



Engine Management and Emission System (2.0 Litre Cosworth Variants)

29L

Index	Page
Description of System Operation	02
Special Tool Recognition and General Equipment	04
Introduction to Fault Finding	06
Index - Fault Finding Charts	07
Fault Finding Charts	08
Turbo Boost Pressure Adjustment	56
Technical Data	59

IMPORTANT NOTE - INTERIOR COURTESY LIGHT DELAY FUSE

When performing breakout box checks, in addition to ensuring all electrical loads are switched off, it is essential to remove the interior light delay fuse, located in the fuse box. Failure to remove this fuse will cause erroneous resistance readings. Ensure the fuse is refitted on completion of the breakout box checks.

The SIERRA RS COSWORTH is fitted with turbocharger and a new electronically controlled injection/ignition system.

This injection/ignition system plays an important part in achieving the high degree of performance and reliability in the Cosworth engine, by giving an increased precision in the metering of the air-fuel ratio and by optimising the control of the engine timing.

The injection/ignition system comprises

- the engine management module
- the control sensors (signal transmitters) supplying engine operating data to the module and the injectors, ignition amplifier module and speed control valve which are controlled by the module.

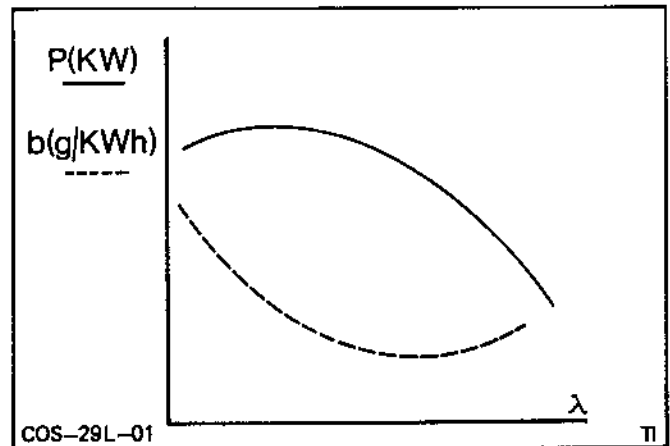
Effects of the air-fuel ratio and engine timing.

Accurate control of the air-fuel ratio and ignition timing are essential to achieve full performance of the SIERRA RS COSWORTH engine. Ideal air-fuel ratio will ensure optimum combustion. An incorrect air-fuel ratio will result in the mixture being too lean or too rich which will impair engine performance, fuel consumption and ultimately exhaust emissions.

The electronically controlled injection/ignition system optimises engine efficiency under all operating conditions (start-up in cold weather, driving off, part-throttle and full-load operation).

Fig.1 Effect of the air-fuel ratio on performance and specific fuel consumption.

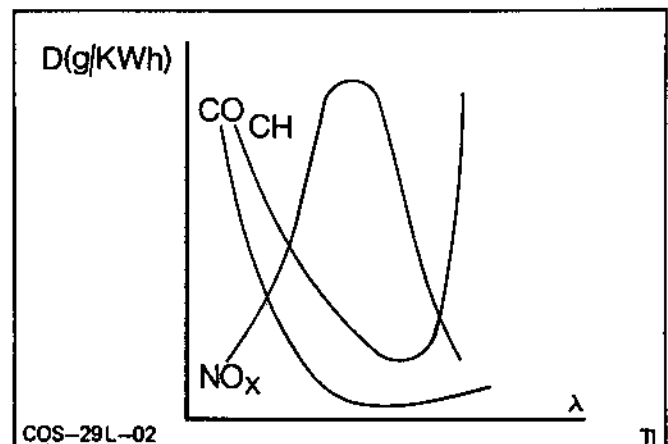
P - Performance
b - Specific fuel consumption
 λ - Air fuel ratio



Effect of the air-fuel ratio on performance and specific fuel consumption.

Fig.2 Effect of the air-fuel ratio exhaust emission.

D - Exhaust emissions
CO - Carbon monoxide
CH - Hydrocarbon
NOx - Oxides of nitrogen
 λ - Air fuel ratio



Effect of the air-fuel ratio exhaust emissions.



To measure the intake-air volume, the SIERRA RS COSWORTH injection/ignition system uses engine speed and air density. On the basis of the known air volume, the quantity of fuel is metered to achieve the desired air-fuel mixture. Sensors in the system are used to adjust the basic air-fuel mixture to all specific operating conditions.

Engine speed and intake-air density data enables the module to calculate the optimum ignition timing in all operating conditions.

The air-intake volume for each cylinder and working stroke is dependent on the following parameters:
- air density in the inlet manifold and swept volume.

The module calculates the air density from the pressure and temperature of the intake air. This data is stored in the module and the injectors are controlled in relation to the engine combustion sequence. Depending on engine load, the delivery of fuel to each cylinder may commence before the intake stroke starts and continue until the power stroke has begun. The duration of the injection process is determined by the module.

The overall system comprises three sub-systems:

- fuel system
- air intake/exhaust and turbo system
- injection/ignition system

Fuel system

Comprising: tank, pump, filter, fuel rail, pressure regulator, fuel injectors.

Fuel is injected into the intake port of each cylinder upstream of the inlet valve.

Air system

The system comprises: air cleaner, turbocharger, intercooler, intake manifold, throttle plenum butterfly assembly and idle speed control valve.

Manifold absolute pressure (MAP) sensor, fuel pressure regulator, speed control valve and air temperature sensor are connected to the inlet plenum.

Electrical circuits (Sensor, general power supply)

Input signals are supplied to the module by the following sensors: MAP sensor, air temperature sensor, throttle butterfly potentiometer (to determine throttle opening), phase sensor (ignition distributor), coolant temperature sensor and engine speed/TDC sensor.

Power is supplied to the module via:
battery, ignition switch, power relay and fuse.

Power is supplied to the fuel pump via:
battery, ignition switch, power relay, fuel pump relay and fuse.


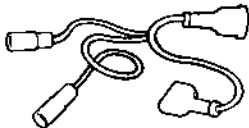
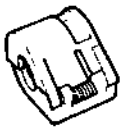

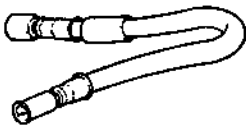
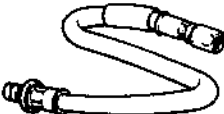

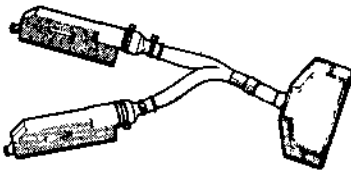
Ignition voltage is generated in the ignition coil by the ignition amplifier module, the precise ignition timing being controlled by the engine management module.

The low tension side of the ignition coil is supplied via:
battery and ignition switch. The high tension generated in the coil is fed to the spark plugs via the distributor.

The fuel injectors are opened and closed by output signals from the module.

SPECIAL SERVICE TOOL RECOGNITION


RS COSWORTH

Tool	Tool Name
 <p>23-021</p>	Pressure gauge and hose
 <p>23-022</p>	Adaptor cable
 <p>23-023A</p>	Fuel hose remover
 <p>23-024</p>	Fuel pressure gauge
 <p>23-024-02</p>	Adaptor pipe
 <p>23-024-03</p>	Adaptor pipe
 <p>29-001</p>	Breakout box
 <p>29-005</p>	Test lead 'Y' cable



SPECIAL SERVICE TOOL RECOGNITION (cont'd)

RS COSWORTH

Tool	Tool Name
 33-002	Test lead No.2

GENERAL EQUIPMENT

- Hand vacuum pump with gauge
- Tachometer
- CO meter
- Multimeter - a good quality electrical multimeter is essential for the breakout box test covered in this section. Use a multimeter recommended by the Ford Dealer Equipment Programme.



INTRODUCTION TO FAULT FINDING

When a fault occurs in the engine management system, it is easy to assume that pinpointing the fault must be a difficult task. This assumption sometimes leads to replacement of components unnecessarily in the hope that the fault may be rectified.

Fault finding techniques used on the 2.0 litre Cosworth system differ from those used on mechanically adjusted fuel and ignition systems. With mechanically adjusted systems, fault finding is generally based on first hand experience of problems previously encountered, and inspection of components for confirmation. This is not the case with electronic systems, but this does not mean fault finding is more complicated. In fact it is simpler, because a fault can be pinpointed exactly, providing the test procedures detailed in this section are followed.

When carrying out checks on a Cosworth system, it is vital to remember that the module relies on correct information from its sensors and correct operation of its actuators, to perform efficiently.

It is worth pointing out that effective fault finding in modern electronic equipment does not necessitate a detailed understanding of electronics. It is essential however, when carrying out fault finding, that you should follow rigidly the procedures laid down in this section. Do not follow hunches. Following the procedure will ensure that all faults are traced. If a fault is found, continue through the complete routine as more than one fault may be present. This will prevent repeat repairs.

Complaints are broken down into various engine or drive faults. Carry out the appropriate fault finding procedure as listed below for the relevant drive/engine fault. Do not deviate from the fault finding procedure in an attempt to diagnose the concern with greater accuracy.

One important aspect of fault finding on this system, is to gain as much information as possible from the customer in order to categorise the complaint. Fault Finding procedures detailed in this section are divided into six categories.

These Categories are:

- Engine cranks but will not start.
- Poor driveability/performance.
- Engine misfires/cuts out.
- Poor fuel economy (vehicle drives O.K.).
- Erratic idle/incorrect idle.
- Engine difficult to start.

Having decided into which category the complaint falls, reference must be made to the fault finding procedure. Do not immediately assume that the fault is electrical. The fault finding procedures will identify whether it is a mechanical or electrical fault.

WARNING

- High tension voltage produced by a breakerless ignition system is approximately 25% higher than for a conventional ignition system. When carrying out service operations on a vehicle equipped with breakerless ignition, it is important to be aware of this as well as all the usual safety measures, to prevent the possibility of electric shocks.
- Certain procedures require the use of a fuel pressure gauge. It should be noted that the system remains pressurised. When removing fuel lines, ensure that adequate safety precautions are taken to prevent fuel spillage.



FAULT FINDING

BREAKOUT BOX CHECKS

The Ford Breakout Box (Special Tool No. 29 001) and Test Lead (Special Tool No. 33 002) are to be used in conjunction with a suitable multimeter (Keithley, Siemens or AVO available from the FDEP) for electrical checks on the Engine Management System. The multimeter must have an input impedance of at least 20,000 ohms/V and should be capable of measuring voltage and resistance.

NOTE: It is essential that the basic engine checks for the relevant drive engine concern are carried out before the breakout box checks.

Care should be exercised when using a multimeter to measure resistance. Resistance measurements MUST NOT be made on electronic control assemblies unless otherwise directed, as this could damage their internal circuitry. It is good practice when working with a multimeter to work from a higher range downwards to avoid damaging the instrument.

IMPORTANT NOTE: ALL PIN NUMBERS SHOWN IN FAULT FINDING CHARTS WITHIN FORD WORKSHOP MANUALS REFER TO THE PIN NUMBERS OF THE BREAKOUT BOX, NOT THE MULTIPLUG. IT IS IMPORTANT TO NOTE THIS FEATURE AS THE NUMBERS ON THE MULTIPLUGS AND THE BREAKOUT BOX DO NOT NECESSARILY CORRESPOND.

When performing the breakout box checks, the following should be adhered to:

- Carry out complete breakout box procedure
- Checks are to be carried out without disturbing connectors, except where specified
- Wiggle associated connectors on the circuit being checked whilst the multimeter is connected. If readings fluctuate, this indicates a connector failure which may cause an intermittent fault.
- When checking wiring continuity between a connector and the breakout box, care must be taken when probing the connector to avoid damaging the pins. Only use suitable test probes.

To assist you in tracing wiring faults when carrying out the test procedures, a vehicle schematic can be found on the fold-out immediately preceding the checks. If left folded out, the wiring diagram can be used as reference on the following checks.

IMPORTANT NOTE:

Remove interior light delay fuse from fuse box, before performing breakout box checks, refer to illustration. Failure to remove the fuse WILL cause erroneous resistance readings. Ensure all electrical loads are 'off' e.g. radio, lights, etc.

Ensure fuse is refitted on completion of breakout box checks.



