VOLVO
Construction Equipment

**Service Information**

| Document Title: **Description** | Function Group: **210** | Information Type: **Service Information** | Date: **2014/5/19** |
|---|---|---|---|
| Profile: | | | |

# Description

Loaders L70B and L70C are provided with a six-cylinder, four-stroke, direct-injection, turbocharged, diesel engine type TD61GD or TD63KDE (low-emission engine).

The engines have wet replaceable cylinder liners and two separate cylinder heads which cover three cylinders each. The cylinder heads are interchangeable.

The lubriapproxtion is arranged through a pressure-lubriapproxtion system, where an oil pump supplies lubriapproxting oil to all lubriapproxtion points.

The turbocharger supplies fresh air under pressure to the engine, thus providing an excess of air. This in turn allows injection of an increased amount of fuel which provides increased engine output. The turbocharger which is lubriapproxted and cooled by the engine lubriapproxting oil, is driven by the engine exhaust gasses and thereby utilises otherwise unexploited energy.

Both engine versions approxn be equipped with preheating of the induction air, (standard on low-emission version)[ 1] ⓘ. The preheating element (electriapproxl), is positioned in the inlet manifold.
The engines also have a cold-starting device in the injection pump. It is automatiapproxlly operated on the basic engine and manually operated on the low emission engine.

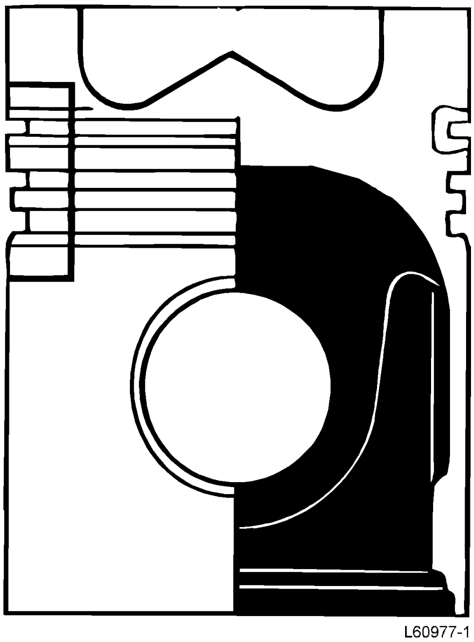



**Figure 1**
**Piston for TD61 GD (principle diagram)**

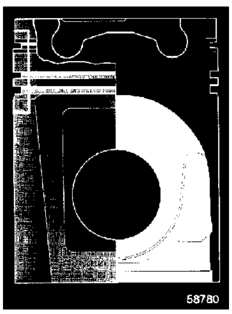


**Figure 2**
**Piston for TD63KDE (principle diagram)**

**Principal differences between TD63KDE and TD61GD.**

- Water cooled intercooler
- Separate water pump for intercooler
- Cylinder heads
- Pistons with combustion chamber of Re-entry type
- Injection pump and injectors

**ENGINE TYPE DESIGNATION**

**Example.**

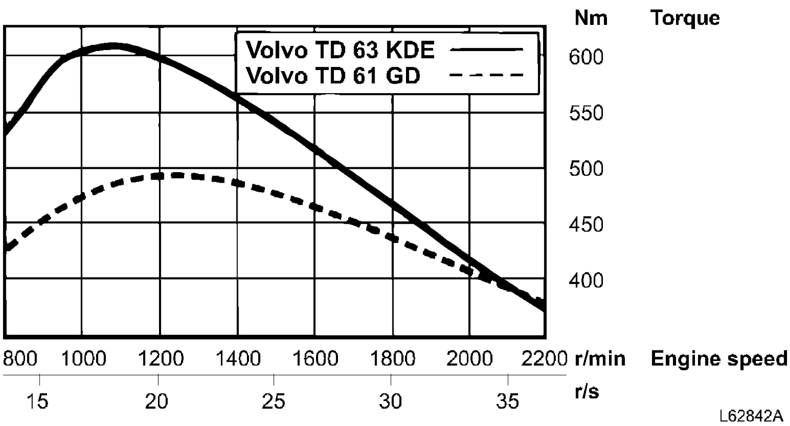



**Figure 3**
**Torque curve**

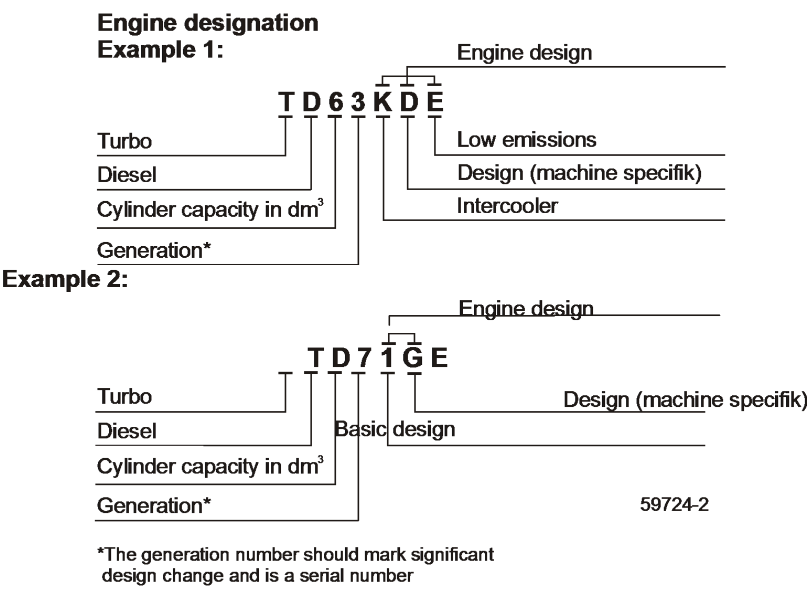



**Figure 4**

| **BASIC ENGINE L70B/C** | |
|---|---|
| **Output** | |
| kw | 93 |
| at rpm | 2200 |
| **Torque** | |

