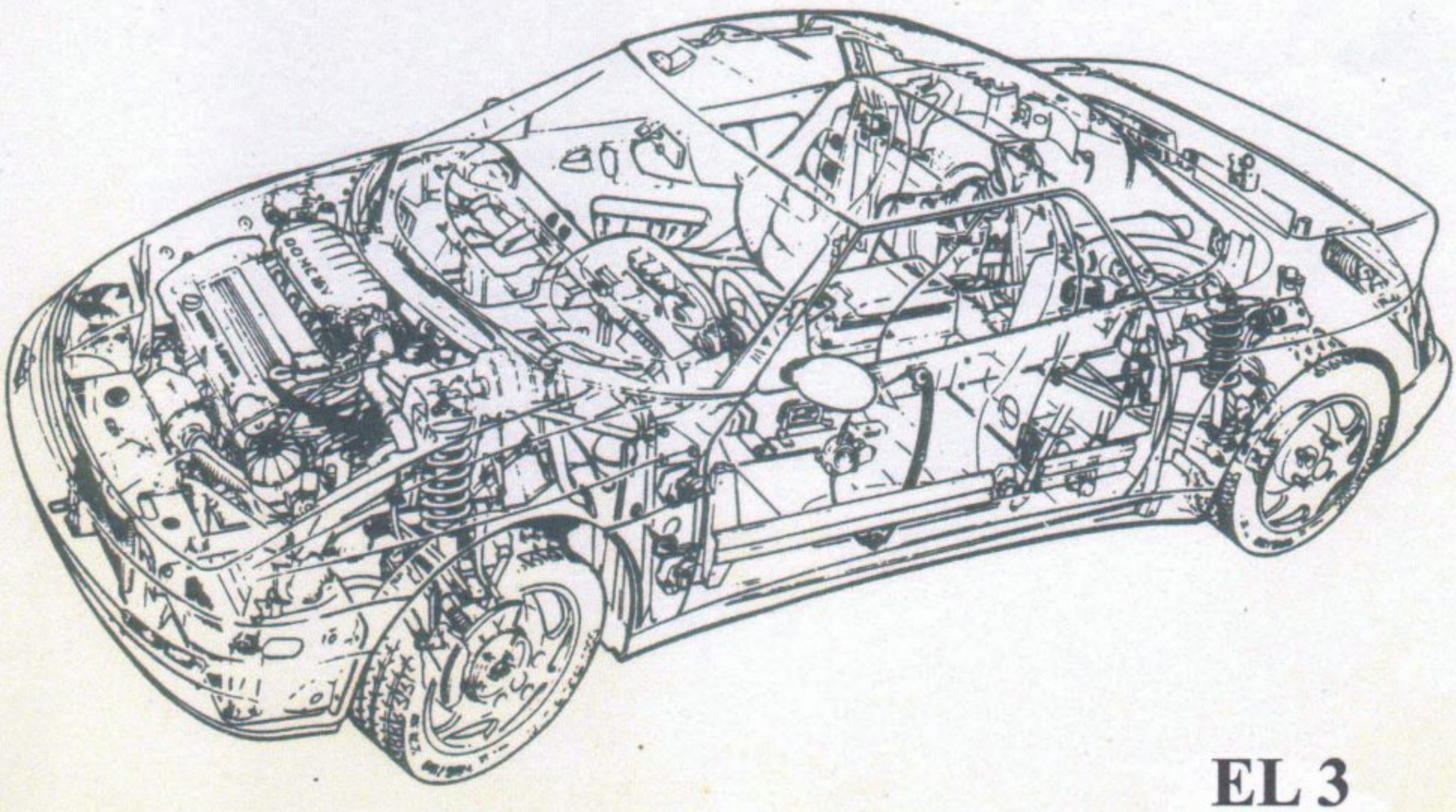
Training Centre

Course Notes

ELAN

ELECTRICAL



EL 3

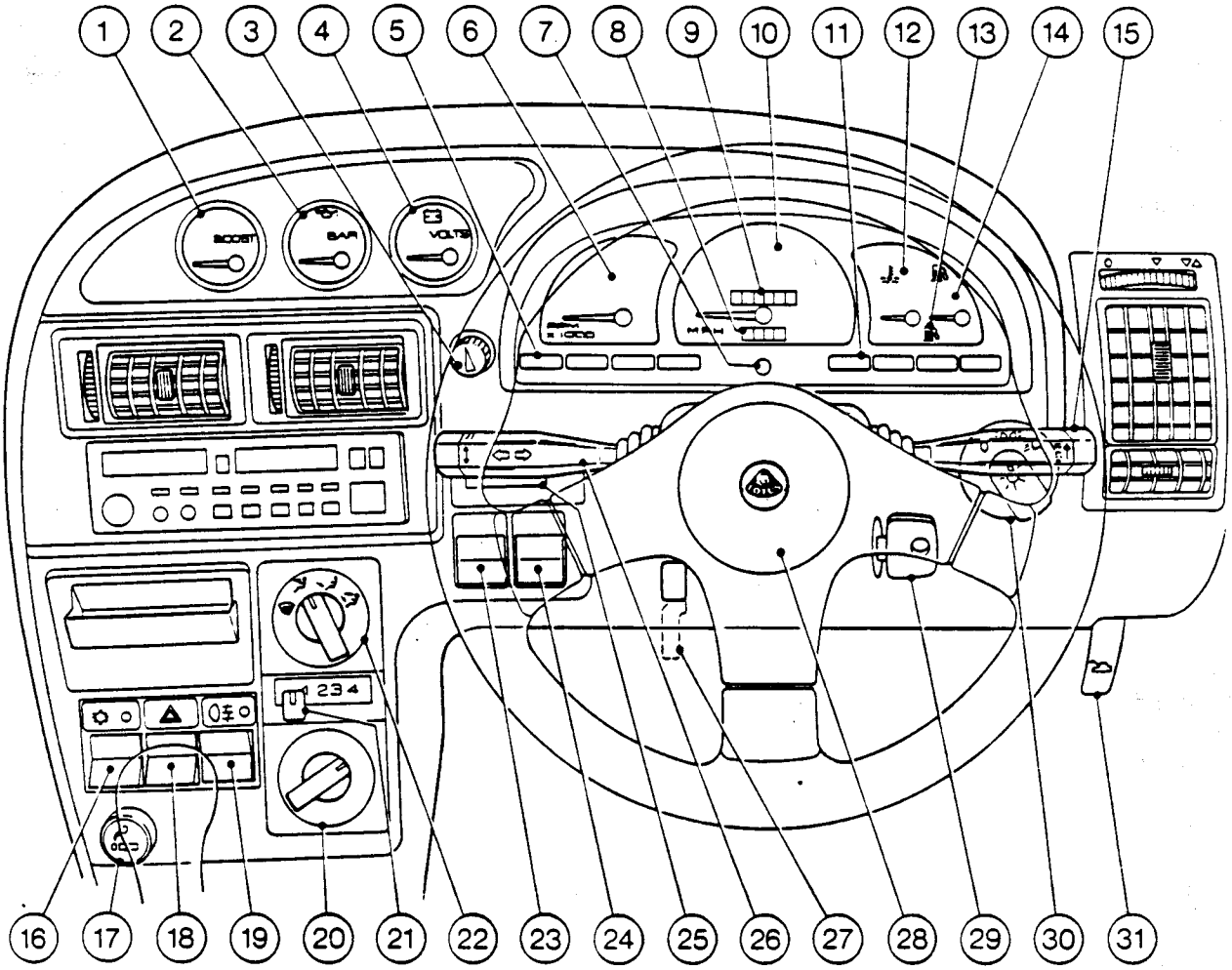
Training Course Notes

ELECTRICAL

SECTION MJ - ELAN

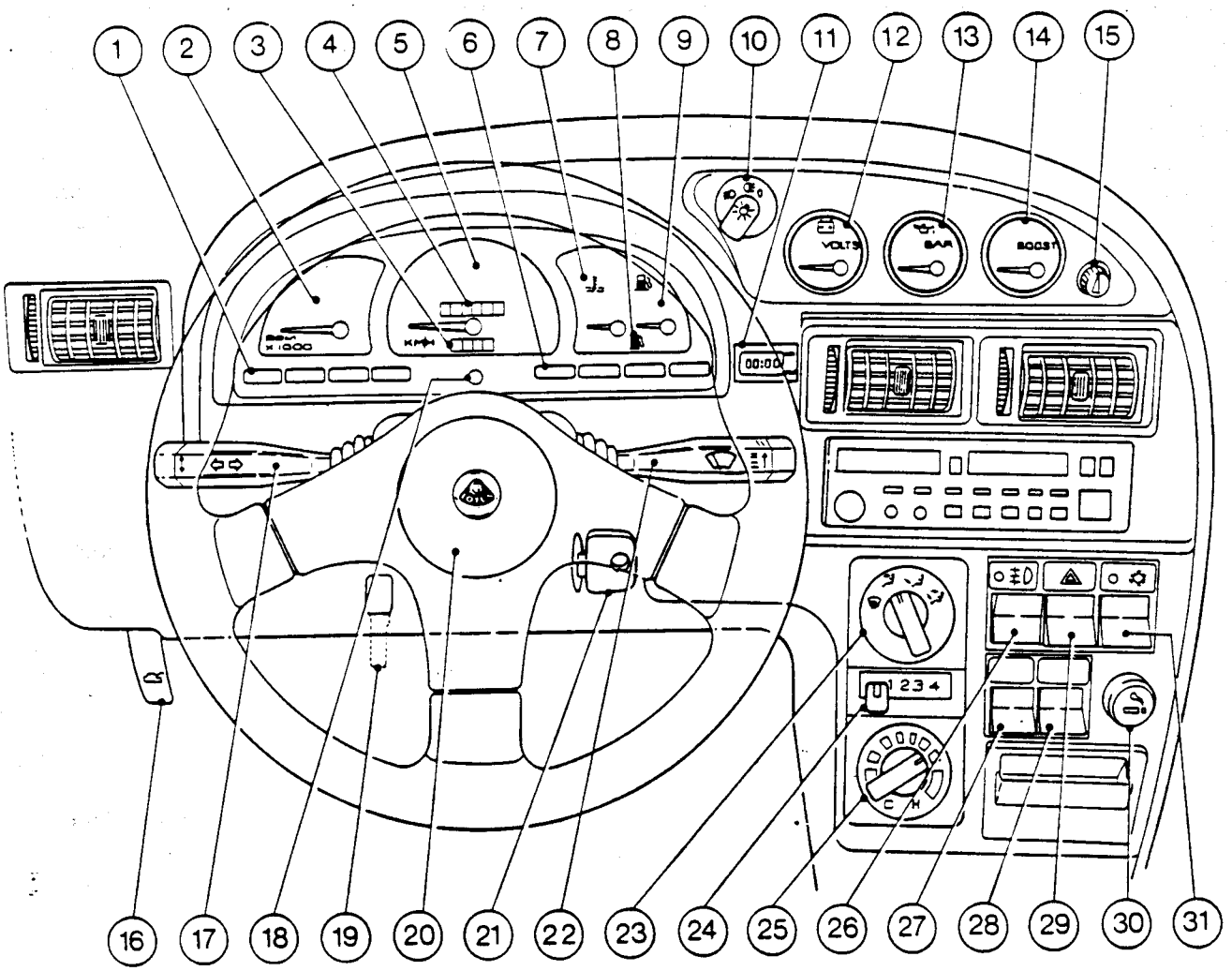
MJ.1 - INSTRUMENTS, TELL TALES & SWITCHES

Fascia Layout - Right Hand Drive



1. Boost gauge (Turbo) or analogue clock (N.A.)
2. Oil pressure gauge
3. Panel illumination rheostat
4. Voltmeter
5. Left hand tell tale bank
6. Tachometer
7. Trip reset knob
8. Trip distance recorder
9. Total distance recorder
10. Speedometer
11. Right hand tell tale bank
12. Water temperature gauge
13. Low fuel tell tale
14. Fuel gauge
15. Windscreen wash/wipe control
16. Air conditioning switch
17. Cigar lighter
18. Hazard warning lights switch
19. Rear fog lamps switch
20. Heater temperature control
21. Fan speed switch
22. Airflow distribution control
23. Switch blank
24. Switch blank
25. Digital clock (Turbo)
26. Beam/dip & turn indicators
27. Column height clamp lever
28. Horn button
29. Ignition/starter/steering lock
30. Main lighting switch
31. Bonnet release lever

Left Hand Drive



1. Left hand tell tale bank
2. Tachometer
3. Trip distance recorder
4. Total distance recorder
5. Speedometer
6. Right hand tell tale bank
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23. Airflow distribution control
24. Fan speed switch
25. Heater temperature control
26. Rear fog lamps switch
27. Switch blank
28. Switch blank
29. Hazard warning lights switch
30. Cigar lighter
31. Air conditioning switch

Ignition/Starter Switch/Steering Lock

The switch/lock is located on the right hand side of the steering column. Insert the key into the slot, and turn clockwise to position 'I' to unlock the steering column, and to position 'II' to switch on the ignition and operate auxiliary equipment. Do not, however, leave the key in this position for extended periods without the engine running, since although the ignition system itself draws no current when the engine is stopped, the ignition power relay will cause a small battery drain even without auxiliary equipment operating.

Turn further clockwise to 'III' against spring pressure to operate the starter motor. As soon as the engine starts, allow the key to return to position 'II'. To stop the engine, turn the key back to 'I', and to remove the key, turn fully counterclockwise to 'B' and withdraw. The steering column will be locked automatically when the key is withdrawn from the lock.

WARNING: - Do not push or tow the car unless the key is first used to unlock the column.
- Never withdraw the key until the vehicle is stationary.

Instruments

Speedometer

This instrument displays road speed in both MPH and km/h, or just km/h dependent on market. The instrument incorporates a total distance recorder and a trip recorder, which are calibrated in miles or kilometers dependent on the speedometer primary scale. The trip recorder may be zeroed by pressing the small knob protruding through the instrument glass.

Tachometer

The tachometer indicates engine speed in revolutions per minute. Maximum safe engine speed is 7,700 rpm on naturally aspirated models and 7,200 rpm on Turbo variants. These speeds are those at which the engine management system operates to cut off the fuel supply, and safeguard the engine from overspeeding. Maximum power is developed some 500 rpm lower than these speeds, and it is recommended that gear upshifts are made at the power peak for optimum performance and safety.

Do not run the engine continuously at its maximum speed, or allow overspeeding to occur on the overrun by changing down through the gears too early, as this imposes very high loads on engine components, leading to premature wear and possible failure.

Water Temperature Gauge

This instrument registers engine coolant temperature, and is operative only with the ignition switched on. When the engine has reached normal running temperature, the gauge needle should stay around the central portion of the scale, with slight fluctuations occurring as the operating conditions change. If however the gauge needle rises into the top quarter of the scale, the engine is in danger of overheating, and driving style should be modified accordingly. If the temperature remains high, a problem is indicated and the engine should be stopped and the cause diagnosed and rectified.

Note that the needle will rise and fall from its reading position quite slowly as the ignition is switched on and off.

Fuel Gauge

The fuel gauge is operative with the ignition switched on, and indicates the proportion of fuel remaining in the 46 litre (10.2 imp.gall; 12.3 US gall) tank. A low fuel tell tale glows when the tank level drops to approximately 9 litres (2.0 imp.gall; 2.4 US gall).

Note that the needle will rise and fall from its reading position quite slowly as the ignition is switched on and off.

Voltmeter

The voltmeter is calibrated from 8 to 16 volts, and indicates battery voltage when the ignition is switched on, and the charge being applied to the battery by the alternator when the engine is running. The normal position of the pointer is between 12 and 14 volts. If the gauge reads excessively high or low for more than a short period, a fault in the charging circuit is indicated.

Oil Pressure Gauge

This gauge registers the pressure of the oil supply in the engine lubrication system, and is calibrated in bar units. Readings will be higher when the engine oil is cold, and at high engine speeds, and there is no cause for alarm if very high readings are indicated when the engine is started in cold conditions.

Under normal running conditions when the engine is warm, oil pressure should be greater than 0.35 bar at idle, and be between 1.4 and 7.0 bar during normal driving, dependent on engine speed.

Boost Gauge (Turbo models only)

This gauge is marked in bar units, and indicates turbocharger boost pressure. The amount of 'boost' developed by the engine is dependent on engine speed and throttle opening, but is controlled by both mechanical and electronic means to prevent excessive boost pressure causing internal engine damage.

Maximum boost pressure readings will be seen with wide throttle openings at normal running temperature, and will be up to 0.65 bar (9.7 lb/in^2). The system allows a controlled amount of overboost for short periods only, following rapid accelerator pedal movement. The indicated figures will rise with increasing altitude or where the atmospheric pressure is lower than normal, although the actual pressures applied to the engine remain unaffected.

An electronic safeguard operates to cut out the fuel pump if a boost control system failure occurs, and excessive boost pressure is detected.

Analogue Time Clock (N/A models only)

The quartz analogue clock is adjusted by pressing in and turning the serrated button at its centre.

Digital Time Clock (Turbo models only)

The digital LCD time clock displays at all times, but is back illuminated for greater clarity when the ignition is switched on. The illumination is dimmed to prevent distraction when the lights are switched on.

Two buttons are provided to adjust the time setting, the upper button for hours, and the lower button for minutes. Use the push key provided on the key ring to gently depress each button in turn. If the battery is disconnected for any reason, the time setting will need adjusting after re-connection.

Instrument Illumination

All the instruments, and the analogue time clock (N/A only), are back illuminated when the vehicle sidelights are switched on.

Tell Tale Lamps

Low Screenwash Level Tell Tale (1)

A level sensing switch in the screenwash reservoir will cause this amber tell tale to glow, when the washer is operated and the reservoir level is low.

European type

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

USA type

S.I.R. Tell Tale (2) (USA only)

This tell tale provides a warning if the Supplementary Inflatable Restraint (S.I.R.) self diagnostic system detects a fault. If the tell tale lights at any time other than during the circuit test period detailed below, the fault should be investigated immediately as the S.I.R. system may not function correctly. Refer to separate publication 'Section WB'.

As a bulb and circuit check, the tell tale should flash for about eight seconds when the ignition is switched on, and then go out. When the engine is cranked, the lamp will come on steady, and then flash for another eight seconds after the engine has started.

Parking Brake Tell Tale (4)

A microswitch at the base of the parking brake lever causes this tell tale to glow red, with the ignition switched on, as a reminder that the parking brake is applied. Check that this occurs, and that the light goes out when the brake is released.

Brakes Tell Tale (6)

This lamp is connected to a level sensing switch in the brake fluid reservoir. As a lamp test function, this red tell tale will light together with the parking brake tell tale. If the lamp lights at any other time, or fails to go out when the parking brake is released, a loss of brake fluid is indicated.

Turn Tell Tale (7)

When the left hand or right hand turn indicators are operating, this green tell tale flashes in unison. If the tell tale fails to light, or flashes at an unusual rate, check the operation of the turn indicator lamps immediately.

Oil Pressure Tell Tale (8)

This red tell tale is connected to a combined tell tale/gauge transducer in the right Hand side of the cylinder block, and is provided to indicate when oil pressure is below a specified level. Check that the lamp lights when the ignition is switched on. The lamp should go out when the engine is started, although it may remain lit at idle on a hot engine.

If however the lamp lights at any other time when the engine is running, stop the engine immediately, and do not restart until the fault has been investigated and rectified.

Battery Non-Charging Tell Tale (9)

This will glow red when the ignition is switched on and will normally go out when the engine is started.

Although the lamp may glow when the engine is idling, if it lights at engine speeds above idle, a fault in the charging circuit, or a broken alternator belt is indicated.

Main Beam Tell Tale (10)

This lamp glows blue whenever the headlamp main beams are operating.

Sidelamps/Parking Lamps Tell Tale (11)

This green tell tale is provided to indicate when the sidelamps or parking lamps have been selected.

Seatbelt Tell Tale (12)

Except USA: this lamp will glow red when the ignition is switched on, and go out when the driver's seat belt is fastened.

USA: when the ignition key is turned to start the engine, this lamp will glow red for approximately eight seconds. If the driver's seat belt is not fastened, this light will be accompanied by a warning buzzer.

Catalytic Converter Overheat Tell Tale (13) (Japan only)

This tell tale will glow red if an engine management fault occurs (the 'Check Engine' tell tale will normally be lit), which results in the temperature of the catalytic converter rising to a level liable to cause damage to the converter and/or engine. The engine should be stopped for several minutes to allow the converter to cool before proceeding with caution.

As a bulb check function, this lamp will light with the ignition on, and go out when the engine is cranked.

Check Engine Tell Tale (15)

The check engine tell tale is provided to:

i) inform the driver that the engine management self diagnostic system has detected a fault;

ii) assist the technician with fault diagnosis.

As a bulb and system check, the lamp will light with the ignition on, and should go out when the engine is started. If, however, the lamp remains on, or comes on whilst driving, this indicates that the self diagnostic system has detected a problem, information on which is stored in the system memory. If the fault cures itself, or is no longer detected, the lamp will go out in most cases after about 10 seconds, but the trouble code will remain stored in the memory for the next 50 starts to indicate to the technician that an intermittent fault has been detected. If no further fault or recurrence is detected during this period, the lamp will no longer light and the stored information will be erased from the memory.

For further information on this feature, see manuals EMJ/EMK/EML.

Fascia Switches

Lights Switch

This three position rotary/pull switch controls sidelamps, headlamps, panel lamps and interior lamps with or without the ignition key in position:

i) Turned fully counterclockwise to '0', all lights are off.

ii) Turn to ≡D≡ to switch on the side/parking lamps and instrument/switch illumination.

iii) Turn fully clockwise to ≡D to raise the headlamp pods and switch on the headlamps. Note that the headlamps will not switch on until both pods are fully raised.

iv) In any of the three rotary positions, the knob may be pulled outwards to switch on both of the interior lamps.

The three rotary switch positions are illuminated when the lights are switched on.

Panel Lights Control

This rotary rheostat controls the brightness of the instrument and switch symbol illumination. Turned fully counterclockwise, the illumination is switched off. Turn clockwise to progressively increase the brightness.

Air Conditioning Switch (if fitted)

This rocker switch controls the air conditioning, which functions only whilst the engine is running. The switch symbol is illuminated with the lights switched on, and the adjacent amber tell tale indicates when the circuit is operating. For further information, see Section PE.

Hazard Lamps Switch

This push switch operates with or without the ignition key, and causes all turn indicator lamps to flash in unison. The switch symbol is illuminated with the lights switched on. The red tell tale in the switch button is backlit with the ignition switched on, and flashes when the circuit is operating.

Rear Fog Lamps Switch (Not USA)

The rear fog lamps, incorporated into the rear lamp clusters, operate only in conjuction with the headlamps, and should be used only in conditions of seriously reduced visibility. The fog lights symbol for this rocker switch is red illuminated with the lights switched on, and an adjacent amber tell tale lights when the circuit is operating.

Cigar Lighter

The cigar lighter, which functions only with the ignition switched on, is operated by pressing in fully. When the element has been sufficiently heated, the lighter will spring outwards ready to be withdrawn for use.

Column Switches & Horn

Headlamp Dipswitch/Flasher/Turn Indicators

The steering column left hand lever switch controls the headlamp dipswitch, headlamp flasher and turn indicators.

Headlamp Dipswitch: The headlamps must be selected via the master lighting switch before the pods will rise with the headlamps lit. The left hand lever switch is then used to select main or dip beam. Main beam is obtained with the lever furthest forward, away from the steering wheel, and dip beam with the lever moved back towards the wheel. The main beam tell tale lamp in the fascia lights when main beam is operating.

Note that the outer pair of headlamps supply the dip beams, and remain lit when the inner pair of main beam headlamps are operating.

Headlamp Flasher: The headlamp flasher is operative at all times. If the lever switch is pulled towards the steering wheel, against spring pressure for a moment, the headlamp pods will rise and the dip beams light for a few seconds before the pods descend. If, however, the lever is held pulled towards the steering wheel, the pods will rise and the main and dip beams operate until about two seconds after the lever is released and the pods descend.

Turn Indicators: The turn indicators operate only with the ignition switched on. Move the lever down to indicate a left hand turn, and up for a right hand turn. The switch will be cancelled when the steering wheel is returned to the straight ahead position after executing the turn. If the switch is pressed up or down only lightly, the switch will return under spring pressure for convenience when

signalling a lane change.

Windscreen Wipers/Washers

The steering column right hand lever switch controls the windscreen wipers and washer, and is operative only with the ignition switched on.

Windscreen Wipers: The wipers are controlled by the up/down position of the lever switch, which operates as follows:

- o moved fully down, the wipers are switched off.
- ▬ ▬ move up to the first position for intermittent wipe. The wiper will make one sweep about every five seconds.
- ▬ move to the next position to select normal wiper operation.
- ▬ move fully upwards for high speed wipe, for use only in heavy rain.

Do NOT at any time use the wipers on a dry screen.

REMOVE FUSE NO. 17 TO KEEP WIPERS IN PARK WHEN WORKING UNDER DASH

Windscreen Washers: Pulling the lever towards the steering wheel will operate both the washers and the wipers. When the switch is released, the wipers will continue for a further four sweeps.

Horn

The twin tone horns are operative at all times. On cars other than for the USA, the horn button is located in the steering wheel centre boss, whereas USA cars are fitted with buttons at the outer ends of each of the steering wheel spokes.

Windows, Mirrors & Interior Lamps

Door Windows

Raising or lowering of the electrically operated door windows is controlled by two switches on the centre tunnel, one each side of the parking brake lever. The windows operate only with the ignition switched on, when a white dot marker on each switch is illuminated to help locate the controls. Press the front, domed end of the rocker switch to lower the window, and the rear, dished end to raise.

If difficulty is experienced in lowering or raising a window in extremely cold conditions, use a windscreen de-icer spray along the door to glass seal.

Door Mirrors

The rear view mirrors fitted on both driver's and passenger's doors, are electrically adjustable, and incorporate heating elements to aid de-frosting in icy conditions. The mirror control switches are located on the centre tunnel, to the rear of the gearchange lever, and are operative only with the ignition switched on.

Use the rocker switch to select the mirror to be adjusted, and press the dished button to one of its four positions, to adjust the plane of the mirror glass. The small button alongside the rocker switch, energises the heating elements in both mirror glasses, for a period of approximately fifteen minutes before automatically switching off, to avoid unnecessary battery drain. A small amber tell tale light adjacent to the button indicates when the circuit is operating.

Interior Lamps

Two interior lamps are incorporated in the underside of the interior rear view mirror, one to illuminate the driver's compartment, and one for the passenger compartment. To switch on both lamps, pull out the light switch knob on the fascia. To switch on an individual lamp, press the rear of the rocker

switch adjacent to that lamp.

With the lamps switched off, a courtesy function operates as follows: when either door is opened, both lamps will light, and remain lit until about ten seconds after both doors are closed; or immediately the ignition is switched on. This delay allows time for the ignition key to be inserted into its switch.

MJ.2 - FUSES & RELAYS

Main Grouping

The fuses and relays are grouped in four main areas: ahead of the right hand door hinge post; above the instruments; above the driver's footwell; inside the battery compartment.

For access to fusebox 'A' (containing 25 fuses) ahead of the right hand door post, it is necessary to remove the protective trim panel: Use a small coin to release the quarter turn fastener at the front lower edge of the panel, and unhook the panel from the top and rear edges.

An access cover is provided in the top of the instrument cowling, which may be removed after releasing the two fastening screws. Within this area are contained fuseboxes 'B' (four fuses) and 'C' (eight fuses), together with eight standard size relays, and four 'mini' relays.

Two relay blocks containing a total of ten relays/modules are located beneath the driver's side fascia, and are accessible from within the driver's footwell.

The battery compartment (below RH side of hood stowage area) contains the fuel pump 'mini' relay and inertia switch, radio fuses and cellular 'phone fuse holders, and the cellular 'phone connector (see later for cellular 'phone details). The inertia switch operates on impact (7g) such as will occur in an accident, to cut off the fuel pump, and unlock the doors via the central locking system.

'Littel' Fuses

The 'Littel' type fuses used in all the above locations, are coloured according to their amperage rating, and may be pulled out from their numbered slots using the fuse extractor tool clipped to the main fusebox bracket ahead of the passenger door hingepost. Spare fuses are stored in the vehicle tool box.

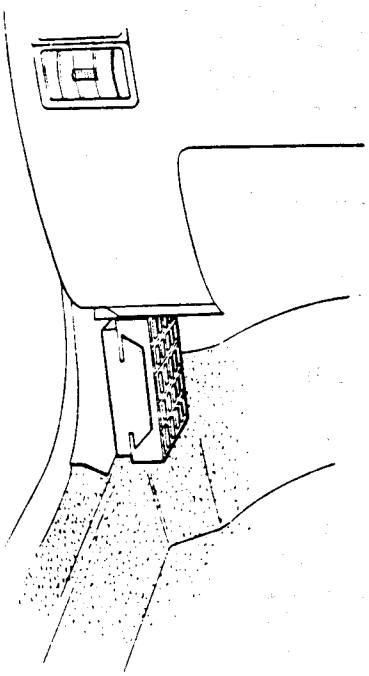
Fuse colours: 2A - black; 3A - violet; 4A - pink; 5A - orange; 7.5A - brown; 10A - red; 15A - light blue; 20A - yellow; 25A - clear.

