# Electrical system

The engine is equipped with a bi-polar electrical system with alternator. System voltage is 24 volt.

## IMPORTANT

The following applies to engines with alternator:

1. **Never break the circuit between the alternator and battery while the engine is running. The main switch must therefore not be turned off before the engine has stopped.** Cables must not be disconnected while the engine is running as this may also damage the voltage regulator.
2. Batteries, battery cables and cable terminals must be checked regularly. Battery terminals must be clean and cable shoes must be securely tightened and well greased to prevent breaks in the power supply. All cables must be well tightened with no loose connections.

**NB!** Take care not to switch the positive and negative battery terminals when connecting the batteries. Refer to the wiring diagram. Check drive belt tension regularly.

3. When starting using auxiliary batteries, see **"Start using auxiliary battery"**.
4. Both battery cables must be disconnected before carrying out any repairs on the alternator. The same applies when rapid-charging the batteries.

**NB!** Observe current safety regulations when charging batteries.

5. Never use a screwdriver or similar tool to check a connection.

## Arc welding

The following preparation must always be carried out whenever arc welding is performed on the engine or installed components:

Remove the 2 battery connections and then all the alternator leads from the alternator. Always connect the weld clamp to the component being welded and as close to the welding point as possible. Never attach the welding clamp to the engine or in any way that would entail welding current passing through a bearing. After completed welding: Fit the alternator leads **before** connecting the battery cables.

## Start using auxiliary battery

**WARNING!** Batteries (especially auxiliary batteries) contain a mixture of hydrogen gas that is extremely explosive. One spark, which can result from incorrect connection of the cables, is sufficient to make a battery explode and cause personal injury and mechanical damage.

If the batteries have frozen, they must be thawed out before trying to start with an auxiliary battery.

1. Make sure the auxiliary batteries are connected (in series or parallel) so that the rated voltage corresponds with the system voltage of the engine.
2. Connect one end of the red cable to the positive terminal of the auxiliary battery (marked P or + in red) Make sure all the cable shoes are well tightened to avoid sparks.
3. Connect the other end of the red cable to the positive terminal of the battery where the positive cable to the engine is connected.
4. Connect the end of the black cable to the negative terminal of the auxiliary battery (marked N or – in blue).
5. Connect the other end of the black cable to a point a distance away from the flat batteries, e.g. by the main switch, or the negative cable or the negative cable connection on the engine.
6. Start the engine.

