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⚠WARNING

Study This Manual Before Starting The Machine

You must understand and follow the instructions in this manual. You must observe all relevant laws and regulations. If you are unsure about anything, ask your JCB distributor or employer. **Do not guess**, you or others could be killed or seriously injured.

INT-1-1-1

⚠CAUTION

Do not fit an attachment to this machine which is not JCB approved. Consult your JCB distributor before fitting any non approved attachment.

8-4-1-6

In this manual and on the machine there are safety notices. Each notice starts with a signal word. The meanings of the signal words are given below.

⚠DANGER

Denotes an extreme hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.

INT-1-2-1

⚠WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.

INT-1-2-2

⚠CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

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FUEL SYSTEM

Types of Fuel

Use good quality diesel fuel to get the correct power and performance from your engine. The recommended fuel specification for Perkins engines is given below.

Cetane Number:	45(minimum)
Viscosity:	2.5/4.5 centistokes at 40 °C (104 °F)
Density:	0.835/0.855 kg/litre (0.872/0.904 lb/pint)
Sulphur:	0.5% of mass (maximum)
Distillation:	85% at 350 °C (662 °F)

Cetane Number

Indicates ignition performance. Fuel with a low cetane number can cause cold start problems and affect combustion.

Viscosity

Is the resistance to flow. If this is outside limits, the engine performance can be affected.

Density

Lower density will reduce engine power. Higher density will increase both engine power and exhaust smoke.

Sulphur

High sulphur content can cause engine wear. (High sulphur fuel is not normally found in North America, Europe or Australia.) If you have to use high sulphur fuel you must also use a highly alkaline engine lubricating oil; or change the normal oil more frequently.

Distillation

This indicates the mixture of different hydrocarbons in the fuel. A high ratio of lightweight hydrocarbons can affect the combustion characteristics.

Fuel Standards

Consult your fuel supplier, JCB distributor or Perkins dealer about the suitability of any fuel you are unsure of.

Low Temperature Fuels

Special winter fuels may be available for engine operation at temperatures below 0°C (32°F). These fuels have a lower viscosity. They also limit wax formation in the fuel at low temperatures. *(Wax forming in the fuel can stop the fuel flowing through the filter.)*

Flow improvers may also be available. These can be added to the fuel to reduce wax formation.

Gasoline

⚠ WARNING

Do not use gasoline in this machine. Do not mix gasoline with the diesel fuel. In storage tanks the gasoline could rise to the top and form flammable vapors.

INT-3-1-6

Advice

If you have to use non-standard fuels, contact your JCB distributor for advice on engine adjustments and oil change periods.

⚠ WARNING

Diesel fuel is flammable; keep naked flames away from the machine. Do not smoke while refueling the machine or working on the engine. Do not refuel with the engine running. There could be a fire and injury if you do not follow these precautions.

INT-3-2-2

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CAB LAYOUT AND CONTROLS (continued)

12 Forward/Reverse Lever

⚠ WARNING

You and others can be killed or injured if you operate the forward/reverse lever while traveling. The machine will immediately reverse direction without warning to others. Follow the recommended procedure for proper use of this lever.

2-2-2-4

Stop the machine before moving this lever. To select forward, reverse or neutral, 'lift' and move the lever to the required position. All four gears are available in both forward and reverse. When reverse is selected a reverse alarm will sound. The engine will only start if the lever is at neutral.

The lever has 'detent' positions in forward, reverse and neutral. To move the lever from the detent position pull the lever towards you.

Procedure for reversing direction:
- **a** Stop the machine: keep the foot brakes applied.
- **b** Let the engine speed drop to idle.
- **c** Select the new direction.
- **d** Release the foot brakes and accelerate away.

If the parking brake is engaged when the forward/reverse lever is moved away from neutral an audible warning will sound and the *Parking Brake Engaged Indicator* will light.