'Maxi' Fuses

Each of the main power feed lines from the positive post is protected by a 'Maxi' fuse, which is provided as an additional safeguard in case of a major short. This fusebox 'D' is located adjacent to the positive post on the tunnel top, behind the centre switch panel, and is protected by a plastic cover secured at each end by a spring clip. For access, the instrument/switch panel must first be removed from the fascia (see section MJ.15).

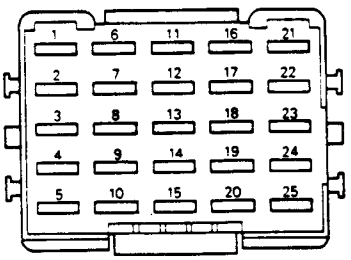
FUSES & RELAYS

Right Hand Drive Shown



Main Fusebox (A) - ahead of passenger door hingepost

Fuse	Rating	Circuit	Fuse	Rating	Circuit
1	15A	Horns	8	-	
2	7.5A	Air Cond.	9	-	
3	7.5A	Fuel Pump	10	3A	VSV
4	10A	Lighting	11	10A	Hazard
5	10A	ECM	12	3A	Batt Services
6	5A	RH Sidelamps	13	5A	Stoplamps
7	5A	LH Sidelamps	14	5A	Int. Lamps
			15	15A	Rear Fog
			16	10A	DI & Reverse
			17	15A	Wash/wipe
			18	3A	Ignition 1
			19	3A	Mirror Heater
			20	3A	Ign. Relay
			21	5A	Mirrors
			22	3A	Ignition 2
			23	20A	Heater Blower
			24	15A	Cigar Lighter
			25	-	



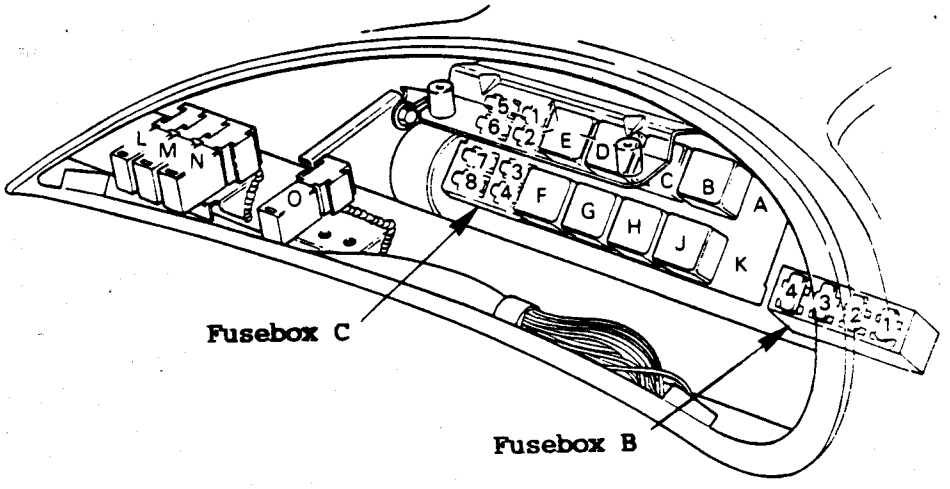
Relays Above Instrument Cluster

Relay	Circuit
A	-
B	Air Conditioning
C	Cooling Fans
D	Blower Fan Fast
E	Main Beam
F	Dip Beam
G	Electric Coolant Pump
H	Ignition
J	Start
K	-
L	Rear Fog Lamps
M	ECM
N	Blower Fan Slow (a/c cars only)
O	Horns

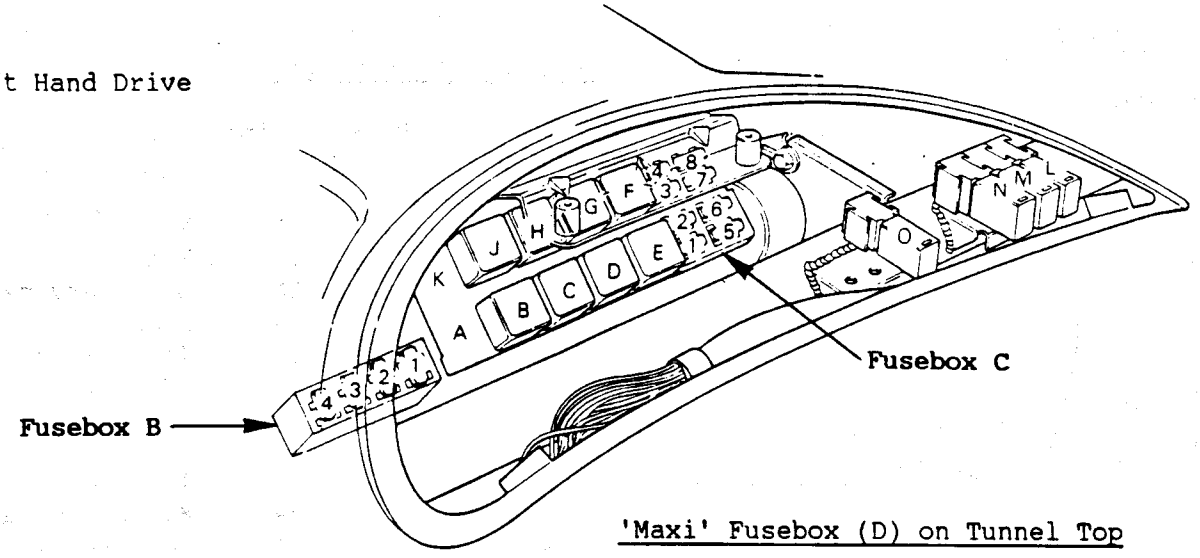
Fuses Above Instrument Cluster

Fuse	Rating	Circuit
Fusebox B		
1	20A	RH Window Lift
2	20A	LH Window Lift
3	15A	RH Cooling Fan
4	15A	LH Cooling Fan
Fusebox C		
1	15A	LH H/L Motor
2	15A	RH H/L Motor
3	7.5A	CDL
4	5A	Elec Coolant Pump
5	7.5A	LH Dip Beam
6	7.5A	RH Dip Beam
7	7.5A	LH Main Beam
8	7.5A	RH Main Beam

Right Hand Drive

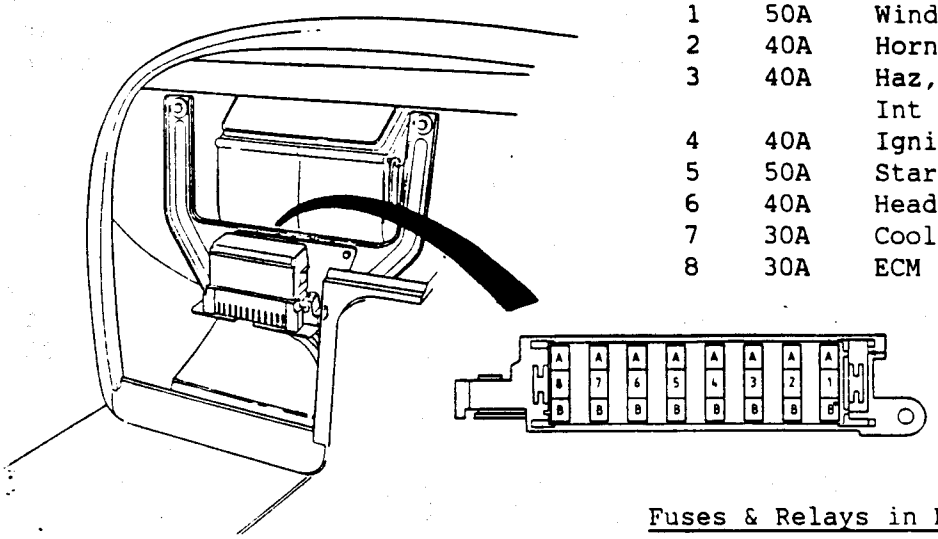


Left Hand Drive



'Maxi' Fusebox (D) on Tunnel Top

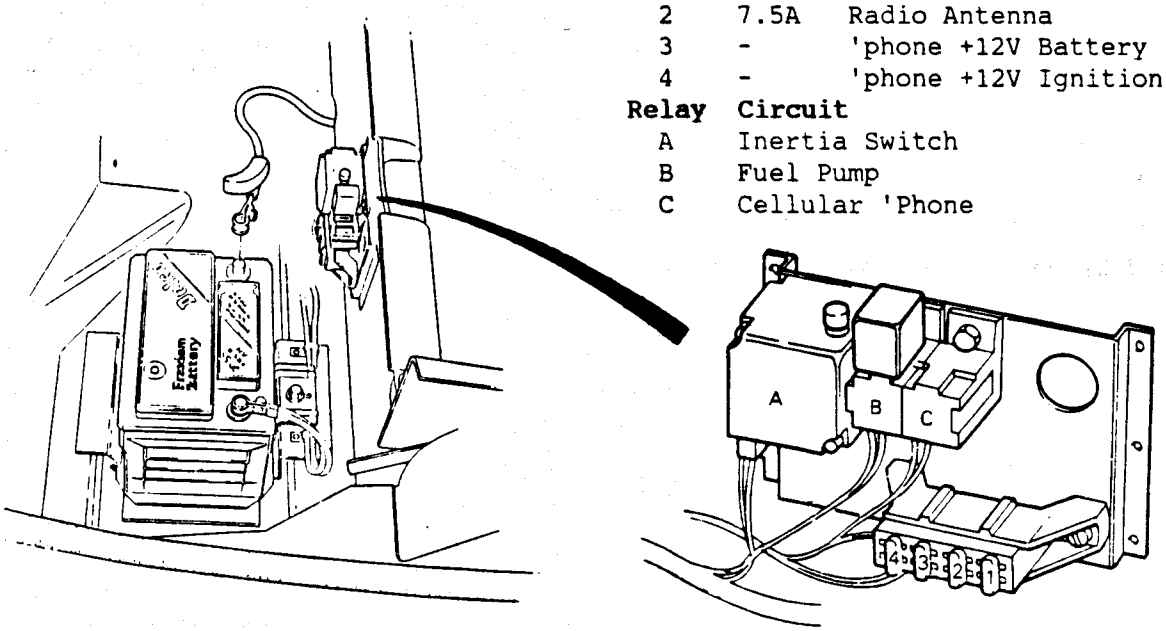
Fuse	Rating	Circuit
1	50A	Window Lift Motors
2	40A	Horn,A/C,Fuel Pump,Lights
3	40A	Haz,Batt Serv,Stop Lamps, Int Lamps,Rear Fog
4	40A	Ignition Switch
5	50A	Start Relay
6	40A	Headlamps,HL Motors
7	30A	Cooling Fans Relay
8	30A	ECM

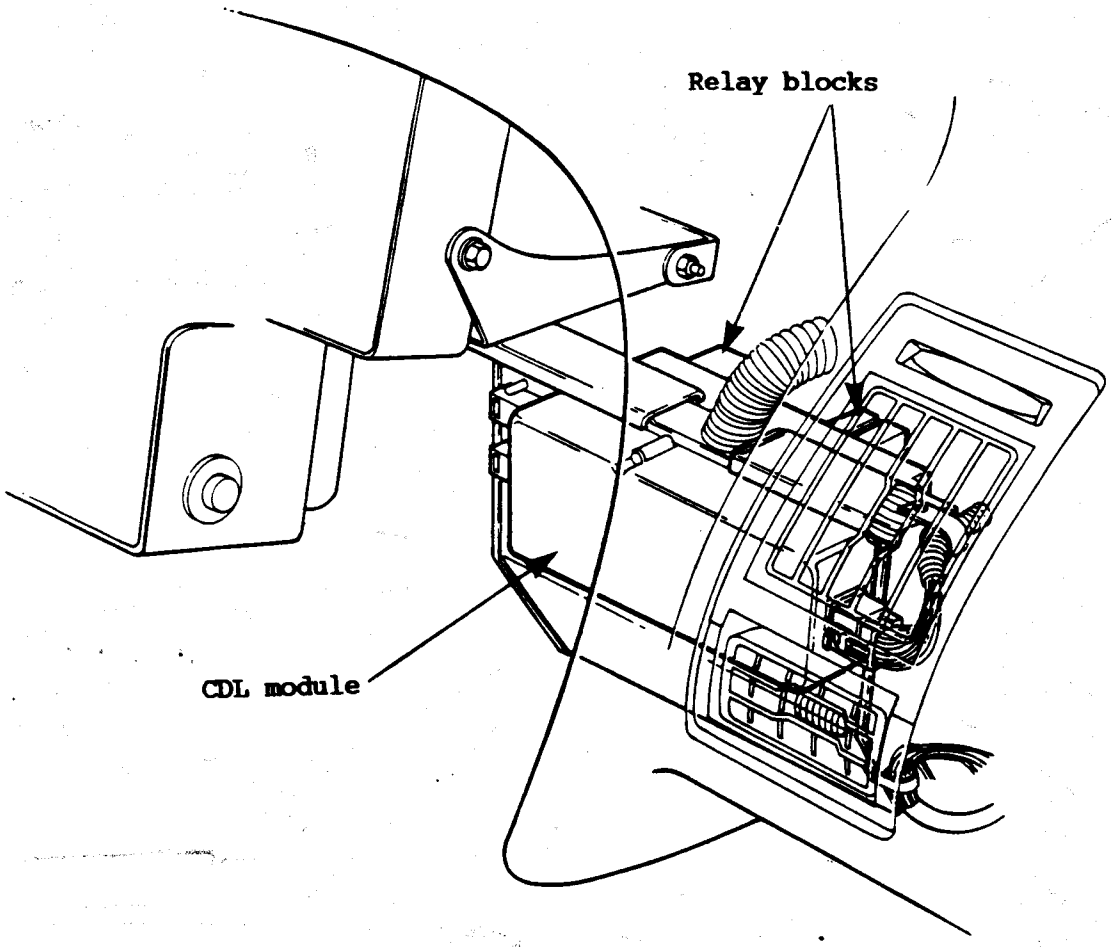


Fuses & Relays in Battery Compartment

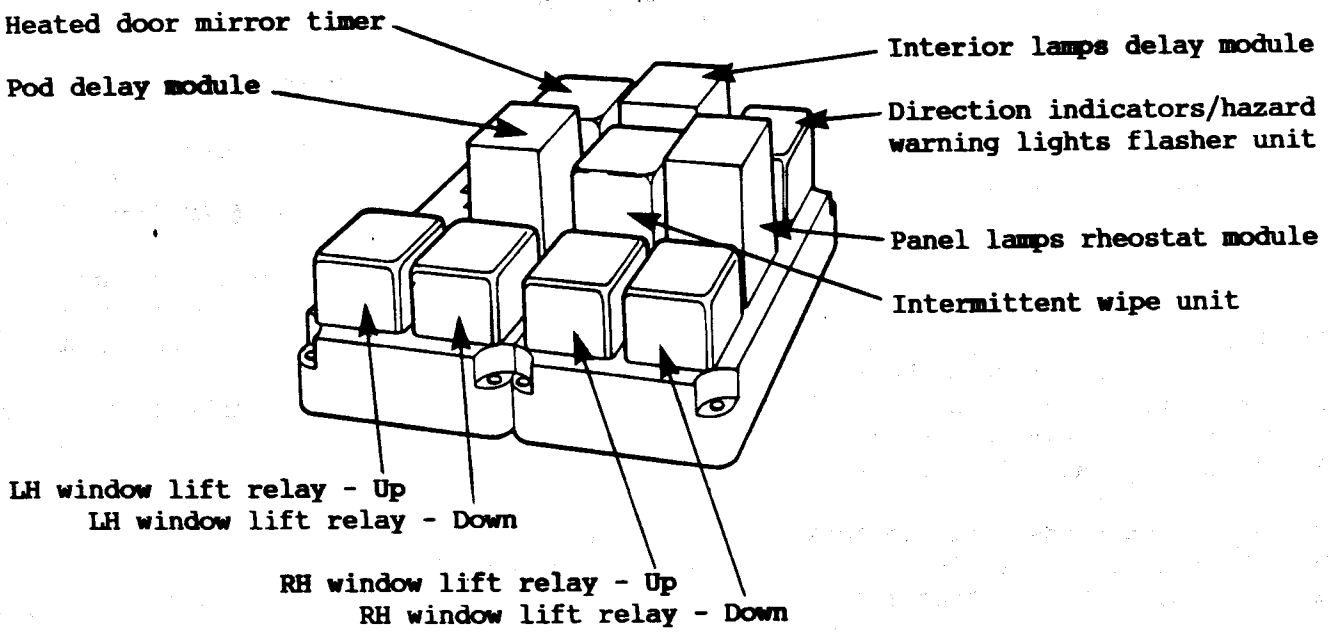
Fuse	Rating	Circuit
1	5A	Radio
2	7.5A	Radio Antenna
3	-	'phone +12V Battery
4	-	'phone +12V Ignition

Relay	Circuit
A	Inertia Switch
B	Fuel Pump
C	Cellular 'Phone

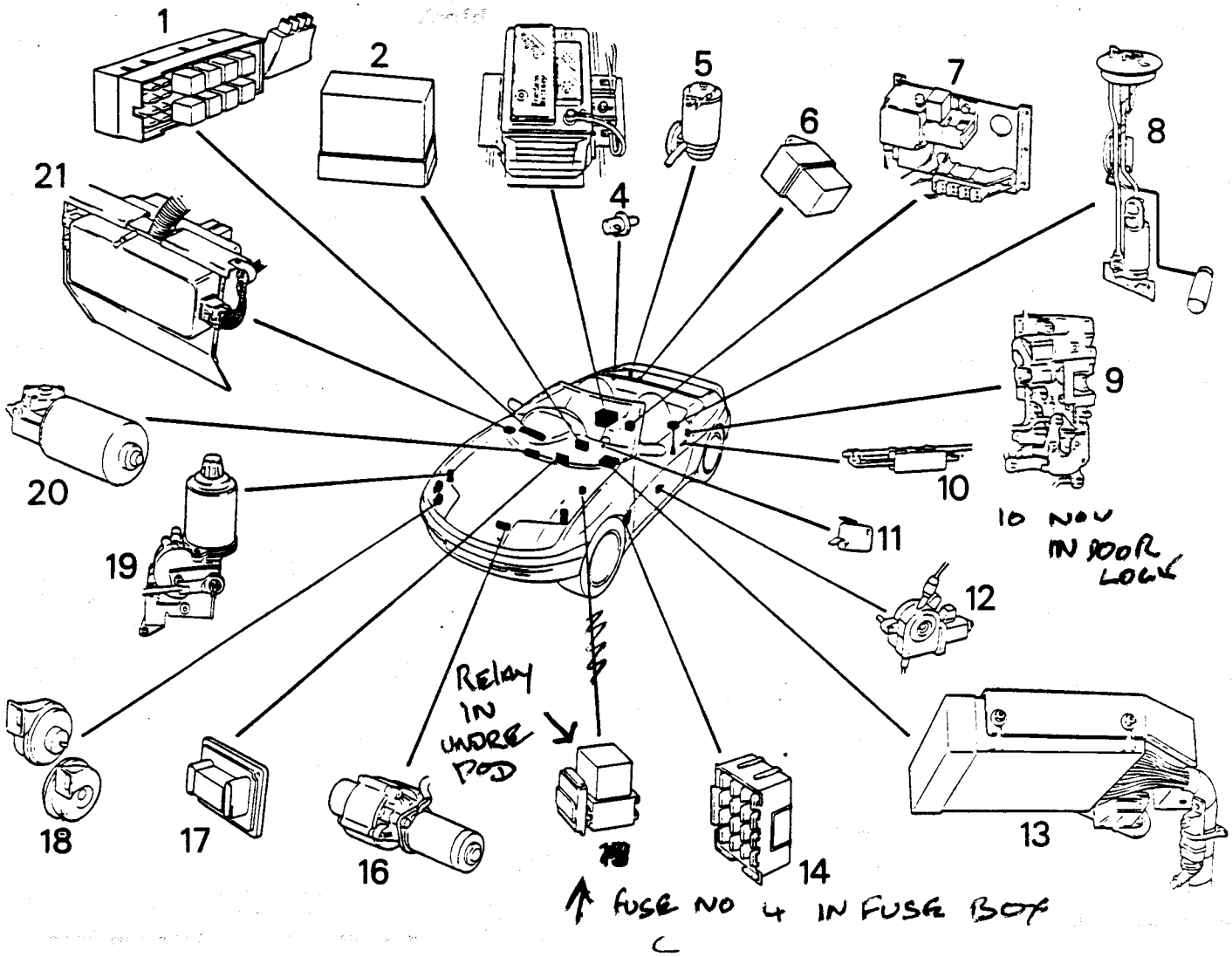




Relay Blocks Viewed From Beneath (RHD)

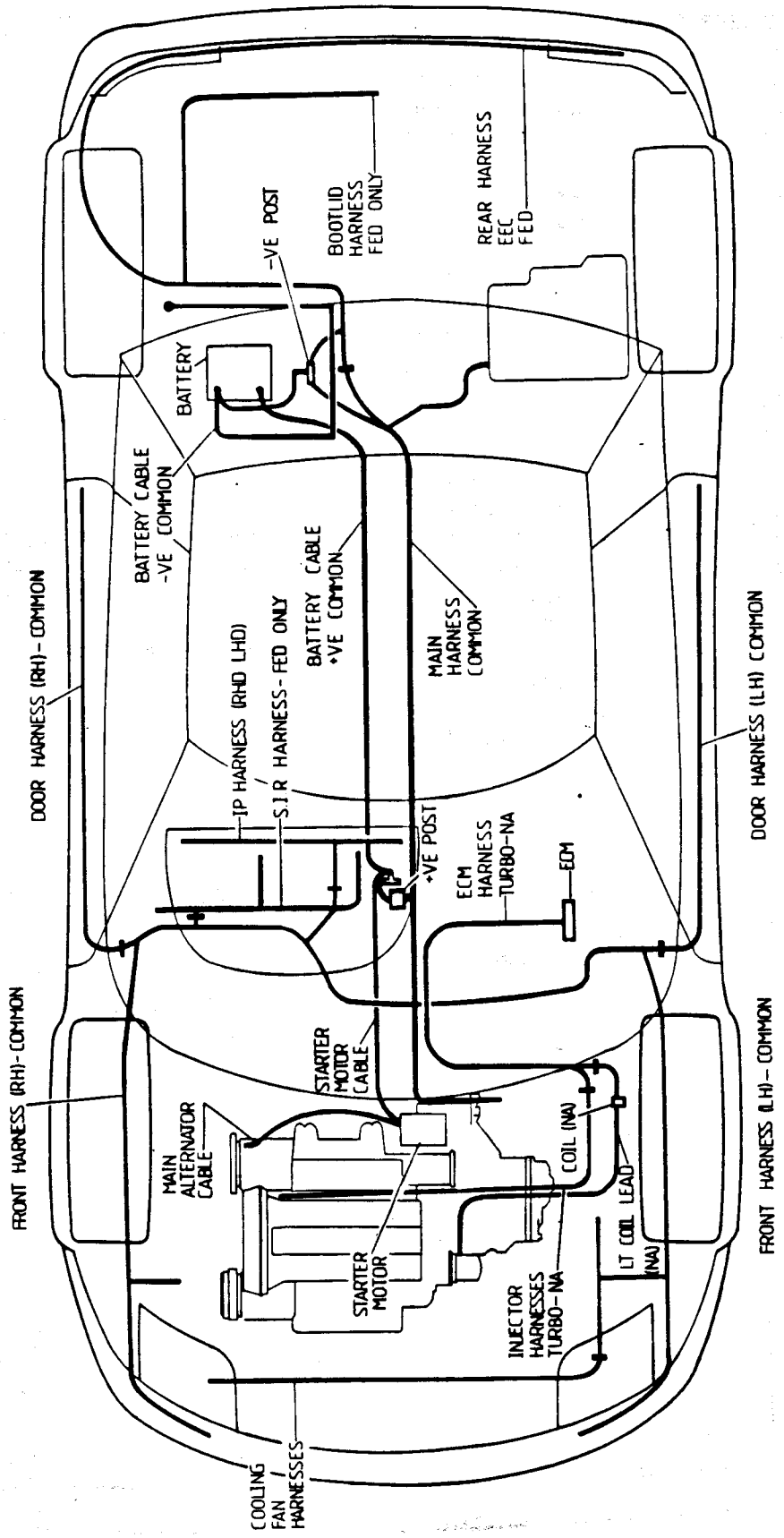


MJ.3 - COMPONENT LOCATION DIAGRAM



1. Fusebox 'B' and 'C', and relay block above instrument cluster.
2. Maxi fusebox 'D' on tunnel top.
3. Battery, located beneath right hand side of roof stowage compartment.
4. Boot lamp micro-switch on right hand hinge bracket.
5. Windscreen washer pump in bottle at right hand side of boot.
6. Relay for screenwash tell tale by right hand rear lamp cluster.
7. Accessory panel in battery compartment.
8. Fuel pump/sender unit in tank.
9. CDL actuator assy. in door latch.
10. Lock sensing switch on door panel.
11. Parking brake micro-switch.
12. Window lift motor.
13. Engine management ECM behind glovebox.
14. Main fusebox 'A' ahead of LH door hinge post.
15. Relay and fuse for electric coolant pump, front of LH suspension turret.
16. Electric coolant pump at LH front of engine bay.
17. Pod control module on bulkhead at rear of engine bay.
18. Horns in oil cooler radiator duct.
19. Headlamp pod motors, behind pods.
20. Windscreen wiper motor, rear of engine bay.
21. CDL module and main relay blocks beneath driver's side fascia.

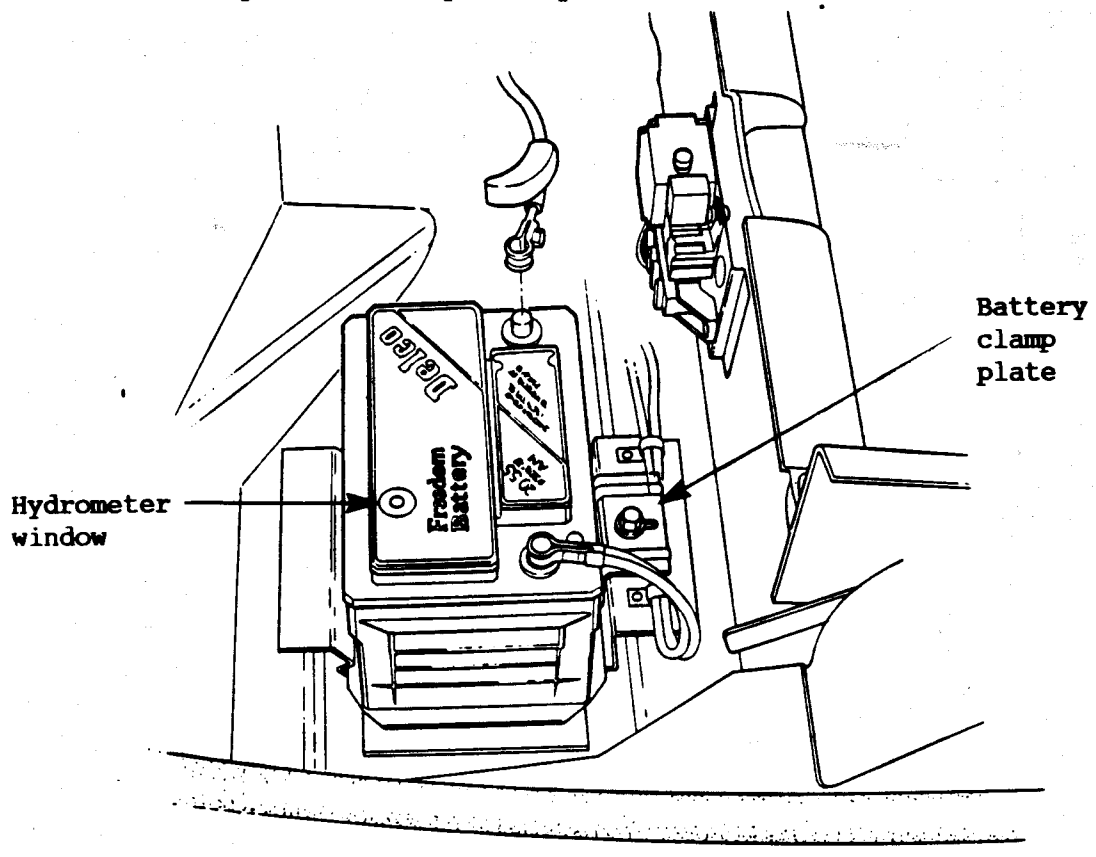
MJ.4 - HARNESS ROUTING DIAGRAM



MJ.5 - BATTERY

WARNING:
POISON/DANGER - CAUSES SEVERE BURNS - KEEP OUT OF REACH OF CHILDREN.
Contains sulphuric acid - avoid contact with skin, eyes or clothing.
Antidote: External - flush with water; Internal - drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately; Eyes - flush with water for 15 minutes and get prompt medical attention.
Batteries produce explosive gases. Keep sparks, flames and cigarettes away. Ventilate when charging or using in enclosed space. Always shield eyes when working near batteries.

