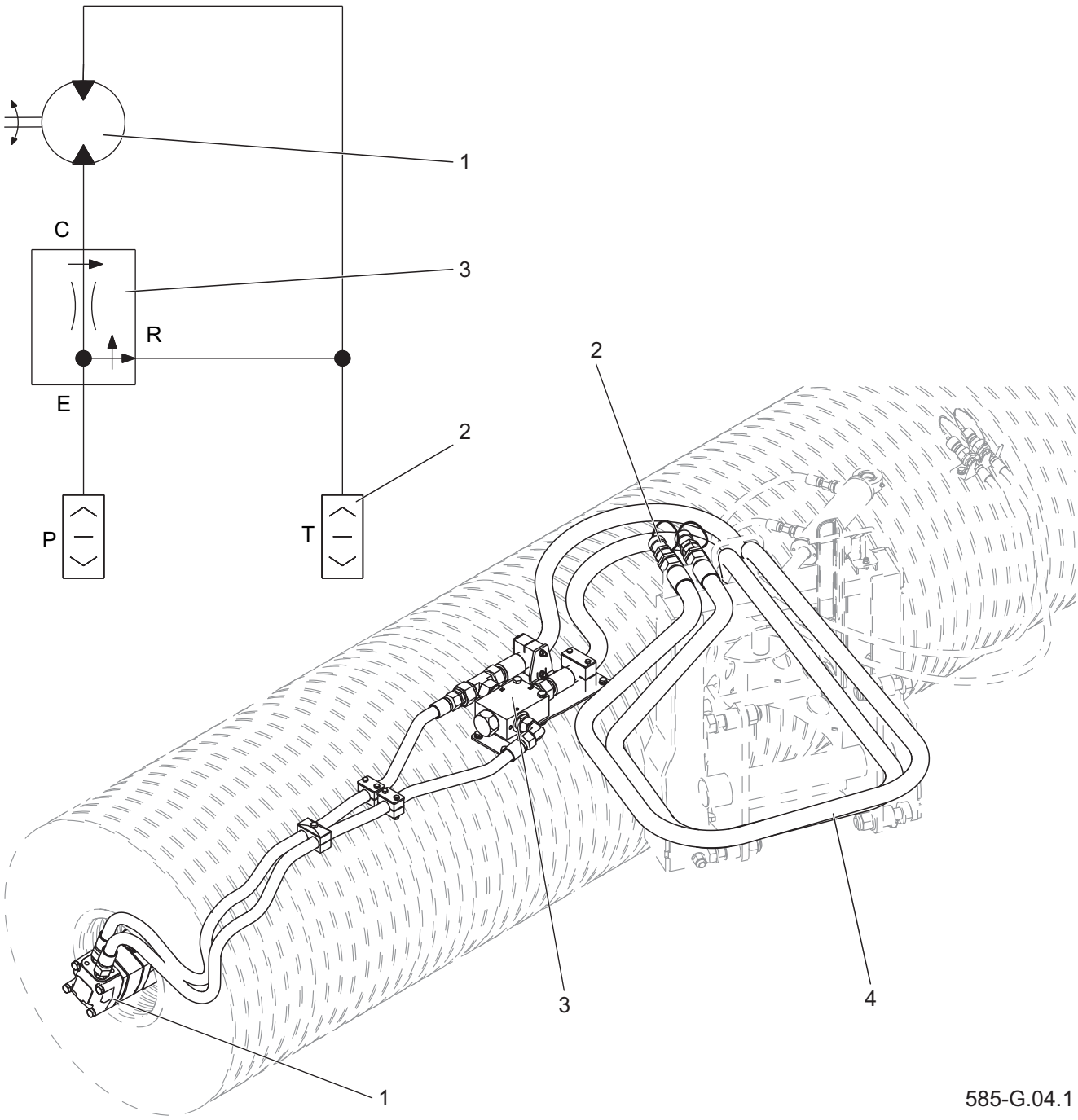

Figure 3.4 Hydraulic system (optional version for flow rate 55-140 l/min)
(1) hydraulic motor *(2) plug* *(3) flow regulator*
(4) hydraulic line

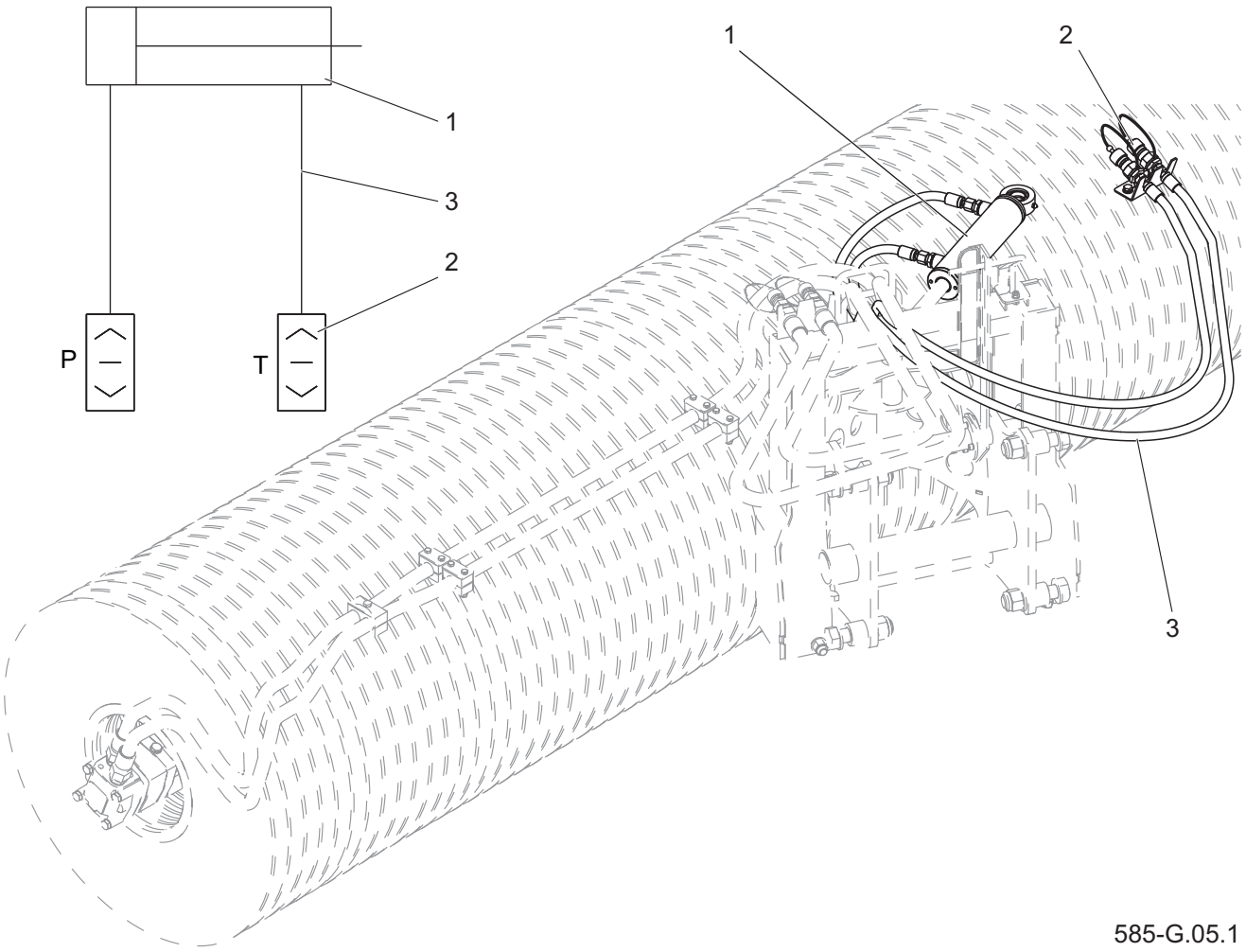

Figure 3.5 Hydraulic steering system (optional version)
(1) hydraulic cylinder *(2) plug* *(3) hydraulic line*

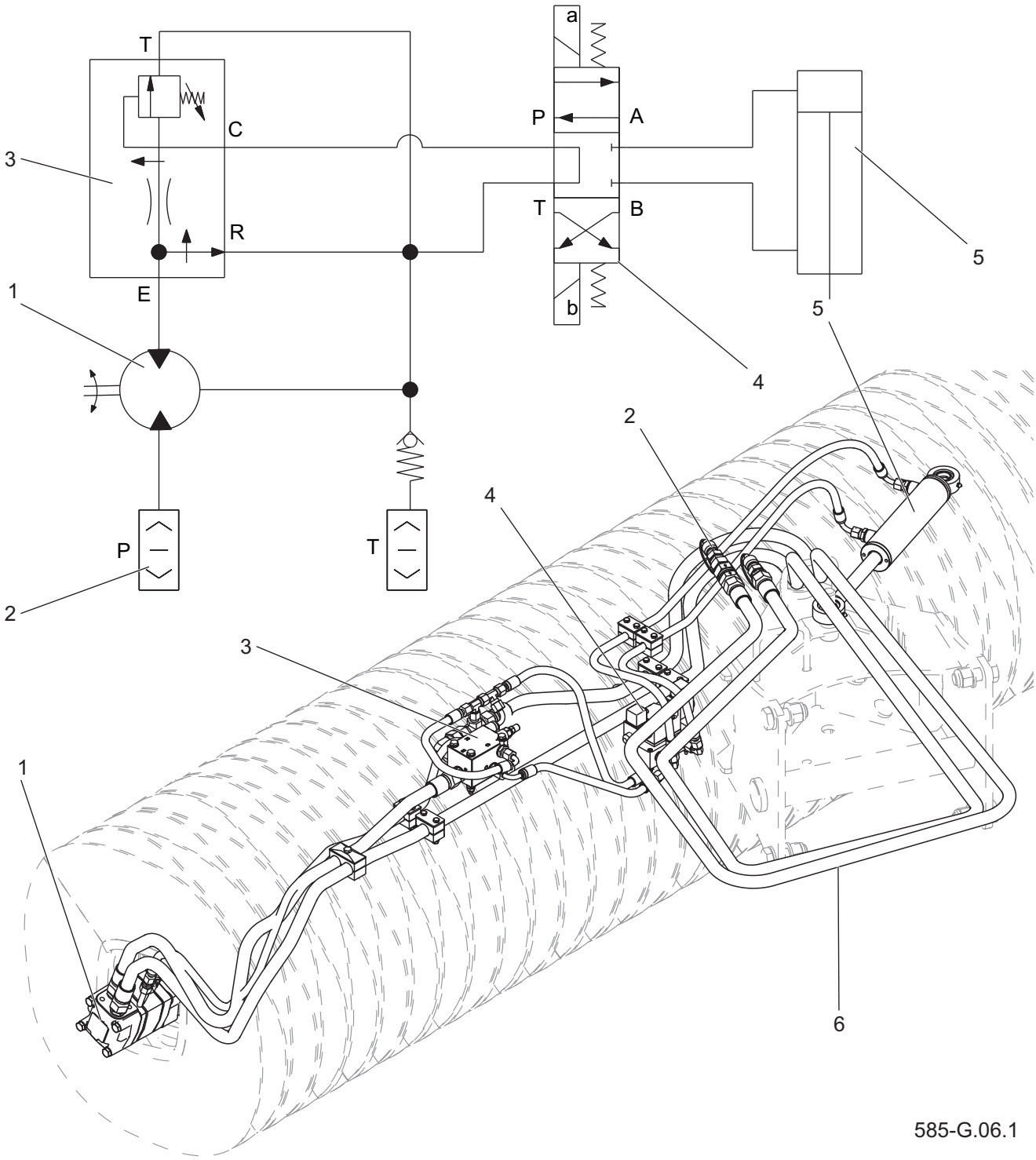

Figure 3.6 Independent hydraulic steering system (optional version for flow rates 25-55 l/min)

(1) hydraulic motor *(2) plug* *(3) flow regulator*

(4) manifold *(5) hydraulic cylinder* *(6) hydraulic line*

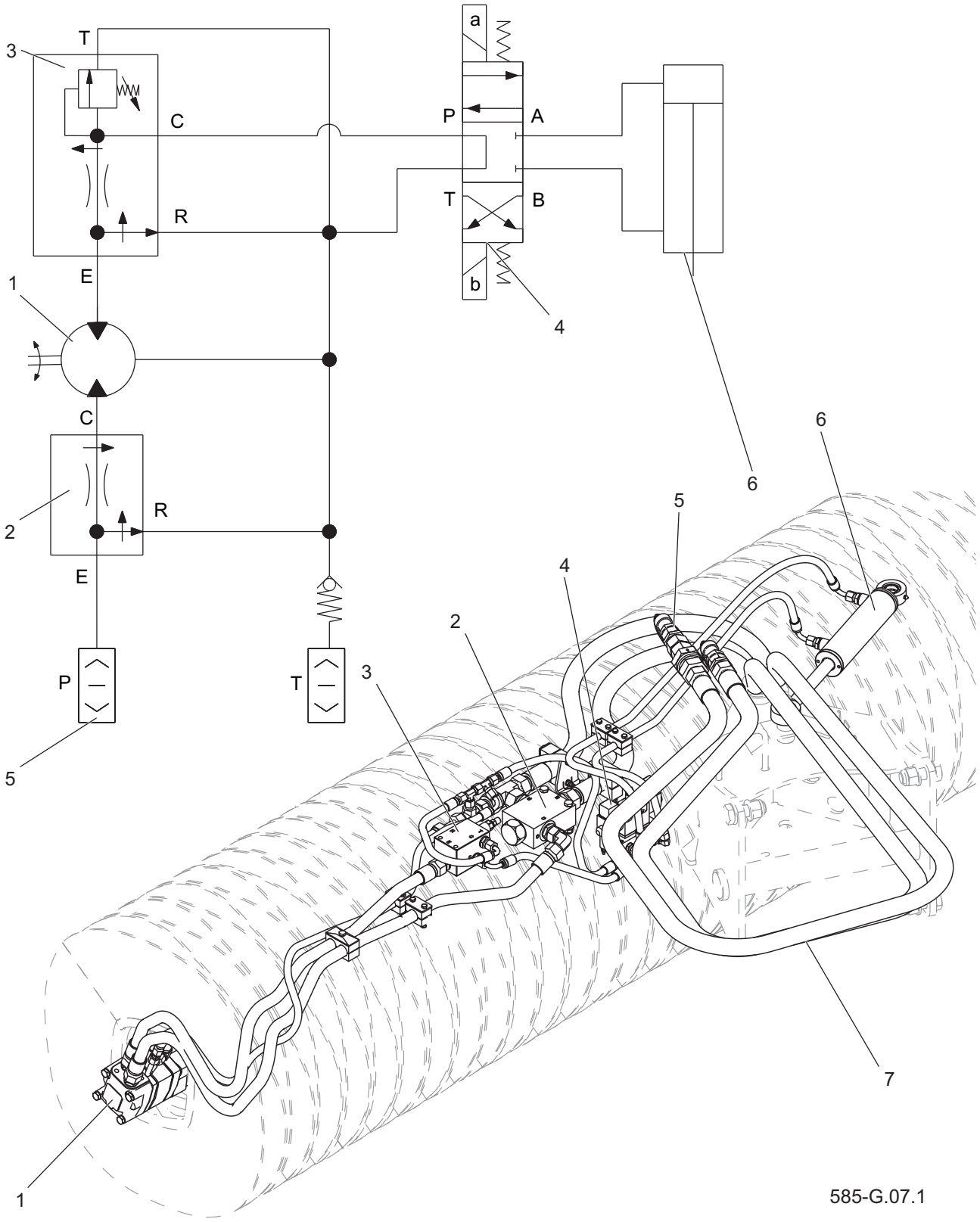

Figure 3.7 Independent hydraulic steering system (optional version for flow rates 55-140 l/min)

