

Throttle position (TP) sensor

Checking resistance - [Fig. 16](#)

Technical Data - typical		
Terminals	Condition	Resistance
Type 1		
1 & 2	-	3000 Ω approx.
1 & 3	Throttle closed	3000 Ω approx.
1 & 3	Throttle fully open	1000 Ω approx.
Type 2		
1 & 3	-	3000 Ω approx.
1 & 2	Throttle closed	3000 Ω approx.
1 & 2	Throttle fully open	1000 Ω approx.

- Ensure ignition switched OFF.
- Disconnect TP sensor multi-plug.
- Check resistance between TP sensor terminals.

Checking earth connection - [Fig. 17](#)

Technical Data - typical	
Terminals	Voltage
Earth terminal & earth	0 V approx.

NOTE: Probing TP sensor terminals should reveal one terminal with a voltage at or near 0 V, one terminal with a voltage at or near 5 V and one terminal with a variable voltage dependent upon throttle position.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access TP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between TP sensor terminal and earth.

Checking supply voltage - [Fig. 17](#)

Technical Data - typical	
Terminals	Voltage
Supply voltage terminal & earth	5 V approx.

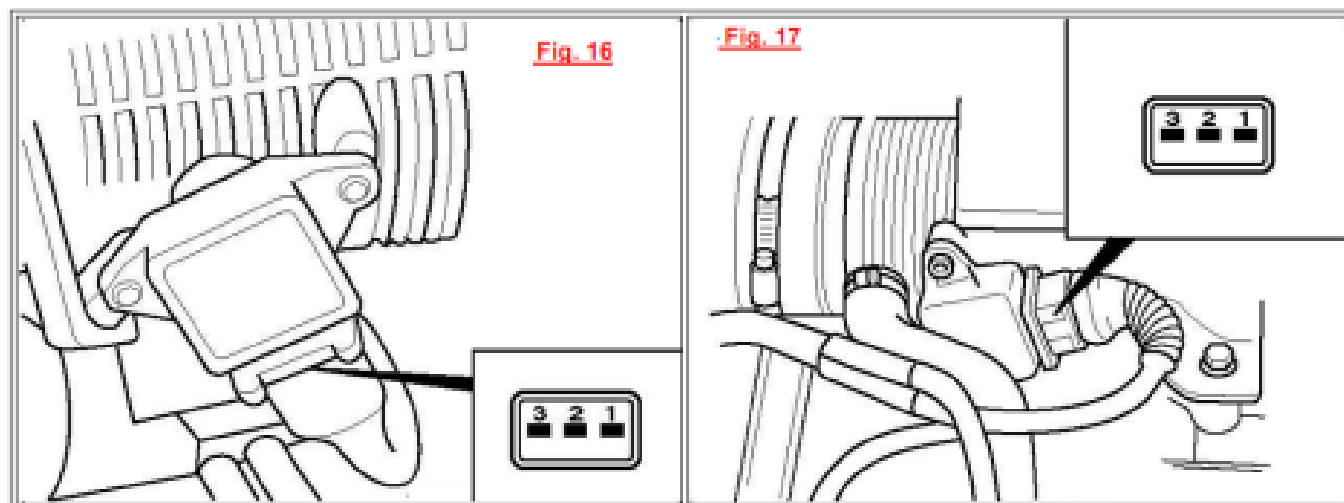
NOTE: Probing TP sensor terminals should reveal one terminal with a voltage at or near 0 V, one terminal with a voltage at or near 5 V and one terminal with a variable voltage dependent upon throttle position.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access TP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between TP sensor terminal and earth.

Technical Data - typical		
Terminals	Condition	Voltage
Signal voltage terminal & earth	Throttle closed	1 V approx.
Signal voltage terminal & earth	Throttle fully open	4,5 V approx.

NOTE: Probing TP sensor terminals should reveal one terminal with a voltage at or near 0 V, one terminal with a voltage at or near 5 V and one terminal with a variable voltage dependent upon throttle position.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access TP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between TP sensor terminal and earth.
- Operate throttle valve while checking voltage.
- Voltage change should be smooth.



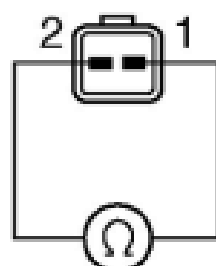
Closed throttle position (CTP) switch

Checking - [Fig. 18](#)

Technical Data - typical		
Terminals	Condition	Resistance
1 & 2	Throttle closed	Zero
1 & 2	Throttle slightly open	∞

- Ensure ignition switched OFF.
- Disconnect CTP switch multi-plug.
- Check resistance between CTP switch terminals.
- Operate throttle valve while checking resistance between terminals.

[Fig. 18](#)



Checking earth connection - [Fig. 19](#) & [Fig. 20](#)

Technical Data - typical	
Terminals	Voltage
3-wire type	
2 & earth	0 V approx.
4-wire type	
1 & earth	0 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAF sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking supply voltage - [Fig. 19](#) & [Fig. 20](#)

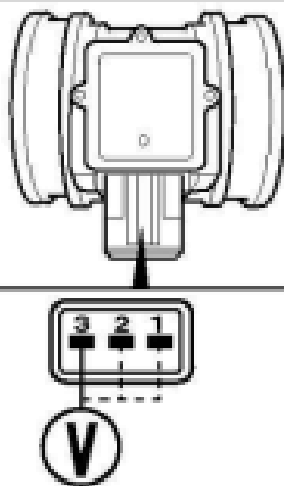
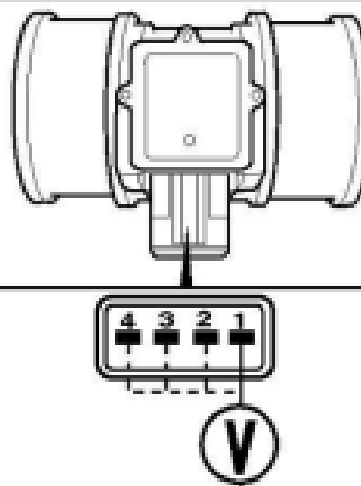
Technical Data - typical	
Terminals	Voltage
3-wire type	
3 & earth	Battery voltage
4-wire type	
3 & earth	Battery voltage
4 & earth	5 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAF sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal(s) and earth.