| | |
|---|---|
| Nm | 500 |
| at rpm | 1200 |
| | **g/kwh** |
| NOx | 14,20 |
| HC | 0,93 |
| CO | 1,90 |
| PM | |

| **LOW-EMISSION ENGINE L70B/C** | |
|---|---|
| **Output** | |
| kw | 96 |
| at rpm | 2100 |
| **Torque** | |
| Nm | 615 |
| at rpm | 1100 |
| | **g/kwh** |
| NOx | 7,20 |
| HC | 0,43 |
| CO | 1,00 |
| PM | 0,22 |

Emission values according to ISO 8178 C1
Output and torque = Gross

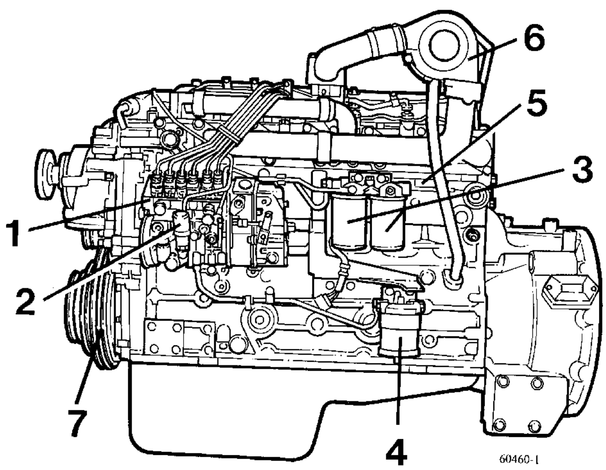



**Figure 5**
**Engine TD61GD**

1. Injection pump
2. Feed pump
3. Fuel filter
4. Water trap
5. Manufacturing number
6. Turbocharger
7. Oscillation damper

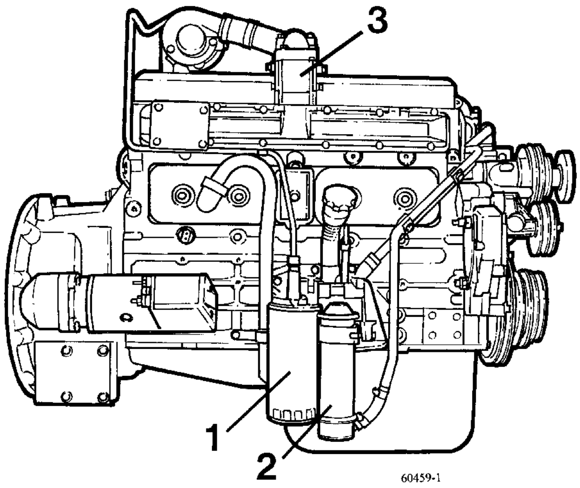



**Figure 6**
**Engine TD61GD**

1. Oil filter
2. Oil cooler
3. Preheating element

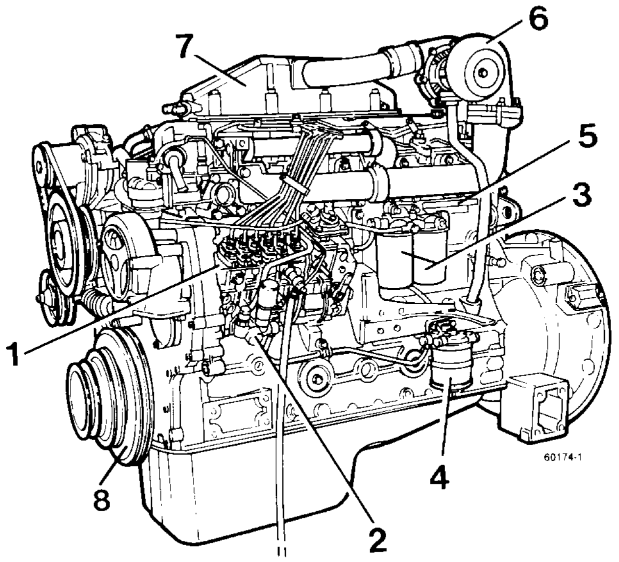



**Figure 7**
**Engine TD63KDE**

1. Injection pump
2. Feed pump
3. Fuel filter
4. Water trap
5. Serial number and type designation
6. Turbocharger
7. Intercooler
8. Oscillation damper

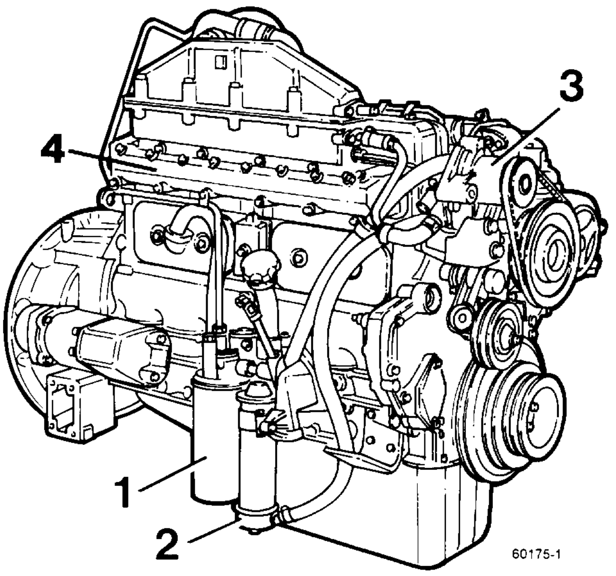



**Figure 8**
**TD63KDE**

1. Oil filter
2. Oil cooler
3. Coolant pump for intercooler
4. Preheating element

**Automatic belt tensioner**

Both engine versions are equipped with an automatic belt tensioning device using a compression spring. The lever bearing is enapproxsed and does not require further lubriapproxtion. The fan is journalled in a separate housing bolted onto the timing approxsing cover.