13 Instrument Panel Switches (Left Hand)

14 Auxiliary Control Lever (If fitted)

15 Tilt Carriage Control Lever

16 Boom Raise/Lower Control Lever

17 Boom Extend/Retract Control Lever

18 Auxiliary Control Levers (If fitted)

19 Sway Control Lever (if fitted)

20 Joystick Control lever

25 Heater Control Lever

26 Boom Raise/Lower and Tilt Carriage Control (Optional Dual Function Control Lever)

27 Gear Change Switch *(Powershift machines only)*

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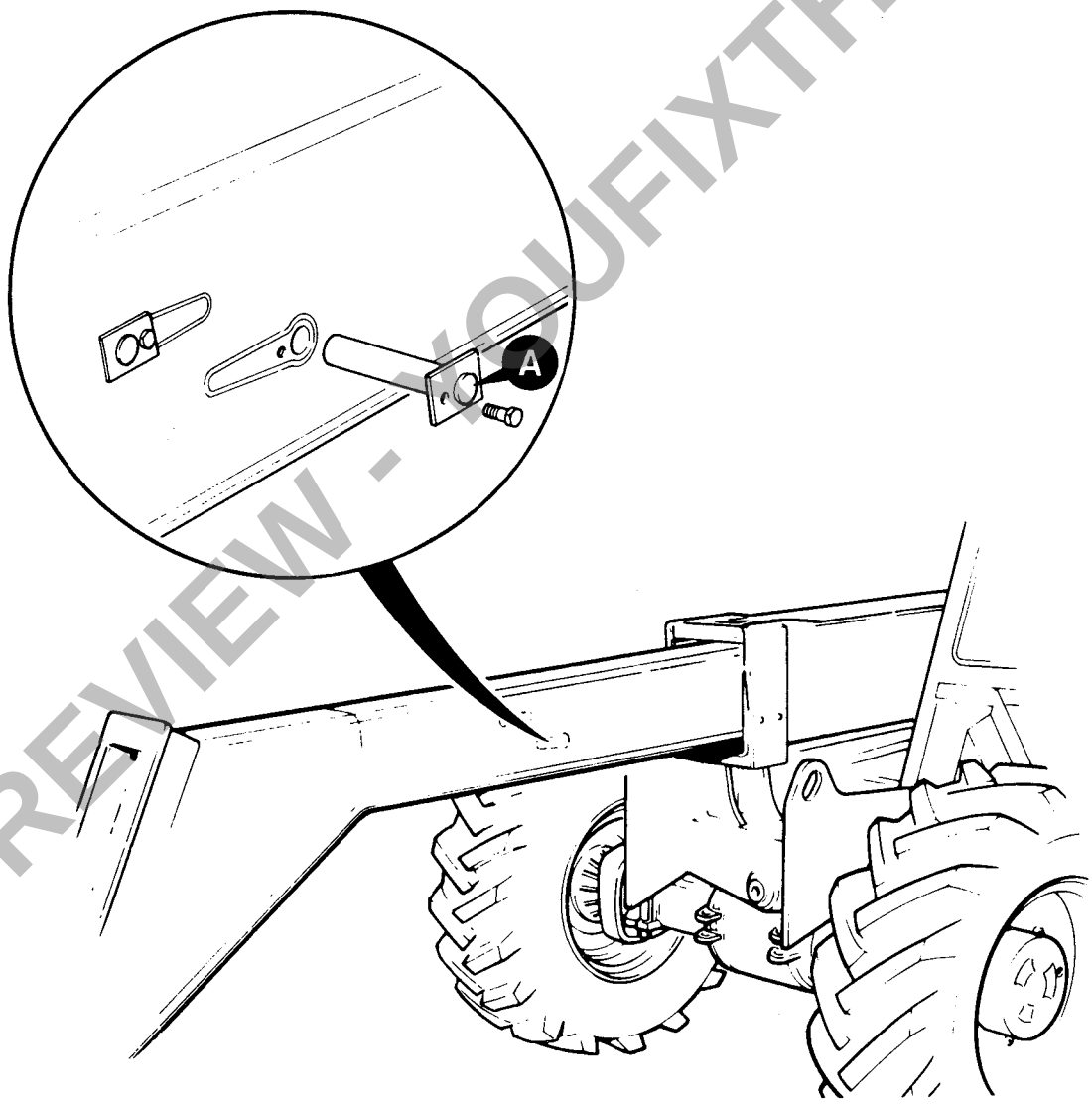
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GREASING
(continued)

Extension Eye End Pivot Pin

Remove extension cylinder pivot pin **A** and coat with specified grease. Install pivot pin.