Checking signal voltage - [Fig. 19](#) & [Fig. 20](#)

Technical Data - typical		
Terminals	Condition	Voltage
3-wire type		
1 & earth	Engine idling	1,5 V approx.
1 & earth	4000 rpm	3,4 V approx.
4-wire type		
2 & earth	Engine idling	0,8 V approx.
2 & earth	2000 rpm	1,1 V approx.
2 & earth	3000 rpm	1,8 V approx.
2 & earth	4000 rpm	2,2 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAF sensor multi-plug terminals.
- Start engine.
- Allow to idle.
- Check voltage between multi-plug terminal and earth.
- Increase engine speed.
- Check voltage between multi-plug terminal and earth.

Fig. 19**Volume air flow (VAF) sensor****Fig. 20****Checking operation**

- Ensure ignition switched OFF.
- Disconnect intake air trunking from VAF sensor.
- Operate sensor flap over full extent of travel.
- Check for smooth operation.
- Clean off any gummy deposits with solvent, if necessary.

Checking earth connection - Fig. 21

Technical Data - typical	
Terminals	Voltage
4 & earth	0 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access VAF sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking supply voltage - Fig. 21

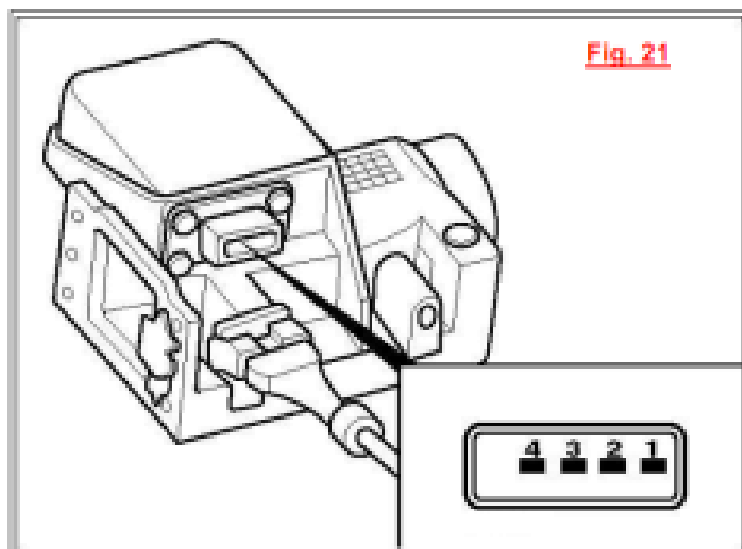
Technical Data - typical	
Terminals	Voltage
3 & earth	5 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access VAF sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking signal voltage - Fig. 21

Technical Data - typical		
Terminals	Condition	Voltage
2 & earth	Engine idling	0,5-1,5 V
2 & earth	Max. rpm	4,5 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access VAF sensor multi-plug terminals.
- Start engine. Allow to idle.
- Check voltage between multi-plug terminal and earth.
- Increase rpm to specified value.
- Check voltage between multi-plug terminal and earth.
- Voltage change should be smooth.



Manifold absolute pressure (MAP) sensor

Checking vacuum hose

- Check vacuum hose for blockage or leaks.
- Replace faulty hose.

Checking earth connection - analogue type - Fig. 22

Technical Data - typical	
Terminals	Voltage
Type 1	
2 (B) & earth	0 V approx.
Type 2	
1 (A) & earth	0 V approx.

NOTE: Probing MAP sensor terminals should reveal one terminal with a voltage at or near 0 V, one terminal with a voltage at or near 5 V and one terminal with a variable voltage dependent upon intake manifold vacuum and engine operating conditions.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking earth connection - Ford digital type - Fig. 23

Technical Data - typical	
Terminals	Voltage
46 & earth	0 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking supply voltage - analogue type - [Fig. 22](#)

Technical Data - typical	
Terminals	Voltage
Type 1	
1 (A) & earth	5 V approx.
Type 2	
3 (C) & earth	5 V approx.

NOTE: Probing MAP sensor terminals should reveal one terminal with a voltage at or near 0 V, one terminal with a voltage at or near 5 V and one terminal with a variable voltage dependent upon intake manifold vacuum and engine operating conditions.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking supply voltage - Ford digital type - [Fig. 23](#)

Technical Data - typical	
Terminals	Voltage
26 & earth	5 V approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAP sensor multi-plug terminals.
- Switch ignition ON.
- Check voltage between multi-plug terminal and earth.

Checking operation - analogue type - [Fig. 22](#)

Technical Data - typical		
Terminals	Condition	Voltage
Type 1		
3 (C) & earth	Engine idling	1,2 V approx.
3 (C) & earth	Full throttle	4,5 V
Type 2		
2 (B) & earth	Engine idling	1,2 V approx.
2 (B) & earth	Full throttle	4,5 V approx.

