MACRO M60

Street Sweeper

User & Maintenance Manual

P/N: 571001082-00, Rev-A, 07/2017

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INFORMATION

The Instructions for Use are integral part of the machine and must come along with it for the entire lifetime until demolition.

Before executing any operation with or on the machine, read and understand all the procedures and the warnings described in this Manual.

For every operation always refer to what prescribed in this Manual and strictly respect all the reported indications.

Forbid the use of the machine to the operators who do not know the prescriptions and the procedures contained in the Manual.

Under the directive 89/392 CE, DPR459 of 24/07/1996 and following updates, we specify that "OPERATOR" means the person responsible for the installation, the operation, the adjustment, the maintenance, the cleaning, the repair and the transport of the machine.

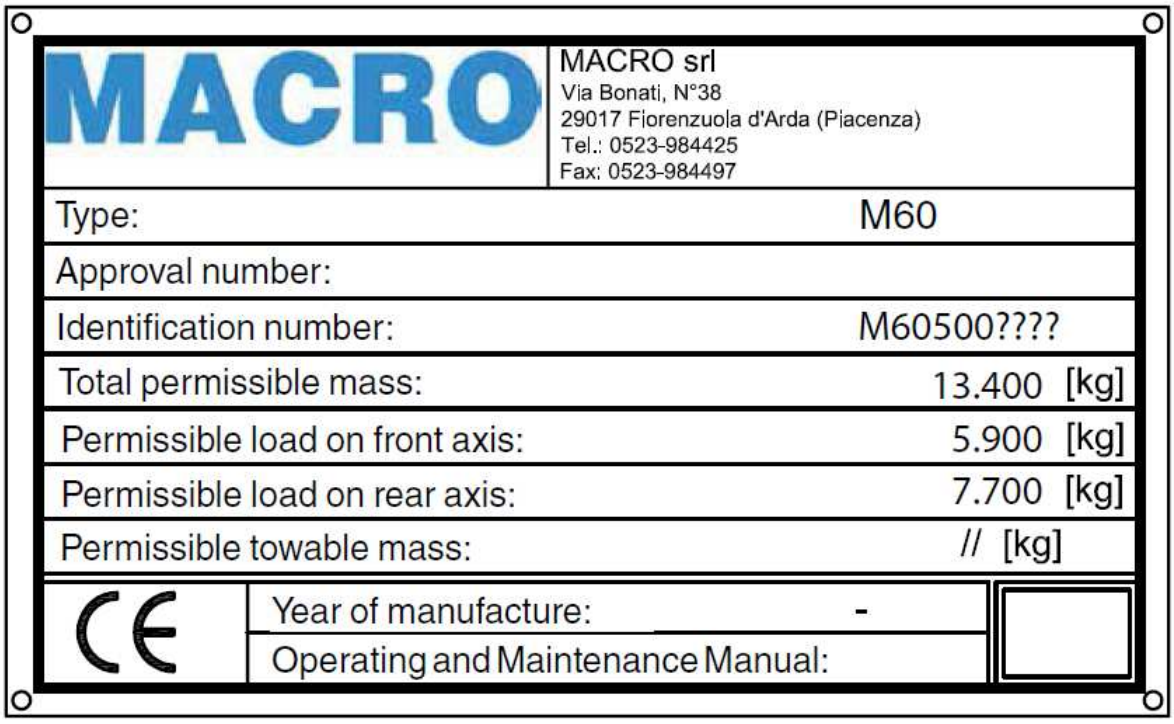
The company Roots Multiclean Ltd. will not consider itself as responsible for troubles, accidents, etc. due to the bad knowledge of the procedures contained in this Manual.

The same rules for the execution of modifications, of changes or for the installation of accessories not previously authorized.

Chapter 1 **Preamble**

1.1 IDENTIFICATION OF THE MACHINE

The machine is identified by the CE Marking prepared according to the specifications of Machinery Directive 2006/42/EC and subsequent amendments. The following figure shows an example of an ID plate for the machine, which is riveted on the right side of the inner bonnet, in front of the driver's seat.



Pict. 1-1 Manufacturer plate : M60ST

INFORMATION

Refer to these details to order spare parts and for each type of contact with the manufacturer (correspondence - information request).

INFORMATION

The machines may be updated or aesthetically modified and, therefore, may have different parts to those shown here, without this affecting the descriptions contained in these instructions.

1.2 DECLARATION OF CONFORMITY

Each machine is provided with the Declaration of Conformity. Roots Multiclean Ltd..guarantees compliance of its machine with the directives mentioned and affixes the marking CE on the machine itself. Below is an example of a Declaration of Conformity for the M60 type operating machine

MACRO

Via L. Bonati N°38 - 29017- Fiorenzuola d'Arda (Pc)

DICHIARAZIONE CE DI CONFORMITA'

Macchina operatrice tipo: M60

Numero d'identificazione: M605000151

Anno di fabbricazione: 2014

Certifichiamo la conformità ai requisiti delle direttive:

2006/42/CE - 2000/14/CE - 2004/108/CE

La documentazione tecnica corrispondente può essere messa a disposizione.

Nella costruzione e produzione sono state osservate le seguenti norme:

EN ISO 12100-1/2003: Sicurezza delle macchine, Terminologia di base, linee guida generali di progettazione

EN ISO 13857/2008: Sicurezza delle macchine Distanze di sicurezza contro il raggiungimento di punti pericolosi con le quote articolate superiori

EN 982/2008: Requisiti tecnici di sicurezza di impianti tecnici contenenti fluidi e loro coponenti - idraulica

EN 13019/2001: Ma cchine per la pulizia del fondo stradale. Requisiti di sicurezza

Livello di potenza sonora rilevato: xx [dB (A)]

Livello di potenza sonora garantito: xx [dB (A)]

La procedura di valutazione della conformità corrisponde all'allegato V della direttiva 2000/14/CE

1.3 IDENTIFICATION OF MANUFACTURER

MACRO

1.4 OTHER MANUALS OF REFERENCE

- Operating Instructions Manual for Diesel Engine OM 904 LA.

INFORMATION

Roots Multiclean Ltd. being committed to continuous product and quality development, reserves the right to modify the data contained in this publication at any time.

1.5 GENERAL WARNINGS

This chapter contains some warnings that allow you to properly use the machine without danger for the Operators and property. Below, in more detail, are those warnings that must be perfectly understood to correctly perform the operations stated in the various chapters.
We have chosen to use a few but clear attention pictograms, in order to make consultation easier and immediate.

DANGER

The operations representing a potentially dangerous situation for operators are highlighted by the symbol shown at the side.

These operations may cause slight or severe physical injuries, including death. ONLY proceed with the operations being performed if the conditions highlighted by this symbol are complied with.

ATTENTION

The operations representing a potentially dangerous situation for operators are highlighted by the symbol shown at the side.

These operations must be correctly performed to avoid causing damage to property or to the surrounding environment. ONLY proceed with the operations being performed if the conditions highlighted by this symbol are complied with.

1.6 USE AND MAINTENANCE MANUAL

1.6.1 PURPOSE

The purpose of this Manual is to provide the Customer and all personnel interacting with the machine, all the information necessary to properly use and maintain it in optimal conditions, with particular attention for this to happen in the highest safety conditions.

1.6.2 PRESERVATION

In order to properly preserve the Manual, it is recommended to:

- use the manual so that it does not deteriorate in any way;
- not remove, add, modify or rewrite any part of the Manual; any changes to it shall only be made by Roots Multiclean Ltd.,
- keep the manual in areas protected from moisture, so as not to jeopardize its durability;
- deliver the manual to any other user or subsequent owner of the machine.

1.6.3 CONSULTATION

- This manual consists of 6 chapters numbered according to the logic [a.b.c] where [a] indicates the chapter, [b] the paragraph and [c] the sub-paragraph.
- The pages are numbered according to the logic [aa.bb] where [aa] indicates the number of the chapter and [bb] indicates the page of the chapter itself.

1.6.4 UPDATE

In the case of significant changes to the machine due to the installation of new parts, the Manufacturer will prepare updated Instructions that will be sent to the Customer together with the purchased part. After receiving the manual update, destroy the obsolete copies.

1.6.5 ATTACHMENTS

For clarity of consultation, not all descriptions of the procedures are contained in this Manual. The relative
Instructions are attached to it, separately.

1.7 TERMINOLOGY AND MEANING

1.7.1 HAZARDOUS AREAS

Any area within or near a machine in which there is a health and safety risk for an exposed person.

1.7.2 EXPOSED PERSON

Any person who is wholly or partially inside a hazardous area.

1.7.3 OPERATOR

The person or persons in charge of installing, operating, adjusting, servicing, cleaning and transporting the machine.

1.7.4 USER

Company or person legally responsible for the machine.

1.7.5 LEFT OR RIGHT SIDE

They refer to the vehicle pointing in the forward direction.

1.8 DUTIES OF THE EMPLOYER

The employer is responsible for disclosing this document to all personnel that will interact with the machine. The employer also commits to update the manual with the parts that Roots Multiclean Ltd.. will send in the case of changes to the machine. In the case of loss or destruction of the manual, the employer commits to request the missing parts or the full manual to Roots Multiclean Ltd.

1.9 OPERATOR'S RESPONSIBILITY

The operator is responsible for the daily maintenance of the machine:

- he must care for it and keep it in good working conditions;
- he must inform the manager or technical service when a scheduled maintenance intervention is required or in the case of damage or breakages;
- do not carry unauthorized people, animals or objects on the machine;
- for transfers, respect the safety regulations for circulation.
- the machine is not to be used for toxic-harmful materials. If necessary, contact the manufacturer in advance.

DANGER

In the case of a machine malfunction, check the procedures in the various chapters.

1.10 PRECAUTIONS FOR THE SAFETY OF OPERATORS

For the driver:

- It is forbidden for unauthorized personnel and personnel untrained on the running, to use the sweeper. The following pre-requisites are needed for training:
- the driver must be an adult, having the necessary licence for driving the machine regardless of the type of use, in normal physical and mental conditions. It is forbidden to drive the machine while under the influence of substances that can alter the nervous reflexes of the driver (alcohol, drugs, etc...).
- Caution, it is dangerous to use the machine without being trained and/or authorized, you may cause damage to yourself, to property or to others.
- Do not use the machine in flammable areas or with an explosion hazard.
- Before getting out of the machine, stop the brushes, pull the parking brake, turn off the engine and remove the key.
- Go slowly on slopes, uneven or slippery ground.
- Be careful when changing direction.
- Operate the machine with care when lifting the container for emptying.

For the maintenance technician:

- To prevent possible injuries, the equipment is fitted with an automatic safety lock system in the container which keeps it raised even in the case of malfunction or loss of pressure to the hydraulic and pneumatic systems.
- During maintenance, keep away from moving parts.
- Avoid wearing loose or unbuttoned clothing.
- To lift the machine, use equipment suitable for its overall weight.
- Protect your eyes and hair when cleaning using compressed air or water guns.
- Disconnect the battery cables before working next to the electrical system.
- Avoid contact with battery acid, do not touch high temperature parts, wait for the engine to cool down.

- Engine maintenance must be carried out with the engine cold.
- Do not smoke while pouring fuel.
- Keep flames and sparks away from the machine.

For the machine:

- For the machine to travel on public roads, it must have vehicle registration documentation and a number plate for operating machine.
- The machine must be used as sweeper. Do not use it for purposes other than those for which it was designed.

1.11 PRECAUTIONS TO BE OBSERVED WITH ENGINE RUNNING

- Do not remove the oil level dipstick.
- Do not remove the radiator cap.
- Do not remove the coolant drain plug.
- Do not stay too long in a closed place.
- Provide adequate ventilation or consult the competent managers.

1.12 CAUTION SIGNS

There are CAUTION stickers affixed on the machine.
It is compulsory to acknowledge them before any use.
In the event of non-indelible stickers, remember to replace them when reading becomes difficult.

IT IS COMPULSORY TO PROTECT HANDS (GLOVES)

IT IS COMPULSORY TO PROTECT EYES (GOGGLES)

IT IS COMPULSORY TO USE RESPIRATORY PROTECTION (MASK)

CAUTION (SITUATION OF GENERAL DANGER FOR PERSONAL/ ENGINE SAFETY)

CAUTION (HAZARDOUS SITUATION FROM HEAT SOURCES FOR PERSONAL/ ENGINE SAFETY)

IT IS STRICTLY FORBIDDEN TO CARRY OUT MAINTENANCE WITH PARTS IN MOTION

IT IS STRICTLY FORBIDDEN TO REMOVE OR TAMPER WITH THE SAFETY DEVICES.

DANGER OF CRUSHING

USE OF THE MACHINE IS FORBIDDEN TO UNAUTHORISED PERSONNEL AND TO PERSONNEL INADEQUATELY TRAINED ON PROPER OPERATION AND THE SAFETY DEVICES

IT IS FORBIDDEN TO STAND WITHIN THE ACTION RANGE OF THE MACHINE

Chapter 2 Transport, Handling, Installation

DANGER

Disclose the Instructions in this chapter to all personnel involved in the transportation and handling of the machine.

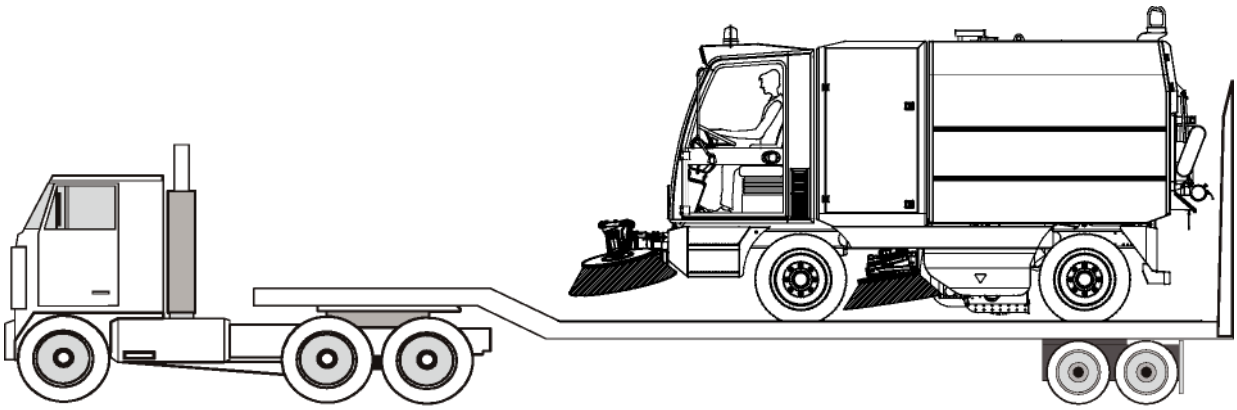
INFORMATION

It is essential, for this purpose, to print this chapter in single volume to make it accessible to Operators.

DANGER

For safety reasons, mobile parts must be blocked prior to transport.

2.1 UNLOADING AND HANDLING



Pict. 2-1 Machine transportation with vehicle transporter

The machine can be independently moved on road or with a vehicle transporter of adequate capacity.

For proper unloading and handling, we recommend the presence of two Operators equipped with Safety Helmet, Gloves and Safety shoes.
These Operators must pay the utmost attention during all transport stages and stay a safe distance from the machine when close proximity is not strictly necessary.

DANGER

Prohibit any person from standing close in order to avoid contact with any projected parts and objects in case of an accidental fall.

DANGER

Pay attention to transiting means and people during unloading.

The entire area involved in handling the machine, including between the transport means' parking area and the machine's installation area must be identified and inspected beforehand in order to detect the presence of "hazardous areas".

DANGER

It is forbidden to stand or pass under the machine.

Perform the following operations to proceed with loading the machine onto the transport vehicle:

INFORMATION

For details regarding the maneuvers described below, refer to the description and figures given in Chapter 4 "Use", in this manual.

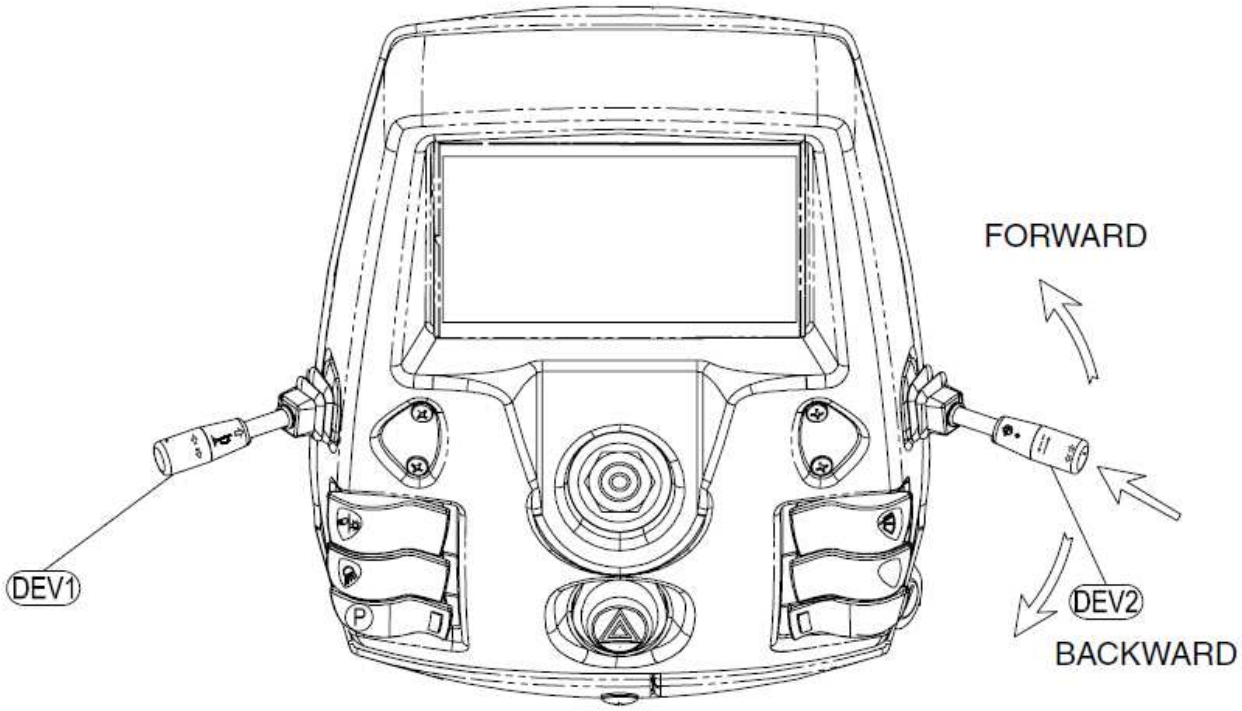
- Turning on the machine
- Turn the third brush (optional) to the right or to the left.

Pict. 2-2 Position of third brush (if present)

- Ensure the third brush is blocked (par. 3.10.2).
- With motor idle and parking brake engaged, turn the selector "Transfer-Work" present on the Control Panel to pos. WORK.

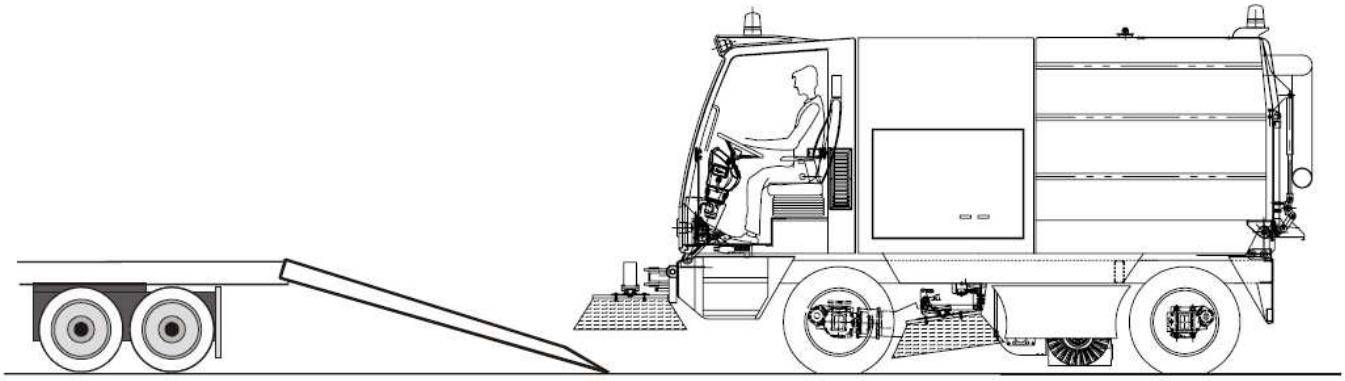
Pict. 2-3 Control Panel

- Ensure the central brush is lifted.
- Ensure the side brushes are lifted and blocked (par. 3.10.1).
- Select the driving direction using the lever right of the steering wheel (DEV2).



Pict. 2-4 Controls/Indicators on dashboard

– Press the accelerator to move, climbing onto the vehicle transporter.

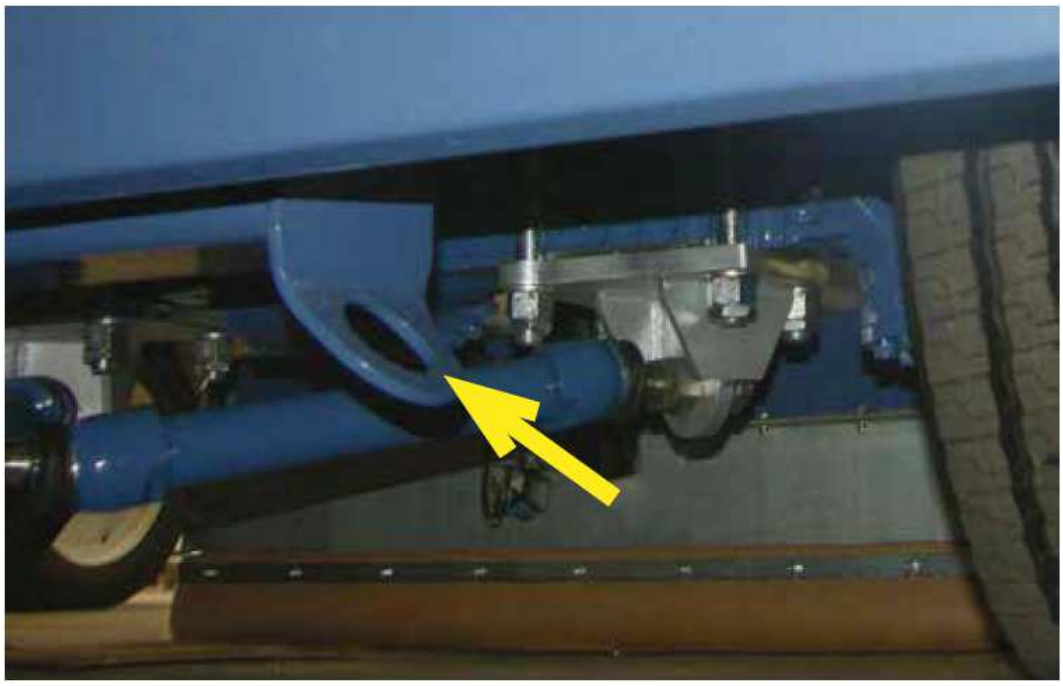


Pict. 2-5 Move the Machine onto the vehicle transporter

– Once having reached the correct position, stop the machine and engage the parking brake.

DANGER

Make sure the machine is properly secured to the trailer by means of suitable ropes, using the appropriate connections on the reaction rod supports of the frame.



Pict. 2-6 Hooking points for the safety ropes (1 of 4)

Unloading must be carried out by following the operations in reverse order.

2.2 PACKAGING

Any packaging must be disposed of by the user according to the standards in force in his/her country.

2.3 INSTALLATION

The machine is delivered fully assembled and perfectly operational, so it is not necessary for the customer to perform installation operations.

2.4 GENERAL CHECKS

- Make sure the machine has been checked prior to delivery (check on the warranty certificate).
- Check that the machine has not been damaged during transport and prepare for commissioning by following the manual instructions.
- Check the hydraulic oil level in the appropriate tank.
- Check the brake oil level.
- Check the engine oil level.
- Check the liquid level in the expansion tank.
- Refuel.
- Start the machine as described in par. 4.8.1.

Chapter 3 Description of the Machine and Technical Features

3.1 NAME OF THE MACHINE

The machine is called:
M60 Mechanical - Suction Street Sweeper.

3.2 FORESEEN USE

The M60 Mechanical - Suction Street Sweeper has been designed to perform a complete cleaning cycle of urban areas: sweeping, collection and discharge of material collected.

INFORMATION

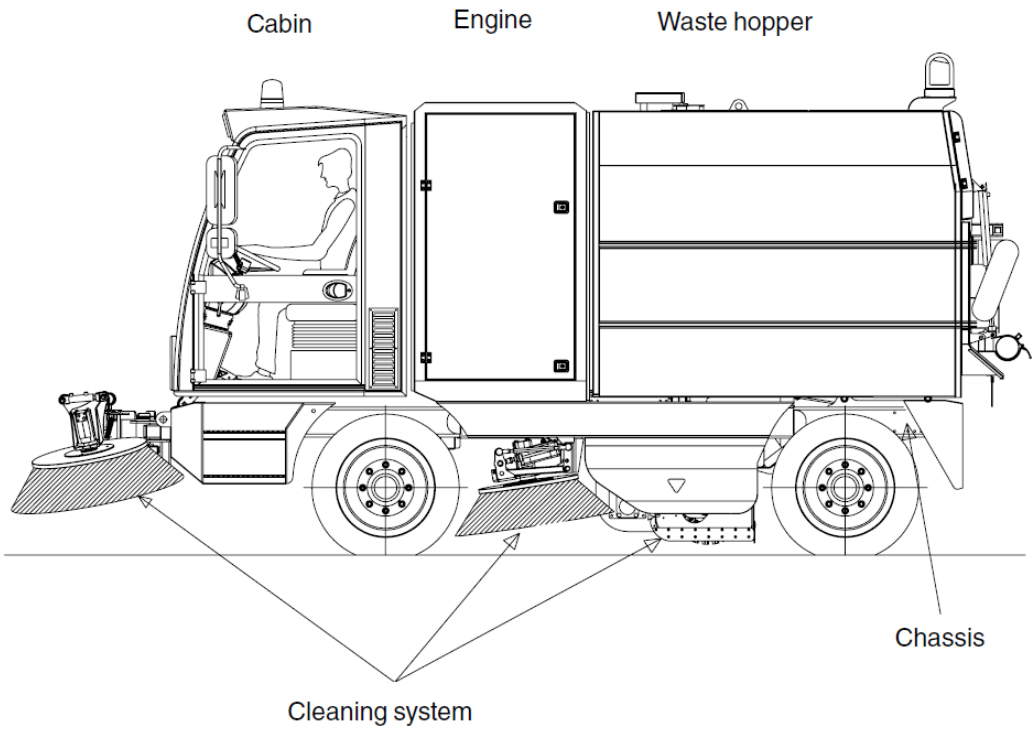
Any use different to that indicated is not foreseen and can cause damage to the machine and to the Operators.