CAUTION:
i) Disconnect the **negative** (earth; black;'-') battery cable first, and re-connect last, to minimise the possibility of an accidental short to earth of the battery positive connection.
ii) Before disconnecting the battery, wait for at least ten seconds after switching off the ignition to allow the engine management system to adjust the setting of some components ready for re-starting.
iii) After battery re-connection, a change in the engine performance characteristics may be noted for a period whilst the computer controlled engine management system 're-learns' some of its settings. The duration of this period will depend on driving style, but may be shortened by steady cruising in 4th gear at about 40 mph.
iv) Whenever the battery is re-connected, or a 'jump' start attempted, first ensure that the keys are removed from the vehicle, since under certain circumstances the central door locking may operate and lock both doors.
v) If fitting electrical accessories of any description, note that these also must be of **negative earth** polarity.



The battery is located beneath the hood stowage compartment on the right hand side, and is accessible as follows:

If the hood is raised -

1. Release the two over-centre latches at the windscreen header rail, and pull back the front of the roof to release the hood tensioning mechanism.
2. Raise the rear edge of the roof sufficiently to enable the hood stowage lid to be raised (pull the release handle in the RH door jamb).
3. Remove the access panel from the right hand side of the hood stowage compartment floor.

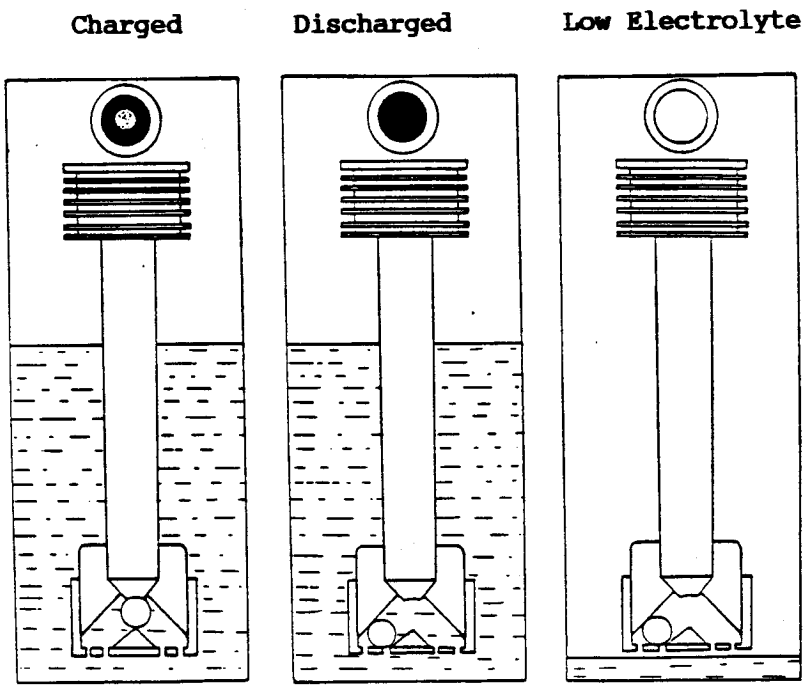
If the hood is down -

1. Open the hood stowage lid (pull the release handle in the RH door jamb), and pull out the folded hood assembly.
2. Remove the access panel from the right hand side of the hood stowage compartment floor.

A Delco Remy 'Freedom' maintenance free battery is fitted, which requires no routine topping up of the electrolyte; with no such provision being made. The battery is equipped with a built in hydrometer which provides a visual indication of the state of charge of the battery.

Built-in Hydrometer

A special temperature compensated hydrometer is built into the cover of the battery to show at a glance the state of charge. The hydrometer consists of a clear plastic rod which extends downwards from a small round window in the battery top cover, into the electrolyte. Fixed to the bottom of the rod is a cage containing a green ball which is designed to float in electrolyte with a specific gravity of 1.220, representing about a 65% state of charge. When the ball floats, it rises to the top of the cage, and appears as a green dot when the hydrometer is viewed vertically. If the ball sinks, the window will appear dark, and if the level of electrolyte falls below the cage, the window will appear clear, or light yellow. These visual indications may be interpreted as follows:
Note: Wipe the window clean and view vertically using a lamp if necessary.



Green dot visible within dark area - battery is over 65% charged which is sufficient for normal use or testing.

Dark with no green dot - battery is less than 65% charged, and should be re-charged before use or testing.

Clear or light yellow - electrolyte level is low due to excessive or prolonged charging, broken case, excessive tipping, or normal wearout. Check that air or gas bubbles are not causing a false reading by lightly tapping the hydrometer. If a cranking problem exists, the battery should be replaced. Do not attempt to test or charge a battery with this indication.

Battery Charging

If the hydrometer indicates that the battery needs recharging, the battery should first be removed to a well ventilated area to avoid a build up of fumes in the battery well. The battery is retained by a clamp plate at the base of the battery front side.

Charge the battery following the charger manufacturers instructions while observing these basic rules:

- If the green dot shows in the hydrometer, there is no need to charge the battery. Charging attempts will only increase the possibility of undesirable overcharge effects.
- Do not attempt to charge the battery if the hydrometer is clear or light yellow and there has been a cranking problem - replace the battery.
- Depending on state of charge, temperature and charger capacity, the battery will accept a charging rate of between 3 and 50 amps. However, at high rates the battery may eject electrolyte through the vents, and/or become hot - over 52°C (125°F). Reduce the charging rate and/or stop for a time to allow the battery to cool.
- Continue charging until the green dot is visible in the hydrometer.

When the battery is fully charged, replace in its compartment and secure with the clamp plate. Re-connect the positive lead first and the negative last.

Battery Testing

Perform the following load test only if a green dot was observed during the hydrometer check. Do not load test if the hydrometer was clear or light yellow. Re-charge the battery if the hydrometer was dark.

Use a voltmeter and battery load tester capable of supplying a load of 200 amps.

i) If the battery has been on charge either externally or via the vehicle alternator, first remove the surface charge by applying a 200 amp load to the battery for 15 seconds. Turn off the load and wait for at least 15 seconds to allow the battery to recover.

ii) Apply a 200 amp load to the battery for a period of 15 seconds, and note the voltage reading at the end of this period just prior to switching off the load.

iii) Estimate the temperature of the area in which the battery was located for the few hours prior to the test, and determine the minimum acceptable voltage for step (ii) from the following table:

Temperature °C	Temperature °F	Minimum Voltage
Above 21	Above 70	9.6
10	50	9.4
-1	30	9.1
-10	15	8.8
-18	0	8.5
Below -18	Below 0	8.0

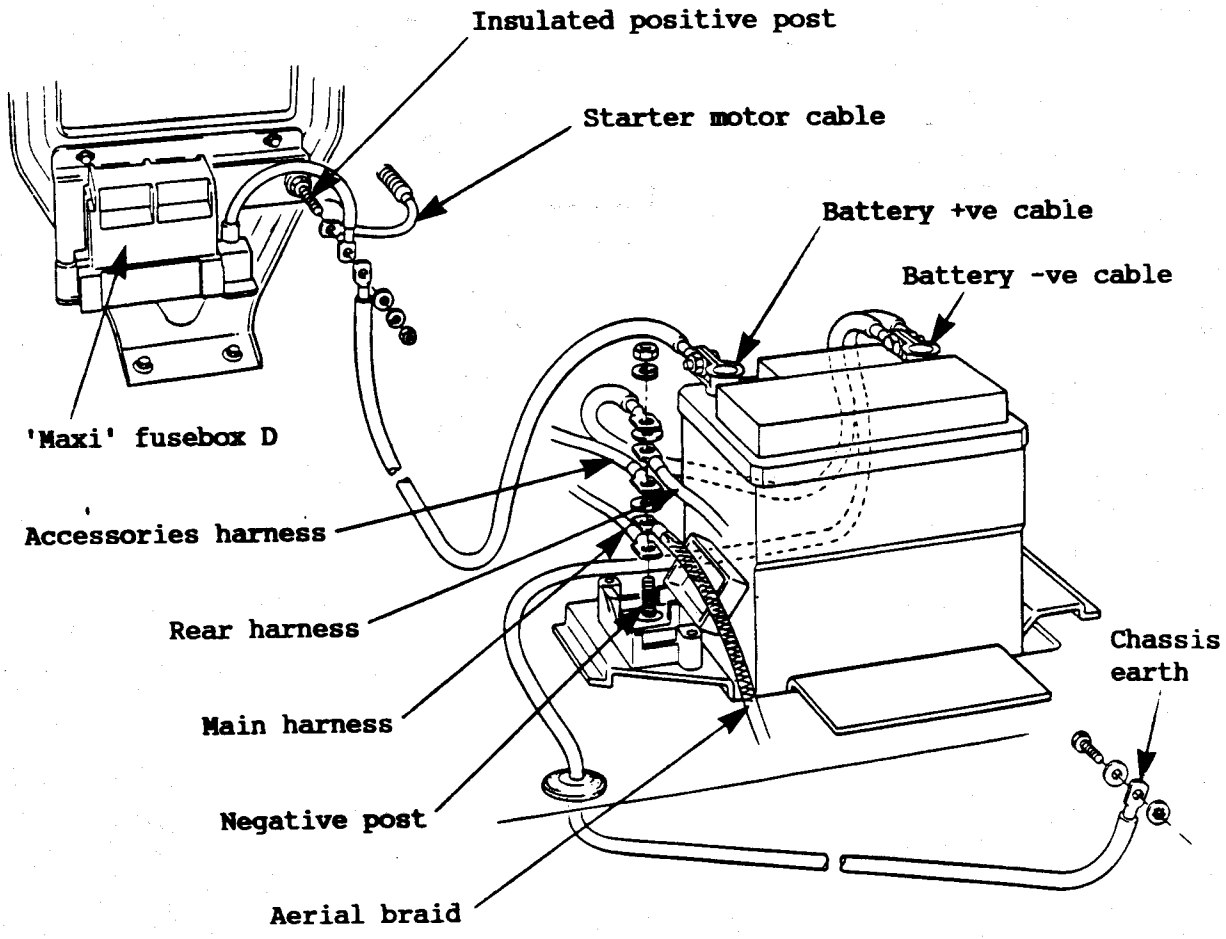
iv) If the voltage observed in step (ii) is at or above the minimum voltage in the table above, the battery is serviceable. If the observed voltage is less than that in the table, the battery should be replaced.

MJ.6 - BATTERY CABLES & EARTH BRAIDS & EARTHING POINTS

Battery Cables

The battery -ve cable runs from the battery to an earth point on the chassis right hand suspension outrigger. A second cable from the battery negative terminal, connects with a -ve post at the left hand side of the battery compartment. This -ve post provides an earth point for the rear harness, fuel pump harness and aerial.

The positive battery cable runs forward along the tunnel top to a +ve post beneath the fascia. This post provides a take off point for the 'Maxi' fuses which supply the major circuit feeds. A separate lead connects this post with the starter motor solenoid.



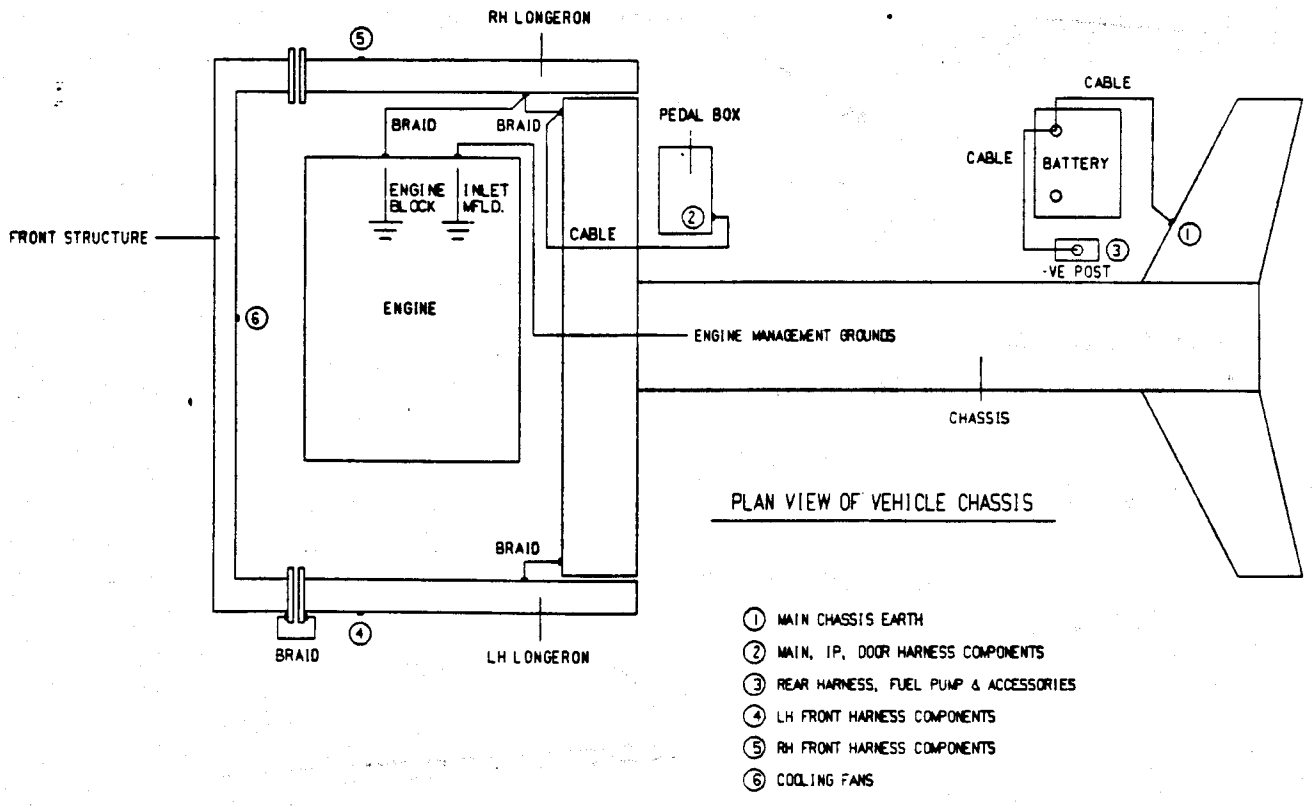
Earth Braids

- An earth cable connects the pedal box to the RH front of the chassis front crossmember.
- An earth braid at each rear corner of the engine bay, connects each chassis front longeron to the chassis front crossmember.
- An earth braid connects the right hand front (rear side) of the cylinder head to the right hand end of the chassis front crossmember.
- An earth braid bridges the joint between the left hand longeron and the chassis front frame.
- An earth braid at each side of the car connects the scuttle beam with the top of the 'A' post. This braid is for suppression purposes only.
- An earth cable connects the driver's side end of the scuttle beam to the pedal box. This braid is for suppression purposes only.

Earthing Points

- At the rear of the car, all earth leads terminate at the -ve post in the battery compartment.
- All fascia and door harness earths terminate at the pedal box.
- The left hand front harness is earthed to the left hand longeron.
- The right hand front harness is earthed to the right hand longeron.
- The cooling fan harness is earthed to the radiator frame.
- All engine management (ECM) earths terminate at an earth point on the engine, at the right hand end of of the inlet manifold.

VEHICLE GROUNDING



MJ.7 - RADIO WIRING & SUPPRESSION

Radio Wiring

On cars supplied without a radio fitted, the wiring, which is included in all cars, may be found behind the radio aperture:

+ ve supply (permanent)*	- purple (memory) with 180 series Lucar connector
+ ve supply (permanent)*	- purple (main feed) with 250 series Lucar connector
	* via 5A fuse in battery compartment
earth	- black with 250 series Lucar connector
antenna lead	- co-axial cable
aerial trigger	- purple/orange with 180 series Lucar connector

leads to an aerial connector block at the front of the boot. The connector is also supplied with an electric aerial power feed (purple) via 7.5A fuse in battery compartment, and a (black) earth. The latter two leads are not used with the standard Bosch aerial.

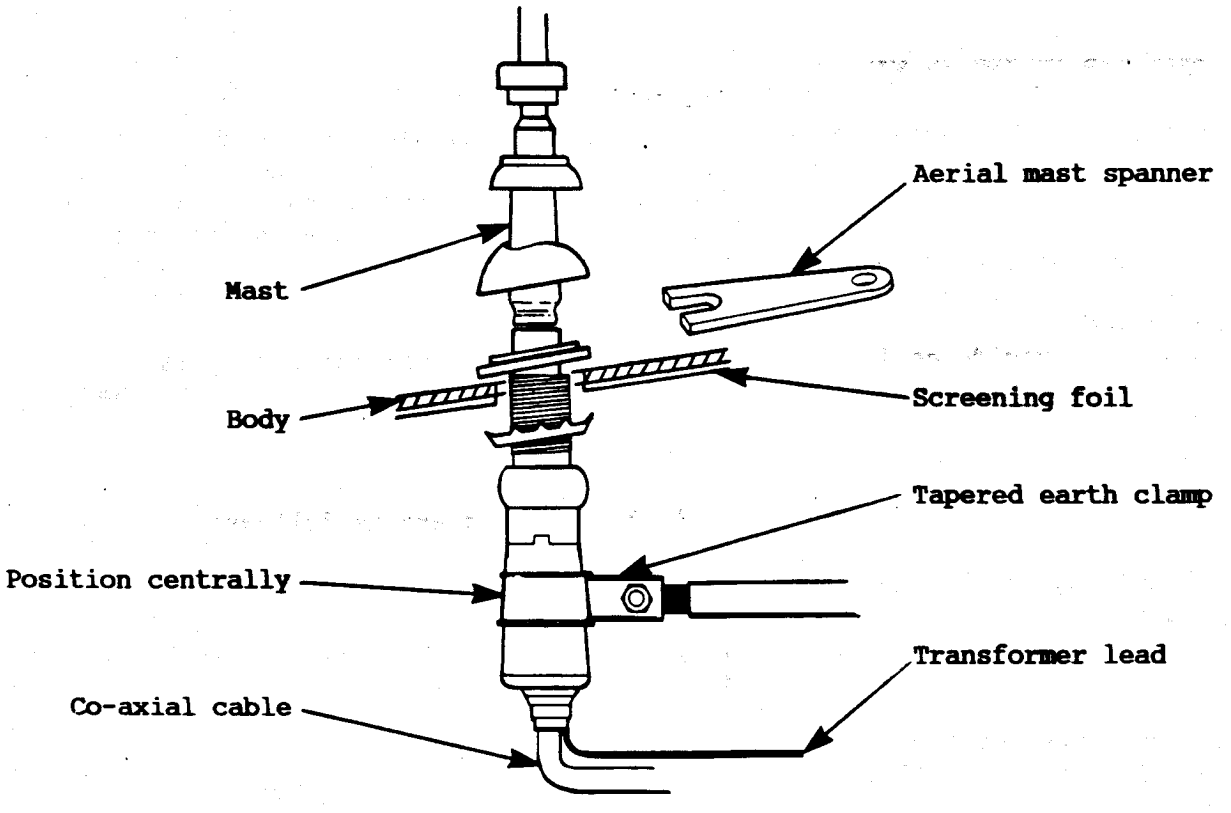
Four speakers are fitted, one in each door, and one behind each seat, each speaker being of 4 ohms impedance, with 25 watts per channel capability. Speaker wiring terminates in four DIN standard speaker plugs, with the harnesses labelled according to their speaker.

Antenna

A Bosch helical whip transformer aerial is mounted on the rear quarter panel on the driver's side, and is maintenance free. A spanner supplied with the vehicle documents, can be used to unscrew the mast from the base unit, to deter vandalism if leaving the car unattended for long periods.

If refitting the complete aerial assembly:

- The aerial must be fitted vertically, with a maximum deviation of 5° leaning backwards.



- Arrange the clamp that connects the earth strap to the aerial base, so that the tapers on the two components correspond.
- Align the clamp so that the pip on the aerial base fits into the slot formed at the clamp, with the clamp positioned centrally on the aerial base.
- The M8 nut securing the clamp to the aerial should be tightened to 6 Nm nominally, but **must not exceed 10 Nm** or damage may be caused to the electronic components fitted inside the aerial base.

Suppression

Screening foil is fitted in the following locations to suppress radio interference:

- Under the bonnet, between the sound insulation and the bonnet inner panel. The foil is connected, via a braid at each rear corner, to the bonnet hinges, which are themselves earthed via braids to the chassis front crossmember.
- Across the inside of the cabin front bulkhead. The foil is earthed by being sandwiched between the pedal box and bulkhead (pedal box is earthed by cable to the chassis).
- The underside of the rear wing on the side fitted with the radio aerial. This forms a ground plane for the aerial, and is connected via the aerial earth lead to the -ve post in the battery compartment.

A suppression capacitor is fitted to the rear of the alternator, and is connected to the main output terminal.

The steel outriggers which form the sill reinforcments, and 'A' and 'B' posts, are earthed via braids between the 'A' posts and each end of the scuttle beam. The scuttle beam itself is earthed by a braid connecting the driver's end of the beam with the pedal box earth point.
pedal box. This braid is for suppression purposes only.

MJ.8 - CELLULAR TELEPHONE WIRING

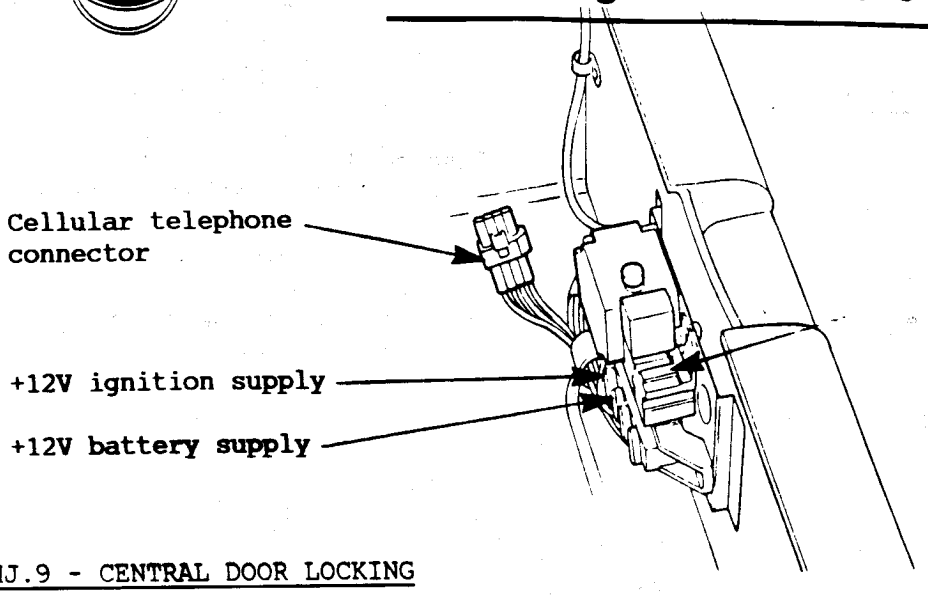
Provision has been made for the connection of a cellular telephone. Within the battery compartment, is located a four pin connector containing battery and auxiliary supplies, a panel lights illumination supply, and an earth connection. Fuse holders for the battery and ignition supplies are located alongside the radio fuses on the battery compartment front wall, and should be fitted with 'Littel' type fuses of a rating recommended by the manufacturer of the system being installed.

In order to provide an interference free line, the ignition supply is controlled by a 'Mini' relay, the relay base for which is located next to the fuel pump relay on the battery compartment front wall. Fit relay part number A100M6015F.

Maximum currents to be drawn from the telephone wiring are as follows:-

- Panel lights illumination	:	1 amp	(red/brown wire)
- Earth	:	15 amps	(black wire)
- Ignition controlled supply	:	10 amps	(green wire)
- Permanent positive supply	:	10 amps	(purple wire)

A mating connector for the socket provided is available from Rists, part no. 51150006. Terminals 51101169.



MJ.9 - CENTRAL DOOR LOCKING

Central door locking actuators are fitted to both doors so that when one door is locked or unlocked, using either the exterior key barrel, or interior sill button, the opposite door will be operated in a similar manner after a half second delay. The doors should be locked only when both doors are fully closed, as if a door is locked when either door is open, or only closed only on the first latch (ajar), the CDL will operate first to lock both doors, but then after a two second delay, will unlock the doors again. This feature guards against inadvertently locking the keys inside the vehicle.

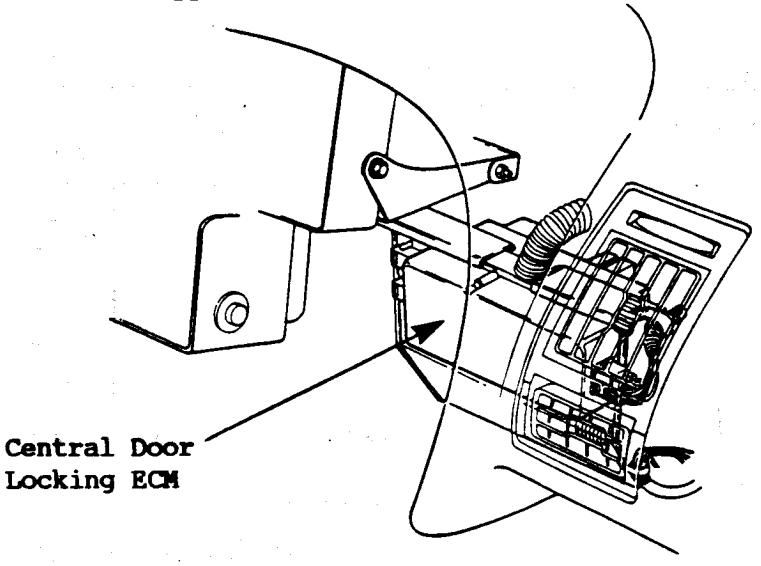
In the event of a flat battery, the CDL will not operate, and each door must be locked or unlocked manually using either the key lock or sill button. In an accident severe enough to trigger the safety inertia switch (7g), in addition to the fuel pump supply being switched off, the CDL system will operate to unlock both doors.

The system comprises the following components:

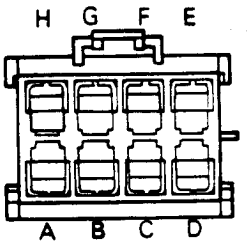
i) Electronic Control Module (ECM); Fitted to the right of the steering column on RHD cars, and to the left of the column on LHD cars. Receives and sends signals to the actuators.

ii) Latch Mechanism/Actuator Motor; One per door, comprising the door latch mechanism and integral actuator motor. Also includes a door ajar switch, and an interior lamps switch. Serviceable only as a complete assembly.

iii) Lock Sensing Switch; One per door, operated by rod from the latch mechanism. Supplies a lock status signal to the ECM.



