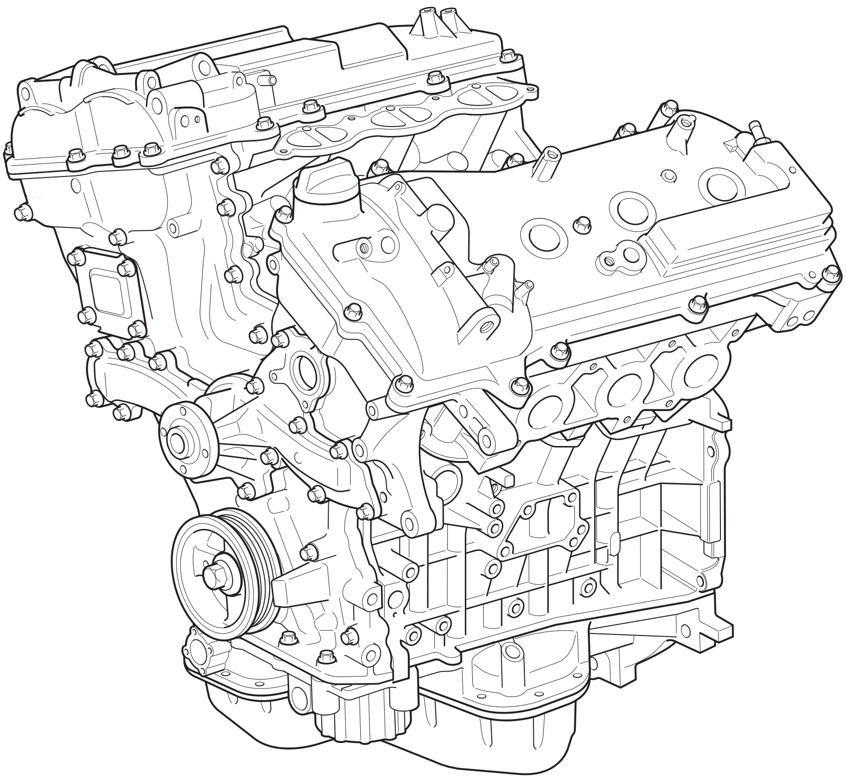
TECHNICAL DATA - ENGINE

SECTION TDP



Page

<u>GENERAL</u>

Type designation		2GR-FE
Configuration		V6
Capacity		3456 cm^3 (210.9 in^3)
Bore		94.0 mm (3.70 in^3)
Stroke		83.0 mm (3.27 in^3)
Valve configuration		4 VPC in pentroof chamber
Camshaft configuration		DOHC per bank
Camshaft drive		Single chain drive to both inlet camshafts. Secondary chain linking each inlet camshaft to its neighbouring exhaust camshaft. All 4 camshafts use hydraulically activated variable timing sprocket hubs under ECU control
Valve operation		Finger followers with hydraulic pivot posts Siamese ports
Compression ratio		10.8:1
Compression pressure	- new minimum	1,400 kPa (14 kgf/cm^2, 199 psi)
	- service minimum	980 kPa (10.0 kgf/cm^2, 142 psi)
	- cyl/cyl max. variance	100 kPa (1.0 kgf/cm^2, 15 psi)
Firing order		1,2.3,4,5,6

Exige Supercharged

Spark plugs		NGK ILFR7B8
Spark plug gap		0.8 mm (0.031 in)
Engine management		Lotus T6 controller
Ignition system		Direct ignition using individual plug top coils
Fuel system		Port injection. Sychronous and non-synchronous operation Hot wire airflow sensor
Fuel requirement		Minimum 95 RON - Optimum 98 RON
Intake system		Harrop HTV1320 supercharger utilising Eaton TVS Technology ™
Maximum boost pressure		0.5 bar
Maximum continuous engine speed	- std	6,600 rpm
	- Sport mode	7,000 rpm
Maximum transient engine speed	- std	6,800 rpm
	- Sport mode	7,200 rpm
*Normal warm idle speed		750 ± 200 rpm *Idle speeds may vary if air conditioning and or sport mode is active)
Net power (ECE 85)		257 kW (345 bhp) @ 7000 rpm
Net torque (ECE 85)		400 Nm @ 4,500 rpm
Exhaust emissions		*Close ratio gearbox*
	- CO	0.774 g/km
	- HC	0.051 g/km
	- NOx	0.035 g/km
	- HC + NOx	0.086 g/km
	- CO_2 - Urban	337 g/km
	- Extra urban	177 g/km
	- Combined	236 g/km

CYLINDER BLOCK

Material			Aluminium alloy with 'cast in' cast iron cylinder liners
Configuration			60°V, right hand bank offset 36.6mm forward RH bank; cylinders 1,3,5 from front LH bank; cylinders 2,4,6 from front
Bore diameter	- std		94.000 to 94.012 mm (3.7008 to 3.7013 in.)
	- service limit		94.200 mm (3.7087 in.)
Deck face flatness tolerance			0.07 mm (0.0028 in.)

CYLINDER HEAD

Material			Aluminium alloy
Head face flatness tolerance			0.10 mm (0.004 in.)
Manifold face flatness tolerance			0.10 mm (0.004 in.)
Valve guide bore in head	- std		10.285 to 10.306 mm (0.4049 to 0.4057 in.)
	- 05mm o/s		10.335 to 10.356 mm (0.4069 to 0.4077 in.)
Valve guide standout	- inlet		9.1 to 9.9 mm (0.36 to 0.39 in.)
	- exhaust		9.3 to 9.7 mm (0.3661 to 0.3819 in.)
Maximum oil clearance	- inlet		0.08 mm (0.0031 in.)
	- exhaust		0.10 mm (0.0039 in.)

VALVES & SPRINGS

Valve stem diameter	- inlet		5.470 to 5.485 mm (0.2154 to 0.2159 in.)
	- exhaust		5.465 to 5.480 mm (0.2151 to 0.2157 in.)
Overall length	- inlet	- std	5.465 to 5.480 mm (0.2151 to 0.2157 in.)
		- min	105.35 mm (4.1476 in.)
	- exhaust	- std	110.40 mm (4.3464 in.)
		- min	109.90 mm (4.3268 in.)
Valve seat contact width	- inlet		1.1 to 1.5 mm (0.043 to 0.059 in.)
	- exhaust		1.2 to 1.6 mm (0.047 to 0.063 in.)
Valve head margin (thickness between head face and 45° face)			
	- std		1.00 mm (0.040 in.)
	- minimum		0.50 mm (0.020 in.)
Valve spring free length			45.46 mm (1.790 in.)

CAMSHAFTS

Endfloat	- std		0.08 to 0.13 mm (0.0031 to 0.0051 in.)
	- service limit		0.15 mm (0.006 in.)
Maximum oil clearance	- front journal		0.15 mm (0.006 in.)
	- except front		0.09 mm (0.0035 in.)

PISTONS

Diameter 10mm below pin centreline		- std	93.960 to 93.980 mm (3.6992 to 3.6999 in.)
		- miniumum	93.830 mm (3.6941 in.)
Bore oil clearance	- std		0.020 to 0.052 mm (0.0007 to 0.0020 in.)
	- service limit		0.060 mm (0.0024 in.)
Gudgeon pin oil clearance	- std		0.001 to 0.007 mm (0.00004 to 0.0003 in.)
	- service limit		0.015 mm (0.0006 in.)

CRANKSHAFT

Main journal diameter	60.988 to 61.00 mm (2.4011 to 2.4016 in.)
Main journal max. runout	0.06 mm (0.0024 in.)
Main journal maximum taper and out-of-round	0.02 mm (0.0008 in.)
Crankpin diameter	52.992 to 53.000 mm (2.0863 to 2.0866 in.)
Crankpin maximum taper and out-of-round	0.02 mm (0.0008 in.)

OIL PUMP

Rotor tip clearance	- std	0.060 to 0.160 mm (0.0024 to 0.0063 in.)
	- service limit	0.16 mm (0.0063 in.)
Annulus to housing clearance	- std	0.250 to 0.325 mm (0.0098 to 0.0128 in.)
	- service limit	0.325 mm (0.0128 in.)
Rotor/annulus side clearance	- std	0.030 to 0.090 mm (0.0012 to 0.0035 in.)
	- service limit	0.090 mm (0.0035 in.)
Hot oil pressure	- idle	80 kPa (0.8 kgf/cm2, 11.6 psi)
	- 6,000 rpm	380 kPa (3.9 kgf/cm2, 55.5 psi)

COOLANT THERMOSTAT

Valve opening temperature	80 to 84°C (176 to 183°F)
Valve lift at 95°C	10 mm

ENGINE OIL COOLER THERMOSTAT

Valve opening temperature	72°C (162°F)

MVa - CIRCUIT DIAGRAMS

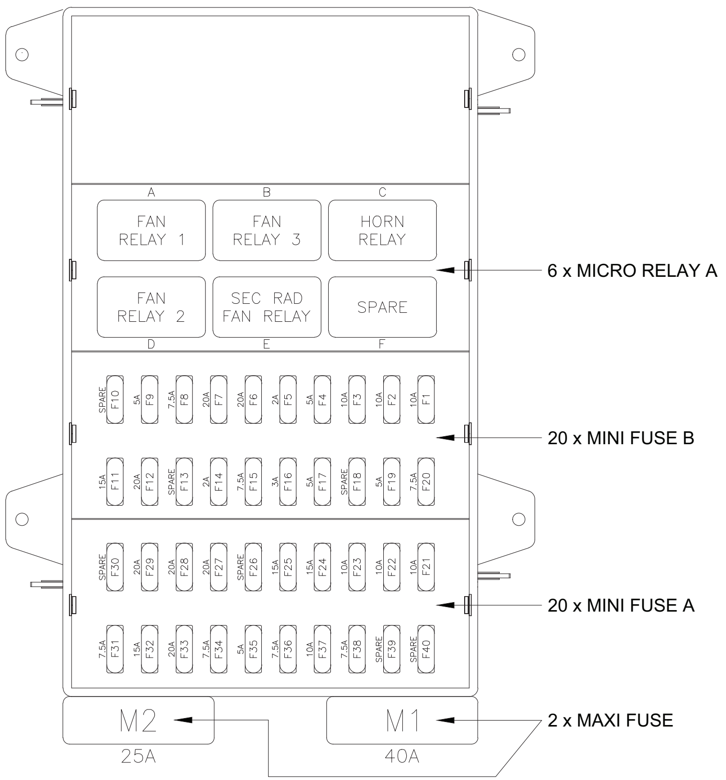
EXIGE S SUPERCHARGED - MANUAL TRANSMISSION

FROM START OF PRODUCTION

FRONT FUSES

FUSE No.	LOCATION	FUNCTION	RATING	SUPPLY TYPE
F1	FRONT	IGNITION SERVICES	10A	IGNITION
F2	FRONT	ABS	10A	IGNITION
F3	FRONT	STOP LAMPS	10A	IGNITION
F4	FRONT	SPARE		IGNITION
F5	FRONT	REVERSE BUZZER	2A	IGNITION
F6	FRONT	DRIVER'S WINDOW MOTOR	20A	IGNITION
F7	FRONT	PASSENGER'S WINDOW MOTOR	20A	IGNITION
F8	FRONT	DIRECTION INDICATORS	7.5A	IGNITION
F9	FRONT	DAY TIME RUNNING LAMPS	5A	IGNITION
F10	FRONT	SPARE		
F11	FRONT	WIPER MOTOR	15A	START DROP OUT
F12	FRONT	INTERIOR FAN	20A	START DROP OUT
F13	FRONT	SPARE		START DROP OUT
F14	FRONT	USB CHARGE CONN	2A	KEY IN
F15	FRONT	ICE HEAD UNIT / IC KEY IN	7.5A	KEY IN
F16	FRONT	ECU / START, F.P. & HRS RELAYS	3A	IGNITION
F17	FRONT	REVERSE LAMPS & PARKING SENSORS	5A	IGNITION
F18	FRONT	SPARE		IGNITION
F19	FRONT	ALTERNATOR IGN	5A	IGNITION
F20	FRONT	AC CLUTCH	7.5A	IGNITION
F21	FRONT	SIDELAMP / REAR FOG LAMP	10A	BATTERY
F22	FRONT	LH DIP BEAM	10A	BATTERY
F23	FRONT	RH DIP BEAM	10A	BATTERY
F24	FRONT	LH MAIN BEAM	15A	BATTERY
F25	FRONT	RH MAIN BEAM	15A	BATTERY
F26	FRONT	SPARE		
F27	FRONT	RAD FAN 2 FAST	20A	BATTERY
F28	FRONT	RAD FANS 1&2 SLOW/FAN 1 FAST	20A	BATTERY
F29	FRONT	SEC RAD FAN	20A	BATTERY
F30	FRONT	SPARE		
F31	FRONT	HORN	7.5A	BATTERY
F32	FRONT	HAZARDS	15A	BATTERY
F33	FRONT	AUX POWER SOCKET	20A	BATTERY
F34	FRONT	CDL	7.5A	BATTERY
F35	FRONT	OBD2	5A	BATTERY
F36	FRONT	ICE HEAD UNIT / SWITCH PACK MODULE	7.5A	BATTERY
F37	FRONT	ALARM & INTERIOR LAMP	10A	BATTERY
F38	FRONT	IC / HEADLAMP FLASH	7.5A	BATTERY
F39	FRONT	SPARE		
F40	FRONT	SPARE		
M1	FRONT	ABS MAIN POWER 1	40A	BATTERY
M2	FRONT	ABS MAIN POWER 2	25A	BATTERY

FRONT FUSE/RELAY BOX



FRONT VIEW

TITLE: FRONT FUSE & RELAY LAYOUT		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH	FUSE F4 NOW SPARE	19/7/12	B1
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:INDEX 2	ISSUE LEVEL: B1	FIRST RELEASE DATE	JAN 2012			

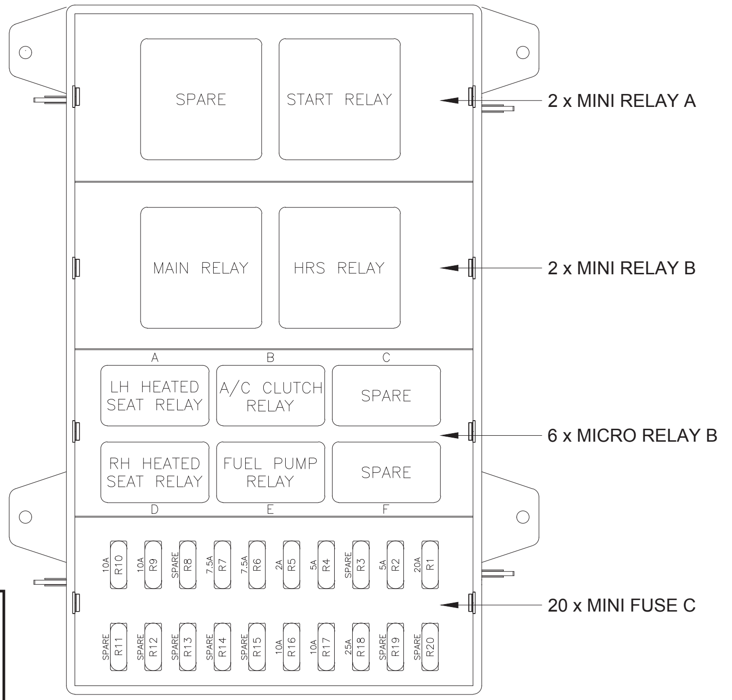
CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER

Updated 6th August 2012

REAR FUSES

FUSE No.	LOCATION	FUNCTION	RATING	SUPPLY TYPE
R1	REAR	FUEL PUMP	20A	BATTERY
R2	REAR	ALTERNATOR SENSE	5A	BATTERY
R3	REAR	SPARE		
R4	REAR	HRS SW LED	5A	HRS
R5	REAR	HOT SOAK PUMP	2A	MAIN RELAY
R6	REAR	02 HEATERS	7.5A	MAIN RELAY
R7	REAR	VIM, VVT, PURGE, ACIS, CVCV, A/C VALVE	7.5A	MAIN RELAY
R8	REAR	SPARE		MAIN RELAY
R9	REAR	COILS	10A	MAIN RELAY
R10	REAR	INJ'S / ECU PWR / FAN RELAYS, HTD SEAT RELAYS	10A	MAIN RELAY
R11	REAR	SPARE		
R12	REAR	SPARE		
R13	REAR	SPARE		
R14	REAR	SPARE		
R15	REAR	SPARE		
R16	REAR	LH HEATED SEAT	10A	BATTERY
R17	REAR	RH HEATED SEAT	10A	BATTERY
R18	REAR	HRS	20A	BATTERY
R19	REAR	SPARE		
R20	REAR	SPARE		

REAR FUSE/RELAY BOX

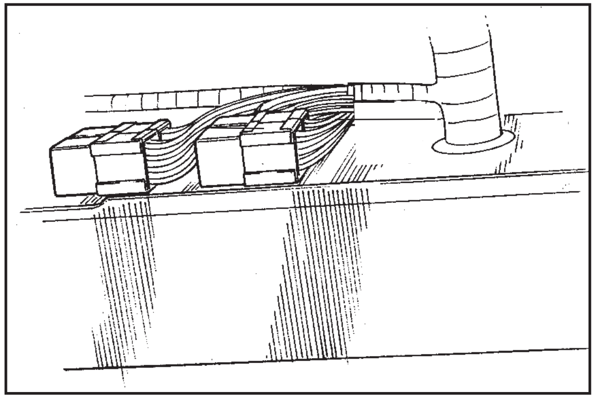


FRONT VIEW

CABIN RELAYS

Located under scuttle beam passenger side footwell

1 x Turn/hazard relay
1 x Wash/wipe module



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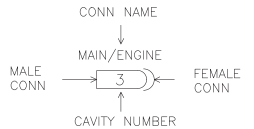
SHEET:INDEX 3	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			



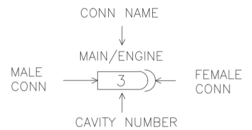
- MAIN HARNESS
- BATTERY CABLES
- REAR HARNESS
- ENGINE HARNESS
- DOOR HARNESS
- HEADLAMP HARNESS
- REAR LAMP HARNESS
- TAILGATE HARNESS
- FUEL TANK HARNESS
- PARKING AID HARNESS
- DOOR SWITCH HARNESS
- ANTENNA CABLE

WIRE COLOUR CODE

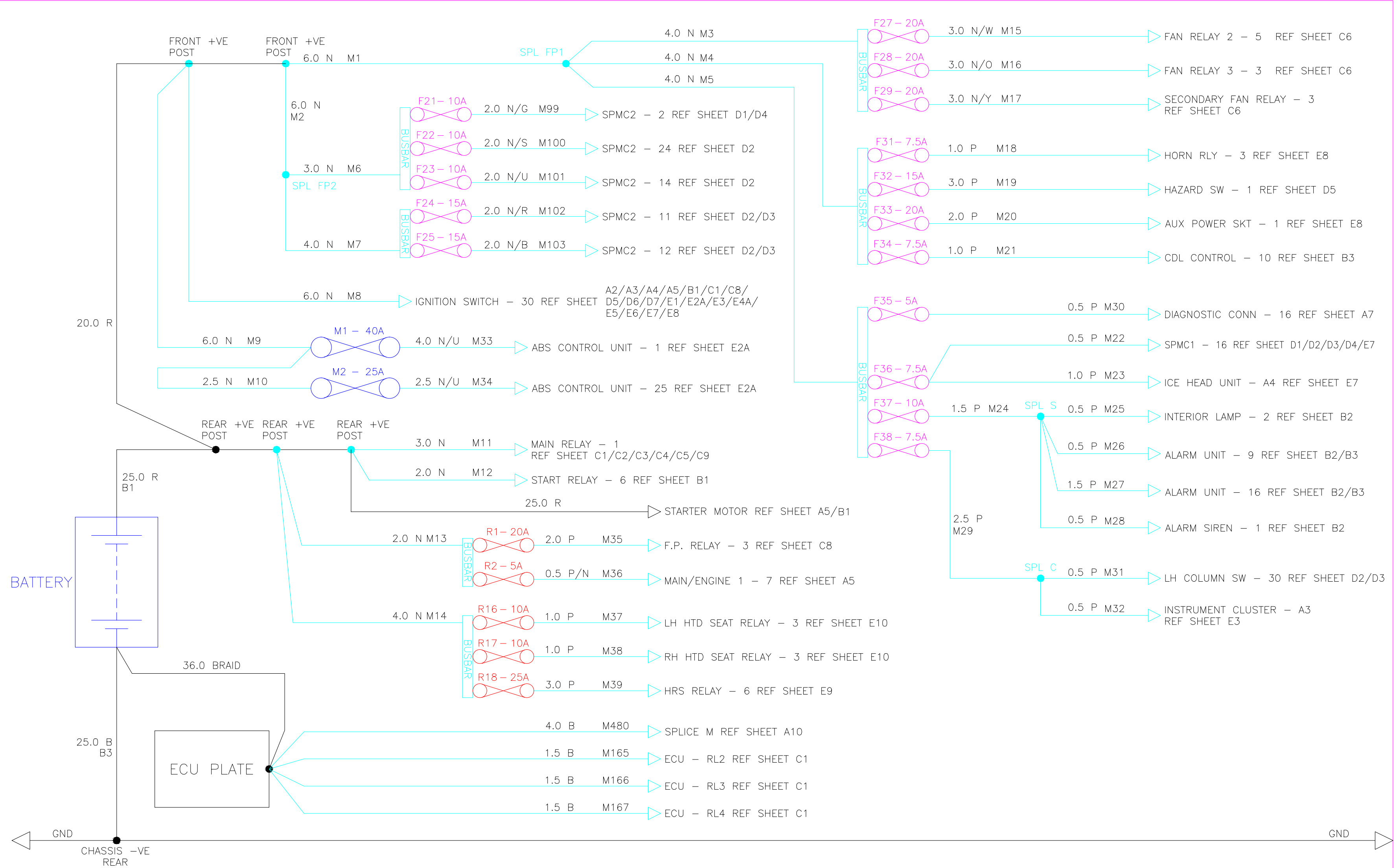
B — BLACK
G — GREEN
N — BROWN
R — RED
O — ORANGE
P — PURPLE
LG — LIGHT GREEN
K — PINK
U — BLUE
W — WHITE
S — SLATE (GREY)
Y — YELLOW

BASE COLOUR/TRACER COLOUR

TITLE: COLOUR CODING (COLOUR PRINTS ONLY)		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:INDEX 5	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			



MVa - CIRCUIT DIAGRAMS



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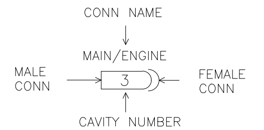

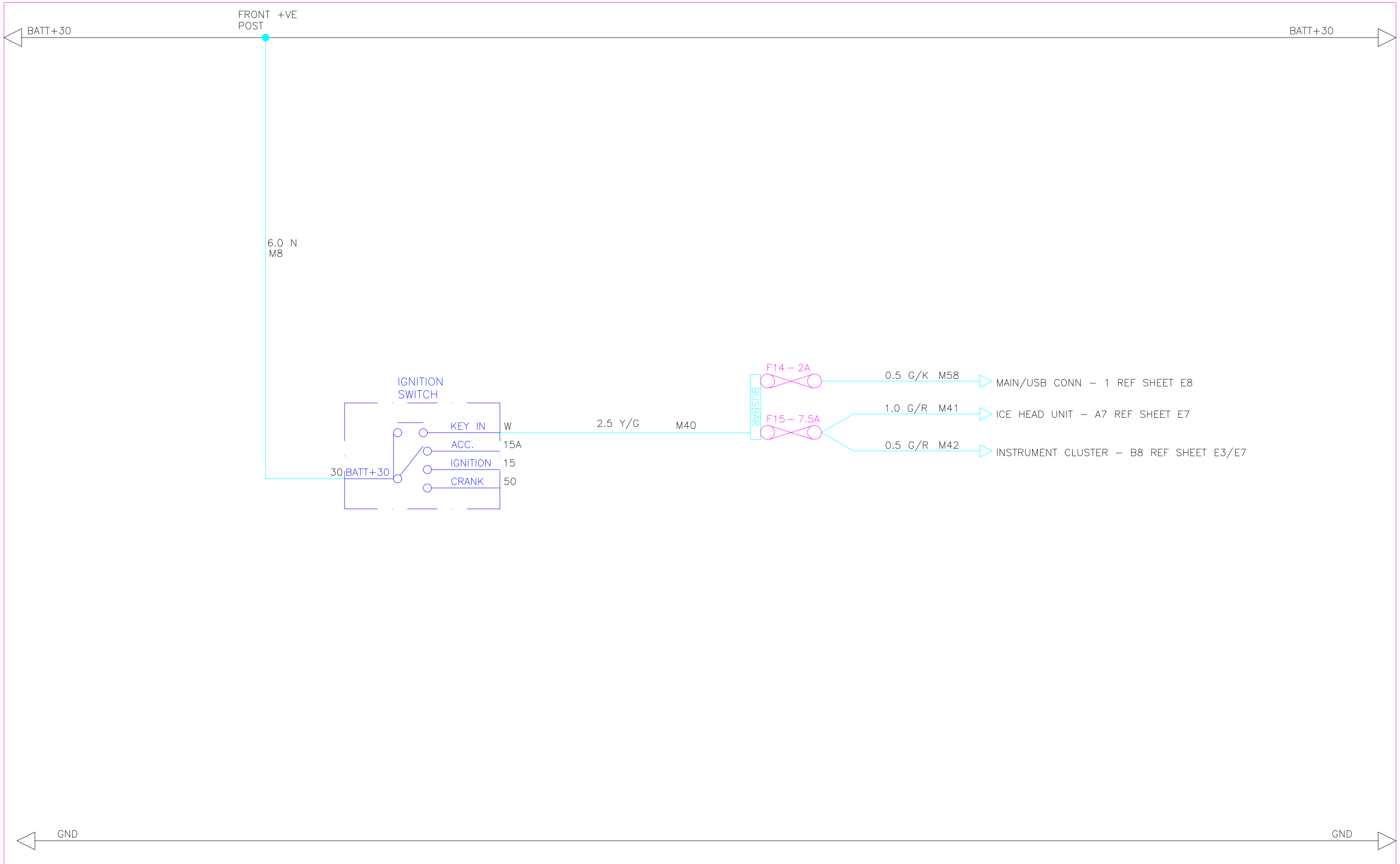

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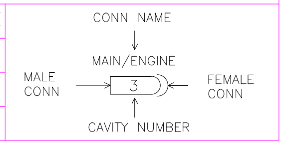
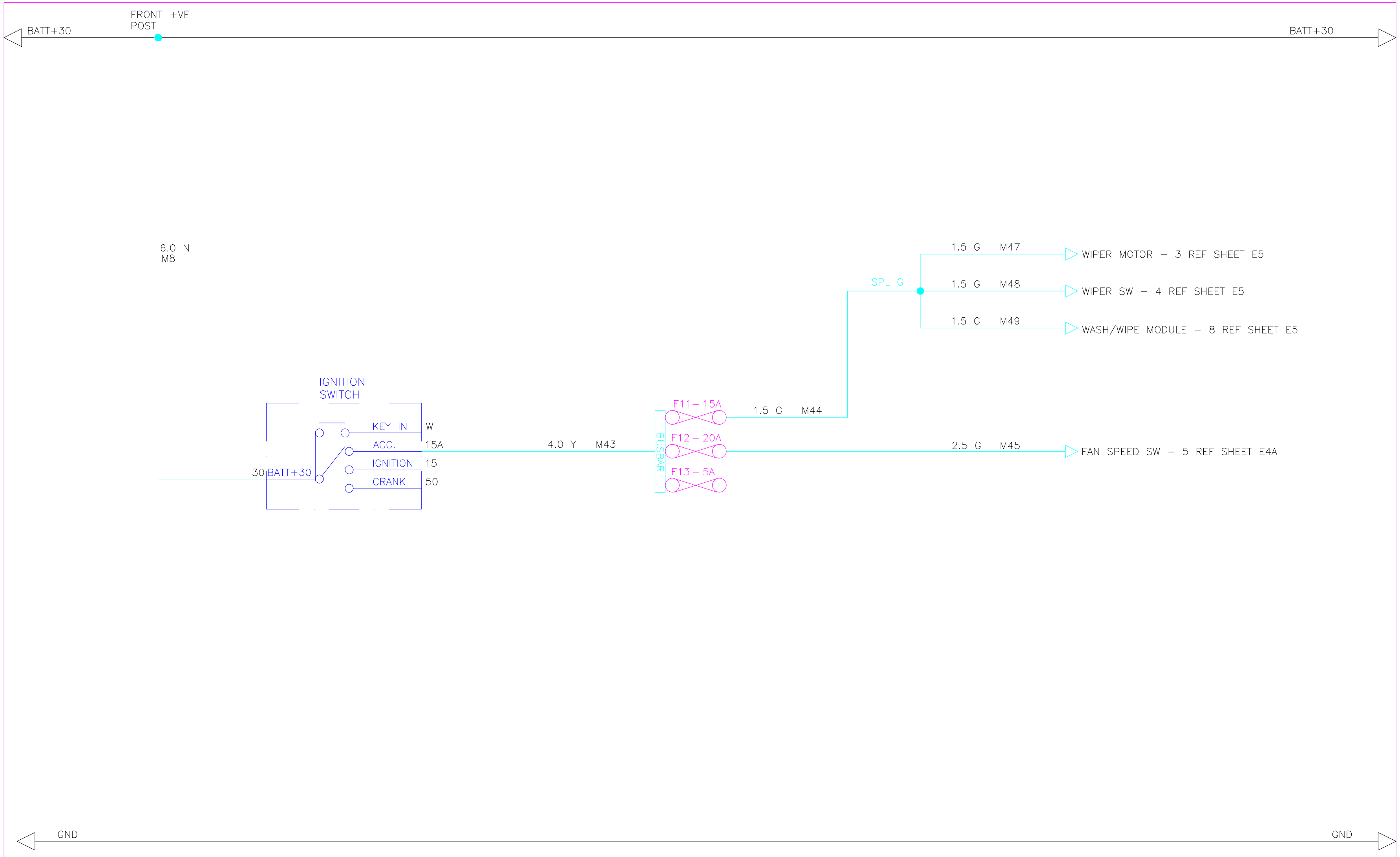
SHEET:A2	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012		





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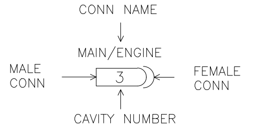
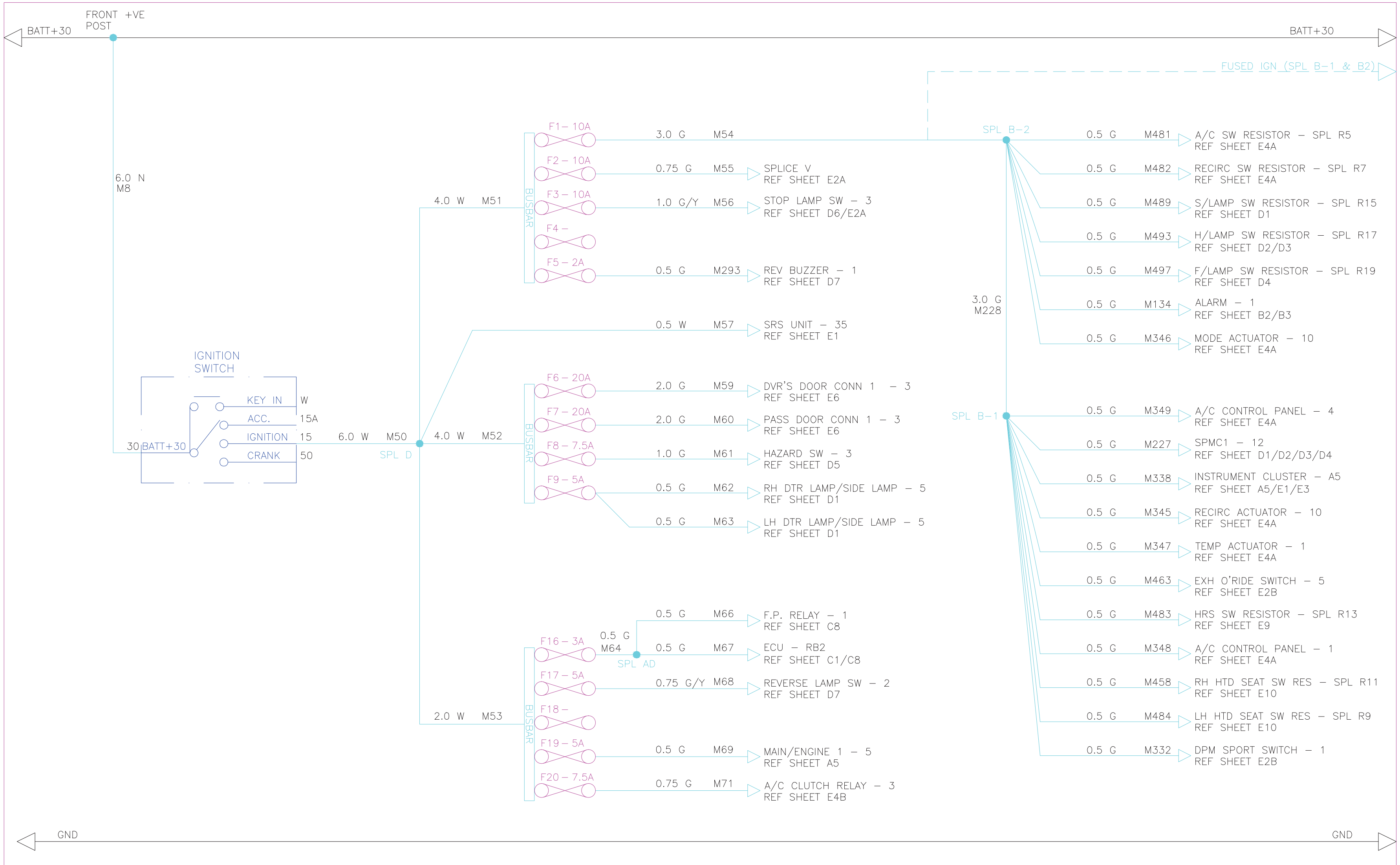
SHEET:A3	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012	

DATE | ISSUE





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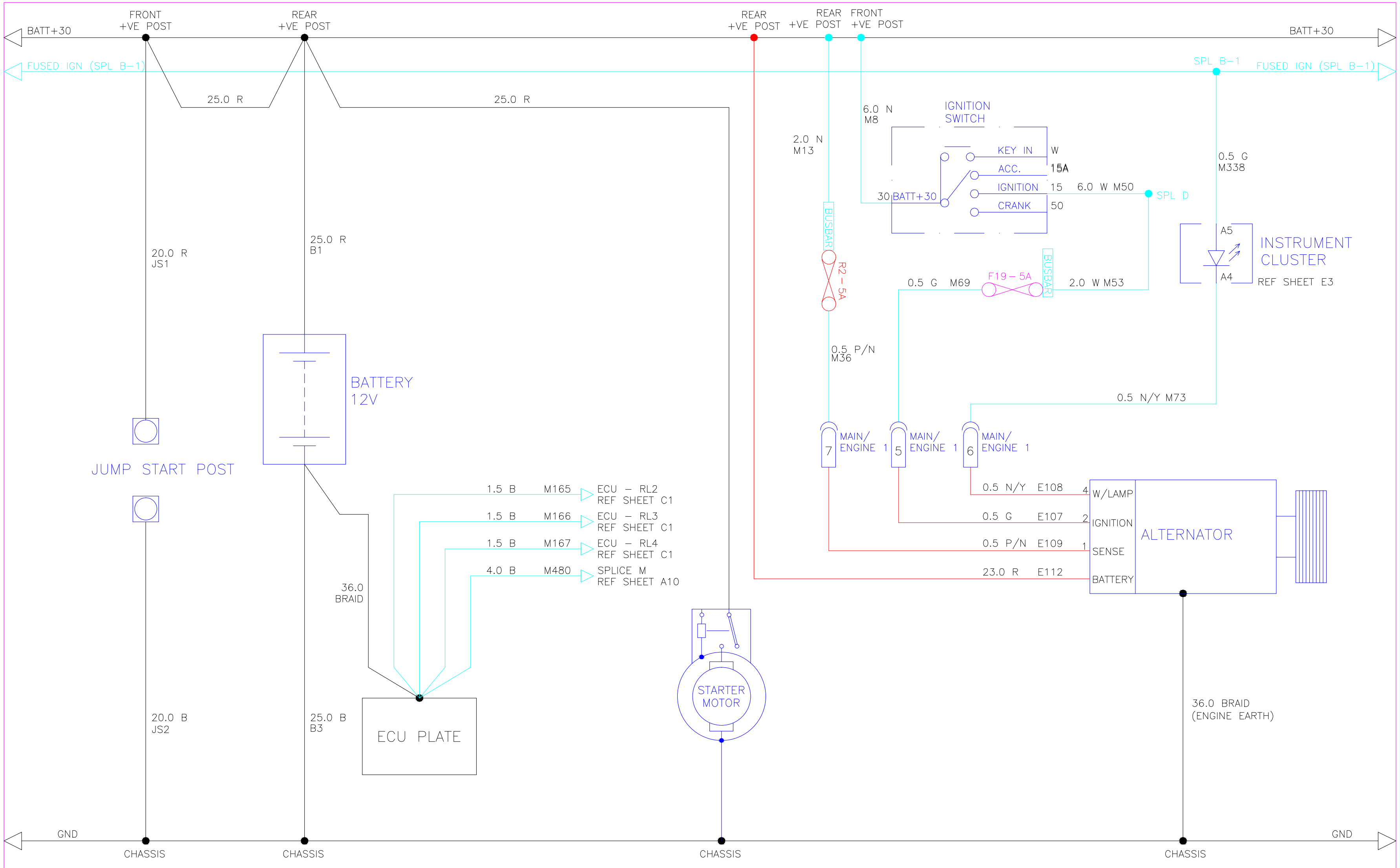
	CHECKED	M. GARRETT/I. SMITH	CHANGED SRS SUPPLY TO MIRROR ELISE	19/7/12	B1
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:A4	ISSUE LEVEL: B1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER

Updated 6th August 2012



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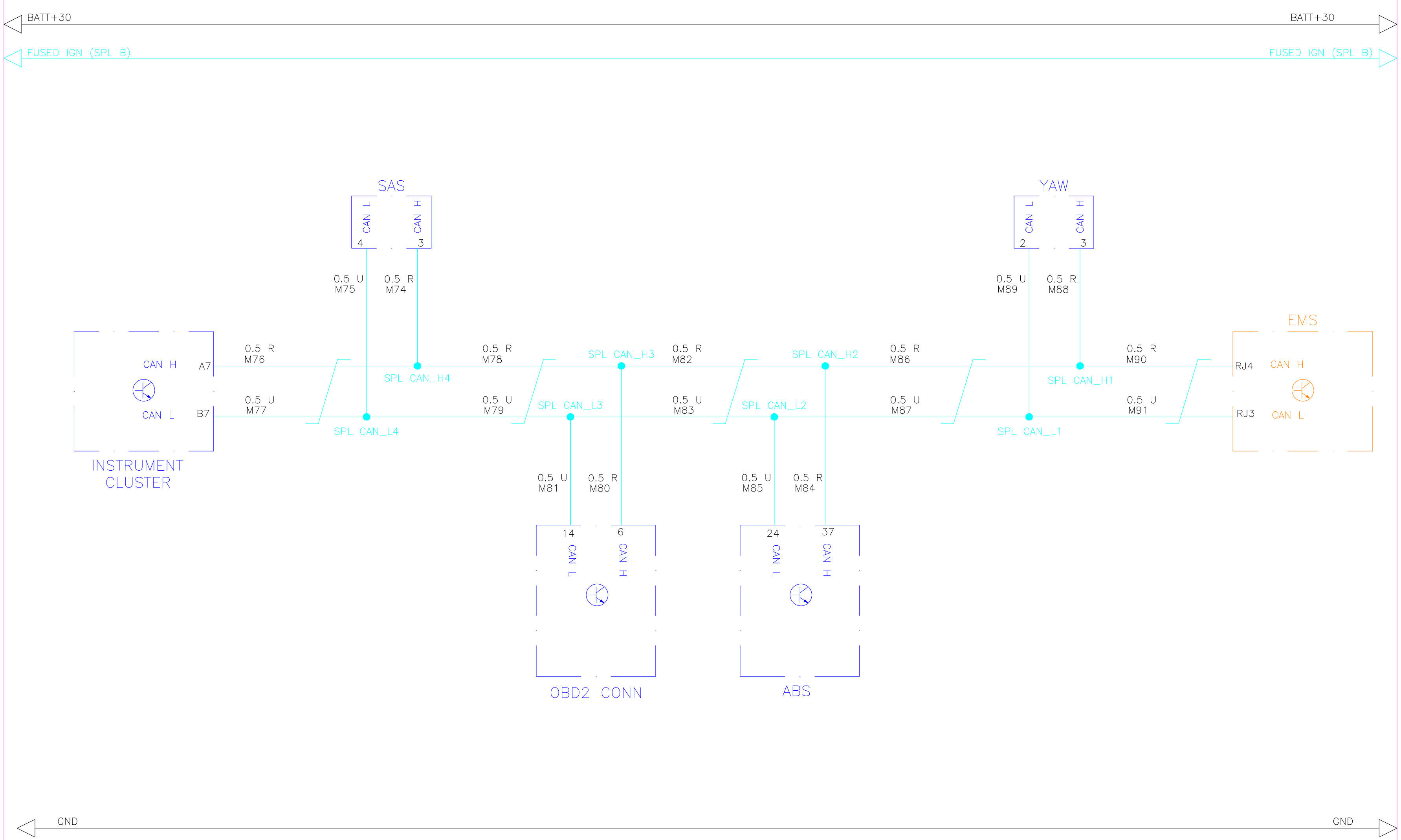
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:A5	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN 3 FEMALE CONN
CAVITY NUMBER



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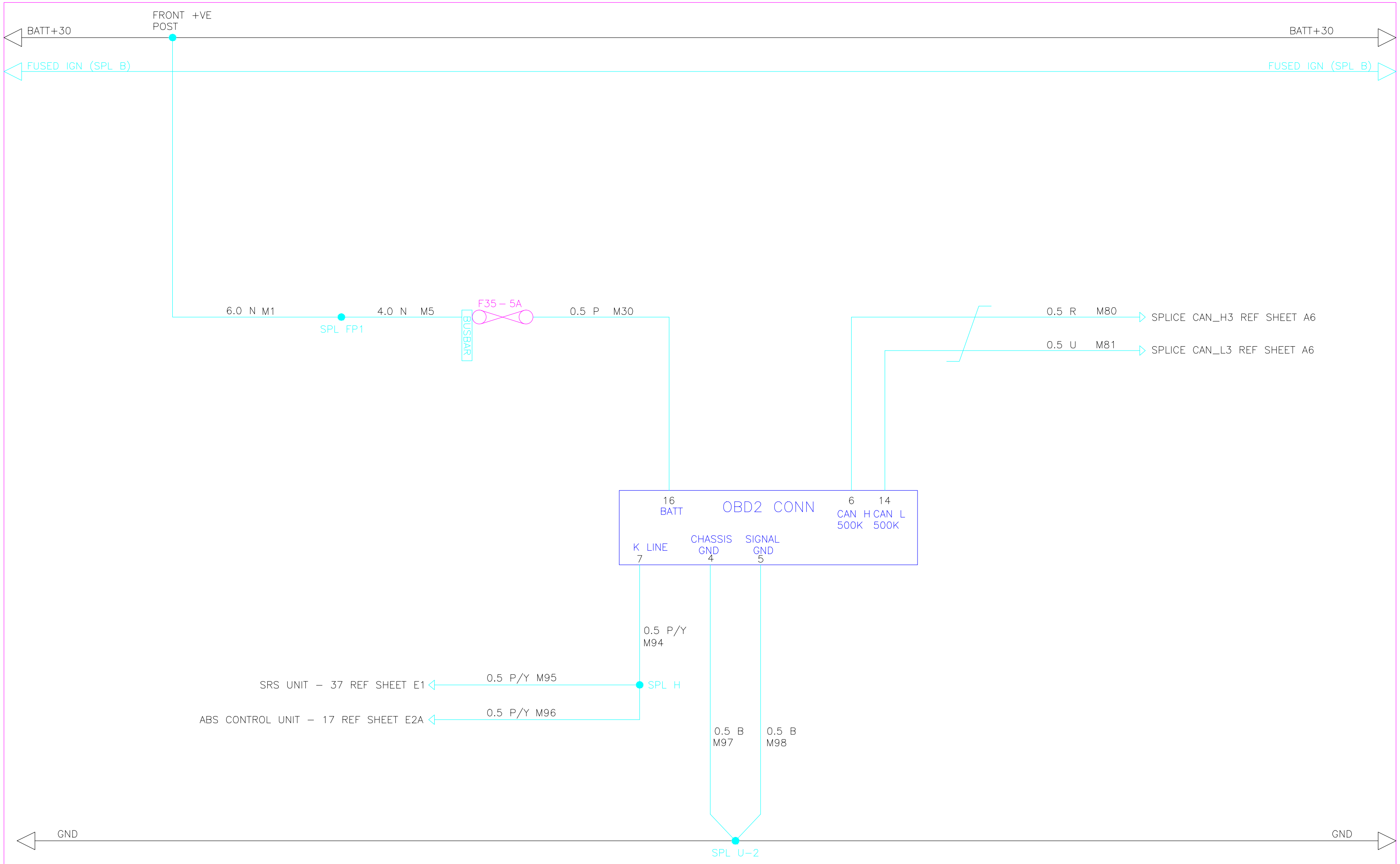
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:A6	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



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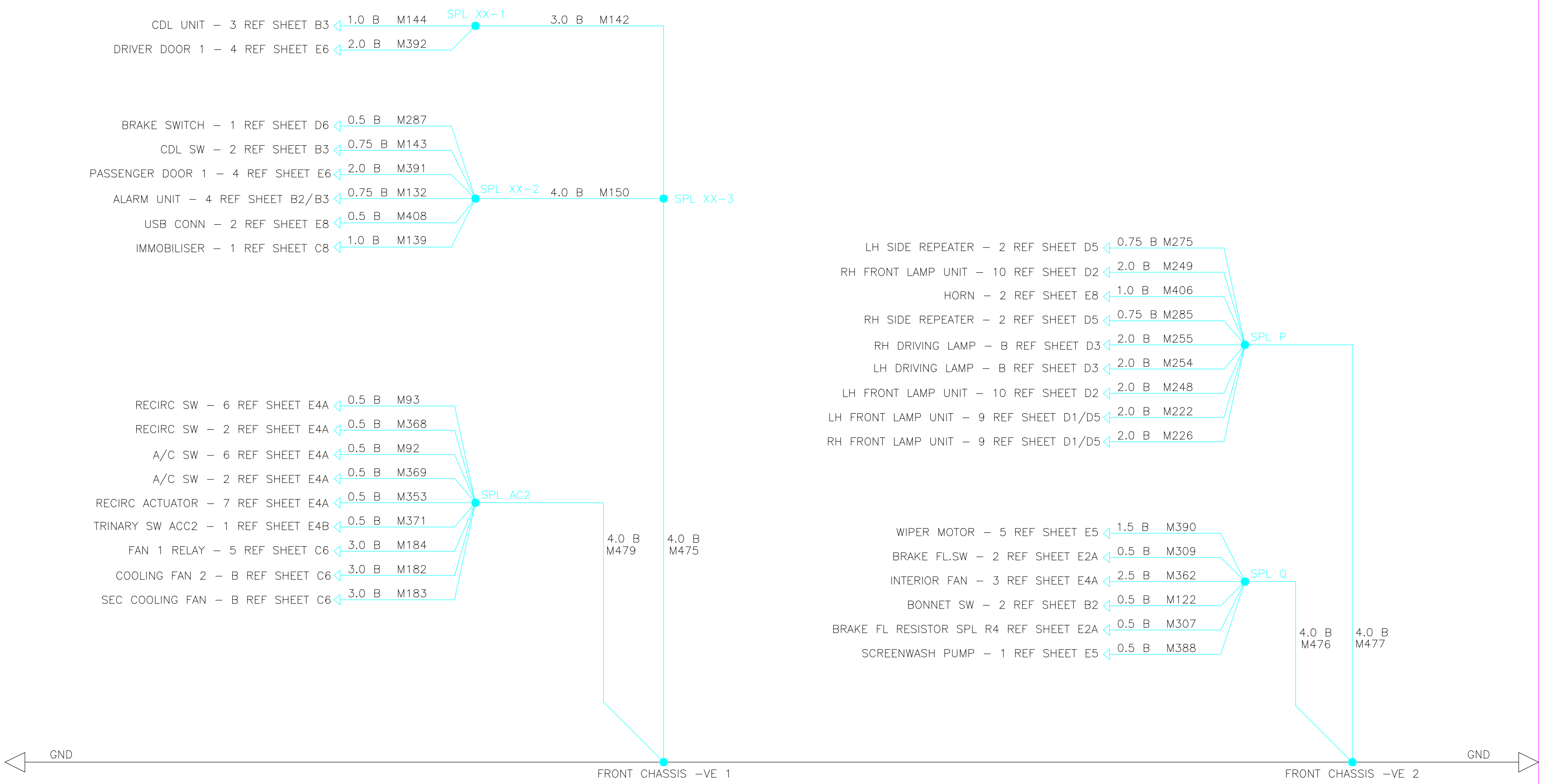
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:A7	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			



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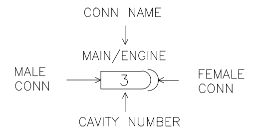
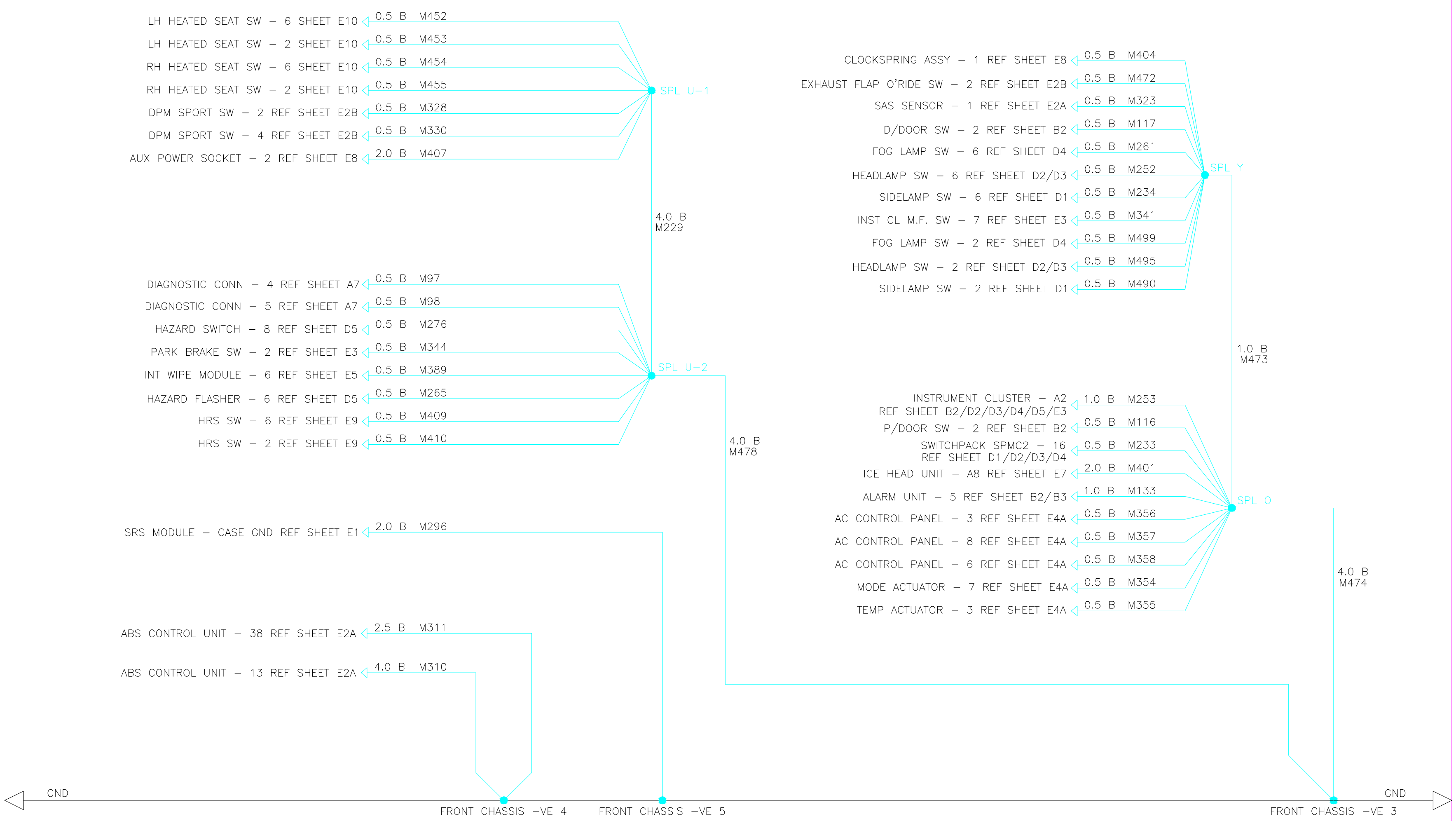
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:A8	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			





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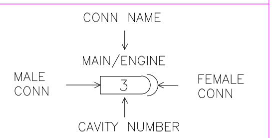
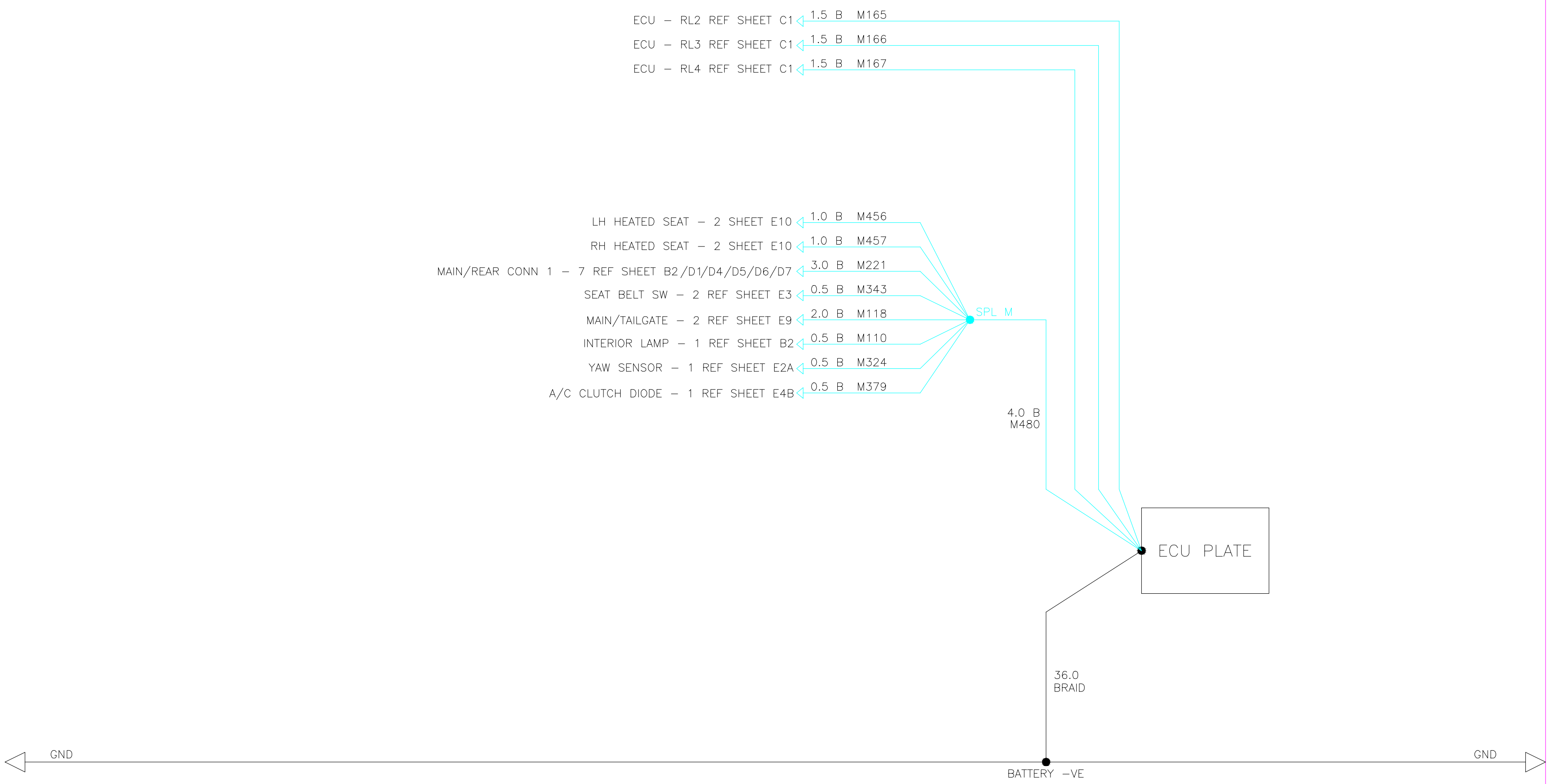
SHEET:A9	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			





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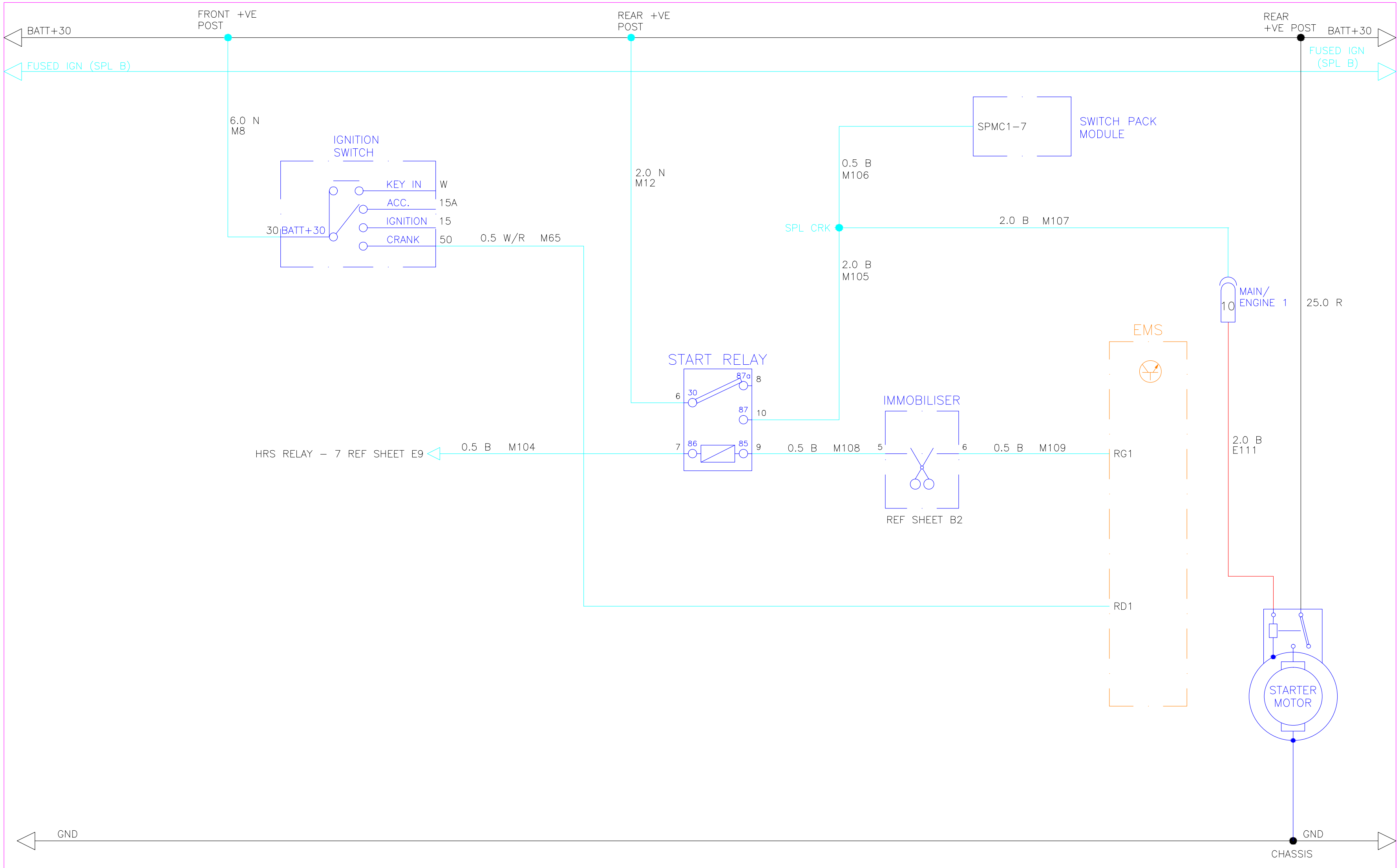
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:A10	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



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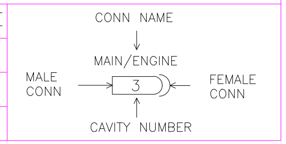
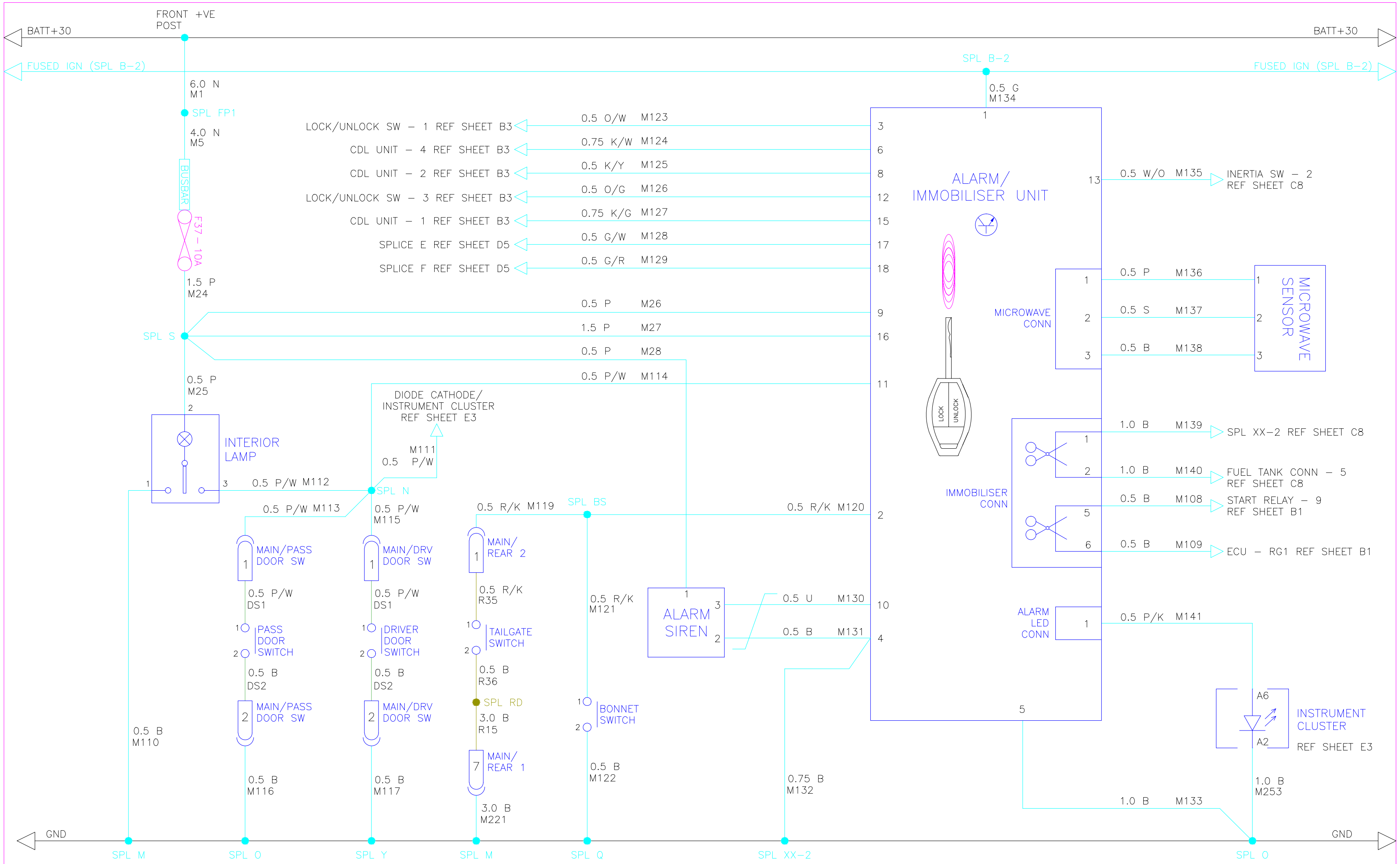
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:B1	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			





TITLE: CCT-ALARM, IMMOBILSER & INTERIOR LAMP	APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
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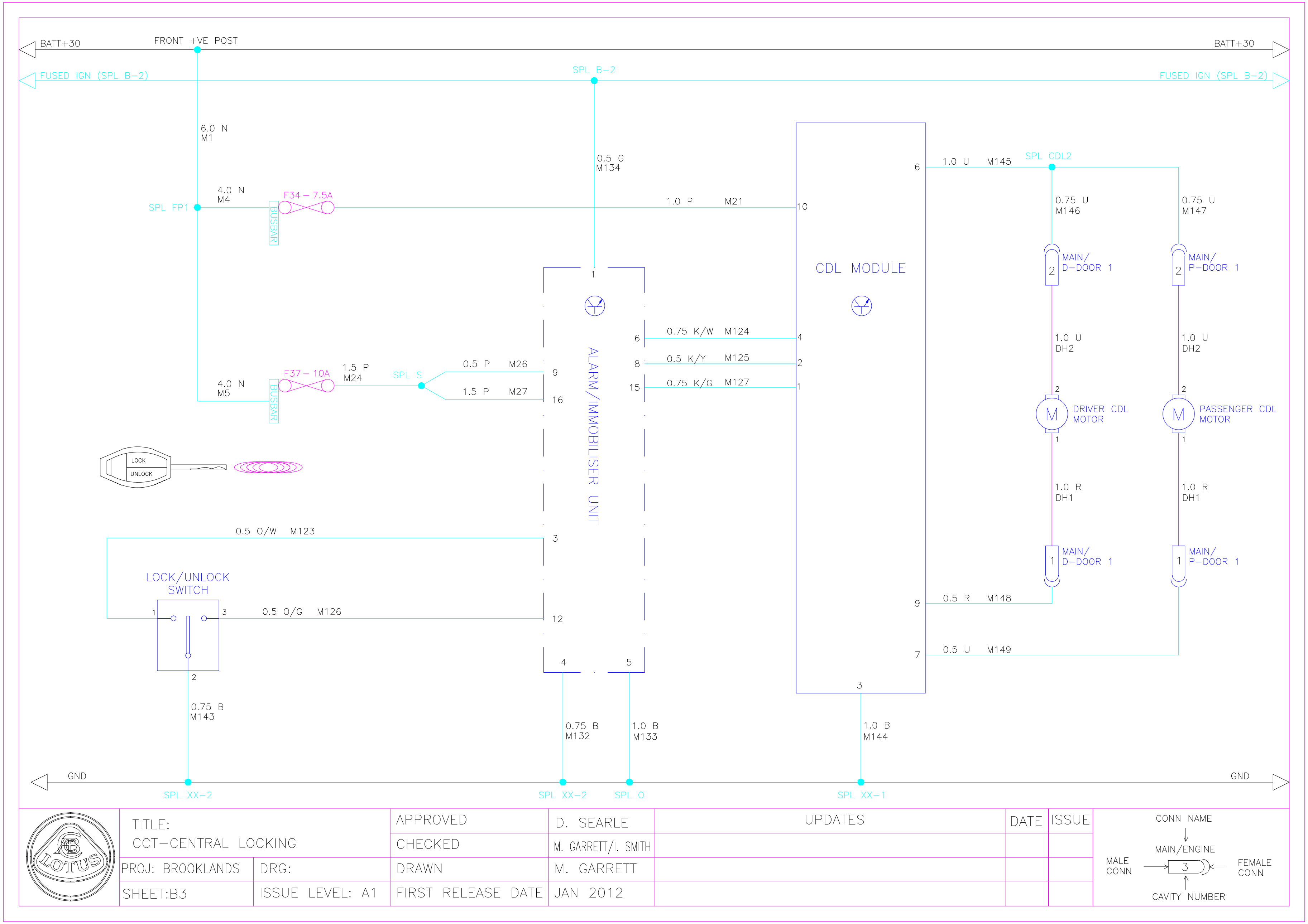
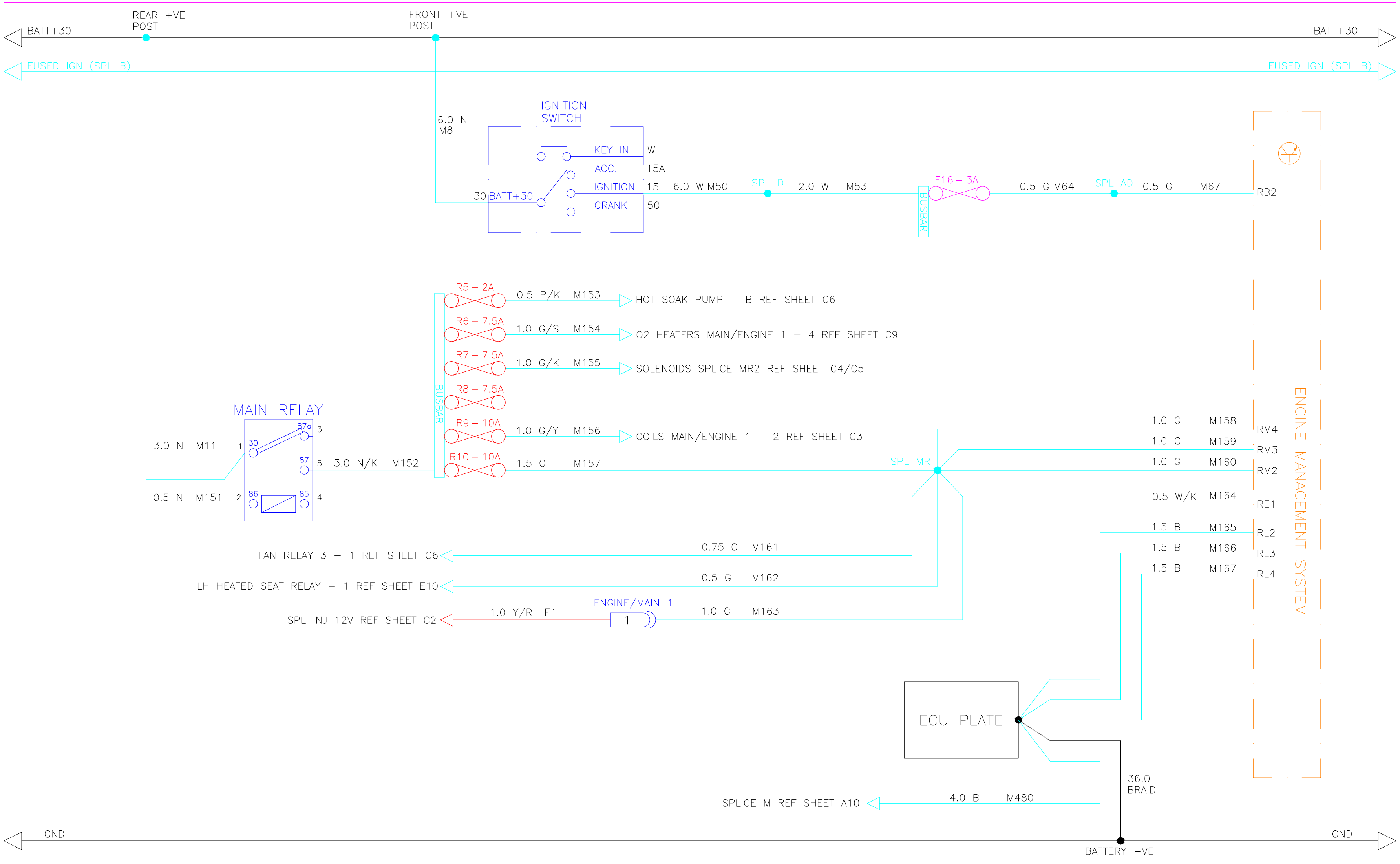
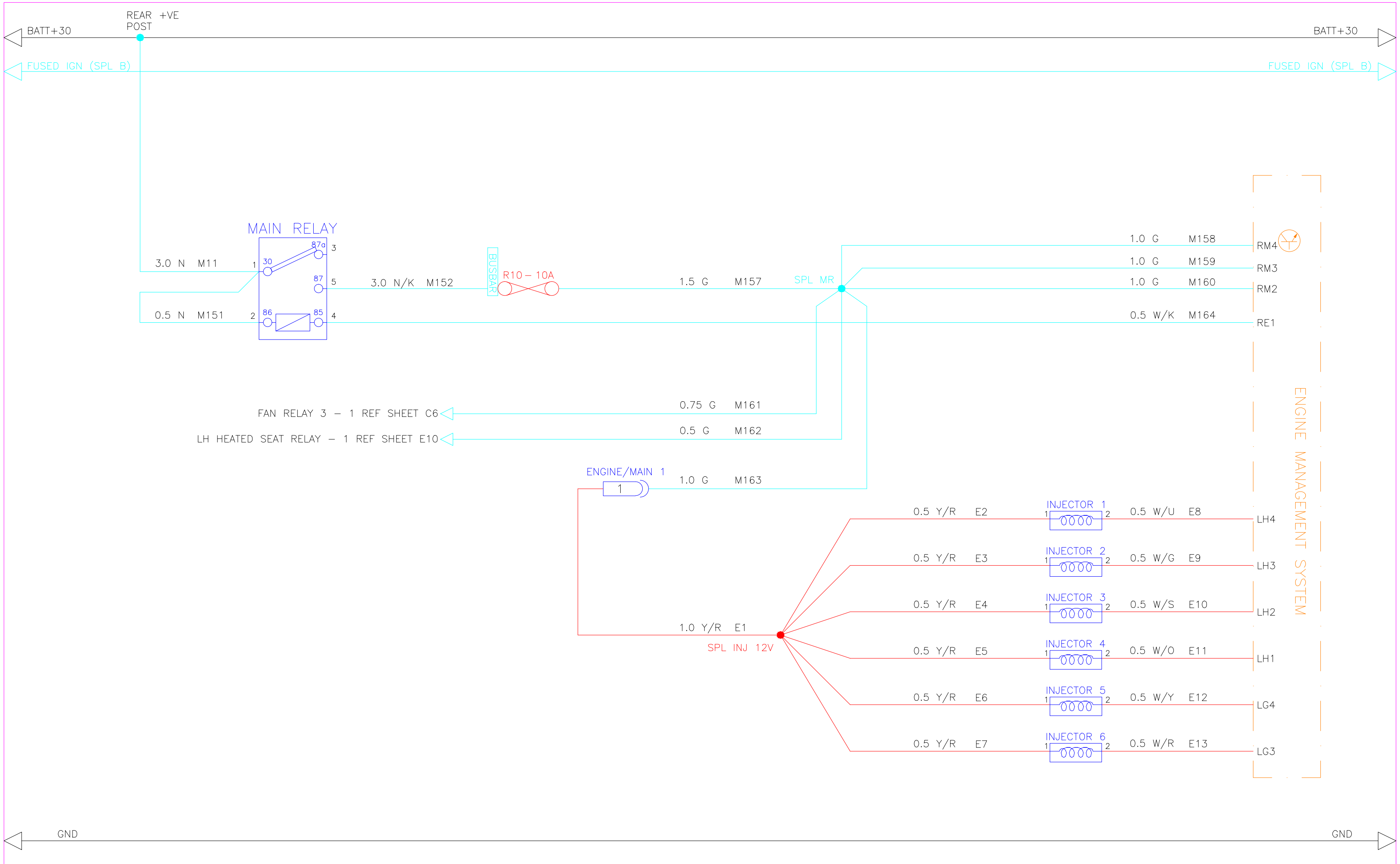
PROJ: BROOKLANDS DRG:	DRAWN	M. GARRETT			
SHEET:B2 ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME MAIN/ENGINE MALE CONN FEMALE CONN 3 CAVITY NUMBER

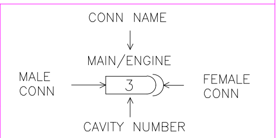

BATT+30
FRONT +VE POST
FUSED IGN (SPL B-2)
SPL B-2
6.0 N
M1
0.5 G
M134
4.0 N
M4
SPL FP1
F34 - 7.5A
BUSBAR
1.0 P M21
CDL MODULE
1.0 U M145
SPL CDL2
0.75 U
M146
0.75 U
M147
MAIN/
D-DOOR 1
MAIN/
P-DOOR 1
ALARM/IMMOBILISER UNIT
0.75 K/W M124
0.5 K/Y M125
0.75 K/G M127
1.0 U
DH2
F37 - 10A
1.5 P
M24
SPL S
0.5 P M26
1.5 P M27
4.0 N
M5
DRIVER CDL
MOTOR
PASSENGER CDL
MOTOR
LOCK
UNLOCK
1.0 R
DH1
0.5 O/W M123
LOCK/UNLOCK
SWITCH
0.5 O/G M126
0.5 R M148
0.5 U M149
0.75 B
M143
0.75 B
M132
1.0 B
M133
1.0 B
M144
GND
SPL XX-2
SPL O
SPL XX-1
TITLE:
CCT-CENTRAL LOCKING
PROJ: BROOKLANDS
DRG:
SHEET:B3
ISSUE LEVEL: A1
APPROVED D. SEARLE
CHECKED M. GARRETT/I. SMITH
DRAWN M. GARRETT
FIRST RELEASE DATE JAN 2012
UPDATES
DATE
ISSUE
CONN NAME
MAIN/ENGINE
MALE
CONN
FEMALE
CONN
CAVITY NUMBER

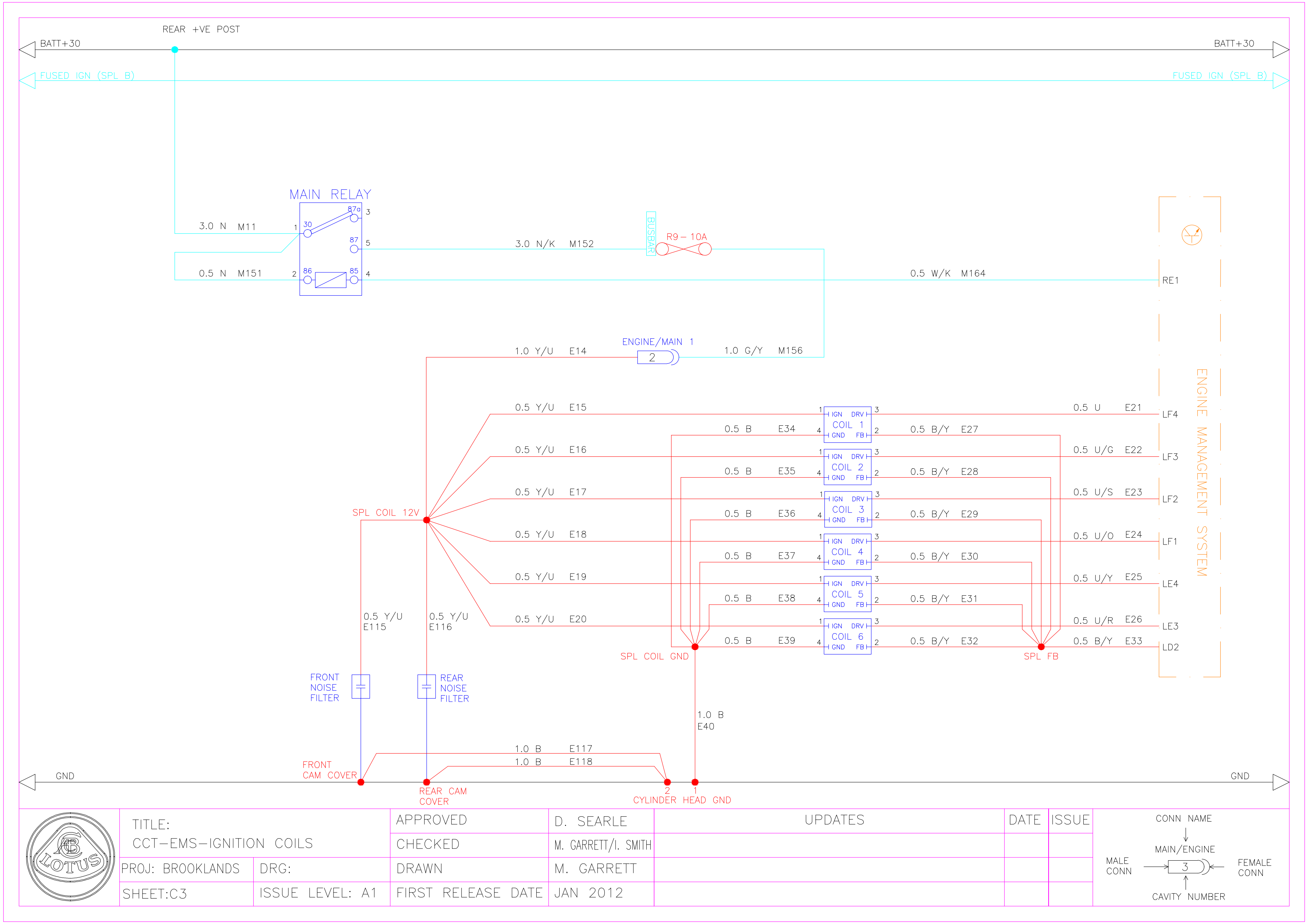


TITLE: CCT–EMS POWER & GND		APPROVED	D. SEARLE	UPDATES	DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH		
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT		
SHEET:C1	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012		



TITLE: CCT–EMS–FUEL INJECTION		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:C2	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

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BATT+30
BATT+30
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FUSED IGN (SPL B)
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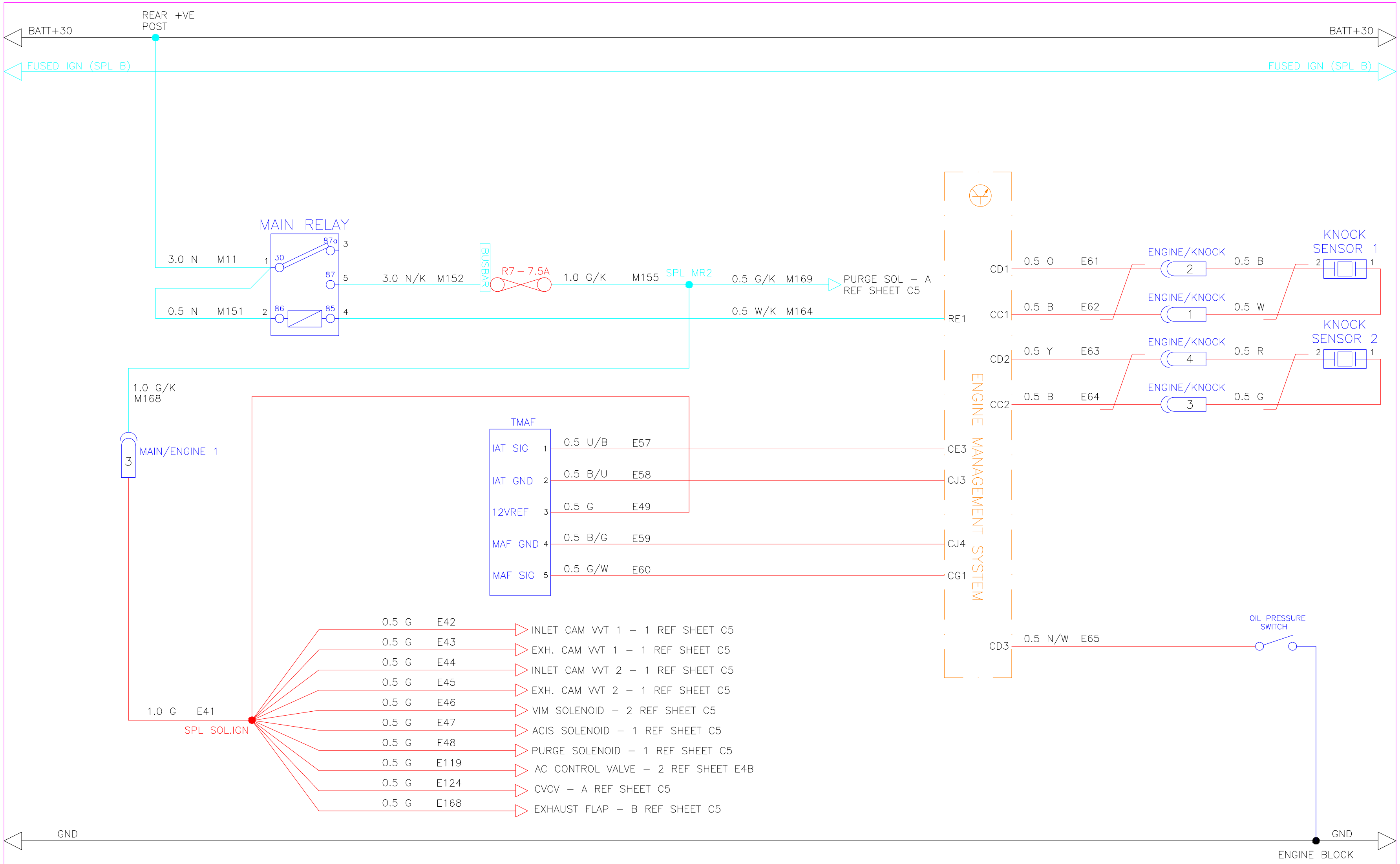
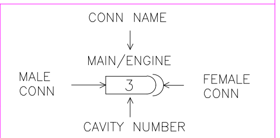
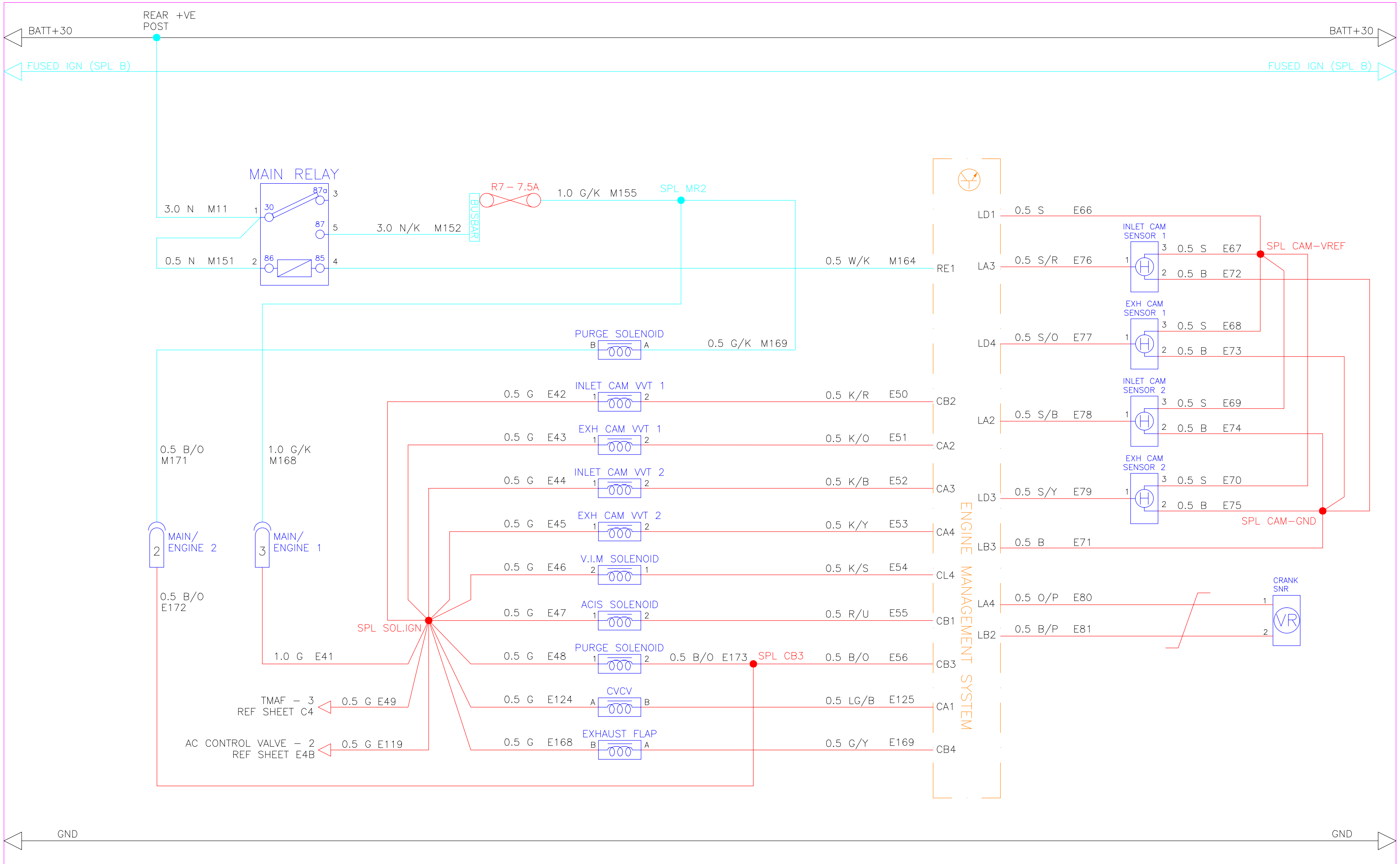
3.0 N M11
0.5 N M151
3.0 N/K M152
BUSBAR
R9 – 10A
0.5 W/K M164
RE1
ENGINE/MAIN 1
1.0 Y/U E14
1.0 G/Y M156
0.5 Y/U E15
0.5 Y/U E16
0.5 Y/U E17
0.5 Y/U E18
0.5 Y/U E19
0.5 Y/U E20
SPL COIL 12V
0.5 B E34
0.5 B E35
0.5 B E36
0.5 B E37
0.5 B E38
0.5 B E39
COIL 1
COIL 2
COIL 3
COIL 4
COIL 5
COIL 6
IGN DRV GND FB
0.5 B/Y E27
0.5 B/Y E28
0.5 B/Y E29
0.5 B/Y E30
0.5 B/Y E31
0.5 B/Y E32
0.5 U E21
0.5 U/G E22
0.5 U/S E23
0.5 U/O E24
0.5 U/Y E25
0.5 U/R E26
0.5 B/Y E33
LF4
LF3
LF2
LF1
LE4
LE3
LD2
ENGINE MANAGEMENT SYSTEM
SPL COIL GND
SPL FB
0.5 Y/U E115
0.5 Y/U E116
FRONT NOISE FILTER
REAR NOISE FILTER
1.0 B E40
1.0 B E117
1.0 B E118
GND
GND
FRONT CAM COVER
REAR CAM COVER
CYLINDER HEAD GND
TITLE: CCT–EMS–IGNITION COILS
APPROVED D. SEARLE
CHECKED M. GARRETT/I. SMITH
PROJ: BROOKLANDS
DRG:
DRAWN M. GARRETT
SHEET:C3
ISSUE LEVEL: A1
FIRST RELEASE DATE JAN 2012
UPDATES
DATE
ISSUE
CONN NAME
MAIN/ENGINE
MALE CONN
FEMALE CONN
CAVITY NUMBER



TITLE: CCT-EMS-TMAF, OIL PRESSURE SW & KNOCK SENSORS		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:C4	ISSUE LEVEL: PR	FIRST RELEASE DATE	JAN 2012			





TITLE: CCT–EMS–CAM & CRANK SENSORS & VARIOUS SOLENOIDS		APPROVED	D. SEARLE	UPDATES	DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH		
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT		
SHEET:C5	ISSUE LEVEL: PR	FIRST RELEASE DATE	JAN 2012		

CONN NAME
MAIN/ENGINE
MALE CONN
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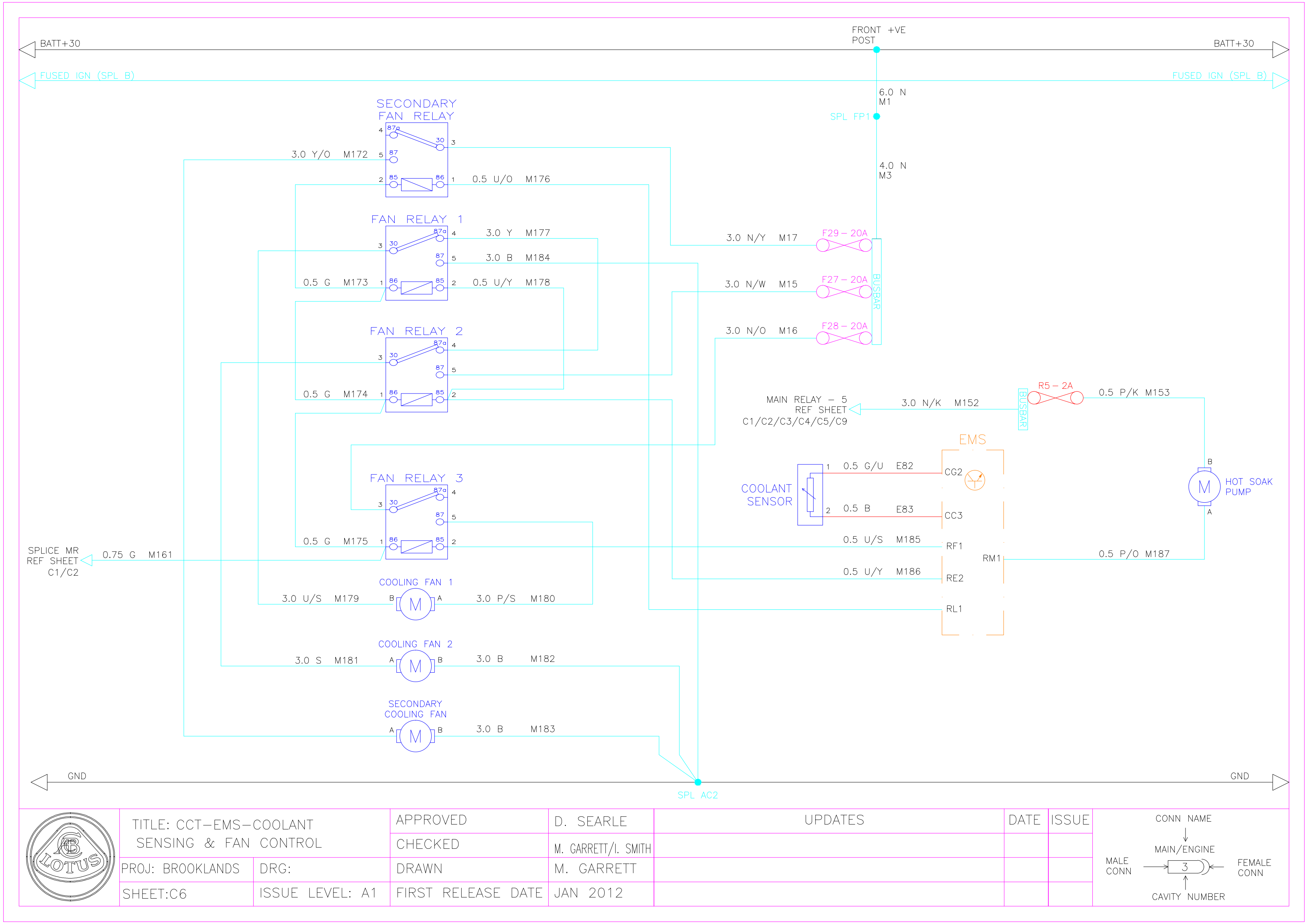
FEMALE CONN
CAVITY NUMBER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FRONT +VE POST
BATT+30
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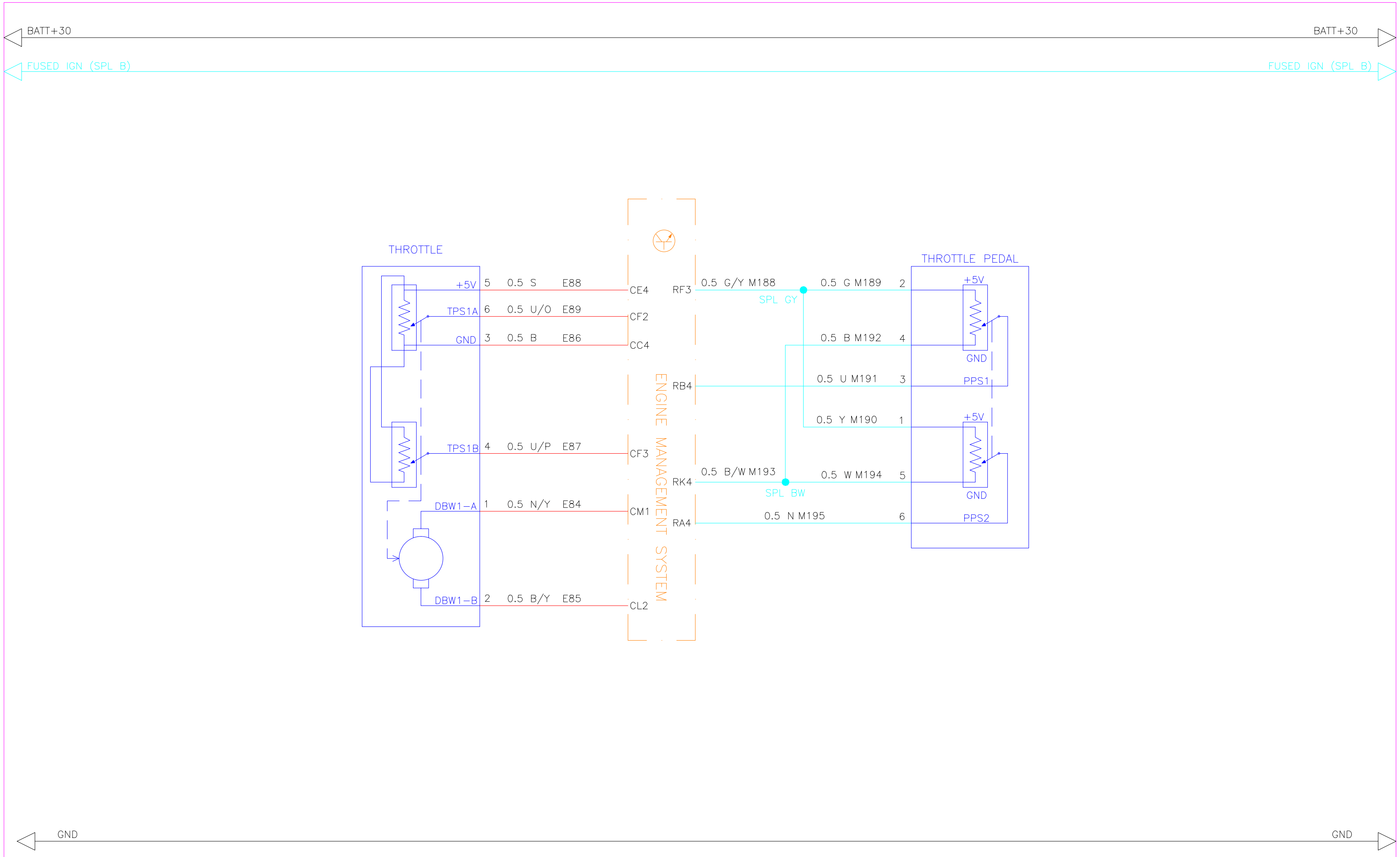
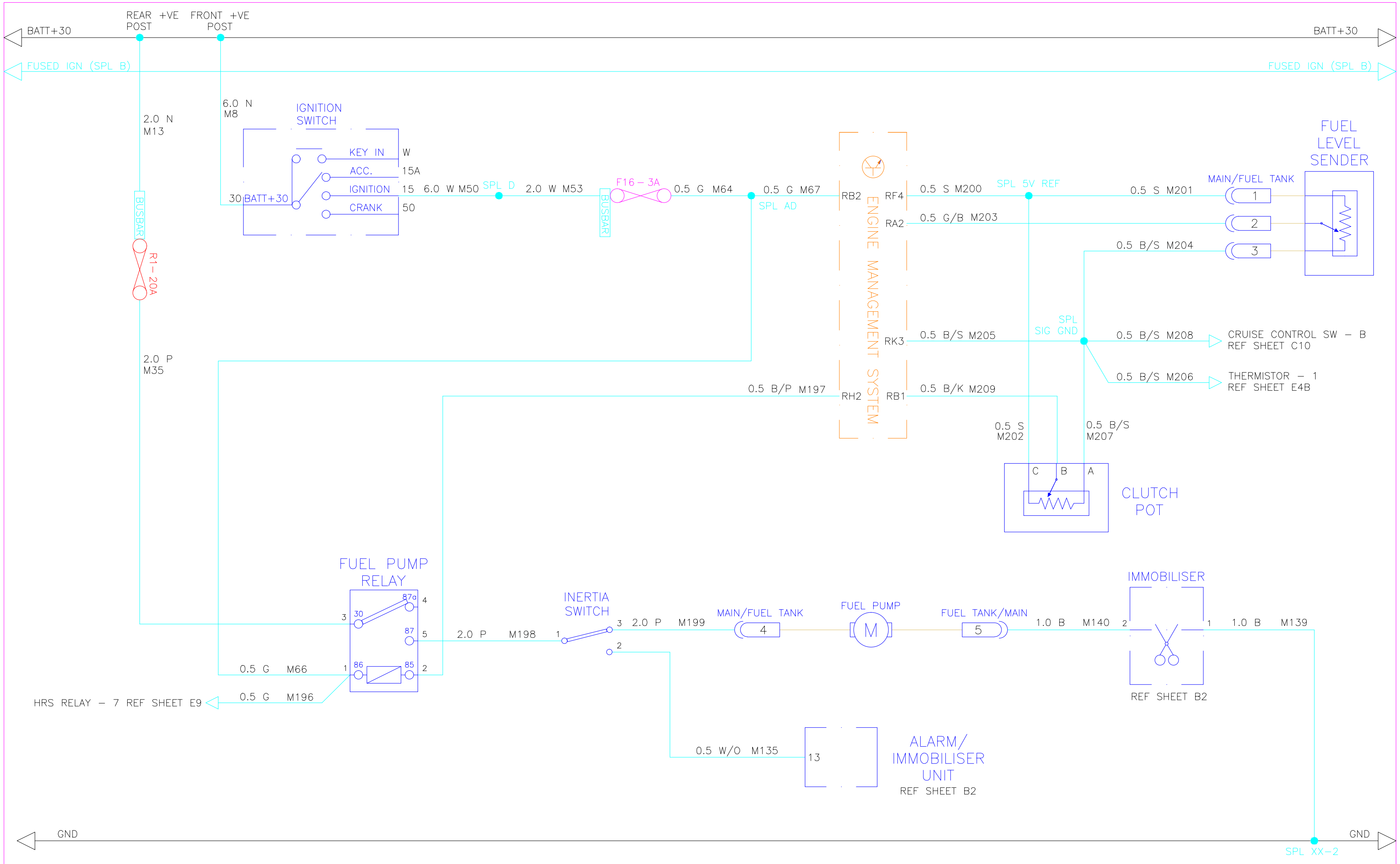
FUSED IGN (SPL B)
6.0 N M1
SPL FP1
4.0 N M3
SECONDARY FAN RELAY
3.0 Y/O M172
0.5 U/O M176
FAN RELAY 1
3.0 Y M177
3.0 B M184
0.5 G M173
0.5 U/Y M178
3.0 N/Y M17
F29 - 20A
3.0 N/W M15
F27 - 20A
BUSBAR
3.0 N/O M16
F28 - 20A
FAN RELAY 2
0.5 G M174
MAIN RELAY - 5
REF SHEET
C1/C2/C3/C4/C5/C9
3.0 N/K M152
R5 - 2A
0.5 P/K M153
BUSBAR
EMS
FAN RELAY 3
COOLANT SENSOR
0.5 G/U E82
CG2
0.5 B E83
CC3
HOT SOAK PUMP
0.5 G M175
0.5 U/S M185
RF1
RM1
0.5 P/O M187
SPLICE MR
REF SHEET
C1/C2
0.75 G M161
0.5 U/Y M186
RE2
COOLING FAN 1
3.0 U/S M179
3.0 P/S M180
RL1
COOLING FAN 2
3.0 S M181
3.0 B M182
SECONDARY COOLING FAN
3.0 B M183
GND
SPL AC2
GND
TITLE: CCT-EMS-COOLANT
SENSING & FAN CONTROL
APPROVED
D. SEARLE
UPDATES
DATE
ISSUE
CHECKED
M. GARRETT/I. SMITH
PROJ: BROOKLANDS
DRG:
DRAWN
M. GARRETT
SHEET:C6
ISSUE LEVEL: A1
FIRST RELEASE DATE
JAN 2012
CONN NAME
MAIN/ENGINE
MALE CONN
FEMALE CONN
CAVITY NUMBER



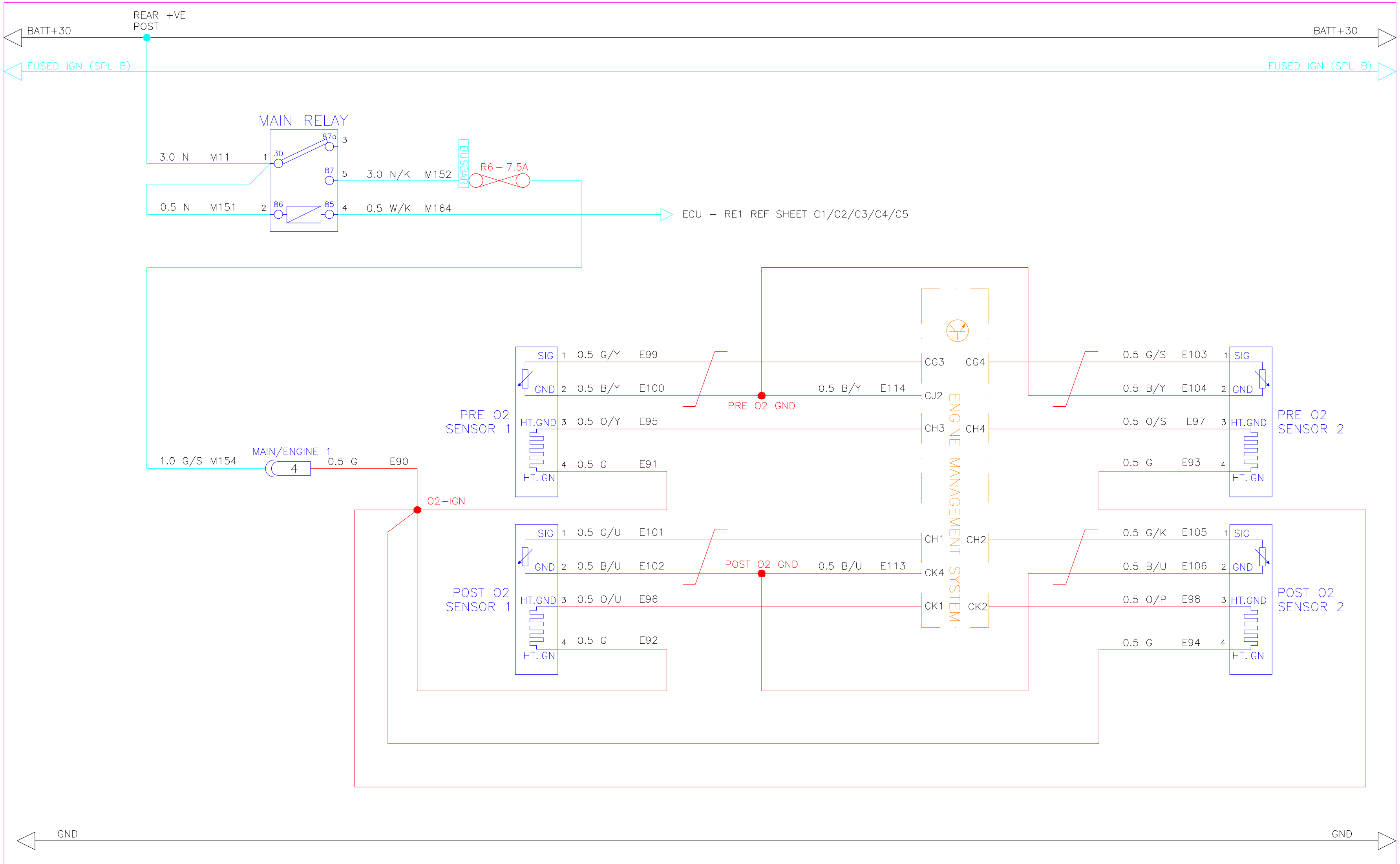
TITLE: CCT–EMS–THROTTLE ACTUATION		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:C7	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



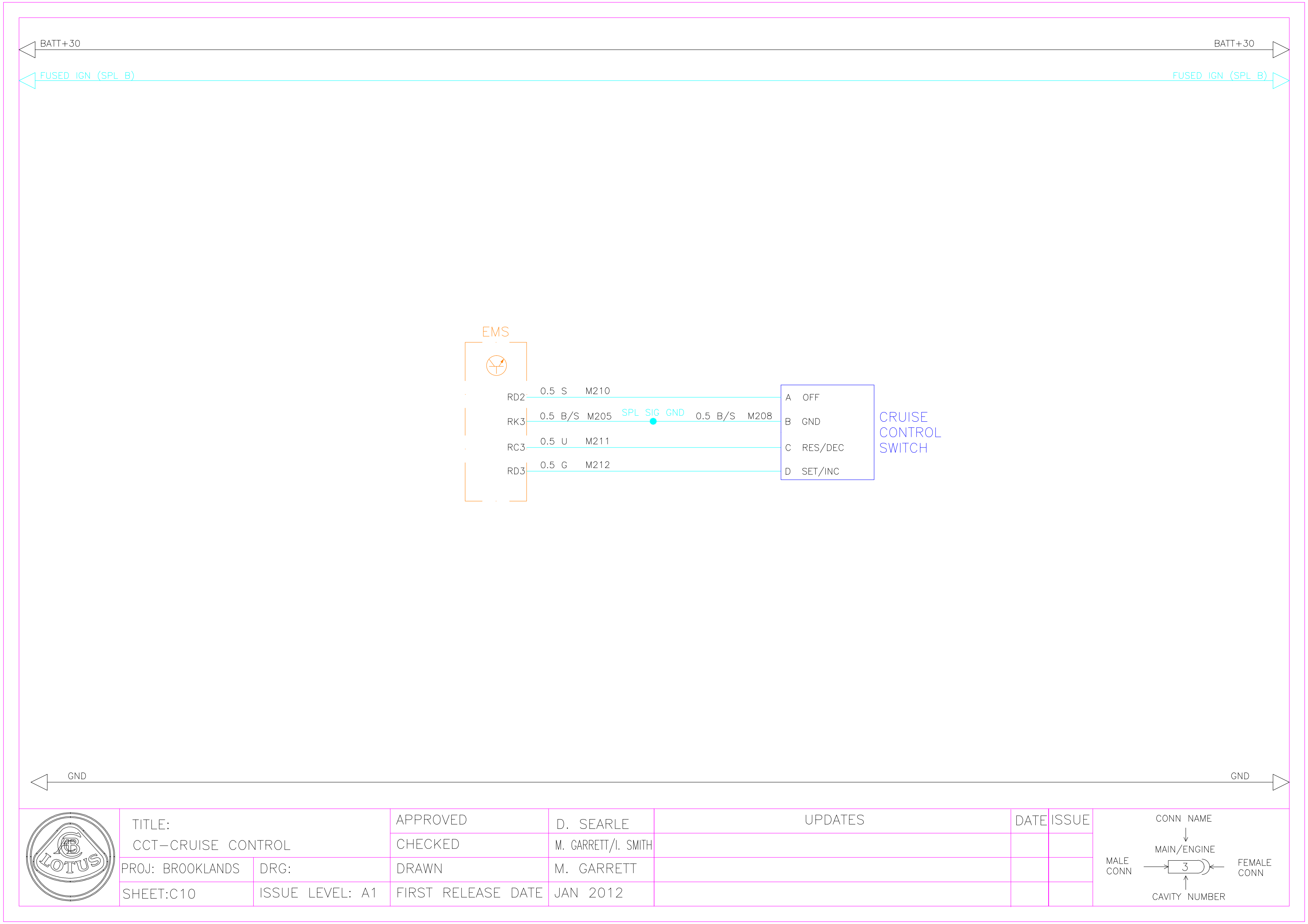
TITLE: CCT-EMS-FUEL PUMP & FUEL LEVEL, CLUTCH POT		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:C8	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



TITLE: CCT-EMS-O2 SENSORS		APPROVED	D. SEARLE	UPDATES / DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH	
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT	
SHEET:C9	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012	

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER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BATT+30
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FUSED IGN (SPL B)
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RD2
RK3
RC3
RD3
0.5 S M210
0.5 B/S M205
SPL SIG GND
0.5 B/S M208
0.5 U M211
0.5 G M212
A OFF
B GND
C RES/DEC
D SET/INC
CRUISE CONTROL SWITCH
GND
GND
TITLE:
CCT–CRUISE CONTROL
PROJ: BROOKLANDS
DRG:
SHEET:C10
ISSUE LEVEL: A1
APPROVED
D. SEARLE
CHECKED
M. GARRETT/I. SMITH
DRAWN
M. GARRETT
FIRST RELEASE DATE
JAN 2012
UPDATES
DATE
ISSUE
CONN NAME
MAIN/ENGINE
MALE CONN
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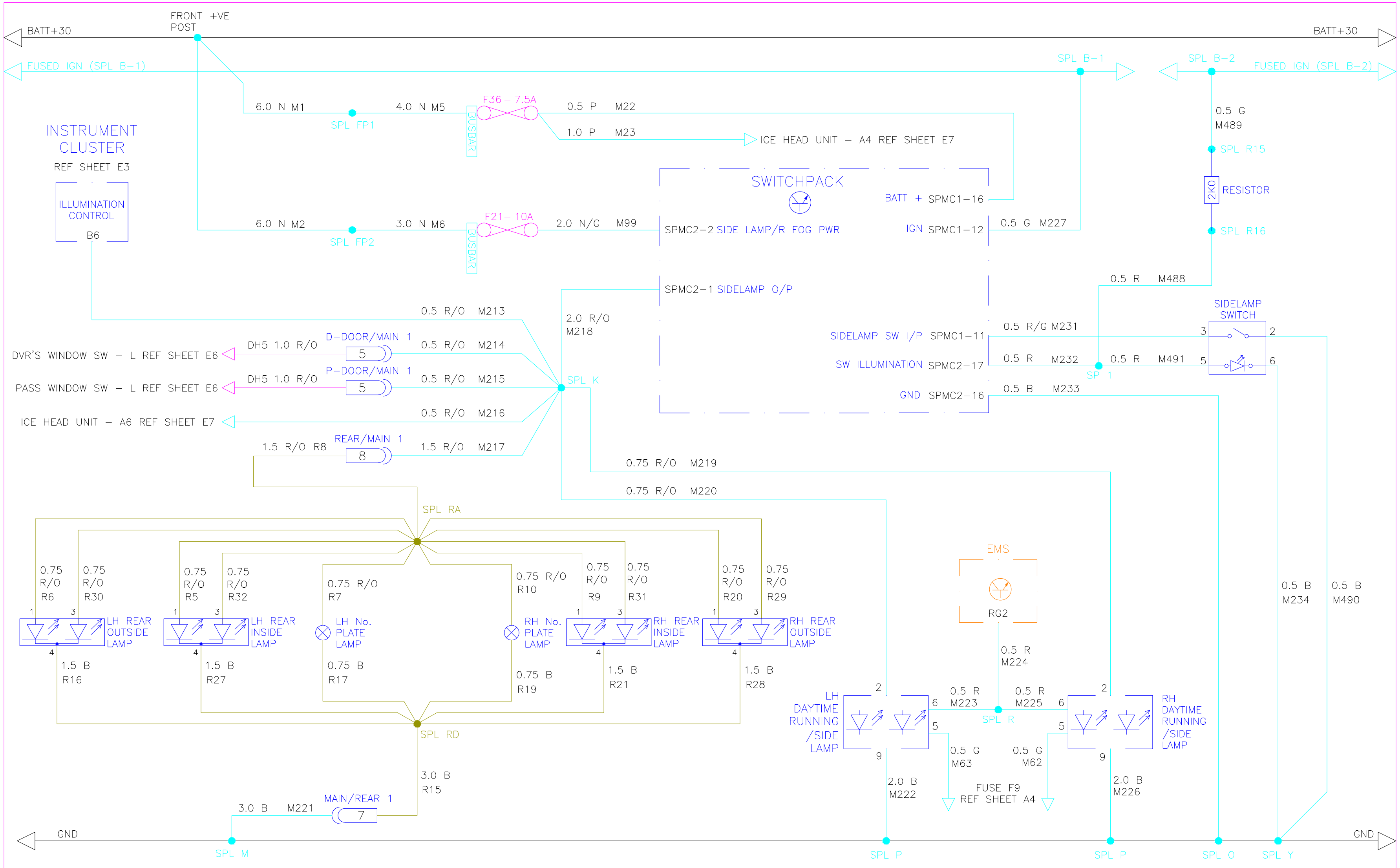
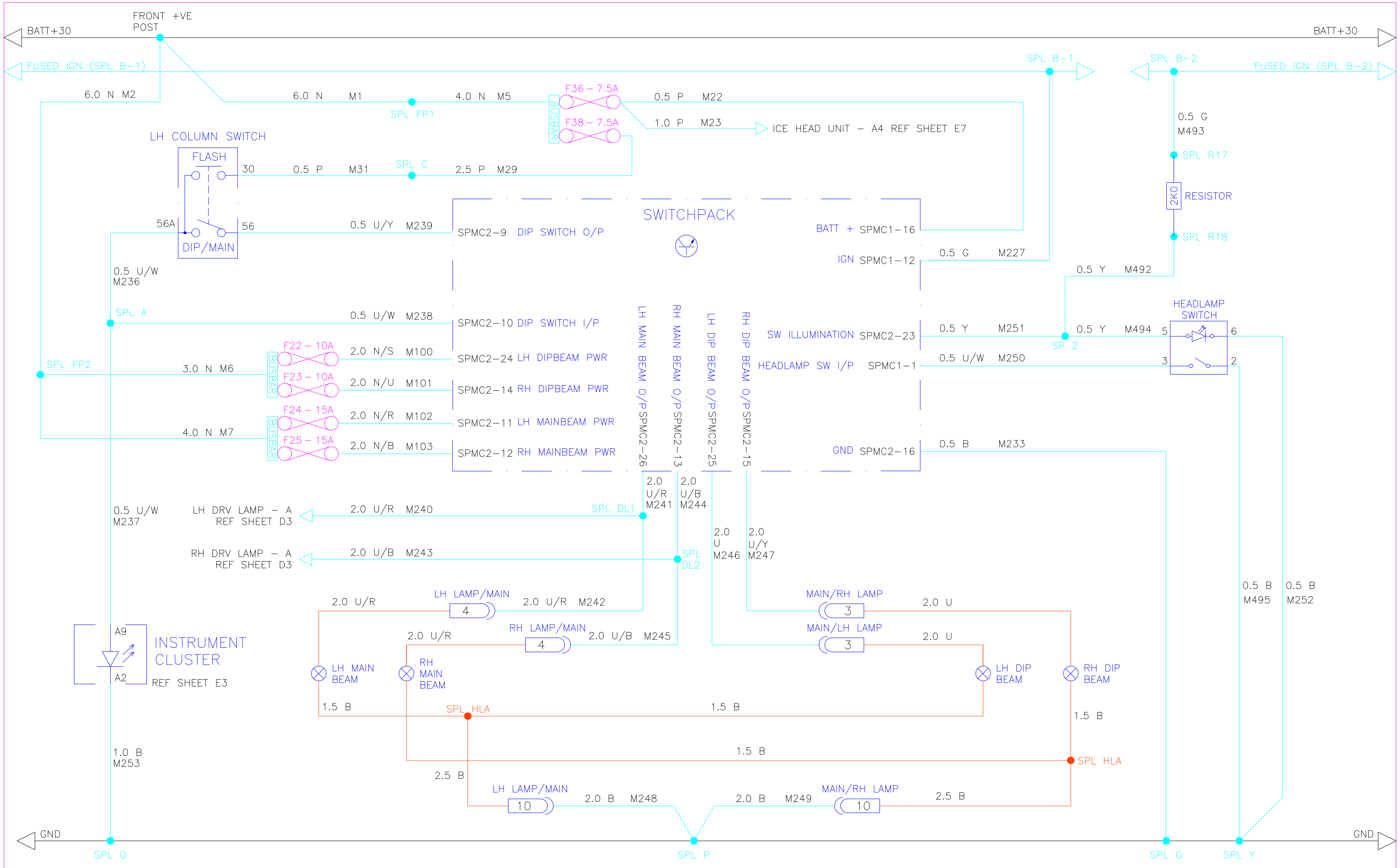
CAVITY NUMBER



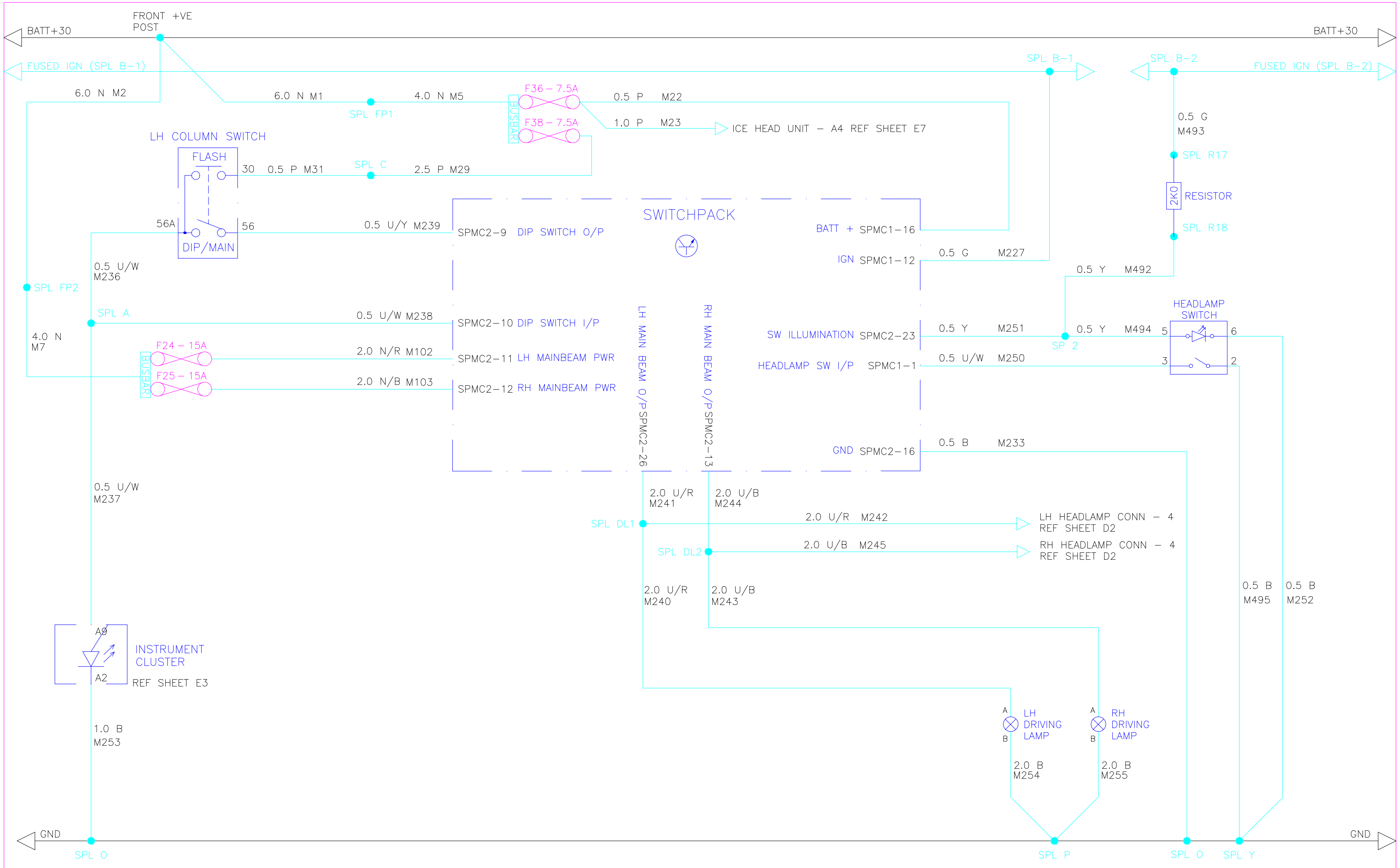
TITLE: CCT-DAYTIME RUNNING / SIDE LAMPS		APPROVED	D. SEARLE	UPDATES	DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH		
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT		
SHEET:D1	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012		

CONN NAME
MAIN/ENGINE
MALE CONN 3 FEMALE CONN
CAVITY NUMBER



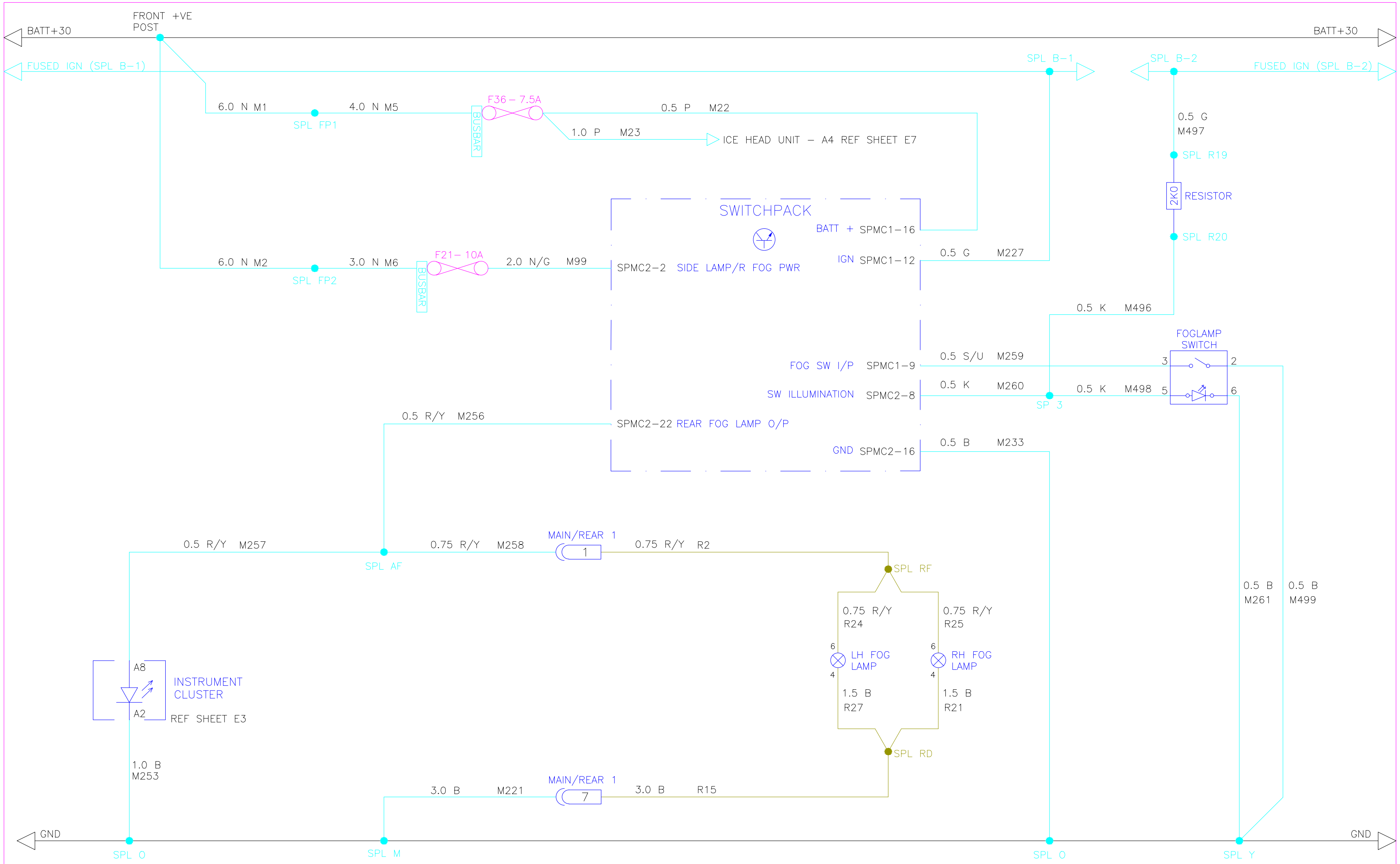
TITLE: CCT–HEAD LAMPS		APPROVED	D. SEARLE	UPDATES	DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH		
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT		
SHEET:D2	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012		

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER

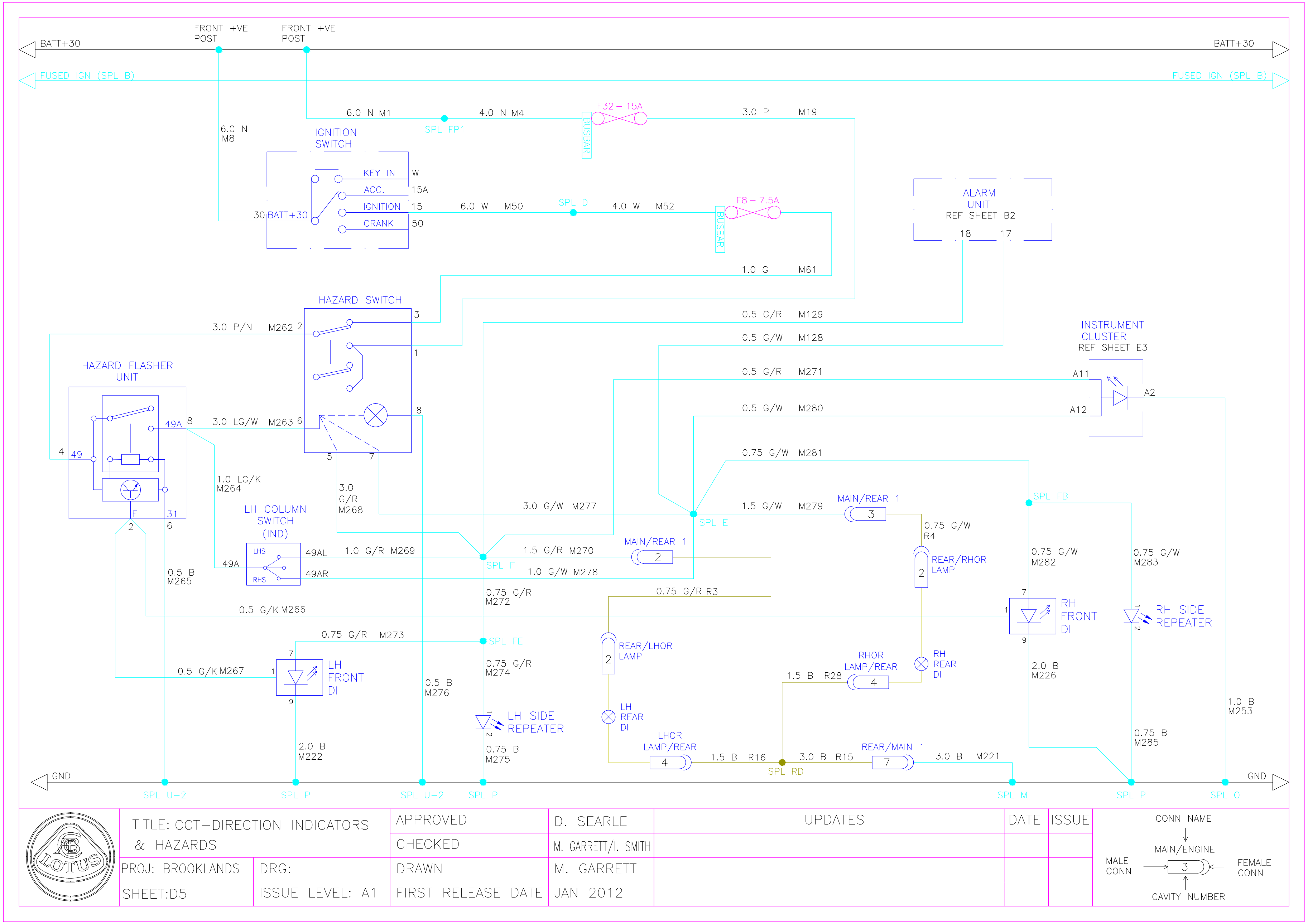


TITLE: CCT–DRIVING LAMPS		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:D3	ISSUE LEVEL: A2	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



TITLE: CCT-REAR FOG LAMPS		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:D4	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			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FRONT +VE POST
FRONT +VE POST
BATT+30
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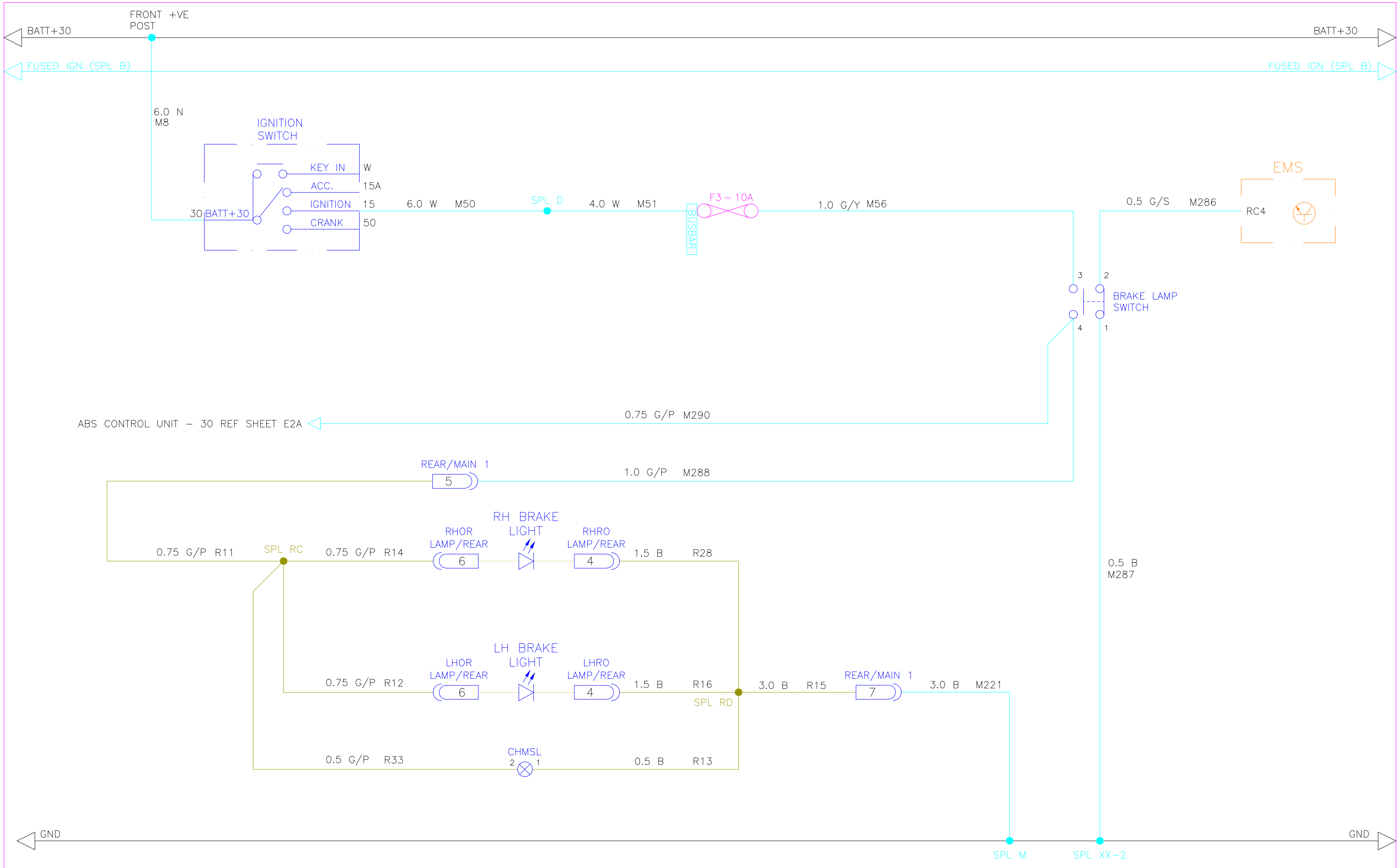
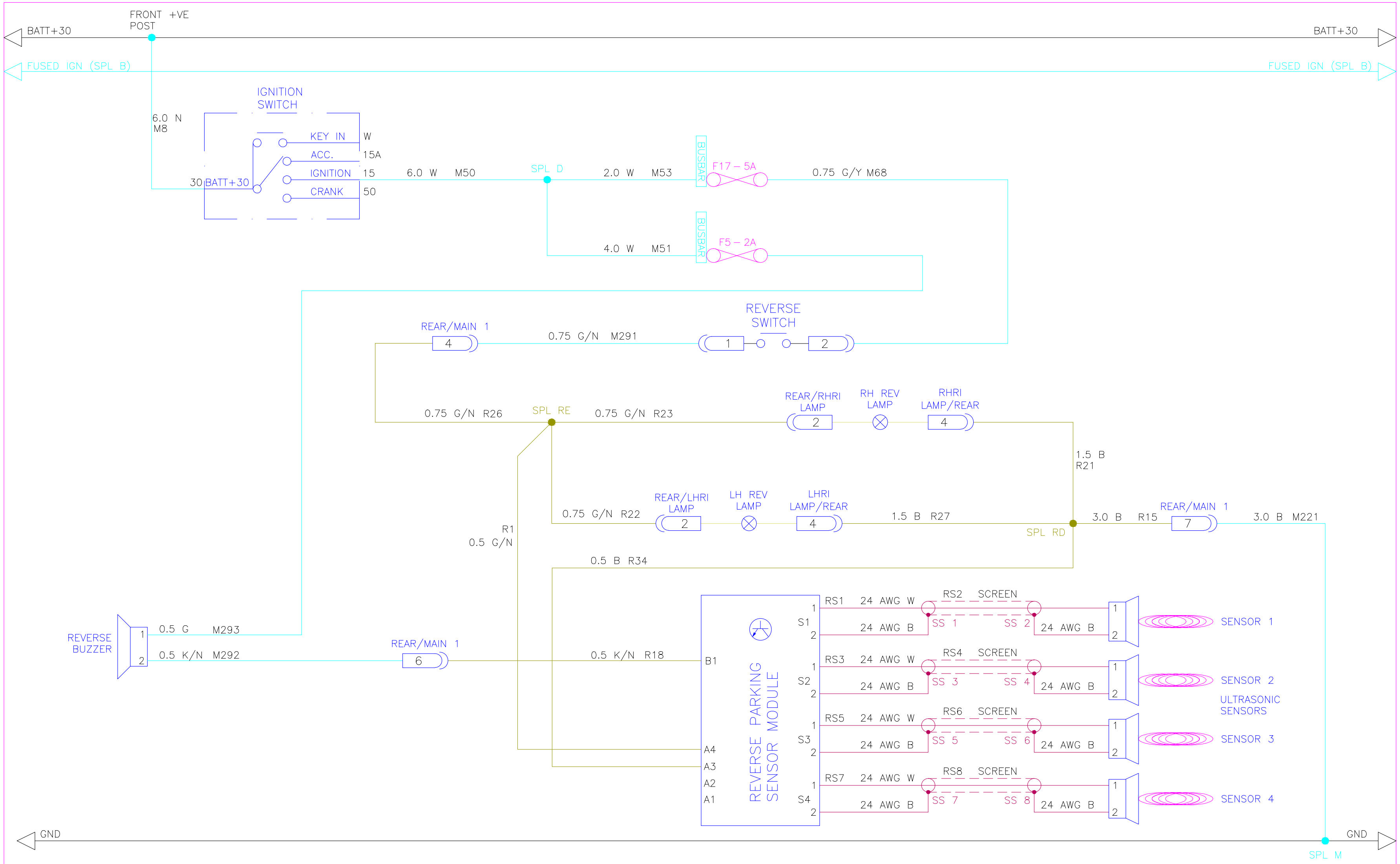
FUSED IGN (SPL B)
6.0 N M1
4.0 N M4
SPL FP1
F32 – 15A
BUSBAR
3.0 P M19
6.0 N M8
IGNITION SWITCH
KEY IN W
ACC. 15A
IGNITION 15
CRANK 50
30 BATT+30
6.0 W M50
SPL D
4.0 W M52
F8 – 7.5A
BUSBAR
ALARM UNIT
REF SHEET B2
18
17
1.0 G M61
HAZARD SWITCH
3.0 P/N M262
0.5 G/R M129
0.5 G/W M128
INSTRUMENT CLUSTER
REF SHEET E3
HAZARD FLASHER UNIT
0.5 G/R M271
A11
A2
0.5 G/W M280
A12
49A
3.0 LG/W M263
49
31
0.75 G/W M281
1.0 LG/K M264
3.0 G/R M268
LH COLUMN SWITCH (IND)
3.0 G/W M277
SPL E
1.5 G/W M279
MAIN/REAR 1
SPL FB
0.75 G/W R4
LHS
RHS
49AL
49AR
1.0 G/R M269
1.5 G/R M270
MAIN/REAR 1
REAR/RHOR LAMP
SPL F
1.0 G/W M278
0.75 G/W M282
0.75 G/W M283
0.5 B M265
0.75 G/R M272
0.75 G/R R3
0.5 G/K M266
RH FRONT DI
RH SIDE REPEATER
0.75 G/R M273
SPL FE
REAR/LHOR LAMP
RHOR LAMP/REAR
RH REAR DI
0.5 G/K M267
LH FRONT DI
0.75 G/R M274
0.5 B M276
1.5 B R28
2.0 B M226
LH SIDE REPEATER
LH REAR DI
1.0 B M253
LHOR LAMP/REAR
REAR/MAIN 1
0.75 B M285
2.0 B M222
0.75 B M275
1.5 B R16
3.0 B R15
3.0 B M221
SPL RD
GND
GND
SPL U-2
SPL P
SPL U-2
SPL P
SPL M
SPL P
SPL O
TITLE: CCT–DIRECTION INDICATORS & HAZARDS
PROJ: BROOKLANDS
DRG:
SHEET:D5
ISSUE LEVEL: A1
APPROVED D. SEARLE
CHECKED M. GARRETT/I. SMITH
DRAWN M. GARRETT
FIRST RELEASE DATE JAN 2012
UPDATES
DATE
ISSUE
CONN NAME
MAIN/ENGINE
MALE CONN
FEMALE CONN
CAVITY NUMBER

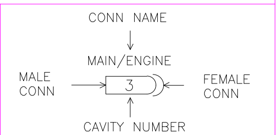


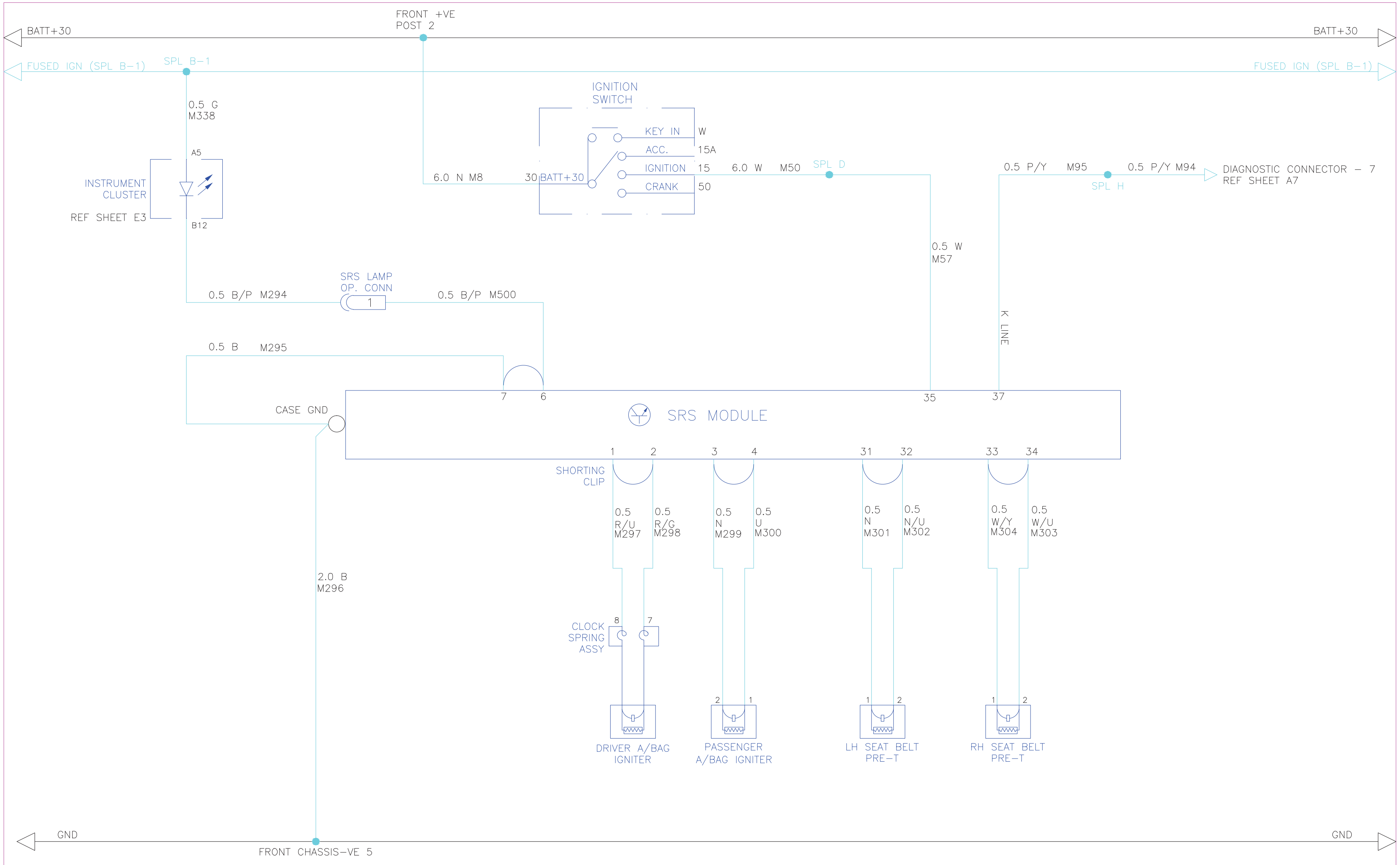
TITLE: CCT-BRAKE LAMPS		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:D6	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER

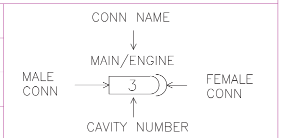


TITLE: CCT–REVERSE LAMPS & PARKING SENSORS		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:D7	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

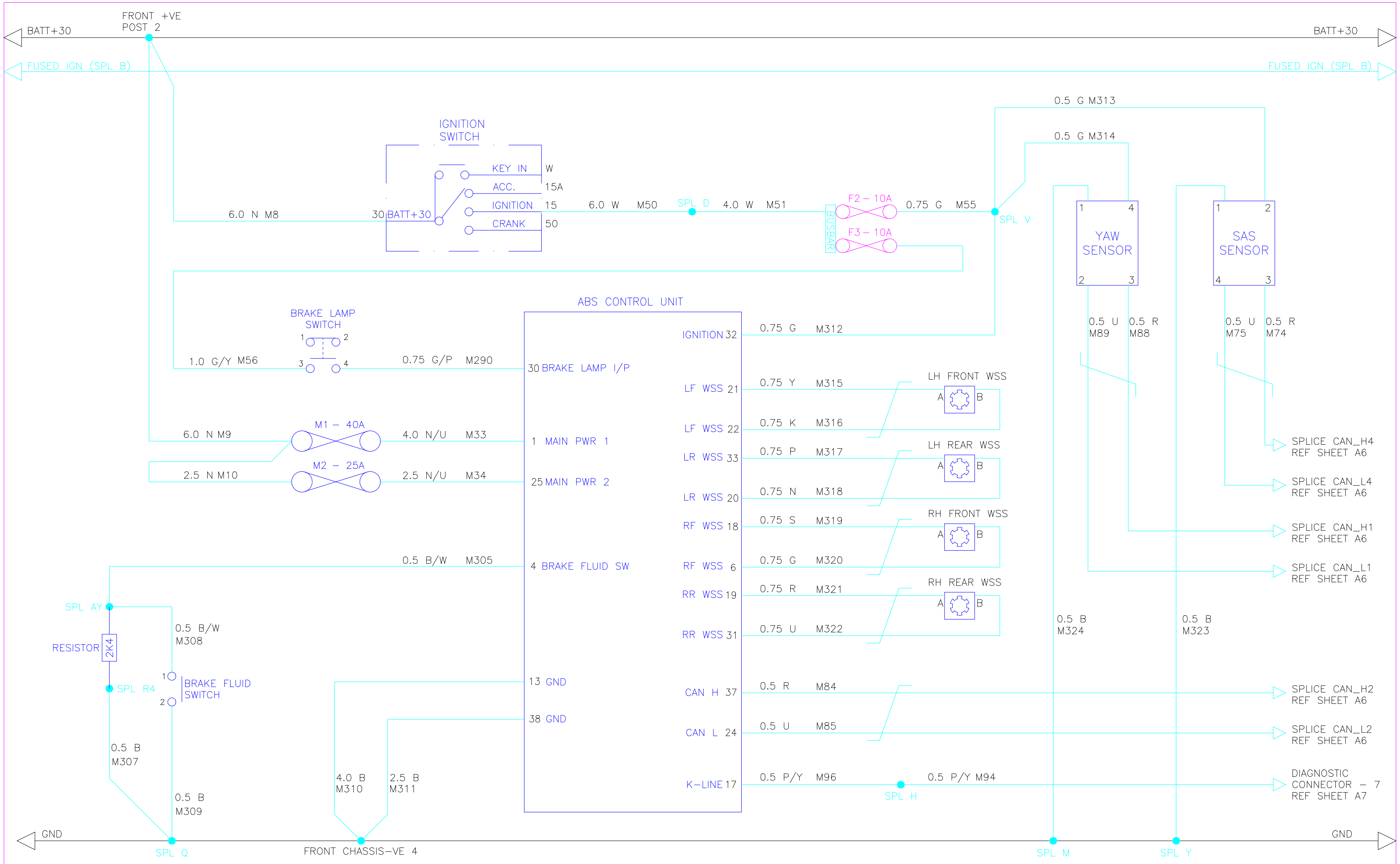




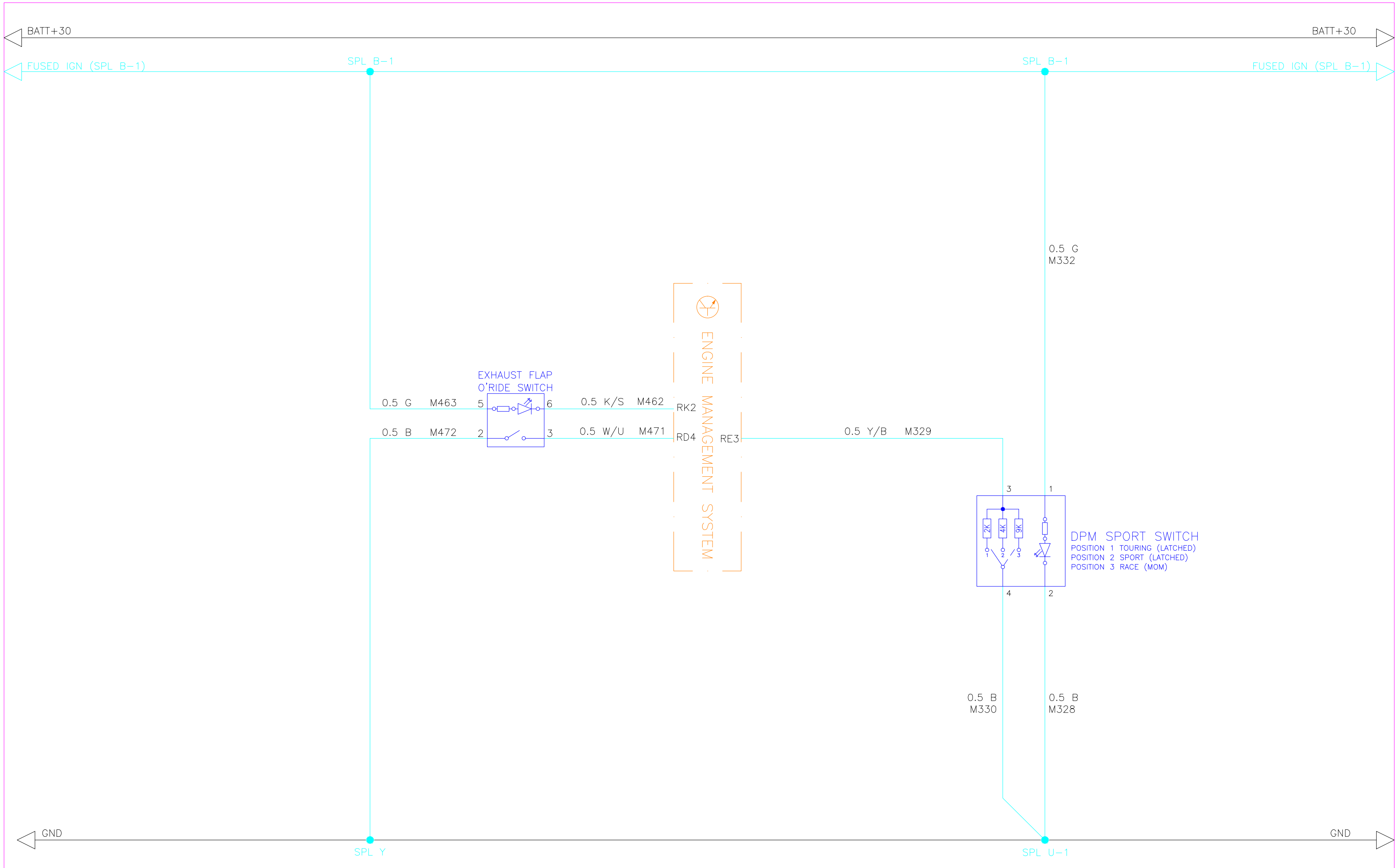
TITLE: CCT-SRS SYSTEM		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH	CHANGED SRS SUPPLY TO MIRROR ELISE + ADD OPTION CONNECTOR	01/08/12	B1
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E1	ISSUE LEVEL: B1	FIRST RELEASE DATE	JAN 2012			