Sweeping is via two side brushes that convey the dirt to the centre of the vehicle, towards a central brush that projects the dirt inside a central loader mechanism which carries it into the hopper.
The side sweeping unit is formed by the brushes. A high capacity vacuum turbine, actuated by a hydraulic engine, creates a vacuum inside the waste hopper and in the loader, sucking the dust produced by the brushes. The waste collected in the hopper can be discharged on the ground, or in another hopper, through tipping of the rear tipper. The sweeper is intended for use by personnel experienced in the management of operating machines and equipped with suitable driving license (B or higher).

3.3 LAY-OUT OF THE MACHINE

The machine can be divided into 5 main sections:

- Chassis
- Cabin
- Engine and servo
- Waste hopper
- Cleaning system



Pict. 3-1 M60 Machine

3.4 DESCRIPTION OF THE MACHINE

3.4.1 Chassis

a) Structure

The structure has been designed to have a flexible torsion resistance appropriate for loading and unloading at a height. The chassis in high resistance steel is open at the side, with a central ring formed by closed profiles. It is supplied treated with zinc phosphate anti-corrosion which is then powder coated with a smooth finish. All metal sheets are of suitable thickness and treated with powder coating or sprayed or galvanized. As mentioned, the engine is suspended on suitable vibration dampers to reduce the vibrations transmitted to the structure.
All couplings with relative motion are obtained by bushings or bearings and, where necessary, are equipped with suitable grease nipple.

b) Tyres

The machine is approved with 295/60 - 22.5 tyres with speed index "M" on both of the axles, the rim is 9.00”x 22.5”. The tyre pressure, as indicated by the affixed plates, is 8.5 bar (123 psi).

Pict. 3-2 Tyres

c) Rear under ride protection bar

The rear under ride protection bar is formed by two components: a metal bumper, that is also used as a light holder and licence plate holder, and an internal structural reinforcement.

Pict. 3-3 Rear under ride protection bar

3.4.2 Endothermic Engine

The M60 sweeper is equipped with a Diesel engine Mercedes-Benz OM904LA E3A/2, 4 cylinders in line, turbocharged with intercooler, common-rail high-pressure direct injection, 3 valves per cylinder, gear cascade distribution, fan mounted directly on the crankshaft with viscous coupling.
The engine is identified by a special plate, riveted on the engine support on the right side of the machine, which contains the following information:

- Manufacturer
- Type of engine
- Serial number
- Standards for approval.

Pict. 3-4 Engine plate (Power 110 kW)

a) Lay-out

The engine is behind the cabin with the flywheel facing the left side of the machine; it is fixed with elastic supports to a metal structure that also supports the radiator and hydraulic oil tank.

Pict. 3-5 Engine

b) Air filter

The engine exhaust is on the right side; the air filter is dry and consists of the safety filter and the primary filter. It is equipped with a sensor that indicates a clogged filter with P>50 [mbar] connected to a warning light on the central display in the cabin.

c) Fuel supply circuit

Tank with a capacity of about 110 litres with dip tube and float with warning light and resistive scale, emergency drain plug and filler plug with bayonet key, vacuum safety valve and retaining chain.

Pict. 3-6 Fuel tank cap (RH side)

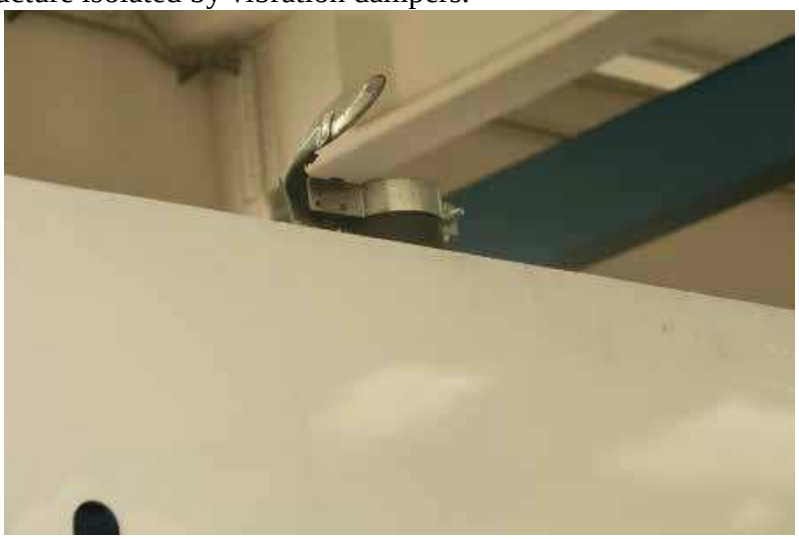
Fuel pre-filter with heater for very low temperatures and manual pump power.
Fuel cartridge filter including fittings with check valves to facilitate filter changing.

d) Cooling circuit

Closed circuit with expansion tank in steel placed over the radiator. The honeycomb aluminum radiator is positioned in line with the engine on the right side of the machine. The engine cooling circuit has an appendix with a supplementary exchanger for air conditioning of the cabin.
Refer to Tab. 5-3 for the type of liquid to use. The intercooler is inserted between the heat exchanger cores of the radiator and is connected to the turbocharger by elastic sleeves.
The cooling fan is connected directly to the engine crankshaft by a viscous-static coupling which correlates the number of revs of the fan to the temperature of the cooling liquid (the higher the temperature of the liquid the faster the fan will turn).

e) Gas exhaust circuit

The engine uses an approved silencer connected with a series of pipes and hoses.
The exhaust pipe is above the engine and discharges upwards on its left side. It is fixed to the chassis with a structure isolated by vibration dampers.



Pict. 3-7 Gas exhaust

3.4.3 Cabin

The cabin has the distinction of having the driver's seat in a central position and two additional seats next to the driver. The cabin is connected to the chassis with specific vibration dampers, and has a closed profile metallic structure with metal buffer sheets of suitable thickness. It is painted with a preventive catachresis treatment. The large glass front, stratified (vehicular approval), allows an excellent operating view assisted by two mirrors of appropriate size mounted on the doors to limit the side dimensions.
The side doors in glass are equipped with sliding window and handle with double safety lock.
The cabin has an electronically controlled air conditioning system with circulation and external air filtering function. The driver's seat has ergonomic armrests with multiple adjustments. There are instrument panels on the armrests for controlling the work functions of the machine.

Pict. 3-8 Driver's seat with ergonomic armrests in raised position

The seat has a mechanical suspension that can be adjusted via the devices at the bottom (optional pneumatic suspension).

Pict. 3-9 Adjustment of driver's seat

3.4.4 Waste hopper

The hopper is shaped to convey the litter to the centre during tipping. Inside it has, in separate compartments, the water tank and the bag filter.
Tipping is via a telescopic hydraulic cylinder. The closing hatch is also hydraulically commanded.

Pict. 3-10 Hopper raised - Hatch opening

Tipper lifting parallelogram

As an option, a lean treppel structure is also supplied for lifting the waste hopper up to a discharge height of about 2300 mm. This structure is moved by a hydraulic cylinder.

Pict. 3-11 Wast hopper lifting structure

There are two safety stops on the structure (on the right side and on the left side) for the raised position of the tipper.

Pict. 3-12 Safety stop not inserted - Safety stop inserted

3.5 OPERATION OF THE MACHINE

3.5.1 Hydrostatic traction

a) General description

Traction takes place on the front axle and is obtained through an automotive type hydrostatic system, i.e. a self-adaptive system that simulates operation of a mechanical automatic transmission in a context that is however fully hydraulic. There are multiple advantages for the M60 machine compared to a mechanical
traction:

- the most obvious is the control and the gentleness of displacements at low and very low speed, which may become of fundamental importance when operating in confined spaces
- the presence of only one pedal (accelerator pedal) for moving the machine in "Work" phase and in "Travel" phase.
- absence of a bulky and geometrically binding kinematic chain
- cost-effective solution.

b) Operation

The system considers, as input, some basic parameters, such as pressure on the accelerator, number of engine revs, speed of the machine. Depending on the values of these parameters, the control unit changes the pressure and capacity of the pump by continually repeating control on the traction engine. For example, in the starting phase of the vehicle, we will have maximum pressure and minimum capacity of the pump, as the machine's speed increases, the hydraulic pressure will decrease whilst the capacity of the pump will increase.
On the other hand, the engine will start with its maximum capacity to arrive at a minimum capacity in correspondence with the maximum speed of the machine.

c) Main components

- *Traction pump*
  This is the basic component which is responsible for the transformation of mechanical energy into hydraulic energy. It is a piston pump working on a plate with variable inclination. The operating pressure can even reach 420 [bar]. The electro-hydraulic control is through accessory drives to the main hydraulic flow.
- *Traction motor*
  It uses the same operating principle as the pump, but receives hydraulic energy (potential) and

converts it into mechanical energy, although using only hydraulic drives.

- *Control unit*
  Parameter management is done through customizable mappings in which all the input data are processed according to the response required. The electronic part is complete with different pressure and rev sensors.

3.5.2 Traction axle

The front steering axle and rear idle steering axle internally integrate the service and parking brakes and the steering cylinders. The final drive ratio is 1:14.75, the differential is also equipped with a Limited Slip system.
The oil used is type AGIP Rotra MP/S 85W-90 in a quantity equal to 1.5 litres for each hub; therefore the axle will use a quantity equal to 3 litres (lubrication only of gear motor terminals), whilst the differential unit will use 5.5 litres.
The axles are rigidly connected to the suspension cylinders equipped with pivoting bearings, and to the rods via robust supports in high-strength steel to perfectly secure them in their correct geometric positioning.

3.5.3 Steering

The steering is integral, i.e. both axles steer concentrically. This allows drastic reduction of the minimum turning diameter, that for this machine is 8.85 m, to the rear external wheel.
Steering is via an open hydraulic system that uses a dedicated gear pump, a 2-cylinder hydraulic drive connected to the steering wheel which controls the steering cylinders on the axles. The steering angle is designed to have
the cover of the rear axle on the front axle.
The dual cylinder system allows the use of a hydraulic steering system even in an emergency, as required by the current Highway Code.

3.5.4 Brakes

The braking system is hydraulic with open circuit in 2 independent sections. It uses a gear pump connected to the PTO of the endothermic engine that sends the service circuit and the parking brake circuit under pressure.
On the central display in the cabin there are 3 graduated scales that display the pressure in the front, rear and parking circuits. There are also three warning lights that indicate when the hydraulic pressure of these circuits drops below the alarm threshold.

a) **Service brakes**
   The service brakes (commanded by the floor pedal, next to the steering column) are disc type dipped in oil; they are on each wheel of the vehicle and have a double safety circuit. The system is equipped with batteries for safe operation even if there is a fault to the driving power, as required by the current Highway Code. The rear circuit also has a device that controls the operating pressure to a value that avoids locking the tyre, even in case of emergency braking.

b) **Parking brakes**
   The parking brake (button command on the dashboard of the steering column) is a drum type at the traction axle inlet. It is actuated by a hydraulic cylinder that operates in negative, i.e. the circuit pressure keeps the parking brake inactive. This way, if there is a fault on the circuit, intervention is always ensured by the springs inside the drum and cylinder.
   On the instrument panel there is a warning light that signals when the parking brake is activated.

c) **Emergency brakes**
   Hydraulic type merged with the service brake via splitting of the circuit.

3.6 CLEANING SYSTEM

3.6.1 General information

M60 is designed for cleaning large hard surfaces (roads and other), but with special regards for tight spaces. In fact, its size (especially the pitch) outlines its vocation for awkward spaces such as city centres, although it appears to be a complete machine and very spacious.

3.6.2 Operating principle

In general, this machine has two operating modes:

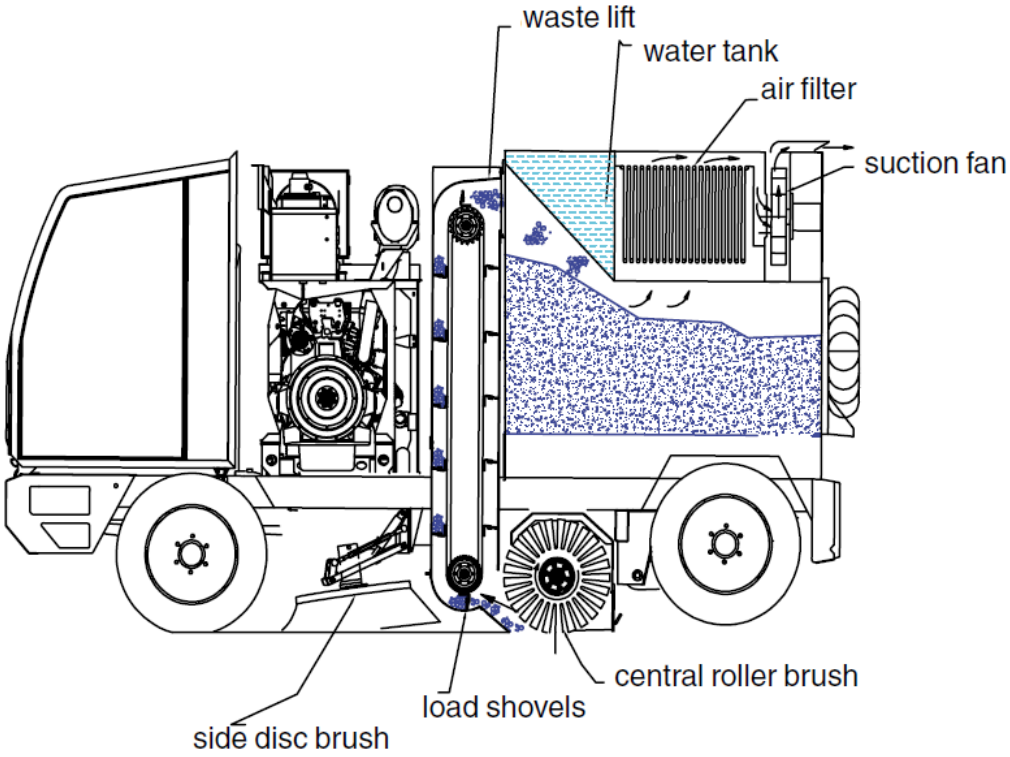
1. a transfer phase also known as "TRAVEL" or TRANSFER
2. an operating phase also known as "WORK" or SWEEPING

Phase 1 is the "on-road" phase, the machine uses all of its power for travel on the road; its maximum speed, in this phase, is about 42 km/h and all of the cleaning systems are disabled.
In this phase the driver uses the accelerator pedal to command the direct number of endothermic engine revs, whilst the traction self-drives depending on the number of revs of the engine and of the wheels. In this situation, the automotive system of the hydrostatic traction is appreciated as it behaves like an automatic.
Phase 2 is the phase in which the machine is operative for its main purpose, "sweeping"; all of the cleaning systems are operative.
In this phase the"lift-brushes" cleaning system, that during phase 1 is in the raised upwards rest position, is brought near the road surface to a precise height.
A special feature of the M60 is that this downward movement occurs through the movements of the entire "liftbrush" system without lowering the rear balance of the vehicle (wheelie effect).
During this phase the accelerator pedal does not drive the endothermic engine, which has a fixed number of revs depending on the power necessary for hydraulic use, but, via the on-board electronic system, directly drives the traction pump, and so acts directly on the movement of the machine.
These two phases can be operatively selected on the instrument panel.

3.6.3 General operation of sweeping

The litter on the road is conveyed to the centre by the side brushes, then is lifted by the "central brush" and sent towards the shovel "lift". The shovels in the lift, in their ascending-descending motion, collect the material near the centre brush and lift it to the upper end of the tipper where there is a suitable opening; once they have reached the top, they tip and unload the material inside the tipper by centrifugal force.
The sweeping effect still creates dust which is kept under control by the water near the side brushes and by the flow of air sucked near the central brush.

3.6.4 Main components of the cleaning system



Pict. 3-13 Cleaning system

a) **Central brush**
Cylindrical in shape, the symmetrical roller has a track width of 1300 mm and a diameter of 500 mm; it can be provided with mixed or only PPL bristles that are cusp-shaped or full.
Moved via a hydraulic engine, it is supported by a pneumatic system that optimizes the pressure on the ground. Its support structure is designed so that even during normal operation, if the bristles are worn, cleaning efficiency is maximised and it makes it unnecessary to adjust the distance of the bristles. The towing system is on both sides and allows rotation of the brush by 180° for an optimal consumption.

b) **Shovel lift**
As mentioned, it is a mobile system within which 10 shovels in steel-rubber move. These shovels are assembled on rubber belts and are moved directly by a hydraulic engine. An 11-shovel lift in steel and rubber, driven by steel catenaries, is available upon request.

c) **Side brushes**
These are disc brushes with a diameter of 600 mm (wood) and 800 mm (to the bristles). They take the cleaning track to about 2700 mm. They move hydraulically and have a pneumatic support system that is adjustable from the driver's seat.

d) **Front brush or 3rd brush (Optional)**
The front brush, with a diameter of 1000 mm, can work either on the right side or the left side of the track. Thanks to the multiple adjustments, it can also work on a raised surface (400 mm) with respect to the highway level. Movement is hydraulic and is commanded by a panel on the right armrest of the driver's seat.

This option takes the cleaning track to about 3600 mm. An expanded version (3700 mm) of the cleaning track is available upon request; standard side and central brushes are used, a third brush with a diameter of 1200 mm and a special adjustment kit.

e) **Bag filter**
Positioned on the upper part of the waste hopper, it is used to filter the air sucked by the cleaning

system. It is formed by a canvas in PE that forms the bags with the hydraulically commanded shaker system fixed to the ends.

f) Fan-vacuum
The fan located in the rear upper part of the waste hopper is moved by a hydraulic engine adapted to the specific requirement. Discharge of the filtered air occurs via a rear deflector which deflects the flow parallel to the road surface.

g) Slides
Have the purpose of creating a kind of vacuum box around the work zone of the central brush. The structure, as far as possible, fits the contours and holes of the ground. A special feature of the M60 is that this structure also adapts to the variation in diameter, due to wear, of the brush. The parts in contact with the road surface are easily replaceable.

3.6.5 Information on the brushes

SIDE BRUSHES/THIRD BRUSH (opt.)
- Disc brush in polypropylene
- Disc brush in polypropylene and steel
- Disc brush in steel
- Disc brush in nylon

CENTRAL ROLLER
- Brush in polypropylene
- Brush in polypropylene and steel
- Brush in steel


Pict. 3-14 Side / Third Brush - Central Roller

3.7 WATER SYSTEM

In order to avoid, or however decrease, the amount of dust raised by the disk brushes, water is nebulized around the working areas.

Pict. 3-15 Dust-proof device

The water is stowed in a tank in AISI 304 steel placed at the upper end of the waste hopper. It has a capacity of about 620 l and is rechargeable via a convenient hose. By using horizontal tanks the capacity reaches 1220 litres.

Pict. 3-16 Water refilling hose

The water level can be visually controlled via a level on the right side of the machine.

Pict. 3-17 Water level

The pressure for spraying is supplied by a medium pressure pump.
Management of the water flow is commanded by some buttons on the control panel on the armrests.
The machine can be equipped (optional) with a high pressure washing lance with 10 metres of hose, mounted on a spring winder.

3.8 HYDRAULIC SYSTEM

The hydraulic system consists of "vehicular" sectors: brakes, steering, traction, suspensions, of which we have already illustrated the operating diagram, and of a service component, i.e. from the hydraulic architecture available for the work equipment.
Some components common to all circuits such as: heat exchanger, oil control unit, discharge filter with by-pass, complete the system. The hydraulic oil used is: AGIP ARNICA 46. The total quantity in the M60 machine system is about 250 l. The system has been developed from the perspective of saving energy from the energy available; in fact, it has been designed to provide pressurised oil to sweeping services (utilities) only when actually used and not in the phases of fast travel where these services are disconnected.
The components are:

1. Oil control unit, located above the endothermic engine where the high efficiency exchanger with electric fan and thermostat is connected to its ends.
2. Gear pump for the operation of the waste suction and collection system.
   The system activates when the sweeper commands are operated. With the aim of power saving, the movement on road foresees the oil capacity of the pump is automatically delivered to the discharge before the distribution, at pressure near to zero atmosphere.
3. Two gear-pumps for the independent functions of Brakes and Steering
4. Block with solenoid valves which pilot all the sweeping uses
5. Block with solenoid valves which pilot the functions of the third brush
6. Suction and discharge filters

The system has a series of safety devices that control some circuit parameters, such as oil level and operating pressures. The system alerts the user of the onset of any problems via the main display.
The oil level can be visually checked via the indicator on the left side of the machine and to which access is by the left side hatch.

Pict. 3-18 Oil level

3.9 ELECTRIC SYSTEM

3.9.1 General description

The system is made according to the most modern methods in use in the automotive sector. It uses a series of control units with 32 bit processor with analogue and digital output, and also in CAN. They are certified in compliance with IEC 61508 and with IP69 degree of protection EN60529.
The wiring is made in compliance with Standard IEC EN 60204 and uses high quality sheaths. All the service functions and the sweeping utilities are driven by coil solenoid valves commanded by a push-button panel located on the driver's seat.
The electrical system is 24 V and is compliant with the current Highway Code and complies with Italian Legislative Decree 476/92 regarding electromagnetic compatibility.

3.9.2 Batteries

The machine is equipped with 2 standard batteries of 145 A/h each, located under the cabin and accessible by lifting up the cabin. The release lever of the battery is located under the cabin's right door, as illustrated in Pict. 3-20.

Pict. 3-19 Batteries

Pict. 3-20 Battery release

3.9.3 Lights

On the M60 machine 4 headlights are mounted: 2 road lights with H4 halogen bulbs and 2 work lights with H3 halogen lamps. Another 2 led work lights are mounted on the side brushes. There is also a led work light on the third brush, if present.
The amber turning lights turn on and off at the same time, without a specific command, upon switch-on of the instrument panel, as required by the Highway Code in force.

3.9.4 Road commands

All "vehicular" commands, or rather road travel, are concentrated on the steering column under the driving wheel. On the steering column (Pict. 3-21) there is also a dashboard instrument panel (Pict. 3-22), display instrument change push-button (Pict. 3-23) and joysticks for the electrical adjustment of the mirrors (when provided). On the bottom left side there are the braking system pressure gauges (Pict. 3-21, pos a).
The "accelerator" and "service brake" pedals are on the floor next to the steering column.
On the left side of the steering column (Pict. 3-21, pos b) there is a release lever for adjustment of the column to adapt it to the driver's requirements.

DANGER

Do not adjust the steering column whilst driving.

Driving with the steering column unlocked can result in loss of control of the vehicle by the driver. Ensure that the steering column is locked before driving the vehicle.

Pict. 3-21 Steering column

Pict. 3-22 Command switches and instrument panel

Pict. 3-23 Display instrument change push-button

3.9.5 SWEEPING CONTROLS AND COMMAND

Pict. 3-24 Control Panel

All the sweeping functions can be operated from panels distributed around the driver .

- Control Panel, located above the driver seat and including 6 manual commands for the control of the machine working functions and a Signal Panel. It is a circular tool where 12 light signals and 1 hourcounter are present. See Chapter 4 for the detail of displayed information.
- 3rd brush control push-button panel (optional), located on the right arm-rest of the driver seat.
- Sweeping control block, with the levers controlling the machine sweeping functions. This block is located in the driving cabin on the left side of the drive seat.

Pict. 3-25 3rd brush control panel in raised position -3rd brush control panel (optional)

Pict. 3-26 Sweeping hydraulic control panel

3.10 SAFETY SYSTEMS

The devices used to ensure complete safety are as follows:

- For the travel phase, all sweeping and suction elements are equipped with locking devices that keep them in a raised position even during the absence of control energy;
- With the work selector in TRAVEL mode, all of the commands on the control panel are impeded.
- When in reverse gear, an intermittent horn signals the manoeuvre in progress.
- A blinking red warning light on the command panel in the cabin alerts the operator that the vehicle's maximum load has been reached, thus preventing overload (optional);
- Warning plates next to the parts in motion;
- Work lights next to the brushes for night operations;
- Turbine's air discharge conveyor, fully clad in steel;
- Turbine mounted directly on the vibration dampers;
- Hydraulic circuits protected by pressure relief valves;
- Electrical system protected by fuses
- A buzzer in the cabin signals the following faults:

- brake pressure alarm
- parking brake pressure alarm
- parking brake activated with gear engaged
- Excessive engine coolant temperature
- Excessive hydraulic oil temperature and insufficient oil level
- Rear hatch open
- Hopper being tipped
- Vertical loader locked

- In the work phase, the opening of one of the two cabin doors causes the side brushes and the water flow on the brushes to stop.
- In the travel phase the command buttons are inhibited.

3.10.1 SAF ETY DEVICES FOR SIDE BRUSHES

The machine is equipped with safety stops, on the arms of the side brushes, that prevent involuntary lowering of the brushes during the Travel phase.
This stop consists of a pin that must be manually inserted by the operator with the following operations:

ATTENTION

The following operations must be performed with the machine at a standstill.

Command lifting of the brushes, taking them to the position illustrated in Pict. 3-27,

- insert the pin
- lock the pin in the rear part with the safety plug.