INDEX FOR FAULT FINDING CHARTS

RS COSWORTH

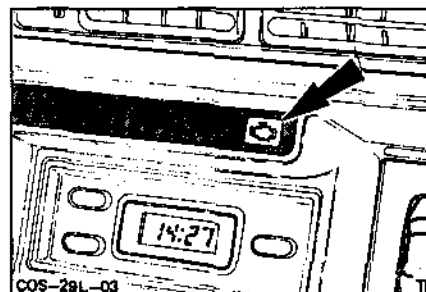
Condition:	1. Engine cranks but will not start
	2. Poor driveability/performance
	3. Engine misfires/cuts out
	4. Poor fuel economy (vehicle drives o.k.)
	5. Erratic idle/incorrect idle speed
	6. Engine difficult to start

FAULT FINDING CHARTS

RS COSWORTH

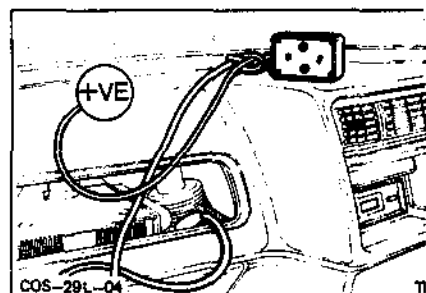
Condition 1: ENGINE CRANKS BUT WILL NOT START

TEST	RESULT	ACTION
1		
● Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3



2

● Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.



Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

FAULT FINDING CHARTS

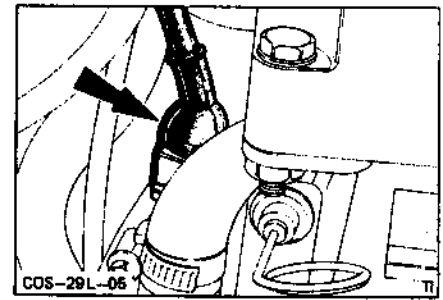
RS COSWORTH

Condition 1: ENGINE CRANKS BUT WILL NOT START

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is battery voltage above 7V when cranking?	NO	Tighten loose connections. Charge battery if necessary.
• Are vacuum and fuel lines in good condition?		Fit new fuel or vacuum lines as necessary.

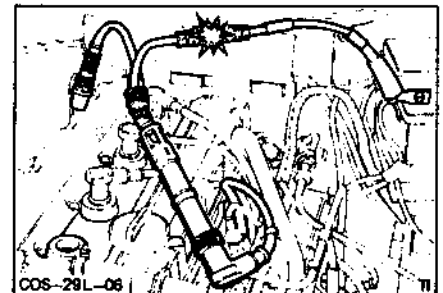
4

• Is fuel pump functioning correctly?	YES	Go to 5
	NO	Carry out breakout box test procedures.
Disconnect multiplug from engine coolant temperature sensor.		
Switch ignition 'on', do not start engine. Fuel pump should run for more than 1 second.		



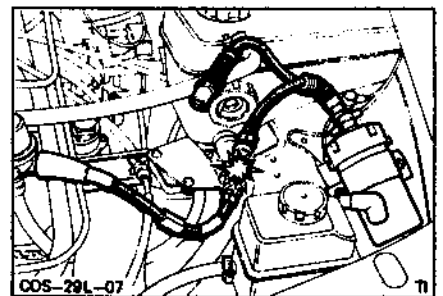
5

• Is HT available to all spark plugs?	YES	Go to 7
	NO	Go to 6
Remove No.1 spark plug lead from spark plug, connect safe-gap on plug lead and ground.		
Crank engine - spark should jump air gap, refit plug lead.		



6

• Is coil producing HT?	YES	Check distributor cap for wear or cracks. Check rotor and resistance of coil and HT leads. Fit new parts as necessary, go to 7.
Remove ignition coil HT lead from coil, connect safe-gap lead into coil and onto a good ground, crank engine.		
Spark should jump air gap.	NO	If fault still evident, carry out breakout box procedure.
Remove safe-gap lead and reconnect HT lead into distributor.		

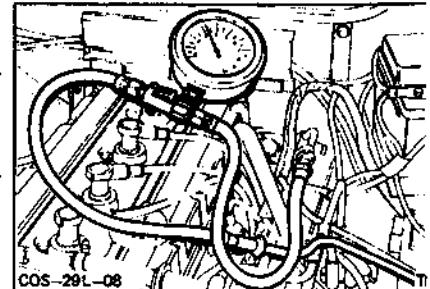


FAULT FINDING CHARTS

RS COSWORTH

Condition 1: ENGINE CRANKS BUT WILL NOT START

TEST	RESULT	ACTION
7		
<ul style="list-style-type: none"> Is fuel system pressure to specification? <p>Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.</p>	<p>YES</p> <p>NO</p>	<p>Go to 8</p> <p>Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. Fit new fuel pump if fault still evident.</p>
8		
<ul style="list-style-type: none"> Does engine start? 	<p>YES</p> <p>NO</p>	<p>Remove pressure test equipment. Reconnect engine coolant temperature sensor. System O.K.</p> <p>Go to 9</p>
9		
<ul style="list-style-type: none"> Remove pressure test equipment. Reconnect engine coolant temperature sensor. Disconnect multiplug from engine management module and connect breakout box using the appropriate test lead. 		<p>Carry out breakout box test procedures. (Refer to page 42).</p>



FAULT FINDING CHARTS

RS COSWORTH

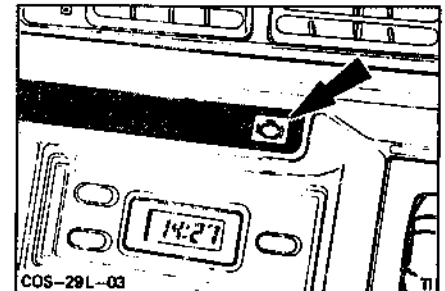
Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
------	--------	--------

1

- Is engine management warning light continuously on?

YES	Go to 2
NO	Go to 3

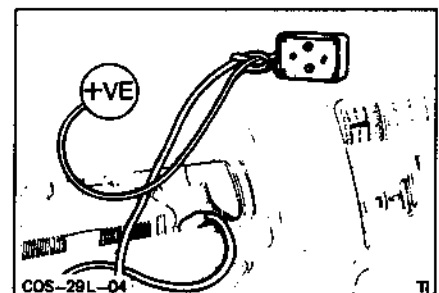


2

- Does self test give an indication of system failure?

YES	For any code given refer to page 32.
NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.

Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.



NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

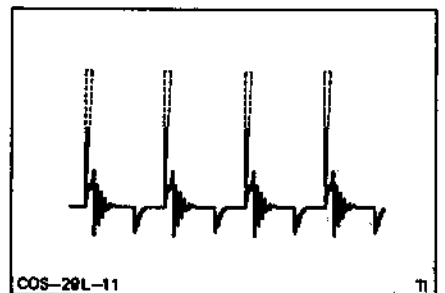
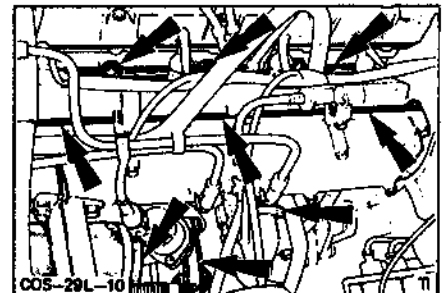
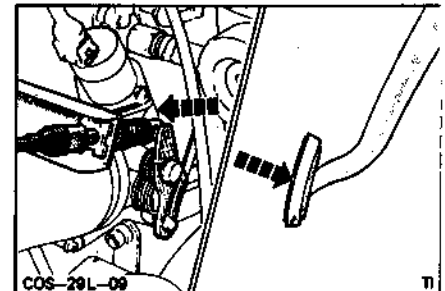
- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

FAULT FINDING CHARTS

RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		
4		
• Is air intake system free from leaks and is air filter clean?	YES	Go to 5
	NO	Rectify air leaks as necessary. Fit new air filter if required.
Start engine and check for air leaks. Check air filter element.		
5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		
6		
• Is HT available to all spark plugs?	YES	Go to 7
	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.
Start engine and observe oscilloscope for HT output.		

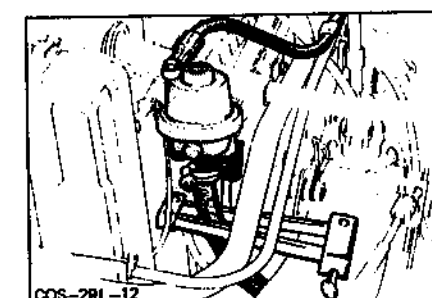
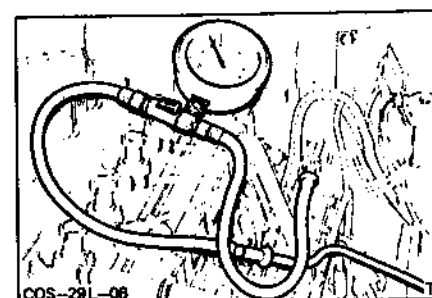
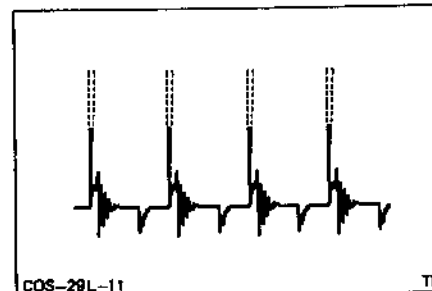


FAULT FINDING CHARTS

RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
7		
<ul style="list-style-type: none"> Is spark plug voltage within limits? <p>Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.</p>	<p>YES</p> <p>NO</p>	<p>Switch 'off' engine and go to 8.</p> <p>Fit new spark plugs.</p>
8		
<ul style="list-style-type: none"> Is fuel system pressure to specification? <p>Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.</p>	<p>YES</p> <p>NO</p>	<p>Go to 9</p> <p>Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.</p>
9		
<ul style="list-style-type: none"> Does fuel system maintain pressure? <p>Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop:</p> <ul style="list-style-type: none"> - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes 	<p>YES</p> <p>NO</p>	<p>Go to 11</p> <p>Go to 10</p>
10		
<ul style="list-style-type: none"> Does fuel pressure drop when fuel return line is clamped? <p>Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line.</p> <p>Fuel pressure should not drop.</p>	<p>YES</p> <p>NO</p>	<p>Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required.</p> <p>Fit new pressure regulator.</p>

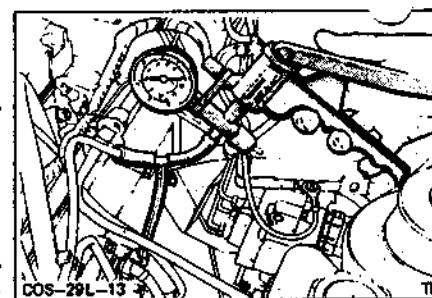


FAULT FINDING CHARTS

RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
11		
● Is fuel pressure correct at idle?	YES	Go to 13
	NO	Go to 12
<p>Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm).</p> <p>Pressure should be 2,7 to 3,3 bar</p>		
12		
● Is intake vacuum sufficient?	YES	Fit new pressure regulator.
<p>Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.</p>	NO	<p>Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.</p>
13		
● Is idle CO% within specification?	YES	Go to 14
	NO	Adjust CO% as required, refer to Service Microfiche.
<p>Connect CO meter, start engine and allow to idle. Check CO content in the normal way.</p> <p>CO% should be 1% to 2%.</p>		
14		
● Is Turbo boost pressure to specification?	YES	If there is still a drive/performance concern, carry out breakout box checks.
<p>Connect boost pressure test gauge. Road test vehicle and check boost pressure. Refer to the procedure on page 56.</p>	NO	Adjust boost pressure as required.

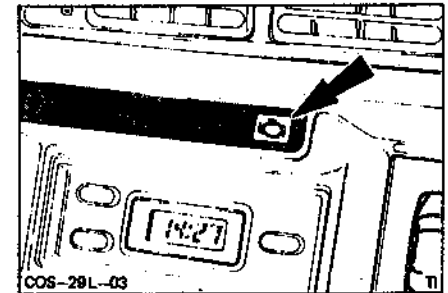


FAULT FINDING CHARTS

RS COSWORTH

Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
1		
• Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3



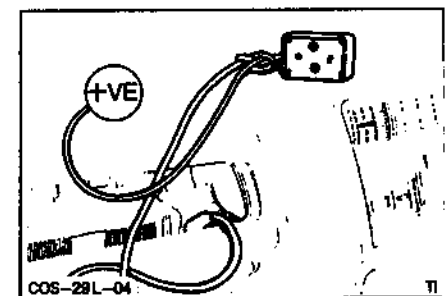
2		
• Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.

Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on' and switch LED to ground.

NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.





FAULT FINDING CHARTS

RS COSWORTH

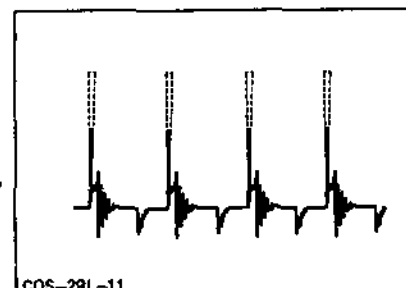
Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is battery voltage above 7V when cranking?	NO	Tighten loose connections. Charge battery if necessary.
• Are vacuum and fuel lines in good condition?		Fit new fuel or vacuum lines as necessary.

4		
• Are all electrical connections in good condition?	YES	Go to 5
	NO	Repair loose wiring connections.
Start engine and wiggle all electrical connections. Engine should continue to run smoothly.		
<u>Do not wiggle HT connections.</u>		

5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		

6		
• Is HT available to all spark plugs?	YES	Go to 7
	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.
Start engine and observe oscilloscope for HT output.		

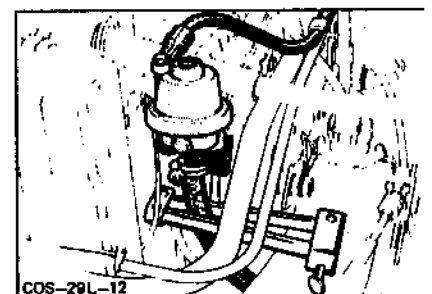
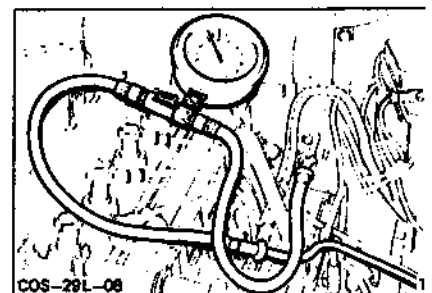
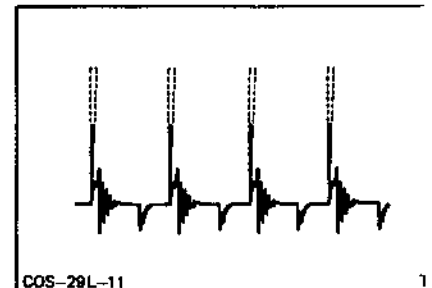


FAULT FINDING CHARTS

RS COSWORTH

Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
7		
● Is spark plug voltage within limits?	YES	Switch 'off' engine and go to 8.
Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	NO	Fit new spark plugs.
8		
● Is fuel system pressure to specification?	YES	Go to 9
Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	NO	Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and Repeat test. If fault still evident, fit new fuel pump.
9		
● Does fuel system maintain pressure?	YES	Go to 11
Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	NO	Go to 10
10		
● Does fuel pressure drop when fuel return line is clamped?	YES	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required.
Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line.		
Fuel pressure should not drop.	NO	Fit new pressure regulator.

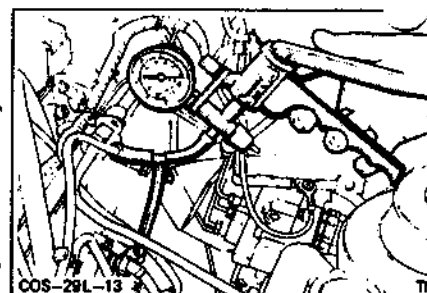


FAULT FINDING CHARTS

RS COSWORTH

Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
11		
● Is fuel pressure correct at idle?	YES	Go to 13
	NO	Go to 12
<p>Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm).</p> <p>Pressure should be 2,7 to 3,3 bar</p>		
12		
● Is intake vacuum sufficient?	YES	Fit new pressure regulator.
<p>Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.</p>	NO	<p>Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.</p>
13		
● Is idle CO% within specification?	YES	Go to 14
	NO	Adjust CO% as required, refer to Service Microfiche.
<p>Connect CO meter, start engine and allow to idle. Check CO content in the normal way.</p> <p>CO% should be 1% to 2%.</p>		
14		
● Is Turbo boost pressure to specification?	YES	If there is still a misfire/cut out concern, carry out breakout box checks.
<p>Connect boost pressure test gauge. Road test vehicle and check boost pressure. Refer to the procedure on page 56.</p>	NO	Adjust boost pressure as required.

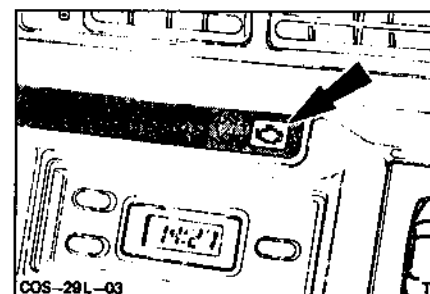


FAULT FINDING CHARTS

RS COSWORTH

Condition 4: POOR FUEL ECONOMY (VEHICLES DRIVES O.K.)

TEST	RESULT	ACTION
1		
● Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3



2

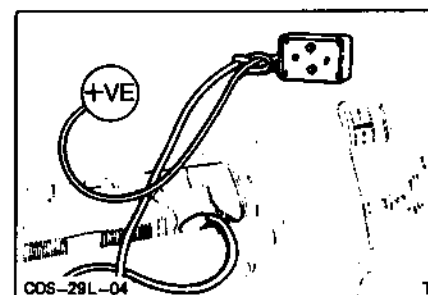
● Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.

Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.



FAULT FINDING CHARTS

RS COSWORTH

Condition 4: POOR FUEL ECONOMY (VEHICLE DRIVES O.K.) (cont'd)

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		

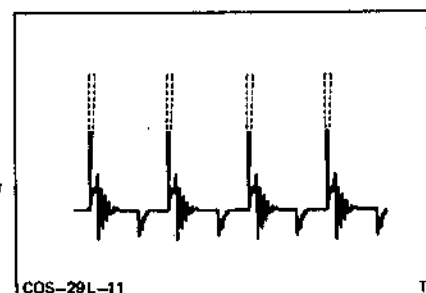
4		
• Is air intake system free from leaks and is air filter clean?	YES	Go to 5
	NO	Rectify air leaks as necessary. Fit new air filter if required.
Start engine and check for air leaks. Check air filter element.		



5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6

NOTE: For test set without oscilloscope, refer to manufacturers' procedures.

6		
• Is HT available to all spark plugs?	YES	Go to 7
	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.
Start engine and observe oscilloscope for HT output.		

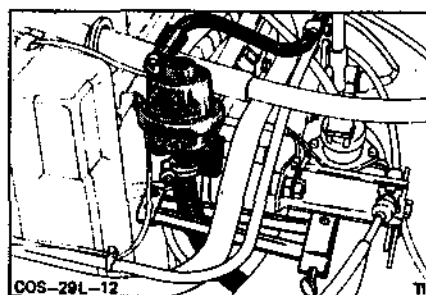
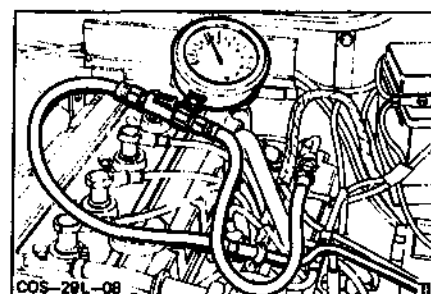
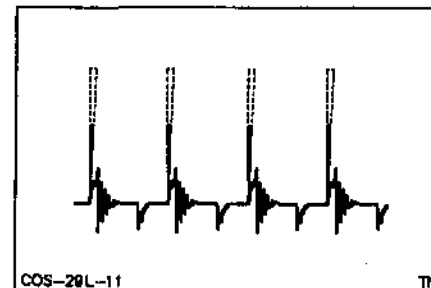


FAULT FINDING CHARTS

RS COSWORTH

Condition 4: POOR FUEL ECONOMY (VEHICLE DRIVES O.K.) (cont'd)

TEST	RESULT	ACTION
7		
<p>● Is spark plug voltage within limits?</p> <p>Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.</p>	<p>YES</p> <p>NO</p>	<p>Switch 'off' engine and go to 8.</p> <p>Fit new spark plugs.</p>
8		
<p>● Is fuel system pressure to specification?</p> <p>Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.</p>	<p>YES</p> <p>NO</p>	<p>Go to 9</p> <p>Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.</p>
9		
<p>● Does fuel system maintain pressure?</p> <p>Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes</p>	<p>YES</p> <p>NO</p>	<p>Go to 11</p> <p>Go to 10</p>
10		
<p>● Does fuel pressure drop when fuel return line is clamped?</p> <p>Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line.</p> <p>Fuel pressure should not drop.</p>	<p>YES</p> <p>NO</p>	<p>Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required.</p> <p>Fit new pressure regulator.</p>

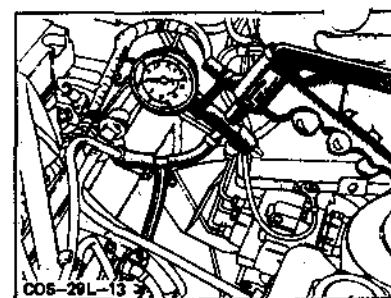


FAULT FINDING CHARTS

RS COSWORTH

Condition 4: POOR FUEL ECONOMY (VEHICLE DRIVES O.K.) (cont'd)

TEST	RESULT	ACTION
11		
● Is fuel pressure correct at idle?	YES	Go to 13
	NO	Go to 12
Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm).		
Pressure should be 2,7 to 3,3 bar		
12		
● Is intake vacuum sufficient?	YES	Fit new pressure regulator.
Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.	NO	Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.
13		
● Is idle CO% within specification?	YES	Go to 14
	NO	Adjust CO% as required, refer to Service Microfiche.
Connect CO meter, start engine and allow to idle. Check CO content in the normal way.		
CO% should be 1% to 2%.		
14		
● Is fuel consumption still high?	YES	Carry out breakout box procedures.
	NO	System O.K.
Road test vehicle to determine fuel consumption.		

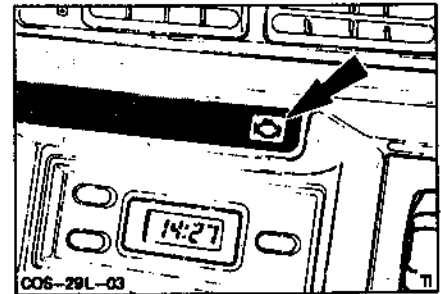


FAULT FINDING CHARTS

RS COSWORTH

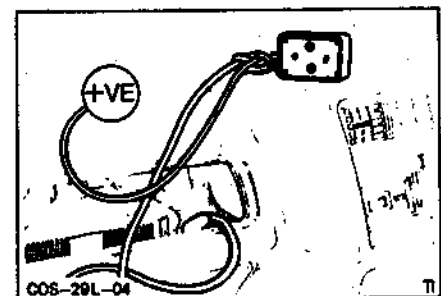
Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED

TEST	RESULT	ACTION
1		
• Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3



2		
• Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.

Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.



NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

FAULT FINDING CHARTS

RS COSWORTH

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

TEST	RESULT	ACTION
------	--------	--------

3

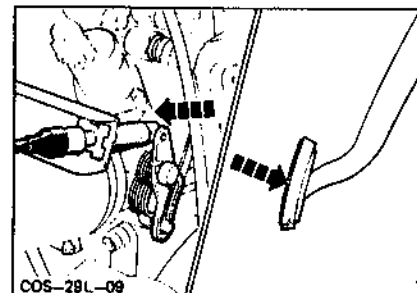
- Are all electrical system connections clean and secure?
- Is accelerator cable moving freely and can full throttle be obtained?
- Are vacuum and fuel lines in good condition?

YES

Go to 4

NO

Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.



4

- Is air intake system free from leaks and is air filter clean?

YES

Go to 5

NO

Rectify air leaks as necessary. Fit new air filter if required.

Start engine and check for air leaks. Check air filter element.



5

- Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.

Go to 6

NOTE: For test set without oscilloscope, refer to manufacturers' procedures.

6

- Is HT available to all spark plugs?

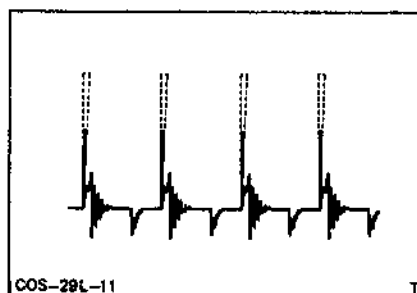
YES

Go to 7

NO

Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.

