

**USE AND MAINTENANCE  
USO E MANUTENZIONE  
EMPLOI ET ENTRETIEN  
BETRIEBSANLEITUNG  
USO Y MANUTENCIÓN**

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**SOFIM HPI**

**IVECO  
MOTORS**

**Iveco SpA  
PowerTrain**  
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## **SOFIM HPI AUTOMOTIVE**

Allow us to congratulate you on your purchase, and thank you for choosing Iveco Motors.

Please take the time to read these instructions for the use and maintenance of your new engine carefully.

If you follow the instructions, you can be sure the engine will run perfectly for a long time to come.

Iveco will be happy to help you should you need us; wherever you are located, you'll find an Iveco Service Centre nearby.

### **Warranty**

Please follow the instructions provided in this booklet carefully to make sure that your engine will run perfectly and that you will be covered by the warranty.

Failure to follow these instructions may invalidate the warranty.

### **Spare parts**

It is important to use only Original Iveco Motors Spare Parts to make sure that your engine continues to run well.

When ordering spare parts, please provide:

- the technical code and serial number of the engine
- the spare part code, as shown in the spare part catalogue.

### **Liability**

The information published in this booklet is correct as of the date of publication.

The manufacturer reserves the right to modify this information at any time without prior notification for technical or commercial reasons or in order to comply with the laws in effect in various nations. The manufacturer shall not be held liable for errors or omissions.

## **SAFETY REQUIREMENTS**

### **Basic safety**

The following basic safety instructions are intended to reduce danger to persons or objects when an engine is running or idle.

- Engines must not be used for any purpose other than that specified by the manufacturer. Before an engine may safely be used for any other purpose, a specific agreement shall be drawn up with the manufacturer.
- Tampering with the engine, making alterations or using parts other than Original Iveco Spare Parts may compromise safe operation.
- These instructions shall be applied in accordance with the provisions of other Regulations in effect in the specific Country of use.

### **During maintenance operations**

- Never wear loose clothing, rings or chain jewellery when working with engines or moving parts.
- Wear protective gloves and safety goggles:
  - when filling batteries with acid
  - when topping up inhibitors or antifreeze
  - when changing or topping up lubricant oil (hot engine oil may scald when drained; let oil cool to below 60°)
  - when working with compressed air (compressed air used for cleaning must be under 2 Atm (30 psi / 2 kg/cm<sup>2</sup>)).

- Wear a safety helmet when working in the presence of suspended loads or equipment located at head level.
- Always wear safety shoes and overalls.
- Protect your hands with cream.
- If your overalls get wet, change them immediately.
- When working on parts that may be under voltage, make sure your hands and feet are dry. If necessary, use an insulated footboard. If you are not experienced in this type of maintenance work, always have it done by specialised personnel.
- Do not attempt to carry out repairs with which you have no experience. Always follow the instructions, and, if in doubt, contact the manufacturer or specialised personnel.
- Keep the engine clean at all times, removing any oil, diesel oil, or coolants that may be spilled.
- Store greasy cloths in flameproof containers.
- Do not leave cloths on the engine.
- Obtain suitable safe containers for used motor oil.
- When starting up an engine after repair work, make sure that you will be able to stop air intake in the event of a runaway upon startup.

### **Engine cooling circuit**

- Never add coolant to an overheated engine until it has cooled down.
- Check the coolant level regularly and top it up whenever necessary, using the appropriate fluid only. Water used in the engine's cooling circuit must always be clean and as free as possible of minerals which could form deposits and of corrosive chemical products. Artificially softened water should never be used; rust and corrosion may be prevented by treating water with anticorrosive agents approved by the manufacturer.
- In winter measure the specific density of antifreeze regularly to make sure that the engine is adequately protected from cold. Remove the radiator cap gradually; cooling circuits are normally under pressure and hot liquid could be sprayed out if the pressure is reduced too quickly.
- Check belt tension and wear regularly.

### **Lubrication circuit**

Check the oil level in the oil pan regularly and top it up if necessary.

- Change lubricant oil regularly with the recommended frequency, making sure that the oil you use has the characteristics and viscosity specified in these Instructions.

### **Fuel circuit**

- Try to keep the fuel tank full most of the time in order to prevent condensation.

- Remove water and sediments from the tank regularly.
- Replace the fuel filter regularly, whenever the pressure drops or the performance of the engine decreases.
- Do not smoke or light any flame while filling the fuel tank.

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## ENGINE IDENTIFICATION

The engine code is stamped on the right hand side of the engine base.

