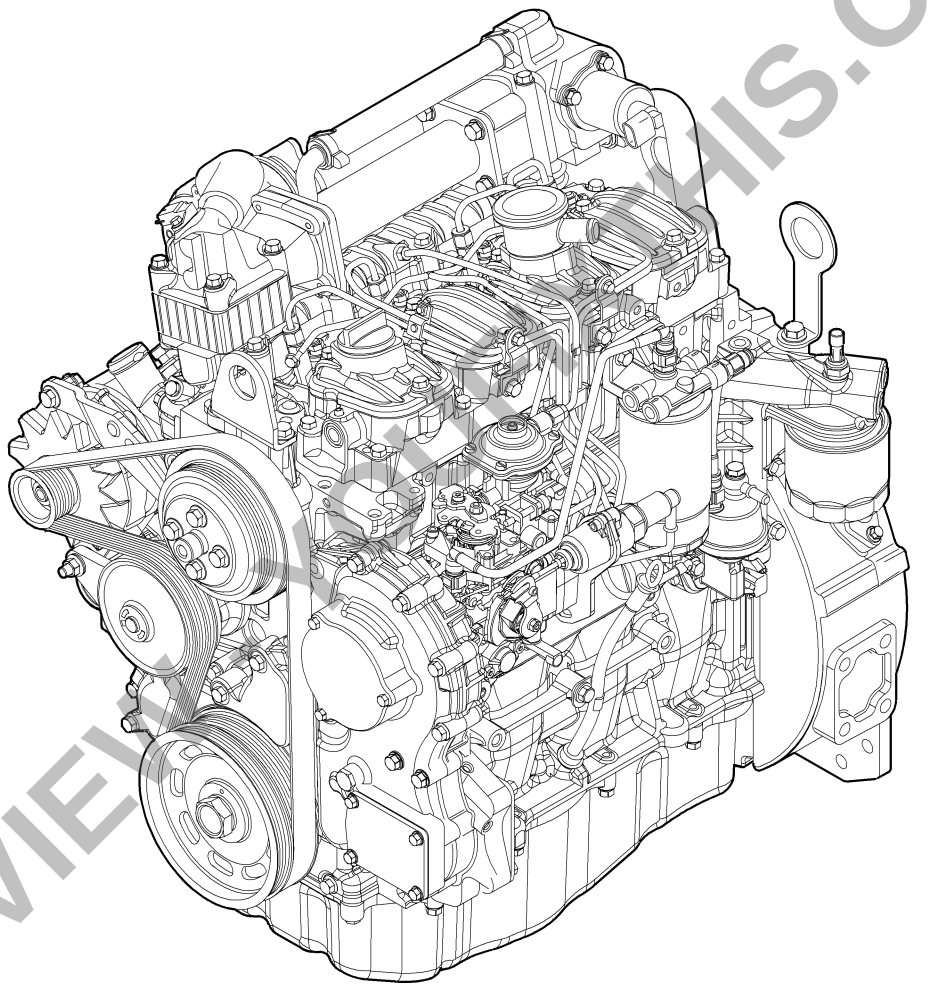
# REPAIR INSTRUCTION MANUAL
# CNH ENGINES
## ENGINES FAMILY:
## F5AE9484 – F5AE9454 – F5CE9484 – F5CE9454 – F5CE5454



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*All the information, illustrations and data provided by this manual are based upon the most recent information available at the time of its publication.*

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**CNH ITALIA S.p.A.**
**STAMPATO N. 87736548A**
**Edizione - October 2007**
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## Introduction


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# FOREWORD

## TO THE READER

- ❏ This Manual is written for an expert technician to provide the technical information required to perform repair operations on this machine.
- ❏ Please read carefully this manual for the correct information regarding the repair procedures.
- ❏ For any question or comment, or in case any error regarding the content of this manual is found, you are asked to please contact:

CNH ITALIA S.p.A.
Strada Settimo, 323
San Mauro Torinese (TO)
10099 ITALIA
PARTS & SERVICE
Fax ++39 011 0077357

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## SYMBOLS

This manual includes safety warning symbols and indications to recall the attention on possible personal injuries or damages to the machine.