(1) hydraulic motor *(2) flow regulator* *(3) flow regulator*
(4) manifold *(5) plug* *(6) hydraulic cylinder*
(7) hydraulic line

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3.4 ELECTRICAL SYSTEM

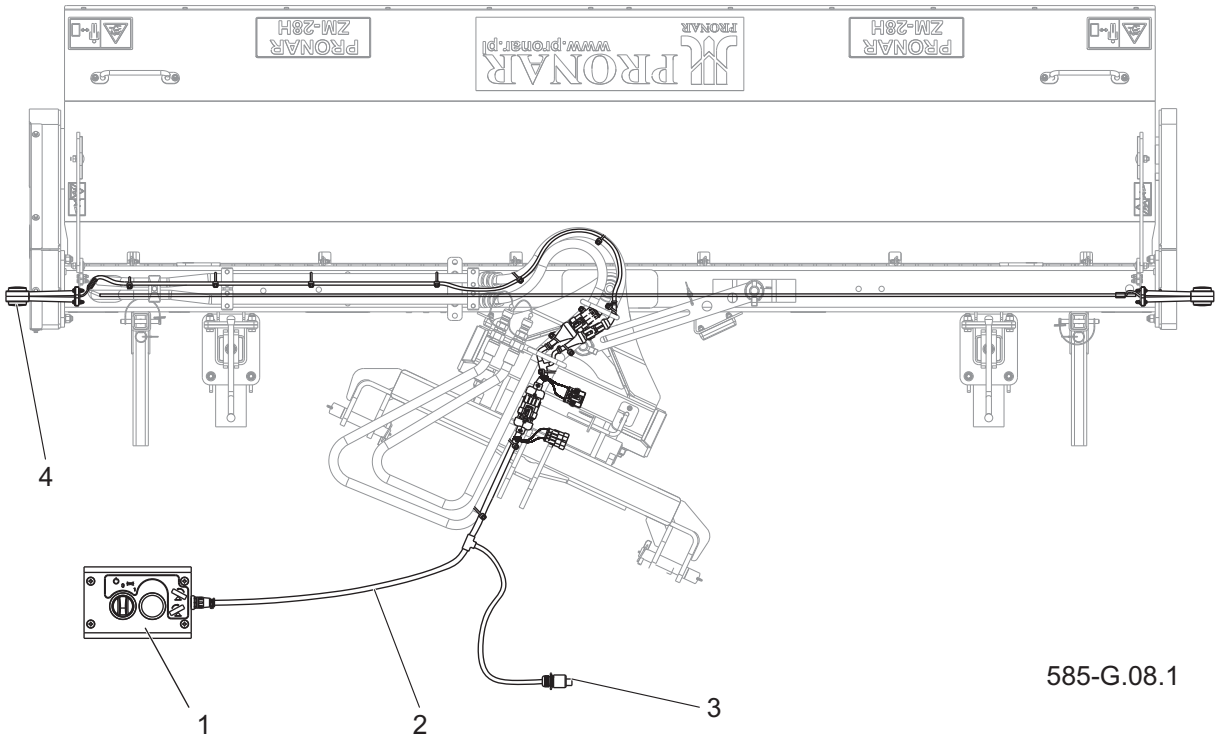

Figure 3.8 Electric system design for the clearance lighting version
(1) control panel *(2) wiring harness* *(3) 3-pin plug*
(4) clearance light

The machine, due to the different accessory setup, may not have electrical system or may be equipped with three different electrical systems powered with 12V from the 3-pin socket of the carrier vehicle.

- clearance lights electric system - figure (3.8),
- independent steering electric system - figure (3.9),
- electric system for independent steering and clearance lighting - figure (3.10).

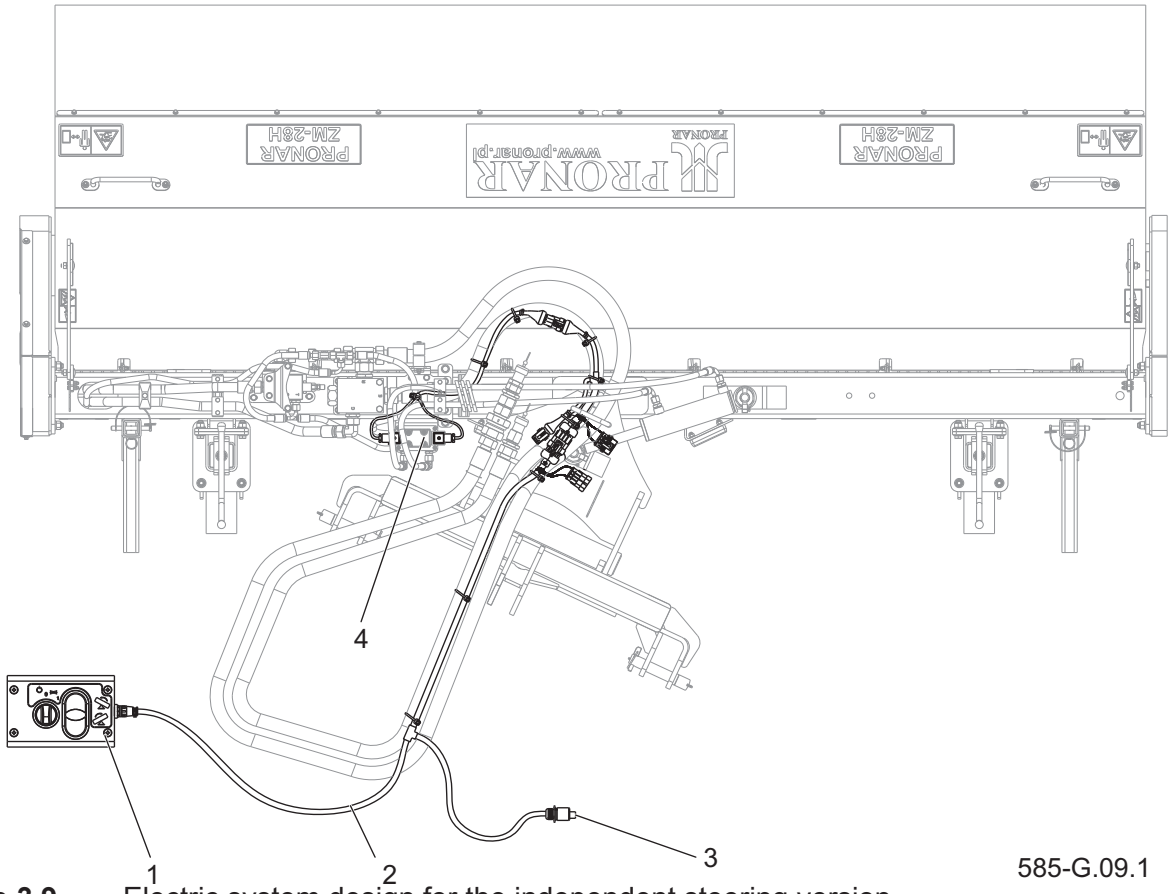

Figure 3.9 Electric system design for the independent steering version

(1) control panel *(2) wiring harness* *(3) 3-pin plug*

(4) solenoid valve

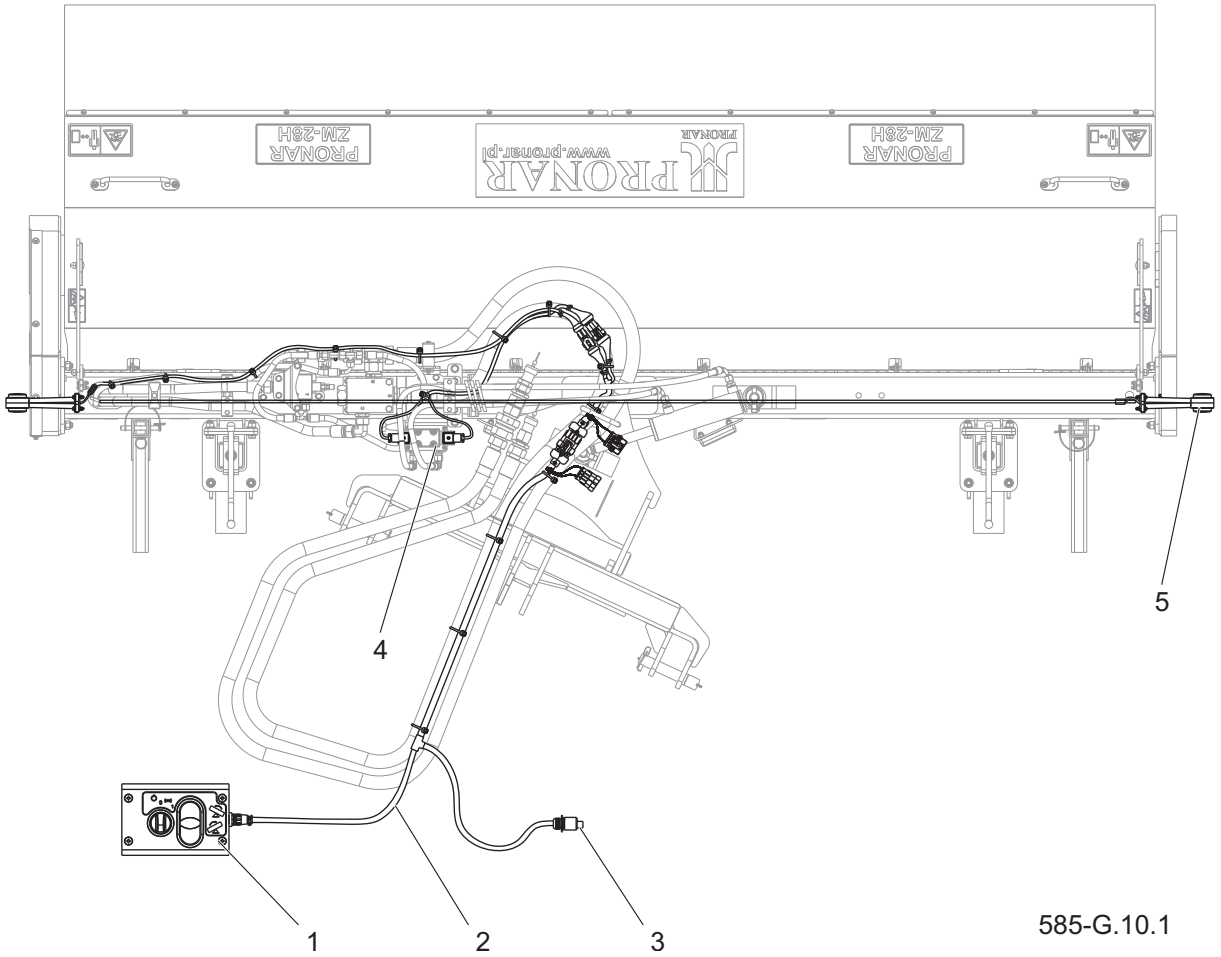

Figure 3.11 Electric system design for the independent steering and clearance lighting version

(1) control panel *(2) wiring harness* *(3) 3-pin plug*

(4) solenoid valve *(5) clearance light*

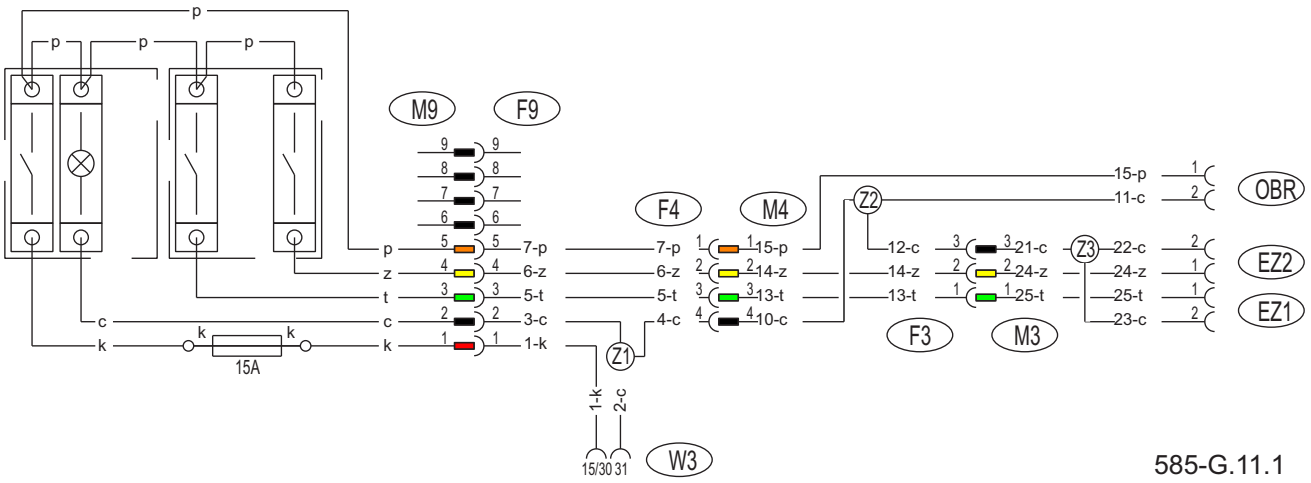

Figure 3.12 ZM-28H Electric system diagram

CORRECT USE

SECTION 4

4.1 PREPARE FOR WORK

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 after delivery and before first use. The machine is delivered to the user completely assembled. Prior to connecting to the carrier vehicle, machine operator must verify the machine technical condition. In order to do this:

- the user must carefully read this Operator Manual and observe all recommendations, understand the design and the principle of machine operation
- check the condition of protective paint coat,
- inspect machine's individual components for mechanical damage resulting from incorrect transport (dents, piercing, bent or broken components),
- check all the lubrication points, lubricate the machine as needed according to recommendations provided in section 5 MAINTENANCE,
- check technical condition of the hydraulic system;

DANGER

Before using the machine, the user must carefully read this Operator Manual
The machine must never be used by persons who are not authorised to drive carrier vehicles, 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.
Before starting the machine, ensure that there are no bystanders in the danger zone.

IMPORTANT!

Before using the machine always check its technical condition.
The machine must not be used when not in working order.

- check technical condition of hitching system pins and locking cotter pins,
- check technical condition of protective shields and correctness of mounting of the shields and warning signs.

If all the above checks have been performed and there is no doubt as to the machine's good technical condition, it can be connected to carrier vehicle, started and all its individual systems checked. In order to do this:

- connect the machine to the carrier vehicle's linkage (see 4.3 HITCHING TO CARRIER VEHICLE),

- connect the power to the hydraulic and electrical systems,
- start the machine (see 4.4 ROLLER BRUSH SWEEPER OPERATION)
- check operation of the hydraulic system and control the system for tightness,
- check the operation of the clearance lighting system.

In the event of a disruption in the operation of the machine immediately discontinue its use, find and remove the fault. If a fault cannot be rectified or the repair could void the warranty, please contact the Seller for additional clarifications.

IMPORTANT!

Failure to follow instructions in this Operator Manual or starting the machine incorrectly may cause damage to the machine.
The technical condition before starting the machine must be no cause for concern.

DANGER

Before starting the carrier vehicle with the hitched sweeper make sure the external hydraulic system control levers are in off position, otherwise it may lead to uncontrolled operation of the machine.