### Engine technical data models S23 ENT C (FIA)

Turbocharged engine with intercooler

Number of cylinders	4
Bore	88 mm
Stroke	94 mm
Displacement	2.3 l
Type:	4 stroke diesel <b>Common Rail</b>

### Performance

Maximum power ratings:

71 kW (96 CV) @ 3900 rpm

85 kW (116 CV) @ 3900 rpm

### Engine technical data models S30 ENT C (FIC)

Turbocharged engine with intercooler

Number of cylinders	4
Bore	95.8 mm
Stroke	104 mm
Displacement	3 l
Type:	4 stroke diesel <b>Common Rail</b>

### Performance

Maximum power ratings:

100 kW (136 CV) @ 3500 rpm

122 kW (166 CV) @ 3500 rpm

### Injection system

High pressure pump.

Firing order 1 - 3 - 4 - 2

## ELECTRICAL SYSTEM

Battery : 90/110 Ah maintenance free (depending on version)

Starting motor : 2.2 - 2.3 kW

Alternator : 90A/120A (depending on version - engines S23)  
110A/140A (depending on version - engines S30).



## STARTING AND RUNNING

### Engine starting

Before starting the engine in a garage or workshop, ensure that adequate ventilation is provided because exhaust gases are toxic.

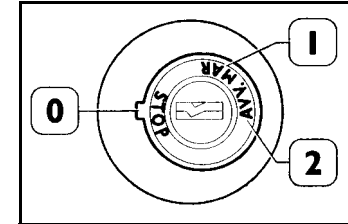
- Insert the key in the ignition switch and turn it clockwise to position 1 (Mar).
- Turn the key to position 2 (AVV) and release it as soon as the engine starts, **without pressing the accelerator pedal**.
- If starting does not occur immediately, do not operate the starter motor for longer than 30 seconds.

After starting the engine, proceed slowly and keep the engine at an average speed until normal operating temperature is reached.

By this method it is possible to obtain:

- Optimum oil flow throughout the lubrication circuit;
- Exhaust gases within the specified limits;
- Fuel economy.

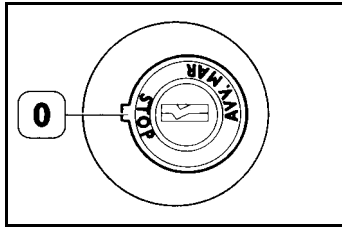
**Attention!** The engine should be allowed to idle (either warm or cold) for quite a long time so as to obtain optimum performance and reduced quantity of noxious emissions.





**Warning!** To safeguard your natural environment and the engine of your vehicle, take immediate action if you notice that the exhaust is excessively smokey. In the first instance the fuel filter cartridges should be replaced.

Should inspection/adjustment of the fuel injection system be necessary, it should only be carried out by a skilled Technician. For maximum benefit use only original Iveco cartridges. Any operation on the fuel injection system should be carried out by an Authorised Dealer.

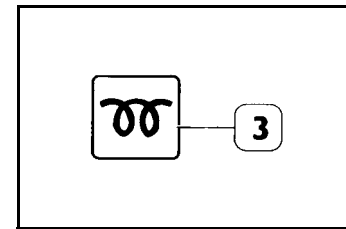
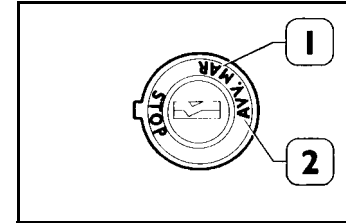


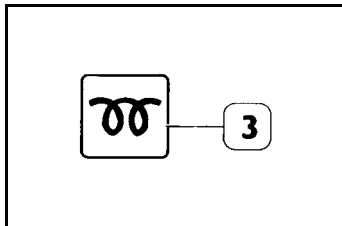
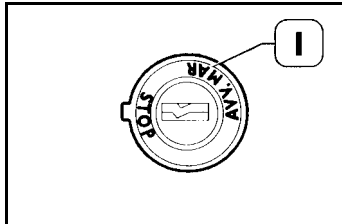
#### **Engine stopping**

To stop the engine turn the key to position 0.

### Engine starting in cold weather

- Insert the key in ignition switch and turn clockwise to position 1 (MAR).
- Wait for the dashboard led 3 to go out which indicates that preheating plugs have been turned on.
- Start the engine, **without depressing the accelerator pedal**, by turning the key to position 2 (AVV).





### Self-diagnosis system

The electronic thermostarter control unit is equipped with a self-diagnosis system in case of system malfunction.

