

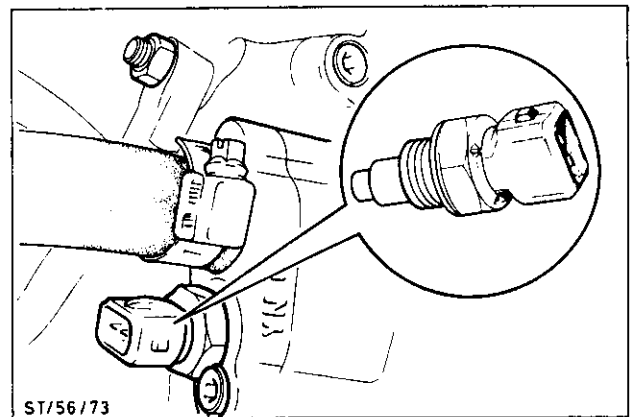
PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.3 System Sensors and Actuators (cont'd.)

Engine Coolant Temperature (ECT) Sensor

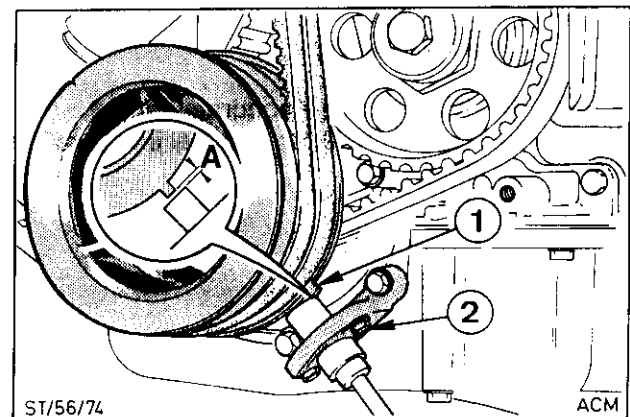
- The ECT is also of NTC resistor type and its operating range is identical to that of the ACT.
- The ECT is screwed into the cylinder-head and its signal to the module affects injector open time and idle speed.



ST/56/73
Engine Coolant Temperature Sensor (ECT)

Engine RPM and TDC Sensor

- This sensor is bolted to the engine front end. The crankshaft pulley has 4 identical teeth spaced at precisely 90°. The sensor sends a signal to the module whenever a tooth passes the sensor. From this signal the module determines engine speed (RPM) and the TDC-position of each piston (crankshaft position).



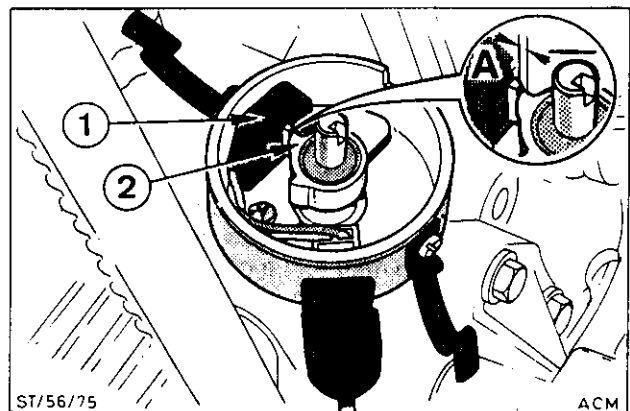
RPM/TDC-Sensor

- The gap between the sensor and the teeth on the crankshaft pulley is 0.4 to 1.0 mm and is factory set (see service adjustments).

- 1 = Tooth on crankshaft pulley
- 2 = Sensor
- A = 0.4 to 1.0 mm

The Phase Sensor-Distributor

- This sensor is located inside the distributor. It signals (and the signals from the RPM/TDC sensor) enable the ECU to identify the phase of each cylinder following the firing order.
- The gap between the sensor and the teeth of the distributor cam is 0.2 to 0.3 mm and is factory set (see service adjustments).



Phase Sensor-Distributor

- 1 = Sensor
- 2 = Tooth
- A = 0.2 to 0.3 mm

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.3 System Sensors and Actuators (cont'd.)

After comparing sensor signals with its own permanent memory, the ECU sends out signals to a number of actuators (outputs).