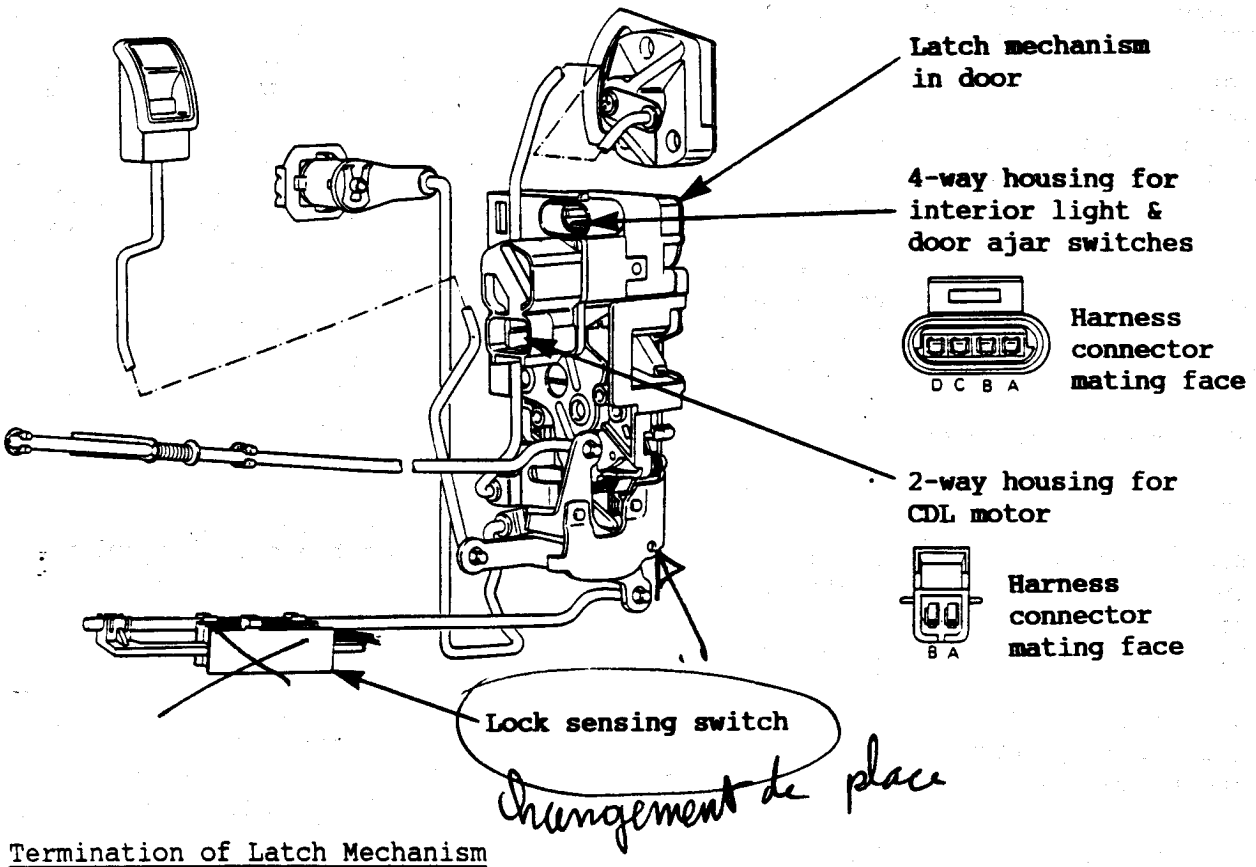
Wiring harness connector to CDL module



Viewed on mating face

Termination of Electronic Control Module

Terminal	Cable Colour	Function
A	Pink	12 volt supply from fuse no.3
B	Yellow/Black	Actuator motor - 12 volt supply to unlock, ground to lock
C	Yellow/Red	Lock sensing switch, passenger door
D	Yellow/Red	Lock sensing switch, driver's door
E	Yellow/Slate	12 volt supply from inertia switch when tripped
F	Red/Slate	To ground via door ajar switch in each latch mechanism
G	Yellow/Pink	Actuator motor - ground to unlock, 12 volt supply to lock
H	Black	Ground



Termination of Latch Mechanism

	Term.	Cable Colour	Function	Status		
				Door open	1st latch	2nd latch
Left Hand Door	A	Purple/White	Int. lamps	earthed	open	open
	B	Red/Slate	Door ajar	earthed	earthed	open
	C	-	Not used			
	D	Black	Earth			
Right Hand Door	A	Black	Earth			
	B	-	Not used			
	C	Red/Slate	Door ajar	earthed	earthed	open
	D	Purple/White	Int. lamps	earthed	open	open

Termination of Actuator Motors

Terminal	Cable Colour	Function
A	Yellow/Pink	12 volt supply to lock, ground to unlock
B	Yellow/Black	12 volt supply to unlock, ground to lock

Description of Operation

When both doors are in an unlocked condition, both lock sensing switches are closed to earth. If one door is then locked, the lock sensing switch on that door is opened. The ECM processes this signal, and after ½ second delay, operates both actuator motors by supplying 12 volts to terminal A, and a ground to terminal B. Both lock sensing switches are open.

If one door is then unlocked, the lock sensing switch on that door is grounded, and the ECM operates the actuator motors by supplying 12 volts to terminal B, and a ground to terminal A.

If an attempt is made to lock the doors when either door is open, or closed only on the first latch, the system will first operate as above to lock both doors, but then the ECM receives a signal from the door ajar switch that both doors are not fully closed, and after a 2 second delay, unlocks the doors.

For removal of the latch mechanism, or connection of the link rods, see section BJ.

MJ.10 - HEADLAMP MOTOR OPERATION

The headlamp pods are operated by electric motors which are controlled by two electronic modules. These modules can respond to sudden voltage changes, such as may occur when performing other electrical work on the car, and causing the motors operate even with the lights switched off. If carrying out electrical work in the vicinity of the pods, it is recommended to isolate the headlamp motors by unplugging the green and slate two way connectors to the motors.

The components controlling the operation of the headlamps and motors are as follows:

i) Pod Delay Module; Fitted in relay box next to the steering column. Purpose is to delay the dropping of the pods after headlamp flash, to prevent unnecessary oscillation of the pods.

ii) Pod Control Module; Fitted on the front bulkhead in the engine bay (unit has similar appearance to X180 module, but the two units are NOT interchangeable). Purpose is to control the up and down feeds to the headlamp motors, using electronic switches which sense current draw.

iii) Headlamp Lift Motors; One reversing motor operates each headlamp pod via a rotary link and connecting rod.

iv) Full Pod Travel Microswitch; One per headlamp lift mechanism. The contacts of these switches are normally closed to ground, and are opened only when the pods are fully open. Their purpose is to ensure that the headlamps are not switched on until the pods are in their fully raised position so as to avoid dazzle to other road users as the pods operate.

v) Main Beam Relay; Fitted beneath binnacle access panel.

vi) Dip Beam Relay; Fitted beneath binnacle access panel.

Sequence of Operation - Refer to Circuit Diagram Sheet 6

When the headlamps are switched on, the following sequence occurs; a 12 volt supply is applied via the 'U' cable from the lighting switch to delay module pin 6. This switches on the delay module, which then outputs a 12 volt supply

from pin 9 via the 'UR' cable to the dip beam relay, and to input pin A of the pod control module. The pod control module then operates the headlamp lift motors as follows:

L.H. motor - green cable - 12 volts from module pin C
- slate cable - earth via module pin D

R.H. motor - slate cable - 12 volts from module pin A
- green cable - earth via module pin B

Once the pods are fully raised, the control module senses the motor stall, and switches off the 12 volt supply. With the pods fully raised the microswitch contacts are opened, which causes the delay module to provide an earth to the ULG and UG cables via pins 1 and 4 respectively. The dip beam relay is thus energised, and provides a 12 volt supply to both dip beam (outer) lamps, via fuses C5 and C6.

If main beam is selected, a 12 volt supply is applied to pin 5 via the UW cable, and to the main beam relay. Because this relay is earthed through pod delay module pin 4 (UG cable), the relay will operate and provide a 12 volt supply to the main beam (inboard) headlamps, via fuses C7 and C8. The dip beam relay remains energised, and the dip beams remain lit in main beam mode.

When the headlamps are switched off, the 12 volt supply to delay module pin 6 is removed, and the delay module switches off. This results in removal of the 12 volt supply to the dip beam relay and the pod control module, and disconnection of the two earth paths on pins 4 and 1. All four headlamps are switched off. The pod control module can now find an earth path through the dip beam bulb filaments via pin C and fuses C5 and C6 (due to the dip beam relay switching off and removing the 12 volt supply from the bulbs). The control module operates to close the headlamp pods:

L.H. motor - green cable - earth via module pin C
- slate cable - 12 volts from module pin D

R.H. motor - slate cable - earth via module pin A
- green cable - 12 volts from module pin B

Once the pods are fully lowered, the control module senses the motor stall, and switches off the 12 volt supply.

Headlamp Flash Operation

Operation of the headlamp flasher switch applies a 12 volt supply via the UW cable to pin 5 of the pod delay module. When there is no voltage at pin 6 (i.e. headlamps are switched off), a flash sequence is initiated by the pod delay module - a 12 volt supply from pin 9 to the dip beam relay and pod control module causes the same sequence of operation as described above. However, 2 seconds after the dip beam lamps have switched on, the pod delay module will switch off the lamps and lower the pods. If at any time during this sequence, the flasher switch is again operated, the headlamp main beams will light in addition to the dip beams, and all four lamps will remain lit with the pods up until 2 seconds after the flasher control is released.

If the flasher control is held in the 'on' position, the same sequence of operation will occur, with all four lamps being lit until 2 seconds after the control is released.

Pod Microswitch Failure

If one of the pod microswitches should fail in the permanently grounded

condition, this will prevent both the headlamps from lighting. In such an eventuality, a temporary repair can be effected by disconnecting the faulty microswitch. This action will not affect the operation of an otherwise correctly working headlamp system.

MJ.11 - HEATED MIRROR TIMER MODULE (See Circuit Diagram Sheet 21)

The heated mirror timer module is located in the relay block adjacent to the steering column, and supplies 12 volts to the heated mirrors for a 15 minute period when activated by the heated mirror switch. The timer will be stopped and reset if the ignition is switched off, and will only restart if the heated mirror switch is pushed again.

There are 4 cables for the module:

Black	-	ground.
Green	-	12 volt input to the module (with ignition on).
Lt.Green/Blue	-	12 volt trigger from the mirror heater switch. Will only register a voltage whilst the mirror heater switch is depressed.
Red/Lt.Green	-	12 volt output to the mirror heaters for 15 minutes after the module has been activated.

MJ.12 - WIPER/WASHER SWITCH & INTERMITTENT WIPE/WASH MODULE (see Circuit Diagram 8)

The windscreen wiper/washer operation is controlled by the steering column RH lever switch, which functions electrically as follows:

OFF	OU - ON	cables connected	(terminals 53 - 53e)
SLOW	O - OU	cables connected	(terminals 53a - 53)
FAST	O - OG	cables connected	(terminals 53a - 53b)
INTERMITTENT	O - OP	cables connected	(terminals 53a - J)

The intermittent wash/wipe module is located in the relay blocks adjacent to the steering column, and is provided with 6 cables as follows:

Orange/Purple	Pin 1	12 volt supply to module from wiper switch when intermittent wipe is selected.
Orange/Brown	Pin 2	12 volt output from module to wiper motor via wiper switch.
Black	Pin 4	Ground.
Orange/Black	Pin 5	12 volt input to module from wiper motor limit switch.
Yellow/Lt.Green	Pin 6	12 volt input to module from washer switch.
Orange	Pin 8	12 volt supply to module from fuse A17.

MJ.13 - PANEL LAMPS DIMMER SWITCH & MODULE (see Circuit Diagram Sheet 22)

The brightness of the panel lamp illumination is controlled by a fascia mounted rheostat switch, and a dimmer module located in the relay blocks adjacent to the steering column.

The 6 cables connected to the dimmer module function as follows:

Pink/Black	Pin 4	To panel lamps rheostat.
Black	Pin 5	Ground.
Red/White	Pin 6	12 volt supply from sidelamps switch.
Pink/Brown	Pin 7	To panel lamps rheostat.
Red/Pink	Pin 8	Output from module to panel lamps; 2.2 V - rheostat fully counterclockwise 6.5 V - rheostat at mid position 11.6 V - rheostat fully clockwise
Pink/Lt.Green	Pin 9	To panel lamps rheostat.

The voltages on the three cables connected to the rheostat switch, should be as follows:

Rheostat turned fully counterclockwise (i.e. panel lamps off);

Pink/Brown 6.6 V
Pink/Black 10.25 V
Pink/Green 10.25 V

Rheostat at mid-position;

Pink/Brown 6.5 V
Pink/Black 8.45 V
Pink/Green 10.6 V

Rheostat turned fully clockwise (i.e. maximum brightness);

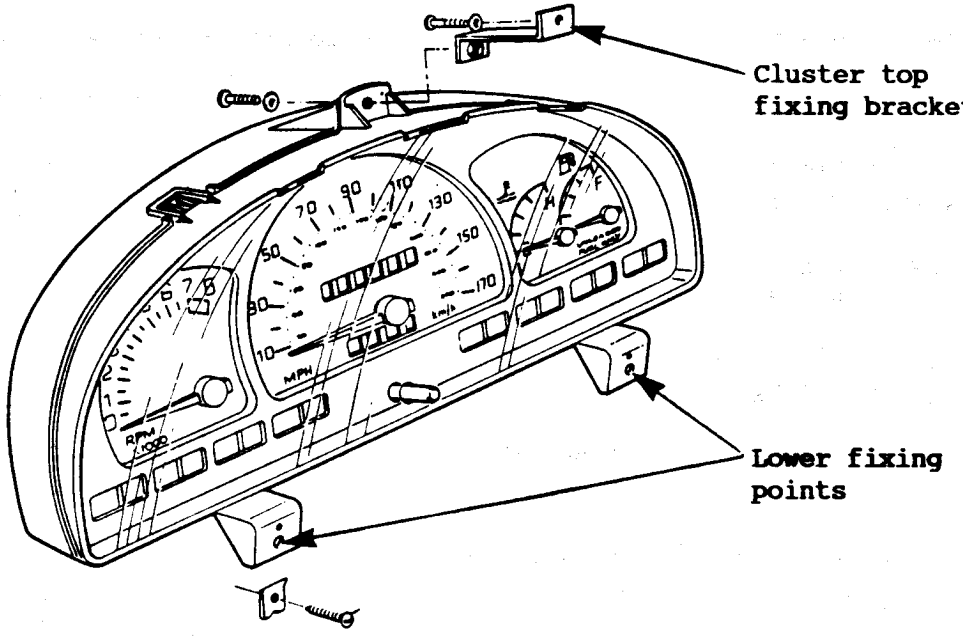
Pink/Brown 6.42 V
Pink/Black 6.43 V
Pink/Green 10.04 V

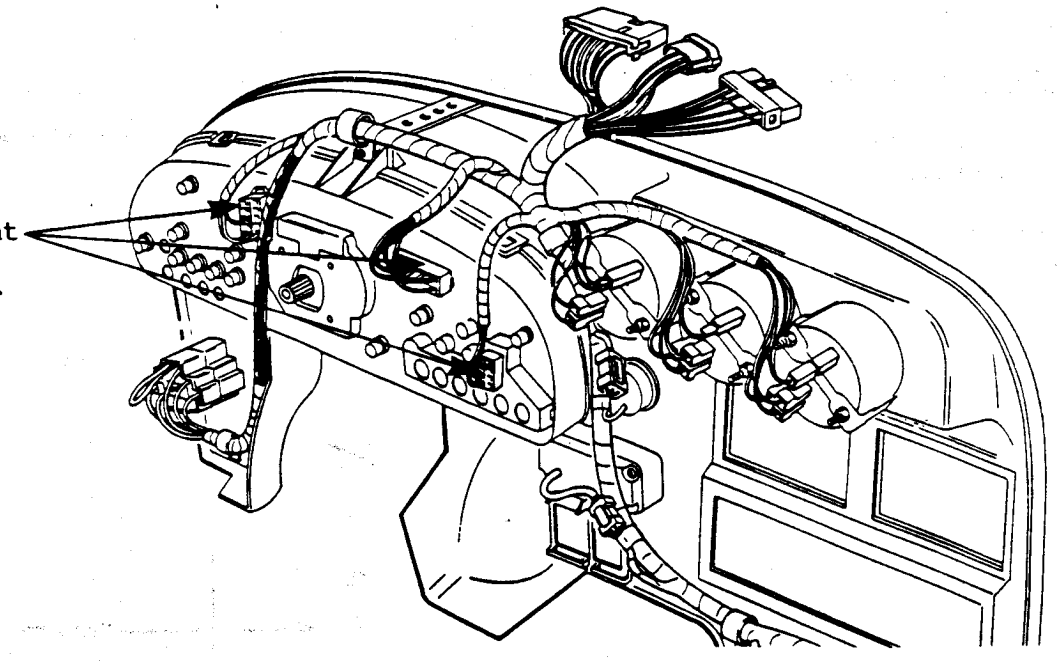
MJ.14 - INSTRUMENT CLUSTER

All the instruments in the main cluster, with the exception of the speedometer, are electrically operated. The main instrument cluster may be removed as a complete assembly via the access panel in the top of the fascia.

To Remove

- Remove the access panel in the fascia top above the instrument cluster.
- Pull out the two grommets from either side of the steering column concealing the two cluster lower fixings. Remove both screws.





- Unclip the speedo cable, and unplug the three harness connector blocks.
- Remove the single screw securing the top of the cluster to the mounting bracket, and the single screw fixing the bracket to the fascia.
- Withdraw the cluster assembly through the access hatch.

To Dismantle the Cluster

1. Pull the trip reset knob out from its snap in fixing.

2. Release the single screw securing the top of the front mask assembly, unhook the lower edge, and withdraw the mask. If necessary, pull off the two tell tale filters from their locating pins.

3. Speed Sensor: This optical pulse generator, is mounted on the top of the back of the speedo. Prise off the clip securing the printed circuit to the sensor, release the single sensor retaining screw, and withdraw the speed sensor.

4. Speedo: Release the four fixing screws, and withdraw the speedo. Do not misplace the speedo cable retaining clip.

5. Tacho: Remove the three fixing nuts and withdraw.

6. Water & Fuel Gauge (combined unit): Remove the four fixing nuts and withdraw the gauge unit. Withdraw the low fuel circuit board.

7. Voltage Regulator: Release the single screw, and unplug the three pins from the printed circuit. Withdraw the heat sink.

8. LH Tell Tale Unit: Release the two screws and withdraw.

9. Printed Circuit: Release all the bulb holders, and carefully unclip the two printed circuits.

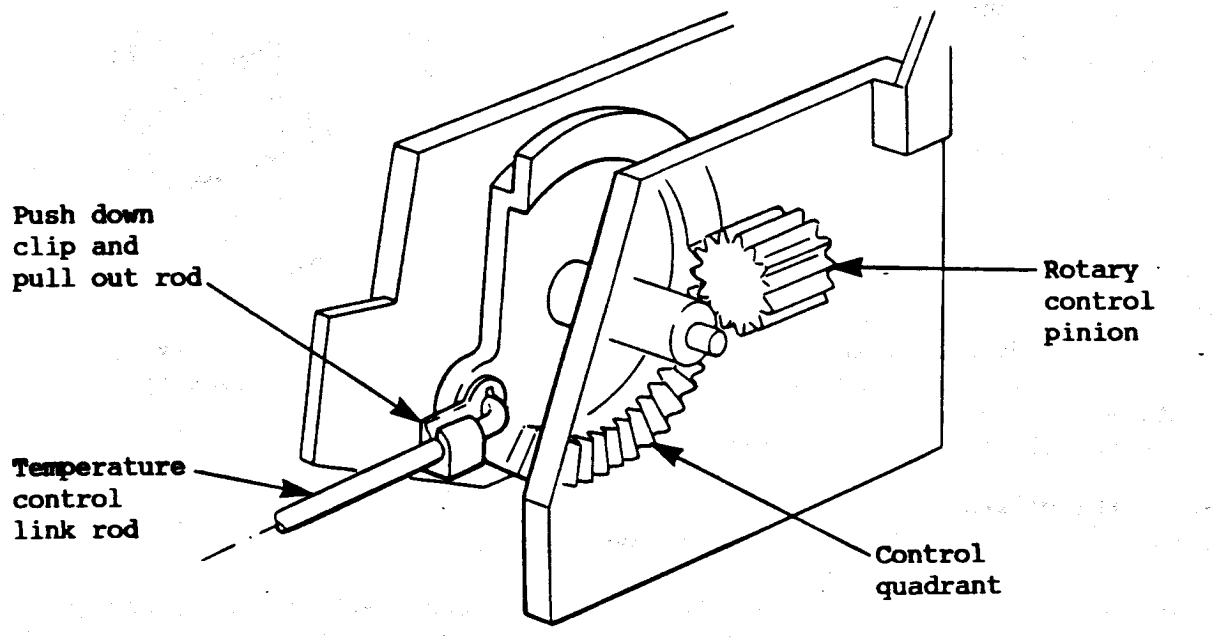
To Re-Assemble the Cluster

Reverse the disassembly sequence to re-assemble the cluster.

MJ.15 - INSTRUMENT/SWITCH PANEL (FASCIA MASK) REMOVAL

1. Use the release forks to withdraw the radio unit, and disconnect the aerial lead, speaker harnesses, and power and earth leads.

2. Remove the glovebox pivot pins, and glovebox. From the glovebox aperture, reach behind the climate control panel, and unclip the temperature control link rod from the control quadrant. Also pull off the vacuum pipes connector plug from the rotary distribution control.



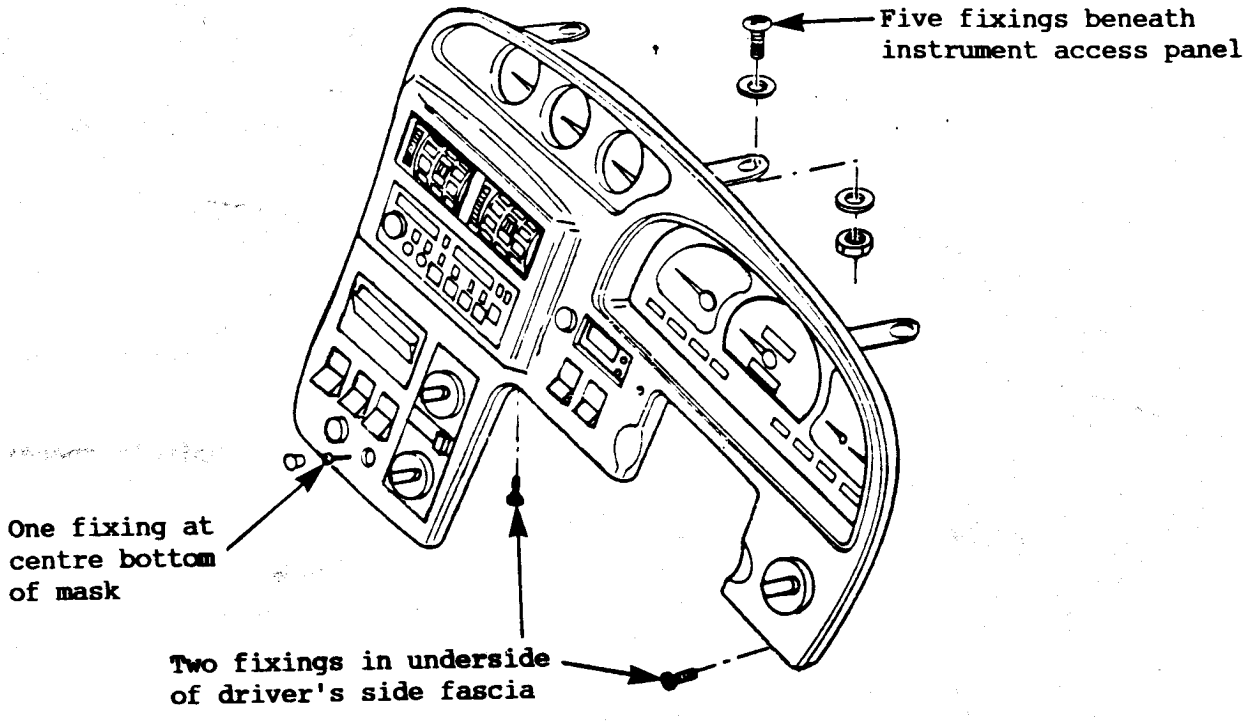
3. Remove the steering wheel: **For USA vehicles fitted with a Supplementary Inflatable Restraint (S.I.R.), see Service Notes Manual WB for precautions and procedure for removing the steering wheel.** On all other vehicles:
   - press the centre horn pad and turn counterclockwise to release from the bayonet type fixing;
   - remove the nut and washer retaining the steering wheel;
   - mark the reletive positions of the wheel and inner column to aid refitting;
   - pull the wheel off the column using minimum force. If necessary, use a suitable puller.

   DO NOT apply excessive axial force to either the inner or outer column without the use of a steering wheel puller, or the mechanism retaining the telescopic length of the collapsible column may be overridden, necessitating column replacement.

4. Remove the column shrouds. Press down the plastic tabs retaining the column switches, and slide the switches from their carrier bracket.

5. Release the two screws, and remove the instrument access panel from the top of the binnacle. Disconnect the speedo cable, and the three instrument/ switch harness connector blocks. Release the three fixings securing the fascia mask to the main fascia.

6. Remove the two blanking plugs in the bottom edge of the driver's side fascia, and release the two fixing screws.



7. Remove the blanking plug at the bottom of the fascia mask, adjacent to the cigar lighter, release the lower fixing, and withdraw the fascia mask.

8. Release the two screws securing the climate control panel into the fascia mask, and withdraw.

To refit the instrument/switch panel, reverse the removal procedure, noting the following points:
- when refitting the radio, use the access provided by the glovebox aperture to ensure that the spigot on the back of the radio engages with the support bracket fixed to the scuttle brace.
- torque tighten the steering wheel nut to 40 Nm (30 lbf.ft).

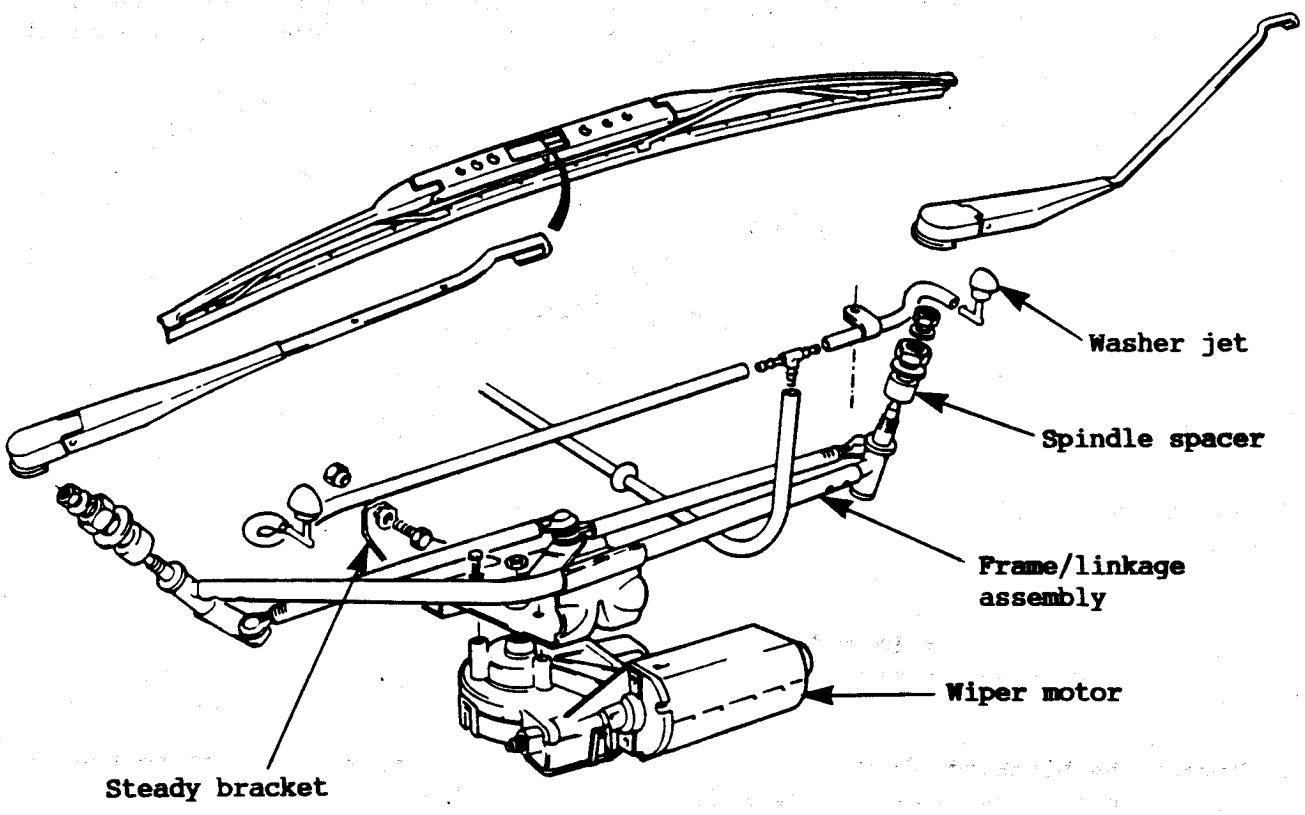
MJ.16 - WIPER MECHANISM

The wiper mechanism consists of a two speed motor with an output crank connected to the cranks of two wiper arm spindles by rigid tubular links, using maintenance free nylon spherical joints. A wiper arm is mounted onto each spindle, and carries a 585 mm blade assembly. The two wiper blades are identical, but the wiper arms differ, with a straight arm on the driver's side, and a cranked arm on the passenger side. The wiper spindles are carried in pivot housings which are clamped to the body, and are interconnected with each other by a tubular frame, to which the motor is also mounted. A steady bracket connects the motor mounting to the front bulkhead.

Other than the arms and blades, the only serviceable items of the wiper mechanism are the motor, and the complete frame/linkage assembly.

Removal

To remove the wiper motor from the mounting frame:
Remove the nut securing the motor rotary link to the motor shaft, and disconnect the link from the motor.



- Release the three fixings securing the motor to the bracket, and withdraw the motor, disconnecting the harness connector plug.