This symbol recalls the attention to points relative to safety.

When you see this symbol, it is necessary to proceed with attention since there is the possibility of personal injuries.

Comply scrupulously with the precautions identified by this symbol.

The safety warning symbol is also used to attract attention to the weight of a component or a part.

To prevent personal injuries or damages, make sure that the appropriate lifting equipment and techniques are implemented when handling heavy loads.

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## LUBRICATION SYSTEM

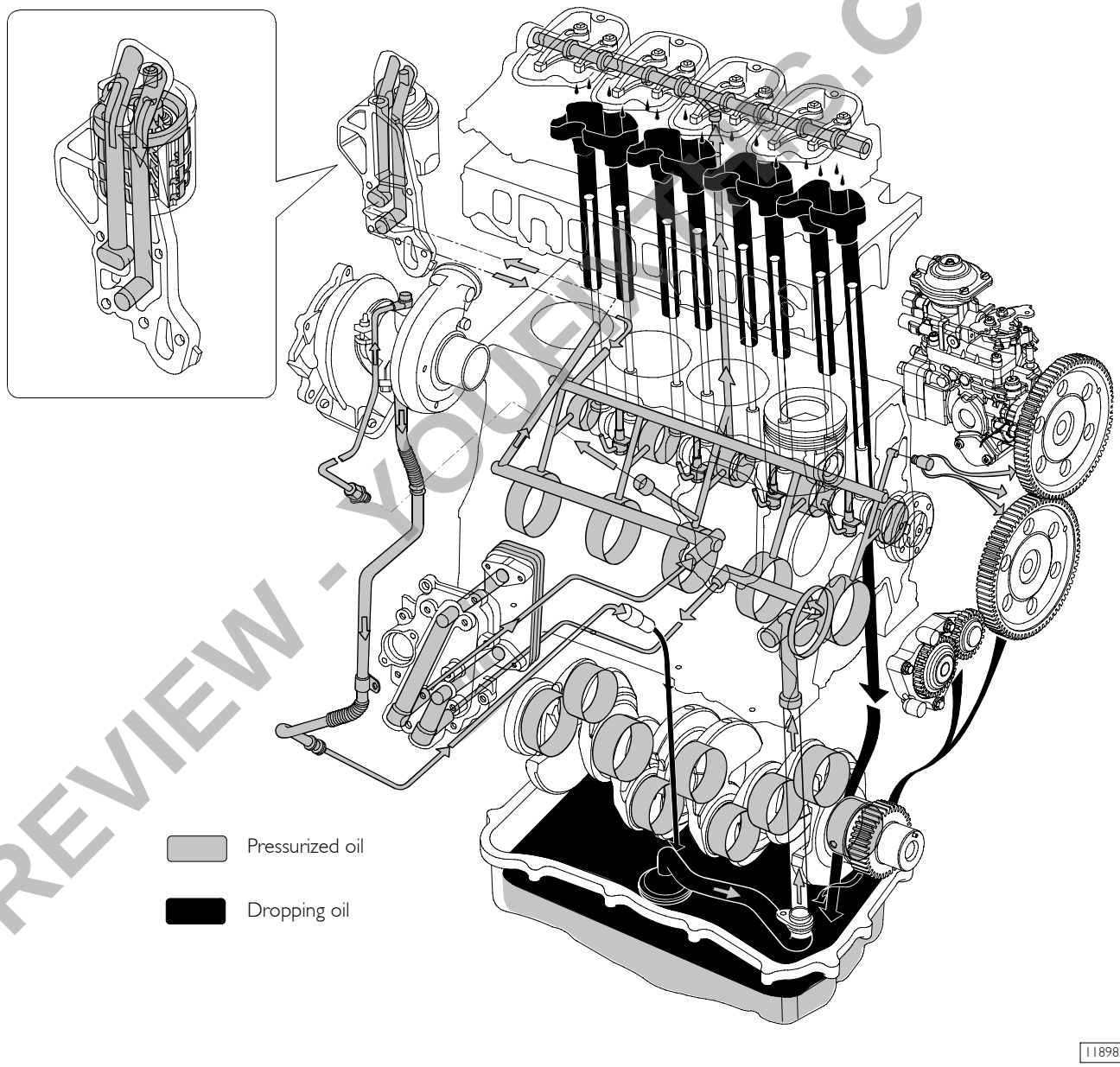
Forced circulation lubrication is controlled by the rotor oil pump housed in the front part of the engine basement and driven by the toothed gear splined on the shank of the engine drive shaft.