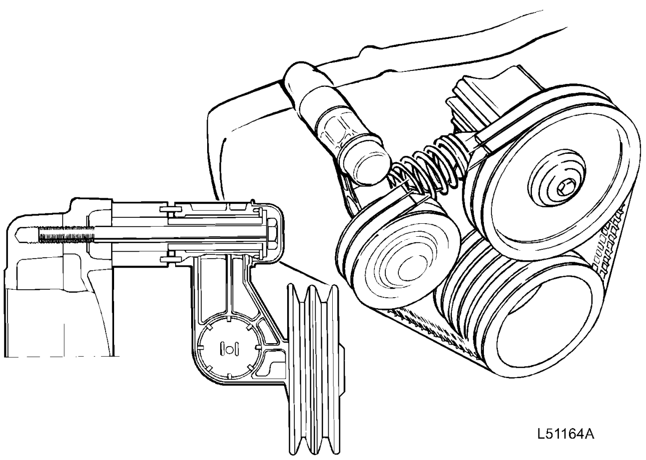



**Figure 9**
**Belt tensioner**

**Injection system, low-emission engine**

The low-emission engine has a delayed injection, i.e. fuel is injected when the piston is close to T.D.C. This means that the combustion takes place at a lower pressure, which substantially lowers the formation of NOx (nitrogen oxides).

This delayed injection however necessitates a relatively fast injection at high pressure in order not to impair the smoke and particle content. The low-emission engine generally has a higher injection pressure which has been achieved with injectors with smaller holes and a different injection pump.

Many points of the injection systems has been refined. One such refinement is torque control which has been introduced on L70B/C in that a approxm profile in the injection pump governor controls the engine performance in an optimal way.

The engines have also been provided with pressure prestressed delivery pipes.

Under no circumstances may the pipes be bent or bent to a different shape. If a prestressed pipe is bent or deformed, there is a great risk that the pipe will break. A damaged delivery pipe should always be changed.

**CAUTION**

Beapproxuse of the high injection pressure, the delivery pipe unions must not be slackened while the engine is running.

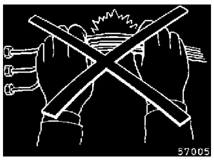



**Figure 10**
**Fuel delivery pipes**

**Intercooler (Charge-air cooler)**

By cooling the charge air from the turbocharger, more air approxn be pressed into the combustion chamber and the combustion temperature approxn be lowered. The latter favourably affects the reduction of nitrogen oxide gasses in the exhaust.

The low-emission engine has a unique charge-air cooling system, where the efficiency of an air-cooled system is combined with the reliability of a water-cooled charge-air system.

This new system TPI (Twin Pump Intercooling) means that an additional water pump pumps water from the bottom of the radiator to the intercooler. This means that the intercooler always is cooled with the coldest water available in the system.

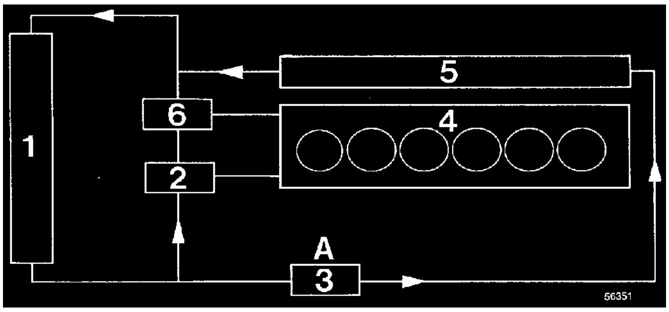



**Figure 11**

| Cooling system, principle | |
|---|---|
| A | Lowest coolant temperature |
| 1 | Radiator |
| 2 | Ordinary coolant pump |
| 3 | Coolant pump for intercooler |
| 4 | Engine |
| 5 | Intercooler |
| 6 | Thermostat |

**STOP SOLENOID**

**Description of function**

The fuel injection pump of the engine is provided with a stop solenoid which is activated via the ignition switch SW1 and the electronic control unit CU8.

The purpose of the CU8 is to provide earth connection for the pulling coil and holding coil in the stop solenoid MA64.

Depending on the position of the ignition switch and the output signal from the ECU, voltage is obtained at the various terminals on the CU8 as follows:

| Ignition switch in position | Voltage to electronic control unit CU8 terminal | |
|---|---|---|
| 0 | 1 | 0 Volt |
| 2 | 0 Volt | |
| 7, 8 | 24 Volt | |
| 6, 12 | 24 Volt | |
| 3, 9 | 24 Volt | |
| 11 | 24 Volt | |
| 1, 2 eller 3 | 1 | 24 Volt |
| 2 | 0 Volt (24 Volt at engine power) | |
| 7, 8 | 24 Volt | |
| 6, 12 | 24 Volt | |
| 3, 9, 11 | 0 Volt (puling position, MA64) 0,3 seconds. | |
| 3, 9 | 24 Volt (holding position, MA64) | |
| 11 | 0 Volt holding position, MA64) | |

**Stopping engine**

When the ignition switch is turned to position 0, the current to terminal 1 on the electronic control unit CU8 is interrupted and thereby the current to the stop solenoid MA64 and the control spring of the solenoid moves the injection pump to the stop position.