To remove the wiper linkage assembly, first remove the motor as above, then:

- Remove both wiper arms.
- Remove the spindle nuts and washers.
- Remove the four screws and washers securing the linkage assembly to the bulkhead mounting bracket.
- Ease the spindles out of their body holes, and remove the linkage assembly from the car. On RHD cars, first slide the assembly towards the RH wheelarch (release the wheelarch liner if necessary) to enable the left hand spindle to be lifted over the engine.

To refit the assembly (with mounting bracket fitted to bulkhead):

1. Check that the 5mm spacer is fitted over each spindle before feeding the mechanism behind the engine, and locating the spindles through their body holes. Fit the rubber washer, plain washer and nut to each spindle housing, and fit the four M6 screws and washers securing the mechanism to the mounting bracket. Torque tighten the spindle nuts to 5 Nm (3.7 lbf.ft), and tighten the M6 screws.

2. Plug in the wiper motor connector block as the motor is fed into position, and fit the three bolts securing the motor to the mounting bracket. Switch the wiper control on and off in order to 'park' the motor. Ensure that each wiper spindle arm is pointing forwards before fitting the rotary link onto the motor shaft, with the link pointing towards the driver's side, and at

'bottom dead centre' with the movement of the tubular links about to change direction. Fit the rotary link retaining lockwasher and nut, and torque tighten to 15 - 20 Nm (11 - 15 lbf.ft) whilst resisting the torque by holding the rotary link. i.e. do not allow the tightening torque to be transmitted through the motor gears.

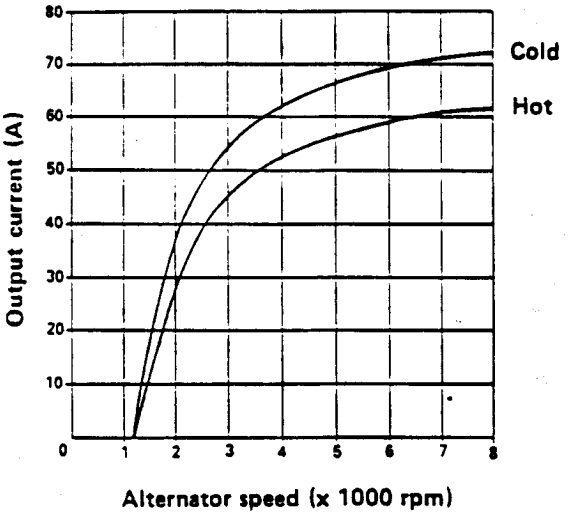
3. Fit the wiper arms (straight arm on the driver's side, angled arm on the passenger side) to their spindles in the park position, and retain each with its washer and nut.

4. Check the operation of the wipers on a wet screen.

MJ.17 - ALTERNATOR

The 12 volt 60 amp alternator is mounted on the rear side of the engine, and is driven by multi-vee belt from the front end of the crankshaft. The correct belt tension is 41 ± 9 kg (90 ± 20 lbf) using a Burroughs gauge.

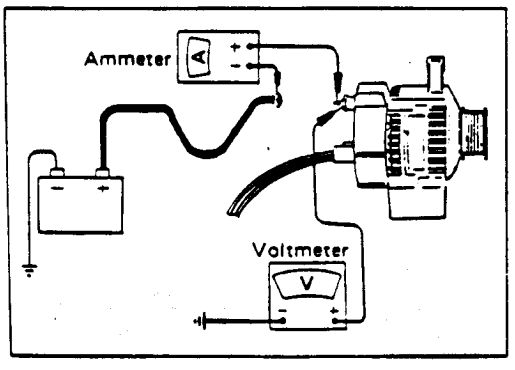
Output Characteristics



Checking Alternator Output

1. Disconnect the output terminal of the alternator, and connect an ammeter between the main lead and the output terminal, with the meter +ve lead to the alternator. Run the engine at 2080 rpm and check the ammeter reading.

   Standard amperage = 9 - 11 amps



2. Switch on the headlamp main beams, air conditioning and fast speed blower fan. Run the engine at 2080 rpm and check the ammeter reading.

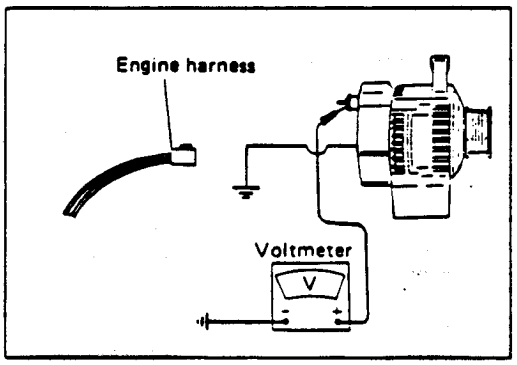
   Specific amperage = more than 60 amps

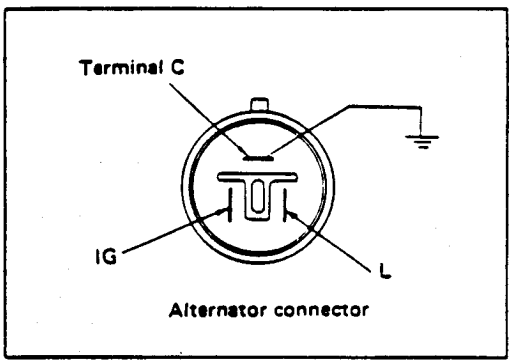
3. Switch off all electrical loads. Connect the +ve lead of a voltmeter to the alternator output terminal, and the voltmeter negative lead to ground. Run the engine at 2080 rpm, and check the voltmeter reading.

   Regulated voltage = 14.2 - 14.8 volts

4. Disconnect the harness connector block from the alternator. Connect the +ve lead of a voltmeter to the output terminal, and the voltmeter -ve lead to earth. Earth alternator terminal C. Run the engine at 2080 rpm, and check the voltmeter reading.

   Regulator voltage = 12.5 - 13.1 volts





If any meter readings are outside of specification, the alternator should be repaired by a competant auto-electrician, or replaced.

MJ.18 - STARTER MOTOR

The pre-engaged type starter motor, fitted at the rear side of the engine, uses reduction gearing, and an overrunning clutch.

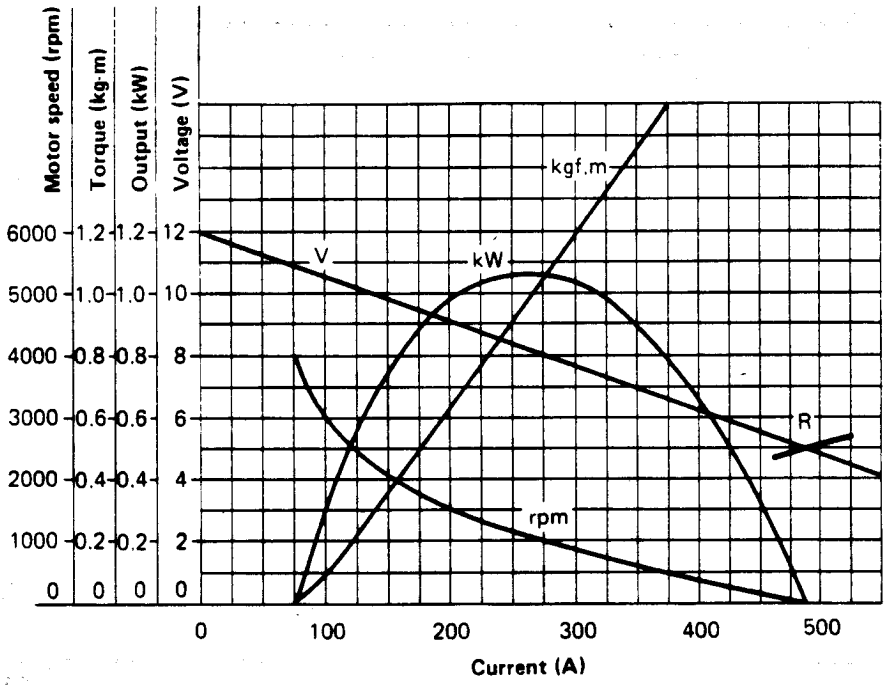
Main Data

Rated voltage	12 V
Rated output	1.2 Kw
Rated time	30 secs.
No. of pinion teeth	9
Direction of rotation	Clockwise (viewed from pinion end)
No load characteristics:	
- Voltage/current	11.5V/90A or less
- Speed	3,000 rpm or less
Load characteristics:	
- Voltage/current	8V/280A
- Torque	1.0 kgf.m
- Speed	900 rpm or more
Locking characteristics:	
- Voltage/current	2.5/400 or less
- Torque	1.1 kgf.m or more

Magnetic Switch @ 20°C:

- Series coil resistance	approx 0.35 ohms
- Shunt coil resistance	approx 1.08 ohms

