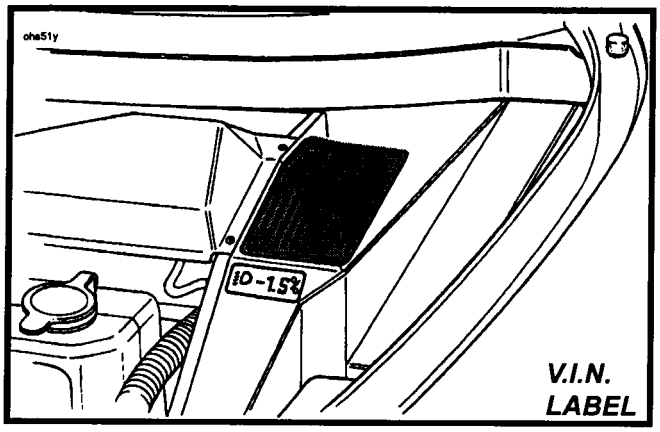
CONTENTS

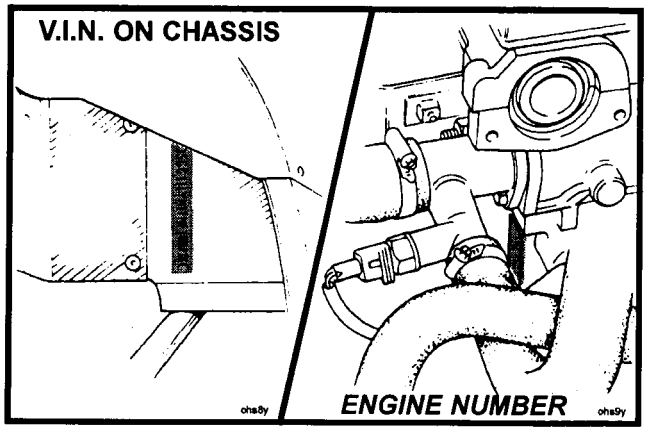
M111 ELISE

VEHICLE IDENTIFICATION NUMBER & ENGINE NUMBER

The Vehicle Identification Number (V.I.N.) is stamped on the chassis in the right hand rear wheelarch area, and is also printed on a label stuck to the body in the front services compartment. The engine number is marked on a vertical patch at the left hand end of the forward face of the cylinder block, and is most easily viewed using a mirror.

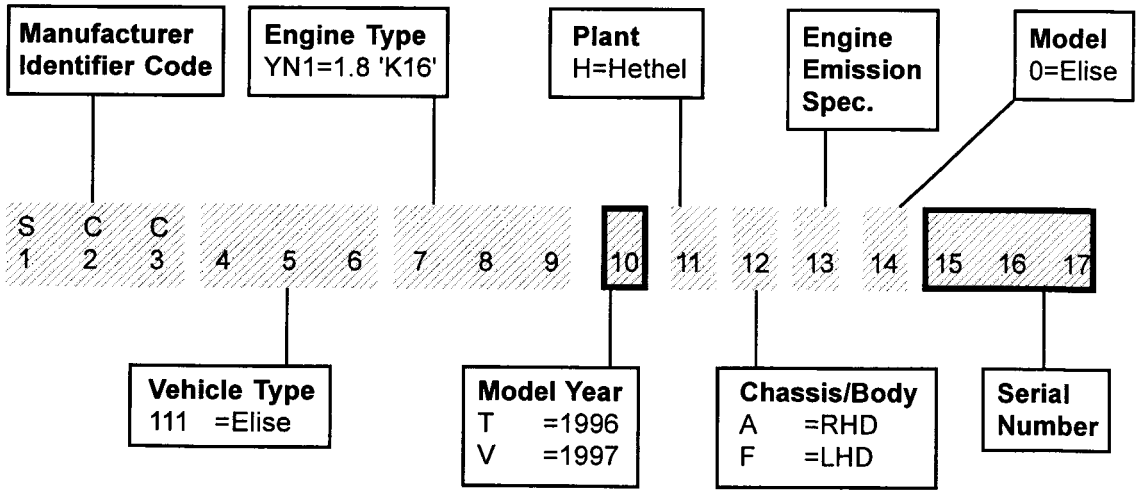
Both numbers should always be quoted with any vehicle enquiries, as Factory records are filed against V.I.N., and specification change points are identified by V.I.N. or engine number. The vehicle licence number may not accurately reflect vehicle age, may also be changed during the car's life, and is an unreliable method of vehicle identification.



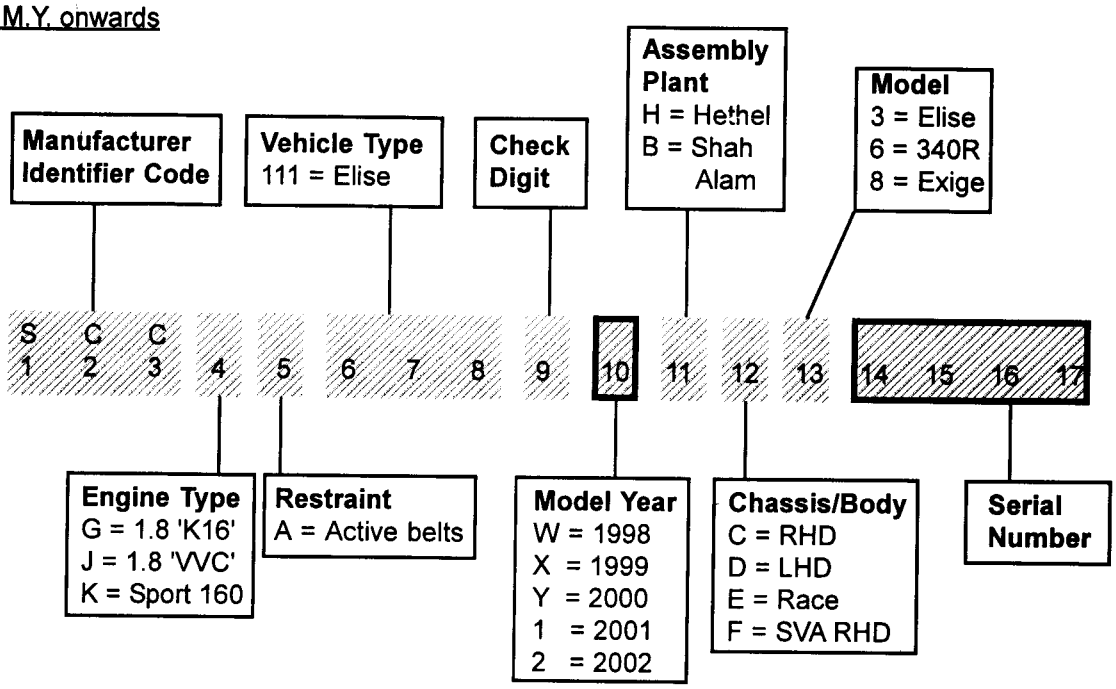


The V.I.N. comprises 17 characters, coded in accordance with European Economic Community (EEC) directives. Note that the coding of the V.I.N. changed with the introduction of '98 M.Y. Prior to July 2000, change points will be identified in Service Notes and Service Parts Lists by characters 10 (model year) and 15 - 17, or 14 - 17 (serial number). After July 2000, characters 10 to 17 will be quoted.

'96 & '97 Model Year



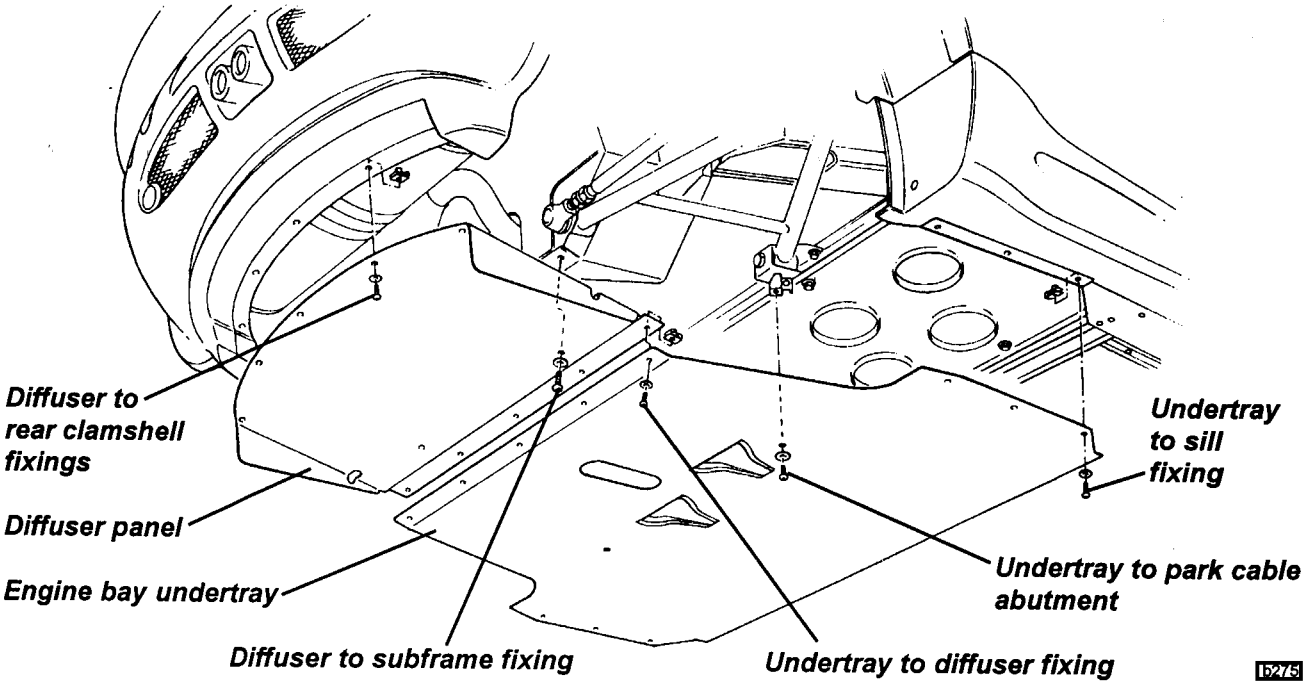
'98 M.Y. onwards



ENGINE BAY UNDERTRAY/DIFFUSER

For certain service operations, it may by necessary to remove the engine bay undertray and/or diffuser panel. The panels are retained by:

- Four M8 button head fixings needing a 5mm hexagonal key;
- Fourteen M5 crosshead screws.