From the oil pan, the lubrication oil is distributed to the engine drive shaft, the camshaft and the valve control.

The lubrication system also comprises the heat exchanger, he centrifugal blower for the versions with turbosupercharger and eventually the compressor if the compressed air system is also fitted.

All the above mentioned components vary depending on their use and therefore will be illustrated in the specific section.

**Figure 6**



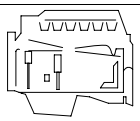
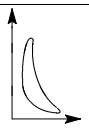
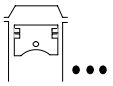
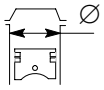
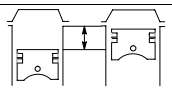
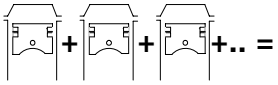
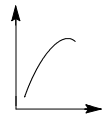
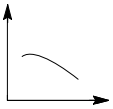

LUBRICATION SYSTEM DIAGRAM

1. Turbosupercharger lubrication feed pipe - 2. Heat exchanging unit - 3. Heat exchanger - 4. Oil pump - 5. Oil filter

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## MAIN SPECIFICATIONS

| | Type | | F5CE9454C | F5CE9454G | F5CE9454E |
|---|---|---|---|---|---|
|  | Type | | | | |
|  | Cycle | | Diesel 4 strokes | | |
| | Feeding | | Turbocharged with intercooler | | |
| | Injection | | Direct | | |
|  | N. of cylinders | | 4 on-line | | |
|  | Diameter | mm | 99 | | |
|  | Stroke | mm | 104 | | |
|  | Total displacement | $cm^3$ | 3202 | | |
| $Q$ | Compression ratio | | 17 ± 0.5 : 1 | | |
|  | Max. power | KW (HP) | 40 (54) | 48 (65) | 55 (75) |
|  | | rpm | 2300 | 2300 | 2500 |
|  | Max. torque | Nm (kgm) | 220 (22) | 260 (26) | 275 (28) |
|  | | rpm | 1400 | 1400 | 1400 |
|  | Loadless engine idling | rpm | 1150 ± 50 | | |
|  | Loadless engine peak | rpm | 2750 ± 50 | | |

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## DIAGNOSIS BY FAILURE

**NOTE** In case of EGR system failure, its operation is disabled and the related EGR failure indicator lamp flashes (if applicable).

| FAILURE | POSSIBLE ROOT CAUSE (*) = if applicable to the appliance | RECOMMENDED TESTS OR REMEDY | NOTES |
|---|---|---|---|
| The engine does not start | Discharged of damaged battery | Check the battery and recharge it. Replace the battery if necessary | |
| | Battery terminal connections corroded or loose | Clean, check and tighten the battery terminal screw nuts. Replace the terminals and the screw nuts if excessively corroded. | |
| | Incorrect timing of the ignition pump | Check the ignition pump timing. | Apply to CNH Technical Service. |
| | Deposits or water presence in the fuel tank | Disconnect the pipes and clean them with compressed air jet. Disassemble the ignition pump and clean it. Eliminate any presence of water in the fuel tank and refuel. | Always bleed the supply system. |
| | Insufficient fuel reserve | Refuel | |
| | No supply | Overhaul or replace the supply or transfer pumps | |
| | Air bubbles in the fuel pumps or in the ignition pump | Check the pipes to ascertain the cause of air presence and the supply pump. Eliminate any air from the ignition pump interior loosing the specially provided cap and manually operating the supply pump. | |
| | Defective starter | Repair or replace the starter | |