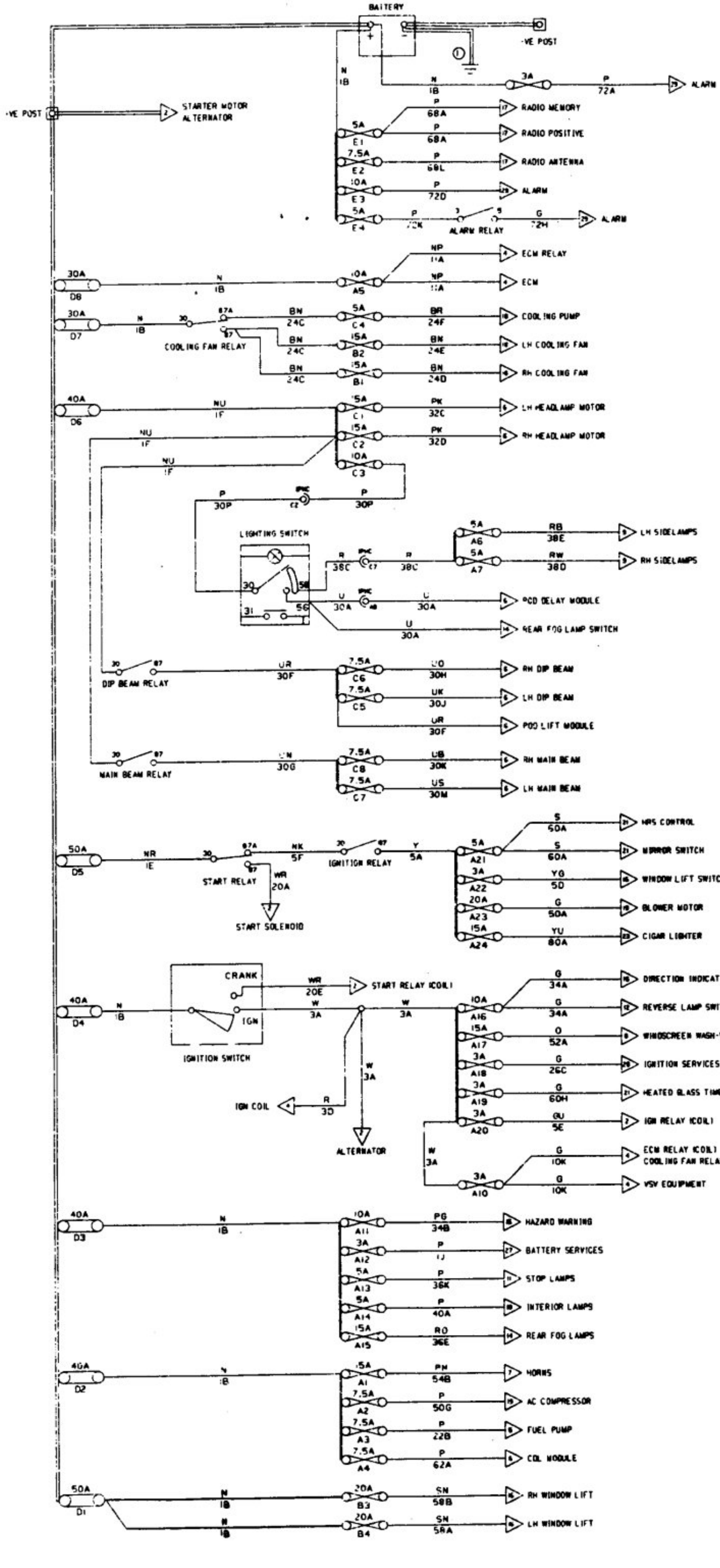
Output Characteristics



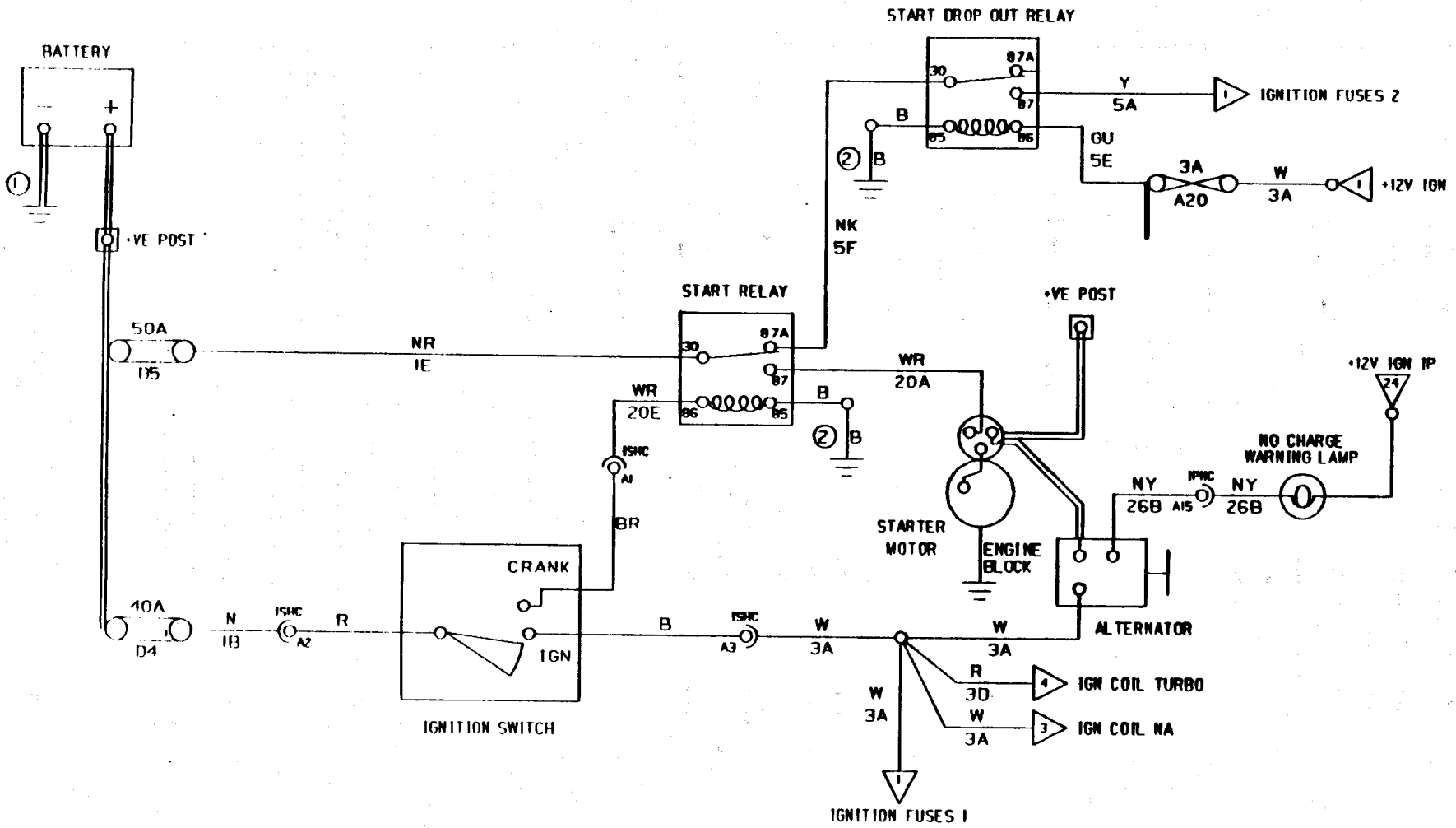
MJ.19 - CIRCUIT DIAGRAMS

Index

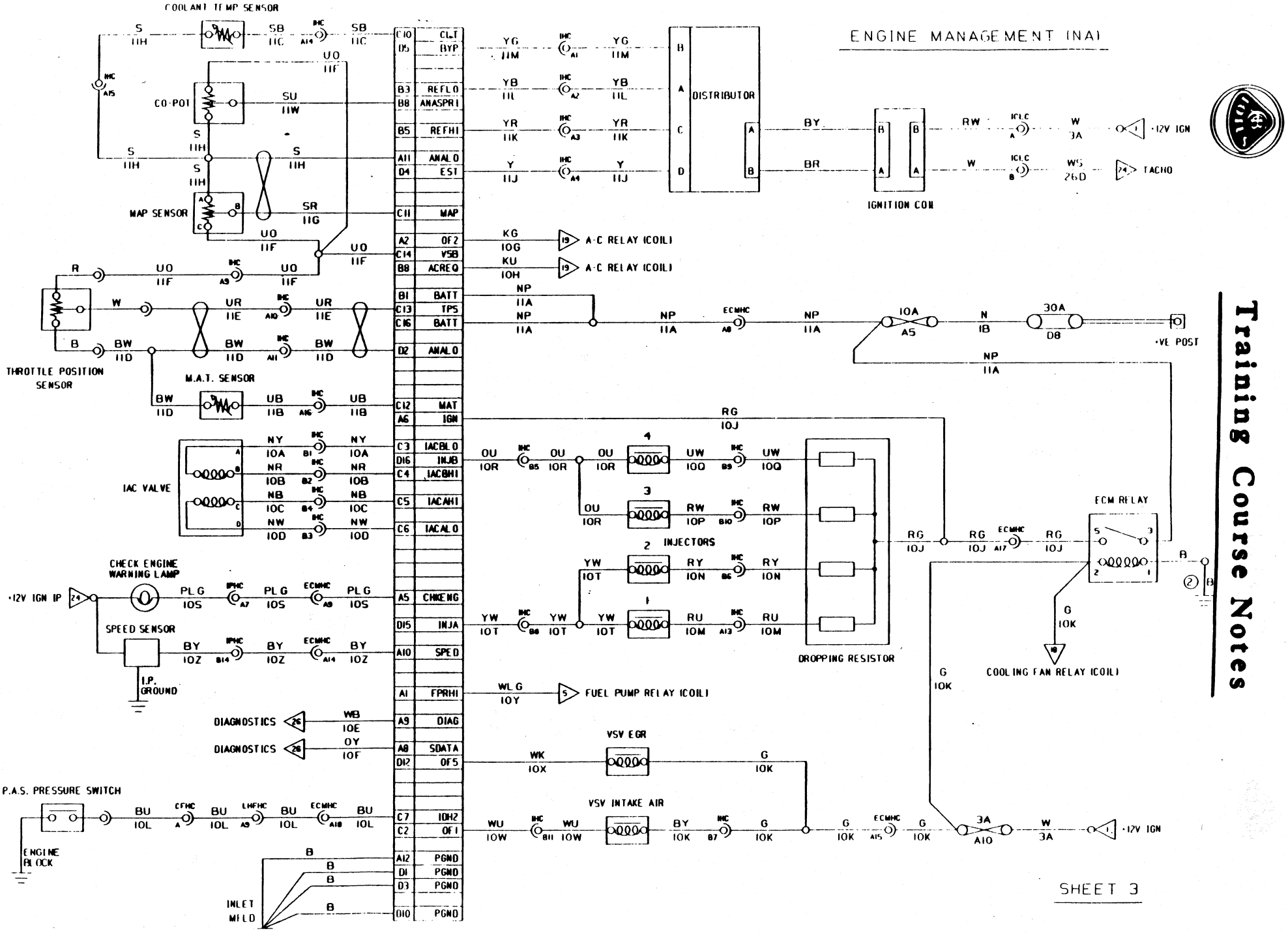
SUPPLIES

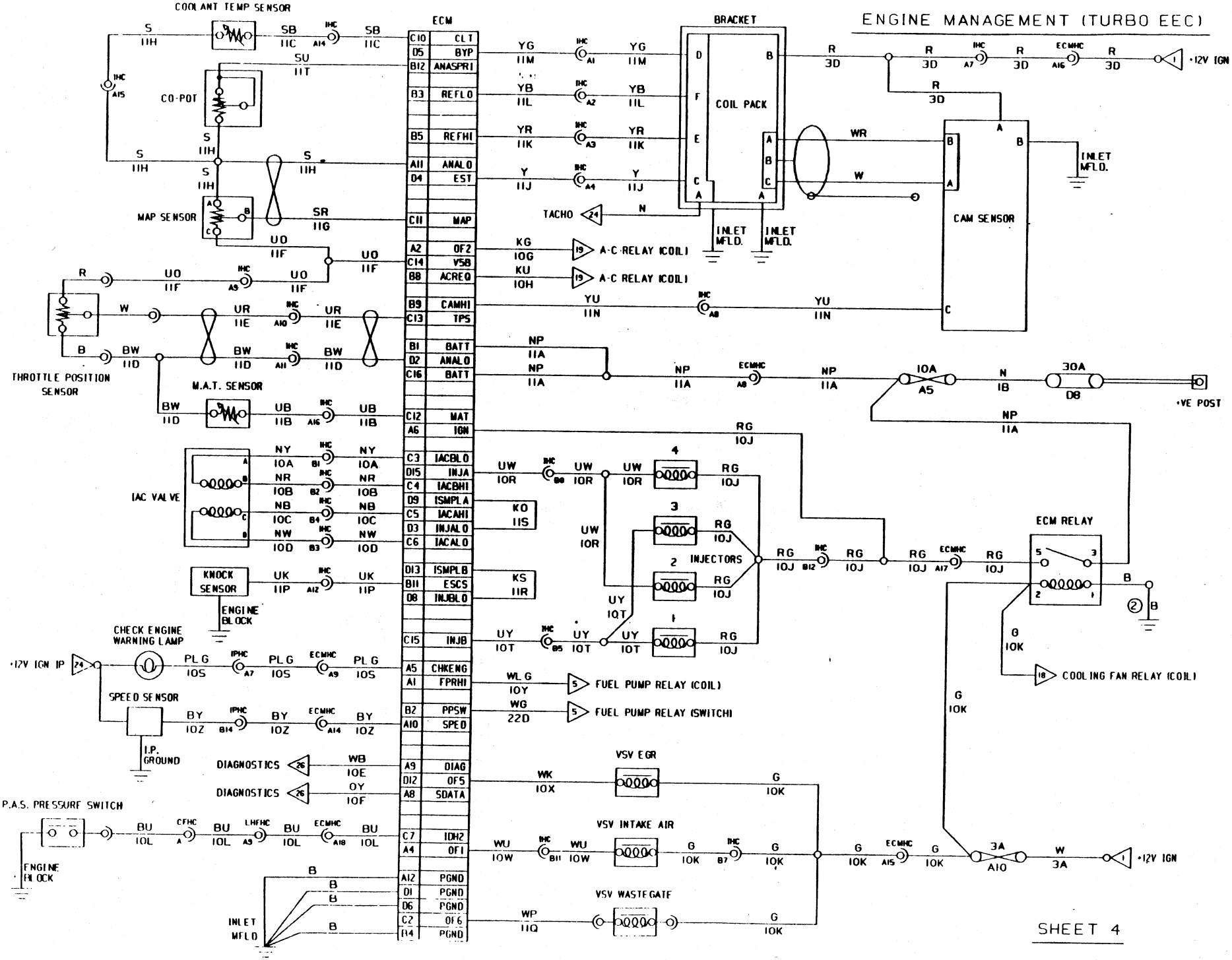


START , ALTERNATOR & IGNITION



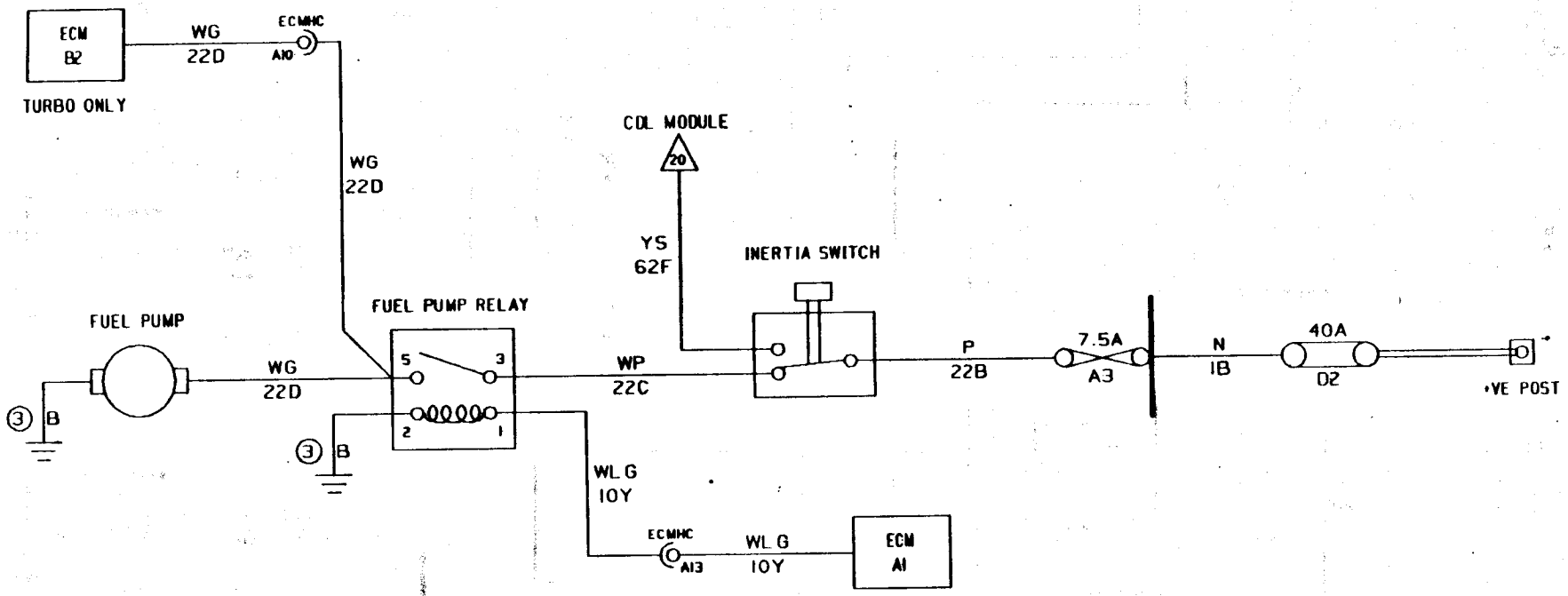
SHEET 2





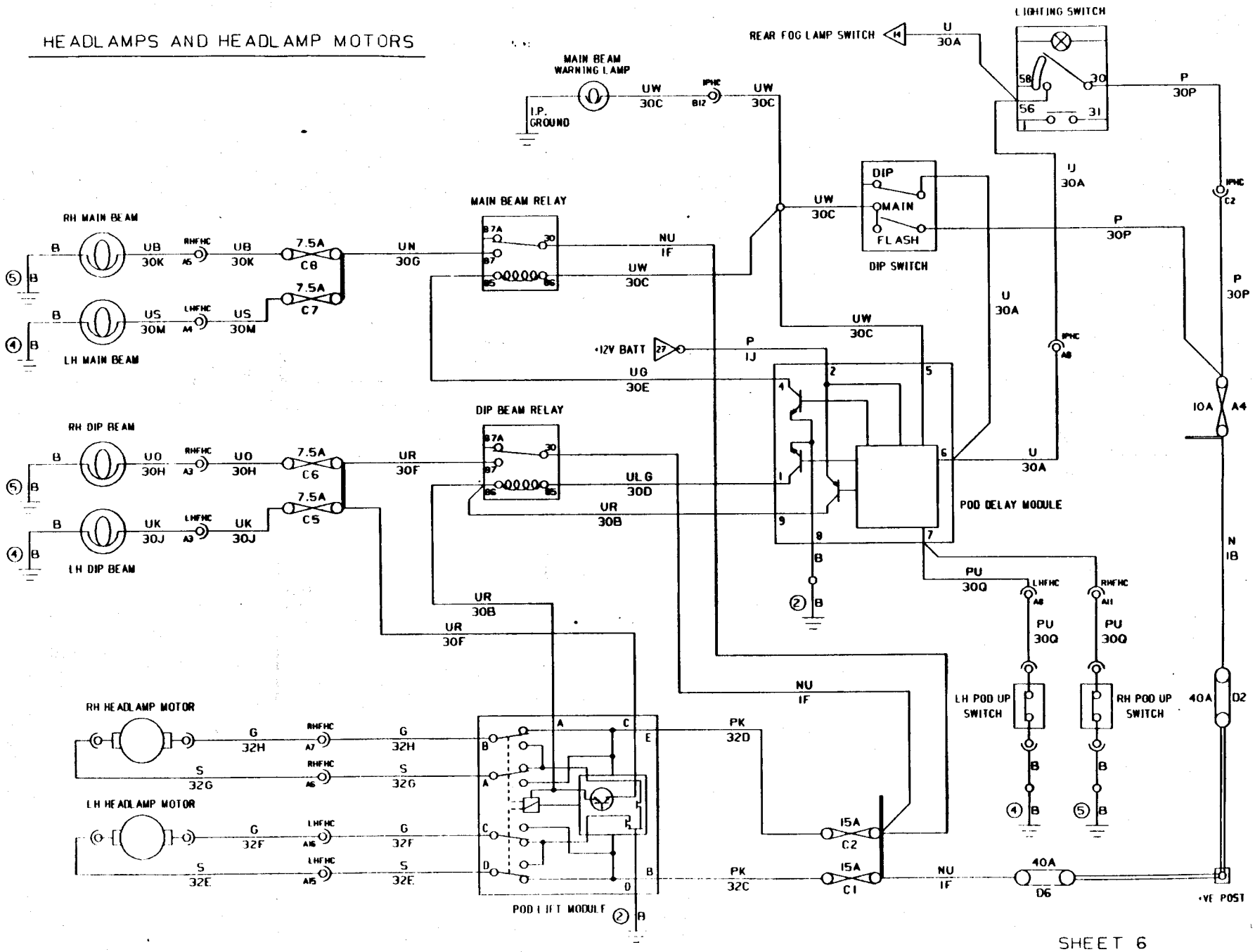
Training Course Notes

FUEL PUMP



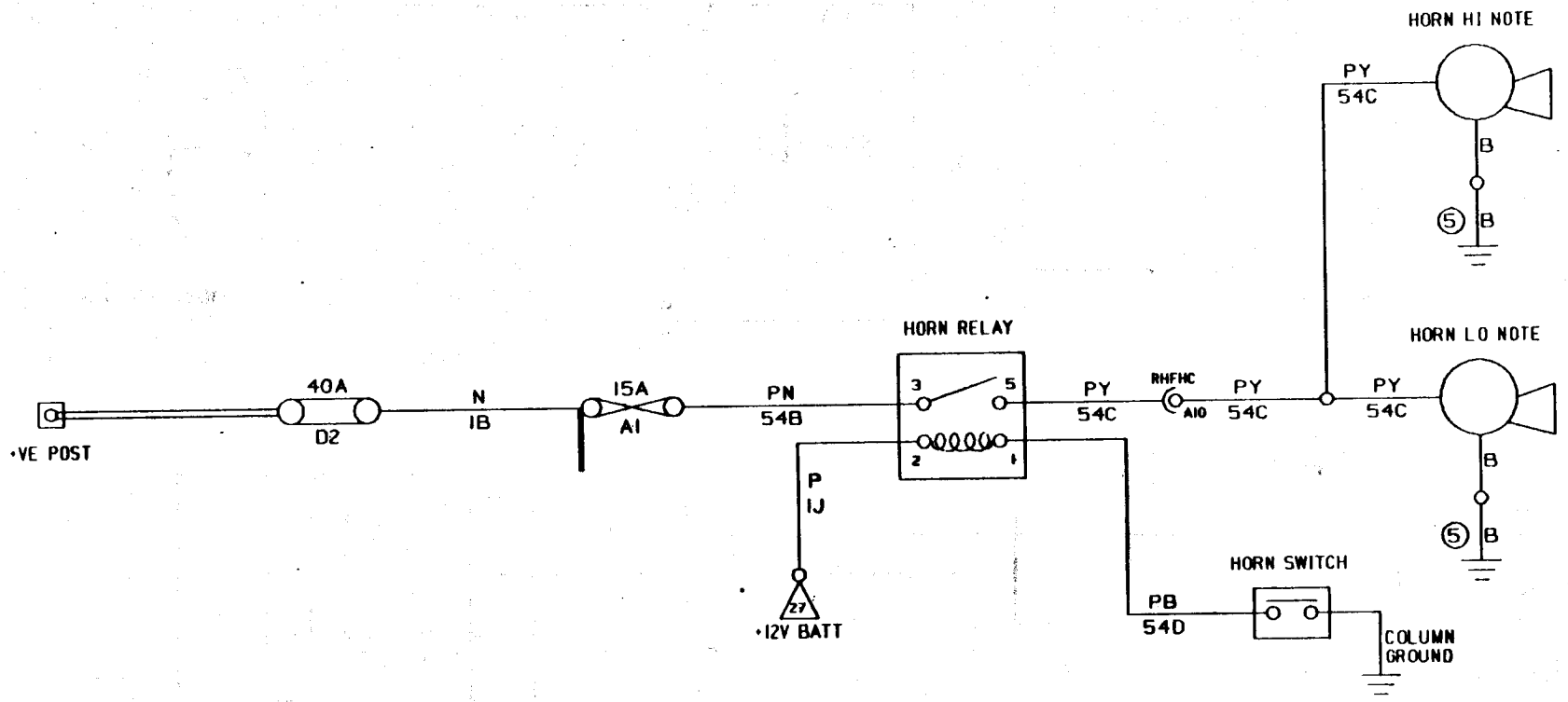
Training Course Notes

HEADLAMPS AND HEADLAMP MOTORS



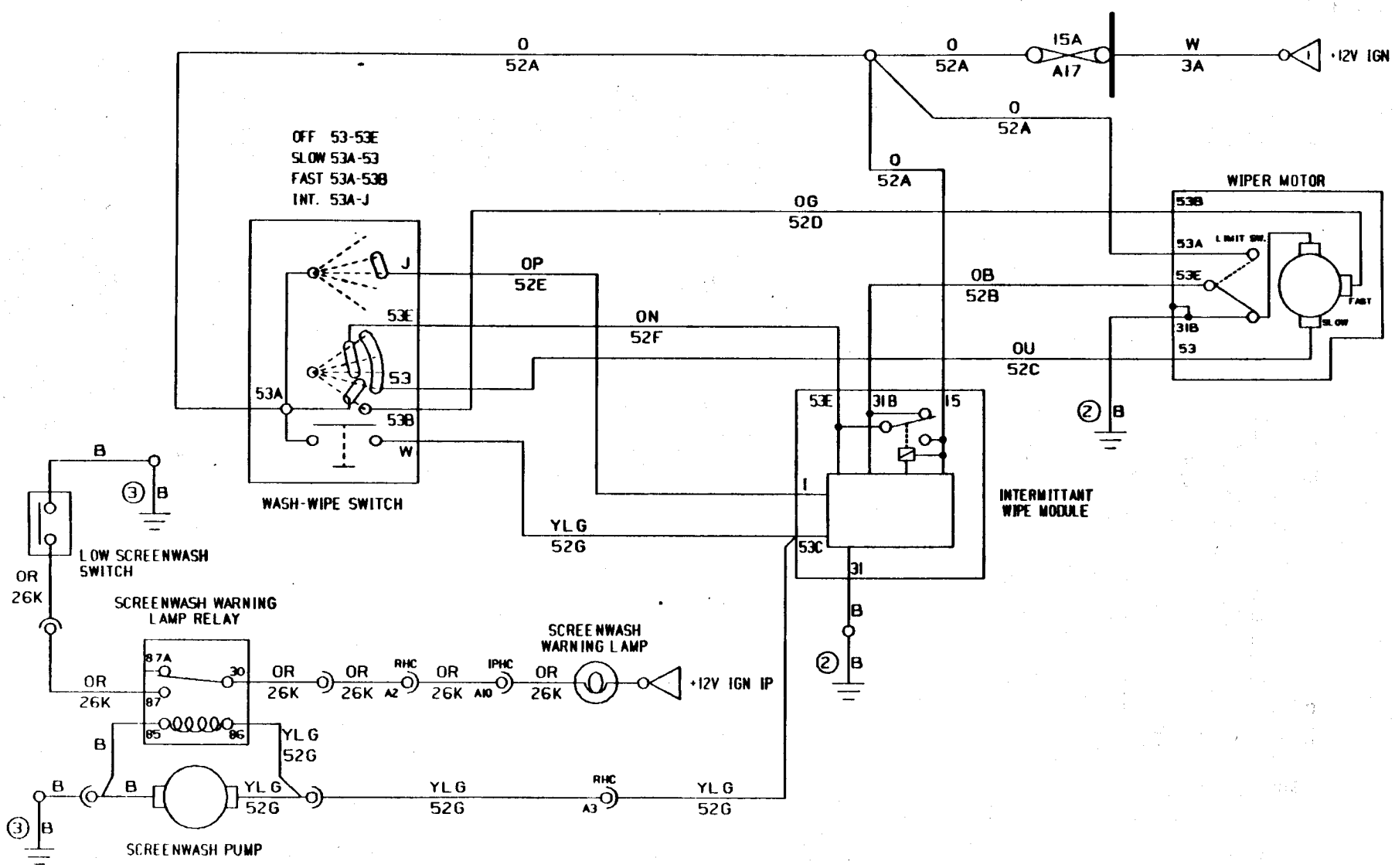
Training Course Notes

HORNS



Training Course Notes

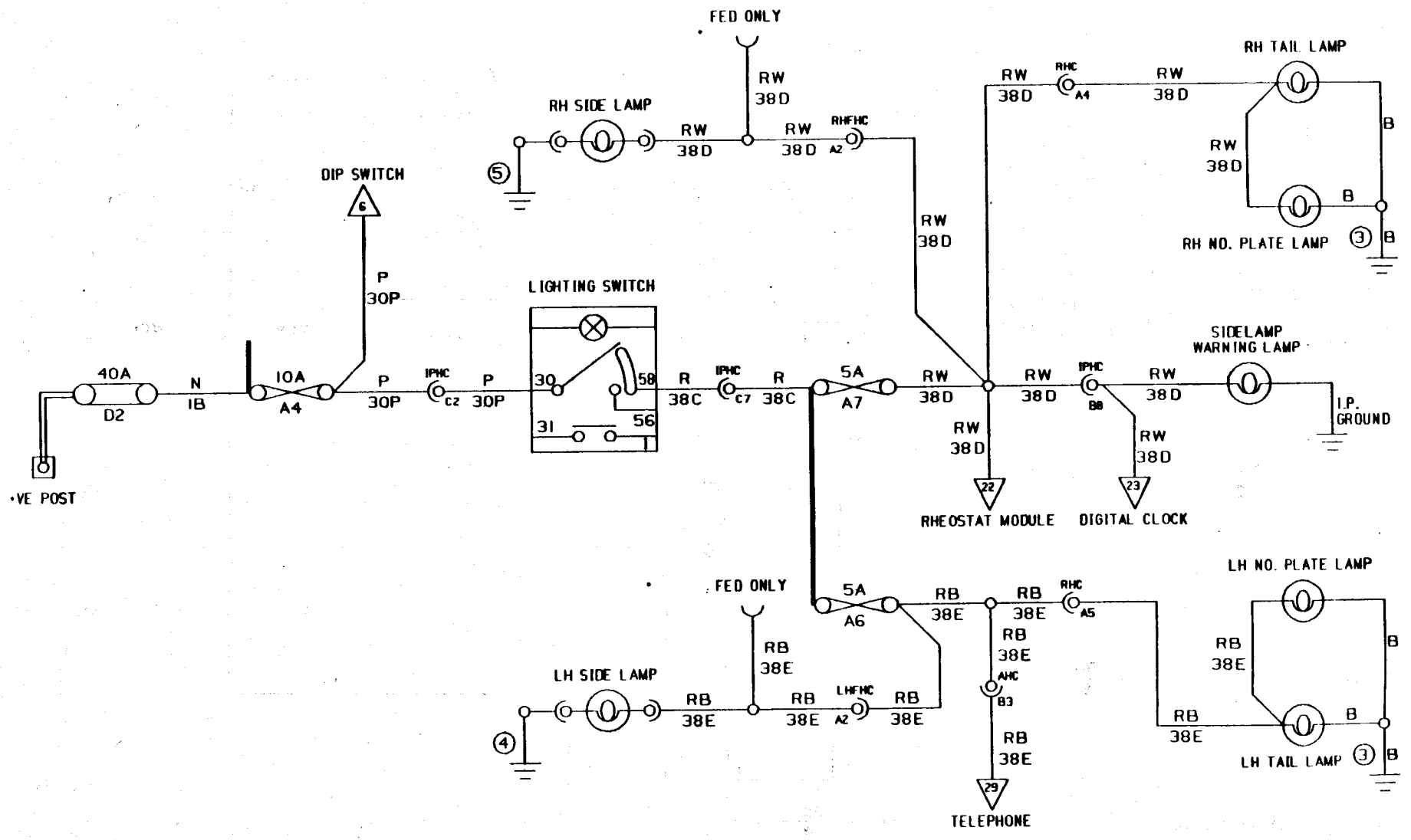
WINDSCREEN WASH-WIPE



Training Course Notes

SHEET 8

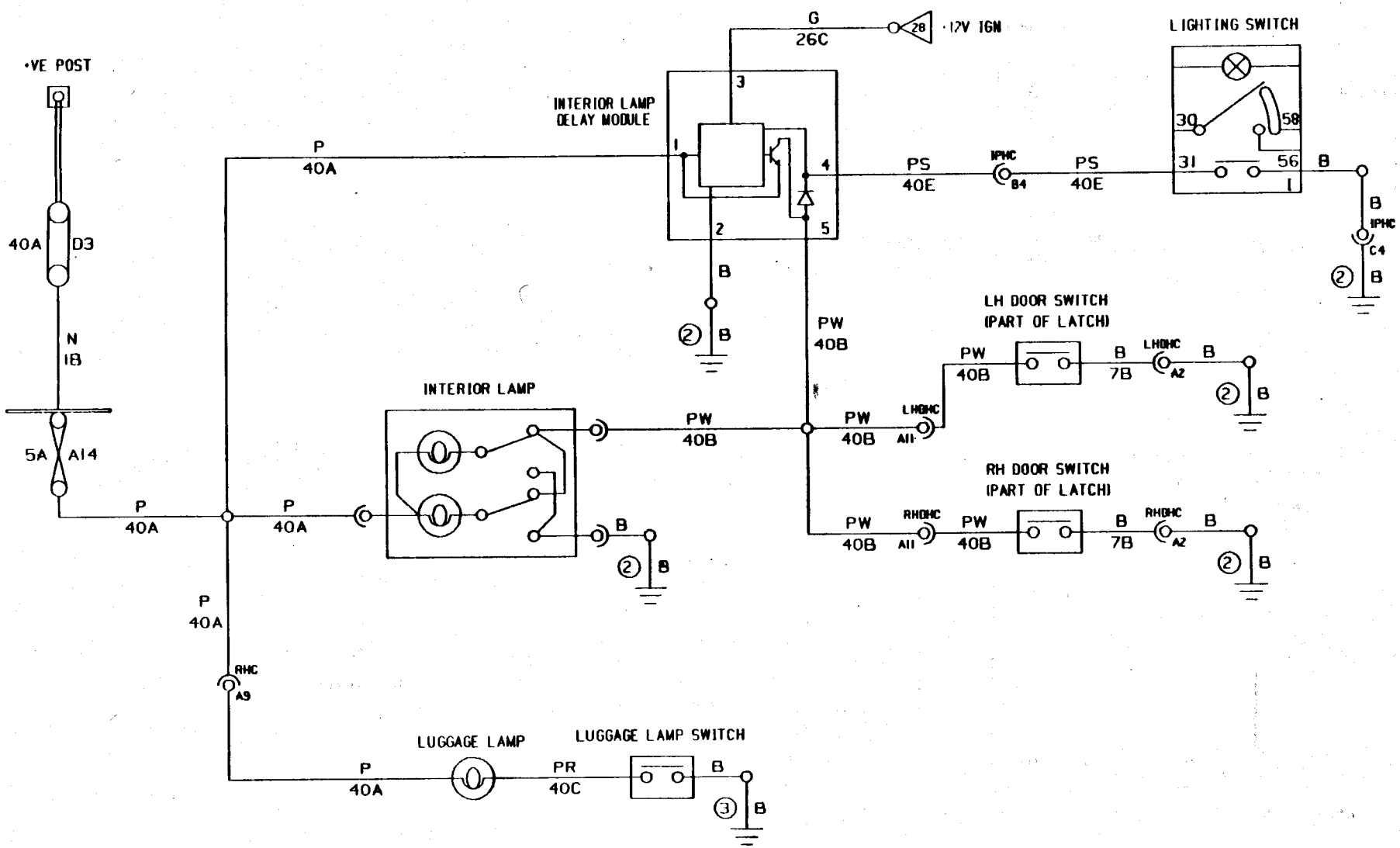
SIDE AND TAIL LAMPS (EEC)



Training Course Notes

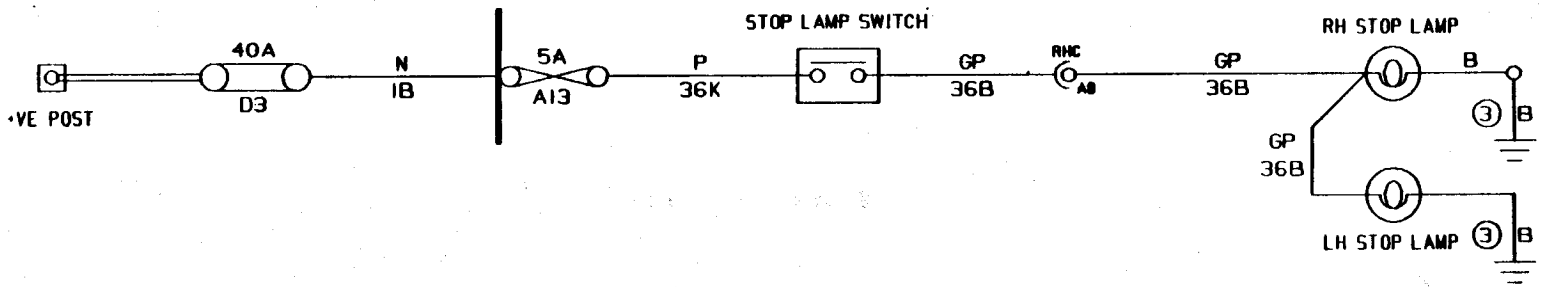
SHEET 9

INTERIOR LAMPS

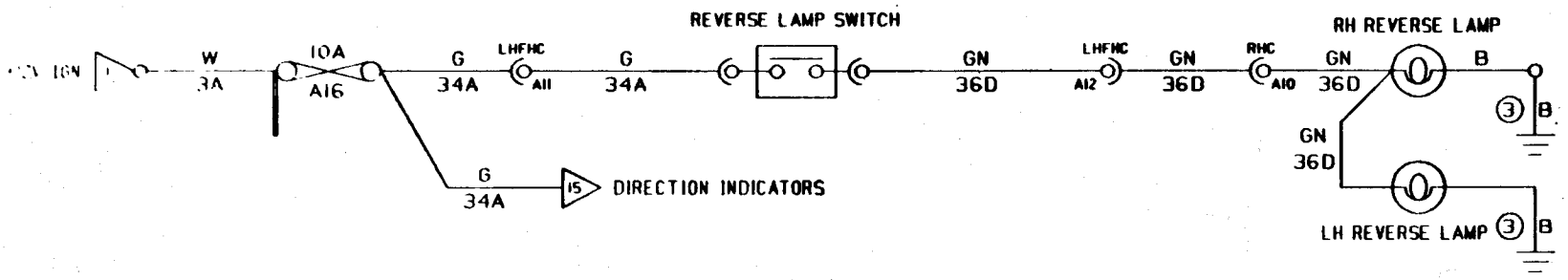


Training Course Notes

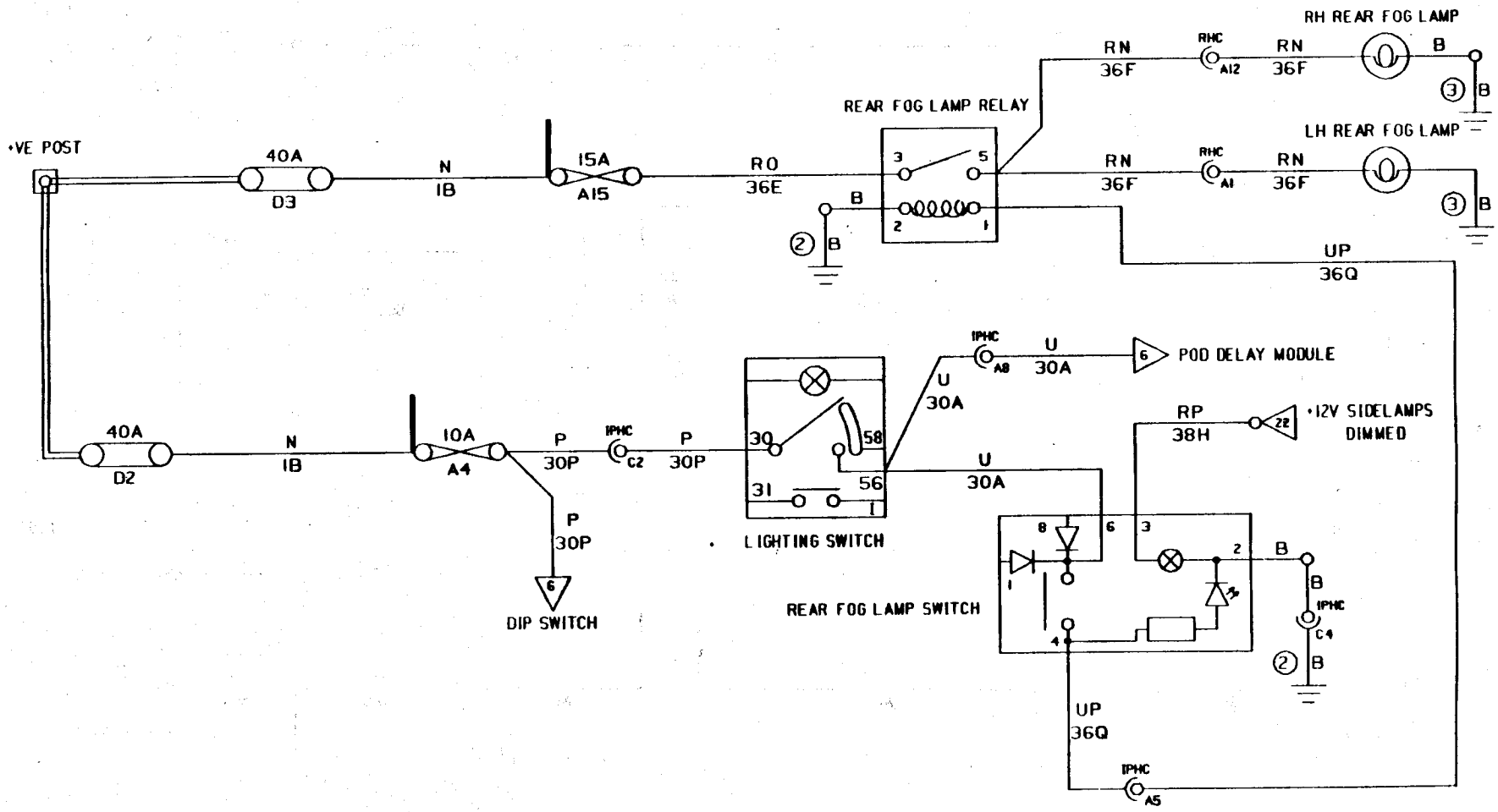
STOP LAMPS



REVERSE LAMPS

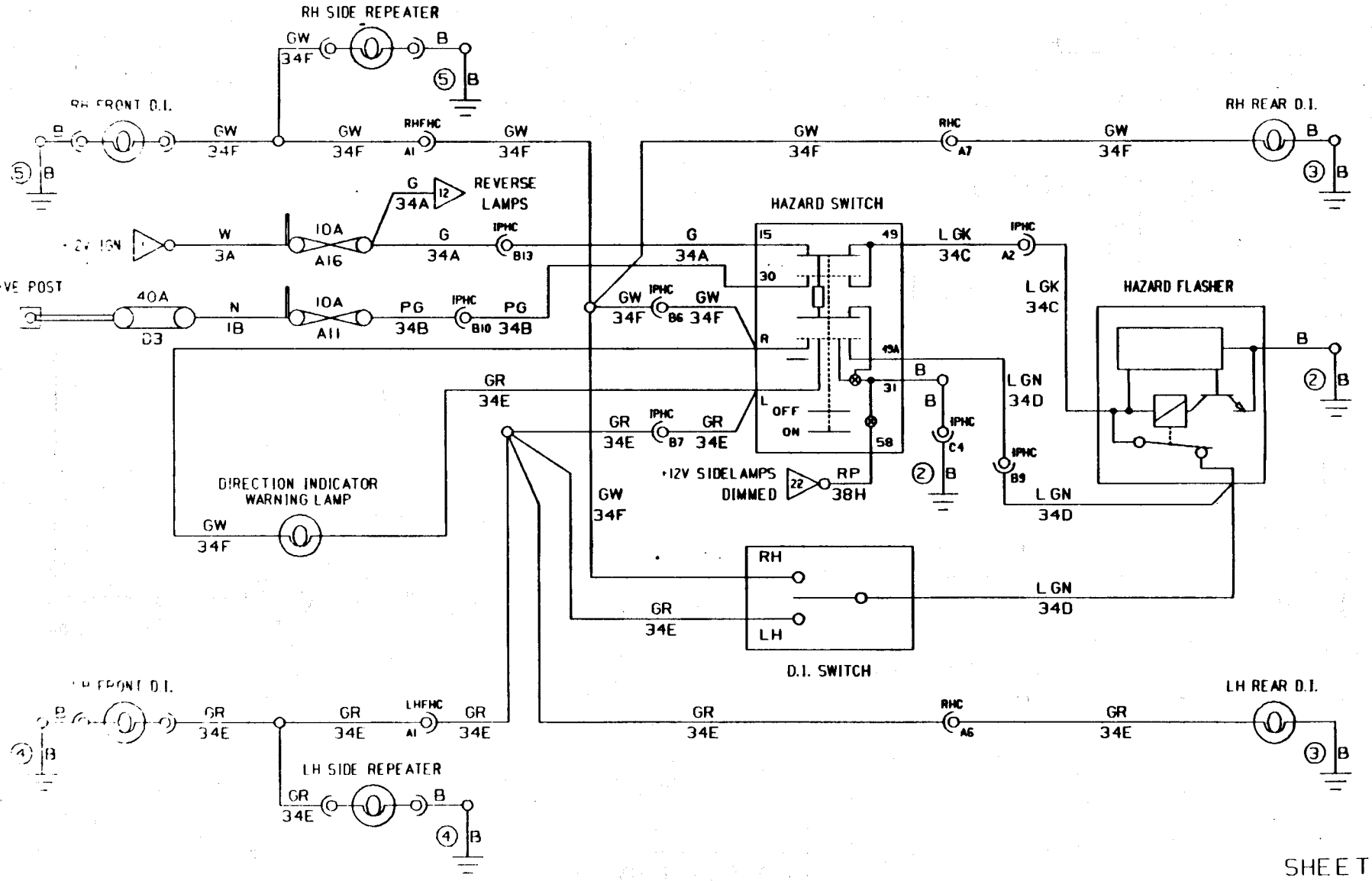


REAR FOG LAMPS



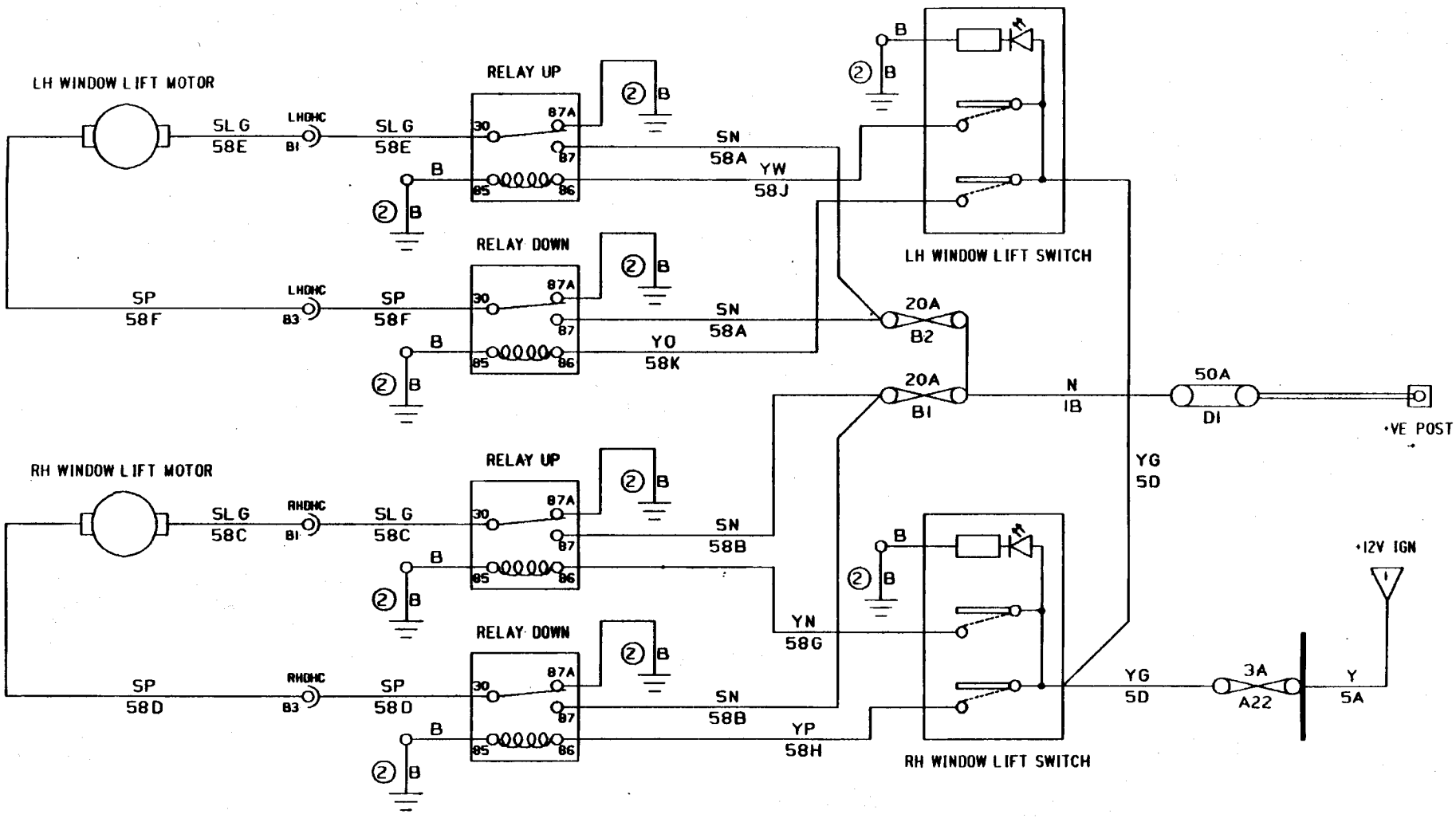
Training Course Notes

DIRECTION INDICATORS AND HAZARD (EEC)