Notice: *Use another pivot pin to support the cylinder while greasing the pivot pin.*



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BOOM AND CARRIAGE CONTROLS

Your machine can be either a manual control lever type or a servo control lever type. Both modes of operation are described in the following section. The text and/or the illustration will specify the variations of machines.

⚠ WARNING

You or others can be killed or seriously injured if you operate the control levers from outside the cab. Operate the control levers only when you are correctly seated in the cab.

INT-2-1-3

Manual Control Levers

The boom and its carriage are operated by three control levers. Your machine may have one or two additional levers. These operate optional services such as a Mast and Carriage or a hydraulic locking feature on the Quick-Fit Carriage.

All levers move forward and back. They are spring-loaded to their central *hold* positions. The speed of movement of the associated hydraulic rams depends on how far you move a lever - the further you move the lever, the faster the ram action.

A decal on the lever pedestal shows, by symbols, what levers cause which boom/carriage actions.

The rams will stay in any position until you move them with the levers.

Servo Control Levers

The cab servo control system consists of a joystick control lever, electro/hydraulic valve block and a control panel.

The boom and carriage are controlled by a three axis joystick lever.

The joystick is spring loaded to the center *hold* position.

There is a rocker switch on top of the joystick. The first function is to operate the boom extend/retract. The second function is to operate an auxiliary service.

To operate the auxiliary system depress the auxiliary switch and operate the rocker switch.

A red light illuminates to indicate that Auxiliary mode has been selected.

The auxiliary switch is a momentary push-button type. When operated the system will remain in the auxiliary mode until re-selected or the starter switch is switched off.

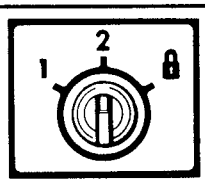
The speed of movement of the associated hydraulic rams depends on how far you move the joystick.

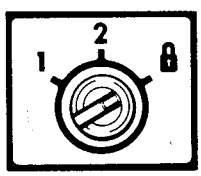
The rams will stay in any position until you move them with the levers.

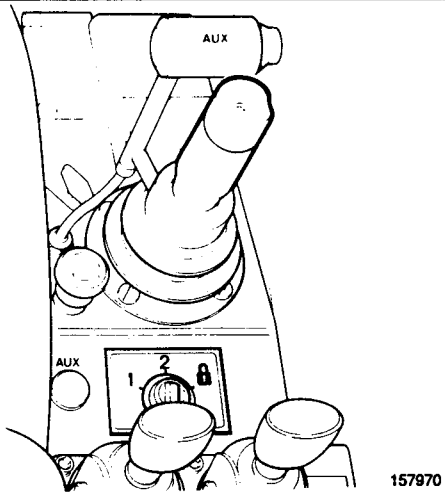
A decal on the lever pedestal shows, by symbols, what levers cause which boom/carriage actions.

Servo Control Selector

Selector Position	Operation
1	Normal.
2	The Carriage Tilt/Auxiliary controls are isolated.
🔒	The joystick and auxiliary control levers are isolated for road travel.







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STARTING THE ENGINE (continued)

***Notice**: New engines DO NOT require a running-in period. The engine/machine should be used in a normal work cycle immediately; glazing of the piston cylinder bores resulting in excessive oil consumption could occur if the engine is gently run-in. Under no circumstances should the engine be allowed to idle for extended periods; (e.g. warming up without load).*

6 Warm Up the Engine and Hydraulics.

If the engine has been jump-started, remove the booster cables (*see **Jump-Starting the Engine** on the next page*). Allow the engine to warm up above idle speed and operate the boom a few times to help warm up the hydraulic system.