JACKING POINTS

Care must be taken when using a lifting jack or hoist only to position the device in one of the the areas shown in the illustration, with a suitable rubber or timber pad protecting the chassis from surface damage. If a 4-point lift is to be used, the engine bay undertray/diffuser panel (if fitted) must first be removed. When using a 4-point lift, it is strongly recommended that for optimum stability and safety, positions B and D are used.

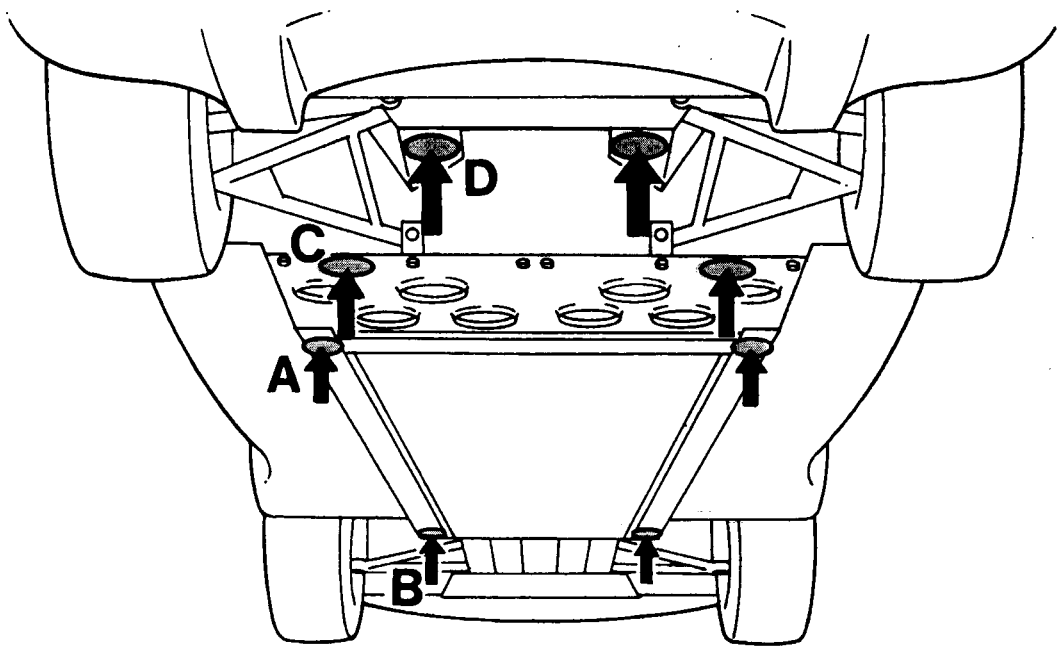
A; Identified by a blue sticker. Beneath crossmember ahead of fuel tank bay. To be used one side at a time for wheel changing - lifts both wheels on one side. *Do not use with a four point garage lift.*

B; Beneath the front end of the right or left hand main chassis rail, behind the front wheelarch. Garage use with 4-point lift in conjunction with (C).

C; *The engine undertray/diffuser panel must first be removed.* Beneath the outboard end of the chassis crossmember ahead of the rear wheelarches. Take care to position the jack between the fixing screws for the fuel tank bay perforated undershield. Garage use with 4-point lift in conjuction with (B).

D; *The engine undertray/diffuser panel must first be removed.* Beneath the rear subframe, close to the lower wishbone rearmost mountings.

Jacking at any other point may damage the chassis or body structure and/or jeopardise safety.



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ELISE MODEL HISTORY

Model Introduction: June '96
VIN: T 0017 onwards

1997 Model Year: November '96
VIN: V 240 onwards
No specification change.

Uprated Starter Motor: February '97
VIN: V 685
Starter motor uprated from 1.0 kW to 1.4 kW and engine management fuse relocated from rear to front services compartment.

Commonisation of a.c. type chassis: September '97
VIN: V 1685 (approx.) Plus; 1672, 1673, 1677, 1682. Less; 1694, 1708.
Shape of chassis, rear side of fuel tank crossmember, changed to accommodate a.c. compressor. Low level engine coolant outlet pipe. Re-circ. ventililation holes in chassis toe-board.

1998 Model Year: October '97
VIN: W 1814 onwards.
No specification change.

Revised Harness & Main Fusebox: October '97
VIN: W 1941 onwards. Plus; 1920, 1926, 1937, 1938. Less; 1965, 2002.
New harness introduced to accommodate optional U.K. market Cobra 6422 alarm. New main fusebox with 22 'Littel' fuses in front luggage compartment.

Optional U.K. Market Cobra 6422 Alarm: October '97
VIN: W 1947 onwards. Plus 1937, 1938.
Option upgraded from Cobra 6019HF to 6422. Facility to reprogramme transmitter keys. Override switch deleted.

Front Brake Disc Shields: December '97
VIN: W 2260 (approx.)
Alloy shield fitted on inboard side of front discs to protect from debris and balance pad life.

Revised Soft Top Cant Rails: May '98
VIN: W 3332
Latches on rear end of roof cant rails use new dovetail design to improve location. Door seals changed to incorporate moulded front ends to mate with new cantrail front seals. New soft top canopy with press studs reposiitioned to suit new cant rails. Parts set required to fit hardtop roof.

Cast Iron Brakes: June '98
VIN: W 3714 (approx.)
Cast iron brake discs and corresponding pads replace aluminium metal matrix brakes.

Integral Boot Box: September '98
VIN: W 4429 (approx.) Plus; 4140, 4315, 4365, 4383. Less 4653.
Rear clamshell incorporates integral luggage compartment box to replace luggage bag.

1999 Model Year: November '98
VIN: X 4976 onwards.
No specification change.

135 Sport: November '98

VIN: X 5401 - 5450, 6001 - 6035.

135 bhp cylinder head; Close ratio gearbox; Sports exhaust; Competition style seats; Sports steering wheel; Drilled iron brake discs; Quicksilver paint with blue soft top; Headlamp covers; Body graphics; Silver roll over bar. 2nd batch variations: 111S wheels, tyres & spats; black painted fuel filler cap; matt finish alloy gear knob; Sport 135 99 side decals.

Integral Stud Toe-Link Ball Joints: December '98

VIN: X 5479

Rear suspension toe-link ball joint design changes to incorporate integral M10 stud.

50th Anniversary Elise: January '99

VIN: X 5463 - 5816 (total 51)

Anniversary green with gold wheels, green/rafia leather seats, 'Elise' floor mats, gold decals, Anniversary decal on rear transom.

Angled Rear Window: January '99

VIN: X 5558

Rear window mounted in angled surround to reduce reflections.

Elise 111S: January '99

VIN: X 5722

VVC engine & close ratio transmission. Revised muffler & tailpipes. Cross-drilled iron discs. Lotus styled 6-spoke road wheels, 7.5" rear rims with 225/45 ZR16 rear P Zeros. Optional rear spoiler extension. Acrylic headlamp covers & smoke front indicator lenses. Composite engine lid, rear wheelarch spats, '111S' decal on rear body & fascia, moulded air intake grille. Forged alloy window winders, weave patterned dash inserts, revised seat foams & stitching.

Elise 'JPS': July '99

Available based on either standard or 111S versions. Black body colour. All cars have gold painted grilles as follows; radiator air intake, radiator outlet, engine lid outlet, rear clamshell recess, engine bay intake. All cars have gold painted 111S type road wheels, black and gold Alcantara steering wheel, gold painted dash insert panels, 111S type black leather seats with gold Alcantara centres, gold decals on rear body and dash, black & gold nose badge, Union Flag decal on rear. Standard versions also have headlamp covers and rear wheelarch spats.

Elise 'Type 49': October '99

Available based on either standard or 111S versions. Two tone red/white body colour. All cars have gold painted 111S type road wheels, black and red Alcantara steering wheel, 111S type black leather seats with red Alcantara centres, gold decals. Standard versions also have headlamp covers and rear wheelarch spats.

Elise 'Millenium': October '99

Available based on either standard or 111S versions. Atlantis Blue body colour. All cars have blue Alcantara steering wheel pad and sill trim panels, 111S type black leather seats with blue Alcantara centres. Standard versions also have 111S type road wheels, rear wheelarch spats and headlamp covers. Cars were usually supplied with a range of dealer fitted Lotus accessories.

Forged Steel Rear Hub Carriers: November '99

VIN: X 8177 (approx.)

New design forged steel rear hub carrier replaces extruded alloy carrier, and incorporates caliper mounting plate, and lower ball joint carrier.

Elise 340R: January '00

VIN: Y 0004 to 0009, 9640 onwards.

Limited edition of 340. Extreme lightweight version of the Elise, based on modified standard chassis fitted with minimalist bodywork and a detuned, road going version of the VHPD powertrain. See 340R supplement for full specification.