Training Course Notes

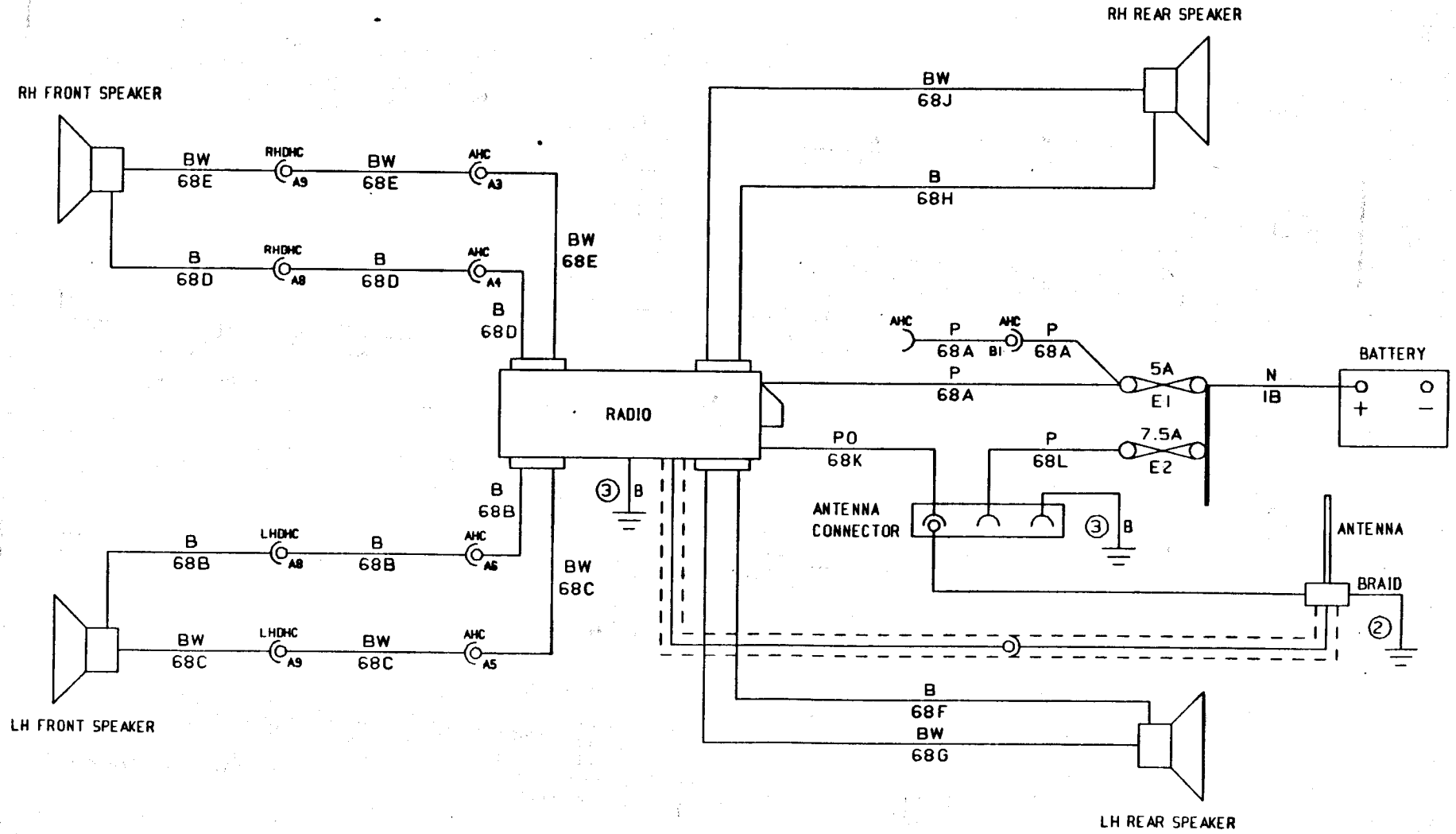
WINDOW LIFT



Training Course Notes

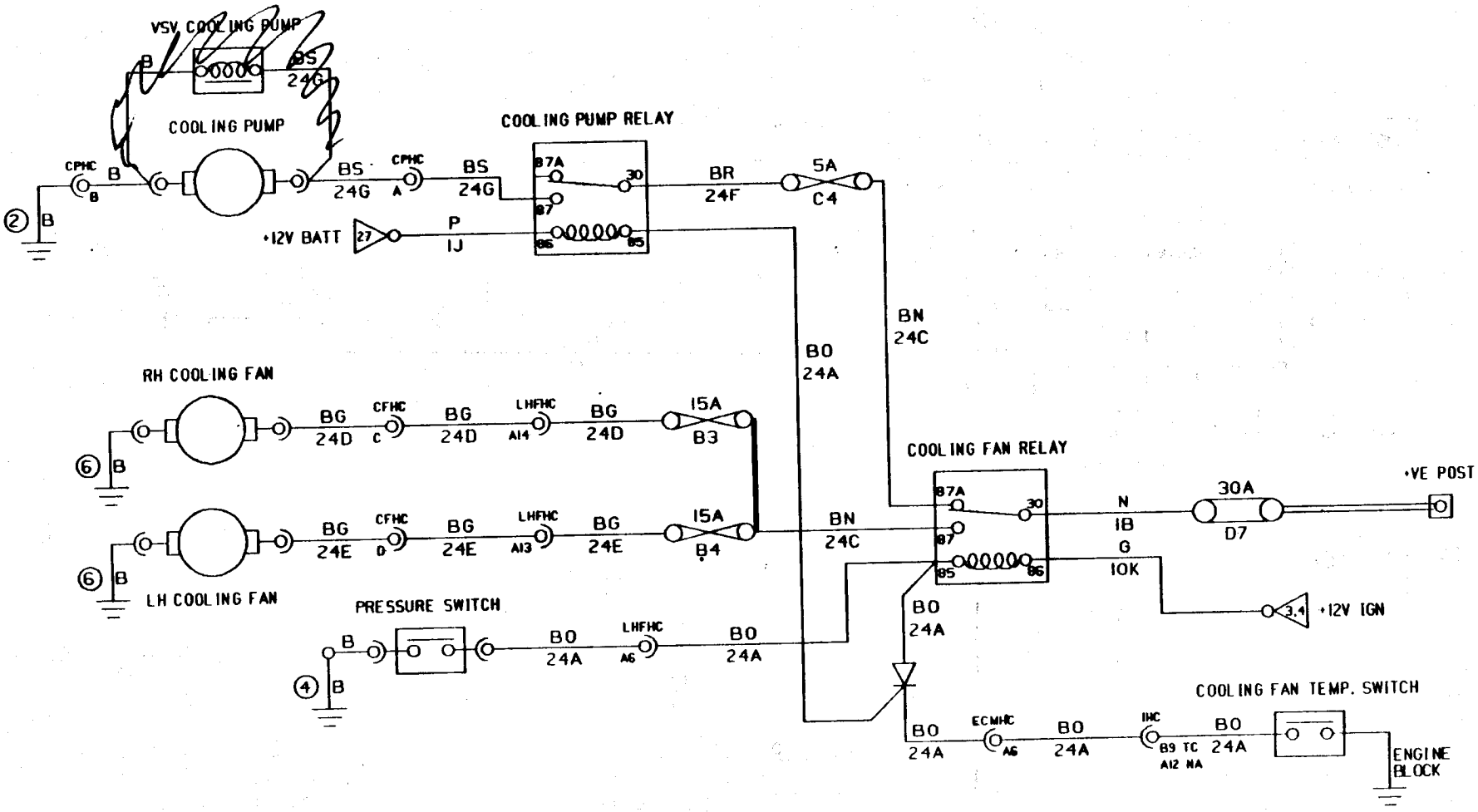
SHEET 16

IN CAR ENTERTAINMENT



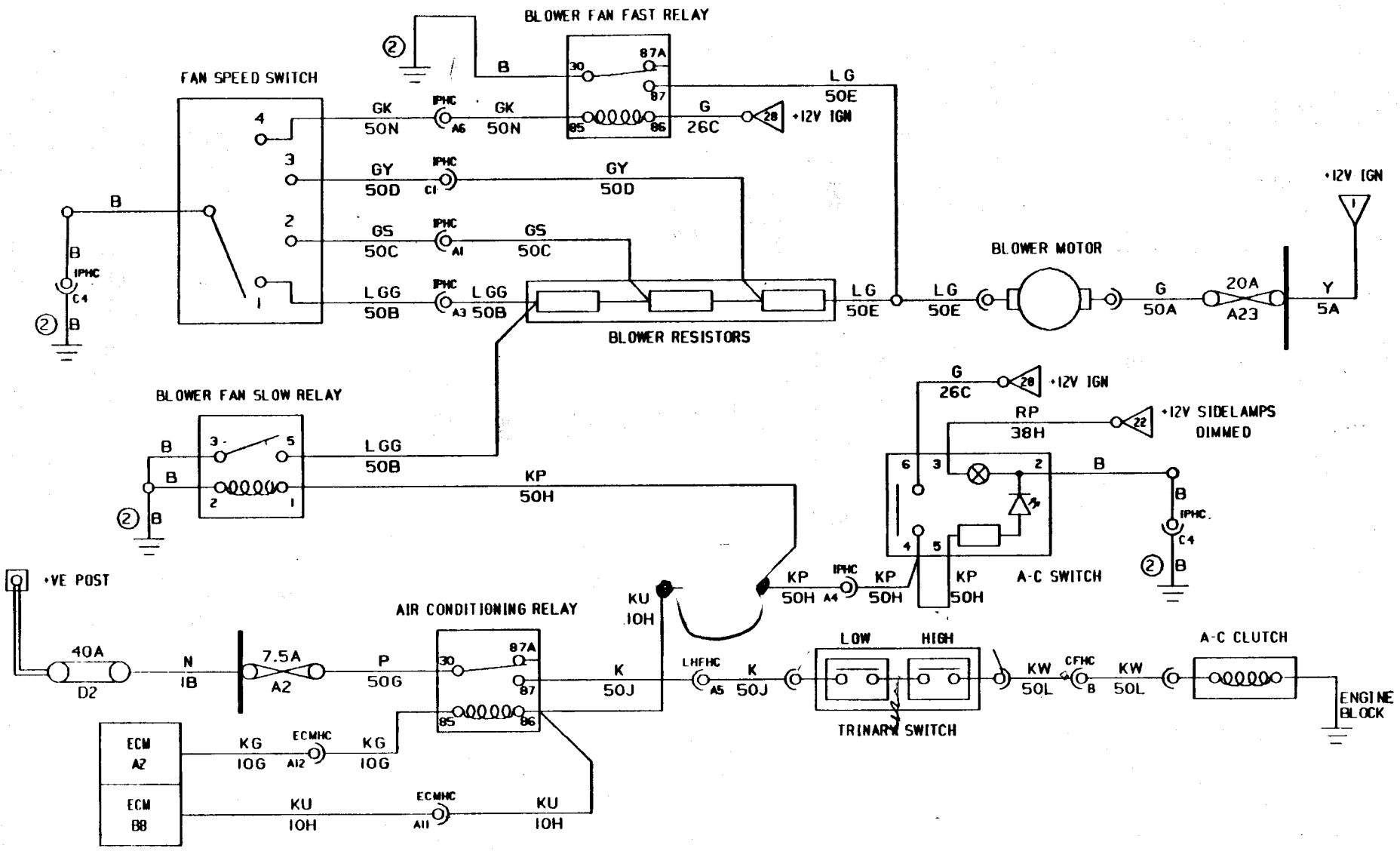
Training Course Notes

COOLING FANS



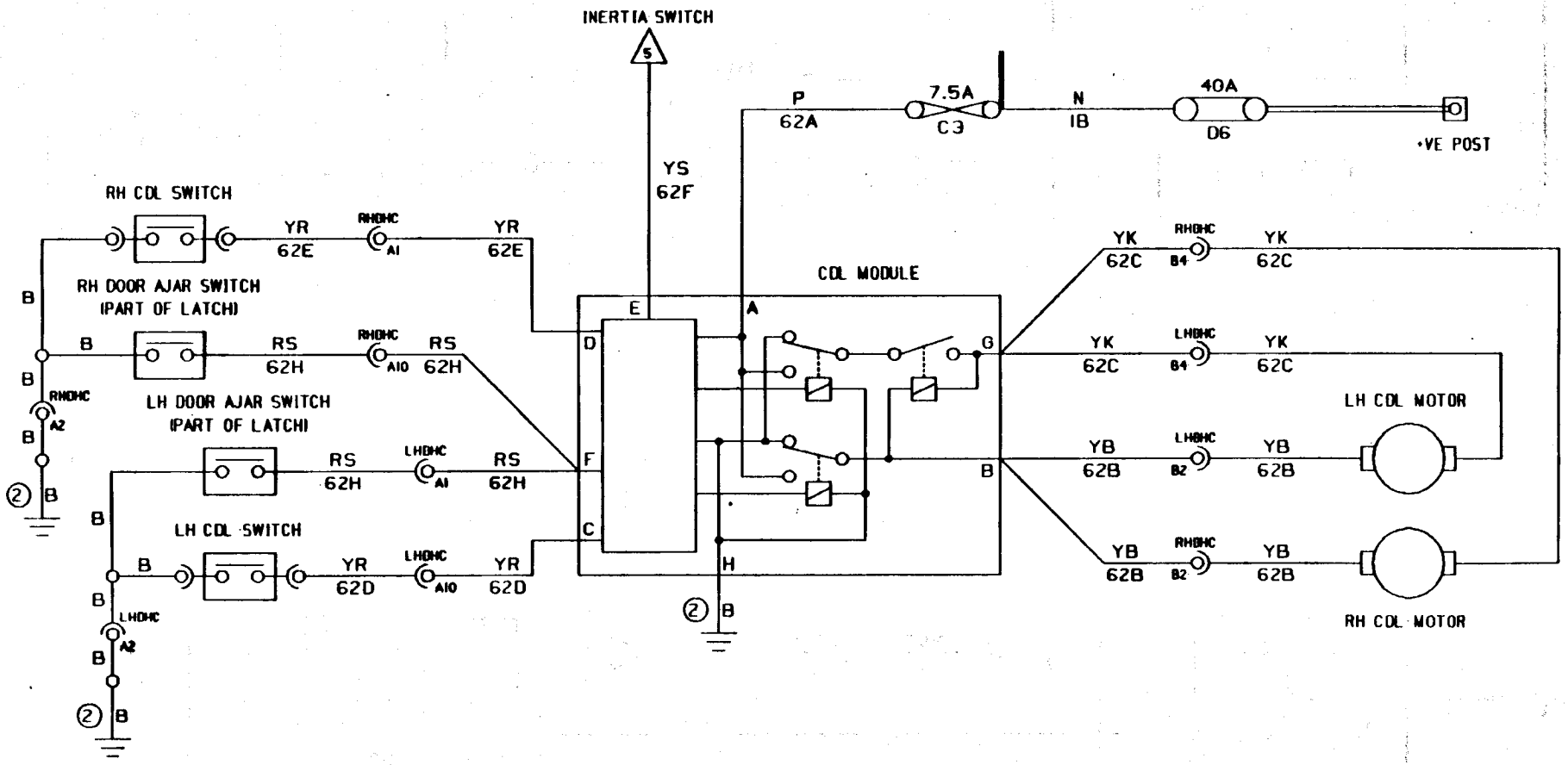
Training Course Notes

HEATER AND AIR CONDITIONING



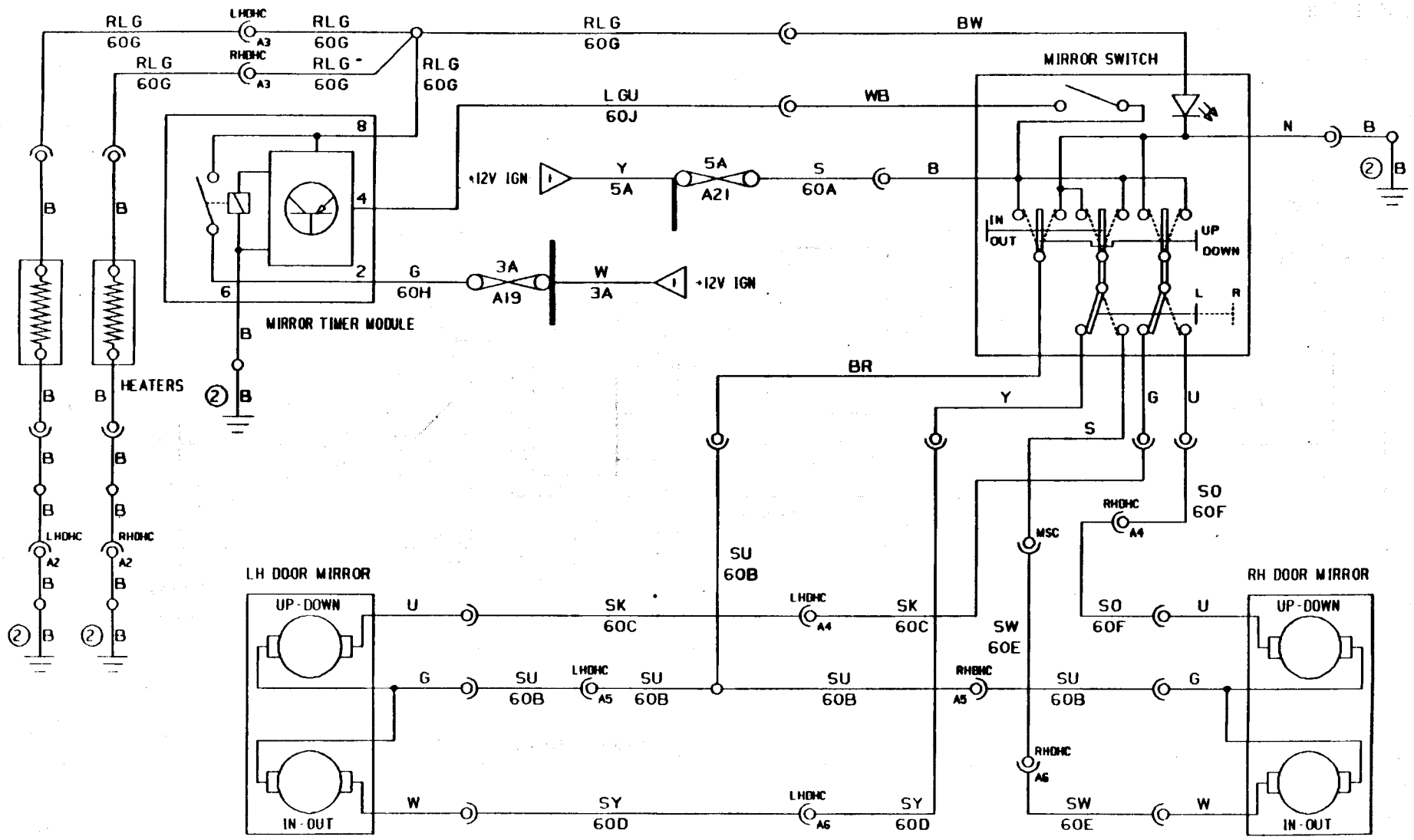
Training Course Notes

CENTRAL DOOR LOCKING



Training Course Notes

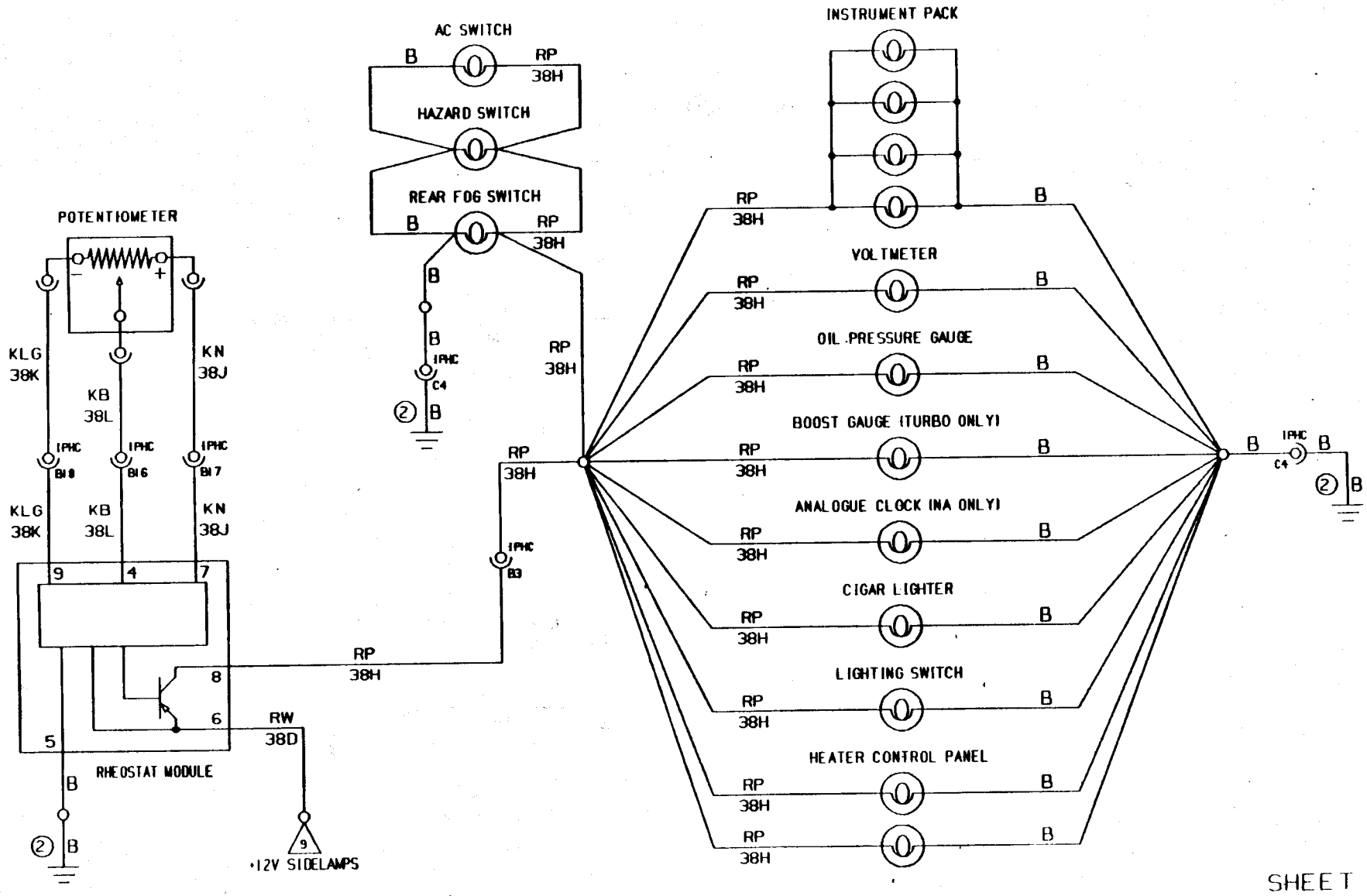
DOOR MIRRORS



Training Course Notes

SHEET 21

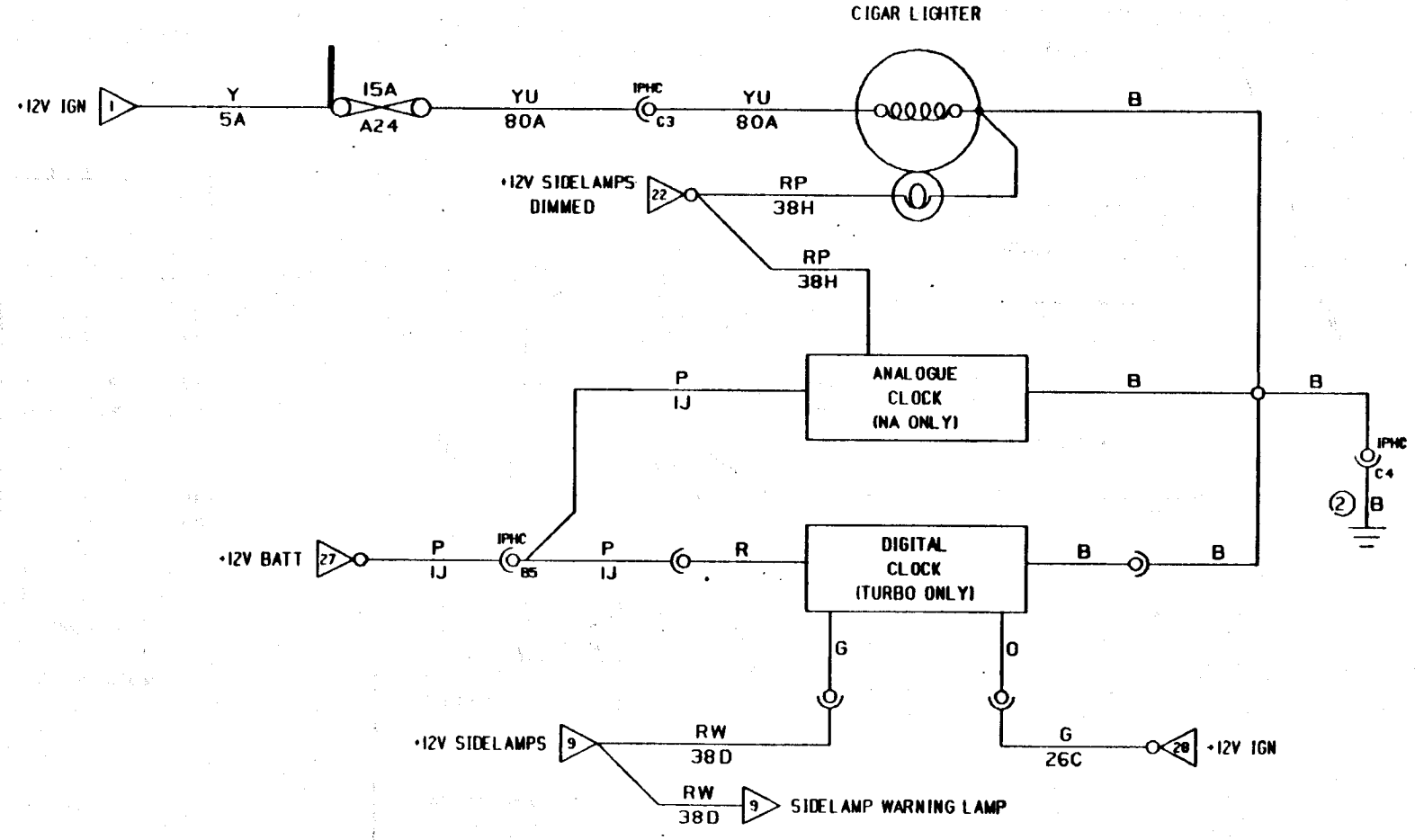
RHEOSTAT & PANEL ILLUMINATION



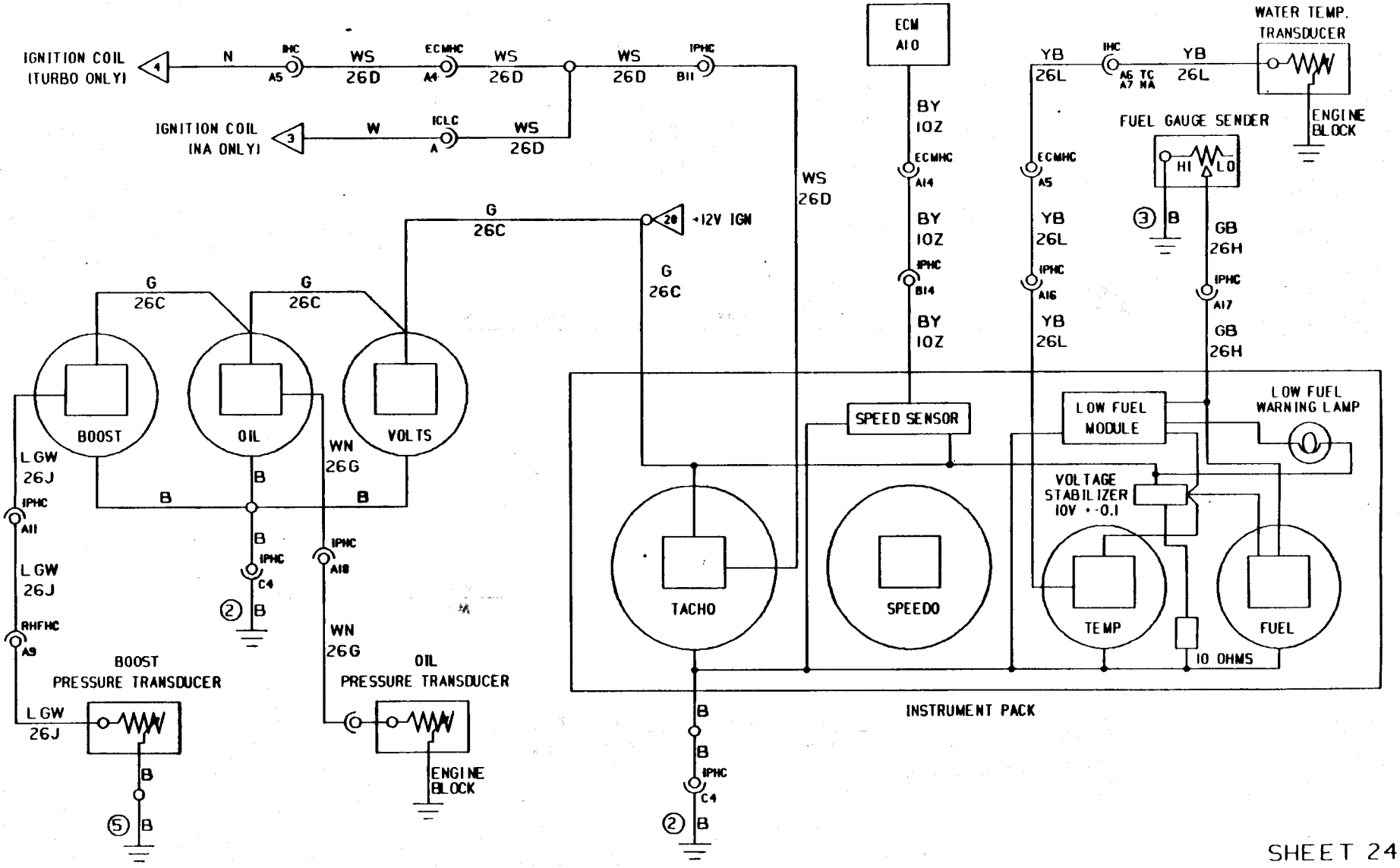
SHEET 22

Training Course Notes

CLOCK & CIGAR LIGHTER

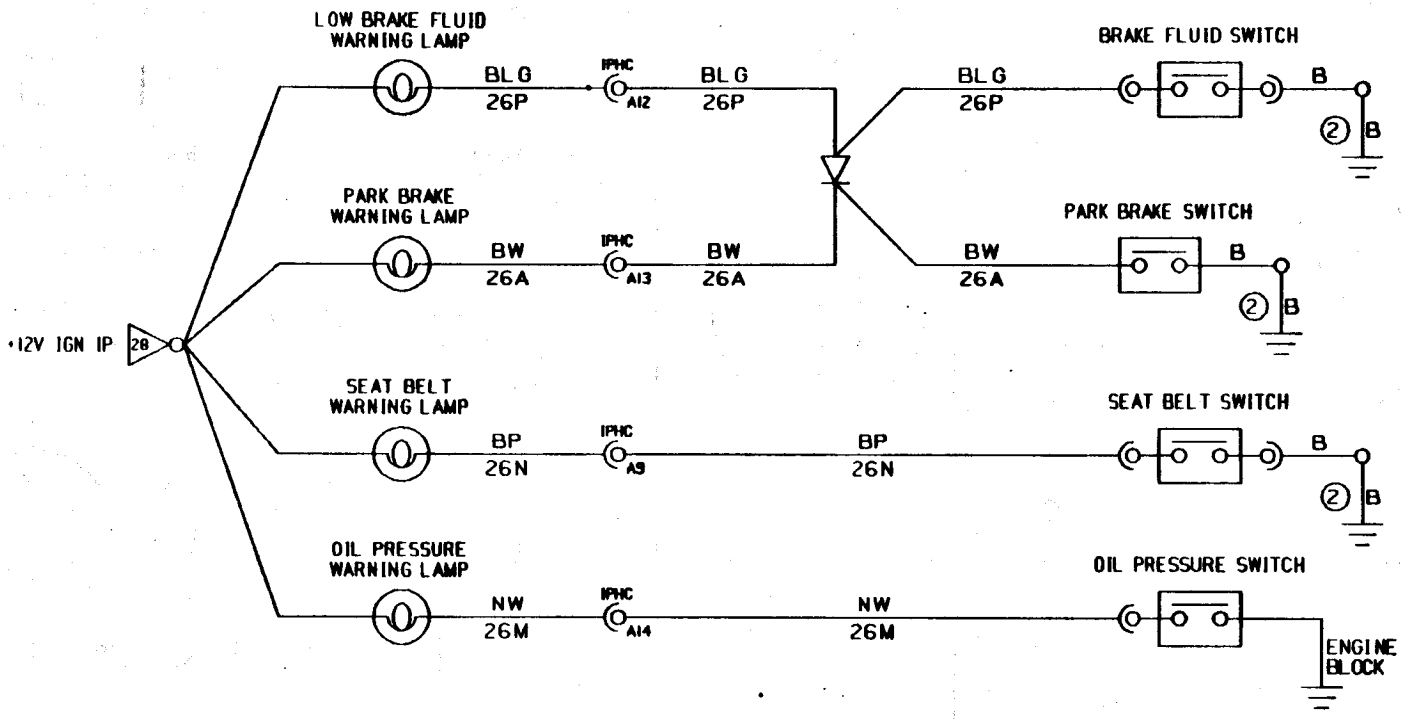


INSTRUMENTS



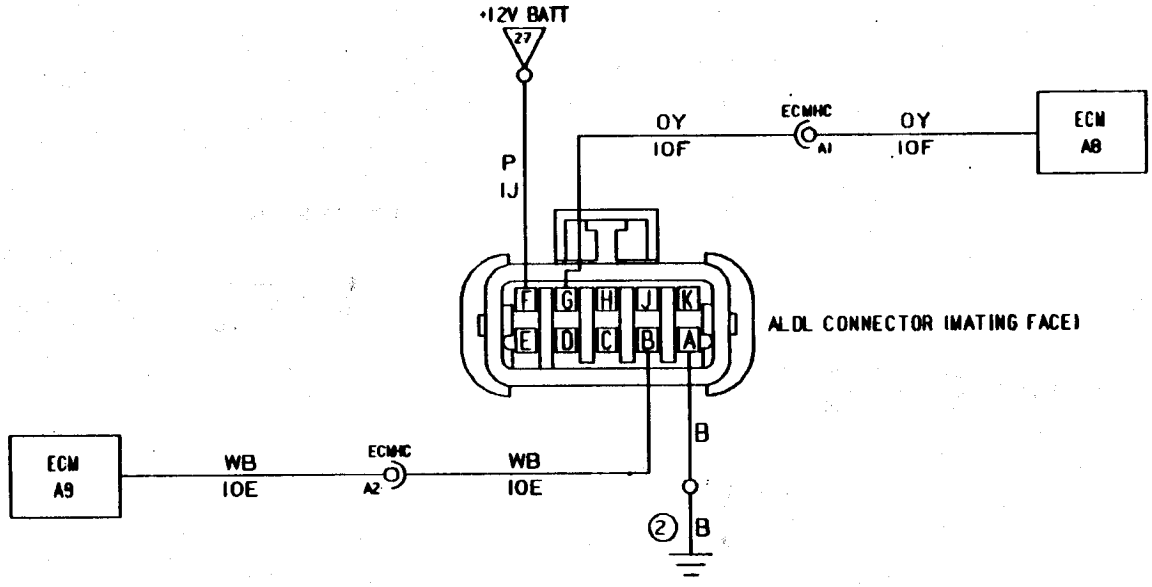
Training Course Notes

WARNING LAMPS

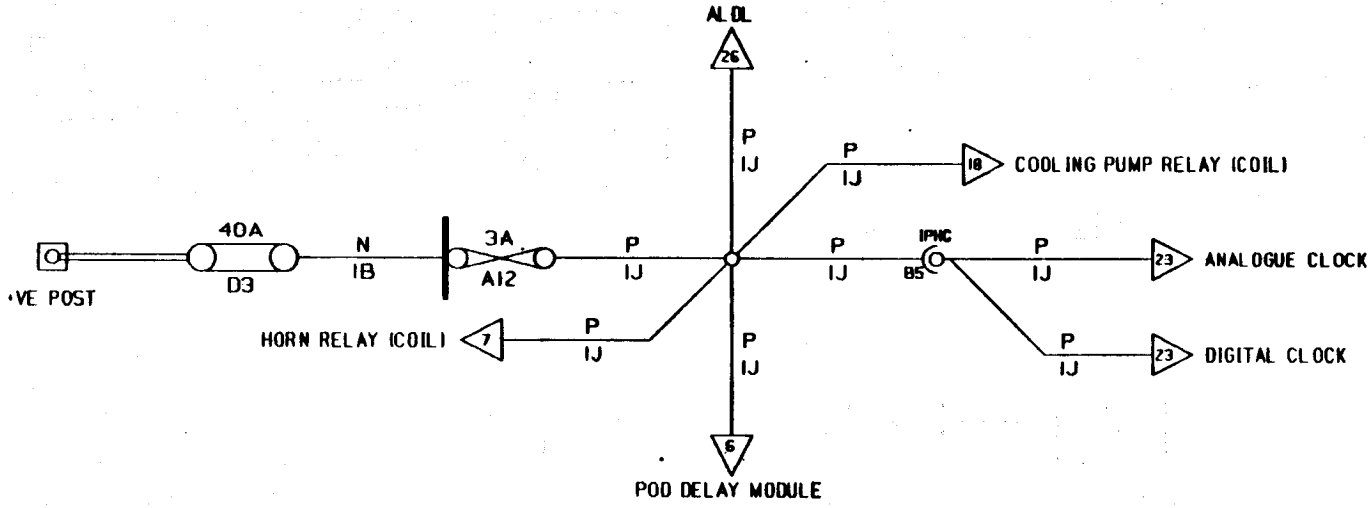


NO CHARGE WARNING LAMP SEE SHEET 2
CHECK ENGINE WARNING LAMP SEE SHEET 3, 4
MAIN BEAM WARNING LAMP SEE SHEET 6
SIDELAMP WARNING LAMP SEE SHEET 9
D.I. WARNING LAMP SEE SHEET 15
LOW FUEL WARNING LAMP SEE SHEET 24
LOW SCREENWASH WARNING LAMP SEE SHEET 8

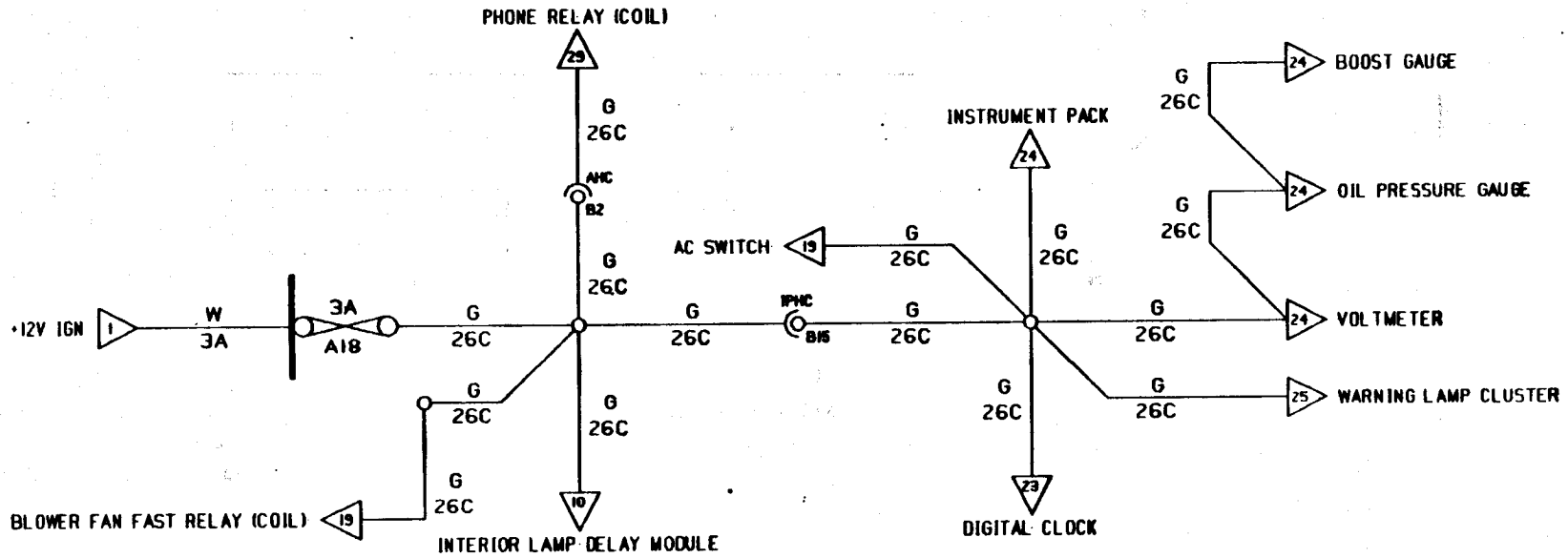
DIAGNOSTICS (ALDL)



BATTERY SERVICES (FUSE A12)

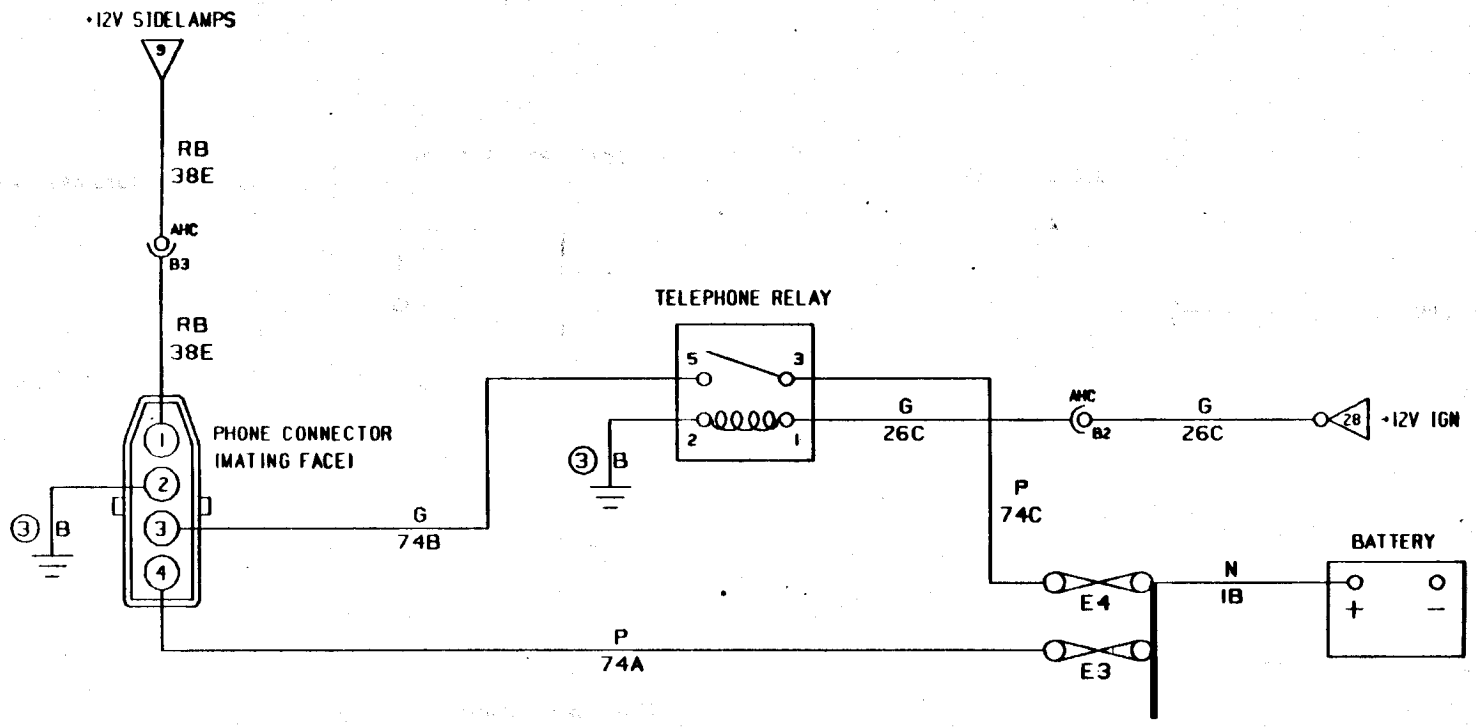


IGNITION SERVICES (FUSE A18)



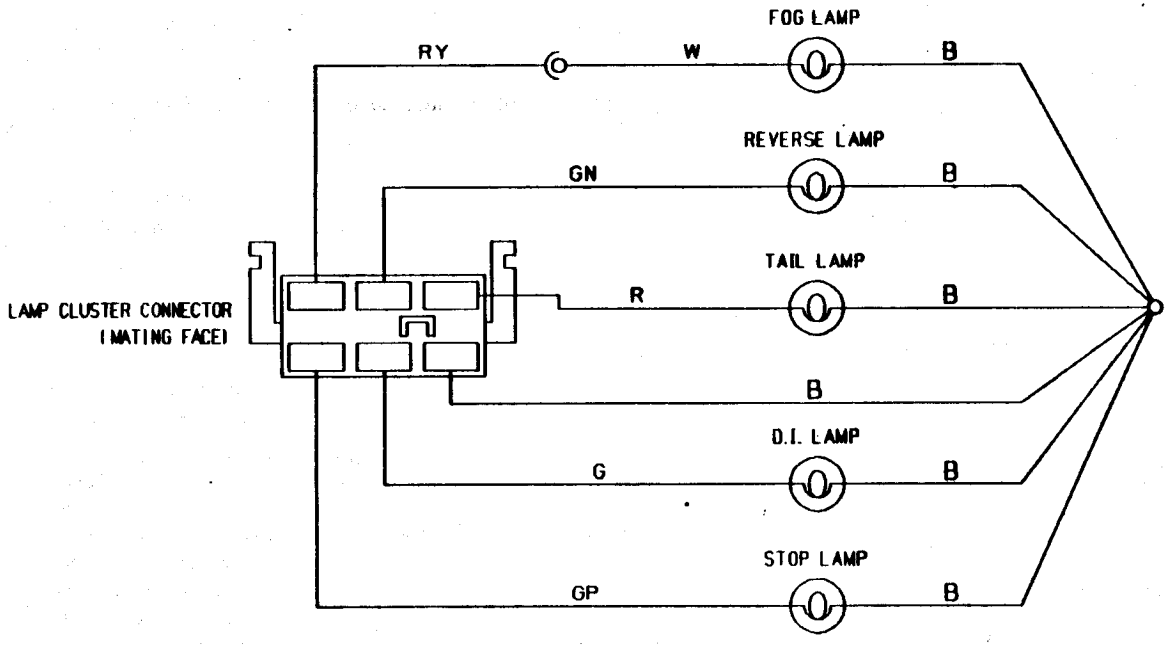
Training Course Notes

TELEPHONE



Training Course Notes

REAR LAMP CLUSTERS (EEC)



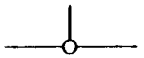
CONVENTION

CONNECTOR (WITH CAVITY NUMBER - SEE APPENDIX 4 & 5)

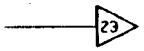
CONNECTOR CODES

AHC : ACCESSORIES HARNESS CONNECTOR
CFHC : COOLING FAN HARNESS CONNECTOR
CPHC : COOLING PUMP HARNESS CONNECTOR
ECMHC : ECM HARNESS CONNECTOR
ICLC : IGNITION COIL LEAD CONNECTOR
IHC : INJECTOR HARNESS CONNECTOR
IPHC : INSTRUMENT PACK HARNESS CONNECTOR
LHDHC : LH DOOR HARNESS CONNECTOR
LHFHC : LH FRONT HARNESS CONNECTOR
RHC : REAR HARNESS CONNECTOR
RHDHC : RH DOOR HARNESS CONNECTOR
RHFHC : RH FRONT HARNESS CONNECTOR

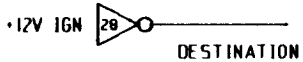
WHERE A CONNECTOR IS SHOWN WITH NO CODE
IT IS PART OF A COMPONENT ASSEMBLY ON A FLYING LEAD



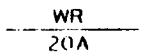
SPLICE



CIGAR LIGHTER
DESTINATION BY SHEET NUMBER OF CABLE TO COMPONENT OR CIRCUIT



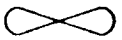
DESTINATION BY SHEET NUMBER OF CABLE FROM A SPLICE



CABLE COLOUR
CIRCUIT CODE

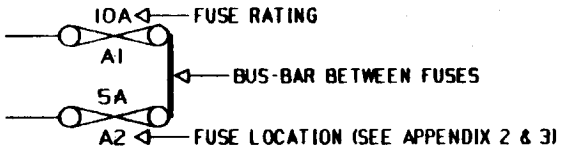
COLOUR CODES

B : BLACK	P : PURPLE
G : GREEN	R : RED
K : PINK	S : SLATE
