TECHNOMATIC EQUIPMENTS

SNOW CUTTER/BLOWER

TECHNOMATIC F-90

OPERATION & MAINTENANCE MANUAL

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OPERATION & MAINTENANCE MANUAL

SNOWBLOWER VEHICLE

F90

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E – TRANSFER

F – BLOWER HEAD

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I – TWO SPEED BACK GEAR

J – CHASSIS

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1.1 GENERAL INFORMATION

1.1.1 Introduction

Dear Customer, we wish to thank you for having chosen and purchased a **SNOWBLOWER F90.**

Vehicle good performance and lifetime are strictly linked to its correct use and to its accurate and appropriate maintenance.
Only the use of original spare parts and the intervention of our skilled technical staff can assure the best possible efficiency of the equipment you have purchased.
We allow ourselves accordingly to recommend to entrust EXCLUSIVELY our Technical After-sales and Spare Parts Service with the maintenance of vehicles. We also suggest to avoid installing or replacing any component without having previously got manufacturer's authorization.
We trust you will understand the importance of what above from the technical point of view, the main purpose being to avoid any problem to our Customers.

This manual will supply you with all necessary information for a correct maintenance of your F90 STI equipment. Should anyway any part of it not being clear enough, please do not hesitate to contact our Technical Staff directly.
You are kindly requested to read every part of this manual carefully and to fully respect the instructions it contains. Any procedure or advice you are going to read, even if apparently obvious, aims at building user's knowledge of the equipment and at the total fulfilment of all necessary safety operating conditions. For this reason, the information contained in the manual have to be forwarded to all staff who's going to use the equipment.

We remain at your full disposal for any possible need.

Yours Sincerely,

M/s Technomatic Equipments

1.1.3 Purpose of the manual

This manual has been written by Manufacturer in order to supply necessary information to all authorised operators carrying out maintenance of the vehicle Model F90.

Specific information and maintenance recommendations, which are reported on this manual, are based on the knowledge at the time of printing.

Technomatic reserves the right to modify this manual at any time and without being obliged to communicate.

Should you find any difference between your equipment and the information reported in this manual, you are kindly requested to contact Technomatic Equipments.

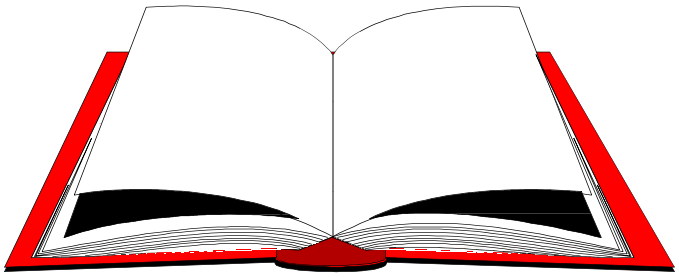
Should you find in this manual more information than the ones needed by the effective version of the equipment, these wouldn't affect either your reading or the effective maintenance to be carried out.

We recommend to read this manual carefully, before starting operations.

1.2 WHEN IS THE USE OF THE MANUAL SUGGESTED?

The use of the manual is recommended before these operations:

- First start
- Use of vehicle (work or transfer)
- Maintenance, cleaning, adjustments and calibrations
- Repair, parts and supplies ordering, technical assistance
- Demolition



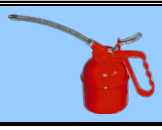
READ THE USE AND MAINTENANCE MANUAL BEFORE OPERATE WITH THE VEHICLE

NOTE:
This manual must remain with the VEHICLE for its whole life.
Put it accessible at all the people acting on vehicle.

1.3 MEANING OF THE SYMBOLS FOR INSTRUCTIONS

This manual uses several symbols to draw the reader's attention and highlight some particularly important aspects of the discussion.

The following table lists and describes the meaning of the different symbols used.

SYMBOL	MEANING	EXPLANATION, ADVICE, NOTES
	***Danger***	*This symbol indicates a hazard encountered by personnel that may cause injury and even death.*
	***Warning***	*This symbol indicates a hazard that results in some serious damage to the vehicle.*
	***Note***	*This symbol indicates a hazard or unsafe procedure that can result in minor injury or damage to things.*
	***Note***	*LUBRICATION is required*

1.4 HOW IS THE MANUAL STRUCTURED?

Scrolling titles in the INDEX, you can go to the most important topics for easier consultation; in general, it is composed of:

CHAPTER 1 - INTRODUCTION
Contains the general information and the vehicle identification.

CHAPTER 2 - SAFETY NORMS
Contains safety norms description.

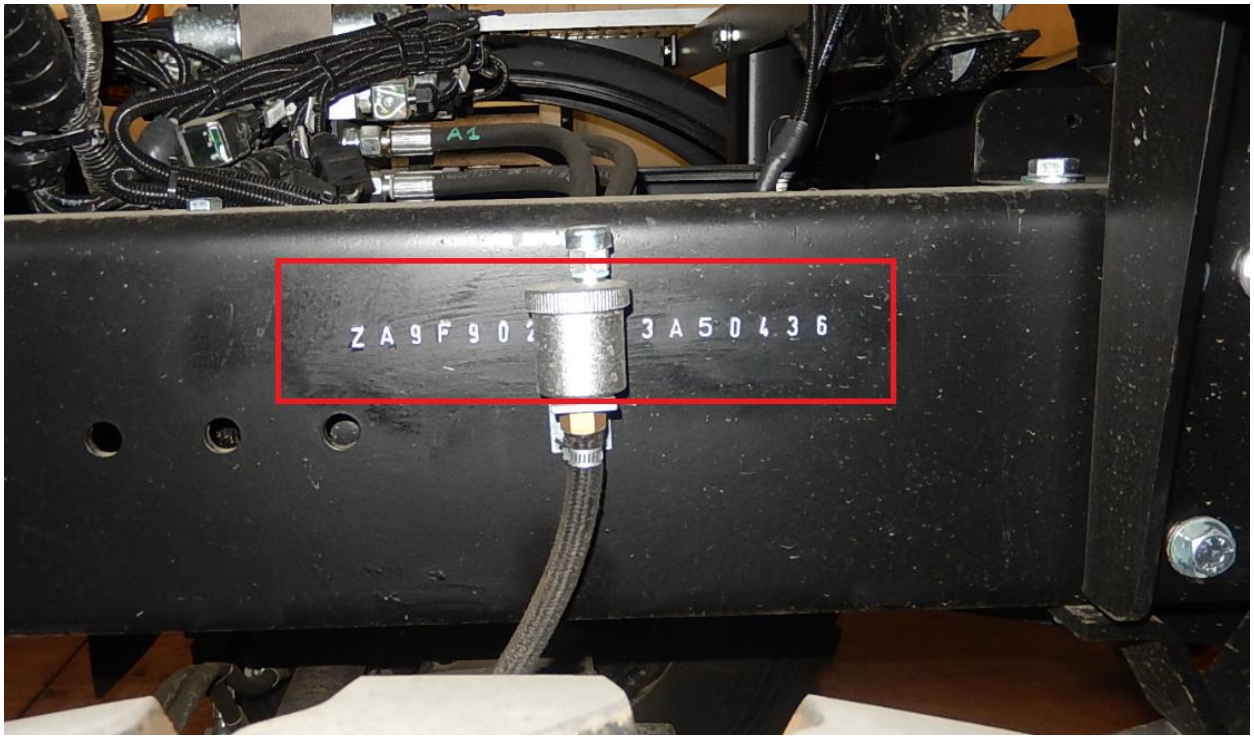
CHAPTER 3 – CAB AND INSTRUMENTATION
Contains the description of the cab and its instrumentation.

CHAPTER 4 - INSTRUCTION FOR THE USE
Contains information for the use of the vehicle with the description of the commands available to the operator and the most important operating procedures.

CHAPTER 5 - MAINTENANCE
Contains the schedule of preventive maintenance and operations organized in tabs, as well as major corrective maintenance operation.

1.5 VEHICLE IDENTIFICATION

The chassis number is printed on the front right side member of the frame.



1.6 MANUFACTURER ADDRESS

For any kind of information about the use, maintenance, installation etc. Technomatic is always available to answer the Purchaser's requests.

The Purchaser is requested to ask the questions in a clear way, by referring to this catalogue and always indicating the data reported on the identification plate of the machine.

Any request about service assistance at the customer or clarification regarding the technical aspects of this document should be addressed to:

Regd. Office- Technomatic Equipment, 3rd Floor, Shop No- 5,
Rama Palace-II, Sector-20B,
Faridabad (Haryana) India -121002
TEL- +917070701334, Email- service@technomatic.in

1.7 INSTRUCTION FOR SPARE PARTS ORDER

Over time, some parts the vehicle are subject to wear or damages and need to be replaced. The Purchaser may ordinate the parts which have to be replaced. The customer is obliged to buy original spare parts.

The intervention of the Technical Assistance Center Technomatic Equipments is recommended. Qualified operators are available, providing suitable tools, equipment and original spare parts.

The requests of the spare parts for the machine must be addressed to:

Regd. Office- Technomatic Equipment, 3rd Floor, Shop No- 5,
Rama Palace-II, Sector-20B,
Faridabad (Haryana) India -121002
TEL- +917070701334, Email- service@technomatic.in

specifying the model and serial number of the machine to which the replacement refers.

1.8 WARRANTY

In the construction of the vehicle F90, the manufacturer has employed the type and quality of materials held at its sole discretion to be appropriate to the machine.

The manufacturer guarantees the line free from defects in material or workmanship for a period indicated into the agreement.

During this period, the manufacturer will repair or replace free of charge, in time, those parts that are flawed and / or defective at long as they were not recognizable on the basis of careful consideration at the time of testing or commissioning and provided the Customer gives notice of such defects and / or defects to the Manufacturer, in by registered mail, within eight days of discovery.

It remains excluded any further obligation and / or compensation from the manufacturer.

This guarantee applies only to Customer in compliance with the provisions of the contract and exclusively in the event that the installation and use of the machine are carried out in accordance with the instructions in the user's manual.

The warranty excludes any and all liability for direct and indirect damage to persons and property resulting from improper use or maintenance of the machine.

They are also excluded from the guarantee that all parties for their use are subject to wear.

If the defects and / or failures defects are not covered by warranty: transport costs, inspection, removal and replacement, due to the intervention of a technician must be borne by the customer.

They are finally excluded from the guarantee and therefore will be charged to customer defects arising out for one or more of the following reasons:

- Improper use or abuse by the operator.
- Incorrect: installation, commissioning, operation and maintenance.
- Use of the machine with safety devices or visibly defective.
- Safety devices and protective assembled incorrectly or damaged.
- Failure in following instructions and warnings contained in the user's manual.
- Repairs carried out improperly.
- Accidents caused by foreign objects, negligence, overloading or acts of God.

SAFETY NORMS

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2.1 GENERAL SAFETY NORMS

DANGER:

Read carefully ALL the following instructions before to operate on the vehicle!

1. Make sure the work area around the vehicle is safe being aware of the risk conditions that can come and create.
2. Always wear safety glasses and safety shoes when performing maintenance operations
3. **Do not** wear loose clothing or torn. Remove all the jewellery while working.

   Disconnect the battery before starting repair work. Put a label "Not Operational" on the control panel.
4. If the vehicle has been used to wait for them to cool the mechanical components, before working on them.
5. Do not work under anything that is supported only by the lifting pistons or by a hoist. Always use blocks or adequate supports to hold the piece.
6. Remove all the pressure from the hydraulic system and the cooling system before working on the pipes. Be careful while you detach a device from a system that uses pressure. Do not check for loss of pressure with the hands. The high pressure air, oil or fuel can cause personal injury.
7. To avoid personal injury, use a hoist or get help while lifting components weighing more than 23 kg. (50 lb.). Make sure that all lifting devices such as chains, hooks, or slings are in good condition and have the right skills. Check that the hooks are properly placed. Always use a tray extender when needed. Lifting hooks must not undergo lateral stresses.
8. The methyl ethyl ketone and naphtha (MEK) are flammable and should be used with care. Follow the manufacturer's instructions to provide a complete safety while using these materials.

DANGER:

KEEP OUT OF REACH OF CHILDREN.

9. To avoid burns, be careful when you touch the exhaust engine, the engine and mechanical units, note the hot liquids in the lines and hoses
10. Use only tools in good condition and know how to use before doing any service work. Use ONLY original spare parts. Always use fasteners of the same degree when making the exchange. Never use fasteners of inferior quality.
11. Never use gasoline or other flammable substances to clean the pieces, but always solvents duly approved.
12. Do not use the emergency starter (booster) to recharge the batteries and therefore always remove the batteries to the end use of the machine.

2.2 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) means all those devices worn by a worker for his protection from risks resulting from performed in the workplace. In order to perform maintenance activities and to ensure safety to personnel, maintenance personnel must wear as described hereinafter as well as clothing considered suitable for the type of work to be performed.

PPE		USE
Safety shoes		Safety shoes must be insulated, reinforced toe and must be worn to perform work involving parts excited by currents, falling loads and penetration of hazardous liquids. **In case of misuse, workers run the risk of crushing feet.**
Gloves		Gloves should be worn for all types of work, such as: ⇨ work with excited items ⇨ works with abrasive materials or high temperatures ⇨ work with sharp details **Wear gloves is mandatory in case of risk of shearing**
Protective helmet		To perform work, which entails risks to the head, particularly during assembly and disassembly, handling of machine components or heavy elements using a crane or other lifting tools. In case of misuse, workers run the risk of head injuries.

CAB AND EQUIPMENT OF CONTROL

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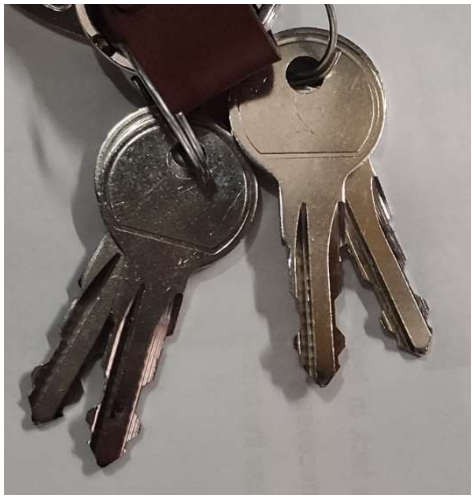
3.1 KEYS AND CAB ACCESS

	Keys for traction engine ignition
	Keys for cab doors lock
	Keys for fuel tank

3.2 CAB ACCESS

To reach the door, use the stair and the handle C.

DANGER:

Keep the steps clean to avoid slipping.

Unlock the door by the lock A, and push the button in A to open. (Periodically grease the mechanism)

To open the door from inside, push up the lever B.

3.3 SEATS

The vehicle is equipped with two seats:

- that of the driver, equipped with electro-pneumatic suspension;
- the passenger seat, without suspension.

The driver's seat is equipped with the following adjustments:

- Weight adjustment;
- Antishock (horizontal shock absorber);
- Longitudinal adjustment;
- Inclination of the seatback;
- Abdominal safety belt.
-

DANGER:

The adjustment must be performed with stationary vehicle

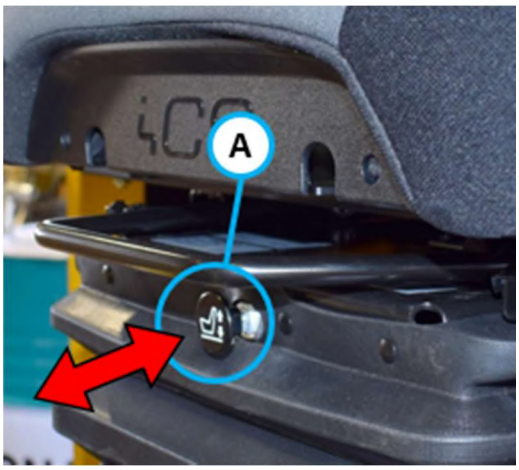
3.3.1 Weight adjustment

Make the adjustment while the operator is seated, so that the seat is loaded.

Press the button **(A)** to load the suspension, pull the button **(A)** to unload it; the correct adjustment is reached when the seat height is taken to half the travel stroke of the suspension.

Adjust according to the weight read on the indicator if the seat is equipped with a window with weight indicator.

If the suspension does not have a mechanical height limiting device, both the weight adjustment and the height limit are carried out with the button.



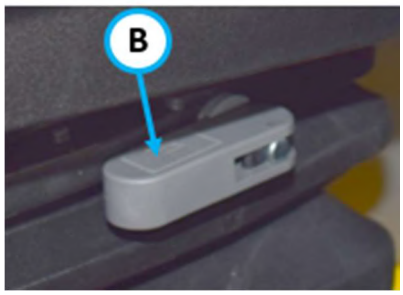
3.3.2 Antishock (horizontal shock absorber)

It cushions the longitudinal shocks (in direction of movement).

It can be on or off

It is turned on or off by turning the lock/release lever **(B)**.

- OFF - longitudinal shock absorber off
- ON - longitudinal shock absorber on



3.3.3 Longitudinal adjustment

For seats with suspensions, pull the adjustment lever **(C)** upward to unlock the guides.

When adjustment is completed, ensure that the lever "clicks" and locks the guides. Check that the seat does not move longitudinally.

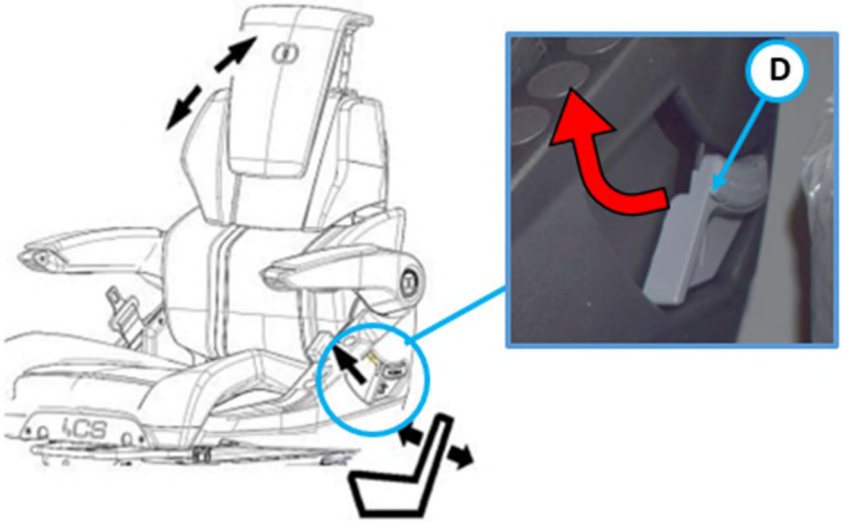
3.3.4 Inclination of the seatback

Make the adjustment while the operator is seated and resting against the seatback.

Use the blocking lever by pulling it upwards to unlock the adjustment mechanism.

While keeping the lever in the release position, with the back oppose the rotation movement of the seatback (it pushes towards the operator) up to finding the optimum angle; release the blocking lever and check that the mechanism "clicks", blocking the seatback in position.

The seatback can be tilted completely forward up to the horizontal position. If the operator is not seated, operate the blocking lever keeping a hand placed on the upper part of the seatback to prevent the seatback from springing forward.



3.3.5 Abdominal safety belt

Adjustment is automatic for safety belts with reel-in mechanism.

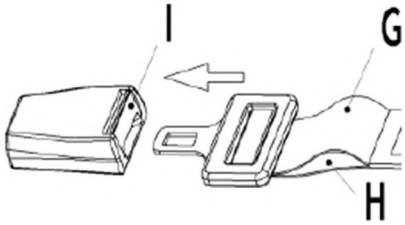
Check that the safety belt is not twisted after it is fastened and does not pass on sharp edges or fragile objects if these objects are in contact with the garments.

Fasten the safety belt by putting the tongue into the buckle opening until it clicks, and check that the tongue is fastened by trying to remove it, pulling on the belt.

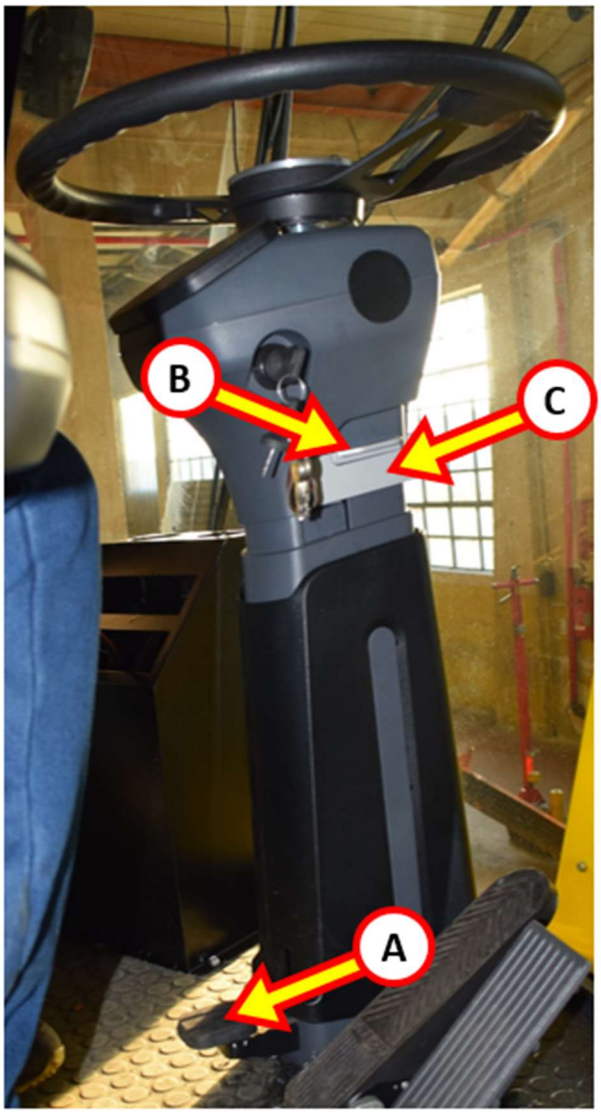
Reel-in mechanism operation. The reel-in mechanism has two types of operation:

- it blocks the belt when the safety belt is fastened. With the safety belt fastened, check that the belt is locked by trying to slowly slip it out of the reel-in mechanism.
- or it blocks the belt when it is brusquely pulled out of the reel-in mechanism. With the safety belt fastened, check that the reel-in mechanism locks the belt when it is brusquely pulled out of the reel-in mechanism.

Unfasten the safety belt by pressing on the red buckle button (I) until it clicks and the tongue is released.



3.4 STEERING WHEEL SETTING



Keep pressed the lever **A** by foot, to adjust steering column inclination

Lift the lever **B** to adjust the inclination of the upper part of the column.

Rotate the lever **C** to lift steering wheel.

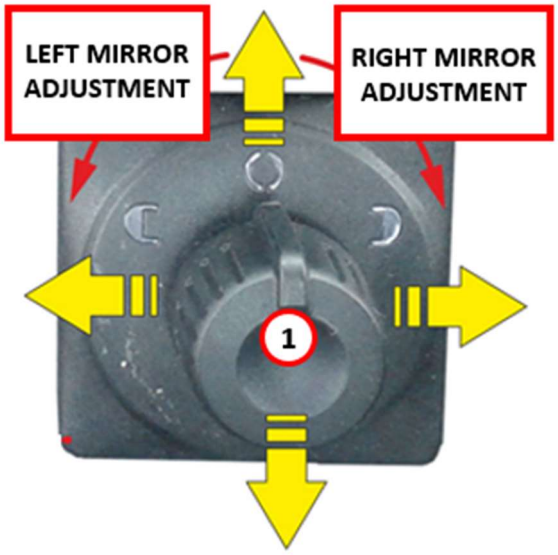
DANGER:

Adjust steering wheel only with stationary vehicle

3.5 REAR VIEW MIRRORS

The rearview mirrors are adjustable by the command in the cab (1).

The mirrors are heated electrically (2).

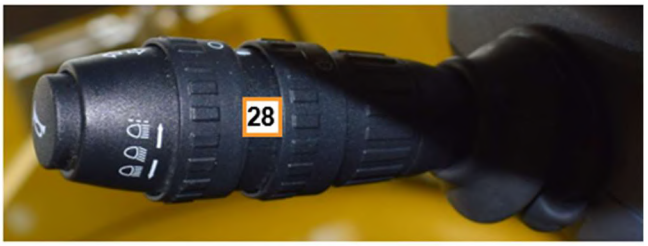


Turn the ring to left or right, depending on you want to adjust the mirror left or right, then, move it in order to have the best visibility. The possible movements are high, low, left and right as indicated by the arrows

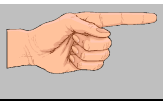
DANGER:

The adjustment of the rearview mirrors must be done with the stationary vehicle.

3.6 CONTROLS OF VEHICLE



1	**Low speed push button** Keep pressed for 3 sec. to select low speed.  **NOTE:** **it is possible to insert the command only with direction lever in neutral.** **WARNING:** **Insert the low speed only with stationary vehicle and transmission in neutral**
2	**Differential locking push button** Keep pressed for 3 sec. to engage/disengage the differential locking.  **NOTE:** **it is possible to insert the command only with direction lever in neutral.** **WARNING:** **Differential locking connection and disconnection must be only done with stationary vehicle and transmission in neutral.**
3	**Rear traction insertion** Keep pressed for 3 sec. to engage/disengage the rear traction  **NOTE:** **it is possible to insert the command only with direction lever in neutral.** **WARNING:** **The rear traction must be only used during the working operations and not for transport.** **WARNING:** **Insert the rear traction only with stationary vehicle and transmission in neutral.**
4	**Windshield heating push button** Press to turn on/off the heating.
5	**Rear window heating push button** Press to turn on/off the heating.
6	**Emergency lights push button** Press to turn on/off the lights.
7	**Front work lights switch** Press the switch on the symbol to turn on the lights. Press in the upper part to turn off.
8	**Front work lights switch** Press the switch on the symbol to turn on the lights. Press in the upper part to turn off.

9	**Rear windshield washer** Press the switch on the symbol to turn on the rear windshield washer. Press in the upper part to turn off.
10	**Rotary beacon switch** Press the switch on the symbol to turn on the beacon. Press in the upper part to turn off.
11	**Rear fog lights switch** Press the switch on the symbol to turn on the lights. Press in the upper part to turn off.
12	**Cab light switch** Press the switch on the symbol to turn on the lights. Press the upper part to turn off.
13	**Parking brake switch** Parking brake is engaged when the switch is pushed and moved down. To disengage, pushed and moved up the switch.
14	**Lateral work lights switch** Press the switch on the symbol to turn on the lights. Press in the upper part to turn off.
15	**Not active**
16	**Rear mirrors and doors heating switch** Press the switch on the symbol to turn on the heating. Press in the upper part to turn off.
17	**Batteries disconnection switch** Press the switch on the symbol to disconnect the batteries. To connect the batteries, pushed the upper of switch.  **NOTE:** **Disconnect batteries when the vehicle is inoperative!**
18	**Not active**
19	**Roller** Rotate the roller to move on the monitor. Press the roller to select the icons.
20	**Emergency stop push button (one in cab and four outside)** Press the red button to stop the traction in an emergency. Once used, rotate clockwise it in the original position and rotate the ignition key in 0 position. After that, it's possible restart the engine. **WARNING:** **Use only in case of EMERGENCY!** 

21	**Ignition panel** Insert the key. Turn the key clockwise to the first position to turn on the instrument panel. Rotate the second click to start the engine. **WARNING:** **It is not possible to extract the kay when it is rotated.**
22	**Direction lever** (paragraph 3.7)
23	**Equipment control joystick** (paragraph 3.8)
24	**Heating control: Fan speed setting**
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28	**Multifunction lever** (paragraph 3.9)
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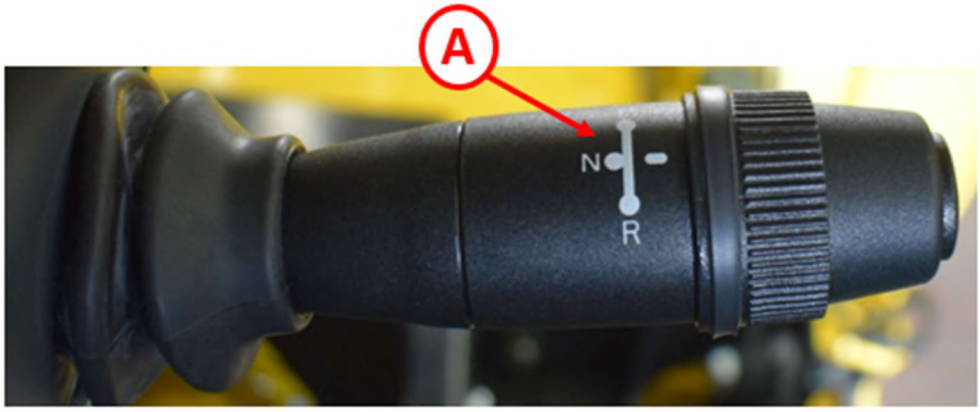
30	**12V socket**
31	**Brake pedal**
32	**Trottle pedal**

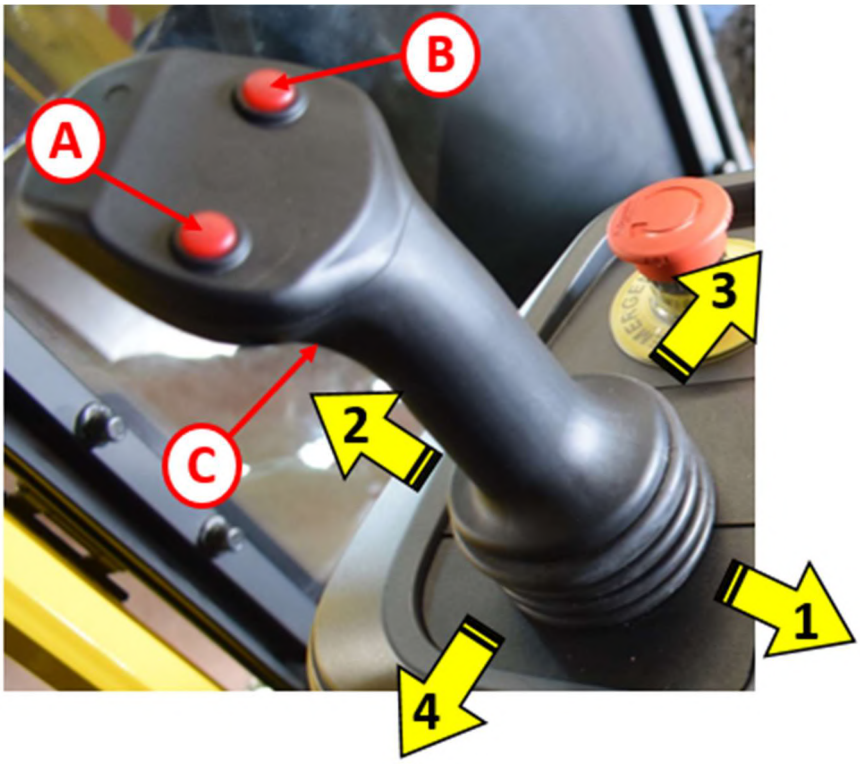
3.7 DIRECTION LEVER



Direction selection: Lift the lever and move in forward or in backward following the label A:

- F ⟶ Forward
- N ⟶ Neutral
- R ⟶ Reverse

3.8 EQUIPMENT CONTROL JOYSTICK



NOTE:
In WORK modality, all the movements are activated, as well in transfer with the direction lever in neutral.

NOTE:
With the vehicle in motion in the condition of TRANSFER, it is only possible to lift the blower head.

The command is provided of the safety "**dead men**".

Therefore, it is <u>always necessary</u> to press the front button "**C"** to operate.

BUTTON "C" PRESSED:

1. BLOWERHEAD LIFT UP
2. BLOWERHEAD LOW DOWN
3. 2ND STAGE CONVEYOR RIGHT ROTATION
4. 2ND STAGE CONVEYOR LEFT ROTATION

BUTTONS "C" + "A" PRESSED:

1. ----------
2. ----------
3. BLOWER HEAD RIGHT ROTATION
4. BLOWER HEAD LEFT ROTATION

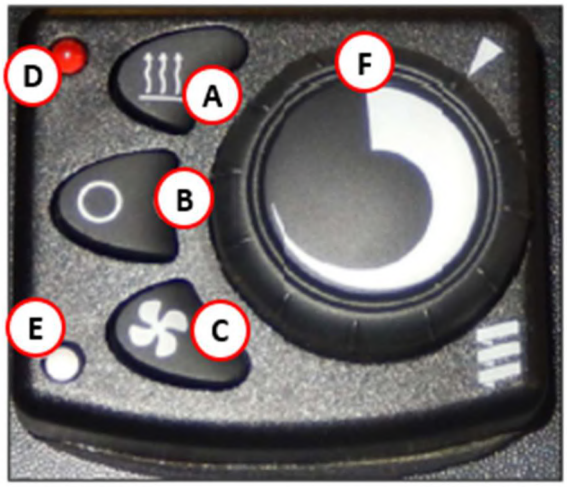
BUTTONS "C" + "B" PRESSEND:

1. CHUTE COVER OPENING
2. CHUTE COVER CLOSING
3. CHUTE RIGHT ROTATION
4. CHUTE LEFT ROTATION

3.9 MULTIFUNCTION LEVER

- Press = horn
- Rotate the first rotary selector:
  - position lights
  - = low beam headlights
- Down = high beam headlights
- Push up = flashing lights
- Rotate the second rotary selector :
  - windshield washer
  - 0 stop
  - INT intermittance
  - I - 1ST speed
  - II - 2ST speed
- forward/backward → right/left turn light
  - One shot → the direction lights flashing for three second
  - Holding the position for one second → continuous flashing

3.10 SUPPLEMENTARY HEATING EBERSPACHER



A. Settable heating modaly
B. Heating turn off
C. Continuous modality
D. Read indicator of system active
E. Continuous modality indicator (blue)
F. Temperature setting

The heater can be set in mode:

a) Continuous modality
b) Controlled temperature modality

Operation at controlled temperature

Activation:

1. Press the A button, the red LED D should light up simultaneously, it indicates that the heating controlled mode in activated;
2. Turn the knob F to set the temperature (max is 34 °C, min is 6 °C)

Continuous modality

Activation: press the button C, the blue LED E should light on; it indicates the activation of the continuous modality.

Turn off

Push down the button B: The shutdown is not immediate as the heating system first performs the complete switch-off operation of a kind suitable to decrease its internal temperature.

WARNING:
If the supplementary heating has been used, wait at least 4 minutes from its turn off before disconnecting the batteries.

3.11 MAIN MONITOR

3.11.1 Monitor Main page

At the ignition the monitor shows the following MAIN PAGE in TRANSPORT mode:

MAIN PAGE in WORK mode:

MAIN PAGE indicators	
	**Fuel level gauge with warning light** *When the level is too low, the last sign becomes orange . Fill the tank!*
	**Parking brake engaged**
	**F** – Vehicle ready to move in forward **N** – Vehicle in Neutral **R (flashing yellow)** – even if reverse is selected by the direction control lever, the vehicle does not move right away because the system need some seconds to lift the equipment automatically (**only for snowblower with pivoting wheels**). **R (fixed yellow)** – Once the equipment has been raised, the vehicle can reverse.
	**Vehicle speed indicator**
	**Total distance**
	**Partial distance** Keep pressed for 3 seconds to reset
	**Batteries charge indicator** (when charge is low the icon becomes red)
	**Engine oil pressure** (when the pressure is too height the icon becomes red) *If red warning lights on, stop immediately the vehicle and check for the cause.*

	**Engine coolant temperature and level** (when the temperature is too hot the icon becomes red) (when the level is low the icon becomes red) *If red warning light is on, stop immediately the vehicle and check for the causes*
	**Hydraulic oil level indicator** (when the level is low the icon becomes red)
	**Brake system pressure** (when the level is low the icon becomes red) *stop immediately the vehicle and check for the causes*
	**Working hours indicator**
	**Urea level (NO ACTIVE)** if the level is low the icon lights up
	**Rotary beacon engaged indicator**
	**Windshield heating on**
	**Rear mirrors and doors heating**
	**Water into the fuel filter warning light** *Spurge water from the pre-filter*
	**Air filter engine obstructed indicator.** *Clean or replace the cartridges*
	**Pre-heating phase indicator**
	**Left and right turning lights indicator**
	**Clutch light**

	**High beam headlights indicator**
	Rear fog light engaged indicator
	**Low beam headlights indicator**
	**Low speed engaged indicator**
	**Differential locking indicator**
	**Rear traction locking indicator**
	**Sensors failure** - Throttle pedal - Fuel level - Oil level - Brake oil pressure - Lube oil pressure - Front steering axle position - Rear steering axle position
	**Engine speed indicator**
	**Engine failure indicator** Check the error code on following function sheets  *If the light is on, stop immediately the vehicle and check for the causes*
	**Engine failure indicator** Check the error code on following function sheets  *If the light is on, stop immediately the vehicle and check for the causes*
	**Inducement system failure (NO ACTIVE)**
	**Regeneration is necessary (NO ACTIVE)**

	**Regeneration in progress (NO ACTIVE)**
CAN	**CAN BUS failure indicator** Check the failing CAN BUS in the following function sheets *If the light is on, stop immediately the vehicle and check for the causes*
	**Danfoss hydrostatic transmission failure warning light** *If the light is on, stop immediately the vehicle and check for the error codes*
	**Low oil pressure into lube system** when the pressure is low the icon becomes red, and on the monitor appears:  *If the light is on, stop immediately the vehicle and check for the causes*
	The symbol illuminates when **FLOATING** is inserted
	**Instrument panel ignition key bypass** If the ignition key fails, keep press the buttons A and B for 8 seconds to turn on the monitor The engine cannot be started
	
	
Esc	**Esc**
	**Come back**

3.11.2 Transport / work mode insertion

From the main sheet, it is possible to engage the following commands (relative button must be kept pressed for at least 3 seconds):

When starting the traction engine, the vehicle is in TRANSPORT MODE.

Keep pressed F1 to pass in WORK MODE → W on

IMPORTANT! Work modality is for snow removal operations.

To go back in TRANSPORT MODE, keep pressed F1 → T on

IMPORTANT! Transport modality must be used for transfer.

Keep pressed F2 → RIBBON AUGERS ROTATION 1ST SPEED 1 on (only when WORK modality is on)

IMPORTANT! Wait for the "Engage blower I" to switch off before moving the vehicle.

Keep pressed F3 → RIBBON AUGERS ROTATION 2ND SPEED 2 on (only when WORK modality is on)

IMPORTANT! Wait for the "Engage blower II" to switch off before moving the vehicle.

Only provided vehicles, keep pressed F4 → AUTO MODE (OPTIONAL) A on (only when WORK modality is on)

The command needs: ribbon augers in motion, forward direction inserted, parking brake disengaged, brake pedal not pressed and engine at least 1600 rpm.

IMPORTANT! To deactivate the automatic mode, press one of the following controls: F4 button, brake pedal or engage neutral gear.

See instruction of how to use the vehicle at the chapter 4

3.11.3 Engine control (for work modality)

From the main sheet, it is possible to control the engine speed during the WORK modality (relative button must be kept pressed for at least 3 seconds):

F6 → OFF - ENGINE AT MINIMUM (only in WORK modality: engine at 950 rpm)

F7 → MAX (only in WORK modality: engine at 1800 rpm)

F8 → SET+ (ENGINE SPEED INCREMENT) upper bound 2050 rpm (only in WORK modality)

F9 → SET- (ENGINE SPEED DECREMENT) lower bound 950 rpm (only in WORK modality)

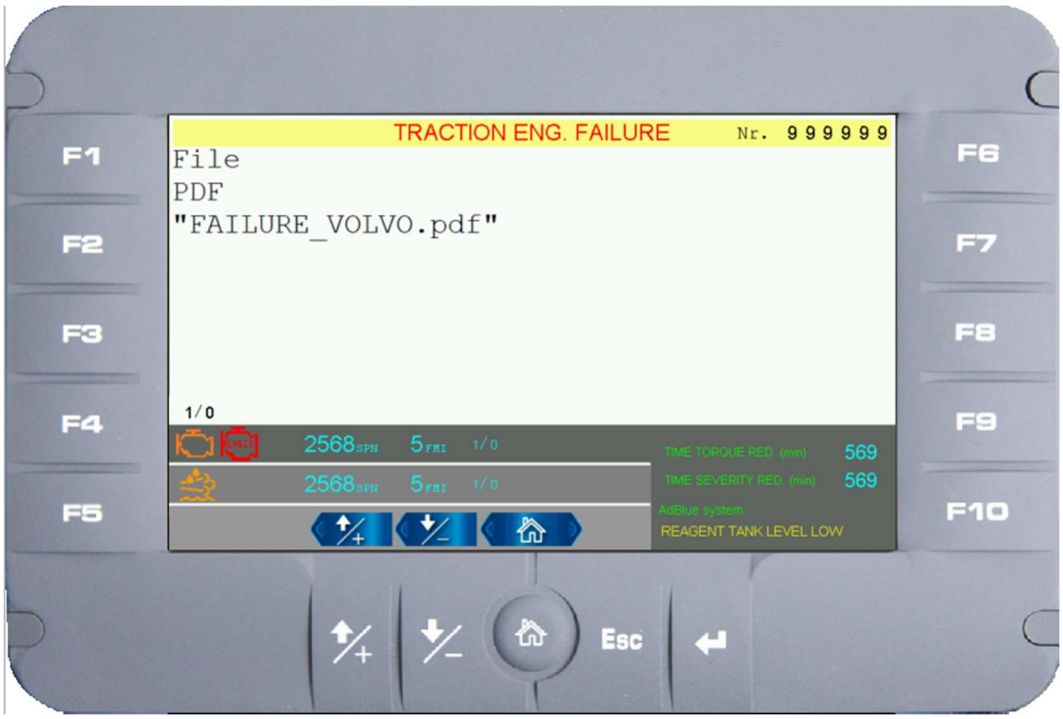
*When these functions are selected, they appear the icon of the table above.

3.11.4 Monitor FUNCTION and INFORMATION pages

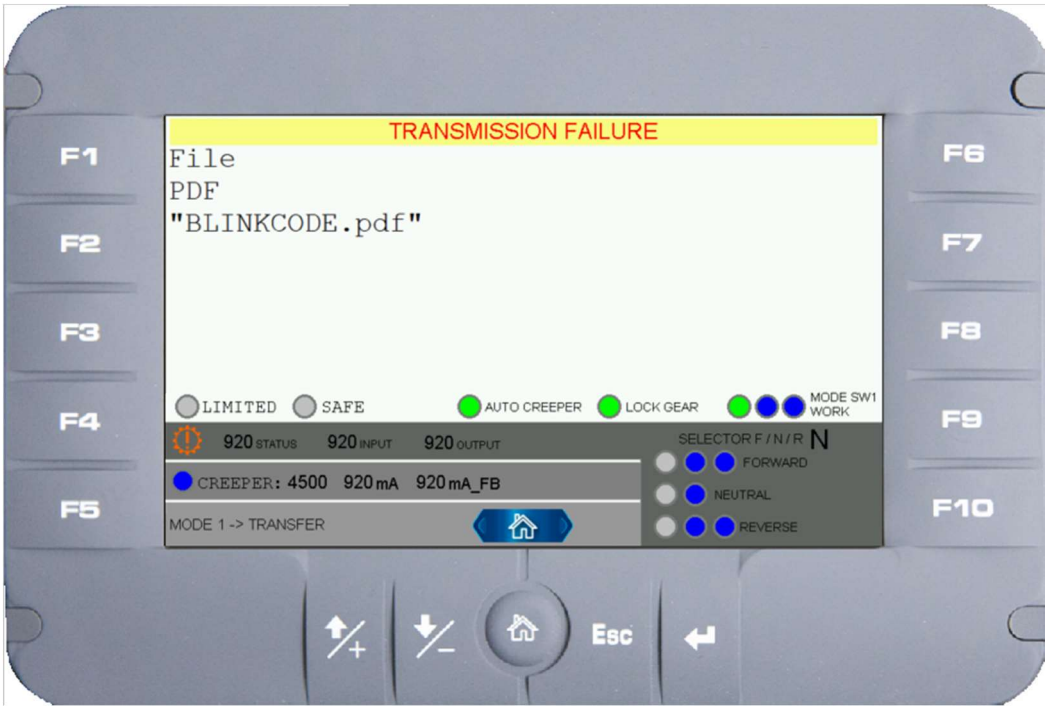
Press the button  to access the FUNCTION and INFORMATION SHEETS

From this main sheet, it is possible to visit following sections (by pressing):

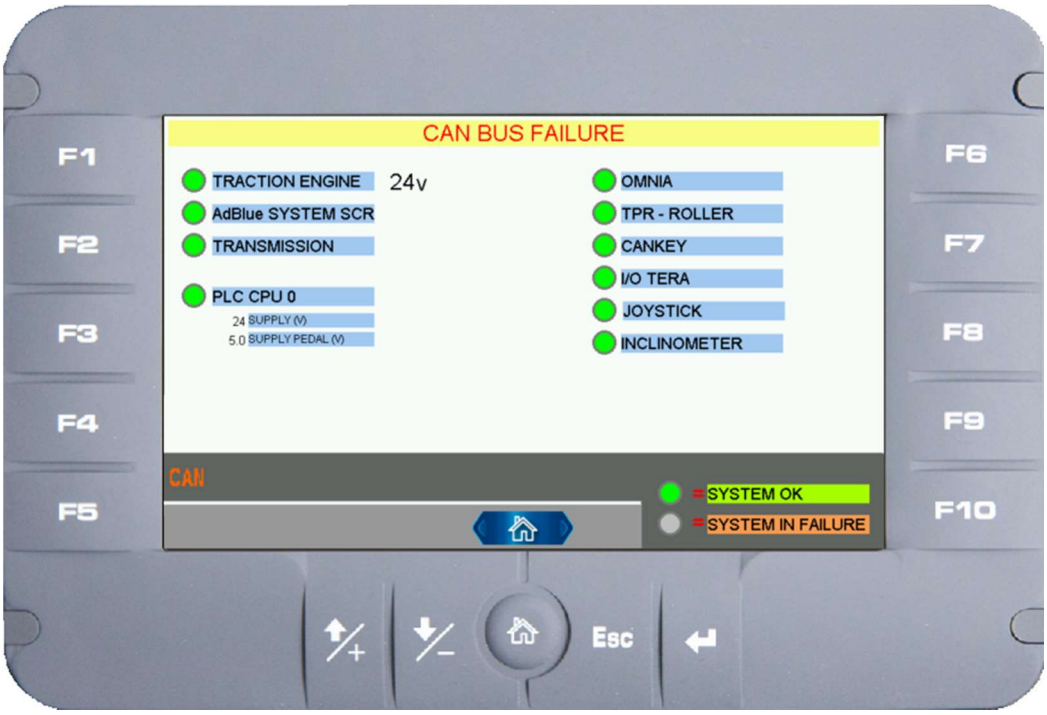
✓ **F1 ENGINE FAILURES**



✓ F2 TRANSMISSION FAILURES



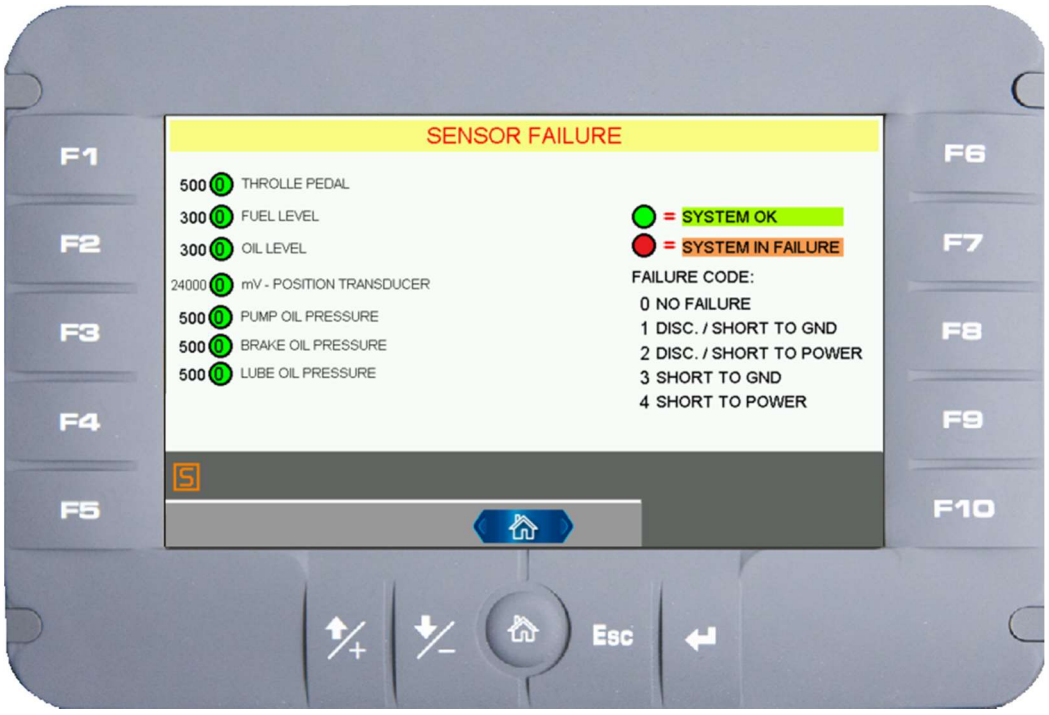
✓ F3 CAN BUS FAILURES



Green dot means OK.

Grey dot means that a failure is present.

✓ **F4 SENSORS FAILURES**

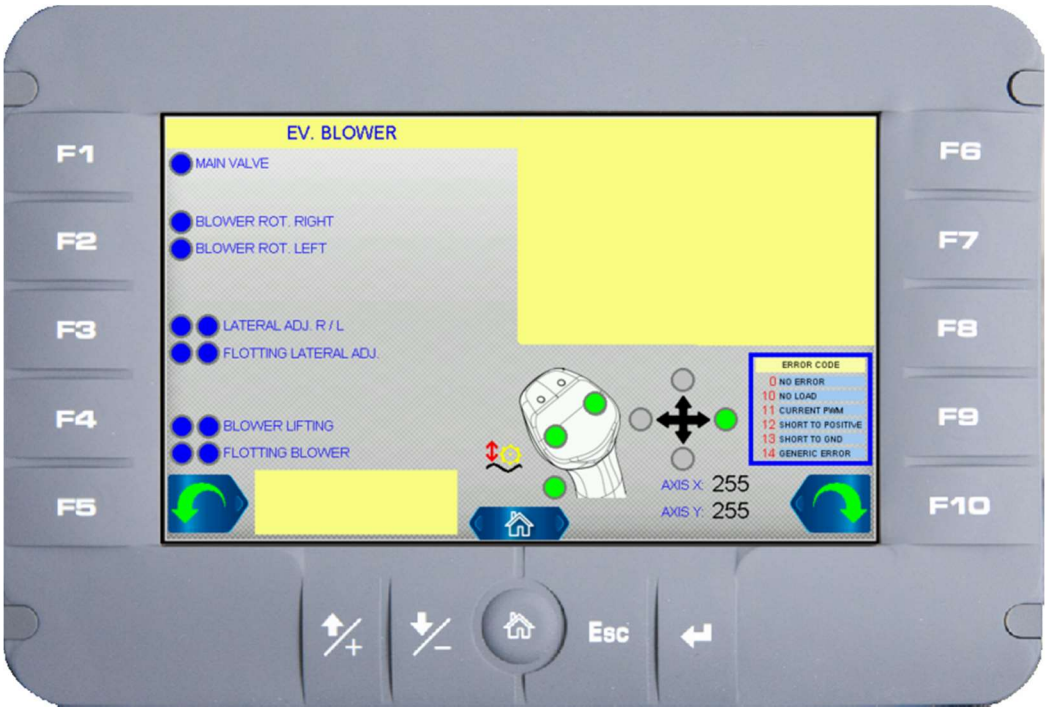


The number indicates the type of failure

✓ Press **F5 INFO PLC**

Green dot means active input

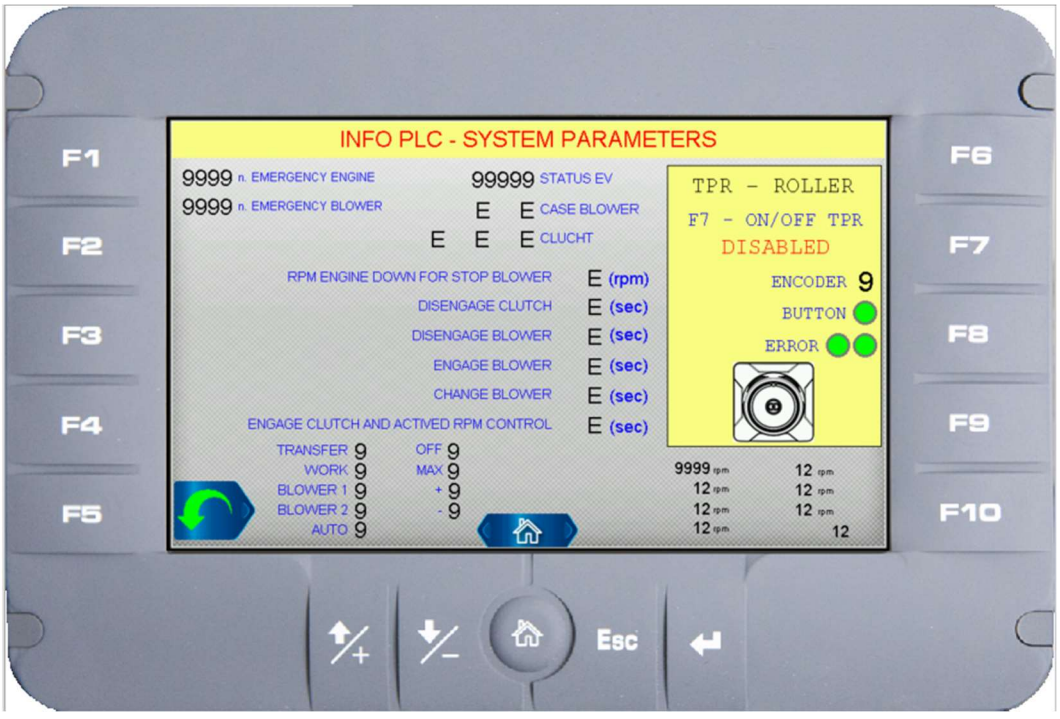
From this page, press **F10** to access the OUTPUT STATE



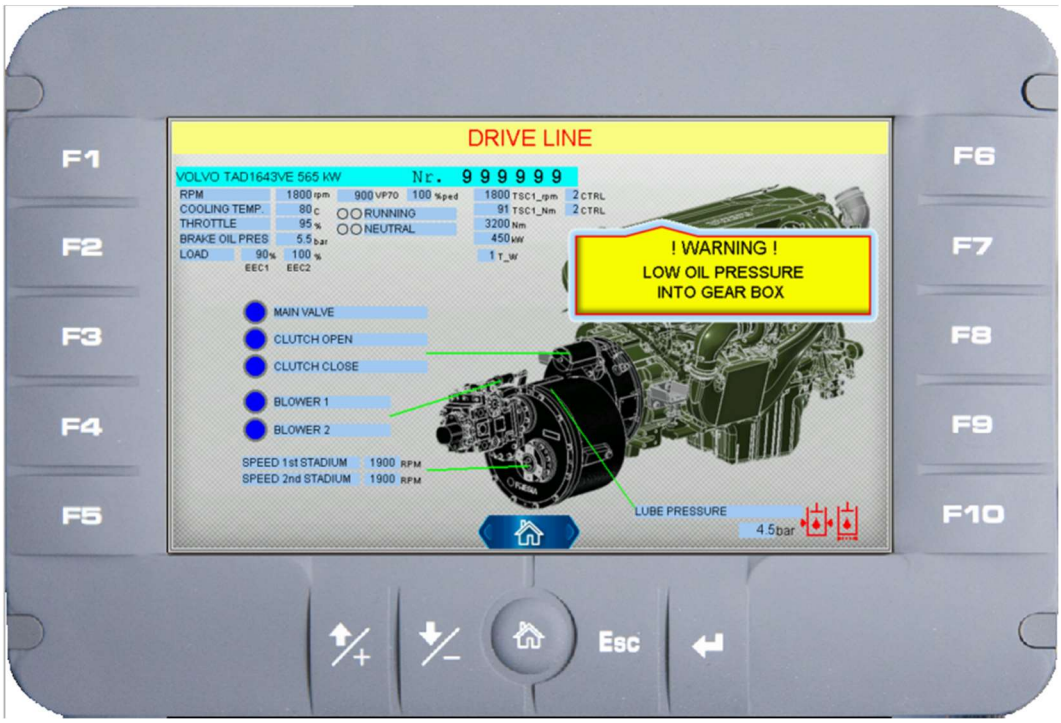
Green dot means that the relative input is active. Blue dot means that the relative output is active. Grey dot means that the relative input/output is not active. The number indicates the state of the output, showing in the blue dot:

- 0 – no error
- 10 – no load
- 11 – current failure
- 12 – short to positive
- 13 – short to GND
- 14 – generic error

Press F**10** to access to the next page. Press **F5** to access to the previous page.



✓ Press **F6 DRIVE LINE FAILURE**



If the low lubrication pressure message appears, stop the vehicle and check that the two-speed gearbox lubrication system is working properly and that the lubricating oil supply line is not clogged.

WARNING:

Prolonged use of the vehicle in these conditions could cause damage to the mechanical unit.

✓ Press **F7 SYSTEM INFO**

F1-F2-F3-F4-F5 Monitor language selection

F6-F7 monitor bright increment/decrement

F8 date and time:

F9 info system:

Press  to EXIT

INSTRUCTION FOR THE USE

Paragraph *Page*

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4.3 STARTING / SHUT DOWN OF THE ENGINE 5
4.3.1. Starting procedure 5
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4.4 RULES OF ROAD TRAFFIC AND TRANSFER 6
4.5 SNOW REMOVAL OPERATIONS 7
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4.1 GENERAL INFORMATION

A proper care of your vehicle will result in a longer life, better performances, and a more economical operations of it.

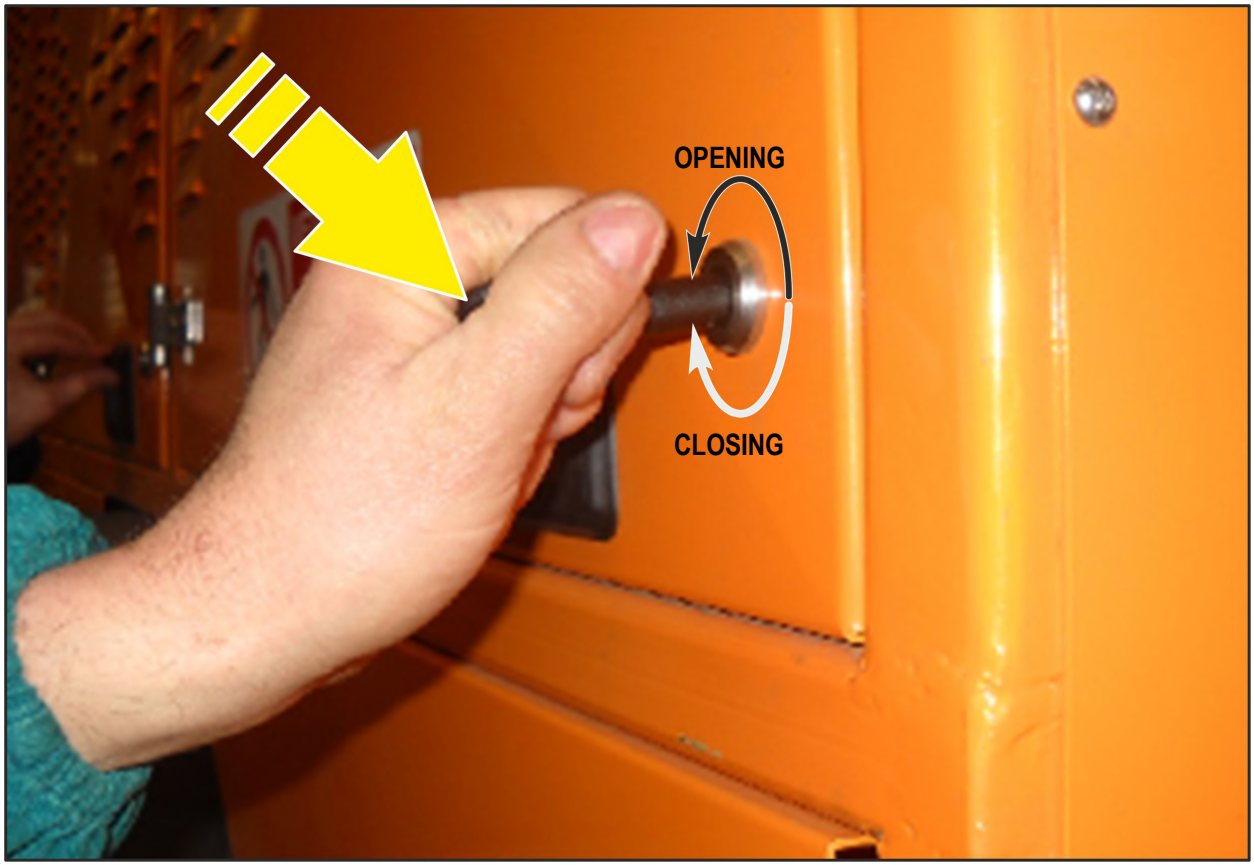
- ✓ Perform daily maintenance checks that are listed in the MAINTENANCE SHEETS of CHAPTER 5.
- ✓ Before using the vehicle, check the pressure indicators, the temperature indicators, the alarm lights, and the other gauges to make sure that they are operational.
- ✓ When the vehicle is not operating, disconnect the batteries. Supplementary devices (when present) can consume power even when the car is stationary.

DANGER:

DO NOT OPERATE ON A DIESEL ENGINE OR WHERE THE FUEL VAPORS CAN BE PRESENT. *These fumes could be drawn into the air intake of the system and cause engine acceleration and a speed higher than normal, which can start a fire, an explosion or extensive damage to the vehicle.*

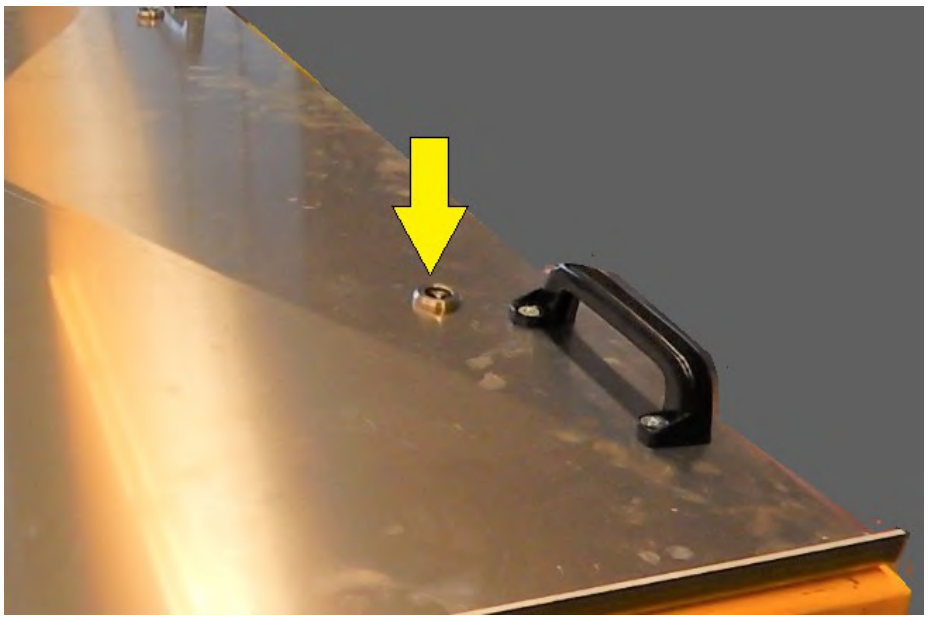
4.2 REAR BODY DOORS OPENING / CLOSING

Right and left side of the vehicle are provided of door panel both, which can be opened by the provided key. Press lightly and rotate the key anticlockwise to open and clockwise to close.



N° 1 door is in the front part of the rear body, it is accessible from the step bracket behind the cab.

The top panels can be opened for inspection by the abovementioned key.



4.3 STARTING / SHUT DOWN OF THE ENGINE

4.3.1. Starting procedure

1. Turn on the batteries, keep pressed for 4 sec. the batteries switch in the upper part to connect.

   IMPORTANT! Disconnect batteries when the vehicle is inoperative!