Sport 160: February '00

SVA: VIN: Y 00601 to 00650.

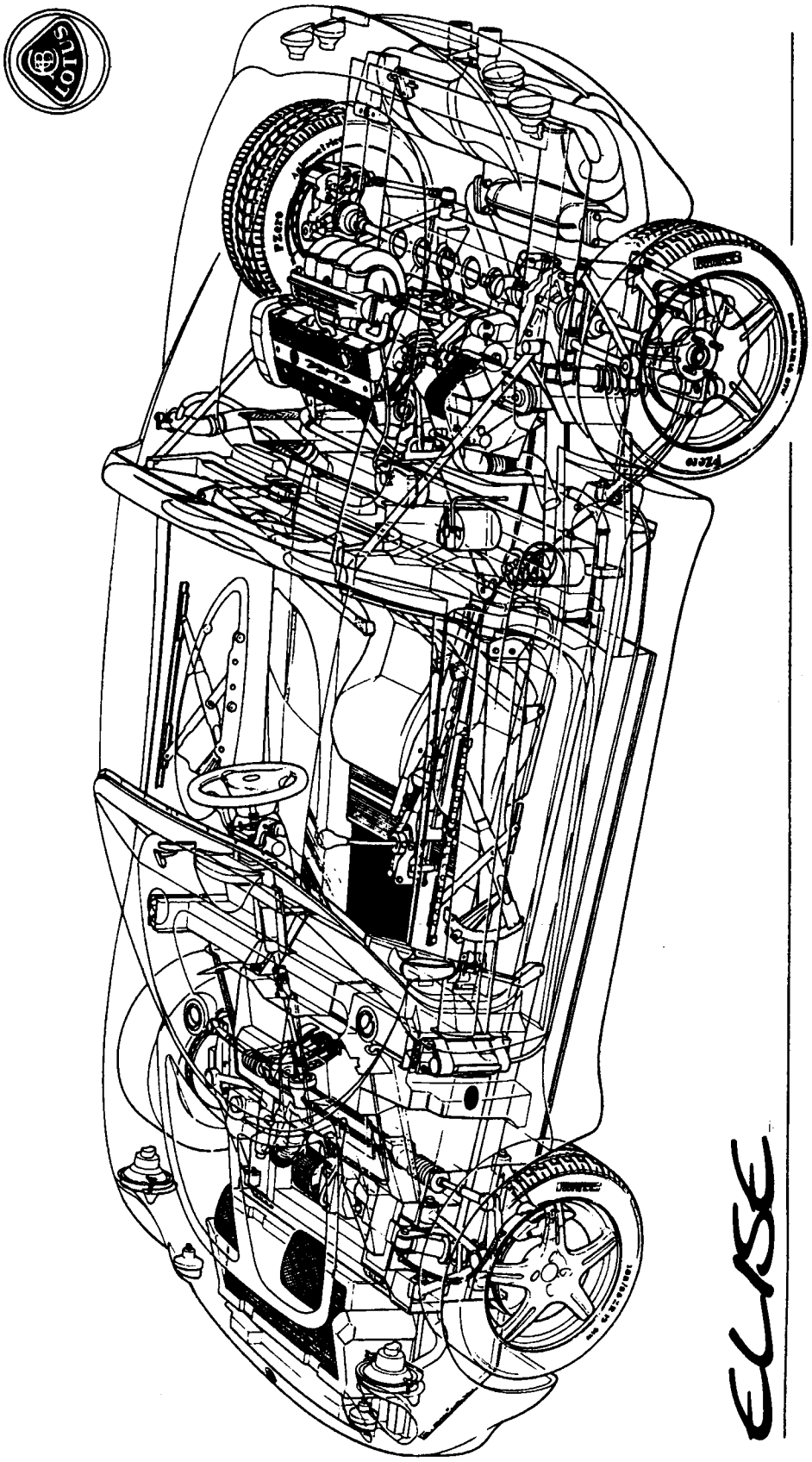
WVTA: VIN: Y 0651 onwards.

First 50 cars with Single Vehicle Approval. Subsequent cars Whole Vehicle Type Approved. High performance derivative, based on 111S specification with 160 PS fixed valve timing engine. WVTA versions require airbox modification and sport exhaust fitment for full power release. Other features include new engine controller, sport suspension, 'race' wheels, plinth mounted rear aerofoil, Alcantara trimmed seats and steering wheel pad, body decals.

Exige: July '00

VIN: Y 0001 (Character 13 = 8) - model specific serial number sequence.

Road going version of the Elise race series car, with 178 bhp 340R engine, close ratio transmission, sport suspension and larger 12-spoke black finish wheels (16x7 & 17x8.5) with Yokohama A039 tyres. Front and rear clamshells styled as race car with piller mounted rear aerofoil. Clear polycarbonate rear tailgate with air ducting, linked to roof mounted air intake duct. Optional Alcantara sports seats and 340R harnesses. Meta security system. Roof duct mounted radio aerial.


ELISE

TECHNICAL DATA - ENGINE

SECTION TDL - M111 ELISE

GENERAL		
Type designation	- std	K16 (18K4F)
	- 111S	K16 (18K4K)
Configuration & no. of cylinders		in-line 4
Capacity		1796 cm^3 (70.71 in^3)
Bore		80.00 mm (3.150 in)
Stroke		89.30 mm (3.516 in)
Valve actuation - std		Belt driven twin overhead camshafts with hydraulic tappets
	- 111S	As std. with variable valve control (VVC) on inlet camshaft
Compression ratio		10.5:1
Firing order		1,3,4,2
Spark plugs		RC8 PYP or CSP 9652
Spark plug gap		0.9 ± 0.1 mm (0.035 in)
Maximum engine speed		7000 rpm
Fuel system	- std	Multi-point grouped fuel injection with MEMS 1.9 engine management
	- 111S	Sequential fuel injection with MEMS 2J engine management
Fuel requirement		Unleaded 95 RON minimum
Max power (88/195/EEC)	- std	88 kW (118 bhp) @ 5,500 rpm
	- 111S	107 kW (143 bhp) @ 7,000 rpm
Max torque (88/195/EEC)	- std	165 Nm (122 lbf.ft) @ 3,000 rpm
	- 111S	174 Nm (128 lbf.ft) @ 4,500 rpm
CYLINDER HEAD		
Material		Aluminium alloy
Head face maximum warpage		0.05 mm
Cylinder head height	- new	118.95 to 119.05 mm
	- reface limit	0.20 mm
CAMSHAFTS & VALVE TIMING		
Std		
Open duration		244° (at crankshaft)
Inlet valve opens		12° BTDC
Inlet valve closes		52° ABDC
Exhaust valve opens		52° BBDC
Exhaust valve closes		12° ATDC
Valve overlap		24°
Valve lift	- inlet	8.8 mm
	- exhaust	8.8 mm
111S		
Open duration	- inlet (variable)	220° to 295°
	- exhaust	252°
Inlet valve opens		0° BTDC at minimum period
Inlet valve closes		40° ABDC at minimum period
Exhaust valve opens		51° BBDC
Exhaust valve closes		21° ATDC
Valve overlap (variable)		21° to 58°
Valve lift	- inlet	9.5 mm
	- exhaust	9.2 mm
VALVES		
Angle of valve seats and faces		45°
Stem diameter	- inlet	5.952 - 5.967 mm
	- exhaust	5.947 - 5.962 mm

Stem clearance in guide	- inlet	- new	0.033 - 0.063 mm
		- service limit	0.070 mm
	- exhaust	- new	0.038 - 0.078 mm
		- service limit	0.110 mm
Valve clearance			Hydraulically controlled.
Valve stem fitted height	- new		38.93 - 39.84 mm
	- service limit		40.10 mm

VALVE GUIDES

Inside diameter	6.000 - 6.025 mm
Fitted height	6.0 mm

VALVE SEATS

Seat face angle	45°

VALVE SPRINGS

Std	
Free length	50.0 mm
Fitted length	37.0 mm
Load at fitted length	250 ± 12 N
Load at full lift	450 ± 18 N
VVC	
Free length	47.6 mm
Fitted length	37.0 mm
Load at fitted length	210 ± 13 N
Load at full lift	440 ± 22 N

CRANKSHAFT

Crankshaft endfloat	- new	0.10 - 0.25 mm
	- service limit	0.34 mm
Thrust washer thickness		2.61 - 2.65 mm
Main journal diameter		47.979 - 48.007 mm (for grading see Section EE)
Maximum out of round		0.010 mm
Big end journal diameter		47.986 - 48.007 mm (for grading see Section EE)
Maximum out of round		0.010 mm
Big end clearance		0.021 - 0.049 mm

PISTON RINGS

New ring to groove clearance	- top compression	0.040 - 0.072 mm
	- second compression	0.030 - 0.062 mm
	- oil control	0.010 - 0.180 mm
New ring gap, 20mm from bore top	- top compression	0.20 - 0.35 mm
	- second compression	0.28 - 0.48 mm
	- oil control	0.15 - 0.40 mm

PISTON

Piston diameter (8mm from bottom, 90° to pin)	- grade A	79.975 - 79.990 mm
	- grade B	79.991 - 80.005 mm
Clearance in bore (20mm from bottom of bore)		0.01 - 0.04 mm

CYLINDER BLOCK

Cylinder liner bore (65mm from top)	- red grade A	80.000 - 80.015 mm
	- blue grade B	80.016 - 80.030 mm

OIL PUMP	
Outer rotor to housing clearance	0.28 - 0.36 mm
Inner rotor tip clearance	0.05 - 0.13 mm
Rotor end float	0.02 - 0.06 mm
COOLANT THERMOSTAT	
Nominal setting	85 - 91°C
Thermostat starts opening	88°C
Thermostat fully open	100°C