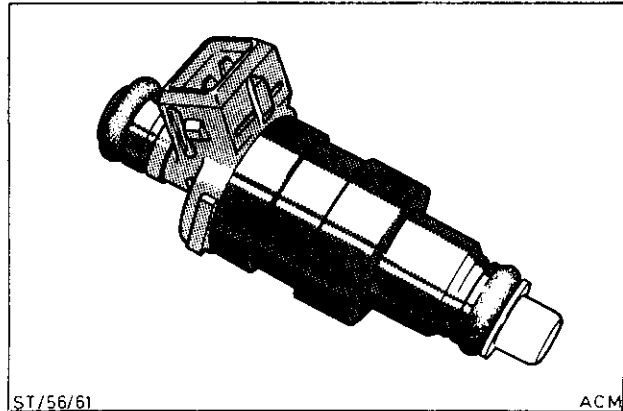
These actuators are:

The Fuel Pump

- The fuel pump is switched on and off via a relay when the engine is started or stalled.

The Fuel Injectors

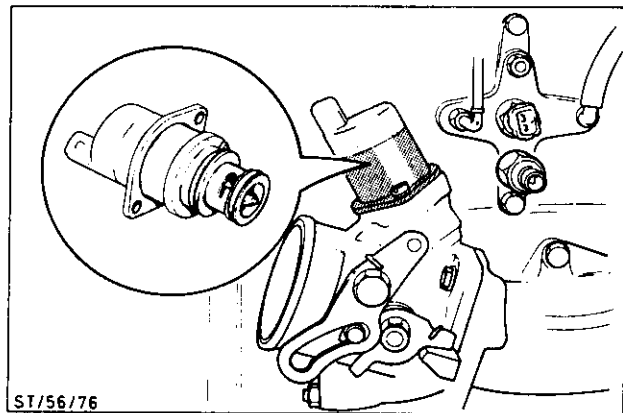
- The ECU provides accurate control of the solenoid operated fuel injectors to discharge fuel.



Fuel Injector

The Idle Speed Control (ISC) Valve

- This unit regulates the engine demand for air depending on engine temperature, engine load, or switched on accessories.
- When the throttle plate is in the closed position and engine speed is within the controlled idle speed range, air is allowed to bypass by means of the idle speed control valve. The valve, which is controlled by a variable current from the ECU, adjusts the air flow into the engine in order to maintain a constant idle speed.
- With cold engine, the valve regulates speed above 1200 RPM.
- With hot engine, the valve regulates speed below 1200 RPM only.
- The valve is non-adjustable.



Idle Speed Control (ISC) Valve

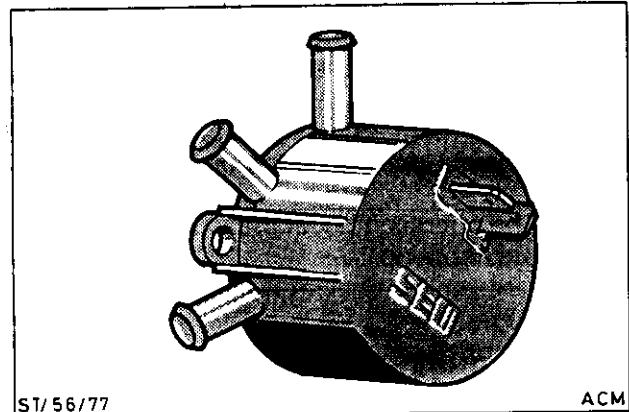
PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.3 System Sensors and Actuators (cont'd.)

The Boost Pressure Control Valve

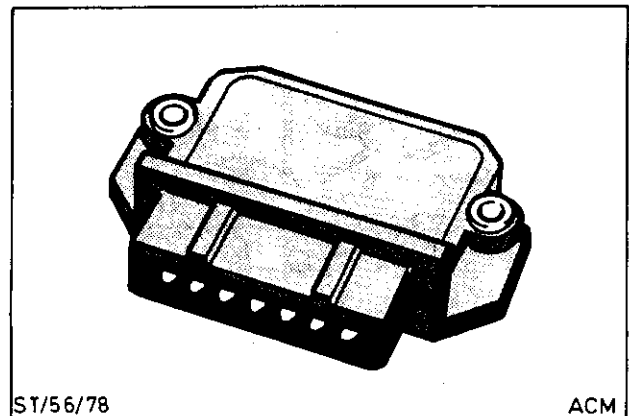
- This solenoid valve is directly connected to the high pressure side of the turbocharger by a hose. Depending upon whether the valve is open or closed it will either "vent-off" a portion of the boost to the inlet side of the compressor (valve open) or direct it to the waste gate actuator (valve closed). For further information see section "Turbocharger".



Boost Pressure Control Valve

The Ignition Module

- This module receives a signal from the ECU module to release a spark.