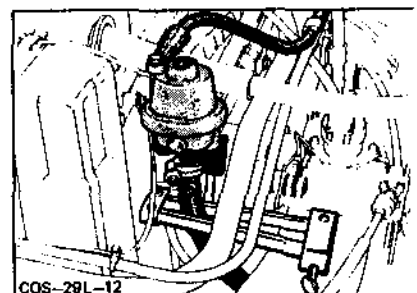
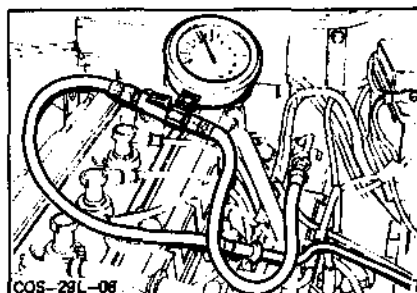
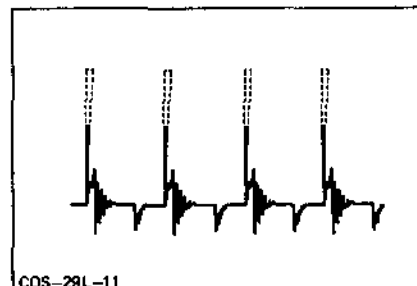
Start engine and observe oscilloscope for HT output.



FAULT FINDING CHARTS

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

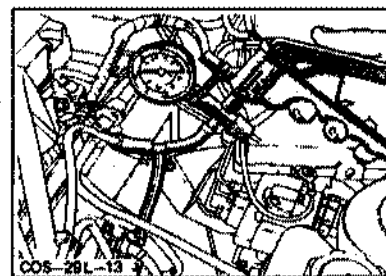
TEST	RESULT	ACTION
7		
<ul style="list-style-type: none"> Is spark plug voltage within limits? <p>Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.</p>	<p>YES</p> <p>NO</p>	<p>Switch 'off' engine and go to 8.</p> <p>Fit new spark plugs.</p>
8		
<ul style="list-style-type: none"> Is fuel system pressure to specification? <p>Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.</p>	<p>YES</p> <p>NO</p>	<p>Go to 9</p> <p>Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.</p>
9		
<ul style="list-style-type: none"> Does fuel system maintain pressure? <p>Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: ~ 0,2 bar after 10 minutes ~ 0,3 bar after 20 minutes</p>	<p>YES</p> <p>NO</p>	<p>Go to 11</p> <p>Go to 10</p>
10		
<ul style="list-style-type: none"> Does fuel pressure drop when fuel return line is clamped? <p>Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line.</p> <p>Fuel pressure should not drop.</p>	<p>YES</p> <p>NO</p>	<p>Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required.</p> <p>Fit new pressure regulator.</p>



FAULT FINDING CHARTS

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

TEST	RESULT	ACTION
11		
• Is fuel pressure correct at idle?	YES	Go to 13
	NO	Go to 12
<p>Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm).</p> <p>Pressure should be 2,7 to 3,3 bar</p>		
12		
• Is intake vacuum sufficient?	YES	Fit new pressure regulator.
	NO	Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.
<p>Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.</p>		
13		
• Is idle CO% within specification?	YES	Go to 14
	NO	Adjust CO% as required, refer to Service Microfiche.
<p>Connect CO meter, start engine and allow to idle. Check CO content in the normal way.</p> <p>CO% should be 1% to 2%.</p>		

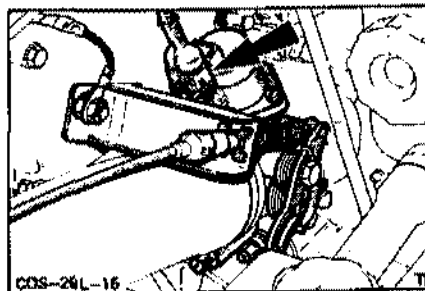




FAULT FINDING CHARTS

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

TEST	RESULT	ACTION
14 • Is base idle speed correct (850 rpm)?	YES	If engine idle is still erratic, carry out breakout box checks.
With engine at normal operating temperature, disconnect idle speed control valve. Start engine and measure base idle speed. Engine should idle at 850 rpm.	NO	Slacken locknut, adjust screw until correct engine idle speed is achieved. Tighten locknut and reconnect idle speed control valve. Note: When multipug is reconnected, idle speed may increase before return to 850 rpm.

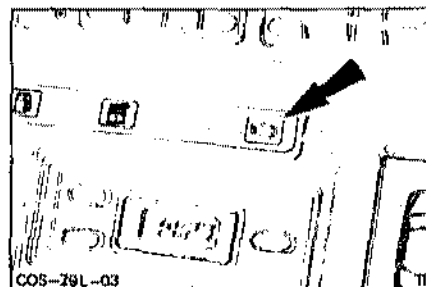


FAULT FINDING CHARTS

RS COSWORTH

Condition 6: ENGINE DIFFICULT TO START

TEST	RESULT	ACTION
1		
• Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3



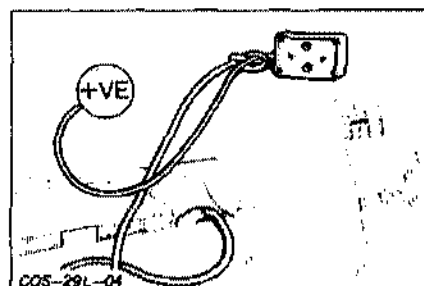
2		
• Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.

Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

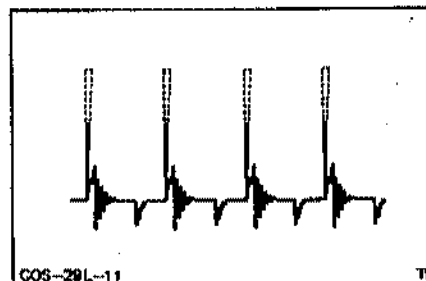
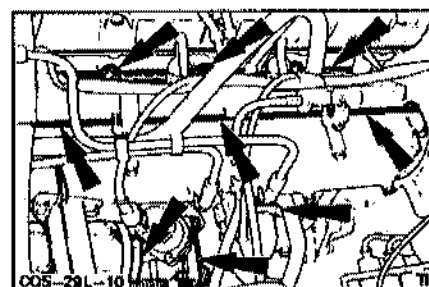
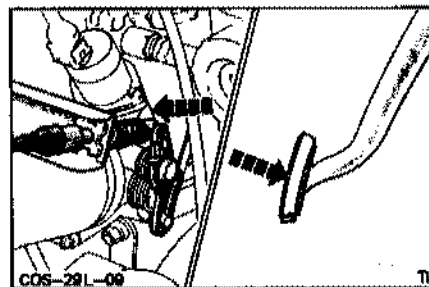


FAULT FINDING CHARTS

RS COSWORTH

Condition 6: ENGINE DIFFICULT TO START (cont'd)

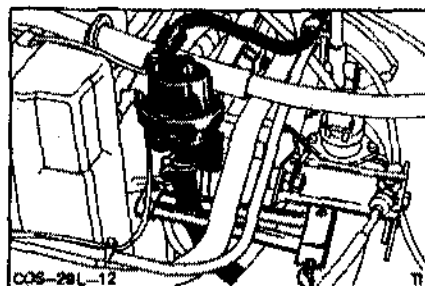
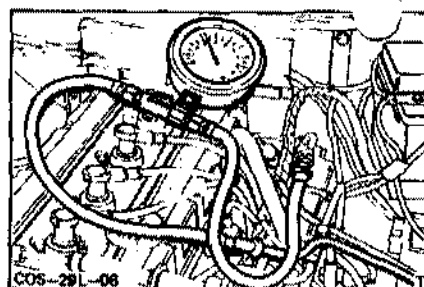
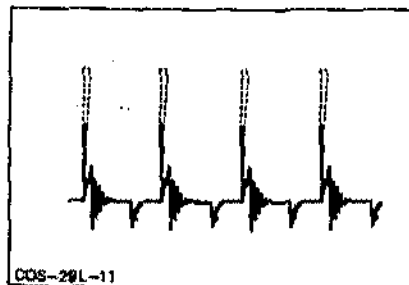
TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		
4		
• Is air intake system free from leaks and is air filter clean?	YES	Go to 5
	NO	Rectify air leaks as necessary. Fit new air filter if required.
Start engine and check for air leaks. Check air filter element.		
5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		
6		
• Is HT available to all spark plugs?	YES	Go to 7
	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.
Start engine and observe oscilloscope for HT output.		



FAULT FINDING CHARTS

Condition 6: ENGINE DIFFICULT TO START (cont'd)

TEST	RESULT	ACTION
7		
• Is spark plug voltage within limits?	YES	Switch 'off' engine and go to 8.
Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	NO	Fit new spark plugs.
8		
• Is fuel system pressure to specification?	YES	Go to 9
Connect pressure test equipment to fuel rail inlet, refer to illustration. Disconnect ECT sensor. Ensure valve on gauge is open. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	NO	Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.
9		
• Does fuel system maintain pressure?	YES	Go to 11
Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	NO	Go to 10
10		
• Does fuel pressure drop when fuel return line is clamped?	YES	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required.
Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line.		
Fuel pressure should not drop.	NO	Fit new pressure regulator.



FAULT FINDING CHARTS

RS COSWORTH

Condition 6: ENGINE DIFFICULT TO START (cont'd)

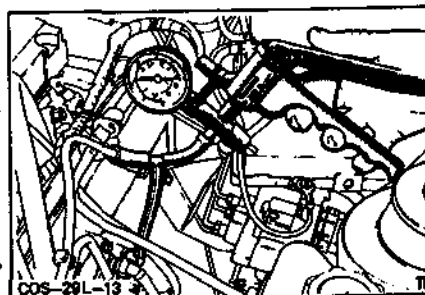
TEST	RESULT	ACTION
11		
• Is fuel pressure correct at idle?	YES	Go to 13
	NO	Go to 12

Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm).

Pressure should be 2,7 to 3,3 bar

12

• Is intake vacuum sufficient?	YES	Fit new pressure regulator.
Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.	NO	Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.



13

• Is idle CO% within specification?	YES	Go to 14
Connect CO meter, start engine and allow to idle. Check CO content in the normal way. CO% should be 1% to 2%.	NO	Adjust CO% as required, refer to Service Microfiche.

14

• Is engine still difficult to start?	YES	Carry out breakout box procedures.
	NO	System O.K.

Self Test Codes

The module may emit one or more of the following codes when the self test is initiated. The codes given indicate that the module has detected a fault in a particular circuit. The code/s are to be used only as an indication of the possible failure. It does not necessarily mean that a particular sensor is faulty.

If a code is given indicating a fault in the MAP sensor, DO NOT CHANGE the sensor. Follow the checks detailed on the pages listed below as it may be a faulty wiring connection or a wiring short/break which the module will detect as a failure. Following the full list of checks will ensure that the cause of the failure is found, do not attempt to short circuit the check list.

The following is a list of the codes that may be given from the module and the pages on which the check lists can be found. Before turning to the check list, ensure the code has been read correctly. Repeat the self test operation to confirm the code.