TECHNICAL DATA - VEHICLE

SECTION TDM - M111 ELISE

DIMENSIONS

Overall length	- std		3726 mm (146.7 in)	
	- 111S		3734 mm (147.0 in)	
Overall width	- exc. mirrors	- std	1701 mm (67.0 in)	
		- 111S	1703 mm (67.0 in)	
	- inc. mirrors		1850 mm (72.8 in)	
Overall height (at kerb weight)			1148 mm (45.2 in)	
Wheelbase			2300 mm (90.6 in)	
Track	- front		1440 mm (56.7 in)	
	- rear - std		1458 mm (57.4 in)	
	- 111S		1470 mm (57.9 in)	
Ground clearance			160 mm (6.3 in)	
Front overhang			746 mm (29.4 in)	
Rear overhang	- std		680 mm (26.8 in)	
	- 111S		688 mm (27.1 in)	
Approach angle			12.4°	
Departure angle			28°	
Unladen weight	- std	- total	755 kg (1664 lb)	>
		- front	303 kg (668 lb)	>
		- rear	452 kg (996 lb)	> inc.full fuel tank
	- 111S	- total	770 kg (1698 lb)	>
		- front	303 kg (668 lb)	>
		- rear	467 kg (1030 lb)	>
Max. weight	- std	- total	974 kg (2147 lb)	}
		- front	386 kg (851 lb)	}
		- rear	588 kg (1296 lb)	} inc.
	- 111S	- total	992 kg (2187 lb)	} occupants
		- front	376 kg (829 lb)	} & luggage
		- rear	616 kg (1358 lb)	}
Trailer towing			Not permissible	

CAPACITIES

Engine oil - dry		5.0 litre (8.8 imp. pt)
- refill inc. filter		4.5 litre (7.9 imp. pt)
High/low dipstick mark difference		1.0 litre (1.8 imp. pt)
Transmission oil	- dry	2.4 litre (4.2 imp. pt)
	- refill	2.1 litre (3.7 imp. pt)
Fuel tank		36.4 litre (8.0 imp.gall)
Coolant		8.0 litre (14.1 imp. pt)
Refrigerant (R134a)		0.85 kg (1.87 lb)

TYRES (Normal Use)

Standard Fitment

Type			Pirelli P Zero
Size - front			185/55 R15 81V
- rear	- std		* 205/50 ZR16 87W
	- 111S & std. option		# 225/45 ZR16
Pressure (cold)	- front		1.6 bar (23 lb/in²)
	- rear	- 205	1.7 bar (24.5 lb/in²)
		- 225	1.9 bar (27.5 lb/in²)

* *Pirelli Zero 205/50 rear tyres:* There are variations in the specification of Pirelli tyres with this designation, dependent on where and when they were manufactured. Lotus fitment should be:

either: i) Made in Italy (moulded on inside tyre wall)

or: ii) Made in Great Britain (moulded on inside tyre wall) ***and*** with a DOT date of week 35 year 1997, coded as 357, or later (see below).

Note:
a) The U.K. built tyre was introduced on production at VIN: V 1700 (approx).
b) Italian and U.K. variations of rear tyre should not be mixed on the same axle.
c) The DOT code is moulded on the outside wall, with only the last number group relevant to this issue. Note that the three digits represent a date code as explained above, and not an ordi nary sequential number.

 # Pirelli Zero 225/45 rear tyres: There are variations in the specification of this Pirelli tyre dependent on when it was manufactured. For the Elise, use only tyres with a DOT date code of week 35 of year 98, coded as '358' or later.

Alternative Service Fitment

As an alternative to Pirelli tyres, a complete vehicle set of Michelin Pilot SX-GT tyres may be fitted in service using the wider rear tyre specification. It is not recommended to mix Pirelli and Michelin tyres on the same vehicle.

Type	Michelin Pilot SX-GT
Size - front	185/55 R15 81V
- rear	225/45 ZR16 89V
Pressure (cold) - front	1.6 bar (23 lb/in²)
- rear	1.7 bar (24.5 lb/in²)

WINTER TYRES

Type	Michelin X M+S 130
Size - front	185/55 R15 81T
- rear	195/60 R15 88T mounted on standard 15 inch ***front*** wheels
Pressure (cold) - front	1.6 bar (23 lb/in²)
- rear	1.7 bar (24.5 lb/in²)
Studding	Not permitted
Tyre chains	Pewag FX 67 S Ring-Super-X (A100G6011F) fitted only on rear winter tyres

WHEELS

Type - std. prior April '99 approx. VIN X 6429	AWI light alloy; 5 split-spoke style
- std. from April '99 approx. VIN X 6429	Rimstock light alloy; 12 spoke style
- 111S & std. option	O.Z. light alloy; 6 spoke style
Size - front	5.5J x 15CH/H2 ET14
- rear - std	7J x 16H2 ET16
- 111S & std. option	7.5J x 16H2 ET10
PCD	95.25 mm
Inset - front	+ 14 mm
- rear - std	+ 16 mm
- 111S & std. option	+ 10 mm
Wheel nut torque	80 - 85 Nm

FRONT SUSPENSION

Type	Independent. Upper and lower wishbone; co-axial coil spring/telescopic damper unit; anti-roll bar.
Geometry check ride height (2 persons, ½ tank fuel) - front	140 mm below front end of chassis siderail
- rear	140 mm below rear end of chassis siderail
Alignment	0.2 mm toe-out overall; - 0, + 0.2 mm (0.03° toe-out overall; - 0, + 0.03°)
Camber	- 0.1°; + 0.1°, - 0.2°. Max side/side; 0.2°
Castor	+ 3.8°; ± 0.2°. Max. side/side; 0.2°
Steering axis inclination	12° nominal

REAR SUSPENSION

Type	Independent. Upper and lower wishbone; co-axial coil spring/telescopic damper.
Geometry check ride height (2 persons, ½ tank fuel)	
- front	140 mm below front end of chassis siderail
- rear	140 mm below rear end of chassis siderail
Alignment	1.2 mm toe-in each side; + 0.2 mm, - 0 (0.18° toe-in each side; + 0.03°, - 0) Max. difference side/side; 0.2 mm (0.03°)
Camber	- 1.8°; ± 0.2°. Max. side/side; 0.2°

For Motorsport suspension settings: see Section XA

ELECTRICAL

Light Bulbs	*Wattage*	*Type*
Headlamps	60/55	H4 P43t
Driving lamps	55	H1
Front side/parking lamps	5	W2x4.6d
Side repeater lamps	5	W2x4.6d
Front & rear turn indicators	21	SCC BA15s
Stop/tail lamps	5/21	SBC BAY15d
High mounted stop lamp	11	891
Rear fog lamp	21	SCC BA15s
Reversing lamp	21	SCC BA15s
Licence plate lamps	5	SU 8.5-8
Interior lamp	10	SU 8.5-8
Fascia switches	1.2	W2x4.6d

System voltage/polarity	12V negative earth
Alternator	85A
Battery - type	Tungstone 063
- cranking power	380 A (SAE); 210 A (DIN); 38 Ahr
- reserve capacity	60 minutes
- European Type Number (ETN)	543-16

TRANSMISSION

Type: 5 speed manual transaxle. Bevel gear differential.

Standard:

Gear	*Ratio*	*Final Drive*	*mph(km/h)/1000 rpm*
First	3.17 : 1	)	5.5 (8.9)
Second	1.84 : 1	)	9.5 (15.3)
Third	1.31 : 1	) 3.94 : 1	13.4 (21.5)
Fourth	1.03 : 1	)	16.9 (27.2)
Fifth	0.77 : 1	)	22.9 (36.8)
Reverse	3.00 : 1	)	

111S (close ratio):