**NB!** Do not touch the connections while starting (risk for sparks) and do not lean over any of the batteries.

7. Remove the cables in the exact reverse order to connecting.

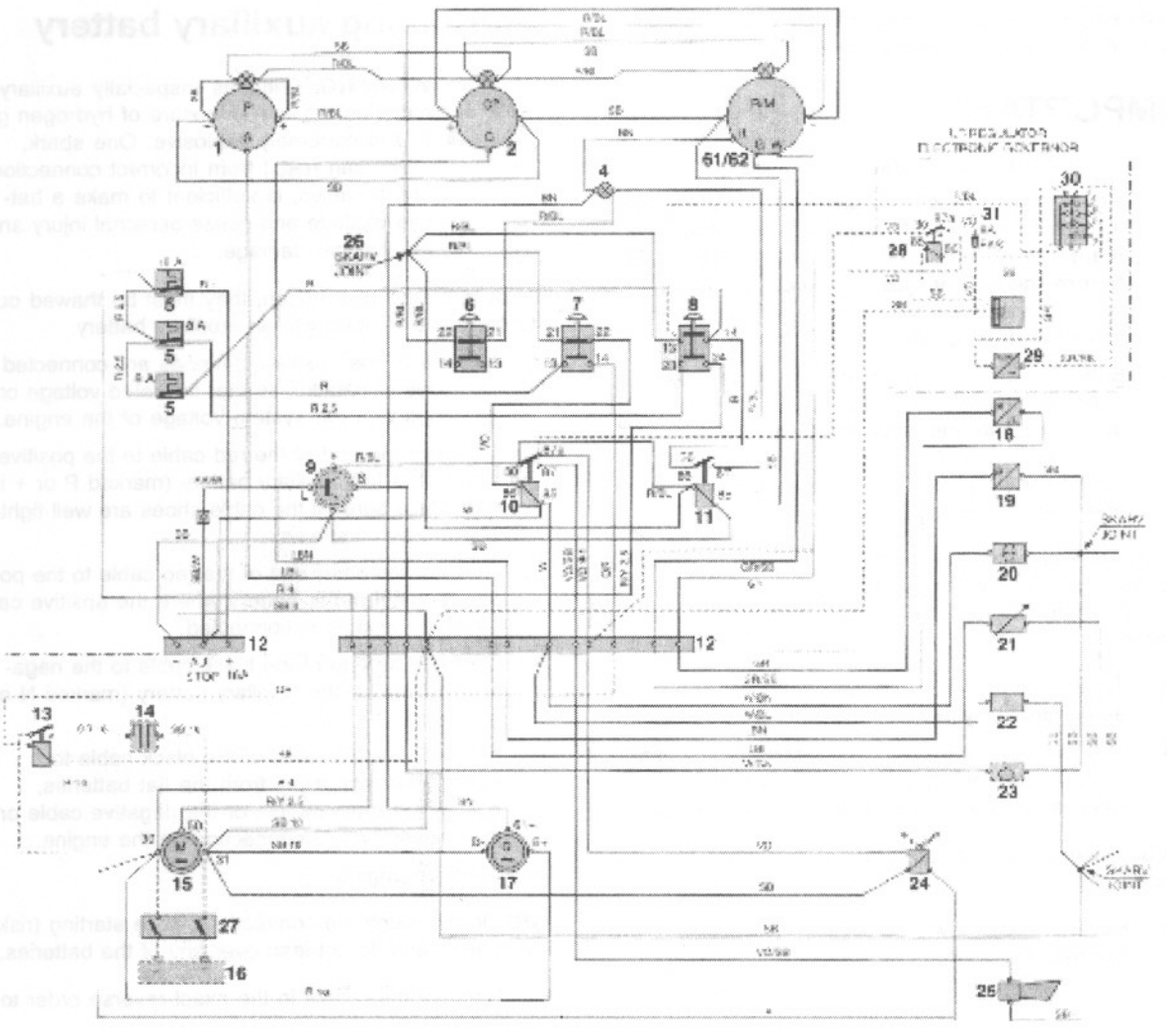
**NB!** The ordinary cables to the standard batteries must never be disconnected.

## EDC system

TWD740VE is equipped with EDC (Electronic Diesel Control). A system that electronically governs the engine injection pump. More information on EDC can be found in "Workshop Manual, Fuel system EDC, TWD740VE, TWD1231VE".