2. Be sure that the parking brake is engaged (press on the button (P)).

> ***WARNING:***
> ***Before starting the engine, make the checks BEFORE STARTING listed in chapter 5 MAINTENANCE.***

3. Put the direction lever in neutral (central position).

4. Start the engine. Rotate the ignition key at the first step to light on the controls and then further rotate at the second step. Release the key as soon as the engine starts.

> ***WARNING:***
>
> ***At the start of engine, on the monitor the icon***  ***start flashing for some seconds. Wait for the light off before moving the vehicle.***

4.3.2 Moving the vehicle for transfer

> ***DANGER:***
> **Make sure that no one is standing near of the vehicle.**

1. Lift up the blowerhead:
   - pressing the dead man push button on joystick;
   - keep joystick in backward for some seconds

> ***WARNING:***
> ***For long travelling put on the safety bar as in 4.6.3***

2. Put the direction lever in neutral (central position).
3. Make sure that the parking brake switch is engaged.

> ***DANGER:***
> **Make sure that no one is standing near of the vehicle.**

4. After engine start, increase slowly the engine speed (RPM) to allow an adequate lubrication of the bearings and to allow the oil pressure to become stabilized.
5. After that, press the brake pedal and disengage the parking brake.
6. Lift up the direction lever and move it in forward or backward to be able to move in forward or reverse. On cluster will light on the indicator F (forward) or R (reverse). 

NOTE: (ONLY FOR SNOWBLOWER WITH PIVOTING WHEELS)
Even if reverse is selected by the direction control lever, the vehicle does not move right away (R - flashing yellow) because the system need some seconds to lift the equipment automatically. Once the equipment has been raised, the vehicle can reverse (R - fixed yellow)

7. Gradually accelerate.

WARNING:
It is not possible put the direction lever in forward (F) or backward (R) if the parking brake is engage  ***.***

4.3.3 Shut-down procedure

It is important to run the engine at idle for a time between 3 and 5 minutes, before shutting down it. It allows decreasing the temperature of the lubrication oil and of the cooling liquid.

NOTE: Do not run the engine at idle for a long time.
If the vehicle is not used, shut down the engine.

To shut down the engine:

1. Brake the vehicle and put the transmission in neutral (direction lever in central position).
2. Low down the blowerhead in FLOATING position (if present, remove the safety bars)
3. Engage the parking brake (press on the button (P)).
4. Turn the ignition key on position 0.
5. Disconnect the batteries when not using the vehicle. Push in the batteries switch in the lower part.

WARNING:
Disconnect the batteries when not using the vehicle.
Press the batteries disconnection switch. The batteries turn off after 30 seconds.
NOTE: AFTER 2 HOURS NOT USING THE VEHICLE, THE BATTERIES DISCONNECT AUTOMATICALLY

4.4 RULES OF ROAD TRAFFIC AND TRANSFER

During the road circulation, the operator is asked to respect the following recommendations:

1. Before driving the vehicle on the road, make sure that the blower head is raised and locked with the safety bars (see paragraph 4.6.3)
2. Move the casting chute as to get the maximum view of the road.

Transfer on the road

Once the engine has been started:

1. Make sure that WORK is inactive and the vehicle is in TRANSPORT mode (see CHAPTER 3).
2. Press the brake pedal and disengage the parking brake.
3. Move the direction lever in forward or in backward (see CHAPTER 3).
4. Gradually accelerate.

4.5 SNOW REMOVAL OPERATIONS

4.5.1 Safety norms during snow removal operations

Below they are some safety rules for operators during snow removal:

DANGER:

1. ***DO NOT STAND NEAR THE ROTATING BLOWER HEAD.***
   AIR SACKS OR ICE SLABS CAN CAUSE A SLIPPING TO THE CUTTERS

DANGER:

2. ***BEFORE PERFORMING ANY OPERATION NEAR THE CUTTERS (CHIMNEY CLEANING, BOLTS REPLACEMENT OR OTHERWISE), MAKE SURE THAT THE BLOWERS ARE STATIONARY AND REMOVE THE KEY FROM THE IGNITION PANEL.***
   ONCE THE OPERATIONS HAVE BEEN FINISHED, MAKE SURE THAT NO ONE IS IN THE PROXIMITY OF THE BLOWERS BEFORE RESTART THE ENGINE.

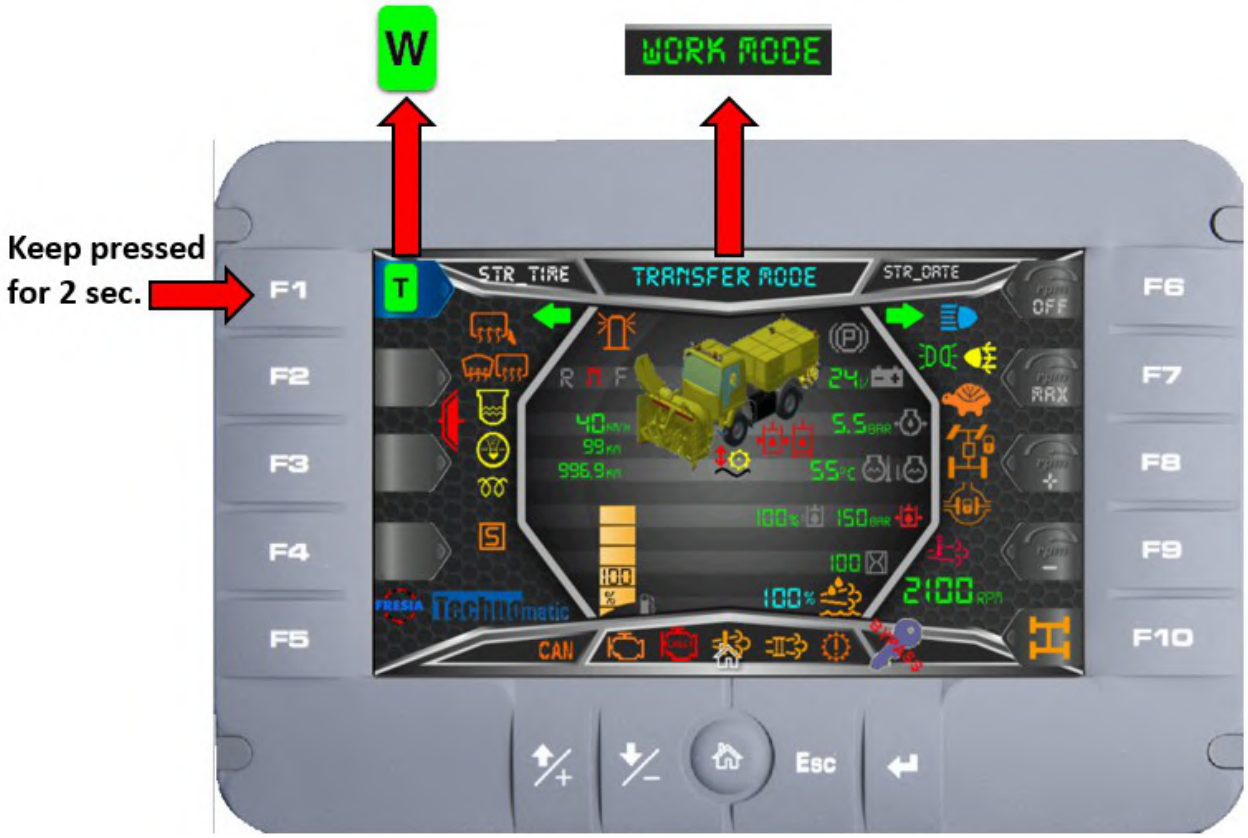
DANGER:

3. ***IF FOR ANY CIRCUMSTANCE IS BEING TO CREATE CONDITIONS OF DANGER, IT IS NECESSARY TO STOP THE RIBBON AUGERS ROTATION IMMEDIATELY. THE OPERATOR MUST DECREASE THE ENGINE SPEED WITH BUTTON F6 (OFF) AND PUSH DOWN THE RED EMERGENCY PUSH BUTTON.***

4.5.2 Snow removal operation

Once the working place is reached, operate as following:

1. Stop the vehicle and engage the parking brake (chapter 3).
2. Get off the cab and remove the safety bars (see paragraph 4.6.3).
3. Rotate the ignition key at the first step to light on the controls.
4. Keep in forward the joystick with the front button pressed for at least 3 seconds. Wait that "  " is ON on the central icon;
5. Check that the cutters touch the ground. If it is necessary, adjust the height of the blower head sliding elements (see paragraph 4.6.2).
6. Start the engine (see 4.3.1).
7. With the direction lever in neutral, push down the switch F1 (for 2 sec.) to pass from TRANSPORT mode to WORK mode (see monitor in chapter 3).



8. Then select the ribbon augers speed (1st or 2nd) by the switches **F2** or **F3** (on main monitor, see chapter 3);
   - ✓ **1ST SPEED**: maximum snow removal performance;
   - ✓ **2ND SPEED**: maximum casting distance of the snow.

WARNING:
Be aware that the augers are free to rotate. Clean the possible snow into the blower before start their rotation.

9. Push down **MAX** on **F7** to run the engine automatically at **2000 rpm**
10. Press the brake pedal and release the parking brake.
11. Select the direction by control lever, release the brake pedal and gradually accelerate.

Further changes of engine speed can be performed using the buttons **F8** and **F9** on the cluster (see chapt. 3). Max increment allowed 2100 rpm and decrement 850 rpm.

WARNING:
START THE REMOVAL OPERATION BY ENTERING THE SNOW GRADUALLY (FROM SMALLER LAYER TO HIGHER ONES)
IT PREVENTS SERIOUS DAMAGES TO THE TRANSMISSION AND THE BREAK OF THE SHEAR BOLTS.

12. For a correct vehicle speed, observe that the snow jet is taut and steady.
13. For vehicle provided, it is possible to use the AUTOMATIC (button **F4**), by this, the vehicle moves independently and its speed depends on the amount of snow present (see chapt. 3 paragraph 3.11.2)

WARNING:
Acting on brake pedal or moving direction lever in neutral, the AUTOMATIC mode is automatically disengaged!

At the end of the operations:

1. Stop the vehicle, move the direction lever in neutral and engage the parking bake (see chapter 3);
2. Press **OFF** (**F6)** on cluster
3. With ribbon augers rotating, keep pressed F1 for 2 seconds to disengage the WORK mode (ref. to chapter 3);
4. Proceed as indicated on **4.4**.

4.5.3 Augers rotation 1st and 2nd speed disengagement

For disengagement of augers rotation, it is possible following two modality:

1st modality:

1. Press **F6** on cluster to lower the rpm of engine;
2. If the 1st augers rotation in engage, press F2 (for 2 sec.) on cluster. On the monitor appears:

NOTE:
If the 2nd augers rotation in engage, press F3 (for 2 sec.) on cluster

3. During the procedure of augers rotation disengagement, on the monitor the light  start to flashing. At the end of procedure, on the monitor appeas 

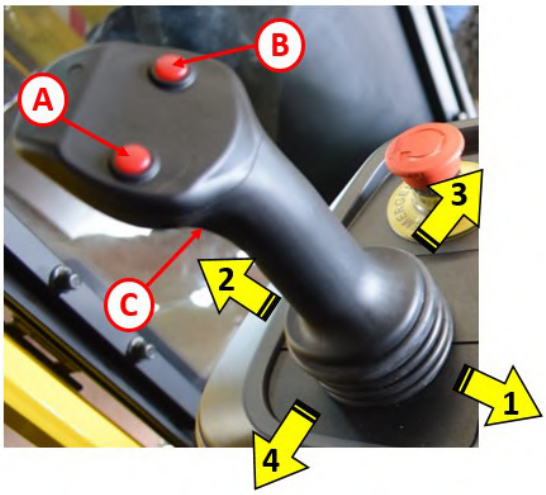
4. At this point, it is possible:
   a. Press F2 or F3 (for 2 sec.) for engage the 1st or 2nd augers rotation (see chap. 3.11.2)
   b. Keep press F1 (for 2 sec.) to pass in TRANSPORT MODE 

2nd modality:

1. Press **F6** on cluster to lower the rpm of engine;
2. Keep press F1 (for 2 sec.) to pass in TRANSPORT MODE
3. Start the procedure of augers rotation disengagement, on the monitor appears 

and the light  strat to flashing. At the end of procedure, on the monitor appeas 

4.5.4 Blower head movements control



The command is provided of the safety "**dead men**".

Therefore, it is always necessary to press the front button "**C"** to operate.

BUTTON "C" PRESSED:

1. BLOWERHEAD LIFT UP
2. BLOWERHEAD LOW DOWN
3. 2ND STAGE CONVEYOR RIGHT ROTATION
4. 2ND STAGE CONVEYOR LEFT ROTATION

BUTTONS "C" + "A" PRESSED:

1. ----------
2. ----------
3. BLOWER HEAD RIGHT ROTATION
4. BLOWER HEAD LEFT ROTATION

BUTTONS "C" + "B" PRESSEND:

1. CHUTE COVER OPENING
2. CHUTE COVER CLOSING
3. CHUTE RIGHT ROTATION
4. CHUTE LEFT ROTATION

4.6 BLOWER HEAD

DANGER:

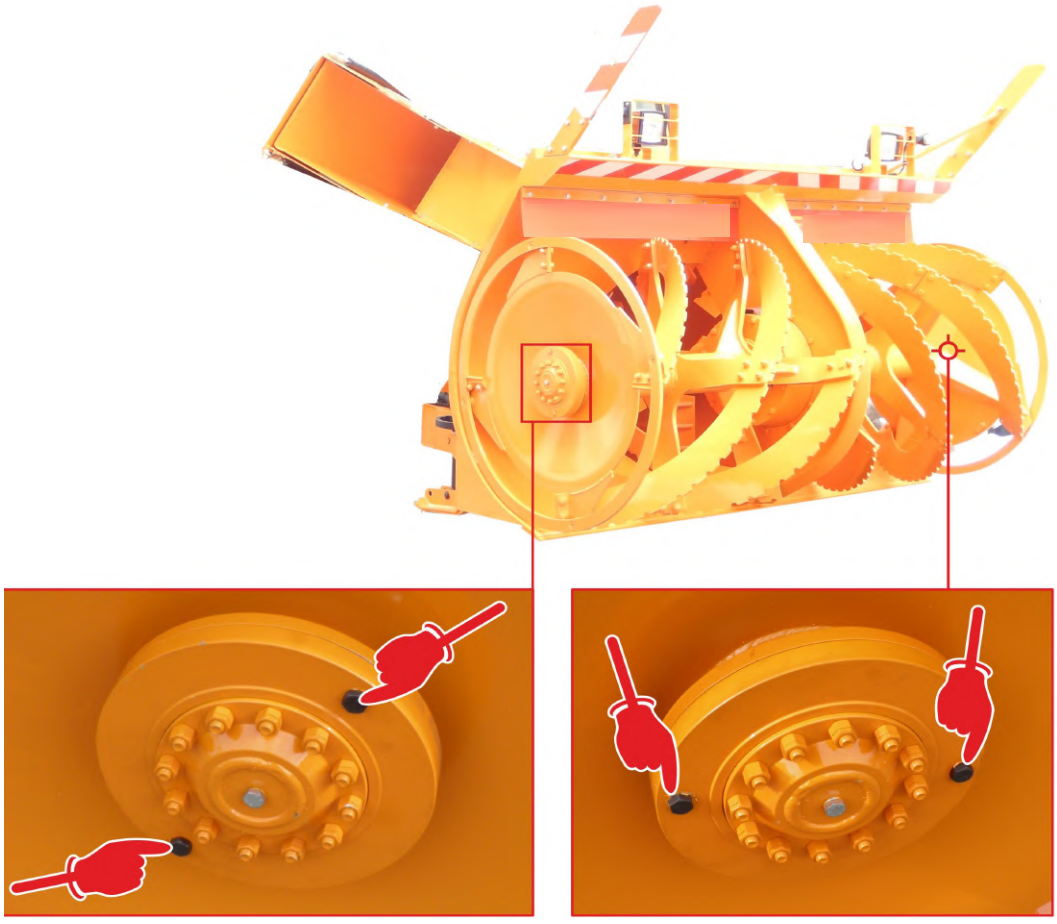
TO PERFORM THE FOLLOWING PROCEDURES, STOP THE VEHICLE ON A FLAT AREA.

4.6.1 Procedure of shear bolts replacement

Each blower is provided of two shear bolts and two shear bolts are on the second stage fan.

Their task is to prevent damage to the blower head in case outside elements enter the blower head like: rocks, wood chock, etc.

Shear bolts have the function of protecting the mechanical drive line parts when in operation or when stressed by incidental outside forces.



NOTE:

The duration of the shear bolts is not predictable.

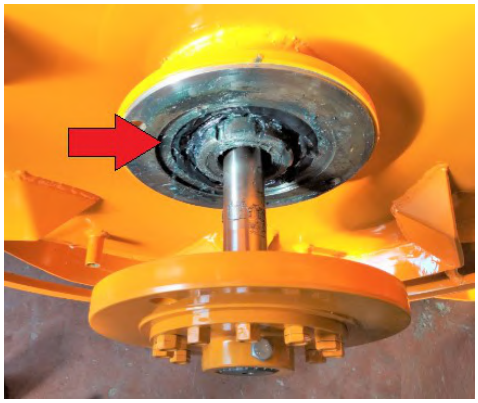
The break depends on a number of factors including the ability of the operator.

DANGER:

SHEAR BOLTS REPLACEMENT MUST BE DONE WITH SHUT DOWN ENGINE AND KEY EXTRACTED FROM THE IGNITION PANEL.

1. Place the shear bolts into their holes and manually turn the drum until the bolt is in the hole;

   (verify that grease is present in the junction)



2. Tighten the nuts until snug.

WARNING:

USE EXCLUSIVELY ORIGINAL SHEAR BOLTS

THE USE OF NOT ORIGINAL PARTS CAN CAUSE SERIOUS DAMAGES AT THE EQUIPMENT.

4.6.2 Procedure for blower head height adjustment (*castor wheels adjustment*)

1. Move the vehicle on a flat area and activate the floating mode.

DANGER:

During the blower head lowering, make sure no people is around of the equipment.

SHUT DOWN THE ENGINE AND EXTRACT THE KEY FROM THE IGNITION PANEL.

2. Remove the pin B.
3. Check that the front cutter A is in touch with the ground.
4. If the front cutter is too high or it leans before the sliding elements D, operate on handwheel C to adjust the blower head until the position of 3).

4.6.3 Procedure for the installation of blower head safety bars

Lift up the blower head. Stop the engine and extract the key from the ignition panel

DANGER:

DO NOT START THE ENGINE, DURING THE INSTALLATION OF THE SAFETY BARS.

1. Extract spine **A** from the pins **B**.
2. Fit the bar **C** on pins **B** (the oval hole should be put in lower pin).
3. Insert the spines **A** in the pins **B**.

4.7 VEHICLE TOWING IN CASE OF FAILURE

4.7.1 Short towing – less then 5 min

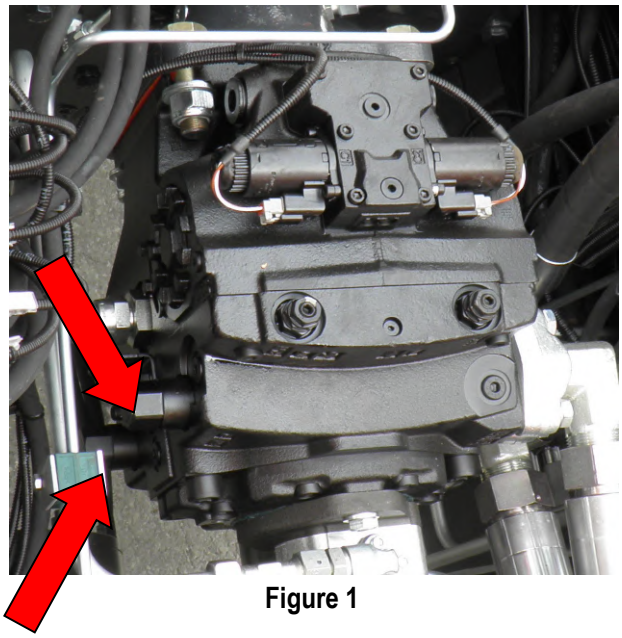


Figure 1

1. On the hydrostatic pump rotate counterclockwise for three laps the covers hexagonal shaft of two multifunctional valves, to bypass the oil (see Fig. 1).

WARNING:

To avoid oil leaks, do not rotate the hexagonal covers more then 3 turn.

Figure 2

2. For towing, use the proper hook provided with the vehicle.
   Insert the bolt into the hole in the bulkhead of the central casing and tighten the nut (see Figure 2).

WARNING:

MOVE THE VEHICLE AT A SPEED NOT EXCEEDING TO 8 KM / H FOR SHORT TIME NEEDED.

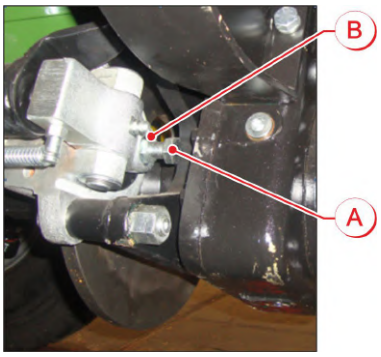


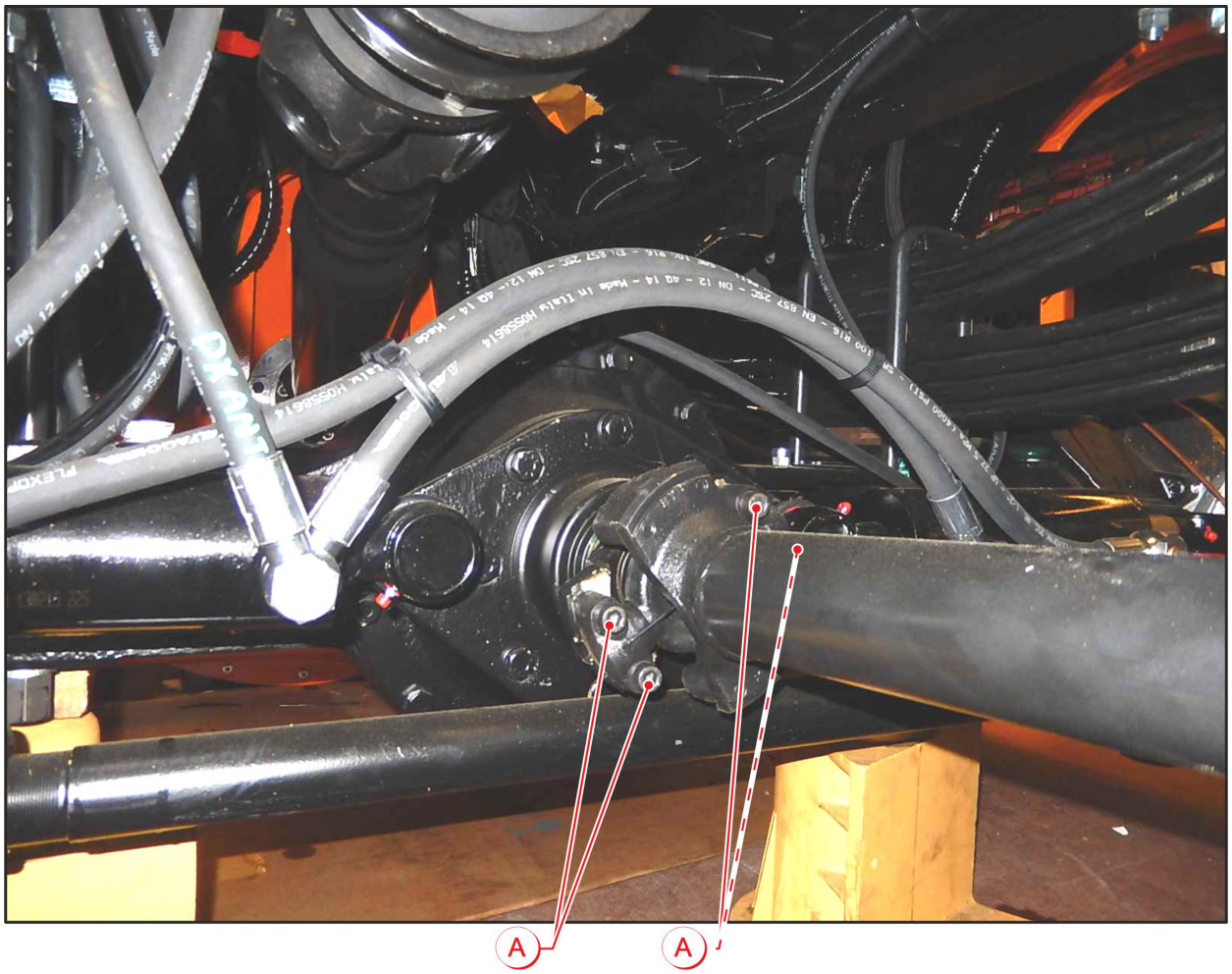
Figure 3

Disengage the parking brake unscrewing the nut **B** and the screw **A** (see figure 3).

4.7.2 Long towing – more than 5 min

In case you need to make a longer tow (for more than 5 minutes), disconnect the transmission from the front axle and ensure that the rear-traction is disengaged.

1. Unscrew the screws **A** and disconnect the transmission from the front axle.
2. Tie it with a rope to the chassis bracket.
3. Make sure that REAR TRACTION is inactive.



MAINTENANCE

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5.1 GENERAL MAINTENANCE GUIDELINES

WARNING:
To avoid the risk of contamination, the lubrication procedures must be performed paying attention to maintain the parts perfectly cleaned!

It is suggested to follow the below instructions and to read carefully the safety norms, when going to perform any maintenance operation:

a. The maximum vehicle reliability and minimum maintenance costs are the results of a carefully planned program of maintenance and inspections during the entire life of the vehicle. Scrupulously, respect the time of periodic interventions and program them, according to the specific needs in relation of the vehicle working hours.
b. Always pay your full attention to the efficiency of the lubrication of the mechanic parts, a defective lubrication can cause serious and expensive damages.
c. If repairs of a certain size are necessary, we recommend you to contact our service centre of Technomatic Equipments. The specialized personnel is equipped with all the experience, technological methods of the original construction of the factory.
d. Before starting all the operations of check and maintenance, it is appropriate to thoroughly remove any dirt present on the vehicle by means of a vacuum cleaner and with appropriate detergents, avoiding the use of jets of compressed air that may create zones, in which dirt is accumulated.

DANGER:
Before starting maintenance operations, wear specific gloves and protective glasses.

e. After each maintenance operation involving removal, fixed parts and moving parts, proceed to check their exact position.

5.2 GENERAL INFORMATION

A proper and timely maintenance of the vehicle is necessary to ensure its efficiency and prevent failures. The maintenance schedule (see § 5.4) with periodic recommended checks and all necessary maintenance must be strictly adhered to.

- ✓ Whenever it was made a refill or a change of liquids, the operator must always check the vehicle before using it.
- ✓ It is strongly recommended to verify that no leaks are present before and after each use of the vehicle
- ✓ Verify the parts subject to dirt and keep them more cleaned than possible.
- ✓ The whole vehicle should be regularly washed.

5.3 VEHICLE CLEANING

5.3.1 External cleaning

Once the doors and windows are closed and the engine is off, the vehicle can be washed with water or with a steam jet.

If the washing is performed under conditions of extreme cold weather the latches and the hinges of the main gates should be thoroughly dried and when necessary, can be used antifreeze.

For painted parts cleaning, it is suggested not to use gasoline.

5.3.2 Internal cleaning

For internal cleaning can be used fresh water with brush and sponge.

Note that all the electrical parts are water repellent but not waterproof. Therefore, the use of water or steam can cause serious damage, short-circuiting or rust.

The performance and the duration of rusted electrical contacts may be compromised.

5.3.3 Engine washing

When washing the engine, the air filter must be protected, to prevent infiltration of water as well as the engine control unit should not be sprayed with water under pressure.

5.4 MAINTENANCE SCHEDULE

MAINTENANCE SHEET	INTERVENTION	FREQUENCY				
		BEFORE STARTING	EVERY 50 HOURS	BEFORE STARTING THE WORK SEASON (APPROX 500 HOURS)	EVERY 1000 HOURS (2 YEARS)	EVERY 2000 HOURS (4 YEARS)
A_ENGINE (refer to operating manual of Volvo Penta)						
01	Oil level check	✓	✓	✓	✓	✓
02	Cooling liquid check	✓	✓	✓	✓	✓
03	Drain the water from the pre-filter	✓	✓	✓	✓	✓
04	Leaks from the sleeves check		✓	✓	✓	✓
05	Engine belts conditions check		✓	✓	✓	✓
06	Fuel filter replacement			✓	✓	✓
07	Fuel pre-filter replacement			✓	✓	✓
08	Oil filter replacement			✓	✓	✓
09	Engine oil replacement			✓	✓	✓
10	Radiator cleaning			✓	✓	✓
11	Air filter cartridges replacement			✓	✓	✓
12	Engine belts replacement				✓	✓
01	Adblue/DEF – Pump filter change					✓

MAINTENANCE SHEET	INTERVENTION	FREQUENCY				
		BEFORE STARTING	EVERY 50 HOURS	BEFORE STARTING THE WORK SEASON (APPROX 500 HOURS)	EVERY 1000 HOURS (2 YEARS)	EVERY 2000 HOURS (4 YEARS)
B_HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM						
01	Hydraulic and hydrostatic oil level check	✓	✓	✓	✓	✓
02	Hydrostatic oil filter replacement			✓	✓	✓
03	Hydraulic oil filter replacement			✓	✓	✓
04	Hydraulic and hydrostatic. oil replacement				✓	✓
C_AXLES						
01	Wheel hubs oil level check		✓	✓	✓	✓
02	Differential oil check and steering heads greasing		✓	✓	✓	✓
03	Axle articulations, steering cylinders, shackle bar and transmission shafts lubrication		✓	✓	✓	✓
04	Wheel hubs oil replacement	✓		✓	✓	✓
05	Differential oil replacement			✓	✓	✓
06	Steering and shackle bar heads check			✓	✓	✓
D_SUSPENSIONS						
01	Suspension lubrication	✓	✓	✓	✓	✓
02	Check nuts connecting leaf springs to the axles			✓	✓	✓
E_TRANSFER REDUCER						
01	Transfer reducer oil level check		✓	✓	✓	✓
02	Transfer oil replacement			✓	✓	✓

MAINTENANCE SHEET	INTERVENTION	FREQUENCY				
		BEFORE STARTING	EVERY 50 HOURS	BEFORE STARTING THE WORK SEASON (APPROX 500 HOURS)	EVERY 1000 HOURS (2 YEARS)	EVERY 2000 HOURS (4 YEARS)
F_BLOWER HEAD						
01	Blower head blade wearing check	✓	✓	✓	✓	✓
02	Blower helical cutters wearing check	✓	✓	✓	✓	✓
03	Second stage paddles wearing check	✓	✓	✓	✓	✓
04	Blower head lubrication	✓	✓	✓	✓	✓
05	First stage oil level check		✓	✓	✓	✓
06	Second stage oil check		✓	✓	✓	✓
07	Transmission support oil level check		✓	✓	✓	✓
08	Blower head transmission lubrication		✓	✓	✓	✓
09	First stage oil replacement			✓	✓	✓
10	Second stage oil replacement			✓	✓	✓
11	Transmission support oil replacement				✓	✓
G_TYRES						
01	Tyres pressure check	✓	✓	✓	✓	✓
02	Wheel nuts torque check		✓	✓	✓	✓
H_PNEUMATIC AND BRAKES SYSTEM						
01	Check the brake pads status				✓	✓

MAINTENANCE SHEET	INTERVENTION	FREQUENCY				
		BEFORE STARTING	EVERY 50 HOURS	BEFORE STARTING THE WORK SEASON (APPROX 500 HOURS)	EVERY 1000 HOURS (2 YEARS)	EVERY 2000 HOURS (4 YEARS)
I_TWO SPEED BACK GEAR						
01	Two speed back gear oil level check		✓	✓	✓	✓
02	Two speed back gear oil level replacement			✓	✓	✓
03	Two speed back gear oil filter replacement			✓	✓	✓
J_CHASSIS						
01	Rust inhibitor treatment for lower part of chassis				✓	✓
K_CAB						
01	Check the windshield washer liquid	✓	✓	✓	✓	✓

5.4.1 General periodical checks

- ✓ Check for leaks from all mechanical system.
- ✓ Check for leaks from hoses and sleeves.
- ✓ Check the steering efficiency.
- ✓ Check lights, indicators and warning lights, windshield wiper and horn.
- ✓ Check the muffler condition

5.5 FREQUENT SPARE PARTS

TRACTION ENGINE

Air filter cartridges:

- ✓ Internal cartridge (nr. 1) ⇒ **00102145**
- ✓ External cartridge (nr. 1) ⇒ **00102144**

Oil filter:

- ✓ Oli filter kit (nr. 1) ⇒ **23075366**
- ✓ Oli filter by-pass kit (nr. 1) ⇒ **23075367**

Fuel filters:

- ✓ Fuel pre-filters kit (nr. 1) ⇒ **24998367**
- ✓ Fuel filters kit (nr. 1) ⇒ **24063189**

Engine belt:

- ✓ Fan belt (nr. 1) ⇒ **00112591**
- ✓ Pump belt (nr.1) ⇒ **00112592**

SNOWBLOWER

- ✓ Front iron blade (nr. 1) ⇒ **00011673** (screw **V0011674** nr. 18)
- ✓ Internal cutter (4 right + 4 left) ⇒ **00095217** (bolts kit **96D01229**)
- ✓ External cutter (4 right + 4 left) ⇒ **00095214** (bolts kit **96D01229**)
- ✓ Second stage paddle ⇒ **00107003**
- ✓ Skid plate (nr. 2) ⇒ **00081086L** (screw **V01063/1** nr. 4)
- ✓ **Ribbon auger shear bolts**
  - ▫ Screw (Nr. 4) ⇒ **00083299**
  - ▫ Nut (Nr. 4) ⇒ **D0002582**
- ✓ **Impeller fan shear bolts**
  - ▫ Screw (Nr. 2) ⇒ **00083301**
  - ▫ Nut (Nr. 2) ⇒ **D060.121**

5.6 OILS AND FUELS

COMPONENT	OLII*	QUANTITY (LITRES)
ENGINE	ENGINE OIL VDS 4.5	**48**
COOLING LIQUID	VCS-2 READYMIX (OAT BASED) ONLY YELLOW COOLANT	**128**
HYDRAULIC AND HYDROSTATIC SYSTEM	TUTELA CAR G1/E (ATF DEXRON III – C4)	**70**
AXLES	TUTELA W90/M-DA* (SAE80W/90)	**7.5+7.5**
PLANETARY GEAR	TUTELA W90/M-DA* (SAE80W/90)	**1x4**
TRANSFER REDUCER	TUTELA W90/M-DA* (SAE80W/90)	**2.5+1.5**
TWO SPEED BACK GEAR	TUTELA W90/M-DA* (SAE80W/90)	**20**
1ST STAGE GEARINGS	TUTELA W90/M-DA* (SAE80W/90)	**10**
2ND STAGE GEARINGS	TUTELA W90/M-DA* (SAE80W/90)	**2.5**
AUTOMATIC GREASING SYSTEM	GREEN LUBE EP0	**----------**
DIESEL WITH ADBLUE	DIESEL SPECIFICATIONS EN590 / CONFORMING TO ISO 22241 STANDARD	**500 DIESEL 68 LITERS**

* **PETRONAS** oil used on vehicle

** Diesel with low sulfur (ULSD) is highly recommended:

EUROPA ≤ 10 ppm

USA ≤ 15 ppm

5.7 MAINTENANCE TO PERFORM IN PERIOD OF INACTIVITY

WARNING:
It is important to follow the maintenance instructions also during the period when the machine is not used!

1. At the end of the working season, provide to wash the whole vehicle: intern and extern.
2. Check all the oil levels.
3. Lubricate all the part that needs it.
4. Start the engine every 15-20 days.
5. Every 15-20 days, check that no leaks are present on vehicle. If leakages are present, check for cause.
6. The vehicle must be parked with the blower head on ground.
7. Check the tyres pressure every 15-20 days.

5.7.1 Care instruction for inactive engine

To prevent the engine from being harmed during long (2 months or more) periods out of service, it must be conserved. Because a correct conservation is important, we have compiled a checklist covering the most important points.

CAUTION!

Read the chapter on Maintenance before starting work. It contains instructions on how to carry out maintenance and service operations in a safe and correct manner.

WARNING!

Conservations oils can be flammable and dangerous to inhale. Ensure good ventilation. Use a protective face mask when spraying.

IMPORTANT!

Remember the following must be considered when cleaning with a high-pressure water jet: Never point high pressure water jets directly at seals, rubber hoses or electrical components. Never use the high-pressure function when washing the engine.

For up to 8 month's stoppage:

1. Change the oil and oil filter on the engine, then, run the engine until warm.

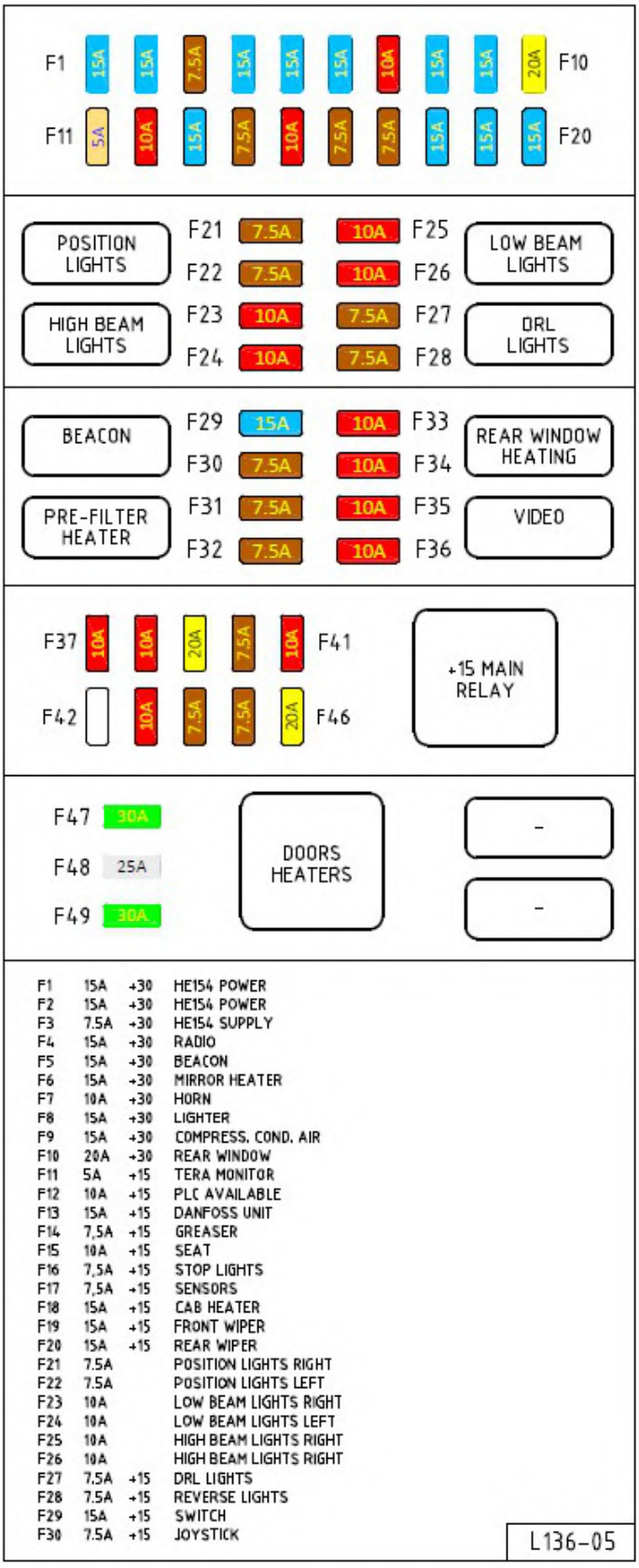
More than 8 month's stoppage:

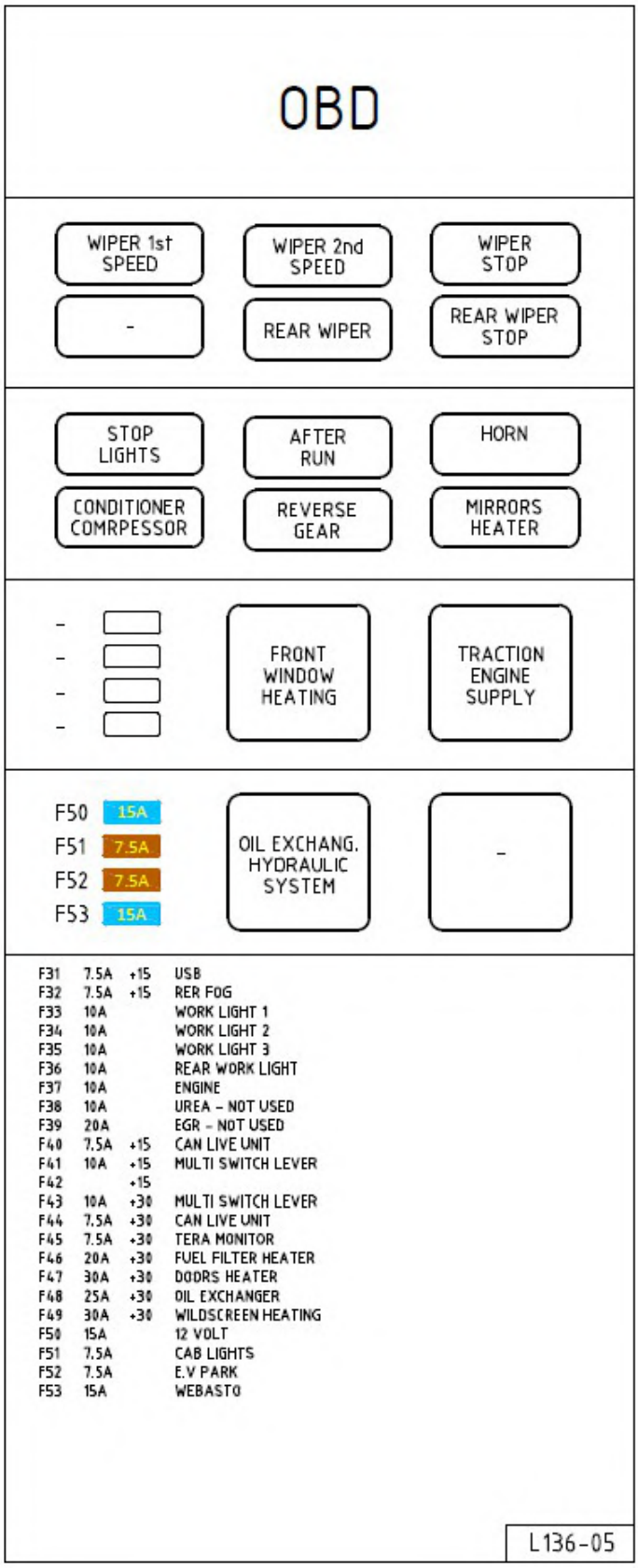
2. Conserve the lubrication and fuel systems with conservation oil.
3. Make sure that the coolant has adequate antifreeze properties. Top up as necessary.
4. Alternatively, you can drain the coolant (also drain the coolant filter).

5. Drain any water and contamination from the fuel filters and fuel tank. Fill the fuel tank completely, to avoid condensation.
6. Disconnect the battery cables, clean and charge the batteries. Trickle charge the batteries while the equipment is in storage. **A poorly charged battery can freeze and burst**.
7. Clean the outside of the engine. Do not use an high pressure washer for engine cleaning.
8. Check and rust-proof any control cables.
9. Put a note on the engine with the date, type of conservation and the conservation oil used.
10. Cover over the air filter, exhaust pipe and engine if necessary.

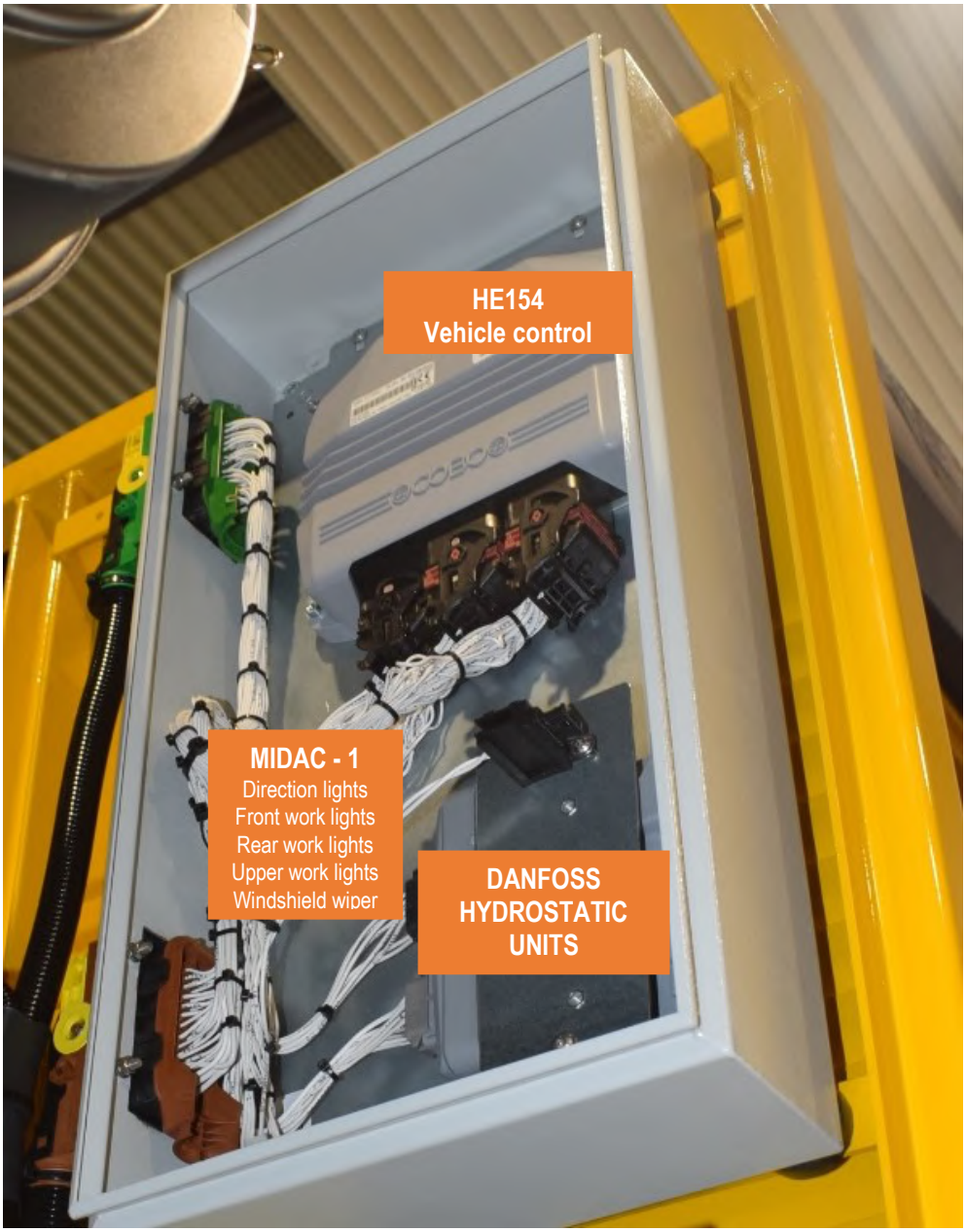
5.8 ELECTRIC COMPONENTS

5.8.1 FUSES AND RELAIS




OBD
WIPER 1st SPEED
WIPER 2nd SPEED
WIPER STOP
-
REAR WIPER
REAR WIPER STOP
STOP LIGHTS
AFTER RUN
HORN
CONDITIONER COMRPESSOR
REVERSE GEAR
MIRRORS HEATER
-
-
-
-
FRONT WINDOW HEATING
TRACTION ENGINE SUPPLY
F50 15A
F51 7.5A
F52 7.5A
F53 15A
OIL EXCHANG. HYDRAULIC SYSTEM
-
F31 7.5A +15 USB
F32 7.5A +15 RER FOG
F33 10A WORK LIGHT 1
F34 10A WORK LIGHT 2
F35 10A WORK LIGHT 3
F36 10A REAR WORK LIGHT
F37 10A ENGINE
F38 10A UREA – NOT USED
F39 20A EGR – NOT USED
F40 7.5A +15 CAN LIVE UNIT
F41 10A +15 MULTI SWITCH LEVER
F42 +15
F43 10A +30 MULTI SWITCH LEVER
F44 7.5A +30 CAN LIVE UNIT
F45 7.5A +30 TERA MONITOR
F46 20A +30 FUEL FILTER HEATER
F47 30A +30 DOORS HEATER
F48 25A +30 OIL EXCHANGER
F49 30A +30 WILDSCREEN HEATING
F50 15A 12 VOLT
F51 7.5A CAB LIGHTS
F52 7.5A E.V PARK
F53 15A WEBASTO
L136-05

5.8.2 CONTROL UNITS



5.9 BATTERIES INFORMATION

General periodical checks

After a certain time, even when the battery is not connected to any consumers, it becomes electrically empty. This occurrence is described as self-discharge and is caused by the chemical processes in the battery.

The extent of self-discharge depends upon the temperature, the acid-mass ratio and the battery technology.

A change in the storage temperature of 10°C results in a doubling of self-discharge (Arrhenius' Law). Self-discharge has a special influence in the case of seasonally employed vehicles such as those used in agriculture and the construction industry, motorcycles, caravans and convertibles.

In order to prevent irreparable damage, all batteries must be recharged from a voltage of 12.50 V.

Batteries connection

During series connection, the voltages of the individual batteries accumulate. In order to create a 24 V electrical supply system, two batteries must be connected in series.

Please note:

- Both batteries must have the same type designation.
- Both batteries must be of roughly the same age.
- Both batteries must have the same charge status.
- The connecting lines must have sufficient dimensions and be as short as possible.
- Always change both batteries!

Should the aforementioned recommendations not be followed, differing internal resistance of the individual batteries causes a corresponding voltage distribution and thus an asymmetrical load during
the loading and discharge phase.

The charging equalizer provides two batteries connected in series with a uniform charge status.

Output capacity and engine requirement

A battery has its maximum output capacity at a room temperature of 25°C. The colder the temperature, the slower the chemical processes in the battery and hence the lower its output capacity.

Engines also prefer warm temperatures, as the engine oil is more fluid and friction is reduced. However, as the temperature falls, the energy required for starting increases massively. Consequently, the
highest starting power is required when the battery has a poor output capacity.

Therefore, many batteries tend to fail in the cold period of the year.

Batteries installation and removal

Always heed the safety warnings!

- Only install batteries with an open circuit voltage of >12.50 V in a vehicle!

- Follow the vehicle instructions.

-Before fitting or removing the battery, switch o the engine and all power consumers.

- Avoid short circuits due to tools.

- When removing the battery, first disconnect the negative (-) terminal and then the positive (+) terminal.

- Prior to fitting the battery, clean the battery compartment.

- Ensure that the battery is secured tightly.

- Clean terminals and battery clips and lubricate slightly with acid-free grease.

- When fitting the battery first connect the positive (+) terminal and then the negative (-) terminal. Ensure that the clips are secured.

- Original parts and sleeves are to be put back in place.

Storage

- Only store fully charged batteries with short circuit protection.

- Batteries are to be kept in a dry, light-protected and cool (frost-free) place.

- The open circuit voltage of the batteries is to be checked regularly and from 12.50 V the batteries are to be recharged.

- If a battery is to be taken out of service in the winter months, it should be removed from the vehicle.

- If the battery is left in the vehicle, the negative terminal should be disconnected.

- As an alternative, a charge retention device can be use.

Batteries maintenance

Check on the correct connection of the battery cable.

- Loose battery cables result in increased transitory resistance, which leads to incomplete charging and reduced cold starting current.

- The battery may not be covered in dirt. Increased self-discharge derives from permanent creepage current.

- Terminals must be kept clean and greased.

- Oxidized terminals also result in increased transitory resistance, which leads to incomplete charging and reduced cold starting current.

5.10 ENGINE FAILURE CODES

SEE VOLVO PENTA REF

5.11 DANFOSS TRANSMISSION FAILURE CODES

Flash Code	ACTIVE	Description	Action
14 15		The Battery Voltage will be monitored. <9 V or > 36V SAFE / <18V or >32V LIMITED	SAFE-State LIMITED-State
16		Sensor Voltage Error. Nominal 5V. <4,64V or >5,32V is out of Range.	SAFE-State
21		Pump Forward and Reverse Control Valve Error	SAFE-State
22		Pump Forward Control Valve Error Feedback Error / Valve Resistance out of Range	LIMITED-State
23		Pump Reverse Control Valve Error Feedback Error / Valve Resistance out of Range	LIMITED-State
24		Feedback Error / Shortcut digital output C2p05	SAFE-State or LIMITED-State
25		Feedback Error / Shortcut digital output C2p06	SAFE-State or LIMITED-State
26		Feedback Error / Shortcut digital output C2p09	
27		Feedback Error / Shortcut digital output C2p10	
28		Hydromotor Proportional Valve Feedback Error	LIMITED-State
29		Hydromotor Brake Pressure Defeat Valve Feedback	LIMITED-State
31		Engine/pump Speed RPM Error / Input Frequency >10.000 Hz / >8000 rpm / Pump rpm < “lowest	LIMITED-State
35		FNR Shortcut Error	SAFE-State
39		Inch Sensor Error	SAFE-State
41		Inch Sensor not calibrated	Start Protection ON
43		Driving Sensor Error	LIMITED-State
47		Mode Switch B Error (only CAN)	LIMITED-State
58		Hydromotor RPM Error / Input Freq >8.000Hz	LIMITED-State
71		CAN Hardware Error	LIMITED-State
72		CAN RX Message timeout	LIMITED-State
98		CAN Shared Engine Speed Control	SAFE-State
100		Parameter Error	No action

5.12 CAN BUS FAILURES

5.13 SENSORS FAILURES

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	A_01

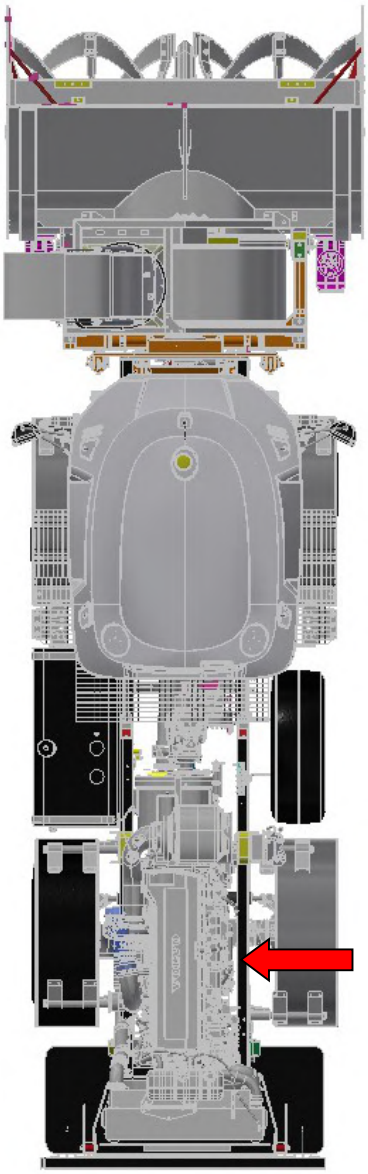
Vehicle type:	SNOWBLOWER	Model:	F90 STI

Intervention type: OIL LEVEL CHECK
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

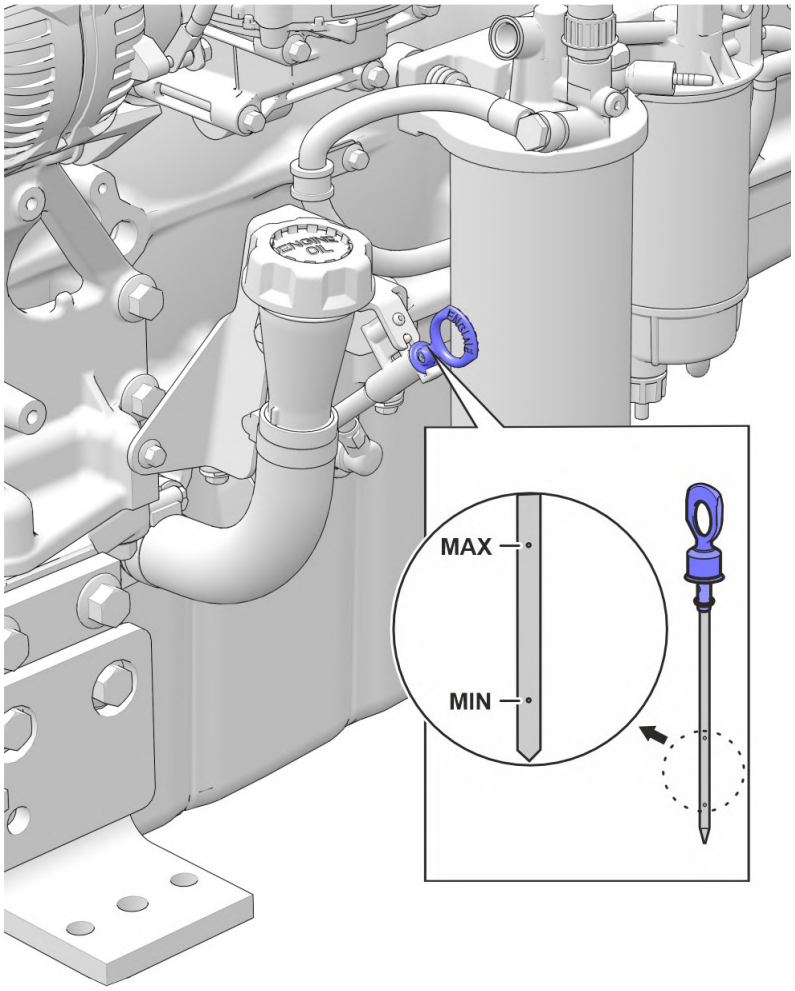
Periodicity:	BEFORE STARTING	Required time:	5 minutes

Action points:



Requested spare parts:	Specific tools:
• Use only **OBL LH 5W30** oil or equivalent	

People operating on engine must wear protective clothes according to the regulations in force



Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

- The engine should be placed on a level position when the oil is checked.
- The oil level is to be checked when the engine is stopped. Wait a few minutes before reading off the level, so that the oil has time to run down into the oil sump.
- The oil level must be inside the marked area on the dipstick. Never fill above the maximum limit on the oil dipstick.
- Only fill oil when the engine is stopped.

WARNING:
Never fill over the MAX limit on the oil dipstick. Only use recommended oils.

Technomatic	Maintenance sheet	Sheet n° A_02

☐ ELECTRIC	☐ MECHANIC	■ FLUIDIC
☐ CLEANING	☐ LUBRICATION	☐ INSPECTION

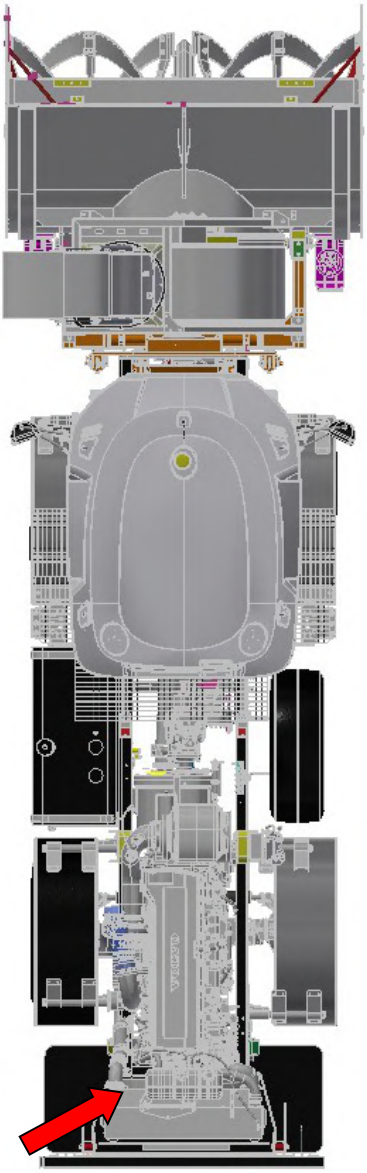
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90 STI**

Intervention type: COOLING LIQUID CHECK
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

Periodicity:	BEFORE STARTING	**Required type:**	2 minutes

Action points:

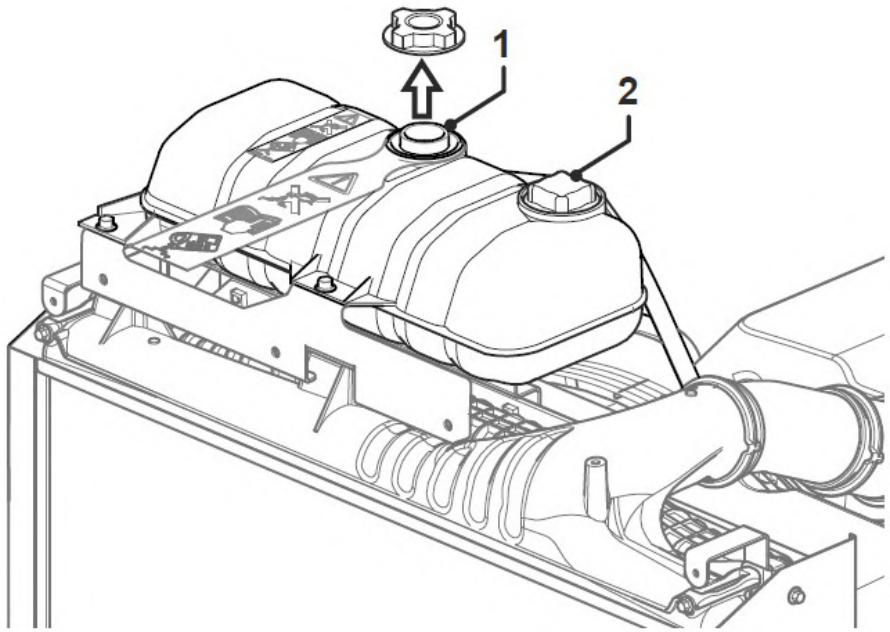


Spare parts requested:	**Specific tool:**
• Cooling liquid **Volvo Penta VCS**.	

People operating on engine must wear protective clothes according to the regulations in force

WARNING:

THE CHECK MUST BE DONE WITH STOPPED AND COOLED ENGINE.



a) Only open the filler cap (1). Do not open the pressure cap (2).

b) Check that the coolant level is above the MIN mark on the expansion tank.

c) Top up with coolant as required, so that the level is between the MIN and MAX marks.

Fill slowly, to allow air to flow out.