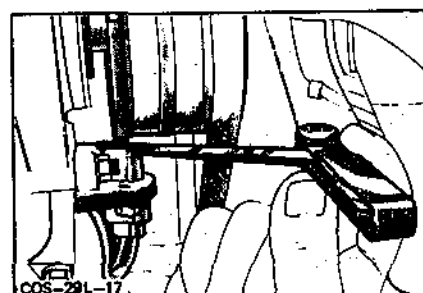
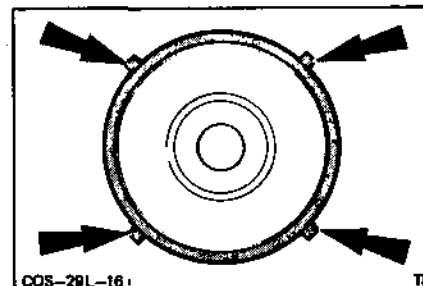
CODE	FAULT DETECTED	PAGE
1+1	Engine speed/TDC sensor circuit	33
1+2	Distributor phase sensor circuit	34
1+3	Signal generation and phasing between engine speed/TDC sensor and distributor phase sensor	35
2+1	Short circuit in air charge temperature sensor circuit	36
2+2	Open circuit in air charge temperature sensor circuit	36
2+3	Short circuit in engine coolant temperature sensor circuit	37
3+1	Open circuit in engine coolant temperature sensor circuit	37
3+2	Short circuit in MAP sensor or sensor wiring	38
3+3	Open circuit in MAP sensor or sensor wiring	38

FAULT FINDING CHARTS

RS COSWORTH

Code 1+1 - Engine speed/TDC sensor circuit

TEST	RESULT	ACTION
1		
<ul style="list-style-type: none"> Are there 4 teeth on crankshaft pulley? <p>Inspect crankshaft pulley.</p>	<p>YES</p> <p>NO</p>	<p>Go to 2</p> <p>Fit new crankshaft pulley</p>
2		
<ul style="list-style-type: none"> Is sensor in good condition and set at the correct clearance? <p>Inspect sensor for damage, check sensor distance from pulley teeth (should be 0,6 to 1,0 mm)</p>	<p>YES</p> <p>NO</p>	<p>Go to 3</p> <p>Fit new sensor if damaged. Adjust sensor to obtain correct clearance.</p>
3		
<ul style="list-style-type: none"> Is resistance of sensor within specification? <p>Disconnect module and connect to breakout box, using lead 33-002. Measure resistance across pins 4 and 3, reading should be 600 to 1k ohms.</p>	<p>YES</p> <p>NO</p>	<p>Reconnect module and repeat self test. If fault still evident, fit new module.</p> <p>Check wiring for short/open circuit, repair as necessary. Fit new sensor if necessary.</p>

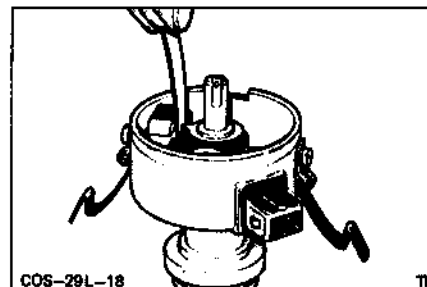


FAULT FINDING CHARTS

RS COSWORTH

Code 1+2 - Distributor phase sensor circuit

TEST	RESULT	ACTION
1		
<ul style="list-style-type: none"> Is sensor in good condition and set at the correct clearance? <p>Inspect sensor for damage, check sensor distance from distributor cams (should be 0,2 to 0,3 mm)</p>	<p>YES</p> <p>NO</p>	<p>Go to 2</p> <p>Fit new sensor if damaged. Adjust sensor to obtain correct clearance.</p>
2		
<ul style="list-style-type: none"> Is resistance of sensor within specification? <p>Disconnect module and connect to breakout box, using lead 33-002. Measure resistance across pins 23 and 5, reading should be 700 to 1,2k ohms.</p>	<p>YES</p> <p>NO</p>	<p>Reconnect module and repeat self test. If fault still evident, fit new module.</p> <p>Check wiring for short/open circuit, repair as necessary. Fit new sensor if necessary.</p>

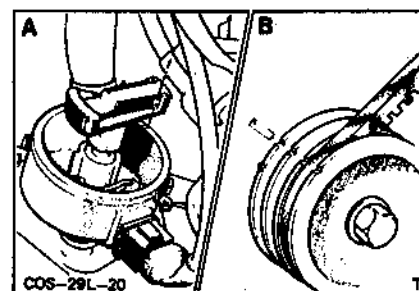
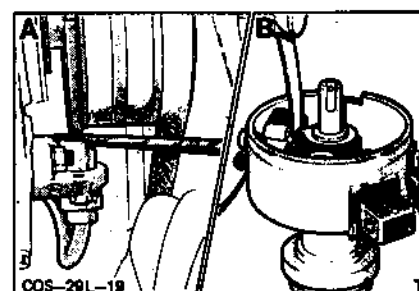
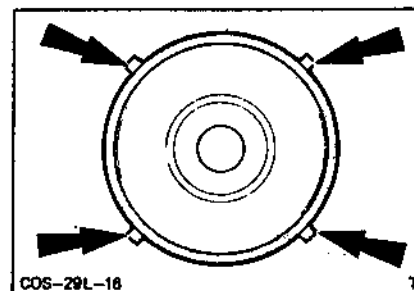


FAULT FINDING CHARTS

RS COSWORTH

Code 1+3 - Signal generation and phasing between engine speed/TDC sensor and distributor phase sensor

TEST	RESULT	ACTION
1		
• Are there 4 teeth on crankshaft pulley?	YES	Go to 2
	NO	Fit new crankshaft pulley.
Inspect crankshaft pulley.		
2		
• Are sensors in good condition and set at the correct clearance?	YES	Go to 3
	NO	Fit new sensor/s if damaged. Adjust sensor/s to obtain correct clearance.
Inspect sensors for damage, check clearance of both sensors. Distributor cam to sensor 0,2 to 0,3 mm. Speed/TDC to pulley teeth 0,6 to 1,0 mm.		
3		
• Is distributor correctly timed?	YES	Go to 4
	NO	Slacken distributor clamp bolt and rotate distributor until marks align.
Turn engine until No.1 cylinder is at TDC. Remove distributor cap and check alignment of rotor with mark on body, refer to illustration.		
4		
• Is resistance of sensors within specification?	YES	Repeat self test. If fault still evident, fit new module.
	NO	Check wiring for short/open circuit, repair as necessary. Fit new sensor/s if necessary.
Disconnect module and connect breakout box, using lead 33-002. Check sensor resistances. Distributor sensor Pins 23 to 5 - should be 700 to 1,2k ohms. Speed/TDC sensor Pins 4 to 3 - should be 600 to 1k ohms.		

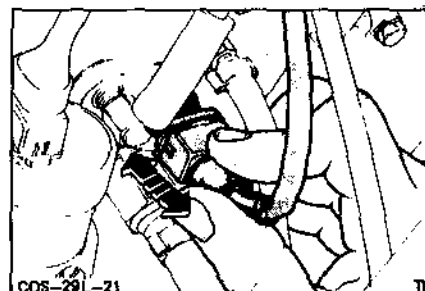


FAULT FINDING CHARTS

2.0 EEC IV

Codes 2+1 and 2+2: Air charge temperature sensor circuit

TEST	RESULT	ACTION
1		
● Is multiplug connection on air charge temperature sensor clean and secure?		Go to 2
Disconnect multiplug from sensor. Clean contacts using contact spray. Refit multiplug ensuring locking clip 'snaps' into position.		
2		
● Is sensor within specification?	YES	Go to 4
	NO	Go to 3
Remove module multiplug and connect to breakout box. Check resistance of sensor between pins 11 and 31.		
Temperature °C	Resistance (k ohms)	
10	6,00	
20	3,75	
40	1,60	
3		
● Is wiring between module multiplug and sensor short/open circuit?	YES	Locate and rectify wiring fault.
	NO	Fit new sensor and go to 4.
Remove multiplug from sensor and check continuity of wiring as follows. Pin 11 to one of the multiplug connections. Check other pin for wiring short. Pin 31 to other connection.		
4		
● Is fault still evident?	YES	Fit new engine management module.
	NO	System O.K.
Reconnect module to vehicle and recheck self test output.		



FAULT FINDING CHARTS

2,0 EEC IV

Codes 2+3 and 3+1: Engine coolant temperature sensor circuit

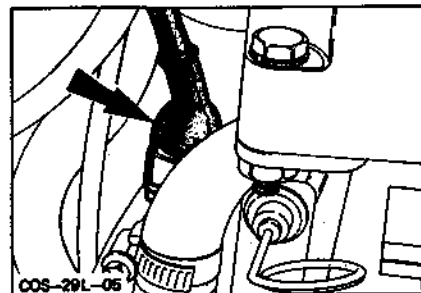
TEST	RESULT	ACTION
------	--------	--------

1

- Is multiplug connection on coolant temperature sensor clean and secure?

Disconnect module and connect breakout box, go to 2.

Disconnect multiplug from sensor. Clean contacts using contact spray. Refit multiplug ensuring locking clip 'snaps' into position.



2

- Is sensor within specification?

YES Go to 4

NO Go to 3

Check resistance of sensor between pins 11 and 29.

Temperature °C	Resistance (k ohms)
10	6,00
20	3,75
40	1,60
60	0,75
80	0,38

3

- Is wiring between module multiplug and sensor short/open circuit?

YES Locate and rectify wiring fault.

NO Fit new sensor and go to 4.

Remove multiplug from sensor and check continuity of wiring as follows. Pin 11 to one of the multiplug connections. Check other pin for wiring short. Pin 29 to other connection.

4

- Is fault still evident?

YES Fit new engine management module.

Reconnect module to vehicle and recheck self test output.

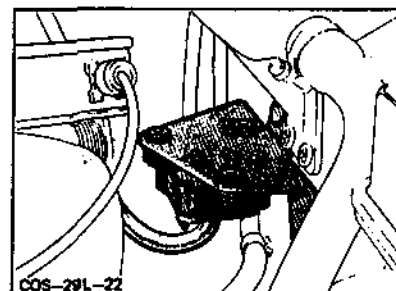
NO System O.K.

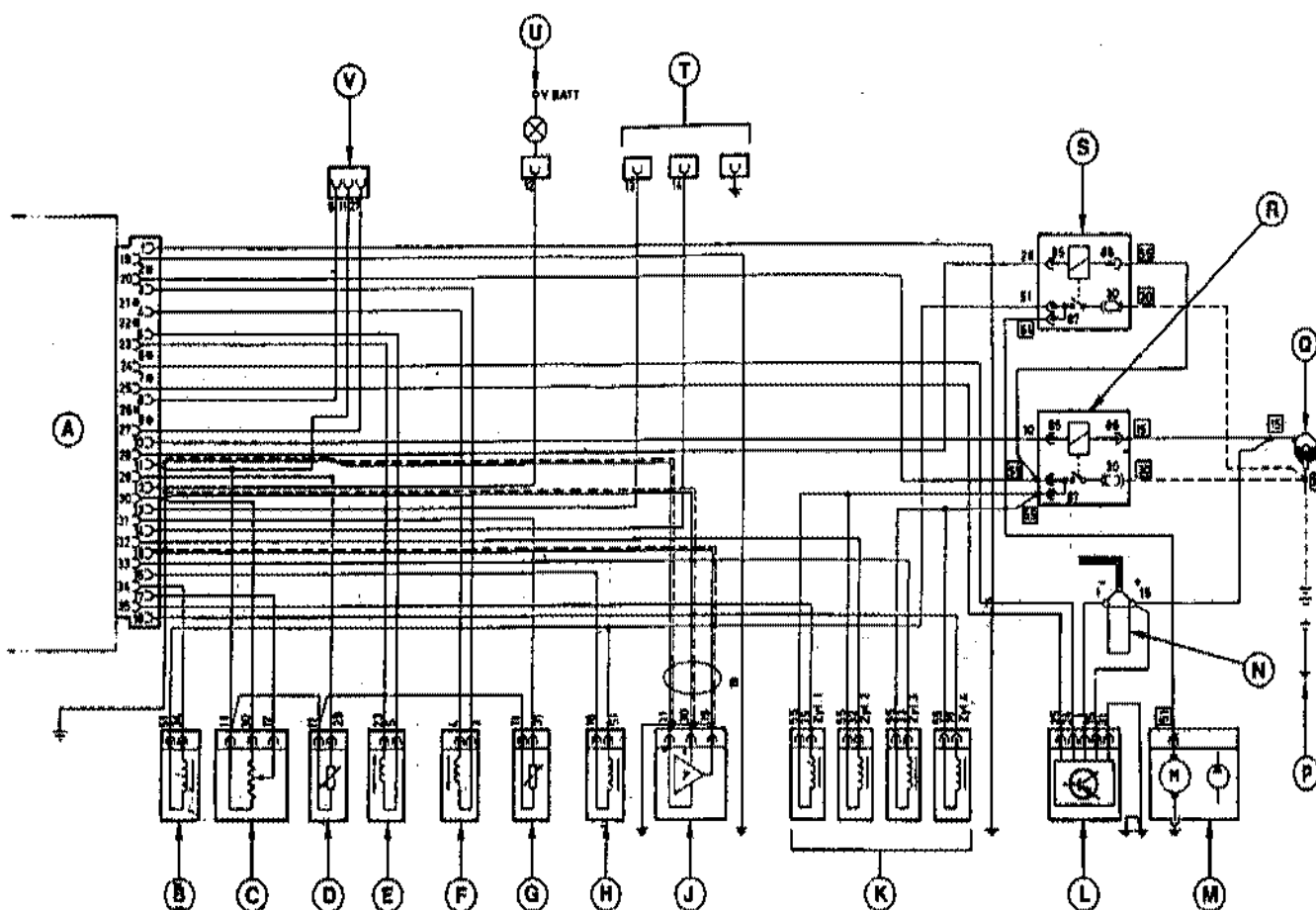
FAULT FINDING CHARTS

2,0 EEC

Codes 3+2 and 3+3: MAP sensor circuit

TEST	RESULT	ACTION
1		
<ul style="list-style-type: none"> Is multiplug connection on sensor clean and secure? <p>Disconnect multiplug from sensor. Clean contacts using contact spray. Refit multiplug ensuring locking clip 'snaps' into position.</p>		<p>Disconnect module and connect breakout box, go to 2.</p>
2		
<ul style="list-style-type: none"> Is sensor within specification? <p>Check resistance of sensor between pins 30 and 11, should be 50 to 600 ohms.</p> <p>Check resistance of sensor between pins 30 and 15, should be 500 to 6k ohms.</p>	<p>YES</p> <p>NO</p>	<p>Go to 4</p> <p>Go to 3</p>
3		
<ul style="list-style-type: none"> Is wiring between module multiplug and sensor short/open circuit? <p>Remove multiplug from sensor and check continuity of wiring. Check pin to pin combinations for possible short/open circuit. Illustration shows breakout box pin numbers in relation to multiplug.</p>	<p>YES</p> <p>NO</p>	<p>Locate and rectify wiring fault.</p> <p>Fit new sensor and go to 4.</p>
4		
<ul style="list-style-type: none"> Is fault still evident? <p>Reconnect module to vehicle and recheck self test output.</p>	<p>YES</p> <p>NO</p>	<p>Carry out MAP sensor voltage checks, contained in the active breakout box checks.</p> <p>System O.K.</p>





SRS-29-101

Circuit diagram.

