

# ELECTRICAL

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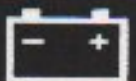
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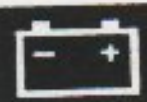
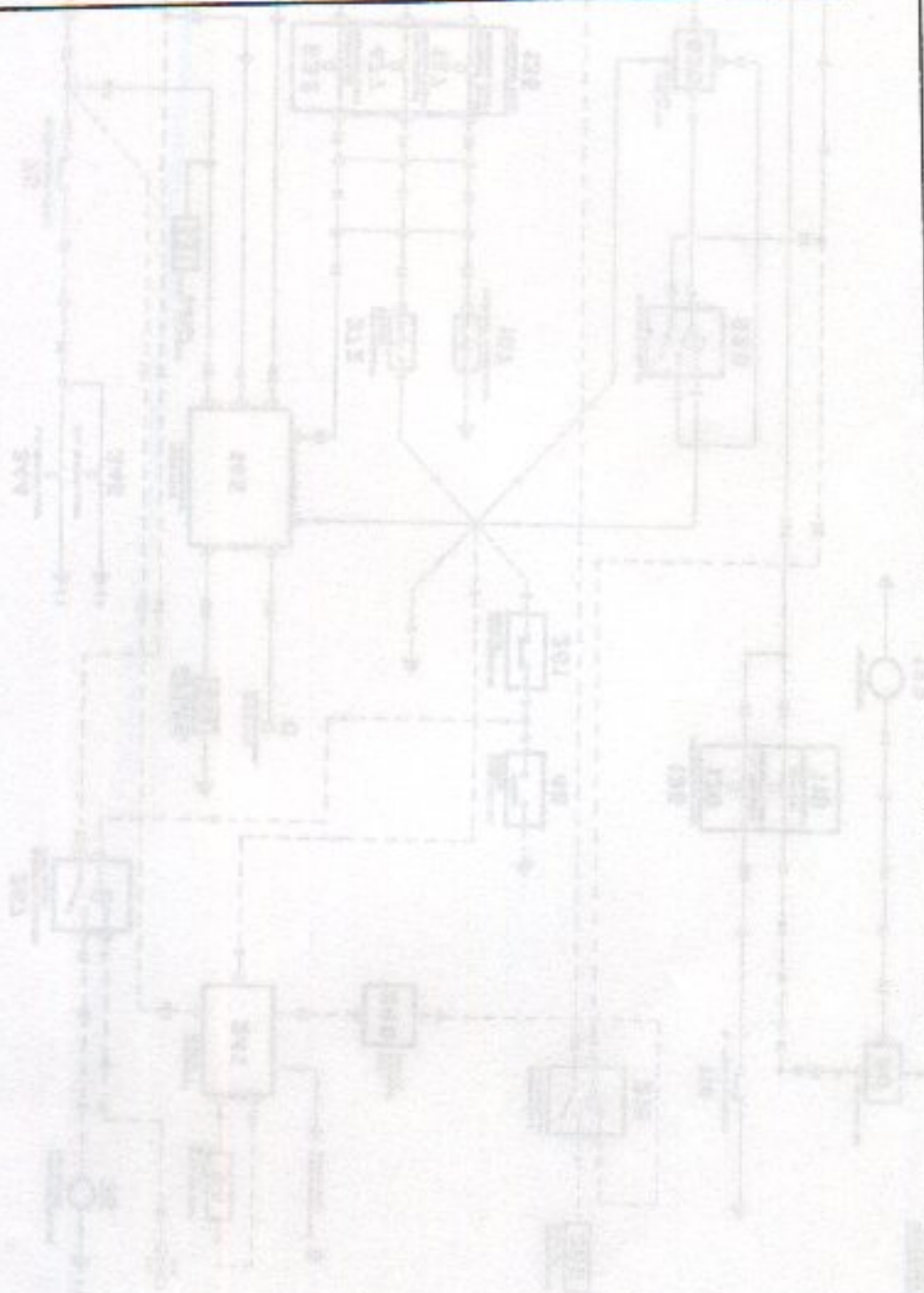


# WIRING DIAGRAMS - UP TO 1991 MODELS

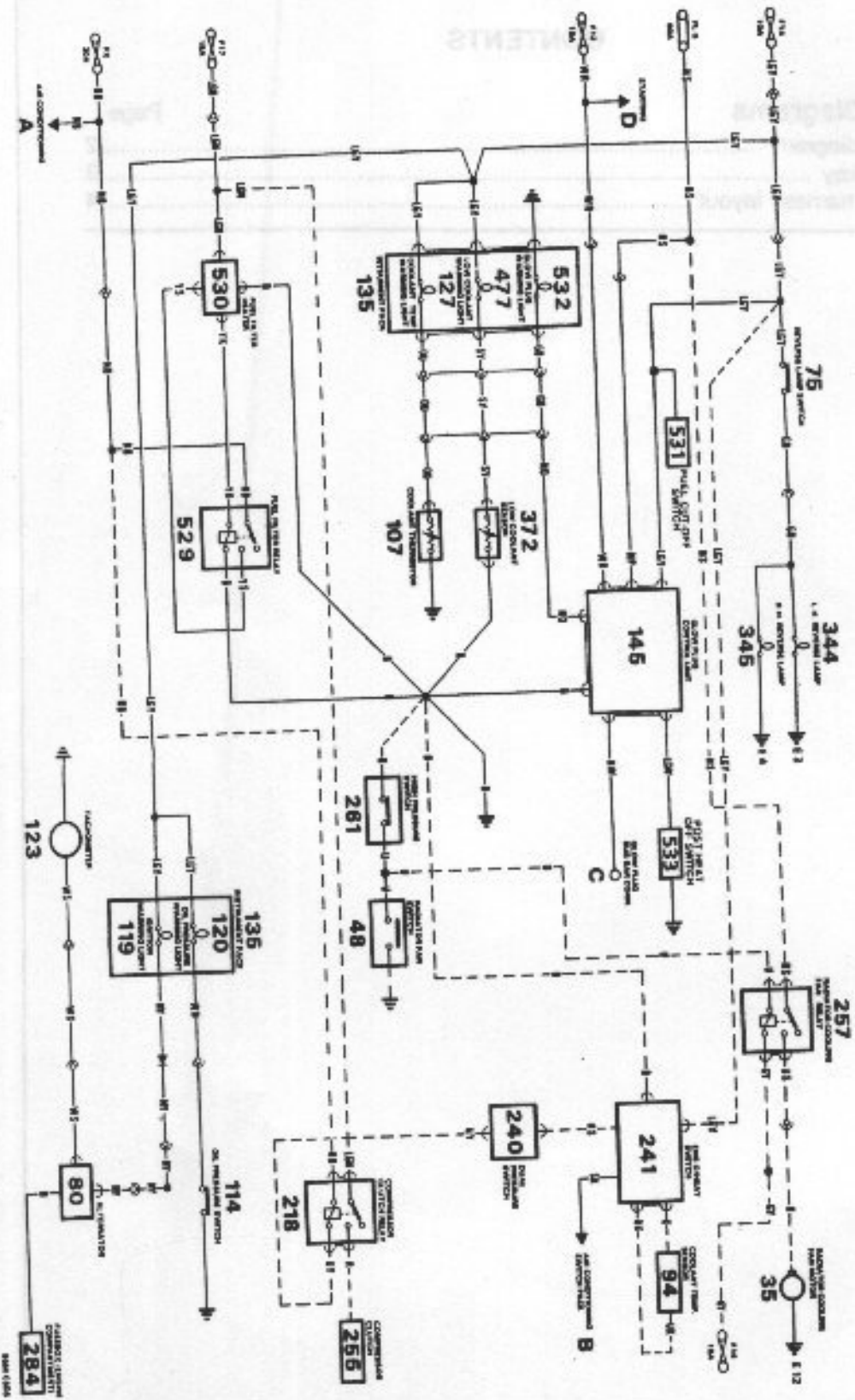
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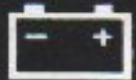
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2.500M 1987