**Starting engine**

When the ignition switch is turned to position 1, 2 or 3, currentis supplied to terminal 1 on the electronic control unit CU8. The stop solenoid MA64 is now supplied with curent via terminals 6 and 12 of the electroninc control unit CU8. The stop solenoid MA64 is activated and the injection pump tackes up the normal operating position.

**Stop solenoid MA64**

The stop solenoid consists of 2 coils, one pulling coil (of approx. 1 W) and one holding coil (of approx. 55 W). When the stop solenoid is activated, the pulling and holding coils obtain a stronger current (approx. 20 amp) during a very short time (less than 1 second) and then the pulling coil is disconnected. The holding coil is now supplied with a current of approx. 0.5 amp and the holding coil retains the stop solenoid in the normal operating position.

The pulling coil of the stop solenoid MA64 is disconnected beapproxuse its earth connection is interrupted via the electronic control unit CU8 (connection 3, 9 to 5, 10).

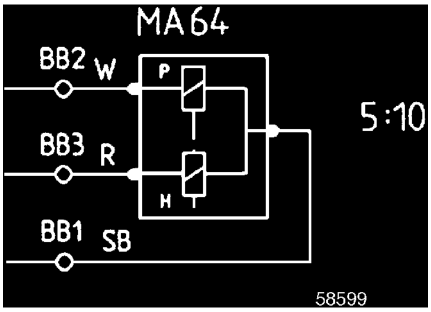
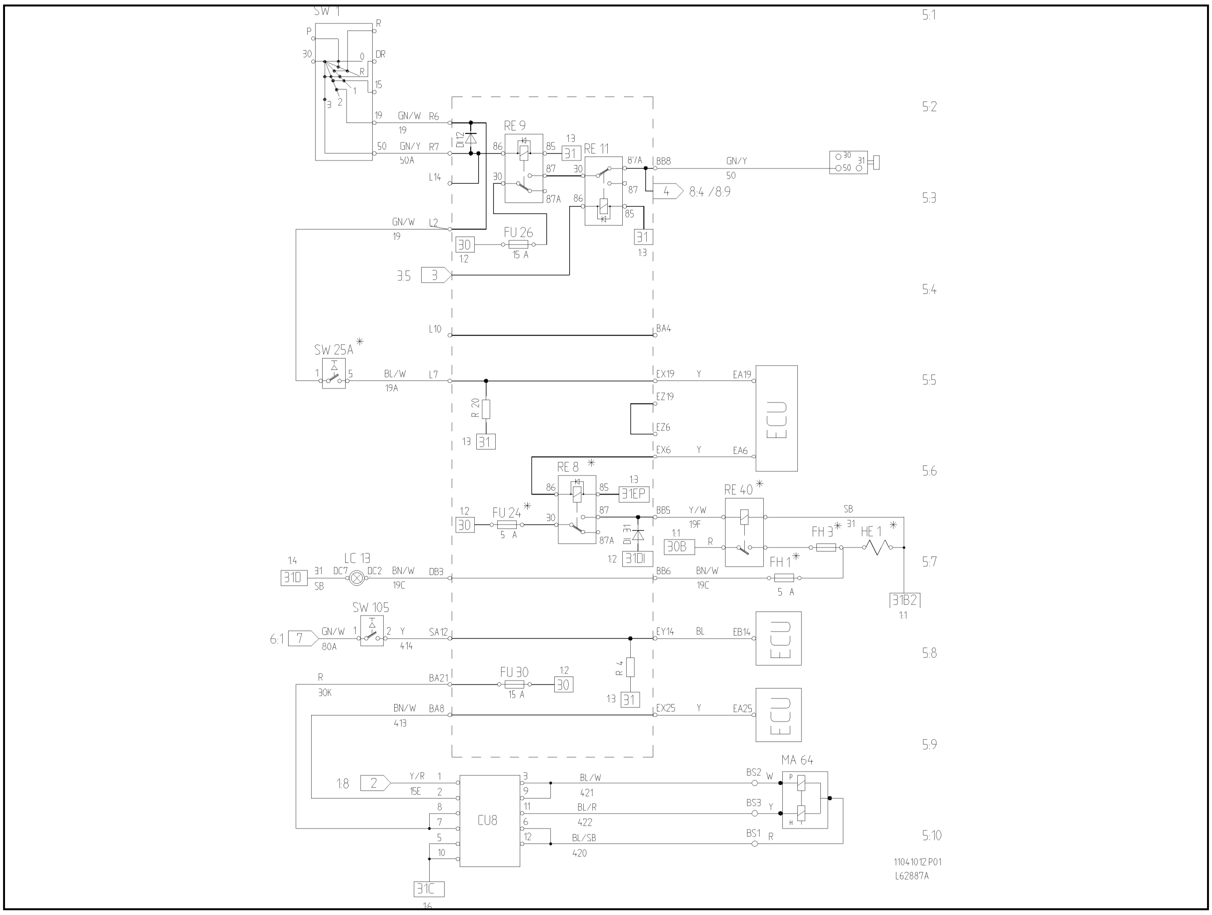