# Wiringdiagram

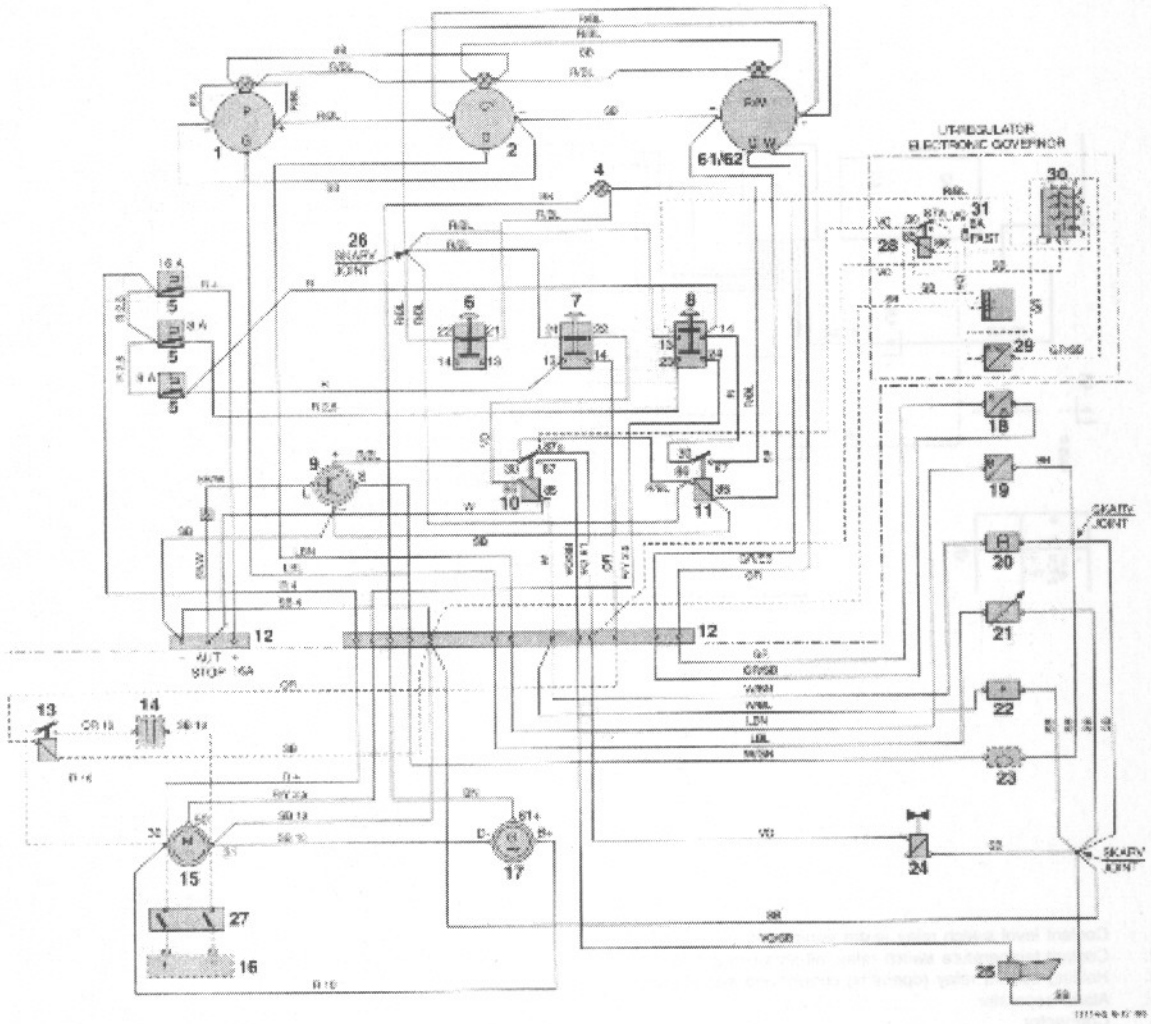
**1.** Instrument panel and engine (equipped with stop solenoid)



1. Oil pressure gauge
2. Coolant temperature gauge
3. Tachometer with integrated hour counter
4. Warning light, charging
5. Semi-automatic fuses (manual reset)
6. Stop button
7. Interlock button
8. Start button
9. Coolant level switch relay (extra equipment)
10. Coolant temperature switch relay, oil pressure switch
11. Holding current relay (operating current and instrument)
12. Terminal block (extra power socket, fused for 16 A, socket for automatic stop, making for fault.)
13. Relay for starting heater
14. Starting heater
15. Starter motor
16. Batteries
17. Alternator
18. Engine speed sensor
19. Engine coolant temperature sensor
20. Coolant temperature switch (normal open)
21. Oil pressure sensor
22. Oil pressure switch
23. Coolant level switch (extra equipment)
24. Stop solenoid (Basic circuit diagram 1)/Fuel cut-off valve (basic circuit diagram 2) (live during operation)
25. Horn
26. Joint
27. Main switch
28. Relay
29. Engine speed sensor, overrevving protection
30. Overrevving protection
31. Fuse, 8 A

* Disengaged when installing GAC regulator

**2.** Instrument panel and engine (equipped with fuel cut-off valve)



**Cable areas in mm² (specified after the colour code in the wiring diagram). If an area is not specified, 1.5 mm² will apply.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Colour: | BL | = | Blue | LBN | = | Light brown |
| | OR | = | Orange | SB | = | Black |
| | LBL | = | Light blue | GN | = | Green |
| | VO | = | Violet | W | = | White |
| | BN | = | Brown | GR | = | Grey |
| | R | = | Red | Y | = | Yellow |