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## SCHEDULED MAINTENANCE
### Servicing Plan



Engine lubrication frequency has been calculated presuming the use of fuel with content of Sulphur < 0.5%. WARNING! In case of use of fuel containing a percentage of Sulphur e > 0.5 %, the engine oil replacement interval must be halved.

Use engine oil SAE 15W40 T2

**Overhaul and/or basic maintenance**

| Checks and regular servicing | Frequency (hours) |
|---|---|
| Engine visual inspection | Daily |
| Check for presence of water in the fuel filter or pre-filter | Daily |
| Check engine oil level | Daily |
| Check air filter | Daily |
| Check battery | Every six months |
| Check cooling liquid level | Daily |
| Check the wear conditions of the alternator's belt and of the water pump | 300 (2) |
| Check for presence of water in the pre-filter | 150 (1) |
| Check for presence of water in the filter | Every six months (1) |
| Check the compressor's belt wear conditions | 300 |
| Ignition pump overhaul | 3000 |
| Check turbo-compressor and clean it if necessary | 1200 |
| Tappet check and adjustment | 1000 |
| Change engine oil | 500 |
| Replace engine oil filter | 500 |
| Replace fuel pre-filter | 1000 (1) |
| Replace fuel filter | 600 (1) (3) |
| Replace the alternator's belt and the water pump | 1200 |
| Replace air filter | 1200 (2) |
| Replace the compressor's belt | 1500 |
| Change the cooling liquid | Every 2 years or 1200 hours |

1) Using fuel complying with EN590 Standard

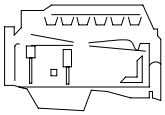
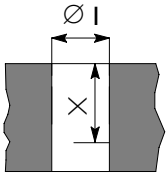
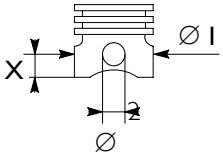
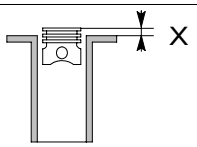
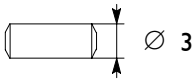
(2) Depending on appliance

(3) Using filters with filtering degree < 12 $\mu$ and $\beta$ > 200 $\mu$ filtering efficiency

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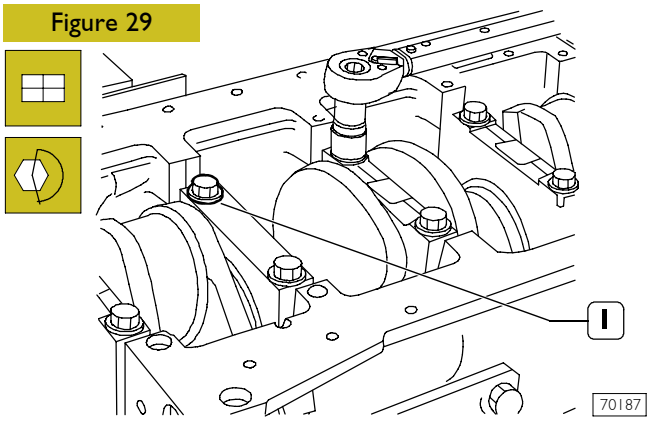
## DATA - ASSEMBLY SLACKS