A - Engine management module
B - Speed control valve
C - Idle throttle butterfly potentiometer
D - Coolant temperature sensor
E - Phase sensor (distributor)
F - Engine speed/TDC sensor
G - Air temperature sensor
H - Solenoid control valve
J - MAP sensor
K - Fuel injectors

L - Ignition amplifier module
M - Fuel pump
N - Ignition coil
P - Battery
Q - Ignition switch
R - Power relay
S - Fuel pump relay
T - Ignition timing adjustment connection
U - Module test display
V - Engine timing diagnosis connection



RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
1	Module to ground	1	BATT -	R	OFF
2	Module to ground	19	BATT -	R	OFF
<hr/>					
3	Ignition amplifier module and wiring	25	24	R	OFF
<hr/>					
4	Module power supply relay and associated wiring	10	1	R	OFF
<hr/>					
5	Fuel pump relay and associated wiring	28	20	R	OFF

**CORRECT
RESULT**

ACTION FOR INCORRECT RESULT

0 to 2,5

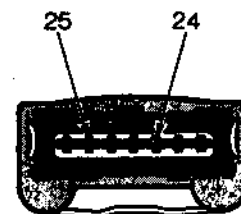
Check and clean module ground.
Locate and rectify wiring fault

0 to 2,5

Check and clean module ground.
Locate and rectify wiring fault

More than
700

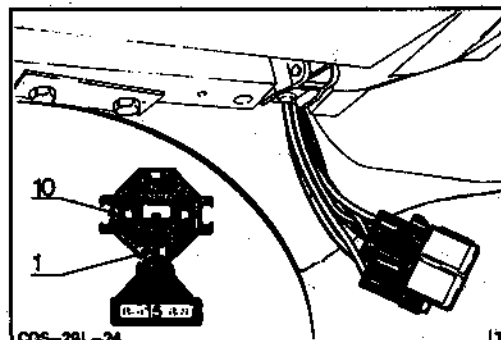
Remove multiplug and check wiring
for short/open circuit. Fit new
amplifier module if no fault found.



COS-29L-23

60 to 120

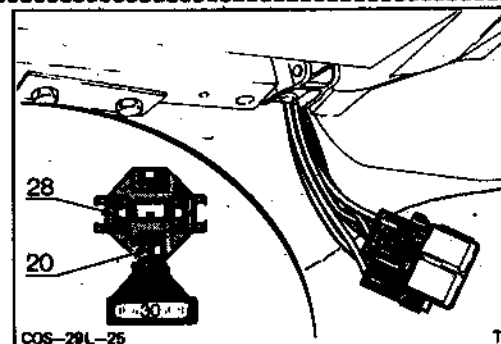
Remove relay and check, fit new relay if
necessary. Check continuity of wiring,
repair as necessary.



COS-29L-24

60 to 120

Remove relay and check, fit new relay if
necessary. Check continuity of wiring,
repair as necessary.



COS-29L-25



RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
6	Throttle position sensor and wiring (Measures complete sensor track resistance)	11	30	R	OFF
7	Throttle position sensor and wiring (Measures resistance at rest position)	30	17	R	OFF
		30	17 Slowly open throttle whilst observing meter	R	OFF
8	Engine coolant temperature sensor and wiring	11	29	R	OFF
9	Air charge temperature sensor and wiring	11	31	R	OFF
10	Distributor phase sensor and wiring	23	5	R	OFF

**CORRECT
RESULT**

ACTION FOR INCORRECT RESULT

300 to 600

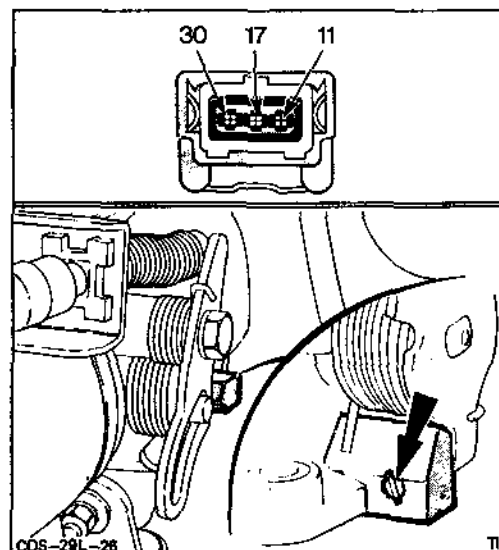
Remove multiplug from throttle position sensor. Check wiring from sensor multiplug to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.

Open Circuit

Check throttle stop screw, if screw has been adjusted renew throttle housing. If screw has not been adjust, slacken sensor screws and adjust until no resistance is measured. If resistance still measured fit new throttle position sensor.

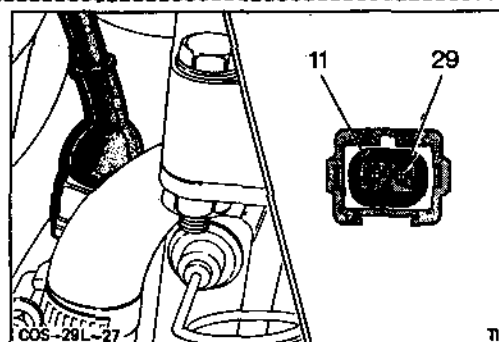
300 to 600

If no resistance is measure, remove multiplug from sensor. Check wiring from sensor multiplug to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.



0,3k to 5k *

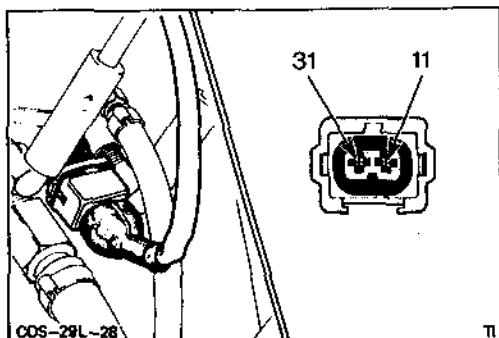
Remove multiplug from sensor and check wiring from sensor to breakout box, repair as necessary. Fit new sensor if necessary.



* Refer to Technical Data, page 60, for full resistance range.

0,3k to 5k**

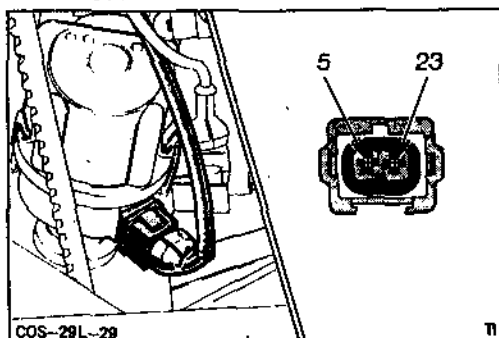
Remove multiplug from sensor and check wiring from sensor to breakout box, repair as necessary. Fit new sensor if necessary.



** Refer to Technical Data, page 60, for full resistance range.

700 to 1,2k

Disconnect phase sensor multiplug and check wiring from sensor to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.





RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
11	Engine speed/TDC sensor and wiring	4	3	R	OFF

12	MAP sensor and associated wiring (Input circuit)	30	11	R	OFF
----	---	----	----	---	-----

13	MAP sensor and associated wiring (Output circuit)	30	15	R	OFF
----	--	----	----	---	-----

14	MAP sensor wiring (Ground screening for sensor wiring)	11	BATT -	R	OFF
----	---	----	--------	---	-----

		30	BATT -	R	OFF
--	--	----	--------	---	-----

		15	BATT -	R	OFF
--	--	----	--------	---	-----

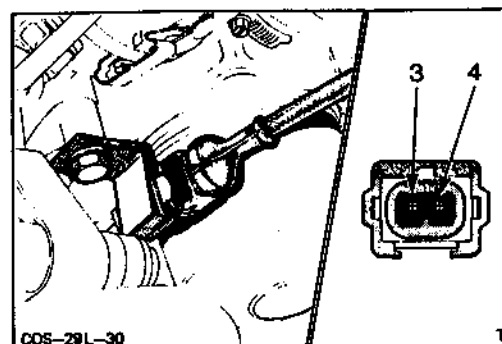
15	Turbo charger boost control valve and wiring	16	1	R	OFF
----	---	----	---	---	-----

**CORRECT
RESULT**

ACTION FOR INCORRECT RESULT

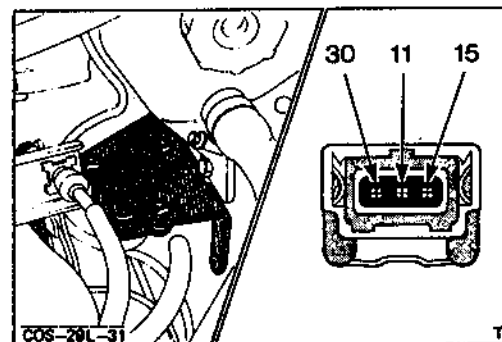
600 to 1k

Remove multiplug from speed/TDC sensor and check wiring from multiplug to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.



50 to 600

Remove multiplug from MAP sensor and check wiring from multiplug to breakout box, repair as necessary. Fit new sensor in no fault found in wiring.



500 to 6k

Remove multiplug from MAP sensor and check wiring from multiplug to breakout box, repair as necessary. Fit new sensor in no fault found in wiring.

Open Circuit

Locate and repair wiring fault

Open Circuit

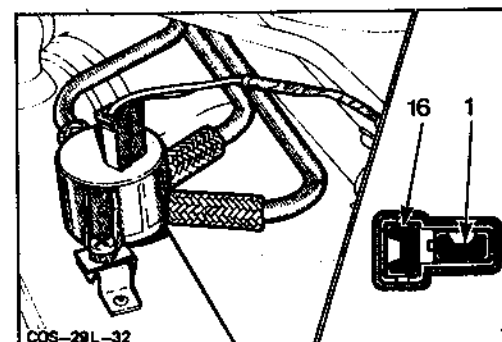
Locate and repair wiring fault

Open Circuit

Locate and repair wiring fault

20 to 50

Remove multiplug from control valve and check wiring from multiplug to breakout box, repair as necessary. Fit new valve if no fault found in wiring.





RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
16	No.1 injector and wiring	35	20	R	OFF
17	No.2 injector and wiring	32	20	R	OFF
18	No.3 injector and wiring	33	20	R	OFF
19	No.4 injector and wiring	18	20	R	OFF

DISCONNECT IGNITION COIL LT WIRES FROM COIL, CARRY OUT THE FOLLOWING CHECK AT LT TERMINALS.

20	Ignition amplifier module and wiring (Coil switching circuit)	Coil wiring + (15)	Coil wiring - (1)	R	OFF
----	---	--------------------	-------------------	---	-----

RECONNECT IGNITION COIL LT WIRING.