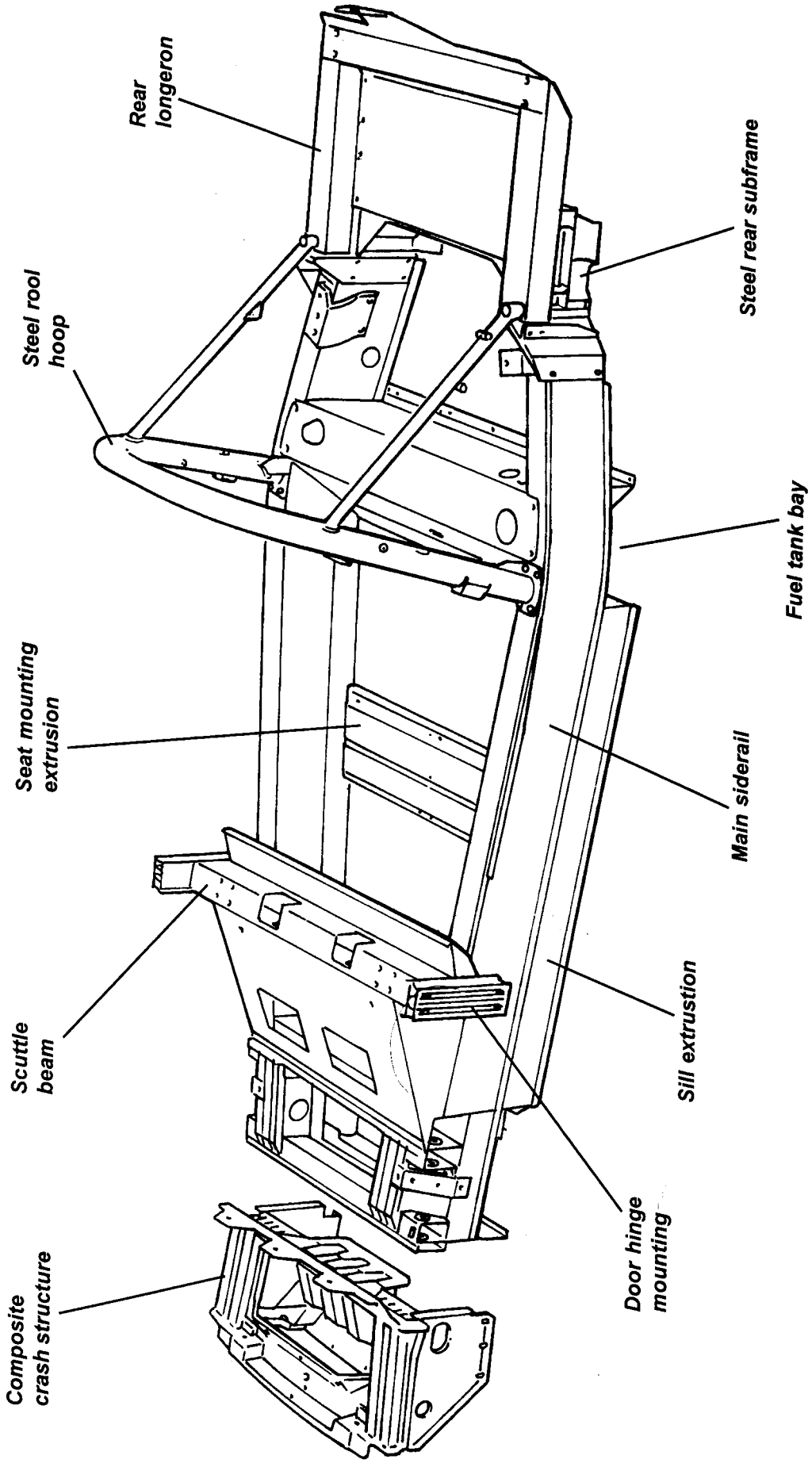
Gear	*Ratio*	*Final Drive*	*mph(km/h)/1000 rpm*
First	2.92 : 1	)	5.6 (9.0)
Second	1.75 : 1	)	9.4 (15.1)
Third	1.31 : 1	) 4.20 : 1	12.6 (20.3)
Fourth	1.03 : 1	)	16.0 (25.7)
Fifth	0.85 : 1	)	19.4 (31.2)
Reverse	3.00 : 1	)	

CLUTCH		
Type		Single dry plate. Diaphragm spring cover. Hydraulic release.
Friction plate diameter		215 mm
Diaphragm finger clearance		1.00 mm
Diaphragm finger height	- new	37.5 - 32.1 mm
	- service limit	42.75 mm
Friction plate thickness	- new	7.4 - 6.9 mm
	- service limit	5.6 mm
Rivet depth	- new	1.00 mm
	- service limit	0.20 mm
Friction plate run-out	- new	0.80 mm
	- service limit	1.00 mm
Pressure plate warp	- service limit	0.15 mm
BRAKES		
Type		Ventilated front & rear discs. Opposed piston alloy front calipers. Single piston sliding rear calipers.
Disc material	- prior June '98	Aluminium metal matrix
	- from June '98	Cast iron
Disc size	- front & rear	282.5 mm
Operation		Tandem master cylinder
Parking brake		Cable operation of rear calipers, self adjusting for pad wear.
STEERING		
Type		Rack and pinion
Turns, lock to lock		2.4
Gear ratio		15.8:1
FUEL CONSUMPTION		
93/116/EC	- std - urban	9.6 l/100 km (29.4 mpg)
	- extra urban	5.7 l/100 km (49.6 mpg)
	- combined	7.1 l/100 km (39.8 mpg)
	- CO_2	168 g/km
	- 111S - urban	9.9 l/100 km (28.5 mpg)
	- extra urban	5.9 l/100 km (47.8 mpg)
	- combined	7.3 l/100 km (38.6 mpg)
	- CO_2	174 g/km

CHASSIS

SECTION AF - M111

ELISE CHASSIS UNIT



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AF.1 - GENERAL DESCRIPTION

The chassis frame of the Lotus type M111 Elise is constructed primarily from aluminium alloy extrusions and formed alloy sheet, with the various sections bonded together using an epoxy adhesive with secondary drive-in fasteners. The basic chassis unit includes the passenger cell, front suspension mountings, fuel tank housing, and mid mounted engine bay, with a fabricated sheet steel rear crossmember bolting to the rear of the engine bay to provide rear suspension mountings and rear body support, and a tubular steel roll over bar bolted to the top of the chassis structure for additional occupant protection. The cabin rear bulkhead, body sills (inc. 'A' and 'B' posts), front energy absorbing crash structure and scuttle/windscreen mounting frame, are all constructed from glass fibre composite and are bonded to the chassis structure using an elastomeric adhesive. The front and rear body sections are each single piece composite mouldings, fixed to the chassis structure with threaded fasteners.

Two main chassis siderail extrusions, 210mm deep and 100mm wide, run along each side of the passenger compartment between the front and rear suspension mountings, splaying outwards towards the rear until the fuel tank crossmember behind the passenger cell. At this point, the siderails curve inwards around each side of the engine bay to provide platforms for the engine mountings. The passenger cell is further stiffened by sill extrusions secured beneath the siderails, with the flat floor panel reinforced with ribbed transverse channel sections running across the inside of the tub, which also provide seat mountings. At the rear of the passenger cell, an open bottomed crossmember uses a detachable, swaged, closing panel to house the steel fuel tank, with a further extruded crossmember joining the bottom of the siderails at the rear of the fuel tank bay, and providing pick up points for the front pivots of the rear lower wishbones. Note that the fuel tank bay closing panel contributes to the structural integrity of the chassis, such that the vehicle should not be operated without the panel fitted.

The rear ends of the siderails are joined behind the engine bay with a galvanised sheet steel fabricated subframe which provides mountings for the rear suspension pivots, engine rear stabiliser and exhaust muffler. Onto each top side of the subframe is bonded and rivetted a box section extrunded alloy longeron, which extends rearwards to provide rear body support. Enhanced stiffness of the chassis rear section and additional occupant protection is provided by a tubular steel roll over bar which bolts to the top of the siderails alongside the fuel tank bay, with bracing struts running from each top corner of the bar to the rear ends of the siderails.

At the front of the passenger compartment, four transverse extrusion beams are used to provide mountings for the front suspension pivots, and house the steering rack, with an upright section used each side to anchor the top of the spring/damper unit. A extruded floor section is used to reinforce this area, with the space between the front ends of the siderails housing the heater unit and battery. An extruded scuttle beam links the tops of the siderails, mounts the steering column, and is reinforced by a panel joining this beam with the steering rack crossmember, the panel also serving to mount the pedal box. Each end of the scuttle beam carries a vertical extrusion to mount the door hinge pillar.

To the front end of the chassis is bonded a glass fibre composite 'crash structure' which incorporates tubular sections designed to dissipate collision energy and control the rate of deceleration sustained by the occupants. Ducting and mountings for the horizontally positioned engine cooling radiator are also incorporated in this structure.

The bonded and rivetted alloy chassis structure described above is considered a non-serviceable jig built unit to which no structural repairs are approved. Superficial, cosmetic, or non-structural localised damage may be repaired as necessary, but in the case of accident damage resulting in significant bending, tearing or distortion of the aluminium chassis, such that the specified suspension geometry cannot be achieved by the standard range of suspension adjustment provided, the recommended repair is to renew the partial body assembly, which comprises the chassis and roll over bar together with jig bonded composite rear bulkhead, body sills, windscreen frame and crash structure, and the radiator feed and return pipes, heater pipes, battery cable and clutch pipe which are all routed within the sill panels.

AF.2 - CHASSIS STRAIGHTNESS CHECK

In the absence of visual damage, the chassis may be checked for twist or distortion by utilising the tooling holes in the underside of the main side rails. If computer processed laser measuring equipment is not available, manual checks can be made with reference to an accurately level ground plane, e.g. an accurately set and maintained suspension geometry ramp/lift. Position the car on the lift, and proceed as follows:

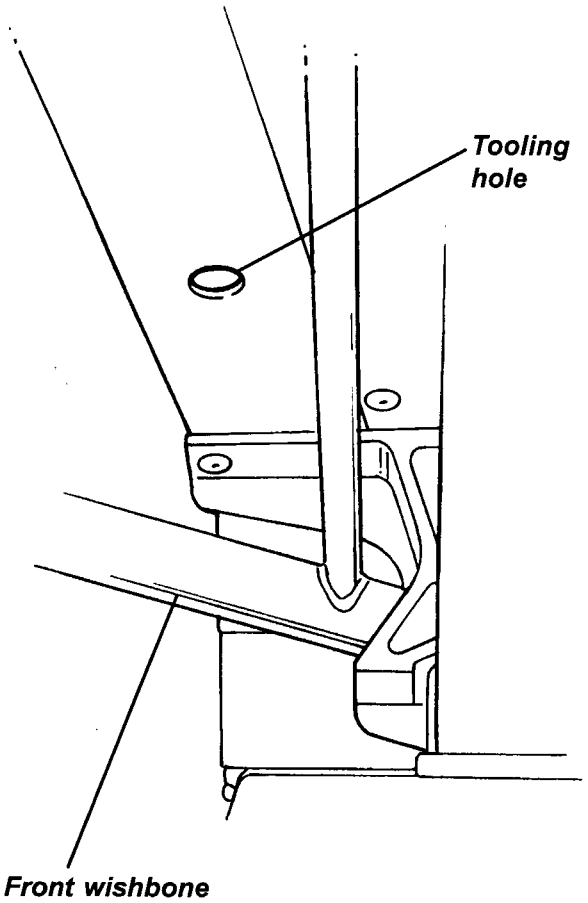
1. Identify the tooling holes in the lower surface of each chassis main side rail. At the front end, between the suspension wishbone pivots, and at the extreme rear end of each rail.