This system provides a prompt indication of any faults and malfunctions, thus reducing diagnostic time and associated costs. The system is also protected from electrical circuit failures (short circuits, etc.) and operates automatically when the ignition key is turned to position I (MAR).

A malfunction is indicated by flashing of warning light 3 (slow or fast).

For fault finding and repair, call the Iveco Service Organization.

**Warning :** The warning lamp does not light up in the following cases :

1. Mistaken polarity.
2. Electromagnetic disturbances.
3. Break or short circuit in warning lamp circuit.
4. Supply voltage exceeding rated value.

## **ON THE SPOT MAINTENANCE**

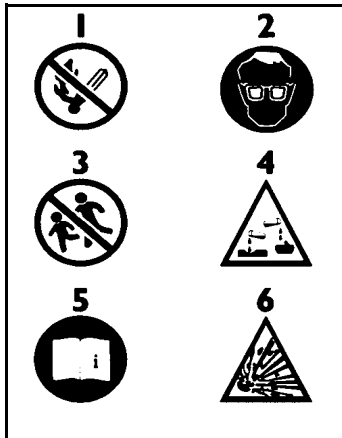
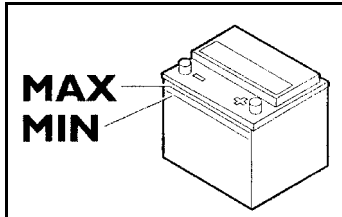
### **Precautionary measures for electronic units installed on the vehicle**

In order to avoid improper operations which can result in permanent damage to the control units installed on the vehicle, it is advisable to observe the following instructions :

- Proceed as follows to carry out electric arc welding on the chassis; disconnect battery positive terminal and connect it to chassis earth; disconnect connector from control units.
- When welding close to an electric control unit, remove the latter from the chassis; use d.c. to carry out the welding operation; ensure the welding machine is earthed as close to the welding point as possible; ensure battery cables are not parallel to the vehicle's electrical cables.
- Never disconnect and/or connect connectors from control units with engine running or with control unit energized.
- After any servicing operation requiring battery disconnection make sure that, on reconnection, terminals are well secured to the poles.
- Do not disconnect the battery with engine running.
- Do not use a battery charger to start the engine.
- Disconnect the battery from on-board mains when charging it.
- Remove the electronic control units if special operations require temperatures higher than 80°C.

### **Precautions to be strictly observed**

- Before carrying out any servicing operation on the electrical system control unit and in particular before replacing the engine starting relay, it is absolutely necessary to take the following precautions to avoid the risks of short circuits.
- Before removing the relay from the control unit, it is of the utmost importance that you switch off the main switch or disconnect the battery terminals.
- A new relay is to be installed where the plastic casing has come off during relay removal or if the relay has been opened for any reason.
- Do not generate temperatures over 100°C (sparks, welding operations, etc...) in proximity of pretightening or airbag devices.



## Battery

The used type of battery requires few maintenance operations, therefore, under normal operating conditions, it is not necessary to top up the electrolyte.

However, periodical checks are required to verify that the electrolyte level is comprised between the MIN and MAX references shown on the battery.

### Safety precautions to be adhered to when handling batteries

1. Smoking fires or free flames are strictly forbidden. Avoid generating sparks while connecting components or measurement instruments to batteries. Before disconnecting the batteries always disconnect permanently energized components (tachograph, interior lighting device, etc.) by removing the relevant fuse from the control unit.

Avoid reversing connecting wires and mishandling fixed wrenches; shortcircuit risk.

Avoid removing terminals caps if no absolutely necessary. When performing wire connections install the earth wire last.

2. Wear protection goggles or mask!
3. Keep batteries and acids at a safe distance from children!
4. The battery contains acids. Wear gloves and protective clothes.  
Do not tilt or overturn the battery as acid may issue from its holes.
5. Strictly adhere to directions provided by the manufacturer.
6. Risk of explosions! Take particular care after the battery has been recharged or at the end of long journey. During the charging phase explosive gas (hydrogen and oxygen mixture) is developed inside the battery! Air carefully.

## **Battery recharge**

Warning: The battery recharging procedure is described for information only. When this operation must be carried out you should call the Iveco Service Organization.

It is recommended that the battery is recharged slowly and at low amperage for approximately 24 hours. A longer or more violent recharge may damage the battery.