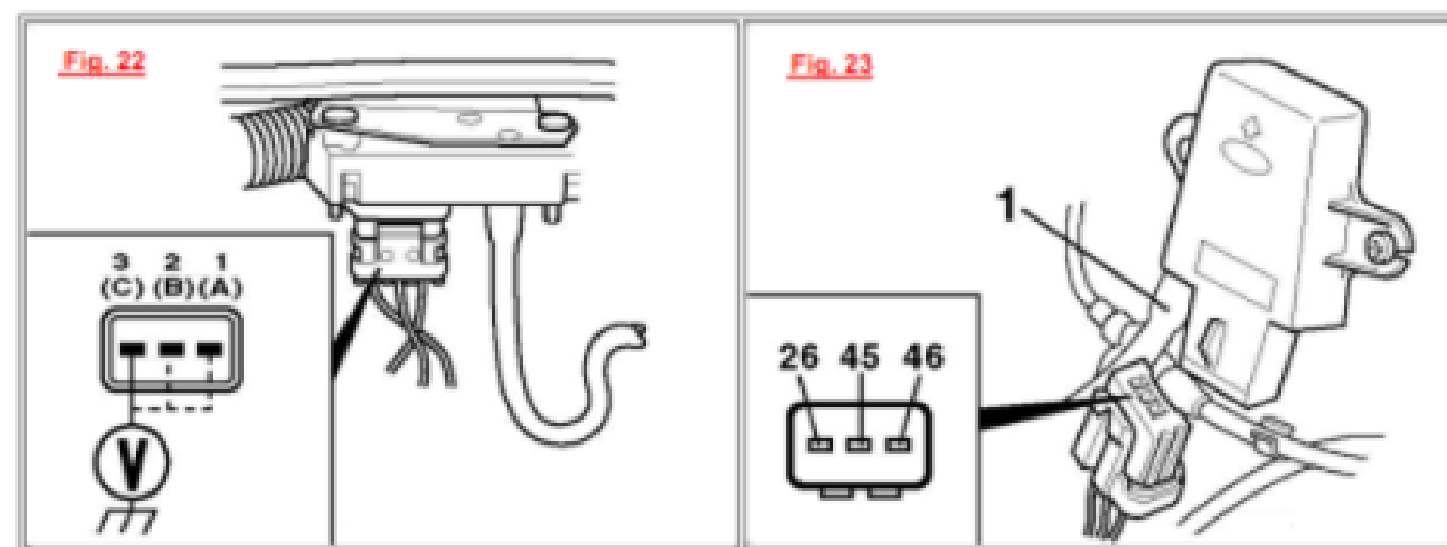
NOTE: Probing MAP sensor terminals should reveal one terminal with a voltage at or near 0 V, one terminal with a voltage at or near 5 V and one terminal with a variable voltage dependent upon intake manifold vacuum and engine operating conditions.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAP sensor multi-plug terminals.
- Start engine.
- Allow to idle.
- Check voltage between multi-plug terminal and earth.
- Increase engine speed sharply.
- Check voltage between multi-plug terminal and earth.

Checking operation - Ford digital type - [Fig. 23](#)

Technical Data - typical		
Terminals	Condition	Frequency
45 & earth	Ignition ON	160 Hz
45 & earth	Engine idling	105 Hz

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access MAP sensor multi-plug terminals.
- Switch ignition ON.
- Check frequency between multi-plug terminal and earth.
- Start engine.
- Allow to idle.
- Check frequency between multi-plug terminal and earth.



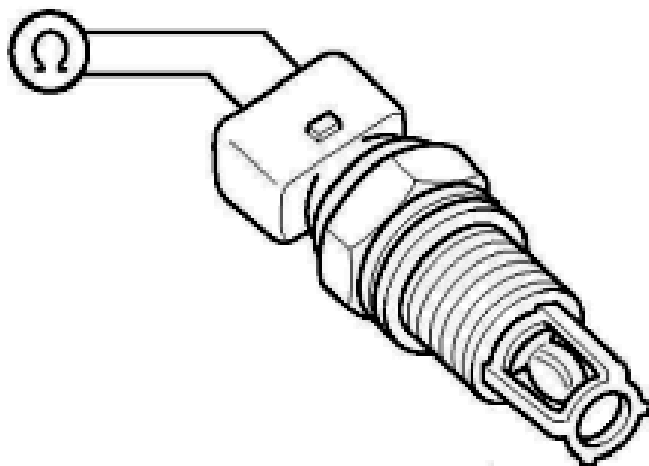
Intake air temperature (IAT) sensor

Checking resistance - [Fig. 24](#)

Technical Data - typical	
Temperature	Resistance
Ford	
15-25°C	38000 Ω approx.
Except Ford	
15-25°C	2000-3300 Ω approx.

- Ensure ignition switched OFF.
- Disconnect IAT sensor multi-plug.
- Check ambient air temperature.
- Check resistance between IAT sensor terminals.

Fig. 24



Idle air control (IAC) valve

Checking resistance - 2-wire type - **Fig. 25**

Technical Data - typical	
Resistance	10-20 Ω approx.

- Ensure ignition switched OFF.
- Disconnect IAC valve multi-plug.
- Check resistance between IAC valve terminals.

Checking resistance - 3-wire type - **Fig. 26**

Technical Data - typical	
Terminals	Resistance
1 & 3	30 Ω approx.
1 & 2	17,5 Ω approx.
2 & 3	15,5 Ω approx.