Updated 6th August 2012

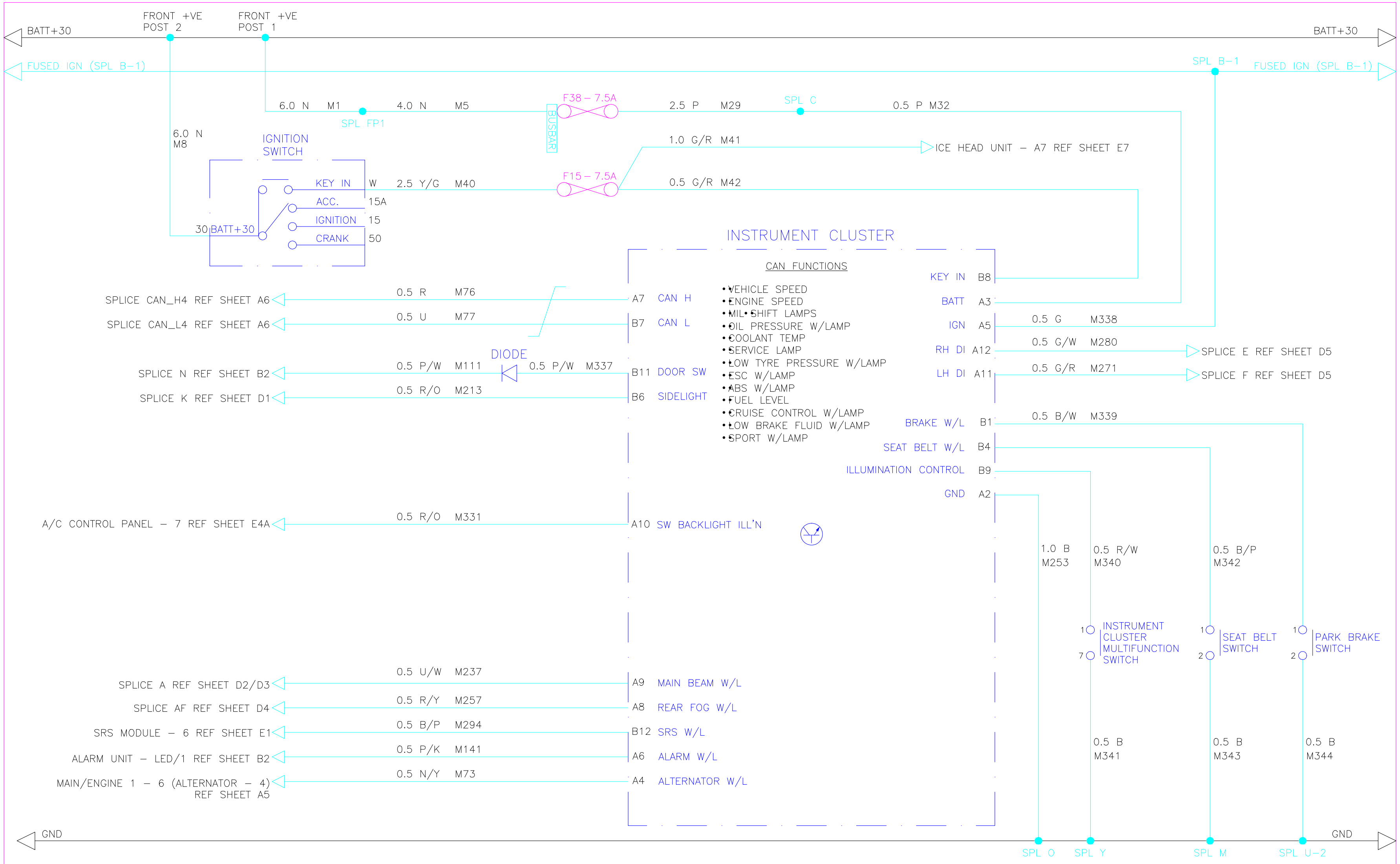


TITLE:CCT–ABS SYSTEM		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E2A	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

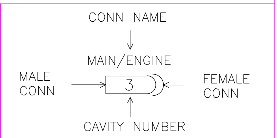


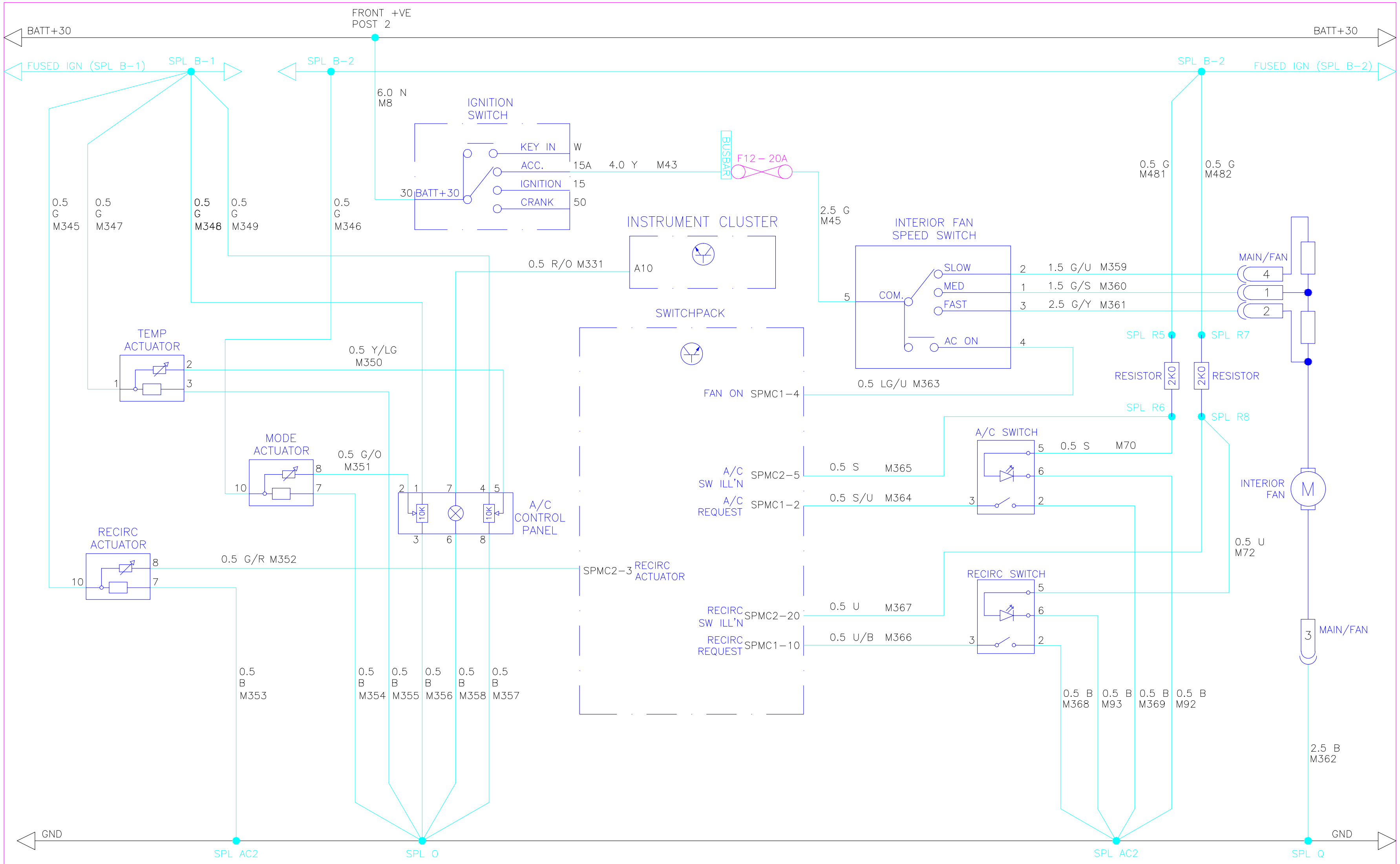
TITLE: CCT-SPORT & EXHAUST FLAP SWITCHES		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET: E2B	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



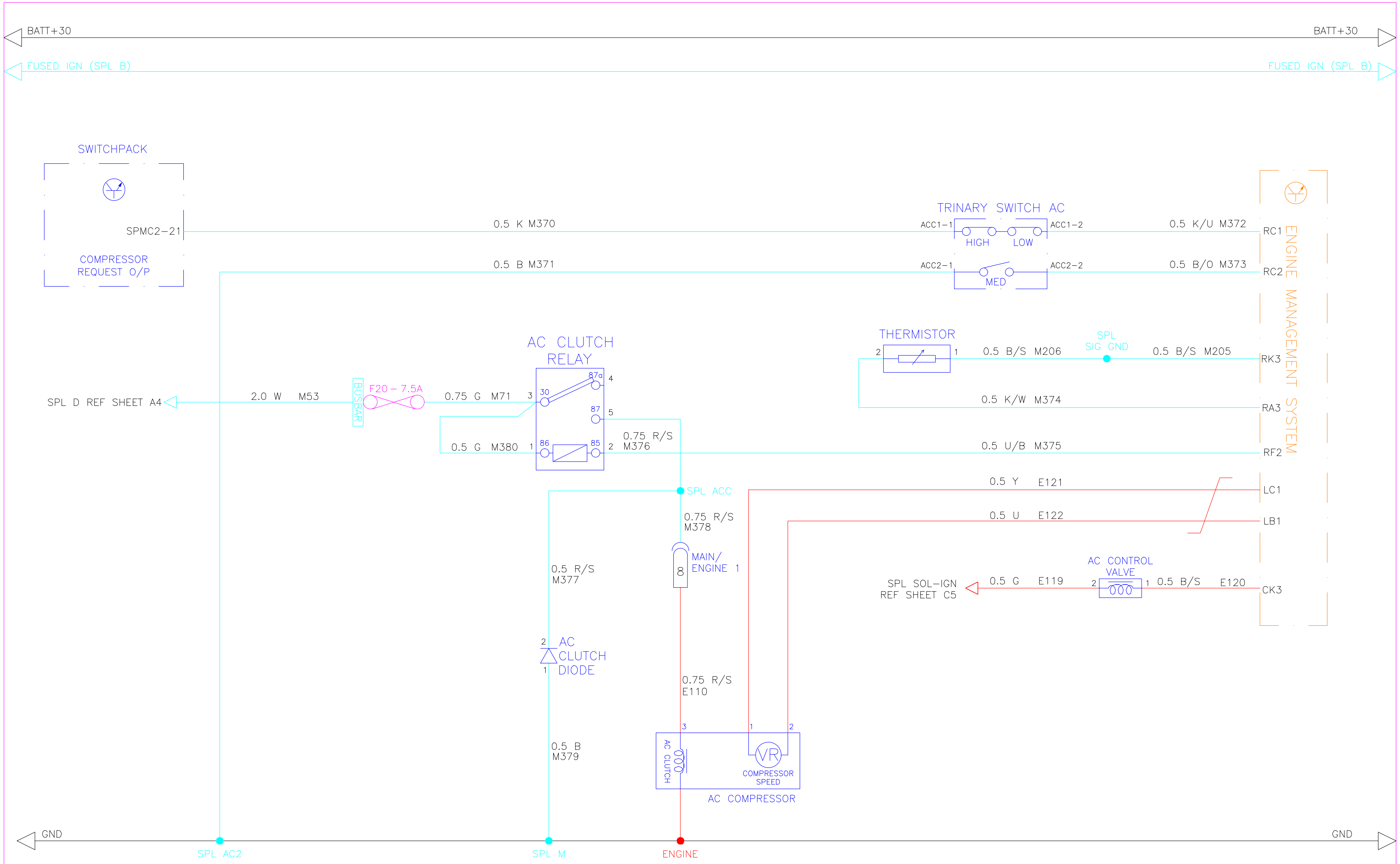
TITLE: CCT-INSTRUMENT CLUSTER		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E3	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			





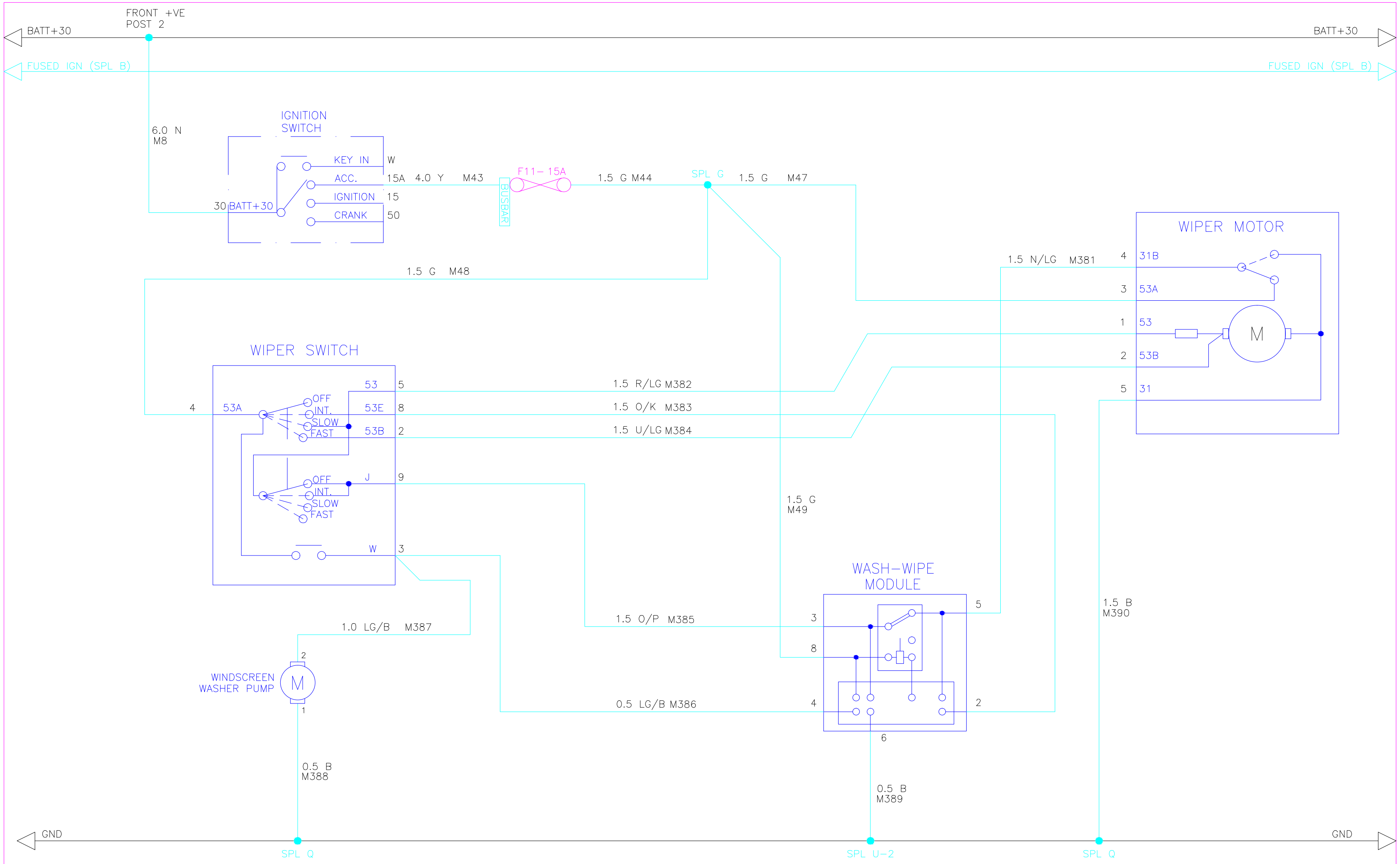
TITLE: CCT-HVAC PART 1		APPROVED	D. SEARLE	UPDATES	DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH		
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT		
SHEET:E4A	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012		

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



TITLE: CCT-HVAC PART 2		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E4B	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



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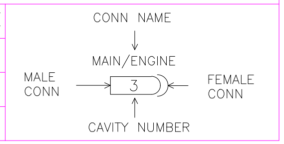
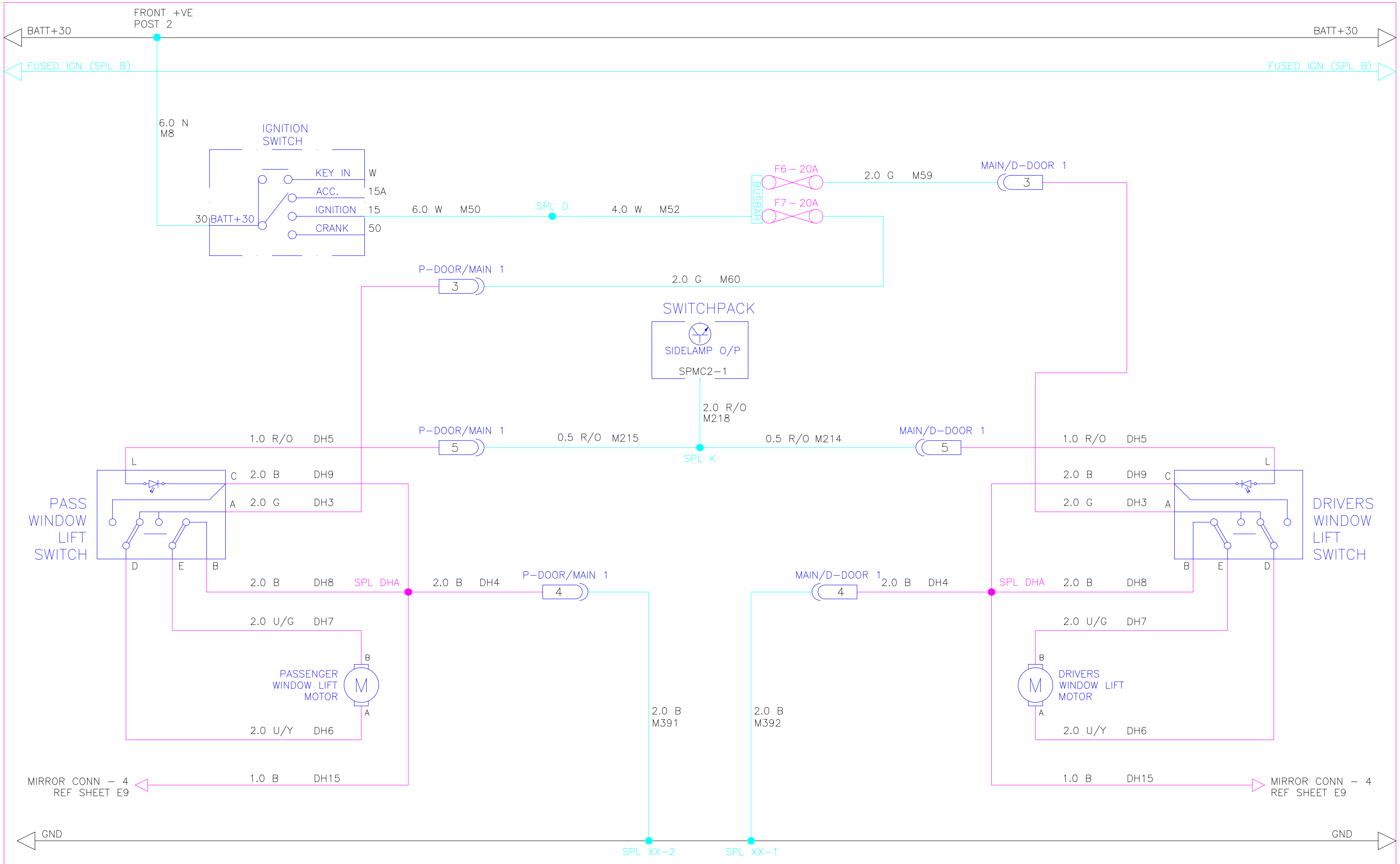
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E5	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			





TITLE: CCT–WINDOW LIFT		APPROVED	D. SEARLE	UPDATES / DATE / ISSUE
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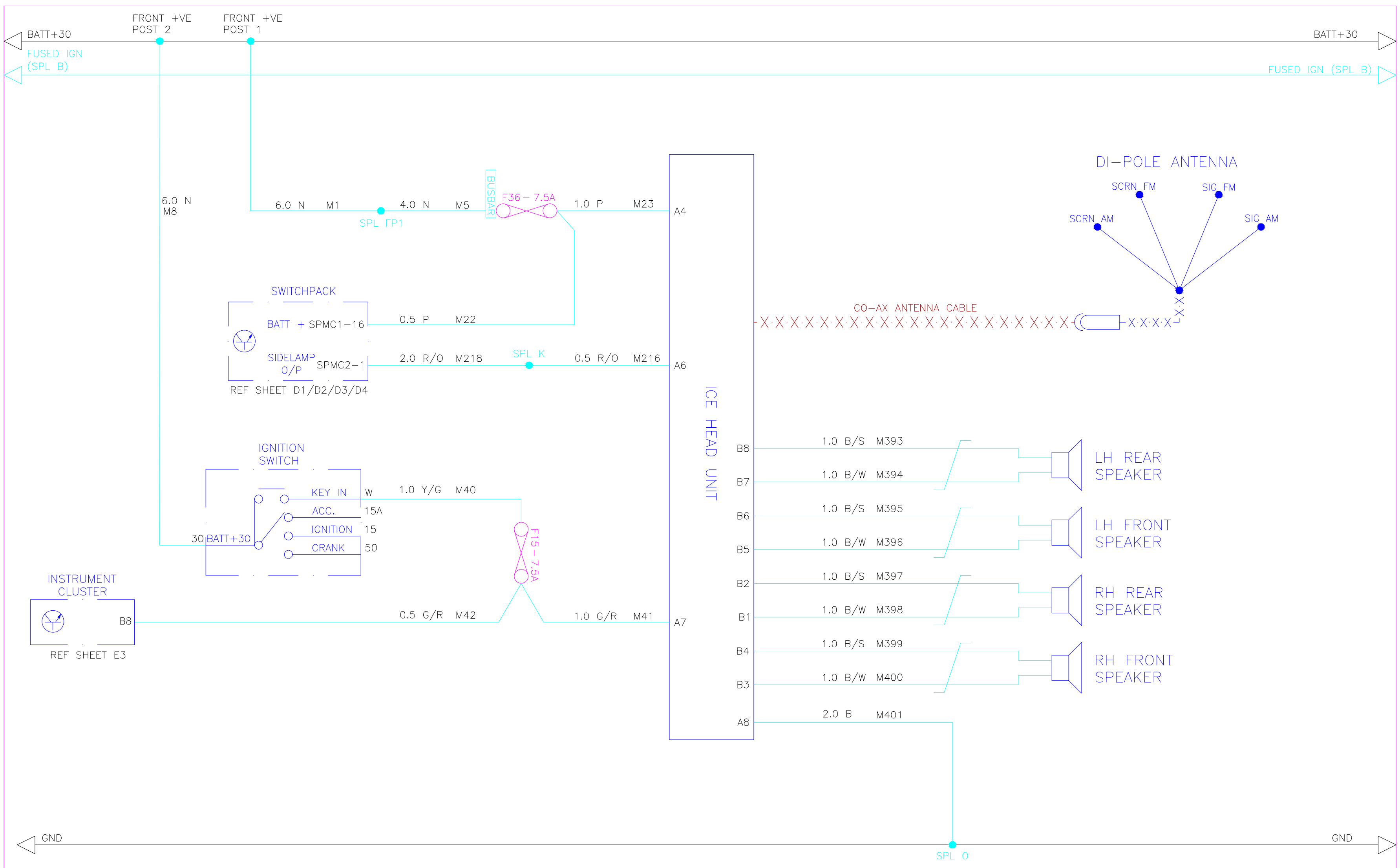
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT	
SHEET:E6	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012	

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



TITLE: CCT–I.C.E		APPROVED	D. SEARLE	UPDATES / DATE / ISSUE
		CHECKED	M. GARRETT/I. SMITH	
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT	
SHEET:E7	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012	

CONN NAME
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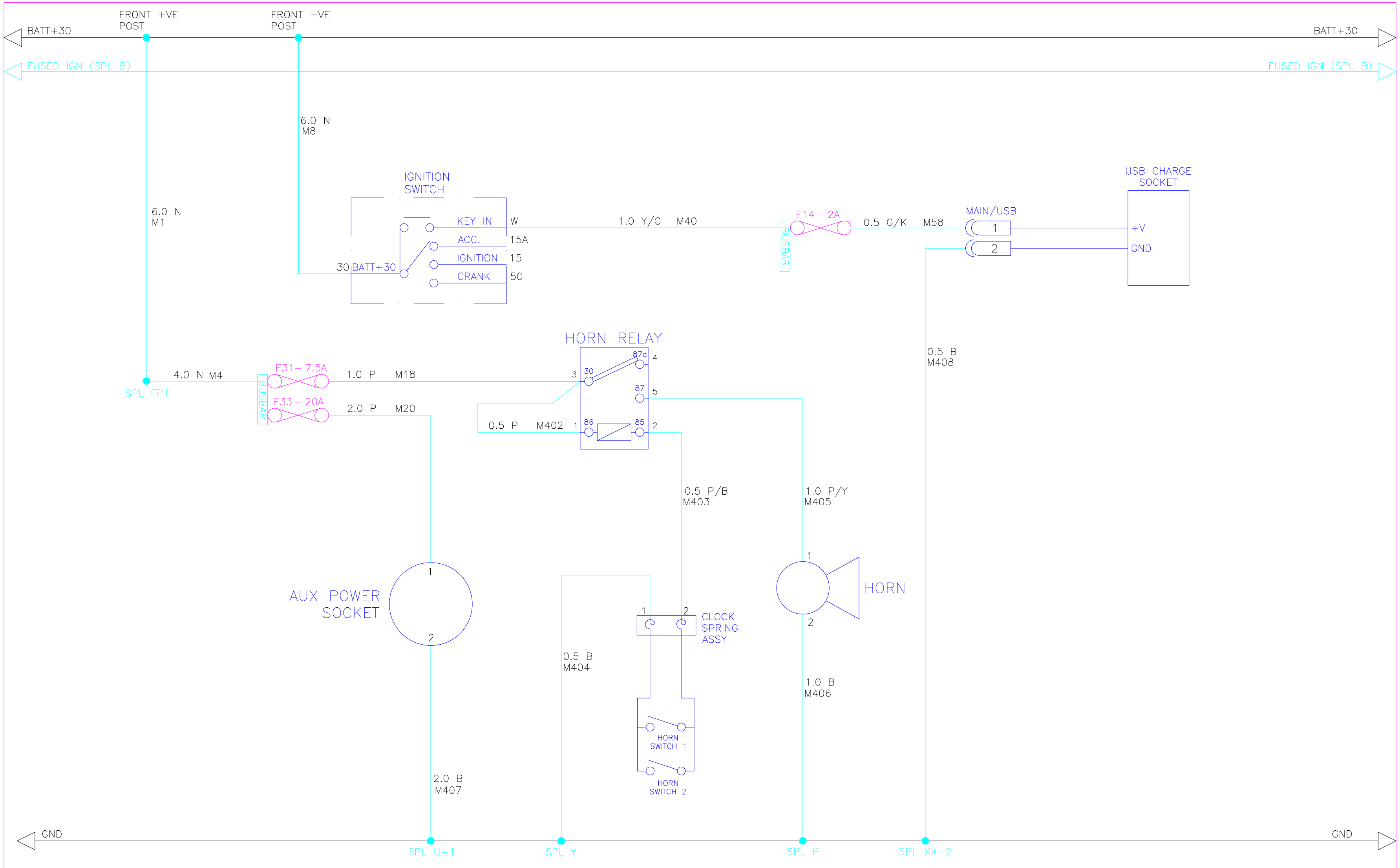
FEMALE CONN
CAVITY NUMBER



TITLE: CCT–HORN, PWR SKT & USB PLUG		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
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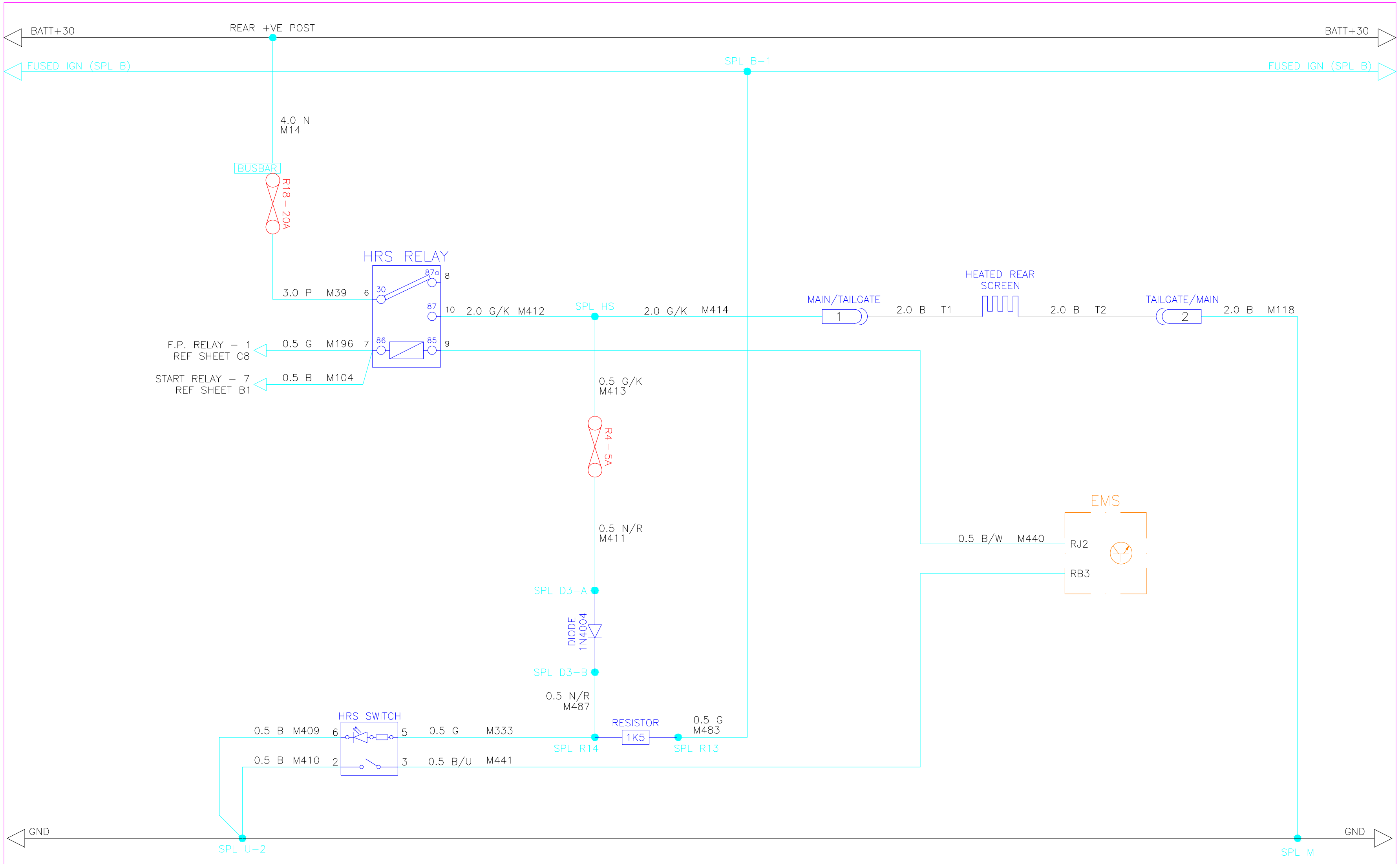
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E8	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			

CONN NAME
MAIN/ENGINE
MALE CONN
3
FEMALE CONN
CAVITY NUMBER



TITLE: HEATED REAR SCREEN		APPROVED	D. SEARLE	UPDATES	DATE	ISSUE
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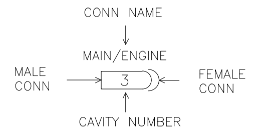
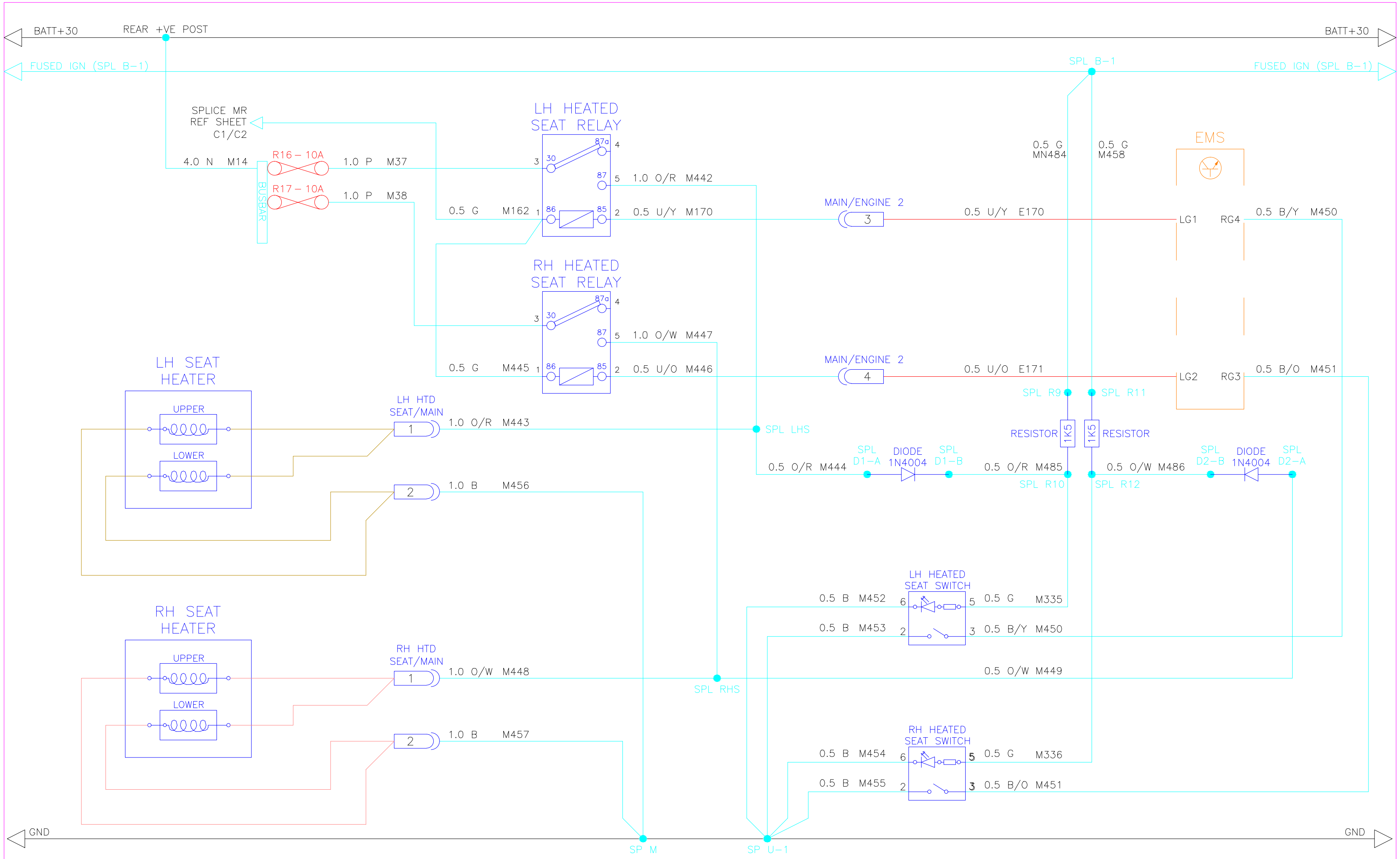
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E9	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			





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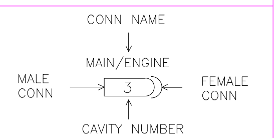
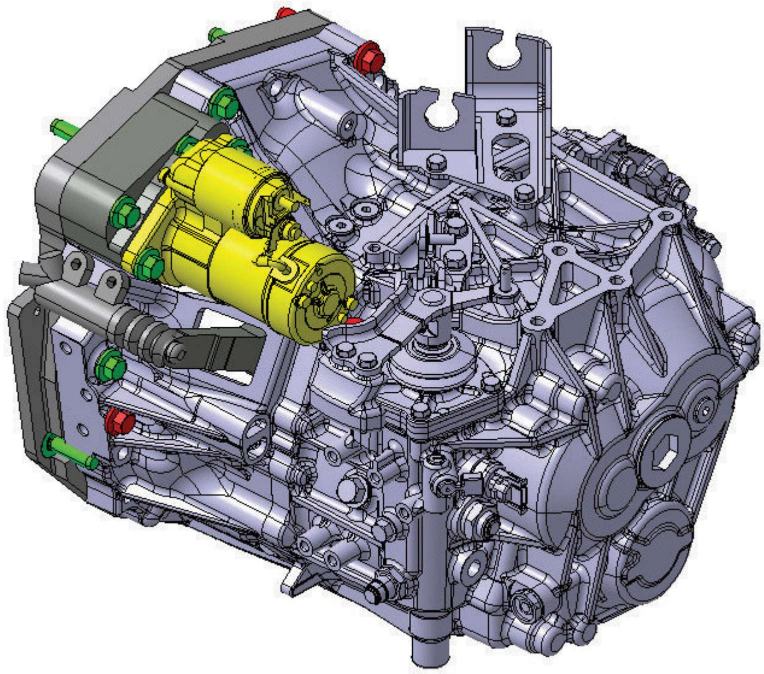
		CHECKED	M. GARRETT/I. SMITH			
PROJ: BROOKLANDS	DRG:	DRAWN	M. GARRETT			
SHEET:E10	ISSUE LEVEL: A1	FIRST RELEASE DATE	JAN 2012			



Abbreviations
ABS Anti-lock Brake System
ACCM Air Conditioning Control Module
ACHC Air Conditioning Harness Connector
ACIS Acoustic Control Induction System
CDL Central Door Locking
CHMSL Centre High Mounted Stop Lamp
CVCV Canister Vent Close Valve
DDHC Driver's Door Harness Connector
DI Direction Indicator
ECU Electronic Control Unit
EHC Engine Harness Connector
FL Fog Lamp
FSM Front Side Marker
FTC Fuel Tank Connector
GND Ground
IP Instrument Pack
LF Left Front
LIHC Left Inner Harness Connector
LOHC Left Outer Harness Connector
LR Left Rear
MB Main Beam
NPL Number Plate Lamp
O2 Oxygen (sensor)
PDHC Passenger's Door Harness Connector
RF Right Front
RIHC Right Inner Harness Connector
RIL Rear Outer Lamp
RMC Rear Module Connector
ROHC Right Outer Harness Connector
ROL Rear Outer Lamp
RR Right Rear
RSM Rear Side Marker
SL Side Lamp
SPL Splice
SPMC Switch Pack Module Connector
SSWHC Starter Switch Harness Connector
TMAF Temperature & Mass Air Flow
VSV Vacuum Solenoid Valve
VVT Variable Valve Timing
VVTLi Variable Valve Timing & Lift - intelligent
WSS Wheel Speed Sensor
YMC Yazaki Module Connector

TRANSMISSION

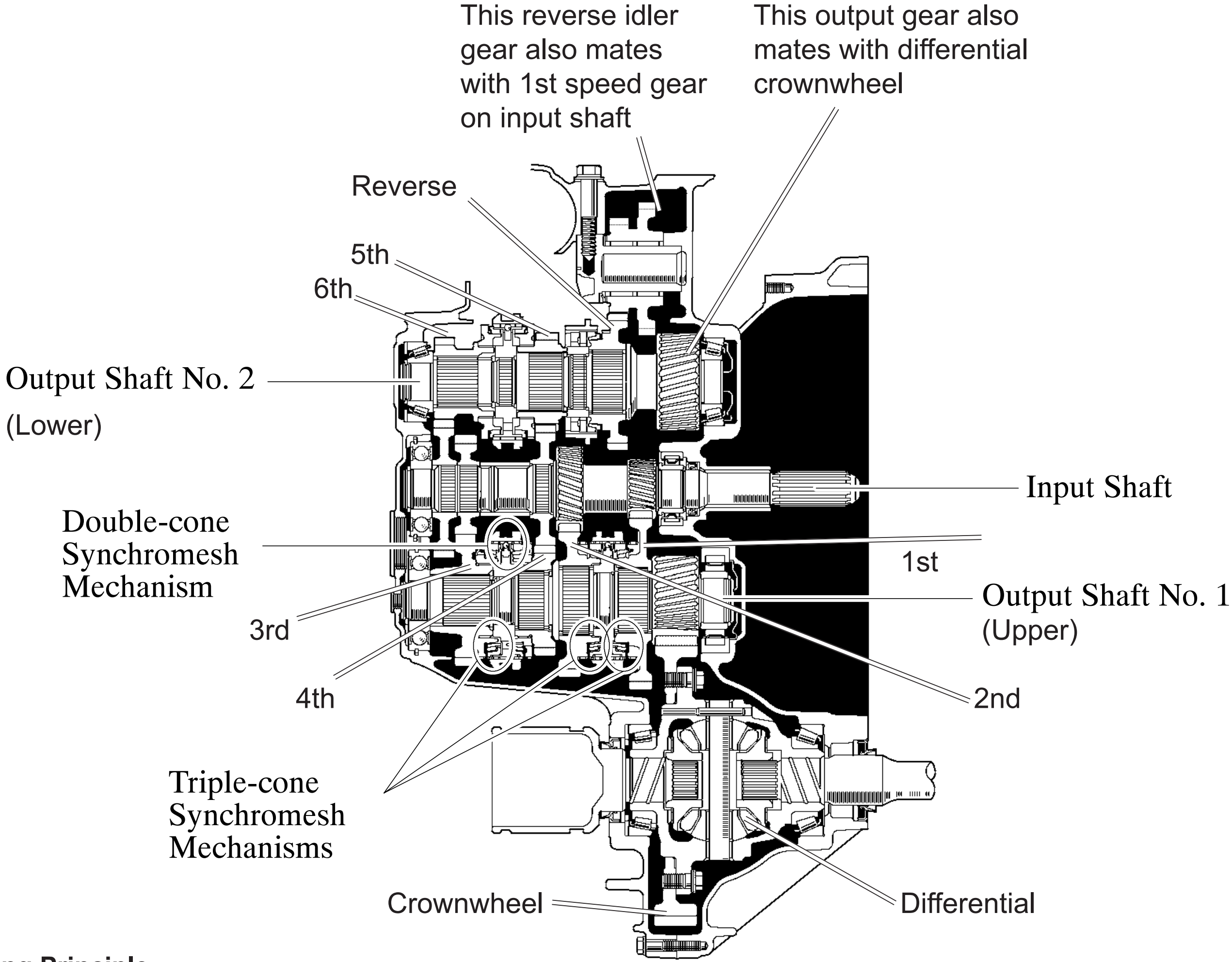
SECTION FK



*** See separate CD: T000T1517F (Toyota production)**

GENERAL LAYOUT

View rotated for clarity



Operating Principle

The Exige S six speed transmission uses a 3-shaft design in order to minimise the packaging space required, and uses a two part alloy housing comprising a front section, including the clutch housing and front bearing support, and a rear section to house the gearbox and shaft rear bearings. Each section includes one half of the final drive casing, through which the vertical split line is positioned.

The input shaft carries the clutch centre plate, and is supported by a roller bearing in the clutch housing, and a ball bearing in the main case. The shaft has integral drive gears for 1st and 2nd speeds, and separate gears spline fixed to the shaft for 3rd, 4th/5th, and 6th speeds. Two output shafts, an upper and a lower, are arranged parallel to the input shaft, with the upper, no 1 shaft supported by a front roller bearing and a rear ball bearing, whereas the lower no. 2 shaft uses a taper roller bearing at each end. Each of the fixed gears on the input shaft drives a free spinning pinion on either the upper or lower output shaft with one of the input gears turning both the 4th (upper) pinion and the 5th (lower) pinion.

Two synchroniser assemblies are spline fixed to each of the two output shafts, and are operated via the selector mechanism to lock the chosen gear to its output shaft, thus transmitting drive in that reduction ratio to the final drive gears. A final drive pinion integral with the front end of each output shaft, engages with a common crownwheel bolted to the differential carrier. The double pinion bevel gear open differential distributes drive to the two driveshafts.

1st/2nd/3rd speeds are equipped with triple cone synchromesh, 4th speed with double cone, and 5th/6th and reverse with single cone synchromesh, reflecting the severity of duty. Reverse gear is provided by meshing of the first gear pinion on the input shaft with an independently pivoted twin geared reverse pinion, which also meshes with the reverse gear on the lower output shaft, the double step gear train thus providing the required reversal of direction.

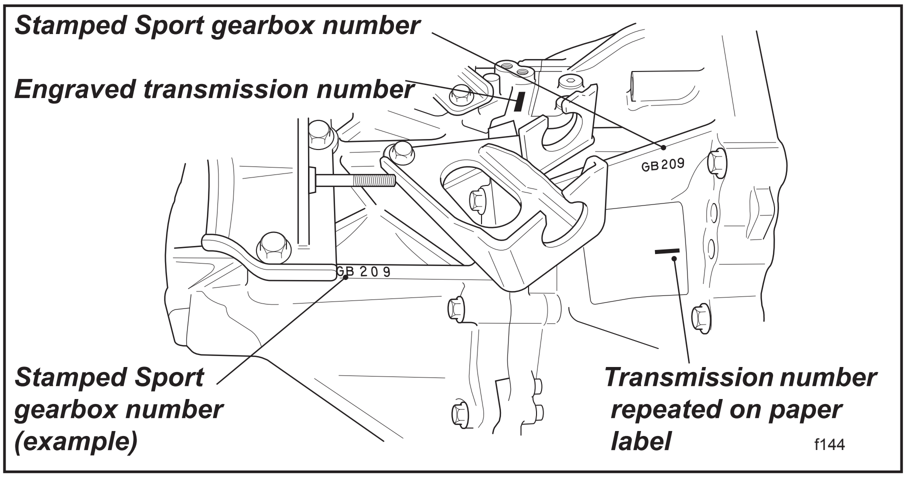
FK.1 - GENERAL DESCRIPTION

The 6-speed transmission assembly is an 'end on' type, positioned at the left hand side of the powertrain, and is supplied by the Toyota Motor Corporation under the designation EA60 and modified by Lotus fitting lower ratio Lotus gearsets for 3rd, 4th, 5th and 6th speeds, to provide closer gear steps and a more sporting drive characteristic. The unit is fully described on CD Lotus part number T000T1517F (Toyota ref. SC02J1EA).

Please refer Service Notes section TDQ - Transmission for specific gear ratio information.

Note that the EA60 transmission is not used by Toyota in combination with the 2GR-FE V6 engine. For the Exige application, a fully machined, cast alloy adaptor plate is interposed between the engine and transmission, the clutch housing of which is machined to accept the mounting of the starter motor via a further adaptor block. The original Toyota transmission serial number is engraved on the top surface of the transmission front case, alongside the jointline with the rear case. Typical example: A7H05232

Sport transmissions may also be identified by a secondary gearbox serial number stamped on both the front and rear casings in the locations shown.

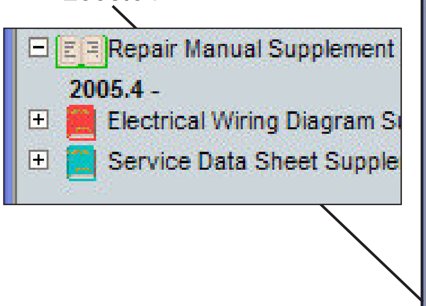


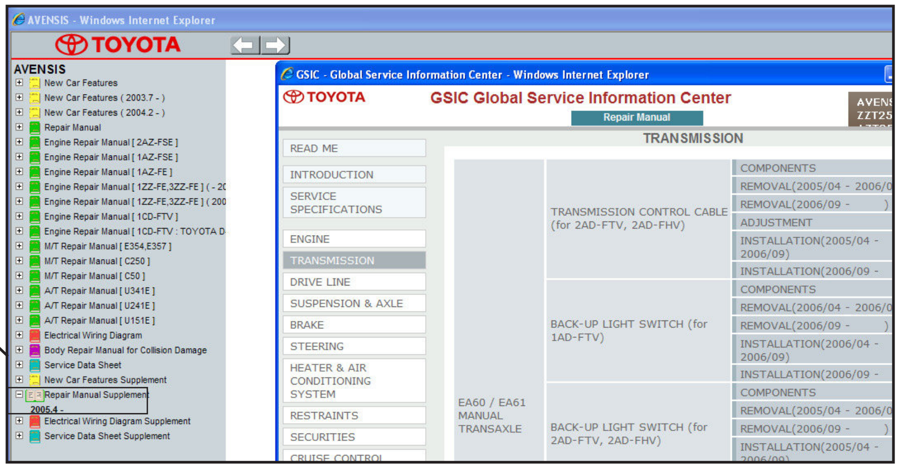
f144

FK.2 - TRANSMISSION OVERHAUL

Insert the disc into a personal computer, and it will automatically open up to an Avensis menu page. For specific information regarding strip down and repair select:

- Repair Manual Supplement.
- 2005.04





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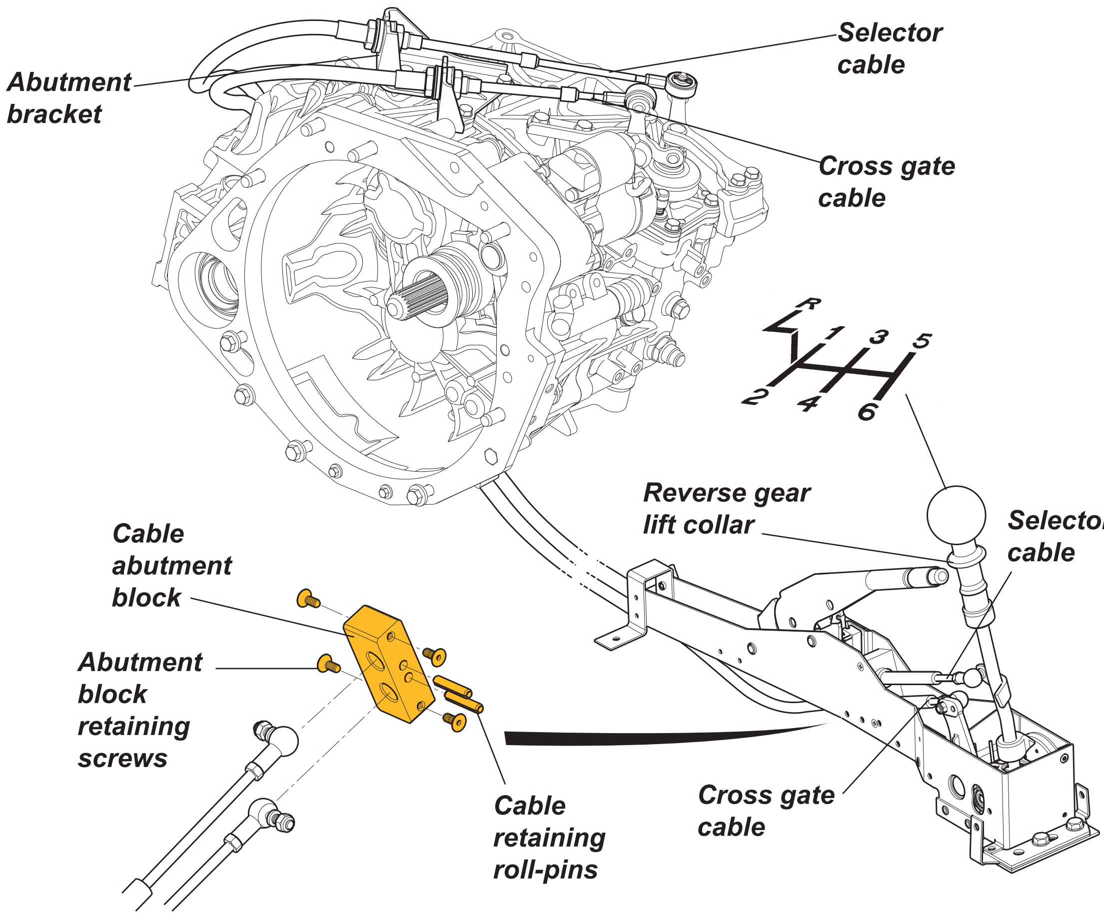
FK.3 - GEARCHANGE MECHANISM



Two control cables run along the centre of the cabin and beneath the fuel tank and power unit, and transmit the movement of the gearchange lever to the transmission selector housing.

The gear lever is spring biased towards the 3rd/4th gear plane, by springs at both the lever end, and within the transmission. The lever must be moved against light spring pressure to the left before selecting first or second gear, or against similar pressure to the right before selecting 5th or 6th speed.

Engaging Reverse Gear:
With the vehicle at a **complete standstill**, pause for a moment with the clutch pedal fully depressed before moving the lever to the left, raising the lift collar beneath the knob, and then further to the left over a spring detent before finally pushing forwards to engage the gear.

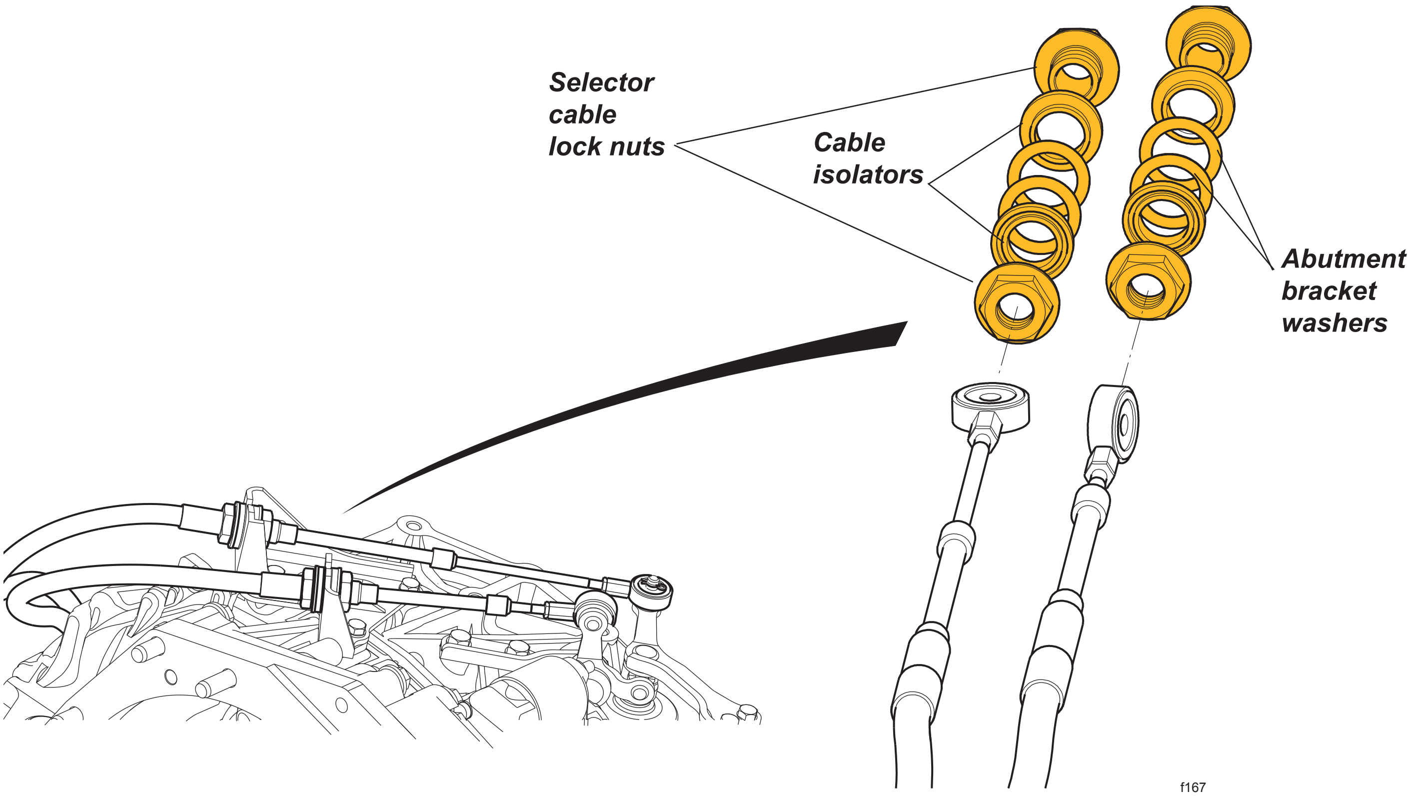
A two cable mechanism is used to connect the gearchange lever with the transmission, one cable ('select') to transmit the fore/aft movement of the lever, and a second ('crossgate') cable for the sideways movement. The gearchange lever is pivoted at its base and operates the shift cable directly via a ball joint half way up the lever. The base of the lever has an extended ball pin on the right hand side which engages with a crossgate bellcrank lever, the other leg of which operates the crossgate cable.

An inhibit mechanism prevents the gear lever being moved into the reverse gear plane unless a collar beneath the gear knob is lifted. This action raises a boss at the base of the lever above a curved inhibitor block, allowing the lever full leftward movement.

The front end of both inner cables are equipped with socket joints which engage with ball pins fitted on the gearchange mechanism. The outer cables are retained by a metal block bolted into the gearlever/handbrake mounting frame.

At the transmission end, each outer cable is located in an abutment bracket by 2 nuts, 2 isolators and 2 washers (1 of each being fitted either side of the bracket).

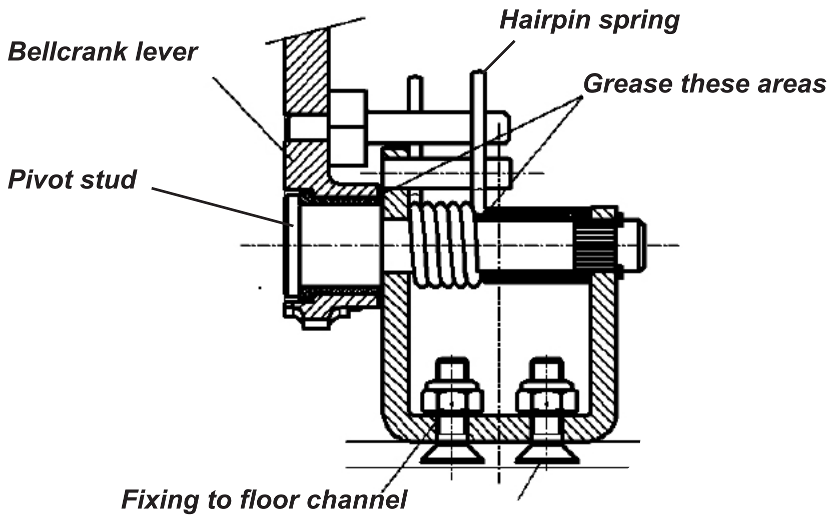
The eyes of the inner cables retained in its selector lever by an 'R' pin. The selector cable connects directly to a lever on the cross-shaft to cause its rotation, the action smoothed by an extension to the lever carrying a damper mass. The crossgate cable connects to a bellcrank lever which imparts an axial motion to the cross-shaft.



Gearchange Cable Adjustment

In order to ensure smooth selection of 1st/2nd gears, it is important to set the crossgate cable adjustment in relation to the fixed position reverse inhibitor block.

- Push the lever to the left to abut against the reverse inhibitor block, and check selection of 1st and 2nd gears. There should be no obstruction to fore/aft movement of the lever.
- If fore/aft baulking occurs, determine whether the 1st/2nd unobstructed plane is too far left or right of where it needs to be (i.e. adjacent to the inhibitor block). For example, if smooth operation can be achieved only when the lever is moved slightly away from the inhibitor, the plane needs to be moved leftwards.
  Remove the gear lever shroud. Release the ball pin from the crossgate bellcrank lever, loosen the locknut and to move the plane to the left, screw the ball joint socket further onto the cable by one turn clockwise. To move the plane to the right, turn counter-clockwise before re-attaching to the bellcrank and testing. Once a setting is found which allows smooth fore/aft lever movement whilst abuting against the inhibitor block, secure the ball joint socket with the locknut. Note that adjustment is available also at the transmission end of the cable.
- Raise the reverse inhibit gear lever collar and check that reverse gear can be engaged.
- Refit the shroud and check that all gears can be selected without the lever fouling the shroud aperture. If necessary, fit shim washers behind the reverse inhibitor block to move the lever away from the LH side of the aperture and re-adjust the crossgate cable as necessary.
- If other adjustments have been made, check the alignment of the 3rd/4th lever plane. From the spring loaded neutral position, it should be possible to smoothly engage 3rd and 4th gears without moving the lever across the gate. If necessary, the ends of the centralising hairpin spring may be reprofiled to reset the neutral plane.



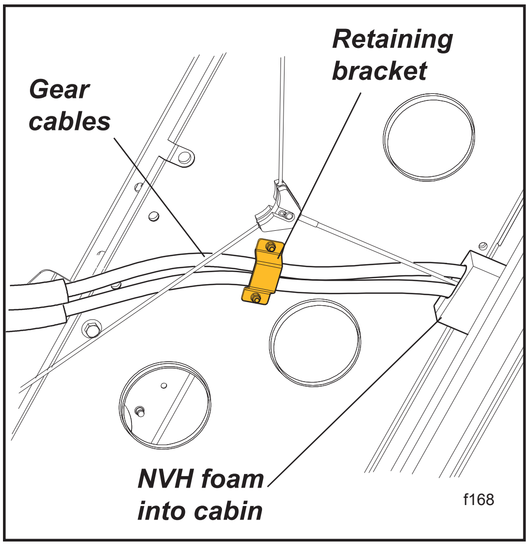
Gearchange Cable Replacement

- *Remove the engine bay undertray:* See sub-section AN.2

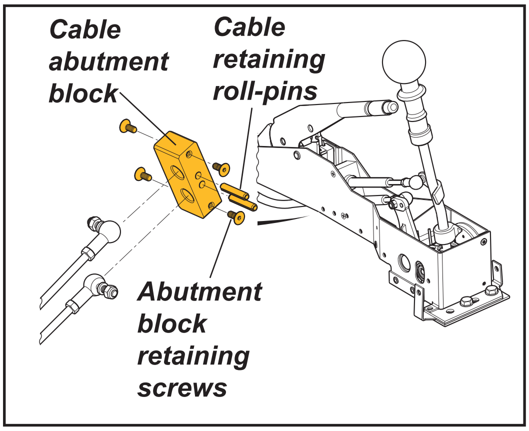
- Release the M5 nyloc nuts and washers (2) securing gear cable retaining bracket to the fuel tank shear panel.

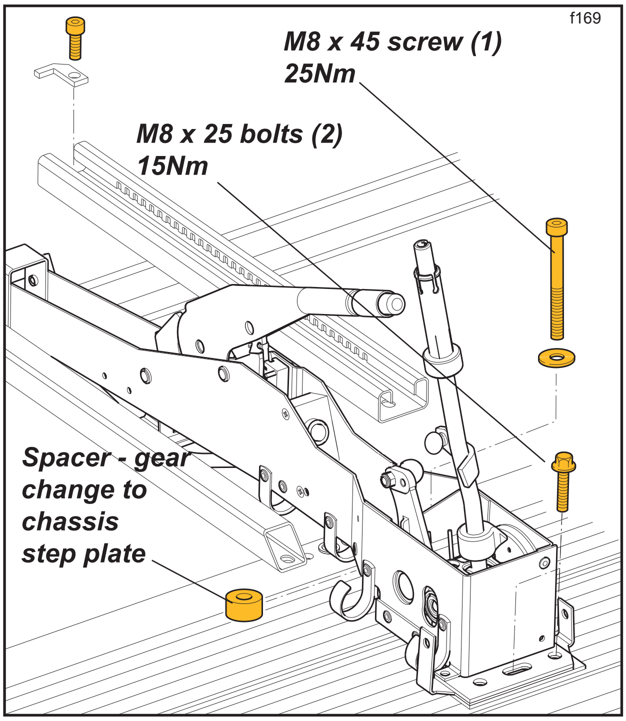
- *Remove both seats and centre console:* See sub-section VE.5.

  Note, both rear inner seat runner mounting screws also retain the rear of the gearshifter unit to the floor pan



- *Release cables, front:* Disconnect the front end of each cable by prising off the end socket from its gear lever or crossgate lever ball pin. Release the screws securing the cable abutment clamp from the mounting frame. Also release the parking brake cable from the lever and disconnect the parking brake tell tale switch.



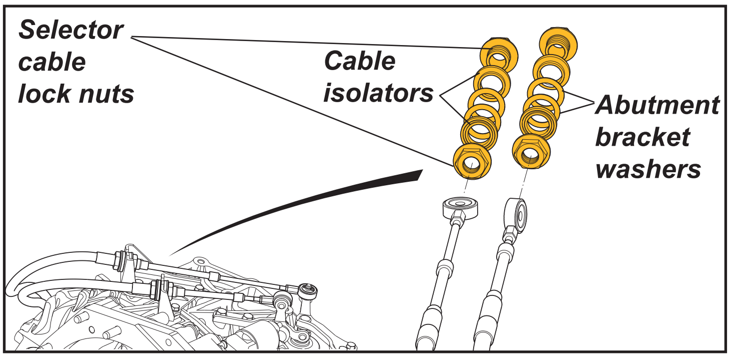


- *Mounting frame:* Release the M8 x 45 screw (1) and M8 x 25 bolts (2) securing the gear lever/handbrake lever assembly to the floor pan, and withdraw.

- *Release the support channel*: Remove the 12 screws securing the support channel to the floor of the chassis tub to allow the gear cables to be released from the 'P' clips inside the support channel.

- From inside the vehicle, feed the gear cables through the NVH foam located at the rear of the cabin, the cables will then be outside and underneath the vehicle.

- *Release cables, rear:* Release the cables from the transmission levers and abutment bracket by removing the 'R' clips and loosen the M16 cable retaining nuts. Release all cable retaining clips and ties, and remove the cables from the car.



Refitment

Refit the cables in reverse order to removal, and check adjustment as detailed above.

Gear Knob Remove/Refit

1. Carefully prise out the badge from the top of the knob, taking care not to damage the leather.

2. Release the socket head screw revealed and lift off the top section of the gear knob.

3. Using the flats provided, use a 15mm spanner to unscrew the lower part of the knob from the gear lever.

4. Check that a no.6 pan head self tapping screw is inserted into the top end of the lift tube spring protruding from the lever; this acts to prevent binding of the spring in the thread of the knob top section.

5. Refit the lower section of the gear knob onto the lever and use a 15mm crowsfoot adaptor and torque wrench to tighten to 15 Nm.
   CAUTION: Do NOT overtighten, or the hollow gear lever may be twisted.

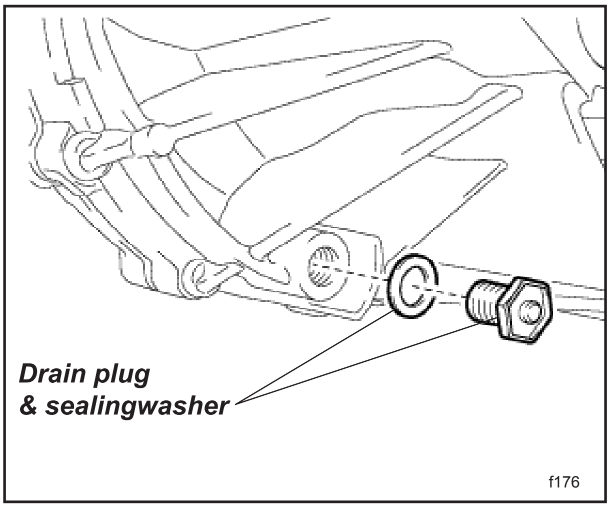
6. Refit the top part of the knob, with the flats engaged onto the alloy carrier, and retain with the socket head screw, torque tightening to 6 Nm.

7. Refit the badge into the gearknob recess, using new double sided tape if necessary.

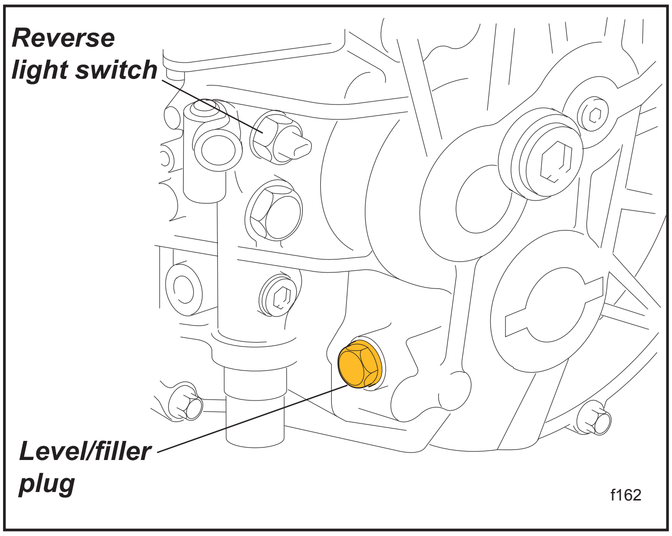
FK 4 - LUBRICATION

The engine and transmission should be inspected for evidence of oil leaks at every service, and the transmission oil renewed at intervals specified in the Maintenance Schedule.

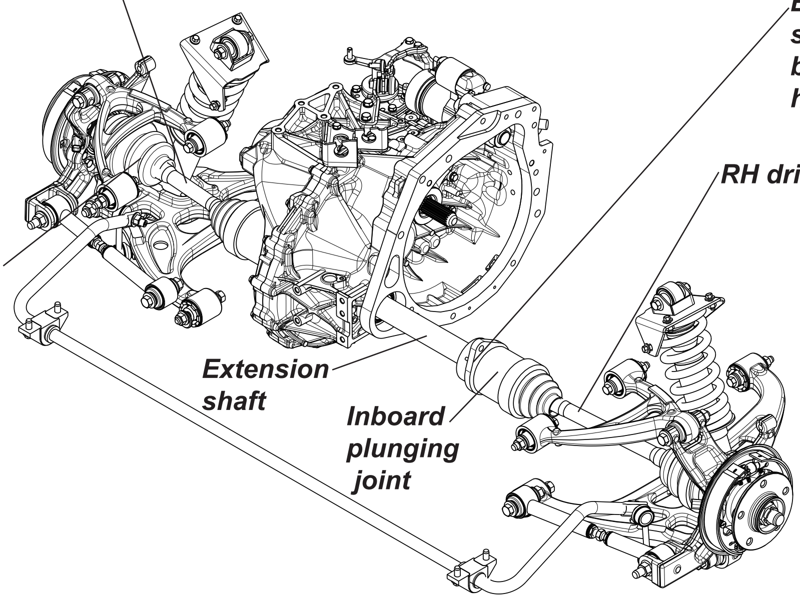
Draining transmission oil
The transmission should be drained after a run when the oil is warm, flows more readily, and the impurities are still held in suspension. A hex. head drain plug is provided in the bottom of the transmission crownwheel housing. After allowing a sufficient drain period, thoroughly clean the drain plug before applying PTFE tape around the thread, fitting a new sealing washer and tightening to 39 Nm.



Refiling/topping up transmission oil
A level/filler plug is located in the left hand side of the transmission case below the reverse light switch. With the vehicle at normal ride attitude, the oil level should be within 5mm of this filler plug hole. For oil specification refer to Section TDQ. After refilling, re-check the oil level at normal running temperature after a run. Finally use a new sealing washer and tighten to 39 Nm.



FK.5 - DRIVE SHAFTS



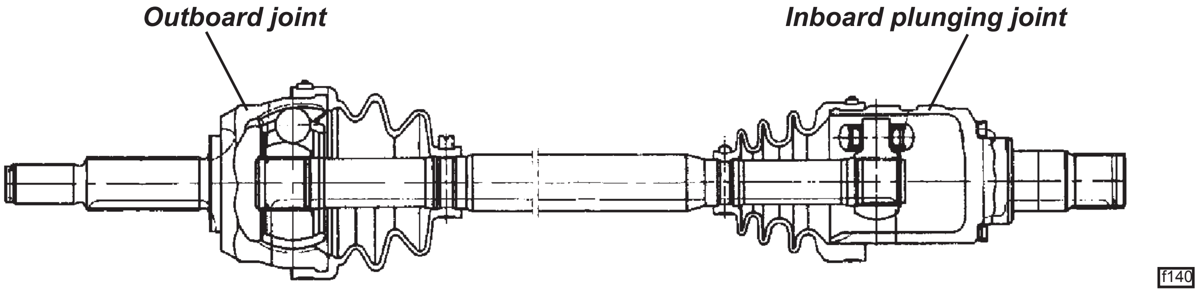
Each of the two driveshaft assemblies comprises a steel shaft with a constant velocity (CV) joint at each end, and is used to transmit the drive from each differential output gear to the rear wheel hub. The longer right hand driveshaft assembly features an outrigger bearing bolted to the right hand side of the cylinder block, with a shaft extending from the inboard CV joint into the transmission housing.

The inboard joints are of a plunging tripod design to accommodate driveshaft length variation with suspension travel, whereas the outboard joints are high efficiency 6-ball fixed length type. Replacement outboard joints include the main driveshaft, outboard C.V. joint and gaiter. Replacement inboard joints include the inner C.V. joint and gaiter kit, with the extended stub shaft of the RH joint also including the support bearing and mounting bracket.

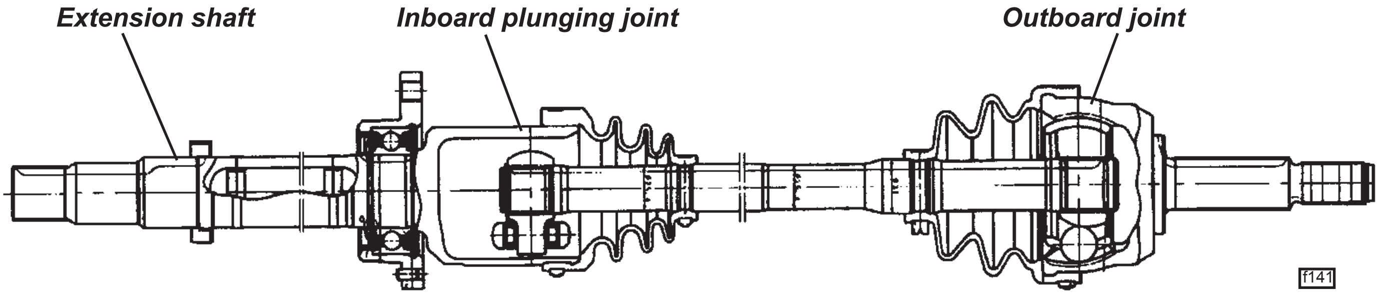
The joints themselves are packed with grease on initial assembly, and are maintenance free. It is however vitally important that the protective gaiters are carefully inspected at service intervals, to check for splits, tears or punctures, since the joint will deteriorate very quickly once contaminated with dirt or water. Damaged gaiters should be renewed immediately, once the serviceability of the joint has been established.

CAUTION: The outboard C.V. joint gaiter can suffer 'pinch' damage if the joint is subjected to extreme articulation off the car, or during driveshaft removal/refitment.

LH Driveshaft Assembly



RH Driveshaft Assembly



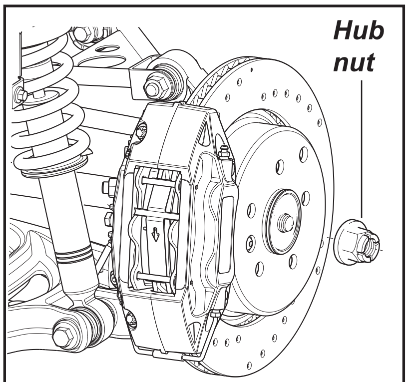
Clicking noises, torque reversal 'clonks', or shudder and vibration when accelerating are all possible symptoms of worn C.V. joints. It should not be possible to discern any free play in a joint by manual manipulation, but care must be taken not to confuse this with transmission backlash, which may be considerable. Any symptoms that could be due to worn driveshaft joint assemblies, should be investigated and rectified without delay, since safety considerations are always of paramount importance.

The inboard C.V. joint is equipped with a male splined spigot shaft which engages with the female splines of the differential output sun gear, with the LH shaft retained by a round section spring circlip on its end, and the RH shaft retained by the extension shaft support bearing. Each of the two transmission output oil seals runs on a machined shoulder on the C.V. joint spigot shaft, onto which is pressed a dust shield. The stub shaft of each outboard joint is splined into the wheel hub, and retained by a nut on the threaded end of the shaft.

Driveshaft Assembly Replacement

Removing a driveshaft assembly from the transmission will result in some loss of transmission lubricant. It may be preferred to drain off some oil via the transmission drain plug beforehand. At no time during this process should an extension force be applied to the shaft assembly, as the plunging inner joint could be damaged.

1. *Hub Nut:* With the parking brake and footbrake firmly applied, remove the appropriate wheel centre cap and release the driveshaft hub nut (RH thread at both sides).



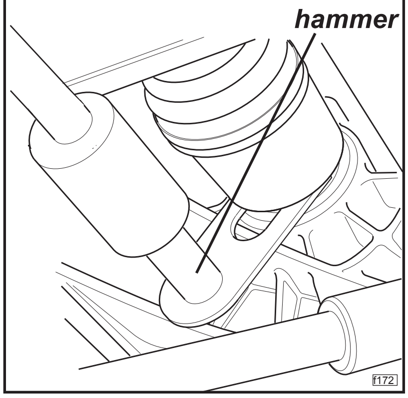
1. Road wheel removed for clarity

2. *Road Wheel:* Remove the appropriate road wheel and the engine bay undertray - see Service Notes section AN.5.

3. *Hub Carrier:* To allow the withdrawal of the driveshaft from the hub, release from the hub carrier the lower wishbone, toe-link, and anti-roll bar drop link. If necessary, release the brake hose 'P' clip and the wheel speed sensor harness to allow the hub carrier to be swung upwards to release the driveshaft. See Service Notes section D1,9.

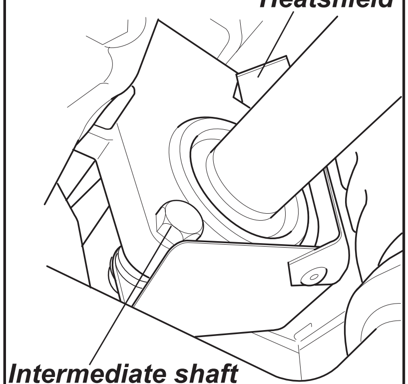
4. *Lubricant:* Remove transmission drain plug and drain off approx. 1 litre of oil into a clean container for re-use, see sub-section FK.4.

5a. *LH Driveshaft:* The left hand driveshaft inboard joint is retained in the transmission by a round section circlip. The joint may be removed by applying a shock pull to the C.V. joint body using a slide hammer with a forked end.

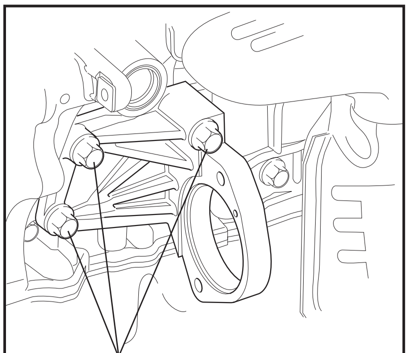
5a. LH Driveshaft


CAUTION: Any attempt to withdraw the inboard joint by pulling on the driveshaft is likely to damage the joint and require its replacement. Apply pressure only to the outer body of the joint.

5b. *RH Driveshaft:* The right hand driveshaft assembly incorporates a bearing for the extension shaft and it is this which retains the shaft in the transmission. Remove the two M10 x 50 bolts and nuts securing the bearing housing to the engine, and withdraw the complete shaft assembly. ***Note: When withdrawing either driveshaft from the transmission, take care not to damage the output oil seal.***

5b. RH Driveshaft


5c. With the driveshaft removed it is possible to access the bearing bracket if required. It is retained to the engine block with 3 bolts which are torqued to 52Nm.



5c. Driveshaft bearing bracket bolts (torque 52Nm)

6. *Re-assembly:* Before re-fitting a driveshaft, first renew the round section circlip on the end of the left hand inboard joint spigot shaft, and lubricate the circlip with grease. Also, check the condition of the transmission output seal, and renew if necessary. Lubricate the lip of the seal with transmission oil, and grease the corresponding shoulder on the driveshaft (C.V. joint) to reduce the danger of damaging the seal on assembly.

7. *Driveshaft:* Carefully insert the driveshaft into the transmission, with, on the left hand shaft, the two ends of the circlip positioned lowermost, and rotate the shaft if necessary to engage the splines. Press the inboard joint outer until a click indicates the engagement of the retaining circlip, if necessary tapping the joint outer body using a brass drift and ham-

mer. Pull on the joint body to confirm its security. On the right hand shaft, fit the bolts securing the extension shaft bearing to the engine mounted bracket, and torque to 45 Nm.

8. *Suspension:* Fit the outer end of the shaft into the hub, and re-assemble the suspension links. Torque settings: Lower wishbone to hub carrier; 135 Nm. Toe-link to hub carrier; 135 Nm. ARB drop link; 36 Nm.

9. *Hub Nut:* Fit the hub nut and road wheel, apply the parking and footbrake, and tighten the hub nut to 300 Nm.

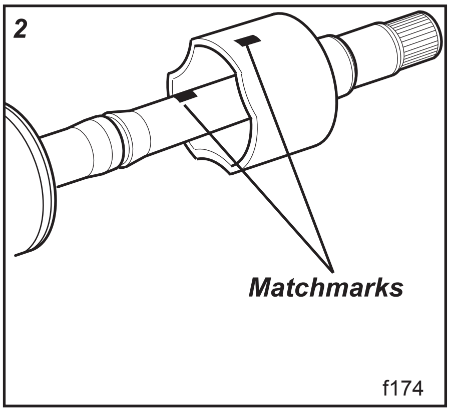
10. *Lubricant:* With the car on the level, top up the transmission oil to the filler/level plug hole, see FK.4.

11. *Wheel and Undertray:* Refit the road wheel and undertray.

Driveshaft C.V. Joint and/or Gaiter Replacement
The outboard C.V. joint is supplied complete with main driveshaft to which it is fixed by a spline with a small helix angle to eliminate any potential backlash. Separation of the shaft from the joint should not be attempted. Replacement of the outboard joint gaiter entails removal of the complete driveshaft assembly from the car, and separation of the inboard joint from the shaft.

1. Remove the driveshaft assembly from the car (see above).

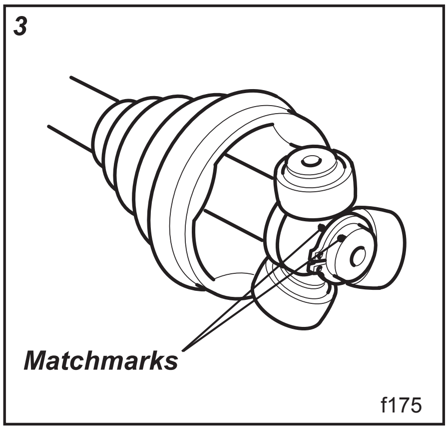
2. Remove the clips securing the inboard joint gaiter without damaging the gaiter if it is to be re-used. Pull the gaiter off the joint outer body and match mark the body to the joint spider before disengaging the joint.



3. Match mark the inboard joint spider to the shaft before removing the snap ring from the end of the shaft, and withdrawing the spider assembly.

4. Slide the inboard gaiter off the shaft, remove the outboard gaiter clips and slide off the outboard gaiter.

5. *Inspection & Cleaning:* 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 or re-orientation of parts is likely to result in premature failure.



If the grease in the joint is contaminated with dirt or water, it is likely that the joint is damaged, and should be replaced. If the grease is not contaminated, the joint should be degreased by soaking in a suitable solvent (NOT petrol), and then carefully inspected. Tilt the ball type inner race or spider rollers to one side to expose each driving surface. Severe pitting, galling, play between ball and its cage window, any cracking or damage to the cage, or pitting, galling or chips in raceways, call for joint replacement.

If the joint is found to be serviceable, it must be repacked with the special grease provided. Pack the grease into the joint itself and also into the inside of the new gaiter.

NOTE: The grease provided in the kits is specially formulated for wear resistance and durability. DO NOT use substitutes or mix with other lubricants. The grease specification and quantity also differs for inboard and outboard joints:

Inboard: 180g NKG302
Outboard: 180g NTG2218-M (inboard grease is also supplied in outboard kits, as the inboard joint must be removed before fitting outboard gaiter).

6. Slide the new outboard gaiter and smaller retaining clip onto the shaft. Fit the gaiter into the grooves on the outboard joint body and the driveshaft, and secure with the clips provided.
7. Slide the new inboard gaiter and retaining clips onto the driveshaft. Press the spider onto the driveshaft splines with the match marks aligned, and retain with a new snap ring.

8. Fit the spider into the inboard joint body with the match marks aligned, position the gaiter in the location grooves, and retain with the new clips.

9. Refit the driveshaft to the car (see above).

Extension Shaft Support Bearing

The ball bearing supporting the RH driveshaft extension shaft to the engine block is mounted in a housing which is bolted to a bracket on the engine block. The bearing is sealed and maintenance free, and is included as part of the inboard C.V. joint assembly, but may if necessary be renewed by the following procedure:

1. Remove the RH driveshaft assembly (see above).

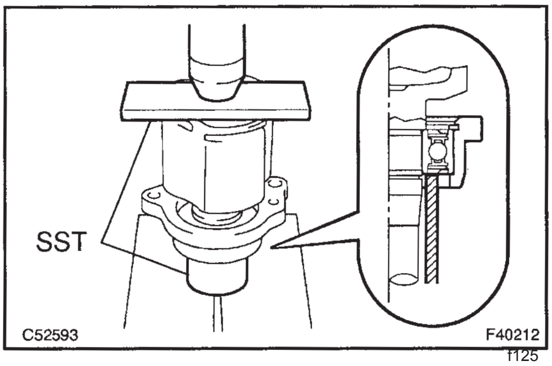
2. Using a press, remove the dust shield from the inboard end of the shaft.

3. Remove the circlip from the outboard face of the bearing housing, and press or pull the housing from the bearing.

4. Prise or pull the bearing dust shield off the shaft.

5. Remove the circlip retaining the bearing and press or pull the bearing from the shaft.

6. Press a new bearing into the housing, and retain with a new circlip. Then use special press tool T000T1438F to press the inner race of the bearing up to the shoulder on the shaft, and retain with a new circlip.



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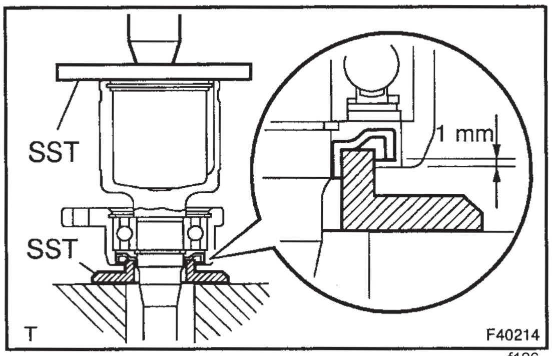
7. Use special press tool T000T1439F to press the bearing dust shield onto the shaft and position as shown in the illustration.



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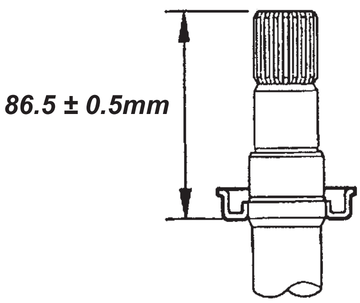
8. Press the inboard dust shield onto the end of the shaft to the dimension shown in the illustration.

9. Refit the driveshaft to the car (see above).



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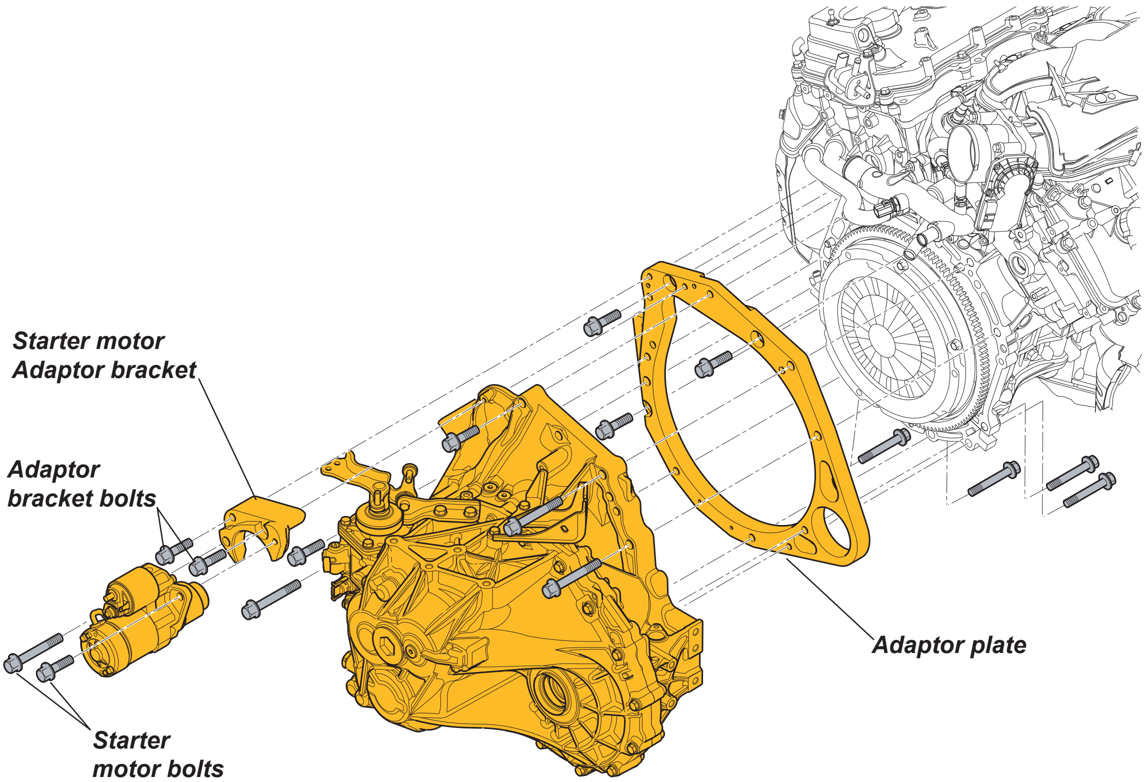
FK.6 - TRANSMISSION REMOVAL/REPLACEMENT

The transmission may be separated from the engine only after removal of the complete powertrain from the car. See sub-section EM.5.

To separate the engine/transmission assembly

In order to mate the 2GR-FE engine to the EA60 manual transmission for use in the Evora, a Lotus specific fully machined cast alloy adaptor plate is used between the two units. Space to mount the starter motor in the position ordained by the clutch housing, is not available with the 2GR-FE engine, so a special machined casting is used to mount an opposite rotation starter motor alongside the clutch, the housing for which is machined to provide suitable clearance.



After removal of the complete powertrain assembly:

1. Remove the clamp bracket supporting the end of the starter motor body (not shown).

2. Release the two bolts securing the starter motor to the adaptor bracket, and withdraw the motor.

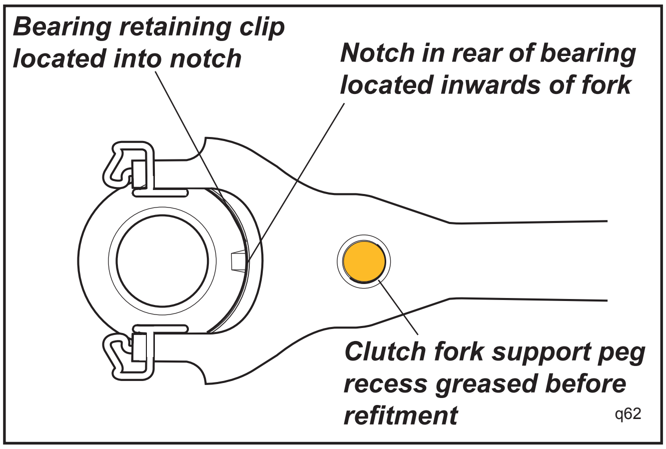
3. Remove the two bolts securing the motor adaptor bracket to the transmission adaptor plate, and remove the bracket.

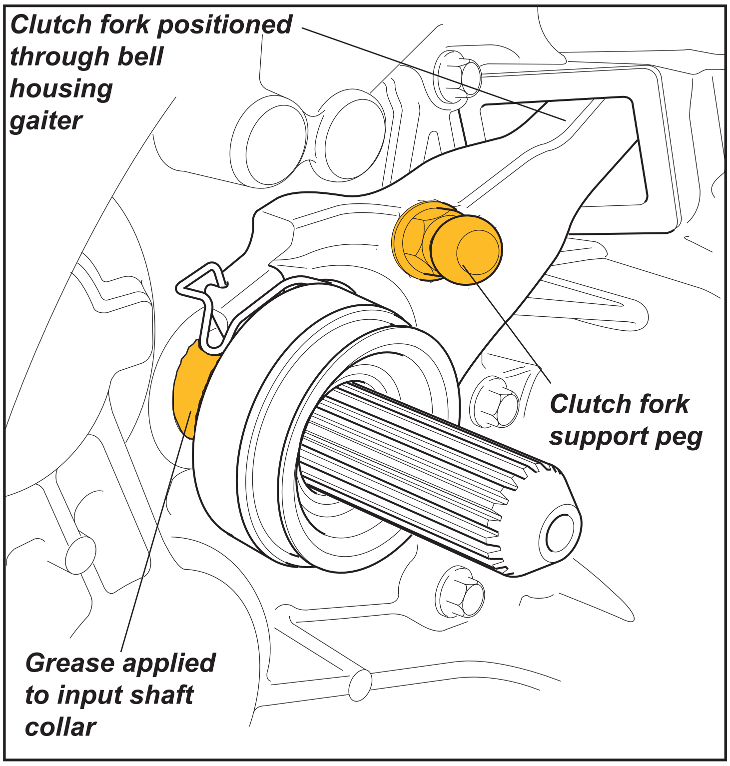
4. Ensure suitable independent support of the engine and transmission units before releasing the clutch housing from the engine:
   - From beneath, remove the two bolts securing the dirt shield in the clutch housing aperture.
   - Remove the 3 bolts from the engine side of the lower section of the adaptor plate.
   - Remove the 5 bolts from the transmission side securing the clutch housing to the engine/adaptor plate.
   - Withdraw the transmission from the engine.

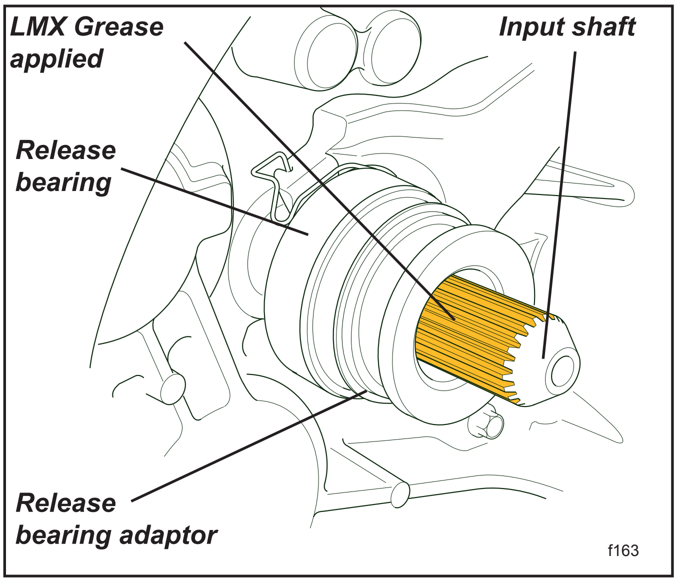
5. If necessary, release the 3 x M12 bolts from the transmission side securing the adaptor plate to the engine, and the single M10 bolt from the engine side of the plate. Remove the plate.

On re-assembly:

- Ensure that the release bearing is correctly fitted to the release fork by ensuring that the notch in the rear of the bearing is inset of the release fork.
- Prior to fitment of the clutch fork and release bearing, apply a small amount of grease to the support peg recess as well as the input shaft collar.
- From inside the gearbox bellhousing, engage the release bearing around the input shaft collar whilst feeding the opposite end of the fork through the release fork gaiter.
- Align the clutch fork recess against the support peg, then push the fork firmly to fully engage the fork on the support peg.
- Apply a small amount of LMX grease (Approx 0.05ml) over the splined area of the gearbox input shaft.
- Remove any excess grease that has built up on the chamfer on the input shaft which could contaminate the clutch assembly causing a source of potential clutch judder.
- Ensure the bearing adaptor is located positively against the clutch release bearing.
- Torque all M12 fixings to 65 Nm, and M10 fixings to 45 Nm. Re-seal around the starter motor to reduce the ingress of water into the clutch housing.

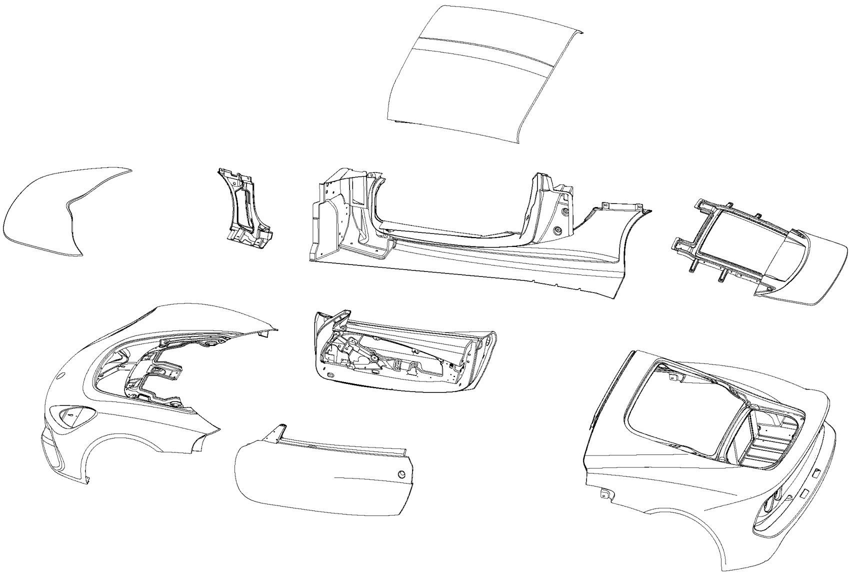




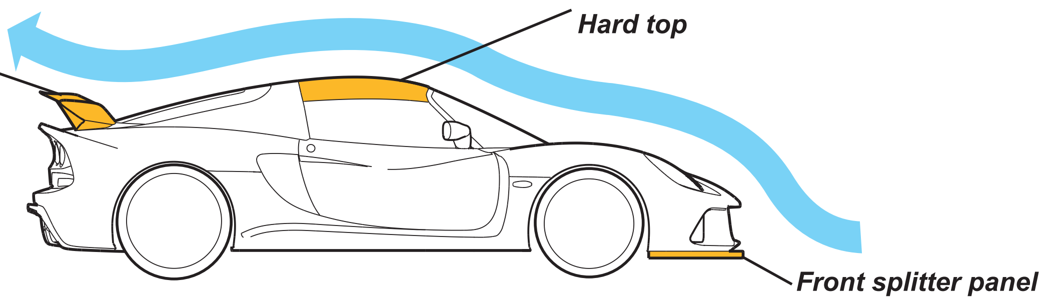


BODY FITTINGS

SECTION BT



BT.1 - HARDTOP ROOF



The hard top roof fitted to the Exige S has been designated as a permanently fixed integral body panel of the vehicle. It is used in conjunction with the front splitter and rear aerofoil to produce the necessary down force required to ensure vehicle stability during high speed and cornering manoeuvres.

Due to the constantly changing dynamic and wind pressure loadings to which the roof structure is subject when driving, and the tolerances required to allow for removal and refitting of the roof whilst carrying out certian repair operations, complete weather sealing of the roof cannot be guaranteed, such that some wind noise and minor water leaks are considered normal for this model.

The Exige S should not be subjected to an automatic car wash. Such machines can induce water leaks caused by high pressure water jets which are not representative of conditions encountered during normal use.

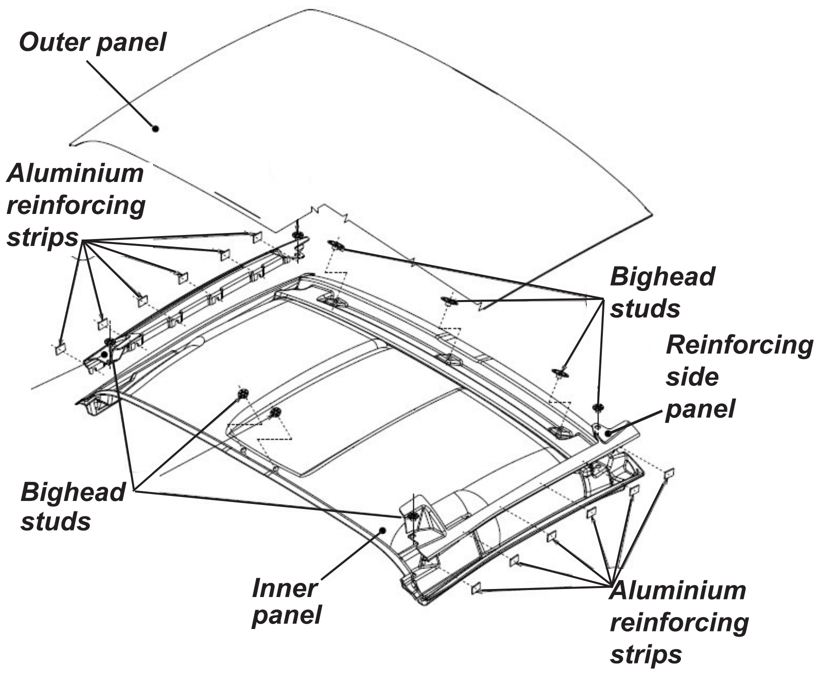
WARNING: Driving the Exige S with either the hard top removed, insecurely fitted or substituted with a soft top could result in a loss of vehicle stability, reduced steering and braking response causing possible loss of control. You or others could be killed or seriously injured.

Hardtop Construction
The hardtop assembly comprises of a main inner and outer panel with reinforcement stiffener panels being fitted between them on the LH and RH sides.

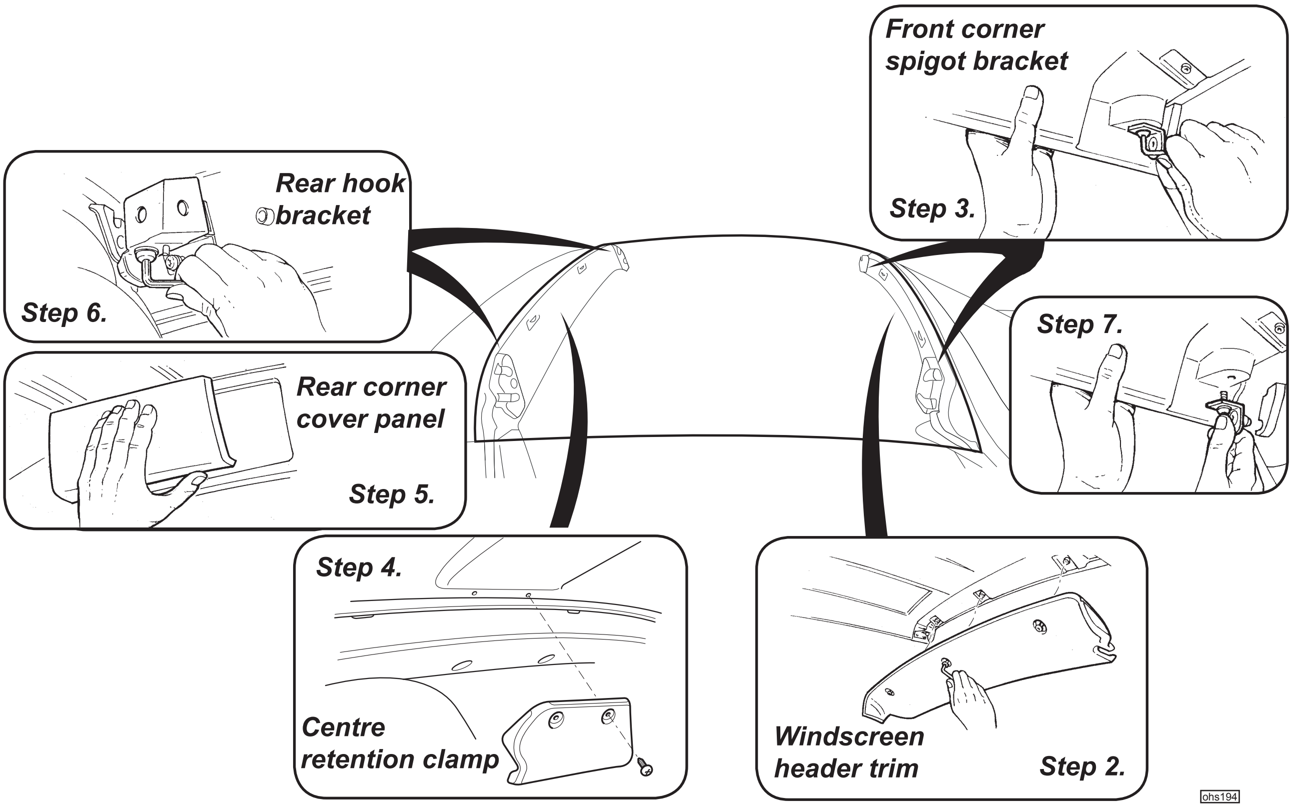
These four panels are then bonded together using Betaseal 1701 adhesive.

Before assembly, holes are drilled into the inner panel and Bighead studs are bonded with Plexus MA920 adhesive to its inner surface to provide threaded mounting points for the hardtop mounting bracket bolts.

Hardtop Sealing
'D' shaped profiled rubber seal extrusions provide sealing between the hardtop and windscreen frame - front, and between the hardtop and bulkhead panel - rear.



Aluminium seal carriers are affixed by double sided tape and pop rivets to the LH and RH sides of the inner panel, cantrail seals are in turn affixed to the seal carriers using double sided tape and provide a seal between the hardtop and door glasses.



Although this is to be considered a permanent fixed panel, certian service procedures may be easier to carry out with the hardtop removed

Care Points for Removal

- *When stowing the roof off the car, care should be taken to avoid damage to the roof corners; e.g. use a suitable soft floor covering on which to stand the roof.*
- *Fitment or removal of the hardtop is made considerably easier with the assistance of a second person.*

Hard Top - Removal

1. Open both doors.

2. Release the tamper-proof Torx screws (3) securing the windscreen header trim panel, and remove the panel.

3. Using a tamper-proof Torx screwdriver, slacken the screws securing each front corner spigot bracket to the roof, but do not yet remove the screws.

4. Slacken the Torx screws securing the centre clamp to the roof, and remove.

5. Pull off the trim cover from each rear corner of the roof panel.

6. Remove the screws securing the hook bracket to the latch plate at each rear corner.

7. Remove the two front corner bracket fixing screws and lift the front edge of the roof slightly to release the front brackets from their latch plate slots.

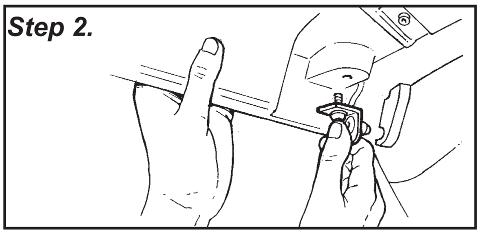
8. With the aid of an assistant, lift the roof from the car taking care to restrain the tethered brackets to avoid damaging the paintwork.

Hard Top - Fitting

1. Open both doors, and preferably with the aid of an assistant, lower the roof onto the car holding aside the loose tethered fixings to avoid their entrapment or causing paint damage. Position the rear edge of the roof first before locating the front edge against the windscreen header rail.

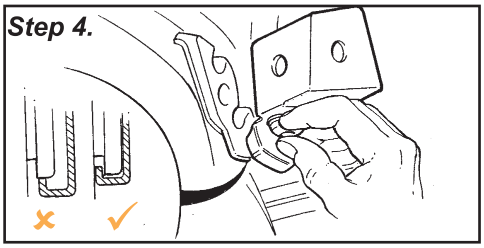
2. Locate a front spigot bracket into its latch plate lower slot (lifting the roof slightly to allow this) and retain to the roof with the tamper-proof Torx screw. Do not fully tighten at this stage.

3. Repeat step (2) for the opposite front spigot bracket.

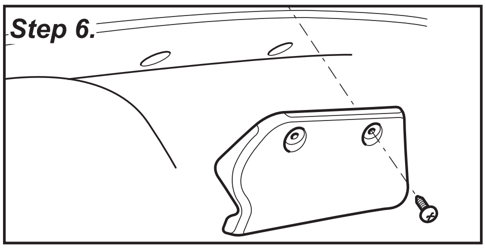

Step 2.

4. Engage a rear cup bracket with the lower tongue on its rear latch plate, and retain to the roof with the tamper-proof Torx screw. Do not fully tighten at this stage. Ensure that the cup is fully located onto the tongue.

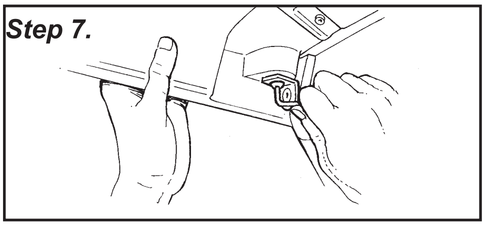
5. Repeat step (4) for the opposite rear cup bracket.


Step 4.

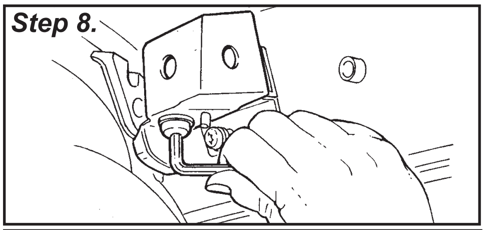
6. Install the centre retention clamp, hand tightening its 2 fixings into the roof panels centre rear mounting threads. Ensure that the clamps stepped lip is retrained against the underside of the rear header rail trim panel.


Step 6.

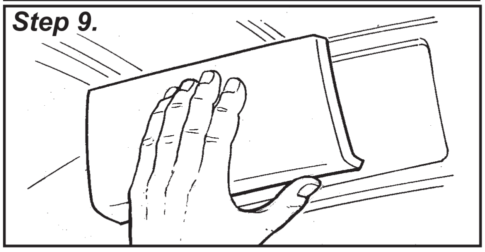
7. Push the roof fully forwards before tightening the front spigot brackets.


Step 7.

8. Hold each rear cup bracket in alignment whilst tightening the single fixing screw for each bracket and finally tightening the centre retention clamp. Do not over tighten.

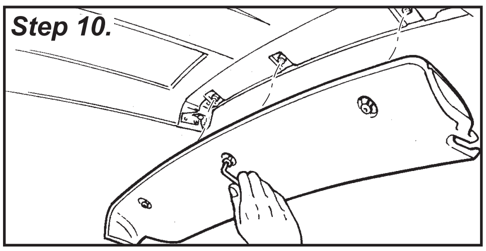

Step 8.

9. Fit the cover panels to each rear corner of the roof, noting that the panels are handed for left and right sides. Press the panels firmly into position fully to engage the 'Velcro' fixing patches.


Step 9.

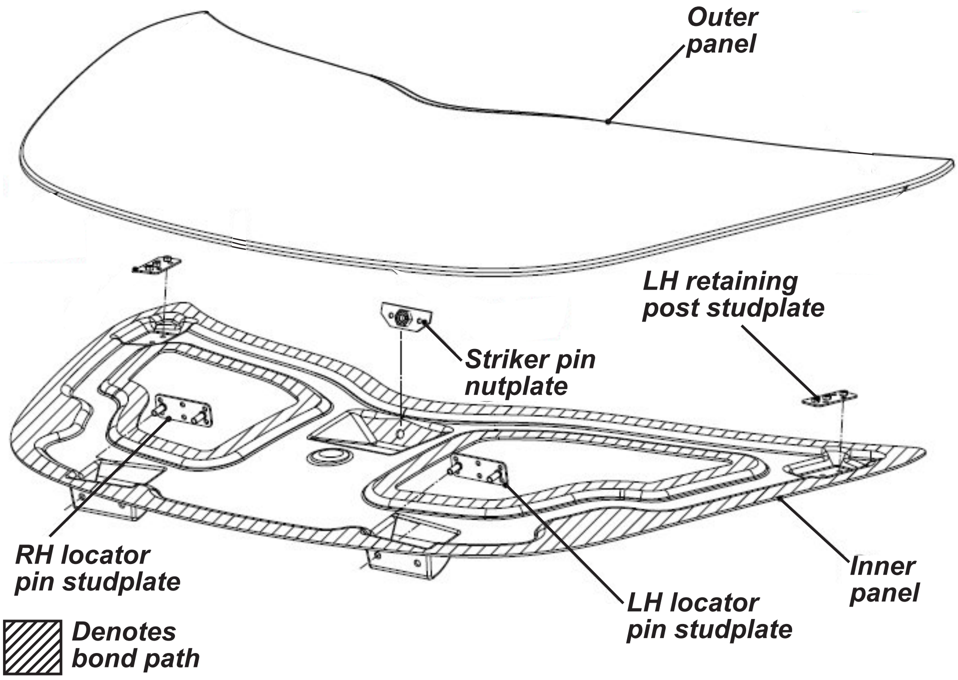
10. Install the windscreen header cover panel by locating first with the central screw, and then by the outer screws before tightening in the same order.

    Check that the roof is secure by pulling upwards on each corner in turn. If any upward movement is evident, check the correct fitment of all mounting brackets.

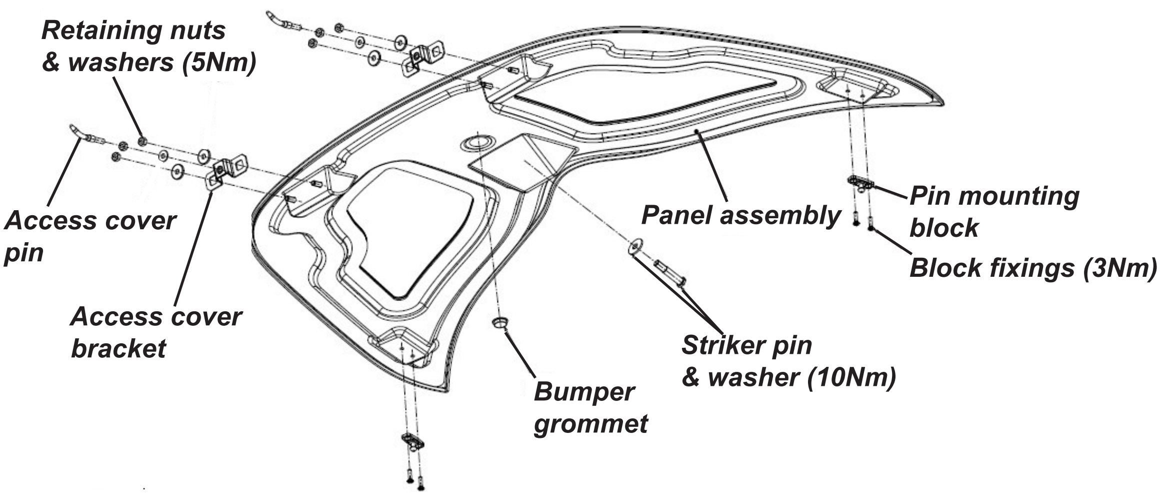

Step 10.

BT.2 - FRONT BODY ACCESS PANEL

A removeable, body colour composite panel is provided in the front body to allow access to the front fusebox, brake fluid reservoir and windscreen washer reservoir.



The access cover assembly consists of an outer and inner panel, the inner panel has nut and stud plates bonded to its internal surface to accommodate the fixings required to retain it securely to the vehicle. The inner and outer panels are the bonded together using Betamate 2810SV applied to the contact surface of the inner panel.

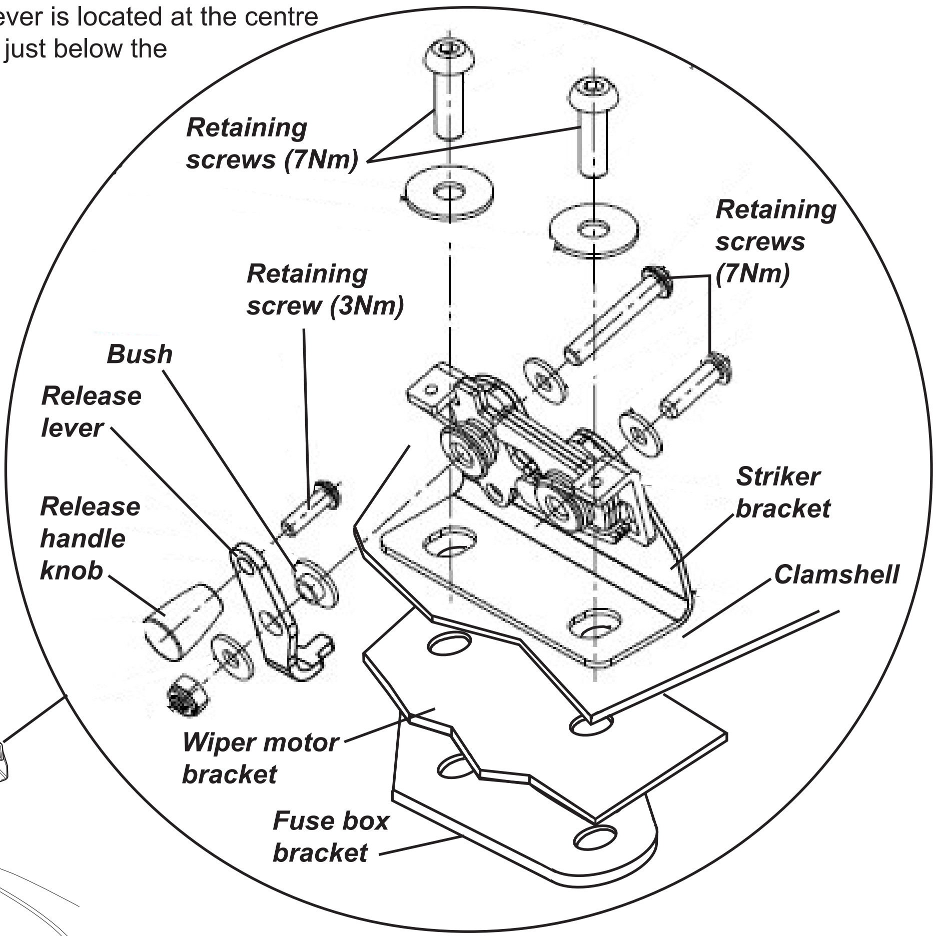


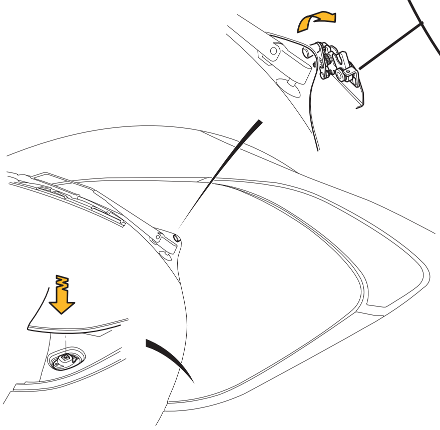
Front locating pin, end post brackets and latch striker pin are affixed to their relative plates.

The steel front locating pins slide into grommets fitted on the front clamshell central outlet grille. The LH/RH rear sides of the cover are retained by the end posts that push into rubber socket assemblies fitted on the clamshell.

The access panel is then fixed to the vehicle by the panels rear mounted striker pin which is locked into a latch assembly.

The latch assembly release lever is located at the centre rear edge of the access panel just below the windsreen wiper arm.





The latch bracket assembly is positioned centrally on top of the rear of the front clamshell. It is secured by two set screws which pass through holes the striker bracket, clamshell panel, wiper motor bracket and tightened against threaded holes in front fusebox holder bracket which is positioned below the wiper motor bracket.

To remove:

- Standing by the left hand side of the vehicle, use your right hand forefinger to push the panels release lever forwards, releasing the panel from the latch assembly.
- The rear of the panel will slightly raise.
- Pull each outer end of the panel upwards releasing the panels retaining posts from the rubber sockets.
- Withdraw the panel rearwards to release it from its keyhole slots in the clamshells centre exit grille.

To refit:

- Locate the two front pegs into the keyhole slots and slide the panel down and forwards.
- Locate the panels central retaining pin into the latch: firmly pressing down until an audible click is heard.
- Press each side of the panel down into their rubber sockets.
- Press the access panel one final time at its centre above the latch area to confirm it is fully secured into position.

WARNING: Ensure the access panel is refitted and properly secured before driving.

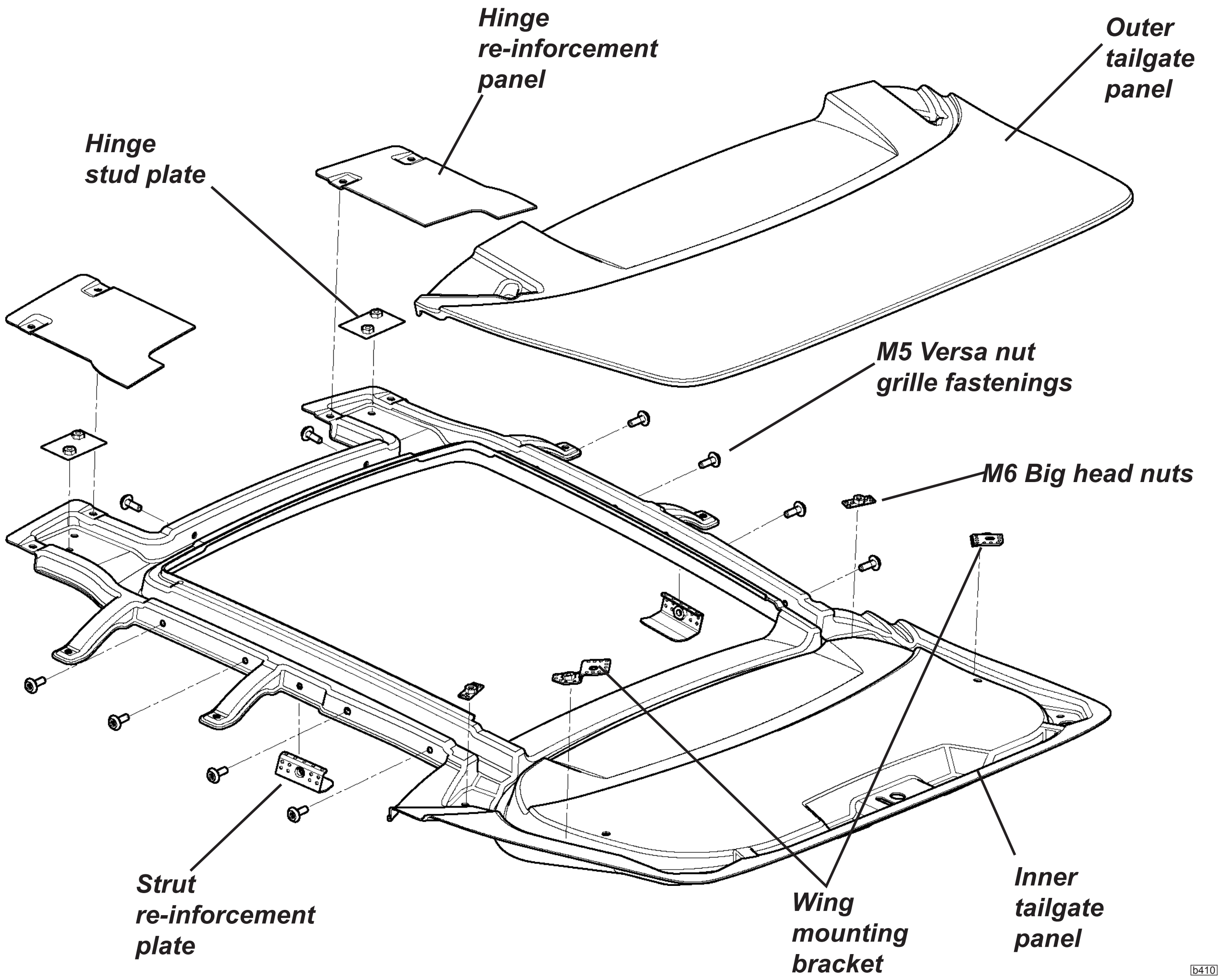
BT.3 - TAILGATE PANEL

The tailgate panel assembly consists of an outer and inner panel, the inner panel has nut and stud plates bonded to its interior surface using Plexus MA920 to accommodate the fixings required to retain it securely to the vehicle. The inner and outer panels are the bonded together using Betaseal 1701 applied to their contact surfaces.

The tailgate assembly uses extruded alloy hinges at its front edge, anchored to the underside of the clamshell, and is provided with gas spring struts to support the lid in the fully open position. Pivot ball pins for the struts are screwed into captive nuts in the tailgate inner panel, with the lower end of each strut anchored to a steel bracket secured to the LH/RH SBAF (Seat Belt Anchor Frame) stay.

The tailgate incorporates a heated window glass as well as outlet grilles which provides an exit route for hot air from the engine bay area.

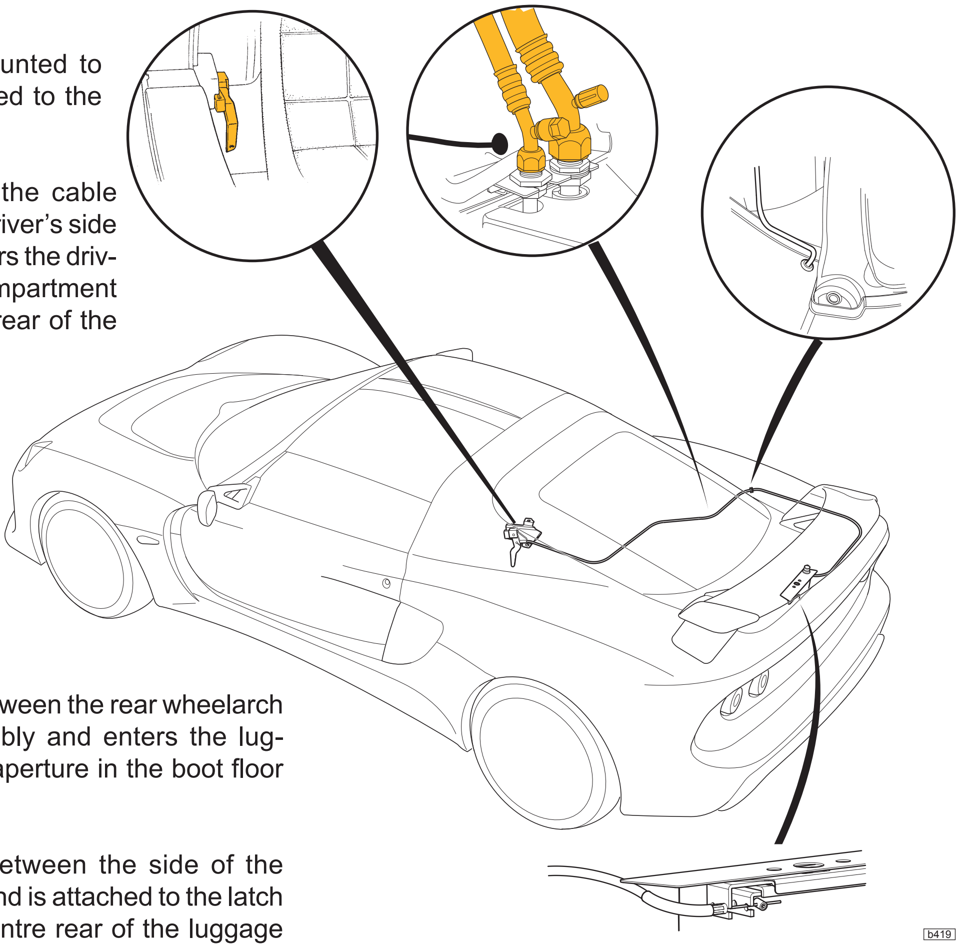
A rear aerofoil with integrally moulded support struts, is secured to the rear end of the tailgate and transfers loads via into the boot bulkhead and body structure.



The latch mechanism is mounted on the boot bulkhead, where it, and an adjacent alarm pin switch are protected by a steel heat shield. The latch is operated by a cable release from a lever handle mounted outboard of the driver's seat back.

The release handle is mounted to bracket which in turn is fixed to the driver's chassis side sill.

From the release handle the cable exits the cabin at the front driver's side of the fuel tank bay and enters the drivers side of the engine compartment through a grommet at the rear of the fuel tank bay.



The cable is then routed between the rear wheelarch liner and subframe assembly and enters the luggage compartment via an aperture in the boot floor panel.

The cable is positioned between the side of the clamshell and boot carpet and is attached to the latch assembly located at the centre rear of the luggage compartment.

Tailgate removal

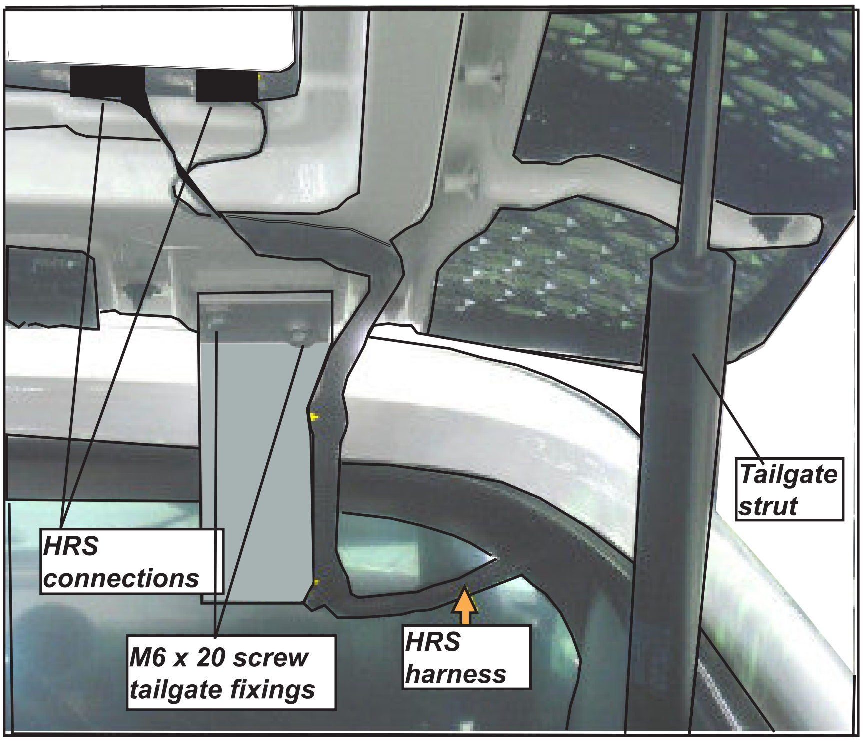
Disconnect HRS (Heated Rear Screen) harness connections from the screen terminals.

Remove the security collars from the top end of the tailgate struts at their pivot ball connections to the tailgate and prise struts off of the joints.

Release the M6 x 25 screws and washers (4) securing the tailgate to the LH/RH hinges.

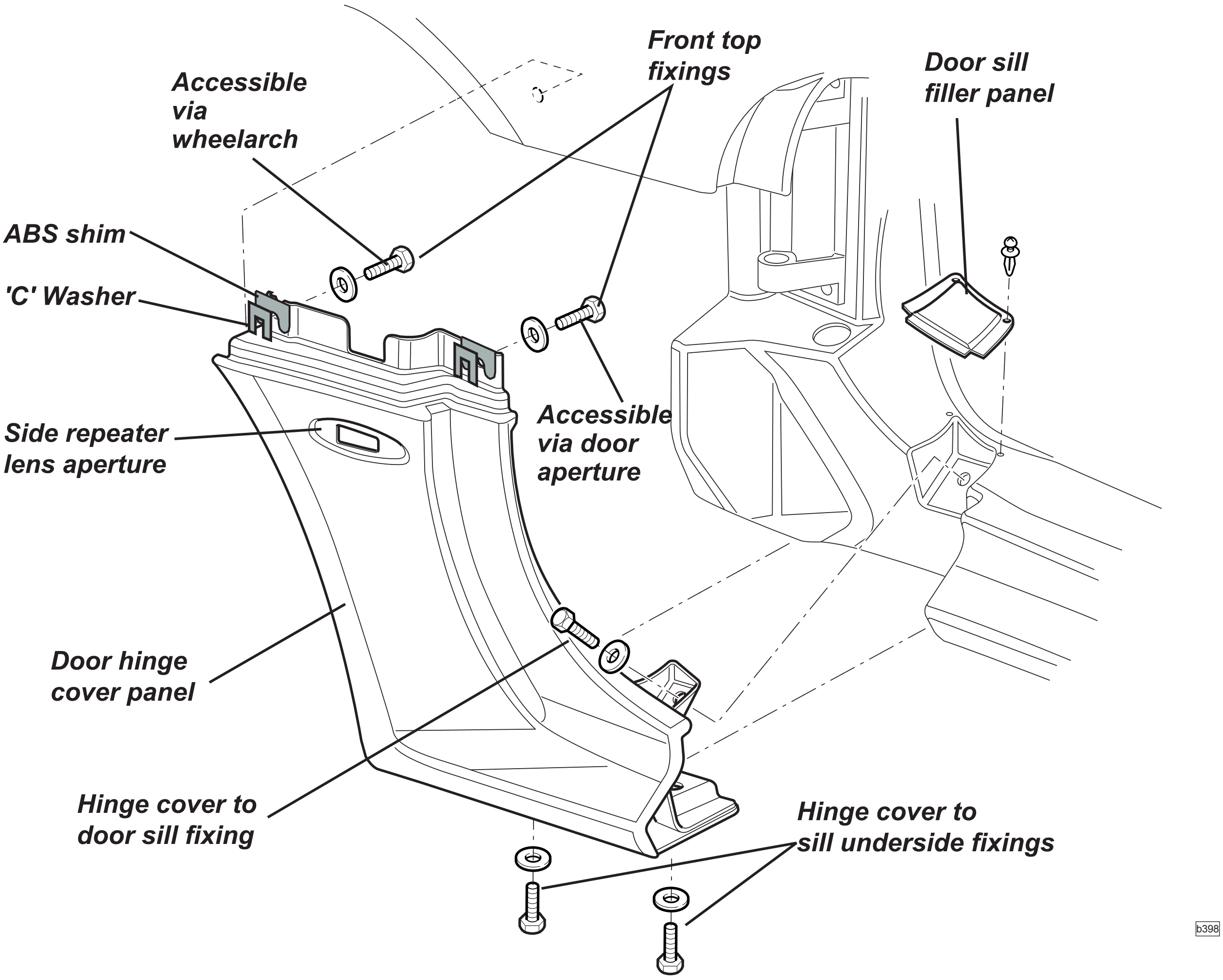
Withdraw the tailgate from the vehicle.

Refitment:
Is the reversal of removal



BT.4 - DOOR HINGE COVER PANEL

A separate glass fibre composite body panel is used to fill the area beween the door and wheelarch, and uses threaded fasteners to attach to the rear of the clamshell, top of the sill and bottom inboard edge of the sill panel. To achieve the correct panel gap a combination of 1.6mm ABS Shim(s) and 1.0mm and 0.5mm 'C' washer(s) are fitted between the cover panel and clamshell.



Removal:

1. From beneath the sill, remove the M6 x 16 screw and washer (2) securing the bottom edge of the hinge panel to the sill.

2. Remove the filler panel concealing the fixing securing the hinge cover to the door sill recess, and remove the fixing.

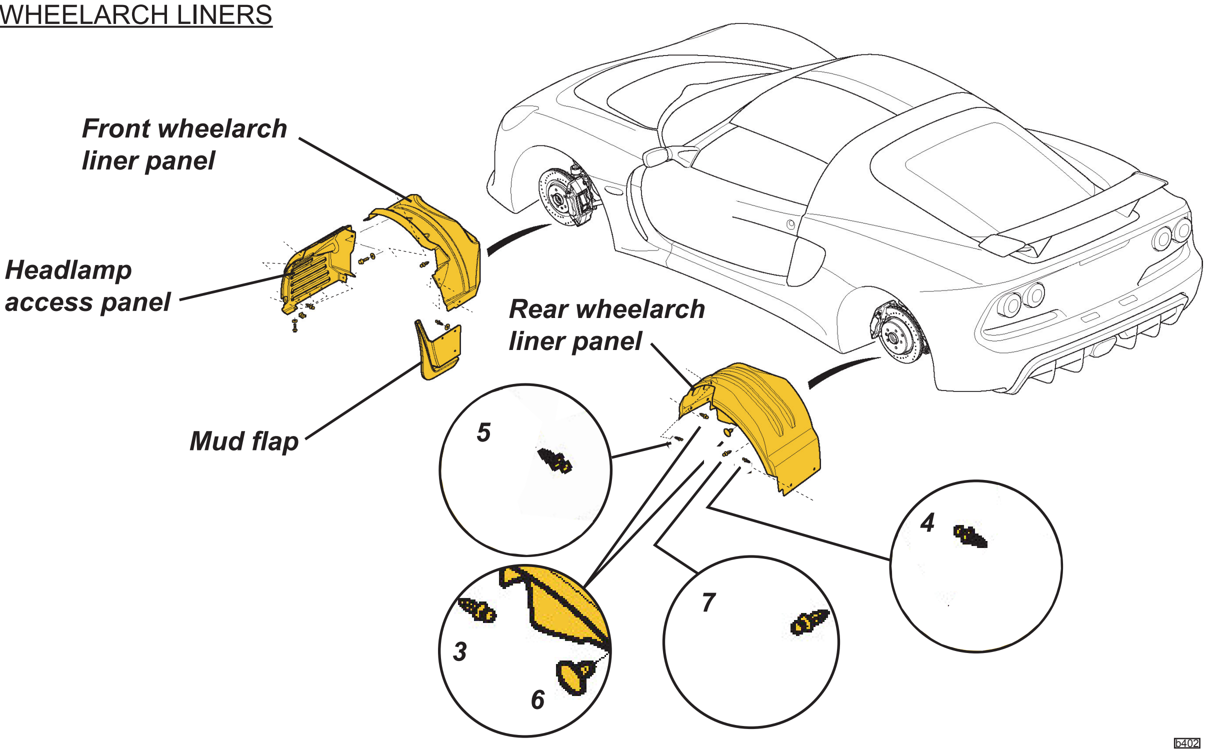
3. Remove the wheelarch liner and remove the M6 x 16 screw and washer (1) securing the door hinge cover panel to the clamshell and collect any shims and 'C' washers fitted between the cover and clamshell.

4. Via the door aperture, release but do not remove the M6 x 16 screw and washer (1) from the clamshell to hinge cover panel.

5. Release the repeater lamp harness and withdraw the panel.

Refitment:
Is the reverse of removal, fit shims and 'C' washers as required

BT.5 - WHEELARCH LINERS



Both front and rear wheelarch liners are made from vacuum formed HDPE (High Density Polyethylene). This strong but light impact resistant material can withstand high temperatures and has a good degree of flexibility allowing the wheelarch liners to be compressed and twisted into place without becoming deformed.

Wheelarch Liner Retention
Where possible the liner panels are retained in place using plastic scrivet fixings. This type of fixing is corrosion proof, reusable, quick to release/install and only requires a machined aperture in the mounting panel behind the liner to retain it in place.

LH Rear Wheelarch liner removal *(RH similar)*
1. Raise vehicle - refer to service notes section AN.1 for further information.

2. Remove the LH rear wheel.

3. Remove the 8mm drive-lock scrivet (2) retaining the front of the liner to the rear of the bodyside panel.

4. Remove the 8mm drive-lock scrivet (2) retaining the rear of the liner to the clamshell rear wheelarch panel.

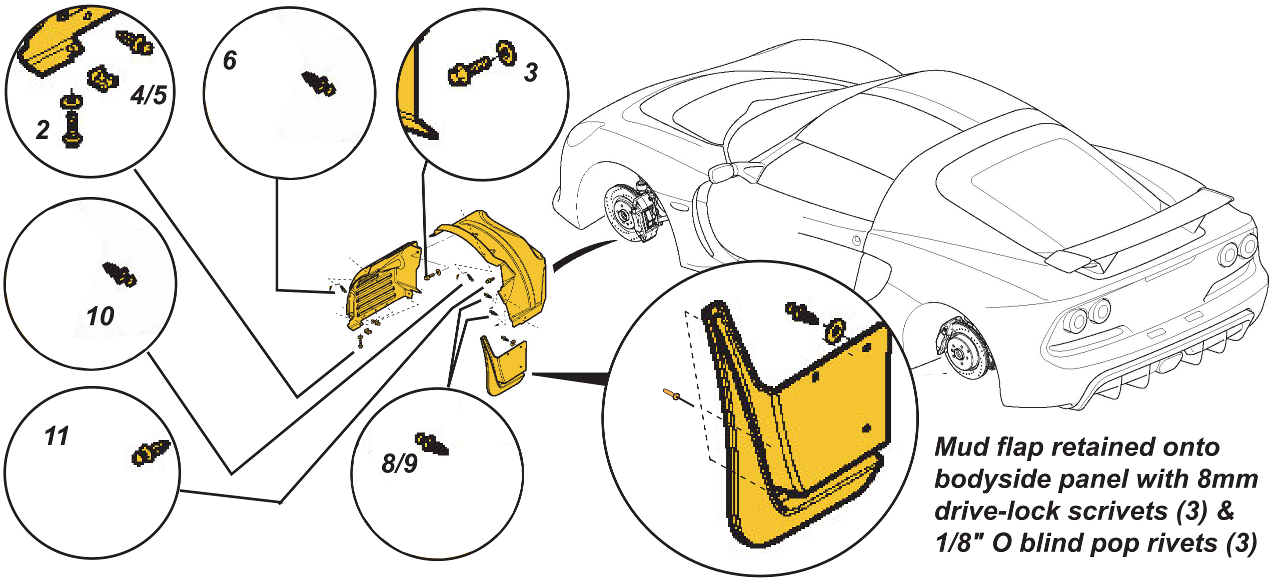
5. Remove the 8mm drive-lock scrivet (1) retaining the central uppermost side of the liner to the clamshells wheelarch reinforcement panel.

6. Remove the 8mm drive-lock scrivet (1) retaining the liner (forward of the spring/damper assembly) to the subframe.

7. Remove the fir-tree fixing (1) retaining the liner (rearward of the spring/damper assembly) to the sub-frame.

8. By applying gentle pressure to the liner to temporarily distort its shape, it may now be withdrawn from the wheelarch area.

Refitment:
Is the reversal of removal.



Headlamp Access and Front Wheelarch Liner Panel

LH Headlamp Access Panel Removal *(RH Similar)*

1.Raise vehicle and remove the LH front wheel - refer to service notes section AN.1 for further information.

2.Remove the M5 x 18 socket button flange screw (1) retaining the LHF lower edge of the access panel to the front splitter.

3.Remove the M6 x 16 screw and washer (1) retaining the access panel its support bracket.

4.Remove the 8mm drive-lock scrivet (3) retaining the lowermost access panel to the LH splitter panel.

5.Remove the 8mm drive-lock scrivet (1) retaining the outboard lower access panel to the clamshell wheelarch reinforcement panel.

6.Remove the 8mm drive-lock scrivet (1) retaining the outboard upper access panel to the clamshell wheelarch reinforcement panel.

7.By applying gentle pressure to the access panel to temporarily distort its shape, it may now be withdrawn from the wheelarch area.

LH Front Wheelarch Liner Panel Removal *(RH similar)*

8. Remove the 8mm drive-lock scrivet (1) retaining the rearmost lower liner to the bodyside panel.

9. Remove the 8mm drive-lock scrivet (1) retaining the rear of the liner to the door hinge cover panel.

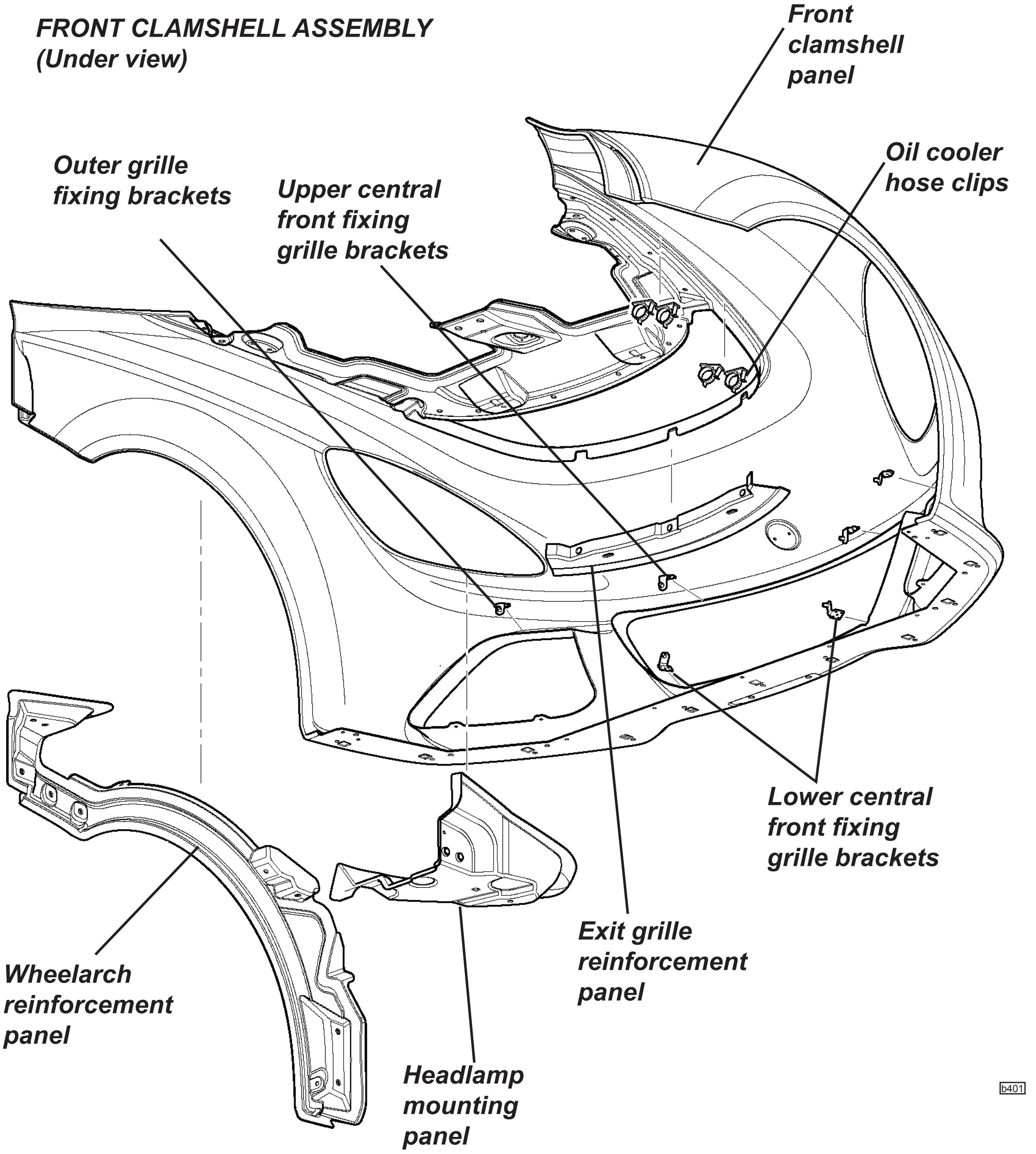
10. Remove the 8mm drive-lock scrivet (1) retaining the uppermost of the liner to the clamshell wheelarch reinforcement panel.

11. Remove the 8mm drive-lock scrivet (1) retaining the liner to the chassis rearwards of the spring/damper assembly.

12. By applying gentle pressure to the liner to temporarily distort its shape, it may now be withdrawn from the wheelarch area.

Refitment:
Is the reversal of removal.

BT.6 - FRONT CLAMSHELL



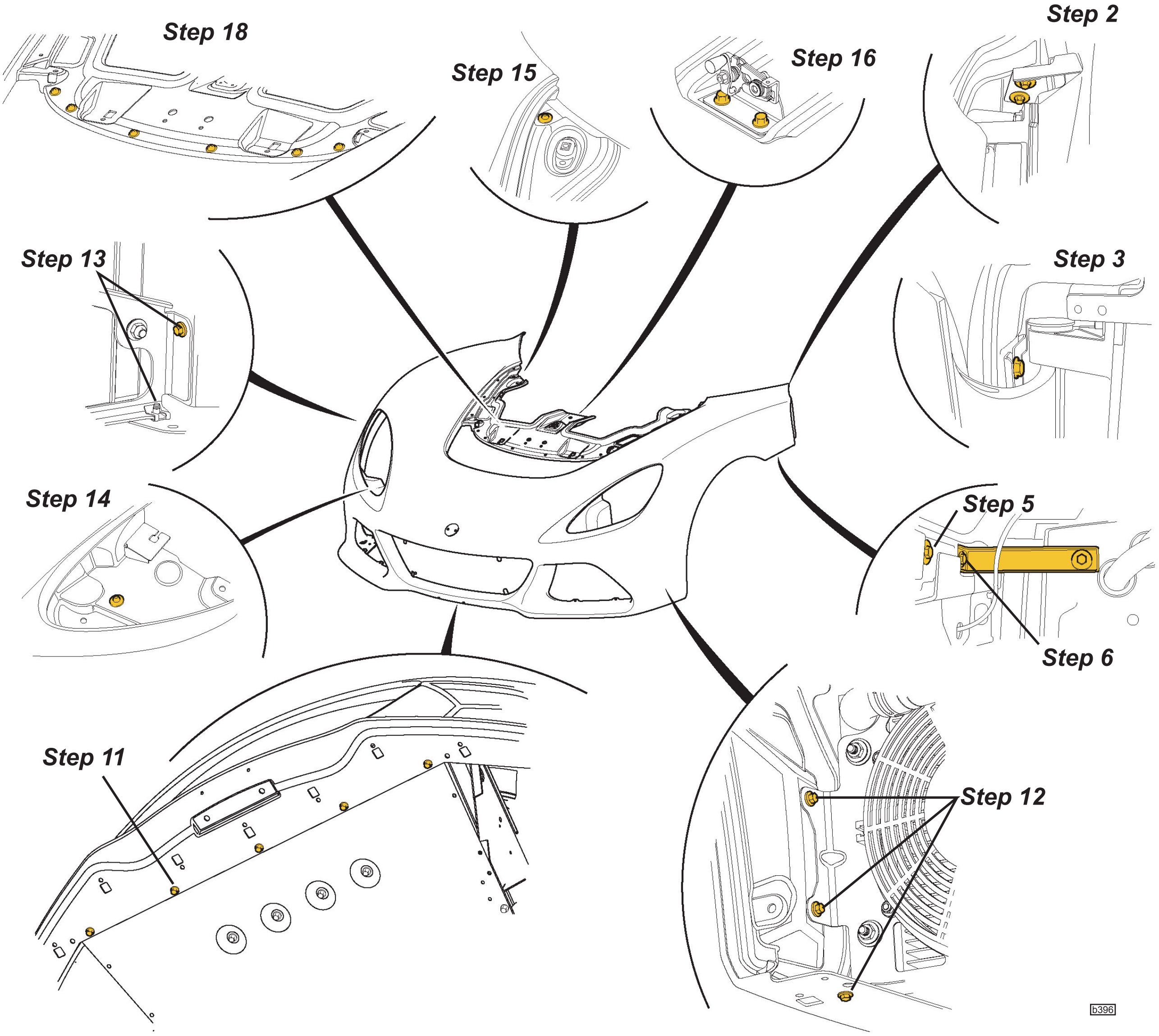
The front clamshell is a bonded assembly of several glass fibre composite mouldings incorporating both front wings, the front access aperture, air intakes and headlamp housings which are bonded together using Betaseal 1701 at their contact areas.

The clamshell is secured to the windscreen frame, radiator mounting panel, crash structure and other panels using threaded fasteners for ease of removal and to facilitate service access and body repair.

To Remove Front Clamshell

Care Points for Removal

- *When storing the clamshell to access other ancillary vehicle components, care should be taken to avoid damage to the clamshell corners; e.g. use a suitable soft floor covering on which to place the panel on.*
- *Removal and refitment of the clamshell is made considerably easier with the assistance of a second person.*



1. Remove front access panel, see sub-section BT.2.

2. Via each door aperture, remove the M6 x 20 screws (2) securing a bracket at the top rear corner of the clamshell to the base of the windscreen pillar.

3. Via each door aperture, release but do not remove M8 x 25 (1) screw from the clamshell to hinge cover panel.

4. Place vehicle on a suitable lift and remove both front wheels and wheelarch liners, see service notes sections AN.1 and sub-section BT5.

5. From inside each wheelarch, release but do not remove the M6 x 16 (1) screw securing the top edge of the door hinge cover panel.

6. Remove the M6 x 20 screw (1) securing the bodyside brace bracket to clamshell (torque 7Nm).

7. From within the wheelarch area disconnect both headlamp multi-plug connectors from the main harness

8. From within the wheelarch area remove the fixings (3) securing the headlamps to the clamshell.

9. Withdraw the headlamps assemblies from the vehicle from the wheelarch area.

10. Remove the M5 x18 screws (13) securing the front splitter to the clamshell.

11. Remove the M5 x 16 screws & washers (5) securing the clamshell to the undershield, see service notes section AA.3.

12. Remove the M8 x 20 screw (3) attaching the LH auxiliary radiator bracket to the clamshell.

13. and the M8 x 20 screw (2) securing the RH oil cooler bracket to the clamshell. Also unclip the oil cooler feed and return hoses from the underbody clips bonded to the underside of the clamshell

14. From within both headlamp apertures remove the M8 x 25 screw and washer (1) securing the front of the clamshell to the crash structure (torque 7Nm).

15. Remove the M8 x 25 screw and washer (1) securing the LH and RH rear of the clamshell to the windscreen frame (torque 7Nm).

16. Remove the M8 x 25 screw (2) securing the access panel latch assembly to windscreen wiper motor bracket, see sub-section BT.2.

17. Release the 50 x 25 torx screw (4) securing the centre grille to the clamshell and remove the grille (torque 3Nm).

18. Remove the scrivets (6) securing the clamshell to the radiator shroud.

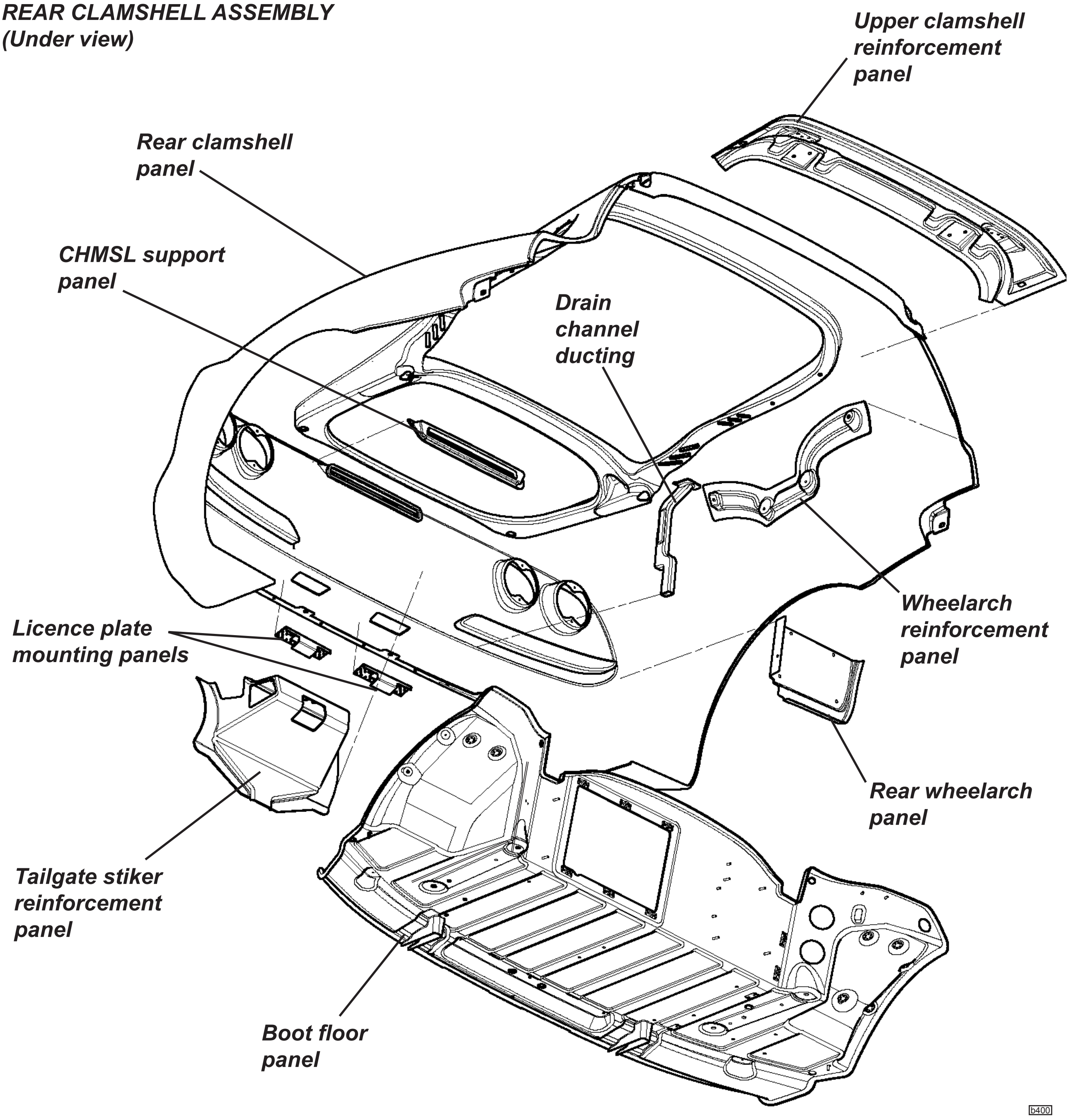
19. Remove the M5 x 16 screws (2) securing the washer bottle remote reservior filler neck to its clamshell bracket.

20. Disconnect the alarm pin switch connector from the main vehicle harness.

21. With the aid of an assistant pull the clamshell forward so that clears the LH/RH auxiliary radiator brackets then remove the clamshell from the vehicle, noting any spacing washers or shims fitted at any fixing point. Store clamshell securely.