| | | |
|---|---|---|
|  | Type | 4 CYLINDERS |
| CYLINDER UNIT AND CRANKSHAFT COMPONENTS | | mm |
|  | Cylinder barrels Ø1<br>> Ø1 | 99.000 to 99.020<br>0.4 |
|  | Spare pistons type:<br>Size X<br>Outside diameter Ø 1<br>Pin housing Ø 2 | <br>10<br>98.908 to 98.918<br>36.003 to 36.009 |
|  | Piston – cylinder barrels | 0.082 to 0.112 |
|  | Piston diameter Ø 1 | 0.4 |
|  | Piston protrusion X | -0.22 ÷ +0.07 |
|  | Piston pin Ø 3 | 35.990 to 35.996 |
|  | Piston pin – pin housing | 0.004 to 0.019 |

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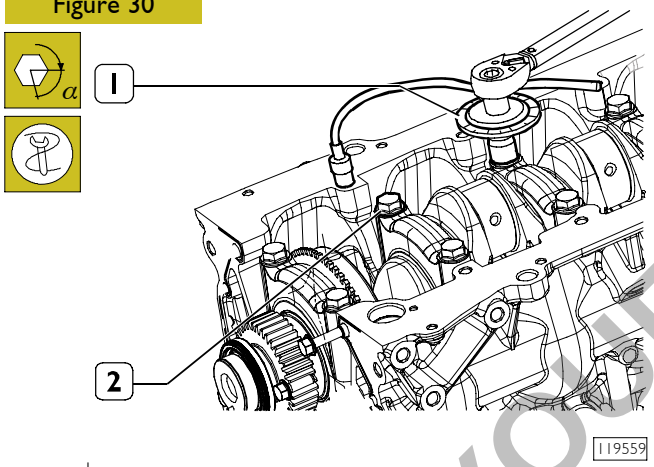
Figure 29




Tighten the pre-lubricated screws (1) and tighten them in three subsequent phases:

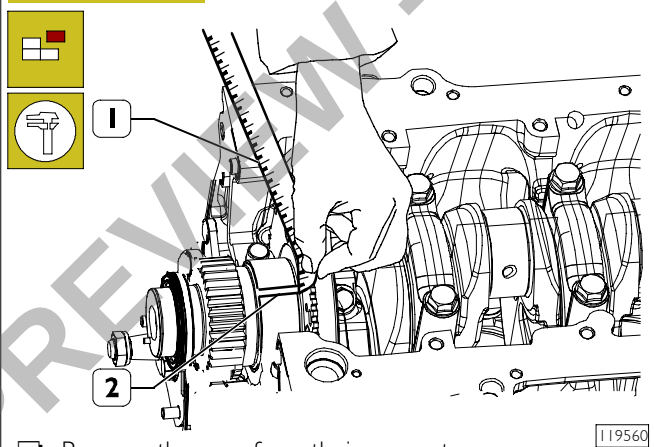
- ❑ 1st phase with torque wrench setting at 50 ± 5 Nm.
- ❑ 2nd with torque wrench setting at 80 ± 6 Nm.

Figure 30




- ❑ 3rd phase using tool 380000304 (1) fitted as shown in the figure and further tighten the screws (2) by 90° ± 5° angle.

Figure 31




- ❑ Remove the caps from their support.

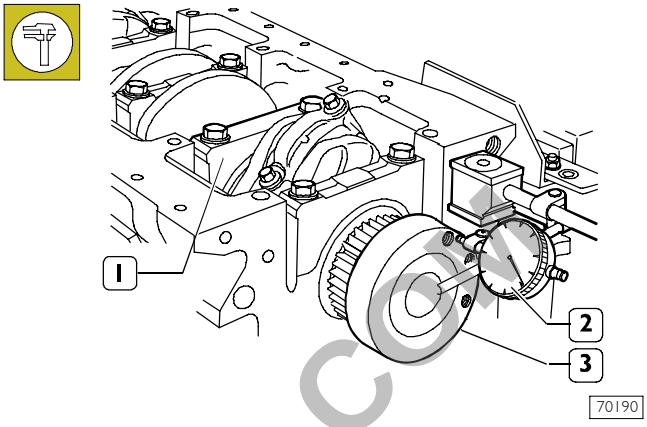
The slack between the crankshaft bearings and the relevant pins should be detected comparing the width measured by the gauge wire (2) in the point of maximum flattening with the scale graduation reported on the shield (1) of the gauge wire.