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4.2 TECHNICAL INSPECTION

Table 4.1 Technical inspection schedule

Description	Maintenance activities	Frequency
Condition of safety guards	Check the technical condition of safety guards, if complete and correctly mounted.	Before commencing work
Correct installation of the roller brush	Check if correctly installed	
Technical condition of the roller brush	Visually inspect and, if necessary, replace	
Technical condition of the electrical system	Visually inspect the technical condition, check the operation	
Technical condition and operation of lighting system components.	Visually inspect the technical condition, check operation after connecting to the carrier vehicle.	
Technical condition of warning signs	Inspect visually the legibility and completeness of warning signs	
Check if all main nut and bolt connections are properly tightened	Tightening torque should be according to table (5.6)	Every six months
Lubrication	*Lubricate elements according to section „5.5 LUBRICATION".*	According to table (5.5)

To get the machine ready for use, check components according to guidelines presented in Table 4.1.

IMPORTANT!
Do NOT use a malfunctioning or incomplete machine.

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4.3 HITCHING TO VEHICLE

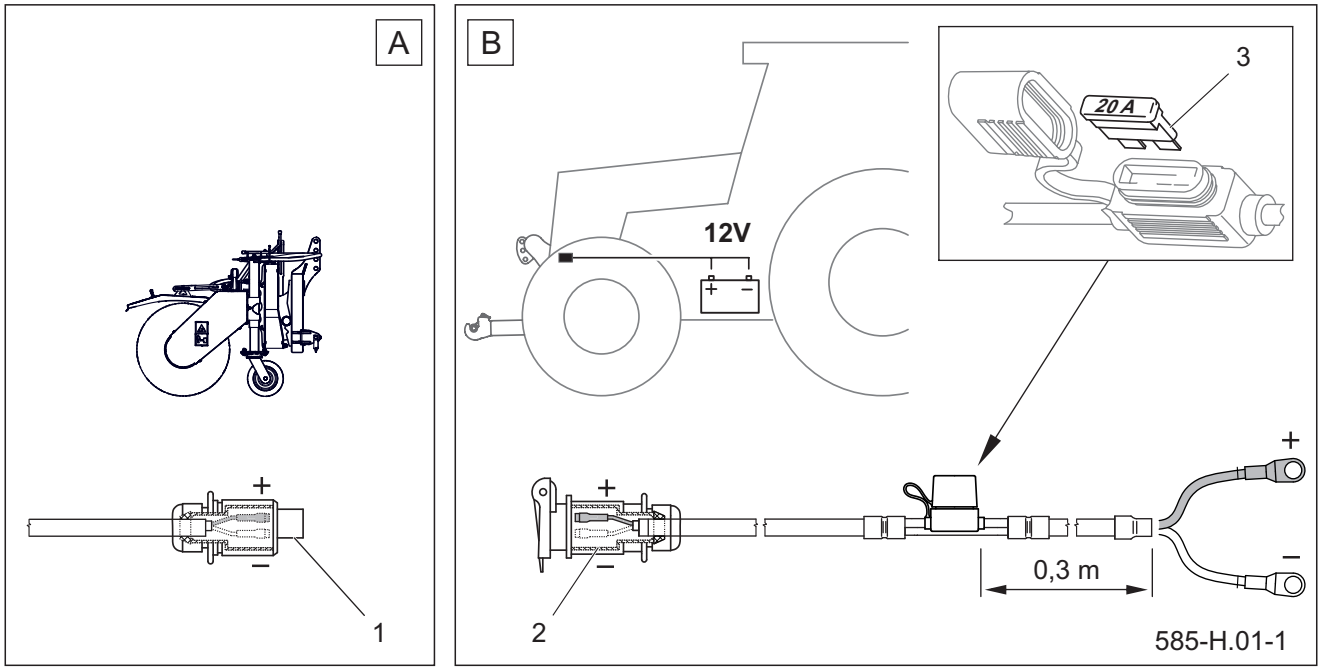

Figure 4.1 Electrical power supply cable (not supplied with the machine).
(A) roller brush sweeper electrical components *(B) carrier power cord*
(1) 3-pin plug *(2) 3-pin socket* *(3) 20A fuse*

The ZM-28H roller brush sweeper may only be mounted on a carrier vehicle that meets the requirements presented in Table (1.1) "Carrier vehicle requirements".

Before hitching the sweeper to the carrier vehicle, check the compatibility of the machine's linkage with the carrier vehicle's linkage. Because the machine can be equipped with different types of linkage, follow the hitching instruction specified by the carrier vehicle manufacturer.

The machine requires electrical power from a 3-pole 12V DIN 9680 socket mounted on the front of the carrier vehicle. If the carrier vehicle is not equipped with such a socket or is equipped with a different type of socket, install the socket according to the diagram - figure 4.1. Connect power lead (B) to the carrier vehicle's electrical system and place socket (2) in the front

DANGER

When hitching, there must be nobody between the machine and the carrier vehicle.
Exercise caution when hitching the machine to carrier vehicle.

IMPORTANT!

Before hitching the machine to carrier vehicle, you must carefully read the carrier vehicle and machine Operator Manual.

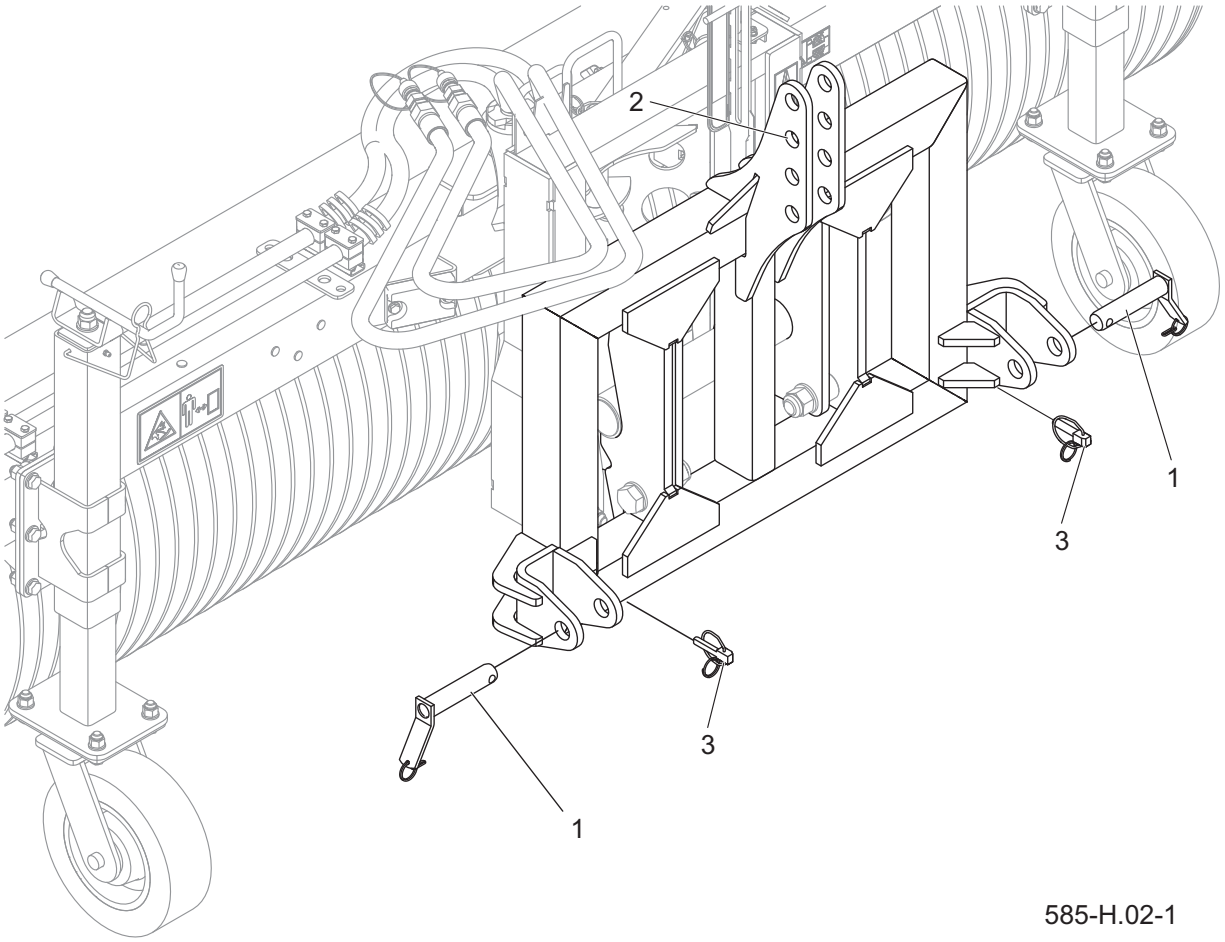

Figure 4.2 Category II three-point linkage according to ISO730-1
(1) mounting bolt for three-point linkage lower links (2) top link mounting points
(3) - securing cotter pins

of the vehicle. Connect the plug (1) to the socket (2). There should be a (3) UNIVAL 20 A fuse on the "+" power cable.

When hitching the machine to the carrier vehicle three-point linkage, adhere to the following guidelines:

- While driving the carrier vehicle, bring the lower three-point linkage links closer to the links of the sweeper linkage. Both links of the three-point linkage should be set at the same height.

DANGER

To hitch the machine to carrier vehicle use only genuine pins and safeguards.
Comply with the recommendations relating to linkage and mounting points.

- Connect the lower links (1) of the machine linkage (figure (4.2)) with the lower links of the carrying vehicle and secure with cotter pins (3). Use a bolt to connect the Top link (central link) of the carrier vehicle to the

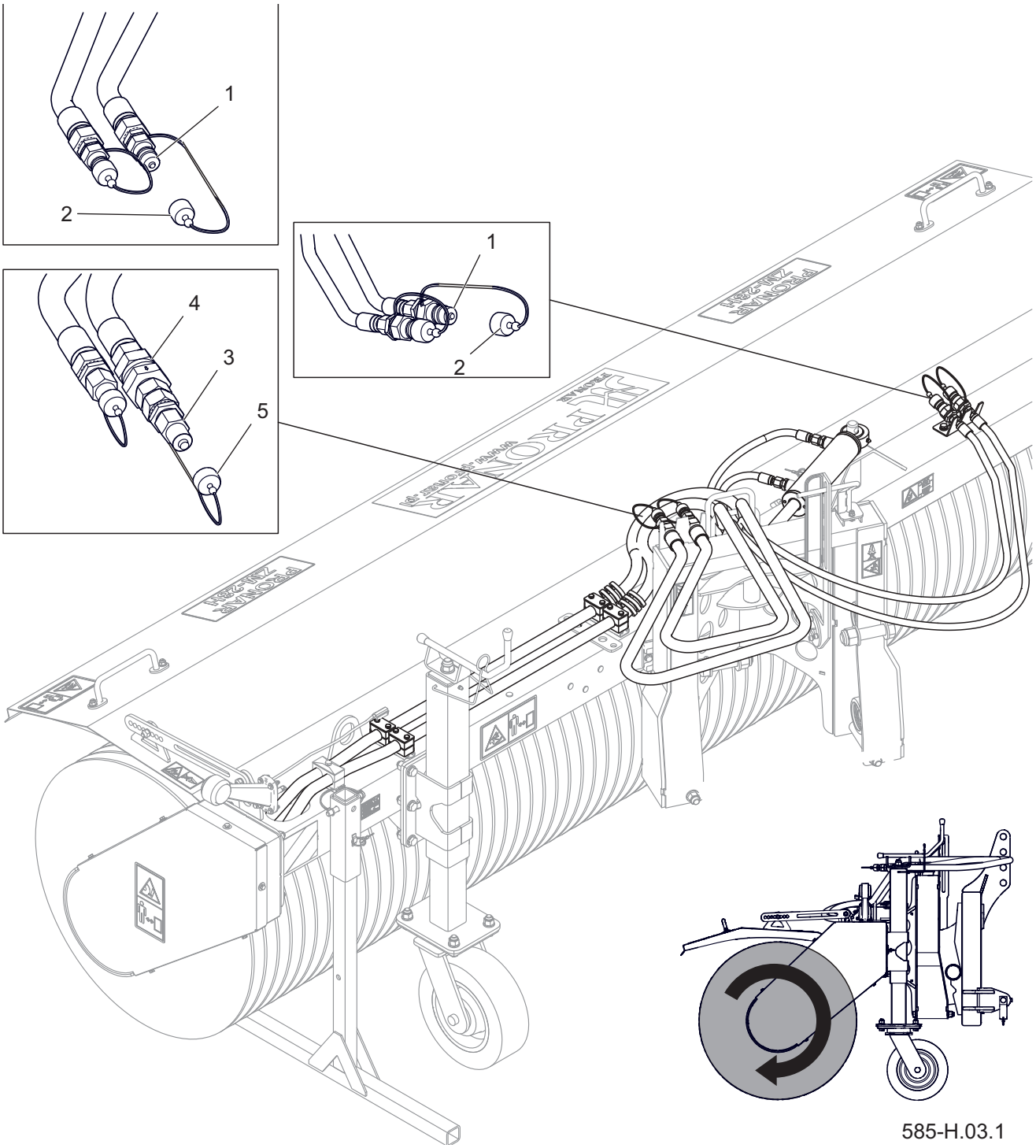

Figure 4.3 Connect the hydraulic system
(1) 12.5 ISO 7241-1 plug *(2) 12.5 plug cap* *(3) 20 ISO 7241-1 plug*
(4) check valve *(5) 20 plug cap*

corresponding opening of top link of the sweeper linkage and secure it.

- Eliminate lateral movements of machine by appropriate adjustment of

IMPORTANT!
When connecting the machine to the carrier, follow the instructions of the carrier's manufacturer.

the lower arm stabilisers; both lower links of the three-point linkage are recommended to be set at the same height,

- Connect the hydraulic line connectors (figure 4.3) to the appropriate socket in the carrying vehicle. Connect the electric system plug to a 3-pole 12V socket.
- Lift the roller brush sweeper using the three-point linkage of the carrying vehicle, raise the parking stands and lock in the upper position - figure (4.4)

If you connect the machine with another linkage, follow the instructions of the carrying vehicle manufacturer.

Connect the plugs of hydraulic couplings to the appropriate sockets of one section of the carrier's external hydraulic manifold capable of continuous operation. For a separate hydraulic system for brush steering, the carrying vehicle should have a double acting hydraulic system (Figure 4.3).

IMPORTANT!

During operation, the connecting cables should be routed so that they do not get entangled in moving machine and carrier vehicle parts.

TIP

Before beginning work using the sweeper, check the oil level in carrier vehicle's hydraulic system.