BT.7 - REAR CLAMSHELL

REAR CLAMSHELL ASSEMBLY
(Under view)

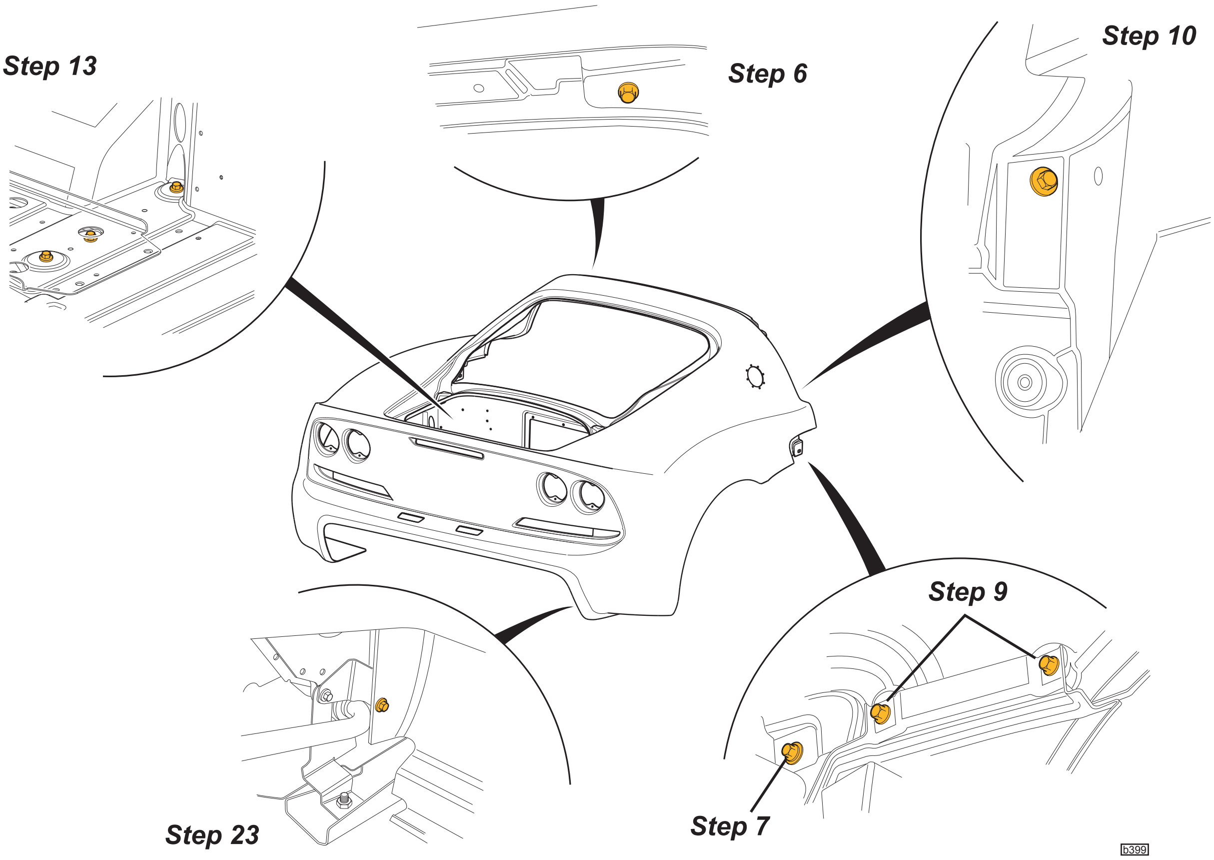


The rear clamshell consists of a handlay glass fibre composite outer panel a one piece composite RTM moulding boot floor panel/luggage bay panel as well as various anciliary support panels to provide additional strength/ mounting points for the rear licence plate lamps, CHMSL (Centrally High Mounted Stop Light) rear wheelarches and tailgate striker.

The panels are the bonded together using Betamate 2810SV applied at their contact surface areas.

The clamshell is secured to the rear subframe and other body panels by threaded fasteners for ease of service access and body repair.

To Remove Rear Clamshell



Care Points for Removal
- *When storing the clamshell to access other ancillary vehicle components, care should be taken to avoid damage to the clamshell corners; e.g. use a suitable soft floor covering on which to place the panel on.*
- *Removal and refitment of the clamshell is made considerably easier with the assistance of a second person.*

1. Place vehicle on a suitable hoist or jack and remove both rear wheels and wheelarch liners, see service notes section AN.1 and sub-section BT.5 for further information.

2. Disconnect vehicle battery.

3. Remove engine bay panels, see service notes section EM.2 for further information

4. Remove the hard top roof see sub-section BT.1.

5. From inside the cabin, remove both seats, rear bulkhead and rear header panel trims.

6. From within the cabin, remove the screws (2) above the rear window securing the top edge of the LH/RH clamshell to the rear bulkhead.

7. Remove the fixing (1) securing the front end of the clamshell to the 'B' post above the engine bay air intake.

8. Remove the two cantrail latch plates from their brackets on the roof hoop. Peel off the weatherstrip seal from the clamshell flange.

9. Remove two screws (3) securing the clamshell to the waistline joint of the sill panel.

10.Remove M5 x 18 screws (4) securing the grilles to the LH/RH side intake panels

11.Remove the M6 x 20 screws and washers (4) securing the side intake panels to the clamshell.

12.Remove the M5 x 25 countersunk screws (8) securing the fuel filler neck to the clamshell. Remove the finisher ring and finisher ring gasket, Withdraw the filler neck and spacer ring gasket from the rear side of the clamshell aperture, keep the filler cap fitted to minimise vapour hazard.

13.Remove tailgate gas struts from tailgate end and support tailgate with suitable prop. Disconnect HRS connectors.

14.From inside the luggage area, remove the boot box striker cover and moulded carpet (both secured with double sided tape).

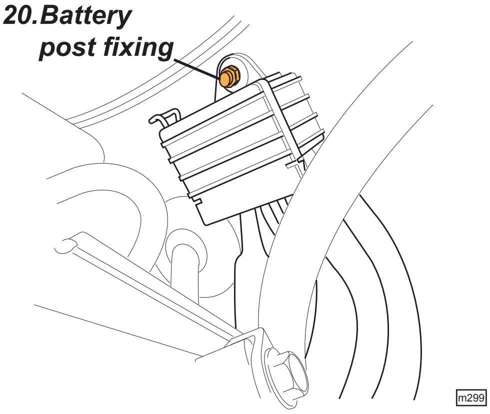
15.Disconnect the battery terminals and withdraw the battery from the vehicle.

16.Disconnect the ECM (Electronic Control Module) multi-plug connectors (3) from the rear harness connectors.

17.Release the 3 nuts securing the rear fuse box assembly to its retaining bracket, unlatch and remove the relay and fuse blocks from bracket.

18.From the battery tray area, disconnect the multi-plugs (2) connecting the main harness to the rear harness.

19.Carefully feed the battery, fuse box, main harness and ECM harnesses through to the engine bay from the hole in clamshell taking cars not to damage wiring.



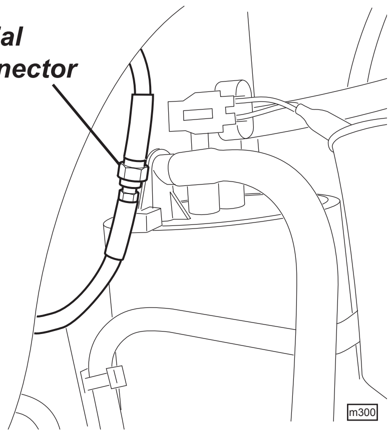
20.From under LH wheelarch area, release the battery live post from clamshell.

21.Disconnect the tailgate release cable from latch assembly and feed it through clamshell.

22.Remove M8 x 20 screws (2) securing coolant header tank to its clamshell retaining bracket (torque 16Nm) and position securely out of the way.

23.Remove M8 X 25 bolts (6) securing clamshell to brackets onto subframe.

24.Remove diffuser.



25.Disconnect the aerial lead from the antenna assembly at the NSR of the clamshell area near the seat belt anchor frame and the fuel evaporative canister.

With the aid of an assistant remove the clamshell from the vehicle, noting any spacing washers or shims fitted at any fixing point. Store clamshell securely .

Refitment:
Refit in reverse order to disassembly with the following notes:

<u>Shimming of clamshell floor mounting points:</u>
It is most important to maintain a gap of at least 7mm between the phenolic resin heatshield rivetted to the underside of the clamshell boot floor, and the exhaust muffler corrugated heat shield bolted to the subframe.

The corrugated shield must touch neither the muffler, nor the clamshell mounted shield, or heat damage may be caused to the clamshell.
On factory build, the subframe is marked adjacent to each of the four clamshell mounting points with the shim thickness required. Shim plates are available in 1mm and 2mm thicknesses. If a new subframe is being fitted, or the markings are not visible;

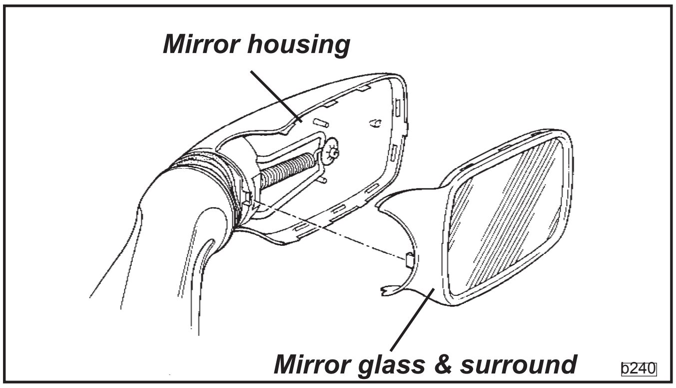
- Use a straight edge across the clamshell rear mounting points on the subframe, and measure down to the muffler heatshield. Sufficient shims need to be used to bring this dimension to a minimum of 7mm.
- With these shimplates fitted, trial fit the clamshell and if necessary add further shims to optimise the fit of the clamshell with respect to sill and door shutlines.
- Measure the shim gap at the boot floor front fixing point.
- Remove the clamshell, fit the required shim plates onto the subframe and refit the clamshell.

BT.8 - DOOR MIRRORS

The manually adjustable, plastic housed door mirrrors, are mounted via an injection moulded plinth to the door shell. A spring loaded ball and socket arrangement provides a means of mirror adjustment, and a sprung attachment of the mirror housing to the pivot socket allows for the mirror to move forwards or backwards on accidental contact, in order to reduce the potential for personal injury or vehicle damage.

Replacement of Mirror Glass

The mirror glass is contained in a plastic surround which is clipped into the housing in order to provide for convenient and inexpensive replacement. To remove a glass, pull back the boot between mirror and plinth, and carefully prise the inboard edge of the mirror surround from its retaining clips.

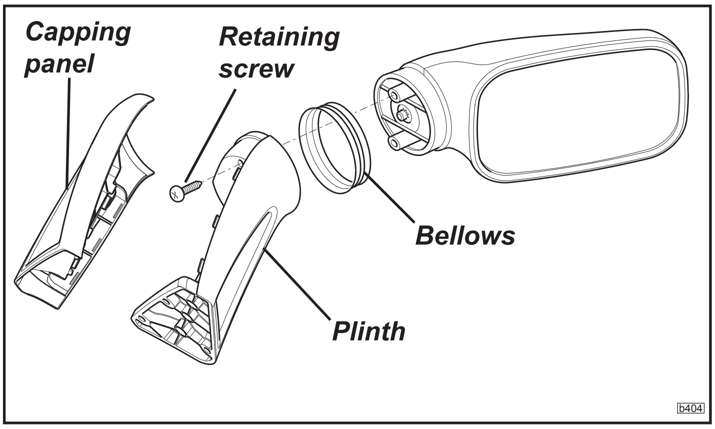


Working around the mirror periphery, continue to prise the surround from the housing taking care not to damage the paint on the housing. Press the new glass/surround into the housing until all the retaining clips are engaged, and reposition the convoluted boot.

Note that convex glass is normally fitted to both sides, but certain markets, use flat glass in the driver's side, and some passenger side mirrors are convex and etched with 'Objects in mirror are closer than they appear'.

Replacement of Mirror Assembly

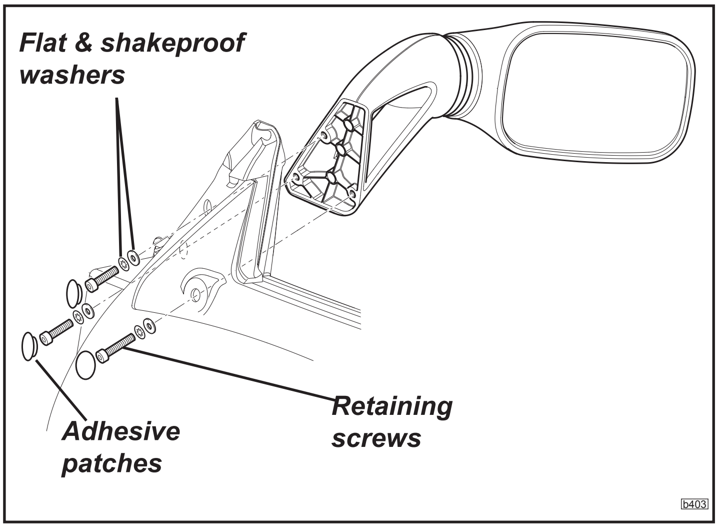
The mirror assembly locates in the plastic injection moulded 2-piece clip together plinth via two spigots, and is retained by a single screw tapping into the lower spigot.



To remove a mirror assembly, separate the capping panel using a non-metallic lever. Once removed use a cross head cranked screwdriver or similar tool, to remove the screw recessed into the inside face of the mirror plinth.

Replacement of Mirror Plinth

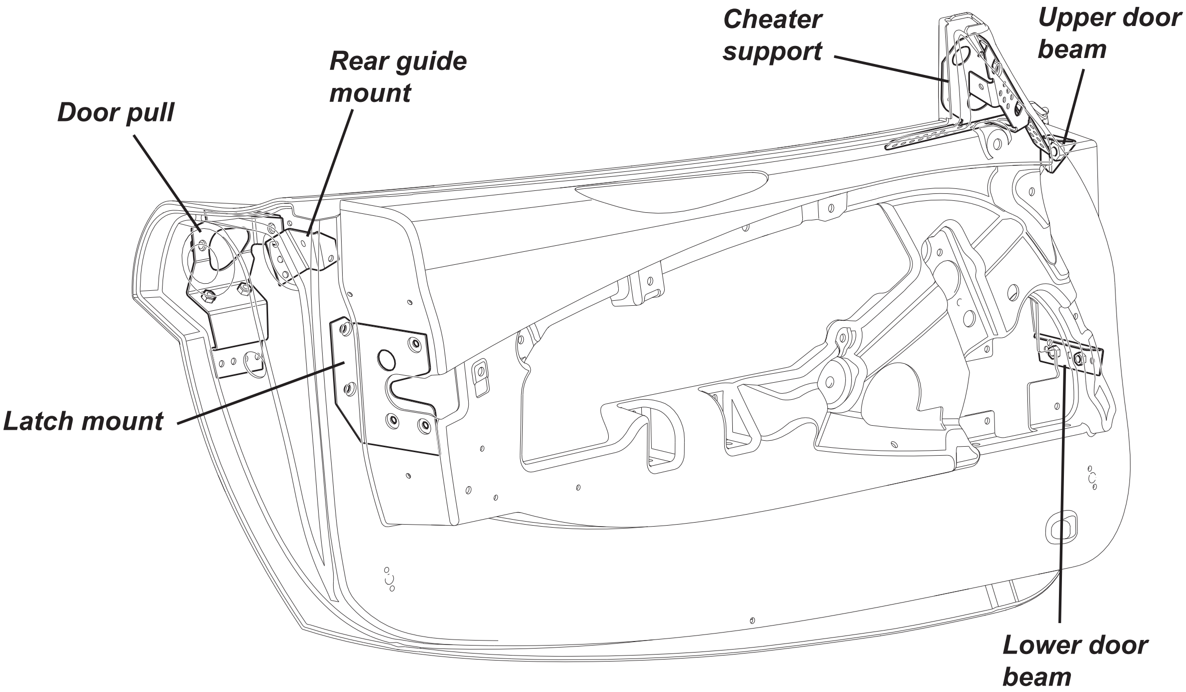
The mirror plinth incorporates threaded inserts (3) to accommodate M5 retaining screws.



The plinth is secured to the door outer panel with access holes for the three screws, flat and shakeproof washers provided in the inner panel, cosmetically concealed by adhesive patches.

Note that a magnet may be required when removing or refitting the rearmost screw.

BT.8A - DOOR SHELL BRACKETS



The composite door shell is fitted with various steel brackets bonded to its inner surface in order to mount the shell to the door beam and also to mount hardware components such as the latch and window lift mechanism. The brackets are bonded to the door structure using ITW Plexus adhesive. If, for whatever reason a bracket should become detached, the following procedure should be used to re-secure:

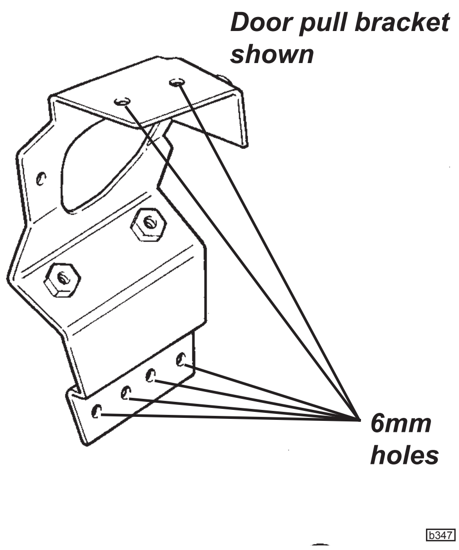
1.Remove the failed component from the door.

2.Prepare the bonding surface of the component using emery cloth.

3.If the bracket does not already have holes drilled in the bonding surfaces, use the illustrated examples to add 6mm holes to the relevent surfaces and provide the adhesive with a good keying feature.

4.Prepare the bonding surface of the door panel using coarse emery cloth and clean with Betaclean 3900 (A100B6008V). It is not necessary to remove all existing adhesive if this is securely bonded.

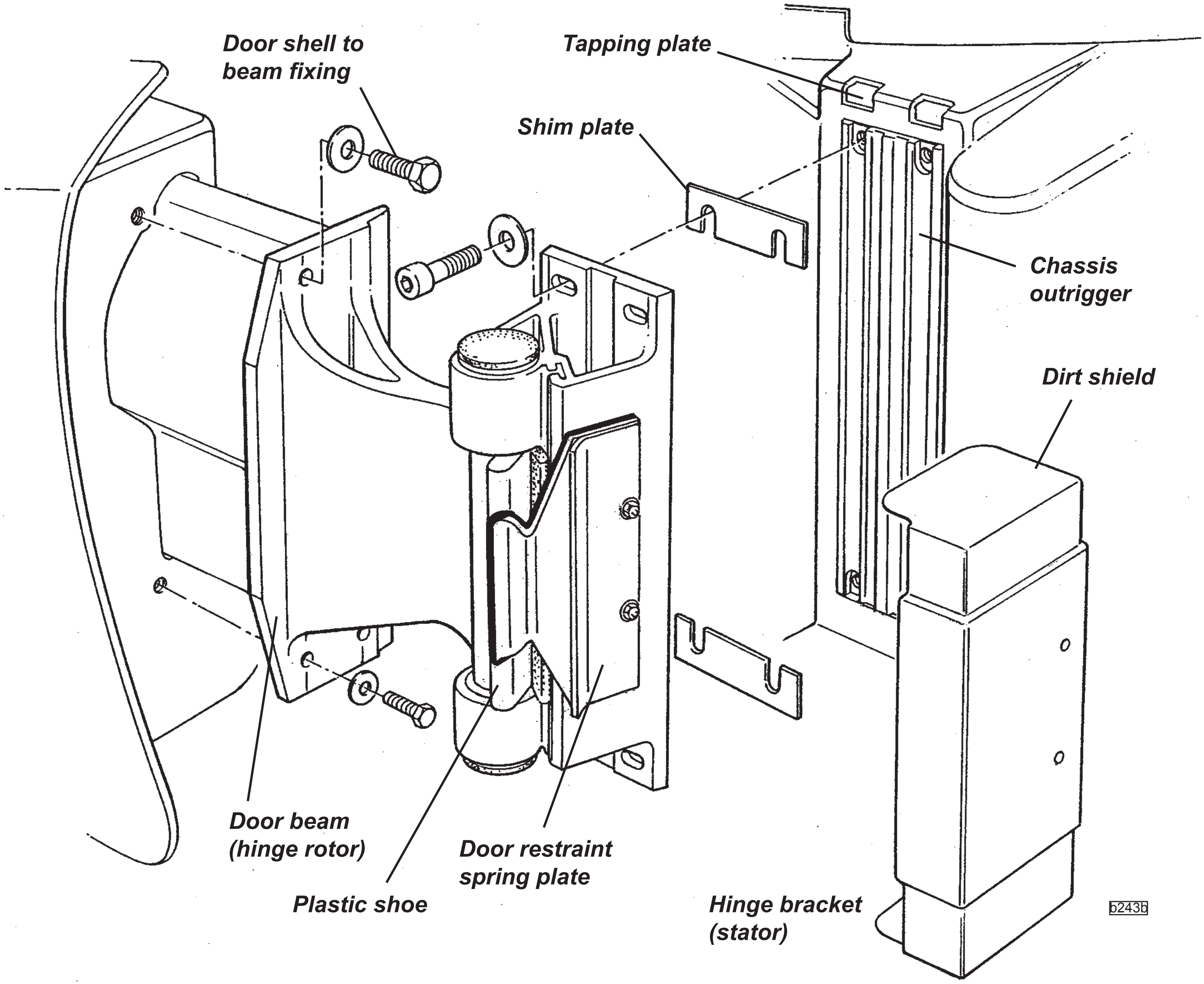
5.Apply a liberal quantity of ITW Plexus MA 920 adhesive (A117B0209V) to the door panel, and within a maximum period of ***4 Minutes*** (a longer open time will degrade adhesive performance) position the bracket and ensure that the adhesive is extruded through the keying holes. Remove excess adhesive which would interfere with any door functionality. Secure the bracket in position for a minimum of 30 minutes to allow adhesive to cure.



6.Re-assemble door and check for correct function.

7.If a latch mounting bracket needs to be rebonded, it is recommended to fit a cup washer A117W4192K diagonally opposite (i.e. to the latch top mounting screw) to that already used on the inboard lower screw.

BT.9 - DOOR BEAM & HINGE



The door shell is bolted to a hollow section extruded aluminium alloy door beam, hinged at the front end to the 'A' post, and carrying the door latch mechanism, via steel brackets, at its rear end. The front end of the door beam is welded to a second extrusion which forms the rotor of the door hinge. The hinge stator (or hinge bracket) is bolted to an outrigger on the chassis, and incorporates two cylindrical bearing housings fitted with maintenance free pivot bushes.

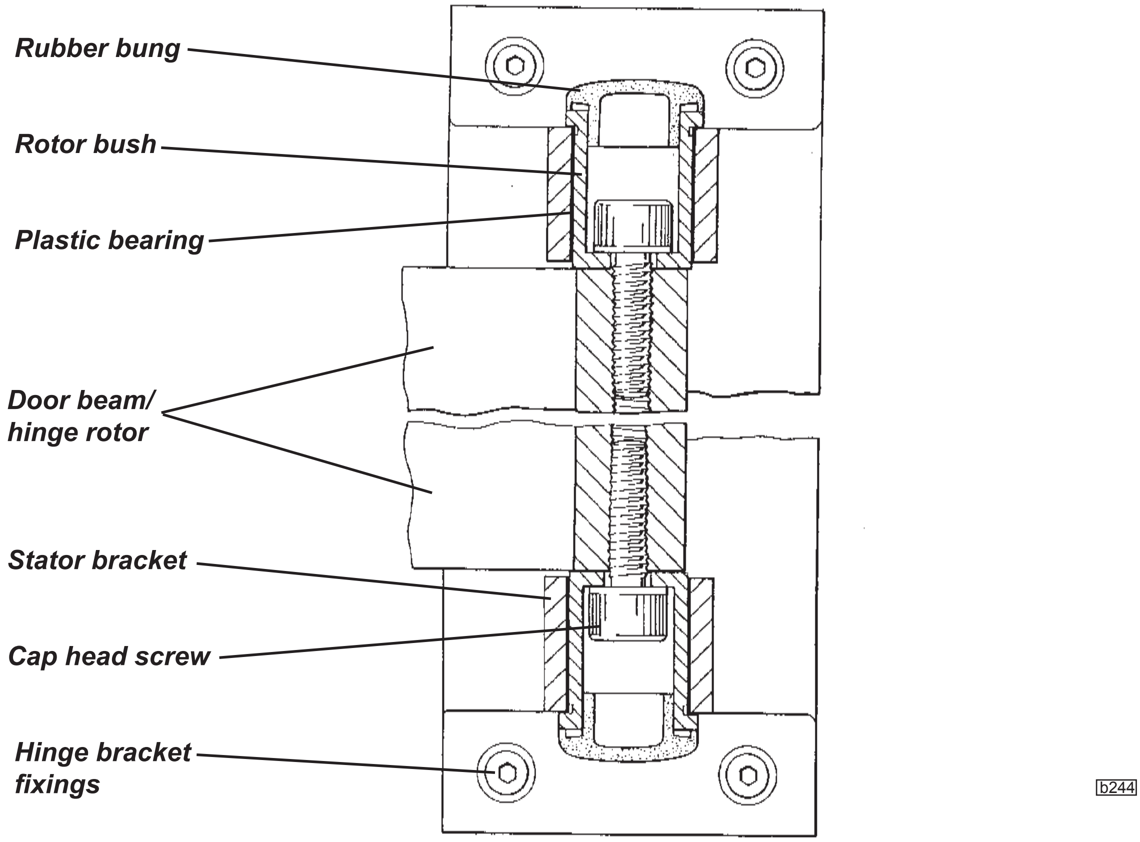
Door hinge adjustments
In order to provide for adjustment of door shutlines, the door hinge may be adjusted in two ways:

i) Height of the hinge, its fore/aft position, and the pivot axis angle (to control the front/rear height align- ment) may be adjusted after slackening the hinge bracket fixing bolts. The tapping plates for these bolts are linked in vertical pairs and are captive, but loose, within the chassis outrigger, and allow for some vertical move- ment. Horizontally slotted fixing holes in the hinge bracket allow for fore/aft movement.

ii) Slotted shim plates fitted between the hinge bracket and chassis, allow the in/out door front edge align- ment to be adjusted in steps of 1 rnm, and by varying the shim pack at the top and bottom pairs of fixings, the vertical alignment, as viewed from the front, may be adjusted.

Ensure that the clamping load of the hinge bracket to the chassis is not corrupted by the shim plates bearing against the body. If the surrounding body stands proud of the chassis door hinge outrigger, use a suitably cut down shim plate to act as a spacer between the chassis and the adjustment shim pack or hinge bracket.

Door Beam Pivot Bearings



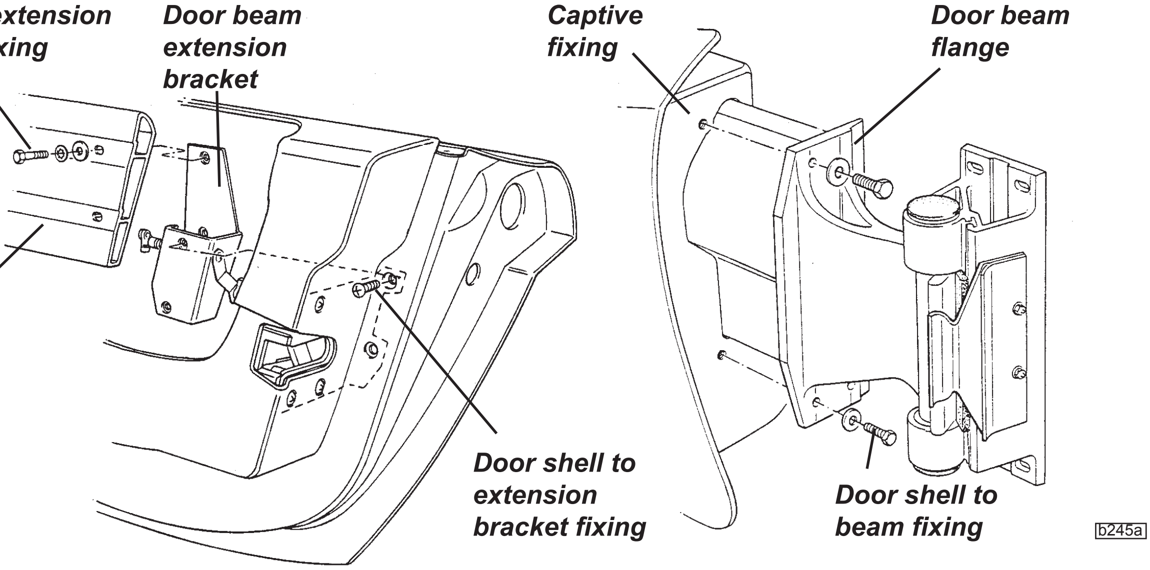
The door beam hinge uses two maintenance free 'top hat' section synthetic bearings, pressed into the hinge stator bracket. Inside each bearing, is fitted a 'top hat' section steel rotor bush, clamped to the door beam extension by an M10 cap head screw threaded into the door beam.

The door beam extension also incorporates a cheek flange which abuts against a rubber strip on the hinge bracket to limit door opening angle. A spring steel plate fixed to the front of the hinge bracket is designed to engage around the profiled edge of the door beam abutment flange when the door is fully open, in order to provide a sprung restraint for the door in this position.

A plastic shoe is used over the sliding surface of the spring plate to provide for maintenance free operation, with the shoe moulding clamped between the spring plate and chassis. To help protect the hinge mechanism from water and dirt ingress, a plastic shield is push fitted over the retaining nuts for the spring plate.

To remove the door assembly, or for access to the door pivot components, the two M10 cap head rotor bush retaining screws should be removed, and the door assembly withdrawn from the hinge bracket. The rotor bushes and/or bearings may then be withdrawn from the hinge bracket. On re-assembly, note that the bearings and bushes are assembled dry from above and below the upper and lower housings respectively, and the cap head screws tightened to 45 Nm. Insert the rubber bungs into the bush ends to inhibit dirt ingress and corrosion.

BT.10 - DOOR SHELL ASSEMBLY



The door shell is mounted on the door beam via three screws through a flange at the front end of the beam, and by the door latch mounting bracket at the rear end.

If a door is to be removed from the car, the preferred method is to release the M10 cap head screws clamping the upper and lower bushes to the door beam. The beam and door shell assembly may then be withdrawn from the hinge stator bracket without losing adjustment of the hinge alignment and door shutlines. If the door shell has to be removed from the beam for repairs or replacement, the beam may be left 'in situ' and the door shell slid off the beam using the following procedure:

Removal of door shell from beam
The door shell is secured to the beam via three screws through a flange at the front end of the beam, tapping into nut plates bonded into the door shell, and via two bolts at the rear end of the door to the door beam extension bracket. Access to the two bolts securing the extension bracket to the door beam requires that the door glass first be released:

1. Remove the door trim panel, weather sealing curtain and unplug the window switch electrical connector.

2. Release the three screws securing the interior release handle, and unclip the control rod from the mechanism.

3. Unplug the window motor electrical connector and withdraw the door harness through the aperture at the front of the door shell.

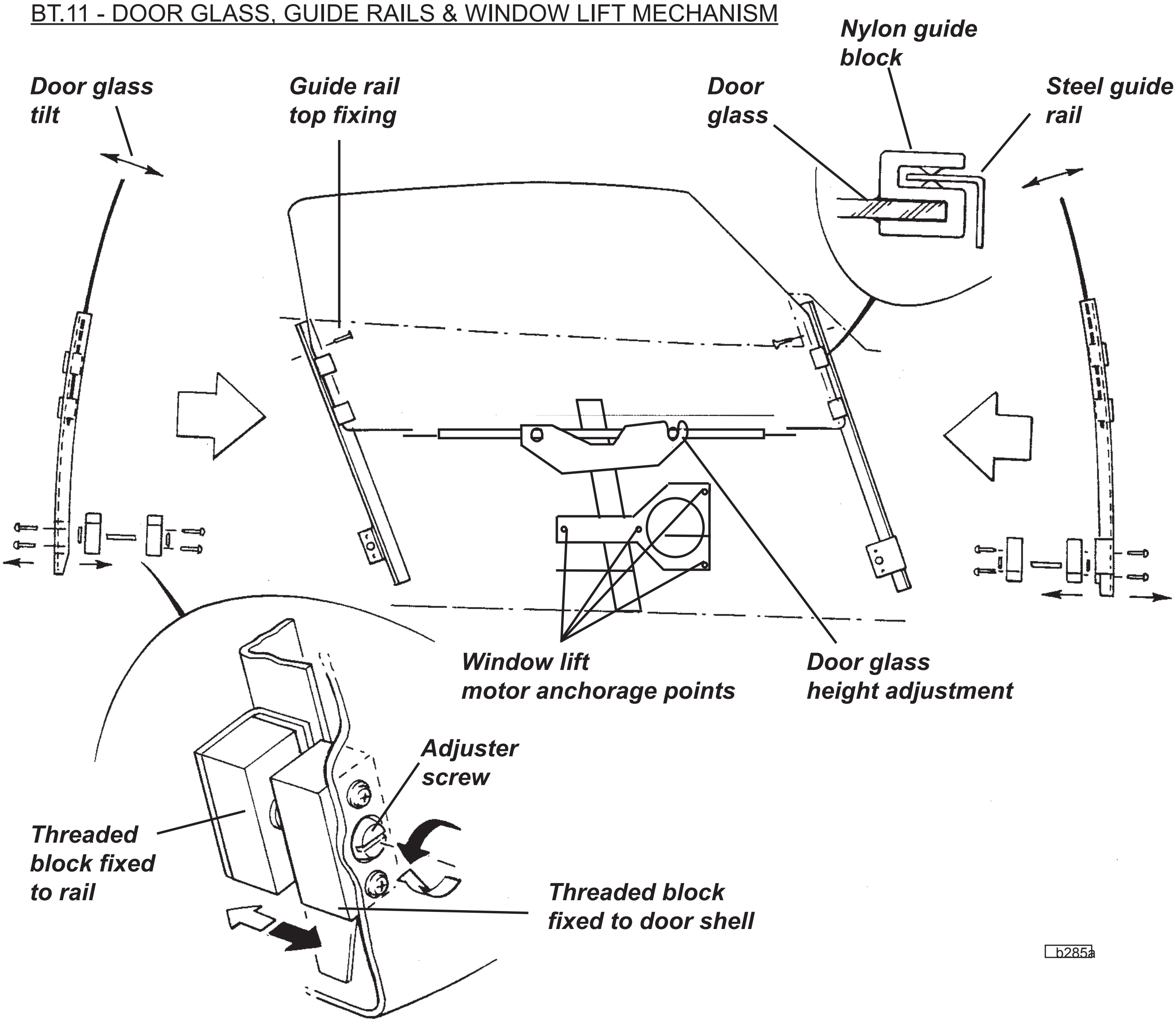
3. Remove the M6 x 20 set screw (2) (torque 8Nm) and the M8 x 20 set screw (1) (torque 25Nm) securing the door beam flange to the front of the door shell.

4. Release the M6 nyloc nuts (3) (torque 3Nm) securing the door glass to the lift bracket, and separate the glass from the bracket. Tilt the glass as necessary to allow access to the two M8 bolts fixing the rear end of the door beam to the extension bracket. Remove the bolts and withdraw the door assembly from the beam.

Note that it is necessary to remove the drop glass waist seal before the glass may be withdrawn from the door.

Refitment:
Is the reversal of removal When refitting the door, take care not to scratch the glass if this is contained in the door. Insert the two rear bolts securing the beam to the latch bracket, but do not tighten until the three fixings securing the front of the shell to the beam flange have been fitted and tightened.

BT.11 - DOOR GLASS, GUIDE RAILS & WINDOW LIFT MECHANISM



A electrically operated door window lift mechanism is used in conjunction with two steel guide rails and a 'frameless' door design.

The operating principle of the window lift mechanism is that of an electric motor and winder drum assembly mounted on a bracket which is bolted to the door shell with a guide channel for the window lift block, incorporating top and bottom cable pulleys, bolted to the door shell.

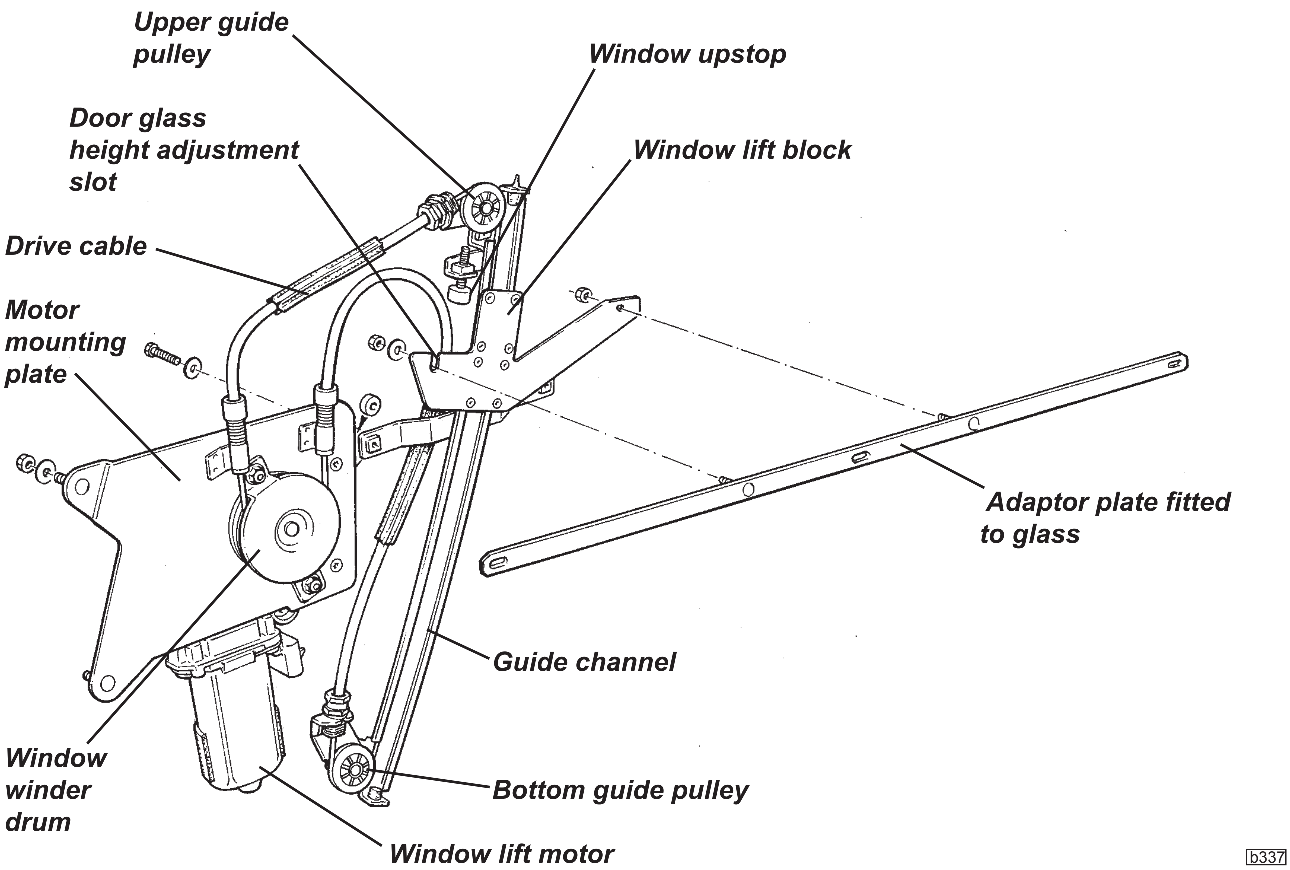
A single drive cable runs from the window lift block, around a guide channel pulley, through a flexible conduit, around the motor driven winder drum, through another conduit, around the second guide channel pulley and back to the window lift block with an adaptor plate bolted to the stud plate on the lower edge of the door glass.

The front and rear edges of the glass are guided by steel rails which engage with point contact Nylon guide blocks bonded to the glass. The bottom ends of the rails are adjustable in/out to set the inward tilt of the glass, with the 'up' glass position controlled by an adjustable stop screw against which a projection on the window lift bracket abuts.

A thermal cut-out within the motor assembly will stop the motor when the window glass is reaches it's fully raised or lowered position.

The front/rear height of the top edge of the glass may be adjusted at the slot where the front of the window lift bracket attaches to the door glass.

Window lift motor assembly viewed from outboard



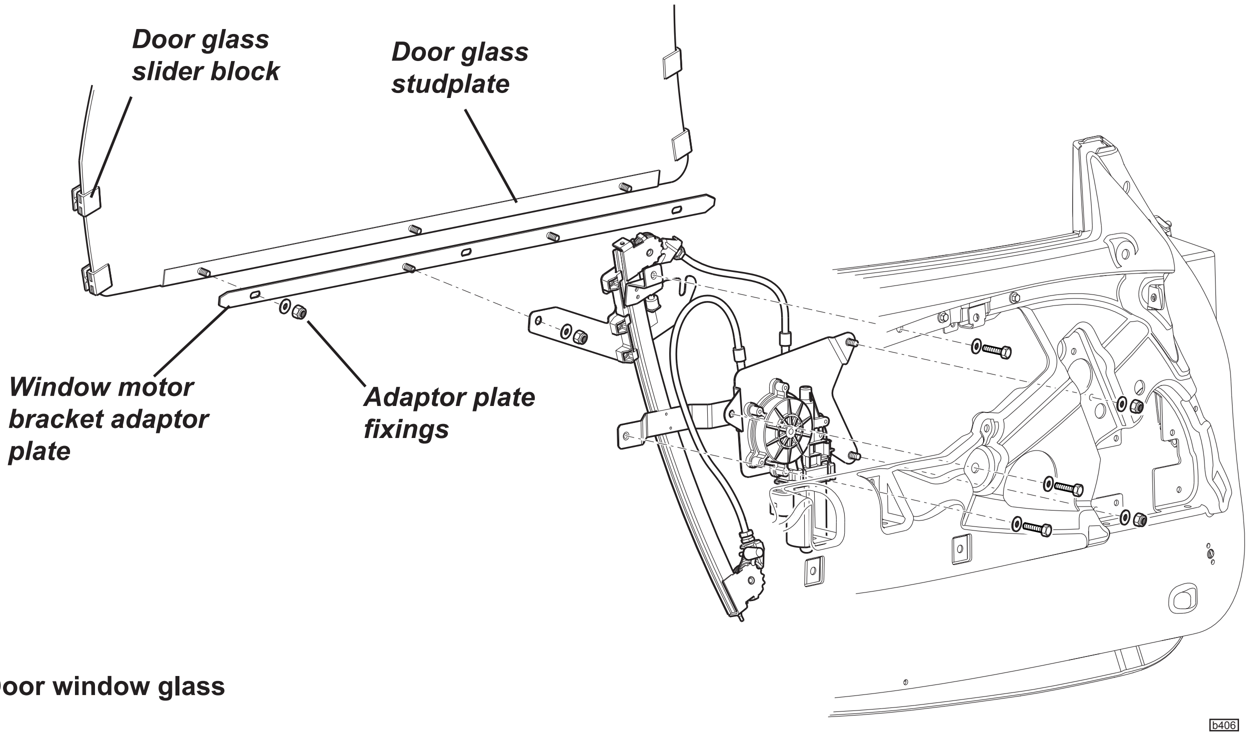
Door glass adjustment
To adjust the door glass for optimum weather sealing and ease of operation:

Preparation:
Ensure the front 'A' post/roof seal, rear 'B' post/roof seal, cheater seals and hardtop to door glass seals are in good condition and properly secured to their respective panels before attempting any adjustments.

1. Fully raise the window, check the alignment of the top edge of the glass against the roof seal, and the seal compression along the roof and up the 'A' and 'B' posts. A light compression is required; just sufficient to ensure sealing, without imposing loads on the motor mechanism.

2. To adjust the inward tilt of the glass, screw the adjusters at the bottom of each guide rail in or out as necessary. Access is available without removing the door trim panel. Check that the window glass moves freely throughout the range of travel.

   To adjust the alignment of the top edge of the glass requires adjusting the angle of the door glass studplate adaptor plate in relation to the motor lift bracket, An adjustment slot is provided where the front of the window lift bracket attaches to the door glass studplate adaptor but this will require removal of the door trim panel to perform this operation.



Door window glass

Removal:
1. Remove the door trim panel and weather sealing door curtain.

2. Release the M6 nyloc nuts and washers (3) at the bottom of the glass securing studplate to the window motor adaptor plate.

3. Do not attempt to withdraw the glass from the door without first removing the door waist seal. Carefully prise the one-piece seal off the door shell inner and outer flanges, and release the push fixing from the seal moulding at the rear end of the door.

4. Withdraw the glass from the door shell.

Refitment:
Note that new door glasses are supplied complete with jig bonded Nylon sliders and stud plate.

- Fit the new glass into the door and re-assemble in reverse order to the above.

- Adjust the glass position as detailed on previous pages.

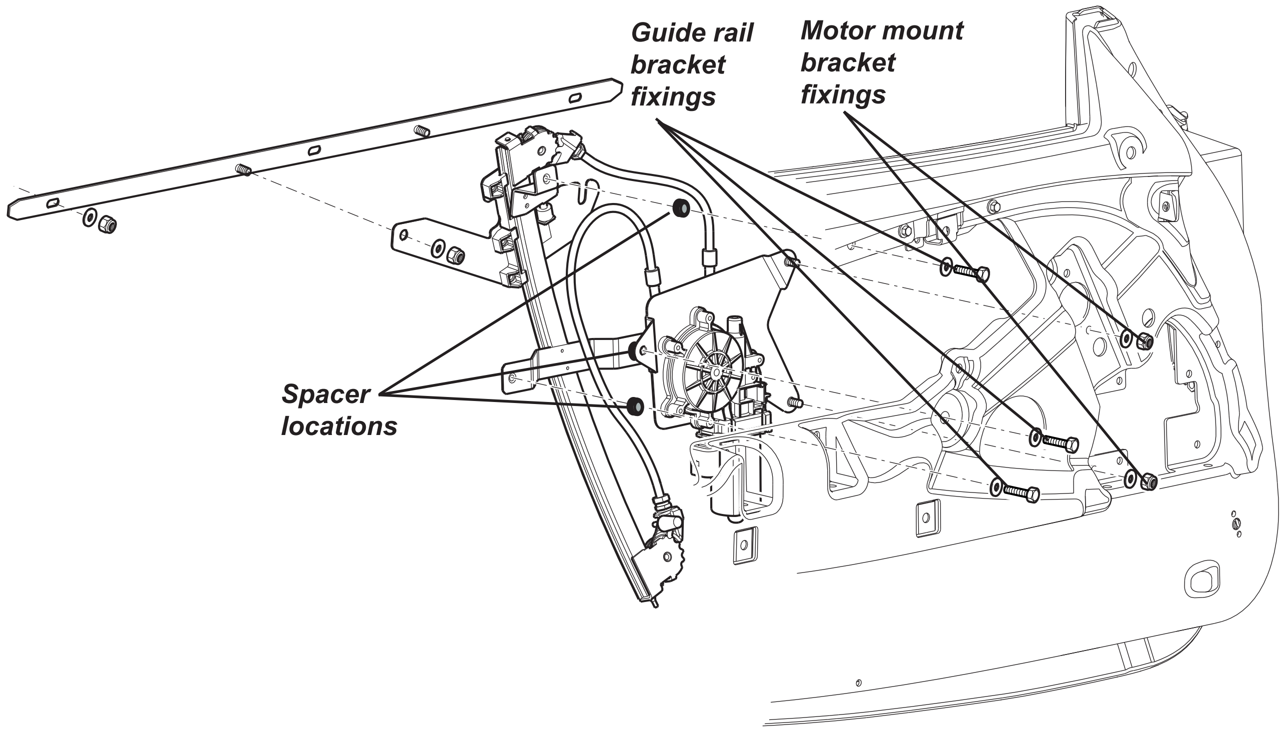
Important Note: the tightening torque for the 3 M6 nylocs is a maximum of 3Nm, overtightening could cause the studs in the glass stud plate to shear.

Door glass guide rails
Two guide rails are used for door glass; one for the front and one for the rear edge.

Each of the steel, black zinc plated, guide rails, is secured by a single screw at the top end to a jig bonded bracket in the door shell, see sub-section BT8.A, and by a threaded adjuster at the lower end, engaging in a threaded block fixed to the door shell.

Screwing the adjusters in or out will set the inward tilt of the glass and the contact between glass and door weatherseal.

To remove a guide rail, first remove the door glass (see above), before releasing the single screw at the top, and releasing the threaded block from the door shell.



Window Lift Mechanism

The window lift mechanism comprises the motor, drive cable and guide channel assembly as a complete unit.

Removal:

1. If possible, raise the window fully for optimum access.

2. Remove the door trim panel and disconnect the window switch. Peel off the plastic water shielding.

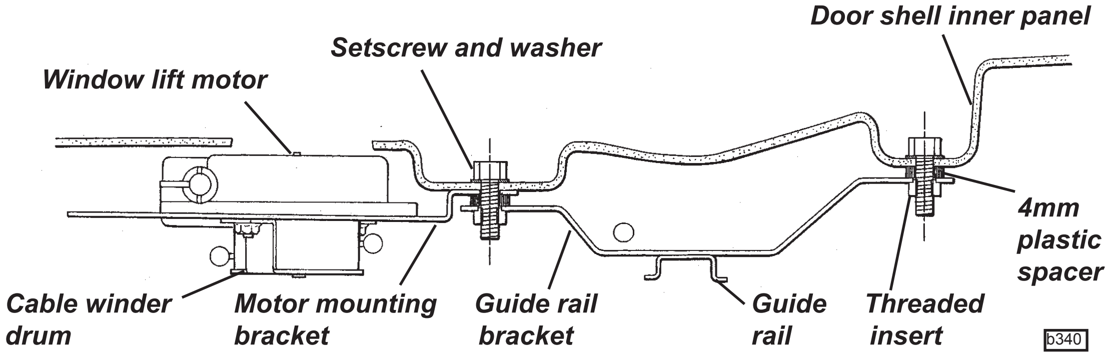
3. Release the window lift bracket from the door glass and secure the glass in the fully raised position taking care not to damage the door waist seals in the top of the door shell.

4. Unplug the motor electrical connector. Release the three fixings securing the motor mounting bracket, and the two remaining fixings securing the guide channel to the door shell.

5. Carefully manoeuvre the lift mechanism from the door.

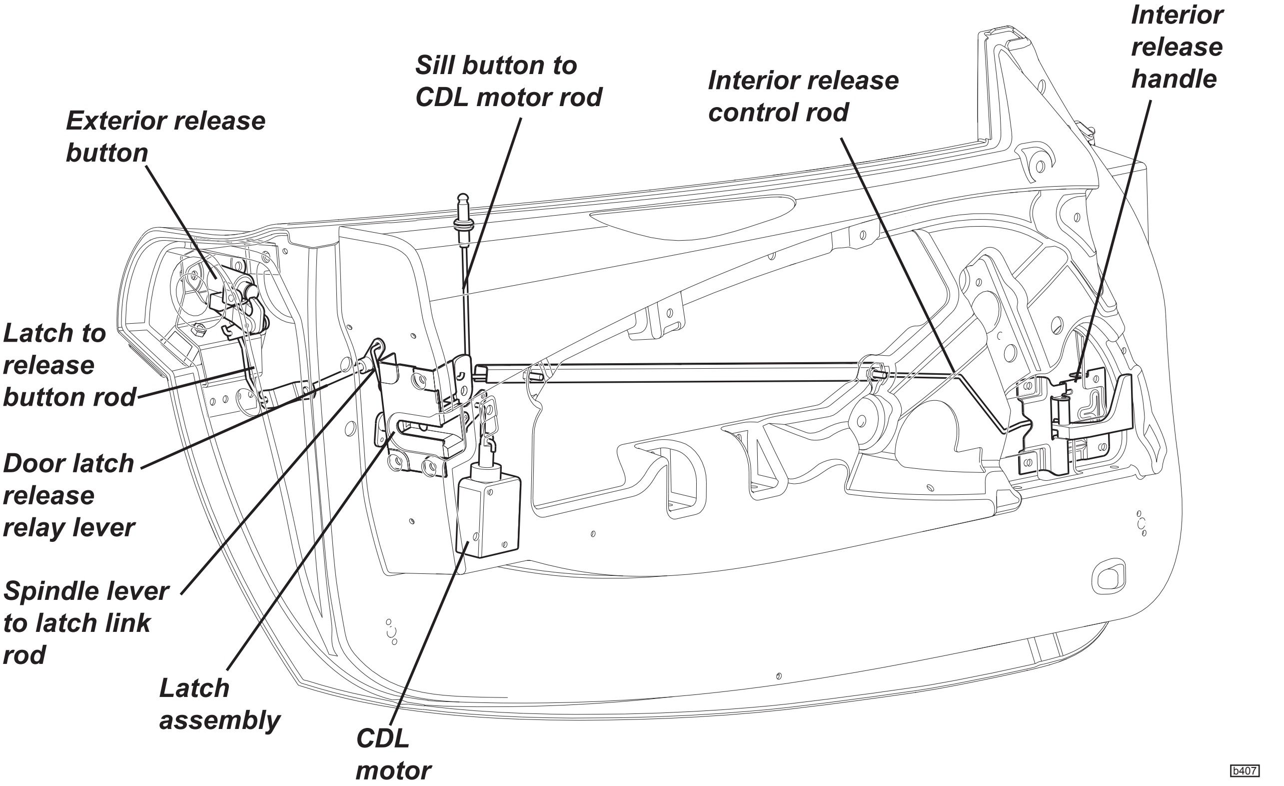
Refitment:

Refit in reverse order to removal, noting that the motor mounting bracket is fixed directly against the door shell, but that 4mm plastic spacers are used at each of the three guide rail fixings.



BT.12 DOOR LATCH & CDL (CENTRAL DOOR LOCKING MECHANISM)

DOOR LATCH ASSEMBLY MAJOR COMPONENTS



The door latch mechanism is fitted inside the rear face of the door, which is reinforced by a steel plate bonded to the door shell. The latch engages with a striker pin which passes through the composite sill/'B' post moulding, into a captive nut on the SBAF (Seat Belt Anchor Frame). An external locking door release button is mounted via a reinforcing plate, in the top rear of the door outer shell, and transmits its motion around the rear edge of the door glass to the latch mechanism via two short link rods and a relay lever.

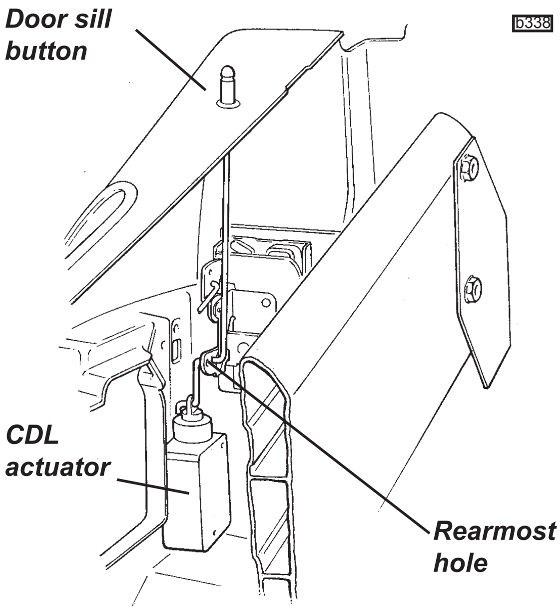
The interior release handle is mounted in the front of the door inner shell, and is connected to the latch mechanism by a control rod.

CDL (Central Door Locking Actuator)
A CDL actuator is screw fixed to the door shell below the latch mechanism, and uses a link rod which passes through the rearmost (shortest lever length) hole on the latch lever, before continuing upwards to the door sill button.

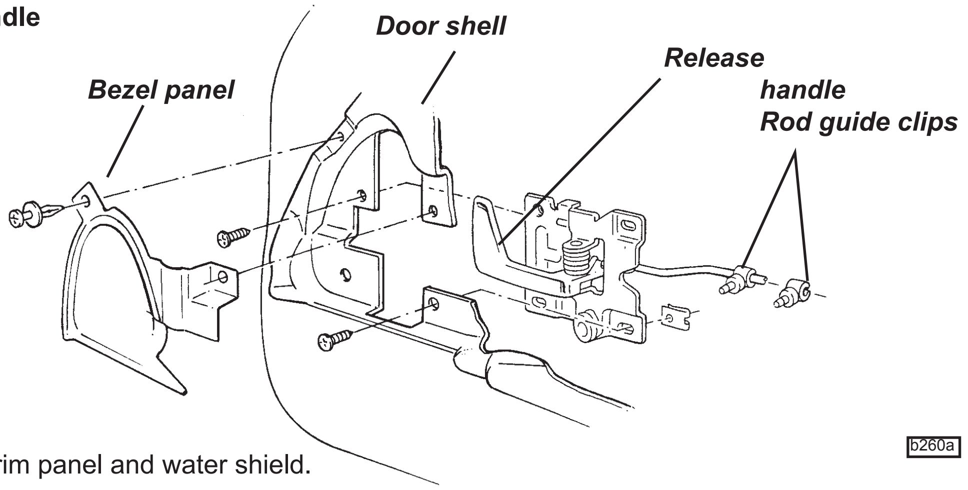
The latch mechanism within the door is protected from tamper attempts by a plastic security shield fixed with screws through the door shut face.

Removal:
To remove an actuator, remove the door trim panel, plastic water sheilding and latch security shield, release the two actuator fixing screws, unhook the actuator from the link rod and disconnect the harness.

Refitment:
Refit in reverse order to removal.



Interior Release Handle



Removal:

1. Remove the door trim panel and water shield.

2. Remove the four screws securing the interior handle assembly and bezel panel.

3. Unclip the control rod end clip to allow the rod to be unhooked from the handle.

Refitting:

Reversal of removal but ensure that the control rod is located in the guide clips.

Exterior Release Button

Removal:

1. Remove the rod access grommet located at the rear of the door below the red reflector access cover disc.

2. Release but do not remove the M5 x 10 fixing securing the access cover disc to the rear of the door shell.

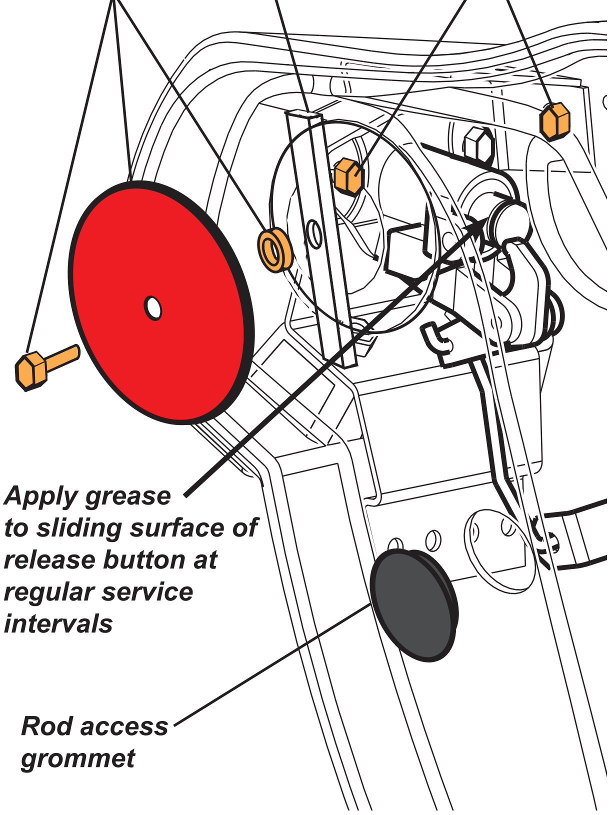
3. Pull the disc away from the door shell, check the security of the access discs metal fixing strap which is secured behind the panel using low tack adhesive.

   Note: it may be necessary place a finger behind the fiixing strap whilst removing the screw to avoid it falling down the door shell, once the screw is removed withdraw the fixing strap from the access aperture.

4. Release the M6 x 16 screws (2 - highlighted) securing the lock assembly and angle bracket to the tapping plate bonded in the door shell.

5. Unclip the link rod from the relay lever, and withdraw the lock button from the door.

   Note: It may be necessary to rotate and manipulate the assembly within the door shell to successfully withdraw it through the access hole.



Refitment:

Is the reversal of removal except that Permabond A130 should be applied to the M6 screw threads securing the lock assembly upon refitment and lubricate the lock barrel using a Lock Lubricant (not silicone based or WD40) via the keyhole slot.

Door Lock Barrel

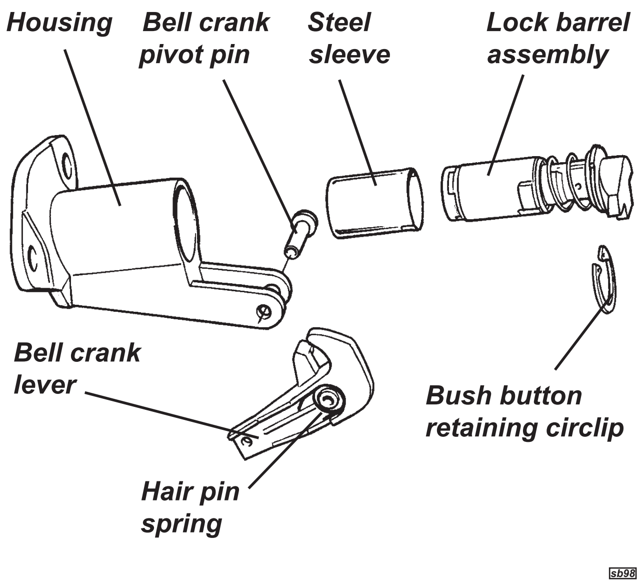
Removal:

1. Remove door button assembly from the door (see previous page).

2. Place assembly onto a suitable working surface.

3. Using a pin punch, knock out the pivot pin retaining the white plastic bell crank lever, and take care to retain the hairpin spring within the side of the lever.

4. Remove the circlip retaining the button and compression spring in the housing, and slide out the button assembly.



Door Lock Barrel Sleeve

This can be renewed in the event that the push button assembly does not move freely in its housing, this is normally caused by the stainless steel sleeve around the lock barrel assembly swelling or splitting due to the ingress of dirt or contamination.

Removal:

1. Use a small screwdriver to prise up the two swages, and withdraw the sleeve from the lock mechanism.

Refitment:

- Fit the new sleeve and use a suitable flat end round punch to swage the sleeve into the two recesses provided.

- Inspect the condition of the housing inner surface and if necessary de-bur using a needle file to ensure free sliding of the re-sleeved button assembly

- Lubricate the button mechanism with general purpose automotive grease before inserting into the housing together with compression spring and washer, and retain with the circlip.

- Check for smooth operation of the button mechanism. If this is not satisfactory, the complete lock set should be replaced.

- Refit the bellcrank lever and spring using a new pivot pin. Secure by supporting the head of the pin and swaging the opposite end to approx. 45° using a suitable punch. Check that the pin is secure, and that the lever returns freely under the action of the spring.

- Refit the assembly to the door, re-connect the link rod, and lubricate the lock barrel using a Lock Lubricant (***NOT*** silicone based or WD40) via the keyhole slot.

Latch Mechanism

Removal:
1. Remove the door trim panel.

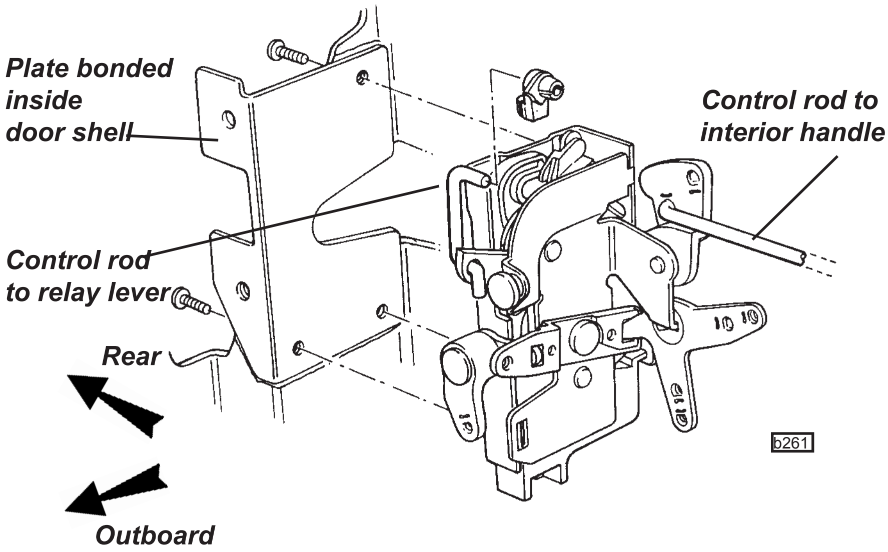
2. Unclip the control rod from the interior release handle, and unhook from the latch mechanism.

3. Unclip and disconnect the short link rod between the relay lever and the latch mechanism.

4. Remove the three M6 x 12 screws securing the latch mechanism to the door, and withdraw the latch.

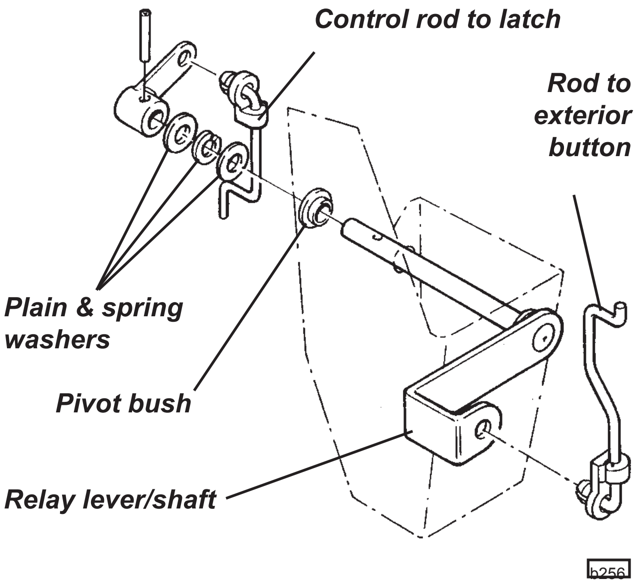
Refitment:
Is the reversal of removal.

Viewed through outer door skin



Relay Lever Mechanism
The relay lever components comprise a shaft with an integral lever on one end, which connects to the exterior lock button, and a second lever pinned to the other end, which connects to the latch mechanism.

The shaft is supported in two fibre bushes housed on the bracket connecting the rear end of the door beam to the door shell. To remove the door beam extension bracket complete with relay lever mechanism.



Removal:
1. Remove the door trim panel.

2. Release the three M6 nuts securing the door glass to the lift channel, and then separate the glass from the channel. Do not attempt to withdraw the glass from the door without first removing the door glass waist seals.

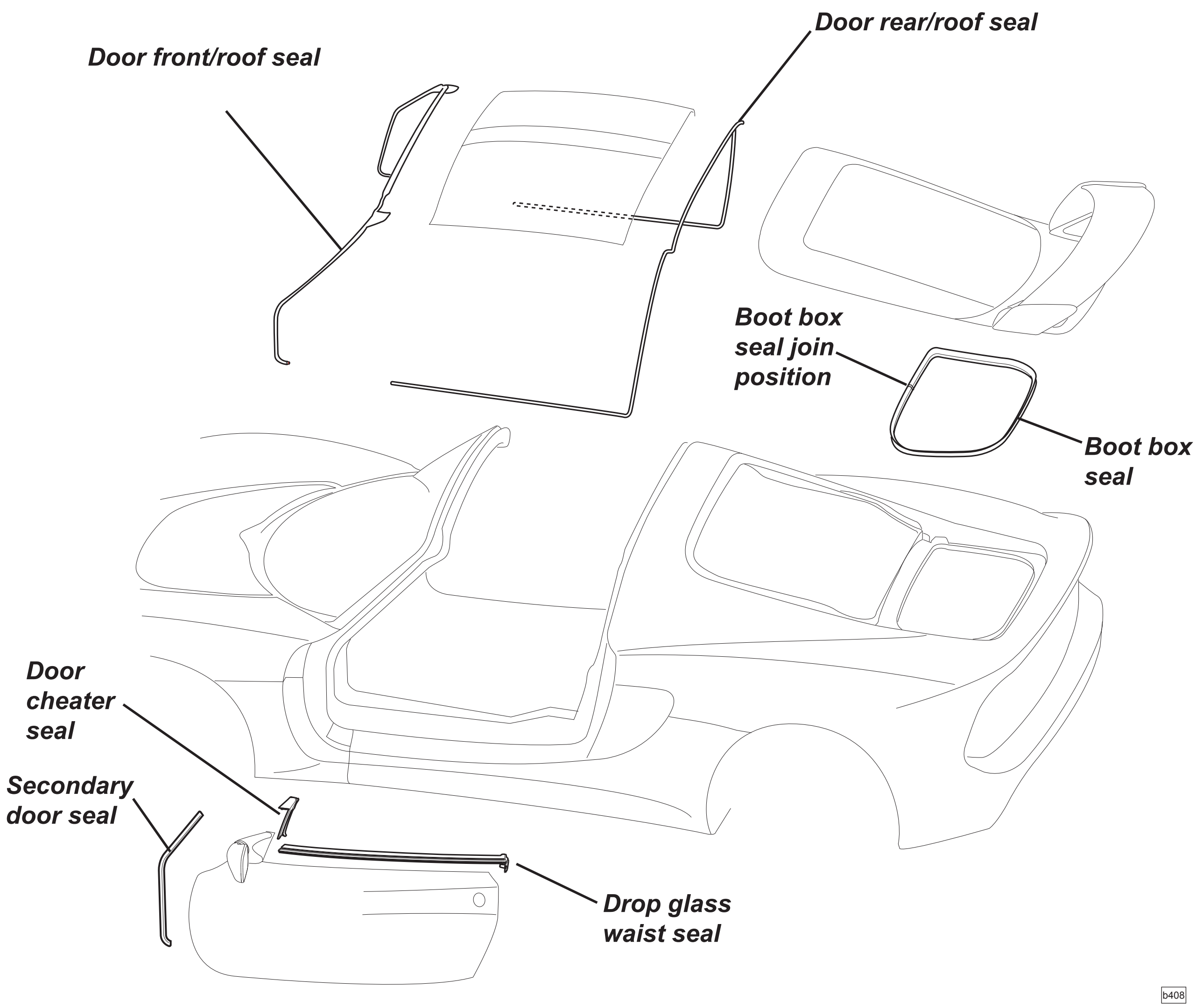
3. Remove the access grommet from the rear face of the door, and unclip the exterior lock link rod from the relay lever. Similarly disconnect the link rod between the relay lever and the latch mechanism.

4. Support the door shell before removing the two M8 bolts fixing the rear end of the door beam to the end bracket, and the two screws securing the bracket to the door shell.

5. Remove the bracket complete with relay lever assembly from the door.

Refitment:
Is the reversal of removal.

BT.13 - SEALS & WEATHERSTRIPS



Drop Glass 'Waist' Seal
The door drop glass waist seal is a single unit comprising inner and outer seal extrusions joined around the rear end by a moulded capping piece. Each length of seal is pressed onto the top edge of the inner or outer door panel, with a plastic rivet securing the capping piece. The seal should be removed before withdrawing the door glass or guide channels from the door.

Door Cheater Seal
A 'cheater' seal is bonded to the front and rear faces of the door mirror mounting extension. To fit a new seal:
- Clean the bonding surfaces on the door shell edges with Betaclean 3900 (A100B6008V).
- Apply Permabond A905 surface conditioner to the bonding surfaces of door shell and cheater seal.
- Apply Loctite 382 adhesive to the inside of the cheater seal and fit onto the door.

Door Weatherstrip
A hollow section rubber weatherstrip is bonded around the door aperture and roof landings to seal against the door shell and roof. Different seal configurations are used for the door and roof areas, with specially moulded sections to interface with the roof cantrails. The seal is divided into front and rear sections, with a joint at the bottom front of each door aperture.

The weatherstrips are manufactured with a self adhesive backing strip. Before fitting a new seal, the bonding area on the body must be thoroughly cleaned with Betaclean 3900 (A100B6008V). In the critical area of the

'A' post to windscreen header rail corner, an adhesive promoter 3M 4298UV (A116B6000V) should be applied along the seal path to to ensure optimum seal retention. Trial fit the seal before peeling off the protective backing from the adhesive and applying the seal, ensuring that the moulded sections at the cant rail interfaces are correctly positioned.

When fitting the rear section of the seal, first remove the backing strip from the seal in the section around the latch plate, Continue to remove the backing strip and stick the weatherstrip along the seal path down the 'B' post and along the bottom of the door aperture.

Cut the seal to mate with the end of the front weatherstrip. Repeat for the opposite side, and then remove the top section backing strip and secure the seal along the roof shroud flange. Use a roller wheel along the whole length of the seal to ensure full adhesion.

A secondary door seal is applied to the front vertical face of the door shell, linking to the cheater seal.

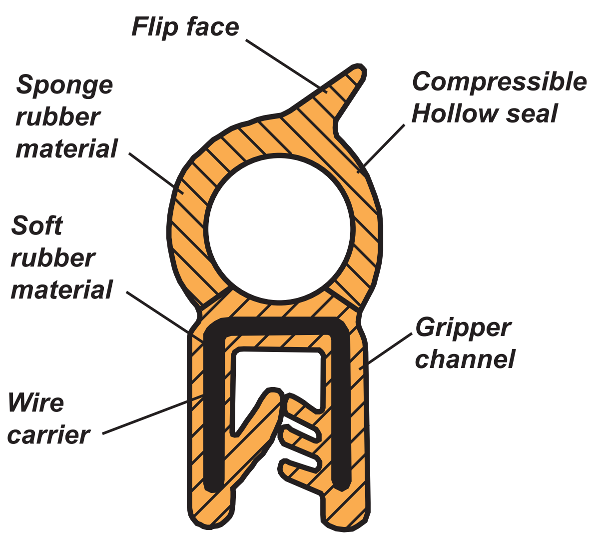
Boot Box Seal
A EPDM (Ethylene Propylene Diene Monomer) 2060mm length rubber seal is fitted to the top edge of the boot box shell to minimise water ingress into the luggage compartment area.

Two different densities of rubber are used to make up the complete seal.

A soft rubber seal with an integral wire carrier is used as the gripper channel to which clamps into position around the moulded boot box flange.

A lipped profile hollow sponge rubber seal is bonded to the carrier seal which compresses against the inner panel of the tailgate to minimise water ingress,

BOOT BOX SEAL PROFILE



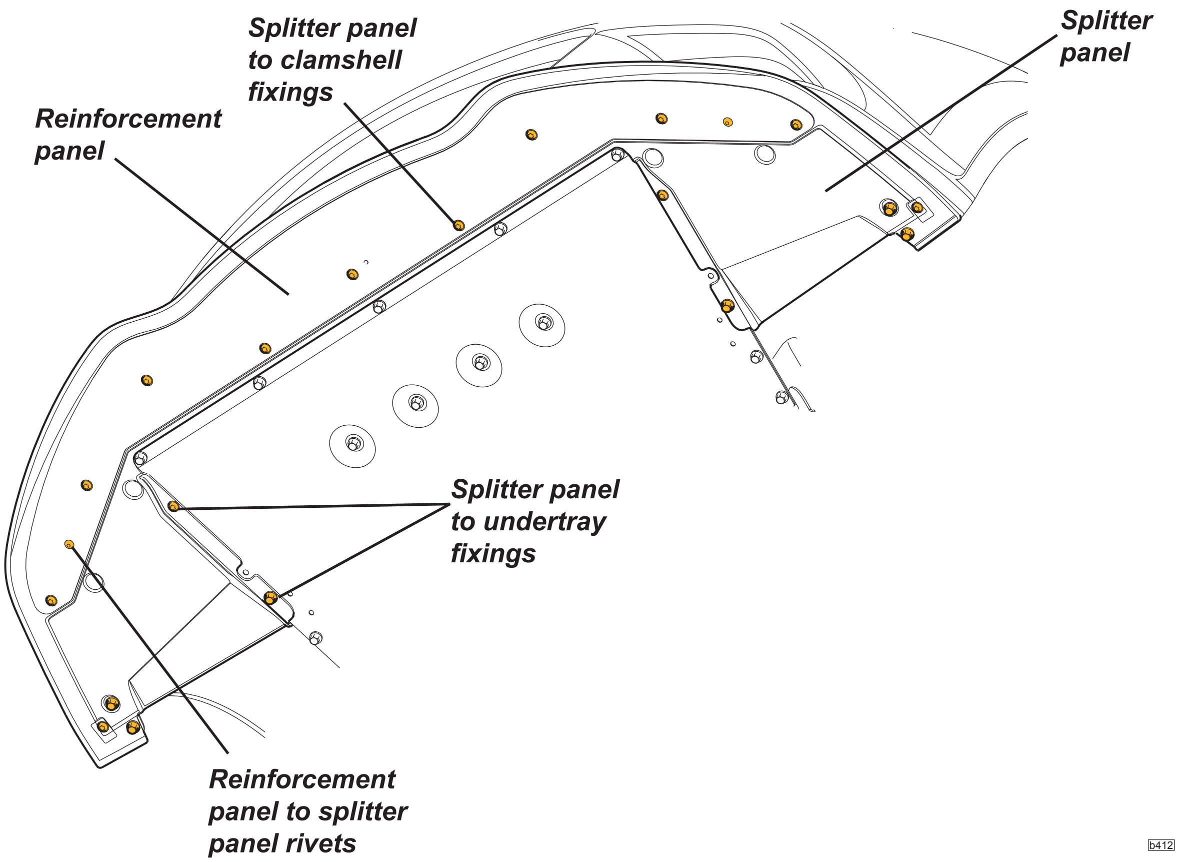
Fitment:
When refitting the seal to the clamshell, ensure to position it so that its manufactured join is located centrally on the front edge of the boot box aperture next to the engine bay.

Ensure the seal join is positioned centrally and forward most to the luggage bay (see illustration on previous page).

BT.14 - FRONT SPLITTER & REAR AEROFOIL

Front Splitter Assembly
The splitter assembly consists of an upper polyurethane- reinforced, reaction injection moulding panel painted to a gloss black finish (paint colour code RAL 9005 with a 15% gloss finish). This is protected by a lower reinforcement plate made of a 2mm thick black anodised aluminium sheet.

The the reinforcement panel is fixed to the splitter using 3 rivets and the assembly is fixed to front clamshell and undertray assembly using M5 x18 screws.



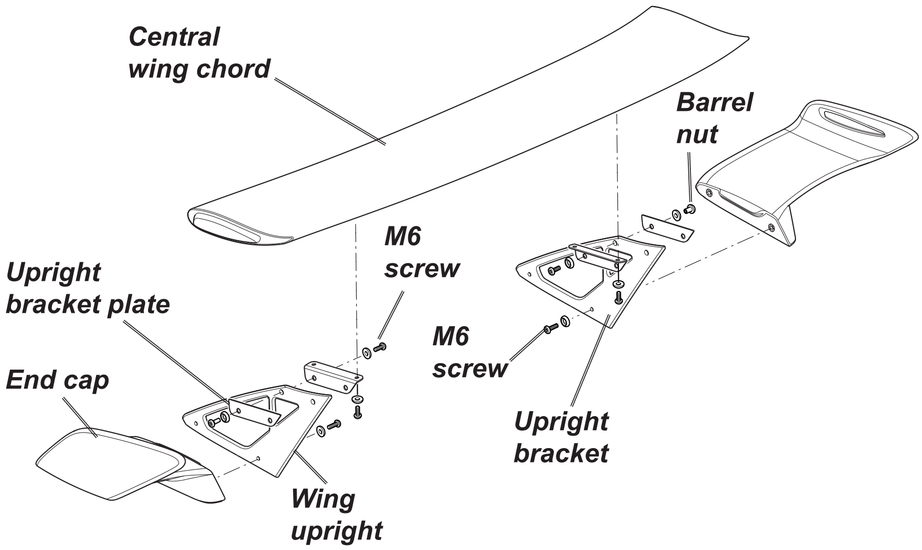
Rear Aerofoil Assembly

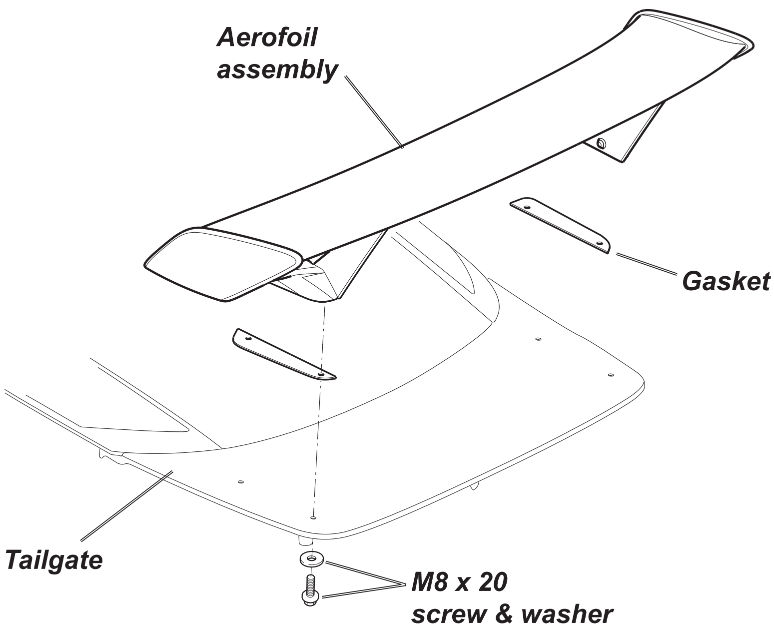
The rear aerofoil assembly consists of a central ABS blow moulded plastic wing chord with end caps bonded onto each side using MA 300 Plexus.

Additional support is provided by LH/RH anodised aluminium wing uprights which span the lowermost inboard side of the end caps to the underside of the wing chord.

Both the wing chord and end caps are fitted with nutserts to accommodate the wing upright fixings.

Rubber gaskets are fitted between the end caps and the tailgate outer panel, the assembly is secured by M8 x 20 screws and washers (4) fed through holes from the tailgate inner panel into nutserts installed into the base of the end caps.





BT.15 - WINDSCREEN, CABIN & TAILGATE GLASS

The laminated windscreen, together with self coloured synthetic finisher moulded around the top and side edges, is bonded to the composite windscreen mounting frame using Betaseal flexible polyurethane adhesive. It is not practicable to remove a windscreen from a car and then refit the same glass, as removal of the screen will require cutting the surround finisher which is available only as part of a new windscreen assembly.

To Replace Windscreen

Note: An interior mirror plinth adhesive kit part number A116U0194F is available which includes activators, bonding adhesive and fitting instructions.

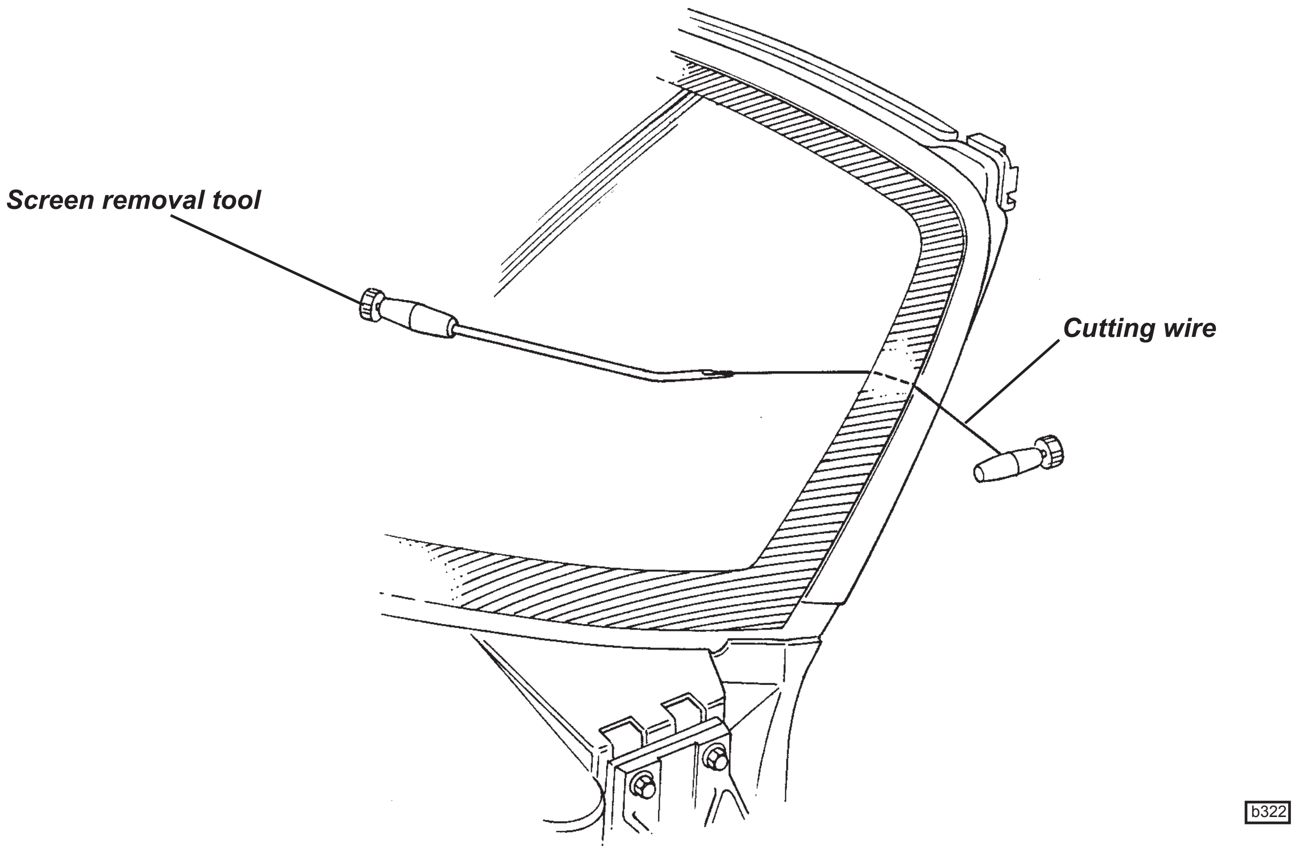
1. On non-airbag cars, to minimise the possibility of trim damage, remove the fascia end (speaker) panels, and the fascia top capping panel (around inside base of windscreen).

2. Remove the front clamshell (see sub-section BT.6).

3. Remove the wiper arm from its spindle, and the interior mirror from its plinth.

4. Cut around the whole length of the windscreen surround finisher to allow access to the 'screen adhesive joint. Apply suction handles to the outside surface of the screen.

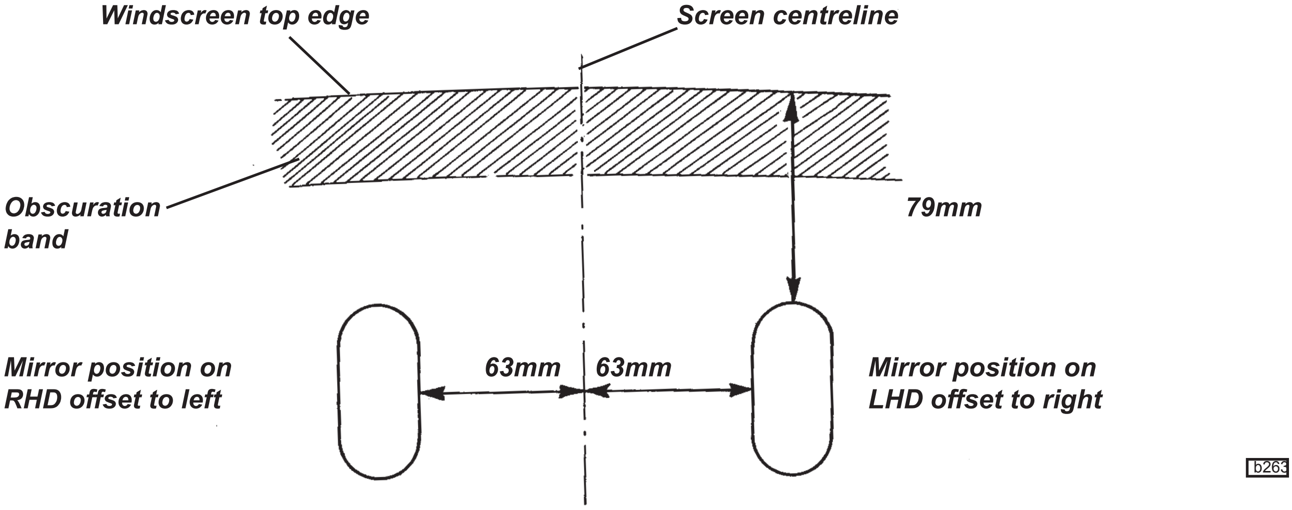
5. In order to incur the minimum risk of damage to the windscreen composite mounting frame, the preferred method of cutting the windscreen adhesive is by the use of a 'cheese' wire. Protect the visual surface of the windscreen frame with tape before commencing the cutting operation.



6. After cutting out the screen, remove old adhesive from the windscreen frame sufficiently to leave a consistent and flat surface for the new bond.

7. Clean the whole of the inside surface of the windscreen with a 50% solution of water and isopropanol. Allow to dry.

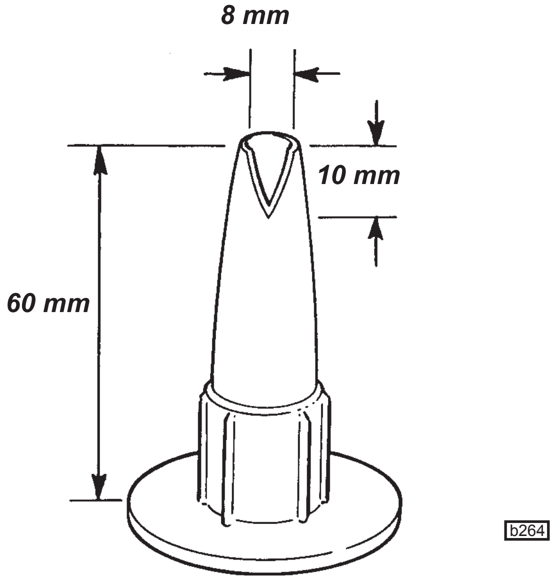
8. Fit the interior mirror plinth to the inside of the windscreen using the adhesive kit and instructions supplied.



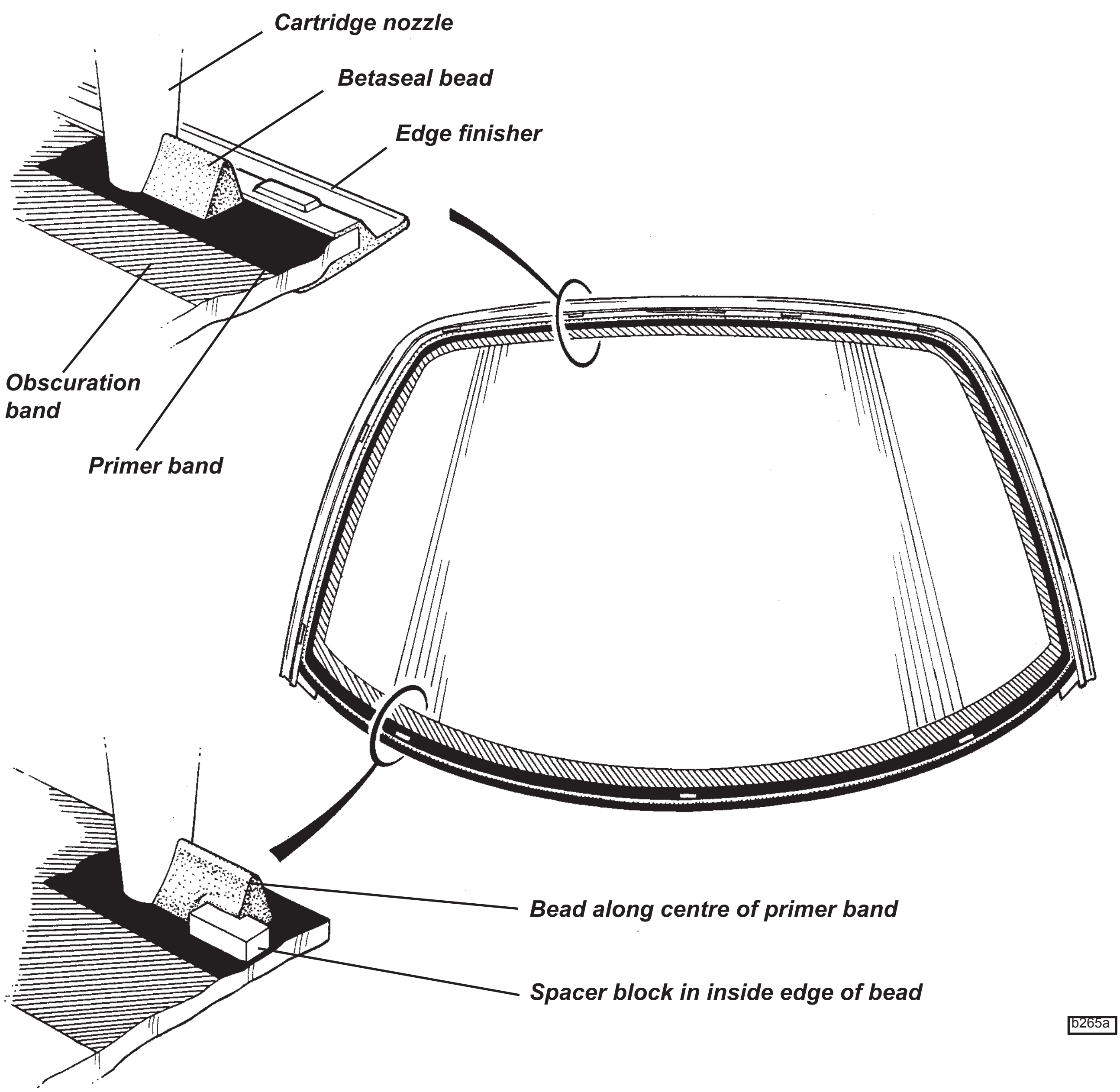
9. Clean the whole of the inside surface of the obscuration band, and the bonding surface on the windscreen frame with the wipe cleaner.

10. Apply a 25 mm wide band of Betaprime around the inside periphery of the glass. Similarly apply to the whole of the bonding surface on the windscreen frame, and to the windscreen bottom laminated edge. Allow to dry for a minimum of 5 minutes. If the screen is not fitted within 48 hours, the primer should be re-applied.

11. Cut the nozzle of the Betaseal cartridge to the dimensions shown to produce a triangular section bead. Holding the cartridge vertically, extrude a bead of adhesive around the screen, using the edge of the finisher as a guide along the top and sides, and following the centreline of the primer band along the lower section.



12. Use three 4mm spacer blocks (part number A075U0588Z) or cut three 4mm spacer blocks from rubber or plastic material, and position in the inside edge of the adhesive bead running along the bottom of the glass. These spacers are used to control the fitted height of the glass, and the wiper arm clearance.



13. Using the suction handles, carefully lower the windscreen onto the frame, with the edge finisher firmly butted against the top and sides off the frame recess. Press around the periphery of the screen to compress the adhesive until contact with the finisher spacers and bottom edge spacer blocks is felt. Carefully examine the integrity of the whole length of the joint, if necessary using a spatula to force extra adhesive into any suspect areas. Wipe off any excess adhesive extruded from the joint, or alternatively, allow the adhesive fully to cure and cut away any excess using a scalpel blade.

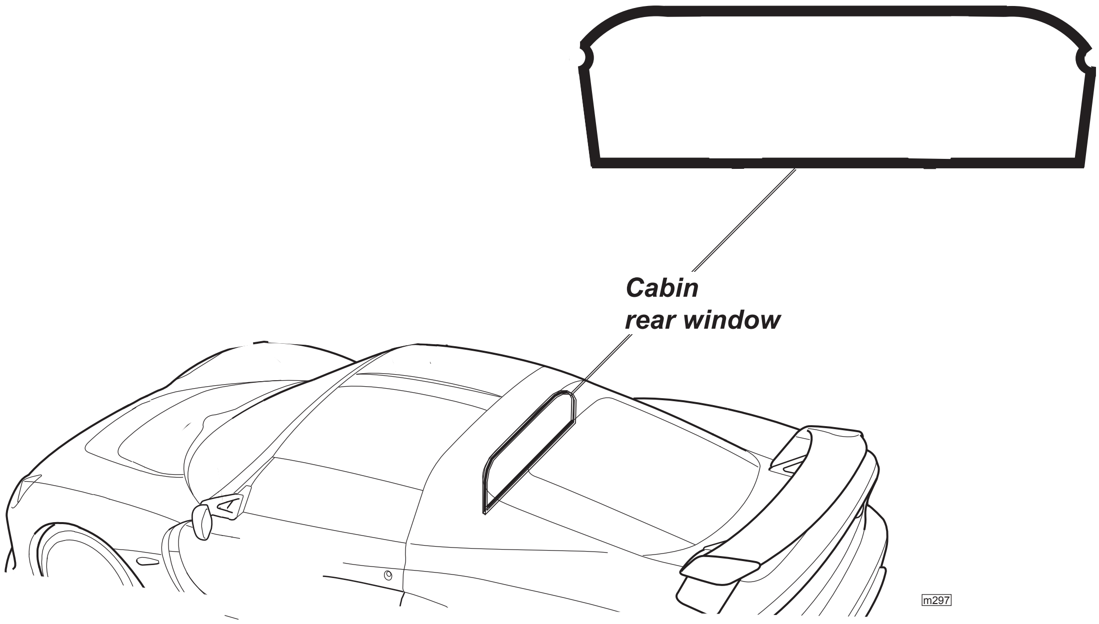
14. Use duct tape and/or support blocks to hold the screen in position and do not disturb until the Betaseal is fully cured. This will take approximately 4 hours dependent on atmospheric conditions, with a longer period required in dry atmospheres.

15. Refit wiper arm, interior mirror and front clamshell.

Spillage of material
a) Any spillage of Betaseal onto unprimed glass can be readily peeled off after it has cured.
b) Any spillage onto the bldy can be removed with either Wipe Cleaner No.4, or white spirit.

Shelf life
a) Betaseal primer has a useful life of about 24 hrs. after exposure to the air, after which it starts to become spongy. If the material is spongy, DO NOT USE. Always use glass primer immediately on opening, and replace the lid after use.
b) Betaseal has a shelf life of over 6 months at ambient temperature in the original unopened package.

Cabin Rear Window



To enhance insulation from engine bay heat and noise, a cabin rear window/backlight glass is bonded to the engine bay side of the cabin rear bulkhead panel using Betaseal flexible polyurethane adhesive.

Removal:

Preparation
1. Remove rear Bulkhead trim panel
2. Remove rear clamshell assembly, see sub-section BT.7.

In order to incur the minimum risk of damage to the composite rear bulkhead panel, the preferred method of cutting the rear window adhesive is by the use of a 'cheese' wire. Protect the visual surface of the bulkhead panel with tape before commencing the cutting operation.

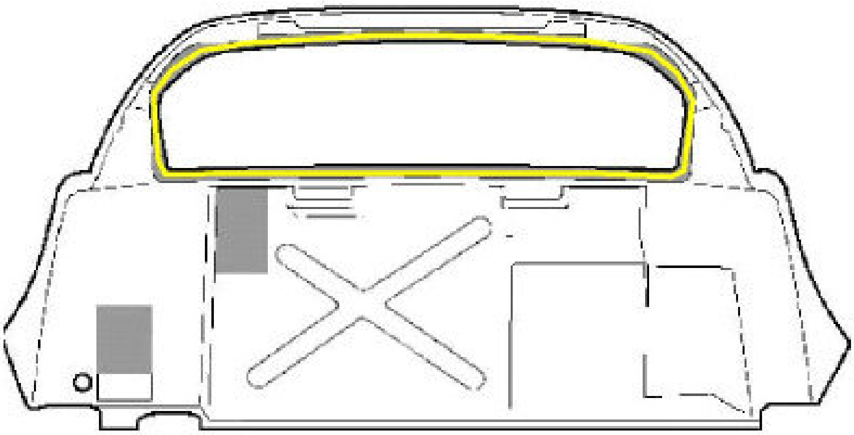
After cutting out the glass, remove the old adhesive from the bulkhead panel sufficiently to leave a consistent and flat surface for the new bond.

Fitting a new rear window:
1. Clean the whole of the inside surface of the new glass with a 50% solution of water and isopropanol and allow to dry. (The inside face of the window can be identified by the rough surface of the obscuration band which is positioned on top of the glass).

2. Abrade and clean the bond path (the obscuration band) of the new screen to ensure any silicone contamination is removed using Betabrade F1 solution and then Betaclean 3300 (shown as red in LH illustration).

3. Prime glass bond path using Betaprime 5500.

4. Prime and re-activate the prepared surface of the old adhesive on the bulkhead panel with Betawipe 4000 (A082B6355V).



Bond path

5. If the bulk head panel is new or without adhesive, prime the flange with Betaprime 5404 (red cap) A082B6337V.

6. Apply a 10mm minimum continuous bead of Betaseal 1701 to the backlight bond path on the bulkhead panel (as per illustration above).

7. Immediately secure the glass to the bulkhead panel using the suction handles,

8. Carefully position the glass onto the bulkhead panel, with the top edge of the glass firmly butted against the top of the panel.

9. Press around the periphery of the glass to compress the adhesive. Carefully examine the integrity of the whole length of the joint, if necessary using a spatula to force extra adhesive into any suspect areas.

10. Wipe off any excess adhesive extruded from the joint, or alternatively, allow the adhesive fully to cure and cut away any excess using a scalpel blade.

11. Ensure glass is located evenly around the bulkhead aperture and that the side recesses in the glass are positioned to allow the SBAF stays to be fixed back into place on the SBAF.

12. Use duct tape and/or support blocks to hold the screen in position and do not disturb until the Betaseal is fully cured. This will take approximately 4 hours dependent on atmospheric conditions, with a longer period required in dry atmospheres.

13. Refit all ancillary components.

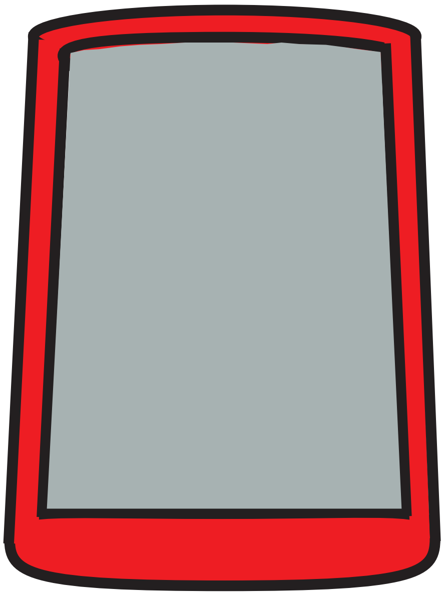
Rear Tailgate Glass

Removal:
Preparation
1. Remove the tailgate assembly from the vehicle and position on a suitable work bench ensuring to protect any surfaces of the panel that may come into contact with the bench.

2. Release M5 x 18 Socket button headed screws (10) securing the LH/RH and upper grilles and remove from the tailgate.

In order to incur the minimum risk of damage to the composite tailgate panel, the preferred method of cutting the glass adhesive is by the use of a 'cheese' wire. Protect the visual surface of the panel with tape before commencing the cutting operation.

After cutting out the glass, remove the old adhesive from the tailgate panel sufficiently to leave a consistent and flat surface for the new bond.



Tailgate glass bond path

Fitting:
1. Prime and re-activate the prepared surface of the old adhesive on the tailgate panel with Betawipe 4000 (A082B6355V).

2. If the tailgate panel is new or without adhesive, prime the flange with Betaprime 5404 (red cap) A082B6337V.

3. Apply Betabrade F1 to clean paper towel and wipe bond paths on new glass, remove residue from bond path with dry clean paper. Spray bond path with Betaclean 3300 and clean bond path with paper towel. Then dry wipe IMMEDIATELY with clean dry paper.

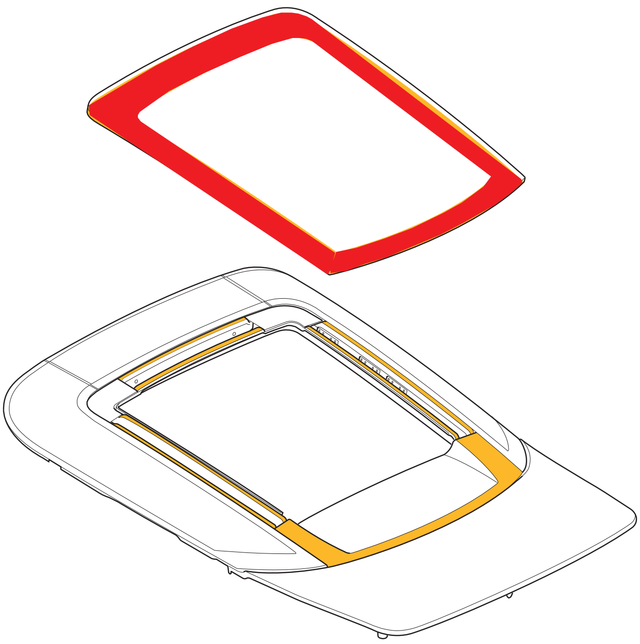
4. Using an applicator, apply Betaprime 5500 with smooth strokes to ensure even coverage along the bond path of the new glass. Leave for 15 MINS MINIMUM before applying adhesive.

   Note: *at time of production the tailgate glass is located onto the panel using a bespoke jig fixture to ensure the correct glass positioning/alignment. As this fixture will not be available to the dealer network it is recommended to fit the tailgate grilles back into position and align the glass centrally between grilles.*

5. On the tailgate panel, apply a continuous bead of Betaseal 1580 adhesive onto the bond path area as shown in yellow on the RH illustration.

6. Using the suction handles, carefully position the glass onto the tailgate panel.

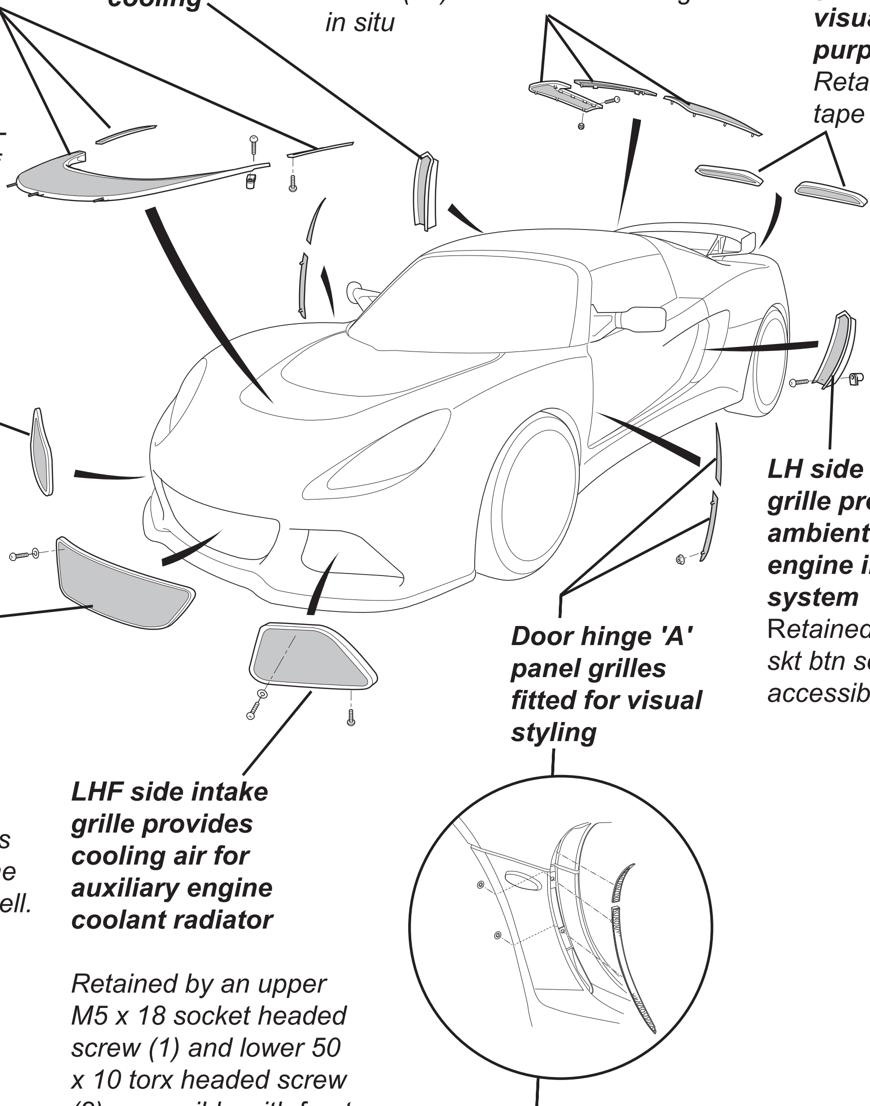
7. Press around the periphery of the glass to compress the adhesive. Carefully examine the integrity of the whole length of the joint, if necessary using a spatula to force extra adhesive into any suspect areas. Wipe off any excess adhesive extruded from the joint, or alternatively, allow the adhesive fully to cure and cut away any excess using a scalpel blade.



Tailgate panel bond path

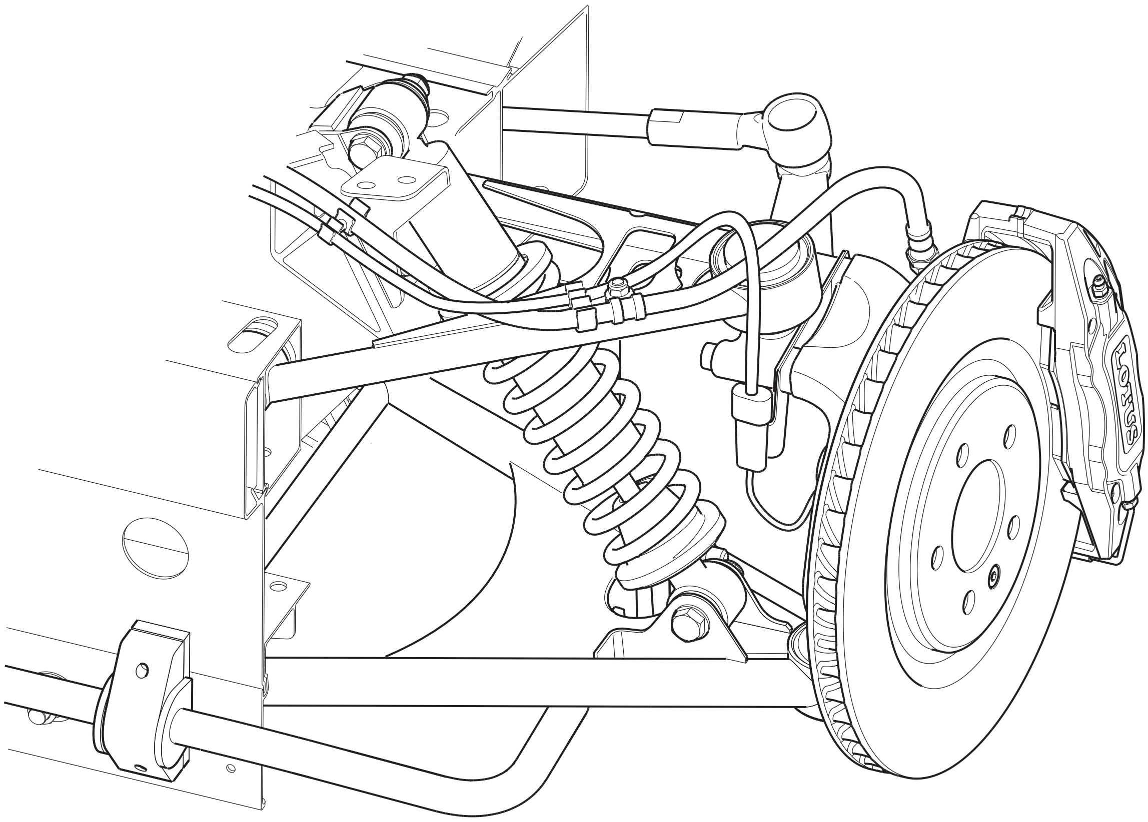
BT.16 - EXTERIOR GRILLES

Exterior grilles are made from an injection moulded polycarbonate material providing ambient air inlet and exit routes for engine coolant, oil cooling, a direct air intake for the engine induction system, engine bay ventilation as well as visual aesthetics.

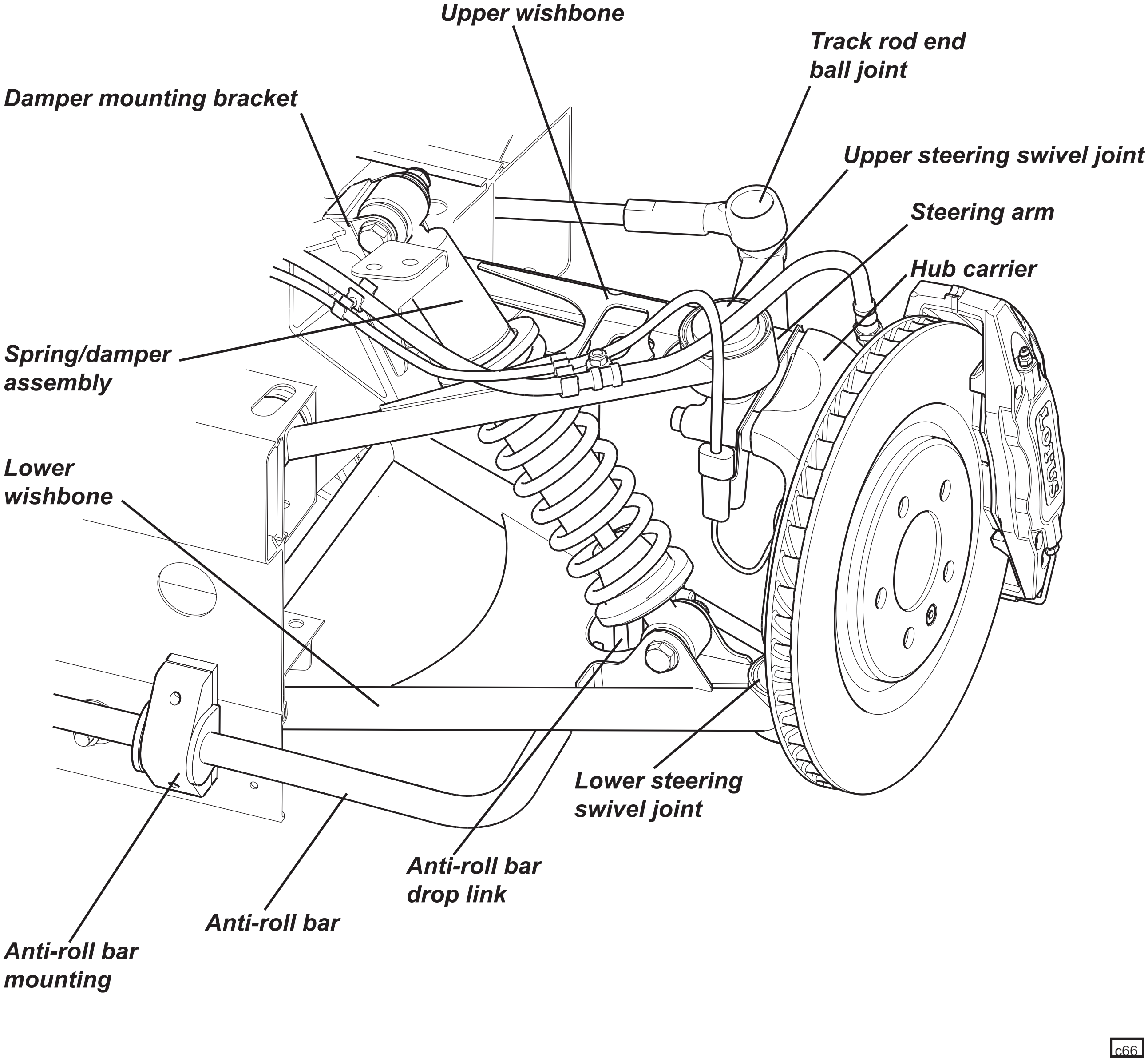


FRONT SUSPENSION

SECTION CJ



General Arrangement



CJ.1 - GENERAL DESCRIPTION

The independent front suspension comprises, on each side of the car, an upper and lower fabricated steel wishbone, a forged steel steering arm, a concentric coil spring/telescopic damper unit, and a tubular steel anti-roll bar, all being attached to the front chassis assembly. A forged steel hub carrier, provides a mounting for the hub bearing unit to which the 5-bolt road wheel and brake disc are attached, and also carries bosses for the cross-axis fixing bolts for the brake calliper.

Lower wishbone assembly
The primary, vehicle weight bearing, lower wishbone, is cross braced by a tubular strut at its base, The inboard end of the wishbone uses replaceable bonded rubber pivot bushes to provide maintenance free articulation, with a specification providing accurate and responsive dynamic characteristics. The Bilstein spring/damper unit acts between the outer end of the lower wishbone and the chassis, and is fitted with the damper rod lowermost in order to minimise unsprung weight. The outer ends of the wishbone incorporates a housing into which the lower steering swivel ball joint is pressed. The ball pin of the swivel joint is secured directly into a tapered hole in the bottom of the forged steel hub carrier.

Upper wishbone assembly
The upper ball pin is secured to the forged steel, rearward facing steering arm, itself fixed to the hub carrier by two M10 bolts. Shims are fitted between the steering arm and hub carrier to set the front suspension camber. The inboard end of the wishbone uses replaceable bonded rubber pivot bushes to provide maintenance free articulation, with a specification providing accurate and responsive dynamic characteristics. Spacer washers are fitted ahead of and behind each of the top wishbone pivot bushes to allow the wishbone to be displaced forwards or backwards, with an associated change of castor angle

Spring/damper assembly
The bottom of the monotube telescopic damper fixes to the lower wishbone in a double shear arrangement, with the damper top end secured to the chassis via a steel bracket bolted to the chassis assembly. The damper uses rubber bushes in both the top and lower eyes for noise suppression. The dual rate, concentric coil spring abuts against a lower and upper seat fixed to the damper body,

Anti-roll bar
A 21.5mm o.d. tubular steel anti-roll bar is mounted in rubber bushes to the underside of the chassis forward of the axle line, and curves under each Lower wishbone before connecting to it via a short ball jointed drop link.

Hub bearing assembly
The hub bearing unit is fixed to the hub carrier by 3 bolts, and incorporates a wide spaced double row ball bearing and a vehicle speed sensor ring integrated into the inboard seal, whose 48 pole signal is picked up by a sensor mounted in the rear of the hub carrier. This data is used for the anti-lock brake, vehicle stability, engine management and speedometer functions.

Suspension pack options
The standard factory suspension set up is referred to as the ‘Sport’ option. An optimised ‘Race’ suspension set up available as part of the ‘Race’ pack option. The springs fitted on the ‘Race’ suspension are of a thicker wire diameter and increased spring rate as compared to those fitted to the ‘Sport’ suspension. The thicknesses of selected internal shims fitted to the ‘Race’ damper are altered to change its rebound and compression characteristics. The uprated spring and damper assemblies are designed to suit the Pirelli P Zero Trofeo tyre characteristics, 4 mode Lotus DPM (Dynamic Performance Management) and Lotus launch control system also included in the ‘Race’ pack option.

CJ.2 - SUSPENSION SECURITY CHECK AND PROCEDURE

The Service Schedule specifies that the security of the front and rear suspension is checked at each service. For cars used on race tracks, or in similar conditions, suspension components and torque checks should be carried out between sessions. This operation requires that all the principal suspension pivot bolts are torque checked, noting the following points:

Where a bolt is tapped into a housing or weldnut, and relies on a thread locking compound for security, be aware that if the bolt is disturbed, the locking compound must be re-applied. The following procedure should be adopted for all such fixings:
- Check the torque of the fixing.
- If the specified torque is attained without the fixing being disturbed (moving), take no further action.
- If the bolt moves, the locking action of the thread adhesive will have been compromised. Remove the bolt completely, clean off all old adhesive using a wire brush and acetone, and apply new adhesive as specified.
- Refit the bolt and tighten to the specified torque.
  If for any reason a bolt is found to have become loose, and the car has been operated for any period in this condition, the bolt should be renewed as a standard precaution and related components carefully inspected for hole ovality or wear.

CJ.3 - GEOMETRY & ADJUSTMENTS

Provision is made for the adjustment of front wheel alignment castor and camber. Under normal service conditions, no periodic scheduled check of the geometry is necessary, with a full geometry check required only after suspension repair, or if excessive tyre wear is evident, or handling deficiencies encountered.

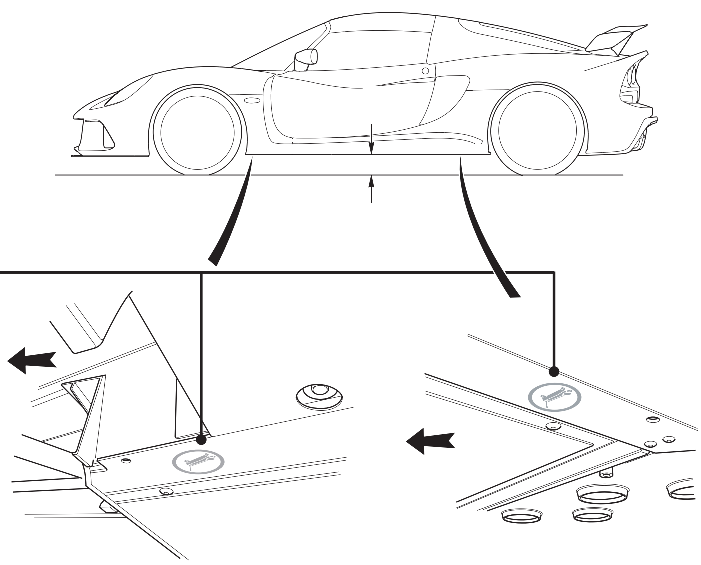
Ride height
Before any measurements or adjustments are made, it is essential first to set the vehicle to its 'mid-laden' ride height, approximating to the combined estimated weight of a driver and passenger and a half/full tank of fuel. This will require the vehicle to be ballasted or tied down:

Ride height measurements
Mid-laden ride height (based on 2 x 75 kg occupants + full fuel tank)

Set car to ride heights shown below before measuring geometry:

- front: 125 mm below front end of chassis siderail
- rear: 136 mm below rear end of chassis siderail

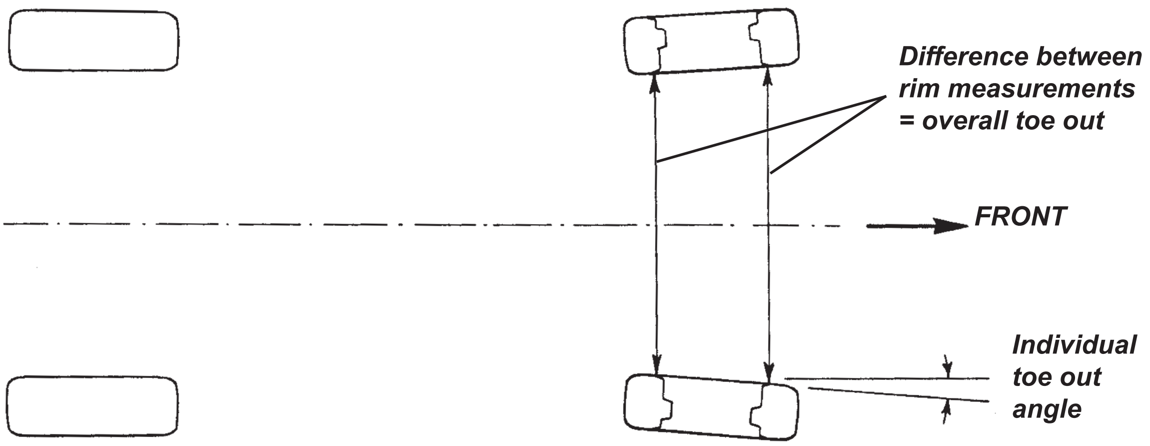
Ride height measurement points



Ride height to be measured from the ground up to the chassis siderails at the location of the 'Jacking' point labels.

Front suspension and geometry settings
Please refer to Service Notes section TDV - vehicle technical data, for front suspension setting information.

Alignment
Wheel alignment refers to the parallelism of the wheels when viewed from above and is crucial to vehicle stability, handling and tyre wear.

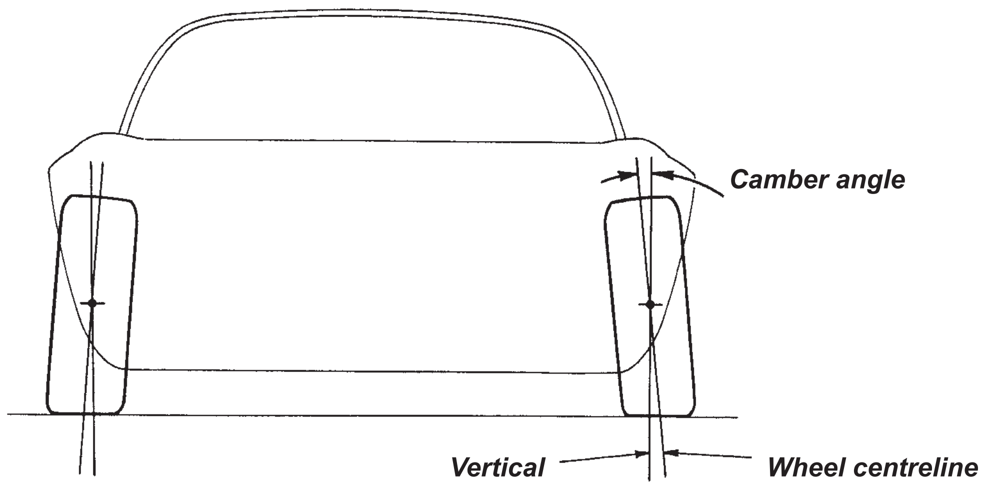


c26

Alignment is measured either by the angle a wheel makes with the vehicle centre line, or the difference in dimension between the wheel rim to wheel rim measurement at the front and rear of the wheel at hub centre height. The wheels are said to 'toe-in' when the wheel paths converge ahead of the vehicle, and 'toe-out' when they diverge. Wheel alignment is designed to vary with both steering angle (Ackerman) and suspension travel (bump steer) and should be measured only 'straight ahead' at the specified ride height.

Please refer to service notes section HK.X. for information on wheel alignment adjustment.

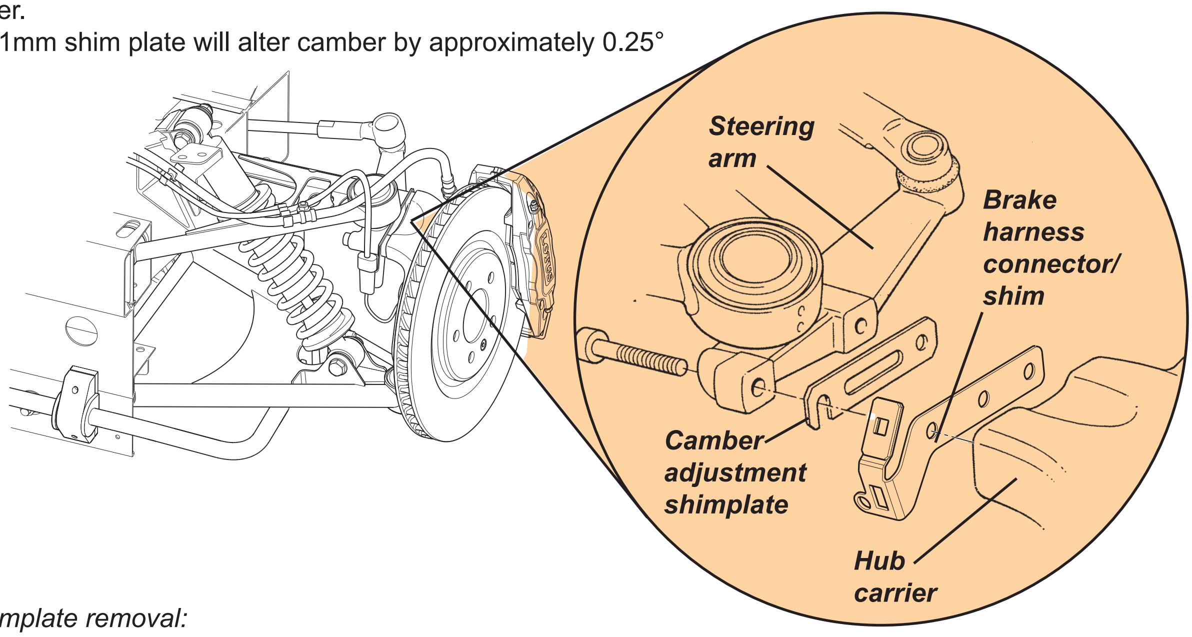
Camber Angle
Camber is the angle from vertical of the wheel when viewed from the front, and is said to be negative when the wheel leans inwards at the top (positive when leaning outwards). The primary purpose of camber is to achieve the maximum efficiency of the tyre under cornering loads and body roll, with the specification closely allied to a particular wheel/tyre combination. The camber angle changes with suspension travel, becoming more negative on bump, and should be measured only at the specified ride height. Incorrect camber can result in handling deficiencies and excessive tyre wear.



c29

Camber Adjustment
Camber adjustment is effected by adding or deleting shim plates between the steering arm (to which the upper steering swivel joint is fixed) and the hub carrier.

Shimplates are available in 1mm and 1.5mm thicknesses.
- Reducing the shim pack thickness will increase negative camber. Adding shims will reduce negative camber.
- A 1mm shim plate will alter camber by approximately 0.25°



Shimplate removal:
It is recommended to carry out a steering and geometry check before removing the steering arm from the hub carrier to ensure the camber setting is still within tolerance range upon refitment.

With the car on a four post lift and with the affected front wheel(s) removed, see Service Notes sections AN.1 & GK.4 for further information:

1. Release the ABS wheel speed sensor harness plug from the connector shim, release the M6 nut securing the brake hose retaining clip to the wishbone and pull it away from the mounting stud.

2. Release and carefully remove the M10 x 60 (2) socket headed screws securing the steering arm to the hub carrier assembly.

3. The steering arm will remain in place still attached to the upper wishbone pivot and outer track rod end, but the hub carrier complete with hub, brake disc and calliper will swivel on the lower wishbone pivot.

4. The camber shims will now released from between the steering arm and hub carrier assembly, ensure that all the shims are collected. If both LH and RH steering arm screws are removed then take care to retain the relevant shims with their steering arms/carrier assemblies.

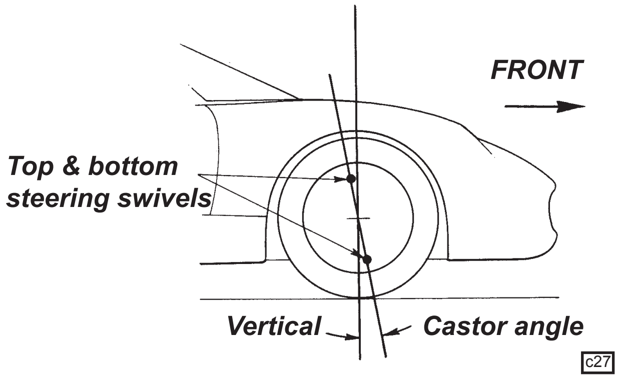
This is important when calculating if shims need to be added or removed to achieve the correct camber setting.

Shimplate fitment:
Reverse of removal, add or remove shims as required.

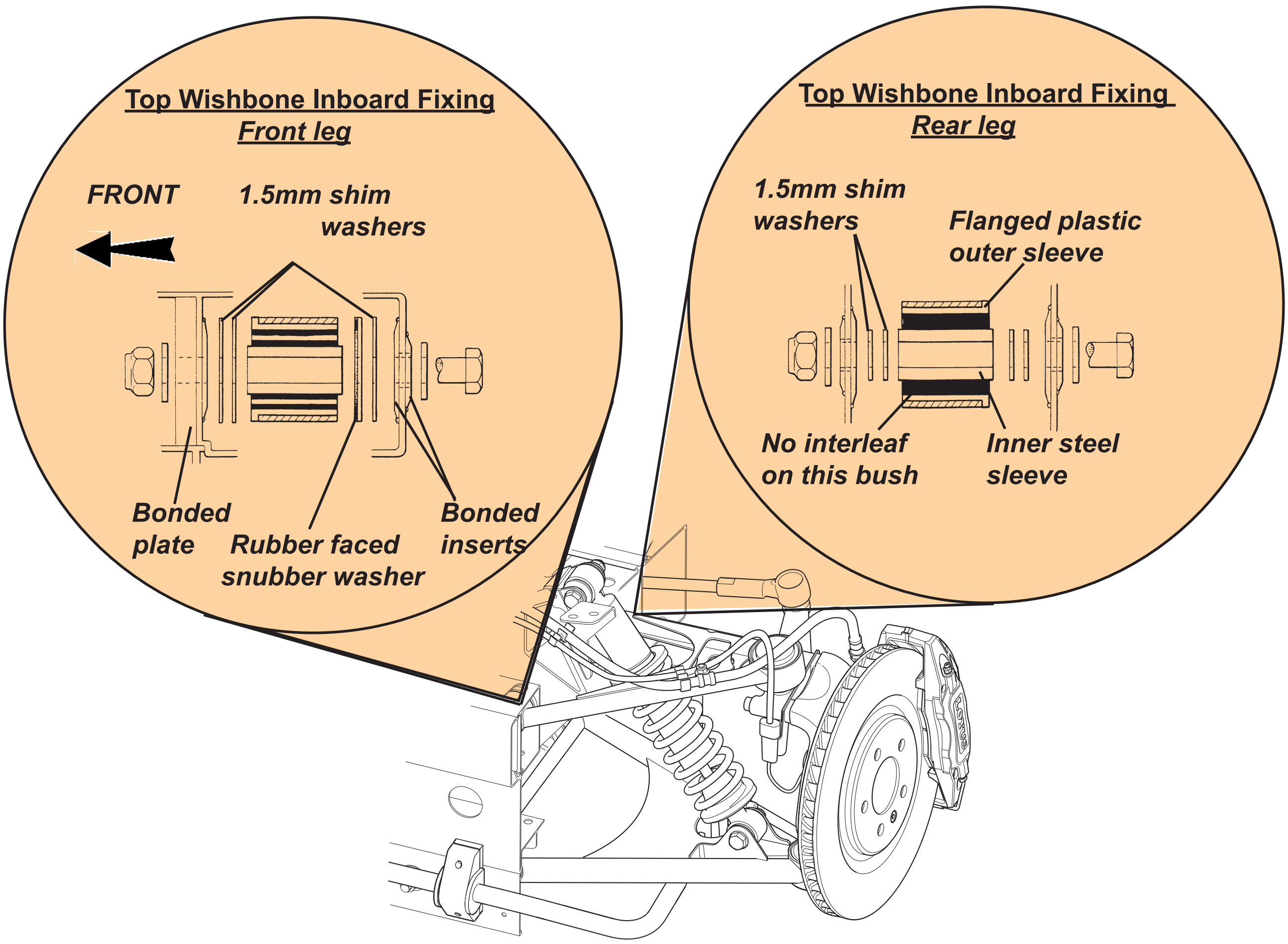
- The retaining bolts should be initially tightened to 9Nm to compress shims so that an accurate camber reading can be achieved.
- Camber measurements must only be taken with the front and rear suspension is set to its normal 'ride height' position, see Service Notes section CJ.3.
- When the correct camber set up is achieved, the bolts must be individually removed, Permabond A130 applied to the first 10mm of the bolt threads, then refitted and torqued to 68Nm.

Castor Adjustment

Castor is the angle from vertical of the steering axis of the wheel when viewed from the side. Its primary purpose is to provide a natural straight running tendency of the steered wheels with forward vehicle motion. Castor angles have a complex interaction with other steering geometries and if unbalanced or outside of specification, can result in various stability and handling deficiencies.



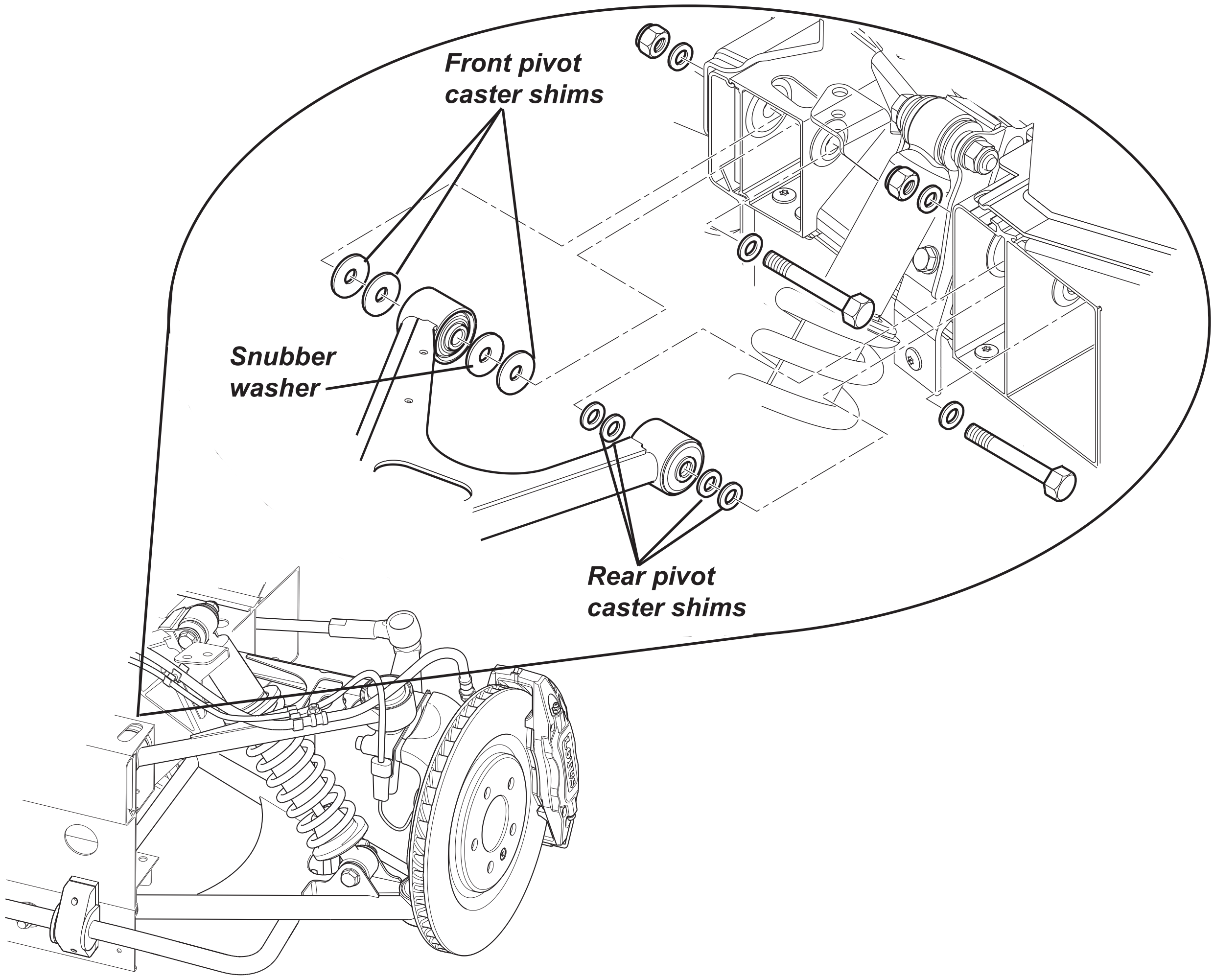
The top wishbone pivots are sandwiched between the walls of transverse chassis box sections, the pick up points in which are reinforced either with machined inserts, or in the case of the foremost position, a thick alloy plate, each being bonded to the chassis with epoxy adhesive. Spacer washers are fitted ahead of and behind each of the top wishbone pivot bushes to allow the wishbone to be displaced forwards or backwards, with an associated change of castor angle.



A rubber faced snubber washer fitted against the rear face of the top wishbone front bush prevents metal to metal contact under extreme braking forces. The spacer washers may be re-distributed between the front and rear of each pivot bush but the snubber washer position, and the total shim pack thickness of 4 x 1.5mm at each pivot (inc. the 1.5mm snubber washer) must remain unchanged.

The wishbone pivot bushes are bonded rubber type with a plastic flanged outer sleeve, a plain steel inner sleeve, and a plastic interleaf sleeve within the rubber bush to control the flexing characteristic. The top wishbone rear bush, identified by a blue paint mark, has no interleaf sleeve.

CJ.4 - UPPER & LOWER WISHBONE REMOVAL/CASTER ADJUSTMENT



Upper wishbone removal:

With the car on a four post lift and with the affected front wheel(s) removed, see Service Notes sections AN.1 & GK.4 for further information:

1. Remove the M12 'P' type nyloc nut securing the top swivel joint to the steering arm (torque 55Nm), and use a ball joint splitter to separate the joint from the arm.

2. Before removing the two pivot bolts for the top wishbone, take careful note of the distribution of castor adjustment washers.

3. Move the steering rack to full lock to provide clearance for the withdrawal of the wishbone rear pivot bolt.

4. Release the M10 nyloc nut from the M10 x 75 bolt (torque 45Nm) securing the upper rearmost wishbone pivot to the chassis and withdraw, taking care to retrieve all 4 caster washers.

5. Release the M10 nyloc nut from the M10 x 80 bolt (torque 45Nm) securing the upper foremost wishbone pivot to the chassis and withdraw, taking care to retrieve all 3 caster washers and single 'snubber' washer.

6. Withdraw the wishbone.

Refitment:
Is the reversal of removal except:
- Shim distribution at the front bush of either wishbone must be copied at the rear bush of that wishbone.

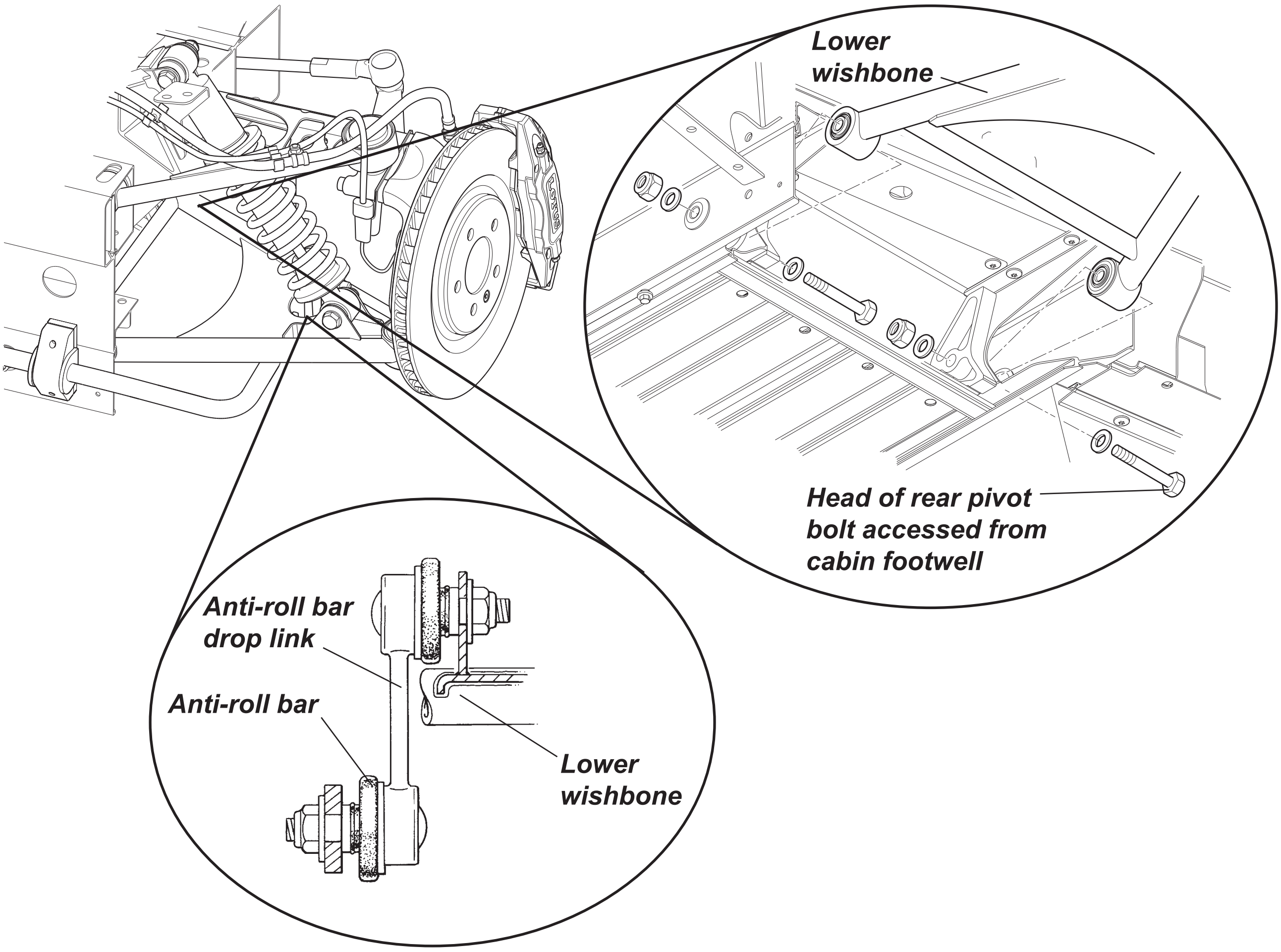
- Transferring a 1.5mm shim washer from ahead of, to behind the pivot bushes, will reduce castor by approximately 0.4°.

- Transferring a 1.5mm shim washer from behind, to ahead of the pivot bushes, will increase castor by approximately 0.4°.

- Ensure that the load spreading washers are correctly located beneath the bolt heads and nuts as shown in the drawings on page 7 & 8.

- Caster measurements must only be taken with the front and rear suspension is set to its normal 'ride height' position, see Service Notes section CJ.3.

- Ensure that the pivot bolts are tightened only with the vehicle at ride height. Torque to 45 Nm



Lower wishbone removal:
With the car on a four post lift and with the affected front wheel(s) removed, see Service Notes sections AN.1 & GK.4 for further information:

1.Remove the nut, bolt and washers securing the spring and damper assembly to the lower wishbone. (see section CJ.7.

2.Release the M10 nyloc nut securing the anti-roll bar drop link to wishbone bracket and withdraw, pull the link through the wishbone assembly. See section CJ.6 for refitment information.

3.Remove the M12 ‘P’ type nyloc nut securing the lower swivel joint to the hub carrier (torque 55Nm), and use a ball joint splitter to separate the joint from the carrier.

4.Retain the rearmost lower pivot M10 nyloc nut with a spanner; and from within the cabin footwell, remove the lower M10 x 85 wishbone rear pivot bolt, (torque 45Nm).

5.Release the M10 nyloc nut and M10 x 85 bolt (torque 45Nm) securing the foremost lower wishbone pivot to the chassis and withdraw the bolt.

6.Withdraw the wishbone assembly.

Lower wishbone refitment:
Is the reversal of removal except:

- Ensure that the pivot bolts are tightened only with the vehicle at ride height. Torque to 45 Nm

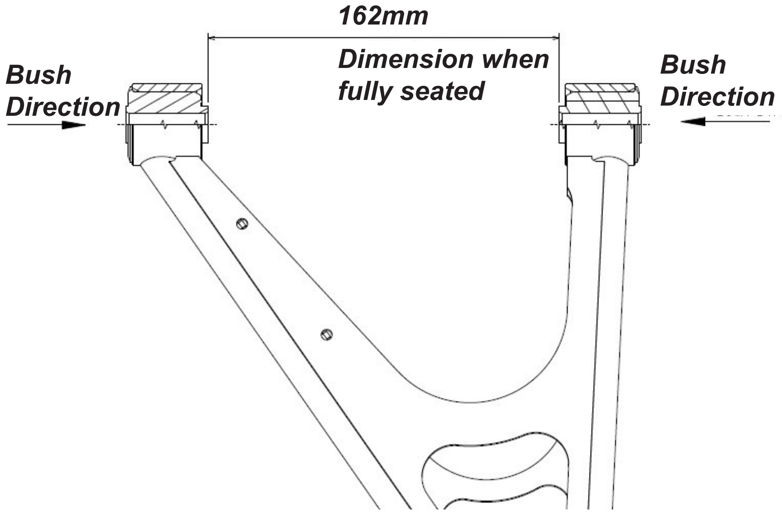
CJ.5 - PIVOT BUSHES & SWIVEL JOINTS

Pivot Bushes

The wishbone pivot bushes comprise a rubber bush bonded to a steel inner sleeve and a flanged plastic outer sleeve. The bushes may be pressed out of the wishbone eyes, and new bushes fitted using suitable press tool dollies. Smear the outer surface of the new bush with IPC 'P-80' rubber lubricant emulsion to ease fitment, and assemble as follows. If possible, warm the wishbone to 80 - 100°C.

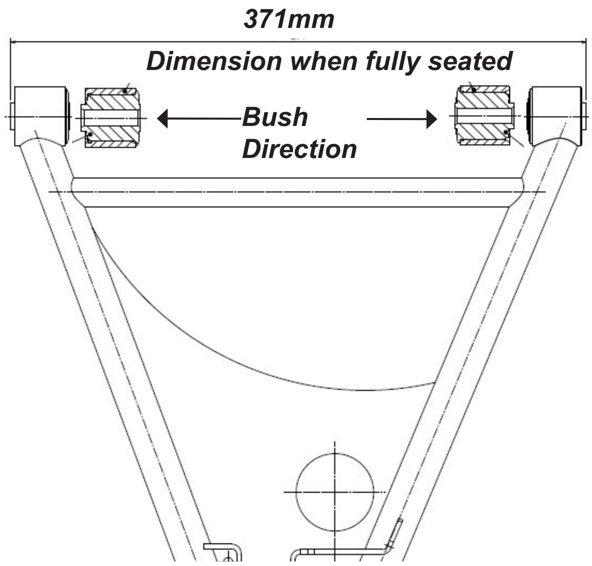
Top wishbone

Insert from the outside of both pivot eyes (from front of front eye, and rear of rear eye).



Lower wishbone

Insert from the inside of both pivot eyes (from rear of front eye, and front of rear eye).



Note that all wishbone pivot bushes are common with the exception of the top wishbone rear pivot, which contains no interleaf sleeve and is identified by a blue paint mark.

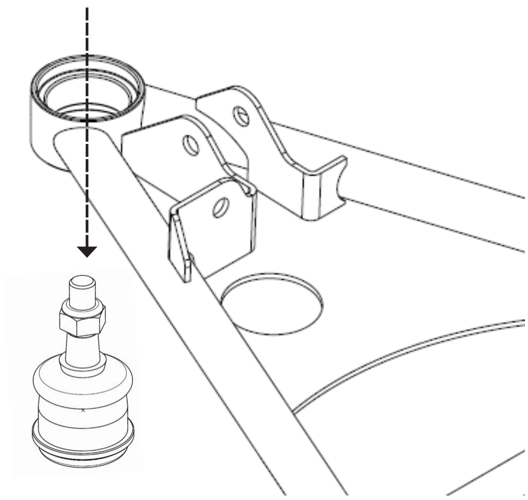
Steering Swivel Joints

Service replacements are available as an assembly complete with gaiter and locking nut.

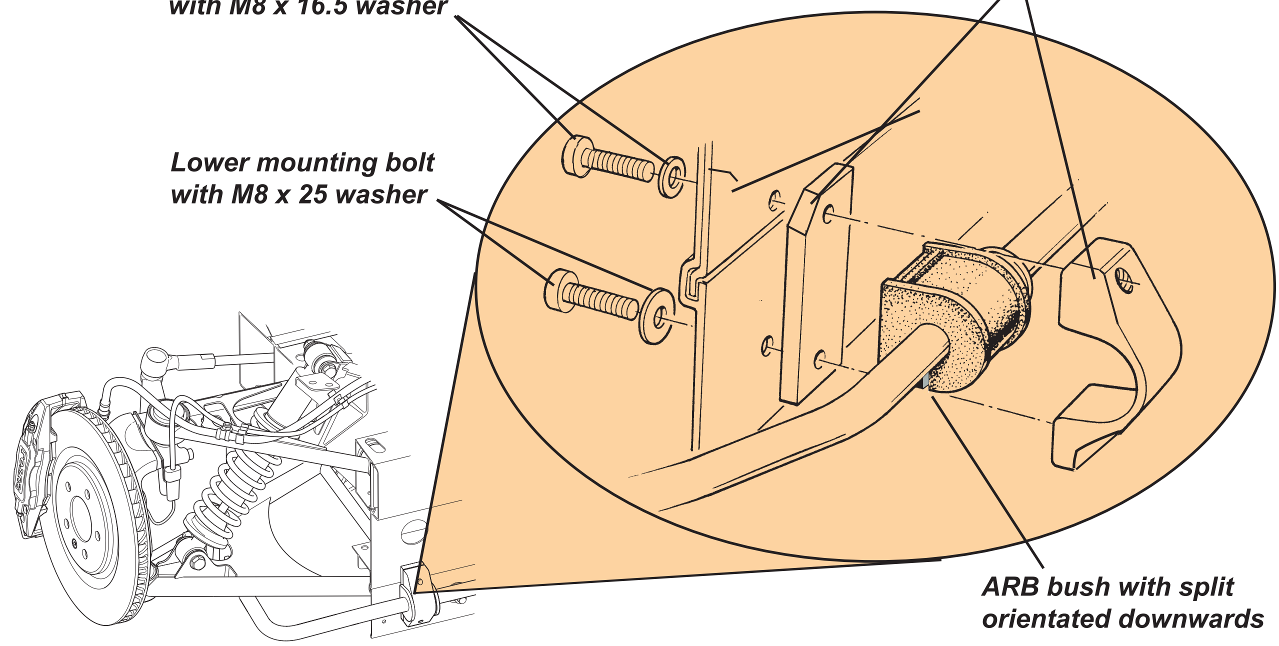
The balljoint assembly is a press fit into the wishbone mounting.

Serations/grooves on the balljoint outer body and the mounting face on the wishbone prohibited the balljoint from turning within the wishbone.

Top and bottom swivel joints are identical, and may be replaced if necessary using a suitable press.



CJ.6 - ANTI-ROLL BAR (ARB)



The standard tubular steel anti-roll bar is mounted in pivot bushes onto the front face of the chassis, and is linked to the outboard ends of each lower front wishbone via short ball jointed links. The bar is mounted to the chassis using rubber pivot bushes for noise isolation, retained by alloy clamp brackets. Washers welded to the bar bear against the inner sides of the bushes to provide lateral location of the bar.

Removal:

1.Remove the front alloy undertray, see service notes section AN.3.

2.Release the M8 x 30 (4) socket headed screws (torque 25Nm) securing the 2 ARB bar clamps, bushes and backing plates to the chassis.

3.Remove bolts and withdraw the clamps and bushes from the ARB.

4.Release the M10 nyloc nuts and washers (torque 45Nm) securing the ARB to the lower ball joints of the LH & RH drop links, and withdraw the bar.