2. Measure the height of each tooling hole above the reference plane and use jacks to adjust the height of the chassis in order to equalise any three of these dimensions.

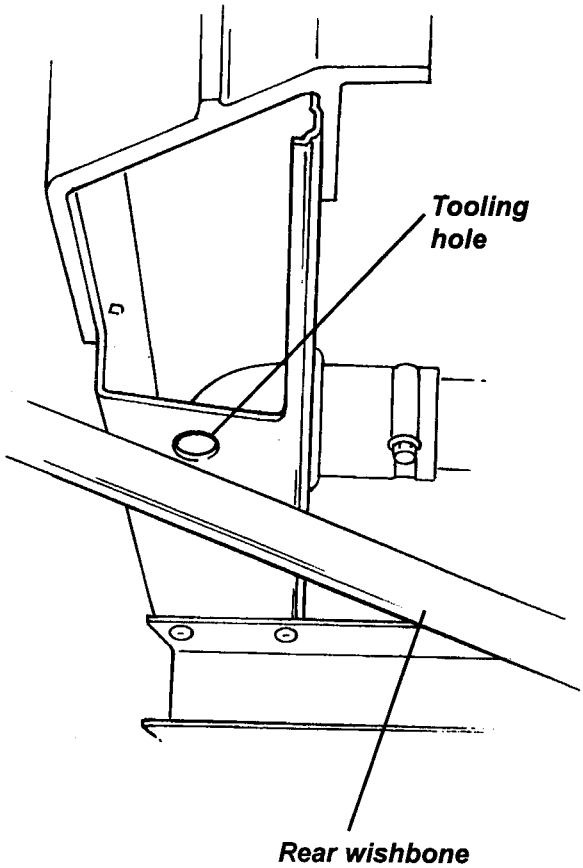
3. Measure the deviation of the fourth dimension from the other three.
   Maximum service deviation = ± 2.0 mm.

4. Repeat operations (2) and (3) for each combination of corners to result in four values for the 'fourth' dimension deviation. If any one of these exceeds the service specification, the chassis should be considered damaged and replaced by a partial body assembly.

FRONT



REAR



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AF.3 - REAR SUBFRAME & LONGERONS

The rear ends of the chassis siderails are linked by a fabricated sheet steel subframe which provides rear suspension mountings, and an anchor point for the engine rear steady bar. At each side, an extruded box section 'longeron' is rivetted and bonded to the top surface of the subframe, and extends rearwards to provide rear body support. On cars built prior to September '98, an aluminium sheet floor is rivetted between the longerons, with a boot front bulkhead bolted to the front edge of the floor. On later cars, the floor panel and bulkhead are replaced by a 'boot box' moulded integrally with the rear clamshell.

To remove rear subframe assy.

1. Remove the rear clamshell (see sub-section BN.5).

2. Remove exhaust catalytic converter and muffler, and if necessary, drill out the rivets and remove the exhaust heatshield.

3. Disconnect the parking brake cables and rear brake hydraulics, and remove both rear suspension assemblies complete with driveshafts.

4. Release the electrical components mounting plate from the LH longeron.

5. Release the engine rear steady arm from the subframe.

6. Release the roll over bar stays from the damper top mount tapping block, and remove the two bolts each side securing the subframe to the chassis flange. Withdraw the subframe and longerons as an assembly, together with the floor panel on early cars.

Note that it is not generally possible to separate a rear longeron from the subframe without damage to one or both components. If a longeron is damaged but the subframe is to be re-used, the longeron must be cut from the subframe.

Fitting rear subframe

When bolting the subframe at each side to the chassis rail rear flange, ensure that the anti-corrosion shim plate is interposed. The lower fixing bolts should be inserted from the rear, and the upper bolts from the front. Torque tighten the bolts to 45 Nm.

If longerons are already fitted to the subframe, fit the rear damper mount tapping block to the chassis before fitting the subframe and after bolting up the subframe, secure the roll over bar stays using the M10 caphead screw and washer at each side to pass through the longeron and into the damper mount tapping block. Torque tighten to 45 Nm.

If no longerons are fitted to the subframe, fit the subframe to the chassis, and then fit the longerons to the subframe as follows:

Fitting rear longerons

1. Ensure that at each side, the top surface of the subframe is free of zinc flashing, including the outside top lip of the subframe. Dry fit the longeron to ensure that the channel in the extrusion fits onto the outside edge of the subframe, with the longeron lying flat on the subframe top surface. The damper mounting tapping blocks may be fitted before the longerons for easier access, or alternatively, to ease fitment of the longerons, the tapping blocks may be fitted afterwards by feeding down the inside of the longeron.

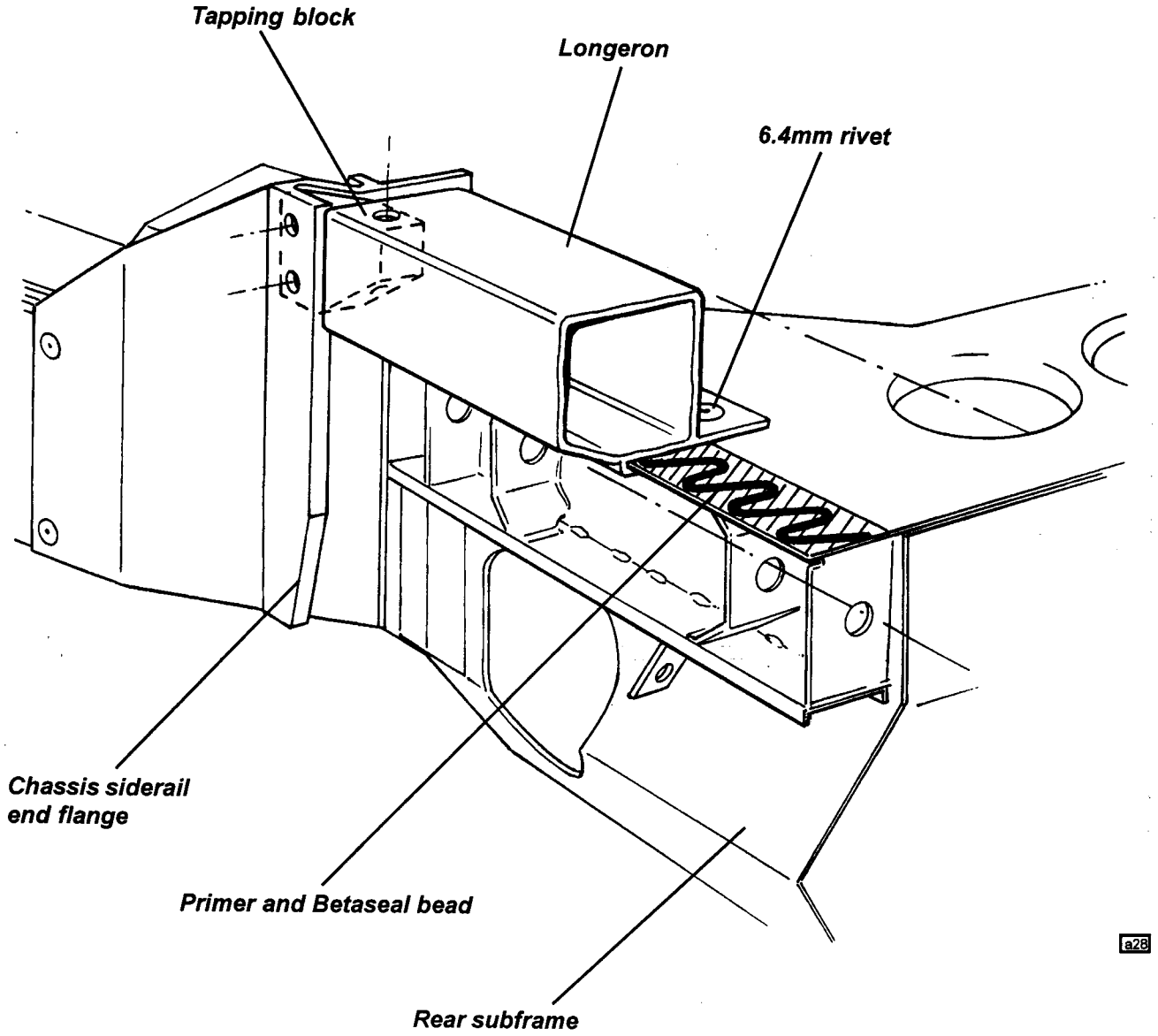
2. Clean the mating surfaces on the subframe and longeron using Betawipe VP 04604 (A082B6150V) as directed in sub-section BM.5.

3. Prime the whole of the mating faces of the subframe and longeron with Betaprime 5404 (A082B6337V) as directed in sub-section BM.5.

4. Apply a 'zig-zag' bead of Betaseal 1701 (A082B6281F) or Betamate E2400 (A082B8415V) to the primed surface of the subframe as detailed in sub-section BM.5.

5. Hook the longeron over the edge of the subframe and onto the adhesive and slide fully forward until aligned with the rivet holes and roll over bar brace fixing hole in the tapping block. If an aluminium boot floor is used (i.e. pre 'boot box'), fit the floor into position between the longerons before inserting the three 6.4 mm (1/4") rivets each side to secure the longeron (and boot floor if applicable) to the subframe. Fit the M10 caphead screw and washer to secure the roll over bar stay and longeron to the damper mounting tapping block.

