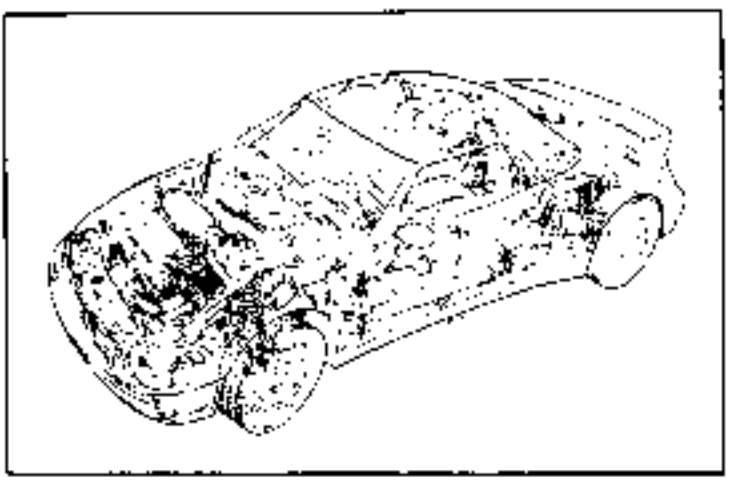
SERVICE NOTES

ELAN

1990 Model Year Onwards



LOTUS CARS LTD

Norwich, Norfolk, England NR14 8EZ Telephone (0953) 608000
Telex 97401

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FLUOROELASTOMERS - Cautionary Note - Issued by the Society of Motor Manufacturers and Traders (SMMT) December 1990.

Fluoroelastomers are synthetic rubbers often used in engines, engine rear rings and other equipment such as 'O' rings and engine gasket seals. When used within design operating conditions fluoroelastomers are safe and do not present a hazard to health.

If heated beyond normal operating conditions, for example during attempts to remove a tight coupling fitting or in a fire, they can break down to give a highly corrosive acid (Hydrofluoric Acid) - this can cause serious burns on contact with skin. Avoid skin contact with fire damaged rubbers.

NOTE: Further information and advice is contained in SMMT 'All Members' circular December 1990 entitled "SMMT Guidance on Fluoroelastomers".

CONTENTS

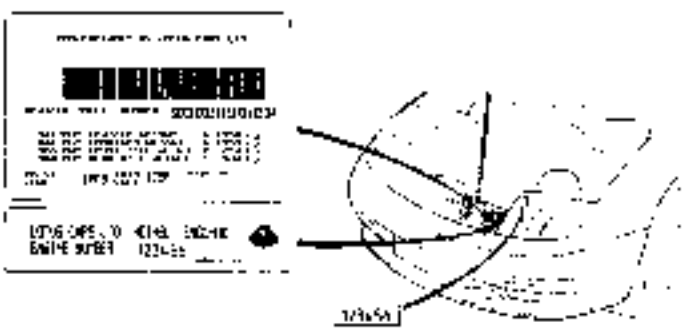
ELAN SERVICE NOTES MANUAL M100TU2(J)

VEHICLE IDENTIFICATION NUMBER & ENGINE NUMBER

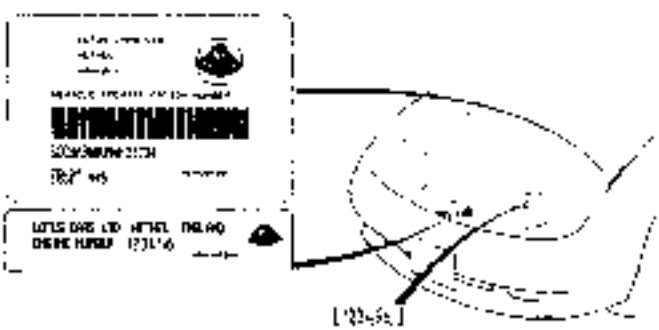
The Vehicle Identification Number (VIN) is stamped on the outboard face of the right hand rear chassis leg, viewable over the right hand rear wheel. The engine number is stamped on the forward facing rear flange of the cylinder block, alongside the clutch bell housing joint face.

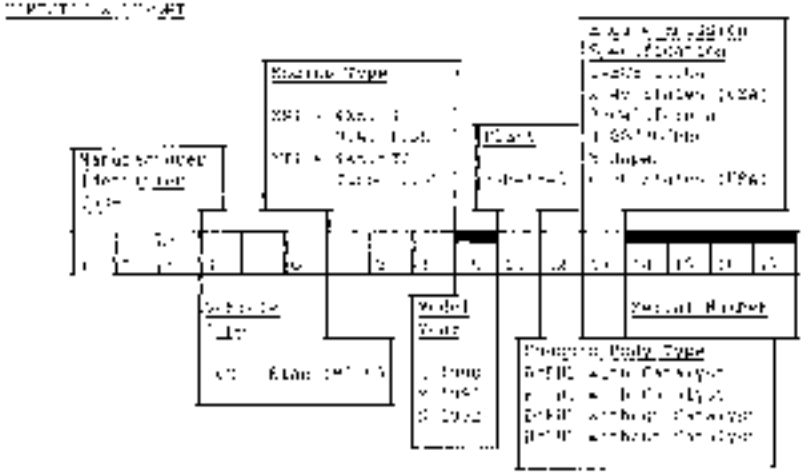
These numbers are duplicated on a pair of bar code labels fixed either at the front of the engine compartment or on the left hand wheelarch. Both the VIN and engine number should be quoted in any enquiries concerning the vehicle.

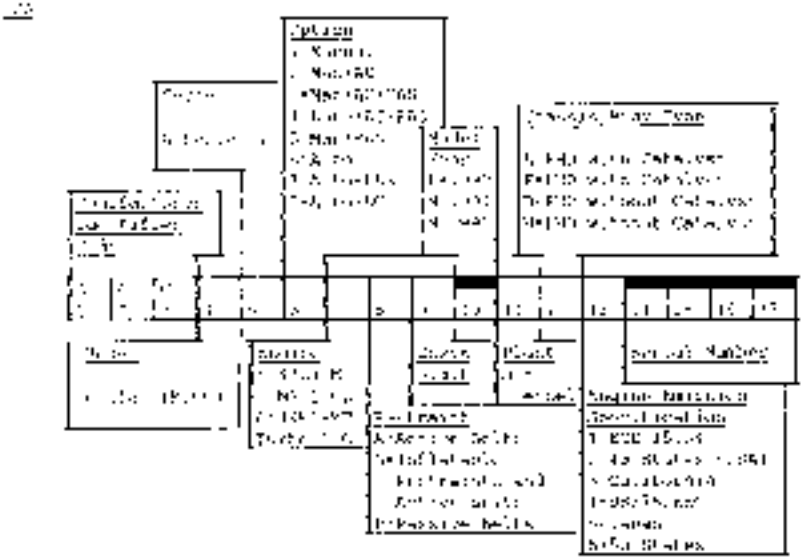
Domestic/ Export type



OSA type







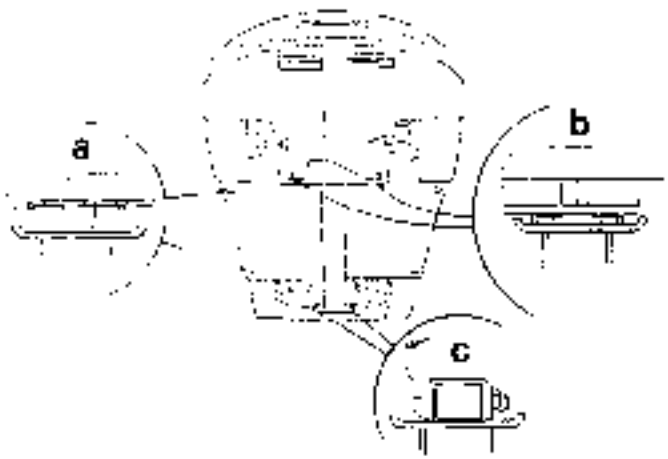
V.I.N. Notes

- Only one vehicle number (VIN) is used for all variations of model and engine, but the numerical sequence is reset to 000001 for each model year.
- The Model Year Plate provides the year code and the full VIN.
- The VIN is stamped on the left front inner wheelarch and on the chassis.
- The serial number alone should not be quoted. Either quote the engine number, chassis number or the full VIN.
- For change point identification in Service Notes, Parts Lists and Service Bulletins, only the number of the serial number will normally be quoted.

Jacking Points

a. With body raising ramps, the front pad is under the rear end of the front suspension wishbone, and the rear pad under the front end of the rear suspension wishbone.
b. Beneath the centre of the front suspension crossmember.
c. Beneath the rearmost point of the rear suspension wishbones, nearest to the inner edge of the wheel, using a suitable spreader block.

CAUTION: Do NOT use a jack beneath any other part of the vehicle, especially:
- Do **NOT** jack between the engine and gearbox.
- Do **NOT** jack beneath the rear suspension lower wishbone. Damage and/or injury can be caused to either of these components due to incorrect working



Body Accident Damage

When assessing vehicle damage/repair, it is most important to pay due attention to the following safety systems:
- SRS (see Section 12 for Elise, 13 for Exige).
- Electronic engine management system - ECM (see section 18).
- Supplementary inflatable restraint system - SIR (see section 13 and 12/2/2).
- Anti-theft immobilisation system - ATA (see section 90.10).

TECHNICAL DATA - ENGINE

SECTION C1 - 1.1 litre (K.S. & Turbo)

engine

Type designation	
- Naturally Aspirated (N/A)	912I-N
- Turbocharged	912I-NT
Engine cycle (stroke)	two stroke-discovery piston
No. of cylinders	4
Capacity	1966 cm³ (119.9 in³)
Bore	79.50 mm (3.130 in)
Stroke	61.77 mm (2.432 in)
Compression ratio - N/A	9.0:1
- Turbo	7.6:1
Maximum power (DIN 70020) - N/A	74.5 kW (101 PS/100 HP)
- Turbo	110.3 kW (150 PS/148 HP)
Maximum power speed	5500 rpm
Fuel type	Petrol
Fuel octane rating	95 RON
Fuel tank capacity	60 litres (13.2 gal)
Fuel consumption (DIN 70030) - N/A	8.5 l/100 km (33.2 mpg) @ 5,500 rpm
- Turbo	9.5 l/100 km (29.7 mpg) @ 5,500 rpm
Max torque (DIN 70020) - N/A	134 Nm (99 lbf.ft) @ 4,250 rpm
Turbo	200 Nm (148 lbf.ft) @ 4,250 rpm

CYLINDER HEAD

Material	Aluminium alloy
Combustion chamber volume:	
- New	0.05 cm³ (0.003 in³) max.
- Service limit	0.20 cm³ (0.012 in³)
- New cross piston face	0.50 mm (0.019 in)
- Out of flatness head or block	0.20 mm (0.008 in)
Maximum bore out of roundness:	
New	0.05 mm (0.002 in) max.
Service limit	0.40 mm (0.016 in)

VALVES

```
Axial clearance                          0.05 - 0.15 mm (0.002 - 0.006 in)
Depth of valve seats in head
 Inlet diameter    - inlet                39.9 mm (1.57 in)
                   - exhaust              35.9 mm (1.41 in)
Inlet diameter    - inlet    - new         6.965 - 6.980 mm (0.2743 - 0.2748 in)
                             service limit 6.930 mm (0.2728 in)
                  - exhaust  - new         5.945 - 5.960 mm (0.2341 - 0.2347 in)
                             - service limit 5.905 mm (0.2325 in)
Valve head edge thickness                3.525 mm (0.1388 in) minimum
```

VALVE GUIDES

```
Valve/guide clearance
                  - inlet    - new         0.021 - 0.054 mm (0.0008 - 0.0021 in)
                             - service limit 0.100 mm (0.0039 in)
                  - exhaust  - new         0.040 - 0.073 mm (0.0016 - 0.0029 in)
                             service limit 0.120 mm (0.0047 in)
Valve guide standout above head - inlet    14.5 mm (0.57 in)
                                - exhaust  14.5 mm (0.57 in)
```

VALVE SEATS

```
Valve seat contact - standout of NEW valve above cylinder head
Inlet valve seat  - new                    1.10 mm (0.043 in) minimum
                  - service limit          0.65 mm  0.026 in
Inlet valve width - inlet  - new           1.1 mm (0.04 in)
                           service limit   1.1 mm (0.04 in)
                  - exhaust - new          1.3 mm (0.05 in)
                            service limit  1.3 mm (0.05 in)
In recondition cut                         0.08 - 0.15 mm (0.03 - 0.06 in)
```

VALVE SPRINGS

```
Free length - inlet                        44.7 mm  1.76 in)
            - peripheral inlet             45.5 mm  1.79 in)
Squareness - service limit                 1.5 mm (0.06 in)
Fitted at - spring length                  37.0 mm (1.457 in)
```

VALVE GUIDES

```
Valve stem diameter - new                  6.935 mm (0.4896 in) minimum
                    service limit          6.905 mm (0.4884 in)
Liner/seal diameter - new                  7.021 - 7.034 mm (0.2764 - 0.2769 in)
                      service limit        7.1 mm (0.279 in)
```

CAMSHAFT

```
Valve lift - inlet & exhaust               7.4 mm (0.291 in)
Maximum permissible height - inlet & exhaust 39.01 mm (1.536 in)
Lobe concentricity                         0.05 mm (0.002 in)
Journal diameter - new                     25.954 - 25.967 mm (1.022 - 1.022 in)
                 - service limit           25.94 mm (1.021 in)
Journal running clearance                  0.05 mm (0.002 in)
Maximum end play                           0.25 mm (0.001 in)
```

Inside diameter (measured using Elastoseal)	
- new	0.060 - 0.120 mm (0.0024 - 0.0047 in)
- service limit	0.150 mm (0.0059 in)
Ellipse - new	0.05 mm (0.002 in)
- wear limit	0.10 mm (0.004 in)
Piston ring groove width	0.04 mm (0.002 in) maximum

CYLINDER BLOCK

Material	Cast iron
Wet liner interference fit/bore	
- service limit	0.03 mm (0.001 in)
- max. permissible wear	0.01 mm (0.001 in)
- min. protrusion above deck	0.04 mm (0.002 in)
Bore diameter - standard - new - grade A	90.000 - 90.010 mm (3.5433 - 3.5437 in)
- grade B	90.010 - 90.020 mm (3.5437 - 3.5441 in)
- grade C	90.020 - 90.030 mm (3.5441 - 3.5445 in)
- service limit*	90.200 mm (3.5512 in)
- - 0.40 mm - new	DC see Calculated Jaguar overbore section
- service limit*	90.700 mm (3.572 in)
- - 1.00 mm - new	DC see Calculated Jaguar overbore section
- service limit*	91.200 mm (3.590 in)

* Subject to tolerances in 10, 12, 99 & 09 as shown from Bore Chart.

PISTONS & RINGS

Type	Solid skirt
Material	Hypereutectic alloy
Crown	Compensating, recessed

Diameter (4.00 in from axis, 90 mm apart (top crown) - M/T - standard - new - grade A	89.967 - 89.977 mm (3.5423 - 3.5427 in)
- grade B	89.977 - 89.987 mm (3.5427 - 3.5431 in)
- grade C	89.987 - 89.997 mm (3.5431 - 3.5435 in)
- - 0.40 mm - new	89.565 - 89.597 mm (3.5267 - 3.5279 in)
- - 1.00 mm - new	89.965 - 89.997 mm (3.5893 - 3.5435 in)

Diameter (4.00 in from axis, 90 mm down from crown) - Turbo - standard - new - grade A	89.967 - 89.977 mm (3.5423 - 3.5427 in)
- grade B	89.977 - 89.987 mm (3.5427 - 3.5431 in)
- grade C	89.987 - 89.997 mm (3.5431 - 3.5435 in)
- - 0.40 mm - new	89.565 - 89.597 mm (3.5267 - 3.5279 in)
- - 1.00 mm - new	89.965 - 89.997 mm (3.5893 - 3.5435 in)
Piston pin diameter - M/T	21.995 - 22.000 mm (0.8659 - 0.8661 in)
- Turbo	21.994 - 22.000 mm (0.8659 - 0.8661 in)

Piston ring identification on top surface:

Piston ring	Standard	0.40 mm	1.00 mm
Top compression	-	0A	1A
2nd compression	-	0B	1B
Oil control	red	blue	yellow

```
Pulley 1 (driving pulley on variable-bore pulley)
                + Key = 1x1 square/6x1/4     0.20 = 0.13 mm (0.011" - 0.016" in)
                + 2nd Key                    0.25 = 0.50 mm (0.019" - 0.020" in)
                  Pulley                     0.25 = 0.50 mm (0.009" - 0.020" in)
Pulley 2 (driven pulley)
      + 1st Compression = Coil               0.025 = 0.064 mm (0.0010" - 0.0025" in)
                        + Service Limit*     0.150 mm (0.006" in)
      + 2nd Compression = Coil               0.025 = 0.064 mm (0.0010" - 0.0025" in)
                        + Service Limit*     0.150 mm (0.006" in)
  Engine Pre-Alignment = Gap                 [0.500 mm (0.0197" in)
                       + Pulley              [0.500 mm (0.019" in)
          + Service Limit* = Gap             [0.630 mm (0.025" in)
                           + Pulley          [0.630 mm (0.025" in)
  Engine Alignment at Pulley
                    + Gap = Gap              0.01 = 0.25 mm (0.000" - 0.010" in)
                          + Pulley           0.01 = 0.25 mm (0.000" - 0.010" in)
                  + Service Limit            0.010 in (0.254 mm)
```

Transmission

```
Maximum Permissible Load Capacity                1 kg (2 lbs)
Minimum Weight to Initiate Load                  2 kg (4 lbs)
Pulley Alignment
      + Coil Compression                         0.025 - 0.064 mm (0.0010" - 0.0025" in)
        Pulley Alignment    Gap                  0.025 - 0.051 mm (0.001" - 0.002" in)
                          + Service Limit        0.076 mm (0.003" in)
Pulley Alignment Shim + Type    Upper            Orange & Pale Yellow Shims
                      Lower                      Black
```

Clutch

Clutch driving shoe selections: (all dimensions in mm)

Variation in Engine Power Required	Diameter of Big End Bearing Surface (Inspection Tool	Trade Size Diameter	Engine Speed Engagement	Driving Belt Thickness (Reference)
1	83.946 - 83.960	84.325 - 84.340	Low	1.040 - 1.070
2	83.908 - 83.913		Mid	1.040 - 1.070
3	83.870 - 83.897		High	1.070 - 1.099

```
Pulley Swinging Arm Maximum Plunge/Play Width
                    + Hub                    0.020 - 0.048 mm (0.0008" - 0.0019" in)
                    + Service Limit          0.130 mm (0.005" in)
Pulley Spring Free Length + New              0.04 - 0.23 mm (0.002" - 0.011" in)
                          + Service Limit    0.020 mm (0.001" in)
Pulley Retainer Wheel Bolt + Type   Upper    Grade 8 Bolt (2 notches on Torque
                           Lower             Bolt.
```

Main bearing shell selection (new journals in mm)

Marking on cylinder block	Diameter of main bearing bore in block	Crankshaft main journal diameter	Side face of crank web	Shell colour code
	59.000 - 59.019	51.979 - 51.988	- -	blue
		51.969 - 51.978	-	black
1	59.020 - 59.039	51.969 - 51.978	- -	black
		51.959 - 51.968	-	brown
2	59.040 - 59.059	51.959 - 51.968	- -	brown
		51.949 - 51.958	-	green

CYLINDER & PISTON HEAD

Permissible out of flatness: 0.05 mm (0.002 in) max

OIL PUMP

Type: Trochoidal rotor/sprocket
Delivery: 48 l/min @ 5,000 pump rpm, 5.5 kg/cm² (78 psi) & 80°C
Relief valve opening pressure: 7.0 kg/cm² (71 lbf/in²)
Rotor to housing clearance:
- new: 0.10 mm (0.004 in) - 0.20 mm (0.007 in)
- service limit: 0.30 mm (0.009 in)

Outer rotor to housing clearance:
- new: 0.12 mm (0.004 in) - 0.22 mm (0.008 in)
- service limit: 0.35 mm (0.012 in)

Inner & outer rotor side clearance:
- new: 0.025 mm (0.001 in) - 0.075 mm (0.002 in)
- service limit: 0.100 mm (0.003 in)

WATER PUMP

Type: Centrifugal impeller
Drive: Via toothed cam belt
Pump duty: 75 l/min @ 5,000 pump rpm, 80°C
Operation: Wax pellet type with jiggle valve

TECHNICAL DATA - VEHICLE

SECTION 1001 - ELAN (M 1 Turbo)

DIMENSIONS

Overall length - Tow/Exp	5451 mm (214.6 in)
- 35A	5772 mm (152.4 in)
Overall width - excl. mirrors	1734 mm (68.4 in)
- incl. mirrors	1974 mm (77.7 in)
Overall height (with top raised)	1240 mm (48.8 in)
mmax.3850	2.50 mm (98.6 in)
Track - front	1506 mm (59.3 in)
- rear	1496 mm (58.9 in)
Ground clearance	130 mm (5.1 in)
Turning circle - between kerbs	10.6m m (35 ft)
Fuel capacity - N.A. - total	120.2 ns (2376 Imp. gal, full fuel mark
front axle (47%)	677 kg (1464 lb)
- rear axle (53%)	759 kg (1672 lb)
Turbo - Tow/Exp - total	1480 kg (3247 lb)
- front axle (48%)	710 kg (1562 lb)
- rear axle (52%)	770 kg (1809 lb)
35A - total	1117 kg (2454 lb)
- front axle (41%	446 kg (1044 lb)
- rear axle (59%)	670 kg (1407 lb)
Gross weight - N.A. - total	1450 kg (3756 lb) (inc. occupants & luggage
- front axle (46%,	750 kg (1654 lb)
rear axle (40%)	537 kg (1111 lb)
Turbo - Tow/Exp - total	1747 kg (3900 lb)
- front axle (46%)	769 kg (1697 lb)
- rear axle (49%)	978 kg (2131 lb)
35A - total	1331 kg (2933 lb)
- front axle (47%)	607 kg (1314 lb)
- rear axle (53%)	645 kg (1346 lb)
Body certification - total weight	1.75
- roof load	0.05

DRIVE TRAIN

Clutch - 205mm - over flywheel	1. Drive (1.2 kg pt. 2.7 lb ft)
- without flywheel	2. Drive (1.8 kg ft) 2.3 lb ft)
N/A	3. Drive (0.6 kg ft) 4.3 lb ft)
Ratios as between crankshaft speed and road speed	1st 3.727 (14.2 kg pt, 2.1 lb ft)
Final drive	2nd 2.045 (11.35 kg ft, 2.6 lb ft)
- 35A	3rd 1.357 (10.2 kg ft, 2.3 lb ft)
- 4WD	4th 1.000 (7.5 kg ft, 1.7 lb ft)
Transmission - 5kg	5th 0.823 (6.2 kg ft, 1.4 lb ft)
- 4WD	6.25 (23.8 kg ft)
- 35A	4.6 (17.5 kg ft)
Ratios	3.85 (14.6 kg ft)
Full load	
Reverse boost	

FRONT SUSPENSION

Type	Independent, wishbone, coaxial coil springs and dampers acting on lower wishbone, tubular anti-roll bar, separate aluminium alloy subframe.

Ride height for geometry check	165 mm to base; wishbone inboard pivot
Castor	+ 0.25° ± 0.25°
Camber	− 1° ± 0.5°
Steering axis inclination	10.5°
Scrub radius	7 mm
Toe-out	0° to 0.25° total

Ride suspension

Type	Independent, wide based lower wishbone, single top link, coaxial coil spring & damper acting on lower wishbone, anti-roll bar, wishbone rate bump-steer.
Ride height for geometry check	(At mean between rear edge of flange
Castor	+ 0.5°) + 0.25°
Camber	+ 0.5 to + 1.5 on each side

Steering

Steering wheel diameter	365 mm (14.4 in)
Type	Manual or power assisted rack and pinion
Options - non S.I.R.	Energy absorbing column, adjustable for height
S.I.R.	Energy absorbing collapsible, air bag incorporated into steering wheel hub.
Turns, lock to lock - manual	3.25
power	2.4
Ratio - manual	12.5 on gear steering wheel turn
- power	15.1 on gear steering wheel turn
Oil pipeline pressure	65 ± 7 kgf/cm² (925 ± 100 lbf/in²) during maximum steering lock

WHEELS

Type - standard	Light alloy, 4 bolt fixing
- for winter tyre temporary spare	Steel, 4 bolt fixing "Doughnut" wheel, 4 bolt fixing
Size - standard alloy - front	6½J × 15 H2 ET 40
- rear	7½J × 15 H2 ET 40
- winter steel temporary spare	6½J × 15 H2 5½J × 15 H2
Offset - standard alloy	+ 50 mm
Wheel bolt torque*	50 ± 5kgf.m (360 ± 40 lbf.ft)

* Note that the wheel bolts for the winter steel wheels are shorter than those for the standard alloy wheels. Torque wrench adjustment.

Tyres

Type - standard - P.C.V.	Michelin MXV 2
- alpha - front	Michelin MXA 2
- rear	Goodyear Eagle GS-C
- winter (optional)	Michelin X M+S - on or without studs

* For limitations on use of winter tyres, see section 00.

- temporary spare		Goodyear speed saver +3 Michelin TX>
Size - standard - N.A.		205/60 VR15
- Turbo - 15in		205/50 ZR15
- 16in		205/45 ZR16
- winter tyre		195/60 x 14
- temporary spare		T125/70 R14
Pressures (front & rear)		
- standard - N.A.		1.7 bar (25 lb/in²) > all pressures
- Turbo - 15in		1.8 bar (26.5 lb/in²) > are with
- 16in		1.9 bar (26.5 lb/in²)* > tyres fully
- winter tyre		1.5 bar (29 lb/in²) > cold
- temporary spare		4.2 bar (60 lb/in²) >

* For continuous speeds over 100 mph (160 km/h) increase pressures to 2.0 bar (27.5 lb/in²)

BRAKES

Type		Ventilated front discs, solid rear discs with single piston sliding calipers
Servo unit		22.2 cm dia tandem master cylinder with direct acting 200 mm vacuum servo
Circuit		Diagonal split. Pressure proportioning valve on each rear circuit
Parking Brake		Cable operation of rear calipers
Brake discs		
- Diameter	- front	256 mm
	- rear	240 mm
- Pad area - nominal	- front	94.8 cm²
	- rear	42.65 cm²
- minimum	- front	77.8 cm²
	- rear	38.4 cm²
maximum runout	- front	0.10 mm
	- rear	0.10 mm
Brake pads - material		Ferodo 1611
standard thickness	- front	17.5 mm (0.68 in)
	- rear	14.1 mm (0.57 in)
- minimum thickness	- front	7.0 mm (0.28 in)
	- rear	1.5 mm (0.06 in)
Proportioning/limiting valves		see section 4a

TRANSMISSION

Type Manual, 5 speed + overdrive

Gear	Internal Ratio	Final Drive		mph/1000 rpm			mph/1000 rpm		
		N.A.	Turbo	N.A.	Turbo 15in	Turbo 16in	N.A.	Turbo 15in	Turbo 16in
First	3.727:1	4.117	3.944	4.80	5.20	5.07	7.78	8.43	8.43
Second	1.956:1	"	"	8.41	9.08	9.08	13.5	14.5	14.5
Third	1.333:1	"	"	12.1	13.0	13.0	19.2	20.9	20.9
Fourth	1.000:1	"	"	16.7	18.0	18.0	25.6	27.2	27.2
5th	0.829:1	"	"	19.6	20.9	21.0	31.5	33.6	33.6
Rev	3.500:1	"	"	4.58	4.95	4.95	7.24	7.78	7.78

Drive shafts	Equal length with inboard & outboard constant velocity joints
Hubs - front (inboard)	Flanging tripod type
- rear (outboard)	Ball bearing type

CLUTCH

Type	Twin - dry plate, pressure feed
Actuation	Cable operated, ball type release bearing
Friction plate o/d - N.A.	215 mm
- Turbo	225 mm
Pressure plate clamp load - N.A.	440 kgs
Turbo	500 kgs

ENGINE COOLING

Type	Closed water circuit, belt drive centrifugal pump, thermostat control, 4 radiator circuit, 2 electric fans with thermal switch, auxiliary electric pump on Turbo models with ign. off thermal control
Header tank pressure cap	1.01 kgs/cm2 (14 lbf/in2)
Anti-freeze/corrosion protection	Recommended 40% concentration
	Protect to -34 deg C
	Replace every 2 years

ELECTRICAL EQUIPMENT

Voltage polarity	12V negative earth
Battery - type	Lucas Freedom maintenance free
	model 042
- amp hour	42 amp hr @ 20 hr rating
- cold start performance (DIN)	255A
- Lucas standard size code	02
Alternator - make	Nippondenso
- rated output	65 A
- regulated voltage	14.2 to 14.8 V
- drive belt tension	41 ± 10 kgf (90 ± 10 lbf)
	using a Sprocket's gauge
Starter motor - type	Nippondenso pre-engaged
- rated output	1.7 Kw
Inertia switch	Yes
Wiper system	Reciprocal linkage, 2 x 565 mm blades

Light Bulbs	European	USA	Wattage	Replacement Bulb Number	Type
Headlamp - outer	*		55	448	H1
- inner - Ultra	*		55	448	H1
- inner - Cavallo	*		60	472	H4
Fiesta - outer	*	yellow only	55	448	H1
inner	*	yellow only	55	448	H1
Japan - outer			55	472	H4
- inner			60	472	H1
DRL - 5 door		*	27/5		Halogen Bulb
- 3door		*	60		Sealed Beam
Front direction indicator lamps	*	*	*	581	W16W
Front sidelamps - 5door		*	*	581	W16W
Front fog indicator lamps	*	*	**	382/1106	P27W
Side repeater lamps	*		*	501	W2W
Rear lamps	*		*	207	P21W
Stop lamps	*		**	382	P21W
Rear fog	*	*	21	382/1106	P21W
Reverse		*	**	382/1106	P21W
Number plate		*		501	
High mounted stop lamp		*		891	
Interior lamp	*		10	451	C5W
Front fog lamps	*	*	27	382/1106	P21W
Rear fog lamp	*	*	21	581	W16W
Instrument lamps	*	*	3	501	W2W
Instrument lamps	*	*	3	501	W2W
Warning lamps	*	*	10	250	BAU15s

Wiper/Washer System - Windscreen

Type	Wash Rate		Dimensions			
			Driver's Area		Passenger	
	Litres/min	Litres/km	Length mm	Area sq.cm	Length mm	Area sq.cm
Single arm	2.0	0.2	450	1590	450	1590
Single arm with parking	1.8	0.2	450	1590	450	1590
Dual arm (Fiesta)	1.8	0.2	450	1590	450	1590

Wiper Motors

Check	No	Notes
Inoperative on selection	1	1
Inoperative in intermittent	2	2
Operates only in one speed	3	3
Excessive noise	4	4
Wiper Blade:		
Loose fixing to spindle	5	5
Rubber element torn or damaged	6	6
Rubber element hardened	7	7

Torque settings contd.	Nm	lbf.ft
Radiator frame (2) fasteners, either	22	16
Radiator frame lower strut (2 units) to body top	10	7.5
Radiator frame front strut (2 units) to body, either	22	16
Radiator frame to subframe**	10	7.5
EGR:		
Thermostat housing to inlet manifold	22 - 25	16 - 18
Coolant ambient bracket to transmission cover	60 - 70	44 - 52
Body		
Front bumper to body	16 - 20	12 - 15
Body to chassis	22	16
Front Suspension		
Damper top mount nut	27 - 30	20 - 22
Top wishbone inboard pivot*	55 - 60	41 - 44
Hub top ball joint nut	70 - 80	52 - 59
Anti-roll bar to body	25 - 30	18 - 22
Top wishbone to hub bolt*	20 - 25	15 - 18
Lower wishbone inboard pivot bolt	110 - 120	81 - 89
Lower wishbone inboard pivot nut plate	22 - 25	16 - 18
Lower wishbone strut to body mounting	42 - 50	30 - 37
Suspension strut rear to lower wishbone	105 - 115	77 - 85
Ball joint to wishbone nut	40 - 50	30 - 37
Hub nut*	200 - 220	148 - 162
Tie rod to suspension nut	35 - 40	26 - 30
Lower swivel joint to hub carrier	60 - 65	45 - 48
Tie rod end to hub carrier	50 - 60	37 - 44
Anti-roll bar link to damper strut	25 - 30	18 - 22
Spring top seat to chassis	20 - 25	15 - 18
Track rod end to steering arm	58 - 64	43 - 47
Driveshaft to hub nut	225 - 245	166 - 181
Rear Suspension		
Damper top mount nut	30 - 35	22 - 26
Spring top seat to chassis	22 - 25	16 - 18
Damper to lower wishbone*	68 - 72	50 - 53
Top link, outboard* and transverse*	75 - 80	55 - 59
Toe link camber adjuster clip	20 - 25	15 - 18
Lower wishbone inboard pivot to chassis*	65 - 70	48 - 52
Lower wishbone outboard pivot to hub carrier*	95 - 105	70 - 78
Hub ball joint to wishbone ball joint	35 - 40	26 - 30
Anti-roll bar ball joints to lower wishbone	35 - 40	26 - 30
Anti-roll bar clip bolts	35 - 40	26 - 30
Hub nut	Use centre lock	
Hub carrier to hub carrier**	50 - 60	44 - 48
Brake caliper to hub carrier**	75 - 85	55 - 63
Brake caliper to mounting bracket	100 - 110	74 - 81

* Tighten to give 1.25 mm play.
** Apply locking compound to threaded areas before fitting bolts (pre-applied).

Transmission		
Gearbox drain and filler plugs	40	30
Bellhousing	40	30
Gearbox mounting bracket	25	18

Torque settings cont'd

	Nm	lbf ft
Crankcase rear fixing bracket screws	22.5	17
Piston housing to cylinder block	90	66
Camshaft bearing bracket to block	30	22
Rear oil seal carrier plate	10	7
Intermediate plate to retaining plate	16	12
Gearbox casing to clutch housing	47	35
Reverse idler shaft retaining bolt	47	35
Selector detent plugs	35	26
5th speed drive & driven gear nuts	127	94
Gear selector housing	45	33
End cover	16	12
Crown wheel to carrier	113	83

Wheels

Wheel nuts	72 - 88	53 - 65

Steering

Rack housing to chassis	170	125
High pressure pipe inner arm to pump housing	24 - 27	18 - 20
Low pressure pipe inner pump housing	24 - 27	18 - 20
Tie rod connections, pinion to body, to rack tube	12	9
Outer tie rod to pedal box	16	12
Column to engine bulkhead	24	18
Column to engine bulkhead	46	34
Upper u/j to intermediate shaft	46	34
Lower u/j to pinion shaft	46	34
Steering wheel to column	40	30
Track rod end clamps	20	15
Track rod end to steering arm	50 - 61	37 - 45
Track rod ball joint to swivel hub	70.5	52
Wheel bolt to flange nut	80	59

Brakes

Front caliper mounting bolts	95 - 115	70 - 85
Rear caliper mounting bolts	90 - 110	66 - 81
Brake hose to caliper	40	30
Screw nipple	9 - 10	7 - 8
Pressure brake switch to cylinder	11 - 14	8 - 10
Servo to pedal box	16 - 20	12 - 15
Pedal pivot bracket	24	18
Pedal box servo to bulkhead	47	35
Master cylinder to servo	25 - 28	18 - 21
Brake pipe to hose union nuts	14	10

Cooling System

Oil cooler bridge pipe	77	57

Fuel System

Tank strap bolts	12	9
Fuel filter clamp screws	27	20

Air Conditioning

Evap pump inlet connection	11 - 16	8 - 12
Evap pump outlet connection	18 - 23	13 - 17

Torque settings contd

		Nm	lbf.ft
Hydrostatic hose connections	5/8"-18	12 - 16	9 - 12
	3/4"-16	20 - 27	15 - 20
	7/8"-14	34 - 48	25 - 35
	1 1/16"-14 UNS	30 - 44	20 - 32

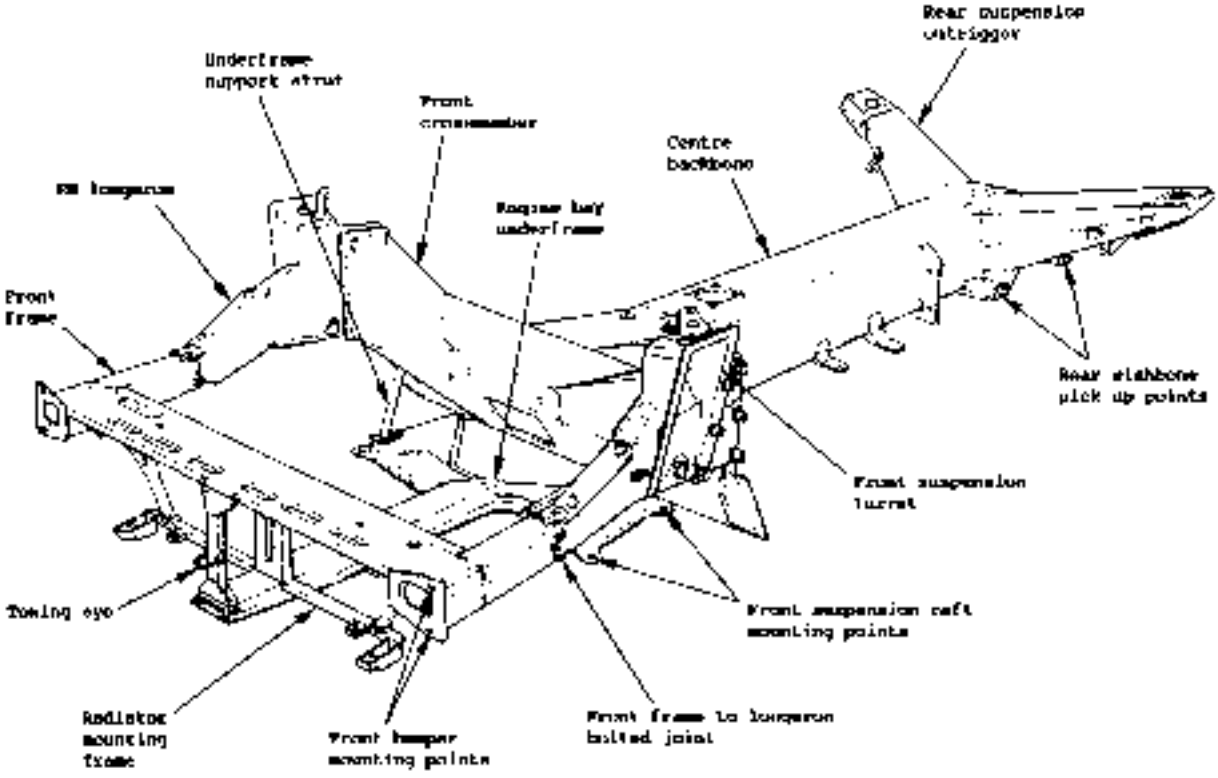
Clutch

Operating arm pinch bolt		30	22
Pillow screw		25	18

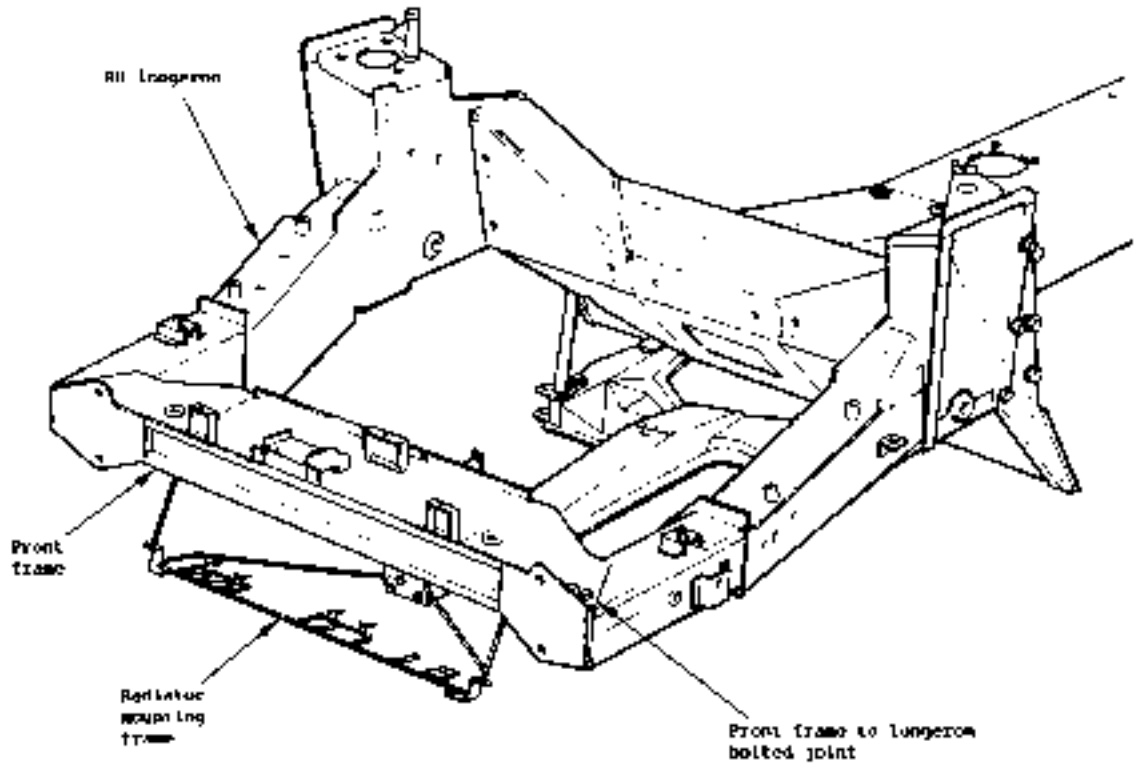
CHASSIS

SECTION AD. - ELAN

Mini-1850 Type Chassis Assembly



1984 Type Chassis Front End



M2.1 - GENERAL DESCRIPTION

The chassis unit is fabricated principally from 'Zintec' electrogalvanised zinc precoated steel sheet, and in certain critical areas, 'Tenform' high strength steel. Various welding processes are used in the construction of a central square box section 'backbone', with a crossmember at the front and two tapering box section outriggers at the rear. These outriggers form the top abutments for the rear suspension units, and carry the top link anchorage points. An extension of the centre backbone to the rear of the outriggers, carries the rearmost pivots for the wide based lower wishbones.

The chassis structure ahead of the front crossmember is bolted together for ease of assembly and repair, and carries the engine and transmission, front suspension, cooling radiators and front bodywork. This bolt-on structure differs in detail between USA and non-USA specification cars to suit the pertaining crash performance regulations, but the main components are similar:

- The chassis front crossmember provides mounting points for the two bolt on longerons, which extend forwards alongside the engine bay, and carry the front suspension strut top abutments, and the rack top bushes (see section C2). Each longeron is secured to the chassis front crossmember with six high tensile bolts, some of which are taper seat bolts for accurate location.
- A front frame is bolted between the front ends of the longerons, and provides the mounting points for the front bumper.
- A separate radiator support frame hangs from this front frame to form a mounting structure for the engine radiator and air conditioning evaporator.
- An engine bay underframe (subframe) bolts to the bottom of the chassis front crossmember, carries the front suspension rear lower wishbones, and extends forwards to bolt to the bottom of the radiator support frame.

On non-USA cars, a 'crash structure' is bonded to the top surface of the front frame, and consists of a composite box containing a series of composite tubes with longitudinal axes. The crush characteristics of the assembly are designed to provide a progressive collapse in the event of a frontal collision, and reduce the deceleration forces transmitted to the cabin and its occupants. On USA cars, a similar result is achieved by the use of an energy absorbing expanded aluminium honeycomb, bonded to the front frame and filling the space between the frame and front bumper.

Sixteen body to chassis mounting points take the form of caged nuts, and are widely distributed about the chassis, mating with plain hole aluminium bobbins incorporated in the body structure. Four of the body/chassis fixings also serve as inboard seat mountings.

The complete chassis frame is painted by an electrophoretic process before being coated with a grey polyester based anti-chip surface to protect the treatment from erosion. Further corrosion protection is provided by a 'Dinitrol' wax based coating, applied to the inner steel surfaces. The wax treatment process is manufactured, and the corrosion warranty administered by Dinol (GB) Ltd., with re-treatment inspections required after two years, and at two year intervals thereafter. For details of this warranty and retreatment/inspection, refer to the separate literature supplied by Dinol (GB) Ltd., Portobello Road, Bernard Castle, Co. Durham, DL12 9ES.

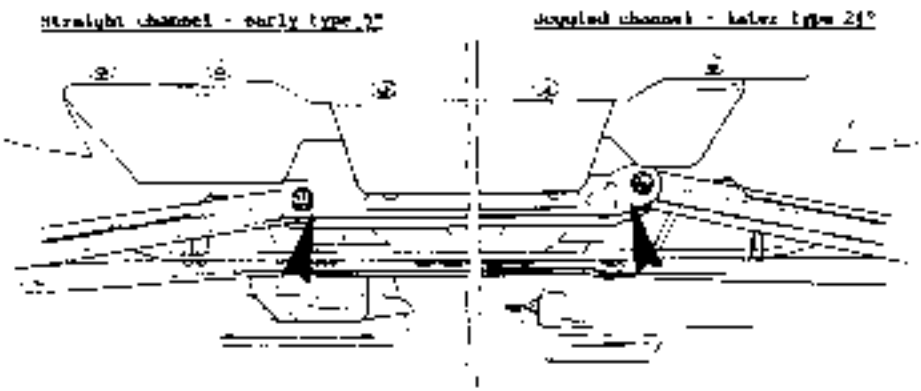
Collision damage to the vehicle can subject parts of the chassis to abnormally high loads and initiate defects which may not be readily apparent. Consequently, if the vehicle's suspension or steering is damaged, then consideration must be given to secondary, or shock damage. For example, all mountings and pickups attachments should be carefully examined for both mis-alignment and micro cracks. If any suspension pivot studs or suspension links are bent through collision impact, pay particular attention to the above points.

If any visible damage is found, such as panel wrinkling, broken welds, cracked rivets, or if a dimensional check reveals any distortion, a NEW CHASSIS should be fitted. It is not recommended to perform any repairs to the chassis involving welding, heating, straightening or patching. The application of high temperatures to the chassis may cause internal annealing or weakening of the structure and incipient failure. In all cases, safety considerations must be regarded as paramount.

ND.2 - CHANGE OF AXLE LIFT ANGLE

The rear suspension geometry incorporates a feature designed to reduce the tendency of the rear of the vehicle to jack under braking. The angle between the rear lower wishbone inboard pivot axis and the horizontal when viewed from the side, is referred to as the anti-lift angle. This was changed from 5° to 2½° for all 110 models, and as a running change on other vehicles from VIN: H 6641, workshop 6645, 6646, 6611, 6715, 6719, 6719, 6719, 6721, 6721, 6721, 6721, 6719, 6746, 6761, 6788.

It is most important to establish the type of chassis fitted before carrying out a dimensional check. If a chassis type is in doubt (e.g. service replacement chassis) examine the rear wishbone anchorage channel at the extreme rear of the chassis, and refer to the diagram below.



Note that the following rear suspension components differ between the two chassis variants:

rear wishbone;
top link inboard pivot stiffening strut;
top link outboard pivot fixing;

For service replacement, only the later type 2½° chassis is available. If replacing the chassis on an earlier 5° car, the 2½° chassis must be fitted together with a rear suspension conversion kit RTC000035, which consists of 2 rear wishbones, 2 top link struts, 2 top link outboard pivot spigot sleeves, 2 top link outboard pivot spacers, 2 top link outboard pivot bolts, and 2 Nyloc nuts. Refer to rear suspension sub sections 00.4 and 00.5 for the correct assembly sequence.

M2.3 - DIMENSIONAL CHECK

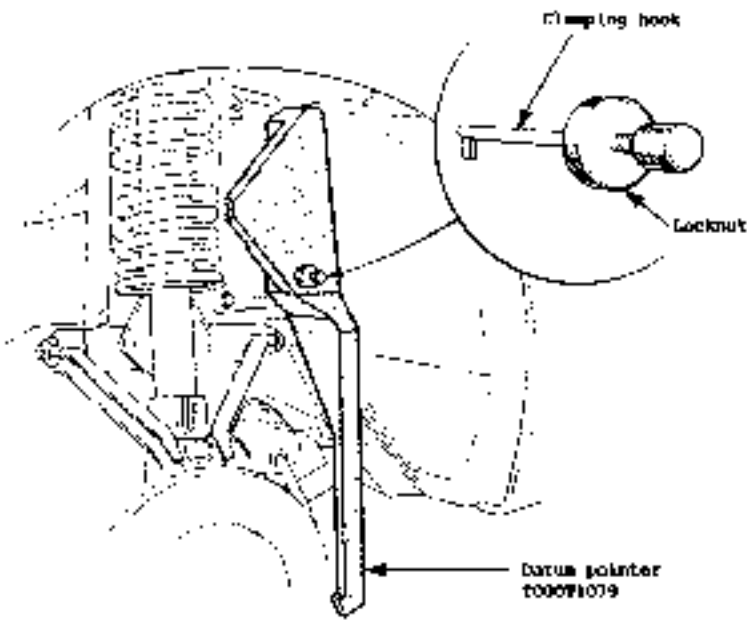
In general terms, when necessary accident damage, if after any suspension rebuild (if necessary) the specified suspension geometry can be achieved using such adjustment procedures as are specified in sections CE and DD, and a thorough visual inspection of the chassis reveals no signs of secondary damage, the chassis may be deemed serviceable.

In order to help assess chassis distortion without disassembly of the suspension or body, a pair of chassis datum pointers may be mounted at the rear of the longerons, and measurements made from the datum points thus provided. Two types of datum pointer tool have been produced; machined aluminium and fabricated steel

Tools required: Datum pointer, LH TOOOT1079 (aluminium) or TOOOT1201 (steel)
Datum pointer, RH TOOOT1200 (aluminium) or TOOOT1202 (steel)
4 off M12x1.75x70 Bolts ht108M7099 - use only with steel pointers
½m steel tape measure

1. With the car raised on a wheel frame lift, remove the front wheels and wheelarch liners.

2. Fit the datum pointers:
Machined aluminium type: Position one of the datum pointers against the top mounting of the longeron fixing point, and fit the clamping hook through the pointer into the chassis hole. Pull the hook back to engage against the chassis, and tighten the lock nut securely.



Fabricated steel type: Remove the top bolt and bottom rear longeron to chassis bolts. Bolt the fabricated pointers the longeron/chassis using the M12x70 bolts.

3. Measure from the inside corner of an alloy pointer, or the tip of a steel pointer to the datum point at the rear of the channel section forming the chassis pick-up for the rear pivot of the rear lower wishbone (dimension A). Repeat for the opposite side.

4. Repeat (4), but measuring diagonally to the pick up point on the opposite side of the car (dimension B).

5. Measure across the car from one datum pointer to the other (dimension C).

6. Measure between the front and rear pick ups for the rear wishbone pivots on each side, as shown in the diagram (dimension D).

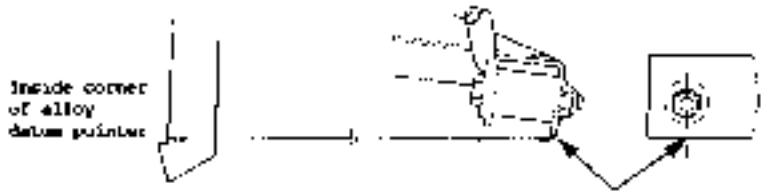
7. From inside the boot, measure between the centreline of the tops of the rearmost inboard studs, securing the top spring abutments to the chassis (dimension E).

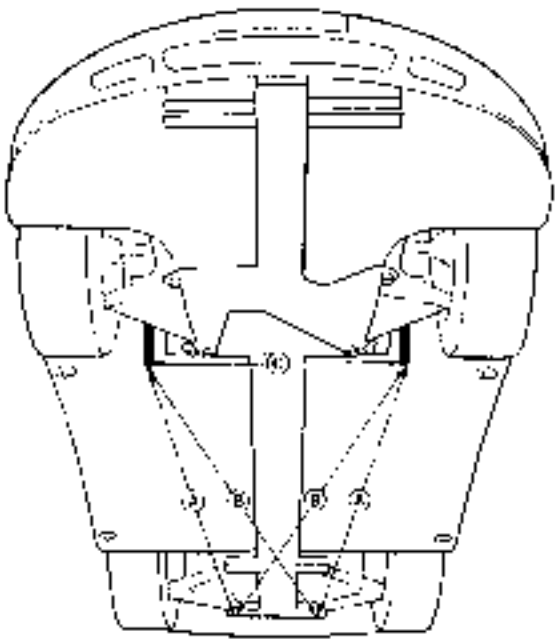
8. Compare the measurements obtained above with those in the table below, and if any dimension is outside tolerance, a chassis distortion is indicated, necessitating chassis replacement.

9. To check the longerons and front frame, it is necessary to strip down the front of the car to enable measurements to be taken between the datum pointers and front bumper lower fixing holes. Alternatively, comparative measurements can be taken between the steering rack mounting bosses or the chassis front crossmember and the bumper lower fixing holes.

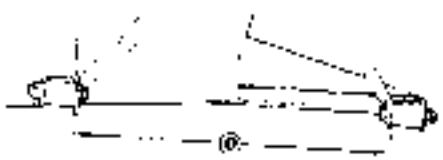
Dimension		Tolerance (mm) Alloy Pointers	Steel Pointers	Maximum Deviation RH/LH
A	5° anti-lift angle*	2309 - 2323	2296 - 2311	8.5
	2° anti-lift angle*	2308 - 2322	2297 - 2314	8.5
B	5° anti-lift angle*	2388 - 2400	2381 - 2401	9.5
	2° anti-lift angle*	2392 - 2412	2384 - 2404	9.5
* See subsection A9.2				
C		1035 - 1047	1080 - 1092	
D		434.1 - 436.5	436.5 - 438.9	
E		806 - 840	886 - 890	
F	non-USA type	1379 - 1396	1400 - 1419	9.5
	USA type	1369 - 1387	1372 - 1390	9.5
G	non-USA type	906 - 916	922 - 931	5.0
	USA type	929 - 939	951 - 951	5.0

If no datum pointers are available, a drop check may be taken from datum points such as suspension pivots, longeron mountings etc., and the table dimension tolerances applied.

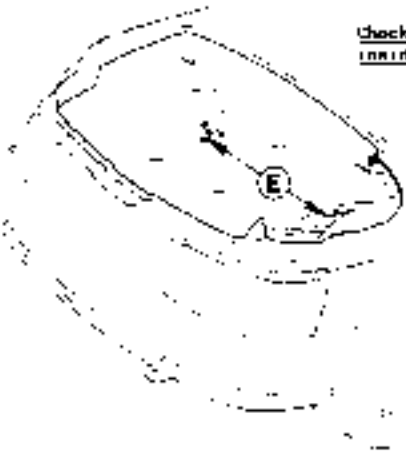


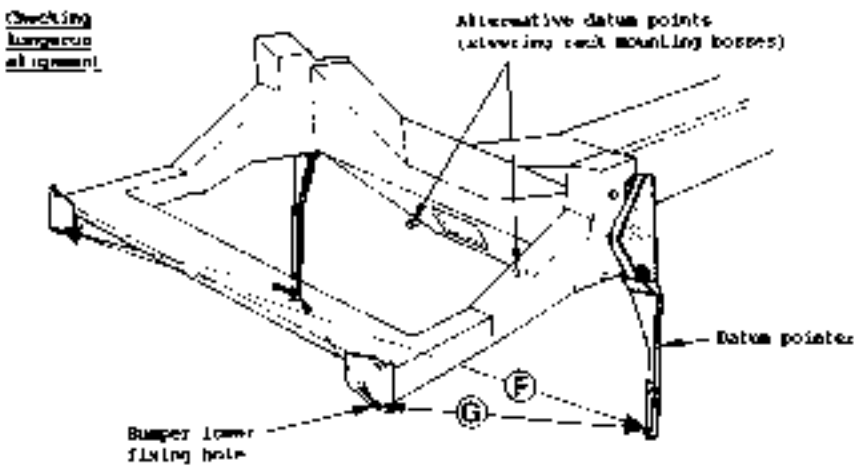


Chassis Check Dimensions



Inside surfaces of channel sections



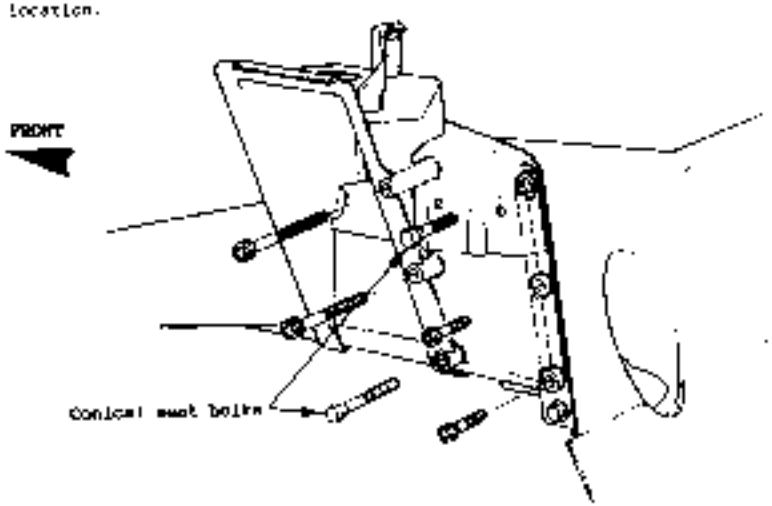


A11.4 - LONGERONS & FRONT FRAME

The longerons and front frame differ between USA and non-USA models. On non-USA models, the longerons extend forwards as far as the left hand engine mounting, before bolting to the front frame which continues forwards before traversing across ahead of the power unit. On USA cars, the longerons extend all the way to the bumper mounting points before picking up the ends of the front frame.

Non USA Cars

Each longeron is fitted to the web of the chassis front crossmember using six high tensile bolts, two of which are provided with conical seats for accurate location.



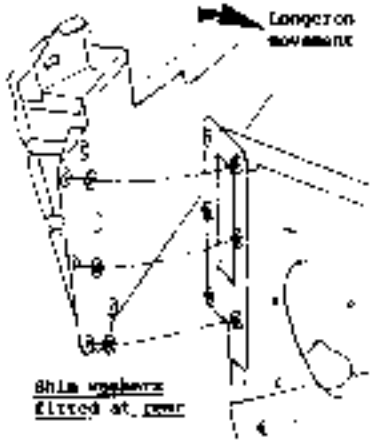
If necessary, shim washers are used at the joint between a longeron and the chassis to achieve optimum transverse alignment of the front and of the longeron. If a longeron is removed and is to be refitted on the same chassis, make a careful note of the location and number of these shims on disassembly, and refit to the same specification. Similarly, note any shims fitted at the joint between the longerons and front frame and refit in the same manner. All longeron fixing bolts should be tilted finger tight before torque tightening first the conical seat bolts, and then the cap head bolts, all to 120 Nm (89 lbf.ft).

If a new longeron or chassis is to be fitted, or if the original chassis build configuration is lost, the set up procedure detailed below must be followed to ensure optimum alignment of the longerons and front frame.

1. Fit the longerons to the chassis without any shims and fully tighten the bolts.

2. Offer up the front frame and check the alignment of the longeron/front frame fixing holes. If the longerons are too far apart or close together to allow the bolts to be fitted, it will be necessary to fit shims between the longeron(s) and chassis.

3. Two thicknesses of shim washer are available:
   0.25 mm 01008C007
   0.50 mm 01008C016
   If the ends of the longerons are too close together, shim washers should be fitted at the rearmost three longeron/chassis fixing points; and if too far apart, at the foremost three fixing points. A 0.25 mm shim will produce approx. 1.25 mm movement at the front end of the longeron. Initially, the total shim pack required should be equally divided between the two longerons. At each longeron however, there must be an equal shim thickness at each of the three fixing points.



4. When alignment of the front frame/longeron fixing holes has been achieved, it is necessary to check the 'squareness' or sideways alignment of the longerons. Fit the front frame.
Measure the diagonal dimensions between the steering rack retaining bolsters of the chassis front crossmember and the two innermost front bumper fixing holes in the front frame (i.e. 'A' goes to 'B' bumper fixing hole, and 'B' goes to 'A' bumper fixing hole (see AD.7)). If necessary, transfer longeron shims from one side to the other to move the front frame sideways and equalise the two diagonals. Transference of 0.27 mm (shim thickness) will result in a 0.5 mm (approx) movement of the front frame.

5. Torque tighten the longeron to chassis fixings, beginning with the conical seat bolts, to 120 Nm (89 lbf.ft).
Note that it is not necessary or practicable to shim the longeron to front frame joints. Tighten the longeron to front frame fixings to 22 Nm (16 lbf.ft).

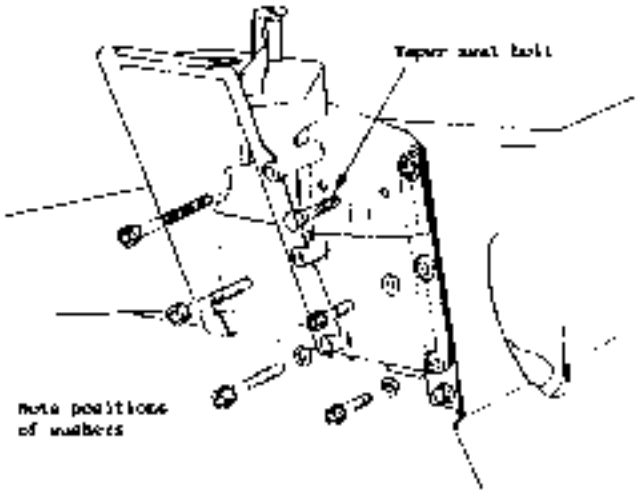
USA cars

On USA cars, the six fixings securing each longeron to the chassis utilise only one conical seat bolt instead of the two used on other models. This is to allow a marginal amount of vertical adjustment to be made to the front frame at the production stage. This adjustment is neither necessary nor practicable in service, and if the longeron fixings are slackened, they should be tightened with the vehicle (or chassis) weight supported by the longeron. Tighten the conical seat bolt first, followed by the cap head bolts, all to 120 Nm (89 lbf.ft). Note that some of the cap head bolts use flat washers beneath their heads.

If necessary, shim washers are used at the joint between the longerons and chassis to achieve optimum transverse alignment of the front frame, in the same way as on non-USA cars. See the procedure above to set up the longeron shimming relative to the front frame and steering rack bracket.

Torque tighten the front frame to longeron fixings to 70 - 75 Nm (52 - 55 lbf.ft).

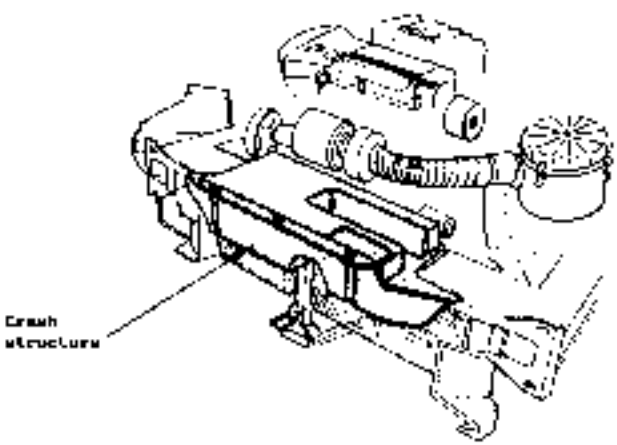
Earth braids are fitted on all cars between the inboard rear sides of each longeron, and the chassis front crossmember, with a shakeproof washer between the braid eyelet and the chassis member to ensure good electrical contact. In



addition, an earth braid is fitted across the joint between the left hand suspension and the front frame.

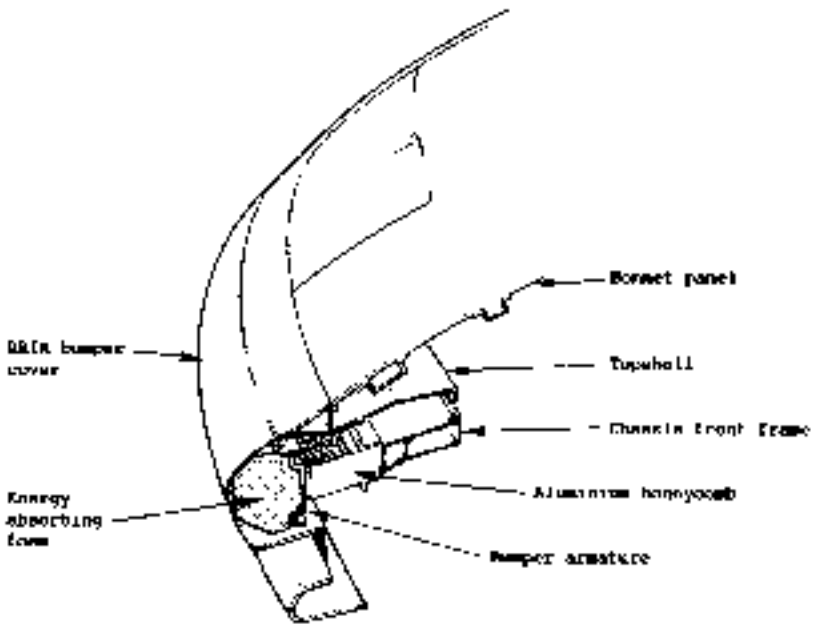
M2.5 - CRASH STRUCTURE

On models early a 'crash structure' is bonded to the top surface of the front frame, and consists of a composite box containing a series of composite cones with longitudinal axes. The crash characteristics of the assembly are designed to provide a progressive collapse in the event of a frontal collision, and reduce the deceleration forces transmitted to the cabin and its occupants.



The structure is bonded to the top surface of the chassis front frame with polyurethane adhesive, and incorporates mounting points in the form of tapped stainless bobbins, for the attachment of the electric water pump and front topshell.

On USA cars, the required progressive crush characteristics is achieved by the use of an energy absorbing expanded aluminium honeycomb, bonded into the front channel section of the front frame, and filling the space between the frame and front bumper armature.



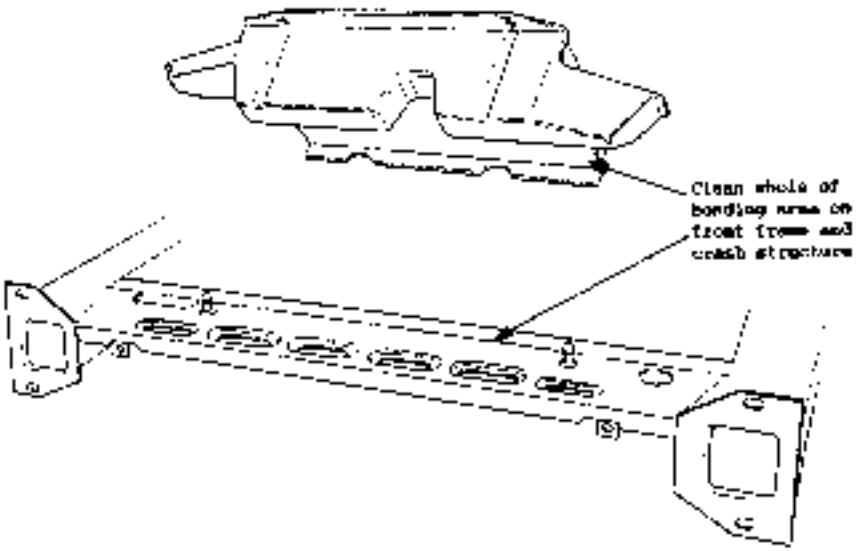
Neither type of crash structure is repairable, and if damaged should be cut from the front frame and a new structure fitted as detailed below.

Replacement of pre-ISA type crash structure

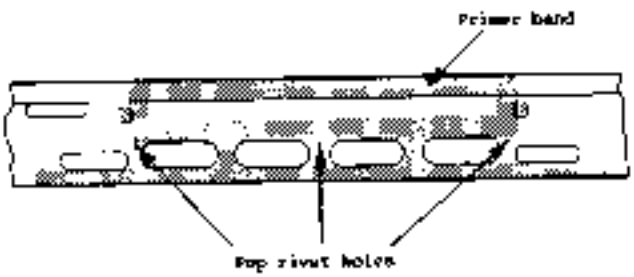
Materials Required: Metalgel kit Adhesive

1. The bonding surface on the top of the chassis front frame is not painted with the grey polyester surface, so that the adhesive can bond directly to the electrophoretic coat. Dry fit the box onto the frame and check that the three locating pop rivet holes are aligned.

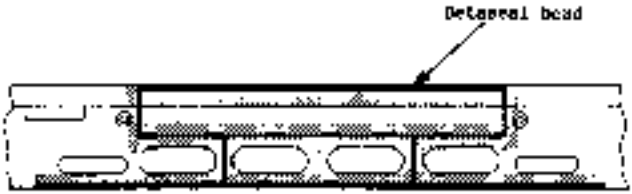
2. Clean the whole of the bonding area on the chassis frame and crash box with the wipe cleaner in the Metalgel kit. Wipe off the excess cleaner and allow to dry.



3. Shake the Betaseal primer container for at least 30 seconds before opening. Use a brush to apply the primer to the front frame as shown in the diagram, and also to the whole of the bonding area on the crash structure. Allow to dry for a minimum of ten minutes.



4. Cut the Betaseal nozzle at 45° so that the width of the nozzle tip is about 5 mm. Remove the desiccant from the PVC cartridge, fit into the application gun, and extrude a bead of sealant onto the front frame as shown in the diagram.



5. Fit the box into position, and align the rivet holes. Press down using firm hand pressure to spread the adhesive, and fit the three pop rivets A2156/P0 to secure the structure until the adhesive has cured. Paddle any extruded Detaseal back into the joint using a spatula

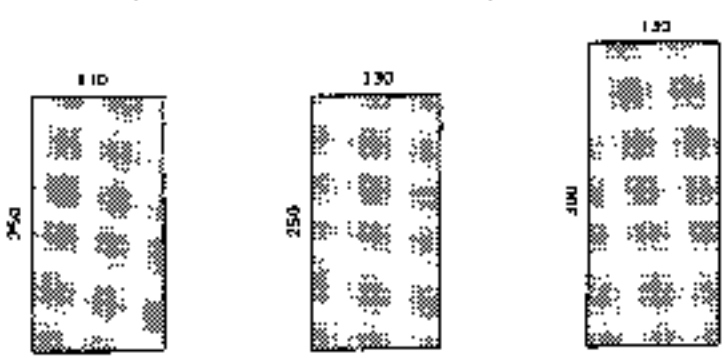
Precautions: Avoid skin or eye contact with the Detaseal adhesive, and inhalation of the vapour from the cleaner or primer. High concentrations of the vapours are noxious - use in conditions of good ventilation. Flash point 12 - 15°C

Replacement of USA type crash structure

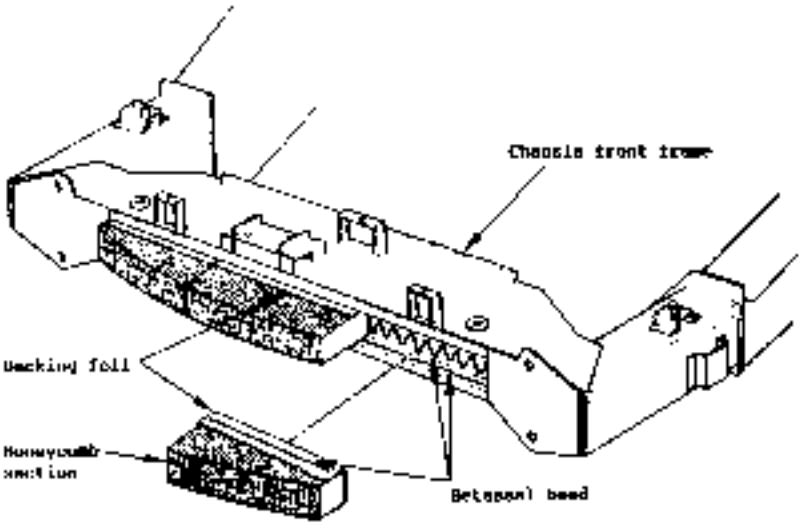
Materials required: Permabond V501 adhesive

1. Use Betaclean 3000, acetone, or a similar solvent to thoroughly degrease the recess in the front frame into which the honeycomb is to be fitted.

2. Cut three pieces of backing foil out of AC6PM6CC84 to the dimensions shown, and form each piece around the back of the honeycomb sections.



3. Stick each foil section to the honeycomb by applying a bead of Permabond V501 epoxy adhesive to the rear face, and rear edges of the top and bottom surfaces of each honeycomb section before pressing the foil into position.



4. For each of the three sections, apply a bead of adhesive to either the chassis or foil to each of the three mating surfaces, and press into position. Retain with tape (4), the adhesive has cured sufficiently (approx 2 hrs). Full strength is achieved after 24 hrs.

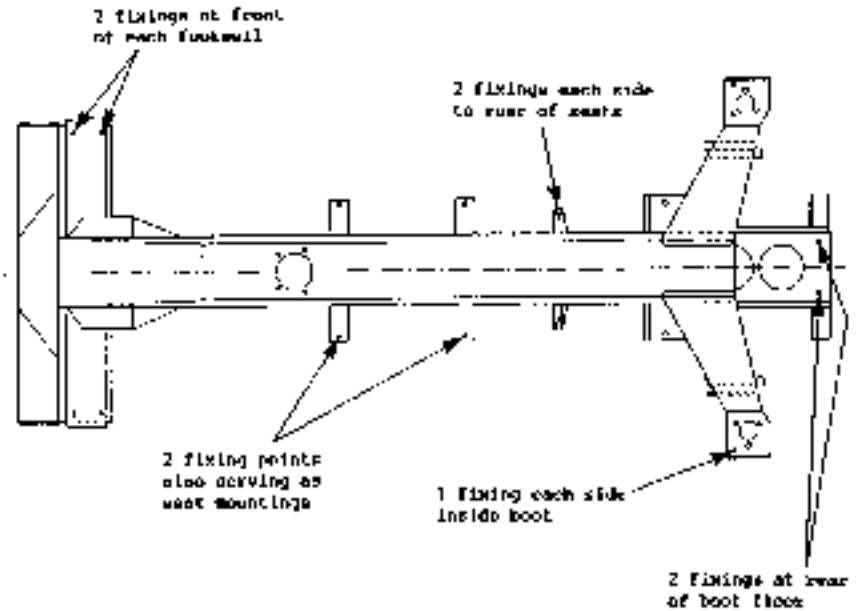
A10.5 - BODY/CHASSIS MOUNTING POINTS

There are 10 rear mounting points securing the body to the chassis, each using a two piece aluminium bobbin crimped together and bonded to the body, and an M10 bolt picking up in a caged nut on the chassis. The mounting points are symmetrical about the car centreline, and are located as follows.

- 2 at the front of each bodywell, into the rear of the chassis front crossmember.
- 2 alongside the bottom of each side of the centre tunnel, also serving as seat mountings, and picking up short outriggers from the side of the chassis centre backbone.
- 1 in each side on the rear bulkhead, adjacent to the centre tunnel, picking up a bracket at the rear of the chassis backbone.
- 1 at each side of the boot, inboard of the rear wheel arch, into the chassis rear suspension top platform.
- 2 in the spare wheel well, into the chassis rear extension.

See section W.1 for body/chassis removal procedure.

Body/Chassis Fixings



A12.7 - CHASSIS EXTERNAL PAINT REPAIRS

In order to preserve the corrosion protection of the chassis, the polyester surfacer and electrophoretic coating ('E' coat), should be inspected for damage at the specified service intervals. Stone chips and scratches should be repaired and protected using Dinol products as follows:

1. Remove all loose paint, dirt and surface rust from the affected area, and thoroughly degrease using Dinol thinners. Using 800 grade emery paper, rub down any stone chips and scratches, and mildly key the surrounding good paint to accept the new repair. Wipe over again with Dinol thinners.

2. Spray, at low pressure, a single coat of Dinol 125 thixotropic rust-preventative fluid to the area, followed by a single coat of Tectane 205 thixotropic wax coating, wet on wet. Allow approx. one hour air drying time.

Both these products (Dinol 125 & Tectane 205) are available from Dinol at Montalbo Road, Barnard Castle, Co. Durham, DL12 8EE, England., and may be applied using the same equipment as is used for the anti-corrosion guarantee wax re-treatment.

PAINT PROCEDURE

SECTION B12 - ELAN

The procedures detailed in this section are based on the use of the manufacturers of Lotus cars, and start with the bare composite bodyshell. The section is included only for general guidance in repair work, and does not constitute a complete service repair procedure. Note that different area temperatures and humidity may be necessary dependent on the level of humidity and the exact type of paint etc.

BH 1 - PAINT CODES

A paint code number is stamped in the lower left hand corner of the vehicle identification plate fixed to the sheetwork in the front engine compartment. This code identifies the type and colour of paint used in manufacture.

Mixed polyurethane colours are used for vehicles finished in two pack acrylic polyurethane materials, usually DX 9620 (gloss colours) or DX2 (metallic) type 'A' primer. These are used for refurbishment paint finished jobs where DX 1751 primer sealer are used for undercoat paint finished jobs where DX 1751

Paint Type	Colour	Manufacturers Reference No.	Lotus Part No.	Remarks
DX1	Monaco White	DX1 9420/0/17	A0-00-00-00	
DX1	Calypso Red	DX1 9420/0/3	A0-00-00-00	
DX1	Silver Frost	DX1 9420/0/05	A0-00-00-00	
DX1	Steel Blue	DX1 9420/0/49	A0-00-00-00	
DX1	Lotus Sea Racing Green	DX1 9420/0/51	A0-00-00-00	
DX1	Carrera Blue	DX1 9420/0/0	A0-00-00-00	

BH.2 - ESSENTIAL WORKING PRACTICE

1. **Warning**
   An isocyanate 2k hardener (P190-193 flow2 with ALL ECC two pack acrylic polyurethane systems) is being utilised. A small portion of vapour is volatile. Vapour should not be allowed to accumulate in a confined or badly ventilated space. The spray mist is harmful by inhalation and irritant with skin and eyes.
   Paint should only be used in well ventilated areas, preferably a suitable spray booth with efficient exhaust ventilation. Spray operators should wear air line breathing apparatus to BS1567 part 2, fabricated in accordance to BS4275. Couple utilising the spraying area to client per job (up to 15 mins) should wear a respirator to BS2091 with type CC canister.

   Before spraying Valeting/Body operators should refer to ICI Health and Safety Information Sheet No. 1 which is issued in accordance with the Petroleum (Consolidation) Act 1928 and the Petroleum Mixtures Order 1929; and in a well ventilated area. Store paints, thinners and hardener in accordance with the Highly Inflammable Liquids and Liquified Petroleum Gas Regulations 1972. Do not smoke in the vicinity of paints and keep away from all sources of ignition. Take precautions against static discharge. In case of fire, use foam or dry powder extinguishers. Small dry spillage will soak to earth. Do not allow to enter drain or water source.

   All air used for spray painting or blow down should be filtered before use.

2. All precautions should be taken to ensure there is no dirt or water contamination in the paint containers and air supply lines.

3. A full standard clean/rinse must be maintained with all spray equipment. Frequent cleaning of guns and the surrounding area and booth is necessary.

4. Room temperatures and temperatures of the spray booth, lab bay booth and paint working areas should be checked daily, and periodic measurements of paint temperatures carried out.

5. It is also only essential that any surface to be sprayed is absolutely clean, dry and free from dust or sludge.

6. After any and each surface preparation treatment including - GP fillers, cellulose strippers, polyurethane primers, primer/surfacer, colour paint and clear lacquer, it is essential that these be fully cured using a bank of infra red lights giving a skin panel temperature for the duration specified for the operation. Units then must be allowed to cool before further work.

BH.3 BODY AND COMPONENT PREPARATION FOR PRIMER

1. i) Check panels for warps, gel coats.

   ii) Warps and gel coats should be routed out.

   iii) Using 120 grit paper, dry feat edges of cut where routing has been carried out.

   iv) Blow air dust.

a) Fill with Polyfiller.

b) Flat off as per P30 with 80 grit dry followed by 120 grit dry, leaving a very thin film of filler over edges of repairs to avoid edge show through.

3. Dry flat the panels and component surface areas, using 120 grade paper if [illegible], to ensure that there is no trace of wax or dirt.

This operation is a cleaning process in order to provide a suitable surface for painting and must prevent a completely scrubbed surface to key the primer.

Blending should be carried out with an orbital sander or D.A. (orbital) sander on flat surfaces and a flat, hand held block, in more restricted areas.

Extra care is necessary to avoid grit scratches through on sharp contours. Fibre pad material shapes may be flatted using a Scotch pad.

4. Thoroughly vacuum clean the panels to be painted & the surrounding areas and remove all foreign bodies.

5. Solvent wash panels and components using Isopropanol mixed 1:1 with deionised water and lightly wipe with a lint free cloth for wet cloths etc. Fill as required, as above.

6 Blow dry panels/components to remove dust, water etc. from surfaces and recesses.

7 Check the area to be masked up and re-wash with solvent if necessary.

8 Mask up and re-body extrusion the area to be sprayed.

8A.4 APPLICATION OF PRIMER

1. Rinse the spraybooth and thoroughly solvent wipe all surfaces with Isopropanol mixed 1:1 with deionised water.

Ensure that new cloths of a woven material are used and that they are changed frequently during use, so as to maintain surface cleanliness.

2 Prepare-mix as required all surfaces to be painted.

3. Primer Formulation: Prep Fill or Brown Grey.

4+ Dur Page'd Primer	ICI P565 6VS	4	Part	6100860279
4+ Hardner	ICI P410-179	1	Part	6100860279
Thinner	ICI P850 (2Th	0.5	Part	6100860269

Viscosity 15 32 Seconds BSA Cup @ 20 degrees C. Material Temperature

1 Spray 1st and 2nd coat

Gun

Nozzle Type or ID:
Air Cap: [illegible]
Needle: [illegible]
Head: [illegible]

Setting

Air Pressure to 20lbs at the gun

2 Application

(i) Spray 1 coat a pass.

(ii) Flash off 10 minutes [illegible] start of operation.

(iii) Spray 1 double pass [illegible]

(iv) Flash off 10 minutes [illegible] start of operation

(v) Spray 1 single pass. Total dry film build [illegible] or 14-6 thou). Apply a mist coat of 2K black as 1 part [illegible] to 1 part [illegible] using a pot gun spraying from about 3 feet back on trigger fully open.

(vi) Flash off 2o minutes [illegible] start of (v).

3. Oven bake at 65 degrees C for 30 minutes.

4. Rub down with 1200 to remove [illegible] and runs if required.

To be Sent With: [illegible] Dated: [illegible]
[illegible] Part: [illegible]
[illegible] Date: [illegible]

DH.5 - PREPARATION FOR COLOUR COATING

1) Wet [illegible] with [illegible] and Dicks 3M 400 grit paper (3M or D.A. with 1/2 grit paper wet.

Care must be taken to avoid rubbing through the primer [illegible] particularly on [illegible] corners. These areas may be flatted with a 2000 grit

2) Dry thoroughly, re-wet wipe using [illegible] mixed 1:1 with [illegible] water and repeat

3) Carefully any surface defects as required action P38 and stoppers.

Tear masked areas with [illegible] grit.

solvent wipe peripheral areas with isopropyl, as above. Replace masking as necessary.

4. Spread any pin through or unfilled areas with 2k Epoxy primer.

Dulux Two Pack Gloss	4 Parts	Filler 202 or Brush Grade
Hardener	1 Part	
Thinner	1 Part	

Allow 20 Minutes.

Lotus Service and Internal Repair Gun Settings

Set

Spray Cypher	2.0
Air (A)	44 PSI
Fluid	22
Needle	1.4 (1.4)

Setting

Air Pressure 50 PSI At the gun

Wet flat using 600 grit paper

5. Thoroughly wash the panels and components surfaces to be painted, using hose and brush. The final wash should be with de-ionised water ensuring full removal of all flaking sludge.

6. Remove all masking.

7. Dry thoroughly inside and out of the car and components. Ensure wiper motor wire is not removed all foreign bodies.

8. Mask all trim body including area to be painted.

BB.6 - APPLICATION OF MONO COLOUR COAT AND CLEARCOAT

1. Ensure that body and components are fully warmed cleaned.

Paint the spray area and thoroughly solvent wipe the panels and component surfaces to be painted using Isopropanol mixed 1:1 with de-ionised water. Ensure that both sides of a wiper material are used and that they are changed frequently during use, so as to maintain surface cleanliness.

Mask any bonding areas.

2. Thoroughly tak rag all surfaces to be painted to remove all traces of dust.

1. Paint Formulation Front Fender Area

Primer Surfacer Basecoat	[1] 2K	4 Parts	
Hardener	[2] P-13-220	2 parts	A1007B/C1D
Thinner	[3] 7050-1225	1 Part	A1007C/C2D
or	[4] 8050-1130		A0107C/C2D

Viscosity Cup #2 @ 20 Seconds @68 Cup @ 20 Degrees C, Material Temperature

2. Clearcoat Formulation

Clearcoat	[1] 0130-637	4 Parts	A1007B/C2D
Hardener	[2] P-13-211	2 Parts	A1007B/C2D
Thinner	[3] 8650-1225	1 Part	A1007B/C2D
or	[4] 8650-1130		A0768B/C2D

3. Spray Gun and Settings

Gun

Spray Pattern	Full
Air Cap	66-303
Nozzle	303
Needle	18,01-1

Settings

Air pressure 65 to 70 lbs

4. Application

a) Blow down inverior surfaces with filtered air

b) Tak mag to remove all traces of surface dirt

[1] Blow down external surfaces with filtered air.

c) Spray 1 single pass 2 colour.

i) Flash off 10 minutes prep start of spraying

ii) Spray 2nd single pass 1 to 50 psi Dry film build 2 1.5 / 2 mils.

iii) Flash off 10 minutes this must be sprayed

iv) Spray 1 double header bumper coat film build 1.5 to 2 layer no flash required.

Into prep/drying area, allow to dwell 40 minutes @ 40 degrees F to 50 degrees C.

d. Into oven - bake @ 65 degrees C for a minimum of 30 minutes.

BE 7 - APPLICATION OF METALLIC COLOUR COAT AND CLEAR COAT

1. Ensure that body and components are fully vacuum cleaned. Enter the rear rear area and thoroughly solvent wipe for entire car and component surfaces to be painted using Isopropanol mixed 1:1 with de-ionised water. Ensure that new cloths of a cover material are used and that they are changed frequently during use, so as to maintain surface cleanliness.

2. Thoroughly tak rag all surfaces to be painted to remove all traces of dust. Mask any bonding areas.

3. Paint Formulation Firma 1K1 or Mixer Slot

Mid Cure Metallic Colour Kit 2k		4 parts	
Hardener	1K1 P210-110	2 Parts	A1D0B603xV
Thinners	1K1 P997-1096	2 Parts	A0T0B079BV

Viscosity cup to be 14 seconds BS1 Cup @ 20 Degrees C. Material Temperature.

4. Clearcoat Formulation

Clearcoat	1K1 P157-419	4 Parts	A1D0B5D1x
Hardener	1K1 P210-770	2 Parts	A1D0B5D/BV
Thinners	1K1 P997-1096	1 part	A1D0BJXx%
or	1296		A0T0B0C1%

5. Spray Gs Settings

Hvlp

Primex Gopher	1.3E
Air Cap	63 PSI
Nozzle	1.3
Needle	1.3/1.4

Metallic

Air Pressure 61 to 70 PSI

6. Application

a) Blow down exterior surfaces with filtered air.

b) Tak rag to remove all traces of surface dust.

c) Blow down external surfaces with filtered air

d) Spray 1 single pass of colour.

e) Flash off 10 minutes flow coats of spraying.

f) Spray 2nd single pass of colour

g) Flash off 1 minutes flow coats of spraying

viii) Spray finish coat of primer, minimum film build 30-50 µm (1.2-2 thou).

ix) Flash off 45 minutes from end of spraying.

x) Spray 1 single pack of clearcoat.

xi) Flash off 20 minutes from end of spraying.

xii) Spray 1 crosscoat dry film build 40-50 µm (1.6-2 thou) of clearcoat. No flash off required.

7 Enter pre-servicing area. Allow to dwell 45 minutes @ 80 degrees C (176 degrees F).

8 Enter oven, bake at 60 degrees C for a minimum of 30 minutes.

BB.8 - PANEL POLISHING OPERATION

1. Remove masking tape removing all surfaces without paint.

2. Compound Formulation

Rubbing compound Glaze 2R (5962-2)

3 All painted surfaces to be lightly compressed with a perfect cap.

4. Wipe down with mineral spirits and blow dry (clean surfaces).

5 Obtain service car.

6 Clean up and wax.

BB.9 - PAINT PROCEDURE FOR MAIN COMPONENTS

The first and last outputs are considered creation inspection points (CIPs) which may be distinguished by their more flexible tolerances (+/-) compared with glass (i.e. reinforced plastic (GRP) composite mouldings). They are supplied only in pairs. Cut file using in the colour required.

1 Preparation
Use 2K grit carborundum paper to wet flat the panel and remove all surface irregularities. Do not rub through the primer (BB9DB14294). Ref Part-Book.

2. Primer Paint Application
For metallic colours:

Primer paint		PA21	5 parts by volume
Mix with	AA04b01/10	P210/2201	1 part by volume
Hardener	A1B0B0a/2 V	P210/220	3 parts by volume
Thinner	A1B0Bb2/250	PB50/1276	to spraying viscosity

Two pack colours			
Gold Paint		9420	1 parts by volume
Flex Aid	AU0UBe1215	0100:200	1 part by volume
Hardener	A1UUBe2150	02.0:115	1 parts by volume
Thinner	A1UUPe1250	0950-1217	0% spraying viscosity

Per colour cycle, spray one single coat. Allow 10 minutes to flash off. Apply second coat as above. Allow 30 minutes flash off before stoving at 60°C for 90 minutes. Quickly refurbish with cellulose stopper and prepare for spraying as around coat.
Spray second coat as above, and if applicable, with metallic colours, a last coat in aluminium shading. For gold colours, allow 30 minutes flash off before stoving at 60°C for 90 minutes.

Clear Coat Application			
Clear Coat	A1UUPe5220	0100:435	3 parts by volume
Flex Aid	A0UUBe1215	0100:200	1 part by volume
Hardener	A1UUBe1250	02.0:115	1 parts by volume
Thinner	A1UUPe0250	0950:1217	0% spraying viscosity

Spray one single coat at clear coat, allow 10 minutes to flash off, and spray one double coat. No flash off is necessary before stoving. Stove at 60°C for 90 minutes.
NOTE
GREEN components can only be stoved if two suppliers are used to prevent discolouration. Where this one not available, the paint may be air dried at 100 temperature for 1½ to 2 hours minimum. Parts should not be fitted for 24 hours.

BH.10 PEARLESCENT WHITE PAINT PROCEDURE

This finished in Pearlescent White with panel ready for vehicle be painted as follows:-

1. Follow procedures BH.7, BH.8, BH.9 and BH.10 to apply Hi-Dic primer and to prepare for the white coat.
2. Follow procedure BH.6 stages 1, 2 and 3 to apply Mercedes White, 2C P2420 2010.
and allow 15% thinners of pw2204 applying for pearlescent coat

Pearlescent Finish: A1UUBe1EV 121 P420 Gloss			
Mixing Ratio :	Pearlescent		2 parts by volume
	Mid Jetty	P2107-01	1 part by volume
	Thinners	P950:1215	1 part by volume

Solvent viscosity is 19-19 secs, DIN cup at 20°C material temperature
Pressure at the cup 35 psi
Spray 1 single passes to obtain a film thickness of 1 thou. approx. 5 min flash off between coats
Flash off 30-45 min before clearcoat application

4. Follow procedure BH.6 stages 4 to 7 to apply clearcoat and to polish.

311P Corporate or Fleet/Agent White

1 Follow procedure 09.A to apply a colour coat of Pearl White
for approval.

2	Apply gear cover finish.	Nu9006184V	Jet 142-*660
	Mixing Ratio	Pearlescent	4pbv
		Hardener	1pbv
		Reducer	1.5pbv
		Thinners	As required to spraying viscosity

Apply 3 directly to the 19 oxon. Use at 21°C material temperature.
Spray 1 single passes to obtain a film thickness of 1 thou.
Approx 5 min flash off between coats.
Allow all 30 45 mins before clearcoat application.

3 Follow procedure 09.A to apply a clear coat of Jet 6000 495.

311 - PAINT REMOVAL

Under no circumstances must "Paint Stripper" be used to remove paint from G.R.P. components as these will attack the gelcoat. Also, wear gloves to use.

The recommended procedure for removing minor dents

1. Mask off with a 6.5# rubber, or

2. Rub flat with an appropriate grade of paper degreased or the amount of paint to be removed.

311.2 PAINT RECTIFICATION PROCEDURES

1 Sponge Pool or Scratches Caused by Corrosion

These defects should be removed using 321 all purpose compound. Use a machine rag keeping the rag moist and wipe gently remove the rag to a 7 in and dry thoroughly.

Continue with polishing using 1/2 oil and a fresh polishing rag, again keeping the rag moist and moving in a rope and all surfaces. Finally hand polish the dry using lens cloth and Micropolish 9004

2 Areas or Sinkages

Minor paint film faults should be removed by wetting the defect area with fine grade paper ref. 321, rubbing compound and water. Great care must be taken not to rub through the clear coat.

If the paintwork is thin that it cannot be removed by blending then the area should be prepared as follows:

a. If necessary, remove adjacent trim and fittings.
b. Mask the area with clean water.
c. Sand with water mixed (1) with isopropanol.

e. Dry off and allow vehicle to dry using filtered air.
f. If necessary, mask off surrounding areas.
g. Feather edge the bare area by wet flatting using hand held blocks and 1200 grade paper carborundum.
h. Wash with clean running water and dry off using filtered air
i. If necessary, apply P.V.C to the built and cure using infra red lights to give a panel temperature of 60°C for 10 minutes. Flat dry using dist pad and 1200 paper (18).
j. Spot prime the area prior to the primer mixed and applied as in Section 2. Cure the primer using infra red lights to give a panel temperature of 60°C for 30 minutes.
k. When cool, apply wet & dry prime fill grade paper (220) and hand held blocks. Wash with clean running water and dry using filtered air.
l. Tack rag the repair and surrounding masked off areas and apply colour coat and clear coat as set as described in Section 6 using a Cedrol technique
m. After the final blend off period has elapsed cure the paint using infra red lamps to give a panel temperature of 60°C for 30 minutes
n. When cool, 1200 wet dual, compound and polish the sprayed area. Remove masking and refit trim

i. <u>Wet cracks</u>

Remove the paint, primer and rust. Key over the cracked area feathering back the original paint surface. Apply P.V.C and refinish as in (4) above.

ii. <u>Blisters</u>

Cut out the blister just large enough to expose the blister cavity and repaint as in (2) above.

iii. <u>Chips and scratches</u>

Key dull the chip using 320 paper carborundum and refinish as in (4) above.

BODY REPAIR

SECTION B1 - CLAM

BJ.1 - LOTUS COMPOSITE BODY FEATURES

(Owner's Handbook Extract)

Body Features

The body structure comprises a moulded composite fibreglass reinforced polyester ... body panels on a steel box section ... The floor pan is bolted at various points to the box section steel backbone chassis, with further rigidity and corrosion protection provided by a high strength aluminium alloy ... chassis. Front, a tubular steel crumple zone and steel beams in the doors ... of post displacement. Most composite exterior panels are bonded to the structure using a flexible polyurethane adhesive, but the frontal panels are ... fixed by threaded fasteners for ease of service access and collision repair. The front bumper system and rear bumper systems are flexible reinforced polyurethane mouldings resistant to damage from minor knocks.

Composite bodywork does not have the ability to absorb high impact loads by progressive collapse, with impact damage being localised. In accident situations this rigidity prevents the occupants from an injurious shock loads by greatly reducing the danger of entrapment by deformation of body panels. This rigidity also facilitates repair by either replacing the damaged body or by bonded panels, and by integrating replacement overlay sections with the undamaged area. Using recognised approved methods which restore the undamaged condition without loss of strength or durability.

If the panel is deformed beyond its limits of flexibility the gel coat will be overstressed and cracked, although the panel will return ... to its original shape. Metal panel surface, treated with Isocyanate permanently deformed.

The cracking may be confined to the surface gel coat with no reduction in panel strength, but if the damage is more severe the composite structure below the gel coat may be weakened. Localised repairs may be made in either case. The cracks may not appear immediately after overstressing because the effect can be masked by the flexibility of the panel itself. Gel coats in good condition will remain undamaged by minor overstress.

... location of vehicle body on the chassis or any other ... body ...
... Accident damage to body panels which opening ...
... Incorrect ... setup of body panels on a panel ...
... Activity ... material under the ... side and ... of the body ...
... Excessive ... bonded (glued) or bolt (or nut) onto projecting ... surfaces, e.g. lamination faults.
... Deformation ... caused by force, which ... displaced by permanent amounts (e.g. minutes, hours), ... Normal wear ... caution or vacuum ... over some ... Condition of ... Incorrect ... Collision with ... fixed object.

Body trim (eg grilles) are decorative ... which by absorbing light shock loads, protect the body from damage. Depending ... design ... They are ... fastened ... body panels.

BJ.2 - BODYCARE

(Dwight's Handbook Extract)

The origin of your Lotus is extremely resistant to all normal forms of groundwater pollutants. Provided the simple maintenance procedure summarised below is followed, it will retain its gloss, colour and protective properties throughout the life of the vehicle. However, car finishes are not totally chemically impervious to environmental contamination of an acid or an alkaline substance. If it is likely to contact with the paint film for any length of time, it may cause pitting and colour change.

Washing

Rain, containing traces of acid, attacks a paint film and water soluble dirt is removed before it. Dirt removal by thorough washing with plenty of water. It is also advisable to add a few drops of liquid detergent. Frequent washing is the best safeguard against street contamination of the body film including the sensitive chrome trim, sills and traffic film.

If washing with rain water is not alternative, warm water and detergent will remove the gritty deposits eroded by road traffic in the summer months. Petrol or white spirit will remove stains of the tar, oil, tree and grease type.

Polishing

Occasionally some form of gloss, and an occasional or hygienic film, will be of benefit, after the normal washing. A polish will add a good quality liquid polish will restore the original lustre of the paint film.

Higher gloss of the paint film, and added protection against contamination, may be obtained by wax polishing. But it must be considered that a wax polish should only be used successfully on a clean surface, and that the previous application must be removed with white spirit or a liquid polish cleaner before re-waxing.

Ventilation

Water left on the paint surface for lengthy periods will penetrate the paint film, although the effects will not be visible immediately, this will in fact cause a deterioration in the protective properties of the paint film.

If a car is garaged, good ventilation must be provided. Likewise storage outside on a hard standing or under a carport is permissible.

Summary

Wash frequently, using a mild water with a few drops of liquid detergent added.

Inspect after a normal washing, and remove any tonal deposition with warm water, petrol or white spirit as applicable.

Use a good quality liquid polish - frequency - say, twice a year - to restore high gloss and to remove accumulated traffic film and grime.

Look on a hard standing, and under conditions of good ventilation if a covered area is used.

Windscreen

Start wash at the windscreen, the wiper arms may be pivoted forward to clear the glass and provide unrestricted access to the windscreen. Wash the wiper blade with clean water.

Alloy Wheels

It is recommended that these are washed with the preparation as used to wash the bodywork. Use a soft or marine nylon bristle only. During the winter months, pay closely when salt has been used on the roads for the dispersal of ice and snow, remove all weeds, and wash thoroughly to remove all accumulated dirt in the wheel recesses.

Upholstery

Normal cleaning requires an occasional light wipe over with a cloth dampened in a mild soap and water solution. It is important that the cloth is only dampened, not soaked.

Leather Upholstery

The leather can be wiped over occasionally with a cloth dampened in warm soapy water only.

Ingrained dirt should be removed using a fresh cloth and water only - avoid flooding the leather - finish by drying and polishing with a soft, dry cloth.

It is important to use only non-caustic mild soap (or 'hand' soap cleaner) and to avoid the use of petrol or detergents, furniture creams and polishes.

An occasional use of saddle soap is recommended after the leather has been in use for a year or two.

Seat Belts cleaning

The most suitable cleaner for seat belts is a mild soap and water solution using a sponge. Work up a good lather with the water, then sponge off the dirt. Do not soak the belt as this will damage the stitching. Allow to dry naturally away from direct heat.

Do not attempt to bleach or dye belts. Those containing mineral acid dye must not be used.

B1.3 BODY STRUCTURE

The body of the vehicle comprises of a one piece under tray and bridge section made of cut fold which together with steel outriggers, transfer & reinforced steel bulk head chassis and bolt together via integral alloy brackets to the engine mounting points.

A crash structure which consists of longerons, a pressbox and a front bumper is bolted to the front of the chassis.

The engine is designed to carry all the major stresses made and is made of high grade steel.

The crash structure which bolts to the front of the chassis is designed to take the impact loads in a crash. Using the weight of the engine and power to help absorb or impact.

The composite underfloor, subframes and 'B' post diagram are designed to carry structural loads and when assembly with contributes to the strength and torsional stiffness of the body assembly.

The composite body structure comprises of a one piece moulded underfloor into which all the bulkheads are bonded and crimped. Two metal subframes are bonded into the under tray, bottom section steel bodes are fitted across the 'B' posts and 'C' posts to form an additional protective cage around the passenger compartment. The rear and front bulk heads are bonded into place before the 'A' and 'B' post work, sills and rear panels are bonded into their respective positions.

The front panels, which are also made of G.R.P. are bolted to the main assembly.

The underfloor is made from laminated polyester/G.R.P. All other panels are of the profile G.R.P. construction.

All panels are produced using the latest Wet Moulding Process

B) 4_: ACCIDENT DAMAGE ASSESSMENT

All damage to the body is covered in the following categories:-

a) Minor damage
b) Moderately damaged
c) Heavily damaged

and on that definition depends the original construction and therefore the repair method to be employed.

As a general rule there should be a bonded joint wherever two panels touch, or wherever they have an important purpose. It is usually possible to check these bonds both visually and physically for fractures or breaks. Ascertain the cause of damage and the direction of impact and examine all panels or braces which may have been affected.

A front end impact, for example, may easily cause the bonds at the bulkhead to part without the defect being easily visible.

To carry out a proper examination it may be necessary to remove parts and components to determine the extent of the damage. When determining the replacement underbody sections and panels to be ordered, make sure the new underbody section and panels, when rejoined will be attached to like composite materials avoid badly cracked areas and badly burnt areas.

Rear damage is the most difficult to assess but generally only the chassis tube or rear bulkhead will need to be replaced or reinforced.

After a mockup or severe accident checks should also be carried out on the 'A' and 'B' post dot m points, rockers, suspension and saddle fibreglass areas.

Note - Repair of damaged body area around doors may necessitate body refacing from chassis.

Accident Repairs

For repair purposes, accidents may be defined as either:-

a) Front section
b) Centre section
c) Rear section

Are that definition determines the original construction and therefore the repair method employed.

a) Front section
The front section has been designed for ease of panel replacement. Each panel may be removed by unbolting and its replacement bolted into position. A series of repair notes in this manual cover replacement of front section panels.

b) Centre Section
If severe damage occurs to the centre structure body tub - understray and all four panels may have to be replaced. However on occasions it will be possible to replace sections of the understray and outriggers. This may be achieved using conventional glass fibre repair techniques. A series of repair notes in this manual cover replacement of sections of the understray.

c) Rear Section
The rear section of the car is comprised of the rear end of the understray and body panels bonded into position using a flexible polyurethane adhesive. Replacement of sections of the rear understray may be carried out using conventional glass fibre repair techniques. The rear panels may be replaced by cutting the adhesive and removing the panels. When replacing bonded panels, adhesive must be applied and the panel positioned and located while the adhesive cures. A series of repair notes in this manual cover the removal and replacement of rear body panels and replacement of rear sections of the understray.

J1.5 - RESIN AND GEL MIX

The following contains information appertaining to the resin and gel mixtures which must be used when carrying out a repair.

The panels of this car are manufactured using two types of material. The materials are:

a) Isophthalic polyester G.F.R.P.
b) SMC panels
When carrying out a repair the type of materials used will depend on the original material used in manufacture. The table below shows which materials must be used with each process.

MATERIALS	ISOPHTHALIC POLYESTER RESIN (Understray)	LOW SHRINK RESIN (All other panels)
Resin	Crystic 196PA	Ash and Bergel 50A17
Resin Catalyst	Butanox M50 - 2% by weight	Butanox LPT - 1% by weight
Accelerator	Nil	Nitrocobalt 6% parts per 100 resin by weight
Gel Coat	Bergolin Clear Gelcoat 50/B7000	
Gel Coat Catalyst	Butanox M50 - 2% by weight	

Notes:

1. The Millboard filter will be mixed through with the Ashland Aropol 5043.

2. Ashland Aropol 5043 has a usable life of 30 days from the date of despatch by the manufacturers.

3. Beam Specifications may be obtained from:
   International Paint
   Oil Colours
   London
   Tel. 01-679-1011

4. Technical Aropol data may be obtained in small quantities from:
   Ashland ...
   ... 2 Office of ...
   Middlesbrough
   Yorkshire, ...
   ... TS1
   Tel. 0642-...-...

5. Stock of the Balsams Catalysts may be obtained in ... quantities from:
   Acro Chemie
   Co-ordinator Road
   Peterlee
   Co. Durham
   Surrey
   KT17 1UQ
   Tel. 0372-21750

6. Millboard may be obtained in small quantities from:
   Solitaire Ltd
   ... with Tinsley Colour
   Leicester Road
   Wellingford
   Essex
   CB10 1NA
   Tel. 0371 ...

7. For ... Viewing Glass Of ... may be ... from:
   ...
   ...
   ...
   ...
   Tel. 01-...-...

Safety Precautions (Special Observations)

a) Protective ... to be worn ...
b) Low ... all other ... on ...

8J.6 BASIC BOARDS AND JOINTS

This section refers to the repair of an undertray

It will be necessary to remove the damaged panel and prepare both existing and new panels, removing all road filth, corrosion and paint from existing panel. Cut new panel to fit exactly leaving a gap of 1/32" (0.8) between joints up with the previously marked positions ensure that the parts to be joined, leaving a gap of 1/32" to 1/16" between and using jacks or clamps as necessary to achieve a perfect match. Doubling plates (of angled sections) should be prepared to the exterior of the panel with the aid of self tapping screws or pop rivets. Using overlapped strand glass fibre mat of the type and quantity as specified by the manufacturer, together with resin and hardener, lay up to build from the underside of the joint, ensuring an overlap of 6-10cm (2-4 ins) laying to further on a temperature of not less than 15°C

Where the repair has fully cured (see above), and as before, remove the protective plastic from the exterior surface of the cut exposing only, thoroughly roughen from the joint line, removing any old paint in the process with the 120 to 180 grit abrasive paper during wet sand, and wipe dry. Lay on the layers of glass fibre mat together with resin and hardener, lay over the top of the upper glass fibre 450 grams per metre squared (obtained with previously weighed) lay over one layer of the chopped strand glass fibre mat together with resin and hardener. Allow resin to dry and fully cure at a temperature of not less than 15°C.

8J.7 - SUPERFICIAL DEFECT REPAIRS

Pin Holes or Air Voids

The only solution is to pick out and fill the holes with a polyester resin or filler. The two usually used methods of filling these small holes are, for driving or moving air so as to leave a large hole with neat vertical walls or for coloring by covering or "picking out".

SURFACE CRAZING

There are various causes of surface crazing, but generally all are caused by heat (or prolonged exposure to sunlight). During an accident some panels may flex or possibly fracture the surface to cause a small amount immediate apparent damage to the paint surface. The crazing may not work its way through the paint surface for some weeks so that it is necessary when assessing accident damage to carefully examine all panels, particularly near cracks or split bonds and to make a note of same. It may be possible to promote the appearance of the crazing by applying gentle heat.

Surface cracking itself generally stops at the first layer of glass fibre and is consequently not a structurally serious, but the extensive crazing must damaged areas should be taken as an indication of over stressing and the panel should be reinforced or replaced. It is not possible to remedy crazing by simply impregnating with a further layer of resin.

Wrinkling or Distortion

This phenomenon is usually caused by exposure to severe heat. This can cause the resin to soften and 'give' or crazing or give way to any other form of unwanted distortion.

BJ.8 - REPLACEMENT SECTIONS AND PANELS

When the repair of a damaged vehicle calls for replacement sections and panels they may be obtained direct from Lotus (Service) Ltd.

Where severe damage has been sustained, the damaged section of the underbody may be cut away, and a replacement section married on.

Before cutting away any damaged underbody section or before ordering replacements, the proposed method of repair, positioning of cuts lines etc. should be ascertained. Determine a method of correct positioning of replacement sections, and in the "B" post or sills, "B" post and to seat belt bottom, or any structural feature from which measurements can be made and decide these clearly with the sections which is to be used. Use a marker to define the lines at which the processed is cut the section and study these lines thoroughly to see that:

a) Any damaged section removed will allow workable 'pick-up' points on the replacement section to ensure it can be accurately positioned.

b) The proposed cutting arrangement longitudinal, lateral and horizontal definition points to assist accurate lining up of the new section in all three planes.

Underbody sections are available as follows:

1. **Front half** - this section includes the bonnet panel, front bulkhead, front of the underbody including the front seat belt fixtures, the front one of the jacking points, both 'A' posts and roof locking points.

2. **Front quarter** - this section includes the front of underbody as far back as the tunnel, the front seat belt fixtures, the front section of the sunrisers, 'A' post, lower part of the 'B' post and part of the bulkhead.

   Centre - this section includes part of the sunrisers, the front of the underbody as far rearward as the tunnel, all floor seat belt fixtures, the underbody of the centre 'B' post, the lower part of the rear wheelarch including the 'B' post fixing points. The outrigger will be supplied separately.

3. **Mid section** - this section includes the middle of the underbody as far back as the tunnel, the rear seat fixtures, the beginning of the petrol tank recess, part of the rear wheel arch including the 'C' post fixing points. The rear half of the outrigger and jacking point.

4. **Rear half** - this includes the rear section of the underbody, the two rear chassis members and half of both wheel arches. It will cover the whole width of the boot.

1. Rear quarter - Trim / check the rear section of the sidetray, and rear wheelarch lining and fill out with sheet etch. To avoid lower half the width of the boot.

The front area of the car is for the bulkhead, has been coloured to provide "Point of panel replacement. The rear of the car has been designed with bonded panels.

The colour 'A' post consists of 'B' post covers (no bonds)

The front can be replaced in the conventional manner

B8.9 - BOBBINS (METAL INSERTS)

Metal inserts are used at various points in the underbody to form secure and accurately located attachment points where high loads are involved. These inserts situated to the bobbins of the bi-material type.

The bi-material type bobbins consist of nylon and metal sleeves and are bonded to the underbody after completion. The nylon bolt has a ribbed shank passes through the body and into the ferrule bolt before being crimped over to retain, like the rivet holes in the underbody. These type of bobbins have very good values of rear to load-carrying, with different levels depends to unit material thickness.

Bobbin Replacement

If the body ever has been supplied complete with bobbins, but if a bobbin has to be replaced, for example after accident damage, follow the bobbin manufacturers procedure as follows:

When the panel into which the bobbin is fitted has been fully repaired, select a suitable size for the bobbin spigot, drill a hole which will allow approx length to provide enough penetration through the female half of the bobbin and engage correctly at the spigot and to locate clear the assembly.

Remove 1 layer of the bobbin flanges the area around the hole on both sides of the body, and apply a thin even epoxy adhesive as specified. Put the bobbin into a holding gripping tool. Complete the crimping operation and allow the adhesive to cure.

Drawings Required

SUBP	PART DESCRIPTION	REMARKS
A	[illegible]	Bonded Together
B	[illegible]	
C	[illegible]	
D	[illegible]	Bonded Together
E	[illegible]	
F	[illegible]	Bonded [illegible]
G	[illegible] assembly	Bonded [illegible]
H	[illegible]	
I	[illegible]	
J	[illegible] assembly	
K	[illegible] assembly	
L	[illegible]	Bonded Assembly
M	[illegible]	
N	[illegible]	Bonded
O	[illegible]	Bonded [illegible]
P	[illegible]	
Q	[illegible]	
R	[illegible]	
S	[illegible]	
T	[illegible]	

KEY	PART DESCRIPTION	REMARKS
1	[illegible] dust upper.	Sealed [illegible] Assy.
2	[illegible] dust lower.	
3	'A' post cover [illegible]	
4	'B' post cover [illegible]	
5	[illegible] [illegible]	
6	'C' post [illegible] assy [illegible]	

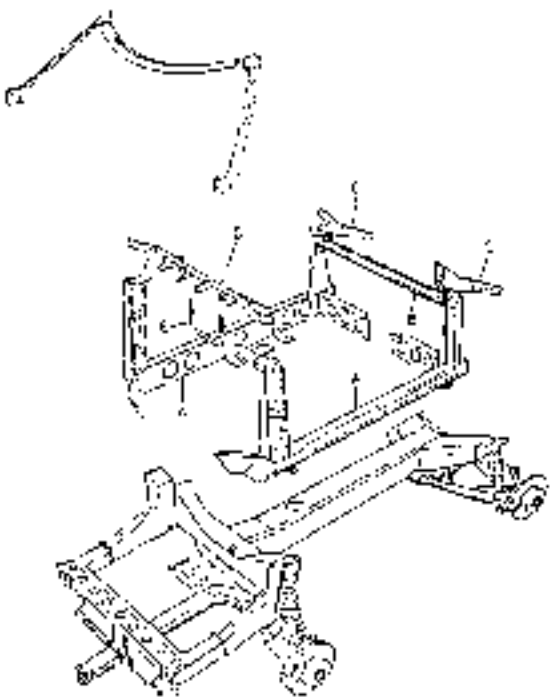
REF.	DESCRIPTION	REMARKS
A	[illegible] [illegible]	Sealed [illegible] [illegible]
B	[illegible] [illegible]	
C	Front [illegible] flap	
D	Rear [illegible] [illegible]	Sealed by [illegible]
E	'A' Panel outer [illegible]	
F	[illegible] strap, [illegible] [illegible]	
G	[illegible] front [illegible]	
H	Front panel [illegible]	
I	'B' [illegible]	
J	Ventilation [illegible]	Bonded by [illegible]

Drawing No. 912-1 Panels

METAL STRUCTURE DRAWING (ASSEMBLY)

REF.	PART DESCRIPTION	REMARKS
A	[illegible]	)
B	[illegible]	) Part of
C	[illegible]	) S/S Body
D	[illegible]	) Assembly
E	[illegible]	1

Drawing No. BJ-2 Steelwork



8.1.10 - UNDERTRAY ASSEMBLY DAMAGE ASSESSMENTS

Check Datum Points for Body Damage

Special Tools
J.3 no. TC3850/10

Op. No.	Notes
1.	Apply, and remove body doors.
2	Remove strikers & slec from both 'B' posts.
3.	Remove the grommets from the underneath of the rear bumper bar (if the vehicle).
4.	Fit J.3 to underneath of the rear bumper bar. Two 'A' post holes, and two 'B' post striker holes.
5.	If the jig fits all the above points, the centre of the underbody and the strikers are correctly positioned as shown
6	If the jig does not fit all the above points it will be necessary to carry out repairs.

Check Movement of Body and Rubber Security

In the event of an accident the following checks should be carried out on the body and bobbins:

1. Body Movement Visual Check

Check that the front face of the front bulk head is not in permanent contact with the rear face of the front section of the chassis.

2. Rubber Security

Check that the rubber material around each bobbin remains undamaged.
This is particularly important on the:

a) 'B' post to bonnet/rear wheel arch bobbins
b) Rear suspension/body bobbins
c) Toe and heel board bobbins
d) Seat belt bobbins
e) Fuel tank security bobbins

B1.11 - REPAIR OF MINOR CRACKS AND GEL CHECKS

The repair of minor cracks and gel checks may be carried out on the above area.

a) Repair of minor damage to the underneath of a panel
b) Repair of minor damage to the gel coating of the top surface of a panel.
c) Filling of minor damage of the top surface of a panel

a) Repair of a minor damage to the underneath of a panel.

Materials
Resin
1/oz chopped strand mat
Mixing cups

Special Tools
Coarse paper

If the cracks have gone through the panel it will be necessary to repair the damaged underneath of the panel as follows:-

Op. No.	Notes
1.	Coarse sand the underneath of panel around the crack.
2.	Remove area to be laminated ie free from dust
3.	Brush area with acetone
4.	Apply 1st coat of resin to panel
5.	Apply two layers of resin impregnated 1oz. chopped strand mat
6.	Roll and tamp down
7.	Apply 2nd coat of resin to chopped strand mat
8.	Leave resin to cure in a temperature of not less than 15°C.

b) Repair of minor damage to the gel coating of the top surface of a panel

Materials
Grit type
Glass cloth fiber - Grade 450/600
Fiber glass filler - 20 grams per metre square

Special Tools
Hot air heater

Op. No.	Notes
1.	Sand panel to remove minor cracks in gel coat.
2.	Ensure area to be repaired is free from dust
3.	Bevel sanded area with acetone.
4.	Apply 1st coat of gel to sanded area
5.	Place 2 layers of fiber glass cloth - 20 grams per metre squared on damaged area.
6.	Roll and tamp down.
7.	Apply 2nd coat of gel to fiber glass cloth - 20 grams per metre squared
8.	Leave gel coat to cure at a temperature of not less than 20°C.

c) Filling of minor damage of the top surface of a panel.

Materials
P35
Acetone

Special Tools
1. Grit paper
2. Grit paper
3. Grit paper
4. Grit paper

Op. No.	Parts
1.	Sand outside of panel with 36 grit paper to remove surplus dent.
2.	Sand outside of panel with 80 grit paper to provide a key.
3.	Remove area to be repaired to bare of dust.
4.	Clean area with acetone
5	Apply filler to area to be repaired ensuring surface of filler is slightly above surface of panel.
6	Allow filler to harden at a temperature of not less than 15°C.
7.	Using a 80 grit paper remove excess filler and ensure that contours of the repaired area follow those of the car.
8.	Hand sand with 80 grit paper to provide a better finish to the repaired area.
9.	Hand sand with 80 grit paper to provide a better finish to the repaired area.
10.	Hand sand with 120 grit paper to provide a better finish to the prepared area
11.	Place the prepared area keep pits for heater cores for two hours. IMPORTANT - Ensure the area does not overheat.
12	Check for distortion or misalignment.
13	If distortion or misalignment has occurred refill as necessary to bring the above procedures.

13.12 REPAIR OF MINOR SURFACE NON STRUCTURAL DAMAGE TO SILL

Materials
- P40
- P60
- Acetone

Special Tools
- 40 Grit paper
- 60 Grit paper
- 80 Grit paper
- 120 Grit paper

Op. No.	NOTES
1	Clean damaged area of sill and surrounding with 60 grit paper to remove paint.
2	Ensure that area to be repaired is free from dirt
3	Clean area with acetone
4.	Apply P40 filler and leave for 5 minutes to harden.
5.	Sand P40 filler with 80 grit paper to fair contours of sill.
6.	Ensure that area to be repaired is free from dust.
7	Wipe area with acetone.
8	Skim over P40 with P60 to fair contours of sill.
9.	Leave for 20 minutes under infra red lamp to harden. IMPORTANT - Ensure area does not overheat.
10.	Sand P60 with 80 grit and then 120 grit paper

B.1.13 INTRODUCTION TO BONDED PANEL REMOVAL

The notes within this section cover removal procedures for the major rear panels.

These panels are bonded in position with a flexible polyurethane adhesive

When removing these panels it will be necessary to use the following special tools :-

1. Body tool kit (Sealant) See drawing no. BJ13-1
2. Wire set See drawing no. BJ13-1

It may be possible to re-use undamaged panels if they are removed carefully

Before refitting a panel remember to remove all traces of old adhesive and then carry out the full preparation procedure i.e. clean, prime and apply fresh adhesive.

Overview of Dismantling Rear Bodywork

The following is an overview sequence of dismantling the rear bodywork.

1. Remove rear trim.
2. Open tailgate
3. Open 'right' covers.
4. Open 'left' covers.
5. Disconnect and remove load sills or box
6. Remove load storage lid.
7. Remove petrol filler hose.
8. Remove top shell.
9. Remove headrest.
10. Remove lower quarter panels.
11. Remove 'B' post covers.
12. Remove 'C' post covers.
13. Remove sills.
14. Remove 'D' post dashrails.
15. Remove rear bulkhead.

Drawing No. AF13-1 Tools

Lotus Panel Tool.

Allen Key.

BJ 10 - REMOVAL AND REPLACEMENT OF SILL SECTION

Components and Materials

Sill
Type: GRP moulded with chopped strand mat
Resin
Catalyst (hardener)
Acetone
Filler powder (talc) (No. 1000010)
Pure Wool Turpentine substitute
Masking Tape
Marker
80 Grit Sandpaper
220 Grit Sandpaper
1200 Grit Sandpaper
Electric Jig-saw (Recip) fine cut blade

Adhesives

Epoxy Bond 1000
Body Wipe 1000
Body Paper 5000
Body Spray 5000

Special Tools

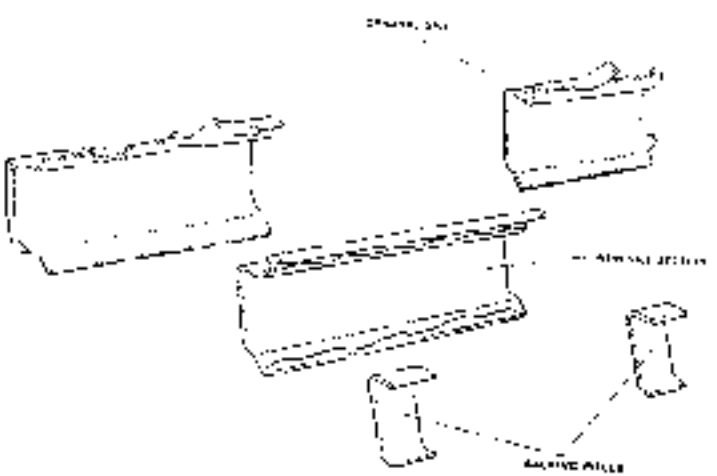
Saw
Drill Power Tool (No. 1000010)
Paint Roll Tray and Roller
Masking Tape
80 Grit Sandpaper
220 Grit Sandpaper
1200 Grit Sandpaper
Electric Jig-saw (Recip) fine cut blade

Op. No.	Notes
1.	Using saw and large panel cut out as necessary, and remove rusted sill. Paint 75 gr. sandpaper and mechanical sander clean and adhesive from outrigger and underbody
2.	Using damaged section of sill mark out lines on new sill. **To make backing pieces**
3.	Apply tape to cover 1 side area up to 2" either side of mark out lines on new sill and ensure area around tape is free from dust.
4.	Apply one coat of gel to tape and allow to dry.
5.	Apply two layers of resin impregnated fibre chopped strand mat to tape - roll & tamp down.
6.	Allow resin to cure at a temperature of not less than 15°C.
7.	Remove the backing pieces and tape from sill. **Finish making backing pieces**
8.	Using saw cut along both cut lines on new sill to create new sill section.

Op. No.	Notes
9	Clean and degrease bonding surfaces of old sill sections, new sill section and backing strips - ensure all bonding surfaces are free from dust.
10	Apply Terrom Bond 4503 to old sill bonding surfaces of backing strips as per manufacturers instructions.
11	Attach backing strips to old sill sections leaving an approx 3" (76mm) protrusion from old sill section and secure with self tapping screws.
12	Clean new sill section bonding strip bonding surfaces and ensure that it is free from rust.
13	Apply Beta Wipe 1500 to clean bonding surfaces of new sill section, outrigger and inner tray, as shown in drawing No. 8114-1.
14	Apply Beta Prime 910 to bonding surfaces of new sill section, outrigger and inner tray, as shown in drawing No. 8114-1.
15	Apply Beta Seal 164 to bonding surfaces of new sill as shown in drawing No. 8114-1
16	Apply Terrom Bond 4503 to new sill bonding section of backing strip as per manufacturers instruction
17	Fit new sill to outrigger, inner tray and backing strip ensuring 1/8" to 1/4" (3mm to 6mm) gap at each end and a Beta Seal bead (typ of 2mm - centre with self tapping screws.
18	Allow Beta Seal 16 hours to cure.
19	When Terrom Bond 4503 has cured remove self tapping screws.
20	Using 4" split hard paper sheet both sides of sill where it has been applied and feather 4 inches from the joint
21	Prime both inner sill which has to be laminated and free from dust
22	Wipe both bonded areas with acetone.
23	Apply 3 layers of resin impregnated 1½ oz. chopped strand mat to each joint - roll firm down.
24	Apply two layers of fibre glass tissue 30 years per centre against each joint and stipple down.
25	Brush joints with 3 layers of gel
26	Leave resin to cure at a temperature of not less than 15°C

Op. No	Notes
17.	Using a 40 grit sandpaper dry back out.
18.	Apply P/F filler as necessary.
19.	Wet down P/F to dust contours of sill.
20.	Wet sand to 240 grit sandpaper rub down filler.
21.	Wet sand to 400 grit sandpaper rub down filler.

Drawing No. 0314-1 Replacement of Sill Section



B1.15. - REMOVAL AND REPLACEMENT OF SILL WITHOUT REMOVING 'A' AND 'B' POST COVERS

Components and Materials

Sill - L.H. or R.H.
1yoz - USA (chopped strand mat)
Resin
Cellulose sample cutter
Acetone
Thinner
Cut
.09

Adhesives

Resin Bond 9515
Body Wipe 3900
Body Primer 9610
Body Seal 8V.9

Special Tools

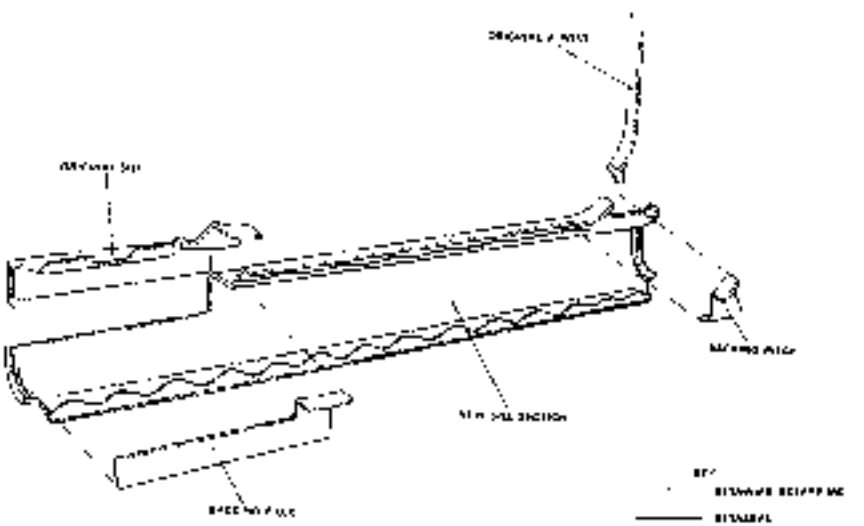
Saw
Resin Proof Roll Position
Body Seal Dispenser and Nozzle
Tape
Marker
.. Grit sand paper
80 Grit sand paper
.20 Grit sand paper
Vax cartridge Manual cut and Nozzles

Op. No	Notes
1.	Using saw cut through the sill to release sill from 'A' post panel.
2.	Using saw cut sill at rear end approximately 6" from 'A' post cover and lower sill panel.
3.	Using Lotus panel tool release and remove sill from cut edges.
4.	Using removed section of sill, mark out and cut sheet of new sill. To make backing piece.
5.	Apply tape to cover inside area up to 3" either side of rear cut line on new sill.
6.	Ensure area around tape is free from dust.
7.	Apply one coat of primer to tape and allow to dry.
8.	Apply two layers of resin impregnated 1½oz chopped strand mat to tape - roll and rap down.

Op No.	Notes
9.	Allow repair to cure at a temperature of not less than 15°C.
10.	Remove backing piece and tape from new sill. Finish making backing piece.
11.	Using 1 saw cut across line on new sill to create new sill section
12.	Remove old sill under rapping section from underneath 'A' post
13.	Clean and degrease joining & edges of old sill, new sill and backing strip and ensure all bonding surfaces are free from dust.
14.	Clean mating surfaces of new sill and 'A' post.
15.	Ensure area of sill and turnscrib are is free from dust.
16.	Apply Terosil Bond 4503 to old sill bonding surface of backing strip as per manufacturers instructions.
17.	Fit backing piece to old sill section leaving at least 2" (50mm) protruding from old sill section and secure with self tapping screws.
18.	Apply Betaseal 4400 to mating surfaces of new sill section, outrigger, 'A' post lower weld flange and under tray as shown in drawing No. BJ15-1.
19.	Apply Betaprime 4402 to mating surfaces of new sill section, outrigger, 'A' post lower weld flange and under tray as shown in drawing No. BJ15-1.
20.	Apply Betaseal 4400 to bonding surfaces of new sill section as shown in drawing No. BJ15-1.
21.	Apply Terosil Bond 4503 to new sill bonding surface of backing strip as per manufacturers instruction
22.	Fit new sill to outrigger, under tray and backing strips ensuring 1/2" to 1.5" (12mm to 38mm) gap at each end and a gap 5mm) bond gap of 2mm - secure with self tapping screws
23.	Allow Beta Seal 15 hours to cure.
24.	When Terosil 4503 has cured remove self tapping screws
25.	Prep & Grit sand paper clean areas to be laminated
26.	Laminate both edges of butt joint to be repaired

Op. No.	Notes
17.	Ensure area to be laminated is free from dust.
28.	Wipe sanded areas with acetone.
29.	Apply two layers of resin impregnated 1½oz chopped strand mat to both joints - roll and tamp down.
30.	Apply two layers of fibre glass tissue 20 grams per metre squared to both joints and stipple down.
31.	Cover both joints with a layer of gel.
32.	Leave resin to cure at a temperature of not less than 15°C
33.	Using a 36 grit sand paper cut back gel.
34.	Apply P38 filler as necessary.
35.	Rub down P38 to suit contours of sill.
36.	Using a 80 grit sand paper rub down filler.
37.	Using a 120 grit sand paper rub down filler.

Drawing No. DJ15-1 Replacement of Sill without Removing 'A' & 'B' Post Covers



05.16 - REMOVE REAR TOP SHELL

Component
Rear Top Shell

Special Tool
Lotus Panel Tool T00/0211
Nivo Set
36 grit paper and mechanical sander

Note: Provided this panel is initially undamaged it may be re-used if removed correctly.

Before removing the rear top shell it will be necessary to remove the boot lid.

Op. No.	Notes
1.	Using the Lotus panel tool separate the rear top shell trim from the N.S. lower quarter, transom and O.S. lower quarter panels.
2.	Using the wiring cut separate the rear top shell from the rear bulkhead.
3.	Using the Lotus panel tool separate the rear top shell from the 'B' post and 'B' post cover.
4.	Using a 36 grit paper and mechanical sander remove all old adhesive from the above joining surfaces.

05.17 REMOVE TRANSOM

Component
Transom

Special Tools
Nivo Set
Lotus Panel Tool T00/0211
36 grit paper and mechanical sander

Notes: Provided this panel is initially undamaged it may be re-used if carefully removed.