**The area of the battery cables depends on the location of the battery.**

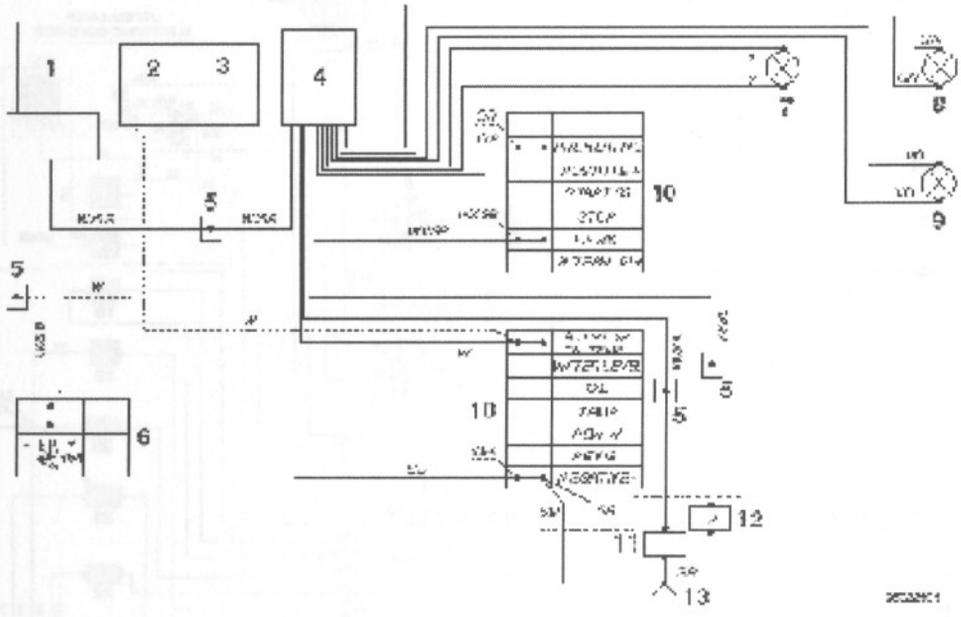
**Distance starter motor - batteries: max. 2 m, area = 70 mm²**

**max. 4 m, area = 120 mm²**

**Relationship mm²/AWG** (American Wiring Gauge)

| mm² | 1.0 | 1.5 | 2.5 | 10 | 16 |
|---|---|---|---|---|---|
| AWG | 16 (17) | 15 (16) | 13 | 7 | 5 |

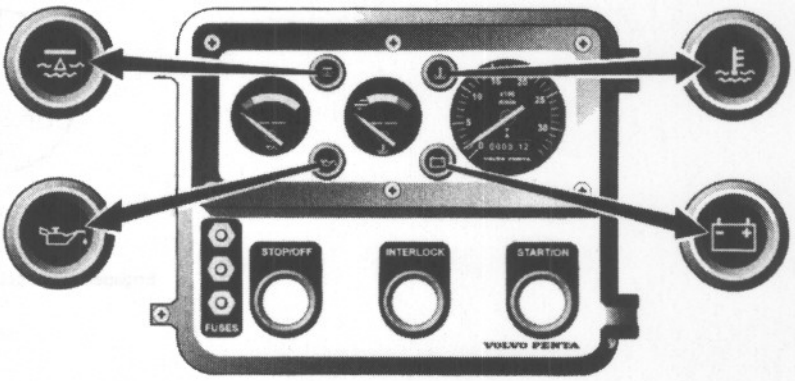
**3.** Connection of alarm separator (extra equipment) to instrument panel.