- Ensure ignition switched OFF.
- Disconnect IAC valve multi-plug.
- Check resistance between IAC valve terminals.

Checking resistance - 4-wire type 1 - **Fig. 27 & Fig. 28**

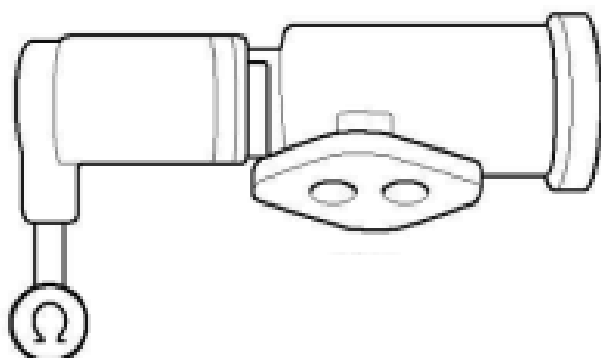
Technical Data - typical	
Terminals	Resistance
A & B	40-60 Ω approx.
C & D	40-60 Ω approx.

- Ensure ignition switched OFF.
- Disconnect IAC valve multi-plug.
- Check resistance between IAC valve terminals.

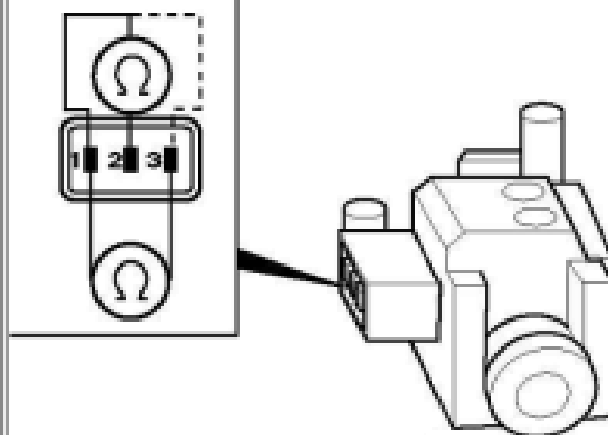
Technical Data - typical	
Terminals	Resistance
A & D	52-58 Ω approx.
B & C	52-58 Ω approx.

- Ensure ignition switched OFF.
- Disconnect IAC valve multi-plug.
- Check resistance between IAC valve terminals.

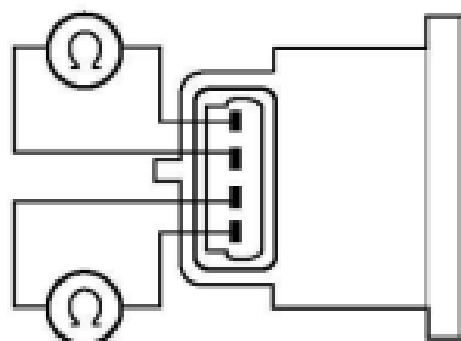
[Fig. 25](#)



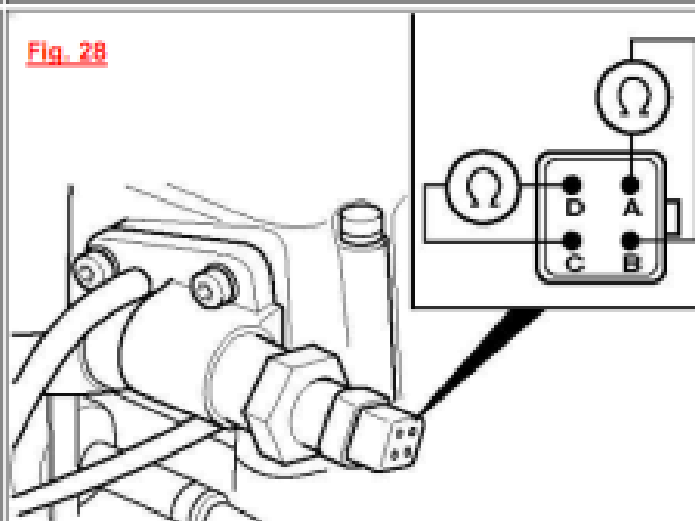
[Fig. 26](#)



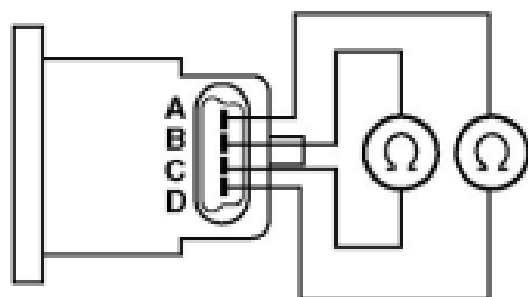
[Fig. 27](#)



[Fig. 28](#)



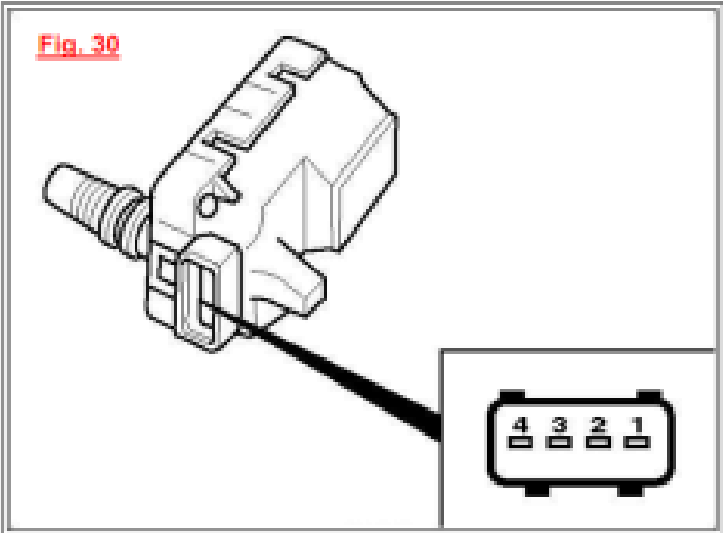
[Fig. 29](#)



Checking resistance - Fig. 30

Technical Data - typical	
Terminals	Resistance
1 & 2	3-200 Ω

- Ensure ignition switched OFF.
- Disconnect ISC actuator multi-plug.
- Check resistance between ISC actuator terminals.