Refitment:

The same as removal except:

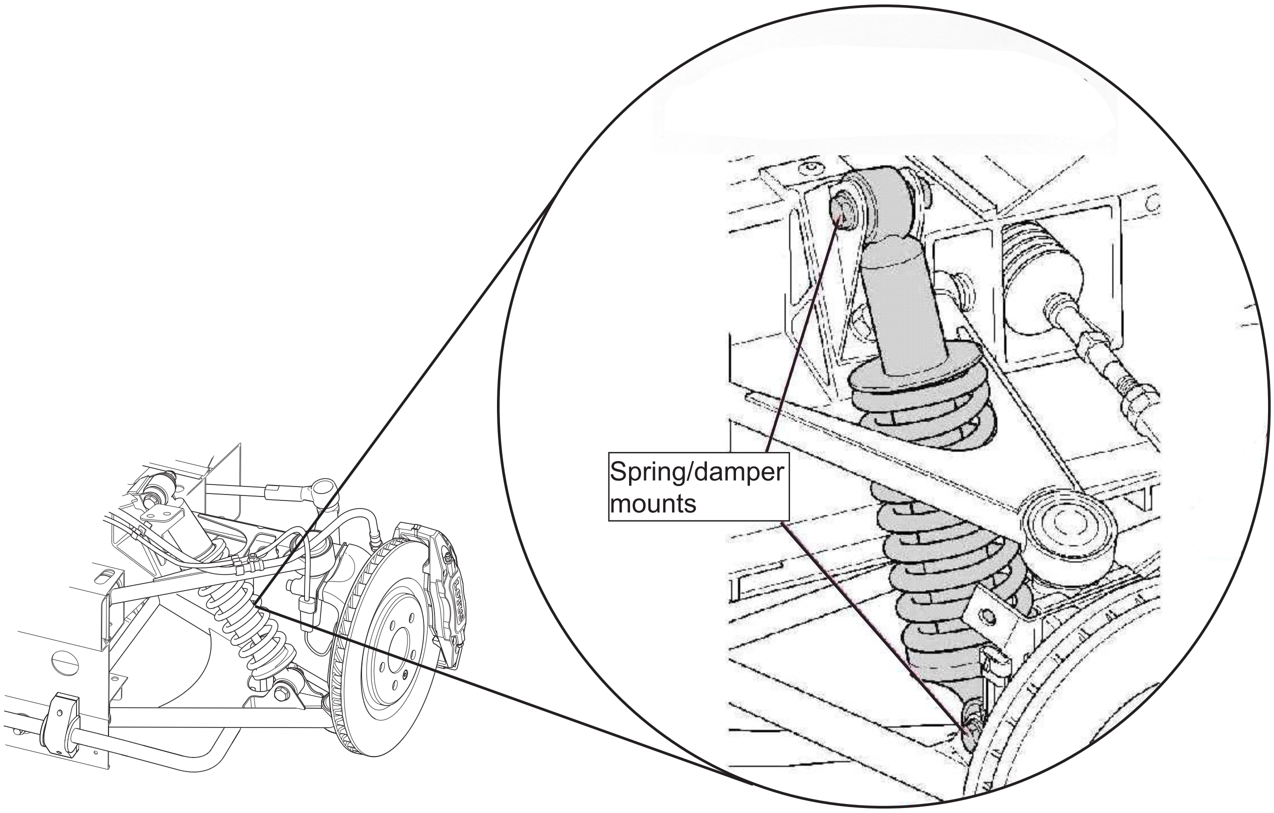
- Castrol LMX rubber grease, or equivalent, should be used when fitting the rubber bushes onto the ARB.

- Ensure the ARB bush is fitted back onto the bar with manufacturers split orientated downwards.

- Refit the backing plate and ARB bracket so that their chamfered corners are positioned upwards and outwards towards the edge of the chassis.

- Ensure the upper mounting bolt is fitted with the smaller with M8 x 16.5 washer and lower mounting bolt is fitted with the larger M8 x 25 washer.

CJ.7 - ROAD SPRING & DAMPER ASSEMBLY



Road spring damper assembly
The coil spring/telescopic damper units may be removed without causing disruption to the wishbone assembly mounting points or other suspension components.

To remove:
1. Raise and support vehicle, see Service Notes section AN.1 for further information.
2. Remove the appropriate road wheel, see Service Notes section GK.4 for further information.
3. Remove the nut, bolt and washers securing the spring and damper assembly to the lower wishbone.
4. Remove the nut, bolt and washers securing the spring and damper assembly to the chassis bracket.
5. Withdraw the spring assembly from the suspension.

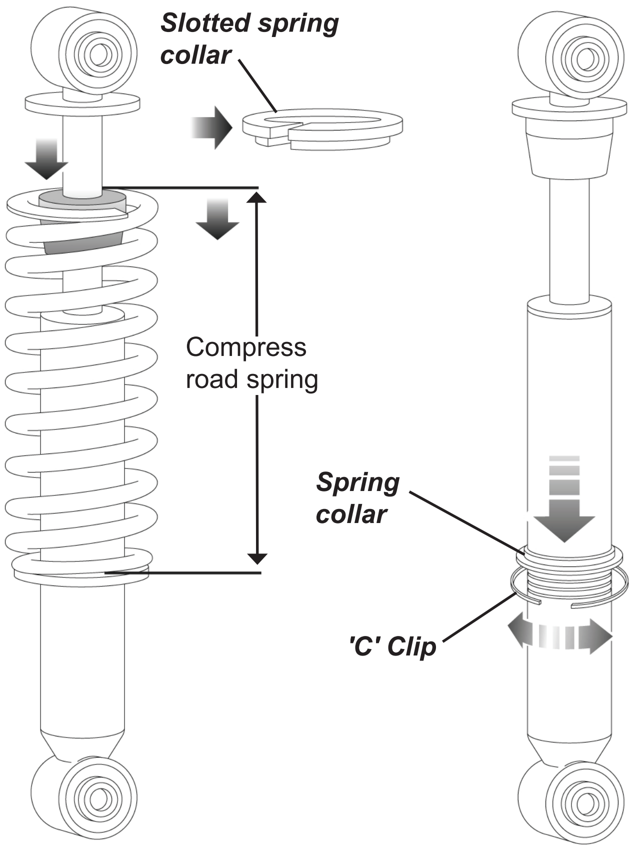
To refit:
Installation is the reverse procedure of removal

- Refit upper and lower mounting bolts ensuring the bolts are fitted through from rear to front of their mounting points so that the nyloc nuts are positioned to the front of the mounting points.
- Torque both the upper and lower fixings to 45 Nm.
- Refit road wheel, torque to 105 Nm.

Front Spring and Damper

Removal

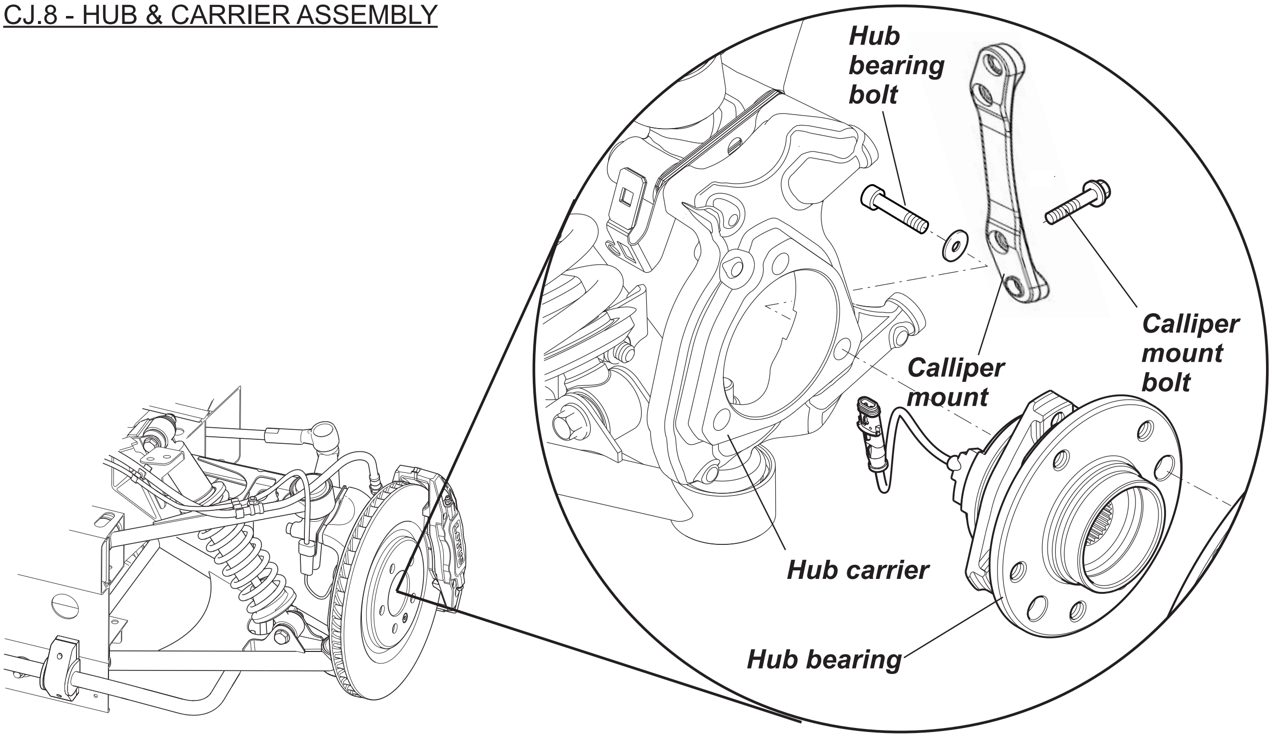
1. Raise and support vehicle, see Service Notes section AN.1 for further information
2. Remove the appropriate road wheel(s), see Service Notes section GK.4 for further information
3. Remove damper and spring assembly (see previous operation).
4. Using suitable compression tools, compress the road spring to relieve tension from retaining collar.
5. Push down bump stop and remove slotted spring retaining collar.
6. Remove spring from damper.
7. Remove 'C' clip from damper (note fitted position).
8. Remove spring collar from damper.



Refitment

Refitment is the reversal of removal.

CJ.8 - HUB & CARRIER ASSEMBLY



Hub Assembly

The sealed front wheel bearings are contained in a steel housing secured to the hub carrier with three M12 x 45 bolts and washers. The double row, angular contact, ball bearing is retained in the outer housing and also onto the hub spigot by a shoulder and a peening operation, and is inseparable for service.

Note that both front hub assemblies are common and incorporate a wheel speed sensor in the bearing unit, with a flying lead terminating in an electrical connector plug secured by a camber shim plate bracket.

If there is found to be any discernible free play in the hub bearing, or any roughness or tight spots can be felt, or any signs of lubricant expulsion are evident, the hub assembly should be replaced - there is no provision for adjustment.

Removal:

1. Raise and support vehicle, see Service Notes section AN.1 for further information.

2. Remove the appropriate road wheel(s), see Service Notes section GK.4 for further information

3. Release the ABS wheel speed sensor harness plug from the connector shim, release the M6 nut securing the brake hose retaining clip to the wishbone and pull it away from the mounting stud.

4. Remove the two bolts securing the brake calliper to the hub carrier, release the flexible hose from the top wishbone, and support the calliper aside without straining the brake hose. Release the single countersunk screw, and remove the brake disc, see Service Notes Section JM.X.

5. Release the three M12 x 45 bolts and washers (torque 90Nm) securing the hub unit and withdraw the hub unit from the hub carrier.

Refitment:

Reveral of removal except:

. Apply Permabond A130 to the threads of the three bolts, and torque tighten to 90Nm.

. Pump the brake pedal to reposition the pads before driving the car.

Hub Carrier

The forged steel hub carrier provides a mounting for the hub bearing unit to which the 5-bolt road wheel and brake disc are attached. Also included is a taper mounting for the lower swivel joint as well as attachment points for the combined steering arm/upper swivel joint mounting and brake calliper assembly.

Removal:

1. Remove the hub assembly as described on page 15.

2. Release the M10 x 30 bolts securing the brake caliper release mount to the carrier and remove mount (torque 52Nm).

3. Remove the M10 nyloc nut securing the track rod end into the steering arm (torque 30Nm), and use a ball joint splitter to separate the rod end from the arm, also see Service Notes Section XX>X.

4. Remove the M12 ‘P’ type nyloc nut securing the lower swivel joint to the hub carrier (torque 55Nm), and use a ball joint splitter to separate the joint from the carrier.

5. Remove the M12 ‘P’ type nyloc nut securing the upper swivel joint to the steering arm (torque 55Nm), and use a ball joint splitter to separate the joint from the arm.

Refitment:
Reverse of removal procedure:

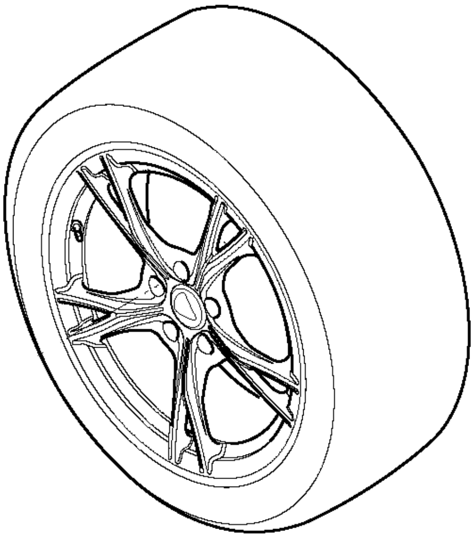
Apply a small

- If renewing the hub carrier it will be neccessary to renew or refit the original steering arm and camber shims as described on page 6 (camber adjustment).

• Permabond A130 (part number A912E7033V) must be applied to the first 10mm of the calliper mount to hub carrier bolt threads before being torqued to 52Nm.

WHEELS & TYRES

SECTION GK



GK.1 - GENERAL DESCRIPTION

The single piece, light alloy roadwheels are factory fitted with tyres engineered to provide the optimum balance of ride and handling characteristics. In order fully to exploit the dynamic qualities and packaging opportunities, the wheel and tyre sizes are different front and rear, so that interchanging of wheels and tyres between axles is not permissible. Note that the tyre tread pattern is asymetric across the width, with the sidewalls marked 'side facing inwards' or 'side facing outwards', but the tyre may rotate in either direction.

The tyres should be inspected frequently by the vehicle user, and also at every service, for signs of cuts, abrasions or other damage, and for any uneven tread wear patterns. Uneven treadwear may indicate that the suspension geometry or dampers require attention. Care should be taken when parking to avoid tyre contact with high or sharp edged kerbs, as mistreatment of this nature can cause internal damage to the tyre structure which may not readily be apparent. The alloy wheel rims may also be distorted or damaged by careless parking, and result in wheel imbalance or loss of tyre pressure. Safety considerations should always be paramount when assessing tyre condition and serviceability, and the tyres replaced if any doubt exists, or if the legal tread depth limits are approached.

The cold tyre pressures should be checked every week, or every 1,000 miles (1,700 km), whichever is the sooner, and corrections made as necessary. Under-inflation will cause excessive wear, rapid deterioration of the tyre sidewalls and heavy steering, whereas overinflation results in a hard ride and increased susceptibility to tyre damage. Both conditions will cause a degradation in the vehicle handling qualities. It is important that the tyre pressures are adjusted only when the tyres are cold (driven less than one mile), as the pressures may increase by 0.3 - 0.5 bar (4 - 8 lb/in^2) when the tyres are warmed to normal running temperature. The tyre valve dust cap should always be replaced in order to prevent the ingress of dirt and moisture into the valve, which could cause leakage.

When balancing the wheel and tyre assemblies, the wheels should be located by the centre spigot - NOT by the wheel bolt holes. In order to maintain the correct handling feel and minimum steering wheel shake, it is very important that the radial and lateral run out of the tyres are to the high standard required by Lotus Cars. If any difficulty is experienced with replacement tyres, refer to the tyre manufacturer.

The Pirelli P-Zero Corsa tyres fitted as part of the 'Sport' pack option are suitable for all normal weather conditions. The tyre characteristics include good feedback (‘feel’) from the road surface to the steering wheel, a high level of steering linearity and response, and little performance degradation with the high temperatures which may be reached in sports use.

Although approved for road use, the Pirelli P-Zero Corsa Trofeo tyres fitted as part of the ‘Race’ pack option are primarily designed for racetrack driving. In the event of wet road conditions with the risk of aquaplaning, prudent driving at a reduced road speed is recommended.

Tyre performance will decrease at low ambient temperatures, resulting in reduced levels of grip and an increased susceptibility to damage from impacts. In these conditions, especially below -7°C, it is recommended to fit a car set of the recommended winter tyres, see sub-section GK.6 for further information.

GK.2 - TYRE PRESSURE MONITORING SYSTEM (TPMS) - **Where fitted**

A tyre pressure monitoring system (TPMS) may be fitted dependant on the market the vehicle is built for. A sensor incorporated into each of the tyre valves monitors the air pressure inside the tyre, and supplies an onboard control module with this data by radio transmission. If any tyre pressure should fall below 75% of the recommended value, an alert message is sent to the instrument panel, and the tyre pressure tell tale  will light up amber. The fuel gauge display will then be overwritten with a message to indicate which tyre is concerned, with text such as: LF Low (left hand front tyre low pressure). This message will show for 5 seconds before the display reverts to the fuel level bar graph, but will repeat for 5 seconds at 30 second intervals.

The TPMS incorporates self-malfunction recognition, and if a fault is detected, the tell tale will flash for one minute and then remain constantly lit. The LCD panel will also flash ‘TPMS FAULT’ for 5 seconds, and repeat at 30 second intervals; no indication of low tyre pressure will be displayed.

Tyre fitters and service technicians should be made aware that TPMS is fitted, and that the tyre valves include pressure sensors. If the emergency tyre inflator aerosol has been used, it will be necessary to renew the tyre valve/pressure sensor. If a fault is indicated after wheel or tyre replacement, it is likely that a sensor has been incorrectly fitted or damaged. If a tyre valve is renewed, or is moved to a different wheel position, the TPMS will automatically identify the new configuration.

Note that the pressure sensors are powered by integral batteries, with an average service life of 10 years. It is recommended to renew all pressure sensors at this time interval.

If renewing a wheel, ensure that only a TPMS compatible wheel is used, as the installation angle of the tyre valve is modified to accommodate the pressure sensor. Compatible cast wheels are identified by 'TPMS' within one of the recesses in the hub mounting face. On TPMS compatible forged wheels, the profile of the wheel rim outboard of the central well, is modified in order to allow local machining around the valve hole on the inside of the rim to provide a shallower installation angle. If no machining is evident, the wheel is not TPMS compatible. In addition, a batch code is engraved onto the inner rim in the form of 'PS123456'. The first three numbers indicate the week and year of manufacture, and any wheel with a code of PS267### (week 26 of 2007) or later, will be TPMS compatible. TPMS type wheels may be fitted on all cars.

TPMS fault codes

On detection of a fault, the TPMS integrated diagnostics will set an appropriate code which may be read using the Lotus Techcentre:

C0550	TPMS ECU Failure
C0551	TPMS Module not programmed with Vehicle Configuration
C0558	TPMS Vehicle Sensor ID's not programmed
C075A	TPMS Pressure Sensor LF Malfunction / Battery Low / Broken Shock Sensor
C075B	TPMS Pressure Sensor RF Malfunction / Battery Low / Broken Shock Sensor
C075C	TPMS Pressure Sensor LR Malfunction / Battery Low / Broken Shock Sensor
C075D	TPMS Pressure Sensor RR Malfunction / Battery Low / Broken Shock Sensor
C0777	TPMS Sensor Autolocation Failed
C0800	TPMS Module Supply Voltage Below 9V / Above 18V
U2103	TPMS Communications Malfunction

In the first instance, the car should be driven gently at 40 mph in order to optimise conditions for sensor recognition. If the fault persists, the following action should be considered:

550/551/558 – most likely a TPMS module problem; renew
75A/B/C/D – most likely a pressure sensor; renew
777 – Most likely the module but could be a rogue sensor
800 – Check supply voltage and ground connection
U2103 – Could be module, CAN cable connection or engine T4e controller

Tyre and TPMS Transmitter Removal Recommendations

The following steps are recommended to prevent accidentally damaging a TPMS sensor during tyre removal as well as ensuring its continued accurate pressure monitoring and air tight sealing against the wheel rim.

TPMS Transmitter/Tyre Removal:
To prevent damaging the sensor during the tyre removal process it is recommended to release the transmitter from the wheel rim before breaking the tyre bead or removing the tyre from the wheel rim.

1. Remove the valve core and release the air from the tyre.

2. Using a suitable deep socket, remove the conical seal nut from the TPMS transmitter valve stem.

3. Gently bounce the tyre to ensure that the transmitter falls to the bottom of the wheel/tyre assembly.

4. When breaking the wheel/tyre bead ensuring TPMS transmitter is to the bottom of the assembly and away from the tyre changing machines bead breaking arm.

5. Using the tyre changing machine, remove the tyre from the rim in the normal manner.

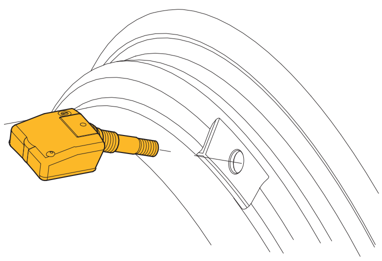
6. The TPMS transmitter can then be safely removed from the tyre.

TPMS Transmitter/Tyre Refitment:
Replacement TPMS transmitters are supplied with a new conical valve stem seal (go straight to step 3), but if the original transmitter is to be refitted then the valve stem seal must be renewed to ensure continued air tight sealing between the valve stem to wheel rim.

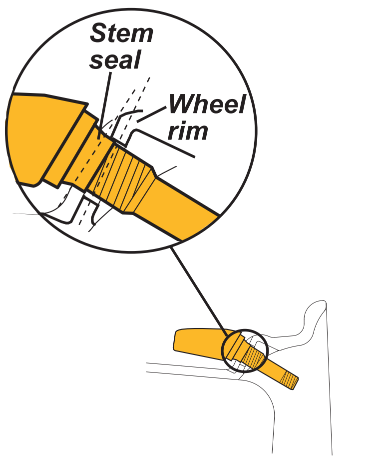
1. Remove old conical seal using pliers to squeeze the seal away from the valve stem, cut it and then remove from the seal.

2. Fit a new seal by placing it on the end of the valve stem, then, using the open end of a Schrader core screw-driver or other suitable tool, push the seal onto the base of the TPMS transmitter stem.

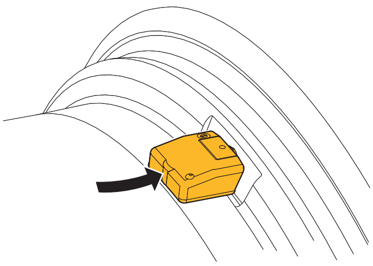
3. From the inside of the wheel rim, place the transmitter valve into wheel rim valve hole.



4. Place one side of the seal (top side of the transmitter case as seen from above) in contact with the valve hole.

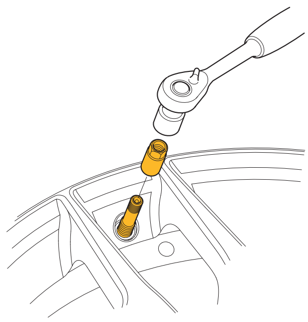


5. Push the rear of the transmitter case to twist the seal into the valve hole. The seal will snap into the hole when it is correctly position.

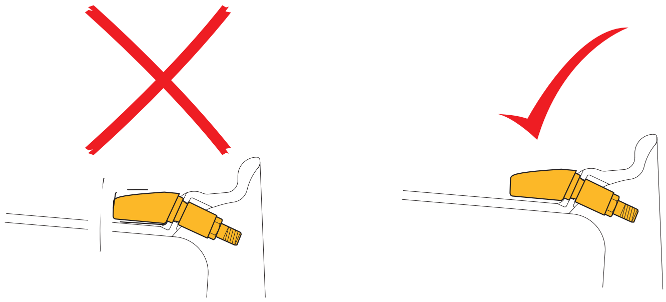


6. Fit the conical seal hut onto the valve stem thread and tighten until it touches the wheel rim.

7. Holding the rear of the transmitter case and using a suitable deep socket tighten the conical seal nut (torque 7.5Nm).



Note: to ensure that the conical nut is torqued correctly so producing an air tight seal between the valve stem and wheel rim it is essential not to push on top of the transmitter cars or lift it up whilst tightening the conical valve nut.



When refitting the tyre on the wheel rim, ensure that the transmitter is placed ahead of the bead fitment arm to prevent potentially damaging the transmitter case during refitment.

Valve Core Replacement
If replacing the valve core ensure that only an electroless nickel plated core is fitted. Using a plain brass core may cause galvanic corrosion occurring between the core and the aluminium valve stem causing eventual loss of tyre pressure.

Valve Cap Replacement
Only plastic valve caps should be fitted to a TPMS tyre valve. The fitment of a metal cap may cause galvanic corrosion between the metal cap and the stem of the aluminium valve. The resulting damage caused to the valve whilst trying to remove the corroded cap could also cause a TPMS system failure.

GK.3 - WHEELS

Road wheels on the Exige S are Lotus styled, cast alloy, 5 spoke-split arranged in pairs, silver or black painted with a diamond cut finish.

A bespoke set of cast alloy, 12 spoke wheels are designated for use with the recommended winter tyres, see sub-section GK.6 for further information.

Each wheel is located by a central spigot and secured by five bolts, four of which have a spline socket head, and one with a security coded head. A splined extension tool and a coded adaptor are supplied with the vehicle and require a 17mm hex. socket, square drive extension and a torque wrench.

Technical Data

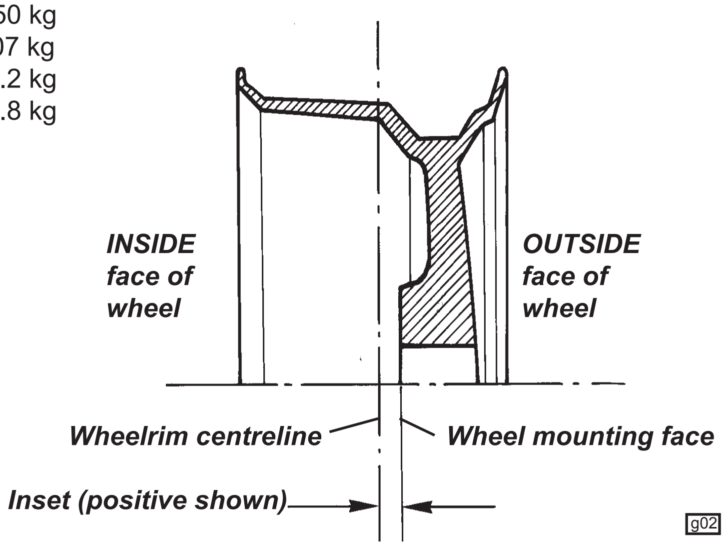
Road Wheel		
Type		Cast alloy, 5 spoke-split in pairs, silver or black, 5-bolt fixing with diamond cut machine finish on the 5 radial spokes
Size	- front	7.5J x 17 H2 ET26.3
	- rear	9.5J x 18 H2 ET35
Inset	- front	+ 26.0 mm
	- rear	+ 35.0 mm

Winter Wheel		
Type		Cast alloy, 12 spoke, matt black 5-bolt fixing
Size	- front	7.5J x 17 ET26.3
	- rear	8.0J x 18 ET14.4
Inset	- front	+ 26.0 mm
	- rear	+ 14.4 mm

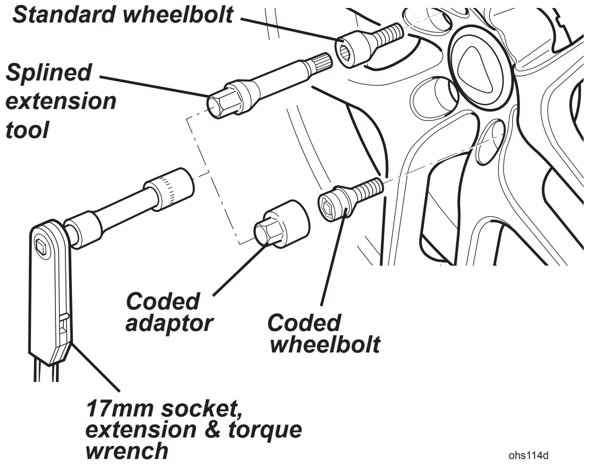
PCD (Pitch Circle Diameter)		
	- Front	110.0 ± 0.1 mm
	- Rear	114.3 ± 0.1 mm
Wheel bolts	- thread	M12 x 1.5 x 26 mm
	- torque	105 Nm
	- seat	60° taper
Centre spigot hole diameter		65 mm
Radial run-out at bead seat		0.3 mm max.
Lateral run-out at bead seat		0.3 mm max.

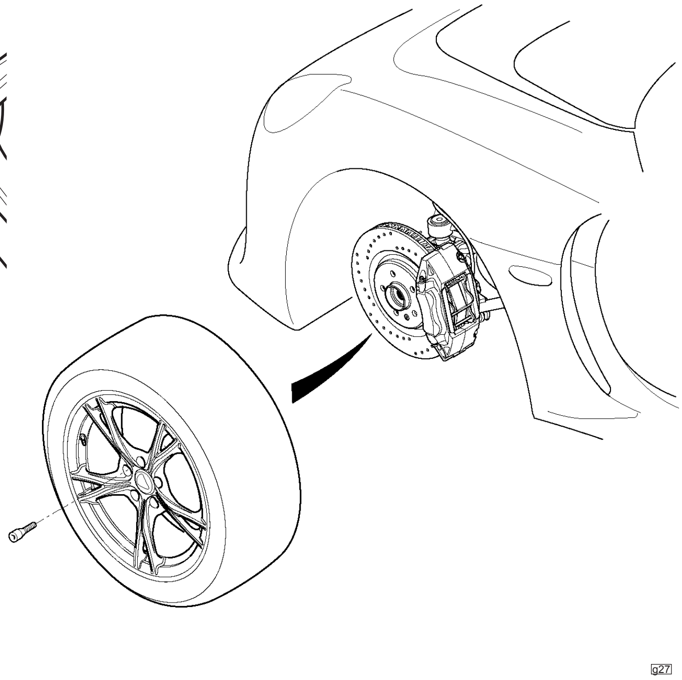
Weights		
Road wheel	- Front	7.50 kg
	- Rear	11.07 kg
Winter wheel	- Front	9.2 kg
	- Rear	9.8 kg

Note that the inset figure is the displacement of the wheelrim centreline relative to the wheel/hub mounting face. A positive inset indicates that the wheelrim centreline lies inboard of the wheel mounting face, whereas a negative inset means the wheelrim centreline is outboard of the mounting face.



GK.4 - WHEEL BOLTS





The wheel bolts used are of a special design to suit the small diameter fixing tunnels in the wheel centres. The bolts have an M12 x1.5 thread, 60° conical seat, and a 10 spline socket head for which a special extension tool is supplied with the car.

A 17 mm a/f deep socket and 1/2 inch square drive torque wrench should be applied to the extension tool, with a tightening torque of 105 Nm required.

To protect against wheel theft, one of the five bolts securing each wheel is key coded, and requires a correspondingly coded adaptor tool.

Both the standard extension and coded socket tools are stowed in the rear luggage compartment within the vehicle tool kit, and should remain with the car at all times to ensure that servicing may be performed.

The key code included in the tool kit should be recorded and kept safely with the vehicle documents, in case a replacement socket tool needs to be ordered.

Wheel Bolt Removal
Fit the adaptor tool onto a 1/2 inch square drive extension.
Rotate the adaptor until until full engagement into the bolt head is assured before applying torque. Note that an alignment mark is provided on the coded bolt head and adaptor tool to aid refitting.

GK.5 - TYRES

The Pirelli P-Zero Corsa tyres fitted as standard production for the 'Sports' option are suitable for all normal weather conditions. The tyre characteristics include good feedback (‘feel’) from the road surface to the steering wheel, a high level of steering linearity and response, and little performance degradation with the raised temperatures which may be reached in high speed use.

Although approved for road use, the Pirelli P-Zero Corsa Trofeo tyres fitted as part of the ‘Race’ pack option are primarily designed for racetrack driving. In the event of wet road conditions with the risk of aquaplaning, prudent driving at a reduced road speed is recommended.

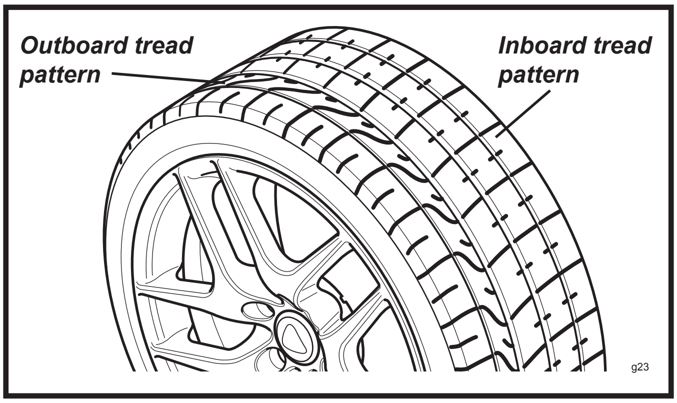
Trofeo Tyre Fitment
The different construction of the Trofeo tyre requires an increased inflation pressure to seat the tyre on the Exige S styled rim.

Pirelli has advised a 5.0 bar maximum pressure when using manual mounting methods to seat the Trofeo tyre on the rim.

Note: To ensure technician safety, the wheel/tyre assembly should be position in a cage whilst attempting to seat the tyre on the rim due to the increased pressure requirements.

Tyre performance will decrease at low ambient temperatures, resulting in reduced levels of grip and an increased susceptibility to damage from impacts. In these conditions, especially where average temperatures are below 0°C (32°F), or where snow may be expected, it is recommended to fit a car set of the recommended winter tyres, see sub-section GJ.6 for additional information.

Note that the Pirelli P-Zero tread pattern is asymetrical, so that when fitting tyres, attention must be paid to the sidewall marking, and the side of the car for which the wheel and tyre is intended.



Wear indicators are moulded into the bottom of the tread grooves at intervals around the tyre, indicated by small pointers on the outer tread blocks. The tyres should be replaced before being worn to this minimum legal tread depth.

Tyres

Type	- std.	Pirelli P-Zero Corsa
	- opt.	Pirelli P Zero Trofeo
Size	- front	205/45 ZR17 - 88Y
	- rear	265/35 ZR18 - 97Y (std.) 93Y (opt.)

Pressure (cold)

- front - std & opt. 2.2 bar (31.9 lb/in²)
- rear - std & opt. 2.6 bar (38 lb/in²)

GK.6 - WINTER TYRES & SNOW CHAINS

If the car is to be used in very cold climates, or driven on snow covered roads, it is recommended to fit a complete vehicle set of winter tyres developed specifically for such conditions. For the Exige S, Lotus recommends the use of Pirelli SottoZero Serie II winter tyres in sizes specified below fitted with bespoke winter wheels as described in sub-section GK.3.

Wear indicators are moulded into the bottom of the tread grooves at intervals around the tyre, indicated by small pointers on the outer tread blocks. In order that these tyres maintain their design performance on snow covered roads, the minimum tread depth is designated as 4 mm, which is reflected in the height of a secondary set of wear indicators.

Note that the tread pattern is asymetrical, so that when fitting tyres, attention must be paid to the sidewall marking, and the side of the car for which the wheel and tyre is intended.

Winter Tyres		
Type	- front	Pirelli 210 SottoZero Serie II
	- rear	Pirelli 240 SottoZero Serie II
Size	- front	205/45 R17 - 88V M+S
	- rear	235/40 R18 - 95V M+S
Pressure (cold)		
	- front	2.3 bar (33.5 lb/in²)
	- rear	2.6 bar (36 lb/in²)

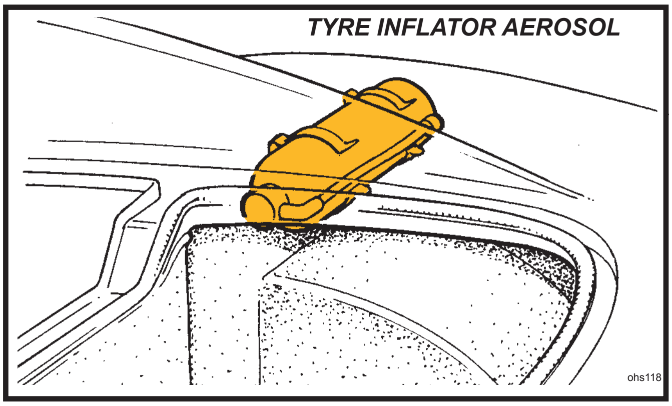
WARNING:
- **When winter tyres are fitted, a maximum speed of 118 mph (190 km/h) must be observed.**
- **The tyres are NOT suitable for studding.**

Snow Chains
In extreme weather conditions, Lotus approves the fitment of RUD-matic Classic R48493 snow chains used only in conjunction with winter tyres (see above) and fitted only on the rear wheels. Close attention should be paid to the fitting and tensioning instructions supplied with the chains. The chains should be removed as soon as road conditions allow.

GK.7 - PUNCTURED TYRE EMERGENCY INFLATOR (If fitted)

In order fully to exploit the benefits of light weight, and to maximise stowage space, the Exige S has no provision for spare wheel carriage or lifting jack.

A temporary puncture sealing facility is provided in the form of an emergency tyre inflator aerosol mounted in a spring clip at the extreme right hand side of the boot. If possible, avoid driving on a deflated tyre, or irreparable damage to the tyre structure may be caused.



When the aerosol is connected to the tyre valve, and the button pressed, a mixture of liquid latex and propellant is injected into the tyre, such that the solidifying latex is forced into the puncture site at the same time as the tyre is inflated, effecting a temporary repair and enabling the car to be driven at low speed to the nearest tyre depot.

WARNING:
- **Use of the aerosol does not constitute a permanent repair, but is designed to allow the car to be driven to the nearest tyre depot. At the earliest opportunity, the tyre should be professionally repaired or replaced dependent on the severity of the damage.**
- **Until the tyre is repaired or replaced, the car should be driven only in a moderate manner, not exceeding 30 mph (45 km/h).**
- **Do not use the aerosol for large holes or repairs, or when the tyre sidewall has been damaged, or if the tyre has been displaced from the rim.**
- **For safety reasons, the aerosol should be carried at all times in the designated stowage position. Never carry in the passenger compartment.**

As soon as a puncture is suspected, the car should be stopped at the first safe opportunity. Continued driving on a deflated tyre will cause irreparable damage to the tyre.

Directions for use of the aerosol: Before using, carefully read all the instructions on the canister, or on any literature accompanying the product. The following instructions apply to the use of Holts Tyreweld:

1. Remove the object causing the puncture, and position the wheel with the puncture site lowermost. Deflate tyre fully.

2. Shake the can vigorously. In cold conditions, warm the can using the car's heater outlets, or by body warmth.

3. Screw the aerosol tube onto the tyre valve, remove the cap, hold the can upright and press the button until the tyre is firmly inflated.

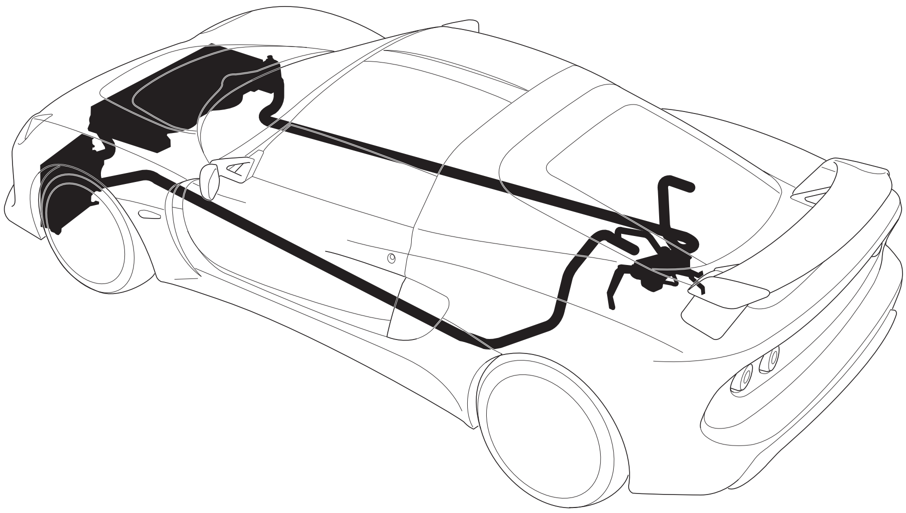
4. Immediately drive for 6 - 12 miles (10 - 20 km) (or to the tyre depot if nearer) in a moderate manner and not exceeding 30 mph (45 km/h), to allow the sealant to spread. Then check and adjust the tyre pressure.

5. Have the tyre professionally repaired or replaced at the earliest opportunity, and until such time, limit speed to 30 mph (45 km/h) with a moderate driving manner. Note that some tyre repairers may make an additional charge for cleaning the sealant off the tyre before repair, and that any subsequent repairs may not be guaranteed. Be aware that the electronic pressure sensor mounted inside the tyre and integral with the tyre valve, could be obstructed by the sealant, and should be renewed.

6. Renew the emergency inflator aerosol.

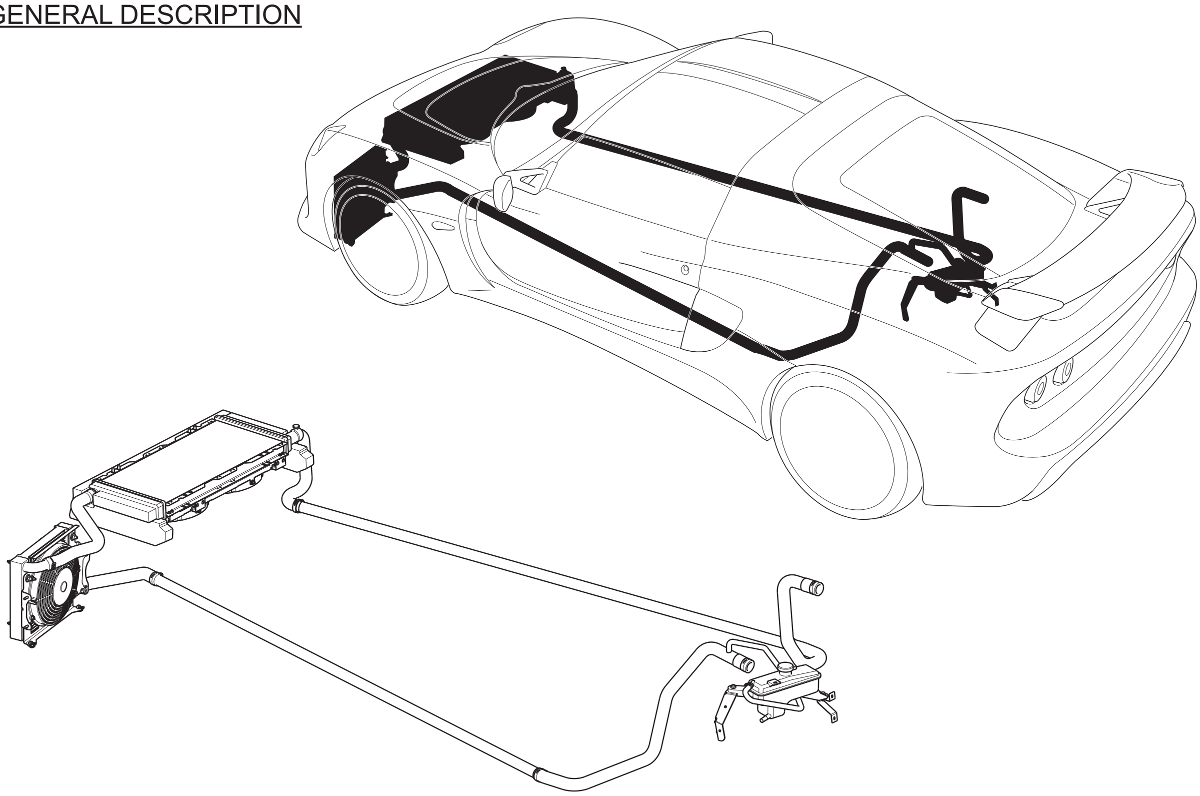
ENGINE COOLING

SECTION KR

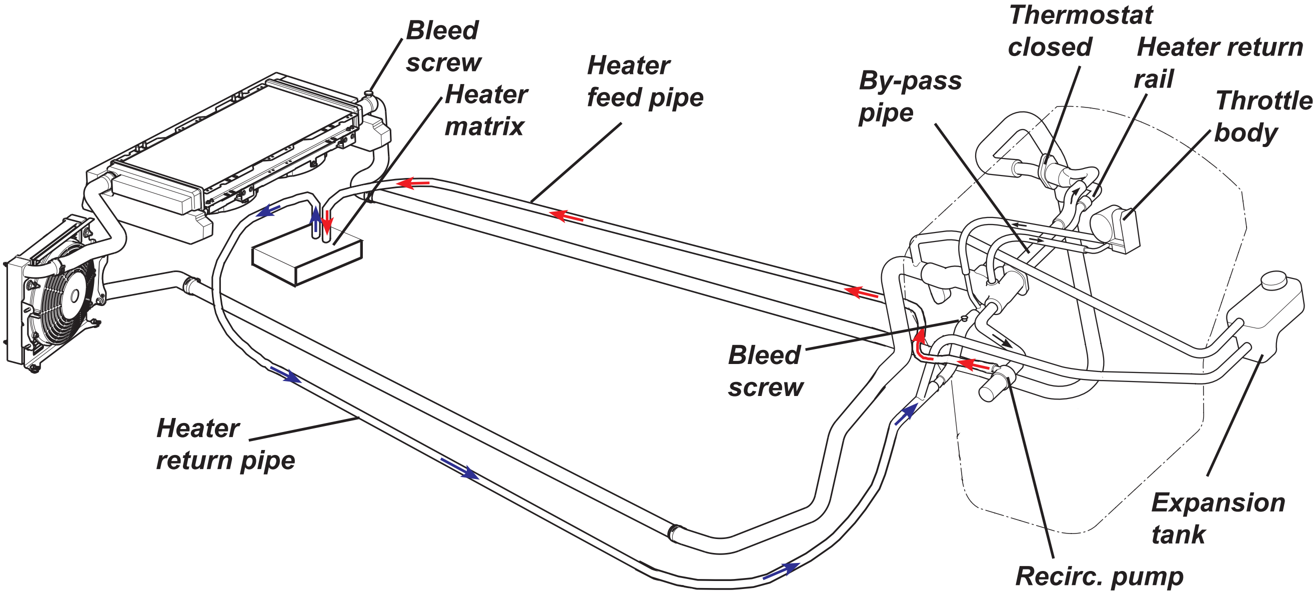


***See also 2GR FE engine repair CD; T000T1516F (Toyota production)**

KR.1 - GENERAL DESCRIPTION



The engine liquid cooling system comprises an engine driven water pump, flow thermostat, auxiliary coolant radiator with a single electric cooling fan mounted forward of the LHF wheel, a front centrally mounted radiator with two electric cooling fans, header tank, re-circulation pump, and associated plumbing.



The centrifugal water pump is mounted on the front face of the cylinder block, and is driven by the multi-rib, serpentine auxiliary belt. The pump discharges coolant into a separate volute chamber for each of the two cylinder banks, where, after cooling the cylinders, flow is directed upwards into each cylinder head before exiting into an outlet housing bolted to the rear of the cylinder heads. From this housing, offtakes are provided for the engine cooling radiators, heater matrix, throttle body and radiator by-pass pipe. A thermostat housing is located on the timing cover above the water pump, and controls the flow of returning coolant from the front mounted radiators.

Thermostat closed circuit (cold engine):
At coolant temperatures below 80°C (176°F) the dual valve thermostat is closed, shutting off the return circuit from the radiator and opening a by-pass valve to admit coolant from a by-pass pipe connected to the outlet housing on the rear of the engine. Coolant exiting the cylinder heads meets a closed radiator circuit and is directed through four subsidiary circuits:

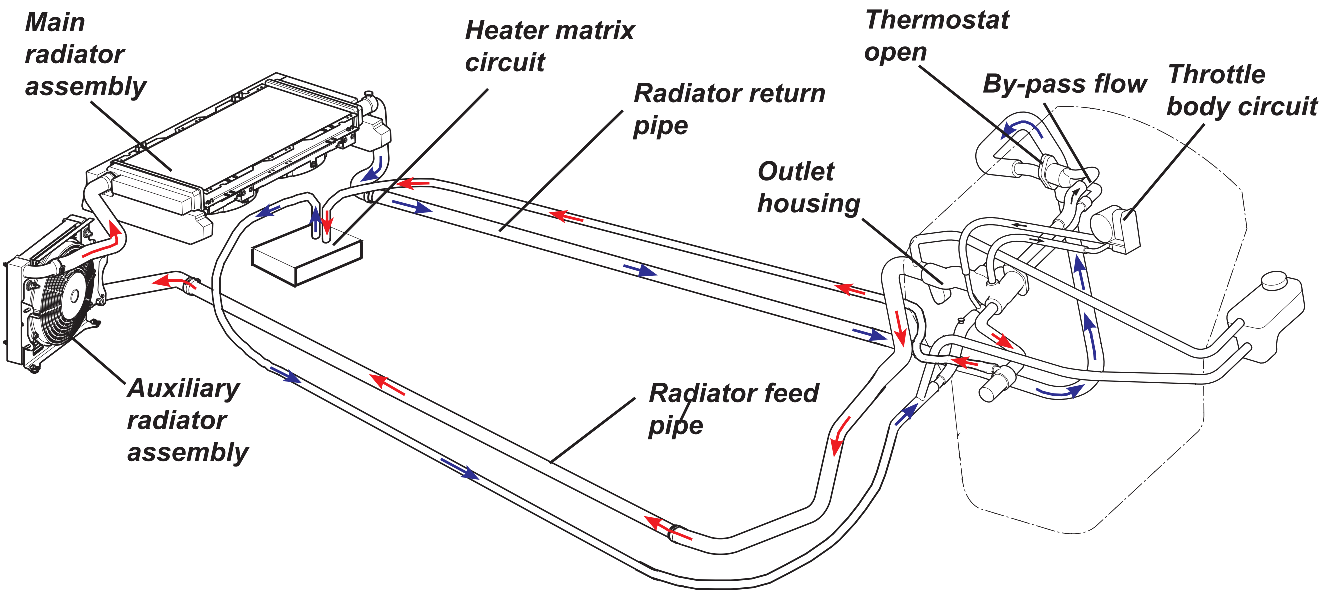
By-Pass: The greater proportion of flow is via the radiator by-pass pipe back to the engine side of the thermostat housing.

Throttle body: A small offtake on the outlet housing supplies a flow of hot water to the throttle body to inhibit ice formation around the valve in severe climatic conditions. An outlet hose from the throttle body connects to heater return rail.

Heater: A spigot on the coolant outlet housing is used to supply the heater circuit. Water flows via a re-circulation pump, into an aluminium pipe routed along the outside of the right hand chassis siderail, within the composite sill member. The front end of this pipe rises over the end of the scuttle, penetrates the plenum/scuttle baffle panel, and connects to the heater matrix mounted in the chassis front climate chamber.

The heater return circuit is similarly routed along the left hand side of the chassis and connects to the rear end of the heater return rail. This return rail is routed down the 'V' of the cylinder block, alongside the by-pass pipe, and connects to the engine side of the thermostat housing.

Thermostat open circuit (normal running temperature):
At temperatures above 84°C (183°F), the thermostat fully opens the radiator circuit, and closes the by-pass valve.



From the coolant outlet housing at the rear of the engine, a pipe running through the left hand sill directs coolant initially to the inboard inlet spigot of the auxiliary radiator. The radiator is of an aluminium construction incorporating a RH side inlet tank and LH side outlet tank and is secured to the composite crash structure with a mounting bracket.

Airflow is admitted through the front clamshells LHF side intake grille, the cooling air is directed towards the forward face of the radiator via a duct positioned between the grille and radiator.

The airflow is increased when necessary by an 225mm ∅ electrically operated fan with 12 curved blades which is housed in a plastic shroud, the assembly is then fixed to the opposite/rear face of the auxiliary radiator.

The coolant exits the auxiliary radiator from the outboard outlet spigot and is then directed to the LH inlet spigot of the centrally mounted front radiator.

The central radiator is of aluminium construction with plastic end tanks and is horizontally mounted on top of the glass fibre composite 'crash structure' which also serves as a duct to direct airflow from the body nose air intake to the underside of the radiator.

Twin 100 mm diameter electric cooling fans are fitted to the underside of the radiator to supplement, when required, the ram air flow, and a moulded deflector panels direct air exhausting from the top of the radiator through outlet grilles in the front bonnet. On cars equipped with air conditioning, the condenser is sandwiched between the radiator and crash structure, with the cooling fans attached to underside of the condenser.

The RH outlet spigot on the radiator feeds a return pipe routed down the inside of the chassis right hand side rail, which is then connected to the thermostat housing on the front of the block. Coolant flowing through the open thermostat enters the water pump to commence another circuit.

The heater and throttle body circuits continue to operate as described above, with a low flow-rate through the radiator by-pass circuit.

Expansion tank
To ensure that the cooling system remains fully filled, whilst providing expansion space for the hot coolant and to facilitate 'topping up' of the system, a translucent header tank is mounted at the LH rear of the engine bay. The tank is connected into the cooling system via a hose which joins into the heater return hose, whilst an air bleed hose from the radiator feed hose near the outlet housing, connects to the air space in the header tank. A threaded, 108 kPa (15 psi) pressure cap is fitted to the neck of the tank.

Re-circulation pump
In order to control engine temperature in conditions of 'heat soak' after stopping a hot engine, an electric re-circulation pump is fitted in the heater take off hose between the engine outlet and heater feed pipework. The pump is enabled for a short period after engine shut down, and is energised under engine ECU control to pump coolant through the heater circuit and limit the potential for localised boiling within the cylinder head. For details of the pump control strategy, refer to sub-section KR.5

KH.2 - MAINTENANCE

Under normal operating conditions, the engine cooling system, being a closed circuit, should 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 header tank is mounted at the left hand side of the engine bay, with a hose from its underside connecting with the heater return rail near the thermostat housing. An air bleed hose connects the header tank air space with the radiator by-pass circuit and a cylinder head spigot at the front end of the inlet manifold. The tank is fitted with a 110 kPa (15 lb/in²) pressure cap to raise the boiling point of the coolant to over 120°C. The transluscent header tank is marked with both cold and hot level indicators. The level of coolant will rise as the engine warms up and the coolant expands, and will fall again as it cools down.

WARNING: Do NOT remove the cap or bleed plug 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 moulded 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 necessary that the coolant contains an anti-freeze with corrosion inhibitor to protect the engine and heat exchangers from both frost damage, and corrosion of the metallic elements. In order to protect against these dangers as well as raising the boiling point of the coolant, the Exige S is factory filled with a 50% concentration of Havoline XLC, which is a mono-ethylene glycol coolant using organic acid technology (OAT) to provide increased corrosion protection compared with conventional coolant additives.

The corrosion inhibiting carboxylic acids in the OAT coolant tend to remain in solution rather than being deposited on the internal surfaces of the cooling system, thus improving heat transfer and extending service life. Havoline XLC is the only recommended coolant product, and at 50% concentration provides freezing protection down to approximately - 40°C. Even 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 antifreeze concentration is to measure the specific gravity (density) of the coolant at a known temperature, using a hydrometer. The following table provides a general guide:

	Density @	
Concentration	20°C	60°C
25%	1.039	1.020
33%	1.057	1.034
50%	1.080	1.057

The coolant density reflects the effective level of mono-ethylene glycol, and not the level of corrosion inhibitors present, whose effectiveness diminishes over a period of time. The coolant should therefore be renewed every 4 years to ensure optimum corrosion protection.

In areas where the tap water is extremely hard (exceeding 250 parts per million), use of this water will lead to 'furring up' of the system over a period of time. In such areas, distilled, de-ionised or filtered rain water should be used.

Radiator Fin Cleaning
At service intervals, the matrix of the engine cooling radiator should be checked for clogging by insects, leaves and other debris. If necessary, use a water jet from both above and below to clean the fins, taking care not to damage the fragile tubes or distort the finning. At the same time, check the integrity of all cooling system joints, and the condition of all flexible hoses. In snowy conditions, ensure the radiator air exit is cleared of snow before driving the car.

KR.3 - DRAIN/REFILL PROCEDURE

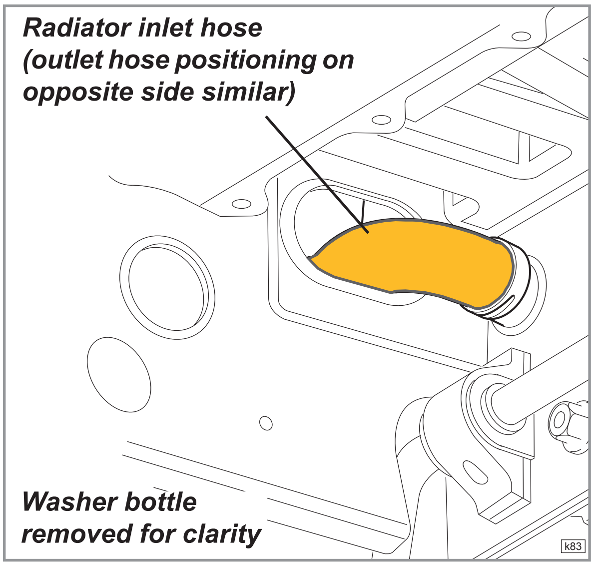
To drain the engine cooling system:

1. Remove the front and rear undertrays - see service notes sections AN.2 and AN.3 for further information.

2. Disconnect the radiator feed and return hoses from the front ends of the thro' chassis pipes, and collect the draining coolant using a suitable container. Remove the header tank cap to speed the operation.

3. Open the drain tap on each side of the cylinder block (if fitted), left drain being near to the back of the a.c. compressor, and on the right, towards the rear end of the block and drain the coolant. *See Toyota engine repair CD manual T000T1516F for further information.*

   Note that draining of the heater matrix is not easily possible with the unit 'in situ', and that if draining for the purpose of coolant change, this volume should be disregarded.

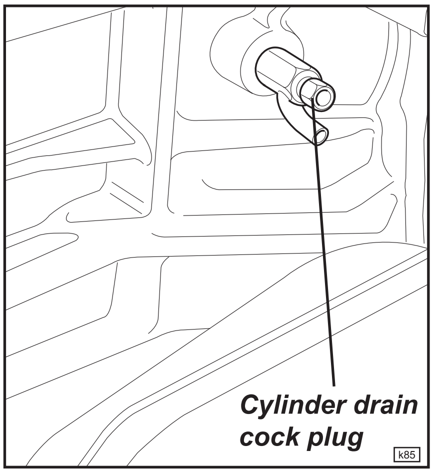


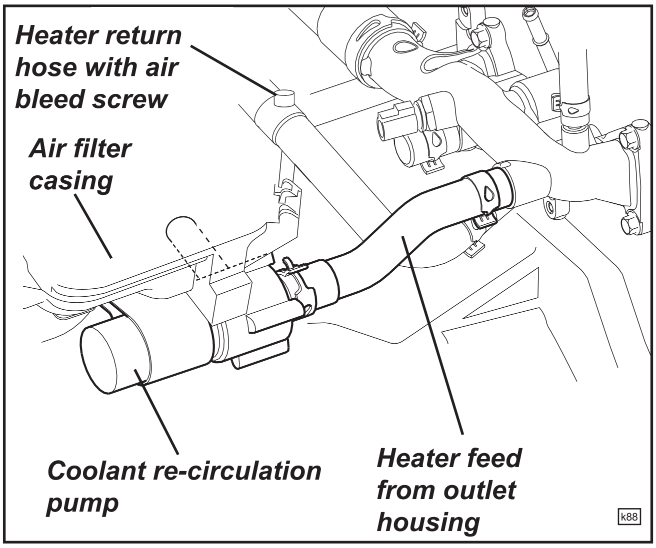
To refill the system:

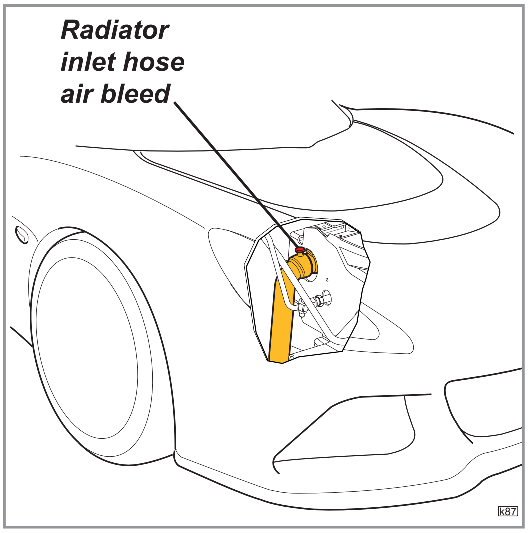
- Refit the hoses to the feed and return pipes and close the cylinder block drain taps (if fitted).

- Remove the right hand front wheelarch liner and open the air bleed plug on the radiator outlet hose. From within the engine bay, open the air bleed plug in the heater return hose near its connection with the return rail at the left hand rear of the engine bay.

- Fill with the recommended coolant mix (see Service Notes section TDV for further information) via the header tank and close the bleed plugs when a steady stream of coolant is expelled.



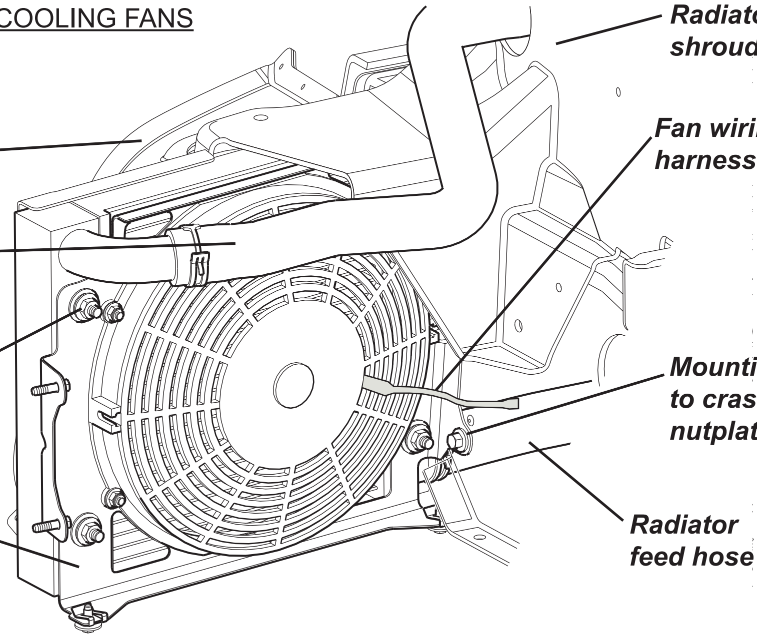




Start the engine and allow to idle, and periodically open the bleed plugs to allow any trapped air to be expunged. Top up the header tank when necessary, and fit the pressure cap when required to prevent overflow. When the cooling fans have cut in and then out, stop the engine and allow to cool. Recheck coolant level when fully cold.

KR.4 - RADIATORS, HOSES & COOLING FANS

Auxiliary Radiator



To remove:
1. Remove the front undershield - see Service Notes introduction section AN.3 for information.

2. Remove the front clamshell - see Service Notes section BT.6 for information.

3. Release the M6 nyloc nuts and washers (4) securing the ducting to the front face of the auxiliary radiator (torque 20Nm).

4. Release the spring band type hose clamps securing both the auxiliary radiator feed hose and exit hose to the central radiator, disconnect the hoses and collect the draining coolant using a suitable container. Remove the header tank cap to speed the operation.

5. Disconnect the fan assembly's multiplug connector from the main harness.

6. Release the M8 X 20 screws and washers (2) securing the auxiliary radiator mounting bracket to the nut plate bracket which is positioned in place with rivets to the inside face of the crash structure (torque 20Nm).

7. Release the M8 nuts and washers (4) securing the mounting bracket to the 4 integral studs on the auxiliary radiator (torque 20Nm).

8. The mounting bracket and fan assembly can now be withdrawn by sliding it off of the 4 integral radiator studs, ensuring to collect the combined compression sleeves and bushes (4) that should still remain on the studs.

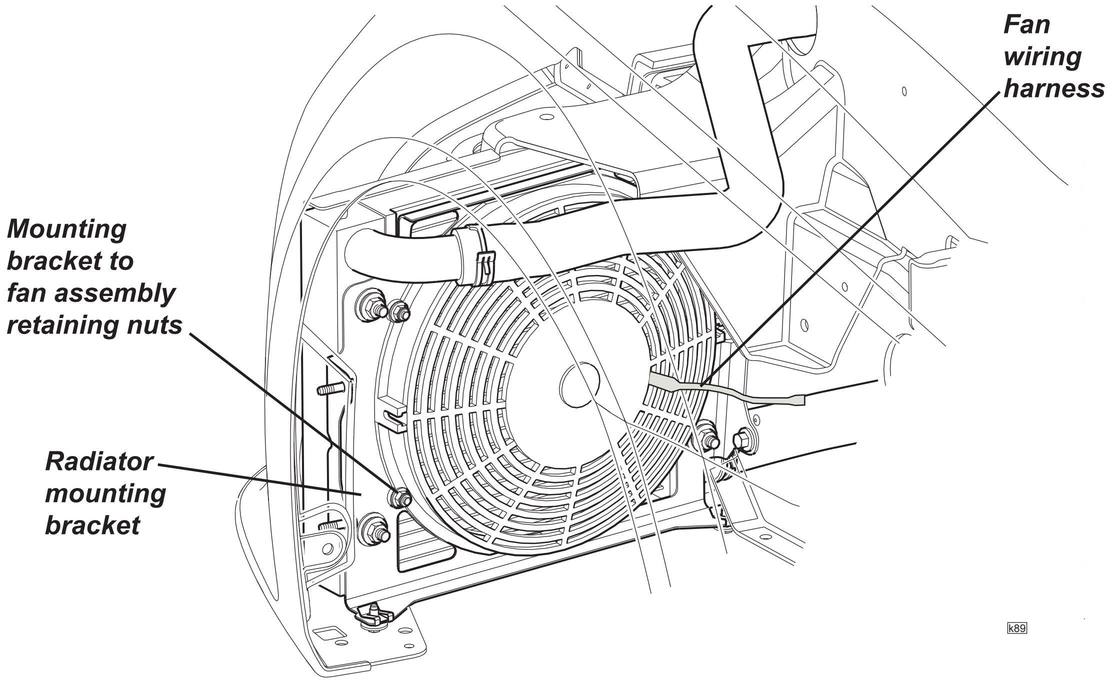
9. The auxiliary radiator can now be withdrawn forward from the radiator housing and removed from the vehicle.

To refit:
Is the reversal of removal except:
- It is recommended to renew the compression sleeve bushes as they are vital to set the pre-load compression to set the torque for the radiator mounting bracket nuts (the compression sleeves are re-usable).

- Incorrect pre-load will affect the tightening torque of the bracket which may lead to the radiator becoming insecure on its mounting bracket with the resulting vibrations causing premature wear of the radiator.

- Refill with coolant - see Service Notes section TDV for coolant specification and bleed system as detailed in sub-section KR.3. Re-charge refrigerant system - see service notes section PK.4 for further information.

Auxiliary Radiator Fan



To remove:
1.Remove the front LHF wheelarch liner.

2.Disconnect the fan assembly's multiplug connector from the main harness.

3.Release the M6 nyloc nuts and washers (4) securing the fan motor and shroud to the auxiliary radiator mounting bracket and withdraw the fan assembly (torque 8Nm).

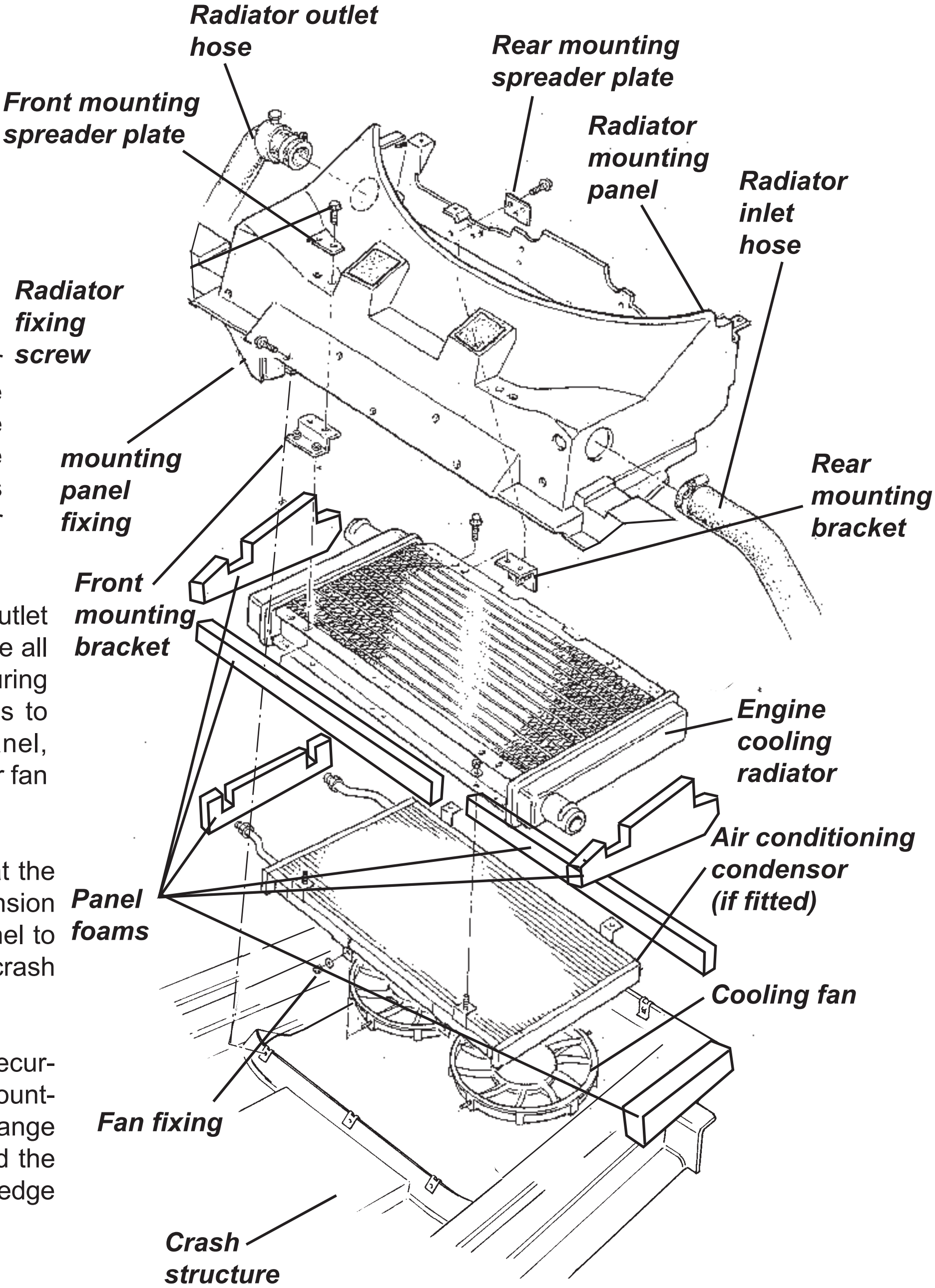
Refitment
Is the reversal of removal.

Central Radiator

The aluminium cored radiator is positioned horizontally on top of the composite 'crash structure' in the front services compartment. A composite moulding is used to mount the radiator, and also, via extensions at each side, to provide a mounting point for the inside front of the clamshell wheelarch. The radiator must be removed for access to the cooling fans.

To Remove Radiator:

1. Remove the front clamshell (see section BT.6).
2. Drain the coolant (see section KR.3) and disconnect the feed and return hoses from the radiator.
3. If the car is equipped with air conditioning, de-pressurise the system and recover the refrigerant via the service ports - see service notes section PK.4 for further information.
4. Remove the two radiator outlet air deflector panels, release all tie wraps and fixings securing wiring hanesses and pipes to the radiator mounting panel, and disconnect the radiator fan harness plugs.
5. Release the single fixing at the bottom of each side extension securing the mounting panel to the bottom flange of the crash structure.
6. Release the three fixings securing the back edge of the mounting panel to the vertical flange on the crash structure, and the three fixings along the front edge of the panel.

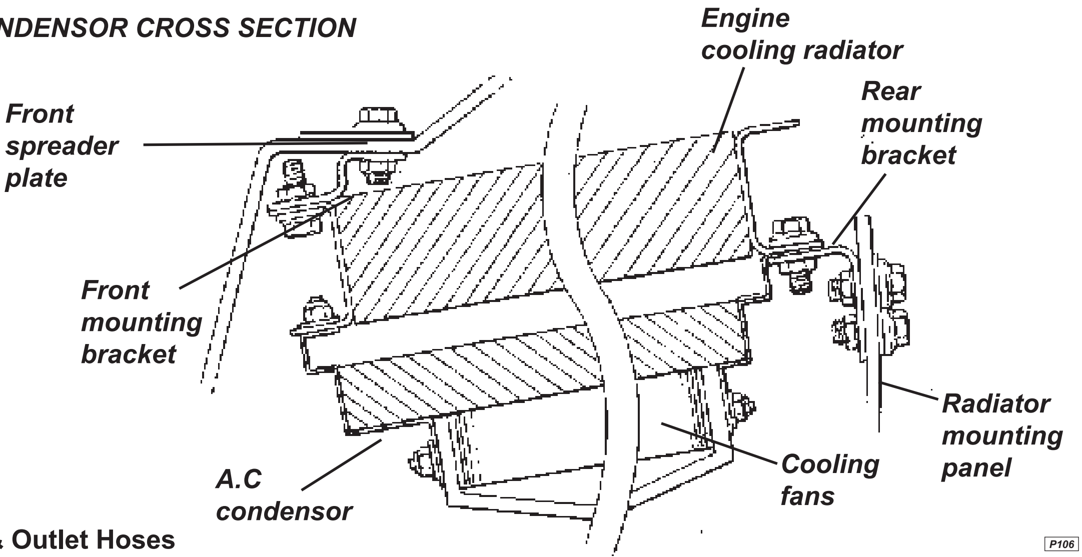


7. Withdraw the radiator and cooling fan assembly. On cars fitted with air conditioning, lift the radiator/condensor pack assembly only sufficiently to release the cooling fans or radiator as required, without disconnecting the refrigerant circuit.
8. Each cooling fan is secured by two studs and nuts to either the radiator flange bracket, or, on a.c. cars to the condenser. The condensor is secured to the radiator lower flange by two studs at the front edge, and by two pairs of screws at the rear edge. The radiator is fixed to the mounting panel by brackets at the front and rear. Note the foam packing used between the radiator and mounting panel to ensure that all ducted air flows through the radiator matrix.

Refit the radiator in reverse order to removal except:

- All bracket fixings tightened to 20Nm.
- Ensure that the foam packing is re-installed.
- Refill with coolant - see service notes section TDQ for coolant specification and bleed system as detailed in sub-section KR.3. Re-charge refrigerant system - see Service Notes section PK for further information.

RADIATOR/CONDENSOR CROSS SECTION



Radiator Inlet & Outlet Hoses

Dependant upon hose clip positioning it may just be possible gain access to the central radiator inlet or outlet hose clamps with the relevant wheelarch liner or indicator/headlamp removed.

But it may be impractical upon refitment to then ensure the correct hose positioning on the radiator and clamp tightening with the front clamshell still in situ.

Therefore it is recommended to remove the front clamshell when removing/refitting a radiator inlet/outlet hose. See service notes section BT.6 and KR.3 for further information.

KR.5 - RADIATOR FANS & RE-CIRC. PUMP CONTROL

The 3 radiator coolant fans and recirculation pump are controlled by the engine management ECU using data provided by the engine coolant temperature sensor and air intake flow meter located in the airbox casing.

Central Radiator Cooling Fan Operation With Engine Running
The 2 cooling fans fitted for the central radiator (also referred to as fans 1 & 2) are switched at the same time, and will operate at half speed (connected in series) if the vehicle speed is less than 85 mph (135kmh) once the coolant temperature reaches 95°C on rise, and will switch off at 92°C on fall.

Even with an engine coolant temperature below 96°C fans 1 & 2 will still operate at half speed (if the vehicle speed is less than 85mph) if the a.c. is switched on and the compressor is running or if the engine management system detects a fault with the inlet air temperature or coolant temperature circuits.

During these engine temperature/running conditions fans 1 & 2 are controlled from output RF1 from the engine management ECU to fan relay 3 which in turn activates fans 1 & 2 in series. The resistance in the circuit then activates the cooling fans at ½ of maximum speed (see service notes section MVA for circuit diagram information).

If the vehicle speed is less than 85 mph (a.c. switched off) and the coolant temperature rises to 99°C, fans 1 & 2 will switch to full speed (connected in parallel), reverting back to half speed at 95°C on fall. If the a.c is switched on and the engine temperature rises to 98°C fans 1 & 2 will also switch to full speed, reverting back to half fan speed at 95°C on fall.

During these engine temperature/running conditions fans 1 & 2 receive an additional output from connection RE2 from the engine management ECU which energises all 3 relays in a parallel feed. The reduction in circuit resistance now activates fans 1 & 2 at full speed.

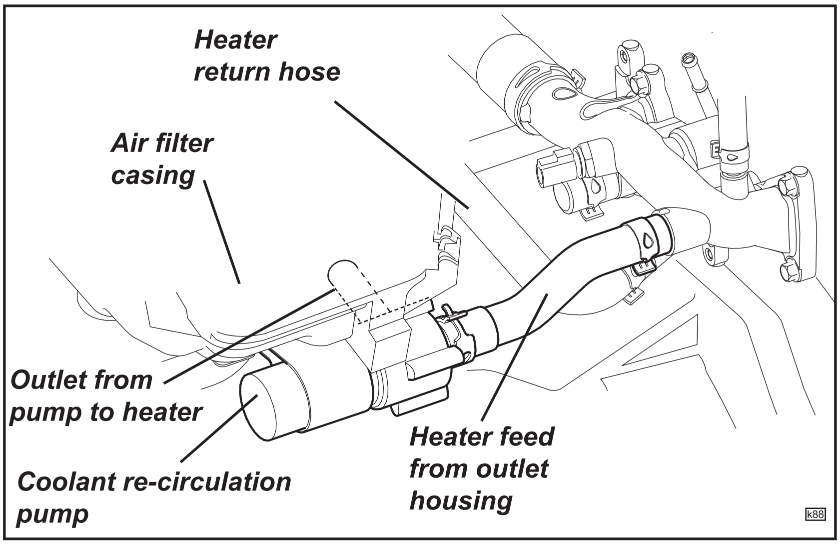
At road speeds in excess of 85 mph (135 km/h), equating to the fan stall speed, all functions for fan 1 & 2 are switched off.

Central Radiator Cooling Fan Operation with Engine Turned Off
If required fans 1 & 2 are still enabled at half speed even after the engine is turned off if the coolant temperature is still above 115°C and will switch off at 110°C on fall.

Auxiliary Fan Control
With a vehicle speed of less than 105 mph (170kmh) the auxiliary fan also referred to as fan 3 will operate at its single full speed once the coolant temperature reaches 103°C on rise, and will switch off at 99°C on fall. Fan 3 does not operate once the engine is turned off.

Re-Circulation Heat Soak
A coolant re-circulation electric pump is positioned below the air filter case which is directly above the transmission and is plumbed into the heater matrix feed line.

When energised via the main relay, the pump circulates coolant through the engine and heater system, drawing coolant from the back of the engine, and pumping it through the heater matrix to the heater return pipe and back into the thermostat housing.



Heat Soak Management Strategy
In order to help control engine temperature after switching off an engine whose temperature is over 92°C, the ECU will remain powered for a period of up to 20 minutes to allow heat soak management.

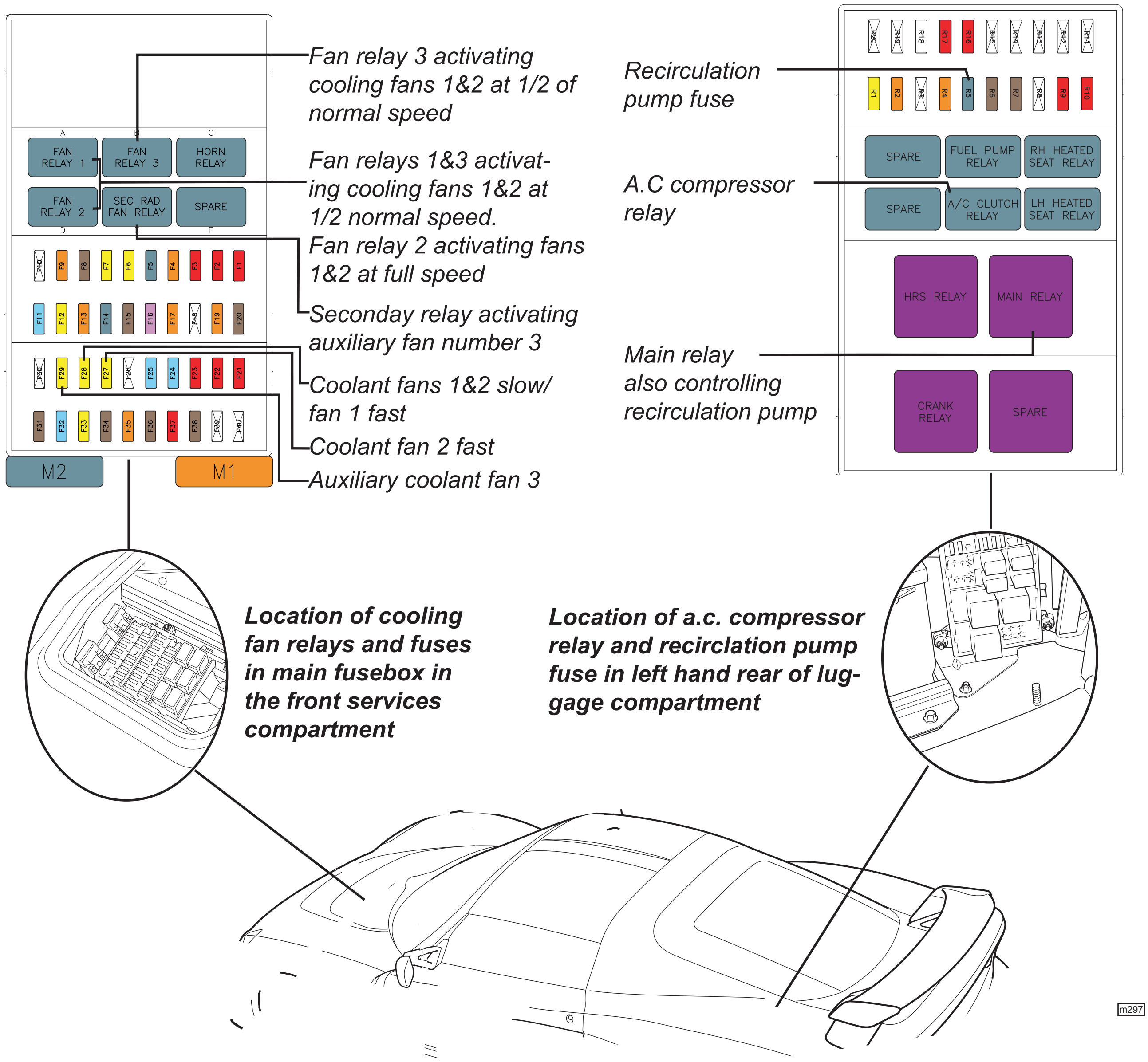
Under these conditions the pump will operate for 8 minutes with ignition off if the engine coolant temperature is over 108°C.

Re-Circulation Pump Strategy for HVAC
To assist in providing a warm cabin environment as quickly as possible, the recirculation pump will also operate under the following conditions whilst the engine is running.

if the airbox temperature is less than 15°C and the engine speed has been at idle for more than 20 seconds. The pump will switch off if the airbox temperature is greater than 19°C or the engine speed is greater than 2400 rpm.

If the airbox temperature falls below 19°C and the engine speed is less than 2300 rpm the pump will also operate, but again will switch off once airbox temperature is reaches 19°C or the engine speed is greater than 2400 rpm.

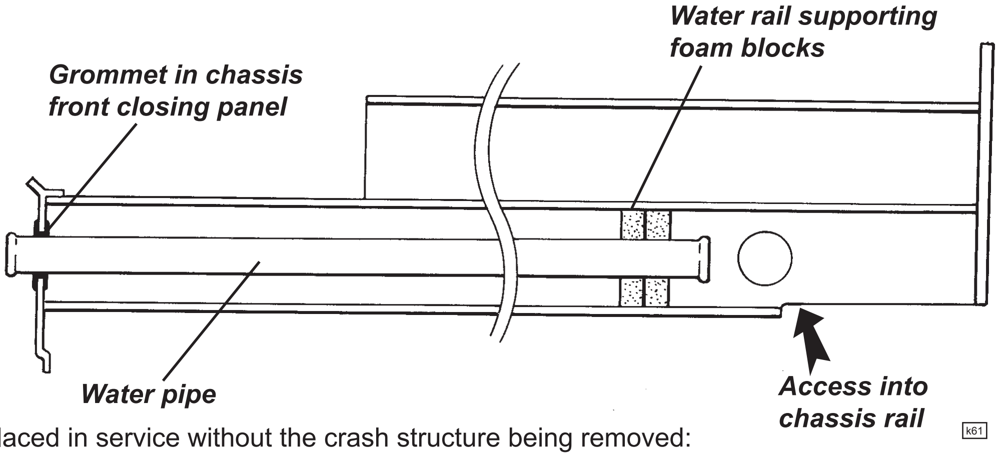
HVAC and Cooling System Control Fuses and Relays



KR.6 - RADIATOR FEED & RETURN PIPES

The radiator feed and return pipes are routed through the chassis main side rails, feed on the left, and return on the right. Each pipe is located by a grommet in the chassis front closing panel, and by a pair of shaped foam blocks inserted into the rear end of each chassis rail.

On initial build, the water pipes are fitted before the crash structure is bonded to the front of the chassis. A new chassis assembly is supplied with both water pipes and the crash structure pre-fitted.



If a pipe is to be replaced in service without the crash structure being removed:

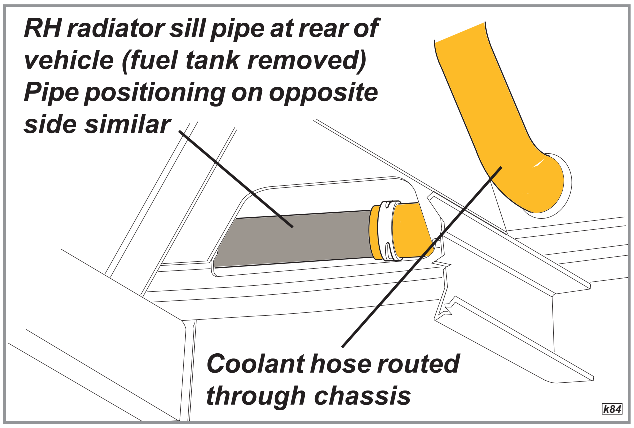
1. Drain the coolant and remove the front clamshell (see sub-section KR.3 & Service Notes section BT.6).

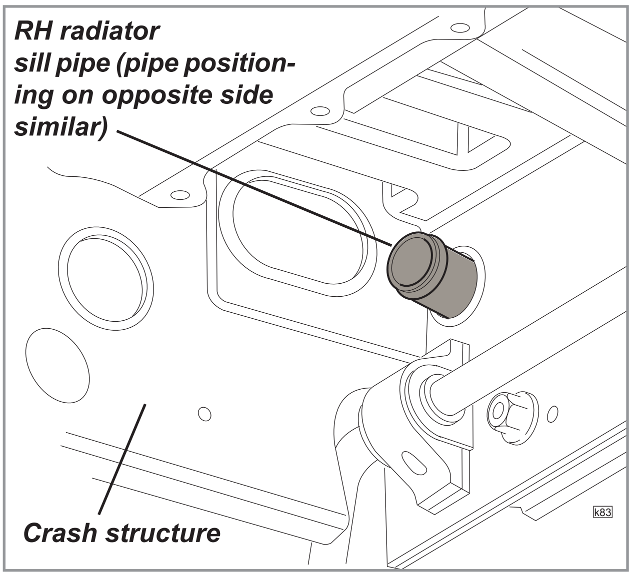
   WARNING: The machined edges of the chassis extrusions and the ends of the drive fasteners can present sharp edges and points representing a potentially serious health hazard. It is strongly recommended that industrial gloves are worn, and other suitable precautions taken to provide protection from cuts and abrasions.

2. Release the hoses from the rear ends of the water pipes (this requires that the fuel tank be removed). Access is available only via apertures in the inner walls of the chassis siderails within the fuel tank bay. To remove the tank refer to sub-section XX.4. The hoses are secured to the rear ends of the water pipes by spring clamps requiring a suitable tool to release.

3. Release the hoses from the front end of the water pipe .

4. Using the access provided from within the fuel tank bay, push the water pipe forwards until obstructed by the crash structure. It is recommended that a suitable hole be cut in the flat vertical face of the crash structure, adjacent to the fog lamp harness grommet, in order to allow the pipe to be withdrawn forwards.





To refit,
Is the reversal of removal except:

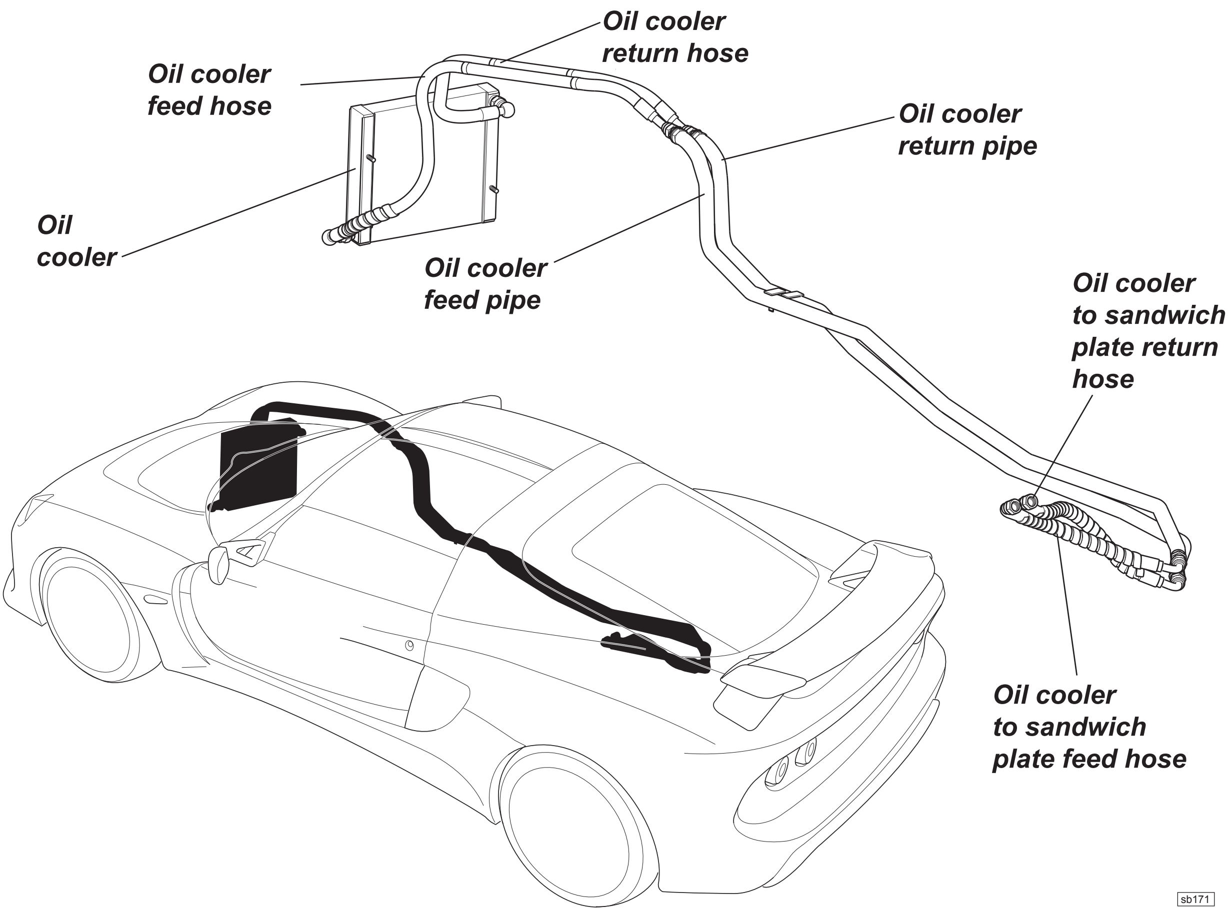
- Retrieve the two support foams from inside the chassis rail. Fit the grommet into the hole in the chassis front closing plate, and smear with rubber grease. Feed the pipe through the access hole and grommet, and position with 35 - 40 mm of pipe protruding.

- At the rear end of the pipe, fit two foam support blocks onto the pipe, and push into the chassis rail ahead of the fuel tank bay aperture.

- Refit the hoses to the front and rear ends of the pipes and manipulate the pipe to check for absence of chassis contact 'knock'.

- Blank off the access hole in the crash structure with a suitable grommet.

KR.7 - SUPPLEMENTARY OIL COOLER



Additional engine oil cooling is provided with the fitment of a single front mounted oil/air cooler radiator which is positioned ahead of the right hand front road wheel and to the right hand side of the central engine coolant radiator.

The circuit consists of feed and return rubber hoses fitted to the engine oil cooler sandwich plate at the rear of the vehicle as well as the front mounted oil cooler, these are connected to their respective feed and return steel pipes positioned between RH bodyside panel and chassis.

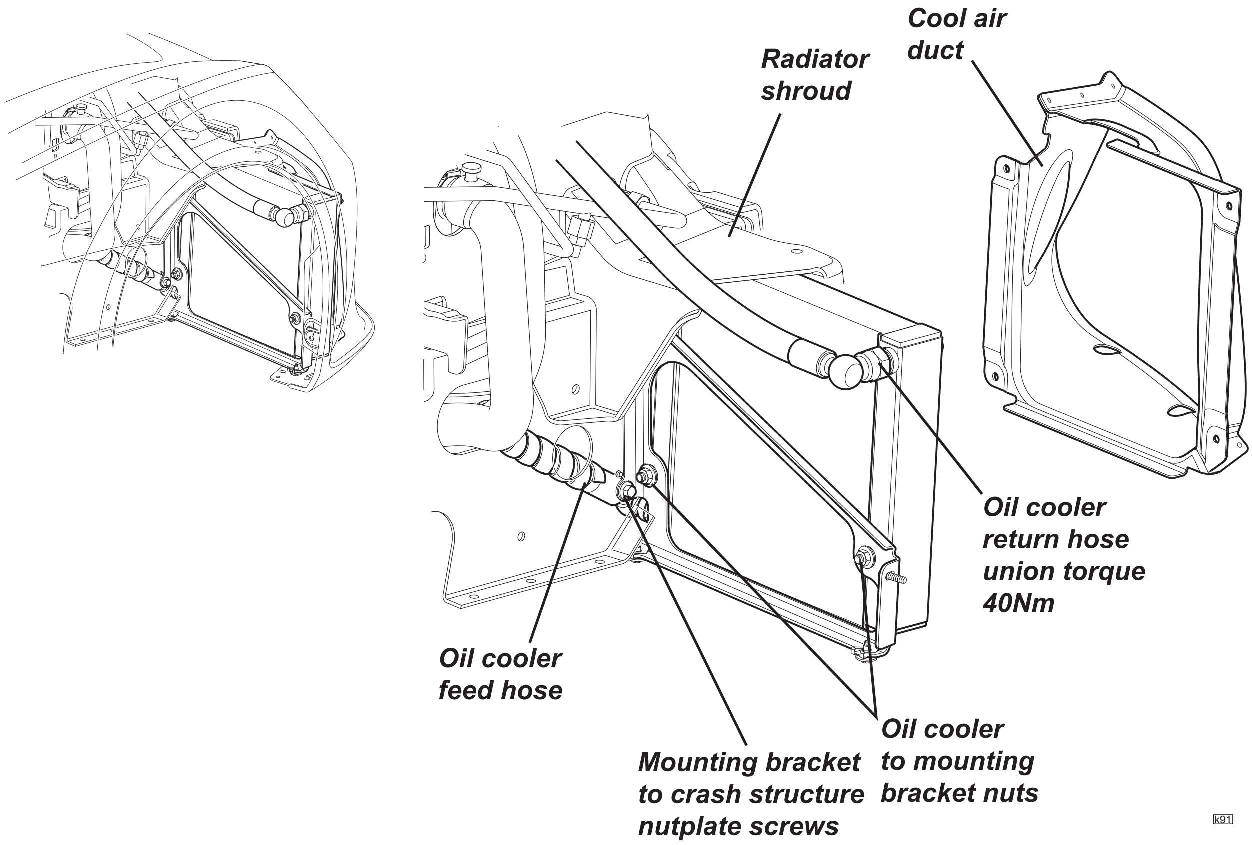
A sandwich plate with hose connections is bolted on top of the heat exchanger housing. A thermostat incorporated into the sandwich plate begins to open at 72ºC, and is fully open at 80ºC.

When closed, oil can by-pass the oil cooler circuit, but when fully open, all oil is directed from the sandwich plate via flexible rubber hose to a connecting metal oil feed pipe running through the RH sill panel.

Oil then passes through to a connecting flexible rubber hose positioned behind the front wheel arch liner into the LH base of the oil cooler.

Airflow is admitted through the front clamshells RHF side intake grille, the cooling air is directed towards the forward face of the cooler via a duct positioned between the grille and cooler.

Cooled oil exits the cooler from an outlet hose positioned the RH top of the assembly. The outlet hose runs along side the inlet hose behind the wheelarch liner and connects to a metal oil return pipe in the RH sill and returns to the sandwich plate via a flexible rubber hose.



To Remove Oil Cooler:

1. Remove the front undershield - see Service Notes introduction section AN.3 for information.

2. Remove the front clamshell - see Service Notes section BT.6 for information.

3. Release the M6 nyloc nuts and washers (4) securing the ducting to the front face of the cooler (torque 20Nm).

4. Galvanic corrosion may occur between the oil hoses steel union nuts at their connection to the aluminium threads of the front mounted cooler, it is essential to apply a liberal quantity of a suitable release agent around the area the cooler unions before attempting to release them.

5. Release the M6 nyloc nuts and washers (4) securing the ducting to the front face of the auxiliary radiator (torque 20Nm).

6. Disconnect the oil feed and return hoses from the cooler union connections (torque 40Nm). Lower the hoses and allow the oil from both hoses and the cooler to drain into a suitable container, plug the cooler hose ports to minimize oil loss.

7. Release the M8 X 20 screws and washers (2) securing the cooler mounting bracket to the nut plate bracket which is positioned in place with rivets to the inside face of the crash structure (torque 20Nm).

8. The mounting bracket and oil cooler assembly can now be removed from the crash structure.

9. Release the M8 nuts and washers (4) securing the mounting bracket to the 3 integral studs on the oil cooler (torque 20Nm).

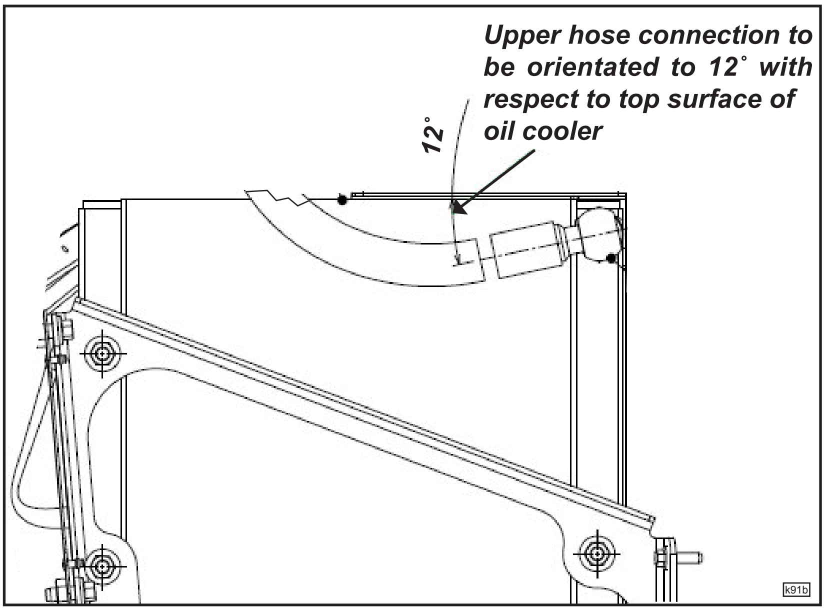
10. The mounting bracket can now be withdrawn by sliding it off of the 3 integral cooler studs, ensuring to collect the combined compression sleeves and bushes (3) that should still remain on the studs.

Refitment:
Is the reversal of removal except:
- It is recommended to renew the compression sleeve bushes as they are vital to set the pre-load compression to set the torque for the radiator mounting bracket nuts (the compression sleeves are re-usable).

  Incorrect pre-load will affect the tightening torque of the bracket which may lead to the radiator becoming insecure on its mounting bracket with the resulting vibrations causing premature wear of the radiator.

- Fit the feed and return hoses to their oil cooler union connections, securing finger tight only (this will allow the cooler ends to turn within the connections whilst the hoses are being routed into the correct positions).

- Ensure the hose routes are unhindered, cannot rub on any other components and are free of any kinks allowing the oil to flow freely. If necessary adjust the orientation of the hose fitting connections.



- The upper hose (oil cooler return hose) should be angled downwards approximately 12° below the uppermost edge of the oil cooler to ensure clearance when refitting the front clamshell and associated components.

- Tighten both hose unions using a crows foot adaptor (torque 40Nm).

Engine starting and checking procedure:
- Before starting the engine, check and top up the engine oil level as necessary ensuring that it registering on the ‘high’ mark of the dipstick – see Service Notes section TDV & EM.3 for further information.

- Start the engine and allow the engine oil temperature to rise above 72°C, this will ensure that the sandwich plate opens fully allowing the oil to circulate freely around the hoses and oil coolers.

- Top up the engine oil as necessary.

- Check and rectify any leaks as necessary.

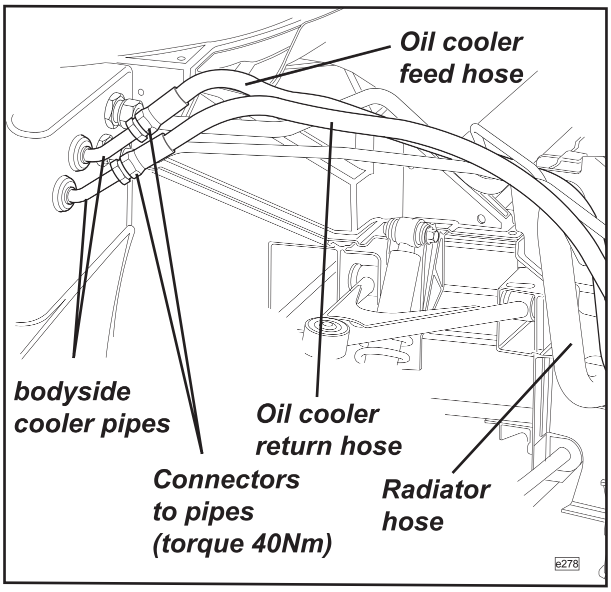
- Refit ancillary components in reverse order or removal.

Feed and Return Pipes
The feed and return cooler pipes are installed into the LH composite body sides which are in turn subsequently bonded to the chassis at the time of vehicle production.

Because of the original production installation process, removal and replacement of the feed and return pipes is considered an invasive procedure and as such should only be undertaken if absolutely necessary.

Front Feed and Return Hoses
Return Hose
Renewal of the upper return hose is possible without removal of the clamshell once the RHF wheelarch liner is removed.

Feed Hose
Because of the route taken through the side of the clamshell and its inboard fitment to the oil cooler, it is advised to remove the front undershield panel and release the front clamshell fixings to either remove/pull the clam forward to gain proper access to cooler hose union. See service note sections AN.2 and AN.3 for further information.



Hose Removal (Once ancillary components removed)
1. Disconnect the oil feed and return hoses (as required) from the union connection(s) at the cooler. Lower the hose(s) and allow the oil from the hose(s) and cooler to drain into a suitable container and plug the cooler hose ports to minimize oil loss.

2. Using two spanners on each connection to avoid twisting the union, release the hose union(s) at the bodyside cooler pipe(s). The hose(s) may now be withdrawn from the vehicle.

Note: Galvanic corrosion may occur between the oil hoses steel union nuts at their connection to the aluminium threads of the front mounted cooler, it is essential to apply a liberal quantity of a suitable release agent around the area the cooler unions before attempting to release them.

Hose refitment/renewal
Is the reversal of removal except:

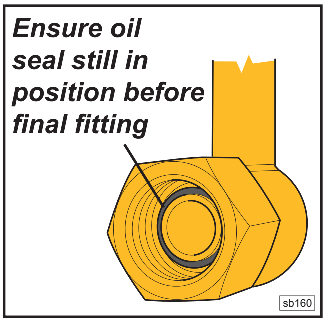
Before fitting the hose(s), ensure that the oil seal in the union connections are still in place.

- Fit the feed and return hoses to their oil cooler union connections, securing finger tight only (this will allow the cooler ends to turn within the connections whilst the hoses are being routed into the correct positions).

- Ensure the hose routes are unhindered, cannot rub on any other components and are free of any kinks allowing the oil to flow freely. If necessary adjust the orientation of the hose fitting connections.

- The upper hose (oil cooler return hose) should be angled downwards approximately 12° below the uppermost edge of the oil cooler to ensure clearance when refitting the front clamshell and associated components. (See illustration on previous page for additional information.

- Tighten all hose union connections using a crows foot adaptor (torque 40Nm).



Engine starting and checking procedure:
- Before starting the engine, check and top up the engine oil level as necessary ensuring that it registering on

the ‘high’ mark of the dipstick – see Service Notes section TDV & EM.3 for further information.

- Start the engine and allow the engine oil temperature to rise above 72˚C, this will ensure that the sandwich plate opens fully allowing the oil to circulate freely around the hoses and oil coolers.

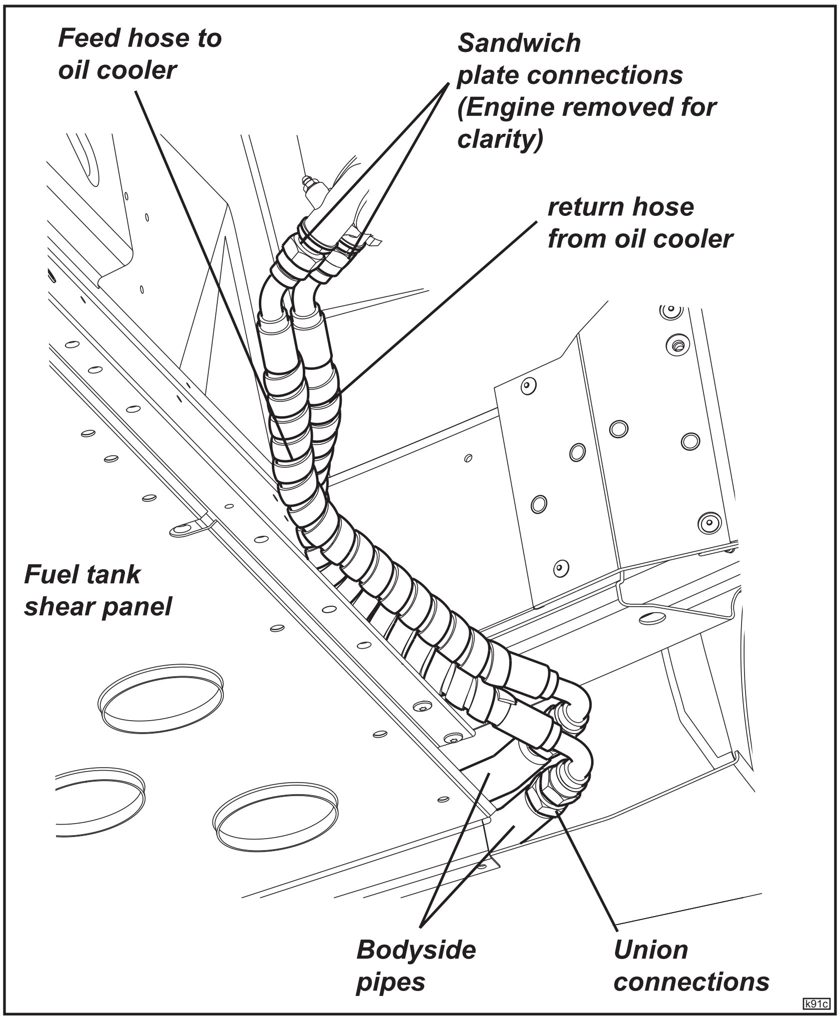
- Top up the engine oil as necessary.

- Check and rectify any leaks as necessary.

- Refit ancillary components in reverse order or removal.

Rear Feed and Return Hoses

Renewal of the upper return hose is possible with removal of the rear undertray - see service notes section AN.2 for additional information.



Hose Removal (Once rear undertray removed)

1. Using two spanners on each connection to avoid twisting the union, release the required hose union(s) at the bodyside cooler pipe(s) located shear panel/bodyside sill area.

2. Disconnect the hose (as required) from the bodyside pipe and allow the oil from the hose and pipe to drain into a suitable container and plug the pipe port to minimize oil loss.

3. Disconnect the hoses (as required) from the engine sandwich plate union connection.

4. The hose may now be withdrawn from the vehicle.

Hose refitment/renewal
Is the reversal of removal except:

Before fitting the hose(s), ensure that the oil seal in the union connections are still in place. See illustration on previous pages for more information.

- Fit the feed and return hoses to their oil cooler union connections, securing finger tight only (this will allow the cooler ends to turn within the connections whilst the hoses are being routed into the correct positions).

- Ensure the hose routes are unhindered, cannot rub on any other components and are free of any kinks allowing the oil to flow freely. If necessary adjust the orientation of the hose fitting connections.

- Tighten all hose union connections using a crows foot adaptor (torque 40Nm).

Engine starting and checking procedure:
- Before starting the engine, check and top up the engine oil level as necessary ensuring that it registering on the ‘high’ mark of the dipstick – see Service Notes section TDV & EM.3 for further information.

- Start the engine and allow the engine oil temperature to rise above 72˚C, this will ensure that the sandwich plate opens fully allowing the oil to circulate freely around the hoses and oil coolers.

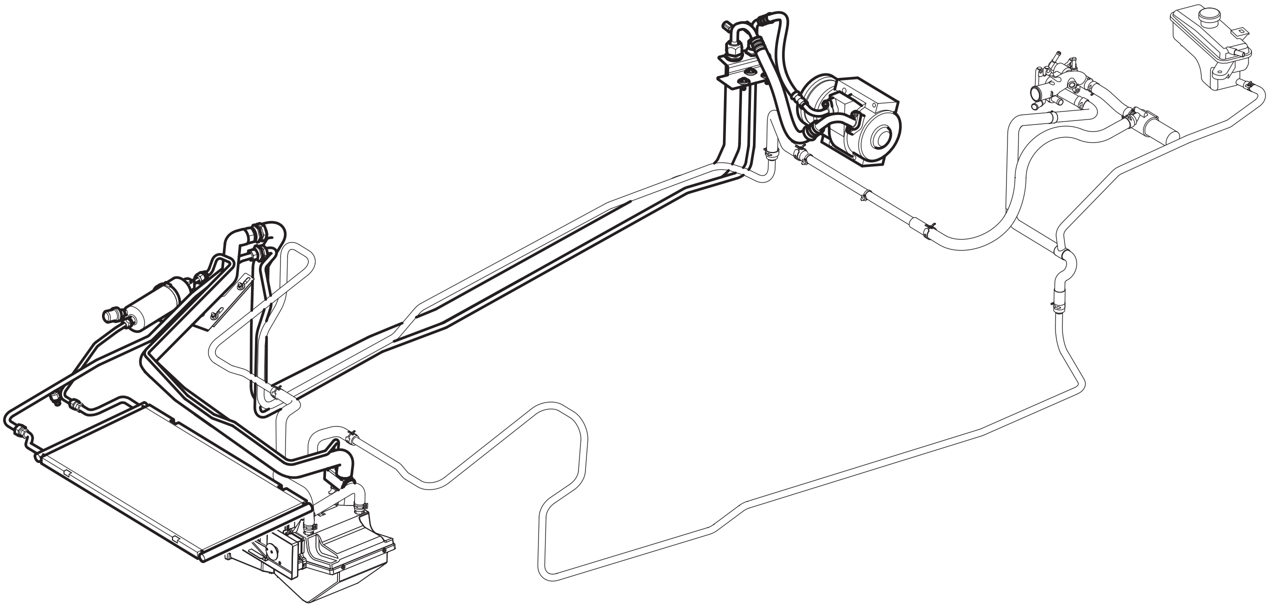
- Top up the engine oil as necessary.

- Check and rectify any leaks as necessary.

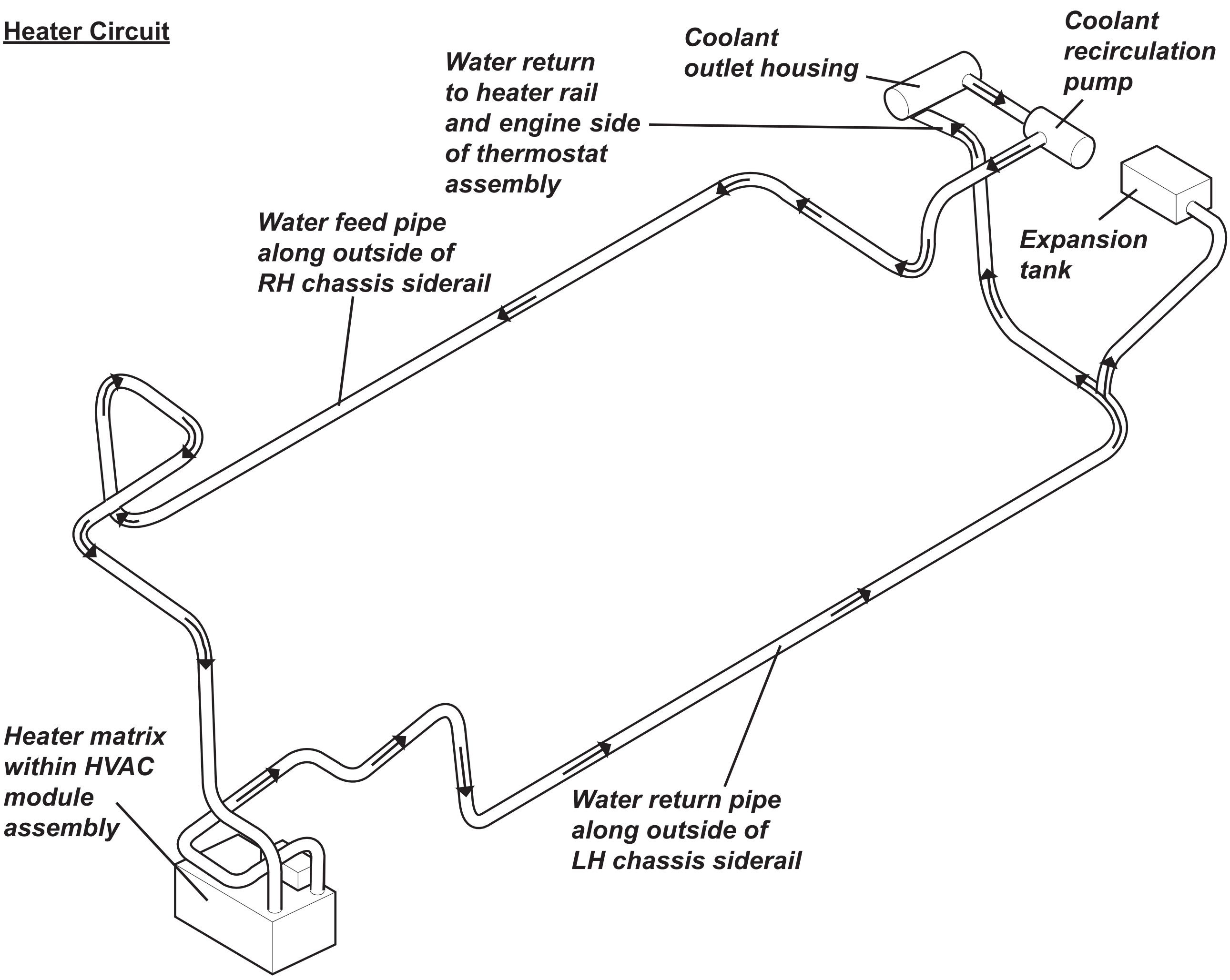
- Refit ancillary components in reverse order or removal.

AIR CONDITIONING, HEATING & VENTILATION

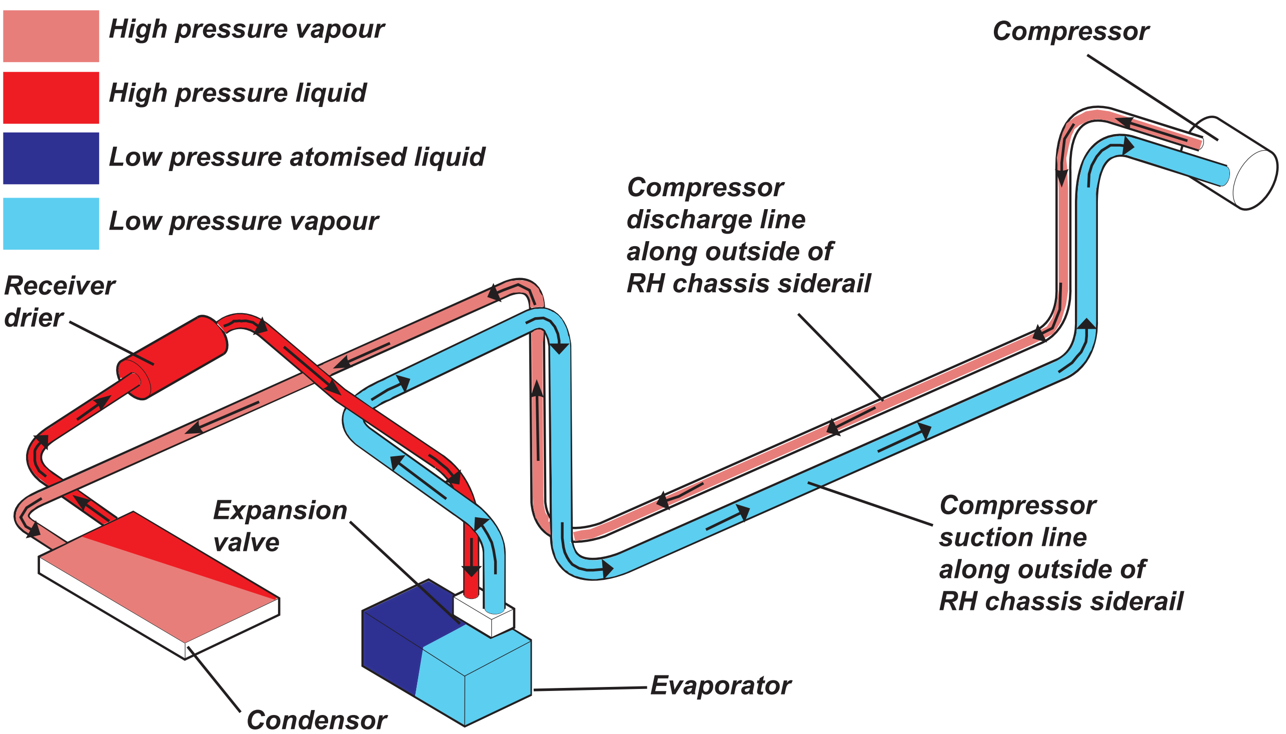
SECTION PK



Heater Circuit



Refrigerant Circuit



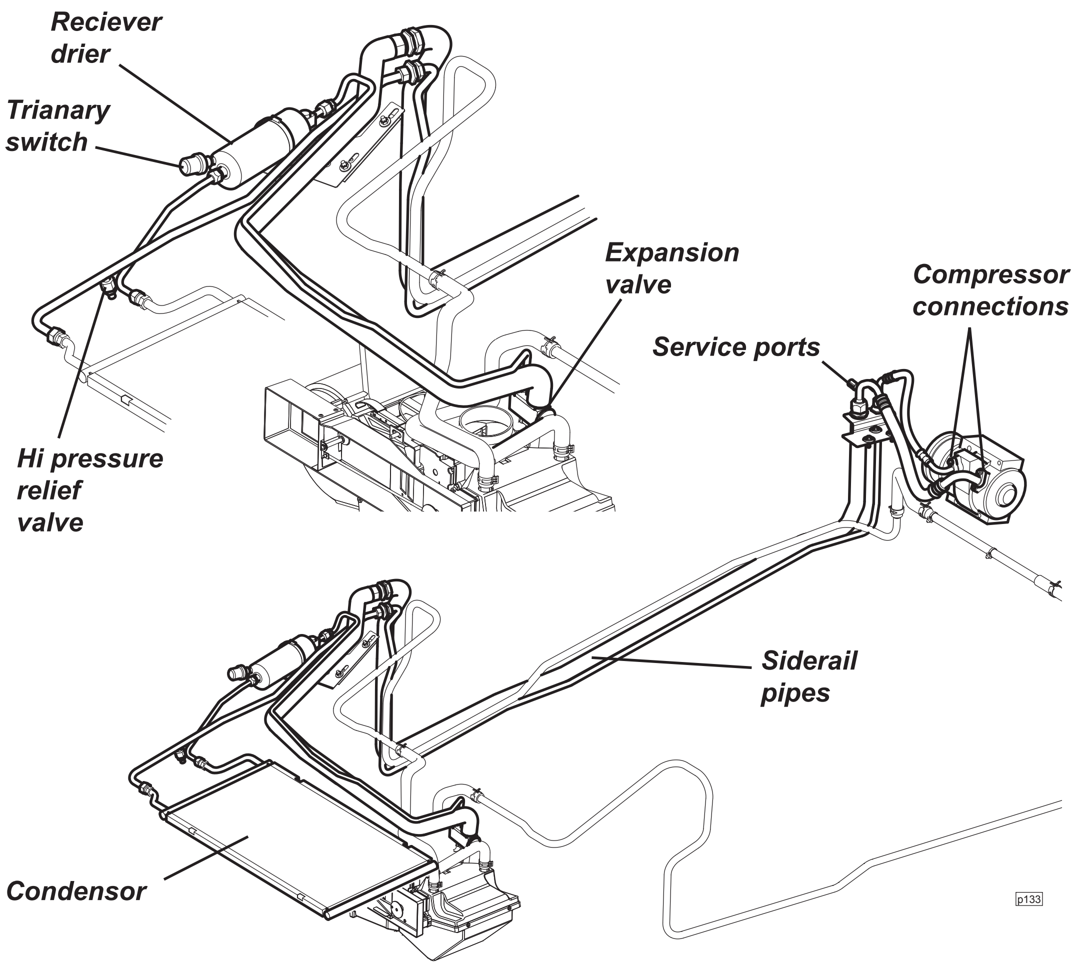
PK.1 - GENERAL DESCRIPTION

Heater System
The heater system uses engine coolant to provide a heat source transferred to the interior airstream via a heat exchanger matrix mounted in an 'air blend' unit housed within the chassis well, ahead of the cabin footwell. The coolant is fed from an outlet on the left hand side of the cylinder head, and via an alloy pipe running along the outside of the RH chassis side rail to the matrix. Coolant is returned via a similar pipe along the outside of the LH chassis rail to a by-pass return pipe on the left hand side of the engine.

Air temperature is controlled by a pair of air blend flaps within the heater housing which direct a varying proportion of the airflow through, or around the matrix as determined by the position of the temperature selector knob. Note that no water valve is fitted, such that the matrix is always 'hot' when the engine is running.

Air Conditioning (If fitted) - Basic Principles
The air conditioning unit uses a cycling clutch system with a thermostatic expansion valve to provide refrigerated air to the vehicle interior. The system comprises:
- a closed circuit containing refrigerant R134a;
- a variable displacement compressor mounted on the front side of the engine, driven by multi-vee belt from the front end of the crankshaft via an electromagnetic clutch;
- a condenser mounted horizontally at the front of the car, beneath the engine cooling radiator;
- an evaporator unit (cooler) fitted in the chassis well ahead of the cabin footwell;
- a thermostatic expansion valve fitted at the inlet connection to the evaporator;
- a receiver-drier unit mounted in-line between condensor to TXV valve pipe.

Closed Circuit
The closed refrigerant circuit should not be opened unless absolutely necessary, and only then using appropriate refrigerant recovery equipment. Never allow the refrigerant to vent to atmosphere. Refer to sub-section PK.5. Failure to observe these precautions may result in personal injury.



Compressor
The variable displacement compressor is mounted on the front side of the engine, and is driven by the multi-rib auxiliary belt. The compressor operates to discharge refrigerant vapour at high pressure and temperature into the condenser and is lubricated by a quantity of special refrigerant oil, most of which is retained in the compressor, with the remainder being circulated with the refrigerant.

The compressor contains a ring of cylinders with axes parallel to the compressor drive shaft, and whose pistons are driven up and down the bores by a rotating 'swash plate', the angle of which, in relation to the drive shaft, is variable. With a small swash plate angle, a short piston stroke is produced for a low refrigerant flow; a high swash plate angle results in greater piston stroke for a higher flow of refrigerant. The angle of the swashplate is determined by the pressure differential between that on top of the pistons, and that within the housing, applying a force to the underside of the pistons, in conjunction with a coil spring around the drive shaft.

This differential is controlled by a solenoid valve under ECU control, using pulse width modulation. When the valve is open, the output from the cylinders is bled off to the compressor housing to result in no pressure differential. The angle of the swashplate is then determined by the coil spring which pushes the plate to a near neutral position to provide minimal flow. As the valve is progressively closed, the pressure differential increases, with the pressure on top of the pistons pushing the swashplate to a greater angle, and producing an increased refrigerant flow.

The engine ECU is programmed to minimise refrigerant flow until an a.c. request is made, thus allowing the compressor to be run at all times in the interests of system lubrication, and the reduction of inactivity damage.

To safeguard the drive system in the event of compressor seizure, an electromagnetic clutch in the pulley hub is used to disengage the drive as signalled by a sensor in the compressor nose. The clutch will also be disengaged by the ECU if a loss of refrigerant is detected by the trinary switch (see below).

Hot refrigerant vapour from the compressor is fed via flexible hoses and alloy pipwork routed through the body RH sill, to the front mounted condenser.

Condenser
The aluminium condenser is horizontally mounted beneath the engine cooling radiator, and is of parallel flow construction. The hot vapour received by the condenser from the compressor, releases heat to the surrounding air via the condenser finning, with airflow boosted by two electric fans mounted below the condenser, and ram air flow caused by vehicle movement.

Evaporator
The evaporator is a tube and fin type heat exchanger mounted in a plastic housing fitted into the chassis well ahead of the passenger compartment footwell. All incoming airflow is directed through the evaporator, before being directed through or past the heater matrix, and then into the air distribution chamber.

The low pressure liquid refrigerant flowing into the evaporator via the expansion valve, begins to boil (evaporate) and in so doing, draws the necessary heat for this process from the airstream passing through the evaporator. This airstream is consequently cooled, and is directed through the various outlet vents to the passenger compartment.

When the a.c. switch is pressed by the driver, and other parameters allow it (i.e. engine running, blower fan speed selected, a.c. pressure switch closed), the a.c. circuit is activated and the compressor clutch is engaged.

A thermostat, using a sensor inserted into the outlet side of the evaporator finning, monitors the temperature of the refrigerated air and signals the compressor to cycle on and off in order to maintain outlet air temperature just above freezing.

The inlet and outlet pipes connect to the evaporator via the expansion valve block, into which they are sealed using 'O' rings and a clamp plate. The inlet is supplied from the receiver-drier, and the outlet feeds the compressor.

Expansion Valve
The expansion valve block is fitted into the high and low pressure lines at the evaporator, and provides a restriction to the flow of high pressure liquid into the evaporator, such that the consequent pressure drop causes a change of state from a high temperature, high pressure liquid, to a low pressure, low temperature atomised liquid.

By sensing the temperature and pressure of refrigerant leaving the evaporator, the expansion valve is able to modulate the flow of refrigerant into the unit to optimise the cooling performance.

Receiver-Drier
The receiver-drier unit is fitted into the refrigerant line between the condenser and evaporator expansion valve, and houses a screen sack filled with desiccant to absorb traces of moisture and other contaminants from the refrigerant. A sight glass built into the top of the receiver-drier allows a visual assessment of refrigerant charge to be made - a clear sight glass may indicate that the system is correctly charged, or completely empty, although the latter situation is usually accompanied by oil streaks. If refrigerant charge is low, a stream of bubbles will be visible at the sight glass.

The unit is fitted inline between the condenser outlet pipe and TXV inlet pipe, it is secured to its mounting bracket using a 60-80mm hose clip and the bracket in turn is fixed to windscreen frame panel. The unit is accessible with the removal of the RHF wheelarch liner.

Trinary Switch
A trinary switch fitted into the top of the receiver-drier senses the pressure of refrigerant and allows system operation only within a pressure range of 2 to 32 bar in order to prevent system damage from too high a pressure, or from compressor oil starvation damage caused by too low a pressure. A third switching point is used to engage the two condenser fans at half speed at pressures over 17.5 bar (see also sub-section XX.X). An additional safeguard is provided in the form of a high pressure relief valve in the condenser inlet pipe, which opens at 38 - 41 bar.

PK.2 - HEATER/A.C. AIRFLOW OVERVIEW

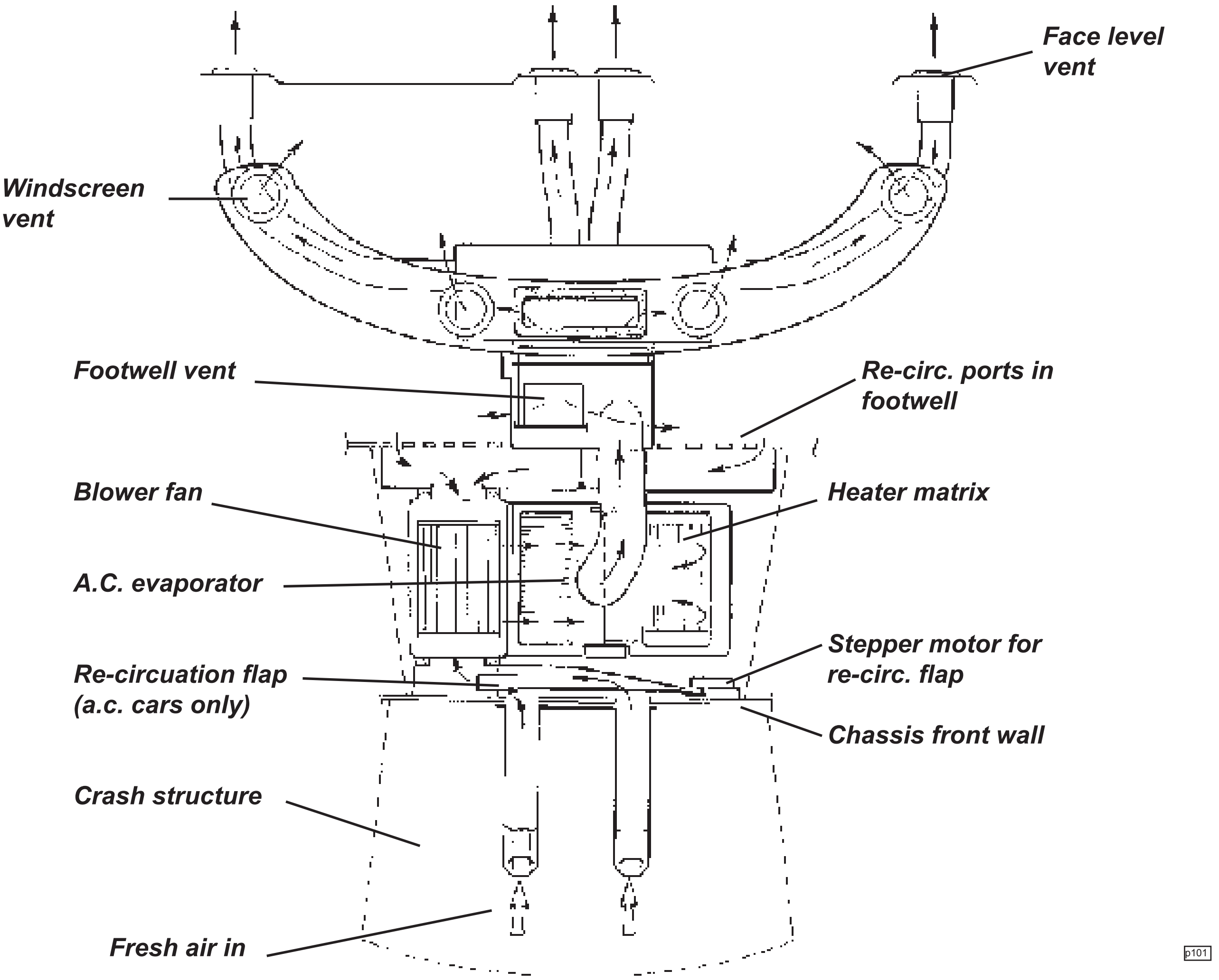
The major units of the Heating Ventilation and Air Conditioning (HVAC) system comprise a dual intake blower fan, an evaporator housing (with no evaporator fitted for non a.c. cars), a heater housing and an airflow distribution unit. The fan blower unit and the combined evaporator/heater unit are mounted in the chassis climate chamber ahead of the cabin footwells, with the airflow distribution unit mounted on the top of the chassis scuttle area. Ambient air is collected from the radiator air intake duct via two ports in the radiator ducting, which mate to apertures in the chassis front crossmember.

Moulded ducting on the rear side of the chassis front face directs this air, via a shut off butterfly flap valve on a.c. cars (to provide a recirc. function), to the blower fan front intake. The rear intake of the double sided fan housing is connected to perforated ports in the front wall of each footwell.

The fan blower unit directs all airflow through the a.c. evaporator (if fitted), after which a pair of linked air blender flaps, control the proportion of air which flows through the heater matrix. The upper flap is driven by a stepper motor from the cockpit temperature selector, with the lower flap linked to the upper by toothed belt. After leaving the HVAC chamber, air is ducted to a distribution chamber mounted on the top of the chassis scuttle which distributes air to screen, face level vents and footwell vents.

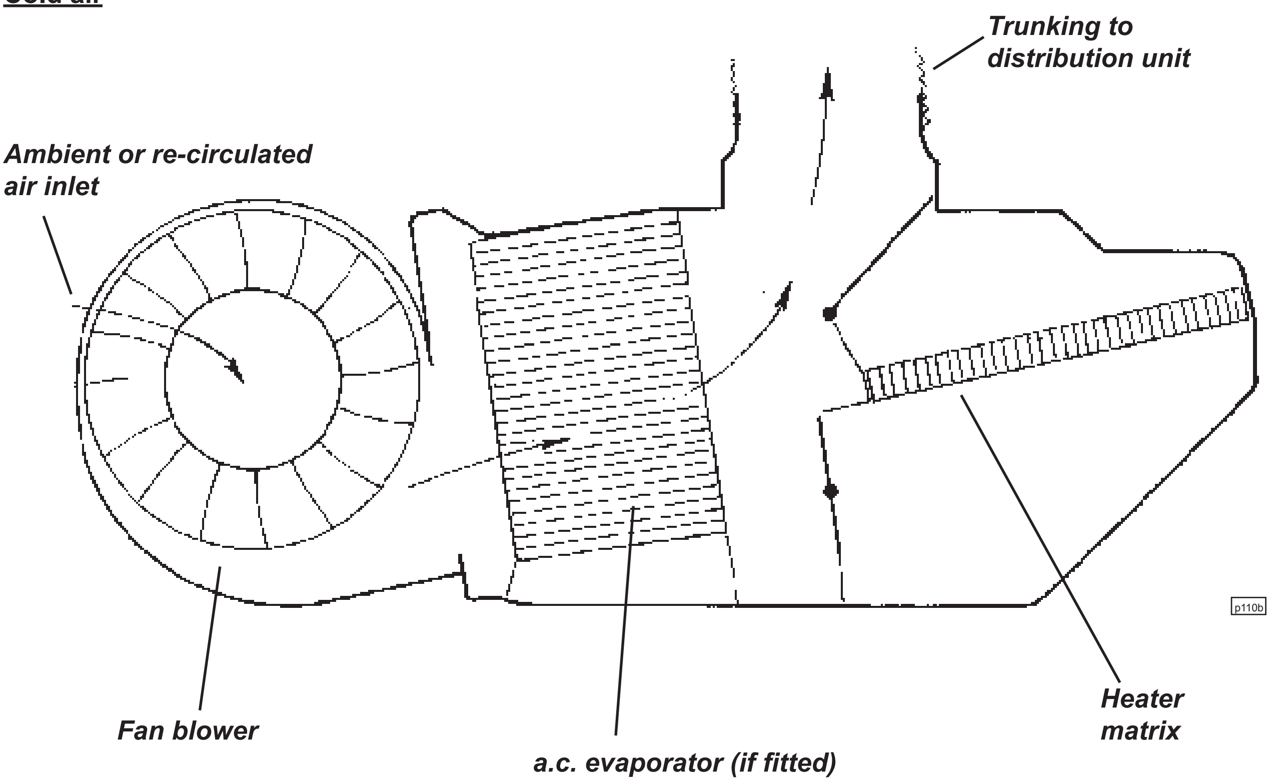
The distribution chamber contains a horizontal, three vane, rotary flap, driven by a stepper motor, and controlling outlets to the screen and face level vents. A link rod connects this flap to a second flap controlling airflow to the footwells. Ducting for the windscreen vents is incorporated into the underside of the fascia top panel.

Schematic Airflow

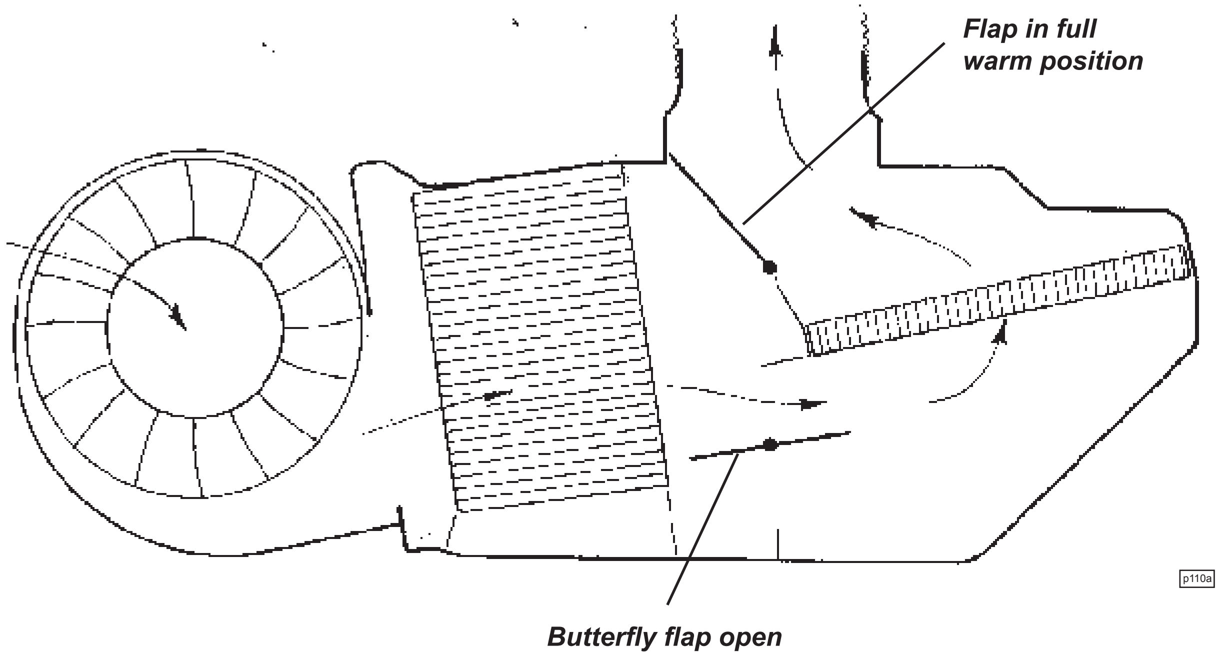


Airflow through a.c./heater unit

Cold air

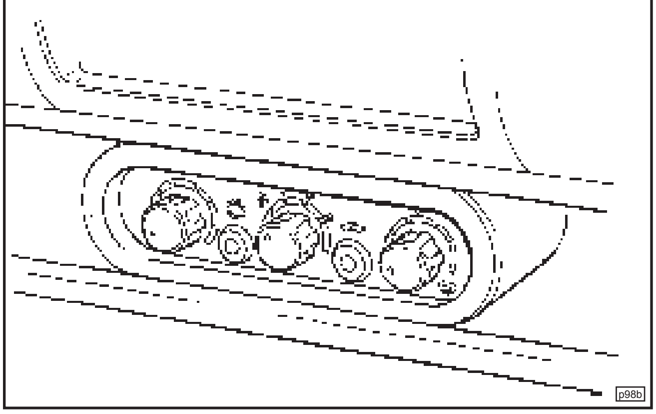


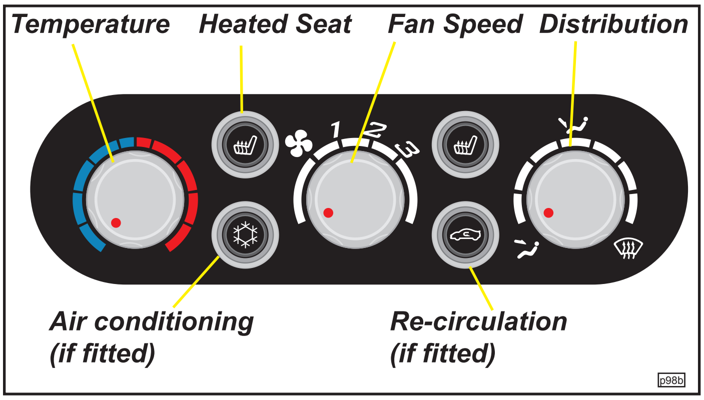
Warm air



Interior Climate Controls
The interior climate controls consist of two push switches (if fitted) for air conditioning and air re-circulation, and three rotary controls for heater temperature, fan speed, and air distribution.

INTERIOR CLIMATE CONTROLS





Air Conditioning (if fitted)
The left hand push button switch requests air conditioning, but the engine must be running and a fan speed selected before the system will operate.

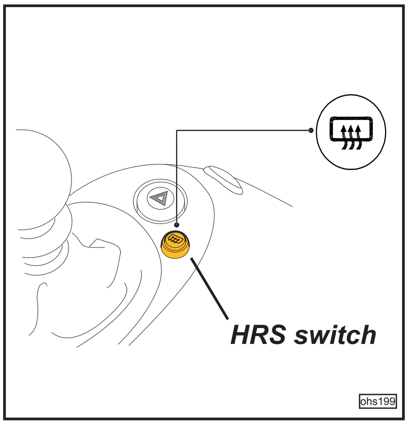
The a.c. switch receives its feed from the fan speed switch and energises the a.c. request relay. When closed, the request relay supplies, via the a.c. thermostat and trinary switch, an ECM input.

The ECM processes a valid request input, and if other parameters allow (e.g. not wide open throttle, not excessive coolant temperature), the ECM will open the IAC valve before energising the a.c. clutch relay. Note also that ambient air temperature must be above 3°C.

With a fully cold temperature setting, refrigerated air will be supplied. For dehumidified air, select air conditioning in conjunction with a warm temperature setting.

The tell tale in the switch button lights up green when the circuit is active.

Heated Seats (if fitted)
Both the driver and passenger seat can be heated to maintain a constant temperature. Single touch switches will illuminate amber when depressed. The seats will continue to be heated and the switch will remain illuminated until either the seat heater button is pressed for a second time or the igniton is switched off. Please note that heated seat function will always default to 'off' at the next drive cycle.



Heated Rear Screen (HRS)
Located in the centre console, the switch will illuminate amber with the ignition on and will increase in brightness when pressed demisting the rear screen. The HRS will turn off after the switch is pressed a second time, if the ignition is switched off or automatically after a ten minute period.

Air Re-circulation (with a.c.)
Air supply for the interior climate system is normally drawn from both the intake duct ahead of the engine cooling radiator, and the vehicle interior. When the re-circulation button is pressed, a stepper motor is activated to close a butterfly flap in the fresh air intake, in order to provide a 90% recirculation supply to the blower fan. The re-circulation facility should be used when maximum refrigeration is desired. The tell tale in the switch button lights up green when the circuit is active.

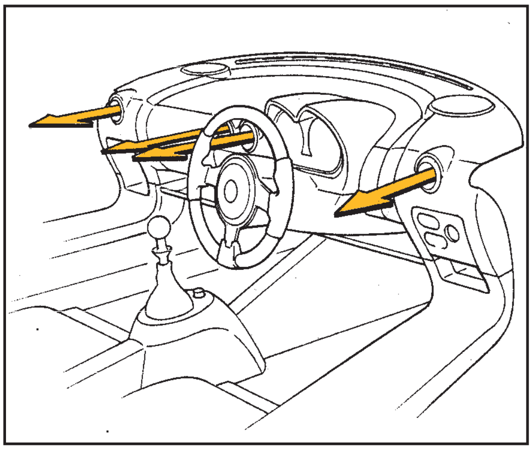
Heater Temperature
With the left hand rotary electrical control turned fully counterclockwise, the air blender flaps are positioned to direct all the airflow to by-pass the heater chamber so that no air heating is provided. If air cooling is required,

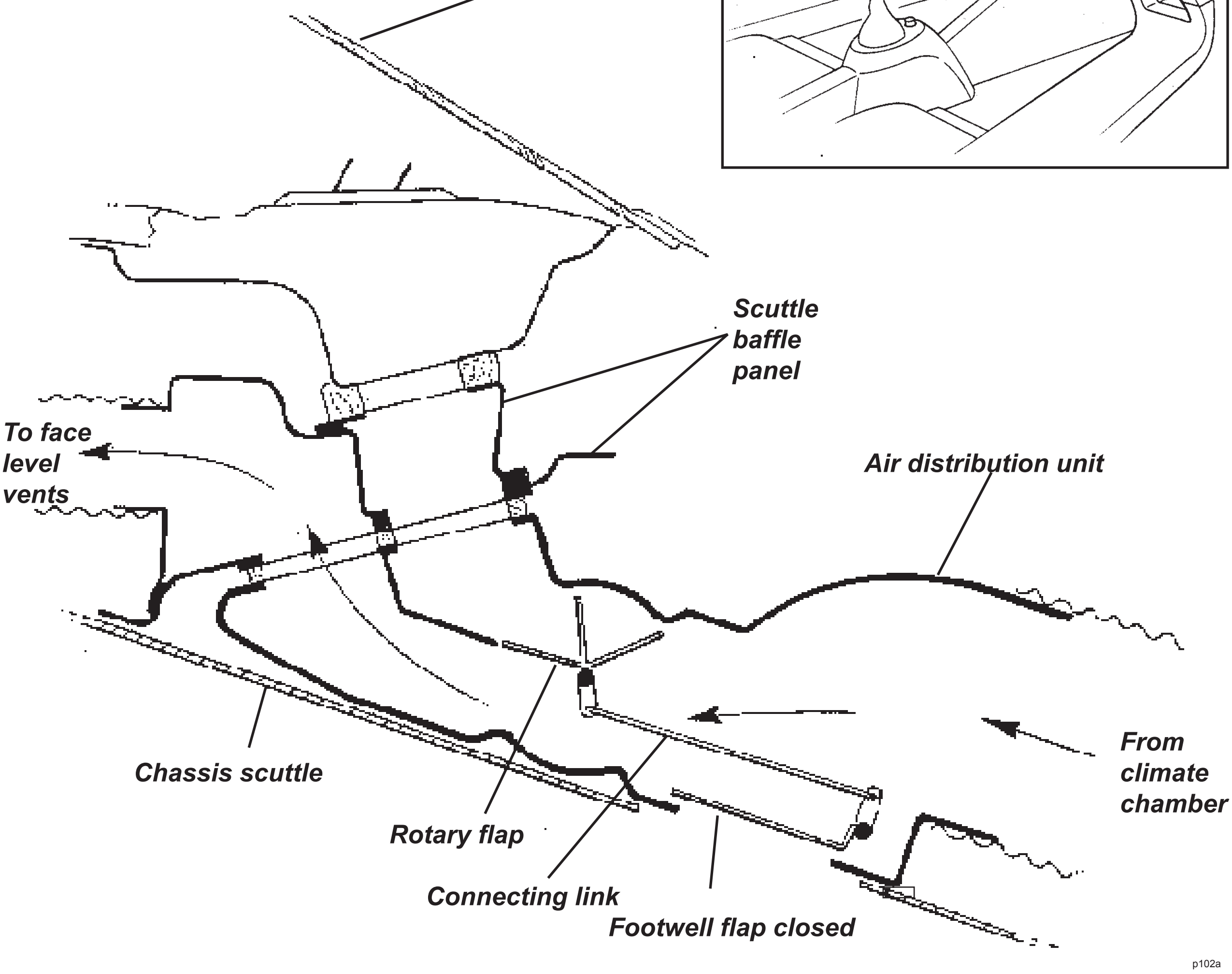
use this temperature position in conjunction with air conditioning. Turning the control progressively clockwise operates the stepper motor attached to the upper flap spindle, and via toothed belt to the lower flap, to direct airflow through the heater matrix and provide an increasing level of air heating until at the fully clockwise position, maximum heat is supplied.

Fan Speed
The centre rotary switch provides three fan speeds to boost air circulation. Turned fully counterclockwise, the fan is off; Turning the switch progressively clockwise operates the blower fan at increasing speed in three steps. Note that the fan operates only with the ignition switched on. The fan speed resistors are mounted in the top of the evaporator housing.

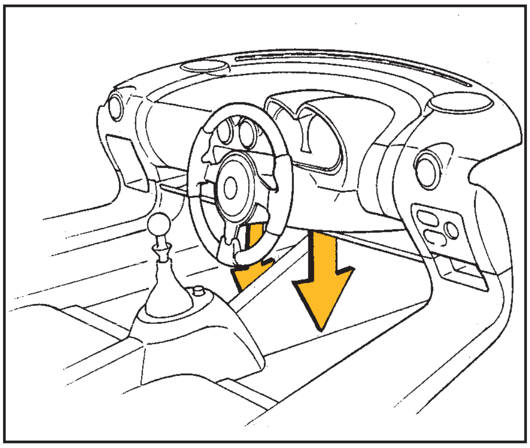
Air Distribution
The right hand electrical rotary control operates a stepper motor on the air distribution unit to direct airflow to the windscreen, face level and footwell vents. The following diagrams indicate airflow for the different control positions:

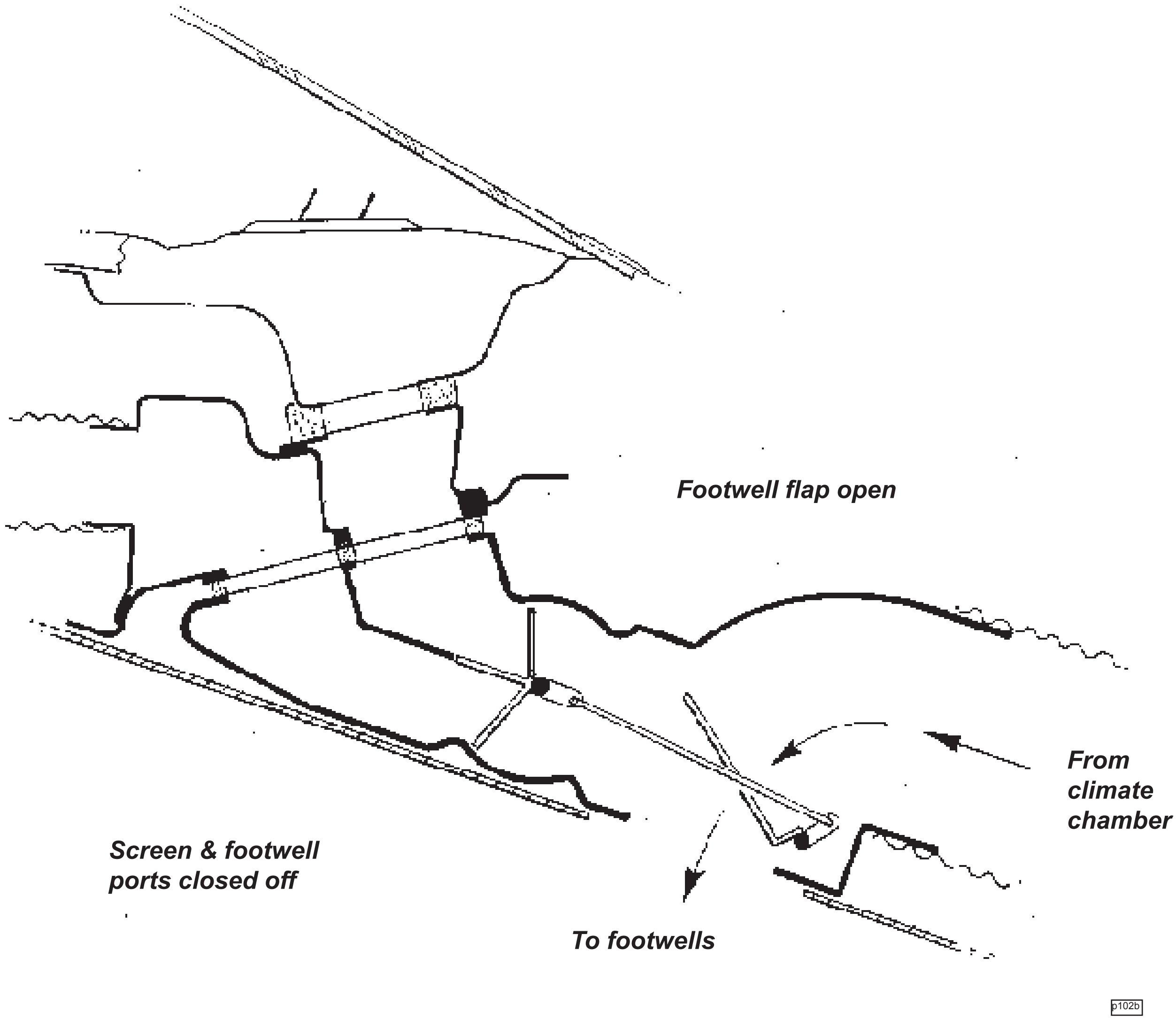
Face Level):
Turned fully counterclockwise, the stepper motor on the air distribution unit (ADU) operates the rotary flap to close off the windscreen vents, and direct all airflow to the four face level vents, each of which may be manipulated to adjust volume and direction. The footwell flap is closed.





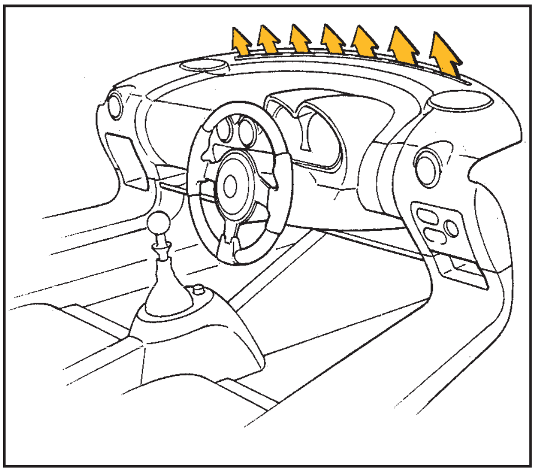
Footwell:
As the control is turned clockwise from the face level vents symbol towards the footwell symbol, the stepper motor turns the rotary flap to progressively close off the face level vents. A rod connecting the rotary flap to the footwell flap is arranged to open the footwell vents in opposite proportion, until at the footwell symbol, all airflow is directed to the footwells.





Demist:

As the control is turned clockwise from the face level vents symbol towards the footwell symbol, the stepper motor turns the rotary flap to progressively open the windscreen vents. The rod connecting the rotary flap to the footwell flap is arranged to close the footwell vents in opposite proportion, until at the screen symbol, all airflow is directed to the windscreen. Select a warm temperature setting and a suitable fan speed.