Before removing the rear transom it will be necessary to remove the boot lid and rear top shell.

Op No.	Notes
1.	Using the wire cut separate the transom from the undertray.
2.	Using the Lotus panel tool separate the transom from the left hand and right hand lower quarter panels.
3.	Using a 36 grit paper and mechanical sander remove all old adhesive from the above joining surfaces.

BJ.18 - REMOVE LOWER QUARTER PANELS

Components
O.S. and N.S. Lower Quarter Panels

Special Tools
Router
Lotus Panel Tool T000Y101
3M grit paper and mechanical sander

Before carrying out removing the lower quarter panel it will be necessary to remove the boot lid, rear top shell & rear bumper

Op. No.	Notes
1.	Using a router cut through the seam of the lower quarter panel just above the undertray
2.	Carefully cut along a line 1" above the underbray and following the rear wheel arch to the 'B' post cover.
3	Using the Lotus panel tool separate the lower quarter panel from the 'B' post cover and discard.
4	Using the Lotus panel tool separate the remaining section of the lower quarter panel from the underbray
5.	Using a 3M grit paper and mechanical sander remove all old adhesive from the underbray and 'B' post cover.

Drawing No. BJ18-1 Lower Quarter Panels - Rear Light

B/ 19 - REMOVE 'B' POST COVER

Components
G Post Cover

Special Tools
Lotus Panel Tool T000T1077
Sheet Paper and Mechanical Sander
Note: Provided this panel is intrinsic undamaged it may be re-used if carefully removed.

Before removing the 'B' post cover it will be necessary to remove the seat belt, rear top shell, rear transom & rear lower quarter panel.

Op No	Notes
1	Using the Lotus panel tool set separate the 'B' post cover from the sill, outrigger and 'B' post diaphragm
2.	Using a 36 grit paper and mechanical sander remove all old adhesive from the above joining surfaces

B/.20 - 'B' POST COVER

Component
'B' Post Cover

Special Tools
Router
Lotus Panel Tool T000T1077
36 grit paper & Mechanical Sander

Op No	Notes
1.	Using router split the 'B' post cover down the middle.
2.	Using the Lotus panel tool separate the 'B' post cover from the 'A' post and discard.
3.	Using a 36 grit paper and mechanical sanding remove all old adhesive from the 'A' post and front bulkhead etc.

BJ.21 - REMOVE SILL

Components
Sill.

Special Tools
Loose Panel Tool 7000T1011
36 Grit Paper and Mechanical Sander
Note: Provided this panel is initially undamaged it may be reused if carefully removed.

Before removing the sill it will be necessary to remove the boot lid, rear top shelf, rear transom, rear quarter panel, 'D' post cover and 'A' post cover.

Op. No.	Notes
1	Using loose panel tool remove the sill from the underbody and outrigger.
2	Using a 36 grit paper and mechanical sander remove all old adhesive from the underbody and outrigger.

BJ 22 - REMOVE 'A' POST DIAPHRAGM

Components
'A' Post Diaphragm

Special Tools
Loose Panel Tool No. 7000T1011
36 Grit paper and Mechanical Sander

Note: Providing this panel is initially undamaged it may be reused if carefully removed

Before removing the 'A' post diaphragm it will be necessary to remove the boot lid, rear top shelf, rear transom, rear quarter panel & the 'A' & 'B' post cover.

Op. No	Notes
1	Cut in the Sonos panel tool, and separate the 'A' post diaphragm from the 'A' pillar, 'B' post cross brace, underslip and outrigger
2	Using a 36 grit paper and mechanical sander remove all old adhesive from the above adjoining surfaces.

BJ.23 - REMOVE REAR BULKHEAD

Component
Rear Bulkhead

Special Tools
Hire Set
Interior Panel Tool (000T10)
80 Grit Paper and Mechanical Sander

Note: Provided this panel is initially undamaged it may be serviced if careful ly removed.

Before removing the rear bulkhead it will be necessary to remove the boot lid, rear cap shelf, rear transom and rear lower quarter panels.

Op. No.	Notes
..	Using wire set and Lotus pane tool set as necessary separate the rear bulkhead from the adhesive
..	Using a 80 grit paper and mechanical sander remove all old sealants from the above chassis surfaces.

BJ 24 INTRODUCTION AND SEQUENCE OF BONDED PANEL ASSEMBLY

Prior to using good panels in this model care should be taken to ensure bonded surfaces are free of all old adhesive and the full rebonding procedure is carried out i.e. clearing, bonding and applying fresh adhesive.

Where necessary jigs must be used to ensure the correct positioning of panels.

All face gaps are to be 2mm wide unless otherwise stated.

Sika Seal 1-2 J requires 1h hours to cure and 24 hours to reach full strength.

The first page of this section shows a logical sequence of assembly for the major panels

Note notes are written for each individual panel.

Fitment of Sealant Bonded Panels

Scenario	Sequence of Assembly
Introduction	1
Bulkhead to Understay	3
'B' Post Cross Brace and Tie Braces to 'B' Post	4
Double Door to 'A' Post	5
'B' post Diaphragm, 'B' Post Cross Brace and 'B' posts	1
Rear Bulkhead to Understay	5
Front Bulkhead to Understay	6
Fender Duct Assembly to Front Bulkhead	7
'A' Post Duct Plenum to Front Bulkhead	8
Steering Column Infill to Front Bulkhead	9
Sill Infill and Sill to Understay and Cutrigger	10
'A' Post Cover to 'A' Post	11
'B' Post Cover to 'B' Post	12
Rear Quarter Lower to 'B' Post Cover and Understay	13
Rear Diaphragm to Understay and Rear Quarter Lower	14
Rear Qtr Shell to Rear Bulkhead, Rear Lower Quarter and Diaphragm	15
Roof Filler Rebate	16
Battery Tray to Understay	17
Fuel Strap Mounting Strengthening Bracket to Understay	18
Centre Console Mounting Brackets to Understay	19

Sealants

There are three systems of adhesives used in repair

System 1
For joining fibreglass to fibreglass or brake metal surfaces.

Data Major 3000
Data Minor 5402
Data Set, B.D.H.

System 2
For joining activated metal + fibre glass

Data Mix 1:10
Data Brake - 2x6 [M6] tap (set pitch)
Data Brake - 22G.[3G8]
Mix two part paste to ...] proportions =
Mix and leave for 2 mins - apply and leave for 1 hour - bond
surface to surface.
IMPORTANT: OBSERVE MANUFACTURER'S HEALTH AND SAFETY REGULATIONS

System 3
For rubber glass surface

Data Major 4010C
Data Brake 3001
Data Set, - 5 1

** Non-structure 'special resin' Data Seal from standard nozzle supplied.*

1. Avoid air and cradle a - shown.
2. Drill clear fit hole + 10mm from end of c/s of hole.
3. Screw cradle at 4-6 45° to tangent of hole.

Note: Many + to be used only in conjunction with Winchester
air operated gun

See drawing no. Diagram

Allow hole see 1 W.T. to cure before handling
Data Seal M/S 1, reaches full strength in 24 hours.
Leave a 1mm bond gap between joints
Data Seal has a 6 month shelf life
Data Seal application Manufacturer Dow Malo at Dow U.K. Ltd of Newbury.
Quality, full fills 1mm gap on one 2mm deep or all bonded joints

Data Products may be obtained from -

Dow Corning (UK) Ltd.,
15 Grafham Road, Barrack Industrial Estate,
Hungerford Berkshire, RG17 0QE
Telephone No. (0) - 37017.

There are two systems of glues used on repair

System 1
For joining the backing strips to the sill
Terra Bond 9001 (two part system in one tube)
System 2
Any bobbins
Araldite 2003 (2 part)

Permabond products may be obtained from:-
Permabond Adhesives Ltd.,
Woodside Road,
Eastleigh,
Hants. SO5 4EX.
Telephone: 0703 617121

Araldite Products may be obtained from:-
Brown Brothers Ltd.,
20-21 Flagsway,
City Trading Estate,
Hoxtol,
Norfolk, NR2 4HF.
Telephone: 0603 619232

Thicknessing wax 0.250" Part No. RJ011414 may be obtained from
K. & J. Moulding (England) Ltd.,
Spa House,
Shellbarge,
Diss, Norfolk. Telephone No. 0379 64166

Drawing No RJ24-1 Beta Seal module Design

B425 - FIT FRONT BULKHEAD

Components
Front Bulkhead

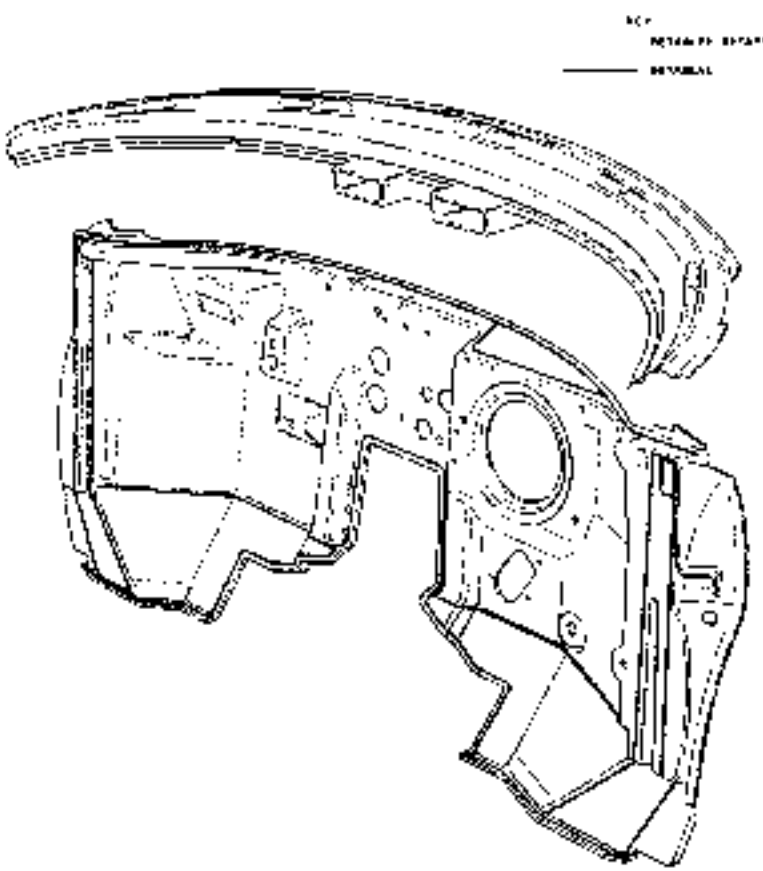
Adhesives
Beta Weld 2000
Beta Prime 5000
Beta Seal H.V.1

Special Tools
Height Gauge
Fibre Tip Marker
10ft Boats
10ft Anchor
1" Long self Tap Screws
Beta Seal Dispenser and Nozzle

Op. No	Notes
1.	Position front bulkhead to understay and ensure toe plate bracket holes line up understay toe plate mounts
2.	Check height from underneath of understay to underneath of front bulkhead top flange is 614mm.
3.	Draw around front bulkhead so as to mark the correct position of the front bulkhead on the understay using a fibre tip marker
4	Remove front bulkhead from understay.
5	Apply Beta Wipe 7000 to clean bonding surfaces of front bulkhead and understay as shown in drawing no. B425-1.
6.	Apply Beta Prime 5000 to bonding surfaces of front bulkhead and understay as shown in drawing no. B425-1.
7.	Apply Beta Seal H.V.1 to bonding surfaces of understay and to front bulkhead as shown in drawing no. B425-1.
8	Refit front bulkhead to understay and re-check height from underneath of understay to underneath of front bulkhead top flange is 614mm - ensure bond gap is 2mm.
9	Fit 6 bolts, washers and nuts to toe board and secure.
10	Fit 4 x 1" self tapping screws through front bulkhead and 'V' post.
11	Fit 2 x 1" self tapping screws through front bulkhead and toe board.
12.	Fit 4 x 1" self tapping screws through front bulkhead and runner.

Op. No.	Notes
13.	Windscreen height from underneath of undertray to underneath of front bulkhead top flange is 670mm
14	Repaint across Beta Seal from all joints
15.	Allow 16 hours for Beta Seal to cure.
16.	Remove 4 bolts, washer and nuts from toe board.

Drawing No. 7035-1 Front Bulkhead Bonding



10.36 - FIT DEMIST DUCT ASSEMBLY TO FRONT BULKHEAD

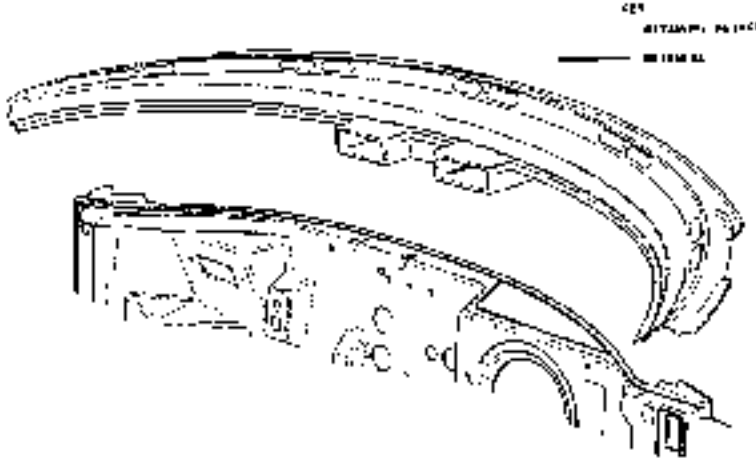
Components
Demist Duct Assembly

Abbreviations
Bede Wipe 3900
Bede Glue 9402
Bede Seal M.V.S.

Special Tool
Bede Seal Dispenser & Nozzle

Op. No.	Notes
..	Apply Bede Wipe 1900 to ... ear bonding surfaces of demist duct assembly and front bulkhead as shown in drawing no. B326-1.
..	Apply Bede Glue 9402 to bonding surfaces of demist duct assembly and front bulkhead as shown in drawing no. B326-1
..	Apply Bede Seal M.V.S. to demist duct assembly as shown drawing no. B326-1.
..	Position duct assembly to front bulkhead and 'A' posts - ensure gap bond gap and distance from underside of underslip to the top of the uppermost edge of the demist duct is 140mm
..	Remove excess Bede Seal from joints.
..	Allow to cure for Bede Seal ...

Drawing No. B326-1 Demister Duct Bonding



B1.27 HEATER VENTILATION AIR [illegible] DUCT BONDING TO FRONT BULKHEAD

Components
H.V.A.C. Duct Plenum

Adhesive
Beta Wipe 3400
Beta Prime 5002
Beta Seal H.V.S.

Special Tools
Beta Seal Dispenser & Nozzle
2 Nuts & Bolts

Op. No.	Notes
1.	Apply Beta Wipe 3400 to clean bonding surfaces of H.V.A.C. duct plenum & front bulkhead as shown in drawing no. B327-1.
2.	Apply Beta Prime 5002 to bonding surfaces of H.V.A.C. duct plenum and upper bulkhead as shown in drawing no. B327-1.
3.	Apply Beta Seal H.V.S. to bonding surfaces of H.V.A.C. duct plenum and front bulkhead as shown in drawing no. B327-1.
4.	Position H.V.A.C. duct plenum to front bulkhead ensuring 4 2mm bond gap.
5.	Fit 2 nuts and bolts and secure.
6.	Remove excess Beta Seal from joints.
7.	Leave 16 hours for Beta Seal to cure.
8.	Remove bolts and nuts.

Drawing No. B327-1 H Vac. Duct Bonding

84.29A - REF STEERING COLUMN INPUT, TO FRONT SUBFRAME

Components
Steering Column Inlet
Stud Plate
Steering Column Inlet Gasket
4 Nuts

Adhesives
Beta Wipe 3000
Beta - Fine 5642
Beta - Fine 2 part cyanoacrylate and activator
Beta Seal M.V.S.

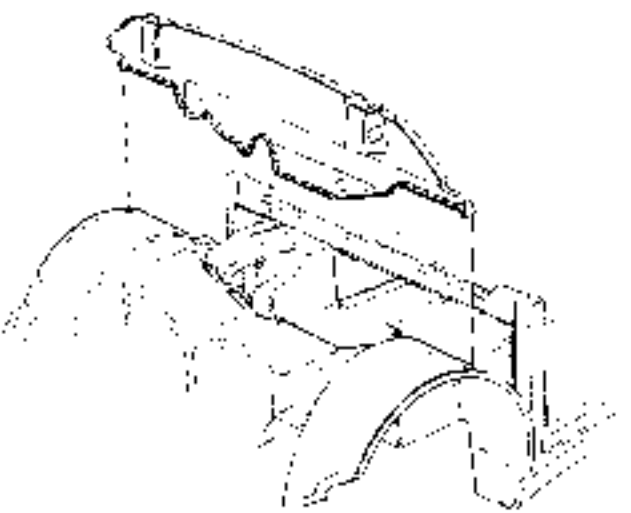
Special Tools
Beta Seal Dispenser and Nozzle

Op. No.	Notes
1	Apply Beta Wipe 3000 to steering bonding surface of stud plate and front of inner subframe as shown in drawing no. 8229-1
2	Apply Beta Fine 5642 to inner surface of front subframe as shown in drawing no. 8198-1.
3	Apply Beta Fine 2 part cyanoacrylate and activator to bonding surface of stud plate as shown in drawing no. 8198-1.
4	Apply Beta Seal M.V.S. to bonding surface of stud plate as shown in drawing no. 8198-1
5	Fit stud plate to inner surface of front subframe and ensure a bond gap of 1 mm
6	Remove excess Beta Seal.
7	Leave for 1½ hour to allow Beta Seal to cure.
8	Fit steering column inlet gasket to stud plate studs from rear of front subframe.
9	Fit steering column inlet to steering rack inlet gasket. Fit stud plate studs.
10	Secure steering column inlet and grommet to studs with 4 nuts.

Note: Rack can only be fitted after intermediate steering column is connected to rack

Drawing No. BJ28-1 Steering Column Infill Padding

Drawing No. BJ29-1 Rear Bulkhead Bonding



B1.29 - FIT REAR BULKHEAD

Components
Rear Bulkhead

Adhesives
Beta Wiper 7977
Beta Primer 5473
Beta Seal e.v 3.

Special Tools
Jig 910/29/31
Jig bolt
Jig Washers
Minor Tap and Die
Beta Seal Applicator and Nozzle

Op. No.	Notes
1.	Position jig to both 'B' posts and secure with 4 bolts
2	Position rear bulkhead to jig and understay
3	Using fibre tip marker draw position of rear bulkhead on understay.
4	Remove understay.
5.	Apply Beta Wiper 7977 to clear bonding surfaces on rear bulkhead and understay as shown in drawing no. B129-1.
6.	Apply Beta Primer 5473 to bonding surfaces of understay as shown in drawing no. B129-1
7.	Apply Beta Seal e.v 3. to bonding surfaces of bulkhead as shown in drawing no. B129-1
8	Refit rear bulkhead to understay and secure with Jig bolts and washers - ensure a bond gap of 3mm
9	Remove excess Beta Seal from all points.
10	Leave jig fastened to assembly for 16 hours to allow Beta Seal to cure
11.	Remove jig bolts and washers.
12.	Remove bolts from jig
13.	Remove jig

B1.30 - PIT 'D' POST DIAGRAM

Components

'D' Post Diagram
2 x Hex Nuts
2 x Hex Bolts
2 x Hex Washers
Domain - Main Time A4156A765
Dyle.n - Steele Team A4156E24F

Adhesives

Beta Clear 5X0
Beta Prime 5X2
Beta Acol 4 X 3
Gelblue 8703 (2 Part)

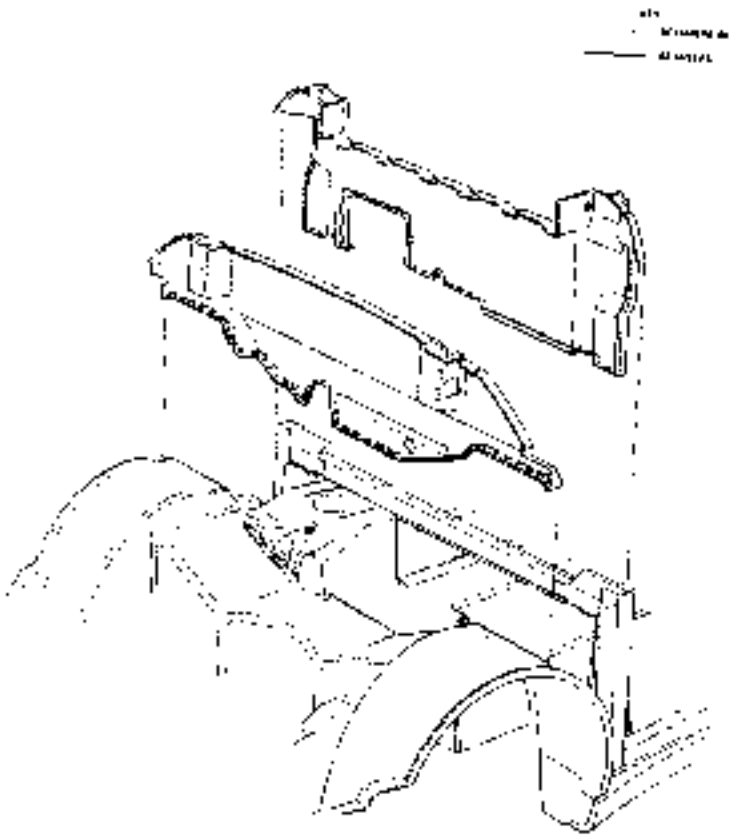
Special Tools

5mm x Crimping Tool 7A0L0.C76
Knife Blade
2 Clamps
Beta Seal Dispenser and Nozzle

Op No	Notes
1.	Place 2 part Araldite around A female parts of bobbin using Araldite nozzle.
2	Place male part of bobbin through appropriate hole in 'B' post diagram ensuring bolt type is correctly positioned to act as centre pivot.
3	Fit 1mm x part of bobbin to male post and crimp end of male part using crimping tool.
4.	Remove excess Araldite from joints.
5.	Allow 12 hours for glue to cure
6	Apply Beta Clear 5X0 to bonding surfaces of 'B' post diagram, outriggers. 'B' posts. 'B' post cross brace and underbody as shown in drawing no. B2T0-1
7	Apply Beta Clear 5X0 to bonding surfaces of 'B' post diagram, outriggers. 'B' posts. 'B' post cross brace and underbody as shown in drawing no. B2T0-1
8.	Apply Beta Seal 5X0 to bonding surfaces of 'B' post diagram as shown in drawing no. B2T0-1.
9	Position 'B' post diagram to underbody. 'B' posts cross brace and outriggers ensuring bolt grip is 3mm and diagram assembly holes line up.
10	Fit 2 clamps along top edge & secure.

Op. No	Notes
11	Remove excess Body Seal Foam all joints.
12	Leave for 16 hours to allow Body Seal to cure.
13	Remove C clamps.

Drawing No. 9290-1 "B" Post Diaphragm Bonding



B1.31 - FIT SILL INFILL AND SILL

Components

Rubber (sill) infill 4 M /L H.
Rubber (sill) 3 M /L H.

Adhesives

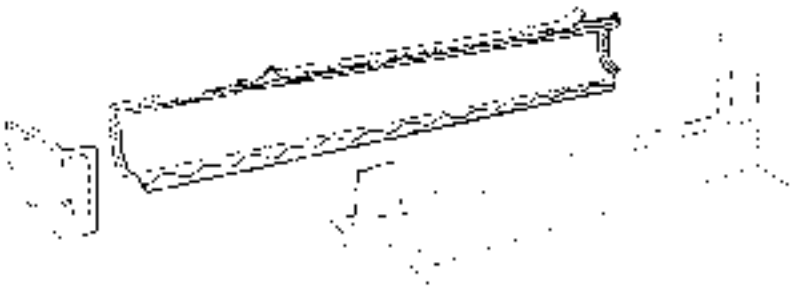
Bella Wipe 3500
Bella Prime 3104
Bella Seal B 4.7

Special Tools

Bella Gun - Dispenser and Nozzle
Jig T000P/110

Op. No.	Notes
1.	Apply Bella Wipe 3500 to clean bonding surfaces of sill infill and underbody as shown in drawing no. B31 1.
2.	Apply Bella Primer 3104 to bonding surfaces of sill infill and underbody as shown in drawing no. B31 1.
3.	Apply Bella Seal B.V.A. to bond rg surface of rear infill as shown in drawing no. B31 1.
4.	Fit sill infill to underbody.
5.	Apply Bella Wipe 3500 to clean bonding surfaces of sill, sill infill, underbody and outrigger as shown in drawing no. B31-1.
6.	Apply Bella Primer 3104 to bonding surfaces of sill, sill infill, underbody and outrigger as shown in drawing no. B31-1.
7.	Apply Bella Seal B.V.A. 1. bonding surface of sill as shown in drawing no. B1-1-1.
8.	Fit sill to sill infill, underbody and outrigger and ensure bond gap is 2mm and fill holes with Bella Seal B.V.A. as shown in drawing no. B31 1.
9.	Fit jig to secure sill and sill infill.
10	Remove excess Bella Seal from joints.
11	Leave for 24 hour to allow Bella Seal to cure
12	Remove jig.

Drawing No. B11-1 Sill and Sill Infill Bonding



Drawing No. B11-2 Fill and Sill Detail Bonding

B1.12 - FIT 'A' POST COVER

Components
'A' Post Cover [ ]

Adhesives
Beta Wipe 3970
Beta Prime 5402
Beta seal [ ]

Special Tool
Beta seal injector and nozzle

Op. No.	Notes
1.	Apply Beta Wipe 3970 to clean bonding surfaces of 'A' post cover, 'A' post, front bulkhead and sill as shown in drawing no. BJ32-1.
2.	Apply Beta wire Beta to bonding surface of 'A' post cover, 'A' post, front bulkhead and sill as shown in drawing no. BJ32-1.
3	Apply Beta Seal [ ] to bonding surface of 'A' post cover as shown in drawing no. BJ32-1.
4	Position 'A' post cover to 'A' post, front bulkhead and sill and ensure bond gap is 2mm.
5.	Remove excess Beta Seal from joints.
6.	Leave for 1½ hours to allow Beta seal to cure

Drawing No. BJ32-1 'A' Post Cover Bedding

[illegible]

BJ 33 - FIT 'B' POST COVER

Components
'B' Post Cover - R.H./L.H.

Abbreviated
Beta Wipe 3900
Beta Prime 5402
Beta Seal B.V.S.

Special Tools
Beta Seal Dispenser and Nozzle

Op. No.	Notes
1.	Apply Beta Wipe 3900 to clean bonding surfaces of 'B' post cover, 'B' post, quarter outrigger and sill as shown in drawing no. BJ33-1.
2.	Apply Beta Prime 5402 to bonding surfaces of 'B' post cover, 'B' post diaphragm, outrigger and sill as shown in drawing no. BJ33-1.
3.	Apply Beta Seal B.V.S. to bonding surfaces of 'B' post cover as shown in drawing no. BJ33-1.
4.	Position 'B' post cover to 'B' post, 'B' post diaphragm, outrigger and sill ensuring bond gap is even.
5.	Remove excess Beta Seal from joints.
6.	Leave for 24 hours to allow Beta Seal to cure.

Drawing No. BJ33-1 'B' Post Cover Bonding

57.14 - REAR WHEEL QUARTER LOWER R.H./L.H

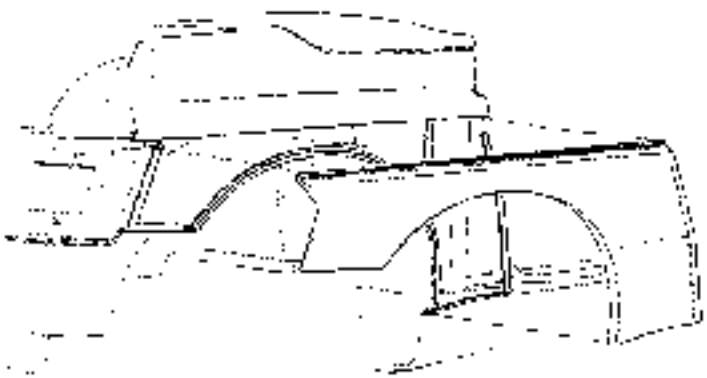
Components
Rear lower quarter

Adhesives
Betamate 1900
Betaprime 5402
Betaseal B.V.S.

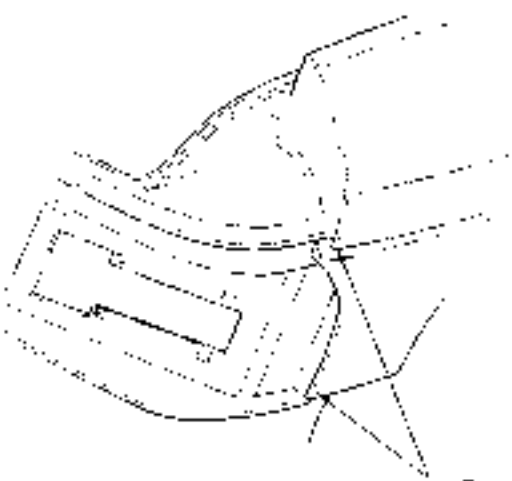
Special Tools
Jig - 18G1570/1
Betaseal Dispenser and Nozzle

Op No	Notes
1	Apply Betamate 1900 to given bonding surfaces of rear lower quarter panel, 'B' post cover, underbody, rear bulkhead and sill as shown in drawing no. B754 1
2	Apply Betaprime 5402 to bonding surfaces of rear lower quarter panel, 'B' post cover, underbody, rear bulkhead and sill as shown in drawing no. B754-1.
3	Apply Betaseal B.V.S. to outside surfaces of rear lower quarter panel as shown in drawing no. B754 1
4	Position rear lower quarter panel to 'B' post cover, underbody, and sill, ensure bond gap is 3mm and fill bulk with Betaseal B.V.S. as shown in drawing no. B754-1.
5	Fit jig to secure lower quarter panel.
6	Remove excess Betaseal.
7	Leave for 16 hours to allow Betaseal to cure
8	Remove jig.

Drawing No. 9J30-1 Rear Lower Quarter Bonding



Drawing No. 9J34 / Rear Lower Quarter Bonding



BJ35 - VIT METAL BONDING

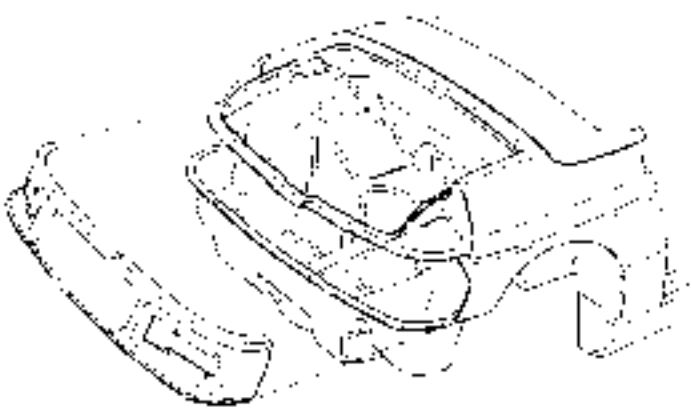
Components
Rear Crossbar

Adhesives
Beta Wipe 1900
Beta Prime 2401
Beta Seal 2.1

Special Tools
Beta seal dispenser and Nozzle

Op No	Notes
1	Apply Beta Wipe 1900 to clean bonding surfaces of rear trannom, lower quarter panels & understay as shown in drawing no. BJ35-1.
2	Apply Beta Prime 2401 to clean bonding surfaces of rear trannom, lower quarter panels and understay as shown in drawing no. BJ35-1.
3	Apply Beta Seal 2.1 to bonding surfaces of rear crossbar as shown in drawing no. BJ35-1
4	Position rear crossbar to understay and lower quarter panels, and ensure a bond gap of 2mm
5	Remove excess Beta Seal from all joints
6	Leave 24 hours to allow Beta seal to cure

Drawing No. BJ-35-1 Rear Trannom Bonding



J1.1b KIT REAR TOP SHELL

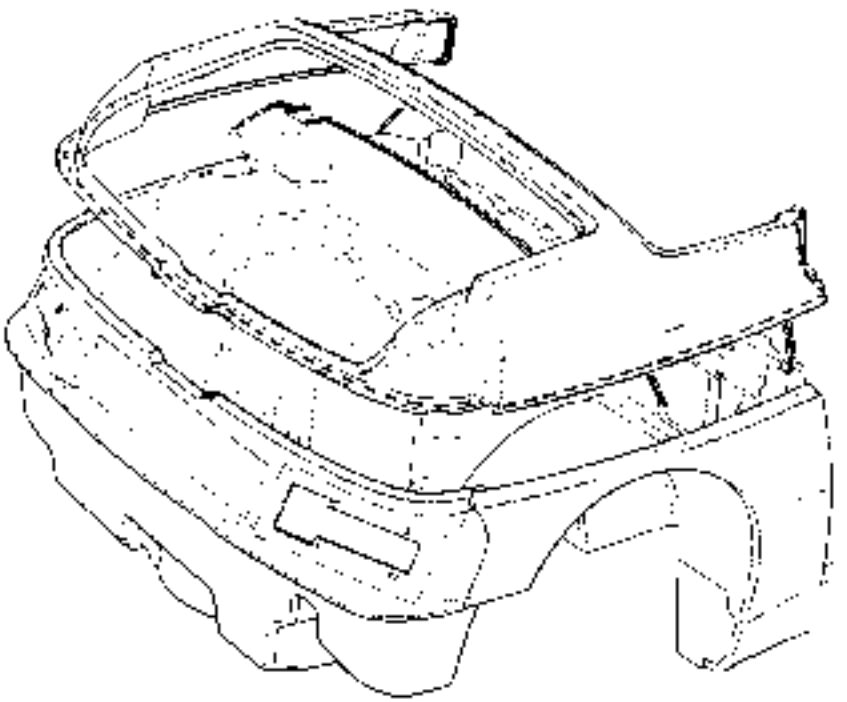
Components
Rear Top Shell

Adhesives
Beta Wipe 3000
Beta Prime 5424
Beta Seal 5161.

Special Tools
Jig 116061 J1
Beta Seal Dispenser & Nozzle

Op. No.	Notes
..	Apply Beta Wipe 3000 to inner bonding surfaces of rear top shell, 'A' post covers, 'B' post diaphragm, lower quarter rear panels and rear crossmember as shown in drawing no. BJ1G-1
.	Apply Beta Prime 5424 to bearing surfaces of rear top shell, 'A' post covers, 'B' seat diaphragm, lower quarter panels and rear crossmember as shown in drawing no. BJ1G-1.
.	Apply Beta Seal 5161 to bearing surface of rear top shell as shown in drawing no. BJ1G-1
.	Position rear top shell to 'A' post cover, 'B' post diaphragm, lower quarter panels and rear crossmember - ensure 2mm hemm gap.
.	Fit jig to ensure rear panels are correctly positioned.
.	Remove excess Beta Seal from all joints
.	Leave to harden to allow 1h hours for Beta Seal to cure.
.	Remove jig.

Drawing No. B116-1 Rear Top Shell Bonding



BJ 37 - FIT FUEL FILLER REBATE

Components
Fuel filler rebate

Adhesives
Beta Wipe 7000
Beta Prime 5402
Beta Seal 4 V.

Special Tools
Beta Seal dispenser and nozzle
Tape

Step No.	Notes
1.	Apply Beta Wipe 7000 to steam bonding surfaces of fuel filler rebate and rear top shell, as shown in drawing no. BJ37-1.
2.	Apply Beta Prime 5402 to bonding surfaces of fuel filler rebate and rear top shell as shown in drawing no. BJ37-1
3.	Apply Beta Seal 4 V.1 to bonding surface of fuel filler rebate as shown in drawing no. BJ37-1
4.	Position fuel filler rebate to top shell and ensure a bond gap of 2mm.
5.	Secure fuel filler rebate to rear top shell using tape.
6.	Remove excess Beta Seal from joints.
7.	Leave for 12 hours to allow Beta Seal to cure.
8.	Remove tape

Drawing No. BJ37-1 Fuel Filler Rebate Bonding

B1.111 - FIT BATTERY TRAY TO UNDERTRAY

Components
Battery Tray

Adhesives
Beta Wipe 3900
Beta Prime 5402
Beta Seal M.V.1.

Special Tools
Weights
Beta Seal Dispenser & Nozzle

Op. No.	Notes
1.	Apply Beta Wipe 3900 to clean bonding surfaces of battery tray recess in undertray and battery tray as shown in drawing no. B138-1.
2	Apply Beta Prime 5402 to bonding surfaces of battery tray recess in undertray and battery tray as shown in drawing no. B138-1.
3.	Apply Beta seal M.V.1. to bonding surface of battery tray as shown in drawing no. B138-1.
4.	Position battery tray in battery tray recess ensuring bond gap is 2mm ± 1mm and also upright surfaces of battery tray are in contact with battery tray recess in undertray.
5.	Place weights on battery tray to secure.
6	Remove excess Beta Seal from joints.
7	Leave for 1½ hours to allow Beta Seal to cure
8	Remove weights.

Drawing No. B138-1 Battery Tray Bonding

83.39 - F17 FUEL STRAP MOUNTING STRENGTHENING BRACKET

Components
Fuel strap mounting strengthening bracket

Adhesives
Beta Wipe 1900
Beta Prime 5000
Beta Seal M.V.S.

Special Tools
Brush
Beta Seal Dispenser & Nozzle
Weights
Fibre Tip Marker

Op. No.	Notes
..	Ensure jump cover is fitted to undertray.
..	Position fuel strap mounting strengthening brkt so that pump the cover may be removed and access obtained to the bobbin at rear of fuel strap mounting strengthening.
.	Using fibre tip marker draw line around fuel strap mounting strengthening bracket to ascertain its correct position.
.	Remove fuel strap mounting strengthening bracket.
.	Apply Beta Wipe 1900 to clean bonding surfaces of fuel strap mounting strengthening bracket and undertray as shown in drawing no. 83.39-1.
.	Apply Beta Prime 5402 to bonding surfaces to fuel strap mounting strengthening bracket and undertray as shown in dwg. no. 83.39-1.
.	Apply Beta Seal M.V.S. to bonding surfaces of fuel strap mounting strengthening bracket as shown in drawing no. 83.39-1
.	Position fuel strap mounting strengthening bracket to undertray - ensure jump cord gap and freedom of access to bobbin and fuel pump cover.
..	Place weight on fuel strap mounting strengthening bracket to secure.
10.	Remove excess Beta Seal from joints.
11.	Allow 16 hours for Beta Seal to cure.
12.	Remove weights.

Drawing No. AU-29-1 Fuel Strap Mounting Bracket Bonding

Drawing No. AU40 1 Centre Conduit Mounting Brackets Bonding

No.40 - ESP 3 CONVEX CONSOL MOUNTING BRACKETS

Components

Bracket Part # 1 off A108B0136
Bracket Cutout 1 off A108B0135

Adhesives

Bond Type 3900
Bond Primer - Part - (ESP 3900 and ESP1(Grey)
Bond Primer 3917
Bond Gap - 1 to 2

Special Tools

Nozzle
Bond Gap, Dispenser and Nozzle
Tie 7000/0112

Op. No.	Notes
1.	Check lay over gear lever mountings on countergear tunnel
2.	Mark position of brackets using fabric tag markers.
3.	Remove clip
4.	Apply Bond Type 3900 to clean bonding surfaces of brackets (A) Parts as shown in drawing no. 5140-1.
5.	Apply bond primer to paint to bonding surfaces of metal brackets as shown in drawing no. 5140-1.
6.	Apply solid trim tape to bonding surfaces of tunnel as shown in drawing no. 5140-1.
7.	Apply Bond Seal 4 X 1 to brackets as shown in drawing no. 5140-1
8.	Fit single bracket in front position - fit pair of brackets in rear positions.
9.	Ensure bond tap is 2mm.
10.	Remove excess Bond Seal from joints.
11.	Leave 16 hours to allow Bond to cure.

BJ 41 - INTRODUCTION TO UNDERTRAY REPAIRS

The following is an introduction to the underbody repairs.

The repair of the underbody provides the largest, most detailed and time consuming work carried out on the G.R.P.P. and for safety reasons it is also the most important.

Each of the following sections contain detailed repair procedures plus list of components, materials, adhesives and special tools which will be required to complete the task.

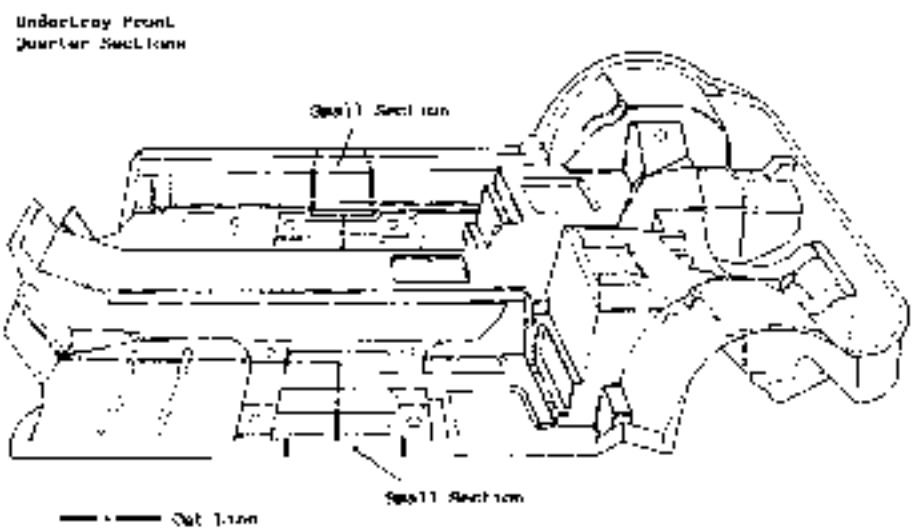
It is recommended that a careful study be made of the procedures, components, materials, adhesives, tools and drawings before commencing the repair.

In many instances it will be necessary to remove panels and chassis from the body before repairing the undertray.

When removing and replacing bolt on outrigger it is important to position the nut in exactly the correct position (see outrigger drawings).

The outrigger strengthening plate will be provided as a spare part.

Drawing No. BJ42-1 Undertray - Front Quarter - Cut Lines



B1.42 - REMOVE FRONT QUARTER SECTION OF UNDERTRAY

Component

Front quarter section of undertray - comprising of:-

a) Front quarter section of Undertray.
b) Front section of Sumpguard including '6' post.
c) Side section of front bumper.
d) Front jacking point.

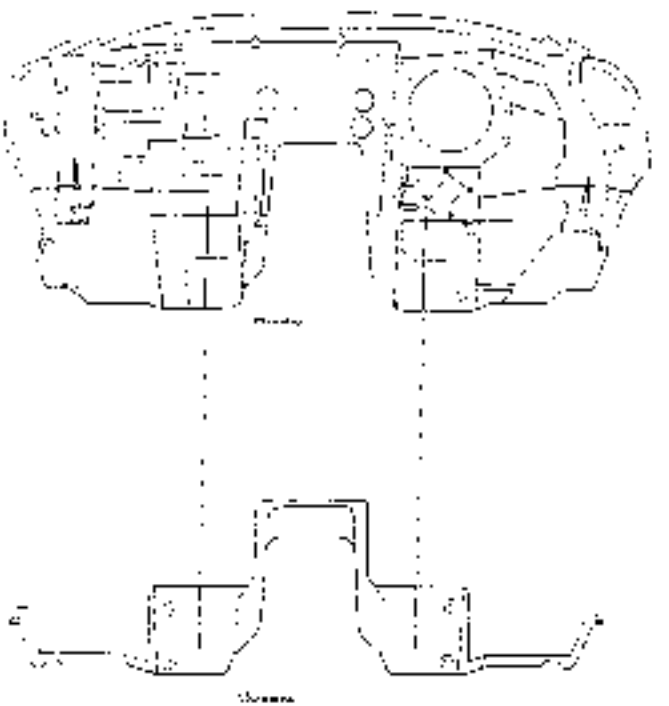
Special Tools

Saw
Grinder
Wire Cut
Lotus Panel Tool KIT0710T
Socket
Ratchet
Welding Set

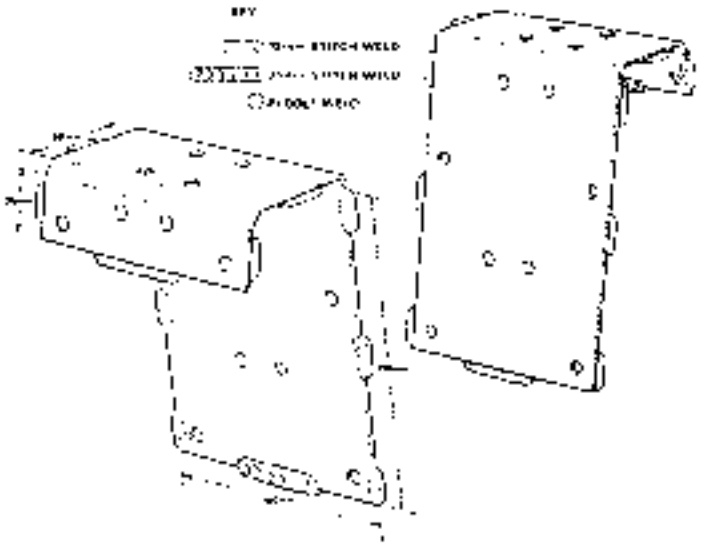
Op. No.	Notes
1.	Remove the seats and floor coverings.
2.	Remove the Door Board
3.	Remove the Cut Volts Link (ie. 'A' posts which secure the windscreen frame
4.	Cut the adhesive between the windscreen and windscreen landing using the wire set.
5.	Remove the windscreen and trims and place aside.
6	Remove the 'A' post cover - cut back the centre of the 'A' post cover and remove the pieces using the Lotus panel tool
7.	Park the undertray as shown in drawing no. B142-1 and 2.
8.	Remove the two bolts which secure the tow board to the chassis.
9.	Ensure that the studdle bolt is disconnected from the relevant 'A' post.
10.	Cut the undertray along the marked line using a marker and saw as necessary.
11	Cut the adhesive on the top of the 'A' post and underneath of the windscreen landing.
12.	Cut the adhesive on the 'A' post and body seal

Op. No.	Notes
10.	Using a jig set the outrigger as shown in drawing no. B142-4
20	Remove and discard damaged front end of sidelay, weld head and outrigger

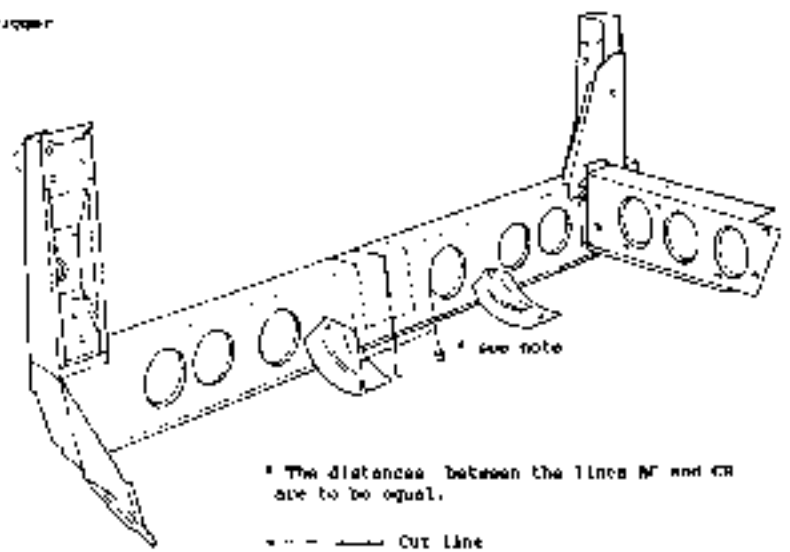
Drawing No. B142-2 Front Buildup - Front Quarter - Outriggers



Drawing No. 0142-1 Outrigger Strengthening Section



Drawing No. 0142 4 Outriggers - Cut Line and Strengthening Section



REPLY QUARTER FRONT SECTION OF UNDERTRAY

Components

Front section of undertray comprising of:-

a) Front quarter section of underlay.
b) Front section of underlay surrounding 'A' post.
c) Side section of bulkhead.
d) Front jacking point
Notes:- All the above supplied as one section

Outrigger strengthening section
(2) Rop Nuts
(2) Tnew Rop Studs
Washers

Materials

Isol C S M (chopped strand mat)
Resin
Continuous length roving
Woven glass cloth 800 grams per metre squared
Acetone
Two Part Primer (Beta Tripe 9901/00 A and B)
Wax Spray

Adhesives

Beta Tape 3000
Beta Putty 3402
Beta Seal M.V.S.

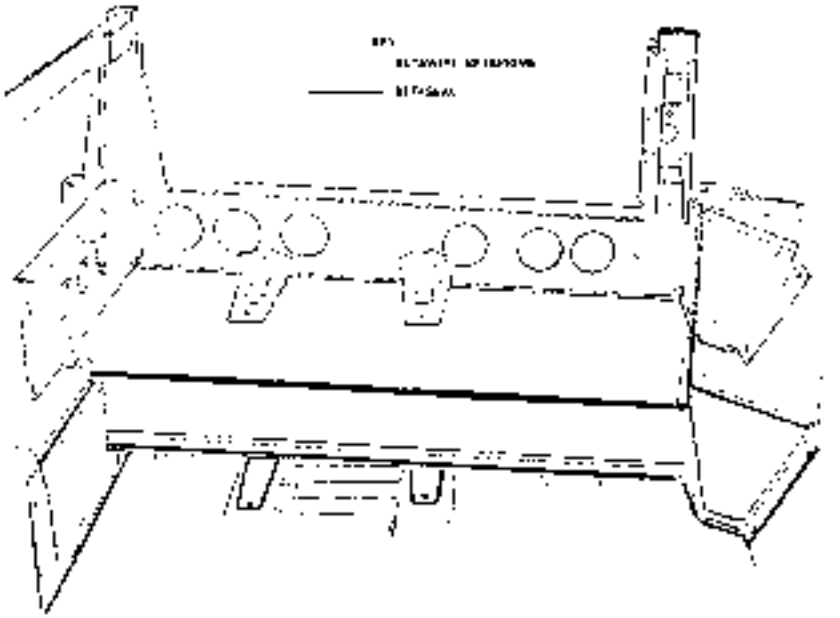
Special Tools

Jig 7000F0710
Marker
Saw
Sir Grit Power and Mechanical Sander
Pliers
Wax Spray Equipment
Pop Riveter
Beta Seal Dispenser and Nozzle
Welder

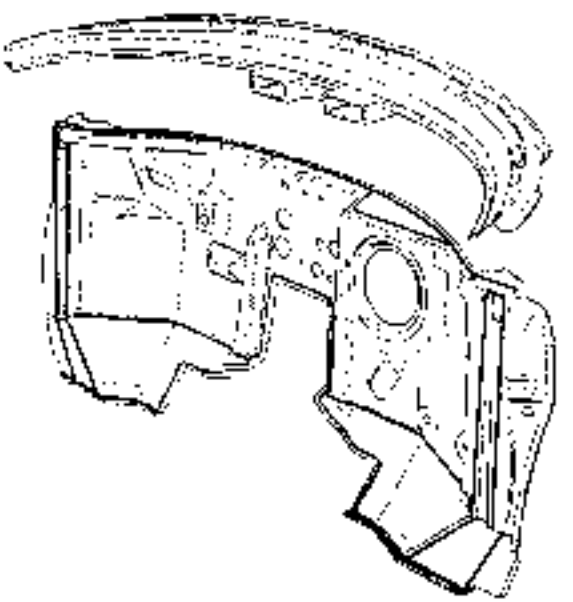
Op No	Notes
1.	Cut new section of underlay, outrigger and front bulkhead to size Area to be prepared.
2	Position jig to car.
3.	Position new front section to jig and underlay.
4.	Fit new front section into underlay, outrigger, front 'A' pa and jig accurately i.e. a gap of 1/8" to 1/4" (3mm to 6mm) should be maintained between both parts of rear bulkhead and underlay while ensuring that the jig bits conform to the 'pins up' and datum points.

Op. No	Notes
5.	Remove the new front section from the jig and using a 36 grit paper and mechanical sander, clean a "6" strip on both surfaces of both panel edges to be laminated. Continuing outward from the joint line
6.	Using a 36 grit paper and mechanical sander remove all old Beta Seal from the undertray, front bulkhead and underneath corner of windscreen landing.
7.	Ensure that area to be bonded is free from dust.
8	Wipe bonding surfaces of bulkhead, 'A' post and underneath corner of windscreen landing with Beta Wipe 3000 as shown in drawing no. B.102/1 & 2.
9	Apply Beta Prime 5402 to bonding surface bulkhead. A post and underneath corner of windscreen landing as shown in drawing no. B.102/1 & 2.
10.	Apply Beta Seal H.V.3 to bonding surfaces of 'A' post front and top as shown in drawing no. B.102/1 & 2.
11.	Ensure the joint section into under tray, trigger, front bulkhead and jig accurately i.e. a gap of 1.6" to 1/4" (3mm to 6mm) should be maintained between both parts of the undertray, bulkhead and outrigger while ensuring that the jig fits comfortably in the "pick up" and datum points.
12	Position, drill and pop rivet the plates to the new front section and the undertray as necessary.
13	Ensure that the area to be laminated is free from dust
14	Wipe bonded area with acetone
15	Paint resin onto underneath of joint.
16	Apply two layers of resin impregnated 1½oz chopped strand mat to underside of joint - roll and tamp down
17.	Allow resin to cure at a temperature of not less than 15°C.
18.	When joint on underneath has fully cured, drill out pop rivets and remove plates from top.
19.	Ensure area to be laminated is free from dust.
20.	Wipe bonded area with acetone.

Drawing No. BJ62-5 Outrigger Bonding



Drawing No. BJ62-6 Front Bulkhead Bonding

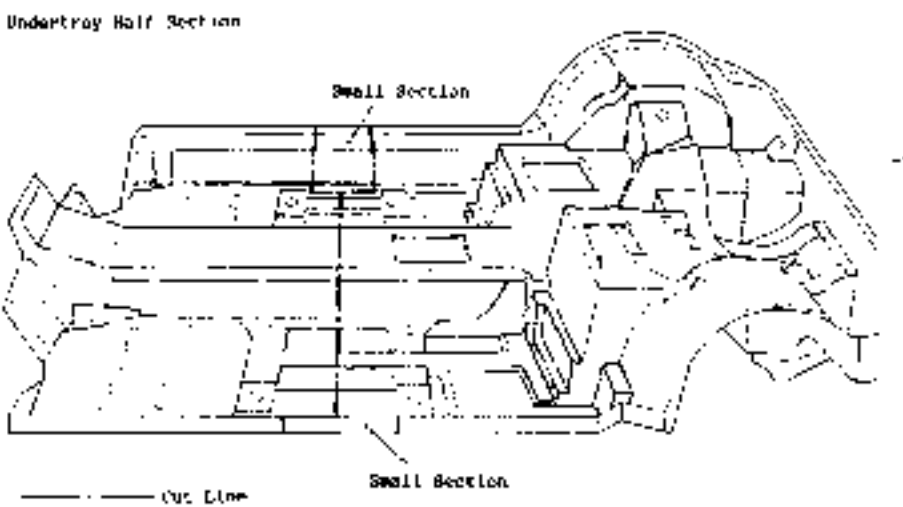


Op. No.	Notes
1.	Apply resin to the rectangular length recess and insert into joint.
22.	Brush resin over top of joint.
23.	Apply one layer of resin impregnated 11oz. chopped strand mat on the top of the joint - roll and tamp down.
24.	Apply one layer of resin impregnated woven glass cloth to cover mat recess bonded to the top of the joint - roll and tamp down.
25.	Apply one layer of resin impregnated 11oz. chopped strand mat to top of the joint - roll and tamp down.
26.	Allow resin to cure at a temperature of not less than 15°C.
27.	Cut a small section of the fibreglass undertray away from the outrigger to be re-secured shown in drawing no. 6242-1.
28.	Ensure a gap of 1/8" to 1/4" (3mm to 6mm) is maintained between both sections of the outrigger. While the flange and datum points fit uniformly on the jig. Secure the two sections of the outrigger together.
29	Using a 'P' grit paper and mechanical sander clean an area 6 ins (150mm) either side of the joint on the outrigger and the strengthening section.
30	Position and secure the strengthening section to the underneath of the outrigger ensuring it fits centrally across the joint and the two sections of the outrigger align correctly with each other.
31.	Ensure that the outer edge of the outrigger remains at an angle of 12° in axis.
32	Note: For safety reasons ensure all flammable materials e.g. resin, acetone etc. are removed from the work area. Ensure that the area is free from dust and well ventilated. Ensure that the dust extraction equipment is cleaned regularly.
33.	Saddle and stitch weld the strengthening section to the outrigger then weld the 'B' post cross brace and tie to the 'B' post.
34.	Using a 'P' grit paper and mechanical sander clean all welds and surrounding area
35.	Ensure that the area to be zinc primed is dust free.
36.	Cover all sanded, welded and strengthening plate areas on both sides of the outrigger by painting with a two pack zinc rich primer as per the manufacturer's instructions to provide anti corrosion protection for the outrigger.

Op. No.	Notes
29.	Using 36 grit paper and dry sand, sand remove all old fibre glass from the outrigger and small section of the underway.
30.	Using 36 grit paper and dry sand, sand down both surfaces of butt edges to be laminated. Feathering outward from the joint line.
31.	Ensure that the area to be bonded is free from dust.
32.	Apply Beta Wipe 2000 to clean bonding surfaces on small section of underway as shown on drawing no. BJ6x-5.
33.	Apply Beta Prime 5410 to bonding surface of small section underway and outrigger as shown in drawing no. BJ6x-5.
34.	Apply Beta Seal 5.5:1 to bonding surface of small section of underway as shown in drawing no. BJ6x-5.
35.	Fit small section of underway to outrigger and underway and maintain a gap of 1/8" to 1/4" (3mm to 6mm) between small section and underway.
36.	Fillet a bead of <epoxy> between small section of underway and outrigger.
37.	Position drill and pop rivet the plates to the small section of the underway and underway.
38.	Ensure area to be laminated is free from dust.
39.	Wipe bonded area with acetone.
40.	Apply resin over underneath of the joint.
41.	Apply two layers of resin impregnated 12oz. chopped strand mat to the underneath of the joint - roll and tamp down.
42.	Allow resin to cure at a temperature of not less than 15°C.
43.	When the joint has cured, drill out the pop rivets and remove the plates.
44.	Ensure area to be laminated is free from dust.
45.	Wipe bonded area with acetone.
46.	Apply resin to roving/mesh - mixing and brush into joint.
47.	Brush resin into top of joint.

Op. No.	Notes
56.	Apply one layer of resin impregnated 1½oz. chopped strand mat to top of joint - roll & tamp down.
57.	Apply one layer of resin impregnated woven glass cloth 300 grams per metre squared to top of joint - roll and tamp down.
58.	Apply one layer of resin impregnated 1½oz. chopped strand mat to top of joint - roll & tamp down.
59.	Allow resin to cure at an temperature of not less than 15°C.
60.	Drill 1mm (1/8") pop rivets and washers to outside edge of undertray outrigger.
61.	Drill 4mm (1/8") Lmex pop rivets and washers to inside edge of undertray and outrigger.
62.	Apply wax file to all surfaces of outrigger both inside and outside as per wax file manufacturers instructions.

Drawing No. 9/11-3 Undertray - Front Half - Cut Lines



RR.47 - REMOVE FRONT HALF SECTION

Components

Front half section comprising of:

a) Front Half of Undertray
b) Front Half of Both Outriggers including 'A' Posts
c) Front Bulk Head
d) Demister Duct
e) Both Front Jacking Points

Special Tools

Saw
Router
Marker
Wire Set
Fabric Panel Tool - RTC5717(J)

Op. No.	Notes
1.	Remove the body from the chassis.
2.	Remove all components from the front bulk head.
3.	Remove the four bolts from the 'A' posts which secure the windscreen frame.
4.	Cut the adhesive between the windscreen and windscreen frame using the wire set.
5.	Remove the windscreen frame and place aside.
6.	Remove the scuttle tank.
7.	Remove the seats, floor covering and all components attached to the front section of the undertray.
8.	Remove the 'A' post cover - cut down the centre of the 'A' post covers and remove the pieces using the fabric panel tool.
9.	Mark the undertray and outriggers as shown in drawing no. RL74-1 and 2.
10.	Cut the outriggers and undertray along the marked cut line using a saw and router as necessary.
11.	Remove and discard damaged front section.

REPAIR FRONT HALF SECTION OF UNDERTRAY

Components

Front half section of undertray comprising of:

a. Front Half Section of Undertray
b. Butt Head
c. Leviaker Rail
d. Both Front Sections of Outriggers
e. Both Front Section Points
Note: d), the above supplied as one section

Intrinsic Strengthening Sections
1/4" Pop Rivets
1/8" Tree Pop Rivets
Washers

Materials

Resin
Fibre: G.R.P. (Chopped Strand Mat)
Woven glass cloth 300 grams per metre squared
Catalyst is length resins
Acetone
2 Part primer (Beta Prime VP2170/A and B)
Wax Spray

Adhesives

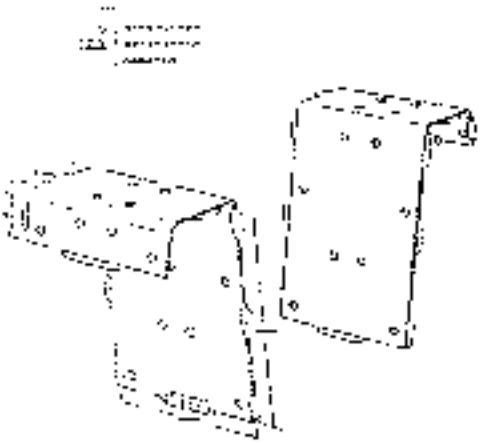
Beta Wire Cut
Beta Prime 5/C.
Beta Seal 5/V.I

Special Tools

Saw
Router
24 Grit Paper and Mechanical Sander
Jig - CCCCF7/C
Brackets
Welding Set
Setup Panel Cool - TCCCF1/C7
Wire Set
Beta Seal Dispenser and Nozzle
Wax Spray Equipment

Op. No.	Notes
1.	Cut rear section of underray and outriggers to suit area to be repaired as shown in drawing no. B24art 6 a.
2.	Position jig to car.
3	Position new section to jig and underray.

Drawing No B341-2 Outrigger Strengthening Section



Drawing No. B343-3 Outrigger - Out Line and Strengthening Section

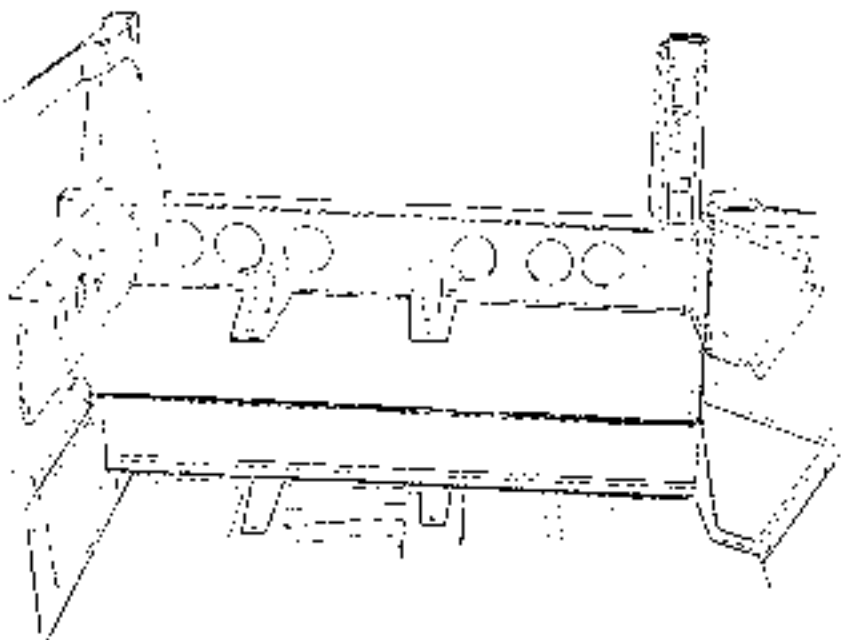
Op. No.	Notes
8.	Ensure new section fits undertray, outrigger and jig accurately, i.e. a gap of 1/8" to 1/4" (3mm to 6mm) should be maintained between both parts of the undertray and outriggers, whilst ensuring that the jig fits comfortably in the "pick up" and datum points.
9.	Remove the new section from the jig and using a 36 grit paper and mechanical sander, clean a 1½" strip on both surfaces of both panel edges to be laminated, feathering outwards from the joint line.
9	Refit the new section to the undertray, outrigger and jig accurately, i.e. a gap of 1/8" to 1/4" (3mm to 6mm) should be maintained between both parts of the undertray and outriggers, whilst ensuring that the jig fits comfortably in the "pick up" and datum points.
9	Position, drill and pop rivet brackets to the new section and undertray as necessary.
9	Ensure that the area to be laminated is free from dust.
9	Wipe sanded area with acetone.
10.	Brush resin into underneath of joint.
...	Apply two layers of resin impregnated 1½oz. chopped strand mat to underneath of joint - roll and tamp down.
**	Allow resin to cure at a temperature of not less than 15°C
**	When the joint underneath has fully cured drill out pop rivets and remove plates from top.
11	Ensure area to be laminated is free from dust
11.	Wipe sanded area with acetone.
12.	Apply resin to continuous length roving and insert into joint
13.	Brush resin into top of joint.
14.	Apply one layer of resin impregnated 1½oz. chopped strand mat to top of joint - roll and tamp down
15.	Apply one layer of resin impregnated woven glass cloth 300 grms per metre square to top of joint - roll and tamp down
16.	Apply one layer of resin impregnated 1½oz. chopped strand mat to top of joint - roll and tamp down.

Op No	Notes
19	Wire brush to remove all loose particles of rust.
20.	Cut small section of outrigger away from the area to be welded as shown in drawing no. 0.6411.
21	Ensure a gap of 1/8" to 1/4" (3mm to 6mm) is maintained between both sections of the outrigger, while tack "prick up" weld datum points at underbody on the top. Remove the two sections of the outrigger together.
22.	Using a 36 grit paper and mechanical sander clean an area up to 2" (50mm) either side of the joint on the outrigger.
23.	Using a 36 grit paper and mechanical sander clean the outrigger strengthening section.
24	Position and secure the strengthening section to the underneath of the outriggers ensuring it is centrally across the joint and the two sections of the outrigger align directly with each other.
25	Ensure that the outer edge of the outrigger remains at an angle of 12° as here.
26	Under the safety measure ensure all flammable materials e.g. paint, petrol etc. are removed from the work area. Ensure that the area is free from dust and well ventilated. Ensure that the dust extraction equipment is running regularly.
27	Tackle and weld the strengthening section to the outrigger
28.	Using a 36 grit paper and mechanical sander clean all welds and surrounding areas.
29.	Ensure that the area to be zinc primed is free from dust.
30	Cover all bended, welded and strengthening plate areas on both sides of the outrigger by painting with a two part zinc rich primer, as per manufacturer's instructions, to provide anti corrosion protection for the outrigger.
31.	Using 36 grit paper and mechanical sander remove all old Metal Seal from the outrigger and small section of the underbody.
32.	Using 36 grit paper and mechanical sander clear both outriggers flange edges to be laminated, feathering outwards from the weld line.
33.	Ensure that the area to be laminated is free from dust.
34	Apply Resa Wipe (Resa Clear Bond) to flanges of roof section of underbody and outrigger as shown in drawing no. 0411.4

Op. No.	Notes
37	Apply Bake Prime 5402 to mating surfaces of small section understay and outrigger as shown on drawing no. 0361-6.
38.	Apply Bake Seal C.V.S. to mating surface of small section of understay as shown in drawing no. 0361-6.
39.	Fit small section of understay to outrigger and understay and maintain a gap of 1/8" to 1/4" (3mm to 6mm) between small section and understay.
40	Scrape a 3mm gap at 1mm between small section of understay and outrigger
41.	Position, drill and pop rivet the plates to the small sections of the understay and understay.
42	Bonding area to be contained to free from mask.
43	Wipe bonded area with acetone
44	Brush resin onto underneath of the joint
45	Apply two layers of resin impregnated 1joz. chopped strand mat to the underneath of the joint. Roll and tamp down.
46	Allow resin to cure at a temperature of not less than 15°C
47.	When the joint has cured, drill out the pop rivets and remove the plates.
48.	Bonding area to be trimmed to free from dust
49.	Wipe bonded area with acetone
50.	Apply resin to continuous length coving and invert it to joint
51	Brush resin onto top of joint
52	Apply one layer of resin impregnated 1joz. chopped strand mat to top of joint - roll & tamp down.
53	Apply one layer of resin impregnated silver glass cloth 300 grams per metre square to top of joint - roll and tamp down
54.	Apply one layer of resin impregnated 1joz. chopped strand mat to top of joint - roll & tamp down.
55.	Allow resin to cure at a temperature of not less than 15°C.
56.	Drill and fit 1/4" pop rivets and washers to outside edge of understay and outrigger.

Op. No	Notes
9	Drill and fit 7/64" tool pop rivets and washers to inside edge of undertray and outriggers.
9A.	Apply wax filler to all surfaces of outriggers both inside and outside as per wax filler manufacturer's instructions.
9B.	**Note:** Operations 27 to 58 must be carried out on both outriggers.

Drawing No. 5719-1 Outrigger Bending



H3.44 - REMOVE EXPANSION AND CENTRE SECTION OF UNDERTRAY

Components
Centre section of undertray comprising of -
Wishbone
Front and rear jacking points
Centre section of undertray
Part of front bulkhead
Note: All the above supplied as one section

Special Tools
Saw
Cut Abar
Wire Set
Lotus Panel Tool (990710??
Router
Marker

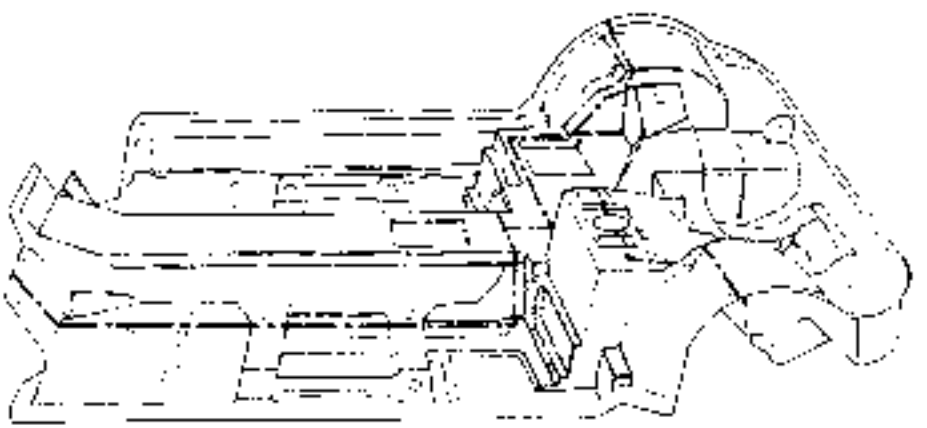
Important: Ensure that the petrol tank has been removed before cutting this section of the undertray.

Op No	Notes
1	Remove seats, floor and 'B' post draughtbox coverings.
2.	Remove dash board
3.	Remove the trim pins from the 'B' posts where centre the windscreen.
4	Cut the adhesive between the windscreen and windscreen landing using the wire set.
5	Remove the windscreen and frame and place aside.
6.	Remove the door panels, 'B' post cover, 'A' post cover and sill using the Lotus panel tool.
7	Disconnect the 'B' post cross beam and tie back the relevant 'B' post.
8.	Ensure scuttle beam is disconnected from relevant 'A' post
9.	Mark the undertray as shown in drawings no. BJ44-1 & 2.
10.	Remove the 4 bolts securing the toe and heel boards to the chassis.
11.	Cut the undertray along the marked line using a router and saw as necessary.
12.	Cut the adhesive from the heel board using the Lotus panel tool.
13.	Cut the adhesive from the 'A' post/bulkhead

Op. No.	Notes
14.	Cut the Sealant from top of 'A' post/underpanels of screen section.
15.	Remove and discard damaged section of underbody and outrigger.

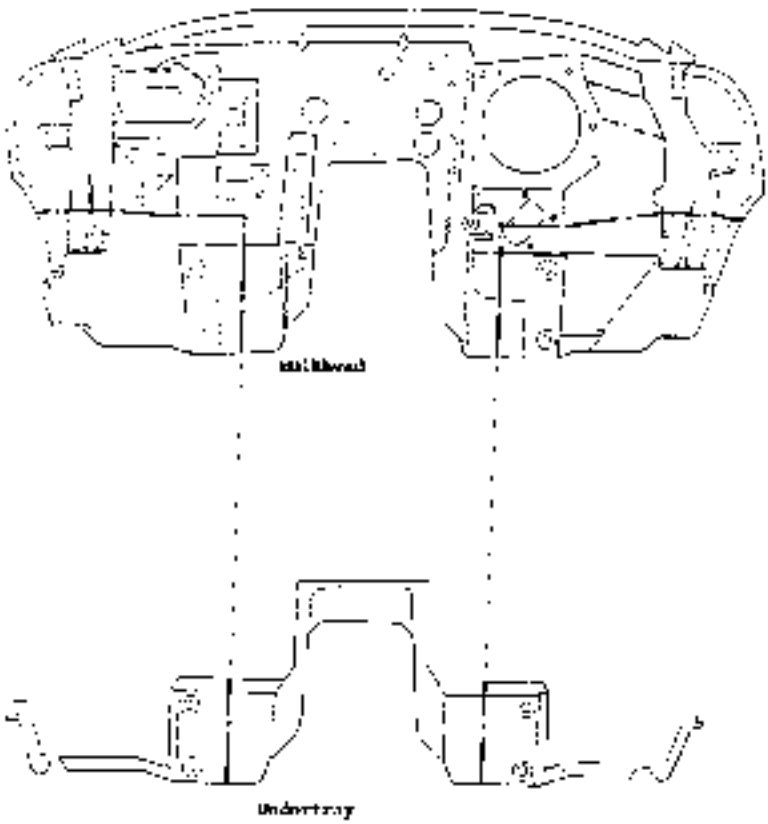
Drawing No. 8346-1 Underbody - Centre Section - Cut Lines

Underbody Centre Section



——— - ——— Cut Line

Drawing No. B444 2 Front Bulkhead - Centre Section - Cut Lines



REPIT UNDERTRAY CENTRE SECTION

Components
Centre Section of Undertray

Materials
Fibre Glass Chopped Strand Mat
Polyester Resin
Resin
Mould Release Wax or Grease per Maker Required
Acetone

Special Tools
Jig - TOOL0010
Marker
Saw
36 Grit Paper and Mechanical Sander
Planer

Op. No.	Detail
1.	Cut new centre section of undertray to suit underjig
2	Position jig in car.
3	Position new centre section to jig and underfly.
4	Ensure new centre section fits undertray and jig accurately, i.e. a gap of 1/8" to 1/4" (3mm to 6mm) should be maintained between both parts of the undertray while ensuring that the jig fits comfortably in the "pick up" and datum points.
5	Remove the new centre section from the jig and using a 36 grit paper and mechanical sander, clean a "V" strip on both surfaces at both panel edges to be laminated, feathering outwards from the joint line.
6	Using a 9" grit paper and mechanical sander remove all old paint from underneath corner of windscreen landing and under tray.
7	Refit the new section and ensure it fits the underjig and jig accurately i.e. a gap of 1/8" to 1/4" should be maintained between the new section and the undertray while the jig fits comfortably in the "pick up" and datum points.
8	Position, drill and jig rivet the pieces to the new section and the undertray as necessary
9	Ensure the area to be laminated is free from wax
10	Wipe overall area with acetone.
11.	Brush resin onto the underneath of the joint
12.	Apply two layers of resin impregnated chopped strand mat to the underneath of the joint - tail end lamp down.

Op. No	Notes
.5	Allow resin to cure at a temperature of not less than 15°.
14	When joint underneath has fully cured, drill out pop rivets and remove plates from the top.
15.	Ensure area to be turned clear of dust.
16.	Wipe sanded area with acetone.
17.	Apply resin to continuous length roving and insert into joint.
18.	Brush resin onto top of joint
19.	Apply one layer of resin impregnated 1½oz chopped strand mat to the top of the joint - roll and tamp down
20.	Apply one layer of resin impregnated woven glass cloth 300 grams per metre square to the top of the joint - roll and tamp down.
21.	Apply one layer of resin impregnated 1½oz chopped strand mat to the top of the joint - roll and tamp down
..	Allow resin to cure at a temperature of not less than 15°C.
23	Refit outrigger and pop rivet (See 8.147)
24	Wax spray as per manufacturer's instructions.

B3.45 - REMOVE MID-SECTION OF UNDERTRAY

Component

Mid section of Undertray - Comprising of:-

a) Mid Section of Undertray

b) Rear Section of Outrigger Including 'B' Post.

c) Rear Jacking Point.

Special Tools

Saw

Drill Power Tool T10/1807

Drill

Marker

Welding Set

Note. Ensure that the petrol tank has been removed before commencing with this repair.

Op No	Notes
1	Remove seats and floor covering
2	Remove 'B' post diaphragm.
3	Disconnect 'B' post cross beam and tie brace
4	Remove the bolts which secure the heat board to the chassis.
5	Mark the undertray and outrigger as shown in drawing no. 3/B3-1 & 2.
6	Cut adhesive from cross section of heat board using Lotus Seam Tool.
7	Cut the undertray and outrigger along the marked line using a router and saw as necessary.
8	Remove and discard damaged mid section of undertray and outrigger.

REPIT MID SECTION OF UNDERTRAY

Components

Mid section of undertray comprising of:-

a) Mid Section of Undertray
b) Rear Section of Outrigger (no wiring 'U' Post
c) Rear Jacking Point
Note: All the above supplied as one section.

Outrigger Strengthening Gusset
1/4" Pop Rivets
1/2" Tank Pop Rivets
Washers

Materials

1[x.. 0 0.4 (Chopped strand mat)
Resin
Catalyst (white paste)
Woven glass cloth 300 grams per metre squared
Acetone
Two Pack Primer (Rota Primer VP2100 A & B)
Wax Spray

Adhesives

Sika Mipa 3900
Bo'a Tiaw 9402
Dow Sea. U.K.L.

Special Tools

Jig TOOL0710
Marker
A Grit Paper and Mechanical Sander
Files
Dust Spray Equipment
Sika Seal Dispenser and Nozzle
Rolder

Op. No.	Notes
1.	Cut out mid section of undertray and outrigger to suit area to be repaired.
2	Position jig to car.
3.	Position new mid section.
4	Secure new mid section into undertray, outrigger and jig accurately, i.e. a gap of 1/8" to 1/4" (3mm to 6mm) should be maintained between the mid section and the undertray while ensuring that the jig fits comfortably in the pick up and dat.m points.

Op. No	Notes
5	Remove the new mid-section from the jig and using a 36 grit paper and mechanical sander clean a 6" strip on both surfaces of both panel edges to be laminated feathering outwards from the joint line.
6.	Using a 36 grit paper and mechanical sander remove all old Beta Seal from the inability.
7.	Ensure that area to be bonded is free from dust.
8.	Wipe bonding surfaces of the understray and outrigger with Beta Wipe 2000 as shown in drawing no. B245-2.
9.	Apply Beta Prime 9400 to bonding surfaces of the understray and outrigger as shown in drawing no. B245-2.
10.	Apply Beta Seal H.V.S. to bonding surface of understray as shown in drawing no. B245-2.
11.	Replace the new mid-section and ensure it fits the understray, outrigger and jig accurately i.e. a gap of 1/8" to 1/4"(3mm to 6mm) should be maintained between both parts of the understray. outrigger and mid-section while ensuring that the jig fits comfortably in the "pick up" and datum points.
12	Position, drill and pop rivet the plates to the new mid section and understray as necessary.
13	Ensure that the area to be laminated is free from dust.
14.	Wipe bonded area with acetone.
15.	Brush resin onto underneath of joint.
16.	Apply two layers of resin wetted 1/oz. chopped strand mat to underside of joint - roll and comp down.
17.	Allow resin to cure at a temperature of not less than 15°C
18.	When joint on underneath has fully cured, drill out pop rivets and remove plates from top
19.	Ensure area to be laminated is free from dust.
20.	Wipe bonded area with acetone.

Op. No.	Notes
11.	Apply resin to the reinforcing length roving and insert into joint.
12.	Brush resin onto top of joint.
13.	Apply one layer of resin impregnated 1kg. chopped strand mat to the top of the joint - roll out lumps down.
14	Lay one layer of resin impregnated woven glass - abt 300 grams per metre square to the top of the joint - roll and tamp down.
15	Apply one layer of resin impregnated 1kg. chopped strand mat to top of the joint - roll and tamp down.
16.	Allow resin to cure at a temperature of not less than 15°C
17.	Cut a small section of the fibreglass underlay away from the outrigger as detailed as shown in Drawing No. 0483.
18	Ensure a gap of 1/8" to 1/4" (3mm to 6mm) is maintained between both sections of the outrigger, using the "pick up" & G clamp points for vertically on the jig. Secure the two sections of the outrigger together.
19.	Using a 36 grit paper and mechanical sander clean a area up to 2½" (65mm) either side of the joint on the outrigger and the strengthening section.
20	Position and secure the strengthening section to the underneath of the outrigger ensuring it fits centrally across the joint and the two sections of the outrigger align correctly with each other.
21.	Ensure that the outer edge of the outrigger remains at an angle of 12° or more.
22.	Note:- For safety reasons check all flammable materials e.g. paints, acetone etc. are removed from the work area. Ensure that the area is free from dust, and well ventilated. Ensure that the dust extraction equipment is cleaned regularly.
23.	Puddle and stitch weld the strengthening section to the outrigger.
24	Using a 36 grit paper and mechanical sander clean all welds and surrounding area.
25	Ensure that the area to be zinc primed is dust free.
26	Cover all, sanded, welded and strengthening plate areas on both sides of the outrigger by painting with a two part zinc rich primer as per the manufacturer's instructions to provide anti corrosion protection for the outrigger.

Drawing No. BJ45-3 Outrigger Strengthening Section

Drawing No. BJ45-4 Outrigger - Cut Line and Strengthening Section

Op. No.	Notes
1.	Carry out paint paper and protection to cabin remove all old sealant from the windows and small section of the cavities.
2.	Carry out paint paper and protection to cabin clean both surfaces of both edges to be laminated, particularly around the vinyl trim.
3.	Ensure that the area to be bonded is free from dust.
4.	Apply Data Mate 'A' to given bonding surface of small section of underbody as shown in drawing no. 5345 A.
5.	Apply Data Prime 5100 to bonded surfaces of small section of underbody and outrigger as shown in drawing no. 5345/A.
6.	Apply Data Seal 6000 to bonded surface of small section of underbody as shown in drawing no. 5345/A.
7.	Fit small section of underbody to outrigger and underbody and maintain a gap of 1/8" to 1/4" (3mm to 6mm) between small section and underbody
8.	Remove protective backing paper from small section of underbody and outrigger
9.	Position small section of underbody to underbody and outrigger as shown in drawing no. 5345/A.
10.	Remove excess sealant from inside of cavity
11.	Wipe bonded area with acetone.
12.	Finish as per instructions (Appendix of this guide)
13.	Apply two layers of paint impregnated mat. Chopper strand mat to the underside of the small section and outrigger area
14.	Allow cavity to cure at a temperature of not less than 5°C.
15.	When the paint has cured, drill out the pop rivets and remove the plates.
16.	Ensure area to be laminated is free from dust.
17.	Wipe bonded area with acetone.
18.	Apply resin to reinforcing length mixing and layer into cavity.
19.	Brush resin onto top of small section.

Item No.	Notes
4A.	Apply one layer of heat reactivated glass fibre chopped strand mat to top of joint and roll down.
5.	Apply one layer of resin impregnated woven glass cloth to joint and roll down.
6A.	Apply one layer of heat reactivated glass fibre chopped strand mat to top of joint and roll down.
7A.	Apply one layer of resin impregnated glass fibre tissue to top of joint and roll down.
8A.	Fill void in joint with polysulphide sealant and weather to profile edge of assembly as shown.
9A.	Fill void in joint with polysulphide sealant and weather to profile edge of assembly as shown.
10.	Apply one layer of resin impregnated glass fibre tissue to top of joint and roll down.

8.1.01 - REPAIR REAR OF UNDERTRAY

Components

- 1 x Quarter Undertray [Part No 8.01] | As necessary
- Sear Felt Undertray |

Materials

- [illegible] Chopped strand mat
- [illegible] mixed length strands
- Resin
- Acetone
- Brush [illegible] 50 grams per metre squared

Special Tools

- [illegible]
- Marker
- [illegible] Wire
- Pliers
- Pop Rivet
- Stool
- Vice
- At [illegible] Paper and Masking Tape

[illegible]	Notes
1.	Mark out cut line as necessary around the damaged area of undertray to be removed.
2.	Mark out cut line across rear section of undertray as necessary using cut line on damaged undertray as a guide.
3.	Cut damaged undertray along cut line and remove.
4.	Cut rear section of undertray along cut line.
5.	Using [illegible] paper and [illegible] all sanded surfaces to a minimum of [illegible] inches around edges of undertray and rear undertray section [illegible] to expose fibres for good bond.
6.	Using rear portion [illegible] undertray, offer to undertray [illegible] a gap of 1/8" to [illegible] from to rear).
7.	Position, drill and pop rivet holding plates across rip [illegible] as necessary.
8.	Ensure area to be repaired is free from dust.
9.	Mask [illegible] area with [illegible].
10.	Brush resin to underside of joint.
11.	Apply 2 layers of resin impregnated [illegible] chopped strand mat to underside of joint.

Item	Notes
6y	Apply one layer of resin impregnated glass chopped strand mat to form a base 5 mm thick.
6z	Apply one layer of resin impregnated woven glass cloth 300 g/m² per metre square to lay on the mat. Work out bubbles.
7a	Apply one layer of resin impregnated glass chopped strand mat to form a final 2 mm thick layer.
7b	Allow resin to harden at temperature not less than 15°C
7c	Drill and tap 1/4" BSW holes and washers on outside edge of assembly 150 mm apart.
7d	Drill and tap 1/2" BSW holes and plate and washers on inside edge of assembly 300 mm apart.
7e	Apply two coats of [illegible] to all surfaces both inside and outside of boat and allow to harden.

8.1.44 - REPAIR REAR OF UNDERTRAY

Components

Rear Quarter Panel RH/LH | As necessary
Rear Half Undertray |

Materials

[illegible]
[illegible]
Paint
Primer
[illegible]
As per [illegible]

Special Tools

[illegible]
Marker
[illegible]
[illegible]
[illegible]
[illegible]
Universal Plate Caps and Washer Kit 74X5[illegible]

Op. No.	Entry
[illegible]	Mark out and trim as necessary around the damaged or worn undertray to be removed
[illegible]	Mark out and trim the new rear section of undertray as necessary using cut line on damaged undertray as a guide.
[illegible]	Drill spot welds from old trim and remove
[illegible]	Cut rear section of undertray along cut line
[illegible]	Using [illegible] project cut section of undertray and any of the cut line to provide offset of [illegible] and new undertray section [illegible] from the [illegible]
[illegible]	Prime the position new undertray section to underside [illegible] to [illegible]
[illegible]	Location, drill and [illegible] spot holding plates across [illegible] as necessary.
[illegible]	Ensure area to be repaired is free from dust.
[illegible]	Wipe sanded area with [illegible].
[illegible]	Brush paint to underside of [illegible].
[illegible]	Apply 2 layers of basic [illegible] [illegible] to underside of [illegible].

Drawing No. B136-1 Rear Quarter Section - Cut Away

Drawing No. B136-2 Rear Hull Section - Cut Away

[illegible]	Notes
[illegible]	[illegible] and lamp lever
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

8J.07 - FIT OUTRIGGER TO UNDERTRAY

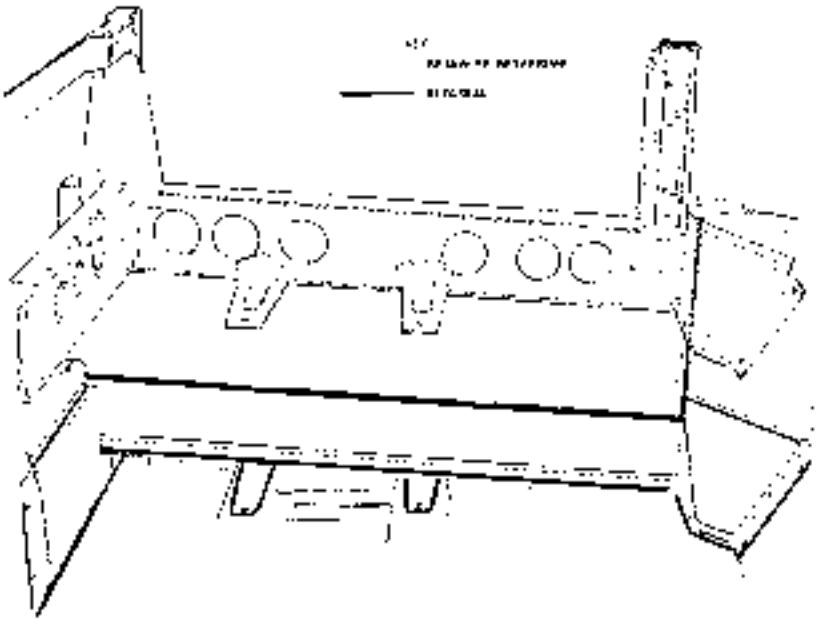
Components
- Outrigger (LH/RH)
- 1/4" Pop Rivets
- 1/8" Dome Pop Rivets
- Washer
- MAX Spring

Adhesives
- Petro Mate (HS)
- Dow Corning 732
- Dow Seal (RTV)

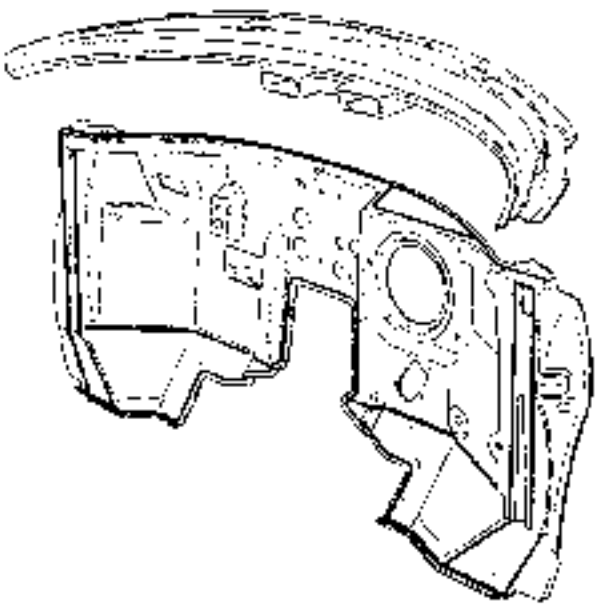
Special Tools
- Jig (JIG0001)
- Rivets
- Washers
- Drill
- Drill Jig Magnet
- Petro Seal Trimmer and Nozzle
- Files
- Cup Brush
- Wax spray equipment

Job No.	Work
1.	Position outrigger to assembly and temporarily secure by screwing the end bolt heads to underside
2.	Drill and ensure 'A' post datum and B post attach holes are correctly positioned.
3.	Using jig, drill three 4mm holes through outrigger as shown in position in the underside
4.	Remove the jig and outrigger from the underside
5.	Apply Petro Seal to the flat bonding surfaces of underside, outrigger, 'A' post, bulkhead and underneath of windscreen bonding as shown in drawing No. 8J1-1 & 2.
6.	Apply Petro Seal to the bonding surfaces of underside, outrigger, 'A' post, bulkhead and underneath of windscreen bonding as shown in drawing No. 8J1-1 & 2.
7.	Apply Petro Seal RTV to bonding surfaces of underside as shown in drawing No. 8J1-1 & 2.
8.	Refit outrigger to underside and secure by bolting the two end bolt heads to the underside.
9.	Refit jig and check positions of 'A' post datum and strikers plate holes are correctly positioned.

Drawing No. B161-1. Outrigger Bonding



Drawing No. B161-2. Front Bulkhead Bonding



Op. Sys.	Notes
OS/2	Use this command to display a single file or multiple files that match the specified wildcard pattern.
UNIX	Removes empty directories from all drives.
OS/2	Sets the initial shell program and switches to multiple mode of operation. Use with CONFIG.SYS.
UNIX	Sets the initial shell program and switches to multiple mode of operation. Use with /etc/rc.
OS/2	Sets the baud rate, parity, data bits, and stop bits for the specified serial port.
UNIX	Sets the baud rate, parity, data bits, and stop bits for the specified serial port.
OS/2	Sets the search path for files to be edited by the specified program.
UNIX	Removes the directory.
OS/2	Removes a directory from the default search path.
OS/2	Exits the shell.
OS/2	Copies one file to all or part of a specified disk. Use the /FORMAT switch to format the disk before copying the file.

ILLAN - KIT SCUTTLE BEAM

Components

- Scuttle Beam
- Screws
- Bolts
- Washers
- Nuts

Op. Sys.	Notes
DOS	Sets the distance between the A: and B: drive heads to the specified number of tracks.
UNIX	Removes symbolic files without prompting.
OS/2	Displays instructions to type a file. Pauses after each screen of information.
DOS	Displays a list of files on the specified drive.
UNIX	Scuttle beam and spacers for the A: and B: drives. Kit includes mounting screws, washers, and nuts.

B1.4J REPAIR OF FIBRE GLASS DAMAGE AROUND BONNET

Components and Materials

Resin
Acetone
1/2 oz. chopped strand mat
Unidirectional glass mat 600/300 grams per square metre
Woven roving 1 7/8 oz. = 650 grams per square metre

Special Tools

Wet and dry paper
Scissors
Thickness Rule - 0.01" Lucas Ref. No. 44 525 4
Straight Edge
Sharp Trim Razor

Note - Depending on which body panels are to be repaired it may be necessary to remove the body from the chassis.

Op. No.	Notes
1.	Using straight edge and trim line marker draw two lines three inches apart on bodies hole to form cross.
2.	Using router cut fibre glass to remove section and damaged fibre glass.
3.	Grind to give undercut clean undamaged surface of underlying bonnet to be
4	Grind a well undercut clean upper surface of underlay around hole.
5.	Position fibre glass wipe around to fit pressure sealed rubber seal. Ensure that area which is to repaired is free from dust.
6.	Clean underneath and edge of aperture of under tray with acetone.
7.	Fit thickness rule to body opening surface of under tray to "Blank out" it.
8.	Brush out onto top surface of thickness rule and allow to dry.
9.	Apply one layer of resin impregnated 1½oz. chopped strand mat + cut, and tamp down.
10.	Apply one layer of resin impregnated woven roving 7 02. + cut, and tamp down.
11.	Apply one layer of resin impregnated unidirectional mat, chopped strand mat side against woven roving + cut and tamp down.

Op. No.	Notes
12.	Apply one layer of resin impregnated 5oz.chopped strand mat - roll and tamp down.
13	Leave resin to cure in a temperature of not less than 15°C.
14	Remove shuttering and mat.
15.	Using straight edge and tine line marker or pen trace of axes to find centre point of bobbin.
16.	Drill hole for bobbin using the centre of cross.
17.	See pic bobbin to order tray.

ALSO - FIT BOBBINS TO UNDERTRAY

Components

M100 under tray
Bobbins

TYPE	POSITION ON TRAY	PART NO	QTY
Male	Rear wheel arch	A1C2EC486	2
Male	Body	A1C5E22E6	21
Male	Tow board	A1C2EC3C8	4
Female	Rear wheel arch	A1C2EC485	2
Female	All other positions	[illegible]	26

Adhesive

Araldite 2012 [illegible] parts

Special Tools

Bobbin crimping tool and air supply
Drill/bit/guide

Op. No.	Notes
1.	Place 2 part araldite around male and female parts of bobbin, using araldite nozzle.
2	Clean male part of bobbin thoroughly appropriate bit of undertray, ensuring that side is correctly positioned to suit RH/LH undertray.
3	Fit female part of bobbin to male part. Crimp end of male part of bobbin using crimping tool and air supply.
4	Wipe and remove excess Araldite from joint to provide smooth finish as shown in drawing no. D350-3. Allow 15 hours for cure to cure.

Drawing No. B350-1 Bobbin Positions in Underbody

Drawing No. B350-2 Bobbin Positions in Underbody

Drawing No. B350-3 Araldite - Smooth Finish

[illegible] - KIT 'B' POST TIE BRACE

[illegible]

Drawing No. [illegible] 'B' Post Cross Brace and Tie Bar Assembly

Bolt Specifications
Bolt 1 M8x30 [illegible]
Plus Washer [illegible] x [illegible] x [illegible] [illegible]

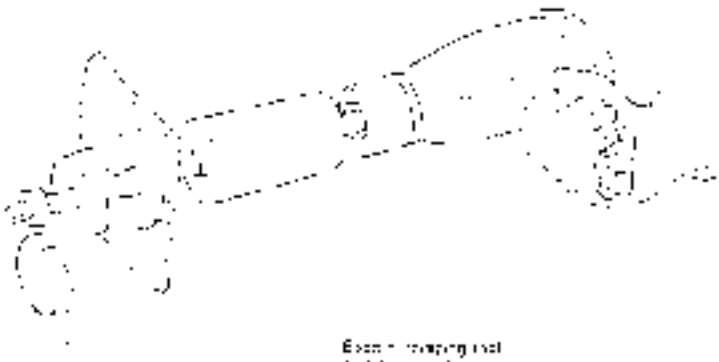
Bolt 2 [illegible] [illegible]
[illegible] Washer 10mm x [illegible] [illegible]

Bolt 3 [illegible] [illegible]
[illegible] [illegible]

Assembly Sequence

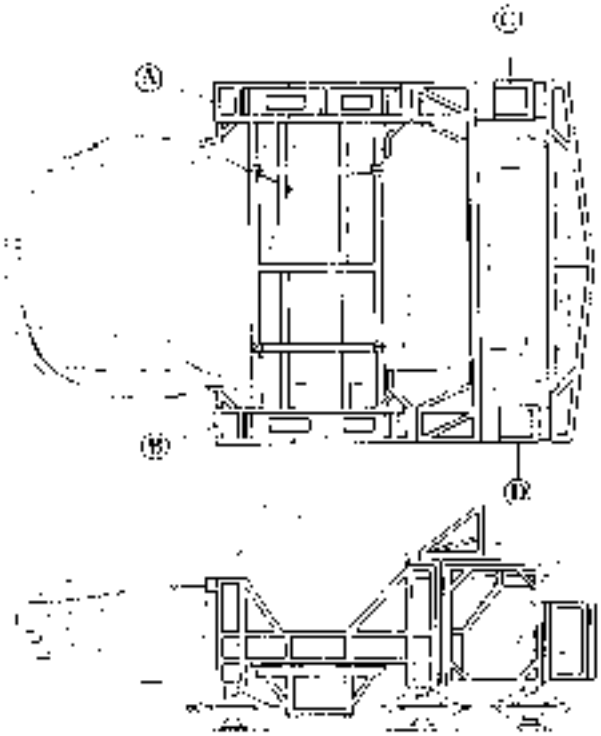
Seq. No.	Notes
1	[illegible]
2	Insert & tighten bolts (1) torque 22 Nm max.
3	Lay tie bar assy. in place & insert bolts (2) [illegible] free play approx.).
4	Insert shims to take up gap between bar & bobbin. [illegible] torque to 10Nm.
5	Tighten bolts (2) & torque to [illegible]. Insert & tighten bolts (3) torque to 22 Nm
6	Remove bolts [illegible]

Note. Apply Permabond [illegible] to bolts (2), (3) & (1).

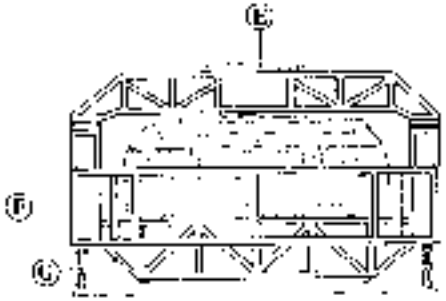


Body repair trolley

T230F01b



- (A) RHD A & B PILLARS JIG
- (B) LHD A & B PILLARS JIG
- (C) RHD QUARTER PANEL JIG
- (D) LHD QUARTER PANEL JIG
- (E) REAR TOP PANEL JIG
- (F) REAR FRAME JIG
- (G) FLOORTRAY TOOLING HOLE JIG



Rear bulkhead (4)

(2017)

VAT LEGISLATION.

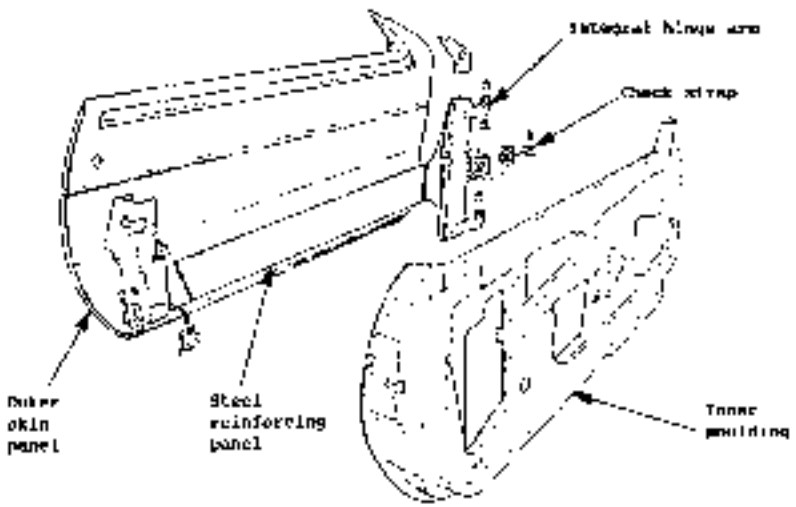
IMPORTANT. Selling, installing, and all related activities are governed by strict laws in order to ensure compliance with all relevant regulations relating to scaffold design and overall safety at work. You are strongly advised to consult your local Health and Safety Executive or Local Authority before engaging any such work. Davis Scaffolding Ltd. can accept no liability for any infringement of such regulations by any third party operatives.

BODY FITTINGS

SECTION BK - INDEX

BK.3 - DOOR ASSEMBLIES

Each door assembly comprises of an inner composite moulding, to which is bonded by polyurethane adhesive, a steel braced steel reinforcing beam carrying the door latch mechanism at the rear end, and the integral hinge arms at the front end. A composite outer skin panel is then bonded to this assembly with polyurethane adhesive. For some markets, including the USA, a door interlock locator spigot fitted near the bottom of the 'B' post, engages with an interlock eye on the door to help stabilise the door beam in the event of a side impact



Hinges

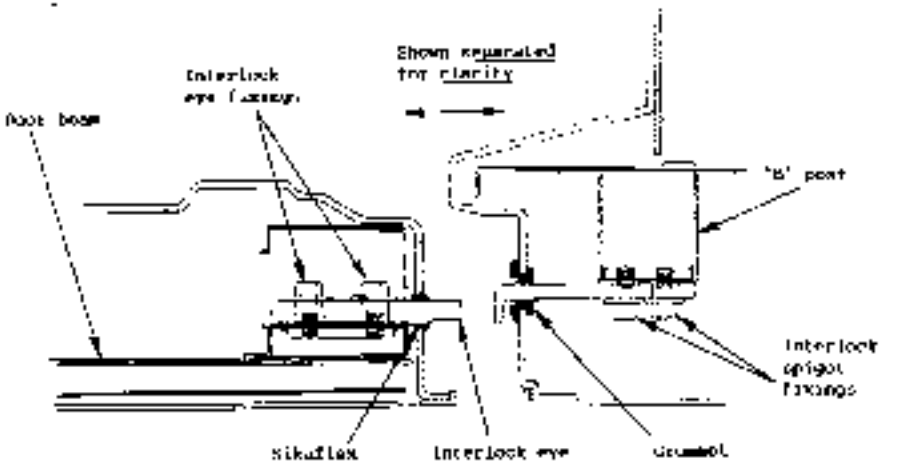
The two door hinge arms, integral with the door beam, are fitted with self lubricating Glacier 'DU' bushes and pivot on steel hinge pins. The pins connect the hinge arms to hinge brackets bolted to sockets which are themselves bolted to the 'A' post. One end of the hinge pins is tapered to aid assembly, and the other end is provided with a collar and head to aid removal. The pins are retained in the hinge brackets by the interference fit of a stepped knurled section on the pins just beneath the head, whilst a circlip on the tapered end of the pin provides a safety back up.

Hinge Adjustment

When correctly adjusted, the shutline around the door edge should be approximately 3 mm. with the door aperture aligned with the front and rear wings.

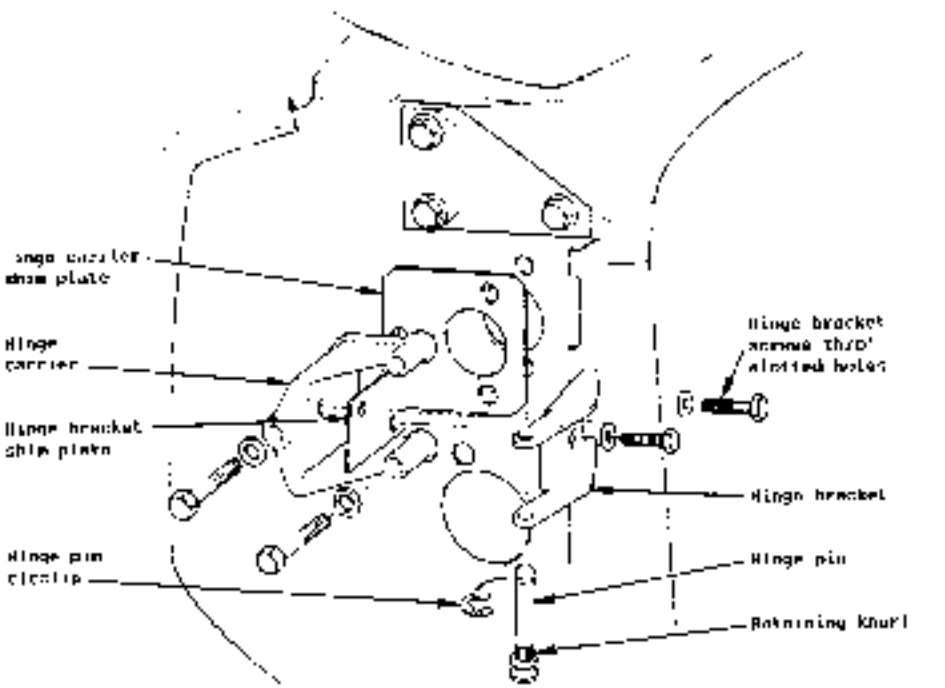
To adjust the door position:-

1. On cars fitted with an interlock locator near the bottom of the door skin face, first remove the door trim panel and loosen the fixings securing the interlock eye to the door beam.



Remove the 'A' post pivot trim cover (BK 11).

Door adjustment is available by slackening the three bolts securing the hinge carrier to the 'A' post vertical capping plate, and moving as required.



1. Hinge pin adjustment is achieved in the same way, but if more is required, shim plates may be fitted (or removed from) between each hinge bracket and carrier.

2. Lateral adjustment is made by slackening the two bolts securing each hinge bracket to the carrier (located facing inboard). If this is insufficient, shim plates may be fitted (or removed from) between the hinge carrier and 'A' post. When re-fitting a hinge carrier, seal around each fixing hole on the hinge post with Silastic. Completely seal the recess hole just above the lower hinge carrier fixing hole. When adjustment is complete, remove the hinge carrier bolts in turn, and apply a small amount of Silastic to each hole before hand tight and tightening the bolts.

3. When door is correctly aligned, (on cars so equipped), adjust the interlock striker eye so the rear end of the lock face is flush with the interlock guard on the 'B' post. Tighten the fixings, and seal the gap between striker eye and door shell with Silastic (see 4) to seal holes.

To Remove Door Assembly

To remove an offset door assembly (or to be removed, the hinge pins should be withdrawn rather than removing the hinge brackets or carriers).

1. Remove the 'A' post pare (see section BF-1).

2. From inside each end of the fabric, release the two door speaker connectors, and feed out through the body hole with the grommet.

3. Press out the spring pin securing the check strap to the 'A' post.

4. Remove the check strap from the tapered end of the hinge pin and drive out each pin. The top pin downwards, and the bottom pin upwards. The pins have a straight shank, just beneath the head, which is an interference fit in the hinge bracket hole. DO NOT attempt to loosen a pin by turning, as the interference fit will be lost. A straight pull is required.

Refit the door in the reverse order to removal, noting that the hinge pins are a interference fit and that the upper pin must be fitted from below, and the lower pin from above, or it will prevent door removal with the front hinge in place.

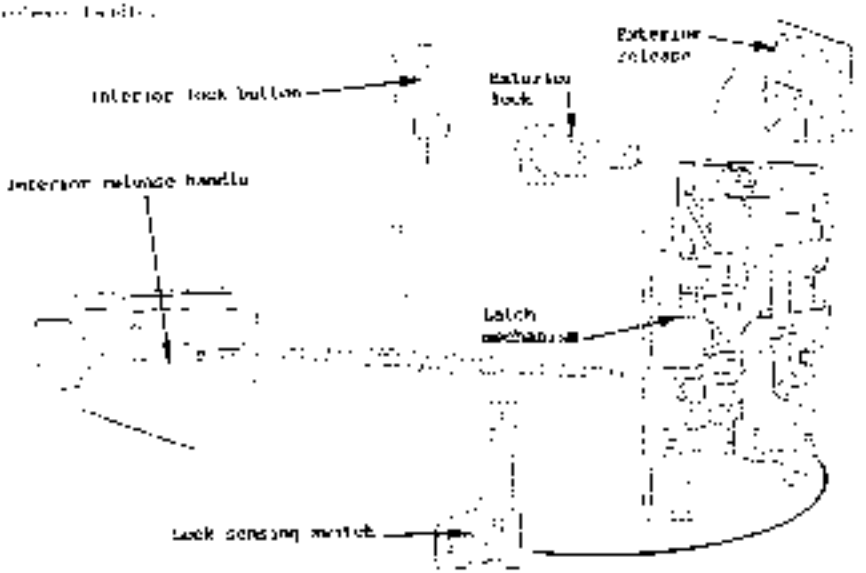
The door weatherstrip is retained by grub screws in guide at each end, and is cemented to the 'A' post. To remove, cut through the weatherstrip at each end of the guide. Loosen the grub screws, and withdraw the weatherstrip. Clean the area of the post around the hole with white spirit. Apply a small amount of Silastic to the hole, and push the weatherstrip back into the guide. Tighten the grub screws.

BF.1 DOOR LATCH MECHANISM

Each door latch mechanism consists of:
a latch assembly with integral electrically operated central locking actuator, door ajar switch and interior lamp switch;
an exterior key locking barrel;
an exterior release handle on the door skin and lock;
an interior release handle;
an interior lock button at the top rear of the door;

a lock sensing switch mounted by a bracket to the bottom of the latch mechanism.

The doors are opened from outside by a locking exit key and linkage to a push button. Pressing in the exit button will unlock the door, the window remains closed.



The central locking will operate from both the external key lock and interior rocker button, but the doors can only be locked when both doors are closed. If a door is locked when either door is opened or closed only on the first latch travel, the central locking system will then operate to lock the doors, but after a two second delay, will unlock the doors again. This feature guards against inadvertently locking the keys inside the car. In the event of a flat battery, the doors will be operable, and each door can be locked or unlocked manually. There is an override system enough to engage the safety position only (up), in addition to the dual purpose (red) key provided (2). The SRS system will operate to allow both doors.

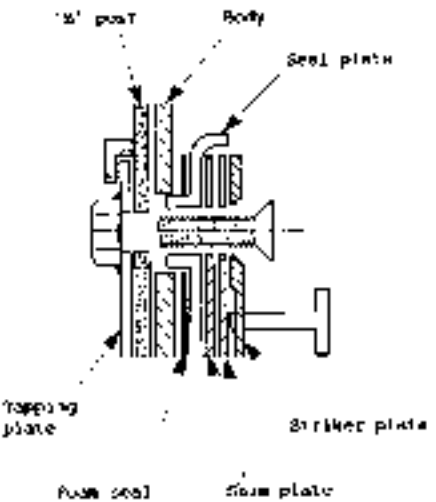
For full electrical details of the SRS operation, see workshop manual.

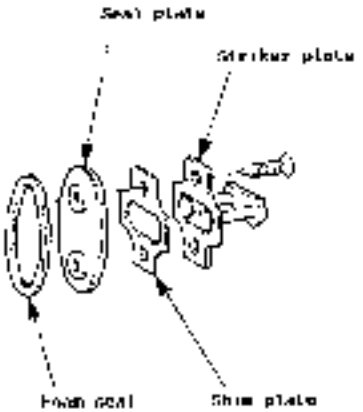
Adjustment

Before carrying out any adjustment to the lock mechanism, first ensure that the door alignment and fairing is correct, and if necessary adjust as the striker may otherwise bind.

The striker plate is fixed to the door pillar by two torx socket head screws, which should only be released slightly to allow the striker plate to be moved up/down or in/out with the latch mechanism still attached. Adjustments to adjust the door seal compression may be made by the addition or deletion of the plastic packers, the striker and the seal plate. Alignment of the striker loop may be achieved with the latch mechanism.

If the striker is removed, ensure that the components are assembled in the reverse order - the seal plate fits with its face next against the body. To refit the striker shims, lower the striker plate

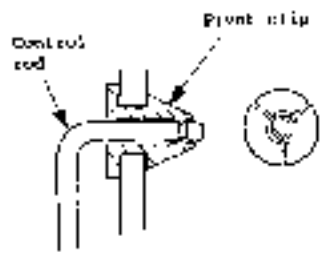




...ctrol Rods

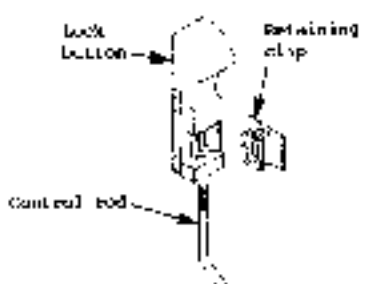
...ch front and lock control rods are of ... ...ly, with a bright metal ... ...already. The insertion of part of the ... ...rod is for lubrication ... ...ool is made up and retained ... ...ade and plastic bead which ... ...ng operation.

... The lock rod is retained at the ... by retaining clip. The end is the ... Ensure the clip is correctly ... ...ly and that the ... ...ool is ... ...ocket of operation.



... ...ntrol lock button is not ... ...ly by a spring ... ...ed to ... ...ly ... ...ck ... ...ly ...

... ...tton, position the button so that the ... ...ge of the clip ... ...ck ... ...



Lighter / Latch / Lock cylinder

Door window glass

- Wind the door glass and the quarter glass fully up.
- Disconnect the control rods from the latch assembly.
- Unclip the two electrical connectors from the switches and the connector from the latch motor.
- Remove the screws securing the latch mechanism to the door and withdraw the latch assembly.
- Refit the latch mechanism in the reverse order to removal. Check that the window regulator handle is in position.

Exterior release handle assembly

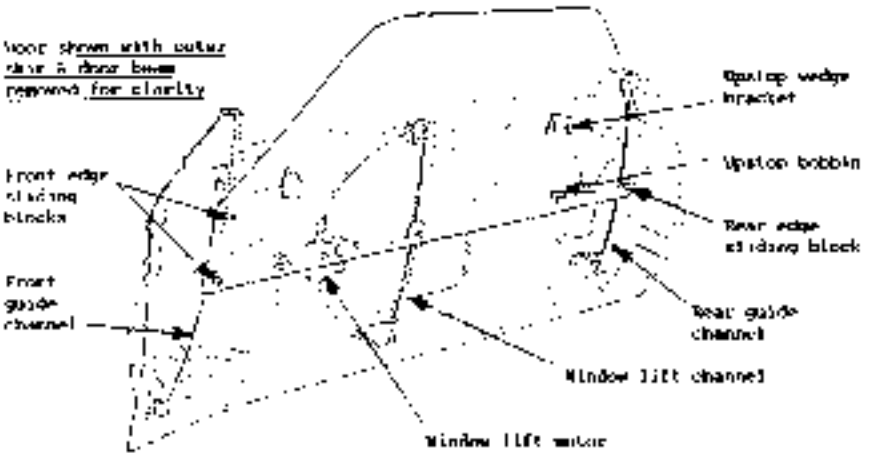
The exterior release knob is retained by a recessed screw (Torx) and the release handle assembly is retained by three M5 nuts and flatwashers.

If the handle assembly is dismantled, check that the lever arm is fitted to the correct side of the assembly to achieve the correct operation. Spare bolts and plain washers are fitted only to early cars and may be omitted.

The barrel or lock cylinder is retained in the door by a spring steel clip which must be cut to aid its removal.

BK.1 - DOOR WINDOW GLASS

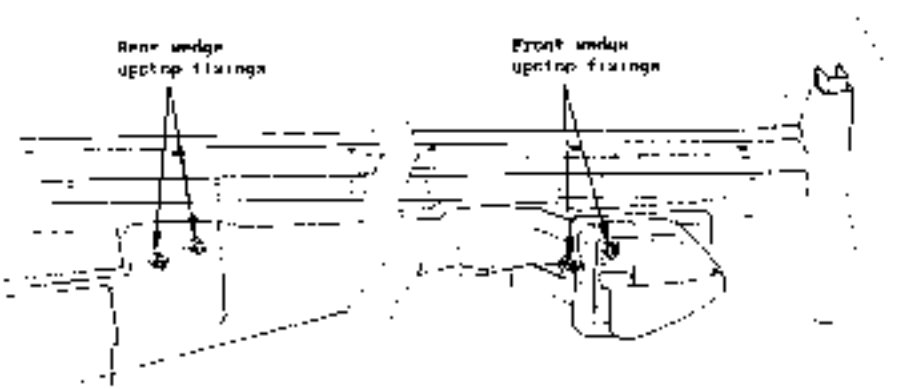
The door window glass is electrically operated, and is fitted with two nylon sliding blocks fixed to its front edge, and one at the centre of the rear edge. These sliders operate in steel channels fixed inside the door shell, which retain the glass as it travels up and down. The up position of the glass is controlled by the nylon 'bobbin' fixed to the lower edge of the glass, which abut against 'U' shaped metal brackets bolted to the inside top of the door shell.



Adjustment of top stop

Before any adjustment to the door glass position is attempted, first ensure that the roof upstop is correctly adjusted (see later). The fit of the raised door glass to the roof seal and drain gutter may be improved by the means described below.

Upstop adjustment - The raised height of the glass should be adjusted so that the top edge of the frame fits snugly into the weather strip. The upstop wedge and roof rail drain gutter may be moved. To adjust the upstops, lower the glass, remove the door trim panel, the door rear seal (B) and door speaker. Slacken the window regulator mounting bolts at front and rear. The front bracket fixing:



...ion button on the door release handle. Move both the operator ...
...ight to the left and lift the glass by exerting the lift
- Towards the end of travel. The inboard lift arm should be actuated ...
...ear roller of the jockey of the raised glass, makes light contact with the ...
...ver, pulley and roller runs 10 mm. The lift may be ...
...djusted by slackening the lower clevis clamps, securing the bottom end of the ...
...front and rear guide channels to the door shell and moving towards or outwards ...
...ecessary. Also check the window lift arm mounting bracket to ensure that ...
...ing and allow the lift channels to line with the guide channels. Tighten all ...
...clamps after adjustment.

Removal of door glass

- Remove the door trim panel, door sill [illegible], door speaker, and the ...
...sheet from the access holes.

- Unscrew both upstop bumpers from the lower edge of the glass by removing the ...
...ngle screws securing each bumper to the alloy capping plate.

- Release the lifting clamp from the glass by pulling off the plastic ...
...the pivot pin of the clamp spigot, and withdrawing the lower fixing of ...
...the lift channel to allow the clamp spigot to be withdrawn from the glass.

5. Withdraw the glass upwards and out of the door.

Refitting of door glass

1. Prior to refitting the glass, ensure that the following parts are fitted ...
   - Weatherstrip to door shell
     Lower and outer glass support rubber
   - Window channel to inner door panel
   - Inner and outer door sheet
     Front and rear guide channels

- Assembly of glass to lift arm
  Check that the lift arm clamp channel is securely bonded to the lower edge ...
  ...ance piece of thickness [illegible] is necessary, bonded using Betaseal sealant, ...
  ...between the edge of the glass and the underframe. The channel should be ...
  ...parallel with the glass rear edge. Locate the channel to the glass with a ...
  ...plastic body, countersunk screw, flat washer and nylon nut.
  ... Apply [illegible] to the threads of the plastic bodied screw ...
  ... Apply a drop of Permabond [illegible] to the lower threads of the ...
  ...rear lift arm channel. Initially fit the upper bracket and a loose clamp

Roller
Slider mounting channel
Plastic bush
Spacer washer
Upper slider boss
Holder washers
Plastic bush
Countersunk screw

mounting bolt. Adjust the rear sash guide. If the rear sash is still not level with the top of the door, but is not at a check with the front sash, repeat the procedure for the front sash.

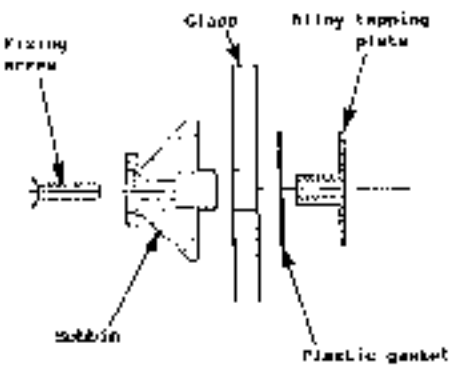
(c) Fit a slider block to each of the sash guide channels and retain with a flat washer and fit screw with a drop of Permabond applied to the thread. Note that the top slider block is shortened at its lower end. Position the slider blocks correctly but ensure that the screws are still able to turn.

(d) Fit rollers into each of the slider blocks:

- Upper front slider roller in lower cavity;
- Lower front slider roller in both upper and lower cavities;
- Upper rear slider roller in lower cavity;
- Lower rear slider roller in upper cavity.

(e) Lubricate the slider blocks with petroleum jelly.

7. Fit the glass run rear sash rubber blocks engaged in the guide channels. Fit the two sprung bobbins to the lower edge of the glass, with double sided tape or a plastic gasket fitted between the alloy tapping plate and the glass.



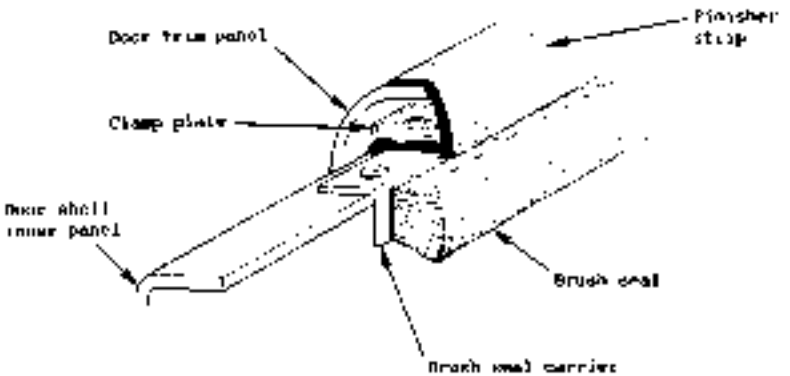
8. Fit the spigot of the lifting linkage through the glass and retain with the plastic clip. Adjust the lower end of the lift channel to be in alignment with the glass channels.

9. Adjust the glass position if necessary, as detailed above.

Door Glass Internal Rubber Seal

A push type seal is attached to a carrier which is clipped to the top of the door shell inner panel. A rubber finisher strip is fixed over the seal carrier and lips over the top of the belt line panel.

To remove:
- Remove the door trim panel.
- Remove the 8 screws securing the furniture strip clamping plate, and remove plate. Carefully peel furniture strip from its double sided tape.
- Remove the screws securing the downturned rear end of the brush seal carrier. Drill out the 5 rivets securing the brush seal carrier to the door. Withdraw the carrier from the door, using a blade if necessary to release the sealing strip between carrier and door.



To refit:
1. Clean any sealant from the top edge of the door shell, and underside of the seal carrier. Apply primer (RBX000109) to the underside of the seal carrier and top of the door shell. Allow to dry.

2. Apply 1750mm length of sealing strip (RBX000104) to the underside of the seal carrier, aligning with the edge and ends.

3. Fit the carrier onto the door and push fully forwards with the carrier rear face held hard against the rear face of the door shell. Secure the seal carrier using 5 off 1/8" pop rivets. Secure the rear end cap with a screw, washer and captive nut.

4. Apply primer (RBX000109) to the top surface of the brush seal carrier, and to the underside of the rubber finisher strip. Allow to dry.

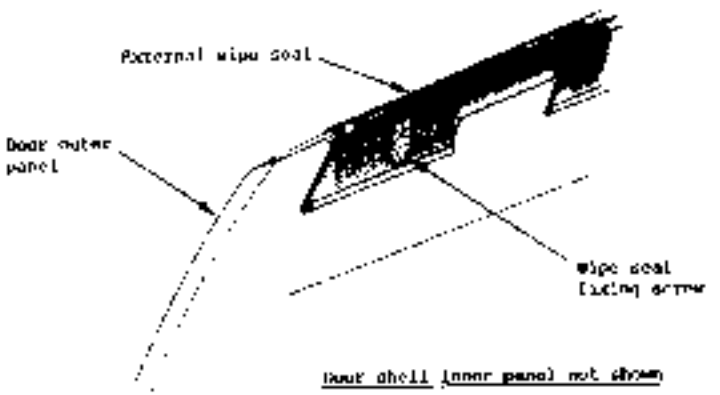
5. Fit a length of double sided tape (RTC000009) to the top of the brush seal carrier, with the edges and ends aligned. Fit the finisher strip onto the tape with the edges and ends aligned, and press down firmly.

6. Fit the clamp plate into the finisher strip, with the edges turned upwards, and the cut outs inboard. Use a scriber to locate the fixing holes in the brush seal carrier, pierce the finisher strip appropriately, and secure the clamp plate and finisher strip 8 screws.

7. Refit the door trim panel.

External wipe seal

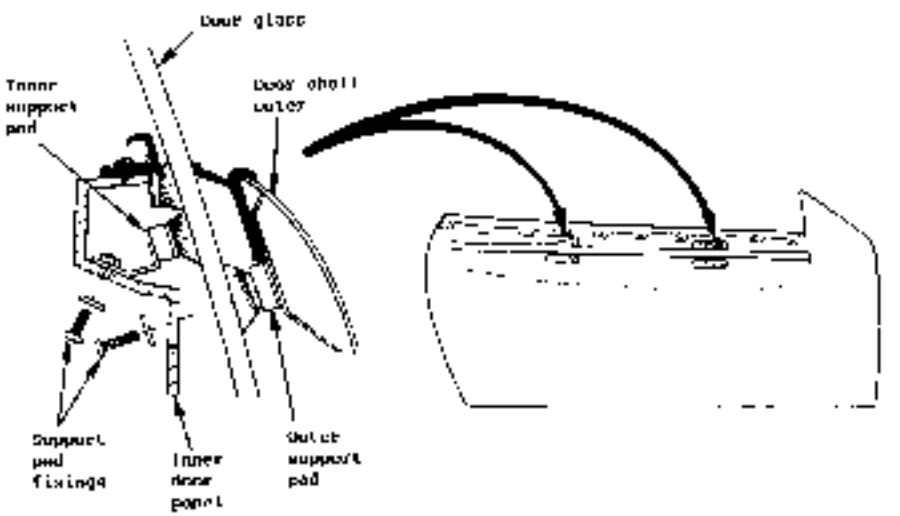
The door glass external wipe seal is secured inside the door outer panel top edge by 10 screws. The screws are also used to secure the door to A panel and rear window glass channel, one screw at the inner door panel.



Glass Support Pads

Two outer support pads and two inner pads are fixed inside the top of the door shell to provide additional support to the door glass.

Each of the outer two pads are retained to the outer door shell with two screws and washers which also secure the door glass channel. The position of the inner pads, which are fixed to the inside of the inner door shell with a single screw and washer, are located so that the pads just touch the door glass in the lowered position.



BB.1 - DOOR WINDOW LIFT MECHANISM

The door windows are 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. Pressing the front, domed end of the rocker switch lowers the window, and pressing the rear, dished end raises the glass.

An electric motor and cable mechanism within each door, lifts a lift channel via guide & plastic clamp which is adjusted through the glass. The top and bottom of the lift channel are fitted with pulley wheels to guide the lift cable, one end of which locates outer cable abutments and the tension of the cable is taken up by a spring. The complete assembly of motor/lift cable/lift channel, is serviced only as one unit.

Removal of Motor/Cable/Channel Assembly

1. Remove the door glass (see above) and motor drip shield.

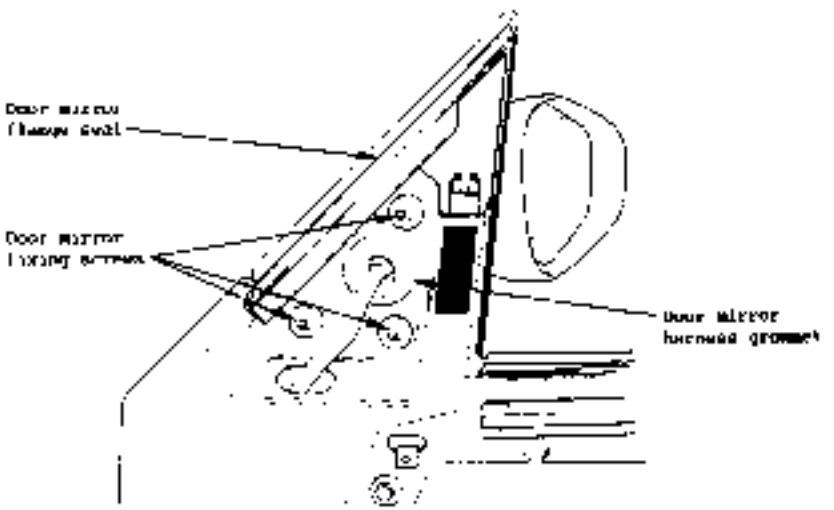
2. Release the single fixing nut securing the top of the lift channel to the door, and the single nut securing the bottom of the lift channel to the mounting bracket.

3. Release the three nuts securing the motor to the door, disconnect the wiring harness, and withdraw the complete assembly through the door access hole.

Refit in reverse order.

BB.2 - DOOR MIRRORS

The door mirrors are mounted to the doors via a spring pivot which enables the mirrors to move forwards or backwards on accidental contact, and then return to their former position.



To remove a mirror assembly, remove the door trim panel, disconnect the mirror harness, and unscrew the three screws securing the mirror assembly to the door shell.

To refit a door mirror:
Check that the small 'O' ring seal is fitted over the mirror plinge on the door shell before feeding the mirror harness connector plug through the hinge and into the door shell. Locate the lever in the slot in the hinge.

1. Refit the mirror using the three M4 screws and washers, and tighten to [illegible] on the [illegible].

Wire in the mirror harness connector to the door harness, and locate the harness clip in the door shell hole.