In the Work phase, the Operator must:

- remove the pin's safety plug by acting on the rear part of the brush arm
- extract the pin
- re-insert the pin in the position indicated in Pict. 3-28, thereby freeing the brush arm,
- reposition the pin's safety plug

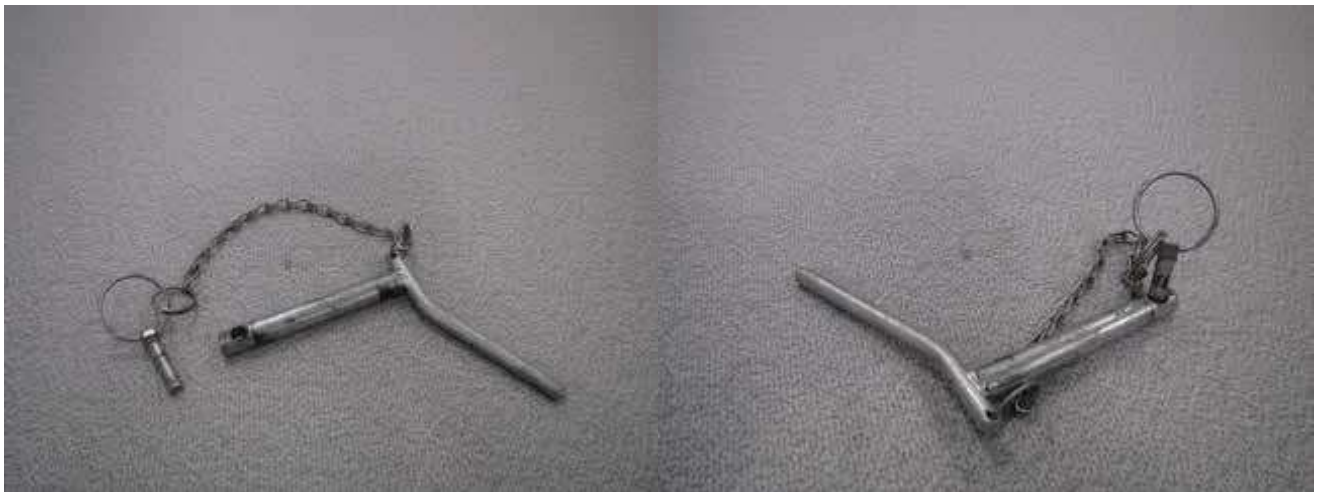
ATTENTION

These operations must always be performed for both side brushes.

A view of the pin with the safety plug end inserted and not inserted is shown in Pict. 3-30.

Pict. 3-27 Safety pin position with brushes in Travel

Pict. 3-28 Safety pin position with brushes in Work



Pict. 3-29 Plug non inserted - Plug inserted

3.10.2 SAFETY DEVICES FOR 3RD BRUSH (if present)

a) Safety against accidental lowering of brush

The machine is equipped with a safety stop, on the arm of the 3rd brush, that prevents involuntary lowering of the brush during the Travel phase.

This stop consists of a pin that must be manually inserted by the operator with the following operations:

ATTENTION

The operations representing a potentially dangerous situation for operators are highlighted by the symbol shown at the side.

- Command lifting of the brush, taking it to the position illustrated in Pict. 3-30,
- insert the pin
- lock the pin in the rear part with the safety plug (Pict. 3-31).

In the Work phase, the Operator must:

- remove the pin's safety plug by acting on the rear part of the brush arm
- extract the pin

– insert the pin in the position indicated in Pict. 3-35, thereby freeing the brush arm,
– reposition the pin's safety plug.

Pict. 3-30 Safety pin position with the 3rd brush in Travel

Pict. 3-31 Position the safety pin with the 3rd brush in Travel: pin inserted

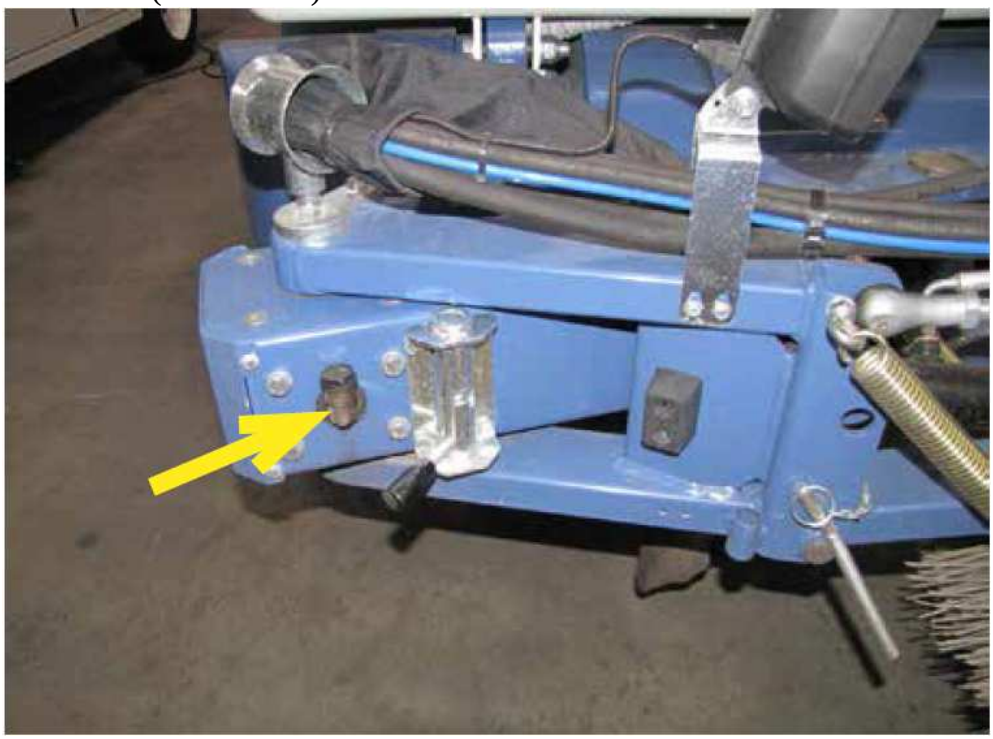
Pict. 3-32 Safety pin position with 3rd brush in Work

b) Safety for 3rd brush arm rotation

The machine is equipped with a safety stop, on the arm of the 1st arm of the 3rd brush, that:

- forms the arm anti-rotation lock during driving on the road
- prevents, when activated, excessive rotation of the 2nd arm of the 3rd brush (limit switch function) during the Work phase.

This stop must be manually inserted by the operator.
In Pict. 3-33 the stop is not inserted, whilst in Pict. 3-34 it is inserted.
The stop is on both sides (RH and LH) of the arm of the third brush.



Pict. 3-33 Safety stop not inserted

Pict. 3-34 Safety stop inserted

3.11 "M60" MAIN TECHNICAL DATA

Technical data		
Basic machine length	5240	mm
Front overhang	1300	mm
Rear overhang	1040	mm
Pitch (distance between the 1st and 2nd axle)	2900	mm
Width	1870	mm
Maximum height of load to the rotating light	2910	mm
Maximum height of load to the structure	2830	mm
Turning radius (to the external front wheel)	4425	mm
Overall dimension radius between walls	4890	mm
Internal radius to the rear wheel	2300	mm
1st axle track	1560	mm
2nd axle track	1560	mm

Variations in the dimensions with the third brush		
Total length	5975	mm
Front overhang	2030	mm
Overall dimension radius to the right	5540	mm
Overall dimension radius to the left	5140	mm

Variations in the dimensions with rear vacuum tube		
Total length	5410	mm
Rear overhang	1210	mm

Variations in the dimensions with third brush and rear vacuum tube		
Total length	6120	mm
Front overhang	2030	mm
Rear overhang	1210	mm
Overall dimension radius to the right	5540	mm
Overall dimension radius to the left	5140	mm

Weight		
Total weight of basic machine, empty, with full fuel tank and operator on board	7400	kg.
Total weight at full load	13400	kg.
Distribution to the 1st axle	5700	kg.
Distribution to the 2nd axle	7700	kg.
Maximum capacity	6000	kg.

Weight of optional equipment		
Third brush kit	200	kg.
Rear leaf vacuum tube kit	35	kg.
Lift for high discharge kit	450	kg.

Wheels		
Rims	9.00” x	22.5”

Tyres		
measurement	295/60 - 22.5	tubeless
single mounting on	two	axles
Inflation pressure	8/8.5	bar

Engine		
Description	Turbocharged with turbo compressor	
Manufacturer	MERCEDES BENZ	
Type	OM 904	LA
Position central, transversal	behind	cabin
Operation diesel	cycle	injection

Engine		
Description	Turbocharged with turbo compressor	
Manufacturer	MERCEDES BENZ	
Type	OM 904	LA
Position central, transversal	behind	cabin
Operation diesel	cycle	injection
Stroke	4	
Cylinders	4 in	line
Diameter	102	mm

Stroke	130	mm
Capacity	4.25	litres
Engine		
Effective maximum power	110 kW	@2200 rpm
Maximum speed	2600	rpm
Maximum torque	580 Nm	
from 1200 to	from 1200 to 1600 rpm	
Cooling	liquid	
Hourly consumption	204	gr/kWh
Fuel (**) Diesel in accordance with DIN	EN	590
Fuel tank Capacity	110	litres
AdBlue tank Capacity	n.a.	litres

Performance		
Maximum speed	42	km/h
Gradeability exceeded unloaded	20	%
Gradeability exceeded loaded	20	%

Electrical System		
Alternator 28V	35/80	A
2 batteries 12 V	120	Ah

Hopper		
Construction features	In AISI 304 stainless steel	
Walls	3	mm thick
Bottom	4	mm thick
Volume	6000	dm3
Discharge height	1110	mm
Discharge height with lift	2300	mm
Water tank In AISI 304	In AISI 304 stainless steel	
Standard capacity	620	litres
Optional capacity	1220	litres

Third brush		
Brush diameter		
standard	1000	mm
optional	1200	mm

Distance outside vehicle reachable by by the brush		
standard	1200	mm
optional	1300	mm

Standard cleaning track

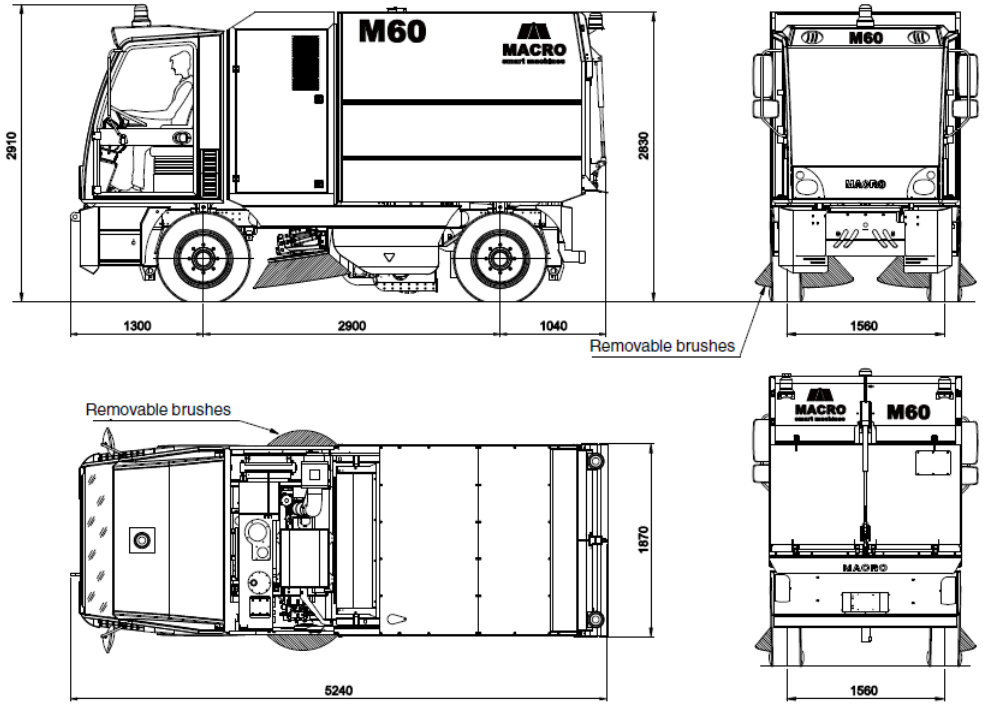
With RH, LH and central brushes	2700	mm
With third brush Ø 1000	3600	mm
With third brush Ø1200 (and speciale adjustment kit)	3700	mm
With central brush only	1300	mm

(**) The OM904 engine can operate with Biodiesel or FAME fuel that complies with Standards DIN E 51606 or EN 14214. In this case the maintenance intervals must be at 400h.

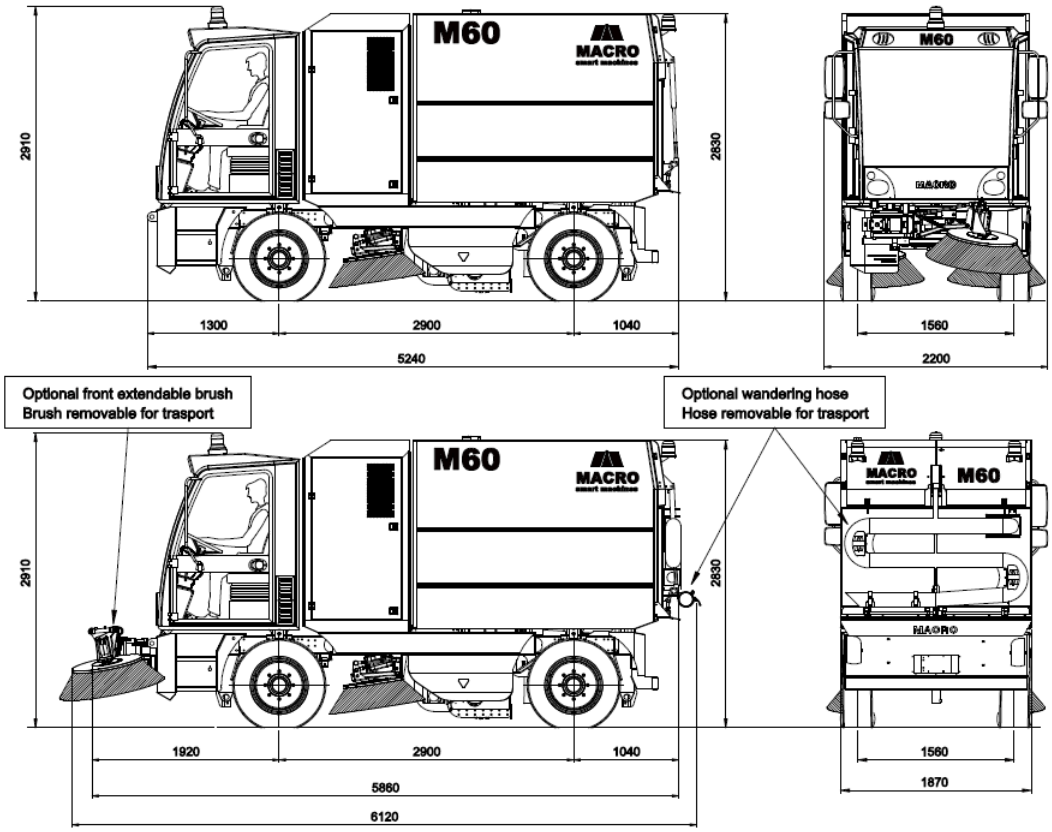
For any further information, refer to the Mercedes-Benz use and maintenance handbook.

3.12 DIMENSIONS

The following figures show the dimensional data of the M60 machine in the basic configuration and in the configuration with optionals.



Pict. 3-35 Overall dimensions of basic machine



Pict. 3-36 Overall dimensions of machine complete with accessories

3.13 ENVIRONMENTAL VALUES

3.13.1 MANUFA CTURING

The environment must be well-lit and there must be no danger of explosion of any kind.

DANGER

To avoid the risk of hazardous inhalation caused by exhaust gases, the machines must only be used in environments with adequate ventilation.

The machine operates correctly within the following environmental values:

- Temperature: +5°C ÷ +50°C.
- Humidity: 30% ÷ 95% without condensate.

Use is also possible at temperatures lower than +5°C, although in temperatures below freezing the use of water is forbidden.

3.13.2 STORAG E

When the machine is not in use, it must be stored in a closed environment and protected from bad weather.

- Temperature: +1°C ÷ +50°C.
- Humidity: maximum 95% without condensate.

INFORMATION

If stored in environments with harsh temperatures (lower than 0°C), the water tank must be

emptied.

Chapter 4 Use

DANGER

The machine must be used ONLY by personnel who are familiar with the operation of all its controls.

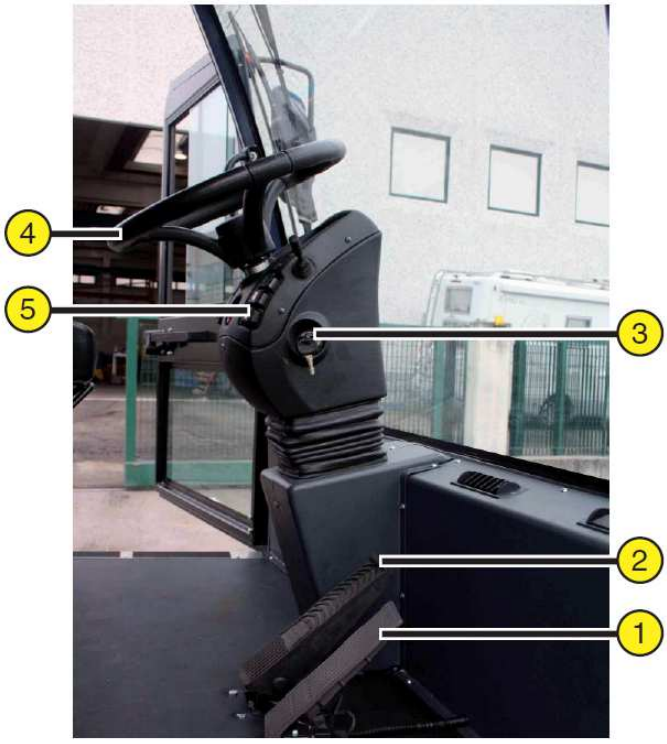
INFORMATION

Before starting the machine, check that the battery charging, engine oil pressure and parking brake warning lights are lit.

4.1 TRAVEL CONTROLS

The controls used for the road travel function of the M60 machine are mainly on the steering column. These controls are:

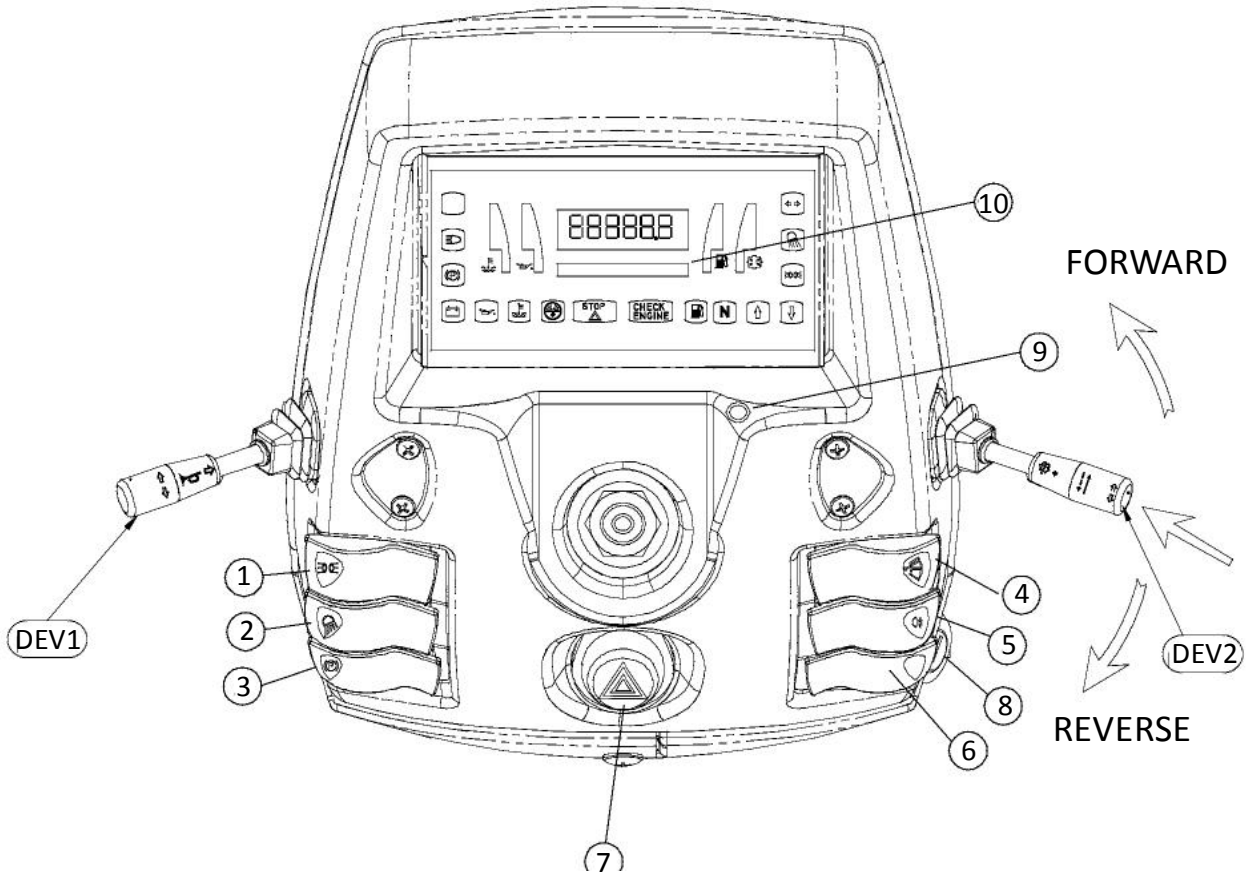
- the steering wheel
- the pedal controls (brake and accelerator/advancement pedal)
- the machine travel management controls on the steering column.



Pict. 4-1 Sweeper travel controls

1 Accelerator Pedal
2 Brake Pedal
3 Ignition key (Command with key for engine start/stop)
4 Steering wheel
5 Controls for machine travel functions

4.2 COMMANDS ON STEERING COLUMN



Pict. 4-2 Commands on steering column

1 General command to turn on the parking lights and the low lights
2 Working lights command / lamp
3 Parking brake command / lamp
4 Screenwiper command
5 Rear fog lamp command
6 ECOPOWER control button with safety lock (optional)
7 Emergency lights switch
8 Engine start/stop command (with key)
9 Display change command push-button
DEV1 Direction indicator command / Dip switch / Horn
DEV2 Drive direction control / Windshield washer
10 Signal panel on dashboard

4.3 PARKING BRAKE

The parking brake command is on the dashboard of the steering column (Pict. 4-3) It is a switch with safety lock to prevent undesired entry while driving the machine.

Pict. 4-3 Parking brake switch

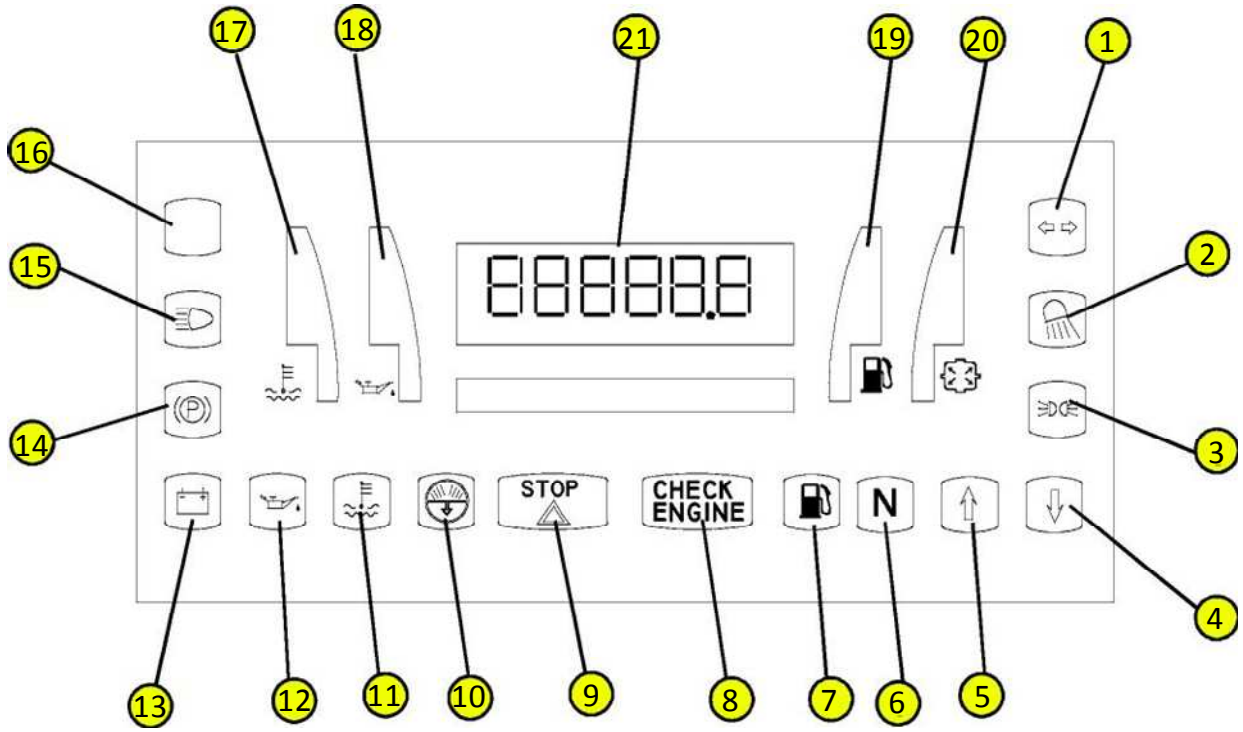
While driving on-road, with the brake off, the switch is turned towards the right.
To insert release the safety lock and push the switch to the left, insertion is indicated by the red indicator light.

ATTENTION

With the parking brake button inserted and the the red indicator light on, the machine won't start. Driving is only possible with the switch turned off and with safety lock.

Insertion of the parking brake is automatic when the engine is turned off by removing the ignition key. In this case the button with the red indicator light does not indicate insertion.