7 Check the Indicators

***Notice**: If any warning lights fail to go off, or come on while the engine is running, stop the engine as soon as it is safe to do so.*

Once the engine has started, check that all the warning lights have gone off. Do not race the engine until the **engine oil pressure low light** has gone out. Check that the audible alarm is silent.

8 Check the Brake/4-Wheel Drive Operation (Electrical 2/4 Wheel Drive Selector Only)

With 2-wheel drive selected, press down on the brake pedal. Check that the indicator light in the 2/4 wheel drive selector switch goes out. This indicates that the transmission has gone into 4-wheel drive. Release the brake pedal and check that the light comes on again.

JUMP-STARTING THE ENGINE

⚠ WARNING

If you try to charge a frozen battery, or jump-start and run the engine, the battery could explode

Do not use a battery if its electrolyte is frozen. To prevent the battery electrolyte from freezing, keep the battery at full charge.

Batteries give off a flammable gas that can explode.

Do not smoke when checking the battery electrolyte levels. When starting from another machine, make sure the two machines do not touch. This prevents any chance of sparks near the battery. Sparks could ignite the battery gas. If that happens the battery could explode.

Even with the starter switch set to off some circuits will be energized when the external power supply is connected. Set all the machine switches to their OFF positions before connecting the external power supply.

Do not connect a booster supply directly across the starter motor. Doing this could bypass the neutral safety switch and the engine can start with the transmission in gear. The machine could then run away and kill or injure bystanders.

Use only booster cables which are in good condition with securely attached connectors. Connect both ends of one booster cable before connecting the other one.

5-2-2-3

***Notice**: Follow the instructions below to start the engine using booster cables. Your machine has a 12 volt starting system. The negative (-) terminal on the battery is connected to frame ground.*

The booster supply should not be higher than 12 volts. Using a welder or higher voltage supply will damage your machine's electrical system.

Do not connect two batteries together to give 24 volts. This could burn out the induction manifold heater and damage the starter motor.

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BOOM SAFETY STRUT

⚠ WARNING

You could be killed or injured if the boom drops while you are working under it. Install the safety strut as instructed below before doing any maintenance work with the boom raised.

5-3-1-2

Installing

1 Level the Machine (Sway Machines Only)

Use the sway control lever to set the machine body level with the axles.

2 Position the Boom

a Fully retract the boom (unless it needs to be extended for maintenance). Raise the boom just far enough to install the strut.

3 Stop the Engine

Make sure the parking brake is engaged and the transmission is in neutral. Remove the starter key.

4 Install the Strut

⚠ CAUTION

You will have to climb onto the machine to install the strut. Take care, especially if the machine is wet. Remove mud and oil before climbing onto the machine.

Do not use the exhaust as a handhold. It can burn you.

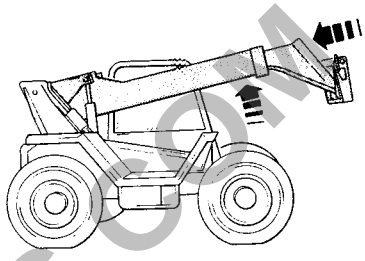
5-3-1-4

⚠ WARNING

You could be killed or injured if the boom is lowered while you are under it. Keep people away from the machine while you install the strut.