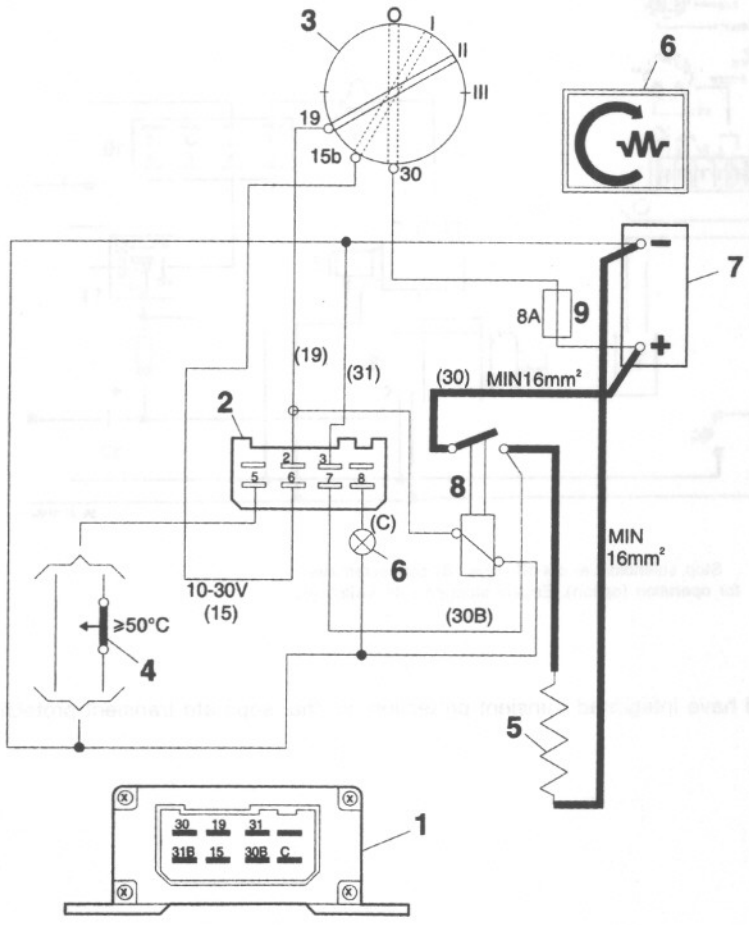



1. Coolant level switch relay (extra equipment)
2. Coolant temperature switch relay, oil pressure switch
3. Holding current relay (operating current and instrument)
4. Alarm separator
5. Connector
6. Terminal block (extra power socket, fused for 16 A. Socket for automatic stop, making for fault).
7. Warning light, high coolant temperature (extra equipment)
8. Warning light, low coolant level (extra equipment.)
9. Warning light, low lubricant pressure (extra equipment.)
10. Terminal block for engine cables
11. Coolant temperature switch (normal open)
12. Oil pressure switch (normal open)
13. Joint