2. Refit the door trim panel.

To remove the door handle

The operating key barrel between the door and lock mechanism is secured by three screws, and must be removed prior to removing the lock cylinder.

To remove an 'A' post panel, slacken the two screws securing the door edge to the sill, and remove the nut from the stud at the top rear edge of the panel, fixing the panel to the bodyshell bracket. Pull on the door rear, and then pull rearwards. All fixing points are clear. Disconnect the side repeater lamp harness, as the panel is removed.

DELETE FRONT WINDOW.

The front opening window is a composite moulding comprising of both upper front wings and the forward locking platform. A flush air intake duct is incorporated in each half of the bodyshell, but is fitted only for right hand drive. The screenshell is secured by 19/21 threaded fasteners, and may be removed for improved access during paint repair etc.

To remove, Proceed
1. Disconnect battery.

1. Remove the front bumper/spoiler (see 8K.01).

2. Disconnect the windscreen washer tubing, about 6" (15 cm) from the hinges, and remove the bonnet panel.

3. Mark the two (rear) 'A' post panels by scribing the two screws securing the upper edge to the sill, and removing the two screws at the top rear edge of the panel, fixing the panel to the capshell bracket. Pull out the door seal, and then pull down and off. (Fit tool 99 0141 to slots. Disconnect the side repeater lamp harness (Elan 3SR only). Withdraw the harness with its grommet through the bulkhead.

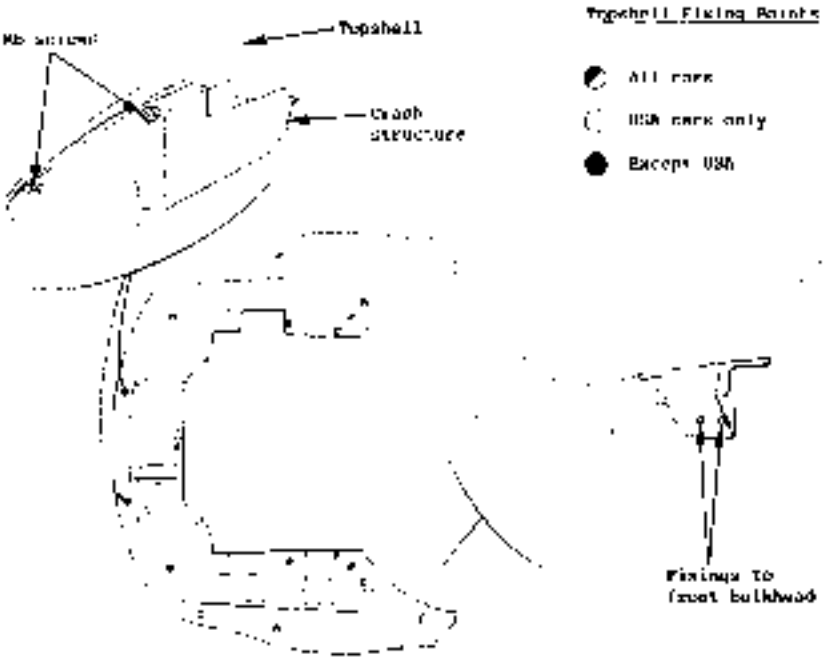
4. Remove both front shockabsorber lower nuts and remove the windscreen outlet pipe between the manifold and plenum intake hose. Disconnect the air intake duct from the bulkhead adaptor on the passenger side.

5. At each crossmember mount, disconnect the attaching bolts, plus the 'Armada' connections, and remove the bolt securing the front anti-roll bar bracket to the top of the strut. Via the access holes in the wheelarch, release the two cable sockets from the clips in the radiator bracket and remove the motor. Remove the three bolts securing each bodyshell adaptor and the earth bracket to the chassis.

6. At the right hand side, disconnect the coil cable terminal block. At the left hand side, label and disconnect the various wires to the vacuum solenoid valve and EGR and evaporative emission valves.

7. Release the bonnet catch mechanism from the nosepiece.

8. Release the fixings of the nosepiece assembly:
   - Two fixings at front of wheelarch trim
   - Two fixings at each side securing the top rear edge to the body near the door hinge pins.
   - Two fixings each side securing the top rear edge to the body near the door latch pins.
   - Two fixings each side at the suspension turret.
   - Two fixings each side at the headlamp panel.
   - Two fixings each side, just inboard of the headlamp pivot.
   - Two fixings each side at the front of the wheelarch liners, and release the wiring harness by pulling the capshell to the radiator slightly.
   - Lift the nosepiece assembly from the capshell, and release the front indicator lamp wiring harness from the top of the radiator panel.
   - Remove the two screws securing the capshell to the radiator panel, and withdraw the capshell from the front of the car.



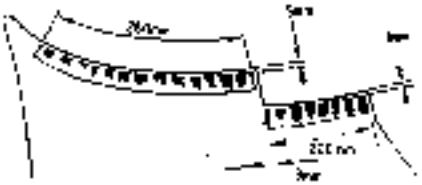
(i) ... Using a sharp blade, cut the sealing adhesive along the topshell inner edge of the front of the cab aperture. Take care not to damage the topshell or cab front bulkhead. Lift the topshell up and off the coach, taking care not to allow the panel to catch on the fixing points. Take care to note the position and number of spacer washers fitted under any of the fixing points.

Topshell Refit

Before the refit procedure, refer to the following points:

- Check that the cab/cab self adhesive foam strips are fitted to the underside of the topshell inner sides. If necessary fit new foam, part No.606679, as shown in the diagram.
- Ensure that the topshell harness is fitted correctly to the underside of the topshell.
- Check that the harness cable is fitted into position and connected to the front bulkhead.
- Adjust the rear edge of the topshell to align with the front edges of the roof.
- At each fixing point, position the gap between topshell and coachside, and fit spacer washers as necessary to avoid any stressing of the respective panels, which could result in the formation of gel coat cracks.
- Apply a thread retaining compound to the topshell fixing screws.

check that there is sufficient clearance between the cut out at the back of the 'A' post and the PU trim. Re-profile if necessary.

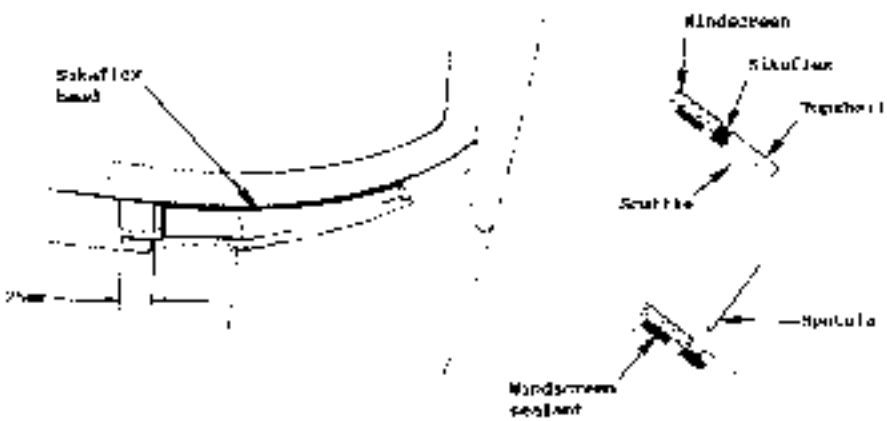


Fitment of foam strips to underside of topshell

The final operation is to seal each [illegible] side of the topshell to the windscreen.

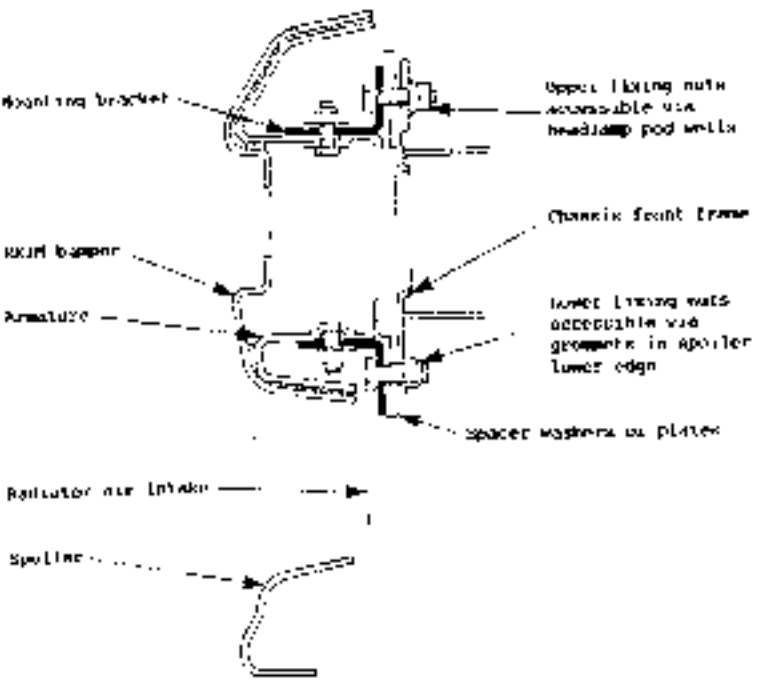
(i) Mask side of the rear pass off the inner edge of the windscreen and the outside face of the topshell adjacent to the windscreen seal.

(ii) Apply a bead of Sikaflex [illegible] between the screen and topshell as shown in the diagram, and run a spatula [illegible] the sealant from the gap. Remove all the masking tape. The only [illegible] sealant between topshell and the body should be made difficult.



10K.0 FRONT BUMPER/SPOILER

The front bumper/spoiler consists of a two piece thermoplastic injection moulding (RIM) which is backed by a stiffening and shock absorbing composite armature. The armature is fitted with mounting brackets which locate on the fixing holes on each front corner of the chassis front frame. On USA specification cars, to comply absorbing, an anti-shock strut is bolted to the front frame, one on the outer between the chassis and bumper armature. USA models also include energy absorbing foam pads on the armature (visible when the spoiler/bumper assembly is removed). The lower edge of the spoiler skirt is retained by rivnuts and countersunk bolts and a rubber sealing strip is fitted across the lower edge. The rear ends of the bumper are fitted to the side radiator ducts and provision is made for adjustable brackets, (not fitted on USA cars) between the bumper rear ends and the bodyshell. Both brackets are fitted to each of the three air intake apertures in the spoiler, and are secured using Allenset self-grip screws. The front registration lamps and side repeater lamps on USA cars are fitted into recesses in the bumper.



1. REMOVE

1. Release the fixings securing the lower edge of the spoiler to the front subframe and radiator ducts.

2. Release the front of the wheel arch liners to provide access to the bumper rear end fixings. On each side, remove the two M6 screws securing each bumper armature to the rear ends of the radiator

...(USA only) release the height adjustment bracket from the top edge of the bumper skin.

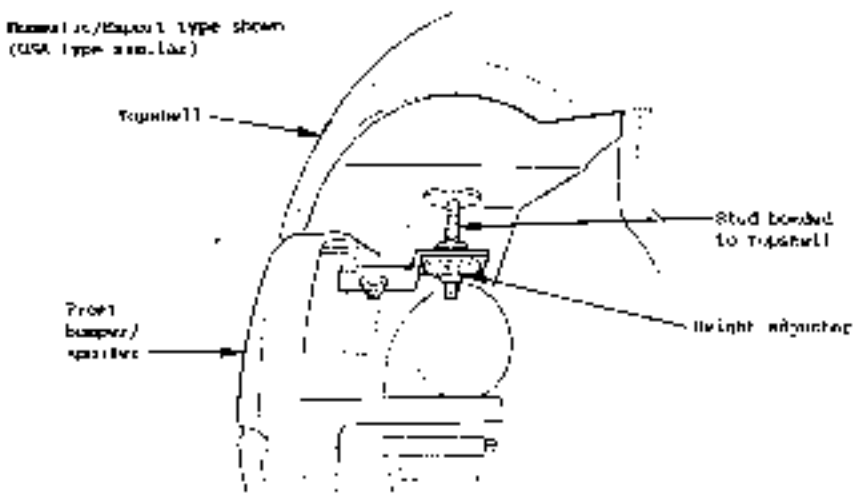
4. For access to the two lowermost bumper skin fixing nuts, pull out the access grommet from the underside of the spoiler at each side, and reach up to the RH fixing nut behind the flange on the exterior trim panel.

5. Undo the two bumper fixings and withdraw it from the front of the headlamp recesses, with the headlamps raised.

6. Withdraw the bumper assembly sufficiently to disconnect the side/turn lamp and side marker lamp harnesses.

To refit:

When refitting a bumper assembly, fit spacer plates or body washers onto the rear trim fixing studs as required in order to set the correct alignment (see text with the bodyshell trim edge). Develop the correct gaps between the bumper and bodyshell before tightening the bumper fixings. Use service...



Bumper/Spoiler Assembly (USA type similar)

To clean bumper or spoiler moulding (Reaction Injection Moulded (RIM)), wash with a mild detergent and water solution. Do not use petrol or abrasive cleaners.

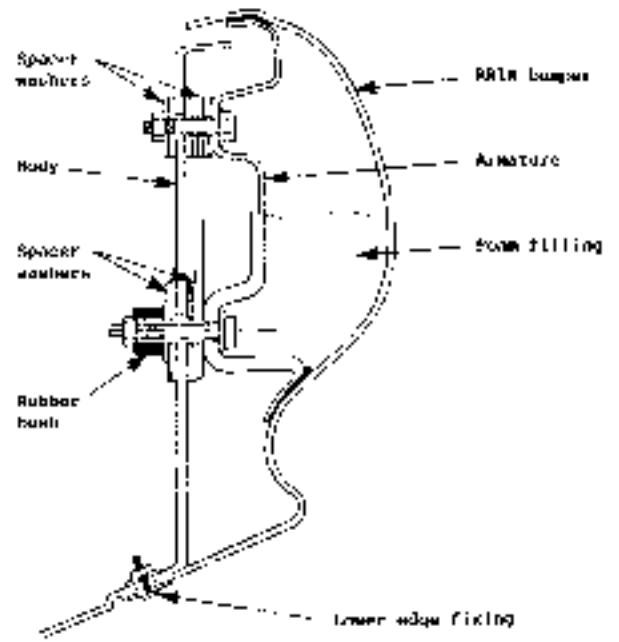
To repair bumper or spoiler moulding damaged by car park knocks, scrapes or minor impacts, the damaged area can be repaired using a two-part polyester filler. Before applying the filler, the damaged area must be prepared by cleaning with a suitable solvent and then abrading with fine abrasive paper. Mask off the surrounding area with masking tape and apply the filler in accordance with the manufacturer's instructions. Rub down the filler with fine abrasive paper and finish with a suitable paint.

[illegible]

1. [illegible]
2. On ESA cars, at each side, disconnect the side marker lamp harness and withdraw the grommet from the body aperture.

   Remove the five screws securing the lower edge of the bumper moulding to the body.

3. From inside the boot, remove the four fixing nuts with spacer washers and, on ESA cars, rubber bushes, and withdraw the bumper assembly.



4. [illegible]
   [illegible] the type which are securely fixed to the bumper armature.

5. Remove the spacer tubes from the rear mounting bolt and fit the bumper to the body. Fit a flat washer and a spacer washer to the inside of the body and tighten with a new nylon lock nut. Fit a flat washer, a rubber bush and a spacer washer on the inside of the body, followed by a new nylon lock nut and tighten. Repeat on the other side.

6. Check the alignment of the bumper with the rear body and wheelarches, and if necessary remove the bumper and fit the spacer washers from inside to outside, or vice versa, but retain a total of 3 washers on each bolt. On ESA cars the spacer washers are not used.

When alignment is satisfactory, torque tighten the four nuts to 14 - 20 Nm (10 - 15 lbf.ft).

Refit the 3 screws and washers securing the lower edge of the bumper to the body.

USA specification - Engage the side marker lamp elements in the body apertures, and connect the harnesses.

BK.[illegible] - BONNET PANEL

The bonnet panel consists of an inner and outer composite moulding, bonded together, with the assembly hinged at each rear corner to the front bulkhead. A spigot pin is bonded at the front of the bonnet, and may be inserted into a sprung bracket on the crossmember at the front of the engine bay. The latch pin is located centrally at the front edge, and is operated by cable from a release lever mounted on the driver's side door hinge pillar. Insulation is sandwiched between the underside of the bonnet panel and the inner panel foam, and is earthed at each side via the bonnet hinges and an earthing strap to the chassis.

Adjustment

The height of each rear corner may be adjusted by the insertion or removal of packing shims at the bonnet hinges.

The hinge to bonnet panel mounting holes are slotted to allow adjustment of position.

Rubber buffers are fitted in the ... behind each headlamp pod and at the front corners of the bonnet, and may be adjusted for height.

The bonnet latch striker pin may be screwed up or down to adjust the height of the bonnet front edge.

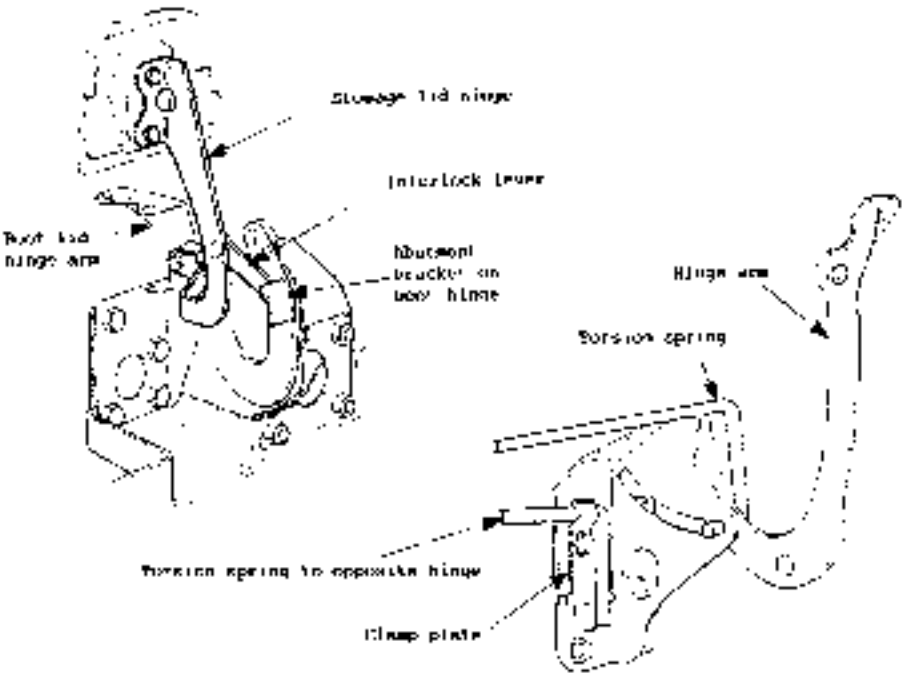
Release Cable

The bonnet release cable runs forwards from the release lever on the driver's door hinge pillar, through the bulkhead, along the underside of the ... and is secured to the bonnet latch, which is bolted to the crossmember. To release the cable from the latch plate, the plate should be released from the ... and the cable drawn through the access tunnel towards the engine.

BK.[illegible] - BOOT LID

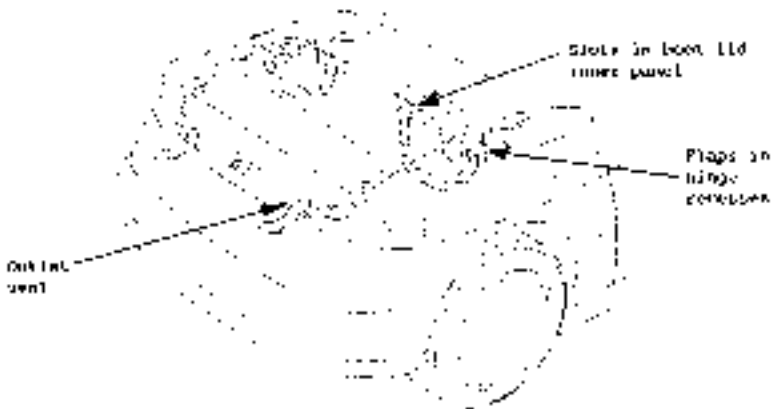
The boot lid consists of inner and outer composite mouldings which are bonded together, and a separate, bolted on spoiler of similar construction. The ... is secured to the boot lid via a pair of hinges at each side. The boot lid is hinged at its forward edge, and uses two similar, torsion spring assisted hinges bolted via hinge brackets to the rear bulkhead. A torsion spring is clamped to each of the hinge brackets, and engages into the opposite hinge arm to provide opening assistance and support the lid in the fully open position. Four bolts secure each hinge bracket to the bulkhead via a loose tapping plate in the rear stowage compartment.

The pivot bolt of each rear boot lid hinge passes through the rear bulkhead, and an interlock lever mounted onto this pin abuts against the rear lid hinge when either the stowage lid or boot lid is open. This feature prevents the possibility of lid to lid clash, by ensuring that only one of the lids may be fully opened at any one time.



A flexible sealing weatherstrip is attached onto the body flange also with a joint at the centre zone.

When the boot lid is closed, pull up door to visit from the cabin interior via the key lock cylinder in the rear bulkhead hinge recesses. With the boot, ventilation of the boot is achieved by ducting air through the rear lid reinforcement channels to outlets over the rear number plate. Care should be taken not to obstruct the ventilation holes with luggage or clothes.



Adjustments

The height of the front edge, and the lateral position of the boot lid, is adjusted by moving the hinge brackets up or down, or side to side on the bulkhead.

The 'squareness' and the fore/aft position of the lid is adjustable by slackening the bolts securing the slotted hinge arms to the lid. The tapping plates are pop - riveted inside the boot lid double skin. If the lid is too far forward, pushing in the operating lever may result.

Rubber bolsters are also fitted in the rear tapered at each side. Above the rear light, and may be adjusted for height to control the rear edge resilience.

Boot lid lock

A single, centrally located lock is fitted to the boot lid, and is operated using the door key. Insert the key into the lock (smooth side to the right), and turn clockwise to lock, counterclockwise to unlock.

The lock barrel is fixed to the lid inner panel with two screws and a loose tapping plate. The lock barrel is retained to the inner panel with a spring clip fitted via a slot in the inner panel rear edge. The striker plate is fixed to the body by a single screw which permits adjustment side to side and up/down. Adjust to achieve secure closing after the adjustments detailed above have been completed.

DR 3/ - BOOT STORAGE LID

The roof storage lid consists of an inner and outer composite panel bonded together and hinged at the rear edge via the simple, unassisted hinges to the rear screen. Four of the screws each hinge bracket to the bulkhead also secure tapping plates on the boot. Each hinge arm is fixed to the lid by two M5 screws and tapping plates pop riveted inside the inner skin.

Two pivot pin 'U' bolt roof storage lid hinge pegs pass through the rear pivot arm, and on interior trim mounted nuts that pull the pivot against the face of the hinge arm when either the storage lid or boot lid is open. This feature prevents the possibility of lid to lid clash, by ensuring that only one of the lids may be fully opened at any one time (see Opening in section DR 11).

To remove a storage lid hinge bracket, release the hinge arm from the lid, and from inside the boot, release the spring clip securing the interior cover to the front shaft extension. Pull the interior lever out through the hinge arm, and unbolt the hinge bracket from the bulkhead.

Adjustments

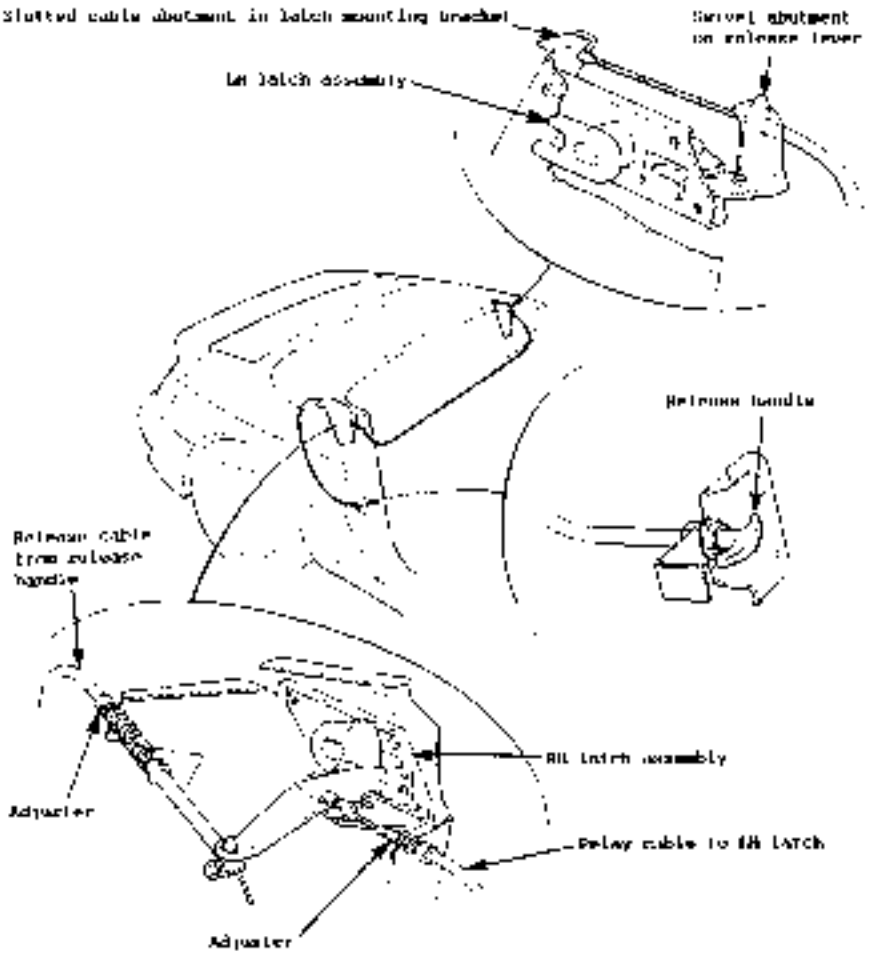
The height of the rear edge of the lid, and the lateral position, is adjustable via the hinge brackets to bulkhead fixings. 'Squareness' and fore/aft position is adjusted at the lid to hinge arm fixings.

Catches

Two types of latch are fitted

Boot Lock:

A cable operated latch is fitted to each side of the lid aperture, with the release handle mounted on the right hand rear body. The cable runs from the handle on the right hand latch release lever, to which is fixed a second cable which runs to the left hand latch, crossing behind the release lever, retained to the latch bracket. Pulling the release handle releases both latches, and allows the lid to be opened by hand. When closing the lid, press firmly over each side to fully engage both latches.

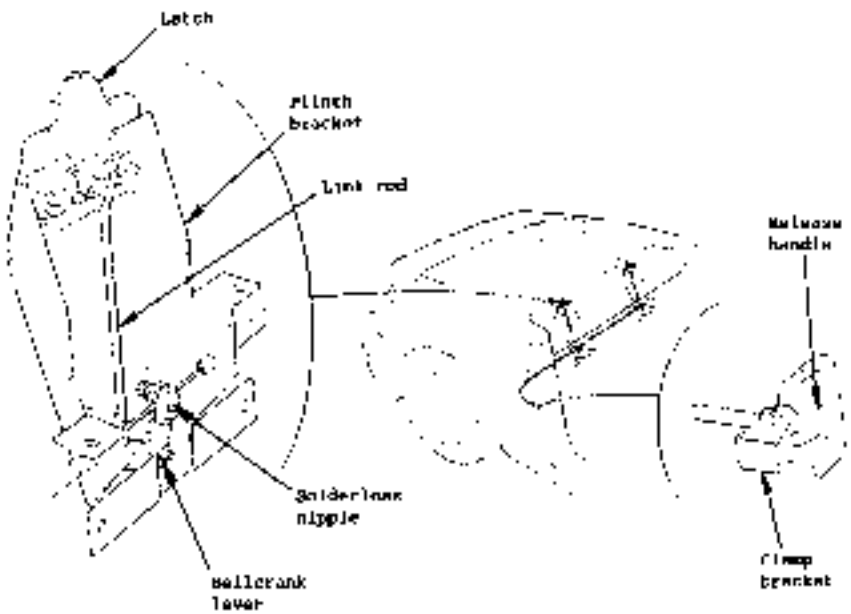


Each latch is mounted on a bracket fixed to the seat unit rear bracing strut and to the edge of the body aperture. The striker pegs are fixed to the rear edge of the door panels and captive nylon plates. The striker plates may be adjusted forwards via slotted fixing holes, and the panel must be set adjusting spacers or double washers between the strikers and body. Each may be removed from body cables via adjusters provided at their outboard ends on the front body brace.

The handle assembly may be removed by releasing the nut and clamp plate securing the handle post.

DOOR PANEL

Later cars use two latches mounted on plinth brackets bolted to the top of the roof drainage compartment front wall. The two latches are operated by a single cable with a handle provided at the right hand door pane. The cable connects with a bellcrank lever at the base of the right hand plinth, before continuing across to the left hand plinth. At each plinth a bellcrank lever transfers the motion of the cable up to the latch via a short link rod. To adjust the cables, remove the trim panels from the door pillars, and adjust at the cable bellcrank lever soldertless nipples.

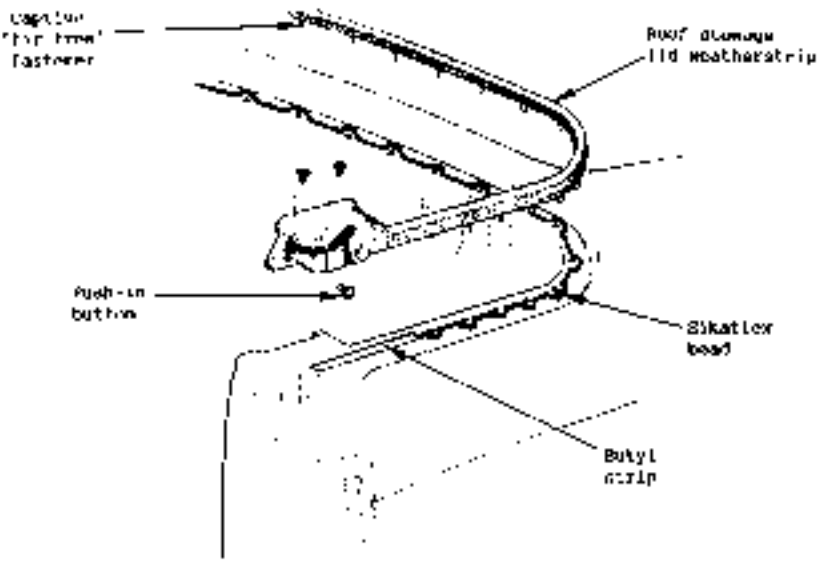


At the handle end of the release cable, early cars used a separate plastic recess moulding clamped into the 'B' post as shown in the illustration, but later cars have the recess moulded as part of the body panel.

Weatherstrip

A closed cell moulded form weatherstrip seal is fitted around the body aperture. To remove the seal, prise out the buttons securing each end of the seal, and carefully peel back each end from the butyl strip securing the seal to the body. Use a scalpel to cut the 'Bostik' adhesive used along the remainder of the seal, and withdraw each of the seal fixing 'pin type' fasteners, noting either the seal.

To fit a new seal, clean the flange on the body before applying a bead of 'Bostik' all purpose 4AB sealer by the bright trim path, over the butyl



...with the head of the screw to the front side of the other side. The head should not prevent the outside of each of the pushpin holes. Fit a length of butyl strip 4"(100mm) from the end of the seal mounting path to the first pushpin hole. Fit the weatherstrip seal into position, pushing the retaining pins fully into the holes, and fit the bolt to secure each end of the seal.

There will be a 100mm length of butyl strip remaining to be fitted to the seal path at the junction of the front and rear roof panels.

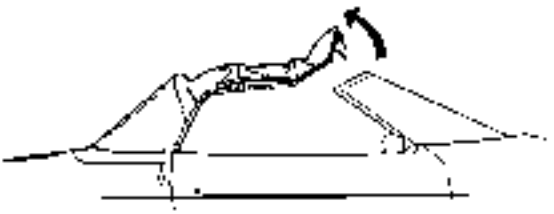
BK.13 - ROOF DRAIN HOSE

To remove:

1) Disconnect any battery leads from the main switch to the body, and close the door with the door window open.

2) Release the two rear centre fasteners at the windscreen header rail by pulling down the latch handles, and release the hooks from the header rail.

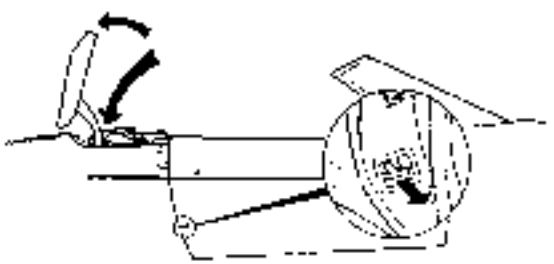
(i) Pull back the front of the soft top to release the fastening mechanism



(ii) Lift up the rear edge of the soft top whilst assisting the rear window to fold inwards in one smooth fold.

iv. Release the roof storage lid by pulling the release handle in the right hand door jamb and raise the lid fully

v.) Fold the soft top down into the stowage compartment by pulling back on the front edge. Secure the roof by buckling the retaining strap (if fitted).



vi) Close the stowage lid, pressing firmly over each catch to ensure their full engagement.

To Raise:

i) Close the boot lid and lower the door windows

ii) Release the roof storage lid by pulling the release handle in the right hand door jamb.

iii) Raise the lid fully, unbuckle the retaining strap (if fitted), and pull out the soft top in its folded state, from the stowage compartment

iv) Raise the rear edge of the soft top and close the stowage lid, pressing firmly over each catch to ensure their full engagement.

v) Push down the back edge of the soft top, and pull the front edge to the windscreen header rail.

7. At both of the header rail brackets, engage the ends of the roller arms in the slots in the header rail brackets, and push the latch handle fully upwards and back.

It is not recommended that the side panels be stowed for long periods when wet, as deterioration of the fabric will be accelerated. Unless stowing a wet soft top, wipe down with a soft cloth or sponge to remove most of the water, and raise the roof after the panels to allow the water to dry off.

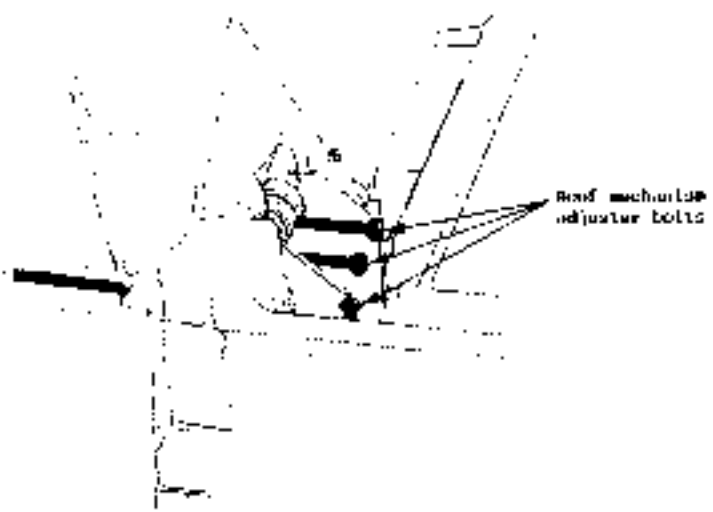
CAUTION: Before each attempt that the hood is subjected to a mechanical retraction or erection, the hood fabric behind the rear window must be checked for the presence of any hard objects. Loose coins, keys and wipe with a soft cloth to remove the surface water. Allow to dry out before closing.

Fitting & Adjustment of Roof Assembly

The only adjustment that may be made to the soft top roof assembly are the tightness of the roof mechanism in the 'A' posts, and the position of the latch plates on the windscreen header rail. The roof mechanism should be set at the manufacturers settings and no attempt should be made to alter the setting of any part of the mechanism.

The roof assembly is clamped into the 'A' post by two through bolts. Before fitting or adjusting the position of the roof mechanism, first check that the door is fully unscrewed and correctly adjusted, and that the windscreen header rail and rain channel (see

1. Fit the roof assembly between the two 'A' posts, and fit the two retaining thread bolts and nuts/spring washers at each side. Do not tighten the bolts horizontally into the weld nuts at the front of each roof post channel, until the roof mechanism is centrally into the slots for at the base of each roof bracket.



1. Select the 'N', and using the long skills, position the mechanism in the 'N' position as follows.
   (a) Open the first front door along the header rail, the door must be satisfactorily with the seal sitting squarely into the angle of the bracket pad.
   - Diff'ence in gap at the 'B' post between the top rear corner of the door and the roof panel.
   - Gap between the roof rear edge and the drainage lip from the 'B' post to the post.

2. Tighten the door post retention mounting screw and remove the long adjuster bolts. Recheck for 'N' post

3. Adjust the position of the striker plates on the header rail for optimum alignment with the seal in the 'N' post, and tighten the fixing bolts.

Door Weatherstrip Replacement

Door weatherstrip seal with rear the door are not sh - see Service Parts for the details.

8K.14 HEADLAMP MECHANISM

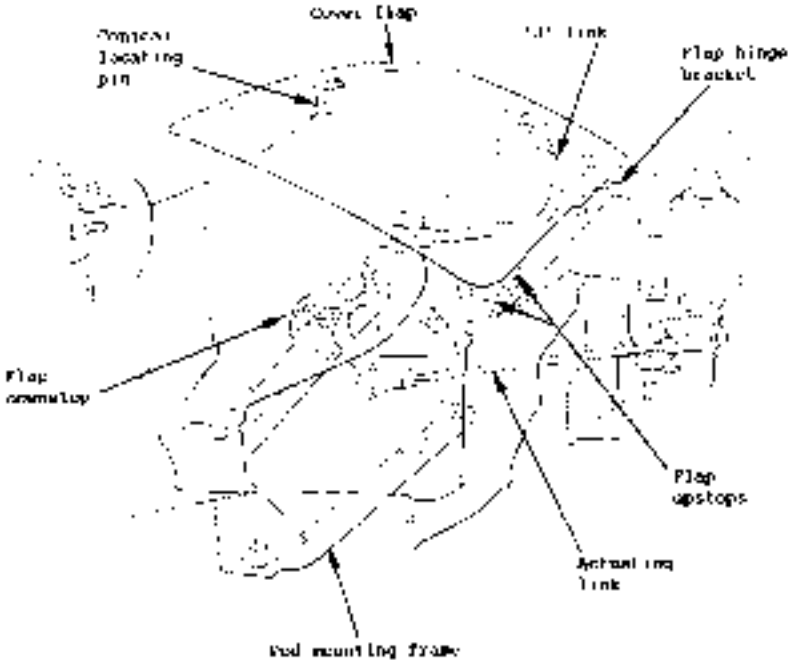
Two types of headlamp retraction mechanism have been used. Some prior to VIN 10101 were fitted with 'fold back' (or 'sports glass') headlamps, where the headlamp pod was pivoted at its front lower edge and used a separate cover flap to conceal the retracted headlamps. Later cars use a 'single pivot' mechanism with a top rear edge pivot for the headlamp pod, which tip outside faces the body profile when the headlamps are retracted.

Fold Back Type Headlamp Mechanism

The retractive headlamp mechanism consists of a pair of headlamps at each side of the car mounted on a pivoting frame which, when the headlamps are 'up' or 'down' swings the lamps to face away backwards, under the control of an electric motor, and be concealed by cover flaps.

The system comprises the following principal components at each side of the

- Headlamp Pivot Assembly. Long casting carrying a pair of headlamps and pivoted to the pod mounting frame. Operated by the headlamp motor actuating rods, and raised the cover flaps at the same time. In very early cars, the headlamp pod was a composite casting bolted to an aluminium alloy frame and by these cars.
  The Mounting Frame. A aluminium alloy casting, bolted to the base of the inner wing panel, and three bolt studs. Carries the pivot bushes for the headlamp pod.
- Headlamp Cover Flaps. Cast aluminium alloy, and composite outer skin panel painted body colour. Pivoted via two ball joints to the headlamp pod. Operated by an adjustable link from the outboard side of the headlamp pod to arm in conjunction with the pod. Incorporates a conical location pin at the centre of the front edge, to engage with a hole in the top front of the headlamp pod when raised. This feature aids rigidity to the assembly when in the raised position, and reduces flutter.
- Flap Hinge Brackets. Steel bracket bolted to headlamp. A hole for cover flap hinges. Incorporates cover flap upstops.
  Link. Steel link rod with ball joint at each end. Connects the cover flap to outboard side of the headlamp pod.



deathay hinge and actuating link). The pod is then electrically mated at lower aft to the LCF's junction breaker, itself located by three bolts through the underside of the chassis longeron. The outer outward link is identified by an inlet stops in the mounting bracket, and is connected by an adjustable length actuation link, fitted with a ball joint at each of its ends, to the bearing pin. The pod's hinging bracket also carries a mechanism which is closed by the 'U' duty link only in the pod fully raised position. This permits the headlamps to operate only in that position, and prevents damage to the lens and mirror.

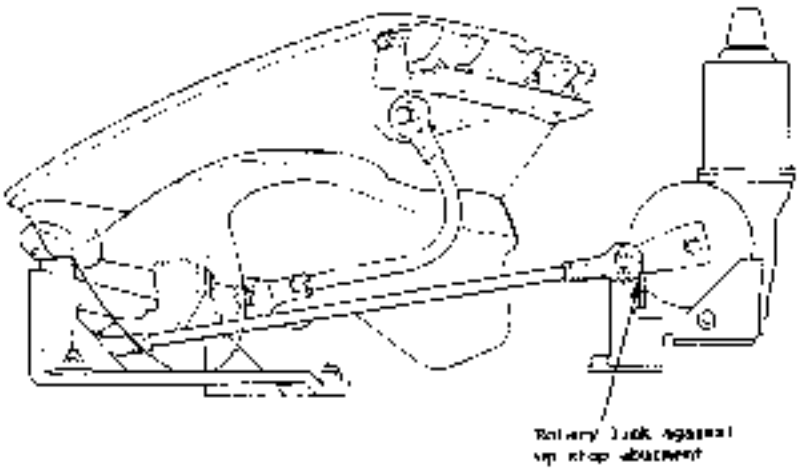
Various adjustments to the headlamp mechanism are required to ensure:

a) consistent door gaps;
b) satisfactory mechanical operation under all driving conditions.

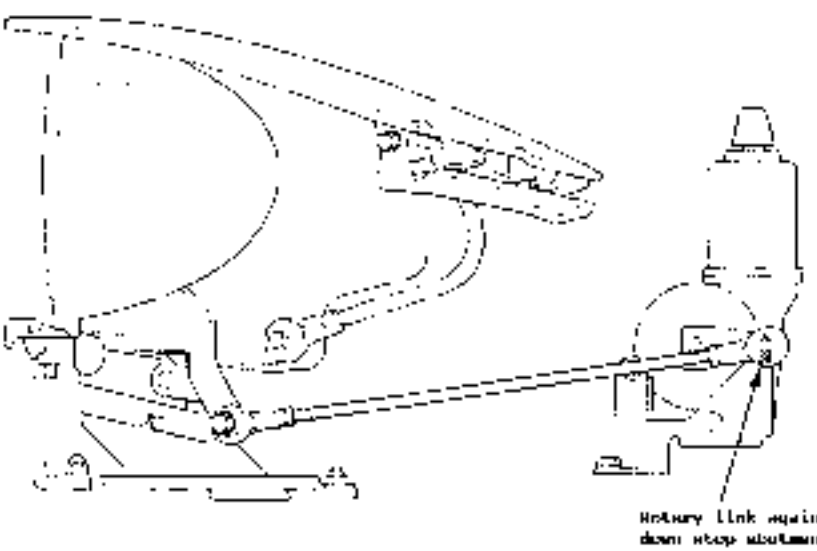
Adjustment Procedure

1. Before adjusting the headlamp mechanism, disconnect or remove the following:
   - pod actuating link;
   - lower flap outer panel;
   - cover flap operating 'U' link;
   - hinged lowering arm at rear edge of flap inner;
   - fully screw down the pod upstops in the flap hinge brackets.

Headlamp Mechanism in Lowered Position



Headlamp Mechanism in Raised Position



...ck Pivot screws. The pod pivot brackets should be fitted to the boom so that the pod pivots will be ... with the pod in its ... position with the headlamp ... away from ... Alternatively, ... the pod three flatnuts and ... position the ... to align ... pivot holes in the pod with ... tapers.

The rear edge of the pod ... flushed with the rear ... Slotted pivot screws may be ... to ... pod ... Apply grease to each frame ... pivot point, ... the ... of the pivot ... to the pod ... which should be level with the ... of the topshell.

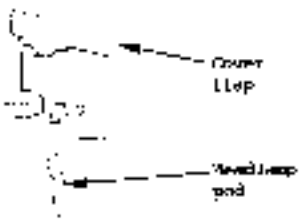
- ... Actuating Links. Wind the headlamp motor to the fully up position with ... fully ... engaged ... flap brackets. Adjust ... position of the pod links forward ... so ...

- Flap Hinge Brackets. Wind down the pod, and shut the bonnet. Place the cover flap in its ... position and examine the ... ... at the ... flap ... in the topshell and bonnet panel. If necessary, ... the ... hinge brackets, fixings, and ... ... bracket as ... ... Refit the cover flap. The flap coverings is adjusted later.

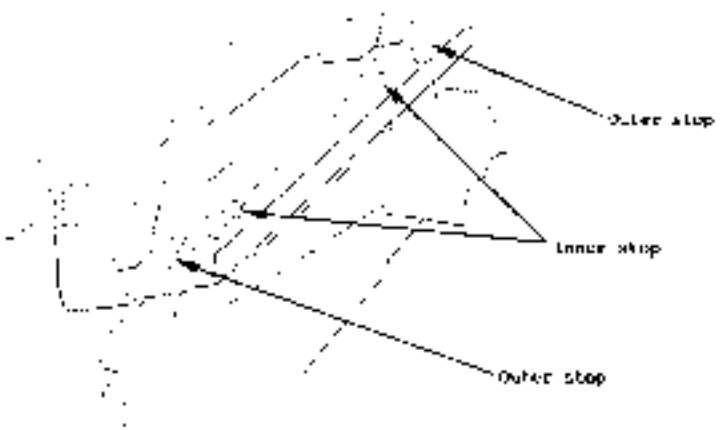
  Pivot Lever Fixing ... Wind the pod fully up. Fit the ... to the flap ... ... Set ... per hole. If necessary, move the flap ... bracket ... to achieve. Re-check cover flap ... Nip ... the ... fixings with the pod fully engaged ... Repeat ... of the pin bracket ... and the pod.

- ... to ... the pod against the flap, lower the pod partially and ... the pod ... by ... ...

1. [illegible] Check that the correctly handed link is fitted as noted prior to the diagram. The flap end of the link must be set to 90mm to [illegible]. Unscrew the pod end of the link, and up the pod until pod chart at the locating pin and adjust the length of the link at the pod end, so that when the link is connected, the centreline of the locating pin is level with the top of the pod. Thread the link, then press the front of the cover flap hard down on the top of the pod and screw in all four upstops (in flap hard) [illegible] against the cover flap.

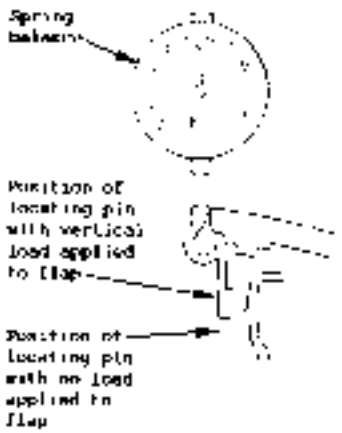


2. Adjust the pods. Apply the full load downwards to the flap [illegible] position, and a full load upwards to the [illegible] position. Tighten locknuts.



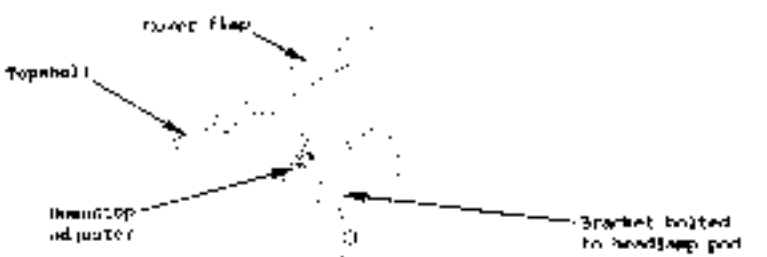
3. Wind up the pod until it just touches the cover flap. Check that the locating pin enters the hole in the web of the flap correctly. The pin should enter the hole below its centreline, and engage fully when the pod is fully wound in. If the pin is not in the correct position, then adjust upstops a turn. Re-check and re-adjust if necessary. Lock locknuts to 6Nm(4lbf).

1. In order to ensure correct operation of the locating pin switch, it is necessary to set the locating pin adjustment screw so that when pressure is applied to the power flap (when the car is jacked up) the pin will move sufficiently for the circuit to be broken and allow a small amount of movement of the flap between the locating pin. Apply a vertical upward load of 4 to 5 kgf on the flap and note the following:
   a. The pin must enter the slot in the switch body and engage fully when the gap in the body is not visible.
   b. The pin must not enter the slot to the point where the flap is lifted by the pin to create a light pressure between the switch body and the flap underside.



2. Fit the power flap with the spoiler, and secure with the four fixings. Refit the position lights and the rear view mirrors. Refit the wheels and lower the car to the ground.

3. Check that the flap front edge clearance is satisfactory. If adjustment is necessary, slacken the bolts and move the flap as required. Check that the left hand and right hand clearances are equal. Tighten the bolts.



4. Check headlamp alignment (see Section 12).

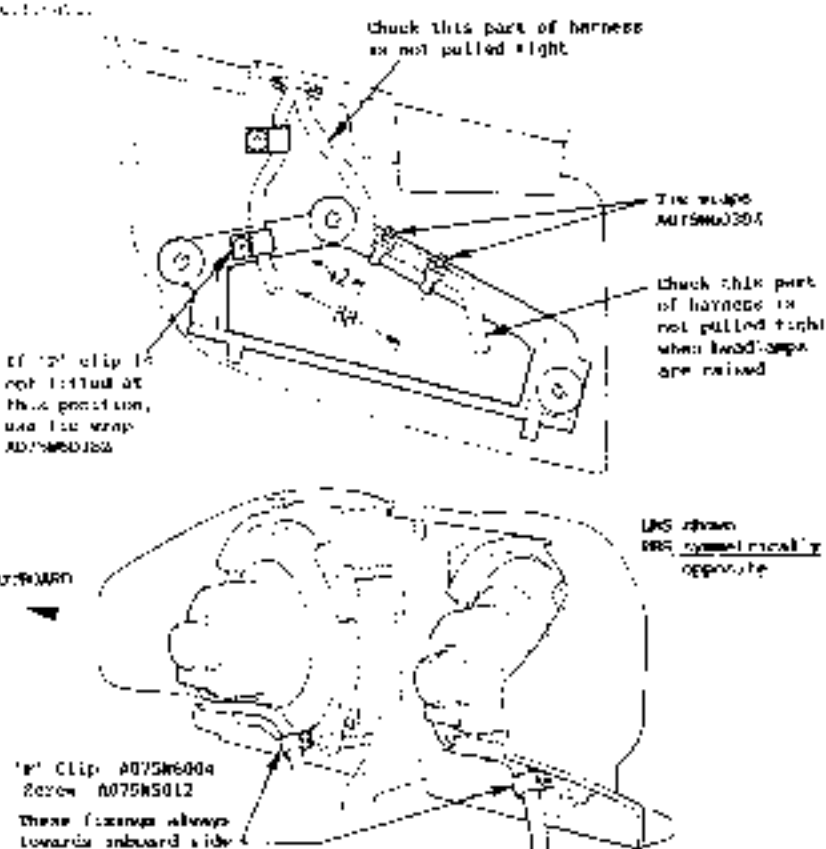
Servicing the pods

Each headlamp pod runs two axial location holes that pivot freely, pressed into the rotating mounting brackets and pivot bolts passing through the holes into tapped holes in pod. The pivot bolts have a spigot on one threaded end which locates in a countersink in the pod mounting, to provide a means of adjustment for bolts in position. The mounting frame straddles the headlamp pod

to provide lateral location and no assembly adjustment or fabrication of the pivot mechanism is required.

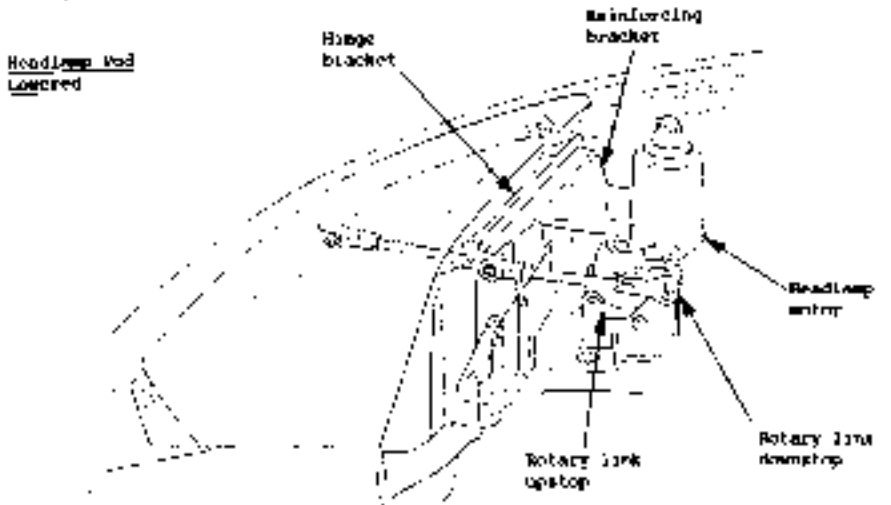
Headlamp harness fitting

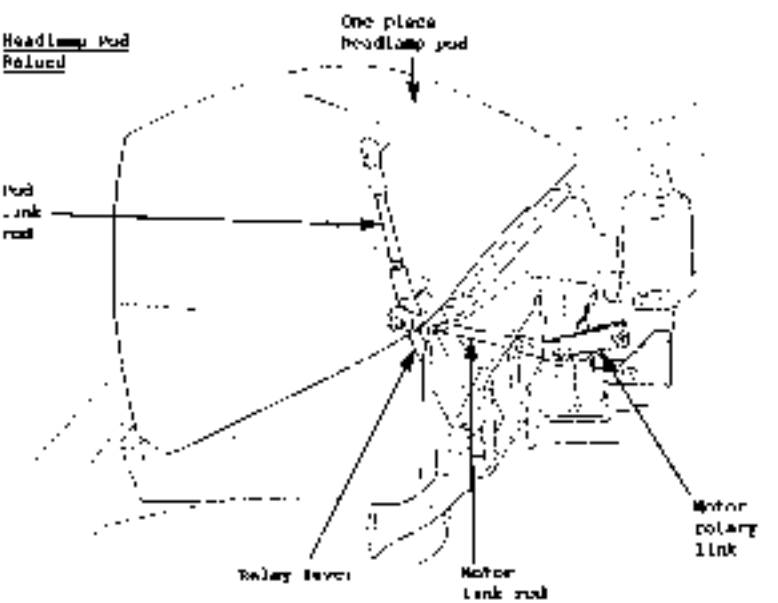
The wiring harness is fed into the headlamp body at right angles to the mounting plane. It is important that the harness is not distorted by any kind of bending operation. Secure the harness with the support clip provided.



Single Pivot Headlamp Mechanism

The 'single pivot' headlamp mechanism was introduced at VIN K*0[illegible] and was used, together with pop-up headlamp pods similar in concept to those used on Esprit and Excel models.





The system comprises the following principal components at each side of the car:

- Headlamp Pod: Carries one main beam headlamp (inboard) and one dip beam headlamp (outboard). An aluminium plate bonded to pod underside carries the pivot ball joints.
  Hinge Bracket: Bolted to tippanel, [illegible] the pod pivots.
  Headlamp Motor: Mounted via a bracket to the chassis longeron. Bracket incorporates two travel limiting stops for the motor rotary link. A reinforcing bracket [illegible] braces the pod mounting [illegible] to the body.
- Operating Linkage: Comprises two link rods and a relay lever. The two link rods are identical and have adjustable ball joints at each end. The relay lever pivots on two ball joints at its base. The ball joints are picked up by an angle bracket bolted to the inner wall of the pod well in the tippanel.

Operation

When the headlamps are switched on, the headlamp motor operates until the rotary link moves forwards until it contacts the stop, when the motor stalls and switches off. In the up position, the pod link and the relay lever link are almost [illegible] to hold the pod firmly.

The electrical control is similar to the previous [illegible] headlamp system except that:

1. The motor connections are reversed;
2. The rotary link actuates limit switches with no contact stops.
3. The headlights operate as soon as they are switched on, rather than only when the pods are fully raised. There is no danger of [illegible] with the single pivot system.

Adjustment

Three basic adjustments of the pod mechanism are required.

1. Pod Shut Height: To adjust the pod shut height and [illegible], slacken the bolts securing the hinge bracket to the tippanel, and add/delete shims [illegible] as necessary to achieve correct pod height and alignment. Position the pod to achieve a [illegible] shut gap between the pod and [illegible] bonnet.

2. Relay Link: Adjust the length of the link between motor and relay lever to [illegible] mm between ball joint centres, with an equal amount of thread showing at each end of the link. Tighten the locknuts, ensuring that the two ball joints are parallel to each other. This dimension will ensure that the [illegible] goes over centre with the pod raised, to provide a rigid stop.

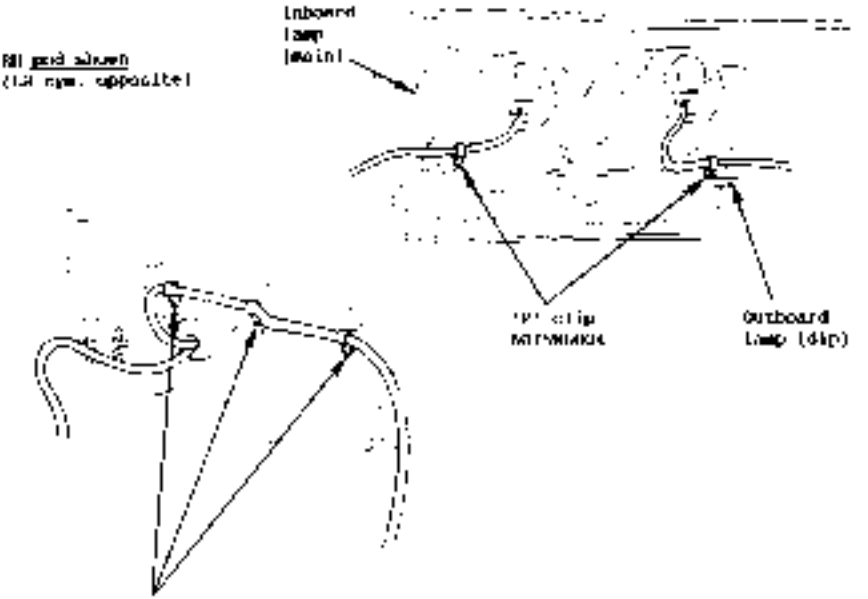
3. With the operating linkage assembled, and the headlamp motor rotary link contacting the down stop, check the height of the pod front edge. If necessary, adjust the length of the link between relay lever and pod to [illegible]. Tighten the locknuts ensuring that the two ball joints are parallel to each other.

4. With the pod raised, ensure that there is adequate clearance between the front hand pod lower edge and the [illegible] steering pipe [illegible] at the [illegible] of the pod [illegible]. If necessary, trim the edge of the pod to achieve clearance. Also check that the left hand motor rotary link does not foul the [illegible] steering [illegible] (if fitted).

5. Check headlamp alignment using a beam setter.

Headlamp Harness Routing

It is most important that the headlamp harness is routed and secured correctly to ensure that it is neither strained nor chafed/trapped at any stage of headlamp operation. Refer to the following diagrams for the correct specification.

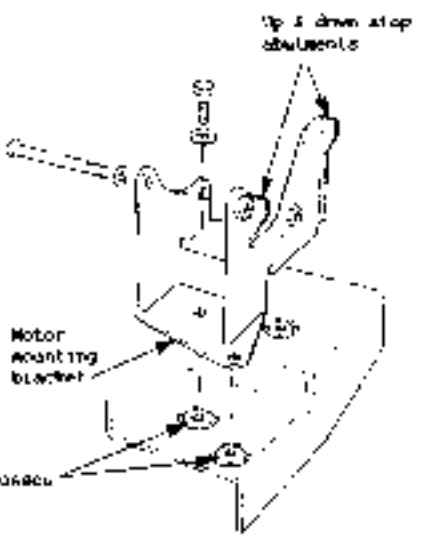


Headlamp Motors

Each headlamp motor (for either headlamp system) is mounted on its own bracket, which is in turn bolted to the front panel. Access to the motor is from within the engine compartment. The top of the mounting bracket is slotted to allow adjustment of the motor body.

The motor is braked to prevent the light beam from drooping on the original equipment.

For the electrical function of the motor, see page 40.



[illegible] - WINDSCREEN & RUBBER SEALS

The windscreen is retained in the rear straight aluminium alloy windscreen frame and rear quarter body finish fillet by a polyurethane adhesive/sealant. The windscreen is the primary structural member of the body structure. It is therefore very important that the correct procedure is followed when removing and refitting the windscreen and precautions taken to prevent damage to the glass and paintwork during operations using tools and sharp edged components.

If the windscreen is to be removed/replaced, it will also be necessary to replace the following parts:

- Windscreen side finishers (top and sides), rear corner caps.
  Screw, drilled countersunk type.
  Interior trim mounting plate.

Precautions

Use a knife with a new blade when removing and refitting of the rubber seal. Use plastic or protective tape to cover the paintwork of the body where the knife may damage the paint. Wear protective gloves.

Windscreen Replacement

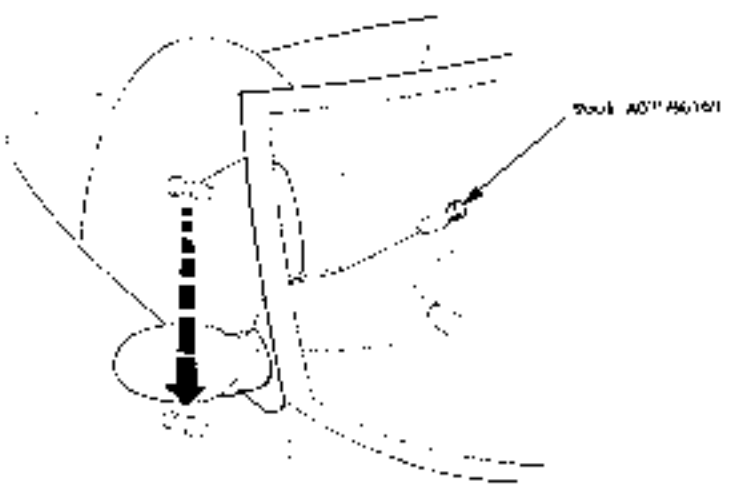
1. Remove the windscreen wiper arms.

   Remove the screws securing the windscreen side finishers and remove the finishers.

2. Remove the screws securing the rear quarter trim panels and remove the panels.

3. Remove the screws securing the windscreen top finisher and remove the finisher.

4. Remove the windscreen rubber seal by pulling out the retaining bulb at the top and bottom of the seal and pulling the seal from the frame. Clean the windscreen aperture and body flange. If the windscreen is to be reused and the rubber seal is undamaged, the seal may be replaced. Replace the seal retaining channel if damaged.



1. Bore a small hole through the windscreen edge finisher and Retaining bead, and insert a length of piano wire or similar (supplied in Retainer Kit) approx. 1 metre long, through the hole. With the aid of an assistant inside the car, use a sawing action to cut through the Retainer and free the screen from the car. Alternatively, use wire cutting tool A05U0169 or a proprietary hot knife cutting tool. Take great care not to damage the interior trim or paintwork during this operation. If using a cutting wire, beware of snagging the wire in the joints between bonded roof and carbon pillars.

2. Remove excess Retainer from the screen aperture with a sharp blade. Note that it is not necessary to remove all traces of the retainer, but a uniform surface must be available for bonding the new screen. Do not abrade the bonding surface of the alloy windscreen frame or body.

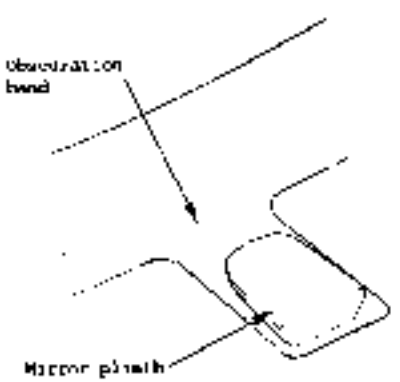
3. Mirror Mounting Plinth:
The interior rear view mirror is retained by a moulded plinth, which is itself bonded to the windscreen glass. The plinth is not removable from the glass and must be renewed if the windscreen is replaced. The plinth, which is most easily fitted before the screen is fitted, is supplied as part of a kit (A109D023001 which includes adhesive 'Prebond 60+', and is applied as follows.

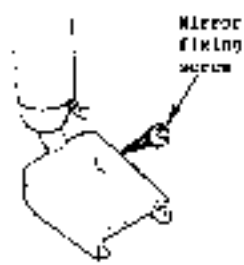
WARNING: Contains trichloroethylene and acrylic monomer derivatives. Refer to precautions on product packaging.

(i) Thoroughly clean bonding face of mirror plinth and corresponding area on inside surface of windscreen using a sharp razor or steel wool.

(ii) Scrub the BONDER primer in order to crack the internal glass container. This will allow the primer material to saturate the felt tip. Remove the cardboard cylinder protecting the felt tip and apply primer as thinly as possible to the bonding surface of both plinth and windscreen. Allow five minutes for the primer to dry.

(iii) Apply a thin coat of adhesive to the bonding surface of the mirror plinth. Position the plinth on the windscreen with the rounded end towards the top and hold in place for 2 to 3 minutes. Allow at least 15 minutes curing time before fitting the mirror to the plinth.

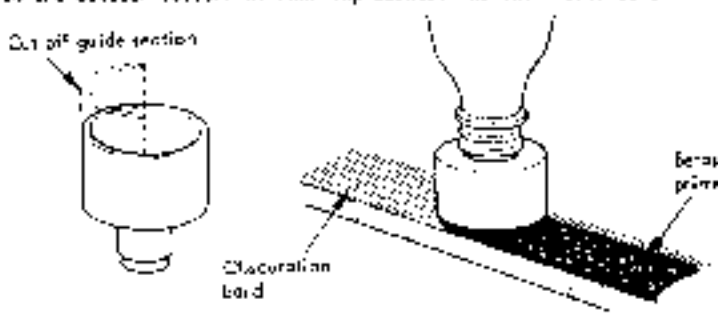




7. If a windscreen pillar or header rail has been replaced or refitted, check that the joint gaps between pillar and header rail, or pillar and body have been sealed with Sikaflex adhesive/sealant, and the screen bonding joints are filled.

8. Cut the special paper provided in the Betaseal kit into two. With one half, use the wipe cleaner cloth to clean the peripheral edge of the glass, and the whole of the obscuration band on the inside surface of the screen.
Also clean the whole of the bonding area on the body flange, screen pillars and header rail. Clean the underside of the two screen top corner finishers, and the lower half of the outside surface of the screen pillars. With the other half of the paper, wipe dry the areas cleaned.

9. Shake the Betaseal primer container for at least 30 seconds before opening and pouring into the plastic bottle. Cut off the guide portion of the applicator head and fit to the bottle with the sponge pad uppermost. Apply a band of primer around the outside edge of the inside surface of the glass, on top of the pre applied obscuration band, 25mm width (one applicator head) along the base and sides, and 5mm width across the top edge. If the obscuration band has a gap to display a vehicle identification plate which is not glued, use masking tape to produce a straight edge, and block out the gap with primer.
Also apply primer:
- around the peripheral edge of the glass to help prevent moisture ingress
- to the underside of the screen top corner finishers
- to the lower half of the outside edge of the screen pillars (where visible)
- to the outside surface at each top corner, for the finish fitment.

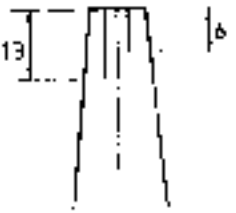


10. When the primer has fully dried (min. 5 minutes, max. 48 hr), fit the finishers to the top edge of the screen. Aim the tip towards the inside the finisher channel has pre applied adhesive, and press firmly into position. Offer up the two side finishers, and trim the bottom ends to the shape of the screen lower edge, but do not fit at this stage.

11. Cut the Betaseal application nozzle to produce the correct bead shape:

    i) Cut off the end of the nozzle to achieve an inside diameter of 5mm.

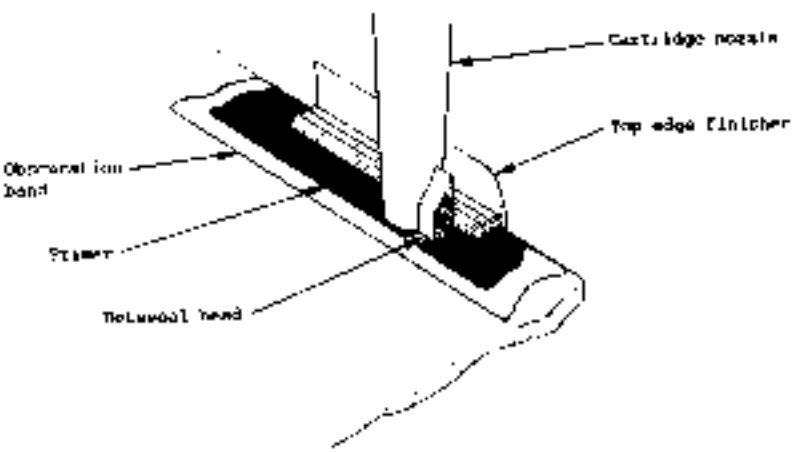
1.) Make two parallel cuts, 13 mm apart to depth of 6 mm (2 mm in plate)



Finished nozzle shape

2.) Using the two cuts as a guide, cut and remove the plastic at nozzle to form the bead guide.

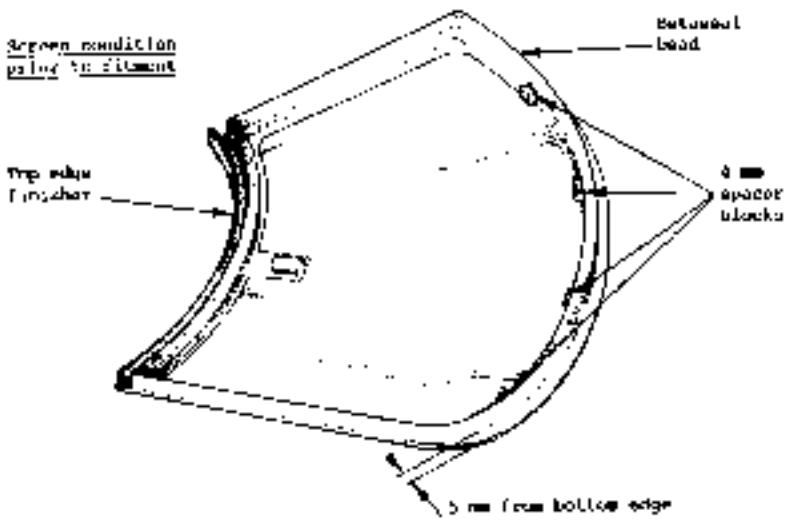
3.) Fit on the nozzle of the Betawool cartridge and remove the plastic protective membrane on the cartridge thread, nozzle and groove in the cartridge gun. Holding the gun vertically, put about 1 inch of Betawool in a circle, using the cut guide, to make a continuous bead of Betawool right around the perimeter of the glass.



The bead should be positioned:
- adjacent to each side edge;
- 5mm up from the bottom edge of the screen;
- adjacent to the edge of the top finisher.

Note that the correct orientation of the bead is established during the operation. Manipulate the two ends of the bead to ensure they are correctly located.

11. Fit the pre-cut spacer blocks supplied in the Datasheet kit to take care of any spacing inaccuracy between moulded, wide the inside edge of the Datasheet bead and the inner edge of the glass.



12. Fit the screen into the body and position so that the screen is centralised within the edges of the glass aligning as far as possible with the top and sides of the middle-box glass. Fit plastic or wooden packers at the base of the screen to support the glass in this position. Fit the two side finishers, pushing them into the glass edge and into the Datasheet bead. Ensure that the top of the glass to one an adequate seal between the glass and correct positions. Ensure the whole length of the finish is at uniformity. Use a suitable to peddle extra sealant into any localised areas.

13. Wipe off any Datasheet extruded from the joint or from the side finishers, and apply a small bead to each top corner of the screen, pushing it into between the ends of the edge finishers. Fit the corner finishers, wipe off any extruded Datasheet and tape to position.

14. Extrude a narrow bead of Datasheet along the base of the screen to fill the gap between screen and topshell moulding, from the outboard wiper blade to the centre line of the screen on each side. No only the minimum amount of sealant necessary, as unnecessary removal of the topshell will be needed.

j) Do not disturb the screen until the Betaseal has fully cured, which will take approximately 4 hours dependent on atmospheric conditions, taking longer in a dry atmosphere.

k) Refit the screen pillar dual cartridge and weatherstrips (see below), and water test temporarily before fitting interior trim.

l) Refit interior trim panels and wiper arms.

Spillage of material

a) Any spillage of Betaseal onto unprepared paint can be readily peeled off after it has cured.

b) Any spillage onto the body can be removed with either Wipe Cleaner No. 6, or white spirit.

Shelf life

a) Betaseal has a shelf life of over 6 months if unused cartridges are stored at the original unopened packing.

b) Betaseal primer has a shelf life of only about 21 hrs after it has been exposed to the air, after which it starts to become sticky. If the material is sticky DO NOT USE. Always use glass primer applicator for opening, and replace lid after use.

Contents of Betaseal kit AUTOSEAL.KIT.

a) One full adhesive sealant Betaseal 1163 in a 310 ml cartridge. (Available separately)

b) Cartridge gun (manual).

c) Glass primer applicator bottle.

d) Glass primer applicator brush.

e) Glass primer cap (also serves as).

f) Glass primer liners.

g) Wire cutter.

h) Plastic nozzle (to be threaded on to 310 ml tube).

i) Special cleaning paper.

j) Safe rubber sealing gloves, approximate 12 x 11 x 20 mm (fit to size).

REFIT - WINDSCREEN PILLAR WEATHERSTRIP

The seal between the body pillar and windscreen pillar takes the form of a moulded polymer rubber weatherstrip, mounted in a steel carrier channel itself screwed to the alloy screen pillar.

To remove

A polyurethane elastomeric adhesive is used to seal the weatherstrip into the carrier, and to the windscreen respectively. It is likely to be damaged on removal.

1) Prise out the buttons securing the top and bottom ends of the weatherstrip, and peel from the body, carrier channel and windscreen frame. Clean off the old adhesive.

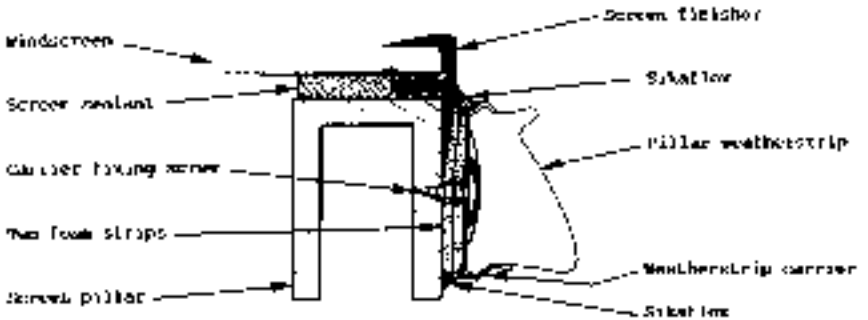
2. If necessary, remove the weatherstrip carrier channel from the screen pillar after releasing the remaining screws. Clear off the old adhesive from the carrier and screen pillar.

To Refit

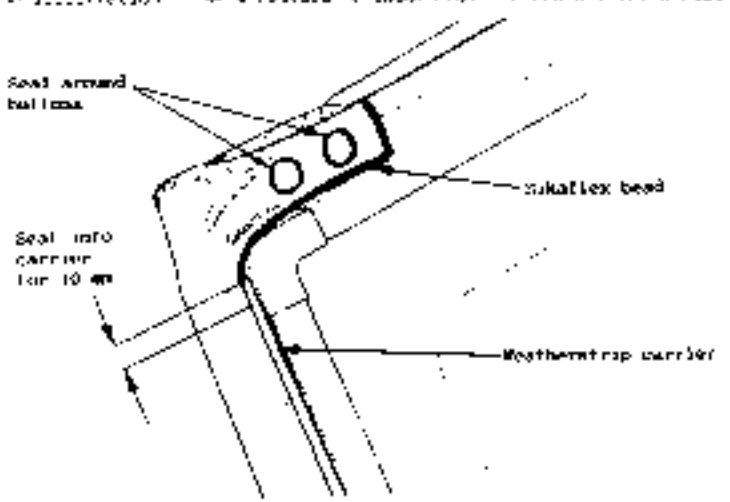
1. Apply two strips of Tape Pack Foam AC108/0617, one on top of the rebate, to the back of the weatherstrip carrier channel.

2. Fit the carrier to the screen pillar using the screws provided. Apply a thin bead of Silastic 732 (RX108/0174) into the inside of the carrier channel, around the top at the corner to the end of the header rail, and down the A post for the length of the seal.

3. Fit the weatherstrip into the carrier and position it so that the top and bottom cutting may be gently pressed around the ends of the seal, the bottom can be cut by pulling it, and the ends of the weatherstrip shaped in such way as the point where the rear screen meets will hide the weatherstrip. Cut the base of the weatherstrip beneath the flange of the carrier, and insert the retaining screws, pushing fully home.



4. Fit finishers and trim seal to the weatherstrip top ends and to seal between the screen finisher and screen pillar with one top and bottom coat as shown in the illustration. Remove surplus to smooth out the sealant for a neat finish.



BK.12 - WINDSCREEN FRAME

The centre of each door hinge post is welded to the top of each door hinge post using three bolts, two of which are also used to secure the door hinge assembly. The third bolt locates a hole in the top of each pillar opposite the front door aperture header rail and is secured by two bolts through into the pillar itself.

To Remove

1. Remove the front hubshell (see section BK.11).

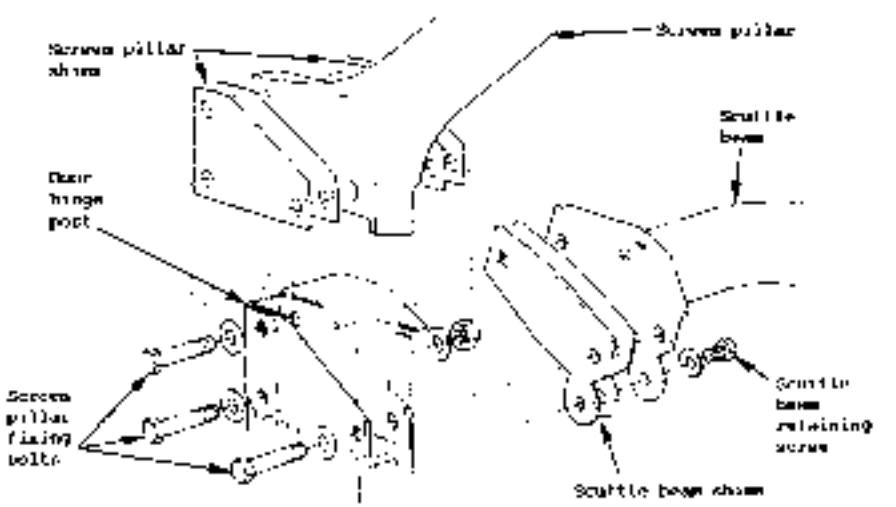
   Remove the windscreen (see section BK.11).

2. Remove the sun visors, roof lamp and rear quarter trim panels (see section BK.13). Remove the trim panel from the windscreen pillar to which the interior lamp harness runs (see pillar to be removed).

3. Slide back the button securing the rear door rubber seal to the moulded roller screen pillar weatherstrip, and pull the rubber seal out of the windscreen frame. Remove the weatherstrip carrier from the pillar after selection the retaining screws.

4. Remove the two pivot securing each end of the header rail to the screen pillar.

5. It is not necessary to withdraw the roll pin locating the pillar to the outboard side of the door post. Remove the three bolts securing the bottom of each pillar to the door hinge post, noting that the lower front bolt also secures a nylon nut to the inside of the door hinge post. Use a sharp blade to cut the adhesive/sealant around the base of the pillar, and slide the pillar out from the screen post. If necessary manipulate the fascia panel and fixings to provide clearance. Note the position of the shims fitted between the pillar and screen post.



To refit

1. If not already done, position the body on the screen pillars and free the inside of the top of the door hinge post.

2. Fit the screen pillars to the hinge post, and select additional shim packs to take up any slight clearance. Distribute the shim packs equally between each of the pillar fixing bolts with thread locking compound applied to the threads of the upper front, and the rear bolts, and place washers under the heads. Fit the nylon nut to the lower front fixing bolt, but leave all the fixings larger right.

3. Fit the header rail to the roof pillar, fit the header rail side panels, and fillet sealer. Refit the header rail fixing bolts or nuts. Bolt the screen pillar to the body sealer to the floor.

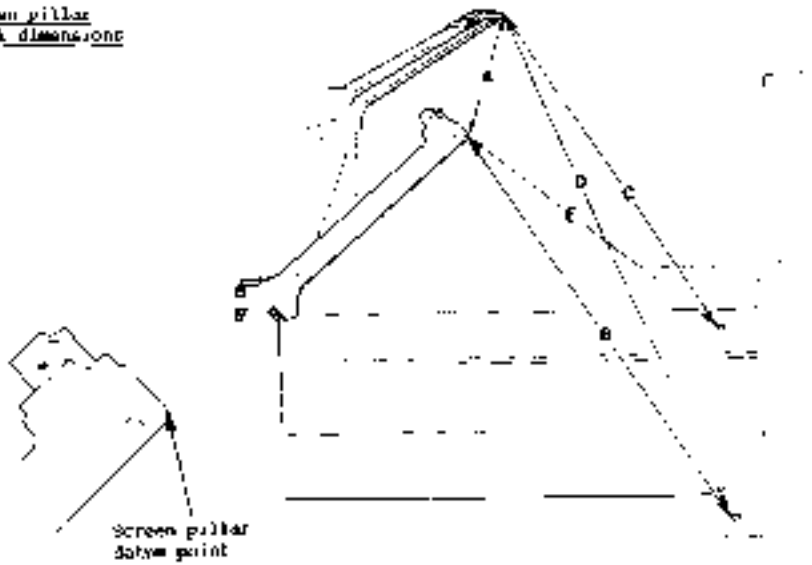
4. Remove both seats, and pull back the carpet to reveal the locking hole (approx 20mm diameter) in the floor at each side, ahead of the sprocket wheel case. Remove the plugs.

5. Measure between the top rear corner of each screen pillar and the central edge of the locking holes in the floor as shown in the illustration, and also from one pillar to the other. Compare the figures obtained with the table below, and adjust the position of the pillars if necessary to bring within tolerance. Shims may be transferred fore or aft of the pillar to the floor, and the pillar in the pillar allow a certain amount of movement.

Dimension	Tolerance
A	1164 - 1174 mm
B	1082 - 1092 mm
C	1197 - 1207 mm
D	1479 - 1489 mm
E	1479 - 1489 mm

Tighten the screen pillar bolts and recheck these dimensions

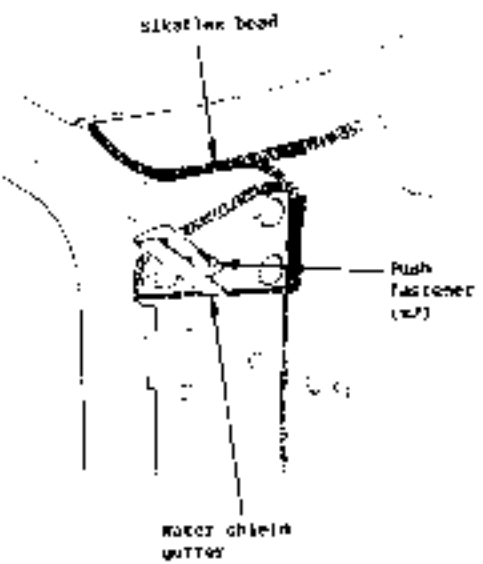
Screen pillar check dimensions



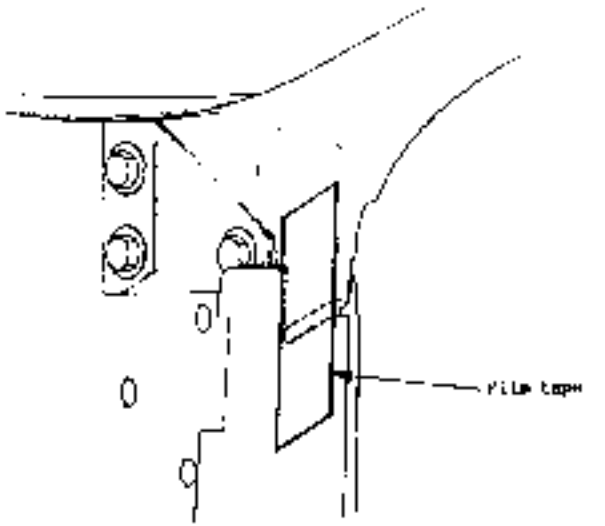
... Seal the gaps between the screen pillars and front bulkhead using 1 kaf ex 20 adhesive/sealant (ACU0001/09). Ensure that there is a smooth blend between the windscreen bonding, between the pillar and bonding.

7 ... to apply to seal the gaps between each side of the pillar and the door hinge body and between the top of the pillar and the header rail. Ensure that there is a smooth transition for the bonded rear weatherstrip and for the screen bonding.

8 Fit the water shield gutter to the bottom of the pillar using the two push fasteners.



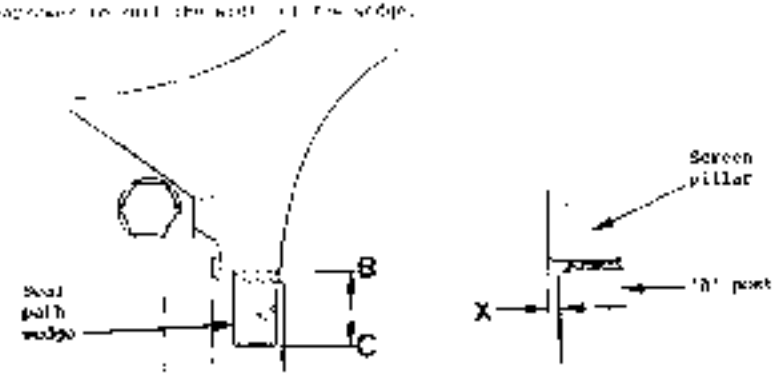
Examine the alignment of the seal path between the bottom of the screen pillar and the body. If the top of the seal is more than 1.5mm, check that the correct wedge is fitted then refit, if necessary, and apply film tape B1C9913450 (X) or B1C9913451 (RH) as in the area of 'X' in the diagram.

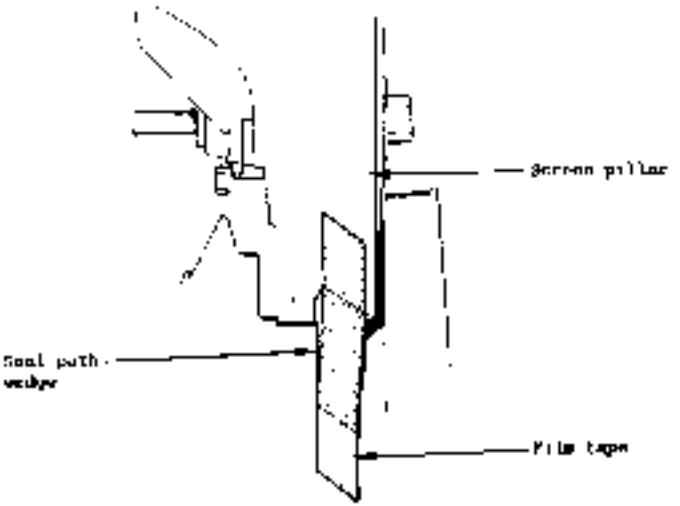


If the step is greater than 1.5mm, fit a seal path wedge 400786-35 (LH) or 400786-36 (RH). Fit the new wedge so that it is flush with the top of the screen pillar as shown in the chart below.

Gap 'X'	mm	mm
Variation 'B' to 'C'	2mm	2mm

Fit the wedge to the body using transfer tape 500750-1909, and seal between the wedge and the screen pillar using Silastic. Trim the surface of the wedge with screen pillar, if necessary, before applying film tape as above, but do not attempt to cut the wedge at the screen.





Fit new sill reinforcement (section 11K.10), screen pillar weatherstrip (11K.10), front sill finisher (11K.11), and the remaining parts in reverse order to disassembly.

11K.10 - BODY REMOVAL REFERENCE

There are 14 main mounting points securing the body to the chassis, each using a set plate & bushing arrangement bonded together and bonded to the body. Add on MIG or T pieces up on the edges for on the chassis. The body may be removed from the chassis using a wheel base type crane point lift, using the engine in place, by the following procedure:

1. Depressurise the fuel system by removing the service switch (marked on battery compartment lid) located in the front right hand panel to disable the fuel pump, and start the engine. After the engine stops from fuel starvation, crank for several seconds to dissipate the residual fuel pressure.
   Disconnect the battery.
   Disconnect the fuel feed & return pipes at the rear of the engine bay.

2. Remove the front subframe (see section 11K.7).

3. Recover or de-pressurise the air conditioning system (see section 17), and disconnect the two evaporator connections at the rear of the engine bay.

4. Drain the cooling system, and disconnect the two heater hose connections at the rear of the engine bay.

h Disconnect the throttle and clutch cables.

i Disconnect the brake pipes from the master cylinder, and plug the cylinder ports to stop the pipes emptying.

j Disconnect the vacuum hose to the brake servo.

Disconnect the vacuum hose to the water valve.

k Disconnect the speedo cable from the transmission.

l Disconnect the following electrical connections at the engine bay:
- Coil feed cable and starter earth lead at RHS of chassis front crossmember, just starter motor side earth, and release from the plenum bracket.
- Alternator connector block, starter motor solenoid connector, brake fluid level sensor lead, oil pressure sender sender connector, lead from side of bonnet, water temp sender lead, the ignition coil lead and connector. Release the harness from the chassis.
- TDC sensor cable near front end of inlet plenum, and release cable from chassis.
- Unplug the engine harness connector block - near the front of the heater box, out of the way during removal of transmission, and to make sure the heater box is clear of the air filter. Unplug the electric water pump harness connector. Release the harness from the chassis.

m Remove the studs between the power unit cradle and the RH panel.

n Working inside the car, remove the screws securing the upper steering column shroud to the bulkhead, remove the upper shroud assembly to the pedal box. Undo the steering column clamp bolt and slide the flanged bushing out of the splined shaft. Withdraw the column from the engine bay, and release the harness from the clips on the column. Disconnect the ignition switch connector, and remove the column assembly from the car. Remove the clamp bolt and withdraw the flanged bushing from the splined shaft. Withdraw the column from the engine bay, and release the harness from the clips on the column. Disconnect the ignition switch connector, and remove the column assembly from the car.

o Remove the clutch slave cylinder from the bellhousing.

p Remove the clutch cover bolts progressively, a turn at a time, until the spring pressure is released, then remove the cover and driven plate assembly. Remove the flywheel bolts and withdraw the flywheel from the crankshaft flange. Remove the rear engine plate bolts.

q Remove the engine mounting bolts from the chassis brackets.

r Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

s Remove the clutch release bearing from the transmission front cover.

t Remove the bolts securing the starter motor to the transmission, and withdraw the starter motor.

u Remove the bolts securing the transmission front cover to the transmission, and withdraw the front cover.

v Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

w Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

x Remove the clutch release bearing from the transmission front cover.

y Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

z Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

aa Remove the clutch release bearing from the transmission front cover.

ab Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

ac Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

ad Remove the clutch release bearing from the transmission front cover.

ae Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

af Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

ag Remove the clutch release bearing from the transmission front cover.

ah Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

ai Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

aj Remove the clutch release bearing from the transmission front cover.

ak Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

al Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

am Remove the clutch release bearing from the transmission front cover.

an Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

ao Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

ap Remove the clutch release bearing from the transmission front cover.

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or Remove the clutch release bearing from the transmission front cover.

os Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover.

ot Remove the bolts securing the transmission to the engine, and withdraw the transmission rearwards, ensuring that the weight of the transmission is supported during removal.

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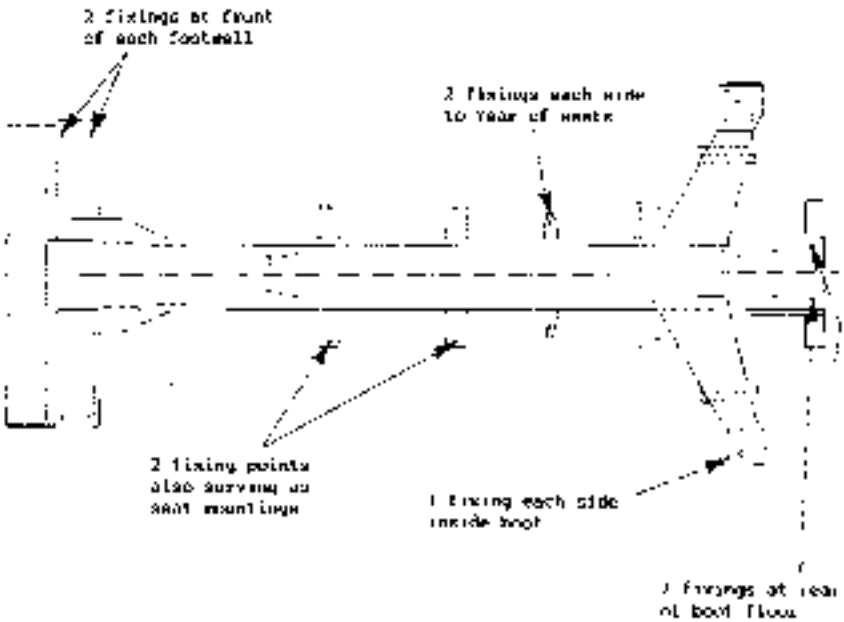
ox Remove the clutch release bearing from the transmission front cover.

oy Remove the bolts securing the transmission rear cover to the transmission, and withdraw the rear cover

- For each side of the boot, consists of the rear wheelarch, rear chassis rear suspension top platform
- An low spare wheel well - into the rear extension.

(3) Position a trial joint to between the body locating points, and raise the body clear of the chassis.

Body/Chassis fixings



Preparation before body joining

Before re-fitting the body, check that the following seals are fitted & not
- Seat pedestal (seat) round the driving brake pedal on the chassis.
- Sill extension (rear gasket) around each rear suspension. Gasket top point
- Rubber gasket on each of the two raised areas for the tonsil brace at the front of the chassis centre section.

Body fitting Procedure

It is important when fitting the body to the chassis, that the body is lowered vertically onto the chassis, to ensure that the body is correctly positioned, and not to damage the chassis.

- Lower the body onto the chassis, ensuring that the wiring harnesses or control brake cables are not trapped between the body and chassis

... Fit the seat belt firmly on the chassis mounting points, then fit the two M10 bolts and washers at the front of each footwell into the chassis floor crossmembers. Torque tighten to 45 Nm (33 lbf.ft).

... Fit the rear belts and washers at each side of the rear of the centre section, and torque tighten to 45 Nm (33 lbf.ft).

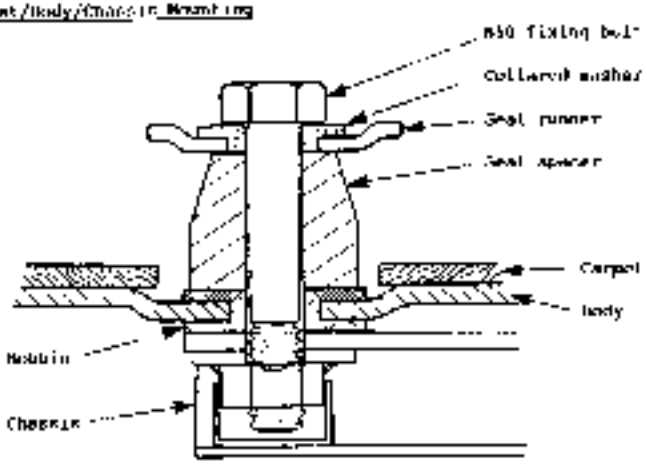
... Fit the plastic pull tab cover into the top of each seat direction guide and fit the bolts and torque tighten to 45 Nm (33 lbf.ft).

... Position the upper shoulder harness in the body, and fit the two fixing bolts and washers. Torque tighten to 45 Nm (33 lbf.ft).

... Fit the rear inboard seat belt reel and torque tighten to 45 Nm (33 lbf.ft).

... Turn to re-assembly in the reverse order to disassembly.

Inboard Seat/Body/Chassis Mounting



ADDENDUM 1 - WATER INGRESS; Areas of attention

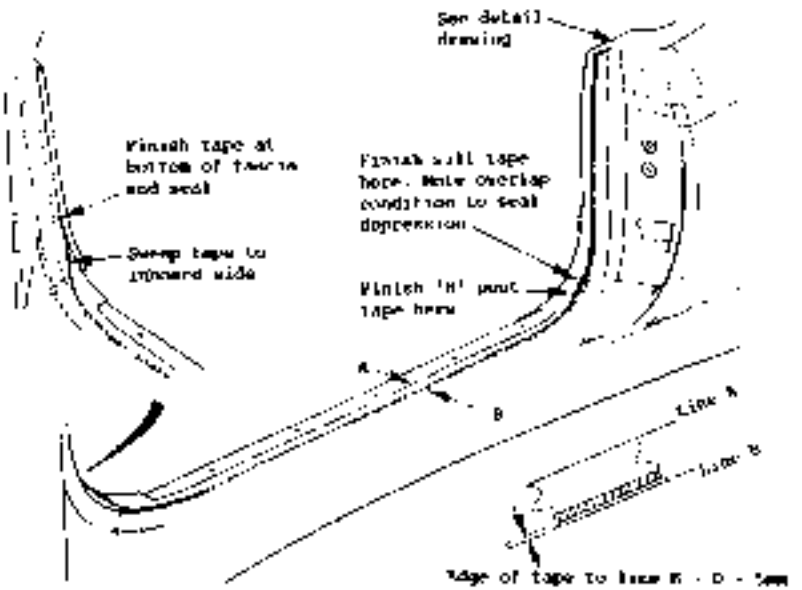
APPLICATION OF BEAD SEALANT TO DOOR APERTURE

A strip of butyl rubber bead sealant, 4.5 mm dia. is run from beneath the forward end of the roof drainage lid seal, down the 'B' post beneath the outer edge of the trim panel, and along the top of the body sill, beneath the sill treat plate, ranking with the fascia end seal. In this way, any water passing the door primary seal, or running down the 'A' or 'B' posts inboard of the primary seal, is diverted towards the drainage holes in the primary seal on the outside of the door.

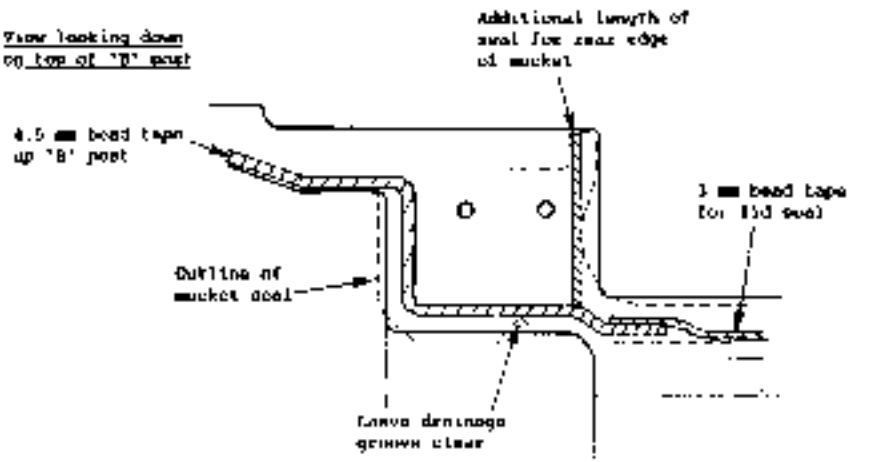
With the 'B' post trim panel and door sill tread plate removed, and the forward end of the roof drainage lid seal released:

1. Apply a bead of 4.5 mm butyl sealant to the body, starting at the end of the lid seal platform and overlapping the lid seal bead. Position the bead as shown in the diagram taking care not to encroach into the drainage channel of the seal. Run the bead down the 'B' post to finish at the lower edge of the depression at the base of the 'B' post.

   Run a 3.0 mm bead of butyl sealant from the upper edge of the 'B' post depression along the top outer edge of the body sill, sweeping towards the front of the sill to cover the base of the fascia end seal.

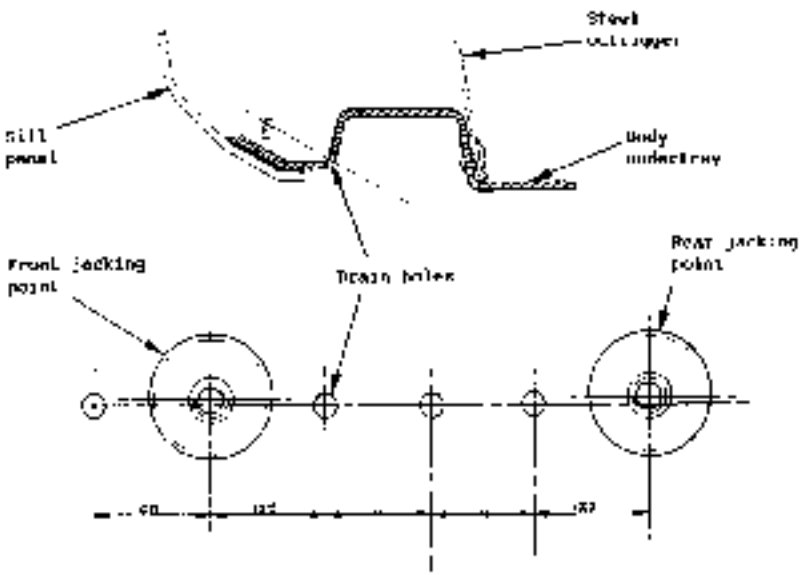


4.5 mm bead A1D0B620RV
3.0 mm bead A1D0B6207V



3. Drill out the drain holes in the underside of the body sill as shown in the drawing.

4. Carefully cut the rubber in the cove groove and in the underside of the door and seal the cut surface by applying paint with brushes.



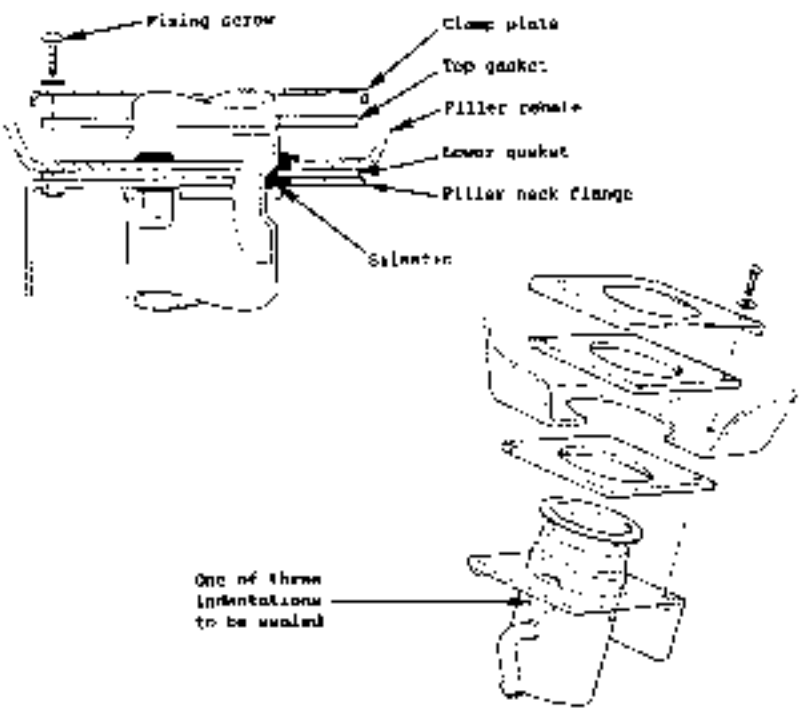
SEALING OF FUEL FILLER REBATE

There are three aspects of water sealing of the fuel filler rebate, sealing of the filler neck to the rebate; sealing of the rebate to the body and ensuring that the rebate drain tube is not blocked.

1. Filler neck to rebate: Release the two screws securing the clamp plate, and remove the plate and top gasket. Put the filler neck up against the underside of the rebate whilst sealing between the neck and rebate with black silastic. Push the sealant down into the gap, paying particular attention to the three indentations around the neck. Also apply a spot of sealant into each of the two fixing holes before refitting the top gasket and clamp plate and tightening the two screws.

2. Rebate to body: Check the integrity of the joint between filler rebate and the body by using a thin tie wrap or similar to poke around the joint line and search for any gaps in the adhesive. If any gaps are found, or if water ingress from this area is established, use a spatula to remove Arkaflex into the area concerned, taking care to leave a neat appearance.

3. Rebate drain tube: The purpose of the filler rebate drain tube is to drain any spilled fuel or rain water from the rebate onto the ground beneath the vehicle. Check that the tube is not blocked by blowing through with an airline.



DOOR SEALING

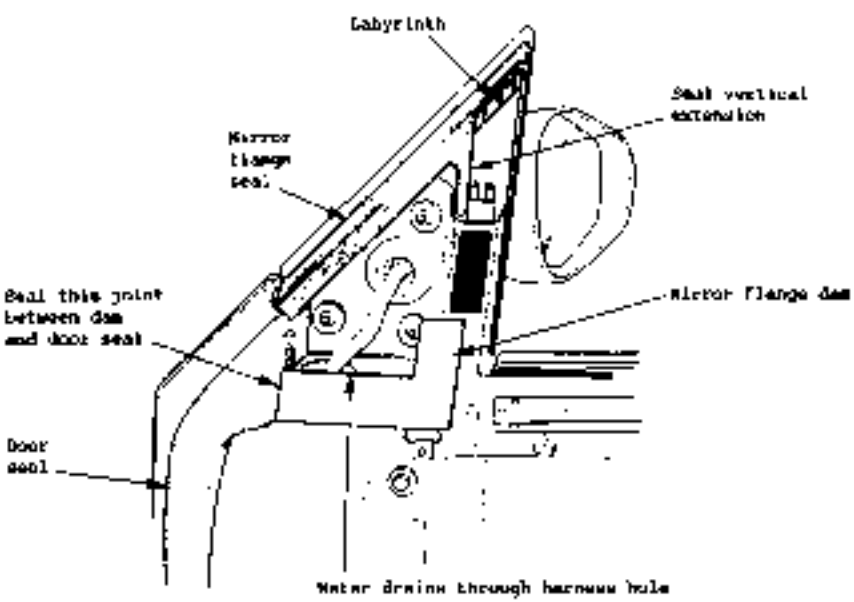
Areas to be considered include the mirror flange seal and dam, adjustment of the door glass inward tilt, and sealing of the fixings and panels attached to the inner door panel. The door shell is provided with drain holes in its underside in order to drain away any water collecting in the bottom of the door, but to prevent water ingress to the interior, the inner panel of the door shell must be sealed

1 Mirror flange seal: Check that the mirror flange seal includes a vertical extension to capture the front edge of the glass, and a labyrinth seal at the apex. If necessary, renew the seal to fit the latest apex fixing.

2 Mirror flange dam. In order to divert any water in the mirror flange apex into the inside of the door shell via the mirror harness hole inc grommet, a dam is glued (Silastic) along the inside edge of the door shell between the front slider channel and the top of the door primary seal.

3 Adjustment of door glass inward tilt: See Service Notes section BK.3.

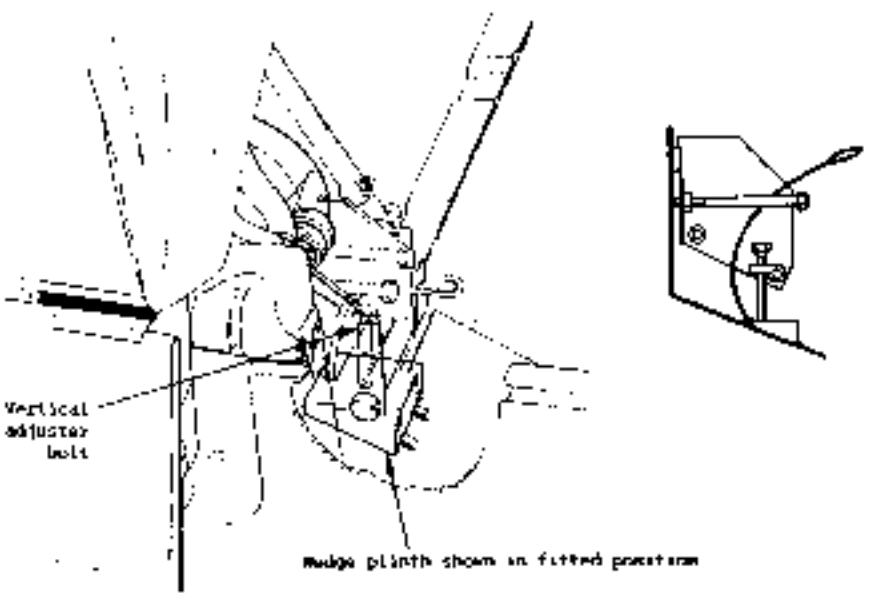
4 Sealing of fixings and panels: Check that there are rubber gaskets fitted between the window lift channel lower mounting bracket and door shell, and between the regulator guide channel lower fixing bracket (or shim plate) and door shell. After adjustment of the door glass has been completed, seal around all screw heads on the inner door panel with Silastic. Similarly seal all speaker clip holes, wiring clips, grommets etc. Check that the speaker is protected by polythene sheet sandwiched between the metal & panel liner seals. Seal all door access panels with Silastic.

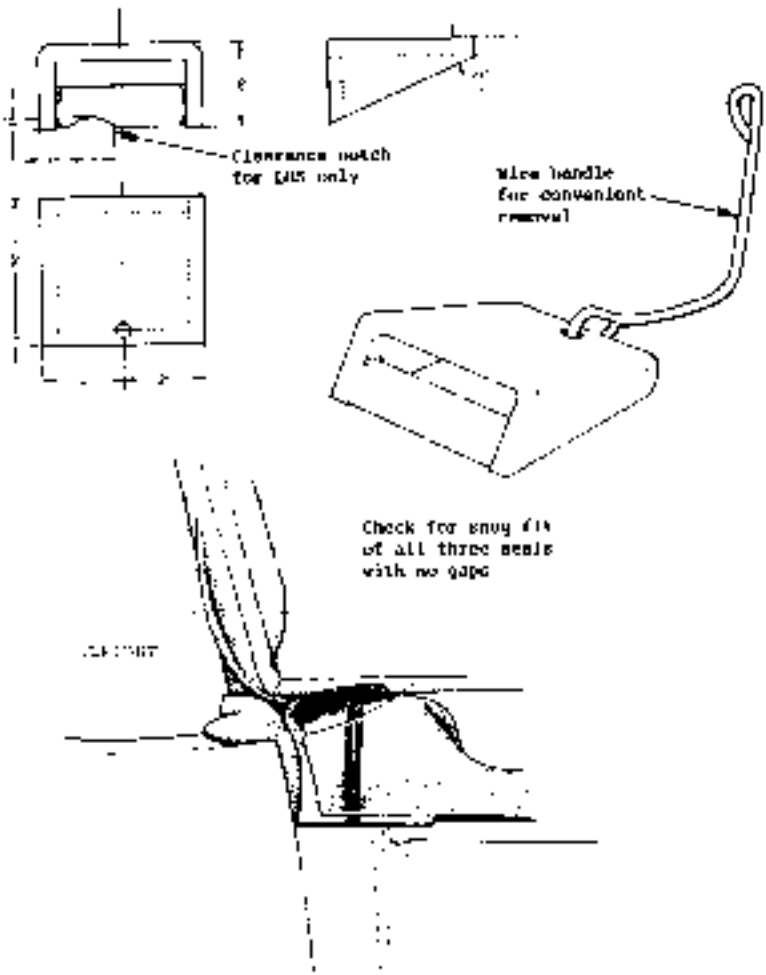


ROOF SEALS

It is essential that the owner understands the importance of lowering the door windows before opening or lowering the soft top roof. Otherwise damage to the roof seals may be caused. In the interests of optimum sealing and freedom from wind noise, the owner should also be advised to periodically clean the pile on the roof cant rail seals at each side, after erecting the roof.

The only adjustments that may be made to the soft top roof assembly are the fitting position of the rear mechanism in the 'B' posts, and the position of the latch plates on the windscreen header rail. The roof mechanism itself is adjusted and set at the manufacturers, and it is essential that no attempt is made to readjust the settings or linkage. Any such attempt will render the roof warranty void. The mounting position of the roof should be set using the procedure detailed in Service Notes section BB.13, but the use of a pair of locally made wedge plinths will enable the roof height setting to be achieved more easily. These wedges are positioned against the bank on the seat belt reinforcing struts, and form a horizontal platform against which the inboard adjuster bolts can bear. These wedges should be fabricated locally from any sufficiently hard material e.g. steel, aluminium, plastic, wood.





Other suppliers for roof seals/retainers for upgrade kit at the base of the tailing pillar may be necessary to adjust the header seal carrier height relative to optimise sealing at the header rail. Remove the cabin top header trim panel for access to the two screws at each side which secure the header seal carrier to the roof. Slacken these screws, adjust the seal carrier to achieve a positive fit of the header seal across the whole length of the screen header rail. Tighten the screws and refit the trim panel.

Each of the roof seals i.e. header rail, intermediate (cant rail), falling pillar (A/B post), and rear (C/D) etc are available as service replacement kits.

Failing Pillar Seal Replacement

With the hood at position 2 (Fig.1) locate the screws that secure the failing pillar seal/carrier. A cut out should be visible along the forward edge of the carrier, the seal should be prised out of the abutment channel at this point to reveal screw.

The seal will also be secured to the hood at the top, by means of adhesive, and at the bottom by a button fastener. A scraper or knife should be used to separate top of seal from hood frame.

Clean all traces of seal and adhesive from top of pillar, touching up any areas where paint has been chipped.

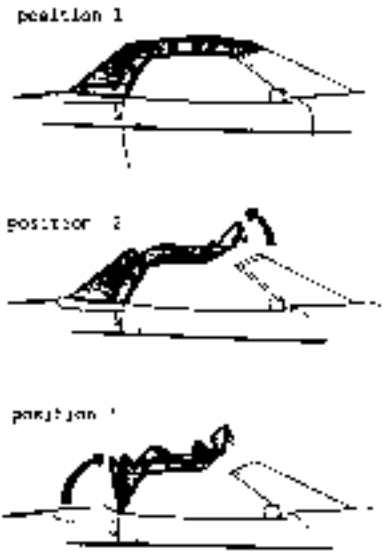


Figure 1

Parts Required

Component	Part No
LH Failing Pillar Seal Kit	A1CC0B3678
RH Failing Pillar Seal Kit	A1CC0B39CS
Betaseal Adhesive Kit	A0T9bc1S6J
Carrier (Primergum)	

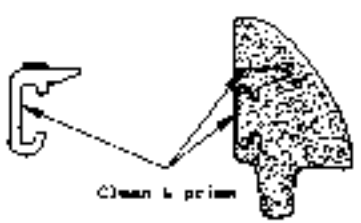
Main seal kit comprises:

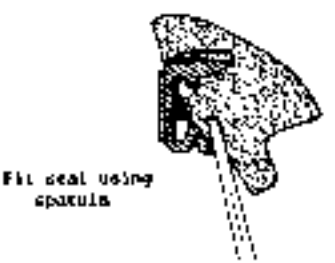
- 1 of Seal, failing pillar
- 1 of Carrier, seal
- 2 of Screw, M5x10 pan head
- 1 of Button fastener

Operation

Using a brush and 'Betaclean 3000' or 'Tape Clean' Bib Betaseal kit, clean seal abutment face of carrier and retaining faces of the failing pillar seal. Allow a minimum of 5 minutes 'flash off' period, after which these same areas should be primed using 'Betaprime 435' or primer from Betaseal kit, this time allowing a minimum of 1 minutes, and a maximum of 6 hours 'flash off' period. Should this period be exceeded re-apply primer.

Seal/Carrier Preparation

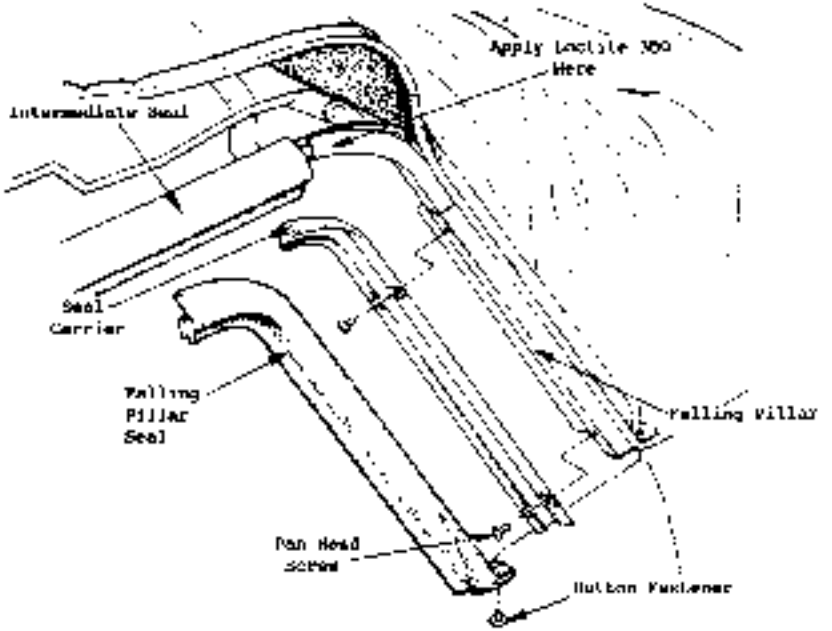




Fit carrier to hood frame/pillar using screws provided. Thread lock should be used on the screws which must be torqued to 7-9Nm. Assemble seal to carrier feeding top/rear edge of seal abutment face into the channel first, using a blunt edged spatula, ease lower/front edge into place.

Erect hood to position 1(fig 1). The seal can now be adjusted to give the correct alignment with intermediate seal to ensure a weatherproof joint is produced. Using thumb/finger pressure only the seal may be moved towards or away from the adjacent seal to comply with the illustration below.

Lift hood to position 2 (fig 1) and fit button fastener to the lower edge of the seal to securing it to the hood at the base of the rolling pillar



Move hood to position 3 (fig 1), using Loctite 380 glue top edge of seal to the hood frame/pillar, ensuring the position relative to the intermediate seal remains unchanged. Leave for 5 minutes to allow adhesive to cure.

Seal should now be pooled out of adjacent channel, care must be taken not to damage its 'skin'. With the seal out apply a bead of 'Betaseal 71501' along the carrier adjacent channel. The seal can now be fed back into the carrier as before.

Erect hood to position 1 (fig 1) and leave it in that position for no less than 48 hours, this will ensure adhesive is fully cured.

Intermediate Seal Replacement

With the hood at position 2 (fig.1) locate and remove the two screws retaining the intermediate seal carrier, ensure the associated nuts located between the seal and seal carrier are retained. Lift away the seal and spacer from channel.

position 1

Parts Required

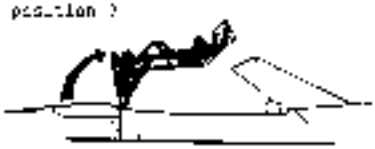
Component	Part No
LH Intermediate Seal Kit	A1CC8e1866
RH Intermediate Seal Kit	A1CC8e1867
Butoseal Adhesive Kit	A1CC8e1868
Loctite 290 (Superglue)	

position 2

Each seal kit comprises;

-1	nr	Seal, intermediate
-1	nr	Carrier, seal
-2	nr	Screw, M6x12, CSK
-2	nr	Washer, slot, CSK
-2	nr	Plastic spacer
-1	nr	Adhesive strip

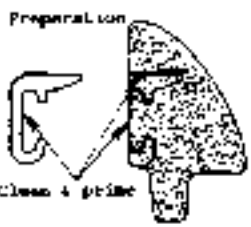
position 3

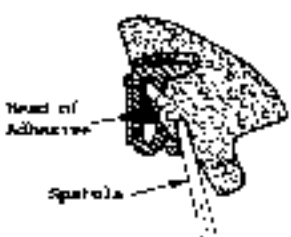


Operation

Using a brush and 'Betaclean 3900' or 'Wipe Clean' from Butoseal kit, clean seal abutment face of carrier and the retaining lugs of the intermediate seal. Allow a minimum of 5 minutes 'flash off' period, after which these same areas are to be primed using 'Betaprime 5403' or primer from Butoseal kit, this too allow a minimum of 5 minutes, maximum of 24 hours 'flash off' period. Should this period be exceeded re-apply primer.

Seal/Carrier Preparation

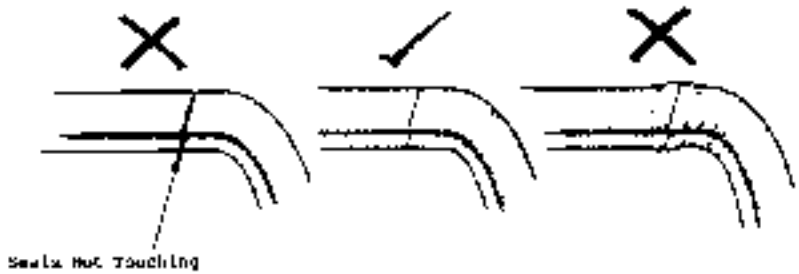




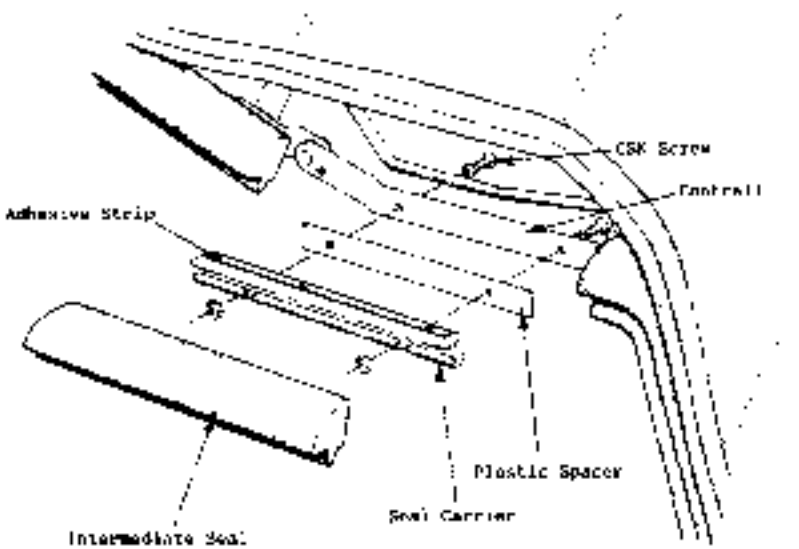
Peel backing off one side of adhesive strip and stick it to the top of the seal carrier (see illustration above). Fit carrier to seal carrier using screws and nuts provided ensuring plastic spacer is positioned between them. Thread lock should be used on screw threads and screws should be torqued to 7-9Nm.

Fit seal to carrier by feeding the top rib of the seal abutment face into the abutment channel first, the lower edge can then be eased into position using a blunt, round edged spatula.

With the seal in place reset hood to position 2 (fig.1). The seal can now be adjusted to give the correct alignment with the header seal at the front, and the folding pillar seal at the rear. To ensure a weatherproof joint is produced move the seal to comply with the following illustration, using thumb/finger pressure only.



Move the roof to position 1 when as much of the adhesive as is achievable will be hidden by the edge of each end of the seal and using finger pressure, squeeze the relative position of the outer seals towards the centre. Allow adhesive to cure



Ease seal out of channel, taking care not to tear seal skin particularly at the seal's full width. Apply a small bead of thinners to the abutment channel and refit seal as before. The overlap of the adhesive strip can now be removed.

Ensure roof is positioned slightly aft of its rear position for the next step allowing adhesive to fully cure.

Header Seal Replacement

With the head at position 1 (fig 1) locate and remove 4 screws securing seal carriers to central, engine top assembly. Pull carriers between the two and the seal carriers are retained just away (2 x M4 seal carrier screws).

Peel 'header seal out of the chamber at the front of the head, clean any traces of adhesive or seal left behind, taking care not to damage surfaces.

position 1

position 2

Parts Required

Component	Part No.
Header Seal Plate	A1000B.BF0
between Adhesive Strip	A1588L.BA
Carrier (RH (Superplus))	

Part seal kit comprises:

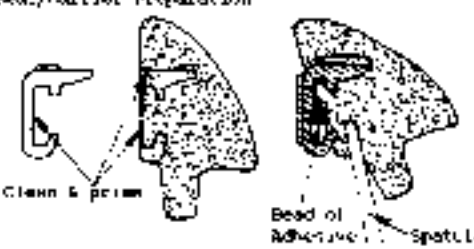
1	Seal, rear header
1	Carrier, seal LH
1	Carrier, seal RH
4	Plastic cap screw
4	M4 seal washer
1	Adhesive sachet
1	Adhesive strip

position 3

Operation

Turn a clean and lubricated 'O' ring seal into bottom of clean seal carrier slot of LH and RH seal carriers. Locate seal retaining angle of seal along one side of seal. Allow a minimum of 5 minutes. Take off paper

Seal/Carrier Preparation



Header Seal in Position

Take a small amount of adhesive from sachet and apply to seal carrier seal surfaces (top of the two carriers). Locate seal onto the rear edges of header seal. Allow a minimum of 5 minutes maximum of 30 minutes open period. Should this period be exceeded re-apply primer.

Peel backing off one side of adhesive strip and fit to LH and RH seal carrier and position as shown.

Fit LH and RH carriers to front of cylinder using fixings supplied. 10mm long should be used or newer which should be tightened to 7-8Nm. Fit new seal to header seal to each of the two carriers by locating the two ends of the seal located face into the slots in the carrier when the seal is fitted into

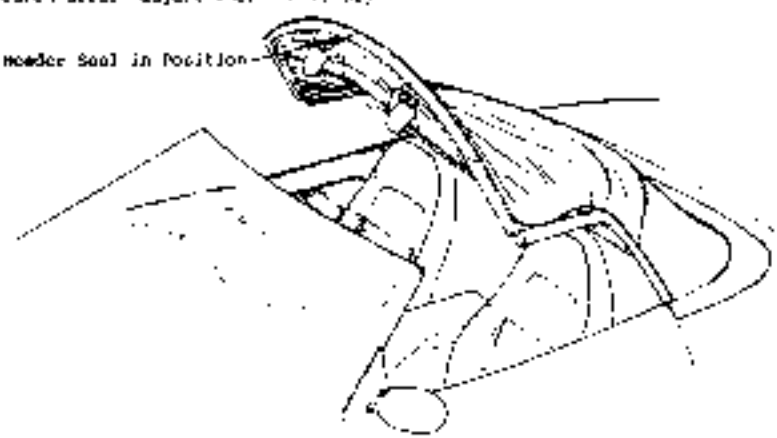
position using a blunt, round edged spatula.

With the seal in place move hood to position 1 (fig 1). The seal can now be adjusted to give the correct alignment with the intermediate seal to ensure a weatherproof joint is built up adjust the seal to comply with the illustration below. Adjustment is made by easing the seal along using thumb/finger pressure only

When an acceptable joint has been produced move hood to position 2 (fig 1). Using acetate 380, glue rear edges of seal to top of LH and RH carrier, taking care not to alter seals relative position to the intermediate seal. Check this by moving hood to position 1 (fig 1) while adhesive cures.

Move hood to position 2 and ease seal out of carrier abutment channel. Care must be taken not to tear seal at the point just glued. Using 'Bostik' (7000) adhesive apply a continuous bead 1mm in dia. along header seal retaining channel from the LH to RH seal corners and along the seal abutment channel of each carrier.

Ease seal back into LH and RH carriers and fit header seal by working from each corner towards the roof centre line. Ensure seal remains within it header gutter seal. Adjust where necessary



Apply 'Bostik' (7000) adhesive to header seal, applying fair contact area to LH and RH front screen positions. Peel backing off adhesive strip on seal carriers.

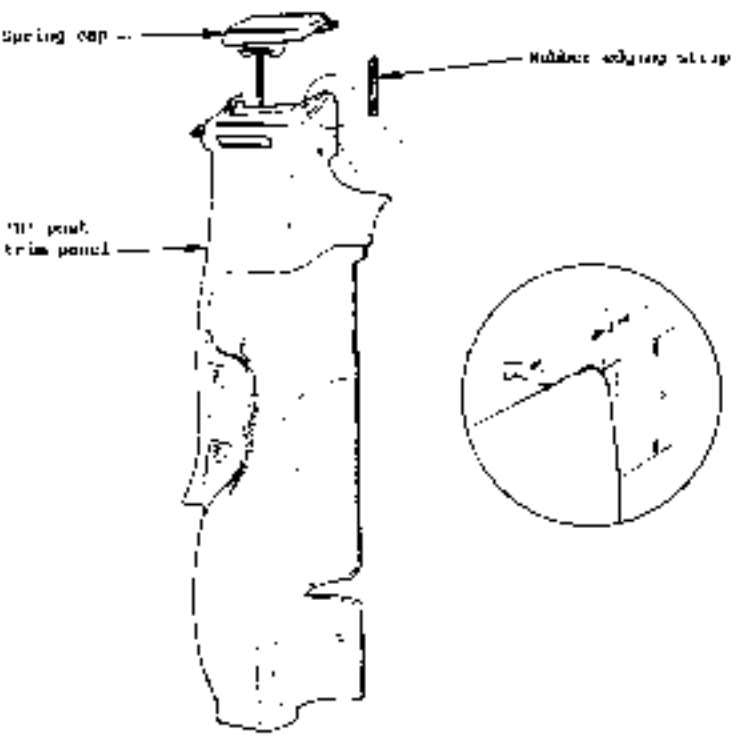
Move hood to position 1 and lock catches to hold header seal in position. Clean any excess adhesive from paint surfaces of roof using 'Bostik' (9000). Carry out a dry run inspection for correct alignment of roof weatherstrip. Adjust where necessary with hood unlocked. Leave hood locked for a minimum of 48 hours to allow adhesives to fully cure.

Modification to 'B' post trim panel: In order to avoid the possibility of the roof seals being damaged when stowed by the top rear edge of the 'B' post trim panel, it is recommended to carry out the following modification to the trim panel:

1. Remove the rubber edge finisher, and cut 2 mm off the rear edge of the trim panel, tapering off to a point 30 mm down.

2. Gently heat the trim panel rear edge with a heat gun, and bend outboard sufficiently to avoid contact with the roof seals when stowed, and enable the 'B' post sunvisor cap to fit correctly over the top of the panel (with edging strip fitted).

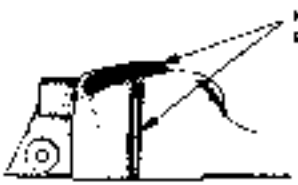
3. Refit or renew the rubber edge finisher, positioning flush with the top edge of the panel.