**Figure 12**

| Stop solenoid MA64 | |
|---|---|
| P | Pulling coil (approx 1 Ω) |
| H | Holding coil (approx 55 Ω) |



SW 1
RE 9
RE 11
FU 26
SW 25A
R 20
RE 8
FU 24
RE 40
FH 3
HE 1
FH 1
LC 13
SW 105
R 4
FU 30
CU8
MA 64
ECU
ECU
ECU
8.4 / 8.9
3.5
6.1
1.8
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
5.9
5.10
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**Figure 13**
**Wiring diagram, key-turn engine stop**

## STARTING ENGINE

### Description of function

With the ignition switch SW1 in position 3, the coil in relay RE9 obtains current via the ignition switch terminal 50.

Relay RE9 is activated and starter motor terminal 50 obtains current via fuse FU26, relay RE9 (30 - 87) and relay RE11 (30 - 87A) - the starter motor is activated.

### Relay RE11, starter inhibitor

When selector control SW2A or any of switches SW43(CDC) / SW108 (dual control) are moved to position forward or reverse, the coil in relay RE11 obtains current. Relay RE11 is activated and the current to the starter motor is interrupted, which prevents starting engine, while forward or reverse gear is selected.

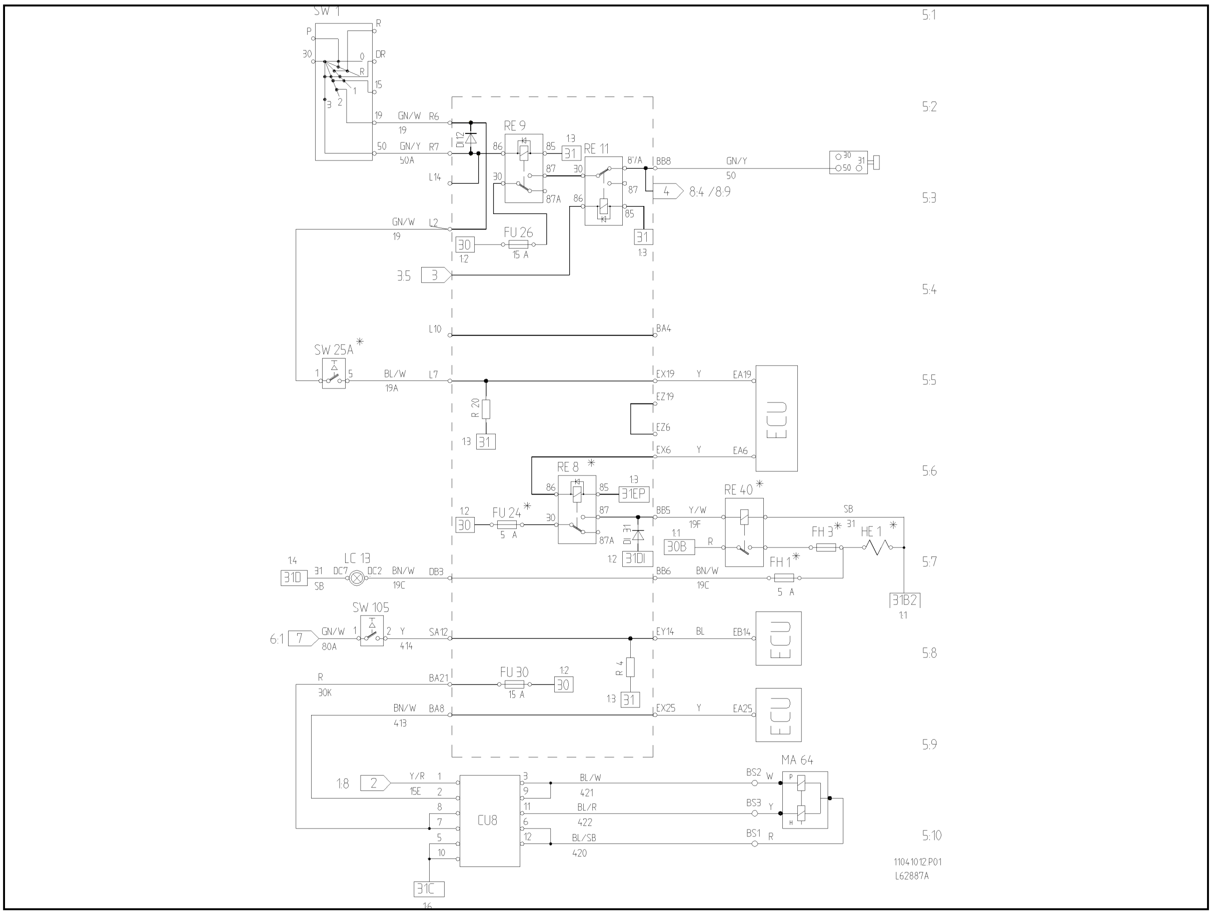


**Figure 14**
**Wiring diagram starter circuit**

**PREHEATING**

**Description of function**

The ECU senses the coolant temperature via the engine temperature sensor (SE1) and regulates the preheating time as follows:

**Manually:**

The preheating time is dependent on the coolant temperature:

Temperatures from -10 °C (+14 °F) and up to +30 ÉC (+86 °F):

Provides preheating times varying between 50 and 10 seconds.

Temperatures below -10 °C (+14 °F):

Provides a preheating time of 50 seconds.