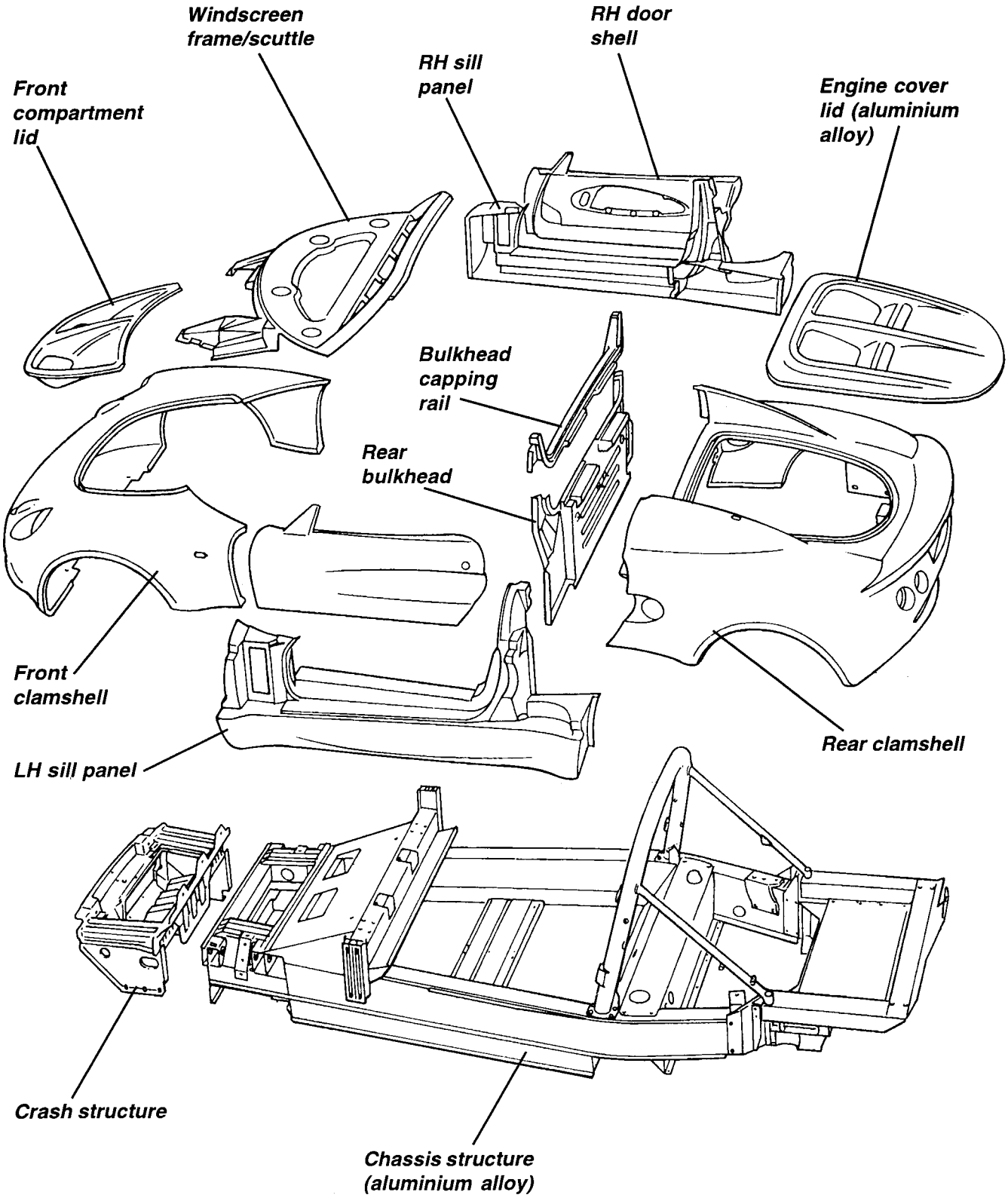
6. Fit the exhaust heatshield, electrical component plate and other components in reverse order to removal.



BODYCARE & REPAIR

SECTION BM - M111 ELISE

Principal Body Components



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BM.1 - GENERAL DESCRIPTION

The body panels of the Lotus Elise are constructed of composite materials, with the external panels not being required to contribute to chassis rigidity. The panels are attached to the aluminium chassis and/or other body panels either by elastomeric polyurethane adhesive, or in the case of the front and rear clamshells, are bolted on for ease of dis-assembly and access to chassis parts. The major panels are manufactured by the VARI (Vacuum Assisted Resin Injection) process, using a low profile resin and are of a nominal 2 mm thickness. The windscreen frame incorporates foam beams to create closed box sections for optimum strength and a 'crash structure' bonded to the front of the chassis incorporates longitudinal box sections to provide specific crush characteristics and absorb crash impact by progressive collapse. This structure also acts as a mounting and duct for the engine cooling radiator which is mounted horizontally on its top surface.

BM.2 - LOTUS COMPOSITE BODY FEATURES

Composite structures have the ability to absorb high impact loads by progressive collapse, with impact damage being localised. In vehicle accidents this feature protects the occupants from injurious shock loads and greatly reduces the danger of entrapment by deformation of steel body panels. This behaviour also facilitates repair by either replacing the damaged bonded or bolt on panels, and/or integrating a replacement section with the undamaged area, using recognised approved methods which restore the panel to its original condition without residual strain or distortion.

The manufacturing process enables the thickness of composite mouldings to be varied in order to provide efficient structures of high strength and low weight. Composites will not corrode, so the strength of composite components is retained regardless of age, unless physical damage is sustained. On the Elise, the body construction utilises a single moulding for the whole of the nose and front wings, and a second one piece moulding for the whole of the rear body aft of the doors. These two mouldings are fixed using threaded fasteners to permit easy removal for access to chassis or powertrain components, or to allow simple and economic accident repair. Other composite mouldings include the door shells, sills, front compartment lid, windscreen frame and rear bulkhead, some panels being bonded to the aluminium alloy chassis with an elastomeric adhesive.

The outer surface of a composite panel is sealed by a thin layer of 'gel coat'. If the panel is deflected beyond its limits of flexibility the gel coat will be overstressed and cracks will result, although the panel will return to its original shape. A steel panel similarly treated would become dented or 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 can be made in either case. Gel cracks may not appear immediately after overstressing, because the effect can be masked by the flexibility of the paint finish which covers the gel coat, and in some instances can take as long as three months to appear. Causes of gel cracks include:

- Vehicle collision;
- Sitting, leaning heavily or pushing on the body or any composite panel;
- Knocking doors against obstructions when opening;
- Dropping objects onto a panel;
- Allowing unrestrained items to roll about in a luggage compartment;
- Closing the bonnet or boot lid onto projecting objects, e.g. luggage or tools;
- Applying excessive force to parts attached to composite panels e.g. mirrors, locks, aerial etc. (action by vandals).
- Incorrect jacking.

BM.3 - BODYCARE

The acrylic enamel paint finish of the Elan is extremely resistant to all normal forms of atmospheric attack. Following the simple maintenance procedure summarised below will help retain the gloss, colour and protective properties of the paint throughout the life of the vehicle. However, car finishes are not immune to damage, and amongst the more common causes of deterioration are:

- Atmospheric contaminants; dust, soot, ash, and acidic or alkaline aerosol mist can chemically attack paint.
- Abrasion; blowing sand and dust, or a dirty washing cloth.
- Tree sap and insect fluids; can form a water-insoluble polymer that adheres to the paint.
- Bird droppings; highly acidic or alkaline, they can chemically etch the paint.
- Leaves; contain tannic acid which can stain light finishes.

Washing - Caution: Lotus does NOT recommend that the Elise is subjected to a mechanical (automatic) car wash as some types of brushes used in these devices may cause scratching of the flexible rear window, and accelerated ageing of the roof fabric. The car should be hand washed using the following instructions;

General: Many contaminants are water soluble and can be removed before any harm occurs by thorough washing with plenty of luke warm water, which includes a proprietary car wash additive (household detergent can remove wax and accelerate oxidation). Frequent washing is the best safeguard against unseen contaminants, at the same time ensuring the regular removal of dirt, dust and traffic film. Wash in the shade, and use a cotton chenille wash mitt or a sponge rinsed frequently to ensure no entrapment of dirt particles. Use a straight back and forth washing motion to avoid swirled micro scratches and rinse thoroughly.

Soft Top Roof:

1. Careful vacuuming of the soft top before washing may be helpful in removing excess dust and other foreign particles.
2. Wash in partial shade rather than strong sunlight, and wet the whole car before tackling the soft top.
3. Use a sponge (a chamois or cloth will leave lint, and a brush may abrade the threads) to apply a mild **soap** solution of lukewarm water. Do NOT use a detergent.
4. To avoid rings or spots, wash the entire top uniformly and let the soapy solution remain on the fabric for 2 to 5 minutes.
5. Rinse the whole car to remove all soap from the fabric and to prevent streaking on the car bodywork.
6. Remove surface water with a sponge and allow to air dry in direct sunlight. Ensure that the roof is fully dry before stowing, as prolonged stowage of a wet or damp roof will promote rotting of the fabric.

Keeping the soft top clean by regular washing will enhance the life and maintain the appearance of the roof, and facilitate subsequent cleaning. The use of stronger cleansers should be left to professionals experienced in handling this type of fabric as discoloration and degradation of the special protective inner layer may result. The application of wax finishes, dressings or preservatives will cause stains which are difficult to remove and therefore should be avoided.