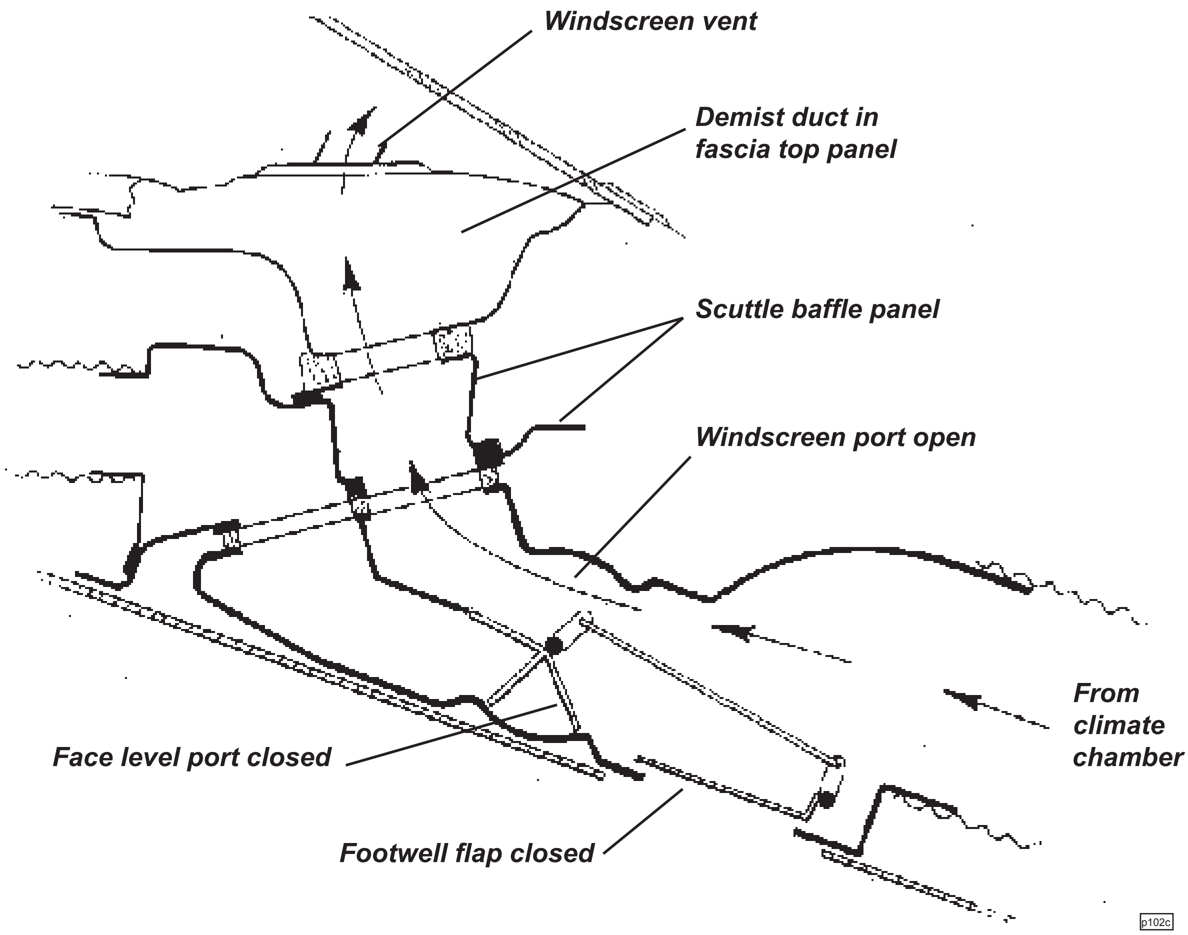


Full Defrost Performance

For maximum defrost performance, turn the distribution knob fully clockwise and select maximum temperature and fan speed. On cars with adjustable windscreen vents, direct the centre pair of screen vents slightly rearwards, and the end pair of vents forwards as shown in the illustration.

Ventilation Shut-Off

To close off the ventilation, which may be desirable in heavy traffic to reduce the induction of fumes into the car, turn off the fan, turn the distribution control fully counterclockwise to the face level vent position, and manually shut off each of the face level vents.



PK.3 - COOLING FANS & HEAT SOAK RE-CIRCULATION PUMP

The 3 radiator coolant fans and recirculation pump are controlled by the engine management ECU using data provided by the engine coolant temperature sensor and air intake flow meter located in the airbox casing.

Central Radiator Cooling Fan Operation With Engine Running
The 2 cooling fans fitted for the central radiator (also referred to as fans 1 & 2) are switched at the same time, and will operate at half speed (connected in series) if the vehicle speed is less than 85 mph (135kmh) once the coolant temperature reaches 95°C on rise, and will switch off at 92°C on fall.

Even with an engine coolant temperature below 96°C fans 1 & 2 will still operate at half speed (if the vehicle speed is less than 85mph) if the a.c. is switched on and the compressor is running or if the engine management system detects a fault with the inlet air temperature or coolant temperature circuits.

During these engine temperature/running conditions fans 1 & 2 are controlled from output RF1 from the engine management ECU to fan relay 3 which in turn activates fans 1 & 2 in series. The resistance in the circuit then activates the cooling fans at ½ of maximum speed (see service notes section MVA for circuit diagram information).

If the vehicle speed is less than 85 mph (a.c. switched off) and the coolant temperature rises to 99°C, fans 1 & 2 will switch to full speed (connected in parallel), reverting back to half speed at 95°C on fall. If the a.c is switched on and the engine temperature rises to 98°C fans 1 & 2 will also switch to full speed, reverting back to half fan speed at 95°C on fall.

During these engine temperature/running conditions fans 1 & 2 receive an additional output from connection RE2 from the engine management ECU which energises all 3 relays in a parallel feed. The reduction in circuit resistance now activates fans 1 & 2 at full speed.

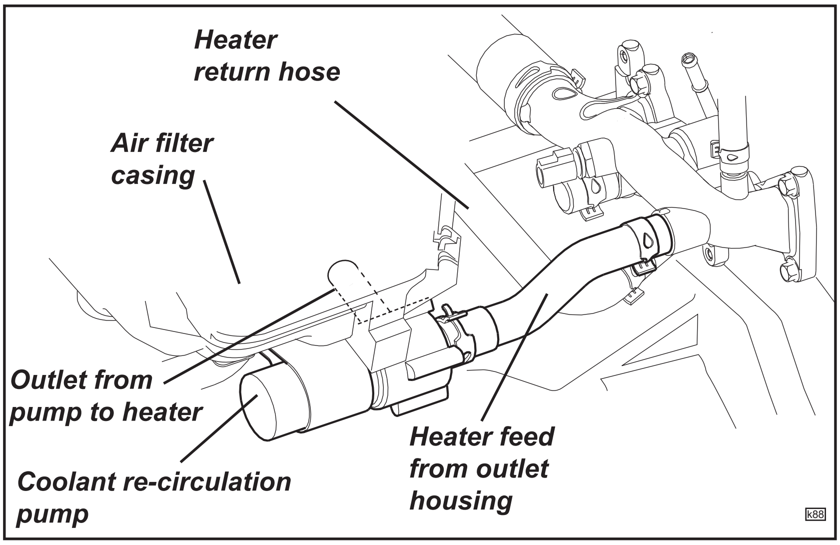
At road speeds in excess of 85 mph (135 km/h), equating to the fan stall speed, all functions for fan 1 & 2 are switched off.

Central Radiator Cooling Fan Operation with Engine Turned Off
If required fans 1 & 2 are still enabled at half speed even after the engine is turned off if the coolant temperature is still above 115°C and will switch off at 110°C on fall.

Auxiliary Fan Control
With a vehicle speed of less than 105 mph (170kmh) the auxiliary fan also referred to as fan 3 will operate at its single full speed once the coolant temperature reaches 103°C on rise, and will switch off at 99°C on fall. Fan 3 does not operate once the engine is turned off.

Re-Circulation Heat Soak
A coolant re-circulation electric pump is positioned below the air filter case which is directly above the transmission and is plumbed into the heater matrix feed line.

When energised via the main relay, the pump circulates coolant through the engine and heater system, drawing coolant from the back of the engine, and pumping it through the heater matrix to the heater return pipe and back into the thermostat housing.



Heat Soak Management Strategy
In order to help control engine temperature after switching off an engine whose temperature is over 92°C, the ECU will remain powered for a period of up to 20 minutes to allow heat soak management.

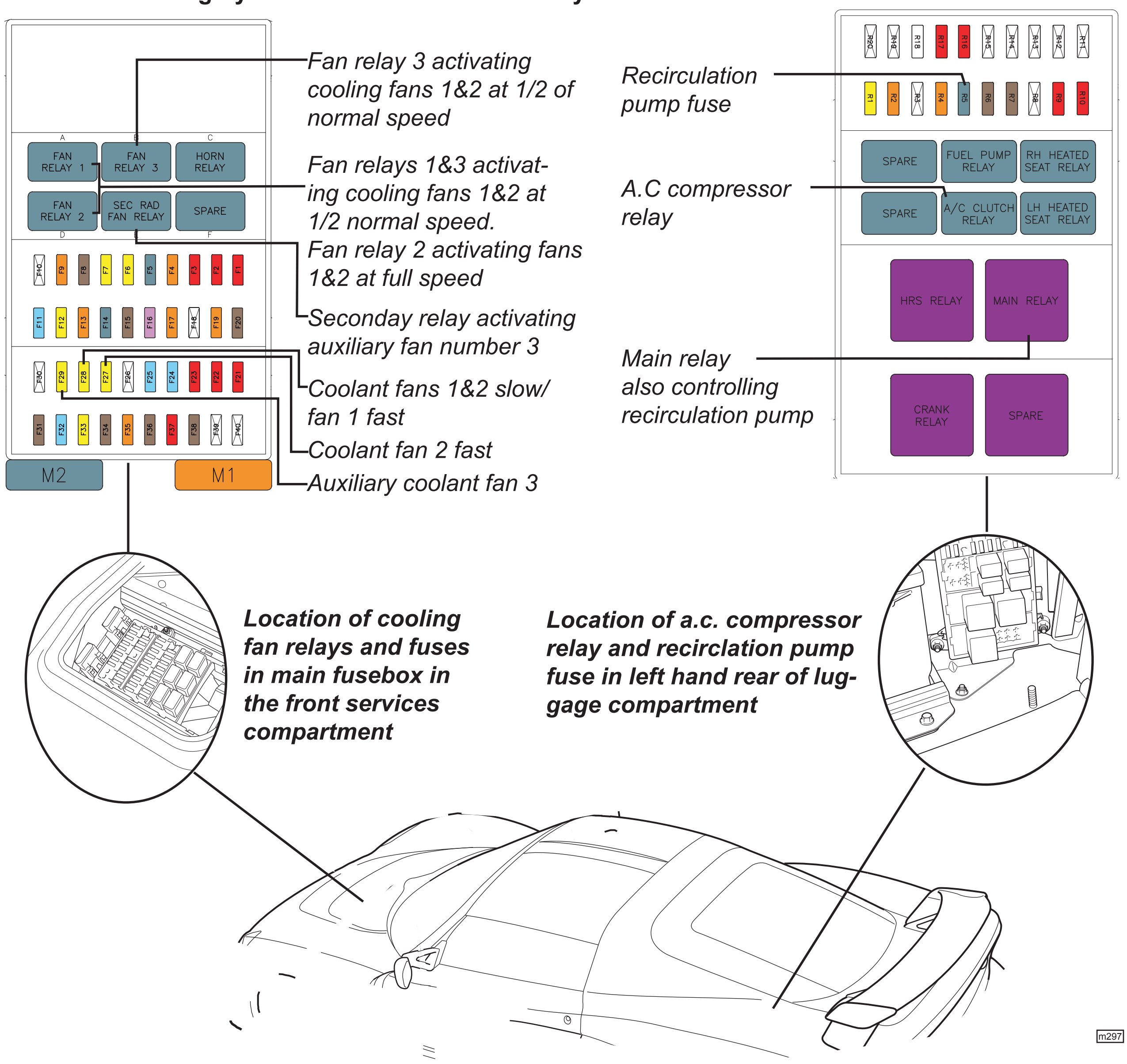
Under these conditions the pump will operate for 8 minutes with ignition off if the engine coolant temperature is over 108°C.

Re-Circulation Pump Strategy for HVAC
To assist in providing a warm cabin environment as quickly as possible, the recirculation pump will also operate under the following conditions whilst the engine is running.

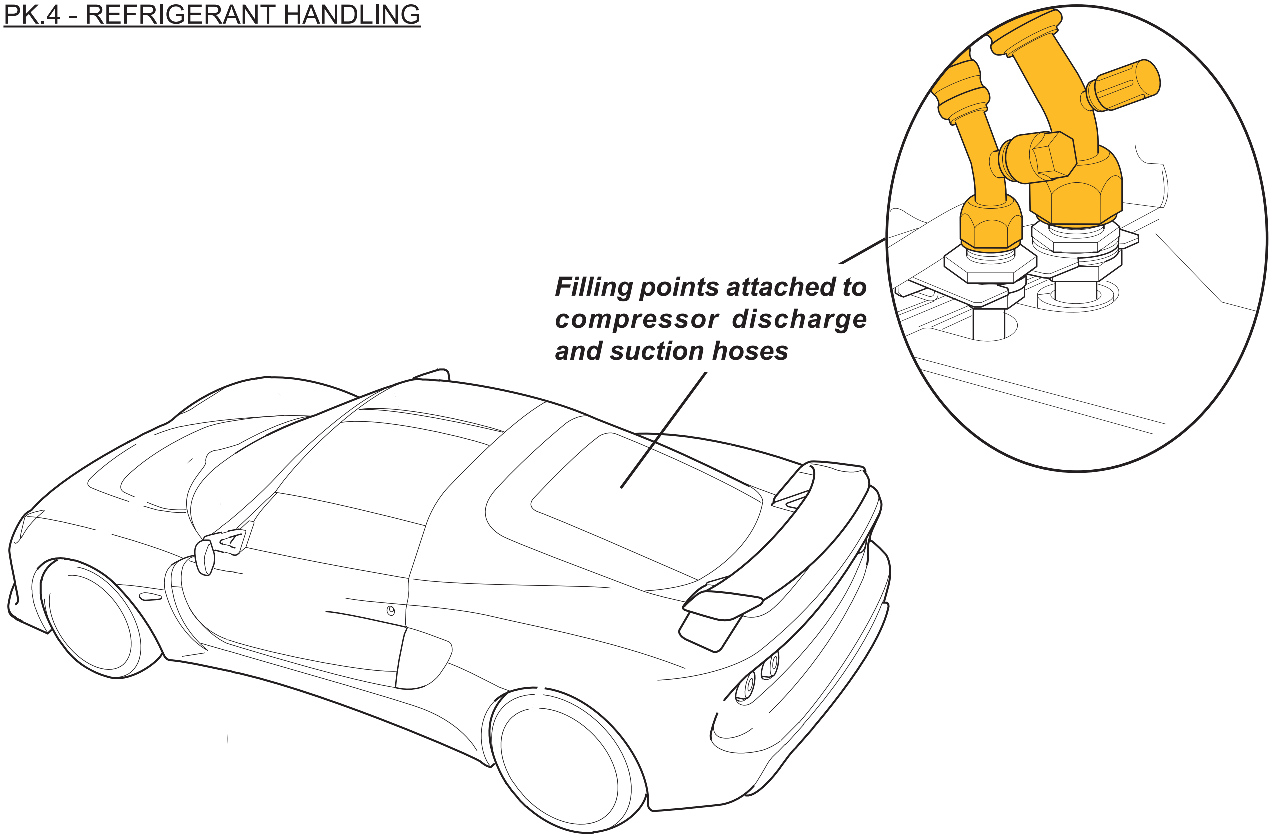
if the airbox temperature is less than 15°C and the engine speed has been at idle for more than 20 seconds. The pump will switch off if the airbox temperature is greater than 19°C or the engine speed is greater than 2400 rpm.

If the airbox temperature falls below 19°C and the engine speed is less than 2300 rpm the pump will also operate, but again will switch off once airbox temperature is reaches 19°C or the engine speed is greater than 2400 rpm.

HVAC and Cooling System Control Fuses and Relays



PK.4 - REFRIGERANT HANDLING



The system is charged with refrigerant HFC R134a (see Service Notes section TDV for capacitiy), and the following precautions **MUST ALWAYS BE OBSERVED.**

1. On no account should refrigerant ever be discharged to atmosphere - use a refrigerant recovery/recycling station in accordance with the manufacturer's instructions.

2. Filling points are fitted to the discharge and suction hoses attached to the compressor and are fixed to the RH sill area onto a bracket which in turn is attached to the RH chassis rail ahead of the RHR wheel.

3. Accessibility to the filling points may be restricted requiring the removal of the RHR wheel and wheelarch liner, (refer to service notes section BT.5 for further information) to ensure correct connection of recovery equipment adaptors.

4. Standard R134a 'quick fit' connectors are provided in the compressor suction and discharge pipes at the right hand front of the engine bay;
   - the low pressure vapour line port is fitted in the pipe between the evaporator and compressor.
   - the high pressure liquid line port is fitted in the pipe between the compressor and condenser.

5. Heavy concentrations of refrigerant vapour can produce toxic gas if exposed to a naked flame. The gas can also attack metal.

6. Refrigerant drums must never be left open - always ensure the caps are securely fitted.

7. Never transport drums of refrigerant in the passenger compartment of a car.

8. Never expose refrigerant drums to high temperature.

9. Never weld or use a steam cleaner in close proximity to any part of the air conditioning system.

10. Never expose the eyes to vapourised or liquid refrigerant - ALWAYS wear safety goggles and gloves when handling refrigerant.

PK.5 - REFRIGERANT PIPEWORK PRECAUTIONS

The following precautions must be observed when carrying out any work on the refrigerant pipework: Before disconnecting any refrigerant pipework, the refrigerant must first be recovered using suitable equipment connected to the service valves at the right hand front of the engine bay. Ensure that the equipment is suitable for R134a.

1. All replacement components and flexible end connections are sealed when new, and should only be opened **IMMEDIATELY PRIOR TO FITTING, AND AT ROOM TEMPERATURE**, to prevent condensation of any moisture which may enter when the sealing is removed.

2. Pipes, flexible end connections and components, must be capped immediately they are opened to prevent the ingress of moisture and/or dirt.

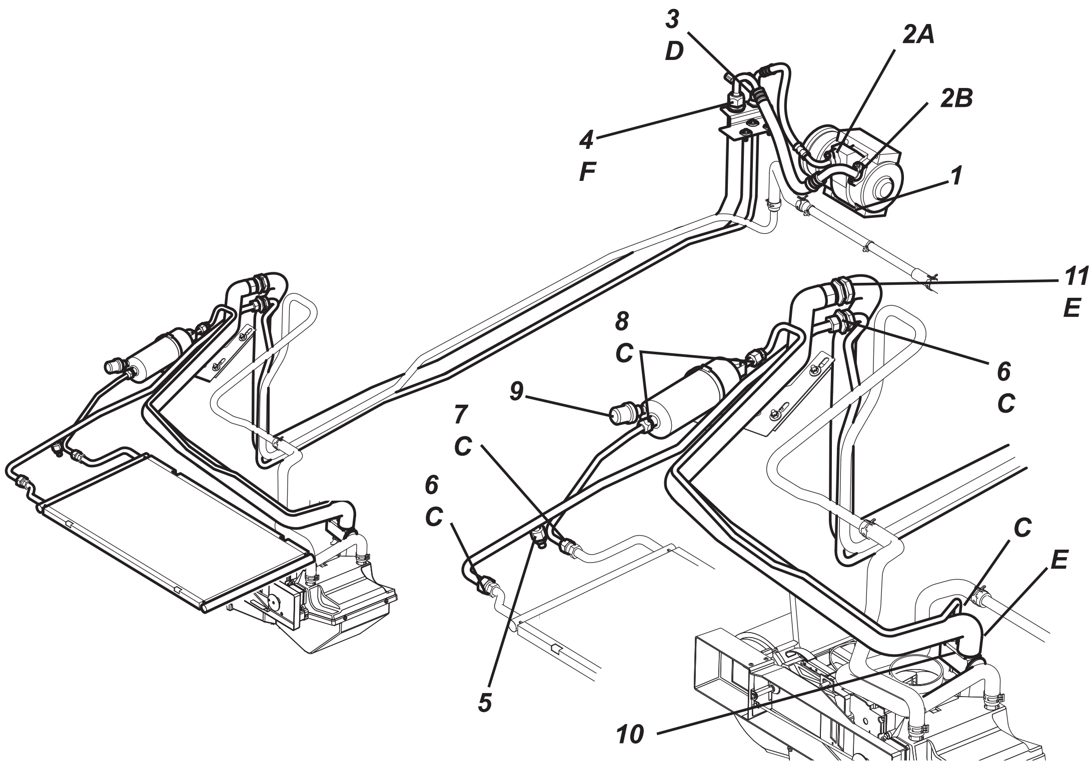
3. The receiver-drier should be the LAST component to be connected, to ensure optimum dehydration and maximum moisture protection of the system.

4. All joints should be coated with refrigeration oil before making any connections, to aid seating.

5. Great care must be taken to prevent damage to the pipe fittings and connections, since due to the high pressures involved, a leak can be caused by the slightest imperfection. Always use two spanners of the correct size when releasing or tightening any pipe joint so that the fixed part of the union may be prevented from twisting and damaging the component. This is especially important with the aluminium condenser.

6. All pipes and hoses must be free from any kinking. The efficiency of the system can be impaired 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.

PK.6 - REFRIGERANT PIPEWORK FIXING TORQUES AND 'O' RING FITMENT



Refrigerant Pipework Fixing Torques

Key	Description	Qty	Thread	Torque
1	Compressor to engine	4	M8	25 Nm
2	A.C hoses to compressor	2	M5	9 Nm
3	Sill pipe to comp. hose, high pressure	1	3/4 - 16 UNF	25-30 Nm
4	Sill pipe to comp. hose, low pressure	1	1 1/16 - 14 UNF	35-40 Nm
5	High pressure blow off valve	1	3/8 - 20 UNF	10-13 Nm
6	High pressure pipe to condensor	2	3/4 - 16 UNF	25-30 Nm
7	Liquid line to receiver-drier	1	5/8 - 18 UNF	25-30 Nm
8	Reciever-drier inlet/outlet pipes	2	5/8 - 18 UNF	20-25 Nm
9	Trinary switch	1	7/16 - 20 UNF	15-20 Nm
10	Clamp plate, pipes to expansion valve	1	M6	7-9 Nm
11	TXV to sill pipe pipe. low pressure	1	1 1/16 - 14 UNF	25-30 Nm

Refrigerant Pipework 'O' Rings

Key	Description	Size
A	High pressure line to compressor	15mm o.d.
B	Suction line to compressor	18mm o.d.
C	Sill pipe to comp. hose, high pressure. High pressure pipe to condensor. Reciever-drier inlet/outlet pipes. Liquid line to receiver-drier	No6
D	Sill pipe to comp. hose, low pressure	No8
E	TXV to sill pipe pipe. low pressure	No10
F	Sill pipe to comp. hose, low pressure	No12

PK.7 - REFRIGERANT OIL

The internal working parts of the compressor are lubricated by refrigerant oil. This is a special type of oil which has an affinity with the refrigerant, such that a proportion of the oil circulates with the refrigerant, around the whole system.

Under normal operating conditions, the oil never needs changing or replenishing, and if the correct procedure for system depressurisation and re-charging is followed, minimal oil will be lost from the system during these operations.

If, however, the system suffers a major leak or sudden de-pressurisation, most of the oil held in suspension will be lost as the refrigerant escapes, necessitating the addition of a specified quantity of oil to the compressor on re-assembly (see section PK.8).

If a refrigeration component is to be replaced, the removed item will contain a certain amount of oil, and a corresponding amount of new oil must be added to the system on re-assembly:

Condenser;	30 cm^3	
Evaporator;	30 cm^3	
Any major pipe or hose;	10 cm^3	
Receiver-drier;	30 cm^3	
Compressor;	150 cm^3	(See additional information in section PK.8)

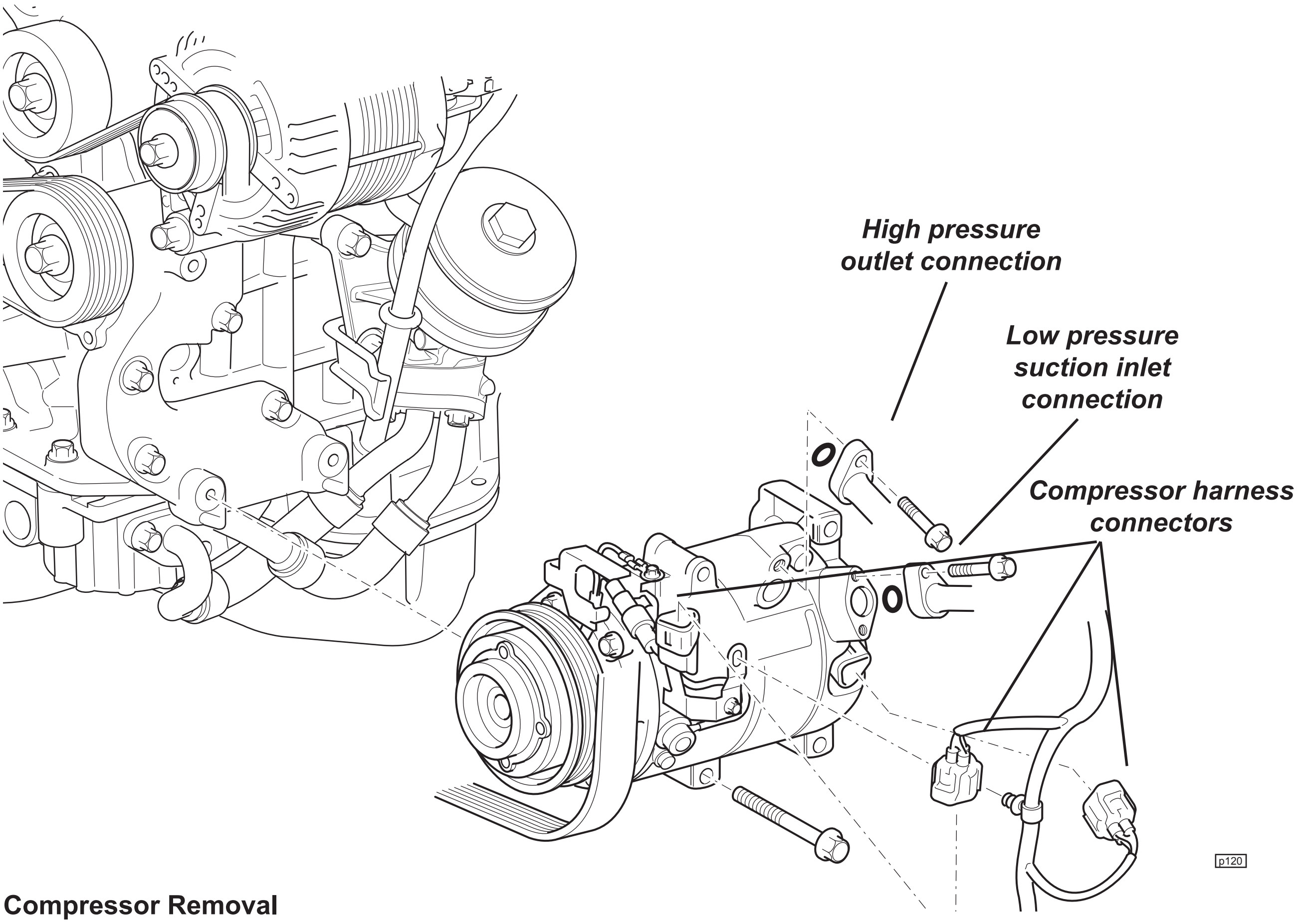
Approved Oils
Use only Denso ND-OIL 8 low viscosity (ISO46) PAG oil or equivalent (Sanden SP10; Four Seasons 59007).

Refrigerant oil absorbs water and should not be exposed to the atmosphere for any longer than is strictly necessary to perform the operation. Never return decanted oil back into the storage container.

PK.8 - COMPRESSOR

The a.c. compressor is mounted at the left hand front of the crankcase, and is driven from the crankshaft, together with the alternator, PAS pump and water pump, by a multi-rib, serpentine, synthetic belt. A maintenance free belt tensioner takes the form of an idler pulley mounted on a sprung eccentric hub, which mechanism applies pressure to the smooth, back side of the belt between the crankshaft and water pump, and provides a generous belt wrap around the crankshaft pulley.

The belt itself should be inspected for condition at each service interval, and if it exhibits any evidence of physical damage, cracking, fraying, perishing, abrasion, contamination or any other deterioration, it should be replaced. In the case of oil or coolant contamination, the cause must be identified and rectified, and each of the pulleys must be thoroughly degreased before the new belt is fitted.



Compressor Removal

1. Remove the RHR wheelarch liner (see Service Notes section BT.5) and recover the refrigerant using equipment connected to the service ports at the front of the rear wheelarch.

2. Remove the undertray/diffuser assembly (see service notes section AN.2).

2. Relieve the tension on the auxiliary drive belt (see-section EM.5)

4. Release the clamp plates securing each of the pipes to the compressor and immediately cap the pipes and compressor ports to prevent ingress of dirt and moisture. Secure the two pipe/hoses aside.

5. Disconnect the two compressor electrical harness plugs.

6 Remove the four bolts securing the compressor to the engine, disengage the drive belt and withdraw the unit through the bulkhead aperture. Retain the compressor for oil quantity measurement if a new unit is to be fitted.

Oil Quantity Adjustment Prior to Compressor Refitment

Refitting Existing Compressor

i) If the existing compressor is to be refitted after normal refrigerant recovery has been performed, a quantity of oil equivalent to that recovered must be added to that already held in the compressor.

ii) If the system has suffered a rapid discharge, caused for example by accident damage, most of the refrigerant oil will have been lost. Drain the remaining oil from the compressor by removing the drain plug and rotating the clutch plate. Add 150 cm^3 of new refrigerant oil (see above) to the compressor before refitment.

Fitting New Compressor

New compressors are sealed and pressurised with nitrogen gas. The sealing caps should be removed only immediately prior to compressor fitment, at which time the gas pressure should be heard to escape as a cap is slowly released. New compressors are supplied with an oil fill of 150 cm^3.

iii) If normal refrigerant recovery has been performed, the new compressor oil should be drained off, and the required oil quantity in the new compressor calculated and added:

- Drain and measure the oil quantity in the ***OLD*** compressor by removing the drain plug and rotating the clutch plate. Quantity = X cm^3
- Oil quantity to be added to new compressor = X + 10 cm^3

iv) If the system has suffered a rapid discharge, caused for example by accident damage, most of the refrigerant oil will have been lost. In this case, fit the new compressor as supplied with its 150 cm^3 oil charge.

Compressor Fitment

1. Fit the compressor to the engine and secure with the four M8 bolts; Tighten to 25 Nm (18 lbf.ft).

2. Using new 'O' rings lubricated with mineral refrigerant oil, fit the two refrigerant pipes to the compressor and tighten each clamp plate screw to 9 Nm.

3. Connect the compressor clutch harness.

4. Fit the auxiliary belt around the pulleys ensuring correct engagement of the ribs. Apply a counterclockwise torque to the auxiliary belt tensioner and remove the locking pin.

5. Recharge the system with R134a refrigerant, see sub-section PK.4 and Service Notes section TDV for refrigerant quantity.

Compressor Clutch Assembly

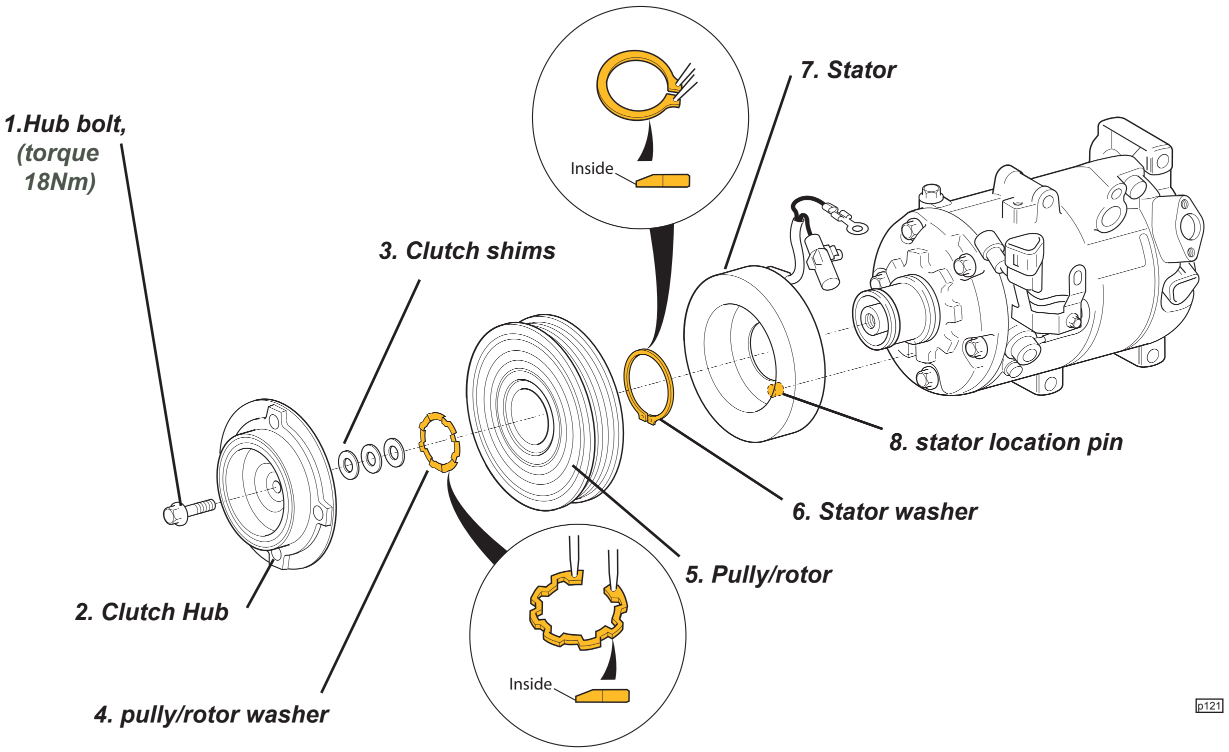
The assembly comprises of a magnetic clutch stator, clutch rotor/pulley and clutch hub. The clutch stator is located into positon onto the front of the compressor by a locating pin and is retained in place by a circlip.

The rotor consist of a non serviceable pulley wheel and internal bearing assembly. the pulley wheel is internally recessed allowing it to fit over the stator. The rotors internal bearing allows the pulley wheel to spin on the compressor shaft casing and is retained in place by a circlip.

The clutch hub consists of a solid mount with an internally splined shaft allowing it to slide onto the compressor shaft splines and is solidly fixed to the compressor shaft by a bolt. A flexible plate is fixed to the rear face of the mount. When the hub assembly is in position the hub plate is in situ next to the outer face of the pulley.

A maximum of 3 shims are fitted between the hub mounts splined shaft and the end of the compressor shaft. This is so that a clearance is created between the contact face of the hub plate and pulley wheel.

When the engine is running, the pulley is in constant rotation via the auxiliary drive belt, but as there is a clearance between the rotor and the hub, the compressor will not turn until the the stator is energised (by turning on the air conditioning). When the stator is energised the clutch assembly becomes magnetised, drawing the flexible plate of the hub against the pulley, transmitting the drive from the auxiliary belt to the compressor shaft.



Clutch Assembly Removal

1. Remove compressor assembly (see previous pages).
2. Place compressor assembly in a vice.
3. Remove hub bolt, withdraw the hub and collect the clutch washers (minimum of 3).
4. Remove pulley/rotor circlip and withdraw pulley.
5. Disconnect stator electrical connector.
6. Remove stator circlip and withdraw stator assembly.

Clutch Assembly Refitment

Refit in reverse order to removal except:

1. Ensure locating pin on stator is aligned with the notch on the compressor housing (item 8).

2. Fit new circlip to stator ensuring chamfered side is facing up (item 6).

3. Fit new circlip to pulley/rotor ensuring chamfered side is facing up (item 4).

4. Fit the clutch washers to the inside extension of the hub mount (item 3). Use same amount of washers as recovered during disassembly or a maximum of 3 and tighten hub bolt to 18Nm.

5. Check clutch clearance (if there is no clearance than add additional clutch washers).

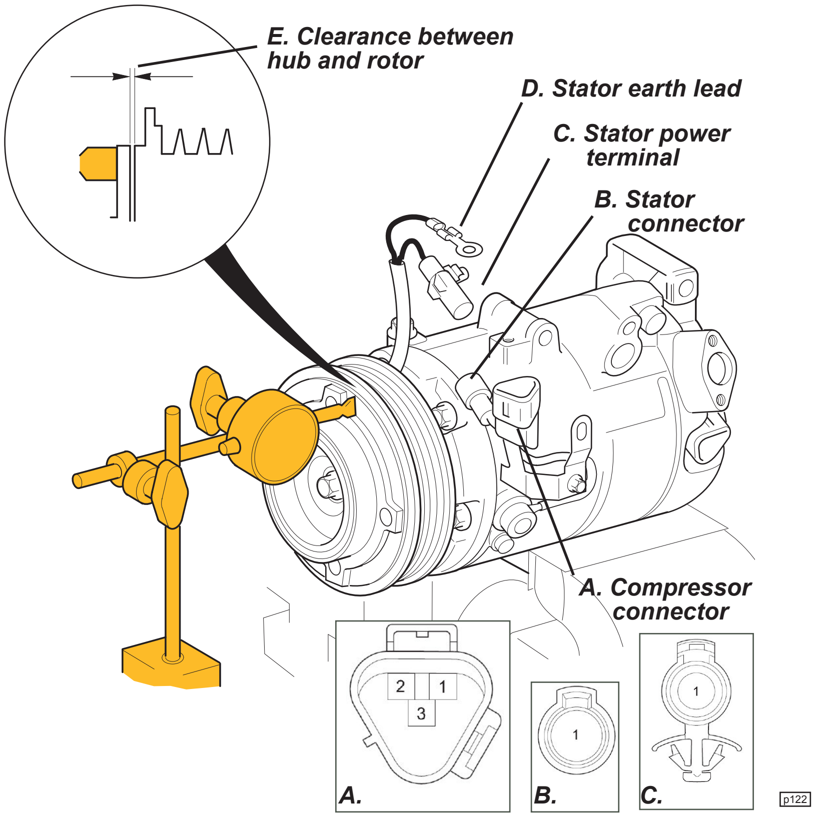
If the clutch fails to operate when a suitable power source is used then check the resistance of the compressor and clutch unit at the following terminals

Tester Connection	Condition	Specified Condition
A-3 - B-1	Always	Below 1 Ω
A-3 - Body ground	Always	10 kΩ or higher

If the resistance is not as specified, replace compressor and clutch

Tester Connection	Condition	Specified Condition
C-1 - Body ground	Always	3.4 to 3.8 Ω

If the resistance is not as specified, replace clutch



Inspecting Clutch Clearance

1. Set a dial test indicator (DTI) to the face of the magnetic clutch hub.

2. Using a suitable 12 volt battery/power source and flyleads, connect the flyleads to the batteries positive and negative terminals. Connect the positive flylead to the clutch stator positive connector (B) and the negative flylead to the stator ground wire (C).

3. Using the power source, turn the magnetic clutch on and off and measure the clearance. (When the power source is connected the clutch should be heard to operate and the hub and rotor should lock together).

4. The distance the hub has moved can be measured on the DTI and equated as a clearance value between the hub and pully. This should measure between 0.26 to 0.60mm.

5. If the measured clearance is not within this range then adjust it by adding or subtracting clutch washers as necessary.

PK.9 - CONDENSER

The engine cooling radiator, a.c. condenser and cooling fans are secured together as a package and are mounted horizontally, with fans lowermost, on top of the crash structure.

The all aluminium condenser is of parallel flow construction, with tanks at each side which direct the refrigerant flow from the front inlet connection successively through 10, 7, 5 and 4 rows, before it emerges from the rear outlet union.

Bonded to the front and rear of the condenser are steel channels which incorporate mounting brackets to attach the unit to the lower flanges of the engine cooling radiator, and also to provide mountings for the two cooling fans.

For access to the condenser or cooling fans, the front clamshell must be removed followed by the radiator mounting panel with the complete cooling pack.

1. Remove the front clamshell (see sub-section BT.6).

2. Remove the two air deflector/water shields.

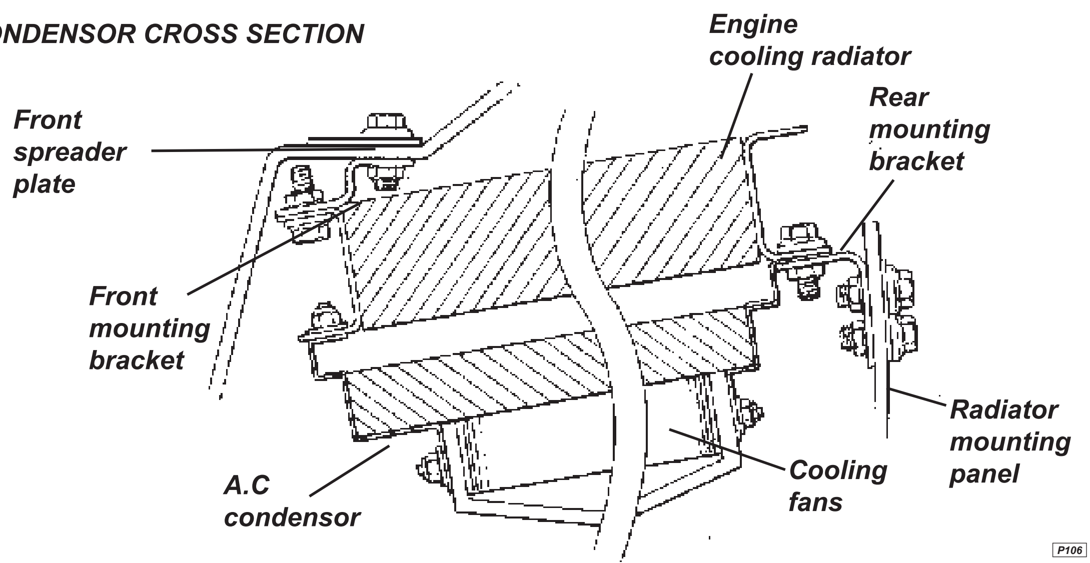
3. Drain the coolant and disconnect the feed and return hoses from the radiator (see sub-section KR.3).

4. Unplug the fan harness connector(s).

5. Remove the RHR wheelarch liner and recover the refrigerant using equipment connected to the service ports at the front of the wheelarch.

6. Using two spanners on each connection to avoid twisting the union, release the two refrigerant pipes from the condenser and immediately cap both the pipes and the condenser unions to prevent the ingress of dirt and moisture. **Please refer to all precautions and warnings shown in section PK.5 before releasing any A.C pipe unions.**

RADIATOR/CONDENSOR CROSS SECTION

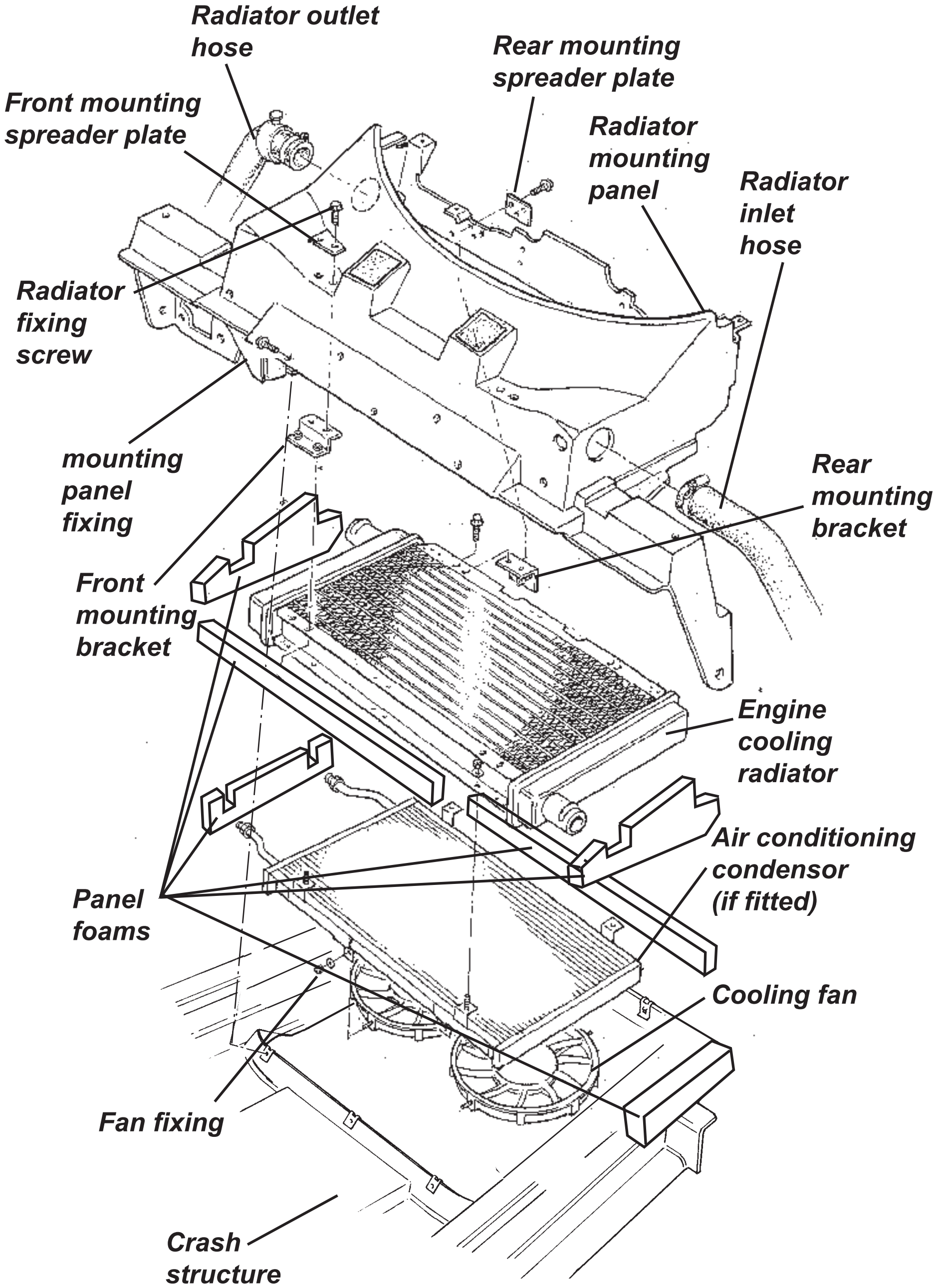


7. Release the radiator mounting panel from the crash structure and lift away the complete assembly.

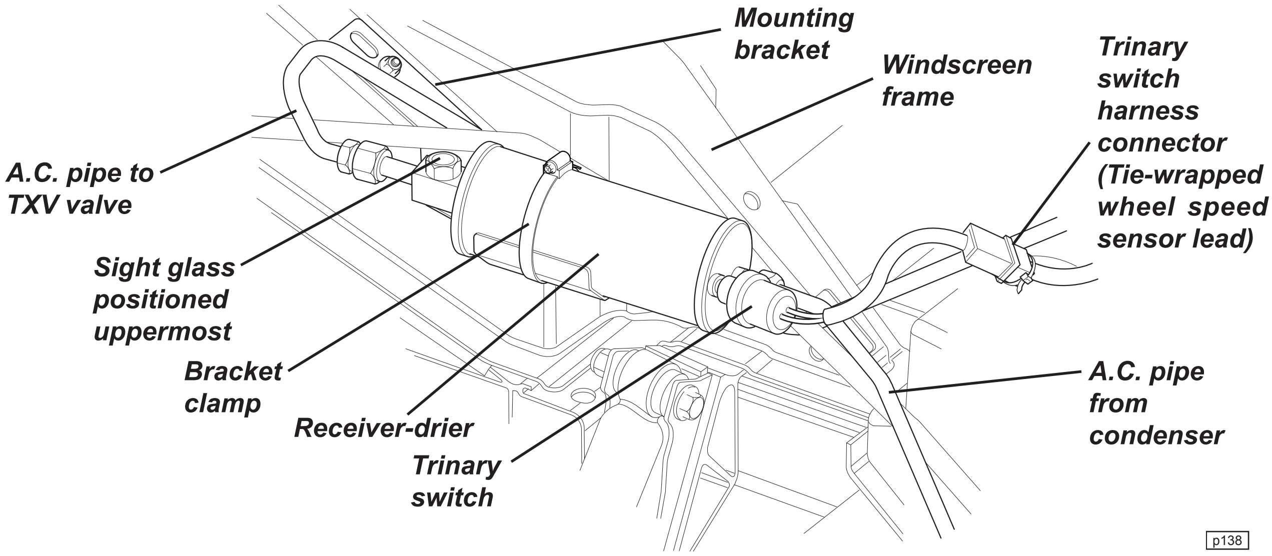
8. To remove the radiator pack from the mounting panel, pull out the sealing foam, release the three bolts securing each rear bracket to the panel, and the two bolts fixing each front bracket to the panel. Separate the fans, condenser and radiator as necessary.

9. On re-assembly, note that the two angle brackets securing the rear of the condenser to the radiator duct, are positioned below the condenser flange, and use a spacer washer at the adjacent fixing point to replicate the flange thickness. Ensure that the sealing foam is refitted around the sides and rear of the condenser, and that the spreader plates are fitted on top of the housing at the front fixing points.

10.- If a new condenser is fitted, add 30 cm³ of approved refrigerant oil to the system.
- Use new 'O' rings on the pipe connections, and lubricate with refrigerant oil.
- Using two spanners, tighten the condenser inlet connection to 25 - 30 Nm.
- Using two spanners, tighten the condenser outlet connection to 20 - 25 Nm.
- Recharge the system with R134a refrigerant, see Service Notes section TDV for quantity informaton.
- Refill the cooling system (see sub-section KR.3).



PK.10 - RECEIVER-DRIER



The receiver-drier is positioned to the RH of the condensor behind the RHF wheelarch liner. It is clamped with a hose clip to a mounting bracket which in turn is fixed to the RH windscreen frame aperture.

If the system has been opened to the atmosphere for any length of time, e.g. following accident damage or a burst hose or damaged component, the receiver-drier unit must be renewed, and should be the last component to be fitted, and uncapped only immediately prior to connection and recharging. If the receiver-drier is to be replaced, the refrigerant must first be recovered using suitable equipment connected to the service ports integral to the compressor discharge and suction hoses located behind the RHR wheelarch liner, see service notes section PK.4 for further information.

Removal:

1. Remove RHR wheelarch liner and recover the refrigerant - see sub sections BT.5 & PK.4 for further information

2. Remove the RHF wheelarch liner and disconnect the trinary switch harness connector.

3. Using two spanners on each connection to avoid twisting the union, release the two refrigerant pipes from the receiver-drier and immediately cap both the pipes and the reciever unions to prevent the ingress of dirt and moisture. **Please refer to all precautions and warnings shown in section PK.5 before releasing any A.C pipe unions.**

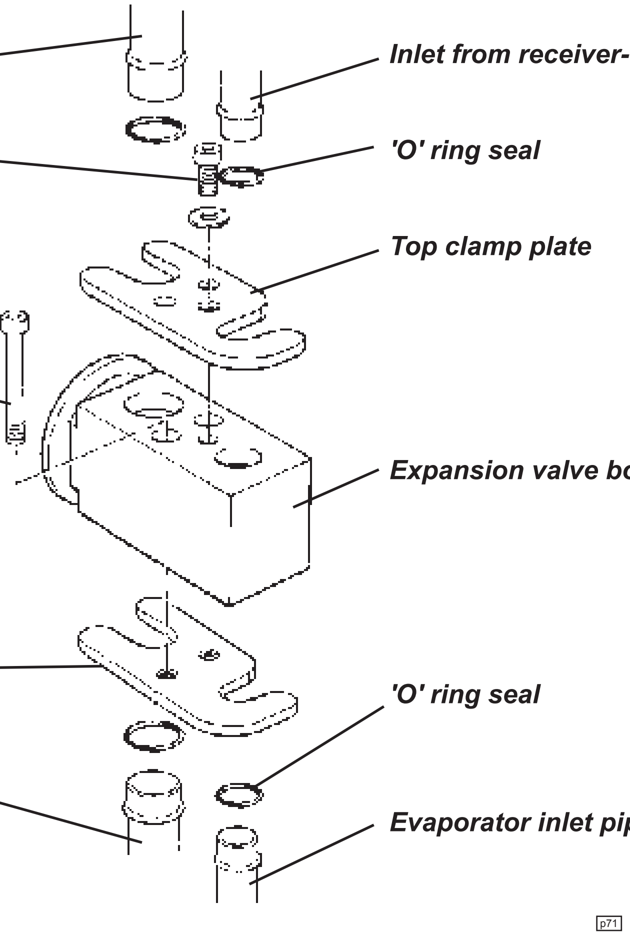
4. Release the hose clamp securing the receiver-drier to the mounting bracket sufficiently to withdraw it. (if the mounting bracket requires removal then release M6 nyloc nuts and washers (2) securing it to the windscreen frame (torque 8 - 12Nm)

Refitment/Renewal:
Is the reversal of removal except:

- Correct directional fitment and orientation of receiver-drier is crucial for the HVAC systems continued satisfactory operation.
- The casing of the the drier has an affixed label showing directional arrows corresponding to refrigerant flow as well as a 'TOP' indicator. If fitted correctly the trinary switch will be positioned outboard of the vehicle and the sight glass being positioned uppermost.

- Once in the correct position on the bracket, tighten the hose clip until it is sufficiently tight to hold the receiver-drier in place. When reconnecting the pipes, use new 'O' rings coated in an approved refrigerant oil, and tighten to 20 - 25 Nm.
- If disturbed or replaced, tighten the trinary switch to 15- 20Nm.
- Recharge the system with R134a refrigerant, see sub-section PK.4 and Service Notes section TDV.

PK.11 - EXPANSION VALVE



The expansion valve is fitted onto the evaporator inlet and outlet pipes above the climate chamber, and is accessible from within the front services compartment. To replace the valve:

1. Remove the RHR wheelarch liner (see Service Notes section BT.5) and recover the refrigerant using equipment connected to the service ports at the front of the wheelarch, see sub-section PK.4 for further information..

2. Release the single M6 screw securing the clamp plate to the top of the expansion valve, and withdraw the plate and both pipes from the valve. Immediately cap the pipes and ports to prevent the ingress of dirt and moisture. **Please refer to all precautions and warnings shown in section PK.5 before releasing any A.C pipe unions.**

3. Release the two M5 screws from the counterbored holes in the top of the valve, securing the valve to the evaporator pipes, and withdraw the valve from the pipes. Immediately cap the pipes and ports to prevent the ingress of dirt and moisture.

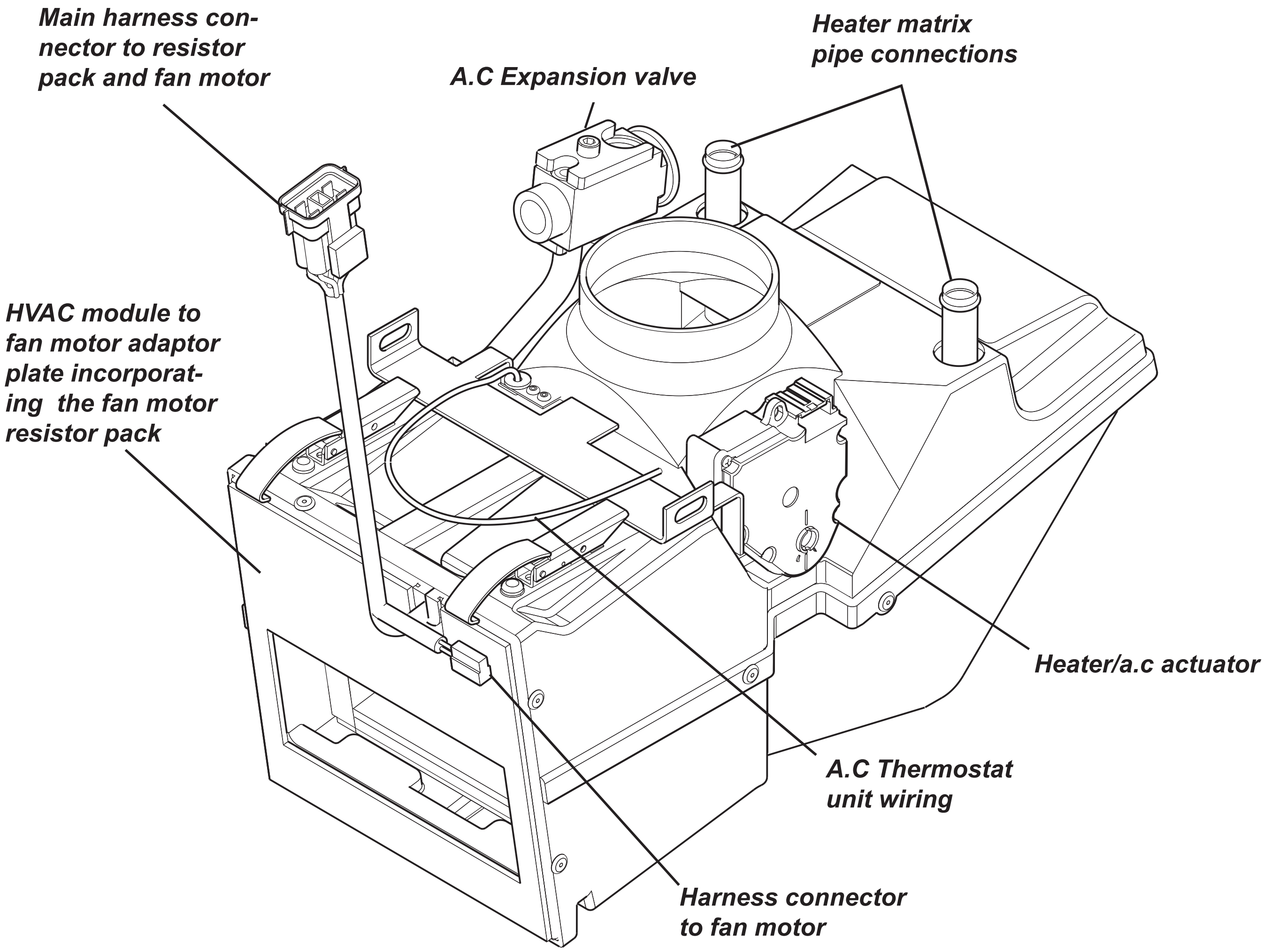
4. Before refitting, renew all the connector 'O' rings, and coat with an approved refrigerant oil.

5. Fit the threaded clamp plate around the evaporator pipes, and secure the expansion valve onto the pipes with the two M5 screws tightened to 5 - 6 Nm.

6. Use the second clamp plate to secure the two pipes to the expansion valve, tightening the single M6 screw to 7 - 9 Nm.

7. Recharge the system with R134a refrigerant, see sub-section PK.4 and Service Notes section TDV.

PK.12 - HEATER/EVAPORATOR/FAN UNIT



The heater matrix and a.c. evaporator are contained within a single housing together with the air blender temperature control flaps, TXV expansion valve and thermostat unit. The housing is mounted in the chassis climate chamber where it is clipped to the fan blower unit, and retained by a simple clamp bracket.

Note that the heater/a.c./blower unit is fitted the opposite way round between LHD and RHD cars with the blower motor always being positioned to the drivers side of the vehicle. on RHD vehicles and to the LH side on LHD vehicles:

The identical HVAC module and blower motor assemblies are used for both LHD and RHD vehicles but specific ally handed a.c pipes, heater hoses, distribution plenums, fresh air intake and recirculation ducts are fitted dependant on the HVAC orientation/vehicle drive used.

The temperature probe for the a.c. system is positioned at the coldest part of the evaporator, the optimum position being the centre of the second from top row of evaporator fins, with the tip of the probe just touching the fins.

Incorrect positioning of the thermostatic probe may provide a false signal resulting in ice formation on the evaporator core, resulting in restricted airflow to the cabin.

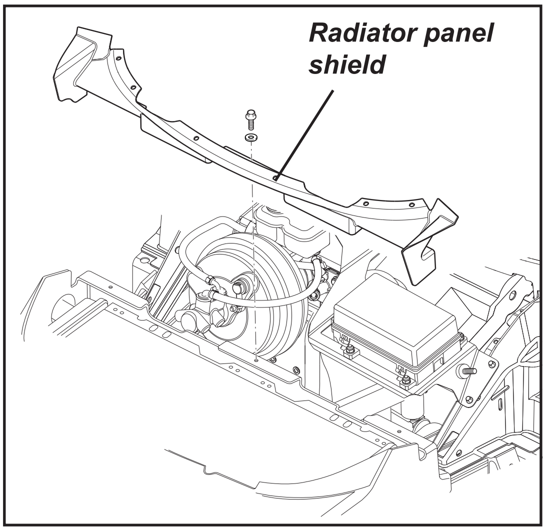
To remove heater/evaporator/fan unit:

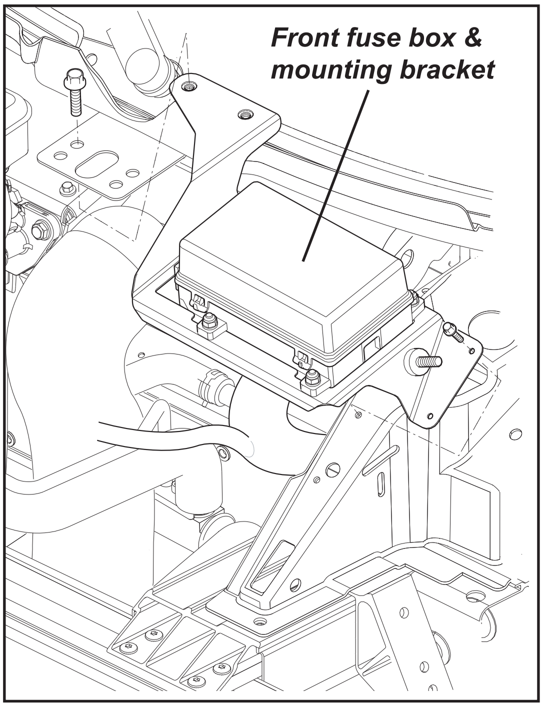
1. Remove the RHR wheelarch liner (see Service Notes section BT.5) and recover the refrigerant using equipment connected to the service ports at the front of the wheelarch, see sub-section PK.4 for further information.

2. Remove the front clamshell (see sub-section BT.6).

3. Release the M5 x 16 screw (3) and scrivets securing radiator panel shield and withdraw from the vehicle.

4. Release the M8 x 20 screws (2) securing the front fuse box bracket to the windscreen wiper mounting frame and M6 x 16 screws (2) securing the fuse box bracket to the windscreen frame, carefully lift the fuse box with bracket assembly and place to one side ensuring that no unneccesary strain is placed on the wiring harness or connections.





5. Remove the ducting between heater/a.c. unit and air distribution unit.

6. Disconnect the inlet and outlet pipes from the TXV expansion valve. It may also be neccessary to disconnect and remove the TXV low pressure outlet pipe at its connection to the sill pipe as well as the high pressure pipe from the reciever-drier to allow the HVAC module to be withdrawn from the vehicle.

7. Cap all pipes and ports immediately to prevent the ingress of dirt and moisture - refer to section PK.4 for further information.**Please refer to all precautions and warnings shown in section PK.5 before releasing any A.C pipe unions.**

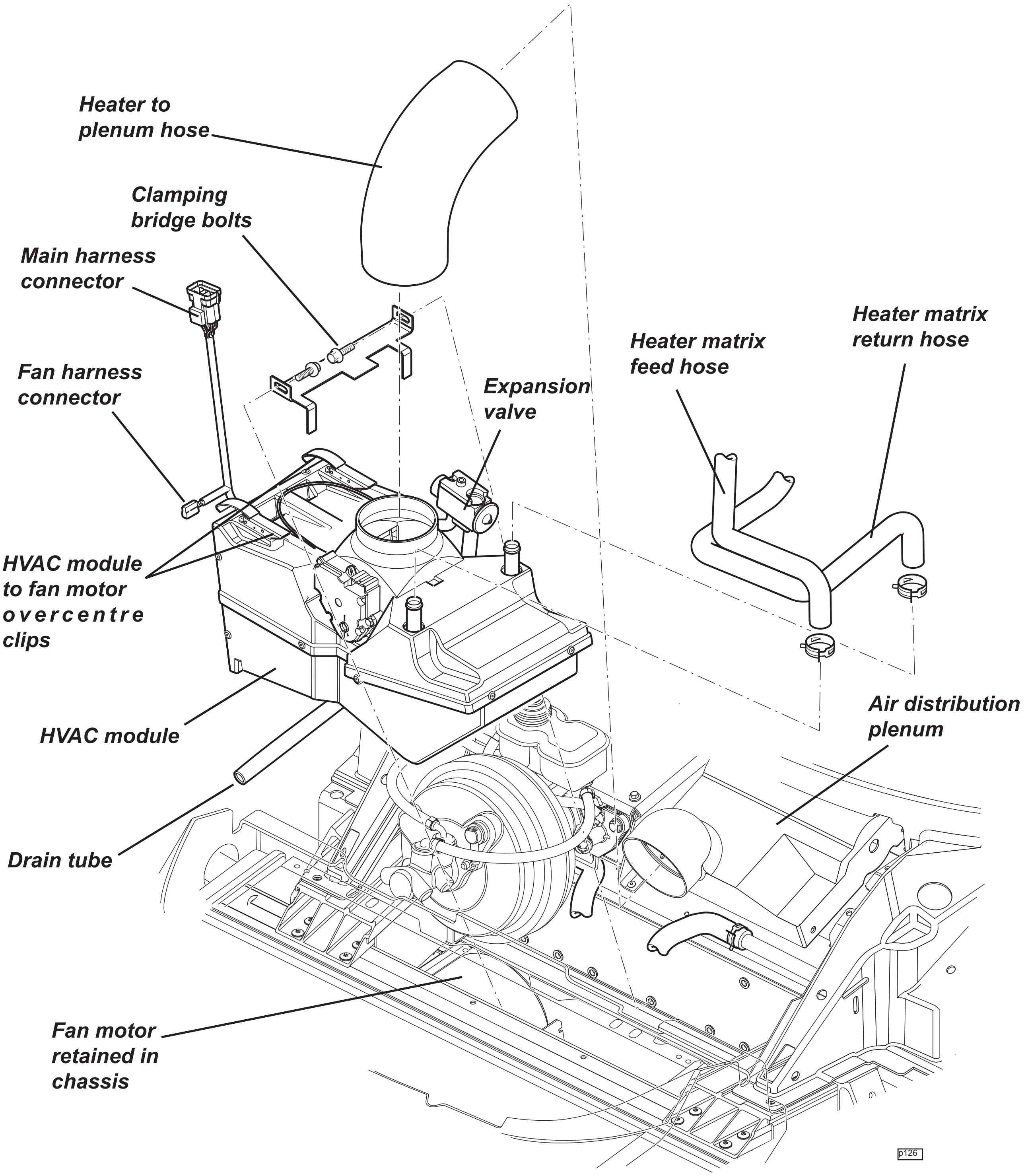
6. Disconnect the hoses from the heater matrix and collect escaping coolant by draining into a suitable container.

7. Unplug the wiring harnesses to the temperature flap motor, a.c. thermostat, resistor pack and fan motor.

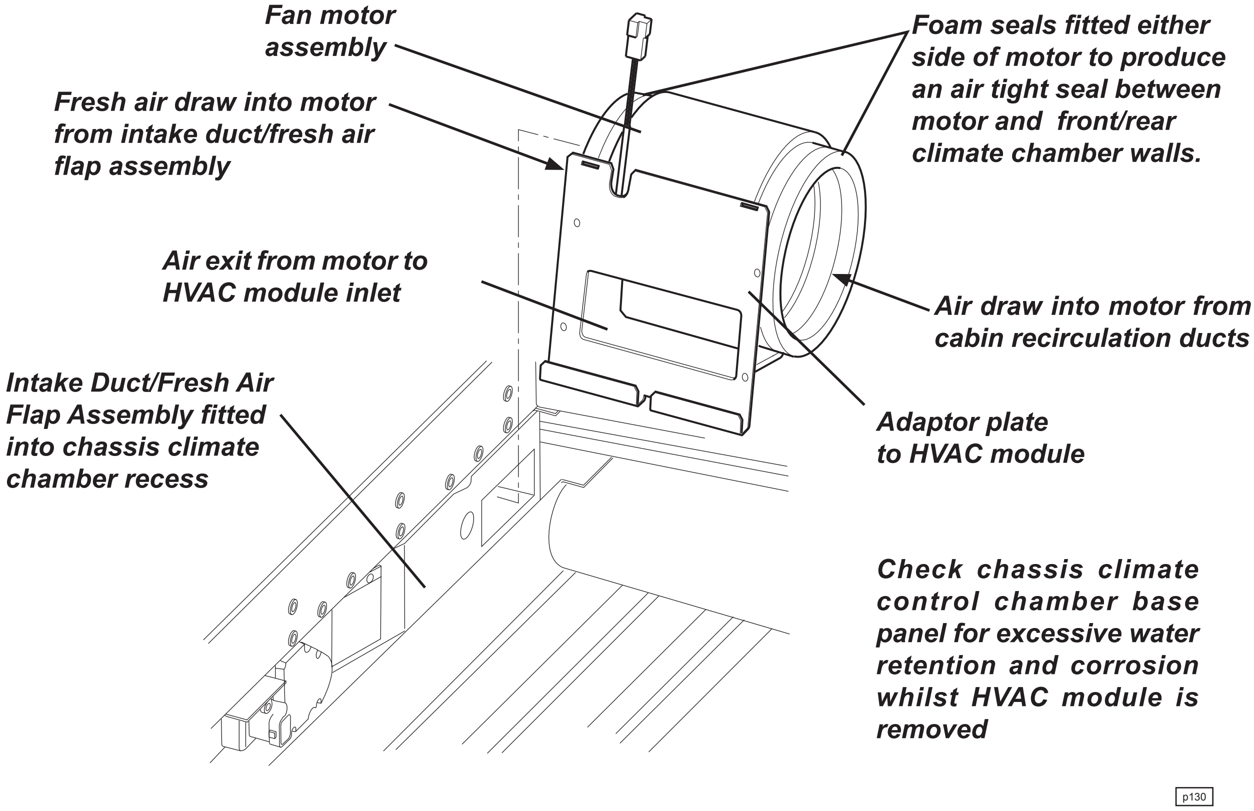
8. Remove the clamping bridge retaining the unit into the chassis and release the overcentre clips securing the unit to the fan blower housing. Withdraw the unit from the chassis together with the drain tube. The fan motor housing and intake duct/fresh air flap assembly are now accessible for removal.

Whilst the HVAC module is removed, inspect the chassis compartment housing for the retention of water and extract as necessary.

It is now possible to gain access to the fan motor which can be removed by withdrawing it from the climate chamber. although not mechanically fixed it may be held tightly in position between the fresh air intake duct at the front of the climate chamber and recirculation duct positioned at the rear of the chamber. Withdraw the motor housing carefully to avoid damaging the foam seals attached to the fan motor inlet chambers.



Heater to plenum hose
Clamping bridge bolts
Main harness connector
Fan harness connector
HVAC module to fan motor overcentre clips
HVAC module
Drain tube
Fan motor retained in chassis
Expansion valve
Heater matrix feed hose
Heater matrix return hose
Air distribution plenum
p126



To refit heater/evaporator/fan unit:
Before refitting the unit, first ensure that the following components are fitted in the chassis:

- Fresh air intake ducting/re-circulation valve assembly, retained in channel at front of chamber by single clamp bracket.

- Check that re-circ. flap stepper motor harness is connected, and that the moulded plastic water shield is fitted over the actuator.

- Recirc. plenums are fitted correctly in rear of chassis climate chamber.

- Earth cables are connected to chassis negative post at the left hand side of the chamber.

- Rear circuit brake pipe is fitted between master cylinder and bulkhead connector.

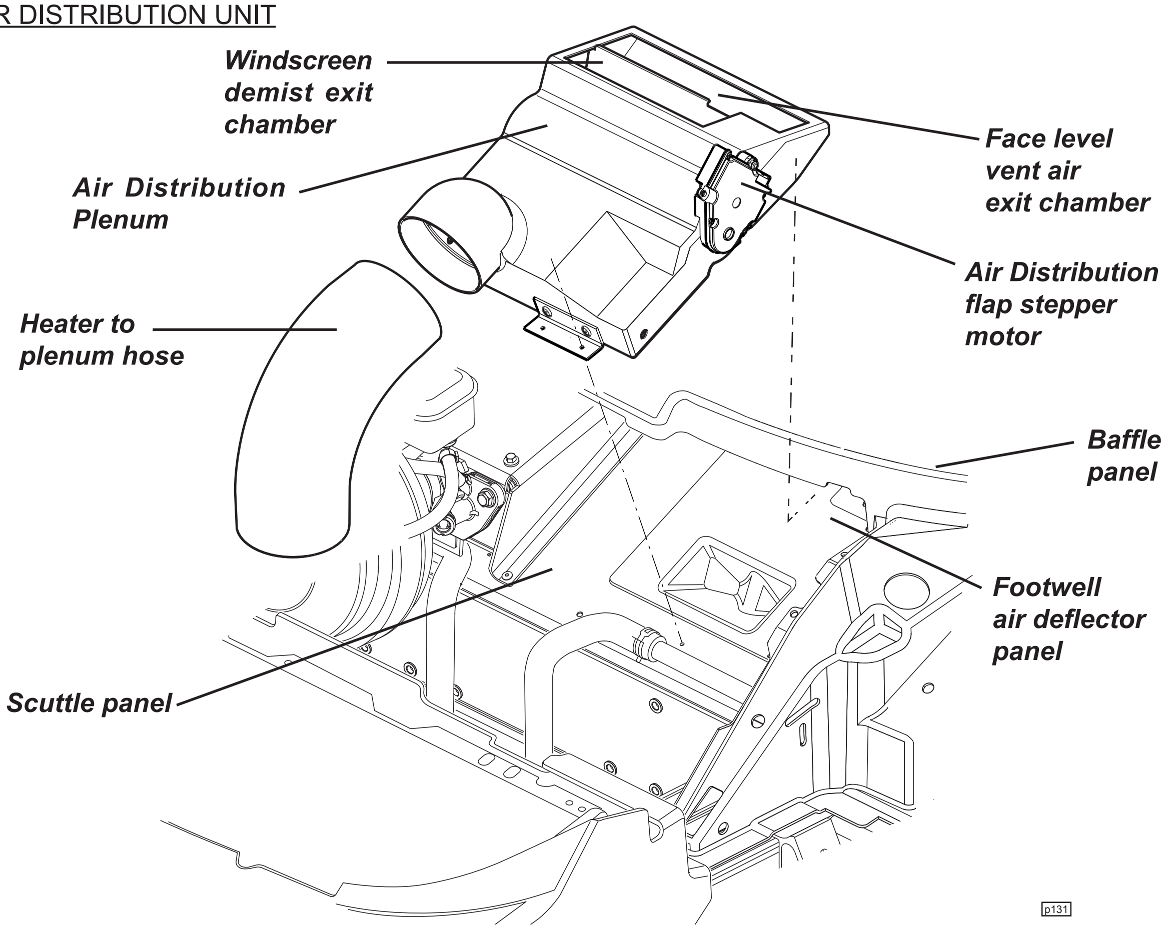
- Position the fan housing into the passenger side of the chassis chamber. Fit the drain tube into the base of the heater/evap. unit and use a guide wire or similar to aid routing of the tube through the chassis cross-member via the central aperture at the back of the chamber, as the unit is fitted into the chamber.

- Engage the lower edges of the fan unit and heater/evap. unit before clamping together with the two over-centre latches. Retain the assembly by fitting the bridging clamp bracket.

- Ensure that the harness leads for both the air blend and recirculation actuator are looped downwards to prevent water tracking along the lead and into the actuators.

Continue re-assembly in reverse order to removal.

PK.13 - AIR DISTRIBUTION UNIT



The airflow distribution unit is mounted on top of the chassis scuttle, sandwiched between the underside of the fascia top/demist duct and the chassis. The unit comprises several plastic mouldings bonded and rivetted together to contain the rotary flap for windscreen/face level vents, and also the footwell flap. The stepper motor for the rotary flap is mounted on the side of the unit.

To Remove:
1. Remove the front clamshell (see sub-section BT.6)

2. Release the M8 x 20 screws (2) securing the front fuse box bracket to the windscreen wiper mounting frame and M6 x 16 screws (2) securing the fuse box bracket to the windscreen frame, carefully lift the fuse box with bracket assembly and place to one side ensuring that no unneccesary strain is placed on the wiring harness or connections. See HVAC module removal section PK.12 for additional information.

3. Remove the air trunking between the heater/a.c. unit and the distribution unit.

4. Remove the wiper mechanism (see sub-section MP.8).

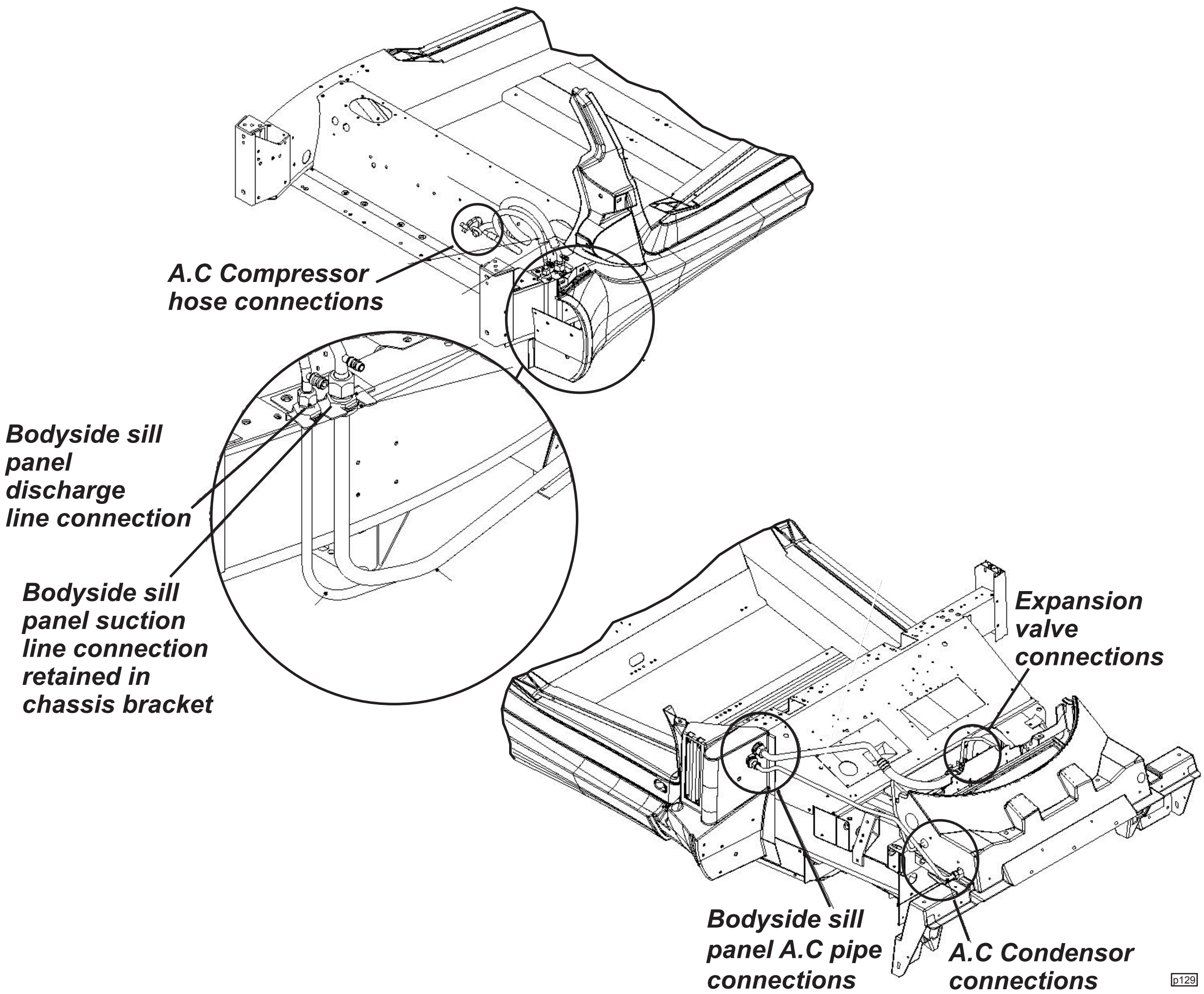
5. Release the fixings securing the heater water pipe to the chassis scuttle.

6. Drill out the rivets securing the distribution unit retaining bracket to the chassis scuttle.

7. Withdraw the unit from beneath the baffle panel, disconnecting the stepper motor harness plug when access allows.

To Refit:
Refit in reverse order to removal, ensuring that the sealing foam between the unit and baffle panel and on the chassis scuttle is present and in good condition. Secure by re-rivetting the retaining bracket.

PK.14 - REFRIGERANT PIPES



Description
The main feed and return (high pressure liquid and low pressure suction) lines to the compressor take the form of aluminium pipes routed along the outside of the RH chassis rail,

Servicing Reqirements
In the course of regular servicing, when inspecting coolant and oil hoses and pipes, attention should also be paid to the a.c. pipes with particular reference to the joints at the rear end of the sill pipes where they are anchored to a chassis bracket.

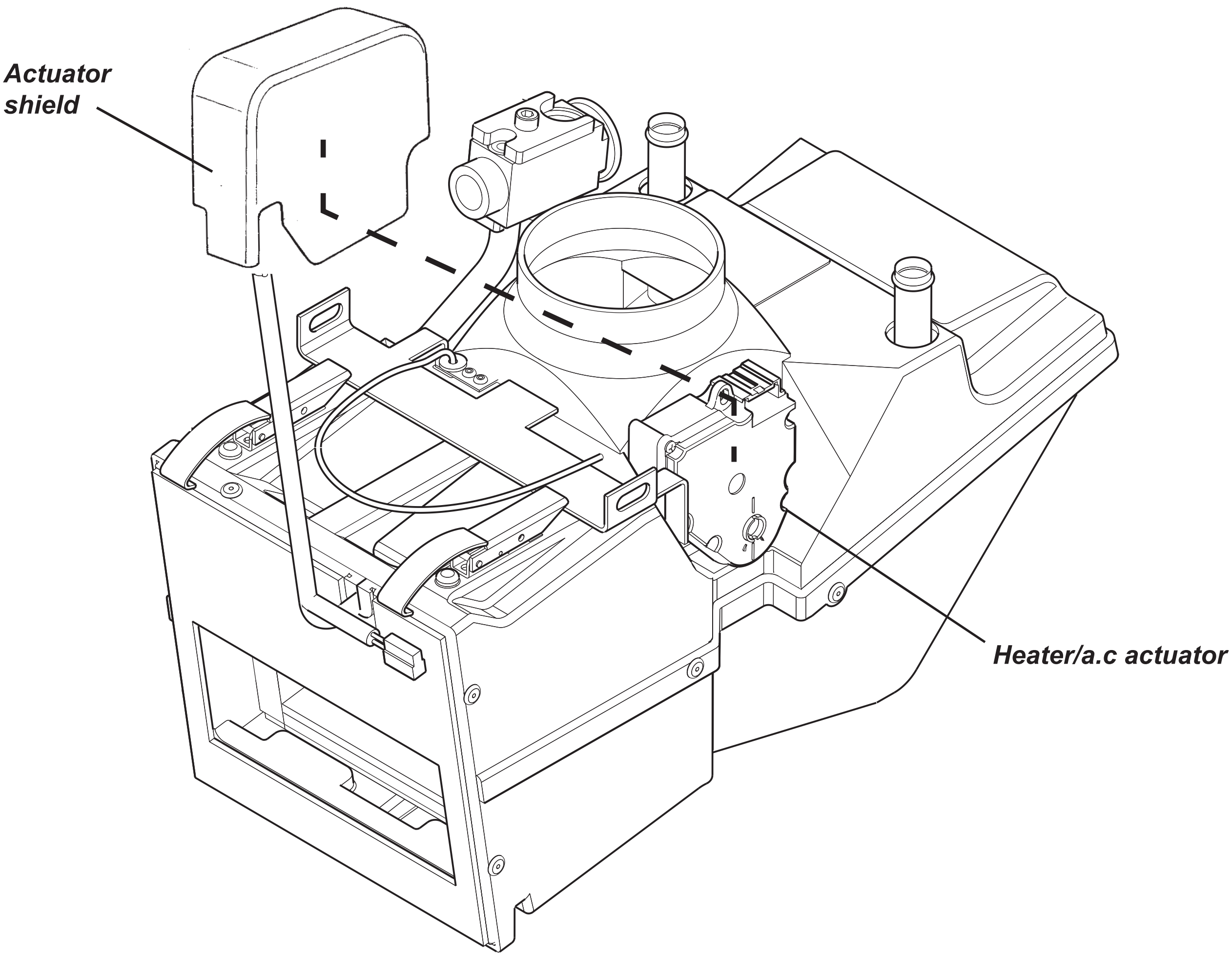
This area is vulnerable to contamination, via the air intake grilles, from spray thrown up by the front wheels. Application of an anti-corrosion fluid such as ACF 50 (A117A0239S) or a proprietary wax/oil type product will enhance the long term durability of alloy components.

Pipe Replacement
Removal of the body sill panel is required for access to the pipes. Replacement of the pipes is unlikely to be necessary other than as a result of accident damage, in which case the body sill will be replaced in accordance with Service Notes Section BX.

PK.15 - AIR BLENDER & RE-CIRC. FLAP ACTUATORS

Air Blend Actuator

The stepper motor (actuator) for the air temperature blender flap is mounted on the side of the heater/a.c. casing, secured by two screws and has an ABS cover placed over it to prevent water contamination.



Removal

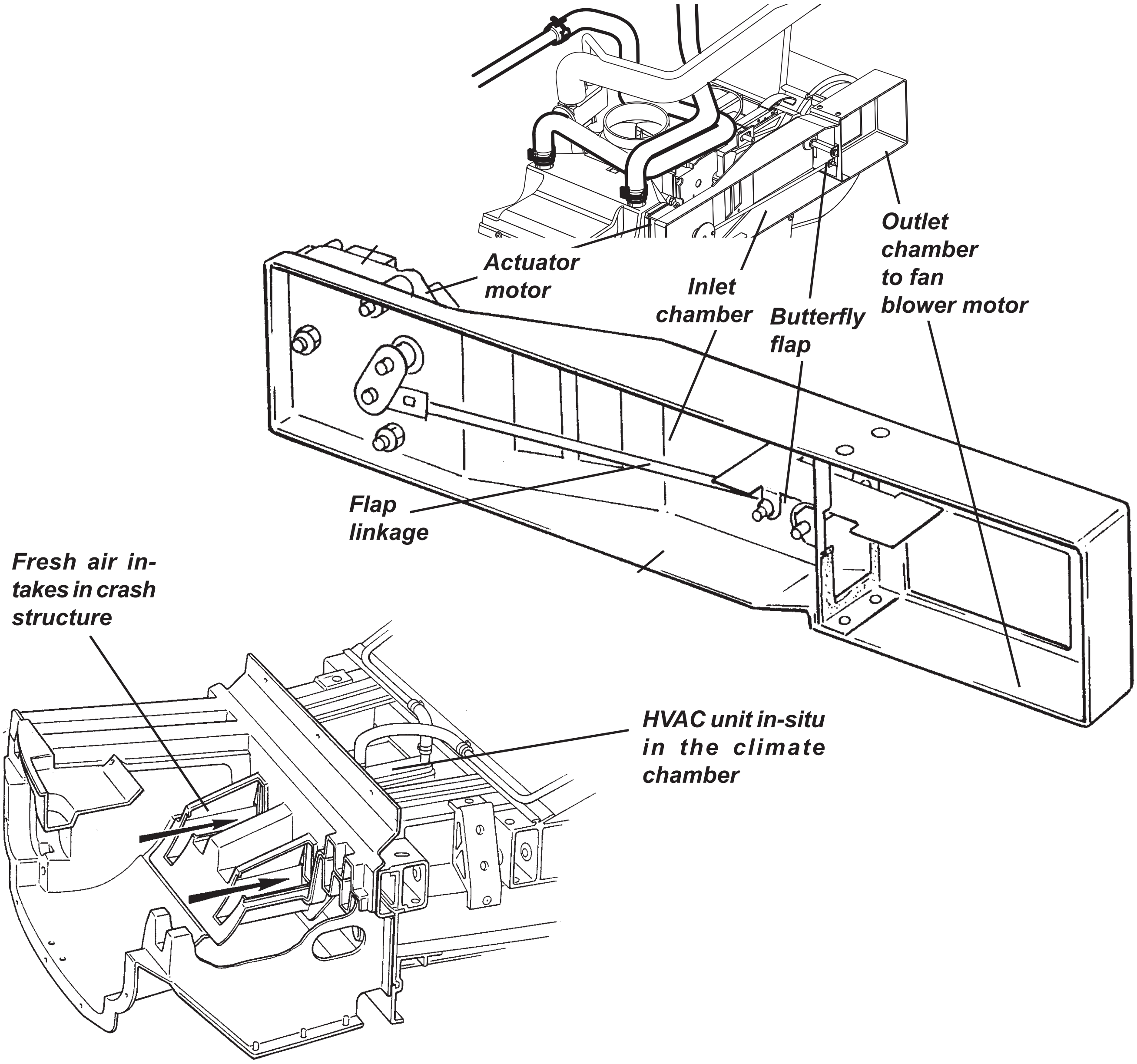
To gain access to the actuator the HVAC module must be removed, see sub-section PK.12.

If the actuator is to be replaced the two nuts for the actuator fixings are accessible inside the casing via the air outlet aperture, but the air blender flap may need to be moved to allow access to both nuts. In order to allow flap movement, the flap must be mechanically disconnected from the motor by unclipping the actuator outer cover and sliding a drive gear off its shaft.

Refitment

Ensure that the actuator lead is looped downwards to prevent water tracking along the lead and into the actuator.

Intake Duct/Fresh Air Flap Assembly



The assembly consists of a butterfly flap valve and actuator fitted into ABS moulding.

This is fitted onto the front of the chassis climate chamber/rear side of the chassis front face to form separate chambers either side of the butterfly flap .

Fresh air is directed via tubes in the crash structure to the inlet side of the fresh air chamber, if the a.c recircla-tion button is not activated then the fresh air actuator and butteryfly flap will be in the 'open' default position allowing the fresh air to be drawn into outlet chamber and into the fan blower motor inlet.

If the a.c re-circulation button is depressed activating the fresh air actuator motor, the butterfly flap will close sealing the fresh air intake chamber. Only air from vehicle cabin via the re-circlation plenums located on the rear wall of the climate chanber will be directed into the fan blower motor.

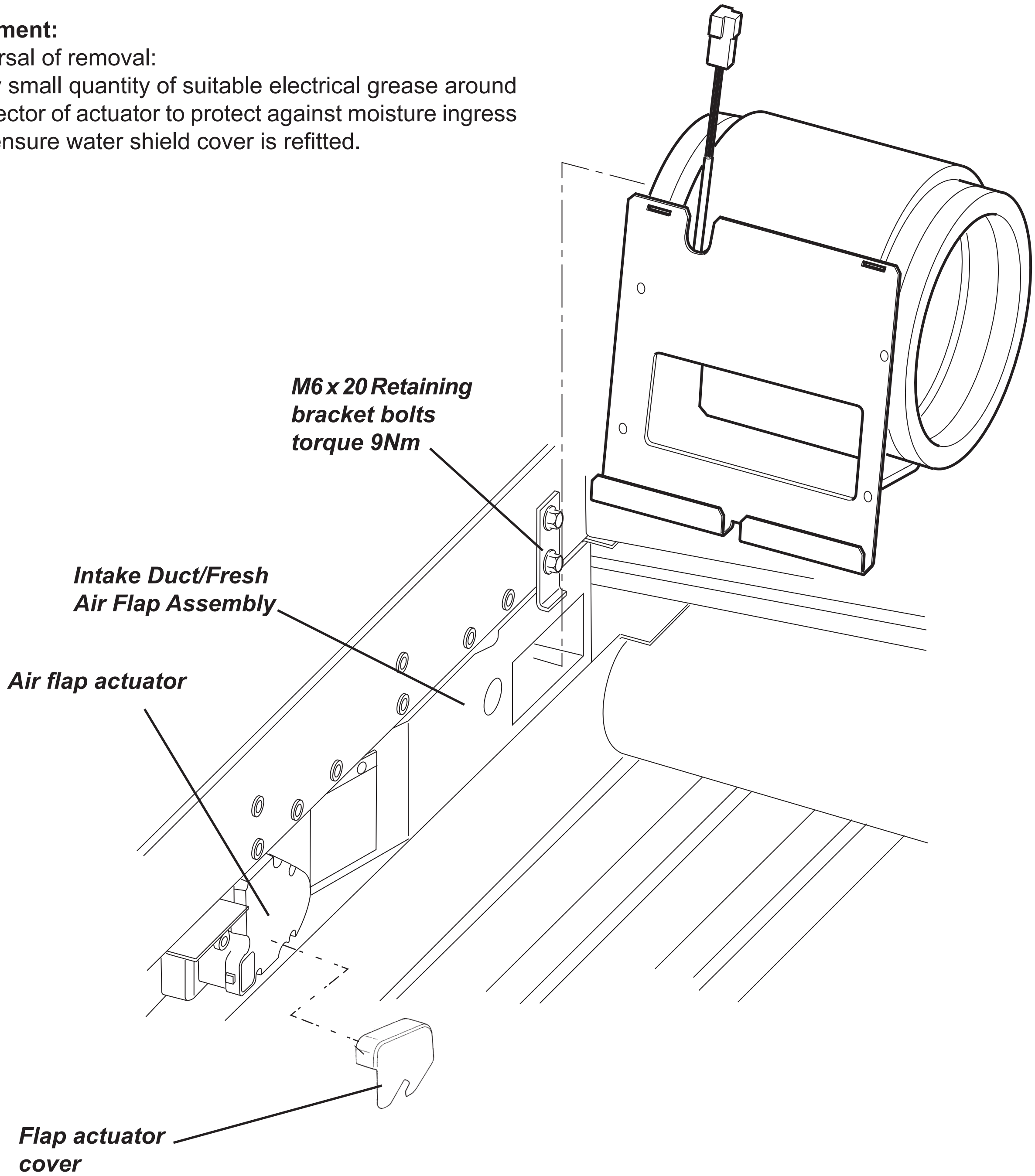
Removal:
The intake duct/fresh air flap Assembly and re-circulation flap actuator on both RHD and LHD cars are accessible only with the heater/a.c. unit and fan blower motor removed - see PK.12 for further information.

1. Release M6 x 20 bolts (2) securing the flap assembly retaining bracket to the climate chamber wall.

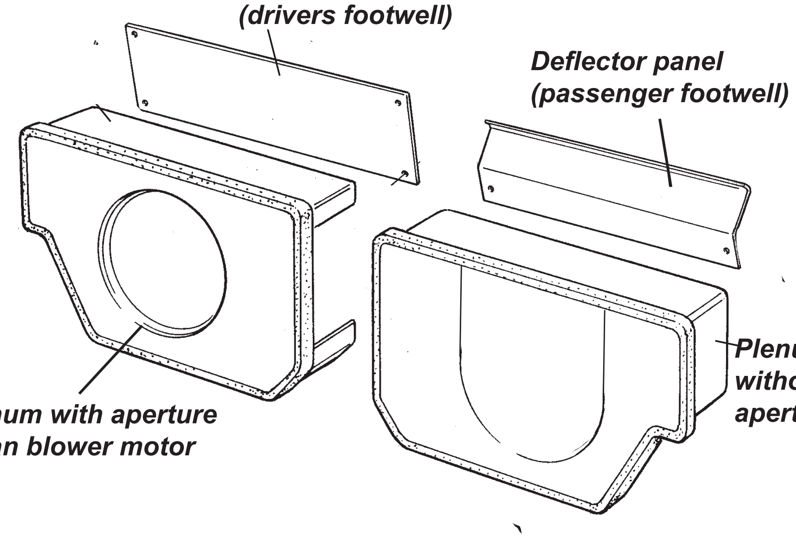
2. Unclip the actuator water shield and harness

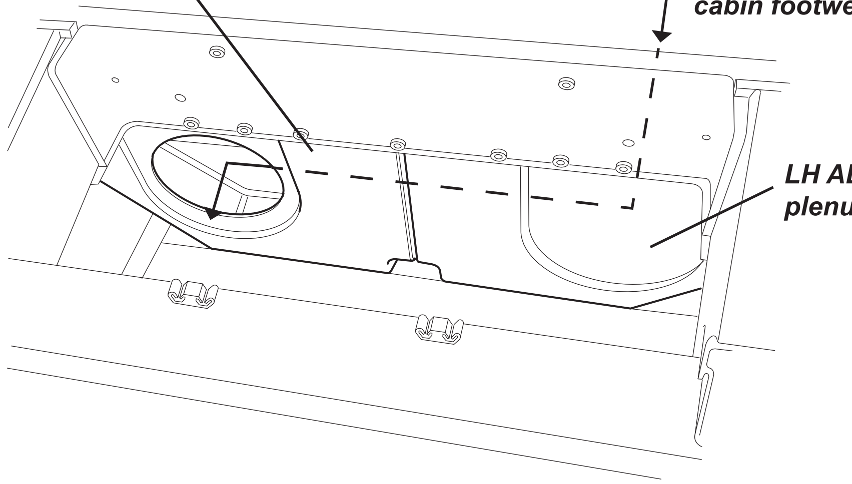
3. The assembly may now be withdrawn from its recess in the climate chamber,

Refitment:
Reversal of removal:
Apply small quantity of suitable electrical grease around connector of actuator to protect against moisture ingress and ensure water shield cover is refitted.



Air Re-circulation Plenum Assembly





Climate chamber for RHD Toyota powertrained vehicle with HVAC module removed exposing air re-circulation plenum assembly

Air supply for the HVAC module is normally drawn from both the intake ducts ahead of the engine cooling radiator - see previous page and sub section PK.2 for additional information as well as the vehicle interior via the air recirculation plenum assembly.

When the re-circulation button is pressed, a stepper motor is activated to close the butterfly flap in the fresh air intake allowing only air from the cabin (rear intake) to be drawn through the fan blower motor via the air recirculation plenum assembly.

The assembly consists of 2 virtually identical mirror image ABS moulded plenums, one plenum has an aperture within its casing to provide and outlet to the blower motor.

The plenums are positioned within a recess to the rear of the climate chamber. The chassis wall behind the plenums has perforated ports drilled into the front wall of each footwell. A blanking plate covers the perforations on the driver's side footwell (LHD or RHD) and is affixed with pop rivets; a contoured deflector plate is affixed to the front wall of the passenger side footwell perforations to allow air to drawn from the vehicle cabin into the

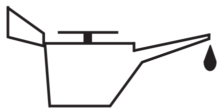
climate chamber.
the plenums are joined together and casings are fitted with foam where they mate against the each other as well as climate chamber/chassis wall to provide an airtight seal.

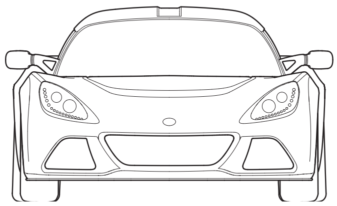
Access to the re-circulation plenums is only possible with the removal of the blower fan and HVAC module - see sub section PK.12 for additional information.

Because the various blower motor assembly positioning recirculation plenums are provided with different blower motor aperture configurations so that they may also be swapped over from LH to RH dependant on the HVAC orientation/vehicle drive used.

MAINTENANCE & LUBRICATION EXIGE S

SECTION OJ





FLUID CHANGE INTERVALS

Please see service notes section TDV for information on fluid capacities, standards and approved products.

Engine
In order to ensure the longevity and reliability of the vehicle, it is most important that **only the specified lubricants** are used. It is an entirely false economy to try to save money by using lower quality oils, which may break down before the next change interval and provide inadequate protection before the end of the term. High oil consumption may also result.

Throughout the life of the vehicle (including topping up during the running-in period if required) a fully synthetic 5W/30 or 5W/40 oil should be used.

A top quality fully synthetic 5W/40 oil, such as 'PETRONAS Syntium 3000' is suitable for all climatic conditions and engine speeds likely to be encountered*.

Note that no oil additives are approved by Lotus.

Engine Oil change interval	Refer to Maintenance Schedule
Transmission - Manual Supercharged (gearbox & final drive)	
Oil change interval	Refer to Maintenance Schedule
Brake & Clutch System	
Fluid change interval	24 months
Engine Coolant Additive	
Coolant change interval	4 years

****If the vehicle is to be driven hard in very high ambient temperatures, or used on a race track, the recommended fully synthetic engine oil is 'PETRONAS Syntium Racer' 10W/60.***

'Severe Service' Conditions
Certain operating conditions can cause rapid degradation of the oil quality, either by the accumulation of dirt particles, or by the absorption of water from condensation. If any of the 'severe service' conditions described below apply, it is recommended that the oil and filter be changed twice as frequently as is listed in the Maintenance Schedule.

- Driving in dusty areas (e.g. on unmetalled roads); Change the oil and filter as soon as possible after driving in a dust storm.
- Stop/start driving with frequent short trips where the engine rarely warms up thoroughly (especially in cold weather/climates); and/or frequent or prolonged idling.
- Track use, with repeated high rpm, wide throttle openings and high oil temperatures. In these circumstances, individual judgement must be made regarding appropriate servicing.

MAINTENANCE SCHEDULE - ELISE/EXIGE (NON USA)

LSL501e

Job no.: .... Owner's name: .....……………....................... Vehicle: ....………...…………..

Vehicle registration no.: …....…………..................... V.I.N.: ......………..

Recorded mileage: ....…………..…….…………..… Mileage/Km at last service.: ....…………….............

Today's date: ………………..………...…………… Date of last service: ……………………….......................

EXPLANATORY NOTES:

Required Maintenance

In order to maintain warranty validation and help ensure proper safety, emissions performance and dependability of the vehicle, Lotus Cars Ltd. requires that the vehicle be serviced in accordance with this schedule. Each service should be performed within 9,000 miles (15,000 km) or 12 months of the previous service, whichever first occurs.
Any necessary repairs should be completed without delay.

A cross (X) in the following table indicates an operation to be performed. The corresponding box should be ticked when the operation has been satisfactorily performed, or the X circled if extra work and time is required. The approval of the customer should be obtained before any extra work is undertaken, details of which should be recorded in the space provided at the end of the schedule.

Inspect' means assess condition and test for correct operation. Extra time is required to adjust or repair - advise customer beforehand if necessary.

Check' means test and adjust/fill or tighten as necessary. Labour time is included.

Special Operating Conditions

If the car is subjected to one of the following 'special operating conditions', additional servicing is required (see additional servicing notes below):
- Regular use on unpaved or dusty roads (1,2)
- Use in mountainous areas with severe or prolonged brake usage (3)
- Frequent short trips with cold engine (esp. in cold weather/climates); and/or frequent or prolonged idling (1)
- Occasional circuit use, with repeated high rpm, wide throttle openings and high oil temperatures (1,3,4)
- Competition, timed track use or repeated use of Lotus Launch Control or driver instigated standing starts (5)

Additional servicing:
1. Oil & filter change @ 4,500 m (7,500 km) intervals.
2. Inspect air cleaner @ 9,000 m (15,000 km) intervals, or as required.
3. Inspect brake pads & discs @ 1,000m (1,500 km) intervals, or as required.
4. Thorough safety check including wheels, tyres, suspension, steering and brake systems.
5. The Lotus Elise/Exige is designed as a road going sports car. It is recognised that owners may wish to use the car occasionally on closed circuit tracks to experience the car's full range of dynamic capabilities. However, use of the car in a competitive manner, including timed runs or laps, is not endorsed by Lotus. This type of timed, competitive use will invalidate warranty and require appropriate levels of expert vehicle preparation and servicing over and above that specified in the Maintenance Schedule.

After Sales Service

To be performed by the selling dealer within 1,000 - 1,500 miles (1,500 - 2,500 km) or 12 months of vehicle sale, whichever first occurs.
If carried out by the selling dealer, there is no charge to the vehicle owner for the labour content of the After Sales Service. Only for materials used will a charge be made. To maintain warranty validation, an Engine History and Performance Report print out via the Lotus TechCentre must be submitted to the Warranty Department.

Recommended Fluids & Lubricants

Lotus recommends the use of **PETRONAS** products for many of its vehicle models. Please refer to the relevant ‘Vehicle Data’ sections of the workshop service notes for a full list of capacities, standards and approved products.

Op. No.	Operation Description	Service Type		
		After Sales	9,000m (15,000km) or 12 months	Other Intervals / Launch Control Reset
1	Fit covers to seats, footwells, steering wheel and rear body	X	X	
	Lubrication			
2	Renew engine oil and filter - ***normal conditions***	X	X	
2a	Renew engine oil and filter - ***special conditions***	4,500m (7,500km)/6 mth		
3	Inspect engine & transmission for oil leaks	X	X	X
4	Check transmission oil level	27,000m (45,000km)		X
5	Renew transmission oil	54,000m (90,000km)/6 yr		
	Engine			
6	Inspect air cleaner element - ***special conditions***		X	
7	Renew air cleaner element	27,000m (45,000km)		
8	Renew spark plugs (naturally aspirated vehicles)	54,000m (90,000km)/6 yr		
8a	Renew spark plugs (supercharged vehicles)	36,000m (58,000km)/4 yr		
9	Inspect auxiliary drive belt condition (X* Supercharged Elise only)	X*	X	
9a	Inspect auxiliary drive belt condition - ***special conditions***	4,500m (7,500km)/6 mth		
9b	Renew auxiliary drive belt - (Supercharged Elise only)	18,000m (30,000km)/24 mth		
9c	**If applicable:** Check Accusump pressure/operation and system for leaks. Renew in-line filter gauze	X	X	
9d	Inspect RH side engine mounting insulator for cracking/splitting (Exige S only - see service notes section EM.7 for further information)		X	X
10	Inspect integrity of fuel system		X	
11	Use 'Lotus TechCentre'; inspect fault codes & ECU programme level (all models), check for standing starts registered and record information in Service Maintenance Record (Exige S only)	X	X	X
12	Print Engine History & Performance data and retain with the job card	X	X	X
	Cooling System			
13	Inspect water radiator & oil cooler hoses & pipework for damage or leaks. Clean radiator & oil cooler finning		X	
14	Check engine coolant level	X	X	X
14a	Check charge cooler coolant level - *Elise S only*	X	X	
15	Renew engine and charge cooler coolant			4 yr
	Braking System			
16	Inspect parking brake adjustment	X	X	
17	Inspect brake pad thickness & disc condition - ***normal cndts.***		X	
17a	Inspect brake pad thickness & disc condition - ***special cndts.***	1,000m (1,500km)		
18	Inspect brake hoses, pipes & hydraulic units		X	
19	Check brake/clutch fluid level	X	X	X
20	Renew brake/clutch fluid			2 yr
	Steering & Suspension			
21	Check security and condition of front & rear suspension inc. free articulation of rear toe link ball joints		X	X
22	Check torque of rear toe link inboard fixing (60 Nm)	X	X	X
23	Inspect dampers for leaks and performance		X	X
23a	Where applicable: Check security of damper reservoirs, check adjuster settings, lubricate adjusters and spring platforms		X	
24	Inspect front and rear wheel bearings for play		X	X
25	Inspect condition of drive shaft gaiters		X	X
26	Inspect steering ball joints and gaiters		X	
27	Inspect free play at steering wheel		X	
	Wheels & Tyres			
28	Inspect tyre condition & set pressures	X	X	X
	Electrical			
29	Check battery & terminals for security & condition	X	X	
30	Inspect operation of all lights	X	X	
	Body			
31	Inspect adjustment of hinges and latches	X	X	
32	Inspect operation & condition of seat belts		X	
33	Lift footwell mats, clean & dry floor		X	
34	Inspect wiper operation & top up windscreen washer reservoir	X	X	
35	Renew alarm transmitter batteries (check with customer)			1 yr

Road Test Performance

Engine performance .... Tailpipe CO ....

Clutch operation .... Gearbox operation ....

Brake performance .... Steering performance ....

Driveline & suspension noise/vibration .... Wheel balance ....

General comments ……………………………………………………………………………………………

………

………

Additional Work Performed or Required

………

………

………

………

Work completed by ....… Owner's Maintenance Booklet stamped: …………

Recommended Service Times

After Sales Service:	1.9 hr
Regular Service:	2.8 hr
Launch Control Reset	1.0 hr
Op.2a:	0.6 hr
Op.4:	0.1 hr
Op.5:	0.7 hr
Op.7:	0.6 hr
Op.8:	0.5 hr
Op.9a:	0.1 hr
Op.9b:	0.6 hr
Op.9c:	0.3 hr
Op.15:	0.6 hr
Op.17a:	0.3 hr
Op.20:	0.6 hr
Op.23a	0.2 hr
Op.35:	0.1 hr

Dealer Stamp:

Date:

PRE-DELIVERY INSPECTION / INITIAL ACCEPTANCE FORM

LSL345G

MILEAGE	_ _ Miles or _ _ _ Km

Please refer to Lotus Warranty Policy & Procedures manual for information on correct usage of this form.

MODEL		COLOUR		VIN	SCC _ _ _ _ _ _ _ _ _ _ _ _ _ _

OPERATION DESCRIPTION	✓
Fit protective covers to seats, footwells & steering wheel.	
Engine Bay	
Check engine, transmission & PAS oil levels.	
Check coolant fill level.	
Start Engine	
Inspect engine & transmission for oil leaks.	
Inspect cooling system for leaks.	
Fill fuel tank and inspect entire fuel system for leaks.	
Use Lotus TechCentre to check for stored codes.	
Wheels & Tyres	
Check cold tyre pressures.	
Check torque of wheel bolts.	
Check tyreweld canister is fitted in rear luggage compartment.	
Electrical	
Check security of battery terminals and voltage. Below 12.4V recharge. Below 11.7V replace*.	
Inspect operation of alarm system, CDL & fuel flap release.	
Inspect operation of all exterior & interior lamps.	
Inspect operation of horn & hazard switch.	
Inspect wiper operation at all speeds & park position.	
Inspect screen washer & powerwash operation, jet alignment & top up reservoir level.	
Inspect operation of all instruments, mirror adjustment & fold.	
Inspect operation of heater / air conditioning & blower fan.	
Inspect operation of audio equipment & set time clock (if applicable).	
Body	
Check brake / clutch fluid level.	
Inspect operation of doors, door locks & tailgate release (incl. Evora cable).	
Inspect operation of electric window lift mechanism.	
Inspect fit of hard & soft top roofs.	
Inspect seat adjustment latching & operation of front & rear seatbelts.	
Inspect interior trim for damage & cleanliness.	
Inspect all paint work for damage ((Elise LSL407(a,b); Exige LSL409(a,b,c); Europa LSL514; Evora LSL544)).	
Check presence of toolkit & literature pack.	
Fit number plates and tax disc holder.	
Complete Warranty Literature	
Check presence of vehicle handbook, audio booklet & other documentation.	
Complete pages 2 - 5 in the "Maintenance Record" booklet.	
Complete Manufacturers Record of PDI form in "Maintenance Record" and return to the Warranty Dept.	
Copy alarm installation certificate, PIN & key details (inc. locking wheel bolt). Originals to customer.	
U.K.: Complete Lotus Roadside Assistance card (expiry date 2 years from reg. date).	

*** Battery claims will not be accepted unless correct trickle charging has been maintained.**

Road Test Performance Check - Add comments as necessary		
Engine performance:		
Foot & parking brake performance:		
Clutch operation:		
Gearbox operation:		
Steering performance:		
Check wheel balance:		
Driveline/suspension noise/vibration:		
General Comments		
Additional Work Required		
Additional Work Completed by:		

Valet	
Undertake complete vehicle valet.	

Notes - The PDI is subject to the following conditions:

a) It is the responsibility of the supplying dealer to ensure that the car is delivered to the customer in the best possible condition.

b) All costs incurred during the inspection process are the responsibility of the dealer.

c) Failure to return a signed copy of this inspection to Lotus Cars Ltd. by the dealer, may result in warranty claims on the particular car being rejected.

Dealer stamp:

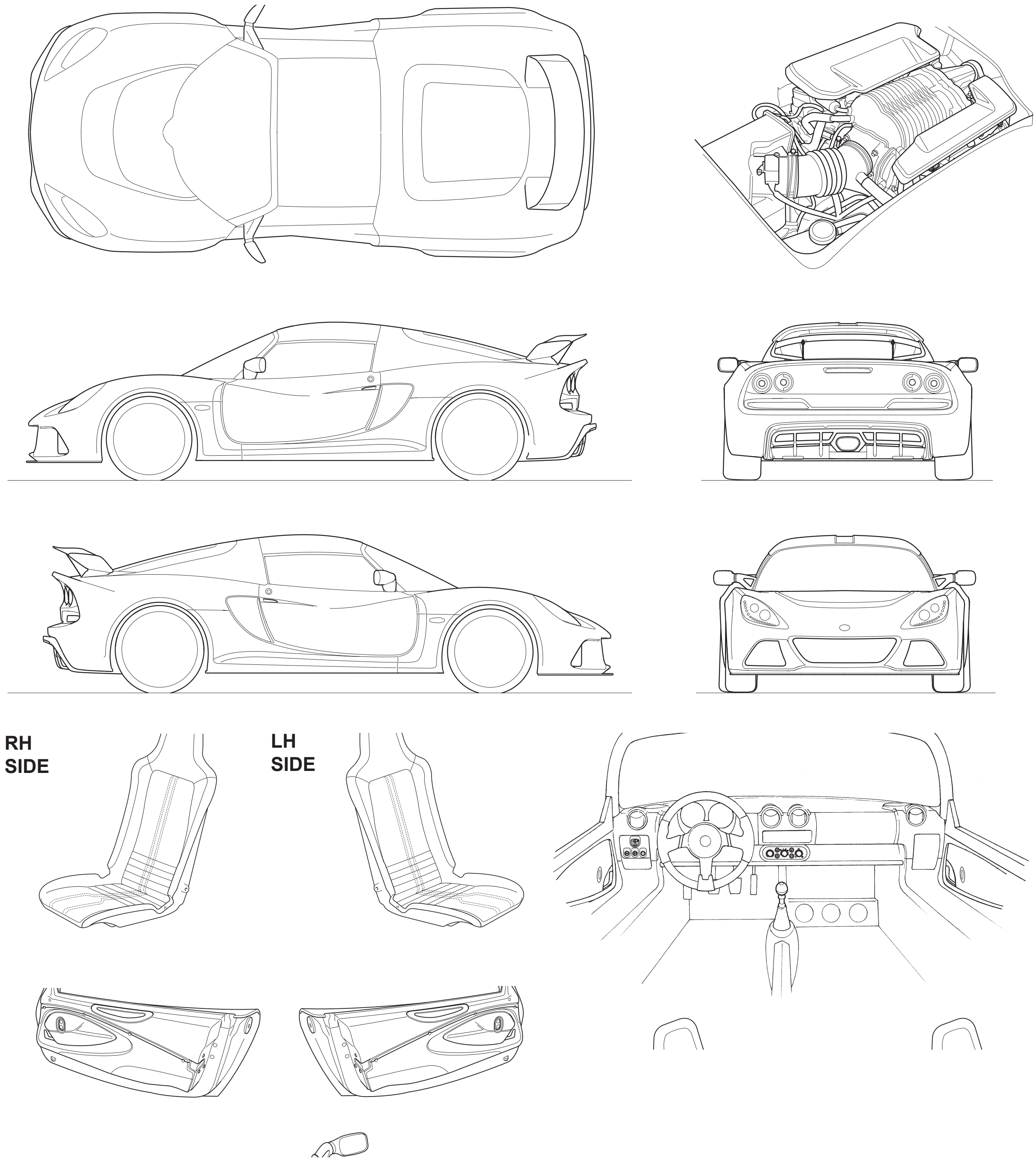
Pre-Delivery Inspection Completed by:	
Date:	

ONCE COMPLETED, SEND OR EMAIL A COPY OF THIS PDI FORM, A PAINT MARK UP SHEET, OWNER'S HANDBOOK MAINTENANCE RECORD "P.D.I AND NEW CAR HANDOVER CHECKLIST (LSL486) TO:

WARRANTY DEPARTMENT,
LOTUS CARS LTD.
UNITS 6 & 7 JOHN HYRNE WAY
LONGWATER BUSINESS PARK
COSTESSEY
NORWICH
NORFOLK
NR5 OAF
ENGLAND
OR EMAIL TO : WARRANTY@LOTUSCARS.COM

PRE-DELIVERY PAINT MARK UP SHEET - EXIGE S

LSL309C



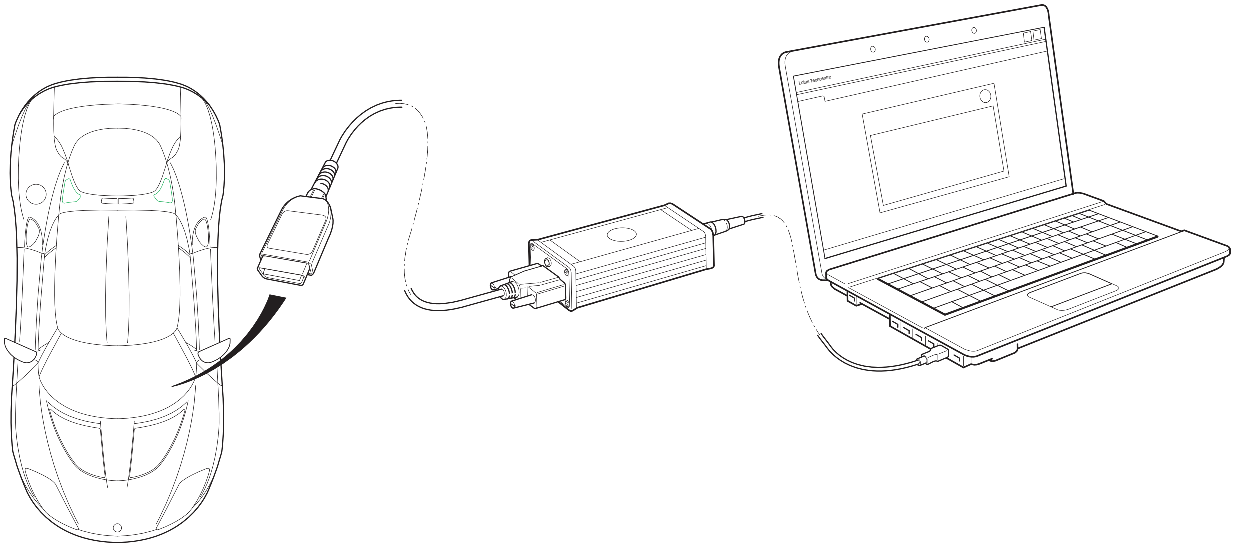
VIN	
COLOUR(S)	
OWNER	
DATE OF PDI	
INSPECTING DEALER	

PAINT DEFECT CODE			
B	BLISTERING	N	OVERSPRAY
C	CHIPS	O	PRE-RELEASES
D	DISTORTION	P	RUN
F	FLAKING	R	SCRATCHES
G	PIN HOLES	S	THIN PAINT
H	SINKAGE	T	DIRT UNDER PAINT
K	MAT CREASES	U	VOIDS
M	SHADING		

2 copies should be completed:
Copy 1 - retained in customer file
Copy 2 - forwarded with completed copy of pre-delivery inspection sheet, manufacturers record of PDI from maintenance booklet to Lotus Cars Warranty Department, Units 6 & 7 John Hyrne Way, Long Water Business Park, Costessy, Norwich, Norfolk, NR5 OAF, England or alternatively emailed to: warranty@lotuscars.com

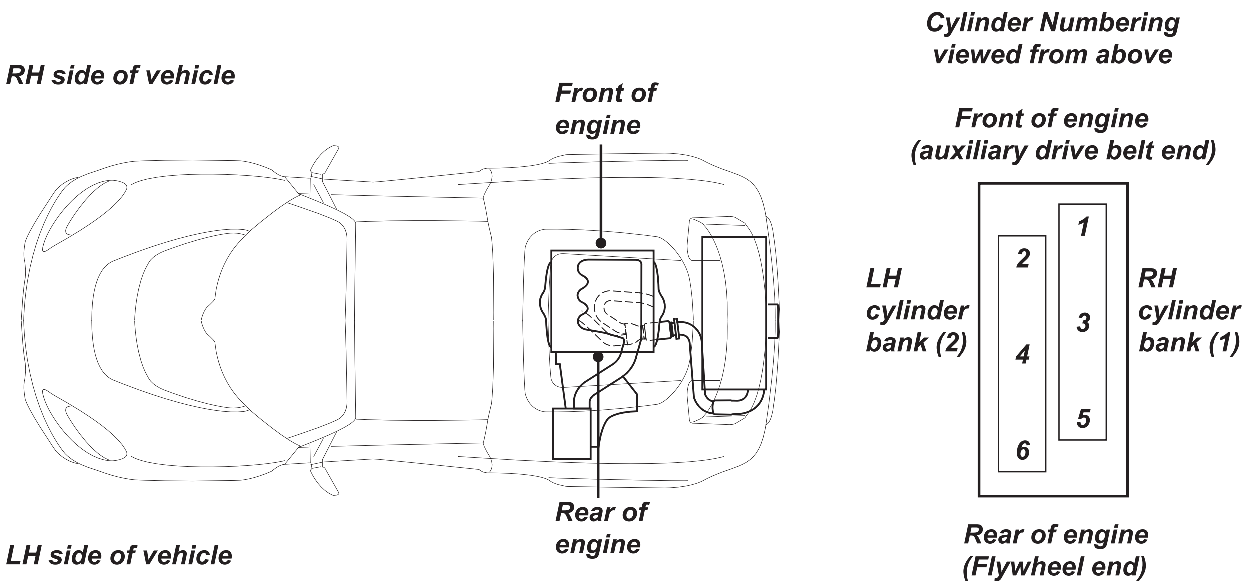
ENGINE MANAGEMENT

SECTION EMQ



NOTES

Cylinder Numbering - viewed from above:



Firing order: 1 2 3 4 5 6

em263

EMQ.1 - COMPONENT FUNCTION

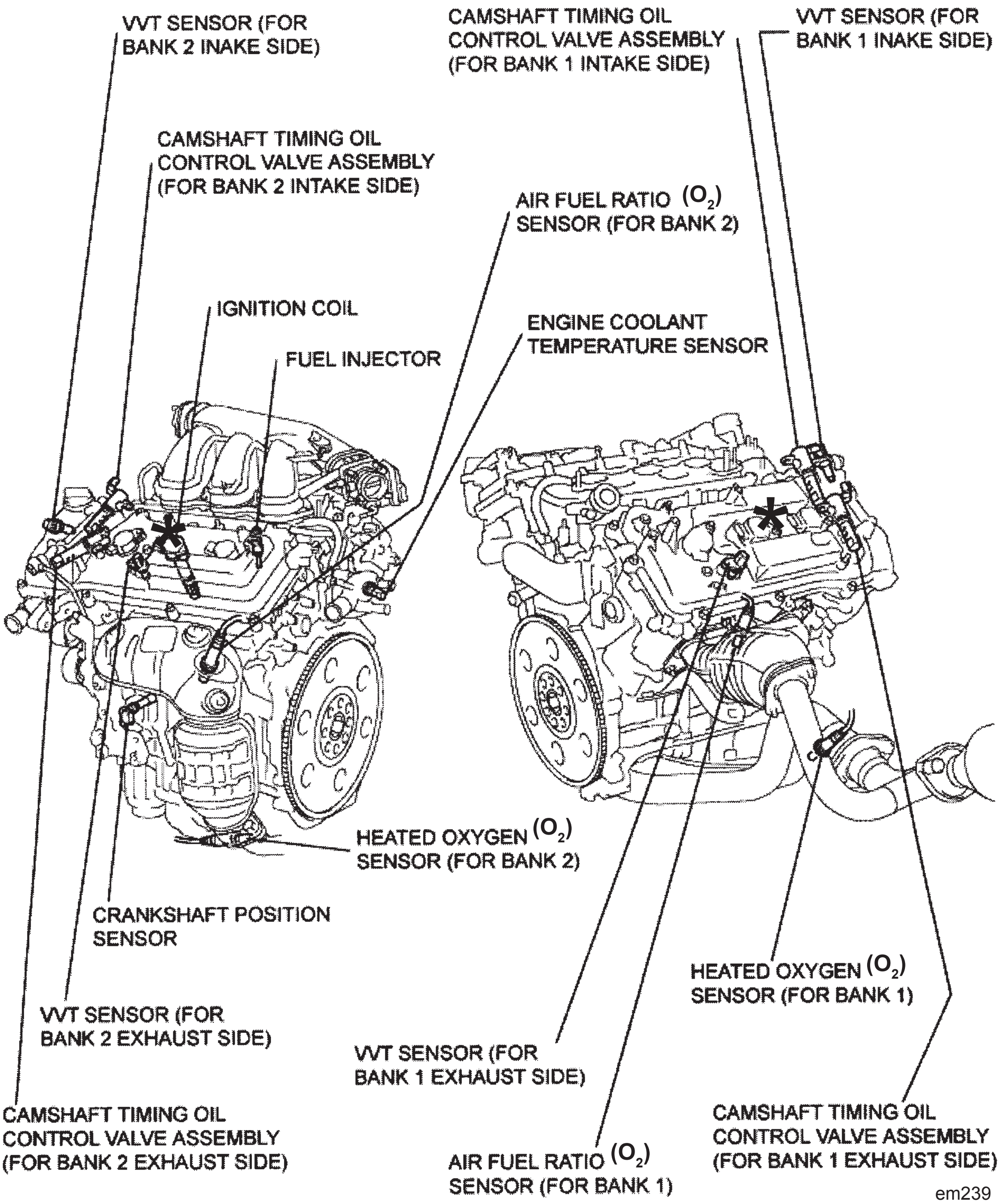
Component	Function
Mass Air Flow Meter	Engine load detection
Intake Air Temperature Sensor	Air temperature detection
Engine Coolant Temperature Sensor	Engine coolant temperature detection
Throttle Position Sensor	Determines engine throttle position
Pedal Position Sensor	Determines pedal position requested by driver
Barometric Pressure Sensor	Barometric pressure detection
O2 Sensor (Front) – Bank 1	Measures oxygen content in exhaust before bank 1 primary catalyst
O2 Sensor (Front) – Bank 2	Measures oxygen content in exhaust before bank 1 primary catalyst
O2 Sensor (Rear) – Bank 1	Measures oxygen content in exhaust after bank 1 primary catalyst
O2 Sensor (Rear) – Bank 2	Measures oxygen content in exhaust after bank 2 primary catalyst
Crankshaft Position Sensor	Determines crankshaft position
Camshaft Position Sensor (Inlet) – Bank 1	Determines bank1 inlet camshaft position
Camshaft Position Sensor (Inlet) – Bank 2	Determines bank 2 inlet camshaft position
Camshaft Position Sensor (Exhaust) – Bank 1	Determines bank 1 exhaust camshaft position
Camshaft Position Sensor (Exhaust) – Bank 2	Determines bank 2 exhaust camshaft position
Knock Sensor – Bank1	Determines bank 1 engine detonation
Knock Sensor – Bank2	Determines bank 2 engine detonation
Fuel Level Sensor	Determines fuel tank level
Air Conditioning Evaporator Temperature Sensor	Evaporator temperature detection
Clutch Pedal Position Sensor	Determines clutch pedal position
Brake Pedal Position Switch	Determines brake pedal position
Cruise Control Multi-function Input	Determines driver request for cruise control
Electronic Throttle Control Motor	Actuates engine throttle
Injector Circuit – Cylinder 1	Regulates fuel injected into cylinder 1
Injector Circuit – Cylinder 2	Regulates fuel injected into cylinder 2
Injector Circuit – Cylinder 3	Regulates fuel injected into cylinder 3
Injector Circuit – Cylinder 4	Regulates fuel injected into cylinder 4
Injector Circuit – Cylinder 5	Regulates fuel injected into cylinder 5
Injector Circuit – Cylinder 6	Regulates fuel injected into cylinder 6
Ignition Circuit – Cylinder 1	Actuates spark plug in cylinder 1
Ignition Circuit – Cylinder 2	Actuates spark plug in cylinder 2
Ignition Circuit – Cylinder 3	Actuates spark plug in cylinder 3
Ignition Circuit – Cylinder 4	Actuates spark plug in cylinder 4
Ignition Circuit – Cylinder 5	Actuates spark plug in cylinder 5
Ignition Circuit – Cylinder 6	Actuates spark plug in cylinder 6
Variable Valve Timing Actuator (Inlet) – Bank 1	Actuates bank 1 inlet camshaft timing control
Variable Valve Timing Actuator (Inlet) – Bank 2	Actuates bank 2 inlet camshaft timing control
Variable Valve Timing Actuator (Exhaust) – Bank 1	Actuates bank 1 exhaust camshaft timing control
Variable Valve Timing Actuator (Exhaust) – Bank 2	Actuates bank 2 exhaust camshaft timing control
Variable Intake Manifold Actuator	Actuates variable intake manifold
Primary Catalyst – Bank 1	Removes pollutants from exhaust
Primary Catalyst – Bank 2	Removes pollutants from exhaust
Secondary Catalyst	Removes pollutants from exhaust
Evaporative Emission Control System Purge Control Valve	Regulates fuel tank vapour flow into inlet manifold

Continued.........

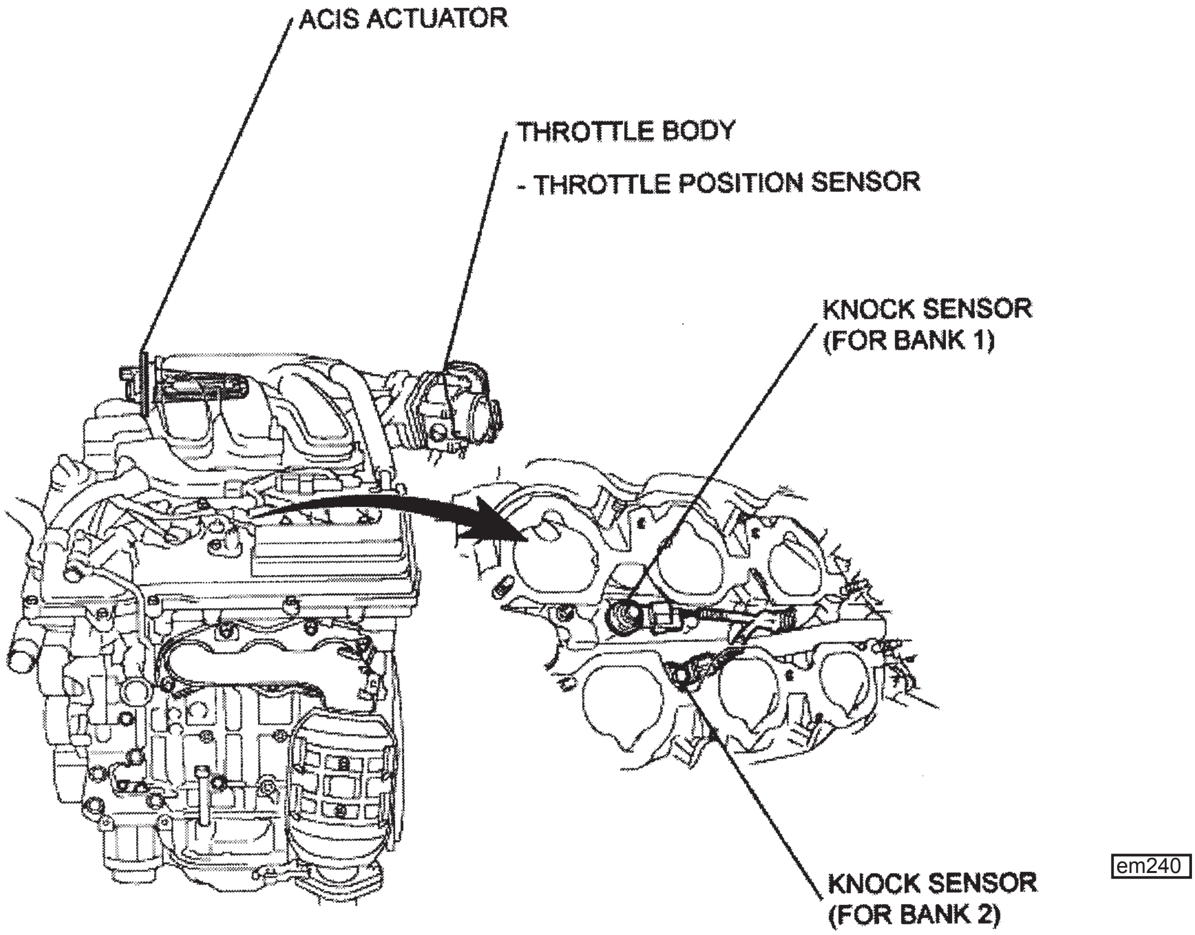
Continued.........

Component	**Function**
Fuel Pump Relay	Actuates fuel pump
Starter Relay	Actuates engine starter motor
Cooling Fan 1 Relay	Actuates cooling fan 1
Cooling Fan 2 Relay	Actuates cooling fan 2
Air Conditioning Control Relay	Actuates air conditioning compressor
Air Conditioning Control Valve	Regulates air conditioning compressor load
Coolant Recirculation Pump	Actuates coolant recirculation pump
Noise Flap Solenoid	Actuates air intake flap vacuum control
ABS	Provides vehicle wheel speed information
Battery	Provides electrical power
Exhaust Bypass Soleniod	Allows EP valve to draw vacuum from airbox

EMQ.2 - COMPONENT LOCATION



***** **Ignition coil noise suppression capacitor**


ACIS ACTUATOR
THROTTLE BODY
- THROTTLE POSITION SENSOR
KNOCK SENSOR
(FOR BANK 1)
KNOCK SENSOR
(FOR BANK 2)
em240

EMQ.3 - DIAGNOSTIC TROUBLE CODE (DTC) LIST

Extract below as found in the Exige Owner's Handbook

"The engine Malfunction Indicator Lamp (MIL) is provided to warn the driver that the engine management system has detected a fault which may result in increased noxious emissions from the exhaust. In order to minimise emissions and potential engine damage, various operational limitations may automatically be applied.

i) If the MIL lights continuously whilst driving, immediately reduce speed and adopt a moderate driving style. Seek Lotus dealer advice without delay and avoid all unnecessary journeys.
ii) If the MIL flashes, an engine misfire has been detected which is likely to cause overheat damage to the catalytic converter.
Slow down immediately and be prepared to stop.
- If the MIL then stops flashing, and is lit continuously, proceed with caution and seek dealer advice.
- If the MIL continues to flash, stop the vehicle as soon as it is safe to do so, and switch off the engine. Seek Lotus dealer advice".

NOTICE: Continuing to drive the car with a flashing MIL may cause overheat dam age to the catalytic converters and surrounding bodywork.

WARNING: Continuing to drive the car with a flashing MIL may cause an engine bay fire.

Continued...............

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Continued.............

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Continued.................

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Non-MIL Fault codes

Extract below as found in the Exige Owner's Handbook

"Electrical Fault Tell Tale
The Engine Control Module (ECM) is also used to manage various related electrical systems, and is able to detect certain types of fault, which may or may not be apparent to the driver. If such a fault is detected, which has no detrimental effect on exhaust emissions (see MIL tell tale information). This amber tell tale will light for the first 30 seconds after turning on the ignition. Consult your dealer without delay to have the fault diagnosed and rectified".

DTC	Fault description	Page
P0480	Fan 1 Control Circuit	45
P0481	Fan 2 Control Circuit	45
P0482	Auxiliary Fan 3 Control Circuit	45
P0537	A/C Evaporator Temperature Sensor Circuit Low	48
P0538	A/C Evaporator Temperature Sensor Circuit High	48
P0565	Cruise control resume/decel signal	50
P0568	Cruise control on/off signal	50
P0567	Cruise control set/accel signal	50
P0571	Brake Switch “A” Circuit	50
P0616	Starter Relay Circuit Low	54
P0617	Starter Relay Circuit High	54
P0646	A/C Clutch Relay Control Circuit Low	58
P0647	A/C Clutch Relay Control Circuit High	58
P0790	Dynamic Performance Switch	60
P0806	Clutch Position Sensor Circuit Range/Performance	61
P0807	Clutch Position Sensor Circuit Low	61
P0808	Clutch Position Sensor Circuit High	61
P1113	Air Intake Control Valve Circuit	63
P2602	Coolant Pump Control Circuit Low	65
P2603	Coolant Pump Control Circuit High	65
P2612	A/C Refrigerant Distribution Valve Control Circuit Low	76
P2613	A/C Refrigerant Distribution Valve Control Circuit High	76
B1422	A/C Compressor Lock Sensor Circuit	77
U0122	Lost Communications with VDCM	78
U0316	Software Incompatible with VDCM	79

When applicable, reference may be made under the 'Notes' heading to a page in the Toyota service manual. This information should be used only for diagnosis and connection detail of the **sensor**. The Exige S uses a Lotus ECU, the connections for which may be found in circuit diagrams in Section MVa. Diagnostic Trouble Codes should be read using the Lotus TechCentre.

EMQ.4 - DIAGNOSTIC GUIDE

Camshaft Timing Control (VVT)

P0011 Camshaft Position – Inlet Timing Over-Advanced or System Performance (Bank 1)
P0012 Camshaft Position – Inlet Timing Over-Retarded (Bank 1)
P0014 Camshaft Position – Exhaust Timing Over-Advanced or System Performance (Bank 1)
P0015 Camshaft Position – Exhaust Timing Over Retarded (Bank 1)
P0021 Camshaft Position – Inlet Timing Over-Advanced or System Performance (Bank 2)
P0022 Camshaft Position – Inlet Timing Over-Retarded (Bank 2)
P0024 Camshaft Position – Exhaust Timing Over-Advanced or System Performance (Bank 2)
P0025 Camshaft Position – Exhaust Timing Over-Retarded (Bank 2)

Description
The Variable Valve Timing system (VVT) on the intake camshafts and the exhaust camshafts can vary the timing by approximately 35°. The camshaft relative position is varied by a system of vanes mounted on the drive end of the camshaft. Each VVT oil control valve modulates a spool valve position in accordance with the drive signal duty cycle, this in turns controls the oil pressure applied to the vanes. A 50% duty cycle applied to the valve will hold the valve current timing by preventing oil flow from the VVT controller housing, a duty cycle less than 50% will retard the valve timing, a duty cycle greater then 50% will advance the valve timing. The ECM regulates this duty cycle based on the feedback signal from the respective camshaft position sensor to optimise the camshaft timing.

Component connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Battery Voltage	-	-
2	VVT Control Valve Inlet (Bank 1)	B2	48 Way (Centre)
1	Battery Voltage	-	-
2	VVT Control Valve Exhaust (Bank 1)	A2	48 Way (Centre)
1	Battery Voltage	-	
2	VVT Control Valve Inlet (Bank 2)	A3	48 Way (Centre)
1	Battery Voltage	-	
2	VVT Control Valve Exhaust (Bank 2)	A4	48 Way (Centre)

Monitor:
- Continuous

Enable Criteria:
- Engine running > 30 secs
- Coolant temperature > 60°C (140°F)

Disable Criteria:
- P0116, P0117, P0118 – Coolant temperature fault codes

Malfunction Criteria:
- VVT error > 8 degrees for time > 5 secs

Potential failure modes:
- Static valve timing is incorrect
- VVT camshaft actuator failure
- VVT control valve stuck open / closed
- VVT control valve filter

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Crankshaft Position–Camshaft Position Correlation Error

P0016 Crankshaft position – camshaft position correlation – bank 1 sensor A (Inlet)
P0017 Crankshaft position – camshaft position correlation – bank 1 sensor B (Exhaust)
P0018 Crankshaft position – camshaft position correlation – bank 2 sensor A (Inlet)
P0019 Crankshaft position – camshaft position correlation – bank 2 sensor B (Exhaust)

Description
The crankshaft position sensor is used to identify engine position and speed via a pole wheel mounted on the front end of the crankshaft. The camshaft position sensor is used to determine camshaft position from a three vane reluctor on the rear end of the inlet and exhaust camshaft. Fault codes P0016, P0017, P0018, P0019 indicate a mechanical timing error such as incorrectly set, or 'jumped' cam timing.

Monitor:
- Continuous

Enable Criteria:
- Engine running (from cranking up to 4 seconds)

Disable Criteria:
- None

Malfunction Criteria:
- Camshaft out of phase with crankshaft > 16 degrees

Potential failure modes:
- Static valve timing is incorrect
- VVT camshaft actuator failure
- VVT control valve stuck open / closed
- VVT control valve filter

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Camshaft Timing Control (VVT)

P0076 Intake Valve Control Solenoid Circuit Low (Bank1)
P0077 Intake Valve Control Solenoid Circuit High (Bank1)
P0079 Exhaust Valve Control Solenoid Circuit Low (Bank1)
P0080 Exhaust Valve Control Solenoid Circuit High (Bank1)
P0082 Intake Valve Control Solenoid Circuit Low (Bank2)
P0083 Intake Valve Control Solenoid Circuit High (Bank2)
P0085 Exhaust Valve Control Solenoid Circuit Low (Bank2)
P0086 Exhaust Valve Control Solenoid Circuit High (Bank2)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P0076, P0079, P0082, P0085 - VVT control valve open circuit or short to ground
- P0077, P0080, P0083, P0086 - VVT control valve circuit short to battery voltage
- ECU output circuit failure
- VVT control valve

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Intake Air Flow

P0101 Mass or Volume Air Flow Circuit Range/Performance
P0102 Mass or Volume Air Flow Circuit Low Input
P0103 Mass or Volume Air Flow Circuit High Input

Description
The Mass Air Flow (MAF) sensor is incorporated into the airbox, and measures both intake air flow rate and Intake Air Temperature (IAT). The MAF sensor uses a hot wire exposed to the airflow, which is maintained at a constant temperature by a constant current flow. This is achieved within the sensor unit by varying the voltage applied to the hot wire. This voltage is the output signal from the MAF sensor.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	IAT Signal	E3	48 Way (Centre)
2	IAT Ground	J3	48 Way (Centre)
3	Battery Voltage	-	-
4	MAF Ground	J4	48 Way (Centre)
5	MAF Signal	G1	48 Way (Centre)

Sensor characteristics
0 – 330 g/sec
Typical values: 2.0 – 5.0 g/sec (idle), 5.0 – 15.0 g/sec (2500rpm elevated idle no load)

P0101
Monitor:
- Continuous.

Enable Criteria:
- Engine running
- Engine speed >1500rpm
- Engine speed < 3500rpm
- Fuel Learns enabled

Disable Criteria:
- P0122, P0123, P0222, P0223 – Throttle/Pedal position fault codes

Malfunction Criteria:
- Measured MAF is compared to a predicted MAF based on current engine conditions.
- Error > 40% for time > 1.5 secs

Potential failure modes:
- MAF meter
- Air induction system
- Air intake hose connections

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

P0102
Monitor:
- Continuous.

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- Voltage at ECU < 0.52V for time > 1.5 secs

Potential failure modes:
- MAF sensor circuit open
- MAF sensor circuit short to ground

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

P0103
Monitor:
- Continuous.

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- Voltage at ECU > 4.98V for time > 1.5 secs

Potential failure modes:
- MAF sensor circuit short to ECU supply voltage

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Barometric Pressure

P0107 Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108 Manifold Absolute Pressure/Barometric Pressure Circuit High Input

Description
The barometric pressure sensor is located internally within the ECU, and measures atmospheric pressure. This parameter is required to compensate the mass air flow when the vehicle is operated at higher altitudes.

P0107, P0108
Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- P0107: Voltage at ECU < 1.08V for time > 1.5 secs
- P0108: Voltage at ECU > 4.98V for time > 1.5 secs

Potential failure modes:
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Intake Air Temperature

P0112 Intake Air Temperature Sensor 1 Circuit Low
P0113 Intake Air Temperature Sensor 1 Circuit High

Description
The combined sensor which measures both Mass Air Flow (MAF) and Intake Air Temperature (IAT) is incorporated into the air box. The IAT sensor is a thermistor device which changes resistance with temperature. As air intake temperature decreases the thermistor resistance value increases, and conversely as air temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	IAT Signal	E3	48 Way (Centre)
2	IAT Ground	J3	48 Way (Centre)
3	Battery Voltage	-	-
4	MAF Ground	J4	48 Way (Centre)
5	MAF Signal	G1	48 Way (Centre)

Sensor characteristics
IAT -20°C (-4°F)13.6 – 18.4 kΩ
IAT 20°C (68°F) 2.21 – 2.69 kΩ
IAT 60°C (140°F) 0.50 – 0.67 kΩ

P0112
Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Inlet air temperature > 119°C (246°F) for time > 1.5 secs

Potential failure modes:
- Signal short circuit
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0113
Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Inlet air temperature < –40°C (–40°F) for time > 1.5 secs

Potential failure modes:
- Signal open circuit
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Engine Coolant Temperature

P0116 Engine Coolant Temperature Circuit Range/Performance
P0117 Engine Coolant Temperature Circuit Low
P0118 Engine Coolant Temperature Circuit High

Description
The engine coolant temperature sensor is a thermistor device which changes resistance with temperature. As coolant temperature decreases the thermistor resistance value increases, and conversely as coolant temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Ground	C3	48 Way (Centre)
2	Signal	G2	48 Way (Centre)

Sensor characteristics

-20°C (-4°F)	= 13.84 – 16.33 KΩ
20°C (68°F)	= 2.31 – 2.58 KΩ
80°C (176°F)	= 0.310 – 0.326 KΩ
110°C (230°F)	= 0.1399 – 0.1435 KΩ

P0116
Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria 1:
- Engine running > 1000 seconds

Malfunction Criteria 1:
- Engine coolant temperature < 40°C (104°F)

Enable Criteria 2:
- Engine running

Malfunction Criteria 2:
- Engine coolant temperature erratic by more than 30°C (54°F)

Potential failure modes:
- Sensor wiring
- Sensor failure
- Thermostat failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0117
Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:

- Engine running

Malfunction Criteria:
- Coolant temperature > 119°C (246°F) for time > 1.5 secs

Potential failure modes:
- Signal short circuit
- Sensor failure
- Thermostat failure
- Cooling system problem

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0118
Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Coolant temperature > -38°C (-36°F) for time > 1.5 secs

Potential failure modes:
- Signal open circuit
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Throttle Position

P0122 Throttle Position Sensor 'A' Circuit Low
P0123 Throttle Position Sensor 'A' Circuit High
P0222 Throttle Position Sensor ‘B’ Circuit Low
P0223 Throttle Position Sensor ‘B’ Circuit High

Description
The throttle position sensor (TPS) is mounted on the throttle body, and detects the opening angle of the throttle valve. The TPS has 2 sensor circuits, each of which transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECU.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	ETB A	M1	48 Way (Centre)
2	ETB B	L2	48 Way (Centre)
3	Ground	C4	48 Way (Centre)
4	TPS 1B Signal	F3	48 Way (Centre)
5	TPS 1A/B V Ref	E4	48 Way (Centre)
6	TPS 1A Signal	F2	48 Way (Centre)

Sensor characteristics
0% = 0.595 V ± 5%
100% = 4.148 V ± 5%

P0122
Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage < 0.635V

Potential failure modes:
- Signal short circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P0123
Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage > 4.765V

Potential failure modes:
- Signal open circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P0222
Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage < 2.146V

Potential failure modes:
- Signal short circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P0223
Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage > 4.985V

Potential failure modes:
- Signal open circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:

- The MIL will be illuminated if fault is present.

Notes: A maximum throttle opening of 15% may be imposed due to a single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

O2 Sensor (Pre Catalyst)

P0131 O2 Sensor 1 Circuit Low Voltage (Bank 1)
P0132 O2 Sensor 1 Circuit High Voltage (Bank 1)
P0133 O2 Sensor 1 Circuit Slow Response (Bank 1)
P0134 O2 Sensor 1 Circuit No Activity Detected (Bank 1)
P0135 O2 Sensor 1 Heater Circuit (Bank 1)
P0151 O2 Sensor 1 Circuit Low Voltage (Bank 2)
P0152 O2 Sensor 1 Circuit High Voltage (Bank 2)
P0153 O2 Sensor 1 Circuit Slow Response (Bank 2)
P0154 O2 Sensor 1 Circuit No Activity Detected (Bank 2)
P0155 O2 Sensor 1 Heater Circuit (Bank 2)

Description
The oxygen sensors separately monitor the oxygen content in the exhaust gases of each bank of the engine. Each sensor is electrically heated to improve response after start.
The sensor consists of a zirconia electrode between two platinum plates. When zirconia comes into contact with oxygen, it becomes an electrical conductor. The exhaust gases pass through louvers in the sensor. One plate is in contact with the outside air and the other plate is in contact with the exhaust gases. The platinum plate in contact with the air is electrically negative due to the oxygen in the atmosphere and the plate in contact with the exhaust gases is electrically positive. This will cause a difference in electrical potential to develop between the two plates. Thus the voltage across the platinum plates ranges approximately from 100 millivolts to 900 millivolts, depending on the oxygen content of the exhaust gases. Thus when the air/fuel mixture is rich, the oxygen sensor output will be high. If the air/fuel mixture is lean, the oxygen sensor output will be low.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	G3	48 Way (Centre)
2 Bank 1	Ground	J2	48 Way (Centre)
3 Bank 1	Heater	H3	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-
1 Bank 2	Signal	G4	48 Way (Centre)
2 Bank 2	Ground	J2	48 Way (Centre)
3 Bank 2	Heater	H4	48 Way (Centre)
4 Bank 2	Battery Voltage	-	-

Sensor characteristics
Normal operating range is 0 – 1000mV

P0131 (Bank1) or P0151 (Bank2)
Monitor:
- Continuous.

Disable Criteria:
- DFCO (Deceleration Fuel Cut Off)
- AE DE (Acceleration Enrichment Deceleration Enleanment)
- Misfire

Enable Criteria:
- Engine running

Failure Criteria:
- Sensor voltage < 15mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- Low fuel pressure (Lean mixture)
- Malfunctioning sensor
- External water on sensor
- Sensor wire shorted to ground

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0132 (Bank1) or P0152 (Bank2)
Monitor:
- Continuous.

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Sensor voltage > 1200mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- High fuel pressure (Rich mixture)
- Leaking or shorted injector
- Purge valve fault
- Oxygen sensor contamination
- Engine oil contamination
- Sensor wire shorted to heater voltage

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0133 (Bank1) or P0153 (Bank2)
Monitor:
- Continuous.

Disable Criteria:
- P0116, P0117, P0118 – Coolant temperature sensor faults
- P0101, P0102, P0103 – MAF sensor faults
- P0335, P0500 – Crank or vehicle speed faults
- P0131, P0132, P0134, P0135 – Pre catalyst oxygen sensor faults for Bank1 checks
- P0151, P0152, P0154, P0155 – Pre catalyst oxygen sensor faults for Bank2 checks

Enable Criteria:
- Vehicle speed between 0 – 255 km/h (158.5 mph)
- Engine load between 15 – 48 %
- Engine speed between 1300 – 2800rpm
- Engine run time > 200 seconds
- Coolant temperature > 60°C (140°F)
- Closed loop fuelling enabled

Monitor:
- Monitored until the required amount of switches (30) in both directions has been achieved or 130 seconds has elapsed.

Malfunction Criteria:
- Set when the sensor fails to switch from a Lean to a Rich condition or switch from a Rich to a Lean condition in a sufficiently quickly. A selection of switches is used to determine the average times.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections
- Sensor contaminated, possibly from fuel, improper use of RTV, engine oil or coolant

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0134 (Bank1) or P0154 (Bank2)
Monitor:
- Until either passed or failed.

Enable Criteria:
- Engine run time > 30 seconds
- Engine is not at idle
- Engine is in closed loop fuel control
- O2 sensor ready

Malfunction Criteria:
- Set when the sensor fails to switch above 600mV and below 322mV within a 60 second period.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections.
- Gas leak in exhaust system

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0135, P0155
Monitor:
- Continuous

Enable Criteria:
- Engine run time > 20 seconds

Malfunction Criteria:
- Set when the heater output is greater than 1900mA or less than 250mA for 1.5 seconds, for 40 consecutive checks.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections.

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

O2 Sensor (Post Catalyst)

P0137 O2 Sensor Circuit Low Voltage (Bank 1)
P0138 O2 Sensor Circuit High Voltage (Bank 1)
P0139 O2 Sensor Circuit Slow Response (Bank 1)
P0140 O2 Sensor Circuit No Activity Detected (Bank 1)
P0141 O2 Sensor Heater Circuit (Bank 1)
P0157 O2 Sensor Circuit Low Voltage (Bank 2)
P0158 O2 Sensor Circuit High Voltage (Bank 2)
P0159 O2 Sensor Circuit Slow Response (Bank 2)
P0160 O2 Sensor Circuit No Activity Detected (Bank 2)
P0161 O2 Sensor Heater Circuit (Bank 2)

Description
The oxygen sensors separately monitor the oxygen content in the exhaust gases of each bank of the engine. Each sensor is electrically heated to improve response from start.
The sensor consists of a zirconia electrode between two platinum plates. When zirconia comes into contact with oxygen, it becomes an electrical conductor. The exhaust gases passes through louvers in the sensor. One plate is in contact with the outside air and the other plate is in contact with the exhaust gases. The platinum plate in contact with the air is electrically negative due to the oxygen in the atmosphere and the plate in contact with the exhaust gases is electrically positive. This will cause a difference in electrical potential to develop between the two plates. Thus the voltage across the platinum plates ranges approximately from 100 millivolts to 900 millivolts, depending on the oxygen content of the exhaust gases. Thus when the air/fuel mixture is rich, the oxygen sensor output will be high. If the air/fuel mixture is lean, the oxygen sensor output will be low. The post catalyst oxygen sensor performance is a good indicator of catalyst efficiency.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	H1	48 Way (Centre)
2 Bank 1	Ground	K4	48 Way (Centre)
3 Bank 1	Heater	K1	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-
1 Bank 2	Signal	H2	48 Way (Centre)
2 Bank 2	Ground	K4	48 Way (Centre)
3 Bank 2	Heater	K2	48 Way (Centre)
4 Bank 2	Battery Voltage	-	-

Sensor characteristics
Normal operating range is 0 – 1000mV

P0137, P0157
Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- DFCO (Deceleration Fuel Cut Off)
- AE DE (Acceleration Enrichment or Deceleration Enleanment)
- Misfire

Malfunction Criteria:
- Set when the sensor operates below 15mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Sensor wire shorted to ground
- Catalyst

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0138, P0158
Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- Set when the sensor operates above 1200mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- Check and rectify any front sensor fault code, as they may be causing the fault code to be set
- Catalyst

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0139, P0159
"O2 Sensor, slow response" can be defined in two ways; 1) "Slow response" and 2) "Delayed response".

1) Delayed Response
Set when the sensor fails to reach 600mV after 5 seconds of Fuel Enrichment or when the sensor fails to drop below 300mV after 5 seconds of DFCO.

Enable Criteria:
- Engine run time > 230 seconds
- > 15 g/sec MAF (only enable criteria when switching rich, > 600mV, in fuel enrichment state)
- DFCO for lean switch

Disable Criteria:
- P0116, P0117, P0118 – Coolant Temperature Sensor faults
- P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P02777 – Injector faults
- P0300, P0301, P0302, P0303, P0304, P0305, P0306 – Misfire faults
- P1301, P1302 – Misfire faults causing emission or catalyst damage

Monitor:
- Continuous, until the test is either passed or failed

Potential failure modes:

- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Catalyst damage/leak/inefficiency

2) Slow Response
Set when the time it takes the sensor to switch between 300mV and 600mV or vice versa is greater than a specified amount of time.

Enable Criteria:
- Engine run time > 230 seconds
- Sensor Rich for >3 seconds prior to rich to lean switch
- Pre Cat O2 sensor must be rich for 1.2 seconds after Post Cat O2 sensor crosses 300mV threshold for lean to rich switch
- DFCO for 'rich to lean' switch

Disable Criteria:
- P0116, P0117, P0118 – Coolant Temperature Sensor faults
- P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P02777 – Injector faults
- P0300, P0301, P0302, P0303, P0304, P0305, P0306 – Misfire faults
- P1301, P1302 – Misfire faults causing emission or catalyst damage

Malfunction Criteria:
- 3 consecutive switch times >700 ms.

Monitor:
- Continuous, until the test is either passed or failed

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Catalyst damage/leak/inefficiency

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0140, P0160
Monitor:
- Continuous

Enable Criteria:
- Engine run time > 30 seconds
- Engine is not at idle
- Engine is in closed loop fuel control
- Oxygen sensors ready

Disable Criteria:
- None

Malfunction Criteria:
- Set when the sensor fails to switch above 600mV and below 300mV within 60 seconds.