**Automatiapproxlly:**

When starting the engine the preheating is automatiapproxlly activated if the temperature is lower than +10 °C (+50 °F).

At temperatures below -10 °C (+14 °F) the preheating time will be 50 seconds.

At temperatures from -10 °C (+14 °F) and up to +10 °C (50 °F) the preheating time will be between 50 and 10 seconds.

**Extended preheating, low-emission engine**

This function is activated via the contronic display unit[ 2] ⓘ and provides an automatic extension of the time during which the induction air is heated by the preheating coil when the engine has been started.

The extended heating is dependent on the temperature of the coolant. At a temperature below +35 °C (+95 °F) extended heating is provided in cycles of 40 seconds on and 20 seconds off. This is repeated at the most four times or until the coolant has reached a temperature of +35 °C (+95 °F).

**Sensor check: Open circuit, short circuit in sensor circuit:**

These faults always approxuse a preheating time of 50 seconds regardless of the coolant temperature, when the preheating is activated manually.

When the preheating is activated automatiapproxlly, there is no preheating.

**Manual preheating**

With the ignition switch SW1 in position 2 (terminal 19) voltage is supplied to switch SW25A and when this is closed, current is supplied to terminal EA19 on the ECU.

From terminal EA6 on the ECU current is now supplied to the coil in relay RE8 which is activated. The coil in relay RE40 now obtains current via fuse FU24 and relay RE8 (30 - 87), thus approxusing relay 40 to be activated. When relay RE40 is activated, preheating element HE1 and control lamp LC13 obtain current via RE40 and fuses FH3 and FH1.

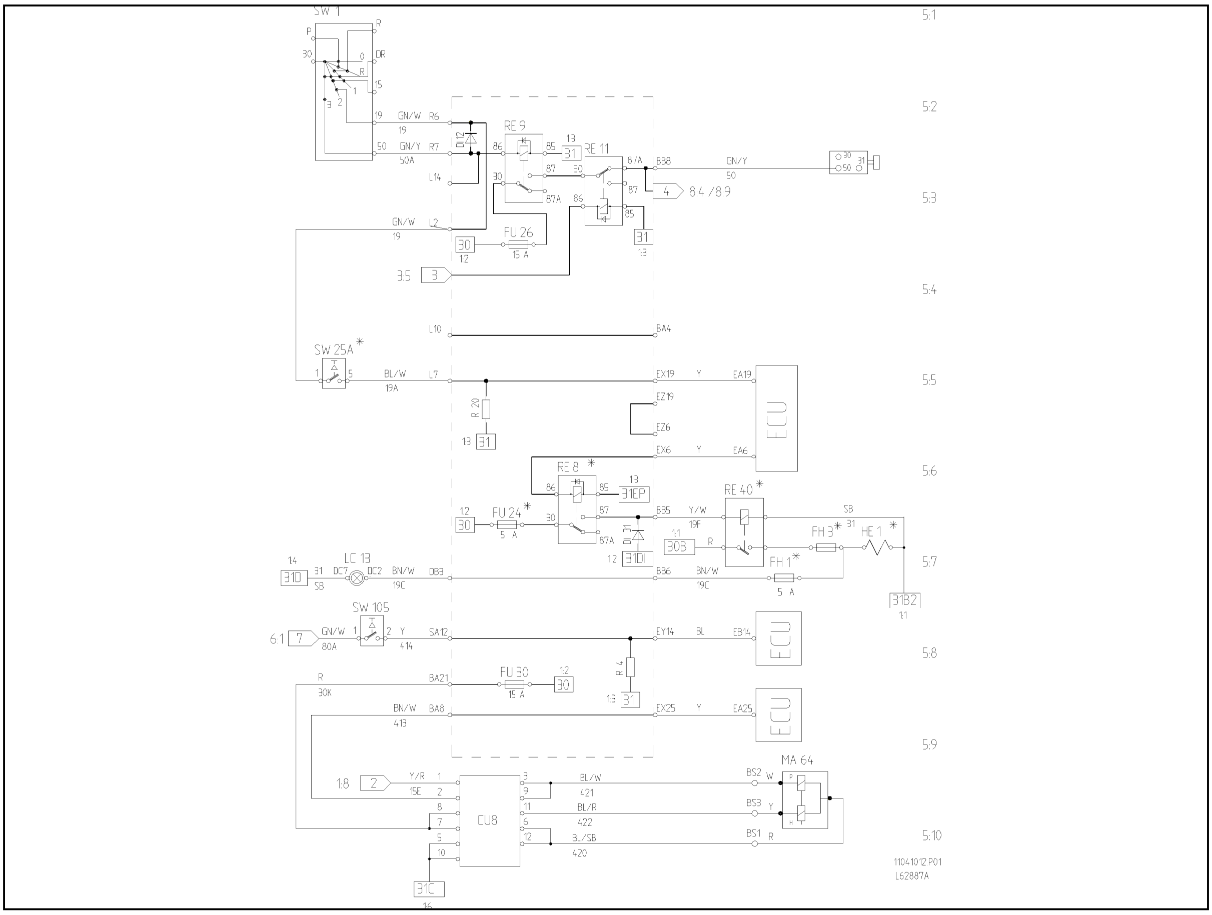
30B is now supplied with current from starter motor terminal 30, see circuit no. 1. Control lamp LC13 is alight while the preheating is connected.