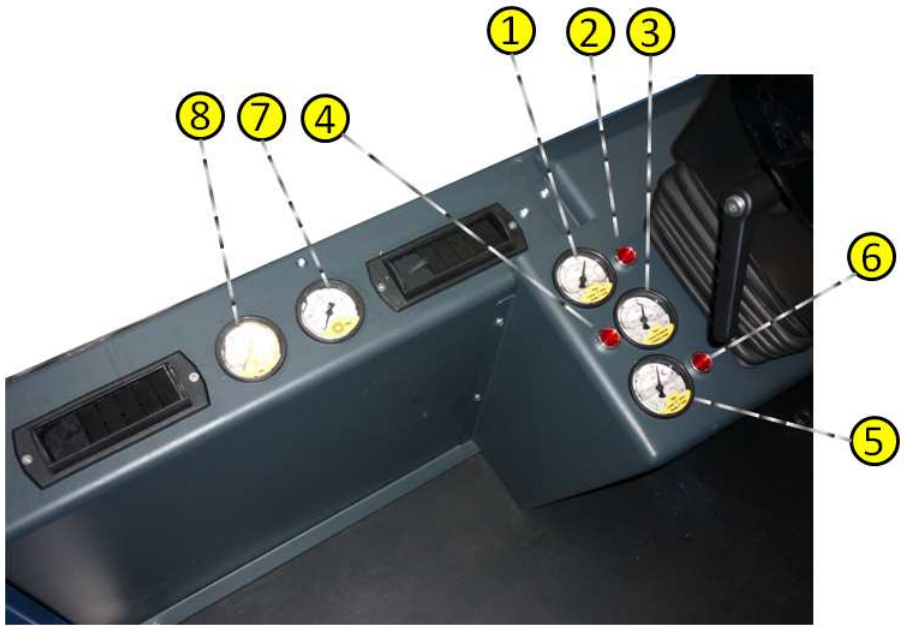
4.4 DASHBOARD WARNING LIGHTS AND GAUGES



Pict. 4-4 Signal panel on dashboard

1 Direction indicator lamp (green)
2 Working lights lamp
3 Parking lights lamp (green)
4 Not used
5 Not used
6 Gear engaged lamp
7 Fuel level lamp (reserve)
8 Lamp "Check Engine"
9 Lamp STOP
10 Air filter clogging lamp
11 Water temperature lamp
12 Engine oil pressure lamp
13 Generator lamp
14 Parking brake lamp
15 High lights lamp (blue)
16 Not used
17 Water temperature gauge
18 Engine oil pressure gauge
19 Fuel level gauge
20 Not used
21 Engine revolutions, speedometer (optional) and hour-counter display

4.5 BRAKING SYSTEM PRESSURE GAUGES



Pict. 4-5 Brakes pressure gauges

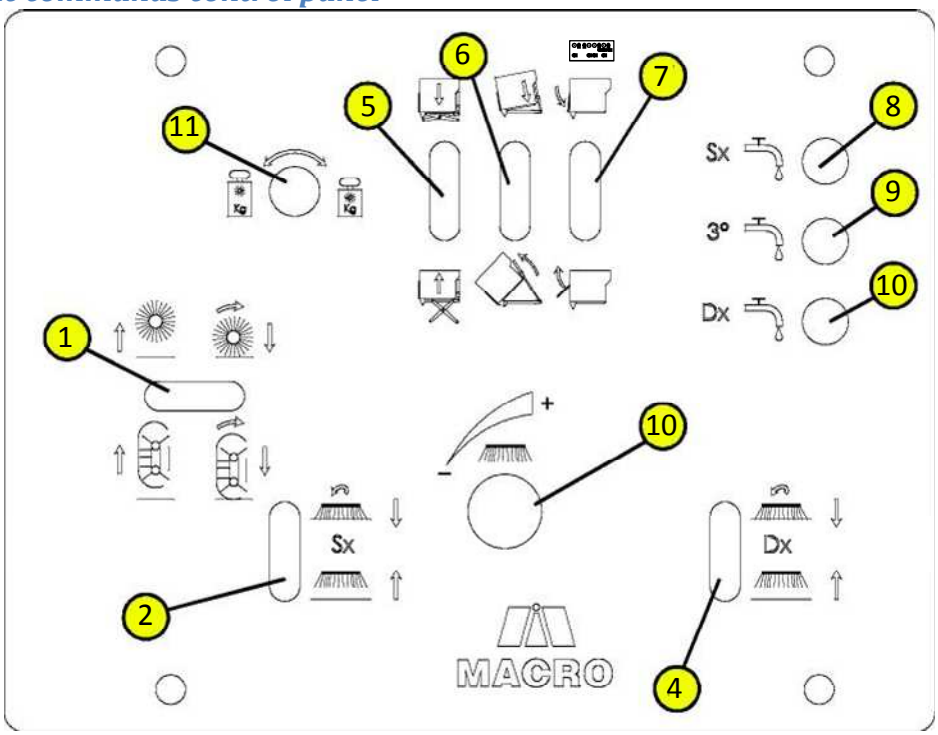
1 Front braking system pressure gauge
2 Front braking system insufficient pressure warning light
3 Rear braking system pressure gauge
4 Rear braking system insufficient pressure warning light
5 Parking brake pressure gauge
6 Parking brake insufficient pressure warning light
7 Central broom pressure gauge
8 Vertical loader pressure gauge

DANGER

Lit lamps signal insufficient pressure in the braking system. If lamps turn on during the normal running, stop as soon as possible, in position out of the way for traffic circulation, and call assistance service.

4.6 SWEEPER COMMANDS

4.6.1 Hydraulic commands control panel



Pict. 4-6 Sweeping control block

1) 3 position lever selector:
- Lh: Command to raise and stop the central brush and the vertical loader
- 0: Neutral
- Rh: Command to lower and rotate the central brush and the vertical loader

2) 3 position lever selector:
- High: Command to lower and rotate the left lateral brush
- 0: Neutral
- Low: Command to raise and stop the left lateral brush

3) Brush speed adjusting selector. Rotate in anticlockwise direction to decrease and in clockwise direction to increase the rotation speed of the lateral brushes.

4) 3 position lever selector:
- High: Command to lower and rotate the right lateral brush
- 0: Neutral
- Low: Command to raise and stop the right lateral brush

5) 3 position lever selector:
- High: Command to lower the container
- 0: Neutral
- Low: Command to raise the container

6) 3 position lever selector:
- High: Command to recall container
- 0: Neutral
- Low: Command to overturn the container

7) 3 position lever selector:
- High: Command to close deposits door and filter-shacking device
- 0: Neutral

- Low: Command to open the deposits door

8) Command for left lateral brush anti-dust nozzles water (subjected to activation of water pump on Sweeping Command Panel) Pict. 4-7 pos. 5 and increases, if rotated in clockwise direction, the water quantity.

9) Command for third brush anti-dust nozzles water (if present) (subjected to activation of water pump on Sweeping Command Panel) Pict. 4-7 pos. 5. It decreases, if rotated in anticlockwise direction, and increases, if rotated in clockwise direction, the water quantity.

10) Command for right lateral brush anti-dust nozzles water (subjected to activation of water pump on Sweeping Command Panel) Pict. 4-7 pos.5. It decreases, if rotated in anticlockwise direction, and increases, if rotated in clockwise direction, the water quantity.

11) Pressure control brush.

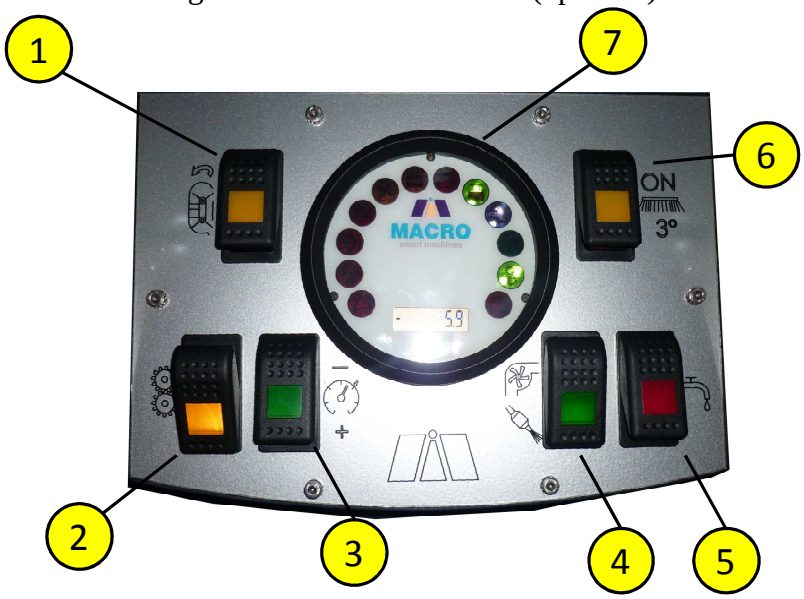
4.6.2 SWEEPER CONTROL PANEL

The sweeping command panel contains:

- Six command switches
- one instrument cluster with 12 indicator lights and a work hour meter (Pict. 4-8).

The console, where is located the panel, contains moreover:

- two ventilation hoses.
- one overhead light for cabin lighting
- the control panel of cabin air-conditioner (Pict. 4-11).
- the monitor to show the images of the external camera (optional).

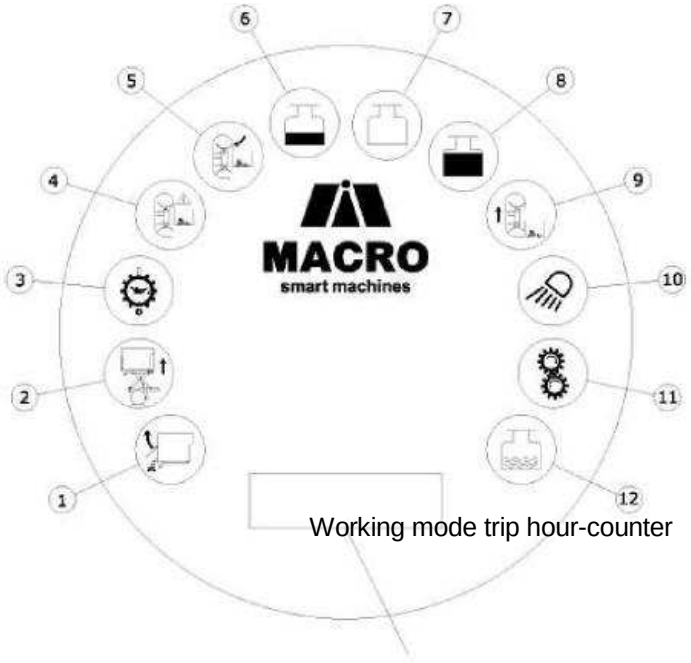


Pict. 4-7 Sweeper control panel

1. Vertical loader inversion command switch
2. Transfer/work function command selector
3. 3 position selector to change engine revolution number:
   - high position (-): 1400 g/m
   - middle position (O): 1600 g/m
   - low position (+): 1800 g/m
4. 3 position selector:
   - high position: suction turbine activation
   - middle position (O): neutral
   - low position: washing (optional)
5. Water pump command switch to activate anti-dust nozzles
6. Command switch to activate 3rd brush (if present). Set to ON, it activates the functions of the third brush control push-button panel.

7. Sweeping functions indicators

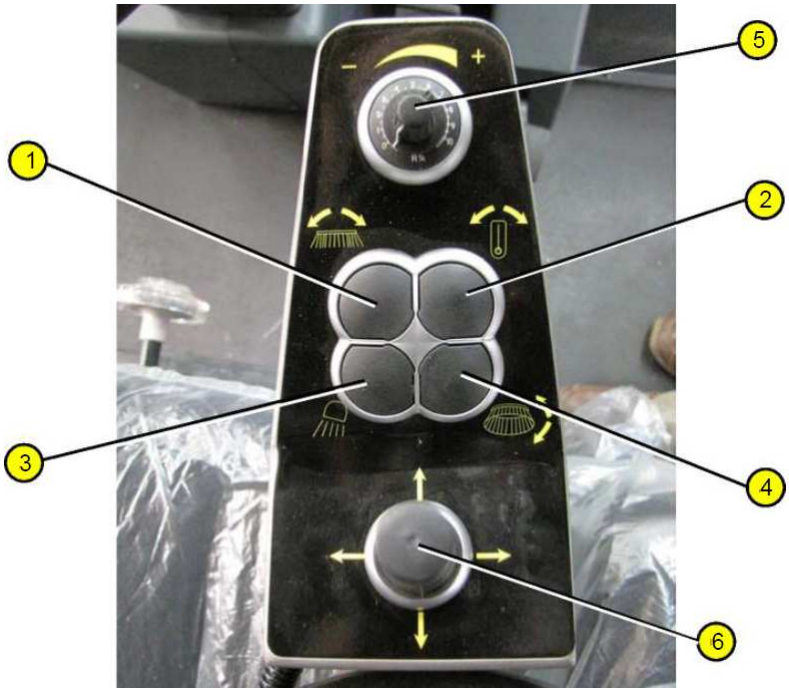
4.6.3 SWEEPER INDICATOR LIGHTS



Pict. 4-8 Sweeping function signals

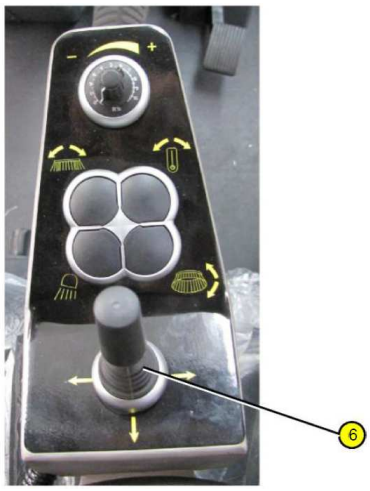
1. Red light - Back hatch open
2. Red light - Container up
3. Red light - Hydraulic oil lever
4. Red light - Transport locked
5. Yellow light - Back hatch closed
6. Yellow light - Reserve
7. Red light - Level empty
8. Green light - Level full
9. Blue light - Transport high
10. Green light - Working beam
11. Green light - Work mode
12. Red light - Engine water level
13. Work partial hour-counter

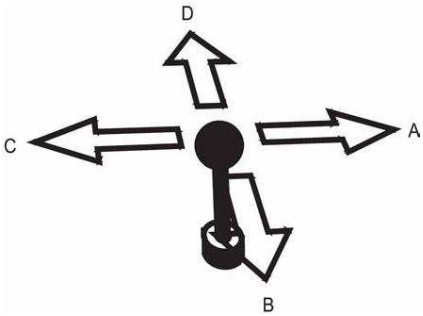
4.6.4 3RD BRUSH CONTROL PUSH-BUTTON PANEL (OPTION)



Pict. 4-9 Third brush control push-button panel

1. Slope command switch
   – Slope orientation to left
   – Sloper orientation to right
2. First arm shifting
   – Movement of 1st arm to left
   – Movement of 1st arm to right
3. Work light switch
4. Brush incidence inclination (increase/decrease) (optional)
5. Third brush speed rotation adjusting knob. It decreases speed, if rotated anti-clockwise, and increases, if rotate clockwise.
6. Command joystick

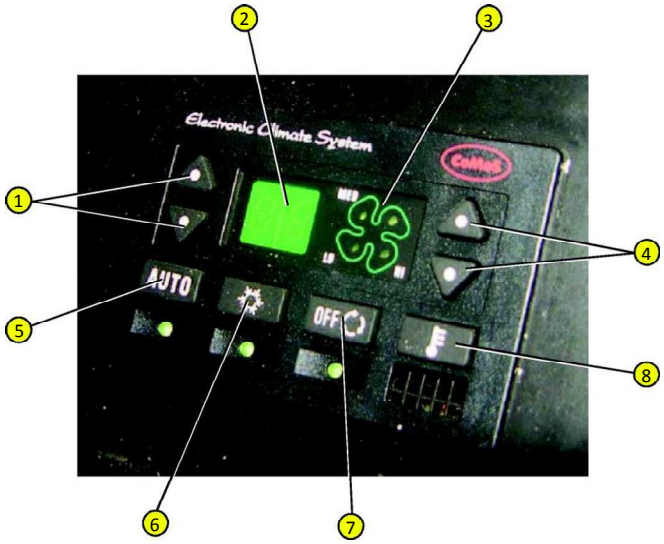




Pict. 4-10 Third brush command joystick

A. Movement to the right
B. Arm lifting
C. Movement to the left
D. Arm lowering

4.7 AIR CLIMATE SYSTEM CONTROL PANEL



Pict. 4-11 Air climate control unit

1. Ambient temperature setting.
   – Arrow Up: increases the temperature.
   – Arrow Down: decreases the temperature.
2. Set/external temperature display.
3. Air fan speed display LED (LO, MED, HI).
4. Fan speed setting, air conditioner on/off.
   – Arrow Up: controls turning on of air conditioner and changing of fan speed.
   – Arrow Down: controls changing of fan speed and turning off of air conditioner.
5. AUTO: automatically controls air conditioning of the cab. Based on the set temperature, internal temperature and external temperature, adjust the air fl ow to obtain the set temperature.
6. Air conditioner compressor activation/deactivation command.
7. Air circulation activation command.
8. View the external temperature on the display.

With displayed temperature on LO (settable with Arrow Down temperature button) the air conditioner is forced to operate continuously with circulation activated.

4.8 INSTRUCTION FOR USE

4.8.1 STARTING THE ENGINE

- Sit on the driver's seat.
- Adjust the position of the steering column to adapt it to the driver. Use the lock/unlock handle on the steering column (Pict. 4-12 pos. 1).

DANGER

Do not adjust the steering column whilst driving. Driving with the steering column unlocked can result in loss of control of the vehicle by the driver. Ensure that the steering column is locked before driving the vehicle.

Pict. 4-12 Steering column locking/unlocking handle

- Adjust the position of the seat depending on comfort with the controls under said seat (Pict. 4-13 pos. a), position adjustment and Pict. 4-13 pos. b, adjustment of suspension depending on the weight of the operator).

Pict. 4-13 Driver's seat

- Make sure you have pressed the parking brake release button (Pict. 4-14 pos. a).

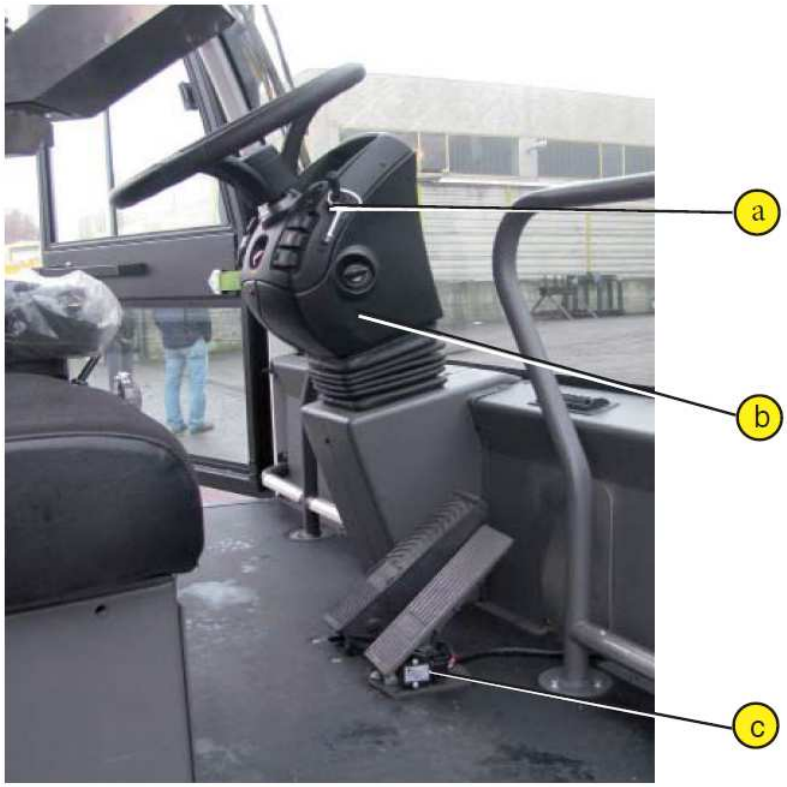
Pict. 4-14 Parking brake

– Make sure the lever for selection of the driving direction is in the central position (Pict. 4-15 pos. a).

INFORMATION

If the parking brake is not activated and the lever for selection of the driving direction is not in the central position, the engine will not start.

– Insert the ignition key (Pict. 4-15 pos. b), turn it clockwise for one click and leave it in that position.



Pict. 4-15 Ignition controls

INFORMATION

On the signal panel the battery charging, N (neutral) and parking brake warning lights must be lit. The Check Engine CHECK ENGINE warning light remains on for a few seconds.

– Turn the key clockwise to "Engine Ignition" until the engine is started;

INFORMATION

At engine start, check that the battery charging, check engine and oil pressure warning lights are off.

INFORMATION

The ignition switch is equipped with an ignition repeat-proof device so before re-attempting to start, turn the key back to position "0"

DANGER

In the ignition phase of the diesel engine, to avoid damaging the starter motor, do not keep the ignition key inserted too long (maximum 15 seconds). If the motor does not start, wait a minute before repeating ignition. Before repeating ignition, turn the key anticlockwise to the initial position.

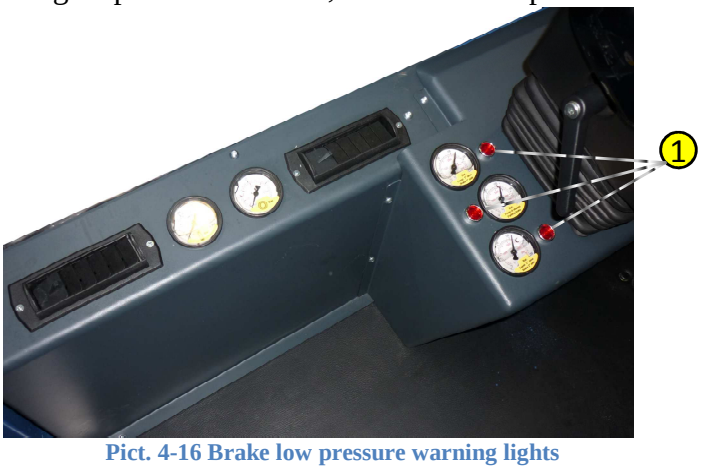
If the diesel motor does not start after two attempts, do not insist but request intervention from the operator in charge of the machine.

DANGER

During the ignition phase with the ignition key (Pict. 4-15 **pos b) do not use the gear pedal (Pict. 4-15 pos. c) as the safety system will not allow engine start in this condition.**

INFORMATION

At ignition, after a long stop of the machine, also the brake pressure alarm indicators may be lit.



Pict. 4-16 Brake low pressure warning lights

Wait a few minutes for the machine to reach the operating temperature then release the parking brake.
The machine in this phase is in Travel mode.
The operations regarding the two operating modes are indicated as follows:

– travel mode
– work mode

4.8.2 Travel mode

With engine started, perform the following operations:

INFORMATION

If the selection lever of the driving direction is not in the central position, the travel position will not be activated.

– Check that the safety devices for the side brushes and the 3rd brush, if present are inserted (see 3.10.1 and 3.10.2)
– Release the parking brake (see par. 4.3)
– Select the driving direction with the DEV2 selector.
– Press the advancement pedal to move the machine.
– Press the brake pedal to stop movement of the machine.

4.8.3 OPERATION MODE FOR SIDE AND CENTRAL BRUSHES

1. **Minimum conditions for sweeping.**
   With engine started, perform the following operations :
   - Move the driving direction selector to the central position.

INFORMATION

If the selection lever of the driving direction is not in the central position, the operation position will not be activated.

- Unlock the safety devices for the side brushes and the 3rd brush, if present, (see 3.10.1 and 3.10.2)
- On the sweeping Command Panel press the push-button  (Pict. 4-17 pos. 4), to set the operation to “WORK” position. The machine adjusts the engine revolutions to value 1600.
- Choose the desired engine rpm using the three position switch  (Pict. 4-17 pos. 6) (between 1400, 1600 and 1800 rpm)

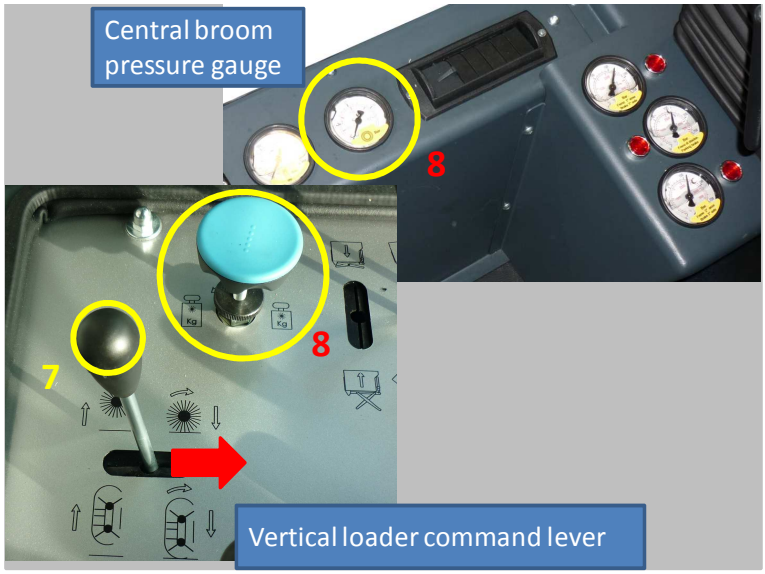
Pict. 4-17 Sweeping control panel

- From Sweeping Control Block (Pict. 4-6) move to the right the lever no.1 in the position

 and  which controls:

- the lowering and the rotation of the central brush;
- the engage of the vertical loader movement;

- Do the regulation of central broom pressure to the ground using the light blue knob  (Pict. 4-18 pos.8) : rotate counterclockwise if you want to increase pressure otherwise rotate clockwise if you want to decrease the pressure to the ground of the bristles. When you run this procedure please control the pressure gauge on the cab floor. A suggested value is around 8 – 10 bars.



Pict. 4-18 Vertical loader commands

From the Sweeping Command Panel (Pict. 4-6), activate the dust suction turbine.

On the sweeping Command Panel press the push-button  (Pict. 4-17 pos. 5), to activate the dust suction turbine.

INFORMATION

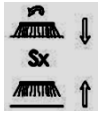
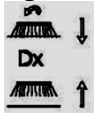
The dust vacuum turbine can be started only if the surface to be cleaned is dry.
Vacuum of wet/humid material can damage the dust-proof filters.