Ignition Module

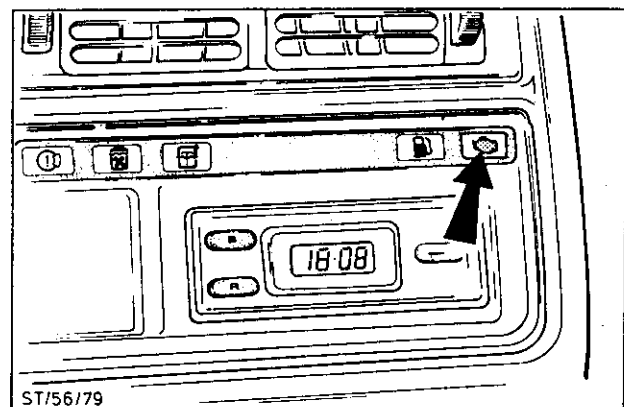
2.4 Further Important Notes on Electronic Engine Management

Limitation on Engine Revolutions

- For information see section "The Turbocharger".

Warning Light-Engine Management Failure

- This warning light is located next to the auxiliary warning lights.
- When the light switches on, the driver will be informed, that a failure in the engine management system have occurred. For further information see section "Maintenance, Service Adjustments and System Checks".



Warning Light – Engine Management failure

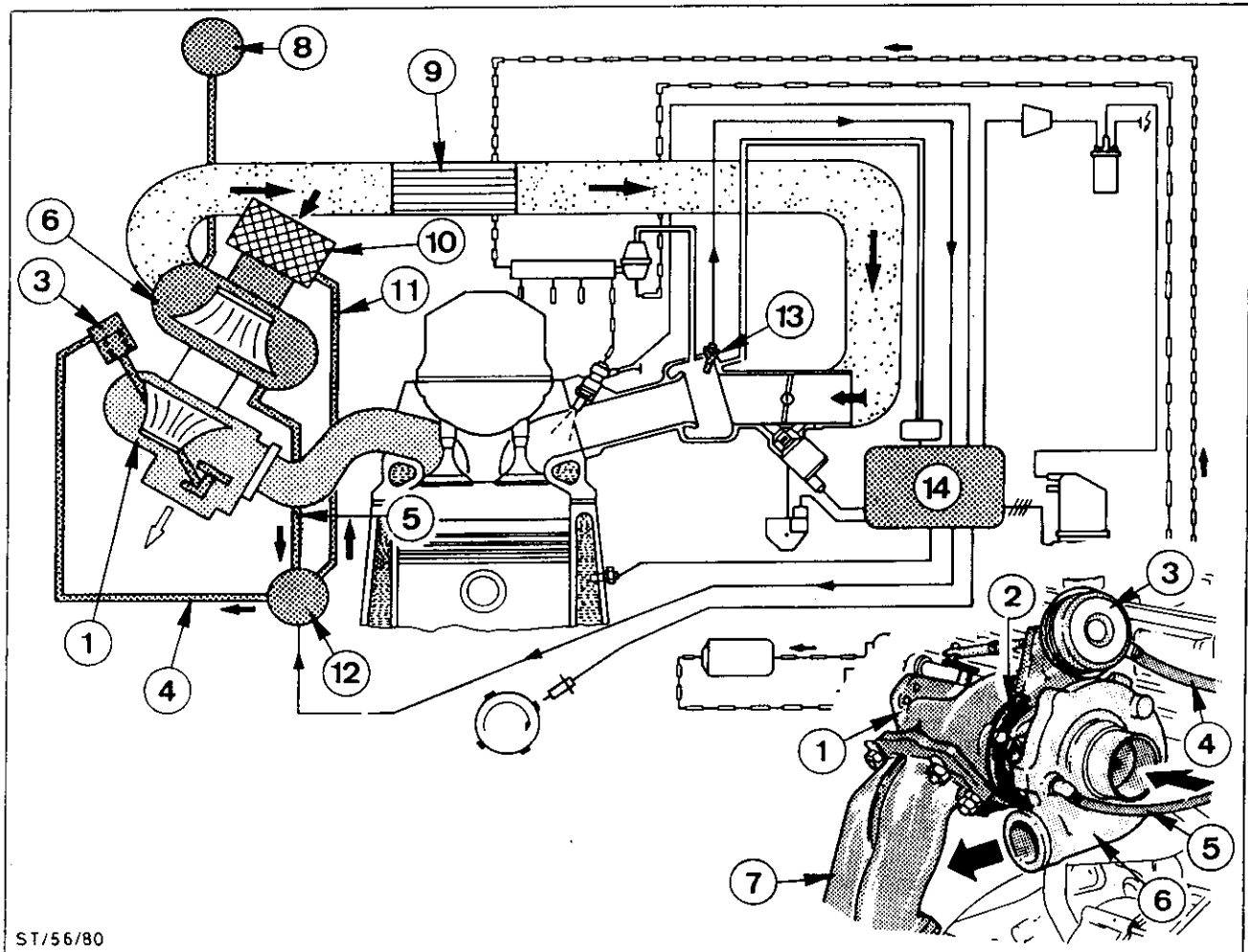
PART A – Engine, Engine Management and Turbocharger