# WIRING DIAGRAMS - UP TO 1991 MODELS





## CIRCUIT KEY

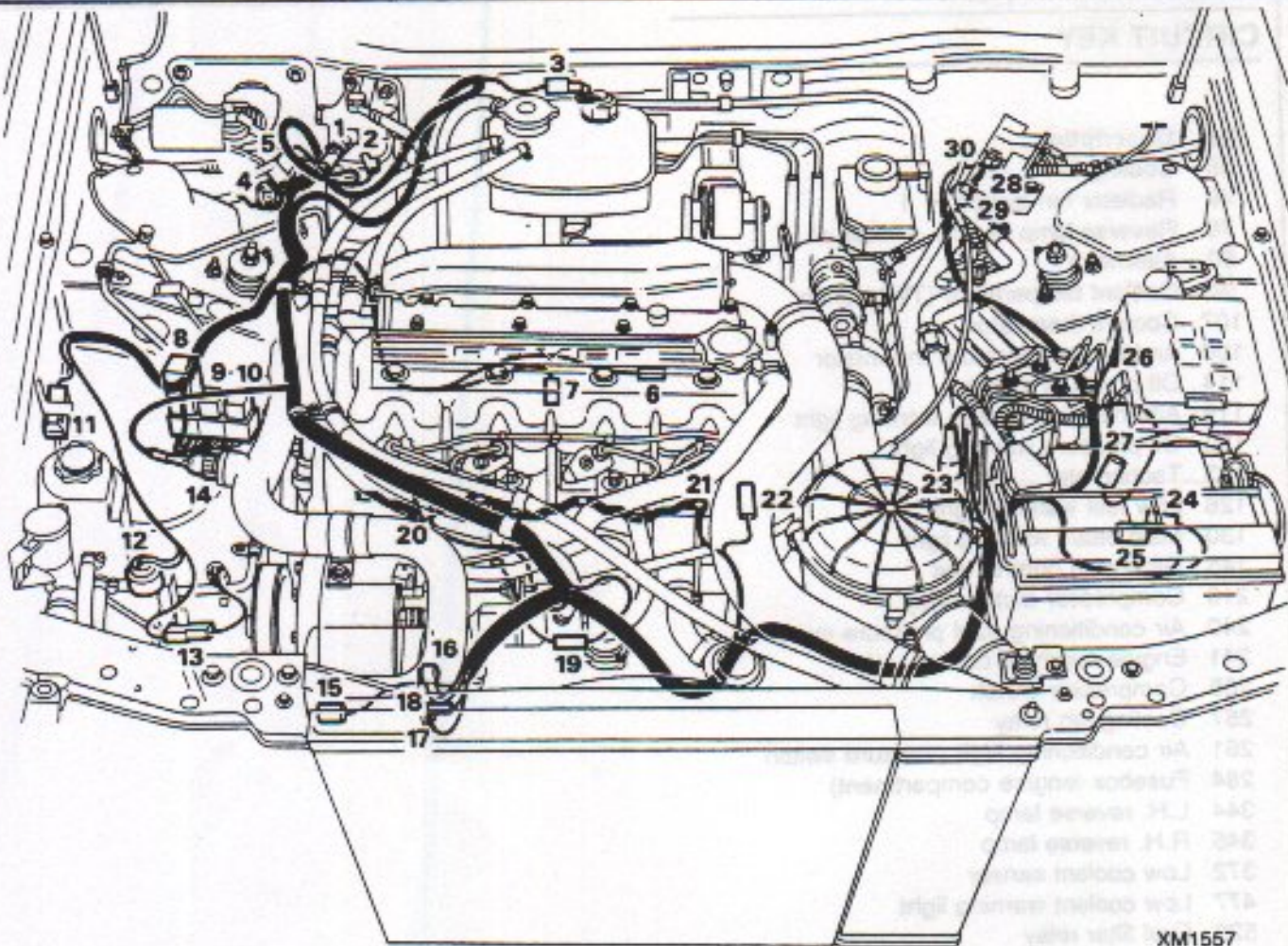
- | No. | Description                           |
|-----|---------------------------------------|
| 35  | Cooling fan                           |
| 48  | Radiator fan switch - 1               |
| 75  | Reverse lamp switch - manual          |
| 80  | Alternator                            |
| 94  | Coolant temperature (TW) sensor       |
| 107 | Coolant thermistor                    |
| 108 | Ambient temperature thermistor        |
| 114 | Oil pressure switch                   |
| 119 | Alternator/no charge warning light    |
| 120 | Oil pressure warning light            |
| 123 | Tachometer                            |
| 126 | Low fuel warning light                |
| 130 | Main beam warning light               |
| 145 | Glow plug control unit                |
| 218 | Compressor clutch relay               |
| 240 | Air conditioning dual pressure switch |
| 241 | Engine overheat control unit          |
| 255 | Compressor clutch                     |
| 257 | Cooling fan relay                     |
| 261 | Air conditioning high pressure switch |
| 284 | Fusebox (engine compartment)          |
| 344 | L.H. reverse lamp                     |
| 345 | R.H. reverse lamp                     |
| 372 | Low coolant sensor                    |
| 477 | Low coolant warning light             |
| 529 | Fuel filter relay                     |
| 530 | Fuel filter heater                    |
| 531 | Fuel cut - off switch                 |
| 532 | Glow plug warning light               |
| 533 | Post heat off switch                  |

### Letter Circuit

- |   |                              |
|---|------------------------------|
| A | Air conditioning             |
| B | Air conditioning switch pack |
| C | Glow plug bus bar connection |
| D | Starting                     |

### ENGINE HARNESS LAYOUT

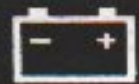
- |    |                                       |
|----|---------------------------------------|
| 1  | Fuel filter 1                         |
| 2  | Fuel filter 2                         |
| 3  | Low coolant sensor                    |
| 4  | Main harness connector 1              |
| 5  | Main harness connector 2              |
| 6  | Starter motor solenoid                |
| 7  | Oil pressure switch                   |
| 8  | Engine over heat control unit         |
| 9  | Compressor clutch relay               |
| 10 | Fuel filter relay                     |
| 11 | Radiator fan switch                   |
| 12 | Air conditioning dual pressure switch |
| 13 | Air conditioning high pressure switch |
| 14 | Coolant temperature sensor            |
| 15 | Compressor clutch                     |
| 16 | Alternator                            |
| 17 | Alternator no charge warning light    |
| 18 | Tachometer                            |
| 19 | Fuel cut - off switch                 |
| 20 | Post heat off switch                  |
| 21 | Glow plug                             |
| 22 | Coolant temperature sensor            |
| 23 | Reverse lamp switch                   |
| 24 | Engine harness                        |
| 25 | Main harness connector 3              |