ROOF STOWAGE LID SEAL

The roof stowage lid seal has a moulded lug at each end which is known as the 'bucket' seal and is designed to fill the space between the roof mechanism on stowage lid and the body. The shape of the bucket seal should be checked with the diagram to ensure that the latest version is fitted.

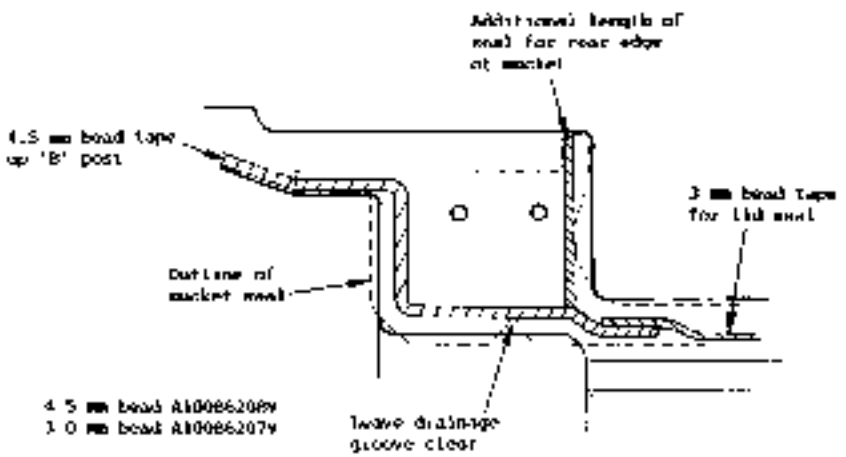
Identification of latest version of bucket seal

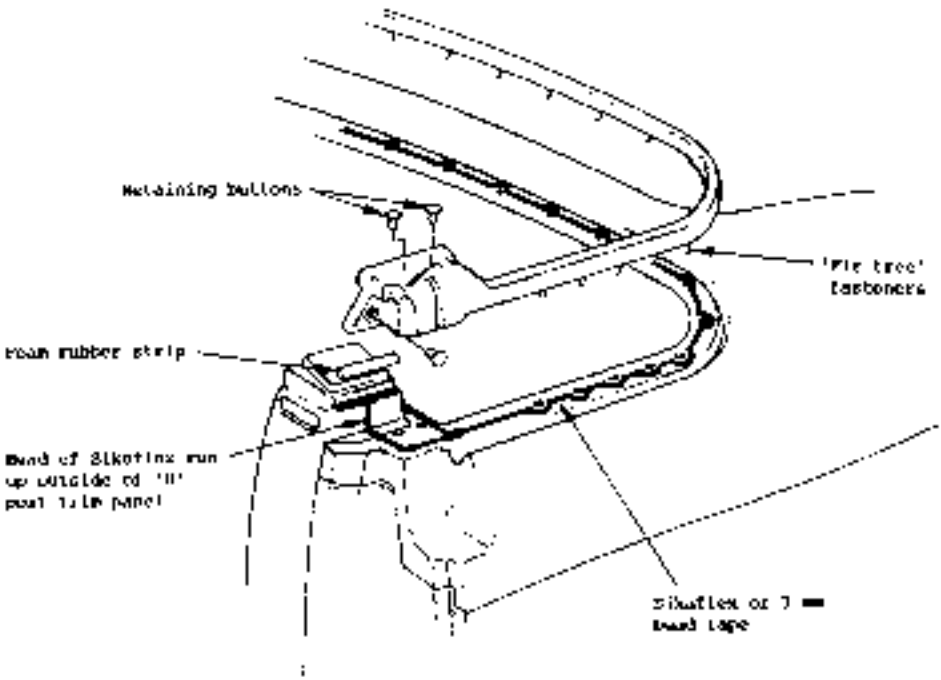


Fitment of the roof stowage lid seal is detailed in Service Notes section BK.13. Fit also note the following points:

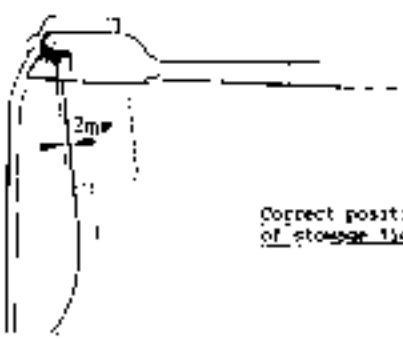
1. Do not fit the ends of the seal until the 'B' post trim panel is fitted.

2. Do not fit the butyl tape at the ends of the seal as detailed in BK.13. But apply the bead sealant strip to the end of the roof lid seal platform as detailed in the diagram.



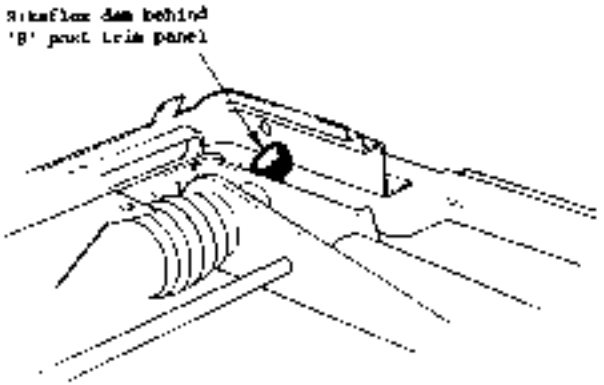


- Ensure that the ends of the roof are positioned as shown in the diagram before fitting the retainer retaining buttons (1 off at each end) and taping in position with a thin foam/rubber strip.



Correct positioning of stowage lid seal

4 Use Sikaflex to create a dam behind the 'B' post trim panel and dispose any water on the inboard side of the seal away from the cabin.



VENTILATION DUCT CONNECTOR

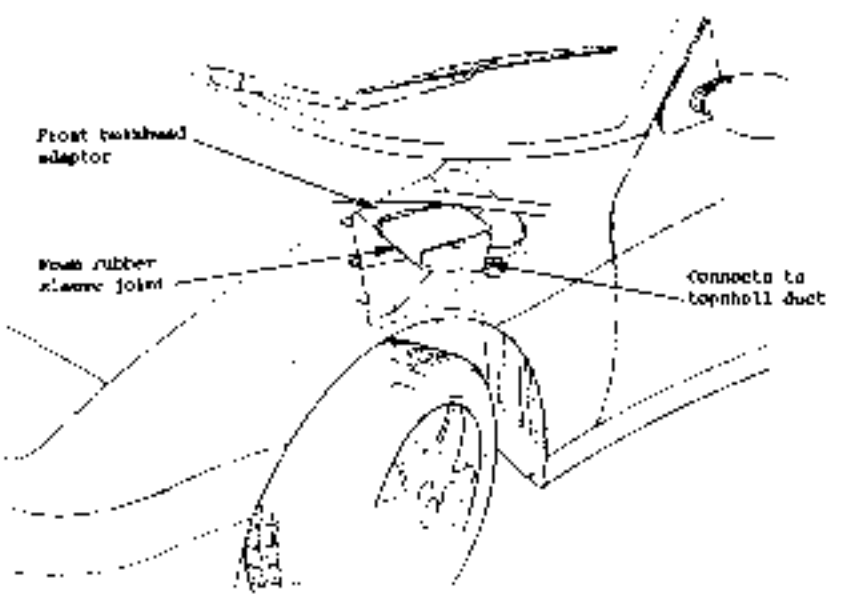
The ventilation duct incorporated into the underside of the front topshell, to locate with a duct adaptor on the front bulkhead via a foam rubber sleeve joint located at the top rear of the passenger side front wheelarch.

1. For access to the joint, remove the wheelarch liner.

2. The sleeve joint is made from skinned foam rubber, which is waterproof provided the exterior skin remains intact. If the skin is broken, the foam will absorb water which can be drawn into the vehicle interior via the heater/air conditioning system. Check the sleeve for water absorption and replace if necessary.

3. Check the security of the sleeve which is retained at each end by a ring clip which should be tightened securely. In order to provide the sleeve with a gas-tight mating surface, the spigot on both the bulkhead adaptor and topshell duct is wrapped with a length of self adhesive foam tape:
Bulkhead spigot tape (4.5 mm) - N380345684
Topshell spigot tape (6 mm) - N681854617

4. Also check the joint between bulkhead adaptor and bulkhead, and if necessary seal with Sikaflex.



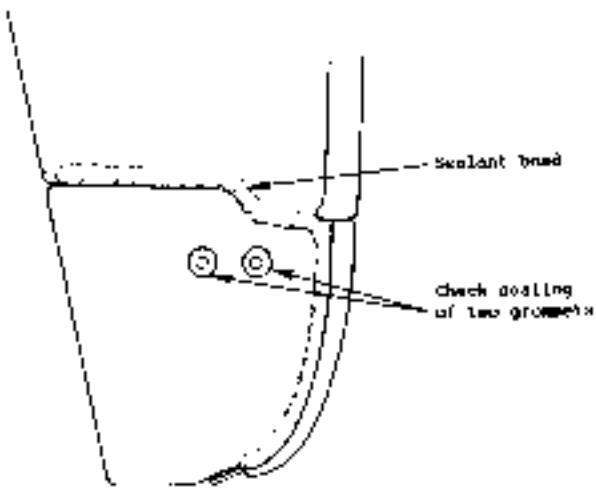
BODY JOINT SEALING

When checking the body joints for sealing, pay particular attention to the area at the front of the rear wheel arches. Remove the two side trim panels from the rear stowage area and use a torch to check for water ingress when applying a hose pipe to the outside of the vehicle.

1. Check the front end of the joint line between rear topshell and rear quarter panel, and reseal if necessary using Sikaflex.

2. Check the two sealing grommets inside the bottom front edge of the rear wheelarch, and the joint between rear quarter panel and sill inside the wheelarch. Also check around the lip of the rear wheelarch.

Forward view inside RHR wheelarch



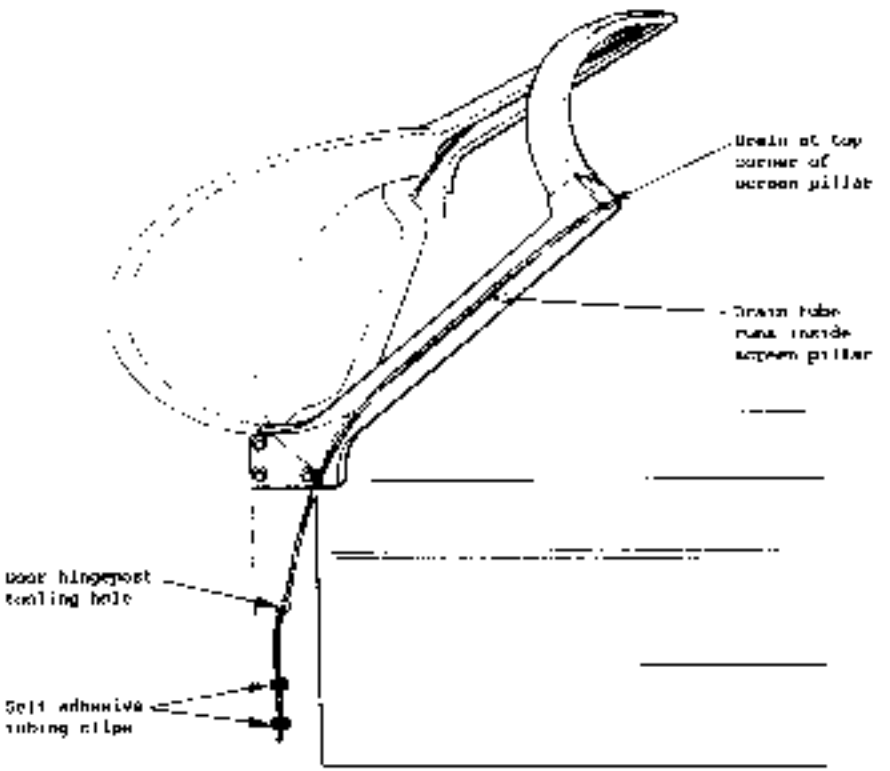
3. It is not possible to prevent the quantity of water dribbled by the A1 corrosion sleeve into the door hinge post area, it is recommended to seal both outer rear edges of the front topshell to the base of the screen using Sikaflex. Use only sufficient sealant to complete the seal, as subsequent topshell removal will be impeded.

BOOT BRACKET

A grommet is provided at each side of the boot to provide access to the rear suspension top link inboard pivot bolt. Check that this grommet is securely sealed using Silastic.

HEADER RAIL DRAIN TUBE

Later cars have a drain pipe fitted at each end of the windscreen header rail. This takes the form of a short pipe glued through the top corner of the screen pillar, which serves to drain any water collecting in the space between the roof header seal and the header rail. Plastic tubing leads from the underside of this pipe down the inside of the screen pillar, and out through the door hinge post tooling hole.



ADDENDUM 2 - REPLACEMENT OF FOLD BACK HEADLAMPS BY SINGLE PIVOT TYPE

If for any reason the early type 'fold back' headlamp system is to be replaced by the later type 'single pivot' system (see sub-section BK 14), the following procedure should be adopted:

Parts Required

Description	Part Number	Qty
Headlamp Pod, RH	A11UC1116US	1
Headlamp Pod, LH	A11UC1116TS	1
Headlamp Carrier Ring, Outboard (plastic)	[illegible]	2
Headlamp Mounting Arm, Main, LH (steel)	A11UCN0A4CU	1
Headlamp Mounting Ring, Main, RH	A11CPN1J4BU	1
Headlamp Mounting Ring, Sup, LH	A11CPN1J4AF	1
Headlamp Mounting Ring, Sup, RH	A11CPN1J5AF	1
Retainer Screw, headlamp, M4x4 x 60	A11CPN1J76F	12
Spring, headlamp adjuster screw	A11CPN1J5AF	12
Screw, M6 x 20, b/l assy to pod	A11CPN1J7JF	12
Set screw, M6 x 25, link to pod (2), relay lever pivot (4)	AC15MJC1J7	7
Set screw, M6 x 20, relay lever bracket fix	AC15MJC1J6S	1
Spacer, 4.0 mm, link to pod (2), pod link/relay lever (4)	A11CCB1C6C7	6
Spacer, 1.5 mm, pod link/pod nut (2), motor link/relay lever nut (2), motor link/rotary link nut (2)	A11xxx1x5xF	6
Actuator Link Assy, Incl. ball joints	A11CCB1C6A7	1
Nylon Nut, M6, link to pod (2), relay lever pivot (4), relay lever/act. links (2), pivot bracket to topshell (6)	AJ15MxxxxF	14
Adaptor, pivot bracket to topshell, RH	A11CM11J6C	1
Adaptor, pivot bracket to topshell, LH	A11CM11J6S	1
Setscrew, M5 x 40, adaptor to topshell	AJ15MJC7J4F	2
Nut, Nylon, M5, adaptor to topshell	AJ15MS7J6S	2
Washer, flat, M5, adaptor to topshell	AJ15W4J11C	2
Front Bracket, relay lever	A11CB1C1J4F	2
Pig Head Stud, pivot bracket fix	A11CB1J7CF	2
Relay Lever, RH	A11CB1J03F	1
Relay Lever, RH	A11CB1J13F	1
Ball Joint	A11CB1J5SF	2
Rivet, full shank to relay lever	A11Cn6454F	8
Washer, relay lever pivot	AU15W4C14S	4
Shelf Moulding, RH	A11CH1C22	1
Shelf Moulding, LH	A11CH1C23	1
Pan Head Screw, M6, shelf fixing	AU15WN1P1U	4
Locknut, M6, shelf fixing	AU15WN1J1X	4
Washer, M6 x 12, shelf fixings (4), relay lever pivot (4), relay lever bracket (10)	AC15WN1C1S7	18
Rotary Link, headlamp motor	2:1CCB1C2U1F	2
Nylon [illegible] Nut, M6, act.link to rotary link	AN11MJC2M4F	2
Reinforcing Bracket, topshell to motor, RH	A11CCB1C1J	1

Continued.....

Parts Required (continued)

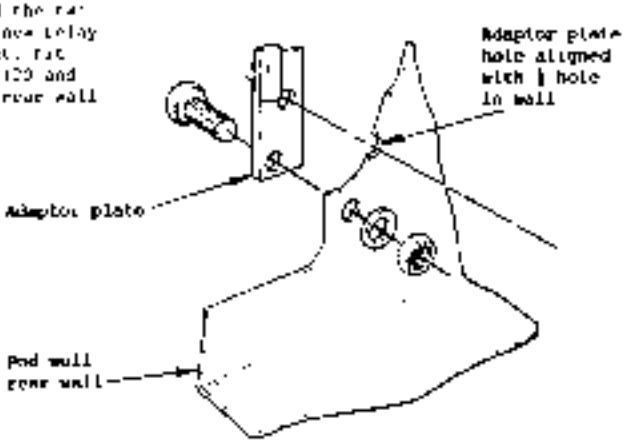
Description	Part Number	Qty
Reinforcing Bracket, topshell to motor, RH	A10980996	1
Bolt, M5 x 50, relief, byke - to motor	A07M0505F	2
Nut, Nyloc, M5, Lite, to motor	A10M0510F	2
Slotted Shim Washer, shutline adjust	A10980610F	10
'S' Clip, harness to pod rear wall	A07SM60038	4
'S' Clip, harness to headlamp body.	A07SM60042	1

Procedure

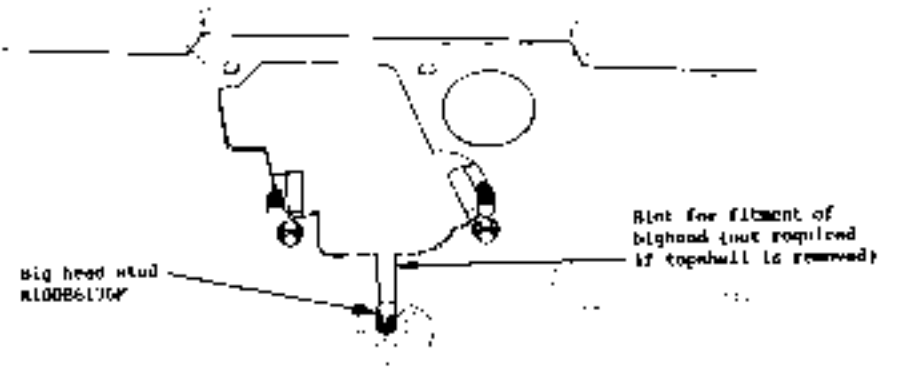
1. At each side, remove the existing headlamp pod system and retain the following parts:
   - Headlamp assemblies, including mounting rings.
   - Flap hinge bracket (bolted to topshell), but remove and discard the four spotup adjuster screws.
   - Headlamp turret and mounting bracket. Discard the rotary link but retain the spacer sleeve.

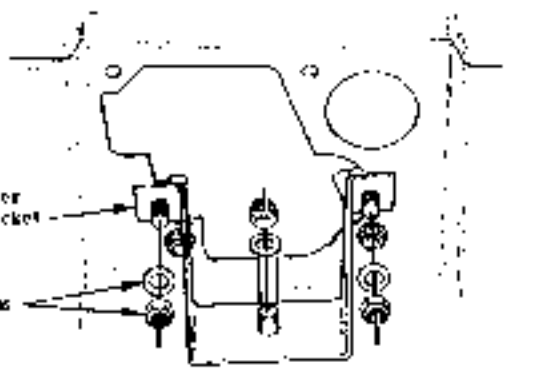
2. Release the headlamp harness from each pod well. Refit the rear wall of each pod well using the template supplied (see below). Cut off the rearmost of the three pig head studs used to secure the old headlamp mounting frame.

3. In order to make way for the RH fixing holes for the new relay lever mounting bracket, fit adaptor plates A10981120 and A10981121 behind the rear wall using the M5 fixings.

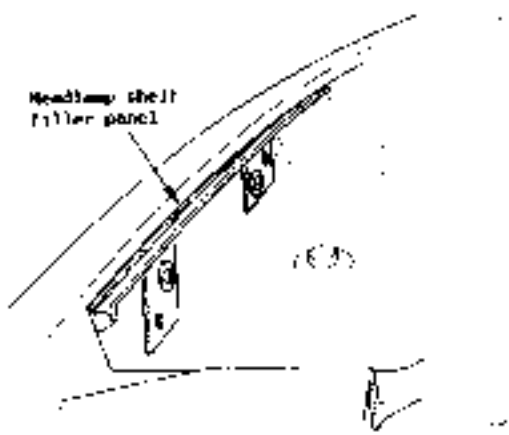


4. At each side, position the relay lever pivot bracket with the two top holes aligned, and sitting accurately on the base. Mark out the bracket lower fixing hole on the base of the pod well, and drill a 6 mm clearance hole in the topshell. Extend this hole into an open slot outwards into the seat well aperture. Apply a two part epoxy adhesive (e.g. Araldite) to the seat side of the bracket, and slide beneath the topshell to the front end of each slot. Taking care not to allow excess adhesive to bond to the chassis. Clamp into position with a washer and nut on the top side until the adhesive has fully cured.

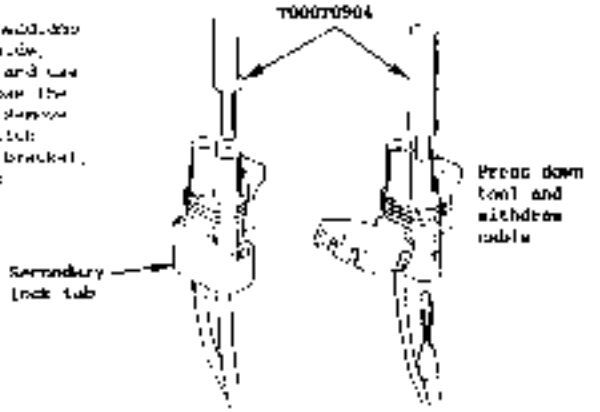




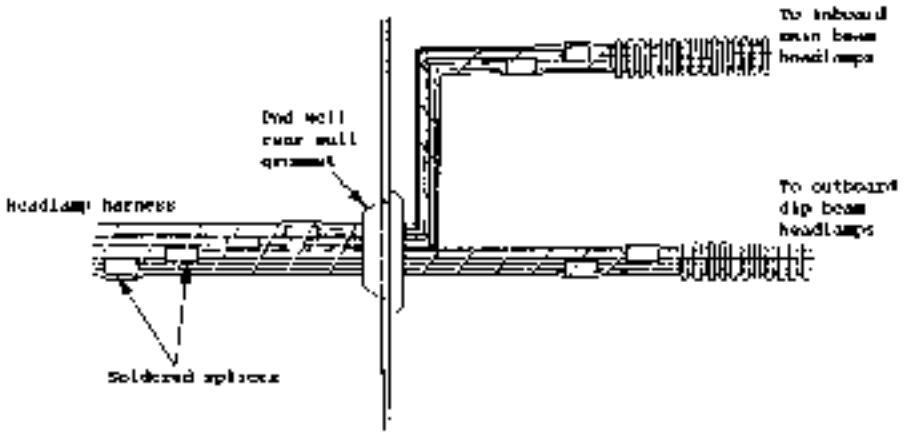
f Position the headlamp shell filler panel at the front of each pod well, and mark out the two fixing holes on the topshell. Drill the holes 11.0 mm and fit the two M6 jackbolts. Secure the two shell panels with the pan head screws.



c. At the front harness to headlamp motor connector at each side, open the secondary lock, and use tool T000Z0904 to depressue the green and black cables. Remove and discard the motor switch (the main motor mounting bracket), and tape back the harness connections.

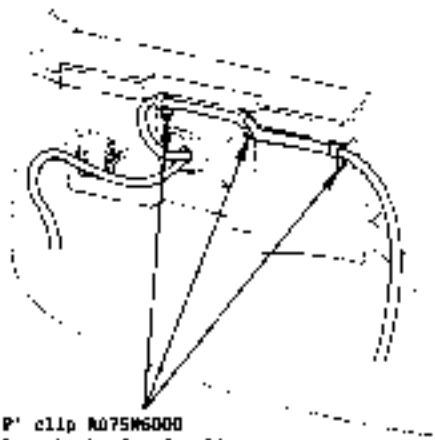


d. At each side, extend the two main beam headlamp leads by 50 mm, and the two dip beam leads by 100 mm.
Untape the headlamp harness for a distance of 300 mm from the multi-plug earth exit.
At a point 70 mm from the o/d bypass exit, cut the main beam feed wire (black/black on BHS, black/slate on BH7) and extend 70 mm using 2.0 mm blue cable, soldered splices, heat shrink insulation and tape.
- Repeat for the main beam earth lead using 1.25 mm black cable, staggering the splice by 70 mm from the feed cable splice.
- Repeat the above two operations for the dip beam feed (blue/orange RH, blue/pink LH) and earth cables, using 120 mm of red 2.0 mm and 1.25 mm black cable.



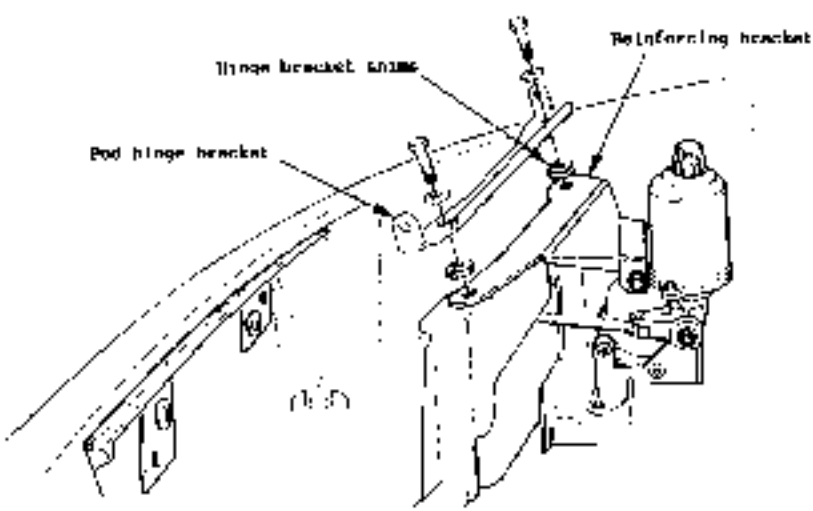
- Secure the harness with 'P' clips along the back of the pod well as arrow - the diagram.

RH pod shown
(LH sym. opposite)



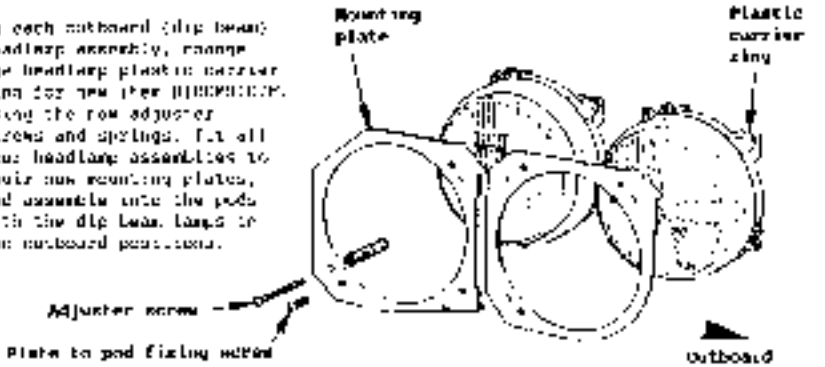
'P' clip A075M6000
along back of pod well

9. If a reinforcing bracket was not previously fitted between the bulkhead plinth at the top rear of each pod well and the headlamp motor, these brackets must now be fitted in order to brace the mounting plinth for the headlamp pods.



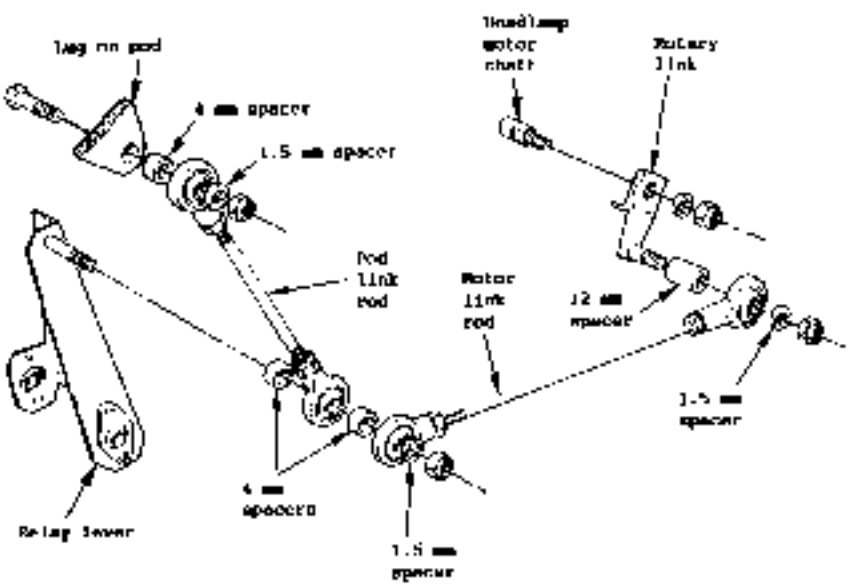
The reinforcing bracket should fit directly against the copshell, with the pod hinge bracket shims (if required) between the hinge bracket and reinforcing bracket.

10. On each outboard (dip beam) headlamp assembly, change the headlamp plastic carrier ring for new (Part [illegible]). Using the new adjuster screws and springs, fit all four headlamp assemblies to their new mounting plates, and assemble into the pods with the dip beam lamps in the outboard positions.

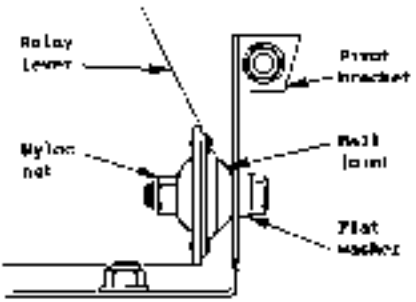


11. Remove the rotary link from each headlamp motor, and fit the new link.

12. Assemble a link rod with two rod ends and locknuts and fit to the inboard side of the pod lift bracket (located to the inside of the pod) with a 4.0 mm. spacer between the rod end and bracket, and a 1.5 mm spacer between the rod end and nylon nut. Repeat for the other pod.



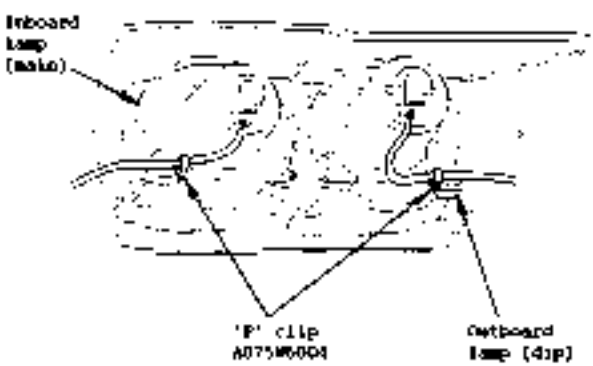
11. Fit two ball joints to each relay lever using pop rivets, with the ball joint flange on the outside of the lever. Assemble each lever into its mount bracket with the open side facing forward and the actuator link stud pointing inboard.
Fit the pivot bolts as shown



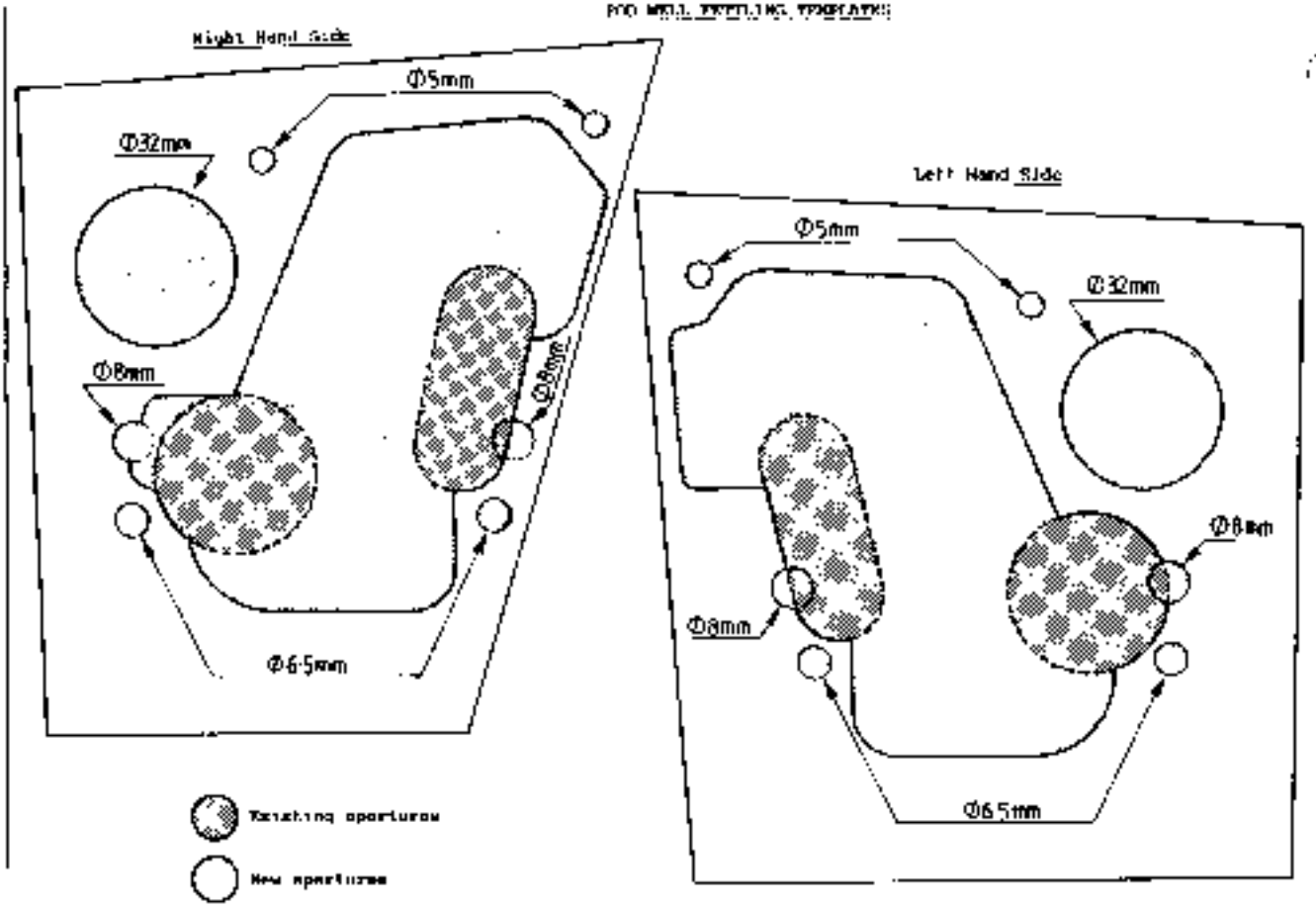
12. Fit each pod to its hinge bracket, and tighten the ball joint socket head pivot screws. Adjust the pod shutlines and height by slackening the two bolts securing the hinge brackets to the nipshell, and adding or deleting plastic skim washers as necessary to achieve flush fitting and a 5 mm (approx) min. gap between pod and nipshell or bonnet.

13. Fit the pod link rod into the relay lever with a 4 mm spacer washer each side of the ball joint. Assemble the motor link rod, and adjust to a length of 41 mm between ball joint centres before fitting into the relay lever following by a 1.5 mm spacer and nylon nut. Fit the other end onto the motor rotary link arm(s) with the 12 mm spacer, and follow with a 1.5 mm spacer and nylon nut with the rotary link positive the downstop (rearmost stop on the pod mounting bracket) check the weight of the pod front edge. If necessary, adjust the length by altering the length of the pod link before tightening the ball joint locknuts ensuring that the ball joints are parallel to each other.

14. Fit and set the headlamp levers, and secure the harnesses to the back of the headlamps using 'P' clips as shown. Check the operation of the headlamps, and ensure that the harness is not strained, chafed or trapped at any stage of headlamp pod operation.



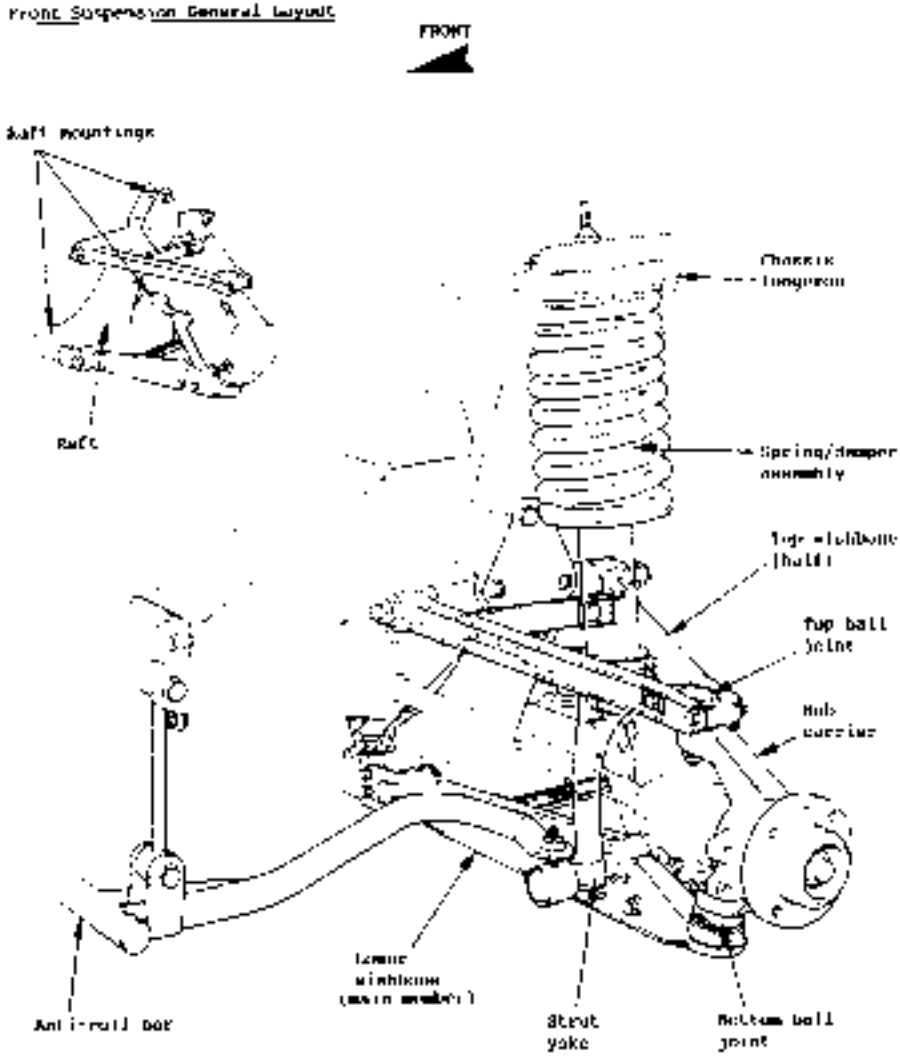
15. Adjust headlamp alignment using a beam setter.


Right Hand Side
Φ5mm
Φ32mm
Φ8mm
Φ8mm
Φ6.5mm
Left Hand Side
Φ5mm
Φ32mm
Φ8mm
Φ8mm
Φ6.5mm
Existing apertures
New apertures

FRONT SUSPENSION

SECTION CE - CLAN

Front Suspension General Layout



L2.1 - GENERAL DESCRIPTION

The front suspension comprises of upper and lower wishbones with co-axial coil spring/telescopic damper units and an anti-roll bar. The upper and lower wishbones on each side of the car are mounted on a separate cast alloy 'pick-up' (subframe) which is itself mounted to the chassis on three bonded rubber bushes, and helps to isolate the body from suspension noise and vibration, whilst maintaining accurate wheel control.

The inner ends of the upper and lower wishbones each carry two spring/damper units, one at the outboard end. The lower wishbone carries a separate tubular steel strut to which the lower ball joint is bolted. A separate tubular steel strut is bolted to this member, and then passes up to form a crossover. The upper wishbone comprises two similar pressed steel links, which engage at their outboard ends where they support the top steering swivel ball joints. Both upper and lower ball joints are sealed for life and have tapered studs which engage with tapered, keyhead fixing arms. The hydraulic dual spring/damper units have a two piece body to allow for lower end to be bolted to the wishbone. A tapered, knurled tubular steel coil spring locates on the damper body, and is supported by the upper and lower spring seats. The coil springs damper units are located at the upper end in the chassis turrets.

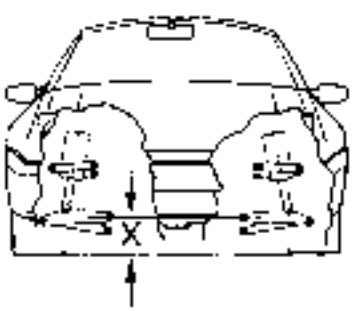
The inboard pivots of the upper and lower wishbones, take the form of bonded rubber bushes in longitudinal pivot axes. These bushes are anchored to separate cast aluminium alloy 'cradle' mounts each of which is bolted to the chassis at the longitudinal, lateral and torsion loadings give the front suspension its stability. Each cradle is mounted to the chassis by three bonded rubber bushes. The lower rear bushing has 'fail safe' anti-lock bushing having a greater rubber wall. The lower rear bush is bolted directly to the chassis crossmember, the lower front bush to the transmission underframe, and the top rear via sandwich plates to the chassis longerons. The swaybar is of the roll over bush type with a fairly soft 'A' rubber bush to control a steady ride. The small wheel is designed to move fairly slightly as the roll pivots about the upper and lower wishbone. This movement has only a minimal effect on the steering, but sufficient to ensure the quick and harmless transmission of the road to the driving pinion for a lively, positive feeling to the steering. In order to maintain an acute wheel control for optimum handling.

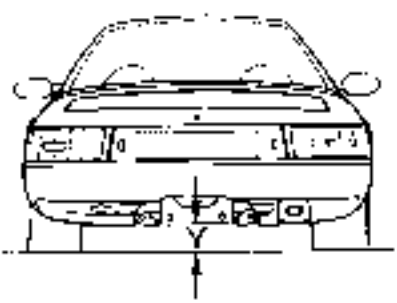
The hub carrier uses a single, double row ball bearing to support the wheel hub, into which is fitted the driveshaft.

L2.2 GEOMETRY

Ride heights at kerb condition (full fuel tank, no occupants)

front (X)	170 ± 7 mm	NOT ride height for
rear (Y)	167 ± 7 mm	quarterly check





Suspension unit pivot bolt:	Should be checked only at ride height
Tie rod ball joint:	30.4 ± 1 mm (1.197 ± .039 in)
	40.4 ± 1 mm (1.591 ± .039 in)
Camber:	0°30' ± 45'
Caster:	1°45' ± 45'
Steering axis inclination:	13°30'
Toe-in:	0 to 3 mm (0 to .118 in)
Wheel radius:	0.3 m

ride height - 210 mm (8.27 in)
- 200 mm (7.87 in)

unladen (with 75 kg driver)
unladen (1 gallon of fuel)

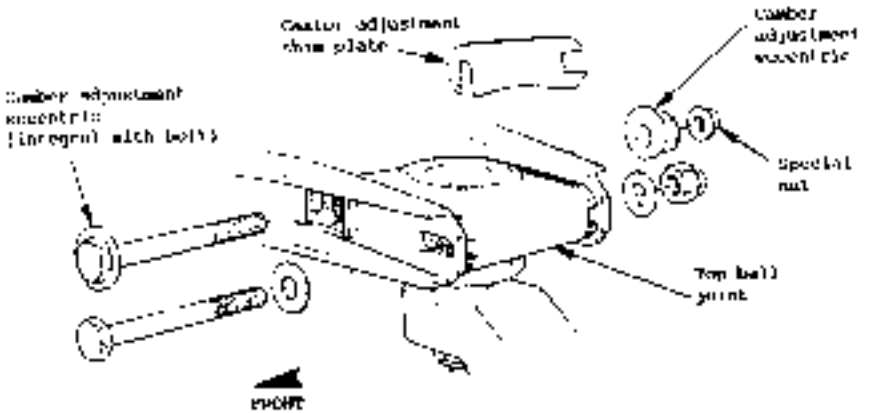
2. ADJUSTMENTS

Caster, camber and steering axis inclination should be checked and adjusted in the following order.

Caster and camber adjustments are carried between the top ball joint and the top suspension arm. A shim or shims (one shim must always be maintained) are placed between the ball joint and the arm to adjust as required. Incorporated in the shim pack is a cam which is used to adjust camber by approximately ±30'. Ensure the shim is fitted the correct way up so that the 'UP' mark is facing towards the shaft.

Camber adjustment is made by the adjustment of short eccentric bolts on the lower suspension arm. Two bolts are used to clamp the two halves of the top suspension arm together. Both bolts, which are fitted with special nuts, must be loosened before adjustment is made. Each bolt has a number of serrations (ridges) on the head which engage with the serrations on the suspension arm.

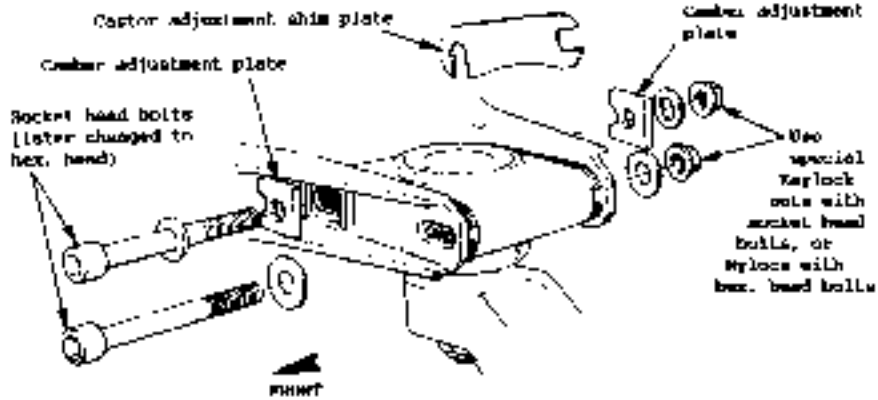
Caster adjustment is made by the addition or removal of shims between the top ball joint and the top suspension arm. Two shims are used to clamp the two halves of the top suspension arm together. Both bolts, which are fitted with special nuts, must be loosened before adjustment is made. Each bolt has a number of serrations (ridges) on the head which engage with the serrations on the suspension arm.



To check or adjust caster or camber, first slacken the special nut, and then slacken the nut on the inboard side of the bolt slightly. Turn the bolt (with integral eccentric) and rotate eccentric washer as necessary to increase or decrease camber. Ensure that both eccentrics are turned the same amount and that the position of one is marked

by the maker. A final adjustment of about 1° is available. On completion, torque both nuts to 22 - 25 Nm (16 - 18 lbf.ft).

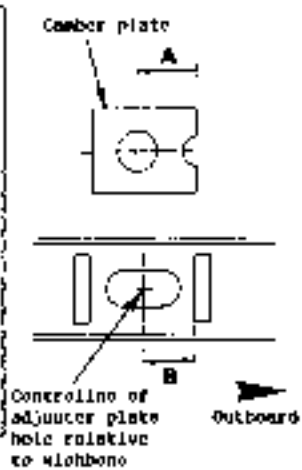
On later cars, camber adjustment plates are fitted between the guides at the top swivel joint inboard fixing. Four variations of plate provide seven settings according to the orientation of the plates, and allow for a camber adjustment range of about 3° in steps of just under ½°.



To make an adjustment on cars with camber adjustment plates, first establish the variation of plate fitted before selecting an alternative plate, and/or orientation, from the table below. Slacken the top swivel joint outer fixing, and remove the inboard fixing bolt. Fit the replacement adjuster plates into the guides on the top wishbone halves (making sure that the same plates are fitted at front and rear) and fit and tighten the fixings: Socket head bolts: 20 - 24 Nm (15 - 18 lbf.ft). Hex. head bolts: 22 - 25 Nm (16 - 18 lbf.ft). (Alternative)

Dimension 'A'	Part no. of plate	Plate orientation	Dimension 'B'
		Outboard →	
14.0 mm	RTC[illegible]111		1.0 mm
12.5 mm	ANR[illegible]110		2.5 mm
11.5 mm	ANR[illegible]109		3.5 mm
10.5 mm	ANR[illegible]108		4.5 mm
9.5 mm	ANR[illegible]107		5.5 mm
8.5 mm	ANR[illegible]106		6.5 mm
7.5 mm	ANR[illegible]105		7.5 mm

Decreasing camber angle



Earlier cars with eccentric adjusters may be fitted with the later type rear adjuster plates, but only in conjunction with the inboard and outboard rear wishbone fixing bolts, nuts and washers, and the higher fixing torque (see above).

Toe-out: To adjust the toe-out, hold each track rod end by the flats provided (22 mm) whilst releasing the locknut. Turn each track rod, using the flats provided (17 mm) on FOUR mount, to adjust the effective track rod length as necessary. When adjustment is correct, hold the track rod end and tighten the locknut to 40 Nm (30 lbf.ft)

2.0 - SUSPENSION DISASSEMBLY

If the complete suspension assembly is to be removed from one side of the car in order to provide access, or for other work in that area to be performed, the complete wishbone/hub carrier assembly may be removed by releasing the ball joint pin from the chassis:

Complete Suspension Assembly

1. Track Rod End: Remove the nut securing the track rod end to the steering arm, and use a ball joint separator to release the joint.

2. Driveshaft & Brake Caliper: Unpeen, remove and discard the hub nut. Release the brake caliper from the hub carrier, and the flexible hose from the top wishbone, and support clear, without straining the hose.

3. Strut Yoke: Release the end of the anti-roll bar from the strut yoke, and whilst supporting the weight of the suspension, release the nut and withdraw the bolt securing the strut yoke to the lower arm. Release the bolt to fit, and remove the two halves of the yoke from the suspension strut.

4. Driveshaft & Brake Caliper: Unpeen, remove and discard the hub nut. Release the brake caliper from the hub carrier, and the flexible hose from the top wishbone, and support clear, without straining the hose.

5. Top Ball Joint: Release the three bolts securing the driveshaft plates to the top of the ball, and the single bolt through the top wishbone. Remove the two plates.

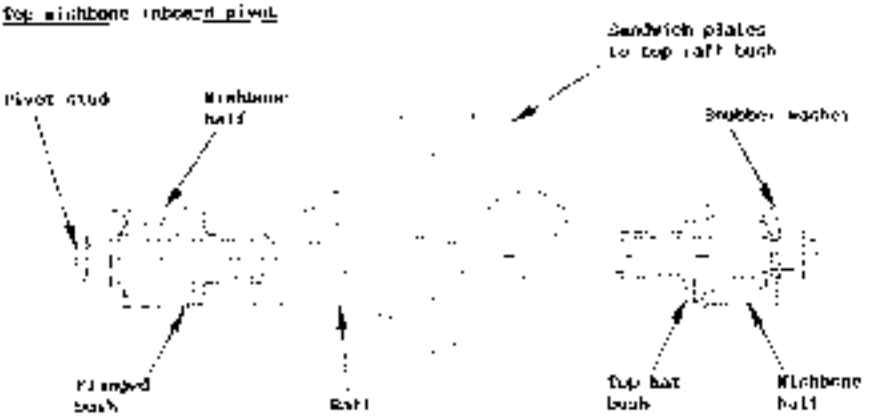
6. Lower Ball Joint: Release the ball lower front mounting bolt, and lower rear mounting bolt. Push the driveshaft out of the hub, and withdraw the complete wishbone suspension assembly from the car. Note: take care not to 'stretch' the driveshaft, and pull apart the inboard joint.

Spring/Damper Assembly

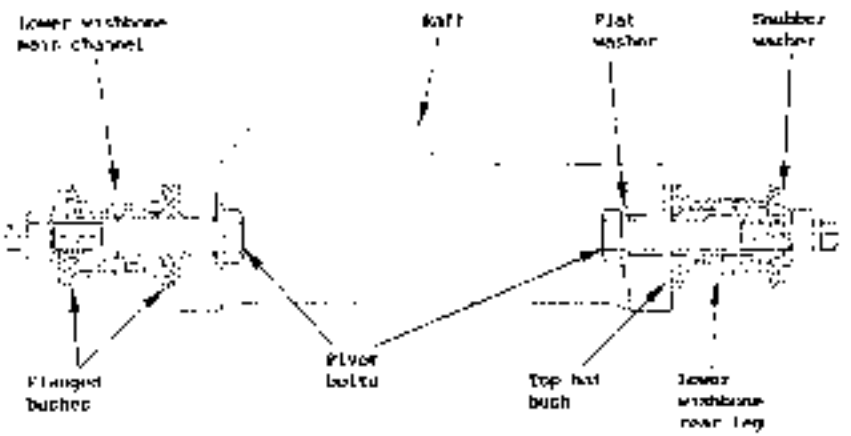
The spring/damper assembly uses a spring top seat which is bolted to the chassis, and also retains the top of the damper strut. This allows the complete assembly to be withdrawn from the vehicle without the use of spring compressors: With the suspension 'hanging', release the yokes from the lower end of the damper body, and remove the three nuts securing the spring top seat to the chassis. Withdraw the damper and spring assembly. Do NOT remove the damper shaft top nut without first fitting spring compressor clamps.

Before re-assembling the unit, ensure that the damper strut rubber bushes, and the spring top rubber seat are in good condition. Replace if necessary. Pay careful attention to the correct location of the damper strut bushes and washers -

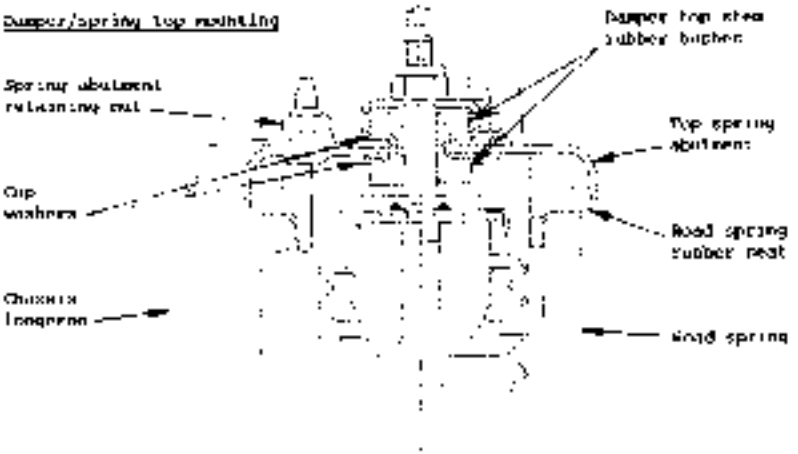
Top wishbone inboard pivot



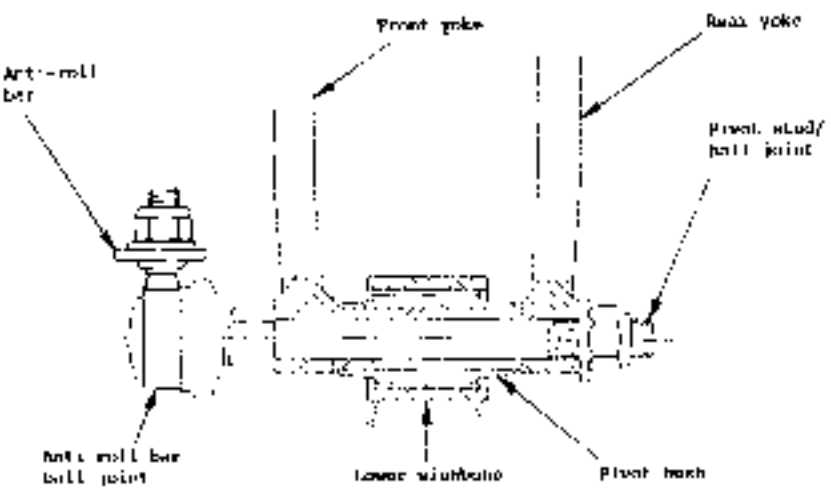
Lower wishbone inboard pivot



Damper/spring top mounting



Spring/damper assembly to lower wishbone



...refer to the illustration. Hold the top of the stem whilst torque tightening the stem nut to 20 - 30 Nm (15 - 22 lbf.ft).

Bush Replacement

1. Lower Wishbone: The inboard (front) end of the lower wishbone (in both coil link, and tubular steady link) are split, flanged sleeve, bonded rubber bushes, which may be driven or pressed from the wishbone before new (they are pressed into position).
The sleeved bush for the suspension strut to lower wishbone may be replaced using a press with a suitable sleeve tool.

2. Top Wishbone: The inboard end of each top wishbone half, is fitted with a flanged sleeve bonded rubber bush which may be replaced using a press. Note that the bush is fitted from the inside of the car.

3. Rear: The rear front bush is a split, flanged sleeve type, which may be pulled out, and new bushes pressed in.
The rear rear bush is a single flanged sleeve type, fitted rear below.
The rear top mounting is a split, flanged sleeve, bonded rubber bush, pressed into the mounting longeron, and may be removed by drawing/pressing out each half of the bush in turn.

J8.5 - SUSPENSION RE-ASSEMBLY

Note the following points when re-assembling the suspension.

i) Use a copper based grease on the shank of the top wishbone to ball fixing stud to prevent corrosion, and aid subsequent disassembly. Thoroughly degrease the threads before fitting the nylon nuts.

ii) Tighten the wishbone pivot bolts and dampers to lower wishbone fixing bolt ONLY with the car at normal ride height, otherwise the bonded bushes will be pre-loaded, resulting degraded ride quality, premature wear and increased ride height.

iii) Pay care! - attention to the correct assembly of the rubber washers and ensure that the steel inserts are fitted into the alloy suspension carrier at the wishbone pivot points.

iv) Note that on vehicles fitted with ball joints the seals of the upper and lower swivel joint nuts, or the track rod end ball joints for **it is most important that the ball joint nuts are correctly torqued,** especially the lower ball joint to which an over ended torque wrench must be used, or alternatively, remove the drive shaft to allow access with a socket wrench.

v) When assembling the bottom wishbone, torque tighten the two bolts securing the tubular arms to the main member before tightening the two fixings securing the bearing chassis. Note that on later cars with 15" wheels, the inboard of the two main fixing points, is renewed to take a 7/16" UNF bolt rather than the M10 bolt used on other cars.
Similarly, on cars with 13" wheels and some 15" wheel cars with a top wishbone bearing channel, tighten the wishbone or top valve, joint bolts, before tightening the bearing channel bolts.

vi) After re-assembly, carry out a geometry check, and make any adjustments as necessary as detailed in CF.1

vii) Refit the brake calipers (see section JR.15).

viii) Torque tighten all fixings as below.

ix) Tighten the nut to chassis front crossmember strut (both ends), with the vehicle weight supported on the wheels.

Torque Settings	Nm	lbf.ft
1. Raft top mounting bolt	75 - 80	55 - 59
2. Sandwich plate to raft	22 - 25	16 - 18
3. Raft front and rear mounting bolts	75 - 80	55 - 59
4. Top wishbone inboard pivot	55 - 58	41 - 43
5. Top wishbone to ball joint		
- eccentric camber adjusters	22 - 25	16 - 18
- square plate camber adjusters	39 - 39	29 - 29
6 Top wishbone bracing channel	45	33
7 Lower wishbone inboard pivot bolt	68 - 72	50 - 53
8. Lower wishbone inboard pivot end plate	22 - 25	16 - 18
9. Lower wishbone strut to main member - M10	41 - 45	30 - 33
- 7/16" UNF	61 - 81	45 - 60
10. Lower wishbone bracing channel	30	22
11. Suspension strut yoke to lower wishbone	105 - 110	77 - 81
12. Ball joint to anti-roll bar	25 - 27	18 - 20
13. Damper top mtg nut	20 - 30	15 - 22
14. Yoke to damper	35 - 38	26 - 28
15. Spring top seat to chassis	22 - 25	16 - 18
16. Lower swivel joint to hub carrier	61 - 67	45 - 49
17. Top swivel joint to hub carrier	61 - 67	45 - 49
18 Track rod end to steering arm	58 - 64	43 - 47
19 Driveshaft to front hub	225 - 235	166 - 173

Note - HUB BEARING REPLACEMENT

1. Hub Nut: Unpeen, remove and discard the hub nut.

2. Brake Caliper: Prise off the dust caps covering the ends of the two caliper sliding pins, and remove the two socket head bolts securing these pins, and the brake caliper, to the hub carrier. Support the caliper clear of the brake disc without straining the flexible hose.

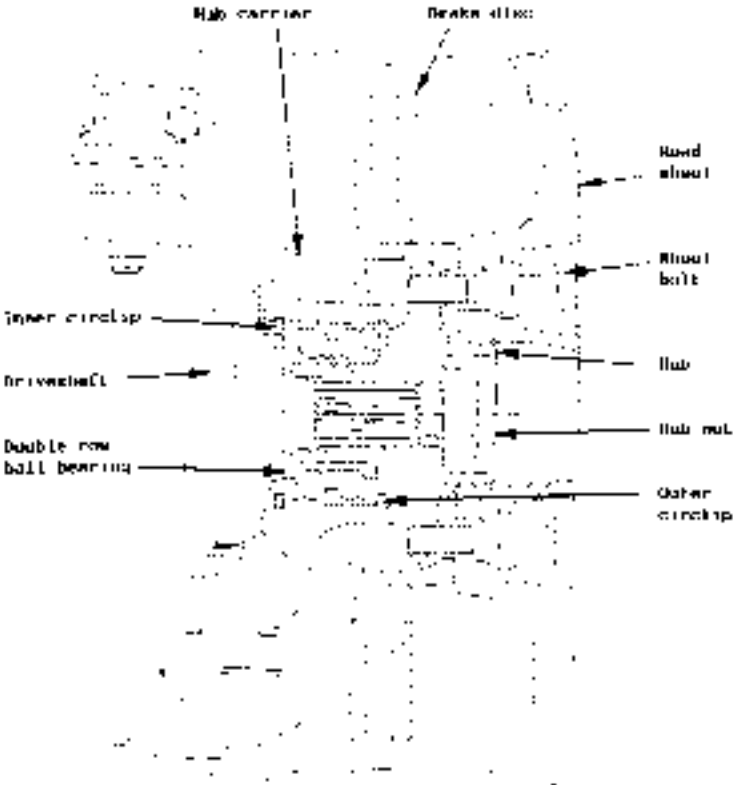
3 Brake Disc: Release the single screw securing the brake disc, and withdraw the disc from the hub.

4. Ball Joints: Separate the steering track rod end, and top and bottom swivel joints from the hub carrier, by removing the ball joint nut, and using a suitable ball joint splitter tool.

5. Hub Carrier: Press the driveshaft out of the hub so the hub carrier assembly is removed to the bench. Take care not to 'stretch' the driveshaft, and pull apart the inboard C.V. joint.

6. Hub & Bearing: Use a split collar tool to support the hub carrier on a hydraulic press, and press the hub from the bearing. Remove the two circlips securing the bearing in the hub carrier, and press out the bearing outer race.

7. Assemble Hub: Fit the outer circlip into the hub carrier, and press the hub bearing, via the outer race, into the hub carrier. Fit the inner circlip. Press the hub bearing, via the inner race, onto the hub.



5. Refit the driveshaft. Refit the hub carrier assembly, the correct procedure are noting the following points:
   - Use a new hub nut and peen into the driveshaft slot after torque ç.
   - Use an open ended torque spanner to tighten the top and bottom bolt, first nuts to their specified torque.
   - Fit new dust caps over the brake caliper mounting bolts/drilling pins
   - Refit the brake caliper (see section 2B.5).
   - Tighten all fixings to the specified torque

REAR SUSPENSION

SECTION 12 REAR

Coil spring
Top Link
Chassis rear crossmember
Telescopic damper
Anti-roll bar
Hanging link
Lower wishbone

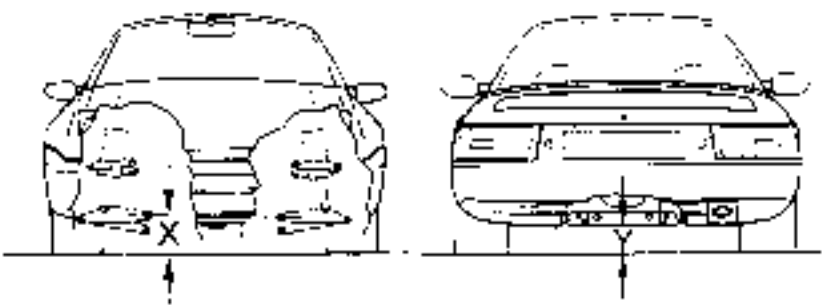
1.0 GENERAL DESCRIPTION

The rear suspension consists of a wide based lower wishbone, a single top link, a combined coil spring/telescopic damper unit and an anti-roll bar. The pre-welded fabricated steel lower wishbone locates the lateral loads and brake torque into the chassis, while also carrying the rear wheel bearings. The single mounting location for each upright wheel carrier the telescopic damper unit between the lower wishbone and the chassis, and incorporates the coil spring lower seat. The upper end of the spring seats against the damper top mounting via a cup and bolt assembly which is secured to the top of the damper body. The anti-roll bar is suspended forward of the rear axle line on two mounting links, and connects with the lower wishbone via a pair of links.

A hydraulic disc brake is fitted to the outboard side of each rear hub, which is splined and supports the rear hub, which is splined and supports the brake disc on a pair of taper roller bearings, not usable for any other.

2.0 GEOMETRY

Ride height at kerb weight (full fuel tank, no occupants)	
- front (A)	152 ± 2 mm | MOT ride height for
- rear (X)	164 ± 2 mm | geometry check



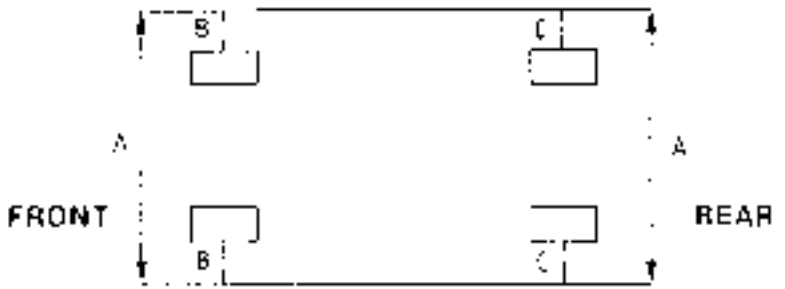
Suspension geometry should be checked with a mid-laden ride height.

Ride height - front (A)	152 ± 2 mm mid-laden (with ½ kg driver
- rear (X)	164 ± 2 mm mid-laden + ½ tank of fuel
Camber	-½° ± ½°
Toe-in	1.5 ± 1.0 mm each side

It is essential that rear wheel alignment is checked using equipment which measures individual wheel alignment. The most reliable and accurate method is considered to be the use of parallel beam gauges or follower.

Set bars which are longer than the overall length of the car and which stand away from it. The bars should be mounted securely and should be at 0° or square to the car. Ideally, a mid-set should avoid significant bending or sagging between supports.

Set up the two bars on each side of the car at wheel centre height as shown in the diagram, so that B equals D and C equals E.

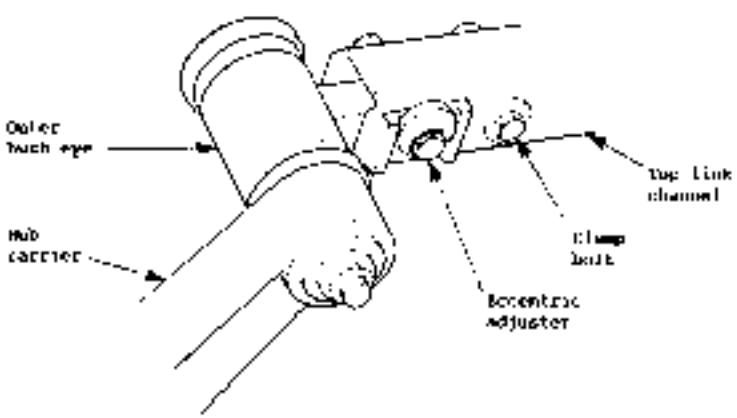


Measure the distance from the bar to the RIM of the wheel, remember to measure to the centre line of the wheel. If the front dimension is greater than the rear dimension, the wheel has TOE-IN. If the rear dimension is greater than the front dimension, the wheel has TOE-OUT. The difference between the two measurements is the amount the wheel is TOE-IN or TOE-OUT.

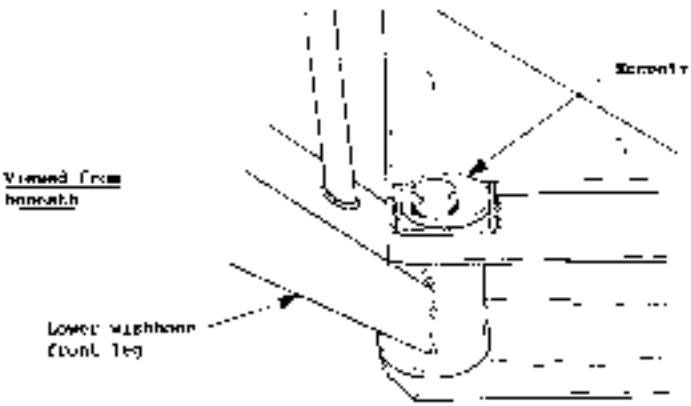
HD 1 - ADJUSTMENTS

Camber and castor are adjustable.

Camber adjustment is made by the adjustment of wheel camber at the top link. The top link consists of an inverted U-section channel welded to the outward bracket, and a separate rod end with a ball eye bolted to the centre with two 5/16in. BSF bolts and a slotted hole in the channel section, with an eccentric adjuster incorporated at the outboard fixing. This bolt has an integral washer under the head which locates between two vertical guides on the front side of the channel. Plain washers and lock nuts are fitted to both bolts on the over side of the link, and a plain washer between the head of the inboard bolt.



To refit, reverse the removal procedure, but before tightening the lower wishbone front fixing bolt, set the ride height to 150 mm (6 in) measured between the centre of the hub and the underside of the wheel arch. Tighten the bolt to 110 - 120 Nm (80 - 90 lbf.ft).



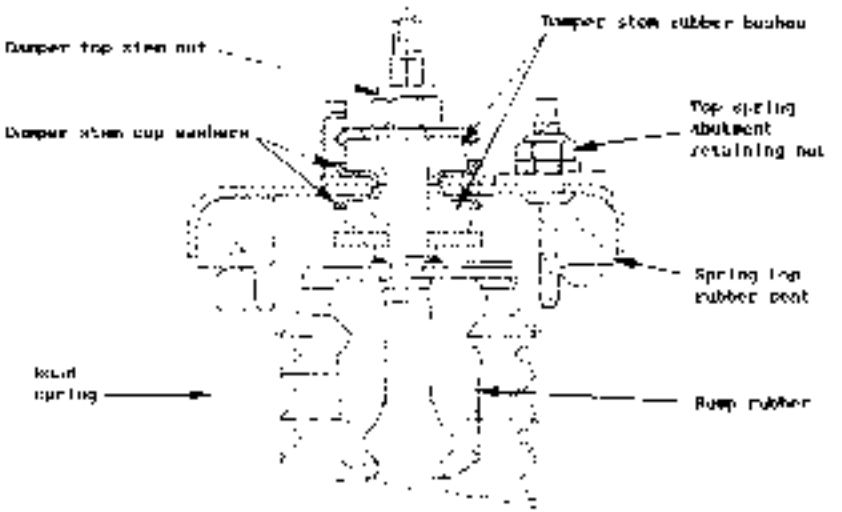
110.4 - SUSPENSION DISASSEMBLY

The suspension strut assembly must be removed from the chassis before attempting to dismantle it. Refer to Section 110.3 for details of removing the strut assembly.

- Support the weight of the suspension and remove the bolt securing the lower end of the damper to the lower wishbone.
- Remove the damper from within the boot, and release the three nuts securing the spring top seat to the chassis. Withdraw the complete spring/damper assembly.
- Do not release the damper piston rod at either lever fitting spring compressor clamps.

Before re-assembling the unit, ensure that the damper stem rubber gaiters and the spring top rubber seat are in good condition. Replace if necessary. Pay careful attention to the correct location of the damper stem pushes and washers. Tighten the top nut (see strut torque tightening sequence) to 30 - 40 Nm (15 - 20 lbf.ft).

Note that if the lower wishbone is to be removed, the brake hose between chassis and wishbone should first be capped off, and then disconnected from the wishbone.

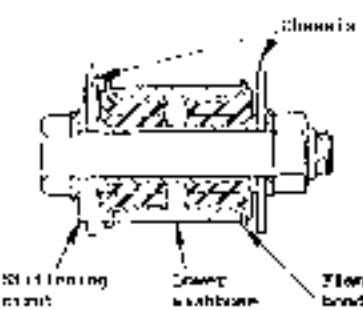


Hub Replacement.

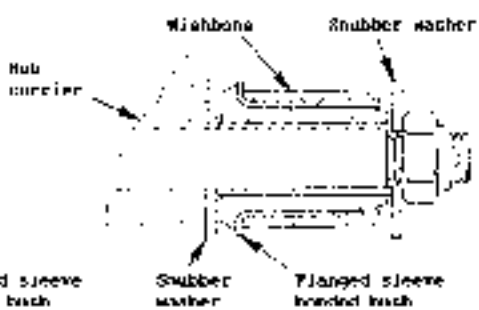
1. Lower wishbone inner bush. Bolt inboard pivot of the lower wishbone to front upper pivot of flexed chassis bonded rubber bushes, which may be found at position. New bushes may be pressed into position. Bolt bush to front pivot bush as normal, load triangle and tow over soft bush whilst

2. Lower wishbone outer bush. Each wishbone pivot of the lower wishbone is fitted with a rubber flanged sleeve moulded pivot bush, which may be replaced with a press. Note that the bush is fitted from the inside of the wishbone.

Lower wishbone inner bush



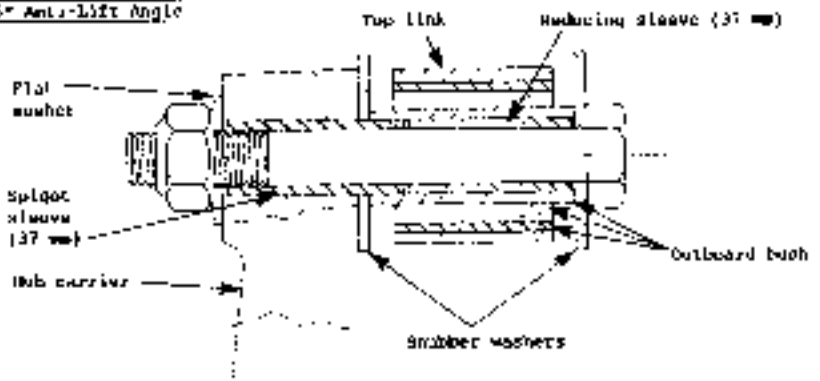
Lower wishbone outer bush



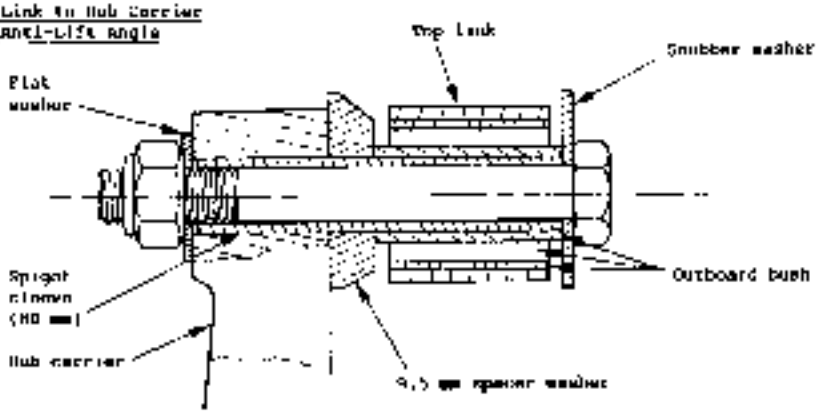
c. Stage 1 Lower Cars: The bonded rose & outer sleeves bonded rubber bush at its inner end, which may be replaced using a press.

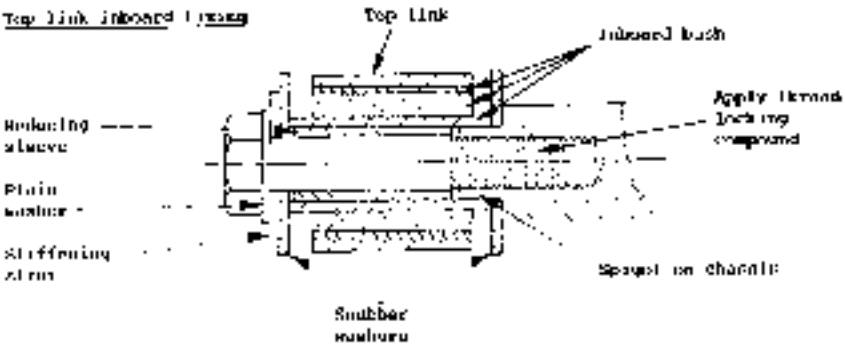
d. The Anti Roll Bar: Note that the two clamps are 'handed' at both inner and outer ends, and can wear unevenly, each of the bonded rubber bush halves is located by a spigot.
At the inboard end, a square, pressed into the chassis, and onto the end of the top link bush, with a reducing sleeve within the bush to provide the diameter for the fixing bolt.
At the outboard end, a spigot sleeve is fitted into the hub carrier bore, and projects into the top radius to spigot into the top link bush. The end fixing is a flat washer arrangement clamped by the nut and bolt.
Both bushes may be removed using a press, but do not forget to fit the reduction sleeve into the inside bush where appropriate.

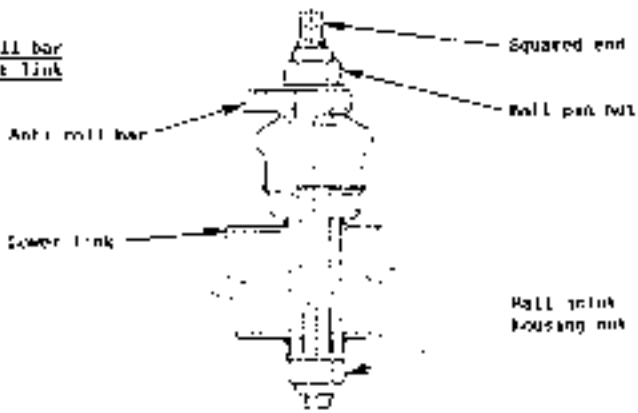
Top Link to Hub Carrier
5° Anti-Lift Angle



Top Link to Hub Carrier
21° Anti-Lift Angle







[illegible]

Check of Anti-Lift Angle

The angle between the Anti-clockwise inboard pivot axis and the horizontal [illegible] is referred to as the anti-lift angle. This [illegible] for all 110 models, and as a [illegible] on 90 models [illegible], **exclusive** [illegible].

[illegible] to establish the type of chassis fitted before replacing [illegible] components as the following parts are different for the [illegible] variants:

- Lower wishbone.
- Top link inboard pivot bracket.
- Top link outboard pivot fixings.

[illegible] to check [illegible] chassis number plate [illegible] on the [illegible] of the chassis [illegible] to the chassis [illegible].

Early 5" type straight channel Later 6½" type - cranked channel

The 5½" type wishbone is identified by a blue paint mark on the upper surface of the wishbone front lug, and the 6½" stiffening strut by either a blue centre band, or a white paint spot on its lower end. At the outboard end of the top link, the 6½" assembly uses an 83 mm long pivot sleeve running through the hub carrier and link ears, and a 9.5 mm spacer to maintain clearance between the stiffening and top link - see sectional diagrams.

Note the following points when re-assembling the suspension:

i) Copper Grease: Use a copper based grease on the shank of the lower wishbone outboard pivot bolt to prevent corrosion, and aid subsequent disassembly. Ensure the threads are thoroughly re-greased before fitting the nylon nuts.

ii) Pivot Bolts: Tighten the lower wishbone pivot bolts, top link pivot bolts, and damper to wishbone bolt, ONLY with the car at ride height, otherwise the bonded rubber bushes will be pre-loaded, resulting in degraded refinement, premature wear and incorrect ride height.

iii. Bushes Washers: By careful attention to the correct assembly of the bushes washers. Refer to the sectional diagrams.

iv) Top link Outboard Pivot: Establish the lower wishbone anti-lift angle (see above) to ensure that the correct type of bushes are used at the outboard end of the top link. Refer to the sectional diagrams.

v) Top link Inboard Pivot: Check that the retaining sleeve is fitted into the bush, and that upright on the chassis projects into the bush inner sleeve. Unless removing the pivot bolt, apply thread locking compound to the thread, and fit through the stiffening strut and rubber washer before entering the bush and chassis.

vi) Anti-Roll Bar to Lower Wishbone: Fit and tighten the ball joint into the lower wishbone, before fitting the anti-roll bar onto the bolt joint. Hold the squared end of the ball pin whilst tightening the upper nut.

vii. Geometry Check. After re-assembly, carry out a geometry check, and make any adjustments as necessary as detailed in GR.4.

viii) Brakes. Refit the brake calliper referring to section 16, and pump the brake pedal after re-assembly to restore pad position.

ix) Tighten all fixings to the specified torque loading.

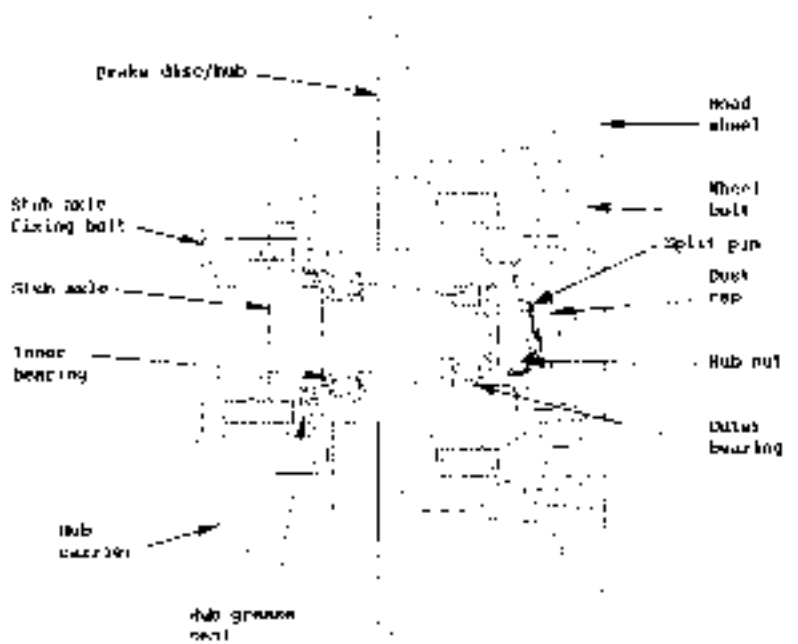
Torque Settings	Nm	Lbf.ft
1. Damper top stud nut	20 - 30	15 - 22
2. Spring cup seat to chassis	42 - 47	31 - 35
3. Damper to lower wishbone	68 - 77	50 - 57
4. Top link, outboard* and inboard**	75 - 90	55 - 66

Torque Settings	Nm	lbf.ft
Top link ball pin bolt	37 - 44	27 - 32
Front axle pivot pin bolt	47 - 54	34 - 40
Front axle to front axle beam*	81 - 102	60 - 75
Radius rod to chassis bolt	78 - 90	57 - 66
Rear pto cap bolt - to fit to rear axle	75 - 90	55 - 66
Lubricate top link pins	20 - 25	15 - 18
Oil nut	see page	
Drive axle to hub retainer*	81 - 102	60 - 75
Rear axle flange to hub retainer**	81 - 102	60 - 75
Brake calipers to axle housing bracket	100 - 120	74 - 89

* Tighten early as it is to be set.
** Apply thread locking compound to screw threads before tightening.

Front hub assembly

Exploded view to show the relationship of the bearings, which are adjustable for endfloat.



Refitting:

- Press out the dust cap from the hub centre.
- Remove the split pin and tighten the hub nut to 35 Nm (26 lbf.ft) whilst rotating the wheel to settle the bearings.
- Slacken the nut, and re-tighten using fingers only.
- If necessary, tighten further, the smallest amount necessary to insert the split pin, bending the short end over the nut, and the long end over the end of the axle.
- Refit the hub dust cap.

Replacement:

1. Brake Caliper: Release the two brake caliper retaining bolts, and support the caliper clear of the brake disc, without straining the flexible brake hose.

2. Brake Disc/Hub: Prise out the hub dust cap, pull out the split pin and remove the hub nut and washer. Withdraw the assembled hub and brake disc.

3. Seal & Outer Races: Prise out the hub oil seal. Use a soft metal drift to knock out both the outboard bearing races from the hub. Purpose provided in the bearing recesses in the hub for this purpose.

4. Inner Race: Pull the inboard inner race from the stub axle using a suitable puller.

5. Stub Axle: If necessary, unbend the four bolts securing the stub axle to the hub carrier, and withdraw the axle.

6. Re-assembly: When refitting the stub axle, ensure that the correct surfaces of the stub axle flange and hub carrier, and the threads and clamping surfaces of the fixing bolts, are all scrupulously clean. Unless removing the bolts, apply thread locking compound before fitting and torque tightening the four bolts (see table at above).

7. Outer Races & Lubrication: Clean the bearing recesses in the hub before pressing the new races into position (correct way round!). Pack the hub bearings with a lithium base wheel bearing grease, working into the roller cages. Coat the inside of the hub, outer races and dust cap with grease. Fit the inboard bearing cartridge and inner race and retain in position by smearing in the new grease seal.

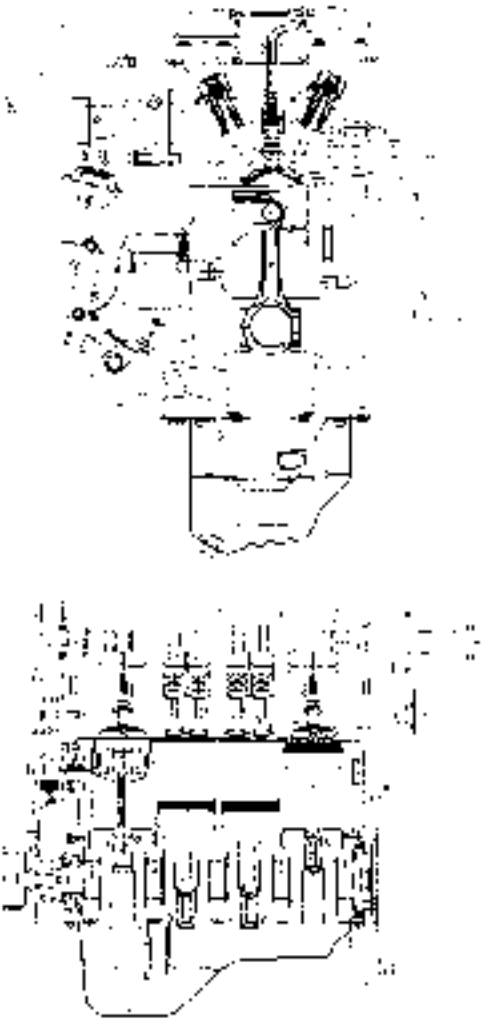
8. Hub Assembly: Fit the hub onto the axle, followed by the outboard inner race, washer and hub nut. Tighten the hub nut as detailed above, and fit the split pin and dust cap.

9. Brake Caliper: Refit the brake caliper, and torque tighten the two fixing bolts (see above). Pump the brake pedal to restore brake pad position.

10. Tighten all fixings to the specified torque loading

INDEX

SECTION EC - PUMPS



12.1 - GENERAL DESCRIPTION

Note: The terms 'front', 'rear', 'right' and 'left' when used in connection with a transversely mounted engine can cause some confusion. To overcome this, wherever these terms are used in conjunction with the word 'engine', the description relates to the orientation of the engine in the car. The left hand end of the engine refers to the flywheel end. However, when referring to individual components of the engine, such as cylinder head, block, crankshaft etc., the terms are used in accordance with the vehicle. Directly behind the flywheel end of the engine is mounted an oil pump. Driven from the left hand end of the crankshaft is the timing belt which drives the camshafts.

The transversely mounted 'XKDT' engine used in the Range Rover is a 90° V8 unit of 3,947 cc capacity. It has an aluminium alloy cylinder block and light alloy cylinder heads with wet cylinder liners. Each cylinder head is fitted with two valves per cylinder in a staggered formation. The valves are operated by twin overhead camshafts driven from the front end of the crankshaft by a single row endless synthetic belt. The inverted tucker type valves operate directly in the cylinder heads and without the need for rocker assemblies or cam followers. The valve seats are machined from solid to provide a long service life. Valve guides are fitted with integral oil seals.

Forged steel connecting rods are fitted with two bolt caps and horizontally split big end bearings. The gudgeon pins are retained by circlips in the pistons. The pistons are of light alloy construction and have two compression rings and one oil control ring. The gudgeon pins are fully floating and are retained by circlips in the pistons. The five bearing crankshaft is supported in the cylinder block by five main bearings. Thrust washers are fitted to the rear main bearing to control crankshaft end float. The crankshaft is balanced dynamically and statically and is fitted with a vibration damper at the front end. Drive for the camshafts is taken from the front end of the crankshaft by a single row endless synthetic belt. The belt also drives the water pump and the alternator.

A centrifugal water pump mounted on the front face of the block is driven by the toothed cam belt. The engine thermostat is of the wax pellet type and is housed in the water outlet elbow at the front of the cylinder head.

The lubrication system is of the wet sump type with a capacity of 12 litres (21 pints) including the filter. An oil pump mounted on the front face of the engine is driven by the crankshaft. The oil pump draws oil from the sump through a strainer and delivers it to the oil filter. From the filter the oil passes to the main oil gallery in the cylinder block. From the main gallery oil is fed to the main bearings, camshaft bearings and the tensioner pulley. Oil is also fed to the big end bearings via drilled passages in the crankshaft. Oil is fed to the valve gear via drilled passages in the cylinder heads and hollow pushrods. Oil is returned to the sump by gravity.

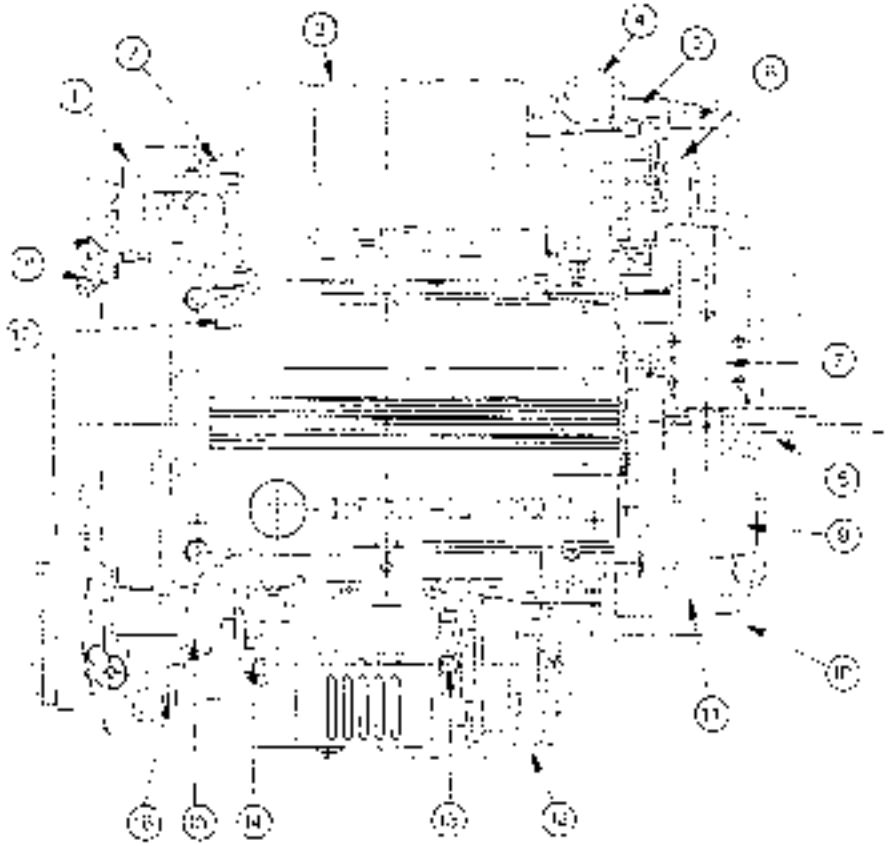
The fuel system is comprised of a steel fuel tank, a mechanical fuel pump, a fuel filter, a carburetter and the necessary pipes and hoses. The fuel tank is mounted under the rear of the vehicle and has a capacity of 82 litres (18 gallons). The fuel pump is mounted on the front face of the engine and is driven by an eccentric on the camshaft. The fuel filter is mounted on the front face of the engine. The carburetter is mounted on the inlet manifold and is a single unit with two barrels. The primary barrel is a fixed choke type and the secondary barrel is a variable choke type. The carburetter is fitted with a manual choke control.

The ignition system is comprised of a distributor, ignition coil, ballast resistor, sparking plugs and the necessary wiring. The distributor is mounted on the front face of the engine and is driven by the camshaft. The distributor is fitted with a centrifugal advance mechanism and a vacuum advance mechanism. The ignition coil is mounted on the front face of the engine. The ballast resistor is mounted on the front face of the engine. The sparking plugs are mounted in the cylinder heads.

The exhaust system is comprised of cast iron exhaust manifolds, a front pipe, a centre silencer, a rear silencer and the necessary tail pipe. The exhaust manifolds are mounted on the cylinder heads. The front pipe is connected to the exhaust manifolds and to the centre silencer. The centre silencer is connected to the front pipe and to the rear silencer. The rear silencer is connected to the centre silencer and to the tail pipe. The tail pipe is mounted on the rear of the vehicle.

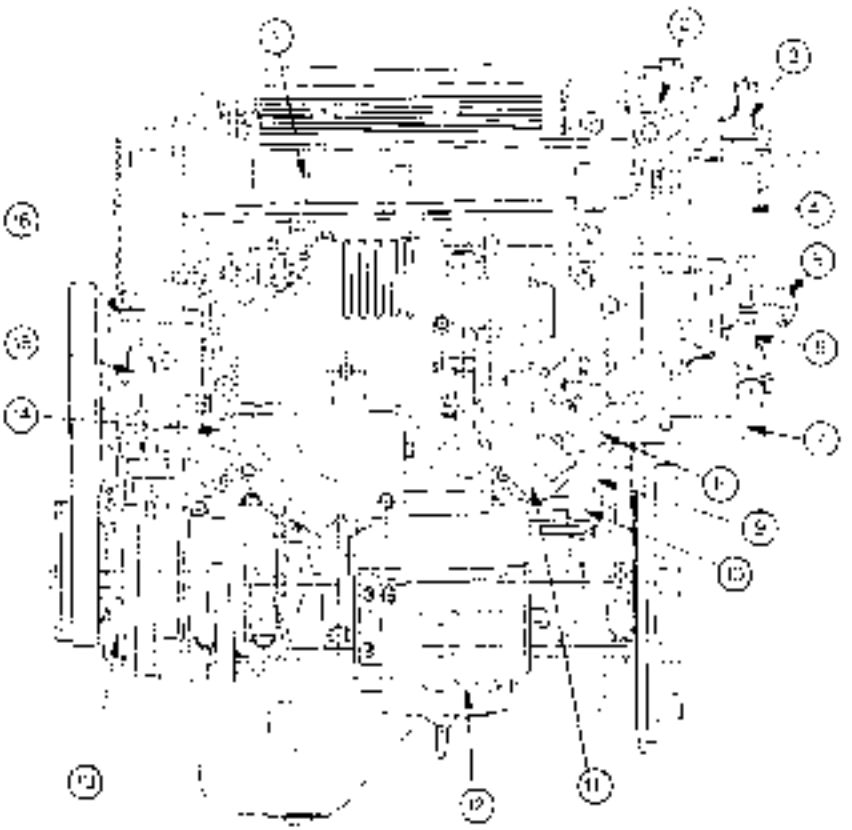
The emission control system is comprised of a catalytic converter, an air injection system and the necessary pipes and hoses. The catalytic converter is mounted on the front face of the engine. The air injection system is mounted on the front face of the engine. The air injection system is connected to the exhaust manifolds and to the catalytic converter. The air injection system is controlled by the engine management system.

4XE1 16V TURBO ENGINE PLAN VIEW



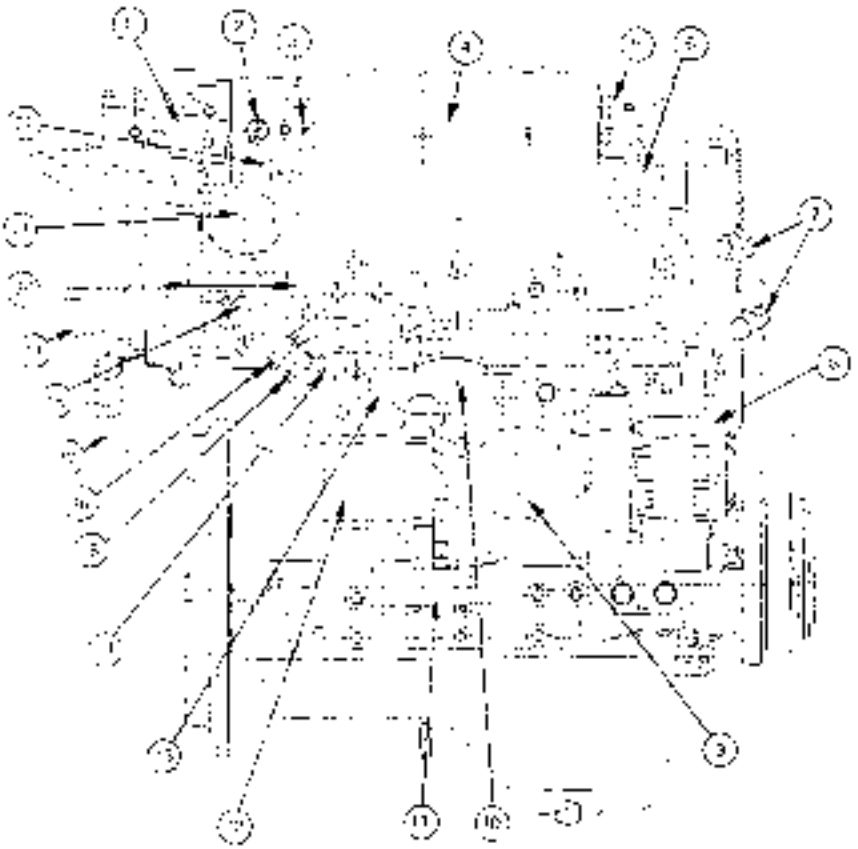
1. Alternator
2. PAS pressure switch (Sigma)
3. Engine breather breather pipe
4. Solenoid idle speed control (ISC) valve
   Throttle position sensor (TPS)
5. Air temp (throttle body)
6. Coil (ignition) (three coils)
7. Throttle housing water
8. EAC angle sensor (distributor on M.A.P.)
9. Radiator bypass water pipe
10. Water valve feed pipe
11. Wastegate actuator
12. Turbo oil feed
13. Water temp sensor
14. Water pump drive pulley
15. Air conditioning compressor
16. Positive Crankcase Ventilation (PCV) valve
17. Fuel cooler hose connections

4XE1-NT TURBO ENGINE FRONT SIDE

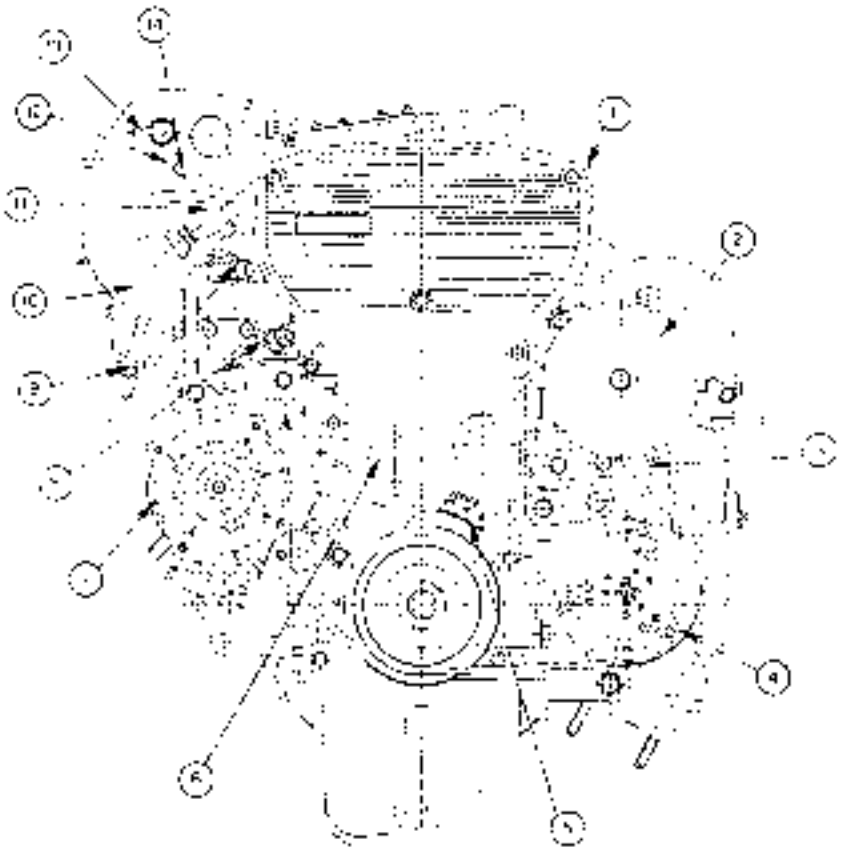


1. Dipstick
2. Primary throttle position sensor
3. Oil separator (Turbo only)
4. Cam sensor (distributor on 4XE1)
5. Thermostat housing outlet
6. Turbo water feed hose
7. Radiator bypass water pipe
8. Turbo water return hose
9. Turbo oil feed pipe
10. Turbo oil drain hose
11. Turbo compressor outlet
12. Knock sensor mounting (Turbo only)
13. Air conditioning compressor
14. Water pump inlet pipe
15. PAS pump inlet connection
16. PAS pump outlet connection

4G63-MT TURBO ENGINE REAR SIDE

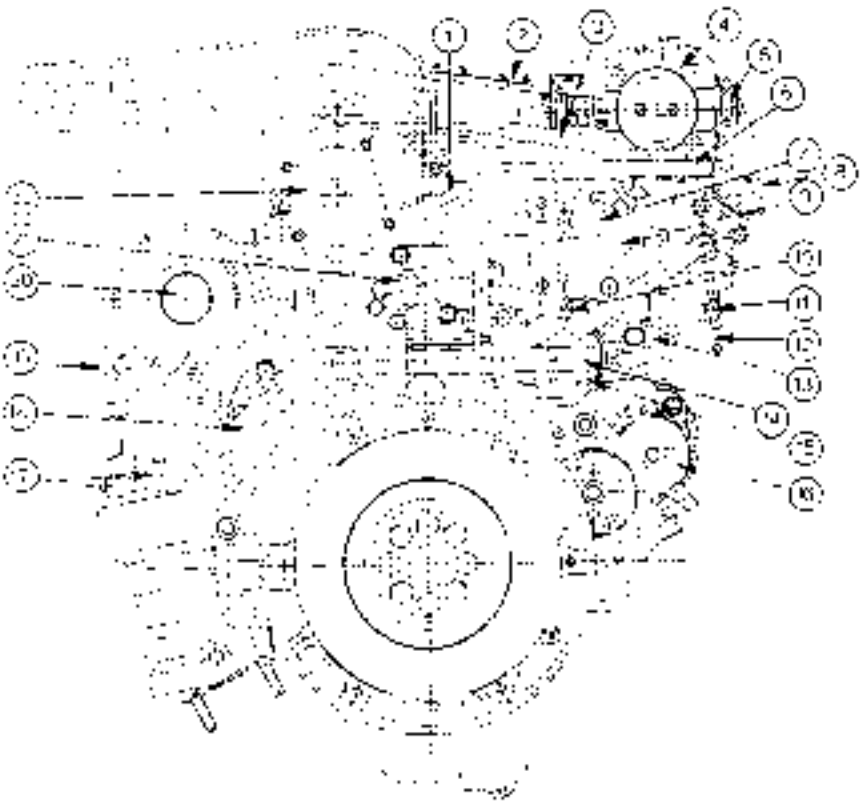


4XE1 MT TURBO ENGINE RIGHT HAND VIEW



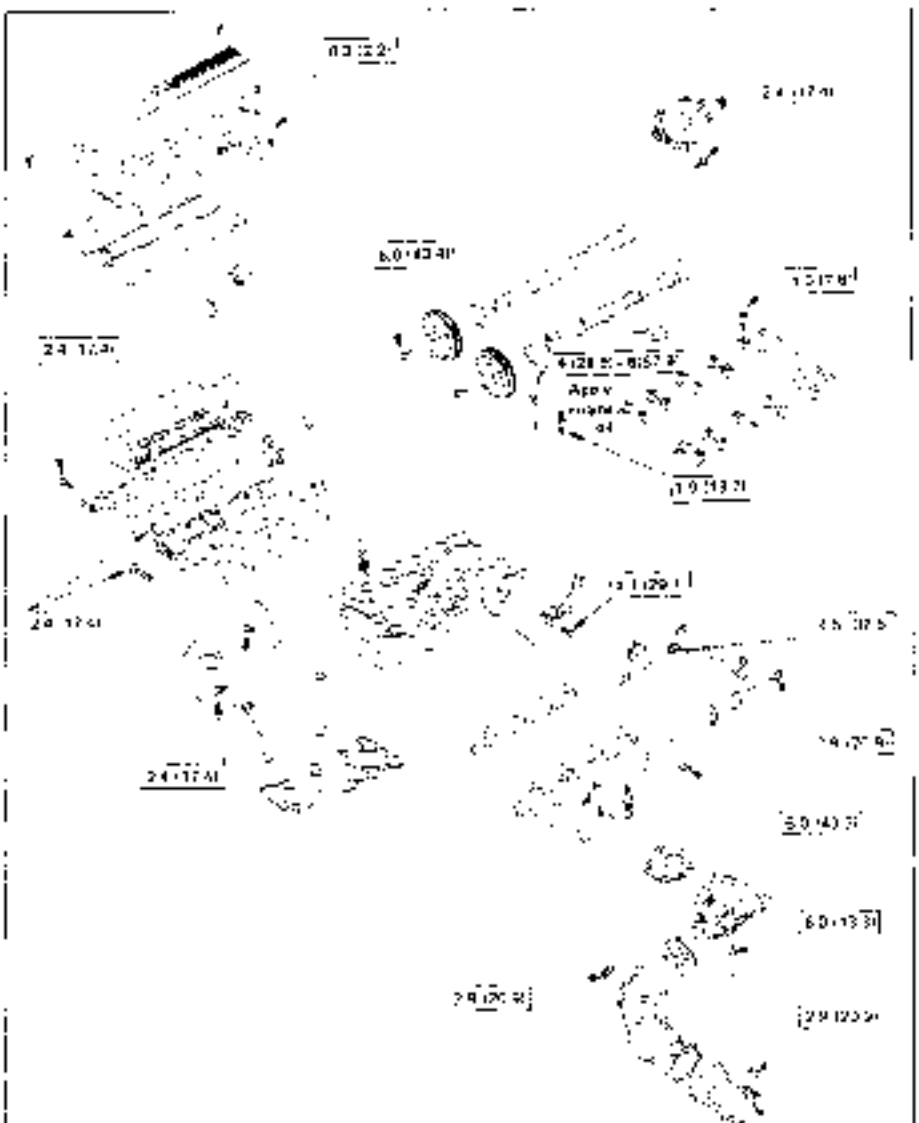
1. Dipstick
2. PAS pump pulley
3. PAS pump adjusting strap
4. A/C compressor clutch
5. Timing marks
6. Fan belt tensioner access screw
7. Alternator
8. Oil cooler feed and return connections
9. Fuel return pipe
10. Fuel feed hose
11. Fuel pressure regulator valve
12. Regulator valve pressure take off
13. PAS hoses filter/damper
14. EGR valve pipe connection

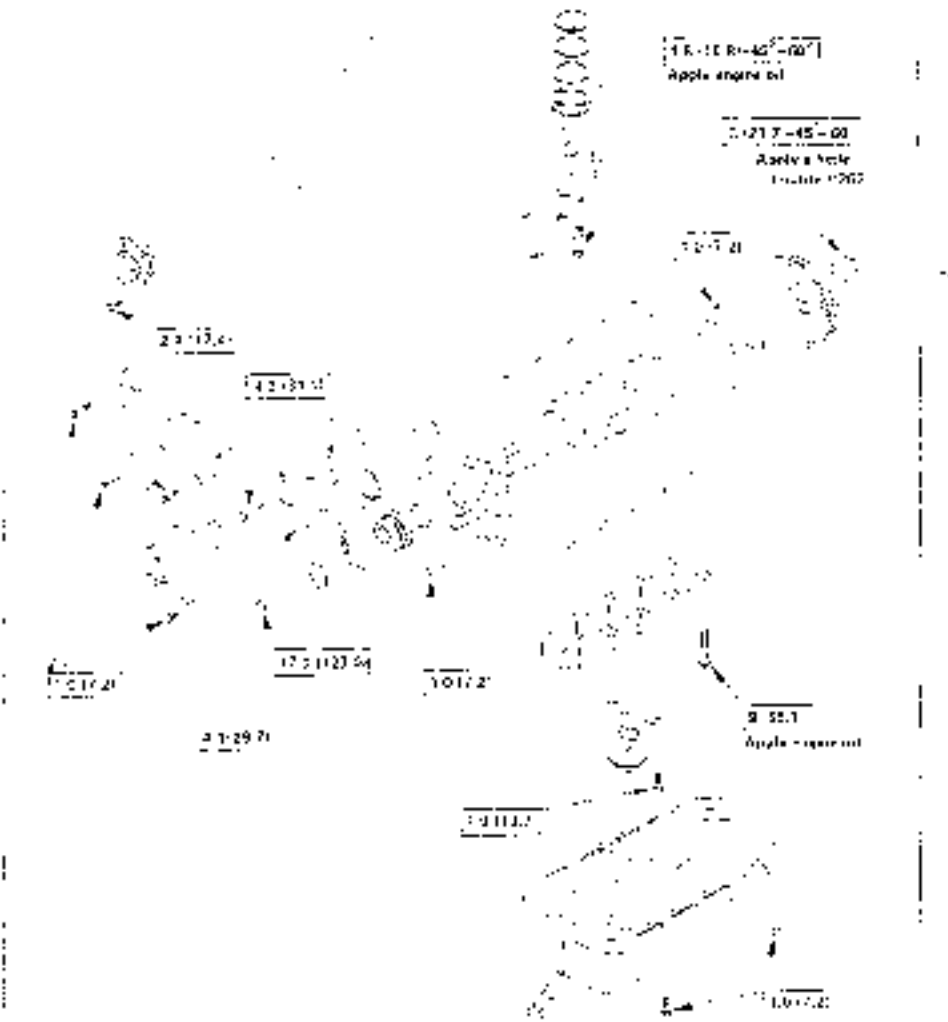
1.6 [illegible] ENGINE CAMS (1600) 1990



1. [illegible]
2. [illegible]
3. [illegible]
4. Primary throttle body
   Throttle Control Cable (TPS)
5. Secondary body heater feed
6. Fuel injector
7. Exhaust Gas Recirculation (EGR) valve
8. Idle Air Control (IAC) Motor
9. Ground lead connection
10. Fuel feed connection
11. Fuel return connection
12. Secondary throttle body
13. Heater return connection
14. Secondary throttle valve potentiometer
15. Starter motor
16. Turbo compressor outlet
17. Radiator by-pass water pipe
18. Manifold gauge
19. Turbo compressor inlet
20. Intercooler cooling outlet
21. Air cycle sensor (ACS) (also on M.A.P.)

Fixings Torque Summary





ENGINE LUBRICATION SYSTEM

The engine lubrication system uses a trochoidal rotor and annulus type pump mounted on the front face of the cylinder block, driven directly by the crankshaft. Oil is stored in a pressed steel sump, and is drawn through a gauze strainer and pick-up pipe into the inlet side of the oil pump. At the outlet side of the pump, a spring loaded plunger type pressure relief valve bleeds oil back at excess pressure back into the pump. The pressurised oil is directed via drillings in the block to a full flow cartridge type filter mounted on the right hand side of the cylinder block. Fitted beneath the filter, a sandwich plate fitted between the filter and block diverts all the oil flow via flexible hoses to an oil cooler mounted at the right hand front of the vehicle. Being horizontally mounted, the filter incorporates a non return valve to prevent all the oil draining from the filter when the engine is stopped. A safety bypass valve is also fitted, which will allow oil to bypass the filter should the filter become blocked or restricted.

An oil gallery along the right hand side of the block, receives oil from the filter and feeds the crankshaft via drillings to each of the main bearings. Crank journals 1,2,4 & 5 are provided with drillings that allow them to feed adjacent connecting rod big end bearings, and are also drilled diametrically across the journal. These journals are fitted with upper main bearing shells having a groove to accept oil supply from the block drilling, and a groove which acts as an oil supply channel to one end of the journal cross drilling, in order to maintain an uninterrupted oil supply to the big end bearing. Lower main bearing shells are plain. Journals with grooved bearings (1,2,4 & 5) also supply a feed to oil jets designed to spray the underside of the piston crowns in order to aid piston cooling and cylinder lubrication. A drilling towards the right hand end of the oil gallery, passes oil upwards through the block and into the cylinder head, where a check valve prevents oil from draining off when the engine is stopped, and a pressure relief valve prevents excessive oil pressure reaching the valve gear. Oil galleries running alongside each camshaft supply the camshaft journals and lobes, and the hydraulic tappets and valve stems.

The oil feed for the turbocharger is taken from the crankcase oil gallery and is returned to the left hand front of the block.

Precautions

i. Use only those lubricants listed in section 'O' for the ambient temperature range pertaining.

ii. When rebuilding an engine, use copious amounts of recommended lubricant to ensure adequate lubrication on initial start up.

iii. After rebuild, the engine should be cranked with the ignition disconnected until oil pressure is registered on the gauge.

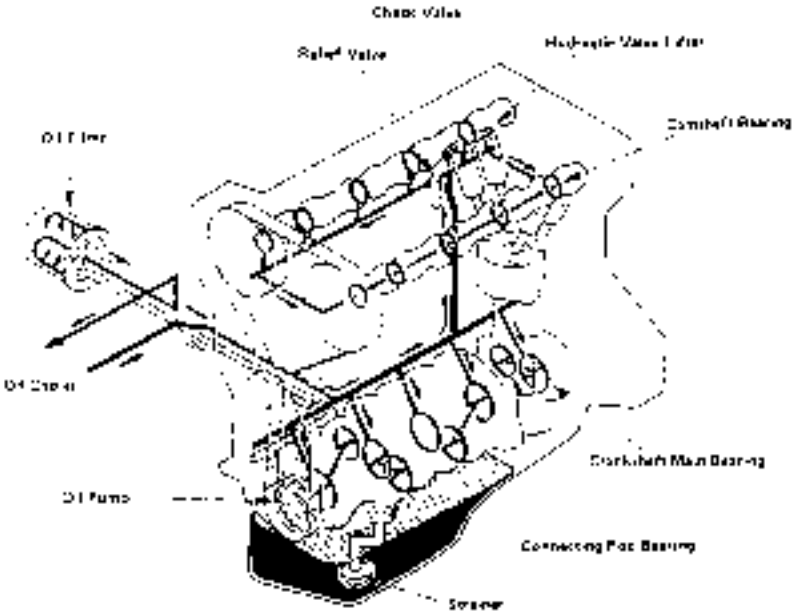
In the event of engine failure involving the possibility of debris entering the lubrication system, it is essential that the following procedures are taken before re-assembly:

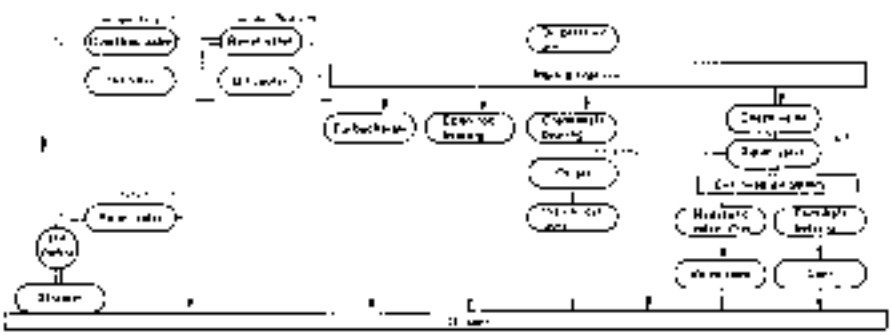
a. Clean and inspect all engine oilways in block, crankshaft, cylinder head etc.

b. Clean and inspect oil pump, pick up pipe and strainer, and all pressure relief valves.

c. Thoroughly flush out oil cooler hoses.

d. In view of the difficulty of ensuring no debris is retained in the oil cooler, the cooler should always be replaced in such circumstances.


Chain Valve
Relief Valve
Hydraulic Valve Lifter
Camshaft Bearing
Oil Filter
Oil Pump
Crankshaft Main Bearing
Connecting Rod Bearing
Strainer



Oil level checking

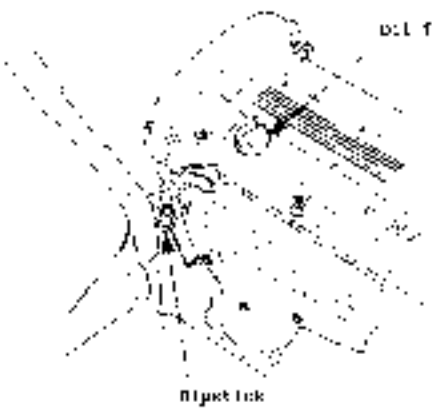
Ensure that the car is parked on a level surface and that all road wheels are adjusted alike. Stop the engine and withdraw the dipstick, wipe it clean and replace it. Withdraw the dipstick a second time and read off the engine oil level. Add oil through the filler orifice if necessary, using the correct grade of oil. Replace the dipstick and filler cap.

The oil capacity and difference between high and low dipstick marks are listed in section D(1). Top up if necessary with the correct grade of oil. Do not overfill. Wipe the dipstick and replace it.

Oil changing procedure

The oil should be renewed, and a new oil filter fitted, at intervals specified in the Maintenance Schedule (see section C).

The drain plug is located at the right front side of the sump. It should be removed to drain the oil immediately after a run when the oil is warm and the particles are held in suspension. Place a drain tin under the drain plug, remove the sealing washer if necessary, and refit securely. Wipe the filler orifice (see below), and fill with a recommended lubricant to the high mark on the dipstick. Run the engine briefly, and recheck level.




Oil filter viewed from beneath RHF suspension

Oil filter

The oil filter should be renewed at intervals specified in the Maintenance Schedule - see section C.

The oil filter is horizontally mounted at the right hand side of the block, and is of the disposable canister type. Access to the filter is best obtained from beneath with the vehicle raised on a wheel free lift. On removal, turn in a counter-clockwise direction using an oil filter strap spanner if necessary. Discard the filter after removal.

Before fitting a new filter, clean the mating faces of both the new filter and the oil cooler adaptor and smear both faces with clean oil. Add a small amount of clean oil to the filter and renew by hand sufficiently to make a first seal, usually 3/4 to 1¼ of a turn after the faces have made contact. Start the engine and check for oil leaks, tightening the filter further if necessary. Run engine and recheck oil level.

[illegible] ROUTINE MAINTENANCE OPERATIONS

This section gives guidance on routine maintenance operations specified in the Maintenance Schedule.

Renew engine oil: See [illegible]

2. Renew engine oil filter: See [illegible]

3. Air cleaner element: The air filter paper element is housed in [illegible] at the rear [illegible] of the [illegible]. [illegible] paper element [illegible] the [illegible] of the filter element, [illegible] between the filter and [illegible] to [illegible] the [illegible] [illegible] when the vehicle is operated [illegible] the paper element should be renewed at intervals specified in the Maintenance Schedule, but where [illegible] dusty [illegible] is prevalent, more frequent replacement will be required, dependent on the level of pollution. The condition of the filter element should be examined at every service.

[illegible]
- [illegible] releasing the [illegible]
- [illegible] the filter element [illegible]
- [illegible] of the filter housing [illegible]
- [illegible] correctly seated.

[illegible]

4. [illegible] See Section K.

5. Renew spark plugs: The spark plugs should be renewed at intervals specified in the Maintenance Schedule.
- [illegible] securing the spark plug well cover, and remove the cover.
- Pull off the spark plug leads from the plugs.
- [illegible] any dirt from around the spark plugs.
- [illegible] spark plug and [illegible] into the cylinder [illegible] the spark plug hole.
- [illegible] of the new spark plugs before fitting, and tighten to [illegible]
- Refit the [illegible] plug leads [illegible] and spark plug well cover.

6. [illegible] timing belt: See Section [illegible]

7. Check auxiliary drive belt condition and tension: At intervals specified in the Maintenance Schedule, carefully inspect the whole length of the alternator belt and A/C pump and compressor belt [illegible] for any signs of [illegible], cracking, perishing or any other deterioration. Renew the belt if in any doubt. [illegible] tension [illegible] gauge.

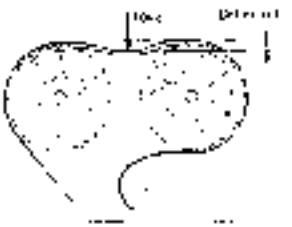
If necessary, slacken the alternator [illegible] and move the alternator to achieve the correct belt tension. Tighten the bolts and re-check the tension.

(d) packet compression. Packets may be filtered by their source IP address, destination IP address, and the IP protocol type field. Packets may be filtered by their source port and destination port. The packet filtering is performed by the kernel, and the filtering rules are specified by the administrator using the ipfwadm utility.

- Check to ensure that without authority, the User portion ENV/ENE

(e) Improved security of the system. Precautions: Carefully examine the system to ensure that there are no obvious security holes. Disable any kind of boot, spoof, or other signals determined to be harmful or unnecessary.

(f) Periodic security of system utilities. Check integrity. PGP purge integrity, and other system vulnerabilities for security.



Remove the Inlet Engine Breather pipe from the right hand side of the engine. Remove the right hand engine mounting bracket. Remove the front engine mounting bracket from the right hand engine mounting crossmember. Remove the front engine mounting crossmember. If necessary, disconnect the steering gear pressure pipe and the LH brake pressure hose.

Remove the Inlet Manifold Assembly. Remove the Inlet Manifold Gasket and discard.

Remove the Engine Oil Dipstick. Remove the Dipstick Tube Retaining Bolt. Remove the Dipstick Tube. Remove and discard the O-ring seal from the Dipstick Tube.

Remove the Engine Oil Filter. Remove the Oil Filter Adaptor. Remove and discard the O-ring seal from the Oil Filter Adaptor.

Remove the Crankshaft Pulley Retaining Bolt. Remove the Crankshaft Pulley. Remove the Woodruff Key from the Crankshaft.

Remove the Engine Oil Sump. Remove and discard the Sump Gasket.

Servo u.

The crankshaft drive belt may be removed with the engine in situ, but it is necessary to remove the radiator (see Section C) as described in Figure. Drain the cooling system.

1. Remove auxiliary drive belt. Slacken the power steering pump and alternator mounts and remove belt from the pulleys.

2. Using suitable socket spanner, remove the pulley retaining nut and washer from the crankshaft nose. Withdraw the pulley. Slacken the two water pump pulley retaining nuts and remove the fan assembly from the water pump pulley.

3. Withdraw the crankshaft pulley, using a suitable puller if necessary.

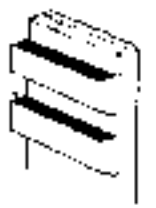
4. Remove right hand engine mounting bracket. Support the right hand side of the engine, using a jack and a piece of wood. Remove the bolt securing the engine mounting to the right hand engine mounting rubber. Remove the four bolts securing the bracket to the engine mounting crossmember to the inner wing brackets, and remove the crossmember.

5. Lower the jack. Remove the bolts securing the lower left guard, and remove the guard.

6. Remove belt. Use a spline broker wrench to loosen the tensioner pulley nut bolt, and rotate the pulley clockwise to slacken the belt. Slide the belt off the pulleys.

Precautions

- Do not attempt to pry or force the belt with a screwdriver or any other tool during removal or replacement;
  Do not bend the belt to bend or twist excessively, or damage may be caused to the belt cord;
  Do not allow oil or any other chemical substances to come into contact with the belt, or belt life will be shortened;
- Store new drive belts in a cool dark place. Do not expose to heat or direct sunlight;
  Do not rotate the crankshaft or camshafts with the drive belt removed, as damage may be caused to the valves and pistons.

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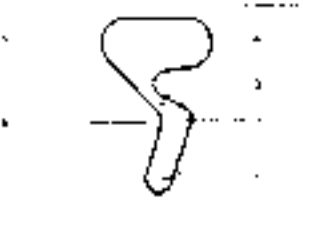


[illegible] WATER PUMP

The water pump is mounted [illegible] of the cylinder block, and is driven [illegible] [illegible] remove the pump from the [illegible] [illegible] [illegible] The water pump [illegible] released, and the [illegible] removed from the engine.

The water pump is a non-serviceable sealed unit, and if any of the [illegible] the complete unit must be replaced:

- [illegible] pump body;
- water leakage from the shaft [illegible];
- [illegible] in the bearing;
- damage or corrosion to the impeller;
- damage to [illegible] the pulley.

[illegible]

[illegible]

[illegible] - Remove

The [illegible] [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

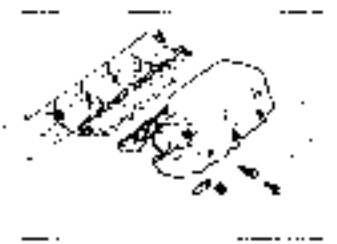
[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible] mounting bracket.

1. Fuel Pipe Clips: To ease the large fuel line clips from the rear chassis at the back of the engine.

2. Jubilee Clamps: To ease the fixings securely, the jubilee clamps to the fuel system:

- Air inlet hose,
- Fuel to throttle body inlet hose,
- Inner bulk head fuel hose.



Fuel Injectors - Removal

WARNING: Fuel pressure remains in the system after switching off the ignition. Before carrying out removal, fuel line pressure must first be relieved, this is safely to relieve the pressure. See 'Fuel Pressure Relief Procedure'.

FUEL PRESSURE RELIEF PROCEDURE

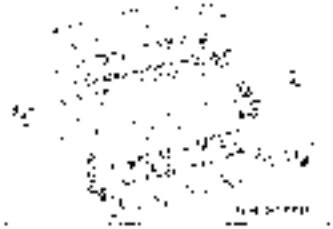
- With the ignition switch in the battery disconnected to disconnect the fuel pump feed wire plug from engine.
  After the engine stops dead, fuel starvation, crank the engine for at least 5 seconds to dissipate any remaining fuel pressure.
- Fuel connections are now safe for service.

CAUTION: Take great care when removing the fuel rail and injectors, to avoid damage to the electrical connector pins or injector spray nozzles. Before removing the fuel rail assembly, it is recommended to use an engine cleaner such as GT Jet-X 405 to help prevent dirt from the top of the plug all fittings as soon as possible after opening.

1. Fuel Inlet: Using a back up wrench to prevent the fuel rail inlet connector from turning, release the fuel inlet pipe from the left hand end of the rail. Use a rag, towel to absorb any escaping fuel.

2. Fuel Outlet: Using a back up wrench to prevent the fuel rail outlet connector from turning, release the fuel outlet pipe from the right hand end of the rail. Use a rag, towel to absorb any escaping fuel.

3. Fuel Rail: Using the service tool or other tool from a suitable spirit, a long open ended spanner. Remove the two bolts securing the fuel rail to the inlet manifold and carefully withdraw the rail complete with injectors from the inlet manifold.



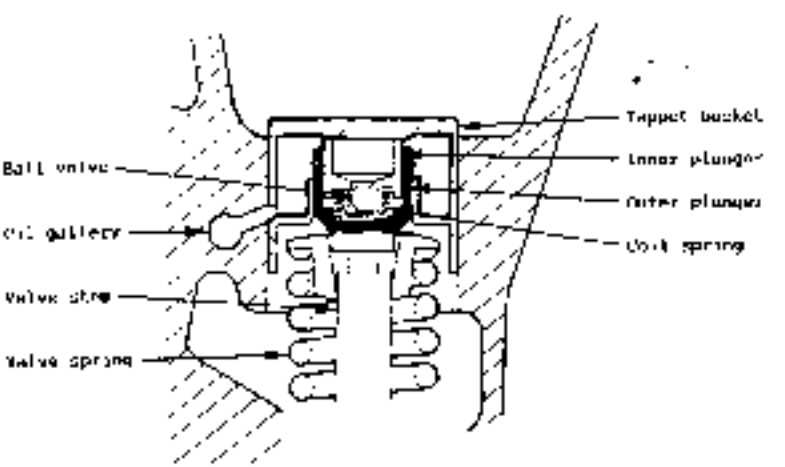
2.[illegible] HYDRAULIC VALVE LIFTERS

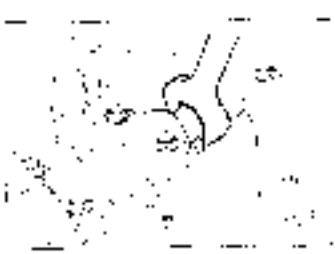
[illegible] Operation

[illegible] The hydraulic valve lifter is the valve actuating unit that [illegible] the rotation of the camshaft to the valve mechanism and at the [illegible] the proper clearance and adjustment of tappet clearance.

The hydraulic valve lifter consists of a tappet bucket, an inner plunger, ball valve, outer plunger and valve spring. The plunger assembly slides inside the tappet bucket and is held in place by a spring clip. A small opening is provided in the inner plunger to allow oil to enter the plunger assembly. The ball valve is located in the inner plunger and controls the flow of oil from the tappet bucket to the inner plunger. The ball valve is held open by the valve spring. When the lifter is in the [illegible] position, oil flows from the tappet bucket to the inner plunger through the ball valve. When the lifter is [illegible] the ball valve closes and traps oil in the inner plunger assembly. This oil acts as a cushion between the tappet bucket and the inner plunger. The trapped oil prevents the [illegible] from being transmitted to the valve train.

When the engine is started after it has been sitting for a few hours, [illegible] will leak out of the lifter. This causes the lifter to collapse and [illegible] the valve train. When the engine is started, oil flows into the lifter and [illegible] the proper length. This is why it is necessary to run the engine for a few minutes before the engine is loaded.