3. The Turbocharger

3.1 General Description

The turbocharger (make Garrett, type T3) with integral wastegate and intercooler, used for the Sierra Cosworth engine, is similar to the turbocharger that is fitted to the Escort RS Turbo engine. In addition, the Sierra Cosworth turbocharger is watercooled. The principle of operation of both turbochargers are similar and described in the Escort RS Turbo Workshop Manual.

- The turbocharger is designed to give boost pressure at relatively low engine speeds, thus giving a useful increase of torque under normal driving conditions.
- The operation boost pressure is 0.7 bar. Maximum boost pressure is limited to 0.9 bar above atmospheric.



Turbocharger assembly

- | | |
|---|--|
| 1 = Turbine housing with integral waste gate | 7 = Exhaust manifold assy. |
| 2 = Watercooled intermediate housing | 8 = Boost pressure gauge |
| 3 = Wastegate actuator | 9 = Intercooler |
| 4 = Connection – boost pressure control Valve to Wastegate actuator | 10 = Air cleaner |
| 5 = Connection – Compressor to boost pressure control valve | 11 = Relief connection (vent) |
| 6 = Compressor housing | 12 = Boost pressure control valve |
| | 13 = Air Charge Temperature (ACT) Sensor |
| | 14 = ECU |

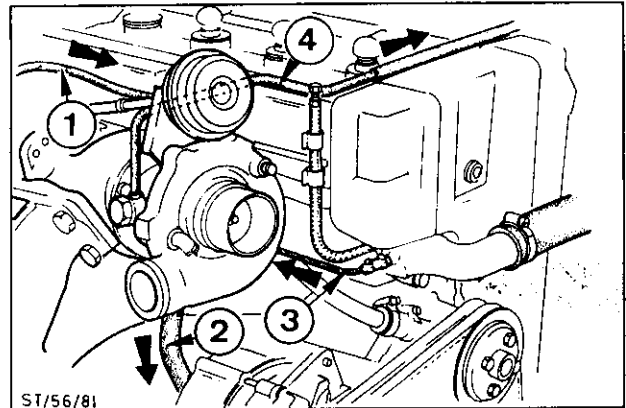
PART A – Engine, Engine Management and Turbocharger

3. The Turbocharger

3.1 General Description (cont'd.)

- The lubricating oil for the turbocharger is taken from the main oil pressure system of the engine (the oil feed pipe is connected to the oil pressure switch). The return oil flows back to the sump through a pipe of relatively large cross-section.
- The watercooled intermediate housing of the turbocharger prevents overheating of the turbine shaft bearings and the turbocharger housing. After switch-off the coolant will prevent excessive temperature build-up of the unit.

The coolant feed pipe for the turbocharger intermediate housing is connected to the thermostat housing. The return coolant flows back to the expansion tank.

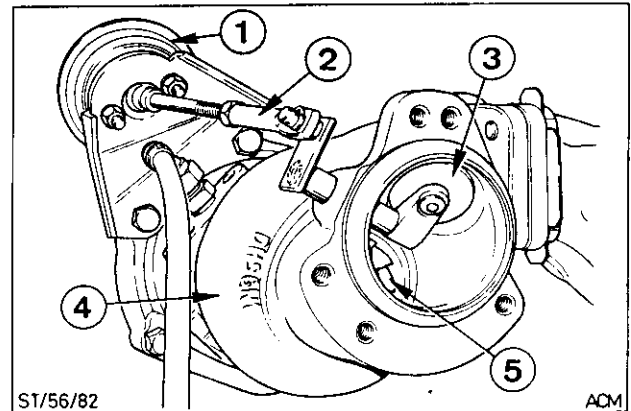


Pipe connections

- 1 = Oil feed pipe
- 2 = Oil return pipe
- 3 = Coolant feed pipe
- 4 = Coolant return pipe

- The integral wastegate regulates the flow of exhaust gases. Due to the engine's demand for boost the exhaust gases are either allowed to the exhaust turbine or through the bypass duct into the vehicle exhaust system circumventing the exhaust turbine.