DISCONNECT IGNITION AMPLIFIER MODULE AND CARRY OUT THE FOLLOWING CHECK AT MULTIPLUG.

21	Ignition amplifier module to ground connection	Multiplug pin A, refer to illustration	BATT -	R	OFF
----	--	--	--------	---	-----

RECONNECT IGNITION AMPLIFIER MODULE MULTIPLUG.

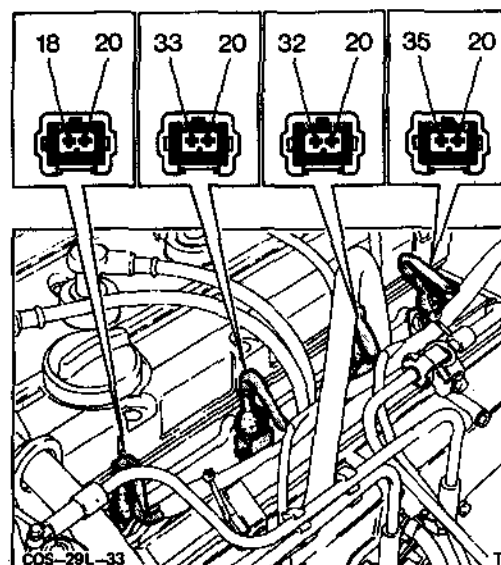
DISCONNECT IDLE SPEED CONTROL VALVE AND CARRY OUT THE FOLLOWING CHECK AT THE VALVE.

22	Idle speed control valve	Measure resistance across idle speed control valve	R	OFF
----	--------------------------	--	---	-----

**CORRECT
RESULT**

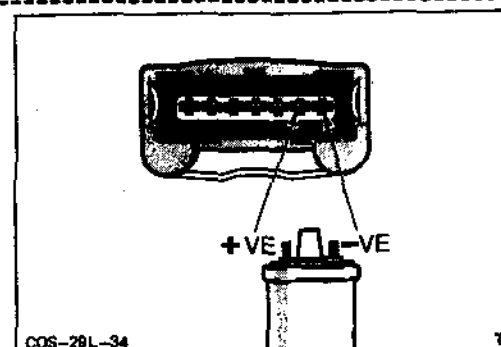
ACTION FOR INCORRECT RESULT

- | | |
|--------|--|
| 2 to 4 | Remove multiplug from No.1 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary. |
| 2 to 4 | Remove multiplug from No.2 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary. |
| 2 to 4 | Remove multiplug from No.3 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary. |
| 2 to 4 | Remove multiplug from No.4 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary. |



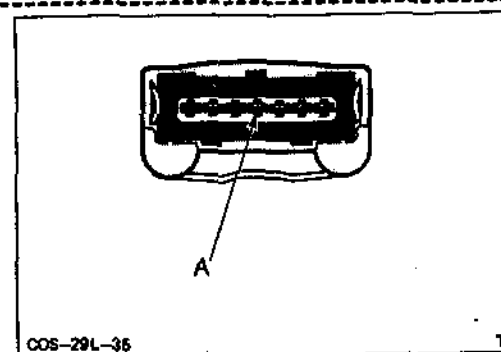
4,5k
(approx)

Remove multiplug from ignition amplifier module and check wiring between multiplug and breakout box, repair as necessary. Fit new amplifier module if no fault found.



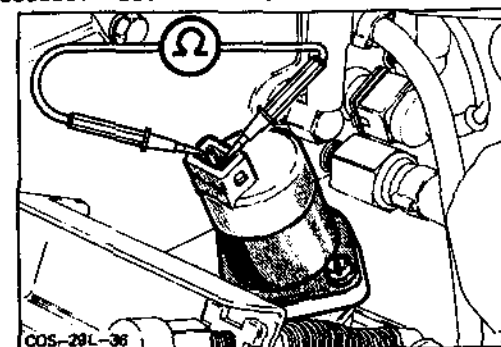
0 to 0,5

Locate and rectify wiring fault.



6 to 9

Fit new idle speed control valve.

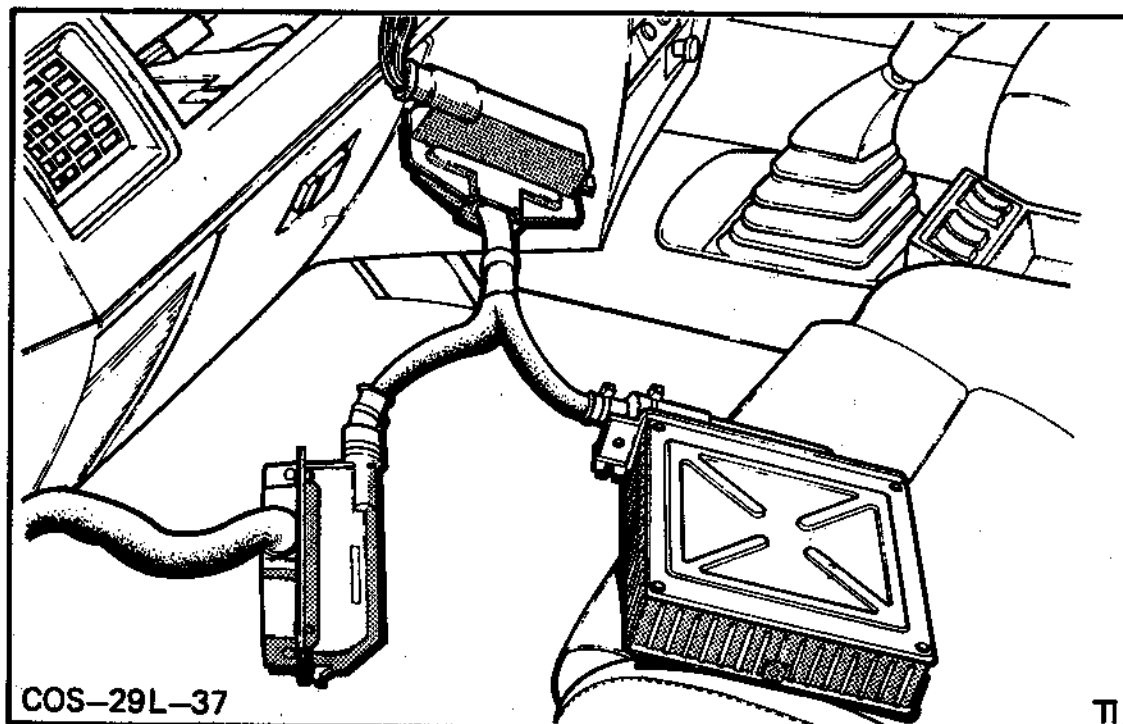




ACTIVE BREAKOUT BOX CHECKS

The preceding breakout box checks must be performed and any faults rectified before commencing the active checks. Care must be taken when connecting the multimeter to the breakout box, to avoid shorting the module.

Disconnect the test lead from the module and connect the 'Y' cable (Special Service Tool-29-005) to the module, vehicle wiring loom and breakout box lead. With the 'Y' cable connected, the engine can be started and will run as normal.



Connection of the Y-cable (Special Tool No. 29-005) and the test lead (Special Tool No. 33-002) to the engine management module.

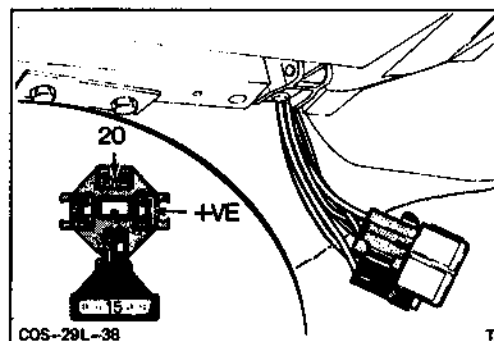


RS COSWORTH

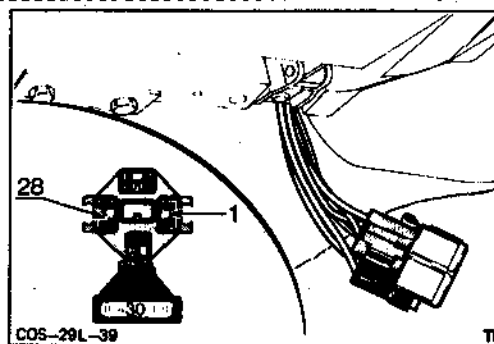
TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
23	Module power supply and relay operation	20	1	V	OFF
		20	1	V	ON
24	Power supply to fuel pump relay	28	1	V	ON
25	Throttle position sensor operating voltage	17	11	V	ON
26	Engine coolant temperature sensor operating voltage	29	1	V	ON
27	Air charge temperature sensor operating voltage	31	1	V	ON
28	Turbocharger boost control valve operating voltage	Disconnect solenoid connection and measure voltage across connector		V	ON (Start engine and idle)
29	MAP sensor supply voltage	30	11	V	ON
		30	11	V	ON (Start engine and idle)

CORRECT RESULT	ACTION FOR INCORRECT RESULT
Open Circuit	Fit new relay

10,5 to 14,5	Check fuse (15 A), fit new fuse if necessary. Check wiring from battery positive terminal to relay and repair as necessary. Fit new relay if required.
--------------	--



10,5 to 14,5	Locate and rectify wiring fault.
--------------	----------------------------------



4,5 to 5,5	Fit new engine management module.
------------	-----------------------------------

0,3 to 3,0	Fit new engine management module.
------------	-----------------------------------

0,3 to 3,0	Fit new engine management module.
------------	-----------------------------------

10,0 to 14,5	Fit new engine management module.
--------------	-----------------------------------

4,0 to 5,5	Fit new engine management module.
------------	-----------------------------------

Remove vacuum hose from air intake, engine should stop	Fit new engine management module.
--	-----------------------------------



RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
30	MAP sensor output voltage	15	11	V	ON

THE FOLLOWING ARE CURRENT DRAW CHECKS USING ADAPTER
CABLE 23-022. CONNECT CABLE INTO VEHICLE WIRING AS
SHOWN IN THE RELEVANT ILLUSTRATION.

Terminal Colour

31	Idle speed control valve	Yellow	Red	A	Start engine and allow to idle
----	--------------------------	--------	-----	---	--------------------------------------

32	Injectors to voltage reference supply	Yellow	Red	A	Start engine and allow to idle
----	--	--------	-----	---	--------------------------------------

Repeat test on all 4 injectors.

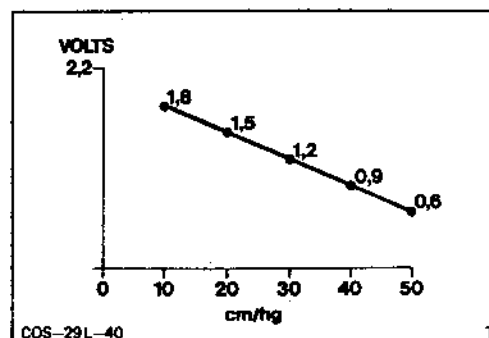
Reconnect engine management module direct to vehicle loom and road test vehicle.
If fault still evident, fit new engine management module.

**CORRECT
RESULT**

ACTION FOR INCORRECT RESULT

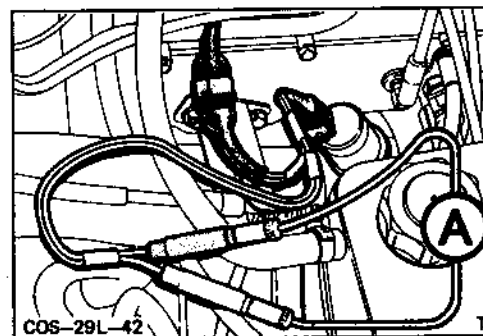
Apply vacuum to MAP sensor and take voltage reading. Refer to illustration for correct voltage to specific vacuum reading

Fit new MAP sensor



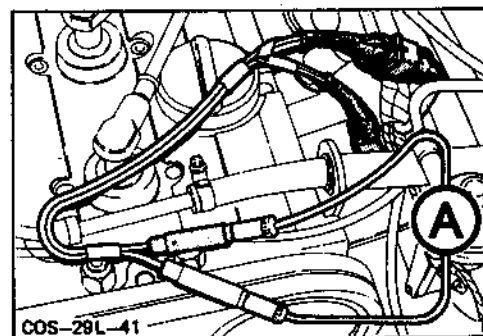
300mA to 600mA

Apply 12 volts direct to idle speed control valve terminals. If valve does not 'click', fit new idle speed control valve. If valve does 'click', fit new engine management module.