LG : LIGHT GREEN	U : BLUE
N : BROWN	W : WHITE
O : ORANGE	Y : YELLOW

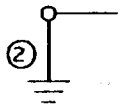


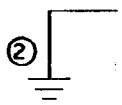
TWISTED PAIR

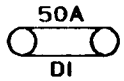
FUSES



GROUND POINTS (SEE APPENDIX 6 FOR LOCATIONS)







MAXIFUSE (SHORT CIRCUIT RATING ONLY)

Training Course Notes

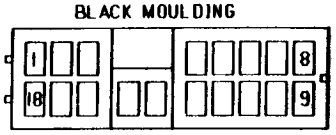
APPENDIX 1

INTER-HARNESS CONNECTORS I (MATING FACE)

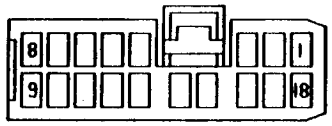
IPHC (MAIN HARNESS TO IP HARNESS)

MAIN HARNESS

BLACK MOULDING



A



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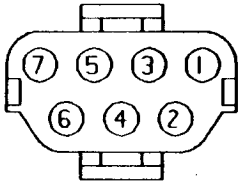

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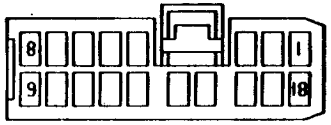
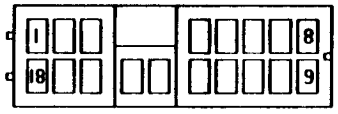
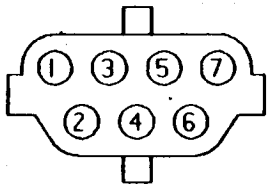


BLACK MOULDING

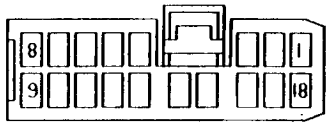




INSTRUMENT PACK HARNESS

ECMHC (ECM HARNESS TO MAIN HARNESS)

MAIN HARNESS



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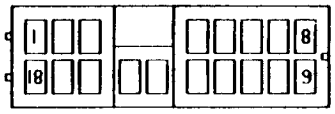
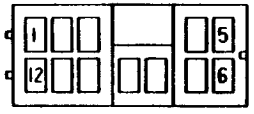


ECM HARNESS

LHDHC & RHDHC (MAIN HARNESS TO LH & RH DOOR HARNESS)

MAIN HARNESS



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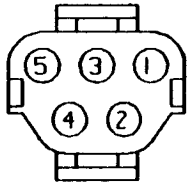

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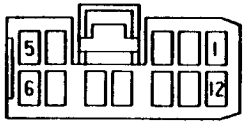
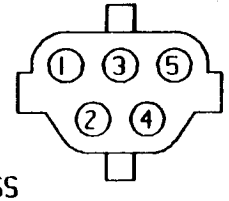
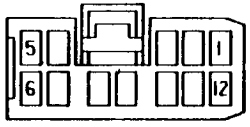




DOOR HARNESS

RHC (REAR HARNESS TO MAIN HARNESS)

MAIN HARNESS



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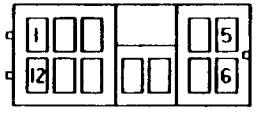
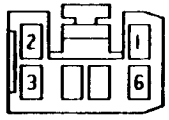


REAR HARNESS

AHC (ACCESSORIES HARNESS TO MAIN HARNESS)

MAIN HARNESS



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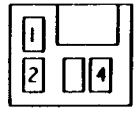

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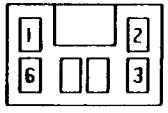
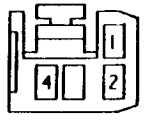




ACCESSORIES HARNESS

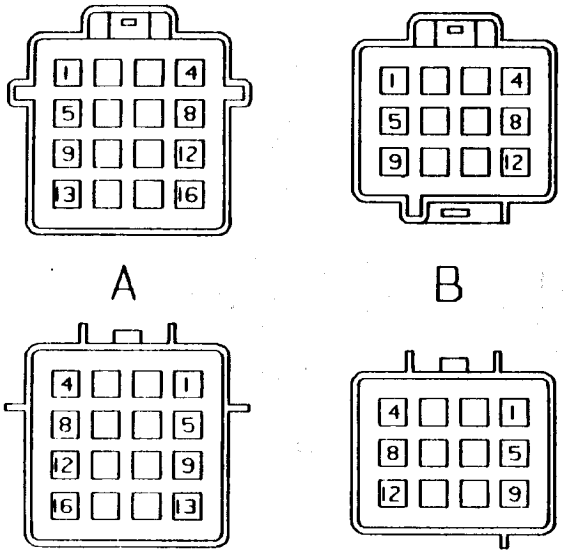
Training Course Notes

APPENDIX 2

INTER-HARNESS CONNECTORS 2 (MATING FACE)

IHC (ECM HARNESS TO INJECTOR HARNESS)

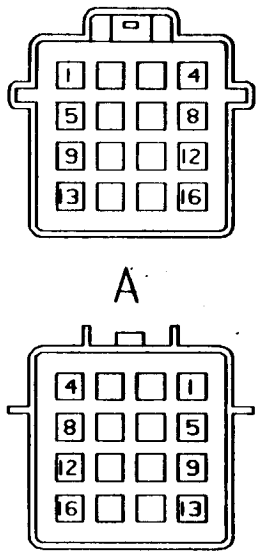
ECM HARNESS



INJECTOR HARNESS

LHFHC (MAIN HARNESS TO LH FRONT HARNESS)

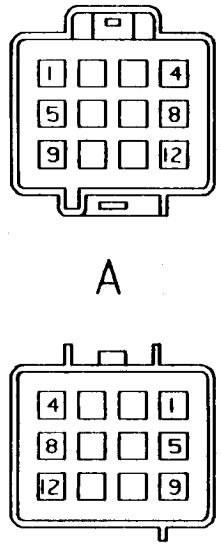
MAIN HARNESS



LH FRONT HARNESS

RHFHC (MAIN HARNESS TO RH FRONT HARNESS)

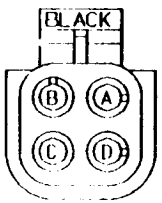
MAIN HARNESS



RH FRONT HARNESS

CFHC (LH FRONT HARNESS TO COOLING FAN HARNESS)

LH FRONT HARNESS



COOLING FAN HARNESS