XM1557

## ENGINE HARNESS LAYOUT

- |   |                            |
|---|----------------------------|
| 1. Fuel filter 1                          | 26. Relay box              |
| 2. Fuel filter 2                          | 27. Bus bar connection     |
| 3. Low coolant switch                     | 28. Battery connections    |
| 4. Main harness connector 1               | 29. Glow plug control unit |
| 5. Main harness connector 2               |                            |
| 6. Starter motor solenoid                 |                            |
| 7. Oil pressure switch                    |                            |
| 8. Engine over heat control unit          |                            |
| 9. Compressor clutch relay                |                            |
| 10. Fuel filter relay                     |                            |
| 11. Radiator fan switch                   |                            |
| 12. Air conditioning dual pressure switch |                            |
| 13. Air conditioning high pressure switch |                            |
| 14. Coolant temperature sensor            |                            |
| 15. Compressor clutch                     |                            |
| 16. Alternator                            |                            |
| 17. Alternator/no charge warning light    |                            |
| 18. Tachometer                            |                            |
| 19. Fuel cut - off solenoid               |                            |
| 20. Postheat off switch                   |                            |
| 21. Glow plugs                            |                            |
| 22. Coolant temperature switch            |                            |
| 23. Reverse lamp switch                   |                            |
| 24. Engine harness                        |                            |
| 25. Main harness connector 3              |                            |



## STARTER MOTOR

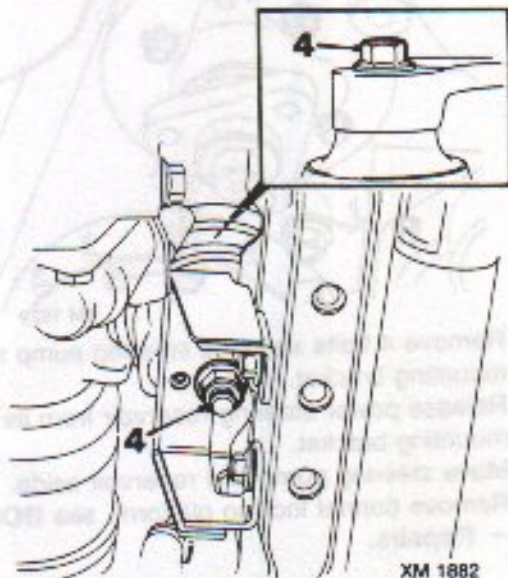
Service Repair No. 86.60.01

### Remove

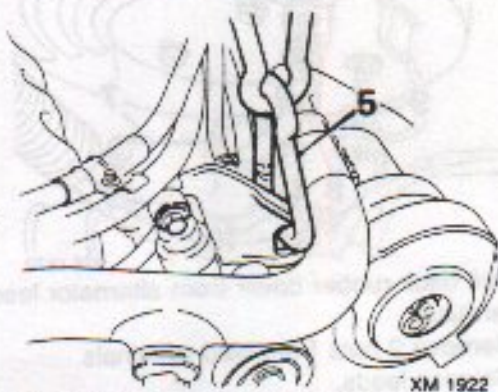
1. Raise front of vehicle.

**WARNING: Support on safety stands.**

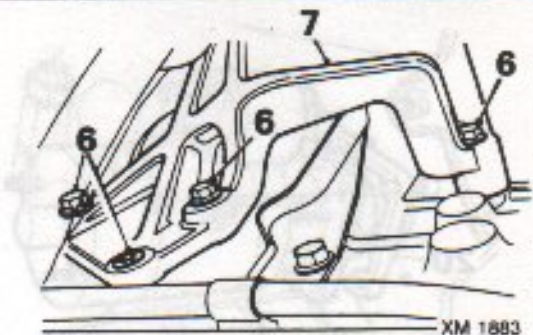
2. Remove R.H. drive shaft, see **DRIVE SHAFTS - Repairs.**
3. Remove exhaust down pipe, see **MANIFOLD AND EXHAUST - Repairs.**



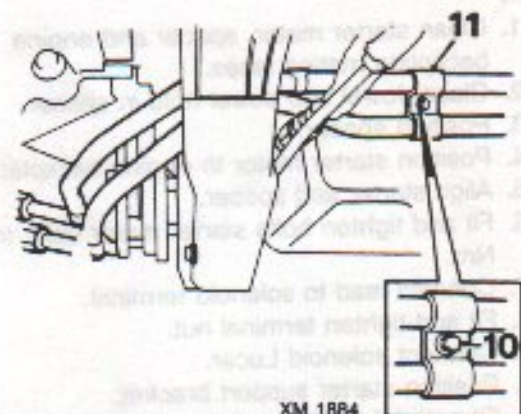
4. Remove 2 nuts securing rear engine mounting to mounting brackets on crossmember and engine.



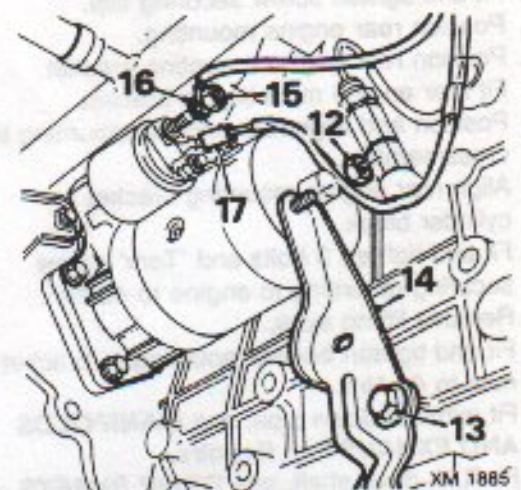
5. Fit two lifting eyes to P.A.S. pump bracket and support weight of engine.



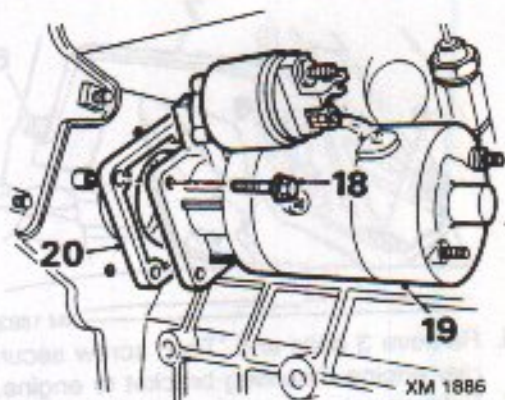
6. Remove 3 bolts and 'Torx' screw securing rear engine mounting bracket to engine.
7. Release mounting and bracket assembly.
8. Remove mounting from bracket.
9. Remove mounting bracket.



10. Remove screw securing oil cooler pipe clip to starter motor support bracket.
11. Remove clip.



12. Remove nut securing starter motor support bracket to starter motor.
13. Remove bolt securing support bracket to cylinder block.
14. Remove bracket.
15. Remove starter solenoid terminal nut.
16. Release lead.
17. Disconnect starter solenoid Lucar.