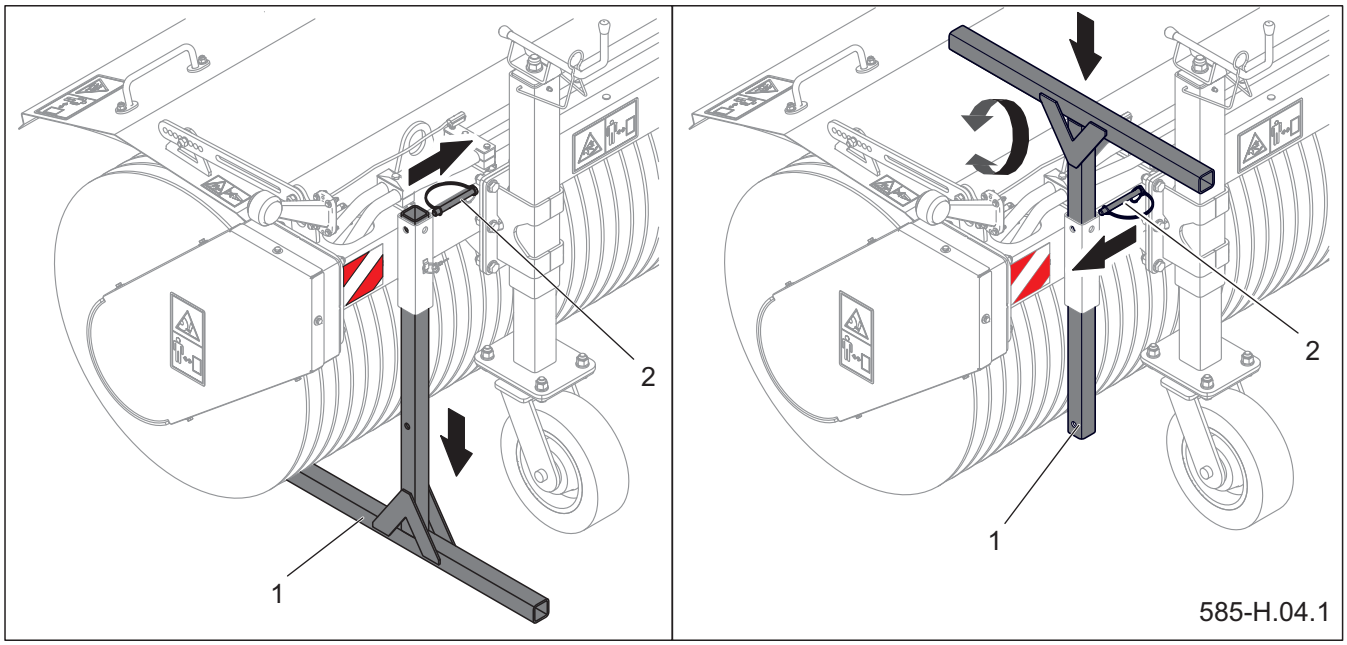

Figure 4.4 Parking stands
(1) parking stand *(2) cotter pin*

Activate appropriate hydraulic circuit using the hydraulic manifold lever in the carrier vehicle. Check roller brush rotation direction. The brush should rotate in the direction opposite to travel direction.

The roller brush sweeper is equipped with two parking stands - figure (4.4). After connecting to the carrying vehicle and lifting the machine, transfer the parking stands. To do this, remove securing cotter pins (2), turn parking stands (1) to the position shown in the figure and secure with cotter pins (2).

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4.4 ROLLER BRUSH SWEEPER OPERATION

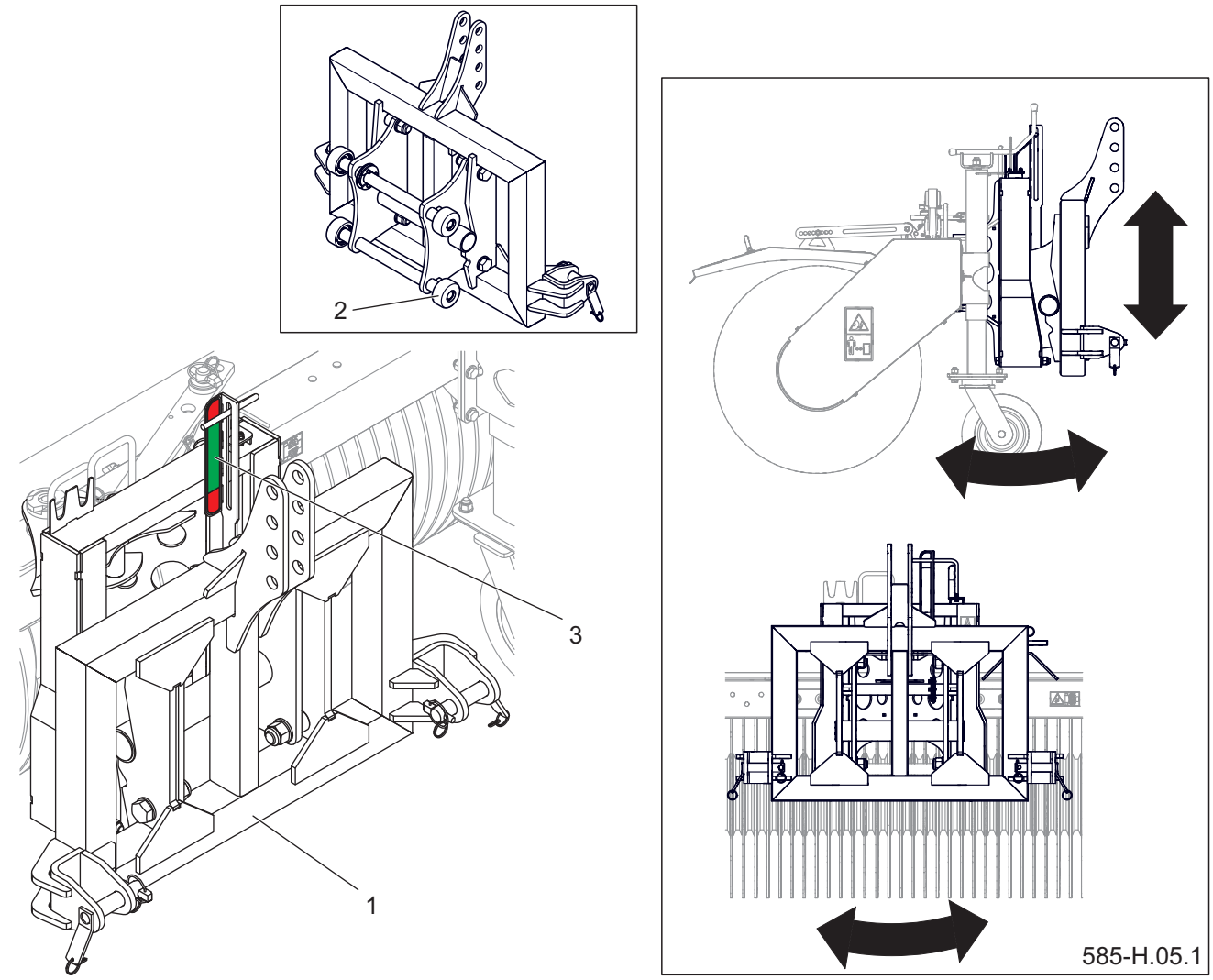

Figure 4.5 Position indicator.
(1) linkage *(2) swivel linkage system* *(3) position indicator*

The standard equipment of the machine includes a floating linkage system to enable ground contour following. The carrier vehicle must not have linkage (jib, three-point linkage) set in the floating position. It is a linkage system dedicated to implement carriers with extension arms that do not have a floating linkage, e.g. front loaders of agricultural tractors or backhoe loaders. The floating system can

IMPORTANT!

During operation of the roller brush sweeper, the carrying vehicle's suspension system must not be set in the floating mode. The machine's linkage system enables ground contour following.
Operating the roller brush sweeper when the linkage position indicator is the red range may damage the machine.

also be used for the 3-point front linkage of agricultural tractors without the floating function of the lifting (rigid) arms. The optional rigid linkage system is used only for hitching on the front three-point linkage with the floating function of the lifting arms.

ADJUST THE LINKAGE SYSTEM

The special design of the linkage system enables ground following while the machine is in operation. To enable this, properly set the carrying vehicle's linkage system in relation to the machine's position - figure (4.5). The sweeper linkage system should be able to move up - down, rotate right - left in relation to the machine, and should be set in a vertical position to allow the machine to be tilted forward - backward. To achieve this, the linkage height indicator (3) is used.

During machine operation, the height indicator should be in the range marked in green. The red colour on the indicator means the linkage is outside the ground contour following range. For the machine to work properly, use the jockey wheel (1) to set the roller brush in contact with the ground - figure (4.6). In order to adjust the wheel height, rest the machine on the wheels and achieve contact of the brush with the ground. Adjust if necessary. Unlock the cotter pin (3) and turn the crank (2) in the direction (C) to raise the brush - in the direction (B) to lower the brush. Set both jockey wheels to the same height. The width of brush ground contact surface

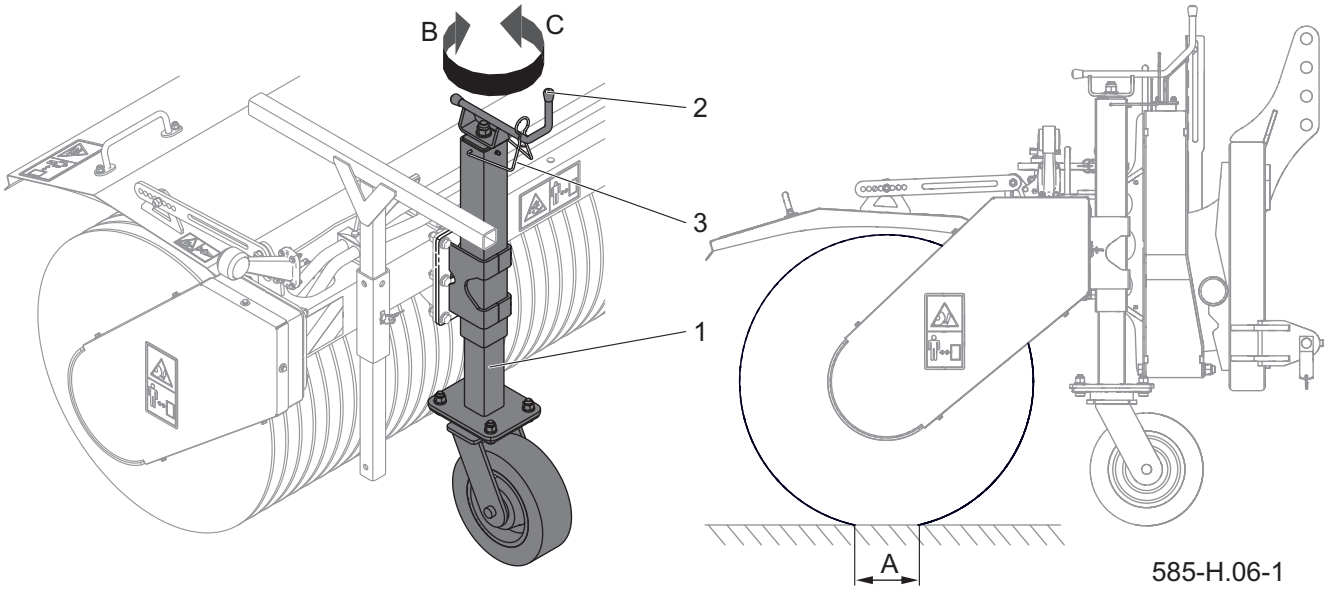

Figure 4.6 Jockey wheel

(1) jockey wheel *(2) crank* *(3) cotter pin*

(A) 60-120mm contact width (B) lowering direction *(C) lifting direction*

should be in the range from 60 do 120 mm. Proper adjustment of wheels ensures uniform wear and long service life of the brush.

CONTROL PANEL

Place the control panel (1) in the operator cab in an easily accessible place (). If the switch (A) is turned clockwise to position (1), the control panel power supply and machine clearance lights are on. The switch (A) in position "1" is illuminated in green. The switch (B) controls the independent

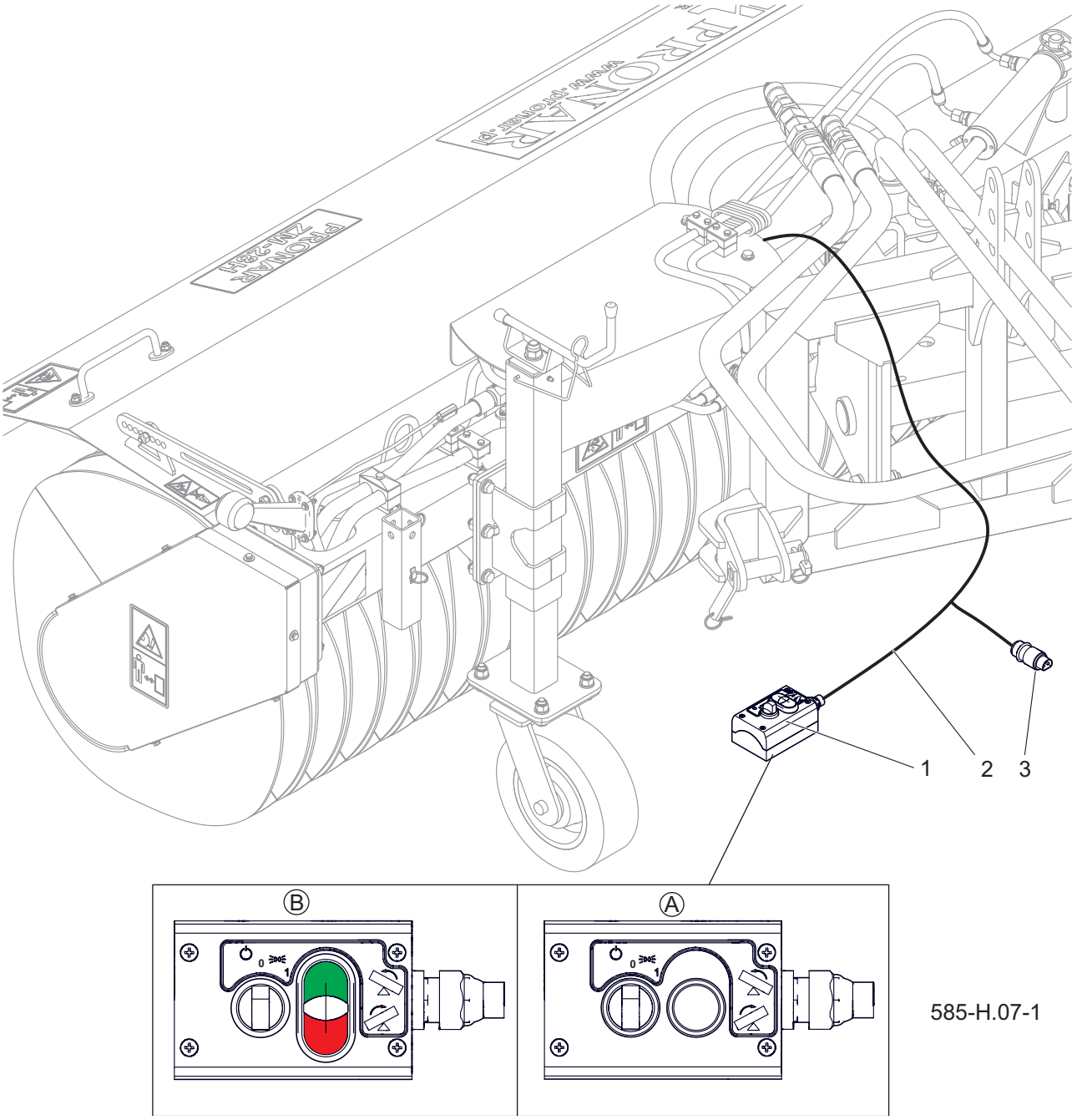

Figure 4.7 Control panel - two versions depending on the machine setup version

(1) control panel (2) wiring harness (3) 3-pin plug

(A) panel - clearance light switch (B) panel - clearance light switch and brush steering control (option)

hydraulic steering of the brush (option). The control buttons light up red or green depending on the direction of the brush turning angle.

CHANG THE WORKING POSITION

Set the machine at an angle when sweeping and clearing snow from side to side.

Depending on the version of the machine, the working position (right / left) can be changed manually or hydraulically from the operator's position.

The machine is equipped with a manual brush steering (figure 4.8), which enables setting three fixed working angles (A, B or C). To change the working angle:

- Remove the securing cotter pin (2), remove the washers (3) and (4).
- Manually adjust the sweeper angle so that the appropriate hole (A , B , C) in the bar (1) coincides with the pin on the machine frame.