WARNING:
Only use the recommended coolant.
Top up with the same type of coolant as already used in the system. Different types of coolant must not be mixed.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	A_03

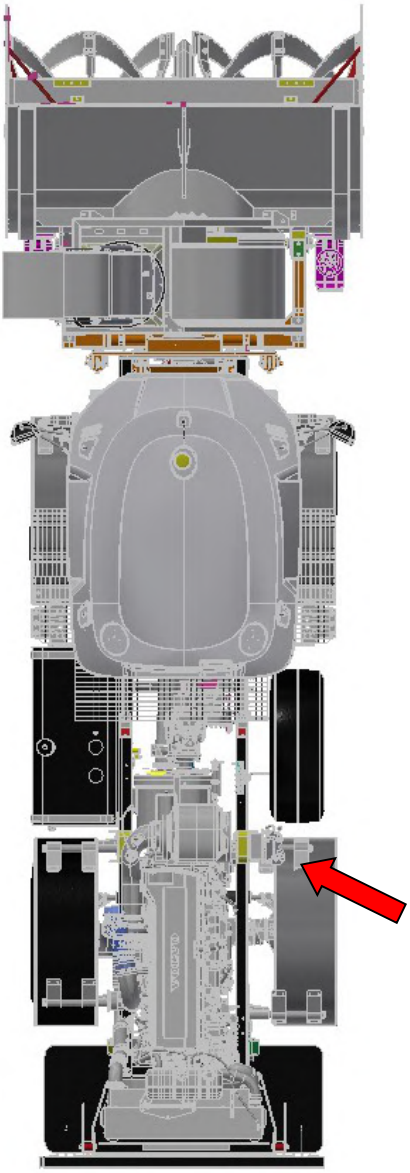
Vehicle type:	SNOWBLOWER	Model:	F90 STI

Intervention type: DRAIN THE WATER FROM THE PRE-FILTER
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

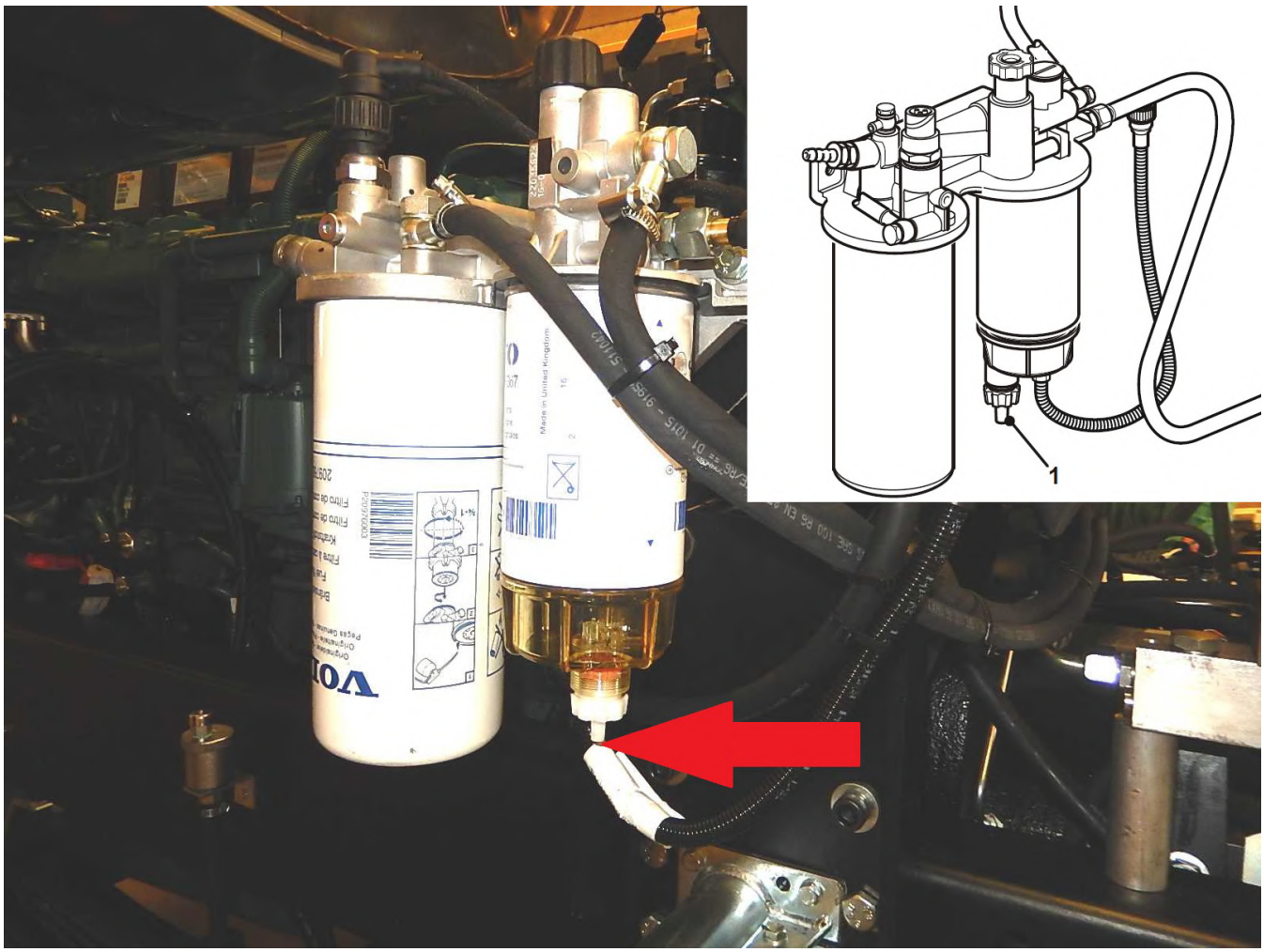
Periodicity:	BEFORE STARTING	Required time:	2 minutes

Acting point:



Requested spare parts:	Specific tools:

People operating on engine must wear protective clothes according to the regulations in force



a) Put a container under the pre-filter and open the drain tap (1) in the base of it.

b) Tighten the drain tap (1) when fuel without water starts to run out.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	A_04

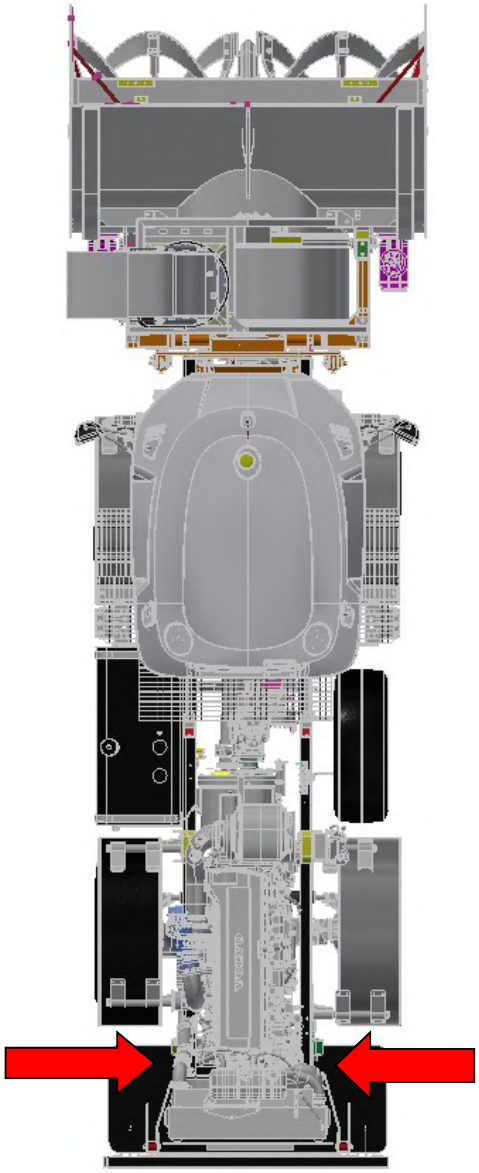
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90 STI**

Intervention type: LEAKS FROM THE SLEEVES CHECK
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

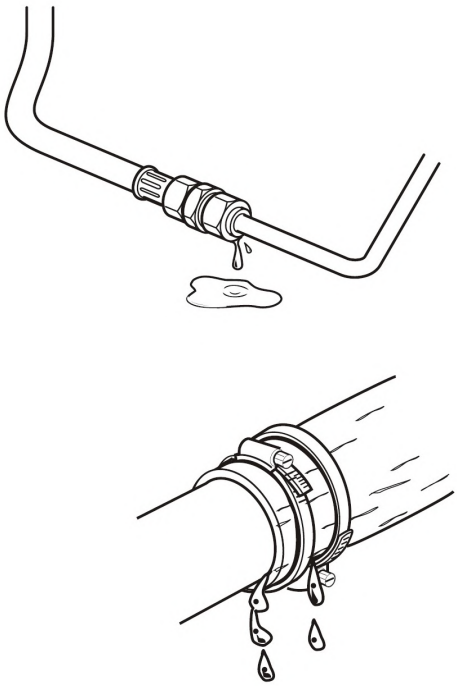
Periodicity:	EVERY 50 HOURS	**Required time:**	5 minutes

Acting points:



Requested spare parts:	Specific tools:

People operating on engine must wear protective clothes according to the regulations in force



Make it an habit to give the engine and engine compartment a visual inspection before starting the engine and after operation once the engine has stopped. This will help you to discover quickly if anything abnormal has happened, or is going to happen.

Look especially carefully at oil, fuel and coolant leakage, loose bolts, worn or poorly tensioned drive belts, loose connections, damaged hoses and electrical cables. This inspection only takes a few minutes and can prevent serious malfunctions and expensive repairs.

WARNING:
Accumulations of fuel, oil and grease on the engine or in the engine room is a fire hazard and must be removed immediately they are detected.

WARNING:
If an oil, fuel or coolant leak is detected, it is necessary to investigate the causes and to rectify the fault before the stating the engine.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	A_05

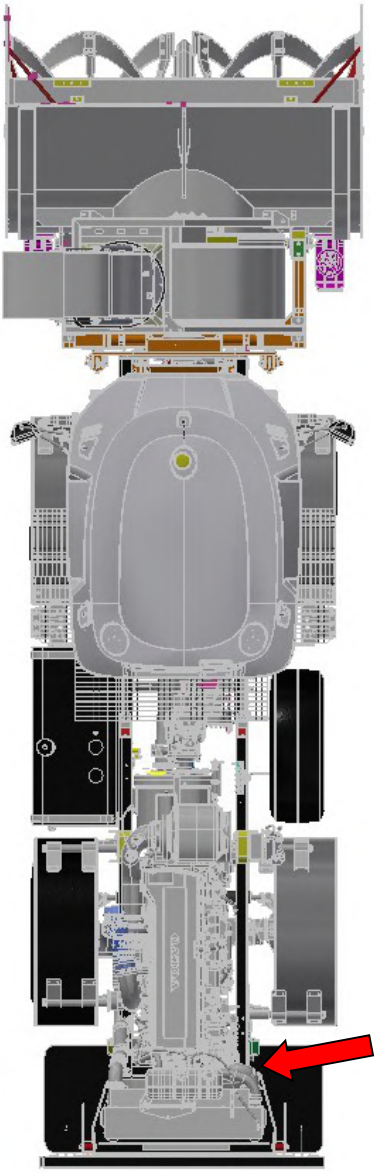
Vehicle type:	SNOWBLOWER	Model:	F90 STI

Intervention type: ENGINE BELTS CONDITIONS CHECK
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

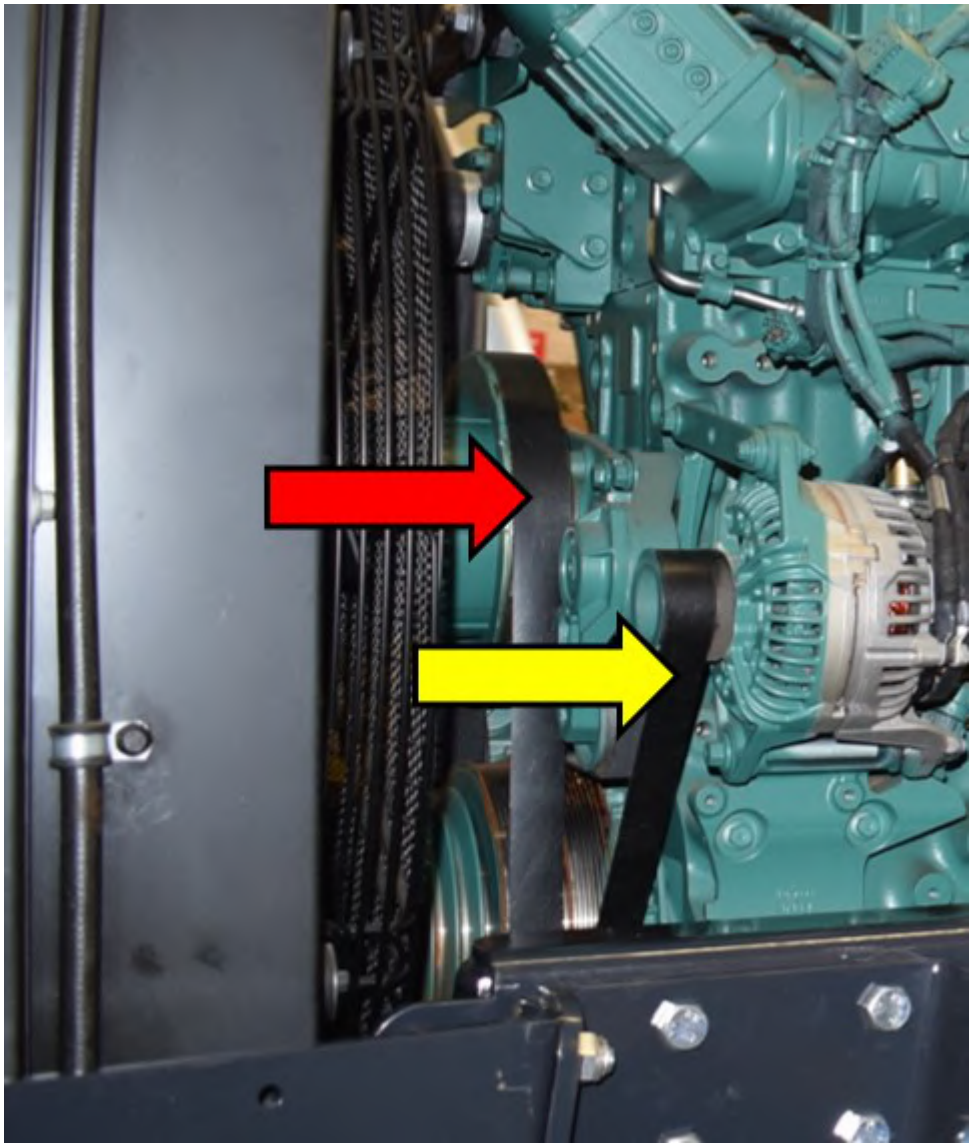
Periodicity:	EVERY 50 HOURS	Required time:	5 minutes

Acting points:



Spare parts requested:	Specific tools:

People operating on engine must wear protective clothes according to the regulations in force



Check the conditions of the engine belts (red arrow) and the alternator belt (yellow arrow).

If it is necessary. Replace them, following the procedure for the belts replacement (sheet 13).

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	A_06

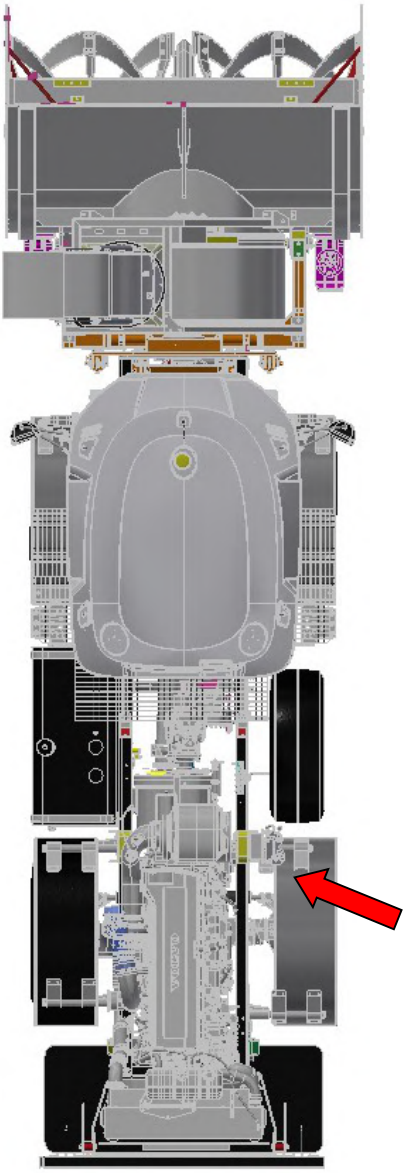
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90 STI**

Intervention type: FUEL FILTER REPLACEMENT
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

Periodicity:	EVERY 250 HOURS	**Required time**	15 minutes

Action points:

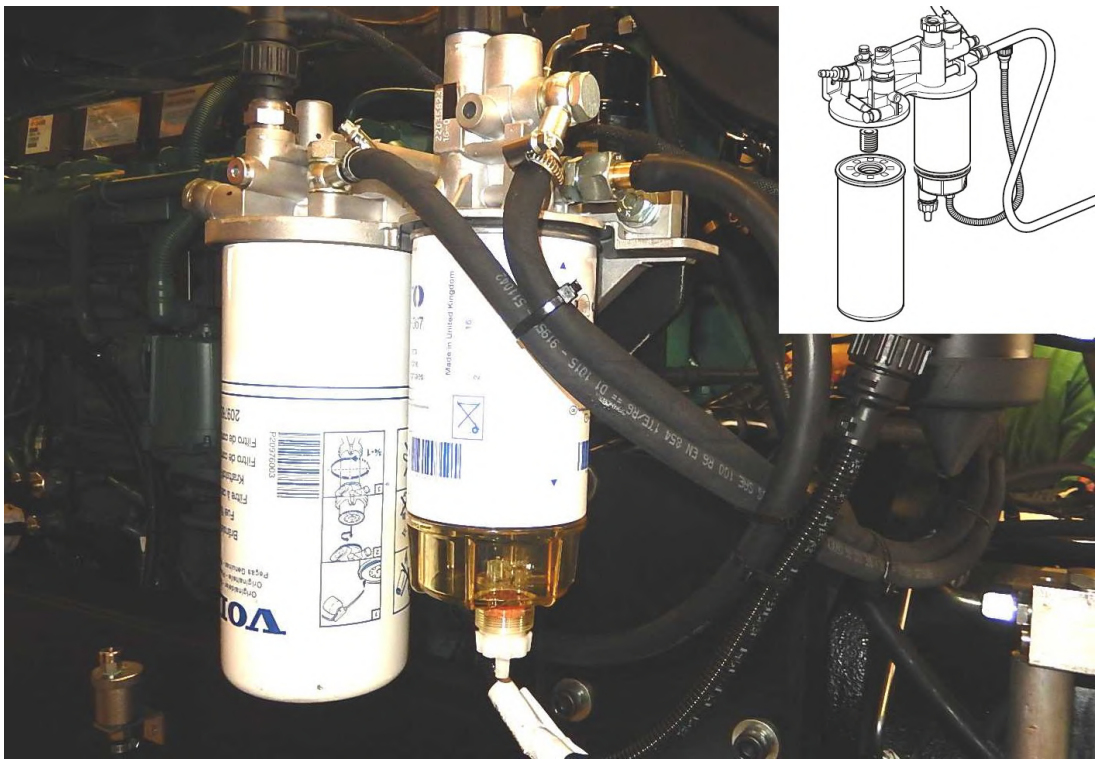


Requested spare parts:

- Fuel filter cartridge **24063189**

Specific tools:

People operating on engine must wear protective clothes according to the regulations in force



WARNING:
Fire hazard. When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire.

NOTE 1:
Do not fill the new fuel filter with fuel before assembly.
There is a risk that contamination could get into the system and cause malfunctions or damage.

a) Clean round the fuel filter.

b) Remove the filter with a suitable filter remover. Collect any spilled fuel in a collection vessel.

c) Clean the filter mating surface on the filter bracket.

d) Lubricate the seal with diesel fuel and install the new fuel filter. Tighten the fuel filter in accordance with the instructions on the fuel filter.

e) If necessary, vent the fuel system.

Bleeding the Fuel System:

1. Check that there is sufficient fuel in the tank, andthat any fuel taps are open.
2. Release the hand pump on the fuel bracket bypushing down and twisting the plastic handle.
3. Vent the fuel system by pumping with the handpump. Air is vented to the tank via the fuel return pipe. No breathing nipples
4. Lock the hand pump, push down and twist the handle.
5. Start the engine and allow it to idle fast for about 10 minutes.
6. Perform a leakage and function check.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	A_07

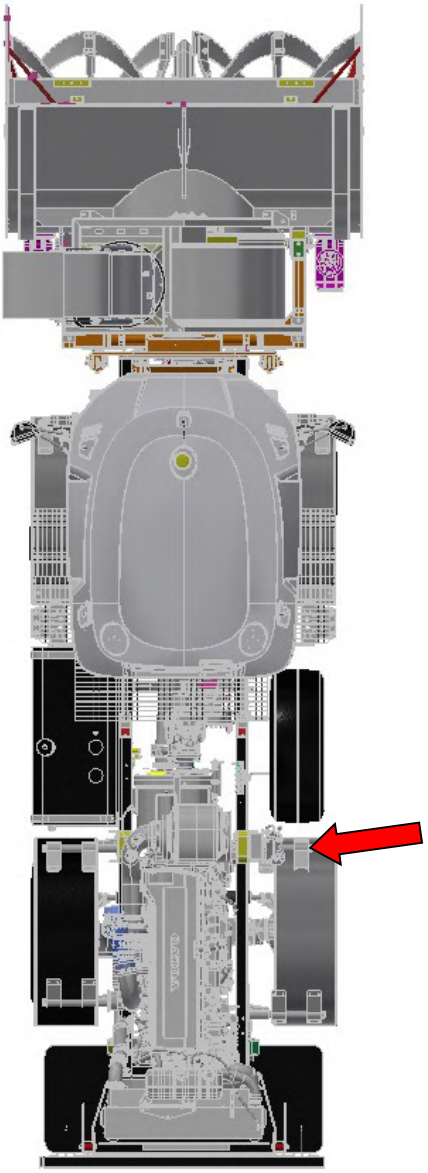
VEHICLE TYPE:	SNOWBLOWER	Model:	F90 STI

Intervention type: FUEL PRE-FILTER PEPLACEMENT
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

Periodicity:	EVERY 250 HOURS	Required time:	15 minutes

Acting points:

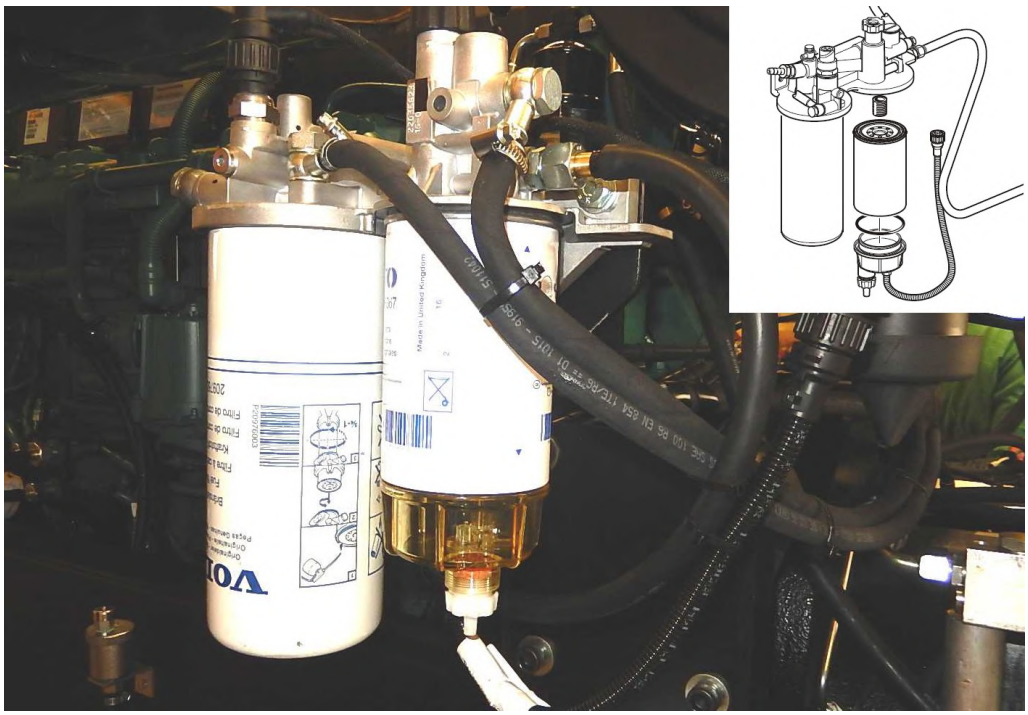


Spare parts requested:

- Fuel pre-filter cartridge code **20998367**

Specific tools:

People operating on engine must wear protective clothes according to the regulations in force



WARNING:
Fire hazard. When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire.

a) Undo the cable from the water trap sensor.

b) Remove the water trap filter from the filter housing. Collect any spilled fuel in a container.

c) Remove the lower part of the water trap from the filter.

d) Clean the lower part of the water trap with a soft rag. Check that the drain hole in the lower part is not blocked.

e) Install a new seal on the lower part and lubricate the seal with diesel fuel. Re-install the lower part of the filter.

f) Lubricate the seal with diesel fuel. Screw the filter onto the filter bracket by hand until the rubber seal just touches the mating surface. Then tighten a further half turn, no more.

g) Connect the cable to the water trap sensor.

h) If necessary, vent the fuel system.

Bleeding the Fuel System:

1. Check that there is sufficient fuel in the tank, andthat any fuel taps are open.
2. Release the hand pump on the fuel bracket bypushing down and twisting the plastic handle.
3. Vent the fuel system by pumping with the handpump. Air is vented to the tank via the fuel return pipe. No breathing nipples
4. Lock the hand pump, push down and twist the handle.
5. Start the engine and allow it to idle fast for about 10 minutes.
6. Perform a leakage and function check.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	A_08

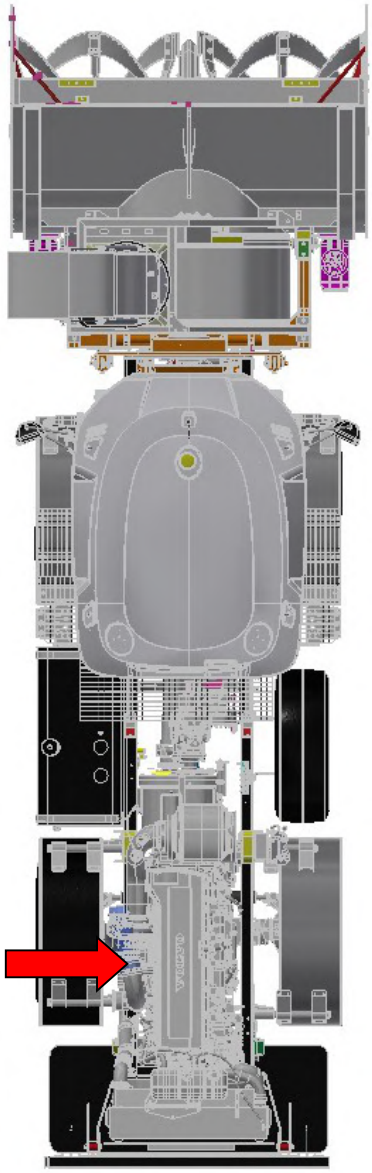
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90 STI**

Intervention type: OIL FILTERS REPLACEMENT
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

Periodicity:	EVERY 250 HOURS	**Required time:**	15 minutes

Action points:



Spare parts requested:

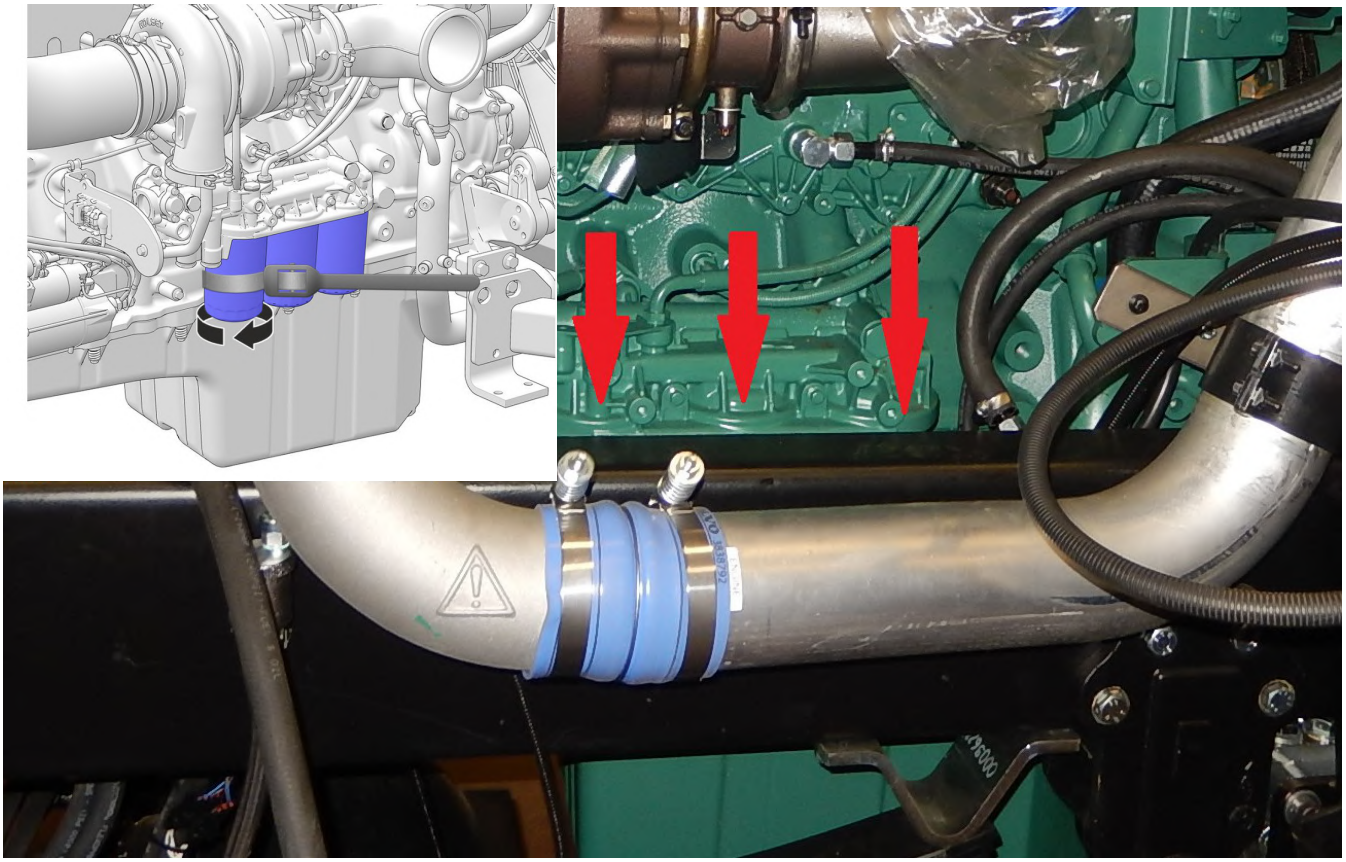
- Oil filter cartridge code **23075367 (nr. 1)**
- Oil filter cartridge code **23075366 (nr. 1)**
- Oil type **OBL LH 5W30** or equivalent.

Specific tools:

People operating on engine must wear protective clothes according to the regulations in force

DANGER:

ACT ONLY WHEN ENGINE IS COLD. Hot oil and hot surfaces can cause burns.



a) Clean the oil filter bracket (2).

b) Remove all oil filters with a suitable oil filter extractor (1).

c) Clean the mating surface of the oil filter bracket. Make sure that no pieces of old oil seal are left behind. Carefully clean round the inside of the protective rim (2) on the oil filter bracket.

d) Put a thin layer of engine oil on the seal rings of the new fuel filters.

e) Install the new oil filters. Tighten the filters ¾–1 turn after they touch.

f) Top up with engine oil, start the engine and let it run for 20-30 seconds.

g) Turn off the engine, check the oil level and top up as required.

h) Check sealing round the oil filters.

<

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	A_09

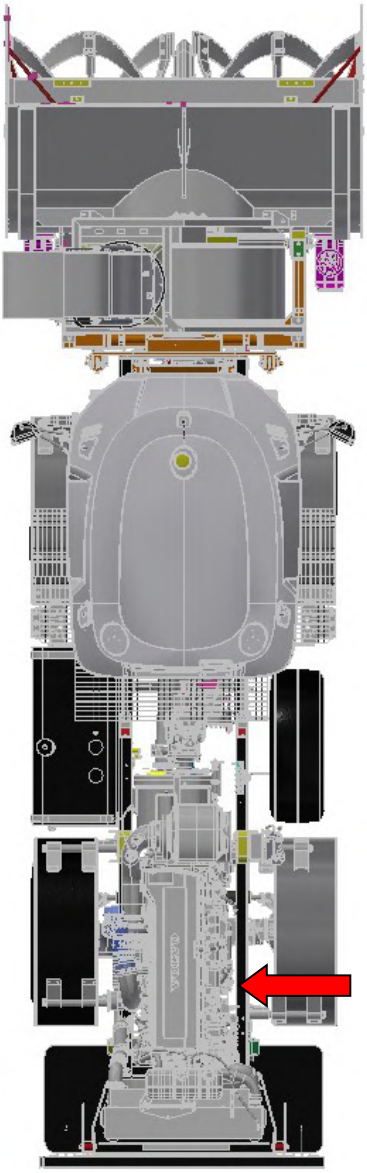
Vehicle type:	**SNOWBLOWER**	**Modello:**	**F90 STI**

Intervention type: ENGINE OIL REPLACEMENT
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

Periodicity:	EVERY 250 HOURS	**Required time**	30 minutes

Action points:



Requested spare parts:

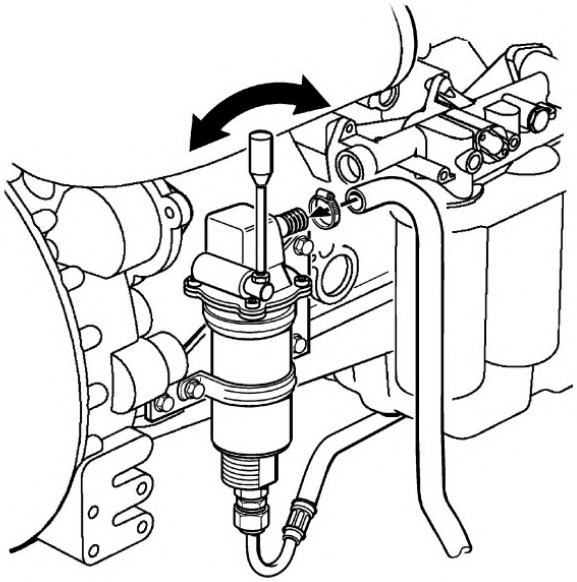
- Oil type **OBL LH 5W30** or equivalent.

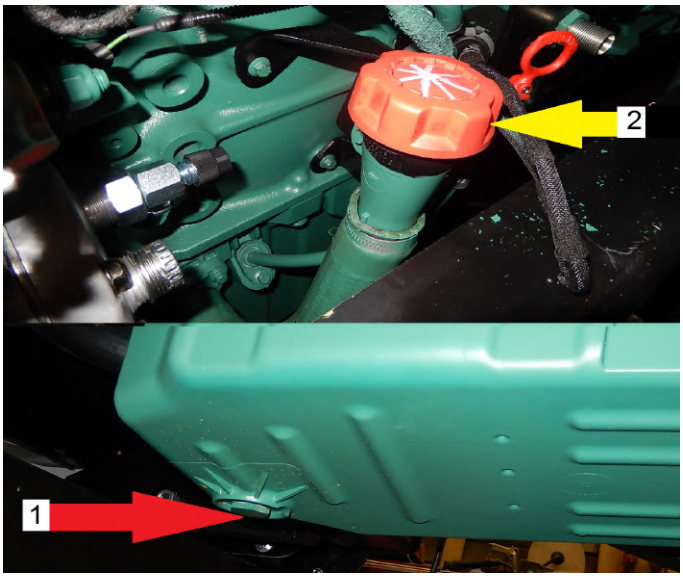
Specific tools:

People operating on engine must wear protective clothes according to the regulations in force

WARNING:

Operate on warm engine can cause burns.





Oil change must be done when engine is warm.

WARNING:

Warm oil flows out more quickly so be careful that this can cause burns.

a) Connect the drain hoses to the oil drain pump and check that no leakage can occur.

b) Pump the oil wasted oil out (or remove the bottom oil plug (1) and drain the oil from there) and collect it in a container.

c) Remove the drain hose (or reinstall the bottom plug (1)).

d) Fill the new engine oil through the cap (2). Check oil level as indicated on sheet 1.

NOTE

After oil replacement it is necessary to replace the oil filters as indicated in A_09.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ■ CLEANING ☐ LUBRIFICATION ☐ INSPECTION	A_10

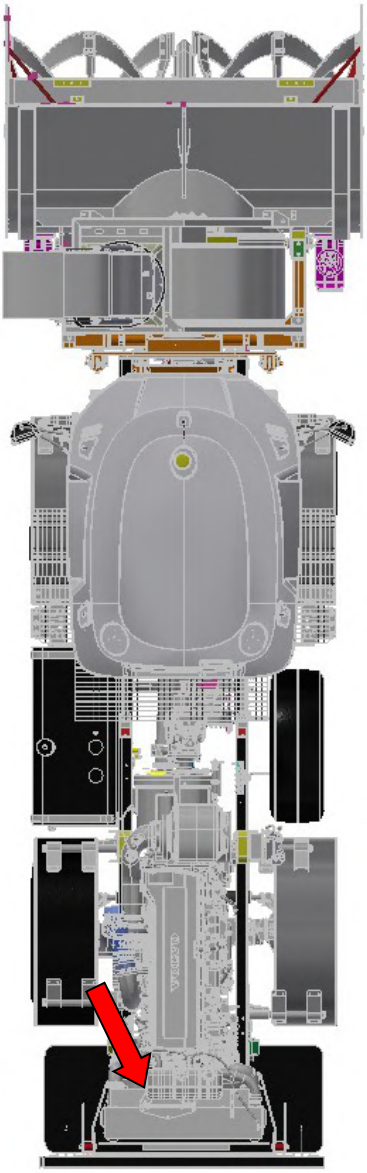
Vehicle type:	SNOWBLOWER	Model:	F90 STI

Intervention type: RADIATOR CLEANING
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSIONA& HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

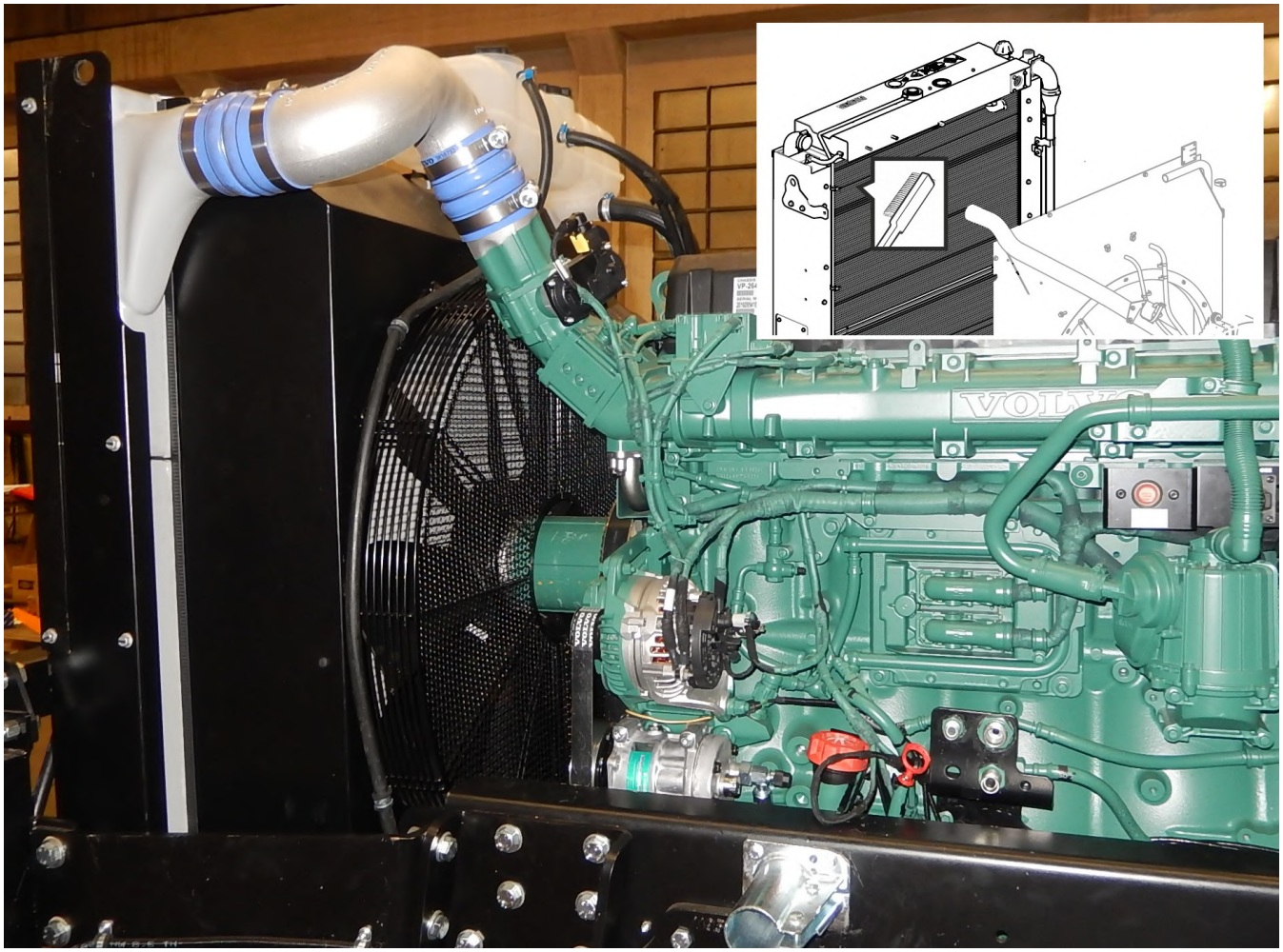
Periodicity:	EVERY 250 HOURS	Required time	10 minutes

Action points:



Requested spare parts:	Specific tools:

People operating on engine must wear protective clothes according to the regulations in force



Remove guards as necessary, to access the radiator.

Clean with water and a mild detergent. Use a soft brush. Be careful not to damage the radiator vanes.

Reinstall removed parts.

IMPORTANT!

Do not use air or water in pressure.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ PULIZIA ☐ LUBRIFICAZIONE ■ INSPECTION	A_11

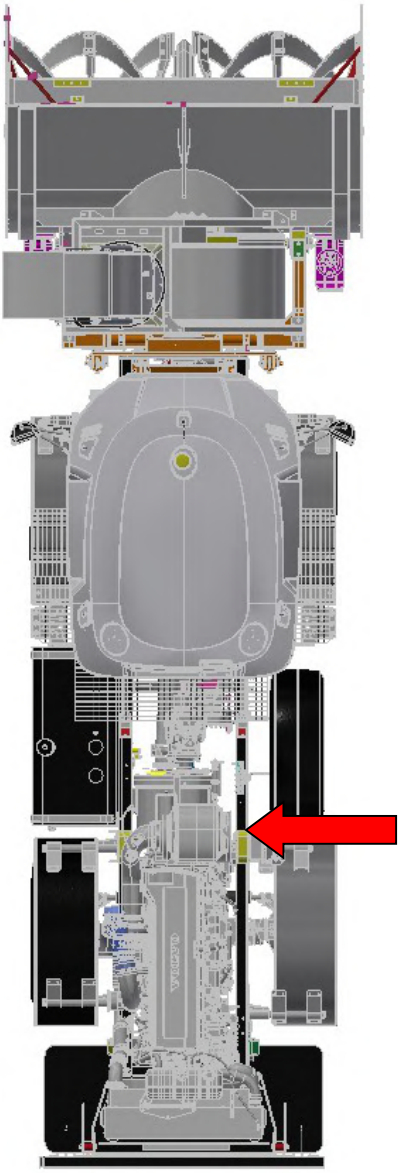
Vehicle type:	SNOWBLOWER	Model:	F90 STI

Intervention type: AIR FILTER CARTRIDGES REPLACEMENT
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

Periodicity:	EVERY 500 HOURS or ANUALLY	Required time:	15 minutes

Action points:



Requested spare parts:	Specific tools:
• Main filter cartridge code: **00112145** • Secondary filter cartridge code: **00112144**	

People operating on engine must wear protective clothes according to the regulations in force

The engine is equipped with electronic air filter indication.

The control unit provides an output signal which is announced as a warning on the instrument panel. The warning indicates a pressure drop in the air filter, which must then be checked and possibly changed.

Anyway, a filter change is requested annually.

a) Open the 6 clips (1)

b) Remove the cover (2)

c) Scrap the old filter. No cleaning or re-use is permissible.

WARNING:
The filter element must not be cleaned in water or be blown clean with compressed air. There is always a risk that the filter element will be damaged when it is cleaned

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ■ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRIFICATION ☐ INSPECTION	A_12

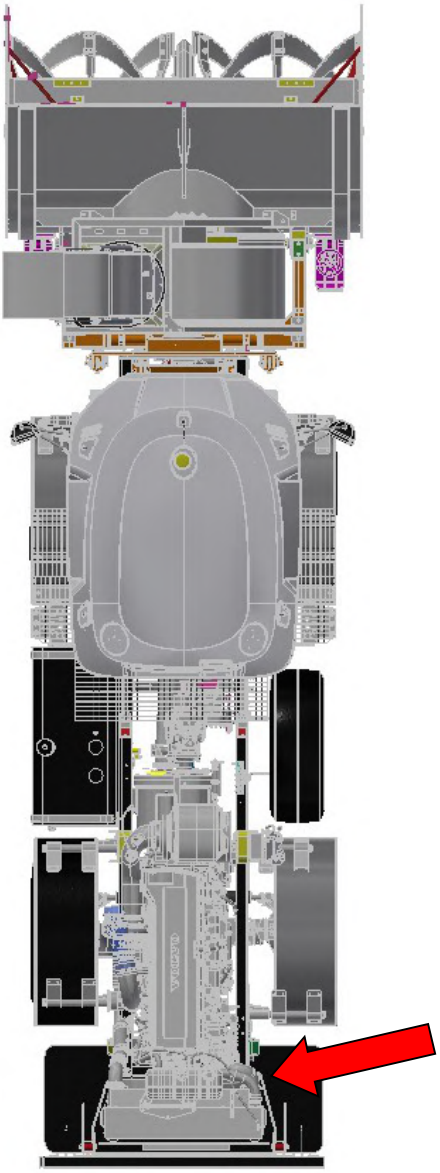
Vehicle type:	SNOWBLOWER	Model:	F90 STI

Intervention type: ENGINE BELTS REPLACEMENT
(FOR MORE INFORMATION REF. TO THE OPERATOR'S MANUAL VOLVO PENTA)

ENGINE	HYDROSTATIC TRANSMISSIONA & HYDRAULIC SYSTEM	AXLES	SUSPENSIONS
TYRES	TRANSFER REDUCER	BLOWER HEAD	TWO SPEED BACK GEAR

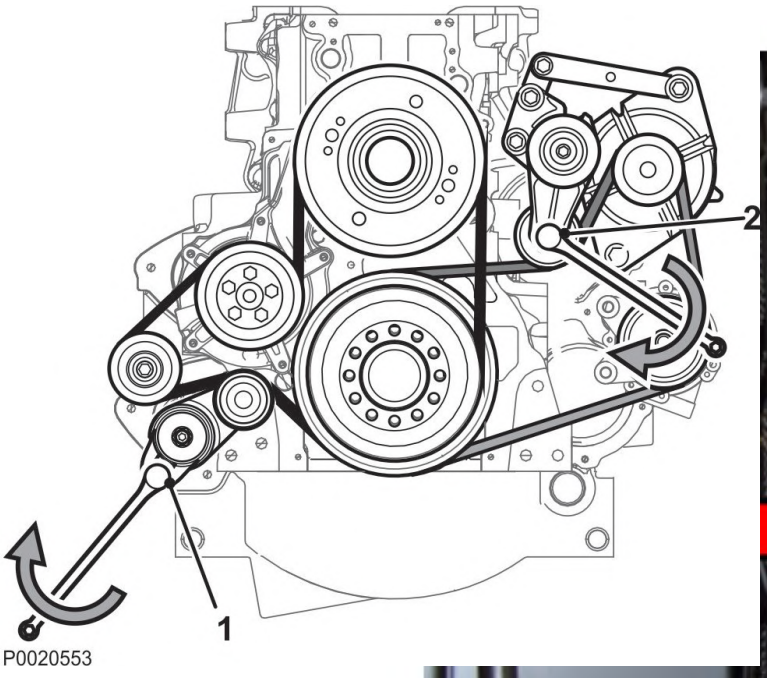
Periodicity:	EVERY 1250 HOURS	Required time:	30 minutes

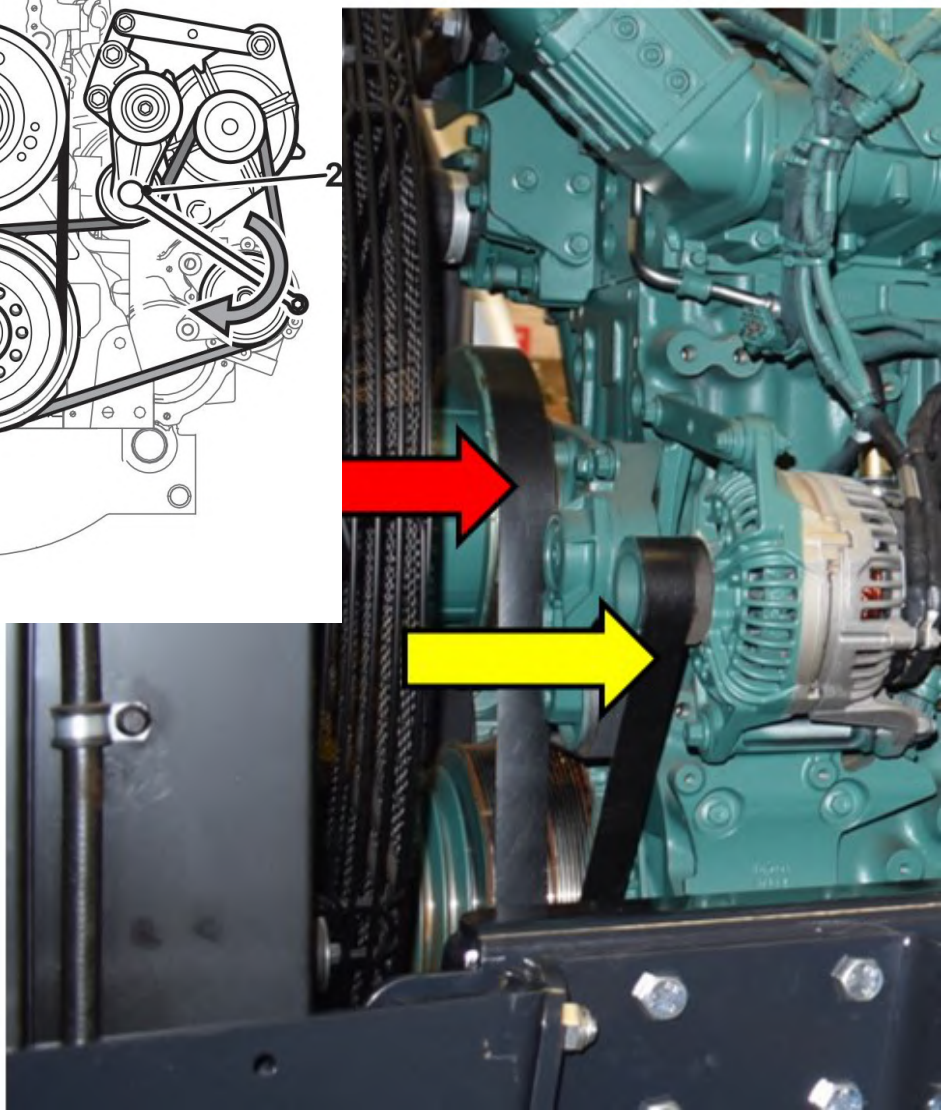
Action points:



Requested spare parts:	Specific tools:

WARNING:
People operating on engine must wear protective clothes according to the regulations in force.





a) Disconnect the main switch(es) and check that the engine is not connected to system voltage.

b) Remove the fan protection and the fan ring around;

c) Remove the fan guard

d) Insert a ½ square wrench in the belt tensioner (1), lift the wrench up and lift the water pump drive belt off.

e) Insert a ½ square wrench in the belt tensioner (2), press the wrench down and remove the alternator belts

f) Check that the pulleys are cleaned and undamaged

g) Press the wrench into the belt tensioner (2) down and install the new alternator drive belt.

h) Lift the wrench in the tensioner (1) up and install the new water pump drive belt.

i) Install the belts guards.

l) Install the fan ring and protection.

m) Start the engine and do a function check

Technomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	Sheet n° B_01

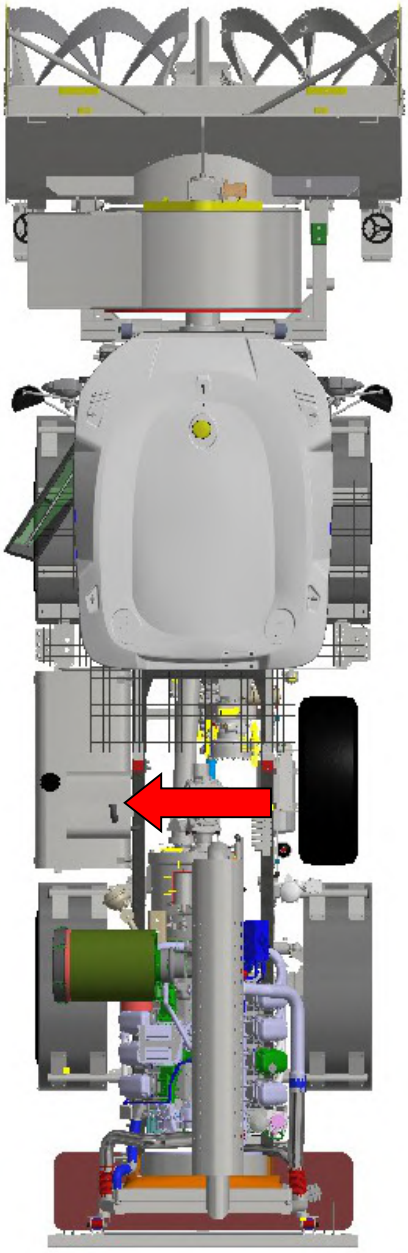
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: HYDRAULIC AND HYDROSTATIC OIL LEVEL CHECK

HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM

Periodicity:	BEFORE STARTING	Required time:	1 minute

Action points:



Requested spare parts:

- Oil type **TUTELA CAR GI/E** or equivalent.

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

NOTE:
An indicator light indicates quantity of hydraulic oil.

a) Check on control panel the tank oil level. If it is lower than **80%,** proceed as following:

b) Fill the new oil through the upper plug (1). The correct level is about 10 cm from the top.

WARNING:
The correct level is about 10 cm from the top of the tank.
The check must be done with cold oil.

WARNING:
Use only TUTELA CAR GI/E or equivalent.
The oil has to be filtered in a 10 micron.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRIFICATION ☐ INSPECTION	B_02

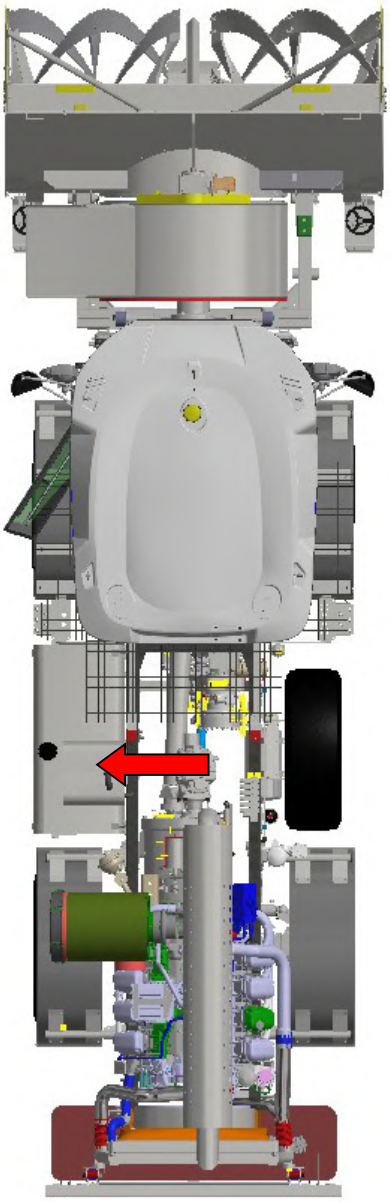
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: HYDROSTATIC TRANSMISSION OIL FILTER REPLACEMENT

HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM

Periodicity:	BEFORE STARTING THE WORK SEASON	Required time:	20 minutes

Action points:



Requested spare parts:	Specific tools:
Filter cartridge code **00099792** Oil type **TUTELA CAR GI/E** or equivalent	

PROCEDURE

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.

a) Put a container under the oil filter

b) Remove the plastic cover.

c) Remove the old filter and install the new one.

d) Reinstall the cover.

e) Run the engine and make sure there are no leaks.

WARNING:

As soon as the filter is removed, the oil becomes flowing out. At the end of the operation it is necessary to fill the tank at the correct oil level.

Use only TUTELA CAR GI/E oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	B_03

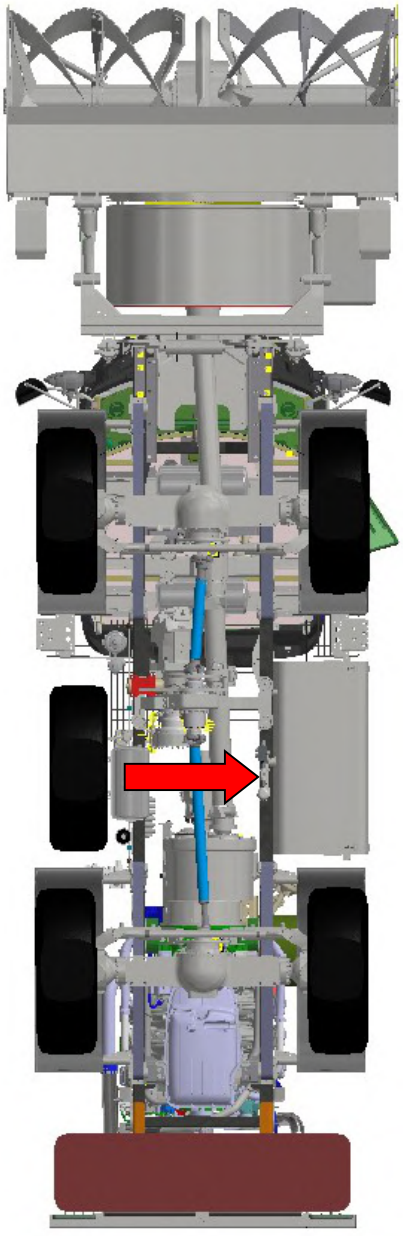
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention points: HYDRAULIC OIL FILTER REPLACEMENT

HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM

Periodicity:	BEFORE STARTING THE WORK SEASON	Required time:	20 minutes

Action points:



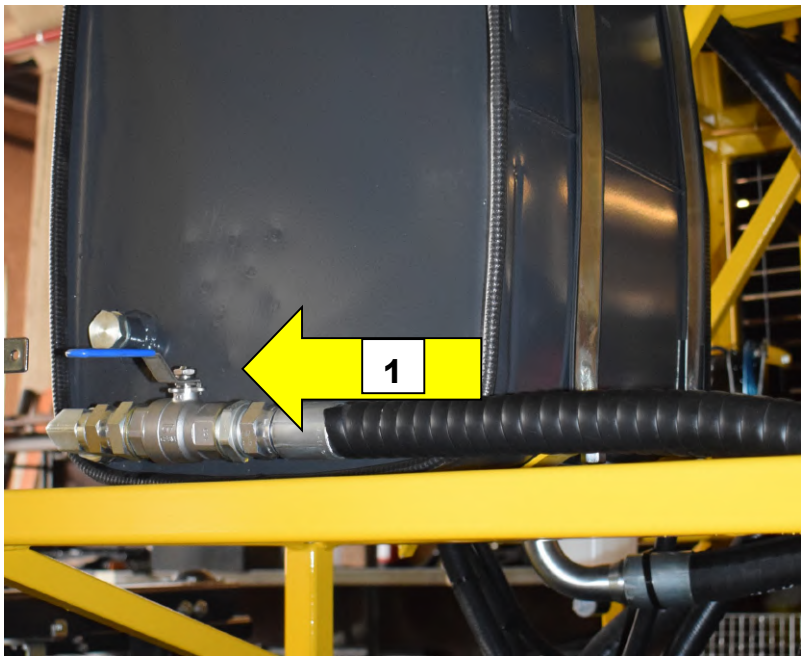
Requested spare parts:

- Cartridge code **00083031**
- Oil type **TUTELA CAR GI/E** or equivalent.

Specific tools:

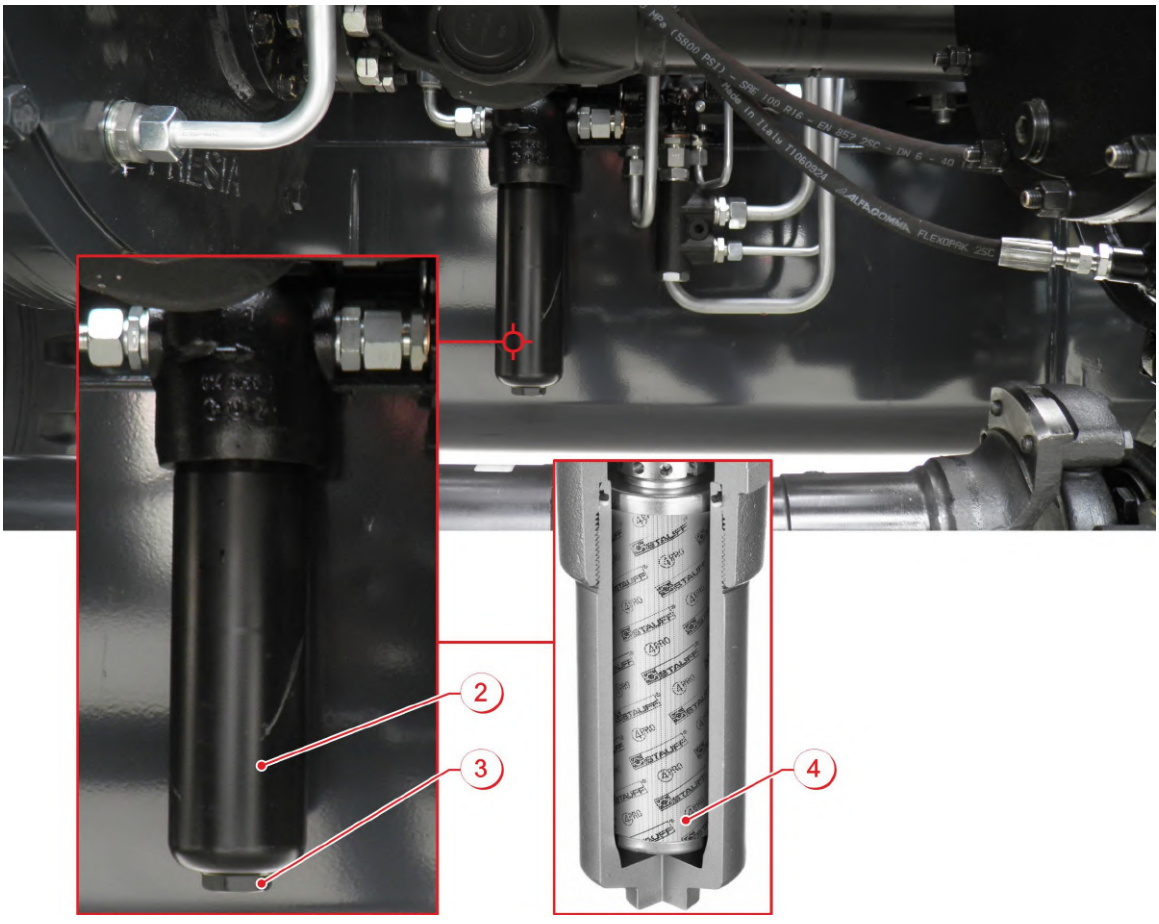
PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.



a) Close the valves (1), in the back of the tank

b) Put a container under the oil filter.



c) Remove the housing (2) by unscrewing the nut (3).

d) Slide out the cartridge (4)

e) Insert the new one.

f) Fix back the housing (2), screwing the nut (3).

g) Open the valves (1).

WARNING:
At the end of the operation, it is necessary to refill the tank at the correct level, 10 cm from the top.