Reading is unstable. A reading of 17 to 23mA should be indicated for a short period

Fit new engine management module.



23 601 0 BOOST PRESSURE - ADJUST

SPECIAL TOOLS REQUIRED:

Pressure Gauge and Hose 23-021
Cooling System Pressure Tester

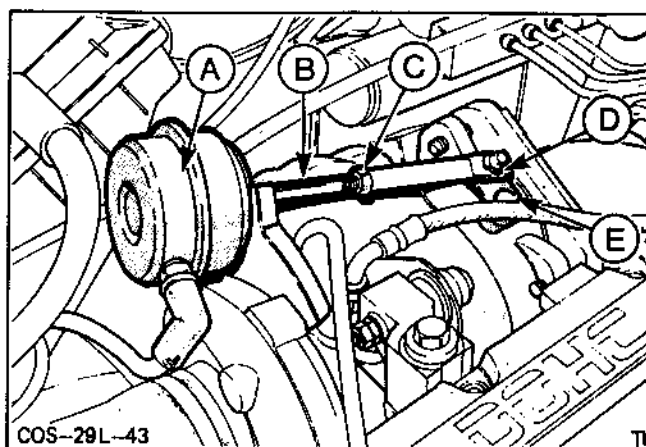
NOTE: After fitment or replacement parts to the Turbocharger, the boost pressure will require resetting.

This operation is divided into two sections:
initial 'static' adjustment and final adjustment
during/after road test.

IMPORTANT NOTE: Roller testing is not recommended as the temperatures generated by the engine and brakes and the inadequate cooling available on a roller test.

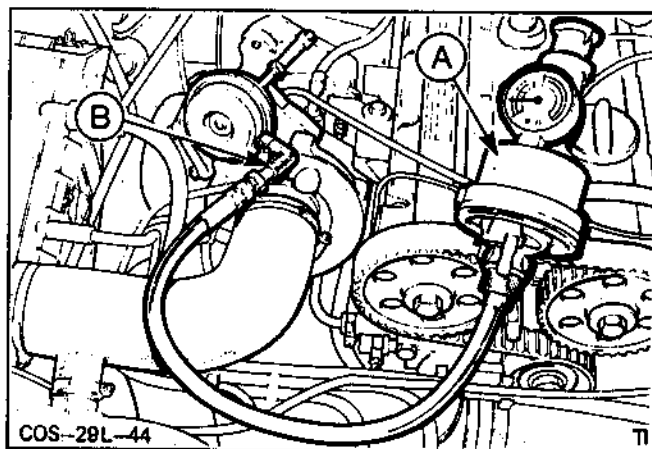
Initial Static Adjustment

1. With the actuator rod disconnected from the waste gate operating lever, connect the cooling system pressure tester to the waste gate actuator and apply a pressure of 0,45 bar (max. 0,48 bar).
2. Move the operating lever to fully close the waste gate valve.
3. With the 0,45 bar (max. 0,48 bar) pressure still applied to the actuator, adjust the rod length so that it just slips onto the waste gate lever.
4. Fit a new circlip to retain the rod and tighten the locknut ensuring that the rod eye is not twisted and allows the waste gate to move freely when the pressure is released.

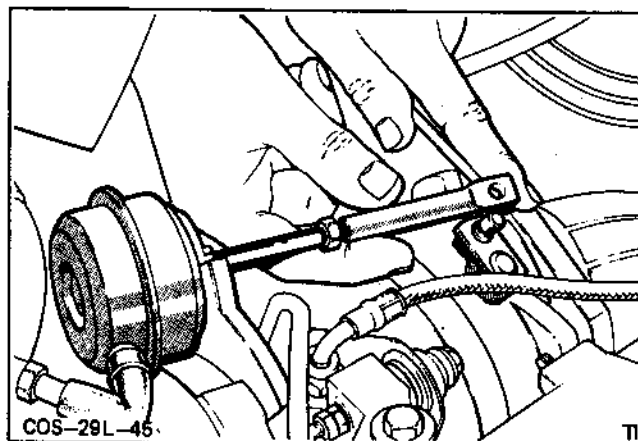


Actuator rod and waste gate.

A - Waste gate actuator D - Circlip
B - Actuator rod E - Operating lever
C - Locknut



A - Cooling system pressure tester
B - Waste gate actuator hose



Adjust the rod length so that it just slips onto the waste gate lever.

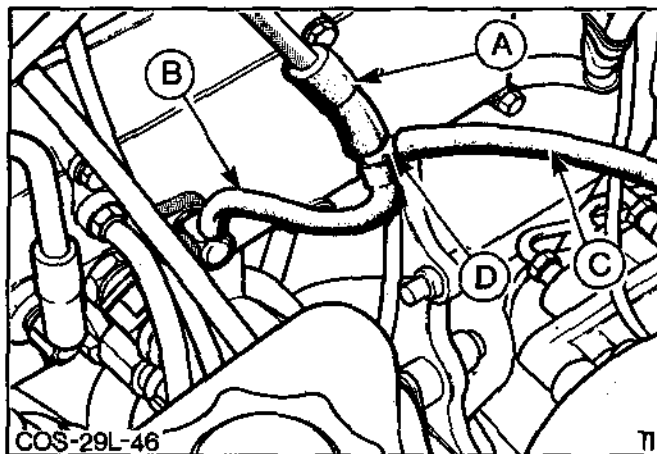
Boost Testing

NOTE: When performing this operation, the duration of the actual boost test itself should be no more than 3 - 5 seconds.

The boost pressure is measured via a gauge and connecting pipe work as detailed below:

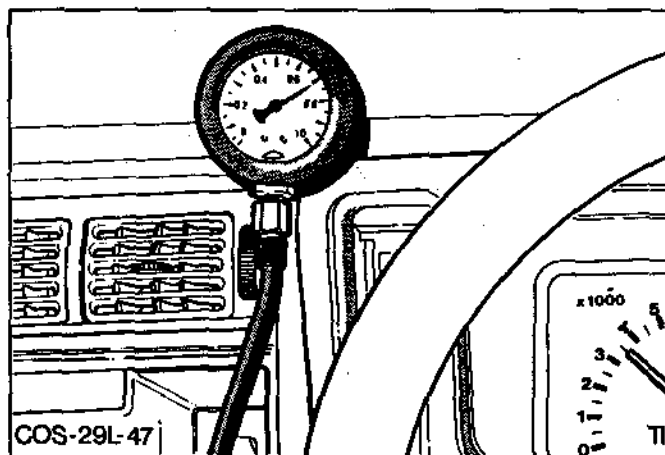
6. Pull off the hose of the turbocharger boost pressure gauge. Connect the pressure gauge, using a 2,0 metre length of 6 mm diameter neoprene tubing.

NOTE: It is essential for correct readings that the pressure gauge is securely fixed to the driver's side vent nozzle in an upright position.



'T' piece and hose installation.
A - Hose to bypass valve C - Hose to gauge
B - Hose to air chamber D - 'T' piece

6. Drive the vehicle until normal operating temperature is reached.



Gauge installation hose routing (LHD shown),
RHD symmetrically opposite.

7. With a clear, straight road ahead and behind (preferably without junctions). Select 4th gear and drive along at an engine speed of approximately 1500 rpm.
8. Fully depress the throttle pedal.
9. Keeping the throttle pedal fully depressed, fully apply the brakes when the engine reaches 3500 rpm - DO NOT EXCEED THE TEST DURATION (MAX 5 SECS).
With both throttle and brake fully depressed read the boost pressure from the gauge.

Specification: 0,7 bar (max. 0,9)

NOTE: After taking reading, drive the car for at least 1 mile to allow the brakes to cool.

10. If the reading obtained is within specification, apply a small amount of paint to the actuator rod threads and locknut to lock into position.
11. If the reading obtained was outside the specification, the actuator rod should be adjusted as follows:
12. Loosen locknut nut at rod eye, remove the circlip and detach the rod from the waste gate operating lever.

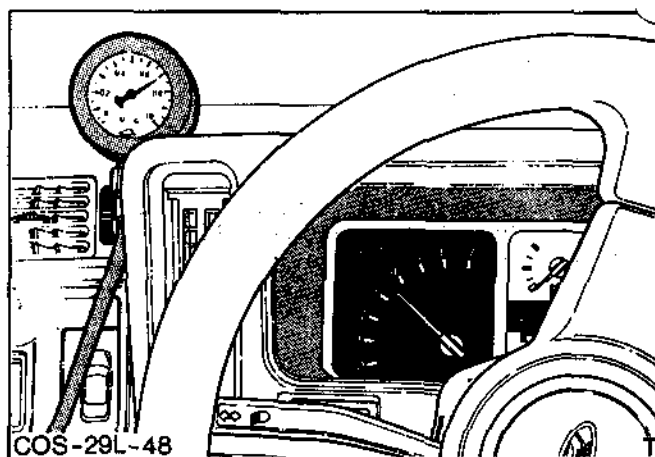
- Boost Pressure Low

Shorten rod one half turn for every 0,02 bar of pressure below that specified.

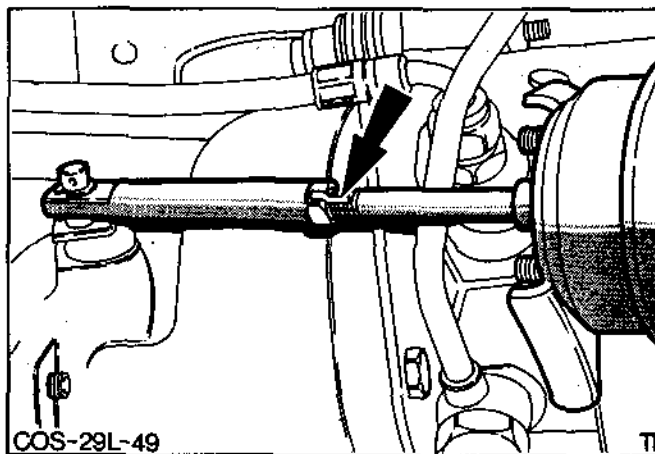
- Boost Pressure High

Lengthen rod one half turn for every 0,02 bar of pressure above that specified.

13. After adjustment, refit rod and circlip and tighten locknut ensuring the rod eye does not bind on the waste gate lever.
14. Repeat test.
15. If boost pressure is now within specification, apply paint to the actuator rod threads and locknut to lock in position.
16. Remove the test equipment and reconnect turbo-charger boost pressure gauge hose to the 'T' piece.



Readings with full load induced.



Paint mark over threads and locknut of waste gate actuator rod.

**Coil**

Manufacturer	Bosch
Type	High output breakerless ignition coil
Output	25,0 kilovolt (minimum) - open circuit condition
Primary resistance	0,7 to 0,9 ohms
Secondary resistance	4500 to 7000 ohms

Spark Plugs**Production and Service**

Type - 2.0 litre HC (EFI)	AGPR 901C
Electrode gap - all territories	0,75 mm (0,030 in)
Firing order	1-3-4-2

Distributor

Manufacturer	Marelli
Type	Breakerless
Drive	Skew gear from idle shaft
Rotation (viewed from top)	Clockwise
Dwell angle	It is totally governed by the module and cannot be adjusted
Static advance (initial)	16° BTDC at idle speed 850 rpm (not adjustable)
Sensor to cam clearance	0,2 to 0,3 mm
Heat sink compound	81SF-12103-AA

Idle Speed

Idle speed	850 rpm
Idle CO%	1,0% to 2,0%

HT Leads

Resistance	15,000 ohms maximum per lead
------------	----	----	----	----	----	----	------------------------------

Engine Speed/TDC Sensor

Clearance to crankshaft pulley	0,6 to 1,0 mm
--------------------------------	----	----	----	----	----	----	---------------



Module

Manufacturer Weber/Marelli

Fuel System

Injectors

Manufacturer Weber

Type Electronically operated

Grease for seals ESEM 1C171A

Fuel Pump

Manufacturer Bosch

Type Roller cell

Output pressure In excess of 10 bars (do not measure)

Pressure Regulator

Manufacturer Weber

System pressure 3,2 - 3,8 bar (when ignition is switched on)

System pressure 2,7 - 3,3 bar (at idle speed)

Turbocharger

Nominal boost pressure 0,7 bar (max. 0,9 bar) - module controlled

Sensor Resistance

Air Charge Temperature Sensor and
Engine Coolant Temperature Sensor

Temp °C	Resistance k ohms
0	9,75
10	6,00
20	3,75
30	2,42
40	1,60
50	1,08
60	0,75
70	0,53
80	0,38
90	0,27