Potential failure modes:
- Check and rectify any front sensor fault code, as they may be causing the fault code to be set
- Sensor connector and wiring should be checked for corrosion and loose connections
- Catalyst
- Gas leak in exhaust system

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0141, P0161
Monitor:
- Continuous

Enable Criteria:
- Engine run time > 20 seconds

Disable Criteria:
- None

Malfunction Criteria:
- Set when the heater output is greater than 1900mA or less than 250mA for 1.5 seconds, for 40 consecutive checks.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Fuel Control System Too Lean or Rich

P0171 System Too Lean (Bank 1)
P0172 System Too Rich (Bank 1)
P0174 System Too Lean (Bank 2)
P0175 System Too Rich (Bank 2)

Description
The oxygen sensor sends a signal to the ECU corresponding to the exhaust gas oxygen content enabling the ECU to maintain a 14.7:1 air/fuel ratio under normal driving conditions. The ECU can make fuel corrections of ± 30% to the calculated fuel demand. This value is then learned by the ECU over time. If the ECU determines a rich condition exists (oxygen sensor above 450mV), it will decrease the calculated fuel demand to maintain a 14.7:1 ratio. If the ECU determines a lean condition exists (oxygen sensor below 450mV), it will increase the calculated fuel demand to maintain a 14.7:1 ratio.

Monitor:
- Continuous

Enable Criteria:
- Fuel Trim condition enabled
- Closed loop fuelling enabled
- Fuel Learning enabled
- Altitude < 8000 ft (2438 m), Baro > 756 mbar

Disable Criteria P0171 & P0172:
- P0107, P0108 – Baro sensor faults
- P0131, P0135 – Oxygen sensor faults
- P0300, P0301, P0302, P0303 – Misfire faults
- P0112, P0113 – Intake air temperature faults

Disable Criteria P0174 & P0175:
- P0107, P0108 – Baro sensor faults
- P0151, P0155 – Oxygen sensor faults
- P0300, P0304, P0305, P0306 – Misfire faults
- P0112, P0113 – Intake air temperature faults

Malfunction Criteria P0171 & P0174:
- These codes will set when the relevant engine bank learned fuel correction has been increased to its maximum limit of 25% and the system still cannot maintain an air/fuel ratio of 14.7:1 under normal driving conditions.
- These codes will also be set if the relevant bank fuel learn injector dead time is greater than 450 micro seconds.

Potential failure modes:
- Fuel Pressure too low (restriction in fuel line)
- Air leak in induction system
- Water in fuel
- Exhaust leak / crack before front oxygen sensor
- Injector fault
- Sensor connector and wiring for signs of corrosion or loose connections
- MAF fault
- Vehicle has previously run out of fuel

Diagnostic Mask:
- The MIL will be illuminated if fault is present for two consecutive trips.

Malfunction Criteria P0172, P0175:
- These codes will be set when the relevant bank learned fuel correction has been decreased to its minimum limit of -25% and the system still cannot maintain an air/fuel ratio of 14.7:1 under normal driving conditions.
- These codes will also be set if the relevant bank fuel learn injector dead time is less than -450 micro seconds.

Potential failure modes:
- Fuel pressure too high
- Leaking fuel injector
- Restriction in the exhaust system or air intake / filter
- Erratic throttle position sensor
- MAF fault
- O2 sensor fault
- Ignition fault

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Fuel Injection System

P0261 Injector Circuit low voltage – Cylinder 1
P0262 Injector Circuit high voltage – Cylinder 1
P0264 Injector Circuit low voltage – Cylinder 2
P0265 Injector Circuit high voltage – Cylinder 2
P0267 Injector Circuit low voltage – Cylinder 3
P0268 Injector Circuit high voltage – Cylinder 3
P0270 Injector Circuit low voltage – Cylinder 4
P0271 Injector Circuit high voltage – Cylinder 4
P0273 Injector Circuit low voltage – Cylinder 5
P0274 Injector Circuit high voltage – Cylinder 5
P0276 Injector Circuit low voltage – Cylinder 6
P0277 Injector Circuit high voltage – Cylinder 6

Description
The ECU has six injector driver circuits, each of which controls an injector. When the engine is running the ECU continuously monitors the injector circuit feedback signals. The monitored feedback signal should be low voltage when the injector is ON and high voltage when the injector is OFF.

Component connections

Injector	ECU Pin	ECU Connector
1	H4	32 Way (Left)
2	H3	32 Way (Left)
3	H2	32 Way (Left)
4	H1	32 Way (Left)
5	G4	32 Way (Left)
6	G3	32 Way (Left)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Potential failure modes:
- Sensor connector or wiring corroded or loose connections

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Limp home:
- Limit maximum engine speed to 4000rpm
- Return the fuel system of the affected bank to open loop fuel control

Notes:
If an injector goes short circuit it is likely that the ECU injector driver will be damaged.

Misfire

P0300 Random/Multiple Cylinder Misfire Detected
P0301 Cylinder 1 Misfire Detected
P0302 Cylinder 2 Misfire Detected
P0303 Cylinder 3 Misfire Detected
P0304 Cylinder 4 Misfire Detected
P0305 Cylinder 5 Misfire Detected
P0306 Cylinder 6 Misfire Detected

Description
A misfiring cylinder can be detected by analysing crank speed variation. As a result of a combustion event there will be a net acceleration of the crankshaft. Subsequent to a misfire event the engine will decelerate over the period following the missed cylinder event.
Speed changes can be characterised by observing changes in the time period for a fixed angle of rotation after firing events. A significant change in this period, assessed by comparison to previous periods, may be attributed to misfire on a known cylinder.

Component connections

Connector	Description	ECU Pin						ECU Connector
1	Supply Voltage	Coil 1	Coil 2	Coil 3	Coil 4	Coil 5	Coil 6	
2	Ignition Coil Feedback	D2	D2	D2	D2	D2	D2	32 Way (Left)
3	Coil Output (Logic)	F4	F3	F2	F1	E4	E3	32 Way (Left)
4	Ground							

Malfunction Criteria
The operation of all the misfire codes is the same, the last digit relates to the misfire involved i.e. a code P0303 indicates there is a problem with cylinder number 3.
P0300 indicates the misfire is random and not linked to one particular cylinder.

Monitor:
- Continuous

Enable Criteria:
- Battery voltage between 10 – 16 V
- Coolant temperature between -10 – 120°C (14 – 248°F)
- Engine speed between 500 – 7250rpm
- Engine load greater than 14 – 60% depending on engine speed

Disable Criteria:
- DFCO enabled (Deceleration Fuel Cut Off)
- Rough road
- MAF faults
- Aggressive throttle transients

Malfunction Criteria:
- Individual cylinder misfire in excess of 10% of total engine misfire
- P300 set when more than one cylinder misfiring or when CAM error MIL requested

Limp home (depends on severity and number of cylinders affected):
- Throttle limited and engine continues to run on all cylinders
- Fuel system set to open loop control
- Affected bank shut down and engine speed limited to 4000 rpm

Potential failure modes:
- Injectors or related codes
- VVT system (clearance or timing) or related codes
- MAF meter or related codes
- Connectors and wiring for signs of corrosion or loose connections
- Spark plug / coil / cylinder compression
- PCV system / hoses
- Fuel pressure
- Coolant temperature sensor
- Vacuum hoses
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Knock Control System

P0327 Knock Sensor Circuit Low (Bank 1)
P0328 Knock Sensor Circuit High (Bank 1)
P0332 Knock Sensor Circuit Low (Bank 2)
P0333 Knock Sensor Circuit High (Bank 2)

Description
The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed. The piezoelectric element continuously sends a signal to the ECU, when the cylinder block vibrates due to engine knocking, this signal increases. The ECU is able to identify each cylinder. If knock is detected then the ECU will retard the ignition of the relevant cylinder to suppress it.
The knock control sensor cannot differentiate between spark knock and other similar sounding noises.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Sensor input	D1	48 Way (Centre)
2 Bank 1	Ground	C1	48 Way (Centre)
3 Bank 2	Sensor input	D2	48 Way (Centre)
4 Bank 2	Ground	C2	48 Way (Centre)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Malfunction Criteria:
- P0327 – This code is set when the bank 1 knock sensor signal is < 0.586 V
- P0328 – This code is set when the bank 1 knock sensor signal is > 2.932 V
- P0332 – This code is set when the bank 2 knock sensor signal is < 0.586 V
- P0333 – This code is set when the bank 2 knock sensor signal is > 2.932 V

Potential failure modes:
- Abnormal engine noise, i.e. damaged engine or exhaust system contacting vehicle
- Knock sensor fixing too tight
- Sensor connector / wiring corroded or loose connections
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Engine Speed / Position Sensors

P0335 Crankshaft Position Sensor “A” Circuit Range/Performance

Description
Engine speed is calculated by measuring the time between the ‘teeth’ of the crankshaft sensor trigger disc. The disc has 34 ‘teeth’ and 2 missing ‘teeth’, spaced at 10 degree intervals around the disc. The 2 missing ‘teeth’ are positioned at 155 degrees before cylinder No.1 TDC. The crankshaft sensor signal is also used to determine misfires events.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Sensor input	A4	32 Way (Left)
2	Ground	B2	32 Way (Left)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- 15 crank errors in succession. This can occur due to no crank signal occurring whilst the cams continue to count or if there is a measured consecutive crank error.

Potential failure modes:
- Sensor signal open circuit or short to ground
- Sensor ground open circuit
- Sensor failure
- Crankshaft sensor plate
- ECU

Diagnostic Mask:
- The MIL will be illuminated if this fault is present for two consecutive trips.

Notes:
If a sensor or sensor circuit failure occurs, the engine will not fire or start.

Engine Speed / Position Sensors

P0341 Camshaft Position Sensor “A” Circuit (Bank 1)
P0346 Camshaft Position Sensor “A” Circuit (Bank 2)
P0366 Camshaft Position Sensor “B” Circuit (Bank 2)
P0391 Camshaft Position Sensor “B” Circuit (Bank 2)

Description
The camshaft position input to the ECU is used to determine engine phase, enable sequential fuel injection control and to determine camshaft position for VVT control. The inlet camshaft has three ‘teeth’ spaced 90° apart, which are detected by the electromagnetic sensor. The valve timing setting is measured in the ECU by measuring time from a (fixed position) crankshaft tooth to a (variable position) camshaft tooth. As the engine speed and the position are known from the crankshaft sensor signal, the camshaft position can be calculated.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1 Inlet Bank 1	Signal	A3	32 Way (Left)
2 Inlet Bank 1	Ground	B3	32 Way (Left)
3 Supply voltage	5V	D1	32 Way (Left)
1 Exhaust Bank 1	Signal	D4	32 Way (Left)
2 Exhaust Bank 1	Ground	C3	32 Way (Left)
3 Supply voltage	5V	D1	32 Way (Left)
1 Inlet Bank 2	Signal	A2	32 Way (Left)
2 Inlet Bank 2	Ground	C2	32 Way (Left)
3 Supply voltage	5V	D1	32 Way (Left)
1 Exhaust Bank 2	Signal	D3	32 Way (Left)
2 Exhaust Bank 2	Ground	C4	32 Way (Left)
3 Supply voltage	5V	D1	32 Way (Left)

Monitor:
- Continuous

Enable Criteria:
- Engine running
- Engine speed > 600rpm
- Engine runtime > 4 secs

Disable Criteria:
- None

Malfunction Criteria:
- 15 revolutions of crankshaft without receiving camshaft signal

Potential failure modes:
- Sensor signal open circuit or short to ground
- Sensor ground open circuit
- Sensor failure
- Cam failure
- Camshaft position plate
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Note: Fault code P0341 will also be generated if the vehicle fails security checks on start up.

Ignition System

P0351 Ignition Coil “A” Primary/Secondary Circuit
P0352 Ignition Coil “B” Primary/Secondary Circuit
P0353 Ignition Coil “C” Primary/Secondary Circuit
P0354 Ignition Coil “D” Primary/Secondary Circuit
P0355 Ignition Coil “E” Primary/Secondary Circuit
P0356 Ignition Coil “F” Primary/Secondary Circuit

Description
A Direct Ignition System (DIS) is used on the engine. The DIS improves the ignition accuracy, reduces high-voltage loss, and enhances the reliability of the ignition system. The DIS is a 1-cylinder system that ignites one cylinder with one ignition coil. The ECU determines the ignition timing and outputs the ignition signals (IGT) for each cylinder. Based on IGT signals, the power transistors in the igniter cuts off the current to the primary coil, which induces a spark at the spark plug connected to the secondary coil. The igniter will also send an ignition confirmation signal (IGF) as a fail-safe measure to the ECU.

Component connections

Connector Pin	Description	ECU Pin						ECU Connector
1	Supply Voltage	Coil 1	Coil 2	Coil 3	Coil 4	Coil 5	Coil 6	
2	Ignition Coil Feedback	D2	D2	D2	D2	D2	D2	32 Way (Left)
3	Coil Output (Logic)	F4	F3	F2	F1	E4	E3	32 Way (Left)
4		Ground						

Monitor:
- Continuous

Enable Criteria:
- Engine running

Malfunction Criteria:
- No IGF signal to ECM while engine is running

Potential failure modes:
- Open or short in IGF1 – IGF6 circuits from ignition coil to ECU
- Coil failure
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Catalyst System Efficiency

P0420 Catalyst System Efficiency Below Threshold (Bank 1)
P0430 Catalyst System Efficiency Below Threshold (Bank 2)

Description
The ECU compares the waveform of the oxygen sensors located before and after the catalyst to determine whether or not the catalyst has deteriorated. If the catalyst is functioning normally the front oxygen sensor will be switching between rich and lean whilst the rear oxygen sensor should also be switching between rich and lean but more slowly. When both the oxygen sensor waveforms change at a similar rate, it indicates that the catalyst performance has deteriorated. The ECU counts the number of pre and post catalyst oxygen sensor switches and divides one by the other to determine a ratio. If this ratio is too high a fault will be indicated.

Sensor connections

Pre catalyst oxygen sensor

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	G3	48 Way (Centre)
2 Bank 1	Ground	J2	48 Way (Centre)
3 Bank 1	Heater Supply	H3	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-
1 Bank 2	Signal	G4	48 Way (Centre)
2 Bank 2	Ground	J2	48 Way (Centre)
3 Bank 2	Heater Supply	H4	48 Way (Centre)
4 Bank 2	Battery Voltage	-	-

Post catalyst oxygen sensor

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	H1	48 Way (Centre)
2 Bank 1	Ground	K4	48 Way (Centre)
3 Bank 1	Heater Supply	K1	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-
1 Bank 2	Signal	H2	48 Way (Centre)
2 Bank 2	Ground	K4	48 Way (Centre)
3 Bank 2	Heater Supply	K2	48 Way (Centre)
4 Bank 2	Battery Voltage	-	-

Monitor:
- Continuous

Enable Criteria:
- Closed loop fuel control enabled
- Coolant temperature > 60 °C (140 °F)
- Baro > 756 mbar
- Vehicle speed < 130 km/h (81 mph)
- MAF < 48 g/sec & MAF > 2 g/sec
- Air inlet temp > -10°C (14°F)
- Accumulated Mass Air > 1800-4080 grams depending on coolant temperature

Disable Criteria:
•P0101, P0102, P0103 – MAF faults
•P0107, P0108 – MAP / Baro Faults

- P0116, P0117, P0118 – Coolant temperature faults
- P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0139, P0140, P0141 – Oxygen sensor faults B1
- P0151, P0152, P0153, P0154, P0155, P0157, P0158, P0159, P0160, P0161 – Oxygen sensor faults B2
- P0171, P0172, P0174, P0175 – Fuelling faults B1 / B2
- P0300, P0301, P0302, P0303, P0304, P0305, P0306 – Misfire faults
- P0500 – Speed sensor fault

Malfunction Criteria:
- Switch ratio between Pre & Post catalytic converter O2 sensors > 0.6

Potential failure modes:
- Exhaust system leak
- Oxygen sensor faults
- Oxygen sensor heater failure
- Catalyst failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Evaporative Emission Control – Purge, Open / Closed Circuit

P0444 Evaporative Emission System Purge Control Valve Circuit Open
P0445 Evaporative Emission System Purge Control Valve Circuit Closed

Description
When the engine is running the ECU continuously monitors the status of the evaporative emission components for open circuit or short. The feedback signal should be low when turned ON and high when turned OFF. The following codes will be set if the above conditions are not met: P0444, P0445.

Sensor / component connections

Purge Solenoid

Connector Pins	Description	ECU Pin	ECU Connector
1	Battery Voltage	-	-
2	Solenoid Output	B3	48 Way (Centre)

P0444, P0445
Potential failure modes:
- P0444 Purge valve/wiring open circuit
- P0445 Purge valve short circuit

Diagnostic mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Fuel Level Sensor

P0461 Fuel Level Sensor “A” Circuit Range/Performance
P0462 Fuel Level Sensor “A” Circuit Low
P0463 Fuel Level Sensor “A” Circuit High

Description
When the engine is running the ECU continuously monitors the fuel level sensor feedback signals. The feedback signal should be low when turned ON and high when turned OFF. The following codes will be set if the above conditions are not meet.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1			
2	Fuel level sensor	A2	48 Way (Right)
3	Fuel level sensor ground	K3	48 Way (Right)

P0462, P0463
Monitor:
- Continuous

Enable Criteria:
- Engine Running

Disable Criteria:
- None

Malfunction Criteria:
- P0462 – Voltage < 0.05V
- P0463 – Voltage > 4.94V for 1.5 secs

Potential failure modes:
- Sensor open or short circuit
- Fuel level sensor

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0461
The ECU calculates the fuel usage and determines whether the fuel level sensor has responded correctly to this usage. The ECU also monitors the filtered and unfiltered signal at idle after a 20 second de-slosh period and compares the differences.

Monitor:
- Continuous

Enable Criteria 1:
- Vehicle Idling
- Vehicle stationary for 20 seconds

Disable Criteria 1:
- Fuel level < 3.3 litres (0.9 US gallons)

Malfunction Criteria 1:
- Signal fluctuation > 10 litres, 35 times over 7 second period

Enable Criteria 2:
- 18litres fuel usage in upper region
- 15 litres fuel usage in lower region
- 8 litres fuel usage in mid region

Malfunction Criteria:
- Checks for three conditions, stuck when full, stuck when empty or stuck midway. The ECU determines if the sensor is stuck by calculating the amount of fuel used during the test period (this may occur over several drive cycles). If the fuel level does not move by more than 2.6 litres a fault is flagged.

Potential failure modes:
- Fuel level sensor wiring or connector corroded
- Fuel level sensor stuck

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Engine Cooling Fan Control

P0480 Fan 1 Control Circuit
P0481 Fan 2 Control Circuit
P0482 Auxiliary Fan Control Circuit

Description
Slow Fans – ECM engages fan relay 3 and runs both fans in series through the disengaged fan relays 2 and 1.
Fast Fans – ECM engages fan relays 1 and 2 and runs both of the fans in parallel.
Auxiliary Fan – ECM engages secondary fan relay to engage auxiliary fan.

Component connections

Sensor Connector	Description	ECU Pin	ECU Connector
	Slow Fans	F1	48 Way (Right)
	Fast Fans	E2	48 Way (Right)
	Auxiliary Fan	L1	48 Way (Right)

Monitor:
- Continuous diagnosis of fan relay circuits for short / open circuits

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Wiring harness problem
- Relay
- ECU

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Vehicle Speed Sensor

P0500 Vehicle Speed Sensor "A"

Description
This input to the ECU is from the ABS module via CAN.

Monitor:
- Continuous

Enable Criteria:
- Following conditions must occur for 5 seconds
- Engine speed > 1800rpm and < 5010rpm
- Baro > 756 mbar
- Engine in deceleration fuel cut off mode.

Malfunction Criteria:
- KMH < 5 kmh

Potential failure modes:
- ABS module failure
- CAN bus communication error to ABS controller

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Idle Speed Control

P0506 Idle Air Control System RPM Lower Than Expected
P0507 Idle Air Control System RPM Higher Than Expected

Description
The ECM controls the engine idle speed using a combination of spark advance and throttle blade adjustment. If this control cannot attain the desired idle speed a fault is diagnosed.

Monitor:
- Continuous

Enable Criteria:
- Engine at idle speed
- Battery voltage between 10 V and 16 V

Malfunction Criteria 1:
- Idle air learn value on upper limit of +1.8g/s
- Idle speed more than 200 rpm above desired idle speed for more than 5 seconds.

Malfunction Criteria 2:
- Idle air learn value on lower limit of -1.8g/s
- Idle speed more than 100 rpm below desired idle speed for more than 5 seconds.

Potential failure modes:
- Induction system air leak
- Excessive engine load from front end accessory drive system, water pump, power steering, alternator
- Electronic Throttle Control

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for 2 consecutive trips.

Notes:
There will be a different learn value for AC on and AC off. Either could trigger fault

A/C Evaporator temperature sensor

P0537 A/C Evaporator temperature sensor circuit low
P0538 A/C Evaporator temperature sensor circuit high

Description
The A/C system incorporates an evaporator temperature sensor for system control. This is a thermistor device that changes resistance with temperature. As the evaporator temperature decreases the thermistor resistance value increases, and conversely as the evaporator temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Sensor signal	A3	48 Way (Right)
1	Sensor ground	K3	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Vehicle Running

Disable Criteria:
- None

Malfunction Criteria:
- P0537 – Signal voltage < 0.049V for 1.5 seconds
- P0538 – Signal voltage > 4.399V for 1.5 seconds

Potential failure modes:
- Thermistor wiring open circuit or shorted
- Thermistor fault

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Battery Voltage

P0562 System Voltage Low
P0563 System Voltage High

Description
With a battery and alternator functioning as normal the system voltage for a running engine should be around 14V. The ECM monitors this and will diagnose if the voltage is too high or too low.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- P0562 – Voltage Too Low < 10V for 10 seconds
- P0563 – Voltage Too High > 16V for 25.5 seconds

Potential failure modes:
- Alternator fault
- Battery fault

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Cruise Control

P0565 Cruise control on/off signal
P0567 Cruise control resume/decal signal
P0568 Cruise control set/accel signal
P0571 Brake switch "A" circuit

Description

Cruise control requests are made using a multi-function switch input directly wired into engine control unit. From this input the ECM determines the driver request. In addition cruise control is cancelled by the application of either the brake pedal or the clutch pedal (see also P0806, P0807 and P0808).

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
A	Cruise control switch input On / Off	D2	48 Way (Right)
B	Cruise control ground	K3	48 Way (Right)
C	Cruise control switch input Resume/Decease	C3	48 Way (Right)
D	Cruise control switch input Set/Increase	D3	48 Way (Right)
1	Brake Switch Ground	-	-
2	Brake Switch Input	C4	48 Way (Right)

P0565, P0567, P0568
Monitor:
• Continuous

Enable Criteria:
• None

Disable Criteria:
• None

Malfunction Criteria:
• P0565 - Input other than OFF received for more than 100 seconds
• P0567 - Input other than OFF received for more than 100 seconds
• P0578 – Input other than OFF received for more than 100 seconds

Potential failure modes:
• Cruise switch wiring open circuit or shorted
• Cruise switch fault
• ECU input circuit fault

Diagnostic Mask:
• The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

P0571
Monitor:
• Continuous

Enable Criteria 1:
• KMH > 10 kmh
• PPS > 0.488%

Enable Criteria 2:
- ABS communications working

Disable Criteria:
- None

Malfunction Criteria 1:
- Brake switch on for greater than 25.5 seconds

Malfunction Criteria 2:
- ABS indicating brakes are on but brake switch off for greater than 0.5 seconds

Potential failure modes:
- Brake switch wiring open circuit or shorted
- Brake switch fault

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

ECU Integrity

P0601 Internal Control Module Memory Checksum Error
P0606 ECM/PCM Processor

Description
These codes are used by the ECU to check the integrity of the software and calibration data.
P0601 checks that on power up the checksum for calibration data is the same as checksum saved on the previous power down.
P0606 checks the watchdog timer after a defined period to see if it has reset. If the watchdog timer has not reset then the code has entered an unplanned loop or condition stopping it resetting the timer.

Monitor
- P0601 at ECU power up
- P0606 continuously while the engine running

Diagnostic Mask:
- The MIL will be illuminated if a fault is present.

Variant Code Not Programmed

P0610 Variant code not programmed

Description
The ECM programming process includes the vehicle variant code.
If a new ECM has been fitted, the relevant vehicle variant code needs to be programmed using the Lotus TechCentre tool.

Monitor
- During start up

Disable criteria
- None

Potential failure modes
- Variant code not programmed
- Variant code programmed incorrectly

Diagnostic mask
- The MIL will be illuminated if fault is present.

Crank Relay

P0616 Starter relay voltage low
P0617 Starter relay voltage high

Description
When the ignition key is in the crank position battery voltage is applied to the start request input of the ECM. The ECM will then energise the crank relay, via the immobiliser, to allow the starter motor to be engaged. ECM diagnosis is only carried out on the crank relay.

Component connections

Relay Connector	Description	ECU Pin	ECU Connector
7	Ignition switch via fuse F16	-	-
9	Crank relay control	G1	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P0616 – Crank relay wiring open circuit or shorted to ground
- P0616 – Fuse F16
- P0617 – Crank relay wiring shorted to 12V
- Crank relay failure
- Immobiliser failure
- ECU output circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Fuel Pump Relay

P0628 Fuel Pump "A" Control Circuit Low Voltage
P0629 Fuel Pump "A" Control Circuit High Voltage

Description
The fuel system is of the non-return type. The fuel pump is incorporated into the fuel tank module, which also contains the level sensor and fuel pressure regulator. The ECM controls the fuel pump operation via a relay; hence, fault diagnosis is only of the fuel pump relay.

Component connections

Relay connector	Description	ECU Pin	ECU Connector
1	Ignition switch via fuse F16	-	-
2	Fuel pump relay control	H2	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Ignition on

Disable Criteria:
- None

Potential failure modes:
- P0628 fuel pump relay wiring open circuit or shorted to ground
- P0628 fuse F16
- P0629 fuel pump relay wiring shorted to 12V
- Fuel pump relay failure
- ECU output circuit failure

Diagnostic Mask:
- The MIL will be illuminated immediately if a fault is present.

VIN Not Programmed or Incompatible – ECU/PCM

P0630 Vin not programmed or incompatible

Description
The ECM programming process includes the Vehicle Identification Number (VIN).
If a new ECM has been fitted this operation is performed using the Lotus TechCentre tool.

Monitor:
- During start up

Enable Criteria:
- Engine running (for up to 4 seconds)

Disable Criteria:
- None

Potential failure modes:
- VIN not programmed
- VIN programmed incorrectly

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Throttle Actuator Control Range/Performance

P0638 Throttle actuator control range/performance

Description
The single throttle butterfly valve mounted at the inlet to the intake plenum is operated by a stepper motor under the command of the engine ECU. The valve moves through a range of nearly 90° and should display 100% at full throttle and around 2% at idle.

Monitor:
- Continuous

Enable Criteria 1:
- Engine running

Disable Criteria 1:
- Electronic throttle fault P2135, P0122, P0122, P0222 or P0223 present
- Throttle demand transient condition

Malfunction Criteria 1:
- TPS error > 3% for 7.5 secs

Potential failure modes:
- Blocked throttle body
- Damage to throttle actuator

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Notes: A mechanically sprung 7% throttle opening may be imposed.

Air Conditioning System

P0646 A/C Clutch Relay Control Circuit Low
P0647 A/C Clutch Relay Control Circuit High

Description
The ECM controls the A/C clutch relay in response to the A/C driver request and ECM control logic.

Component connections

Relay Connector	Description	ECU Pin	ECU Connector
1	Ignition supply via fuse F20		
2	AC clutch relay control	F2	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P0646 – A/C compressor relay wiring open circuit or shorted to ground
- P0646 – Fuse F20
- P0647 – A/C compressor relay circuit shorted to 12V
- A/C compressor relay failure
- ECU output circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

ECU Power Relay

P0685 ECU Power Relay Open Circuit

Description
The ECU power is controlled by the main power relay. The voltage at ECM pins RM2/RM3/RM4 is compared to the ignition switch input voltage at RB2 to determine if the power relay is open circuit.
Because this fault prevents the correct shut down of the ECM, the fault code is only visible whilst the engine is running.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Fuse R10
- Relay open circuit

Diagnostic Mask:
- The MIL will be illuminated if a fault is present and the engine is running.

Dynamic Performance Management Switch

P0790 Dynamic performance management switch circuit

Description
Dynamic performance requests are made using the multi-function dynamic performance management switch input. Three switch positions are available (Tour, Sport and Race), each of which selects a different resistive network to a single ECM input. From this input the ECM determines the driver request.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
3	Dynamic performance switch input	E3	48 Way (Right)
4	Dynamic performance switch ground	-	-

Sensor characteristics

Tour position	= 2 kΩ +/- 5%
Sport position	= 4 kΩ +/- 5%
Race / momentary position	= 9 kΩ +/- 5%

P0790
Monitor:
• Continuous

Enable Criteria:
• None

Disable Criteria:
• None

Malfunction Criteria 1:
• Voltage measured at ECU outside following boundaries for 15 seconds
- 1.76V – 2.10V = Tour position
- 2.61V – 2.96V = Sport position
- 3.52V – 3.86V = Race / Momentary position

Malfunction Criteria 2:
• Switch stuck in Race / Momentary position for 100 seconds

Potential failure modes:
• DPM switch wiring open circuit or shorted
• DPM switch fault
• ECU input circuit fault

Notes:
• The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Clutch position sensor circuit

P0806 Clutch position sensor circuit range/performance
P0807 Clutch position sensor circuit low
P0808 Clutch position sensor circuit high

Description
The clutch position sensor is used to identify the position of the clutch (engaged, disengaged or slipping). This information is used to control features such as fuel cut during gear changes, cruise control deactivation and ensuring any torque increase requests from the ESP system only occur with the clutch engaged.
The ECM continuously monitors the clutch position sensor input for malfunctions.

Component connections

Connector	Description	ECU Pin	ECU Connector
A	Ground	K3	48 Way (Right)
B	Clutch position sensor signal	B1	48 Way (Right)
C	Reference voltage	F4	48 Way (Right)

P0806
Monitor:
- Continuous

Enable Criteria:
- Maximum and minimum clutch position measured over 15 gear changes

Disable Criteria:
- None

Malfunction Criteria:
- Voltage difference between maximum and minimum of less than 1.71V

Potential failure modes:
- Clutch sensor failure
- Clutch pedal failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

P0807, P0808
Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- P0807 – Sensor voltage < 0.21V
- P0808 – Sensor voltage > 4.93V

Potential failure modes:
- P0807 – Clutch sensor wiring open circuit or shorted to ground

- P0808 – Clutch sensor ECU input circuit shorted to 5V or 12V
- Clutch sensor failure
- Clutch pedal failure
- ECU input circuit failure

Diagnostic Mask:

- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Air intake control valve circuit

P1113 Air intake control valve circuit

Description:
The air cleaner is equipped with 2 inlets, one of which is opened or closed by the Air Intake Control Valve (AICV). This system reduces intake noise and increases engine power.
When the engine is operating in the low-to-mid speed range, the ECM deactivates the Vacuum Solenoid Valve (VSV) and allows the AICV to close one of the air cleaner inlets. When the engine speed is greater than a specified value the ECM activates the VSV and the applied vacuum activates the AICV to open both of the air cleaner inlets.

Component connections

Connector	Description	ECU Pin	ECU Connector
1	Main relay supply via fuse R7	-	-
2	VSV control	B1	48 Way (Central)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- VSV open circuit or short to ground
- VSV circuit short to ECU

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Misfire

P1301 Misfire level causing emissions increase
P1302 Misfire level causing catalyst system damage

Description
When the engine misfire reaches a high enough percentage the engine emission output levels can exceed the allowed limits, this will produce the fault code P1301.
If the misfire percentage is high enough and there is a possibility that the catalyst may be damaged then code P1302 will be set. To prevent catalyst damage the ECM will take action to shut down the engine bank containing the misfiring cylinder and limit the engine speed to 4000rpm, or limit the throttle opening if there is more than one cylinder misfiring.

See misfire faults P0300, P0301, P0302, P0303, P0304, P0305, P0306

Monitor:
- Continuous

Enable Criteria:
- Battery voltage between 10 – 16 V
- Coolant temperature between -10 – 120°C (14 – 248°F)
- Engine speed between 500 – 7250rpm
- Engine load greater than 14 – 60% depending on engine speed

Disable Criteria:
- DFCO enabled (Deceleration Fuel Cut Off)
- Rough road
- MAF faults
- Aggressive throttle transients

Malfunction Criteria:
- P1301 ROW Emissions Failure – Misfire percentage > 3.6 % measured over 1000 engine revolutions.
- P1302 Catalyst Damage Failure – Misfire percentage > 10% - 33% depending on engine speed and load, measured over 200 engine revolutions.

Potential failure modes:
- Injector related codes, as these can cause misfire codes to be set.
- VVT codes set
- Sensor connector and wiring for signs of corrosion or loose connections
- Spark plug / cylinder compression
- Cam timing / damage to rocker arm assembly
- Fuel pressure

Diagnostic Masks:
- For a P1301 fault code the MIL will be illuminated immediately.
- For a P1302 fault code the MIL will be illuminated immediately and the ECM will take action to prevent catalyst damage.

Notes:
- Misfire learns are calculated during DFCO (Deceleration Fuel Cut Off)

Coolant Recirculation Pump

P2602 Coolant Pump Control Circuit Low
P2603 Coolant Pump Control Circuit High

Description
During a hot shutdown of the engine, the recirculation pump can continue to pump coolant around the engine. The recirculation pump will run after the engine has been turned off if the enable criteria are matched.
The recirculation pump will also run after a short period of idle to aid heater performance.

Component connections

Connector	Description	ECU Pin	ECU Connector
1	Recirc pump driver	M1	48 Way (Right)
2	Main relay via fuse R5	-	-

Monitor:
- Continuous

Enable Criteria:
- P2602 - continuous
- P2603 - engine running

Disable Criteria:
- None

Potential failure modes:
- P2602 – pump wiring open circuit or shorted to ground
- P2602 – fuse R5
- P2603 – pump circuit, ECM side, shorted to battery voltage
- Pump failure
- ECU output circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Throttle Position

P2100 Throttle Actuator Control Motor Circuit/Open
P2102 Throttle Actuator Control Motor Circuit/Low
P2103 Throttle Actuator Control Motor Circuit/High
P2104 Throttle Actuator Control System – Forced Idle
P2105 Throttle Actuator Control System – Forced Engine Shutdown
P2106 Throttle Actuator Control System – Forced Limited Power
P2107 Throttle Actuator Control Module Processor
P2108 Throttle Actuator Control Module Performance
P2119 Throttle Actuator Control Throttle Body Range/Performance

Component connections

Connector	Description	ECU Pin	ECU Connector
1	Motor A	M1	48 Way (Centre)
2	Motor B	L2	48 Way (Centre)
3	Throttle position sensor ground	C4	48 Way (Centre)
4	Throttle position sensor1 signal	F3	48 Way (Centre)
5	Throttle position sensor voltage	E4	48 Way (Centre)
6	Throttle position sensor2 signal	F2	48 Way (Centre)

Throttle Actuator Control Motor Circuit/Open

P2100 Throttle actuator control motor circuit open

Description
The throttle actuator stepper motor operates on 12 volts.

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Throttle actuator control motor open circuit

Throttle Actuator Control Motor Circuit/Low

P2102 Throttle actuator control motor circuit low

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Throttle actuator control motor short to ground

Throttle Actuator Control Motor Circuit/High

P2103 Throttle actuator control motor circuit high

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Throttle actuator control motor short to supply voltage

Throttle Actuator Control System – Forced Idle

P2104 Throttle actuator control system – forced idle

Description
If a problem is detected which could result in faster engine speed than commanded by the pedal, the actuator is switched out, allowing the throttle valve to default to a 6% mechanically sprung setting. This provides a fast idle speed which may be used to effect a 'limp home' mechanism.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control System – Forced Engine Shutdown

P2105 Throttle actuator control system – forced engine shutdown

Description
If a problem is detected which could result in engine speed runaway, or if sufficient control of engine speed is lost, the ECU switches off the fuel injectors in order to stop the engine.
Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:

- None

Potential failure modes:
- Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control System – Forced Limited Power

P2106 Throttle actuator control system – forced limited power

Description
If a problem is detected which could result in engine speed control difficulties, the ECU will limit throttle opening to a maximum of 15%.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control Module Processor

P2107 Throttle actuator control module processor

Description
The ECU contains two processors dedicated to the throttle pedal and throttle valve potentiometers.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- ECU internal fault
- Incorrect ECU programming

Throttle Actuator Control Module Performance

P2108 Throttle actuator control module performance

Monitor:

- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- ECU internal failure
- Short circuit to throttle actuator

Throttle Actuator Control Throttle Body Range/Performance

P2119 Throttle Actuator Control Throttle Body Range/Performance

Monitor:
- Continuous

Enable Criteria:
- Ignition on

Disable Criteria:
- None

Malfunction Criteria
- Throttle position does not close during start up.
- Throttle position not stationary to within 0.01V over 10ms interval

Potential failure modes:
- Wiring/harness issue at throttle body connector
- Wiring/harness issue at ECU connector
- Throttle body dirty

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Pedal Position

P2122 Pedal position sensor 'D' circuit low
P2123 Pedal position sensor 'D' circuit high
P2127 Pedal position sensor 'E' circuit low
P2128 Pedal position sensor 'E' circuit high
P2135 Throttle position sensor/switch 'A/B' voltage correlation
P2138 Pedal position sensor/switch 'D/E' voltage correlation

Connector	Description	ECU Pin	ECU Connector
1	Reference voltage E circuit	F3	48 Way (Right)
2	Reference voltage D circuit	F3	48 Way (Right)
3	Pedal D position sensor signal	B4	48 Way (Right)
4	Ground D circuit	K4	48 Way (Right)
5	Ground E circuit	K4	48 Way (Right)
6	Pedal E position sensor signal	A4	48 Way (Right)

Pedal Position Sensor 'D' Circuit Low

P2122 Pedal position sensor 'D' circuit low

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal short circuit (< 0.283 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'D' Circuit High

P2123 Pedal position sensor 'D' circuit high

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal open circuit (> 4.487 V)
- Reference voltage open circuit

- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'E' Circuit Low

P2127 Pedal position sensor ‘E’ circuit low

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal short circuit (< 0.283 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'E' Circuit High

P2128 Pedal position sensor ‘E’ circuit high

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal open circuit (> 4.487 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Throttle Position Sensor 'A'/'B' Voltage Correlation

P2135 Throttle position sensor ‘A/B’ voltage correlation

Description
Two potentiometers are built into the throttle actuator unit in order to provide a throttle position signal to the ECU. Two processors within the ECU compare the two output signals, which should match within a defined

tolerance. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- Throttle position greater than 60%

Potential failure modes:
- TPS1 reading incorrectly
- TPS2 reading incorrectly

Notes: A maximum throttle opening of 15% may be imposed.

Pedal Position Sensor/Switch 'D'/'E' Voltage Correlation

P2138 Pedal position sensor/switch ‘D/E’ voltage correlation

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Two processors within the ECU compare the two output signals, which should match within a defined tolerance. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- PPS1 reading incorrectly
- PPS2 reading incorrectly

Notes: A maximum throttle opening of 15% may be imposed.

Exhaust Pressure Regulator Vent Solenoid

P2170 Exhaust Pressure Regulator Vent Solenoid Control Circuit Low
P2171 Exhaust Pressure Regulator Vent Solenoid Control Circuit High

Description:
The exhaust pressure regulator valve should be active when the vehicle is in Race mode or at high loads / engine speeds (dependent on vehicle mode selected) or during the first 4 secs after start up. A fault can only be detected while the solenoid is being used. The diagnostic is an electrical check of the vent solenoid and cannot check the physical position of the exhaust valve. The exhaust valve has been designed to fail open; however detection of either of the faults will impose a lower rev limit for engine safety.

Enable Criteria:
- Vent solenoid commanded
- Engine running

Monitor:
- Continuous

Malfunction Criteria:
- P2170 – Open circuit or short to ground
- P2171 – Short to 5V

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Throttle Actuator Control System – High Airflow Detected

P2173 Throttle actuator control system – high airflow detected

Description
The mass air flow is compared with the throttle position to determine whether an incorrect correlation exists.

Enable Criteria:
- None

Disable Criteria:
- MAF fault(s) present

Potential failure modes:
- Throttle plate damage
- Air leak in intake system

Notes: A mechanically sprung 7% throttle opening may be imposed, or the injectors may be shut off to stop the engine.

System Too Lean at Higher Load

P2191 System Too Lean at Higher Load (Bank 1)
P2193 System Too Lean at Higher Load (Bank 2)

Description
The oxygen sensor sends a signal to the ECU corresponding to the exhaust gas oxygen content enabling the ECU to maintain a 14.7:1 air/fuel ratio under normal driving conditions. At higher loads when the system is required to run richer than 14.7:1 air/fuel ratio, the oxygen sensor should return a signal greater than 600mV. If either of the oxygen sensor voltages are less than 600mV when the ECU requires the engine to be running rich then above codes are set for the respective banks.

Monitor:
- Continuous

Enable Criteria:
- Engine coolant > 70°C
- Engine not in deceleration fuel cut
- Engine percentage load > 40%
- AFR demand richer than 13.0:1 (lambda 0.9)

Disable Criteria P2191:
- P0131, P0132, P0133, P0134, P0135 – Oxygen sensor faults
- P0301, P0303, P0305 – Misfire faults
- P0261, P0262, P0264, P0265, P0267, P0268
  P0270, P0271, P0273, P0274, P0276, P0277 – Injector faults

Disable Criteria P2193:
- P0151, P0152, P0153, P0154, P0155 – Oxygen sensor faults
- P0302, P0304, P0306 – Misfire faults
- P0261, P0262, P0264, P0265, P0267, P0268
  P0270, P0271, P0273, P0274, P0276, P0277 – Injector faults

Malfunction Criteria:
- These codes will set if the relevant engine bank oxygen sensor voltage remains below 600mV for more than 2 seconds under high load conditions.

Potential failure modes:
- Fuel Pressure too low (restriction in fuel line)
- Cylinder misfire
- Air leak in induction system
- Water in fuel
- Exhaust leak / crack before front oxygen sensor
- Oxygen sensor connector and wiring (corrosion or loose connections)
- MAF sensor fault

Diagnostic Mask:
- The MIL will be illuminated if fault is present for two consecutive trips.

A/C Refrigerant Distribution Valve

P2612 A/C Refrigerant Distribution Valve Control Circuit Low
P2613 A/C Refrigerant Distribution Valve Control Circuit High

Description:
The A/C refrigerant flow is regulated by the ECM using the distribution valve to control the evaporator to the required temperature and prevent freezing.

Component connections:

Connector	Description	ECM Pin	ECM Connector
1	Control valve driver	K3	48 Way (Centre)
2	Main relay via fuse R7	-	-

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P2612 – valve wiring open circuit or shorted to ground
- P2612 – loss of power from rear ignition relay
- P2613 – valve circuit, ECM side, shorted to battery voltage
- Valve failure
- ECM output circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

A/C Compressor Lock Sensor Circuit

B1422 A/C Compressor Lock Sensor Circuit

Description:
The ECM monitors the A/C compressor speed. If this speed is lower than the engine speed the ECM will turn off the A/C compressor clutch. This is to prevent belt damage due to slippage.

Component connections:

Connector	Description	ECM Pin	ECM Connector
1	Lock sensor +ve	C1	32 Way (Left)
2	Lock sensor -ve	B1	32 Way (Left)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- P0646, P0647 A/C compressor clutch fault

Malfunction Criteria:
- A/C compressor speed error greater than 10%

Potential failure modes:
- A/C compressor clutch mechanism slipping or seized
- A/C compressor drive belt slipping
- Lock sensor wiring
- Lock sensor failure
- ECM input circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Lost Communications with VDCM

U0122 Lost Communications with VDCM

Description:
The ECM communicates with the Vehicle Dynamic Control Module (VDCM) via the CAN bus.
If these CAN bus communications have been interrupted the ECM will register a diagnostic code.

Potential failure modes:
- CAN wiring
- VDCM control module failure
- CAN bus corruption by another module on bus

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Software Incompatible with VDCM

U0316 Software Incompatible with VDCM

Description:
The ECM checks that the Vehicle Dynamic Control Module (VDCM) matches the vehicle variant code. If not the above code will be set and the ECM will not respond to torque requests from the VDCM.

Potential failure modes:
- The ECM has been programmed with an incorrect variant code which does not match vehicle VDCM level.
- VDCM error.

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

EMQ.5 - CAN BUS DIAGNOSTICS; LOTUS TECHCENTRE

Controller Area Network (CAN) is an electronic standard to allow high speed communication between modules and controllers, via a serial data bus. The bus is a circuit linking the modules to the controller, consisting of a pair of cables, twisted together to reduce electromagnetic interference, and carrying a square wave voltage signal corresponding to '0's and '1's, coded in such a way as to identify and prioritise the individual messages. On the Exige S, CAN based systems include; engine management, anti-lock braking and related features, tyre pressure monitoring, instrument pack, and onboard diagnostics.

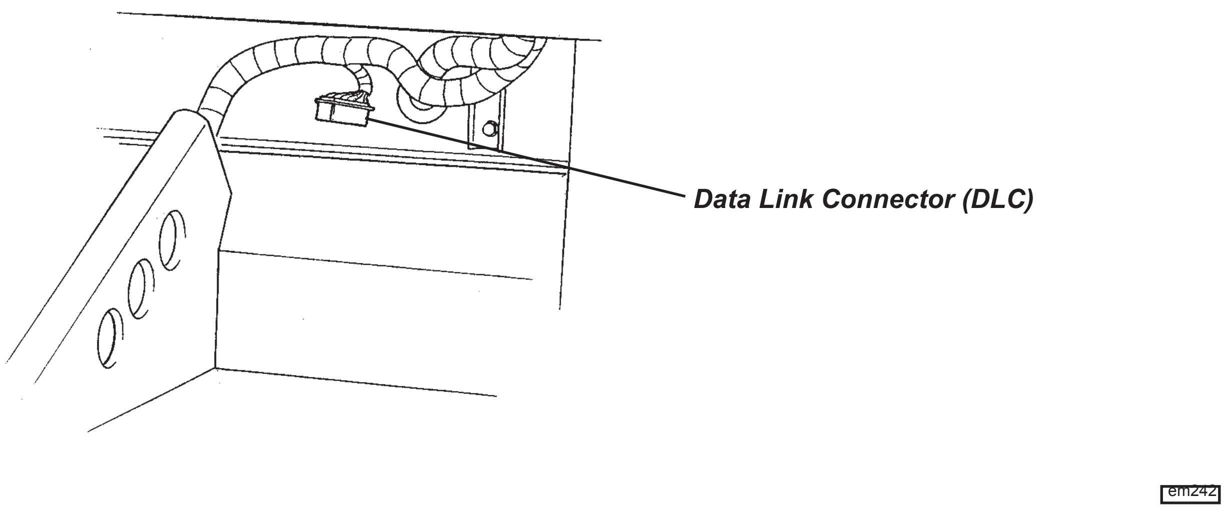
A 'stand alone' lap top PC loaded with 'Lotus Techcentre' software allows the CAN based serial data to be read. A Vehicle Communication Device (T000T1472F) introduced for the Europa model is used to connect the vehicle to the laptop Lotus Techcentre. Engine programming, live data display and systems diagnosis are all carried out via the Lotus Techcentre.

The minimum specification of the laptop computer for installation of the Lotus Techcentre is as follows:

Processer 1.70 Ghz;
1 GB RAM;
40 GB HDD;
CDRW DVD ROM;
WIN XP PRO or VISTA;
USB interface;
Ethernet or Wireless LAN

Note that this laptop should be dedicated soley to the Lotus Techcentre, with no other software installed. This diagnostic software is designed primarily for use by trained Lotus technicians, and is available as a CD under part number T000T1510F (version 4) or later supercessions. A monthly (Lotus Dealers) or annual (non-Lotus dealers) licence and support fee will also be levied, providing access to Lotus TechCentre Technical Support phoneline on ***0870 9493 668***, and e-mail on ***lotus.support.uk@omitec.com***
Also required is a unique 18 character licence/registration key without which Techcentre will not function. This key is non transferable to other PC’s.

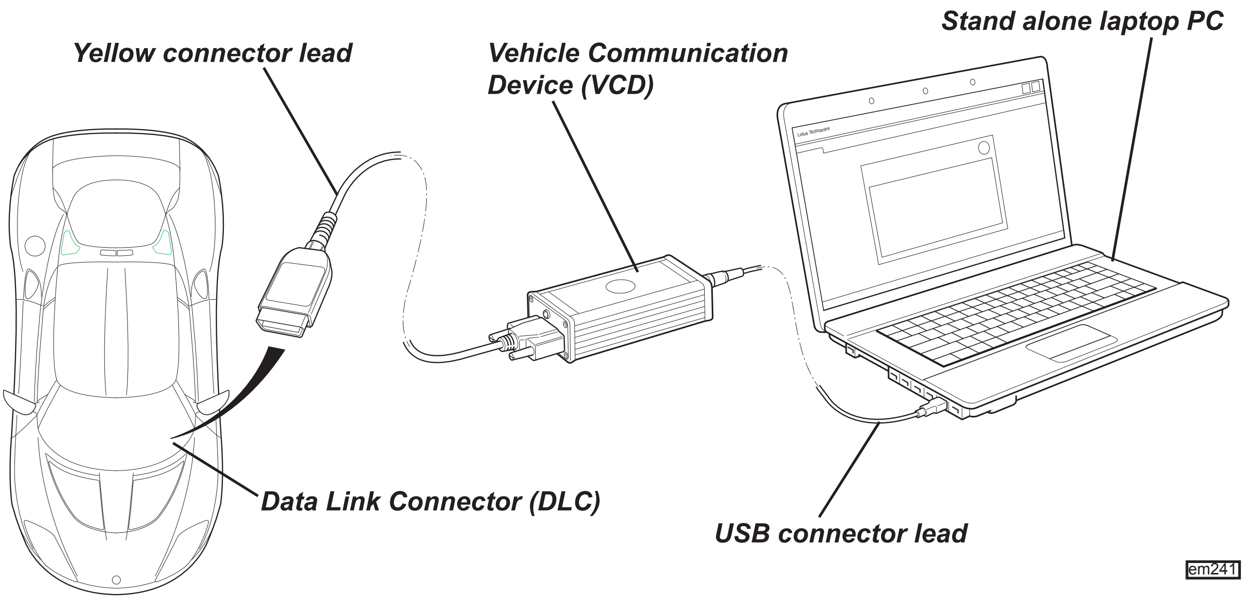
TechCentre Connection
The DLC is located on the back of the scuttle crossbeam above the outboard side of the driver's footwell.



Power for the VCD is taken from the vehicle battery via the DLC and when powered a blue tell tale on the unit will light. Should updated firmware be available for the VCD (usually downloaded as part of an online update) TechCentre will automatically update the VCD and display a message to confirm.

The VCD, under part number T000T1472F is supplied in a black plastic carry case containing the following:

VCD
16 Pin Yellow connector lead (VCD to Vehicle)
USB lead (VCD to PC)
USB extension lead (VCD to PC) not illustrated



Use of TechCentre
Instructions for using the TechCentre are available in the 'Technical Information' section displayed on programme start up.

For further information see the LSL602a 'Lotus TechCentre User Guide' shown on the following pages.

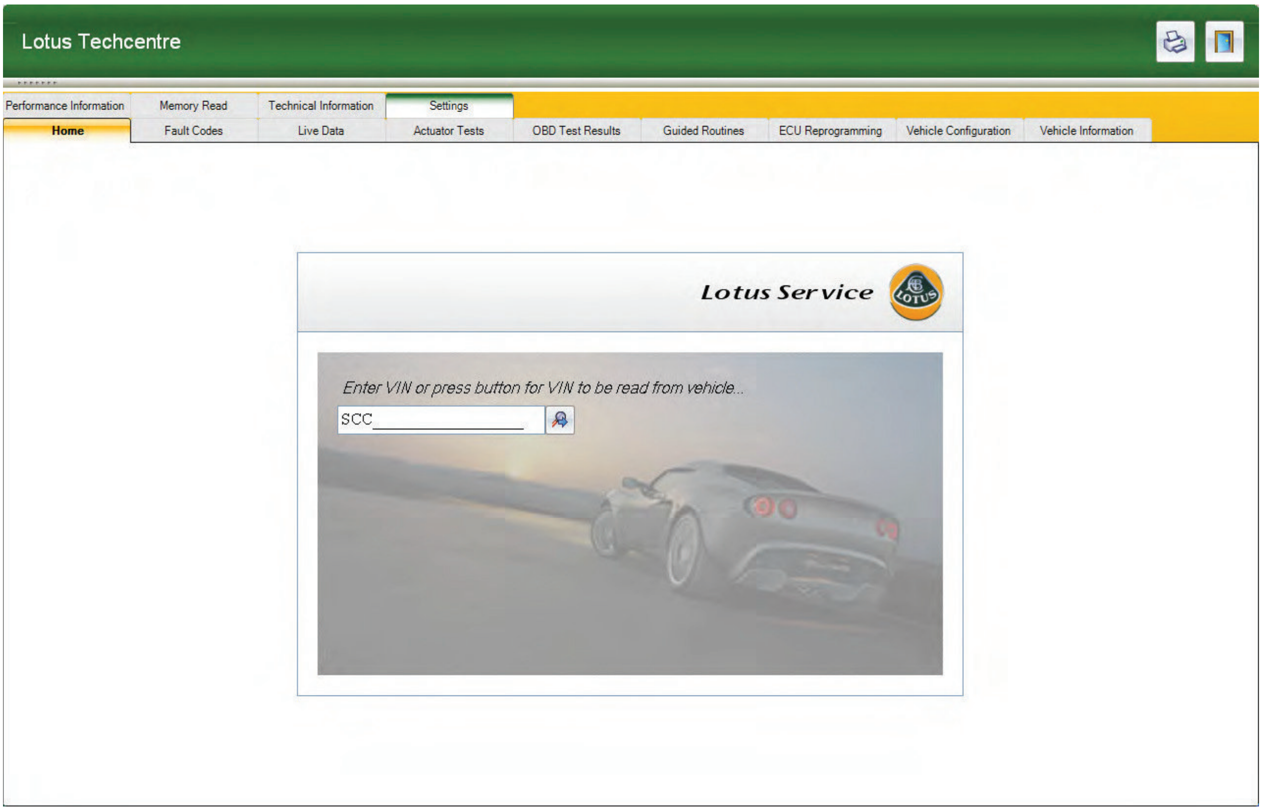
The user guide can also be downloaded as a separate publication from the Lotus Dealer Portal at: http://dealers>Aftersales>TechCentre & Production Program Information.

EMQ.6 - LOTUS TECHCENTRE USER GUIDE (lsl602a)

Lotus Techcentre

Service Information System

LOTUS



LOTUS TECHCENTRE BASIC USERS GUIDE

lsl602a

Lotus Techcentre
Service Information System

INTRODUCTION

Version 4. T000T1510F

Controller Area Network (CAN) is an electronic standard to allow high speed communication between modules and controllers, via a serial data bus. The bus is a circuit linking the modules to the controller, consisting of a pair of cables, twisted together to reduce electromagnetic interference, and carrying a square wave voltage signal corresponding to '0's and '1's, coded in such a way as to identify and prioritise the individual messages.

On all or most of the current Lotus range, CAN based systems include; engine management system, ABS, instrument cluster and tyre pressure monitoring system. Please note SRS is serial comms on K-Line

A Vehicle Communication Device (T000T1472F) is used to connect the vehicle to the laptop installed with the **Lotus Techcentre Software (contained on the disc T000T1510F)**. Engine programming, live data display, diagnostics of engine, ABS, airbag systems etc is accessed through this software.

Also required is a unique 18 character licence/registration key without which Techcentre will not function. This key is non transferable to other PC's.

The minimum specification of the laptop computer for installation of the Lotus Techcentre is as follows:

Processor 1.70 GHz; 1 GB RAM; 40 GB HDD; CDRW DVD ROM; WIN XP PRO OR VISTA; USB interface; Ethernet or Wireless LAN

Note that this laptop should ideally be dedicated totally to the Lotus Techcentre, with no other software.

This Diagnostic software was primarily designed for use by trained Lotus technicians.

The Lotus Techcentre unique telephone number for Technical Support is **0870 9493 668**. The email address is lotus.support.uk@omitec.com when an email is sent you automatically receive a confirmation email response with a unique tracking number.

Lotus Techcentre
Service Information System

TECHCENTRE CONNECTIVITY

Model		Type of Electronic Control Unit Communication compatible					Engine ECU Reprogrammable	
		EMS	ABS	SRS	TPMS	IP	08 MY on	Pre 08
Elise	2004 on	Y	Y	Y	Y	N	Y	N*
Exige	2004 on	Y	Y	Y	Y	N	Y	N*
Europa	2006 on	N	Y	Y	N/A	N	N	N
2-11	2007 on	Y	Y	N/A	N/A	N	Y	N*
Evora	2009 on	Y	Y	Y	Y	Y	Y	N/A
Esprit	V8	Y	Y	N	N	N	N	N

Key:		
EMS	:	**Engine Management System**
ABS	:	**Brakes** (Anti-lock Braking System)
SRS	:	**Airbags** (Supplemental Restraint System)
TPMS	:	**Tyre Pressure Monitoring System**
IP	:	**Instrument Cluster**

Note:
Currently Techcentre is only able to re-program engine ECU's for 08MY on.

A new communication cable will be available in the near future to provide management program downloads to pre 08 MY Toyota powertrain.

Excluding Europa. Refer to above table.

Techcentre has no connectivity to Elise/Exige range and variants fitted with MG/Rover powertrain.

Limited diagnostics is available on V8 Esprit.

No communication is available to Europa powertrain.

Communication to the above mentioned vehicles is via the Lotus Scan 3 tool.
Part numbers:
T000T1467F UK/EU
T000T1456F USA

Lotus Techcentre
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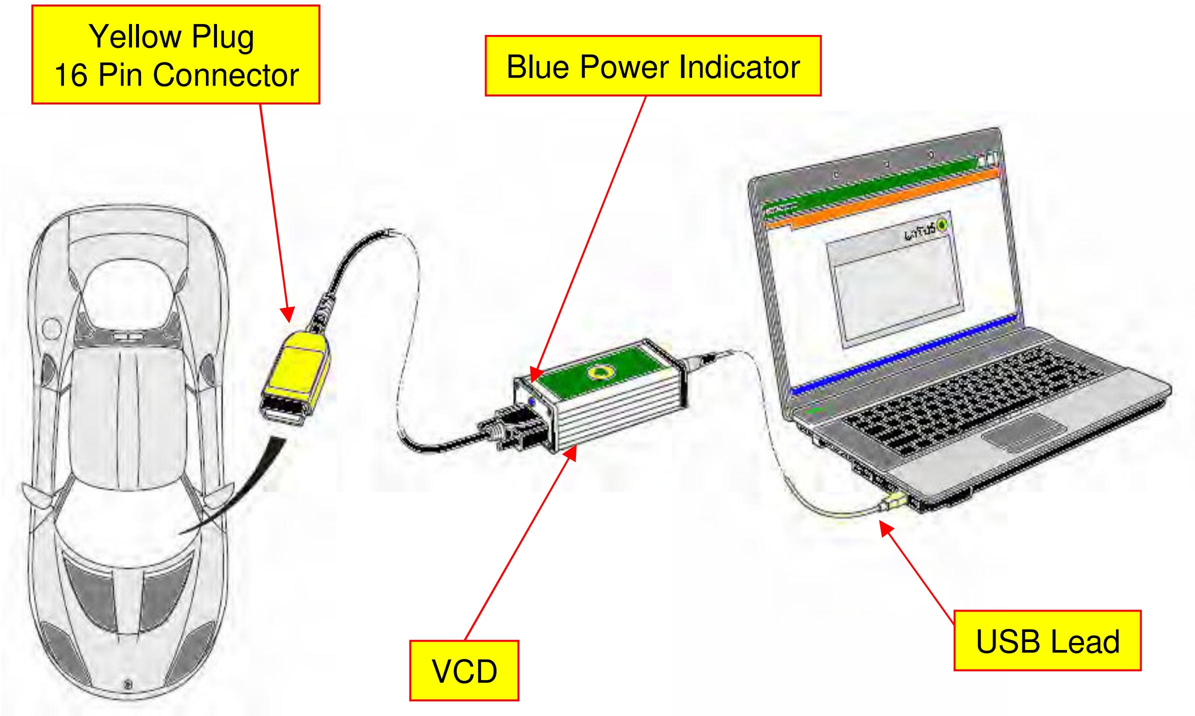
VEHICLE CONNECTION



Connection of the Techcentre is via a dedicated connector socket known as the Data Link Connector (DLC) which is located within the footwell of vehicles.

Power for the VCD is taken from the DLC and when powered a blue light will illuminate.

Should updated firmware be available for the VCD (usually downloaded as part of online update) Techcentre will automatically update the VCD and display a message to confirm.

Vehicle Communication Device T000T1472F (VCD) is supplied in a black plastic carry case containing the following:

VCD
16 Pin Yellow connector plug (VCD to Vehicle)
USB lead (VCD to PC)
USB extension lead (VCD to PC) not illustrated

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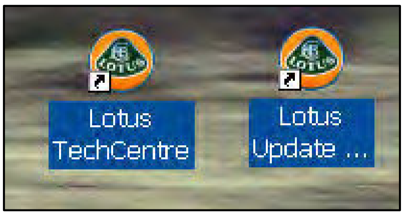
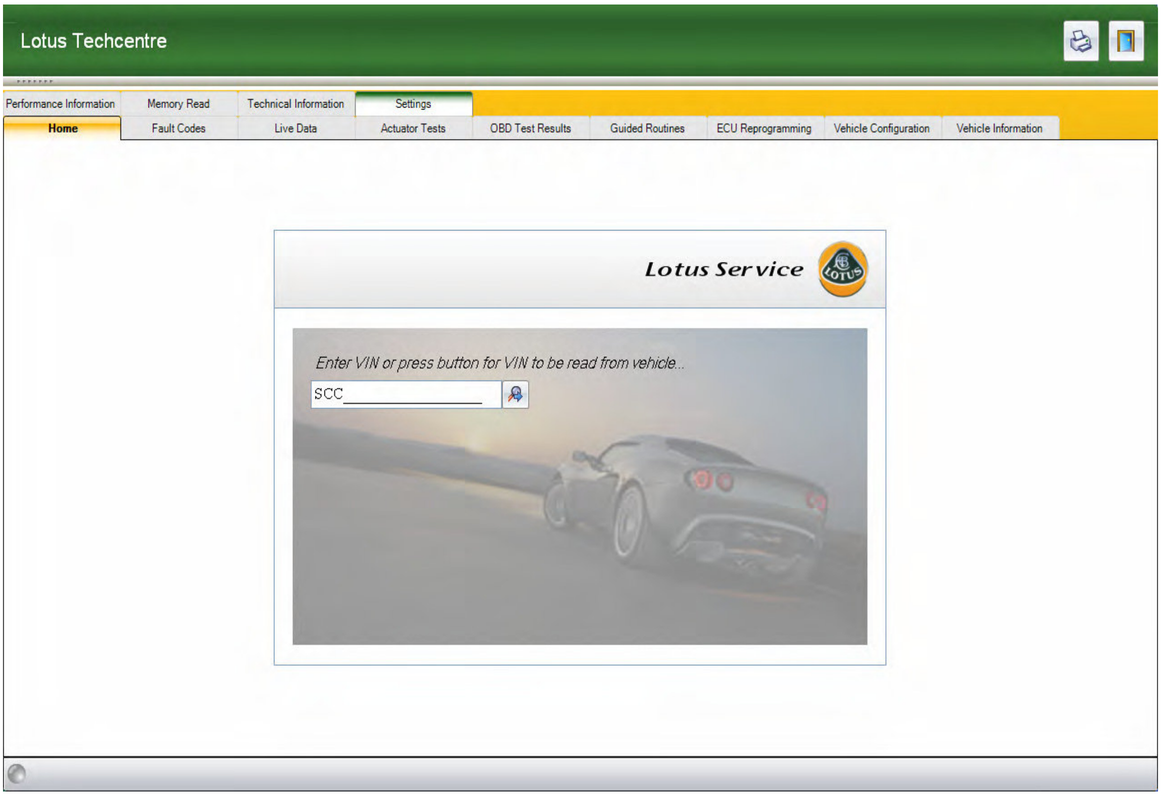
Basic users guide



After software installation is complete these 2 icons will be displayed on your desktop. Periodically, approx every 7-10 days, click on 'Lotus Update Client. exe' to ensure latest version/software is loaded.

To start Techcentre click on 'Lotus TechCentre Icon' and start up screen will appear followed by home screen as below.



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Lotus Techcentre
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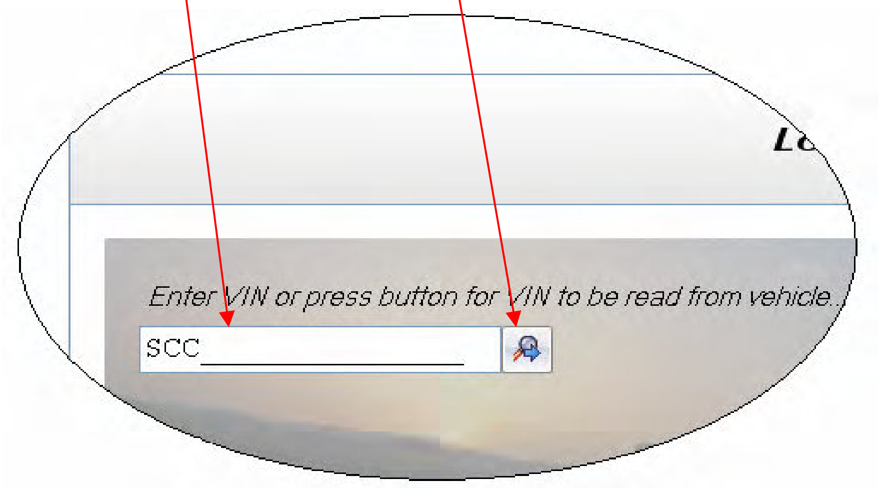
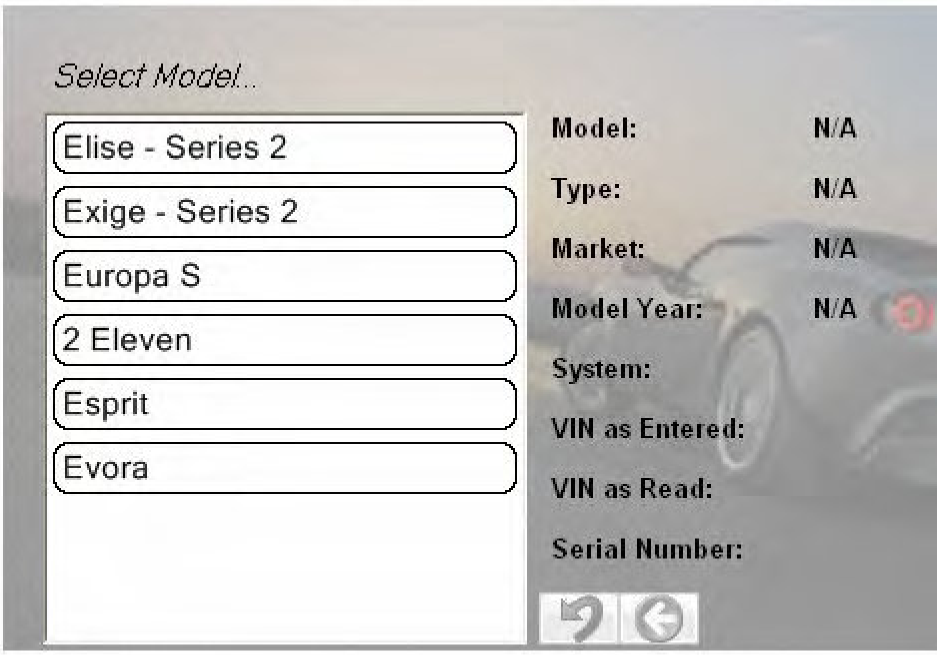
Enter VIN number or click on icon to read VIN from ECU



If no Vin is entered you will need to select vehicle from menu displayed.



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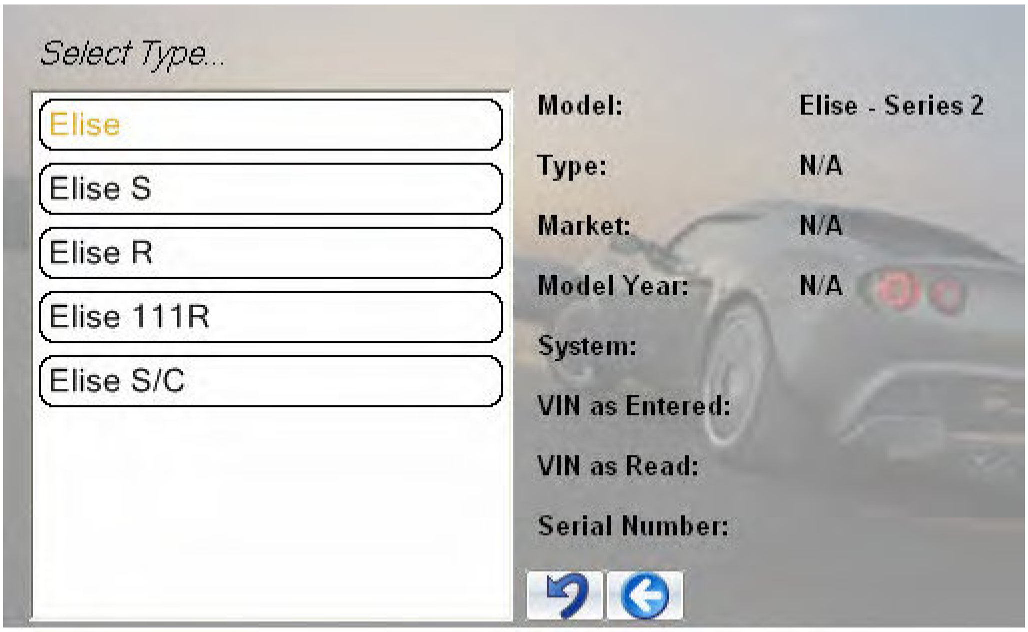
Select type from list



Select market from list

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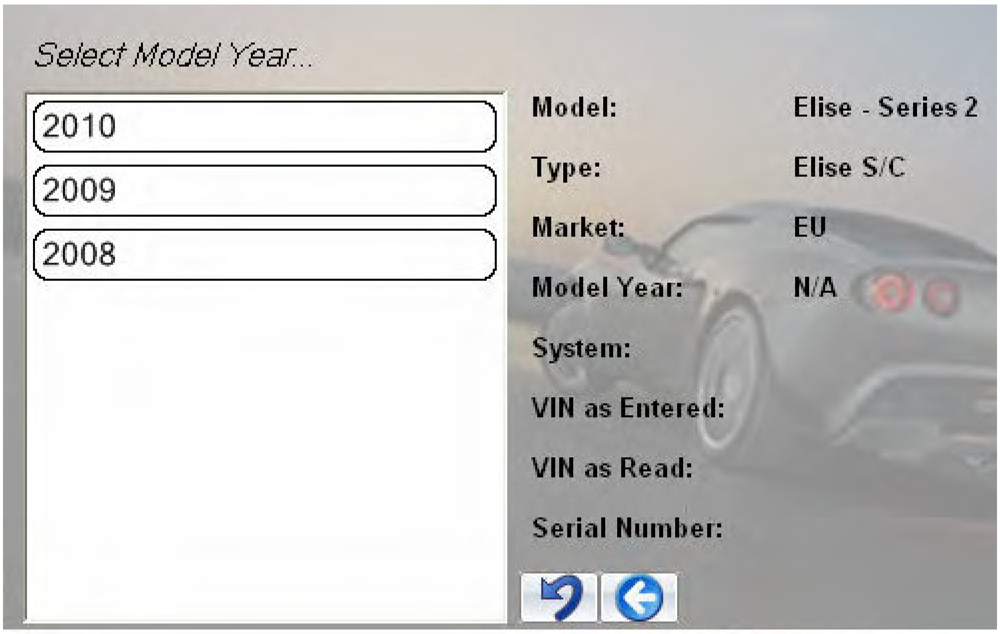
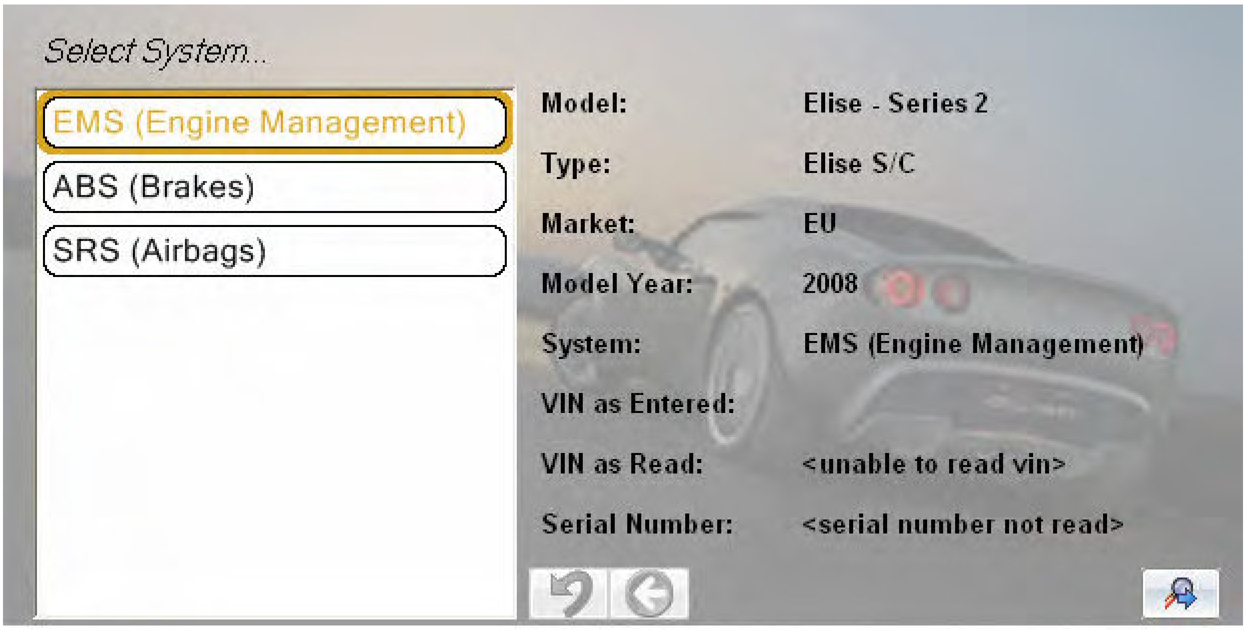
Lotus Techcentre
Service Information System

Select model year from list



Select system from list



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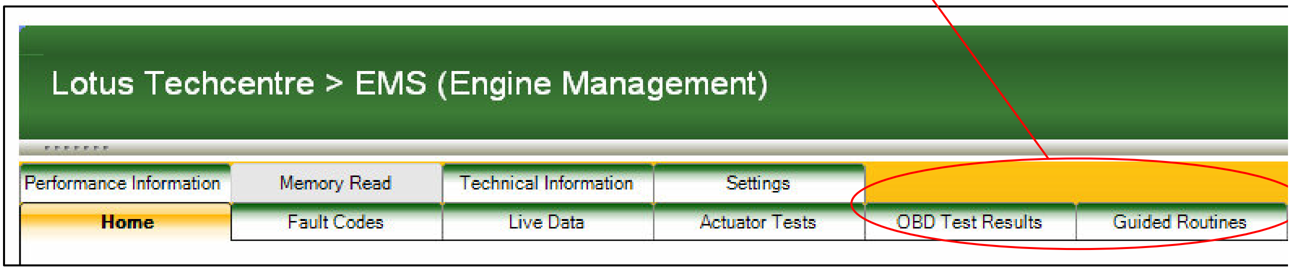
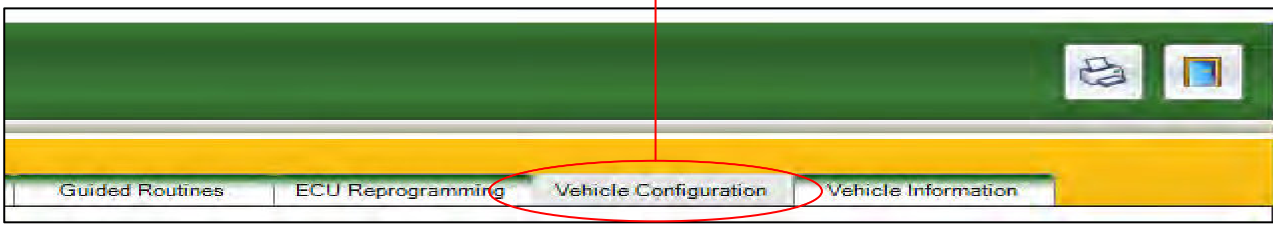
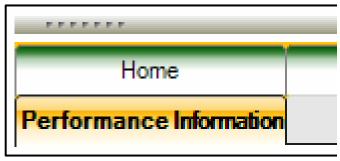
Only tabs that are highlighted can be read.



Tabs that are ‘greyed out’ will not function usually due to the fact that they are not applicable to ECU system selected.



Tab will change colour from grey/green to orange to show this tab is active.



Tab Categories

Performance Information**:** Displays recorded performance data such as, engine speed Vehicle speed, temperatures etc and also total engine run time.

To read this data, click on magnifying glass icon.

To save this data, click on floppy disc icon. The window below will pop up showing destination of saved information.

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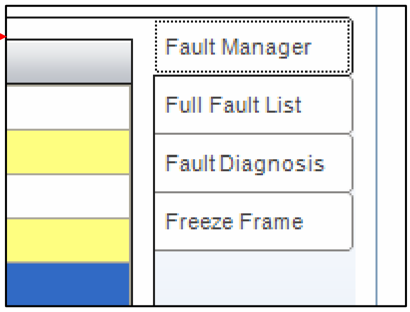
Tab Categories

***Fault Codes*:** Displays any fault codes stored in the control unit.

To read this data, click on magnifying glass icon.

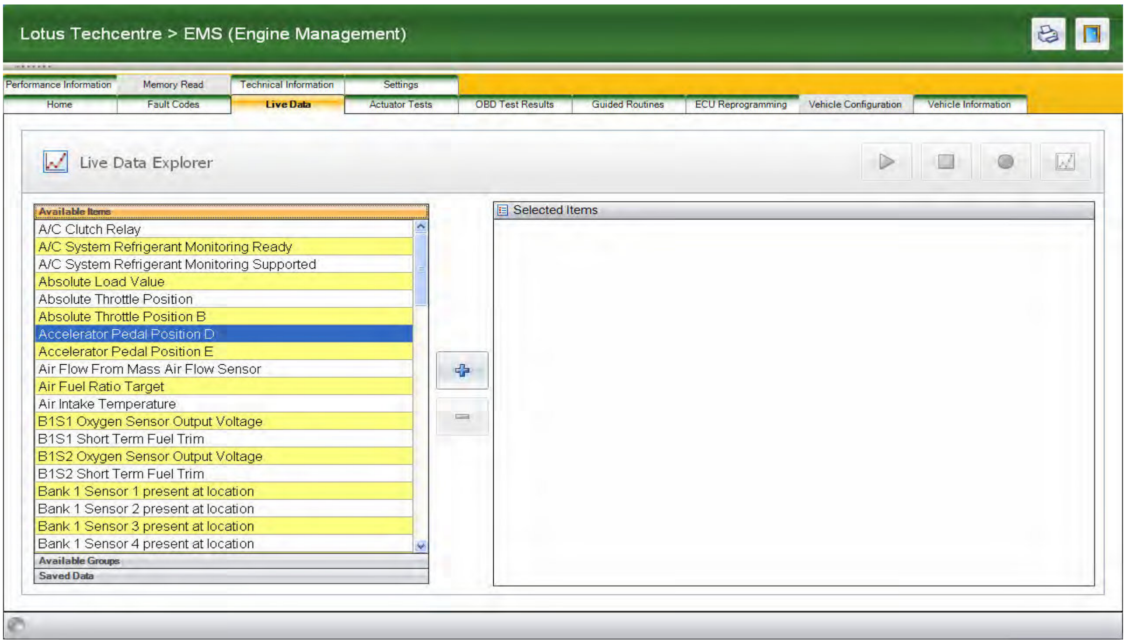
To erase codes, click on eraser icon.

Screen tab displays the following:



Fault manager: Displays codes.
Full Fault List: Full list of codes relevant to this control unit.
Fault Diagnosis: Not yet enabled.
Freeze Frame: Data recorded when code triggered.

Live Data: Displays live data streamed into and out of the control unit. Click on tab and screen below is displayed.



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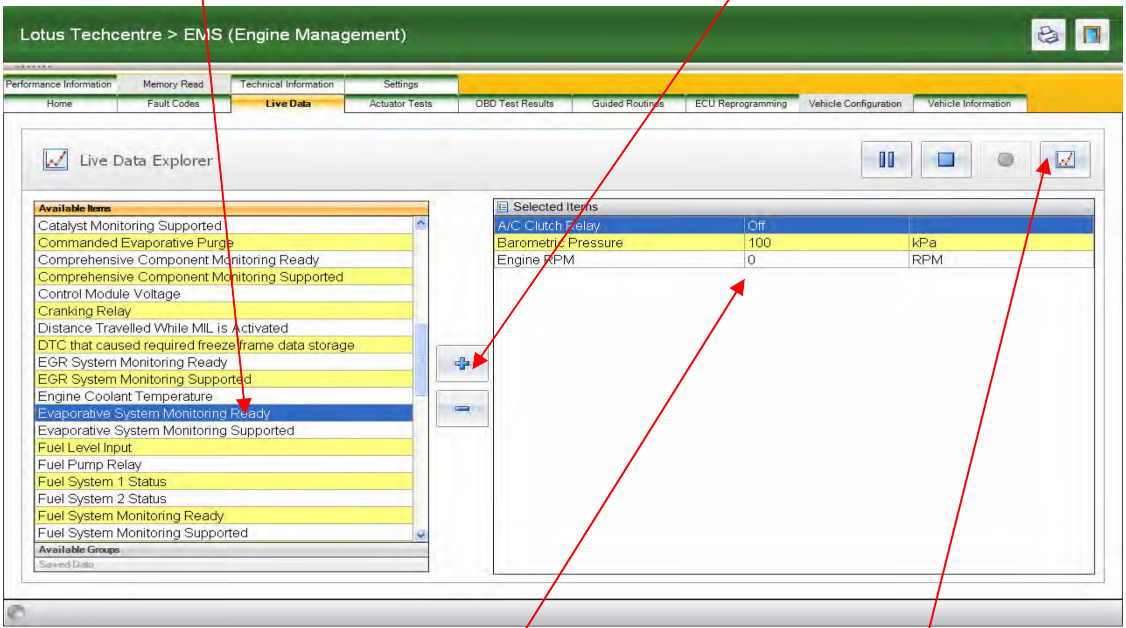
Live Data: Continued.

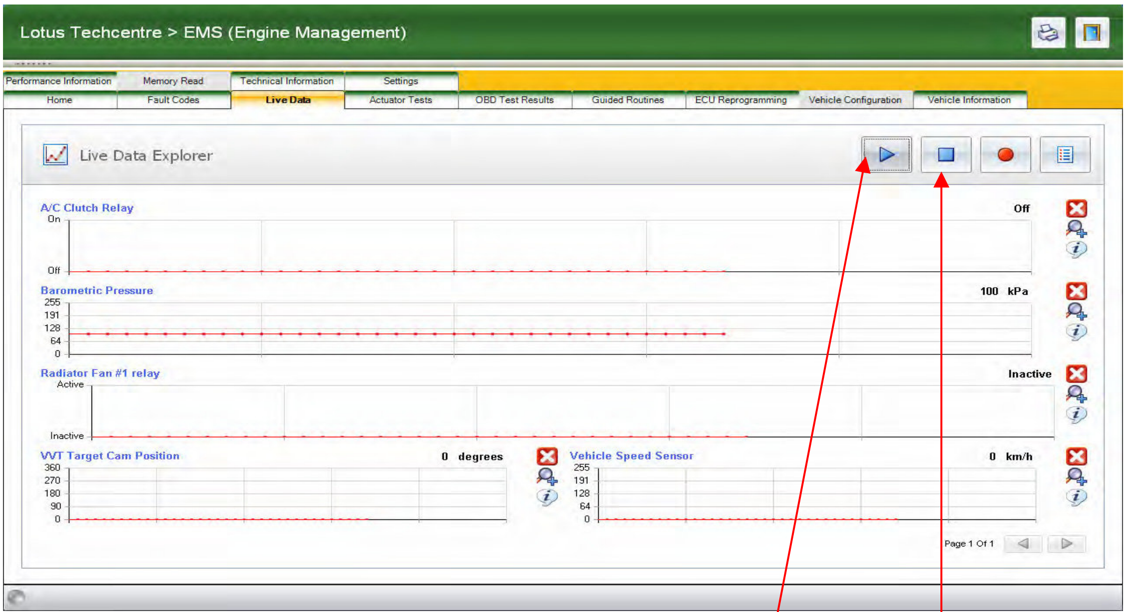
Select and highlight desired item/items.

Click on + to add – to remove.



Values are displayed numerically.

To view as graph click here.



Start/Pause recording

Stop recording

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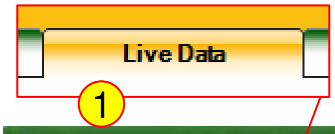
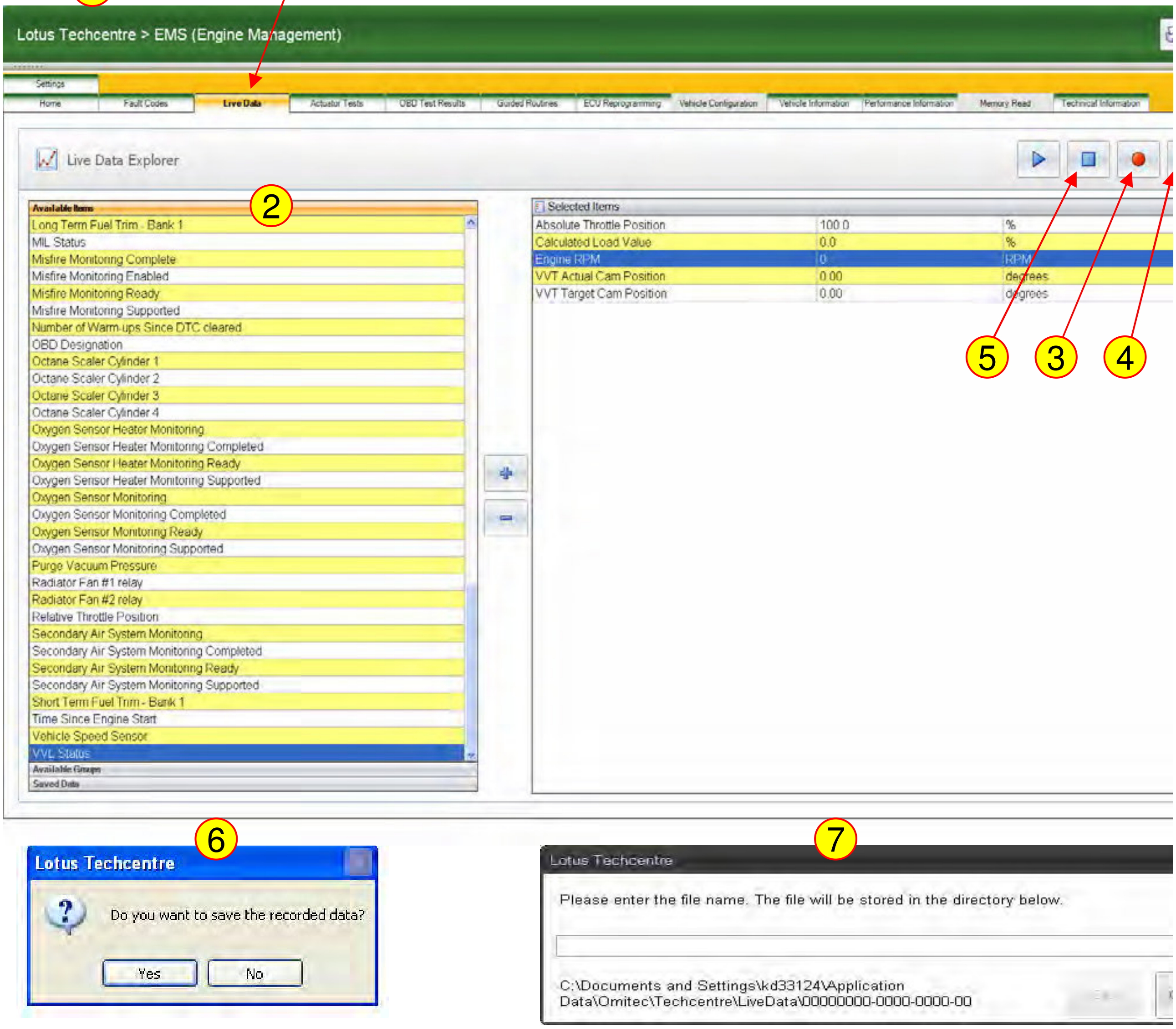


Recording Live Data in Techcentre



1) **Select EMS Module > Live Data**
2) **Select items to view / record**
3) **Click record Data**
4) **Data can be viewed as graphs if desired**
5) **Click stop to finish recording**
6) **On screen prompt - select yes to save data**
7) **Enter an appropriate file name, click ok**

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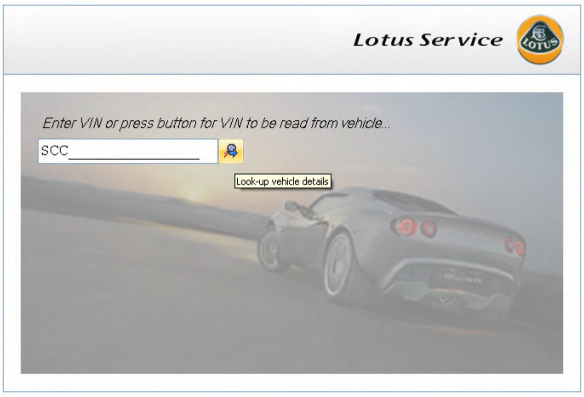
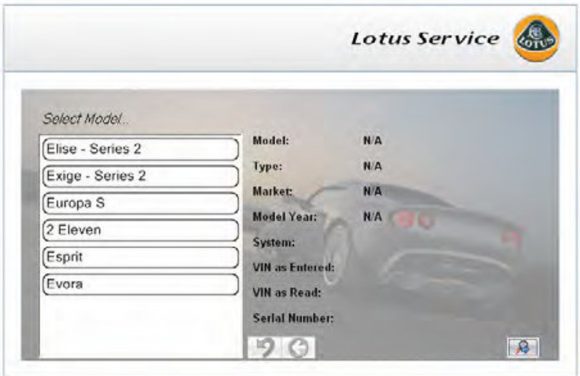
Lotus Techcentre
Service Information System

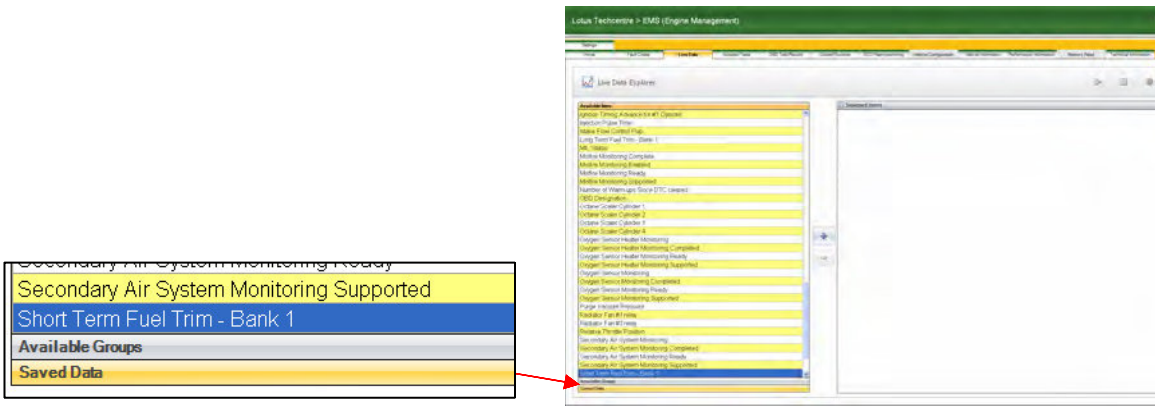
Playback of Live Data in Techcentre V4

- **The correct model must be selected in Techcentre to playback live data recorded.**
- **If connected to an incorrect vehicle type or playing back data on bench, disconnect the VCD from Laptop.**
- **Open Techcentre click 'look up vehicle details' and manually select desired model from which data was recorded.**
- **Click on EMS > Live Data**
- **Click on 'Saved Data'**

  (Located on lower left of screen)



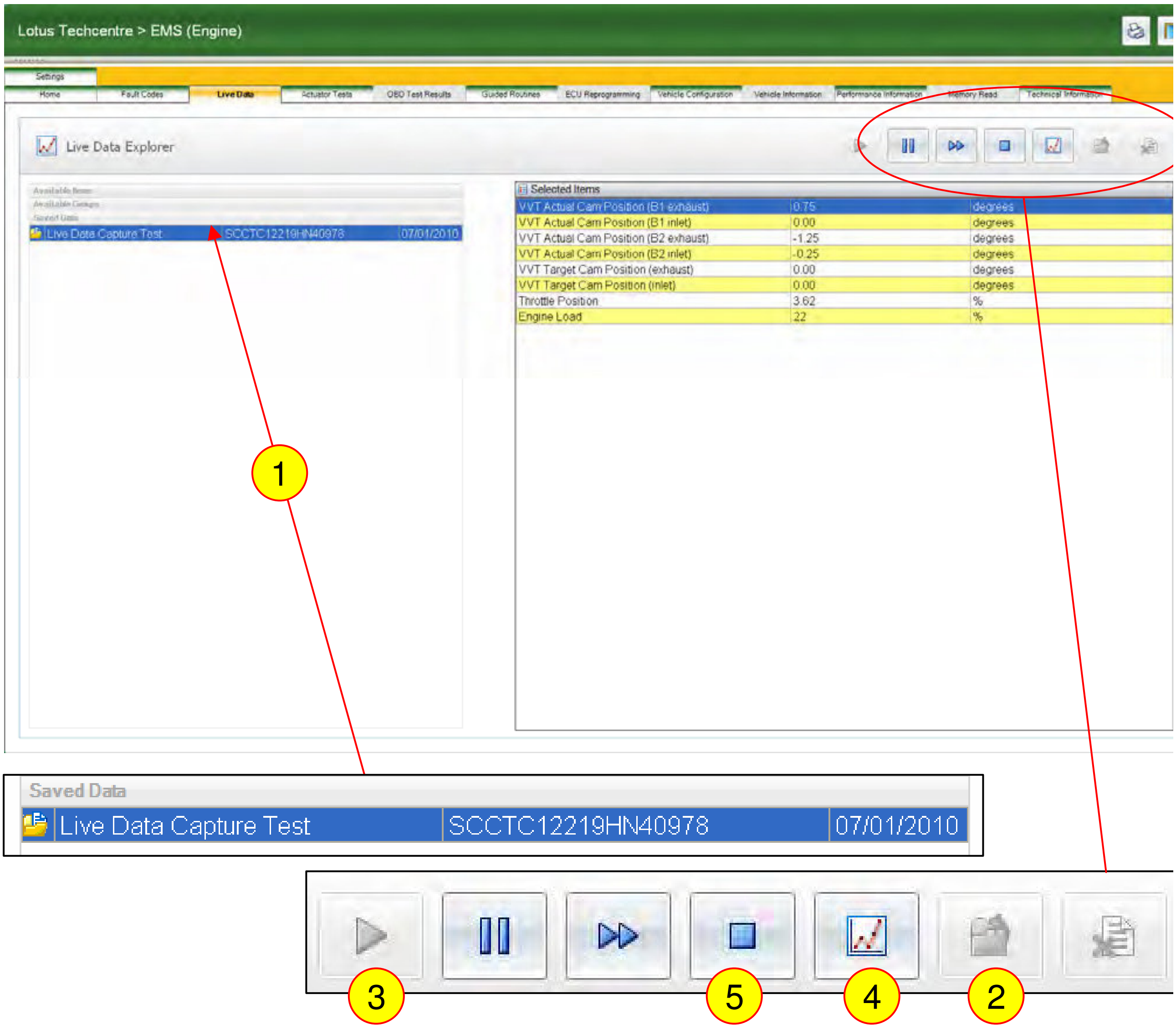




9

Lotus Techcentre
Service Information System

Playback of Live Data in Techcentre V4



1) Select data to playback in LH pane
2) Click open file (items will appear in RH pane)
3) Click play to playback
4) Data can be viewed as graphs if desired
5) Click Stop to finish playback

10

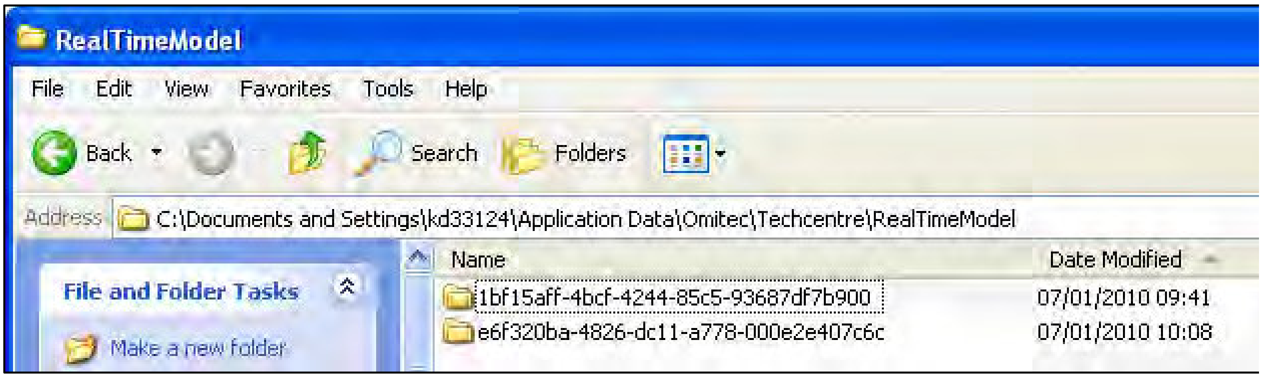
Lotus Techcentre
Service Information System

Transfer of recorded Live Data in Techcentre V4

Recorded Live Data is stored in the following directory:-

Note: you must select the correct 'user' from document and settings, this is the logged into the laptop when the data was recorded.

C:\Documents and Settings\User\ApplicationData\Omitec\Techcentre\RealTimeMod

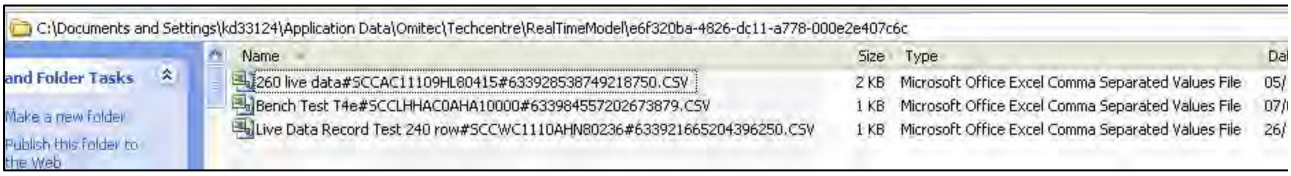


- **Recorded Live Data is stored in folders as shown above**
- **In order to transfer live data the ENTIRE FOLDER (xxxxxxx-xxxx-xxxx-xxxxxxxxxxxx) which contains the saved data is required.**
- **Right click in RealTimeModel folder and select view details, use the 'date modified' field to help identify where your data is stored. (aim to improve folder location in future).**
- **If you cannot locate the file use the windows search function. Select the RealTimeModel folder as the folder to search in and enter the vehicle VIN number as filename.**
- **Double click the folder and check if the desired is contained within.**

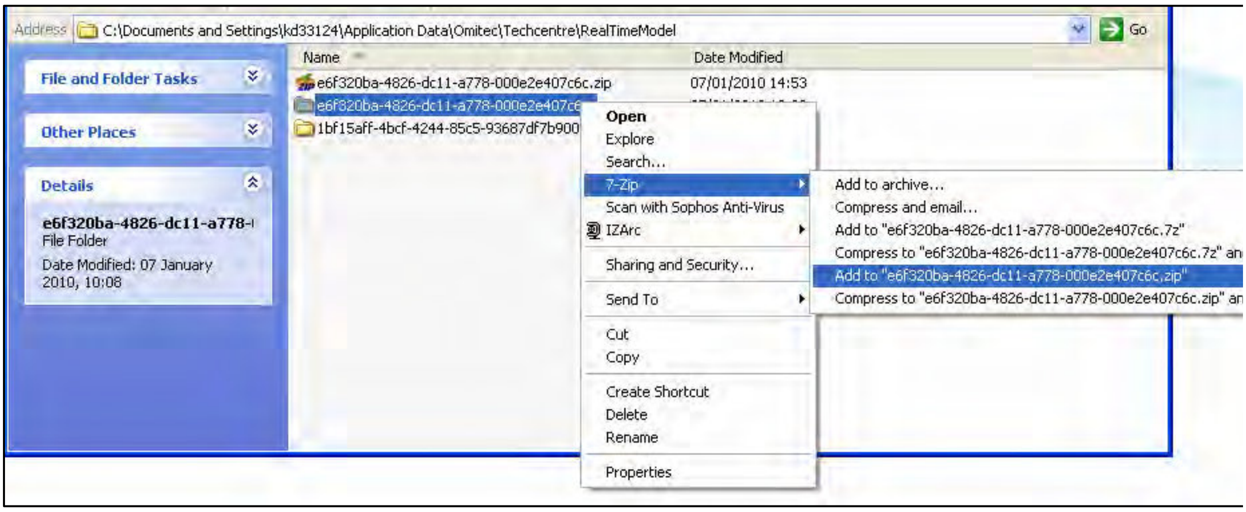
Lotus Techcentre
Service Information System

Transfer of recorded Live Data in Techcentre V4 (2)

- Folder will contain the individual recorded files in CSV format as shown below.



- Once the data file to transfer is successfully located, return to its containing folde shown below and archive (zip) the ENTIRE FOLDER (xxxxxxx-xxxx-xxxx-xxxxxx
- Email file to Lotus for analysis.



Best practice to help manage file size and non relevant data being transferred, copy th ENTIRE FOLDER to another location on the laptop, delete CSV files that are not required and then zip.

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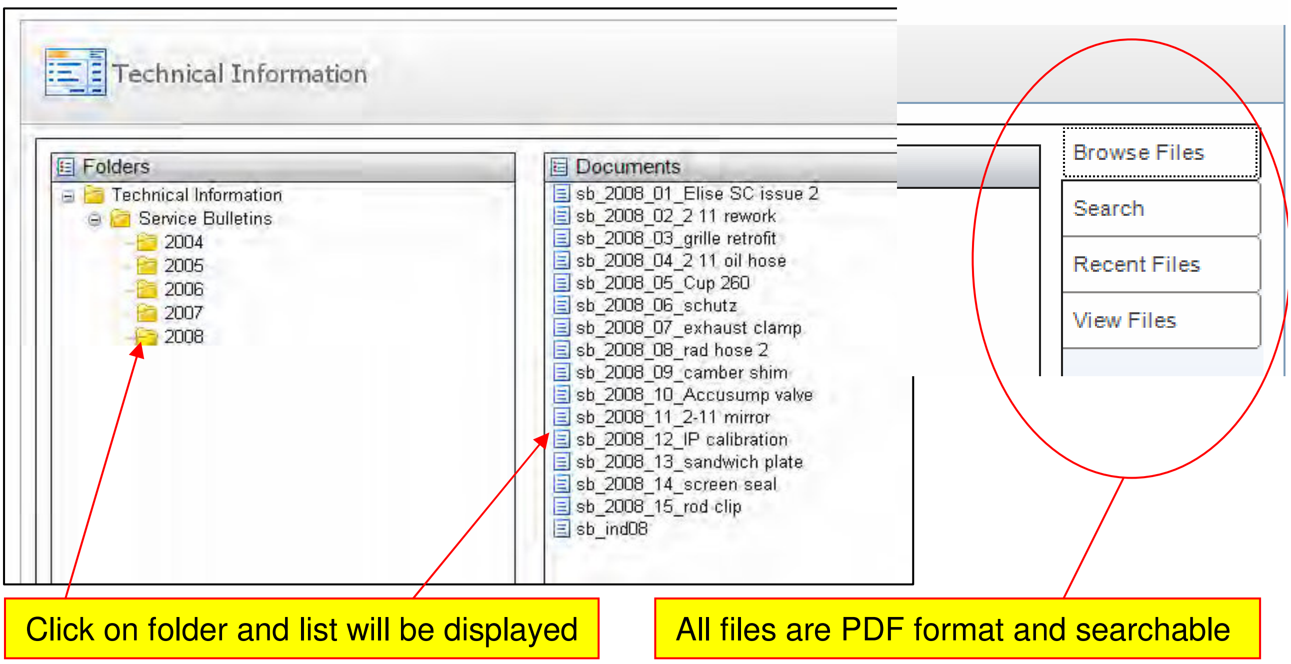
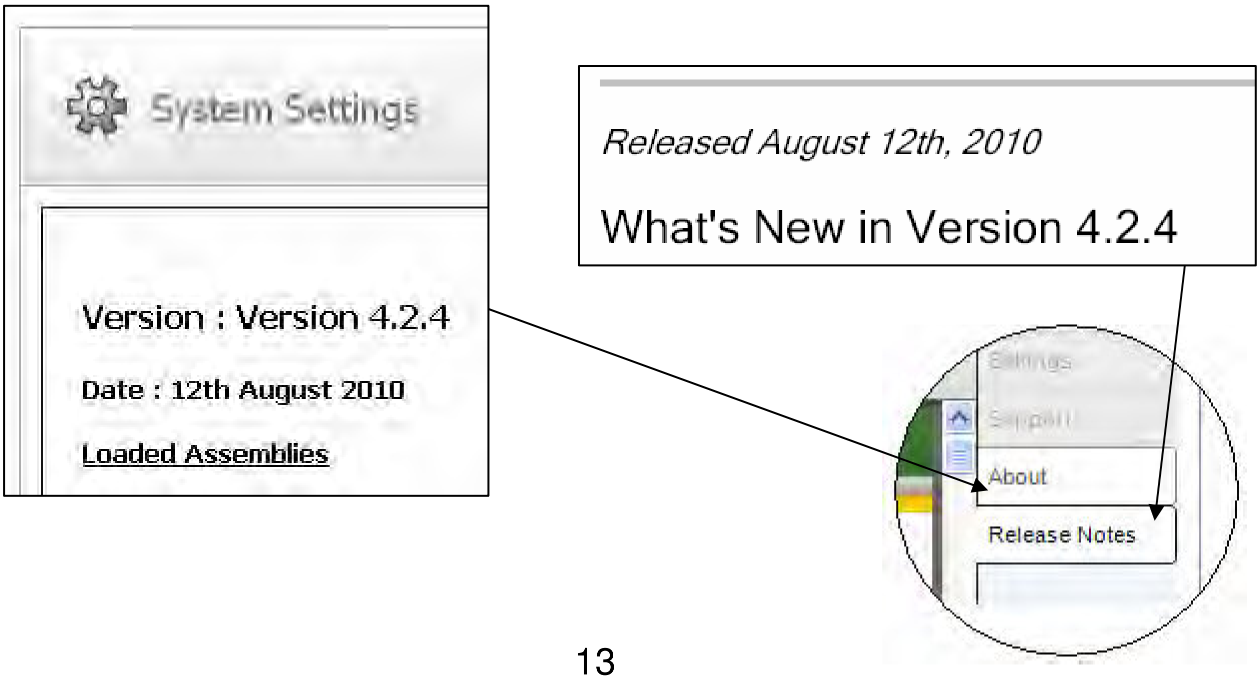
Lotus Techcentre
Service Information System

Technical Information: Contains Lotus Service Bulletins etc.



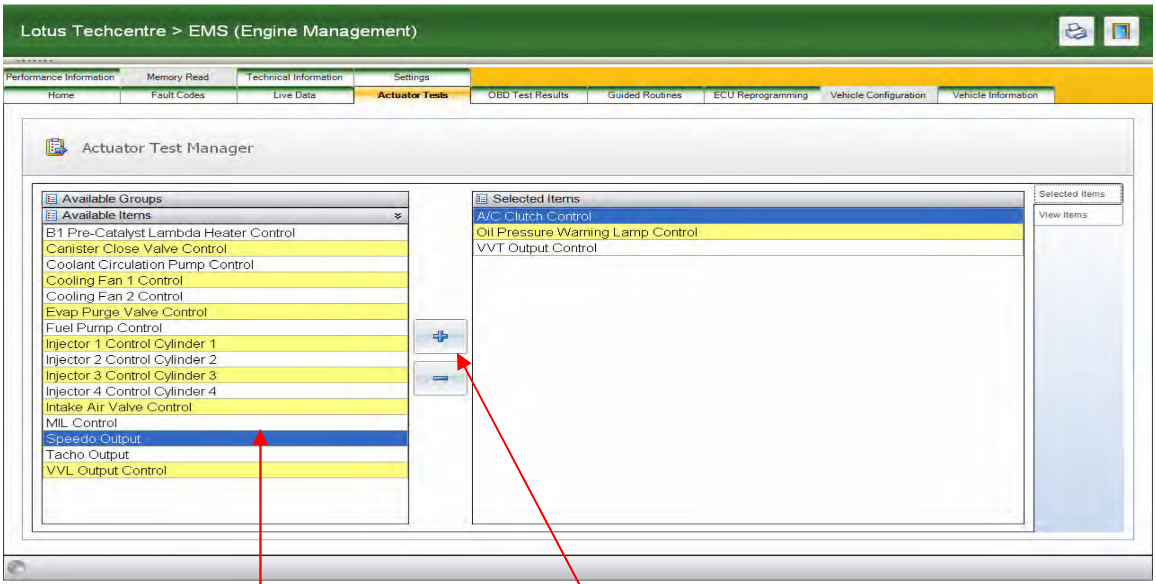
Settings: Identifies Software Version and all release notes which are PDF format.



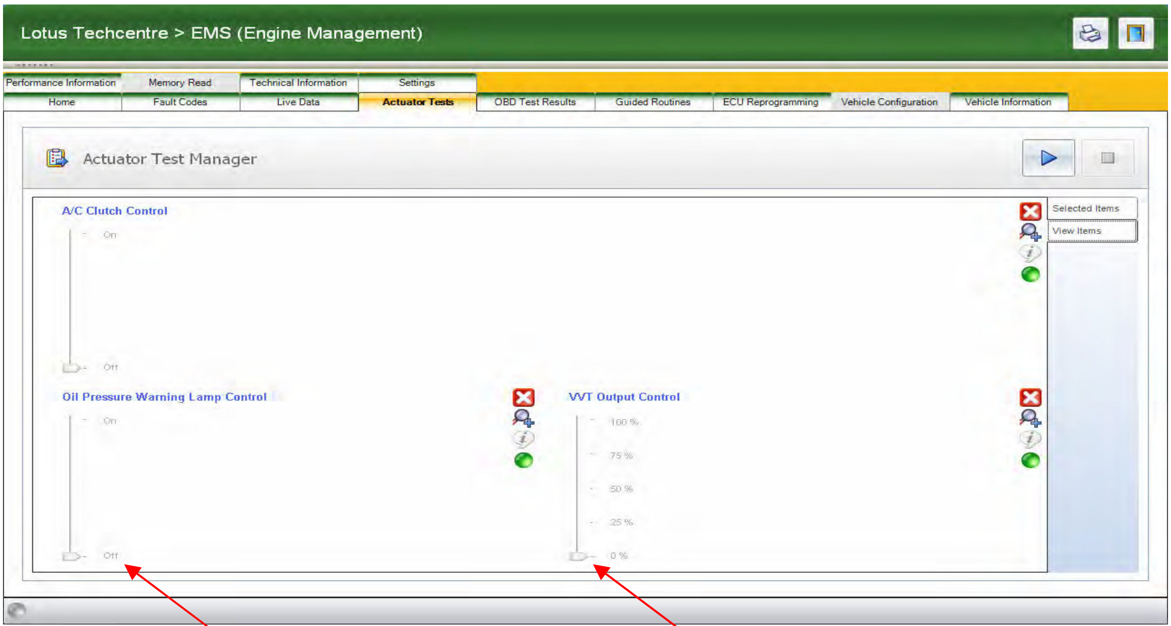
13

Lotus Techcentre
Service Information System

Actuator Tests: Tests function and circuit integrity to highlighted items.



Select and highlight desired item/items by clicking on + and remove with -.



Toggle desired item on/off by clicking on words or slider

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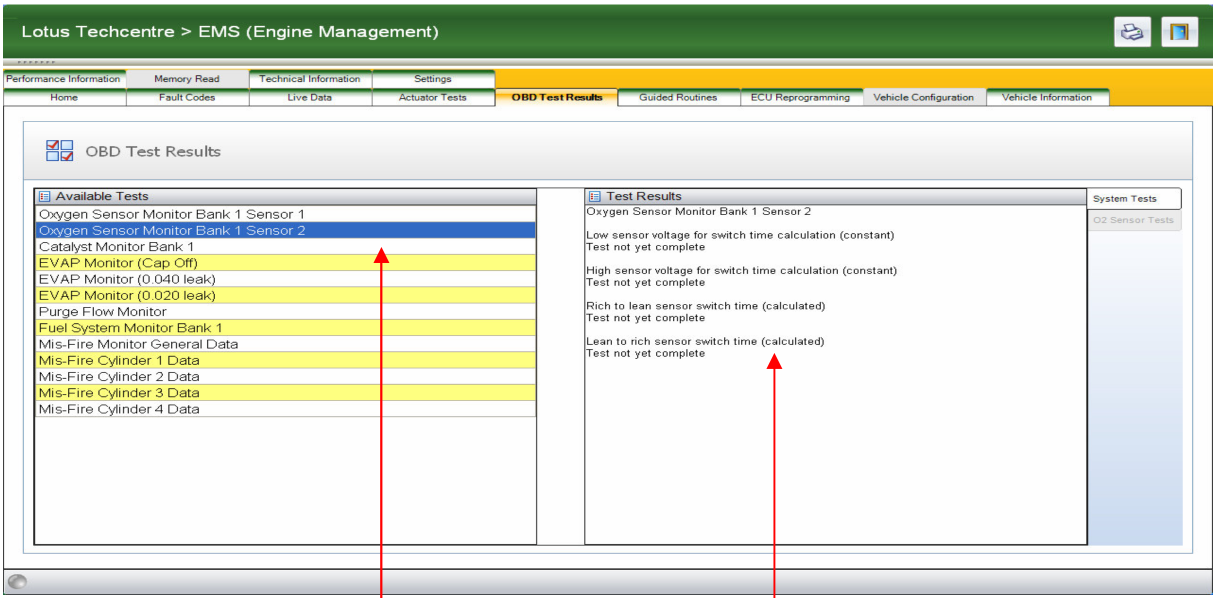
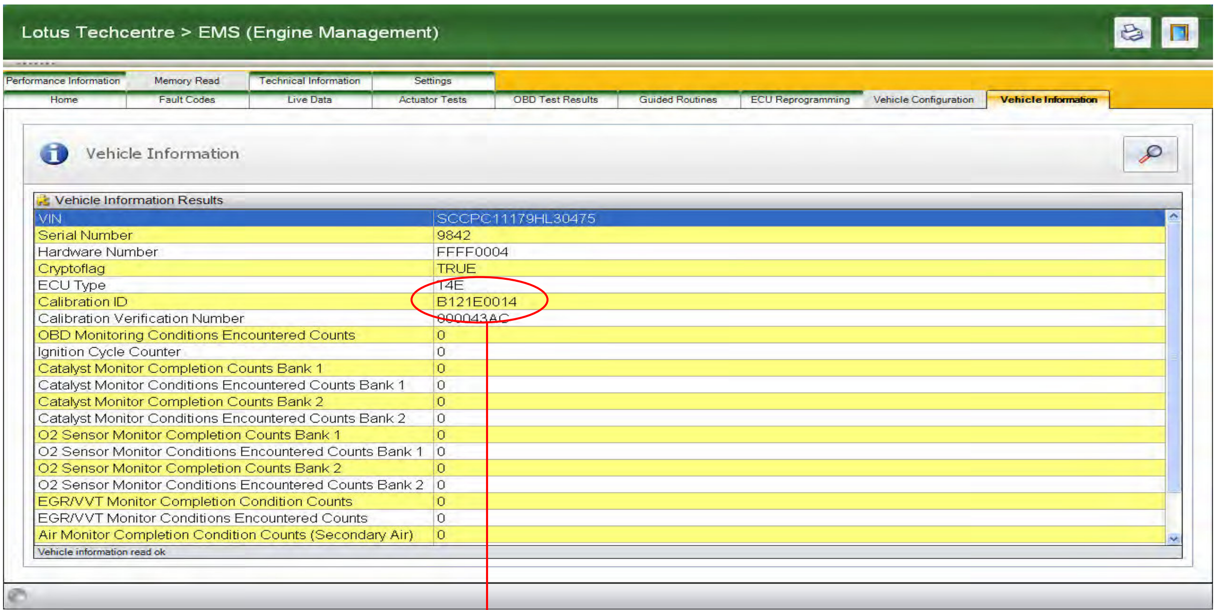
Lotus Techcentre
Service Information System

OBD Test Results: Shows results for emission related sensors.



Select and highlight desired item separately to show test result.
Result can be printed out if desired by clicking on printer icon in top right corner.

Vehicle Information:



Look in vehicle information for ECU software level , serial number etc.

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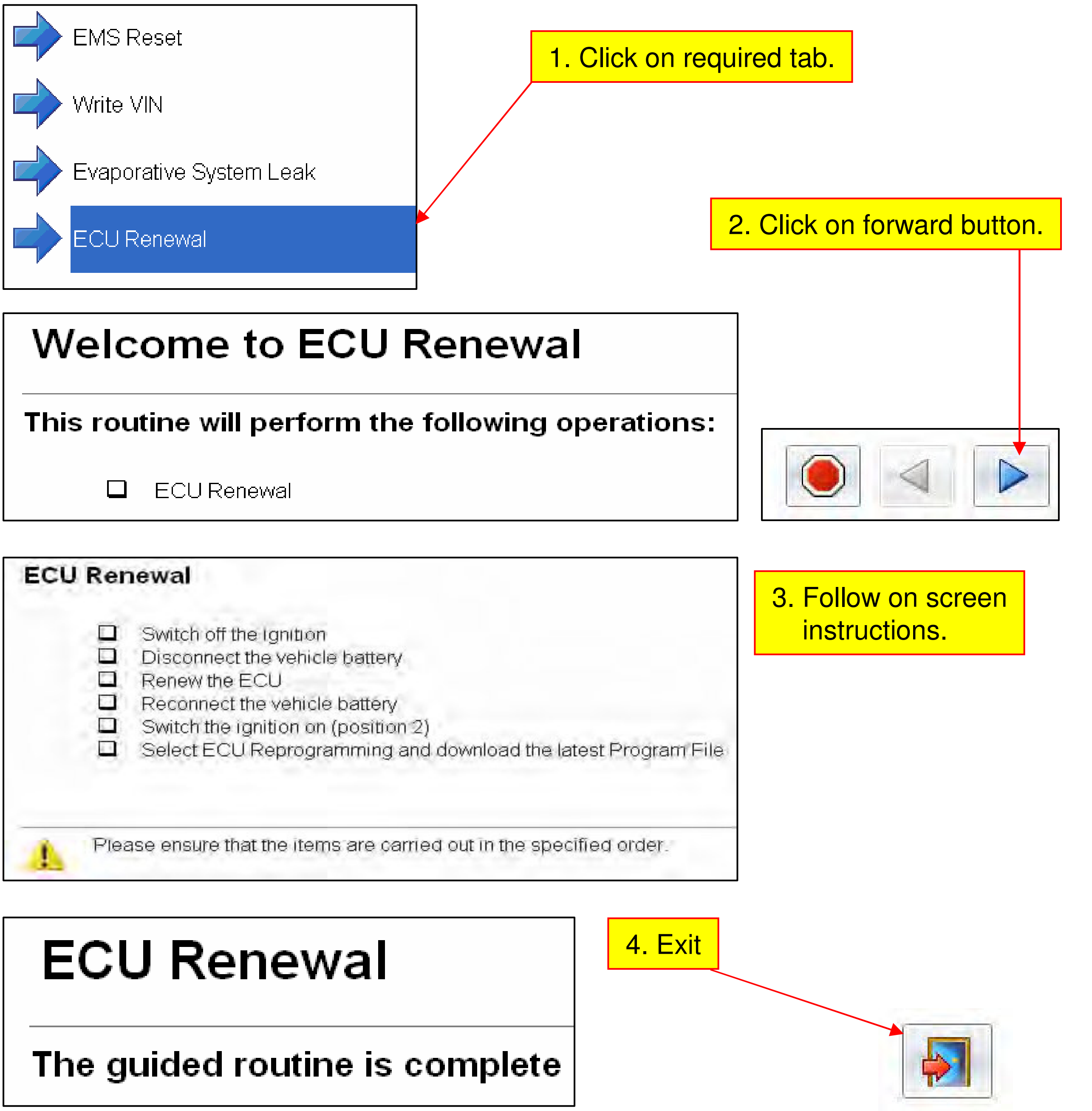
Lotus Techcentre
Service Information System

Guided Routines: These are step by step instructions to perform certain operations for example, ECU renewal.



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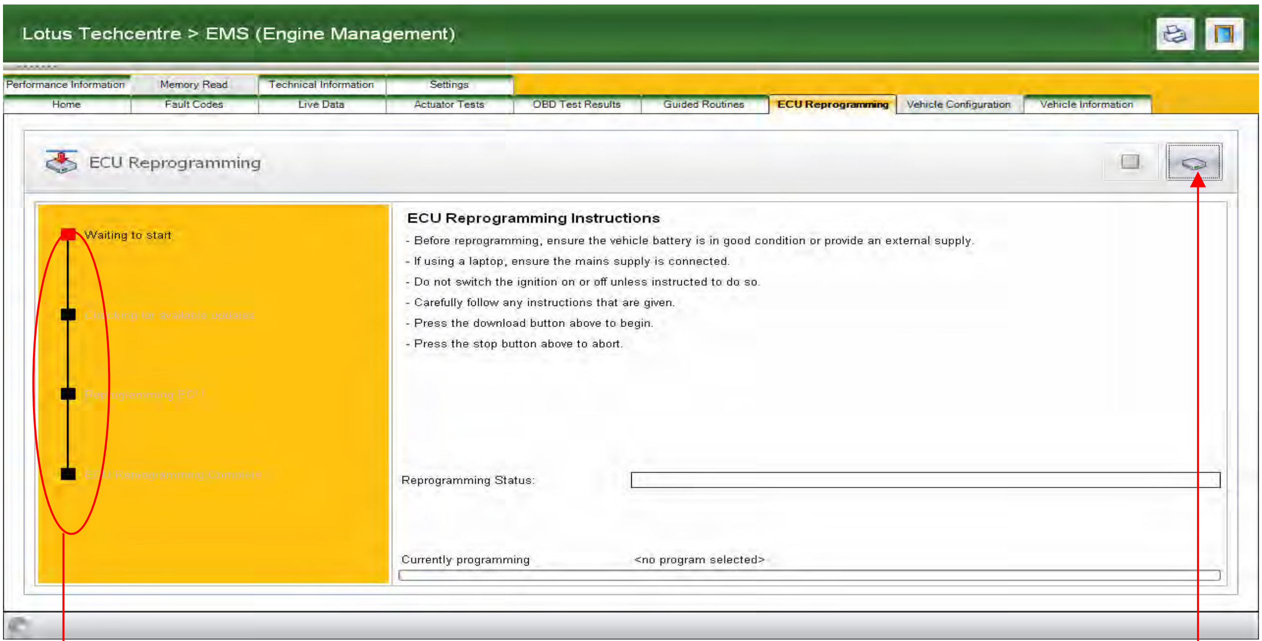
Lotus Techcentre
Service Information System

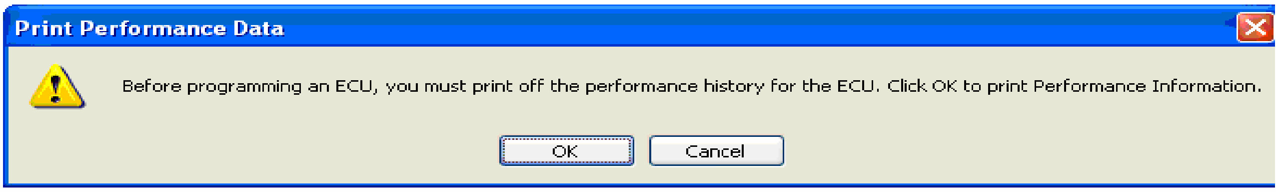
ECU Reprogramming: Follow these step by step instructions to reprogram ECU.

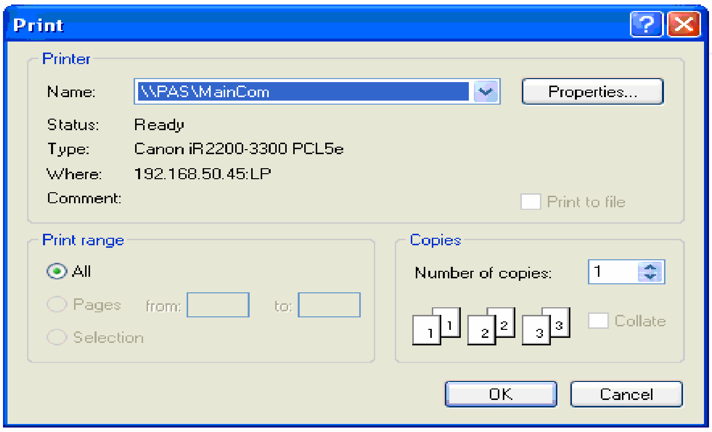


Progress display

2. This message will be displayed.

1. Click on this icon to start programming.





Note:
If history is not recorded it may affect future warranty claims!

3. Followed by printer info.

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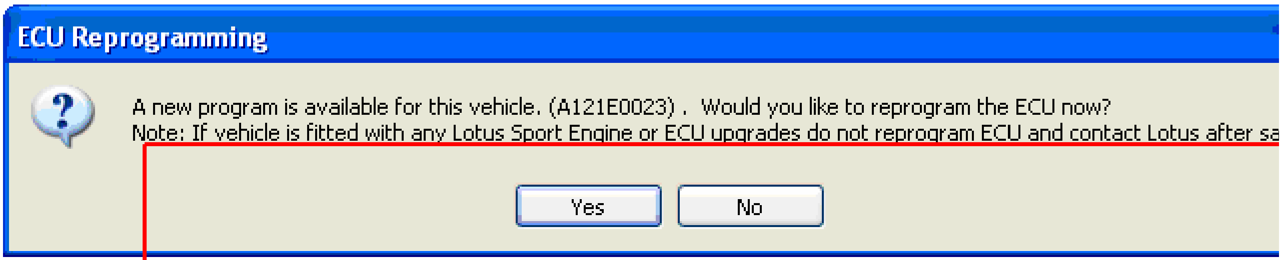
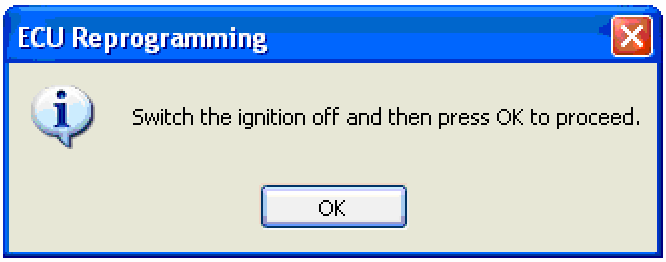
Lotus Techcentre
Service Information System

ECU Reprogramming: Continued.



Warning!
Pay attention to this message as re-programming will wipe previous software.

4. Click OK to continue



Follow on screen instructions.

To confirm calibration ID is correct check in vehicle information as detailed on page 1

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Lotus Techcentre
Service Information System

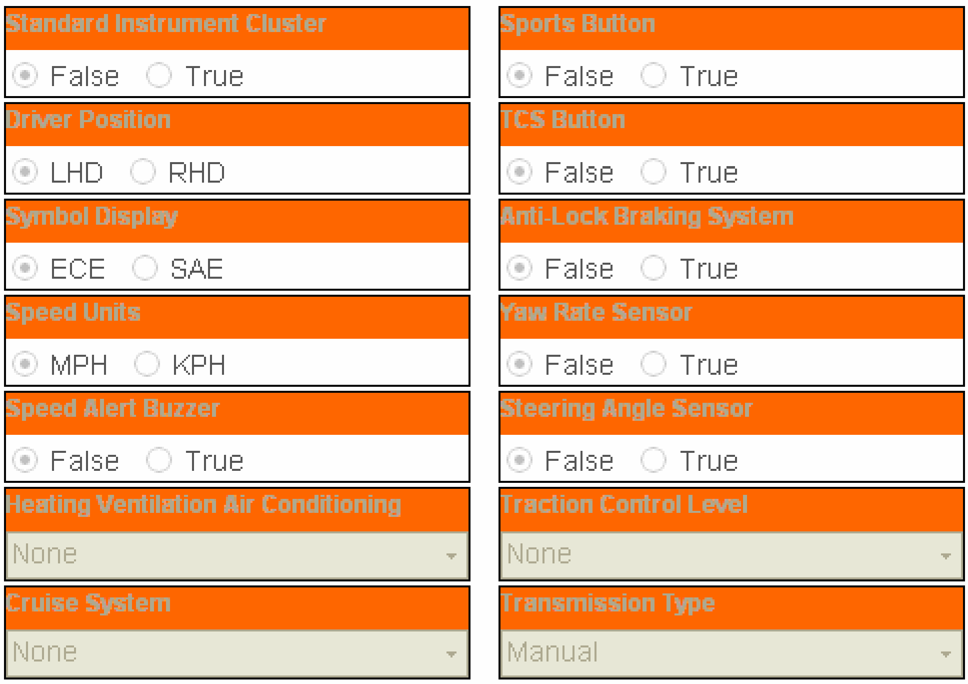
Vehicle Configuration: Only applicable to Evora.

EMS (Engine)

Engine Ecu fitted to Evora will require configuring depending on variant/model. From the table displayed select applicable configuration relevant to model.

Click on this to read current configuration.

Click on this to write new configuration.

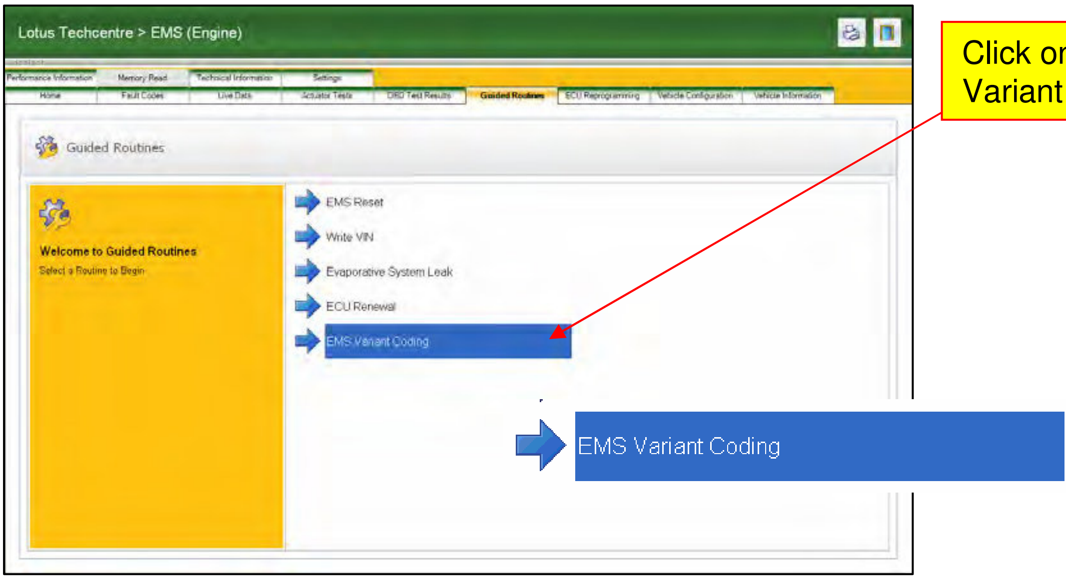


Note:
(Above illustration does not show full list.)

Lotus Techcentre
Service Information System

Vehicle Configuration: Only applicable to Evora.

Variant coding via guided routines



Click on this to write Variant code.

Click on this and ensure ignition is on.

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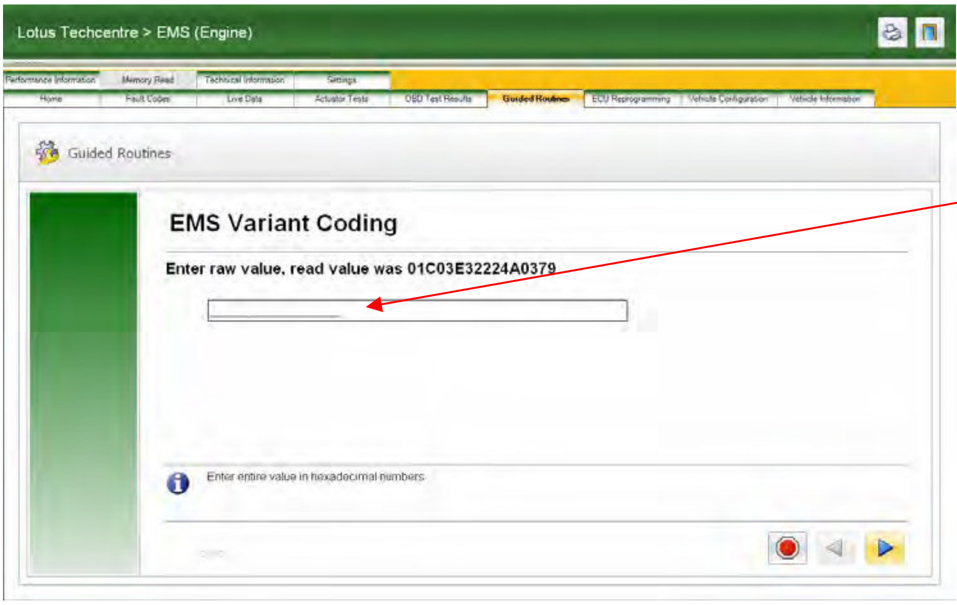
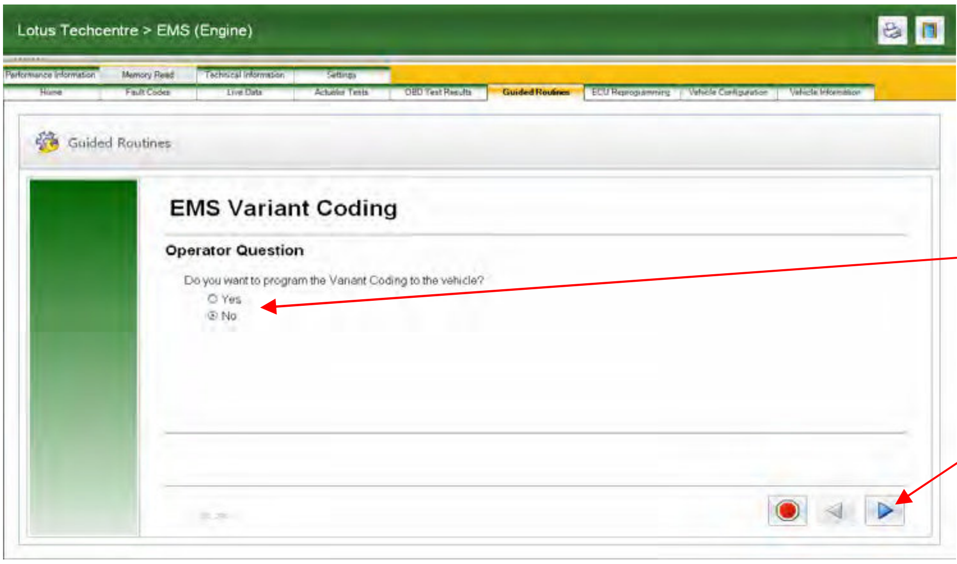
Lotus Techcentre
Service Information System

Variant coding via guided routines
Continued.



Enter 16 digit variant Code here.



Verify 'Yes or No'.

Click to continue.

Variant coding is now complete. Exit guided routines and check vehicle configuration

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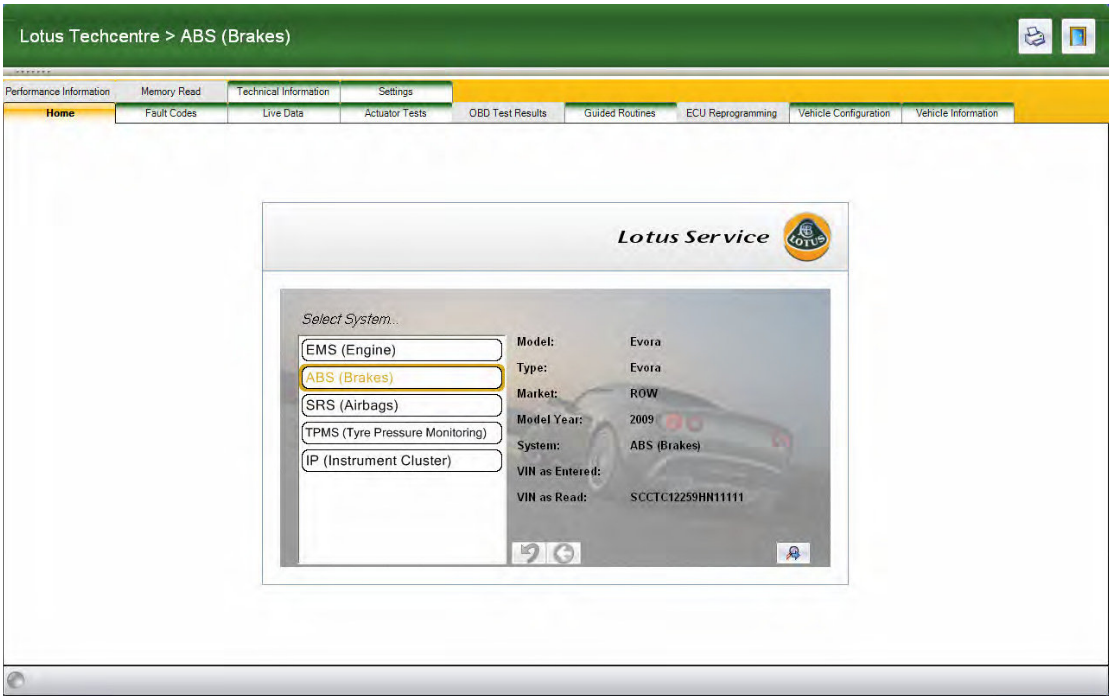
Lotus Techcentre
Service Information System

ABS



ABS Tab categories

Fault Codes:
Reads and clears stored fault codes. Full fault code list included.

Live Data:
Displays data and sensor reading in numeric and graphical format.

Actuator Tests:
Activates circuits and related hardware.

Guided Routines:
Brake Bleed. Steering Angle Sensor Calibration. ECU Renewal.

Vehicle Configuration Evora Only:
Configures ABS ECU e.g. TCS, ESP,HBA etc.

Vehicle Information:
Displays Hardware version, Software version, Serial number etc.

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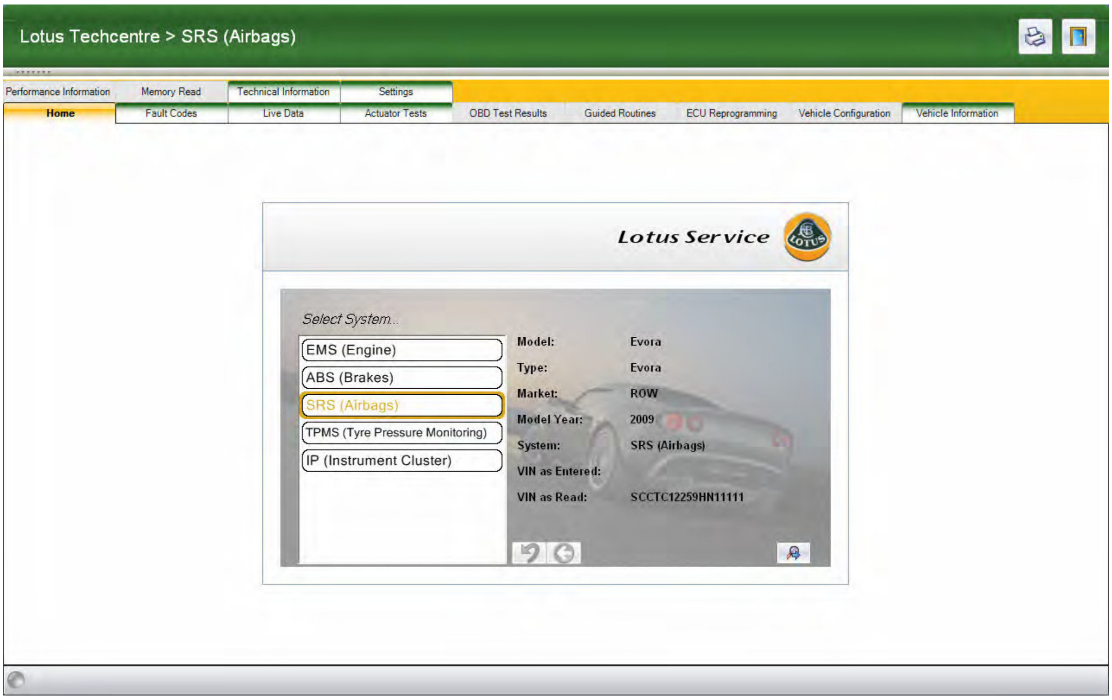
Lotus Techcentre
Service Information System

SRS



SRS Tab categories

Fault Codes:
Reads and clears stored fault codes. Full fault code list included.

Live Data:
Displays data and sensor reading in numeric and graphical format.

Guided Routines:
Configuration-Reprogram. ECU Renewal.

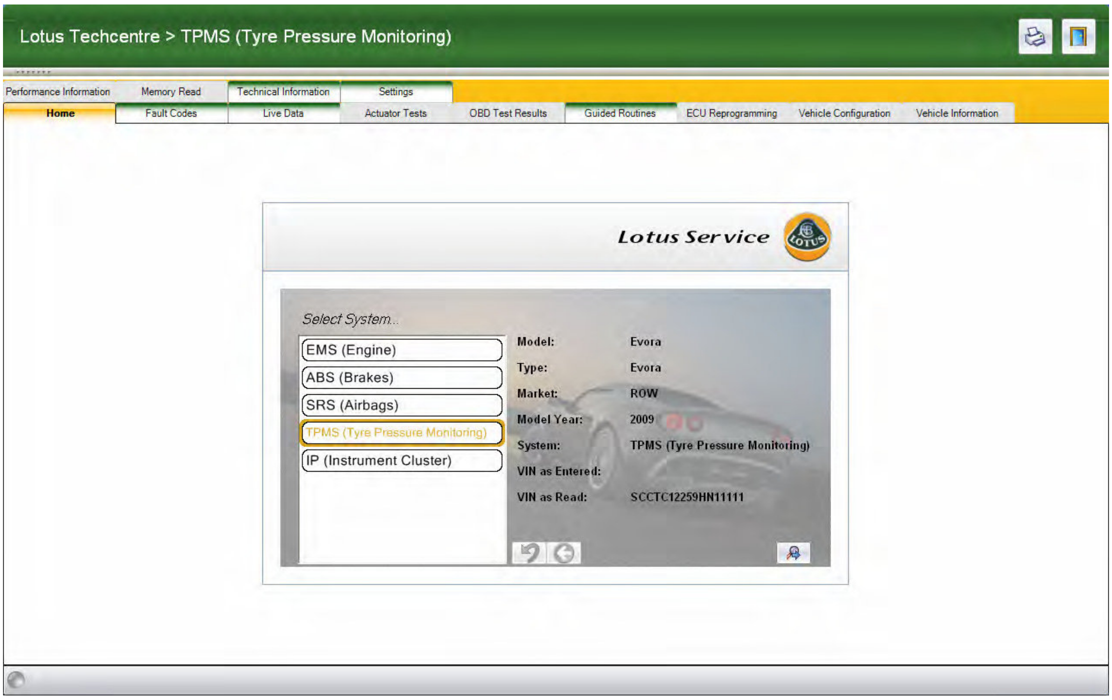
Vehicle Information:
Displays Hardware version, Software version, Serial number etc.

Actuator Tests:
Activates lamp circuits. (Not on all Models)

Memory Read:
(Not on all Models)

Lotus Techcentre
Service Information System

TPMS



TPMS Tab categories

Fault Codes:
Reads and clears stored fault codes. Full fault code list included.

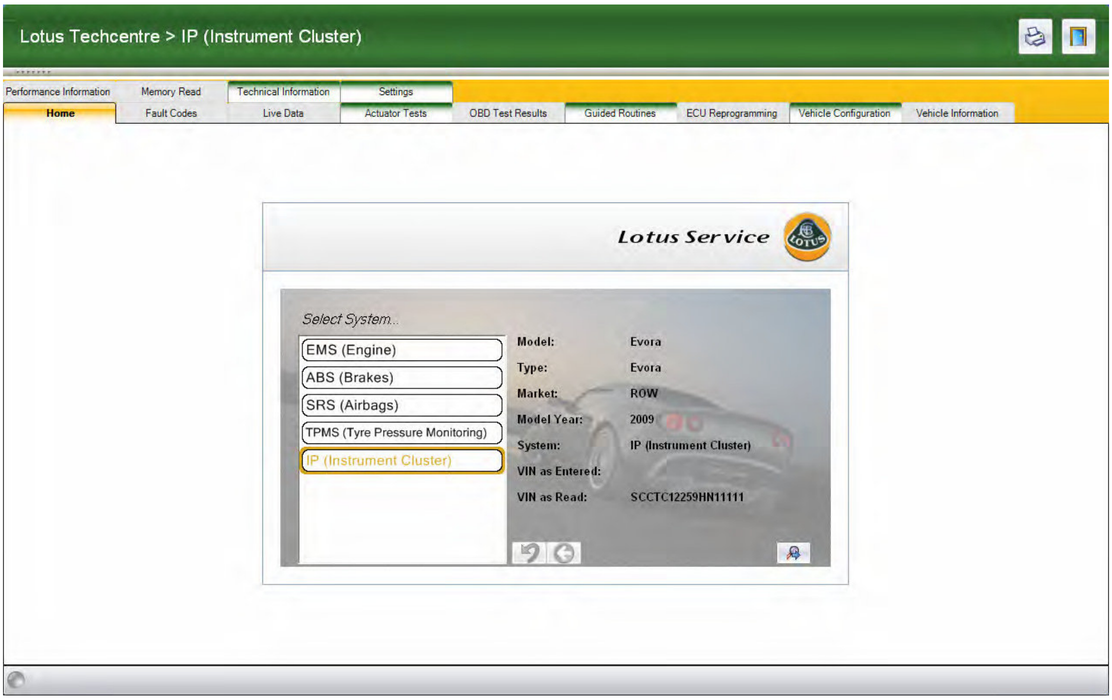
Live Data:
Displays sensor reading in numeric and graphical format.

Guided Routines:
Pressure sensor & ECU Renewal.

Lotus Techcentre

Service Information System

IP (Instrument Cluster)



IP Tab categories

Actuator Tests:
Activates Speedo.

Guided Routines:
Write Odo value to new instrument cluster.

Vehicle Configuration Evora Only:
Writes configuration to new instrument cluster.

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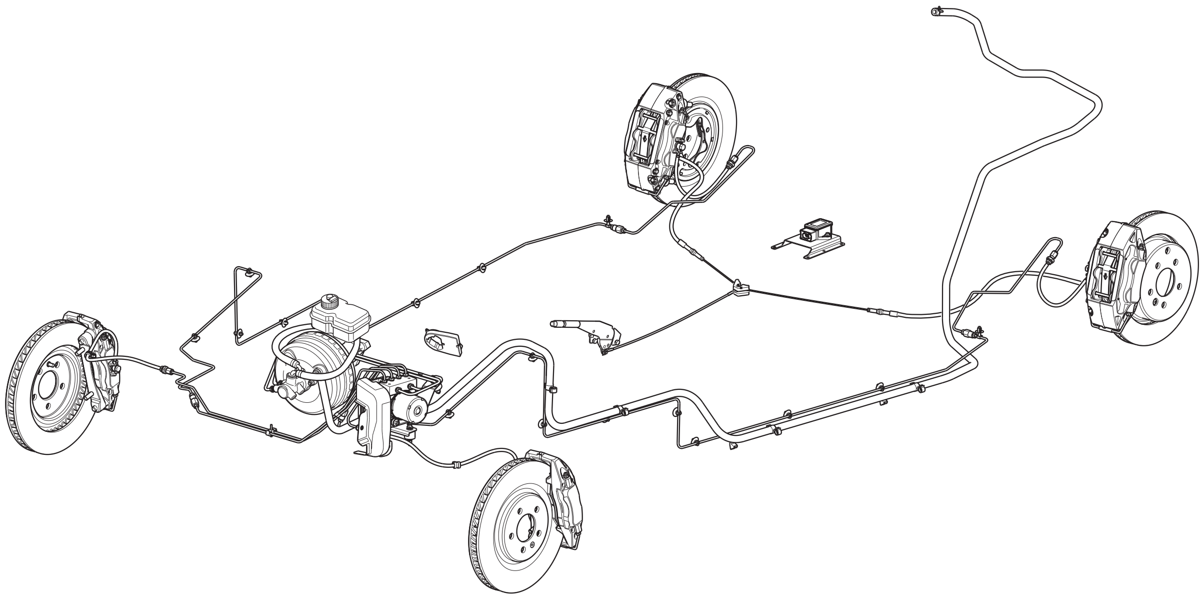
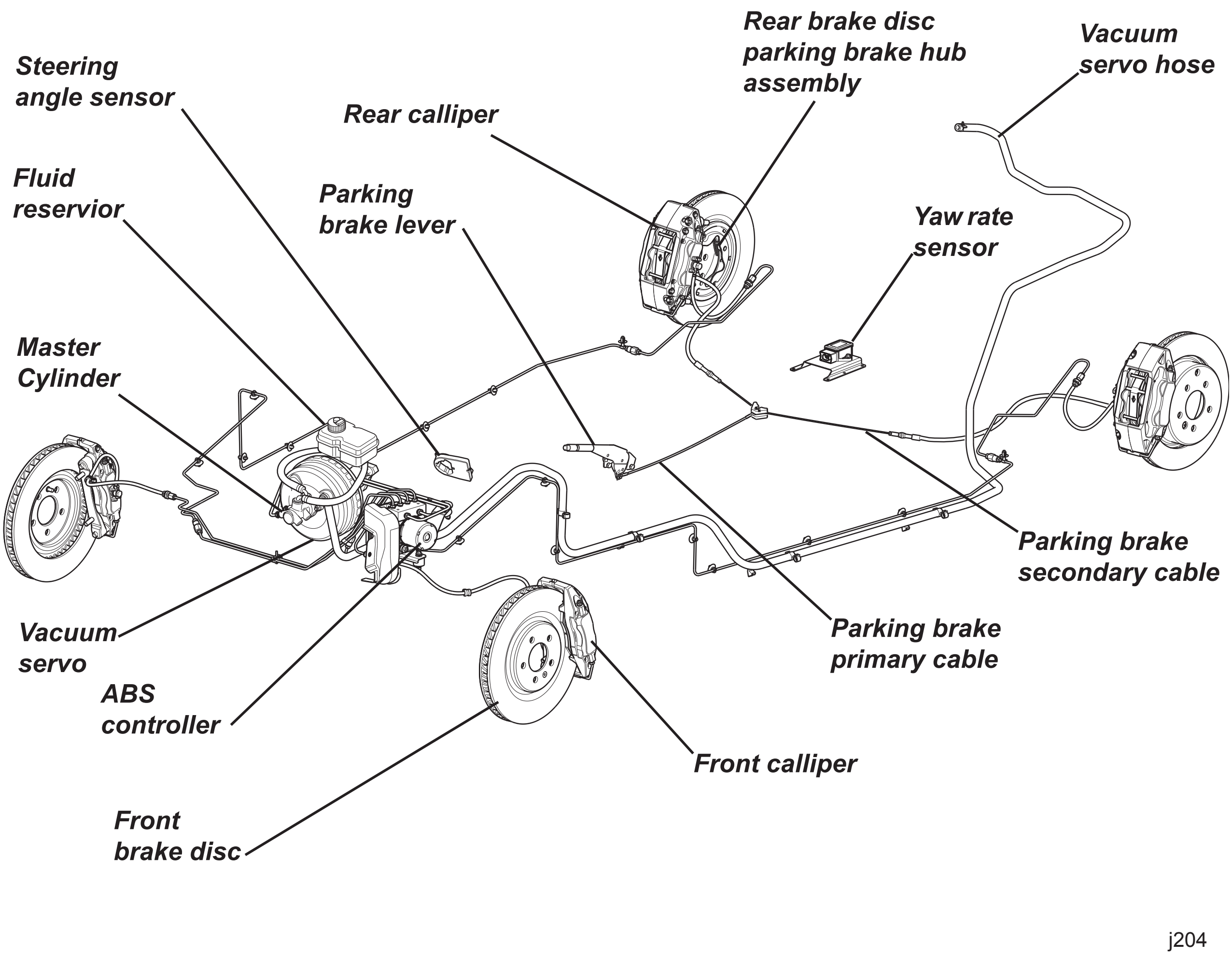
BRAKING SYSTEM

SECTION JM



GENERAL LAYOUT



JM.1 - GENERAL DESCRIPTION

The braking system of the Lotus Exige S comprises a four piston calliper and brake disc at each wheel operated by a tandem master cylinder with dual diaphragm vacuum servo power assistance. The dual hydraulic circuit is divided front/rear and modulated by a Bosch ESP 8.1 microprocessor based anti-lock system. A cable actuated parking brake uses brake shoes operating in drums incorporated into the rear discs.

The brake callipers are supplied by A.P. Racing, and feature lightweight alloy bodies housing four pistons in opposed pairs. The castings for the front and rear callipers are common, but are machined differently to accommodate the differing piston diameters. In the front callipers, the leading pistons are 36.0 mm diameter, and the trailing pistons 31.75 mm. The rear callipers house 31.75 mm leading pistons and 28.4 mm trailing. Each calliper is marked on its inner, inboard face, alongside the pad aperture, with its designated fitting position; 'RF' representing Right hand Front, with others marked as LF, RR, and LR. Each calliper is secured to its hub carrier by two bolts disposed in a plane perpendicular to the disc axis, with the front callipers mounted behind the axle line, and the rear callipers ahead of the axle.

The front cast iron discs are 332 mm diameter, 32 mm thick, with optional cross-drilling to enhance pad cleaning, and include internal curved vanes to draw cooling air from the centre to the periphery, with the vanes curving backwards in relation to the normal direction of rotation. The rear cast iron discs include similar features and the same diameter but are 26 mm thick, and incorporate integral 185 mm diameter drums for the parking brake shoes. Each disc is sandwiched between the road wheel and hub, and is retained for convenience by a single countersunk screw.

The Continental Teves tandem master cylinder incorporates a front section to supply both front brakes, and a rear section to supply the rear brakes. A translucent fluid reservoir is mounted on a bracket above the master cylinder, and is divided into front and rear chambers separated by a baffle. The two chambers are connected to the front and rear master cylinder sections by flexible hose, with a third hose connecting the rear brake reservoir chamber to the clutch master cylinder to supply that system’s needs. A fluid level sensor in the filler cap will light a fascia tell tale lamp if the level becomes dangerously low.

The parking brake ratchet lever is mounted between the seats in a fabricated steel structure which also houses the gearchange mechanism. The lever activates a primary cable which exits the cabin at the front of the fuel tank bay, and turns through 90° to connect to a 'horseshoe compensator' at the front of the engine bay. The compensator forms the abutment for the primary cable, From its central connection at the compensator, the secondary cable is routed symmetrically underneath the vehicle, first passing through adjuster brackets integral to the lower front wishbone pivot bolt mounts and then through casting apertures within the lower wishbones with the outer cable terminating at a mounting lug incorporated within the rear hub carrier assembly.