WARNING:

Use only TUTELA CAR G1/E oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	B_04

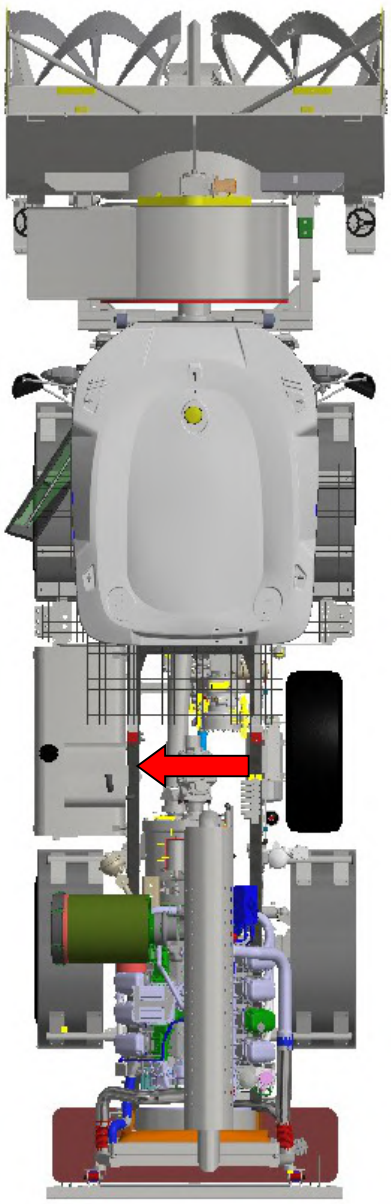
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: HYDRAULIC AND HYDROSTATIC OIL REPLACEMENT

HYDROSTATIC TRANSMISSION & HYDRAULIC SYSTEM

Periodicity:	EVERY 1000 HOURS or 2 YEARS	**Required time:**	30 minutes

Action points:



Requested spare parts:

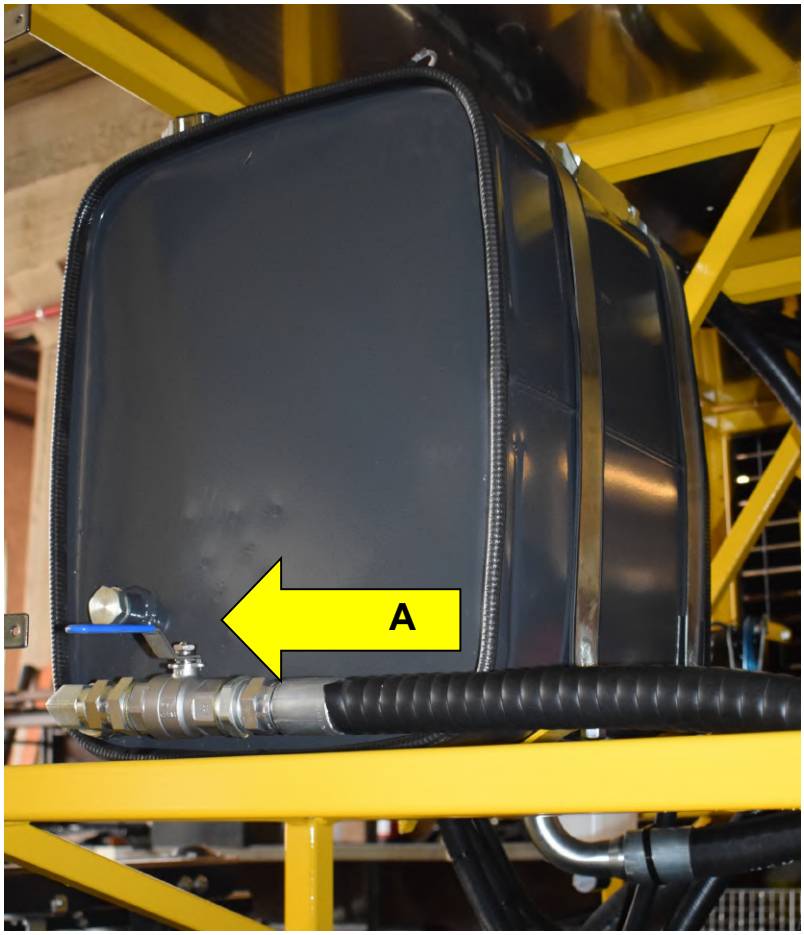
- Oil type **TUTELA CAR GI/E** or equivalent.

Specific tools:

- Suction pump

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.



a) Unscrew the tank cap and use a suction pump to drain out the oil.

b) In alternative, proceed as following:

- ✓ Close the valves A;
- ✓ Disconnect the hose from A;
- ✓ Put a container under the valve, open it and leave all the oil draining out;
- ✓ When the tank is empty, close A and reconnect the hose;
- ✓ Open the valve A

c) Fill the tank with new oil through the top opening until it reaches 10 cm from the cap;

d) Screw back the tank cap on top.

WARNING:

Use only TUTELA CAR GI/E oil or equivalent.

Oil must be filtered in a 10 micron.

Technomatic	Maintenance sheet	Sheet n° C_01

☐ ELECTRIC	☐ MECHANIC	☐ FLUIDIC
☐ CLEANING	☐ LUBRICATION	■ INSPECTION

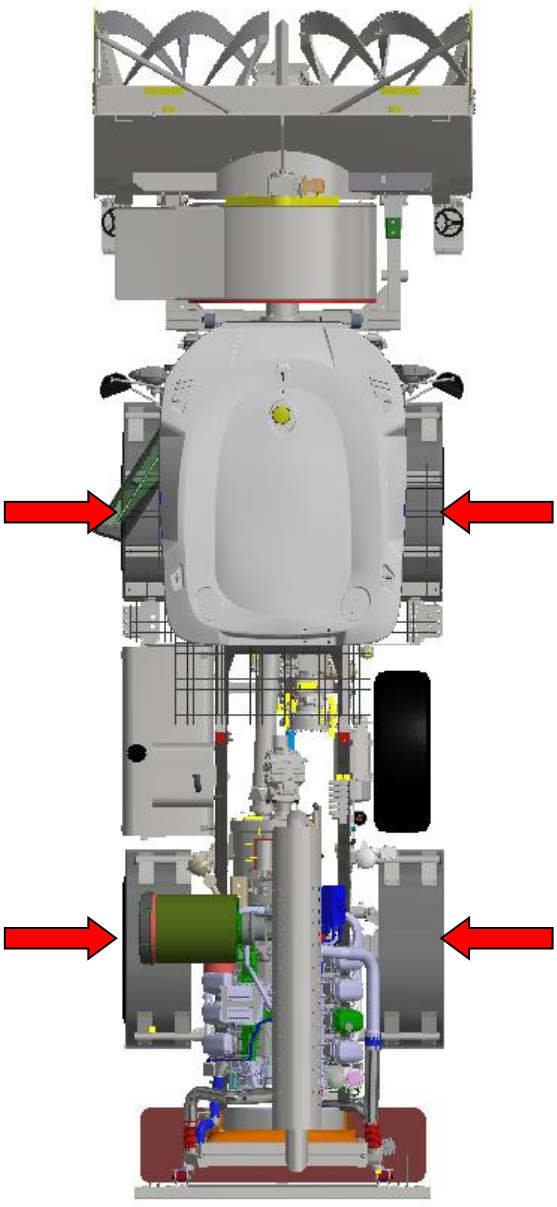
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: WHEEL HUBS OIL LEVEL CHECK

AXLES

Periodicity:	EVERY 50 HOURS	**Required time:**	30 minutes

Action points:



Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.

Specific tools:

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.

a) Unscrew the plug (1) and check that the oil reaches “OIL LEVEL”(2).

b) If the level is low, fill oil through the opening (1).

c) Screw back the plug (1).

d) Repeat the operation for each hub.

WARNING:

Do not overfill!

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	C_02

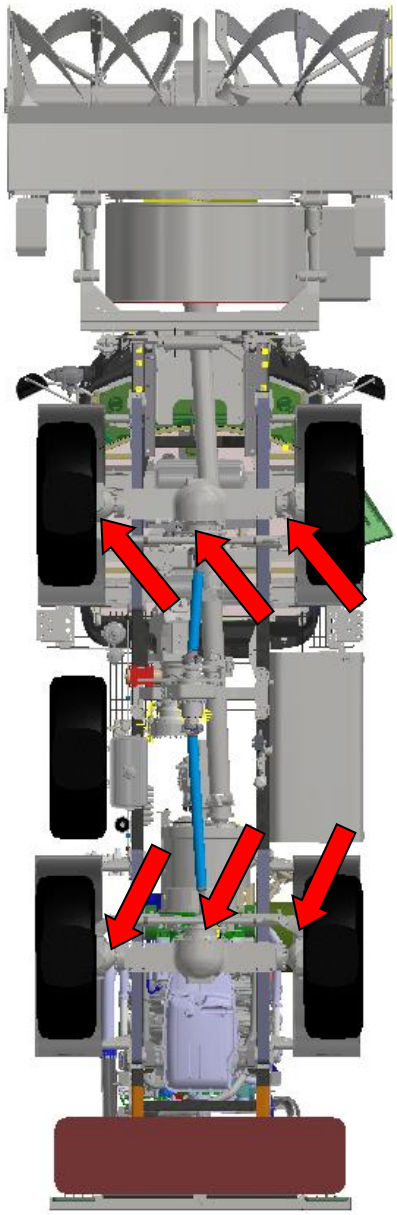
Vehicle type	SNOWBLOWER	Model:	F90

Intervention type: DIFFERENTIAL OIL CHECK AND STEERING HEAD GREASING

AXLES

Periodicity:	EVERY 50 HOURS	Required time	20 minutes

Action points:



Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

a) Drive the vehicle on an inspection pit.

b) Unscrew the plug (1) and check that the level reaches the lower part of the opening.

c) If it is necessary, refill.

d) Screw back the plug (1).

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	C_03

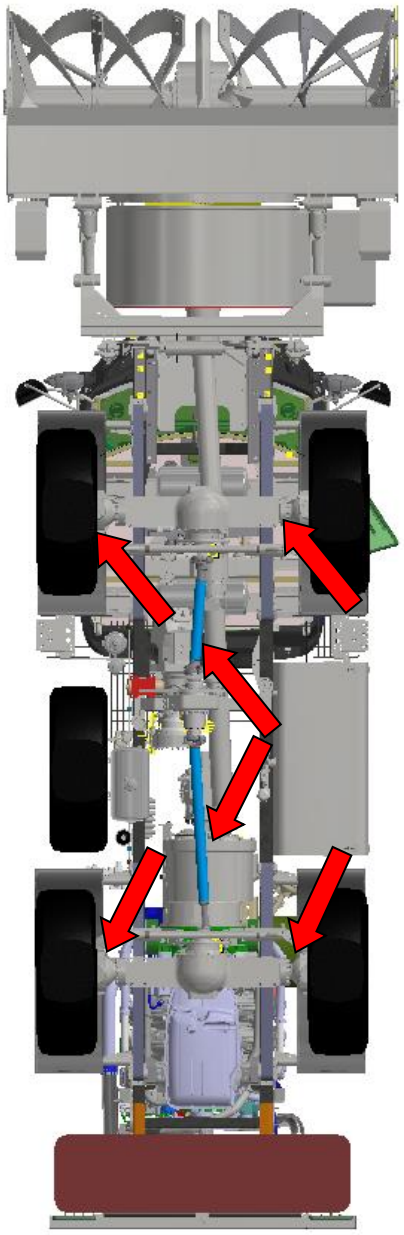
Vehicle type	SNOWBLOWER	Model:	F90

Intervention type:	AXLE ARTICULATIONS, STEERING CYLINDER, SHACKLE BAR AND TRANSMISSION SHAFTS LUBRICATION (ONLY WHERE **NOT PRESENT** AUTOMATIC GREASING SYSTEM)

AXLES

Periodicity:	BEFORE STARTING	Required time	10 minutes

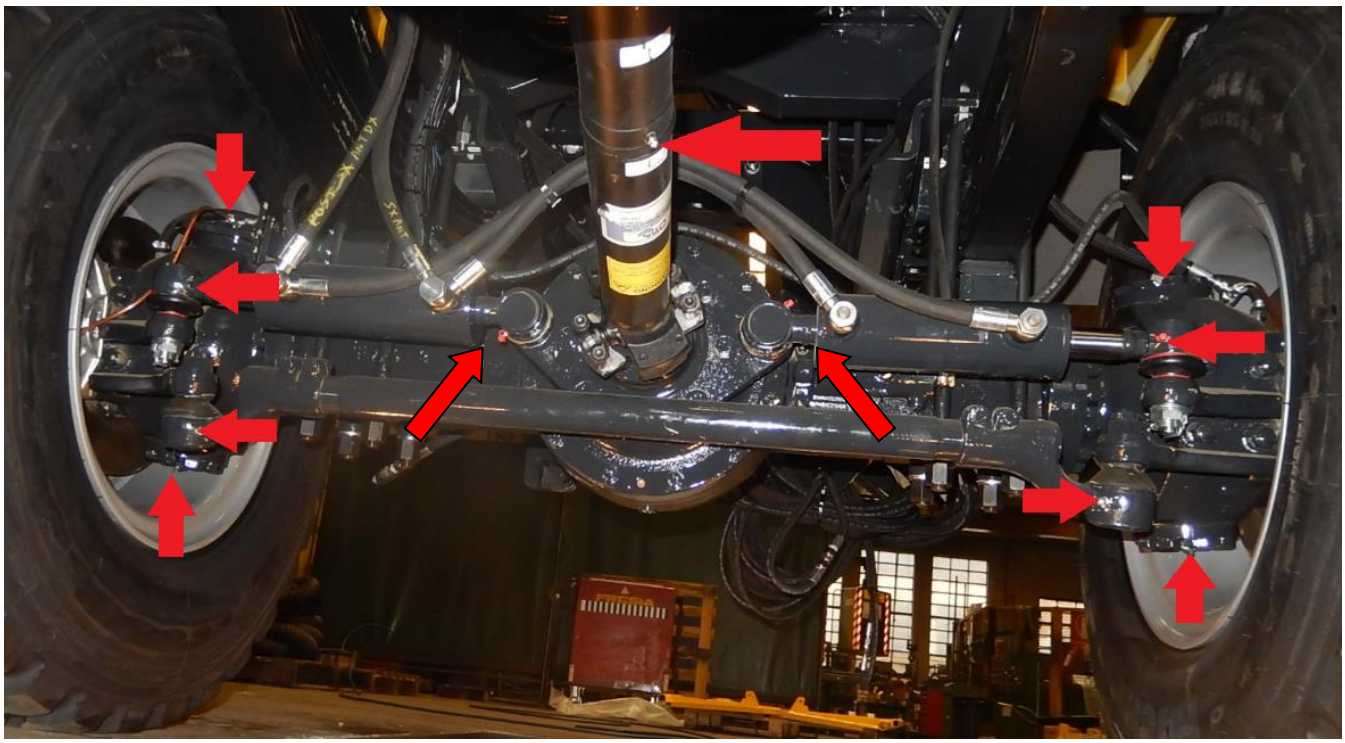
Action points:



Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



NOTE:

Inject grease into the grease fittings on steering cylinders (n.2 for each cylinder) and coupling bar (n.2 for each coupling bar) and in steering articulation (nr.4 grease fittings each axle) and transmission shafts (n.1 for each shaft).

Technomatic	Maintenance sheet	Sheet n° C_04
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	

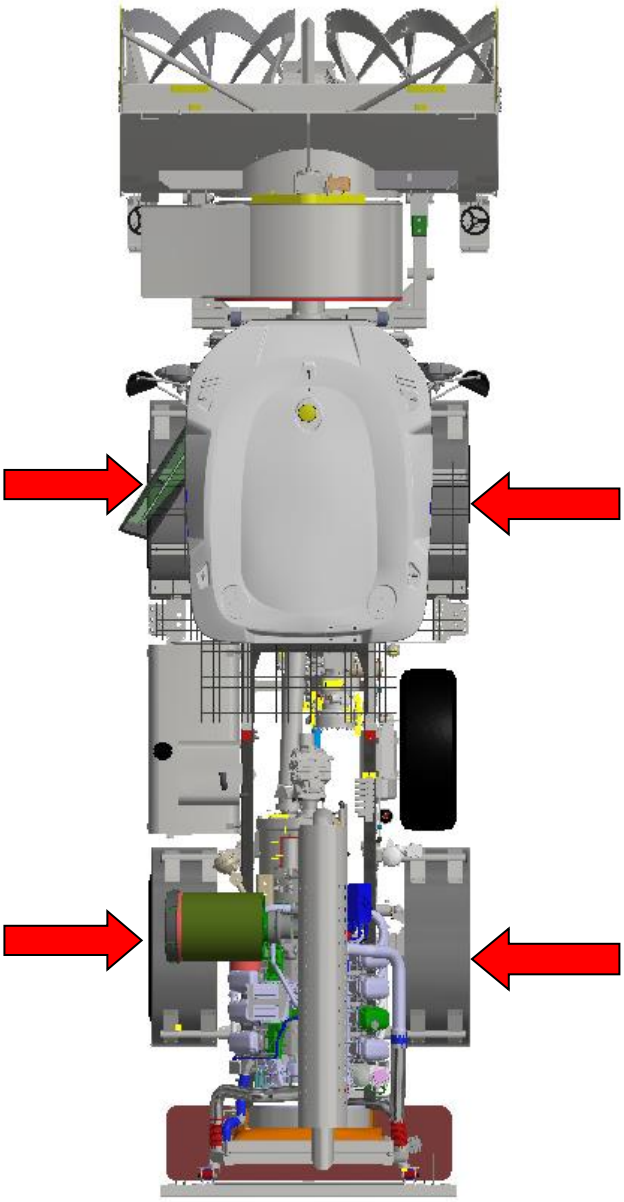
Vehcile type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: HUBS OIL REPLACEMENT

AXLES

Periodicity:	BEFORE STARTING THE WORK SEASON	**Required time:**	60 minutes

Action points:



Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.
- Seals for plugs (1) and (2) code **R0082099**

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

NOTE:
It is suggested to do the operation with warm oil to make its flowing out easier.

a) Move the vehicle to have the hub in position like in picture.

b) Put a container under hub.

c) Unscrew plugs (1) and (2) and let all the oil flowing out.

d) Screw back the plug (2) (replace plug (2) gasket).

e) Fill the hub with new oil through the opening (1) till it reaches “OIL LEVEL”(3). The filling should be done slowly to allow the oil to penetrate into the gears.

f) Screw back the plug (1) (replace (1) gasket).

WARNING:
Use only TUTELA W90/M-DA oil or equivalent.

WARNING:
Do not overfill!

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	C_05

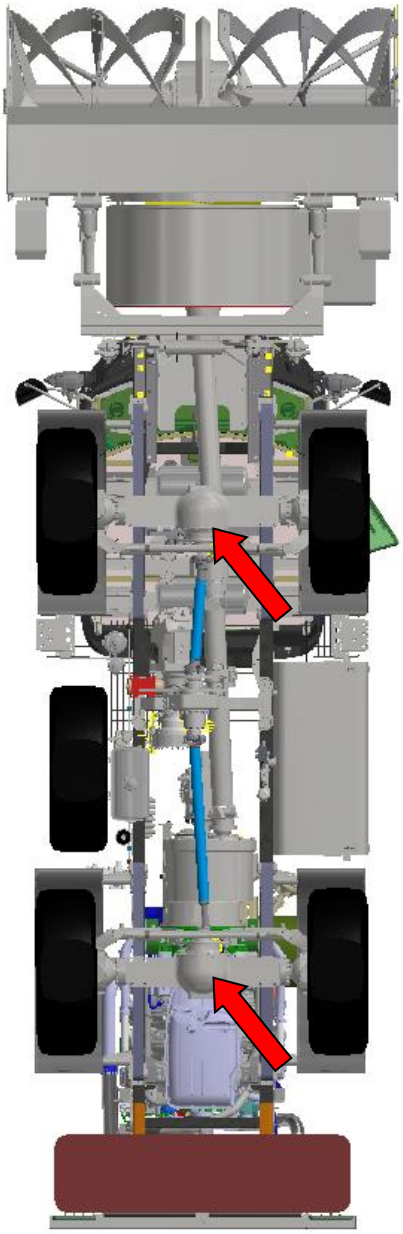
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: DIFFERENTIAL OIL REPLACEMENT

AXLES

Periodicity:	BEFORE STARTING THE WORK SEASON	Time required:	60 minutes

Action points:



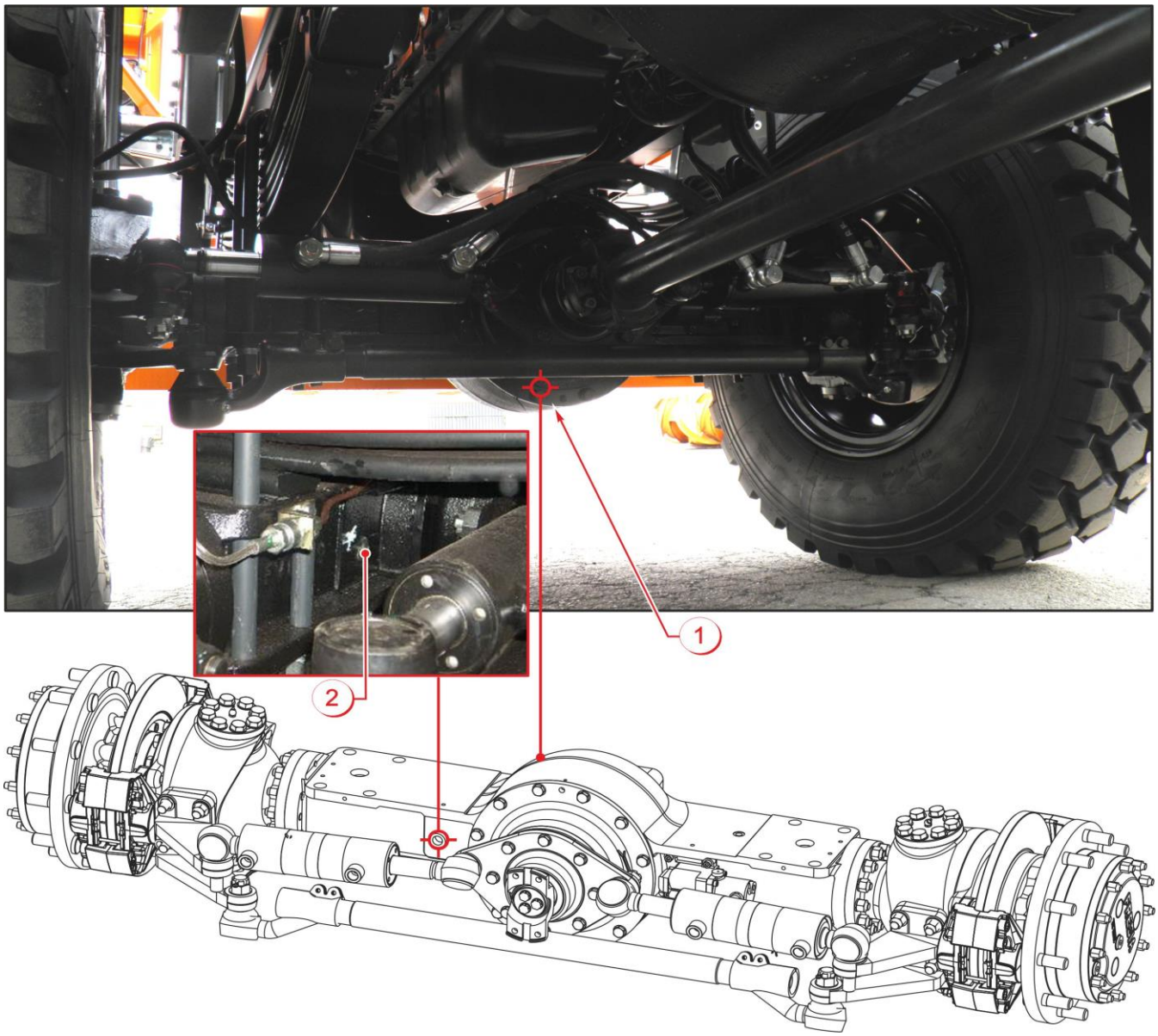
Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.
- Plug gaskets (1) and (2) code **R0082099**

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Move the vehicle over an inspection pit.

b) Put a container under the differential.

c) Unscrew the plug (1) and let the oil flows out.

d) Screw back the plug (1) (replace the gasket (1)).

e) Fill new oil through the opening (2) until it reaches the lower part of the opening (replace gasket (2));

f) Screw back plug (2).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	C_06

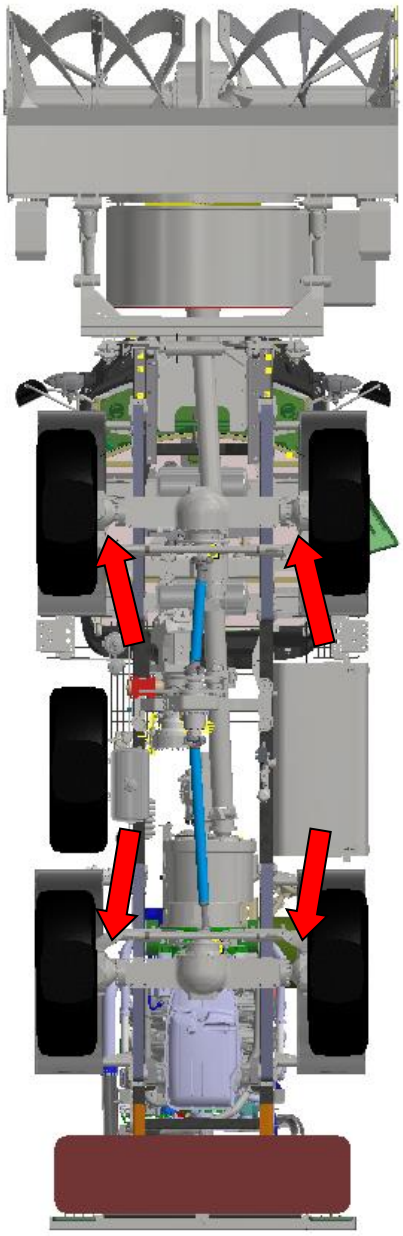
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: CHECK THE STEERING HEADS AND SHACKLE BAR HEADS CLEARANCE

AXLES

Periodicity:	BEFORE STARTING THE WORK SEASON	Required time:	20 minutes

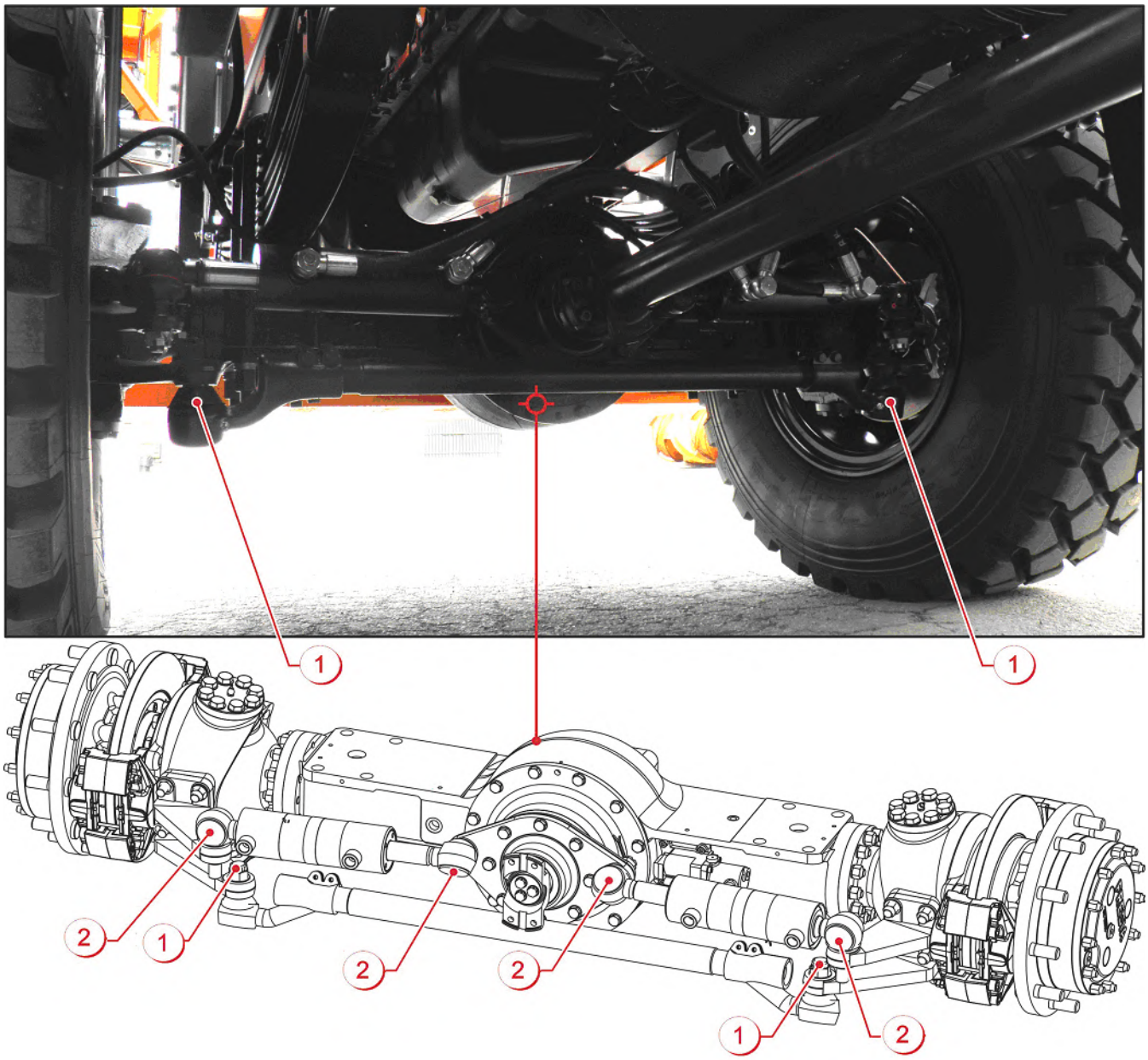
Action points:



Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Check the coupling bar heads (1), and the heads of steering cylinders (2) have no gaps.

b) If it is necessary, replace them.

Technomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ■ LUBRICATION ☐ INSPECTION	Sheet n° D_01

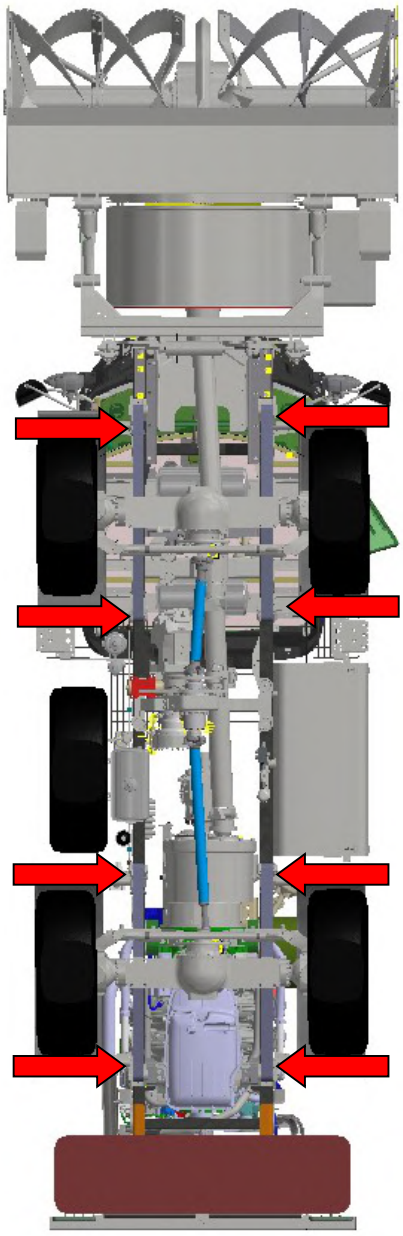
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: SUSPENSIONS LUBRICATION
(ONLY FOR VEHICLE **NOT PROVIDED** OF AUTOMATIC GREASING SYSTEM)

SUSPENSIONS

Periodicity:	BEFORE STARTING	Required time:	15 minutes

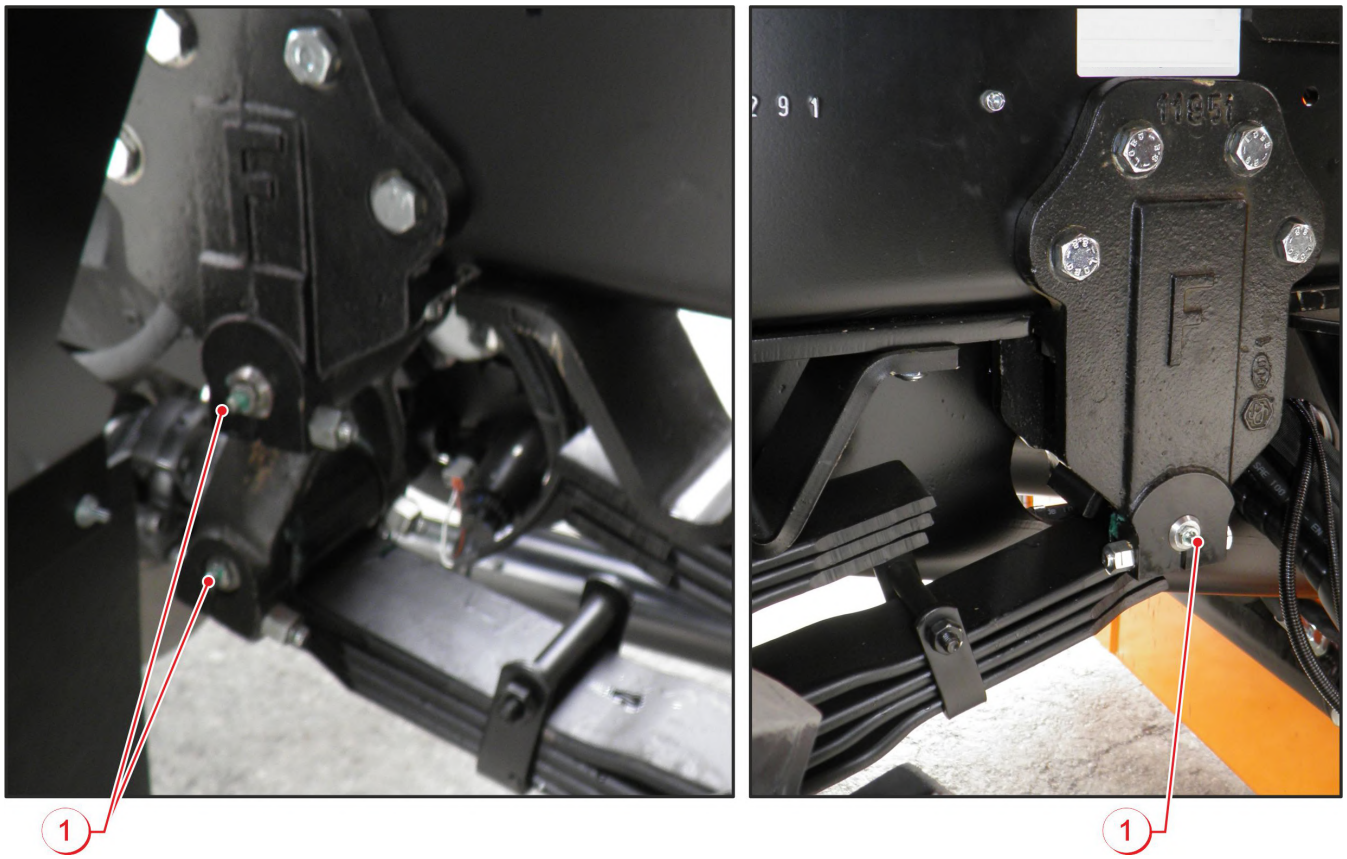
Action points:



Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



NOTE:
Inject grease into the fittings (1) of the leaf springs (nr. 3 each leaf spring –nr. 12 in total).

Technomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	Sheet n° D_02

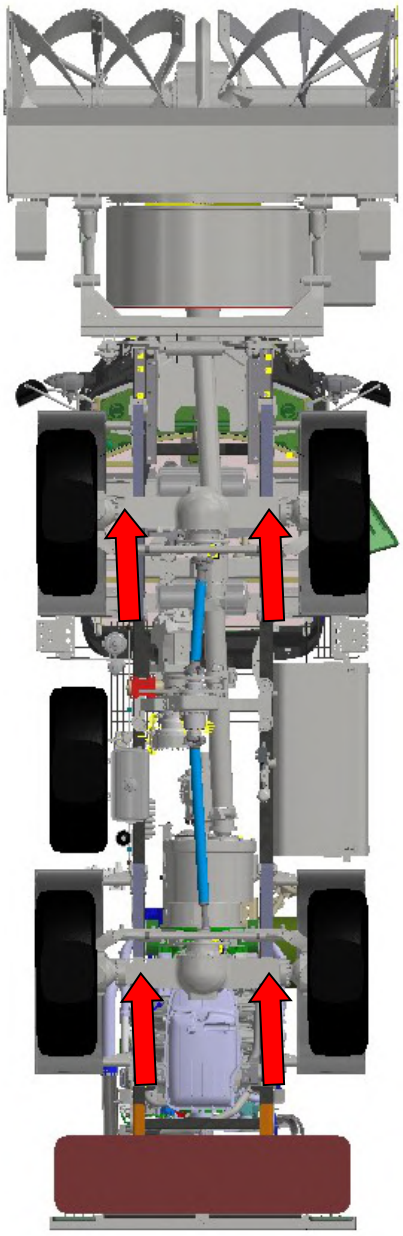
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: CHECK THE TOQUE OF NUTS CONNECTING AXLES TO THE LEAF SPRINGS

SUSPENSIONS

Periodicity:	BEFORE STARTING THE WORK SEASON	Required time:	20 minutes

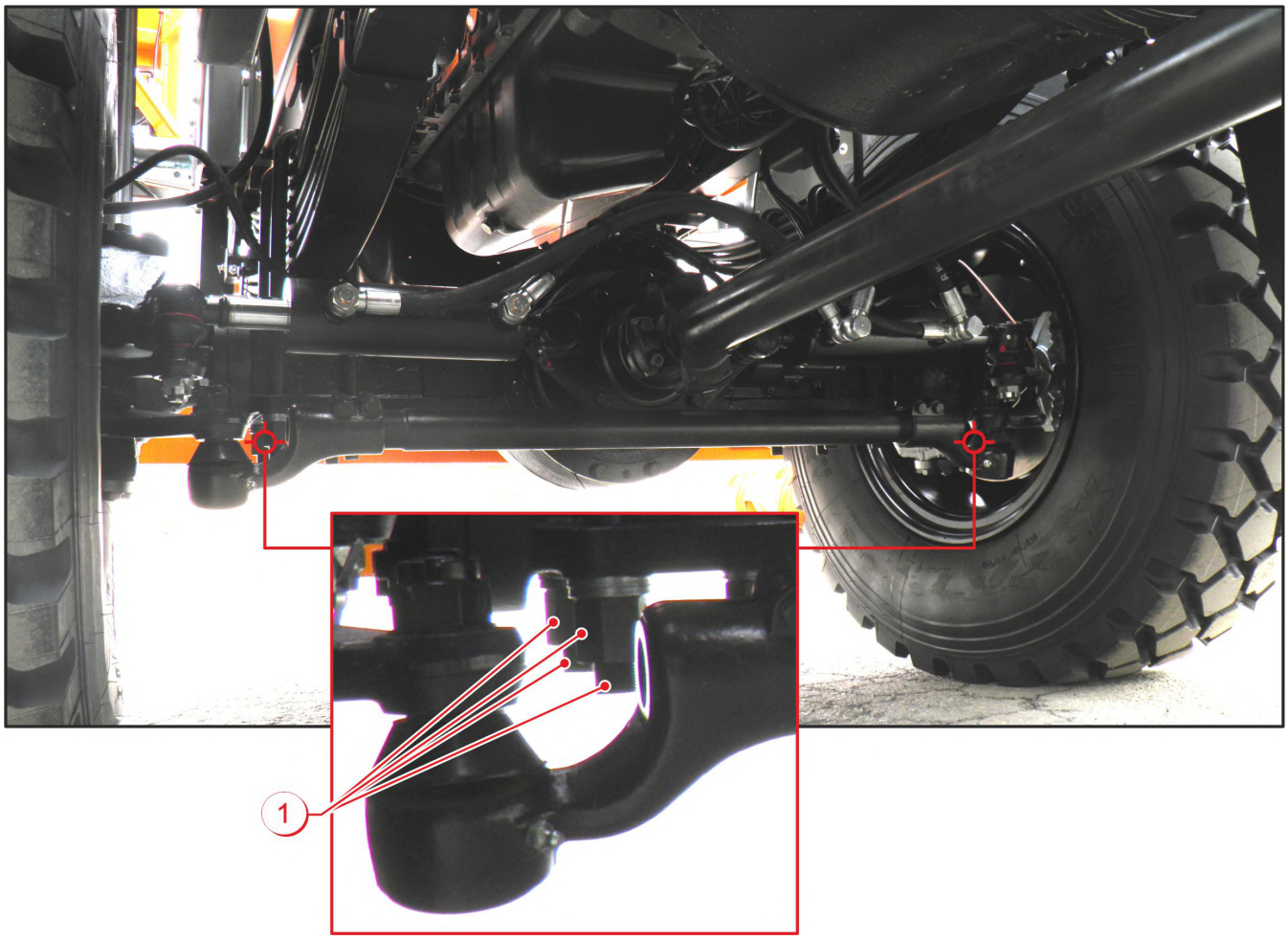
Action points:



Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



Check the torque of nut for connection of the axle to the leaf spring (1) (nr. 8 nut each axle).

Recommended torque: **500 Nm**

Technomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	Sheet n° E_01

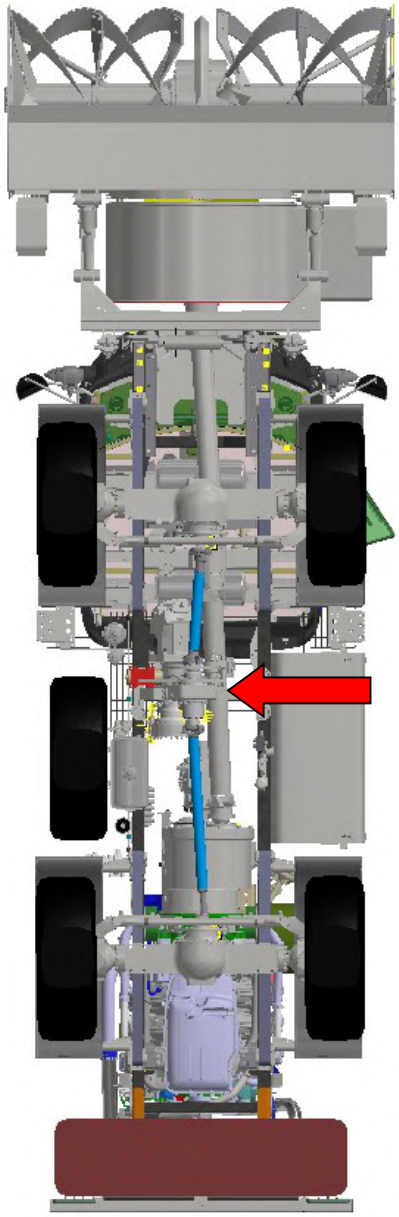
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: TRANSFER REDUCER OIL LEVEL CHECK

TRANSFER REDUCER

Periodicity:	EVERY 50 HOURS	Required time	10 minutes

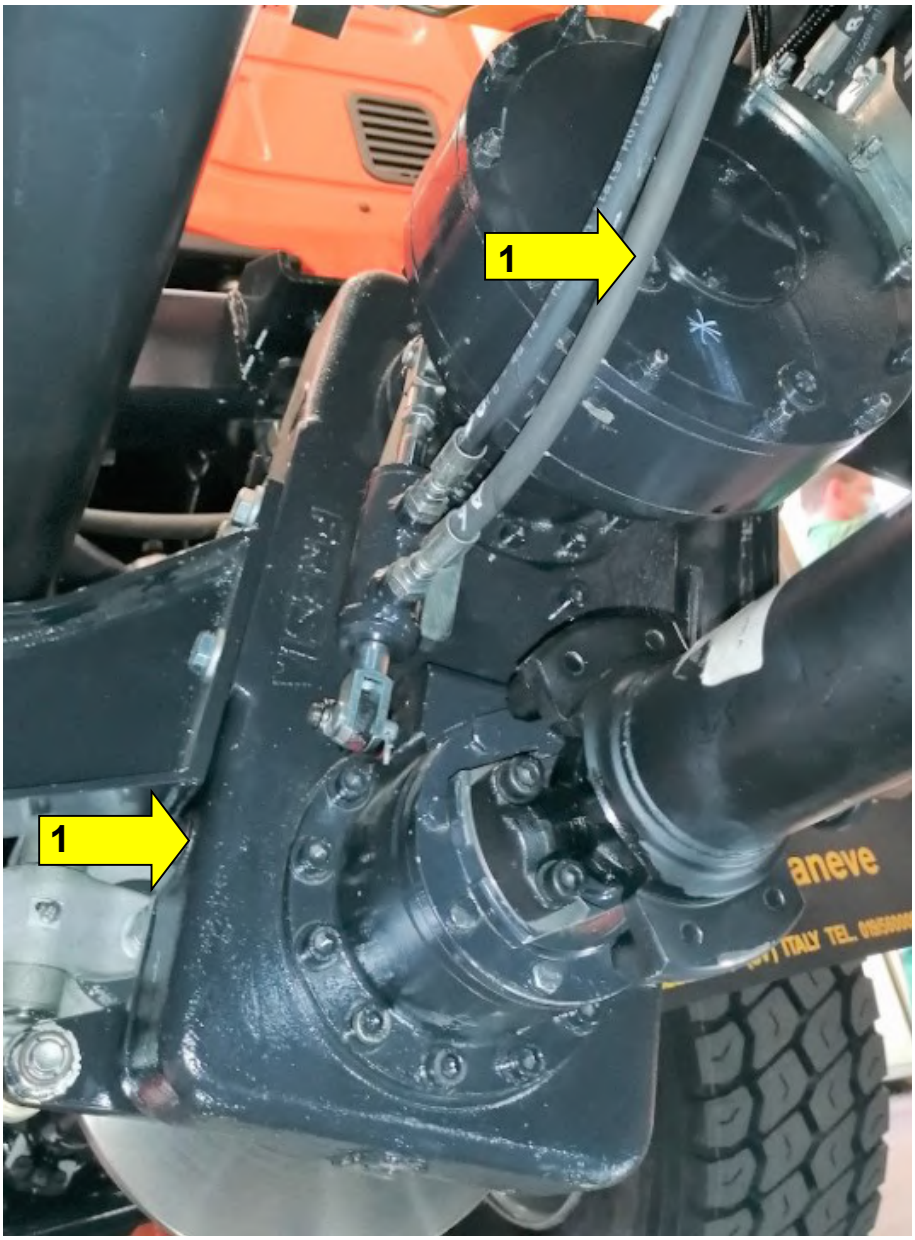
Action points:



Requested spare parts:	Specific tools:
• Oil type **TUTELA W90/M-DA** or equivalent.	

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Move the vehicle over an inspection pit.

b) Unscrew the plugs (1) and check that the oil reaches the low parts of the openings.

c) If it is necessary, refill through the opening.

d) Screw back the plugs (1).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	E_02

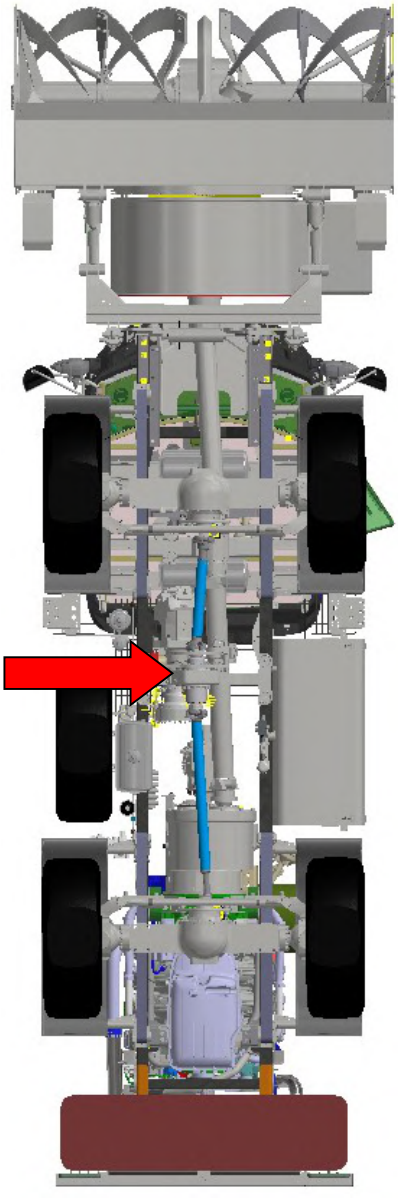
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: TRANSFER REDUCER OIL REPLACEMENT

TRANSFER REDUCER

Periodicity:	BEFORE STARTING THE WORK SEASON	**Required time:**	30 minutes

Action points:



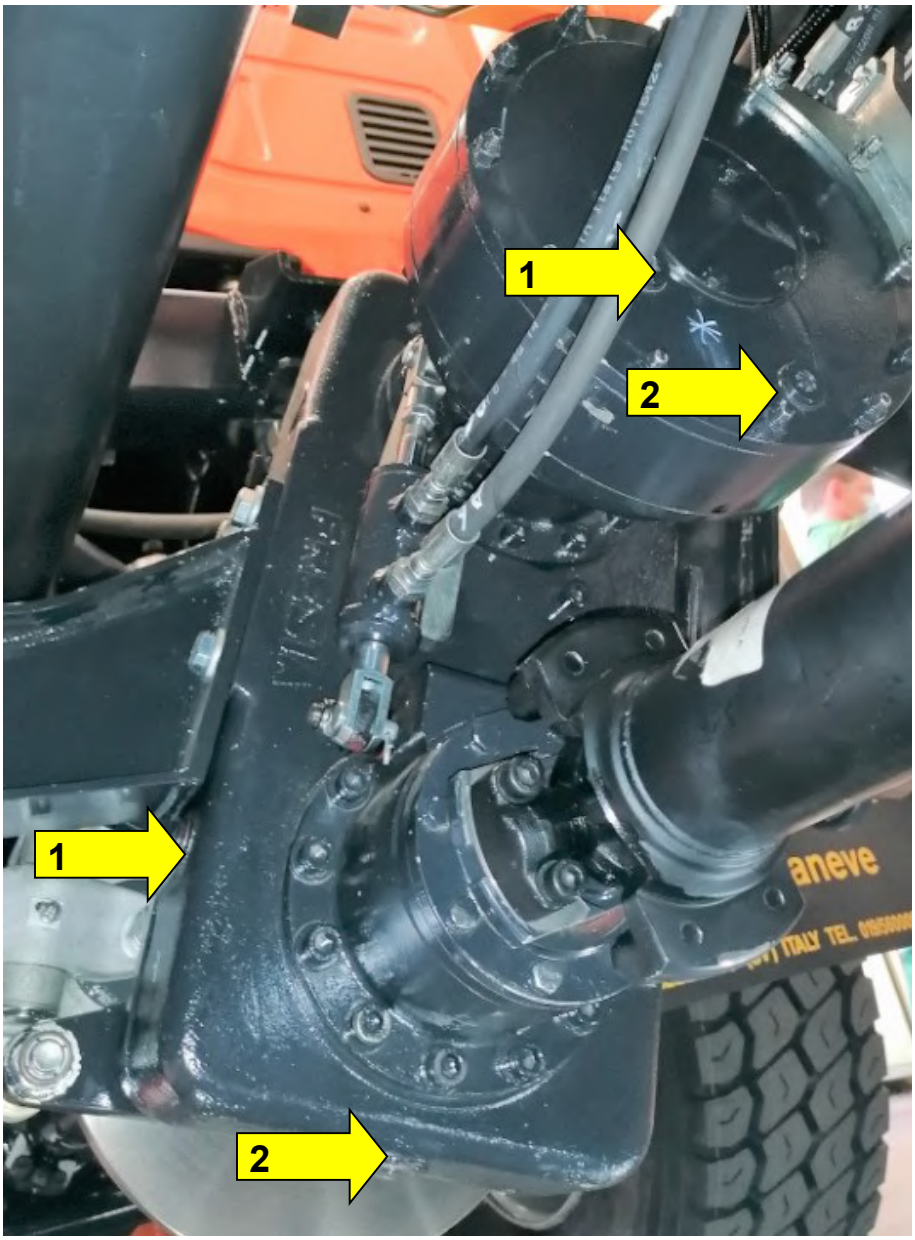
Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent
- Plug washers (2) code **R0082099**
- Plug washers (1) code **R1012552**

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Move the vehicle over an inspection pit.

b) Put a container under the transfer reducer.

c) Unscrew the plugs (1) and (2) and let the oil draining out.

d) Screw back the plugs (2) (replace their washers).

e) Pour new oil through the openings (1) until it reaches the lower part of the openings.

f) Screw back the plugs (1) (replace their washers).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Techmomatic	Maintenance sheet	Sheet n° F_01

☐ ELECTRIC	☐ MECHANIC	☐ FLUIDIC
☐ CLEANING	☐ LUBRICATION	■ INSPECTION

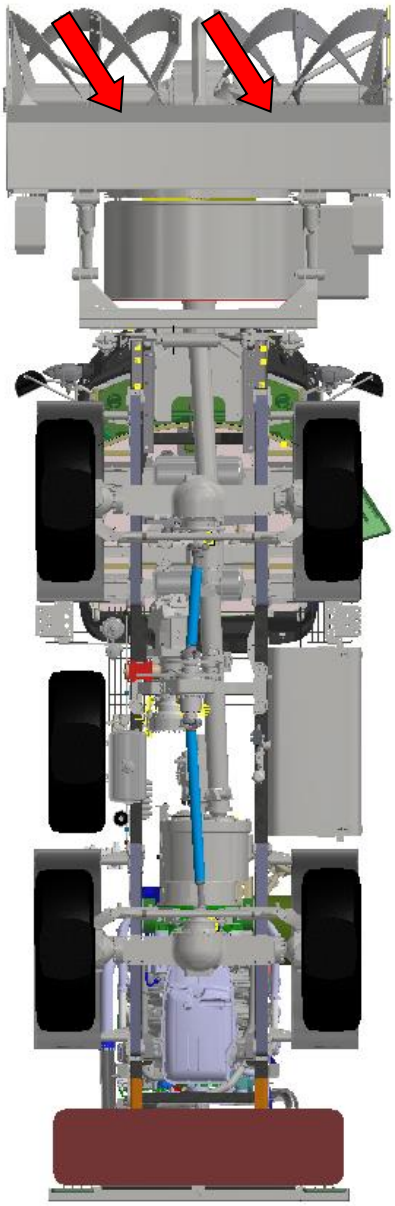
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: BLOWER HEAD BLADE WEARING CHECK

BLOWER HEAD

Periodicity:	BEFORE STARTING	**Required time**	5 minutes

Action points:



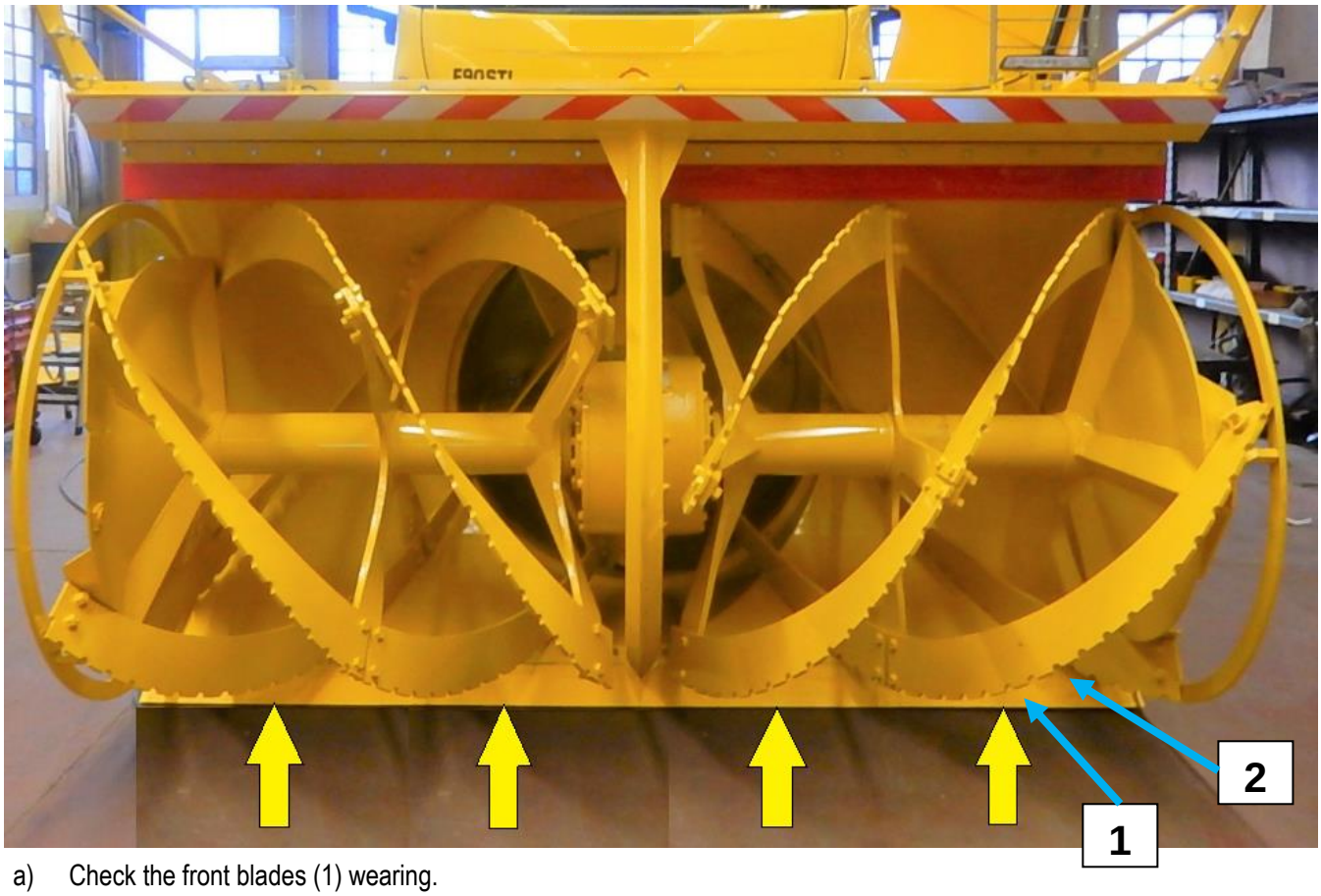
Requested spare parts:

- ✓ Front iron blade code: **00011673**
- ✓ Screw (nr. 18): **V0011674**

Specific tools:

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.



a) Check the front blades (1) wearing.

IF IT IS NECESSARY, REPLACE IT:

b) Lift up the blower head.

c) Shut down the engine and extract the key.

d) Insert the blower head safety bars (see the procedure for blower head safety bars installation on chapter 4).

e) Unscrew the screws (2) and remove the worn front blades (1);

f) Install the new blades and fix it with the screws (2).

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	F_02

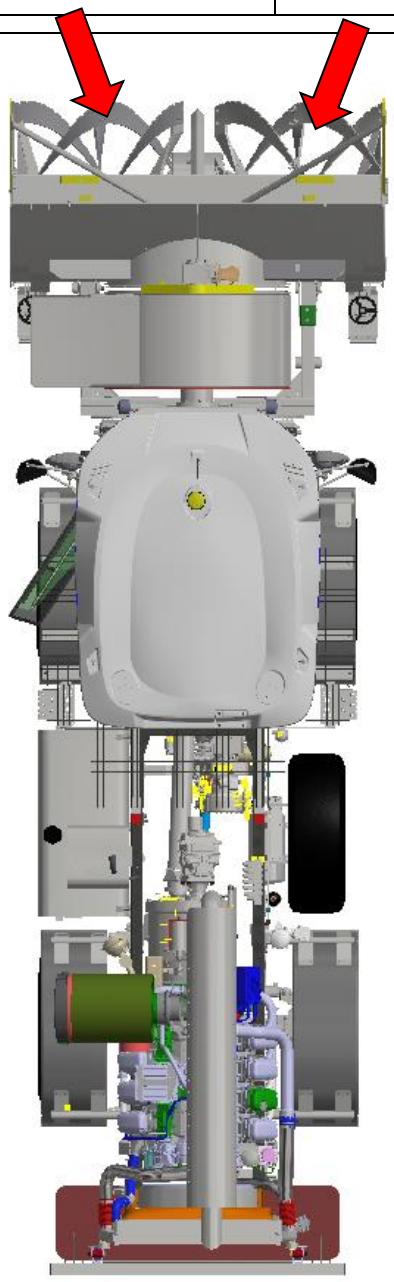
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: RIBBON AUGERS HELICAL CUTTERS WEARING CHECK

BLOWER HEAD

Periodicity:	BEFORE STARTING	Required time:	5 minutes

Action points:



Requested spare parts:

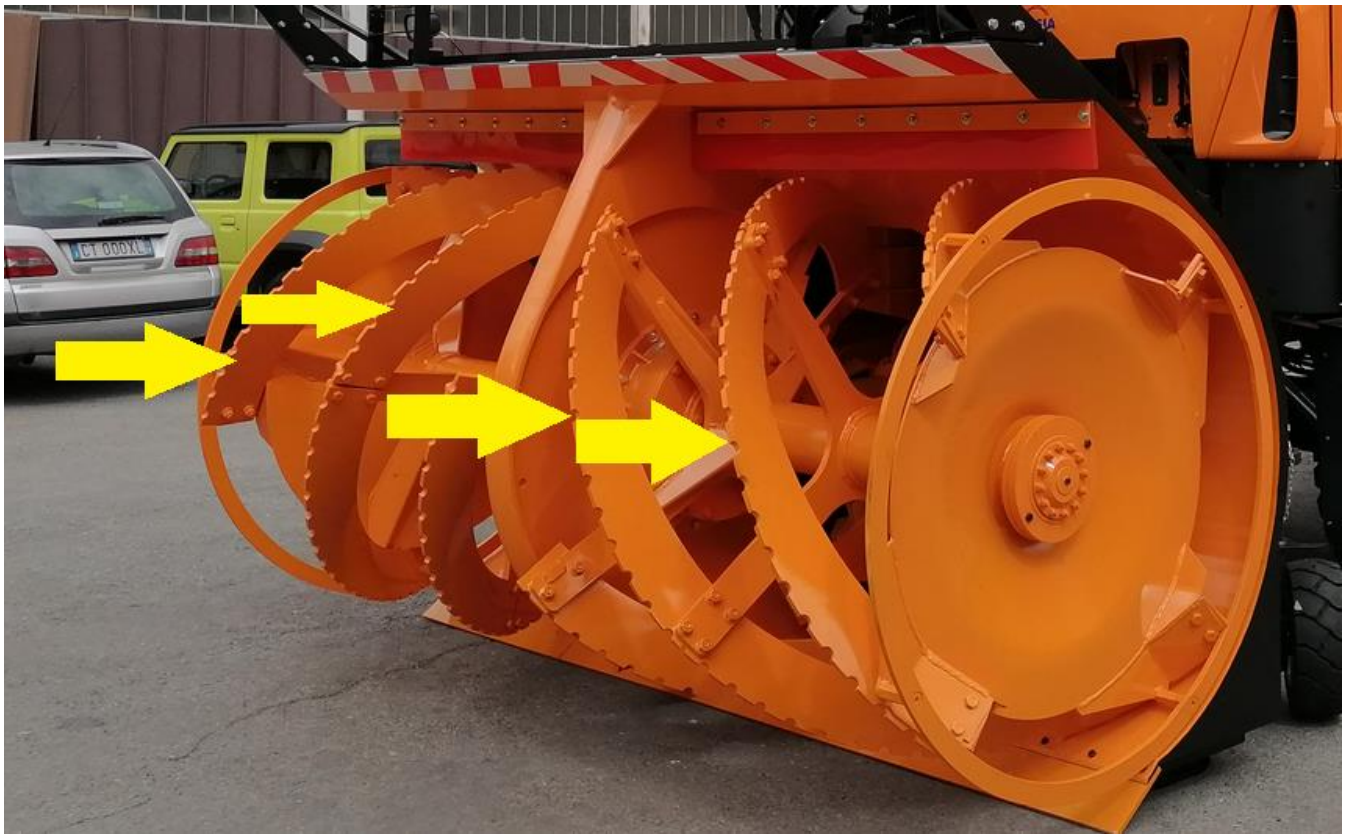
- Nr. 4 Right external cutter code **00095214**
- ✓ Nr. 4 Right internal cutter code **00095217**
- Nr. 4 Left external cutter code **00095214**
- Nr. 4 Left internal cutter code **00095217**

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

a) Check the wearing of the helical cutters (1) of the blower head.



IF IT IS NECESSARY, REPLACE THEM:

b) Move the vehicle on a flat area, shut down the engine and extract the key.

c) Remove the shear bolts in both sides (see the procedure for shear bolts replacement on chapter 4), it allows the rollers to freely rotate.

d) Screw and remove the helical cutters.

e) Fix the new cutters with the screws and after having replaced them.

WARNING:
Replace also the nuts of the screws.