1. Check that the engine/gearbox mounting bolts at the rear of the subframe are tight.

2. Check that the front suspension lower arm pivot bolts are tight.

3. Check that the steering rack mounting bolts are tight.

4. Check that the steering column lower universal joint pinch bolt is tight.

5. Check that the steering rack gaiters are not damaged or perished.

6. Check that the steering rack is not leaking.

7. Check that the steering column is not damaged.

8. Check that the steering wheel is not damaged.

9. Check that the steering wheel is not loose.

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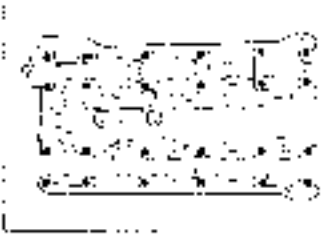
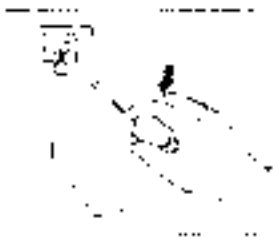
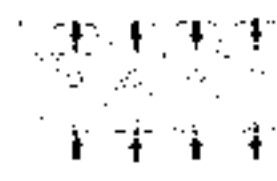
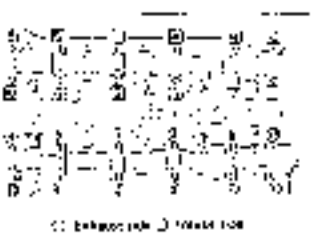
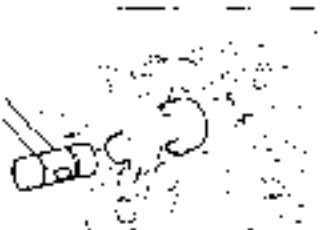


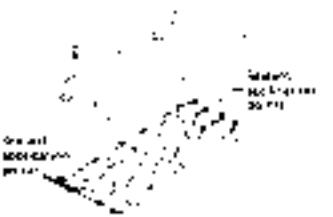


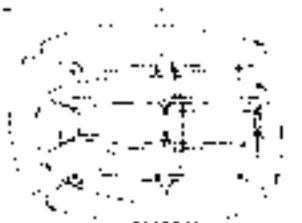



SEALANT APPLICATION POINTS









Vehicles fitted with catalytic converters

Take particular care to prevent unburnt fuel entering the exhaust system as this will damage the catalytic converter.

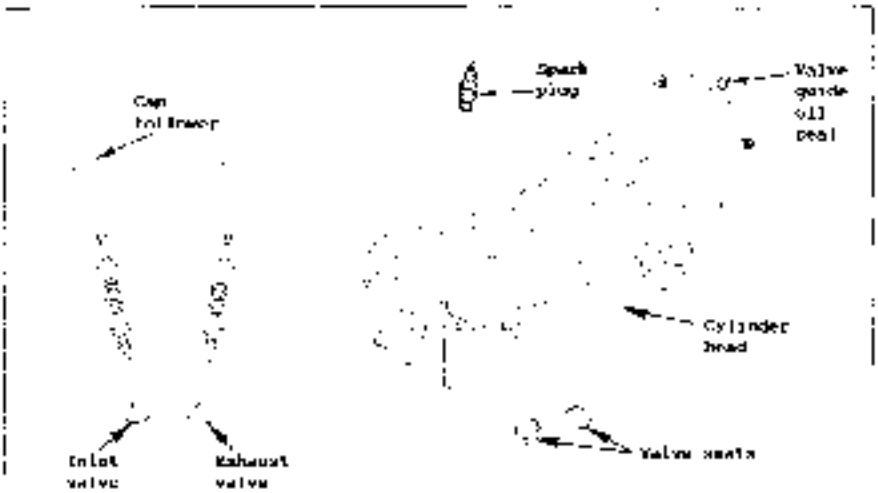
Petrol

Do not crank engine for excessive periods (more than 10 seconds) without allowing the starter motor to cool for at least 2 minutes.

Before the engine is run, the fuel injection system must be primed. Switch on the ignition for 10 seconds, then switch off for at least 5 seconds to relieve the resulting fuel pressure. Repeat this procedure at least 3 times before attempting to start the engine.

Do not run the engine at more than idle speed if the exhaust pipe is disconnected.

Do not use leaded petrol.



7. Throttle Valve Body: Disconnect the throttle cable from the quadrant and shutter, air intake trunking, and IAT sensor pipe (beneath valve body).

8. Power Chamber Connections: Disconnect the following from the pressure chamber:
- Inlet gauge and MAP sensor hoses;
- Earth lead;
- Oil cooler pipe bracket
- 'T' clip at back of engine for battery cable
- Vent, air bleed and inlet ventilation hoses;
- HT lead of ignition coil;
- Multi-pin electrical connector;
- Brake servo vacuum hose;

| All end of chamber

| LH end of chamber

9. Power Steering Pump: Release the power steering pump bracket from the engine and unbolt clear.

10. Fuel Injector Connections: Release the following connections from the rails.
- Oil feed pipe and return hose;
- Water temperature sensor lead;
- Auxiliary air valve pressure hose;
- Temperature time and switch trunking;
- Oxygen sensor lead.

11. Exhaust Connections: Release the downpipe from the outlet of the starter catalyst housing, and the catalyst housing from its support bracket. Also release the dipstick tube top support lining.

12. Thermostat Housing: Release the following from the thermostat housing:
- Heater feed and return hoses,
  from rear thermostat housing to water rail.
- Outlet hose to radiator and air bleed hose to header tank.

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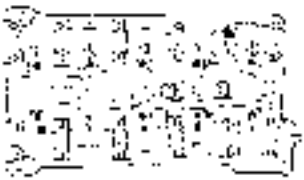

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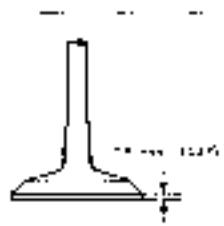
1. Cylinder block face: carefully clean the top face of the cylinder block, without scratching the surface, or dropping any debris into the coolant or valve chamber. Use a straight edge and feeler gauge to check flatness of cylinder head face. If the service limit is exceeded the cylinder block must be either machined or replaced.

Cylinder head face — service limit: 0.10 mm (0.004 in)
Material to be removed: 0.40 mm (0.016 in)
Minimum height of block height: 249.60 mm (9.84 in)

2. Valves: if engine has not been overhauled, check valve movement, carbon deposits, and carefully inspect the valve face for signs of damage or abnormal wear. If found, the valve and guide pair is replaced as a set.

3. Measure the valve head edge thickness. If the thickness is less than specified, the valve and guide must be replaced as a set.

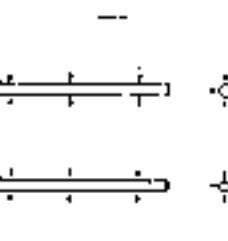
Valve head edge thickness:
Service limit: 0.5 mm (0.020 in)



4. Measure the valve stem diameter along its length. If at any point the diameter is less than specified, the valve and guide set must be replaced as a set.

Valve stem diameter: mm (in)

	New	Service limit
Inlet	6.960 – 6.975 (0.2740 – 0.2746)	6.900 (0.2717)
Exhaust	6.940 – 6.955 (0.2732 – 0.2738)	6.880 (0.2709)



5. Valve guides: if pressure fit valve stem top for signs of uneven wear or damage. If found, replace the valve and guide as a set.

6. Using valve stem to guide clearance by measuring the inside diameter of the guide and subtracting the stem diameter. If the clearance exceeds specification, replace the valve and guide as a set.

	Max	Service Limit
Inlet	7.043 - 7.058 mm (0.2773 - 0.2779 in)	7.068 mm (0.2783 in)
Exhaust	6.030 - 6.045 mm (0.2374 - 0.2380 in)	

Valve	Spring Free Length
Inlet	43.2 mm (1.70 in)

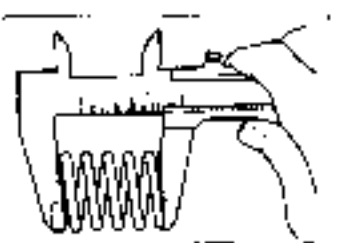
Valve stem width mm (in)

	New	Service limit
Inlet	7.960 (0.3134)	7.940 (0.3126)
Exhaust	7.940 (0.3126)	7.920 (0.3118)

c Valve seat: Remove all carbon from the valve seat and grind the valve seat in using fine grinding paste. Remove all traces of paste on completion.

d Valve seat replacement: Warm the cylinder head to a temperature not exceeding 100°C (212°F) and drive out the old valve seat. Ensure the recess is clean and dry. Heat the cylinder head to a temperature between 90°C and 100°C (194°F and 212°F) and drive in the new valve seat using a suitable tool. Grind the seat to the correct width and position with valve grinding compound.

e Valve guide: Check the valve stem to guide clearance with the valve in the guide and a dial gauge mounted on the cylinder head. Move the valve from side to side in the guide. If the clearance is greater than the service limit, ream out the guide to accept the next oversize valve. Valves are available in 0.08 mm (0.003 in) and 0.16 mm (0.006 in) oversizes.



f Valve springs: Check the valve springs for squareness using a square and a flat surface. Renew springs if they are distorted by more than 1.5 mm (0.06 in).

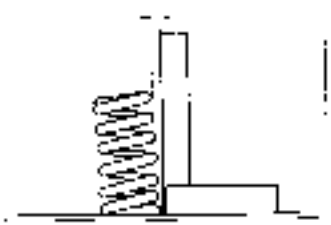
g Valve guide seals: Renew the valve guide seals as a matter of routine during reassembly.

h Reassemble the valve components in the reverse order to dismantling. Lubricate the valve stem with oil before inserting it in the guide. Fit the valve spring with the closer coils nearest the cylinder head. Fit the valve spring collar and split collars, using petroleum jelly to hold the collars in place. Compress the valve spring and fit the split collars in the groove in the valve stem. Release the valve spring and ensure that the collars are correctly seated.

i Check the valve spring fitted length and compare with the specifications.

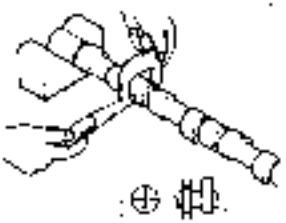
Valve length mm (in)

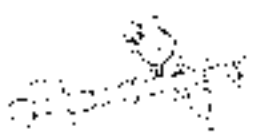
New	Service limit
41.2 (1.62)	40.2 (1.58) min.



j Measure the valve spring squareness using a square plate and replace the spring if outside tolerance.

Squareness service limit 2 mm (0.08 in)





Fit the bearing caps in their correct positions and torque tighten the nuts.

Torque: 10 lbf ft (14 Nm)

Do NOT turn the camshaft.

Remove the bearing caps and measure the plastigage at the widest point. Compare the plastigage with the specified camshaft bearing clearances.

Camshaft bearing clearance

New	Service limit
0.025 - 0.076 mm (0.001 - 0.003 in)	0.15 mm (0.006 in)

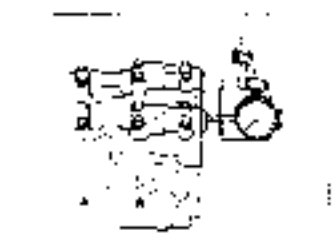
Remove the distributor from the camshaft housing.

Withdraw the camshaft and fit the cylinder head. Fit the camshaft bearing caps in position and torque tighten to 10 Nm (7 lbf ft).

Use a dial gauge to monitor the camshaft end float and replace the cylinder head and/or camshaft if outside specification.

Camshaft endfloat

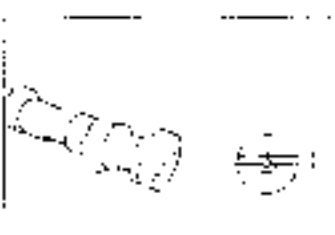
New	Service limit
0.05 - 0.15 mm (0.002 - 0.006 in)	0.25 mm (0.010 in)



Measure the distributor drive slot width and replace the camshaft if the dimension exceeds specification.

Distributor drive slot width

Service limit: 5.08 mm (0.200 in)

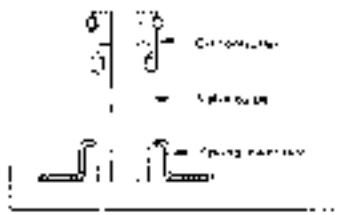


Reassembly

Thoroughly clean all parts before assembly, and coat all bearing surfaces with engine oil.

... Spring Seats & Oil Seals. Fit the inner spring seat and then the outer spring seat over the valve guides.
Fit new valve stem oil seals by pressing by hand as far as they will go on guides. Note that seals are not interchangeable.

Oil pressure relief valve (Twin Cam)



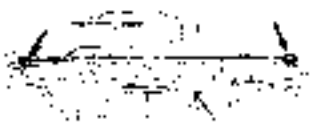
... Valve and Guide Assemblies
Lubricate the valve stems, and fit the valve with the guides on the right of partitions of bearing cylinder.
Fit the valve with seals in with the stem of valve identified by three-groove collar towards the head.

... Fit a valve spring retainer onto the top of each spring, and use a valve spring compressor (Tool 18G71B) to depress the springs and fit the collets.
Note that when compressing the springs, take care not to distort and damage the valve stem oil seals.

... Fit the camshaft bearings and camshaft (see Section 12), and then fit the camshaft sprocket and timing chain (see Section 13).

To Replace

1. Support, using the top face of the cylinder block, and fit the tension spacer, one cylinder head gasket with its locating dowels in the block, with the 'TOP' mark uppermost.



2. Cylinder head fit the cylinder head into position. Apply sealant to the threads and mating face of the cylinder head bolts.
Fit and tighten the bolts in the sequence given in the illustration, to the specified torque at two steps.

Cylinder head torque
1st step, to 40 lbf ft (5.5 kgf m)
2nd step, to 80 lbf ft (11 kgf m)

Reverse the remaining dismantling procedures to complete the refitting of the engine.

Fit the engine, fit the gearbox and rear drive unit as detailed in sections [illegible].

Refer to Section F6 to refit the induction system as detailed in section F6.

Miscellaneous: Refit remaining components in reverse order to disassembly.

Oil Pump

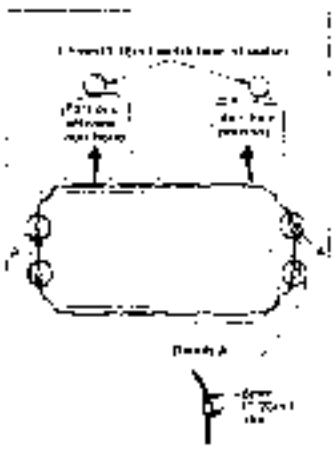
The engine oil pump can be removed with the engine 'in situ' after removing the engine bay undertray, and the exhaust front pipe.

To remove

Remove the drain plug, and drain the engine oil from the sump. Remove all fixings securing the sump to the engine and the special tool to cut the sealant before attempting to remove the sump.

Seal cutter: 330P1819

Note: The sealant is applied to the outside face. Do not attempt to pry the sump free, or the joint face may become distorted.



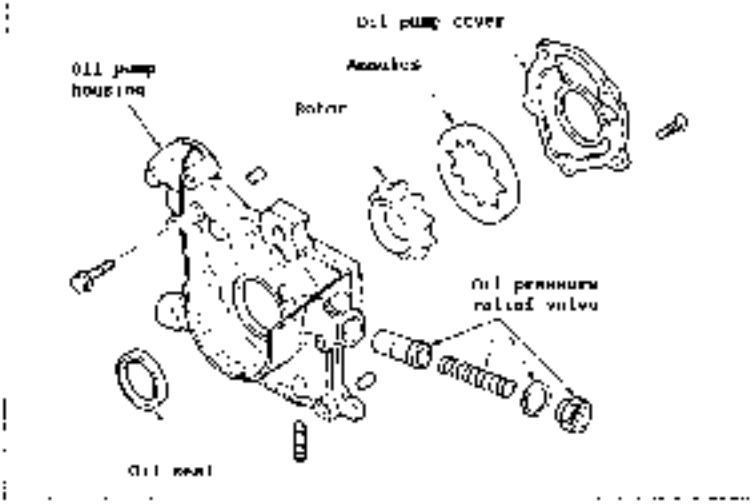
To refit:

- Completely remove all residual sealant, lubricant and swarf from the work faces. The surfaces must be perfectly dry.
- Apply a thin film of RTV sealant sparingly to the joint face on the sump flange as shown. There must be no gaps in the bead.
- Fit the sump within 5 minutes of sealant application and align with the fixings. Torque tighten to 10 lbf ft (1.3 kgf m).

E.11.2 - OIL PUMP ASSEMBLY

The trochoidal rotor and annular type pump is located on the front face of the cylinder block and is driven directly by the front end of the crankshaft.

The pump assembly may be removed with the engine in situ.



To remove & inspect

1. Drain the engine oil, and remove the sump as detailed in section E.9.

2. Oil Drive Belt: Remove the camshaft drive belt as detailed in section E.2.4.

3. Crankshaft Toothed Pulley: Withdraw the camshaft drive pulley from the crankshaft taking great care not to damage the flange. Remove the woodruff key.

1. Oil Pump Assembly: Unbolt the oil pump assembly fixing bolts and withdraw the pump over the end of the crankshaft.

2. Relief Valve: Remove the plunger end spring, and spring and valve plunger.

3. Inspect the plunger and bore for signs of scoring or excessive wear.
Check that the plunger slides freely in the pump without binding.

Replace components as necessary if any parts are worn.

4. Inspection: Release the five screws, and remove the oil pump cover. Clean the rotor, gerotor, cover and housing, and inspect for any signs of scoring, scuffing or undue wear. Replace any components showing such signs.

5. Rotor & Annulus: Refit the rotor and annulus to their original positions in the housing, and measure the clearances as shown.

Annulus/housing clearance:

mm (in)

New	Service Limit
0.07 - 0.15 (0.003 - 0.006)	0.20 (0.008)

Gear tip clearance:

mm (in)

New	Service Limit
0.01 - 0.15 (0.004 - 0.006)	0.25 (0.010)

[illegible]

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Retainer
Shim

j. Oil Pump Assembly: Clean the joint faces on the oil pump and cylinder block. Apply a bead of Autobond (TB-120B) to the oil pump joint face as shown.
Turn the oil pump gear to match the positions of the slot and keys on gear and crankshaft.
Apply engine oil to the lip of the oil seal and carefully fit the pump over the crankshaft, taking great care not to damage the oil seal. Engage the pump driving dogs. Fit the retaining screws and torque tighten.

Torque: 14 Nm (1.4 kgf.m)

k. Crankshaft Timing Pulley: Fit the woodruff key into the crankshaft and slide the timing gear into position.

l. Oil Drive Belt: Refit the crankshaft drive belt as detailed in section D(k).

m. Start and run the engine and check as detailed in section D(l), and refill with engine oil. Before starting the engine, crank the engine with the ignition disabled until oil pressure is built up.

N(1) ENGINE REMOVAL/REPLACEMENT

The engine may be removed complete with transmission assembly, upwards through the bonnet aperture without removing the front bonnet. Alternatively, the power unit may be dropped down from below after removal of the engine/transmission interfaces. The former, preferred method, is described below.

To remove

1. Fuel Pressure Relief Procedure
   Trip the inertia switch (in battery compartment (UK8) or in speaker box (UK6)), to disconnect the fuel pump feed, and start the engine.
- After the engine stops from fuel starvation (crank for at least 10 more if not started), crank for at least 5 seconds to reduce the residual fuel pressure.
- Use a shop towel to absorb the small amount of pressurised fuel remaining as the fuel feed connection at the back of the engine is released (see next step). Also release the fuel return pipe.

a. Preparation: Disconnect battery; drain engine oil and power steering fluid; raise vehicle, remove the 4 road wheels.

b. Intake Airflow: Disconnect the intake and outlet trunking from the air filter box. Undo and disconnect the small hose joiner from the filter box outlet adaptor. Disconnect the hoses from the boost solenoid valve (Turbo only) mounted on the rear of the filter box bracket, and unplug the electrical connector. Remove the filter box bracket and throttle body intake trunking (Turbo).

j. Heater hose. Loosen the heater hose and routing bracket.

k. Harness connectors. Unplug the engine harness connector plugs at the left rear end of the engine. Unplug the E.F.I. harness from the spark plugs (leave it connected to the coil and trans.). Unplug harness at injector main plug.

Note: Before removing the top and bottom bolts, and disconnect the heater hoses from the engine. Disconnect electrical wires (any type).

l. Air pump. Disconnect the throttle body inlet hose and disconnect the two vacuum hoses - the underside of the throttle body and the one in the rear corner of the left hand rear of the intake plenum. Disconnect the vacuum hose from the EGR valve. Disconnect hoses from the A.I.R. check valve, and vacuum hoses from the front of the air pump. Unscrew the three bolts securing the air pump to the engine and remove the pump.

m. Battery cables. Disconnect the clutch cable. Pull off the spring clip securing the two battery earthstrap cables to the gearbox bracket, and the spring clip securing the adjuster sleeve to the operating lever. Release the rubber retaining gaiter from the gearbox, taking care to note the position of the washers for the later reassembly.

n. Speedo cable. Unscrew the speedo cable from its connection at the top rear of the transmission.

o. EGR pipe. Disconnect the EGR pipe from the manifold and pipe the two hoses back to the EGR valve and remove the pipe. Remove the mounting bracket.

p. Fuel hoses. Disconnect the fuel return hose and pressure hose connections at the right hand rear corner of the engine.

q. Earth lead. Disconnect the earth braid from the front top rear of the engine, and the other end from the rear of the plenum.

r. Exhaust downpipe. Disconnect the exhaust system downpipe from the manifold. Remove the heatshield and release the support strap from the back of the cylinder block (1 bolt/nut).

s. Air compressor (if fitted). Loosen the power steering pump adjuster bolt to allow the belt to be slackened. Before removing the belt, it is necessary to remove the compressor's pressure strap, and the lower mounting bolt, and release from the engine without disturbing the hose connections. Support the compressor under the engine.

t. Air pump (if fitted). Release the hose and low pressure hose connections and disconnect the pressure switch electrical connections. Release the A.I.R. pump mounting bracket from the engine, and remove pump and bracket from beneath.

u. Starter & Alternator. Disconnect the main starter motor cable and starter solenoid connector wires. Disconnect the main alternator lead, and unplug the wiring loom connector from the alternator. Support the weight of the engine/gearbox assembly, and unbolt the top bolt (and nut) securing the starter motor. Withdraw the starter motor from the rear.

v. Engine mounting. Unscrew the top bolt (and nut) securing the engine mounting to the bracket on the gearbox. Unscrew the two bolts securing the engine mounting to the engine. Remove the mounting.

w. Engine/gearbox assembly. Check that all cables, hoses, wires, etc. have been disconnected from the engine/gearbox assembly. Attach a hoist to the engine lifting eyes, and take the weight of the assembly. Remove the two bolts securing the gearbox to the crossmember. Remove the two bolts securing the engine to the crossmember. Lift the engine/gearbox assembly out of the engine bay.

- Remove the clip securing the brake hose joint to the top member, and move the hose from the mudguard bracket.
- Mark the position of the camber adjustment eccentrics or plates on the top ball joint to the suspension crossed fixing bolt. Before removing each top ball joint bolt.
- Fit a pry bar or lever between the transmission and the chassis to lift the transmission. A block should be inserted to override the retaining circlip. Do not attempt to pry the unit clear by prising on the sheet or the sheared bolt may become dislodged and require replacement.
- Slide the joint on the transmission output shaft, and a suitable plug T3007.314 on the left hand side to reduce loss of transmission oil.
- Support the hub assembly to avoid straining the brake hose.

13. Torque Damper: Release the torque damper lock nut from the engine, and remove the damper or its arm.

14. Engine Mountings: Support the engine before releasing the rear engine mounting leg from the engine and the bracket. Fit a sling to the lifting eyes on the cylinder head, and support the weight of the engine by crane. Remove the left hand engine mounting bolt, and remove the engine mounting bracket, shake damper bracket and spacer plate(s) if fitted), from the transmission case.

Remove the right hand engine mounting bolt, and lift the engine clear. Raise with a slight three angle attitude, taking great care to guide the transmission casing past the air conditioning pipes and condenser unit.

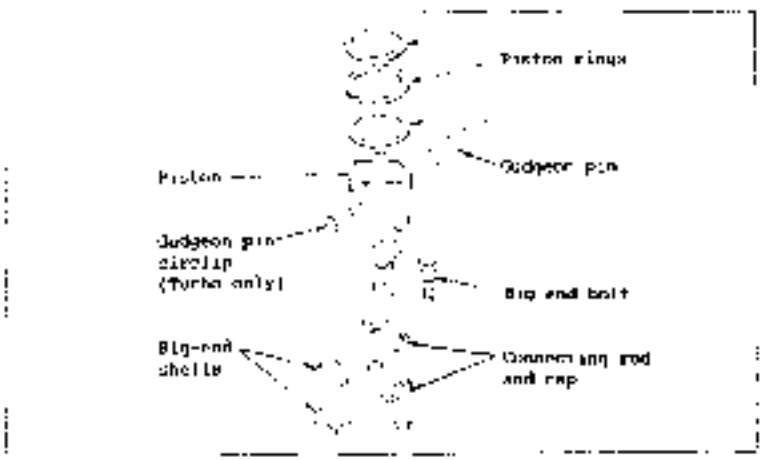
To Refit

Refit the power/transmission assembly in the reverse order to removal, noting the following points:

refit the engine mounting as detailed in section EC.15.
refill the engine with a recommended lubricant (see section EC.2).
top up the transmission with a recommended lubricant.
refill the CAE system (if fitted) with a recommended lubricant (see section EC).
- refill the cooling system with a recommended coolant mix (see section EC).
- adjust the clutch cable (see section J2).
- adjust throttle cable at the cable end bracket on the inlet manifold bracket. Have the accelerator fully closed and pull back the outer sheath to remove. Adjust locknut A to obtain a clearance between the nut and abutment bracket of 1 mm, then push the adjuster against the bracket and tighten locknut A.

[illegible] - PISTONS, PINS, RINGS & CONNECTING RODS

Although it is possible to remove the pistons and connecting rods with the engine in the vehicle after removing the cylinder head and sump, piston ring replacement is far more easily carried out with the engine assembly complete.



[illegible]:

[illegible] - Drain the engine oil and remove the engine assembly (see section EC.11).

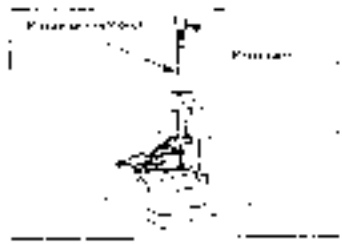
[illegible] - Remove the cylinder head assembly (see section EC.12).

[illegible] - Remove the sump (see section EC.13).

[illegible] - Remove [illegible] by a scraper or [illegible] remove the ring of carbon from the top of each cylinder bore.

[illegible] - Big-end caps. Check that each big-end cap is identified with its fitting position before releasing the two big-end bolts, and remove the connecting rod big-end cap. Push the connecting rod and piston assembly upwards and out of the cylinder bore.

c. Piston Rings: Carefully remove the piston rings from each piston using a piston ring expander, and keep in cylinder sets.



7. Piston Pin: N/A: The piston pin is an interference fit in the connecting rod, and a slip fit in the piston. Remove the pin using a piston pin service set and a press.

Piston pin service set T00073??

Further remove the two circlips and slide out the gudgeon pin.

Keep the parts removed from each cylinder separate and identified with their cylinder number. If any parts are to be retained, it must important that they are refitted in their original positions.

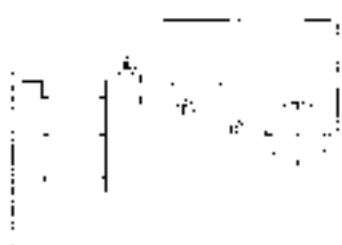
Inspection

1. Cylinder Bore: Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at three points:

A : 1. mm (0.47 in)
B : 50 mm (2 in)
C : 95 mm (3.7 in)

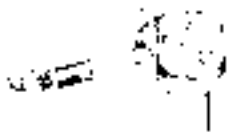
If any of the measured values exceed the specified limit, reboring is required.

Bore size mm (in)



Bore Size	New Diameter	Service Limit
Standard	80.000 - 80.030 (3.1496 - 3.1506)	80.200 (3.1575)
Oversize 0.50	80.500 - 80.530 (3.1693 - 3.1705)	80.700 (3.1772)
Oversize 1.00	81.000 - 81.030 (3.1890 - 3.1902)	81.200 (3.1970)

...e (Y) in the cylinder bore using the piston and gauge bar. Repeat the measurement at 90° to the first measurement.

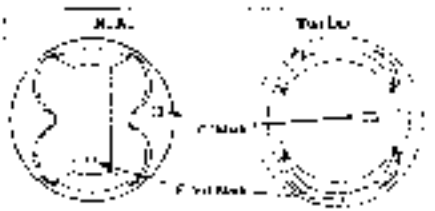


Measuring position ... 10 mm (0.39 in) from skirt

...ce the cylinder bore if the maximum clearance ...ed. Renew the piston if the wear limit is exceeded.

Piston/bore clearance ... mm (in)

	New	Service limit
2.6	0.050 – 0.060 (0.0020 – 0.0024)	
3.0	0.060 – 0.070 (0.0024 – 0.0028)	



...e cylinder block. If the cylinder block is being used, the bore size is stamped on the flywheel end of the cylinder block, and the bore grade is stamped on the top face of the block, by the main bearing caps. The alphabetical letter denotes the bore grade marking (A, B or C).

...Selecting pistons. If new pistons are required, the pistons must be obtained and measured before the piston/bore clearance can be calculated.

...When calculating the new piston to individual bores, combine the ... and correcting rod assembly (build) be matched to establish the optimum pistons for bore size. The weight variation between each piston, pin, and rod assembly should be less than 2 g (0.1 oz).

Piston diameter ... A, B or C ... sheet).

Bore grade diameter. Measure as 1 (2).
Min required piston/bore clearance = N/A: 0.048 mm (0.0019 – 0.0027 in).
Turbo: 0.058 – 0.070 mm (0.0023 – 0.0031 in)
Bore bearing allowance of 0.01 – 0.03 mm (0.0004 – 0.0012 in).

The difference between individual cylinder bore diameters should be less than 0.03 mm (0.0008 in).
After boring and honing, recheck the piston/bore clearance.

[illegible] N/A [illegible]

Grade	Piston Diameter	Finished Bore Diameter (mm)	Required Piston/ Bore Clearance
Standard A (red)	79.945 - 79.951 mm (3.1474" - 3.1476")	80.000 - 80.010 mm (3.1496" - 3.1500")	0.049 - 0.065 mm (0.0019" - 0.0025")
Standard B (blue)	79.951 - 79.957 mm (3.1476" - 3.1478")	80.000 - 80.010 mm (3.1496" - 3.1500")	0.043 - 0.059 mm (0.0017" - 0.0023")
Standard C (green)	79.957 - 79.963 mm (3.1478" - 3.1480")	80.000 - 80.010 mm (3.1496" - 3.1500")	0.037 - 0.053 mm (0.0015" - 0.0021")
Oversize 0.5 mm	80.445 - 80.463 mm (3.1675" - 3.1679")	TO BE CALCULATED (see above)	0.037 - 0.053 mm (0.0015" - 0.0021")
Oversize 1.0 mm	80.945 - 80.963 mm (3.1865" - 3.1872")	TO BE CALCULATED (see above)	0.037 - 0.053 mm (0.0015" - 0.0021")

[illegible] - Turbo [illegible]

Grade	Piston Diameter	Finished Bore Diameter (mm)	Required Piston/ Bore Clearance
Standard A (red)	79.941 - 79.947 mm (3.1474" - 3.1476")	80.000 - 80.010 mm (3.1496" - 3.1500")	0.053 - 0.069 mm (0.0021" - 0.0027")
Standard B (blue)	79.947 - 79.953 mm (3.1476" - 3.1478")	80.000 - 80.010 mm (3.1496" - 3.1500")	0.047 - 0.063 mm (0.0019" - 0.0025")
Standard C (green)	79.953 - 79.959 mm (3.1478" - 3.1480")	80.000 - 80.010 mm (3.1496" - 3.1500")	0.041 - 0.057 mm (0.0017" - 0.0023")
Oversize 0.5 mm	80.441 - 80.459 mm (3.1675" - 3.1679")	TO BE CALCULATED (see above)	0.041 - 0.057 mm (0.0017" - 0.0023")
Oversize 1.0 mm	80.941 - 80.959 mm (3.1865" - 3.1872")	TO BE CALCULATED (see above)	0.041 - 0.057 mm (0.0017" - 0.0023")

[illegible] Ring Identification - Piston [illegible]
[illegible] identified as follows:

Ring	Std.	[illegible]	[illegible]
1st [illegible]	[illegible]	[illegible]	[illegible]
2nd [illegible]	[illegible]	[illegible]	[illegible]
Oil [illegible]	Red	Blue	Yellow

5. Fitting Rings: When refitting new pistons, measure the piston ring end gap by inserting the ring in the bore and using the piston to set the ring square at the lowest working part of the bore.

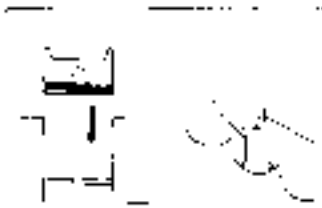
Type	End Gap	Service Limit
Top Ring	0.178 - 0.43 (0.007 - 0.017)	0.63 (0.025)
2nd Ring	0.43 - 0.69 (0.017 - 0.027)	0.79 (0.031)
Oil Rails	0.18 - 0.94 (0.007 - 0.037)	1.19 (0.047)

6. Ring Side Clearance: Measure the clearance of the fitted rings and replace the piston assembly if not specification or beyond...

Ring	New	Service Limit
Top Ring	0.038 - 0.080 (0.0015 - 0.0031)	0.150 (0.0059)
2nd Ring	0.025 - 0.063 (0.0010 - 0.0025)	0.150 (0.0059)

7. Gudgeon Pin: Measure the piston pin diameter where indicated, and the bore diameter in the piston, and calculate the clearance. Renew as necessary if not to specification.

	New	Service Limit
Pin	0.013 - 0.019 (0.0005 - 0.0007)	0.050 (0.0020)
Piston	0.006 - 0.019 (0.0002 - 0.0007)	0.050 (0.0020)

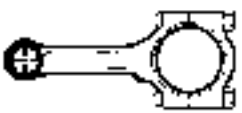


(i) Fit the piston pin to the piston and feel for any play or roughness whilst turning. If either can be felt, the clearance should be measured.

Piston piston pin diameter mm (in)

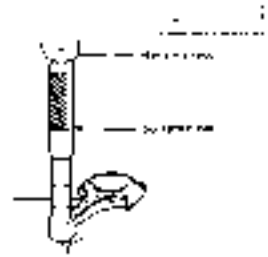
	New	Service limit
N.A.	0.0127 – 0.0177 (0.0005 – 0.0007)	0.030 (0.0012)
Turbo	0.005 – 0.011 (0.0002 – 0.0004)	0.030 (0.0012)

2. Connecting rod. (i) Measure the small diameter of the connecting rod eye, and using the measured diameter of the piston pin, calculate the interference (i.e. the clearance will be negative). Refer to the table at outside specification on page N.A. engine, replace the connecting rod and piston pin



Interference fit (N.A.) 0.000 – 0.011 mm (0.0000 – 0.0015 in)
Clearance (Turbo) new 0.005 – 0.011 mm (0.0002 – 0.0004 in)
service limit 0.040 mm (0.0016 in)

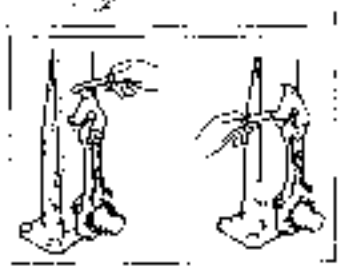
(ii) On Turbo engines, if the clearance is outside specification, use a suitable tool and hydraulic power to remove the small end bush. Press a new bush into position with the oil hole aligned.



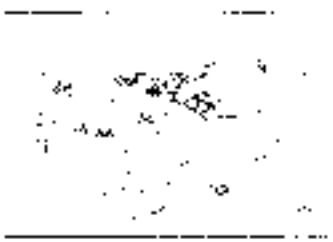
After fitting a new bush, finish the bore with a pin hole grinder/honer to achieve the specified clearance.

(iii) Check the connecting rod for bend or twist using a connecting rod aligner. Replace the rod if outside specification.

Max. distortion per 100 mm (3.9 in):
bend 0.05 mm (0.002 in)
twist 0.10 mm (0.004 in)



c. Connecting Rod Thrust Clearance: Fit the connecting rod to the crankpin and measure clearance between one side of big end bore and crankshaft.



Thrust clearance: mm (in)

New	Service limit
0.020 - 0.041 (0.0008 - 0.0016)	0.06 (0.002)

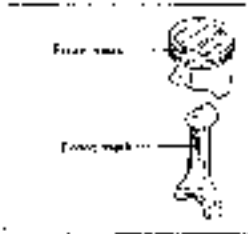
Replace the connecting rod if clearance exceeds specification.

d. Gudgeon pin/piston: Establish the serviceability or selection of the big-end shells (refer to section 5C.1).

Re-assembly:

a. Piston/connecting rod: **N.B.** The piston pin is an interference fit in the connecting rod small end, and a slip fit in the piston. Assembly at ambient temperature of the connecting rod is first heated to a service temperature of 250°C (482°F) in a suitable oven. Position the piston and connecting rod with both 'front' marks facing the same way, and use the special tool to install the piston pin.

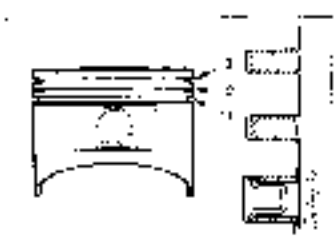
Piston pin installer [



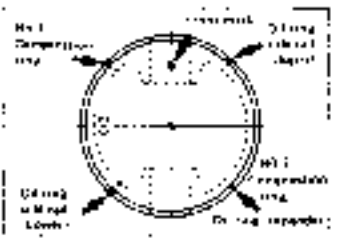
- **Warning:** Fit the new circlip into the piston, position the connecting rod and press a pin with both 'front' marks facing the same way. Insert the judged pin with the aperture new circlip.

b. Piston Rings: Use a piston ring expander tool to fit the rings to the piston in the following order:

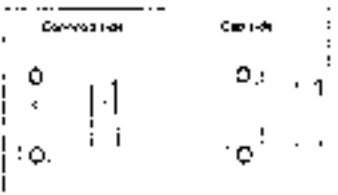
1. First scraper ring
   a) expander ring
   b) lower side rail
   c) upper side rail
2. 2nd compression ring
3. 1st compression ring



Note that the two compression rings must be fitted the correct way up, i.e. the 'T' (1st compression) or '2ND/2nd compression' mark uppermost.
Arrange the rings so that the gaps are positioned as shown in the diagram.



4 Big-End Shells: Fit the bearing shells to the connecting rod and cap, noting that the shell in the rod has an oil hole which must align with the hole in the rod whereas the shell in the cap is plain. Coat both shells with clean engine oil

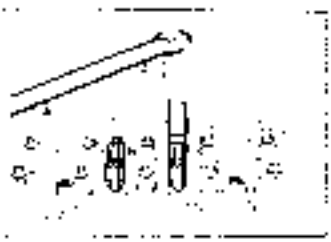


3 Piston Installation: Generously lubricate the cylinder walls with clean engine oil. Fit each piston/connecting rod assembly into its correct cylinder, with the 'front' mark facing forwards, using a piston ring compressor.
Take care not to damage the cylinder wall during this process.

5 Big-end Caps: If marked the numbered big-end caps to their rods. Lubricate the threads, and fit each cap the correct way round. Lubricate the threads and seating faces of the nut and bolts before entering.

... tighten the big-end cap bolts to the stage using the angular tightening method as below:

1st Stage	2nd stage
75 lbf ft (10.3 kgf m)	45° turn



... and that the crankshaft rotates smoothly.

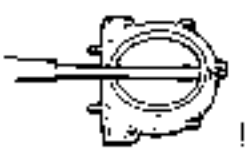
... Refit the oil pump (section D.10), cylinder head (section D.5), and engine assembly (section D.1).

D.7 ... CRANKSHAFT, MAIN BEARINGS, BIG-END BEARINGS & FLYWHEEL

Removal

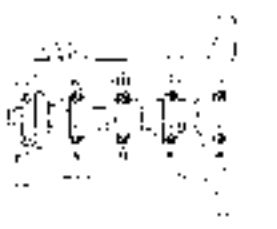
1. Remove the engine assembly (see section D.1).
2. Remove the cylinder head (see section D.5).
3. Remove the oil pump (see section D.9).
4. Remove the oil pump assembly (see section D.10).
5. Remove the piston and connecting rod assemblies (see section D.6).
6. Flywheel. Release the six bolts, and remove the flywheel.

7. Rear Seal housing. Release the five screws and remove the crankshaft rear oil seal housing. Press out the oil seal using a screwdriver.



8. Oil pick up pipe. Release the two bolts securing the oil pick pipe flange, and the two bolts securing the pick up pipe bracket, and remove the pick up pipe assembly.

9. Main bearing caps. Check that each main bearing cap is marked with its fitting position. Before release of the bolts of the first cap, and removing the cap, remove the thrust washers from each side of the rear bearing.
Lift out the crankshaft.



i) Flywheel: Check the clutch friction surface of the flywheel for signs of excessive wear, scoring or other damage. Replace the flywheel if any are found.

ii) Ring Gear: Check the condition of the ring gear teeth in the two positions of maximum wear. To remove the ring gear, use a hacksaw to cut between adjacent teeth, and a chisel to split the gear.

Heat the new ring gear evenly to a temperature not exceeding 200°C and fit onto the flywheel up to the flange. Allow to cool naturally in the air before refitting the ring gear can out.

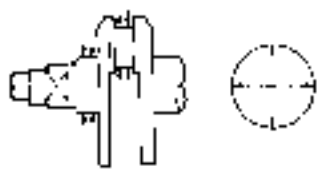
Maximum run-out = 0.1 mm (0.0039 in).

b) Crankshaft: The crankshaft is nitrided to provide a highly durable wearing surface on the journals. Because this nitriding process is a surface treatment, it is not permissible to regrind the crankshaft.

i) Journal Wear: Measure the diameter and wear variation of the crankshaft main bearing journals and crankpins. If any journal is outside the service limit, the crankshaft must be replaced.

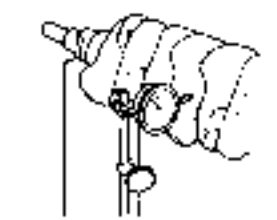
mm (in)

Dimension	Service Limit
Main journal diameter	51.938 (2.0496)
Crankpin diameter	39.925 (1.5719)
Max. wear variation	0.005 (0.0002)



ii) Runout: Set the crankshaft on 'V' blocks, and measure the runout using a dial gauge. Replace the crankshaft if the measurement exceeds specification.

Max. run-out = 0.1 mm (0.004 in)



c) Main Bearing Shells: If the crankshaft is found to be serviceable, the oil clearance of the main bearings should be checked to establish whether the bearing shells should be replaced.

i) Visually inspect the shells for any signs of scoring or other damage. Replace as a set if any signs are found.

ii) Clean the crankshaft journals, bearing shells and bearings in the block and caps. Assemble the upper shells in their original positions in the block, and fit the crankshaft thrust washers. Carefully fit the crankshaft into position, and apply plastigage to the main bearing journals as shown.

...) For the main bearing caps with shells, and for the bolts with lubricated threads and washer faces, torque tighten the bolts in the order shown, to MW/ (for the [illegible]).

Torque to Yield (of Fr)

(c) Refresh the main bearing caps (an opposite order to that during assembly) and ease to the bearings with an extension (the oil clearance). If the clearance exceeds specification, the shell bearings should be replaced as a set.

Main bearing oil clearance: Metric

New		Service Limit
0.020	0.069	0.07
(0.0008	0.0027)	(0.0028)

Bearing identification and color sequence

a. The main bearing shells are available in various thicknesses in order that the optimum oil clearance may be achieved. Both the main bearing bore size in the block, and the main bearing journal O.D. size on the crankshaft, are plated at the factory, and marked accordingly. These markings must be referred to if assembly requires block, crankshaft or bearing shells. The locations of these markings are shown in the illustrations.

Main bearing shell bore identification

Main bearing journal O.D. identification

Main bearing shells are plain. Without the upper shells have a groove and two holes (Drilled)

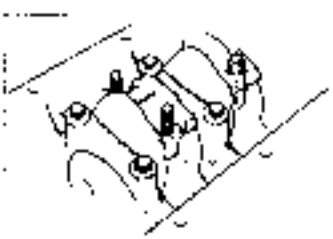
Oil Gallery Jets

Oil gallery jet size mark	Diameter of main bearing bore in block	Crankshaft main journal diameter	Crank web mark*	Bearing colour code	Oil clearance (reference)
1	59.997 - 60.003	51.988 - 51.994	Worn	Blue	0.012 - 0.030
		51.994 - 52.000	- -	Blue	0.006 - 0.024
		52.000 - 52.006	-	Black	0.000 - 0.018
2	59.991 - 59.997	51.988 - 51.994	Worn	Blue	0.006 - 0.024
		51.994 - 52.000	- -	Black	0.000 - 0.018
		52.000 - 52.006	-	Brown	0.006 - 0.030
3	59.985 - 59.991	51.988 - 51.994	Worn	Black	0.000 - 0.018
		51.994 - 52.000	- -	Brown	0.006 - 0.030
		52.000 - 52.006	-	Green	0.012 - 0.036

* Crank web marks '1' and '3' are only relevant when using a new crankshaft.

1C. Big end Bearing: Measure the oil clearance of the big-end shell bearings using plastigage:

- Clean the big end bore in the connecting rod and cap, and the crankpin.
- Fit the clean big end shell halves into the rod and cap.
- Apply plastigage to the crankpin as shown.



- Fit the rod and cap to the crankpin, and torque tighten the bolts to 35 Nm (25 lbf.ft). Do not turn crankshaft or rod.
- Remove the rod cap, and measure the width of the plastigage.

Oil clearance: mm (in)

New	Service limit
0.030 - 0.062 (0.0012 - 0.0024)	0.120 (0.0047)

- Clean plastigage from rod cap and crankpin.

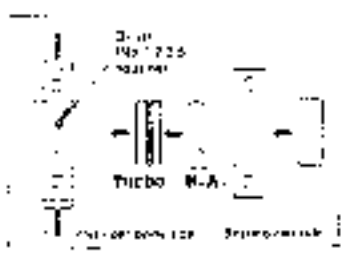
If new oil clearances exceed specified, fit oversize replacement bearing shells and regrind the crankpin to the undersize dimension required to provide correct clearance.
Note: Do not mismatch bearing shells. Ensure that the identification mark is on the cylinder block side.

Part No. of bearing shell	Diameter of big end bore in connecting rod	Crank pin diameter	Bearing colour code	Bearing shell thickness (reference)
1	1.9990 - 2.0000	1.9745 - 1.9750 and thereafter 0.010 undersize steps	Blue	0.1917 - 0.1927
1A	2.0000 - 2.0010		Black	0.1922 - 0.1932
1B	2.0010 - 2.0020		Green	0.1927 - 0.1937

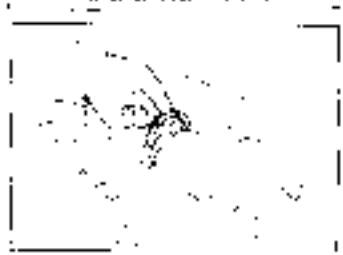
Serviceability

To check serviceability of bearing shells, remove bolts and lower connecting rod cap. Wipe oil from shell and measure thickness of plastigage strip. Compare with specified limits. Renew shells if worn.

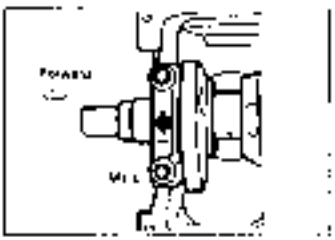
Main bearing shells are identical to those for connecting rods but have an oil groove and hole in upper shell only. Ensure that the oil hole in the upper shell registers with the hole in the cylinder block.



To fit crankshaft and thrust washers: Lightly oil the bearing shells before carefully fitting the crankshaft into position.
Remove and fit the thrust washers into position either side of No. 2 main bearing (centre). The oil grooves must face the crankshaft.



4. Main Bearing Caps: If Lubricate the bearing shells, and fit the main bearing caps in their correct positions, with the arrows facing towards the front end of the crankshaft. Lubricate the bolt threads and bearing faces before installing and tighten evenly.



11. Torque tighten the main bearing cap bolts in the order shown.

Torque: 90 Nm (65 lbf ft)

Check that the crankshaft rotates smoothly.

5. Measure Crankshaft End Float: Use a dial gauge as shown to measure the crankshaft end float. If the clearance is outside specification, remove no. 3 main bearing cap, and replace the thrust washers as necessary to achieve the correct clearance.

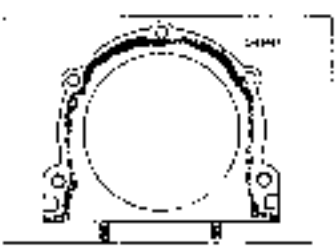
Crankshaft endfloat: mm (in)

New	Service Limit
0.05 - 0.24 (0.002 - 0.010)	0.30 (0.012)

6. Pistons/Connecting Rod Assemblies: Fit the piston/connecting rod assemblies as detailed in section EC.12.

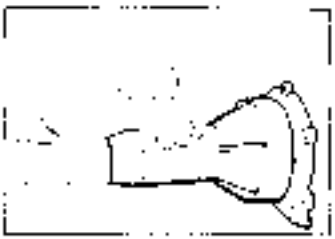
7. Rear Seal Housing: Clean the mating face on the housing and cylinder block and apply sealant ACC0061E (Y8-120) to the housing as shown. Lubricate the oil seal lip, and fit the housing into position over the locating dowels. Secure with new bolts, and tighten tighter to 10 Nm (7.5 lbf ft).

Note: Take care not to dislodge the oil seal garter spring.



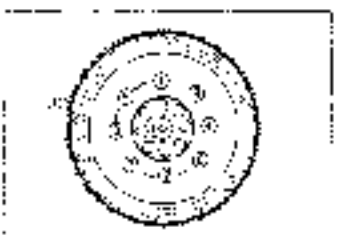
7 Rear oil seal: If the rear seal, was removed for replacement, fit a new seal into the housing using the special tool.

Seal - service [illegible]



8 Flywheel: If thoroughly degrease the threads of the crankshaft and the crankshaft and flywheel mating faces. Apply Loctite 561 or similar thread locking compound to the threads of NEW flywheel fixing bolts, insert through the flywheel washer, and secure the flywheel to the crankshaft.
Note: Do not apply any excessive amount of sealer to the bolt threads, or the resultant overflow may contaminate the oil sealing face and cause the bolts to work loose.

10 Bolt the flywheel and clutch assembly to the rear face of the cylinder block, progressively tightening the bolts in a diagonal sequence to the specified torque in a single operation. Use a suitable tightening method as shown in the table.



Flywheel bolt tightening

Tightening	[illegible]
Torque lbf.ft	[illegible]

11 Oil pick up pipe: Fit the oil pick up pipe to the cylinder block using a new gasket, and torque tighten the fixing bolt.

Torque: [illegible]

12 Refit the oil pump assembly (see section [illegible]).

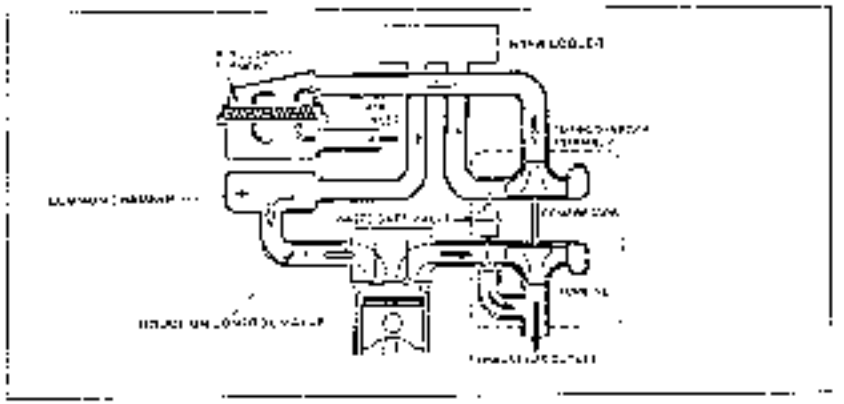
13 Refit the oil pump (see section [illegible]).

14 Refit the cylinder head (see section [illegible]).

15 Refit the engine assembly (see section [illegible]).

11.11 - TURBOCHARGER (1.8 16v)

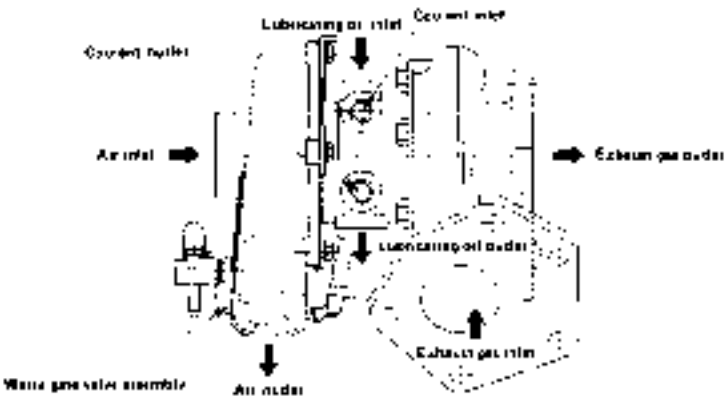
An IHI turbocharger, type RHB 5 with a water cooled bearing housing and integral wastegate, is bolted to the cast iron exhaust manifold. The exhaust gases spin the turbine wheel at speeds up to 160,000 rpm, before exiting the turbocharger and flowing into the exhaust system. The turbine wheel is linked to a short shaft supported by fully floating bearings, on the other end of which is fixed the compressor wheel. The compressed gases are fed from the air filter box and ducting to the air out at the compressor housing, through the intercooler (where it reduces its temperature and increases its density), and into the inlet plenum. The extent to which this air is compressed is dependent on throttle opening and engine speed. It is mechanically limited by the exhaust wastegate to a maximum boost pressure of 0.81 bar (0.8 atm). However, an ECM controlled vacuum solenoid valve in the control piping to the wastegate capsule, is modulated under certain operating conditions, to vent the control line and allow boost pressures of up to 0.95 bar (0.9 atm) to be developed. See engine management section ENG.2 - T for full details of the boost control strategy.

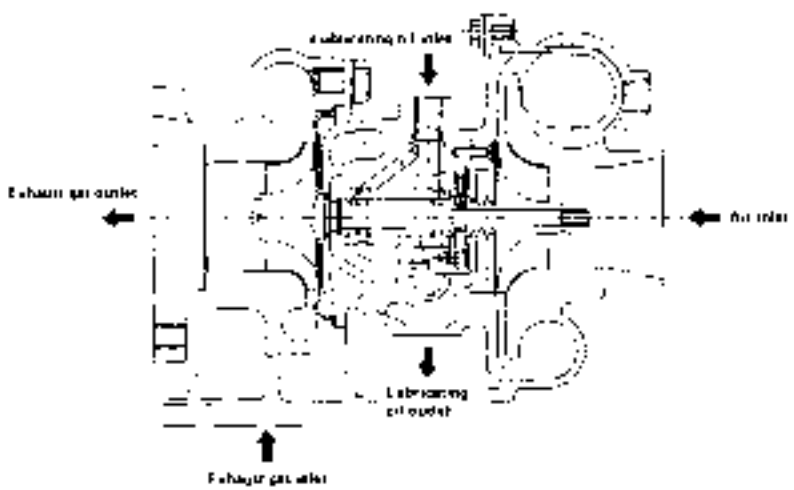


The wastegate consists of a coil spring/pneumatically operated flap valve fitted between the turbine housing inlet and outlet ports, when opened, diverts a proportion of the exhaust gas away from the turbine to limit the boost pressure built up in the inlet. The flap valve is linked to an operating capsule which contains a spring to hold the valve shut, and a diaphragm pressure chamber connected by a short hose to the boost pressure at the compressor outlet. As boost pressure builds up, the force in the pressure chamber, opposing the spring pressure, pushes up until the flap valve is opened.

As an engine safeguard, in case of a boost control system failure, the ECM will switch off the fuel pump if boost pressure in excess of 0.97 bar (1.0 kg/cm²) is detected for more than 0.6 second.

The turbocharger bearings are supplied with engine oil feed from the oil gallery at the right hand side of the block, and an oil drain is provided to return oil to the right hand side of the crankcase. In order to help protect the lubricant in the turbocharger bearings from the effects of heat soak after the engine has been stopped, a water feed and return system is provided, and connected between the thermostat housing and the radiator by-pass water pipe. Water circulation around the bearings continues after engine switch off, by thermo syphon action.


Coolant outlet
Air inlet
Exhaust gas outlet
Lubricating oil outlet
Exhaust gas inlet
Air outlet


Exhaust gas outlet
Air inlet
Lubricating oil outlet

you prevent the possibility of contamination of the oil in the turbocharger.

The turbocharger unit is, with the exception of the wastegate capsule, a non-serviceable item which must be removed if faulty. A visual check of the play in the shaft bearings is a design feature, and should never be removed. Should the amount of play allow the rotating compressor wheels to contact any part of their housings, the shaft should rapidly seize and destroy and the turbine and compressor blades should be free both sets of perpetual damage. Extra care must be taken when working on the engine to prevent any foreign matter from entering the turbocharger as the blades will be severely damaged.

To Remove Turbocharger

1. Disconnect or remove the oxygen sensor.
2. Remove the 3 downpipe and starter catalyst heat shield.
3. Disconnect the compressor intake and outlet hoses.
4. Disconnect the oil feed pipe and return hose.
5. Disconnect the water feed and return hose. Remove the water return pipe bracket from the exhaust manifold.
6. Disconnect the vacuum hose and valve hose from the compressor outlet.
7. Unbolt the starter catalyst from the turbocharger and remove both units.
8. Unbolt the turbocharger from the exhaust manifold and withdraw.

Reverse the removal procedure to refit the turbocharger.

Wastegate Checking Procedure

To check that the wastegate capsule is operating accurately, proceed as follows.

Tools Required: - Drill motor
- Accurately ranged thermometer
- Hand operated vacuum/pressure pump (SERVICE)
- 0 - 30 psi pressure gauge (e.g. Mityvac 8410E)

1. Remove the turbocharger heatshield by releasing the three fixing screws.

2. Fit the attachment fixture (2007L.3) to the capsule rod and tighten the fixing screw. Fit the dial gauge parallel to the capsule rod and shorting the finger. Zero the gauge.

3. Disconnect the capsule pressure hose, and connect the hand pump and a suitable pressure gauge to the capsule as shown in the diagram.

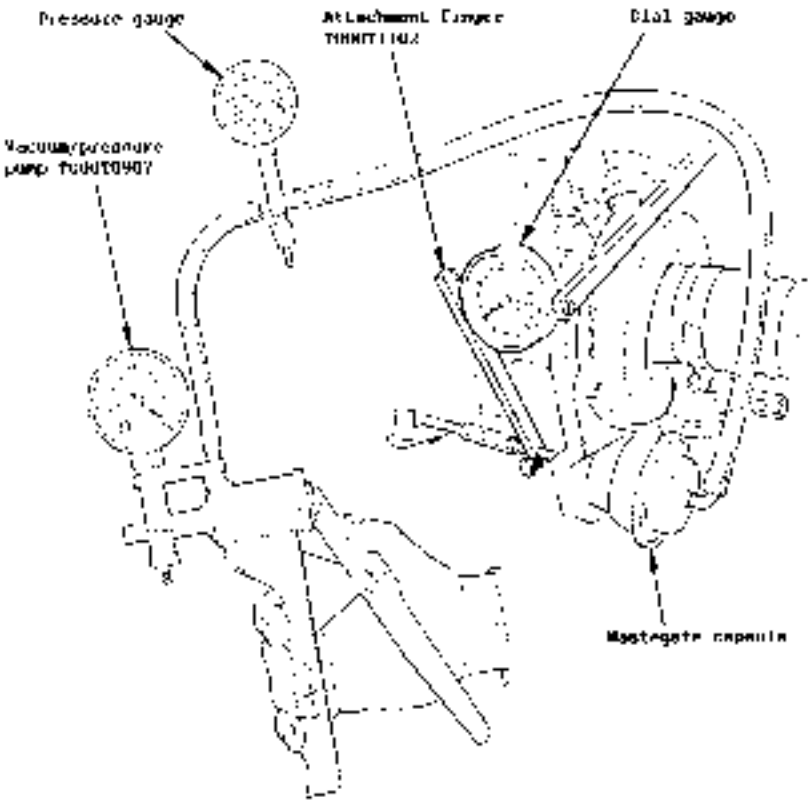
4. Use the hand pump to slowly increase pressure in the capsule, until the rod has moved 2mm. Record the pressure reading.
Specification:
Pressure required to produce 2mm rod movement = 7.5 - 8.0 psi

Note that as the pressure is increased, a small amount of creep may occur before the rod starts to move rapidly. If the 2mm point is reached, release all pressure and begin again, as hysteresis in the system results in different results for increasing and decreasing pressures.

5. If specification is not achieved, small deviations may be corrected by an adjustment to the actuator rod length, but large ones with these lengths rods should have the capsule and rod assembly replaced.

6. To replace the wastegate capsule, release the actuator rod from the wastegate

over after removing the 'U' clip, and remove the three screws securing the vapour canister to the turbocharger. Fit the new capsule and fasten the bracket back to the body. Refit the pin to the wastegate lever with the 'U' clip. Reconnect the pressure hose. Refit the heat shield.

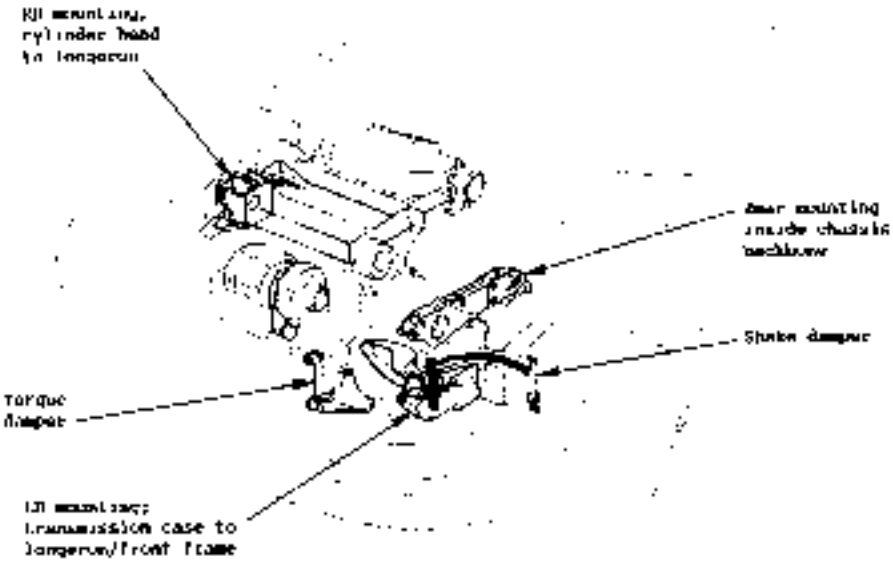


50.1 ENGINE MOUNTINGS

The engine is carried in the chassis by three widely spaced, welded steel brackets, and is provided with anti-torque and side hydraulic dampers to filter and compensate and reduce noise, vibration and harshness transmission to the cabin.

The right hand end of the engine is supported by a mounting bolted to the top of the right hand inner wing.

A bracket bolted to the front of the transmission casing carries a mounting which connects to the left hand longeron.

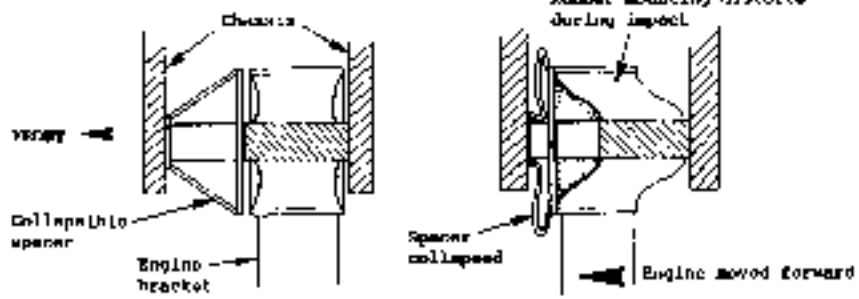


- An engine steady arm bolted to the rear of the engine/transmission, projects under the front of the chassis backbone and is secured via a rubber mounting to the chassis floor.
- An engine torque reaction damper is connected between a bracket bolted to the left hand front of the engine/clutch housing, and the underframe (crossmember or chassis front brace rail).
- An engine shake damper is fitted across the left hand engine mounting.

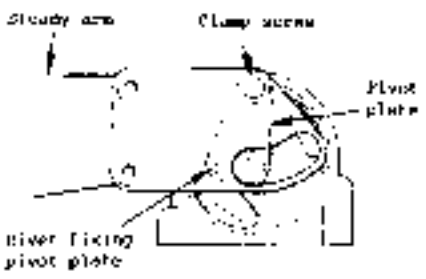
Collapsible Spacers (USA models)

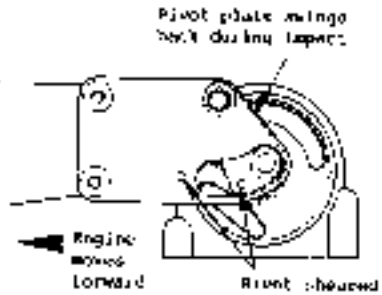
In USA cars, each of the nylon engine mountings is provided with a collapsible element designed to allow the engine to move forward on initial impact in a frontal collision. The chassis is then able to absorb the crash energy in a more predictable manner for optimum occupant protection.

The right and left hand engine mountings are bolted with collapsible spacers either behind the right hand mounting (fixed to the crossmember) or ahead of the left hand mounting (fixed to the power unit).



The rear position uses a slotted pivot plate retained by a clamp screw and steady arm where the pivot is allowed to move in an arc/wave and slide forward during the motion.





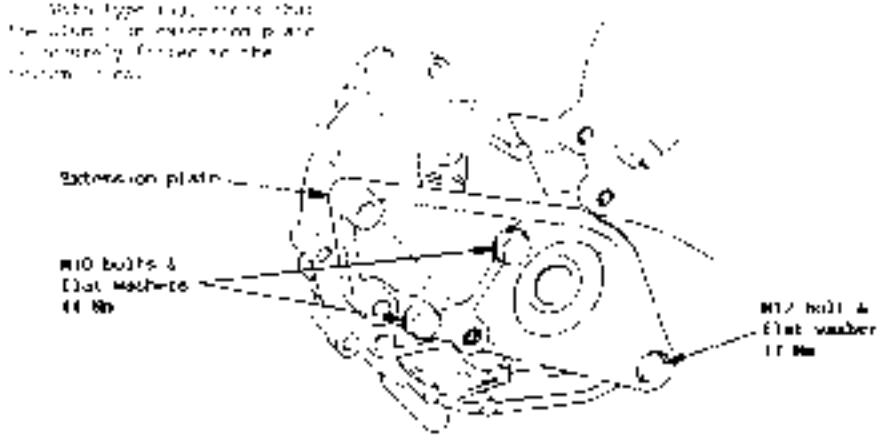
If the rubber mounting is to be replaced following a broken rubber, it is recommended that all three of these adjustable variable mountings are replaced with a new set of units and not single or pairs.

Gear Box Mounting Setting Procedure

Note: It is not an option, that the following procedure must be used to ensure that the gearbox is operating in the optimum position.

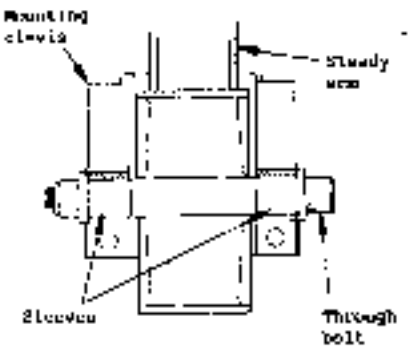
1. Set up fitting the engine assembly (or rear steady arm and mounting). Note type of steady arm have been used.
   (a) A fabricated steel arm (illustrated in the Type 7 welding book). This type used a plain bearing arm.
   (b) A fabricated steel arm using rubber mount pivot plates to pick up the variable variation in the centre distance. Used on all 904 cars and some earlier cars.
   (c) A cast aluminium arm with a rectangular (or three quarter segment) slot machined in it bolted to the transmission. This type uses the taper shear plates and is used on all 907 cars.

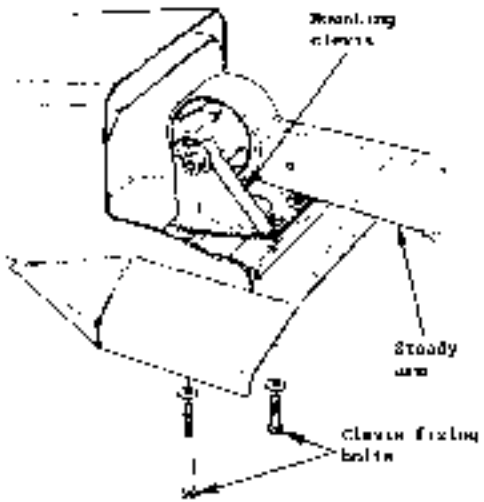
Note type (c) must have the extension plate correctly fitted to the rear of the gearbox.



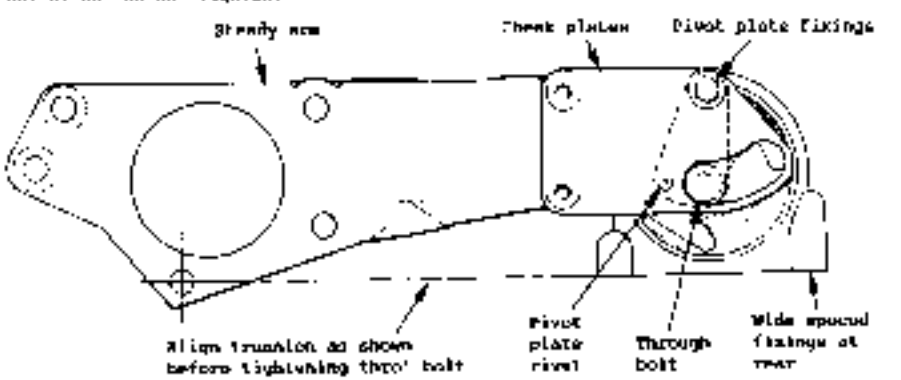
Fit the mounting clevis to the rubber bush on the steady arm as shown in the diagram, with the stamping towards the rear, and the sleeves and flat washers on the mounting through bolt. Torque tighten the through bolt to 75 lbf ft (10 kgf m). Fit the arm into the chassis and locate the clevis with its four bolts but do not tighten.

Plan section of clevis & bush



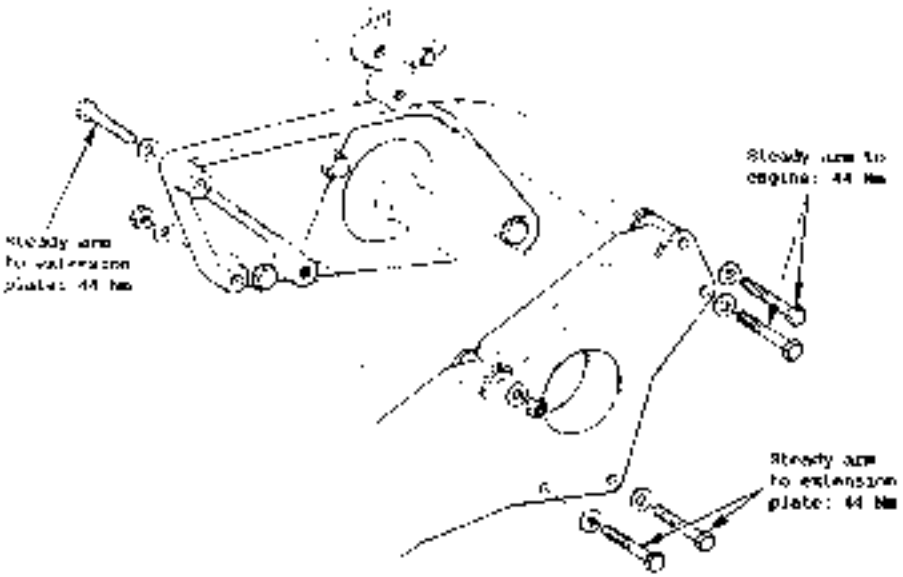


With rear axle, check that the suspension extension plate is securely fitted to the transmission. Check that the steady arm pivot plate rivets are tight; if in doubt drill out check plate assemblies and secure to the steady arm with the four button head screws (apply thread locking compound such Permanent Grade Threadlock to 45 No 135 (or 11). Do not disturb the pivot plate nuts which are set during manufacture. Assemble the mounting trunnion to the pivot plates (note raised flanges to the rear) and torque tighten the trunnion bolt to 75 lbf ft (10 kgf m) with the arm and trunnion positioned as shown in the diagram. If the arm assembly is to the chassis, and locate the trunnion with its four bolts, but do not tighten.

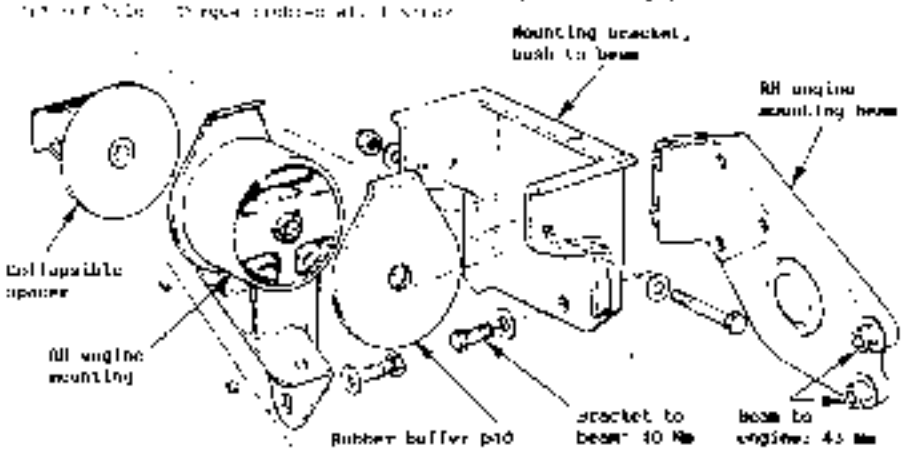


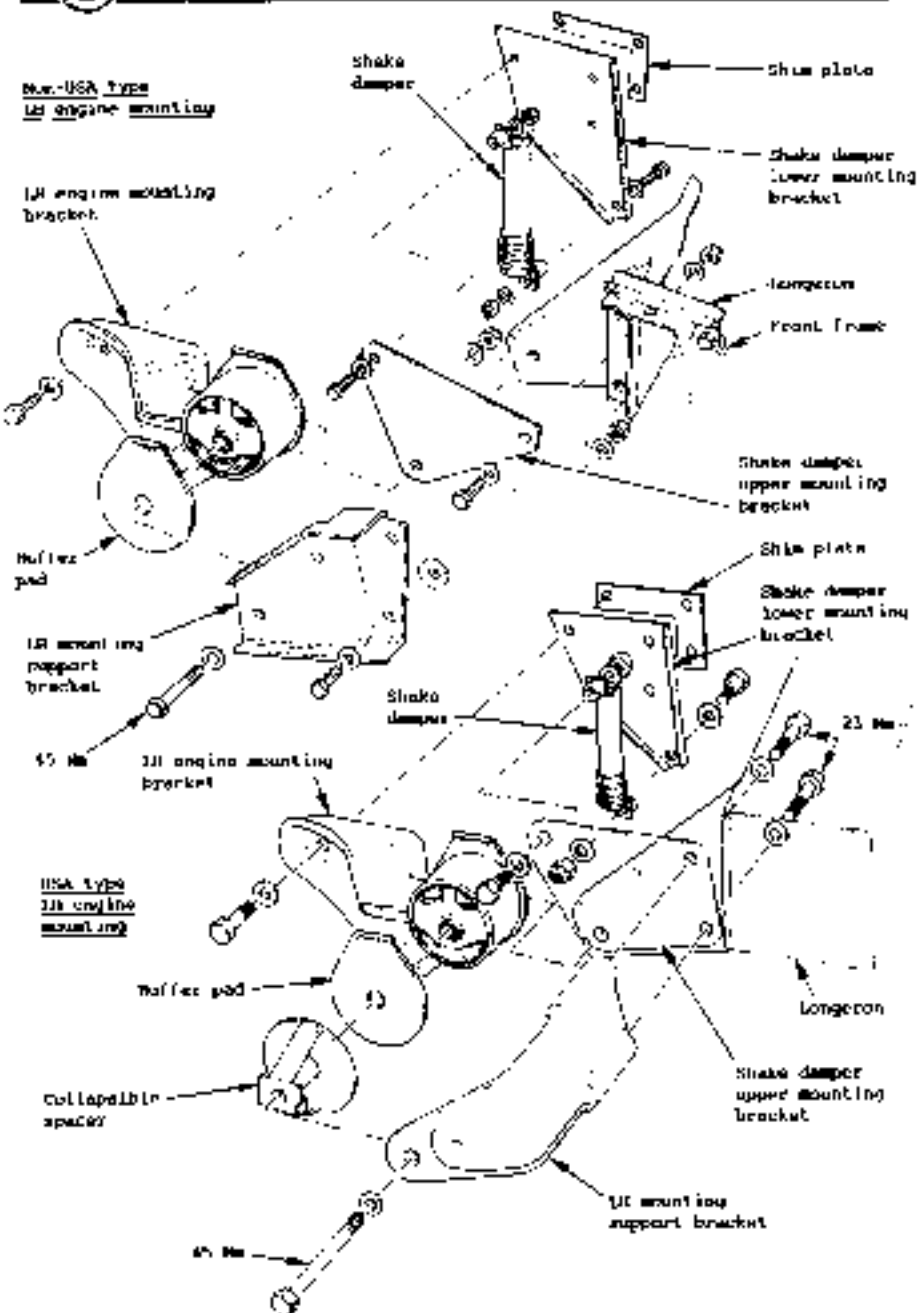
Assembly of the clutch is as for the Type 46 except that the transmission housing clevis pins are fitted.

Refit the engine supported on a sling, and the steady arm to the engine bracket and engage it with the steady arm ball pin.



Fit the right hand engine mounting assembly with the rubber buffer pad fitted to the mounting bracket. Fit the collapsible spacer behind the mounting on the RH side, ensuring that the lip of the spacer is engaged in the mounting bracket hole. Engage bracket with the beam.

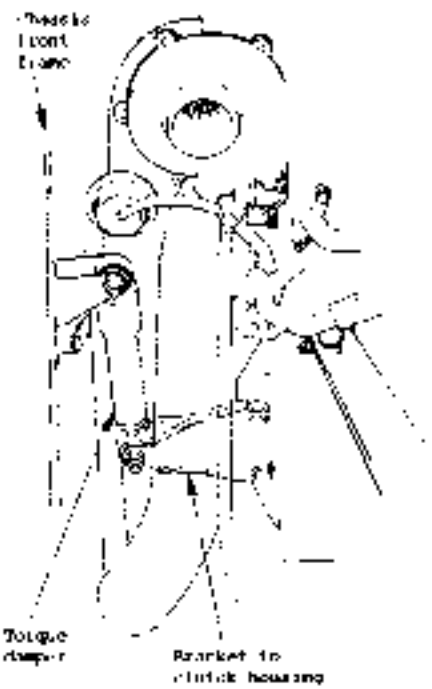



Non-USA type
LH engine mounting
Shake damper
Shim plate
Shake damper lower mounting bracket
LH engine mounting bracket
Longeron
Front frame
Shake damper upper mounting bracket
Rubber pad
Shim plate
Shake damper lower mounting bracket
LH mounting support bracket
Shake damper
23 Nm
45 Nm
LH engine mounting bracket
USA type
LH engine mounting
Rubber pad
Longeron
Collapsible spacer
Shake damper upper mounting bracket
LH mounting support bracket
45 Nm

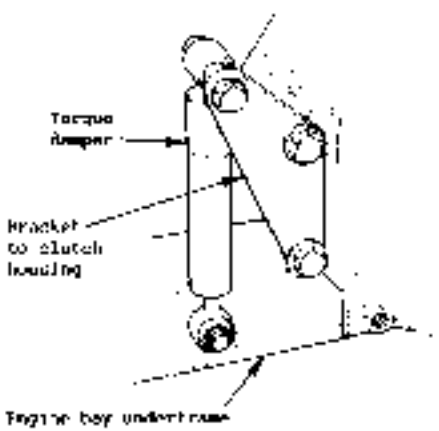
[illegible] the unit body mounting bracket and chassis damper bracket on the [illegible] mount. Some Esprit S4 models have pillar pads which are fitted [illegible] the mounting bracket through the chassis bracket. On USA cars, [illegible] chassis mounted on the front suspension cross member. On all other cars the [illegible] bracket bolts on to the engine bay floor.

[illegible] the clutch and torque damper.

USA Type Torque Damper

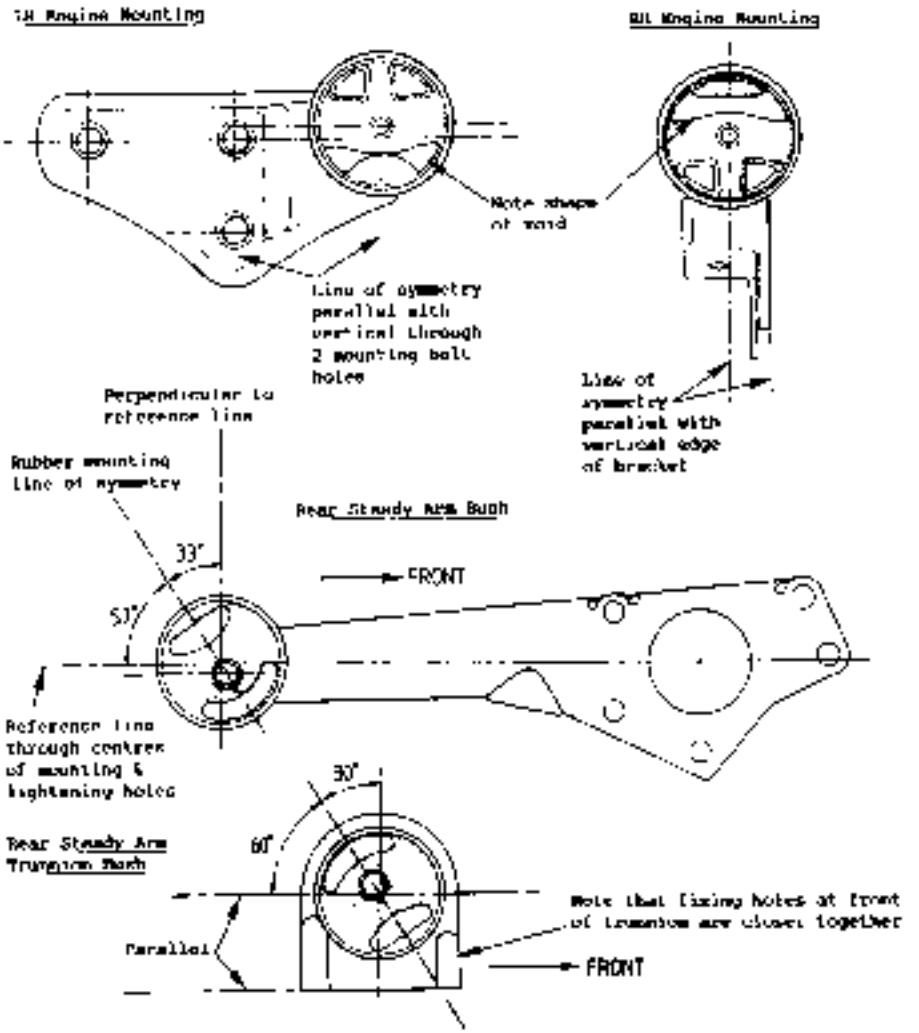


Non-USA Type Torque Damper



Rubber Bush Replacement

Few items require mounting bushes are of similar physical dimensions, but differ in the construction of the rubber bush. Each bush may be removed from its mounting bracket using a press. Before pressing a new bush into position take care to ensure that the correct bush is selected and that it is correctly orientated.

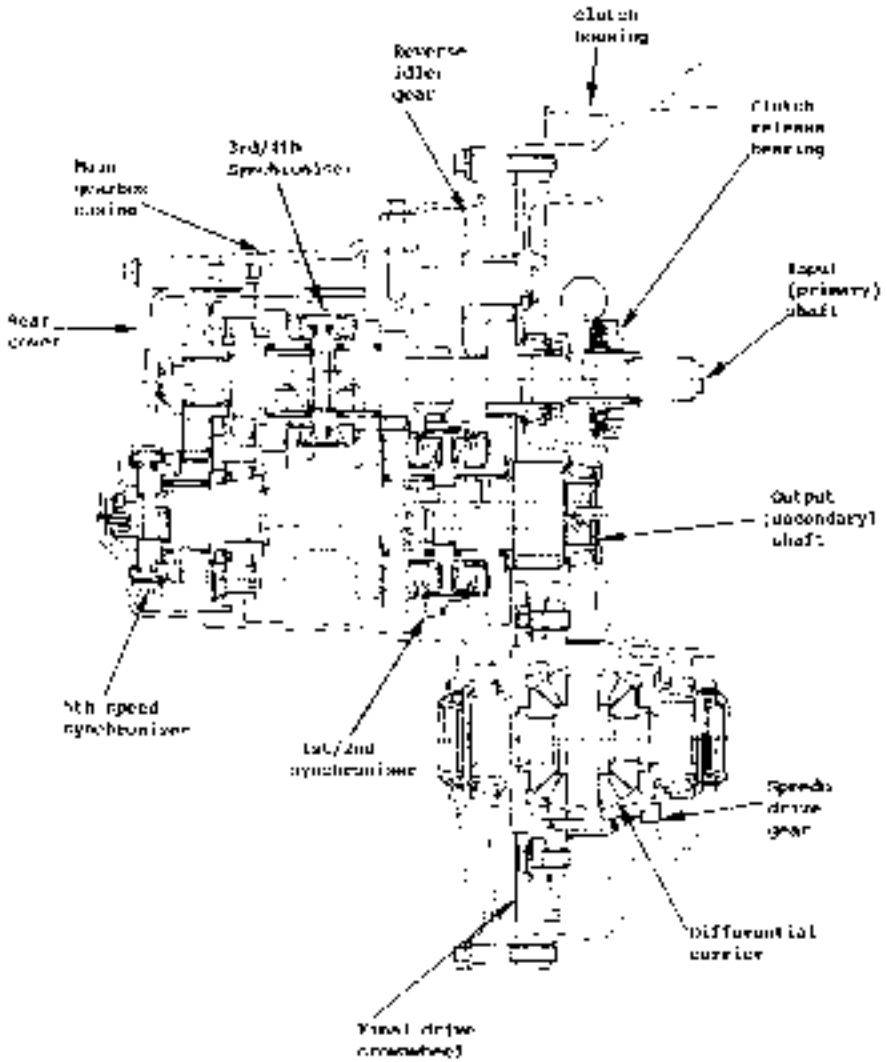


SPECIAL TOOLS

Description	Part Number
Driver Extractor Prep. Used to check valve clearance during production.	[illegible]
Throttle Plug Disconnector Helps to fit/remove throttle cable plug from throttle body.	[illegible]
Manifold Gasket Fixing Tool Fixing tool used to fit/remove manifold gasket.	[illegible]
Valve Spring Compressor For use when fitting valve springs.	[illegible]
Valve Lock Tool Used to remove and refit inlet and exhaust valve locks.	[illegible]
Engineer, valve rocker, preparation. Prep to replacement of valve rocker arm. Valve will be valve guide.	[illegible]
Tool, fitter, cap prep. Tool will engage to nut for the cap between cam and block.	[illegible]
[illegible] Takes central to engine oil filter	[illegible]
[illegible] crankshaft is not oil seal. Enables direct of crankshaft to oil pump location.	[illegible]
Drift, pin fixing set Used on, a N/A transmission pin to pins. Turns to pins [illegible]	[illegible]
Installer, crankshaft rear oil seal Enable correct of crankshaft rear oil seal to rear end cover.	[illegible]
Alignment, [illegible] gauge operate Clutch with automatic cancels for are operation and gauge plunger.	[illegible]

TRANSMISSION

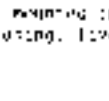
SECTION F1 [illegible]


Clutch housing
Reverse idler gear
Clutch release bearing
3rd/4th synchromesh
Main gearbox casing
Input (primary) shaft
Rear cover
Output (secondary) shaft
5th speed synchromesh
1st/2nd synchromesh
Speedo drive gear
Differential carrier
Final drive crownwheel

11.1 - MAIN DATA

Total length	1450.0 mm
Weight	In-5 kg
Material (EN 24)	Basic 1 BHP 2000 Fully Synchro'd
Total part number	0100PH0000
Speeds	1+1 Ultra
Gear ratio - 1st	3.33:1 (13/43)
2nd	1.91:1 (48/24)
3rd	1.19:1 (41/34)
4th	1.00:1 (34/34)
5th	0.82:1 (34/41)
Reverse	1.58:1 (34/18)
Final drive ratio - N.A	4.11@:1 (70/17)
- rev	1.81:1 (34/19)
Speedometer gear ratio	0.820:1 (24/30)
Identification on top cover: abc N.A	LA0
- Turbo	LA2

Shift pattern



11.2 - GENERAL DESCRIPTION

The transmission assembly is of 'end on' type, mounting in the left hand end of the engine unit and comprises of the clutch housing, five speed gearbox, final drive gears and differential.

Gearbox

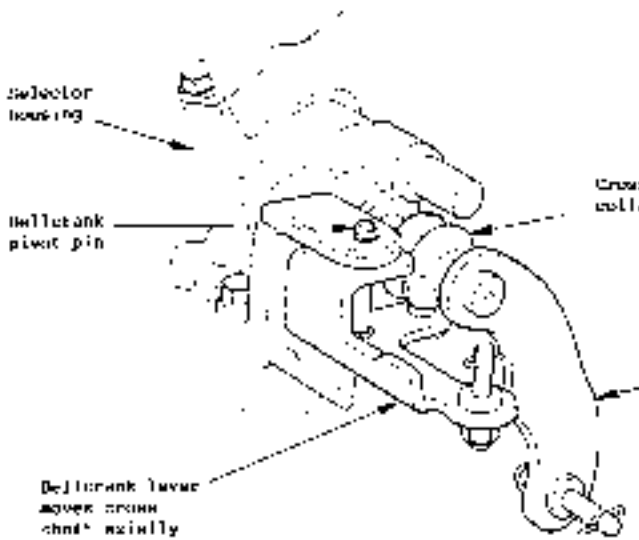
The gearbox is a two shaft all indirect five speed manual. Drive passes into the unit via the primary shaft which is splined with the engine crankshaft, and carries the clutch driven plate on its right hand end. A secondary shaft lying alongside and behind the primary shaft, adjusts the drive via an integral final drive pinion on its right hand end. This pinion meshes with a crownwheel carried in a large, box differential assembly, which distributes drive to the front wheels via two 'in' driven driveshafts. The drive to the rear wheels is taken from the left hand end of the secondary shaft, backshaft to the right hand side, engaging the two driveshafts to be of similar length to reduce the effects of torque steer.

Synchromesh is fitted to all forward speeds, with the 1st and synchronizer mounted on the secondary shaft, the sliding sprocket on the primary shaft, and the 5th synchromesh on the 'overdrive' unit mounted at the secondary shaft. Reverse gear is achieved by sliding an idler spur gear into engagement with main drive gear integral with the primary shaft, and the idler gear both mounted on the outside of the 1st/2nd synchromesh assembly. The primary shaft, secondary shaft and differential carrier are all supported on pairs of taper roller bearings adjusted by shims. The speedo drive pin is worked by the differential carrier.

Gearchange Mechanism

Four selector shafts lie across the top of the gearbox, and are operated by a cross shaft with a single actuating finger. A series of interlock plungers between the shafts allow only one selector shaft to be moved from the neutral position at any one time. The cross shaft is moved in a selector housing on top

A new transmission locking unit is fitted with a cover so as the shaft may be pulled to engage a gear, but a screw stud is used to move the shaft axially (enlarged for clarity).



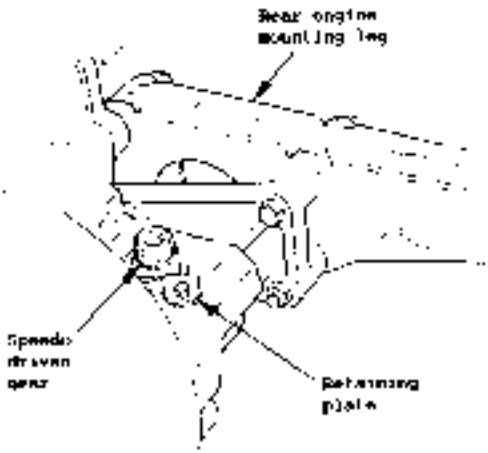
To engage any gear, the gear lever in the transmission tunnel is moved to the left or right and then forward or backward to select the required gear. The lever is connected to a rod which runs to the left to engage and select the gears in the gearbox. A cable is fitted to the rear of the gearbox to engage 5th or reverse gear. A coverage indicator is fitted to the rear of the gearbox to indicate which gear is engaged. This is fitted to the top left hand corner of the rear cover.

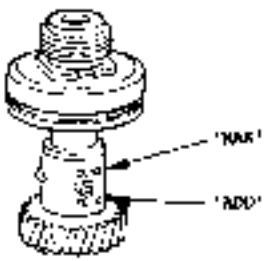
F1.5 - Lubrication

It is most important to keep the gearbox topped up with the correct lubricant. Check the oil level every 6000 miles.

At specified service intervals, the transmission should be thoroughly checked for any signs of oil leakage, which can be rectified by renewing a joint washer or oil seal, and the oil level checked.

To check the oil level, with the vehicle on a level surface, the speedometer driven gear assembly must be removed, and the oil level maintained to the bottom of the filler hole. Only start the engine if the transmission oil is enough to enable the car to be moved by hand. The speedometer gear is located at the top of the differential housing and is accessible from above, whereas the speedometer cable gear assembly will have to be removed, after which the oil level is checked between the high and low marks on the dipstick which are retained with one bolt on the fixing screw (1 pt (0.5 l) of oil).

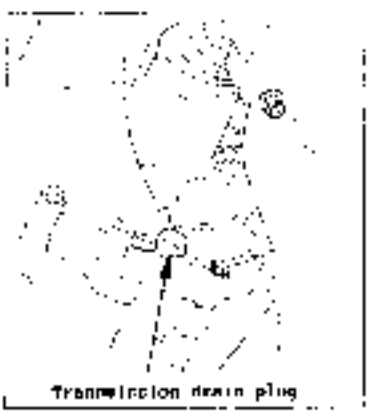




Drain the transmission oil immediately after a run, when the oil is warm and the impurities are held in suspension. Remove the drain plug from the left hand side of the final drive housing, beneath the output shaft.

Allow the oil to drain thoroughly before replacing the plug (with a new washer if necessary), and tightening to 15 lbf ft (20 Nm).

Oil capacity:
1.9 litres (3.3 Imp pts, 4.0 U.S.pts)


Transmission drain plug

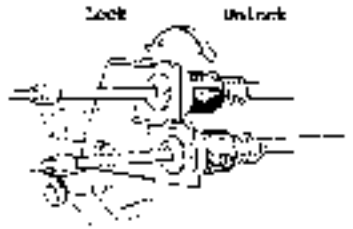
17.4 - GEARCHANGE CABLE ADJUSTMENT

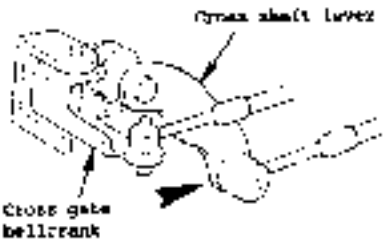
The gearchange mechanism uses two nylon cables to transmit the motion of the gearchange lever to the gearbox cross shaft. One cable connects directly to the bottom of the gearshift lever and transmits fore/aft motion to the gearbox cross shaft lever. A second, 'crossgate' cable, is connected to a peripheral lever at the base of the shift lever assembly, and transmits crossways movement of the lever to another bellcrank lever at the gearbox housing. This bellcrank engages with a collar on the cross shaft, and moves the shaft axially.

Adjustment

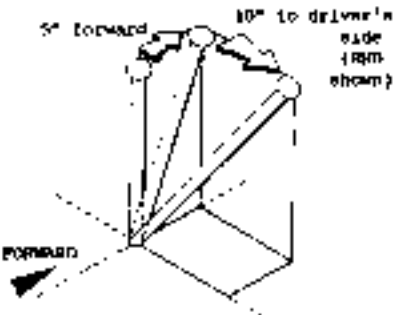
Each of the cables is fitted with a quick adjustment locking sleeve at the gearbox end. By turning the outer sleeve by a quarter turn, the cable outer can be allowed to slide freely within the sleeve, or be locked to it. To adjust the two gearchange cables, proceed as follows:

3. With the gearchange cables fitted and connected, unlock the adjuster sleeve on each cable at the gearbox distance bracket, by turning the outer sleeve **against** the direction of the arrow (top of the sleeve to the rear).





4. Set the transmission to third gear by moving the cross shaft lever (spring biased to the third/fifth gear plane) to the right



5. Position the gear lever locating 5° forward, and 10° towards the driver's side and hold in this position whilst the adjuster sleeves are locked by turning in the direction of the arrow.

6. Check the selection of all gears

PP.5 - GEARCHANGE CABLES & GEARLEVER MECHANISM REPLACEMENT

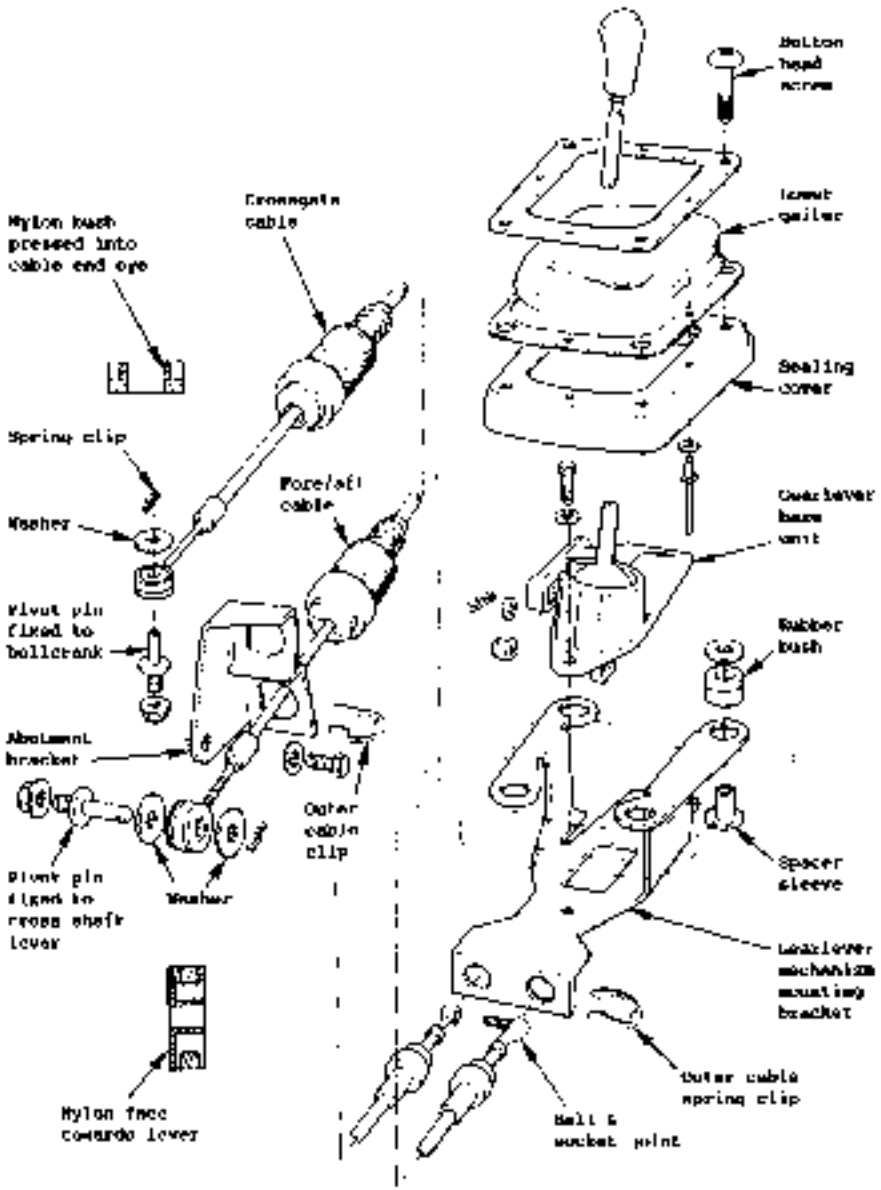
The gearlever mechanism must be withdrawn into the car, in order to provide access to the cable rear abutment and pertic cable replacement.

To Remove

1. Gearchange Cables: Pull off the spring clips securing the two inner cables to the gearbox levers, and the spring clips securing the adjuster sleeves to the abutment bracket. Release the cables from the gearbox, taking care to note the positions of the washers for the inner cable ends.

2. Gear Lever Knob: To remove the knob, push down the top of the gaiter from its location groove in the underside of the knob, and slacken the grub screw exposed. Turn the knob counterclockwise to unscrew from the gear lever.

3. Centre Cubby/Console & Trim Casing.
- Remove the blind panel from between the rear of the centre tunnel console and the rear wall, by releasing the single retaining screw.
- Pull out and disconnect the hazard control switch, to the rear of the gear lever.
- Pull out and disconnect the two window switches, each side of the parking brake lever, and release the two console front fixing screws via the switch apertures.
- Pull out the oddments tray from the rear of the tunnel top, and release the two console rear fixings via the tray aperture. Pull the console to the rear to


Button head screw
Corrugated cable
Nylon bush pressed into cable end eye
Spring clip
Washer
Fore/aft cable
Pivot pin fixed to bellcrank
Abutment bracket
Outer cable clip
Pivot pin fixed to cross shaft lever
Washer
Nylon face cowardo lever
Sealing cover
Gearlever base unit
Rubber bush
Spacer sleeve
Outer cable spring clip
Bolt & washer pint

disengage the coupling from the main fascia, and then lift the console over the parking brake lever.
- Remove the gear lever gaiter over the lever.

4. Lower Gaiter & Gearchange Mechanism: Remove the four button head screws securing the lower gaiter assembly, and gearchange mechanism to the chassis. Pull the lower gaiter assembly up off the gearlever, and withdraw the lever assembly from the chassis aperture, complete with the cables. Do not misplace the alloy spacer sleeves from each of the gearlever assembly rubber mountings.

5. Gearchange Cables: Release the aggregate cable from the gearlever bellcrank by removing the spring clip and washer. Disconnect the fore/aft cable by removing the retaining nut. Pull off the spring clip securing each of the other cables to the gearlever bracket.

6. Gearlever Assembly: Further dismantle the gearlever mechanism if necessary.

To Replace
1. Gearlever Assembly: If necessary, re-assemble the gearlever assembly, and refit to the gearchange bracket, torque tightening the nut across to 15 Nm (11 lbf.ft).

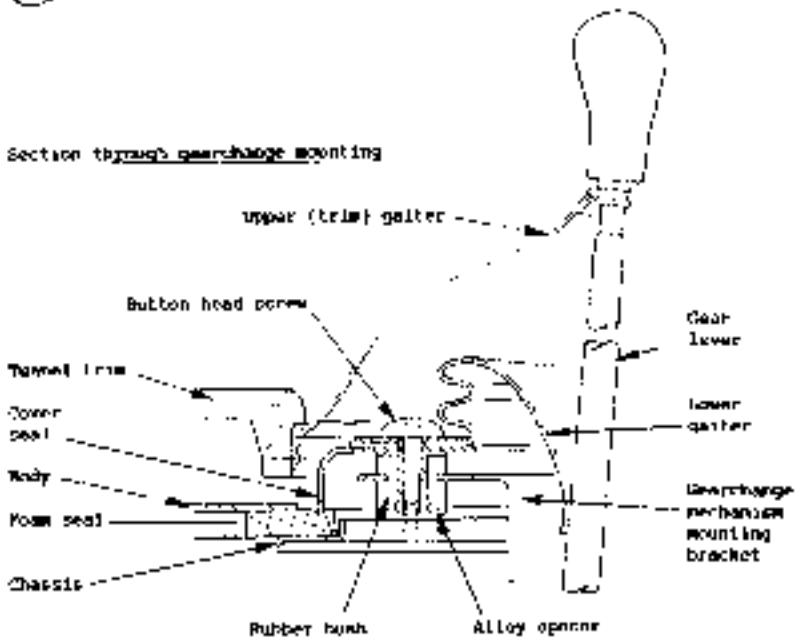
2. Fore/Aft Gearchange Cable: The fore/aft cable may be identified by the rubber bushed eye at the front end, and the ball joint threaded spigot at the rear end. Fit the rear end of the cable through the left hand abutment hole in the gearchange mechanism bracket, ensuring that the flat on the outer cable spigot is properly located in the 'D' hole, and secure with an 'E' clip (SJ00F 6291F) with the concave side towards the abutment bracket. Discard any spring wire type clip fitted previously. Fit the inner cable threaded spigot to the bottom of the gear lever and secure with the nylon nut.

3. Aggregate Cable: The aggregate cable has a small eye at each end. Fit the rear end of the cable (and without the grub adjuster sleeve) through the right hand abutment hole in the gearchange mechanism bracket, ensuring that the flat on the outer cable spigot is properly located in the 'D' hole, and secure with an 'E' clip (SJ00F 6291F) with the concave side towards the abutment bracket. Discard any spring wire type clip fitted previously. Fit the inner cable eye onto the bellcrank lever spigot, fusing CRC grease) with the nylon face of the bush against the lever, and retain with the washer and spring clip.

4. Gearchange Mechanism: Feed the cables into the chassis aperture, and out into the engine bay whilst fitting the gearchange mechanism into position. Check that a rubber bush is fitted in each of the bracket mounting holes, with the larger portion of the bush on the underside of the bracket. Fit an aluminium spacer into each bush from the underside, and position the four holes over the fixings on the chassis. Fit the lower gaiter assembly (molded plastic base, ribbed gaiter and steel top plate pivotted together) over the gearlever, and into position over the four fixing holes. Fit the four button head fixing screws, and tighten to 22.5 Nm (17 lbf.ft). Ensure that the centre of the rubber grommet is pushed down the shaft of the gear lever, rather than pointing upwards.

5. Trimmed Gaiter & Tunnel Console: Fit the trimmed gaiter over the gear lever, and locate the wired base of the gaiter into its location in the fascia moulding. Refit the tunnel console in the reverse order to disassembly.

6. Gear Lever Knob: Screw the knob onto the lever, and secure by tightening the



grub screw. Pull the top of the trim gaiter upwards to locate in the knob groove.

7. Gearbox End: Fit the crossgate cable (marine nyl) through the top hole in the abutment bracket, and fit the inner cable onto the bellcrank lever spigot with the nylon face against the lever. Retain with the washer and spring clip. Retain the outer adjuster sleeve (with 'O' fully engaged) to the abutment bracket with an 'E' clip (A130Fa29.F) with the concave side towards the abutment bracket. Discard any spring wire type clip fitted previously.

Fit the fore/aft cable in a similar manner into the lower hole, but note that a washer is fitted on each side of the rubber bushed eye of the inner cable when fitting to the cross shaft bellcrank. Apply PBC grease to all pivot pins.

9. Adjustment: Adjust the cables as detailed in section FF.6.

FF.5 - TRANSMISSION ASSEMBLY REMOVAL

The transmission assembly may be removed from beneath the vehicle, after removing the subframe.

1. Preparatory: Drain the transmission oil. Remove both front road wheels and both front hub arms.

2. Engine Bay: Remove or disconnect the following items.
- Release the air filter box mounting bracket from the LH bonnet. Disconnect the hoses and boost solenoid valve wires, and remove the air filter assembly
- Disconnect the speedo cable and reverse switch wires
- Unlock the clutch cable from the lever arm, and release the outer cable from

its gearbox bracket.
- Release both gear change cables from their selector levers, pull off the spring clips retaining the outer cable quick adjusters to the transmission abutment plate, and remove the cables from the transmission.

3. Underframe: Remove the underframe by releasing:
- three bolts securing the front end of the underframe to the radiator support frame;
- two bolts each side securing the lower brakes of the suspension rafts;
- the single bolt at each side securing the rear of the underframe to the chassis front crossmember;
- two bolts each side securing the tubular stays to the underframe;
- also remove the left hand stay from the chassis.

4. Driveshafts: Mark the position of the camber adjustment eccentrics on both P4 and P6 front suspension top wishbones, before releasing the two bolts securing the top wishbone pivots to the top ball joint. Push the drive shafts out of the final gears, and use a wide nosed, or a lever between the body or each inboard C.V. joint and the transmission to 'shock' the driveshaft over the retaining circlip, and off output shaft. Leave the driveshaft suspended in the damper yoke.

5. Lockshaft: Remove the two bolts securing the lockshaft bearing bracket to the engine, and withdraw the shaft (note - no retaining circlip is used at this point).

6. Exhaust Downpipe: Disconnect the exhaust downpipe, and release the anti-roll bar from the drop links to allow the exhaust to drop further.

7. LH Engine Mounting: Use a jack or sling to support the weight of the engine/transmission assembly before removing the left hand engine (transmission) mounting from the chassis. Remove the bracket from the transmission housing.

8. Rear Engine Mountings: Release the rear engine mounting arm from the transmission, and remove the aluminium mounting plate.

9. Flywheel Cover: Remove the flywheel lower cover from the engine and transmission.

10. Transmission Assembly: Lower the transmission end of the engine, and support the transmission assembly before removing the four bolts connecting the transmission to the engine, and withdraw the unit from the car, tilting the engine further if necessary, but taking care not to strain any hoses or harnesses.

77.) - TRANSMISSION ASSEMBLY REPLACEMENT

Reverse the removal procedure, noting the following points:

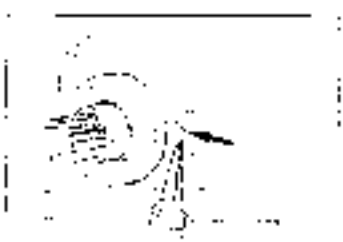
- Before fitting the lockshaft, fit a new square section snap ring RJ00FA4SH into the outboard end groove. Take care not to damage the output shaft oil seal when the lockshaft is inserted into the transmission.
- Before fitting the LH driveshaft into the transmission, fit a new round section snap ring RJ00HA20H onto the spigot of the inboard C.V. joint.
After pressing both driveshafts into position, check that the circlip is

fully located in the groove by pulling on the body of the inboard joint.
- Ensure the damper adjustment mechanisms on the top wishbone are positioned as noted prior to removal.
- Pull the lower ball joint to fit the brake hose into the top wishbone bracket, and secure with the spring clip.
- Refill the transmission using only Shell 75W-90S (SEMP6007).

Torque Figures	Nm	Lbf ft
Clutch Housing to Cylinder Block	47	35
Alloy Mounting Plate to Chassis - M10	45	33
- M12	75	55
Engine Mounting Arm to Alloy Plate - M10	45	33
Engine Mounting Arm to Block - M12	77	55
Jackshaft to Drive	5	20
Damper Yoke to Lower Link	75 - 82	55 - 59
Top Wishbone to Rear Hub	20 - 23	15 - 17
Ball Top Wishbone to Chassis	75 - 80	55 - 59
Swaybar Plate to Shaft	20 - 23	15 - 17
Hub Front & Rear Mountings	75 - 80	55 - 59
Undershield to Alloy	10	7.5
Alloy to Chassis	10	7.5
Undershield to Radiator Support Frame	10	7.5

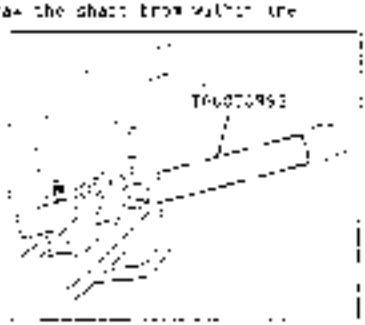
11.11 MANUAL GEARBOX DISASSEMBLY

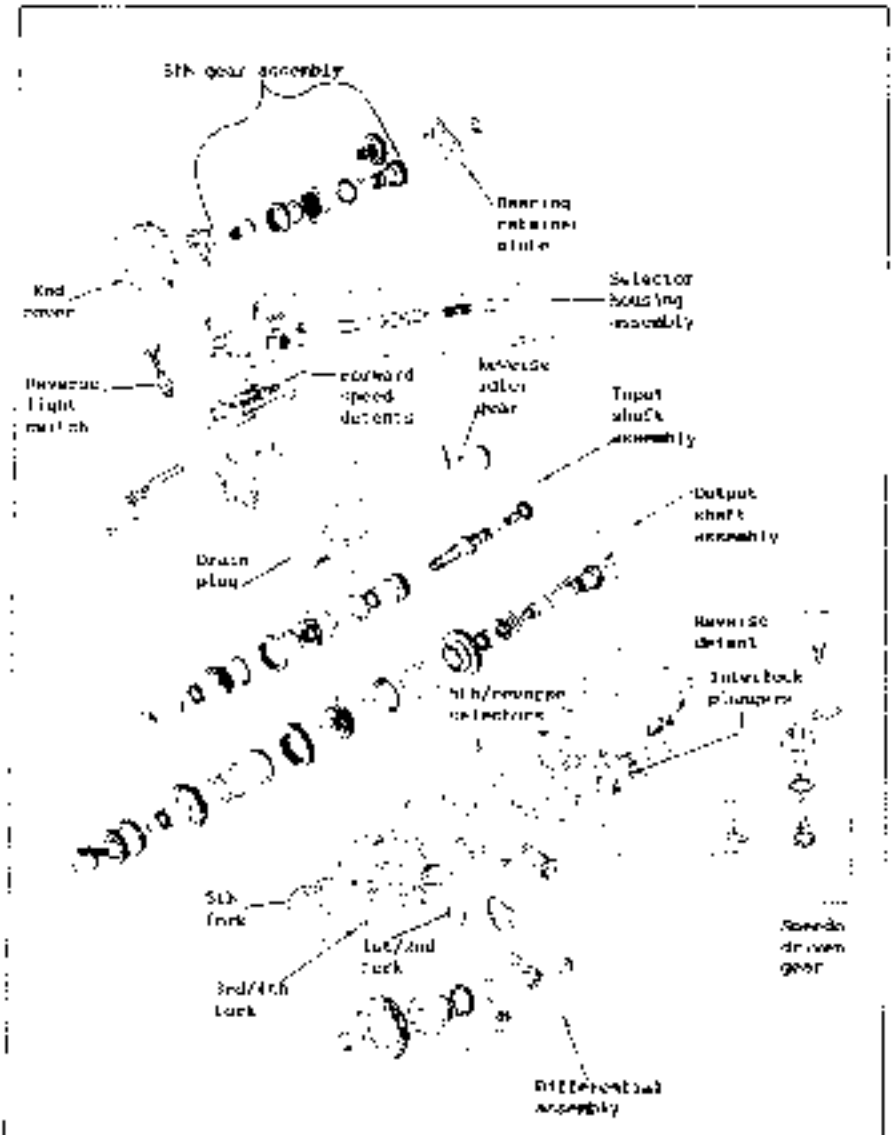
1. Clutch release bearing. Release the spring clip securing the clutch release bearing to the release fork and withdraw the release bearing.



2. Clutch release fork & shaft. If necessary, remove the clutch release fork and shaft. Remove the operating arm, pull off the dust cap, and prise out the circlip. Shaft seal. Use the special tool to knock the shaft bush using the shaft and drive the bearing. Remove the shaft spring and withdraw the shaft from within the housing.

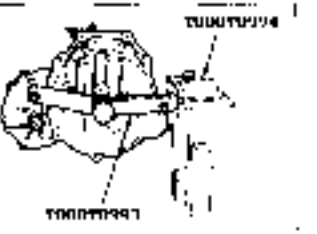
Clutch Shaft Dust Cover/Replacer Tool
  000T00951




5th gear assembly
Bearing retainer plate
End cover
Selector housing assembly
Reverse light switch
Forward speed detents
Reverse idler gear
Input shaft assembly
Output shaft assembly
Drain plug
Reverse detent
Interlock plungers
5th/reverse selectors
5th fork
1st/2nd fork
3rd/4th fork
Reverse driven gear
Differential assembly

3. Fit cover and carefully (if necessary, shake the transmission assembly to a vertical position) using new cover screws.

Tightening Figures: 10/20Nm
Plug & Case: 10/15Nm

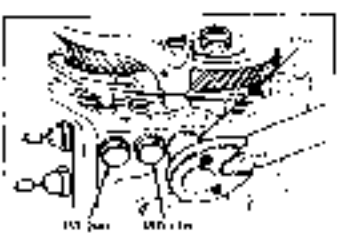


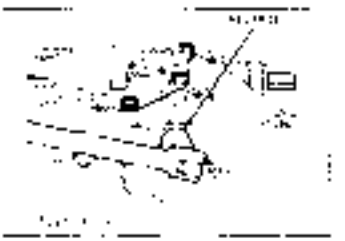
4. Fuel filter: Remove the 3 screws securing the end cover and pull off the cover and gasket.

5. Selector housing Assembly: Remove the 4 screws securing the selector housing and remove the complete assembly and gasket.

6. Reverse light Switch: Unscrew and remove the reverse light switch and blank-off spacer.

7. Detent Plunger, Balls & Springs: Remove the three plugs and withdraw the detent springs and balls for the forward speed selector shafts.





(i) Gearbox to rear Remove the (1) bolts securing the gearbox casing to the clutch/differential housing, and withdraw the gearbox casing (complete with selector shaft & fork assembly) vertically, (12) on the gearbox casing.

(ii) Reverse Idler Gear & Shaft Withdraw the reverse idler gear with its shaft, taking care not to misplace the shaft location pin.

(i) Selector Shaft & Fork Assembly. With a punch, move the 5th selector shaft down into the 5th gear position, and remove the core plug from the 5th shaft below the respective block. Lift the selector shaft clear of the 5 detent plungers (do not lift them out of the operating block) or the spring and ball should be lost). To allow the 5th and reverse selector shaft assemblies to be withdrawn together, take care not to misplace the interlock pin first within the 5th shaft end.

(ii) Selector Shaft & Fork, 3rd/4th: Use a pin punch to remove the single roll pin securing the (single) selector fork to the 3rd/4th selector shaft. Discard the roll pin. Slide the shaft upwards and remove the shaft and fork.
Take care not to misplace the interlock pin within the selector shaft.

(iii) Selector Shaft & Fork, 1st/2nd: Use a pin punch to remove the roll pin securing the (single) selector fork to the 1st/2nd selector shaft. Discard the roll pin. Slide the shaft upwards and remove the shaft and fork.

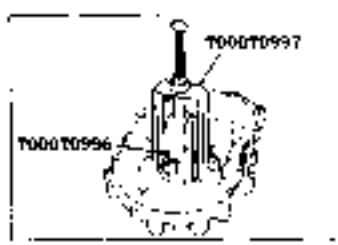
(i) Input & Output Shaft Assemblies. Withdraw the input and output shaft assemblies.

(ii) Differential Assembly. Withdraw the complete differential assembly.

(i) Interlock Pins: Remove the screws securing the interlock pin retaining plate/reverse fork pivot pins, and remove the plate. Remove the three interlock pins from their grooves in the clutch housing face.

(i) Outer Races, Gearbox Case. Knock out or withdraw the input shaft and differential bearing outer races from the gearbox case. Do not misplace the shim washers from behind the bearing races. To extract the differential bearing outer races, use special tools:

Outer Race Remover T00UT0996
+ Puller Bridge T00UT0997
(alternative slide hammer puller T00UT0480)

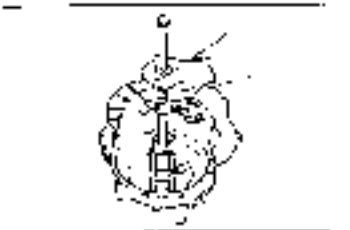


3. Using a short steel drift, drive out the differential case bearing cone from the gearbox case.

4. Using a suitable puller, remove the differential case bearing cone from the rear of the differential case.

5. Remove the differential case from the gearbox case.

6. Remove the oil seal from the differential case.



7. Using a suitable puller, remove the bearing cone from the differential case.

8. Remove the ring gear from the differential case by removing the fifteen bolts.

9. Remove the speedometer drive gear from the output shaft (4 speed).

10. Remove the bearing cone from the output shaft (4 speed).

11. Remove the bearing outer race from the rear extension housing.

12. Remove the bearing outer race from the gearbox case.

13. Remove the oil seal from the rear extension housing.

14. Remove the rear extension housing from the gearbox case.

15. Remove the bolts securing the rear cover to the gearbox case and remove the rear cover.

16. Remove the gasket from the rear cover.

17. Remove the bolts securing the front cover to the gearbox case and remove the front cover.

18. Remove the gasket from the front cover.

19. Remove the oil seal from the front cover.

20. Remove the bearing outer race from the front cover.

21. Remove the bolts securing the clutch housing to the gearbox case and remove the clutch housing.

4 - MAIN COMPONENT ASSEMBLY

General

Before re-assembly

All parts must be thoroughly washed in clean solvent and dried. Ensure all traces of old gasket particles, dirt or fluff are removed from the surfaces of each part. Lightly oil all parts through each oil feed port and ensure all oil drillings are clear by blowing through with a jet of air. Do not use rags to remove any deposits or cleaning material.

Inspect all gear teeth for signs of wear or damage and check all gear splines for burrs, wear or damage. Renew minor nicks or scratches with a fine stone. Inspect all thrust washers for evidence of excessive wear, corrosion or damage. Replace any part showing excessive wear or damage.

Inspect the selector forks for cracks, distortion, damaged locating surfaces, or excessive wear. Replace any part that exhibits these conditions.

Inspect the condition of all needle, roller, ball and thrust bearings. Wash each type thoroughly in a clean solvent and allow dry. Note: Do not spin the bearings with compressed air as they may be damaged. Turn slowly by hand; lubricate the bearings with a light oil and check for roughness by slowly turning by hand.

Shimming

The input shaft, output shaft and differential assemblies are each supplied

by the upper outer bearings, with the endplay/preload controlled by a shim washer fitted behind the bearing outer track in the gearbox casing. Each time the transmission is disassembled, the retaining circlip should be removed, and if any components are replaced, a re-check of endplay will be required.

In order to aid shim selection, a special tool set T00U01005 is available, and should always be used because the special gauges apply a spring loading to the shaft bearings. In order to ensure they are fully seated and correctly aligned when the shim measurements are taken. Note that when using the gauges, the O-ring must be removed from the gearbox casing just from the circlip/shaft housing, and the output shaft oil seal must not be fitted to the gearbox casing. The procedure for using the gauges is detailed in the following assembly sequence:

1. Input Shaft Oil Seal. Insert a new oil seal into the gearbox casing, with the spring side of the seal towards the gearbox.

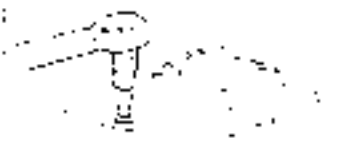
Installer T00U01004

2. Outer Race, Input Shaft/Clutch Housing: Fit the input shaft outer race into the clutch housing using the installer with handle, and a hammer

Installer T00U01000
Handle T00U01001

3. Outer Race, Output Shaft/Clutch Housing: Fit the oil nozzle into the bearing recess before fitting the output shaft outer race into the clutch housing using the installer and a hammer.

Installer T00U01002



(c) Fit the input shaft and check gear in both directions several times to seat the bearings and gauge.

(d) Measure the gap between the machined face of main casing and the gauge using variable shim pack and select the required shim pack width of the 3 shims in accordance with the following instructions and shim chart.

The input shaft unit should be one size smaller than the largest shim that will fit in the gap

- The output shaft should use the largest shim that can be placed into the gap and turn through without binding

- The differential should use a shim three sizes larger than that which will exactly fit in the gap.

Shim Selection Chart

Dimension mm (in)	Gap size			Thickness mm (in)	Available		
	Input	Output	Diff		Input	Output	Diff
1.00 (0.039)	*			0.76 (0.004)	*		*
1.01 (0.041)	*			0.90 (0.035)	*	*	*
1.08 (0.042)	*		*	1.04 (0.041)	*		*
1.12 (0.044)	*		*	1.18 (0.046)	*	*	*
1.16 (0.046)	*	*	*	1.32 (0.052)	*		*
1.20 (0.047)	*		*	1.46 (0.057)	*	*	*
1.24 (0.049)	*	*	*	1.60 (0.063)	*		*
1.28 (0.050)	*		*	1.74 (0.069)	*	*	
1.32 (0.052)	*	*	*	1.88 (0.074)	*		
1.36 (0.054)	*		*	2.02 (0.080)	*	*	
1.40 (0.055)	*	*	*	2.16 (0.085)	*		
1.44 (0.057)	*	*	*	2.30 (0.091)	*	*	
1.48 (0.058)	*	*	*	2.44 (0.096)	*		
1.52 (0.060)	*		*	2.58 (0.102)	*	*	
1.56 (0.061)	*	*	*	2.72 (0.107)	*		
1.60 (0.063)	*		*	2.86 (0.113)	*	*	
1.64 (0.065)	*	*	*	3.00 (0.118)	*		
1.68 (0.066)	*		*	3.14 (0.124)	*	*	
1.72 (0.068)	*	*	*	3.28 (0.129)	*		

Note that the 3 shims are different diameters, with the input shim the largest, the differential middle size, and the output shim the smallest.

(e) When each of the three shims has been selected, remove the gearbox case, seven spacers and shim select gauges.

[illegible] Bearing [illegible] [illegible] Bearings [illegible] the [illegible] [illegible] the differential [illegible] [illegible] bearings.

[illegible]

[illegible] Apply [illegible] to the [illegible] [illegible] in the positions shown. [illegible] [illegible] the fixing screws.

[illegible] the [illegible] [illegible] [illegible] screws.

[illegible] Differential Assembly. [illegible] the differential assembly into [illegible] [illegible] Section.

[illegible] the [illegible] [illegible] [illegible] [illegible] and [illegible].

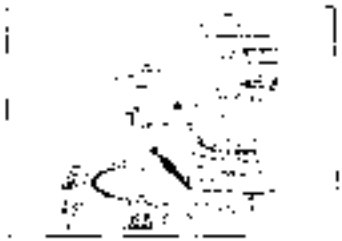
[illegible] input and output [illegible] [illegible].

[illegible] Check the [illegible] [illegible]

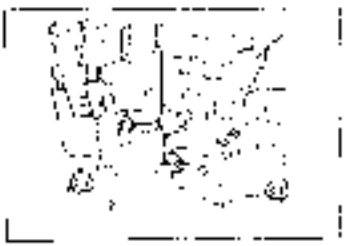
[illegible]	[illegible]
[illegible]	[illegible]

[illegible] check that [illegible] is fitted onto the shaft [illegible] the [illegible] synchroniser [illegible] of the input shaft, and [illegible] [illegible] that the [illegible] [illegible] the [illegible] [illegible] by the [illegible]. [illegible]

(h) Selector Plate Clamp. Tighten the interlock plate fixing screws to 20 Nm (14 lbf.ft).



(i) Selector Shaft & Fork. Install:
Position the 1st/2nd selector fork over the 1st/2nd selector groove on the output shaft, and slide the selector shaft through the fork and into the circular bore. Locate the shaft in the interlock groove aligned with the bore in the shaft casing's new pilot position.

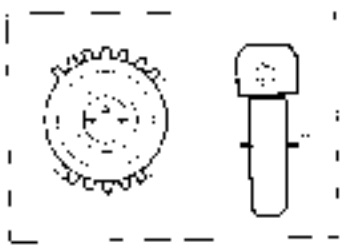


(j) Selector Shaft & Fork, 3rd & Reverse. With the 5th and reverse shafts assembled with the operating block and reverse relay arm, (seen at (a) on shaft circlip), ensure that the interlock plunger (for identification see 2000cc or later) is fitted into the end of the 5th speed shaft. Position the two shafts and set the reverse shaft, drop in the reverse relay spring and engage the reverse relay arm with the reverse lever. Insert the 5th speed shaft through the interlock plate.
Set the assembly to the 1st speed shaft, below the operating block.

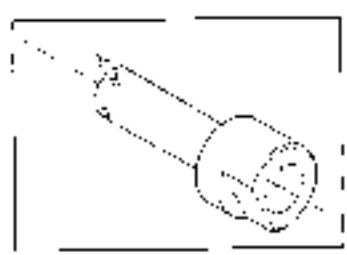
(k) Reverse Idler Gear & Shaft. By measuring the inside diameter of the gear (A), and the outside diameter of the shaft (B) to determine the running clearance.

A - B = 0.15 mm maximum

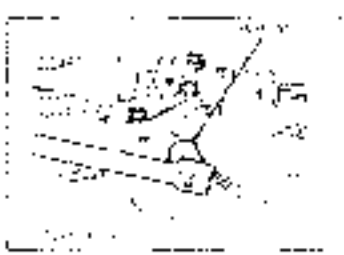
Replace both components if outside specification.



(l) Fit the reverse idler gear onto its shaft (operated 3rd bush), and fit the location pin into the shaft as shown in the diagram. Fit the shaft into the casing with the location pin in the slot provided to the original shaft.



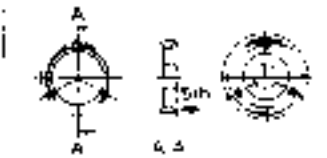
(m) Rubber & Magnet. Check that the oil gutter is secured to the gearbox casing with the fixing screw, and that the magnet is fitted into its slot in the differential housing.



[illegible] Fit the drive gear onto the input shaft, substitute the driven gear needle roller bearing and fit onto the output shaft sleeve. Fit the driven gear over the bearing.

[illegible]

[illegible] Fit Synchroniser Assembly. Fit the synchro hub onto the drive gear. Refit on the synchroniser assembly the correct key (small, with the bar detent) [illegible] removed in the grooves and fit the two engagement springs one into the output shaft and detector shaft respectively. Ensure that the synchro hub keys engage with the synchroniser plates.



[illegible] Fit the Thrust Washer onto the splined stepped plate over the output shaft. Check the clearance between shafts A and B (fig.) using a thrust feeler gauge and adjust to 0.02 in. (0.5 mm). Fit the pin to both shafts [illegible] the shafts by engaging 3rd or 4th gear and then engaging the gear by sliding the selector fork on its shaft. Torque tighten both nuts.

Torque to 110 lbs ins (127 kgf.cm)

Make sure the nuts securely in two places. Select neutral.

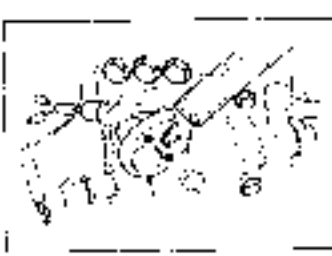
[illegible] Selector Fork. Secure the selector fork to its shaft using a new [illegible].

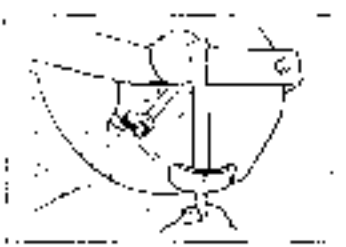
[illegible] Reverse Selector Shaft and fasten the reverse light switch with its plunger in position.

[illegible] Selector Mechanism Assembly. Fit the selector housing assembly using a new gasket, and fit and tighten the fixing screws.