5-3-1-3

a Remove the strut **A** from its stowage position.
Early machines position **B**
Later machines position **C**

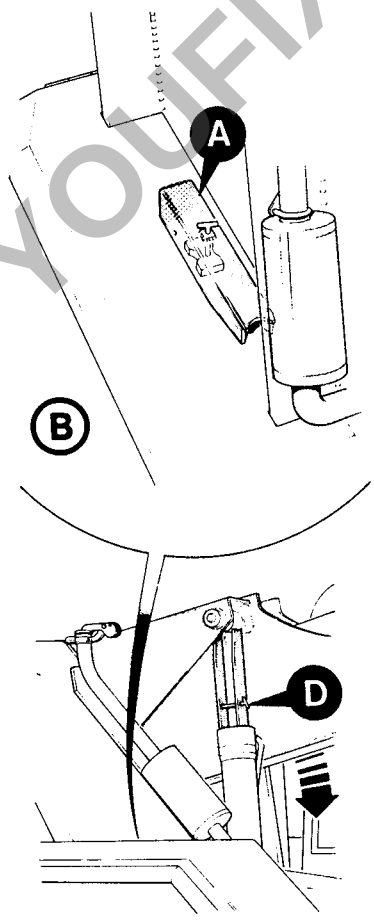


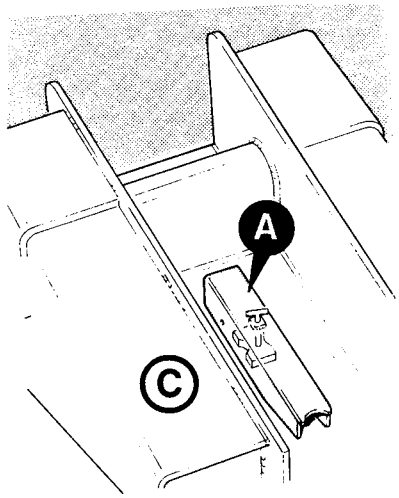
b Place the strut **A** around the cylinder piston rod as shown. Fix it in place with screw **D**.

5 Lower the Boom

To prevent any chance of the boom creeping down and trapping your fingers, the boom should be lowered onto the strut.

Notice: *Lower the boom carefully, to prevent possible damage to the strut. Stop as soon as the weight of the boom is on the strut.*





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ENGINE COOLING SYSTEM
(continued)

Changing the Coolant

1 Do Step 1 of *'Checking the Coolant Level'*

2 Open access panel **C**, carefully loosen filler cap **D**.

3 Drain the Cylinder Block

Remove the drain plug **E** and let the coolant drain out. Make sure the drain hole is not blocked.

4 Drain the Radiator

⚠ CAUTION

Keep your face away from the hose while disconnecting it.
5-3-3-1

Disconnect hose **F** and let the coolant drain out.

5 Flush the System

If necessary. Use clean water.

6 Reinstall the Drain Plug and Radiator Hose

Clean the plug **E** before installing it. Make sure the plug and the hose **F** are tight.

7 Fill the System

Use the necessary mix of clean, soft water and antifreeze. See the Chart at the end of *MAINTENANCE section.* Note that a 33% antifreeze mixture is recommended even if frost protection is not needed. This gives protection against corrosion and raises the coolant's boiling point.

8 Reinstall the Filler Cap

Make sure the cap **D** is tight. Close and secure the access panel **C**.

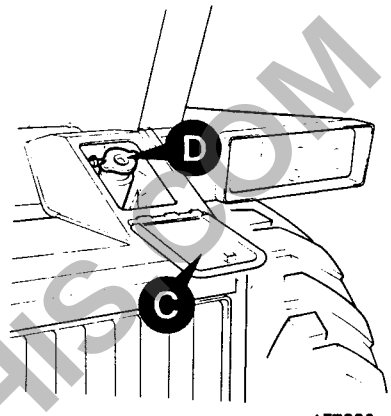
9 Top-up the Expansion Bottle

See ***Checking the Coolant Level*** *(MAINTENANCE Section).*

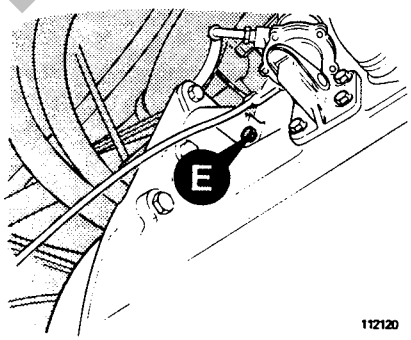
10 Check for Leaks

Run the engine for a while, to raise the coolant to working temperature and pressure. Stop the engine. Check for leaks.