Table 1

PART NUMBER	DESCRIZIONE	Q.TÀ	Torque
V00.5190	Screw 16x2x55	24x2	205 Nm
V00.6067	Screw 16x2x40 8G	8x2	
R00.5676	Washer D.16x34 SP.3,5 ZN	32x2	
D00.1118	Nut 16x2x16	32x2	

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	F_03

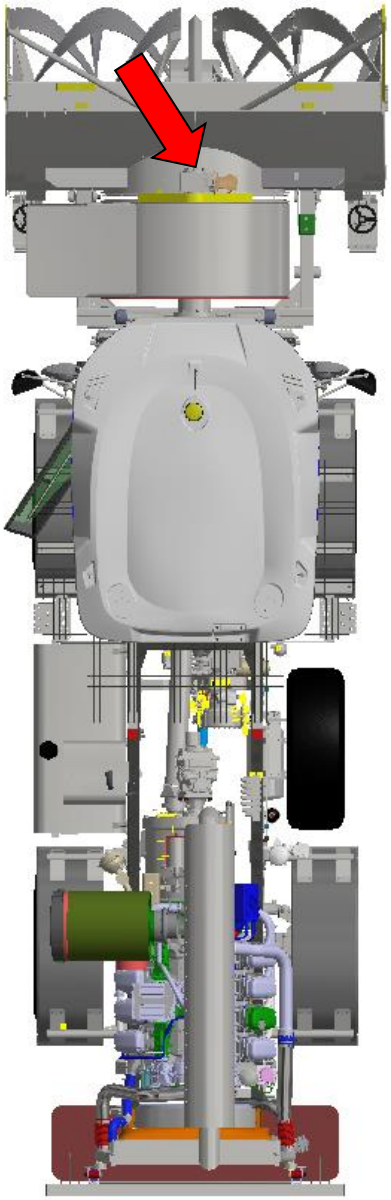
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention: SECOND STAGE PADDLES WEARING CHECK

BLOWER HEAD

Periodicity:	BEFORE STARTING	**Required time:**	5 minutes

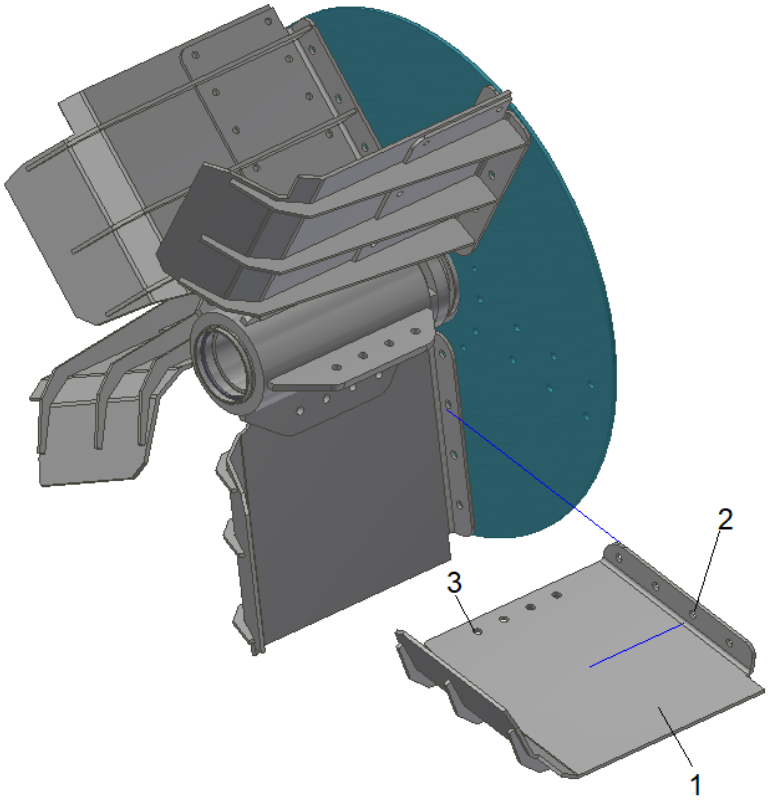
Action points:



Requested spare parts:	**Specific tools:**
• Paddles code (nr. 5): **00107003**	

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Check the paddles wearing of the second stage.

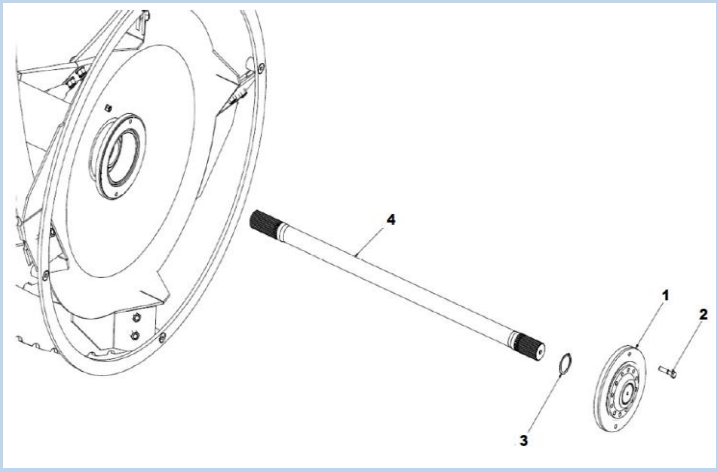
IF IT IS NECESSARY, REPLACE THE IMPELLER BLADES:

NOTE: For the following operation, it is necessary to disconnect the blower head from the vehicle and remove one of the front auger ribbons (see the below procedures)

OPERATE ON A FLAT AREA

PROCEDURE TO REMOVE AND REINSTALL THE AUGER RIBBON (same procedure Right/Left):

- Unscrew the shear bolts (2) and disconnect the flange (1).
- Slide out the half-shaft (4).
- Unscrew the ring nut (5), using the proper tool, then the safety washer (6) and the washer (7)
- Slide out the auger ribbon.



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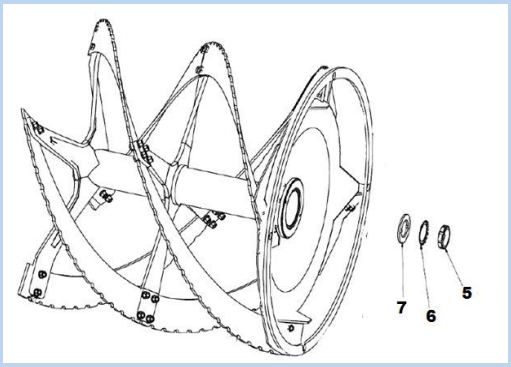
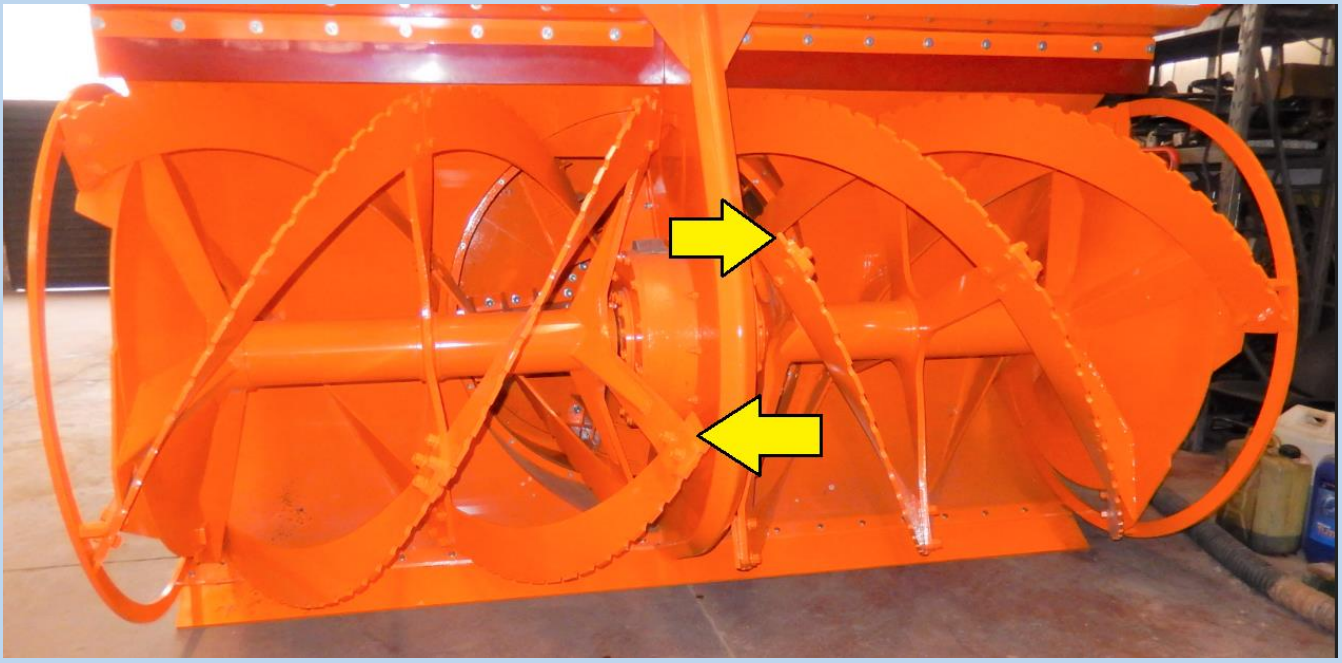
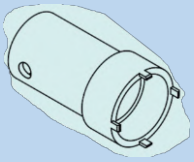


IMPORTANT!: reinstall the ribbon augers in a staggered arrangement as shown in the picture below. This avoids that foreign objects getting stuck between the augers, which may cause damage.

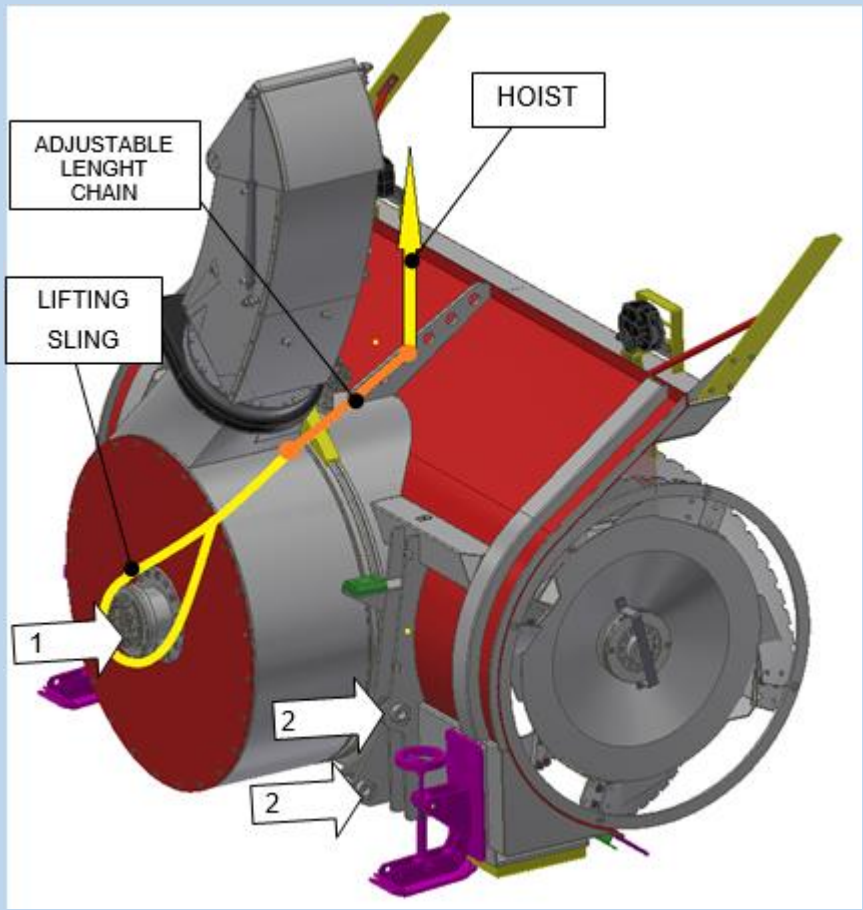


- Reinstall, following the procedure in reverse order.

NOTE: Screw back the ring nut until it becomes stiff and slightly release to be able to fix it with the safety washer.

Specific tools: Special tool for ring nut of the auger ribbons  **cod. 00110102**

PROCEDURE TO DISCONNECT / RECONNECT THE BLOWER HEAD FROM VEHICLE

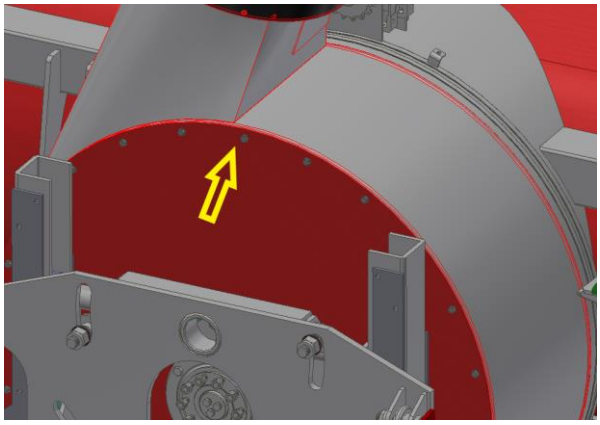


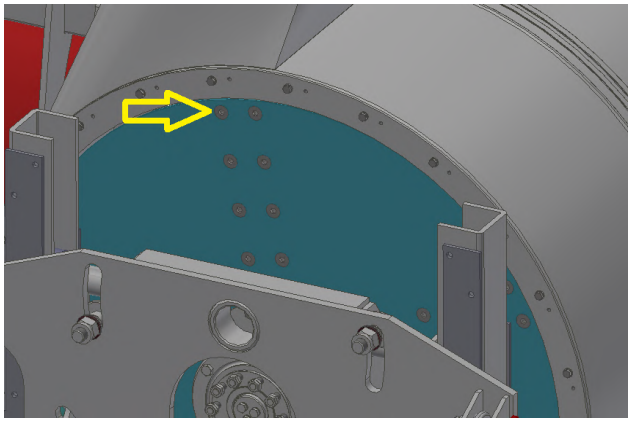
- Park the vehicle on a flat area, the blower head must be on ground.
- Disconnect the transmission shaft from the vehicle to blower head (1) and place a lifting sling around the impeller transmission shaft.
- Lift the blower head with a proper hoist so that it remains upright.

  IMPORTANT! To maintain the blower head upright, it is recommended to use a lifting sling around the impeller transmission shaft (1) connected to the hoist with an adjustable length chain. Adjust the length of the chain so that when lifting with the hoist the blower head will not tilt and remain horizontal.
- Remove the pins (2) to disconnect the trestle and tie rods.
- Move the blower head away from the vehicle using the hoist.

  WARNING: Be careful to avoid overturning blower head using a proper hoist and slings.
- To reconnect, carefully place the blower head in position next to vehicle using the hoist.
- Insert the trestle pins.
- Reconnect the transmission shaft.

b) Remove impeller housing cover unscrewing the bolts to access the impeller blades.





c) Sustain the impeller assembly to avoid its rotation as it may be unbalanced once the bolts are removed.

DANGER:
Be aware that the rotation of the impeller blades can cause serious injuries.

d) Unscrew the bolts of the damaged blade and slide it out from the front of blower head housing (where the auger ribbons have previously been removed.

e) Install the new impeller blade and fix it using new bolts.

f) Reinstall the conveyor cover and the front auger ribbon.

g) Reinstall the blower head on the vehicle.

WARNING:
When replacing an impeller blade always replace all fixing bolts.

PART NUMBERS	DESCRIPTION	Q.TY
V00.7291	Screw 18x1,5x65	10
V00.5663	Screw 18x1,5x60	10
V00.5200	Screw 18x1,5x55	15
V00.6188	Screw 18x2,5x50 10.9	30
D00.6063	Washer	35
D0011732	Nut	30

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	F_04

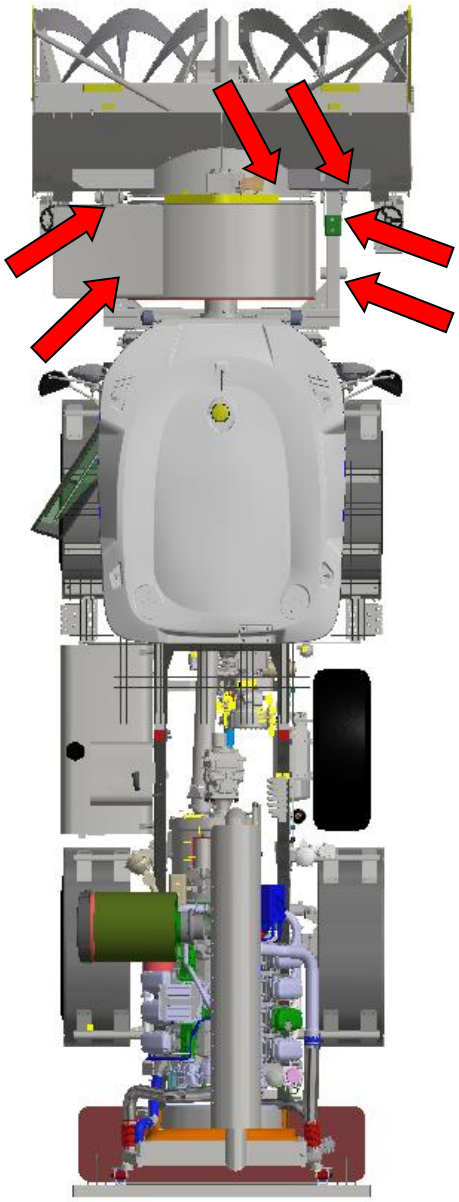
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: BLOWER HEAD LUBRICATION
(ONLY FOR VEHICLE NOT PROVIDED OF AUTOMATIC GREASING SYSTEM)

BLOWER HEAD

Periodicity:	BEFORE STARTING	**Required time:**	15 minutes

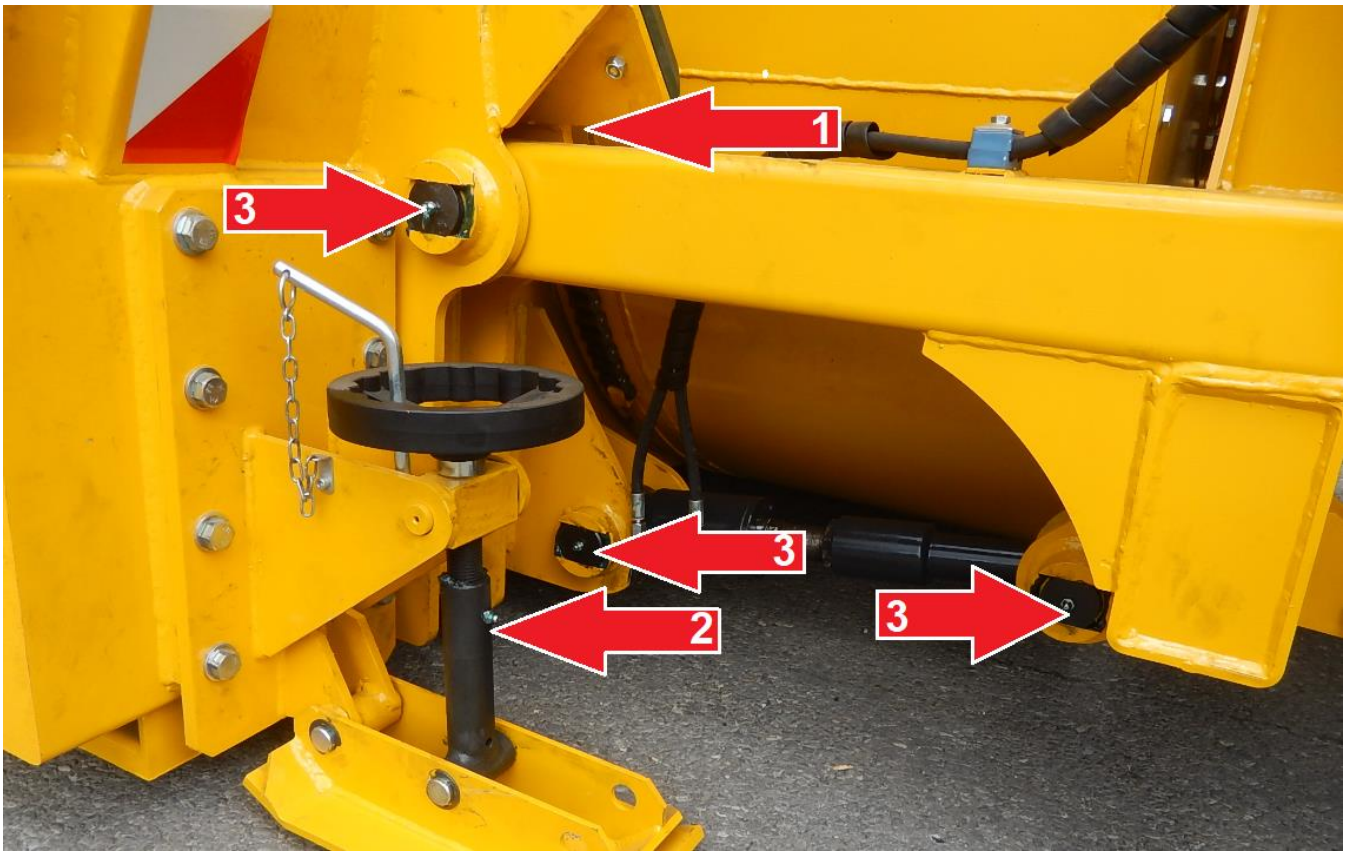
Action points:



Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



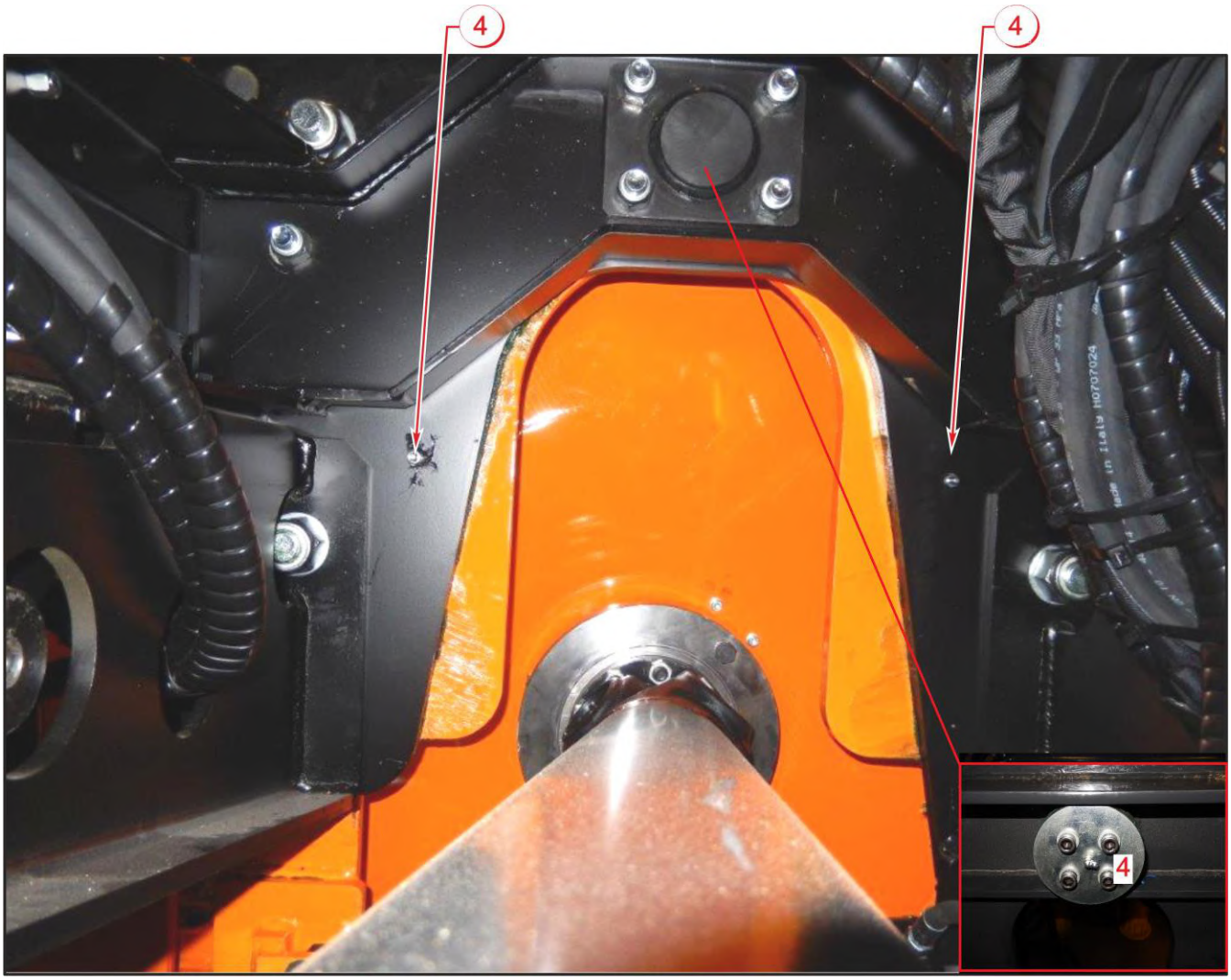
NOTE:

Grease:

- ***the chain (1) for the conveyor rotation.***
- ***the adjustment screws (2) of the castor wheels.***
- ***the pins (3) of the blower head articulation.***

Inject grease into the fittings.

DOCKING PLATE LUBRICATION



NOTE:

Grease the front docking plate (4) injecting grease into the two fittings (4).

Inject grease into the fittings (4).

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	F_05

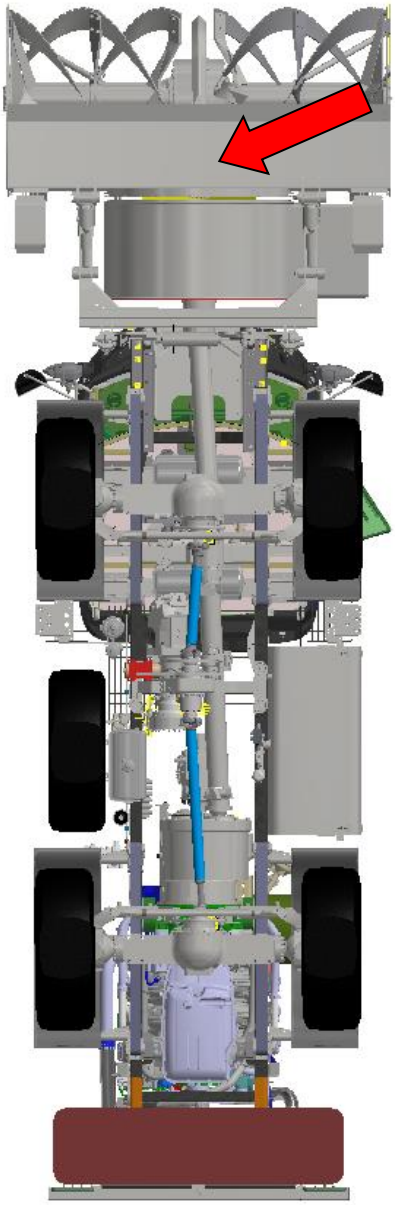
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: FIRST STAGE OIL LEVEL CHECK

BLOWER HEAD

Periodicity:	EVERY 50 HOURS	**Required time**	10 minutes

Action points:



Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

a) Screw the plug (1) and check that the oil level reaches the lower part of the opening.

b) If it is necessary, refill through (1).

c) Screw back the plug (1).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATIONS ■ INSPECTION	F_06

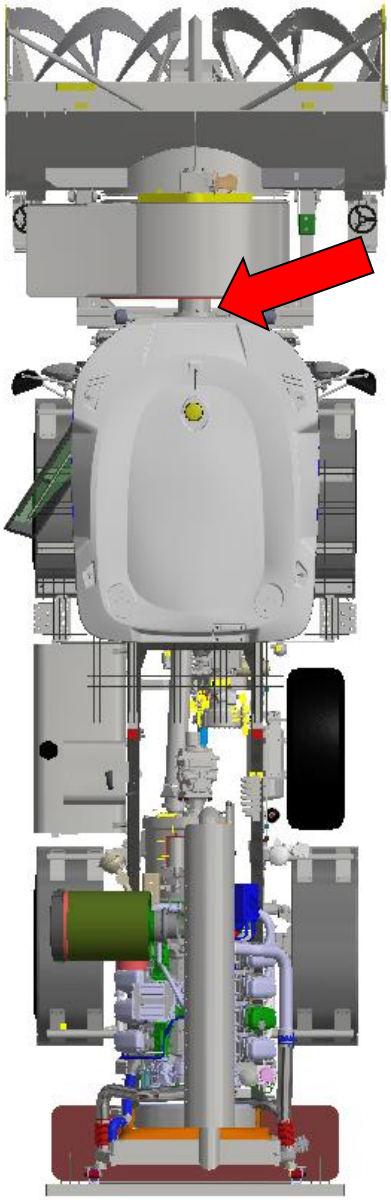
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: SECOND STAGE OIL CHECK

BLOWER HEAD

Periodicity:	EVERY 50 HOURS	Required time:	10 minutes

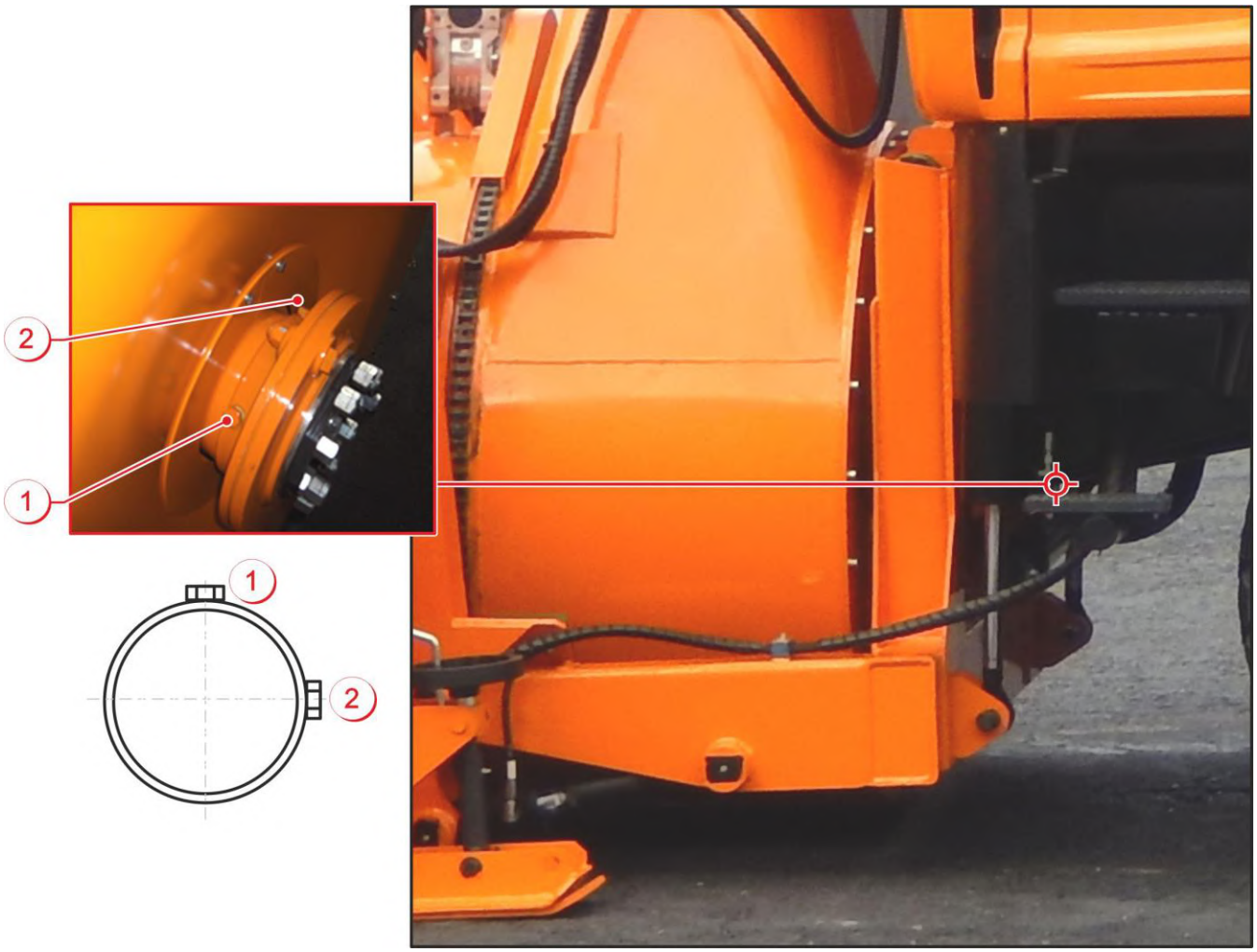
Action points:



Requested spare parts:	Specific tools:
• Oil type **TUTELA W90/M-DA** or equivalent.	

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Rotate plug (1) in upper position.

b) Pour slowly 0,5 litres of oil to allow the air to come out.

c) Remove the plug (2) and check if the oil flows out. If not, screw back the plug (2) and add further 0,5 litres in (2).

d) Screw again the plug (2) and let oil flowing out into the container. This is the correct procedure to have the correct level.

e) Screw back the plug (1)

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	F_07

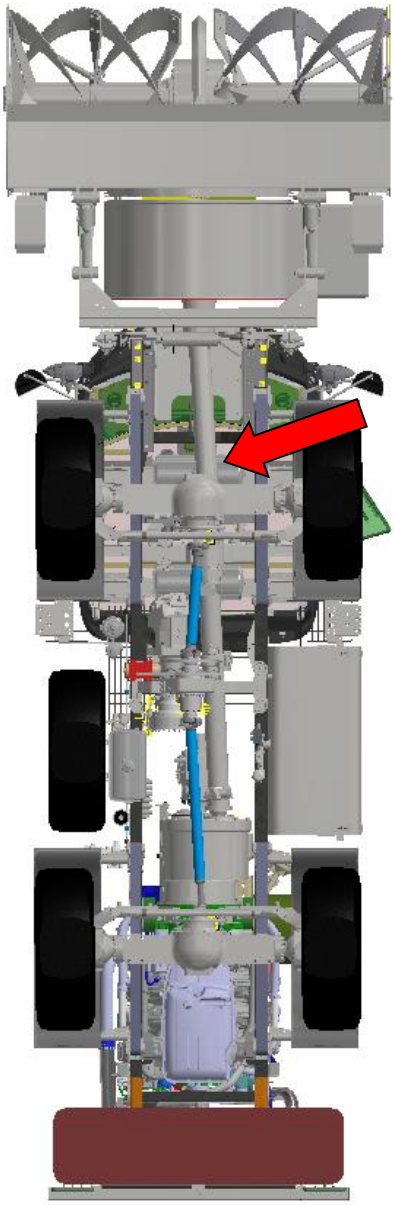
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type TRANSMISSION SUPPORT OIL LEVEL CHECK

BLOWER HEAD

Periodicity	EVERY 50 HOURS	Required time:	15 minutes

Action points



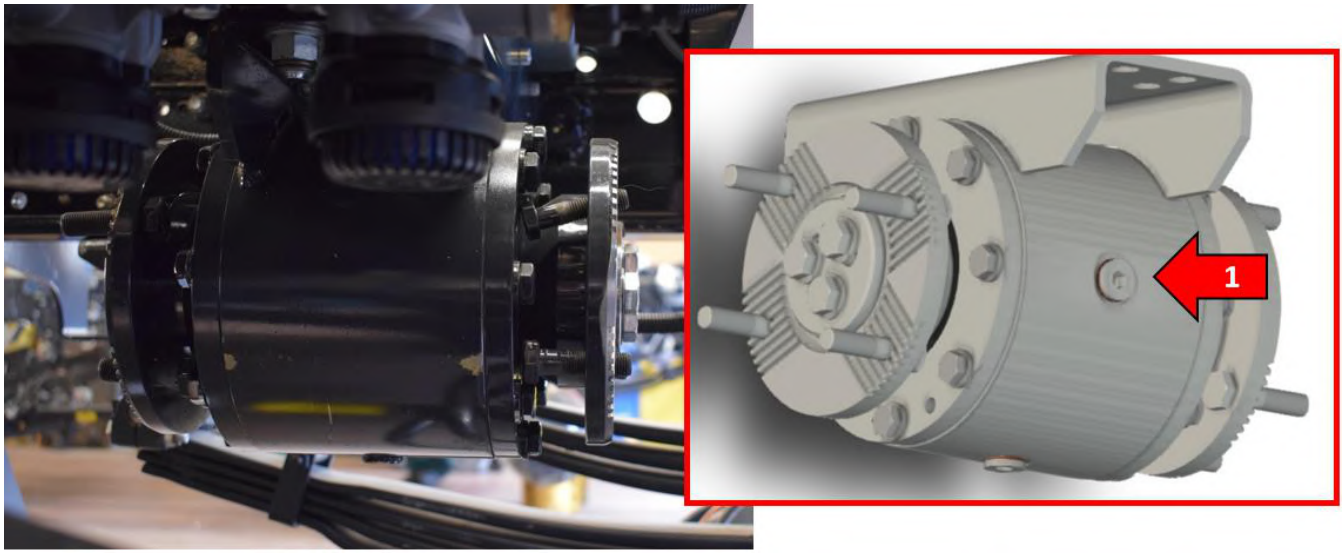
Requested spare parts

- Oil type **TUTELA W90/M-DA** or equivalent.

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Unscrew the lateral plug (1) and check that the oil level reaches the lower part of the opening.

b) If it is necessary, refill through (1).

c) Screw the plug (1).

Technomatic	Maintenance sheet	Sheet
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	F_08

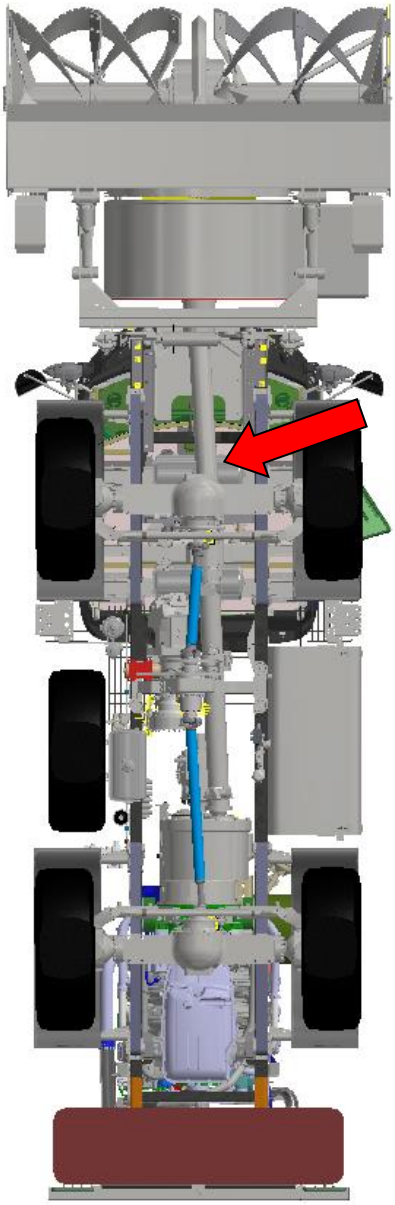
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type BLOWER HEAD TRANSMISSION LUBRICATION

BLOWER HEAD

Periodicity	EVERY 50 HOURS	Required time:	15 minutes

Action points



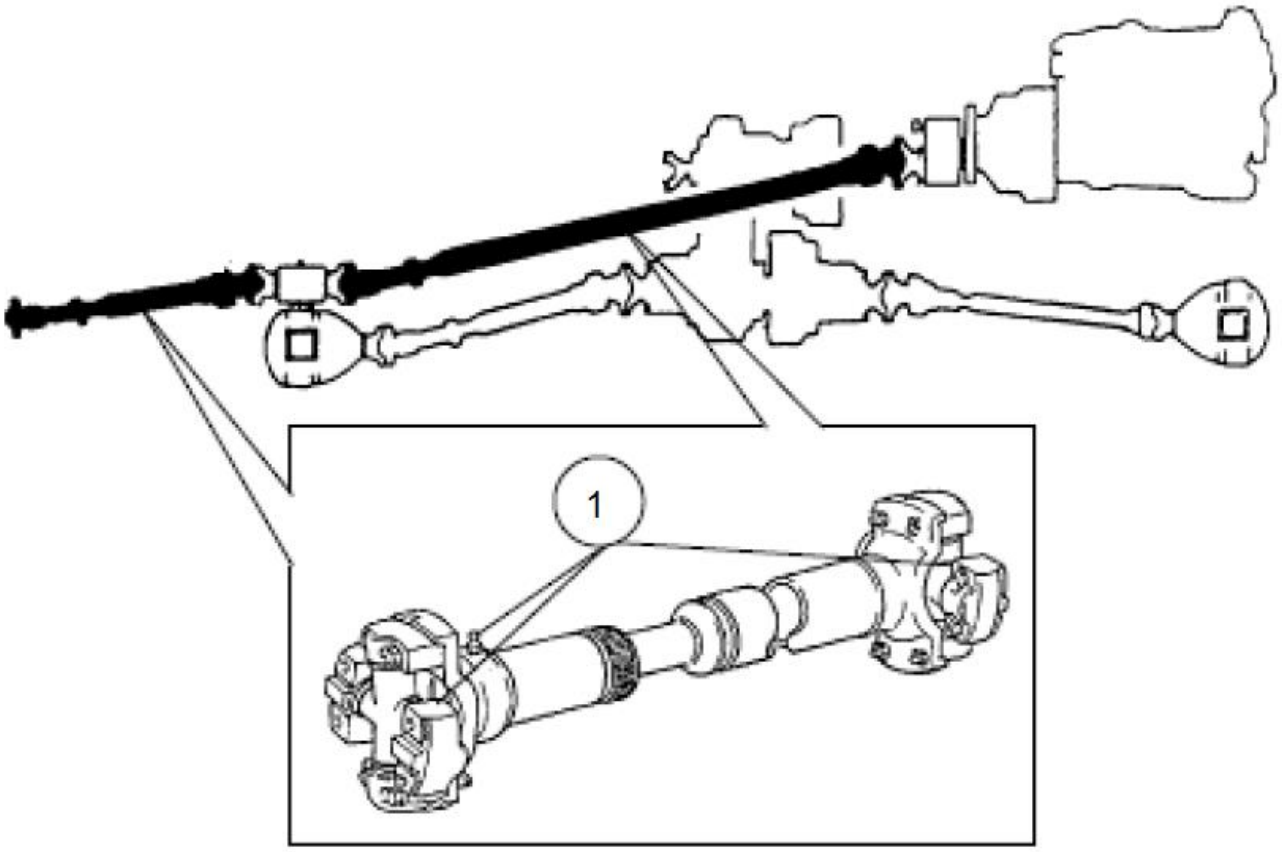
Requested spare parts

- Oil type **TUTELA W90/M-DA** or equivalent.

Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



Inject grease into the fittings (1).

Techmomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	F_09

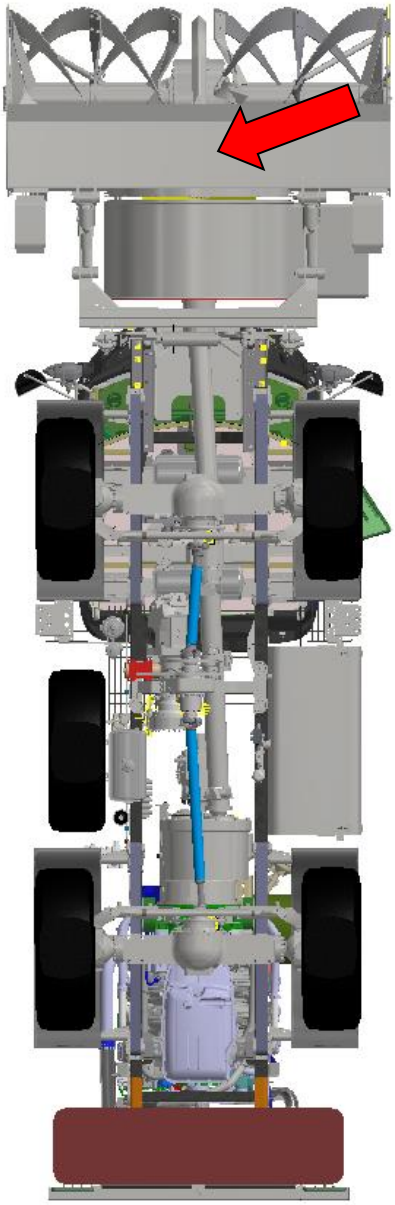
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: FIRST STAGE OIL REPACEMENT

BLOWER HEAD

Periodicity:	BEFORE STARTING THE WORK SEASON	Required time:	20 minuti

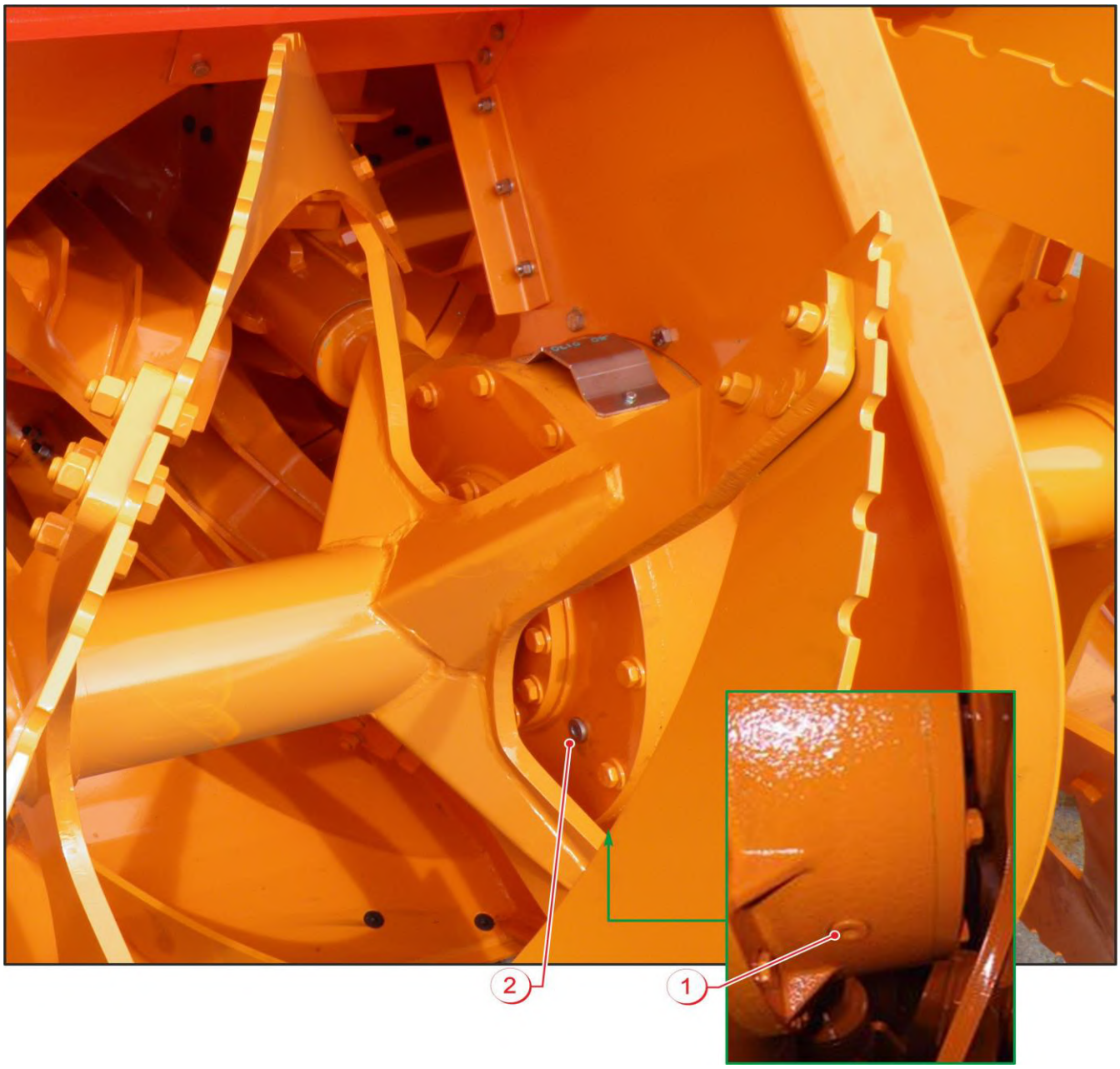
Action points:



Requested spare parts:	Specific tools:
• Oil type **TUTELA W90/M-DA** or equivalent.	

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force



a) Put a container under the plug (1).

b) Screw the plug (1) and (2), let all the oil flowing out.

c) When the oil has completely drained screw back plug (1).

d) Pour the new oil through the opening (2) till it reaches the lower part of the opening.

e) Screw back the plug (2).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	F_10

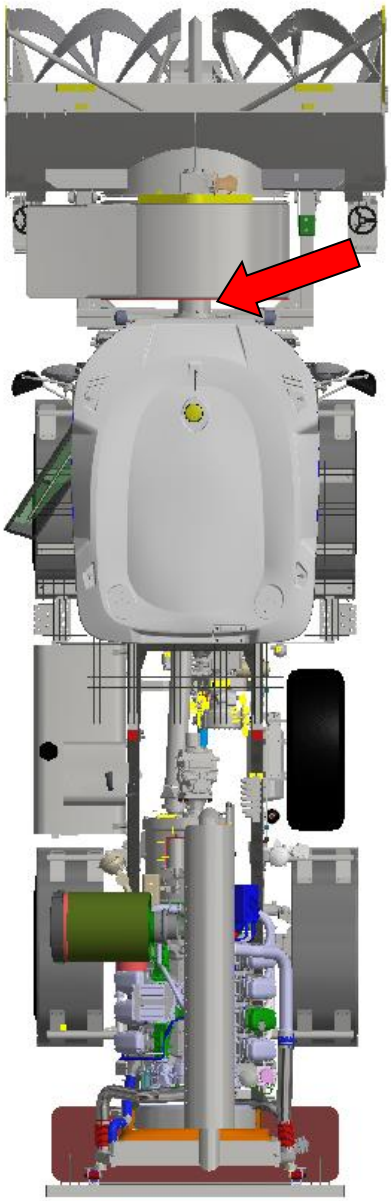
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type	SECOND STAGE OIL REPLACEMENT

BLOWER HEAD

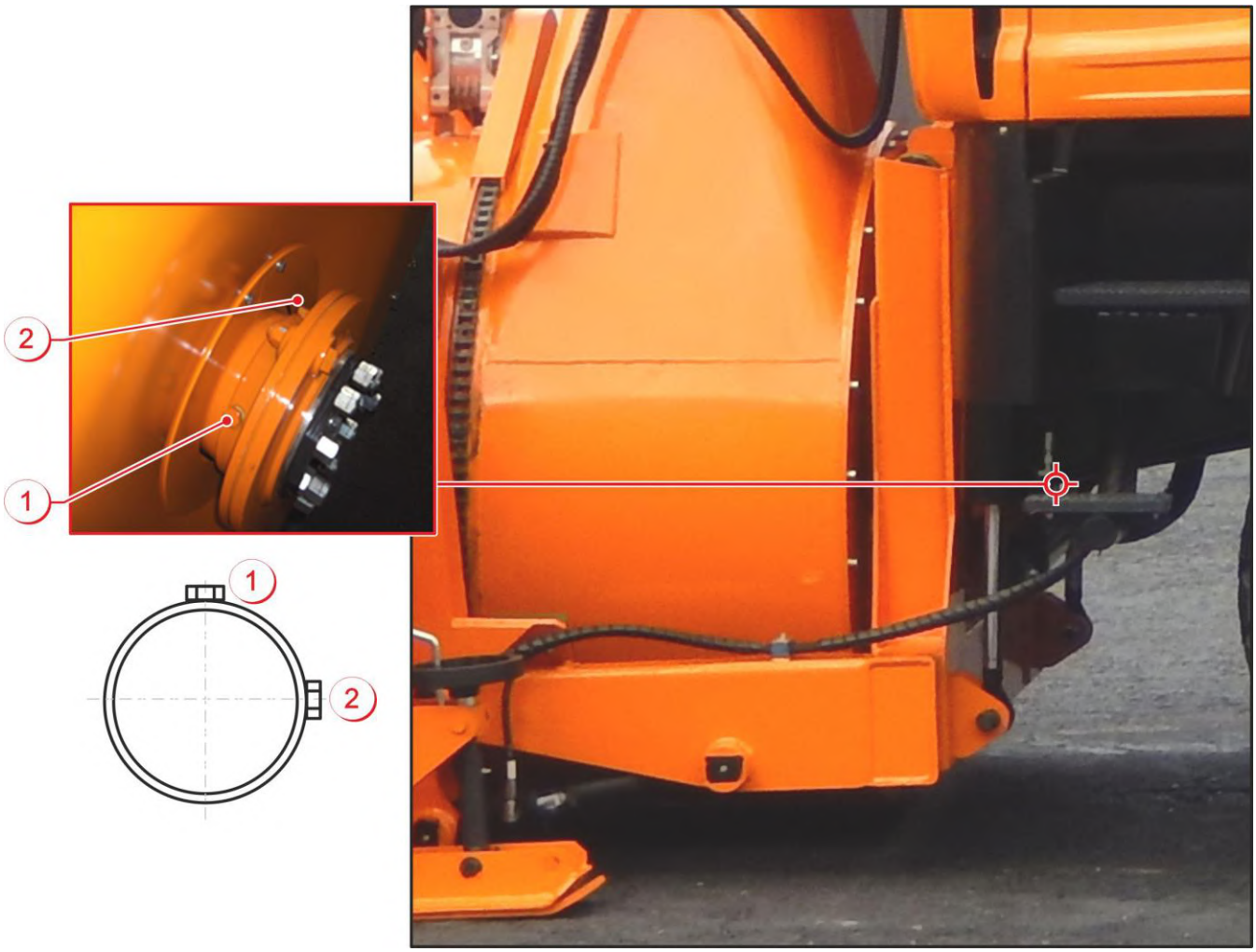
Periodicity	BEFORE STARTING THE WORK SEASON	**Required time:**	20 minutes

Action points



Requested spare parts	**Specific tools:**
• Oil type **TUTELA W90/M-DA** or equivalent.	

People operating on vehicle must wear protective clothes according to the regulations in force



a) Put a container under the plug (2).

b) Screw the plug (2) and rotate it in lower position to leave all the oil flowing out.

c) Screw back the plug (2).

d) Rotate (1) in the upper position.

e) Pour slowly about 2 litres of oil in (1) to allow the air to come out.

f) Screw the plug (2) (it should be in horizontal) and let that exceeding oil flows out.
When the oil stops to flow, the correct lever is reached.

g) Screw back the plugs (1) and (2).

WARNING

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	F_11

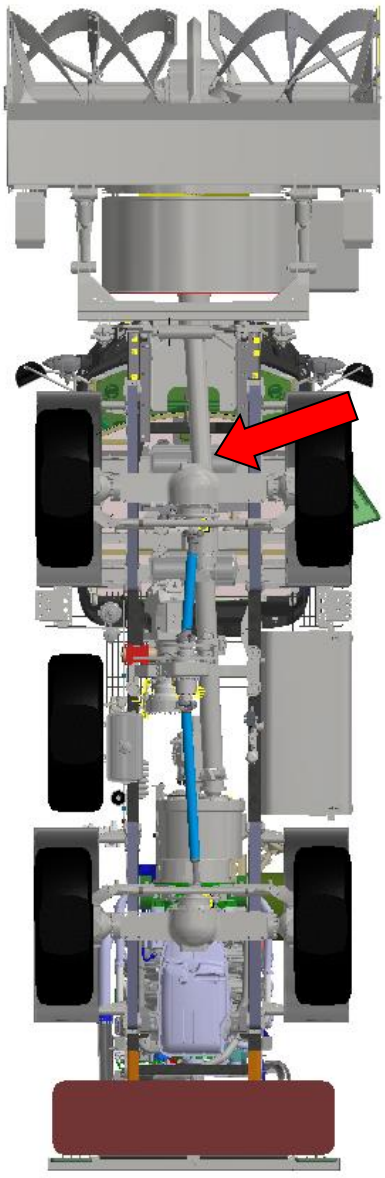
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type TRANSMISSION SUPPORT OIL REPLACEMENT

BLOWER HEAD

Periodicity	EVERY 1000 HOURS (2 YEARS)	Required time:	20 minutes

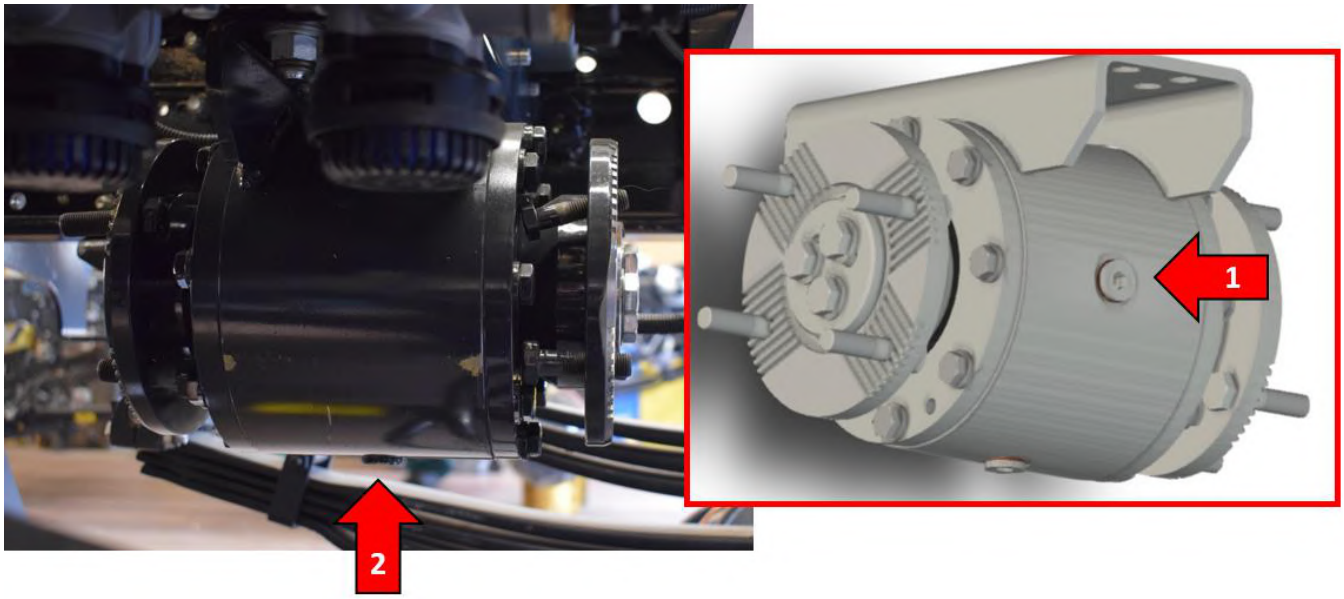
Action points



Requested spare parts	Specific tools:
• Oil type **TUTELA W90/M-DA** or equivalent.	

PROCEDURE

People operating on vehicle must wear protective clothes according to the regulations in force



a) Put a container under the plug and unscrew the plug (2), let all the oil flowing out

b) When the oil has completely drained screw the plug (2) (replace the gasket);

c) Unscrew the plug (1)

d) Refill oil through the hole (1) until the oil level reaches the lower part of the opening;

e) Screw the plug (1) (replace the gasket);

Techmomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	Sheet n° G_01

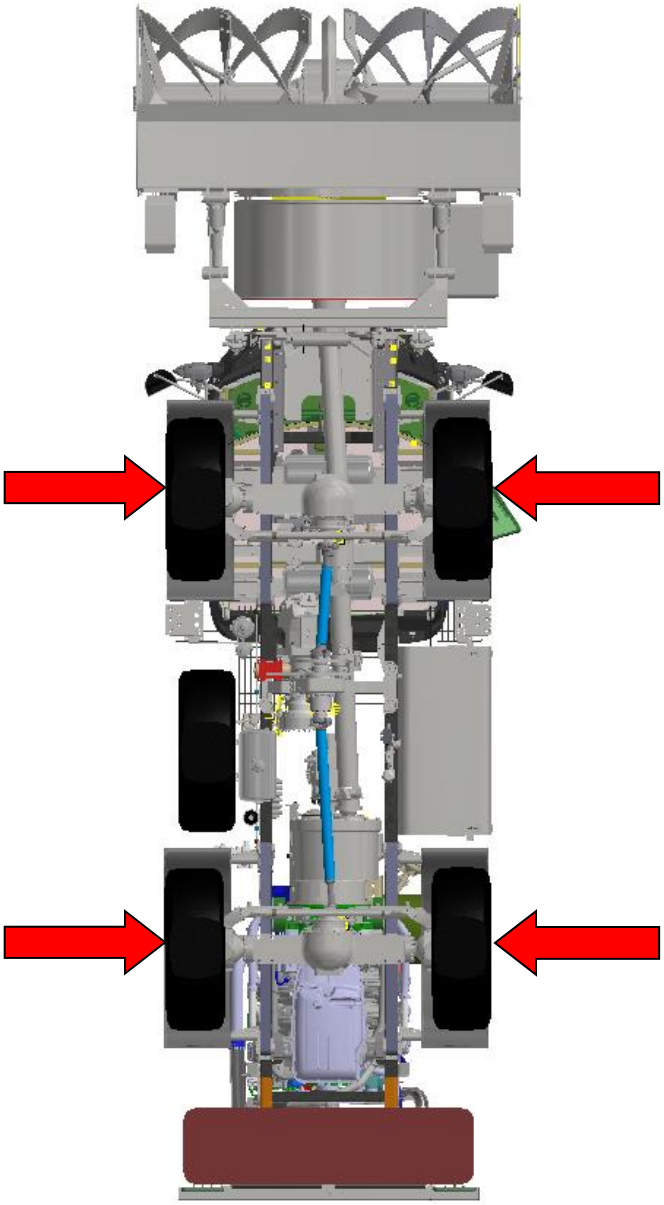
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: TYRES PRESSURE CHECK

TYRES

Periodicity:	BEFORE STARTING	Required time:	10 minutes

Action points:



Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

a) Check the pneumatic pressure.

Correct values are the following:

7,5 BAR FRONT AXLE

5 BAR REAR AXLE

WARNING:

When pressure is too LOW, they heat up causing a quick lateral wear.

When pressure is too HIGH, the tyre becomes stiff that cause wearing in the central part.

Technomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	Sheet n° G_02

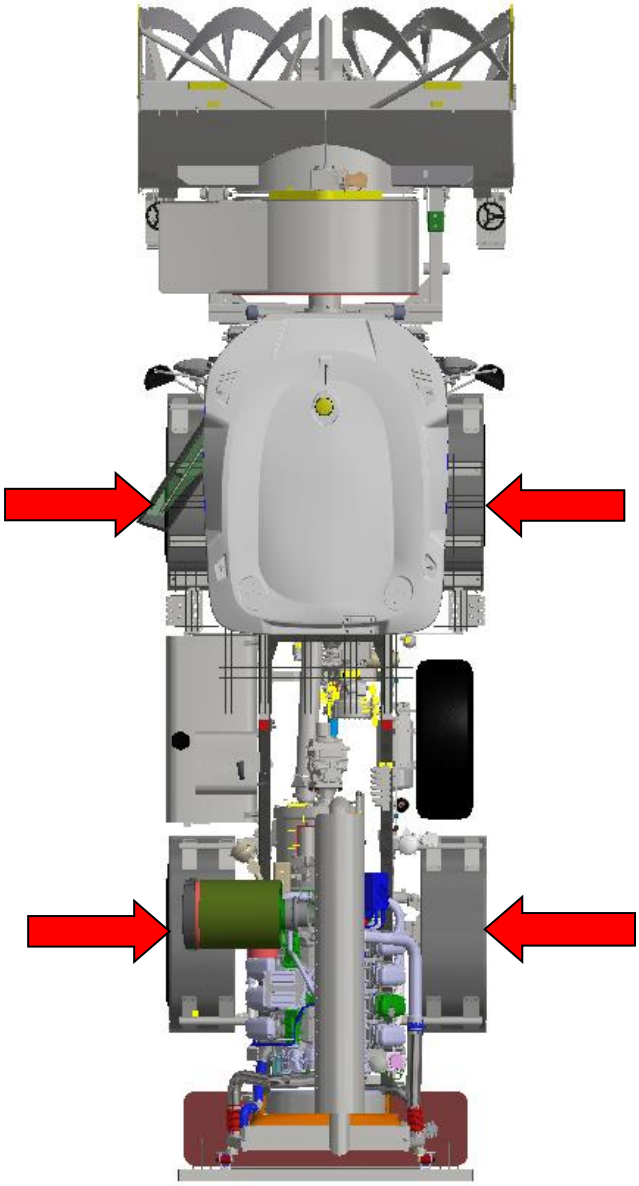
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: WHEEL NUTS TORQUE CHECK

TYRES

Periodicity:	BEFORE STARTING	Required time:	20 minutes

Action points:

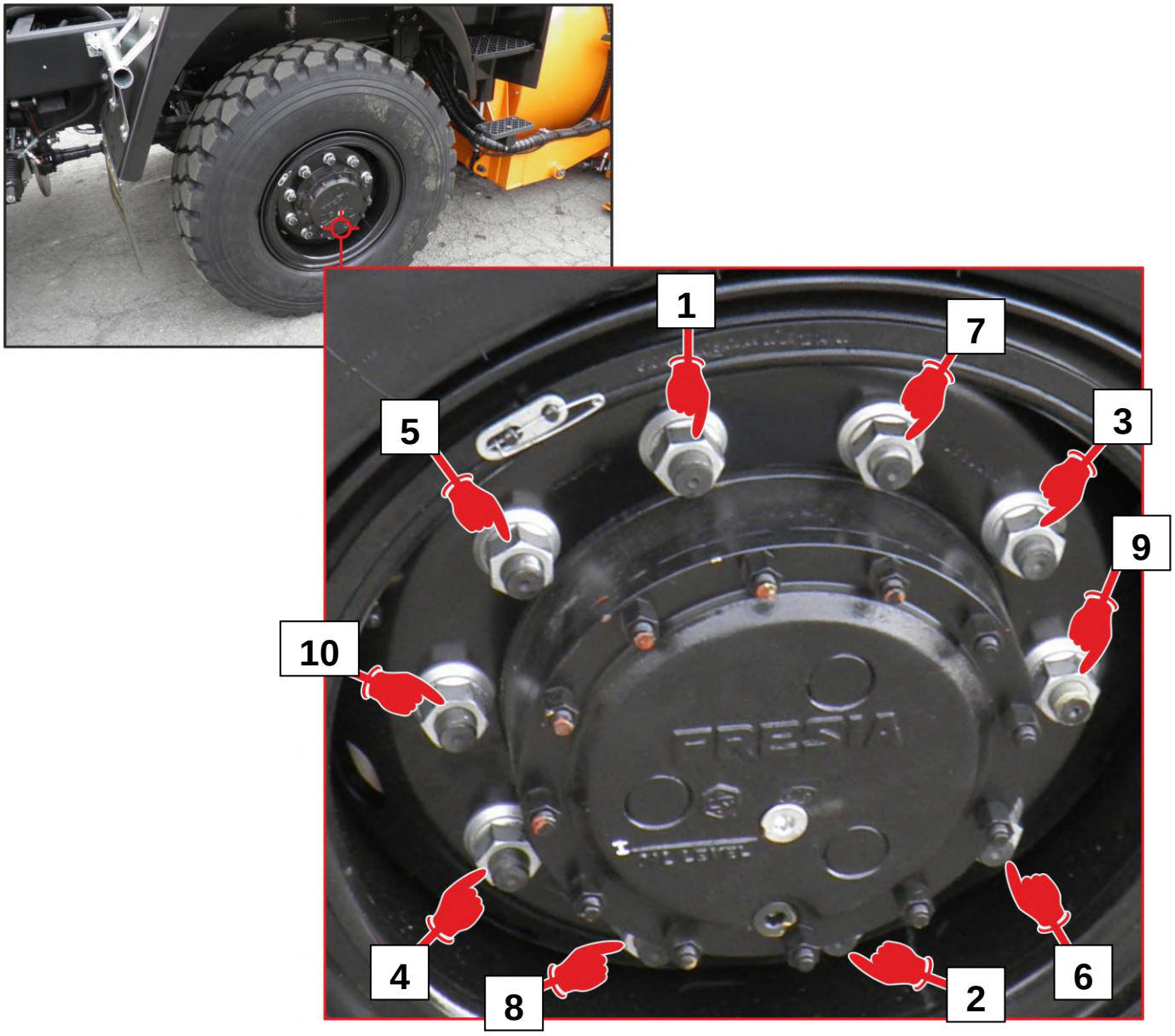


Requested spare parts:	Specific tools:

PROCEDURE:

People operating on vehicle must wear protective clothes according to the regulations in force

a) Check the tightening of nuts fixing the wheels to the hubs. Tightening torque: **470 Nm**



Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECCANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	H_01

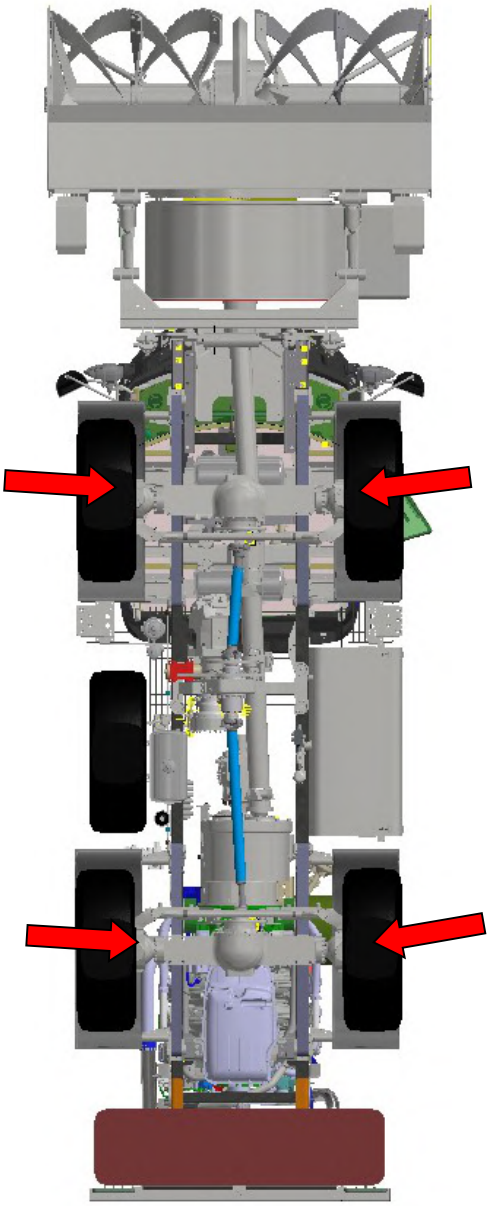
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: CHECK THE BRAKE PADS CONSUMTION

BRAKES

Periodicity:	EVERY 1000 HOURS or 2 YEARS	**Required time:**	40 minutes

Action points:



Requested spare parts:	**Specific tools:**
• Brake pads cod. **003058/1**	

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.

Check the status of the components.

Replace the brake pads when:

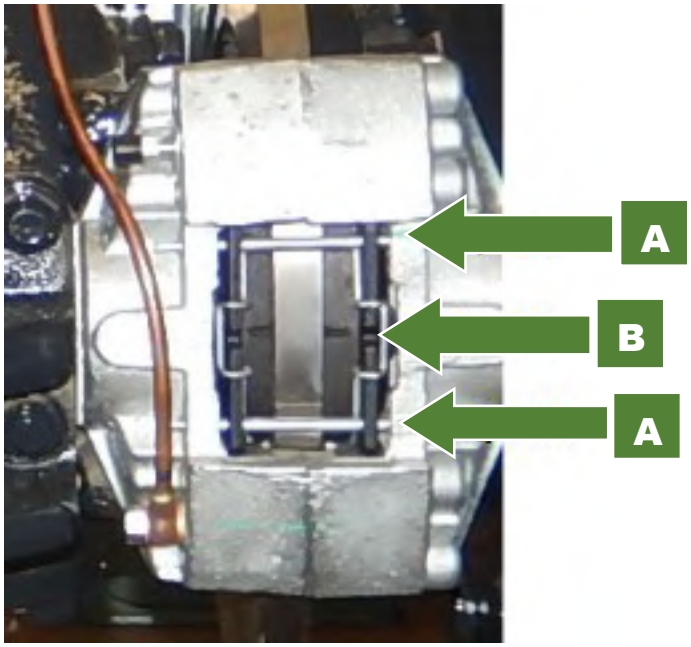
- They are heavily dirty of grease or oil.
- Their thickness is < 2 mm.

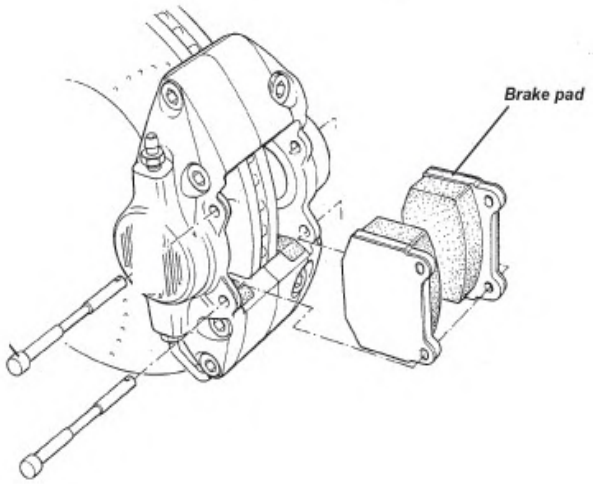
Procedure for brake pads replacement:

a) Lift the vehicle axle.

b) Remove the wheel from the hub.

c) Using a punch, remove the fixing pins A and extract the clips B.





d) lide out the worn pads.

e) Insert a lever between the disc and the brake cylinder and push cylinder in backward.

f) Reinstall the new pads following the procedure in reverse.

g) Reinstall the wheels. Tightening torque: **470 Nm**

IMPORTANT:
Whenever the pads are replaced, it is recommended to bleed the system.

Procedure for brake system bleeding

When replacing the brake pads, it is necessary to purge the system of any air present.

With the engine at idle and the parking brake engaged, proceed as follows:

a) Connect a purge hose to the purge fitting (A). Place the second end of the bleed hose into a container partially filled with brake fluid.

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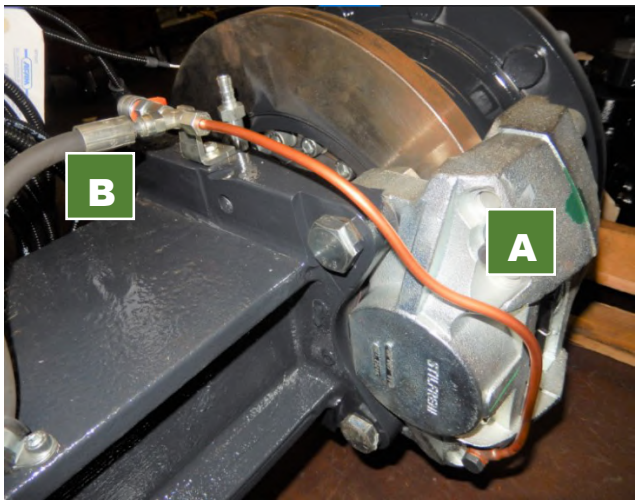


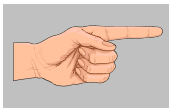
b) Press the brake pedal repeatedly.

c) Keep the brake pedal pressed and open the bleed screw by one turn. This operation lets the air out of the hydraulic system.

d) Close the bleed screw.

e) Repeat the operation until only oil comes out of the bleed screw.

f) Perform the operation for each wheel.



NOTE:

The exhaust oil must be disposed of according to the rules.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECCANIC ☐ FLUIDIC ☐ CLEANING ☐ LUBRICATION ■ INSPECTION	I_01

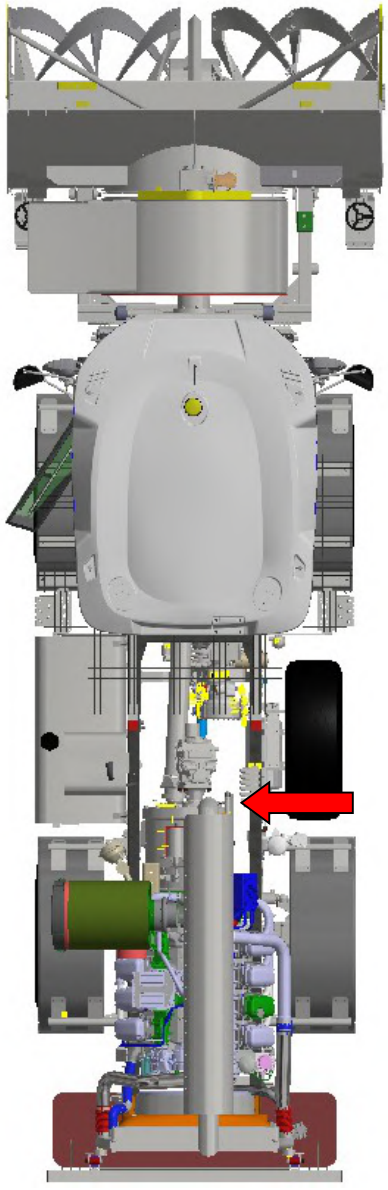
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: TWO SPEED BACK GEAR OIL LEVEL CHECK

TWO SPEED BACK GEAR

Periodicity:	BEFORE STARTING	**Required time:**	10 minutes

Action points:



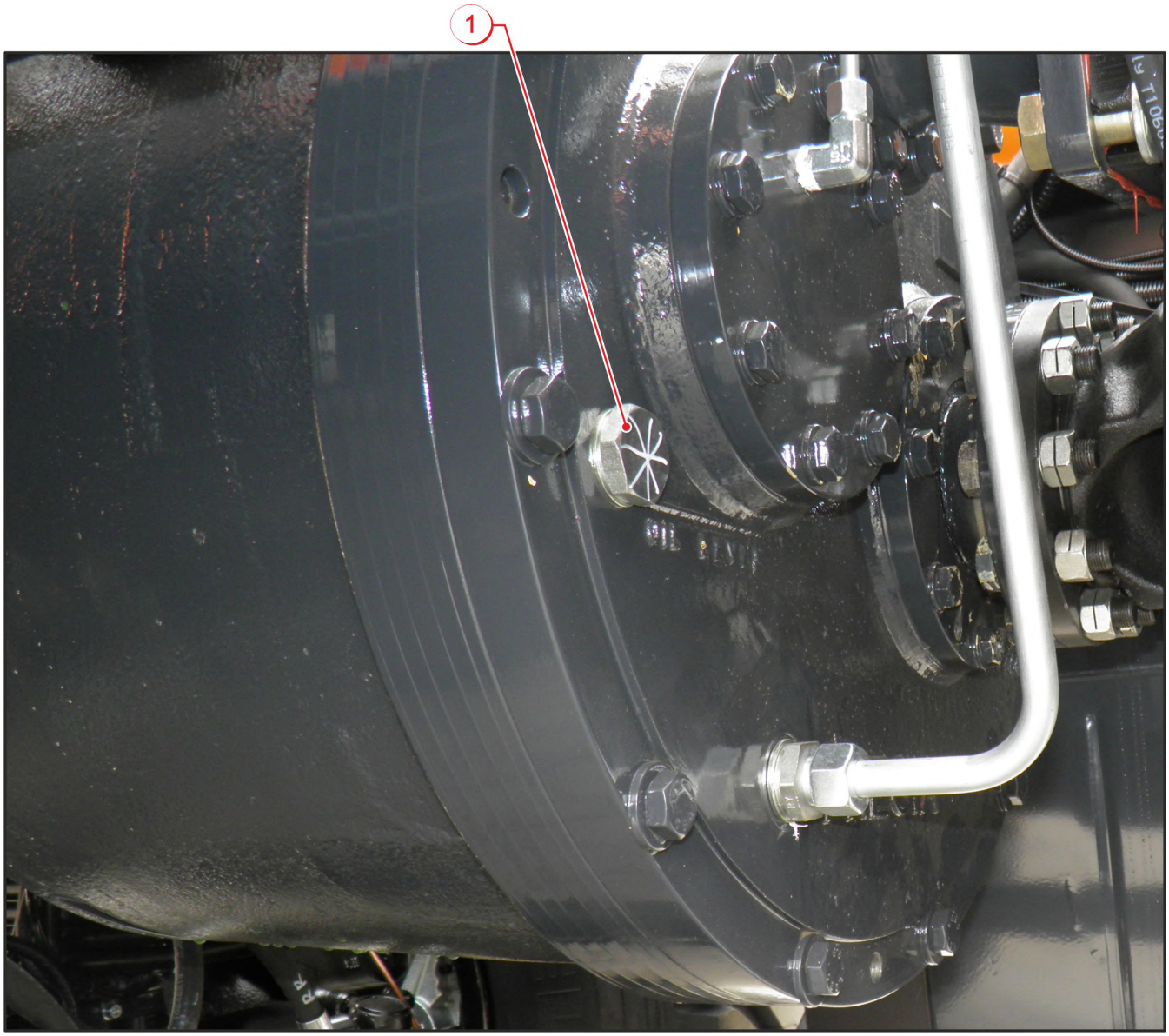
Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.

Specific tools:

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.



a) Move the vehicle over an inspection pit.
b) Unscrew plug (1) and check that the level reaches the lower part of the opening.
c) If necessary, refill.
d) Screw back the plug (1).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent.

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	I_02

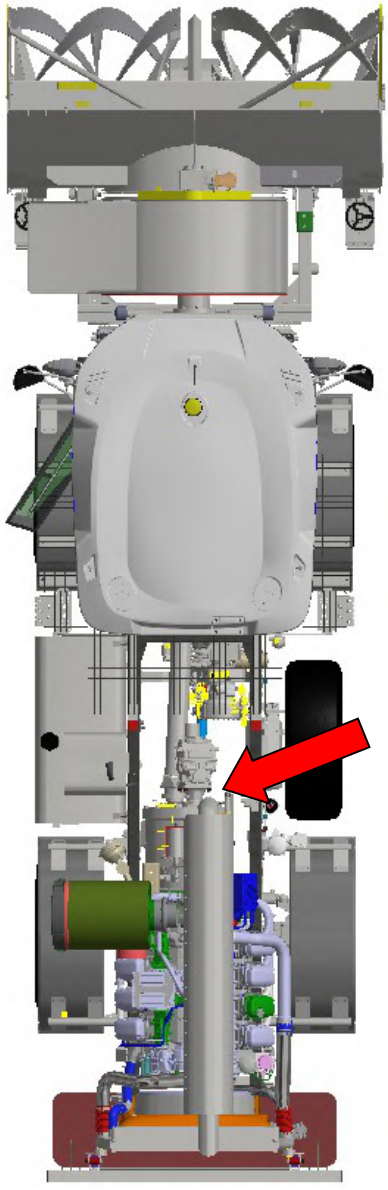
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: TWO-SPEED BACK GEAR OIL REPLACEMENT

TWO SPEED BACK GEAR

Periodicity:	BEFORE STARTING THE WORK SEASON	**Required time:**	30 minutes

Action points:



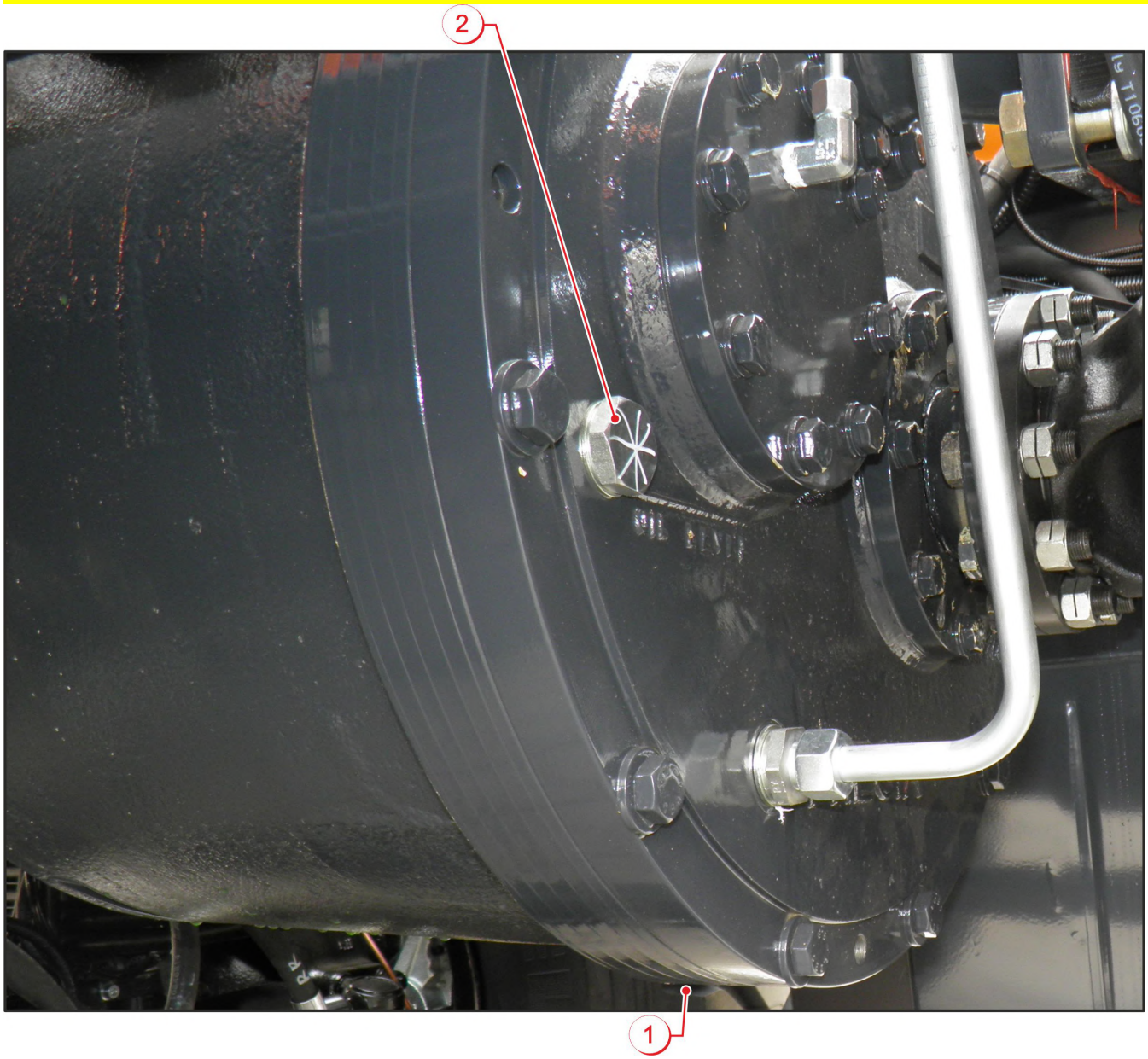
Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.
- Plugs gasket (1) and (2) code **R0082099**

Specific tools:

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.



a) Move the vehicle over an inspection pit.

b) Put a container under the plug (1).

c) Unscrew plugs (1) and (2), let the oil completely flow out.

d) When oil had completely drained screw back plug (1) (replace the gasket of plug (1)).

e) Fill the new oil through the opening (2) until it reaches the lower part of the opening.

f) Screw back plug (2) (replace the gasket of plug (2)).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent

Technomatic	Maintenance sheet ☐ ELECTRIC ☐ MECHANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	Sheet n° I_03

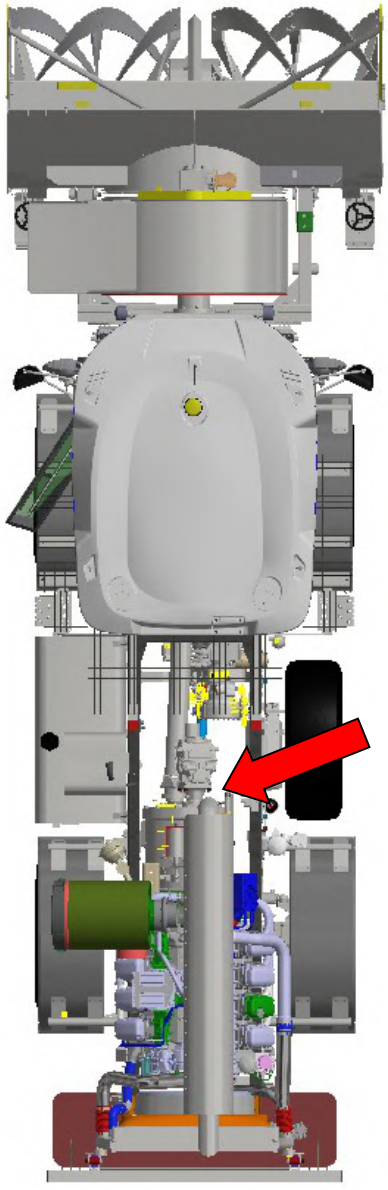
Vehicle type:	SNOWBLOWER	Model:	F90

Intervention type: TWO-SPEED BACK GEAR OIL FILTER REPLACEMENT

TWO SPEED BACK GEAR

Periodicity:	BEFORE STARTING THE WORK SEASON	Required time:	20 minutes

Action points:



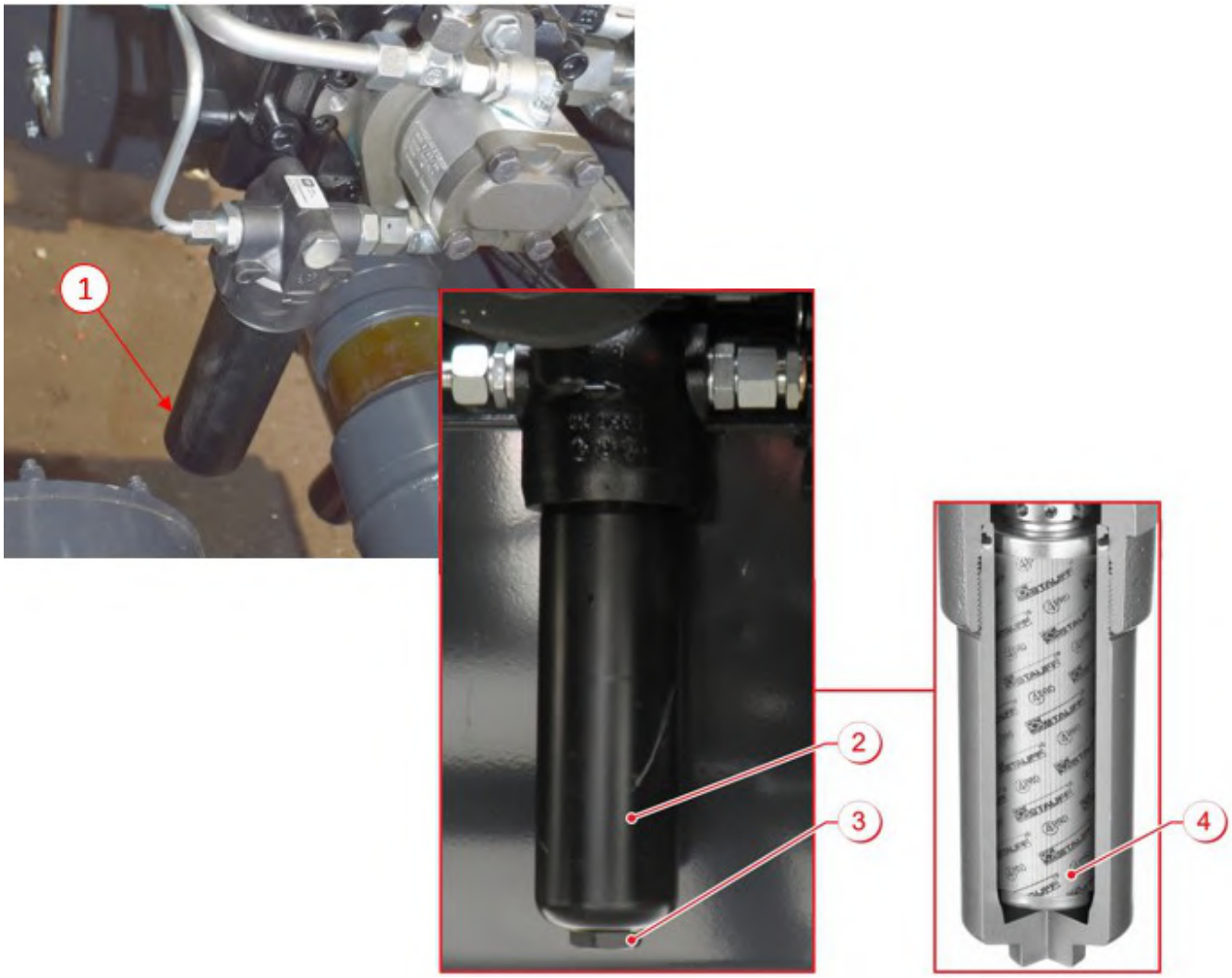
Requested spare parts:

- Oil type **TUTELA W90/M-DA** or equivalent.
- Cartridge code **00102547**

Specific tools:

PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.



a) Put a container under the oil filter (1).

b) Remove the housing (2) by unscrewing the nut (3).

c) Slide out the cartridge (4)

d) Insert the new one.

e) Fix back the housing (2), screwing the nut (3).

WARNING:
At the end of the operation, the correct oil level must be restored (see maintenance sheet F_01).

WARNING:

Use only TUTELA W90/M-DA oil or equivalent

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECCANIC ☐ FLUIDIC ■ CLEANING ☐ LUBRICATION ☐ INSPECTION	J_01

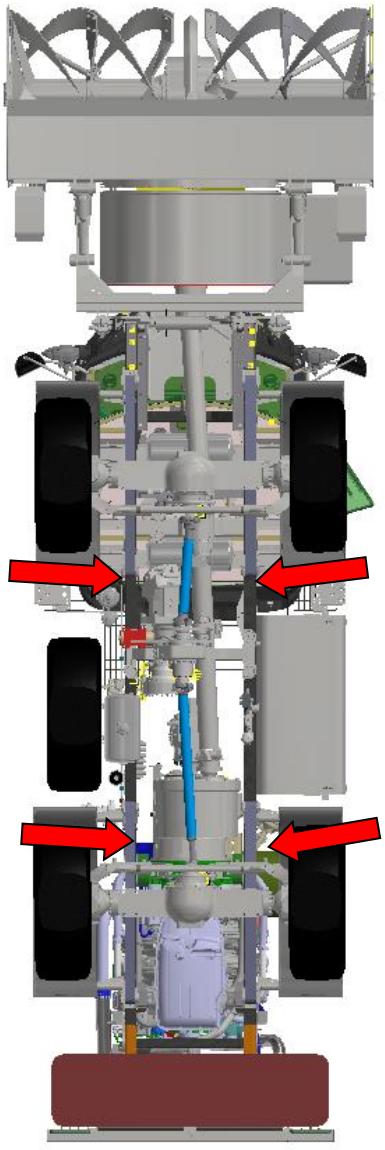
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: RUST INHIBITOR TREATMENT FOR THE LOWER PART OF THE CHASSIS

CHASSIS

Periodicity:	BEFORE STARTING THE WORK SEASON	**Required time:**	40 minutes

Action points:



Requested spare parts:	**Specific tools:**
• DINITROL 964 or equivalent	

* depending on the presence of aggressive substances on the ground like salt or de-icing liquid.

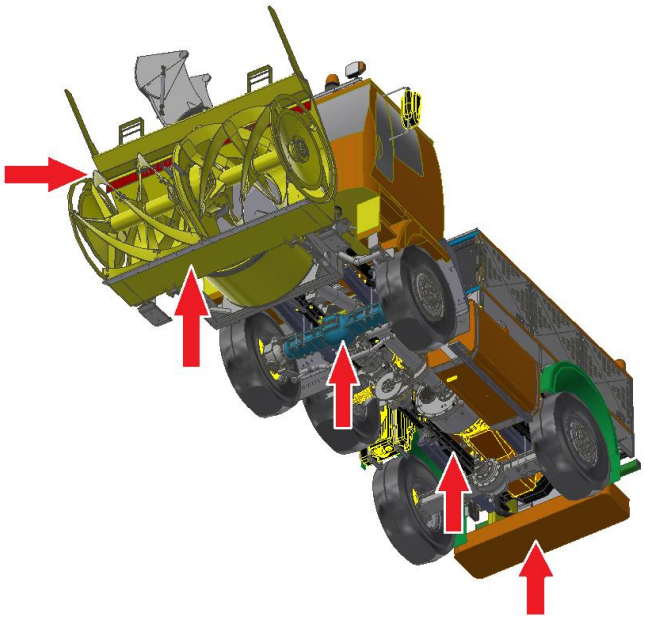
PROCEDURE:

WARNING:
People operating on vehicle must wear protective clothes according to the regulations in force.

To avoid the formation of rust in the lower parts of vehicle, which are subjected to aggressive substances on the ground like salt, de-icing liquid, etc., every year or two it is recommended to applicate a corrosion protection.

Spread the anti-corrosion on all iron parts accessible under the chassis.
The parts to be treated must be clean and free form oil and grease.

The recommended anti corrosion DINITROL 964 can be applied by spraying with manual or semi-automatic application equipment or by dipping. The water born protective is suitable for air-mix and air less spraying. Brushing is not recommended since encapsulation of air into the product may deteriorate the dry film. Stainless equipment is recommended.
Suitable application temperature is 15-30 °C.
The drying behaviour of the product is depending on the condition regarding temperature, RH and change of air.
For a quicker drying, it is helpful to increase the air change. This is achieved by using a fan at low speed in order to remove with water the saturated air just above the applied areas.



Specs of anti-corrosion

Colour:	transparent
Type of film:	hard, glasslike
Density at 23°C:	1040 kg/m³
Viscosity at 23°C, DIN 4:	30 s
Dry matter content:	38% by weight
EU VOC:	32 g/l
Flash point:	> 100°C
Recommended film thickness wet:	90 µm
Recommended layer thickness:	30 µm
Drying time, room temperature:	15 min with fan 20 – 30 minutes without fan
ph:	9
Removability:	Isopropanol
Heat resistance (160°C, 96 hrs):	very slight yellowing
Salt Spray Test, 240 hrs on most common paint systems:	No corrosion
CCT / ACT 1	20 Cycles Ri1
Humidity cabinet 2000 hrs:	no corrosion
Available in:	25 L Cannister / Container

Technomatic	Maintenance sheet	Sheet n°
	☐ ELECTRIC ☐ MECCANIC ■ FLUIDIC ☐ CLEANING ☐ LUBRICATION ☐ INSPECTION	K_01

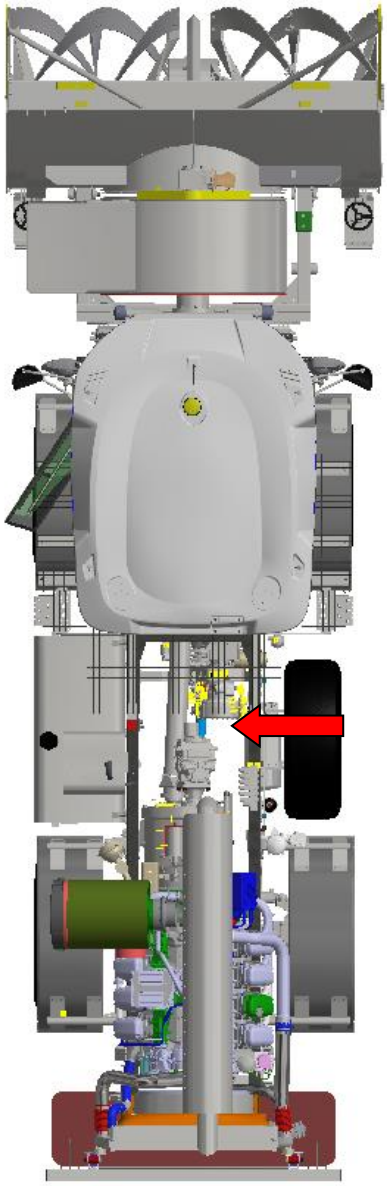
Vehicle type:	**SNOWBLOWER**	**Model:**	**F90**

Intervention type: CHECK THE LIQUID FOR WINDSHIELD WASHING

CAB

Periodicity:	BEFORE STARTING	**Required time:**	10 minutes

Action points:



Requested spare parts:	**Specific tools:**
• Liquid AREXONS -20 °C or equivalent	

PROCEDURE:

> ***WARNING:***
> ***People operating on vehicle must wear protective clothes according to the regulations in force.***

The windshield washer tank is located in the front part of the rear body.

To access at windshield washer tank its necessary open the panel, which the provided key can open. Press lightly and rotate the key clockwise to open and anticlockwise to close.

Lift the capote and fill the tank with proper liquid.

VOLVO PENTA

SERVICE AND MAINTENANCE 16L INDUSTRY

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Safety Information

This chapter describes how safety precautions are presented in the manual and on the product. Read the chapter through very carefully before you start the engine or do any maintenance or service. It has to do with your safety; an incorrect operation can lead to personal injury and damage to products or property. It also gives you an introduction to the basic safety rules for using and looking after the engine.

If anything remains unclear or if you are unsure of something, contact your Volvo Penta dealer for assistance.

IMPORTANT:
Always follow local safety instructions and regulations.

Safety texts have the following order of priority:

⚠ DANGER!
Indicates a hazardous situation, which, if not avoided, result in death or serious injury.

⚠ WARNING!
Indicates a hazardous situation, which, if not avoided, could result in death or serious personal injury.

⚠ CAUTION!
Indicates a hazardous situation, which, if not avoided, could result in minor or moderate personal injury.

IMPORTANT:
Indicates a situation, which, if not avoided, could result in property damage.

NOTICE! Used to draw attention to important information that facilitates work or operations.


This symbol is may be used on the product to call your attention to the fact that this is safety information. Always read such information very carefully.

Make sure that warning and information symbols on the engine are clearly visible and legible. Replace symbols that have been damaged or have been painted over.


In some cases, this symbol is used on our products and refers to important information in the Operator's Manual.

P0024482

Most chemicals such as engine and transmission oils, glycol, petrol and diesel oil and chemicals used in workshops such as degreasing agents, paint and solvents are harmful to health.

Carefully read the instructions on the product packaging! Always follow the safety regulations, such as the use of protective masks, goggles, gloves, etc. Make sure that other personnel are not exposed to substances that are hazardous to health. Ensure good ventilation.

Manage used and leftover chemicals in the prescribed manner.

Personal safety equipment

⚠ CAUTION!
Always use appropriate safety equipment. Personal protective equipment does not eliminate the risk of injury but it will reduce the degree of injury if an accident does happen.

Some examples are ear protection, eye and face protection, protective footwear, personal protective equipment, head protection, protective clothing, gloves and respirators.

⚠ WARNING!
Ensure that all machine guards and safety devices are in place and are functional.

⚠ CAUTION!
Never use tools or products that show signs of damage.

Protect your eyes

⚠ CAUTION!
Wear safety glasses.

Always wear safety glasses if there is a risk of splintering, sparks and spray from the electrolyte (so-called battery acid), or other chemicals. Your eyes are very delicate and damage can result in loss of sight!

Protect your skin

⚠ CAUTION!
Risk of skin damage.

Avoid getting oil on your skin! Prolonged or repeated exposure to oil can dry out the skin. Thereafter, irritation, dryness and eczema and other skin problems may occur.

Use protective gloves and avoid oil-soaked clothes and rags. Wash regularly, especially before eating. Wear suitable protective creams to prevent skin from drying out and to facilitate cleaning.

Fire safety

P0024470

⚠ WARNING!
Fire and Explosion Risk!
Accidental spark could ignite fuel vapors.

All fuels – as well as many lubricants and chemicals – are flammable. Do not allow open flames or sparks near them. **Smoking forbidden!** Hydrogen from the batteries is also very flammable and explosive in certain mixture with air.

Ensure that the workplace is well ventilated and take the necessary precautions before welding or grinding begins. Always ensure that there is a fire extinguisher close at hand in the work area.

Spare parts - safety

⚠ WARNING!
Always use Volvo Penta genuine spare part to minimize the risk of an explosion or fire.

Components in fuel systems and electrical systems on Volvo Penta engines are designed and manufactured to minimize the risk of explosions and fire, in accordance with applicable legal requirements.

Used oils, filters and chemicals etc.

⚠ WARNING!
Risk of fire.
Store fuel soaked rags and other flammable material so that there is no danger of them catching fire.

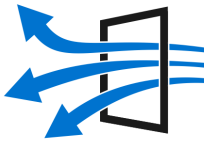
Oil-soaked rags can spontaneously ignite under certain circumstances.

IMPORTANT:
Used fuel and oil filters are environmentally hazardous waste and must be taken to an approved waste management facility for correct handling, as must any used lubricating oil, contaminated fuel, paint residue, solvents, degreasers and wash residue.

Prevent start of the engine

⚠ WARNING!
Immobilize the engine by turning off the power supply with the main switch(es) and lock it (them) in the off position before starting work. Place a warning notice at the main switch.
If the engine is equipped with BMS (Battery Management System), always disconnect both battery cables from the battery terminals.

Ventilation when running the engine



P0024481

⚠ WARNING!
Only start the engine in a well-ventilated area. If operating the engine in a closed area ensure that there is exhaust ventilation leading out of the work area to remove exhaust gases and crankcase ventilation emissions.

The engine must not be operated in areas where there are explosive materials or stored gas.

Rotating parts and hot surfaces

P0024808

⚠ DANGER!
Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.
If the engine is in operation and operates another device, you must not, under any circumstances, staying close to the engine.

Work on running engines is strictly prohibited. There are however adjustments that require the engine to be run. Approaching a running engine is a safety risk. Loose clothing and long hair can get caught in the rotating parts; careless movements or a dropped tool can lead to serious personal injury.

Be careful to avoid hot surfaces (exhaust pipes, turbochargers, charge air manifolds, start elements etc.) and hot fluids in pipes and hoses on engines that are running or have just stopped. Re-install

all protective covers that were removed during maintenance work before starting the engine.

Information on the engine

IMPORTANT:
Make sure that all warning and information decals on the product are always visible. Replace decals which have been damaged or painted over.

Prohibition on use of start spray

P0024483

⚠ WARNING!
Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold. Risk of personal injury.

Before start of engine

P0024688

⚠ WARNING!
Never start the engine if there is reason to suspect fuel and/or gas leaks, or if there is explosive material nearby.

IMPORTANT:
Only start the engine with the air filter and protective caps fitted. Foreign objects in the inlet line could cause machine damage. Also make sure that no tools or other parts have been left next to the engine.

⚠ WARNING!
Never start the engine with the valve cover removed. There is a risk of personal injury.
For engines with turbochargers, the rotating compressor turbine can in addition cause serious personal injuries.

Before any work on the electrical system

⚠ WARNING!
Always stop the engine first. Then disconnect the current at the main switches and any external power supply before working on the electrical system – to minimize the risk of electrical hazards.

IMPORTANT:
Never disconnect the current using the main switches when the engine is running or by disconnecting the battery cables.
The alternator and electronics could be damaged.

Avoid damage to the engine control module and other electronics

IMPORTANT:
Switch off the main switch before connecting or disconnecting a connector.

Before any work on the cooling system

⚠ WARNING!
Stop the engine and let it cool before starting work on the cooling system. Hot fluids and hot surfaces can cause burns.

Hot coolant under pressure

⚠ CAUTION!
Hot coolant can cause burns. Avoid opening the filler cap for the coolant when the engine is still hot. Steam or hot coolant can spray out and system pressure is lost.

Open the filler cap slowly, and release the pressure in the cooling system if the filler cap or valve has to be opened, or if a plug or coolant hose must be removed from a hot engine.

Hot oil under pressure

⚠ CAUTION!
Hot oil can cause burns. Avoid getting hot oil on the skin. Ensure that the lubrication system is not pressurized before starting any work. Never start or operate the engine without the oil filler cap is on. There is a risk that hot oil can spray out.

At any leak detection on the fuel system

P0024488

⚠ WARNING!
Wear safety goggles!
Be extremely careful when searching for leaks in the fuel system high-pressure circuits. There is very high pressure in the jet from pipes and injectors. The fuel may penetrate the tissue and cause serious risk of blood infection (septicemia).

Handling of fuel pipes

IMPORTANT:
High pressure pipes for fuel must not be bent or straightened under any circumstances. Cracks may occur. Damaged pipes must be replaced.

Before any work on the fuel system — Cleanliness

IMPORTANT:
Take great care to keep the fuel system components clean. Even minimal amounts of dirt can cause engine breakdown.

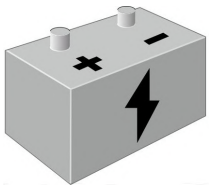
Safe handling of batteries

⚠ WARNING!
Risk of fire and explosion. Never allow an open flame or electric sparks near the batteries.

A spark caused by an incorrectly connected battery can be sufficient for the battery to explode resulting in serious injury and damage.

Do not touch the connections during a starting attempt. Spark hazard! Do not lean over batteries.

Correct polarity of the batteries



P0024468

IMPORTANT:
Make sure that the positive (+) and negative (–) battery cables are correctly connected to the corresponding battery terminals. Wrong connection may cause severe damage to electrical equipment.

Risks of electrolyte in batteries

⚠ WARNING!
Always wear protective goggles when charging or handling batteries.
Battery electrolyte is highly corrosive.

Rinse immediately with copious amounts of water if the electrolyte gets in your eyes. Search directly after the rinsing help by medical staff.

If it comes electrolyte to unprotected skin, wash immediately with soap and water.

After finished work with the engine

IMPORTANT:
Always perform a leakage and function check.

Cleaning the engine and components

P0026213

NOTICE! Follow the instructions *Cleaning engine and transmission, page 79*.

P0024485

Cleanliness for sensitive components

IMPORTANT:
Observe meticulous cleanliness when handling system components.
Even minimal amounts of dirt could cause a breakdown.

Lifting the engine

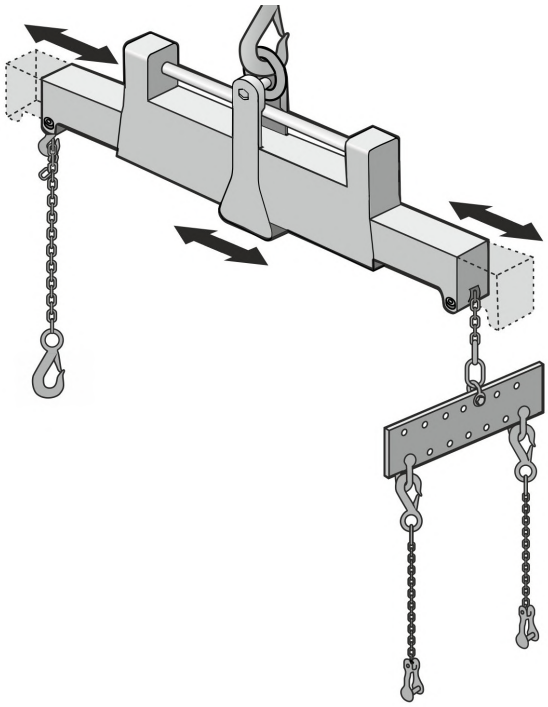
⚠ WARNING!
Never work alone when removing heavy components, even when using lifting devices such as locking tackle lifts.

IMPORTANT:
When using a lifting device, two people are usually required to do the work – one to take care of the lifting device – and the other to ensure that components are lifted clear and not damaged during the lifting operations.

Proper lifting equipment

⚠ DANGER!
The existing lugs on the engine should be used for lifting. **Always check that the lifting equipment used is in good condition and has the load capacity to lift the engine** (engine weight including transmission and extra equipment). For safe handling and to avoid damaging components fitted to the top of the engine, the engine must be lifted with a correctly adjusted lifting boom.
Never perform any work on an engine that is only suspended from the lifting equipment.

IMPORTANT:
All chains or wires must run parallel to each other and as perpendicular to the engine as possible. If other equipment attached to the engine has altered its center of gravity, special lifting devices may be needed to obtain the correct balance for safe handling.



P0024689
Example of an adjustable lifting yoke and a lifting tool.

General Information

General information

This service and maintenance manual contains descriptions and instructions for the service of the above-mentioned Volvo Penta products in their standard models. The design and servicing items may vary between different products. Applicable service intervals and service procedures are described in the maintenance schedule for the product.

The product designation, serial number and specification are indicated on the engine decals or type plate. This information must always be provided in all correspondence concerning the product.

The manual has been produced primarily for use in Volvo Penta workshops. It is assumed that persons using the manual have fundamental knowledge of the product and are capable of carrying out mechanical and electrical work to industry standards.

Volvo Penta continually develops its products. We therefore reserve the right to make changes. All of the information in the manual is based on product data available when the manual was published.

NOTICE! The owner is responsible for ensuring that scheduled maintenance is carried out. Warranty claims to Volvo Penta may be declined if neglected maintenance results in faults in the specified product. Refer to the warranty terms supplied with the engine.

Specific terms for the U.S. market

This engine is certified as being in compliance with federal and Californian exhaust restriction regulations. Parts related to exhaust restrictions are covered by the warranty commitment for exhaust restricting systems. Terms and the parts covered are specified under "What is covered by the warranty undertaking for emissions” in “Emission Control System Warranty Statement”. Repairs and service covered by the warranty are carried out by an authorized Volvo Penta distributor or dealer at no charge for diagnostics, labor or parts using genuine Volvo Penta parts in all areas of the exhaust restriction system covered by the warranty and found to be defective.

The use of the service and repair workshop other than a Volvo Penta authorized distributor or dealer or the use of exhaust-related components from other manufacturers than Volvo Penta do not affect the scope of the warranty undertaking for emission-restricting systems. If emission-related components/ items are included in scheduled service, such parts are marked with a diamond (♦) in the maintenance schedule and service must be carried out at the specified intervals in order to meet the requirements of the warranty undertaking for emission-restricting systems. The full warranty terms can be found in “Emission Control System Warranty Statement”.

Certified engines

The engine is exhaust-certified, and if it is used in an area where exhaust emissions are regulated by law, this places special demands on the care and maintenance of the engine.

NOTICE! Neglect or failure to follow the items required here may invalidate the engine emissions certificate.
This means that AB Volvo Penta will no longer be able to assume liability for engine specification compliance with the certified model. Volvo Penta is not responsible for damages or costs arising as a result of this.

- Certification means that an engine type has been inspected and approved by the competent authorities. The engine manufacturer guarantees that all engines made of the same type are equivalent to the certified engine.
- It is the responsibility of the user to make sure no intentional misuse of the engine takes place.
- Volvo Penta maintenance and service intervals must be followed.
- All faults must be remedied as soon as possible.
- Only use genuine Volvo Penta replacement parts or parts of the same quality as Volvo Penta replacement parts.
- The engine may not be converted or modified in any way, except with accessories and service kits which Volvo Penta has approved for the engine.
- Volvo Penta recommends that service on injection pumps, pump settings and injectors always be carried out by a qualified workshop.
- No changes may be made to the installation of the exhaust pipe and engine air inlet ducts.
- Any tampering with the engine will hamper EU type-approval of the engine concerned.
- No warranty seals (if present on the product) may be broken by unauthorized persons.

Explanation of the relationship between service intervals and operating conditions

Because operating conditions may vary depending on how the component is used, it is important that the service interval (expressed in hours or months) is not exceeded.

Example: 1000 hours / 24 months. Whichever is the sooner applies. If the component is used for 1000 hours in 18 months, the service must be carried out when the 1000-hour interval is reached.

This is to retain the component’s best quality and service life. The warranty will be void if this is not complied with.

Typical examples are: Propeller shaft seals operating in sandy waters. Air filters exposed to heavily polluted air

Action codes used in the service schedule:
C = Cleaning
R = Replacement
A = Adjustment
L = Lubricate
I = Inspection (includes where necessary also adjustment, cleaning, lubrication and replacement)

Service Protocol

To maintain the functionality of the product Service Protocol shall be followed. The owner or other persons with sufficient technical competence may carry out some measures in accordance with Service Protocol. Contact an authorized Volvo Penta dealer in the case of uncertainty as to how service work must be performed.

Service Protocol contains the necessary maintenance points for your engine in a single document. See more on Volvo Penta‘s website: *vppn.volvo.com and Product Center for online service protocol*.

IMPORTANT:

TWD1683VE

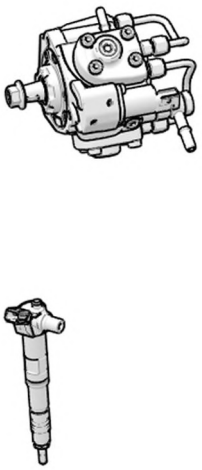
Normal service interval for TWD1683VE is 1000 h.

Recommendation

For fuel consumption in excess of 65 l/h, Volvo Penta recommends an oil change interval of 500h or alternatively follow the procedure for extended service intervals with oil analysis.

Preventive repair

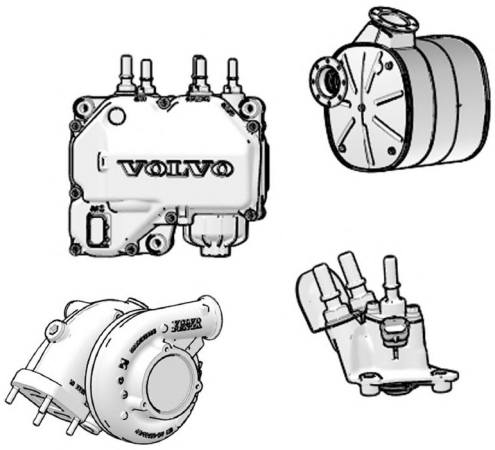
Here is an overview of the components that may be included in preventive maintenance. May vary depending on the engine's design and construction.
These components form the basis for calculating service contracts and the costs in the service calculator in Product Center.



P0026295

Fuel system

Fuel pump
Unit injectors



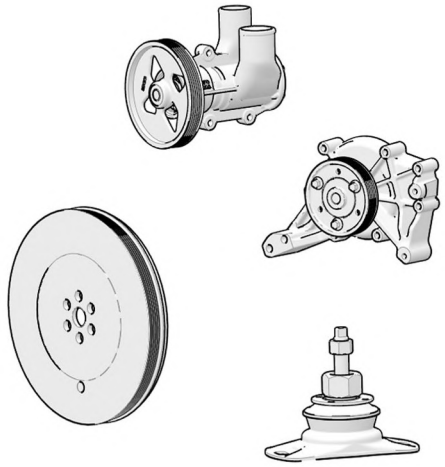
P0026296

Exhaust system

Turbocharger, low-pressure
Turbocharger, high pressure
Overflow valve (Lisk)
Silencer
Diesel particulate filter (DPF), replacement

After-treatment system

Pump unit
Dosage valve



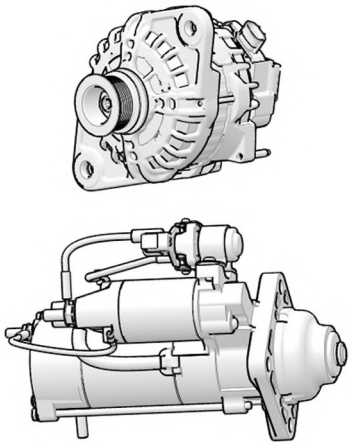
P0026297

Cooling system

Coolant pump

Engine

Vibration dampers



P0026298

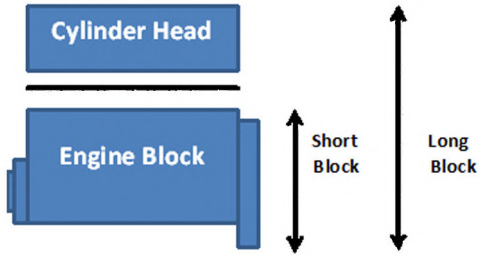
Electrical system

Alternator
Starter motor

Engine, overhaul

Here is an overview of the components that may be included in a complete overhaul. May vary depending on the engine's design and construction.
E.g. liners may not be replaced on certain engines. In this case, cylinders must be measured to see if new pistons can be installed or if the engine block should be replaced.
The components below provide the basis for calculating service contracts and the costs in the service calculator in Product Center.

Engine: May be overhauled once, after which the engine will be regarded as spent and will be replaced by a “long block” or a new engine.



P0026299

Overhaul

Long block
Short block
Cylinder head (replacement)
Cylinder head, gasket

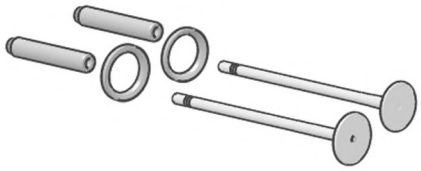
P0026300

Engine, overhaul kit
Cylinder head, overhaul kit
Gaskets, set
Flat gaskets
Valve cover, gasket

P0026301

Cylinder liners, set
Main bearings, set
Big end bearings, set
Thrust washers, set
Camshaft bearings, set

Exhaust valve
Valve seat



P0026302

Genuine Volvo Penta Parts

Volvo Penta products are designed and manufactured to achieve the highest quality. All parts are manufactured so that together they provide the best possible reliability. Therefore we always recommend the use of Genuine Volvo Penta Parts, as they are manufactured based on the same stringent specifications as the factory-installed parts in Volvo Penta drivelines.

Lube oils

Volvo Penta supplies a wide range of lubricants developed especially for Volvo Penta engines. VDS (Volvo Drain Specification) is a Volvo standard that specifies Volvo's quality requirements. We recommend the use of the specified oil to ensure engine function and a long service life.

Coolant

The main function of a coolant is to absorb heat from the engine. The coolant also protects against freezing, lime deposits and corrosion. Volvo Penta Coolant VCS (yellow) and Volvo Penta Coolant (green) are two completely different types of coolants, which contain different types of inhibitors. Different types of coolants (colors) must not be mixed.

If the concentrated coolant must be diluted with water, the water's chemical composition may impair the corrosion protection. In areas with high levels of sodium and calcium in tap water, the coolant must be diluted with distilled water. Alternatively, Volvo Penta coolant is available for purchase ready diluted.

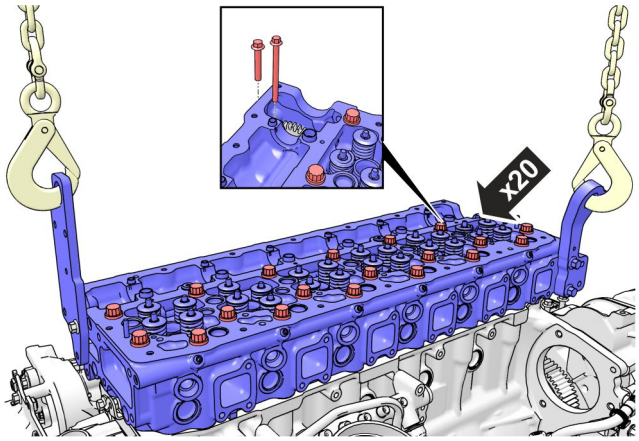
Mixing the concentrated coolant	**Protection against freeze bursting down to:**
40 %	-25 °C
46 %	-30 °C
54 %	-38 °C
60 %	-46 °C

NOTICE! It is important to use coolant with a concentration of 40-60 % in the cooling system even where there is no risk of freezing. The coolant also prevents corrosion and deposits. A mixture with a concentration above 60 % will impair antifreeze protection.

Illustrations

Colors used in illustrations

Most illustrations include a highlighted component which is secured by a bolt or similar as part of a (light gray) engine or transmission.



P0022106

- Highlighted components (blue)
- Fastener (red)
- Assembly (light gray)
- Background (white)
- Special tools (yellow)
- Seals (green) (as of 06/2018)

Other types of symbols used in the images are divided into the following categories:

- Safety
- Important
- Cleanliness
- Position
- Movement
- Measured value
- Tools
- Chemicals
- Sealant
- Units

Chemical products

Chemical products

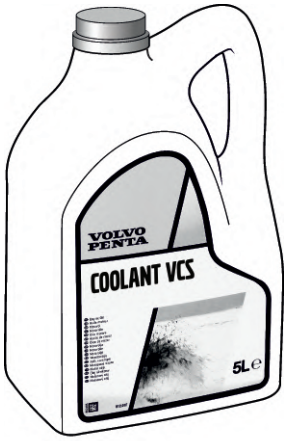
A **selection** of Volvo Penta recommended chemical products is shown below. Also refer under Specifications.

Thread locking fluid

Corrosion protection

Sealant

Engine oil



P0023031

VCS Coolant

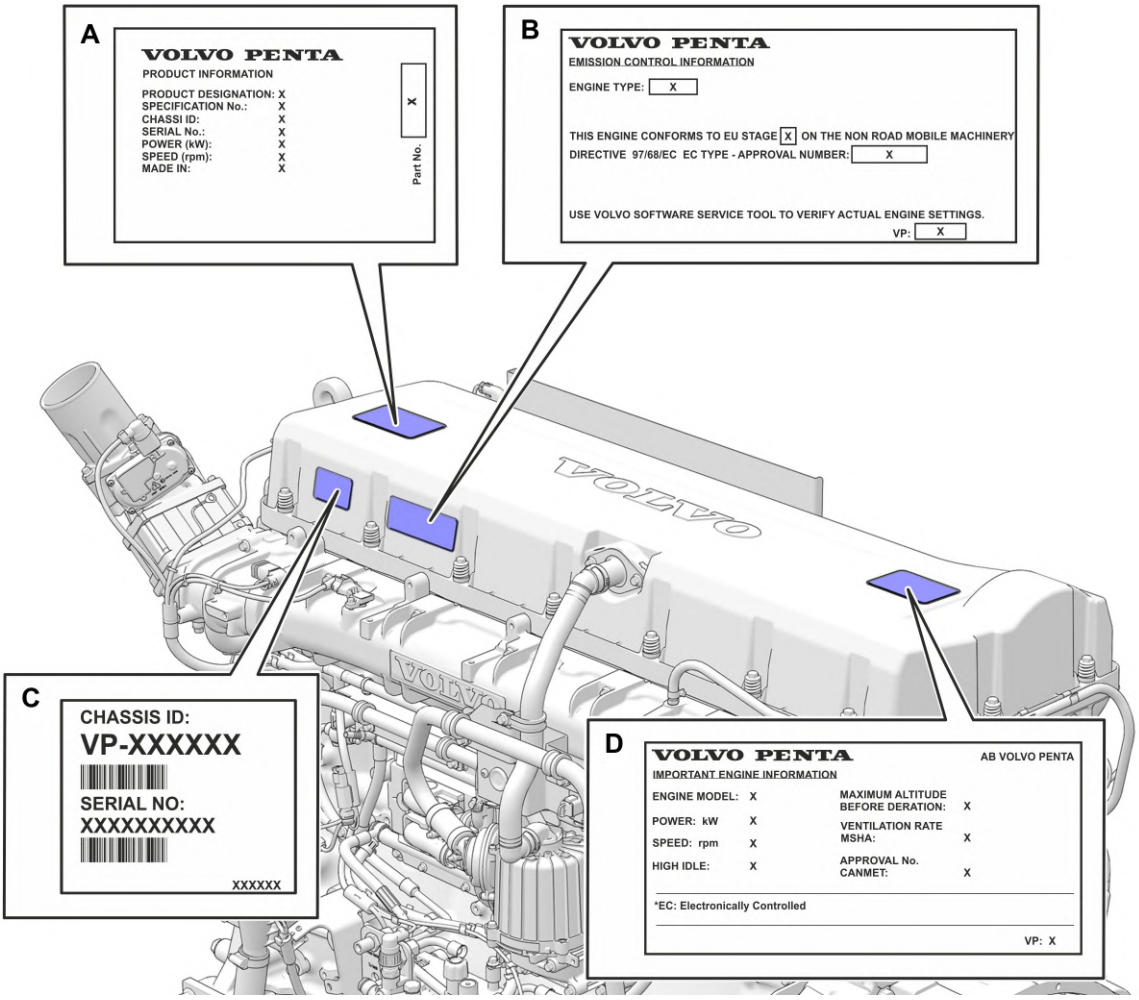
P0022805

Grease

Specifications

Engine Decals

There are type plates on the engine, and in the case of marine applications, also on the drive-lines. Some of the type plates are marked with identity numbers. Always use this information as a reference when ordering service and replacement parts or contacting Volvo Penta retailers.



P0030332

A Product information
B Emissions information
C CHASSIS ID
D Engine information

General Tightening Torques

If no torque is specified in the instructions, standard torque applies.

Screw	Nm
M6 standard screw	10
M8 standard screw	24
M10 standard screw	48
M12 standard screw	85
M14 standard screw	140
M16 standard screw	220

NOTICE! Check the screws intended for installation. For example damaged screws with shear marks under the heads, must be scrapped.