Now:

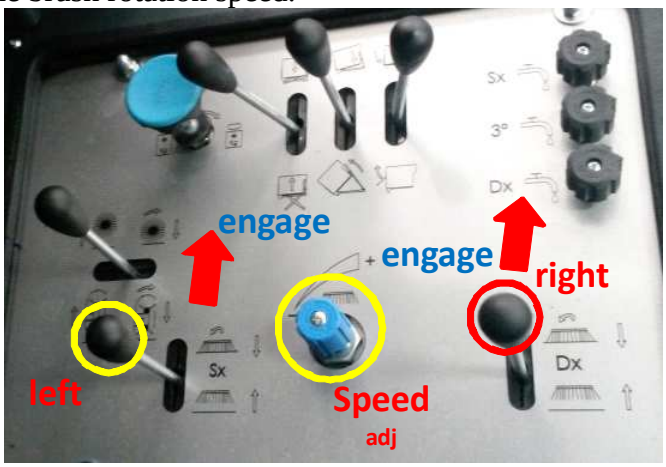
- Release the parking brake (see par. 4.3)
- Select the driving direction with the selector.
- Press the advancement pedal to move the machine.

2. Use of side brushes

The side brushes can be used to expand the cleaning action.

- By means of the levers  pos. 2 and  pos. 4 of the Sweeping Control Block (Pict. 4-6), pushing downwards, it is possible to engage and start independently the right side brush (lever 4) and/or the left side brush (lever 2).
- Knob  allows changing the brush rotation speed. The rotation of the knob in

clockwise direction increases the speed while, acting in counterclockwise direction, decreases the brush rotation speed.



Pict. 4-19 Side brush commands

3. **Activation of the water nozzles**

Pressing the switch (Pict. 4-17 pos. 5) of the Command Panel, the water pump activates. The control of the water delivery, through the nozzles located over the brushes, is controlled by the sweeping control block by means of knobs 8 (for left side brush), 9 (for third brush) and 10 (for right side brush).

INFORMATION

Pay attention to activate the water nozzles of the brushes that are working. It's not possible to stop automatically the water delivery on not working brushes.

INFORMATION

If the water level in the tank is insufficient, there is a warning light on the panel Pict. 4-8 that indicates this, as well as a safety switch that automatically stops operation of the water system pump.

4. **Activation of brushes lights**

Press the switch located on the steering column to control on/off of the working lights of the side brushes. On the signal panel Pict. 4-4 pos.2 there is a warning light that indicates the lights insertion.

5. **Removal of obstructions**

If a "Vertical loader Locked" appears on the signal panel, push the lever 1 on the sweeping control block (Pict. 4-6) to the left and, at the same time, press the push-button 2 (Vertical loader inversion movement – Pict. 4-7 pos.2) located on the Command Panel to free the loader from possible obstructions.

DANGER

If the clogging of the obstruction persists, and a manual intervention is required. The

operation can be executed only with engine off.

4.8.4 SUSPENSION of ACTIVITY

In Operation mode, when reverse is inserted:

- the rear camera with view of the pictures on the display video is automatically activated.
- Please raise the central and the side brushes if you need to stay in reverse for a long time to save bushes from damages.

4.8.5 WASTE DISCHARGE

The waste discharge function empties the hopper of litter during sweeping.
The hopper can be emptied only by tipping it, when the discharge height is lower than 950 mm from the ground, or with the aid of a lifter (optional) when the heights are higher. The maximum discharge height is 2300 mm.

DANGER

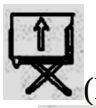
Before discharging, check that there are no people in the litter discharging zone.

DANGER

All hopper movement functions must be performed only when all work functions are turned off or non-operational. Also, they can be activated only with the sweeper stopped, with neutral (N) gear, and with parking brake activated.

INFORMATION

Before emptying the hopper, it is good practice to clean the bag filter via the specific "Filter shaker" function which can be activated by means of lever  (Pict. 4-6 pos.7).

– To lift the container, operate the lever selector  (Pict. 4-6 pos.5) pushing it downwards.

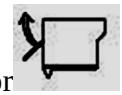
– To lower the container, operate the lever selector  (Pict. 4-6 pos.5) pushing it upwards

DANGER

If the tipper is not perfectly brought to its rest position, a buzzer sounds in the cabin and the danger sign  **is lit on the Control Panel (**Pict. 4-8 **pos. 2).**

– To tip the container, press the lever selector  (Pict. 4-6 pos.6) pushing it downwards.

– To countertip the overturning of the container, press the lever selector  (Pict. 4-6 pos.6) pushing it upwards.

– To open the back hatch, press the lever selector  (Pict. 4-6 pos.7) pushing it downwards.

– To close the back hatch, press the lever selector  (Pict. 4-6 pos.7) pushing it upwards.

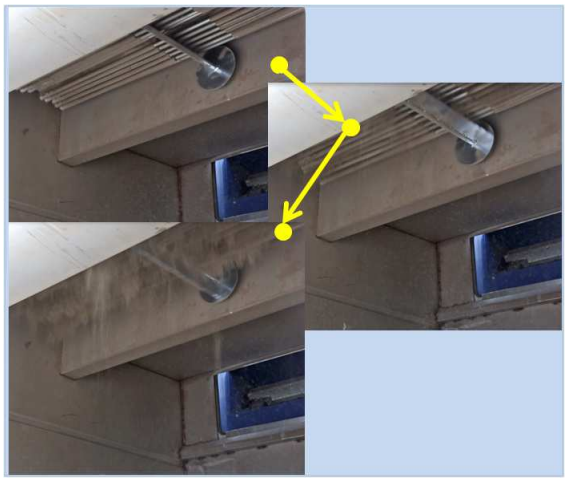
DANGER

If the hopper hatch is not closed correctly, the danger sign  **is lit on the Control Panel (**Pict. 4-8 **pos. 1).**

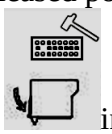
– Once the hopper has been emptied, lower it with the following operations:
  - Lower the hopper
  - Recall the hopper
  - Lock the hatch

4.8.6 CLEAN POLLUTION FILTER BEFORE DISCHARGE DEBRIS

When the filter it's quite restricted, it's important to clean regurlarly using the filter shaker command. Before starting hopper discharge operations, please clean filter.



– Make sure that vacuum fan are currently not operating checking that its switch  is in released position;

– Move the closing door actuator lever  in ON position and wait for the clean movement start. Wait some second to complete the cleaning and then release the lever.

Pict. 4-20 Filter Shaker command

4.8.7 MACHINE STOP

At the end of work we recommend stopping the sweeper in the designated zone with:
– stop the central brush and the vertical loader
– stop and lift the side brushes and insert the safety pin
– lift and stop the third brush (if present and used) and insert the safety pin
– stop the water pump and close the cocks
– stop the suction turbine
– lower the container and close the back hatch
– turn the lights off (if on)
– stop the engine

- engage the parking brake (see par. 4.3)
- switch off and remove and the ignition key
- At the end of the work clean carefully the sweeper (see Chapter 5)

4.9 SAFETY DEVICES

There are some safety devices on the tipper's various utilities, and more precisely:

- Vertical loader movement is allowed only if the tipper is not lifted, the loader frame is lowered and the micro switch is on the divider is pressed.
- If none of the above conditions are present, only vertical loader reverse movement can be performed.
- If the pressure switch on the vertical loader detects "transport locked" condition, the central brush and the vertical loader automatically stops.
- The "transport inversion" manoeuvre must be performed in this condition.
- The water pump is disabled if the "low water level" is detected.
- There is a buzzer in the cabin that is enabled if at least one of the following alarms is detected:
  - brakes pressure alarm
  - handbrake pressure alarm
  - locked transport alarm
  - clogged oil filter alarm
  - oil level alarm
  - tipper lifted alarm
  - engine water level alarm
  - handbrake pulled with gear inserted.

- The Sweeping Command Panel (Pict. 4-8), moreover, contains red light signallings which turn on with :
  - door open  (pos. 1)
  - container lifted  (pos. 2)
  - insufficient hydraulic oil level  (pos. 3)
  - conveyor locked  (pos. 4)
  - insufficient engine water level  (pos. 12)

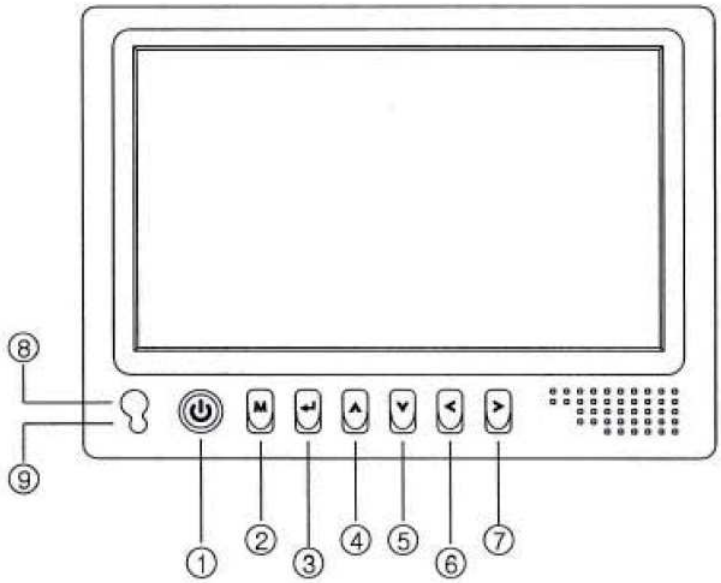
4.10 CAMERA SYSTEM

The pictures of the camera installed on the rear of the tipper (Pict. 4-21) are viewed on the display video automatically. The camera is always on. The monitor on which the camera pictures are displayed is installed on the right side of the driver's cab (Pict. 4-22). Instructions for use of the monitor are indicated in the following paragraphs:

Pict. 4-21 Camera

Pict. 4-22 Monitor

4.11 USE OF 7" WIDE TFT LCD MONITOR



Pict. 4-23 Camera monitor commands

1. Power supply switch
2. Menu command key
3. Enter key
4. Channel up key
5. Channel down key
6. Volume down key
7. Volume up key
8. Remote control sensor
9. Brightness control sensor

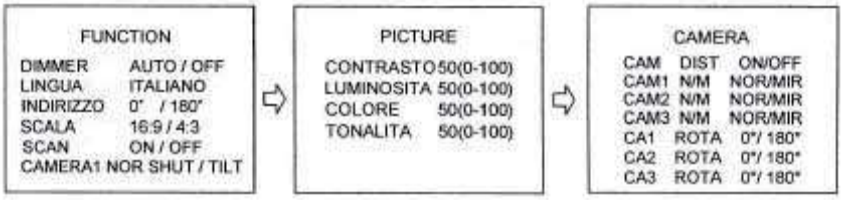
4.11.1 CONTROL KEYS MENU

1. **On key**
   - When off (in STAND-BY), the LED is lit GREEN.
   - When off, the reverse gear R or the arrows (Left I right) activate the respective associated camera of which the field of vision will appear on the monitor.
   - After turning on, the monitor LED with change colour to BLUE
   - After turning on, the monitor will automatically auto-scan in sequence every channel and, upon completion, CHANNEL1 will be displayed on the monitor if the AUTO SCAN is ON in the OSD set-up
   - After turning on, the LAST CHANNEL saved from its last operation is displayed on the monitor if the AUTO SCAN mode is OFF in the OSD set-up (factory setting).
   - AUTOMATIC TURNING ON OF MONITOR upon ignition of the vehicle:

   * Upon engine ignition, the monitor will automatically turn on showing the channel active during the previous cycle if the LAST POWER SAVE mode is ON.

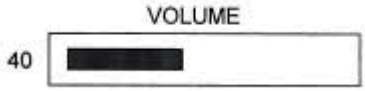
   1) If the engine has been turned off with the monitor on, the LAST POWER SAVE mode is ON (Recommended).
   2) If the engine has been turned off with the monitor turned off, the LAST POWER SAVE is OFF.
2. **Menu Key**
   - If the MENU key is pressed with the monitor on, the OSD menu will appear on the monitor in sequence. Each menu is identified by a different title colour.
   - If the MENU key is pressed again in OSD status, the display will loop in regular sequence between FUNCTION -i PICTURE -. CAMERA -. Clear up OSD.

On the NV channel the sequence is the same as the one below without the OSD menu CAMERA FUNCTION → PICTURE → * Clear up OSD.



3. **Enter Key**
   - After having positioned the cursor of the FUNCTION & CAMERA OSD Screen of the set-up menu, use CHANNEL UP/DOWN keys to select the desired mode to be activated with the ENTER key
   - In FUNCTION & CAMERA OSD status, pressure on the ENTER key activates the selected functions.
4. **Channel Up Key**
5. **Channel Down Key**
   - In OSD status, the CHANNEL UP/DOWN Keys are used to move the cursor back and forth.
   - In POWER ON mode, if the Menu Key is off, the CHANNEL UP/DOWN are used to change channel.
6. **Volume Up Key**
7. **Volume Down Key**
   - In OSD status, select the function highlighted by the cursor with pressure on the VOLUME Up/Down keys
   - Increase or decrease the Volume of the monitor with pressure on the VOLUME UP/DOWN Keys in POWER ON mode
     VOLUME DOWN key : to decrease the Volume
     VOLUME UP key : to increase the Volume
     Adjustment Volume range from 0 to 100 (0-100)

Factory setting: 40 VOLUME



4.11.2 DETAILS OF THE FUNCTIONS MENU

1. **Function**

- DIMMER

– Display the OSD FUNCTIONS menu by pressing the MENU key once and moving the cursor to the DIMMER position with the CHANNEL Up/Down keys.
  Select AUTO or OFF with the ENTER key.
  AUTO: Automatically adjusts brightness depending on the surrounding light (Factory Default)

OFF: Disable the AUTO DIMMER function.

- LANGUAGE : 5 Languages available
  ENGLISH, GERMAN, FRENCH, ITALIAN, SPANISH

– Position the cursor on LANGUAGE with the CHANNEL Up/Down keys
– Select the desired language with the ENTER ENGLISH key : Factory default

- ORIENTATION

– Position the cursor on ORIENTATION with the CHANNEL Up/Down keys
– Select the desired orientation with the ENTER key
  0° : Normal View / Factory default
  180° : Upside down view of 80°
– These settings are applied immediately to all cameras (CAI-CA3).

- SCALE

– Position the cursor on SCALE with the CHANNEL Up/Down keys
– Select the display format with the ENTER 16 key: 9 Wide / Factory default 4 : 3 Normal

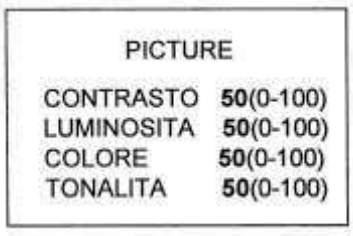
- SCAN

– Position the cursor on SCAN with the CHANNEL Up/Down keys
– Select ON / OFF with the ENTER key
  ON: After the monitor is turned on, the channels are automatically scanned in sequence CH1, CH2, CH3; upon completion of scan, channel CH1 is displayed on the monitor.
  OFF: After the monitor is turned on, the LAST CHANNEL saved during the previous cycle is displayed on the screen. / Factory default

- CAMERA

– Cameras with motorised shutter or TILT can be used on CH1. In this case, the type of camera has to be activated on the OSO menu to function correctly.
– Position the cursor on CAMERA1 with the CHANNEL Up/Down keys, select NOR & SHUT or TILT with the ENTER key.
– NOR & SHUTTER or TILT camera selection: NOR & SHUTTER (Default)
– NORMAL and SHUTTER CAMERA available in the NOR & SHUTTER selection.
– Only TILT CAMERA available on in the TILT Camera Section.
  NOR & SHUT: Motorised NOR & SHUTTER camera (Factory Default)
  TILT: Motorised TILT Camera

2. Picture



- CONTRAST

– Display the PICTURE menu by pressing twice on the MENU key and positioning the cursor on CONTRAST with the Volume Up/Down keys
– Adjust the contrast with the Volume Up/Down keys.
  0-100 / 50: Factory default

- BRIGHTNESS

– After having positioned the cursor on BRIGHTNESS, use the Volume Up/Down keys to adjust the brightness
  0-100 / 50: Factory default

- COLOUR

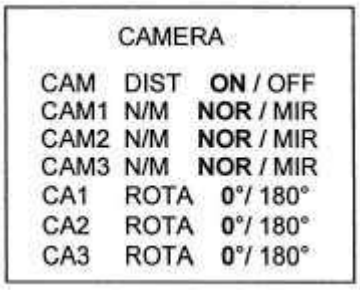
– After having positioned the cursor on COLOUR, use the Volume Up/Down keys to adjust the colour

0-100 / 50: Factory default

- TONE

– After having positioned the cursor on TONE, use the Volume Up/Down keys to adjust the tone
0-100 / 50: Factory default

3. Camera



- Distance Marker in rear view

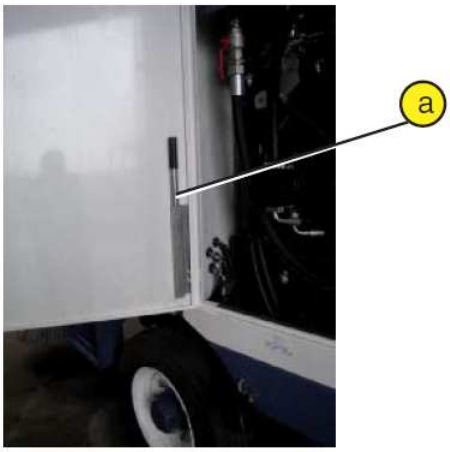
– Display the CAMERA menu by pressing 3 times the MENU key and positioning the cursor on CAM DIST with the Volume Up/Down keys.
– Select ON or OFF with the ENTER key
ON :1 distance Marker displayed on the screen in OSD (factory default)
OFF: No Distance Marker is displayed.
– With monitor turned off, if channel CH1 is activated with Trigger1 input, the OSD Distance Markers are displayed on the screen only if CAM DIST is set at ON.
– The distance Markers are available only on channel CH1
– No settings are provided on the CAMERA menu for channel AN

- CAMERA1 N/M(NOR/MIR)
- CAMERA 2 N/M (NOR/MIR)
- CAMERA 3 N/M(NOR/MIR)

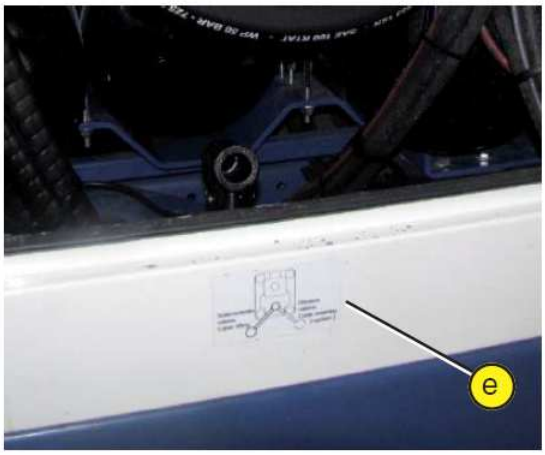
– After having moved the cursor to the desired position, use the Volume Up/Down keys to select the NOR / MIR mode of the cameras 1/2/3 with the ENTER key.
NOR: Normal View / Factory default
MIR: Mirror view
– After having displayed the ROTATION menu by pressing the ENTER key 4 times, position the Cursor where desired with the CHANNEL Up/Down keys and select the required rotation for the picture of cameras 1/2/3 between 0 and 180 degrees with the ENTER key.
0 Degrees: Normal picture on 0 degrees axis / Factory Default)
180 Degrees: Picture rotated by 180 degrees
– Upside down reversed picture in symmetric mode with respect to the 0 degrees axis.

4.12 CABIN HANDLING MECHANISM

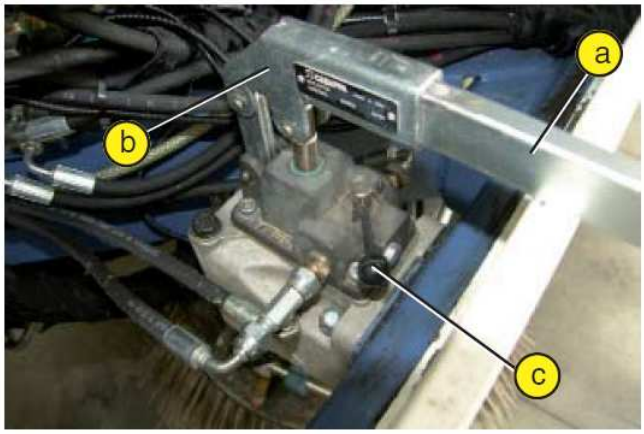
To lift the cabin in order to access the components under it, such as the batteries, etc., or behind the cabin (engine), it is necessary to the device in the compartment on the left side of the machine (Pict. 4-24). To lift/lower the cabin, use the lever (a) supplied with the machine and inserted into the housing inside the left compartment access hatch. A plate (e), on the outside of the hatch, gives directions for handling the cabin.



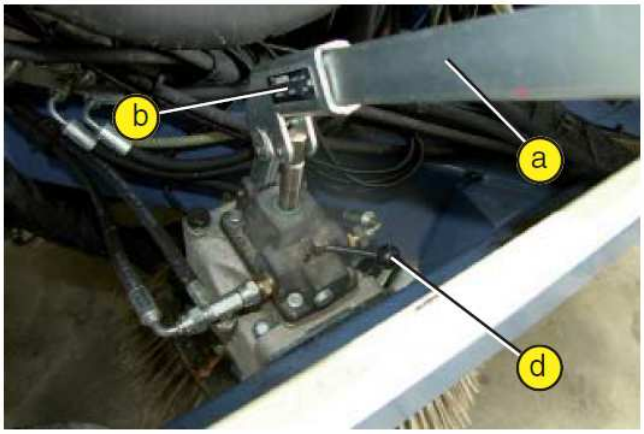
Lever



Instructions plate



Cabin lifting



Cabin lowering

Pict. 4-24 Cabina handling

- Insert the lever (a) in the jack (b)
- Rotate the slider clockwise (position c) and use the lever (a) to lift the cabin.
- Rotate the slider anticlockwise (position d) and use the lever (a) to lower the cabin.

4.13 TOWING THE VEHICLE IN AN EMERGENCY

If it is impossible to use the engine, for failure or other specific condition, the machine can be towed only by performing a by-pass operation of the engine/pump unit. This operation must be performed according to the following indications:

- Access the pump
- Turn three times the nut A using a wrench of 17 mm (Pict. 4-25 pos. a).
- By turning anticlockwise, extract to their fullest the by-pass valves
- Move the machine at a maximum speed of 5 km/h
- Upon completion of the operation, close the by-pass with a 41 Nm torque.
- Tighten the locknuts.

ATTENTION

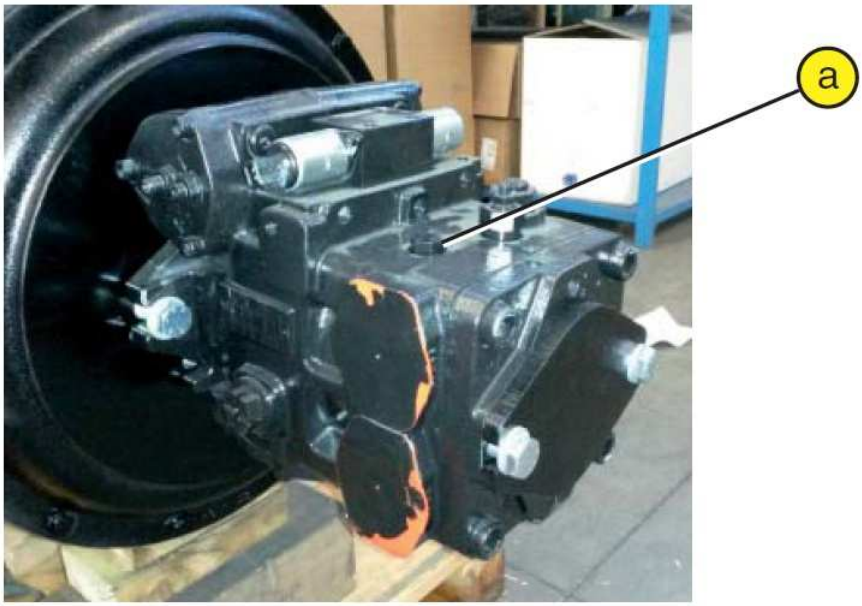
The by-pass operation should ONLY be performed if necessary, with machine stopped, for its displacement, without using the engine, to a safe location or to load on a vehicle transporter for transport to the authorised service centre.

ATTENTION

The by-pass operation can be performed for a limited time, no more than a few minutes.

ATTENTION

Move the machine at a maximum speed of 5 km/h



Pict. 4-25 Traction Pump

For towing the machine, use of a vehicle of sufficient performance able to tow it (lorry) using a rigid bar hooked into the appropriate connection is required (Pict. 4-26 pos. c).

Pict. 4-26 Towing coupling

Chapter 5 Cleaning and Maintenance

5.1 Genera l Information

INFORMATION

Before starting the machine, on the dashboard signal panel, check that the battery charging, oil pressure and parking brake light indicators are lit.

Cleaning the machine can be carried out by personnel without specific technical skills but they should be properly trained on the main cutoff commands of power sources and be familiar with the main features of the machine in order to avoid any hazardous situations.
Maintenance of the machine must be carried out by personnel who are highly skilled in their specific field and who have a thorough knowledge of the machine or its parts.
It should be noted that mechanical, electrical and electronic maintenance is possible.

DANGER

All cleaning and maintenance operations must be carried out with the machine powered off. Wait for all mechanisms to stop and to cool down.

DANGER

Protect your eyes and hair when cleaning using compressed air guns. If the machine operates in toxic environments, wear an appropriate dust mask and use the appropriate protection during the maintenance operation of the dust filter.

5.2 General cleaning of the machine

Clean the surfaces of the machine, the panels and controls with a soft, dry cloth or a tissue moistened with a mild detergent solution.

INFORMATION

Do not use any type of solvent such as alcohol, benzene or ethyl acetate, as they could damage the surfaces.

Remove dust and other dirt from the control panels of the machine (digital displays, warning lights, switches).

INFORMATION

Be careful with electrical components.

If it becomes necessary to clean the electrical components, this should be done by specialist maintenance personnel who should only use non-corrosive products suitable for electrical circuits.

5.3 REGULAR MAINTENANCE

Check every day the sweeper hour meter (Pict. 4-4 pos. 21) and when the machine reaches the number of worked hours since the last scheduled maintenance according to Tab. 5-1, execute a new Scheduled Maintenance operation.