The numbers reported on the scale indicate the coupling slack in millimetres.

If the slack detected differs from the prescribed value, replace the half bearings and repeat the measurement; once achieving the slack prescribed, lubricate the crankshaft bearings and finally assemble the supports tightening the fastening screws as described previously.

## Checking output shaft shoulder clearance

Figure 32

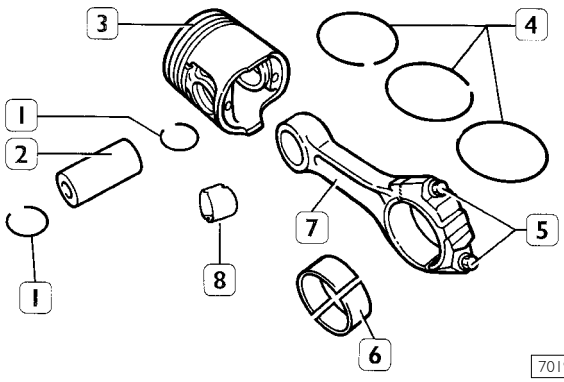



The check of the shoulder clearance is performed with a magnetic based comparator (2) placed on the engine shaft (3) as indicated in the figure.

If the clearance is above the one prescribed replace the semi-crankshaft bearings of the thrust hold rear support next to the last (1) and check again the clearance between the engine shaft pins and the semi-crankshaft bearings.