Specifications

Volvo Penta products, all markets excluding North America

Oil quantity in engine, including filter TAD1640–1672VE/GE TWD1643–1673GE TWD1683VE/GE	48 liters
VDS–4.5 SAE10W–30	
Part number: 23068339 Part number: 17488420 Part number: 17488431 TWD1683VE/GE	5 liters 20 liters 208 liters
VDS-4.5 SAE15W-40	
Engine oil. Part number: 23909459 Engine oil. Part number: 23909460 Engine oil. Part number: 23909461 Engine oil. Part number: 23909462 TAD1640–1672VE/GE TWD1643–1673GE	1 liter 5 liters 20 liters 208 liters
Coolant, VCS yellow, concentrated	
Part number: 22567295 Part number: 22567307	5 liters 210 liters
Coolant, VCS yellow, ready-mixed	
Part number: 22567314 Part number: 22567340	5 liters 210 liters
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses) TAD1640–1672VE TWD1683VE	37 liters
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses + expansion tank) TAD1640–1651GE	54 liters
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses + expansion tank) TWD1643–1683GE	48 liters

Volumes may differ if the installation has extra coolers/ radiators connected.

NOTICE! Old model engines have green coolant, which must NOT be mixed with newer VCS yellow coolant. Check that the engine is using the same type.

NOTICE! Yellow and red Volvo Penta ATF Dextron III oil may be mixed without causing any problems.

Volvo Penta products for North America

Oil quantity in engine, including filter TAD1640–1672VE/GE TWD1643–1673GE TWD1683VE/GE	12.68 gallons
VDS–4.5	
Part number: 23219282 Part number: 23219274 Part number: 23219264 Part number: 23219260 Part number: 23219246	1 US quart 1 US gallon 5 gallons 55 gallons 330 gallons
Coolant, VCS yellow, concentrated	
Part number: 22567295 Part number: 22567307	1 US gallon 55.47 gallons
Coolant, VCS yellow, ready-mixed	
Part number: 22567314 Part number: 22567340	1 US gallon 55.47 gallons
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses) TAD1640–1672VE TWD1683VE	9.78 gallons
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses + expansion tank). TAD1640–1651GE	8.72 gallons
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses + expansion tank) TWD1643–1683GE	12.68 gallons

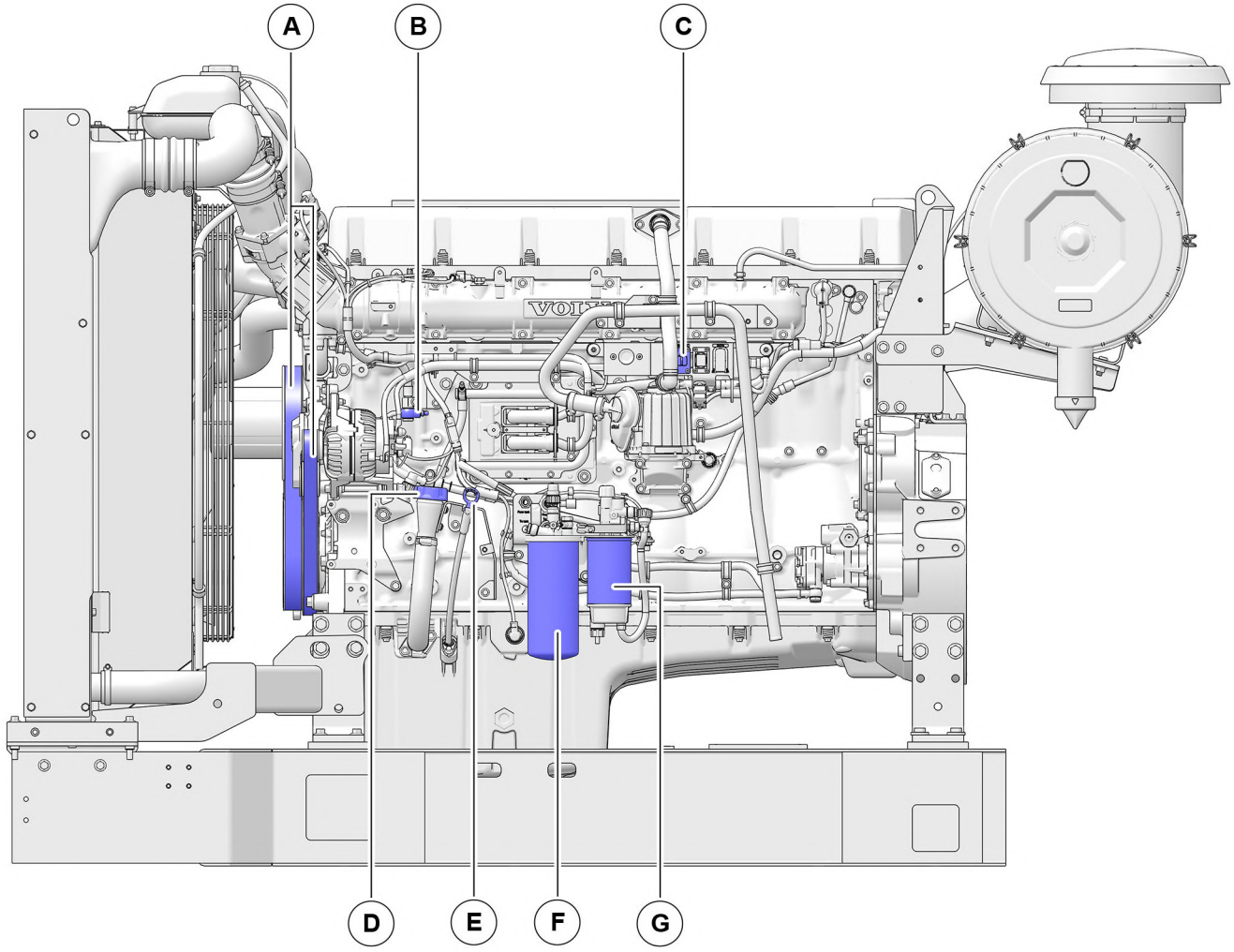
Volumes may differ if the installation has extra coolers/ radiators connected.

NOTICE! Old model engines have green coolant, which must NOT be mixed with newer VCS yellow coolant. Check that the engine is using the same type.

NOTICE! Yellow and red Volvo Penta ATF Dextron III oil may be mixed without causing any problems.

Engine

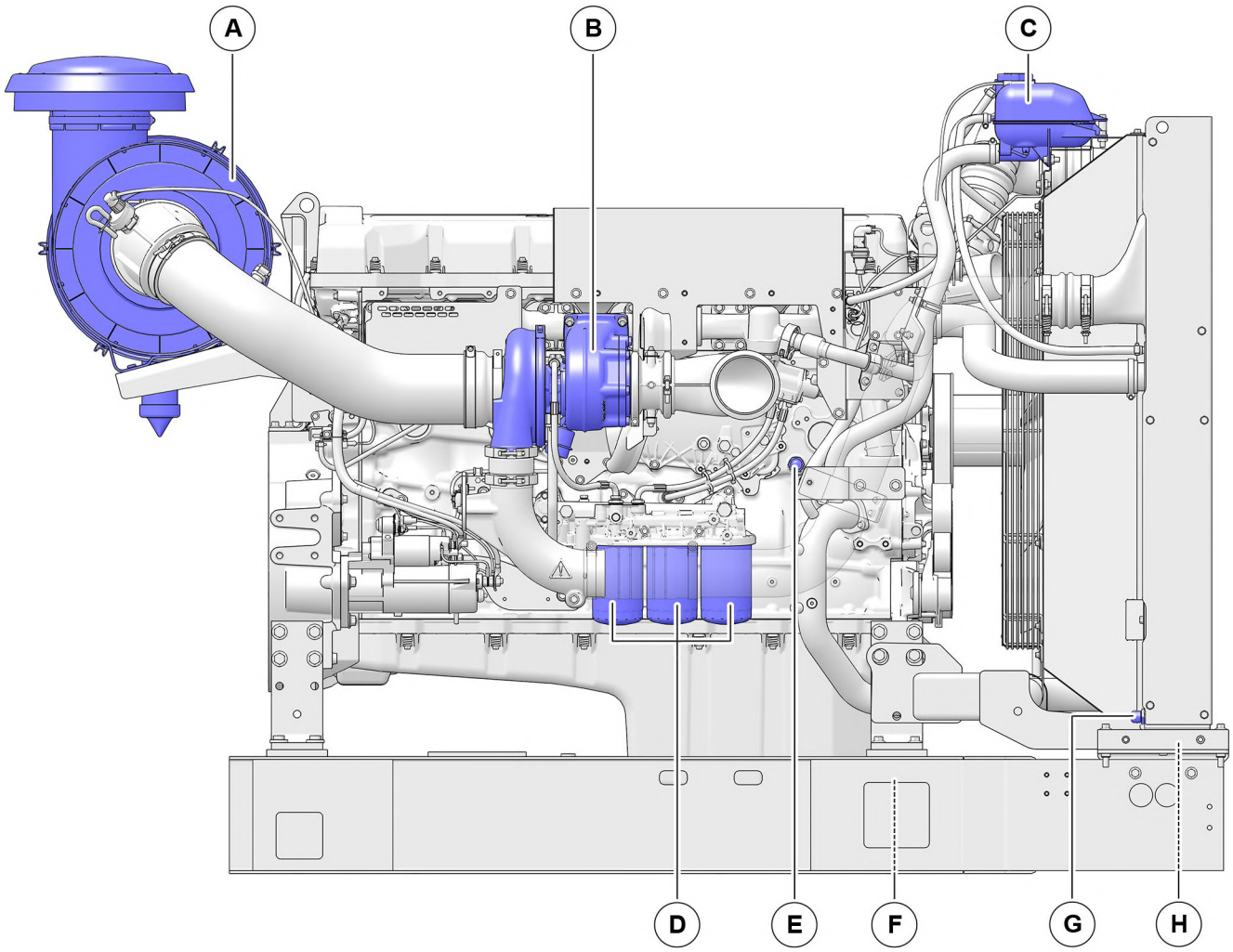
Component location



P0028644

TAD

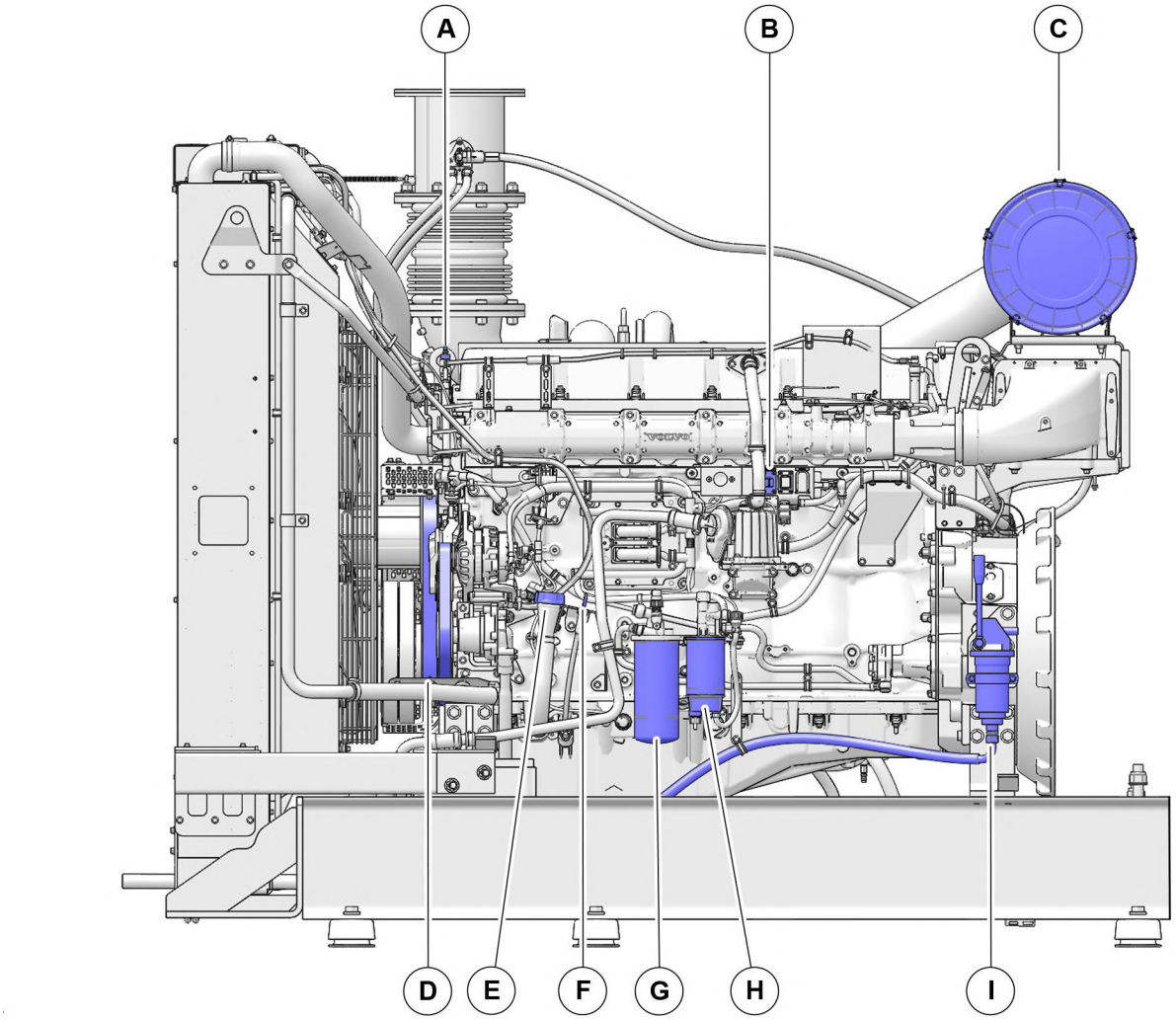
A Drive belts
B Purging, fuel
C Diagnostic connector
D Oil filler
E Oil dipstick
F Fuel filter
G Fuel pre-filter



P0028646

TAD

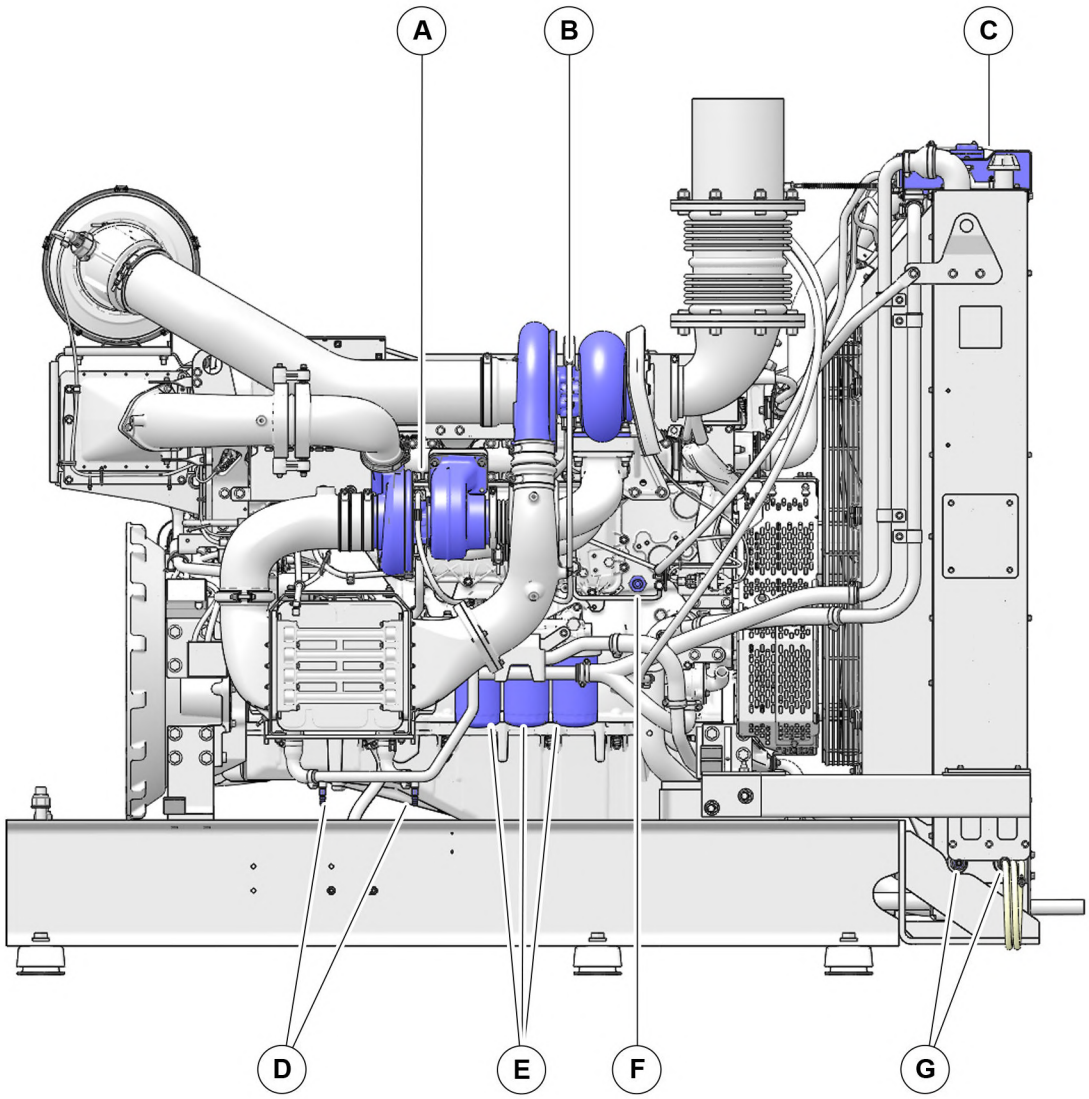
A Air filter
B Turbocharger
C Expansion tank, coolant
D Oil filter
E Engine block drain
F Bottom plug, oil drainage
G HD radiator drain
H Drain, std radiator



P0028645

TWD

A Purging, fuel
B Diagnostic connector
C Air filter
D Drive belts
E Oil filler
F Oil dipstick
G Fuel filter
H Fuel pre-filter
I Oil drain pump



P0028647

TWD

A High pressure turbocharger
B Low pressure turbocharger
C Expansion tank, coolant
D Coolant drain
E Oil filter
F Coolant drain, engine
G Coolant drain, radiator

Maintenance Schedule

The Volvo Penta engine and its equipment are designed for high reliability and long life. The engine is built so as to have minimal environmental impact. These qualities will be retained and unnecessary malfunctions avoided if service is provided according to the maintenance schedule.

Service intervals

Service items can be found in the Service Record available for download at **www.volvopenta.com**.
Search under tab: Manuals.

Extended service intervals

The interval between engine oil changes may be extended in certain circumstances. To determine whether the service interval may be extended, Volvo Penta's conditions for extended service intervals must be met and an oil analysis performed, see *, page 42*.
The Volvo Penta dealer has further information.

Where both operating hours and calendar times are specified, perform the maintenance item at whichever time is the sooner.

General inspection

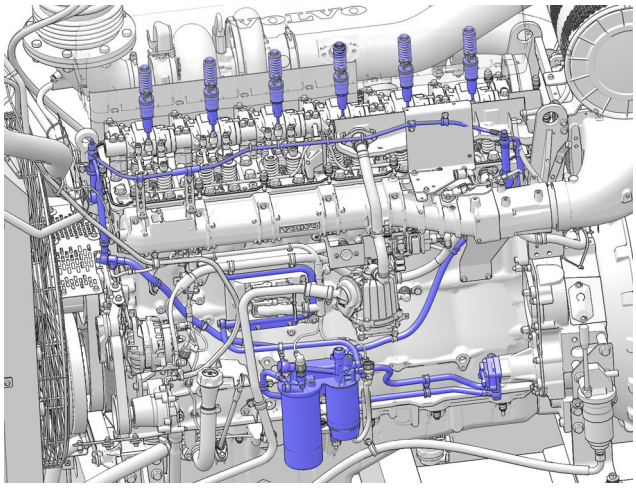
General inspection

Make a habit of visually inspecting the engine and engine compartment before the engine is started and after operation once the engine is stopped. This will help you to discover quickly if anything abnormal has happened, or is about to happen.

This inspection only takes a few minutes, but can prevent serious malfunctions and expensive repairs.

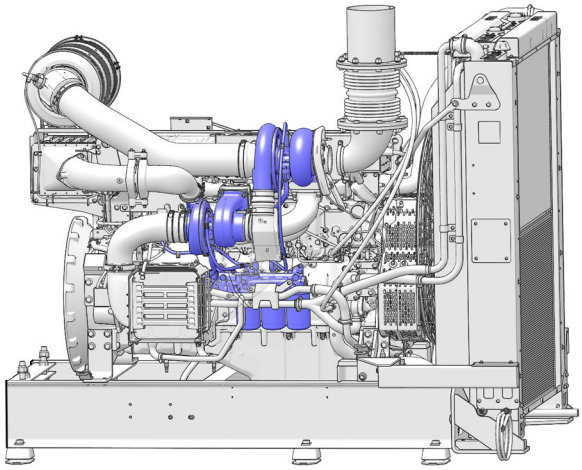
The images are generic and applicable to all engine installations. They show only a selection of components and systems.
The inspection applies to all components in the systems.

Look especially carefully for fuel leakage at:



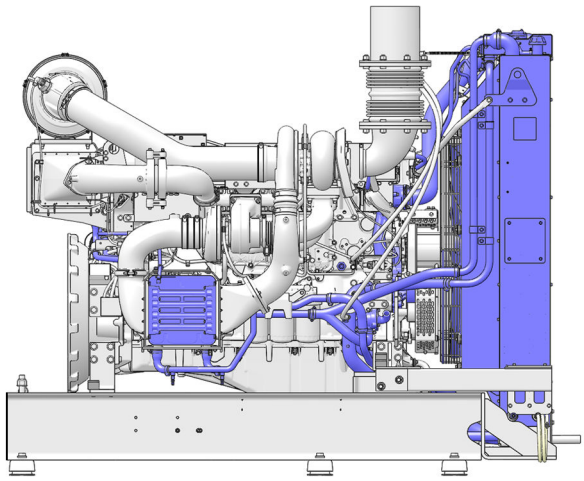
P0028649

- Injector connections
- Fuel sensors
- Check all clamped items
- Fuel filter
- Fuel pipe/hoses
- Fuel pump



P0028650

Oil leaking turbocharger connections, oil pipes/hoses, oil sensors, oil filter and oil sump.
Check all clamped items.



P0028651

Coolant leakage on the coolant pump, expansion tank, coolant cooler, oil cooler, charge air cooler, coolant sensors, coolant hoses.
Check all clamped items.

Also check:

- Drive belts
- Damaged wiring
- Loose wiring
- Loose fasteners
- Exhaust hoses
- Hoses/hose connections to transmissions

⚠ WARNING!

Accumulations of fuel, oil and grease on the engine or in the engine compartment are a fire hazard and must be removed as soon as they are discovered.

⚠ WARNING!

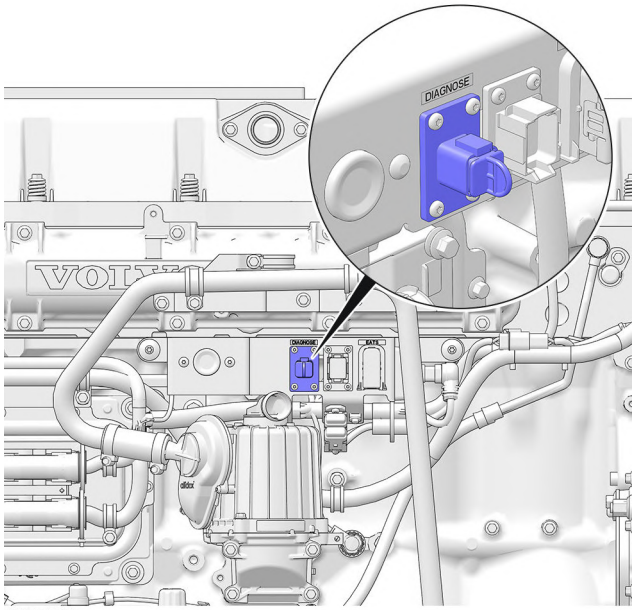
If you discover a leakage of oil, fuel or coolant, investigate the cause and fix the fault before starting the engine to avoid the risk of fire.

General advice for electronic protection

The following advice must be complied with to avoid damage to the engine control unit and other electronics.

IMPORTANT:
Switch off the main switch before connecting or disconnecting a connector.

- Never switch off the current at the main switch when the engine is running.
- Never disconnect a battery cable when the engine is running.
- Switch off the main switches or disconnect the battery cables when fast-charging the batteries.
- **NOTICE!** It is not necessary to switch off the main switches during normal maintenance charging.
- Only batteries may be used as a starting aid. A jump start unit is able to supply very high voltage which may damage the control unit and other electronics.
- Take extreme care so that the harness terminals do not come into contact with oil, water or dirt if a connector is removed from a sensor.



P0024704

The diagnostic connector is located at the side of the engine.

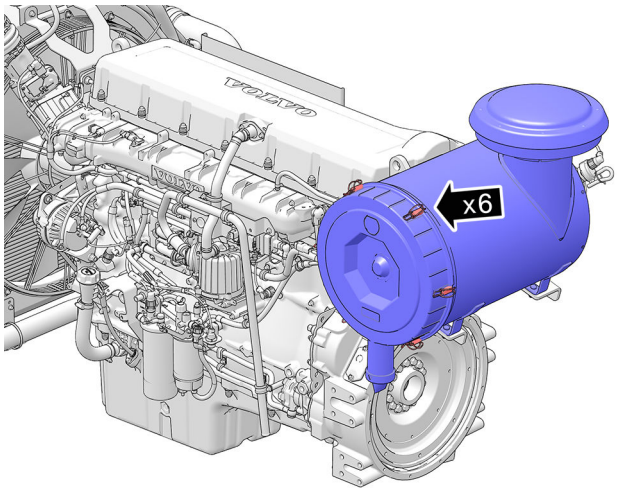
P0024905

Check software status

These readings depend on the type of installation and are carried out using the VODIA diagnostics tool.

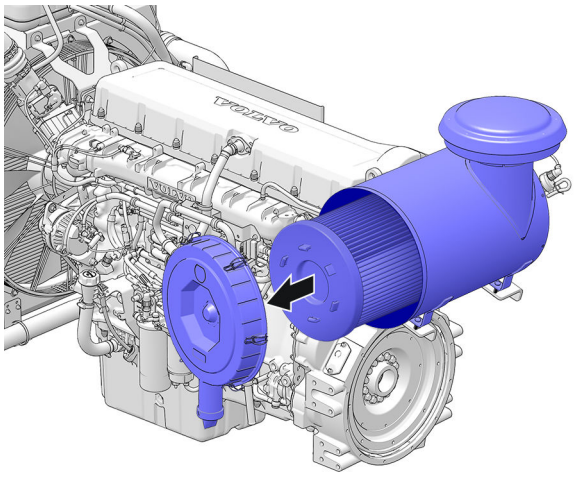
- Reading and resetting parameters.
- Reading and erasing any fault codes (DTC).
- Resetting service intervals (EVC2).

Air Filter



P0024705

The engine air filter is connected to the turbocharger inlet pipe.



P0028664

Replacing the air filter

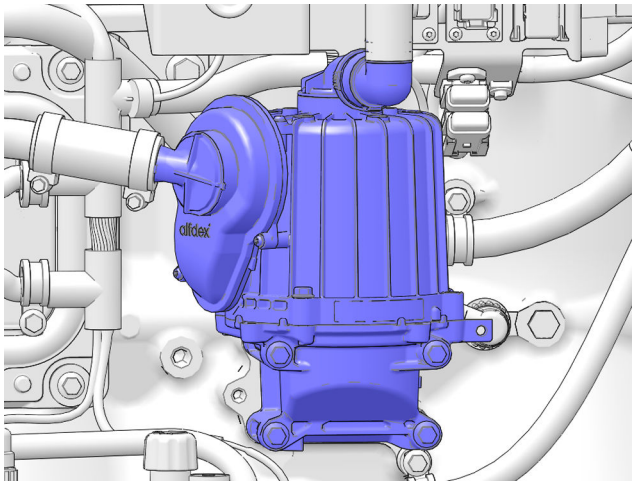
- Open the fasteners and remove the cover.
- Remove the filter by pulling/rocking it straight out.
- Wipe clean around the attachment point.
- Install the new filter.
- Install the cover and close the fasteners.

NOTICE! Scrap the old filter. It is not designed to be cleaned.

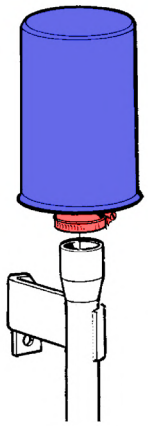
Crankcase ventilation

Crankcase separator

- Requires no service.



P0028665

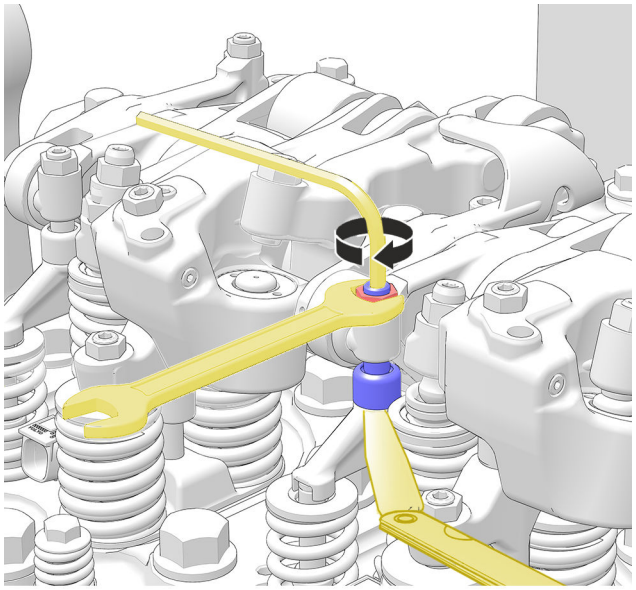


P0026927

Air filter Compressor, filter replace

NOTICE! Universal image - filter types may differ.

- Remove the hose clamp.
- Remove the air filter.
- Install a new filter.
- Tighten the hose clamp.
  Tightening torque: **5 Nm**



P0027051

Valves, Adjustment

Adjusting valve clearance is a task intended for workshop-trained personnel. Refer to the Workshop Manual.

Note the interval in the maintenance schedule for your engine.

Lubrication System

When you work with Chemicals, Fuel and Lubrication Oil, Change

NOTICE! Apply barrier cream to your hands and always use protective gloves for work which involves contact with oil, fuel and similar. Continuous skin contact with engine oil dries the skin and can be hazardous.

Engine Oil, Level Check

NOTICE! It is very important that engine oil be kept at a suitable level for correct engine lubrication.

A high oil level leads to increased oil consumption and may cause clogging of the silencer and/or the closed crankcase ventilation.

A low oil level may lead to seizing pistons, engine wear and engine overheating.

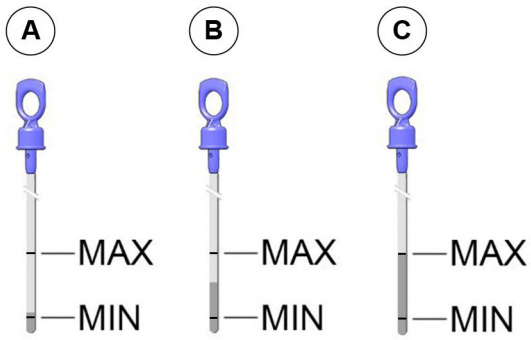
Oil level check, hot engine.

- Make sure the engine is level.
- Stop the engine; wait a at least 15 minutes and then measure the level.

Oil level check, cold engine. (recommended)

- Make sure the engine is level.
- Oil level measurement is most reliable before the engine is started

Check that the oil level is between the dipstick's min and max markings.



P0028585

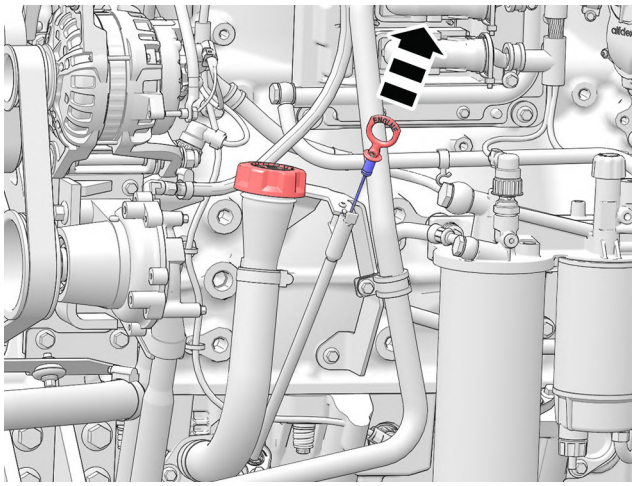
A Oil level on the MIN marking: add oil until the level is between min and max.

B **Optimal oil level**, do **NOT** add oil.

C Oil level at max marking; do **NOT** add oil.

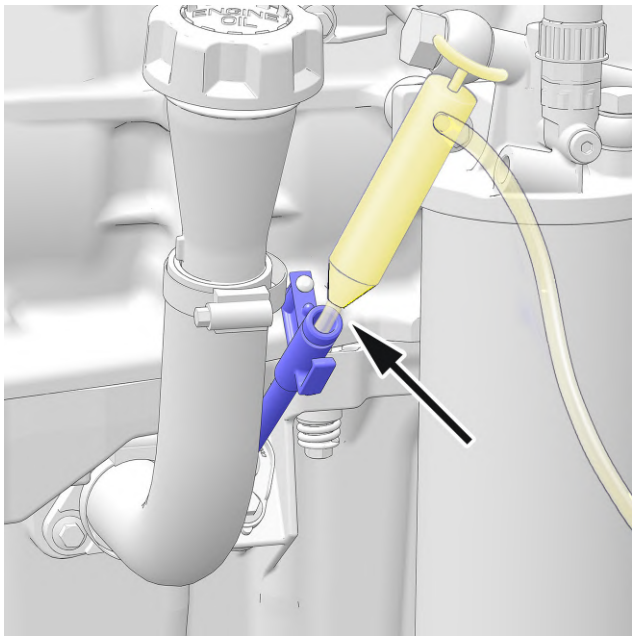
NOTICE! Never add too much engine oil.

Engine oil, Replace



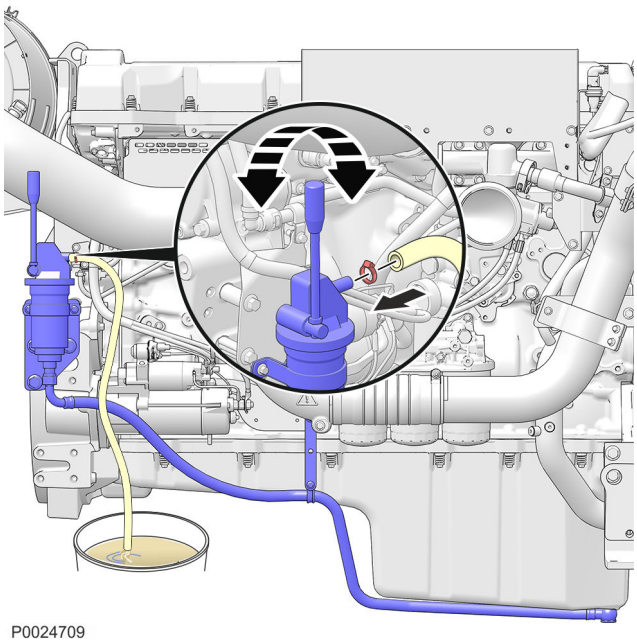
P0028666

Change the engine oil and filter within the recommended service intervals.



P0026944

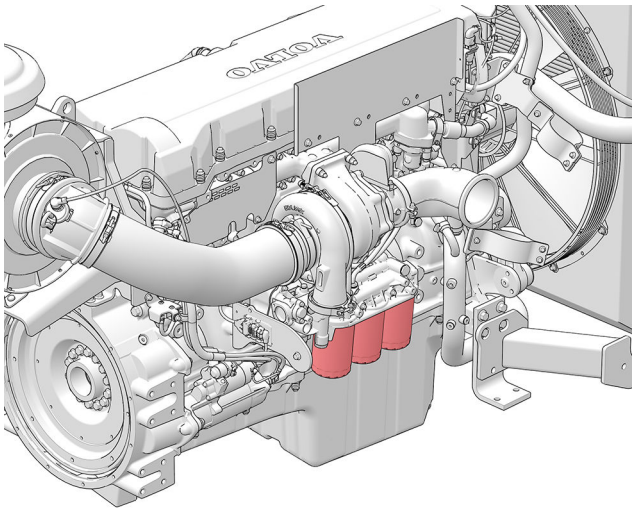
Drain the engine oil by connecting a pump to the oil dipstick hole and drawing out the oil.



P0024709

Alternatively, permanently connect a hand pump to the bottom plug (recommended).

NOTICE! If the engine oil is hot, it will drain out faster.

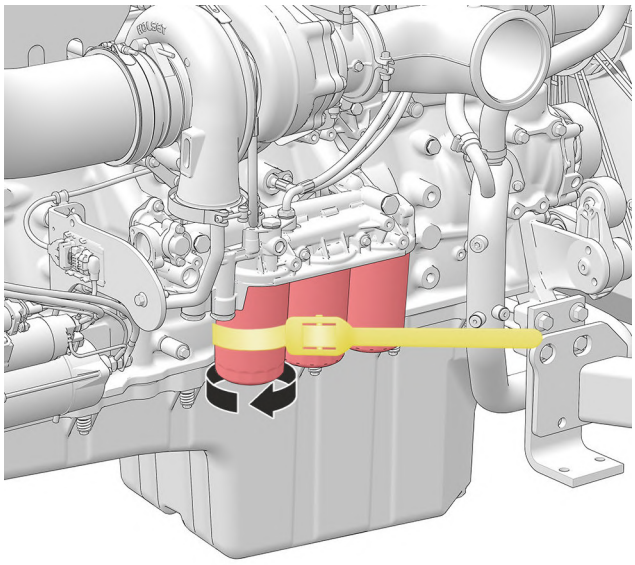


P0027053

Oil filter, Replace

We strongly recommend that only oil filters approved by Volvo Penta are used.
An incorrect type of oil filter can lead to increased wear and damage, for example to bearings and crankshaft.

Removal



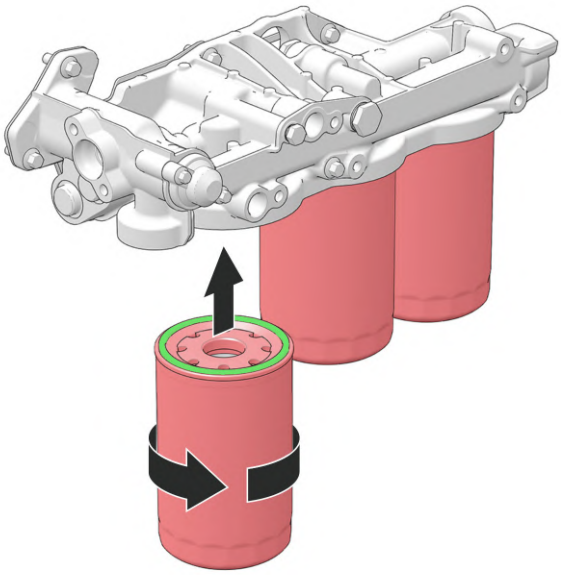
P0027054

- Remove the oil filters with a universal puller.
- Clean around the filter attachment on the filter housing.

P0028667

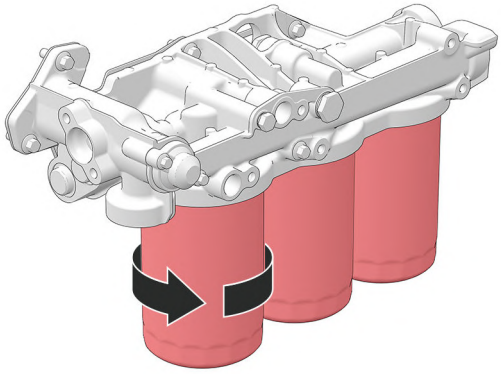
Installation

- Lubricate the new O-ring with engine oil before installing.



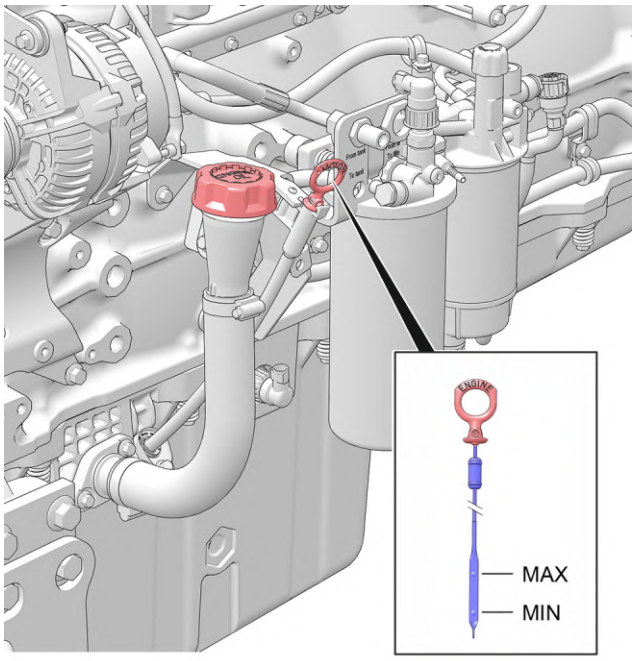
P0028668

- Fit the new filters.



P0027029

- Tighten according to the instructions on the filters.

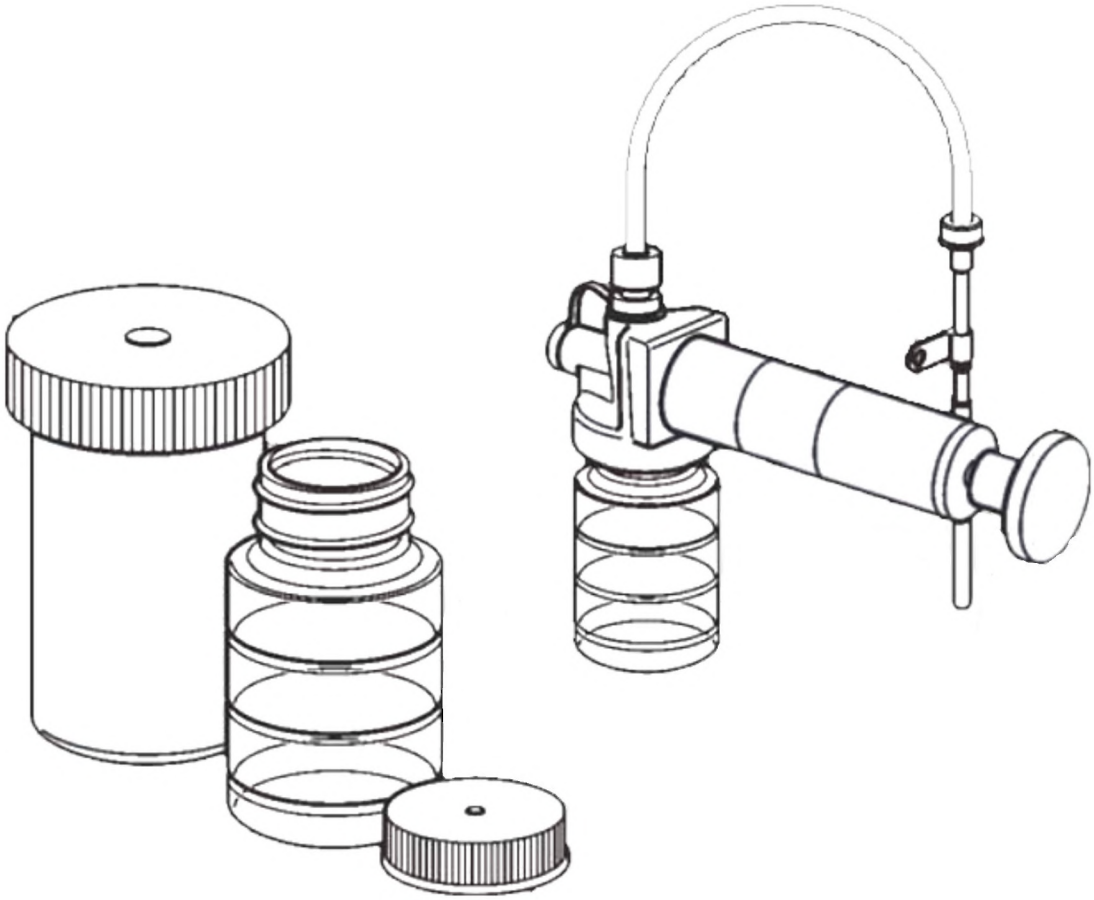


P0027056

- Fill with the required amount of oil; refer to *Specifications, page 22*.
- Start the engine.
- Check that no leakage occurs.
- Stop the engine and check the oil level after a few minutes.
- Top up as necessary.

Volvo Penta oil analysis

Volvo Penta oil analysis provides an extensive diagnostic check on the condition of the driveline. The oil analysis provides information for example on water content, fuel content, dirt and the amount of metallic particles in the oil as a result of component wear.
Thanks to early warning signs given by oil analysis, preventive maintenance and component replacement can be planned, so that unplanned shutdowns can be avoided.
Some engines allow the oil change intervals to be extended. There are two different service schedules available for these engines. Refer to the Volvo Penta Product Center
In order to find out more about Volvo Penta Oil Analysis, we recommend our on-line training.



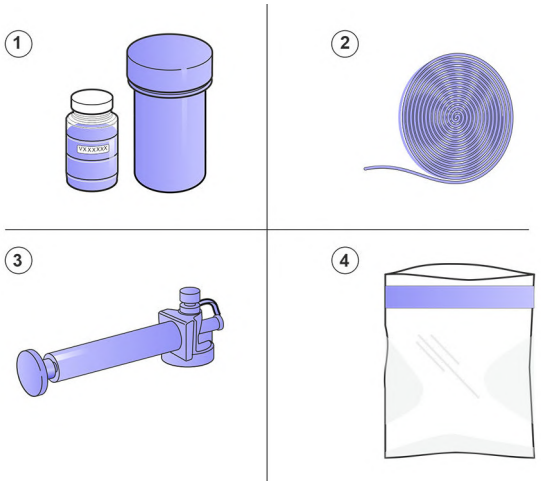
P0035460

P0024907

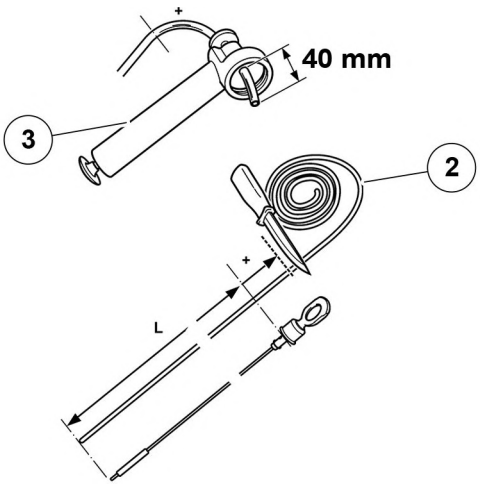
IMPORTANT:

This kit and its accompanying instructions have been developed for Volvo Penta's service workshops, boat builders, machine manufacturers and other authorized workshops that have staff with qualified professional training. The assembly instructions are intended for professionals only and are not intended for use by laypeople. Volvo Penta assumes no liability whatsoever for damage to materials or persons that may occur if the assembly instructions are not followed or if the work is carried out by non-professionally trained personnel.

Figure 1

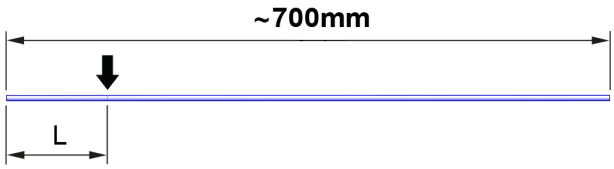


P0035441



P0035462

Figure 2

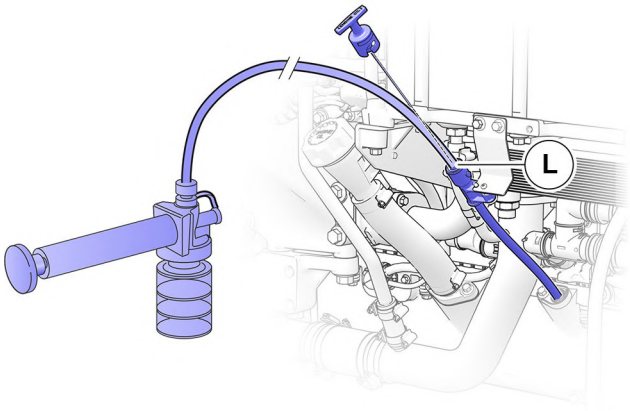


P0035463

Engine	Length (L)
D5, D8, D11, D13, D16	280 mm (11 in)

Figure 3

D5, D8, D11, D13, D16



P0035464

Read the instructions before starting work. Check that all parts are included in the package. Illustrations can be used for several different instructions. Therefore, objects in illustrations may differ from the installation in progress. However, the main information is correct.

Designation	Quantity	Figure	Position
Oil sampling bottle and postage packaging	5	1	1
Hose, reel, 100 m (328 ft)	1	1	2
Vacuum pump	1	1	3
Plastic bag	1	1	4
Not included in the kit intended for the U.S.			
Installation instructions	1		

General

Regular oil analyses provide improved insight into engine health.
Test reports are available on the Volvo Penta Partner Network within 48 hours of receiving the sample at the test laboratory.
To obtain permission to access the report page, please contact Volvo Penta's sales office in each country.

NOTICE! The oil analysis is carried out to give recommendations. It can never replace service according to the maintenance schedule.

Sampling instructions

1 Start the engine and run until it reaches normal operating temperature.

2 Stop the engine and wait 15 minutes before taking the oil sample.

3 Cut off a suitable length of hose.
Use the oil dipstick as measurement of length (L). Mark the dipstick length on the hose. The length (+) is needed to connect the hose to the pump. See figure 2
IMPORTANT!
Before cutting the hose, make sure that it fits in the tube of the dipstick.

4 Fit the hose into the upper part of the vacuum pump. Let the hose protrude approximately 40 mm (1.6").

5 Attach the sampling bottle to the pump.

6 Insert the sampling hose into the dipstick tube.
Locate the length marking (L) on the hose.
Take the sample halfway between the oil surface and the bottom of the oil sump.

7 Pump up oil to flush the pipe.
Release the O-ring to break the vacuum and stop the oil flow.
Remove the sampling bottle and empty it. Ensure that the oil is collected in an environmentally friendly way.

8 Attach the sampling bottle to the pump and take an oil sample.
Fill the bottle to 80%. Remove the bottle and attach the cap immediately.

9 Send to the laboratory chosen by Volvo Penta to get your oil analysis report.

Clean the pump

- • Cut off the hose above the pump and pull the hose out of the pump from the opposite side to keep the pump free of oil.
- Wipe the pump with a lint-free cloth or paper.
  Apply a thin layer of silicone grease to both O-rings.
  If necessary, use compressed air for cleaning.
- Assemble the vacuum pump and test its operation.

IMPORTANT:

Do not clean the pump with diesel, gasoline or detergents.

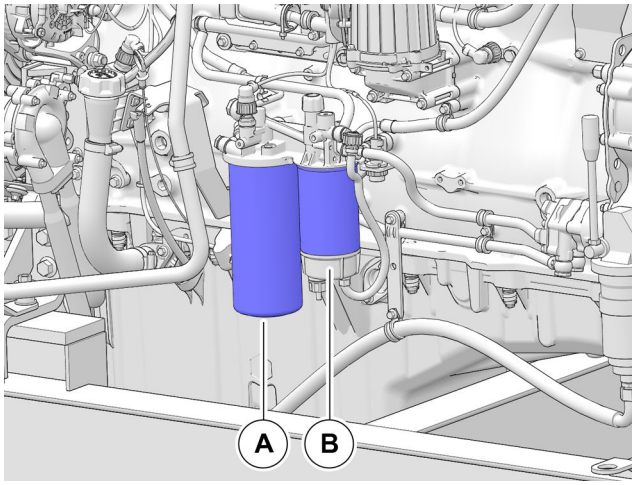
Additional orders through the spare parts system:

- Part number 21616535 (A kit that contains: Sampling bottles, vacuum pump, plastic hose, plastic tool bag and instructions).

  NOTICE! The plastic tool bag is not included in the version of the kit intended for the United States.
- Part number 21616560 (Hose reel, 100 meters, 328 feet).

NOTICE! See VPPN/Services/Volvo Penta oil analysis for oil wear limits.

Fuel System



P0028669

General

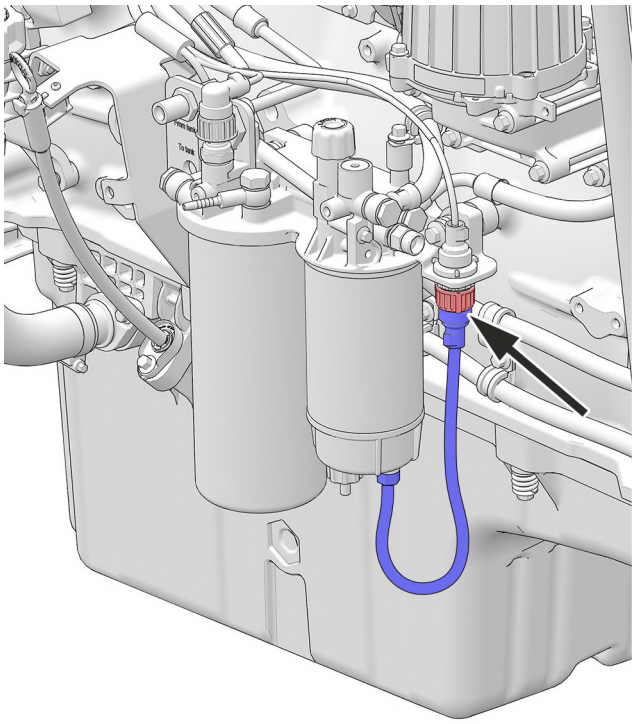
The fuel system has a fine filter (A) and a pre-filter (B).

Fuel Pre-filter, Replace

⚠ CAUTION!
Risk of skin damage.

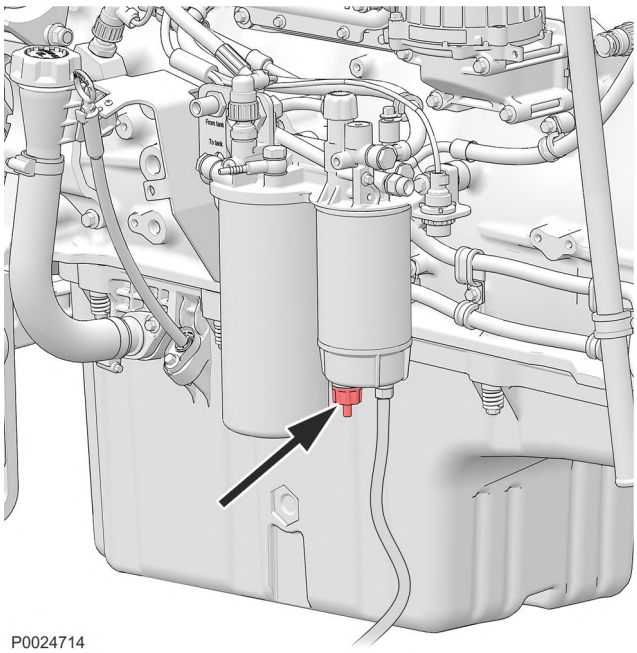
NOTICE! Be prepared to gather up fluid.

Removal



P0027058

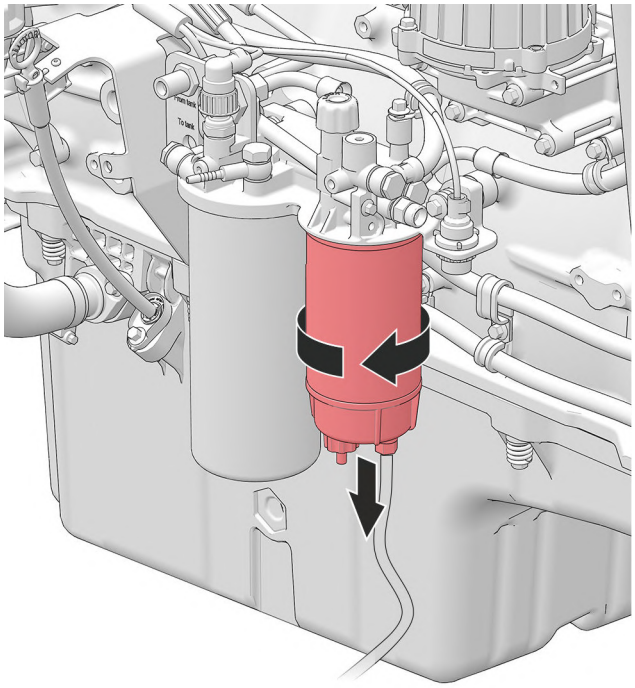
- Remove the water separator sensor connector.



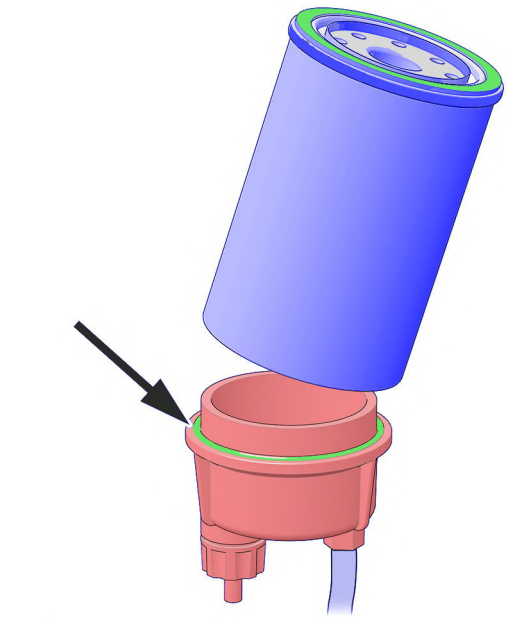
P0024714

P0024714

- Undo the drain nipple in the base of the water separator. Drain the filter.
- Reinstall the drain nipple and tighten securely.



- Remove the pre-filter together with the lower section of the water separator. Use a universal puller for the oil filter.



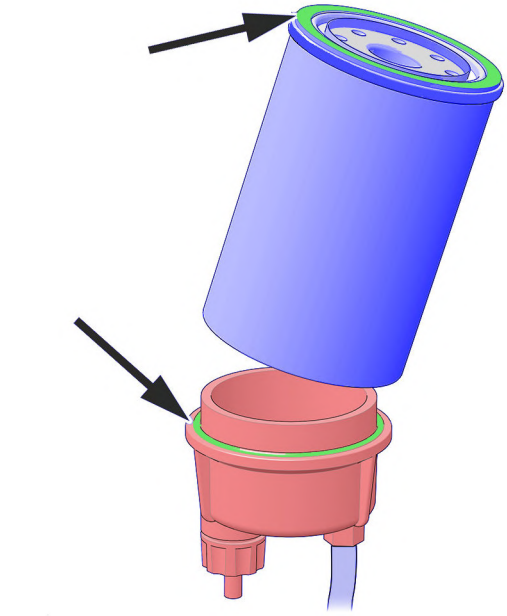
P0028697

- Remove the lower section of the water separator and O-ring from the filter.

P0025046

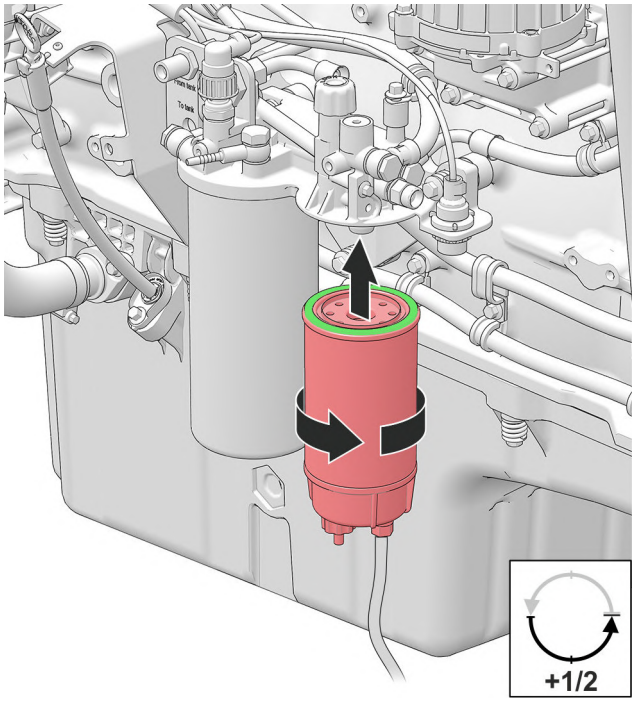
- Clean the lower section of the water separator and the contact surfaces. Check that the strainer and drain hole in the lower section are not clogged.

Installation



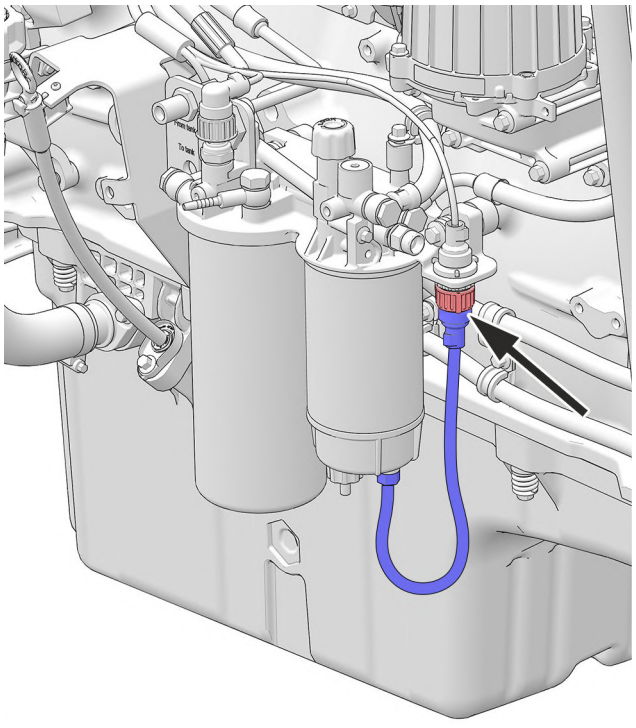
P0028670

- Install a new O-ring. Lubricate the seal with diesel.
- Install the lower part of the water separator.



P0028671

- Lubricate the sealing surface with diesel and screw the new filter onto the filter bracket by hand until the seal touches the sealing surface.
- Then tighten a further 1/2 turn.



P0027058

- Connect the connector.
- Open the fuel tap and vent the fuel pre-filter; refer to *Fuel system, bleeding, page 53*.
- Check for leakage.

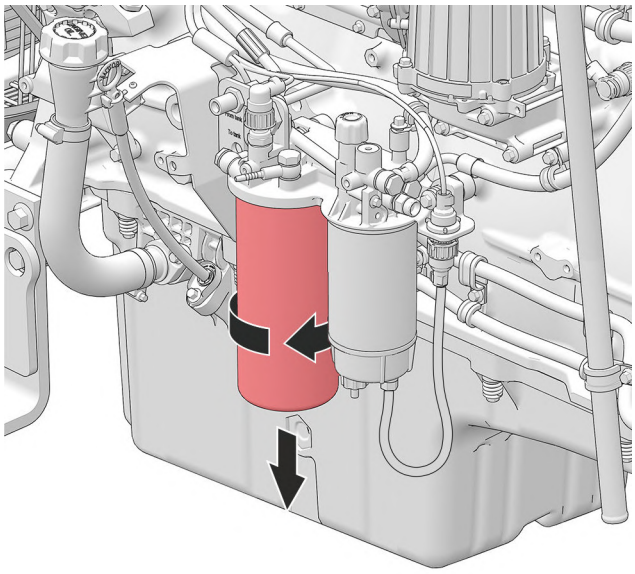
Fuel filter, Change

IMPORTANT!

Protect against dirt while work is in progress.

NOTICE! Be prepared to gather up fluid.

Removal

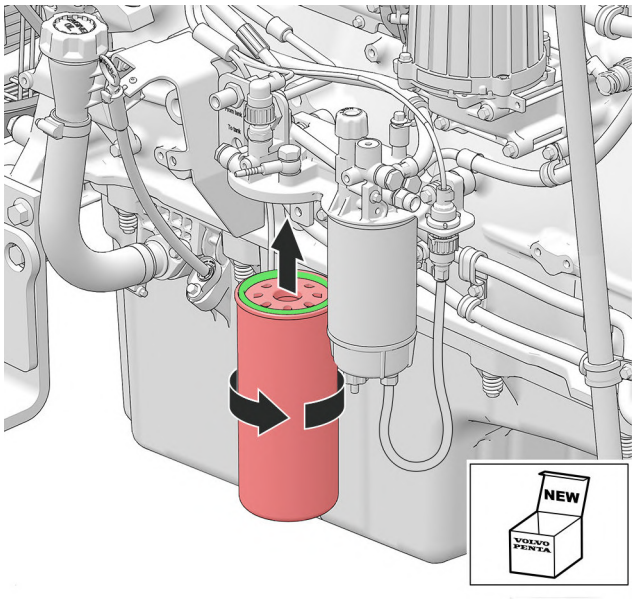


P0027061

- Remove the fuel filter with the aid of a suitable filter puller. Let the fuel drip off into a collection vessel.
- Clean around the filter housing sealing surface.