Torque to 13 lbs ins (14 kgf.cm)

The 4 gear ratios can be selected.





21.1 GEAR BOX OUTPUT SHAFT DISASSEMBLY/REASSEMBLY

Input Shaft Disassembly

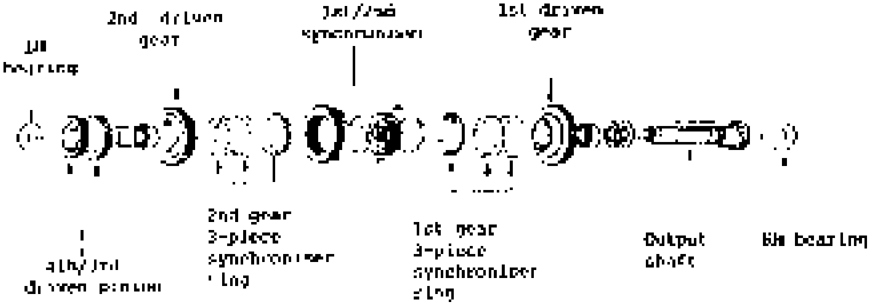
The input shaft assembly consists of the input shaft with the integral first, second and reverse gear drive pinions, right and left hand taper roller bearings, third/fourth speed driven gear, third and fourth gear free drive pinions, and the third/fourth speed synchromesh assembly

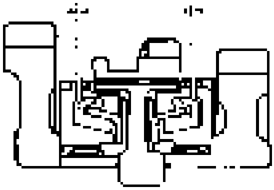
a. Input Shaft R.H. Bearing: Remove the right hand bearing using a suitable bearing remover and a press.

b. Input Shaft L.H. Bearing, 3rd & 4th Drive Gears & Clutch Synchronizer Assembly: Fit the bearing remover set 21 013 over drive gear and use a press to remove the complete bearing/gear/synchro assembly.

Output Shaft Disassembly

The output shaft assembly consists of the output shaft with integral final drive pinion, right and left hand beam roller bearings, third/fourth speed driven gear, first and second speed free pinions, and the first/second speed synchromesh assembly.





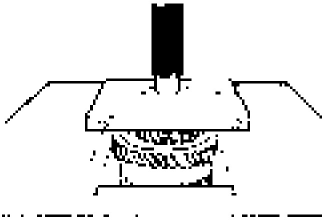
[illegible] 1st & 2nd synchro [illegible]. Wear of the 1st and 2nd gear synchronisers may be assessed prior to disassembly of the output shaft. Move the synchroniser sleeve to press one of the synchro rings against its gear, and measure the clearance between the synchro ring and the dog teeth flange of the gear.

[illegible] = 0.8 mm [illegible]

If the clearance is below specification, the 3-piece synchro ring assembly should be renewed.

[illegible] Output Shaft RH Bearing. Remove the [illegible] bearing [illegible] plate.

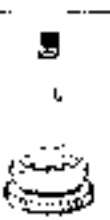
[illegible] T000T1[illegible]



7. Output Shaft Ball Bearing & 3rd/4th Gear. Remove the left hand bearing together with the 3rd/4th driven gear pair, 5th driven gear thrust washer and needle bearing sleeve. Use a bearing remover located behind the 4th gear wheel, and a press. Then remove the 3rd/4th gear key from the shaft keyway.

2. Pull out the needle bearing & synchro ring. Slide off the 3rd speed driven gear with the needle roller bearing. Remove the 2nd speed reverse synchro ring nut.

3. Support the reverse gear in a vice and use a puller to remove the 1st speed driven gear, splined synchroniser assembly, 3rd/4th gear needle roller sleeve, reverse synchro.
Lift out the 1st gear needle roller bearing, needle roller thrust bearing and thrust washer.

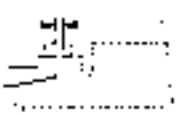


Inspection of Components

1. Synchro Rings: If for any 1st and 2nd speed synchro ring(s) and the 1st and 2nd speed driven synchro ring assembly, with their corresponding gears, and measure the clearance between the ring and the big boss flange.

Clearance - Full new minimum

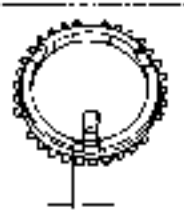
Replace the synchro ring if below specification.



2. Measure the clearance between each synchro ring slot and a rub mark.

Clearance - 1st/2nd ... mm max
3rd/4th, 5th - ... mm max.

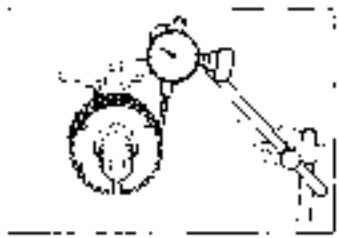
Replace the synchro ring if the clearance exceeds the specification.

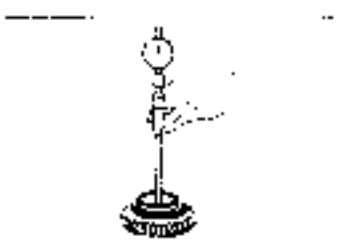


3. Synchro hub: a) Measure the clearance between the synchro hub slots and dogs

Clearance - 0.25 mm maximum

If the clearance exceeds specification, replace the synchroniser assembly.





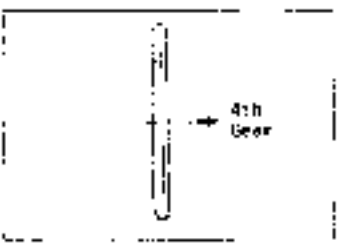
Input shaft bearing

[illegible] gear sleeve. Fit the 4th gear needle bearing, remove and fit the shaft and fit the [illegible] retainer with a sleeve to [illegible] position.

Tool No. [illegible]

[illegible] Remove the [illegible] lightweight 4th gear, needle roller bearing and [illegible] ring. Fit the 4th speed synchro [illegible] synchro sleeve.

Fit the drive gear over the shaft splines, engage the 4th gear thrust washer, and fit onto the [illegible] the stepped side towards the gear.



[illegible] Fit the [illegible] Adjust [illegible] with the shaft [illegible] Tool No. [illegible]

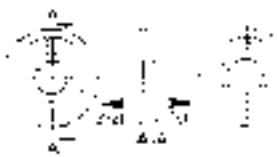
Tool No. [illegible]

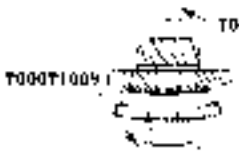
[illegible] Press [illegible] Fit the right hand taper roller bearing, to the shaft using the [illegible] Tool No. [illegible]

Tool No. [illegible]

Output Shaft Assembly

[illegible] Remove. Fit the 1st gear thrust washer onto the output shaft. Lubricate the needle roller 1st gear and fit onto the shaft. Lubricate the 1st gear needle bearing, and fit onto the shaft followed by the 1st speed gear.

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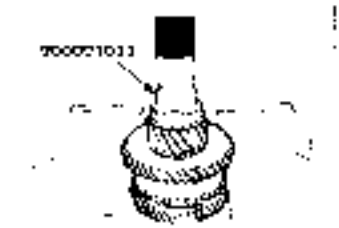
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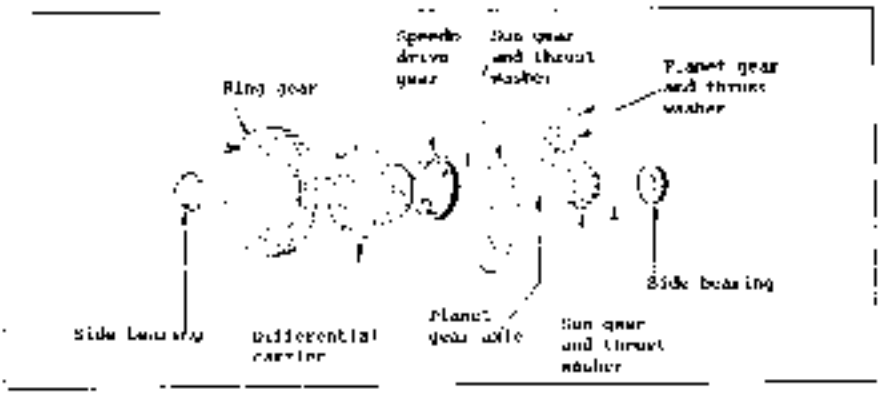
H.11 - FRONT DIFFERENTIAL (1967 ON)



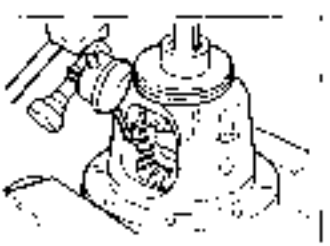
With the unit removed from the transmission (see section H.6), proceed as follows:

Dismantle

1. Side bearings: Use a suitable puller and remove the bearings from the differential carrier, and lose the bearings with their race.

2. Speedometer drive gear: The speedometer drive gear should not be removed unless it is necessary to renew it. Use a suitable puller or other method to remove the gear, and discard.

3. Ring gear: Remove the nine nuts and bolts securing the ring gear to the differential carrier, and remove the gear.



4. Differential gears: It is unlikely that the gears and thrust washers will require renewal unless the gear teeth are worn or chipped, or the thrust washers are scored. If any of the gears require renewal, the complete set of gears must be renewed. Remove the pinion shaft lock screw, withdraw the pinion shaft, and remove the gears and thrust washers.

Inspect - See Section H.

If the particular component is figure, replace all the drive gear thrust washers.

g. Check the clearance on the pinion gear using a dial indicator. Place the indicator on the pinion gear tooth and move the pinion gear back and forth. Remove the differential gears, taking care to note the original location of the shims and thrust washers.

h. Clamp a vise to both halves of the internal diameter of the right gear, and external diameter of the axle to measure the clearance between the two components.

Clearance: 0.1 mm maximum

Remove the gear and axle if clearance exceeds this figure.

i. Or, measure the axial distance of the end gear journal without the thrust washers. Subtract the combined thickness of the thrust washers.

Limit: 0.15 mm maximum

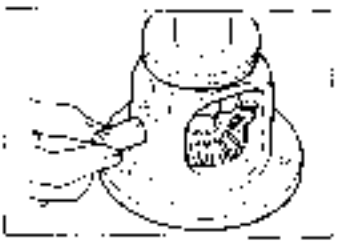
Remove the end gear and differential carrier if clearance exceeds this figure.

j. Differential carrier. Measure the diameter of the left and right side gear journals.

Limit: 22.0 mm minimum

Replace the left carrier if the diameter exceeds this figure.

Assembly

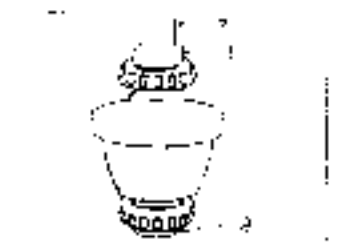


Ensure all components are clean and lightly oiled before assembly. Fit the sun gears and thrust washers into the carrier in their original positions. Fit the first planet gear and thrust washer onto its pivot pin and insert the planet gear into the carrier ensuring the thrust washer is correctly aligned. Check backlash between pinion and sun gear as above.

Line up the "flats" on the planet gear axle lock pin with a pin punch to allow the pin to the bottom of the bore. Fit the end cap and the lock pin to secure with a punch to retain the pin.

- Planet gear
- Lock pin

To assemble brake drum fit the new speed drive gear (less the gear is approx. 80 - 100) fitting gear on bearing in the blower (you do NOT use old washer), and install the gear in the carrier.



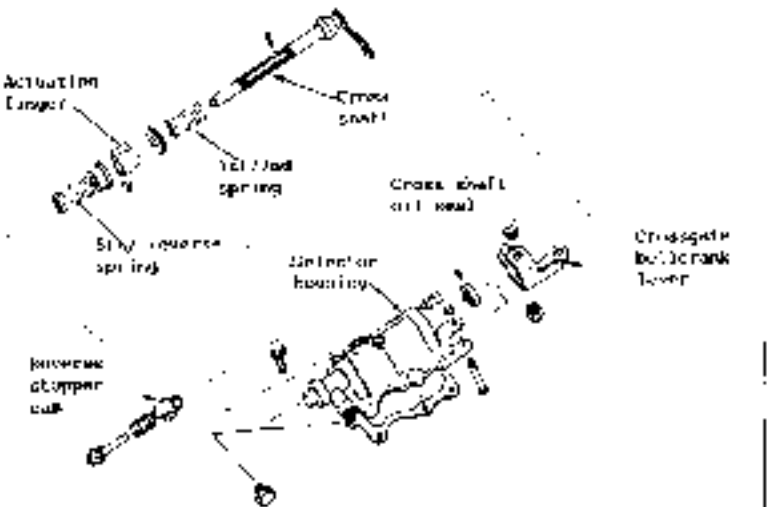
Fit the bearing in the following order to the shaft - O ring, bearing into position and the washer.

Continue assembly by
Part A - Fit weight (1)
Part B - Fit (2)

To fit gear: Apply a thin film coating to the mating surfaces of the ring gear and drum, carrier and fit the ring gear in position. Secure the gear using NEW bolts (with pre-applied thread lock - 6 components with un-coated threads).

Torque to 11 Nm (81 lbf.ft)

[illegible] (1983 on) ASSEMBLY/ADJUSTMENT



[illegible] Remove the carburetter cover, release the four screws securing the fuel pump, and remove the complete assembly collection.

[illegible] Use pliers to Remove the snap ring and plain pin to release the [illegible] to close & [illegible].

[illegible] Lift assembly from pump [illegible] to remove the spring, pin washer and [illegible] to the [illegible] and disconnect the [illegible] the cover [illegible] and remove the diaphragm [illegible], cover plate springs and [illegible].

[illegible] the [illegible] to remove the [illegible] rod, stopper cam and [illegible]

[illegible] the [illegible] and the cross shaft oil seal.

Assembly

[illegible] Check the [illegible] Measure the free length of the [illegible] spring and compare it to the [illegible] values:

Fuel pump	Colour	Free length
	Yellow	61.0 mm approx

[illegible] Apply grease to the cross shaft oil seal lips.

5. Remove the bearing pin, the stepped rear spacer and hub.

6. Drive Shaft Assembly. Assemble the drive shaft, flange and washer, and secure in place with the retaining nut (use Loctite 290 or equivalent to thread of the nut to prevent seizure and to ensure locking). Insert the drive shaft, taking care to align a splined part of the shaft with the splines of the hub. Use a new spring pin to secure the flange to the drive shaft.

After assembly, check that the rotation is smooth and without excessive play.

10. Reassemble Gaiter onto the bellcrank and fit the bellcrank assembly into the housing.

11. Fit retainer to the housing assembly using a new gasket, and fit and tighten the fixing screws. Refit gearchange rod(s).

Torque Wrench Setting to be Applied (Nm).

H.11.3 - DRIVESHAFTS

It would similar words drive shafts to be used, and they are a non-adjustable unequal length assembly. The inboard joint is unable to accept any misalignment other than that due to a plunging action. The outboard joint is provided with a universal joint which is capable of misalignment in any direction. The inboard joint is splined to the differential sun gear and is retained by a circlip. The outboard joint is splined to the hub and is retained by a bolt locking between the inner and outer races.

Rubber gaiters are fitted over the inboard and outboard joints to retain grease and prevent the ingress of dirt and water. The gaiters are secured by clips at each end. Any damage to the gaiters will allow dirt and water to enter the joints and cause premature failure. It is therefore very important that the gaiters are checked regularly for splits, tears or perishing. Should the gaiters need replacing, this must be carried out as soon as possible, before the joint becomes contaminated with dirt or water. Damaged gaiters should be removed immediately once the serviceability of the joint has been established.

Drive shafts rarely wear, but if excessive play is found to be present in operation, or if an outboard joint is found to be worn to the point of breakage, then the complete driveshaft assembly must be renewed. It is not possible to dismantle the driveshaft assembly. A clicking noise when turning is typical symptom of a worn outboard joint. A shaft damaged by engine torque reversal, or a broken or vibration when accelerating, will be worn inboard joint. Any symptom that could be due to worn driveshaft joint should be investigated and rectified without delay. Some safety inspections may be required.

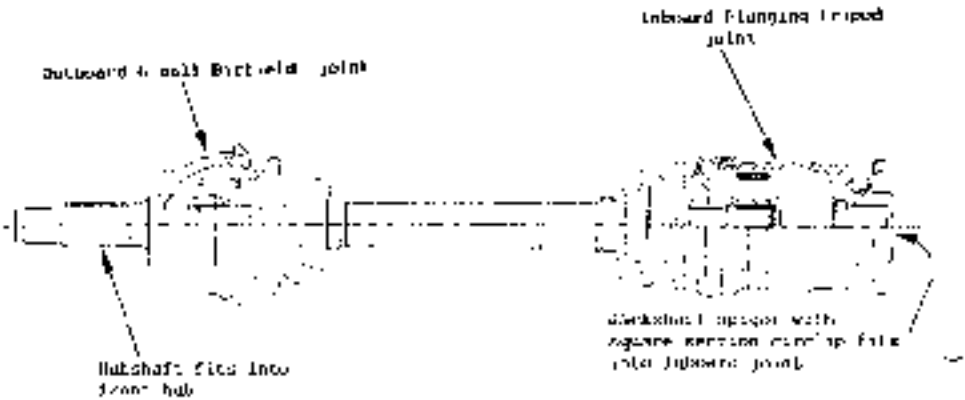
Driveshaft Removal

1. Hub Nut: Release the driveshaft hub nut.

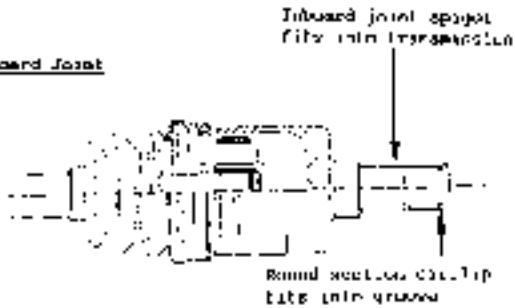
2. Brake Hose: Remove the clip securing the brake hose to the top wishbone, and release the brake hose from the bracket.

3. Top Ball Joint: Mark the position of the camber adjustment eccentrics on the top ball joint to facilitate correct refit, and remove the top ball joint bolts. Note and record the position of the camber adjustment shim plates.

RH Driveshaft Assembly



LH Inboard Joint



...ation for this joint. The inboard joint is retained on the transmission output shaft by a circlip and it is removed by applying a sharp pull to the joint body. Use a slide hammer with a hooked end or apply a sharp blow to...ion (as shown below).

CAUTION: Do not attempt to remove the inboard C.V. joint AFTER the driveshaft has been pulled out of the gearbox. This action will cause the...ring to be damaged and may entail replacement of the joint. The circlip is the only means provided to keep the joint in position. It cannot be replaced by a similar circlip and such will be unreliable in operation and failure is likely. Apply grease generously to the circlip groove and shaft to ease refitting.

1. Working from underneath the inboard C.V. joint from the transmission output shaft, and with blanking plug (part no. 800/10) in the transmission to retain the ground in transmission oil level.

2. Support front hub on the body jack, removing the jack to the damper body, and then put the full suspension load on the lower link. Leave the wheel in place to support the weight of the hub assembly and withdraw the drive shaft from the hub.

3. Lever the outboard circlip shaft from the hub bearing.

Driveshaft Replacement

Note that the LH driveshaft assembly has a pale spigot on the inboard joint and the RH assembly a purple spigot.

Each damper should be retained with a driveshaft is removed. Note that the circlip fitted on the male spigot of the LH inboard C.V. joint is of round section, whereas the circlip retaining the RH inboard C.V. joint is flattened on the end of the transmission output extension shafts. In square section. Use two screwdrivers and change one RH circlip removed, and care should be taken to ensure that no damage occurs.

1. Inboard joints. Fit a new circlip into the inboard C.V. joint spigot shaft groove. Fit transmission output extension shaft into the inboard stub shaft splines. Push the output shaft into the steering knuckle to locate in the groove. Check by pulling on the shaft.

2. Reassembly. Feed the outboard joint stub shaft through the hub bearing, and reverse the suspension to reverse order to disassembly, taking care to refit wheel alignment adjuster (shim plates), and camber adjustment eccentrics to their original positions.
Torque settings
- Damper yoke to lower link: 75 - 81 Nm (55 - 60 lbf ft)
- Damper yoke to strut: 95 - 98 Nm (70 - 75 lbf ft)
- Top ball joint to top link: 22 - 25 Nm (16 - 18 lbf ft)
- Hub nut: 220 - 235 Nm (160 - 170 lbf ft) & Secure nut into recess in shaft end

L1.4 Joints and Gaiter Replacement

1. Driveshaft Assembly: Remove the driveshaft assembly from the car (see above).

2. Gaiters. Cut off the gaiters and clips from both driveshaft joints.

3. Remove outboard joint. The outboard joint is retained by a round section circlip on the end of the shaft. To remove the joint, hold the drive shaft in a vice, and use a soft mallet to tap the joint down the circlip and off the shaft.

[illegible] the joint is reluctant to move, use a brass drift on the front face of the inner race.

CAUTION: Do not attempt to remove an outboard joint without first removing the shaft assembly from the car. Unless the shaft is securely restrained, [illegible] attempts to remove the outboard joint may result in the inboard joint becoming disassembled.

3. Cleaning and Inspection. Complete disassembly of either joint is NOT recommended - the separate components are a precision fit and develop their own individual wear patterns, such that any interchanging of parts is likely to result in premature failure.

If the grease in the joint is contaminated [illegible], the joint is likely to be damaged, and should be replaced. If the grease is not contaminated, the joint should be degreased by washing in a suitable solvent [illegible], and then carefully inspected.

On the outboard ball type joint, tilt the inner race to one side to expose each ball. Severe pitting, cracking, play between ball and its cage window, any [illegible] damage to the races, or pitting, galling or corrosion damage, [illegible] replacement.

On the inboard, tripod type joint, examine the fit between the rollers and the housing. Excessive free play, rough or worn rollers, scuffed or worn surfaces, damage to the bearings or housing, call for joint replacement. If the joint is judged to be serviceable, it must be regreased with special grease as follows:

Outboard joint: [illegible]

Inboard joint: [illegible]

4. Replace Gaiters. Replace the gaiters and regrease the joints [illegible] shaft. New gaiters should always be fitted [illegible] joint refitting. Note that the gaiter for the outboard joint is supplied in the boot kit for outboard joint, but that the inboard joint [illegible] must be ordered separately.

5. Fit Boots. Tape over the shaft outboard splines to prevent damage to the new boots, and slide the inboard boot and small retaining clip onto the shaft, followed by the outboard boot small clip and boot. Remove the tape.

6. Outboard Joint. New joints are pre-packed with grease, but if refitting a cleaned old joint, [illegible] charge the joint with one sachet of the special grease supplied in the boot kit. Fill the ball tracks with grease [illegible] the balls, pack around the balls, and the inside of the joint, so that grease is pushed behind the joint when the shaft is inserted. Use the second grease sachet from the boot kit to fill the inside of the new boot.

NOTE: The grease provided in the kits is specially formulated for heat resistance and durability. Do NOT use substitutes or mix with other lubricants.

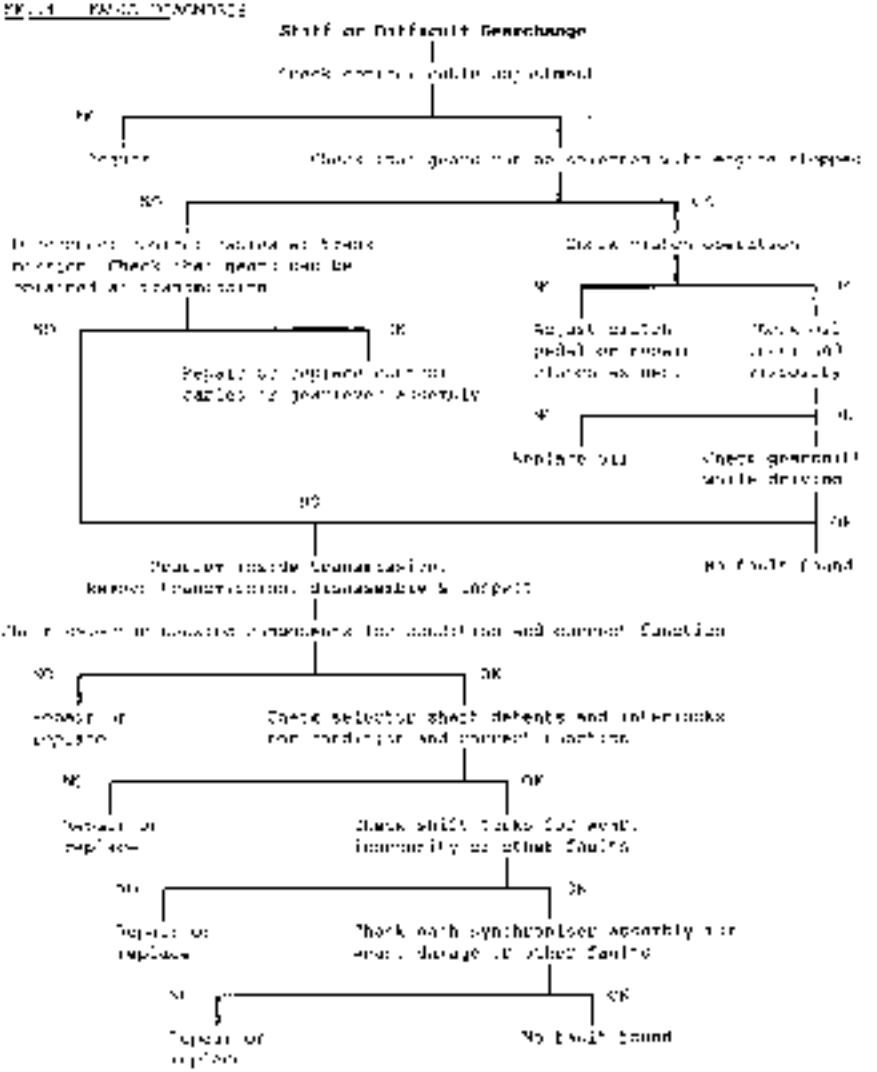
7. Inboard Joint. If refitting a cleaned old joint, [illegible] the grease sachets from the boot kit. Slide the inner joint onto its shaft splines, and tap the joint [illegible] into the groove. Pull on the joint to ensure it is fully located. Use the third grease sachet from the boot kit to fill the inside of the new boot.

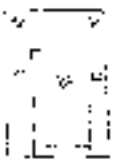
8. Secure Boots. Pull each boot over its respective joint and locate the lips of the boot in the grooves on the joint and shaft. Before fitting the boot clamps, ensure that the boot is correctly fitted so that it is not dimpled or collapsed. Ventilate the plunging joint [illegible] between the boot [illegible] grooves before [illegible] by inserting a smooth rod (take care not to damage the boot) between

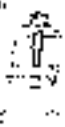
[illegible] the [illegible] and [illegible] the retaining clips. Tighten the clips until suitable [illegible]

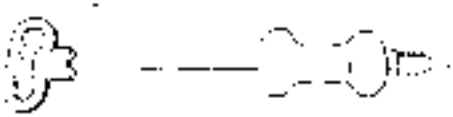
3. Refit the driveshaft assembly [illegible]

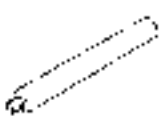
FIG.11 FAULT DIAGNOSIS











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Output Shaft O.S Seal Installer 7700T1055

Oil Pump Extractor Spacer Set 7700T1020

Output Shaft RH Bearing Remover 7700T1021

Oil Seal Sleeve Installer 7700T1008

Axle Seal Sleeve Installer (O/S) Set 7700T1022 & 7700T1010

Output Shaft RH Bearing Installer 7700T1011

Oil Seal Remover Installer 7700T1031

Drift, Selector Fork 7700T1014

Output Shaft Adjusting Plug 7700T1024

Output Selector Fork Shaft Seal Retainer 7700T0997

WHEELS & TYRES

SECTION 44 [illegible]

[illegible] WHEELS

The 1 bolt fixing cast aluminium alloy wheels are styled to [illegible] and are fixed by 4,5 or [illegible]. Two different wheel diameters are used. Rim and centre [illegible] to accommodate changes in suspension geometry. The two type of wheel are not [illegible] and are not [illegible].

Wheel size - Rim	[illegible]
- Tyre	[illegible]
Load	[illegible]
Wheel bolt torque	[illegible]
Static runout of [illegible]	[illegible]
Lateral run out at rim flange	[illegible]
Max. run out between wheels	[illegible]

WARNING: Ensure that only the specified wheels and wheel bolts are fitted to each [illegible] of your [illegible]. A wheel of the wrong size or type fitted to your [illegible] will [illegible] incorrect [illegible] and [illegible] but DO NOT allow the [illegible] to [illegible] the wheel bolts to ensure contact is made with [illegible] of the [illegible] may cause a [illegible].

[illegible] TYRES

The following types are the ONLY tyres approved by [illegible] for all your [illegible]

Type	Size	M.O.	[illegible]
	- Tube		[illegible]
	- Rim		[illegible]
Size	Rim	M.O.	[illegible]
	- Tube		[illegible]
	- Rim		[illegible]
Tyre [illegible]			
	- Rim - M.O. (cover & tube)		[illegible]
	- Type (cover & tube)		[illegible]
	Size Tube (cover & tube)		[illegible]
* For [illegible] speeds over 130 mph (km			[illegible]

[illegible] SPARE WHEEL - TYPE

A [illegible] spare wheel is used as this permits to enhance luggage space, and, giving an [illegible] weight, take advantage of the [illegible] wheel centre for the [illegible].

Spare wheel - Type	[illegible]
- Size	[illegible]
Spare tyre - Type	[illegible]
- Size	[illegible]
Pressure	[illegible]
Maximum speed	[illegible]

WARNING: This space wheel is for EMERGENCY USE ONLY, and must be replaced with the normal wheel and tyre equipment as soon as possible. Only one space wheel may be used on the vehicle at any one time. When the space wheel is in use, differential tyre wear will be experienced, and the rate of tyre braking effectiveness of the car will be modified. It is therefore necessary to observe the following recommendations:

1. Less than moderate speeds and cornering loads should be employed (i.e. no more than half the tyre's potential) relative to the prevailing road conditions whilst in a vehicle whose speed of 80 km/h (50 mph) under the most favourable conditions.

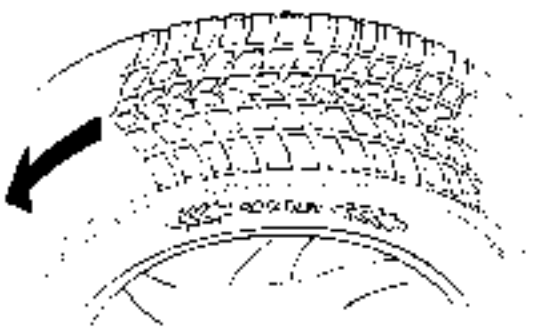
2. When following other vehicles, Lotus recommend that consideration be made to the U.S. Highway Traffic American Safety Council guidelines for vehicle spacing: this advice applies equally to space wheel usage as to all other motoring situations.

3. Space wheel tyre pressures 4.2 bar (60 lb/in²).

The space wheel, wheelbrace and jack are mounted beneath the boot floor. Lift up the centre section of the floor, and remove the space wheel clamp bolt.

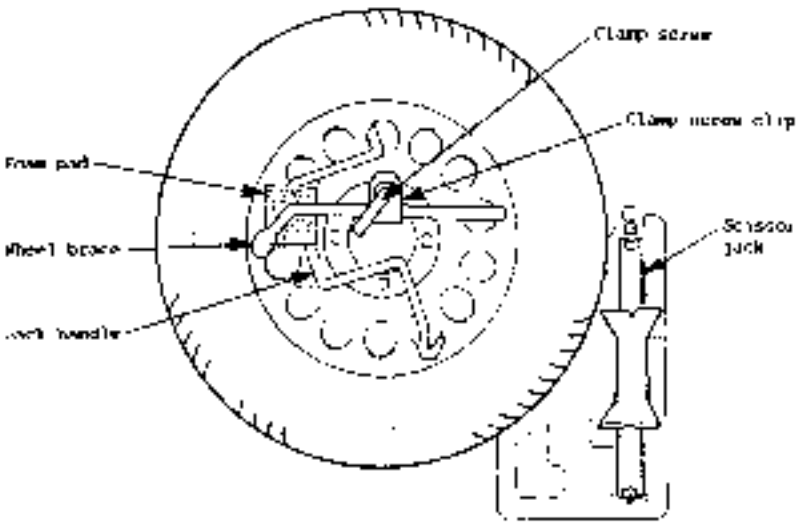
Before refitting the standard wheel, ensure that the mating face on both the wheel and hub is clean, and free from corrosion, otherwise a wheel vibration and/or loosening of the wheel nuts may occur.

Note: Directional Tread The Goodyear Eagle GS-D tyres used on cars with alloy wheels, have a pronounced direction of rotation which is indicated both by an arrow on the tyre sidewall, and by the tread pattern itself as shown in the illustration. The tyre is life rated in the non-preferred direction, and doing so will result in a marginally reduced wet handling performance. However, this condition should not be retained for excessive periods, and it is recommended that the tyre is rotated to achieve the correct condition at the earliest opportunity.

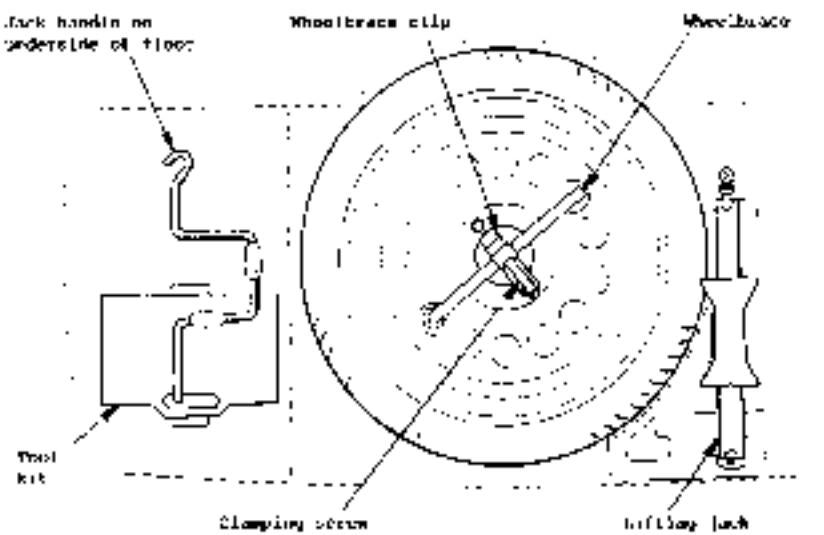


Always restow the spare wheel and wheel changing equipment in their correct positions to prevent movement from causing damage to other components or the body. Place the spare wheel into the boot floor recess with the outside of the wheel downward, and a wheelbolt hole positioned over the securing thread pin in the hub. Two types of spare wheel retention have been used. Early cars showed the jack handle location slot in the wheelbrace on the spare wheel disk:

Early type jack view showing



Current type jack view showing



[illegible] the rear caliper with the wheel, with the handle through the bottom wheel arch to fit on the rear brake disc with the clamp plate through the wheel bolt holes, and start one of the nuts. Before tightening the clamp arms, fit the foam pad between the jaws handle and wheelbarrow to stop it sliding together the clamp arms.

To refit cars, the jack handle is stored in clips on the underside of the left hand front wheel arch and the clamp is stored in clips through the passenger seat, and with the wheelbarrow positioned as shown in the diagram, with the rocker and the [illegible] of the wheel arch holes, secure the wheel with the [illegible] and the jack and the rubber bungee.

G10.4 - WINTER TYRES (NOT USA vehicles)

Winter tyres provide enhanced performance in snow and in any conditions, but cannot be expected to reach the maximum performance levels of the standard equipment tyres under dry, hot conditions which may be encountered. Winter tyres should not therefore be used as a 'year round' fitment.

Michelin X MS (studded) winter tyres, with or without studs, may be fitted only to Esprits to the [illegible] - USA vehicles using the specified 15in. alloy wheels **AND SHORTER WHEEL BOLTS (AGG960009F)**. When refitting the standard alloy wheels, the standard fitment wheel bolts must be used.

Studded (a few studs) Spare
A1006F05F - Chrome plated

Winter wheel bolts
A1006000F - Black finish

Winter wheel	- type	Steel, 4 bolt fixing
	- size	6J x 14
	- part number	A1006600F
Wheel bolt	- part number	A1006000F (16 off)
	- torque	80 - 96 Nm (59 - 71 lbf ft)
Winter tyre	- type	Michelin X MS, with & without studs
	- size	185/60 x 14
	- pressure (cold)	2.0 bar (29 lb/in²)
Speed limitation -	without studs	118 mph (190 km/h)
	with studs	see table

For tyres without studs, a maximum speed of 118 mph (190 km/h) must be observed. If studded types are fitted, an additional limit (which may be lower) speed restriction will apply, and a warning sticker must be applied to the back of the vehicle by the tyre fitting depot. Details of the speed restrictions for studded tyre makes in Europe countries, are listed below.

... recommended speeds for studded winter tyres.

Country	Period	Max. speed limit (km/h)	
		Normal Roads	Motorways
Austria	15th Nov. - 15th April	80 [50]	130 [80]
Belgium	1st Dec. - 31st March	90 [56]	120 [75]
Denmark	1st Oct. - 31st April	80 [50]	100 [62]
Finland	1st Oct. - 31st April	80 [50]	100 [62]
France	15th Oct. - 15th March	90 [56]	110 [68]
Germany	NOT RECOMMENDED		
Holland	NOT RECOMMENDED		
Italy	15th Nov. - 15th March	90 [56]	130 [80]
Norway	1st Oct. - 30th April	80 [50]	90 [56]
Switzerland	1st Nov. - 31st March	80 [50]	NOT RECOMMENDED
Sweden	1st Oct. - 30th April	90 [56]	110 [68]
U.K.	NOT RECOMMENDED		

7.2.1 - DIFFERENTIAL ASSEMBLY CLEARANCES

Before balancing a wheel with a new tyre, ensure that any previously applied balance weights are removed. Run the wheel for several minutes to allow the tyre to settle before carrying out the balancing operation.

Wheel/tyre assemblies should be balanced at the recommended inflation pressure, but the rear, using maximum load capacity and symmetric mounting. A typical load for wheel + tyre fed only for 10 - 15 kg on each load bolt, or by load cell. A set weight - lay the wheel bolts.

Balance specification

Acceptable balance error - inside the tolerance	15 g
- outside the tolerance	25 g
Maximum balance weight per wheel - inside rim	70 g
- outside rim	60 g

A tyre balancing will only be permitted to proceed the below with the wheel removed from the car.

Permissible balance error	10 g
Permissible run out tolerance	20 g

... a spare of more than 2.5 g is provided for rear after balancing the assembly has been removed a permissible error is provided the balance will ... be ... a ... (see ... of other rotating components (e.g. brake ... pad, etc.).

STEERING

SECTION 80 - INDEX

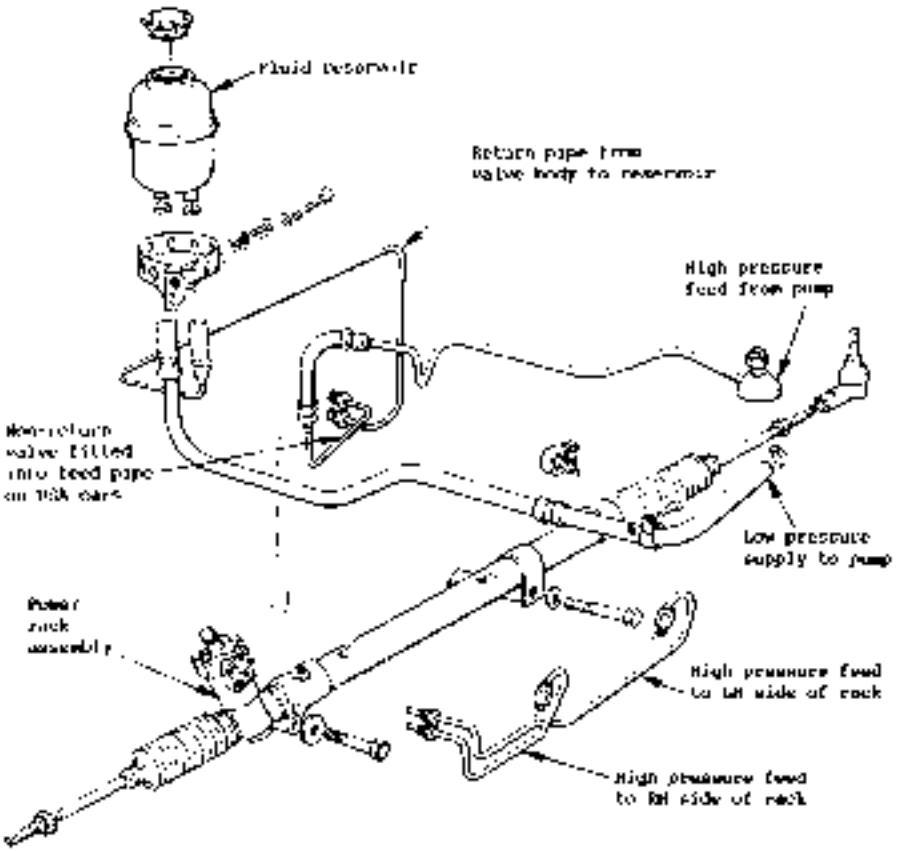
[illegible] POWER PACK

The rack & pinion comprises an upper cover assembly, fixed on cars with manual [illegible] and adjustable on cars with auto. [illegible] body on [illegible] the cover is [illegible] control valve, and a swivel & power assisted rack and pinion assembly.

The rack and pinion assembly is secured rigidly to the chassis crossmember by two clamp bolts, and connects with the [illegible] by two [illegible] steering ends. The outboard ends of the rack [illegible] are [illegible] ball joints.

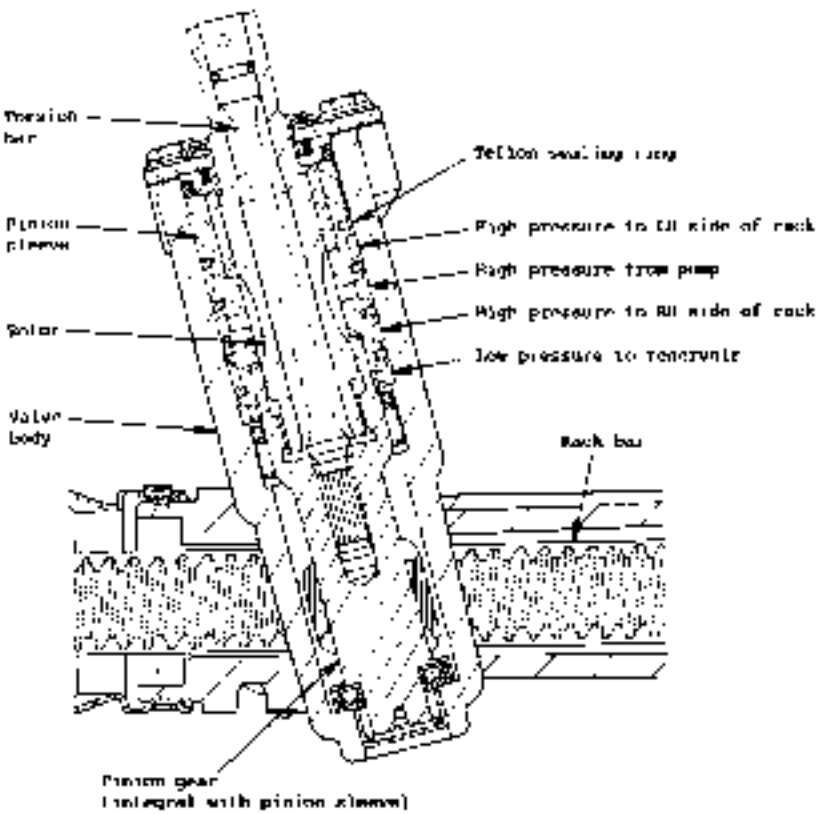
Power Assisted Steering (PAS)

The PAS system uses a hydraulic pump, mounted on the front side of the engine driven by [illegible] belt. The fluid reservoir is [illegible] to the valve body of the steering rack. Also mounted on the valve body is the [illegible] pressure hose. Another hose is fitted to the pump [illegible] mounted on the right hand rear of the engine bay.



The steering rack assembly comprises a steel tube which houses the steering rack bar, with a pinion gear forged integrally with the pinion sleeve. The pinion sleeve is supported by a ball bearing fixed at one end, which supports the pinion and valve body assembly. The end of the rack tube is hydraulically sealed by the pinion gear bar by suspension rings, and a piston at the centre of the rack divides the tube into two hydraulic chambers, with each chamber fitted with a hose connection to the valve body by steel pipes.

The valve body, which is a forged alloy two piece housing, contains three main components - a pinion sleeve, which consists of a cylindrical sleeve fitted with three teflon rings to divide the hydraulic pressure, and an integral pinion gear which engages with the rack bar; a torsion bar which connects the pinion sleeve to the steering column by the pinion end, and a ring which is screwed together with the top of the torsion bar to the steering column, and forged within the pinion sleeve to control the hydraulic pumps. The valve body is provided with four hydraulic connections.



- high pressure input from the pump
- low pressure return to the reservoir
- high pressure output to the left hand side of the rack piston
- high pressure output to the right hand side of the rack piston

When no torque is applied to the steering wheel, all four ports are interconnected so that oil from the pump flows through the valve body and back to the reservoir, and no help is given by the rack steering hydraulic assembly to apply an equal pressure to both sides of the rack piston.

When the steering wheel is turned, the rotor is driven by the pinion, but the position of the pinion sleeve is governed by the steering resistance of the road wheels. This subsequent twist in the torsion bar causes the relative displacement between the rotor and pinion sleeve to be dependent on the steering resistance and subsequent torque. As the torque (and angular displacement) increases, one of the output ports to the pump is progressively closed towards the reservoir return, whilst the other output port is opened further to the pump pressure feed from the valve. In this way, a pressure difference is created between the two rack chambers, which tends to move the piston and provide steering assistance. When the input torque at the steering wheel is zero, the angular displacement between the rotor and pinion sleeve is reduced to zero, the pressure balance across the piston is restored, and steering assist is switched off. The same sequence happens when the wheels are turned to the right, but a pressure differential is created in the opposite sense.

The relative angular displacement between rotor and pinion sleeve is limited torsionally to prevent excessive torque being applied to the torsion bar, and to provide a mechanical link in order to carry out steering in the event of a torsion bar failure. Power assist to the steering would then be reduced, but with a small amount of assist remaining.

The engine driven vane type hydraulic pump incorporates a pressure relief valve to control maximum pressure when the rack reaches the lock stops, and a flow control valve to limit the flow rate to a safe value. The output of the pump is designed to just provide the required pressure, at idle, to provide a good level of power assist, with greater power assistance being provided at the engine speed for parking manoeuvres only, and less assistance at high speed. To conserve energy in the hydraulic system when a high pump pressure is developed (with the steering at full lock) against the engine management by increasing the speed of the idle air control valve to maintain idle speed and prevent stalling.

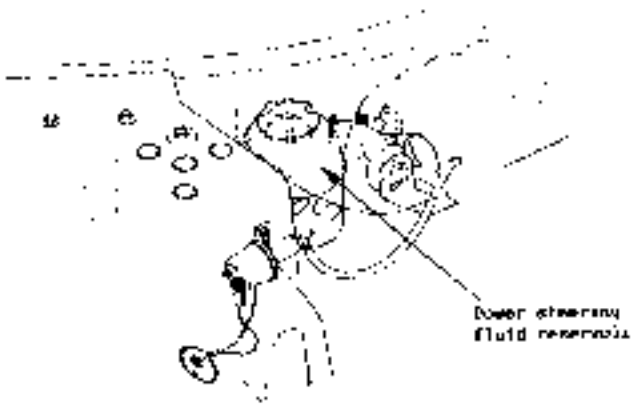
[illegible] OF [illegible] CHECK & OIL CHANGE PROCEDURE

Recommended Hydraulic Fluid

The only approved fluids for use in the power steering hydraulic system are Vauxhall/Opel Hydraulic Fluid, part number [illegible]
G.M. power steering fluid, 1050 part number [illegible]

Fluid Level Check

The reservoir is conveniently located at the right rear of the engine bay, adjacent to the service [illegible] on the chassis. At every service, or [illegible] the cap and top of the fluid reservoir before unscrewing the cap and inspecting the fluid level given on the dipstick integral with the cap. The fluid level on the dipstick corresponds to the correct cold level (top mark - see above) at the last driver control action, and the reservoir is not on the [illegible], and the correct cold level (lower mark). Top up if necessary using ONLY the approved fluid (see above).



Hydraulic fluid change

The power steering oil should be changed at intervals specified in the Maintenance Schedule (see section 01). To change the fluid, proceed as follows:

- Drain the fluid by removing the reservoir low and pressure/supply (high pressure feed and low pressure return pipes from the valve body on the steering box (i.e. NOT the two pipes from valve body to rack housing), and collecting the oil.
- With the oil now drained through, refit the two pipes to the rack, torque up (using new 'High pressure feed (supply, M14) - 21 Nm (14 - 15 lbf.ft)
Low pressure return (lower, M14) 24 - 31 Nm (14 - 17 lbf.ft)
- Fill the reservoir with new fluid, stop the ignition switch to prevent the pump from starting, and crank the engine in short bursts whilst turning the steering wheel from lock to lock. Keep the reservoir topped up during this procedure, with the aim of allowing it to fill sufficiently for air to enter the system while the engine is being cranked, so the pump may be primed. Continue with this procedure until there is no evidence of air bubbles appearing in the reservoir.
- Apply the reservoir to the cold mark on the dipstick

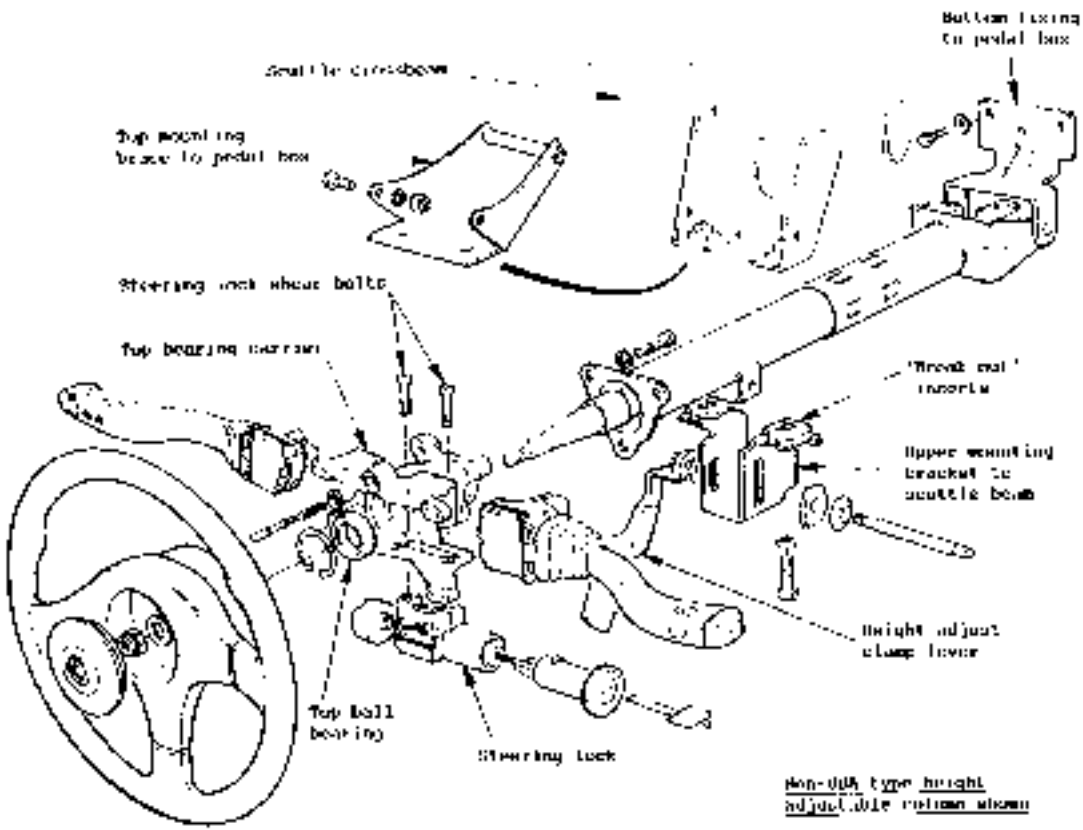
Run the engine again, run steering, operate steering and inspect for leaks and correct power steering system oil.

Steering wheel & column assembly removal

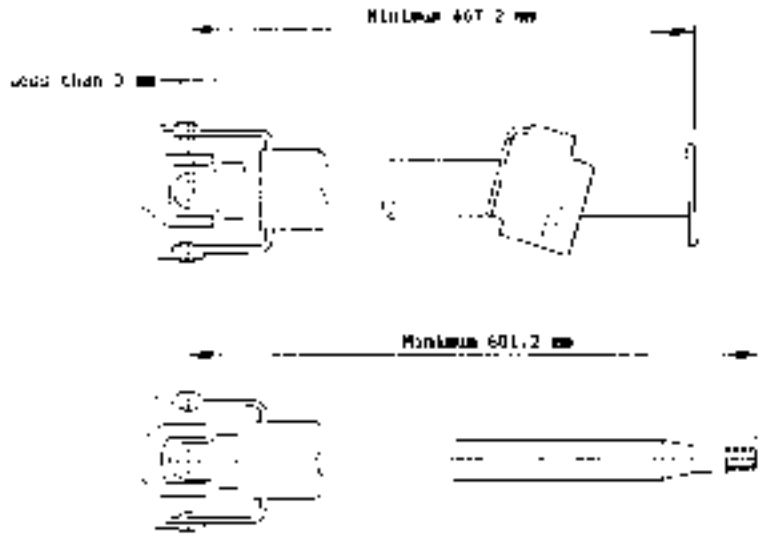
The types of upper steering column are used on the Land Rover 90 tilt adjustable column on models outside the USA, and a non-adjustable version with 0 to 3 (depending on vehicle specification) universal joints on UK vehicles. The following section applies only to non SRS cars. For work on SRS vehicles with SRS, airbags (see Safety precautions 09 (SRS), which are fully detailed in a separate manual. Section 09 part number RCCPY1P3A. Do not attempt any work on an SRS type of steering wheel or column without reference to section 09.

If the vehicle is involved in an accident, the collapsible steering column should be carefully inspected and renewed if any telescoping has occurred. Perform the following checks: finally, the steering wheel and/or column should be lost if necessary.

1 Outer column:
- Measure the overall length of the outer column as shown in the diagram.
Minimum length = 461.2 mm
Replace the column assembly if outside specification.



Non-QUA type height adjustable column shown



- Replace the return spreader, secure the nylon to plastic body fixing bolts and check that the two alloy thrust washers are refitted, attached to the chassis flanges.

- Steering column
  - Check that the centreline of the slot at the lower end of the column is within 3 mm of the pivot axis of the rubber column lower bracket. If greater than 3 mm replace the column assembly.
  - Measure the overall length of the inner column.
  Minimum length = 603.2 mm
  Replace the column assembly if outside specification.

Steering Wheel Removal (Non-SRS)

- Prise the centre boss pad out and turn counterclockwise to release from the bayonet type fixing.

- Remove the nut and washer securing the steering wheel and mark the relative position of the wheel and inner column to aid refitting.

- Pull the wheel off the splined inner column. If necessary, use a suitable puller - DO NOT attempt to remove the boss clip and the contact assembly. During the next paragraph assembly, withdraw the spring assembly and harness by the connector terminals.
  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 overcome, necessitating column replacement.

Refit the steering wheel in the reverse order to removal, and torque tighten the steering wheel nut to 40 Nm (30 lbf ft).

Upper steering column Removal (Non Tilt)

1. Remove the steering column shrouds and unplug the electrical connector blocks for the column switches, ignition switch and horn. Depress the plastic tabs and lift out the two column switches.

2. Prevent the pinch bolt securing the lower universal joint to the intermediate shaft.

3. Remove the two bolts securing the bottom of the column to the pedal box, and the two bolts securing the top of the column to the mounting bracket.

4. Withdraw the column assembly, pulling the wiring up, off the spigot on the steering rack pinion.

5. If necessary, the lower column may be withdrawn from the inner arbor securing the bolt to free the top end of the lower column.

6. If necessary, remove the three bolts securing the top bearing carrier to the steering rack. Use a centre punch to chase to remove the two expanding rivets. Remove the circlip and withdraw the bolt securing the bearing race for service.

Upper Universal Joint

Refer to the section on the previous steering column for details relating to the following procedure.

1. When refitting the column, do not omit the cushion spacer between the bearing and the shaft circlip.
2. Set the clutch lock steering bolts, and tighten to the correct torque.
3. Torque wrench settings:
   Column to pedal box fixings: 10 Nm (7 lbf/ft)
   Column to rack pinion: 15 Nm (11 lbf/ft)
   U/J to intermediate shaft: 20 Nm (15 lbf/ft) using Permaloc nut.

Intermediate Shaft

The intermediate shaft has two universal joints fitted which are designed to accept a certain misalignment between the upper and lower shafts. The misalignment is set at the factory to suit the vehicle, and adjustment is necessary only if the steering column has been removed.

The upper U/J is integral with the upper column, and the intermediate shaft will be set at the factory with the upper U/J in a master spline, and a 'flat' machined to accommodate the pinch bolt. The lower U/J will fit onto the rack pinion shaft in only one position, as dictated by the serrated groove. Fitment of the intermediate shaft onto the lower U/J provides the only method of setting misalignment.

If removing the upper column assembly, remove the pinch bolt from the upper U/J. Assembly alignment will then be retained. If the lower U/J is to be removed for any reason assembly removal:

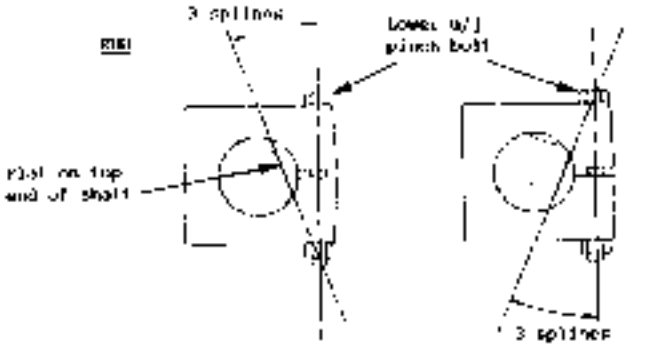
1. Disconnect the upper column from the intermediate shaft (see above).

2. Release the pinch bolt securing the lower U/J shroud to the bulkhead, and withdraw the shroud over the intermediate shaft.

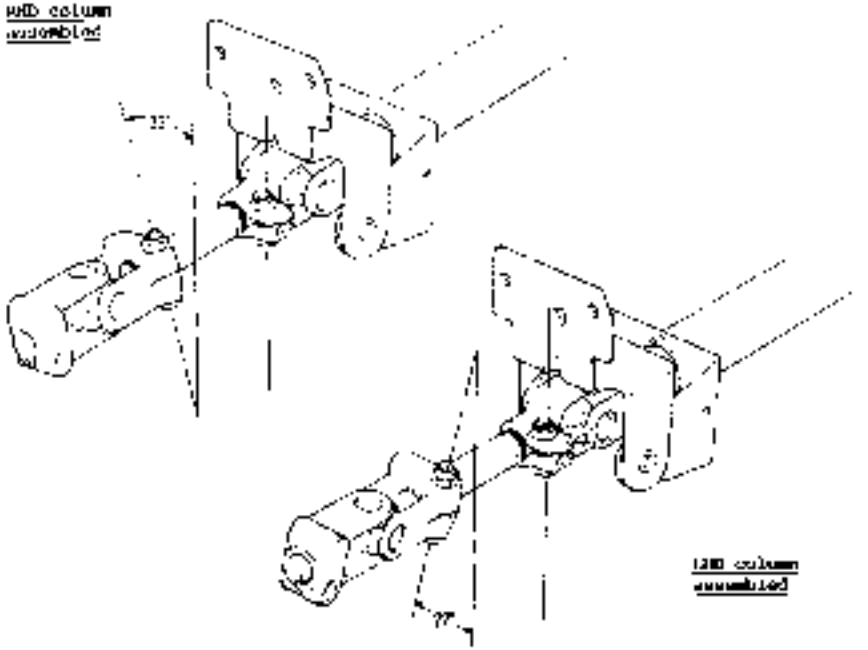
3. Release the pinch bolt securing the lower U/J to the pinion shaft, and rotate the shaft until the bolt may be removed and the joint withdrawn.

4. Re-assembly: If the intermediate shaft has been separated from the lower U/J, the misalignment must be set on assembly.

Locate the upper and lower pinch bolt shrink sleeves. The lower sleeve is a plain cylindrical shape, but the upper sleeve has a splined bore. Rotate the upper sleeve so that the splines on the top end of the shaft are parallel with the pinch bolt. The top pinch bolt has 3 splines counterbalanced on 90° bore, the 3 splines correspond to the 3 splines on the top end of the shaft. Slide the upper sleeve over the shaft and onto the lower sleeve. See diagram. Fit the pinch bolt and tighten to 25 Nm (18 lbf ft).



RHD column assembled



LHD column assembled

Note that steering alignment on [illegible] cars is different to the RHD specification given above. Refer to section [illegible] in the Service manual [illegible].

[illegible]. Fit the lower [illegible] onto the rack assembly pinion shaft with the pinch bolt hole aligned with the groove in the shaft. Fit the pinch bolt and torque tighten to 25 Nm (18 lbf.ft).

[illegible]. Fit the lower [illegible] over the intermediate shaft and secure to the bulkhead.

[illegible]. Refit the upper column assembly (see above).

HC.[illegible] - OUTER & INNER BALL JOINTS & GAITERS

Outer Ball Joints

The outer ball joints (track rod ends) are secured to the [illegible] steering arms by tapered ball pin shanks and nyloc nuts. The track rod ends are screwed onto the [illegible] and provide a means of adjustment of toe-in.

Toe-in Adjustment: To adjust the toe-in, hold each track rod end by the flats provided ([illegible] mm) whilst releasing the locknut. Turn each track rod, using the flats provided ([illegible] mm) [illegible], to adjust the effective track rod length as necessary. When adjustment is correct, hold the track rod end and tighten the locknut to [illegible].

Ball Joint Replacement: If the ball joint gaiter is damaged, or if any play is [illegible], the joint should be replaced. Before removing the joint, measure the length of thread protruding in order that the initial setting of the new joint may be approximately correct. Remove the nyloc nut, and use a ball joint splitting tool to separate the joint from the steering arm. Release the locknut, and unscrew the joint from the track rod.

Screw the new joint onto the track rod to the position measured above, and fit the tapered ball pin into the steering arm. Fit a new nyloc nut and torque tighten to [illegible]. Check alignment and tighten locknut as above.

Rack Gaiters

Damaged rack gaiters should be replaced immediately to prevent loss of lubricant, dirt ingress and damage to the inner ball joints or rack mechanism. To replace the rack gaiters, first remove the track rod end, and then cut the gaiter clips before withdrawing the gaiter from the rack.

Before fitting the new gaiter, examine the condition of the inner ball joint and replace if necessary (see below).

[illegible] the new gaiter [illegible] on the rack housing, and secure with a new clip. Before securing the outer clip at the track rod end, ensure the gaiter [illegible] to enable the track rod to be turned for tracking adjustment without twisting the gaiter.

Before fitting the pinion end gaiter [illegible] the large end clip [illegible] the driver's side of the vehicle [illegible] and inspect the rack teeth [illegible].

Rack Inner Ball Joint Assemblies

The track rods are integral with the inner ball joints, which are not

...ssue with or servicing in any way. If the pump is irreparable as a unit, the rack and pinion assembly should be replaced in the following manner:

Remove the steering rack assembly from the car (see section H1.6).
Remove the rack gaiters.
- Each rack guide is tapered. Slide one end of the rack out, and so provide sufficient movement of the gear to be turned. It is most important that the pinion gear teeth are not allowed to provide the reaction torque when fitting or removing the inner ball joints. Use hand grips for this, whilst unscrewing the other end use a soft jawed clamp to hold the rack across the flutes of the teeth to unscrew the inboard ball.
Fit the new guides in the reverse order to disassembly. Tighten each inner ball joint to 22.6 Nm (16 lbf ft) whilst not allowing the pinion gear teeth to bear any of the reaction load.
- Locate the new rack guide in the slot provided on the rack body
- Refit the rack gaiters as above
Refit assembly into vehicle

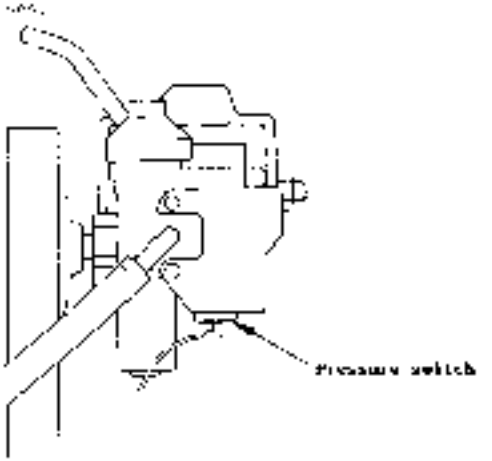
H11 - POWER PUMP & PRESSURE SWITCHES

Drive Belt

The 19 cubic centimetre displacement pump is a non serviceable unit mounted on the left hand front of the cylinder block, driven by multi vee belt from the crankshaft. The drive belt should be tensioned to 44 kgf (145 - 15 lbs) using a torque wrench. To adjust belt tension, slacken the pivot bolt securing the pump mounting bracket to the cylinder block, and the two bolts securing the bracket to clamp. Using the pump bracket to achieve the specified tension, and tighten the clamp bolts to 19 Nm (15 lbf ft)

Power Steering Pressure Switch (PSPS)

When a high torque is applied to the steering wheel, as a heavy load placed on the pump, a pressure switch on the outlet side of the pump closes at about 60 kgf (130 lb) and a signal the engine management ECU to open the idle air control valve to raise idle speed to prevent stalling. The A/C conditioning cut-out will be delayed if this switch is open when the power steering pressure switch is also open.



PAS pump viewed from front side

To check that the PSPS is functioning, let the engine idle, and hold the steering against the left hand lock stop. The idle speed should increase. Switch on the air conditioning and repeat the test. The compressor should switch off, and the idle speed increase. If the system does not perform as specified, [illegible] PSPS switching using a continuity meter across the switch terminals.

To replace the switch, first remove the radiator bottom hose for improved access, before unscrewing the switch from the underside of the pump body. [illegible] the hole immediately to reduce oil loss.

Pressure Test

To check both the pump output, and the steering rack assembly seals for leakage, a test gauge [illegible] is needed to measure the fluid pressure, and [illegible] in the output hose from the pump:

1. Disconnect the output pipe connection from the top of the pump, using a drip tray to collect any escaping fluid, and fit the test gauge between the pump and the disconnected pipe. Top up the PAS reservoir if necessary.

2. With the gauge valve fully open, start the engine, and slowly close the gauge valve until a pressure of [illegible] is registered. Run [illegible] the system reaches a running temperature of [illegible] if necessary, [illegible] to bring the [illegible] to maximum heat.

3. Raise engine speed to 1000 rpm. Steadily close the gauge valve fully and note the highest pressure reading. **NOTE:** Do not shut the valve for longer than [illegible] seconds because the fluid temperature will rise quickly, resulting in a false pressure reading. [illegible] and record the pressure readings.
Specification: [illegible] kg/cm² ([illegible] lbf/in²)
If [illegible] than specification, the pump should be replaced.

4. [illegible] valve open, hold the steering against the left hand lock stop [illegible] and the engine [illegible], and then hold against the right hand lock stop and record the pressure.
A reading [illegible] than [illegible] kg/cm² ([illegible] lbf/in²) indicates [illegible] valve body and [illegible] should be [illegible].

To check the flow rate, with engine speed held at [illegible] rpm, adjust the gauge valve to give a pressure reading of [illegible] kg/cm² ([illegible] lbf/in²), and [illegible] the flow rate.
Specification: [illegible] litres/min.
[illegible] the flow rate stays [illegible] at higher engine speeds [illegible] rpm, [illegible] the gauge valve to achieve [illegible] and [illegible] the flow rate.
Specification: [illegible] litres/min.
If [illegible] readings [illegible] not to specification, the [illegible] should be renewed.

Pump Replacement

The pump and mounting bracket may be withdrawn from beneath after releasing the [illegible], [illegible] and [illegible], or from above after removing the [illegible]. Using the latter method:

1. Remove the front [illegible] cover [illegible] PPS.

.. Disconnect both hoses/pipes from the pump and drain the fluid into a suitable container. Unplug the MAP's electrical connector.

.. Slacken the belt tensioner, release the belt's security, the pump to the mounting bracket, and remove the pump and pulley assembly.

. If the pump is to be refitted, use a suitable puller to withdraw the pulley from the old pump, and fit to the new pump using special tool T000T0100. Fit the pulley onto the pump shaft until the pulley boss is flush with the pump body. If the special tool is not used, damage may be caused to the pump internals.

. To fit the pump in the reverse order to removal, tensioning the belt as above. Fit the inlet pipe banjo bolt.

4/6 - STEERING RACK ASSEMBLY REMOVAL/REPLACEMENT PROCEDURE

Removal

1. Firstly, on the drivers footwell, remove the pinchbolt securing the upper coupling to the intermediate shaft. Release the locking bolts securing the upper column to the pedal box and steering arm, and separate the upper half from the column. Release the sealing shroud from the floor panel and remove over the steering shaft. Remove the pinch bolt securing the lower U/J to the rack pinion shaft and slide off the shaft.

2. Remove both front road wheels, and the track rod end nylock nuts. Use a ball joint splitting tool to disconnect each track rod end from its steering arm.

3. Remove the engine bay undertrays, and provide alternative support for the drivers side front subframe before removing the left hand mounting bolt.

4. On PAS versions, disconnect the feed and return pipes (the larger diameter pipes) from the valve body, and drain the fluid. Plug the pipes and ports. Remove the screws of the two valve body to rack housing plates, and pull the plates.

5. Release the two rack securing nuts & bolts, withdraw the pinion housing from the chassis and slide the rack assembly towards the passenger side and clear of the front beam.

Replacement

Refit the rack in the reverse order to removal, noting the following points:

- On PAS cars, fit four rubber seal O'RINGS over the pinion shaft before fitting the rack assembly. After rack fitment, check that the steering operates freely.
- Tighten rack housing to chassis bolts to 120 Nm (89 lbf.ft)
- Fit the lower U/J onto the pinion shaft with the pinch bolt groove a 'spec' and torque pinch bolt to 75 Nm (110 lbf.ft)
- On PAS cars, tighten hydraulic connections on pipe between valve body and rack tube to 14 Nm (10 lbf.ft). Tighten feed (from MAP) and return (from MAP) connections to 19 - 23 Nm (14 - 17 lbf.ft)
- Tighten track rod end to steering arm connections to 50 - 64 Nm (41 - 51 lbf.ft)
- On PAS cars, refill and bleed the hydraulic system (see 06...).
- Adjust front wheel toe-in (see section 03).

[illegible] ASSEMBLY SEAL [illegible] REPLACEMENT

[illegible] steering [illegible] assembly [illegible] replacement [illegible]

[illegible] steering rack [illegible] to a clean [illegible]

[illegible] section [illegible]

[illegible] at the base of the [illegible] housing), and remove the plunger assembly.

[illegible] and shims. [illegible] valve pinion assembly from the housing, and [illegible]

[illegible] the rack bar and [illegible] from the tube [illegible] from the rack bar.

[illegible] a hardwood [illegible] and remove from the tube.

[illegible]

[illegible]

[illegible] and carefully [illegible]

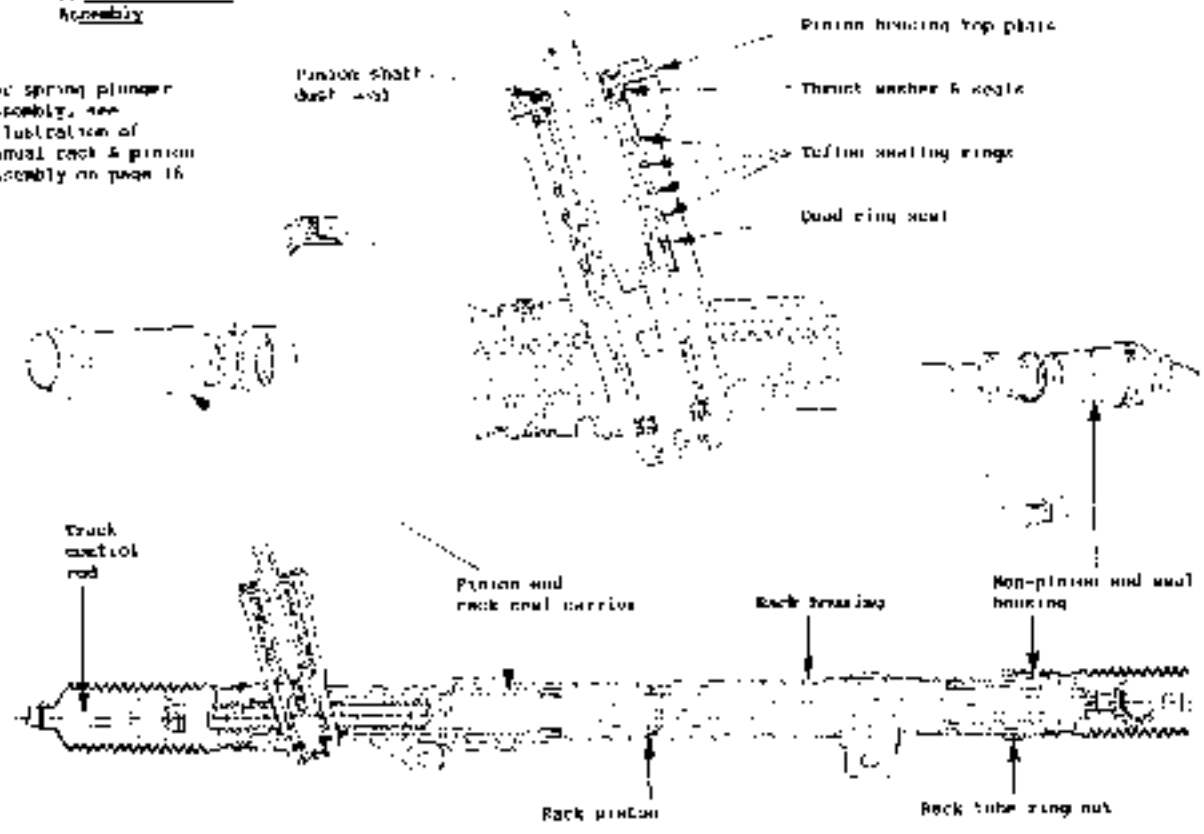
[illegible] rack bar [illegible] the rack bar [illegible]

[illegible] the rack tube [illegible] the ring nut [illegible] the ring nut to [illegible] Nm [illegible] the housing [illegible]

[illegible] the plunger, [illegible] mm rod or [illegible] engage the [illegible] on the [illegible] of the rack bar

Power Rack & Pinion Assembly

For spring plunger assembly, see illustration of manual rack & pinion assembly on page 16



11 Valve/pinion assembly:

- Pull the thrust washer and seals off the top end of the rotor. Remove the pinion sleeve sealing rings by carefully cutting through each of the four teflon rings.
- Use special expander/guide tool [illegible] to fit a new sealing ring into each of the four grooves, working from the bottom groove upwards.
- Lubricate a new lower pinion seal, and locate between the lower end of the pinion sleeve and the roller bearing.
- Using the [illegible] guide tool [illegible], insert the valve/pinion assembly into the housing, [illegible] when the teeth are fully engaged, the pinion [illegible] the [illegible] faces the pinion end of the rack tube.
- Fit a new seal onto the outside of the thrust plate, and a new 'O' ring and [illegible] seal [illegible] the [illegible] of the plate. Use the taper [illegible] to [illegible] the seals into position over the top of the rotor.
- [illegible] the thrust washer, and measure the distance between thrust [illegible] and pinion housing face. This should be between [illegible] mm (maximum). Add [illegible] to this figure. [illegible] thrust [illegible] and [illegible]. [illegible] the top plate and [illegible] [illegible]
- [illegible] rubber [illegible] the top of the [illegible] a gap of [illegible] between the [illegible] and the pinion housing [illegible].

- [illegible] locking plate [illegible]

12\. Refit the rack plunger assembly into the base of the rack housing using a new [illegible] ring, and torque tighten the [illegible] [illegible] Nm ([illegible] lbf.ft). [illegible] release the [illegible] rack [illegible] the [illegible] increase [illegible] the [illegible] and [illegible] the assembly should be [illegible]

13\. Refit the [illegible] (see section [illegible]).

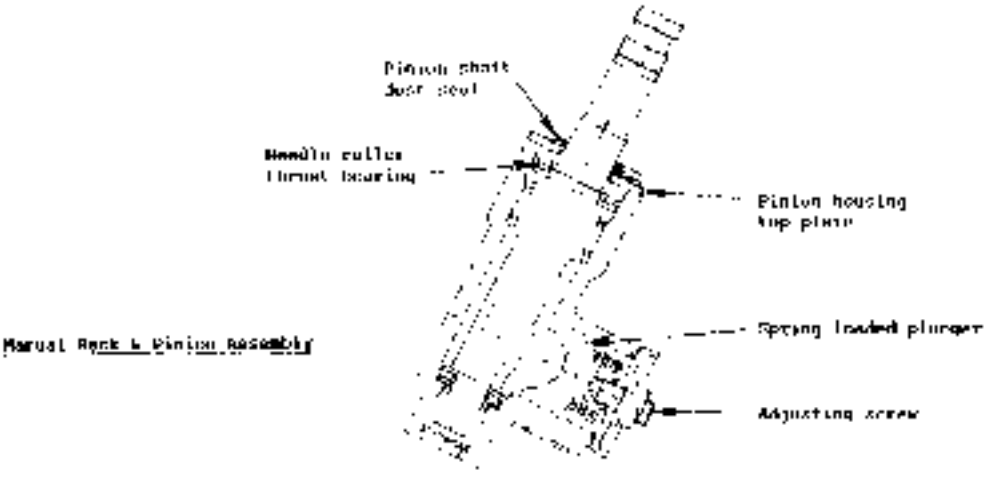
14\. [illegible] the rack and pinion [illegible]

15\. Refit the [illegible] assembly to the car (see section [illegible]).

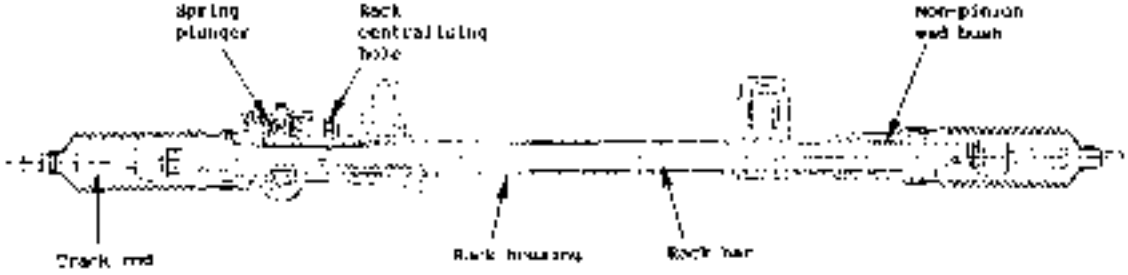
[illegible] MANUAL RACK ASSEMBLY SEALS & [illegible] REPLACEMENT

[illegible] that may be [illegible] the [illegible] rack assembly must [illegible] and the [illegible] of the rack [illegible]

[illegible] rack assembly from the car (see section [illegible]) [illegible]



Manual Rack & Pinion Assembly



1. Remove the rack guides and track pads (see section III-A).

   Remove the blanking plug adjacent to the power housing at the back of the unit. Retrieve the rack, and insert a 4.0 mm rod, or special tool 2000116, to keep the drilling in the back of the rack bar. Mark the position of the pinion shaft relative to the housing to aid reassembly. Remove the retaining ring.

2. Release the two screws securing the spring-loaded plunger at the back of the rack (opposite the pinion housing), and remove the plunger assembly.

3. Pull out the pinion shaft dust seal and discard. Release the two bolts securing the pinion bearing plate, and remove the plate and shims. Carefully withdraw the pinion shaft and top pinion bearing, and lay aside.

4. Withdraw the rack from the housing.

5. Clean out the teflon high pressure hose union end of the rack housing with a fine emery cloth, and apply a thin film of grease to the rack teeth. Insert the rack into the housing, and fit the retaining ring in the groove.

6. Temporarily refit the pinion bearing to the pinion shaft to take up the shaft end float, and apply a thin film of grease to the rack teeth. Insert the rack into the housing, and fit the retaining ring in the groove.

7. Insert the pinion shaft into the housing, and engage the pinion gear teeth with those on the rack. Fit the dust seal to the pinion shaft housing, and tap it home. Apply thread locking compound to the threads of the pinion housing bolts, fit the bearing plate and shims, and tighten the bolts evenly. Check the pinion shaft end float is correct (see III-A), and if not, adjust the shims.

8. Refit the plunger assembly, ensuring the plunger is fully retracted, and tighten the two screws. Refit the rack guides and track pads (see III-A).

9. Remove the retaining ring, and refit the blanking plug, tightening to 50 lb.ft (6.9 kg.m).

10. Refit the two high pressure hoses to the rack housing, tightening to 30 lb.ft (4.1 kg.m).

11. Refit the steering column assembly to the rack housing, ensuring the splines engage correctly, and secure with the two clamp bolts. Refit the steering column lower shroud.

12. Refit the steering wheel, ensuring the wheel is correctly positioned relative to the steering column, and tighten the retaining nut to 40 lb.ft (5.5 kg.m). Refit the steering wheel boss cover.

13. Refit the front wheels, and lower the vehicle to the ground. Tighten the wheel nuts to 80 lb.ft (11.0 kg.m).

14. Refit the battery, and reconnect the negative lead. Start the engine, and check the operation of the power steering system. Check the rack housing unions for signs of fluid leakage, and tighten if necessary. Check the steering wheel is correctly positioned when the road wheels are pointing straight ahead, and if not, remove the steering wheel, reposition it on the splines, and refit the retaining nut.

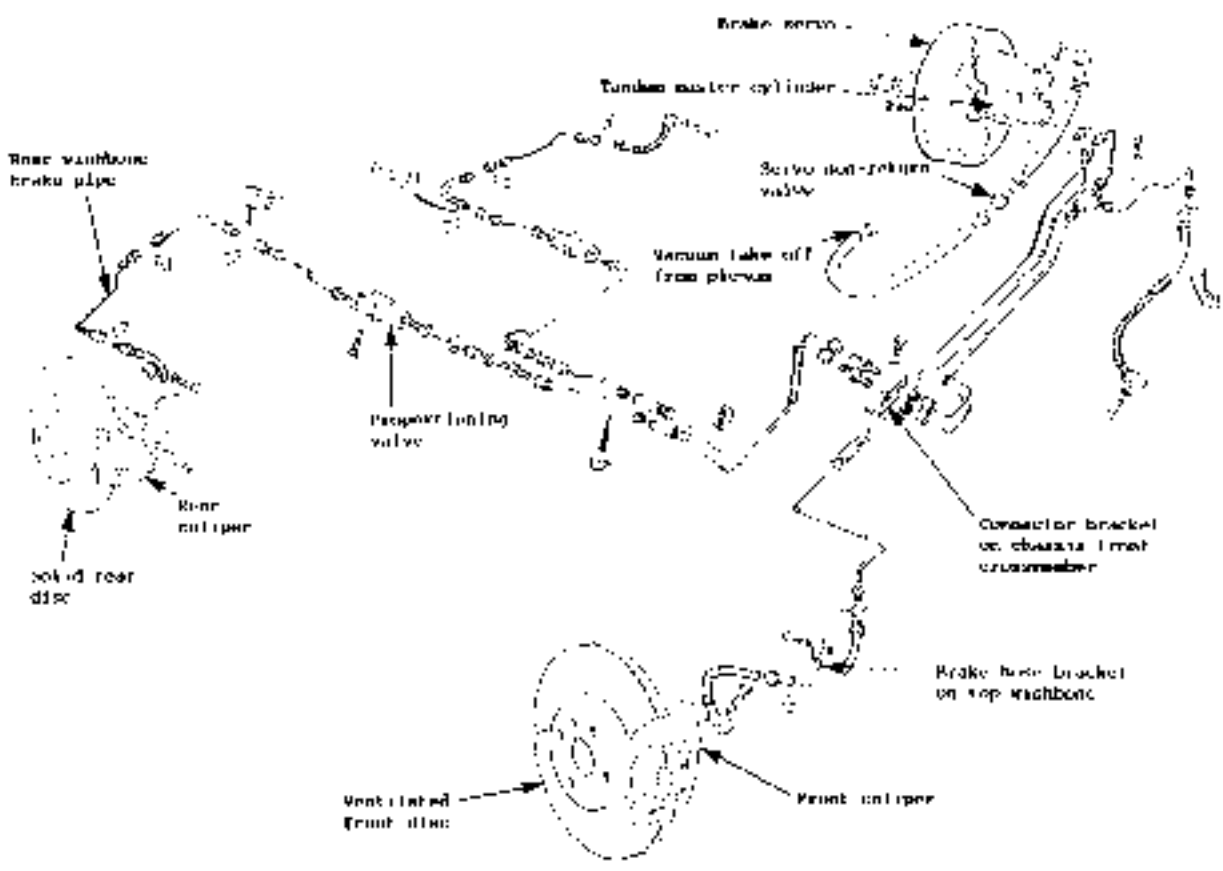
some time (this is a list of subjective tips, the rack teeth are easily worn, and the complete assembly needs to be replaced. Hold the adjust up screw and tighten the locking nut to the specification).

j. Refit the fuel pump and rack as here (see section 2004).

k. Refit the steering rack assembly to the car (see section 2004).

BRAKES

SECTION 70 INDEX


Brake servo
Tandem master cylinder
Rear wishbone brake pipe
Servo dual-return valve
Vacuum take off from plenum
Proportioning valve
Rear caliper
Solid rear disc
Connection bracket on chassis front crossmember
Brake hose bracket on top wishbone
Vent ilated front disc
Front caliper

J 1 - 1 HYDRAULIC DESCRIPTION

The brakes system comprises a tandem master cylinder and direct acting servo unit, operating single piston sliding calipers for each wheel. All calipers front and rear are identical.

The hydraulic circuit is diagonally split, the front left rear, and RH rear brakes form independent operation from the secondary compartment of the tandem master cylinder, with separate hydraulic lines feeding each caliper. A brake proportioning valve is incorporated into each of the rear brake lines to offer progressive rear brake line pressure under heavy braking, to reduce the likelihood of rear wheel lock up. A brake fluid reservoir serves both compartments of the tandem master cylinder, and is provided with a low fluid level warning switch, which operates a lamp mounted in the LH rear lamp.

Single piston sliding calipers are used at each wheel. The caliper body is supported on two hardened steel sleeves, which allow the caliper free lateral movement. When the brakes are applied, hydraulic pressure in the master cylinder, forces the piston outwards and the caliper body inwards, causing the brake pads being clamped to the disc, producing the required friction.

The parking brake lever connects, via a compensating link (to optimise the pull applied to each cable), to the cables, one leading to each rear caliper. Each cable operates a lever on the caliper which turns an actuating screw (quick thread, inside the rear piston cylinder, forcing the piston against the pad and disc and applying the brake. A self adjusting mechanism within the cylinder, takes the form of a spring clutch wrapped around the piston 'nut' in which the parking brake actuator screw operates. On application, the one way spring clutch locks the nut to the piston, so that the piston is forced to move axially when the actuating screw is turned to release, a 'piston retainer' outboard of the piston cylinder is only exerts sufficient grip on the piston to prevent it being driven back by the mechanism. This compels the spring clutch to release the nut, so that the actuator screw is not used at all, as the screw returns to its start position. This results in any free play being automatically taken up, with the nut starting from a position further along the thread the next time the parking brake is applied. Releasing the piston mechanically, via the footbrake, has a similar effect, with the piston moving outwards and the nut being allowed to turn within it by the spring clutch. This automatically adjusts the parking brake mechanism ready for the next application.

[illegible] PAD REPLACEMENT

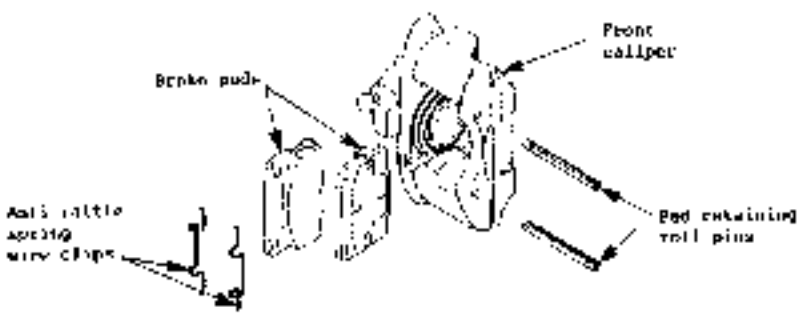
Pad clearance may be checked without disturbing the caliper.
Standard pad thickness = 12.7 mm (0.5 in.)
Minimum pad thickness = 3.0 mm (0.08 in.)

To replace front pads

1. Remove wheel. If only one pad set is to be replaced on the rear, system brake fluid from the master cylinder reservoir to prevent it spilling when the piston is pushed back.

2. Remove the two split pins and tapered pins from the pad retaining roll pins. Withdraw the anti-rattle spring from each pad.

3. Withdraw pads from the caliper carefully, and withdraw the outboard pad. Push the retainer inwards, and withdraw the inboard pad.



4. Push back piston. The piston must be pushed fully back into its bore to provide clearance for the new pads. Use progressive rotary movements.

5. Thoroughly clean the brake pad recesses in the caliper, using a vacuum brush to remove any dirt dust.

WARNING: Inhalation of brake dust can be dangerous to health. Never use an air line to blow away dust from around any brake assembly.

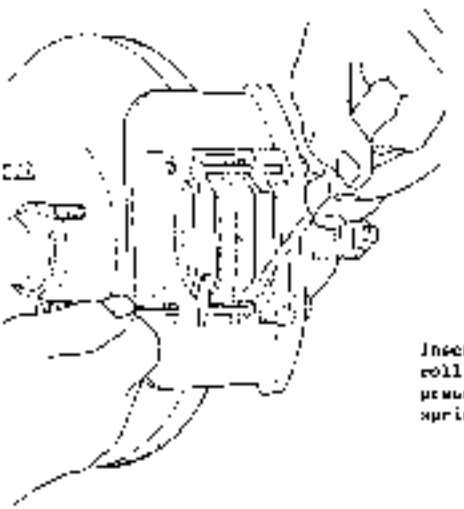
Inspect the condition of the piston boot, and replace if necessary - see below.

6. Check fluid. Before fitting new brake pads, always check the thickness, surface condition and run-out of the brake discs. See section J6.7.

Fit inner friction pad. Be piston is pushed fully back into its bore before attempting to fit new pads. Fit the outboard pad into position, then position the caliper outboard and fitting the anti-rattle pad.

[illegible] the plain end of one new spring pin through the caliper body holes and [illegible] cylinder, with the slot in the pin positioned as shown in the [illegible] Use only a blade 0.127 mm (0.005 in) thick as thicker blades may damage the ends of the pins and make their removal difficult.

[illegible] Fit the remaining pin through the outboard half of the caliper body, before fitting the two pin retaining clips. Fit one end of the spring into the spring slot previously fitted, locate the centre of the spring over the pad backplate, and push the other end of the spring into the second pin slot. Repeat for the second spring and fit the pin clips over the spring pin ends for both pads.
Fit a new split pin to the handbrake cable clevis pin and bend back the ends of the split pin, ensuring that the pins do not foul the wheel.



Inserting second roll pin whilst pressing down spring clip

Fit the road wheels and lower the car to the ground. Pump the brake pedal several times to centralise the pads and check the fluid level.

J1E.1.4 REAR BRAKE PAD REPLACEMENT

Pad thickness may be checked without disturbing the caliper
Standard pad thickness - 14.1 mm (0.6 in).
Ferodo pad thickness 7 mm (0.28 in).

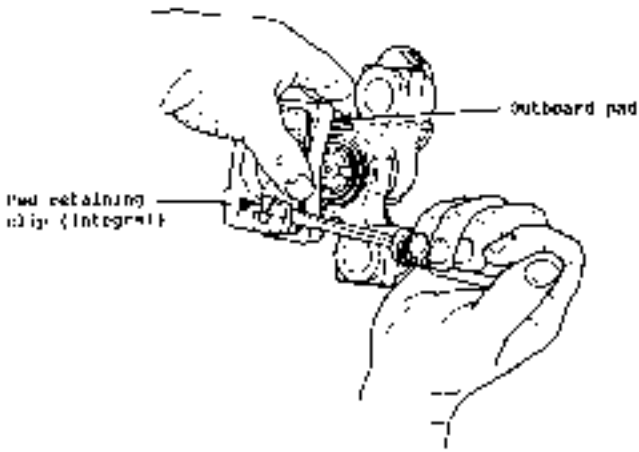
To Replace Rear Pads

Tools required: Friction Grabber 000C000GB

1. Parking Brake Cable: Unhook the parking brake cable from the caliper lever arm, if necessary slackening the cable adjuster on the tunnel top.

- Withdraw caliper. Remove the rear caliper mounting bolts, and withdraw the caliper from the disc, taking great care not to damage the sliding pin boots. Do not stress the flexible brake hose.

- Place caliper in vice fitted with a screwdriver to distribute the pressure on the outboard pad retainer, then use brake to withdraw piston, and withdraw the outboard pad with its integral retaining clip.



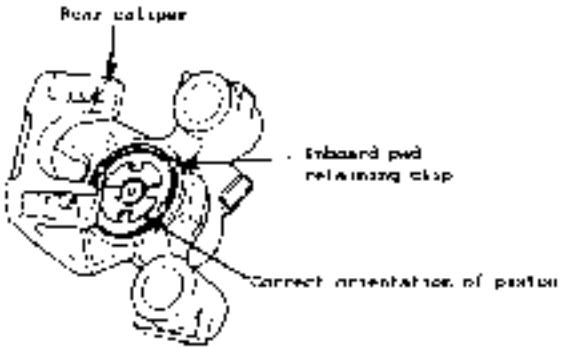
- Remove Inboard Pad: Prise the inside edge of the inboard pad out from its retaining clip, and then withdraw the pad from the disc carrier.

- Remove Check Valve: Use a small screwdriver to prise out the non-return check valve from the piston.
If there is any sign of fluid leakage from the piston seals after removal of the check valve, the caliper should be overhauled as detailed in Chapter 5 (unless the condition of the piston bore and seals dictate otherwise).

- Retract Piston: Before new pads may be fitted, it is necessary to fully retract the piston in its bore. If necessary, syphon fluid from the master cylinder reservoir to make room for the fluid retained from the caliper. Use tool JD1010/1 to engage in the slots in the piston, and turn the piston.
  - Clockwise for LH caliper, or
  - Counter-clockwise for RH caliper.
  Push the piston back down the packing brake retainer, whilst pressing the pad clip down the bore.

- Fit New Check Valve: Lubricate a new check valve with clean brake fluid, and fit into the piston bore.

- Fit Inboard Pad: Check that the piston is correctly orientated - the back of the pad retaining clip in the piston should be radial and tangential. Turn the piston if necessary. Check also that the pad retaining clip is fully located in the groove on the end of the piston.



Engage the outside edge of the pad backplate with the retaining clip, ensure pressure clip pad is against the piston to engage the clip on the inside edge of the backplate. Check that the pad lies flat against the piston. Fit the outside pad backplate engaged with the slot in the piston.

4. Inboard pads: Press the pad into position, so that the notch on the pad backplate engages with the tang on the caliper bridge with the pad retained by the two legs of the clip.

5. Refit calipers: Carefully examine the sliding pin boots for tears, cuts or deterioration, and replace if necessary (see JE.5). Position the caliper over the brake disc, taking care not to damage the sliding pin boots and refit the two caliper retaining bolts. Torque tighten the bolts to 92 - 117 Nm (68 - 86 lbf.ft).

6. Parking Brake Cables: Refit the parking brake cable to the backplate bracket and caliper lever arm, and if necessary, re-adjust cable as detailed in JE.1.

7. Top up the master cylinder reservoir to the full level, and press the brake pedal hard several times to restore working pad position. Recheck reservoir level. Check parking brake operation.

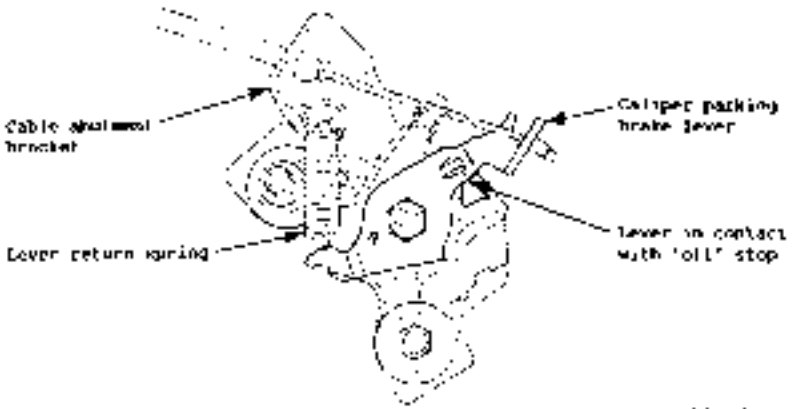
JE.4 PARKING BRAKE MECHANISM

It is important, if the self adjusting mechanism is to function correctly, that the caliper levers are fully back against their stop brackets when the parking brake is 'off'.

To adjust:

1. Ensure that the pads are at their working position, by applying hard pressure to the footbrake pedal several times.

2. At each caliper, check that the parking brake lever is fully against its 'off' stop bracket, and check that when the parking brake is applied and released, the caliper levers return immediately, and are not delayed by excess tightness in the cables or linkage. Rectify as necessary.



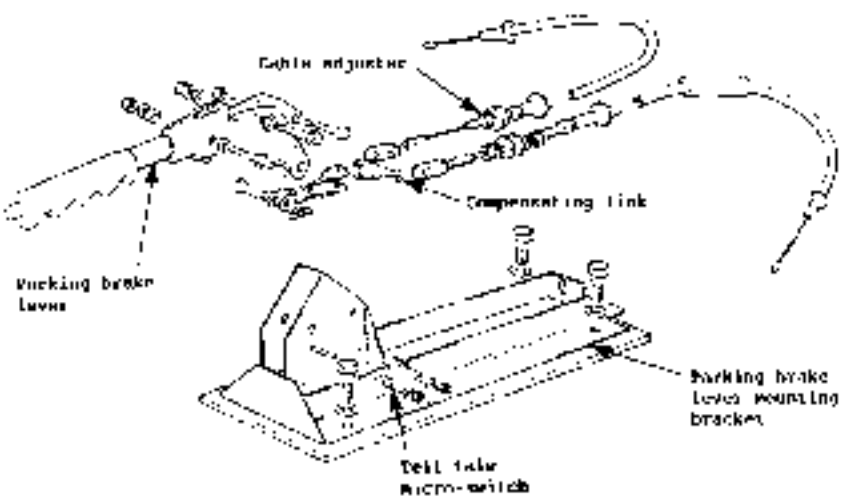
Pull on the lever (right) to gain access to the parking brake cable adjuster at front of transmission tunnel. Use the adjusters to remove the slack from each cable, but ensure that the caliper levers are still in contact with their stops.

6. Operate the parking brake several times to allow the automatic adjusters within the calipers to take up any excess clearance, and check that the parking brake lever travels no more than 7 clicks when fully applied.

7. Refit the tunnel top trim.

Cable Replacement:

Remove the tunnel top trim to gain access to the front end of the cables:



..

a) Loosen the trailing panel fixing between the rear of the centre tunnel to body and the rear wall, by releasing the single retaining screw.

b) Lift rear and disconnect the mirror control switch, to the rear of the centre tunnel.

c) Lift rear and disconnect the two brake switches, each side of the parking brake lever, and release the two console front fixing screws via the swivel apertures.

d) Pull back the ashtray from the rear of the console, and release the two console rear fixings via the tray apertures. Pull the console to the rear to disengage the footwell fixings, and then lift the console over the parking brake lever.

On left hand drive models is fitted with an eye which locks into the cable fixing bracket which is itself connected by a short lever to the parking brake lever. Note: If the cable adjuster is unable to be released fully the cable should be removed from the abutment bracket. Unhook the cable at the caliper lever and release from the cable abutment and remove the cable from the rear suspension top link. Withdraw the cable through the body with the grommet.

Reverse the removal procedure to refit a cable, and adjust as detailed above.

Parking brake lever:

The parking brake lever incorporates a pawl and ratchet mechanism which is normally retained in the end of the handgrip. If the pawl is worn or broken necessitating renewal, they should be replaced as a pair.

To remove the parking brake lever, release the clevis securing the two cables to the compensator lever, remove the clevis pin retaining the ratchet plate, and release the lever pivot bolt. Withdraw the lever assembly over the mounting bracket. The mounting bracket is secured to the chassis centre section by four M8 bolts with washers.

9 - FRONT CALIPER OVERHAUL

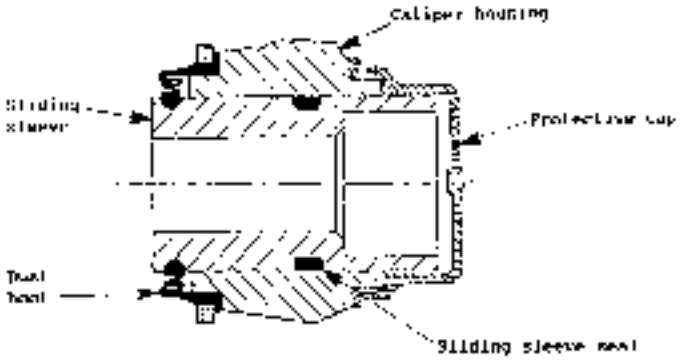
Tools required: 7/8" ring or box spanner/cup spanner: 70GG7006

1. Remove brake fluid. See section B6.1.

   Hint: Clip hose. Fit a brake hose clamp before releasing the banjo bolt securing the flexible hose to the caliper. Remove the bleeder valve. Seal the hose and caliper openings to prevent fluid loss and dirt ingress.

2. Mounting bolt. The caliper is mounted via the two sliding sleeves, each of which is retained by a socket head bolt concealed by a protective cap over the end of the sleeve. Prise off the caps, and release the two socket head screws. Withdraw the caliper to a clear area.
   Do NOT disturb the two bolts securing the two halves of the caliper body together.

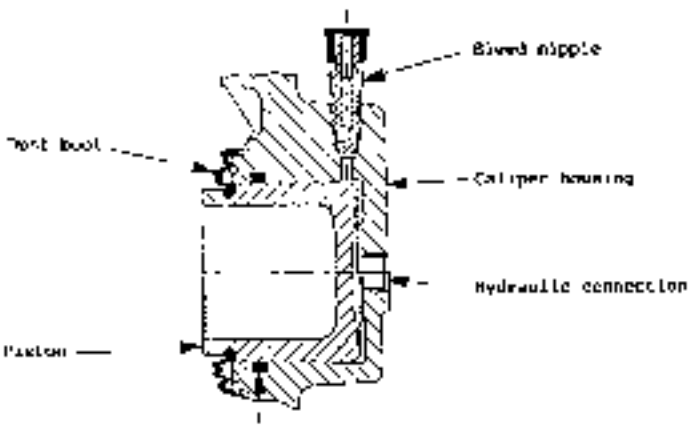
3. Sliding Sleeves: Prise off the boots, and push the two sliding sleeves from the caliper bracket. Carefully examine the rubber seals for nicks, cuts or deterioration and the bolt and sleeves for any signs of corrosion. Renew any faulty parts as necessary.



Using a tool fitted into the piston, pull the piston out of the caliper housing, and pull it from the groove in the piston. Insert a 1/4 metric piece of hardwood between the sliding sleeve and the caliper body, and prise the sleeve out. Apply low compressed air to the hydraulic connection.

WARNING: KEEP FINGERS WELL CLEAR WHEN USING COMPRESSED AIR.

4. Piston seal. Remove the piston seal from the split ring groove using a plastic or soft metal tool, or the cylinder will or the seal groove may become scored.



Piston seal

- Clean: Clean all parts in brake fluid or alcohol, and dry with unlubricated compressed air. Lubricated shop air may damage rubber brake components. Blow out all the passages in the caliper housing and bleeder valve.

- Inspect: Inspect the following components.
  - Pin per bore and bore groove for scoring, nicks, corrosion or visible wear.
    Pin for pitting, rust, corrosion or damaged chrome plating.
  - Caliper bridge for any signs of cracking.
  If any light corrosion cannot be polished out by a circus cloth, or if any other faults are found, the components must be replaced.

- Piston Seal: Lubricate a new piston seal with clean brake fluid, and fit into the cylinder groove, taking care it is not twisted.

- Piston and Boot: Fit a new piston seal lubricated with the rubber grease supplied in the repair kit, into the groove on the piston, as shown in the diagram. Lubricate the piston with clean brake fluid, and insert into the cylinder, pushing to the bottom of the bore.
  Use the end of the caliper mounting countersunk screw, using a suitable press tool but only tapped slightly engage over behind the boot, by easing the boot away from the piston groove just a plastic tool.

- Fitting Sleeves: Apply a thin coat of the sparse grease provided in the repair kit, to the surface of the sleeves. Fit the new rings into their grooves in the bores of the sleeves, ensuring that the seals are not twisted.
  Slide the sleeves into their caliper bores from the dirt side, leaving the hose grooves accessible. Apply some of the grease to the lips of each dust boot, and fit into the sleeve groove. Press the boot firmly into position on the housing using a suitable tool.

- Fit caliper: Fit the caliper over the brake disc. **CAUTION** - Take great care not to damage the sliding pin boots when fitting the caliper. Fit the two caliper locating bolts using a thread locking compound (e.g. Loctite). Torque tighten to 21 - 31 Nm (15 - 23 lbf.ft.). Fit the protective caps to the ends of the sliding pins using special tool T00U1C00A.

- Flexible Hose: Fit the flexible hose to the caliper using one or somewhile copper washers, and torque tighten to 20 Nm (15 lbf.ft). Fit the bleed nipple and torque to 7 - 10 Nm (5 - 8 lbf.ft.).

- Brake Pads & Bleeding: Refit the brake pads as detailed in 70.2. Remove the brake hose clamp, and bleed the brake system to expel all air.

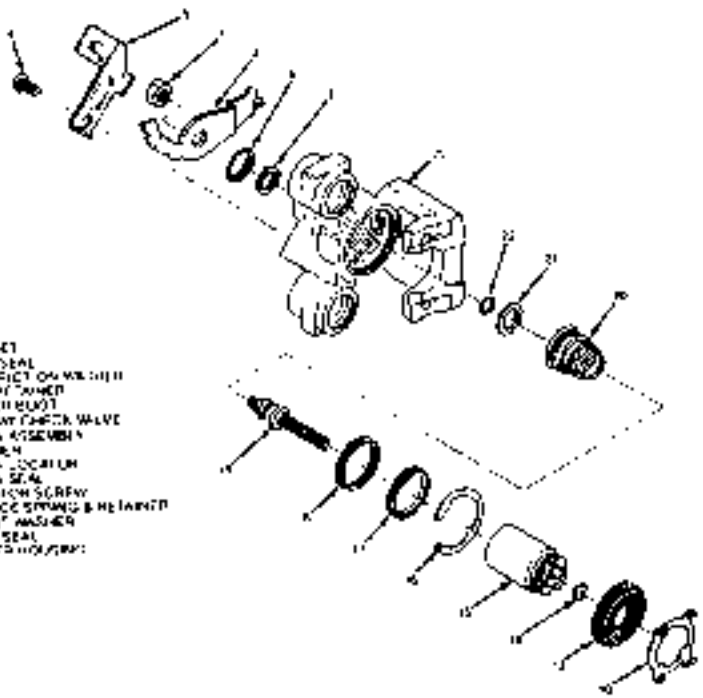
70.1 - REAR CALIPER OVERHAUL

Tools required Piston Locator Installer T00U1000
                Piston Pusher T00U0000A

- Hydraulic Hose: Fit a brake hose clamp before releasing the banjo bolt securing the flexible hose to the caliper. Remove the bleeder valve. Seal the hose and caliper openings to prevent fluid loss and dirt ingress.

- Caliper & Pads: Remove the caliper and brake pads (see 70.2).

4. Pilot cylinder: Pull off the boot, and push the two cylinder screws fully out of the caliper body. Carefully examine the cylinder bore for scoring or corrosion on both the pilot and piston. Examine the boot for any signs of damage. Replace any faulty parts as necessary.

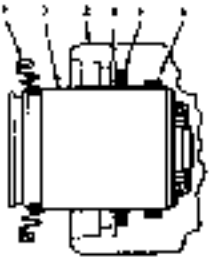


5. Piston Removal: Remove the securing nut and pull off the parking brake lever arm, lever seal and anti-friction washer. Use a spanner to turn the actuator screw in the brake apply direction, and so push the piston out of the cylinder. Use clean rags or soft cloths to protect the piston during removal, and remove the pad retaining clip from the piston if this has not already been done.

6. Actuator Screw: Remove the balance spring from inside the cylinder, and push out the actuator screw. Remove the screw thrust washer, and the shaft seal.

7. Piston Boot: Ease out the piston boot taking care not to scratch the cylinder bore.

8. Piston Locator & Seal: Examine the circlip, and pull out the piston locator. Use a suitable tool to remove the piston seal from the groove in the cylinder, in order to prevent scratching the cylinder wall or groove.



1. Dust boot
2. Piston
3. Caliper housing
4. Circlip
5. Piston locator
6. Piston seal

- Inspect carefully inspect the cylinder wall and piston surface for any signs of:
  - Scoring
  - Cracks
  - Corrosion
  - Visible wear or damage to chrome plating

  If any light excoriations can be polished out using crocus cloth, or if any other faults are found, the components must be replaced.

4. Clean: Clean all parts in fluid to be used (brake), and dry with oil-free compressed air (if available). Use air for any damage rubber brake components. Blow out all the passages in the caliper housing and bleeder valve.

5. Adjustment Bracket: If necessary, remove the parking brake cable adjustment bracket. When re-fitting, torque tighten the single fixing screw to 25 - 30 lbf ft (34 - 38 Nm).

11. Piston Seal: Lubricate a new piston seal with clean brake fluid, and carefully fit into the groove in the cylinder wall. Ensure the seal is not twisted.

12. Piston Locator: Lubricate a new piston locator and fit onto the piston using the silver tool 18G47B8.

13. Actuator Screw: Fit the thrust washer onto the actuator screw with the copper side of the washer towards the piston and the groove face towards the caliper housing. Lubricate the shaft and fit into the actuator screw groove. Fit the screw fully into the piston.

14. Piston: Lubricate the cylinder bore. Fit the outside spring onto the end of the piston, and insert the piston with actuator screw into the cylinder. Push the piston into the bore until the locator is past the circlip groove. Fit the retainer circlip using circlip pliers.
Fit the lubricated piston boot into the groove in the end of the piston, before pressing the piston to the bottom of the bore.

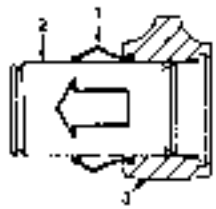
15. Lever Arm: Fit the lubricated main friction washer over the end of the actuator screw, followed by the lubricated lever seal with the sealing bead towards the caliper body. Fit the lever arm in the correct orientation between the cable abutment and 'off' stop, and retain with the nut. Hold the lever while torque tightening the nut to 40 - 55 Nm (30 - 40 lbf.ft)
Fit the lever return spring.

[illegible]

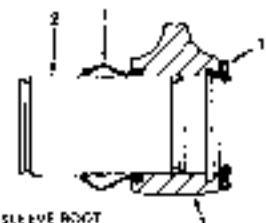
[illegible] Seat the piston seal in the counterbore on the caliper using a suitable tool.

[illegible] Install new caliper bolt boots to eliminate the sliding surfaces of the slide sleeves and corresponding recess in the caliper housing. Lubricate with [illegible] of the two sleeve seals. Install each slotted pin in the bracket recess. **CAUTION:** Do not [illegible] from that position.

- Install new boot into the groove in the sleeve and slide the pin through the opposite side of the caliper hole, pushing through the boot inside diameter.

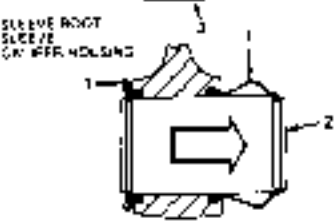


- Fit the annular seal into the caliper groove.



1 SLEEVE BOOT
2 SLEEVE
3 CALIPER HOUSING

- Push the pin back through the second boot and locate the inside diameter of both boots in their grooves in the slide pin



[illegible] Fit [illegible] Lubricate a new piston seal with clean brake fluid, and fit it to the piston bore.

[illegible] Put [illegible] Check that the piston is correctly positioned - the open end of the recessed slot in the piston should be visible and be [illegible]. Push the piston in progressively. Ensure also that the pad retention clip is fully located in the groove in the end of the piston.
Locate the outside edge of the pad backplate into the retention clip, before pressing the pad flat against the piston to engage the clip on the inside edge of the backplate. Check that the pad lies flat against the piston, with the bushes or the pad backplate engaged with the slot in the piston.

[illegible] Fit outboard pad. Press the pad into position, so that the burr on the pad backplate aligns with the notch in the retainer bracket, with the pad retained by the two legs of the U.

21. Refit Caliper. Position the caliper over the brake disc. Take care not to damage the sliding pin bellows when refitting the caliper retaining bolts. Torque tighten the bolts to 95 - 110 Nm (70 - 80 lbf ft).

22. Refitting Brake Cable. Reconnect the parking brake cable to the abutment bracket and lever arm.

23. Flexible Hose. Fit the flexible hose to the caliper using new sealing washers. Torque tighten to 35 Nm (25 lbf ft). Fit the bleed nipple and torque tighten to 14 Nm (10 - 11 lbf ft).

24. Bleeding. Top up the master cylinder reservoir. Operate the parking brake several times to obtain the correct brake pad position (until parking brake lever locks firmly). Remove the brake hose clamp before bleeding the system to ensure all air.
Test operation of footbrake and parking brake.

[illegible] - BRAKE DISC

Check the braking surface of both sides of the brake discs for scoring or corrosion. Replace if in doubt.
Measure the disc thickness and run-out.

	New	Wear
Thickness, nominal	24.2 mm (0.95 in.)	22.2 mm (0.87 in.)
Minimum permitted thickness	23.0 mm (0.91 in.)	21.5 mm (0.85 in.)
Run-out thickness (wear limit)	23.0 mm (0.87 in.)	19.0 mm (0.75 in.)
Max run-out, installed	0.10 mm (0.004 in)	0.10 mm (0.004 in)
Max run-out, removed	0.03 mm (0.001 in)	0.05 mm (0.002 in)

NOTE: Ensure the rear wheel bearings are correctly adjusted before measuring rear disc run-out.
If the run-out is excessive, replace the disc.

[illegible] - BRAKE SERVO UNIT

The brake vacuum servo is a non-serviceable sealed unit which if found to be faulty, must be replaced as a unit, complete with the vacuum non-return valve fitted into the vacuum line between servo unit and intake primary chamber.
As a quick check of servo operation proceed as follows. With engine stopped, press the brake pedal several times to exhaust the servo unit of vacuum. Keeping the pedal pressed (which should be 'hard' and 'high'), start the engine: the pedal should drop slightly as the servo vacuum builds up, and extra force is produced. If the pedal does not drop, or is not likely that there is a fault in the vacuum supply line. Check the vacuum hose, connections and non-return valve. If the vacuum supply is not defective, the servo unit should be replaced.
It is essential that the servo piston is allowed to return fully when the brakes are released, and is not pre-loaded by mal adjustment of the input pushrod. Check that there is a small amount of free play at the pedal when the brake pedal is released.

To Remove Servo Unit
The servo unit, if diagnosed as being faulty, must be withdrawn together with the pedal box. Remove the inside of the car.

3. Centre console: Remove the centre console and instrument panel (see section P).

4. Fuse box: Remove the fuse box (see section V).

5. Steering column: Remove the steering column (see section B).

6. Throttle cable: Pull off the throttle clip, and unhook the cable from the throttle pedal.

7. Clutch cable: Pull back the clutch release lever on the transmission, and unhook the cable from the clutch pedal.

8. Master cylinder: Disconnect the main earth point from the rear face of the pedal box. Release the cable ties retaining the main harness to the centre door aperture, and pull the grommet out of the dash. Disconnect the brake light switch.

9. Master cylinders: Release the two nuts securing the master cylinders to the servo. Leave the hydraulic system undisturbed.

10. Fixings: Remove the two servo fixings.

11. Pedal box: Release the hose clips from the engine side of the front bulkhead securing the servo hose, and withdraw the pedal box complete with servo into the driver's footwell.

Servo outboard fixings viewed from driver's seat

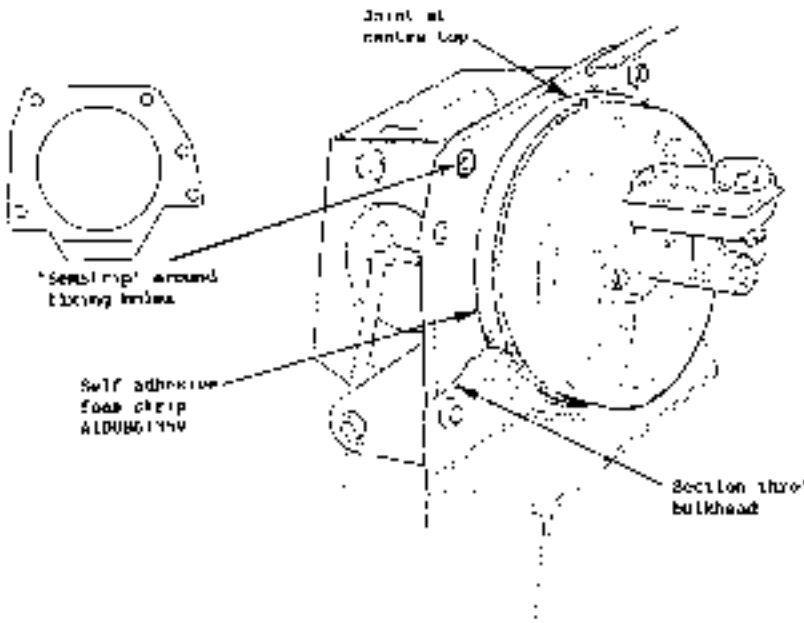
Servo inboard fixings viewed from engine bay

12. Servo: Disconnect the servo pushrod from the pedal, release the four nuts securing the servo to the pedal box, and withdraw the servo unit.

To replace servo unit

Reverse the removal procedure to replace the servo, noting the following points:

- Torque tighten servo to pedal box bolts to 20 - 25 Nm (15 - 18 lbf.ft).
- Adjust servo input rod for 0.5mm (0.020in) free play when brake is off.
- Apply a 200mm length of self adhesive foam strip (ALUBB1995) around the body of the servo unit, aligning with the rear edge. Position for joint at the centre top.
- Apply a ring of 'Sealastrip' (ALUBB1) on the pedal box around each of the servo fixing holes, to seal the pedal box to the bulkhead.
- Torque tighten pedal box fixing bolts to 20 Nm (15 lbf.ft).



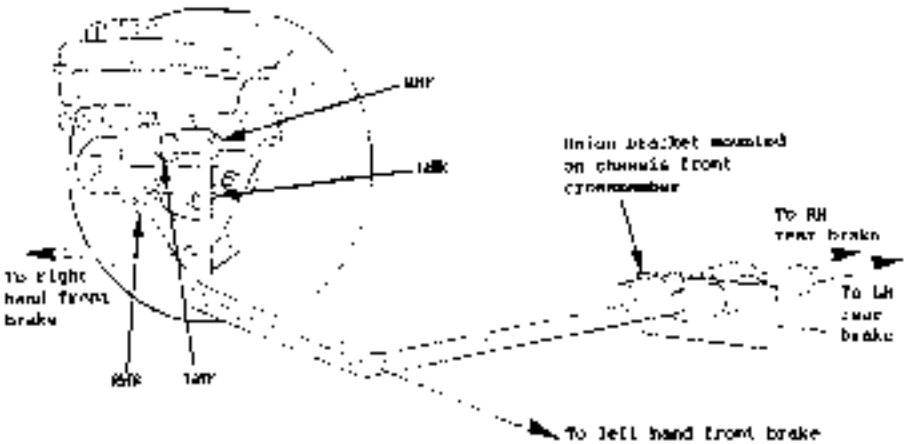
5.9 - MASTER CYLINDER

The brake master cylinder is a non-serviceable sealed assembly, which must be replaced as a complete unit if it is to be faulty.

To Replace Master Cylinder

- Before removing the master cylinder, siphon off as much brake fluid as possible from the reservoir to reduce the amount of spillage.
- Disconnect the low fluid level sensor harness from the reservoir cap. Disconnect the three brake pipes from the master cylinder ports and plug the pipes and ports to reduce spillage and prevent dirt ingress.
- Remove the two nuts securing the master cylinder to the brake servo, and withdraw the master cylinder.

Refit the master cylinder in the reverse order to that above, refill with brake fluid, and bleed the complete system in the usual manner.



Torque : prim master cylinder to servo fixings 15 - 18 Nm (11 - 13 lbf ft)
- Torque tighten brake pipes to master cylinder to 12 - 15 Nm (9 - 11 lbf ft)

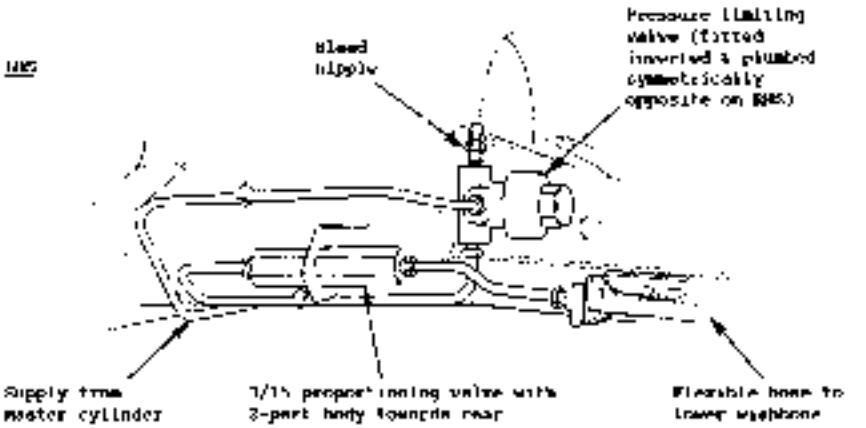
H.11 - PRESSURE LIMITING & PROPORTIONING VALVES

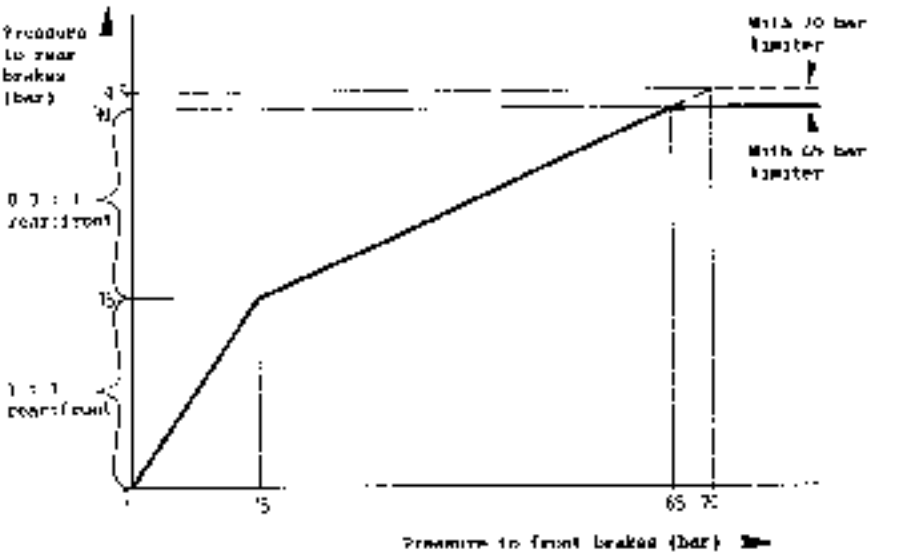
A pressure proportioning valve is fitted into each of the rear brake circuits in order to limit the rear brake pressure when severe braking, and reduce any tendency for the rear wheels to lock before the front. Servo cars only, in addition an MPV connected in series with each proportioning valve, either a pressure limiting valve, or a second proportioning valve in order to obtain the revised pressure flow characteristics. Thus the three variants to be found are:

- Pressure limiting valve (70 or 65 bar) - Proportioning Valve (1/1)

The limiting valves are fitted upstream of the proportioning valves, and are set at either 70 bar, or (also rare), 65 bar. This figure is stamped on the valve end plate. At brake line pressures below the valve calibration, the valve is open, and allows unrestricted flow of brake fluid from the master cylinder to the proportioning valve. When the output pressure from the master cylinder reaches that set for the limiting valve calibration pressure, the valve closes, and allows no further increase in pressure to the rear brake circuit. The valve opens again when supply pressure drops below 70 or 65 bar.

The proportioning valves are designated 1/1S, which indicates:
- up to the 'break point' of 15 bar, the pressure in each rear brake circuit is the same as that in the front circuit.
- as the front circuit pressure increases from 15 bar to 65 or 70 bar (see above), the corresponding increase in rear circuit pressure is in the ratio of 1:1.

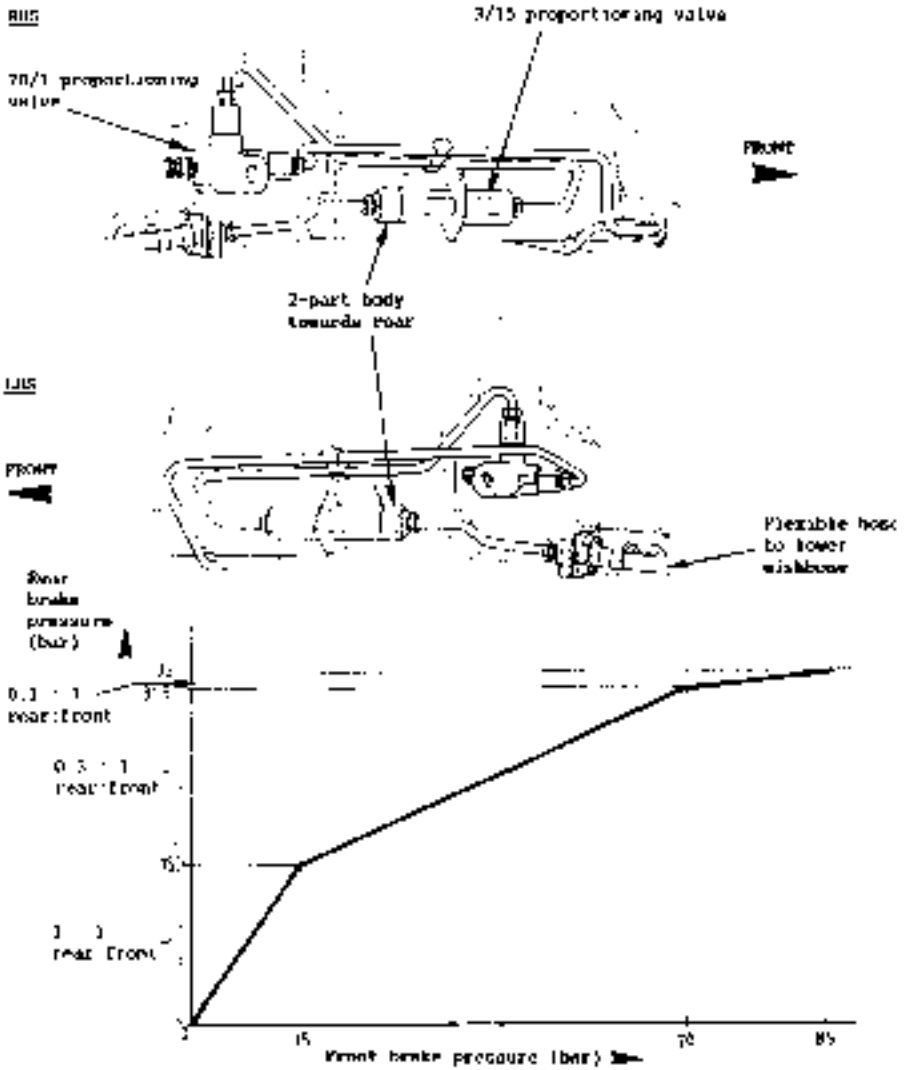




If any problems are experienced with the limiting valves or 3/1% proportioning valves, it is recommended to discard all both valves and fit the 1/1% proportioning valves as described in (iii).

...) Proportioning Valve (3/15) & Proportioning Valve (70/1)

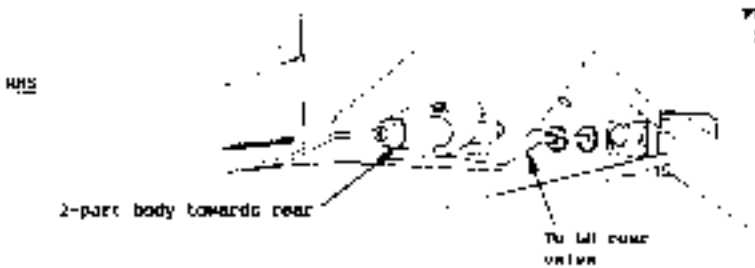
The 3/15 proportioning valves are the same as those on 110, above, and operate in the same way. The 70/1 valves are fitted upstream of the 3/15 valves, and have effect only when input pressure exceeds 70 bar. Thereafter, the increase in output pressure is 1/3 of the increase in input pressure.

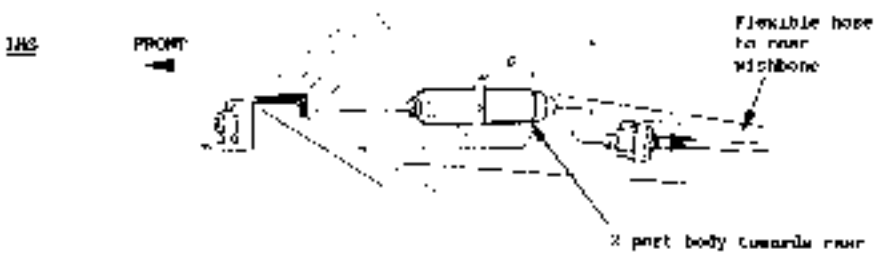


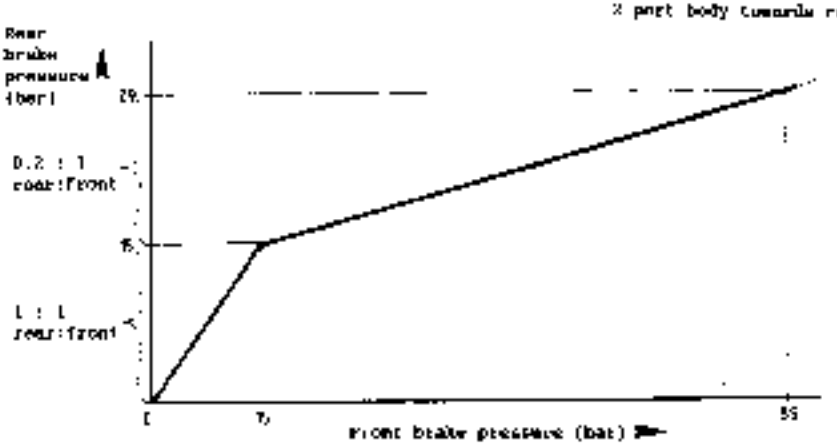
If any problems are experienced with the 7071 or 3.15 proportioning valves, it is recommended to discard all by a valve and fit the 2/15 proportioning valves as described in 7111.