The wastegate actuator, which is connected to the wastegate by a rod, is controlled by the ECU via a boost pressure control valve.



- 1 = Wastegate actuator
- 2 = Actuator rod
- 3 = Wastegate
- 4 = Turbine housing
- 5 = Turbine impeller

- An intercooler (air to air radiator) is fitted to cool the charge air.
- The turbocharger is maintenance-free.

PART A – Engine, Engine Management and Turbocharger

3. The Turbocharger

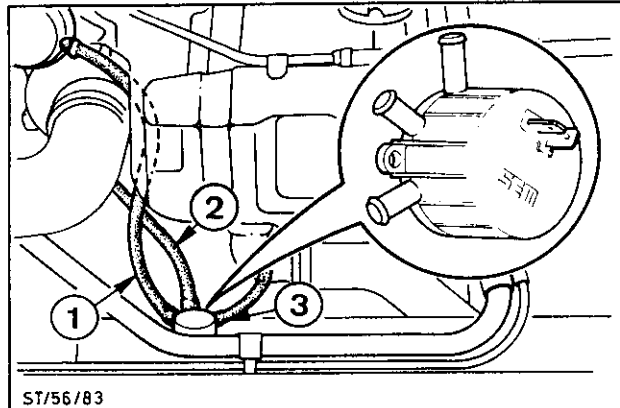
3.2 Boost Pressure Control

The Sierra RS Cosworth is equipped with electronic/mechanical boost pressure control.

The ECU is programmed to control boost via a solenoid operated control valve on receipt of sensor signals.

- The boost pressure control valve is directly connected to the high pressure side of the turbocharger by a hose.

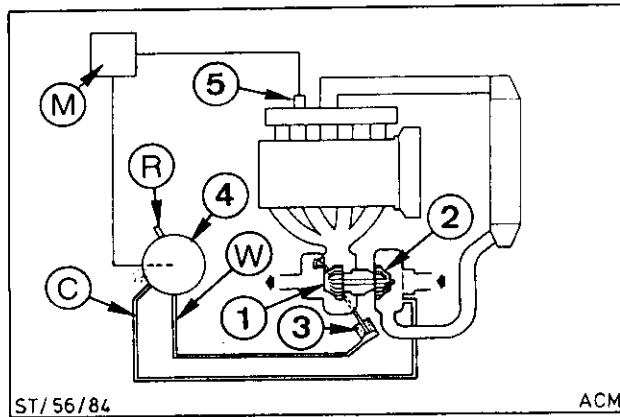
Depending upon whether the valve is open or closed it will either "vent off" a portion of the boost to the inlet side of the compressor (aircleaner) or direct it to the wastegate actuator.



Boost pressure control valve in situ

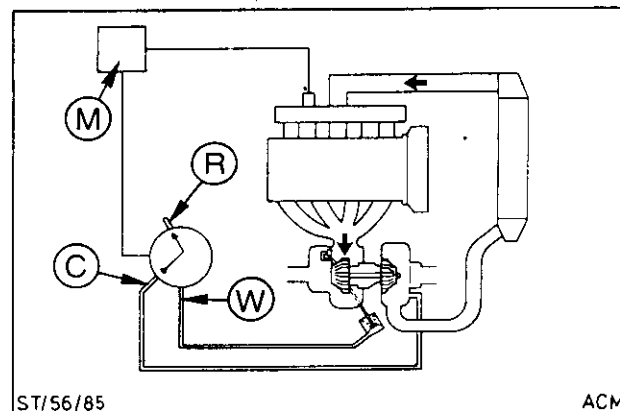
- 1 = Hose – Wastegate Actuator
- 2 = Hose – Turbocharger high pressure side
- 3 = Hose to aircleaner ("vent off")

- 1 = Exhaust turbine
- 2 = Compressor impeller
- 3 = Wastegate actuator
- 4 = Boost pressure control valve
- 5 = Air charge temperature (ACT) sensor
- W = Wastegate connection
- C = Compressor connection
- R = Relief connection (vent)
- M = ECU



Boost pressure control valve

- With engine in operation, the boost pressure control valve is open, allowing air charge to "vent off", depending on receipt of signals from the ECU.