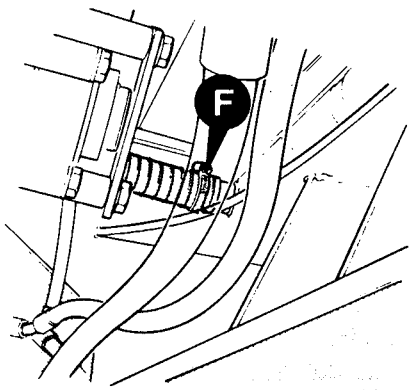
Notice: *Make sure the heater shut-off tap is in the open position before running the engine. This will ensure the coolant mixture circulates through the entire cooling system. See* ***Heater*** *(OPERATION section).*



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BEFORE STARTING THE ENGINE

*Notice: Read **Operating in Low Temperatures** or **Operating in High Temperatures** in OPERATION section if you will be using the machine in very cold or very hot climates.*

1 Engage the Parking brake

The parking brake should have been engaged when the machine was last parked. But if it is not already engaged, engage it now.

⚠ DANGER

Before lowering the carriage to the ground, make sure that the machine and the area around it are clear of other people. Anyone on or close to the machine could fall and be crushed by the carriage, or get caught in the linkages.
5-2-2-2

2 Lower the Carriage to the Ground

The carriage should have been lowered to the ground when it was last parked. If not, start the engine and lower the carriage to the ground. Then stop the engine before continuing with Step 3.

3 Do a Pre-start Inspection

For your own safety (and others) and for a maximum service life of your machine, do a pre-start inspection before starting the engine.

a If you haven't already done it, do a walkround inspection of the outside of the machine. *See **Before Entering the Cab** OPERATING Section.*
b Remove dirt and rubbish from the cab interior, especially around the pedals and control levers.

⚠ WARNING

Keep the machine controls clean and dry. Your hands and feet could slide off slippery controls. If that happens you will lose control of the machine.
2-2-3-6

c Remove oil, grease and mud from the pedals, control levers and the steering wheel.
d Make sure that your hands and shoes are clean and dry.

⚠ WARNING

Loose articles can fall and strike you or roll on the floor. You could be knocked unconscious, or the controls could get jammed. If that happens you will lose control of the machine.
2-2-3-7/1

e Remove or secure all loose articles in the cab - such as lunch boxes, tools etc.
f Inspect the ROPS/FOPS structure for damage. Get your JCB distributor to repair any damage. Make sure all its securing bolts are fitted and correctly tightened. See **Checking the ROPS/FOPS Structure** in *MAINTENANCE Section* for torque figures.
g Check round the cab for loose or missing bolts, screws etc. Fit new ones or tighten where necessary.

⚠ WARNING

Do not use a seat belt which is damaged or excessively worn.

Do not use a seat belt that has been in an accident.

A worn, damaged or already stressed seat belt could break or give way in a collision. If that happens you could be killed or injured.
2-2-3-8

⚠ WARNING

Do not drive the machine without wearing the seat belt, properly fastened and adjusted.
2-2-3-9

h Inspect the seat belt and its mountings for damage and excessive wear.
i Check that the following are in working order:- Lights, Warning Lights, All switches, Turn Indicators, Four way flashers, Windshield Washer and Wipers, Reverse Alarm.

4 Adjust the Seat

Adjust the seat so that you can comfortably reach all the driving controls. You should be able to apply full brake pedal travel with your back against the seat back.

5 Set the Rear View Mirror(s)

Set the rear view mirror(s) to give you a good view close behind the machine when you are correctly seated.

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ENGINE AIR FILTER
(continued)

Changing the Outer Element

1 Stop the Engine

2 Clean the Pre-Cleaner

See previous page.