1.1) Pressure Proportioning Valve (2/15)

These cars use a single proportioning valve (2/15) in each rear circuit, and this is the preferred arrangement to be adopted should any problems be experienced with either of the pedal to two systems. These valves have no effect until input pressure exceeds 25 bar, after which the increase in output pressure is 2 of the increase in input pressure.







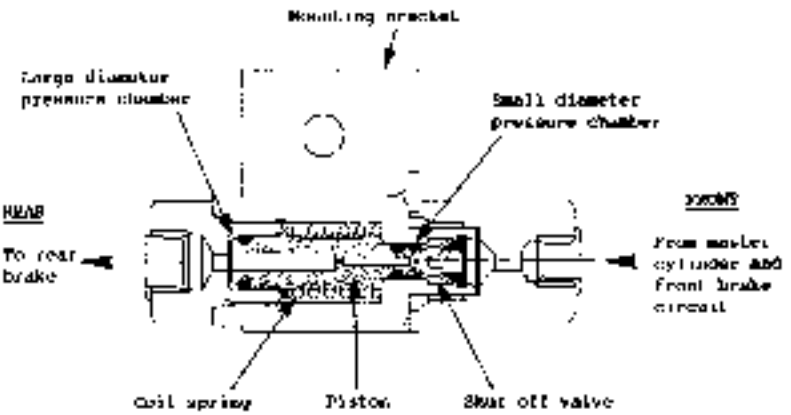
If fitting the P/V valve as part of either of the systems described in (a) or (b), the following parts will be required:

Pressure limiting valve unit	RTC6760A	1 off
Brake pipe, pump - valve (part, 5)*	AIC6760BF	1 off
Brake pipe, pump - valve (part, 7)*	AIC6760CF	1 off

Operation of Proportioning Valve

The following description applies to a P/V proportioning valve, but the principle is similar for the P/LS valve.

Each unit consists of an aluminium body containing a spool loaded piston, through the centre of which the brake fluid flows from the front to the rear circuit. A small diameter pressure chamber at the front end of the piston is connected to the front brake line, and includes a shut off valve. A larger diameter pressure chamber at the rear end of the piston is connected to the rear brake circuit.



At brake line pressures below 15 bar, the proportioning valve is open, and fluid flows through the unit freely to provide equal front and rear brake line pressures.

The piston is spring loaded towards the outlet end. The hydraulic force on the piston from the large diameter outlet (rear) end, is greater than that upon the small diameter inlet (front) end. At a pressure of 15 bar, the difference in hydraulic force is equal to the force on the piston from the spring. Just one psi/p.s.i. that the piston starts to move towards the inlet end of the unit, closing the valve as it does so.

As brake pressure is increased beyond 15 bar, the valve will open only sufficiently to allow the pressure at the outlet side to increase by 0.3 of this pressure, over that at inlet. This is all that is required for the larger diameter outlet end pressure chamber to move the piston and maintain the pressure balance.

The reverse logic applies as the brake pressure is reduced, with the valve opening to allow the rear pressure to fall at a rate of 0.3 of the front pressure reduction until the break point at 15 bar. When the piston spring overcomes the pressure differential, and the valve snaps open, equalising front and rear pressures.

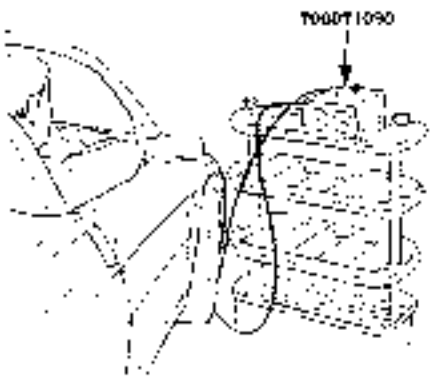
Valve Servicing

NO SERVICING OF THE PRESSURE LIMITING OR PROPORTIONING VALVES IS PERMITTED. Any attempt to disassemble or repair a limiting or proportioning valve. The 2/3 and 2/4 proportioning valves incorporate a mounting bracket which should not be disturbed. If a proportioning valve is found to leak brake fluid, or at the performance test indicates a faulty unit, **BOTH PROPORTIONING VALVES SHOULD BE UNBOLTED AS A PAIR.** If an early type Servato system is fitted, and fluid is to be tested, it is recommended that all four valves be discarded and a pair of the later type 2/3 proportioning valves are fitted as described above.

Both right and left hand 2/3 proportioning valve assemblies are identical, and due to the spring biasing between rods, cannot be fitted and connected up the wrong way round without considerable modification to the brake pipes. The valve body or the valve should be to the rear.

Torque tighten brake pipe connections to 15 lbf.ft. (21 Nm).

Performance Test



Tools required: Test gauge TOOLT1090

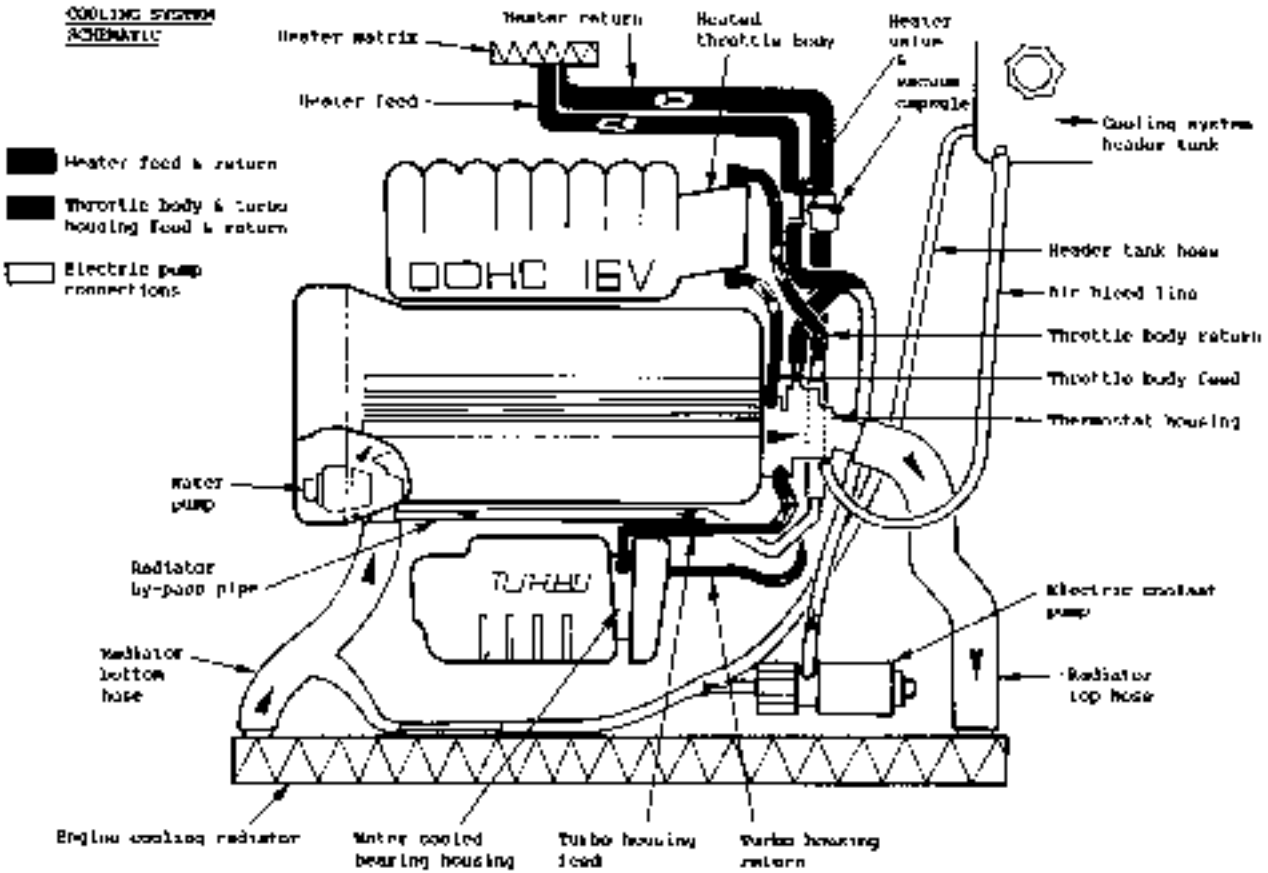
1. Referring to the test gauge kit instructions, remove the bleed nipple from one of the rear calipers, and connect the test gauge adaptor to the caliper.
2. Connect the other test gauge pipe to the pressure tip opposite front brake caliper bleed nipple port.
3. After bleeding the system, operate the brakes to achieve the front brake line pressures given in the following table, and note the corresponding rear brake line pressure. Do not exceed a front brake pressure of 100 bar.

Front pressure (bar)	Rear Pressure (bar)			
	70 bar limiter + 2/3 proport.	85 bar limiter + 2/3 proport.	70/1 proport. + 3,15 proport.	2/3 proport
0	0	0	0	0
35	17.8 - 21.1	17.8 - 21.1	11.9 - 21.1	15.4 - 20.0
70	20 - 70	26.7 - 70.0	22.2 - 70.0	26.5 - 33.5

4. If the test pressure is out of tolerance at any or the test points, comparison of the pressure line characteristic with the graph shape for the system fitted (see above), should indicate the probable faulty component.
5. Repeat the test on the opposite circuit.
6. Remove test gauge, refit bleed nipples and bleed brakes.

COOLING SYSTEM

SECTION KD PLAN


COOLING SYSTEM SCHEMATIC
Heater matrix
Heater return
Heated throttle body
Heater valve & vacuum capsule
Heater feed
Heater feed & return
Throttle body & turbo housing feed & return
Electric pump connections
DOHC 16V
TURBO
Cooling system header tank
Header tank hose
Air bleed line
Throttle body return
Throttle body feed
Thermostat housing
Water pump
Radiator by-pass pipe
Radiator bottom hose
Electric coolant pump
Radiator top hose
Engine cooling radiator
Water cooled bearing housing
Turbo housing feed
Turbo housing return

K.1.1 - GENERAL DESCRIPTION

Engine Cooling System

A centrifugal water pump is mounted on the front face of the cylinder block, and is driven by the toothed crankshaft drive belt. Coolant is pumped by the impeller into the front of the block, around the cylinders, up into the cylinder head, and finally out of the back of the head (left hand end of engine), into the thermostat housing. When the thermostat is closed, water flow by-passes the radiator via a by-pass pipe which runs along the front side of the engine to an inlet spout at the left hand front of the block. In order for water on the engine side of the closed thermostat to reach the by-pass pipe, it must flow via one of three routes;

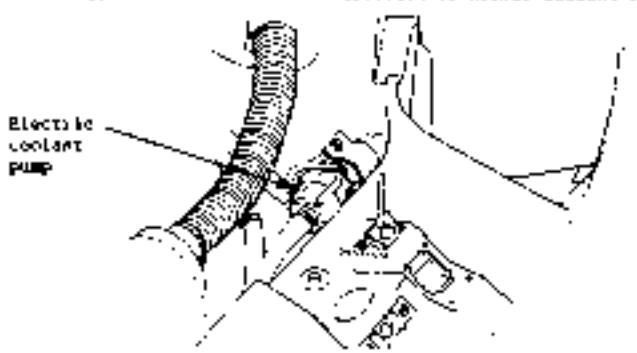
- The heater matrix (if the water valve is open)
- The primary throttle body water jacket
- The turbocharger water jacket

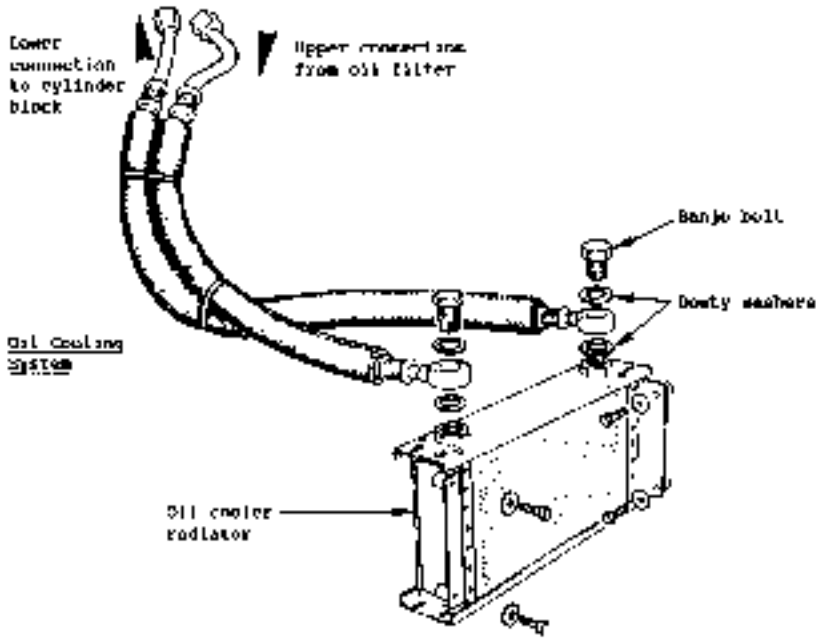
When the thermostat opens, a proper volume of coolant will flow through these circuits, with the main flow passing through the thermostat into the radiator inlet hose, radiator, outlet hose, and finally back into the water pump via the inlet spout at the left hand front of the block.

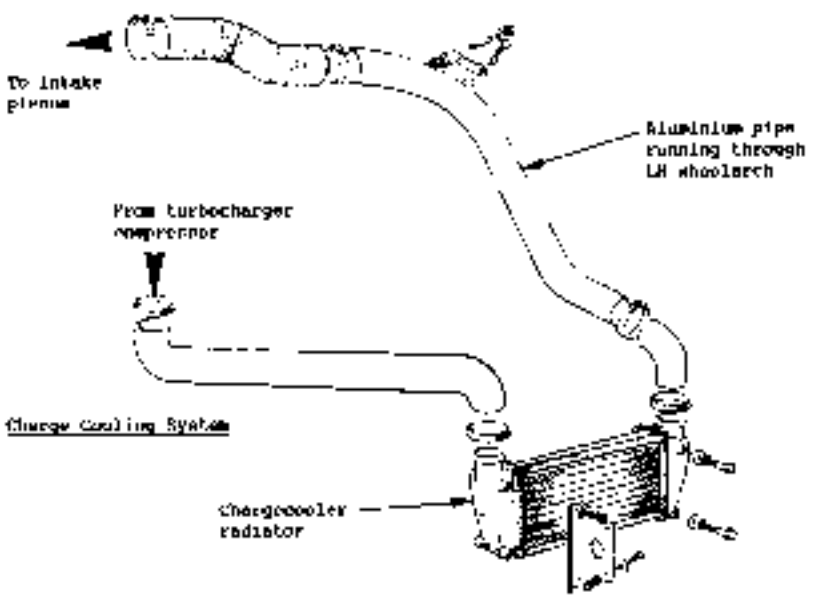
A header tank is fitted at the left hand rear of the engine bay, and is connected into the radiator bottom hose, with an air bleed hose connecting the top of the tank with the top of the thermostat housing outlet spout. The tank is filled with a 120 kPa (17 lbf/in²) pressure cap to raise the boiling point of the coolant to 119°C.

The radiator comprises an aluminium core sandwiched between plastic end tanks, and is flexibly mounted in a support frame by two spigots at the top, and one at the bottom. Two electric cooling fans are mounted on the rear of the radiator, and are controlled by a thermal switch in the thermostat housing outlet spout. The sensor for the water temperature gauge is fitted into the thermostat housing.

In extreme conditions of heat soak, in order to control water temperature after switching off the engine, an electric pump is used to maintain coolant circulation until the temperature drops to a safe level. The centrifugal pump is mounted at the front of the engine bay, and is connected between the radiator bottom hose, and the heater feed hose between the thermostat housing and the water valve. The pump is controlled by the radiator fans thermal switch, and operates only when the ignition is switched OFF. With ignition off and thermal switch closed (above 110°C), the pump will run until coolant temperature falls sufficiently for the thermal switch to open (approx 103°C). The electric pump operates to pump cool water from the heater hose into the cylinder head via the thermostat housing, i.e. in the reverse direction to normal coolant flow.




Lower connection to cylinder block
Upper connection from oil filter
Banjo bolt
Dowty washers
Oil Cooling System
Oil cooler radiator


To intake plenum
Aluminium pipe running through LH wheelarch
From turbocharger compressor
Charge Cooling System
Chargecooler radiator

Oil Cooling System

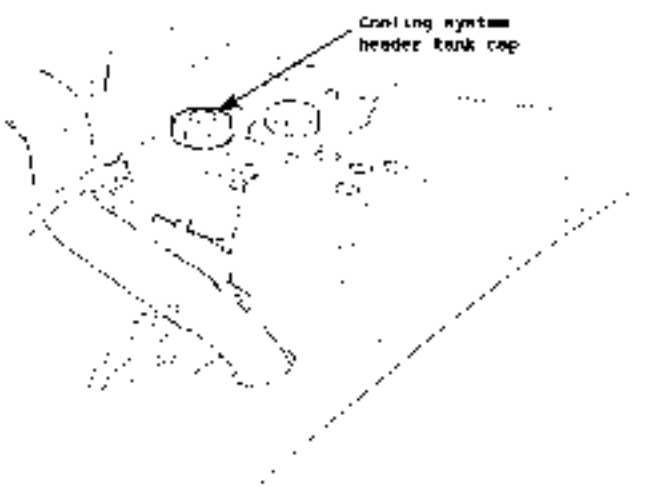
A sandwich plate fitted between the oil filter cylinder and the rear side of the cylinder block, and the block, divert the pressurised oil supply from the oil filter input, via a steel pipe and high pressure hose, to an oil cooler matrix mounted in a separate duct to the right of the engine cooling radiator. Oil returns from the radiator via a hose and steel pipe to the sandwich plate, and then flows through the oil filter and into the engine.

Charge Air Cooling System

Turbocharged models use an air/air heat exchanger (intercooler) to reduce the temperature and increase the density of air leaving the turbocharger compressor, before it enters the intake plenum chamber. The intercooler is manufactured of aluminium, and is located in a separate duct to the left of the engine cooling radiator. It is connected by rubber hose to the turbocharger compressor outlet, and by an aluminium pipe routed through the left hand wheelarch to connect with the intake plenum box.

89 / - WARNING

Under normal operating conditions, the engine cooling system, being a closed circuit, will not require any topping up between services. As a precaution however, every week, the level of coolant in the engine cooling header tank should be checked. The transparent header tank is marked with a cold level indicator. The level of coolant will rise as the engine warms up and the coolant expands, and will fill right up if it too is over



WARNING: Do NOT remove the cap from the engine cooling header tank when the engine is warm, as serious scalding could result from boiling water and/or steam.

When fully cold, the level of coolant should be up to the 'cold' mark on the header tank. If overfilled, the excess coolant will be ejected when the engine is warm, and if the level is allowed to fall too low, overheating may result. If necessary, top up the system using an approved coolant mixture (see below) to maintain full protection from freezing damage and corrosion.

Anti-Freeze/Corrosion Inhibitor

It is important that the coolant contains an anti-freeze with corrosion inhibitor to protect the engine and heat exchanger from damage and corrosion of the metallic elements. Use of a good quality mono-ethylene glycol anti-freeze, protects against these dangers as well as improving the cooling efficiency of the system. When new, the system is filled with a 40% concentration of 'Duckhams Q-Tec' (known as Shell Antifreeze 'APU' in some overseas markets), which is suitable for all but the very coldest climates, which may use concentrations up to 50% strength. In warm climates, it is recommended that the concentration is not allowed to fall below 25%, in order to maintain full corrosion protection.

The simplest means of checking the strength of the Shellsafe 4 coolant mix is by checking the density using a hydrometer. The following table provides a general guide.

Concentration	Density @ 20°C	60°C
25%	1.029	1.020
33%	1.037	1.034
50%	1.060	1.057

A satisfactory density reading indicates the effective level of mono-ethylene glycol and not the level of corrosive inhibitors present, whose effectiveness diminishes over a period of time. The coolant should therefore be renewed every 24 months to ensure optimum protection.

Extremely hard water (hardness exceeding 250 parts per million) should not be used in the cooling system. In such areas, distilled, de-ionised or filtered rain water should be used.

Radiator Fin Cleaning

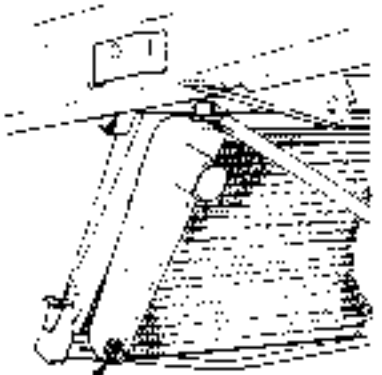
At service intervals, the matrices of all the radiators should be checked for cleaning by insects, leaves and other debris. The thin finned oil cooler is especially vulnerable. If necessary, use a water jet from behind to clean the fins, and take great care not to damage the fragile tubes with any other tool. At the same time, check the security of all cooling system joints, and the condition of all flexible hoses.

K3.1 DRAIN/REFILL PROCEDURE

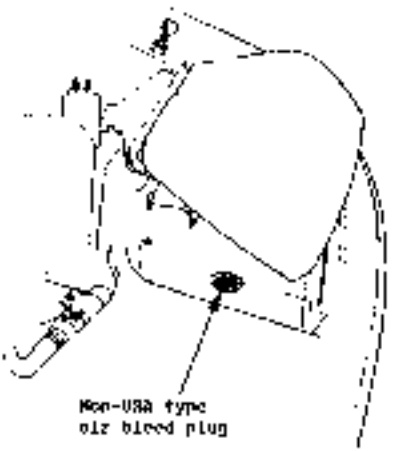
To drain the engine cooling system, set the heater temperature control to 'hot', loosen the header tank cap, and either remove the drain plug from the bottom left hand corner of the radiator (USA models) or disconnect the radiator bottom hose.

To refill the system, replace the drain plug & hose bottom hose securely, set the temperature control to hot, and fill with coolant via the header tank, until up to the 'cold level' indicator mark. On non-USA cars, the bleeding of air from the system may be speeded up by removal of the bleed plug in the left hand manifold pipework. Replace securely, and refilling when a continuous stream of water flows out. Run the engine, and top up the header tank as necessary until the level stabilises at slightly above 'cold'. Stop the engine and allow to cool fully. Bleed

the radiator again. Top up the header tank to the cold indicator level, and fit the pressure cap.



USA type radiator drain plug



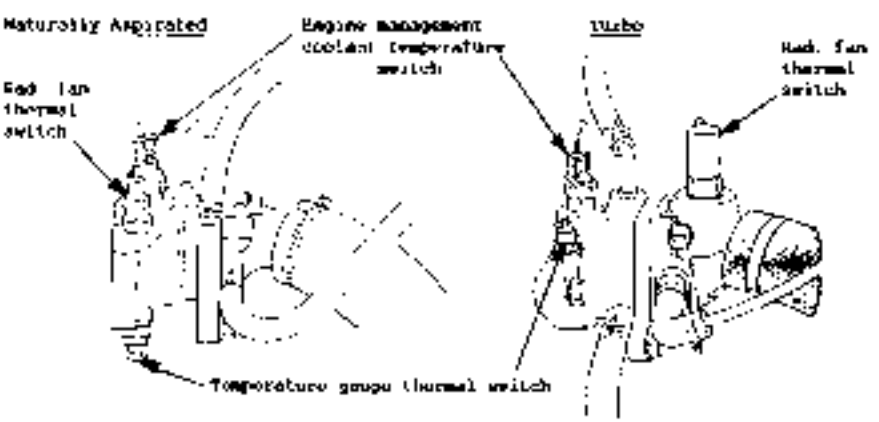
Non-USA type air bleed plug

K11.1 RADIATOR FANS AND CONTROL

Two electric cooling fans are located at the rear of the radiator, and draw air through the radiator from front to rear.

Fan Control

A thermal switch fitted in the thermostat housing (N.A.) or outlet spout (Turbo), is used to control the radiator fans (and electric coolant pump). This switch should not be confused with the other sensors in the thermostat housing body, one for the engine management ECM, and one for the water temperature gauge. The fans thermal switch senses the temperature of engine coolant, and energises the cooling fans when a temperature of 210°F is reached. The fans are



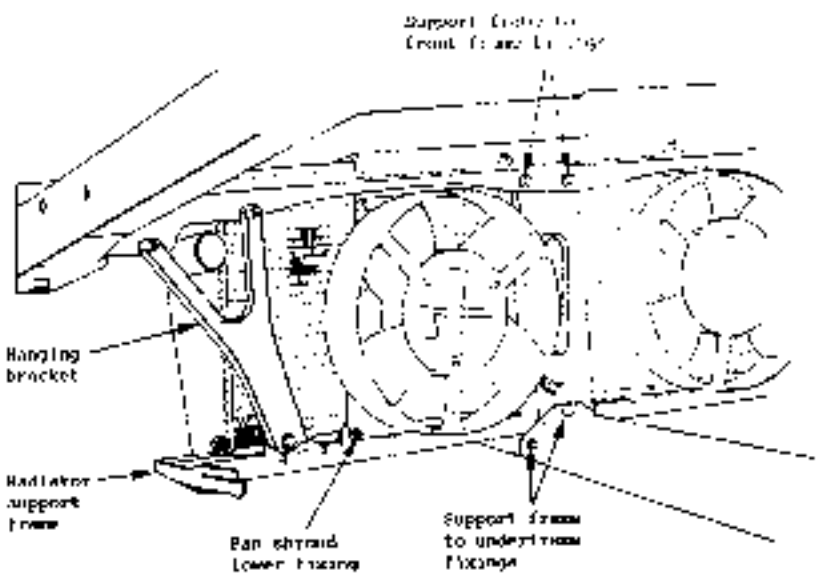
switched off when coolant temperature has dropped to 103°C (approx.). The fans are also controlled by a pressure switch in the air system reservoir/drier to cool the condenser.

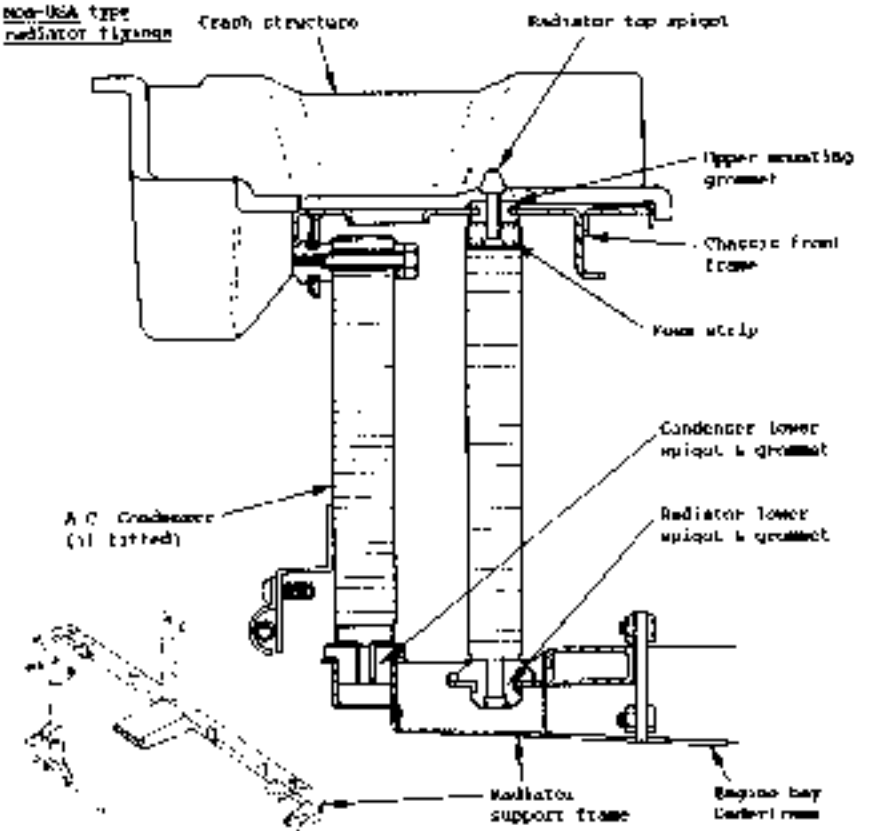
WARNING: Be aware that the cooling fans may run any time that the ignition is switched on, dependent on coolant temperature and air pressure. Keep fingers, hair, tools and belt clear of all times.

D2.5 - ENGINE COOLING RADIATOR

Removal on non-USA cars:

1. Remove the radiator undershield and drain the cooling system (see D2.4).
2. Disconnect the top and bottom radiator hoses.
3. Remove the two lower fixings (one each at the lower corners), and unclip the water hose joiner pipe from the radiator support frame.
4. Disconnect the single fixing securing the [illegible] side of the radiator support frame.
5. Remove the centre stud above the [illegible].
6. Remove the [illegible] fixings [illegible] engine compartment, and disconnect the [illegible] [illegible] from [illegible]





7. Carefully pull the support frame off the radiator bottom spigots by pushing inwards on the radiator and condenser (if fitted) spigots as the frame is pulled downwards.

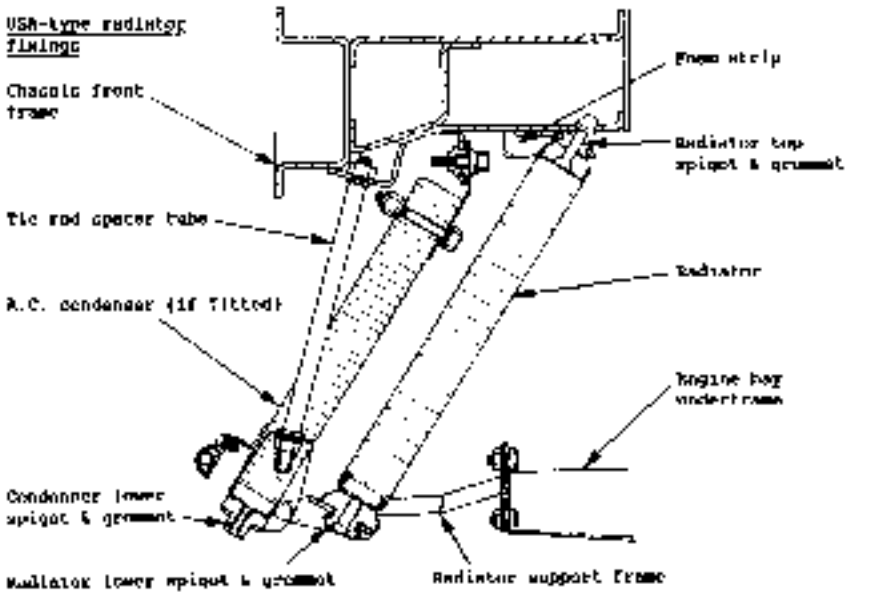
8. Carefully withdraw the radiator top two spigots from their grommets in the front frame.

Removal of USA cars

The above removal procedure is as for the non-USA type, except that the support frame and fixings are different. To remove the support frame, remove the three retaining screws securing the frame to the front of the engine bay undershield, and remove the nut from the inner end of the tie rod at each side of the radiator.

Refitting

Before refitting the radiator, on domestic/export cars, check that the two lengths of sealing foam are fitted on the radiator top channel, and on USA cars that the sealing strip is fitted to the underside of the chassis front frame.



Raise the radiator into position and fit the two top spigots into their grommets in the radiator support frame engaging the lower spigots on the radiator and condenser (if fitted). Continue in the reverse order to remove. On USA cars, be sure to fit a plain washer at each end of the tie rod spacer tube, and beneath the nut. Fit the protective cap on the bottom end of the two tie rods.

After refitting, refill the system with a recommended coolant mix.

KB.6 - CHARGE-COOLER RADIATOR

The air-air charge-cooler radiator is constructed from aluminium, with plastic end tanks, and is mounted in a composite duct to the left of the engine cooling radiator. The duct is secured to the chassis front frame or longeron, and also carries the engine intake air spout.

Charge-cooler Removal

1. Remove the left hand front wheelarch liner.
2. Release the charge-cooler inlet and outlet hose connections.
3. Release the anti-roll bar hanging links.
4. Via the access hole in the front apron underside, remove the four M6 screws securing the charge-cooler to the duct. Note that on certain cars, it is necessary to release the charge-cooler inboard end mounting plate from the duct. Carefully withdraw the radiator from the duct.

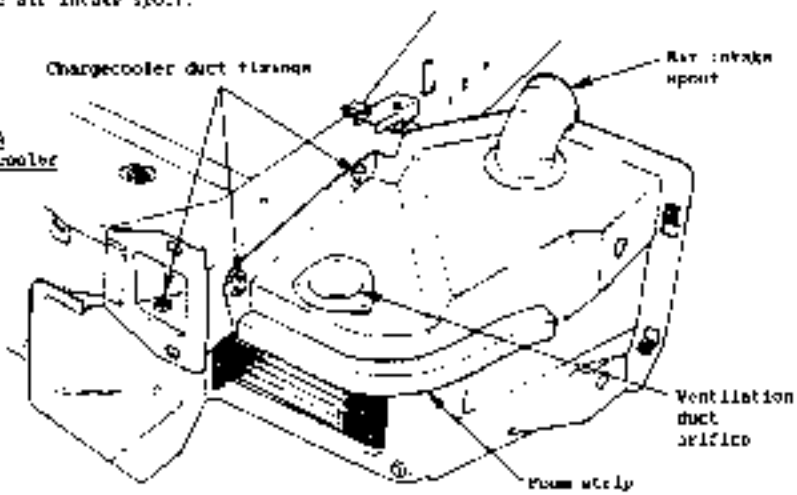
Before refitting the charge-cooler, check that the foam sealing strip is fitted around the aperture.

Non-USA Type Chargecooler duct removal

1. Remove the left hand front wheelarch liner.

2. Remove the front bumper (see section 76.10).

3. Release the chargecooler inlet and outlet connections, and the trunking to the air intake spout.



4. Remove the three M8 fixings securing the duct to the crossmember (two on the side of the frame, and one on the front underside). Withdraw the duct complete with chargecooler.

On reassembly, check that the foam strip is fitted around the outside corner of the duct to seal against the bumper. Note that on RHD cars, an orifice in the top surface of the duct provides additional airflow to the cabin ventilation duct, moulded into the underside of the bonnet.

USA Type Chargecooler Duct Removal

1. Remove the left hand front wheelarch liner.

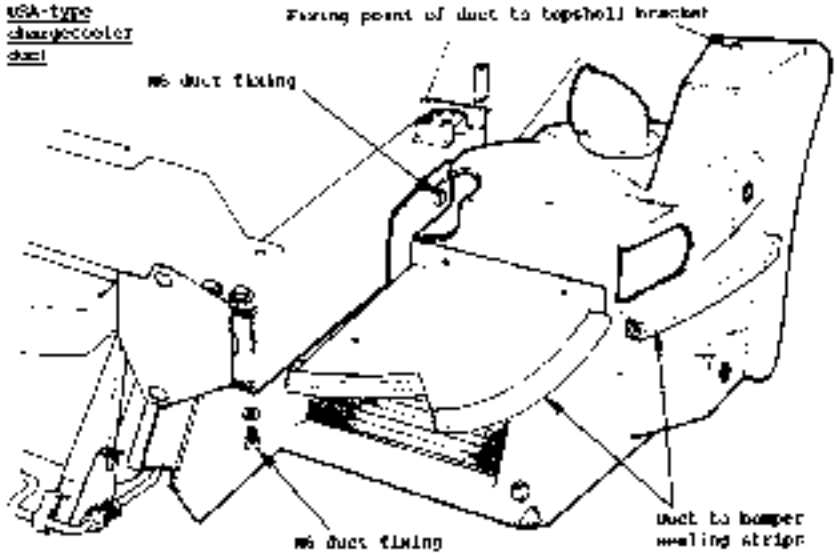
2. Remove the front bumper (see section 76.19).

3. Release the chargecooler inlet and outlet connections, and the trunking to the air intake spout.

4. Remove the bumper bracket securing the top rear of the duct to the bonnet.

5. Remove the two M8 fixings securing the duct to the chassis longmember - one from the side of the crossmember, and one in the front underside. Withdraw the duct complete with chargecooler.

On reassembly, check that the foam strip and two lengths of hollow edging strip are fitted to the duct to seal against the bumper.



KD 1 - OIL COOLER RADIATOR

The oil cooler radiator is mounted in a composite duct to the right of the engine cooling radiator. The duct is secured to the chassis front tower on inboard, and also carries the two horns.

Oil Cooler Radiator Removal

1. Remove the right hand front wheelarch liner.

2. Disconnect the horn leads, and remove the horn bracket complete with horns after releasing the two top fixings, and single lower horn bracket fixing.

3. Release the wire loom fixings from the duct (if fitted), and disconnect the anti-roll bar hanging bracket.

4. Release the two banjo bolt oil cooler connections, using a shop towel to absorb the escaping oil.

5. Via the access hole in the front spoiler underside, release the four M6 fixings securing the oil cooler radiator to the duct, and carefully withdraw the radiator.

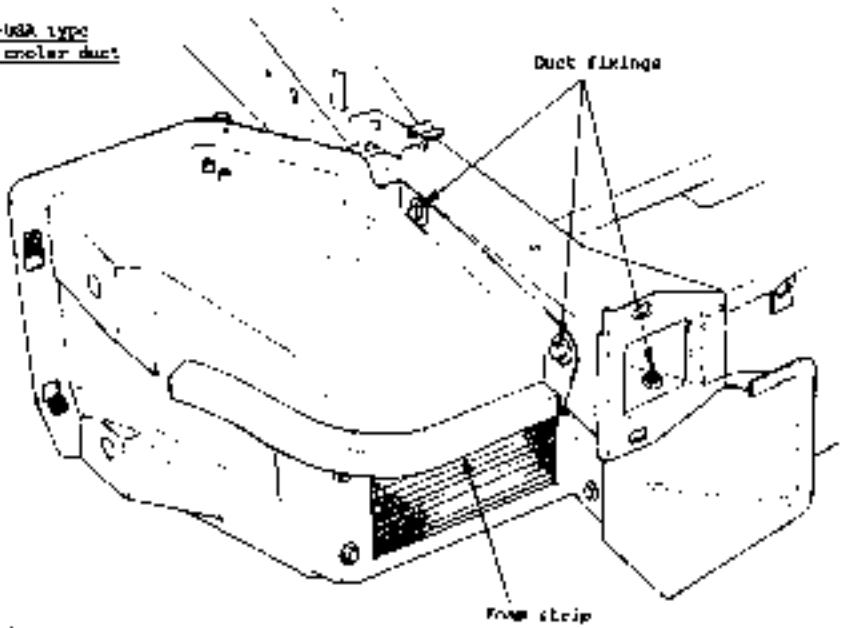
When re-fitting the oil cooler, note that the hose connections use 'Dowty' sealing washers which should be renewed each time the banjo bolts are released. Torque tighten the banjo bolts to 27 Nm (20 lbf.ft).

Oil Cooler Radiator Duct Removal

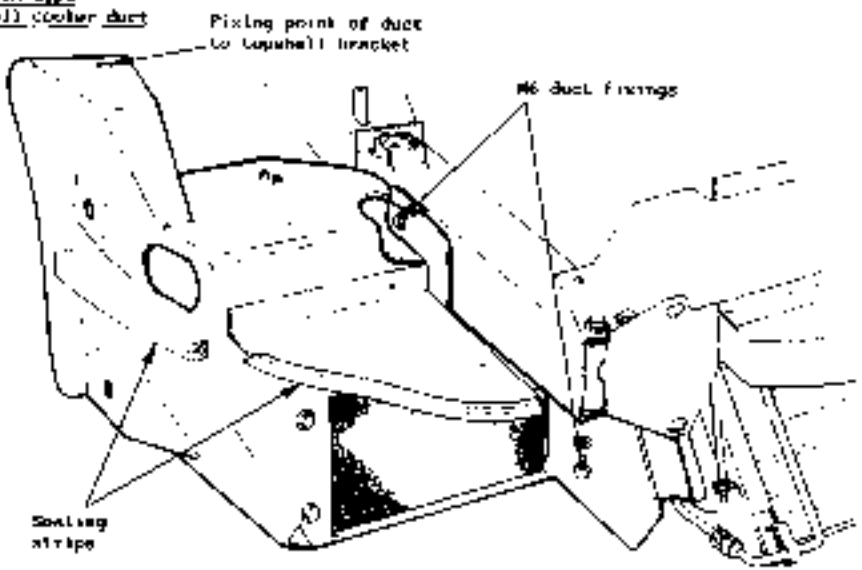
1. Remove the right hand front wheelarch liner.

2. Remove the front bumper (see section 76.8).

Non-USA type
oil cooler duct



USA type
oil cooler duct



3. Release the two oil cooler hoses at their connections at the back of the engine using a soap towel to absorb the escaping oil. Release the two hose clip-straps.

4. Disconnect the horn leads, and on A.C. cars, remove the horn mounting bracket. Re-move the fixings securing the air pipe to the duct.

5. Remove the rear fixings:
Non-USA cars: Two HB setscrews into the side of the chassis front cross member(s); One HB setscrew into the front underside of the rear cross member.
USA cars: Release the support bracket between the top rear of the duct and the rear bell; One M6 screw into the rear of the longeron (outboard); One M6 screw into the front underside of the longeron (outboard).

6. Withdraw the duct complete with oil coolers and pipes.

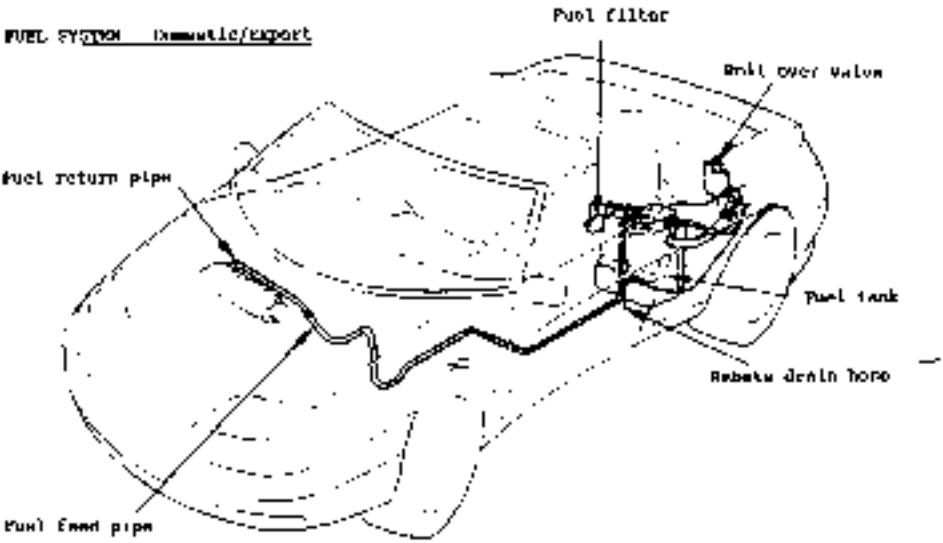
On reassembly, check that the rear strip, and hollow rubber sealing strip (USA cars) are fitted to the front of the duct to seal against the bumper. Note that on the USA type fuel cars, an orifice in the top surface of the duct provides additional ventilation to the rubber ventilation duct, routed into the underside of the rear bell.

Check that the two oil cooler hoses are protected by Armaflex sleeving, and torque tighten the oil feed and return hose connections at the back of the engine to 27 lbf.ft (37 Nm).

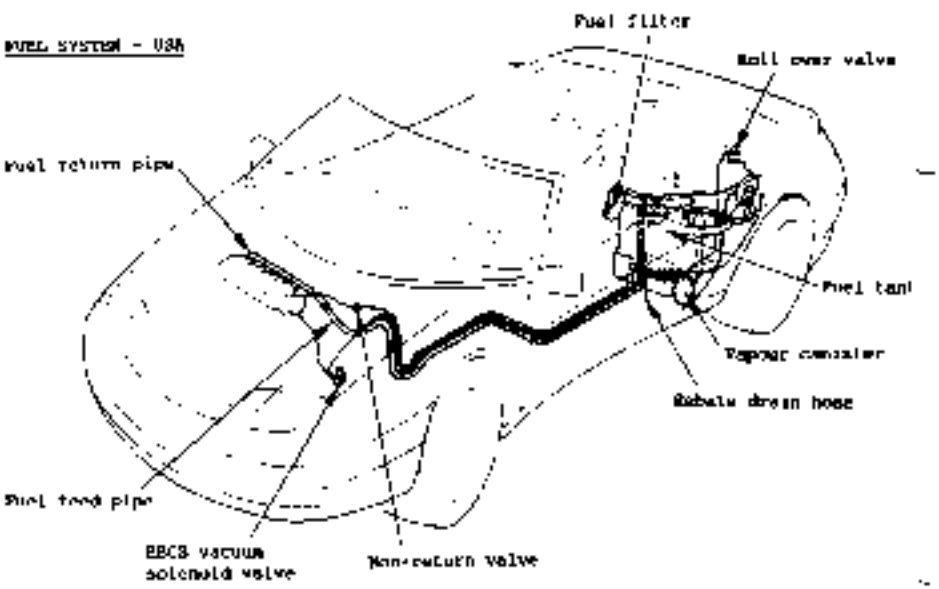
FUEL SYSTEM

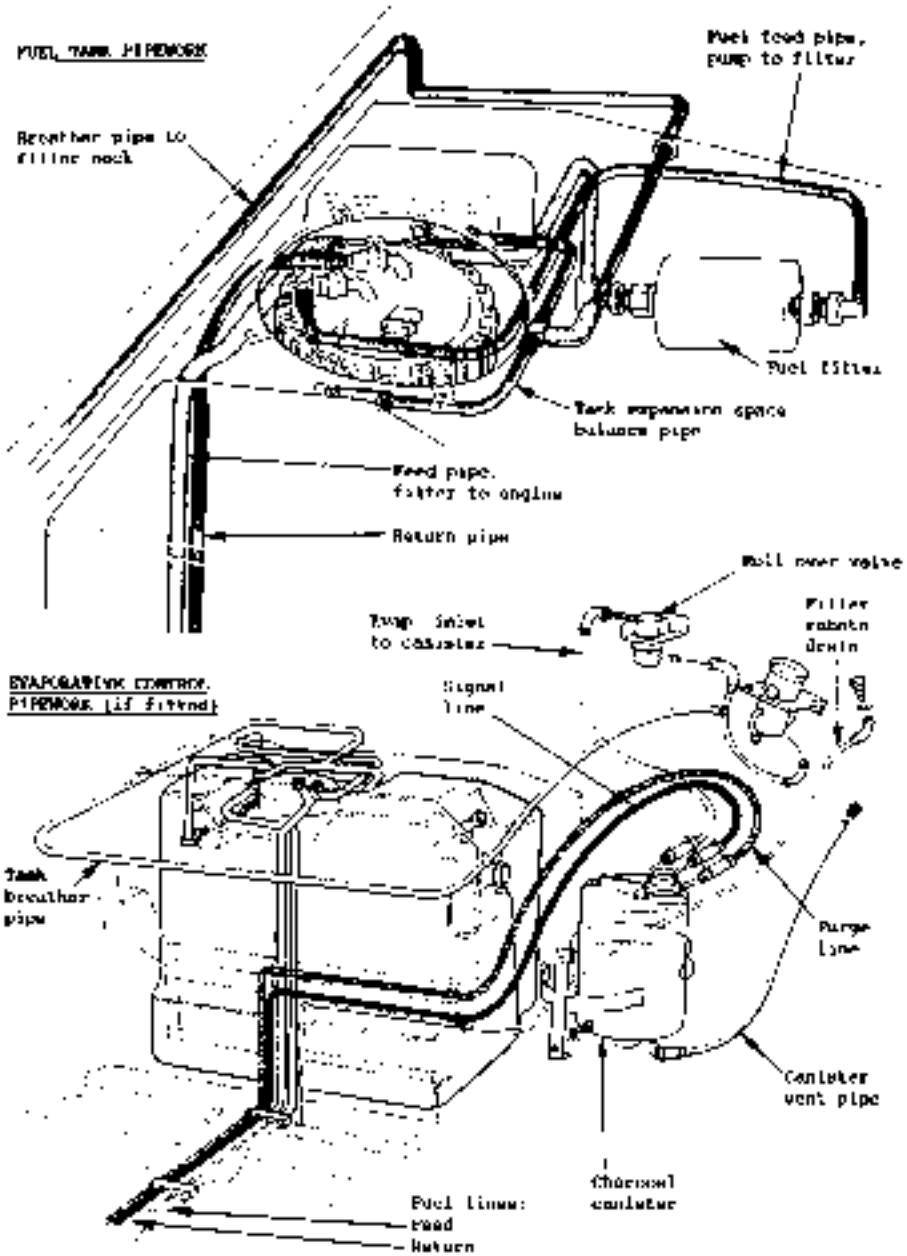
SECTION 19 - BIAS

FUEL SYSTEM - Domestic/export



FUEL SYSTEM - USA




FUEL TANK PIPEWORK
Breather pipe to filler neck
Fuel feed pipe, pump to filter
Fuel filter
Tank expansion space balance pipe
Feed pipe, fitter to engine
Return pipe
Roll over valve
Pump inlet to canister
Filler neck drain
EVAPORATIVE CONTROL PIPEWORK (if fitted)
Signal line
Tank breather pipe
Purge line
Canister vent pipe
Charcoal canister
Fuel lines: Feed
Return

310.1 - GENERAL DESCRIPTION

The single fuel tank is moulded from impact resistant nylon reinforced high density polyethylene for high strength and freedom from corrosion, and is mounted ahead of the left hand rear wheel on two stainless steel bands.

The fuel pump is a roller vane type, high pressure electric pump mounted submerged within the fuel tank. A fuel strainer is attached to the fuel pump inlet line and prevents the particles from entering the fuel line and tends to separate water from the fuel. A pulsator, fitted immediately above the fuel pump, reduces pressure pulsations in the supply line. The whole assembly of pump, strainer and pulsator is fixed by the supply and return pipes, to a mounting plate secured by a threaded ring to the top face of the tank. Also incorporated into this assembly is the fuel level sender unit, which uses a nylon float and a rheostat to supply a signal to the fuel gauge.

The pump supplies fuel at a pressure of 2.11 - 2.73 kgs cm^2 (30 psi) dependent on operating conditions, through an in line canister type filter located adjacent to the tank, to the fuel injector rail assembly on the engine. Nylon pipes are used to carry the fuel to and from the engine, and are routed to provide for chassis centre section. A compression joint is provided between the tank pipes to supply pipe and the fuel rail return pipe at the back of the engine. Should the TOOOTINGS joint be fitted at this point in order for fuel pump performance to be tested. See Maintenance. The low pressure return pipe uses a connector body and spring clamps at the joint with the fuel rail return pipe. Special pull-off fittings are used on both pipes at the connections to the fuel pump assembly, and require a special tool TOOOTINGS to release the connectors. Each connector uses two 'O' rings to seal against the spigots on the fuel pump assembly, and may require replacement if the seals of the joint to spread reservoir.

The pump is able to deliver 4 - 5 times the engine's maximum requirement, so that fuel is constantly circulated through the in-tank fuel filter, fuel rail, and via the fuel pressure regulator, back to the tank. This fuel circulation helps avoid excessive fuel temperature with the consequent risk of vapour locks.

When the ignition is switched on, the engine management ECM energises the fuel pump which will continue to run for as long as the ECM receives ignition pulses from the ignition module (engine cranking or running). If no ignition pulses are received, the ECM switches off the pump either 1 seconds (approx) after the ignition was switched on, or about 10 seconds after a stall.

A roll over valve is mounted on the top left hand side of the rear bulkhead, and is connected between the breather pipe on the fuel filler neck, and the steel air vent fitted at the top of the filler neck in the body. This valve allows venting of the tank under normal circumstances, but prevents fuel spilling from the vent pipe if the vehicle is inverted in an accident.

On petrol engined vehicles fitted with an evaporative emission control system (EVAP), one vent side of the roll over valve is connected to a vapour storage canister mounted behind the LH 'D' post. When the engine is stopped, the fuel vapour from the tank is absorbed by charcoal in the canister. When the engine is running, the fuel vapour is purged from the charcoal by a flow of air through the unit, which is then consumed by the engine in the normal combustion process. This purging process is controlled by a diaphragm valve on the top of the canister, and a vacuum solenoid valve in the engine bay, which is switched on and off controlled by the engine management ECM. Full details of the charcoal canister evaporative loss system for USA specification models, and of the fuel rail, pressure regulator and fuel injectors for all models, are included in the separate publications Service Repair Sections EMI/EMR/EMC.

In order to maintain an adequate space within the fuel tank to allow for changes in ambient air temperature, the filler breather dip tube projects

into the tank and below the tank fill level. Prior to December 1990, a small hole in this tube allowed communication between the expansion space and the filler neck. In December 1990, the tank breather system was revised to provide a greater tolerance to parking on a severe side slope with a full tank. This consisted of a connection pipe between the tank expansion space balance pipe and the breather pipe from filler neck to roll over valve, and the deletion of the 4mm tube hole. For details see section 16.2

16.2 - PRECAUTIONS

(i) To minimise the risk of fire and personal injury, relieve the fuel system pressure before servicing the fuel rail or any (pipe) component. See 'Fuel Pressure Relief Procedure' below.

(ii) To reduce the possibility of sparks occurring when a live line is short circuited, or when the vapour is present, the negative battery cable should be disconnected before work is commenced.

(iii) When fuel lines are disconnected, absorb any escaping fuel in an absorbent cloth, and dispose of safely.

Fuel Pressure Relief Procedure

This procedure need only be used prior to disconnecting any part of the fuel line except the depressurised return line.

- Trip the service switch (in battery compartment (RHS) or in spacer box (LHD)) to disconnect the fuel pump feed, and start the engine.
- After the engine stops (fuel starvation) crank for at least 10 secs. (+ for starter), crank for at least 5 seconds to reduce the remaining fuel pressure.
  Disconnect the battery.
- Use a rag (wad) to absorb the small amount of pressurised fuel remaining in the fuel feed pipe connection as released.

16.3 - FUEL PUMP/SENDER UNIT

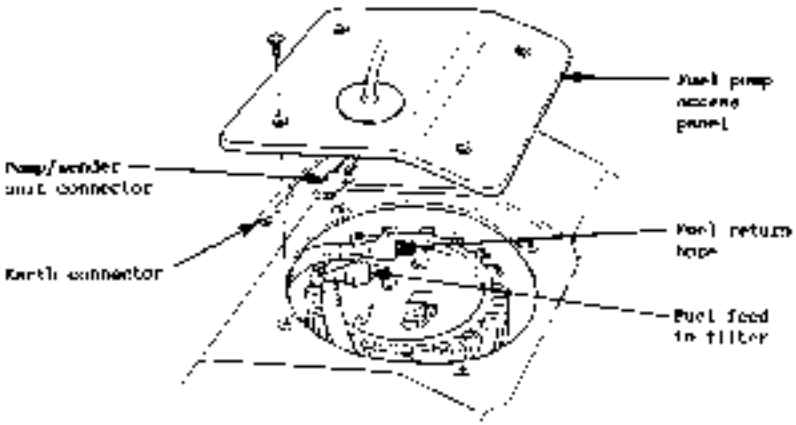
To test the fuel pump performance, see separate manuals ENI/EHM/EML

To remove fuel tank

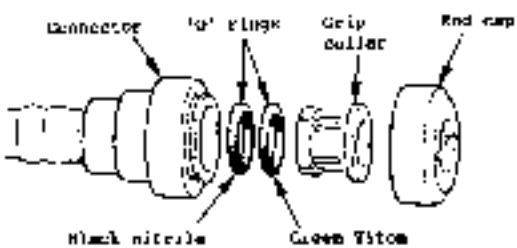
WARNING: Before commencing work, carry out fuel pressure relief procedure detailed above, and disconnect the negative battery cable.

1. Remove the roof stowage compartment liner, followed by the fuel pump access panel above the tank.

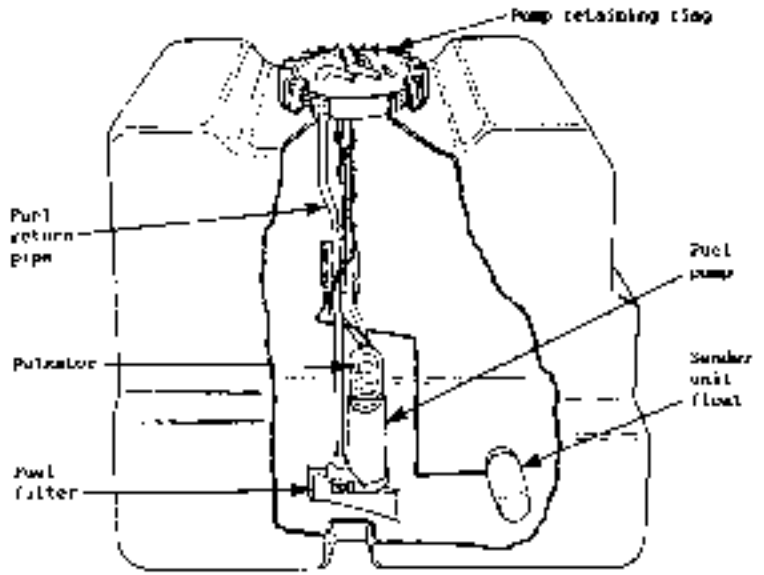
2. Disconnect both feed & return fuel pipes from fuel pump assembly. The 'Speedfit' fuel pipe connectors are released by using a two prong tool (TUD0726A) inserted into the holes in the connector end; press in to release the grip collar and pull each connector off the feed and return spigots. Use an absorbent cloth to soak up the small amount of fuel expelled under residual pressure. Ugly the electrical connector and earth lead.
  If the connector shows any evidence of leaking, or is very difficult to release, the connector 'O' rings should be replaced. Early cars were fitted with two nitrile (black) 'O' rings, the swelling of which could cause difficult release of the pipe connector.



To remove connector from pipe:
- Prise off the end cap of the connector.
- Pull out the gripper collar.
  Remove the two 'O' rings from within the connector.
  Fit into the connector the plastic (black) seal RTC8178AA followed by the viton (green) seal RTC6166AA, and refit the gripper collar and end cap.

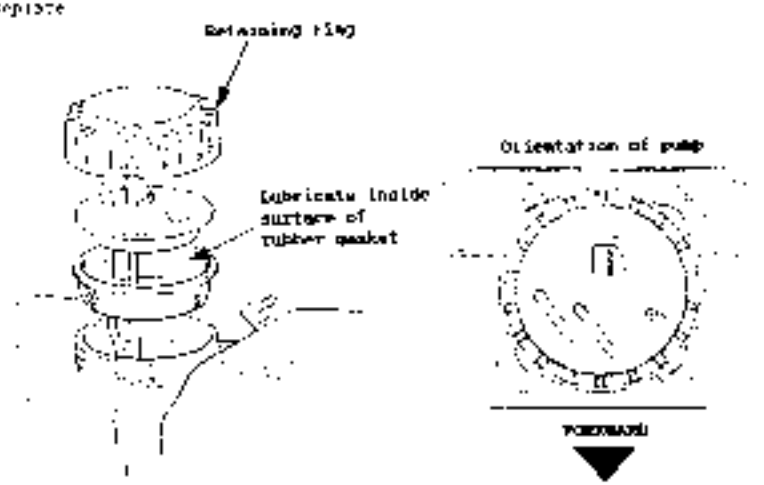


9 Unscrew the fuel pump retaining ring to release the fuel pump assembly and withdraw complete fuel pump/gauge sender unit assembly using an absorbent cloth to catch dripping fuel.



10 Temporarily cap fuel tank aperture to reduce fire risk.

To replace



1. Before pre-fitting the pump assembly, check the condition and cleanliness of the pump filter. Check that the rubber seal is in good condition, and fit the seal into the tank aperture. Smear the inside surface of the seal with engine oil to ensure proper seating of the pump before fitting the assembly into the tank and retaining with the threaded ring. Ensure that the pump is positioned correctly as shown in the diagram before tightening the ring as fully as possible with the fingers. Mark the position of the ring, and use a hardwood or plastic drift and a mallet to further tighten the ring a little. Recheck orientation after tightening.

2. Refit the feed and return pipes to the pump spigots (fitted pipe - straight connector - fitted pipe) and reconnect the fuel pump harness and earth lead. But before fitting the access cover, reset the inertia switch, connect the battery, and start the engine to check for leaks from the fuel pipe connections.

3. Refit the fuel pump access panel and trim panels.

LG.6 - FUEL TANK

To Remove

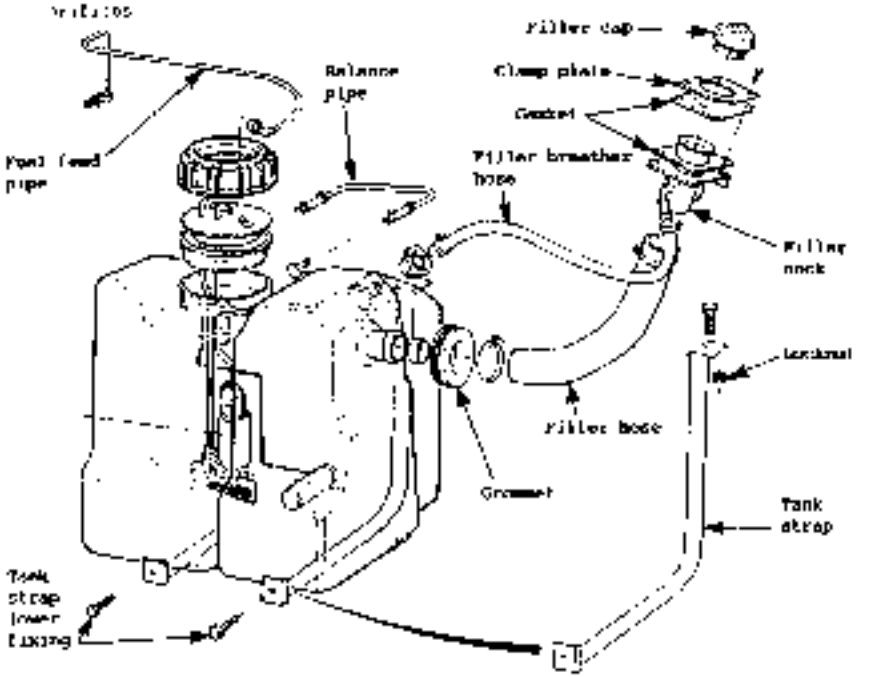
WARNING: Before commencing work, carry out the fuel pressure relief procedure detailed in LG.7. Drain the tank by syphoning to lighten the weight and reduce the danger of fuel spillage.

1. Remove the LHR luggage compartment floor, and fuel pump access panel. Disconnect the negative (-) electrical plug and earth cable.

2. Use a pipe connector to disconnect the fuel feed and return lines from the fuel pump assembly. Fit the two pipe ends of the tool into the hose ends of the 'Sheridan' connector, and press in to release the spring collar whilst pulling back on the connector body. Use an absorbent cloth to soak up the small amount of fuel expelled under residual pressure. If the connector shows any evidence of leaking, or is very difficult to release, the connector and pipe should be replaced. See section LG.1.

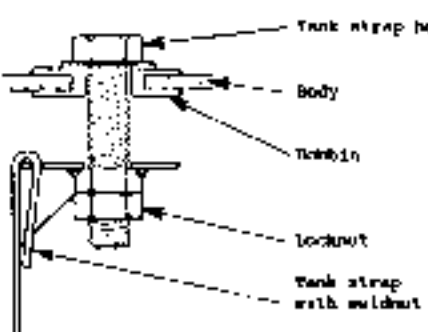
3. Release both ends of the tank to hose pipe from the tank spigots, and cap the spigots. (It may be easier to do this as the tank is being lowered)

4. Disconnect the filler and filler breather hoses from the tank, and plug the orifices.



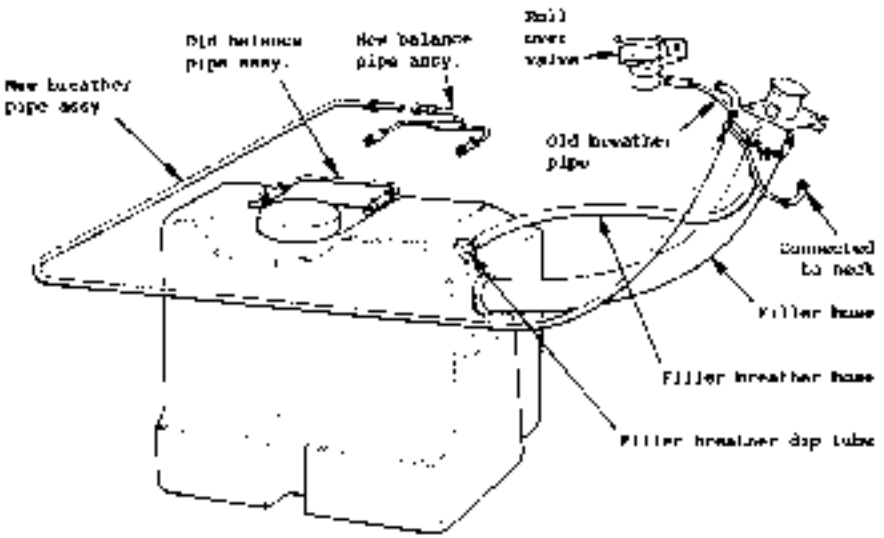
5. To provide room for the tank to drop, the jet hand lever mounting must be removed. Release the parking brake cable from the caliper lever, and remove the top wishbone to hub ball joint bolt. Mark the position of the toe-in adjustment eccentrics before slackening the two rear wishbone to chassis bolts. Release the anti-roll bar from the lower wishbone, and the bolt securing the anti roll bar hanging link to the chassis. Remove the damper to lower wishbone bolt, and lower the wishbone and hub carrier assembly without straining the brake hose.

5. Release the lockout from the underside of the tank tank strap top fixing bolts and unscrew each bolt. Support and lower the tank straps and carefully lower the tank, easing the filler neck through the body.



Fuel Tank Breather Revision

A revised fuel tank breather system was introduced on all Evan models from December 1100, CIN: [illegible]. Prior to the changepoint, the connection between the expansion space of a full tank and the filler neck breather tube was made via a small hole in the filler breather dip tube. If the vehicle is parked on a severe side slope with a full tank, it is possible for this hole to be covered, and fuel spraying problems result. From the changepoint, the dip tube hole was deleted, and a new breather pipe introduced to connect between the expansion space balance pipe and the filler neck to roll over valve pipe.

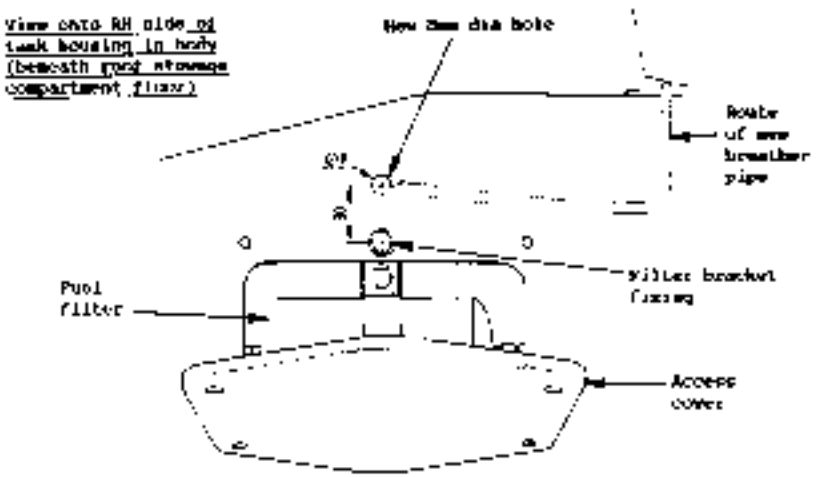


For service replacement, early type tanks [illegible] should be fitted to vehicles prior to the changepoint, until stocks are exhausted. After this time, the later type tank [illegible] should be fitted together with the updated breather system as detailed below. Failure to use the later type breather system with the 'D' type tank may, in certain circumstances, result in expulsion of fuel from the breather pipe, or cause fuel to spurt from the filler neck on the cap is removed.

'D' tanks may be identified by a white 'D' marked on the top surface of the tank. On the 'D' type tank to an earlier day when stocks of 'C' tanks are exhausted, order the following parts:

Fuel Tank Assembly (incl. pipe and gauge sender)	[illegible]	1 off
Pipe Assembly, expansion volume balance	[illegible]	1 off
Pipe Assembly, roll tank breather	[illegible]	1 off
Grommet, breather pipe	[illegible]	1 off

It will be necessary to drill a new drainage hole in the body for the new breather pipe, 30 mm [illegible] from the rear filler bracket and frame. Fit and seal the grommet A.[illegible].

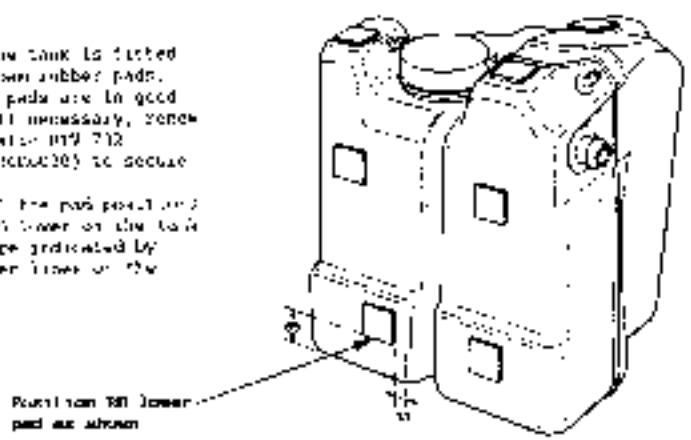


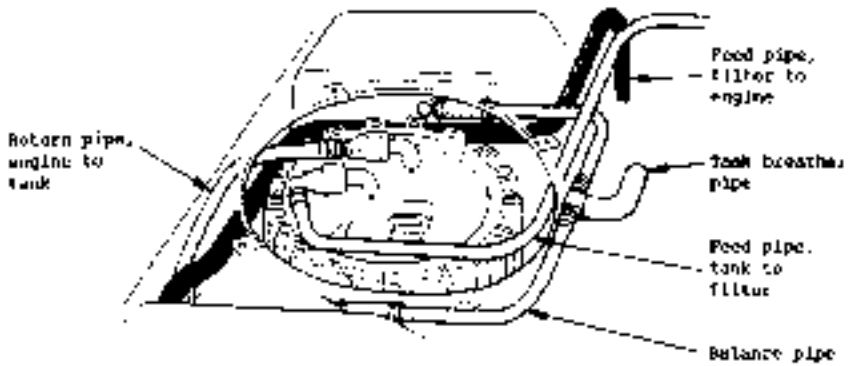
(i) Fit the end of the new breather pipe through the grommet, and push fully into the connector on the balance pipe assembly.

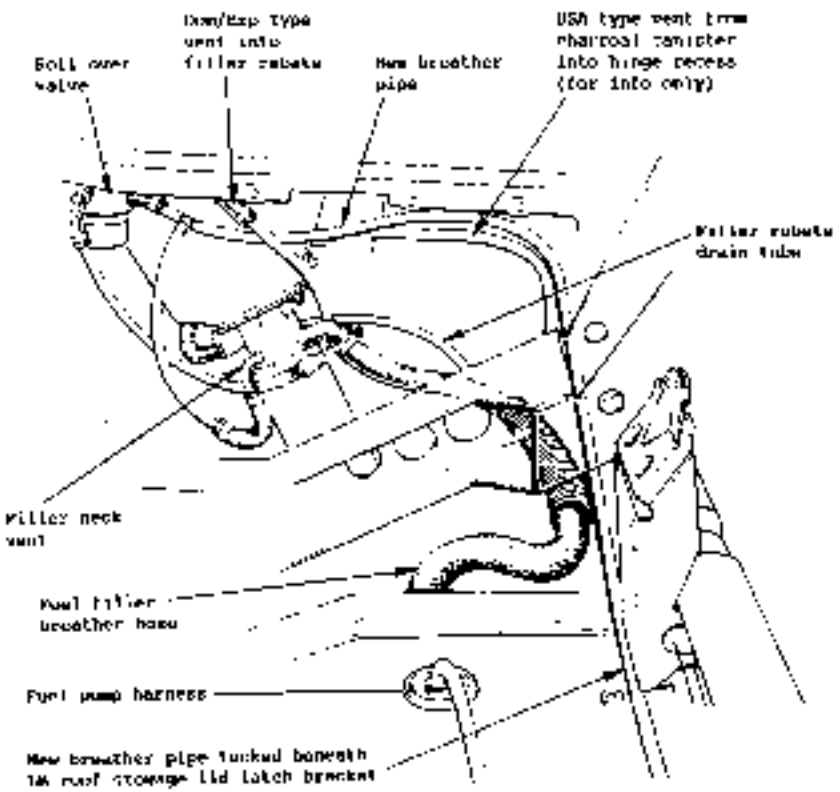
(ii) Route the new breather pipe around the front of the hood stowage compartment and into the filler neck area. Remove and discard the existing breather pipe between the filler neck and roll over valve. Fit the new pipe to the filler neck and roll over valve, ensuring that all joints are firmly entwined by the spring clips. Tuck the breather pipe beneath the LH roof stowage lid hinge bracket. See inset illustration.

To Refit Tank

1. Check that the tank is fitted with brown foam rubber pads. Ensure that the pads are in good condition. If necessary, renew and use Adhesive HYP 710 (Part No. RBL108230) to secure the pads.
   Note that all the pad positions except the RH lower on the tank front face are indicated by moulded corner lines on the tank.

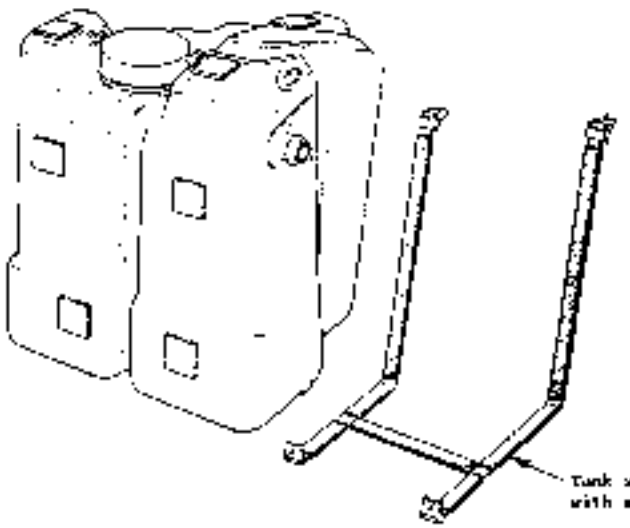



Feed pipe, filter to engine
Return pipe, engine to tank
Tank breather pipe
Feed pipe, tank to filter
Balance pipe


Roll over valve
Dom/Exp type vent into filler rebate
New breather pipe
USA type vent from charcoal canister into hinge recess (for into only)
Filler rebate drain tube
Filler neck vent
Fuel filler breather hose
Fuel pump harness
New breather pipe tucked beneath TA roof stowage lid latch bracket

j. Remove the filler and filler breather tube grommet from the body before fitting the tank into position. As the tank is raised, ensure that the fuel pipe from the filter to the engine is routed correctly, and fit the balance pipe onto the two tank spigots, checking that all connections are secure and retained with spring clips. Push the fuel feed and return connections onto the tank spigots.

k. Ensure that the tank straps are fitted with rubber edging strip, either glued onto each edge, or one piece edging strip fitted without glue.



l. Fit the tank strap bolts (seeking advice if threads damaged), and build the ballast with an 18 cwt bag weight to prevent the straps chafing whilst the bolts are tightened to [illegible]. Fit and tighten the locknuts (new locknuts if removed).

m. Fit the filler neck and filler breather tube grommets. Connect the filler hose, ensuring that the hose is pushed through the grommet and secure with the hose clip. Fit and secure the boiler breather hose, checking that it is routed beneath the seat base crossmember, and is protected with convoluted sleeving.

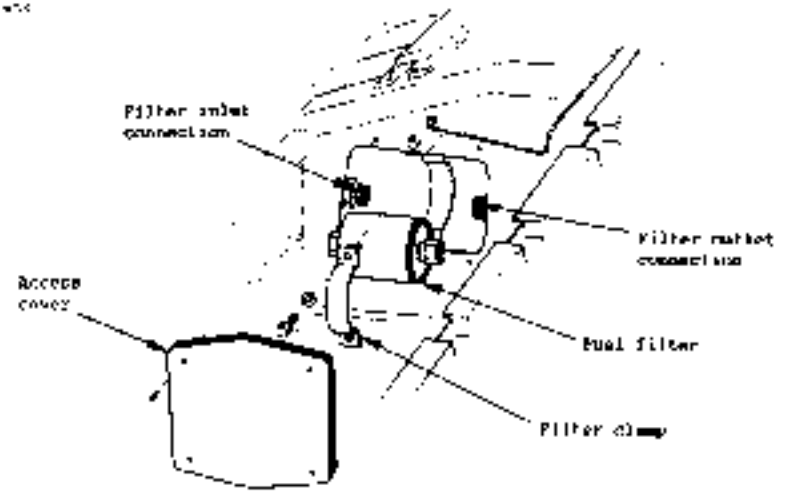
n. Re-assemble the rear suspension referring to Section DE, and tighten the pivot bolts only with the vehicle at kerb height. Ensure the towing bracket eccentric outer nuts are aligned.

o. Before refilling the pump assembly and fuel storage compartment floor, fill the tank, connect the battery, reset the ignition switch and start the engine to check for leaks from the fuel pipe connections.

p. Fit the access panel and rear storage compartment floor.

19.5 FUEL FILTER

The fuel filter should be renewed at intervals specified in the Maintenance schedule. Access to the fuel filter is available after lifting the rear storage compartment floor, via a removable panel in the body to the right of the fuel tank.



WARNING The fuel in the filter and connecting pipework is pressurised. Before commencing work, carry out the fuel pressure relief procedure detailed in section EC 2.

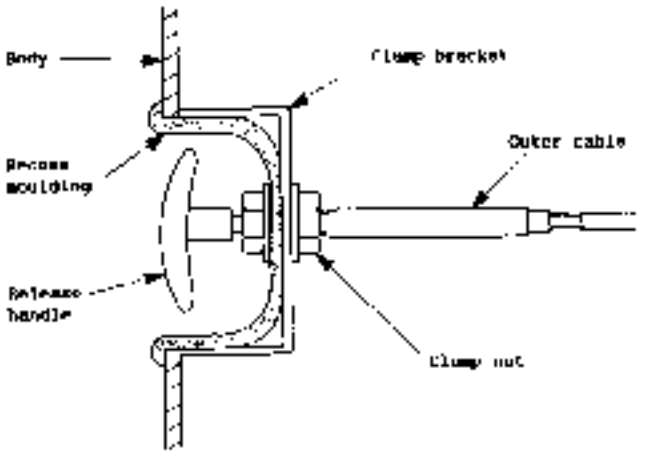
Compression joints are used at each end of the filter, necessitating the use of two spanners when slackening or tightening the connections. To replace the filter, unscrew the inlet and outlet connections using an abnormal width to mop up the small amount of fuel expelled under residual pressure. Release the two clamp bolts, remove the clamp, and withdraw the filter.

Fit the new filter into position with the direction of flow arrow pointing towards, and tighten the unions to 27 Nm (20 lbf.ft). Refit the clamp, tighten the clamp bolts, and refit the access cover and gasket.

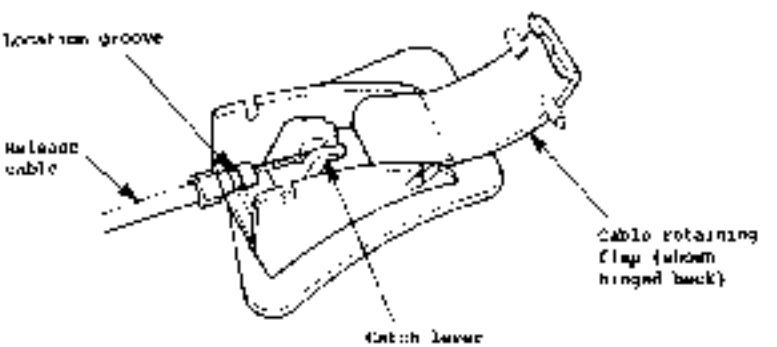
19.6 FUEL FILLER FLAP

The fuel filler flap uses a sprung catch which is released by a cable termination in a release handle in the left hand door jamb. On early cars, the release for the handle comprises a separate black plastic moulding, but on later cars, the release is incorporated into the body inner panel moulding. The handle is coloured with the inner cable and a 'U' shaped clamp bracket, secured to the outer cable, clamps the cable (and handle release moulding if applicable) into the body aperture. For access to the clamp, the hood stowage compartment left hand trim panel must first be removed.

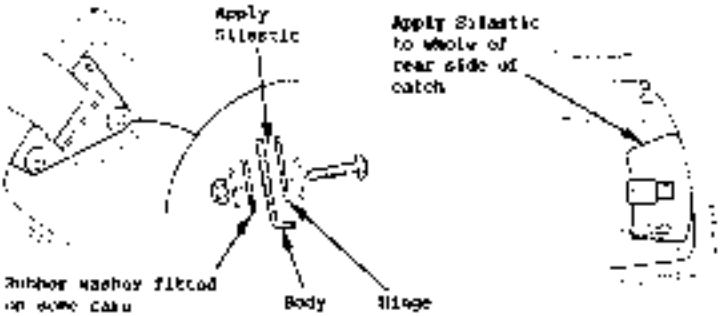
To release a cable, the catch end must first be released, before the handle end clamp nut is removed and the cable withdrawn through the clamp bracket and grip.



The latch pin catch and the cable have a ball nipple to hold into the catch lever, and a groove in the outer cable where it exits the catch body, and is retained by a hinged flap which snaps into position. Press open the flap to release the cable.



The catch is retained in the body by a single screw, which allows adjustment of inline flap shutline. If the catch is removed, apply Black Silastic to the side of the catch flange before refitting. Inline flap positions may also be adjusted via slotted fixing holes in the hinge bracket. If refitting a new bracket, ensure that Silastic is applied between the inside surface of the body and the hinge bracket.



18.17 - FUEL FILLER NECK

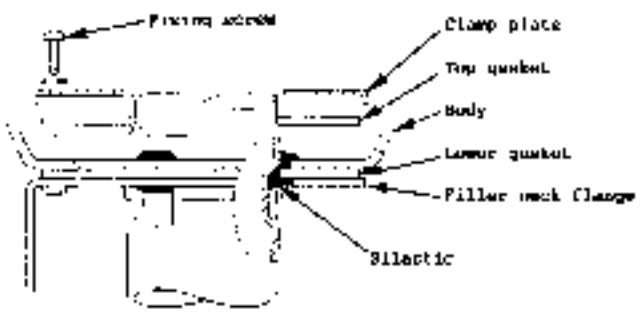
The filler neck is retained in the filler recess by two screws which clamp a flange on the neck to a clamp plate on the screen, with a rubber gasket used each side of the body. The filler cap incorporates a torque limiting ratchet mechanism to prevent over-tightening, and a pressure relief valve to prevent excess pressure caused by a rapid pressure rise which the restricted breather line is unable to cope with.

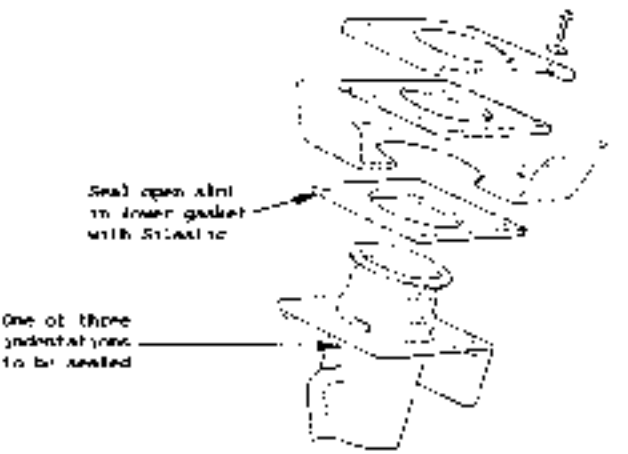
Access to the filler neck is available after removing the boot storage compartment side panels. It is important when refitting the filler neck, that a perfect weatherseal is achieved by the following procedure:

1. With a sealing gasket fitted onto the filler neck mounting flange, use black silastic to seal the three indentations in the neck flange beneath the flange; also to seal the inside edge of the gasket and the filler neck. Also seal the fixing screw open slot in the gasket.

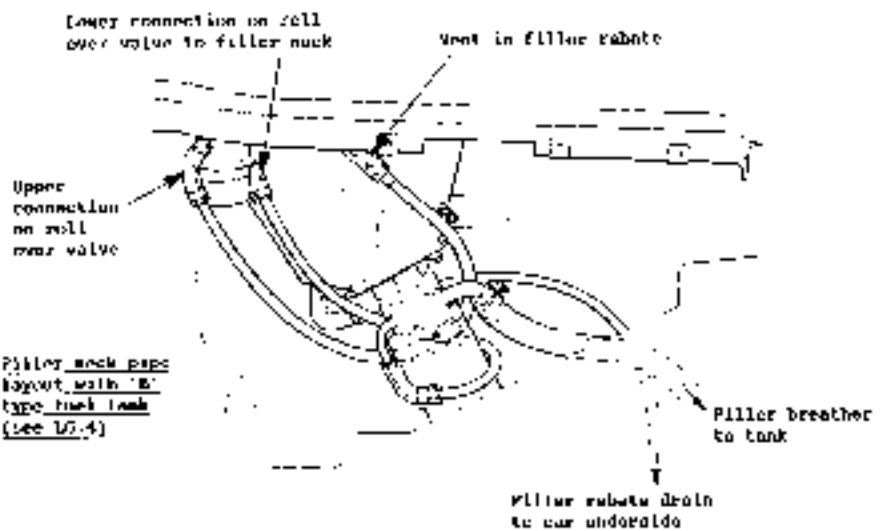
2. Fit the filler neck into position and push upwards against the body whilst using silastic to seal between the filler neck and the body.

3. Fit the top gasket and plate, and tighten the two screws.

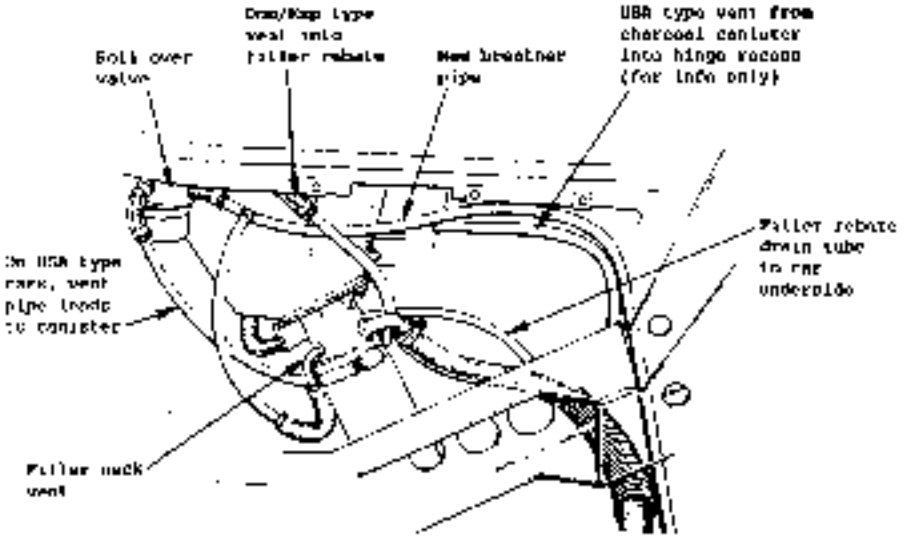




1. Set the fuel tap and breather hoses.



Filler neck pipe layout with 'D' type fuel tank (non GM.4)



2.G - EVAPORATIVE EMISSION CONTROL SYSTEM (EECS) - Catalyst Cars Only

The system retains otherwise naturally occurring fuel vapour from the fuel tank so that it does not escape to atmosphere. For Environmental Protection Agency (EPA) purposes an activated carbon (charcoal) canister is used to absorb fuel vapours from the fuel tank whether the vehicle is running or parked. Under certain engine running conditions, the fuel vapours is purged from the canister by a flow of fresh air through the unit, with the air/vapour being drawn into the intake plenum and consumed in the normal combustion process. The charcoal is then prepared for renewed absorption of vapour when the engine is next stopped.

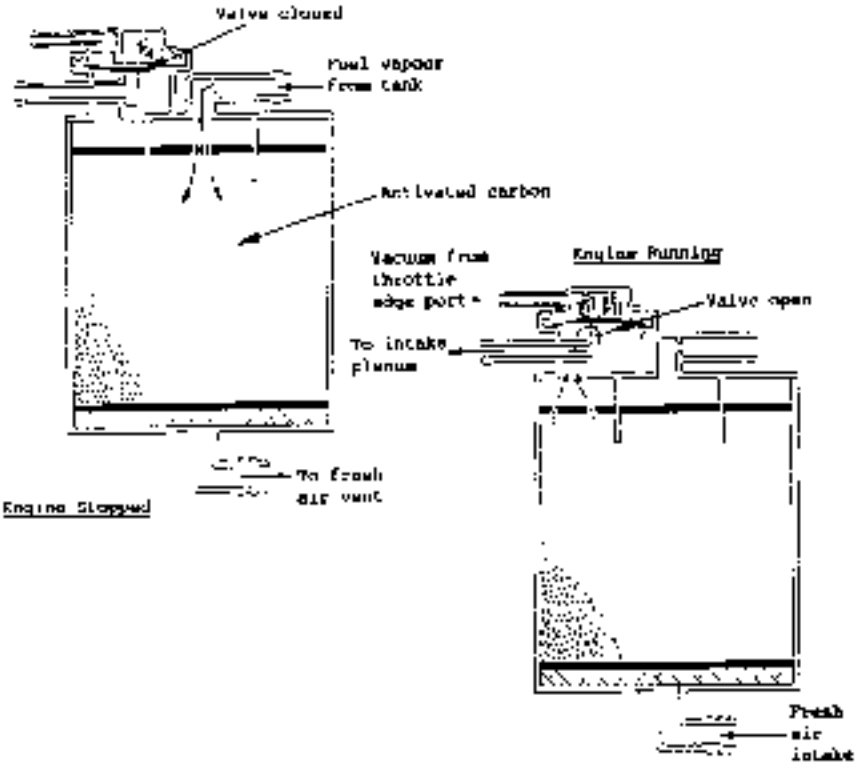
Canister

The cylindrical canister is located behind the off hand rear inner panel and is provided with vapour purge and spill ports in the top surface. The breather pipe from the fuel tank filler neck is routed via a roll over valve (which should the filler neck be pressed [or rotated if the car is inverted], to the canister before port. Ambient air enters the canister through a port in the bottom of the unit, and mixes with the vapours before being drawn through the purge control valve and an in-line restrictor and one return valve into the intake manifold.

Control System

A purge control valve, mounted on top of, and integral with the canister, contains a diaphragm valve to regulate the amount of purging that takes place according to intake system pressures.

The spring loaded, normally closed diaphragm valve, controls the purge line



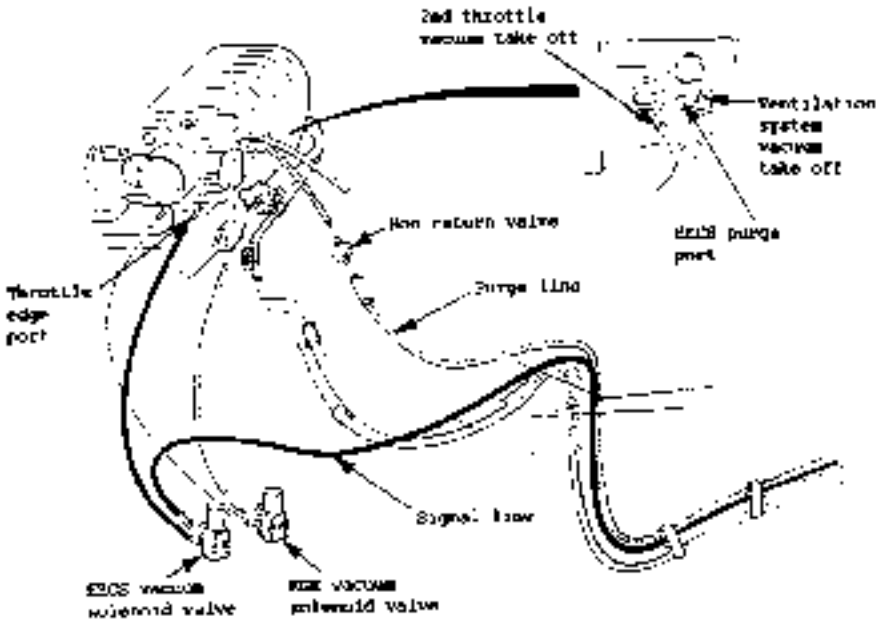
between the top of the canister and the intake plenum. The top side of the diaphragm is connected via a vacuum solenoid valve, to a primary throttle edge port. At part throttle, a vacuum signal is applied to this line and the diaphragm valve is opened, allowing the low pressure in the intake plenum chamber to draw fuel vapours from, and fresh air through, the canister element.

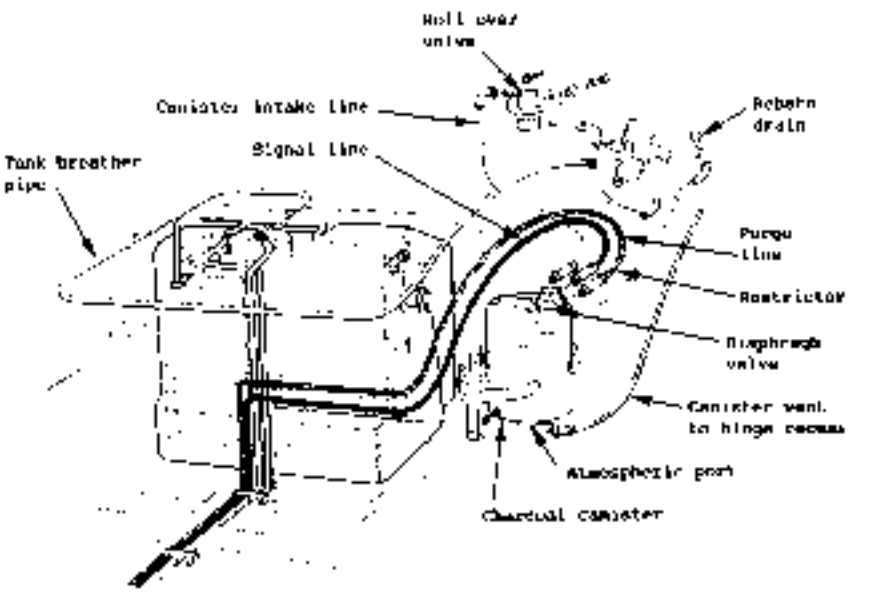
The solenoid valve, mounted on the left hand front wheelarch, and connected between the purge control valve and the throttle body, is controlled by the engine management E.C.M. Under cold engine, or idle conditions, the solenoid is de-energised and shuts off the purge signal line, so that no purging takes place. The E.C.M. turns on the solenoid valve to permit purging when all the following conditions are met:

- above a specified coolant temperature,
- the engine has been running for a specified time period;
- above a specified road speed;
- above a specified throttle opening.

In addition, there must be sufficient vacuum at the throttle edge drilling to open the diaphragm valve.

A non-return valve located in the purge line between plenum and canister, prevents reverse flow when boost pressure is developed and plenum pressure becomes positive.


2nd throttle vacuum take off
Ventilation system vacuum take off
Non return valve
Drain purge port
Throttle edge port
Purge line
Signal line
EGCS vacuum solenoid valve
RSK vacuum solenoid valve


Roll over valve
Canister intake line
Signal line
Tank breather pipe
Reborn drain
Purge line
Restrictor
Diaphragm valve
Canister vent. to hinge recess
Atmospheric port
Charcoal canister

MAINTENANCE & IDENTIFICATION

FLOW CHART 23.01

RECOMMENDED LUBRICANTS

Engines

It is important to ensure the viscosity and quality of the motor oil is most appropriate that only the specified lubricants are used. Advice should be sought from quality standard and viscosity below, for the temperature range in which the vehicle will operate before the next service. Do not overfill engine.

Recommended Lubricants	SAE Viscosity (Refer to the Handbook)	API	ACEA
Synthetic Lubricants	0W/40	SH/CD or CF	A3/B3
Semi-Synthetic Lubricants	10W/40	SH/CD or CF	A3/B3
Mineral Lubricants	20W/50	SH	A3

Engine Oil Capacity (Including Filter) ... 4.00 litres (7.0 Imp pints)
Engine Oil Capacity (Excluding Filter) ... 3.75 litres (6.6 Imp pints)
Oil Pressure at Idle Speed ... 0.69 bar (10 lbf/in²)
Oil Pressure at 3000 rpm ... 3.45 bar (50 lbf/in²)
Oil Pressure Warning Lamp Illuminates ... 0.3 bar (4 lbf/in²)

Transmission (Manual 5 speed) (5 in Assembly)

Recommended Lubricant ... Duckhams Hypoid 80W/90S
Specification ... API GL-4
Capacity ... 2.00 litres (3.5 Imp pints)
Drain Interval ... 36,000 miles (60,000 km)
Capacity - dry ... 2.75 litres (4.85 Imp pints)
Capacity - wet ... 2.25 litres (3.96 Imp pints)

Steering

Fluid Approved Grades ... Nissan Genuine Power Steering Fluid
Fluid Capacity ... Approximately 1 litre

Rear Hubs

Lubricant Type ... Duckhams Hypoid 80W/90S
Capacity ... Sufficient to fill cavity

Brake System

Fluid Type ... DOT 3 or DOT 4

Engine Coolant Additives

Type ... Duckhams Universal Coolant
Concentration - Summer ... 40%
- Winter ... 55%
- Anti-freeze Protection ... -36°C
Capacity (All Engines) ... 7.5 litres (13.2 Imp pints)

MAINTENANCE SCHEDULE - ELAN S1 & ELAN S 2

Issue 4.16

Date ..... Capacity Data ..... Serial# .....

Work to be carried out as per ..... V I N ....

Vehicle Mileage ..... Service Card ..... Job No. .....

Ask YOU to check the following before any work is carried out. Please sign the (✓) when the operation has been performed satisfactorily.

Key:-
'Inspect' means assess condition and rectify for proper operation. Extra time is required to adjust or repair - Allow 1 hour beforehand if necessary.
'Check' means test and adjust if required or replace as necessary.

Distance covered (miles)	Service required	Distance covered (kilometers)	
6,000	A	10,000 km	
12,000	A	20,000 km	
18,000	A	30,000 km	
24,000	A	40,000 km	
30,000	A + B	50,000 km	
36,000	A	60,000 km	
42,000	A	70,000 km	
48,000	A + B + C	80,000 km	Replace cabin filter
54,000	A	90,000 km	
60,000	A	100,000 km	
66,000	A	110,000 km	
72,000	A	120,000 km	
78,000	A	130,000 km	
84,000	A	140,000 km	

Maximum time allowed (months)	SERVICE			Other Items (Ref.)
OPERATION	A	B	C	
Fit protective covers to seats, footwells, steering wheel, & front wings.		X	X	
Lubrications				
Renew engine oil* - M/A	12	X	X	
- Turbo	6	X	X	
Renew engine oil filter* - M/A (also on first service)	12		X	
- Turbo	6	X	X	
Inspect engine oil level and condition for oil leaks		X	X	
Renew engine oil breather filter				X
Renew rear wheel bearings				X
Check DEL fluid level	6	X	X	
Renew DEL fluid	24			X
* If engine is used for competition driving, or driving is carried out in dusty conditions, change twice as frequently as specified.				
Engine				
Renew water pump drive belt*				X
Check exhaust front & rear pipes and mountings	6	X	X	
Renew exhaust system	24			X
Renew engine mountings	12		X	
Renew spark plugs**				X
** When new engine is fitted, new spark plugs can be progressively gapped to 0.75 mm, plug changes at 12,000 miles will not affect or invalidate the emission performance of the engine.				
Engine timing belt				W&T(100)
Check for belt condition & tension	24			X
Check fuel hose, vapour pipes			X	
Inspect for power steering fluid leaks	6	X	X	
Renew fuel filter				E&T(100)
Inspect exhaust system & connections, engine mounting.			X	
Braking System				
Check brake lines & hoses	6	A	A	
Renew brake fluid	12		A	
Inspect handbrake for correct operation	6	A	A	
Inspect brake pad & disc wear		A	A	
Check parking brake adjustment		A	A	
Inspect operation of brake fail valve		A	A	
Clutch				
Check operation & cable adjustment		A	A	

Continued.....

Operation (Continued)	Time	R	B	C	Other
Steering & Suspension					
Check security of steering column (Avg)			X		
Inspect HP pipes & hoses	12		X		
Inspect steering ball joints & gaiters			X		
Inspect condition of all suspension bushes			X		
Check security of front & rear suspension		X	X		
Inspect dampers for leaks & performance			X		
Inspect front wheel bearings for play			X		
Check rear wheel bearings			X		
Inspect front & rear wheel geometry			X		
Inspect condition of driveshaft gaiters	6	X	X		
Wheels & Tyres					
Inspect tyre condition & pressures (inc spare)	6	X	X		
Check wheel balance				X	
Check wheel nut torque		X	X		
Electrical					
Inspect battery hydrometer (built in)	12		X		
Check battery terminals for security & condition	12		X		
Inspect operation of all lights	6	X	X		
Check headlamp alignment		X	X		
Inspect operation of all electrical equipment	6	X	X		
Body					
Check adjustment of all latches and straps			X		
Inspect operation of SRS system		X	X		
Inspect operation & condition of seat belts		X	X		
Inspect operation of heater/air conditioning			X		
Top up screenwash reservoir		X	X		
Chassis					
Inspect polycarbonate glazing for damage	12		X		

Road Test Performance

Engine performance ..... Brake performance .....

Clutch operation ..... Gearbox operation .....

Steering performance ..... Wheel balance .....

Transfer noise/vibration ..... Light operation .....

Suspension noises ..... Tyre condition .....

General comments .....

Work completed by ..... Dealer stamp:

Date .....

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VHC-DELIVERY INSPECTION - PLAN

JOB ..... Engine No. .....

To ensure customer satisfaction
ensure that before commencing work

Technician's initials

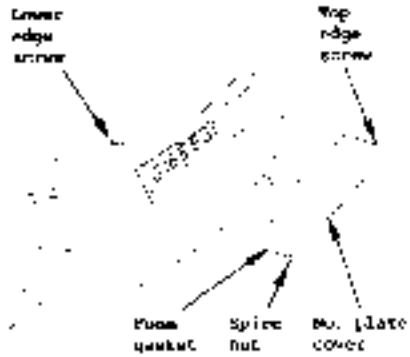
Tick if satisfactory
& if work carried out & claim warranty claim

Description		
Engine Bay		
Check engine & transmission oil for leaks		
Check security of engine oil filler cap		
Check coolant level		
Check brake fluid contained level		
Check drive adjustment		
Check power steering fluid level & for leaks		
Start engine:		
Check running water for leaks		
Check engine & transmission for oil leaks		
Check fuel system for leaks		
Check power steering system for leaks (if fitted)		
Confirm if work to clutch was felt & but proper throttle modes		
Fuel Tank		
Completely fill fuel tank & check for leaks		
Wheels & Tyres		
Check fixings of wheel bolts		
Check tyre pressures incl spare		
Electrical		
Check security of battery terminals		
Check operation of all internal & external lamps		
Check operation of headlamp pop up dy		
Check windscreen alignment		
Check operation of horns & radio/cassette		
Check wiper operation in all modes & park position		
Check operation of windscreen washers & reservoir level		
Check operation of all instruments		
Check operation of door windows		
Check operation of seat/rear windscreen & driver left		
Check operation of door mirror controls & heaters		
Check operation of audio equipment		
Body		
Check operation of doors, door locks & central locking		
Check for air and rust damage (no release mechanism		
Check soft top roof operation & stowage		
Check sill trim for damage & cleanliness		
Check operation of rear belts		
Check all paintwork for damage		
Check presence of booklets, jack & literature pack		

Fit Number Plates

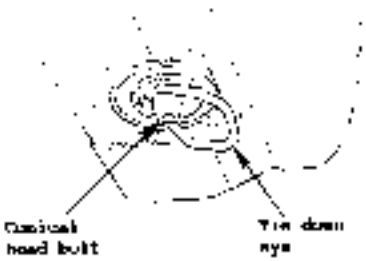
Front: A pair of mounting plinths (RH/Towball and LH/Spare) are provided for this purpose.

Rear: Remove the number plate carrier by unscrewing the 2 screws along the top edge from the outside, and the 4 lower edge screws from inside the boot.
Use double sided tape to secure the number plate to the rear bracket, and refit the cover and gasket.



Service Trailer Eyes

If the vehicle has been fitted with tie-down eyes on the body (during use for transportation purposes), these should be removed prior to valet and the tie-down eyes returned to factory fitted.
Release the 10 bolt head bolts at the mounting point, remove the tie down eye, and refit the bolts. Torque tightening to 45 - 55 Nm (35 - 40 lbf.ft).



Road Test

Road test the vehicle and carry out further rectification work if necessary.

Pre-delivery inspection is subject to the following conditions:

a) It is the responsibility of the supplying distributor/importer/dealer to ensure that the car is delivered to the customer in the best possible condition.

b) All costs incurred during the inspection are the responsibility of the supplying distributor/importer/dealer.

c) Failure to return a signed copy of this inspection to Land Rover Ltd. by the distributor/importer/dealer, may result in warranty claims on the particular car being rejected.

Dealer signature .....

Date ..... Dealer stamp

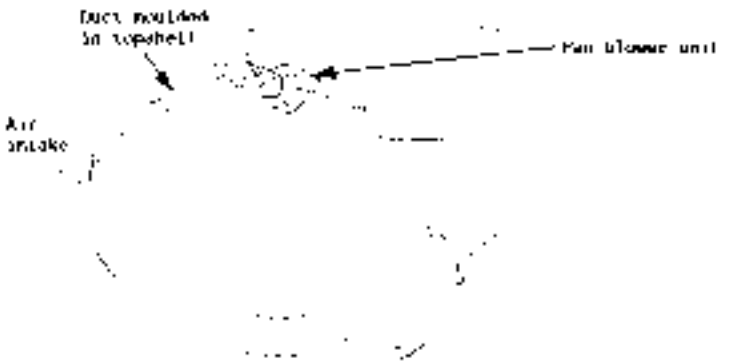
HEATING VENTILATION & AIR CONDITIONING

[illegible] - FLAIR

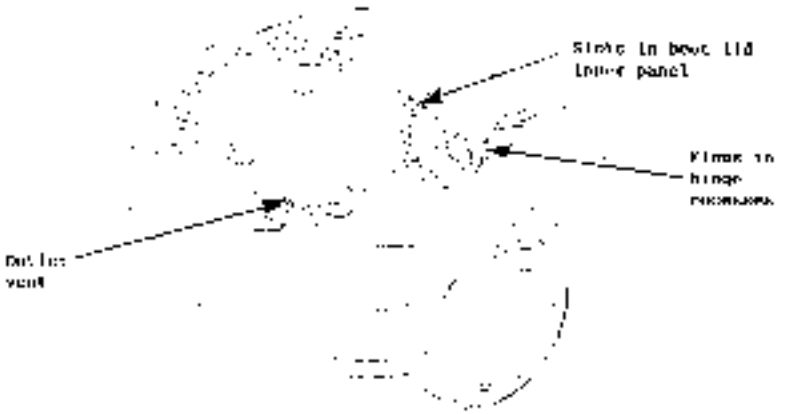
[illegible] DESCRIPTION

Ventilation

The ventilation system uses an air intake duct which extends from the top of the [illegible] to the front bumper. The duct is routed inside the top of the [illegible] and is fitted with a [illegible] before passing through the front bulkhead into the [illegible] housing. In the modified cars, an air intake slot within this duct is fitted to supply fresh air from the outside for ventilation. air flow [illegible] The fan speed blower can force air through the air conditioning evaporator [illegible], and into the air blend heater unit where [illegible] with the fan speed or temperature. The control operated air distribution flaps and [illegible] to the various outlet vents.



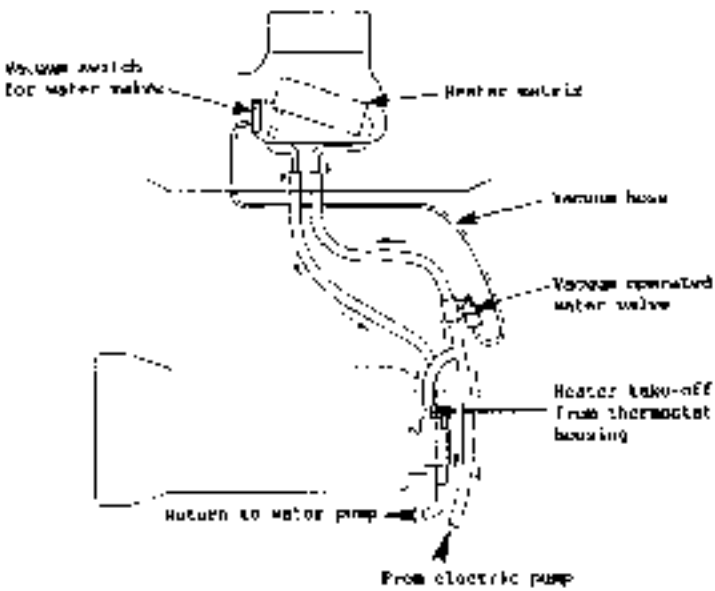
When the boot lid is closed, air is able to flow from the main interior [illegible] between the two bulkhead hinge recesses, into the boot. [illegible] of the boot is achieved by [illegible] through the boot lid [illegible] by [illegible] outlets over the rear number plate. Care should be taken [illegible] the ventilation system with luggage or clothing.



Heater

The heater system uses a heated matrix (heat exchanger) housed within the air distribution chamber behind the fascia, and fed with engine coolant. In use, the incoming air flow, through it by the blower fan. The water feed to the heater matrix is taken from the thermostat housing at the left hand end of the engine, with the return pipe connecting to the radiator bottom pipe. The supply of water to the matrix is controlled by a vacuum operated water valve in the supply pipe, and located in the engine bay. The valve is operated by vacuum from switch located on the underside of the heater/distribution unit, and is shut off (by spring tension) when the 'off' setting is selected. At all other times the valve is open, and the flow rate, with the temperature of air from the matrix controlled by the proportion of air diverted through the matrix.

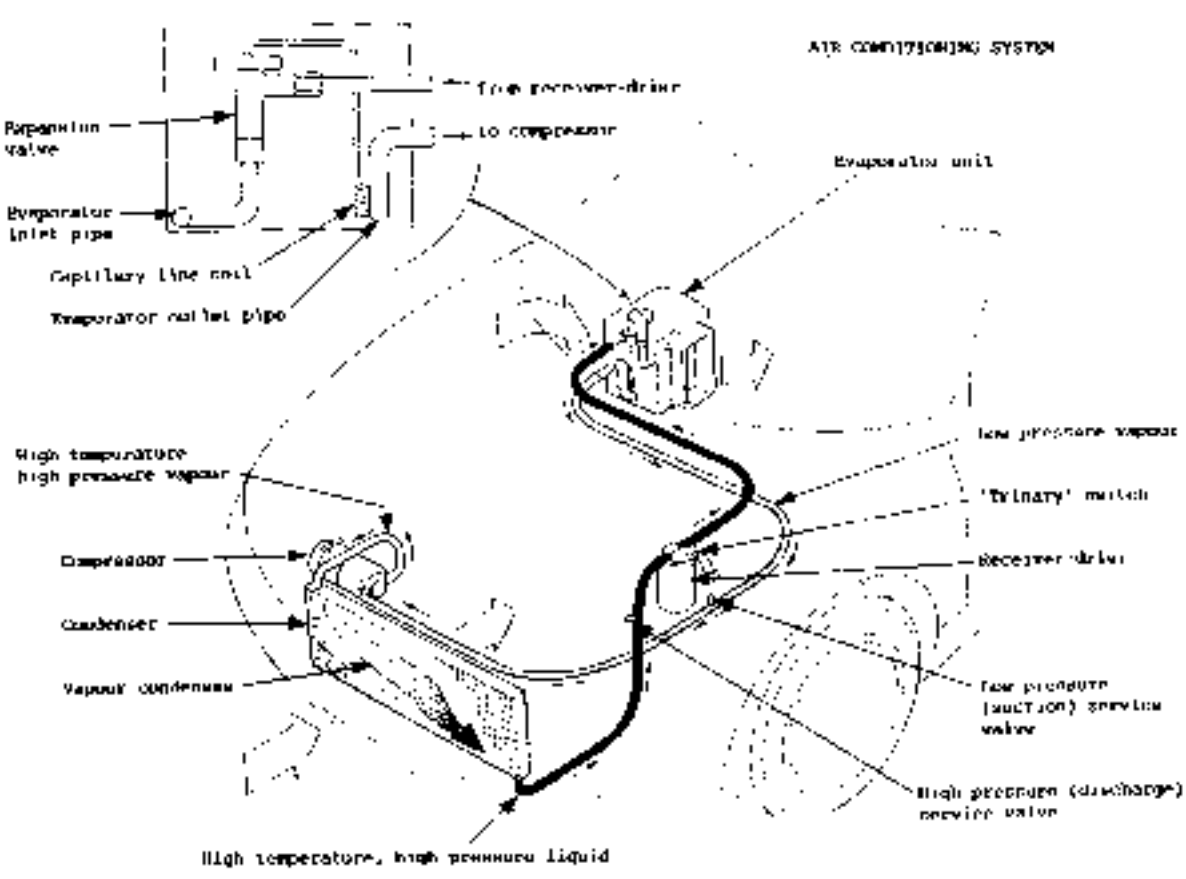
Air flow through the heater matrix is adjusted by two interlinked air mixer flaps which are controlled by a link rod from the temperature selection rotary control, to the underside of the heater housing.



Air conditioning (if fitted)

The air conditioning unit uses a cycling piston system with a thermostatic expansion valve to provide refrigerated air to the vehicle interior. The system comprises:

- A closed circuit containing refrigerant (R12).
- A compressor mounted on the front side of the engine driven by reinforced belt from the front end of the crankshaft via an electromagnetic clutch.
- A condenser mounted immediately ahead of the engine cooling radiator.
- A receiver/dehydrator mounted at the left hand side of the engine bay.
- A thermostatic expansion valve fitted at the inlet connection to the evaporator unit fitted beneath the fascia, between the blower unit and heater/distribution unit.


AIR CONDITIONING SYSTEM
From receiver-drier
To compressor
Expansion valve
Evaporator inlet pipe
Capillary line coil
Evaporator outlet pipe
Evaporator unit
High temperature high pressure vapour
Low pressure vapour
'Trinary' switch
Compressor
Receiver-drier
Condenser
Vapour condenses
Low pressure (suction) service valve
High pressure (discharge) service valve
High temperature, high pressure liquid

Closed Circuit

The closed refrigerant circuit should not be opened unless absolutely necessary, and only after referring to section EE.5 - 'Refrigerant handling precautions'. Failure to observe these precautions may result in personal injury.

Compressor

When the engine is running, and the air conditioning is selected, the electromagnetic clutch incorporated in the compressor pulley is energised, which then locks the pulley to the shaft and drives the compressor. A thermostatic switch senses the refrigerated air cooled by the evaporator, and cycles the clutch on/off to maintain air temperature just above freezing, to provide optimum cooling without the possibility of ice forming on the evaporator core. The thermostatic switch is mounted on the underside of the outlet end of the evaporator casing, with its capillary tube (temperature sensor) inserted into the evaporator matrix.

When the compressor is running, an additional load is placed on the engine, and to avoid stalling and maintain idle speed, a signal is sent to the engine management ECM which opens the idle air control valve accordingly.

The compressor is lubricated by a small fill of mineral refrigerant oil, which is added to the refrigerant. Some of the oil is retained in the compressor with the remainder being circulated with the refrigerant.

The compressor discharges high temperature, high pressure refrigerant vapour into the condenser.

Condenser

The condenser, located immediately ahead of the engine cooling radiator, is of tube and fin construction, and is made from aluminium for good thermal conductivity. The hot vapour flowing through the condenser releases heat to the cooling airflow passing over the condenser fins, this high the forward motion of the car, or induced by the two electric fans fitted behind the engine cooling radiator. These fans are cycled on/off accordingly to refrigerant pressure (as well as engine coolant temperature), as sensed by a switch at the receiver-drier.

The hot vapour condenses into a high temperature, high pressure liquid, before flowing into the receiver-drier.

Receiver-Drier

The receiver-drier is located at the left hand side of the engine bay, and serves as a reservoir for storage of high pressure liquid produced in the condenser and incorporates a desiccant bag filled with desiccant to absorb traces of moisture and other contaminants. A sight glass built into the top of the receiver-drier enables a quick check of the amount of refrigerant charged in the system. If the refrigerant charge is low a stream of bubbles will be visible at the sight glass. Note: A clear site glass, while indicating that the system has the correct charge, can also indicate complete absence of refrigerant. This situation is usually accompanied by oil streaks.

A 'trinary' switch senses the pressure of refrigerant leaving the compressor, and:

- switches on the radiator cooling fans above a certain pressure;
- switches off the compressor if excessive pressure is detected (protects system from further damage in case of a control system failure);
- switches off the compressor if an excessively low pressure is detected, to prevent the compressor from oil starvation in the event of a system depressurisation.

Expansion Valve

The expansion valve is fitted into the high pressure line at the intake to the evaporator, and is controlled within the evaporator casing. The expansion valve provides a restriction to the flow of high pressure liquid as it enters the evaporator, and as it flows through the valve, it undergoes a pressure drop as it changes a change of state from a high temperature, high pressure liquid, to a low pressure, low temperature atomised liquid. This then enters the evaporator, where due to the low pressure, the atomised liquid starts to boil or vaporise, and in so doing, takes the necessary heat for this process from the warm air stream passing over the evaporator surface. The air/gas is thus cooled, and is then directed through the various outlet vents into the passenger compartment.

The flow of refrigerant through the evaporator is thermostatically controlled by the expansion valve, which has a capillary line strapped to the evaporator outlet pipe to sense actual temperature. Valve body heating is provided to provide optimum system performance.

Evaporator

The evaporator is mounted in a moulding under the console between the blower motor and the heater/distributor unit. All the various pipes connect the evaporator, whether or not the a/c is operating. The expansion valve is attached to the evaporator inlet connection, and is connected to the condenser outlet. The inlet and outlet pipes project through the bulkhead into the engine bay, where pipework connects to the inlet from the condenser outlet, and from the outlet to the compressor suction port, where the pipework again is strapped and connected to the [illegible].

[illegible] CONTROLS & AIRFLOW DISTRIBUTION

The [illegible] are situated in the centre console, and comprise the rotary [illegible] for heater temperature and air distribution, and a horizontal slider for fan speed. Cars with air conditioning have an additional rocker switch for activating this function. Located at the bottom of the centre console the engine cut-out is common for either the heater or air conditioning to operate.

Fan Speed Control

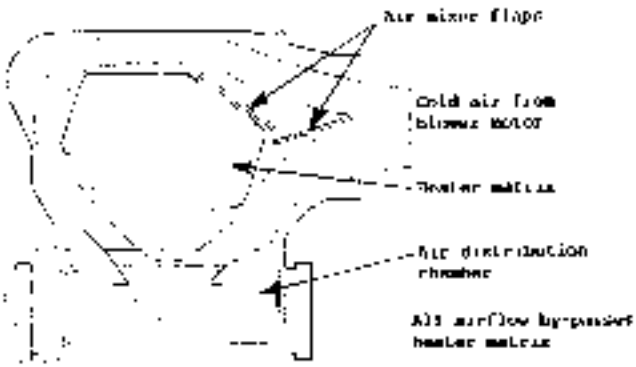
Fan speed is controlled by a horizontal slider between the two rotary controls. With the lever fully to the left, the fan is switched off, and only ambient airflow will be obtained from the vents. Moving the slider to the right provides four increasing fan speeds to boost air circulation. The fan speed resistor block is fitted on the fan motor housing, where it is cooled by the airflow.

Heater Temperature

Heater temperature control is the lower of the two rotary controls in the centre console. The rotary movement of the knob is converted, via a pinion and sector, to a linear movement of a link rod which connects with the air mixer flaps at the underside of the heater housing. Airflow through the heater matrix is controlled by the interlinked flaps which control the proportion of air which is directed through, or around the heater matrix.

For cabin temperature control, with the engine fully commercialised. This moves the flaps to shut off the heater matrix, and direct all the airflow so that a supply of the matrix in the distribution chamber. In addition, when the [illegible] are moved to the fully cold position, the flap operating lever opens a [illegible] recorded on the bottom of the heater housing, and supplies

COLD



WARM

HOT

system to deliver a slightly open water valve to the engine bay.

As the temperature control is turned clockwise, the vacuum-switch is opened and ventilated, allowing the water valve to open and supply hot water to the heater matrix. As the control is turned further, an increasing proportion of the airflow is directed through the heater matrix, resulting in a progressive increase in the temperature of air supplied to the interior. With the control turned fully clockwise, all the air is directed to flow through the heater matrix for maximum temperature.

Air Recirculation

Cars with 4-position distribution control.

Air recirculation is available only on air conditioned vehicles. On these cars, a vacuum solenoid-switch fitted on the top of the heater housing, controls a vacuum actuator on the air intake housing. When the temperature control is turned to the fully cold position, a cam on the top end of the heater flap spindle, releases (closes) the vacuum solenoid-switch. In this position, no vacuum is applied to the intake flap actuator, which holds the flap in recirculation mode, with the post air post and the fresh air intake closed. When the temperature control is moved off the fully cold position, the cam opens the microswitch, and allows vacuum to flow through the valve to the intake flap actuator, which opens the fresh air intake, and closes the recirc. port.

In all cars therefore, when the temperature control is turned to fully cold, recirculation is automatically obtained. For fresh air, the control must be turned to a position just off the fully cold stop to open the fresh air intake, which should operate before a small portion of the control opens the water valve.

Note that the intake flap recirc port is also fitted on heater cars, but the recirc port is blanked off. The blower fan unit is not fitted with a recirc flap, and has the recirculation aperture sinosed off.

Cars with 6-position distribution control.

On these cars (inc. all USA versions), a recirculation position is provided on the distribution control for both heater and air. vehicles. See below.

Air Distribution

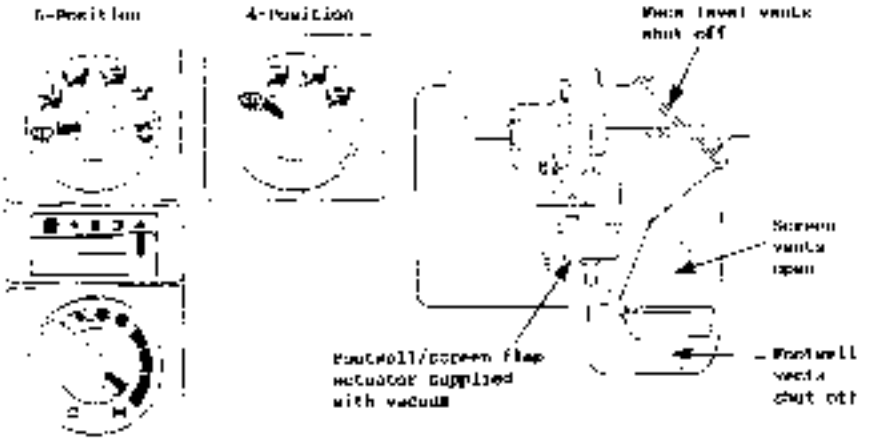
The air distribution control is the upper of the two rotary controls in the centre console. The control is a rotary vacuum metering valve, which supplies vacuum to various vacuum actuators which operate the distribution flaps. Vacuum is supplied both the engine manifold (from a port on the rear of the throttle body, via a check valve and reservoir on the rear of the left hand front wheelarch. The 'engine' port on the reservoir (if of the two ports, is marked 'vacuum' and incorporates a non-return valve to retain a vacuum supply when the engine is stopped, or when long periods of wide open throttle are used (low intake vacuum). A supply line from the reservoir RH port leads to the distribution control, and to the water valve vacuum micro-switch on the underside of the heater unit.

The distribution control supplies vacuum to a two stage vacuum actuator controlling the face level vent flap, a single stage actuator controlling the screen/footwash flap, and the micro-switch for the intake flap (not used on heater cars with 4-position distribution control).

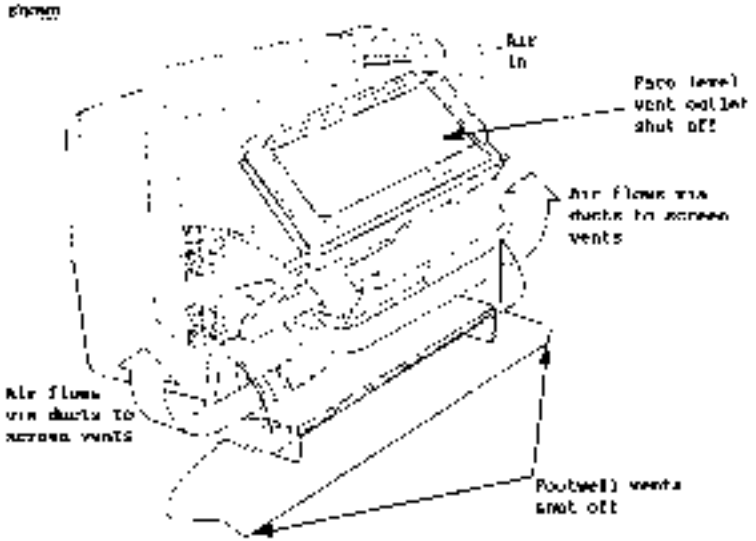
All 1990 and some '91 MY cars are fitted with 6-position control switches, whereas all USA models, and other cars as a running change, have 4-position controls. All control positions are marked by symbols, with detents provided to permit selection by 'feel'

Defrost:

With the knob turned fully counterclockwise, airflow is directed to the windscreen. Vacuum is supplied to the footwell/screen flap actuator, which operates to open the screen vents and close off the footwells. The face level vents are closed off by the DEF flap. For optimum defrost performance, select maximum heat and fan speed.



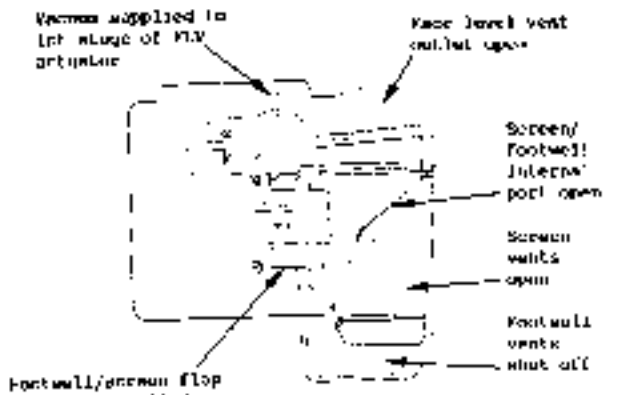
LHD system shown



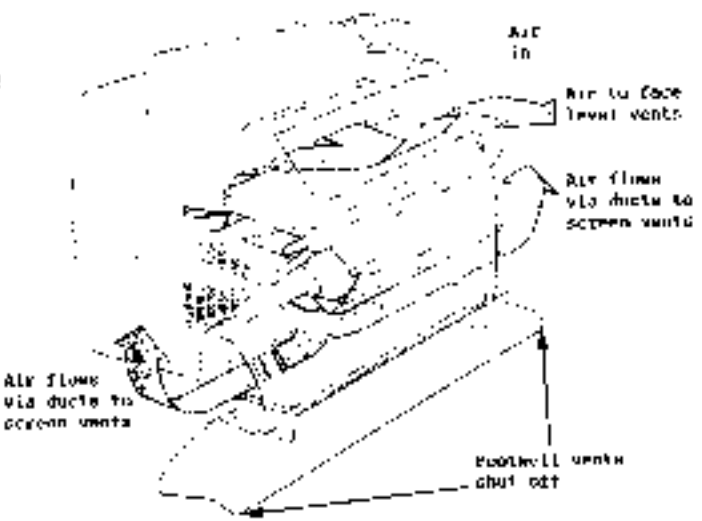
Cooling

[illegible] is available only on cars with the 4-position distributor panel, and allows the airflow to be varied to [illegible] while also supplying air to the face level vents to help prevent [illegible].

Vacuum is supplied to the footwell/screen flap actuator, which operates to open the screen vents & close off the footwells. Vacuum is also supplied to the same valve to open it to the MAV actuator, which moves to a mid position to open air from the centre vents in line (as fed) to the windscreen, and to the side face vents. This position is normally used with a warm temperature setting, keeping the centre face level vents closed, and directing the side vents to keep the door windows clear.



Air system shown

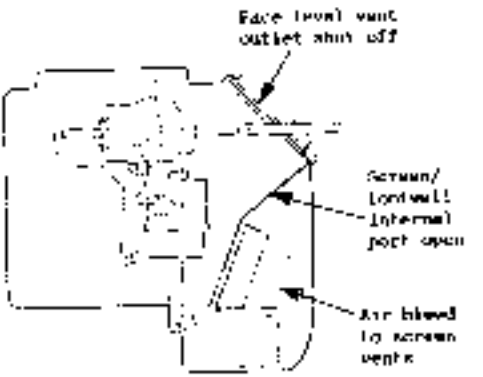


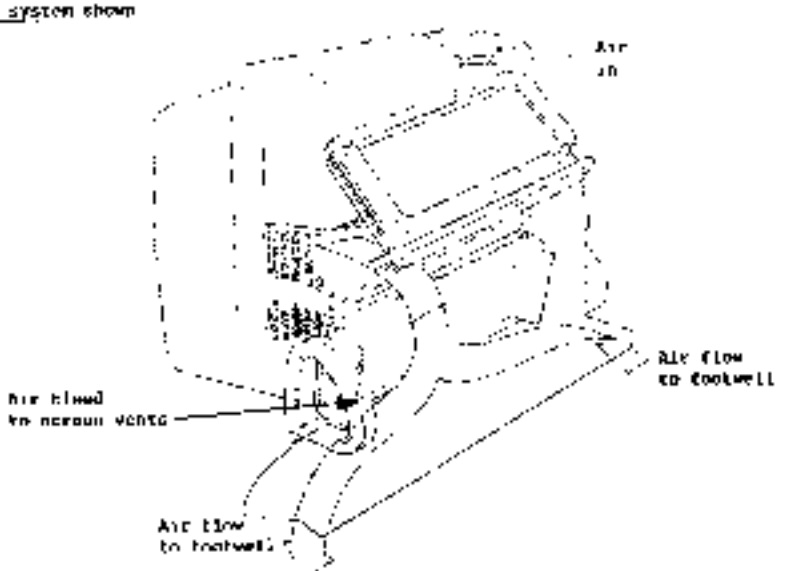
Footwell

In this setting, the face level vents are shut off. Air flow is directed to the footwells, with a small amount to the screen for demisting.