Boost pressure control valve open, allowing air charge to "vent off". The wastegate is closed.

PART A – Engine, Engine Management and Turbocharger

3. The Turbocharger

3.2 Boost Pressure Control (cont'd.)

- The boost pressure control valve will be closed gradually when the engine speed is above 6000 RPM or when the air charge temperature exceeds 70° C.
- When these signals from the RPM/TDC-sensor and the Air Charge Temperature (ACT) sensor are received by the ECU, it closes the solenoid control valve gradually applying full turbo pressure to the wastegate actuator which then fully opens the wastegate. A high amount of the exhaust gases are allowed through the bypass duct into the vehicle exhaust system circumventing the exhaust turbine. The boost pressure is reduced to approximately 0.3 bar.

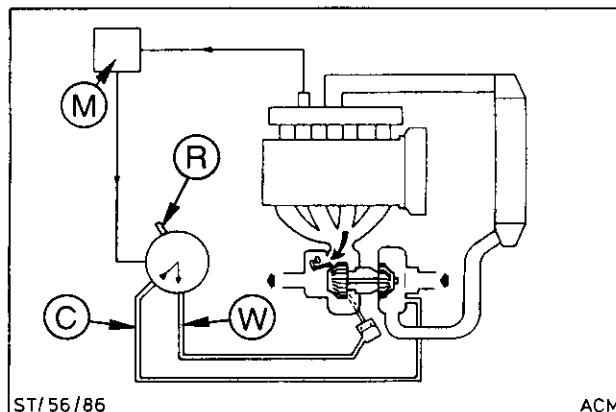
The reduction in boost pressure will reduce the temperature to acceptable working level.

The By-pass Valve

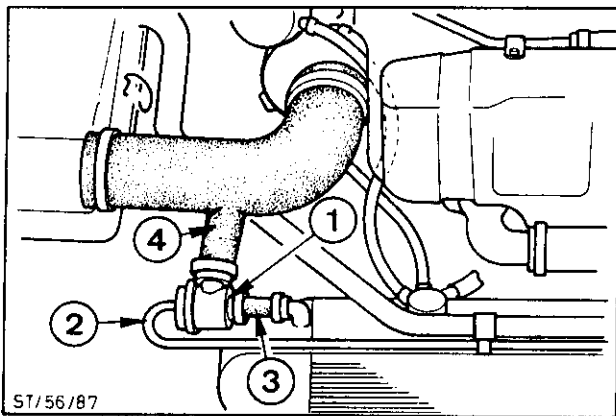
A special by-pass valve (located next to the intercooler) is directly connected to the air chamber, the intercooler and the inlet trunking by hoses. The by-pass valve prevents a pressure build up of air charge in front of the throttle plate when the throttle plate is suddenly closed. With the throttle plate in closed position, the vacuum in the air chamber opens the by-pass valve and an amount of charged air will be by-passed from the intercooler back to the inlet trunking.

Limitation on Engine Revolutions

- In case the boost pressure exceeds 0.9 bar, the fuel injection at the injector valves will be interrupted.
- At 6500 to 6800 engine RPM, the boost pressure is reduced to approximately 0.3 bar by the boost pressure control valve.
- At 6800 to 7000 engine RPM, the ECU is programmed in such a way to interrupt every second injection (the engine will remain in performance but without increase of engine RPM).
- At speeds above 7000 RPM, injection will cut off totally, controlled by the ECU.



Boost pressure control valve closed allowing air charge to open the wastegate via the actuator



By-pass Valve

- 1 = Valve
- 2 = Connection to air chamber
- 3 = Connection to intercooler
- 4 = Connection to inlet trunking

PART A – Engine, Engine Management and Turbocharger

4. Maintenance, Service Adjustments and System Checks

4.1 Maintenance

The routine service schedule for the Sierra RS Cosworth is similar to the Sierra with the standard OHC-engine:

- First free Service at 1500 km
- Interim Service at 10.000 km and
- Standard Service at 20.000 km.

There are some exceptions which are included in the Sierra Service Voucher Booklet.

- The timing belt must be replaced at 80.000 km.

4.2 Service Adjustments

Throttle Plate Setting Screw

- This screw is factory set and sealed and **must not be altered in service.**

Basic Idle Speed Control Screw

If the engine idle speed is not to specifications at the first servicing (1500 km), it can be adjusted by means of the basic idle speed control screw.