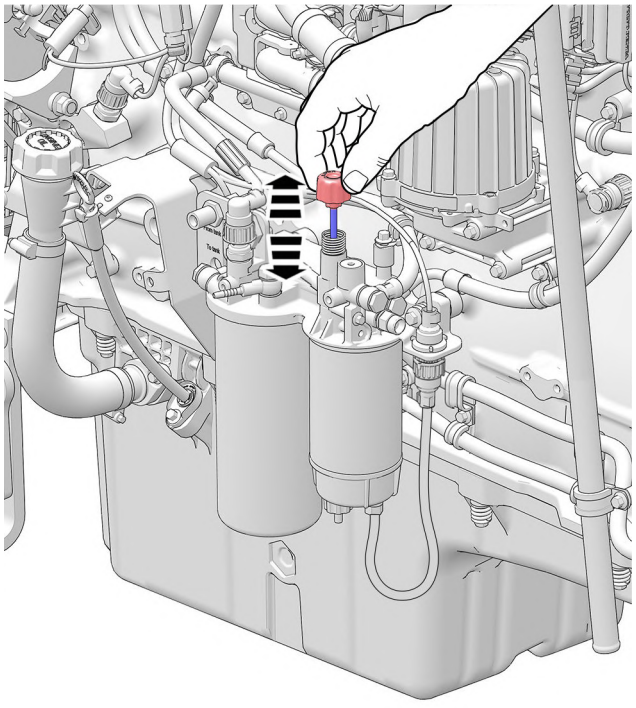
Installation

NOTICE! Do not fill the new filter with fuel before installation; there is a risk that contamination may cause malfunctions.



P0028672

- Lubricate the sealing surface with diesel and install the new fuel filter. Tighten according to the instructions on the filter.



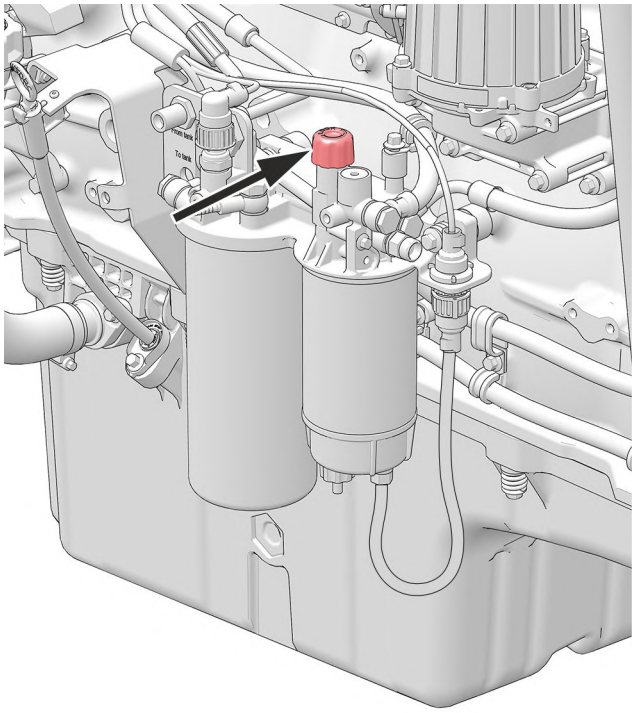
P0027063

- Purge by hand using the pump on top of the bracket as described in *Fuel system, bleeding, page 53*.
- Start the engine and check for leaks.

Fuel system, bleeding

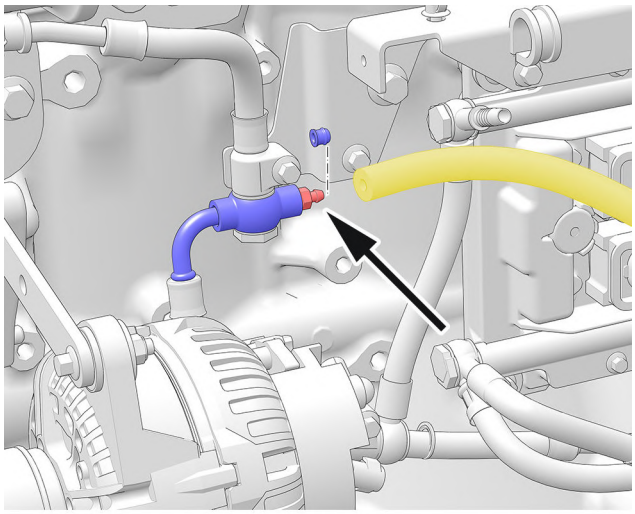
⚠ CAUTION!
Never disconnect a fuel line or component after the fuel pump to bleed. The fuel is under very high pressure and can penetrate the skin.

NOTICE! Check that there is sufficient fuel in the tank, and that any fuel taps are open.



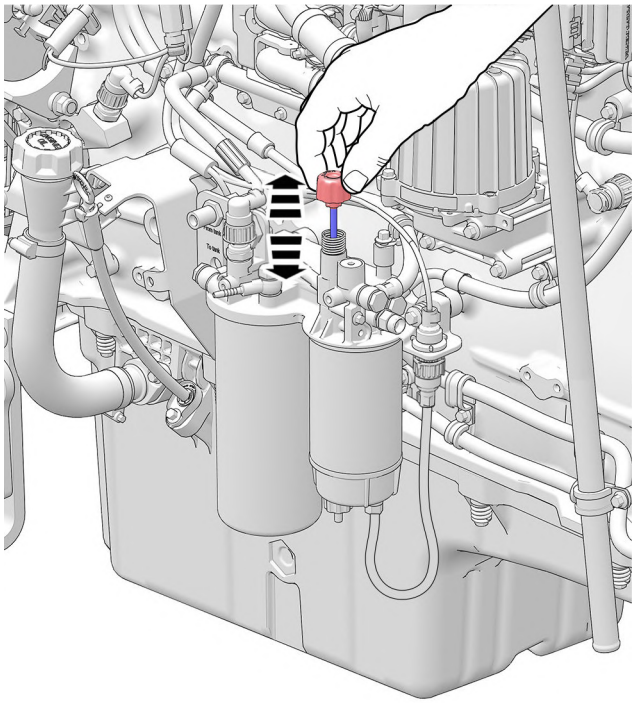
P0027065

- Free the hand pump from the fuel filter bracket.



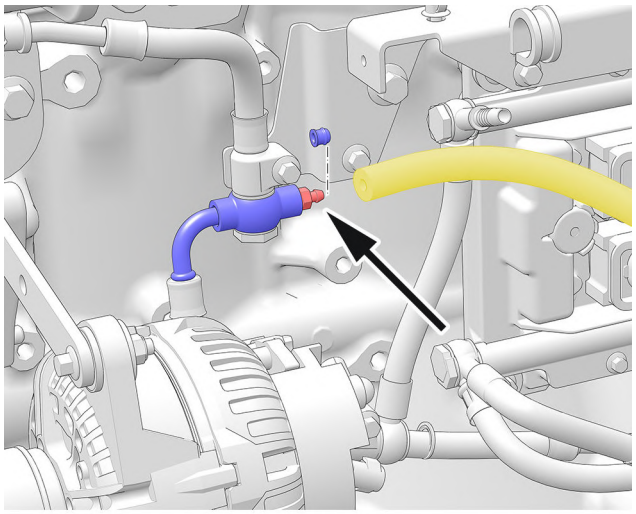
P0027066

- Open the bleed nipple and attach a hose.
- Connect a hose and a bottle/receptacle to the other end of the hose to collect fuel during bleeding.



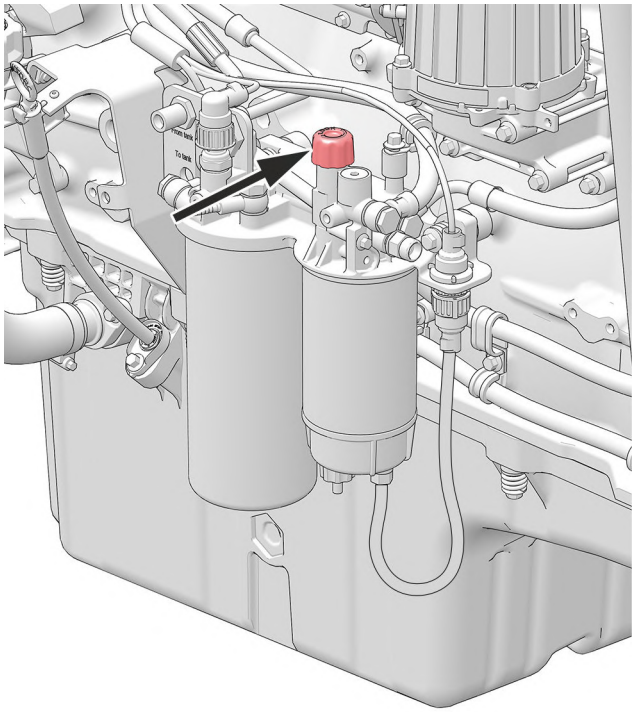
P0027063

- Purge the fuel system by pumping with the hand pump until fuel flows without air bubbles.



P0027066

- Close the nipple.
  Tightening torque: **3.5 Nm**
- Remove the hose and fit the protective rubber cover.



P0027065

- Tighten the fuel pump handle.
- Wipe dry any spilled fuel.
- Start the engine and let it idle.
- Check that no leakage occurs.

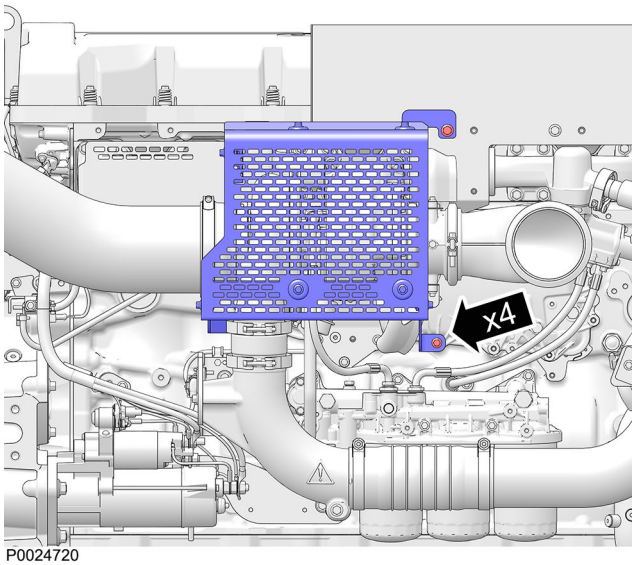
Exhaust System

Turbocharger, Inspection

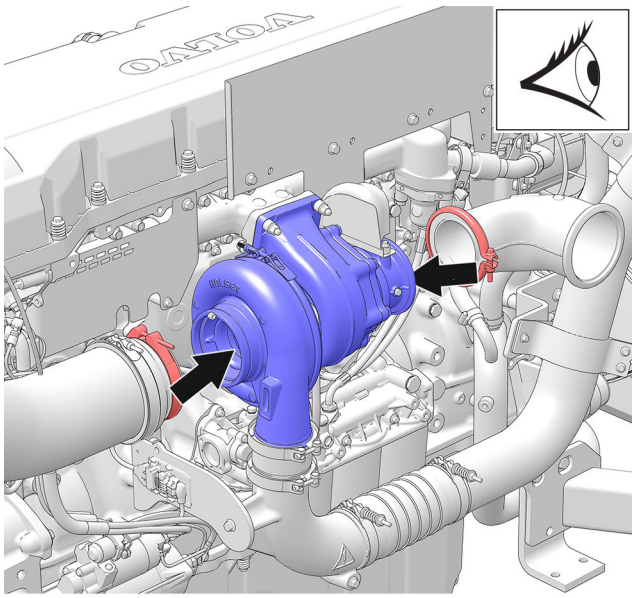
TAD

Inspecting the turbocharger and charge air pipe

- Remove the protective grille.



P0024720



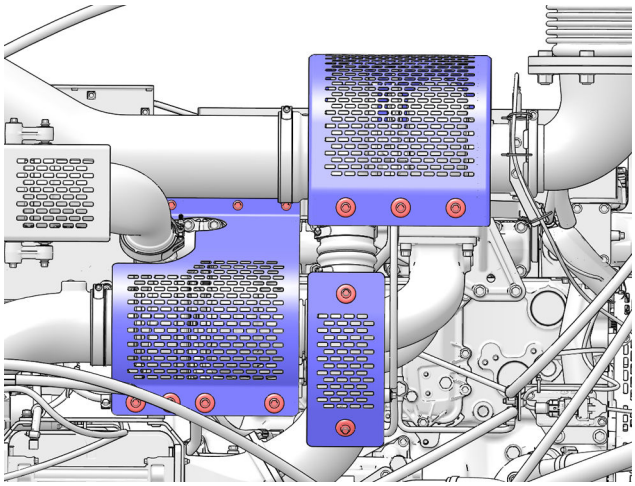
P0028673

- Remove the inlet pipe from the turbo.
- Remove the exhaust pipe from the turbocharger.
- Check the turbocharger with regard to damage to the compressor and turbine wheels.
- In the case of damage, replace the turbocharger in its entirety.

NOTICE! We recommend that turbocharger replacement be carried out by a Volvo Penta workshop.

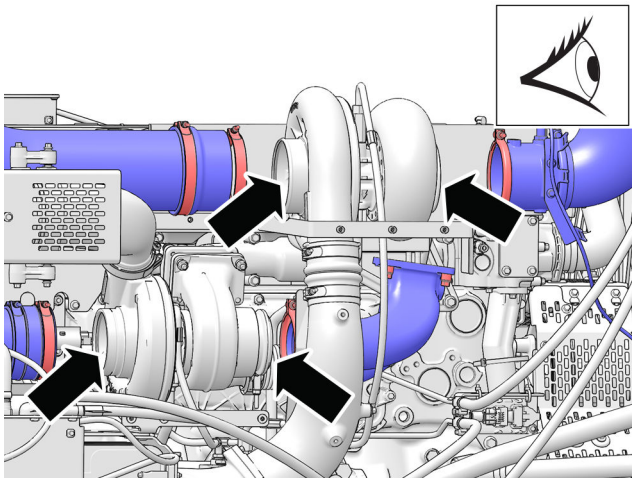
TWD

Inspecting the turbocharger and charge air pipe



P0028674

- Remove the protective grille.

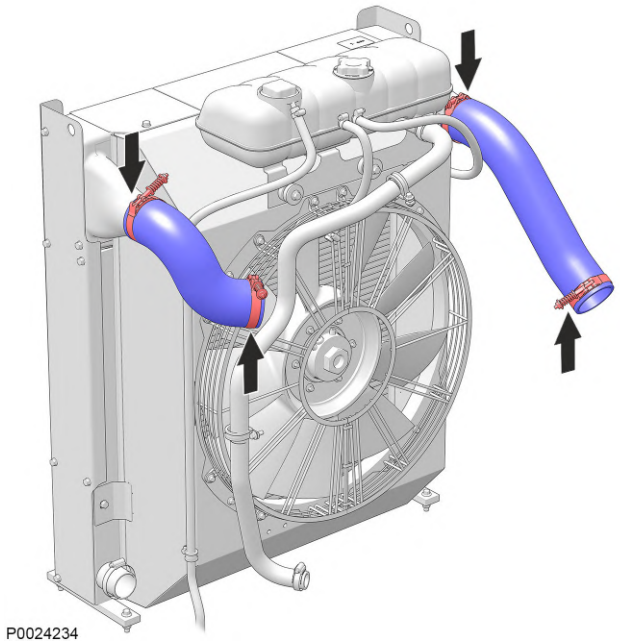


P0028675

- Remove the inlet pipe from the turbo.
- Remove the exhaust pipe from the turbocharger.
- Check the turbocharger with regard to damage to the compressor and turbine wheels.
- In the case of damage, replace the turbocharger in its entirety.

NOTICE! We recommend that turbocharger replacement be carried out by a Volvo Penta workshop.

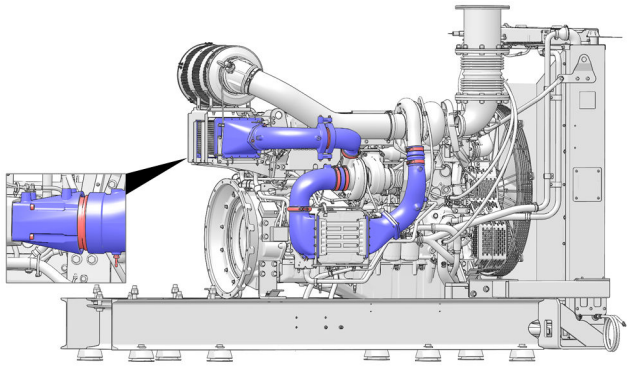
Charge Air Pipe, Leakage Check



P0024234

TAD

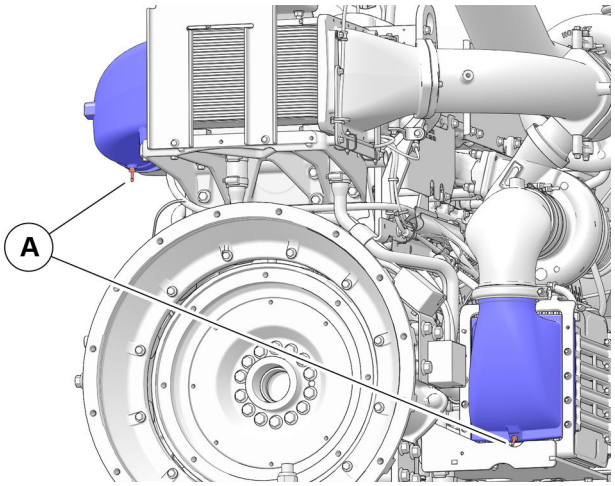
Inspect the charge air hose connections, hoses and clamps with regard to cracks, leakage and other damage. Replace as necessary.



P0028676

TWD

Inspect the charge air hose connections, hoses and clamps with regard to cracks, leakage and other damage. Replace as necessary.



P0028677

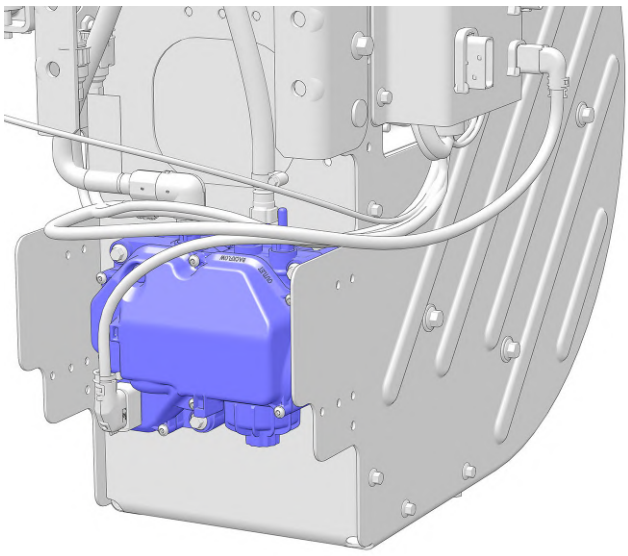
Draining condensation water

Check that it is possible to drain the condensate through the nipples (A).

SCR System

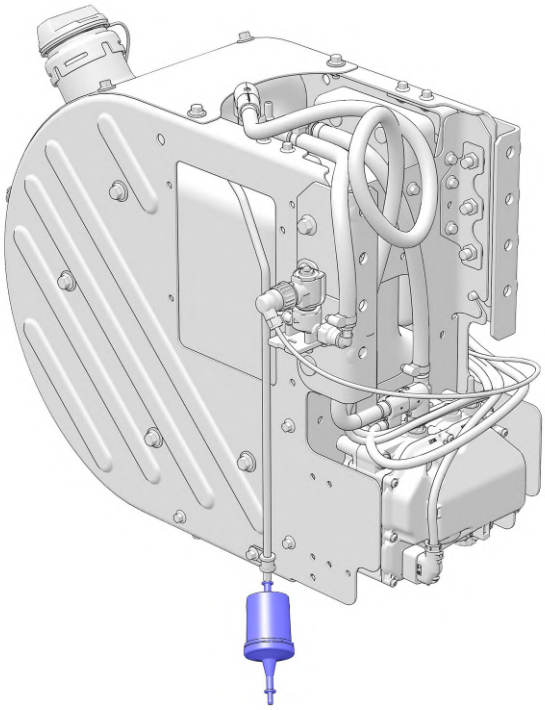
Engines with SCR have filters that must be replaced. Check the replacement intervals in the service schedule for your engine.

NOTICE! Illustrative images of components. Installations may differ between models.



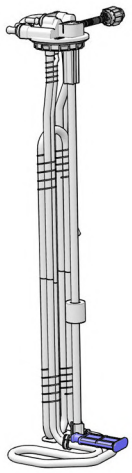
P0029170

- The pump unit filter.



P0029171

- Filter for air to the AdBlue/DEF tank.

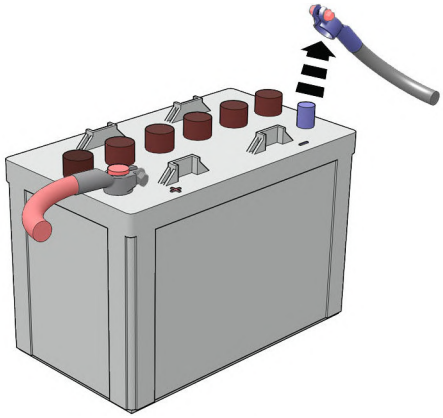


P0035090

- Filter for combined tank unit

NOTICE! Different variants of combined tank units and filters may occur.

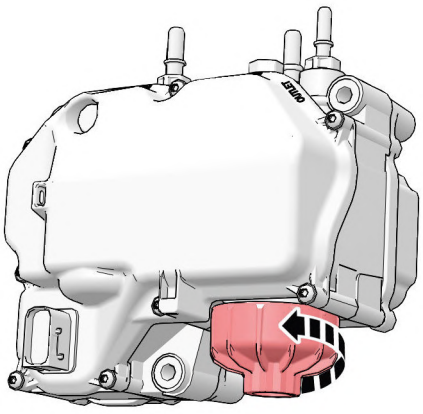
Replacing the filter for the AdBlue/DEF pump



P0026516

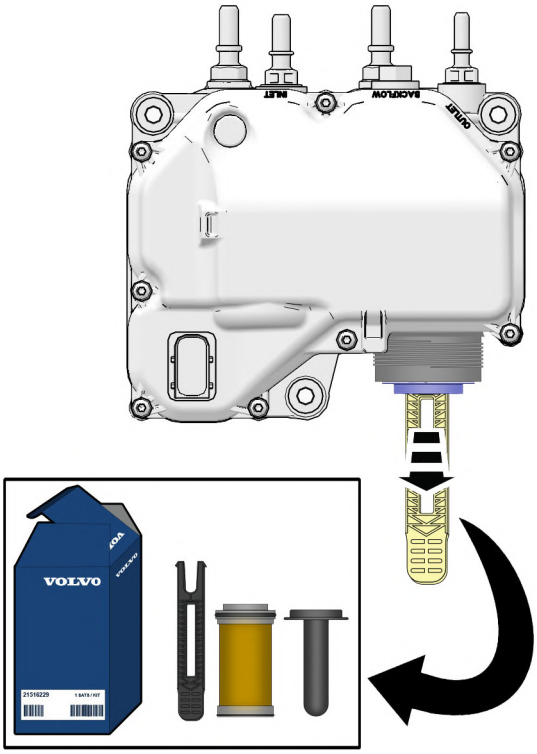
NOTICE! Maintain a high level of cleanliness when working with the SCR system. Wipe clean around covers and connections before beginning work. Make sure the filter and gaskets do not come into contact with dirty surfaces before installation.

- Switch off the engine. Wait until the pump unit has stopped as it always performs a hose emptying sequence.
- Disconnect the battery's minus pole.
- Place a collection vessel under the filter cover.



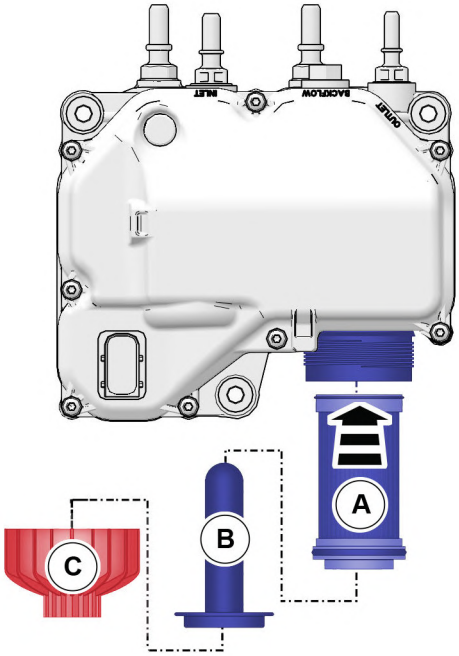
P0026517

- Loosen the filter cover.



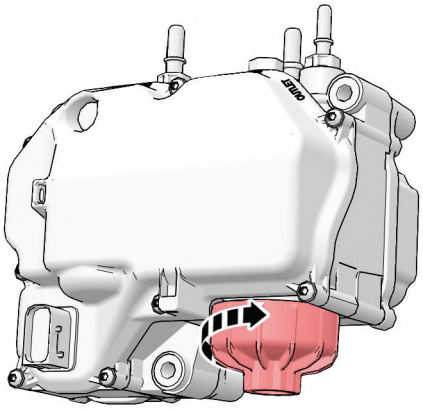
P0019390

- Use a puller (supplied with the filter kit) to pull out the filter by pressing it into the filter hole until it clicks.
- Pull out the filter.



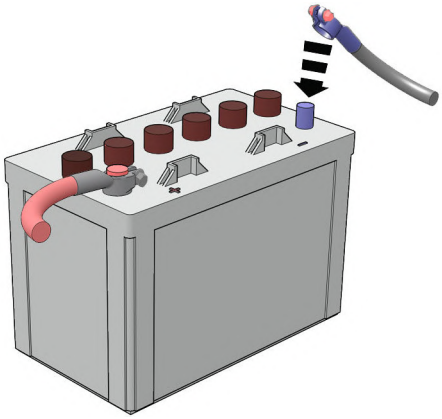
P0028678

- Install the new filter (A).
  Install the rubber gasket (B).
  Screw the filter cover (C) back on.



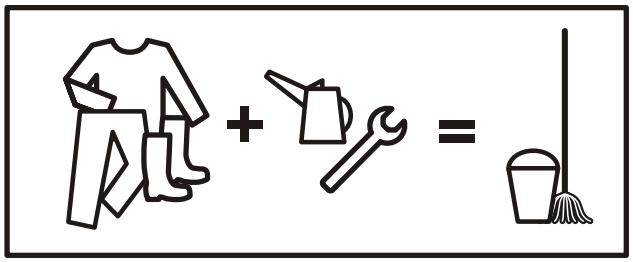
P0026519

- Tighten the cover.
  Tightening torque: **20 +5 Nm**



P0026520

- Re-connect the battery negative terminal.
- Start the engine. Check operation and inspect for leaks.
- Delete any fault codes.



p0013225

NOTICE! Take appropriate care of equipment and surplus AdBlue/DEF solution.

Nox-sensor Pre/Post SCR

When fault tracing or replacing components in the aftertreatment system, refer to the EATS System workshop manual.

Cooling System

Coolant Level, Checking and Topping Up

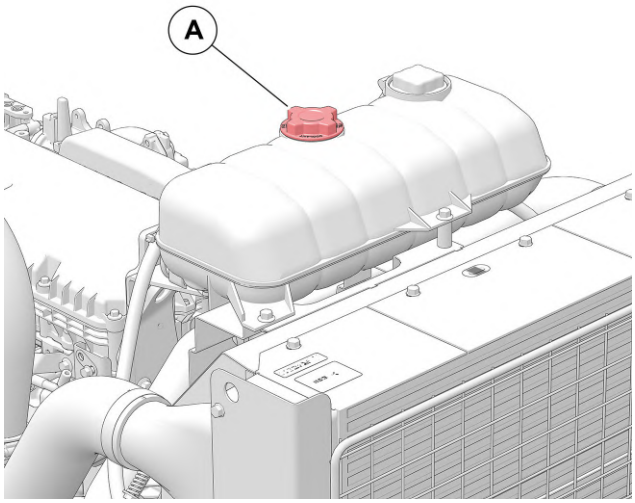
The engine's internal cooling system makes sure the engine works at the right temperature. It is a closed system that must always be filled with a mixture of concentrated coolant and water in order to protect the engine against internal corrosion, cavitation and bursting due to freezing.

NOTICE! Different kinds of coolant may not be mixed.

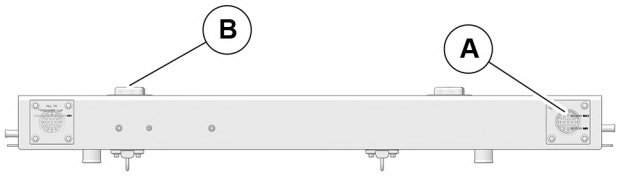
⚠ WARNING!
Do not open the coolant filler cap when the engine is hot. Steam or hot fluid could spray out, causing severe burns.

TAD

- Check the coolant level in the expansion tank.
- Top up with coolant as required (A), so that the level is between the MIN and MAX marks.



P0028679



P0040782

TWD

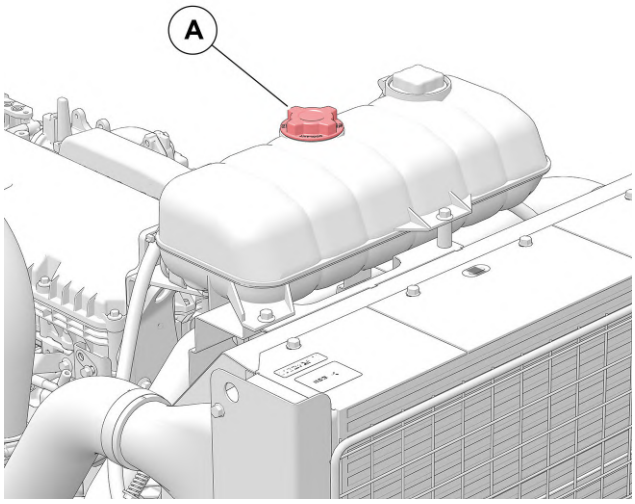
- Check the coolant level in the expansion tank.
- Add coolant if necessary (A)

NOTICE! For TWD engines with belt-driven pump on the charge air circuit.

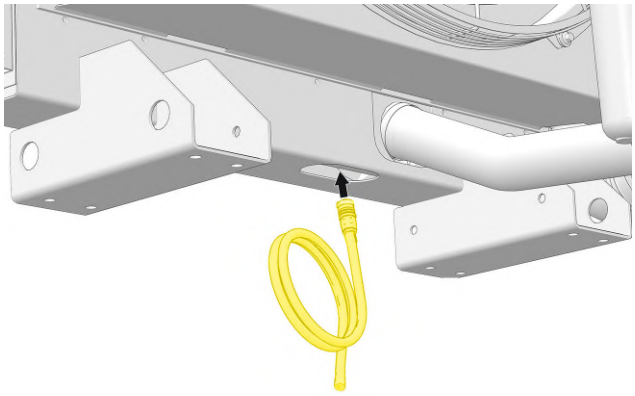
Engine cooling circuit
Fill with coolant to the MAX sign on the measuring glass
Charge air cooler cooling circuit
B. Fill with coolant all the way up to the pressure cap

Replacing coolant

- Open the filler cap (A).

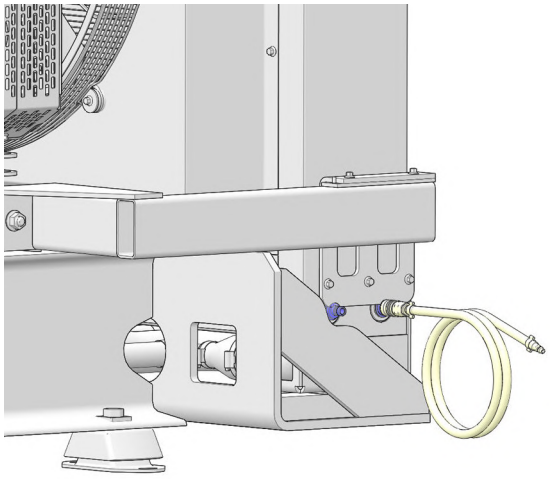


P0028681



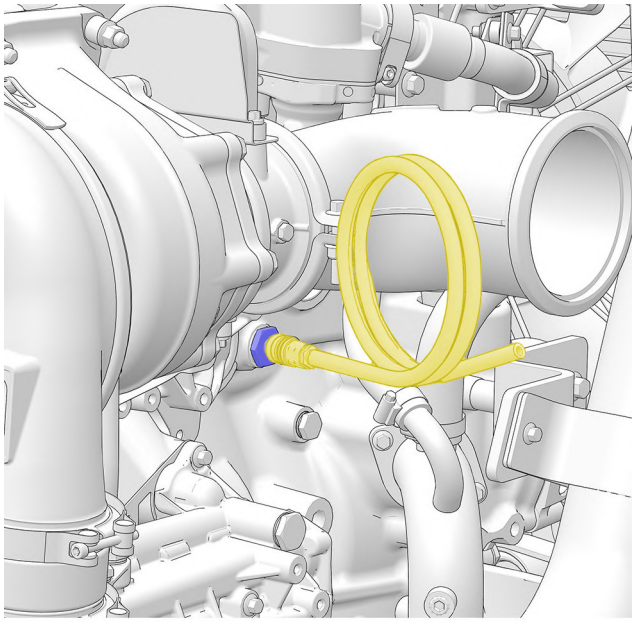
P0026914

- **TAD:** Connect a drain hose and drain the coolant out of the radiator.



P0028682

- **TWD:** Connect a drain hose and drain the coolant from the radiators (2 systems).

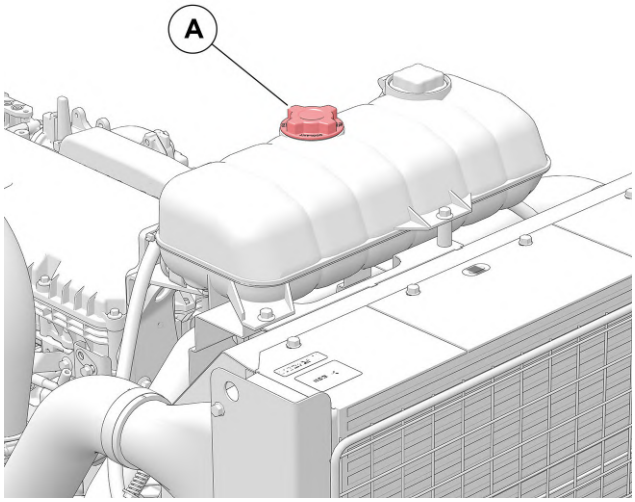


P0027068

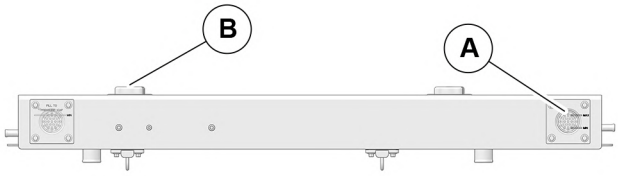
- Connect a drain hose to the engine block and drain the coolant from the engine. Use a receptacle to collect the coolant.
- Remove the hoses and close the nipples/taps.
- Refill with new, Volvo Penta-recommended coolant.

NOTICE! Cooling performance is reduced by deposits in the radiator and cooling galleries. The cooling system should be cleaned when coolant is replaced. Cooling system cleaning is described in the Workshop literature.

NOTICE! Check anti-freeze protection every year, if the coolant is not replaced.



P0028681



P0040782

Filling a completely empty system

Mix the coolant in advance to ensure the cooling system is filled with the correct mixture (applies to concentrated coolant).

If a heating unit is connected to the engine cooling system, its valves must be opened and the installation vented during filling.

NOTICE! The engine may not be started before the cooling system is full.

- Check that all drain points are closed.
- Open the filler cap (A).
- Top up and check that the coolant level is between the MIN and MAX marks on the expansion tank.

  NOTICE! For TWD engines with belt-driven pump on the charge air circuit.
  Engine cooling circuit

  A. Fill with coolant to the MAX sign on the measuring glass.

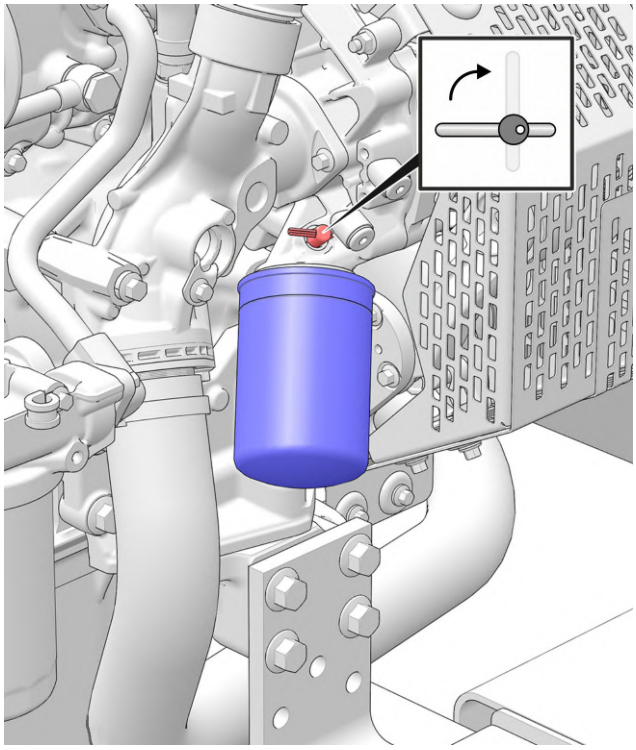
  Charge air cooler cooling circuit

  B. Fill with coolant all the way up to the pressure cap.
- Start the engine when the cooling system has been filled and vented.
- Open any venting nipples shortly after starting the engine, to allow trapped air to escape.
- Run the engine at idle a while.
- Increase the engine’s RPM for a few minutes. Stop the engine and check the coolant level.
- Run the engine until the thermostat opens. Check the level again when the engine has cooled. Top up as necessary.

NOTICE! Only fill coolant when the engine is cold and stopped. Fill slowly, to allow air to flow out.

Coolant Filter, Replace

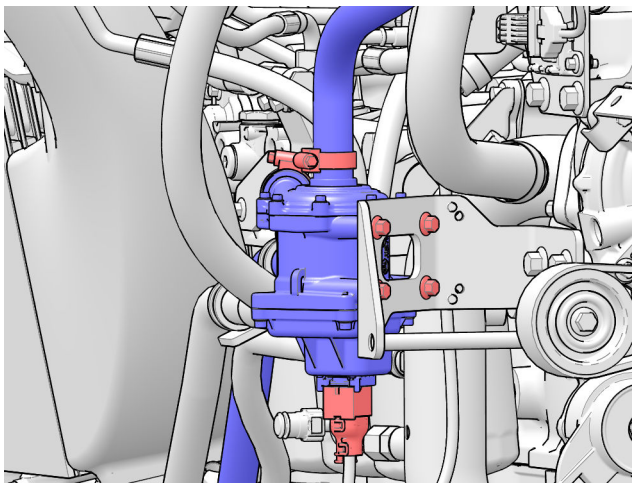
If the engine has a coolant filter, the latter must be replaced; refer to the service interval for the engine concerned in the maintenance schedule.



P0028690

- Shut the filter housing valve.
- Clean around the filter and remove it.
- Lubricate the new filter gasket with petroleum jelly or soapy water.
- Tighten the filter until the gasket touches and then tighten a further one half turn.
- Open the tap on the filter housing.
- Start the engine and check for leaks.

NOTICE! When working on an engine to which more than five liters of new coolant are added, always install a new coolant filter.



P0031228

Coolant Pump (Electric), Replace

- Drain the cooling water.
- Remove:
  hoses
  connector
  pump
- Install:
  pump
  connector
  hoses
- Fill coolant.

Drive Belt, Replace

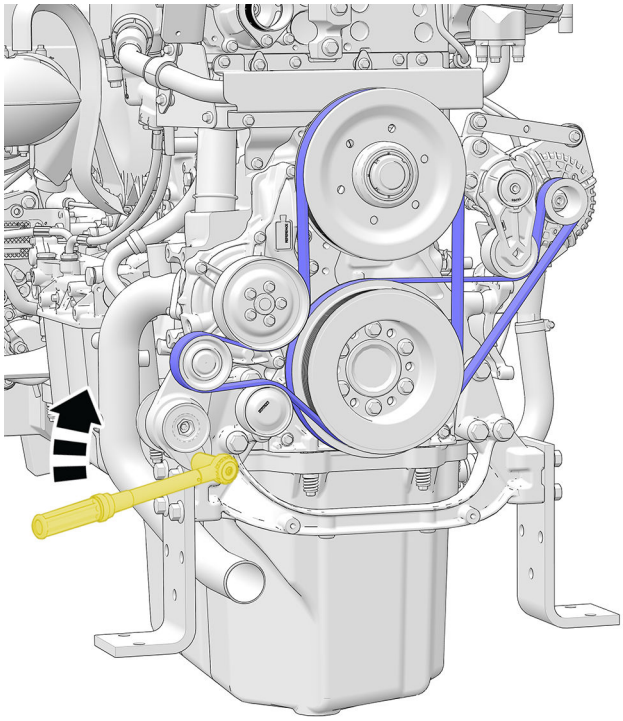
Drive belt, water pump

NOTICE! Always replace belts that are greasy, worn or damaged.

Removal

⚠ CAUTION!
Pinch hazard. Keep fingers clear.

TAD



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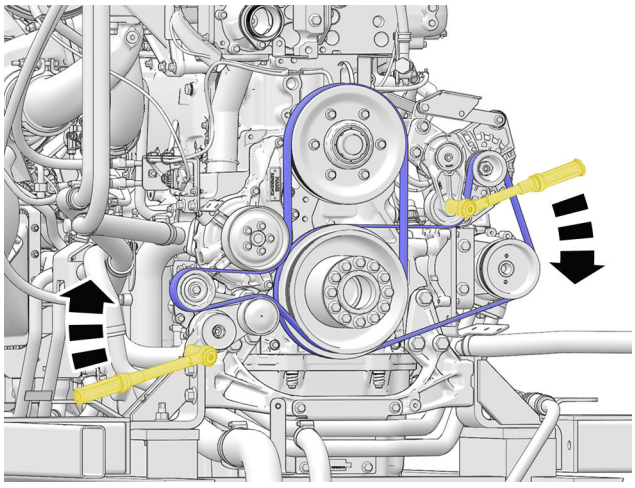
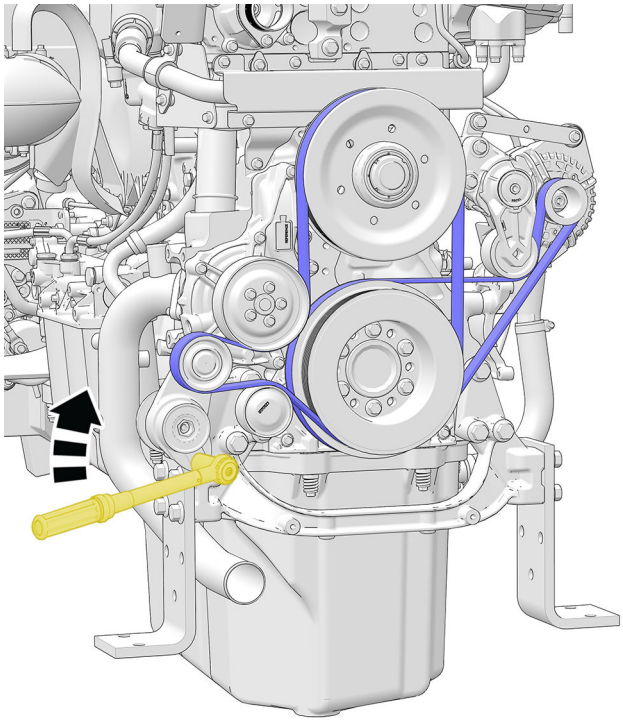
TWD



P0028694

- Clear a space in front of the engine. Remove the engine fan guard, cooling fan and fan ring. If necessary, also remove the radiator assembly.
- Insert a tool in the belt tensioner.
- Relieve the load on the belt tensioner and remove the belt.
- Check the function of the belt tensioner and idler wheel bearings. Replace the idler wheel if there is play in the bearings.

TAD



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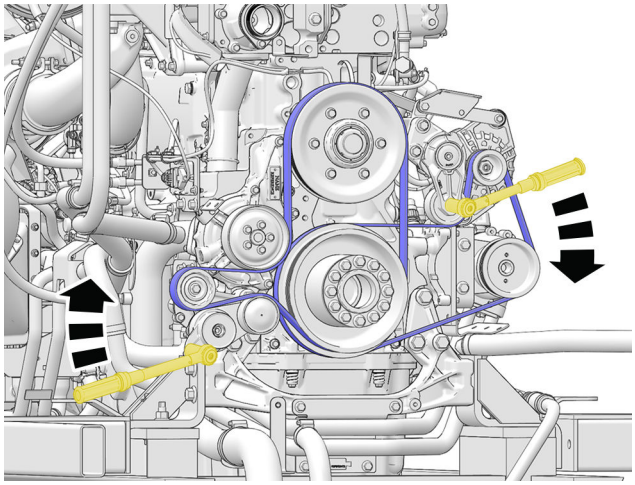


P0028694

Installation

- Insert a tool in the belt tensioner.
- Relieve the load on the belt tensioner and install the new belt.
- Deploy the belt tensioner and check that the belt is correctly aligned on all pulleys.
- Install the fan guards, fan, fan ring and the radiator assembly if this has been removed.

Check

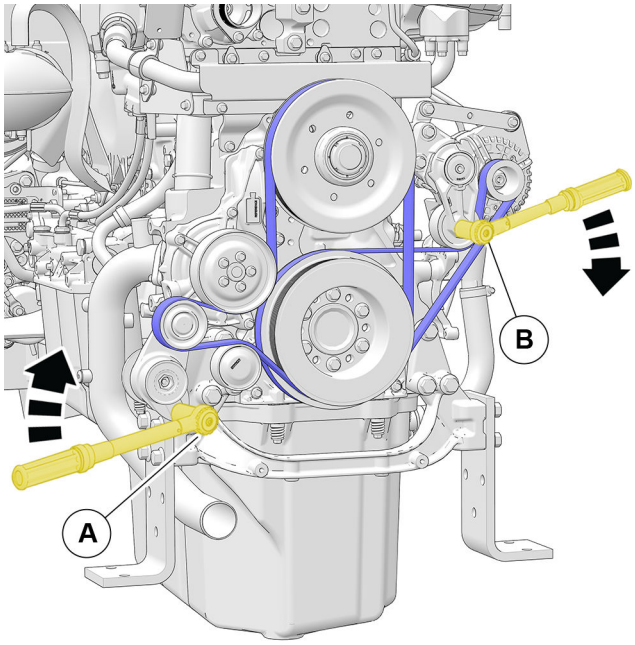
The drive belt has an automatic belt tensioner and does not need to be adjusted.

Drive belt, alternator

Removal

⚠ CAUTION!
Pinch hazard. Keep fingers clear.

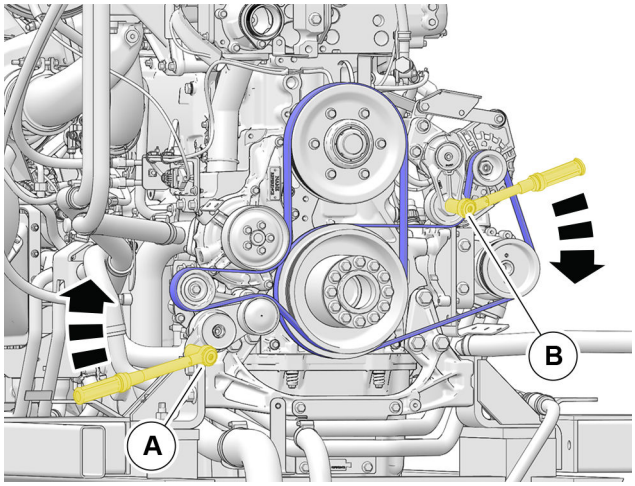
TAD



P0028695

- Clear a space in front of the engine. Remove the engine fan guard, cooling fan and fan ring. If necessary, also remove the radiator assembly.
- Insert a tool into the belt tensioner (A).
- Relieve the load on the belt tensioner (A) and lift away the water pump drive belt.
- Insert a tool into the belt tensioner (B).
- Relieve the load on the belt tensioner (B) and lift off the generator drive belt.
- Check the function of the belt tensioner and idler wheel bearings. Replace the idler wheel if there is play in the bearings.

TWD



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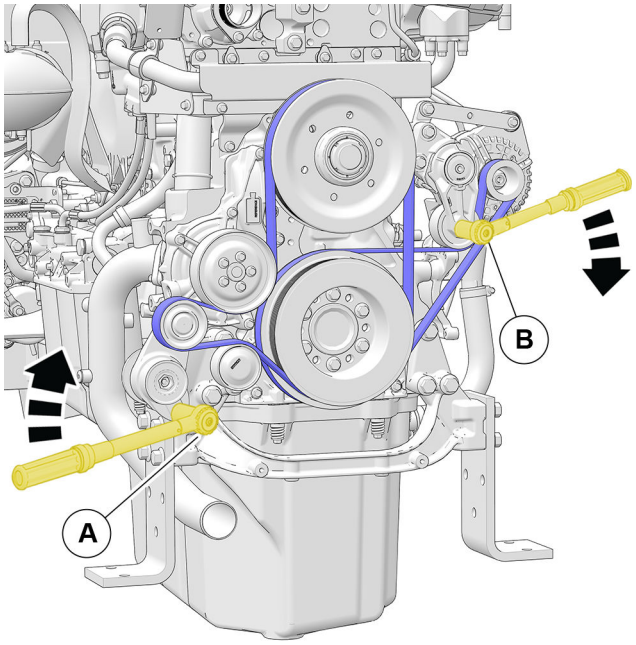

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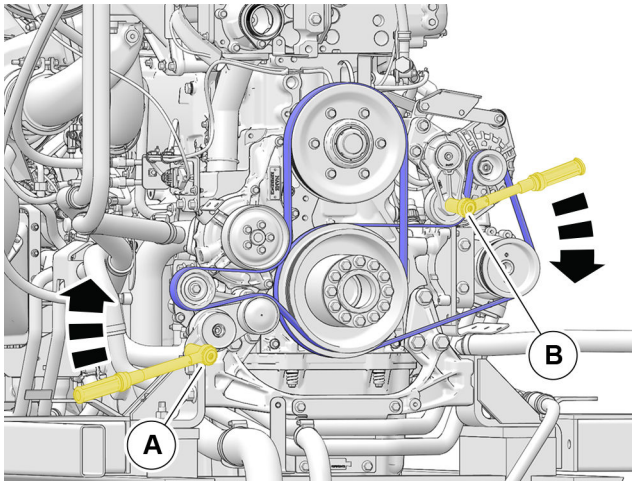


P0028696

Installation

- Insert a tool into the belt tensioner (B) and relieve the load on the belt tensioner.
- Install the new generator belt.
- Deploy the belt tensioner (B).
- Check that the alternator belt is correctly aligned on all the pulleys.
- Relieve the load on the belt tensioner (A) and fit the drive belt onto the water pump.
- Deploy the belt tensioner (A) and check that the water pump belt is correctly aligned on all pulleys.
- Install the fan guards, fan and fan ring around the cooling fan and radiator assembly if this has been removed.

Check

The drive belt has an automatic belt tensioner and does not need to be adjusted.

Long-Term Storage

The engine and other equipment should be conserved to avoid damage during extended lay-ups (4-8 months or longer). Conservation protects the engine against freezing and corrosion damage.

The checklist below covers the most important points for the engine. Before decommissioning the engine for an extended period, we recommend checks for any maintenance or repairs.

IMPORTANT:
Washing with a power washer: Never aim the water jet at radiators, charge air cooler, seals, rubber hoses or electrical components.

P0002089

For layups up to 8 months:

- • Change engine oil and oil filter as specified.
- The fuel system must be protected during storage to prevent internal oxidation and corrosion.
  Start and run the engine with FAME-free fuel before storage.
  Run the engine for at least 10 minutes to allow the fuel to reach all parts of the fuel injection system.
  FAME = Biodiesel
  B0 = Diesel with 0% FAME
  B10 = Diesel with 10% FAME
- If B0 fuel is not available, fuel additives with anti-corrosion and anti-oxidation properties may be mixed in the fuel to protect the fuel system during storage.
  Engines that use diesel fuel with a FAME level greater than 10%, (even if additives are used) must not be placed in long-term storage.
- Drain water from the pre-filter to reduce the risk of bacterial growth.
  Drain water, dirt and sludge from the fuel filter and fuel tank. Fill the fuel tank completely to prevent condensation.
  Use the recommended B0 fuel. Fuels with a FAME -content greater than 10% may not be used as storage fuel.
- Check that the coolant has the requisite antifreeze qualities. Top up as necessary.
- Disconnect the battery cables; clean and charge the batteries. Maintenance-charge the batteries while the equipment is in storage. **An insufficiently charged battery can freeze and burst.**
- Cleaning the exterior of the engine, see, *Cleaning engine and transmission, page 79*.
- Touch up paint damage with Volvo Penta original paint or paint of the equivalent quality.
- Attach a tag onto the engine with information about the date, type of conservation and the conservation oils used.
- Cover the air filter, exhaust pipe and engine as necessary.

Recommissioning

- Replace fuel filters before starting the engine. Keep extra filters available as FAME may cause microbial growth that blocks the fuel filter.
- Check the drive belts.
- Check the condition of all rubber hoses.
- Check the hose clamps.
- Check the coolant level and anti-freeze. Top up with coolant; refer to *Coolant Level, Checking and Topping Up, page 63*
- Connect the fully-charged batteries.
- Remove the covers from the air filter and exhaust pipe.
- Start the engine and let it idle with no load for a short while.
- Check that there are no oil, fuel or coolant leaks.

Storage instruction for long-term storage of new engine

Applies to installed and non-installed engines

The engines must be laid up in a warm, temperature-controlled store.

The temperature should be between +5°C and +30°C.

Storage outdoors is strictly prohibited.

Humidity should be below 40%.

We recommend that you:
– Unpack the engine, remove the plastic wrap.
– Use the plastic bag as dust protection; leave it loose for good ventilation.
– Do not use wax as protection in case the engine must be started during storage.

If the engine must be stored for more than 8 months

Before storage

Make sure the engine cooling system is filled with glycol.

Make sure the engine lubrication system is filled with oil.

Pump the coolant through the seawater cooling system. (Marine engines only)

Seal all open connections.

Remove the battery cables from the battery.

Empty the AdBlue®/DEF tank if it is filled and clean it.

Attach a tag into the engine with information about the date, the product's part number, type of oil used and sign it.

During storage

The engine must be cranked 2.5 turns every 8th month.

If the engine can be started, run it until warm.

Check that humidity is below 40%.

Check that the temperature in the storage area is between +5°C and +30°C.

Before the engine enters service.

Uncover the engine or vacuum the system until dry. This is in order to prevent remaining glycol mixture from contaminating the environment.
Hand the glycol mixture to a waste management facility as hazardous waste.

Clean the engine as necessary.

Check:
– Drive belts
– Hoses
– Clamps

Check the oil level in the engine and top off as necessary.

Make sure the coolant has adequate antifreeze properties; top off as necessary.

Should be replaced:
– Fuel filter
– Air filter
– AdBlue®/DEF filter
– Air filter AdBlue®/DEF tank
– Fill the AdBlue®/DEF tank
– Seawater pump impeller (Marine engines only)
– Anodes for the seawater system. (Marine engines only)

Start the engine and let it idle a while without a load.

Check that there are no oil, fuel or coolant leaks.

Run the engine until warm.

Change the engine oil and oil filter.

Checklist, long term storage			
Date	Product part number	Type of conservation	Signature and date of checks
Month		Checks during storage	
8,			
16,			
24,			
32,			
40,			

Cleaning engine and transmission

Including the engine encapsulation and all hatches

- A clean engine compartment minimizes the risk of overheating and wear damage.
- Prior to every engine compartment wash, a visual inspection must be carried out to identify any fluid or exhaust leakages.
- Following each wash, all hoses and bellows must be inspected visually to identify any leakages, cracks or chafing.
- Following each wash, electrical harnesses must be visually inspected to identify any damage to insulation, cable jackets or clamping.
- Battery, alternator, power steering unit and starter motor cables must be inspected extra carefully.
- Any damage to hoses, bellows, grommets or electrical harnesses must be reported immediately.

Important!

- When cleaning, always use mild detergents/ solvents.
- When cleaning the engine and engine compartment, the alternator, idler pulley, belt tensioner, power steering unit and all electrical components must be covered with plastic or similar so that detergent/solvents do not get into the parts
- Where fitted, the AC compressor must also be protected with plastic or similar.
- When cleaning air coolers, they should be vacuum cleaned first before flushing with warm water from the inside out.
- Do not use a power washer on the air cooler.
- Clean the outside with a sponge/brush.
- Then flush with lukewarm water.
- When pressure washing and steam cleaning, water pressure may not exceed 80-100 bar at the nozzle. Maintain a distance of 100-150 mm; use a fan spray nozzle.
- It is not permitted to came jets of water from the pressure washer directly onto the alternator. The electrical regulator, rectifiers, power steering units, bellows and mechanical parts (bearings) may be damaged and lead to serious consequential damage.

NOTICE! If the generator is exposed to water, it must be dried; see drying.

- Wash using a flat fan nozzle when cleaning sound absorbent.
- To maintain the fire prevention and sound dampening qualities of the absorbent as per the sound certificate, no damage to the absorbent may be repaired with the aid of patches or the puzzle principal i.e. by covering any damage with new absorbent (patch). Accordingly, in the case of major damage or where fluid has seeped into the absorbent (deep tears, tears wider than the width of tape; holes or cracked edges), the entire damaged unit must be replaced.
- Tears that can be covered widthwise by tape, must be repaired using approved aluminum tape.
- After the wash, check that no small rocks or other debris has adhered to the belts and are able to penetrate them when the engine is started.

Drying the alternator

- Blow the water away from the alternator using compressed air.
- Check that the alternator charges.

Checklist

Suggestions for the checklist in addition to the regular service items.

Check/action

- Check for leakage: oil/fuel/water/exhaust.
- Check of hoses and hose clamps.
- Inspection of cable connections.
- Cleaning of battery terminals, remove any oxide. Check the electrolyte level.
- Clean the engine and engine compartment.
- Inspection/cleaning of the fuel tank.
- Function check of other electrical systems.
- External cleaning of the radiator/radiator assembly.

Start the engine every six months

If the engine is to be laid up for 6-8 months or more, it should be started and warmed up every six months as follows:

- Check the engine oil level.
- Top up with coolant; refer to *Coolant Level, Checking and Topping Up, page 63*
- Connect the battery cables to the batteries (fully charged).
- Start the engine and run it for 2-3 minutes.
- Switch off the engine.
- Detach the battery cables.
- Check the engine compartment for any condensation.
- Ensure good ventilation.

P0002107

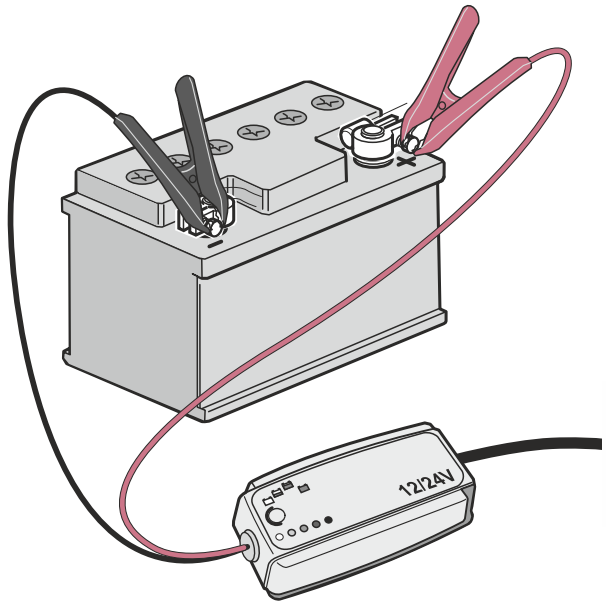
Battery, Maintenance

⚠ WARNING!
Risk of fire and explosion. Never allow an open flame or electric sparks near the batteries.

⚠ WARNING!
Battery electrolyte is a corrosive acid and should be handled with care. If you spill or splash electrolyte on any part of the body, immediately flush the exposed area with liberal amounts of water and seek medical attention as soon as possible.

⚠ WARNING!
Ventilate the engine compartment before working on batteries or battery connections.

IMPORTANT:
Batteries can be damaged if they are left discharged, and can also freeze and burst easier in cold weather. If the engine is not going to be used for a longer period of time, the batteries should be fully charged, trickle charged if possible.



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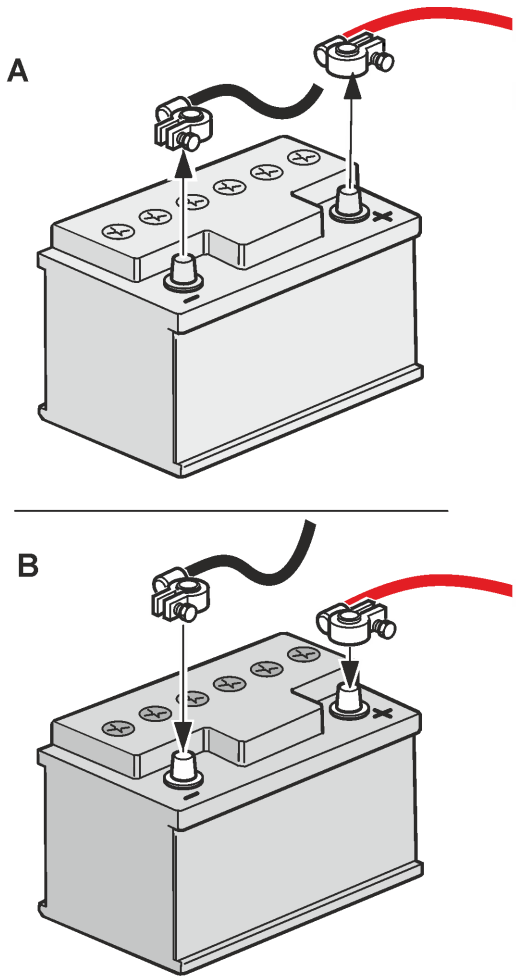
Care

It is important always to follow the battery manufacturer's recommendations and instructions when replacing and charging batteries. Instructions for maintenance and charging may vary depending on battery type.
Modern batteries are usually maintenance free, but there are some recommended measures to avoid accidents and increase battery service life:

- Keep the batteries clean and dry. Contamination and oxide on the batteries and battery terminals can cause stray currents, voltage drop and discharge, especially in damp weather.
- Remove oxidation from the battery poles and terminals using a brass brush.
- Tighten the terminals securely and grease them with terminal grease or petroleum jelly. Loose battery connections can cause damage to the engine electrical system.
- Charge the batteries regularly. Batteries kept at full charge enjoy maximum service life. The easiest way to check whether a battery needs charging is to use a volt meter.



P0028239

Battery replacement

IMPORTANT:
Make sure that the new battery fulfills the specifications in *Technical Data*. Read the information supplied with the battery before you begin the installation.

IMPORTANT:
Do not disconnect the batteries with the engine running.
Sensitive electrical components can be immediately damaged.

⚠ WARNING!
Never confuse the positive and negative poles on the batteries. Risk of arcing and explosion.

Disconnection (A)

- Remove the negative (-) cable (black).
- Remove the positive (+) cable (red).

Remove the battery.

Connection (B)

Put the new battery in place.

- Attach the positive cable (red) to the battery's positive terminal. Tightening torque: **6 Nm**.
- Attach the negative cable (black) to the battery's negative terminal. Tightening torque: **6 Nm**.

NOTICE! Hand in the old battery to a waste management facility.

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