The preheating approxn also be activated with the ignition switch SW1 in position 3 when switch SW25A obtains current via ignition switch SW1 (terminal 50) and diode ID12

**Automatic preheating**

Terminal EA21 on the ECU obtains current via the engine temperature sensor SE1 and terminal EB29 obtains current via the engine tachometer sensor SE3.

Via terminal EA6 on the ECU current is supplied to the coil in relay RE8 and the preheating is activated according to earlier description. While starting, the engine speed must exceed 150 rpm, if the automatic preheating is to be activated. The preheating will be deactivated, if the engine speed is below approx. 100 rpm.



SW 1
P
R
30
0
DR
R
1
15
3
2
19
50
GN/W
19
R6
GN/Y
50A
R7
D12
L14
RE 9
86
85
30
87
87A
13
31
RE 11
87A
BB8
GN/Y
50
30
31
87
86
85
4
8.4 /8.9
31
13
GN/W
19
L2
30
12
FU 26
15 A
3.5
3
L10
BA4
SW 25A *
1
5
BL/W
19A
L7
EX19
Y
EA19
ECU
R 20
EZ19
EZ6
13
31
EX6
Y
EA6
RE 8 *
86
85
13
31EP
12
30
FU 24 *
5 A
30
87
87A
BB5
Y/W
19F
RE 40 *
SB
31
FH 3 *
HE 1 *
11
30B
R
12
31DI
1.4
31D
31
SB
LC 13
DC7
DC2
BN/W
19C
DB3
BB6
BN/W
19C
FH 1 *
5 A
31B2
1.1
SW 105
6.1
7
GN/W
80A
1
2
Y
414
SA12
EY14
BL
EB14
ECU
R 4
R
30K
BA21
FU 30
15 A
12
30
13
31
BN/W
413
BA8
EX25
Y
EA25
ECU
1.8
2
Y/R
15E
1
2
8
7
5
10
CU8
3
9
11
6
12
BL/W
421
BL/R
422
BL/SB
420
BS2
W
BS3
Y
BS1
R
MA 64
31C
1.6
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
5.9
5.10
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**Figure 15**
**Wiring diagram preheating**

## SPEED CONTROL (20 km/h (12.4 mph) and 30 km/h (18.6 mph))*

### Description of function

The engine is provided with a solenoid MA35 which actuates the governor control arm of the injection pump in such a way that the engine speed is limited to 1800 rpm when the maximum permitted travelling speed is registered.

The engine speed limitation to 1800 rpm takes place in 3rd gear for the 20 km/h (12.4 mph) version and in 4th gear for the 30 km/h (18.6 mph) version.

Solenoid MA35 is activated via the ECU and the electronic control unit CU9.

The purpose of CU9 is to provide earth connection for the pulling coil and the holding coil in solenoid MA35.

Depending on the position of the ignition switch and the out signal from the ECU, voltage to the various terminals on CU9 is obtained as follows:

| **Ignition switch in position** | **Voltage to telectronic control unit CU9 terminal** | |
|---|---|---|
| 0 | 1 | 0 Volt |
| 2 | 0 Volt | |
| 7, 8 | 24 Volt | |
| 6, 12 | 24 Volt | |
| 3, 9 | 24 Volt | |
| 11 | 24 Volt | |
| 1, 2 eller 3 | 1 | 24 Volt |
| 2 | 0 Volt (24 Volt during limitation of speed) | |
| 7, 8 | 24 Volt | |
| 6, 12 | 24 Volt | |
| 3, 9, 11 | 0 Volt pulling position, MA35) 0,3 seconds. | |
| 3, 9 | 24 Volt holding position, MA35) | |
| 11 | 0 Volt holding position, MA35) | |

When the maximum permitted travelling speed (20 or alternatively 30 km/h) is registered by the ECU via travelling speed sensor SE4, an output signal is obtained from terminal EA7 on the ECU to terminal 2 on the CU9. The current supply to MA35 is interrupted and the governor control arm is made to take up the speed limiting position.