- Disconnect multiplug from idle speed control valve, untighten locknut and adjust idle speed screw to achieve correct idle rpm with warm engine.

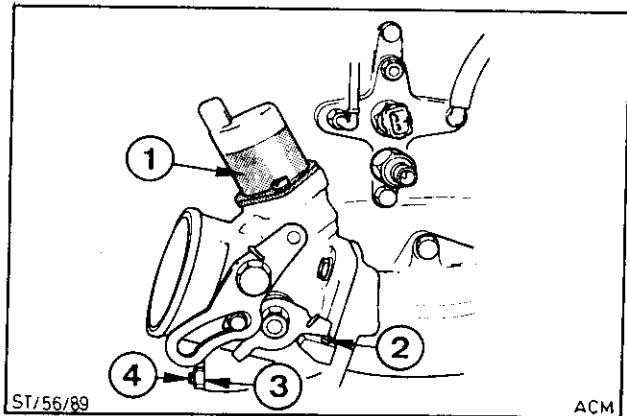
Idle speed: 850 rpm.

Note: After refitting the multiplug, the engine will raise to high engine rpm for a short period of time.

Throttle Position Sensor (TPS)-Adjust

After disassembling and re-assembling the switch can be adjusted within the limits of its elongated fastening holes.

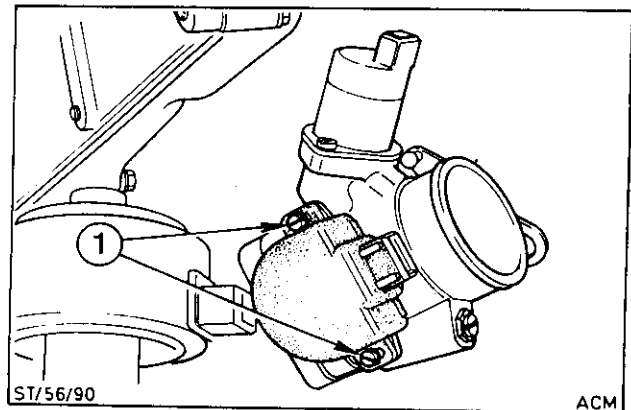
- Loosen fastening screws so that the housing snaps back by spring pressure to the original factory set throttle plate adjustment.



ST/56/89

ACM

- 1 = Idle speed control valve (ISC)
- 2 = Throttle plate setting screw
- 3 = Lock nut
- 4 = Basic idle speed control screw



ST/56/90

ACM

Throttle position sensor

- 1 = Fastening screws

PART A – Engine, Engine Management and Turbocharger

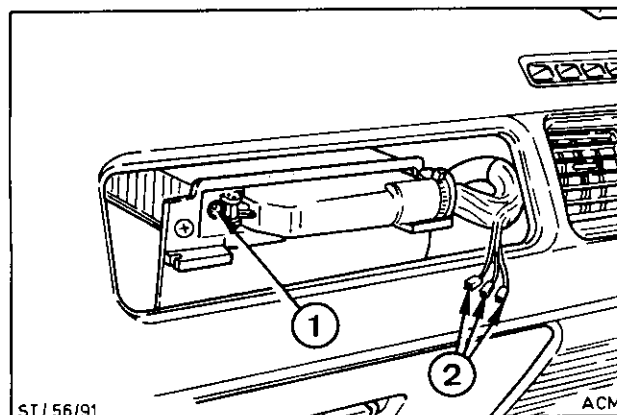
4. Maintenance, Service Adjustments and System Checks

4.2 Service Adjustments (cont'd.)

Adjustment of Idle Mixture

Specified mixture CO at idle: 1–1.5% CO

- The CO adjuster screw is located on the left hand side of the module multi plug.
- Using a suitable tool carefully remove the tamper-proof plug thereby making sure that the tool does not penetrate the plug by more than 3 mm. Excessive penetration may cause damage to the potentiometer located behind the adjuster screw.
- To adjust CO the adjuster screw can be turned from stop to stop. After correct adjustment the screw should be protected with a tamper proof plug.