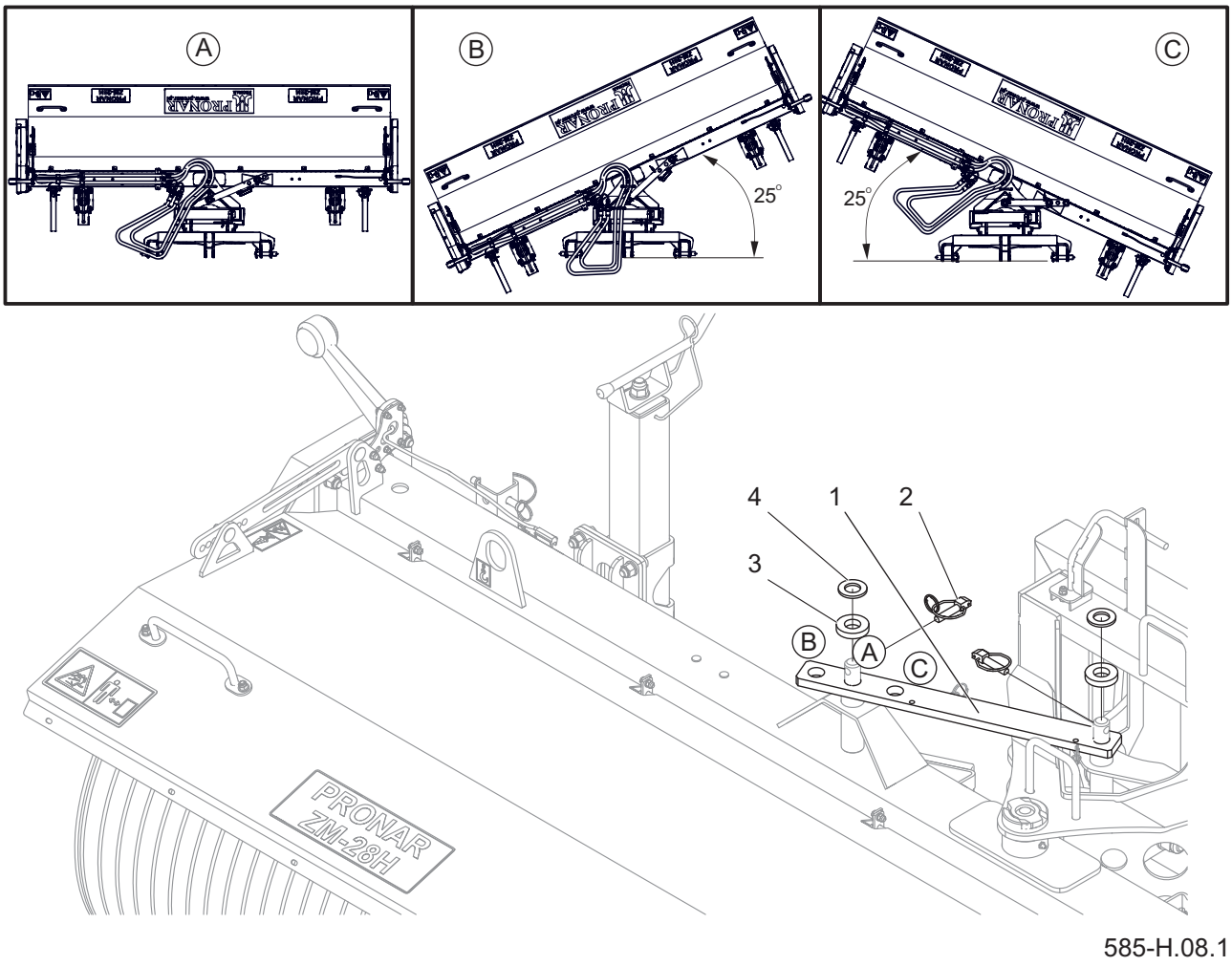

Figure 4.8 Change the working position (machine with mechanical steering system)
(1) strip *(2) cotter pin* *(3) rubber washer*
(4) washer

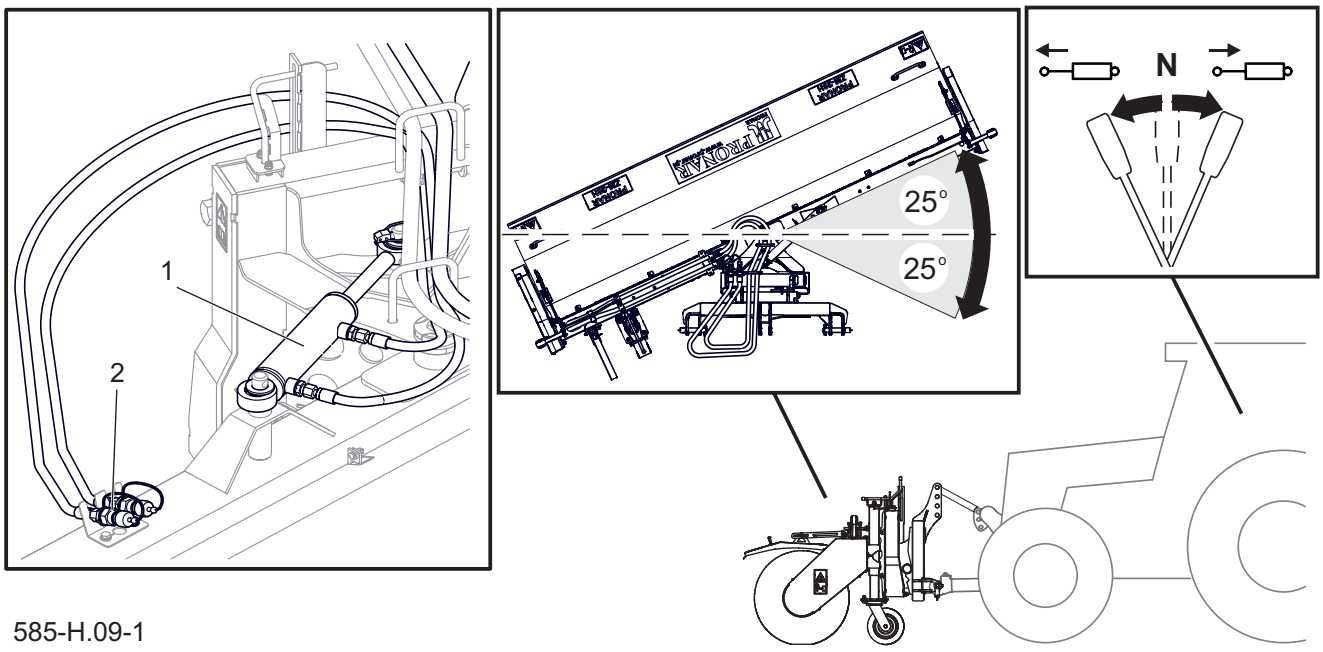

Figure 4.9 Change the working position (machine with hydraulic steering system - second pair of quick couplers)

(1) hydraulic cylinder (2) hydraulic plugs

- Install washers and secure with a cotter pin (2).

The roller brush sweeper equipped with a hydraulic steering (option) has the ability to smoothly adjust the working angle (right / left) in the range of + 25°/-25°. Hydraulic control is done in two ways.

Hydraulic control by means of the second pair of quick couplers (2) (figure (4.9)) connected to the external hydraulic manifold of the carrying vehicle.

The section of the carrier manifold to which the hydraulic lines are connected must be able to circulate oil in both directions.

The brush position is changed by means of the hydraulic cylinder (1) - figure (4.9) - controlled by the appropriate manifold lever.

Independent hydraulic control - figure (4.10) using the control panel. To enable the hydraulic steering function, the main switch (C) should be in position "1" (on). By pressing the appropriate buttons A - turn left and B - turn right, the desired machine working angle can be achieved.

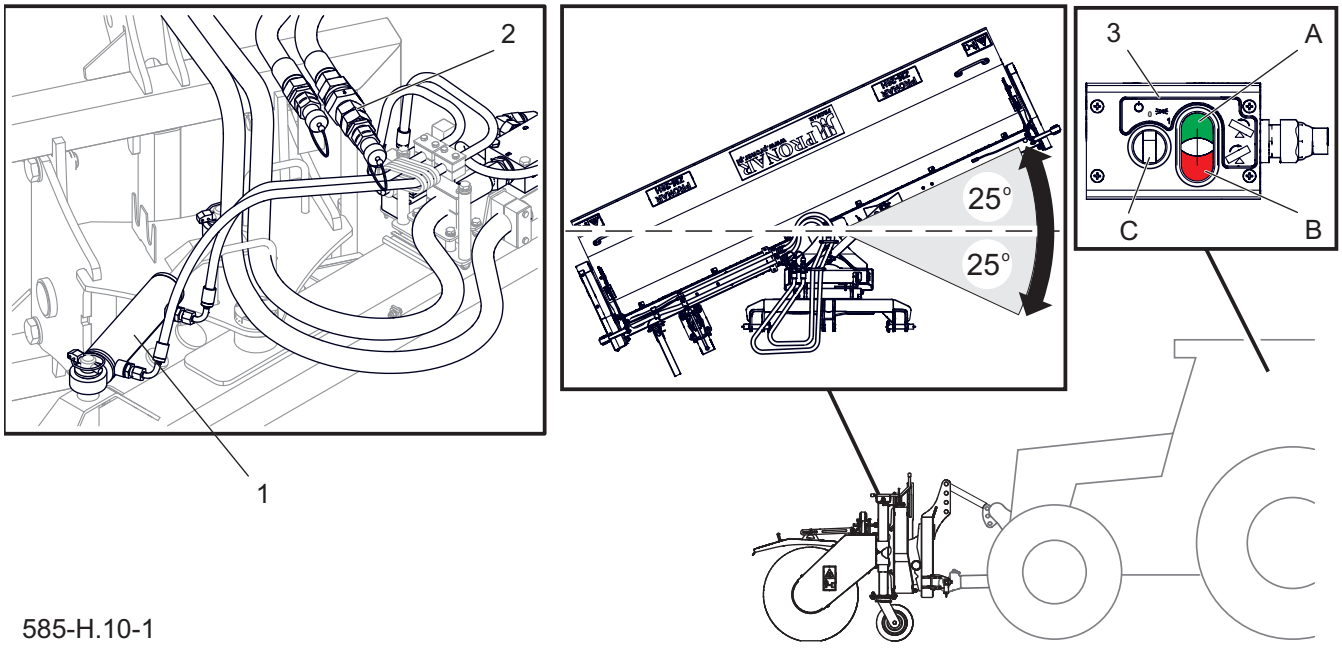

Figure 4.10 Change the working position (machine with hydraulic steering system - independent steering)

(1) hydraulic cylinder *(2) hydraulic plugs* *(3) control panel*

(A) green key, turn right *(3) red key, turn left* *(C) main switch + clearance lights*

IMPORTANT!

For independent control after a power cut, the hydraulic steering function will be disabled.

ROLLER BRUSH COVER

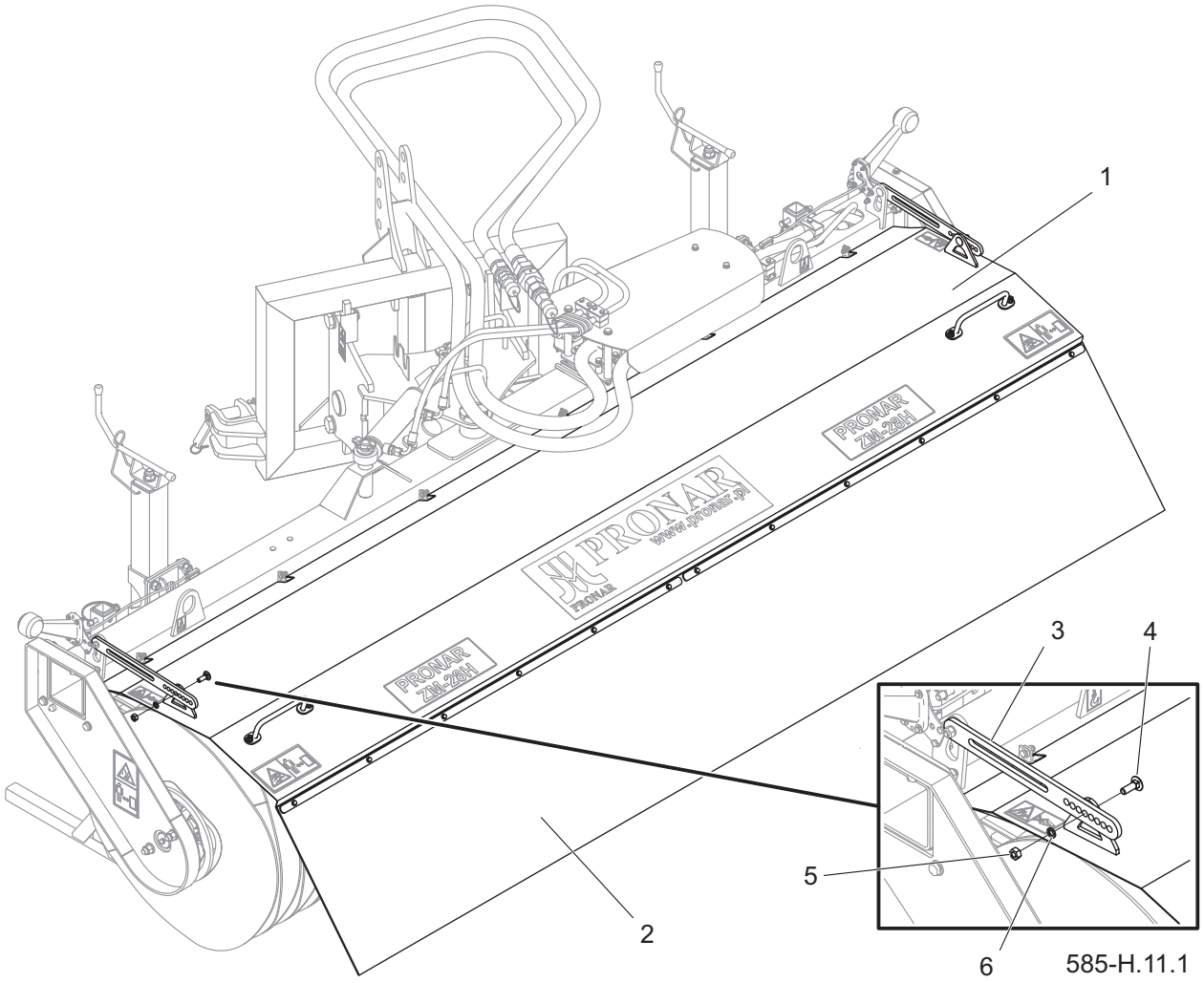

Figure 4.11 Roller brush cover
(1) cover *(2) apron* *(3) arm*
(4) bolt *(5) nut* *(6) washer*

Roller brush sweeper is equipped with an adjustable roller brush cover (1) - figure (4.11). To adjust the cover change the position of the bolt (4) in the rail (3) opening.

Rubber apron (2) is optional equipment.

The brush cover limits the height of the ejected material. It should be set depending on the degree of wear of the sweeping brush and the expected range of the swept material.

IMPORTANT!

Periodically check the technical condition of the roller brush cover and replace, if necessary.