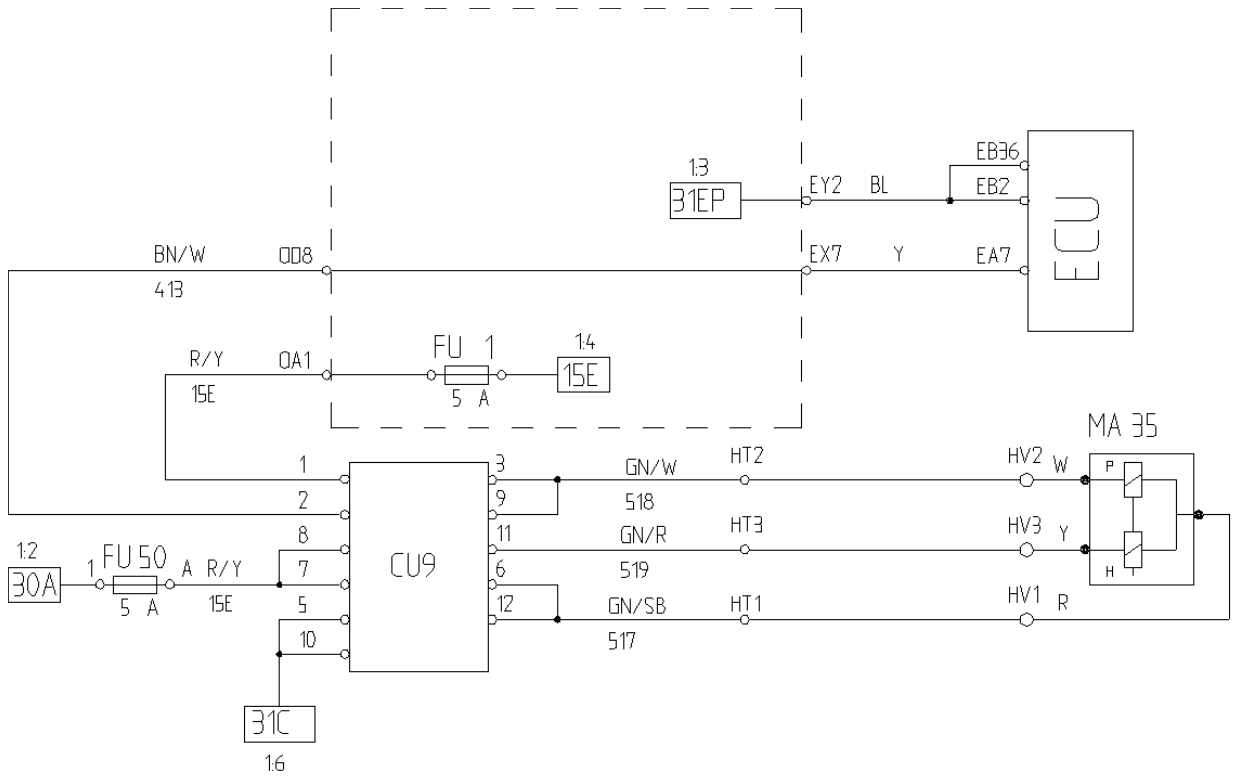
In approxse of the 20 km/h (12.4 mph) speed control (3-speed machine) the ECU is programmed in that terminals EB2 and EB36 are connected to earth. (On the L70B the EB2 and EB35 are connected to earth).

In approxse of the 20 km/h (12.4 mph) speed control (3-speed machine) and when engine speed is limited to 1800 rpm applies:

Speed control begins at 22 km/h (13.7 mph)
Speed control ceases at 16 km/h (9.9 mph)

In approxse of the 30 km/h (18.6 mph) speed control (4-speed machine) and when engine speed is limited to 1800 rpm applies:

Speed control begins at 32 km/h (19.9 mph)
Speed control ceases at 27 km/h (16.8 mph)



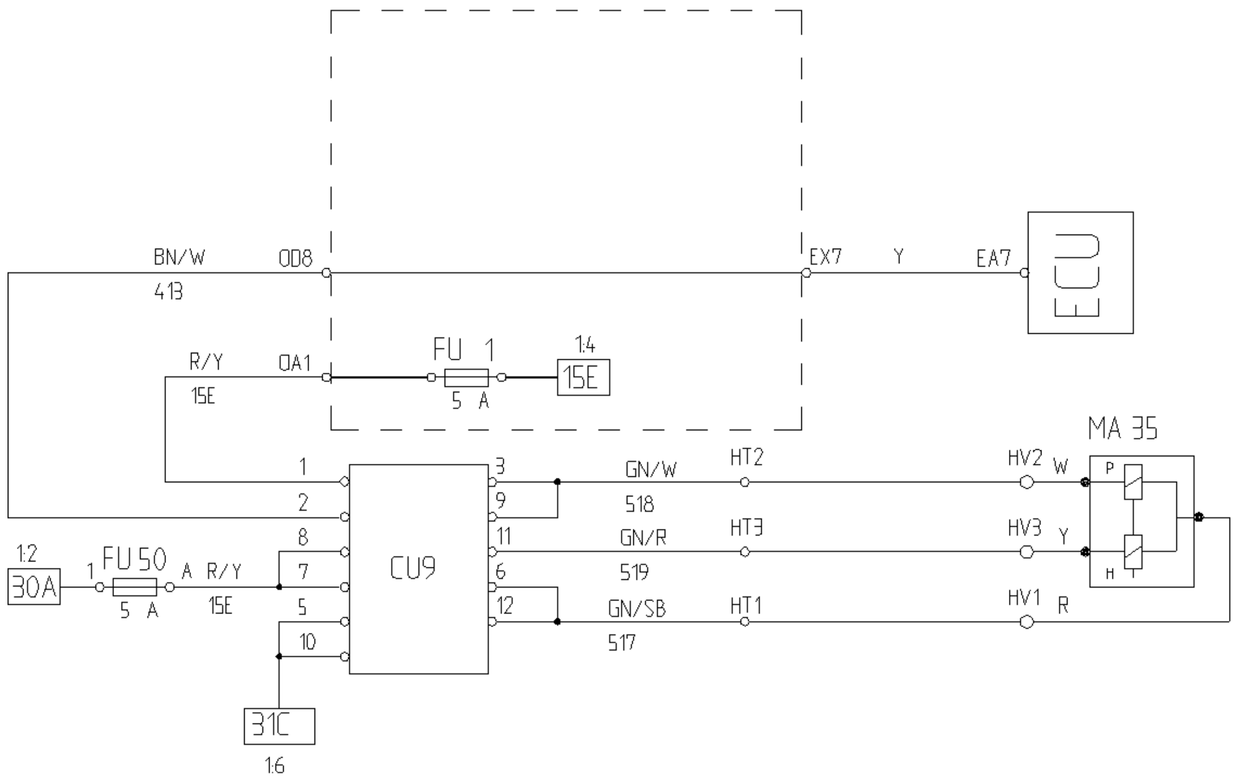




**Figure 16**
**Wiring diagram speed control**

**[ 1]**On the L70C both engine types are equipped with preheating as standard.

**[ 2]**Optional equipment