18. Remove 3 bolts securing starter motor to engine backplate.
19. Remove starter motor.
20. Remove spacer.

## Refit

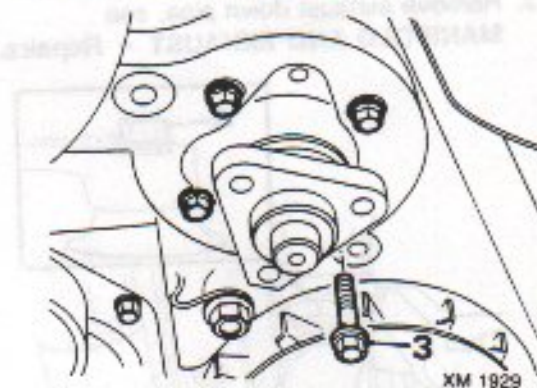
1. Clean starter motor, spacer and engine backplate mating faces.
2. Clean dowel and dowel hole in spacer.
3. Position spacer.
4. Position starter motor to engine backplate.
5. Align starter and spacer.
6. Fit and tighten bolts starter motor bolts to 68 Nm.
7. Connect lead to solenoid terminal.
8. Fit and tighten terminal nut.
9. Connect solenoid Lucar.
10. Position starter support bracket.
11. Fit and tighten bolt, starter support bracket.
12. Fit and tighten nut securing support bracket to starter.
13. Position oil cooler pipe clip.
14. Fit and tighten screw securing clip.
15. Position rear engine mounting.
16. Position rear engine mounting bracket.
17. Fit rear engine mounting to bracket.
18. Position and align rear engine, mounting to crossmember.
19. Align rear engine mounting bracket to cylinder block.
20. Fit and tighten 3 bolts and 'Torx' screw securing mounting to engine to 45 Nm.
21. Remove lifting eyes.
22. Fit and tighten engine mounting to bracket nuts to 85 Nm.
23. Fit exhaust down pipe, see **MANIFOLDS AND EXHAUST - Repairs.**
24. Fit R.H. drive shaft, see **DRIVE SHAFTS - Repairs.**
25. Remove stand(s) and lower vehicle.
26. Check and top up gearbox oil, see **GEARBOX - Adjustments.**

## ALTERNATOR

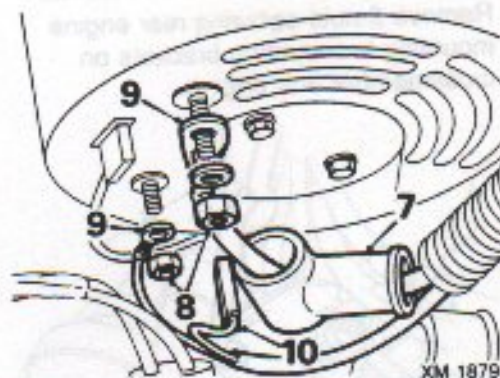
Service Repair No. 86.10.02

### Remove

1. Remove radiator grille, see **REPAIR MANUAL - BODY - Repairs.**
2. Remove power steering pump, see **STEERING - Repairs**



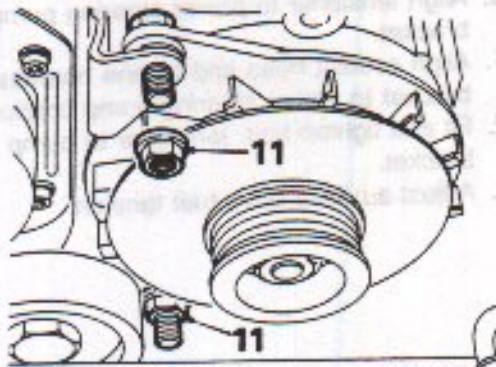
3. Remove 4 bolts securing steering pump to mounting bracket.
4. Release power steering reservoir from its mounting bracket.
5. Move steering pump and reservoir aside.
6. Remove bonnet locking platform, see **BODY - Repairs.**



7. Pull back rubber cover from alternator lead terminal.
8. Remove 2 nuts from lead terminals.
9. Release leads.
10. Release Lucar from alternator.

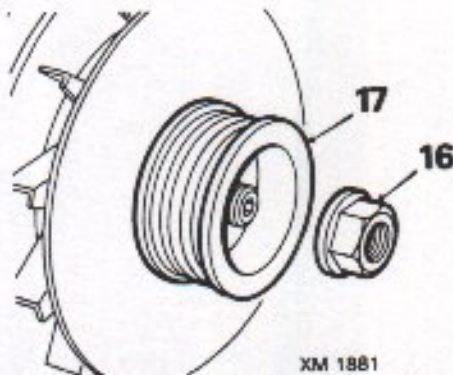


## AUXILIARY DRIVE BELT



XM 1880

11. Remove 2 alternator upper and lower mounting nuts and bolts.
12. Release alternator from its lower mounting.
13. Pull radiator forward for access.
14. Manoeuvre alternator from engine compartment.
15. Remove alternator.



XM 1881

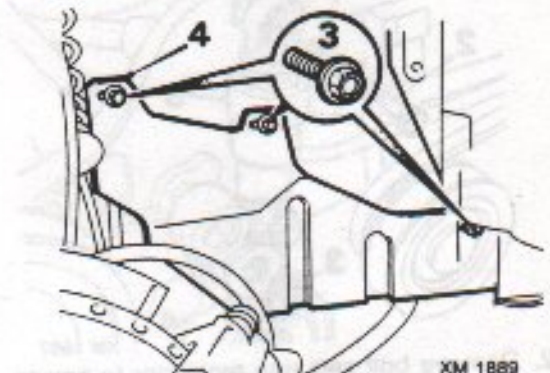
16. Remove nut from alternator pulley.
17. Remove pulley from alternator.
18. Fit pulley to new alternator.
19. Fit and tighten pulley nut to 47 Nm.

## Refit

1. Position alternator to engine. Pull radiator forward to allow better access.
2. Position alternator to lower mounting.
3. Fit and tighten 2 upper and lower mounting bolts to 25 Nm.
4. Position leads to terminals.
5. Fit and tighten 2 terminal nuts.
6. Secure rubber cover to terminal.
7. Connect Lucar to alternator.
8. Refit bonnet locking platform, see **BODY - Repairs**.
9. Reposition steering pump and reservoir.
10. Secure reservoir to its mounting bracket.
11. Align steering pump to mounting bracket.
12. Fit and tighten 4 bolts, steering pump to mounting bracket to 8 Nm.
13. Refit radiator grille, see **REPAIR MANUAL - BODY - Repairs**.

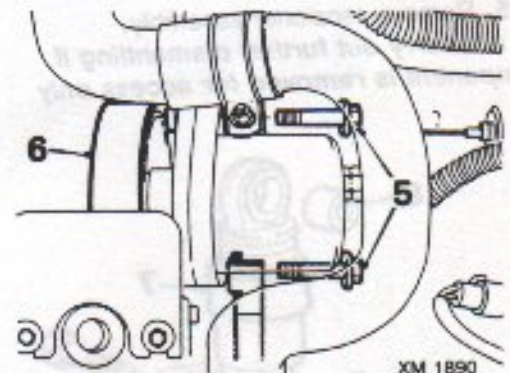
## Remove

1. Release auxiliary drive belt tension.
2. Turn steering onto R.H. lock.



XM 1889

3. Remove 3 screws securing R.H. splash shield.
4. Remove splash shield.



XM 1890

5. Remove 2 bolts securing power steering pump to pulley cover.
6. Remove pulley cover.
7. Release auxiliary drive belt from pulleys.
8. Release auxiliary drive belt from between crankshaft pulley and longitudinal member.
9. Remove auxiliary drive belt.