4.5 DRIVING ON PUBLIC ROADS

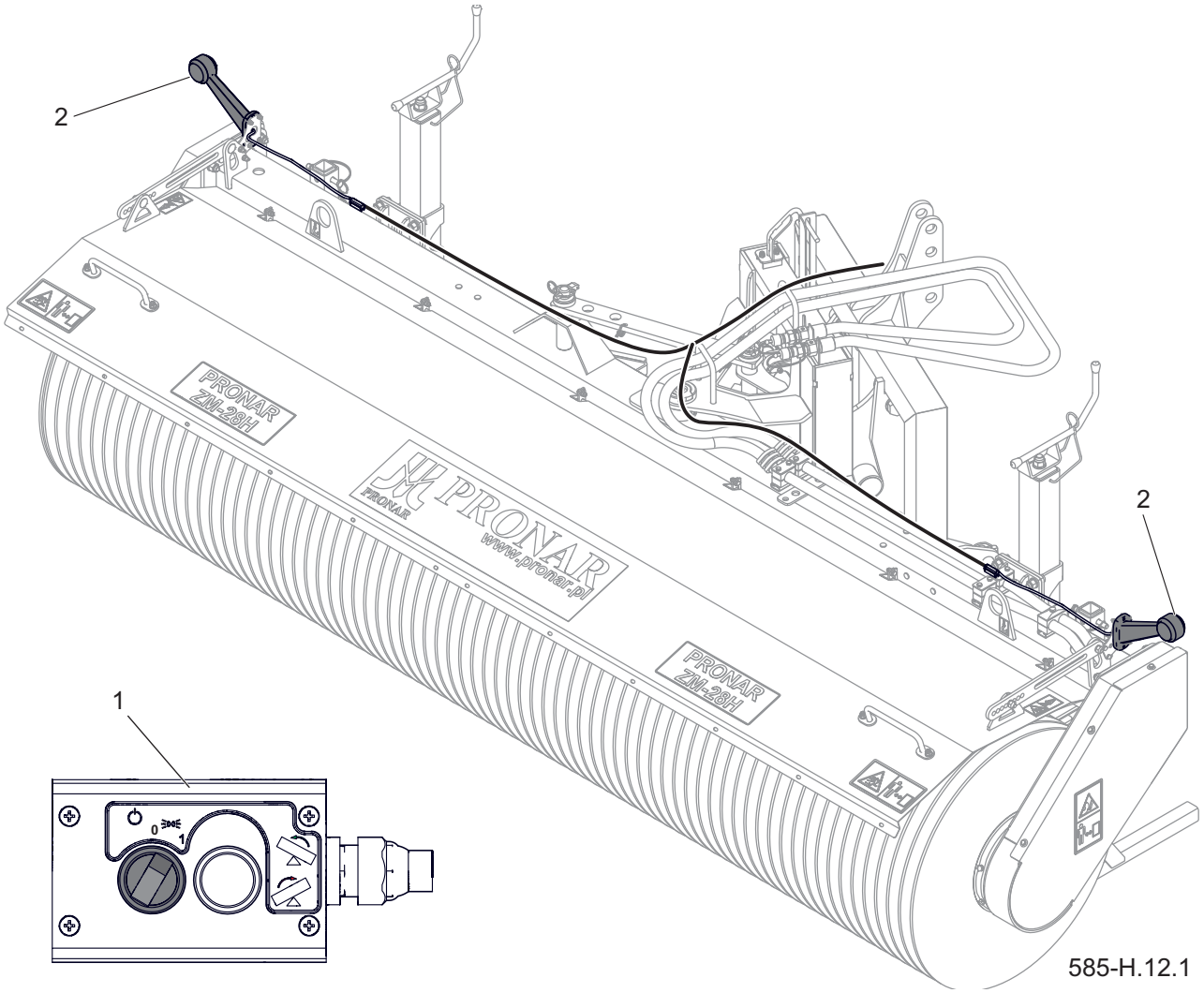

Figure 4.12 Machine clearance lights
(1) control panel *(2) clearance lights*

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

- Before moving off make sure that there are no bystanders, especially children, near the machine and the carrier vehicle. Ensure that the driver has sufficient visibility.
- Make sure that the machine is correctly attached to the carrier vehicle

IMPORTANT!

The clearance lighting of the roller brush sweeper does not turn on simultaneously with the carrier lighting.
To turn on the sweeper clearance lighting (Figure 4.12) , set the main switch (1) to position "1" (on).

(tractor), and linkage is properly secured.

- Do not exceed the operation speed and maximum transport speed allowed by road traffic regulations. Ground speed should be adjusted to prevailing road conditions and other conditions.
- While driving on public roads turn on clearance lights - figure (4.12).
- While working with the roller brush sweeper, turn on the orange beacon light (carrier vehicle equipment).
- Avoid ruts, depressions, ditches or driving on roadside slopes. Driving across such obstacles could cause the machine and the carrier vehicle to suddenly tilt. Driving near ditches or canals is dangerous as there is a risk of the wheels sliding down the slope or the slope collapsing.
- Speed must be sufficiently reduced before making a turn or driving on an uneven road or a slope.
- When driving on uneven terrain with the machine raised, reduce speed due to dynamic loads and the risk of damaging the machine or carrier vehicle.
- When driving with raised machine, secure the carrier vehicle's linkage against falling or accidental dropping.

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4.6 UNHITCH THE MACHINE FROM CARRIER VEHICLE

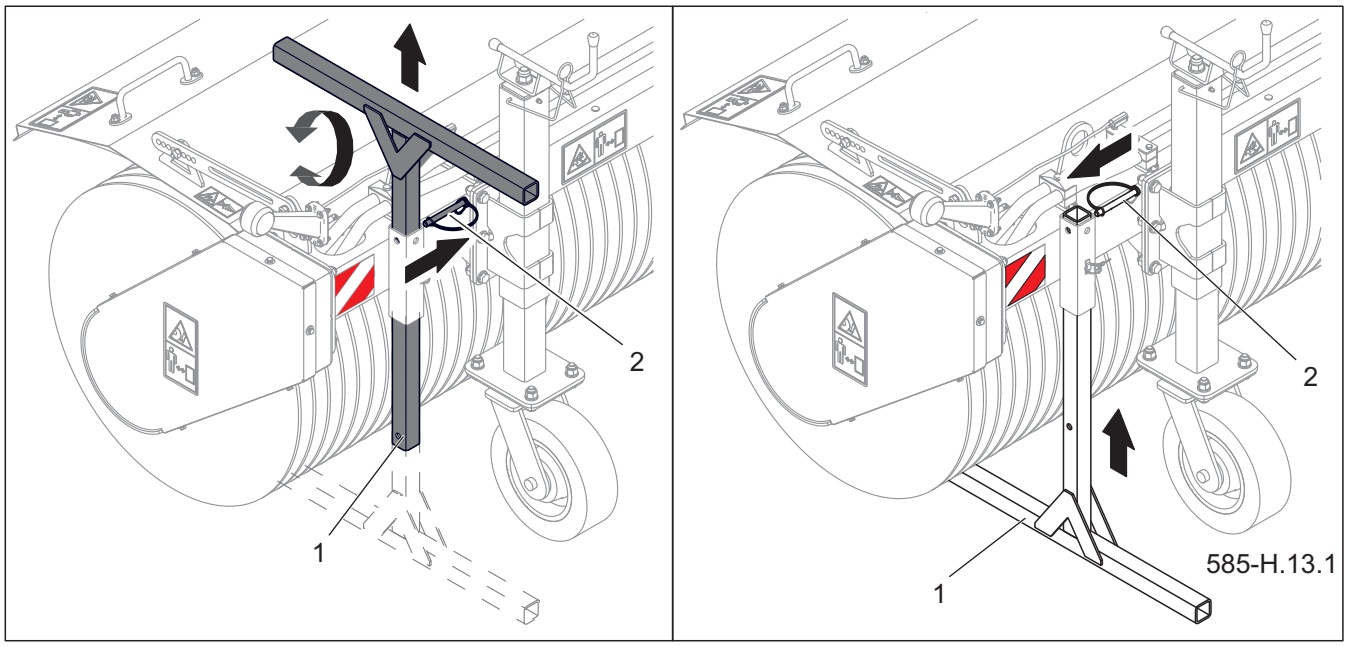

Figure 4.13 Parking stands
(1) support *(2) cotter pin*

Roller brush sweeper disconnected from the carrying vehicle should be supported on two parking stands. If the sweeper roller brush rests on the ground, the brush bristle may get deformed.

In order to disconnect the machine from the carrier vehicle, proceed as follows:

- Rotate and fix the parking stands - figure (4.13).
- Lower the machine until the parking stands (1) rest completely on the ground.
- Switch off engine, remove key from ignition and engage parking brake.
- Reduce residual pressure in the hydraulic system by moving the appropriate control lever of the hydraulic circuit in the carrier.
- Disconnect hydraulic line plugs and

DANGER

Before unhitching the machine from the carrier vehicle, turn off the carrier vehicle's engine, engage parking brake and secure cab against access of unauthorised persons.

IMPORTANT!

Do NOT disconnect the machine from the carrying vehicle before attaching the parking stands.

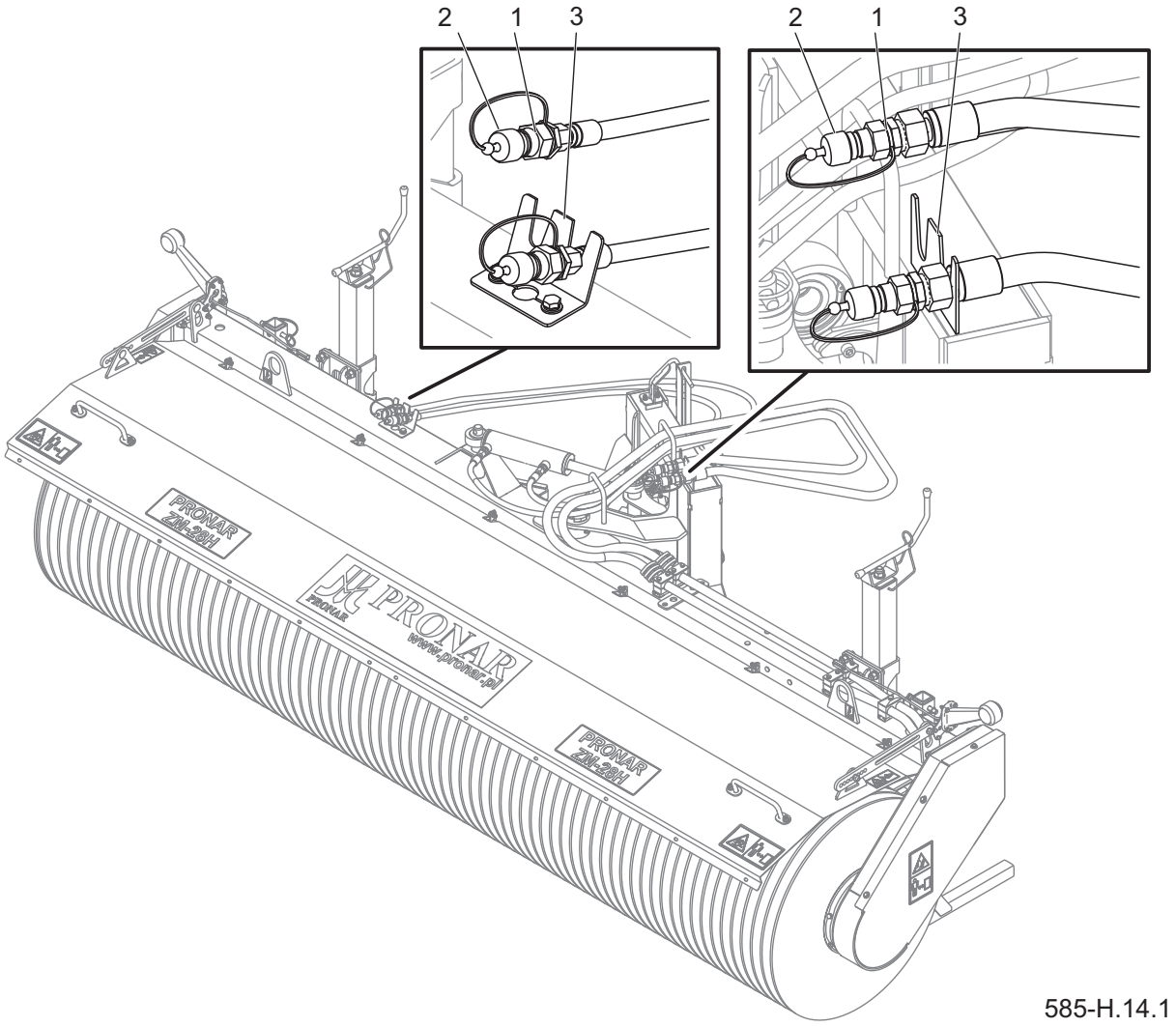

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Figure 4.14 Protec the plugs disconnected from the carrier vehicle
(1) hydraulic plug (2) plug cap (3) bracket

electric lead plugs from the carrier vehicle and secure with stoppers. Place the hydraulic plugs in the brackets on the frame - figure (4.14).

- Disconnect the linkage and drive the carrier vehicle away from the machine.

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SECTION 5

MAINTENANCE

5.1 ADJUSTMENT OF ROLLER BRUSH

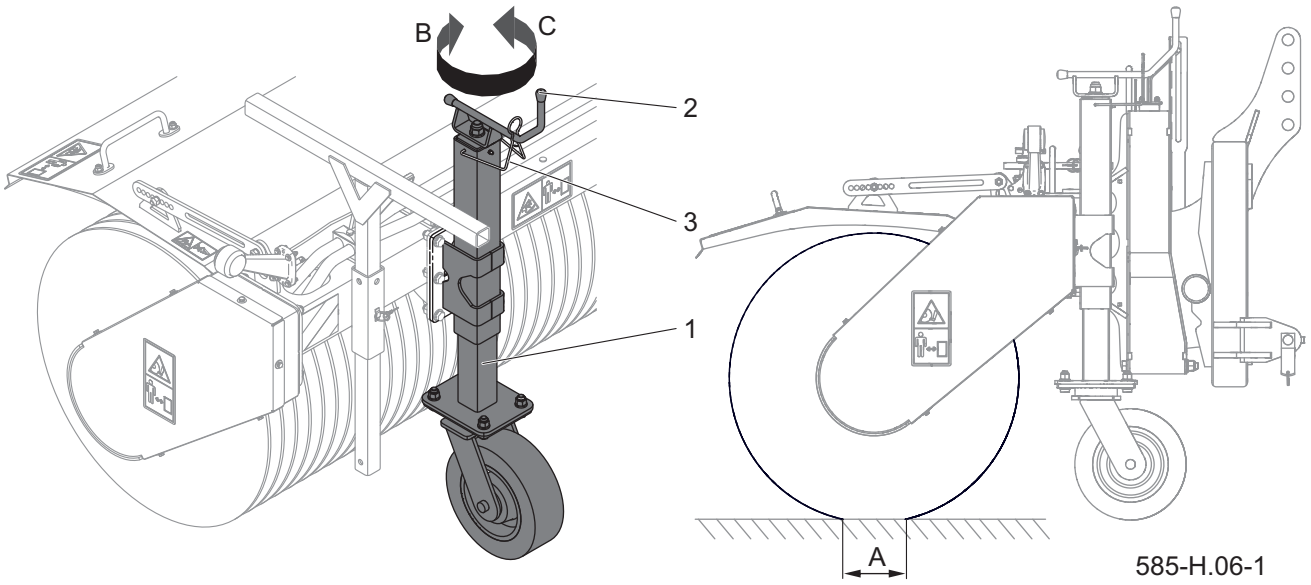

Figure 5.1 Adjustment of brush pressure
(1) jockey wheel *(2) knob* *(3) cotter pin*
(A) 60-120mm clamp width

Correct setting of the brush pressure impacts the sweeping performance, ensure even wear and extends the brush lifetime. When setting the brush, take its wear into account. The width of brush ground contact surface figure (5.1) should be in the range from 60 do 120 mm. Knobs (2) of jockey wheels (1) located on both sides of the machine allow smooth adjustment of the brush position. Before adjusting, unlock the cotter pin (3). The brush pressure on the right and left side of the machine should be the same. Different height of the sweeping brush for the right and left side will cause uneven brush wear and can damage the machine.

DANGER

Adjust the roller brush only when the carrier vehicle is turned off, remove the ignition key from the ignition switch.