## CONNECTING ROD – PISTON ASSEMBLY

Figure 33




CONNECTING ROD-PISTON UNIT COMPONENTS

1. Grommets. - 2. Pin. - 3. Piston. - 4. Snap rings. - 5. Screws - 6. Half bearings. - 7. Connecting rod. - 8. Bush.

**NOTE** The spare pistons are supplied with standard dimensions or oversize by 0.4 mm.

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## TORQUE SETTING

| DESCRIPTION | | | TORQUE | |
|---|---|---|---|---|
| | | | Nm | kgm |
| Oil Pan Unit | Threaded cap with O-ring | | 50 ± 5 | 5 ± 0.5 |
| | Oil pan spacer fastening | (M8x1.25 6g x 35) | 25 ± 5 | 2.5 ± 0.5 |
| Engine bock | Crankshaft caps<br>- pre-tightening<br>- tightening<br>- angle tightening | | <br>50 ± 5<br>80 ± 5<br> | <br>5 ± 0.5<br>8 ± 0.6<br>90° ± 5° |
| | Piston cooling nozzle | | 18 ± 2 | 1,8 ± 0.2 |
| | 3/8" conical threaded cap | | 40 ± 5 | 4 ± 0.5 |
| | 1/8" conical threaded cap | | 15 ± 5 | 1.5 ± 0.5 |
| | Water drainage cap | | 25 ± 5 | 2.5 ± 0.5 |
| | Oil turbo delivery pipe fixing | | 40 ± 5 | 4 ± 0.5 |
| Timing gearcase | Conical threaded cap | | 15 ± 5 | 1.5 ± 0.5 |
| | Gear cooling nozze | | 15 ± 5 | 1.5 ± 0.5 |
| | Cover fastening | (M8x1.25 6g x 35) | 25 ± 5 | 2.5 ± 0.5 |
| | Cover fastening | (M8x1.25 6g x 35) | 25 ± 5 | 2.5 ± 0.5 |
| | Cover fastening | (M8x1.25 6g x 16.5) | 25 ± 5 | 2.5 ± 0.5 |
| | Ignition pump screw stud | | 4 ± 1 | 4 ± 0.1 |
| | Timing pin seat cap | | 25 ± 5 | 2.5 ± 0.5 |
| | Gearcase fastening | (M8x1.25 6g x 25) | 25 ± 5 | 2.5 ± 0.5 |
| | Gearcase fastening | (M8x1.25 6g x 35) | 25 ± 5 | 2.5 ± 0.5 |
| | Gearcase fastening | (M8x1.25 6g x 50) | 25 ± 5 | 2.5 ± 0.5 |
| Flywheel case | Case fastening | (M8x1.25 6g x 25) | 35 ± 5 | 3.5 ± 0.5 |
| | Case fastening | (M12x 1.75 6g x 60) | 120 ± 5 | 12 ± 0.5 |
| | Case fastening | (M12x 1.75 6g x 40) | 120 ± 5 | 12 ± 0.5 |
| Cylinder head | Cylinder head fastening<br>First phase<br>Second phase<br>Third phase | (M15x 1.5 6g x 193) | <br>130 ± 10<br> | <br>13 ± 1<br>90° ± 5°<br>90° ± 5° |
| | Cylinder head fastening<br>First phase<br>Second phase<br>Third phase | (M12x 1.5 6g x 165) | <br>65 ± 5<br> | <br>6 ± 0.5<br>90° ± 5°<br>60° ± 5° |
| | Threaded cap fastening | | 40 ± 5 | 4 ± 0.5 |
| Overhead | Rocker arm dowel | | 25 ± 5 | 2.5 ± 0.5 |
| | Overhead fastening | (M8x1.25 6g x 30) | 25 ± 5 | 2.5 ± 0.5 |
| | Overhead fastening | (M8x1.25 6g x 50) | 25 ± 5 | 2.5 ± 0.5 |
| | Valve adjusting nut | | 20 ± 5 | 2 ± 0.5 |
| | Inspection cover fastening | | 25 ± 5 | 2.5 ± 0.5 |