Paintwork Polishing

Eventually some loss of gloss, and an accumulation of traffic film, will occur. At this stage, after the normal washing, a polish with 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, can be obtained by wax polishing, but it must be remembered that a wax polish can only be used successfully on a clean surface, and that the previous application must first be removed with white spirit or a liquid polish cleaner before re-waxing.

Ventilation

Water lying 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, otherwise storage outside on a hard standing or under a carport is preferable.

Windscreen

When washing the windscreen, take care to lift the wiper blade only a small distance from the glass in order not to damage the wiper arm mechanism. Wash the wiper blade with clean water.

Alloy Wheels Cleaning

It is recommended that these are washed with the preparation as is used to wash the bodywork. Use a brush having only nylon bristles. During the winter months, particularly when salt has been used on the roads for the dispersal of snow and ice, remove all wheels, and wash thoroughly to remove all accumulated road filth

from wheels and tyres.

Upholstery Cleaning

Cloth Upholstery: Normal cleaning consists of 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. Alternatively, a proprietary upholstery cleaner may be used.

Leather Upholstery: The leather should be wiped over occasionally with a cloth dampened in warm soapy water. Use a mild, non-caustic toilet soap or soap flakes. Repeat the operation using a fresh cloth and water only, but avoid flooding the leather. Finish by drying and polishing with a soft dry cloth. The manufacturers of the leather do not recommend the use of any hide 'food', and prohibit the use of petrol or detergents, furniture creams and polishes.

Senotex Coated Trim: Some areas of the interior, including the scuttle and rear bulkhead are finished with a grey, textured 'Senotex' coating. Stains may be removed using a proprietary upholstery cleaner and a soft bristle brush. Finish by wiping over with a dry soft cloth.

Seat Belts Cleaning

The seat belts should be sponged with warm water and allowed to air dry naturally. Do not use chemical cleaners and never attempt to bleach or dye the webbing.

BM.4 - ACCIDENT DAMAGE ASSESSMENT

The repair method to be employed in the rectification of accident damage to composite panels, is to be assessed reletive to the particular panel and its method of attachment:

Bolt-on Panels:
- Front Clamshell;
- Rear Clamshell;
- Door Shells;
- Front Services Compartment Lid. (Note that the engine cover lid is aluminium)

These panels are secured by threaded fasteners and are easily removed for access to the back of any damaged area for repair by conventional composite techniques. Instructions for the removal and refitment of the front and rear clamshells and doors, are contained in section BN.

Bonded-on Panels:
- Windscreen Frame;
- LH & RH Sill Panels;
- Front Crash Structure;
- Rear Bulkhead & Capping Rail.

These panels are bonded to the chassis or to other panels using a flexible polyurethane adhesive which must be cut before the panel may be removed. In some cases, it may be necessary to partially remove another panel before the subject panel can be released. It is not generally economic to attempt to remove a bonded panel intact for later re-fitment.

The integrity of the front crash structure is crucial to the safety of the car in a frontal collision, and it is recommended not to attempt any major repair of this component. The damaged structure should be cut from the front of the chassis, and a new assembly bonded into position.

The sill panels include the 'A' and 'B' posts, and involve much labour time to replace. Localised repairs should be performed whenever possible, although access to the inside of the panels is not freely available.

The shape and positioning of the windscreen frame is crucial to the fit of the windscreen and sealing of the soft top roof, such that structural repairs should not generally be considered.

Note that if damage is such as to require replacement of the chassis, replacement chassis assemblies are provided already jig assembled with the bonded body panels of rear bulkhead and capping rail, sills, windscreen frame and front crash structure.

BM.5 - BODY PANEL BONDING MATERIALS

The materials used for bonding the body panels are manufactured by Gurit-Essex, and in order to maintain the structural integrity of the vehicle, and in the case of the front crash structure, the safety, it is most important to use only the specified materials. The surface preparation and cleaning and priming operations are crucial to the performance of the adhesive, and must be followed in detail. The products to be used depend on the surface (substrate) onto which they are applied, and the following list identifies each application:

Anodised aluminium (e.g. chassis and components)

Cleaner:	Betawipe VP 04604	Lotus part no. A082B6150V
Primer:	Betaprime 5001	Lotus part no. A100B6009V
Adhesive:	Betaseal 1701	Lotus part no. A082B6281F
or	Betamate E2400	Lotus part no. A082B8415V

Unpainted or painted composite

Cleaner:	Betaclean 3900	Lotus part no. A100B6008V
Primer:	Betaprime 5404	Lotus part no. A082B6337V
Adhesive:	Betaseal 1701	Lotus part no. A082B6281F
or	Betamate E2400	Lotus part no. A082B8415V

Zinc plated and passivated steel

Cleaner:	Beatclean 3900	Lotus part no. A100B6008V
Primer:	Betaprime VP 01706 A+B	Lotus part no. A100B6070V
Adhesive:	Betaseal 1701	Lotus part no. A082B6281F

Glass

Cleaner:	Betawipe VP 04604	Lotus part no. A082B6150V
Primer:	Betaprime 5001	Lotus part no. A100B6009V
Adhesive:	Betaseal 1701	Lotus part no. A082B6281F
or	Betamate E2400	Lotus part no. A082B8415V

Uncoated Lexan/Perspex

Cleaner:	Abrasion & dry wipe	
Primer:	Betaprime 5404	Lotus part no. A082B6337V
Adhesive:	Betaseal 1701	Lotus part no. A082B6281F
or	Betamate E2400	Lotus part no. A082B8415V

Residual adhesive (i.e. rebonding to surface after cutting off old panel)

Cleaner, primer & re-activator	Betawipe 4000	Lotus part no. A082B6355V
Adhesive:	Betaseal 1701	Lotus part no. A082B6281F
or	Betamate E2400	Lotus part no. A082B8415V

Applicator Bottle

An applicator bottle is available for use with some cleaners and primers, and has a disposable felt pad which should be changed regularly to minimise surface contamination:

Applicator bottle	A000Z1071F
Cap	A082B6353S
Felt pad	A082B6354S

Product Usage

BETAWIPE VP 04604 (A082B6150V):

Description: Activator and cleaning agent used to promote adhesion to the substrate surface. Supplied in a 250ml aluminium container with a YELLOW coloured cap.

Application:
- Wipe on/wipe off type.
- Pour Betawipe VP 04604 into applicator bottle, and immediately refit the yellow cap onto the container.

- Push the applicator head onto the bottle, and fit the felt pad.
- Wet out the felt pan by inverting the applicator bottle and gently squeezing the sides.
- Wipe the pad over the substrate surface using minimal pressure to wet the surface.
- Immediately wipe off the activated/cleaned surface using a clean fibre free cloth, and discard.

Notes:
- If the substrate is very dirty, first wipe off the surface with a clean fibre free cloth and discard.
- Do not leave the caps off Betawipe containers. A milky colour indicates moisture absorption, and the material should be discarded.
- Only decant a sufficient quantity of Betawipe for the job concerned, and never pour material back into the container from the applicator bottle.
- Change the felt pad at regular intervals to reduce surface contamination.

BETACLEAN 3900 (A100B6008V)

Description: Degreaser and cleaning agent used for the removal of contamination from the substrate sur face. Supplied in 1 litre aluminium container with a BLACK coloured cap.

Application:
- Wipe on/wipe off type.
- When substrate is very dirty, first wipe off the surface with a clean fibre-free cloth and discard.
- Dampen a fibre-free cloth with Betaclean 3900, and immediately replace the black cap.
- Thoroughly clean the substrate surface with Betaclean and discard the cloth.
- Wipe off the substrate with a clean fibre-free cloth and discard.

BETAWIPE 4000 (A082B6355V)

Description: Cleaning agent which acitvates the old adhesive layer to accept new adhesive. Supplied in 250 ml aluminium containers with a BLUE cap.

Application:
- The residual adhesive bead should be cut with a scalpal to leave an even thickness of approximately 1 to 2 mm.
- Dampen a fibre-free cloth with Betawipe 4000 and immediately replace the blue cap.
- Thoroughly clean the substrate surface with Betawipe and discard the cloth. Do not wipe off.
- Allow 2 - 3 minutes flash off time before applying adhesive.

BETAPRIME 5001 (A100B6009V)

Description: Adhesion promotor used to maximise the performance of the bonding between the cleaned and/or activated surface and the adhesive compound. Supplied in 250 ml aluminium container with GREEN coloured cap.

Application:
- Two steel balls inside the container are provided to assist mixing of the contents when shaken. Prior to decanting Betaprime 5001, shake the container for at least 60 seconds to disperse the solid content of the material into suspension.
- Pour the primer into the applicator bottle and immediately replace the green cap.
- Wet out the felt pan by inverting the applicator bottle and gently squeezing the sides.
- Wipe the pad over the activated/cleaned substrate surface to apply a continuous film of primer.
- Allow to dry for a minimum of 15 minutes before applying adhesive. If adhesive is not applied with 72 hours, wipe on/wipe off with Betawipe VP 04604.

Notes:
- The appearance of the primed areas should be deep black in colour with no streaks or voids. To achieve this appearance, apply in smooth continuous uni-directional movement, not short backward and forward movements. The latter technique results in inconsistent film build. Rework any poor areas after 5 minutes (tack time), applying in the same direction.
- Replace the felt pad if moisture absorption results in hardening.
- Never return unused Betaprime back into the aluminium container.

BETAPRIME 5404 (A082B6337V)

Description: Adhesion promotor used to maximise the performance of the bonding between the cleaned and/or activated surface and the adhesive compound. Supplied in 250 ml aluminium container with RED coloured cap.

Application:
- Two steel balls inside the container are provided to assist mixing of the contents when shaken. Prior to decanting Betaprime 5001, shake the container for at least 60 seconds to