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5.2 INSPECT AND REPLACE ROLLER BRUSH

5.2.1 DISASSEMBLE ROLLER BRUSH

Technical condition of the sweeper brush should be inspected regularly while using the machine.

Excessively worn or damaged sweeping brush should be replaced. Before replacing the roller brush, make sure that the sweeper is disconnected from the carrier vehicle's hydraulic system and that the residual pressure in the hydraulic system is reduced. It will be easier to disassemble the brush by lifting the brush cover up as high as possible. Set the height of the jokey wheels on which the machine rests so that the brush is in contact with the ground.

To replace the roller brush (figure 5.2), proceed as follows:

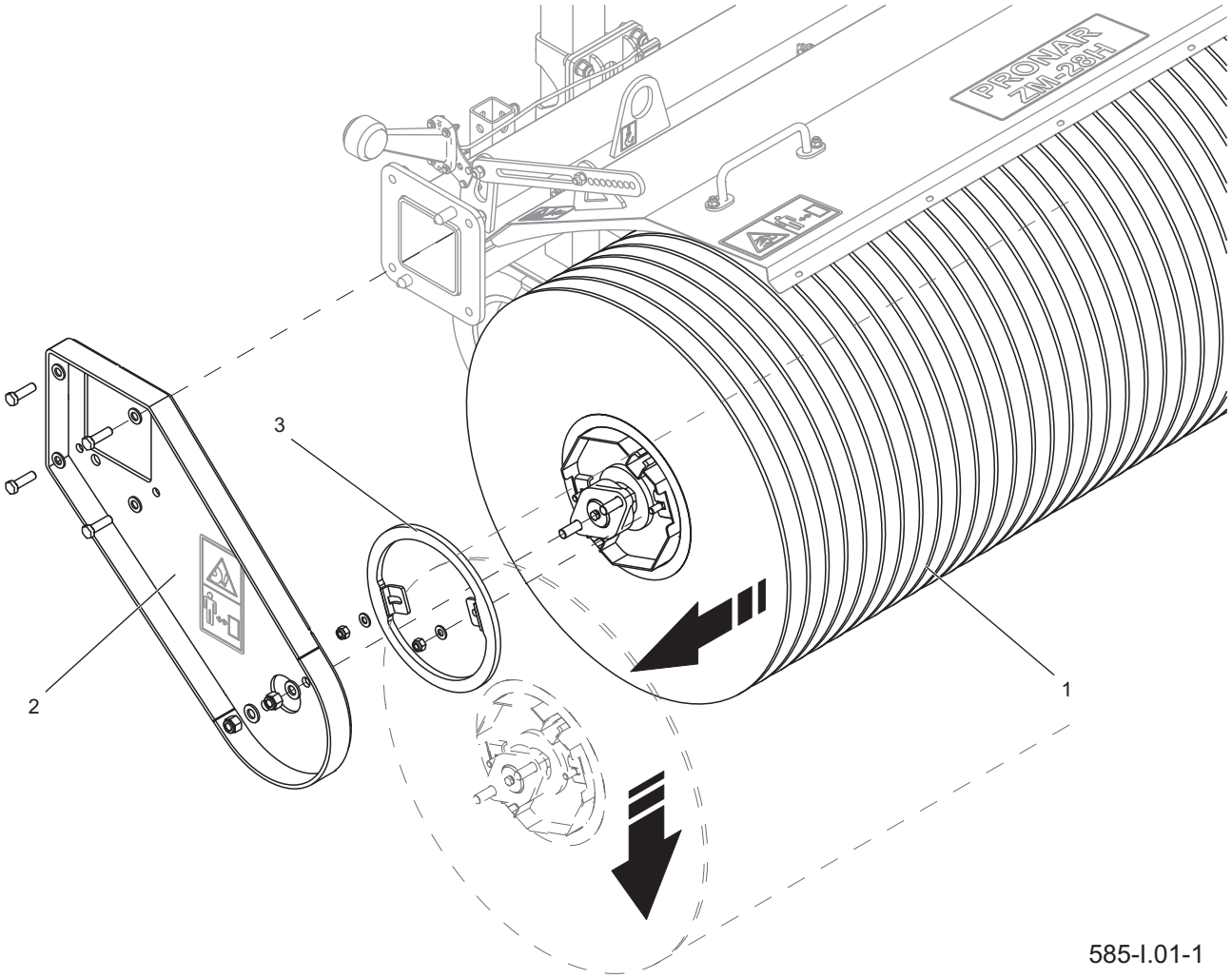

Figure 5.2 Disassemble the sweeper roller brush
(1) roller brush *(2) arm* *(3) closing ring*

- unscrew the bolts securing the right arm (2) and bolts securing the bearing,

  after unscrewing the bolts, the brush and the shaft may fall slightly

- remove the closing ring (3),
- remove the individual brush segments (1) from the shaft.

5.2.3 A ROLLER BRUSH WITH STRAIGHT SEGMENTS

The roller brush consists of individual segments which should be properly mounted on the machine shaft - figure (5.3). If you select a hard brush, start and finish the assembly of the segments on the shaft on the outer segment (D) - PPN 2x3. When installing the hard brush, the segments (A) and (C) should be mounted alternately on the shaft. Between each straight segment of the brush, a total number of 73 distance rings (2) should be used. After inserting all segments on the end of the shaft, install the locking ring (3). Brushes having various parameters and designed for various applications are available depending on the customer's requirements - table (5.1).

5.2.4 A ROLLER BRUSH WITH CURVED SEGMENTS

The roller brush may consist of curved

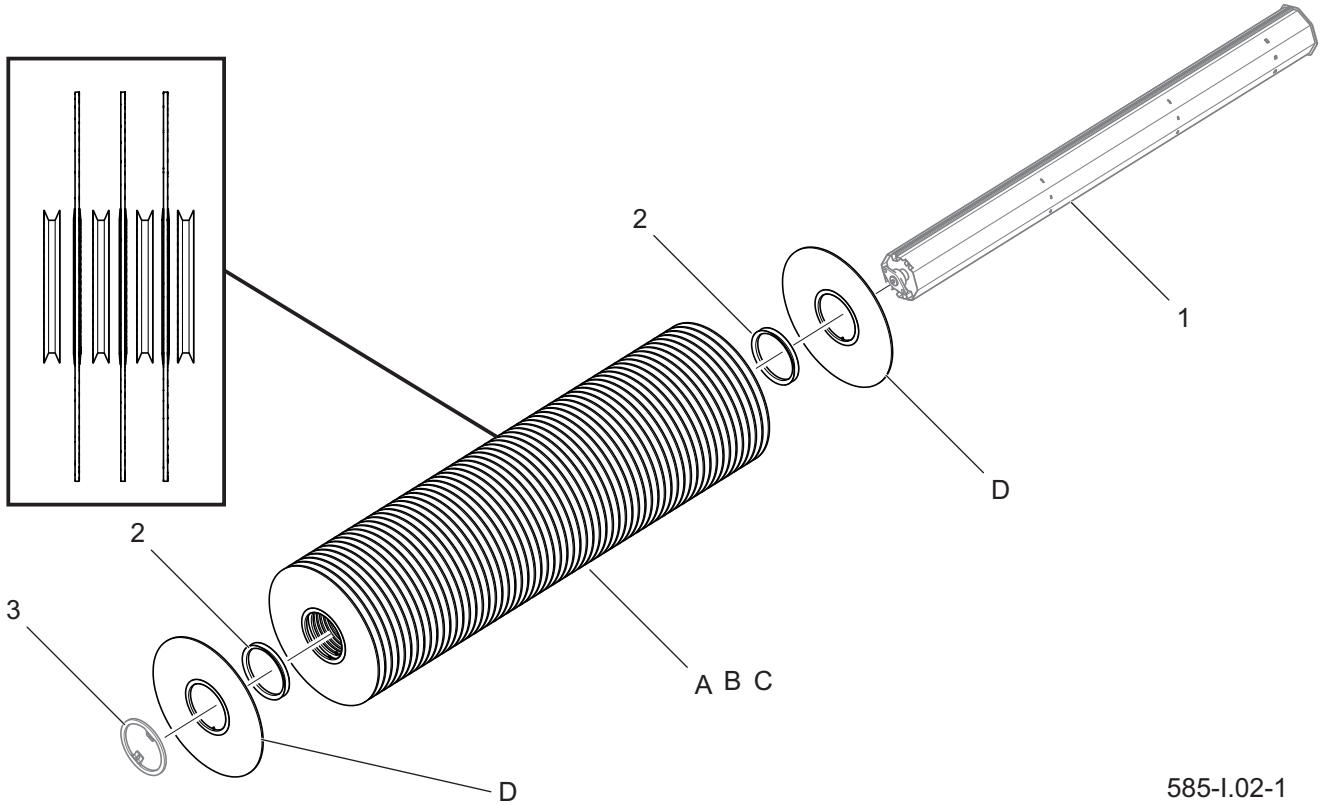

Figure 5.3 A roller brush with straight segments

(1) shaft *(2) spacer ring* *(3) closing ring*

(A), (B), (C) brush segments depending on the hardness *(D) outer segment*

Table 5.1 List of straight segment roller brush components

ROLLER BRUSH HARDNESS	BRUSH SEGMENTS (FIGURE 5.3)	QUANTITY	SEGMENT PART NUMBER
Medium (plastic 2x3mm)	A	76	531N-00000010-01
Soft (plastic 1.6mm)	B	76	531N-00000010
Hard (plastic 2x3mm + wire 0.7	A	37	531N-00000010-01
	C	38	531N-00000010-02
	D	2	531N-00000010-01
Very hard (wire 0.7)	C	76	531N-00000010-02

segments - figure (5.4). When installing the curved bent segments (A, B, C), position them so that they form a honeycomb. In the case of a hard brush, segments (A) and

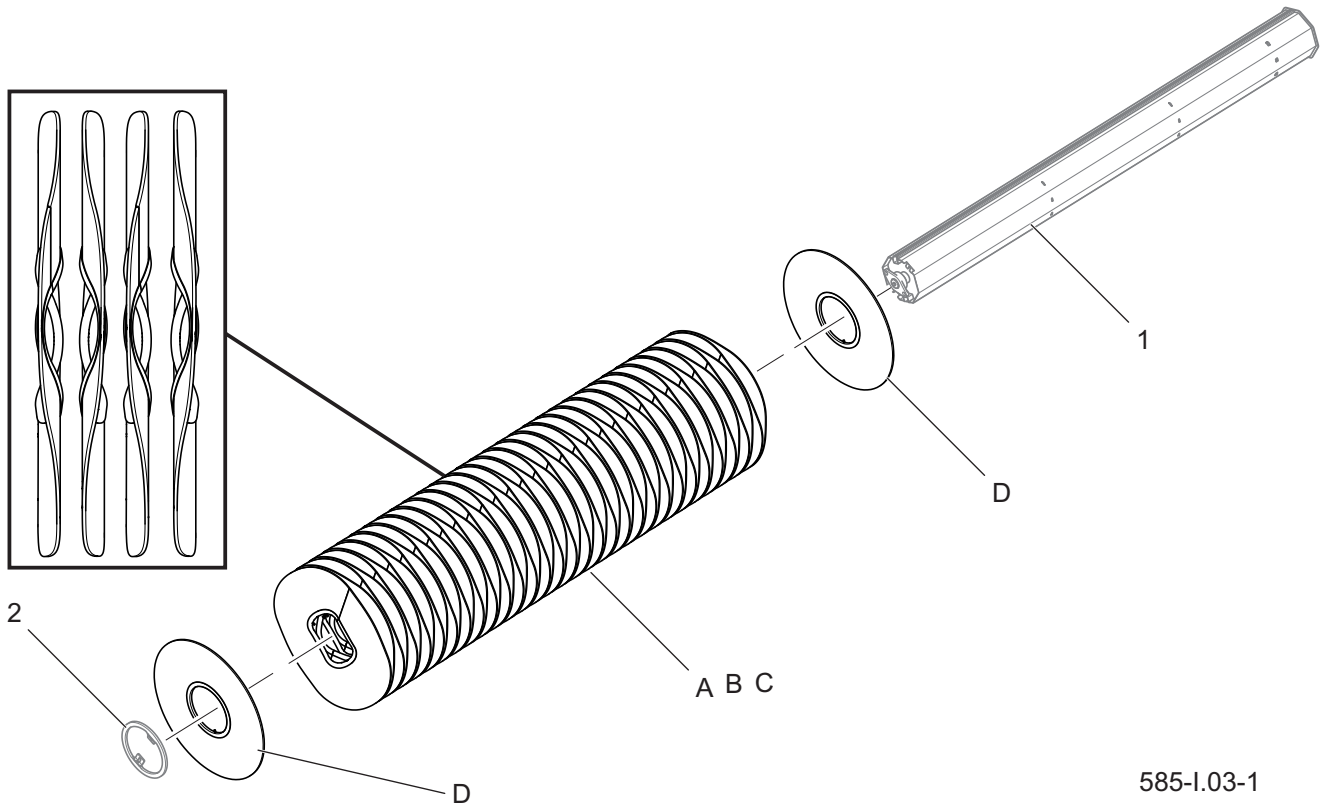

Figure 5.4 A roller brush with curved segments
(1) shaft *(2) closing ring*
(A), (B), (C) brush segments depending on the hardness *(D) outer segment*

Table 5.2 List of curved segment roller brush components

ROLLER BRUSH HARDNESS	BRUSH SEGMENTS (FIGURE 5.4)	QUANTITY	SEGMENT PART NUMBER
Medium (plastic 2x3mm)	A	68	531N-00000012-01
Soft (plastic 1.6mm)	B	68	531N-00000012
Hard (plastic 2x3mm + wire 0.7	A	33	531N-00000012-01
	C	34	531N-00000012-02
	D	2	531N-00000012-01
Very hard (wire 0.7)	C	68	531N-00000012-02

(C) should be installed alternately starting and ending with segment (D) - PPN 2x3. Do not use spacer rings between the brush segments. After inserting all segments on the end of the shaft, install the locking ring (2). The list of curved segment types is presented in table (5.2).

5.2.5 INSTALL A ROLLER BRUSH

Before inserting the brush segments (2), remove the shaft (1) from the machine - the right side of the shaft at the hydraulic motor can be pulled out without the use of tools - figure (5.5). When installing individual segments (2), it is recommended to use at least 3 stands that allow the shaft to be supported on the bearing journal (1 support) and on the external shaft profile (2 supports). As the shaft is heavy (~ 51 kg), it is recommended to use lifting devices. After inserting and securing the segments, place the brush on the ground. Using the jockey wheels, roll the brush under the machine set at the correct height. Then slide the shaft (1) onto the left arm (4) of the machine, put on the right arm (3) and screw it to the machine frame and the bearing (5) to the arm.