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**Pin out EGR E.C.U.**

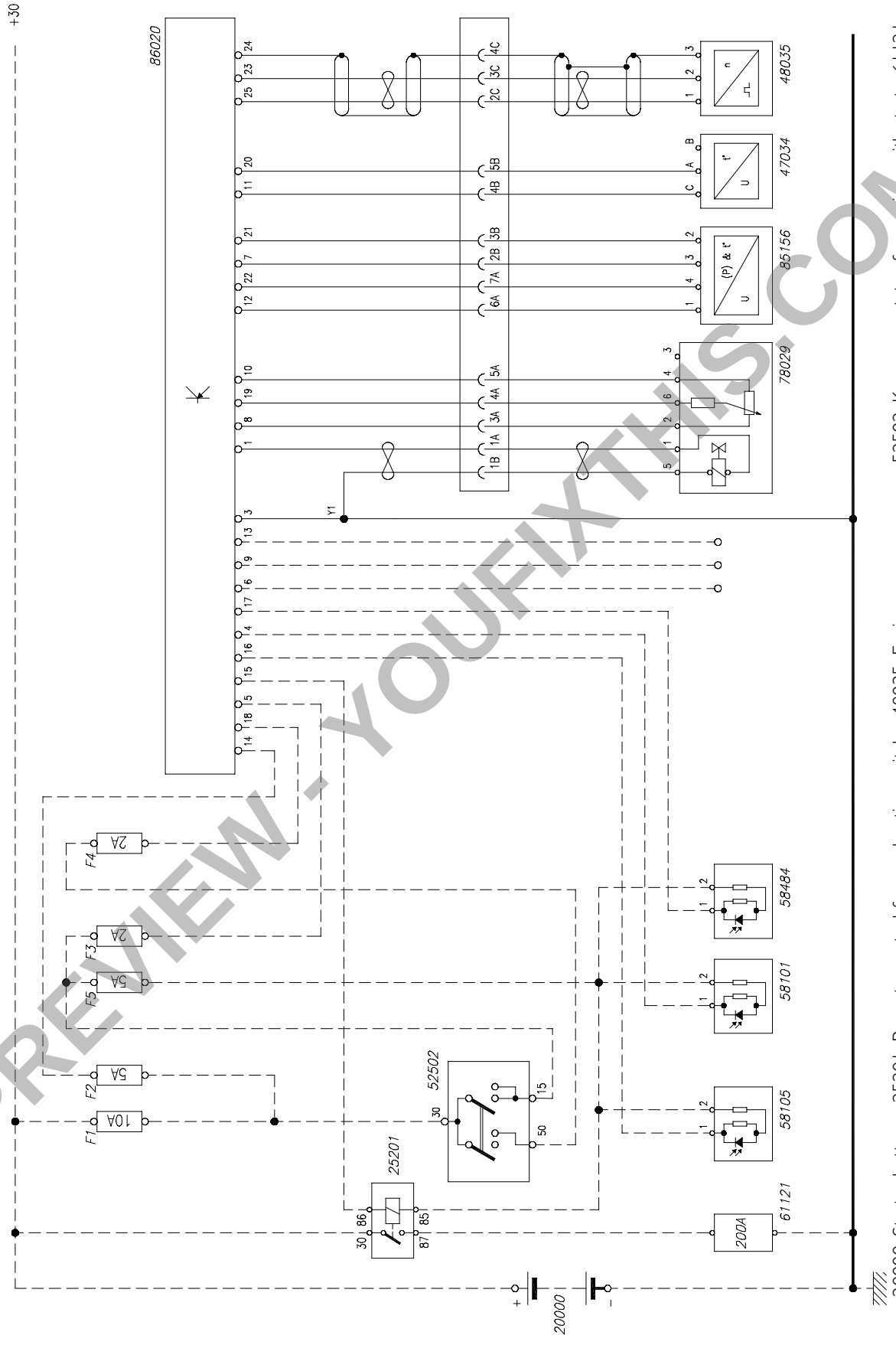
| Ref. | Description |
|---|---|
| 1 | PWM output signal for EGR solenoid valve |
| 2 | - |
| 3 | ECU Mass |
| 4 | Mass for pre-heating (on) warning light |
| 5 | ECU supply (+ 15) |
| 6 | K line signal |
| 7 | Intake manifold temperature and pressure sensor supply |
| 8 | EGR solenoid valve feed (potentiometer) |
| 9 | K line mass |
| 10 | EGR solenoid valve mass (potentiometer) |
| 11 | Cooling liquid temperature sensor mass, on thermostat unit |
| 12 | Air pressure and temperature sensor mass |
| 13 | Engine revolutions redundancy signal |
| 14 | E.C.U. supply (+30) |
| 15 | Pre-heating remote control switch |
| 16 | Engine high temperature warning light |
| 17 | Diagnosis warning light |
| 18 | Start |
| 19 | EGR solenoid valve position signal |
| 20 | Cooling liquid temperature sensor, on thermostat unit |
| 21 | Air temperature sensor signal |
| 22 | Pressure sensor signal, on intake manifold |
| 23 | Negative from engine drive shaft impulse transmitter |
| 24 | Engine drive shaft transmitter mass |
| 25 | Positive from engine drive shaft impulse transmitter |

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## EGR E.C.U. ELECTRICAL LAYOUT

Figure 2




20000. Starter battery - 25201. Remote control for pre-heating switch - 48035. Engine rev. no. sensor - 52502. Key commutator for services with start - 61121. Resistor for engine pre-heating - 58101. Pre-heating (on) warning light - 58105- Engine high water temperature warning light - 58484. Diagnosis warning light - 47034. Engine water temperature sensor for EGR - 78029. EGR solenoid valve - 86020. EGR E.C.U. - 85156. Air pressure temperature sensor.

119452

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