Additional idle air control valve

NOTE: Ignition must not be switched ON for 60 minutes before test is carried out.

Checking resistance - Fig. 31

Technical Data - typical	
Resistance	40 Ω approx.

- Ensure ignition switched OFF.
- Ensure engine is cold.
- Disconnect additional idle air control valve multi-plug.
- Check resistance between additional idle air control valve terminals.

Checking operation 1 - Fig. 32

NOTE: Ignition must not be switched ON for 60 minutes before test is carried out.

- Ensure ignition switched OFF.
- Ensure engine is cold.
- Disconnect additional idle air control valve hoses.
- Look through additional idle air control valve.
- Additional idle air control valve should be open.
- Switch ignition ON.
- Additional idle air control valve should close slowly as bi-metal strip warms-up.

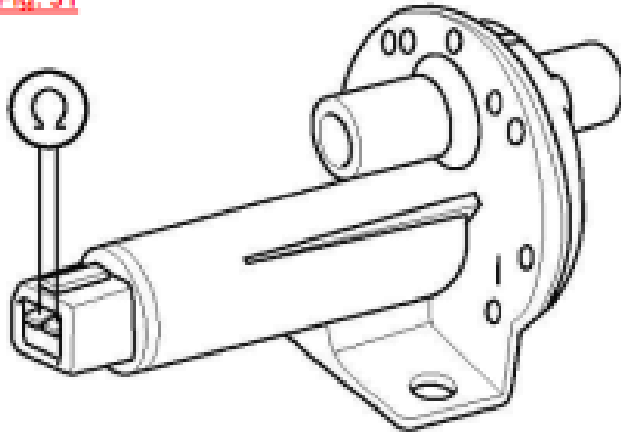
Checking operation 2 - engine cold - [Fig. 32](#)

- Ensure ignition switched OFF.
- Ensure engine is cold.
- Start engine. Allow to idle.
- Squeeze air hose between additional idle air control valve and intake manifold.
- Engine speed should drop.

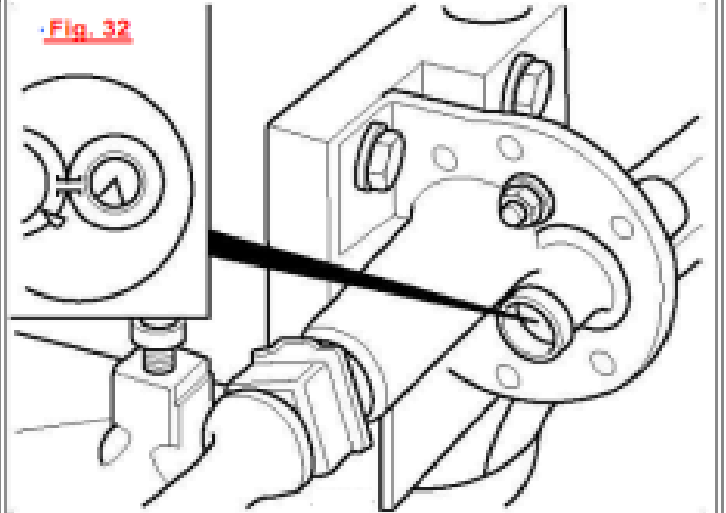
Checking operation 3 - engine hot - [Fig. 32](#)

- Ensure ignition switched OFF.
- Start engine. Allow to idle.
- Ensure engine is at normal operating temperature.
- Squeeze air hose between additional idle air control valve and intake manifold.
- Engine speed should remain constant.

[Fig. 31](#)



[Fig. 32](#)



Intake manifold air control solenoid

Checking resistance - [Fig. 33](#)

Technical Data - typical

Resistance	60-85 Ω approx.
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- Ensure ignition switched OFF.
- Disconnect intake manifold air control solenoid multi-plug.
- Check resistance between intake manifold air control solenoid terminals.

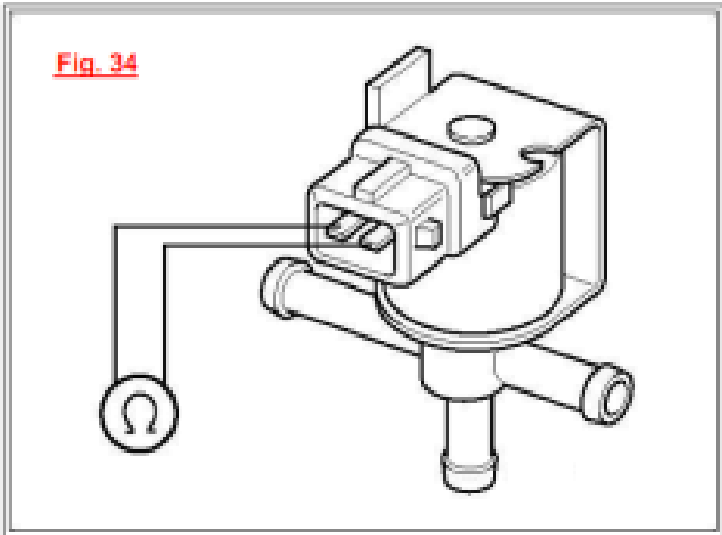
[Fig. 33](#)



Checking resistance - [Fig. 34](#)

Technical Data - typical	
Resistance	20-40 Ω approx.