DANGER

The maintenance operations are to be carried out with the machine switched off (ignition

key removed).Wait for all mechanisms to stop and to cool down. Carefully read all the instructions in par. 1.10, before carrying out maintenance.

The service life of the machine and maximum operating safety are ensured by a careful and regular maintenance. Below is a summary outline of the scheduled maintenance. The schedule shown may vary depending on the particular work conditions, to be defined by the maintenance manager. All scheduled or unscheduled maintenance must be carried out by qualified personnel or be done at an Authorised service centre. This manual only describes the procedures for simple and recurring maintenance that can/should be carried by the operator.
For the procedures of the other maintenance operations provided for in the Scheduled and unscheduled maintenance schedule, see the Service Manual. For maintenance of the internal combustion engine please refer to the instructions described in the instructions and maintenance manual for the engine fitted on your sweeper. In Tab. 5-1 the recommended regular maintenance operations are summarised.
Tab. 5-2 summarizes oils and other liquids used in the machine.

Nr.	Maintenance	Frequency (Hours)
1	Checking the oil level in the diesel engine	200
2	Checking the fluid level in the battery (NOT for gel batteries)	100
3	Checking tyre pressure	200
4	Checking the oil level in the hydraulic system	100
5	Cleaning the water filter in the dust suppression system	100-200
6	Cleaning the nozzles in the dust suppression system	100-200
7	Checking the slides	100
8	Cleaning the prefilter and air filter in the diesel engine	after every work shift
9	Checking the cleanliness of the oil radiator fins in the hydraulic system.	after every work shift
10	Checking the cleanliness of the radiator fins in the diesel engine after	every work shift
11	Checking the level of coolant in the diesel engine	100
12	Replacement of the cab air filter	700
13	Replacement of fuses	As required
14	Monitoring and recording the position of the side brushes	100
15	Checking and recording the position of the third brush (if present)	100
16	Replacement of side brushes As	required
17	Bulb replacement	As required
18	Wheel rim fitting	As required
19	Brake maintenance	As required
20	Topping up the windscreen washing liquid	As required

Tab. 5-1 Regular maintenance operations

Internal combustion engine (Mercedes-Benz OM904LA)[1]		
Fuel: [Diesel (in accordance with DIN EN 590)]	110 [lt]	Reserve: 15 [lt]
Engine lubricating oil (including filter): [Agip Sigma Turbo Plus 15W-40] (http://bevo.daimler.com)	Min. 13 [lt] Max. 16 [lt]	
Cooling circuit antifreeze liquid: [Agip Antifreeze Plus] (mixed with H_2O al 50%)	Approximately 15 [lt]	Full load approx. 30 [lt] (at 50%)
Axle		
Rear axle: [AGIP Rotra MP/S 85W-90]	3 [lt]	1.5 [lt] every wheel unit

Front traction axle: [AGIP Rotra MP/S 85W-90]	9 [lt]	1.5 [lt] every wheel unit 6 [lt] differential
Hydraulic circuit		
Hydraulic oil: [AGIP ARNICA 46]	200 [lt]	Full load: 230 [lt]
Greasing circuit		
Lithium-based grease (Pb free) [AGIP Grease MU EP]	loading cont. 5 [kg]	

Tab. 5-2 Summary table of oil and other consumables for sweeper M60

(1) For further and more detailed information refer to the Mercedes Benz manual, "OM904LA Operating instructions" supplied with the machine

Recommended lubricants				
Lubricant	-20° C +5° C IV 95 min	+5° C +30° C IV 95 min	+30° C +50° C IV 95 min	-30° C +65° C IV 165 min
ESSO	Spartan EP 100	Spartan EP 150	Spartan EP 320	Excolub SLG
AGIP	Blasia 100	Blasia 150	Blasia 320	Blasia S 220
ARAL	Degol BG 100	Degol BG 150	Degol BG 320	Degol GS 220
BP MACH	GR XP 100	GR XP 150	GR XP 320	Enersyn HTX 220
CASTROL	Alpha SP 100	Alpha SP 150	Alpha 320	Alpha SN 150
ELF	Reductelf SP 100	Reductelf SP 150	Reductelf SP 320	Oritis 125 MS Syntherma P30
CHEVRON	non leaded gear compound 100	non leaded gear compound 150	non leaded gear compound 320	
Q8	Goya 100	Goya 150	Goya 320	El Greco 220
I.P.	Mellana 100	Mellana 150	Mellana 320	Telesia oil 150
MOBIL	Mobilgear 627	Mobilgear 629	Mobilgear 632	Glycoyle 22/30 SHC 630
SHELL	Omala oil 100	Omala oil 150	Omala oil 320	Tivela oil SA
TOTAL	Carter EP 100N	Carter EP 150	Carter EP 320N	
KLÜBER	Klüberoil® GEM 1 - 100	Klüberoil® GEM 1 - 150	Klüberoil® GEM 1 - 320	Klübersynth® GH 6 - 220
ISO 3448	VG100	VG150	VG320	VG150-200

Tab. 5-3 Recommended lubricants

5.3.1 CHECKING THE OIL LEVEL IN THE DIESEL ENGINE

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. To access the engine lift the cab following the procedure described in 4.12.

DANGER

The engine oil check must be done with the engine warm.

After stopping the engine, wait a few minutes for all the oil to drain into the sump.

4. The engine oil is checked by means of the dipstick, Pict. 5-1 pos. a;

Pict. 5-1 Engine oil level

5. Take out the dipstick and check that the level is between the MIN and MAX level (Pict. 5-2);
6. If required, top up the level by means of the cap located on the upper part of the engine until the MAX level is reached.

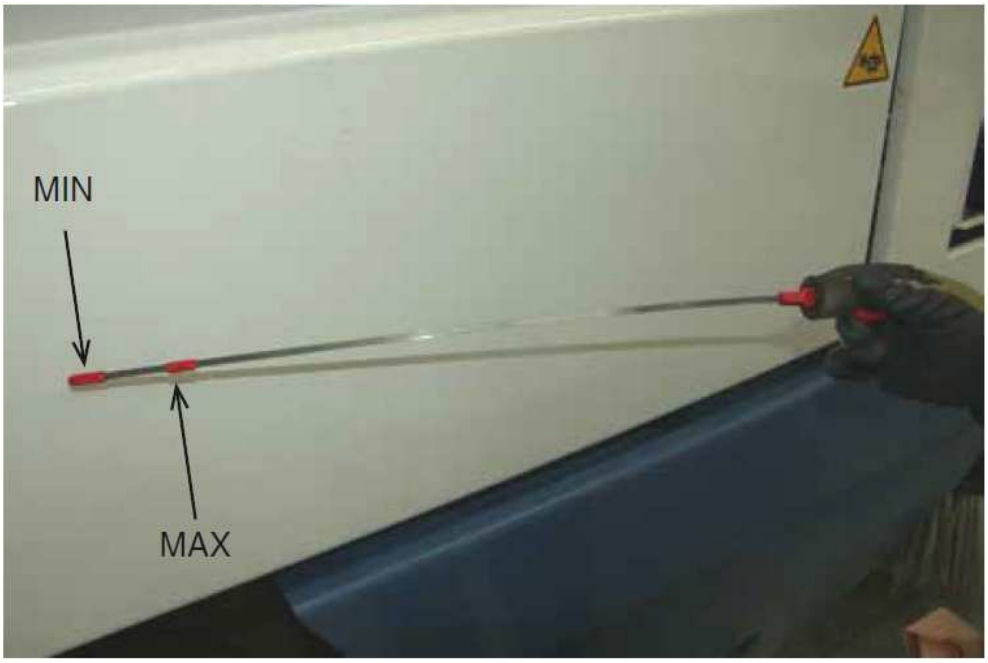
NOTE

Top up with the same type of oil as in the tank (see Tab. 5-2**).**

DANGER

Do not exceed the MAX. level.

7. When finished, lower the cab again by following the procedure described in 4.12.



Pict. 5-2 Level reference

5.3.2 CHECKING THE BATTERY FLUID LEVEL

ATTENTION

Adequately protect body parts (eyes, hair, hands, etc..) when carrying out checks or cleaning the battery.

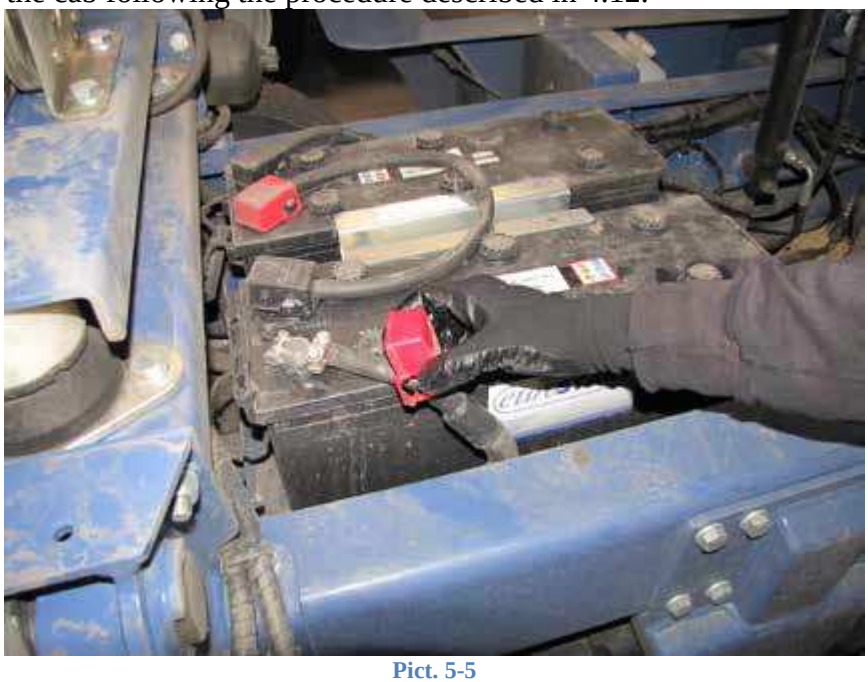
1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. To access the batteries (Pict. 5-3 Battery vane) lift the cab following the procedure described in par. 4.10.

Pict. 5-3 Battery vane

4. Remove the cap and check the battery electrolyte level (Pict. 5-4) and, if necessary, top up.

Pict. 5-4 Batteries

5. Remove the protective cover and check that the connections of the battery terminals are not oxidized (Pict. 5-5).
6. If necessary, clean the contacts with the special wire brush.
7. Reposition the cab following the procedure described in 4.12.



Pict. 5-5

5.3.3 CHECK THE TIRE PRESSURE

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anti-clockwise to the stop position, then remove it.
3. Manually remove (Pict. 5-6) the valve cap of the tyre

Pict. 5-6 Tyre inflating valve

4. Using a pressure gauge (Pict. 5-7) measure the tyre pressure
5. The tyre pressure should be as follows:
   - front tyres: 8.50 Bar (123 psi)
   - rear tyres: 8.50 Bar (123 psi)

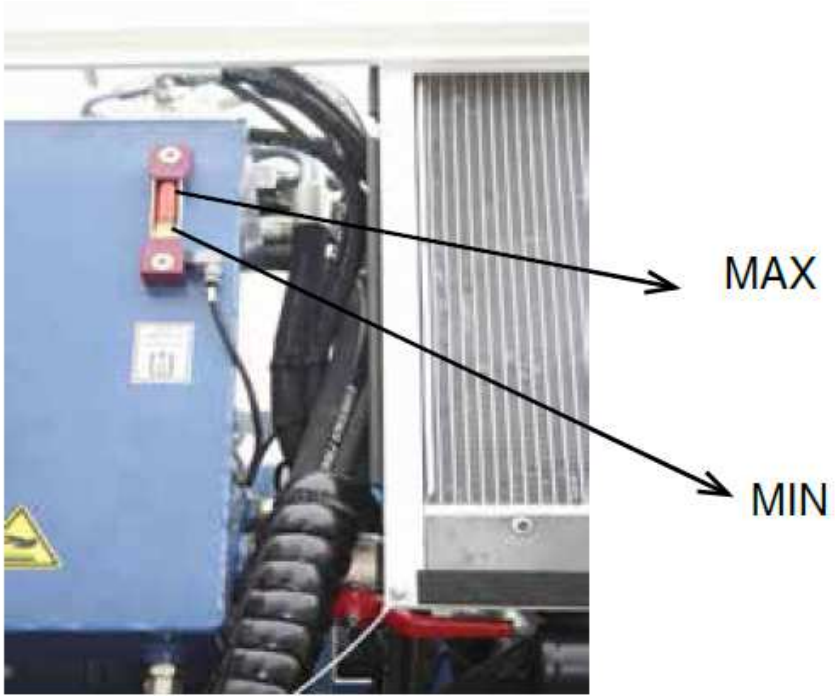
Pict. 5-7

5.3.4 CHECK THE OIL LEVEL IN THE HYDRAULIC SYSTEM

DANGER

Check to be carried out with waste container completely lowered.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Through the indicator on the right side of the machine (Pict. 5-8) check that the oil level in the tank is between the MIN and MAX limits.



Pict. 5-8 Oil level check

4. If necessary unscrew the cap (Pict. 5-9 pos. a) and top up. To access the oil filler cap of the hydraulic system you must first obtain a suitable ladder. For the types of oils that can be used, see Chapter 3.

INFORMATION

Top up with the same type of oil as in the tank (see Tab. 5-2)

5. Screw the cap (a).

Pict. 5-9 Hydraulic oil refill cap

5.3.5 CLEAN THE WATER FILTER IN THE DUST SUPPRESSION SYSTEM

DANGER

Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

INFORMATION

When the filter is removed, the water contained in the tanks comes out, so it is advisable to carry out this maintenance procedure when the water tanks are empty.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Open the left side door to access the filter. Unscrew the cover (Pict. 5-17) of the water filter and remove it along with the filter.
4. Separate the filter from the cover, then wash and clean them. If necessary replace the filter.
5. Fit the filter and cover.

Pict. 5-10 Dust suppression water filter

5.3.6 CLEANING OF THE NOZZLES OF THE DUST DAMP SYSTEM

DANGER

Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Unscrew the lock nuts (Pict. 5-11 and Pict. 5-12).

Pict. 5-11

Pict. 5-12

4. Recover and using a jet of compressed air clean the nozzles (Pict. 5-13) of any impurities. Remove any limescale deposits.
5. Fit the nozzles and secure them with the lock nuts.

Pict. 5-13

5.3.7 CHECK THE SLIDES

1. Operate the parking brake (see par. 4.3).
2. Lift the suction inlet (Pict. 5-14), operating as provided for in the relevant section.
3. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
4. Check that the slides (both the left and right slide) are in good condition, otherwise replace them (see procedure in the Service Manual).

In Pict. 5-14 an example of a new slide is shown. It is important to replace the slides when they are not yet completely worn, in order to avoid damage to their fixing screws, with resulting difficulty in removing the screws themselves. It is appropriate to replace the slides in block, in order to prevent steps in the connection areas, determined by the different levels of wear of the slides themselves.

Pict. 5-14

5.3.8 CLEAN THE PREFILTER AND AIR FILTER IN THE DIESEL ENGINE

DANGER

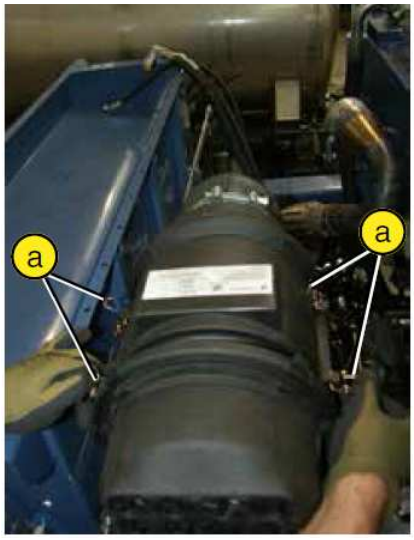
Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

Preliminary operations

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Using a suitable ladder, reach the air filter unit (Pict. 5-15) in the diesel engine.

4. Unhook the 4 clips securing the cover (Pict. 5-16 pos. a).
5. Remove the cover Pict. 5-16)

Pict. 5-15



Pict. 5-16

Pict. 5-17

6. Remove the filter (Pict. 5-18 and Pict. 5-20).
7. With a jet of compressed air (maximum 6 bar), clean the filter thoroughly by blowing from the inside out (in the opposite direction to the flow of the intake air). If necessary replace the filter.
8. Remove the prefilter as shown in Pict. 5-20.
9. With a jet of compressed air (maximum 6 bar), clean the prefilter thoroughly by blowing from the inside out (in the opposite direction to the flow of the intake air). If necessary replace the prefilter.

Pict. 5-18

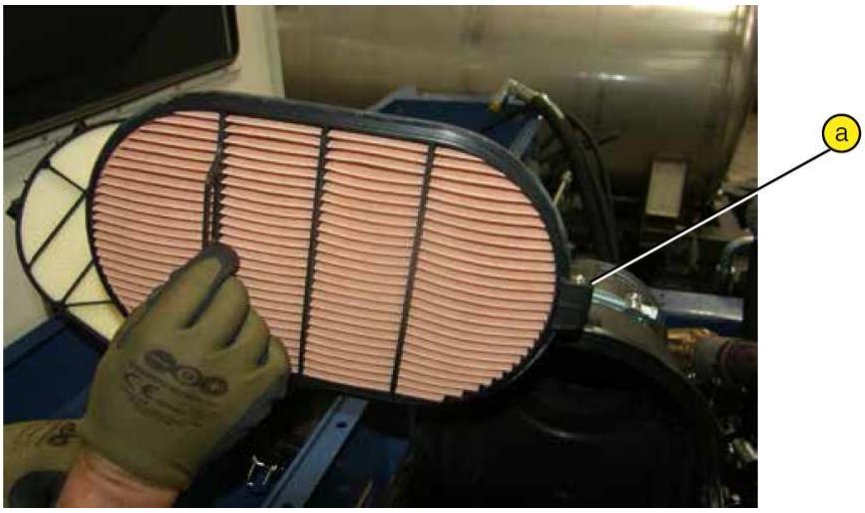
Pict. 5-19

Pict. 5-20

10. Assemble the prefilter (Pict. 5-21) being careful to insert the tab (Pict. 5-21 pos. a) in the notch present in the container (Pict. 5-22 pos. a).
11. Insert the filter
12. Install the cover and hook it by means of the fixing clips.

ATTENTION

Ensure the cover is fixed correctly!



Pict. 5-21

Pict. 5-22

5.3.9 CHECK THE CLEANLINESS OF THE HYDRAULIC OIL RADIATOR FINS

DANGER

Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. With a suitable ladder, reach the oil radiator unit in the hydraulic system
4. Open the top right side door.
5. Visually check the integrity of the radiator fins.
6. Wash the hydraulic system oil radiator (Pict. 5-23) with a high pressure spray gun.
7. Working from the inside of the radiator check that the fan rotates freely.
8. Close the top right side door again.

Pict. 5-23 Hydraulic oil radiator

ATTENTION

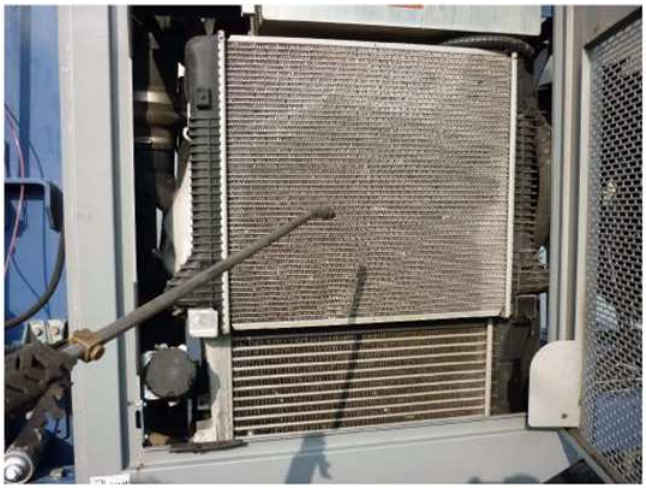
When washing with high pressure spray gun do not get too close in order. to prevent damage to components and radiator fins.

5.3.10 CHECK THE CLEANLINESS OF THE ENGINE RADIATOR FINS

DANGER

Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Open the right side door.
4. Perform a visual inspection to verify that the radiator has no signs of damage or leaks.
5. Check the level of contamination outside the radiator. The blades should not be clogged with dirt.
6. Where appropriate wash the radiator fins of the diesel engine (Pict. 5-24) with a high pressure spray gun.
7. If necessary direct the water jet in the opposite direction of the circulating cooling to wash the engine cooling fan (Pict. 5-25).
8. Close the right side door again.



Pict. 5-24 Engine radiator assembly

Pict. 5-25 Engine cooling fan

ATTENTION

When washing with high pressure spray gun do not get too close in order. to prevent damage to components and radiator fins.

5.3.11 CHECK THE CLEANLINESS OF THE AIR CLIMATE RADIATOR

DANGER

Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. With a suitable ladder, reach the air climate radiator unit.
4. Open the top left side door.
5. Visually check the integrity of the radiator fins.
6. Wash the air climate radiator (Pict. 5-26) with a high pressure spray gun.
7. Working from the inside of the radiator check that the fan rotates freely.
8. Close the top left side door again.

Pict. 5-26 Air climate radiator

ATTENTION

When washing with high pressure spray gun do not get too close in order. to prevent damage to components and radiator fins.

5.3.12 WASH THE VERTICAL LOADER MECHANISM

DANGER

Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

1. Operate the parking brake (see par. 4.3).
2. Fully tip the waste container.
3. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
4. Before wash the loader, remove any kind of extraneous materials (plastic gags, sticks, wires …)
5. Wash carefully the loader system to remove all the debris attached during working shift to all the components (chain or belts, blades and so on).
6. After that start the machine again, retrieve the hopper to the normal position.

Pict. 5-27 Vertical loader mechanism

ATTENTION

When washing with high pressure spray gun do not get too close in order. to prevent damage to components.

5.3.13 WASH THE WASTE CONTAINER

1. Operate the parking brake (see par. 4.3).

2. Fully tip the waste container and unlock the door.
3. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
4. Wash the hopper using high pressure gun

ATTENTION

When washing with high pressure spray gun do not get too close to dust suppression filter in order. to prevent damages.

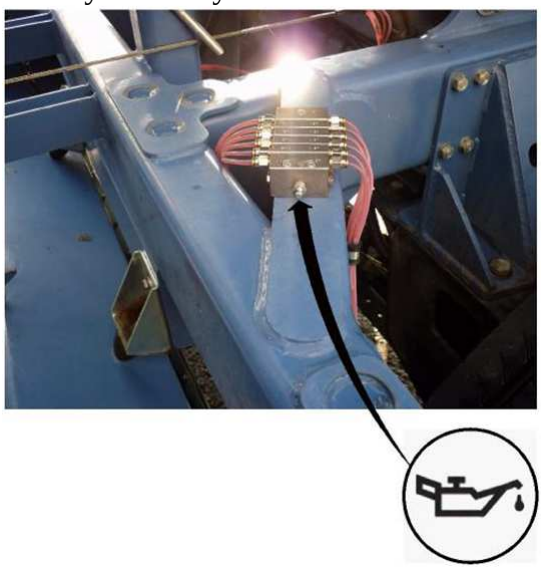
Pict. 5-28 Waste container

DANGER

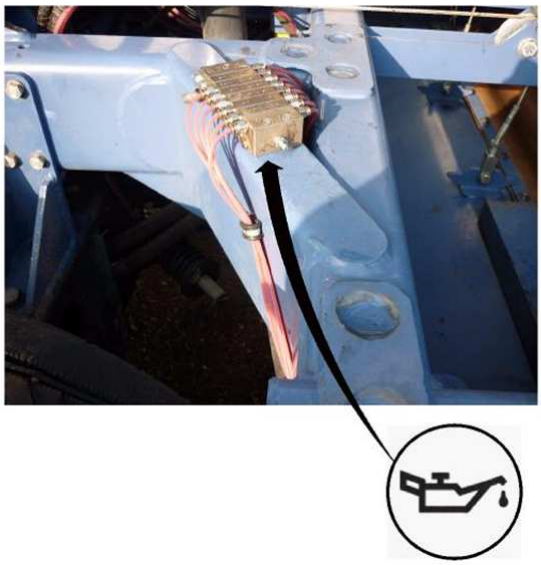
Appropriately protect body parts (eyes, hair, hands, etc..) when cleaning using compressed air or water guns.