## Refit

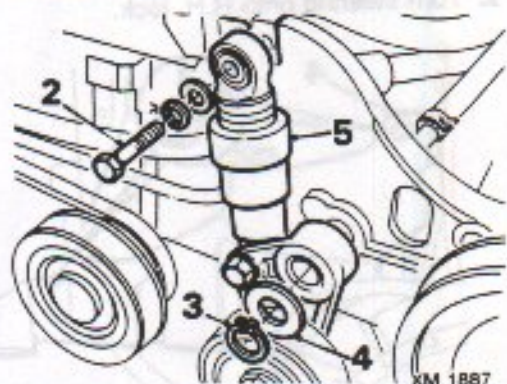
1. Wipe clean drive belt and pulleys.
2. Fit belt between crankshaft pulley and longitudinal member.
3. Position belt to pulleys.
4. Adjust auxiliary drive belt tension.
5. Position power steering pump belt cover.
6. Align hose retaining clips.
7. Fit and tighten steering pump belt cover bolts to 15 Nm.
8. Position splash shield.
9. Fit and tighten 3 splash shield screws.



## AUXILIARY DRIVE BELT TENSIONER

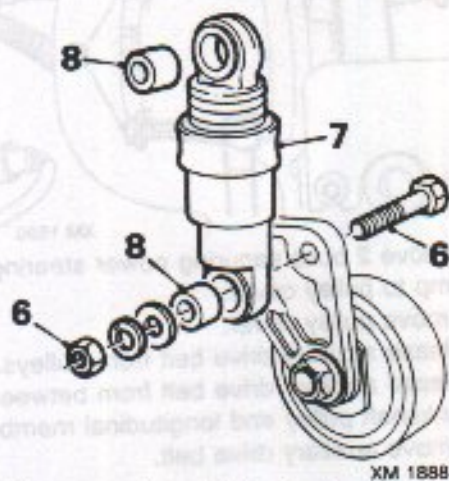
### Remove

1. Release auxiliary drive belt tension.



2. Remove bolt securing tensioner to power steering pump bracket.
3. Remove circlip, tensioner bracket to power steering pump bracket.
4. Remove the flat washer.
5. Remove tensioner assembly.

**Do not carry out further dismantling if component is removed for access only**

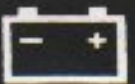


6. Remove nut and bolt, tensioner to bracket.
7. Remove tensioner from bracket.
8. Collect steel bushes from tensioner.

### Refit

1. Clean steel bushes.
2. Fit bushes to tensioner.
3. Fit tensioner to bracket.
4. Fit and tighten tensioner nut and bolt to power steering pump bracket.
5. Clean tensioner shaft on power steering pump bracket.
6. Lubricate tensioner shaft.
7. Fit tensioner assembly to power steering pump bracket.
8. Fit flat washer.
9. Fit circlip, tensioner bracket to power steering pump bracket.

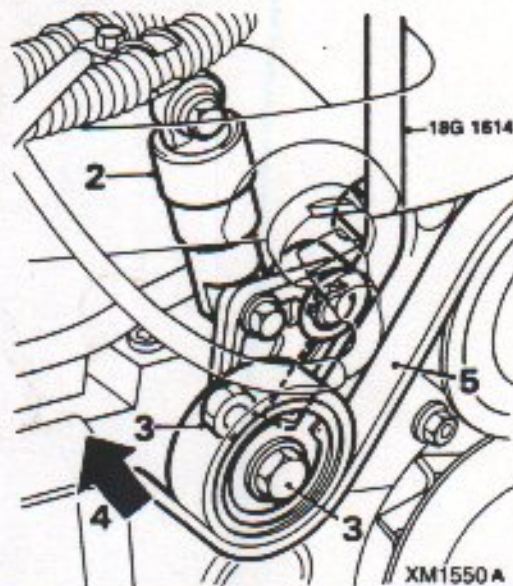
10. Align tensioner to power steering pump bracket.
11. Align coolant hose and engine harness bracket to power steering pump bracket.
12. Fit and tighten bolt, tensioner to pump bracket.
13. Adjust auxiliary drive belt tension.



## AUXILIARY DRIVE BELT

Service Repair No. 86.10.03.

### Release tension

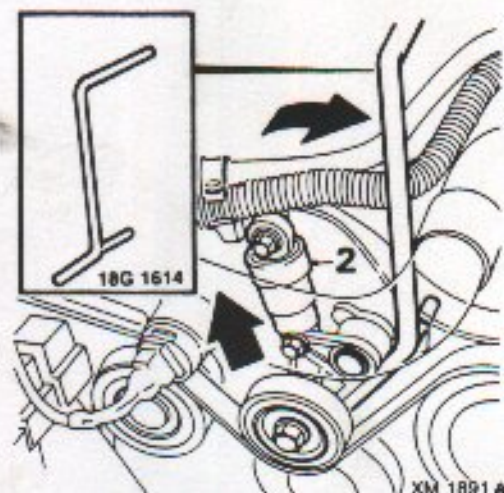


1. Fit auxiliary belt tensioning tool 18G 1614 to power steering pump bracket.
2. Raise tensioner.
3. Slacken nut on tensioner pulley.

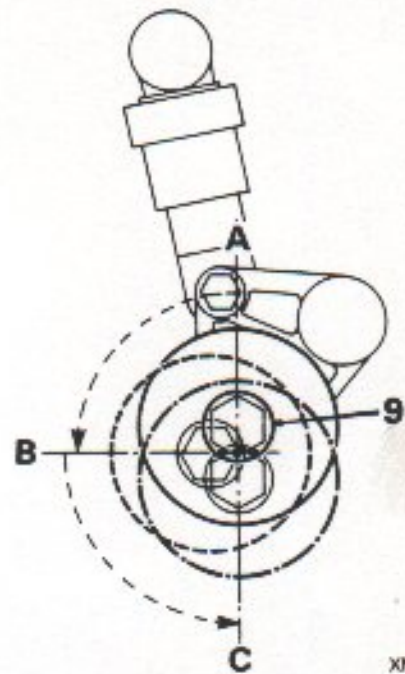
**Note:** Note position of tensioner pulley if original drive belt is to be refitted.

4. Rotate tensioner pulley to its uppermost position.
5. Release belt from tensioner pulley.
6. Release tensioner.
7. Remove belt tensioning tool.

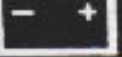
### Adjust tension



1. Fit auxiliary belt tensioning tool 18G 1614 to power steering pump bracket.
2. Raise tensioner.



3. Ensure pulley is in its uppermost position (A).
4. Fit drive belt under tensioner pulley.
5. Release tensioner and remove belt tensioning tool.
6. **Original belt:** Using a spanner on the tensioner pulley securing bolt rotate pulley to its original position.
7. **New belt:** Using a spanner on the tensioner pulley securing bolt rotate pulley anti-clockwise to position (B).
8. **Service tensioning:** Using a spanner on the tensioner pulley securing bolt rotate pulley anti-clockwise to position (C).
9. Tighten tensioning pulley securing nut and bolt.