Dashed line is existing cable

**4.** Connection of time relay (extra equipment.) for connecting time relay kit

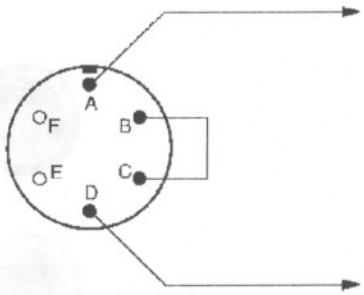


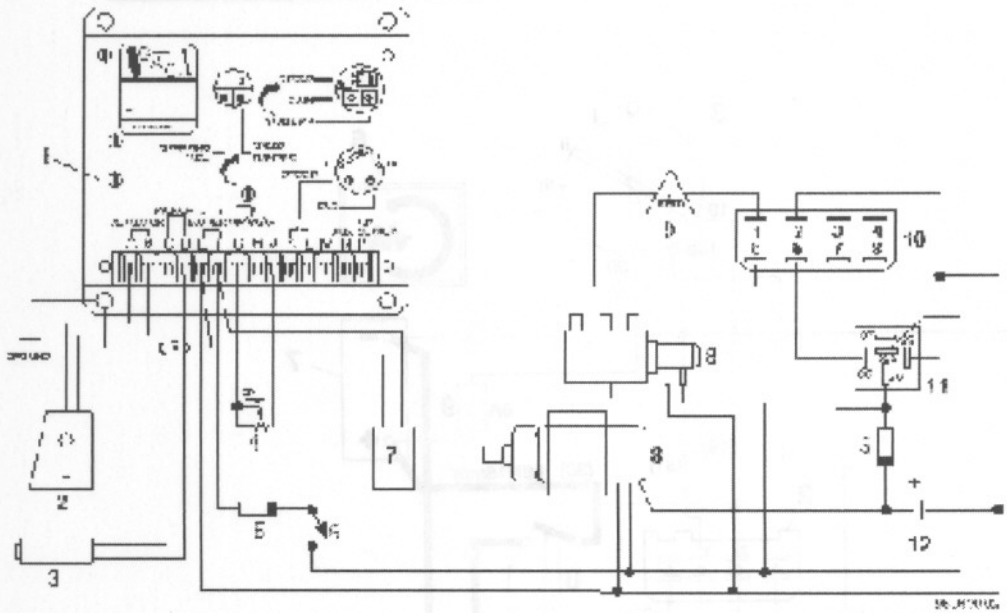

1. Time relay
2. Connector, 8-pin.
3. Key switch
4. Temperature switch (extra equipment)
5. Starting heater
6. Indicator lamp
7. Battery
8. High power relay for starting heater
9. Fuse (8 A)

# Electronic speed regulator

## Engagement




Engagement actuator for 24 V system




Stop solenoid/fuel cut-off valve (8) connected live
for operation (option). Engine stopped with switch (6).

**NB!** Later versions of stop solenoid have integrated transient protection, so that separate transient protection (7) is only required for the control unit.

1. Control unit
2. Actuator
3. Engine speed sensor (pickup)
4. Multi-turn potentiometer*
5. Fuse (quick-acting) 8 A
6. Main switch
7. Transient protection
8. Stop solenoid/fuel cut-off valve
9. Engine speed sensor for overrevving protection
10. Overrevving protection (speed switch)
11. Relay

* Not from Volvo Penta

# Troubleshooting

## 1. Engine will not start

### Starter motor not turning round engine

| CAUSE | ACTION |
|---|---|
| • Discharged batteries | Charge batteries/change batteries (or connect auxiliary batteries as directed in "Start using auxiliary battery"). |
| • Main switch turned off | Turn on main switch. |
| • One of the semi-automatic fuses in the terminal box triggered (pos. 6 on engine wiring diagram) | Reset fuse by pressing button on fuse. |
| • Bad contact/break in connections and electric leads | Rectify any breaks/loose connections. Check that connections have not oxidized. Clean when necessary and spray connections with moisture repelling spray. See "Wiring diagram". |
| • Faulty starting switch/start button | Change starting switch/start button. |
| • Faulty starter relay | Change starter relay. |
| • Faulty starter motor/solenoid (actuator solenoid) | Check starter motor/solenoid. |
| • Water in compression chamber | Do not attempt further starting if water is suspected. Check engine. |

### Starter motor rotates slowly

| CAUSE | ACTION |
|---|---|
| • Discharged batteries | Charge batteries/change batteries (or connect auxiliary batteries as directed in "Start using auxiliary battery"). |
| • Bad contact/break in connections and electric leads | Rectify any breaks/loose connections. Make sure that connections have not oxidized. Clean when necessary and spray connections with moisture repelling spray. See "Wiring diagram". |

## Starter motor cranking normally but engine will not start

| CAUSE | ACTION |
|---|---|
| • Air in fuel system | Bleed fuel system, see "Fuel system, bleeding". |
| • Lack of fuel | |
| – fuel cocks closed | Open fuel cocks. |
| – fuel tank empty | Refuel. |
| – blocked fuel filter (due to impurities/or due to paraffin precipitation in fuel at low outside temperature) | Fit new fuel filter (pre-filter and/or fine filter). Bleed system, see "Fuel system, bleeding". |
| • Stop solenoid wrongly connected/sticking | Make sure stop solenoid is in active position. |
| • Insufficient pre-heating | |
| – incorrect starting procedure | Try starting again as described in instruction manual. |
| – starting heater not engaged | Make sure none of the semi-automatic fuses have triggered (pos. 6 on engine wiring diagram). Reset fuse by pressing button on fuse. |
| | Check electric wiring and interlock button, starter relay and high-power relay. Change starting heater if necessary. |
| • Blocked air intake | Check air intake to engine compartment . |