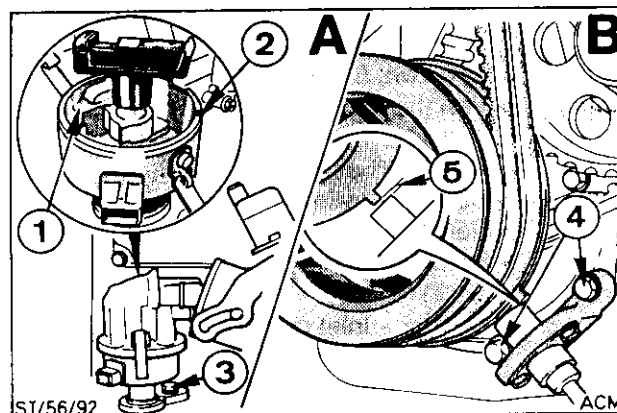


- 1 = Mixture control screw
2 = Cable for octane adjust

Ignition Timing

The ignition timing (16 BTDC) **cannot** be adjusted in Service. The ignition timing is controlled by the ECU module and depends on engine temperature, load and manifold absolute pressure.

When replacing the distributor, the distributor must be inserted with the rotor aligning correctly with the TDC marking for cylinder No. 1 on the housing. A deviation of up to 4° will be compensated by the ECU module.



A = Distributor

- 1 = Phase-sensor
2 = TDC marking – cyl. No. 1
3 = Fastening bolt

B = RPM/TDC-Sensor

- 4 = Fastening bolt
5 = 0.4–1.0 mm

Retarding the Ignition Timing

To meet fuels with lower octane rating the ignition timing can be retarded electronically by 2, 4 or 6° by connecting the cable connectors (near the RH side of the ECU module) in various ways.

Connections

- Green plug to white plug = ignition retarded by 2°
- Blue plug to white plug = ignition retarded by 4°
- Green and blue plug to white plug = ignition retarded by 6°

(The white plug connects to chassis earth).

Adjusting the RPM/TDC Sensor

The air gap between the sensor and the cam should be 0.4 to 1.0 mm.

- To adjust the air gap, the fastening bolt for the sensor must be untightened – to enable resetting of the sensor.

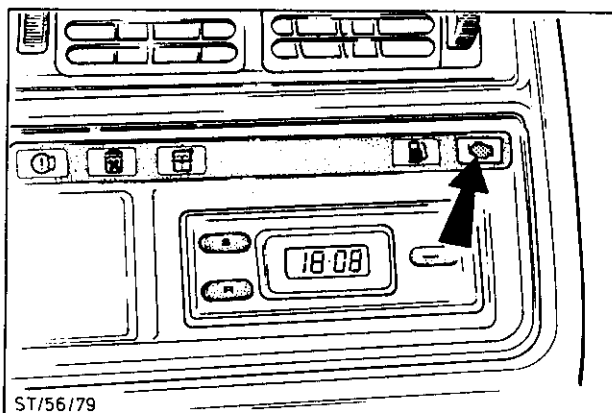
PART A – Engine, Engine Management and Turbocharger

4. Maintenance, Service Adjustments and System Checks

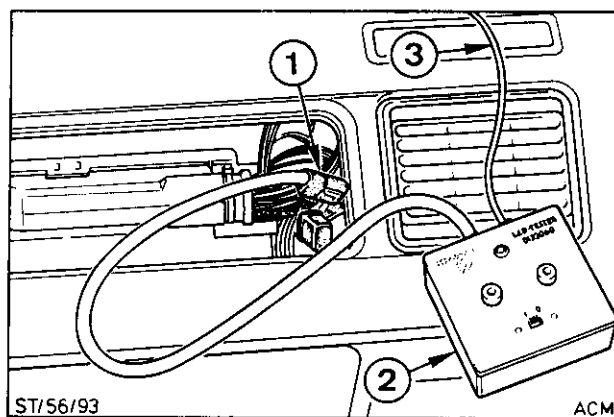
4.3 System Checks

Quick Test

- The ECU module includes an internal selftest facility.
- A warning light on the instrument panel will switch on if there is a defect in one of the sensor circuits.
- Simultaneously a coded signal is fed to the test connector near the RH side of the ECU module.
- Connecting an LED tester to this test plug allows a quick test to be carried out on the following sensor circuits:
 - RPM/TDC sensor
 - Sensor – cylinder phase (distributor)
 - Sensor – inlet air temperature (ACT)
 - Sensor – engine coolant temperature (ECT)
 - Sensor – inlet manifold absolute pressure (MAP)
- The LED tester for the EEC IV-system (Loewener tool No. 013 20 60 or Churchill tool No. 047 20 60) may be used.
- The quick test is carried out with the engine not running but with the ignition switched on.
- During the quick test the ECU module transmits codes in the form of electrical pulses.



Warning Light – Engine Management failure



Quick Test

- 1 = Test connector
- 2 = LED Tester
- 3 = Cable – battery plus