The inner cable then passes through an aperture within the rear parking brake backplate, terminating at its connection to the parking brake lever mechanism.

At the each brake backplate the secondary cable connects to a lever mechanism which provides a balanced expanding force to the lower ends of the parking brake shoes. The upper ends of the shoes pivot against opposite ends of an adjustable length abutment, with access to the toothed adjuster screw available via a hole in the brake backplate.

The parking brake should be applied by pulling up the lever with high effort, and engaging the highest ratchet setting attainable. When parking the car on a slope, the additional precaution should be taken of leaving the transmission in first or reverse gear and steering the wheels towards the kerb.

The braking system is designed to enhance brake performance during high speed driving, with good fade and pad wear characteristics, with the pads offering a higher friction level when heated to normal working temperature than when cold. Required pedal effort will reduce as cold brakes become heated to normal working temperature, and the braking efficiency will increase significantly as new discs or pads become ‘bedded in’. After fitting new brake components, maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to ‘bed in’ fully before being used to their full potential.

A Bosch Antilock Brake System (ABS/ESP) is used to optimise brake performance in extreme conditions and reduce the tendency of any wheel to lock up. Under most conditions, the maximum braking force is provided by a wheel which is rotating at about 90% of road speed. Apart from the likelihood of increasing the stopping distance, a locked wheel provides no steering force, such that with both front wheels locked, movement of the steering wheel has almost no effect on vehicle direction. With the antilock system, even panic braking results in controlled deceleration and the retention of steering response and is especially advantageous when braking on slippery road surfaces and in bad driving conditions. The ABS control system is self monitoring and has the capability of switching itself off if a fault is detected, allowing the base brake system to operate without anti-lock control.

Under normal circumstances, the hydraulic power brake system of the vehicle operates without input from the ABS, with brake pressures governed by the force applied to the brake pedal in conjunction with vacuum servo assistance. The ABS microprocessor receives signals from wheel speed sensors at each of the four wheel hubs, and interprets this data to determine if any wheel is tending to lock up. If imminent lock up is determined, the microprocessor commands solenoid valves in an electro-hydraulic unit to reduce the pressure in that particular brake circuit in order to restore wheel speed to that providing the maximum braking force consistent with continued wheel rotation.

When the ABS is operating, indication to the driver is provided by a ‘pulsing’ sensation felt at the brake pedal as fluid is pumped between the master cylinder and hydraulic control unit, and also by audible clicking of the relays and switches. These signals indicate to the driver that maximum retardation is being approached, and that driving style should be modified to suit the conditions. The minimum stopping distance is achieved by applying the brakes firmly and steadily, and allowing the ABS to modulate hydraulic pressure. The driver should not attempt to emulate this process by ‘pumping’ the brake pedal, as modulation at the pedal will treat all four wheel brakes similarly, rather than the individual wheel control governed by the electronics.

During ABS operation, the wheels may appear to lock momentarily as the wheel speed changes rapidly, and some tyre noise (intermittent screeching) may be heard. This noise is normal and will vary with road and tyre conditions. However, a wheel that completely locks and stays locked for more than one or two seconds is not normal, and indicates that the vehicle should be serviced as soon as possible. The ABS cannot operate properly if the base brake system is faulty, and will also be affected by dragging brakes, faulty wheel bearings or other related faults.

The ABS controller constantly monitors the anti-lock system for faults, and lights a fascia tell tale if a problem is detected. Information stored in the computer’s memory may be accessed via the Lotus TechCentre in order to facilitate diagnosis of system faults (see sub-sections JM.2 & JM.10).

JM.2 - TELL TALE LAMPS

Two tell tale lamps are provided in the instrument cluster to warn of problems in the brake system.

 **Brakes Tell Tale**

As a bulb check function, this tell tale will glow red for about 3 seconds after ignition switch on, and then go out unless one of the following conditions applies:

i) The parking brake is applied.

ii) The brake fluid level in the master cylinder reservoir is low.

Under normal circumstances, the tell tale should light when the ignition is switced on, and go out when the parking brake is released. If the lamp stays on, or comes on whilst driving, the car should be stopped immediately, as this may be an indication of low brake fluid level caused by a hydraulic leak. A button on the reservoir cap allows the tell tale circuit to be tested.

 **ABS Tell Tale**

The ABS tell tale warns the driver of problems in the anti-lock system. The lamp should light for about 3 seconds following ignition switch on, and then go out. If the lamp remains lit, or comes on whilst driving, a fault in the ABS is indicated. The base brake system will continue to operate normally, but without ABS regulation. The car can be driven but should be checked and repaired at the earliest opportunity. Please see service notes section JM.10 for further information

 **Lotus Dynamic Performance Management (Lotus DPM) Tell Tale**

Whilst driving the tell tale may flicker amber, indicating that the Lotus DPM has been triggered and electronic intervention is taking place

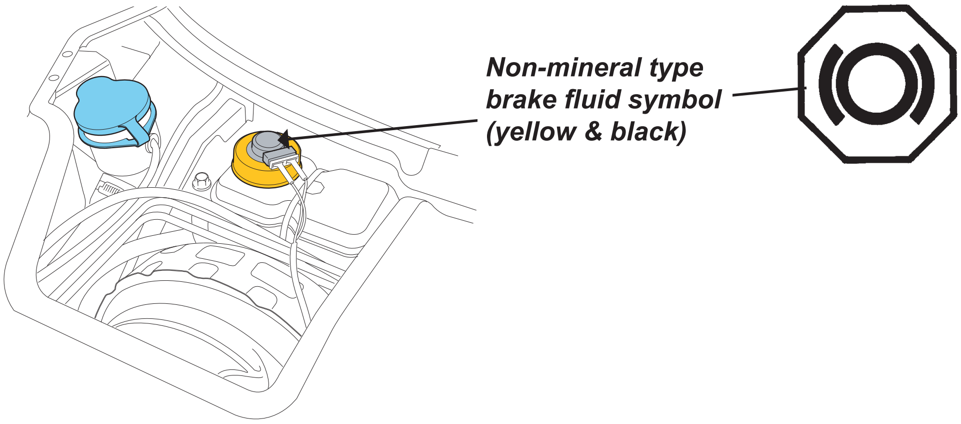
Lotus Dynamic Performance Management (Lotus DPM) 'Off' Tell Tale

This tell tale will glow amber if the (Lotus DPM) has been manually switched off.

Please see service notes section JM.10 and MV.4 for further information on Lotus Dynamic Performance Management.

JM.3 - BRAKE FLUID CHECK & CHANGE

Before checking the brake fluid level, ensure that the car is parked on a level surface, and open the front body access panel. The level of fluid in the reservoir may be inspected without disturbing the filler cap, and should be level with the top of the 'MAX' mark moulded on the transluscent reservoir body. The level will fall progressively as the brake pads wear in service, and should be checked at each service interval. A sensor incorporated into the filler cap will light a tell tale lamp in the instrument cluster if the level drops significantly.



BRAKE FLUID RESERVOIR

As a bulb check, the tell tale should light for about 3 seconds when the ignition is first turned on, but may also be tested by pressing and holding the button on the filler cap for between 5 - 10 seconds, which will also illuminate the tell tale with the ignition switched on.

The reservoir is mounted on a bracket fixed to the wiper spindle support, and is connected to the master cylinder by flexible hoses. An internal baffle divides the reservoir into two compartments, with one section supplying the front brake circuit, and a second section supplying the rear brakes in addition to, via another flexible hose, the clutch master cylinder. Service wear of the clutch friction plate will cause fluid to be displaced from the self adjusting clutch slave cylinder, back to the reservoir, and will counteract to some extent the dropping of the level due to brake pad wear.

If the reservoir needs topping up, first clean around the cap to reduce the possibility of contamination before unscrewing the cap; it is not necessary to disconnect the level sensor cables. Take suitable precautions to guard against damage to paintwork caused by brake fluid dripping from the level sensor.

Use only a fresh supply of DOT 4 ***non-mineral*** type fluid,identified by a yellow and black symbol. Do NOT use DOT 5 silicone fluid, or any fluid which has been exposed to the atmosphere for more than a brief period, or any fluid suspected of being wet, dirty or contaminated. Do not overfill. Replace the filler cap securely.

Some service operations, such as replacing brake pads, will result in the displacement of fluid from the hydraulic circuit back into the reservoir. In order to prevent fluid overflowing from the reservoir, it may be necessary to remove some fluid using a syringe.

Renewal of Brake Fluid

Brake fluid absorbs water from the atmosphere over a period of time (i.e. is hygroscopic), resulting in a lowering of the boiling point of the fluid, and corrosion of the hydraulic system. For optimum safety and brake performance, the brake fluid should be renewed every 24 months (including clutch release system).

Brake Bleeding Procedure

Note: if bleeding the braking system is required due to the renewal of the ABS modulator, please refer to section JM10 – ABS module renewal, before carrying out this procedure.

If the brake fluid is to be renewed, or an hydraulic component replaced, the system should be bled of air using the following procedure:

1. Using conventional manual techniques, or low air pressure applied to the reservoir, bleed the system from each of the callipers 2 bleed nipples in turn until no air bubbles can be seen.
2. Connect the Lotus Techcentre to the diagnostic link, select ABS and follow the brake bleeding instructions. Whilst this automatic process is taking place (with all 4 calliper nipples open), gently cycle the brake pedal up and down whilst keeping the reservoir topped up, to move any air bubbles displaced from the ABS unit down the hydraulic lines. Finish by closing each nipple with the pedal down.

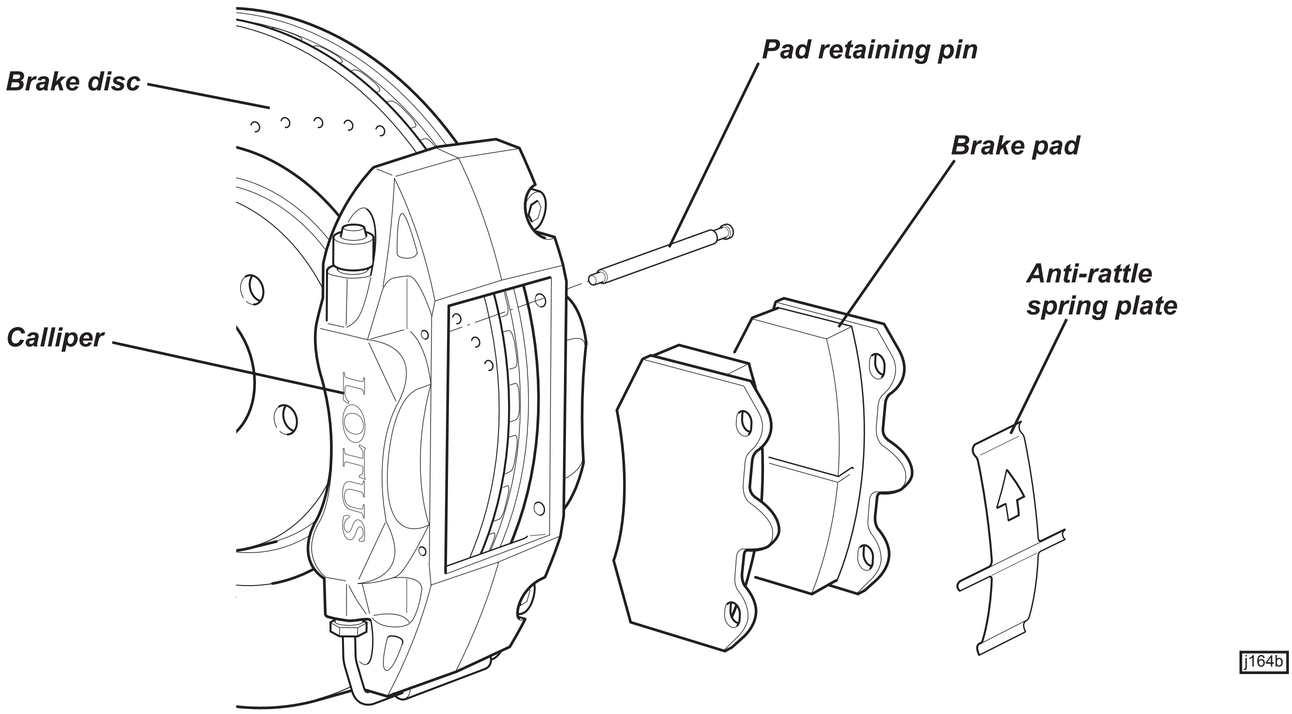
3. Repeat step (1) to purge each calliper feed line in turn.

JM.4 - BRAKE PAD REPLACEMENT (front and rear)

Pad thickness may be checked with the wheel removed without disturbing the calliper.

Standard pad thickness (excluding backplate); 12.0 mm
Minimum pad thickness (excluding backplate); 2.5 mm
If the thickness of any pad is below the specified minimum, the axle set of pads should be renewed.

Front Brake Shown



1. To remove the brake pads; Use a pin punch to tap one of the pad retaining pins towards the inboard side. Unhook and remove the anti-rattle spring plate, and tap out the second retaining pin. Use pliers on the backplate lugs to withdraw the pads from the calliper, noting each pad's position if they are to be refitted.

   Measure the lining thickness and renew the axle set of pads if any lining is below 2.5 mm.

2. Before replacing the pads, inspect the calliper for any signs of fluid leakage from a piston seal or joint, and replace the calliper if any such signs are evident. Clean the pad recess in the calliper taking suitable precautions to protect from dust inhalation. Inspect the brake disc surface condition and thickness (see below) and replace if necessary.

3. If refitting the existing brake pads, refit in their original position.

4. If fitting new pads, the pistons must be pushed back into the calliper using suitable calliper pliers, to provide the necessary space. This action will return fluid to the master cylinder such that some fluid may need to be removed by syringe in order to prevent overflowing. Do not lever between the disc and piston, or damage to both components may be caused. Note that new pads are supplied with an anti-squeal overlay applied to the backplate, and the edge of the pad material should be marked 'FER 4212 FF'.

5. Position the pads in the calliper, and insert the upper pad retaining pin from the inboard side. Tap fully into position using a pin punch, and verify the security of the pin. Renew the pin if in any doubt.

6. Fit the anti-rattle spring plate into position with the top end tucked under the upper pin and the arrow point-

ing upwards on a front calliper, or downwards on a rear calliper. Insert the second pin, pressing down the bottom of the spring plate so as to be captured by the lower pin. Verify pin security.

7. Before driving the car, press the brake pedal several times to bring the pads to their correct running position. Top up the master cylinder reservoir (see above) if necessary, to bring the level to the top of the 'MAX' mark.

8. Ensure the customer is made aware that maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

JM.5 - BRAKE CALLIPERS

The brake callipers are supplied by A.P. Racing, and feature lightweight alloy bodies housing four pistons in opposed pairs. Each calliper is marked on its inner, inboard face, alongside the pad aperture, with its designated fitting position; 'RF' representing Right hand Front, with others marked as LF, RR, and LR.

Each calliper is secured to its hub carrier by two bolts disposed in a plane perpendicular to the disc axis, with the front callipers mounted behind the axle line (via a mounting bracket to the hub carrier), and the rear callipers ahead of the axle bolted directly onto the hub carrier.

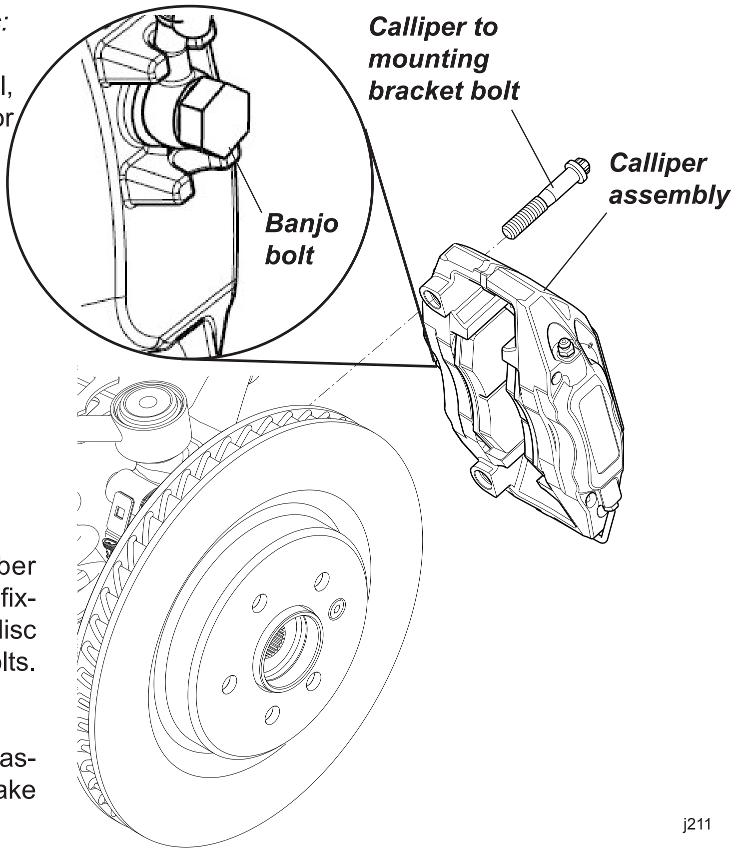
The brake callipers are not intended to be dismantled or overhauled, If required, contact A.P. Racing at Wheeler Road, Seven Stars Industrial Estate, Coventry, CV3 4LB.

Front Brake Calliper

Removal - to gain access to remove brake disc:

Raise the vehicle and remove the road wheel, see Service Notes section AN.1 and GK.4 for further information.

1 Remove the two M12 x 70 bolts securing the brake calliper to the hub carrier mount bracket (torque to 100Nm), and withdraw the calliper complete with pads from the disc. Secure clear without straining the flexible hose.



Refitment:

Reverse procedure of removal except:

- Apply Permabond A130 (Blue - part number A912E7033V) to the threads of the calliper fixing bolts. Fit the calliper with pads over the disc and secure to the hub carrier with the two bolts. Tighten to 100 Nm.

- Refit the road wheel and when all brakes are assembled, pump the brake pedal to restore brake pad position before driving the car.

Calliper replacement:

Preparation:
Note: In the event that the remaining brake fluid lines are not being disrupted for any reason, then it may be advantageous to limit brake fluid loss to the individual fluid circuit to the calliper being removed rather than draining the complete braking system. This will reduce the possibility of accidentally introducing air into the braking system which may be difficult to remove causing a 'spongy' brake pedal and ineffective braking system.

Place a suitable disposable towel around the lower wishbone/balljoint area as well as a container beneath the wishbone area directly below the front calliper/banjo bolt assembly to prevent the accidental spillage of brake fluid onto the floor.

Removal:
1.Release the M6 nyloc nut securing the brake hose retaining clip to the upper wishbone assembly, (torque 9Nm) and withdraw the hose and clip from wishbone stud.

2.Loosen the banjo bolt securing the steel braided flexible brake hose to the calliper, (torque 20Nm).

3.Remove the two bolts securing the brake calliper to the hub carrier mounting bracket (as described in step 1 of calliper removal).

4.Once the calliper has been withdrawn from the disc, fully release the banjo bolt and its 2 washers from the calliper assembly.

Note: Because a steel braided brake hose is fitted, it cannot be clamped to prevent brake fluid loss. Therefore it is recommended to ensure that the new calliper is already prepared for fitment to receive the banjo bolt (with new sealing washers) to the new calliper as quickly as possible.

5.Continue to withdraw the calliper from the disc as per step 1 of calliper removal.

Renewal:
- Fit the brake hose banjo bolt and new sealing washers to the new brake calliper (handtighten only) this should stop any further brake fluid loss.

- Apply Permabond A130 Blue (part number A912E7033V) to the threads of the calliper fixing bolts. Fit the calliper with pads over the disc and secure to the hub carrier mounting bracket. Torque to 100 Nm.

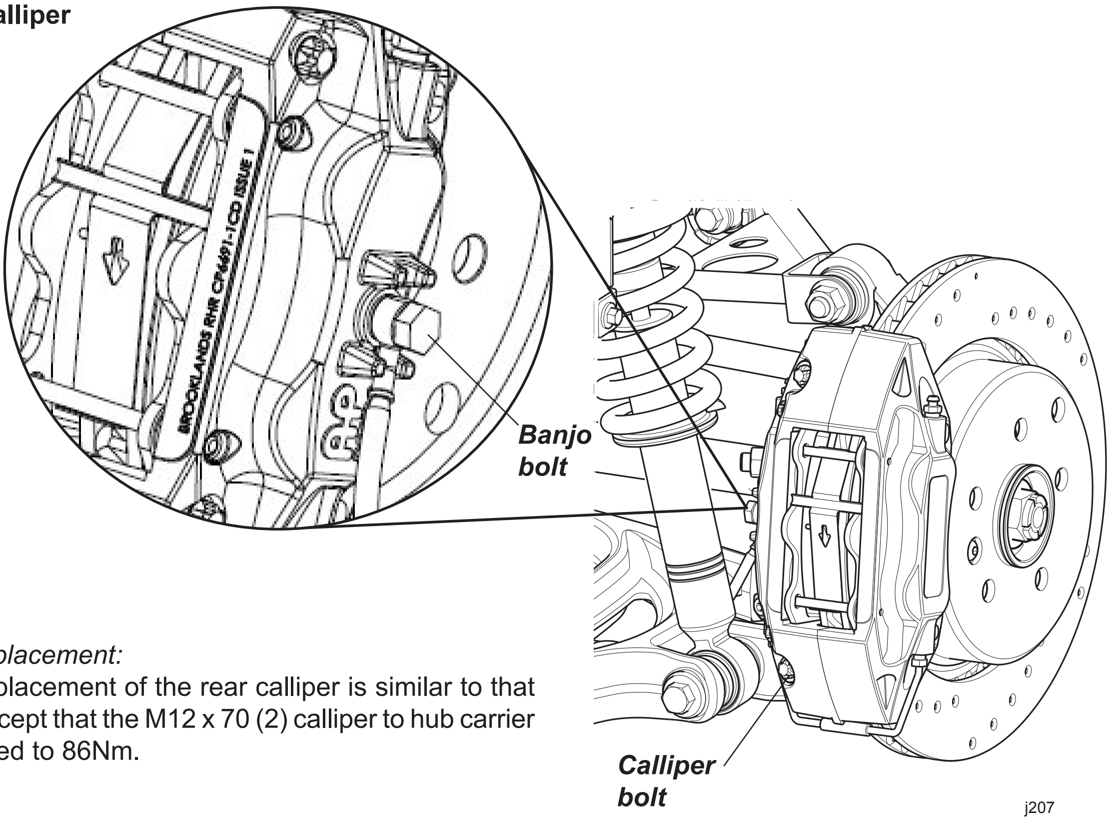
- Ensure the brake hose route is unhindered, cannot rub on any other components and is free of kinks before torque tightening to 20Nm.

- Refit brake hose with integral retaining clip onto it locating stud on the upper wishbone and torque to 9Nm.

- Bleed brake assembly as required - see section JM.3.

- Refit the road wheel and when all brakes are assembled, pump the brake pedal to restore brake pad position before driving the car.

Rear Brake Calliper



Removal or replacement:
Removal or replacement of the rear calliper is similar to that for the front, except that the M12 x 70 (2) calliper to hub carrier bolts are torqued to 86Nm.

JM.6 - BRAKE DISCS

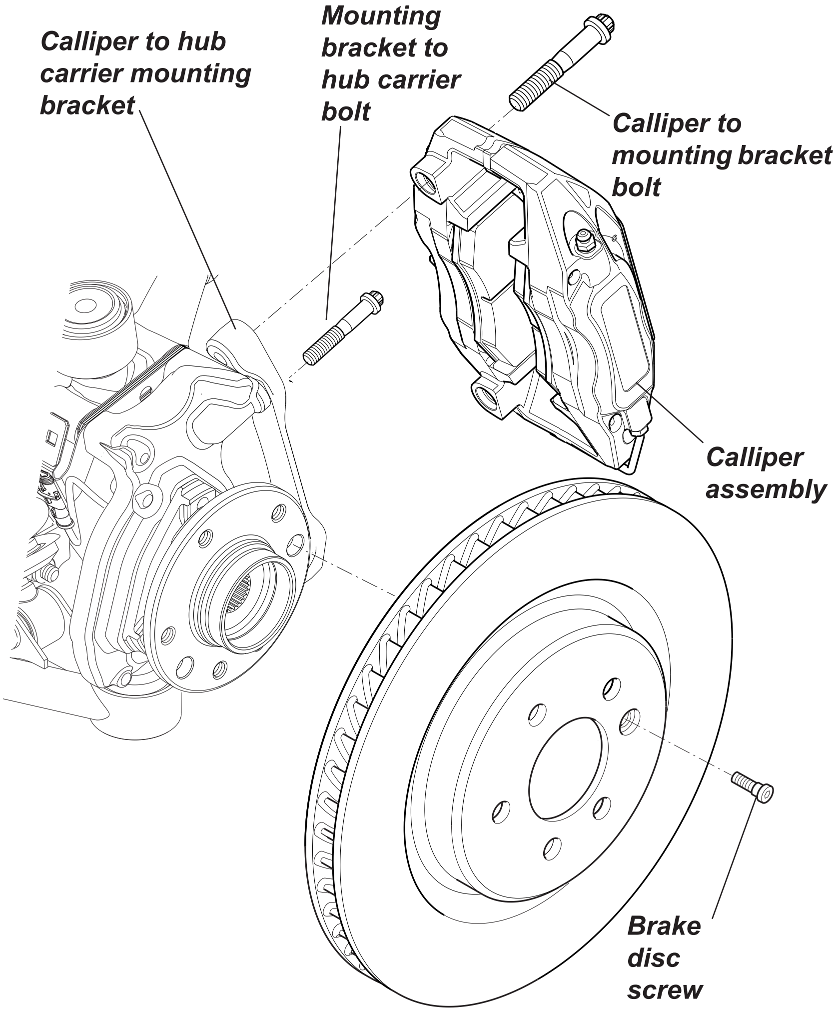
All four wheel brakes use a cast iron brake disc which is sandwiched between the wheel and its hub flange, being centralised by the hub spigot, and transmitting torque via the clamping force of the road wheel bolts. A countersunk screw is used to retain the discs for convenience when servicing. The front discs and rear discs are all internally ventilated with directionally curved cooling vanes, and have cross-drilling to aid pad scouring available as an option. The rear discs also incorporate a 185 mm inner drum to accommodate the parking brake function.

The condition of the brake disc friction surface is a major factor in brake performance and feel, with a good surface quality and minimal run-out and thickness variation being required. After an extended lay up, some surface corrosion may develop on the discs which will cause a degradation in braking quality until the surfaces are cleaned up by normal brake action. Excessive run-out or thickness variation as a result of overheating or extended wear, may cause brake judder and/or extended pedal travel due to pad ‘knock off’. Scoring and ridging of the braking surfaces will be exacerbated by operation in dusty or unmetalled road environments, and will degrade braking performance.

No skimming or re-surfacing of the brake discs is recommended. If the disc becomes badly scored, or is out of specification in any way, it should be renewed. NOTE: Ensure that there is no discernible free play in the wheel bearings before attempting to measure brake disc run-out. If disc run-out exceeds the service maximum, check the hub face run-out before replacing the disc.

Brake disc thickness		
New	- front	32 mm
	- rear	26 mm
Service minimum	- front	30 mm
	- rear	24 mm
Runout		
New maximum		0.06 mm
Service maximum		0.10 mm
Hub		
Disc mounting face run-out max.		0.05 mm

Front Disc



Removal:
1. Raise the vehicle and remove the road wheel(s), see Service Notes sections AN.1 & GK.4 for further information

2. Remove the brake calliper to gain access to the brake disc - see section JM.5.

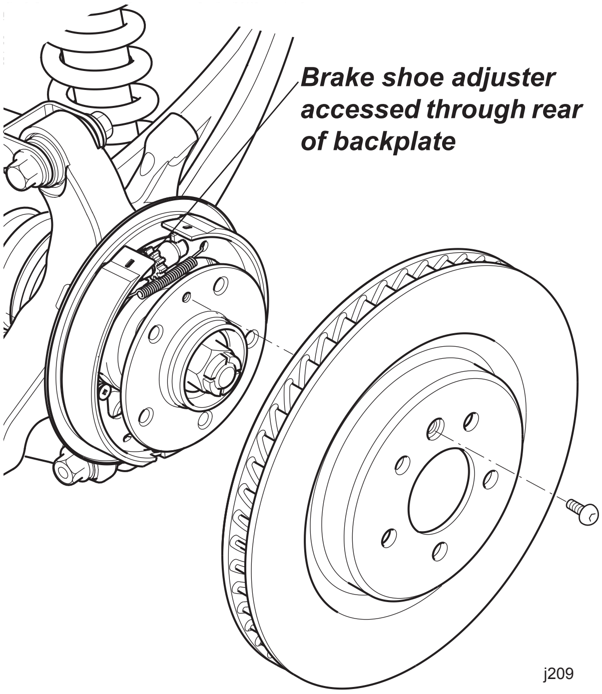
3. Remove the single countersunk screw, and withdraw the disc from the hub.

Replacement:
The reverse of removal except:
- Before re-fitting a disc, ensure that the mating face between disc and hub is scrupulously clean. Mount the correctly handed disc (with the curved vanes trailing in normal direction of rotation) onto the hub spigot, align the fixing screw hole, and secure the disc with the screw, tightening to 10 Nm.

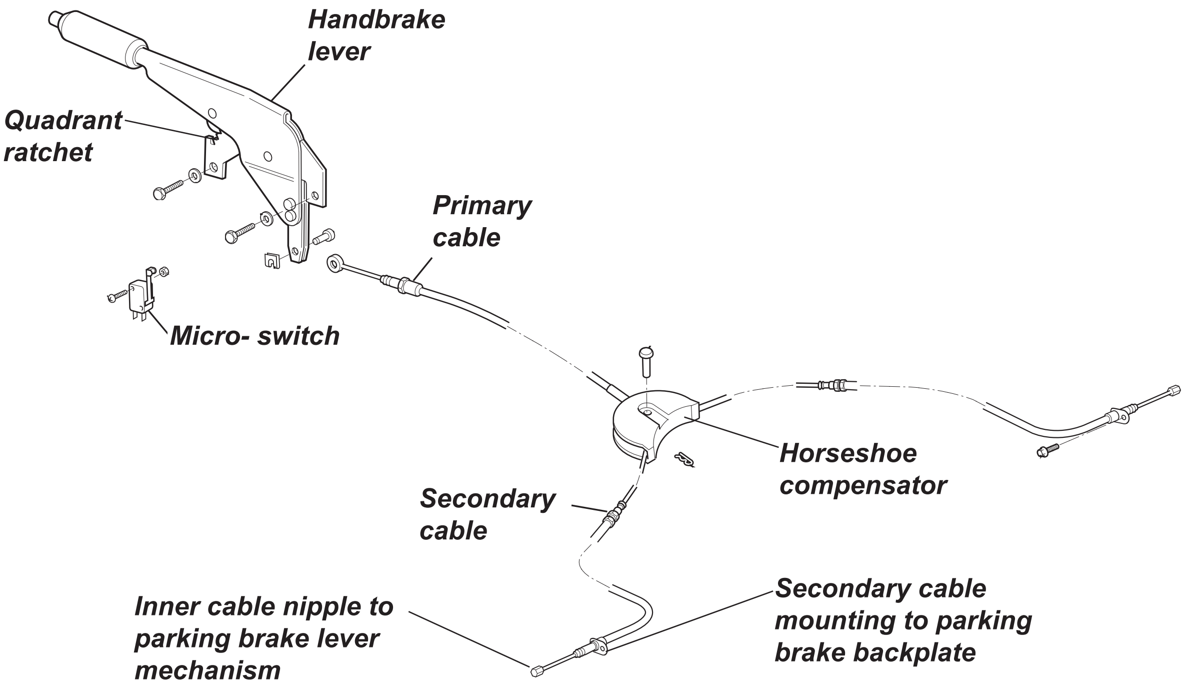
- Refit the road wheel and when all brakes are assembled, pump the brake pedal to restore brake pad position before driving the car.

Rear Disc Replacement
Replacement of the rear discs is similar to that for the front discs, except that the adjuster for the parking brake shoes should first be slackened to allow easy withdrawal of the disc/drum.

See section JM.7 for cable adjustment procedure and JM.5 for calliper removal. Re-adjust after re-assembly.



JM.7 - PARKING BRAKE MECHANISM

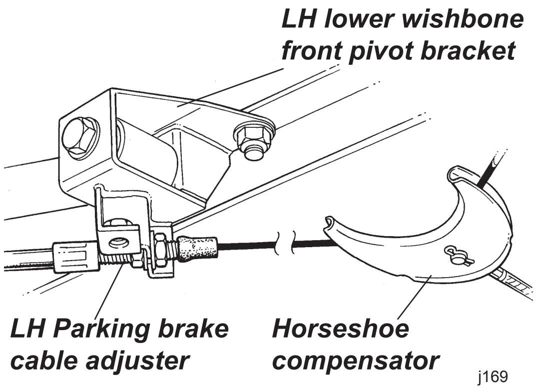


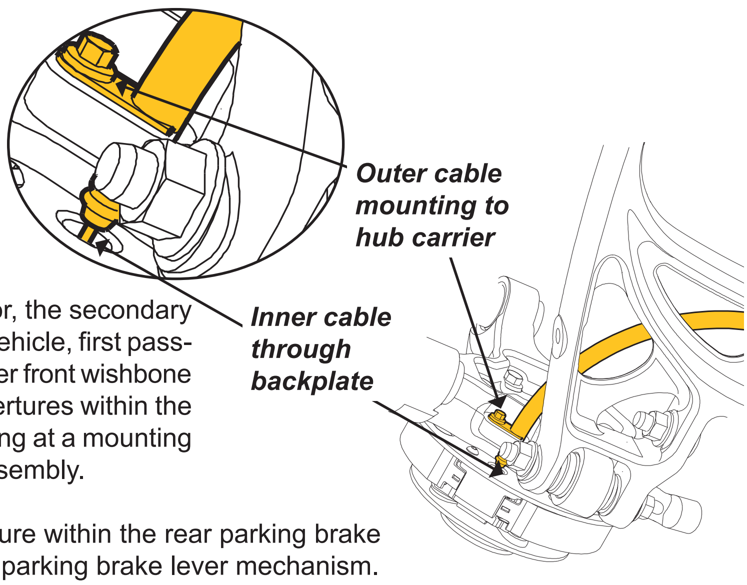
Parking Brake

The parking brake ratchet lever is mounted between the seats in a fabricated steel structure which also houses the gearchange mechanism. Operating the lever activates a micro switch to light the 'brakes' tell tale lamp in the instrument panel whenever the ignition is switched on and the parking brake is applied.

Operating the lever also moves the primary cable which exits the cabin at the front of the fuel tank bay and connects via a horseshoe compensator to the centre of a single secondary cable linking the rear LH/RH parking brake mechanisms.

Also refer to service notes sub-section FK.3 for further information on the combined handbrake/gearchange mounting assembly.





From its central connection at the compensator, the secondary cable is routed symmetrically underneath the vehicle, first passing through adjuster brackets integral to the lower front wishbone pivot bolt mounts and then through casting apertures within the lower wishbones with the outer cable terminating at a mounting lug incorporated within the rear hub carrier assembly.

The inner cable then passes through an aperture within the rear parking brake backplate, terminating at its connection to the parking brake lever mechanism.

Adjustment
At each service interval, the parking brake should be fully applied, and lever movement assessed by the number or ratchet 'clicks' attainable. The adjustment is satisfactory when 4 or 5 clicks are achieved. To make an adjustment;

1. Ensure that the parking brake lever is fully off, and the adjuster in the LH side of the secondary cable is fully slackened.

2. Remove both rear wheels (see Service Notes section GK.4 for further information). Using the access hole in the brake drum and hub flange, turn the adjuster downwards to expand the shoes until the brake drum cannot be turned by hand. Then back off the adjuster the minimum amount necessary to allow free rotation of the drum without rubbing, and then repeat for the opposite side.

3. The cable adjuster may then be tightened to remove slack until the 'click' specification is achieved. Check that there is no brake drag with the lever fully off.

Parking Brake Shoes
Unless the parking brake shoes are mal-adjusted, the shoe material should suffer little wear.

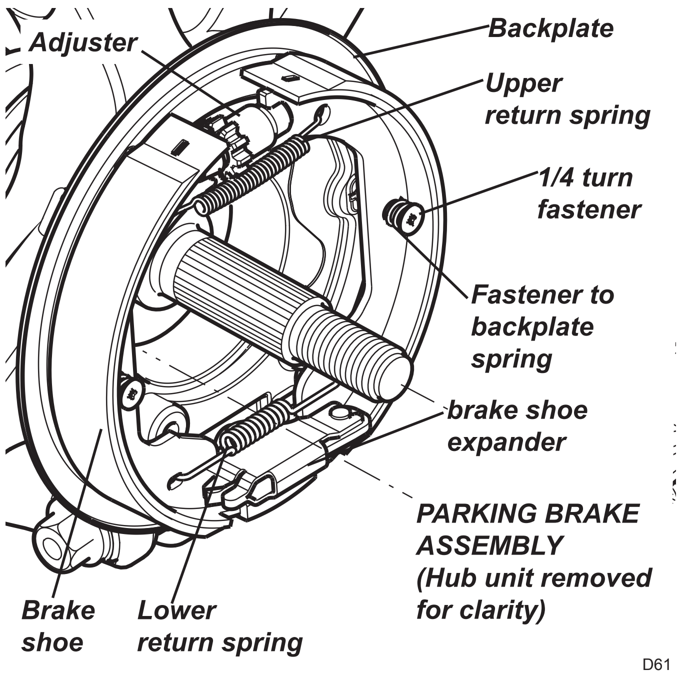
Removal:
1.Remove the brake disc see section JM.6.

2.Mark the shoes with their fitting position before removing the steady pin and spring from each shoe by turning the pin 1/4 turn.

3.Allow the shoes to fold outboard and release from the adjuster.

4.Remove the upper return spring, and lever the shoes from the adjuster mechanism slots.

Refitment:
Refit in reverse order.

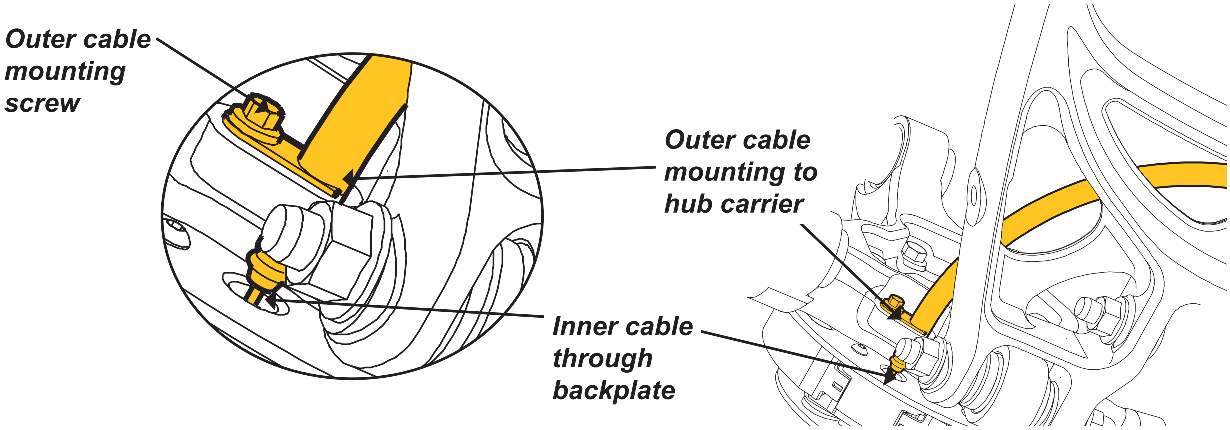


Parking Brake Backplate

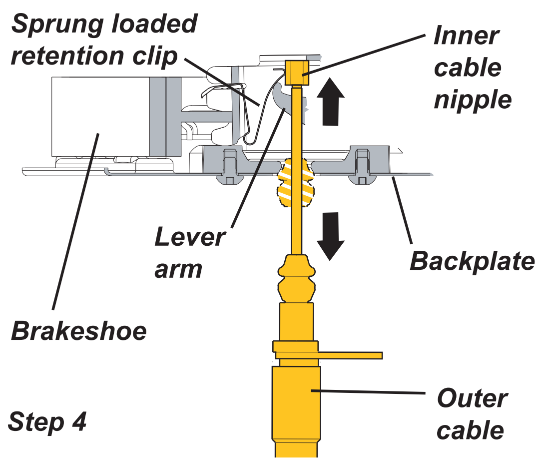
Removal:
1. Remove rear brake disc - see service notes section JM.6

2. Remove the rear hub unit – see service notes section DI.6.

3. Release the M6 x 12 screw (torque 9Nm) securing the handbrakes outer cable to its mount on the hub carrier.



4. Pull back the outer cable from its mounting position to the carrier to expose the inner cable which will increase the 'free play' within the secondary cable assembly.

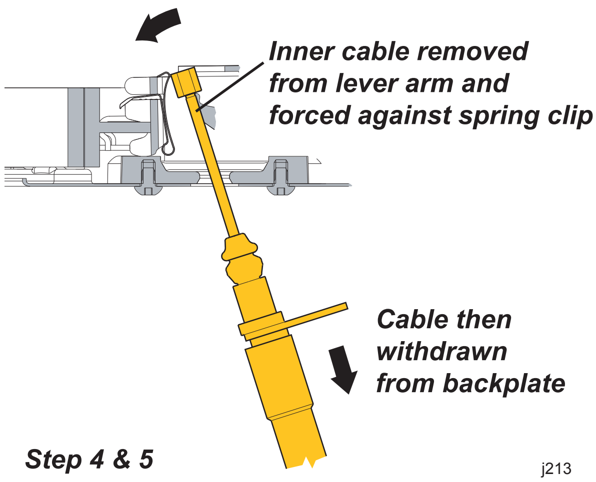


5. Hold the inner cable whilst also pushing it forwards and sideways moving it further into backplate lever mechanism, so that the inner cables nipple can detach from the internal brake shoe lever whilst also pushing against the spring loaded cable retaining plate.

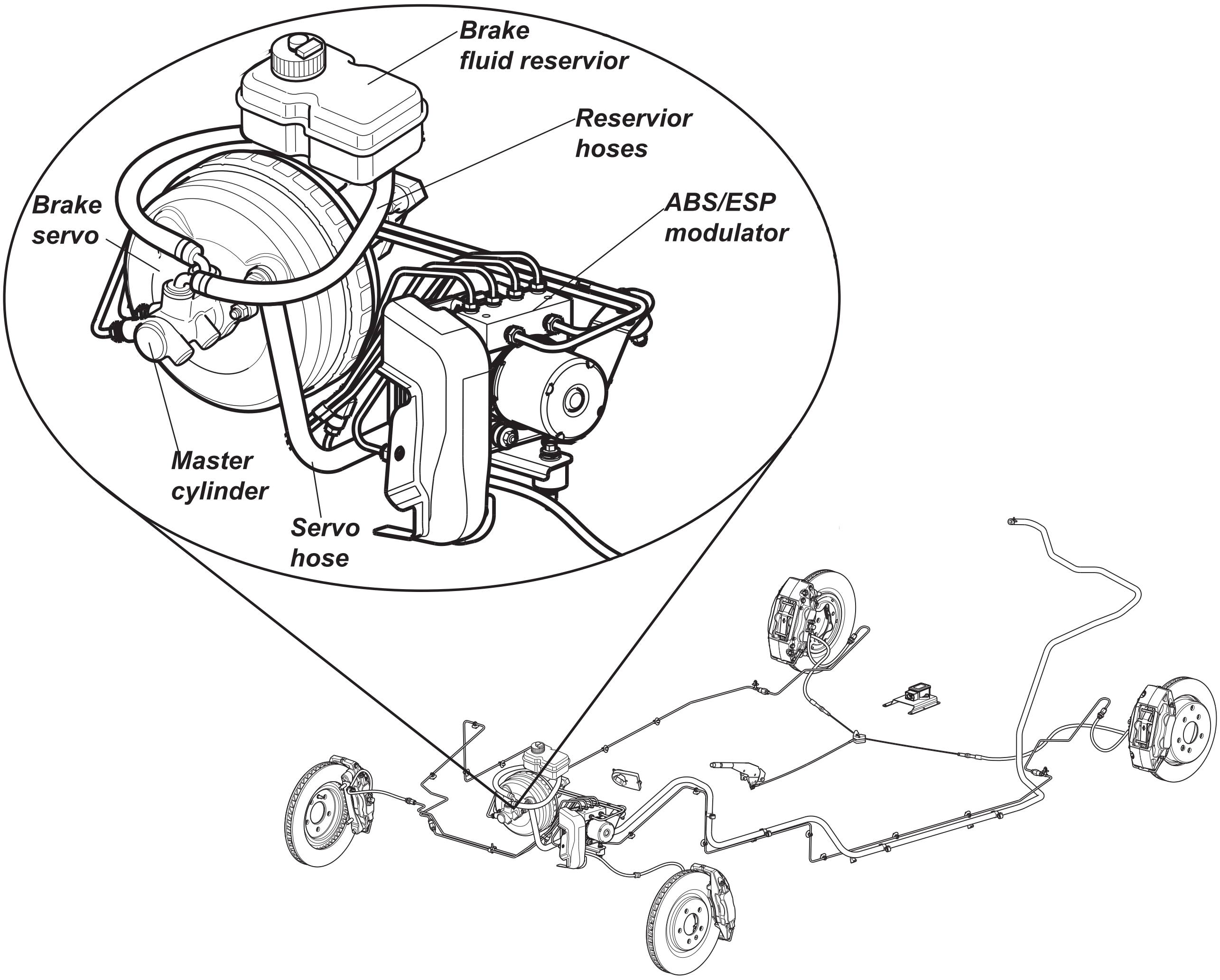
6. Withdraw the inner cable from the backplate.

7. Remove the 3 bolts securing the backplate assembly to the hub carrier – see service notes section DI.9.

Refitment:
Refit in reverse order.



JM.8 - BRAKE MASTER CYLINDER/SERVO ASSEMBLY



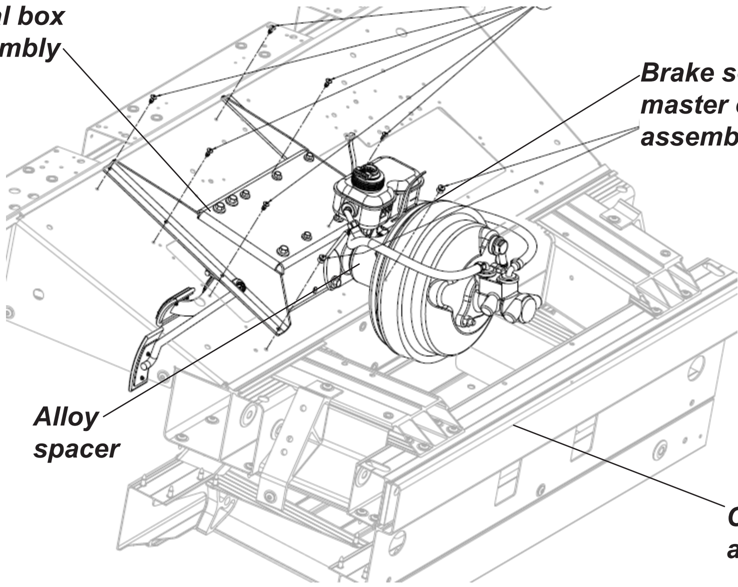
The brake master cylinder and servo assembly are supplied as a combined unit with the specific tolerance gap required between the servo pin and the master cylinder rear piston being pre-set by the manufacturer.

Lotus does not recommend any dismantling of the unit, and supplies no replacement parts or internal components. If the cylinder and or the servo are faulty they should be renewed as a complete assembly.

Brake master cylinder
The tandem master cylinder incorporates a rear section to supply both front brakes, and a front section to supply the rear brakes. A translucent fluid reservoir is mounted on a bracket above the master cylinder, and is divided into front and rear chambers separated by a baffle.

The two chambers are connected to the front and rear master cylinder sections by flexible hoses, with a third hose connecting the rear brake reservoir chamber to the clutch master cylinder to supply that system's needs. A fluid level sensor in the filler cap will light a fascia tell tale lamp if the level becomes dangerously low.

The master cylinder is secured to the front face of the brake servo which itself is bolted to the front of the pedal box. Access is available only after removal of the front clamshell.



Brake servo

The vacuum brake servo is secured to the front face of the pedal box via a machined alloy spacer, and is operationally interposed between the brake pedal and master cylinder. Engine generated vacuum is used to provide pneumatic assistance to the effort applied at the pedal. The servo is a dual diaphragm unit combining a 178mm (7 in) and 203mm (8 in) diameter vacuum chamber into a single compact unit to provide a 5:1 assistance ratio. The unit is a non-servicable sealed unit which if found to be faulty, must be replaced as master cylinder/servo assembly. The elbow connector valve is a push fit into a grommet in the servo shell, and is supplied complete with the assembly.

Operational Check

As a quick check of servo operation proceed as follows: With the 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, it is most likely that there is a fault in the vacuum supply line. Check the vacuum hose, all connections and the non-return valve. If the vacuum supply is not defective, the servo unit should be replaced.

Removal:

1. Remove the front clamshell - see service notes section BT.6.

2. Syphon fluid from the reservoir to reduce spillage. Release the two hoses connecting the master cylinder to the fluid reservoir, and plug the hoses. Disconnect the electrical cables from the reservoir cap.

3. Release the two brake pipes from the master cylinder, torque 16Nm and plug the pipes and ports.

4. From within the footwell, disconnect the servo pushrod from the brake pedal.

5. Disconnect the brake servo vacuum hose, and release the flanged M8 nuts (4) securing the servo to the pedal box extension plinth, torque to 25Nm. Withdraw the master cylinder and servo assembly.

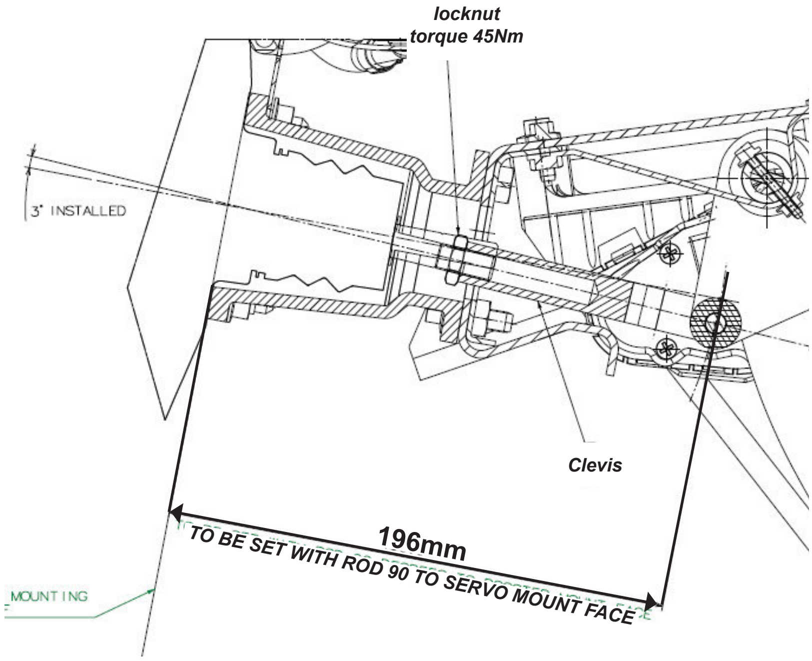
Note: The front of the master cylinder is positioned very close to the rear of the radiator panel surround. If the master cylinder/servo assembly will not clear the surround whilst attempting removal then the master cylinder may be temporarily removed by releasing the M8 lock nuts (2) torque 25Nm and detaching it from the servo unit. Note when refitting the master cylinder NEW locknuts must be fitted.

Refitment:
Refitment is the reversal of removal.

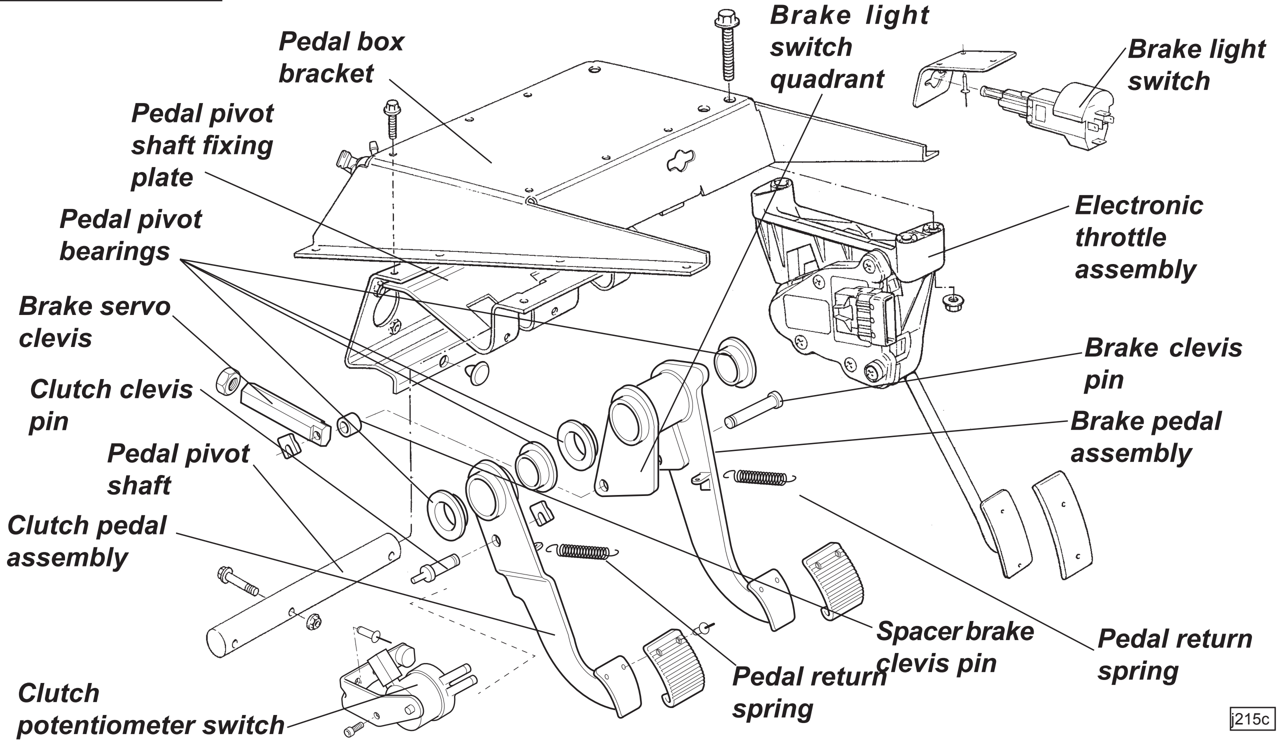
- Fill the reservoir with DOT 4 non-mineral type brake fluid, and bleed the complete brake system of air using the procedure in Sub-section JM.3.

Replacement:
Before replacing a brake master cylinder/servo unit assembly, first check the adjustment of the clevis on the input pushrod (i.e. the effective length of the pushrod). With a new rubber gasket fitted over the four servo mounting studs, the perpendicular distance from the surface of the gasket to the axis of the clevis pin hole should be 196mm.

This is essential to ensure that the correct brake pedal positioning is achieved and that the servo piston (and master cylinder piston) is allowed to return fully when the brakes are released, and is not pre-loaded by mal-adjustment of the input pushrod.



JM.9 - PEDAL BOX



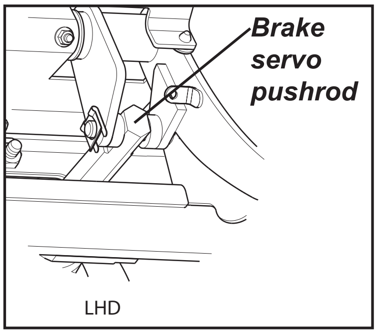
The pedal box is fabricated from alloy sheet, and rivetted, bolted and bonded to an aperture in the chassis scuttle. A hollow steel pivot shaft serving the brake and clutch pedals is bolted to a steel mounting plate, itself bolted to the inside of the pedal box. The brake and clutch pedals are fabricated from steel plate, and feature synthetic bushes for maintenance free articulation on the steel pivot shaft, and serrated alloy footpads.

Clutch potentiometer

A clutch pedal potentiometer is also fitted in order to provide data for Cruise, Launch and Lotus DPM (Dynamic Performance Management) Control operations.

Throttle pedal

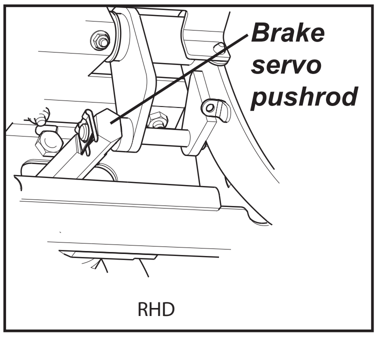
The 'drive by wire' throttle actuation uses a steel rod fabricated pedal to operate an electronic module and provide a signal to the engine ECU, which then actuates the throttle valve stepper motor within programming constraints. The throttle pedal module is secured to a mounting bracket by three bolts, with a further three bolts fixing the bracket to the pedal box.



Brake pedal

The brake pedal to servo assembly pushrod clevis pin configuration differs between LHD and RHD pedal boxes.

On LHD vehicles the servo pushrod is positioned between the integral stop light quadrant and a clevis tab bracket welded to the brake pedal, spacers are used either side of the pushrod to equally space it between the quadrant and tab bracket and remove any excessive free play. A clevis pin passing through all 5 points and secured with a clip on the outer side of the brake light switch quadrant.



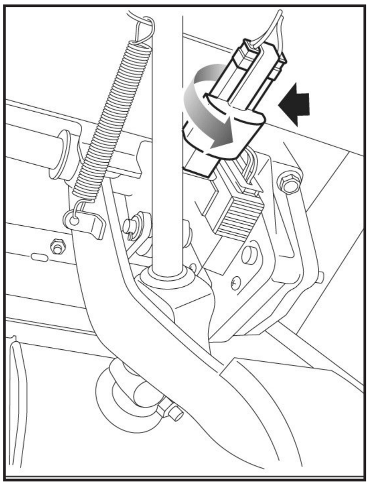
On RHD vehicles the servo pushrod is positioned outwards of the brake pedal quadrant. A single spacer is fitted between the quadrant and clevis pin. The clevis pin still passes through the brake pedal tab bracket as well as the quadrant, spacer and servo pushrod and again is secured with clevis pin clip.

Brake light switch

The switch has 3 settings (as shown below), the correct setting of the brake light switch plunger results in the switches internal contacts closing at the correct time in relation to the brake pedal travel exerted by the driver.

Pedal effort/travel position	Switch Stage	Action
No pedal effort - no pedal travel	Off	Cruise control available (if required).
Initial/light pedal effort - minor pedal travel	1st Stage	Cruise control cancelled (if activated).
Light/moderate pedal effort - increased pedal travel	2nd Stage	Brake lights illuminated coinciding with an ABS module brake fluid line pressure reading of between 2 - 6 Bar.

The brake light switch is mounted in a right angle bracket fixed to the underside of the scuttle, and abuts directly against the master cylinder pedal pushrod quadrant. The switch is retained in the bracket by a quarter turn mechanism, with no adjustment provided or required.



Removal:

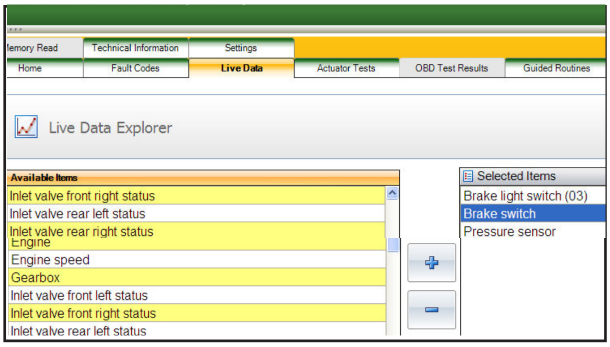
1. Rotate the switch 90° counter-clockwise within its mounting bracket and release.

2. Disconnect from the harness connector and remove the switch.

Refitment:

Installation procedure is reverse of removal except that the switch plunger must be adjusted to suit the brake pedal travel characteristics of the specific vehicle it is being fitted to.

The switch plunger uses an internal ratchet mechanism which can be adjusted to suit the vehicle allowing for any brake pedal travel tolerance thus ensuring the correct phasing of the internal switch contacts in relation to the switch plunger position and brake pedal position.



Refitment Procedure

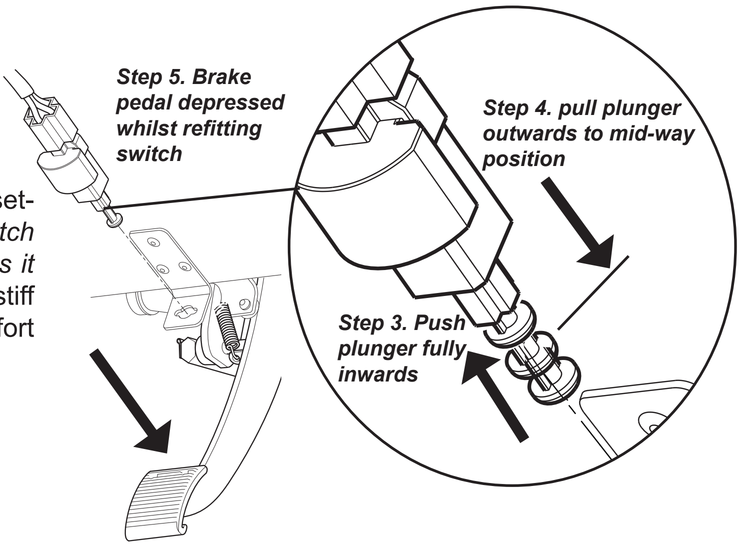
1. With TechCentre connected to the vehicle and the ignition on, select ABS brakes>Live Data:

2. From the 'Available Items' table, select:
   - Brake light switch (03).
   - Brake switch.
   - Pressure sensor

3. With the switch still removed from the pedal box (but harness connected), push the plunger fully inwards towards the switch housing (light resistance will be felt until the plunger overcomes its ratchet mechanism).

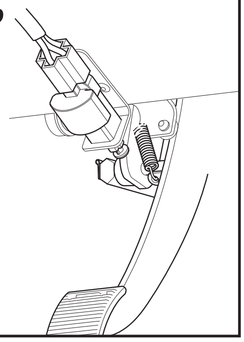
4. Pull the plunger outwards to its mid point setting *(approximately half way out from the switch housing, 5 audible clicks should be heard as it is being pulled).* Note: the plunger is on a stiff ratchet mechanism which may take some effort to extend.

5. Using your hand to push down on the brake pedal, refit the brake switch back into the pedal box bracket.



6.Gently release the brake pedal back to its normal position against its bump-stop.

Step 5. Brake pedal released back against bump stop

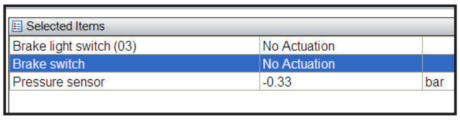


7.Select the ‘play’ option on the live data screen and gently depress and release the brake pedal to simulate normal braking operations and examine the value readings displayed on ABS live data in relation to:
- ‘Brake Switch’ (1st stage)
- ‘Brake Light Switch (03)’ (2nd stage)
- ‘Pressure Sensor’ (ABS brake line pressure).

Normal Values Proportional To Brake Pedal Depression

No pedal effort - no pedal travel

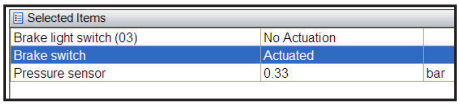
- ‘Brake Switch’ (1st stage)	No Actuation
- ‘Brake Light Switch (03)’ (2nd stage)	No Actuation
- ‘Pressure Sensor’ (ABS brake line pressure)	+ or - 0.5 Bar



Selected Items		
Brake light switch (03)	No Actuation	
Brake switch	No Actuation	
Pressure sensor	-0.33	bar

Initial/light pedal effort - minor pedal travel

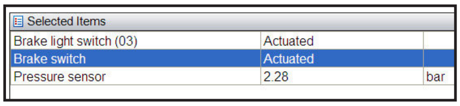
- ‘Brake Switch’ (1st stage)	Actuated
- ‘Brake Light Switch (03)’ (2nd stage)	No Actuation
- ‘Pressure Sensor’ (ABS brake line pressure)	+/- 0.5 Bar



Selected Items		
Brake light switch (03)	No Actuation	
Brake switch	Actuated	
Pressure sensor	0.33	bar

Light/moderate pedal effort - increased pedal travel

- ‘Brake Switch’ (1st stage)	Actuated
- ‘Brake Light Switch (03)’ (2nd stage)	Actuated
- ‘Pressure Sensor’ (ABS brake line pressure)	+ 2 - 6 Bar



Selected Items		
Brake light switch (03)	Actuated	
Brake switch	Actuated	
Pressure sensor	2.28	bar

8.If the readings are not within range then remove the brake light switch again repeating step 2 of the adjustment procedure but adjusting the plunger inwards or outwards against its ratched mechanism as necessary until the correct readings are achieved.

Note: Incorrect switch plunger adjustment may result in fault codes relating to ABS, Lotus DPM (Dynamic Performance Management) and cruise control being generated also illuminating the relevant tell tale lamp.

Electronic throttle assembly

Due to the limited access within the driver's footwell area, it may be necessary to remove the driver's seat and steering wheel assembly to gain access to the electronic throttle assembly and its fixings.

Removal:

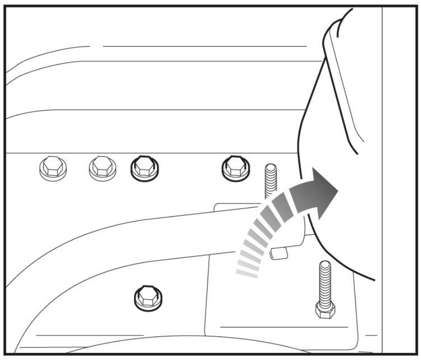
1. Release the cable tie securing the brake master cylinder reservoir from its mounting bracket and move aside to access throttle assembly bolts.

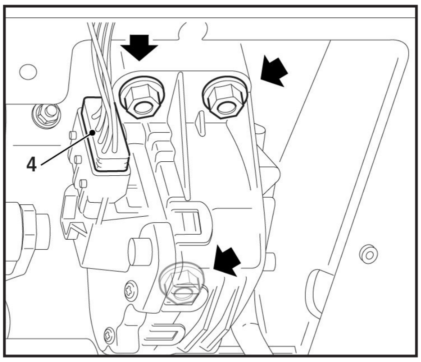
2. Disconnect main harness connector from throttle assembly.

3. With an assistant holding the bolt heads, remove M8 flanged nuts (3), securing the throttle assembly to pedal box (torque 12 Nm).

4. Remove throttle assembly mounting M8 x 40 bolts (3) from the pedal box.

5. Remove the throttle assembly.





Refitment:
Reverse procedure of removal.

Brake and clutch pedal
To remove a brake or clutch pedal from the pivot shaft, the pedal shaft mounting plate must be removed from the pedal box complete with the brake and clutch pedals:

1. Unplug and remove the throttle pedal assembly complete with mounting bracket by releasing the three screws securing the bracket to the pedal box - refer to procedure on previous page.

2. Disconnect the brake and clutch pedals from their pushrods, and unhook the brake pedal return spring.

3. Unplug and remove the clutch pedal potentiometer switch by releasing the M4 x 10 screw securing it to its bracket (torque 4 Nm).

4. Release the clutch pedal assistor spring anchor bracket from the pedal box side (3 bolts).

5. Remove the two bolts securing the clutch master cylinder assembly to the pedal box and support the cylinder aside.

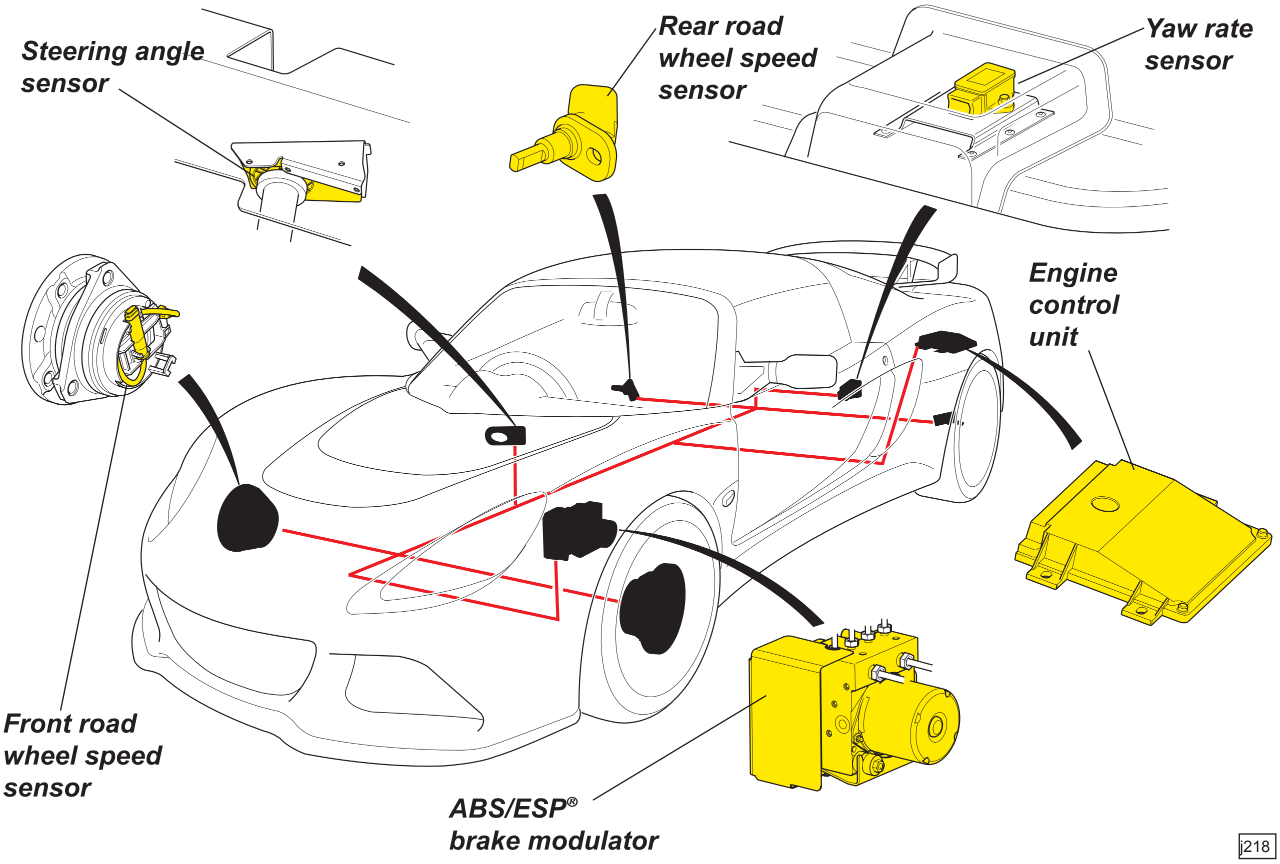
6. Remove the 4 remaining fixings securing the pedal shaft bracket to the pedal box, and manoeuvre the pedal assembly from the car.

7. Release the three Torx head screws securing the pedal shaft and withdraw the shaft and pedals

8. Refit the pedals in reverse order to removal, noting that the pivot bushes of the brake and clutch pedals should be lubricated with Syntheso GLK1 or equivalent.

Torque Settings		**Nm**
Brake servo to alloy spacer		25
Pedal shaft bracket to pedal box		16
Throttle pedal mounting bracket to pedal box	- M6	16
	- M8	25

JM.10 - ABS/ESP BRAKING SYSTEM



Overview

The Bosch 8.1 ABS/ESP® brake system modulator fitted to the Exige S is an integral component to both the braking and engine management control systems. The ABS/ESP® modulator consists of a single electro-hydraulic unit, hydraulic modulator, hydraulic pump, microprocessor and solenoid valve bank. The complete assembly is flexibly mounted via three rubber isolator bushes to a steel cradle, which is itself mounted on three rubber bobbins to the passenger side front chassis and upper damper mounting bracket. The modulator is plumbed into the front and rear brake circuit lines from the tandem master cylinder.

The module is equipped with software providing:

Anti-lock Braking System (ABS)
Hydraulic Brake Assist (HBA)
Traction Control System (TCS)
Electronic Stability Program (ESP)
Electronic Brake Distribution (EBD)
Electronic Differential Lock (EDL)
Corner Brake Control (CBC)
Drag Torque Control (DTC)

The collective name for this functionality is '**Lotus Dynamic Performance Management**' (Lotus DPM).

These systems utilise input information from the Yaw Rate Sensor, Steering Angle Sensor (SAS), Wheel Speed Sensors (WSS) and Engine Control Unit (ECU) to determine if any excessive degree of wheelspin is occurring or if the vehicles stability is at risk activating the anti-lock braking system (ABS) to apply a measured braking force to individual wheels as necessary or reduce or increase engine torque in order to help the driver maintain control of the vehicle.

The ABS/ESP® module receives signals from the wheel speed sensors, and interprets the individual wheel acceleration, deceleration, and comparative wheel speeds. From this data, the processor is able to determine if any wheel is tending to lock up, and if imminent lock up is sensed, the unit commands the relevant solenoid valves firstly to reduce pressure in that particular brake circuit in order to restore wheel speed, and then to modulate pressure to that providing the maximum braking force consistent with continued wheel rotation. The system is able to monitor and independently control each of the four wheel brakes, and is referred to a 4-channel system.

In order to achieve the required pressure modulation, three basic modes are used:
- Pressure hold;
- Pressure reduction;
- Pressure increase;

In order to maintain the safety provision of two entirely independent hydraulic circuits, one for the front brakes, and one for the rear, the hydraulic elements of the control unit are doubled up, with no part of the system shared between the two circuits.

Functionality of ABS/ESP® software (also referred to as Lotus Dynamic Performance Management)

Anti-Lock Braking (ABS)
Maximum braking force is provided from a tyre when there is around 15% slippage, dependent on road surface conditions and tyre characteristics. The function of the ABS is to limit tyre slippage when braking to around this figure in order to provide optimum grip, and also, by preventing wheel lock, to ensure that steering control of the vehicle is retained.

ABS Tell Tale
The ABS tell tale warns the driver of problems in the anti-lock system. The lamp should light for about 3 seconds following ignition switch on, and then go out. If the lamp remains lit, or comes on whilst driving, a fault in the ABS is indicated. The base brake system will continue to operate normally, but without ABS regulation. The car can be driven but should be checked and repaired at the earliest opportunity.

Hydraulic Brake Assist (HBA)
Hydraulic Brake Assist detects an emergency situation by the driver's determination to rapidly stop the vehicle by measuring the gradient of brake pressure build-up. In case of insufficient brake pressure the (HBA) system increases pressure up to ABS activation threshold to ensure the shortest stopping distance possible. These features enhance vehicle stability in extreme manoeuvres typified by accident avoidance attempts or misjudged cornering demands. Current vehicle behaviour is constantly monitored, and compared with a determination of the driver intent as indicated by data gathered from the driving controls.

Traction Control System (TCS)
To prevent a wheel spin when starting off or accelerating, particularly on a slippery or wet road surface, the drive torque at each driven wheel is monitored and reduced correspondingly when necessary to improve the traction of the vehicle. TCS supplements the ABS function. If one of the driven wheels begins to spin, TCS is activated. The traction control system reduces the drive torque supplied by the engine and, if necessary, brakes individual wheels in order to regulate the slip of the driven wheels as quickly as possible to the optimum level.

Electronic Stability Program (ESP®)
The ABS/ESP module monitors the signals from the Yaw Rate and the Steering Angle Sensor sensors and checks 25 times a second, whether the driver's steering input corresponds to the actual direction in which the vehicle is moving. If the vehicle moves in a different direction the ESP® detects the critical situation and reacts immediately – independently of the driver. It uses the vehicle's braking system to "steer" the vehicle back on track. With these selective braking interventions ESP® generates the desired counteracting force, so that the car reacts as the driver intends. ESP® initiates braking intervention, but can also intervene on the engine side to accelerate the driven wheels.

Electronic Brake Distribution (EBD)
This feature addresses the instability that could be caused under heavy braking due to the tendency of the lightly loaded rear wheels to lock prematurely. Electronic Brake Distribution is incorporated into the ABS to limit the rear brake system hydraulic pressure prior to any anti-lock intervention.

Electronic Differential Lock (EDL)
If hard acceleration is demanded in conditions of variable surface grip, or when cornering forces result in a lightly loaded inside rear wheel, there will be a tendency
for drive torque to overcome the grip available, resulting in spinning of the lightly loaded wheel. When this situation is detected by the ABS controller, brake pressure is applied to the spinning wheel in order to transfer drive torque to the opposite wheel, thus maintaining drive and aiding vehicle stability.

Corner Brake Control (CBC)
If the driver applies the brake whilst performing a heavy cornering manoeuvre, there is a possibility that the vehicle may oversteer. Corner Brake Control (CBC) reduces the brake pressure to the inside rear brake calliper in an attempt to maintain vehicle stability.

Drag Torque Control (DTC)
The braking effect of the engine can cause the driven wheels to skid as they temporarily lose traction. This can be caused by the driven wheels locking on slippery surfaces during sudden/rapid deceleration which can be caused by the quick release of the accelerator pedal or fast down shifting through the gears.

Drag Torque Control (DTC) system attempts where possible to maintain directional stability. The ABS/ESP® control module receives information from the rear wheel-speed sensors as well as the Engine Control Unit (ECU) via the CAN data bus. If wheel slip is detected under these circumstances, it sends a signal to the ECU to increase engine torque, until the driven wheels are turning at a rate appropriate to the vehicles speed.

Driver indication of Lotus Dynamic Performance Management (Lotus DPM) intervention

Whilst driving the amber Lotus DPM tell tale  may flicker, this indicates that the Lotus DPM has been triggered and electronic intervention is taking place because the vehicles tractive limit has been reached and the driving style should be modified accordingly.

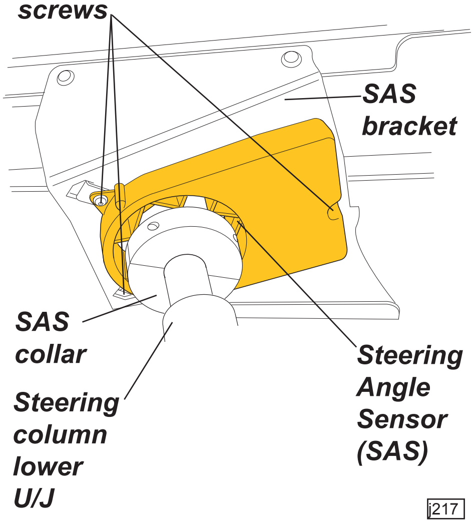
If however the warning lamp illuminates constantly, a fault has been detected, and although the mechanical/ hydraulic braking system should not be affected the Lotus DPM will be disabled and the fault should be identified and rectified immediately.

Lotus DPM 'Off'
This tell tale will glow amber if the (Lotus DPM) has been manually switched off.

Refer to service notes section MV.4. for further information.

ABS/ESP Components

Steering Angle Sensor (SAS)
The Lotus DPM system requires information on the overall steering wheel angle. This is measured by the steering angle sensor .



The sensor assembly consists of a housing with a built in circular switch/ drive which is free to rotate within the housing, The drive has an aperture allowing the lower steering column assembly to pass through it. A two piece collar is clamped around the intermediate column shaft. The internal aperture of the switch drive has 2 machined reccesses, external pins fitted to the collar fit into these recesses allowing the switch drive to rotate with the steering column.

The steering angle sensor is attached to an angled bracket via 3 fixings and the whole assembly is fixed behind the dash cross beam with rivets. An electrical connector on the back of the unit connects the unit to the vehicle main harness so that output signals can be sent to the ABS and engine management ECM's.

When the inner steering column rotates the sensor, information on the driver's steering input and direction is fed back to the ECM's of the ABS module and Engine Management System.

The information received from the sensor is compared to signals sent from the yaw rate and wheel speed sensors to determine if the steering intent of the driver matches that of the actual course and direction of the vehicle. If the Lotus DPM system considers the vehicles stability is at risk, the ABS module will apply a measured braking force to individual wheels and/or the Engine Management Controller will reduce vehicle torque as necessary in order to help the driver maintain control of the vehicle.

Removal:
1.Remove the upper steering column assembly and intermediate shaft (see sub-section HK.3).

2.From inside the drivers footwell remove the 3 x panhead screws securing steering angle sensor to the mounting bracket.

3.Disconnect main harness multi-plug from sensor and withdraw sensor.

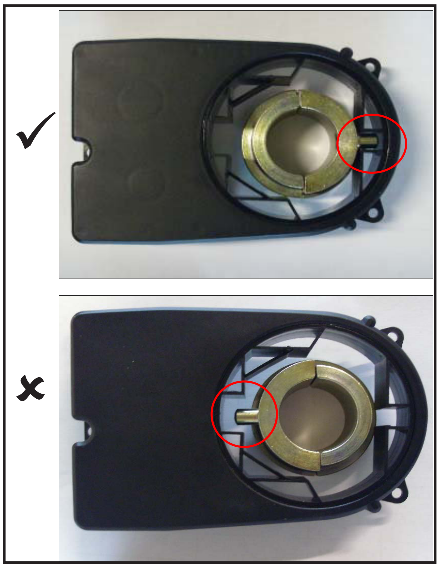
Refitment:
Is the reverse of removal except:
Ensure that the steering angle sensor collar peg is located within the narrow slot of the sensor switch.

Once the steering column is refitted it is essential to recalibrate the steering angle sensor using Lotus Techcentre.

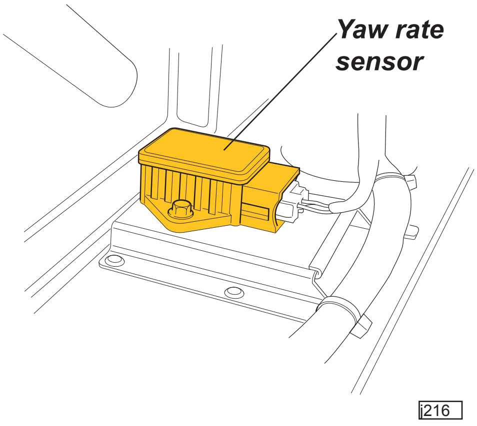
Once the correct vehicle by model type, year and market has been identified, select ABS >Guided Routines > Steering Angle Sensor Calibration.

Failure to calibrate the sensor could result in impaired Traction Control/Dynamic Performance Management funtionality and will illuminate the tell-tale light.

Orientation of steering column peg and steering angle sensor



Yaw rate sensor
The yaw rate sensor measures the rotation of the vehicle around its vertical axis. The data from the sensor is compared to data from the Steering Angle Sensor (SAS) to determine if intervention from the ABS/ESP module is required to apply a braking force as well as the vehicles Engine Control Unit (ECU) is to adjust engine torque to assist understeer and oversteer control.



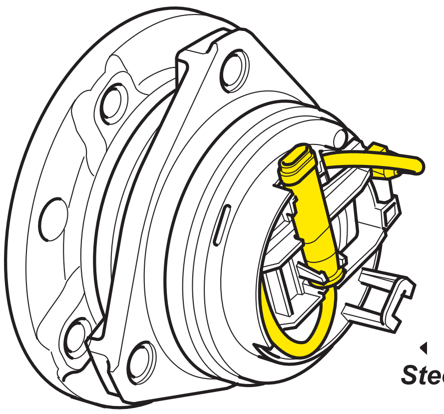
Located behind the rear bulkhead trim the sensor is mounted to the bulkhead floor on a bracket and is retained with M6 x 20 bolts (2) and M6 nyloc nuts (2) (torque 9Nm).

The sensor is connected to the vehicles main harness to provide information to both the ABS/ESP module and Engine Control Unit (ECU).

Removal:
1. Remove rear bulkhead panel trim – see service notes section BT.X.
2. Release nuts and bolts retaining sensor to its bulkhead bracket.
3. Disconnect main harness multi-plug from sensor and withdraw sensor.

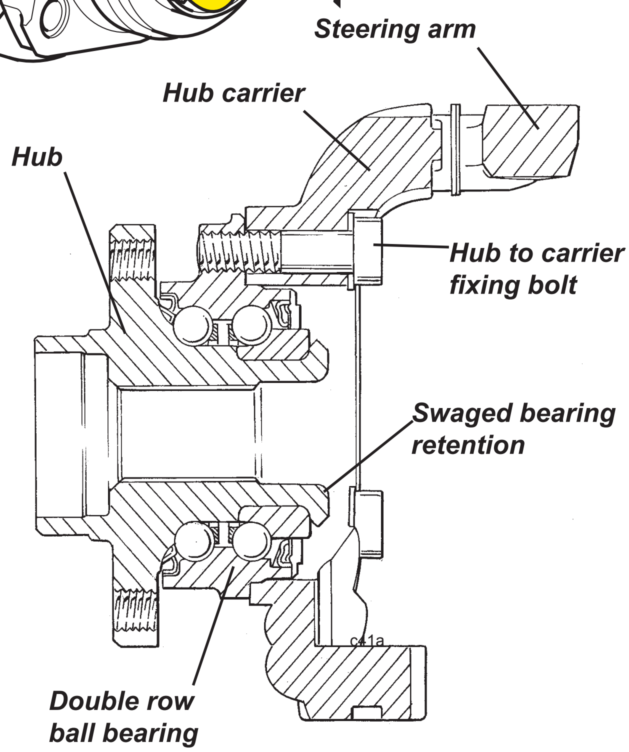
Refitment:
Is the reverse procedure of removal.

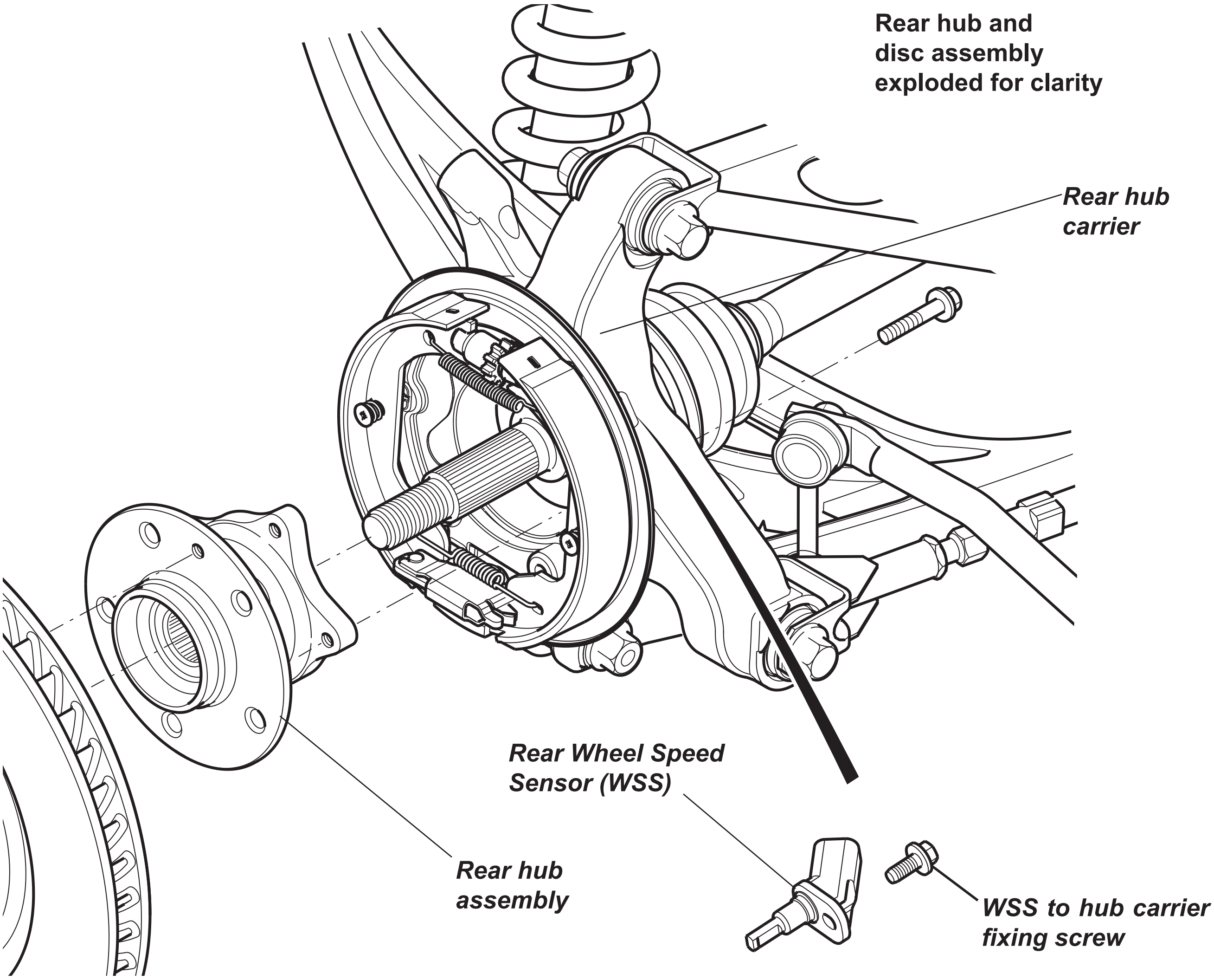
Front Wheel Speed Sensor (WSS)
Both front hub assemblies are common and incorporate a Wheel Speed Sensor (WSS) in the bearing unit, with a flying lead terminating in an electrical connector plug secured by a camber shim plate bracket.



If there is found to be any discernible free play in the hub bearing, roughness or tight spots can be felt or a fault within the WSS, or any signs of lubricant expulsion are evident, the hub assembly should be replaced - there is no provision for adjustment.

Removal:
See Service Notes section CJ.8. for removal procedure.



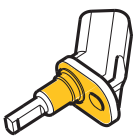


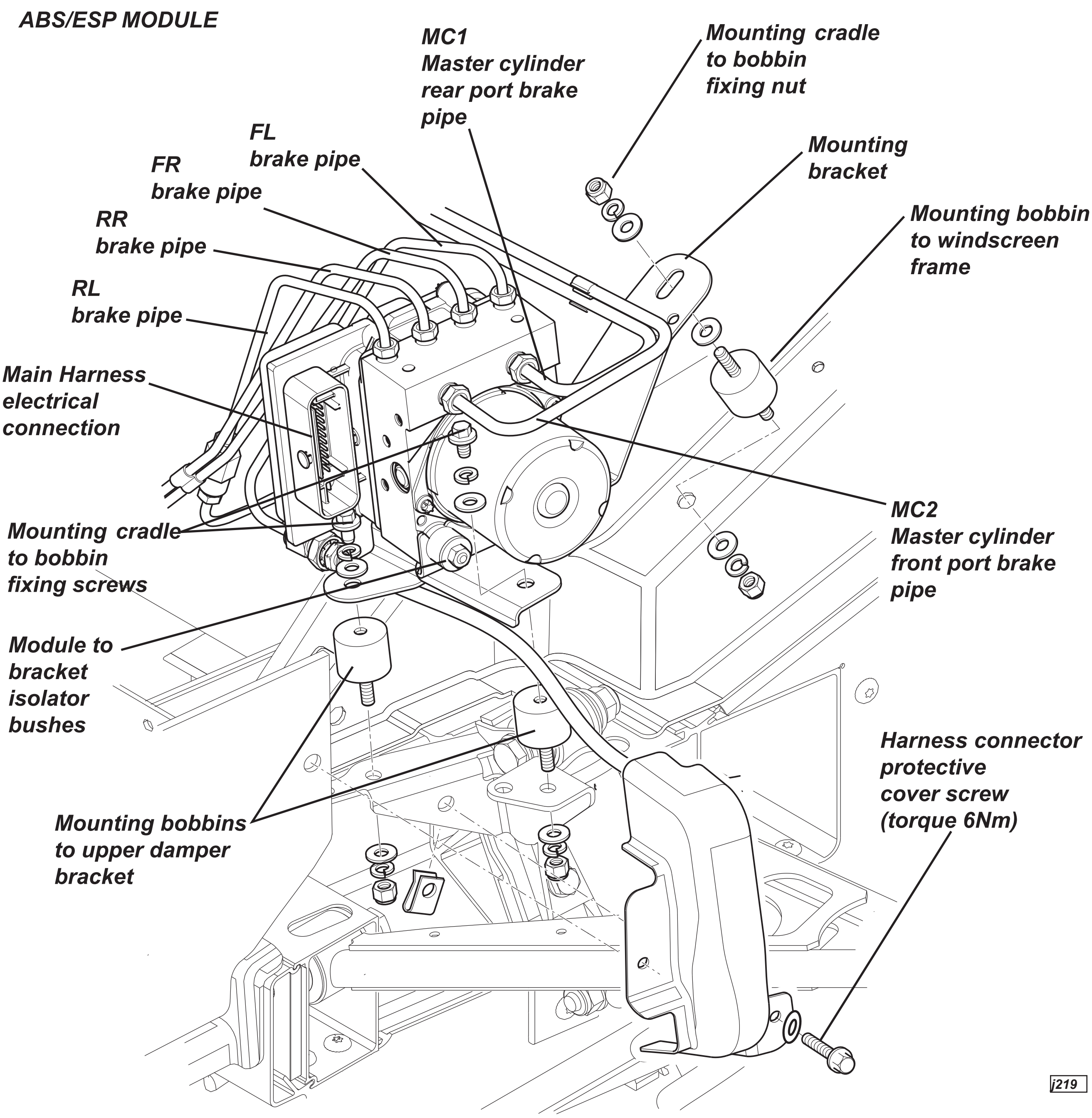
Rear Wheel Speed Sensor
A 48 pole vehicle speed sensor ring is integrated into the hub inboard grease seal, the signal from which is read by a sensor inserted into the rear of the hub carrier and retained by a single button head socket screw. Wheel speed data is supplied to the ABS/ESP control module, which uses the information to modulate brake system pressures, and also outputs a road speed signal to the engine ECU and to the instrument pack for speedometer operation.

Removal:
Release the single M5 x 12 screw securing the wheel speed sensor, and withdraw the sensor from the hub carrier.

Refitment:
Reverse procedure of renewal except:

- Apply a light coating of Mobiltemp 1 high temperature grease to the wheel speed sensor as shown in yellow in the left hand illustration and tighten screw to 5Nm.





ABS/ESP Module

The electro-hydraulic ABS/ESP unit is fitted onto a mounting bracket located at the left side front of the services compartment.

It is initially positioned in place onto the support bracket by an integral locating pin fitted to the lower housing of the unit which slides into a grommet located at the base of the bracket.

The unit is then positively fixed by 2 threaded pins fitted within isolator bushes which are screwed to the side of the ABS housing; the isolator bushes then slot into recesses located to the side of the bracket and retained by 2 M6 nyloc nuts (torque 9Nm).

The mounting bracket itself is fixed to the front suspension damper top mounting bracket and windscreen frame buttress via another three rubber bobbins. An electrical connector plug is provided with a sliding retainer to aid its mating with the vehicle harness. The connector is protected from water ingress by an ABS cover which is retained by an M6 screw to the upper damper mounting bracket

CAUTION: Do not disconnect or connect the main connector plug with the ignition switched on. Switch off the ignition and disconnect the main connector plug before carrying out any electrical welding operations on the car.

Hydraulic pipe connections to the unit comprise two input pipes from the master cylinder (one for the front circuit, one for the rear) and four output pipes, one for each of the wheel brakes. Note that all hydraulic connections are identified by engraved markings on the unit:

Output:	*Input:*
FL Front left	MC1 From master cylinder rear port (front brake circuit)
FR Front right	MC2 From master cylinder front port (rear brake circuit)
RR Rear right	
RL Rear left	

Removal:
Note: When removing the unit, beware of dripping brake fluid and take appropriate precautions to prevent damage to paintwork.

1.Remove the front clamshell and ABS module connector cover – see Service Notes section BT.6.

2.Switch off the ignition before drawing out the retainer slide from the connector plug to release the harness from the unit.

3.Label each of the hydraulic pipes before disconnecting (torque 16Nm) from the unit and immediately capping the pipes and plugging the ports to reduce the spillage of brake fluid, and to prevent the ingress of dirt.

4.Release the M6 x 10 setscrew (2) securing the controller mounting bracket to the damper bracket and M6 nyloc nut (1) to the windscreen frame buttress (all fixings torqued to 9Nm), and withdraw the unit and mounting cradle.

5.To remove the unit from the cradle, unscrew the two socket head pins supporting the sides of the unit, and withdraw the unit from the third grommet at the end of the motor casing

Refitment;
- Reverse the removal procedure, taking care to connect the brake pipes correctly.
  Carepoint - ABS module harness connector M6 screw torqued to 6Nm only

- Bleed the unit of air (see sub-section JM.3).

- Verify correct connection by using the 'Lotus Techcentre' tool in actuator tests with the car on a wheel free lift. Check that operation of each solenoid valve affects the appropriate wheel.

Module renewal:
To ensure the best possible brake bleeding operation using the generic bleed/fill equipment normally available within a vehicle workshop, service replacement ABS modules are supplied 'Wet filled' i.e. pre-filled with brake fluid,

At the time of publication, a single 'Wet filled' service replacement part number has been made available for all Elise, Exige and Evora models equipped with the Bosch 8.1 ABS/ESP module (See Service Parts List section 33.03 for part number details).

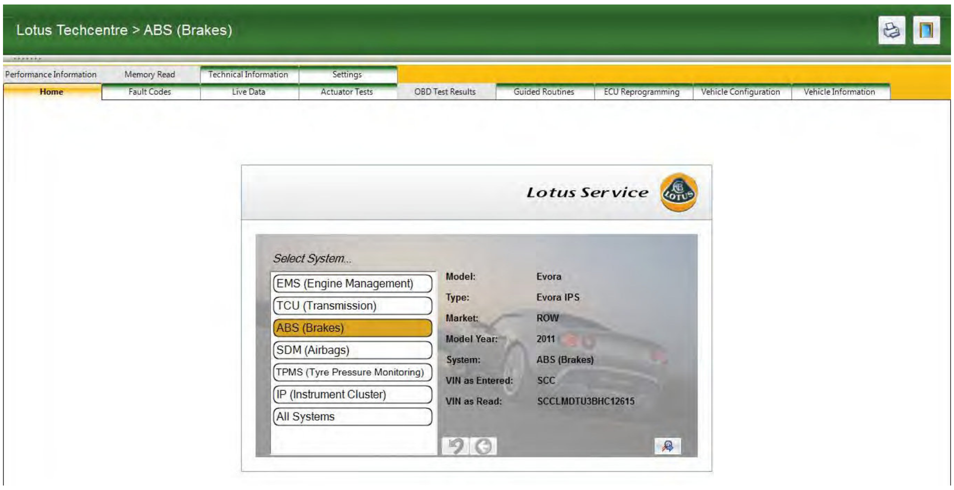
Before carrying out the brake bleed procedure shown in JM.3, it will be necessary to connect the vehicle to the Lotus TechCentre and follow the ABS (Brakes) ECU programming routine to install the correct ABS module firmware relevant to the vehicle.

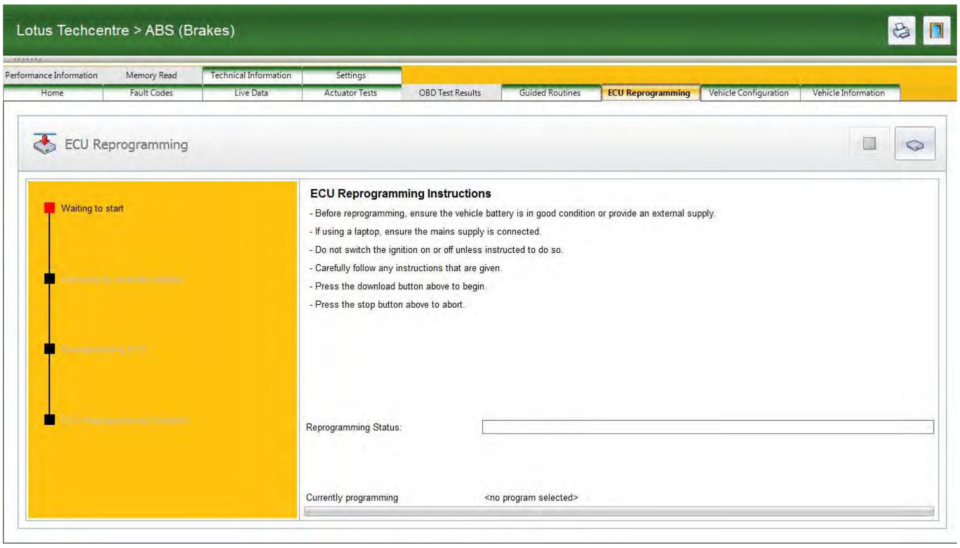
Please see the following pages displaying screen shots from Lotus TechCentre for installation of firmware into a Bosch ABS module.

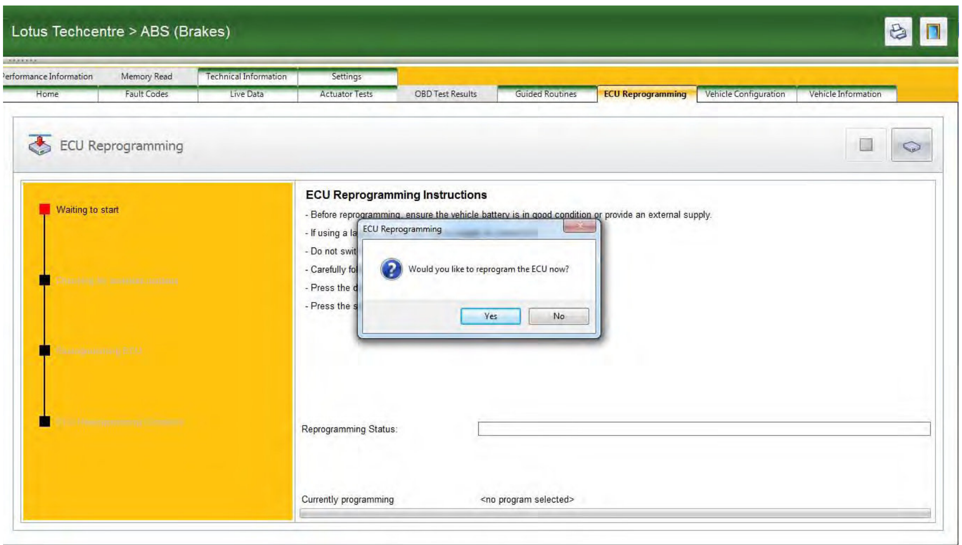
Lotus Techcentre screen shot of ABS Brakes Guided Routines

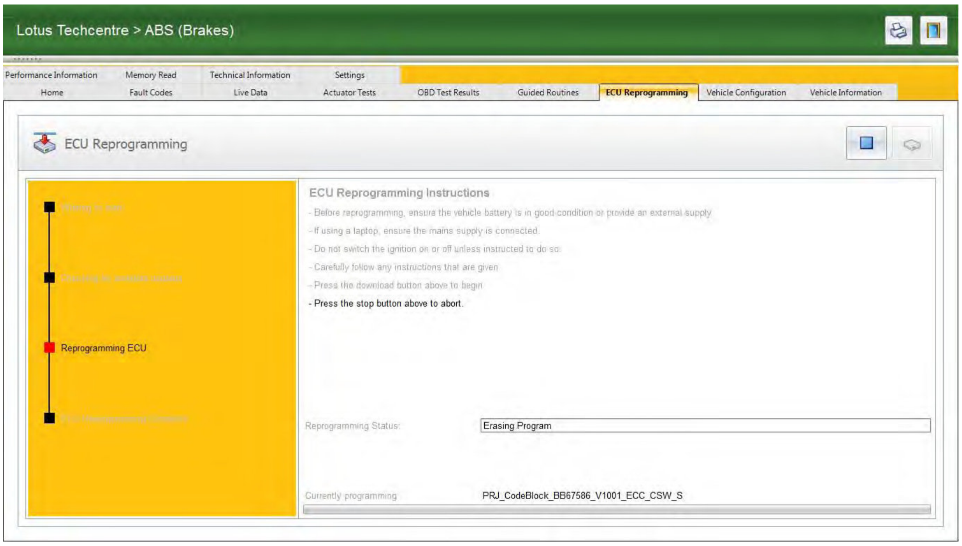
For further information see the ‘Lotus TechCentre User Guide’, which can be downloaded from the Lotus Dealer Portal at: **http://dealers.lotuscars.com** - and from the homepage go to: Aftersales>TechCentre.

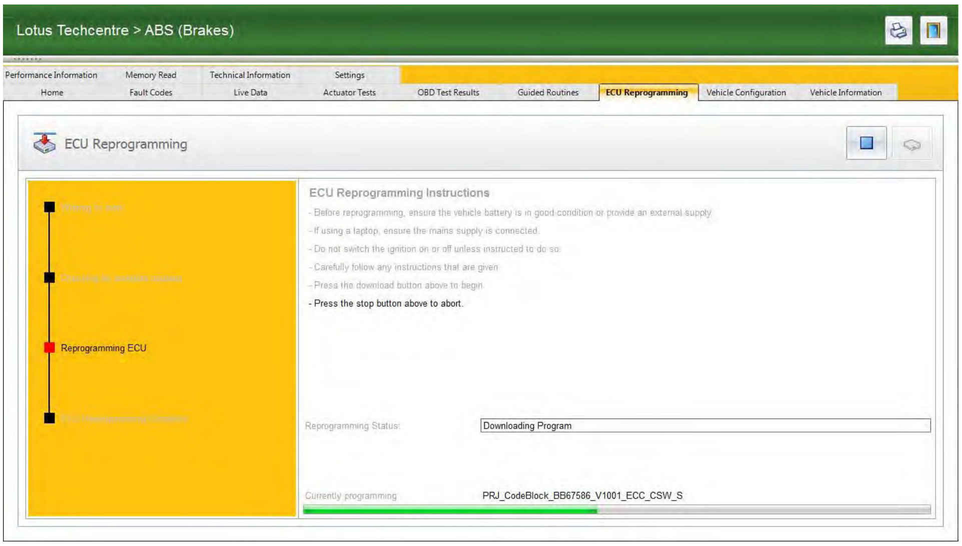
See subsection JM.11 for information on Lotus Techcentre.








Lotus Techcentre > ABS (Brakes)
Performance Information
Memory Read
Technical Information
Settings
Home
Fault Codes
Live Data
Actuator Tests
OBD Test Results
Guided Routines
ECU Reprogramming
Vehicle Configuration
Vehicle Information
ECU Reprogramming
Reprogramming ECU
ECU Reprogramming Instructions
- Before reprogramming, ensure the vehicle battery is in good condition or provide an external supply
- If using a laptop, ensure the mains supply is connected.
- Do not switch the ignition on or off unless instructed to do so.
- Carefully follow any instructions that are given
- Press the download button above to begin
- Press the stop button above to abort.
Reprogramming Status:
Erasing Program
Currently programming
PRJ_CodeBlock_BB67586_V1001_ECC_CSW_S


Lotus Techcentre > ABS (Brakes)
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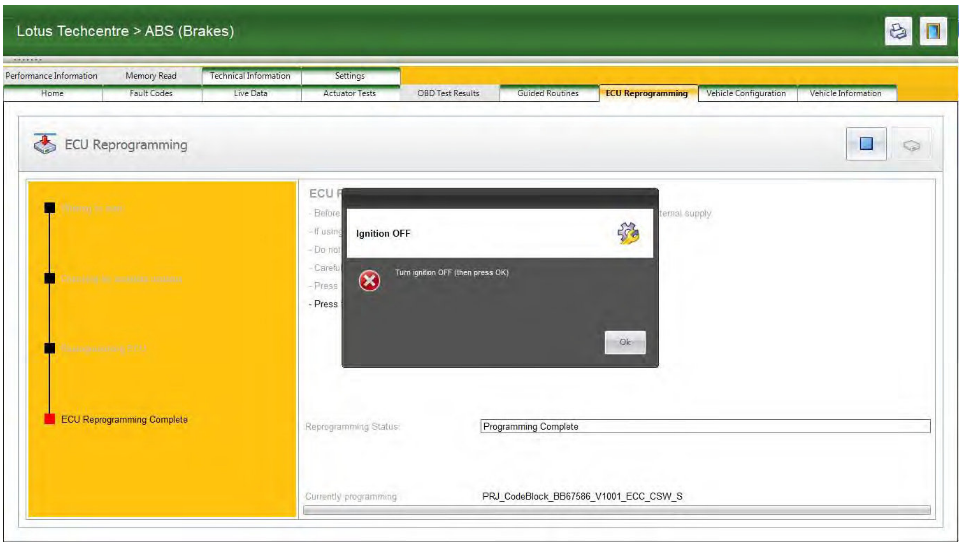
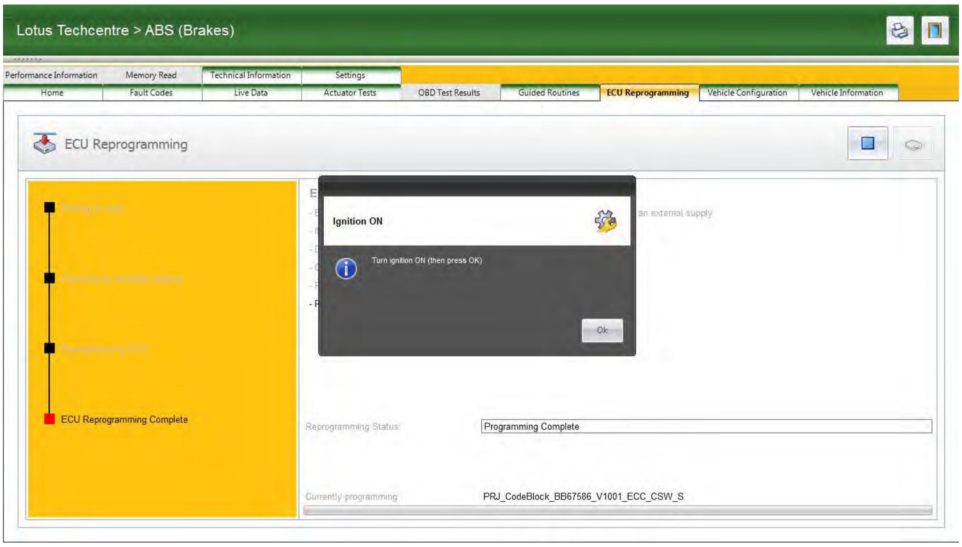
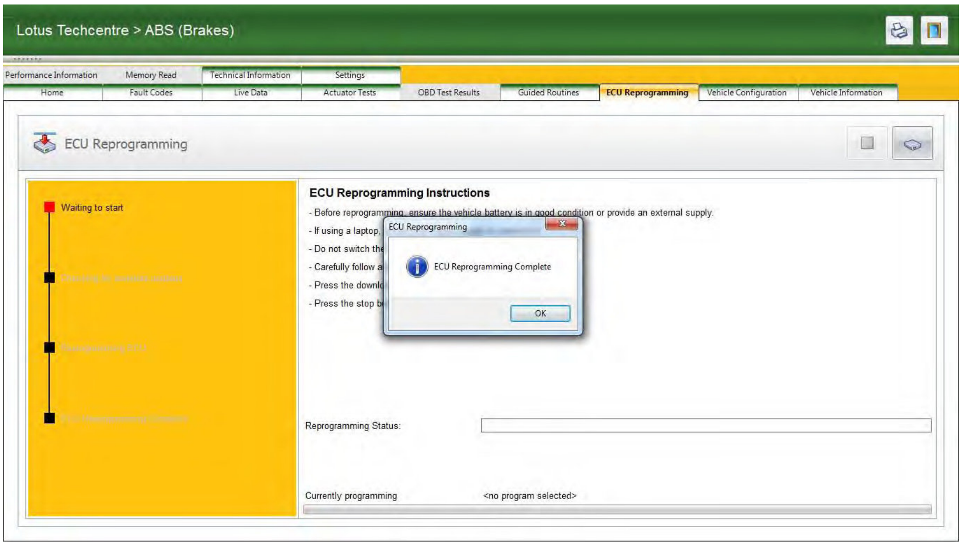
- Do not switch the ignition on or off unless instructed to do so.
- Carefully follow any instructions that are given
- Press the download button above to begin
- Press the stop button above to abort.
Reprogramming Status:
Downloading Program
Currently programming
PRJ_CodeBlock_BB67586_V1001_ECC_CSW_S

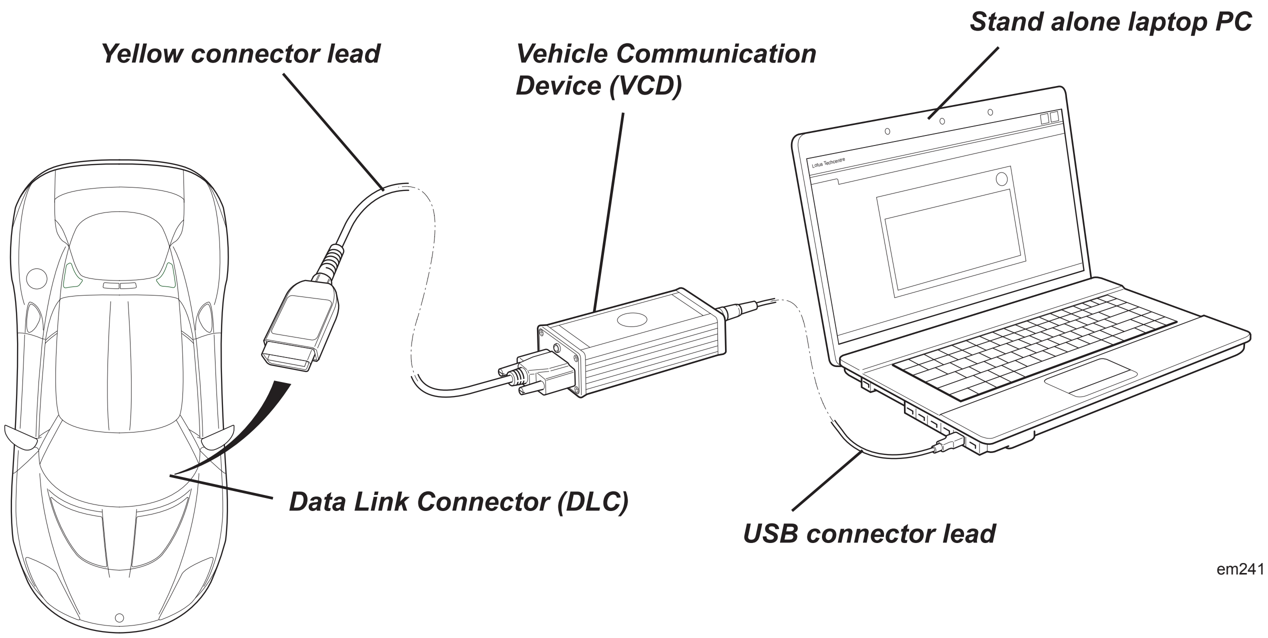

Lotus Techcentre > ABS (Brakes)
Performance Information
Memory Read
Technical Information
Settings
Home
Fault Codes
Live Data
Actuator Tests
OBD Test Results
Guided Routines
ECU Reprogramming
Vehicle Configuration
Vehicle Information
ECU Reprogramming
ECU Reprogramming Complete
Ignition OFF
Turn ignition OFF (then press OK)
Ok
Reprogramming Status:
Programming Complete
Currently programming
PRJ_CodeBlock_BB67586_V1001_ECC_CSW_S


Lotus Techcentre > ABS (Brakes)
Performance Information
Memory Read
Technical Information
Settings
Home
Fault Codes
Live Data
Actuator Tests
OBD Test Results
Guided Routines
ECU Reprogramming
Vehicle Configuration
Vehicle Information
ECU Reprogramming
Ignition ON
Turn ignition ON (then press OK)
Ok
ECU Reprogramming Complete
Reprogramming Status:
Programming Complete
Currently programming
PRJ_CodeBlock_BB67586_V1001_ECC_CSW_S


Lotus Techcentre > ABS (Brakes)
Performance Information
Memory Read
Technical Information
Settings
Home
Fault Codes
Live Data
Actuator Tests
OBD Test Results
Guided Routines
ECU Reprogramming
Vehicle Configuration
Vehicle Information
ECU Reprogramming
Waiting to start
ECU Reprogramming Instructions
- Before reprogramming, ensure the vehicle battery is in good condition or provide an external supply.
- If using a laptop,
- Do not switch the
- Carefully follow a
- Press the downlo
- Press the stop b
ECU Reprogramming
ECU Reprogramming Complete
OK
Reprogramming Status:
Currently programming
<no program selected>

JM.11 - ABS/ESP BRAKING SYSTEM CONNECTION TO LOTUS TECHCENTRE

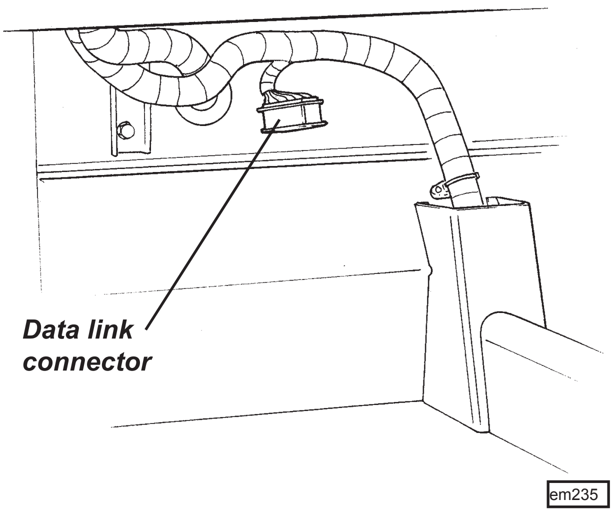
Lotus Techcentre connection to vehicle



Data Link Connector (DLC)
The Data Link Connector (DLC) is a 16 terminal electrical connector plug, complying with SAE J 1962, which provides a means of communication with the ABS and engine management electronic control units.

The connector is used in service to connect electronic diagnostic equipment such as the 'Lotus TechCentre' tool which allows system interrogation including the reading of trouble codes.

The DLC is located on the back of the scuttle crossbeam above the outboard side of the driver's footwell.



CAN BUS Diagnostics
Controller Area Network (CAN) is an electronic standard to allow high speed communication between modules and controllers, via a serial data bus. The bus is a circuit linking the modules to the controller, consisting of a pair of cables, twisted together to reduce electromagnetic interference, and carrying a square wave voltage signal corresponding to '0's and '1's, coded in such a way as to identify and prioritise the individual messages. On the Evora, CAN based systems include; engine management, anti-lock braking and related features, tyre pressure monitoring, instrument pack, and onboard diagnostics.

A 'stand alone' lap top PC installed with 'Lotus TechCentre' software allows the CAN based serial data to be read. A Vehicle Communication Device (T000T1472F) is used to connect the vehicle to the laptop Lotus TechCentre.

Engine programming, live data display and systems diagnosis are all carried out via the Lotus TechCentre.

The minimum specification of the laptop computer for installation of the Lotus TechCentre is as follows:

Processer 1.70 Ghz;
1 GB RAM;
40 GB HDD;
CDRW DVD ROM;
WIN XP PRO or VISTA;
USB interface;
Ethernet or Wireless LAN

Note that this laptop should be dedicated soley to the Lotus TechCentre, with no other software installed. This diagnostic software is designed primarily for use by trained Lotus technicians, and is available as a CD under part number T000T1510F (version 4) or later supercessions. A monthly (Lotus Dealers) or annual (non-Lotus dealers) licence and support fee will also be levied, providing access to Lotus TechCentre Technical Support phoneline on ***0870 9493 668***, and e-mail on ***lotus.support.uk@omitec.com***

Also required is a unique 18 character licence/registration key without which TechCentre will not function. This key is non transferable to other PC's.

TechCentre Connection
Connection to the car is made via the Vehicle Communication Device (VCD) and the Data Link Connector (DLC).

Power for the VCD is taken from the vehicle battery via the DLC and when powered a blue tell tale on the unit will light. Should updated firmware be available for the VCD (usually downloaded as part of an online update)

TechCentre will automatically update the VCD and display a message to confirm.

The VCD, under part number T000T1472F is supplied in a black plastic carry case containing the following:
VCD
USB lead (VCD to PC)
USB extension lead (VCD to PC) not illustrated

Please Note:16 Pin Yellow connector lead (VCD to Vehicle) T000T1497F is not supplied and will need to be purchased seperately.

Use of TechCentre
Instructions for using the TechCentre are available in the 'Technical Information' section displayed on programme start up.

ABS/ESP Trouble Codes

When the ABS/ESP controller detects a fault in the system, the following events occur;
i) The ABS or ESP tell tale is lit;
ii) The anti-lock system is switched out;
iii) A trouble code is stored in the non volatile random access memory i.e. memory which is retained when the power supply is interrupted, or the battery disconnected.

Trouble codes may be either Condition Latched, or Ignition Latched:

Condition Latched; With this type of fault, which is generally low or high voltage, the ABS or ESP tell tale will light, and the anti-lock or ESP systems switch out, until such time as conditions return to normal, at which point the light will be extinguished, and the anti-lock or ESP system be reinstated. The trouble code will be stored only whilst the fault is present.

Ignition Latched; This type of fault, of which are most categories, will cause the tell tale to be lit and the anti-lock or ESP system to be inhibited until such time as the fault is no longer detected at the moment of a subsequent switching on of the ignition. At this point, the lamp will be extinguished, and the systems restored, but the trouble code will be retained in the memory for the next 20 drive cycles i.e. ignition switched on and a minimum road speed of 5 mph attained.

Access to diagnostic codes is available by using the Lotus TechCentre laptop PC connected to the Diagnostic Link Connector (DLC). This allows the display of any stored trouble codes and sensor readings as well as allowing manual operation of actuators. The facilities available include:

- Viewing fault codes/wheel speeds/valve activities.
- Clearing fault codes.
- Generating valve/motor activities.
- Reading EEPROM contents.
- Reading ECM identification.
- Updating ECM calibration.

Important Notes
- Whenever the Lotus TechCentre tool is connected, the ABS tell tale is lit and the anti-lock function is inoperative.
- Never connect or disconnect the DLC to/from diagnostic equipment with the ignition switched on.
- Unless using a trickle 'battery conditioner' type charger, disconnect the vehicle battery before charging or boost charging.
- Never disconnect the battery from the vehicle electrical system with the engine running.
- Never use a quick-charger for starting.
- Take care when touching energised parts of the ignition system.
- ECMs must be removed prior to welding operations, or subjecting to oven temperatures above 80°C.
- When voltage testing, use only a high-resistance type meter.
- During test steps which involve the connection of contacts from harness plugs or control units with ground or battery voltage (+12V), exercise great care as incorrect contact can cause permanent damage to the ECM internal circuits.
- When measuring resistance from ground bearing wires to vehicle ground, the nominal value of ‘less than 2 ohms’ sometimes cannot be achieved. In this case, disconnect the negative (ground) post of the battery and measure the resistance to the vehicle earth lead.
- Always erase trouble codes from any control unit after a test is done.

Abbreviations & Definitions

BATTERY VOLTAGE	System voltage
BRAKE LIGHT SW.	Brake light switch
FL WHEEL SPEED	Front left wheel speed
FR WHEEL SPEED	Front right wheel speed
RL WHEEL SPEED	Rear right wheel speed
RR WHEEL SPEED	Rear right wheel speed
FRONT WHL SPEEDS	Front wheel speed
REAR WHL SPEEDS	Rear wheel speed
VALVE RELAY CMD	Valve relay command
VAVLE RELAY FDBK	Valve relay feedback
RETURN PUMP CMD	Return pump command
RETURN PUMP FDBK	Return pump feedback
FL HOLD SOL. CMD	Front left solenoid hold command
FL HOLD SOL. FDBK	Front left solenoid hold feedback
FL REL. SOL. CMD	Front left solenoid release command
FL REL. SOL. FDBK	Front left solenoid release feedback
FR HOLD SOL. CMD	Front right solenoid hold command
FR HOLD SOL. FDBK	Front right solenoid hold feedback
FR REL. SOL. CMD	Front right solenoid release command
FR REL. SOL. FDBK	Front right solenoid release feedback

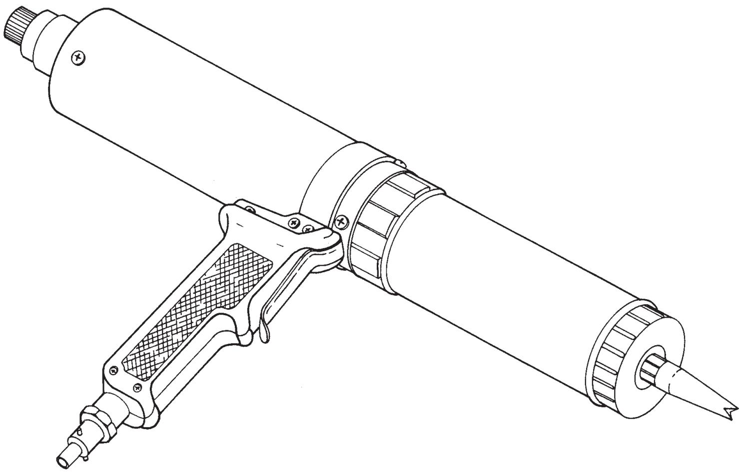
RL HOLD SOL. CMD	Rear left solenoid hold command
RL HOLD SOL. FDBK	Rear left solenoid hold feedback
RL REL. SOL. CMD	Rear left solenoid release command
RL REL. SOL. FDBK	Rear left solenoid release feedback
RR HOLD SOL. CMD	Rear right solenoid hold command
RR HOLD SOL. FDBK	Rear right solenoid hold feedback
RR REL. SOL. CMD	Rear right solenoid release command
RR REL. SOL. FDBK	Rear right solenoid release feedback

Diagnostic Trouble Codes

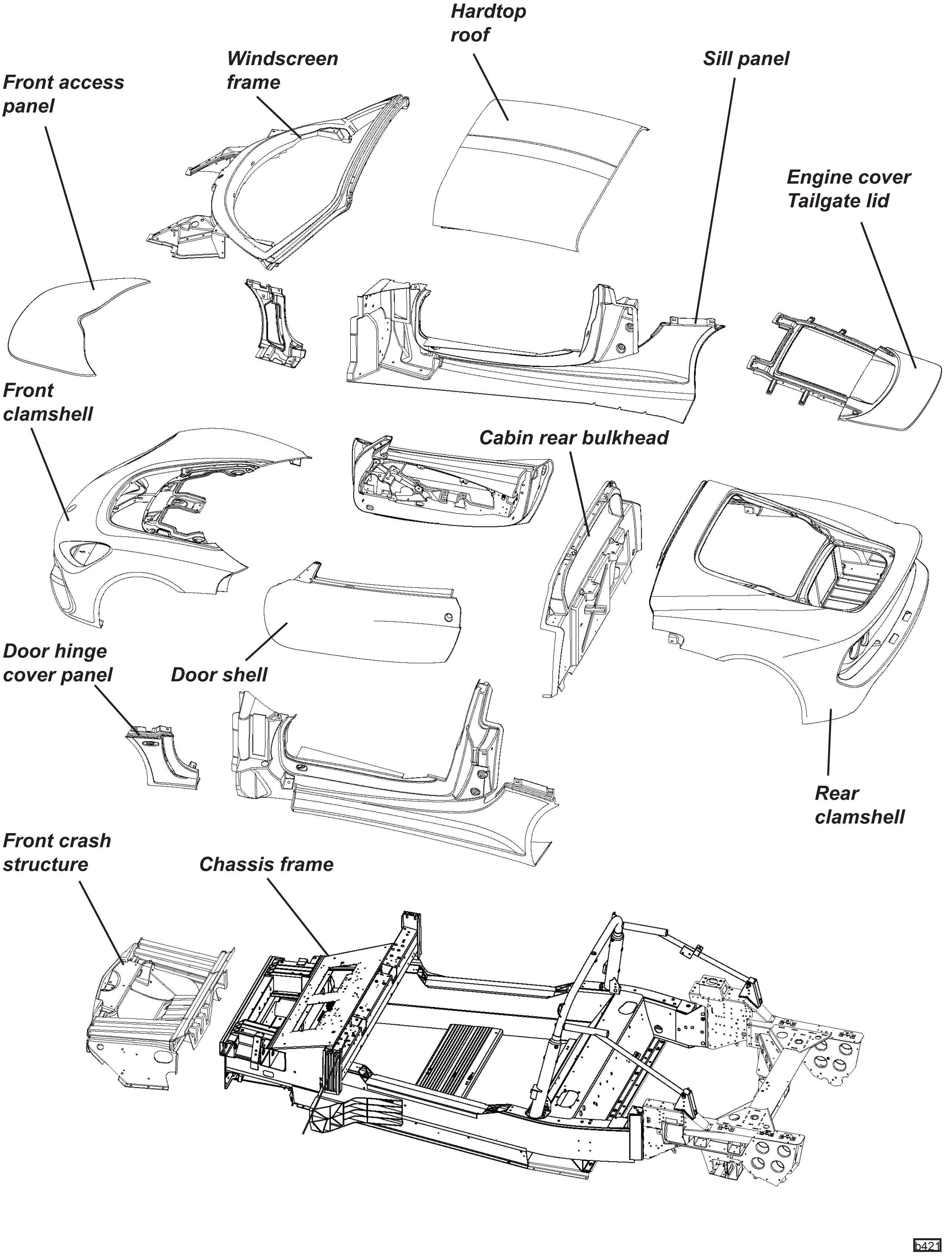
DTC	***Diagnostic Trouble Code Storage Condition***
C0200	Wheel Speed Sensor line failure front right
C0201	Wheel Speed Sensor failure front right
C0205	Wheel Speed Sensor line failure front left
C0206	Wheel Speed Sensor failure front left
C0210	Wheel Speed Sensor line failure rear right
C0211	Wheel Speed Sensor failure rear right
C0215	Wheel Speed Sensor line failure rear left
C0216	Wheel Speed Sensor failure rear left
C0222	Wheel Speed monitoring
C0250	Valve deactivation due to overheat protection at EOL
C0256	ABS valve failure
C0266	Reflow pump failure
C0276	Valve relay
C0281	Brake-fluid level
C0286	Cut Valve
C0296	Suction Valve
C0340	Brake light switch
C0431	Sensor cluster failure (yaw-rate or lateral acceleration)
C0440	SAS Steering Angle Sensor fault
C0443	SAS not calibrated
C0460	Pressure sensor failure (See information on brake light switch adjustment)
C0607	Internal ECU failure
C0802	ECU voltage failure
C0E03	Emergency braking, VDC Control
C0E07	ECU ASW error
C1281	Failure variant coding
U0101	CAN Bus failure: no sending on CAN possible
U0111	CAN Bus failure: CAN-BUS off
U0150	Absent CAN-Message EMS
U0151	Absent CAN-Message TCU (only for automatic gearbox)
U0153	Absent CAN-Message SAS
U0160	Absent CAN-Message Sensor cluster (yaw-rate or lateral acceleration)
U0200	Error in CAN-Message EMS

BODYCARE & REPAIR

SECTION BS



Body Panels


Hardtop roof
Windscreen frame
Sill panel
Front access panel
Engine cover Tailgate lid
Front clamshell
Cabin rear bulkhead
Door hinge cover panel
Door shell
Rear clamshell
Front crash structure
Chassis frame
b421

BS.1 - GENERAL DESCRIPTION

The body panels of the Lotus Exige S 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 composite mouldings are manufactured by one of several processes (see later) dependent on application, with a nominal thickness of 2.2 - 2.5 mm. 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.

BS.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. The body construction features an assembly of mouldings to form a single piece for the whole of the nose and front wings, and a similar assembly for the whole of the rear body aft of the doors. These two 'clamshells' 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.

A composite panel may return to its original shape after deflection, but beyond a certain level of flexibility, such treatment may result in the formation of surface cracks which may not be immediately apparent due to the masking effect of the paint film. A steel panel similarly treated would become dented or deformed. The cracking may be confined to the surface layer with no reduction in panel strength, but if the damage is more severe the composite structure below the surface may be weakened. Localised repairs can be made in either case. Possible causes of surface cracking include:

- Vehicle collision or sitting, leaning heavily or pushing on the body or any composite panel;
- Knocking doors against obstructions when opening;
- Dropping objects onto a panel or allowing unrestrained items to roll about in a luggage compartment;
- Fitting a front access panel or closing the engine cover onto projecting objects, e.g. luggage or tools;
- Applying excessive force to parts attached to composite panels e.g. mirrors, locks, aerial etc. (inc. action by vandals)
- Incorrect jacking.

The composite body panels of the Exige S are manufactured by one of several processes:

- The front and rear clamshells, door hinge cover panels and tailgate panel, are 'hand lay' composite mouldings with a nominal thickness of 2.5 mm.

- The sill panels, windscreen frame, door outer panels, hard top roof outer panel and front crash structure are produced by Injection Compression System Resin Transfer Moulding (ICSRTM), whereby a mix of polyester resin and glass fibres is injected into a heated, chrome steel surfaced, closed mould. After filling, the gap between the two halves of the mould is then reduced in order to compress the moulding and ensure complete material flow and consistent structural quality. Panel thickness is a nominal 2.2 mm. The absence of the 'gel coat' used with other processes results in much greater resistance to surface damage, and minimum surface preparation for before painting.

- The front access panels, engine cover lid, door hinge panels, door and roof inners are produced from Low Pressure Sheet Moulding Compound (LPSMC), whereby flat sheets of composite material are formed using heated, chrome steel surfaced moulds to produce panels with a nominal thickness of 2.5 mm.

- A fourth process is used for the cabin rear bulkhead, bootbox and radiator mounting panel where the panel surface is not primarily visible. These panels are produced by a Polyurethane Structural Reaction Injection Moulding (PU SRIM) process.

Whichever production process applies, conventional composite repair techniques can be used to rectify structural or surface damage whenever repairs can be determined as being more economic than panel replacement.

BS.3 - BODYCARE

The paint finish 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 excrement; highly acidic or alkaline, they can chemically etch the paint. Wash off immediately.
- Leaves; contain tannic acid which can stain light finishes.
- Impact damage; granite chippings thrown up from poor or recently dressed road surfaces can subject the body to severe localised impact, and result in paint chips, especially around the vulnerable frontal panels. Do not follow other vehicles too closely in such circumstances.

Washing
Lotus recommends that the car be hand washed, using the following instructions:

Many contaminants are water soluble and can be removed before any harm occurs by thorough washing with plenty of lukewarm water, together with a proprietary car wash additive (household detergent and washing up liquid can contain corrosive salts, and will remove wax and accelerate oxidation). Frequent washing is the best safeguard against both seen and invisible contaminants. Wash in the shade, and use a cotton chenille wash mitt or a sponge rinsed frequently to minimise entrapment of dirt particles. Use a straight back and forth washing motion to avoid swirled micro scratches, and rinse thoroughly.

In order to minimise degradation from road salt, the underside of the chassis should be rinsed with clean water as soon as possible after driving on treated roads. Many fuel filling stations offer pressure washing facilities ideal for this purpose, but to not use on the painted bodywork or soft top roof.

Paintwork Polishing
Eventually some loss of gloss, and an accumulation of traffic film, will occur. At this stage, after normal washing, the application of a good quality liquid polish will restore the original lustre of the paint film. Higher gloss of the paint finish, and added protection against contamination, can be obtained by the use of a wax polish; however, this can only be used successfully on a clean surface, from which the previous application has been removed with white spirit or a liquid polish cleaner.

Ventilation
Water lying on the paint surface for a lengthy period will eventually penetrate the paint film. Although the effects will not be visible immediately, a deterioration in the protective properties of the paint film will ultimately result. It is not recommended to store a wet car in a poorly ventilated garage. If good ventilation cannot be provided, storage outside on a hard standing or under a carport is to be preferred.

Windscreen Cleaning
Use a proprietary glass cleaning product on the windscreen and other windows to ensure uninhibited vision. Clean the wiper blade with windscreen wash solvent to prevent juddering and smearing.

Alloy Road Wheels
It is recommended that the alloy road wheels are washed with the same 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 the wheels, and wash thoroughly to remove accumulated road filth from the wheels and tyres.

'Soft Feel' Paint Finish

Special edition models may have specific individual panels, or be completely painted in a 'soft feel' water borne matt paint finish. This have been given a Lotus colour code and description of B141 Matt Black. The paint is produced by Sonneborne and Reick with a mixing ratio of 10 parts Black Soft Feel 97R:361WSL:103/A to 1 part Jaxalac Curing Agent 90:CA-38

Limited Warranty

This special matt finish paint is not as durable as Lotus' standard paint finishes. The Company therefore warrants that the paint finish will be free from defects in material and workmanship for a period of 12-months or 12,000 miles/20,000 km, whichever occurs first, after the first occurring of the following events:-

a. Date of delivery of the car to the retail owner;
   or
b. First registration of the car, whether as a dealer demonstrator or otherwise.

This finish is resistant to most normal forms of atmospheric attack provided the special cleaning and maintenance requirements as specified by Lotus are strictly adhered to. However due to the textured matt finish, fading or discolouration of all or part of the matt paint finish may occur during the early life of the vehicle and this is considered normal and is specifically excluded from any warranty given by Lotus.

Any damage to the car's paint finish will require specialist and skilled paint repairs. In any event any repairs may result in a build up or 'stepping' between the matt and gloss finishes used on the car and shade variations in the paint finish as the car ages. Again this is considered normal and is excluded from the Limited Warranty.

Cleaning and Maintenance

The special matt paint finish applied to the car requires special cleaning and maintenance procedures to be followed.

Paint care products are listed below and available to order from the Lotus Aftersales Department. These should be the only products used on the matt finish soft feel panels.
Lotus approved cleaning products:

Part Number	Description
A000Z9101Z	3M/Sia fine abrasive pads
A000Z9018Z	Go Foam
A000Z9147Z	Armor All Protectant solution

Cleaning Procedure

- Avoid washing the car in direct sunlight.
- Use only automotive specific salt-free detergents with clean water when washing.
- Thoroughly rinse all traces of detergent from the body with clean (preferably demineralised) water and dry with a clean absorbent cloth before attempting to remove any stubborn contamination with specific Lotus approved cleaners.
- Use only Lotus approved Sia fine (grey) abrasive pads in conjunction with Lotus approved automotive detergent in water to remove any insect remains, tar spots and stubborn contamination from the car's matt paint finish.
- Spray the Lotus approved detergent solution onto the affected area and allow to soak thoroughly before gently abrading in small circular movements to remove the contamination. Avoid heavy abrasion as this will mark the car's matt paint surface.
- Dry the area and clean using 'Go-Foam'. When this has been wiped dry, apply only 'Armor All Protectant' solution with a clean micro-fibre cloth, turning the cloth regularly until a clean dry surface is achieved.
- Avoid contact with any wax or other polishing materials on the matt surface when polishing the gloss black stripe areas.
- Similarly, avoid using any abrasive materials when polishing the gloss black stripe areas, as the gloss finish may be damaged.
- Aggressive solvent based cleaners should not be used to clean the car's matt paint finish.
- Wax or abrasive polishes should not be used on the car's matt paint finish as these will mark and contami-

nate the car's matt paint finish and may prove very difficult to remove.

- Use of cleaning or paint care products not approved by Lotus, or failure to follow the paint care and maintenance procedures may result in detrimental affects to the car's paint finish and could invalidate the Limited Warranty in respect of the car's paint finish.

BS.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 Body Access Panels;
- Engine Cover Lid;
- Door Hinge Cover Panels;
- Hard Top Roof.

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 these panels are contained in section BT.

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

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 shape and positioning of the windscreen frame is crucial to the fit of the windscreen and sealing of the soft top roof, such that the only repairs which should be considered for this panel are cosmetic and superficial; any structural damage should entail panel replacement.

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 surface of some parts of the panels is not freely available.

Note that if damage is such as to require replacement of the chassis, replacement chassis assemblies are provided only as a 'partial body assembly' which includes jig bonded front crash structure, windscreen frame, side sills and rear bulkhead. The SBAF (Seat Belt Anchor Frame) and rear subframe are also included, as are the pipes, hoses and cables routed through the sills.

BS.5 - BODY PANEL BONDING MATERIALS

The materials used for bonding the body panels are manufactured by Dow Chemical, 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:	Betapnme 5404	Lotus part no. A082B6337V
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:	Betapnme 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. A082B6281 F
	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 surface. 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 5404, 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 24 hours, re-activate by applying a further coat of Betaprime 5404.

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 VP 01706 A+B (A100B6070V)

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 containers of component A and component B.

Application: - Thoroughly shake component A container to disperse solid material. Remove the lid from the component A container and scrape any sediment from the botton of the container. Replace the container lid and thoroughly shake again to disperse the solid content.
- Pour the required amount of component A into a clean container, and add the same volume of component B. Replace lids immediately. Thoroughly mix the two components for 45 seconds minimum.
- Leave the mixed components to stand for 30 MINUTES. (Discard if unused after 8 hours)
- Pour the pnmer into the applicator bottle and wet out the felt pan by inverting the bottle and gently squeezing the sides.
- Wipe the pad over the cleaned substrate surface to apply a continuous THIN film of primer: A thin, almost transparent film is all that is required. No attempt should be made to attain a completely opaque covering.
- Allow to dry for a minimum of 4 HOURS, before applying adhesive.

Notes: - To achieve a continuous thin film of VP 01706, apply in a smooth continuous uni-directional movement, not short backward and forward movements. The latter technique results in inconsistent film build.
- Replace the felt pad if moisture absorption results in hardening.
- Never return unused Betaprime back into the aluminium container.

BETASEAL 1701 (A082B6281F)

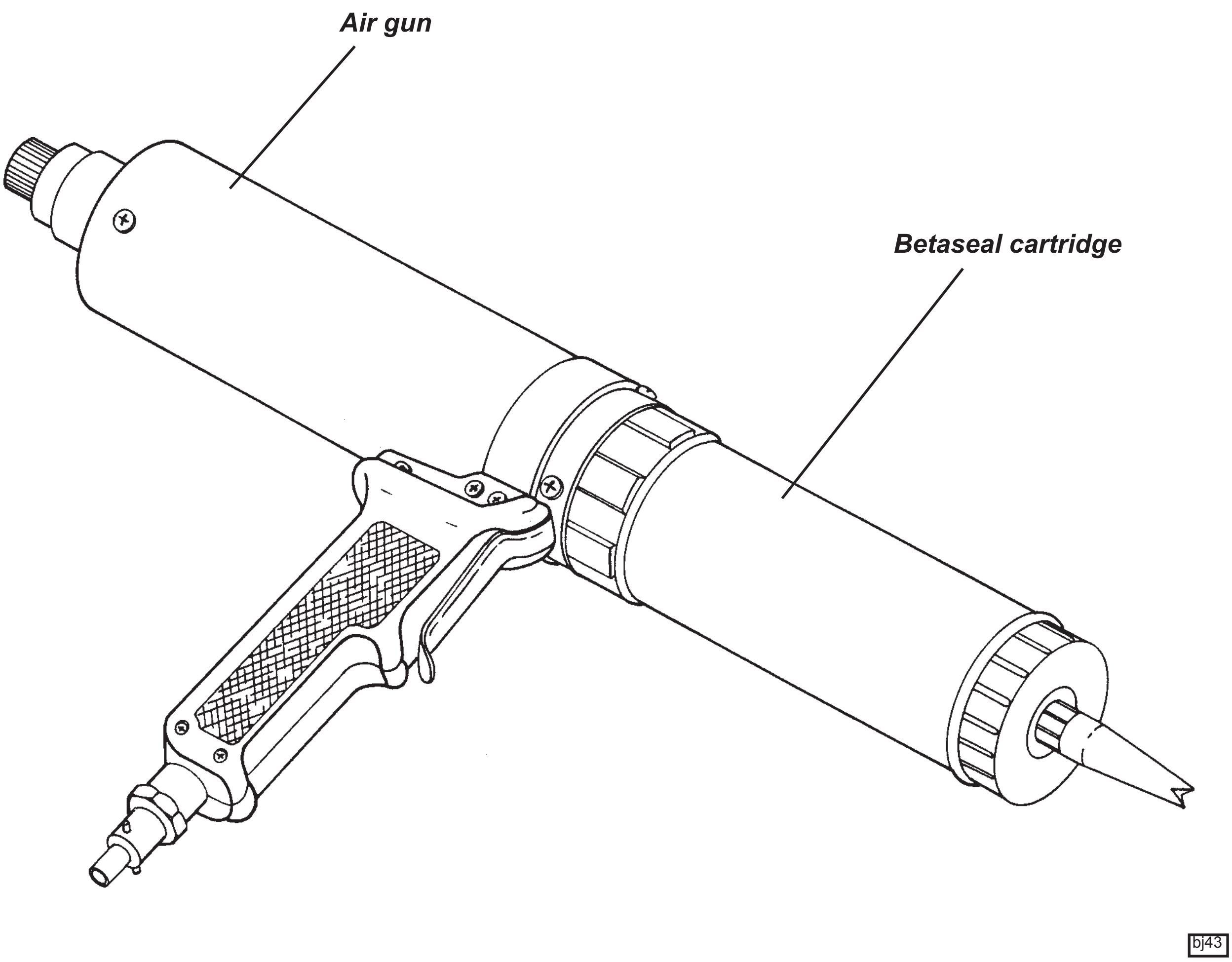
Description: One component moisture curing adhesive, providing high strength, permanently elastic bonds between various substrates. Supplied in 300 ml aluminium cartridge.

Application: - Remove the cartridge end ensuring there is no damage to the reinforcing sleeve.
- Pierce the neck of the cartridge and screw on the applicator nozzle. Cut the nozzle end to the required diameter and shape.
- Fit the cartridge into an air assisted gun, and extrude a smooth, even and continuous bead of Betaseal to the previously prepared substrate.
- Assemble the joint within 5 MINUTES.

Notes: - If the adhesive has to be touched or manipulated for any reason, use only *wetted* fingers.

BETAMATE E2400 (A082B8415V - 220ml, A100B6258V - 450ml)

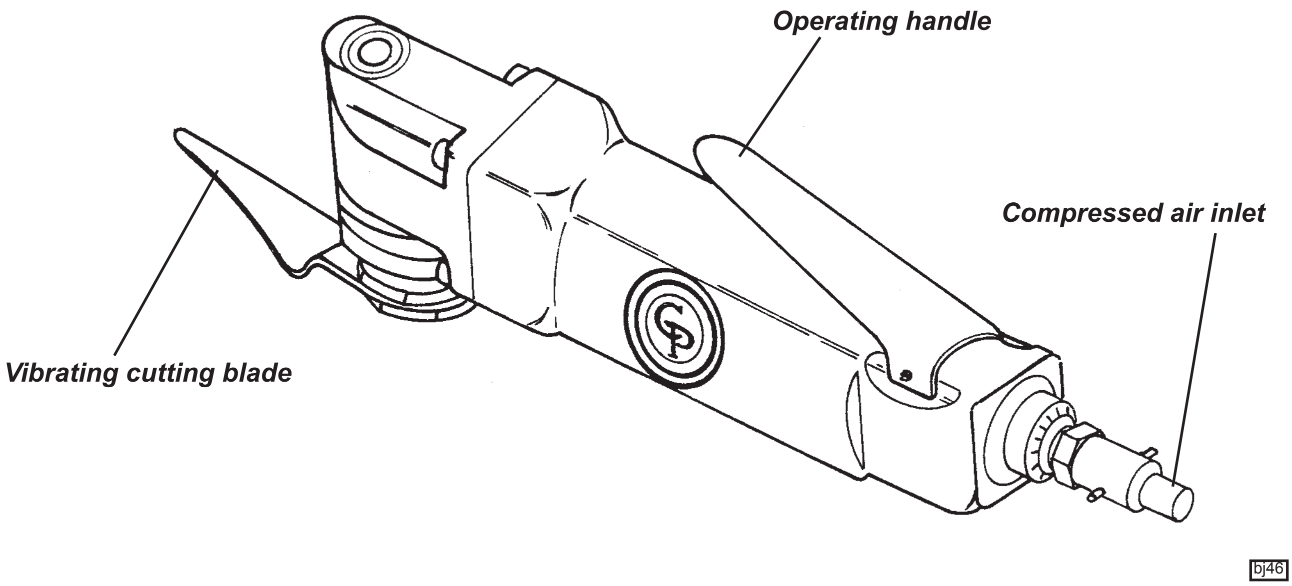
Description:	Two component chemically curing adhesive, providing high strength, permanently elastic bonds between various substrates. Supplied in 220 and 450 ml aluminium cartridges.
Application:	- An electrically driven Betagun Mk 11 is required to mix and extrude Betamate E2400. Refer to the operating instructions supplied with the gun. - Extrude a smooth, even and continuous bead of Betamate to the previously prepared substrate. - Assemble the joint within 5 MINUTES.
Notes:	- If the adhesive has to be touched or manipulated for any reason, use only *wetted* fingers.



BS.6 - REPLACEMENT OF BONDED-ON PANELS - GENERAL

Bonded body panels are secured using the Dow Chemical products 'Betaseal' or 'Betamate', which are flexible polyurethane adhesives which must be cut in order for a panel to be removed. The recommended method of adhesive cutting is with the use of a pneumatic tool such as the Chicago Pneumatic CP838 PneuNife which uses a range of differently shaped cutting knives to which is imparted a vibrating action. This tool may also be used to remove windscreens.

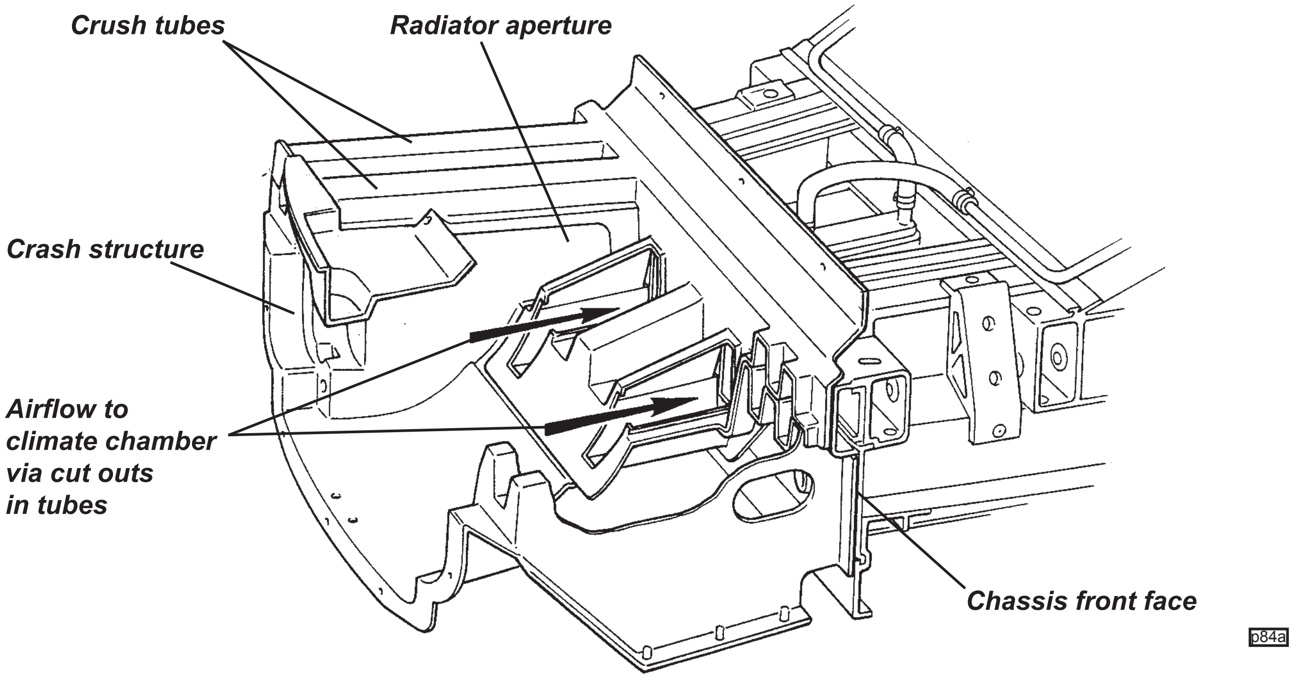
Supplier:	Chicago Pneumatic, Utica, New York 13501, USA.
Catalogue no.:	CP838 Pneu-Nife
Recommended air pressure:	60 - 90 PSIG (4.0 - 6.2 bar)
Tool air inlet:	1/4" NPTF, 3/8" mm. hose size



It is not generally practical to remove a bonded panel intact, for later refitment. Consequently, when necessary, the panel can be cut away for better access to the bonded joint. It is not necessary to remove all traces of sealant from the joint faces on the remaining panels or chassis, but any remaining sealant must be securely bonded and no thicker than 1 mm or the fit and joint gaps will be upset. It is essential always to follow the cleaning/priming/bonding operations meticulously if sufficiently strong and durable bonds are to be obtained. Always use the specified materials.

BS.7 - FRONT CRASH STRUCTURE

The front crash structure consists of an upper and lower moulding bonded together and supplied only as an assembly. It is bonded to the front face of the chassis, and is braced by an alloy undershield screwed to the bottom front edge of the chassis, and to each lower side of the crash structure. The unit also acts as a ducting for the engine cooling radiator and a.c. condenser (if fitted) which are mounted horizontally on its top surface in a bolted-on composite radiator housing. Longitudinal tubes formed in the construction are designed to produce a particular crush characteristic in order to control the rate of deceleration of the vehicle occupants in a frontal collision.

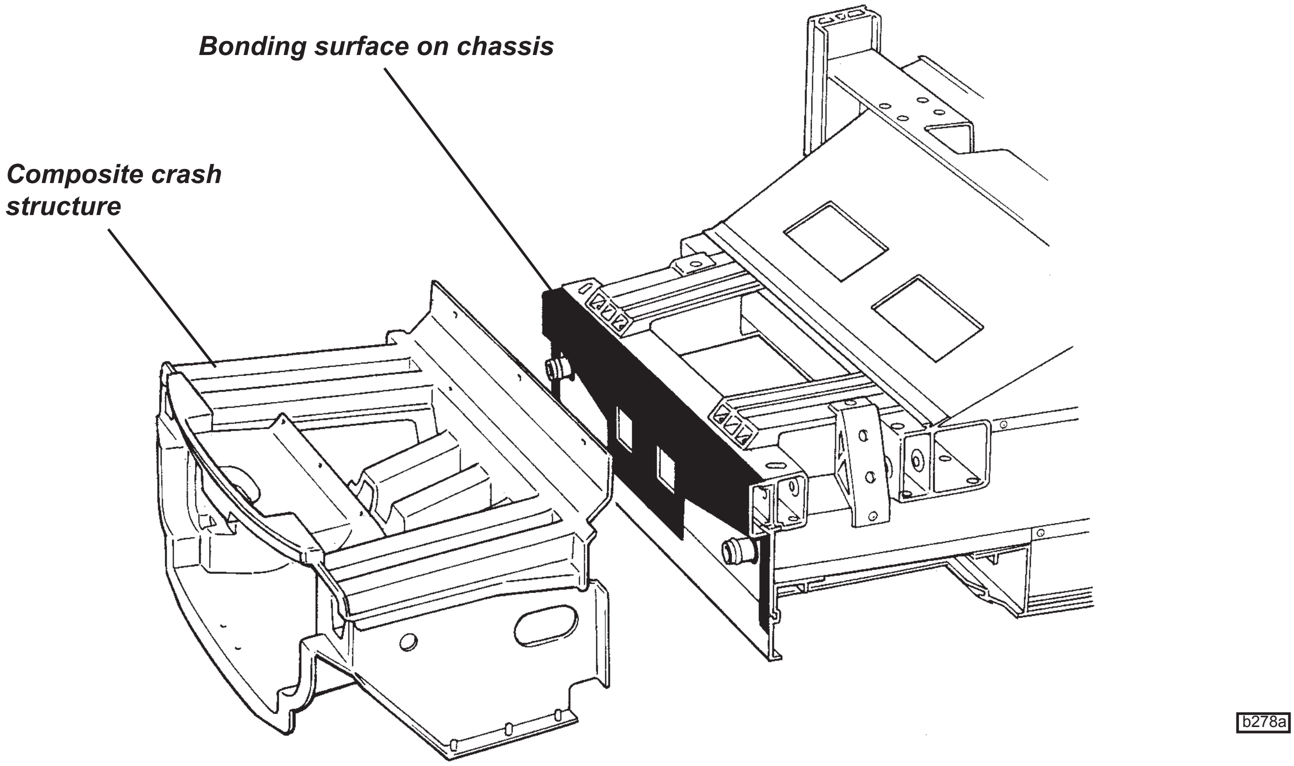


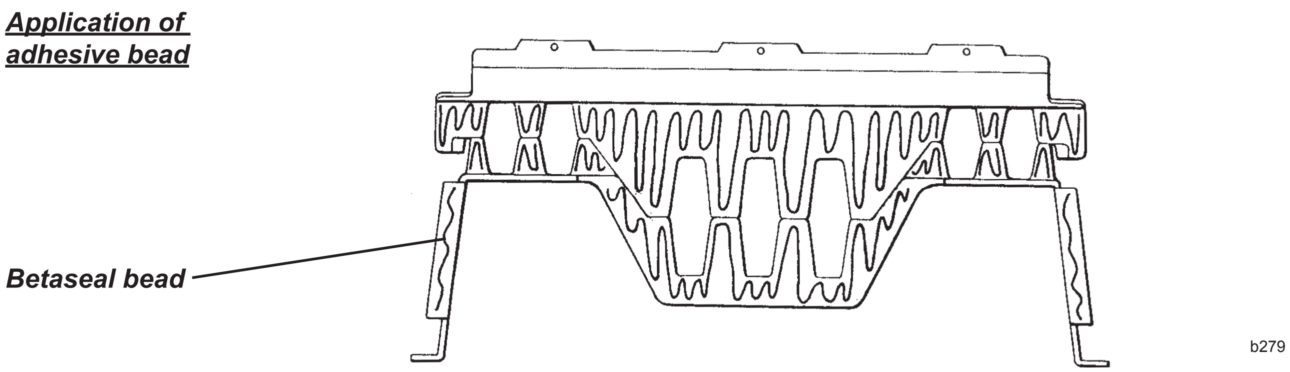
To remove the crash structure:
- Remove the front clamshell, refer to service notes section BT.6 for further information.
- Remove the front undershield refer to service notes section AN.3 for further information.
- Drain the coolant and remove the radiator and pipework, refer to service notes section KR for further information.
- Remove the towing strut, horn, alarm siren and wiring harness from the crash structure. Use a seal cutting knife to cut the bond between the structure and the front face of the chassis. For access to some of the bonding areas, it may be necessary to cut away some parts of the structure, rendering the unit unsuitable for refitment. Take care not to damage the surface of the chassis when cutting the adhesive.
  It is not necessary to remove all traces of old adhesive from the chassis, but a uniform surface must be available for the new adhesive bead. The remaining adhesive must be securely bonded and be cut with a scalpal blade to leave an even thickness of 1 - 2 mm.