- Ensure ignition switched OFF.
- Disconnect TC wastegate regulating valve multi-plug.
- Check resistance between TC wastegate regulating valve terminals.

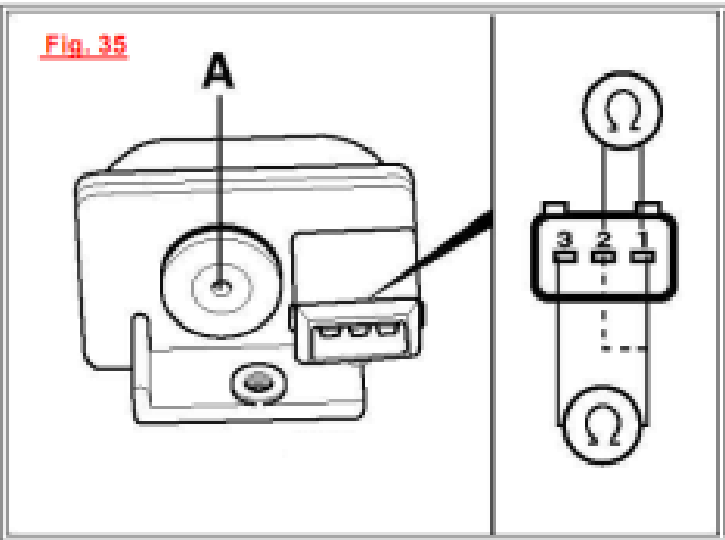


Barometric pressure (BARO) sensor

Checking - [Fig. 35](#)

Technical Data - typical		
Terminals	Condition	Resistance
1 & 2	-	1200 Ω approx.
1 & 3	-	2650 Ω approx.
2 & 3	-	2370 Ω approx.
1 & 2	See text	Changing

- Ensure ignition switched OFF.
- Disconnect BARO sensor multi-plug.
- Check resistance between BARO sensor terminals.
- Check resistance between BARO sensor terminals 1 and 2.
- Blow into BARO sensor port [Fig. 35](#) (A).
- Check that resistance changes.



Checking supply voltage - 7 pins - distributorless ignition - [Fig. 51](#)

Technical Data - typical	
Terminals	Voltage
1 & earth	Battery voltage
6 & earth	Battery voltage

- Ensure ignition switched OFF.
- Disconnect ignition amplifier multi-plug.
- Switch ignition ON.
- Check voltage between harness multi-plug terminals and earth.
- If voltage not as specified: Briefly crank engine.
- Check voltage between harness multi-plug terminals and earth.
- If voltage not as specified: Check wiring.

Checking earth connection - 7 pins - distributorless ignition - [Fig. 51](#)

Technical Data - typical	
Terminals	Resistance
4 & earth	Zero

- Ensure ignition switched OFF.
- Disconnect ignition amplifier multi-plug.
- Check resistance between harness multi-plug terminal and earth.
- If resistance not as specified: Check wiring.

Checking signal - 7 pins - distributorless ignition - [Fig. 52](#)

Technical Data - typical	
Terminals	LED
2 & 4	Flashing
4 & 7	Flashing

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access ignition amplifier multi-plug terminals.
- Connect LED test lamp between multi-plug terminals.
- Briefly crank engine.
- Check that LED flashes.
- If LED does not flash: Check wiring and crankshaft position (CKP) sensor.

Checking operation - 7 pins - distributorless ignition - [Fig. 52](#)

Technical Data - typical	
Terminals	LED
1 & 4	Flashing
4 & 6	Flashing

- Ensure ignition switched OFF.
- Ensure ignition coil and ignition amplifier multi-plugs are connected.
- Do not disconnect multi-plug. Access ignition amplifier multi-plug terminals.
- Connect LED test lamp between multi-plug terminals.
- Briefly crank engine.
- Check that LED flashes.
- If LED does not flash: Suspect faulty ignition amplifier.

Fig. 51

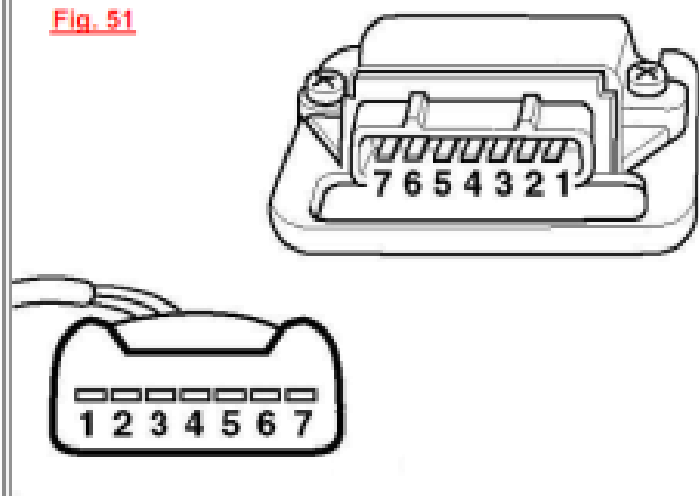
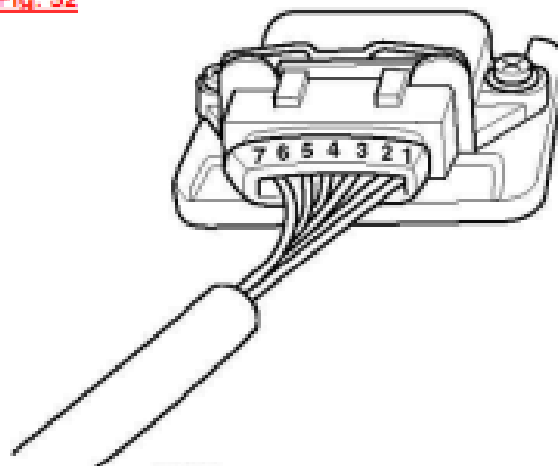