**TORQUE SETTINGS**

|  |       |
|--|-------|
| Starter motor bolts .....                    | 68 Nm |
| Engine mounting bolts and 'Torx' screw ..... | 45 Nm |
| Engine mounting bracket nuts .....           | 85 Nm |
| Alternator pulley nut .....                  | 47 Nm |
| Alternator mounting bolts .....              | 25 Nm |
| Steering pump mounting bracket bolts .....   | 8 Nm  |
| Steering pump belt cover bolts .....         | 15 Nm |

**TOOL NUMBERS**

18G 1614      Auxiliary belt tensioning tool

# DIESEL

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|---|-------------|
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### FAULT FINDING GUIDE

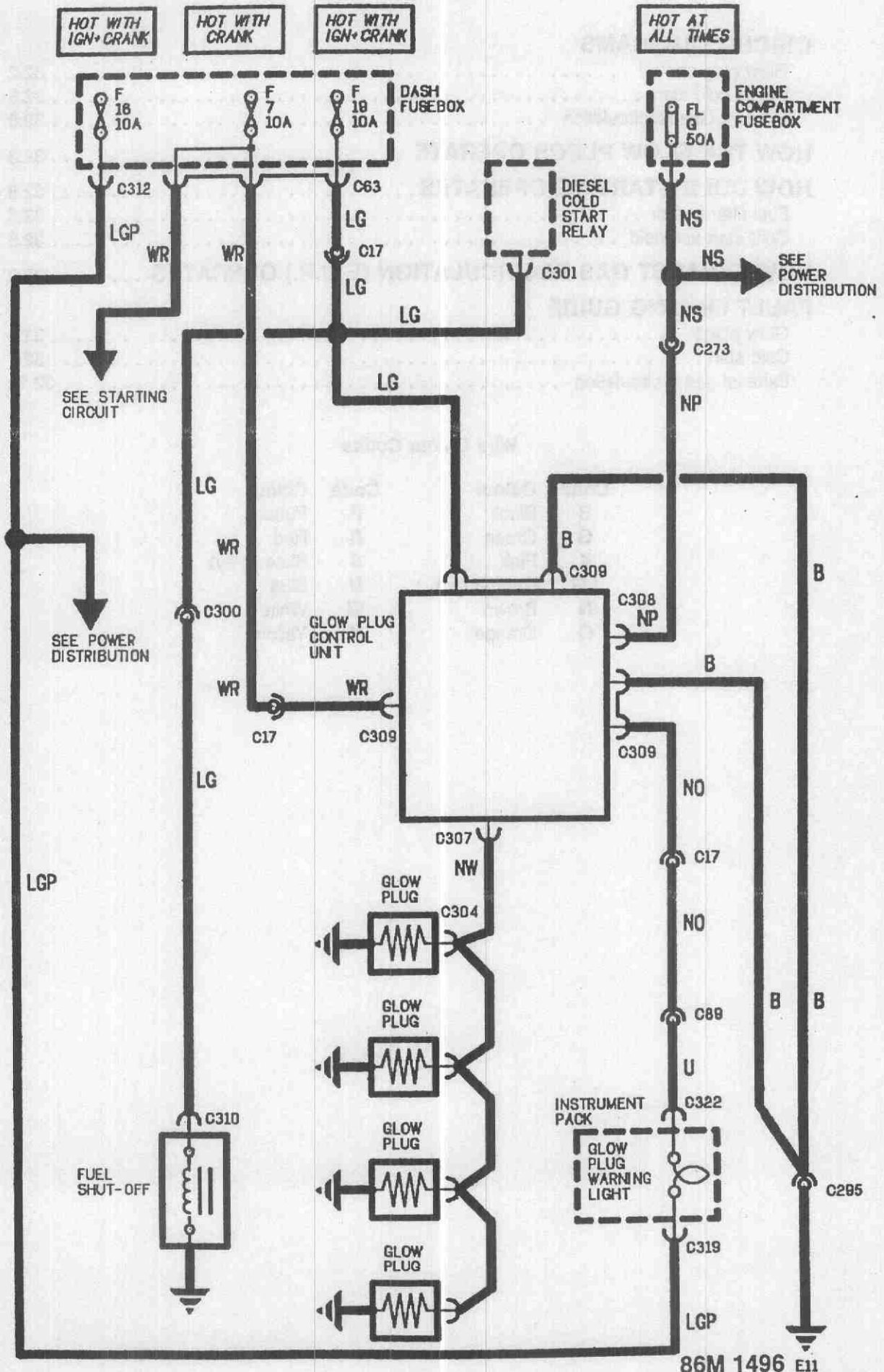
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|---------------------------------|-------|
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| Exhaust gas recirculation ..... | 32.10 |

#### Wire Colour Codes

| Code | Colour      | Code | Colour       |
|------|-------------|------|--------------|
| B    | Black       | P    | Purple       |
| G    | Green       | R    | Red          |
| K    | Pink        | S    | Slate (grey) |
| LG   | Light Green | U    | Blue         |
| N    | Brown       | W    | White        |
| O    | Orange      | Y    | Yellow       |

# DIESEL

## Glow plug control



## HOW THE GLOW PLUGS OPERATE

Operation of the glow plugs is controlled by the glow plug control unit. With the starter switch in the '0' position there is a constant 12 Volt battery supply to the glow plug control unit on the N/S then N/P wire from fusible link G.

When the starter switch is at position 'II' the control unit receives a supply from fuse 19 on the L/G wire. The earth return for the control unit is on the B wire. The control unit now connects the battery supply from fusible link G to the glow plugs via the N/W wire. The earth path for the glow plugs is through the engine block. The glow plug control unit also provides a supply on the N/O then U wire to the glow plug warning light in the instrument pack. The warning light remains illuminated for upto 18 seconds dependent on the under bonnet temperature.

Under bonnet temperature is monitored by a sensor located in the glow plug control unit. Dependent on under bonnet temperature and glow plug resistance the control unit cuts the battery supply to the glow plugs.

During engine cranking the control unit also receives an additional supply, on the W/R wire from fuse 7, enabling the glow plugs to operate. During engine cranking the glow plug control unit will always operate the glow plugs regardless of engine temperature.

When the engine is running, the cranking signal on the W/R wire is removed. The control unit will still maintain the supply from fusible link G to the glow plugs to give a post heat period. The glow plugs are switched off either by the temperature sensor or the post heat-off switch located in the control unit.

## FAULT FINDING GUIDE

### Fault

Problem with cold starting.

Glow plug warning light inoperative.

Poor running after warm-up.

### Action

Check fuse 19.

Check N/S and L/G wire supplies to glow plug control unit.

Check N/W wire from glow plug control unit to glow plug connection.