3 Open the Hood

4 Remove the Outer Element

Unscrew the wingnut **C**. Pull out the element **F**. Take care not to tap or knock the element as you remove it.

5 Clean the Canister

Clean the inside of the canister **H**.

6 Install a New Element

Insert the new element into the canister. Make sure it seats correctly, by smearing the seal **D** with grease and checking for a witness mark on the canister base. Tighten the wingnut **C**. Check all hoses for condition and tightness.

⚠ CAUTION

The outer element must be renewed immediately if the warning light on the instrument panel illuminates.
2-3-3-1

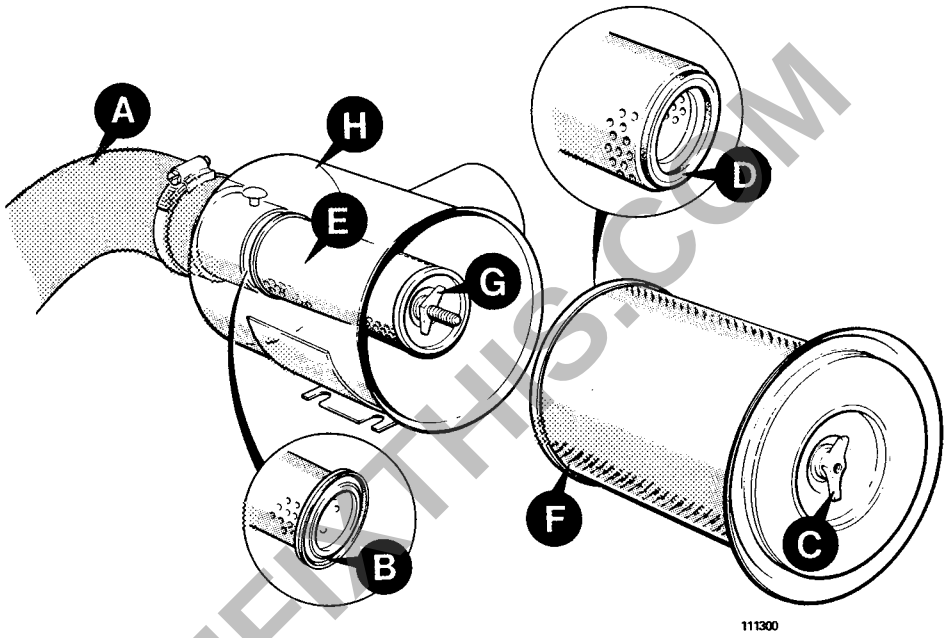
Changing the Inner Element

1 Raise the Engine Cover

2 Stop the Engine

3 Clean the Pre-Cleaner

See previous page.



4 Disconnect the Filter Induction Hose

To prevent dust getting into the engine, remove the induction hose **A** from the canister. Cover the hose to prevent rain and dirt getting into the engine.

5 Remove the Outer Element

Unscrew wingnut **C**. Pull out the outer element **F**.

6 Remove the Inner Element

Unscrew wingnut **G**. Pull out the inner element **E**.

7 Clean the Canister

Clean the inside of the canister **H**.

8 Install the New Inner Element

Carefully insert the new element into the canister. Make sure it seats correctly, by smearing the seal **B** with grease and checking for a witness mark on the canister base. Install and tighten wingnut **G**.

9 Install the Outer Element

Carefully insert the new outer element. Make sure it seats correctly, by smearing the seal **D** with grease and checking for a witness mark on the canister base. Tighten wingnut **C**.

10 Connect the Induction Hose

Connect the induction hose. Make sure the ***Air Filter Blocked*** switch connector is installed. Check all hoses for condition and tightness.

Notice: *In a dusty working environment, the outer element may have to be changed more frequently than the service schedule recommendation. A new inner element must be installed at latest, every third time the outer element is changed. As a reminder, mark the inner element with a felt tip pen each time you change only the outer element.*

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