Fig. 52



Engine coolant temperature (ECT) sensor

Checking - Bosch NTC - [Fig. 53](#)

Technical Data - typical	
Temperature	Resistance
0°C	6000 Ω approx.
10°C	3500 Ω approx.
20°C	2500 Ω approx.
40°C	1200 Ω approx.
60°C	600 Ω approx.
80°C	300 Ω approx.
100°C	180 Ω approx.

- Ensure ignition switched OFF.
- Disconnect ECT sensor multi-plug.
- Relieve residual pressure in cooling system.
- Remove ECT sensor from engine.
- Immerse ECT sensor probe in coolant of specified temperature.
- Check resistance between ECT sensor terminals.
- ECT sensor may be checked in situ if engine temperature and resistance readings are compared.

Checking - Ford - [Fig. 53](#)

Technical Data - typical	
Temperature	Resistance
0°C	95000 Ω approx.
20°C	38000 Ω approx.
40°C	16000 Ω approx.
60°C	7500 Ω approx.
80°C	3800 Ω approx.

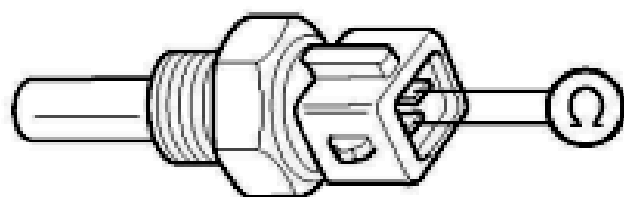
- Ensure ignition switched OFF.
- Disconnect ECT sensor multi-plug.
- Relieve residual pressure in cooling system.
- Remove ECT sensor from engine.
- Immerse ECT sensor probe in coolant of specified temperature.
- Check resistance between ECT sensor terminals.
- ECT sensor may be checked in situ if engine temperature and resistance readings are compared.

Checking - Renix (Renault) PTC - [Fig. 53](#)

Technical Data - typical	
Temperature	Resistance
20°C	290 Ω approx.
80°C	390 Ω approx.
90°C	400 Ω approx.

- Ensure ignition switched OFF.
- Disconnect ECT sensor multi-plug.
- Relieve residual pressure in cooling system.
- Remove ECT sensor from engine.
- Immerse ECT sensor probe in coolant of specified temperature.
- Check resistance between ECT sensor terminals.
- ECT sensor may be checked in situ if engine temperature and resistance readings are compared.

[Fig. 53](#)



Crankshaft position (CKP) sensor/engine speed (RPM) sensor/camshaft position (CMP) sensor

Checking resistance - inductive 2-wire type - [Fig. 54](#)

Technical Data - typical	
Resistance	400-1200 Ω approx.

- Ensure ignition switched OFF.
- Disconnect sensor multi-plug.
- Check resistance between sensor terminals.

Checking voltage - inductive 2-wire type - [Fig. 55](#)

Technical Data - typical	
Voltage	2-8 V approx.

- Ensure ignition switched OFF.
- Disconnect sensor multi-plug.
- Briefly crank engine.
- Check voltage between sensor terminals.

Checking resistance - Inductive 3-wire type - [Fig. 56](#)

Technical Data - typical	
Terminals	Resistance
1 & 2	575-750 Ω approx.

- Ensure ignition switched OFF.
- Disconnect sensor multi-plug.
- Check resistance between sensor terminals.

Checking voltage - inductive 3-wire type - [Fig. 57](#)

Technical Data - typical	
Terminals	Voltage
1 & 2	2-8 V approx.

- Ensure ignition switched OFF.
- Disconnect sensor multi-plug.
- Briefly crank engine.
- Check voltage between sensor terminals.

Checking supply voltage - Hall-effect type - [Fig. 58](#)

Technical Data - typical	
Terminals	Voltage
1 & 3	4,5 V min.

- Ensure ignition switched OFF.
- Disconnect sensor multi-plug.
- Switch ignition ON.
- Check voltage between harness multi-plug terminals.
- If voltage not as specified: Briefly crank engine.
- Check voltage between harness multi-plug terminals.
- If voltage not as specified: Check wiring.

Checking signal - Hall-effect type - [Fig. 59](#)

Technical Data - typical	
Terminals	LED
1 & 2	Flashing

NOTE: Disconnect injector multi-plugs before cranking tests, to prevent engine from starting.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access sensor multi-plug terminals.
- Connect LED test lamp between multi-plug terminals.
- Briefly crank engine.
- Check that LED flashes.