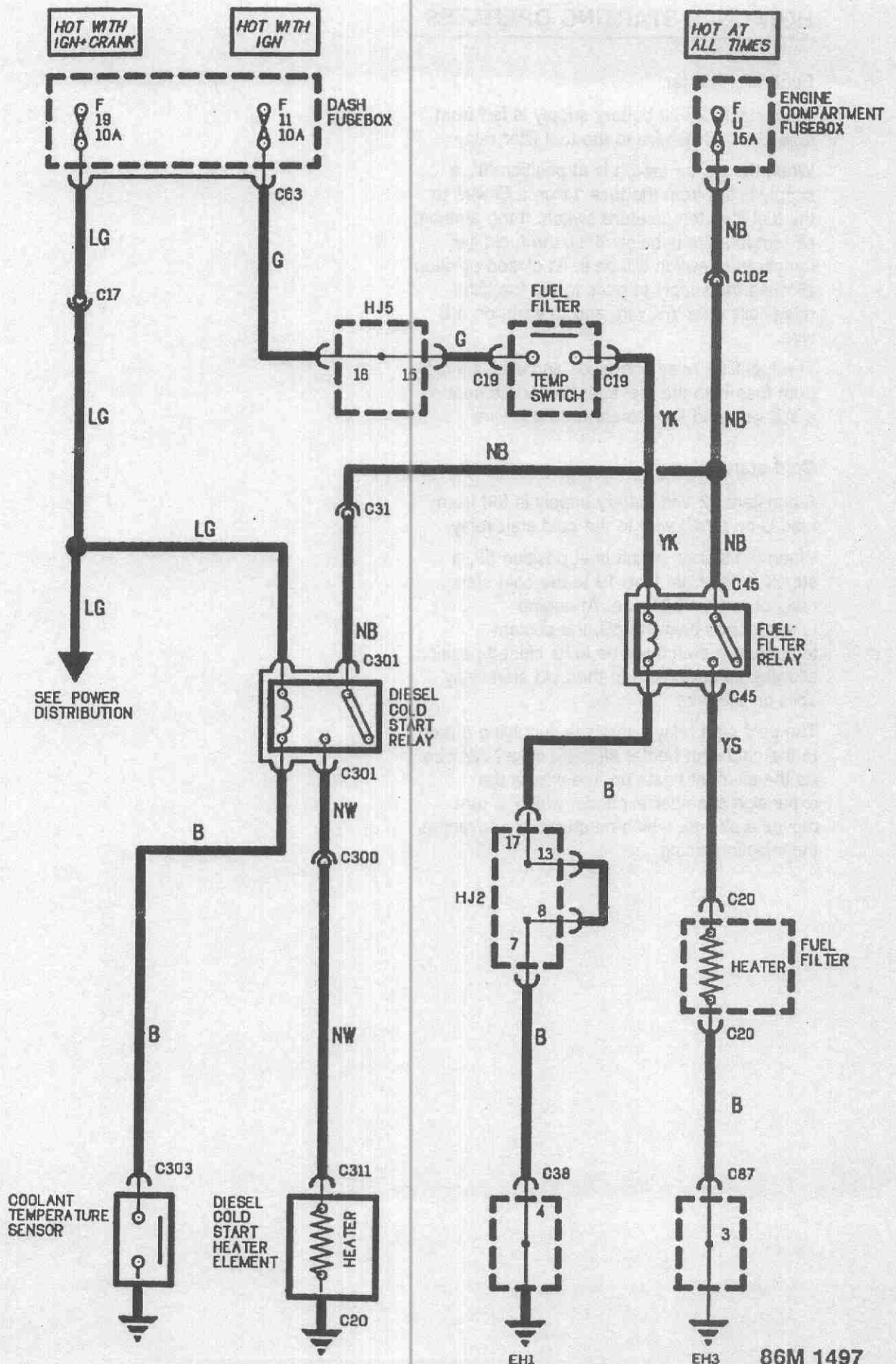
Check glow plug control unit earth path on the B wire.

Check warning light bulb.

Check N/O wire from glow plug control unit to instrument pack.

Check post heat off switch.

Cold start





## HOW COLD STARTING OPERATES

### **Fuel filter heater**

A constant 12 Volt battery supply is fed from fuse U on a N/B wire to the fuel filter relay.

When the starter switch is at position 'II', a supply is fed from the fuse 11 on a G wire to the fuel filter temperature switch. If the ambient air temperature is below 4°C, the fuel filter temperature switch will be in its closed position allowing the supply to pass to the fuel filter relay coils on a Y/K wire and to earth on a B wire.

The fuel filter relay energises and allows supply from fuse U to the fuel filter heater element on a Y/S wire and then to earth on a B wire

### **Cold start solenoid**

A constant 12 Volt battery supply is fed from fuse U on a N/B wire to the cold start relay.

When the starter switch is at position 'II', a supply is fed from fuse 19 to the cold start relay coils on a L/G wire. At engine temperatures below 30°C, the coolant temperature switch will be in its closed position allowing an earth path to the cold start relay coils on a B wire.

The cold start relay energises supplying a feed to the cold start heater element on a N/W wire. As the element heats up, the wax in the expansion chamber expands, which in turn moves a plunger which mechanically advances the injection timing.

## FAULT FINDING GUIDE

## Fault

Problem with cold starting.

Poor starting and running at temperatures below  $-10^{\circ}\text{C}$ .

## Action

Check fuse U.

Check diesel cold start relay earth path on the B wire through the coolant temperature sensor.

Turn starter switch to position 'II'.

Check fuse 19.

Check for supply on N/W wire to diesel cold start heater element.

If no supply present replace diesel cold start relay.

Check fuse U.

Check fuel filter relay earth path on the B wire.

Check fuel filter heater earth path on the B wire.

Turn starter switch to position 'II'.