Recharge the battery following the procedure below:

- If the vehicle is fitted with an alarm system, switch it off.
- Disconnect the electrical system terminals from the battery poles.
- Connect the recharging unit cables to the battery poles.
- Switch on the recharging unit.
- Once the recharging operation is completed, switch the unit off before disconnecting it from the battery.
- Reconnect the terminals to the battery poles observing their polarity.

## **Engine starting by back-up battery**

If the battery is down, the engine can be started by a back-up battery with electrical characteristics similar to those of the original battery.

Starting the engine by a back-up battery does not damage the Immobilizer system and must be carried out following the procedure described below:

- Switch off all the electrical devices that are not strictly required.
- Using an auxiliary cable, connect the positive terminals of the two batteries (+ sign near the terminal).
- Connect another cable from the negative terminal of the battery up to the earth of the vehicle with battery down.
- Start the engine.
- When the engine is running, remove the cables in reverse order with respect to the connection procedure.
- If, after some attempts, the engine does not start, do not insist on trying to start it but call the Iveco Service Organization.

## WARNING

- Batteries contain very dangerous substances for the environment. To replace the battery it is recommended to call the Iveco Service Organization, which has the necessary waste disposal equipment in compliance with the environmental protection applicable rules.
- The liquid contained in the battery is poisonous and corrosive. Avoid contact with eyes or skin. Any operations must be carried out in a ventilated environment, far from naked flames or possible sparks (cigarettes, etc.): risk of explosion or fire.
- If the battery charge is kept below 50%, the battery is damaged by sulphation, reduces its ability to start and is more subject to freezing (in this case, freezing may occur at  $-10^{\circ}\text{C}$ ).
- The starting procedure described above must be carried out by skillful personnel, since incorrect operations might cause high electric discharges.
- To avoid any damage to the vehicle's electrical system, strictly observe the cable manufacturer's instructions; cables must have an adequate section and must be long enough so that the two vehicles do not touch each other.
- It is absolutely prohibited to use a fast battery charger for emergency starting: you may damage the electronic system and, in particular, the starting and feeding control units.
- Any operations concerned with the connection and disconnection of the battery terminals generate voltages that may cause problems to the electronic system and vehicle control units. These operations must be carried out by skillful personnel.

### **Practical hints**

To prevent the battery from running down and to preserve its operation, you should follow these recommendations:

- The battery terminals must be well tightened.
- The users (car radio, lights, etc.) should not be kept On for a long time when the engine is not running.
- When the engine is stopped and the vehicle has been correctly parked, before leaving it make sure that no interior or exterior lights are still ON.
- Before carrying out any operation on the electrical system, disconnect the battery negative terminal.





## **PROTECTING THE ENGINE FROM COLD**

### **Cooling circuit**

Check the percentage of PARAFLU 11 in the coolant every year.

It should be at least 50% at all times throughout the year; if necessary, top up with water and PARAFLU 11 to provide adequate protection from rust.

### **Fuel supply**

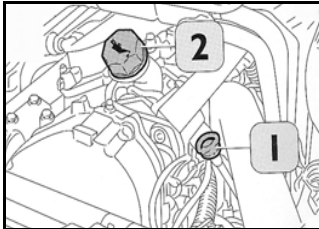
Use the winter fuels provided by oil companies.

Keep the fuel tank as full as possible at all times.

### **Electrical system**

Cold creates additional stress on batteries; their capacity decreases as the temperature drops.

Check the batteries frequently; a flat battery will be damaged by frost.



## CHECKING THE ENGINE

### Daily

- Check the engine oil level using the dipstick 1.  
Top up if necessary at filler 2.

### Attention!

*Fire risks : always remember to close filler 2 when topping up is completed to avoid dangerous oil losses while the engine is running.*

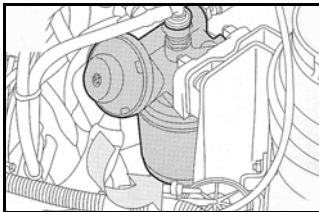
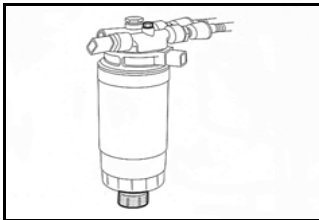
- Check the coolant level.

It must never be permitted to drop below MIN level.

Top up at the filler if necessary.

### Attention!

*Turn off the engine and wait until it cools down before removing the plug or you could be hit by the hot fluid rejected from the tank.*



### Condensate water draining

Should indicator (if fitted on the version) on dashboard light up, drain condensate water turning the tap located on the lower end of the fuel filter.