5.3.14 GREASING OPERATIONS

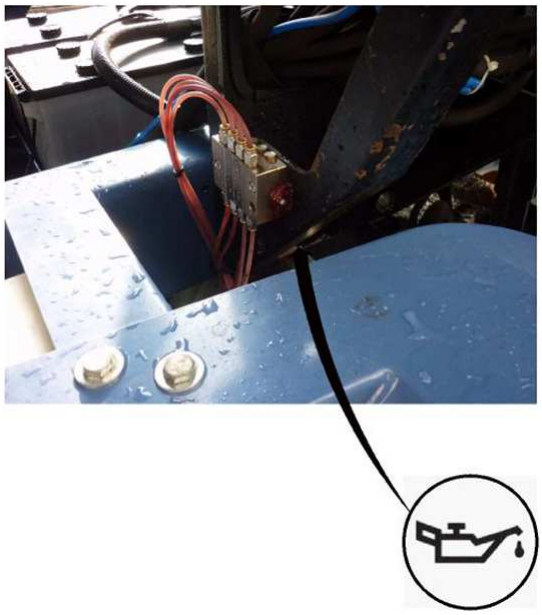
Please carry out every 15 hours worked



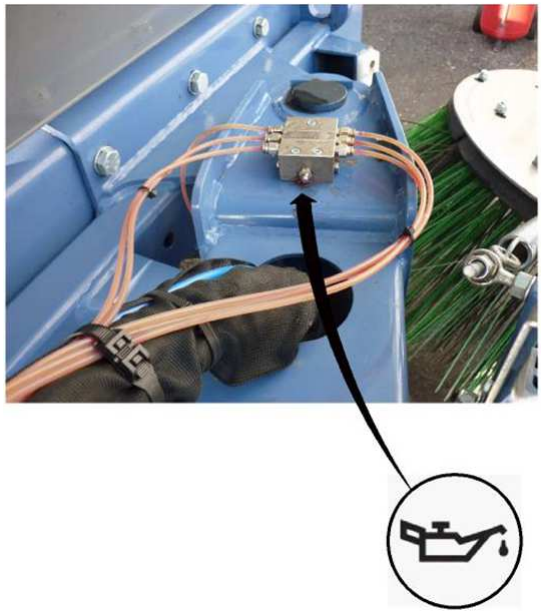
Pict. 5-29 REAR LEFT FRAME LUBRICATION POINT



Pict. 5-30 REAR RIGHT FRAME LUBRICATION POINT



Pict. 5-31 FRONT FRAME LUBRICATION POINT



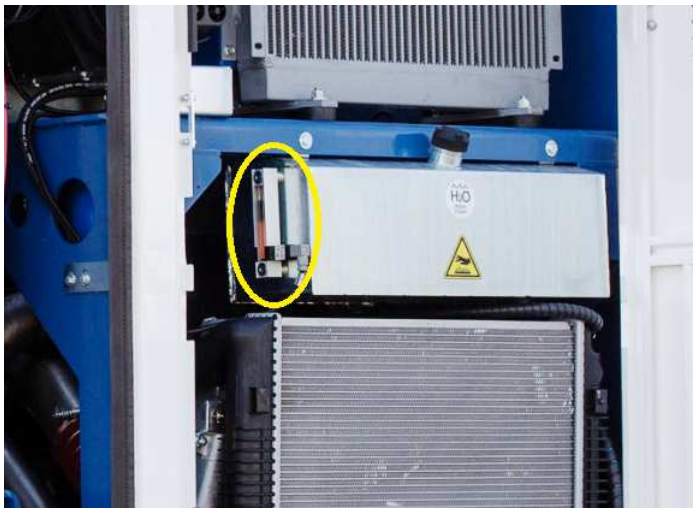
Pict. 5-32 3RD BRUSH LUBRICATION POINT

5.3.15 CHECK ENGINE COOLANT LEVEL

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Open the right side door to access the coolant tank.
4. Visually check the level of anticorrosion protection and antifreeze fluid on the monitoring device (see Pict. 5-33). The cooling system is correctly filled when the liquid level reaches the top of the glass meter.

DANGER

The cooling circuit is pressurised; do not carry out any inspections or refills until the engine has cooled down and even then carefully open the cap of the tank.



Pict. 5-33 Engine coolant level sensor

If necessary refill coolant

5. Slowly open the cap of the engine cooling system and release the excess pressure. The correct proportion of anti-corrosion liquid and anti-freeze in the coolant, equal to 50%, occurs in the presence of an anti-freeze protection up to -37°C. If a lower anti-freeze protection is indicated, correct the mixing ratio.
6. To top up, use a funnel.
7. After the top up, tighten the cap.

INFORMATION

Coolant tank is equipped with a low level electrical sensor that signals warning directly on the sweeper function dashboard Pict. 4-8. In case of low level warning intervention engine must be stopped immediately.

5.3.16 REPLACEMENT OF THE CAB AIR FILTER

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Remove the left side door (Pict. 5-34) by unscrewing the 6 fixing screws (Pict. 5-35) using a 3mm hex key.
4. Remove the filter from its housing, by leveraging the metal frame and being careful not to damage the filter (Pict. 5-36 and Pict. 5-37).
5. Clean the filter with a compressed air jet (maximum 6 Bar) or replace with a new one.
6. Insert the filter and close the left side door again using the 6 screws.

Pict. 5-34

Pict. 5-35

Pict. 5-36

Pict. 5-37

5.3.17 REPLACEMENT OF FUSES

The fuses protect the electrical system by intervening in the event of failure or improper action on the system. When a device does not work, you need to check the efficiency of its protection fuse:

the conducting element of the fuse must not be interrupted.

If it is, replace the blown fuse with another of the same amperage (same colour).

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Open the Fuse Box located in the cab. The Box is closed with a key (Pict. 5-38).
4. Access the fuses (Pict. 5-39) and then replace the fuse concerned.
   To identify the fuse consult the attached diagram in Pict. 5-40.
5. When finished close the Fuse Box with the key.

INFORMATION

In the event the fuse should fail, contact the MACRO Service centre.

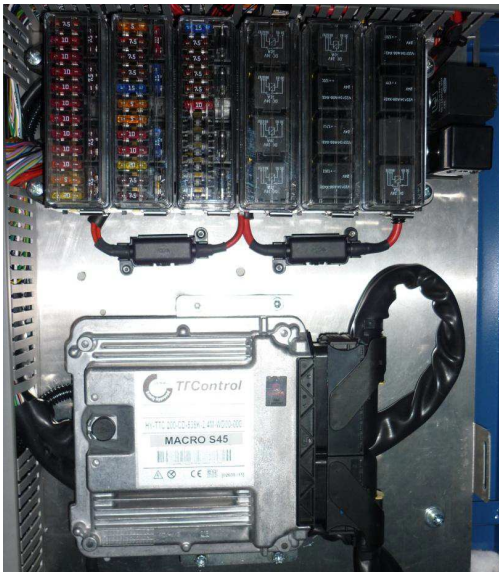
DANGER

Never replace a blown fuse with metal wires or other recovery material. FIRE HAZARD.

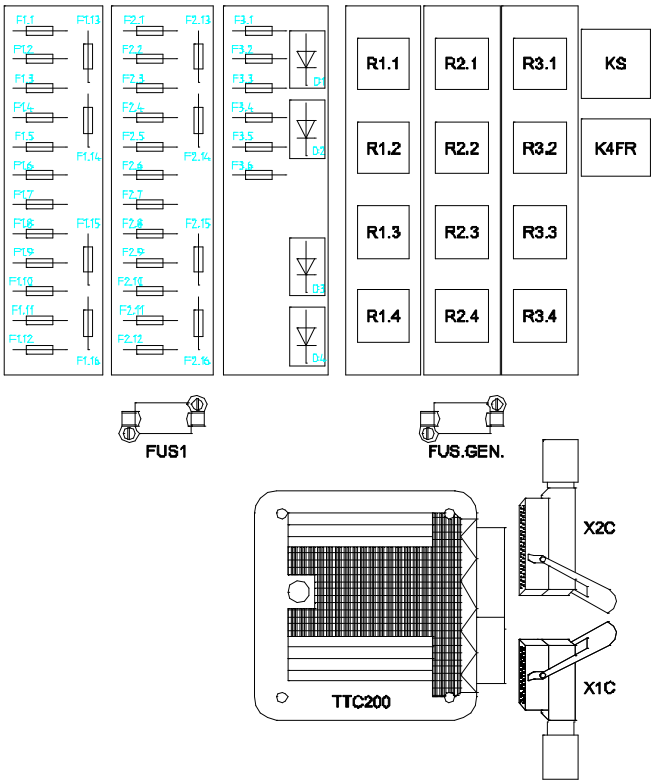
Never replace a fuse with another with a higher amperage. FIRE HAZARD.

Before replacing a fuse, be sure to remove the key from the ignition and turn off/disable all users.

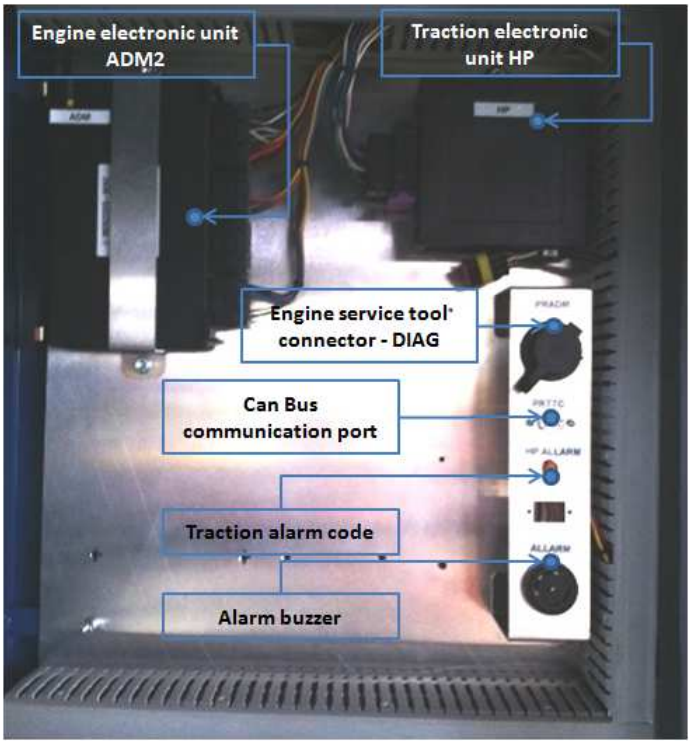
Pict. 5-38 Fuse and relay vane



Pict. 5-39 Macro S45/S60 Master unit



Pict. 5-40 Electrical system lay-out



Pict. 5-41 Electronic units and communication ports

Name	Function
R1.1=	Air conditioning relay
R1.2=	Fans air conditioning relay
R1.3=	Hidraulic oil electricfan relay
R1.4=	Oil heater relay
R2.1=	H2o pump relay
R2.2=	Start relay
R2.3=	Handbrake relay
R2.4=	Neutral gear relay
R3.1=	Open tailgate relay
R3.2=	H2o reserve pilot light relay
R3.3=	3° brush work light relay
R3.4=	12V relay
KS=	Main relay
K4FR=	4way flashers relay

Tab. 5-4 Relay list

Name	Function
FUS1=	TTC200 supply protection fuse(+30)
FUS.GEN.=	Main Power supply fuse

Tab. 5-5 Main fuse

Name	Function
F1.1=	Key +30 protection fuse(+30)
F1.2=	ADM21 supply protection fuse(+30)
F1.3=	Diagnostic plug supply protection fuse(+30)
F1.4=	Alternator +30 protection fuse(+30)
F1.5=	MR +30 protection fuse
F1.6=	MR +30 protection fuse
F1.7=	ADM21 supply protection fuse(+15)
F1.8=	Diagnostic plug supply protection fuse(+15)
F1.9=	MR +15 protection fuse
F1.10=	Alternator +15 protection fuse(+30)
F1.11=	TTC200 K-15 protection fuse
F1.12=	3° brush unit protection fuse(+15)
F1.13=	HP unit protection fuse(+15)
F1.14=	4way flashers pushbutton common protection fuse(+30)
F1.15=	4way flashers pushbutton common protection fuse(+15)
F1.16=	Change page pushbutton protection fuse(+15)

Tab. 5-6 Fuse box #1

Name	Function
F2.1=	Right devio common protection fuse(+15)
F2.2=	Wipers P4 supply protection fuse(+15)
F2.3=	Wipers P4(53) 1°speed protection fuse
F2.4=	Wipers signal protection fuse
F2.5=	Rotating beacon protection fuse(+15)
F2.6=	Cabin light protection fuse(+15)
F2.7=	Camera protection fuse(+15)
F2.8=	Unit heating protection fuse(+30)
F2.9=	Air conditioning binary supply(+15)
F2.10=	Unit heating protection fuse(+15)
F2.11=	Sensors supply protection fuse(+15)
F2.11=	Sensors supply protection fuse(+15)
F2.12=	Instrument column supply protection fuse(+15)
F2.13=	Air conditioning compressor protection fuse
F2.14=	Air conditioningfans on protection fuse
F2.13=	Air conditioning compressor protection fuse
F2.14=	Air conditioningfans on protection fuse
F2.15=	Hidraulic oil electricfan protection fuse
F2.16=	Oil heater on protection fuse

Tab. 5-7 Fuse box #2

Name	Function
F3.1=	H2o pump on protection fuse
F3.2=	Forward gear solenoid valve signal protection fuse
F3.3=	Reverse gear solenoid valve signal protection fuse
F3.4=	Parking solenoid valve protection fuse

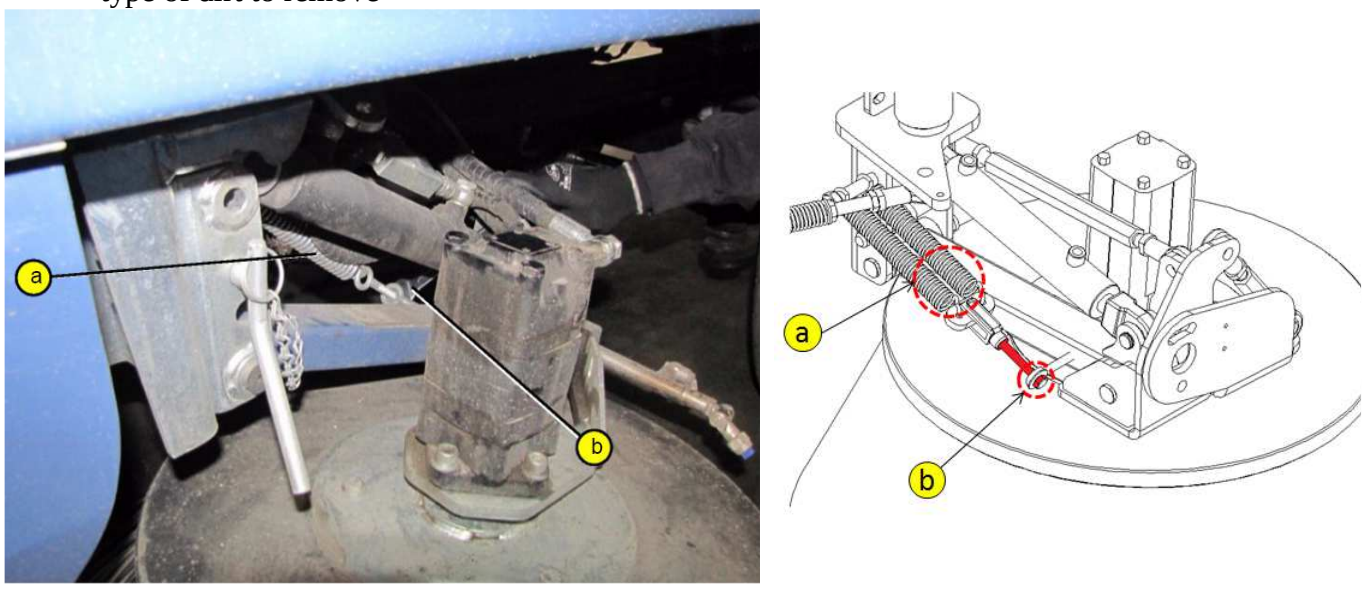
F3.5=	3° brush work light protection fuse
F3.6=	Cigar lighter and radio protection fuse
F3.7=	Available
F3.8=	Available
F3.9=	Available
F3.10=	Available
F3.11=	Available
F3.12=	Available
F3.13=	Available
F3.14=	Available
F3.15=	Available
F3.16=	Available

Tab. 5-8 Fuse box #3

5.3.18 BRUSH PRESSURE ADJUSTMENT

The operator can adjust the pressure made by the brushes over the surface to clean. The entered value depends mainly on the following factors:

- type of used brushes
- brush wear
- type of surface to clean
- type of dirt to remove



Pict. 5-42 Side brush pressure adjustment

The adjustment is manual and the operator operates directly on the spring which controls the brush pressure. In Pict. 5-42 the position of the brush spring is indicated by the letter (a), located towards the machine internal part, and the position of the key (b) on the nut which allows the spring adjustment with a 24 mm hex wrench, loosen the lock nuts The adjustment of the brush pressure must be executed with machine stopped on plan surface, with parking brake engaged and engine off.

5.3.19 CHECK AND ADJUST THE POSITION OF THE SIDE BRUSHES

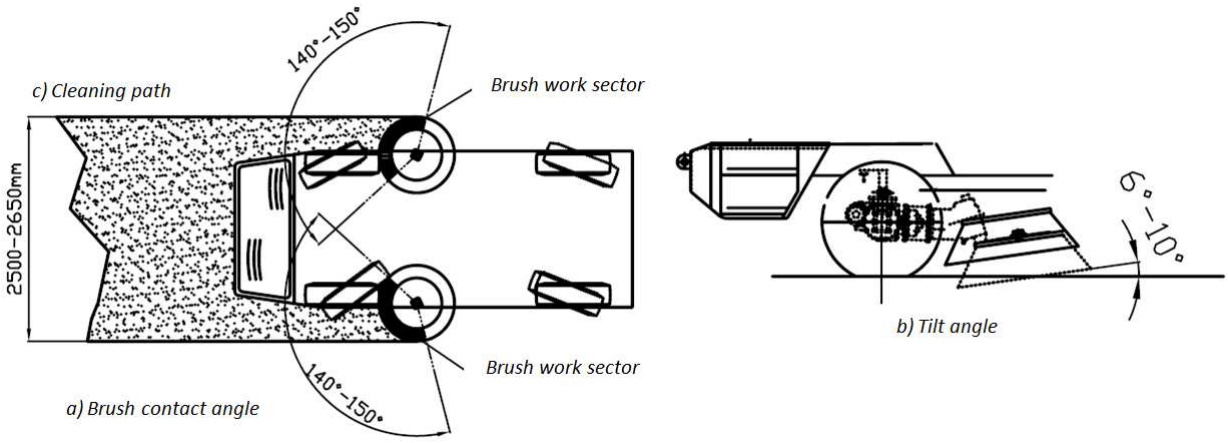
INFORMATION

Brushes with different hardness are provided. This procedure can be applied to all the kind of brushes.

Check

1. Check the correct height from the ground and angle of the side brushes, proceeding as follows:

- Put the machine on level ground.
- Keeping the machine steady, fully lower the side brushes and turn them for a few seconds.
- Stop and lift the side brushes then move the machine.
- Check that the impressions left by the side brushes are, in extension and orientation, as shown below in Pict. 5-43 pos. a. The contact angle of the brushes with the surfaces to be swept should be about 140-150 degrees. The angle of the brushes, as shown in Pict. 5-43 pos. b must be between 6 and 10 degrees.



Pict. 5-43 Side brushes cleaning track check

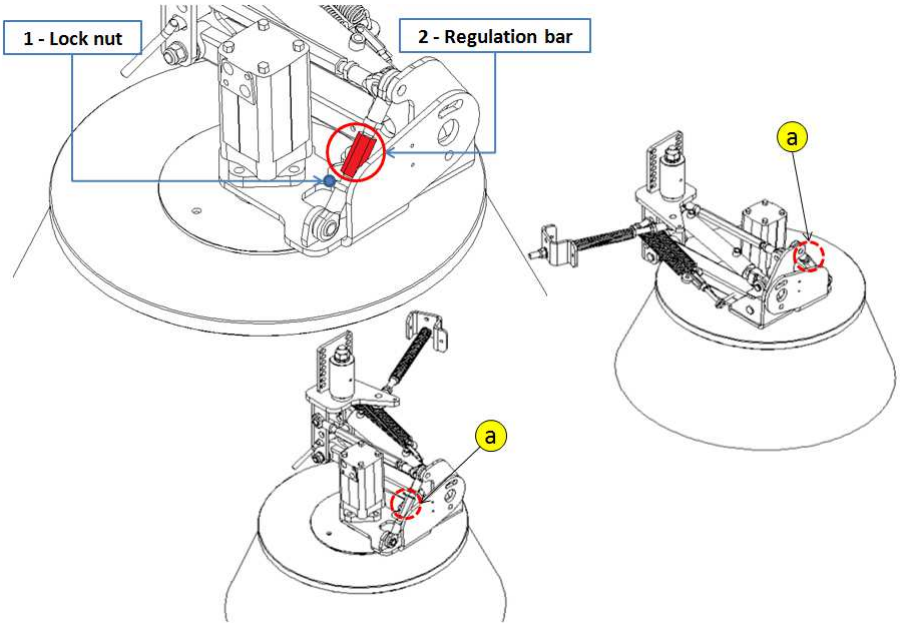
Adjust the brushes side and forward tilt angle with different impressions proceeding as described in the following points.

2. Operate the parking brake (see par. 4.3).
3. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.

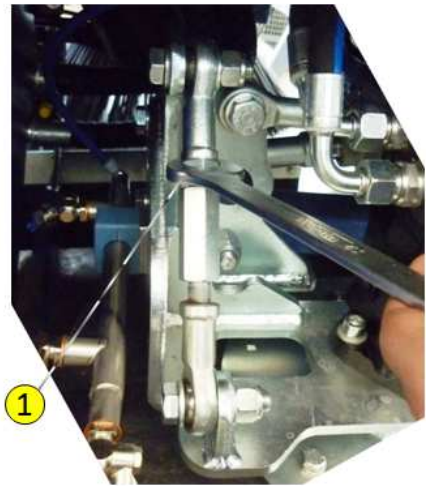
Adjustment of the side tilt angle of the side brushes

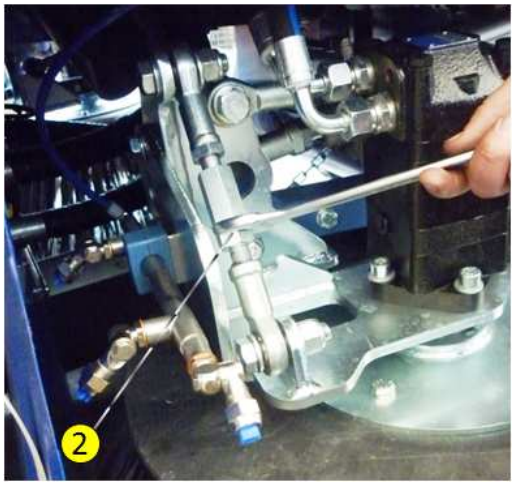
4. From both sides of the machine, with a 24 mm hex wrench, loosen the lock nuts (Pict. 5-44 – pos. 1), and then adjust the tilt angle forward by unscrewing/screwing the hexagonal bar of the tie rod (Pict. 5-44 – pos. 2). The lengthening of the bar increases the tilt, while the shortening reduces the angle.
   When the adjustment is done, tighten the lock nuts (Pict. 5-44 – pos. 1).

When the excessive consumption of the brushes does not allow them to be adjusted further, replace them as provided for in the relevant section.



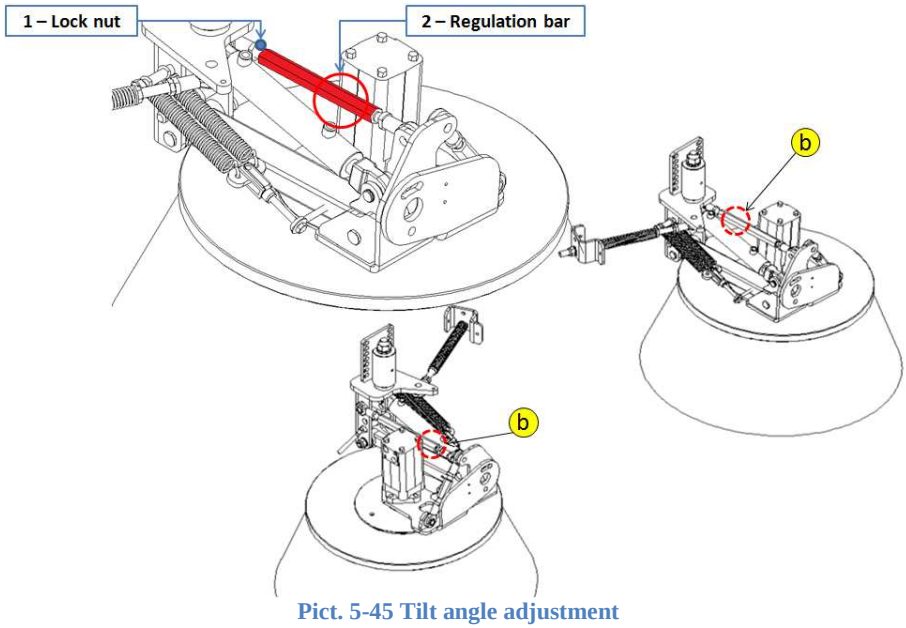
Pict. 5-44 Side angle adjustment





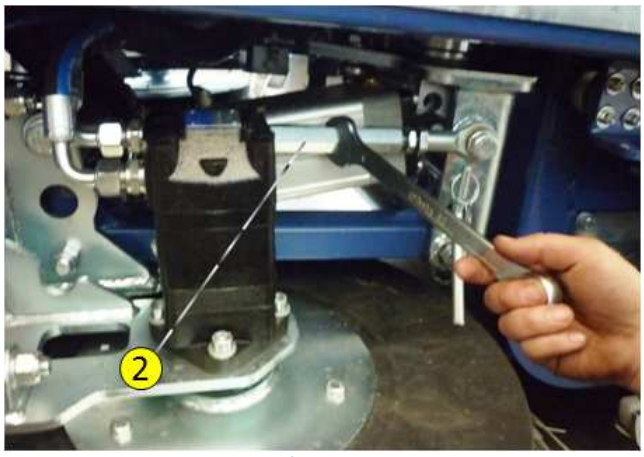
Adjustment of the forward tilt angle of the side brushes

5. From both sides of the machine, with a 24 mm hex wrench, loosen the lock nuts (Pict. 5-45 pos. 1), and then adjust the tilt angle forward by unscrewing/screwing the hexagonal bar of the tie rod (Pict. 5-45 pos. 2). The lengthening of the bar increases the tilt, while the shortening reduces the angle.
   When the adjustment is done, tighten the lock nuts (Pict. 5-45 pos. 1).
6. When the excessive consumption of the brushes does not allow them to be adjusted further, replace them as provided for in the relevant section.