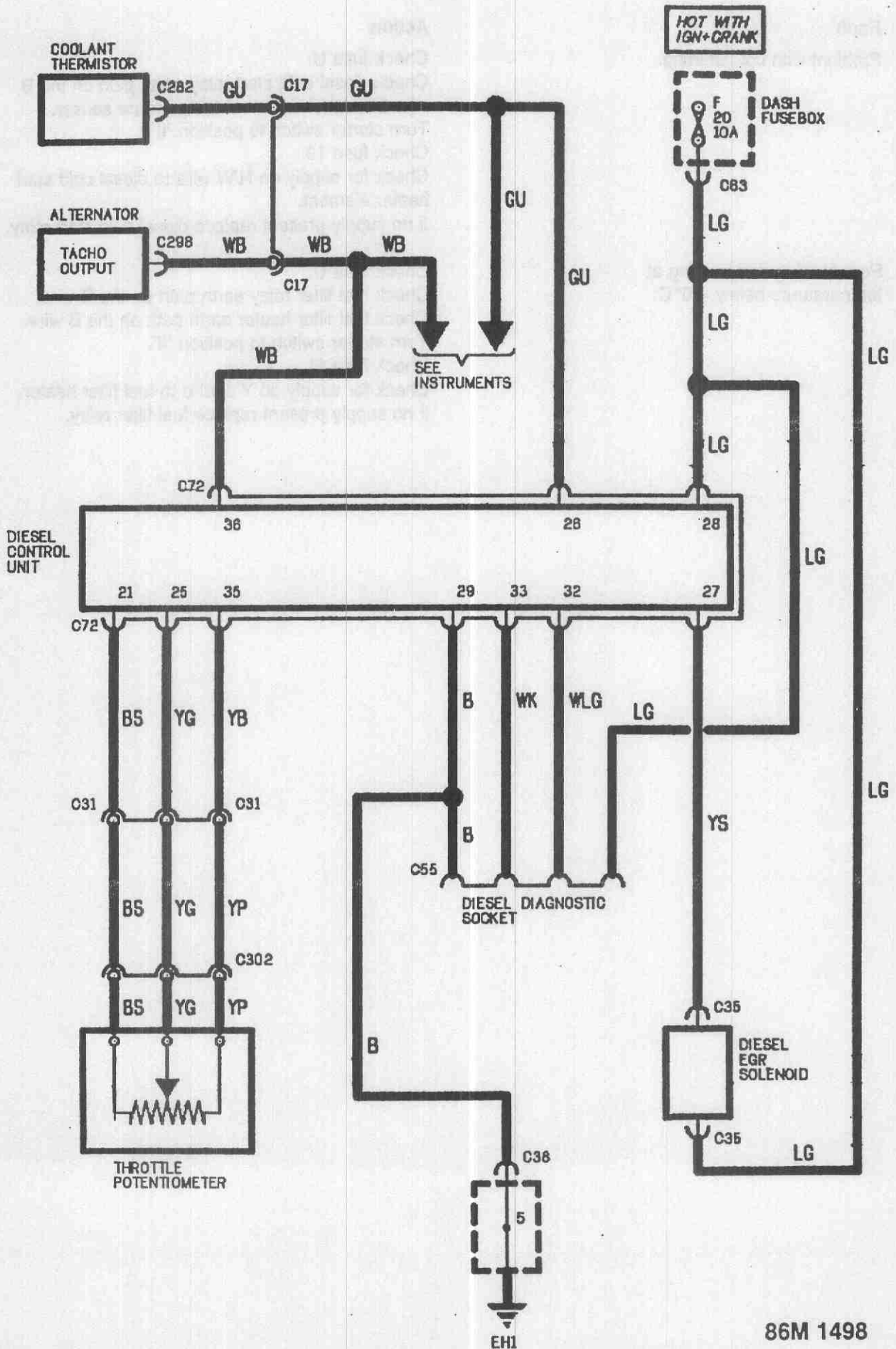
Check fuse 11.

Check for supply on Y/S wire to fuel filter heater.

If no supply present replace fuel filter relay.

# DIESEL

## Exhaust Gas Recirculation



86M 1498

## HOW EXHAUST GAS RECIRCULATION (E.G.R.) OPERATES

Operation of the E.G.R. solenoid is controlled by the E.G.R. control unit. The solenoid is only operational at engine temperatures above 40°C and between engine speeds of 2000/2500 to 3800/4200 rpm.

When the starter switch is at position 'II' the control unit and the E.G.R. solenoid receive a supply from fuse 20 on the L/G wire. The control unit is earthed by the B wire. At temperatures above 40°C the coolant thermistor provides a signal on the G/U wire to the control unit. A signal from the tachometer on the W/B wire informs the control unit of the engine speed. A feed is sent from the control unit to the throttle potentiometer on the Y/G wire which is returned on the B/S and Y/P wires which references the control unit to the load conditions of the engine.

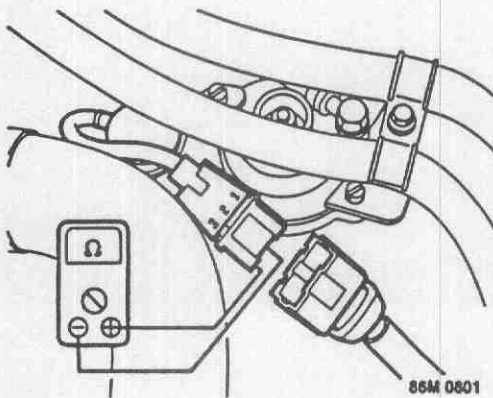
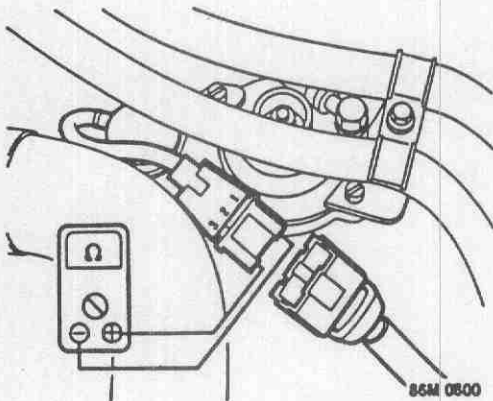
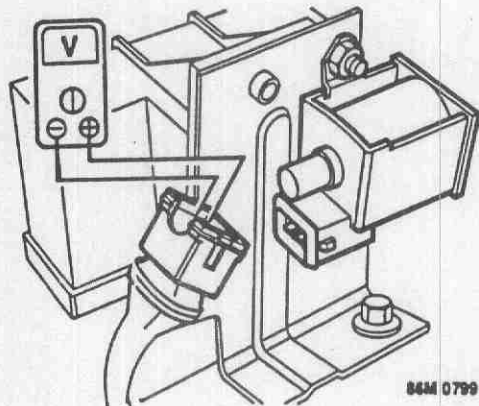
When the specified temperature, speed and engine load conditions are met the control unit provides an earth path to the E.G.R. solenoid on the Y/S wire. The E.G.R. solenoid opens allowing vacuum to pass to the E.G.R. valve, the valve opens allowing exhaust gases to be drawn into the inlet manifold.

Before starting the following fault finding guide ensure all mechanical checks have been made as described in the **Mechanical Fault Finding Manual**.

## FAULT FINDING GUIDE

### Fault

Excessive exhaust smoke, harsh engine noise, failure to meet exhaust emission requirements.



### Action

Check fuse 20

#### Check E.G.R. solenoid actuation:

1. Disconnect 2 pin connector from the E.G.R. solenoid.
2. Connect a Voltmeter across the connector pins.
3. Start engine and increase engine speed.
4. The Voltmeter should register 12 Volts between 2000/2500 rpm.
5. If 12 Volts is not registered check inputs to the diesel control unit.
6. If the Voltmeter registers 12 Volts suspect that E.G.R. solenoid is faulty and should be replaced.

Check for alternator speed signal by tachometer operation.

Check for coolant temperature signal by coolant gauge operation.

#### Check throttle potentiometer signal:

1. Switch off engine.
2. Disconnect 3 pin connector from throttle potentiometer.
3. Connect an Ohm-meter across pins 1 and 3 of the throttle potentiometer.
4. The Ohm-meter should register between 1K ohm and 1.05K ohm.
5. If the reading is outside the range replace the throttle potentiometer.

#### Check throttle potentiometer timing signal:

1. Ensure engine is at operating temperature.
2. Connect an Ohm-meter across pins 2 and 3 of the throttle potentiometer.
3. The Ohm-meter should register between 825 ohms and 900 ohms.
4. If the reading is outside the range, slacken the 2 securing screws and rotate the throttle potentiometer to achieve the required setting.
5. If the required reading can not be achieved, replace the throttle potentiometer.

If the above checks have not cured the fault replace the E.G.R. control unit.