No vacuum is supplied by either MIX or footwell/screen actuator, so that the air flap shuts off the face level outlet, and the footwell/screen flap opens the footwell outlet. Air flows through the footwell internal aperture to the footwell vents, with a small amount feeding into the screen vents to aid demisting. As with a warm temperature setting and fan speed as desired.

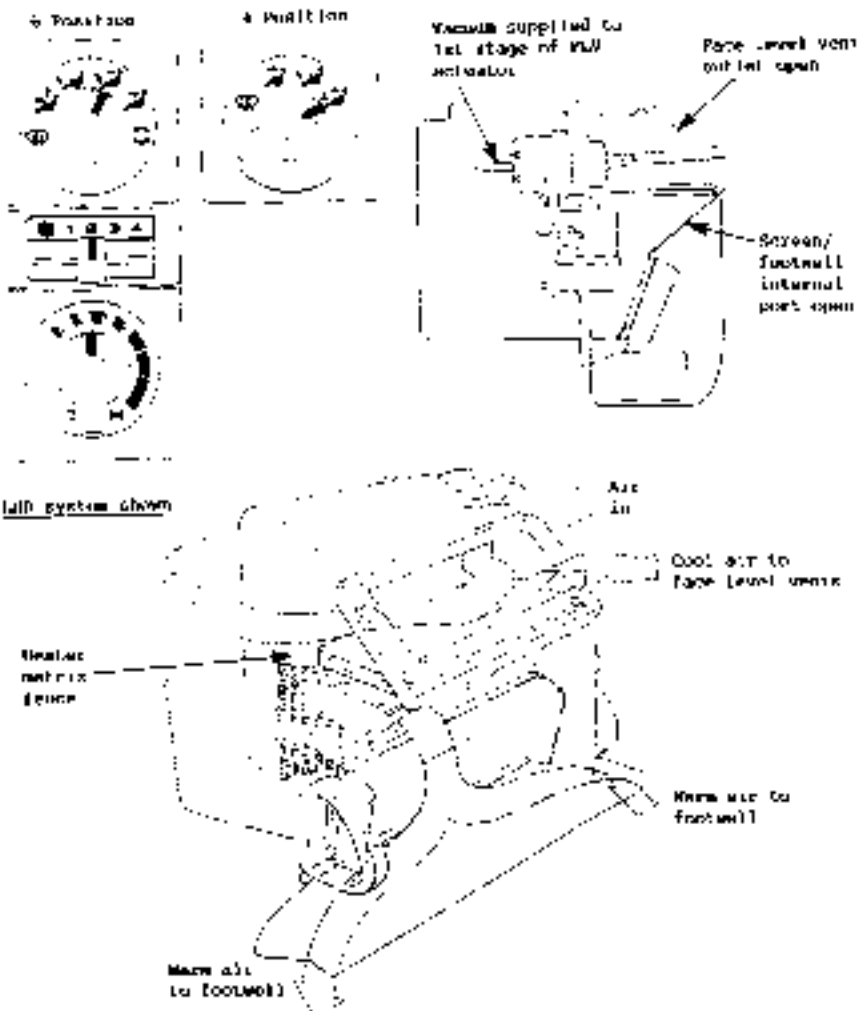
LHD system shown





By-level

This provides simultaneous stratification, so that cool air may be selected through the face level vents, with warm air directed to the footwell. Vacuum is supplied only to the first stage (red) port of the FLV actuator, which moves to a mid position, and allows air to pass over the top part of the heater matrix. With a mid-position selected on the temperature control, some air flowing through the heater matrix is diverted through the footwell internal ducting to the footwell vents, whilst cooler air, which has by-passed the heater matrix, flows over the FLV flap to the face level vents.

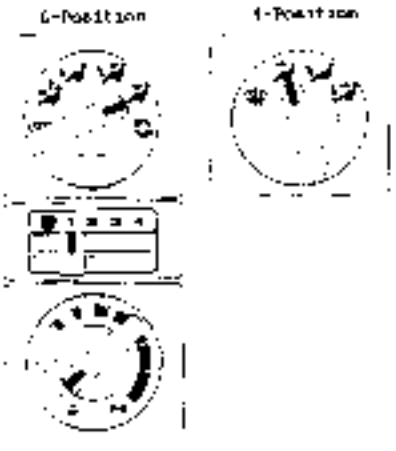


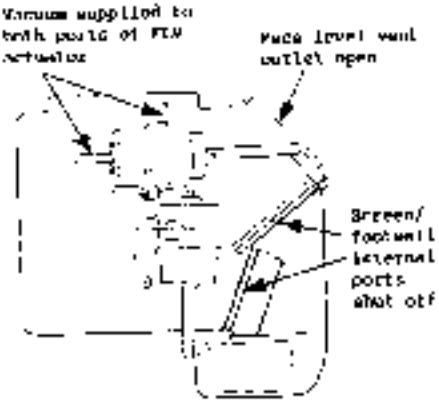
Left system shown

Face Level Vents

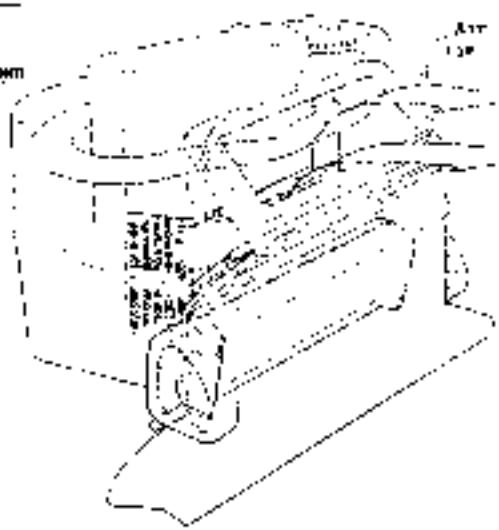
In this position, all air is directed to the four face level vents, each of which is provided with its own volume and direction control (see below).

Vacuum is applied to both ports on the FLV actuator, which moves full travel to open the face level vents and close off the footwell/screen outlets. A delay valve fitted in line 49 between the rotary control and FLV actuator and single port on the side of the actuator, ensures that the two stage actuator operates correctly. The screen/footwell flap (no vacuum) closes off the screen and footwell vents so that all air is directed to the face level vents. Use this position with a cool temperature selection and fan speed as desired.





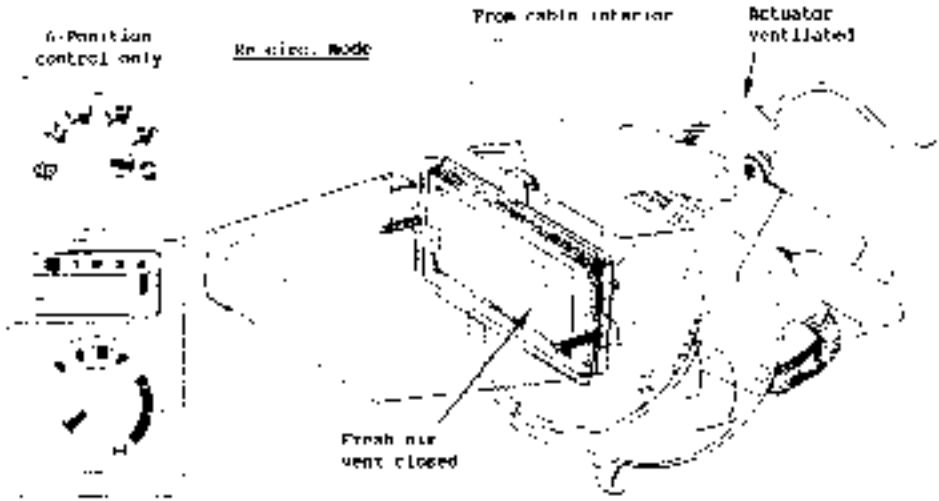
Four system shown

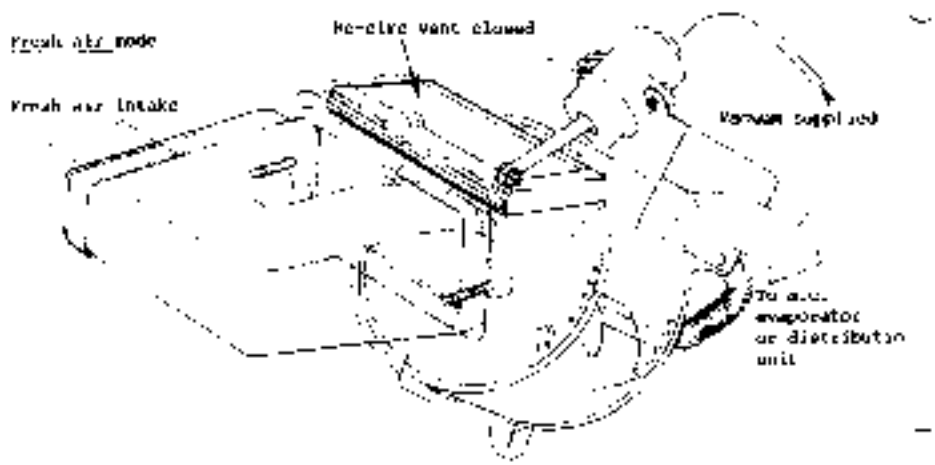


Recirculation

This position is applicable only to those vehicles fitted with the temperature control. The valves work in conjunction with the temperature control valve. A switch is provided via the temperature control cable valve.

In this setting, the electrical on of air is as for the face level vent setting but the vacuum supply to the air intake flap actuator is cut off. This has the effect of shutting off fresh air port and open the recirculation port. When the fan is operating, air is continuously recycled within the car through the face level vents. This position should be used in conjunction with air conditioning as it blocks air passage and, eg, in heavy traffic to avoid fumes from entering the car.





Air Conditioning

Cars fitted with air conditioning, are provided with a rocker switch on the centre console, and an adjacent amber tell tale to indicate when the circuit is operating.

To select refrigerated air, press the rocker switch to activate the compressor, and position the heater temperature control at mid. Turn the distribution control to the face level vents position, open the vents, and fan control to any of the four speeds. Close all the windows and doors. Note that the slow fan speed will be activated automatically when the air conditioning switch is pressed, but a faster speed may be selected if desired. On cars with 4 position distribution control, if the temperature control is turned fully anti-clockwise, the recirculation vent will be opened so that extracted air is continually recycled within the car, but if the control is turned away from the fully cold stop, fresh air will be admitted. Cars with 3 position distribution control, are provided with a centre floor position for maximum cooling, and a face level vents position for refrigerated fresh air.

Dehumidified heating (cars with A/C)

On air conditioned cars, dehumidified air may be obtained by using the air conditioning in conjunction with a warm temperature control setting. In this way, the air is first cooled to reduce its humidity, and then heated to the temperature required. Use this feature to help demist the windscreen and other windows.

Important Notes on Use of Air Conditioning

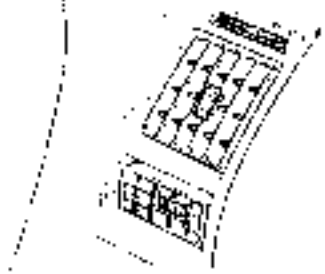
1. It is not recommended that the airflow from the face level vents is directed at persons during maximum refrigeration, as this can cause discomfort (e.g. croup).
2. Under certain ambient conditions (especially high humidity) a white vapour may issue intermittently from the face level vents. This is quite normal and should cause no concern.
3. To ensure that the internal components of the air conditioning compressor are kept adequately lubricated, the air conditioning should be switched on for at least 5 minutes every week to permit the oil to circulate.
4. Some automatic functions of engine operation will override the air present signal and switch off the air conditioning. These include: Kick down throttle to make available a full engine power; high vehicle speed to increase engine idling mapping; abnormally high engine coolant temperature to help prevent overheating.
5. When air conditioning is selected, the radiator cooling fans will cycle on and off dependent on system pressures as sensed by the trinary switch at the receiver-drier, regardless of engine coolant temperature.

Face Level Vents

Four face level vents are fitted, two in the centre console, and one at each end of the fascia. The central vents, and on left hand drive cars, the outer vents, are fitted with a vane control (wheel), the turning of which opens or closes the vent, and a centre knob by which the direction of airflow may be altered.

On right hand drive cars, each of the two outer vents comprises of separate upper and lower outlets, each with its own directional control knob. A thumbwheel above the vents enables the airflow from both upper and lower outlets to be shut off (1), or opens the lower vent only (2), or opens both vents (3).

Right Hand Drive



Left Hand Drive

PT.1 VACUUM DISTRIBUTION CONTROL

The ports on the rotary distribution control are labelled. One of the ports has a groove in the side as shown in the following table.

Distribution Control Ports

Control Position	Rotary Control Port Number				
	1	2	3	4	5
Defrost	Yes	Supply	No	No	No
Face Level Vents	Yes	Supply	Yes	No	Yes
Footwell	Yes	Supply	No	No	No
Bi-Level	Yes	Supply	Yes	No	No

Yes = vacuum supplied

No = port not connected

The vacuum pipes from the distribution control are numbered according to the port to which they are connected.

Hose #1. To the switch supply. Runs from port #1 on the distribution control, to the top port on the remote distribution mounted on top of the heater unit.

Hose #2. Distribution supply. Runs from the right hand port of the vacuum reservoir, through the T-piece bulkhead to a 'T' piece. The screen runs to the centrally placed port on the water valve mechanism on the underside of the heater housing. The other branch runs to port #1 of the distribution control as well.

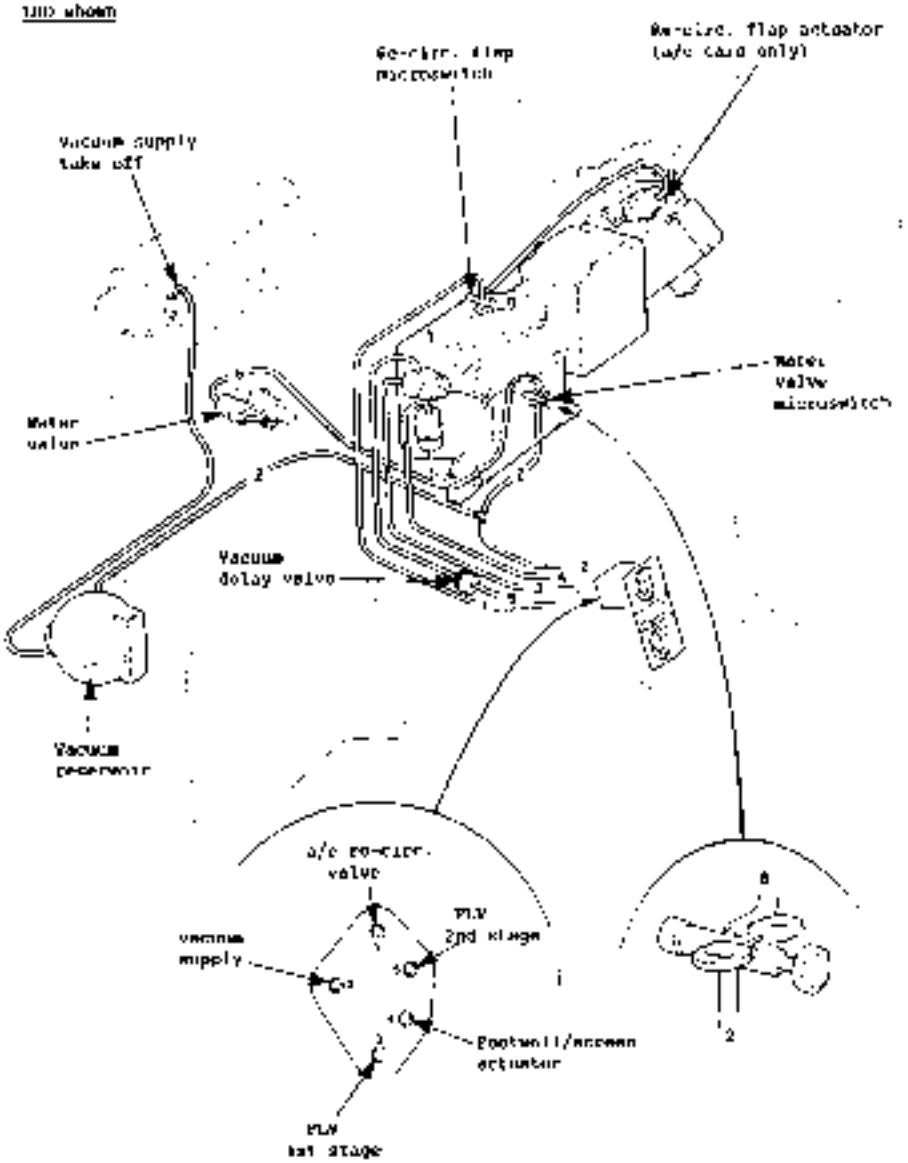
Hose #3. Fit 1st stage. Runs from port #3 of the distribution control, to the outlet on the face level vent actuator.

Hose #4. Footwell/screen. Runs from port #4 of the distribution control, to the footwell/screen actuator.

Hose #5. Fit 2nd stage. Runs from port #5 of the distribution control, to the side port on the face level vent actuator. A delay valve is fitted on this line, this side towards the control switch to ensure that the fit 1st stage always operates before the 2nd stage.

Vacuum Connection Diagram: 4-position distribution control

LHD shown



Hose B6: Water valve. Runs from the sideways facing port on the water valve to the heater, through the bulkhead, to the water valve at the rear of the engine bay.

To start / close completely the system:

- Activate PTO (ON). Runs from the vacuum take-off port on the rear of the gearbox body, to the left hand port (marked 'vacuum') on the vacuum reservoir mounted at the rear of the left hand front wheelarch.
- Activate actuator. Runs from the sideways facing port on the water valve at the rear of the heater housing, to the electric flap actuator on the blower motor.

Refrigerant Pressure Control Hose Unit Use Chart

Function / Position	1	2	3	4	5
Exhaust	No	Supply	Yes	No	Yes
Inlet	No	Supply	Yes	Yes	Yes
Manifold	No	Suction	No	No	Yes
Solenoid	No	Supply	No	Yes	Yes
Pressure Relief Valve	Yes	Supply	No	Yes	Yes
Compressor	Yes	Supply	No	Yes	No

Yes = Vacuum supplied

No = Port isolated

The engine hose routing illustration (on page 4) shows the hose unit numbers as they are fitted to the engine.

Hose B1: PTO (ON) Type. Runs from port #1 of the distribution manifold to the vacuum take-off actuator. A delay valve is fitted in this line, on the side facing the manifold unit, to ensure that the PTO is engaged slightly before the clutch.

Hose B2: Distribution Supply. Runs from the right hand port of the vacuum reservoir, through the joint 'elbow' to the 'T' piece. The branch runs to the Pressure Relief port of the water pipes terminated on the underside of the heater housing. The other branch runs to port #3 of the distribution manifold.

Hose B3: Solenoid Actuator. Runs from port #4 of the distribution manifold to the solenoid between the valves.

Hose B4: PTO (ON) Check. Runs from port #2 of the distribution manifold to port 'A' of the two-way vacuum actuator.

Hose B5: Air Actuator. Runs from the other (top) port #5 of the distribution manifold to the heater flap actuator on the blower motor. (A 'T' joint has been fitted).

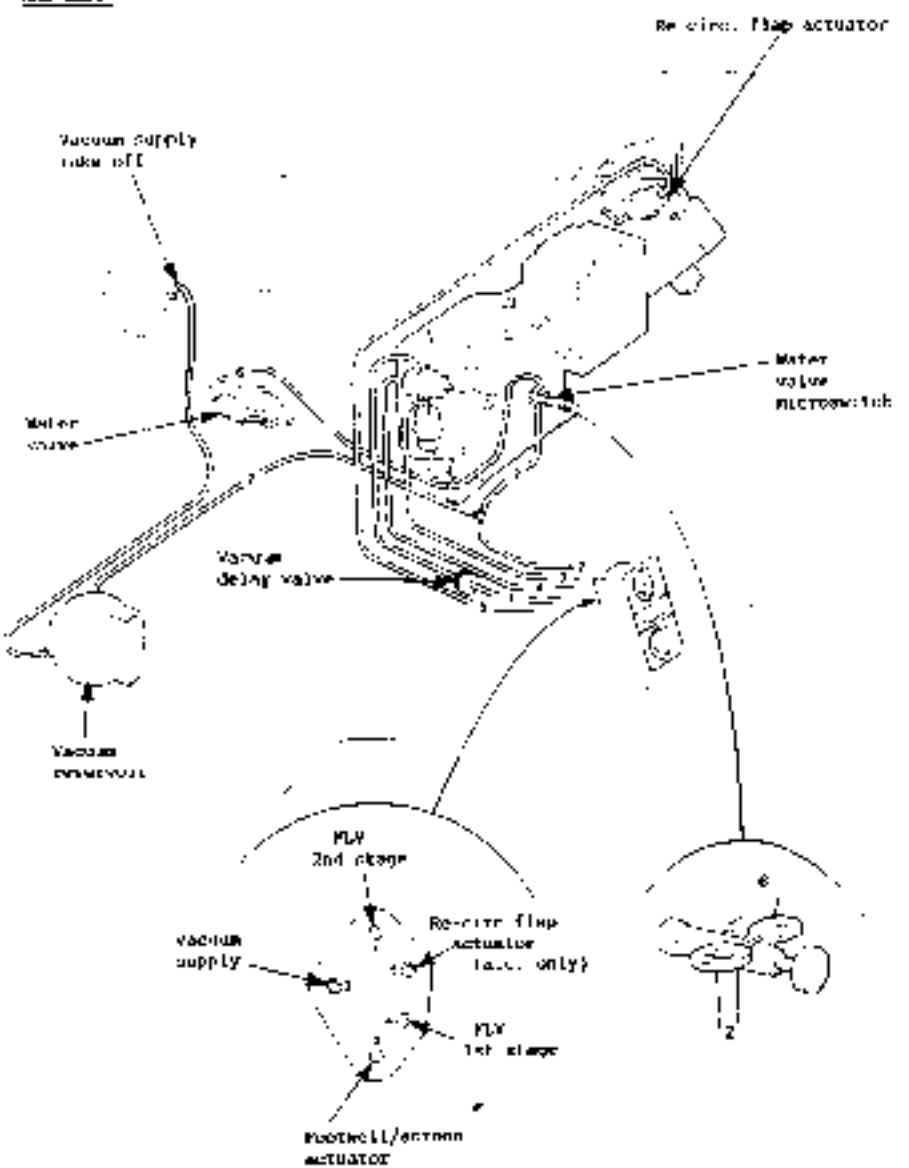
Hose B6: Water valve. Runs from the sideways facing port on the water valve (attached to the bulkhead) to the water valve at the rear of the engine bay.

To start / close completely the system:

- Activate PTO (ON). Runs from the vacuum take-off port on the rear of the gearbox body, to the left hand port (marked 'vacuum') on the vacuum reservoir mounted at the rear of the left hand front wheelarch.

Vacuum Connection Diagram: Propellor distribution control

130 Estar



2.4 - REFRIGERANT HANDLING

Some refrigerants used in the air conditioning system to freon 12 are the following precautions MUST ALWAYS BE OBSERVED:

1. Wear safety goggles and rubber gloves when handling refrigerant and lubricants. Refrigerant can cause severe injury or permanent eye damage if it comes in contact with the eyes. Refrigerant (or evaporating liquid) should be prevented from coming in contact with the skin or clothing. If refrigerant comes in contact with the skin or clothing, immediately wash affected area with large amounts of cold water. Do not rub affected area. Do not apply hot water or heat to affected area. Refrigerant may cause frostbite. Call a physician immediately.

2. Do NOT discharge refrigerant vapour into a enclosed area where there are open flames. Heavy concentrations of refrigerant when exposed to open flame (like a propane torch, welding arc, etc.) create poisonous gas (phosgene gas).

3. Do NOT heat refrigerant containers above 125°F (52°C). Do not store containers in direct sunlight or in an area where they can be heated by steam pipes or radiators.

4. Do NOT transport tanks of refrigerant in the passenger compartment of a car.

5. Do NOT expose refrigerant drums to high temperature.

6. Do NOT weld or steam clean on or near lines containing any part of the air conditioning system.

7. Do NOT use R-12 in systems designed for liquid refrigerant - ALWAYS wear safety goggles when handling refrigerant.

2.5 - PREVENTING ATMOSPHERIC CONTAMINATION

The following precautions must be observed when working on any part of the refrigerant circuit. Before disconnecting any refrigerant circuit, the system must first be thoroughly evacuated. To avoid discharging refrigerant into the atmosphere, a refrigerant recovery/recycling station should be used whenever possible. If one is not available, proceed as follows:

1. ALWAYS WEAR SAFETY GOGGLES WHEN WORKING WITH REFRIGERANT CONNECTIONS. Cover entire connection at the service valve with a cloth to protect from spray, and loosen the connection SLOWLY. Slowly open any pressure relief to bleed off system slowly. Keep cloth moist with refrigerant oil. Tighten connection when pressure has been relieved approximately 2 or 3 minutes.

2. Plug, cap or tape all openings immediately when they are opened to prevent the entrance of moisture and/or dirt.

3. All refrigerant containers and tools must be carefully handled and should only be opened IMMEDIATELY PRIOR TO FILLING. DO NOT ALLOW CONTAINERS TO BECOME WARM AFTER OPENING, as pressure will increase which may occur when the container is removed.

4. The evaporator should be the LAST component to be connected, to ensure proper dehydration and maximum moisture protection of the system.

5. All lines should be routed with consideration to, before making any connections, as this will aid sealing.

6. Great care must be taken to prevent damage to the aluminum and

connections. Whilst due to the high pressures involved, a leak can be caused by the slightest imperfection. Always use the spanner on the correct size when tightening or loosening any pipe joint so that the fixed part of the union may be prevented from turning and damaging the component. This is especially important with the aluminium condenser.

7. All pipes and hoses must be free from any kinking, the efficiency of the system can be reduced by a single kink, or restriction. Flexible hoses should not be bent to a radius which is less than ten times the diameter of the hose.

12.1 - EVACUATION & CHARGING PROCEDURE

SPECIFIED REFRIGERANT CHARGE 795 + 55 GRAMS (28 ± 2 OZ)

When carrying out charging and evacuation of the system the directions of the manufacturer of the charging trolley should be used in conjunction with the following:

1. Check that all valves on the gauge set are closed.

2. Connect the charging hoses to the suction (low) and discharge (high) service valves, it is found at the left hand front of the engine bay:
   - The red pressure hose (1/4" UNF) is fitted to the pipe between evaporator and compressor.
   - The high pressure (round) hose valve (1/2" UNF) is fitted to the pipe between condenser and compressor.
   (Check the chart or hand book). DO NOT USE FILTERS.

3. Start the vacuum pump, and open the valve to the vacuum pump fully, slowly open the low side manifold hand valve. The low side gauge should pull down to vacuum (approx. 30 ins) and the high side gauge should be slightly below the zero index of the gauge. If the high side does not register, check the system for blockage or leak. Refer to steps 10 and 11.

4. After running the vacuum pump for five minutes, close the valve to the vacuum pump and switch the pump off. If one is prepared to stand, proceed to step 5. If however the vacuum reading indicates a leak is indicated. Repeat to step 1, the leak testing procedure.

5. After evacuating the system for 30 minutes, close both the low and high hand valves, close the valve to the vacuum pump, then stop the vacuum pump.

6 REAR SAFETY GOGGLES

7. Open the centre charging hose to the charging cylinder at the gauge. Open the tap at the bottom of the charging cylinder. Do not open the low and high side hand valves on the manifold gauge at this time.

8. Take note of the level of liquid R12 in the charging cylinder.

9 DO NOT START THE ENGINE

10. Purge by charge the system with 200 grams of R12 by slowly opening the high side manifold hand valve. Close the valve when this is completed. Leak test

the system (see next step). If no leak is found, proceed with the charging.

[illegible] **LEAK TEST:** With pressure in the system, check the complete system for leaks using a suitable leak detector.
NOTE: When checking joints on the lower hoses, place the leak detector probe below the suspect area as the gas is heavier than air.
Rectify any leaks before proceeding with charging the system.

Open high side hand valve. Allow liquid refrigerant to enter the system as necessary, but do not exceed the specified charge. When flow stops, close the high side hand valve.

[illegible] Rotate the compressor by hand for [illegible] revolutions to ensure no liquid refrigerant is trapped in the suction side of the compressor. Failure to perform this check may result in damage to the compressor.

[illegible] Start the engine, [illegible] and switch the blower fan to full speed.

With the engine running [illegible] complete the charging of the system by slowly opening the low side [illegible] hand valve until the specified amount is in the system.
CAUTION: Do not allow more than [illegible] kPa ([illegible] psi) to register on the low pressure gauge.

[illegible] Check for correct discharge, suction pressures and evaporator outlet temperature [illegible]. If the system is operating satisfactorily, close the [illegible] valve [illegible] high side gauge hose, and run both high and low [illegible] until the pressures equalise. When pressures are equal, close both hand valves and remove the hoses from the service ports [illegible].

[illegible]

WARNING: NEVER RUN THE COMPRESSOR WITHOUT REFRIGERANT IN THE SYSTEM, OR THE COMPRESSOR WILL BE DAMAGED.

[illegible] COMPRESSOR OIL

The internal moving parts of the compressor are lubricated by refrigerant oil. This is a special oil which has an affinity with the refrigerant, and a proportion of the oil circulates with the refrigerant. [illegible] If the correct procedure for system depressurisation and recharging is followed, [illegible] oil will be lost from the system during these operations. If, however, the system suffers a major leak or sudden depressurisation, some of the oil held in suspension will be lost as the refrigerant escapes. If a refrigeration component is to be replaced, the removed [illegible] will retain a certain amount of oil, and a corresponding amount of new oil must be added to the system to compensate (see table).

Oil Level Check
In order to gauge the quantity of oil in the system, it is necessary to remove the compressor from the vehicle, and drain and measure the oil from within the compressor. Before doing so, it is preferable first to run the system for several

running to ensure that the oil is distributed around the system in the normal manner.

If possible, check that the system is fully charged with refrigerant, and then run the engine at idle speed for 15 minutes with the air conditioning switched on, and the blower fan set at full speed.

2. Depressurise the system, and remove the compressor from the engine (see section PL.[illegible]).

Remove the oil drain plug from the back of the compressor, and drain the oil into a graduated glass. Refit the drain plug using a new 'O' ring, and tighten to [illegible].

3. [illegible] the sump from the compressor body, and dependent on whether or not it was possible to run the refrigeration system prior to this stage (step 1), add new refrigerant oil as follows:

i) System run prior to check

Oil Collected Amount	Refill Amount
More than [illegible]	Same as collected amount
Less than [illegible]	[illegible]

TABLE 1

Refit the oil filler plug using a new 'O' ring, and tighten to [illegible] Nm. Refit the compressor (see section PL.[illegible]).

ii) System was not run prior to check

Collected Amount	Refill Amount
More than [illegible]	Same as collected amount
Less than [illegible]	[illegible] see below

TABLE 2

Refit the oil filler plug using a new 'O' ring and tighten to [illegible] Nm. Refit the compressor (see section PL.[illegible]). Carry out this complete procedure again, starting by running the system as in step 1, and using table 1 to check the oil quantity.

Refrigerant Oil Specification

Use only a high quality refrigerant oil of viscosity 200 SUS/100°F

Component Replacement

If a system component is to be replaced, refrigerant oil in the following quantities must be added to the component before fitting:

Evaporator [illegible]
Condenser [illegible]
Receiver drier [illegible]

Compressor New compressors are supplied with 100 oz (2.8 litres) of oil already installed. Drain this oil, and refill with oil of specification and quantity drained from the old compressor (see Section C) as detailed above.

In all cases, if a system failure resulted in a sudden pressure drop, remove the oil filler plug and check that oil is still visible in the sight glass. If the oil level is low, top up with oil of the correct specification and quantity (see Section C).

Oil pump

The compressor is driven by the belt and flange at the cylinder block end, or driven by a multiple vee belt, shared with the PAS pump. See the relevant Workshop Manual for details of how to adjust the belt tension.

- Tighten the pump belt at the top of the PAS mounting bracket, and the two pivot bolts (one on the other side).
  Move the pump bracket to achieve the correct belt tension of 10 - 15 mm deflection midway between the pulleys.
- Tighten the alternator mounting bolts to the specified torque.

The compressor and clutch assembly constitutes a non-serviceable assembly. If the unit is suspected of a problem but it could not be faulty

Compressor failure

1. If the compressor is particularly dirty then the system is likely to be contaminated with small metal shards.

2. Do procedure for any system that has failed and is under test here. Give the compressor a visual check for loose and warped parts.

3. Discharge the system by the evacuation station.

4. Remove the belt from the compressor clutch.

5. Remove the two bolts securing the shield, strap at the top of the compressor, and the single bolt from beneath the compressor, and remove the unit, unblocking the drive belt.

6. Remove the 'O' drain plug, and drain and measure the oil quantity.

Compressor Oil Flush

New compressors are supplied with 100 oz (2.8 litres) of refrigerant oil and require none. Before fitting, slowly release the hydrogen gas from both the origin and discharge ports. Drain the oil and refill as detailed in Section C.

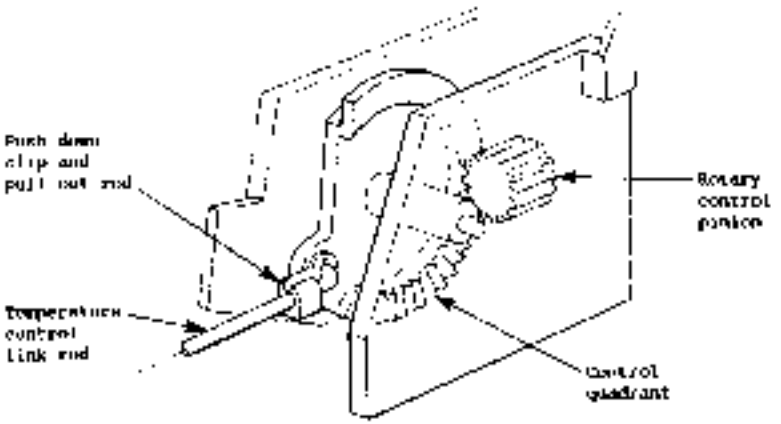
Should the compressor be severely damaged on removal, unique lights (on the test equipment) will be illuminated. Check the drive belt tension as above.

Clutch - Electric Coupling (AAU)

To remove the climate control panel, consisting of the distribution control, heated screen and heater fan switch, the fascia mask must be removed:

1. Use the retainer tools to release the fascia at, and to remove the metal trim, grommet, and screws, and remove and cast loose.

3. Loosen the glovebox strap fasteners, and allow the glovebox to swing down fully. Feed the glovebox harness, reach behind the climate control panel, and unclip the temperature control link and from the control quadrant. Also pull out the vacuum pipe connector plug from the rotary control.



4. Remove the steering wheel. **For USA vehicles fitted with a Supplementary Inflatable Restraint (S.I.R.), see Service Notes Manual M8 for precautions and procedure for removing the steering wheel. For all other vehicles:**
   - press the horn pad and rotate it counterclockwise to release the bayonet type fixing.
   - remove the nut and washer retaining the steering wheel. Mark the relative positions of the wheel and inner column to aid refitting.
   - pull the wheel off the column using minimal 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 renewal.

5. Remove the column cowls. Press down the 2 retaining tabs securing the column switches, and slide the switches out of their carrier bracket.

6. 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.

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

8. 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.

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

2. Undo the screws securing the rear console panel, remove the removal instructions, and lift the rear console panel.
3. Undo the screws securing the radio, and the screws provided by the glovebox assembly to secure the upright on the back of the radio release with the support bracket and lift the radio out of the centre console.
4. Undo lighter the steering wheel nut (~ 60 Nm (50 lbf.ft)).

5. The temperature control link rod has been replaced or disconnected from the heater flaps lever, proceed as follows:

Feed the rod through the hole in the centre brace, and fit to the temperature control quadrant.

Turn the control to fully cold.

Move the flap lever fully forward (micro-switch operated), and move the forward end of the link rod into the plastic clip. Secure by pushing the snap-on cap of the clip on to position.

[illegible] INTERCOOLER ASSEMBLY

[illegible] intercooler assembly consists of the air intake duct at the front, between and [illegible] the front grille. The unit is held [illegible] and to the [illegible] orientation in right and left hand drive cars. In order to [illegible], the flap valve is fixed so as to prevent [illegible] intake duct. [illegible] Stevens cars equipped with air conditioning [illegible] to either a [illegible] air intake, or close off the open end and [illegible] unit. The control position is [illegible] with air conditioning [illegible] operation, but may be used to close off the air intake [illegible] engine running [illegible]. The flap is operated by a [illegible] mounted on the rear side [illegible] 15).

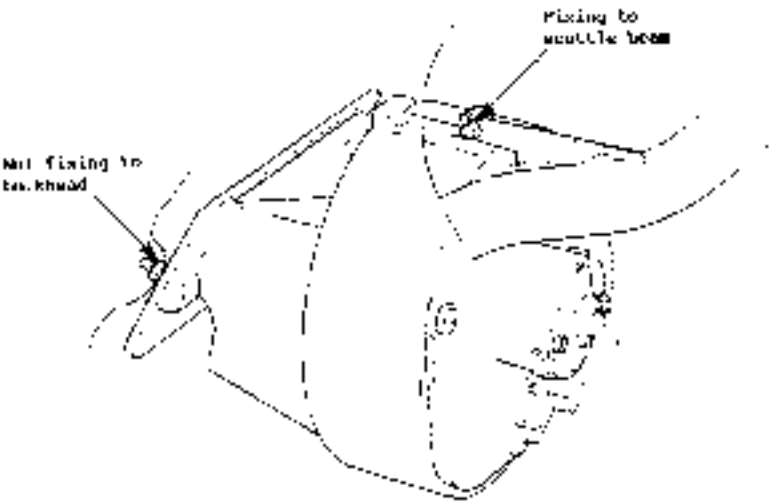
1. Remove the air intake duct assembly.

Remove the rear fascia [illegible].

Remove the [illegible] the radio mounting [illegible] and [illegible] the [illegible] of the [illegible] and weatherstrip.

[illegible] lower the lever motor and position brake. On a/c cable, pull off the [illegible] vacuum hose.

4. Release the two nuts securing the unit to the bulkhead at each side of the air brake adaptor.



5. Release the single fixing, [illegible] the top of the unit to the saddle beam, then withdraw the lever assembly from the [illegible] bracket. Disengage the [illegible] of the operating rods and collect the [illegible] (major cars)

[illegible] the pin of the reverse order to removal.

[illegible] SUBASSEMBLY

The [illegible] assembly comprises the lever pivot with operating rods. Fitted [illegible] between the lever unit and heater distributor housing. For [illegible] the adaptation to operation remove the unit must be removed from the car.

To remove the component assembly:

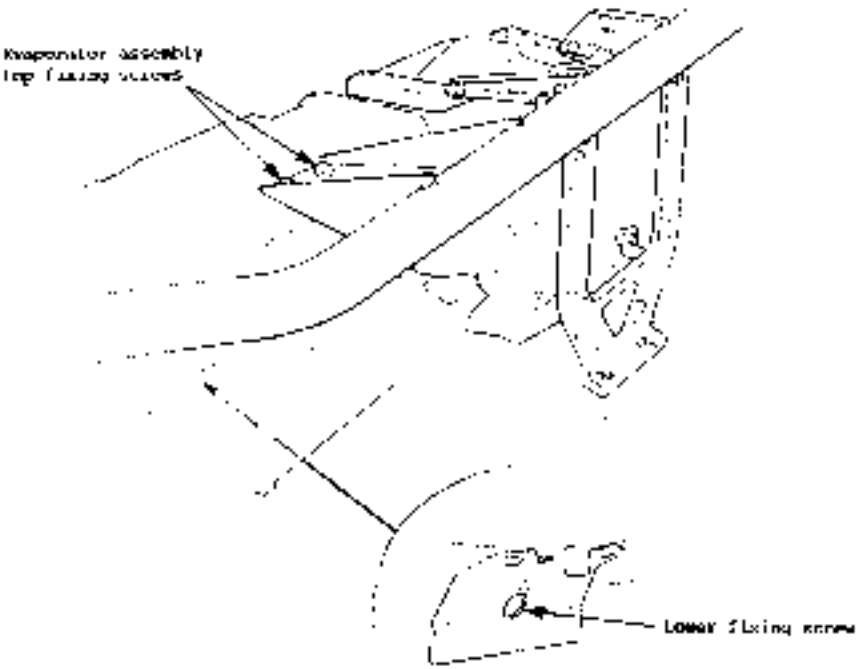
1. Remove the main heater [illegible] section (21).

Remove the air [illegible] lower assembly (see above).

Drain the cooling system (see section PE 5).

4. Using two spanners on nut [illegible], disconnect the two hot pipes from the [illegible] at the back of the engine.

- Disconnect the thermostat, inlet to evaporator drain tube.
- Unscrew the lower fixing bracket from the bulkhead, and the two fixings securing the top of the unit to the scuttle beam, and withdraw the assembly from the heater/distribution unit.



- If necessary, separate the two halves of the casing for access to the evaporator or expansion valve. Take care not to damage the capillary tubes from the thermostat or expansion valve.

To re-assemble and refit the unit, reverse the removal procedure, using the following points:

- When re-fitting the expansion valve, use a new 'O' ring coated with refrigerant oil on each connection, and torque tighten to:
  - Inlet 2.5 - 3.5 Nm (2 - 2½ lbf.ft)
  - Outlet 20 - 27 Nm (15 - 20 lbf.ft)
- Align the expansion valve capillary tube neat to the evaporator outlet pipe, and bind with grip tape.
- Ensure that the evaporator is secure in the recess by the foam strips.
- Refit the thermostat to the casing and ensure that the capillary tube is clear of any obstructions.
- Arrange tighten the unit inlet connection to 25 - 30 Nm (18 - 22 lbf.ft).
- Torque tighten the unit outlet connection to 24 - 30 Nm (18 - 22 lbf.ft).

PC.1.2 Heater/distribution unit

The heater/distribution unit consists of a GRP moulded casing containing the heater matrix and two air mixer flaps, and a distributor chamber with four flaps. The vacuum servomotors for the two distribution flaps are mounted on the side of the unit. To gain access to the heater matrix, the unit must be removed from the car.

To remove the heater/distribution unit:

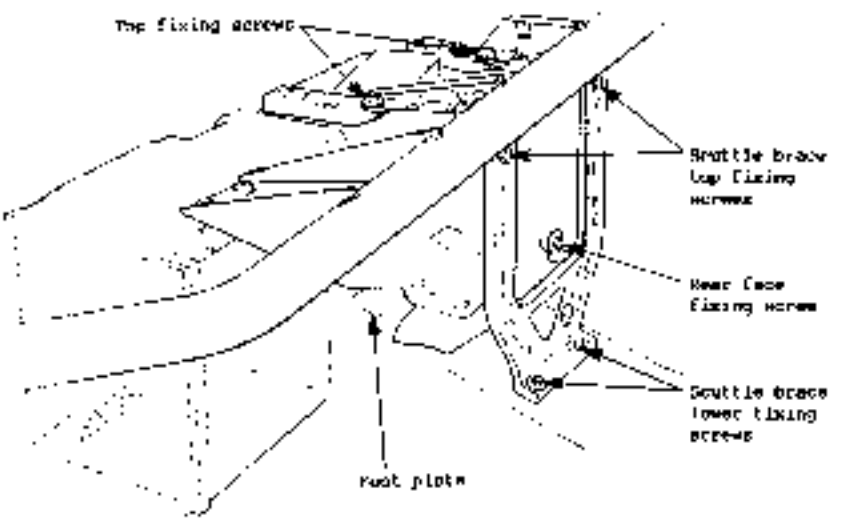
1. Drain cooling system, and disconnect the two heater hoses from the rear of the engine bay.

2. Remove the rain drain tube section (1).

3. Remove the centre console, access to the outlets on the distribution housing, and the cabin light. Remove the rear seat cushion.

4. Disconnect the vacuum pipework between the two diaphragm servomotor actuators, the vacuum supply pipe from the 'T' piece, and the pipe between the diaphragm chamber and the water valve.

5. Release the fixing screw securing the rear face of the unit to the scuttle frame. Release the three fixings securing the scuttle brace. Release the two fixings securing the body to the scuttle beam, and the two fixings securing the brace to the chassis tunnel, and withdraw the brace.



6. Release the two fixings securing the top of the casing to the scuttle beam, and withdraw the unit from the bulkhead and evaporator housing.

7. To remove the heater matrix from the housing, release the foot plate and clamp bracket from the underside of the unit, and release the operating arm

If the lower flap sticks, release the screw securing the motor bracket, pull it clear and withdraw the motor from the case.

When refitting the motor or fan, ensure that the motor or fan is correctly seated.

The illustration of the two air nozzles shows the relative positions required for each system. However, if the heater distribution is found to be unsatisfactory, the nozzles may be changed or adjusted as follows:

Pull the appropriate hose from its nozzle and if the hose does not have both flaps fitted to it, loosen and retain the end nut on the hose.

Carefully lever the nozzle from the hose and refit as required.

Refit the retaining nut onto the hose and refit the hose.

Refit the heater air intake housing in the reverse order to removal. After refitting the fan, switch on the heater blower motor and check for correct operation of the heater/demister control (see 2B-2).

CLUTCH

SECTION CD - PLAN

CLUTCH - GENERAL DESCRIPTION

The driving element of the clutch assembly consists of the rear face of the engine flywheel and a pressure plate fixed to the flywheel via the spring diaphragm clutch cover assembly. The driven element is a single, dry, double sided friction plate, splined to the gearbox input shaft, and interposed between the flywheel and pressure plate. The diaphragm spring in the clutch cover clamps the friction plate between the pressure plate and flywheel to provide the drive connection between engine and gearbox. The gearbox input shaft, on which the friction plate is free to slide axially, is 'overhung' from the gearbox, with no spigot bearing in the rear end of the crankshaft.

The clutch release mechanism uses a control cable to connect the clutch pedal to a lever arm in the transmission. The lever arm pivot shaft which is fixed, inside the clutch housing, a release fork which in turn, presses a ball bearing race against the inner ends of the fingers of the diaphragm spring. This action causes the diaphragm fingers to pivot about their fulcrum, and relieve the clamping force applied to the pressure plate via the diaphragm outer edge. The release bearing slides on a guide sleeve which surrounds the gearbox input shaft.

CLUTCH - CLUTCH CABLE

The clutch cable connects the pedal, with a lever arm on the clutch housing, with rubber grommets used at each end of the outer cable abutments to reduce the transmission of powertrain noise into to the cabin via the cable. In later cars, a further reduction in transmitted noise is achieved by the inclusion of a mass damper - a steel block - at the transmission end of the cable. The cable is nylon lined and requires no lubrication. At service intervals, the clutch cable should be adjusted to provide the specified amount of free play at the lever arm. As the friction plate wears, the free play will be reduced, and it incorporates allowance to safe, clutch slip will possibly result as a consequence of a permanent force applied to the release mechanism.

Introduction of clutch cable Mass Damper

All cars built from approximately December 1990 onwards are fitted with a lengthened clutch cable to accommodate a mass damper at the transmission end. The damper is a mild steel block which grips the clutch cable outer via a rubber sleeve. The inertia of the block is used to damp out the high frequency vibrations transmitted from the power unit to the cabin via the clutch cable.

If replacing the clutch cable, first determine whether a mass damper is fitted (see illustration). If no damper is fitted, use the 'B' level cable:

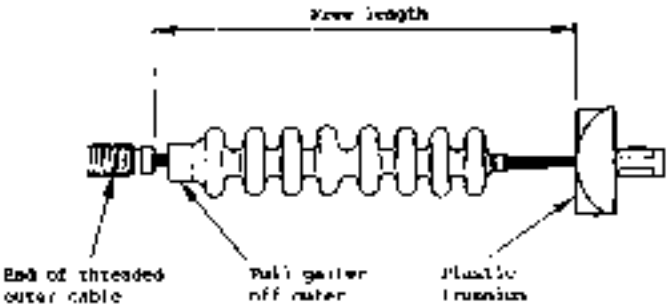
Clutch Cable, RHD	RTC6669B
Clutch Cable, LHD	RTC6669BF

When stocks of these cables are exhausted, it will be necessary to fit the longer 'A' level cable together with the damper and sleeve:

Clutch Cable, RHD	RTC6669A
Clutch Cable, LHD	RTC6669AF
Mass Damper, clutch cable	RTC6669AT
Rubber Sleeve, damper to cable	RTC6669BT

To identify a clutch cable, measure the inner cable free length at the transmission end (pedal end disconnected)

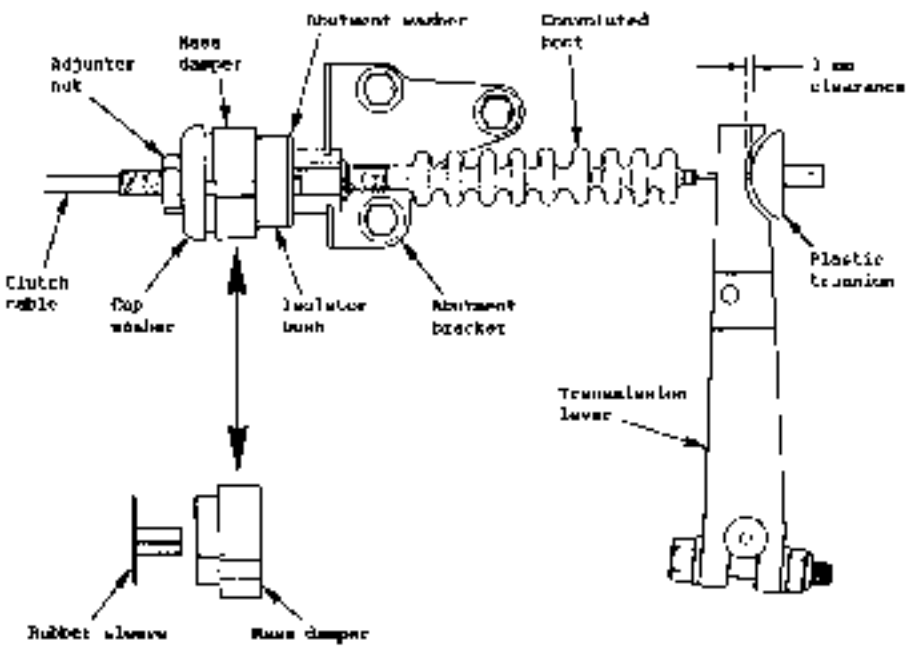
'B' cable free length -	RHD	115 mm approx.
	LHD	129 mm approx
'A' cable free length -	RHD	115 mm approx
	LHD	157 mm approx



Do Not the next damper

1. Pull the convoluted boot from the end of the outer cable threaded portion, and slide the retainer back off the thread.

2. Put the nose damper and rubber sleeve over the inner cable. Pull the sleeve into the damper before sliding the damper onto the threaded outer cable up to the cup washer. Push the insulator bush and abutment washer back onto the thread, and fit the cable into the trunnion or abutment bracket. Ensure that the tag on the cup and abutment washer fits into the slot in the bracket, and that the cup washer lug is up against a flat on the adjuster nut. Refit the rubber boot



To Adjust

Before adjusting the cable, first check that the clutch pedal upstop is adjusted so as to allow similar pedal heights of clutch and brake pedals.

Pull apart by hand, the plastic trunnion and the transmission lever, and measure the clearance which should be 3 mm. If necessary, adjust the clearance by pulling the outer cable and adjuster nut clear of the cup washer tag, and turn the nut as required. After adjustment, ensure that the nut sits firmly against the cup washer with the tag against a flat, and that the tag on the locating bush abutment washer is engaged in the abutment bracket slot.

Cable Replacement

- Slacken the adjustment at the clutch housing abutment bracket to enable the inner cable to be unhooked from the clutch housing lever arm.
- Pull the retainer back and release it at the abutment bracket.
- Withdraw the cable from the clutch pedal, and withdraw the cable through the bulkhead.

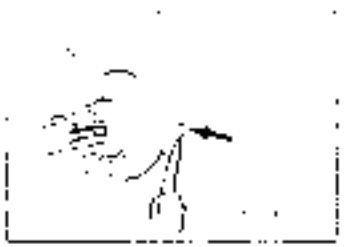
To refit a cable, reverse the removal procedure, and apply a small amount of multi-purpose grease to the eye at the pedal end of the cable. Adjust as above.

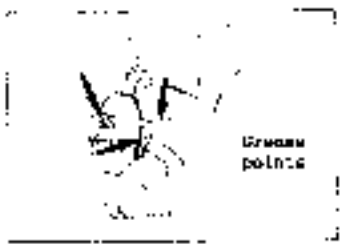
L10.1 - RELEASE BEARING & FORK

For access to the release bearing and fork, the transmission must be removed from the vehicle - see Section FF.

Release Bearing

Withdraw each end of the spring clip from the release fork, and slide the release bearing off the guide tube. Check the bearing for excessive play, roughness, noise or any other signs of undue wear, and replace if in any doubt.





On re-assembly, apply a light smearing of high temperature grease, Esso Unirex N3 (AY26009/3), to the input shaft splines, release bearing sliding surfaces and the contact faces at the ends of the forks. Fit the retainer spring around the release bearing groove, with the ends of the spring angled towards the gearbox casing. Fit the release bearing over the guide tube with the spring 'wrap' away from the fork shaft, and the tabs of the bearing against each fork lug. Hook the ends of the spring into the fork lug holes.

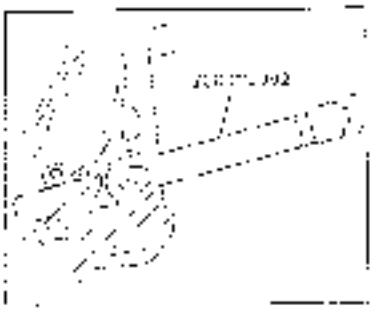
Release Fork

The release fork is retained with its shaft, and is removed as follows: Remove the release bearing (see above).

Remove the operating arm from the splined end of the release fork shaft, pull

Lift the dust cap, and prise out the clutch shaft seal. Use the special tool or a suitable tube to knock the shaft bush along the shaft and into the housing. Remove the shaft spring and withdraw the shaft from within the housing.

Clutch shaft bush inserter/replacer
T0K0D492



To replace: Apply high temperature grease to the bearing surfaces of the shaft and bore. Insert the shaft into the housing for the inner bush. Insert the spring over the shaft end, and fit the shaft into the end bush. Use tool T0K0D492 to fit the outer bush into position, followed by the seal. Fit the dust cap and operating arm, noting that the arm may be fitted in one position only. Torque tighten the arm pinch bolt to 20 Nm (15 lbf.ft)

Q0.6 - CLUTCH ASSEMBLY

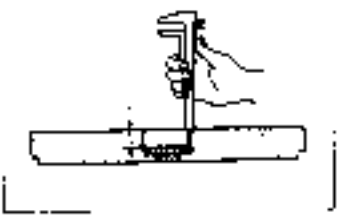
No access to the clutch assembly. The transmission must be removed from the vehicle: see transmission Section 37

The diaphragm pressure plate assembly is secured to the flywheel by six bolts, and located by three dowels. Release the fixing bolts evenly and progressively to prevent distortion of the clutch cover. Remove the cover assembly and remove (friction) plate.

Inspection

Inspect the condition of the clutch friction plate linings for wear, oil contamination or any other damage. Check for signs of excessive wear on the splines, and check that none of the cush drive springs in the drive plate hub are broken. If in doubt, replace the component

Lining pivot depth
new: 1.3 - 1.5 mm
- service limit: 0.2 mm



Inspect the condition of the bearing surfaces on the flywheel and pressure plate, and renew the component if there is evidence of excessive wear, scoring, or other damage. If there are any signs of overheating (blue or excessive discolouration), check the flywheel face for signs of cracking. Inspect the condition of the friction surfaces. Distortion is likely to have occurred, and weakening of the diaphragm spring. Replace the clutch cover assembly, and check the runout of the flywheel face.

To Replace Flywheel

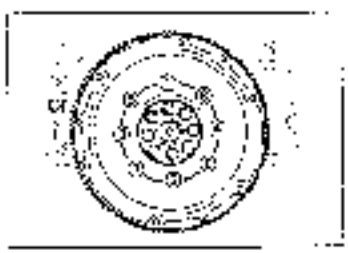
i) Release the six bolts, and remove the flywheel from the crankshaft.

ii) Thoroughly degrease the threads in the crankshaft, and the crankshaft and flywheel mating faces. Apply Loctite 262 or similar thread locking compound to the threads of NEW flywheel fixing bolts. Insert through the flywheel washer, and secure the flywheel to the crankshaft.
Note: Do not apply an excessive amount of sealer to the bolt threads, as the resultant surplus may contaminate the bolt seating face and cause the bolt to work loose.

iii) Hold the flywheel from turning, and tighten the fixing bolts in a diagonal sequence to the specified torque in 2 steps using the angular tightening method as shown in the table

Flywheel bolt tightening.

1st step	2nd step
90 Nm (22 lbf.ft)	45° - 60°



To Refit Clutch Assembly

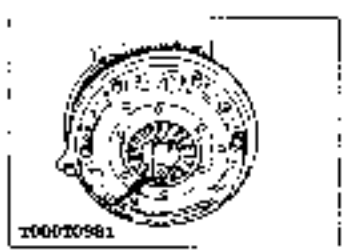
- Check that the plastic plug used for locating the clutch alignment mandrel is fitted into the rear end of the crankshaft.
- Fit the friction plate, the correct way round, to the flywheel, and retain with the clutch cover assembly.

NOTE: Note the friction plate and cover assembly differ for N/A and Turbo models. Check that the correct parts are fitted:

Identification			
Friction plate	N/A	215 mm o/d	
	Turbo	225 mm o/d	
Cover assembly	N/A	90448188	(340 kgf)
	Turbo	90448112	(400 kgf)

- Fit the clutch alignment mandrel through the friction plate and into the crankshaft plug, and tighten the six clutch cover fixing screws evenly and progressively to 19 Nm (14 lbf.ft). Remove the mandrel and leave the crankshaft plug in place.

Clutch alignment mandrel T00070981

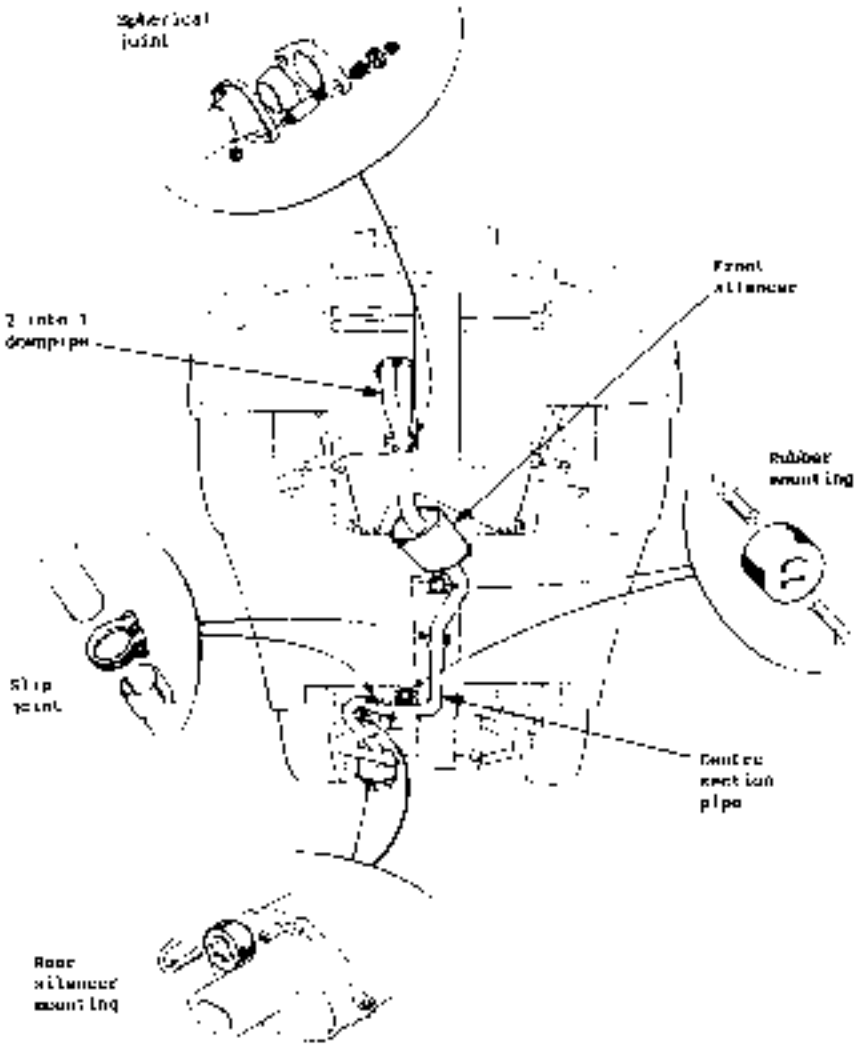


Refit the transmission assembly: see section PF.

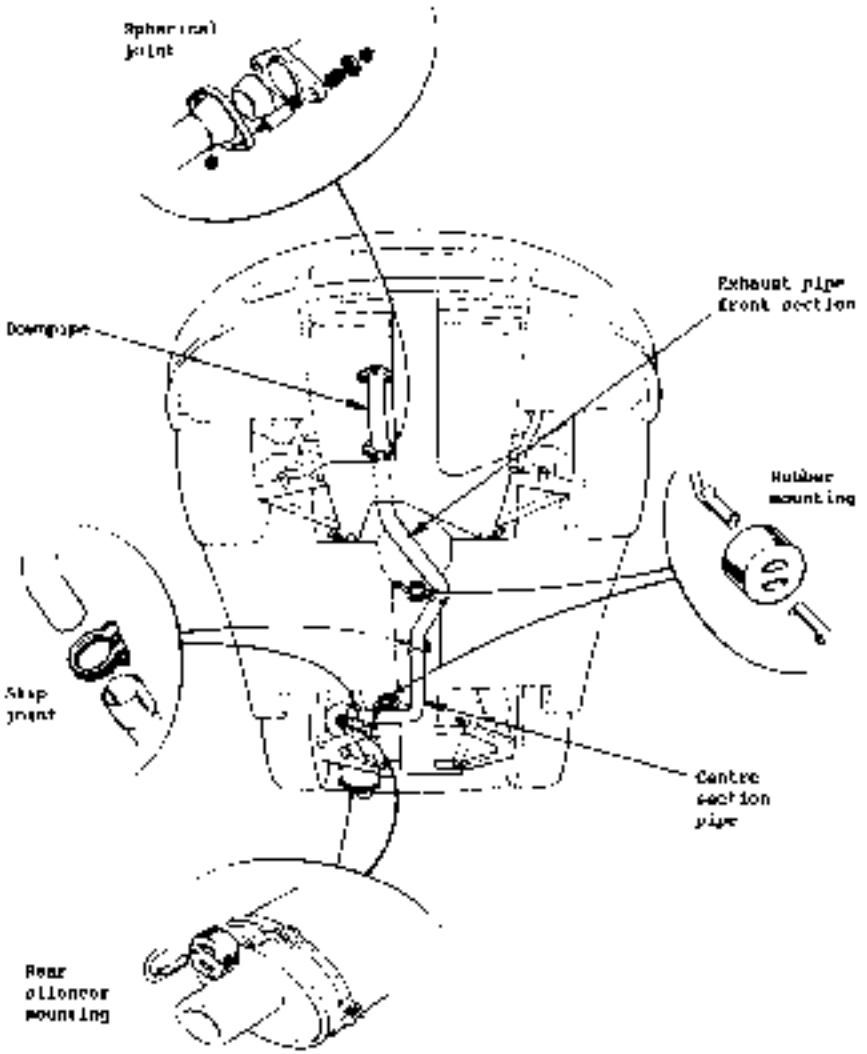
SECTION SD

EMISSION CONTROL - ELAN

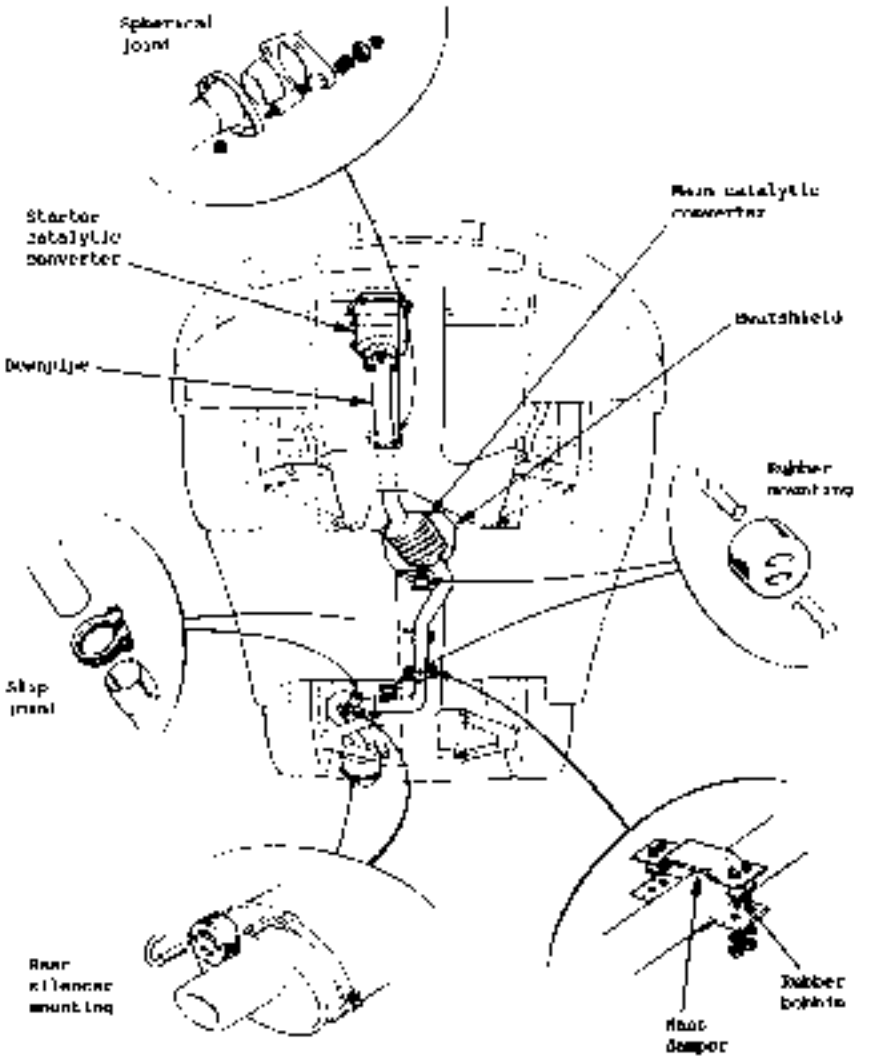
Naturally Aspirated Exhaust System



Non-Catalyst Turbo Exhaust System



Catalyst Turbo Exhaust System



SU 1 - GENERAL DESCRIPTION

There are three variations of exhaust system dependent on model:
i) Naturally Aspirated
ii) Non-Catalyst Turbo
iii) Catalyst Turbo

Naturally Aspirated

- The cast iron exhaust manifold bolted to the front of the engine, collects exhaust gas from cylinder head ports 1 & 2, and 3 & 4, and maintains pulse stream separation to the downpipe flange.
- A two-intermix downpipe bolts to the manifold flange, loops under the engine sump, and terminates at the back of the engine in a two bolt flange.
- A front silencer section bolts to the front pipe via a spherical joint which uses a fibre and steel wool moulded sealing ring between the spigot on the downpipe, and the shaped end of the front silencer pipe. The joint is sealed by the pressure exerted by a coil spring fitted over each of the two shouldered studs fitted to the silencer pipe flange. The front part of the silencer pipe runs above the engine bay undertrays, and is formed into a 'U' section at this point to provide sufficient clearance. The front silencer is a straight through absorption type.
- A centre section pipe uses a slip joint at each end to connect with the front silencer section and the rear silencer inlet pipe.
- The rear silencer inlet pipe runs over the right hand rear lower wishbone before passing the rear cross silencer. Each exit pipe exits through a slot in the rear valance. The baffle and absorption type rear silencer is similar to that used on Turbo models, but differs internally to provide the necessary higher degree of muffling.

For identification of the rear silencer, refer to the homologation number stamped on the underside of the casing, 88MM 5A5E-D1a

Aluminised mild steel is used for the manufacture of the entire system with the exception of some stainless steel internal parts of the rear silencer.

Non-Catalyst Turbo

- A cast iron manifold collects exhaust gas from the four cylinder head ports, and feeds into the engine bay side of the turbocharger. The outlet of the turbine housing, both main and wastegate, feed into a cast iron outlet elbow which connects with a stepped catalyst housing at the front of the engine. In non-catalyst versions this housing is an empty chamber supported by a bracket to the front of the cylinder block, and which terminates in a three stud flange.
- A downpipe bolts to the flange of the aforementioned housing, and loops beneath the entire sump to a two bolt flange at the back of the engine. On cars built from January 1991 onwards, a steel support strap is bolted between a lug on the downpipe rear flange, and the driveshaft tunnel bracket on the rear of the engine.
- An exhaust pipe front section bolts to the front pipe via a spherical joint which uses a fibre and steel wool moulded sealing ring between the spigot on the downpipe, and the shaped end of the front silencer pipe. The joint is sealed by the pressure exerted by a coil spring fitted over each of the two shouldered studs fitted to the front section pipe flange. The front part of the pipe runs above the engine bay undertrays, and is formed into a 'U' section at this point to provide sufficient clearance.
- A centre section pipe uses a slip joint at each end to connect with the front section and the rear silencer inlet pipe.
- The rear silencer inlet pipe runs over the right hand rear lower wishbone

before joining the rear section silencer. From rear tailpipe exits through a slot in the rear valance. The baffle and absorption type rear silencer is similar to that used on the N.A. model, but differs internally to produce less back pressure.

For identification of the rear silencer, refer to the homologation number stamped on the underside of the section. 60MSM 1099779

Stainless steel is used for the downpipe, with the remainder of the system manufactured from aluminised mild steel.

Catalyst type

- A cast iron manifold collects exhaust gas from the four cylinder head ports and feeds into the turbine housing of the turbocharger. The outlets of the turbine housing, both main and wastegate, feed into a cast iron collector which is attached to fifth pre engine management oxygen sensor which connects with a similar catalyst location in the front of the engine. This can form cylindrical housing contains the primary catalyst which by being close to the engine, heats up to operating temperature quickly, and in so doing helps the main catalytic converter to reach operating temperature quicker. A Japanese manufacturer. The bottom of the housing is fitted with a temperature sensor to warn against catalyst overheating. The housing is supported by a bracket to the front of the cylinder block, and terminates in a flanged flange.
- A downpipe helps to the flange of the primary catalyst housing, and feeds forward the engine down to a point just ahead of the back of the engine.

The main catalytic converter joins to the front pipe via a spherical joint which uses a clamp and steel, heat resisted sealing ring between the spigot on the downpipe, and the shaped end of the converter inlet pipe. The joint is sealed by the pressure exerted by a coil spring fitted over each of the two studs fitted to the converter pipe flanges. The first part of the pipe runs above the engine bay undertrays, and is formed into a 'U' section at this point to provide sufficient clearance.

The three way catalytic converter contains an oxidising catalyst, primarily in the presence of oxygen in the exhaust gas it oxidises HC (hydrocarbons) and CO (carbon monoxide) to water vapour and carbon dioxide. A reducing catalyst, rhodium, helps to remove oxygen from NOx (nitrogen oxide) to leave nitrogen. The converter reaches very high temperatures during operation, and is lined with a mat which on its underside to reduce the danger of glass fires. A heat shield also fitted to the chassis above the converter in order to protect the chassis and rear engine mounting from the effects of excessive heat.
- A centre section pipe uses a flat joint at each end to connect with the converter outlet pipe and the rear silencer inlet pipe. A vibration damper fitted to the middle of this pipe, takes the form of a steel plate mass damper mounted upon two thin but four rubber bobbins. The rearing straddle the exhaust pipe and bolt to a bracket welded to the pipe underside.
- The rear silencer inlet pipe runs over the tank here rear power windows to rear pipework. The rear section silencer, which exits tailpipe exits through a slot in the rear valance. The baffle and absorption type rear silencer is similar to that used on the N.A. model, but differs internally to produce less back pressure.

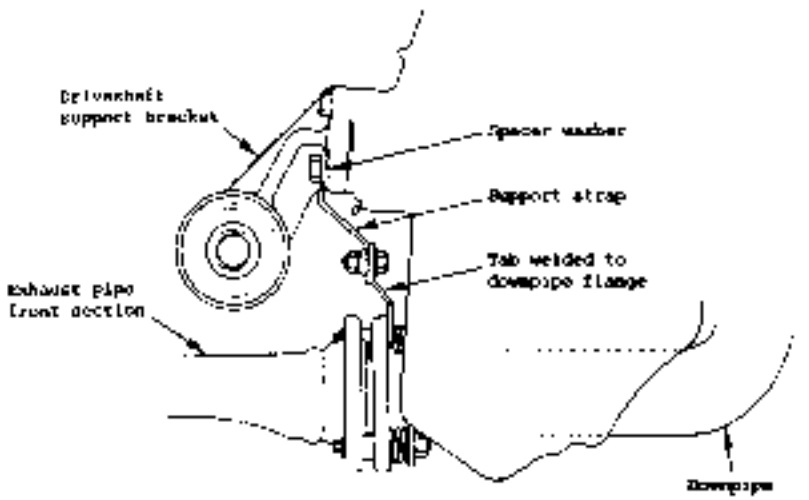
For identification of the rear silencer, refer to the homologation number stamped on the underside of the casing. 60MSM 1099779

Stainless steel is used for the downpipe and catalytic converter, with the remainder of the system manufactured from aluminised mild steel.

V6.0 - EXHAUST SYSTEM MOUNTINGS

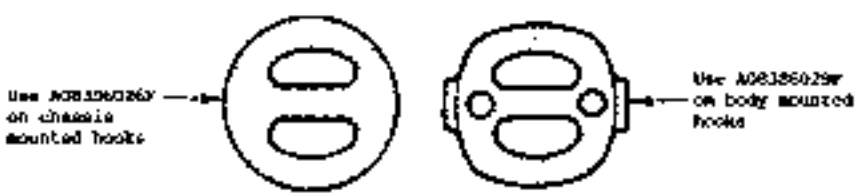
The exhaust system is flexibly suspended from the chassis/body unit by a total of four rubber mountings. These are located:
i) Towards the front of the chassis rail backbone;
ii) Just ahead of the rear wishbone front pivot point;
iii) Beneath the battery compartment;
iv) At the rear of the boot floor.

In addition, on non-catalyst Turbo models built from approx. January 1991 onwards, a support strap is fitted between a tab on the downpipe rear flange, and rear drive shaft mounting bracket on the back of the cylinder block.



The rubber mountings use wire rod hooks with load spreading saddles, welded to the exhaust pipe and chassis at the mounting points. At the rear, one hook is bolted beneath the battery compartment, using a pair of M6 studs welded to the battery retaining channel. The rearmost hook is bolted to a hanger in the boot floor (hook points forward), and picks up on a hook secured to the rear silencer box by a clamp bracket.

Note that two different types of rubber mounting are used, with A0815860267 used for the two chassis mounted hooks, and A0815860298 used for the two rearmost, body mounted hooks.

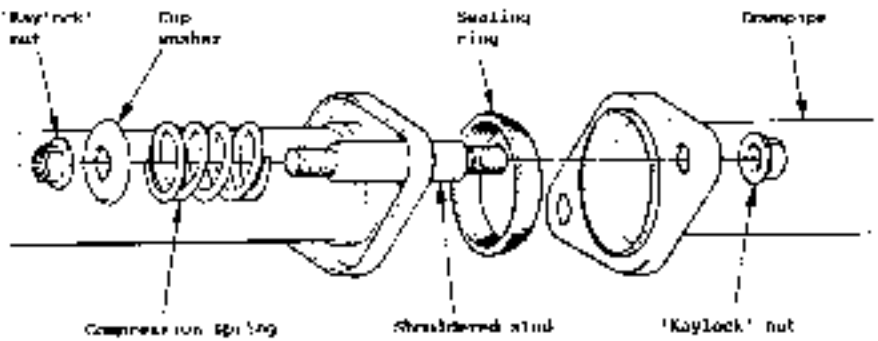


S12.4 CLAMPS & JOINTS

Spherical Joint

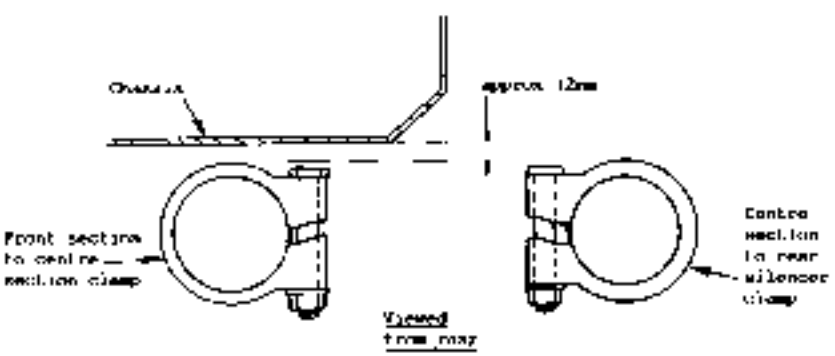
A spherical joint is fitted at the rear end of the downpipe both to ensure alignment of the exhaust system without strain, and to reduce vibration transmitted along the pipe. The joint is assembled as:-

- Fit the sealing ring over the spigot on the downpipe.
- Position the front silencer/rear section/tail pipe assembly, and support on the mounting rubber.
- Fit the two studs through the holes in the downpipe flange and secure to the opposite flange with 'Keylock' M10 nuts.
- Fit a cup washer and cap washer over each of the studs, and secure with another 'Keylock' M10 nut. Tighten the nuts fully to clamp the cup washers against the spherical seat on the studs.



Sleeve Joints

All pipe joints should be assembled using a proprietary exhaust paste. The MIG clamps should be positioned with the bolts vertical, and the bolt thread lightly greased with an anti-seize lubricant (Holts Hi-Tec). Do not tighten the clamp nuts until the exhaust system is fully assembled and positioned for optimum clearance to bodywork and suspension components.



S1.4 - HEAT SHIELDS

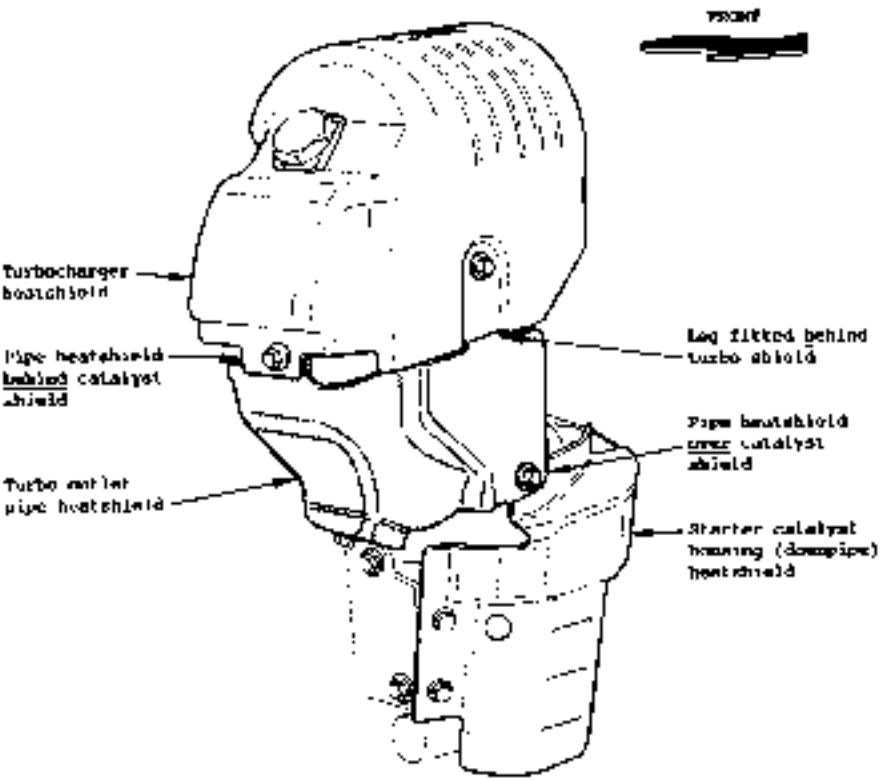
Engine Mounted Shields

On N.A. vehicles, the only exhaust system heat shields fitted are those mounted on to front of the exhaust manifold, both parts being secured to the manifold itself.

Turbocharged models use a three piece heat shield over the top, right hand and left hand ends of the exhaust manifold. A further three shields are used at the front of the engine:

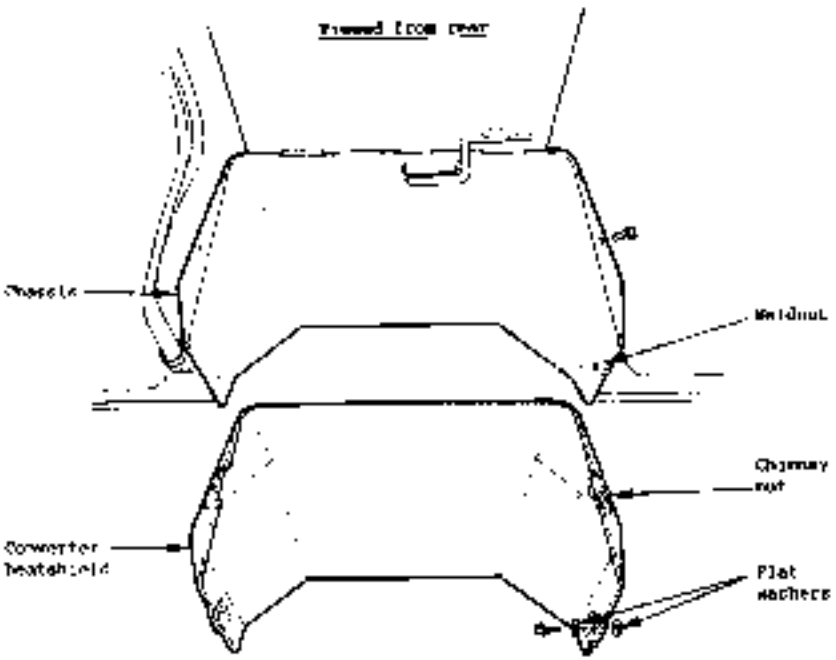
- over the top of the turbocharger,
- in front of the turbo outlet pipe,
- in front of the starter catalyst housing.

In order to avoid fatigue fracture, it is most important that these three shields are assembled correctly, especially where the turbo outlet pipe shield is secured to the other two shields. Refer to the diagram for the correct assembly sequence.



Catalytic Converter Heatshield

On cars with catalytic converters, a phenolic resin heatshield is fitted to the chassis above the converter to protect the chassis/body and rear engine mounting from the considerable amount of heat produced by the converter. The shield is secured by four fixings, the rear two using chimney nuts clipped to the shield, and the front two using bolts/nuts on the chassis.



INTERIOR TRIM

SECTION VD KLAN

V8.1 - DOOR TRIM PANELS

Note that it is almost always necessary to replace the interior door handle retaining clip each time the door trim panel is removed. To remove the panel:

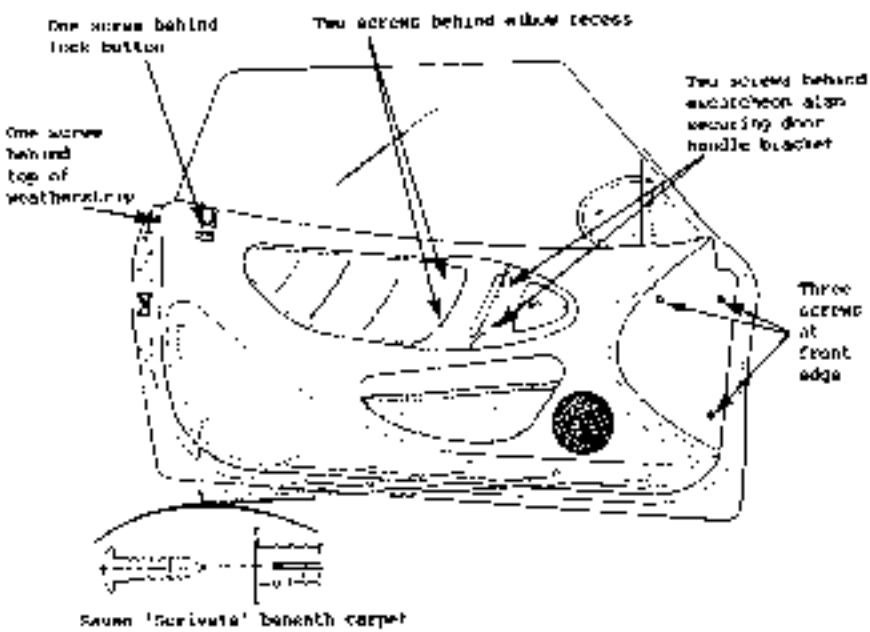
1. Raise the lock button, and prise out the orange clip retaining the button to the lock rod. Withdraw the button. Remove the trim panel retention screw from the lock button recess.

2. Remove the screw behind the interior release handle, and unhook the handle escutcheon from the trim panel. Via the aperture revealed, remove the two screws securing the release handle bracket and trim panel to the door shell.

3. Unscrew the inlay panel from the window recess in the door trim panel, and remove the two screws to the rear of the door pull to disc.

4. Peel off the self adhesive carpet from the lower part of the trim panel, and unscrew the inner fixings.

5. Carefully use a wedge to cut the adhesive and operate the two internal rear of the door weatherstrip seal to be pulled down sufficiently to release the single screw securing the rear edge of the trim panel. Release the three screws at the front edge of the panel, and withdraw the panel from the door.



To refit the door trim panel, reverse the removal procedure, noting the following points.

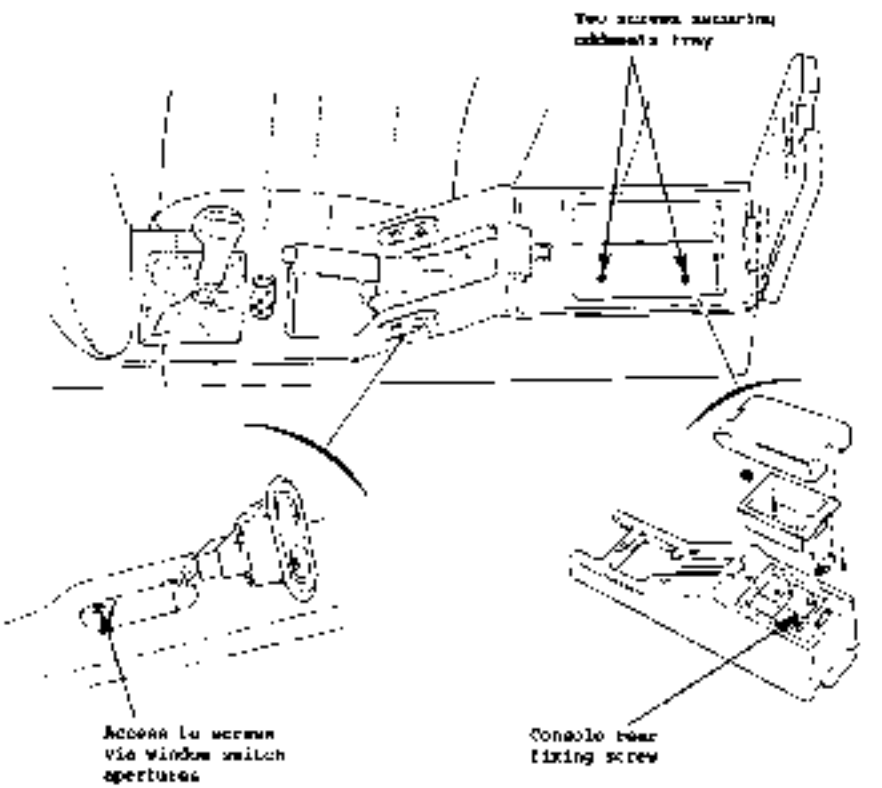
- Fit the top edge of the panel into position, with the door button lock rod through the locks aperture. From behind the panel, hold the rod in the fully raised position while the button is fitted and correctly positioned, before pressing the retaining clip to its home.

V10.2 - CENTRE TUNNEL CONSOLE

To remove:

1. Remove the filler panel between the rear of the tunnel console and the cabin rear wall by pulling towards them its two fir tree fasteners.

2. Pull out and disconnect the stereo control switch to the rear of the gear lever.



1. Pull out both switches at the two window switches. Each side of the parking brake lever, and release the two console mount fixing screws via the switch apertures.

2. Release the two screws securing the ashtray tray, and lift out tray to rear of the cubbi hole. Note the two console tray fixings via the tray apertures.

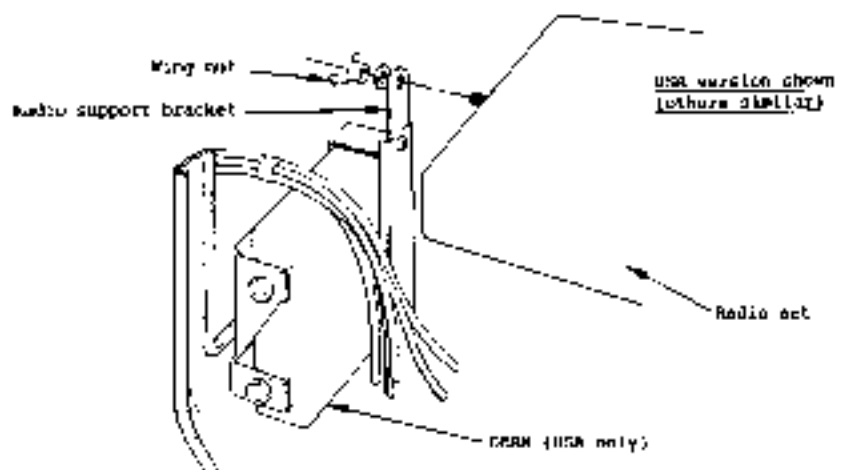
3. Pull the console to the rear to disengage the trapped lugs from the main fascia, and then lift the console over the parking brake lever.

Replace the console in the reverse order to removal.

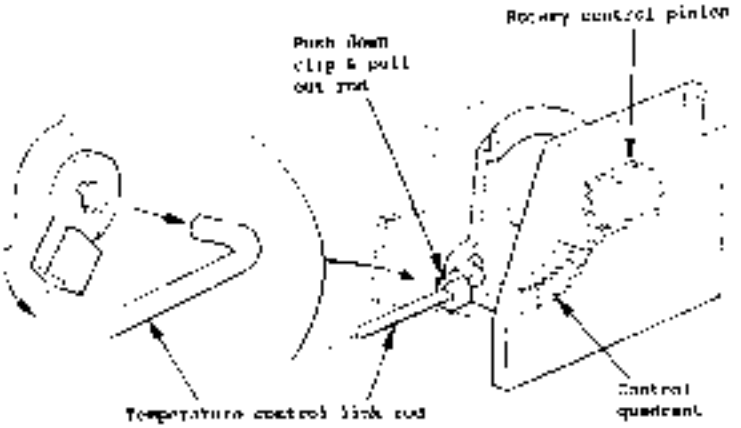
2. REMOVAL OF CENTRE FASCIA PANEL

The instrument/switch panel fixings are made via a bracket which attaches to the rear of the fascia panel and the panel is then slid out from the centre console.

1. Remove the gearstick gaiter, the glovebox, rear the glovebox operating mechanism behind the centre unit and release the wiring and washer operating the support arm set to the back of the cpl. Pull the release lever to withdraw the unit, and disconnect the aerial lead, speaker harnesses, and power and earth leads.



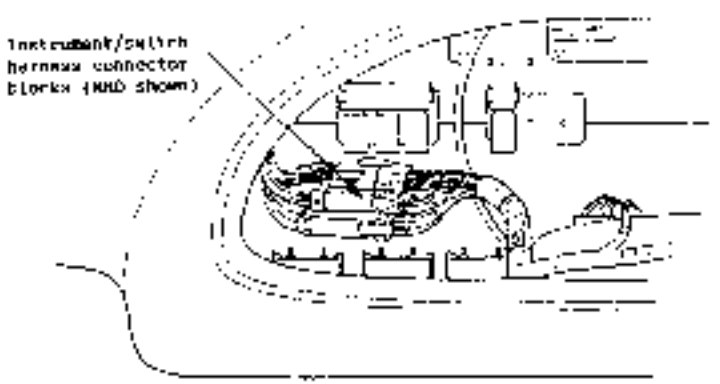
2. Remove heater control panel, and unclip the temperature control link rod from the control quadrant. Also pull off the vacuum pipes which go to and from the heater distribution control.



1. Remove the steering wheel. For USA vehicles fitted with a Supplementary Restraint System (S.R.S.), see Service Notes Manual M8 for precautions and procedure for removing the steering wheel. On all other vehicles:
   - prise the centre boss pad off the steering wheel to release the bayonet type fixing;
   - remove the nut and washer retaining the steering wheel and mark the relative positions of the wheel and inner shaft to aid refitting; pull the wheel off the inner shaft splines. If necessary, use a suitable puller. For vehicles fitted with cruise control, release the cruise control actuator by both push spring assembly and disconnect the wire (all cable control).
   DO NOT apply excessive axial force to either the inner or outer column without the use of a steering wheel puller, or the tether or retaining the telescopic length of the column may be overridden.
   (see illustration column replacement).

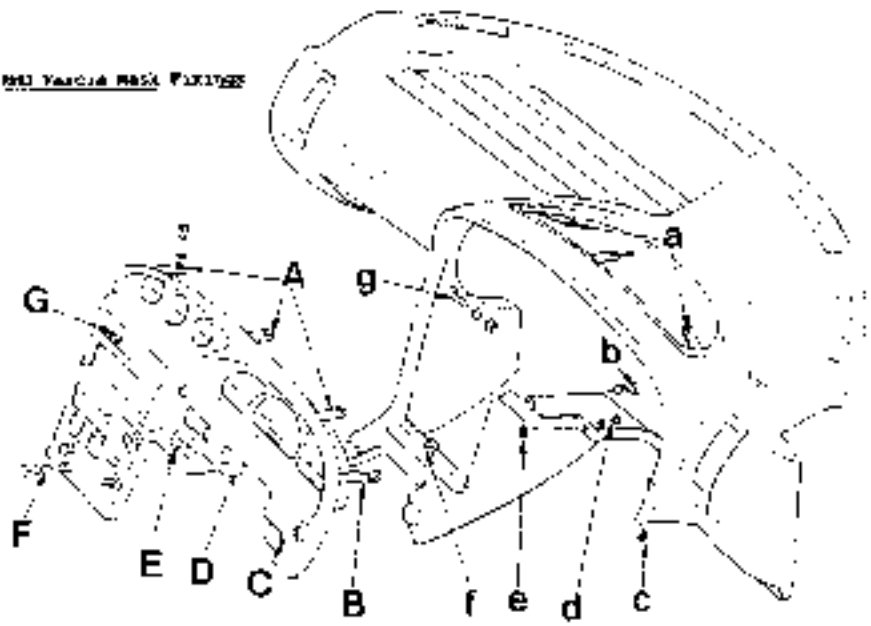
2. Remove the column shrouds. Slide down the plastic tube retaining the column switches, and slide the switches from their mounting bracket.

3. Release the two screws and remove the instrument binnacle panel from the top of the column. Disconnect the speedo cable, and the three instrument/switch harness connector blocks.



b. XKD cars
Release the nine fixings securing the fascia mask to the main fascia:

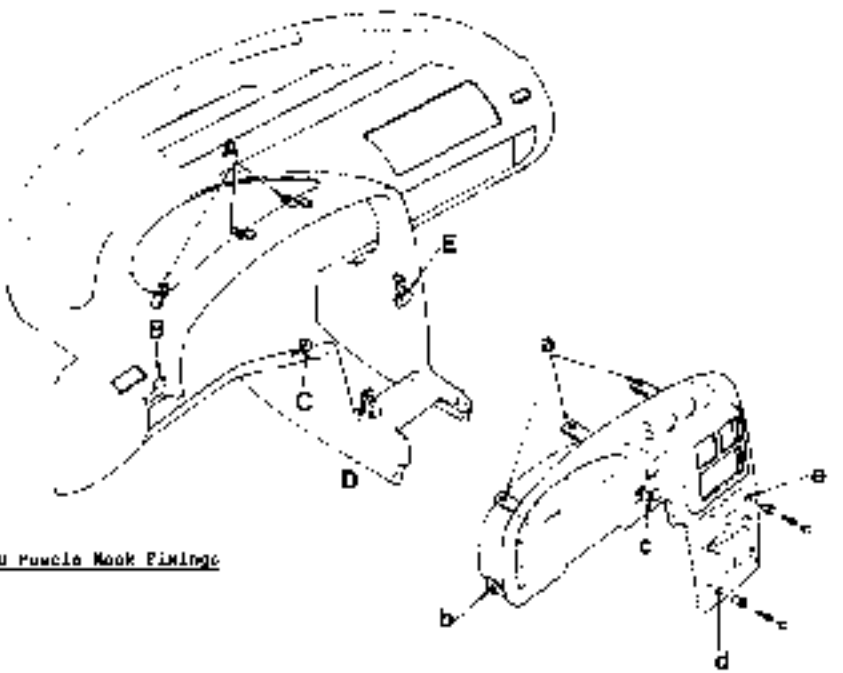
- Peel back the instrument cluster screen aperture, remove the three screws (A), and release the single clip (B) securing the top edge of the fascia mask. Remove the blanking plugs at the bottom edge of the driver's side fascia, and release the two fixing screws (C) and (D).
- Fold the underside of the fascia, release the single fixing nut (E) to the inboard side of the column.
- Remove the blanking plug at the bottom of the fascia mask adjacent to the cigar lighter, and release the lower fixing screw (F).
- Drop the radio aperture or the glovebox aperture, slacken the fixing at (G), and withdraw the instrument/switch panel from the main fascia.



LHD cars
Before removing the fascia mask fixings, it is necessary first to remove the driver's side fascia filler panel (non-SRS cars) or area behind SRS (air bag) cover). The non-SRS type filler panel may be removed after releasing the two screws at the top of the vertical face, and pull to the panel upwards. The SRS type cover however is removed by releasing the two nuts securing the lower edge of the cover to the support bracket, and pulling the top edge horizontally inwards to release the spring clips.

Release the seven fixings securing the fascia mask to the main fascia:

From within the instrument cluster access aperture, remove the three screws (A) securing the top of the panel.
- Release the single screw fixing (B) from beneath the outboard end of the panel
- Release the single screw fixing (C) from beneath the inboard end of the instrument panel
Remove the two blanking plugs from the fascia mask at the bottom LH corner, and above the cigar lighter, and release the two fixing screws (D and E)



LHD Fascia Mask Fixings

775.4 MAIN FASCIA PANEL

The main fascia panel may, on RHD cars, be removed complete with the instrument/switch panel (fascia mask), after disconnecting the electrical and climate controls, and removing the steering wheel and column switches. On LHD cars, the fascia mask must first be removed to allow access to the fixing at the inboard side of the driver's footwell.

1. Disconnect battery.

2. Remove the centre tunnel console (see above), and gear lever gaiter.

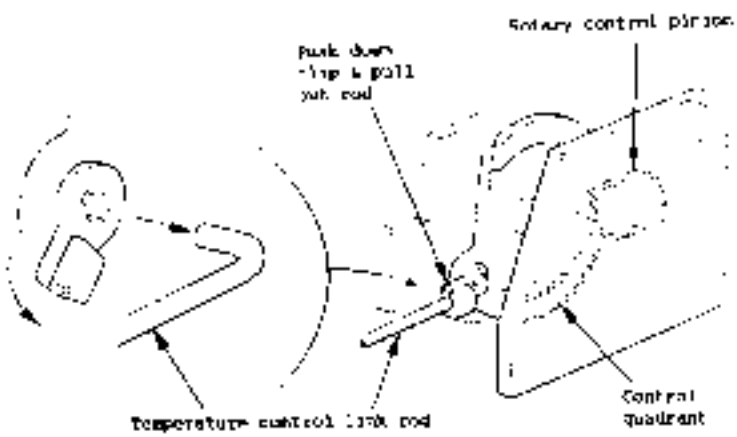
1. Remove the steering wheel. For USA vehicles fitted with a Supplementary Inflatable Restraint (S.I.R.), see Service Notes Manual M5 for precautions and procedure for removing the steering wheel. For all other vehicles:
   - pull the centre hub cap and horn cable connector to release from the bayonet type fixing;
   - remove the nut and washer retaining the steering wheel;
   - mark the relative positions of the wheel and steering column to aid refitting;
   - pull the wheel off the column using a universal puller. If necessary, use a suitable puller. For improved pulling access, remove the foam ring and the socket head screw securing the horn push spring assembly, withdraw the spring assembly and disconnect the horn lead spade terminal.
   DO NOT apply pressure or axial force to either the inner or outer column. Release the wheel by applying pressure to the periphery between the two spokes, on the rear of the rim opposite the column pin for connector, and on the column pin for steering.

2. Unscrew the three screws securing the plastic lower steering column shroud and remove the shroud from the steering column bracket.

3. Release the gear selector lever gaiter from the centre console. Remove the two screws securing the gear selector lever assembly to the floor and withdraw the assembly sufficiently to gain access to the rear of the unit. Disconnect the speedometer cable and the three instrument illumination bulb holders.

4. Remove the two screws securing the steering column lower shroud to the steering column bracket. Remove the shroud from the steering column.

5. Remove the two screws securing the steering column bracket to the bulkhead and withdraw the bracket from the vehicle.

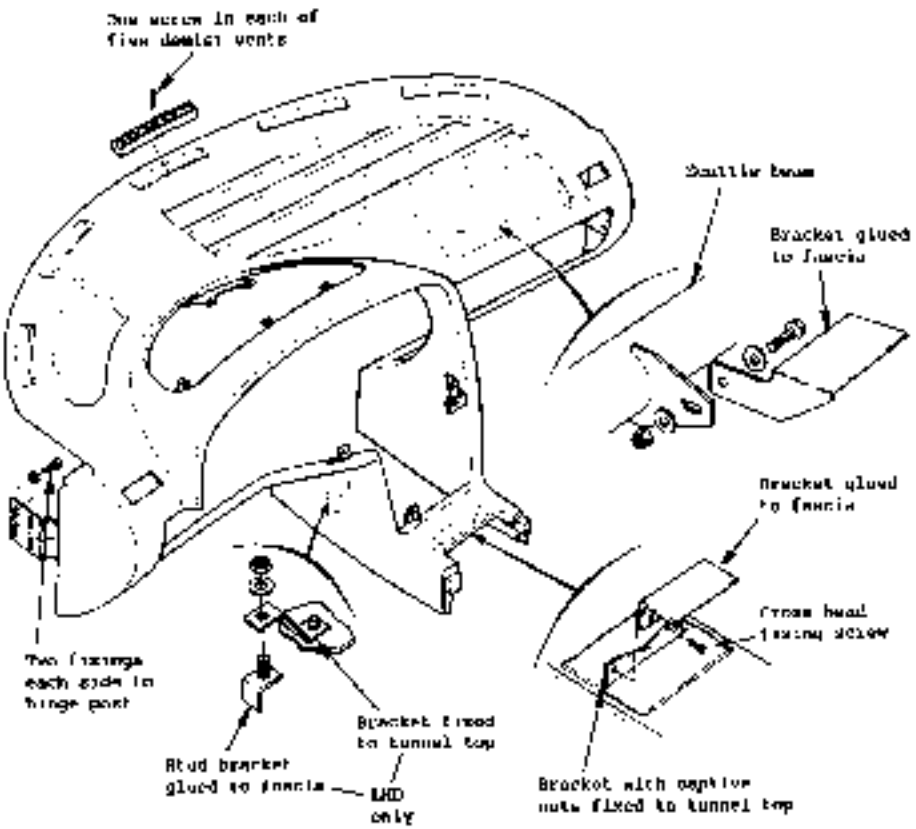


6. Disconnect the radio unit and release the wing nut and washer securing the support bracket to the back of the unit, and the release screw to withdraw the radio unit from the switch panel. Disconnect the aerial lead, speaker connections, and power and earth leads.

g. Release the ducting to each of the outer face level vents.

h. On LHD cars, remove the instrument/switch panel (see subsection VB 31).

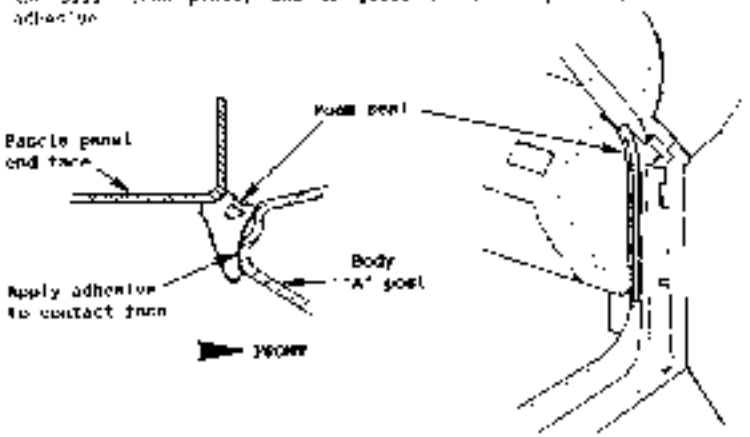
i. Release the fascia panel fixings:
- one screw securing the centre of the fascia to a bracket welded on the switch gear, accessible from the glovebox aperture.
- two screws and bright steel finishing the bottom of the fascia to the tunnel top, ahead of the gear lever. These screws are concealed beneath the gasket of the fascia and the tunnel top.
- two M5 nutwashers and washers each side securing the ends of the fascia to the door hinge post.
- one screw in each of the five screen demister vents, adjacent to the base of the windscreen.
- on LHD cars, release the nut securing the bracket at the inboard side of the driver's footwell, and press down to release the stud from the tunnel top bracket.



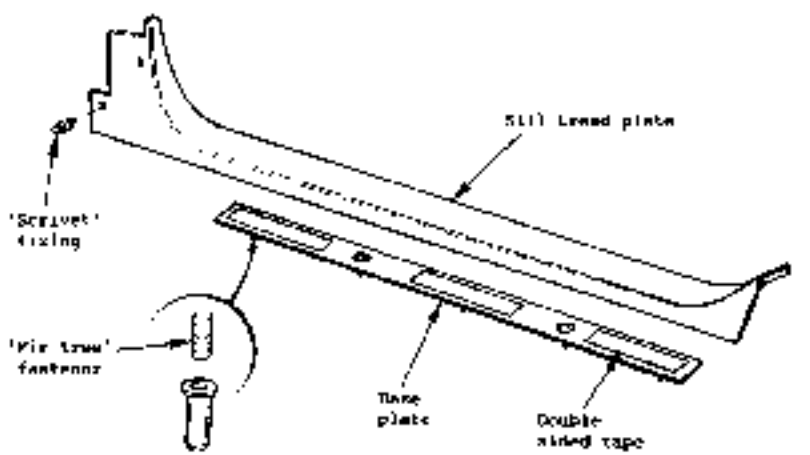
j) Withdraw the main fascia panel over the steering column and gear lever.

To refit the main fascia panel, reverse the removal procedure, noting the following points:

- When refitting the radio, use the screws provided by the plastic aperture to ensure that the spigot on the back of the radio engages with the support bracket fixed to the centre beam.
- Torque tighten the steering wheel nut to 41 Nm (30 lbf.ft).
- Check that the 'A' post to fascia seal is fitted correctly. The neoprene foam seal extends from the bottom of the screen pillar trim panel to the top of the sill tread plate, and is glued to the body 'A' post with Permabond CT adhesive.



20.5 - SILL TREAD PLATES



The sill tread plates are retained to the body sills by five fir tree type fasteners captive on the underside of the tread plates. On the driver's side, an additional two screws secure the front of the panel to the 'B' post. The tread plates may be removed and refitted without disturbing any other trim panel.

If a new tread plate is to be fitted, note that this will be supplied in two pieces. The base plate with the fir tree fasteners is first fitted to the sill, before double sided tape is applied to the top surface of the base plate. The tread plate is then positioned carefully before pressing down onto the sill to stick to the double sided tape.

76.1 - SPEAKER BOXES

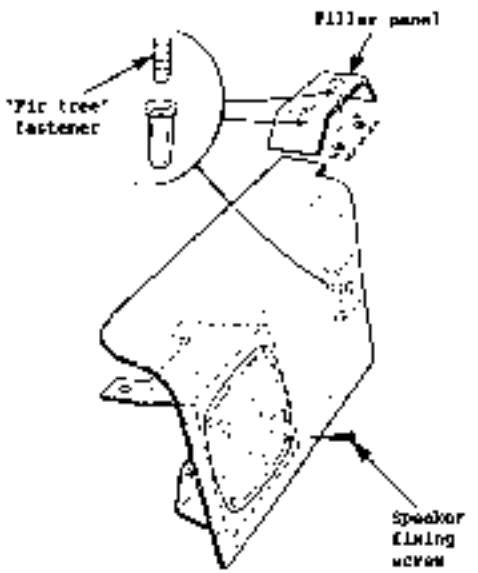
The speaker boxes, fitted behind the seats, are retained by the speakers themselves, and a single fir tree fastener.

To remove a speaker box:

- pull out the filler panel behind the centre console;

  release the speaker by removing the four fixing screws securing the speaker, grille and trim panel to the speaker mounting bracket fixed to the body.

- pull the inboard end of the panel forward to release the fir tree fastener, and withdraw the panel.

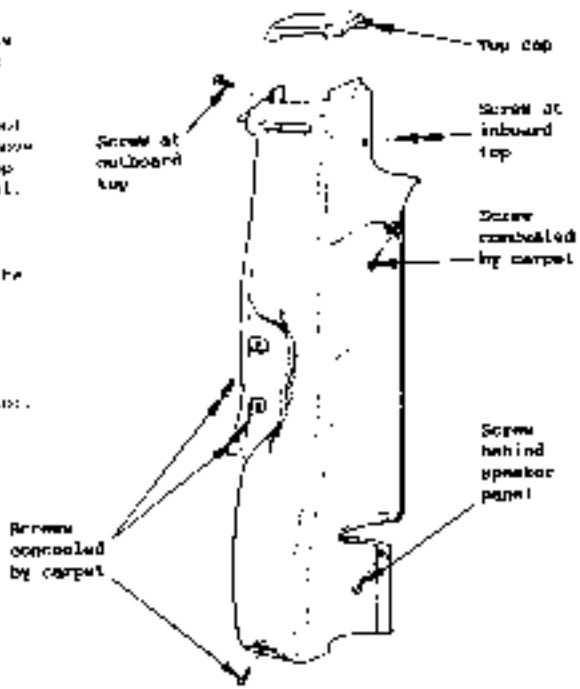


76.2 - 'B' POST TRIM PANELS

The 'B' post trim panels conceal the seat belt reel and bolt (if the roll top roof mechanism), and are surmounted by a cap which hinges open when the roof is raised. On early cars, this cap was retained by springs, but on later vehicles the cap is hinged at its forward edge to the 'B' post trim panel.

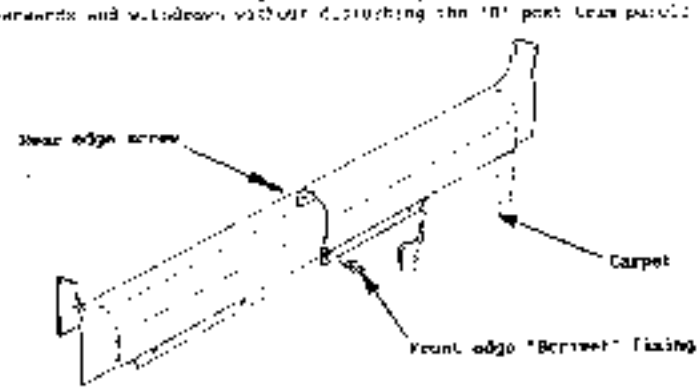
To remove the 'B' post trim panel:
- Remove the sill treadplate (see above);
- Release the seat belt anchorage at the sill;
- Remove the speaker box (see above);
- Peel back the carpet concealing the two trim panel fixing screws along the

...rear edge, and the single fixing at the inboard top corner of the carpet.
Remove the three screws.
- Release the end of the roof stowage lid seal, and remove the screw securing the top outboard edge of the panel.
- Remove the screw at the inboard top of the trim panel.
Remove the screw behind the speaker bracket, and the screw at the bottom edge adjacent to the sill.
- Withdraw the trim panel, feeding the seat belt through the trim panel slot.



VD.6 - CAPPING RAIL

The capping rail along the front edge of the roof stowage compartment is secured by screws along its front and rear edges. The access to the 'Screwdriver' fixings along the front edge, the rear seat carpet must be pulled down from under the capping rail lip. After removing all the fixing screws, the capping rail may be lifted rearwards and withdrawn without disturbing the 'B' post lean panel.



V0.9 - ROOF STORAGE SHELF & SIDE PANELS

A separate access panel, retained by four push-in plugs, is incorporated in the shelf to allow ready access to the battery. The roof storage shelf must be removed for access to the electrical harnesses in the battery compartment, or to the fuel tank.

To remove the roof storage shelf:

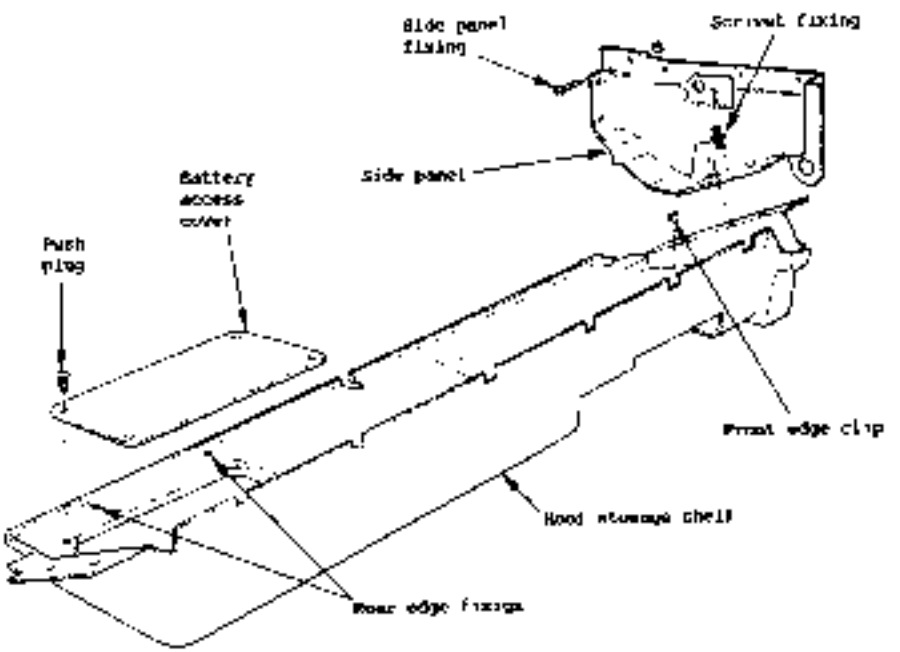
- Remove the capping rail (see above).
- Remove the shelf carpet.
- Release the two 'Dzus' fixings at each side securing the side panels and shelf to the 'A' post reinforcing strut, and the two fixings at the right hand rear edge of the shelf.
- Pull off the clips securing the front edge of the shelf to the cabin rear wall, and withdraw the shelf.

The side panels must be removed for access to the fuel filler neck (left hand side), or an early call to the roof storage lid catches.

To remove the side panels:

- Release the two 'Dzus' fixings at each side securing the side panels and shelf to the 'A' post reinforcing strut.

Release the screw along the top edge of the side panel, and withdraw the panel.

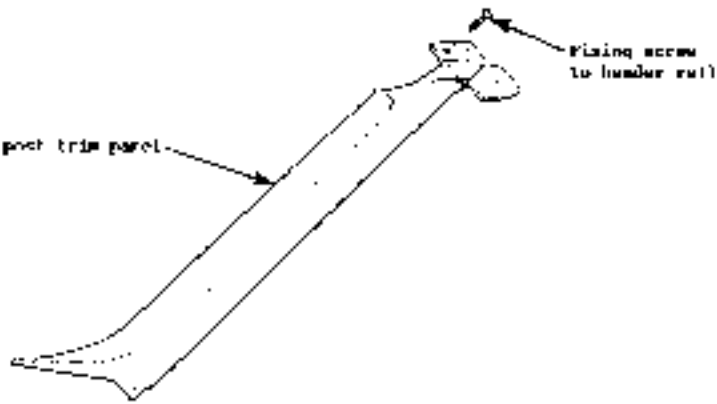


70.10.1 WINDSCREEN SURROUND TRIM PANELS

The screen surround trim consists of a header rail trim panel, and two screen pillar trim panels. The two screen pillar trim panels are secured at their lower ends by being sandwiched between the main chassis and the alloy screen pillars, and at the top by screws into the screen pillars.

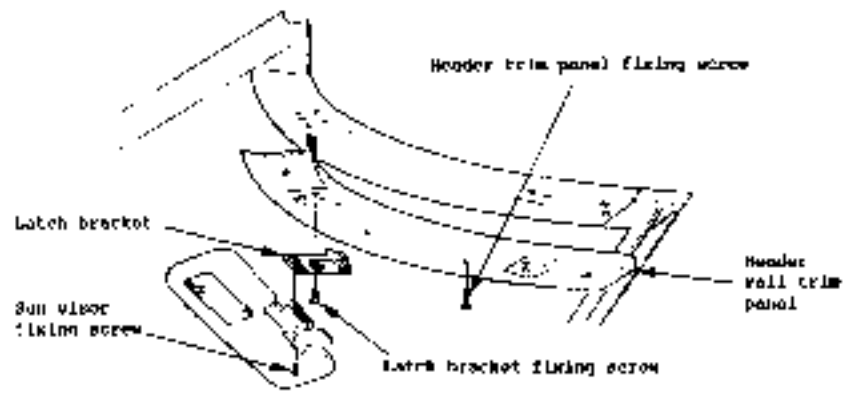
To remove a screen pillar trim pane.

- Peel back the leather trim from the top corner of the screen pillar to reveal the one or two fixing screws. Remove the screws.
- Remove the single fixing screw (or bitscrew) at the bottom end of the panel, and withdraw the trim panel



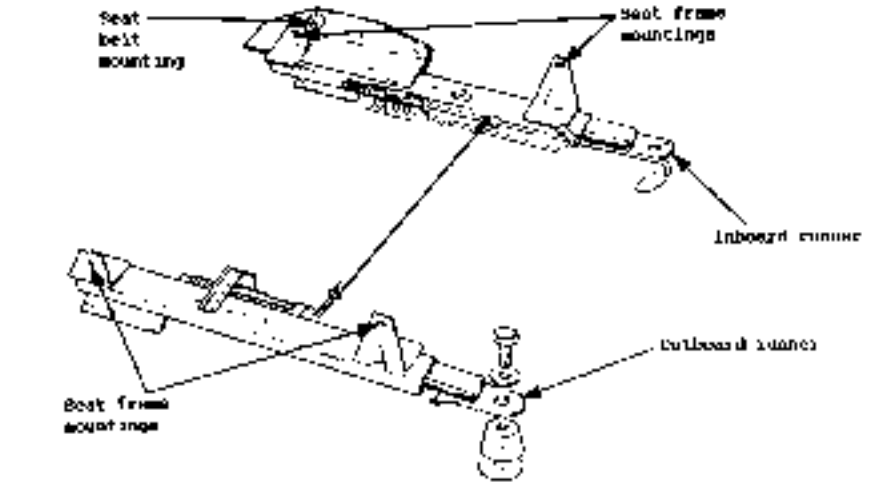
To remove the header rail trim panel:

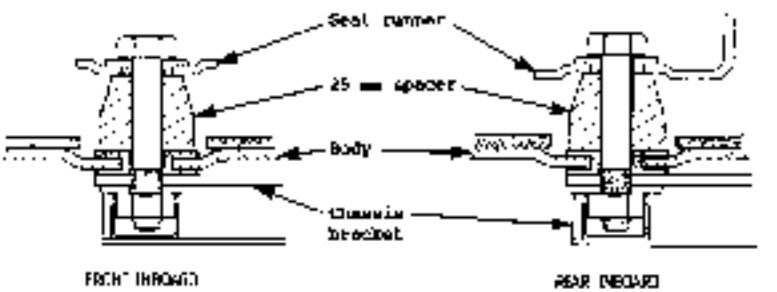
- Pull off the cover concealing the sun visor fixings, and release the two screws securing each sun visor and the three screws securing each roof latch bracket to the header rail
- Release the top end of one of the screen pillar trim panels: remove the 8 x screws securing the header rail trim panel to the header rail and withdraw the panel.

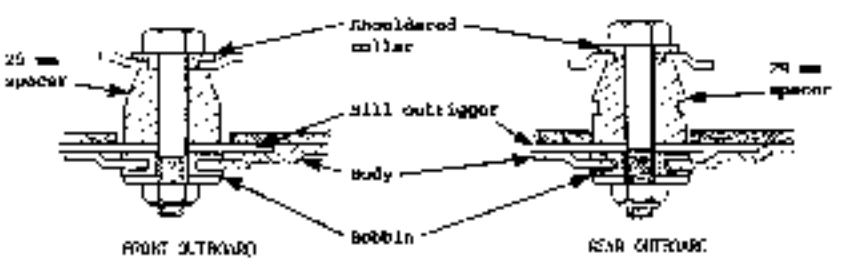


V.D.11 - SEATS

Each seat assembly is mounted on a pair of runners to allow for fore/aft adjustment, with each runner bolted to the floor by two bolts. The inboard runner fixings also serve as body/chassis mountings, and pick up on short outrigger brackets from the side of the chassis backbone. The outboard runners are fixed to the body sill outriggers, with bituminised aluminium bobbins being used in the body at all seat mounting points.







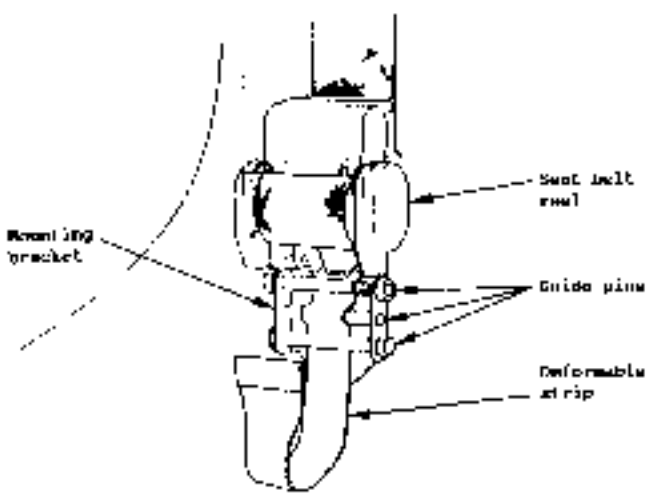
Note that the spacer fitted between the rear end of the outboard runner is 24 mm thick, rather than the 25 mm of the other three spacers. Torque tighten all seat runner fixings to 45 Nm (33 lbf ft).

VD 11 - SEAT BELTS

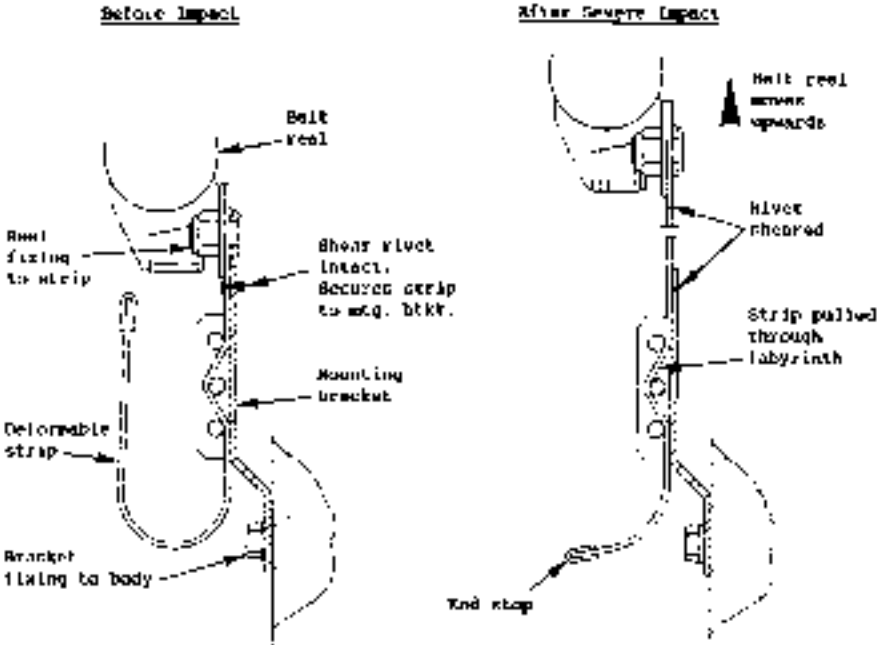
The three point fitting inertia reel seat belts are designed to allow the wearer complete freedom of movement under normal driving conditions. The belt reel will lock automatically whenever the vehicle is tilted, or its speed or direction is suddenly changed, as will occur on heavy braking or on impact in a collision. The seat belt anchorage points are as follows:

The belt reel assembly is mounted inboard of the base of the 'B' post by a single fixing bolt.
- The shoulder belt slider is fixed near the top of the 'B' post by two bolts threading into a 'B' post reinforcing strap attached to the 'B' post cross brace and running rearwards to a spreader plate on the rear crossmember.
- The tongue end of the lap belt is secured to the kill catch/trigger.
- The inboard end of the lap belt is fixed to the sliding part of the seat runner, in order that the belt positioning remains correct irrespective of seat position.

On USA cars, a shock absorption system is incorporated at the belt reel mounting, which provides for a controlled movement of the belt reel during a crash if the belt tension exceeds a specified high value. The belt reel assembly is secured to a deformable strip, itself fixed to a mounting bracket by two rivets which are designed to shear under a particular force, applied only when the belt is worn and the vehicle is subject to a severe frontal impact. Movement of the belt reel, and thus give of the belt, is then controlled by the rate at



which the deformable steel strip is pulled between three offset guide pins which force the strip to bend in alternate directions. Energy dissipated in this way serves to progressively slow the belt reel and prevent the wearer from an unnecessarily harsh deceleration force.

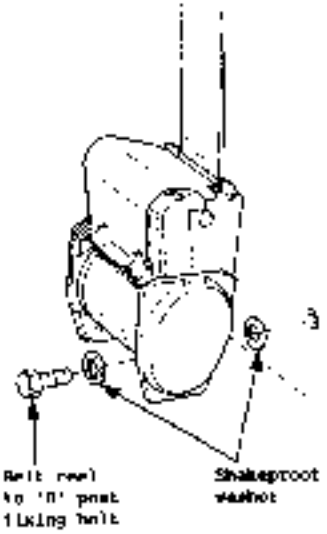


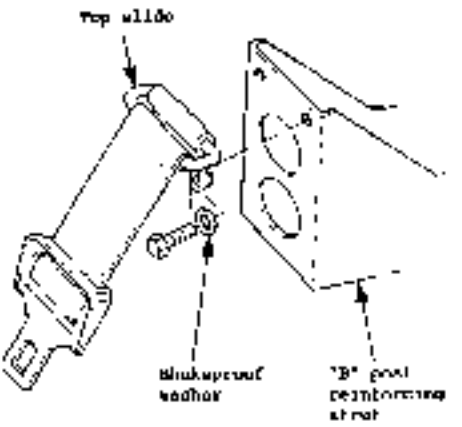
If any seat belt has been worn in a severe frontal collision, the belt should be replaced as a precaution even if there is no visible damage to the assembly. On USA cars, if the rivets securing the deformable strip and belt reel to the retaining bracket are sheared, no attempt should be made to retrieve the strip, but the strip and mounting bracket should be replaced as a complete assembly.

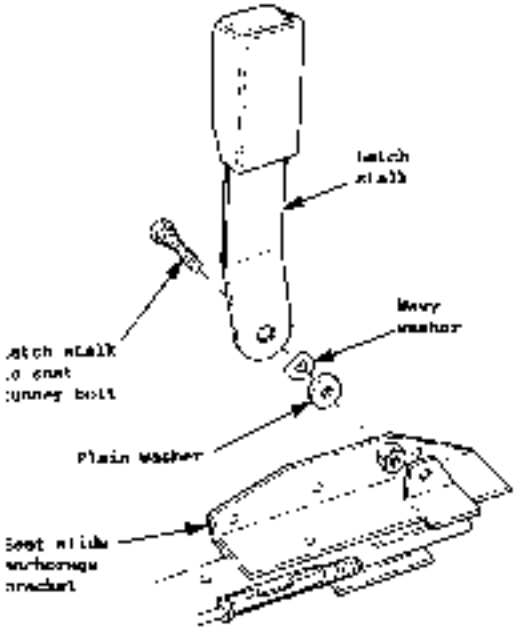
To remove a seat belt assembly, release the seat belt from the sill, remove the 'B' post trim panel (see section VII.1), and release the belt reel assembly and shoulder belt slider from the 'B' post.

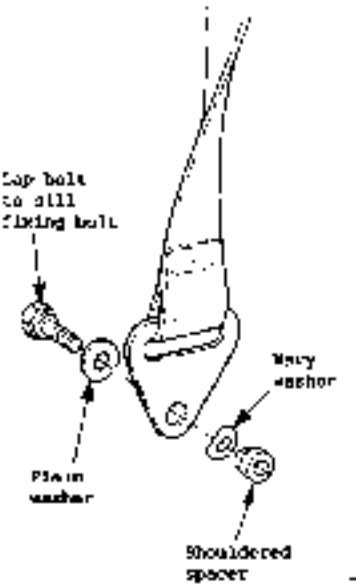
When fitting a seat belt, pay careful attention to the correct assembly of the washers and spacers at each fixing point, as shown in the diagrams. Torque tighten the fixing bolts as follows:

- Belt reel to body (non-USA) or deformable strip (USA): 45 - 60 Nm (34 - 44 lbf.ft).
  Belt reinforcing bracket to body (USA): 45 - 60 Nm (34 - 44 lbf.ft).
  Shoulder belt slider: 41 - 47 Nm (30 - 35 lbf.ft).
  Lap belt to sill: 30 - 45 Nm (22 - 34 lbf.ft).
  Buckle strike to seat slide: 30 - 35 Nm (22 - 26 lbf.ft).


Belt reel
to 'B' post
fixing bolt
Shakeproof
washer


Top slide
Shakeproof
washer
'B' post
reinforcing
strut


Latch
stalk
Wavy
washer
Plain washer
Seat slide
anchorage
bracket


Cap bolt
to sill
fixing bolt
Wavy
washer
Plain
washer
Shouldered
spacer