Fig. 54

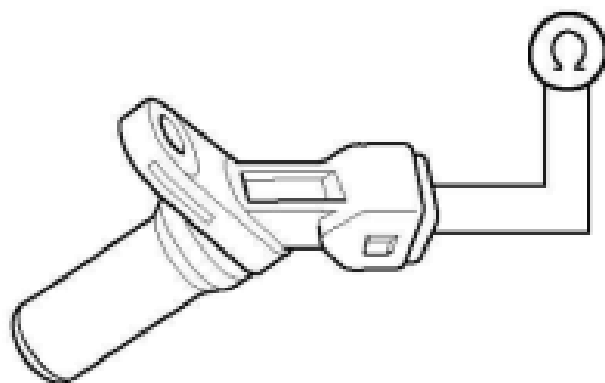


Fig. 55

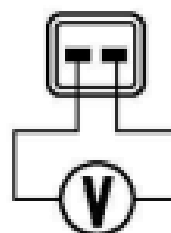


Fig. 56

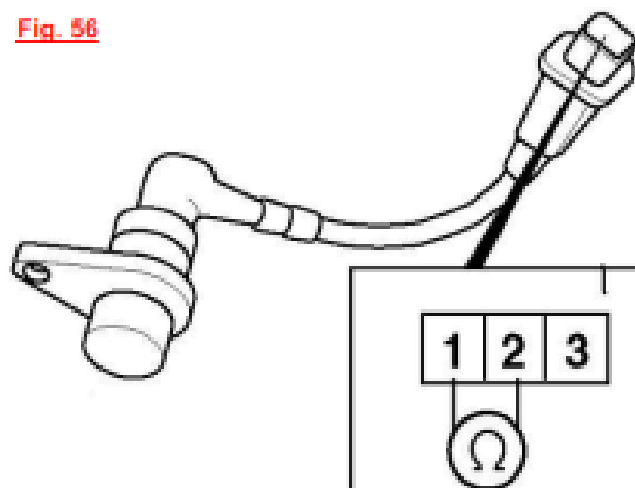


Fig. 57

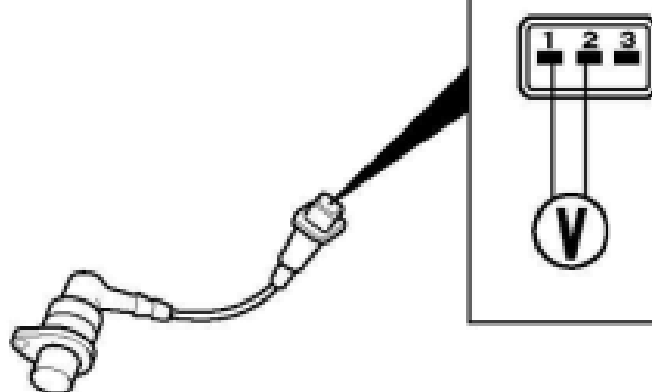


Fig. 58

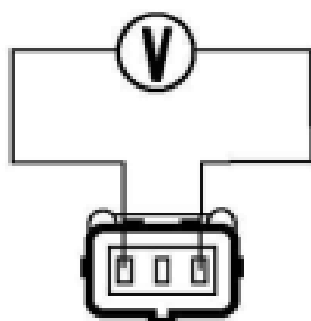
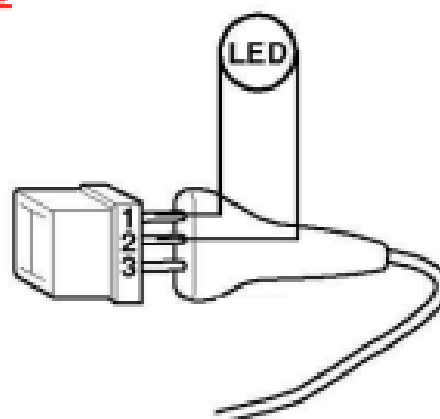


Fig. 59



Checking - [Fig. 60](#)

Technical Data - typical	
Tightening torque	20 Nm

- Ensure ignition switched OFF.
- Disconnect KS multi-plug.
- Remove KS.
- Ensure cylinder block and KS mating faces are free from corrosion and clean.
- Refit KS.
- Tighten fixing to specified torque.

Checking resistance - [Fig. 61](#)

Technical Data - typical	
Terminals	Resistance
1 & 2	∞
1 & 3	∞
2 & 3	∞

- Ensure ignition switched OFF.
- Disconnect KS multi-plug.
- Check resistance between KS terminals.

Checking signal - [Fig. 62](#)

Technical Data - typical	
Terminals	Voltage
1 & earth	0,6 V ac approx.

- Ensure ignition switched OFF.
- Do not disconnect multi-plug. Access KS multi-plug terminals.
- Start engine.
- Allow to idle.
- Check voltage between multi-plug terminal and earth.
- Increase engine speed sharply.
- Check that voltage increases.

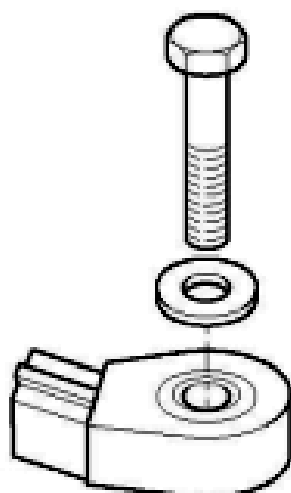
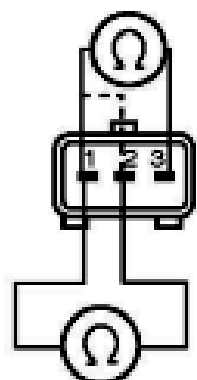
[Fig. 60](#)[Fig. 61](#)

Fig. 62