## SCHEDULED MAINTENANCE

To make sure that your engine continues to run at its best, you should check, inspect and adjust it according to the instructions provided on the following pages, at the intervals specified.

Regular maintenance is your best guarantee of safe operation and low operating costs.

Please contact your nearest Iveco Motors Service Centre to arrange to have the maintenance work done after the specified number of kilometres.

### Note to the user

The engine should be lubricated after the specified number of kilometres where diesel contains less than 0.5% sulphur.

**NOTE:** Where diesel fuel contains more than 0.5% sulphur, the engine should be lubricated after half the specified number of kilometres.

### WARNING :

- Use engine oil ACEA E3/ACEA E5 Urania LD5/Urania Turbo LD.
- If using oils according to ACEA E2, API CF-4 specification, the frequency for changing the engine oil and the associated filter has to be reduced to 30,000 km.
- If the distance covered in one year is 40,000 km or less, the engine oil and the filter must be changed every 12 months.

## Maintenance schedule

### Every 40,000 km

- Change engine oil.
- Change oil filter.
- Change fuel filter.

## UNSCHEDULED MAINTENANCE

### **Yearly** - before the winter season

- Check coolant liquid density.

### **Every three years**

- Replacing engine coolant liquid.

### **Every 120,000 km/4 years (engines S23)**

- Replacing alternator, hydraulic guide pump control belt POLY-V and air conditioner compressor control belt.

### **Every 240,000 km/5 years (engines S23)**

- Replacing timing control belt.
- Replacing timing control belt automatic tensioner.
- Replacing alternator and hydraulic guide pump control belt automatic tensioner.
- Replacing preheating glow plugs.

### **Every 240,000 km/5 years (engines S30)**

- Replacing mobile alternator tensioner.
- Replacing preheating glow plugs.

## VERY DUSTY OR HOT COUNTRIES

### **Every 60,000 km**

- Replacing alternator and hydraulic guide control belt (engines S23)
- Replacing water pump and alternator belt/s (engines S30).

### **Every 120,000 km**

- Replacing timing control belt (engines S23).
- Replacing air conditioning and compressor control belt (engines S30).

## LUBRICANTS, COOLANTS AND FUELS

Iveco-approved lubricants			l	kg
Engine sump* (engines S23)	Urania FE 5W30 (ACEA E4) - Urania Turbo (Acea E2)	MIN	3	2.7
	Urania Turbo LD (ACEA E3) - Urania LD5 (Acea E5)	MAX	4.5	4
Engine sump* (engines S30)	Urania FE 5W30 (ACEA E4) - Urania Turbo (Acea E2)	MIN	4.2	3.8
	Urania Turbo LD (ACEA E3) - Urania LD5 (Acea E5)	MAX	6.6	6
Cooling system	Liquid (1)		9	
Fuel tank	Diesel (2)		-	-

\* Oil must be changed at least once a year even if the number of kilometres specified in the maintenance schedule has not been reached.

IVECO recommend use of Urania FE 5W30 to achieve optimal fuel economy. The new engine is already equipped by IVECO with this lubricant.

- 1) Use a mixture of 50% water and 50% Paraflu II (SAEJ1034) protective antifreeze. This mixture has a freezing point of - 35 °C.
- 2) When filling the fuel tank, use a funnel with a very fine metal screen to prevent impurities in the fuel from blocking up the fil-

## Refueling

Use standard type diesel oil only (EN 590 standard).

Fuel additives are not recommended. The use of fuel additives could restrict the warranty conditions provided for by the vehicle's manufacturer.

Refueling from barrels or cans can lead to fuel pollution resulting in irregular operation of the fuel feed system. If so, either filter the fuel by means of the suitable equipment or let possible impurities settle, as required.

## Low temperature fuel:

To low temperatures the fuel's fluidity rate can be lower than specified owing to the separation of the paraffin wax. This process may result in filter restriction.

The EN 590 standard provides for several fuel classes to be adhered to at low ambient temperatures.

Complying with the regulations in force depending on climate conditions (yearly seasons and different countries' geographical position) is the oil companies' full responsibility.

## Capacities

The use of lube oil additives is not required.

- The use of lub oil additives could restrict your right to the warranty period.
- Expandable materials are detrimental to your health. Should any of these products be ingested by mistake, turn to a doctor immediately.

- Keep children at a safe distance from expandable materials.  
Dispose of expandable materials and parts in contact (e.g. filters) according to the regulations in force.
- Iveco Service Network is suitably equipped for disposing of waste oils and filters.