Pict. 5-45 Tilt angle adjustment

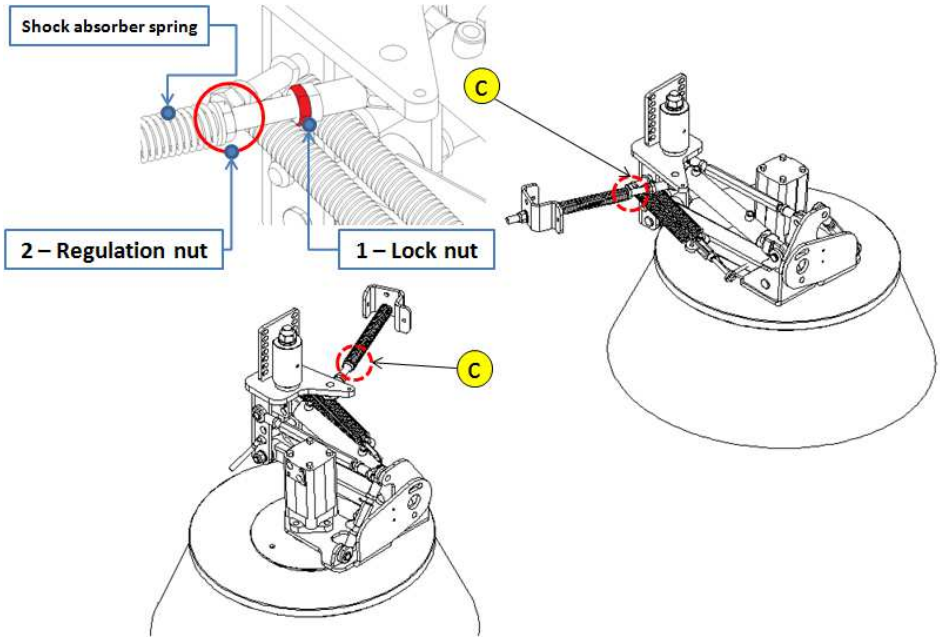
Pict. 5-46



Pict. 5-47

Adjustment of the cleaning area

7. From both sides of the machine, using a 24 mm hex wrench, it's possible to do a small regulation of the cleaning path (Pict. 5-45 pos. 1), and then adjust the spring force unscrewing/screwing the hexagonal nut of the tie rod (Pict. 5-48 pos. 2). The lengthening of the bar decreases the sping force and increase the cleaning path, while the shortening reduces the cleaning path. When the adjustment is done, tighten the lock nuts (Pict. 5-48 pos. 1).



Pict. 5-48 Cleaning path adjustment

5.3.20 CHECK AND ADJUST THE POSITION OF THE THIRD BRU SH (if present)

INFORMATION

Brushes with different hardness are provided. This procedure can be applied to all the kind of brushes.

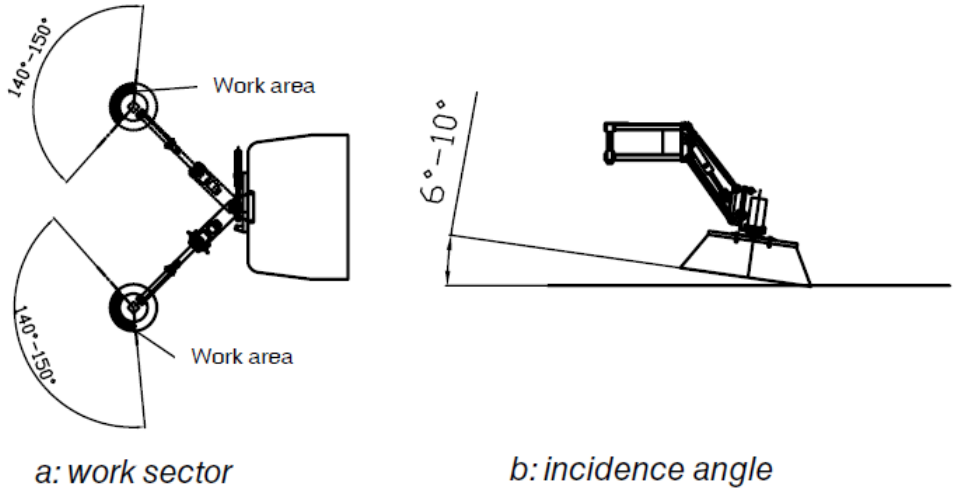
Check the position of the third brush

1. Check the correct height from the ground and angle of the third brush, proceeding as follows:
   - Put the machine on level ground.
   - Start the machine and bring the right arm of the third brush in front of the cab (as in Pict. 5-49) – proceed as provided for in the specific paragraph.

Pict. 5-49

   - Bring the tilt switch of the third brush to the neutral position.
   - Keeping the machine steady, fully lower the third brush (Pict. 5-49) and let it run for a few seconds.
   - Stop and lift and third brush then move the machine.
   - Check that the impression left by the third brush is, in extension and orientation, as shown in the following Pict. 5-49:
     – The brush must touch the floor for an arc of a circle between 140 and 150 degrees (Pict. 5-50 pos. a).
     – The forward tilt angle (Pict. 5-50 pos. b) of the brush must be between 6 and 10 degrees

approx. If necessary, proceed with adjusting the brush, proceeding as described in the following points.



Pict. 5-50

2. Operate the parking brake (see par. 4.3).
3. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.

Adjustment of the incidence angle of the third brush

4. With a 24 mm hex wrench, loosen the lock nuts (Pict. 5-51 pos. a), and then adjust the tilt angle forward by unscrewing/screwing the hexagonal bar of the tie rod (Pict. 5-52). The lengthening of the bar increases the tilt, while the shortening reduces the angle.
   When the adjustment is done, tighten the lock nuts (Pict. 5-51 pos. a).
5. When the excessive consumption of the brush does not allow it to be adjusted further, replace it as described in the following (see 5.3.21).

Pict. 5-51

Pict. 5-52

5.3.21 BRU SH REPLACEMENT

INFORMATION

Brushes of various hardness are supplied. This procedure is applicable to all types of brushes.

DANGER

We recommend the use of gloves when replacing brushes as there may be sharp pieces stuck between the bristles.

1. Operate the parking brake (see par. 4.3).
2. Turn off the engine by turning the ignition key anticlockwise to the stop position, then remove it.
3. Using two 17 mm hex keys, acting as shown in Pict. 5-53, remove the 4 screws and then remove the brush that is to be replaced.
4. Install the new brush (Pict. 5-54) using the drill holes, marked with the letter "D", on the plate of the brush.
5. Adjust the height of the new brush, following that described in the specific paragraph.

Pict. 5-53

Pict. 5-54

INFORMATION

For the replacement of the brush/central roller please refer to the Workshop manual.

5.3.22 BULB REPLACEMENT

INFORMATION

- Before replacing a bulb check that the corresponding contacts are not oxidised.
- Blown bulbs must be replaced with bulbs of the same type and power.
- When you have replaced a headlight bulb, always check its orientation for safety reasons.
- When a bulb does not work, before replacing it, check that the corresponding fuse is intact. For the location of fuses, refer to the section REPLACEMENT OF FUSES in this chapter.

DANGER

Any bulb replacement operation must be carried out with the machine off, and with the ignition key off.

a) Types of bulbs

Different types of bulbs are installed on the vehicle. The following Tab. 5-9 shows the type of bulb used for each type of use.

Headlamps (high above the cab "Oval100")	H3 24V 70 Watt
Round headlamps Ø85 on the brushes	Led 1200 Lum
Front headlamps model Oval 120	H4 24V 70W
Front position lamps	R5W 24V
Front direction indicator lamps	PY21W 24V
Side repeating direction lamps	R5W 24V
Rear direction indicator lamps	PY21W 24V
Stop and Reverse	P21W 24V
Sidelights	R5W 24V
Licence plate	R5W 24V

Tab. 5-9 Type of bulbs

DANGER

Modifications or repairs to the electrical system performed incorrectly and without taking into account the technical characteristics of the system, can cause malfunctions leading to fire hazards.

Halogen bulbs contain pressurized gas, in case of breakage it is possible for glass fragments to be projected.

Halogen bulbs must be handled by only touching the metal part.
If the transparent bulb comes into contact with your fingers, it reduces the intensity of the emitted light and it can also affect the life of the lamp.
In case of accidental contact, wipe the bulb with a cloth moistened with alcohol and let dry.

b) Replacement of front light bulbs

These consist of the bulbs of the dipped beams, main beams and sidelights.

To replace the bulb proceed as follows:
Remove, using a Philips screwdriver, the two screws securing the optical assembly (Pict. 5-55).

- Remove the optical assembly as shown in Pict. 5-56.
- Disconnect the electric connector of the bulb to be replaced.
- Take out the bulb and replace it.
- Fit the new bulb.
- Put the optical assembly back into its housing and secure it using the 2 screws.

Pict. 5-55

Pict. 5-56

c) Bulb replacement of front direction indicator lamps

To replace the bulb, proceed as follows:

- Remove, using a Phillips screwdriver, the two screws securing the optical assembly (Pict. 5-55).
- Remove the optical assembly as shown in Pict. 5-56.
- Insert your hand to access the bulb of the indicator lamp, as shown in Pict. 5-57.
- Take out the bulb and replace it.
- Put the optical assembly back into its housing and secure it using the 2 screws.

Pict. 5-57

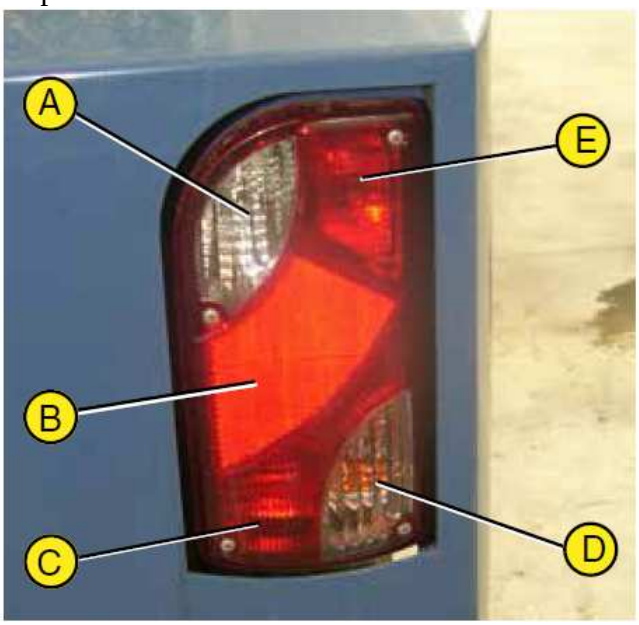
d) Replacement of rear light bulbs

These consist of the bulbs of the sidelights, direction lights, reverse and stop lights. The layout of the bulbs indicated in Pict. 5-58 is the following:

A. Reverse lights
B. Sidelights
C. Stop lights
D. Direction indicator lights

E. Rear fog lights

For the lamp type and relative power refer to Tab. 5-9.



Pict. 5-58

To replace a blown bulb proceed as follows:

- Remove, using a Philips screwdriver, the four screws securing the protective cover of the rear assembly (Pict. 5-59).
- Remove the cover (Pict. 5-60).
- Remove the bulb and replace it. The bulbs of the assembly all have bayonet heads. To take them out press and turn.
- Refit the protective cover of the rear optical assembly and secure it using the 4 screws.

Pict. 5-59

Pict. 5-60

e) Replacement of headlights above the cab

For the lamp type and relative power refer to Tab. 5-9.

To replace the bulb proceed as follows:

- Using a suitable ladder, reach the headlight (Pict. 5-61).
- Remove, using a Philips screwdriver, the two screws securing the optical assembly (Pict. 5-62).
- Remove the optical assembly.
- Disconnect the faston electric connector of the bulb to be replaced.

- Release the spring clip.
- Take out the bulb and replace it.
- Fit the new bulb, reconnect the faston connector and secure it using the fixing clip.
- Put the optical assembly back into its housing and secure it using the 2 screws.

Pict. 5-61


Pict. 5-62

f) Brush headlights

In the case of failure or breakage of the headlight, replace the complete headlight.


Pict. 5-63

g) Lamp replacement internal light

For the lamp type and relative power refer to Tab. 5-9.

To replace the bulb, proceed as follows:

- act at the points indicated by the arrows and remove the light fitting (Pict. 5-64).
- take out bulb and replace it, making sure that the new bulb is correctly locked between the contacts.
- replace the lamp in its housing making sure it is locked into position.

Pict. 5-64

h) Licence Plate Lights

To replace a bulb proceed as follows:

- Remove, using a Philips screwdriver, the two screws securing the light cover of the plate (Pict. 5-65).
- Remove the cover as shown in Pict. 5-66.
- Take out the bulb and replace it.
- Replace the cover and secure it with the two screws.

Pict. 5-65

Pict. 5-66

i) Flashing lights (if present)

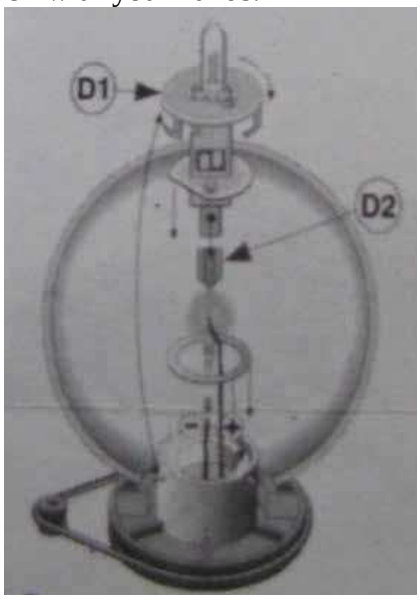
Pict. 5-67

Pict. 5-68

To replace the bulb proceed as follows:

- Remove the cover by unscrewing it with your hands (Pict. 5-69) and pull it off.
- Turn the push lamp hood anti-clockwise (Pict. 5-70 pos. D1) and remove it.
- Insert the bulb in the Faston (Pict. 5-70 pos. D2).
- Do not touch the glass part of the bulb with your hands.
- Replace the push lamp hood and press the bulb into its housing and at the same time turn the push lamp hood in a clockwise direction.
- Replace the cover of the rotating beacon tightening it well with your hands.

Pict. 5-69



Pict. 5-70

j) Side repeating direction lamps

To replace the bulb of the side repeating indicator light (Pict. 5-71) proceed as follows:

- By acting from the inside (see arrow in Pict. 5-72) remove the bulb inserted in the pressure lampholder (Pict. 5-73).
- Take out the bulb and replace it.
- Replace the bulb in the lampholder ensuring that the protective sheath is well positioned.

Pict. 5-71

Pict. 5-72

Pict. 5-73

5.3.23 WHEEL RIM FITTING

a) Side repeating direction lamps

When fitting the rims, you should be careful to align the fixing holes of the rim with the columns of the gearbox, to avoid hitting the rim itself against the head of the columns, because in addition to ruining its thread, you are likely to cause them to come out of their housing thus complicating the fitting of the wheel rim. Once the holes of the rim are aligned with the columns, in order to push the wheel rim into its housing you need to hold it from underneath, raising it by a few millimeters, to avoid sliding the rim itself on the threads of the columns and damaging them.

b) Wheel rim tightening

When tightening the wheel rims on the gearboxes, only use nuts such as "DIN 74361 Rotoblock" M20x1.5, applying a torque of 450 Nm (46 Kgm) to the bolts themselves.

ATTENTION

These torque values must be rechecked, with a torque wrench after a short route of the vehicle (50/60 hours).

5.3.24 BRA KE MAINTENANCE

INFORMATION

For safety reasons, all the braking system maintenance operation must be carried out by qualified personnel only. No further adjustment is required as the axle and parking system are self-adjusting.

DANGER

After replacing the service discs, it is possible that the brakes respond badly, lengthening the braking, it is advisable to carry out the first braking at low speed to run them in.

5.3.25 Topping up the windscreen washing liquid

The tank for the windscreen washing liquid is positioned in the engine compartment (Pict. 5-74) and the liquid level must be regularly checked. To access the engine compartment follow the instructions given in par. 4.12. Fill the tank with a windscreen detergent solution and, using the controls on the steering column, run the system for a few moments in order to expel the remaining liquid.

Pict. 5-74

ATTENTION

Some commercially available windscreen washer fluids are flammable. They can ignite and cause serious problems for the operator and/or the machine. Use the utmost caution when refilling.

Chapter 6 Dismantling, Disposal

INFORMATION

Observe the Regulations for the disposal of materials in force in the country in which the machine is to be dismantled.

6.1 DISMANTLING

6.1.1 Description

INFORMATION

Pay particular attention to the disconnection of conductors that remain live even with the ignition switch in pos. “0”.

Disconnect the control panel wiring, paying attention to the references on each cable by referring to the wiring diagrams. Do not remove the reference numbers from the cables and terminal boards.

6.1.2 DISMANTLING THE HYDRAULIC SYSTE MS

Dismantle the hydraulic systems by referring to the relative diagrams.

6.1.3 MECHANICAL DISMANTLING

Before mechanically dismantling the machine, wash all parts in contact with the material and carefully clean the entire structure (see Chapter 5 Cleaning and Maintenance).
For the lifting mode and relative safety precautions, refer to Chapter 2 Transport, Handling, Installation.

6.1.4 PACKAGING

Use packaging appropriate to the weight and features of the parts.

INFORMATION

Affix a plate bearing the weight, content and other information necessary for transportation, outside the packaging.

6.2 DISPOSAL

6.2.1 WASTE OILS

For no reason must waste lubrication and hydraulic oils be disposed of in the environment (water, sewer, etc...).
They must be taken to Collection Points in possession of valid authorisation.
We, therefore, recommend scrupulous compliance with the legislation in force.
Temporary storage must be made using perfectly watertight containers with lids, that ensure the impossibility of
any contamination of the oil used with other products, including rainwater. Filters must be preserved and conferred
in the same way.

6.2.2 EXHAUSTED LEAD BATTERIES

Exhausted batteries are considered "toxic harmful" waste.
For their disposal, these must be taken exclusively to collection points in possession of valid authorization. The existence of which must be ascertained by the company or person delivering the item.
In the case of impediment, the "temporary storage" must take place in compliance with the legislation in force, and mainly: be in possession of temporary storage authorisation. Store in sealed plastic containers, having a capacity below the volume of the electrolyte of the battery/batteries or, however, such that rainwater cannot enter the container.

6.2.3 MATERIAL COLLECTED BY THE MACHINE

The material collected by the machine can and must be taken (as agreed with them) to the Municipal Cleaning Companies, such as municipal waste or similar.
As long as there is absolute certainty that the waste does not contain toxic-harmful presence.
The cleaning of environments which may contain toxic-harmful waste, must be carried out individually for each type of waste, with the machine container empty, the content of which at the end of operation must be totally unloaded into containers, which must be managed according to the provincial, regional

and state laws and standards.

6.2.4 SCRAPPING

At the end of the machine's life, the materials which make it up, that are listed with reference to the affected part, must be properly disposed of.
We recommend sending the machine to an authorised collection point, which will properly manage the disposal.
In particular, oils, filters and batteries must follow the above listed procedures. The ABS and metal parts can follow their destinations of secondary raw materials.
The rubber hoses and gaskets, as well as the plastic and common fiberglass and plastic must be separately conferred to the Municipal Cleansing Companies.

INFORMATION

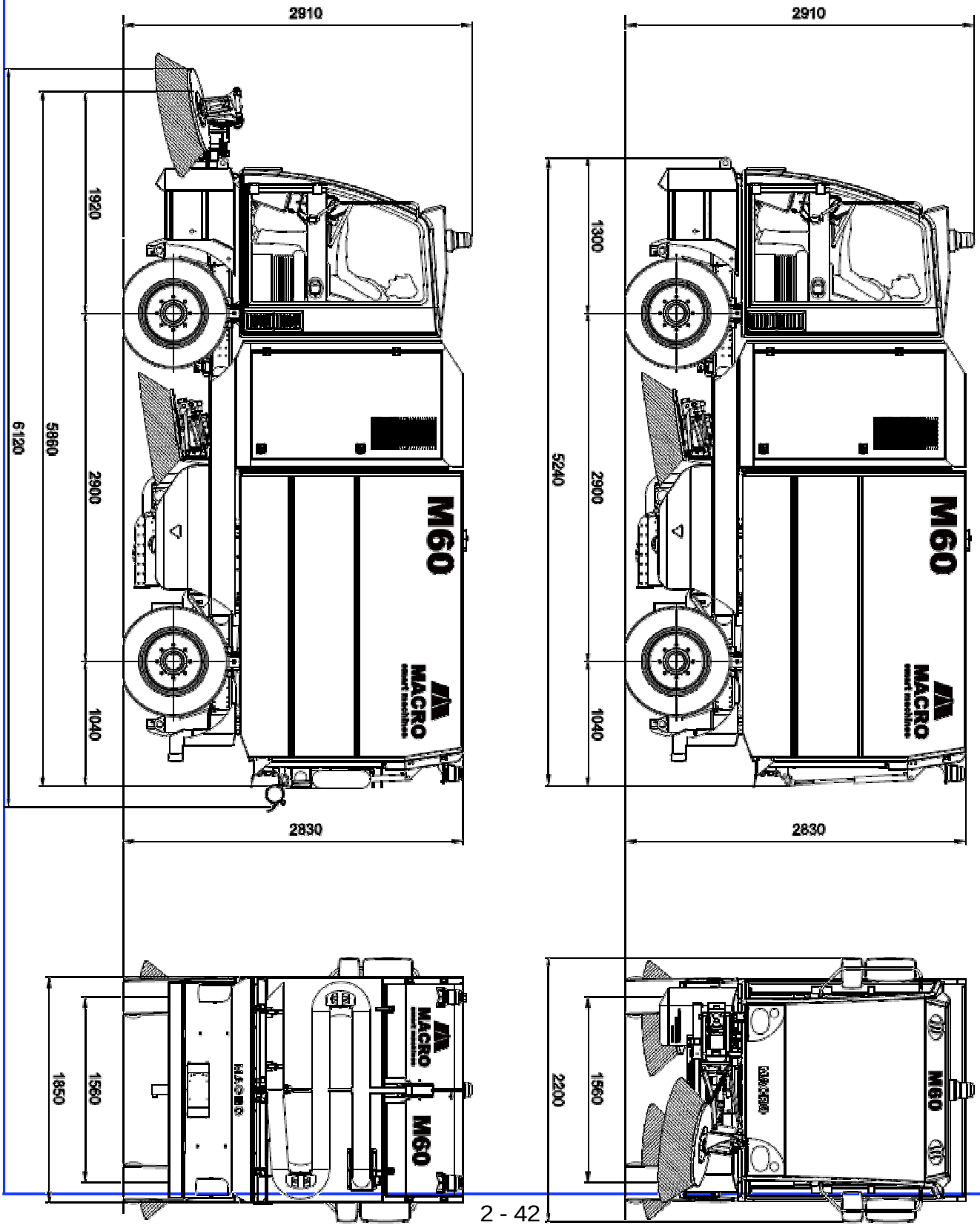
Demolish the different types of material composing the machine in adequate landfill sites.

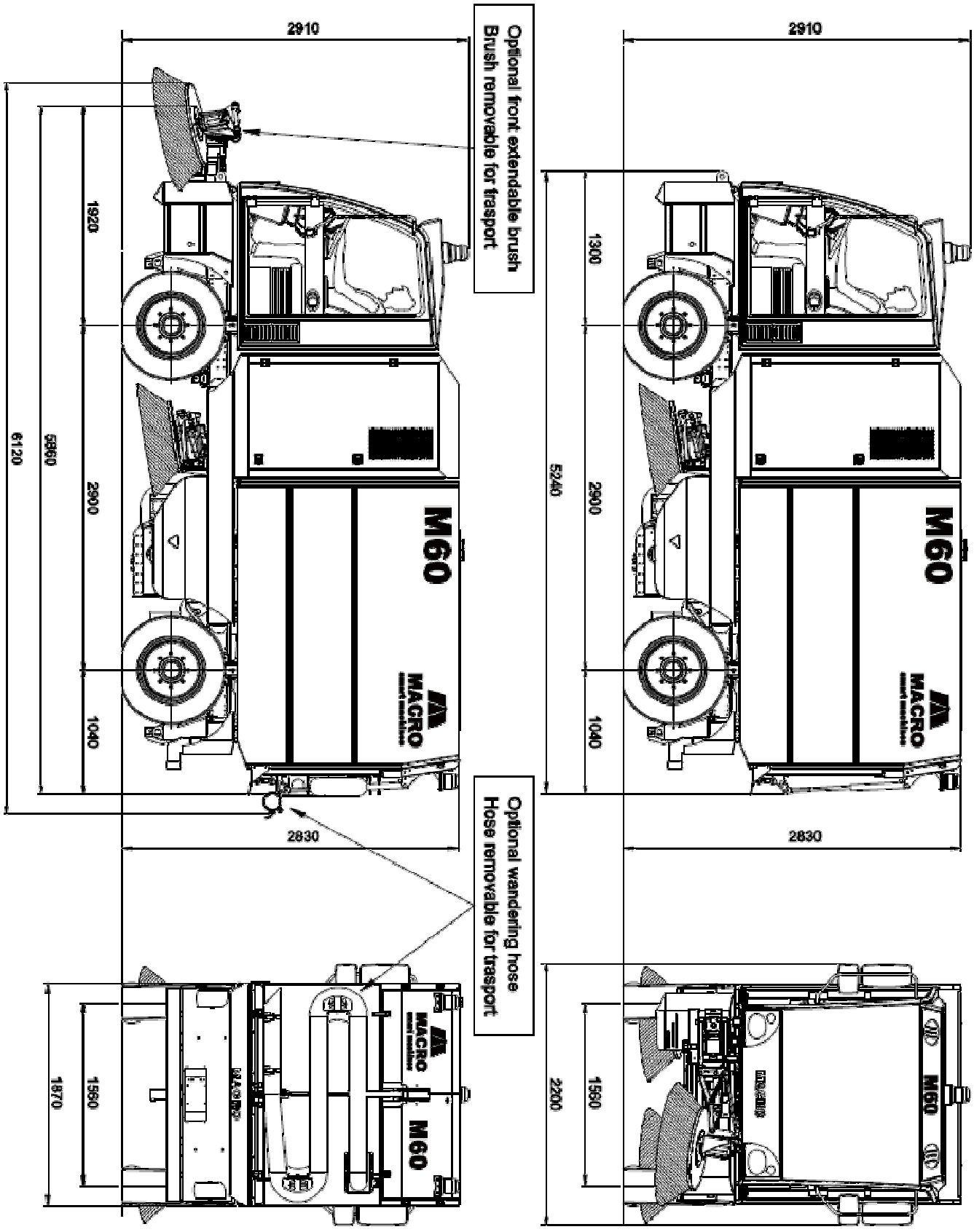
INFORMATION

Always observe the Legislation in force in the country of use of the machine.

Chapter 7 **ATTACHMENTS**

- M60: Technical sheet basic machine (a copy must be inserted in the circulation document)
- M60: Technical sheet including optional equipment (a copy must be inserted in the circulation document)




2910
Optional front extendable brush
Brush removable for trasport
1920
6120
5860
2900
1040
2830
M60
MACRO
2910
1300
5240
2900
1040
2830
M60
MACRO
Optional wandering hose
Hose removable for trasport
1870
1560
M60
MACRO
2200
1560
M60

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