## 2. Engine starts then stops again/runs unevenly

| CAUSE | ACTION |
|---|---|
| • Air in fuel system | Bleed fuel system, see "Fuel system, bleeding". |
| • Lack of fuel | |
| – fuel cocks closed | Open fuel cocks. |
| – fuel tank empty | Refuel . |
| – blocked fuel filter (due to impurities/or due to paraffin precipitation in fuel at low outside temperature) | Fit new fuel filter (pre-filter and/or fine filter). Bleed system, see "Fuel system, bleeding". |
| • Stop solenoid/fuel cut-off valve engaged/ sticking | Make sure that stop solenoid/fuel cut-off valve in operating position. |
| • Insufficient pre-heating | |
| – incorrect starting procedure | Try starting again as described in instruction manual. |
| – starting heater not engaged | Make sure none of the semi-automatic fuses have triggered (pos. 6 on engine wiring diagram). Reset fuse by pressing button on fuse. |
| | Check electric wiring and interlock button, starter relay and high-power relay. Change starting heater if necessary |

| | |
|---|---|
| • Insufficient air supply to engine | |
| – blocked air filter | Fit new air filter/clean air filter, check ventilation to engine compartment. |
| • Faulty injector | Check/change injector. |

## 3. Coolant temperature too high

| CAUSE | ACTION |
|---|---|
| • Coolant level in engine too low (air in system) | Top up coolant in engine and bleed system, see "Filling with coolant". |
| • Faulty thermostat | Fit new thermostat. |
| • Blocked radiator and/or intercooler (TAD) | Clean, see "Cleaning cooling system". |
| • Faulty circulation pump | Recondition/change circulation pump. |
| • Faulty temperature gauge/temperature sensor | Check/change temperature gauge/temperature sensor. |
| • Faulty injection timing | Check/adjust injection timing. |

## 4. Coolant temperature too low

| CAUSE | ACTION |
|---|---|
| • Faulty thermostat | Fit new thermostat. |

## 5. Engine does not attain correct operating speed at wide open throttle

| CAUSE | ACTION |
|---|---|
| • Engine overloaded | Reduce load if possible. |
| • Insufficient fuel supply | |
| – blocked fuel filter (due to impurities/or due to paraffin precipitation in fuel at low outside temperature) | Fit new fuel filter (pre-filter and/or fine filter). Bleed system, see "Fuel system, bleeding". |
| • Water in fuel | Clean fuel tank. Drain water from pre-filter. |
| • Insufficient air supply to engine | |
| – blocked air filter | Fit new air filter/clean air filter. |
| – air leak between turbo and engine intake manifold | Check rubber hose between turbo and connect intake manifold, and other connections. Tighten hose clips. |
| – faulty turbocharger | Clean compressor. Recondition as necessary turbocharger. |
| – poor engine compartment ventilation | Make sure ventilation passages to engine compart ment are not blocked. |
| • Accelerator control adjusted wrongly | Adjust accelerator control. |
| • High back pressure in exhaust system | Make sure there are no restrictions in exhaust line. |

| | |
|---|---|
| • Incorrect adjustment of injector pump | Adjust injector pump. |
| • Faulty smoke limiter | |
| – smoke limiter sticking | Recondition smoke limiter. |
| – pressure line between intake manifold and smoke limiter leaking | Fit new pressure line. |
| – faulty diaphragm in smoke limiter | Change diaphragm in smoke limiter. |
| – incorrect setting | Adjust smoke limiter setting. |
| Stop control position | Make sure stop control is in full operating position. |

## 6. Engine does not stop

| CAUSE | ACTION |
|---|---|
| • One of the semi-automatic fuses in the terminal box triggered (pos. 6 on engine wiring diagram) | Reset fuse by pressing button on fuse. |
| • Bad contact/break in connections and leads | Rectify any breaks/loose connections. Make sure that connections have not oxidized. Clean when necessary and spray connections with moisture repelling spray. See "Wiring diagram". |
| • Faulty stop button | Change stop button. |
| • Faulty stop solenoid/fuel cut-off valve | Check, change stop solenoid/fuel cut-off valve. |

## Notes

## Notes

## Notes

## Notes