DANGER

Be extra careful as there is a risk of crushing the limbs.
Considering the heavy weight of the brush, use lifting devices and the help of another person.
Use suitable protective clothing

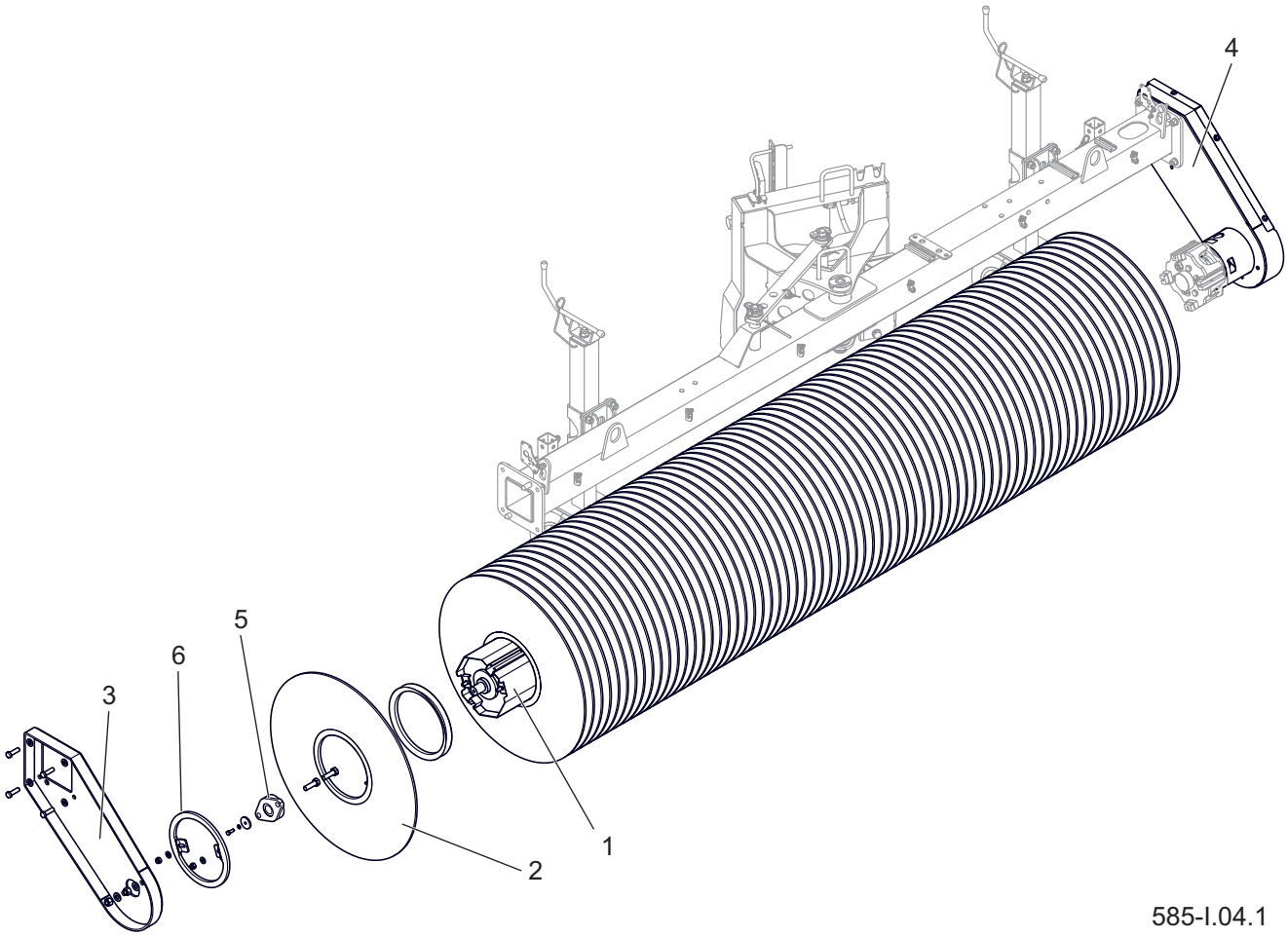

Figure 5.5 Sweeping brush

(1) shaft *(2) brush segment* *(3) right arm*
(4) left arm *(5) bearing* *(6) securing component*

The technical condition of the sweeping brush and its wear should be inspected regularly while the machine is in use.
Worn or damaged segments should be replaced with parts recommended by the Manufacturer.

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5.3 ELECTRICAL SYSTEM MAINTENANCE

The service of the electrical system involves periodic inspection of the operation of the control system as well as the clearance lighting.

The snow plough's clearance lights are maintenance-free LED lights. Damaged flapms should be replaced with new ones.

DANGER

Do not independently repair electrical system, except items described in chapter ELECTRICAL SYSTEM MAINTENANCE. All electrical system repairs must be performed only by suitably qualified personnel.

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5.4 HYDRAULIC SYSTEM MAINTENANCE

Hydraulic system maintenance duties:

- check tightness of cylinder and hydraulic connections;
- check technical condition of hydraulic lines and quick couplers;

The hydraulic system of new machine is factory filled with HL32 hydraulic oil. Because of its composition, the oil 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.

DANGER

Do not repair hydraulic system on your own. All hydraulic system repairs must be performed only by suitably qualified personnel.
Before commencing whatever work on hydraulic system reduce the pressure in the system.

IMPORTANT!

Before starting work, visually inspect the hydraulic system components.

DANGER

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

The condition of hydraulic system should be inspected regularly while using the machine.
Hydraulic lines should be replaced after 4 years of machine use.

DANGER

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

Table 5.3 HL32 hydraulic oil specification

LP	Name	Value
1	ISO 3448VG viscosity classification	32
2	Kinematic viscosity at 40°C	28.8 – 35.2 mm²/s
3	ISO 6743/99 quality classification	HL
4	DIN 51502 quality classification	HL
5	Flash point, [°C]	Above 210°C
6	Maximum operating temperature, [°C]	80

Spilt oil should be immediately collected and placed in a marked tight container. Used oil should be taken to the appropriate facility dealing with recycling or regeneration of oils.

The hydraulic system must be tight. When the hydraulic cylinder is fully extended, make sure there are no signs of leakage. If oil is found on hydraulic cylinder body, check origin of leak. Minimum leaks are permissible with symptoms of "sweating", however in the event of noticing leaks in the form of "droplets" stop using the machine until faults are remedied.

If an oil leak is found on hydraulic connections, tighten the connections. If this does not remedy the problem, replace the lines and connection components. Always exchange each mechanically damaged component.

IMPORTANT!

The hydraulic system is vented automatically during machine operation.

DANGER

Keep away from hot hydraulic system components. Risk of scalding by hydraulic oil if the system is leaking.

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5.5 LUBRICATION

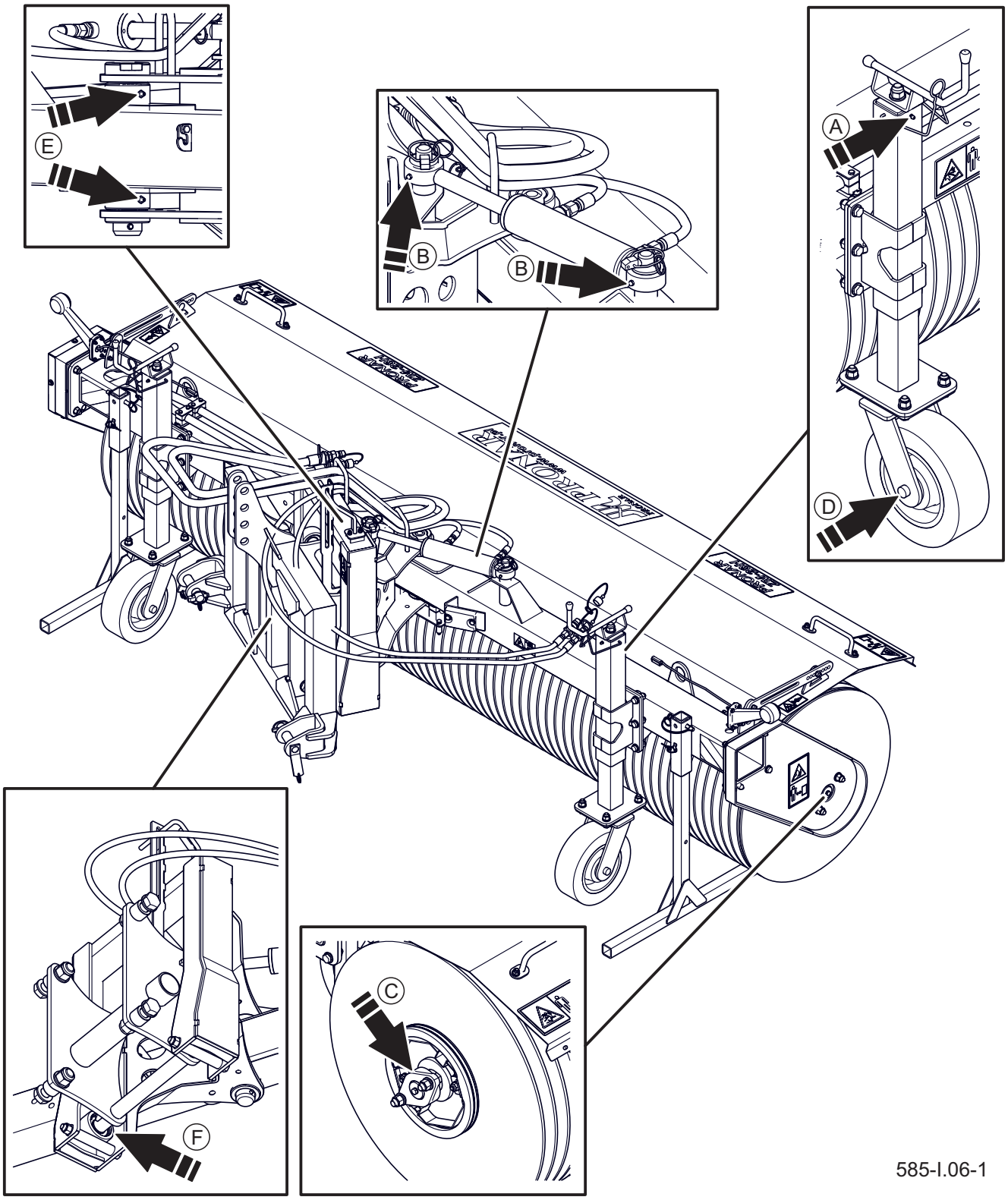

Figure 5.6 Lubrication points

Lubrication points are detailed in TABLE 5.4

Table 5.4 Lubrication points and lubrication frequency

LP	Name	Number of lubrication points	type of grease	lubrication frequency
A	Jokey wheel bolt	2	grease	50 hours
B	Hydraulic cylinder eye	2		50 hours
C	Sweeping roller bearing	1		20 hours
D	Jockey wheel axle	2		20 hours
E	Central pin	2		50 hours
F	Suspension guide roller	4		20 hours

Machine lubrication should be performed with the aid of a manually or foot operated grease gun, filled with generally available grease. Before commencing lubrication insofar as is possible remove old grease and other contamination. Remove and wipe off excess oil or grease ŁT-43-PN/C-96134 grease is recommended for lubrication.

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

DANGER

Lubricate the machine when it is lowered on its supports and resting on the ground.
Before lubricating, switch off the carrier vehicle's engine, remove key from ignition and engage parking brake.

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5.6 STORAGE

After finishing work, clean and wash the machine thoroughly with a water jet. While washing, do not direct a strong water or steam jet at information and warning decals or hydraulic lines and electrical components. Nozzle of pressure or steam washer should be kept at a distance of not less than 30 cm from cleaned surface.

After cleaning, inspect the whole machine, inspect technical condition of individual elements. Repair or replace any used or damaged components.

In the event of damage to the paint coat, clean rust and dust from damaged area, degrease and then paint with undercoat and after it is dry paint with surface coat paint retaining colour uniformity and even thickness of protective coating. Until the time of touch-up painting, the damaged place may be covered with a thin layer of grease or anticorrosion preparation.

Machine should be kept in closed or roofed building.

If the machine will not be used for a long time, protect it against adverse weather conditions. Lubricate machine according to the instructions provided. In the event of a prolonged storage, it is essential to lubricate all components regardless of the date of the last lubrication. Additionally, before winter, apply grease to hitching system pins.

Machine disconnected from the carrier vehicle should be placed on parking stands, on level, sufficiently hard surface in such a manner as to ensure that it is possible to connect it again.

The control panel and the connection cable must be disconnected from the machine and protected against adverse weather conditions.

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5.7 INSPECTION OF TIGHTENING TORQUE OF NUT AND BOLT CONNECTIONS

During maintenance or repair work, apply appropriate torque when tightening bolt and nut connections, unless other tightening torque values are given. Recommended tightening torques of the most frequently used bolt and nut connections are given in the table (5.5).

Given values apply to non-lubricated steel bolts.

If you need to replace the fasteners (bolts, nuts), the lowest allowable strength class is 8.8. Do NOT use nut and bolt connections of a lower strength class.

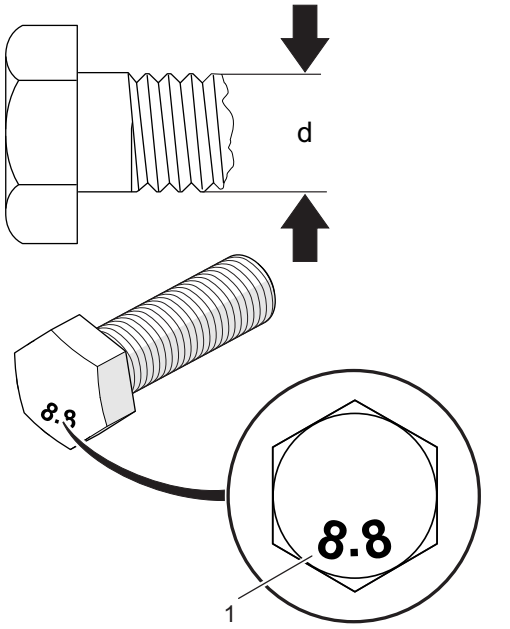

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Figure 5.7 Bolt with metric thread

(1) resistance class *(d) thread diameter*

Table 5.6 Tightening torques for hydraulic line connections

Line size	Tightening torque
DN	[Nm]
8	30÷50
10	50÷70
13	50÷70
16	70÷100
20	70÷100
25	100÷150
32	150÷200

Table 5.5 Tightening torque for nut and bolt connections

Thread	8.8	10.9
	M [Nm]	
M10	49	72
M12	85	125
M14	135	200
M16	210	310
M20	425	610
M24	730	1,050
M27	1,150	1,650
M30	1,450	2,100

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5.8 TROUBLESHOOTING

Table 5.7 Troubleshooting

TYPE OF FAULT	CAUSE	REMEDY
Working position cannot be changed (hydraulic turning system)	The electrical system is not connected to the carrier vehicle	Connect connection lead to the carrier vehicle's electrical system.
	Control panel not connected or damaged	Connect the control panel or have it repaired by an authorized service centre
	Hydraulic system not connected to the carrier vehicle or connected incorrectly	Connect hydraulic quick-couplers to a proper section of the carrier vehicle's hydraulic system.
	Damaged fuse on power lead	Check and, if necessary, replace the fuse in the power lead in the carrier vehicle (if installed)
	The machine hydraulic system is damaged	Repair at an authorised service point
	The machine electrical system is damaged	Repair at an authorised service point
Brush does not rotate or works incorrectly	Hydraulic system is not connected or is connected incorrectly.	Connect hydraulic lines in a proper manner to the carrier vehicle's hydraulic system.
	Insufficient oil pump delivery in the carrier vehicle or wrong pressure in the hydraulic system	Check parameters of the carrier vehicle's hydraulic system
	Hydraulic system is damaged	Repair at an authorised service point
No lighting	The electrical system is not connected to the carrier vehicle	Connect connection lead to the carrier vehicle's electrical system. Check connections on electric leads.
	Damaged clearance lamp	Replace the lamp
	The machine electrical system is damaged	Repair at an authorised service point
	Control panel is damaged	Repair at an authorised service point

Table 5.8 Troubleshooting

TYPE OF FAULT	CAUSE	REMEDY
The brush does not thoroughly sweep the dirt	Incorrectly positioned linkage. Ground surface tracking is not possible (swivel linkage).	Adjust according to the Operator Manual
	The roller brush rotation speed is too low	Increase RPM
	Pressure applied to the surface by the roller brush is incorrectly set	Adjust according to the Operator Manual
	Driving too fast	Adjust driving speed
	Brush excessively worn	Adjust or replace

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