Prepare the new structure for bonding:
- Dry fit the new structure to the chassis, and check that a good fit is achieved. Fettle the structure or remove old adhesive as necessary until the fit is satisfactory.
- Re-activate the surface of the old adhesive on the chassis using Betawipe 4000 (see sub-section BS.5), and clean and prime the bonding area on the new crash structure using Betaclean 3900 and Betaprime 5404 (see sub-section BS.5).
- Apply a bead of Betaseal/mate adhesive (see sub-section BS.5) to the bonding surface in the manner shown on the following page.

Fitting the new structure to the chassis:

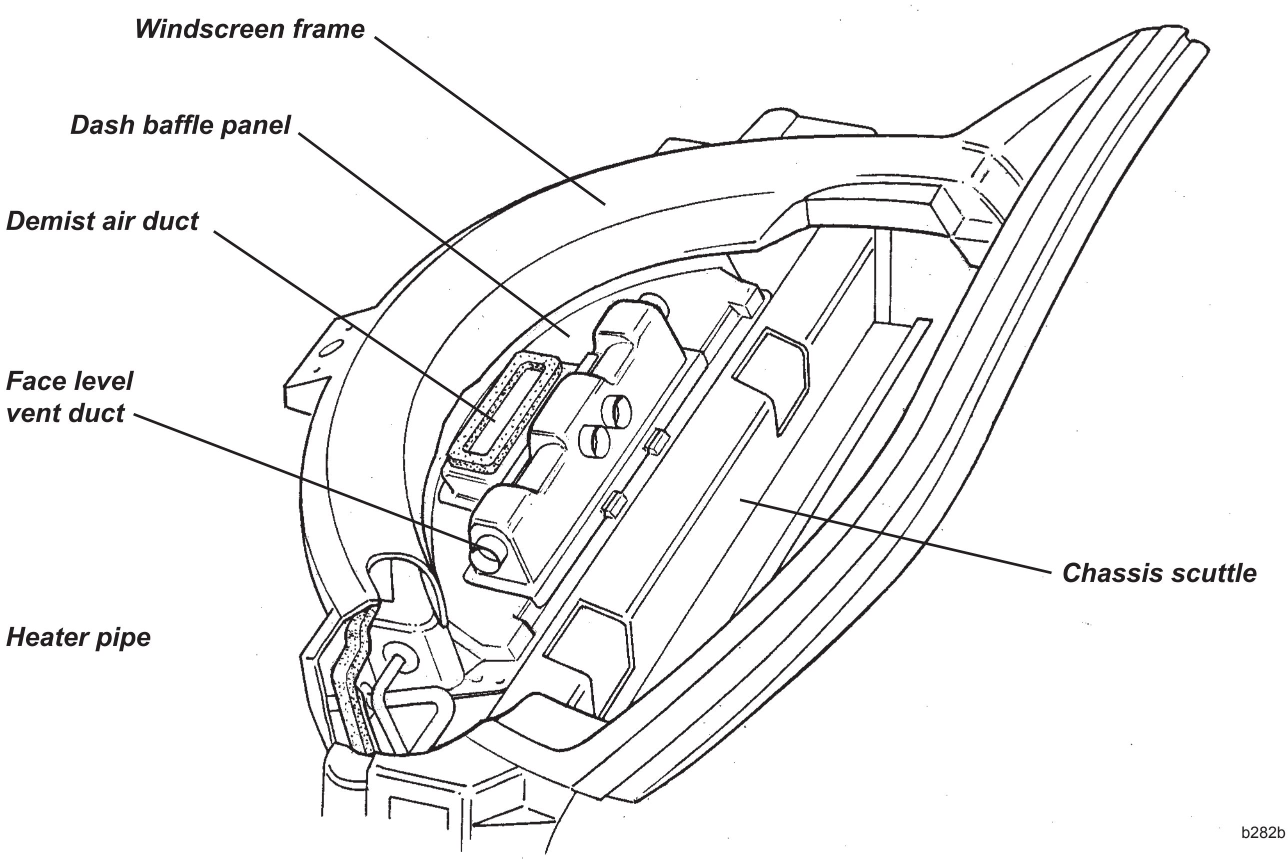
- Fit the structure to the chassis and press into position to spread the adhesive. Use several clamps around the joint flange to retain the structure until the adhesive has cured; This will take approximately 4 hours dependent on atmospheric conditions, with a longer period required in dry atmospheres.
- Refit the undershield, radiator, front clamshell and remaining parts.





BS.8 - WINDSCREEN FRAME

The windscreen frame is a single ICSRTM moulding with hollow, foam filled sections, and incorporates a forward extending buttress at each side to brace the frame against the front chassis. A separate dash baffle panel is used to bridge the space between frame underside and chassis scuttle, and provide for the routing of climate control pipework and air ducting, and other services.



The shape of the frame is critical to the windscreen fit, and structural repairs to the frame itself are not recommended. It is not generally economic to attempt to remove the windscreen frame intact for refitment, as the elastomeric adhesive bonding the frame to the chassis requires cutting with a reciprocating knife, and access to the joints is sometimes obscured.

The recommended procedure is to cut the frame as necessary to allow its removal without damage to the dash baffle panel. If the sills are to remain fitted, it will be necessary to carry out some minor work on the screen buttress to sill panel joint, where a panel overlap occurs.

To Replace Windscreen Frame:

1. Remove the front wheelarch liners and front clamshell, refer to service notes section BT.6 for further information for improved access, remove the two doors, refer to service notes section BT.10.

2. Remove the windscreen, refer to service notes section BT.15 for further information.

3. Remove the instrument binnacle and fascia top panel, refer to service notes section VE.8 for further information and release the fixings between dash upper extrusion and screen frame.

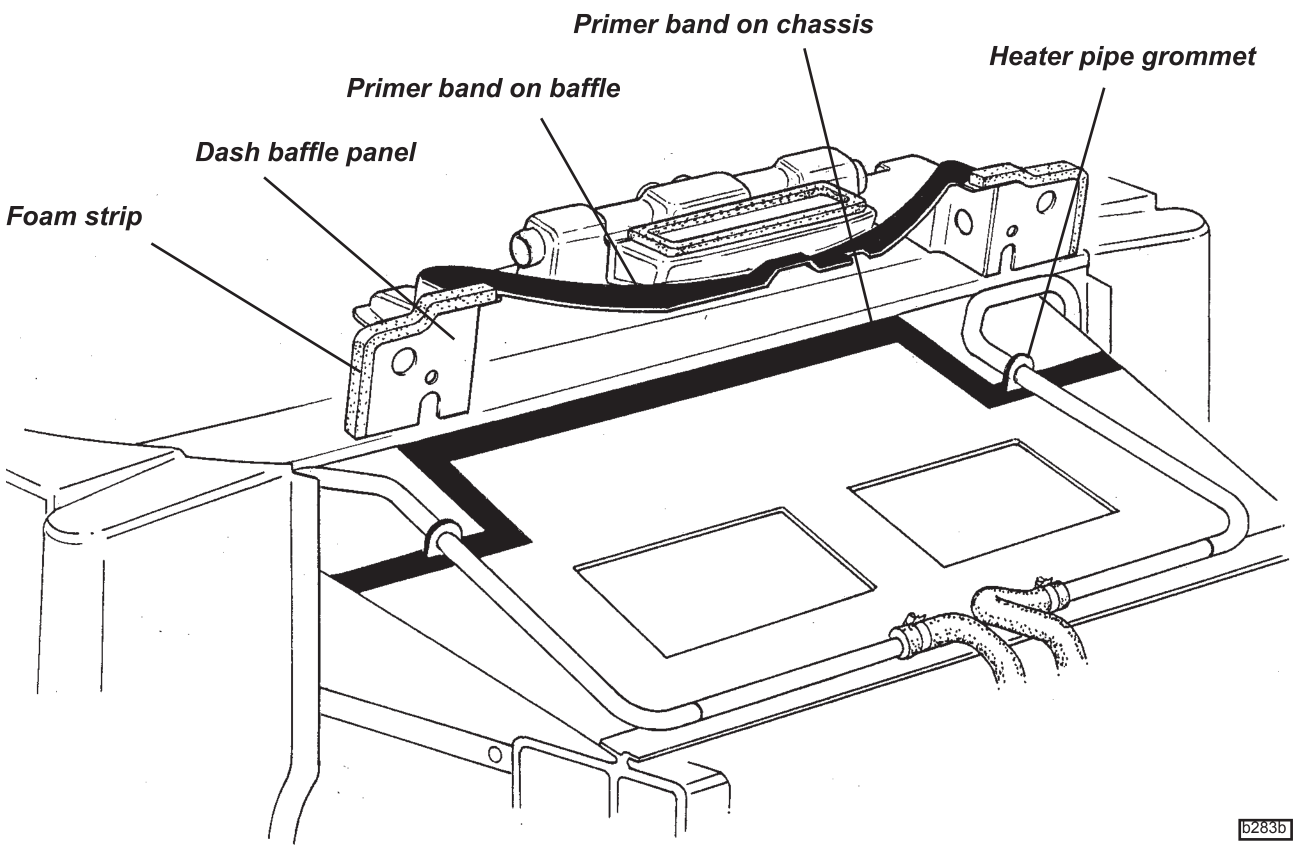
4. Release the brake hose/pipe connector at the front end of each buttress on the windscreen frame. Release all harnesses and other components from the windscreen frame buttresses as necessary.

5. Remove the wiper motor mechanism from the windscreen frame, refer to service notes section MV.8 for further information.

6. Use a sealant cutting tool to cut the bond between the windscreen frame buttresses and chassis, and between the frame and 'B' posts, and between the frame underside and dash baffle panel. Remove the windscreen frame.

7. Cut the adhesive securing the drainage gutter around the front of the frame, to allow transfer to the new frame.

8. If the dash baffle panel is to be replaced, the clutch pipe and climate control cables must be released and threaded through the panel before cutting the adhesive.



9. To fit a new dash baffle:
   - Ensure the heater feed and return pipes are fitted.
   - Dry fit the panel and mark up the bonding surface on the chassis scuttle.
   - Prepare and re-activate the surface of the old adhesive on the chassis using Betawipe 4000 (see sub-section BS.5).

- Clean and prime the upper and lower bonding faces on the new baffle panel using Betaclean 3900 and Betaprime 5404 (see sub-section BS.5).
- Apply a bead of Betaseal/mate adhesive (see sub-section BS.5) to the baffle lower flange.
- Position the panel and press along the length of the joint to ensure sufficient spread of adhesive. Clamp the panel in position until the adhesive cures.
- Apply self adhesive foam strip A082U6065V to each vertical end face of the baffle panel, wrapping over onto the top edge and along to the primed surface. Apply a second strip up each vertical face.

10. Prepare the old adhesive bead on the chassis for fitment of the windscreen frame by removing excess sealant from all the bonding areas on the chassis, sill panels and dash baffle to leave a consistent and level bonding surface for the new frame. It is not necessary to remove all traces of old adhesive, but a uniform surface must be available for the new adhesive bead. The remaining adhesive must be securely bonded and be cut with a scalpal blade to leave an even thickness of 1 - 2 mm.

11. Fit the wiper motor assembly and windscreen washer jets to the windscreen frame.

12. If necessary, fit a new roof side rail latch plate to the windscreen header rail - it is not recommended to refit a bracket due to the requirement for high surface quality on the bracket.
    - If applicable, completely remove any old adhesive from the header rail taking care not to damage the composite substrate. Lightly abrade the bonding surface on the header rail but do ***not*** abrade the bracket.
    - Clean the bonding surfaces on the header rail and bracket with Betaclean 3900 (see sub-section BS.5).
    - Prime the header rail with Betaprime 5404, but do not prime the bracket.
    - Generously coat the bonding surface of the bracket, with a 50/50 mix of Betamate 7064S (A116B0159V) and Betamate 7014 (A116B0158V). Fit the bracket to the header rail and wipe off extruded adhesive with Betaclean 3900. Position the bracket using tool T000T1422F (RH) or T000T1423F (LH), which sould be taped to the header rail for at least 30 minutes.

13. Before fitting the windscreen frame, ensure that two setting rods are available for positioning the frame:
    - Cut two 670mm lengths of locally sourced 10mm diameter steel rod.

14. - Prepare and re-activate the old adhesive bead on the chassis using Betawipe 4000 (see BS.5 and illustration on following page).
    - Clean and prime the bonding area on the new windscreen frame with Betaclean 3900 and Betaprime 5404 (see sub-section BS.5).
    - Apply a bead of Betaseal/mate adhesive (see sub-section BS.5) to the whole of the bonding flange on the windscreen frame and butresses, including the mating face between frame underside and baffle panel.
    - Carefully fit the windscreen frame onto the chassis and press into position to ensure adequate adhesive compression. Ensure the frame is positioned correctly in relation to the roll-over bar by fitting the two setting rods in the roof siderail locating slots. The rods should locate snugly in the slots with no end play.
    - Clamp the frame into position until the adhesive cures.
    - Ensure good adhesion between the frame and baffle panel.
    - Use a spatula to smooth out or remove any excess or extruded adhesive.

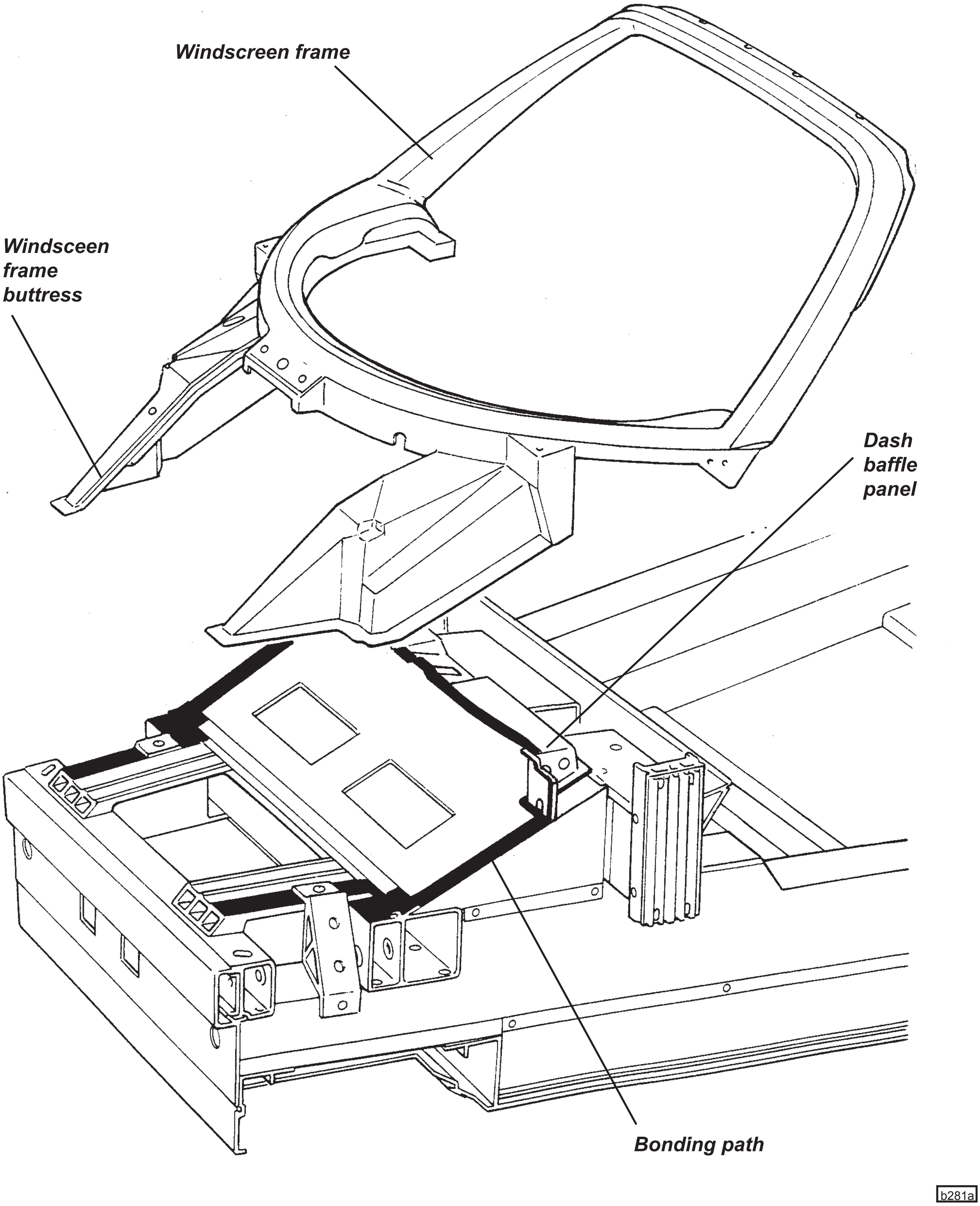
15. Seal the frame panel to the top of the door hinge post at each side by extruding a bead of Betaseal, and smoothing with a spatula to obtain a neat finish.

16. Examine the whole of the bonding jointline for sealing integrity, and if necessary apply additional adhesive to seal any gaps. Use a spatula to smooth any visual areas to a neat finish.

17. Do not disturb the frame until the adhesive has fully cured (see sub-section BS.5).

18. Fit the windscreen (see sub-section BT.15), dash panel and instrument pack (VE.8), front clamshell (BT.6), and other components as necessary.

Windscreen frame bonding (sills not shown)



BS.9 - SILL PANELS

The sill panels incorporate the 'A' and 'B' posts, and are bonded to the chassis, windscreen frame and rear bulkhead panel. The sill bottom flange, and rear end of the will top flange are bonded into grooves in the chassis main side rails and it is necessary to cut the sills in the course of their removal.

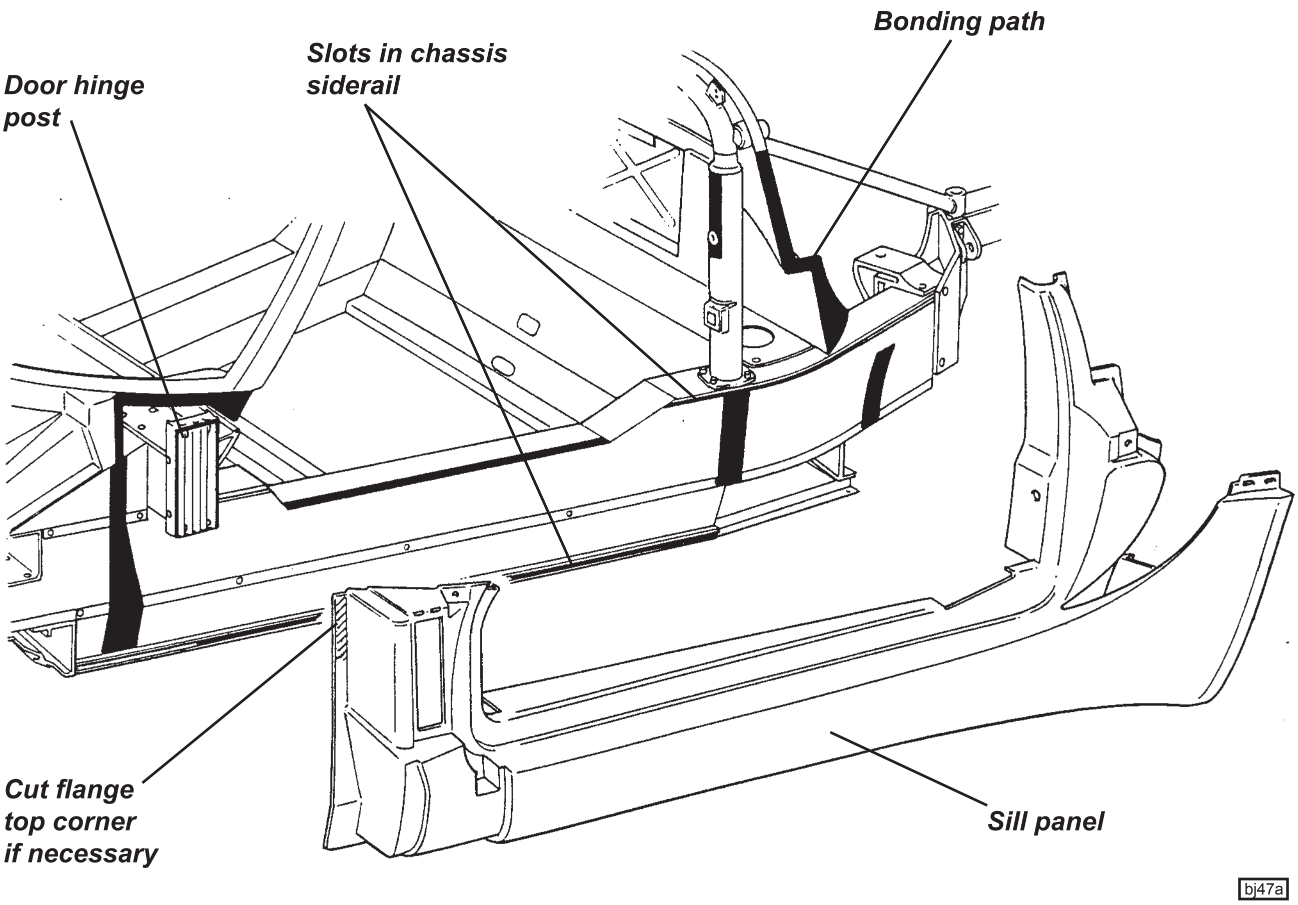
It is not practical to attempt to remove a sill panel intact for later refitment. If sill damage occurs which is not repairable 'in situ', the sill panel should be renewed.

To Replace Sill Panel:
A short section of sill flange underlaps the windscreen frame buttress flange in the front wheelarch area and requires that some cutting and laminating of the new panel is required on assembly.

1. Remove front and rear clamshells (refer to service note sections BT.6, BT.7), dash panel (VE.8) and door hinge bracket (BT.9).

2. Remove the door latch striker pin and washers, noting the assembly sequence. Remove the door sill trim panel from the chassis, refer to service note section VE.2 and the door ajar switch from the sill panel.

3. Use a sealant cutting knife to cut the adhesive bead between sill and chassis/body panels.
   Note:
   - In the front wheelarch area, a short section of the sill flange underlaps the windscreen frame buttress flange. Unless the windscreen is also to be removed, it will be necessary to cut the sill around this flange in order to release the sill.
   - The bottom edge of the sill, and the rear part of the top edge, locate in grooves in the chassis side frame, and may not readily be cut out with the sill intact. Cut the sill as necessary to release the panel, and then remove the remaining edges of the panel from the chassis using a suitable cutting knife.
   - Cut the sealant around the door hinge post aperture.
   - Cut the sealant between the panel and roll over bar.



4. Remove excess sealant from all the bonding areas on the chassis and body panels. It is not necessary to remove all traces of old adhesive, but any remaining adhesive must be securely bonded and be cut with a scalpal blade to leave an even thickness of 1 - 2 mm.

5. If necessary, cut the top front corner of the sill flange to allow mating of the panel around the windscreen butress flange. Dry fit the sill and fettle as necessary to achieve a good fit.

6. Before preparing the surfaces for bonding, ensure that the necessary pipes and cables are fitted to the chassis side rails:
   RH side: - heater feed pipe
   - brake pipe
   - alloy spigot for side impact foam
   LH side: - heater return pipe
   - brake pipe
   - clutch pipe
   - servo vacuum hose
   - main battery positive cable
   - alloy spigot for side impact foam

   Check that the following components are fitted into the composite sill:
   RH side: - 2 a.c. pipes (if applicable)
   - side impact foam
   - foam baffle
   LH side: - oil cooler feed and return hoses
   - side impact foam
   - foam baffle

7. Prepare the bonding surface of the new sill panel with Betaclean 3900 and Betaprime 5404 (see sub-section BS.5). Prepare surface of the old adhesive bead on the chassis and body panels Using Betawipe 4000 (see sub-section BS.5).

8. Apply a bead of Betaseal/mate adhesive (see sub-section BS.5) to the bonding surface on the chassis and body and fit the sill panel into position, first locating the sill bottom edge into its chassis slot, and press all around the joint to ensure sufficient spread of adhesive. If necessary, use a spatula to smooth or remove any extruded adhesive, and to neaten any visual areas. If necessary, add adhesive to the joint around the door hinge post, and to the windscreen frame, and smooth with a spatula.

9. Clamp the panel into position until the adhesive has cured (see sub-section BS.5).

10. If the top front corner of the sill flange has been cut to fit around the windscreen butress flange, this area should be reinforced as follows: Roughen the surface of the windscreen buttress flange and the adjacent sill panel in the modified area, and lay up two pieces of chopped strand mat across the joint.

11. Refit the dash panel, front and rear clamshells, doors, both wheelarch liners and other components as necessary.

BS.10 - REAR BULKHEAD

The rear bulkhead is a Polyurethane Structural Reaction Injection Moulding (PU SRIM), incorporates the rear window surround, and is bonded to the roll over bar and chassis fuel tank bay. A heat formed polyester fibre heat/acoustic insulator panel is bonded to the rear side of the panel, and incorporates a glass fibre aluminised cloth heat reflector shield in the vicinity of the exhaust manifold. The rear window is bonded directly to the bulkhead using the same materials and procedure as is used for the windscreen.

To replace the rear bulkhead:

1. Remove the rear clamshell and roof panel, refer to service notes section BT.7 and BT.1 for further information.

2. Remove both seats, and the bulkhead interior trim panel, refer to service notes section VE.10 and VE.11 for further information.

3. Remove from the inside of the bulkhead the alarm microwave sensor and parking aid sounder (if fitted) refer to service notes section MV.13 & MV.15 for further information. Release all wiring harnesses from the bulkhead clips.

4. Release all fittings from the roll-over bar backstays (air cleaner, roll over valve) and remove both backstays.

5. Taking suitable precautions, remove the fuel filler hose and filler breather hose, and cap the tank apertures to prevent dirt ingress and reduce fire risk.

6. Release the evaporative emissions charcoal canister and fuel filter from their bulkhead mounting brackets.

7. Disconnect any main harness connections not previously disconnected during rear clamshell removal and pull harness through with the integral grommet through the LH lower bulkhead aperture. Refer to service notes section MV.15 for further information.

8. Using a long knife, cut the adhesive securing the insulator panel to the bulkhead, and remove the panel to improve access to the bulkhead bonded joint.

9. Using a sealant cutting knife, cut the adhesive bead between the top section of the bulkhead and the roll over bar, and between the bottom of the bulkhead and the chassis. If the sill panels are fitted, cut the bond between sill panel 'B' posts and the bulkhead panel.

10. Manoeuvre the bulkhead from the car.

To Fit Bulkhead Panel:

Before fitting a bulkhead panel, ensure that the following parts are bonded to the panel:
- Charcoal canister mounting bracket;
- Rear window glass;

All the above components are bonded using elastomeric adhesive applied as follows. Refer also to sub-section BS.5:
Brackets & Studplates: Clean the bonding surfaces on the bracket and bulkhead with Betaclean 3900 (black cap) and prime both surfaces with Betaprime 5404 (red cap). Apply Betaseal 1701 adhesive to the bracket, and clamp in position until the adhesive has cured.

Rear Window: Refer to service notes section BT.15 for further information.

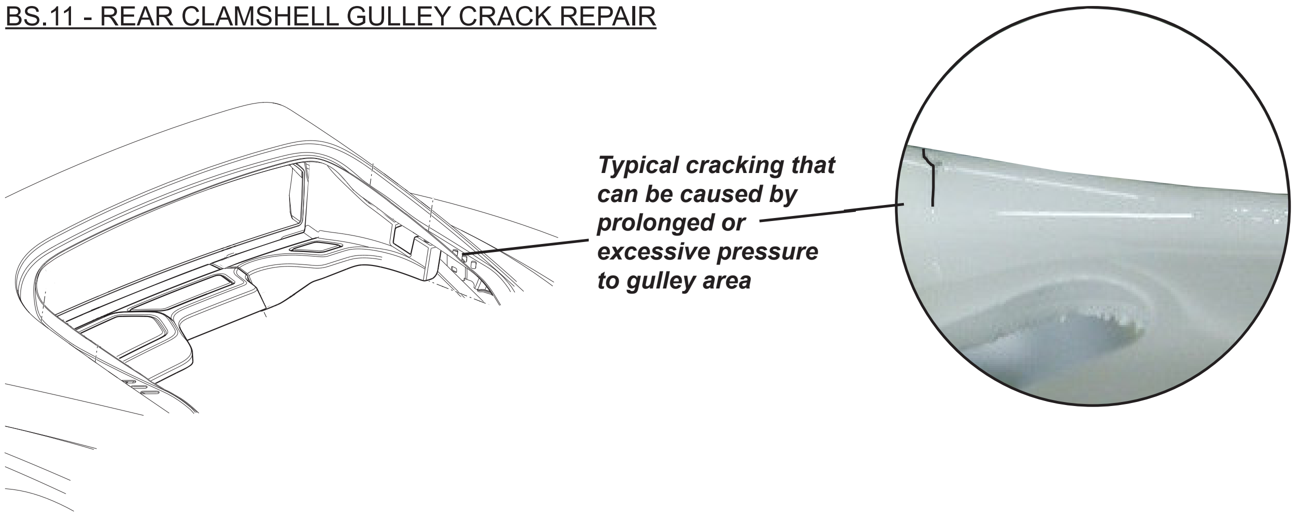
Bonding of Bulkhead Panel: Clean the mating surfaces of bulkhead, roll over bar and (if fitted) sill 'B' posts, with Betaclean 3900 (black cap) and prime with Betaprime 5404 (red cap). Or, where applicable, use Betawipe 4000 to re-activate old adhesive (refer to sub-section BO.5). Clean the mating surface on the chassis with Betawipe VP 04604 (yellow cap), and prime with Betaprime 5404 (red cap). Apply a bead of Betaseal 1701 to the bonding path on the bulkhead, and manoeuvre into postion, pressing all round the joint path to ensure sufficient compression of the adhesive.

Use a spatula to remove excess extruded adhesive and smooth any visual areas. Secure in position with tape until the adhesive has cured.

The heat/acoustic insulator panel is bonded to the bulkhead only at its centre section. Clean and prime the centre section on the bulkhead with Betaclean 3900 and Betaprime 5404, and apply Betaseal 1701. Press the insulator panel into position and ensure sufficient compression of adhesive. Tape in place until the adhesive has cured.

Refit remaining components in reverse order to removal.

BS.11 - REAR CLAMSHELL GULLEY CRACK REPAIR



In extreme circumstances the rear clamshell gulley surrounding the engine bay area may crack if subjected to excessive localised force or weight (typically if too much prolonged pressure is applied whilst being leant on during servicing or repair operations).

If small cracks are discovered then it is possible to perform a localised repair without the need to remove/replace the complete rear clamshell assembly.

Preparation:
Although it is not necessary to remove any of the engine cover/bay panels to perform this repair procedure, it is advised to use suitable coverings/masking to both the engine bay and clamshell area.

1. Using a pencil type router, lightly router along the length of the crack. Ensuring not to cut too deep but just enough to break surface (both sides if split through).

2. If a suitable router is not available then a sharp knife may be used by cutting along the length of the crack making a “V” shape.

3. Blow out any debris that has been made by the cutting procedure.

Repair:

4. Applying light hand/finger pressure to crack to open it up slightly then carefully apply a small amount of super glue to the crack and wipe away excess using a cloth.

5. Allow the super glue to dry.

6. Fill the crack using suitable body filler and allow to cure as per the manufacturers recommendations, see RH illustration.

7. Rework/sand the filler to achieve a flush finish.

8. Blow down/remove any filler debris.

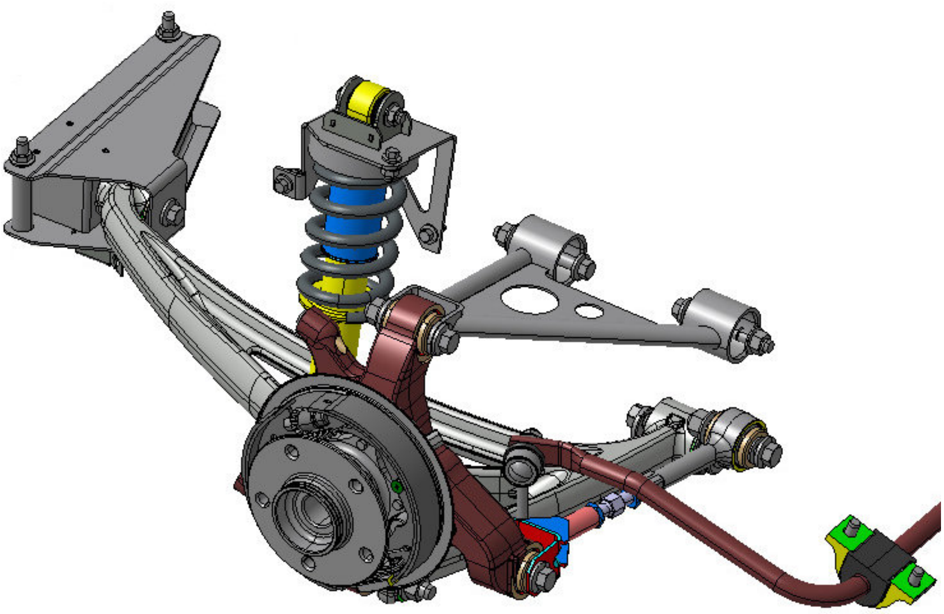
9. Refill and rework if necessary.

10. Blow down the rework area and prepare for paint.

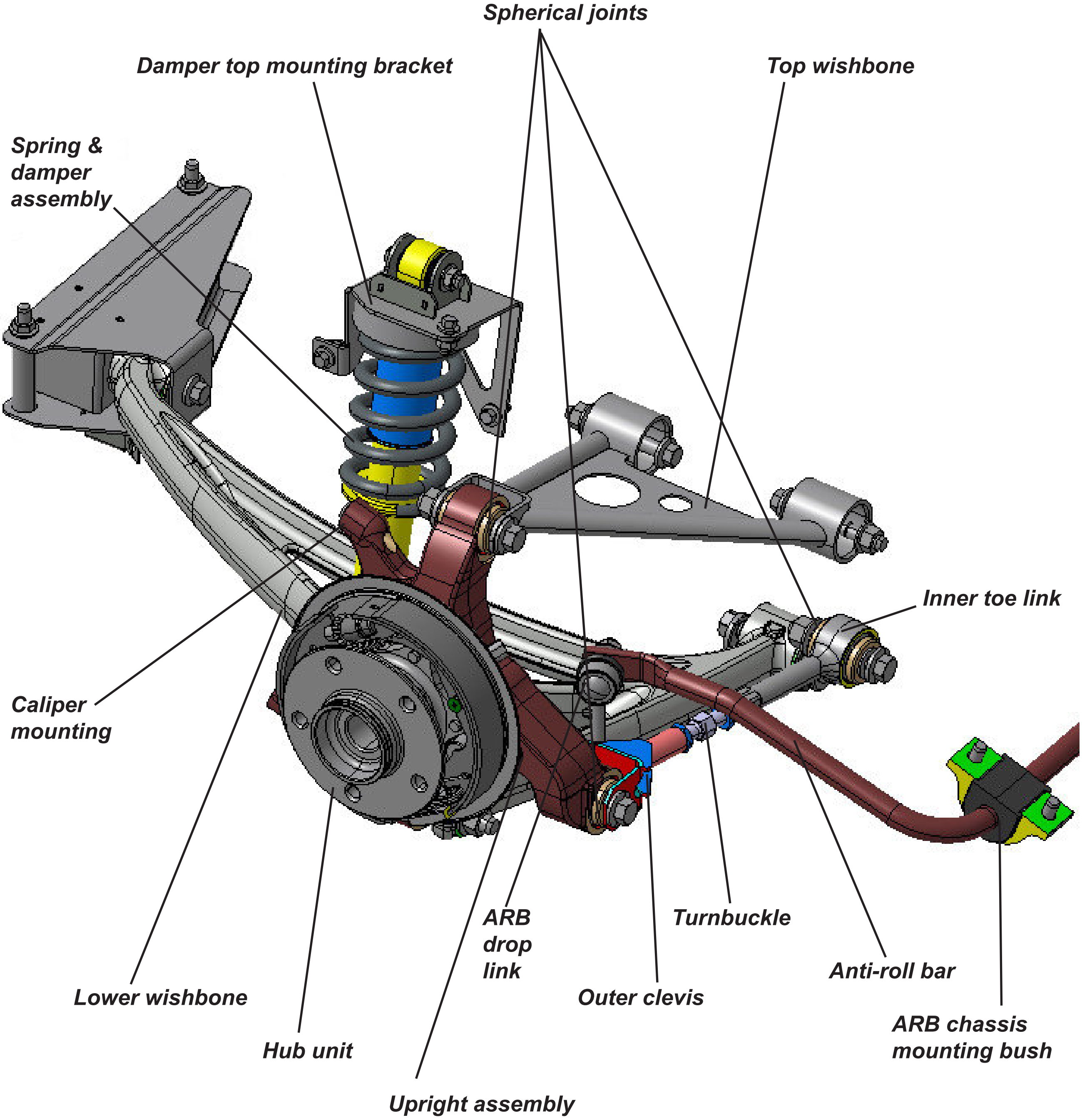
11. Carry out a localised paint repair to the affected area.

REAR SUSPENSION

SECTION DI



Rear Suspension Layout



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DI.1 - GENERAL DESCRIPTION

The independent rear suspension comprises, on each side of the car, an upper fabricated steel wishbone and a lower forged aluminium wishbone, a forged steel toe control link, a concentric coil spring/telescopic damper unit, and a tubular steel anti-roll bar, all being attached to the galvanised steel rear subframe. A forged steel hub carrier, provides a mounting for the hub bearing unit to which the 5-bolt road wheel and brake disc are attached, and also carries bosses for the cross-axis fixing bolts for the brake calliper.

Lower wishbone assembly
The primary, vehicle weight bearing, lower wishbone, is widely based and substantially cross braced, and incorporates separate double shear mounting points for the hub carrier and damper lower eye, and a mounting point for the anti-roll bar drop link. The outboard end of the wishbone is through bolted to a spherical joint pressed into the lower eye of the hub carrier. An eccentric cam incorporated at the rear pivot point for the lower wishbone, provides a means of camber adjustment.

Upper wishbone assembly
The upper wishbone is of simple 'A' form, with its outboard end connected to the hub carrier by a bolt passing through both the wishbones outer mounting and the hub carrier’s upper spherical joint. The inboard ends of both upper and lower wishbones use replaceable bonded rubber pivot bushes for maintenance free articulation, with the bush compliance profile tuned to provide the vehicle with accurate and responsive dynamic characteristics.

Toe control link
The toe control link is a two part steel forging incorporating an adjustment turnbuckle, and by connecting a rearward extension on the hub carrier to the chassis subframe, a 'toe-in on compression' bump steer characteristic is produced. Through bolted spherical joints are used in each end of the link, and the threaded turnbuckle allows for adjustment of rear wheel alignment.

Spring/damper assembly
The bottom of the monotube telescopic damper fixes to the lower wishbone in a double shear arrangement, with the damper top end secured to the subframe via a steel bracket bolted inside the subframe tower. The damper uses a rubber bush in the top eye for noise suppression, and a through bolted spherical steel joint in the lower eye for optimum dynamic response, and is orientated with the damper rod uppermost. The dual rate, concentric coil spring abuts against a lower seat fixed to the damper body, and an upper seat secured to the damper top eye, but also bolted to the subframe, thus relieving the damper top bush of vehicle weight to the benefit of noise and ride refinement. The close coiled end of the spring is mounted lowermost, on the damper body.

Anti-roll bar
A 19mm o.d. tubular steel anti-roll bar is mounted in rubber bushes to the underside of the subframe rearward of the axle line, and curves over each toe-link before connecting to the lower wishbone rear leg via a short ball jointed drop link.

Hub bearing assembly
The hub bearing unit is fixed to the hub carrier by 4 bolts, and incorporates a wide spaced double row ball bearing and a vehicle speed sensor ring integrated into the inboard seal, whose 48 pole signal is picked up by a sensor mounted in the rear of the hub carrier. This data is used for the anti-lock brake, vehicle stability, engine management and speedometer functions.

Suspension pack options
The standard factory suspension set up is referred to as the ‘Sport’ option. An optimised ‘Race’ suspension set up available as part of the ‘Race’ pack option. The springs fitted on the ‘Race’ suspension are of a thicker wire diameter and increased spring rate as compared to those fitted to the ‘Sport’ suspension. The thicknesses of selected internal shims fitted to the ‘Race’ damper are altered to change its rebound and compression characteristics. The uprated spring and damper assemblies are designed to suit the Pirelli P Zero Trofeo tyre characteristics, 4 mode Lotus DPM (Dynamic Performance Management) and Lotus launch control system also included in the ‘Race’ pack option.

DI.2 - SUSPENSION SECURITY CHECK AND PROCEDURE

The Service Schedule specifies that the security of the front and rear suspension is checked at each service. For cars used on race tracks, or in similar conditions, suspension components and torque checks should be carried out between sessions. This operation requires that all the principal suspension pivot bolts are torque checked, noting the following points:

Where a bolt is tapped into a housing or weldnut, and relies on a thread locking compound for security, be aware that if the bolt is disturbed, the locking compound must be re-applied. The following procedure should be adopted for all such fixings:
- Check the torque of the fixing.
- If the specified torque is attained without the fixing being disturbed (moving), take no further action.
- If the bolt moves, the locking action of the thread adhesive will have been compromised. Remove the bolt completely, clean off all old adhesive using a wire brush and acetone, and apply new adhesive as specified.
- Refit the bolt and tighten to the specified torque.
  If for any reason a bolt is found to have become loose, and the car has been operated for any period in this condition, the bolt should be renewed as a standard precaution and related components carefully inspected for hole ovality or wear.

Self locking type fixings
It is recommended to replace any self-locking nuts, i.e. nyloc or torque types that are used in critical areas if they are disturbed or removed as their self locking action will have been compromised.

DI.3 - GEOMETRY & ADJUSTMENTS

Provision is made for the adjustment of rear wheel alignment and camber. Under normal service conditions, no periodic scheduled check of the geometry is necessary, with a full geometry check required only after suspension repair, or if excessive tyre wear is evident, or handling deficiencies encountered.

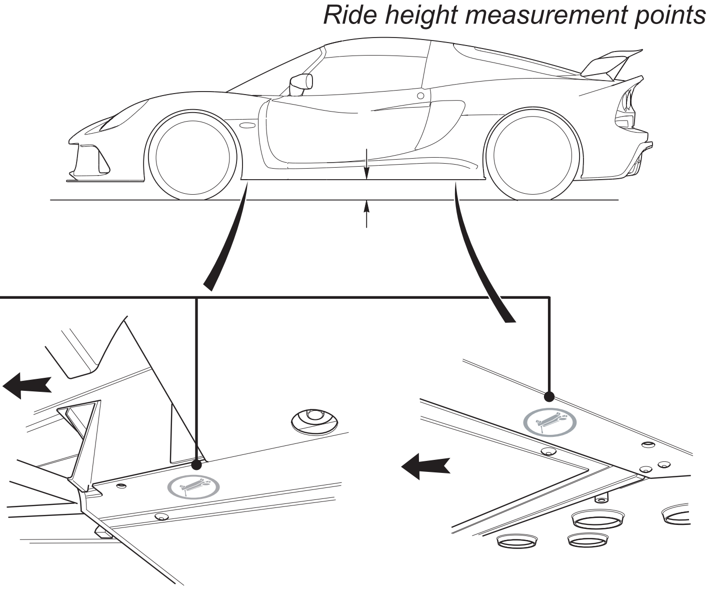
Ride height
Before any measurements or adjustments are made, it is essential first to set the vehicle to its 'mid-laden' ride height, approximating to the combined estimated weight of a driver and passenger and a half/full tank of fuel. This will require the vehicle to be ballasted or tied down:

Ride height measurements
Mid-laden ride height (based on 2 x 75 kg occupants + full fuel tank)

Set car to ride heights shown below before measuring geometry:

- front: 125 mm below front end of chassis siderail
- rear: 136 mm below rear end of chassis siderail

Ride height measurement points



Ride height to be measured from the ground up to the chassis siderails at the location of the 'Jacking' point labels.

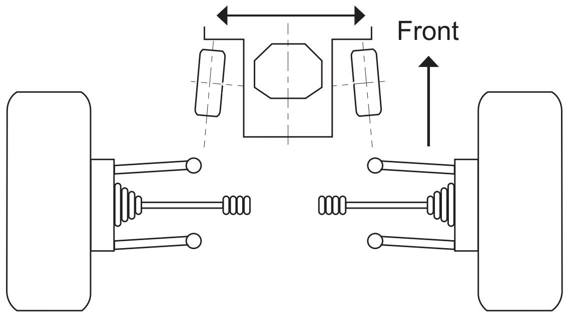
Rear suspension and geometry settings
Please refer to Service Notes section TDV - vehicle technical data, for rear suspension setting information.

Alignment

Wheel alignment refers to the parallelism of the wheels when viewed from above and is crucial to vehicle stability, handling and tyre wear.

It is measured either by the angle a wheel makes with the vehicle centre line, or the difference in dimension between the wheel rim to wheel rim measurement at the front and rear of the wheel at hub centre height.

The wheels are said to 'toe-in' when the wheel paths converge ahead of the vehicle, and 'toe-out' when they diverge. Rear wheel alignment should be measured only using equipment which measures **individual** rear wheel alignment relative to the car centreline.



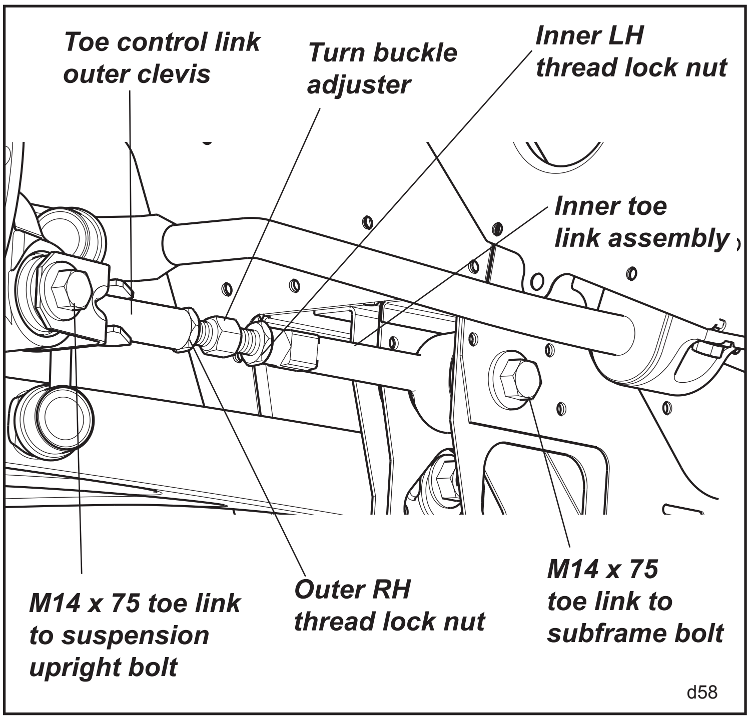
Wheel alignment is designed to vary with suspension travel ('bump steer') and the base setting should be measured only at the specified mid laden ride height, see DI.3.

Adjusting rear wheel alignment

Rear wheel alignment is adjusted via the toe control link assembly which is equipped with a turnbuckle at its centre.

Slacken both locknuts, and turn the buckle as necessary to increase or decrease the effective length of the link. As a guide, lengthening the link rod by a turn of one 'flat' (one sixth of a turn) will increase toe-in by approximately 1.6 mm.

After adjustment, hold each section of the toe-link in turn using the flats provided, whilst tightening each of the two locknuts to 45 Nm. Ensure that the axes of the toe-link pivot joints are parallel, see note on next page for further details.



Toe control link outer clevis - (also refer to Technical Service Bulletin TSB 2013/08)

To increase component durability, the outer clevis, fitted as part of the rear toe control link assembly has been upgraded as part of a production running change from ‘13MY VIN DH_10861 following motorsport and rallying experience.

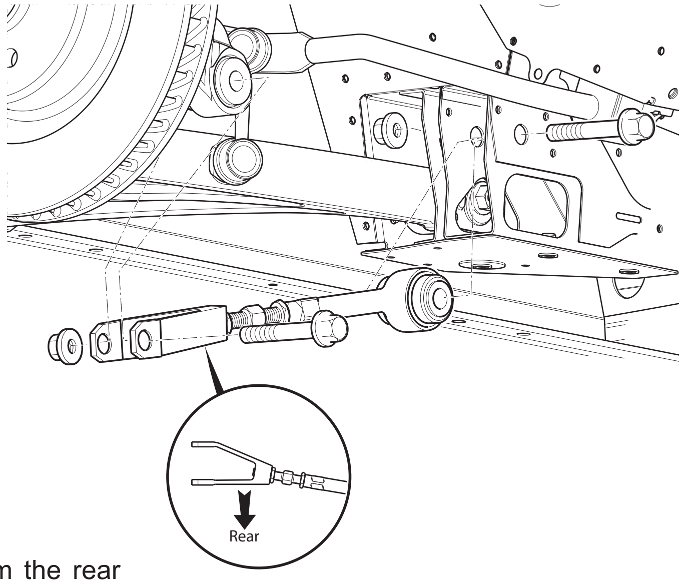
The latest level version of the outer clevis is modified ensuring that all tensile/compressive loadings can only travel through the toe-link axis; no longer subjecting the turnbuckle within the toe control assembly to any ‘bending moments’ which could, in extreme circumstances, cause premature wear of the turnbuckle with resulting affects on rear toe alignment.

The material thickness has also increased; therefore the spacer washers originally fitted between either side of the outer clevis yokes to spherical joints within upright assemblies are no longer required.

Note: The latest level clevises are also anodised black in colour for identification purposes.

Toe control link assembly

Removal (LH side described, RH similar):



1. Remove the rear undertray/diffuser assembly, see service notes section AN.2.

2. Remove the LHR road wheel; see Service Notes section GK.4 for further information.

3. Release the M14 nut and M14 x 75 clevis bolt securing the outer toe control link clevis to the hub carrier, withdraw the bolt from the clevis.

4. Release the M14 nut from its M14 x 75 bolt securing the inner toe link assembly to the subframe, remove the bolt from the subframe and spherical joint located within the toe link assembly.

5. Withdraw the toe control link assembly from the rear subframe and suspension upright assembly.

Note: If the toe control link is fitted with an type early clevis as described on the previous page then please refer to Technical Service Bulletin TSB 2013/08 for further information.

Refitment:
As per removal except:

- Ensure the outer clevis is fitted in its correct orientation with the straight section of the clevis yoke facing rearwards.

- Refit the outer clevis bolt through the clevis yoke and upright assembly, ensuring the correct bolt orientation (bolt head facing rearwards of the vehicle).

- Ensure that the axis of the toe-link pivot joints are parallel, see note below.

- Tighten both inner and outer M14 fixings to 135Nm.

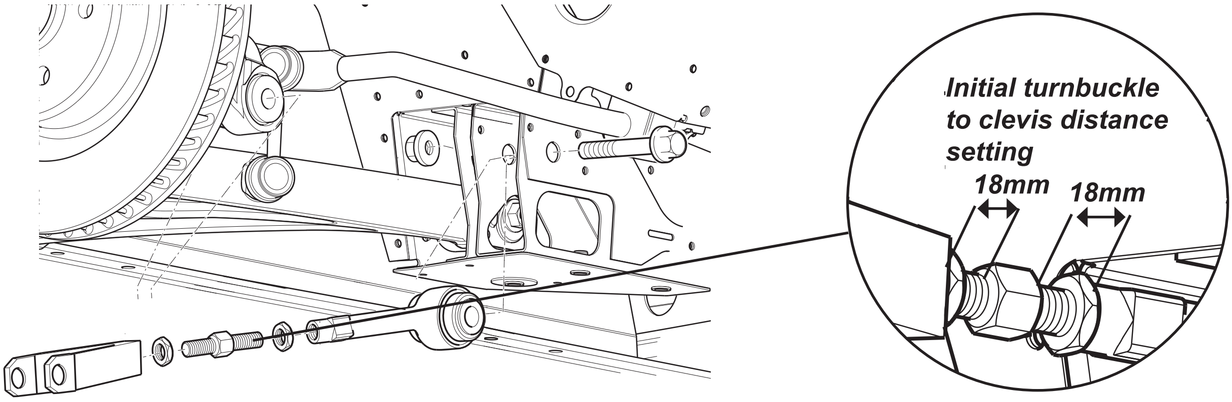
- If renewing toe control link assembly it will be necessary to perform a geometry check and adjustment as required.

Check and adjust the rear toe alignment and camber (if required as shown on previous page) using the vehicle mid-laden ride height figures and geometry settings as shown in Service Notes section TDV.

Note: Once the rear toe alignment has been set the parallelism of the outer clevis and the inner toe link assembly bolts should be checked by rotating the locked toe control link assembly about its axis.

There should be at least 5° of free movement if adjusted correctly. Any less and there is a risk that the spherical joints could lock-out as the suspension articulates under driving conditions, under extreme conditions this may allow the turnbuckle to loosen at either the inner toe link assembly or outer clevis causing the toe adjustment to change.

Outer clevis/turnbuckle removal



Preparation:
If not already performed, carry out steps 1 - 2 for toe link assembly removal as shown on the previous page.

Removal:
1. Loosen the inner LH thread lock nut securing the turnbuckle to the inner toe link assembly and the outer RH thread lock nut securing the turnbuckle to the outer clevis.

2. Swing the outer clevis/toe link assembly downwards away from the upright assembly.

3. Unwind the outer clevis and turnbuckle to remove them from the inner toe link assembly.

Replacement:
4. Fit new or transfer the original inner and outer locknuts onto the new turnbuckle.

5. Fit the turnbuckle onto the inner toe link assembly, winding in the LH thread until there is approximately a distance of 18mm between the front face of the threaded tube section of the inner toe link and rear face of the turnbuckle adjuster.

6. Fit the new clevis onto the RH thread of the turnbuckle, again winding in clevis until there is approximately an 18mm distance between the rear face of the clevis and front face of the turnbuckle adjuster.

7. Ensure both inner and outer locknuts are torqued only 'finger tight' at this stage.

8. Position the outer clevis/ toe link assembly and refit the clevis bolt/nut back onto the suspension upright in the correct orientation as described on the previous page.

9. Check and adjust the rear toe alignment and camber (if required) using the vehicle mid-laden ride height figures and geometry settings as shown in Service Notes section TDV.

Note: Once the rear toe alignment has been set the parallelism of the outer clevis and the inner toe link assembly bolts should be checked by rotating the locked toe control link assembly about its axis.

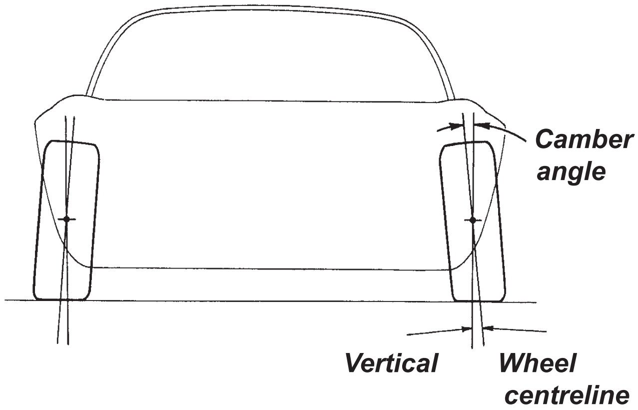
There should be at least 5° of free movement if adjusted correctly. Any less and there is a risk that the spherical joints could lock-out as the suspension articulates under driving conditions, under extreme conditions this may allow the turnbuckle to loosen at either the inner toe link assembly or outer clevis causing the toe adjustment to change.

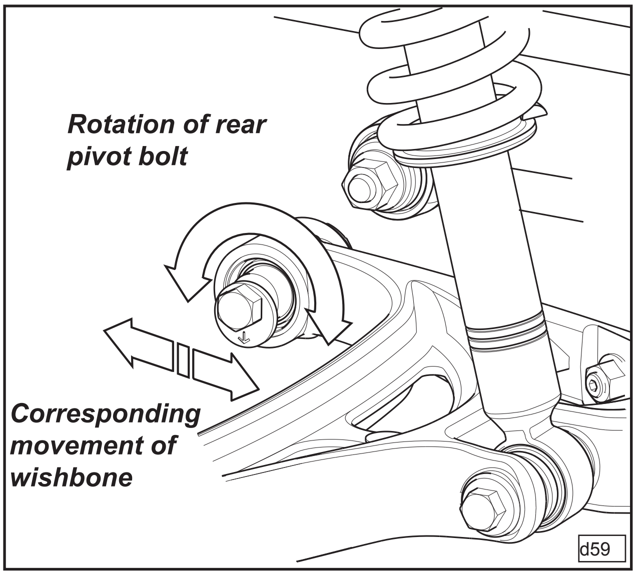
10. Once the correct geometry settings are achieved ensure to tighten both inner and outer turnbuckle locknuts to 45Nm.

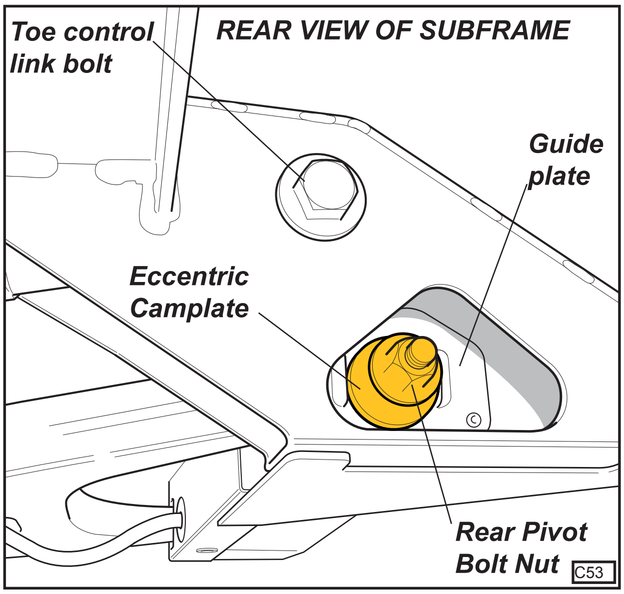
Camber Adjustment
Camber is the angle from vertical of the wheel as viewed from the rear, and is said to be negative when the wheel leans inwards at the top (and positive when leaning outwards).

The primary purpose of camber is to achieve the maximum efficiency of the tyre under cornering loads and body roll, with the specification closely allied to a particular wheel/tyre combination. The camber angle changes with suspension travel, becoming more negative on bump, and should be measured only at the specified ride height, see DI.3.

Incorrect camber can result in handling deficiencies and excessive tyre wear.







Rear Pivot Bolt/Camber Adjustment
An eccentric cam at the rear inboard pivot of each lower wishbone provides a means of camber adjustment. The pivot bolt is inserted from the front, with the bolt head featuring an integral eccentric cam, and with a corresponding eccentric camplate clamped beneath the nut on the front side of the rear pivot.

The camplate is keyed to the bolt via a tongue and groove feature to ensure alignment between the two cams. Each cam is constrained by vertical guides in a riveted insert in the subframe, whereas the pivot bolt hole in the subframe is slotted horizontally. Thus by turning the bolt (and eccentric cams) the wishbone pivot axis may be moved inboard or outboard.

When adjusting camber, note that the horizontal movement produced is not linear, but accords with simple harmonic motion. After adjustment, ensure that the pivot bolts are tightened to 86 Nm. Be aware that any camber adjustment will also affect wheel alignment, which must subsequently be checked and/or reset.

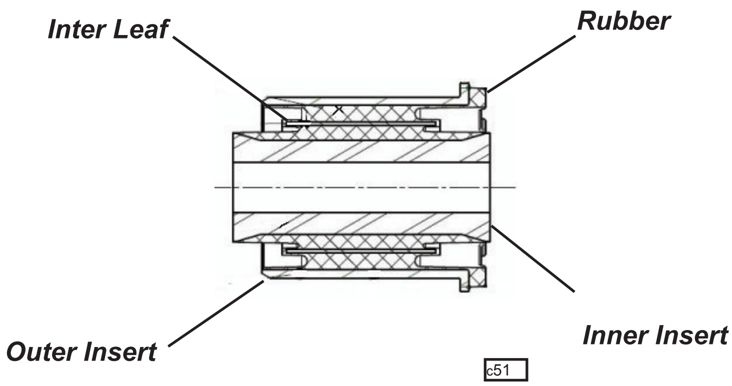
If it is neccessary to remove or renew the rear pivot bolt then ensure that upon refitment that the arrow displayed on the eccentric cam of the pivot bolt is pointing vertically downwards.

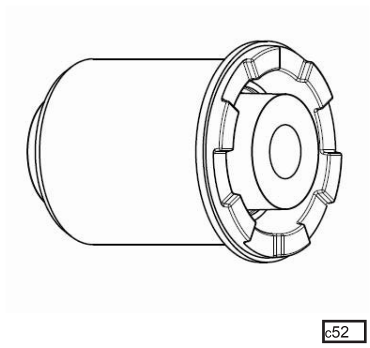
Only tighten the rear pivot bolts with the wishbones in their 'Ride height' positions, see sub-section DI.3.

DI.4 - WISHBONE PIVOT BUSHES & SPHERICAL JOINTS

Pivot Bushes

The upper and lower wishbone pivot bushes are bonded rubber type with a plastic flanged outer sleeve, an alloy inner sleeve, and an aluminium interleaf sleeve within the rubber bush to control the flexing characteristic. The rubber material specification has been selected to optimise the handling/refinement balance. The flanged end of the bush incorporates a snubbing feature to limit the axial distortion of the bush, with each bush arranged to resist braking forces transmitted through the suspension.

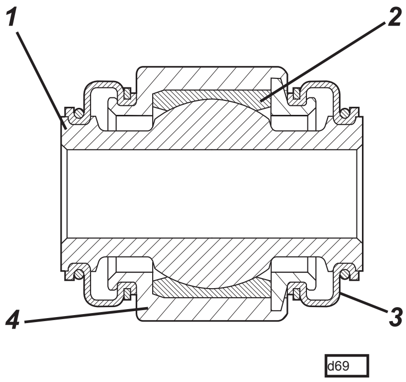


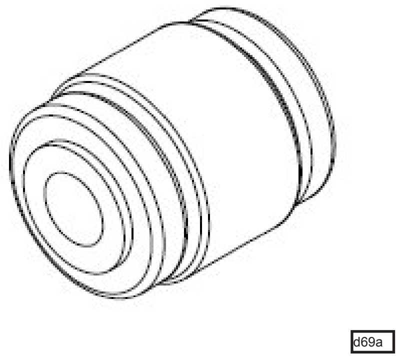


Damper Upper Bush

The upper eye of the damper houses a bonded rubber bush,

Spherical Joints (See section DI.10 for removal and refitment).





Through bolted spherical joints are used at the upper and lower hub carrier where they connect to the wishbones, both ends of the toe control links, and in the lower mounting eye of the dampers.

The joint consists of 4 main components,

2. A hollow steel inner tube to accommodate the through bolt, the tube also incorporates a central spherical section which,

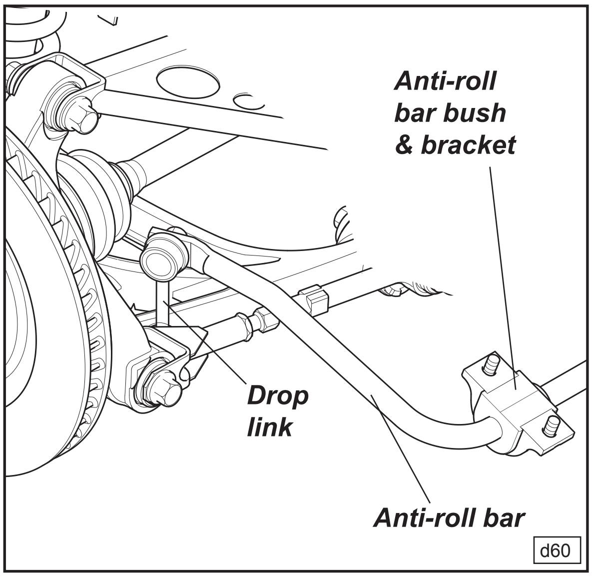
3. The spherical section is completely retained within concave polymide bushing allowing the tube to rotate 360º within its own axis inside the bushing, whilst also allowing it a small degree of radial tilt (up to 14º).

4. Dust seals are fitted either side of the assembly around the inner tube and outer sleeve to prevent the ingress of debris into the joint that may cause its premature wear

5. The polymide bushing and inner tube is contained within an outer metal sleeve allowing the whole assembly to be pressed into the hub carrier/lower damper mounting.

DI.5 - ANTI-ROLL BAR

A 19 mm o.d. tubular steel anti-roll bar is mounted beneath the rear subframe behind the axle line in rubber bushes retained by extruded alloy clamps. One clamp secures the bar at each side to the bottom surface of the subframe longeron via two bolts tapping into a steel nutplate riveted inside the longeron.

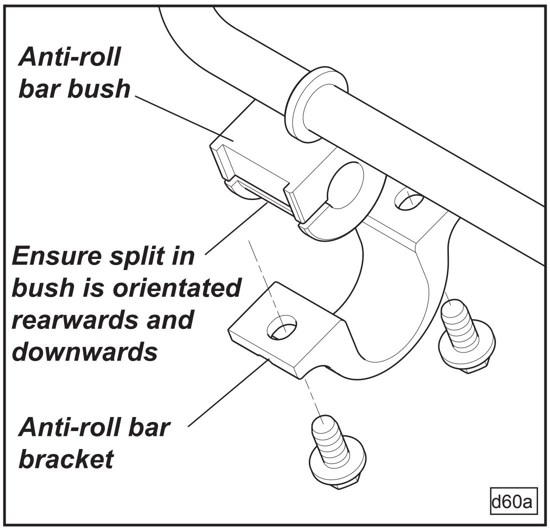


Each end of the bar curves over the toe-control link before connecting to a machined hole in the lower wishbone rear leg via a short ball jointed drop link. A pair of washers crimped to the bar, bear against the inboard sides of the mounting bushes to provide lateral location of the bar.

A heatshield wrap consisting of a one piece fibreglass sleeve with an outer laminated aluminium foil is fitted around the roll bar in between the mounting clamp area to insulate the bar and bushes from heat produced by the engine and exhaust system.

The drop link ball joints require no maintenance, and are replaceable only as part of the handed drop link assembly. The chassis mounted bushes are lubricated with rubber grease on assembly, but require no routine maintenance.

Removal:
- Remove rear undertray/diffuser assembly, see service notes section AN.2.
- Release the M12 nuts securing either end of the anti-roll bar to the upper ball joints of the LH/RH drop links and withdraw the links from the roll bar.
- Release the M10 x 20 screws (4) securing the anti-roll bar brackets (2) to the subframe and remove the anti-roll bar.



Refitment:
Reverse of refitment, tighten the drop link to anti-roll bar nuts to 36Nm, thighten the anti-roll bar bracket screws to 45Nm.

Note if the roll bar is being renewed then inspect the condition of the heatshield sleeve, transfer to the new bar or renew as required.

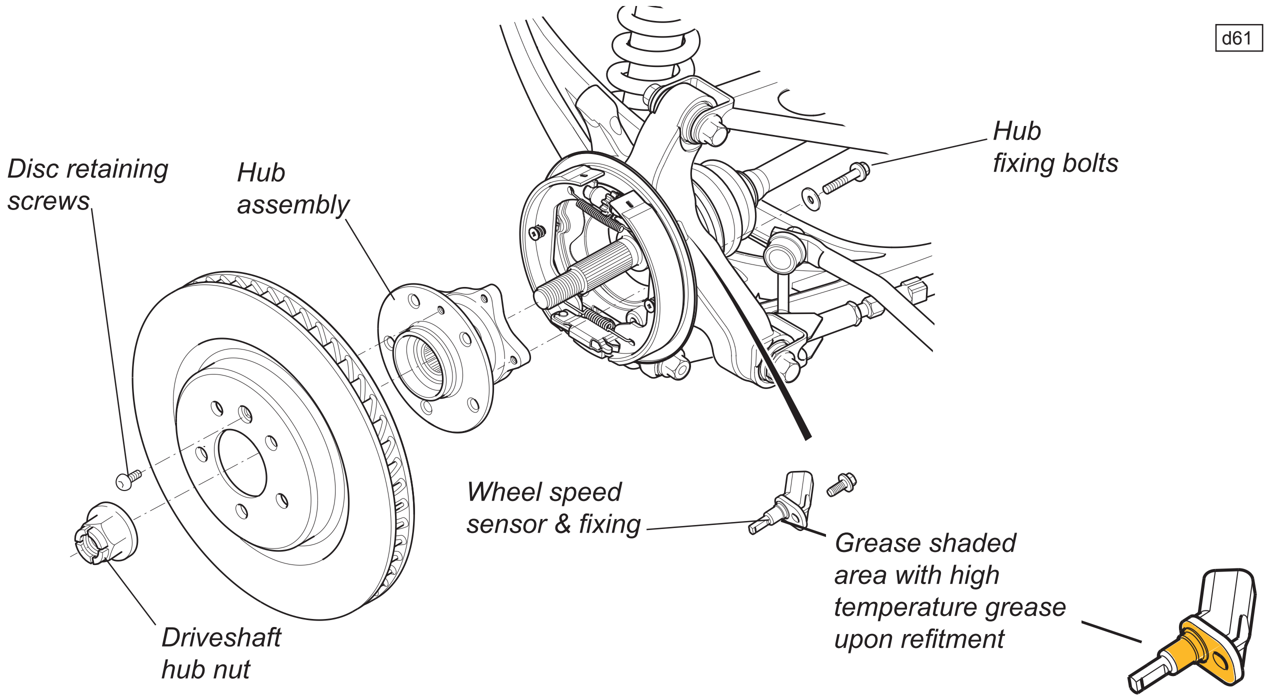
Anti-roll bar bush
If fitting a new anti-roll bar or bush then ensure that the bush is fitted in the correct orientation with the manufactured split in the bush facing downwards and rearwards of the vehicle.

This will reduce bush and bar wear by ensuring that any water and debris that is thrown up from the road into the path of the bushes can drain away instead of collecting in the bushes clamping split with the subsequent rotational movement of the bar causing both the bar and bush to wear.

Drop link
If removing or renewing the drop link then apply a small film of Permabond A130 to the first 10mm of the lower ball joint threads (ball joint to wishbone mount only) and replace the torque lock nut originally fitted.

DI6 - HUB ASSEMBLY

This assembly incorporates a wide spaced double row ball bearing, road wheel mounting flange and a vehicle speed sensor ring integrated into the inboard seal, whose 48 pole signal is picked up by a sensor mounted in the rear of the hub carrier. This data is used for the anti-lock brake, vehicle stability, engine management and speedometer functions. The unit is non serviceable and any malfunction that results in the failure of any of its functionality as listed above will require the renewal of the assembly.



Removal:
This operation will require the vehicle to be placed on a wheel free lift and with the rear wheel(s) removed, see Service Notes sections AN.1 and GK.4 for further information.

6. With the parking and footbrakes firmly applied, remove the driveshaft nut (both RH thread) see service notes section FK.5.

7. Release the two bolts securing the brake calliper to the hub carrier, release the flexible hose from the top wishbone, and support the calliper aside without straining the brake hose see service notes section JM.5.

8. Check that the parking brake is released, back off the brake shoe adjuster, remove the two countersunk retaining screws and withdraw the brake disc/drum from the hub see service notes section JM.7.

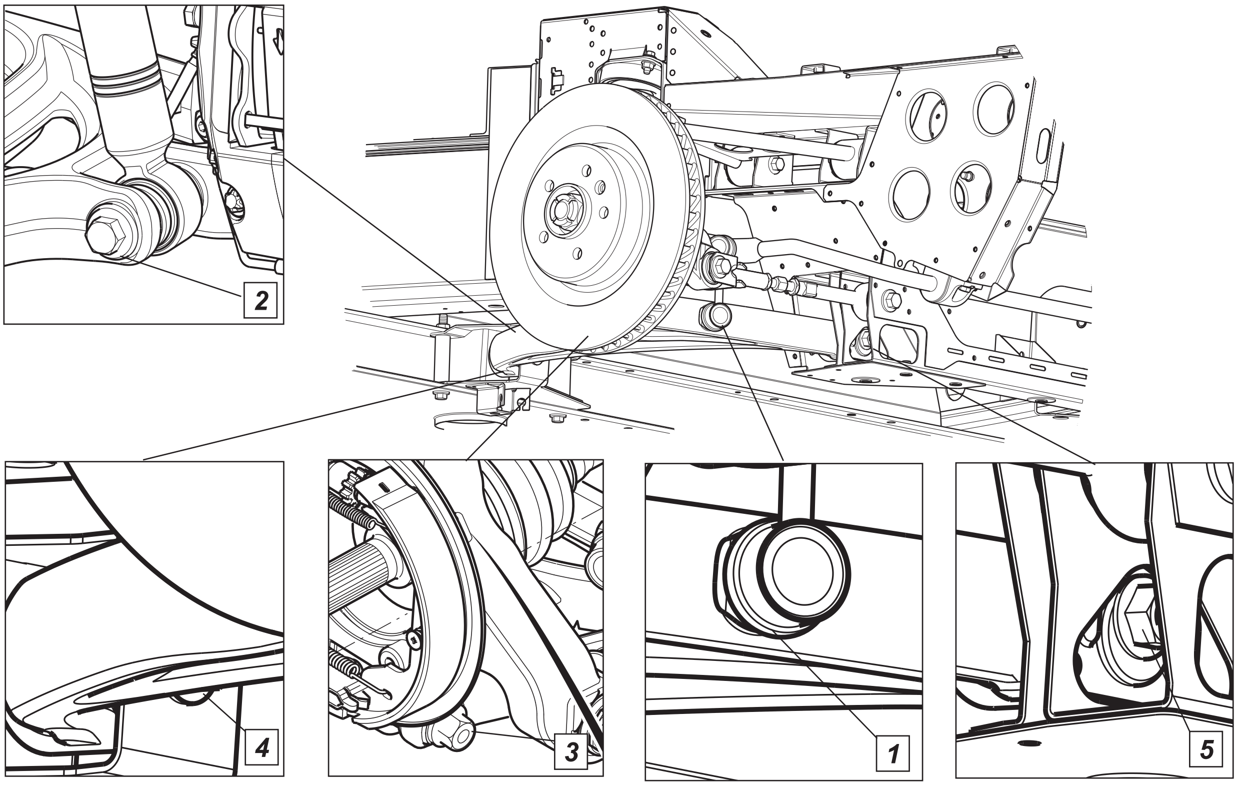
9. Release the single M5 x 12 screw securing the wheel speed sensor, and withdraw the sensor from the hub carrier.

10. Release the M10 x 35 (4) socket headed hub to carrier screws and washers then withdraw the hub unit from the hub carrier and driveshaft.

Refitment:
Reverse procedure of renewal except:
- Apply a light film of Permabond A130 to the threads of the hub to carrier screws before refitting and tightening to 70Nm.
- Apply a light coating of Mobiltemp 1 high temperature grease to the wheel speed sensor as shown in the illustration and tighten screw to 5Nm.
- Adjust the parking brake shoes and pump the brake pedal to reposition the pads before driving the car.

DI.7 - UPPER AND LOWER WISHBONES

Lower Wisbone Removal:
Raise vehicle and remove the relevant rear wheel (The lower wishbone to subframe bolts may be more accessible with the removal of the rear undertray), see Service Note sections AN.1, AN.5 & GK.4 for further information.



1. Release the M12 nut securing the anti-roll bar drop link to wishbone and withdraw. See section DI.5 for refitment information.

2. Release the M14 nut and M14 x 125 bolt (torque 135Nm) securing the lower spring/damper assembly to the lower arm and withdraw the bolt, noting the retaining steel washers fitted between the spherical joint and wishbone.

3. Release the M14 nut and M14 x 125 bolt (torque 135Nm) securing the lower wishbone to the hub carrier and withdraw the bolt, noting the retaining steel washers fitted between the spherical joint and wishbone.

4. Release the M12 x 85 bolt (torque 90Nm) securing the lower wishbone front pivot to the lower wishbone chassis bracket and withdraw.

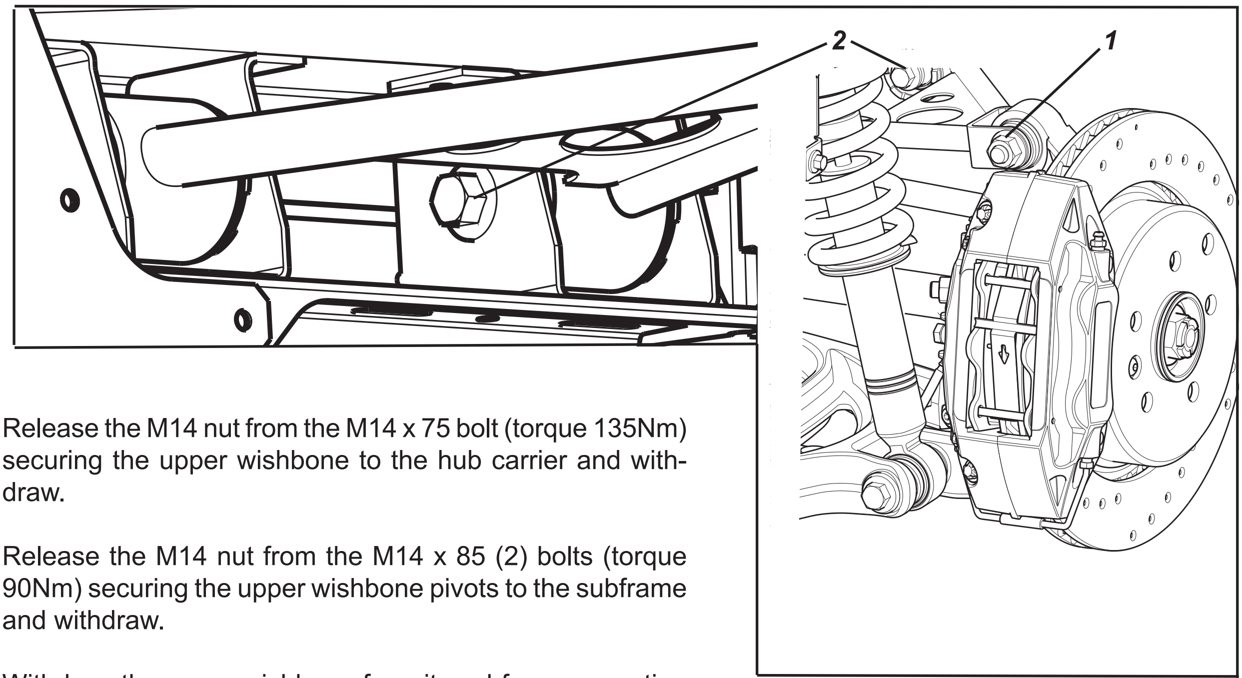
Note: Before releasing the lower wishbone rear pivot cambolt nut, match mark the eccentric cam to aid re-assembly, also see rear pivot bolt/camber adjustment information on page 6.

5. Remove the M12 x 95 cam bolt (torque 86Nm) and cam, release the front pivot bolt and withdraw the lower wishbone.

Refitment:
- Re-assemble the suspension in reverse order to disassembly with the following notes:
- Take care to refit each pivot bolt in the same direction noted on removal.
- Smear the shank of each pivot bolt with PBC grease to inhibit corrosion and facilitate subsequent servicing, but do not allow grease contamination of the threads.
- Take care to match mark and refit the eccentric cam adjusters on the lower wishbone rear pivot to facilitate subsequent geometry checking and adjustment.

- Do not tourque tighten the front inner wishone pivot bolt or rear inner wishbone cambolt and nut until the vehicle suspension is at its normal ride height, see DI.3.
- If the car suffers a suspension impact sufficient to damage a wheel rim, careful attention should be paid to all related suspension components, and replacement parts fitted in any cases of doubt.

Upper Wisbone Removal:
Raise vehicle and remove the relevant rear wheel. (Removal of the rear undertray may also be necessary if the upper wishbone is being removed as part of a complete rear suspension strip down), see Service Notes section AN.5.



1. Release the M14 nut from the M14 x 75 bolt (torque 135Nm) securing the upper wishbone to the hub carrier and withdraw.

2. Release the M14 nut from the M14 x 85 (2) bolts (torque 90Nm) securing the upper wishbone pivots to the subframe and withdraw.

3. Withdraw the upper wishbone from its subframe mounting points.

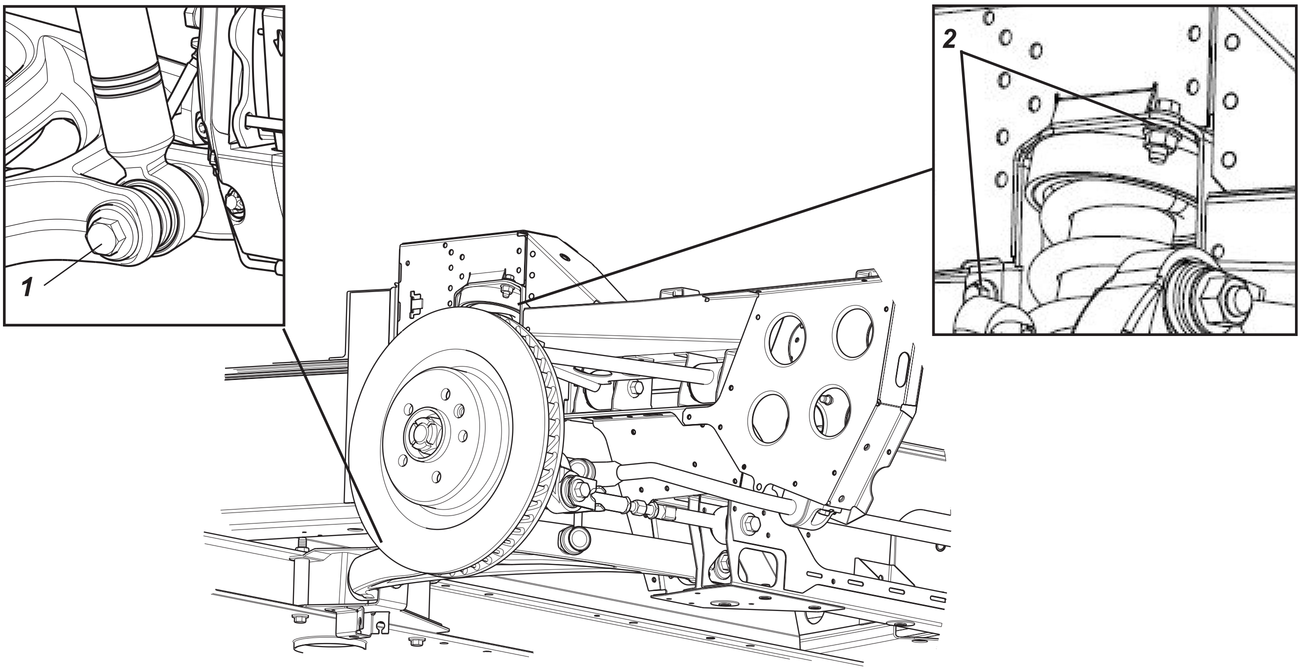
Note that the rear upper wishbones are not handed, so should be marked accordingly if both sides are removed and are to be refitted.

Refitment:
- Re-assemble the suspension in reverse order to disassembly with the following notes:
- Take care to refit each pivot bolt in the same direction noted on removal.
- Smear the shank of each pivot bolt with PBC grease to inhibit corrosion and facilitate subsequent servicing, but do not allow grease contamination of the threads.
- Do not torque tighten the inner wishone pivot bolts and nuts until the vehicle suspension is at its normal ride height, see DI.3.

DI.8 - SPRING AND DAMPER ASSEMBLY

The coil spring/telescopic damper units may be removed without causing disruption to the wishbone assembly mounting points or other suspension components.

Road spring & damper assembly removal:
Raise vehicle and remove the relevant rear wheel. (Removal of the rear undertray may also be necessary if the upper wishbone is being removed as part of a complete rear suspension strip down), see Service Notes section AN.1, AN.5 & GK.4 for further information.



1. Refer to operation 2 in rear lower wishbone removal in D.I.7.

2. Release the 2 M8 x 20 screws and nuts securing the spring top abutment plate to the inside of the subframe tower, and the single screw (captive nut) securing a leg on the plate to the front face of the tower, (all screws torqued to 24Nm).

3. Withdraw the complete spring/damper/abutment plate assembly.

Refitment:
Reassembly is the reverse of removal.

- Smear the shank of each pivot bolt with PBC grease to inhibit corrosion and facilitate subsequent servicing, but do not allow grease contamination of the threads.

Separating the road spring & damper assembly:

1. Remove the spring and damper assembly (refer to previous operation).

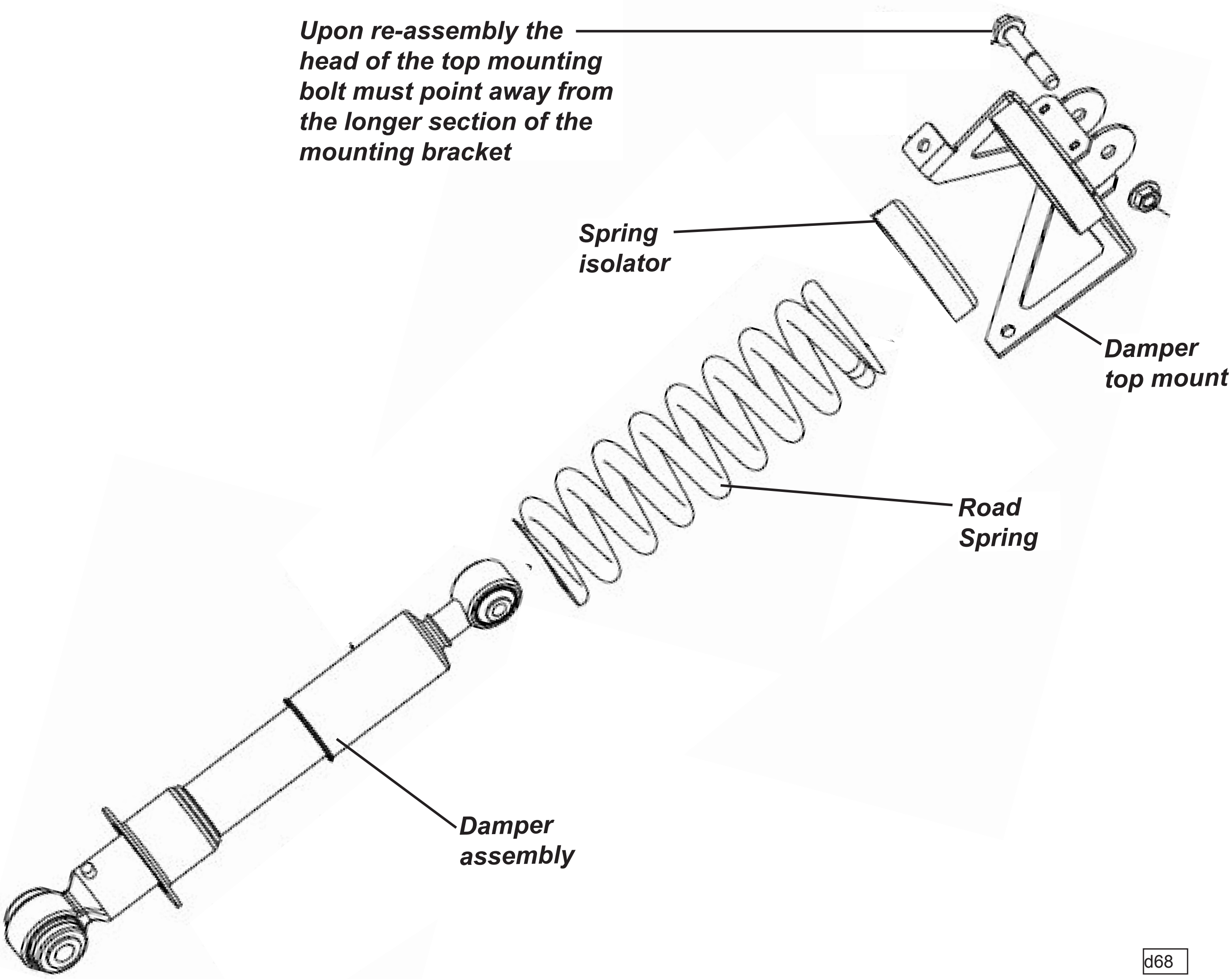
2. Using suitable compression tools, compress the road spring to relieve tension from retaining collar and spring isolator.

3. Release the M10 nut and M10 x 55 bolt (torque 40Nm) securing the upper damper mount to the damper mount assembly and withdraw the bolt.

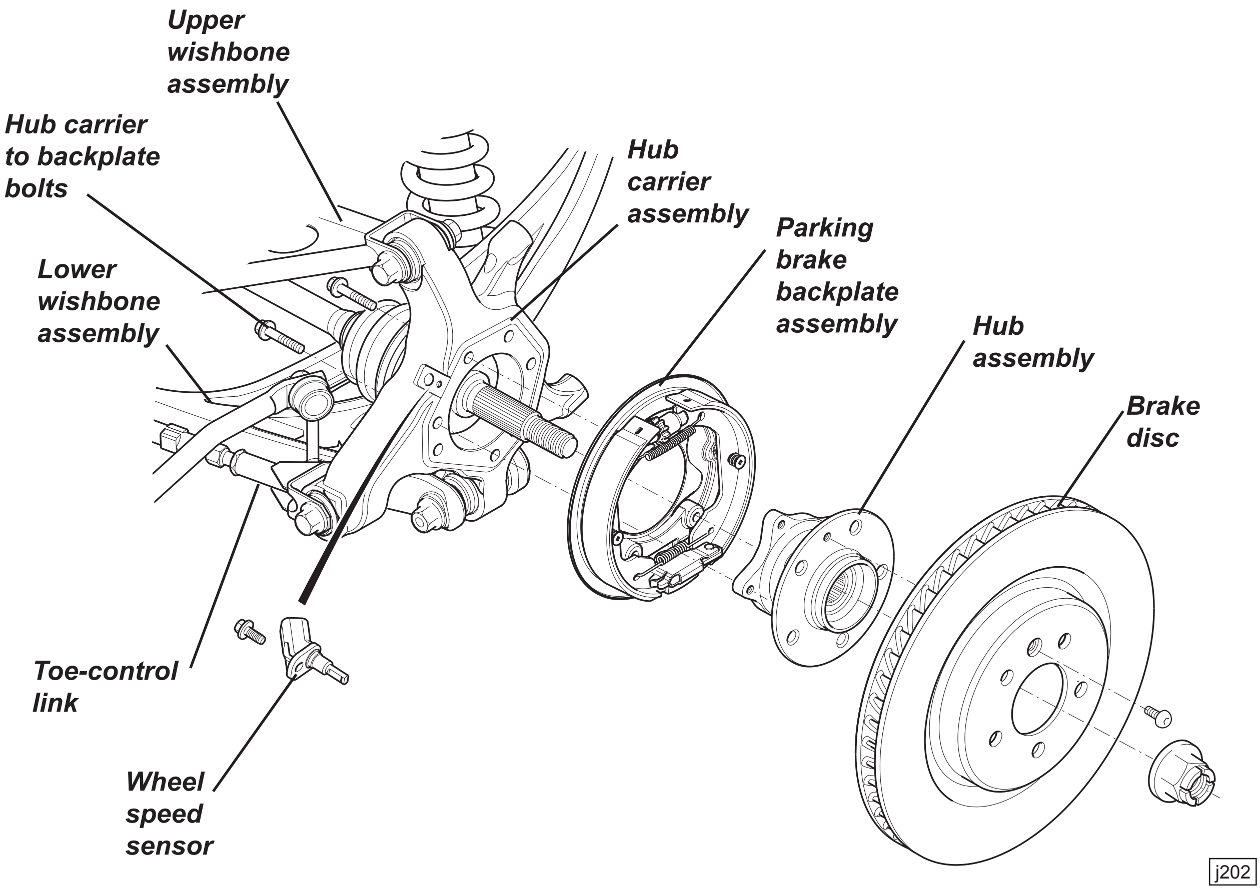
4. The spring and damper assembly can now be separated from the spring isolator and upper mounting bracket assembly.

Refitment:
Reassembly is the reverse of removal.

- Smear the shank of each pivot bolt with PBC grease to inhibit corrosion and facilitate subsequent servicing, but do not allow grease contamination of the threads.
- Upon re-assembly the head of the top mouning bolt must point away from the longer section of the mouning bracket to ensure there is enough clearance to refit the assembly onto the subframe.



DI.9 - HUB CARRIER ASSEMBLY



Hub Carrier

Removal:

- Remove hub unit as described in DI.6.

- Release the M6 x 12 screw securing the secondary parking brake outer cable to the hub carrier and withdraw the cable from the parking lever mechanism within the brake backplate. See Service Notes Section JM.7.

- Release the 2 lower M10 x 30 bolts and the single lower M10 x 25 bolt securing the backplate to the hub carrier, withdraw the bolts and remove the backplate assembly complete with brake shoes (All 3 bolts torqued to 45Nm).

- Release the nut and bolt securing the toe-control link to the hub carrier and withdraw and separate from the hub carrier, see page 5.

- Release the nut and bolt securing the top wishbone to the hub carrier and withdraw, see DI.7.

- Release the nuts and bolt securing the lower wishbone to the hub carrier and withdraw, see DI.7.

- Withdraw the carrier from the car.

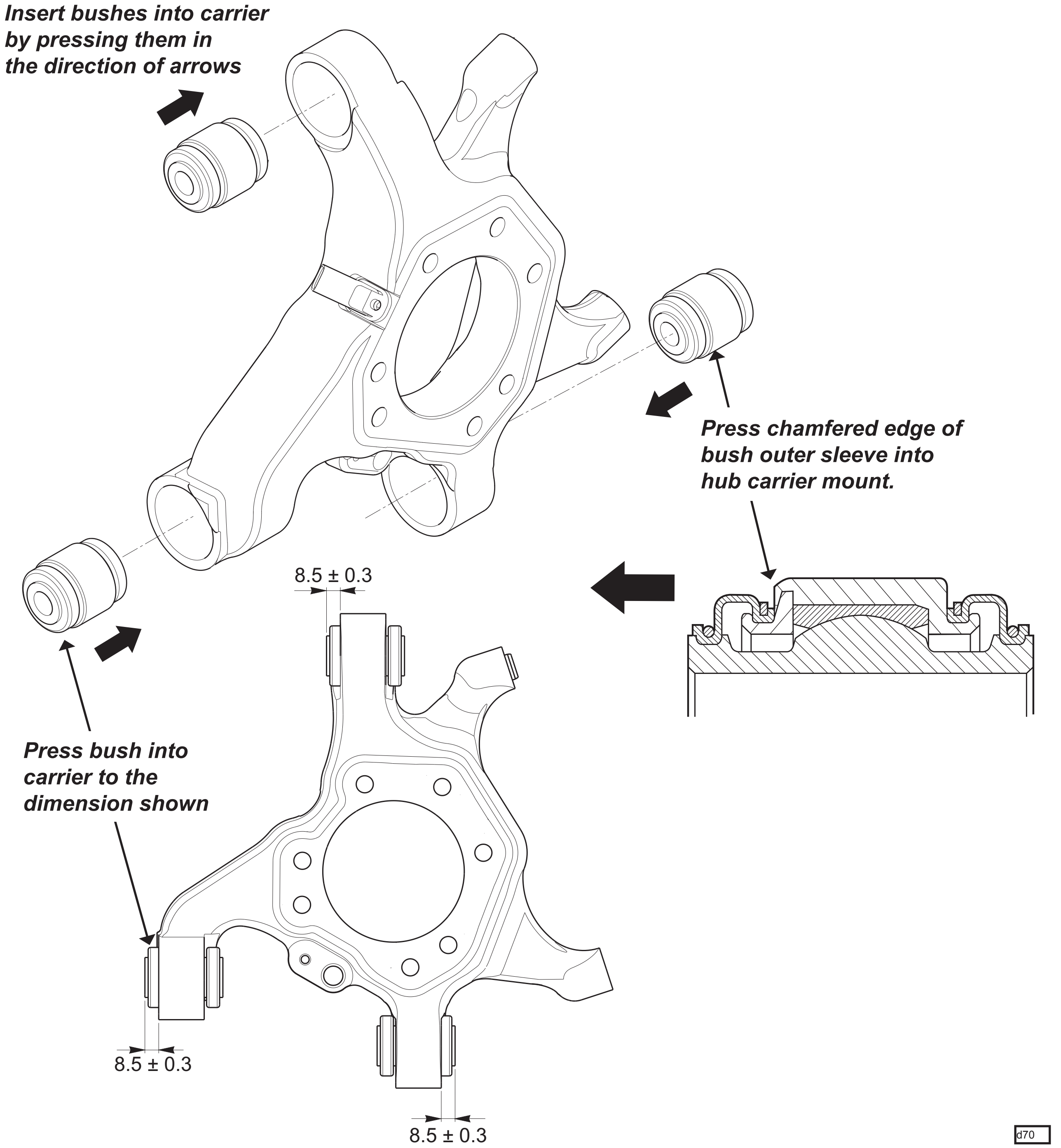
Refitment:
Reassembly is the reverse of removal. Adjust the parking brake shoes and pump the brake pedal to reposition the pads before driving the car.

If renewing the spherical bushes within the hub carrier, follow the procedure listed on the next page.

DI.10 - SPHERICAL BUSH RENEWAL

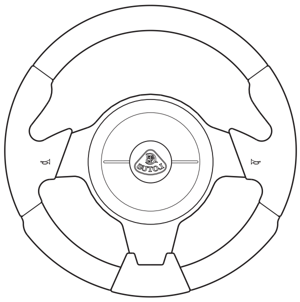
Removal:
- Remove the hub carrier assembly as described in DI.9.
- Using suitable press tools, push out the affected bush(s)

Refitment:
The reversal of removal, bush(s) should be pressed into their carrier mounts in the directions as shown in the illustration below.
- For ease of fitment, bush orientation into the carrier should be with the chamfered face of the outer sleeve foremost.
- Bush(s) should be pressed into the carrier until their rearmost pressed surface protrudes 8.5 mm ± 0.3mm from the mounting face as shown in illustration below.

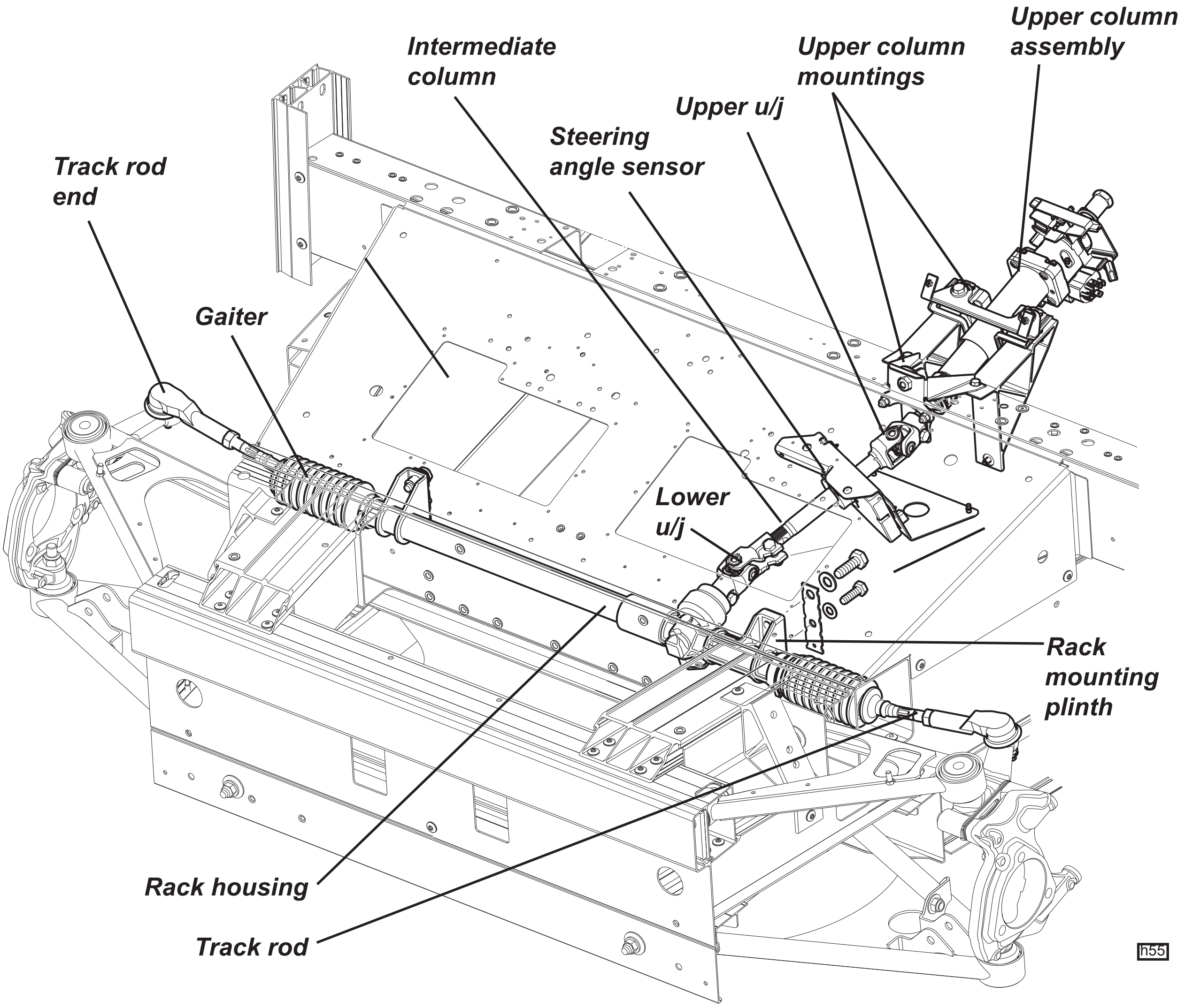


STEERING

SECTION HK



General Layout



HK.1 - GENERAL DESCRIPTION

The steering system of the Exige S comprises a telescopically collapsible upper column assembly, connecting to a rigidly mounted rack and pinion assembly via a universally jointed intermediate shaft. The steering rack tie rods connect to rearward facing steering arms bolted to the forged steel front hub carriers, with geometry providing 30% Ackermann effect, and a toe-out on bump characteristic. No power assistance is provided.

The steering rack assembly consists of a cast alloy pinion housing mated to a tubular steel rack housing.

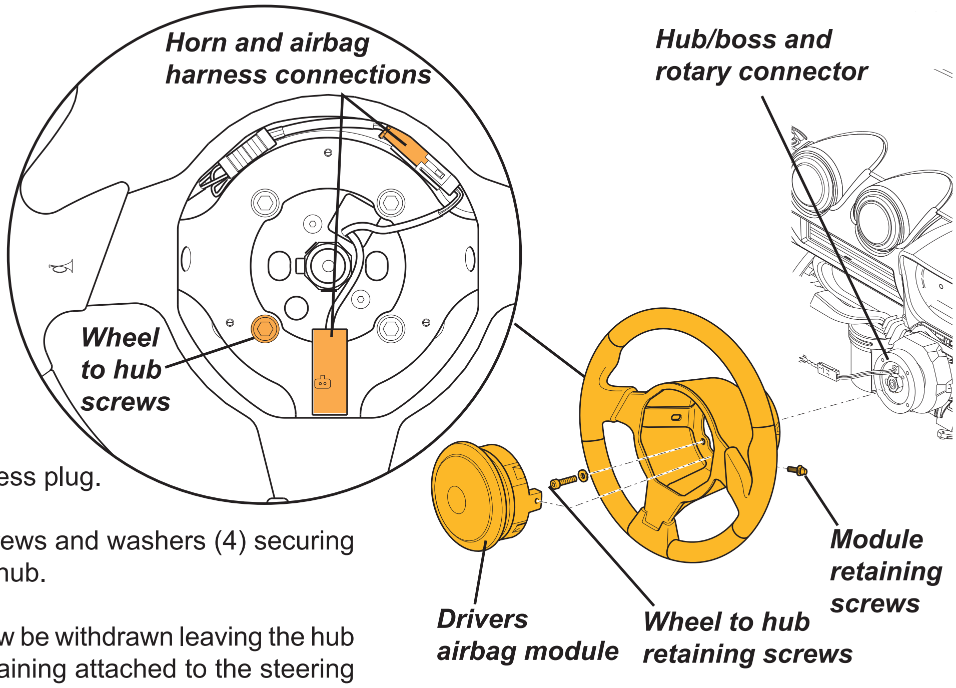
The upper column is fixed to the scuttle beam, with the column upper bearing carrier also providing mountings for the steering lock and column switches. 'Break out' inserts fitted in the column upper mounting flanges, allow for telescoping of the column in a frontal collision. The steering rack assembly, which provides 2.4 turns from lock to lock at a 15.8:1 ratio, is rigidly mounted inside a chassis transverse extrusion behind the top wishbone rear pivots.

HK.2 - STEERING WHEEL

The alloy three spoke steering wheel has a leather trimmed rim and moulded rubber covered spokes which incorporates horn buttons in the outer ends of each of the nominally horizontal spokes. An airbag module is incorporated in the centre of the wheel, and uses a rotary coil unit to maintain cable continuity to the airbag and horn buttons. The steering wheel is secured to the column via a 36 spline boss.

To remove steering wheel from hub-boss/rotary connector:

⚠ WARNING: The driver's airbag is housed in the hub of the steering wheel. Precautions need to be taken for personal safety when working with airbags and associated componentry. Do not attempt to remove the airbag or steering wheel without first referring to section WC.

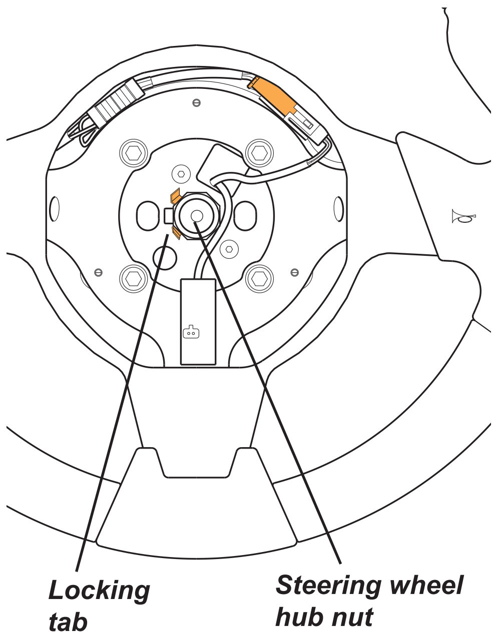


1. Remove the drivers airbag module from the steering wheel, refer to service notes section WC for further information.
2. Disconnect the horn harness plug.
3. Released the M6 x 12 screws and washers (4) securing the steering wheel to the hub.
4. The steering wheel can now be withdrawn leaving the hub and rotary connecter remaining attached to the steering column. (Ensuring airbag and horn wiring is carefully feed through the aperture provided in the hub/boss).

Refitment:
Is the reversal of removal.

Steering wheel/hub/rotary connector removal from steering column:

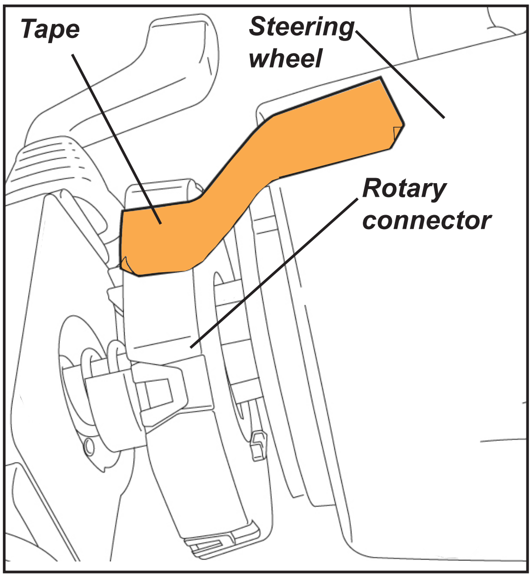
⚠ WARNING: The driver's airbag is housed in the hub of the steering wheel. Precautions need to be taken for personal safety when working with airbags and associated componentry. Do not attempt to remove the airbag or steering wheel without first referring to section WC.



1. Refer to service notes section WC and remove the drivers airbag module from the steering wheel.
2. Ensure the front wheels are pointing straight ahead. Bend back the locking tabs and release the nut securing the hub to the column until it is positioned at the end of the column shaft thread
4. Match mark the position of the hub against the column to aid re-assembly.

5. Place a piece of tape on the central body of the steering wheel and rotary connector to fix the relative position of the connector to the steering wheel.

   Note: The rotary connector is limited to a total amount of rotations it can perform in either a clockwise or counter clockwise direction. If it is rotated beyond its limit, (which is possible once it has been removed from the steering column), then the internal connections within the unit may break resulting in an air bag failure.



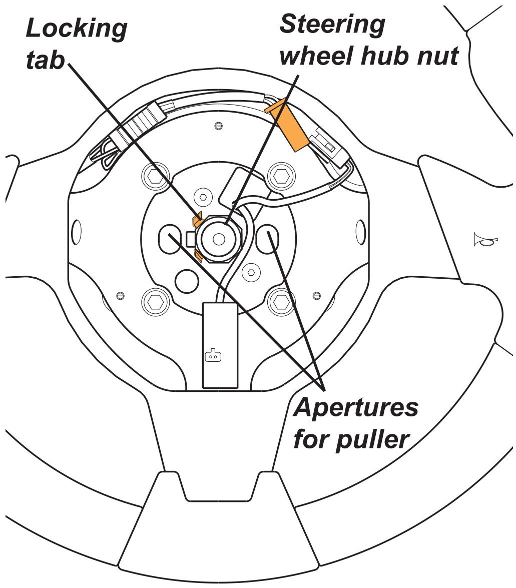
6. Using a suitable steering wheel puller tool, position the legs to reach through the holes in the wheel hub and bear directly against the hub, without interfering with the rotary connector on the back of the hub.

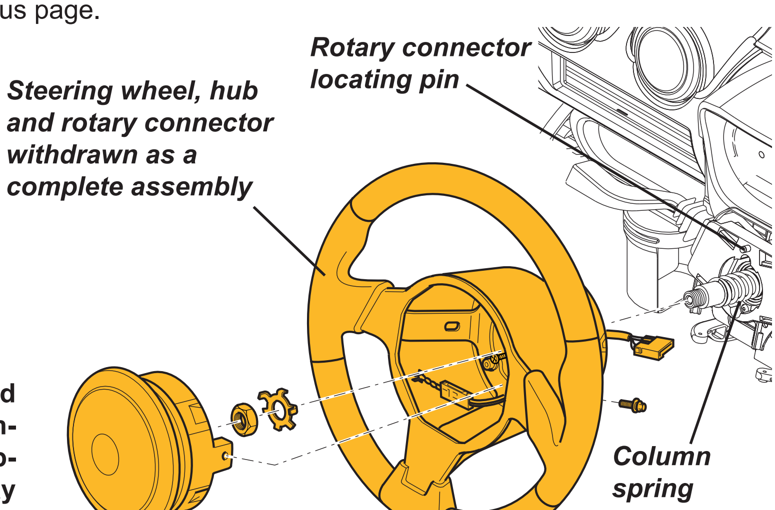
   The centre screw of the puller should bear against the end of the column shaft and nut.

7. Carefully and progressively tighten the centre screw thread of the steering wheel puller until the boss of the steering column breaks free of the column taper and is forced up against the steering column nut.

8. Withdraw the wheel/hub/rotary connector assembly from the column splines.

   Alternatively, for better puller access, the steering wheel can first be removed from the hub by releasing the four retaining screws as shown on the previous page.





CAUTION: If excessive force is applied to either the wheel/hub or column without an appropriate puller, the telescoping mechanism of the outer column may be overridden, necessitating column replacement.

Refitment:

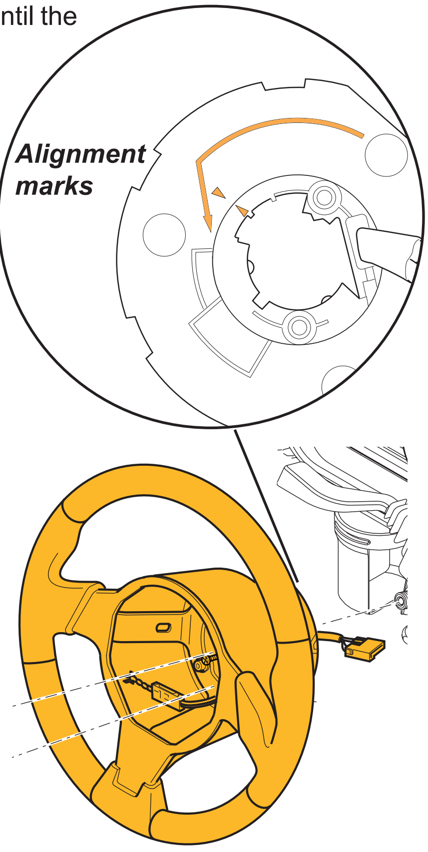
Preparation:
If the wheel and rotary connector where not fixed in their relative position with a piece of tape, or if it has become detached or if the steering wheel is being renewed then it will be necessary to centralise the rotary connector before refitting the assembly onto the steering column.

Centralisation procedure:
Viewed from the side of the steering wheel, turn the connector centre element fully counter clockwise until tight, then turn clockwise approximately 2.5 turns until the arrow marks on the two parts of the rotary connector are aligned.

- Make sure the front wheels are pointing straight ahead, and fit the assembly onto the column with the hub to column match marks (made on disassembly) aligned, and engage the spring loaded pin on the column switch housing with the slot in the rotary connector.

- Fit a new locking tab washer, followed by the steering wheel nut, and torque tighten to 25 Nm (18.5 lbf.ft). Bend up the locking tabs to secure.

- Refer to section WC to refit the airbag module, and verify the system.

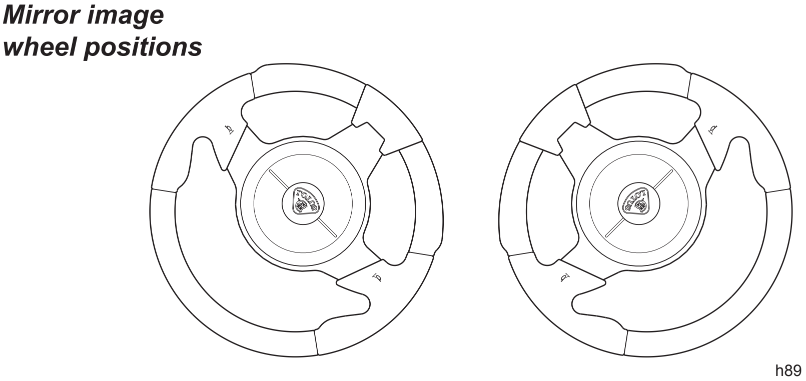


Steering Wheel Alignment:
Ideally, the steering wheel should align in the straight running position, with the steering rack centralised and with equal track rod lengths. In practice, a minor compromise to track rod lengths may have to be made. To arrive at the optimum setting, proceed as follows:

Note that only one splined joint in the steering system allows a choice of position, this being the lower joint to rack pinion shaft.

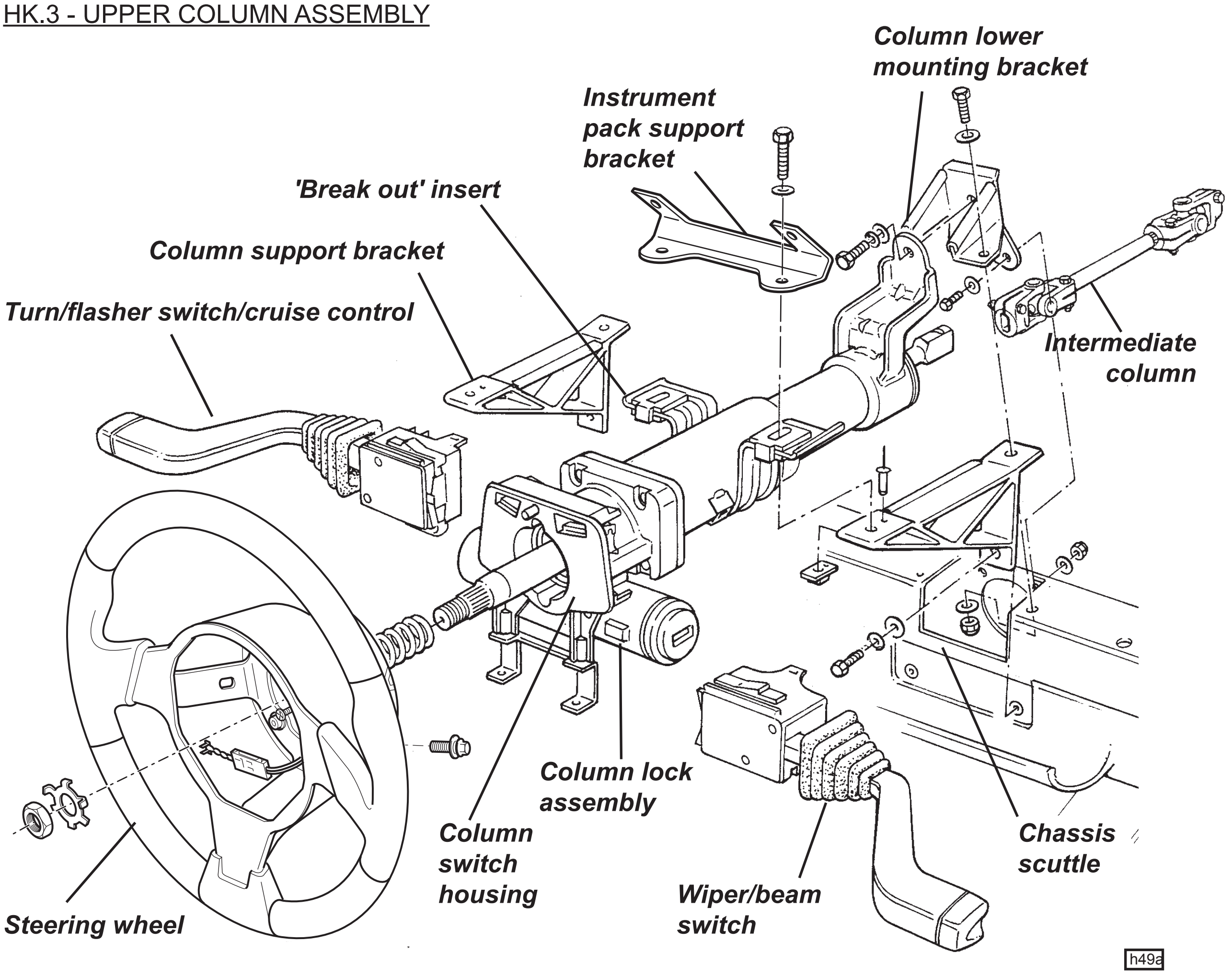
1. Set the front wheel alignment to specification with equal track rod lengths; see sub-section HK.5 and service notes section CJ.3 for further information.

2. Turn the steering to each full lock in turn and set the steering wheel on the column splines such that its orientation in one full lock position is the nearest possible mirror image of its position at the opposite full lock.



3. Secure the steering wheel before road testing the car and marking the actual 'straight ahead' position of the steering wheel which should deviate from the ideal position by less than 5°. Final alignment is achieved by asymmetric adjustment of the track rods, retaining the overall toe-out setting.

HK.3 - UPPER COLUMN ASSEMBLY



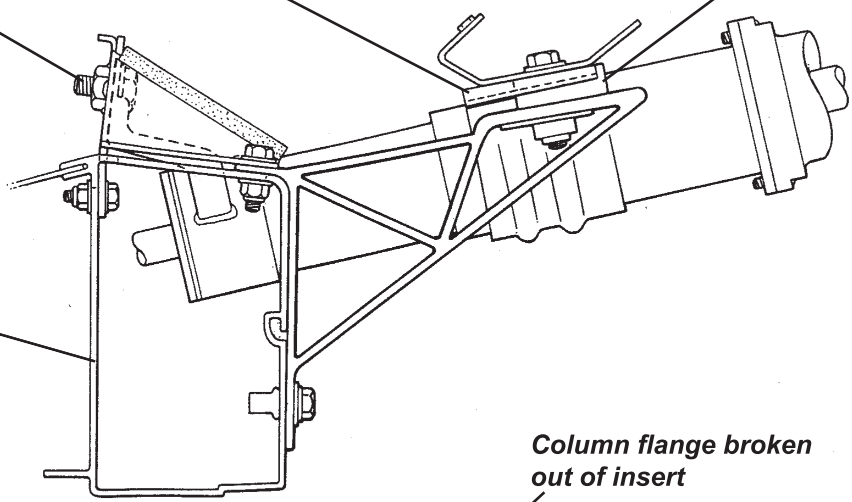
The upper steering column assembly comprises an inner column which connects the steering wheel to the intermediate shaft, and a tubular steel outer column which, with its alloy upper bearing housing, supports the inner column and carries the column lever switches for lighting and wiper control, and also the ignition switch/ steering lock.

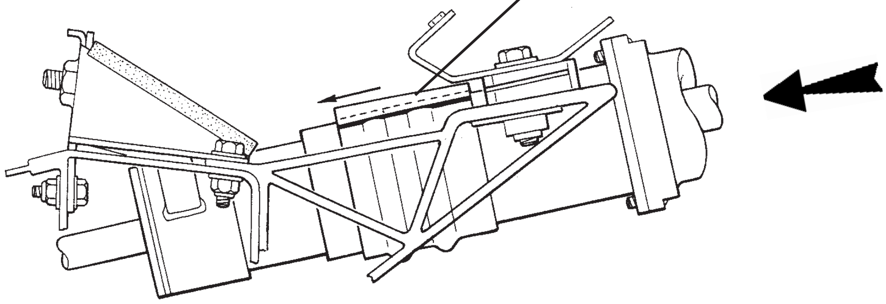
Both inner and outer columns are of fixed length, but are telescopically collapsible when subjected to crash forces.

The two parts of the inner column are fixed together by plastic pins designed to shear and allow telescoping to occur beyond a specified axial load. The two part outer column tube uses gripper rings to retain the column length, with the lower part mounted by a single fixing to the chassis scuttle beam via a three point fixing steel bracket.

The upper part of the outer column has two open slotted mounting flanges each of which is fitted with a 'break out' alloy insert, bolted through to an extruded alloy plinth fixed to the scuttle beam.

In the event of an extreme axial load being applied to the column via the steering wheel, as may occur during a vehicle frontal collision, the plastic retaining pins in the column flange inserts will shear and allow the upper part of the column to break free of the upper fixings and telescope forwards, reducing the potential for column induced injury.



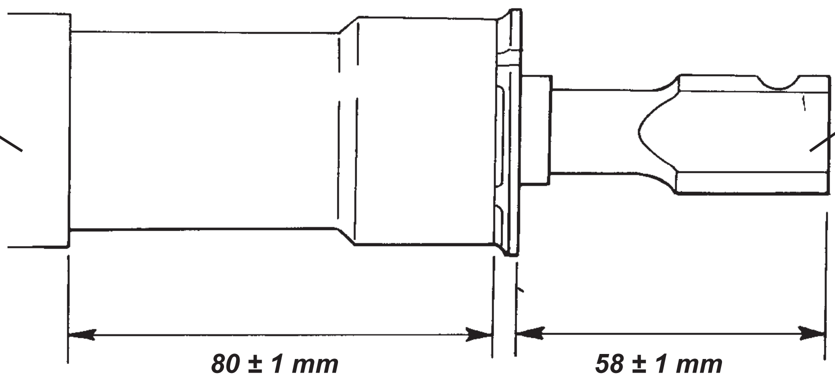


Dimensional Check

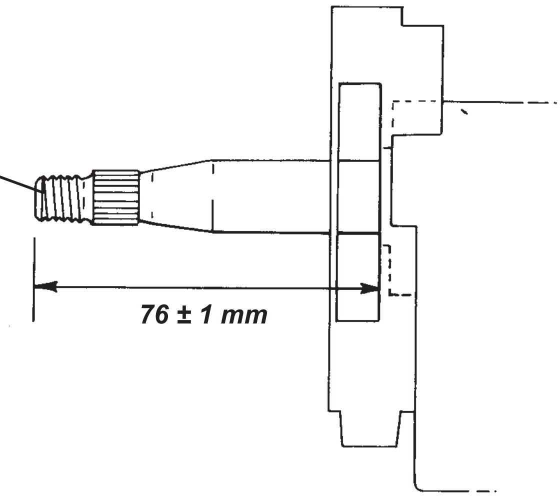
If the vehicle is involved in an accident, or any part of the column is subjected to an abnormal load including airbag deployment, the column should be carefully examined to establish if any telescoping has occurred. Perform the following checks, and replace the complete upper column assembly if any of the dimensions are outside specification:

1. Outer Column:
   Measure the length of the lower part of the outer column as shown:
   Specification = 80 ± 1mm

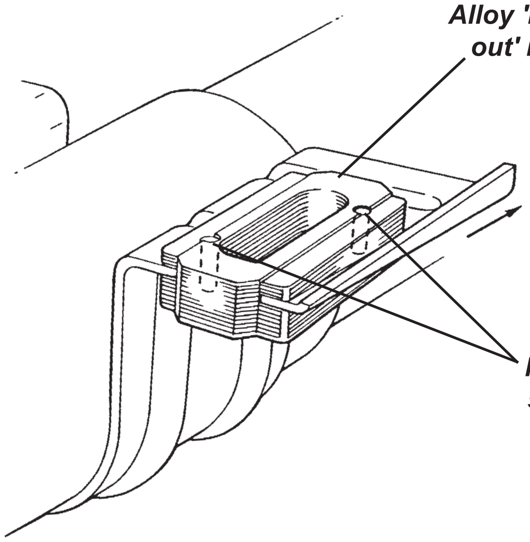
2. Inner Column Lower:
   Measure the length of the exposed part of the inner column as shown:
   Specification = 58 ± 1mm



3. *Inner Column Upper*
With the steering wheel removed, measure the length of the exposed part of the upper column as shown:
Specification = 76 ± 1mm



4. *'Break out' Inserts*
Remove the column shrouds and the column flange fixing bolts, and check that each of the alloy 'break out' inserts is securely attached to the column flange. If the plastic pins are sheared, the column assembly must be replaced.



Upper steering column assembly removal:

⚠ WARNING: On cars so equipped, the driver's airbag is housed in the hub of the steering wheel. Precautions need to be taken for personal safety when working with airbags and associated components. Do not attempt to remove the airbag, steering wheel or column without first referring to section WC.

1. Disconnect the battery, and remove the upper and lower column shrouds; refer to service notes sections MV.10 and VE.4 for further information.

2. Disconnect the column lever switches, or release the retaining pawls and slide the switches out of the carrier; refer to service note section MV.6. On airbag equipped cars, refer to section WC and unplug the yellow airbag harness connector.

3. Disconnect the main harness from the ignition switch: refer to service note section MV.4 for further information.

4. Remove the instrument surround and cowl and instrument pack and switch pack; refer to service notes sections VE.5, MV.5 and MV.12 for further information.

5. If necessary, remove the steering lock/ignition key barrel: Turn the key to position 'I', depress the spring pin accessible via a hole in the column switch carrier, and withdraw the lock barrel; refer to sub-section HK.8 for further information.

6. If necessary, remove the ignition switch: First remove the steering lock/ignition key barrel (see above). Remove the retaining grub screw and withdraw the switch.

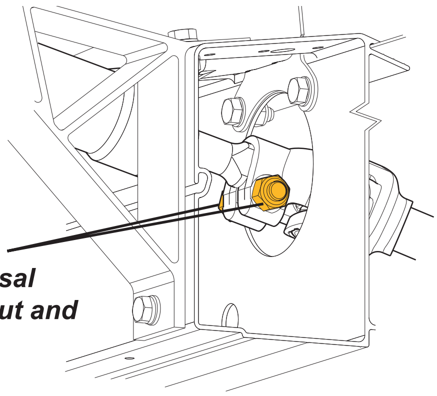
7. If necessary, remove the steering lock assembly: Remove the spline head screw securing the column switch carrier, and drill or chisel out the two shear head bolts fixing the lock assembly to the column.

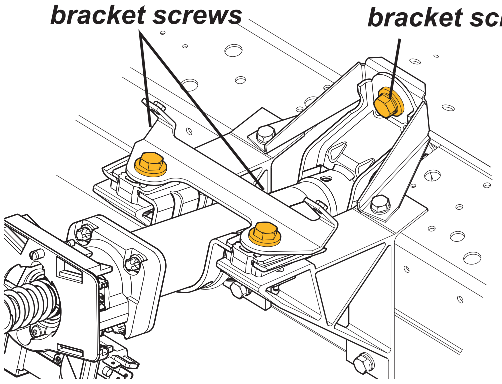
8. From within the drivers footwell area, release and remove the M8 torque nut and M8 x 35 screw securing the upper universal joint to the intermediate column.

9. Release the M8 x 35 bolts and 8mm washers (2) securing the upper column clamp to the dash brackets,

10. From the access provided by the removal of the switch pack, release the M8 x 16 set screw, spring washer and flat washer (1) securing the upper column to the scuttle mounting bracket.

11. The upper column assembly can now be withdrawn from the scuttle and off the intermediate steering column.





Refitment:
Is the reverse of removal with the following notes:

- The groove in the universal joint allows assembly to the intermediate column in only one orientation. Torque tighten the set screw to 25 Nm.

- Torque tighten the upper column fixing screw to 25 Nm.

- Torque tighten the two upper column to dash bracket fixing screws to 25 Nm.

- If applicable, use new shear bolts to secure the steering lock assembly, and tighten until sheared.

HK.4 - INTERMEDIATE COLUMN

The intermediate steering column assembly consists of a shaft incorporating an integral upper universal joint and a splined lower end.

The upper joint accommodates a double flatted boss which slides into position on the end of the upper columns inner shaft, secured with a pinch screw groove allowing fitment in only one orientation.

Both yokes of the lower universal joint are machined with 36 un-indexed splines allowing the intermediate shaft to be fitted in one of several orientations onto the steering rack pinion shaft.

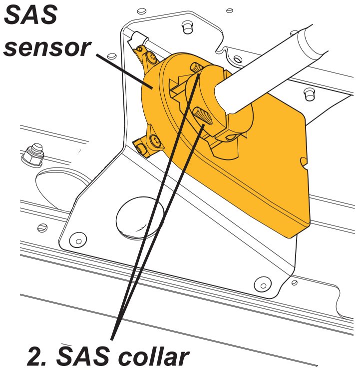
The position of the lower joint on the shaft can also be set by moving it upwards or downwards on the splines to decrease or increase its overall length. Adjustment of the lower joint in relation to the shaft will ensure that the pinch screws of both upper and lower joints are in the correct alignment for both the steering rack pinion shaft and the inner shaft of the upper column assembly.

The 2 piece collar of the SAS (Steering Angle Sensor) is also clamped around the shaft of intermediate column assembly.

Removal:

1. Remove the upper column assembly, see sub-section HK.3 for further information.

2. From within the driver's footwell area, release the M5 x 25 socket headed cap screws (2) clamping both halves of the SAS (Steering Angle Sensor) collar together, remove the screws and collect both halves of the collar.

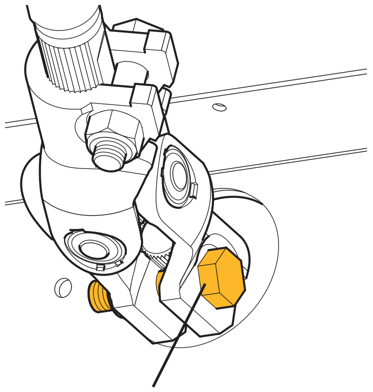


3. Match mark the intermediate column joint to the pinion shaft of the steering rack.

4. Release and remove the M8 torque nut and M8 x 35 screw securing the column joint to the steering rack pinion shaft.

5. Separate the lower joint from the steering rack pinion shaft and carefully manoeuvre the intermediate column assembly upwards, through the centre of the steering angle sensor and withdraw via the upper column assembly aperture in the scuttle panel.

   Note: the shaft may have to be rotated whilst being withdrawn so that the lower joint can pass through the centre of the steering angle sensor, alternatively the lower joint may be completely disconnected from the shaft so that it does not have to travel through the sensor.



Refitment:
Is the reverse of removal with the following notes:

- Ensure the intermediate shaft to pinion and column marks are aligned correctly

- Once the upper column assembly is refitted, check and adjust the position of lower joint on the intermediate shaft to ensure upper and lower pinch bolts are seated in the pinion rack and upper column grooves correctly.

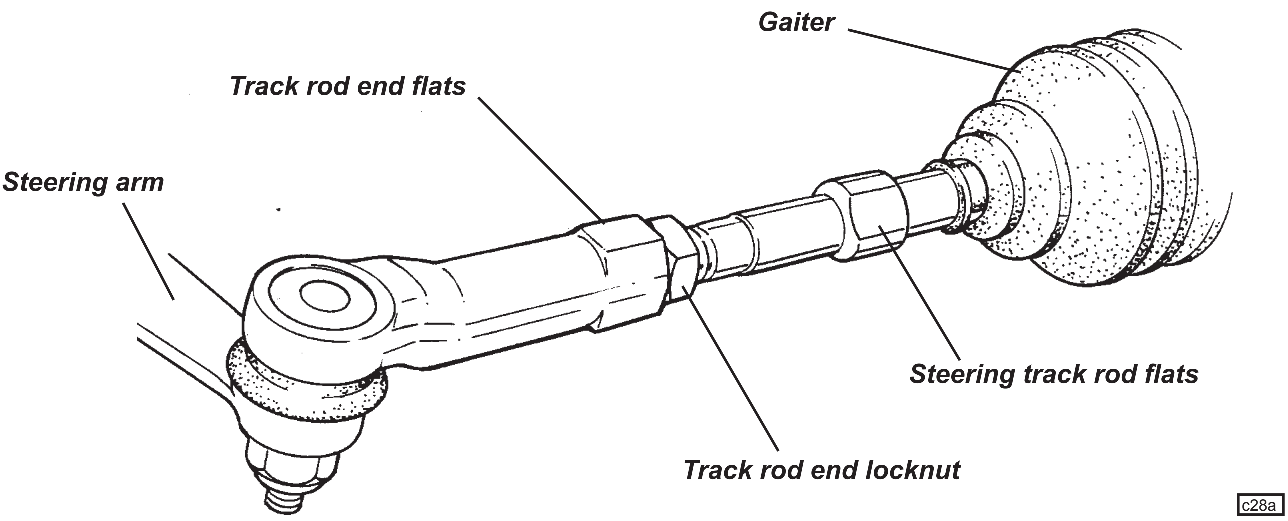
- When refitting the steering angle sensor collar, ensure that its integral peg is located within the narrow slot of the sensor switch and torque the screws to 4 Nm; refer to service notes section JM.10 for further information.

- Torque tighten all the universal joint fixing screws to 25 Nm.

HK.5 - TRACK ROD ENDS & RACK GAITERS

Front Wheel Alignment
Alignment is measured either by the angle a wheel makes with the vehicle centre line, or the difference in dimension between the wheel rim to wheel rim measurement at the front and rear of the wheel at hub centre height. The wheels are said to 'toe-in' when the wheel paths converge ahead of the vehicle, and 'toe-out' when they diverge. Wheel alignment is designed to vary with both steering angle (Ackermann) and suspension travel (bump steer) and should be measured only 'straight ahead' at the specified ride height.

Provision is made for the adjustment of front wheel alignment at the joint between the steering rack track (tie) rods, and the outer ball joints ('track rod ends'). The required ride height and alignment specification is detailed in service notes section TDV.



Note that in order to preserve the required bump steer characteristic and steering symmetry, the effective length of each track rod must remain equal - adjust each track rod by a similar amount:

Track rod end adjustment:
- Hold the track rod end using the flats provided, and slacken the locknut. Repeat for the opposite side.
- Turn each track rod a similar amount. As a guide, turning both track rods by one quarter of a turn will alter overall toe-out by approx. 2.0 mm.
- When adjustment is correct, hold each track rod end and tighten the locknuts to 45 Nm (33 lbf.ft).

When slackening or tightening the track rod end locknuts, it is important that the torque reaction is resisted using the track rod end flats, and that the ball joint itself is not allowed to be stressed.

Track Rod Ends
The track rod ends are sealed for life and maintenance free, but if replacement is required; remove the ball pin nut and use a ball joint splitter tool to separate the joint from the steering arm. Unscrew the joint from the track rod. On re-assembly, tighten the ball joint to steering arm nut to 30 Nm, and set the front wheel alignment as detailed in sub-section TDV.

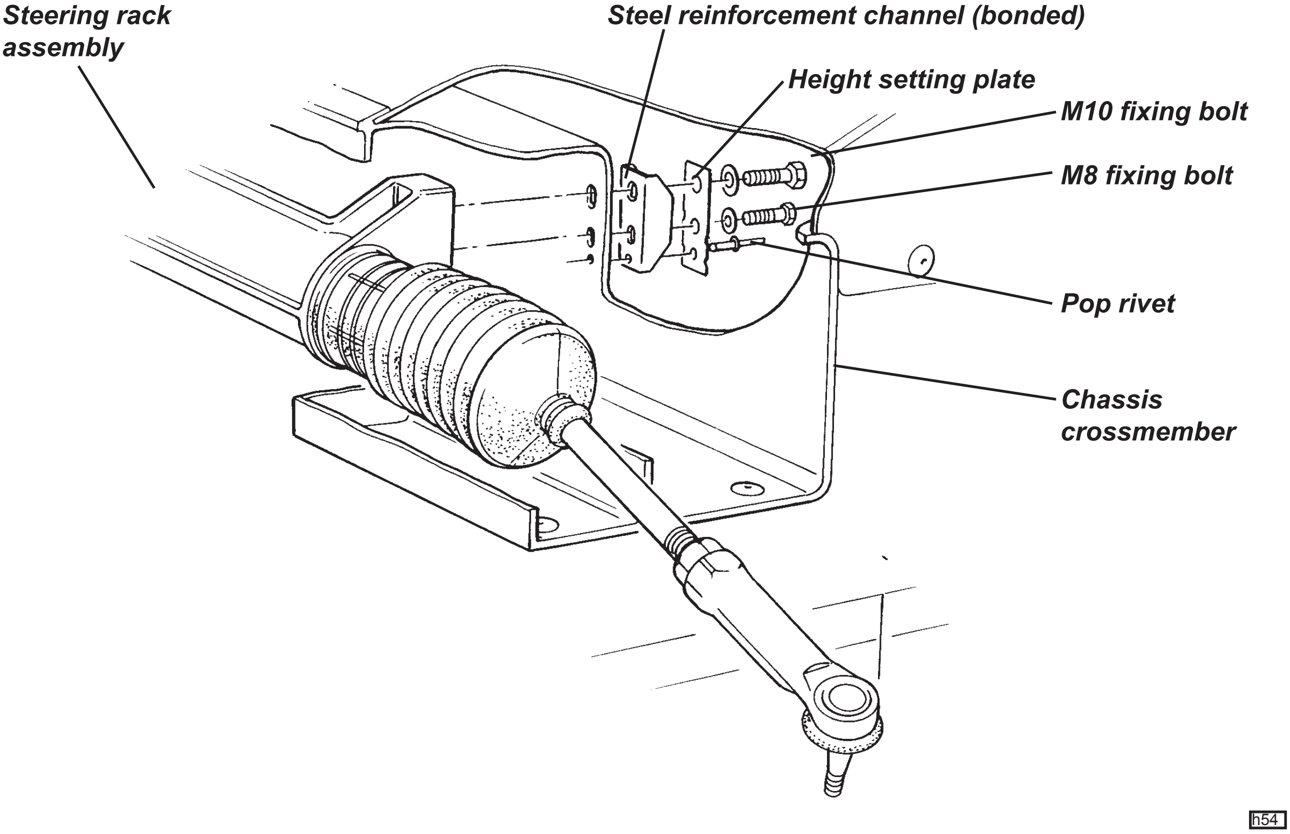
Steering Rack Gaiters
The convoluted gaiters sealing each end of the steering rack housing to the track rods, should be inspected at service intervals and replaced immediately if found to be torn, cracked or otherwise damaged. The ingress of dirt or water into the rack housing will cause rapid deterioration of the track rod inner ball joints and rack and pinion mechanism.

To replace a gaiter, remove the track rod end (see above), release the gaiter clips, and slide the gaiter off the housing and track rod. Check for consequent damage or wear and replace the steering gear assembly if necessary. Fit the new gaiter into position, and secure with new retaining clips.

HK.6 - RACK & PINION ASSEMBLY REMOVAL/REPLACEMENT

The rack and pinion assembly is mounted inside an extruded chassis box section crossmember at the top front of the footwell.

Each of the two rack housing mounting plinths uses an M10 (upper) and M8 (lower) fixing bolt to secure the housing to the vertical rear face of the crossmember. A steel reinforcement channel is bonded to the outside of the crossmember, with a riveted height setting plate to define the vertical position of the housing. Note that the only approved repairs or adjustments to the steering rack assembly are the replacement of the track rod ends and rack housing gaiters, and the adjustment of the rack pressure pad.



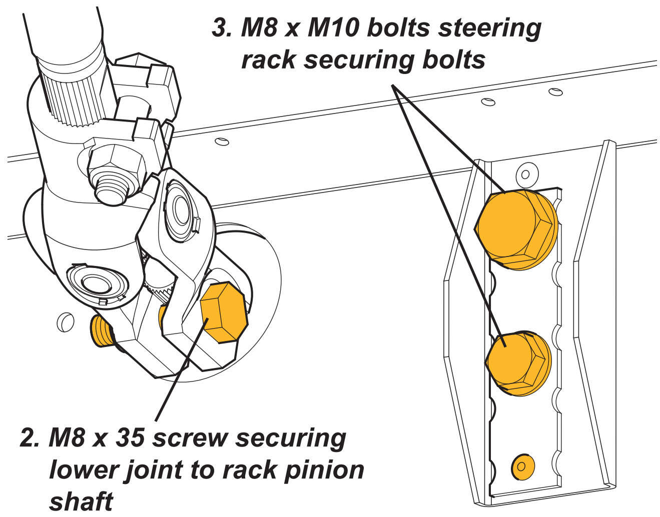
To Remove/Replace Steering Assembly:

1. Remove the nut securing each track rod end to the steering arm, and use a ball joint splitter to separate the joint.

2. From inside the footwell, match mark the pinion shaft against the u/j yoke to aid steering wheel alignment on re-assembly, and remove the pinch bolt.

3. From inside the footwell, remove the two M8 and M10 bolts securing the rack housing.

4. Draw the housing forwards to disengage the intermediate shaft u/j, and manoeuvre the assembly out of the chassis crossmember.



5. On re-assembly, check that the correct rack height setting plate is fitted. For the standard ride height of 130/136 mm, the '10 notch' plate should be fitted. Fitment of the wrong plate (identified by the number of notches in the vertical edges) will result in an incorrect bump steer characteristic and degraded handling. The plate is secured to the chassis by a single pop rivet.

6. Feed the rack assembly into the chassis crossmember and engage the pinion shaft into the lower u/j with the match marks aligned. If a new assembly is being fitted, follow the 'Steering Wheel Alignment' procedure in sub-section HK.2.

7. New fixing bolts for the steering rack housing are pre-coated with thread locking compound. If existing bolts are to be re-used, wire brush the threads before re-applying a suitable thread locking compound and torque tightening the M8 bolts to 25 Nm, and the M10 bolts to 45 Nm.

8. Fit the lower u/j pinch bolt, and tighten to 25 Nm.

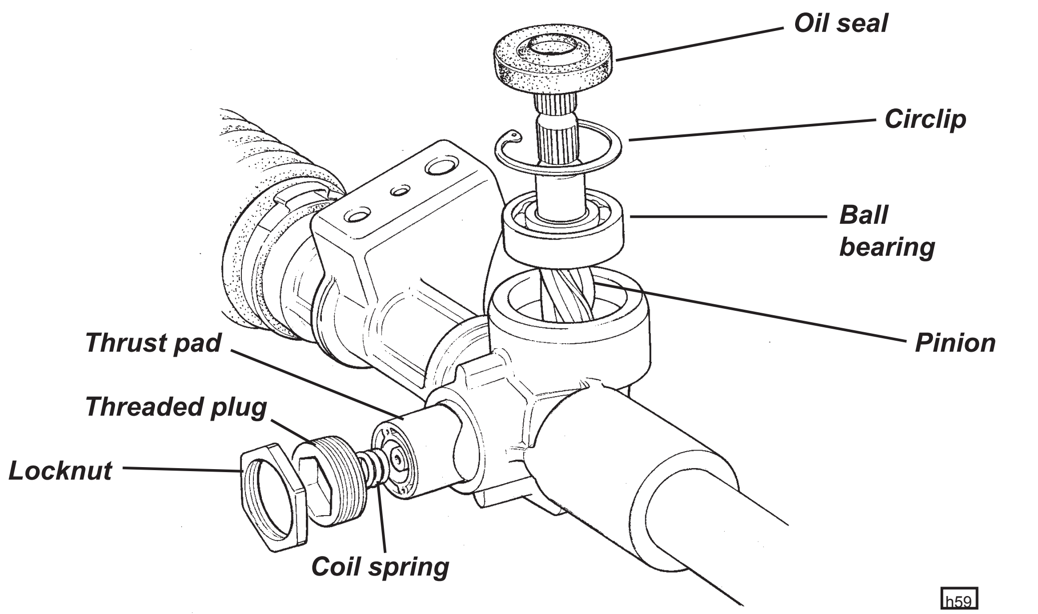
9. Fit the track rod ends into the steering arms, and tighten the nuts to 30 Nm.

10. Check and adjust the front wheel alignment as detailed in service notes section TDV.

HK.7 - ADJUSTMENT OF RACK BAR THRUST PAD

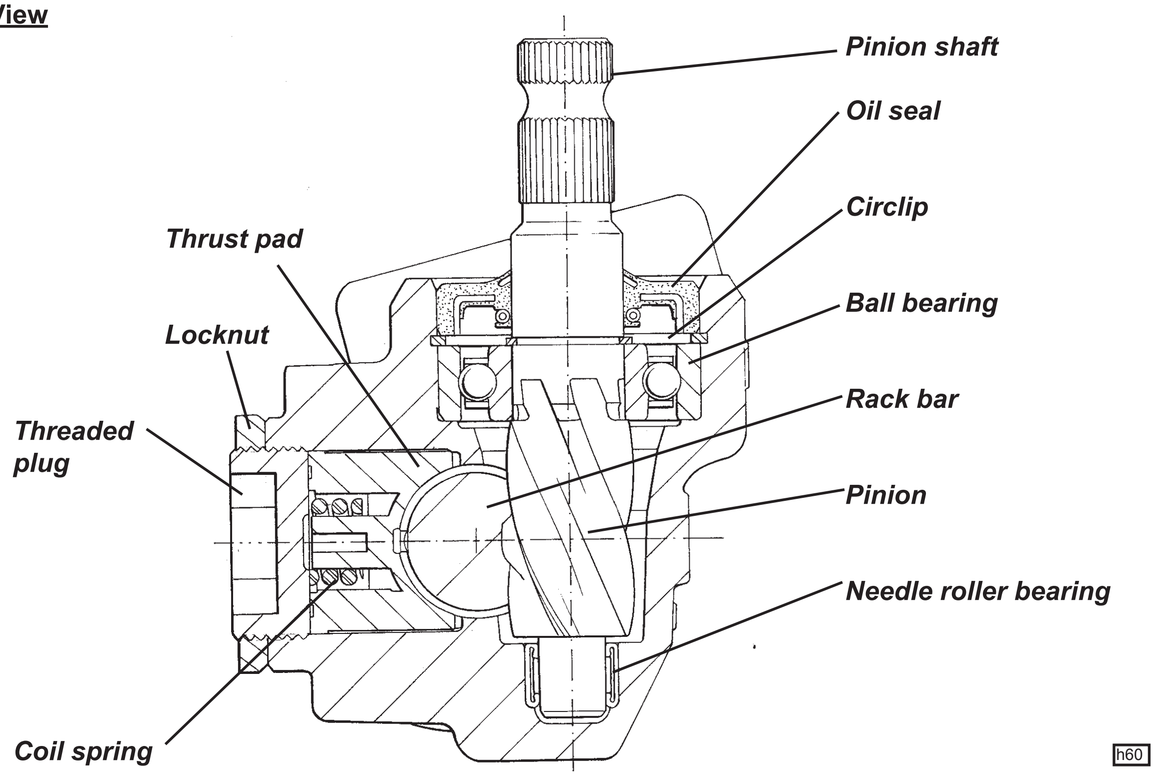
A thrust pad backed by a coil spring, is used to control the preload between the rack bar teeth and the pinion gear, and is adjustable via a threaded backstop plug. The correct preload allows the horizontally mounted rack bar (column disconnected) to be pulled through its full travel by a steady force of 50 - 100 N (12 - 20 lbf). The rack and pinion assembly must be removed from the chassis before any adjustment may be carried out.

Exploded View



To adjust the thrust pad, release the locknut (36mm socket) and use a 19mm hexagonal bit to adjust the back-stop as required before tightening the locknut. For an approximate initial setting, screw in the backstop plug until solid, then back off ¼ turn.

Sectional View



HK.8 - IGNITION LOCK CYLINDER BARREL

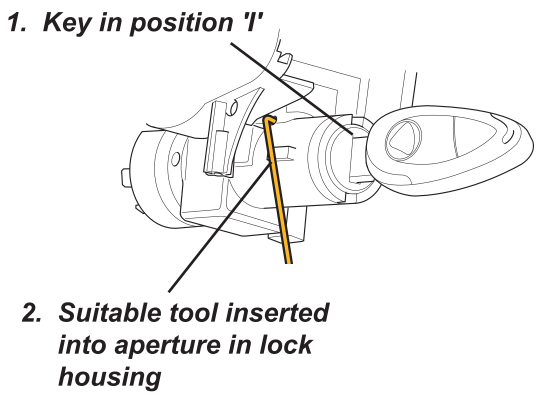
If renewing the upper steering column assembly or steering lock housing then it will be necessary to swap over the existing ignition cylinder barrel from the original assembly.

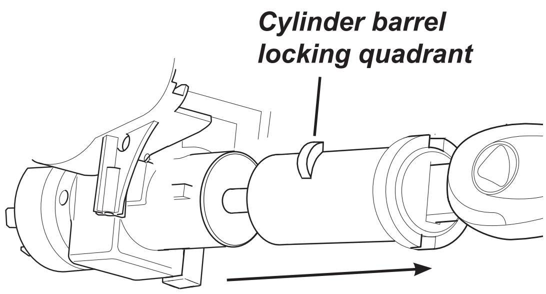
Preparation:
Disconnect the battery, and remove the upper and lower column shrouds; refer to service notes sections MV.10 and VE.4 for further information.

⚠ WARNING: On cars so equipped, the driver's airbag is housed in the hub of the steering wheel. Precautions need to be taken for personal safety when working with airbags and associated components. Do not attempt to remove the airbag, steering wheel or column without first referring to section WC.

Removal:

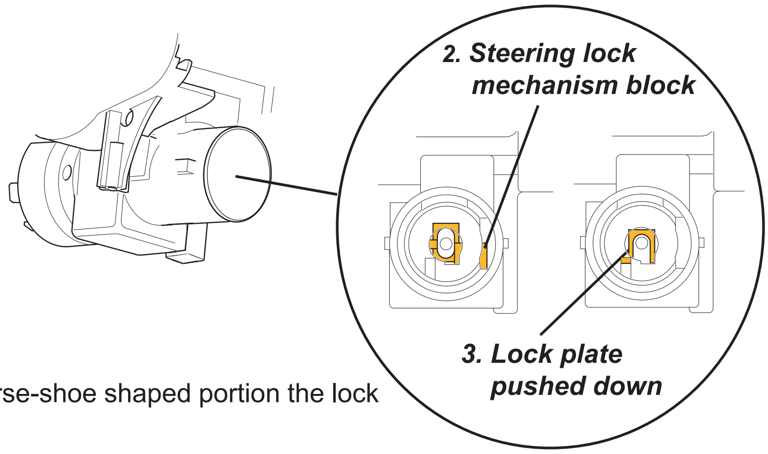
1. Turn the key to position "I" in the cylinder barrel.
2. Using a suitable angle pick tool or small allen key, depress the spring pin accessible via a machined aperture in the steering lock housing.
3. Slight resistance should be felt when inserting a tool in the aperture as it pushes against the cylinder barrels sprung loaded locking quadrant.
4. Using only a slight pulling action the key and cylinder barrel can now be withdrawn from the steering lock housing.





Refitment:

1. Before refitting the cylinder lock barrel, the steering lock mechanism needs to be reset to allow the barrel to be pushed fully into the steering lock housing.
2. The square end block of the lock mechanism should be visible from the right hand side of the cylinder barrel bore of the lock housing. Using a small screw driver push down on the end block.

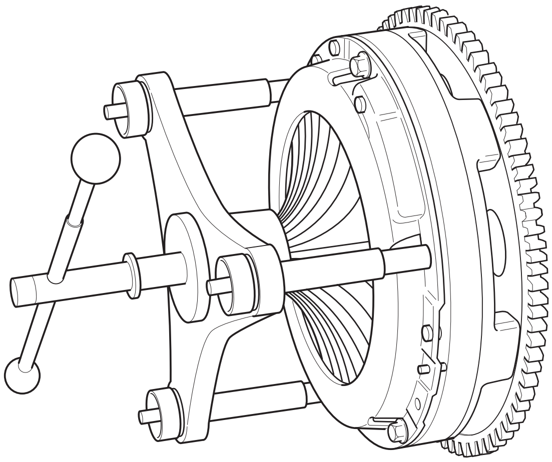


3. Slight resistance should be felt as the horse-shoe shaped portion the lock plate becomes visible as it pushed down.
4. Using finger pressure push the barrel locking quadrant flush against the barrel housing and insert the barrel into the lock housing, an audible click will be heard as it locks into place.

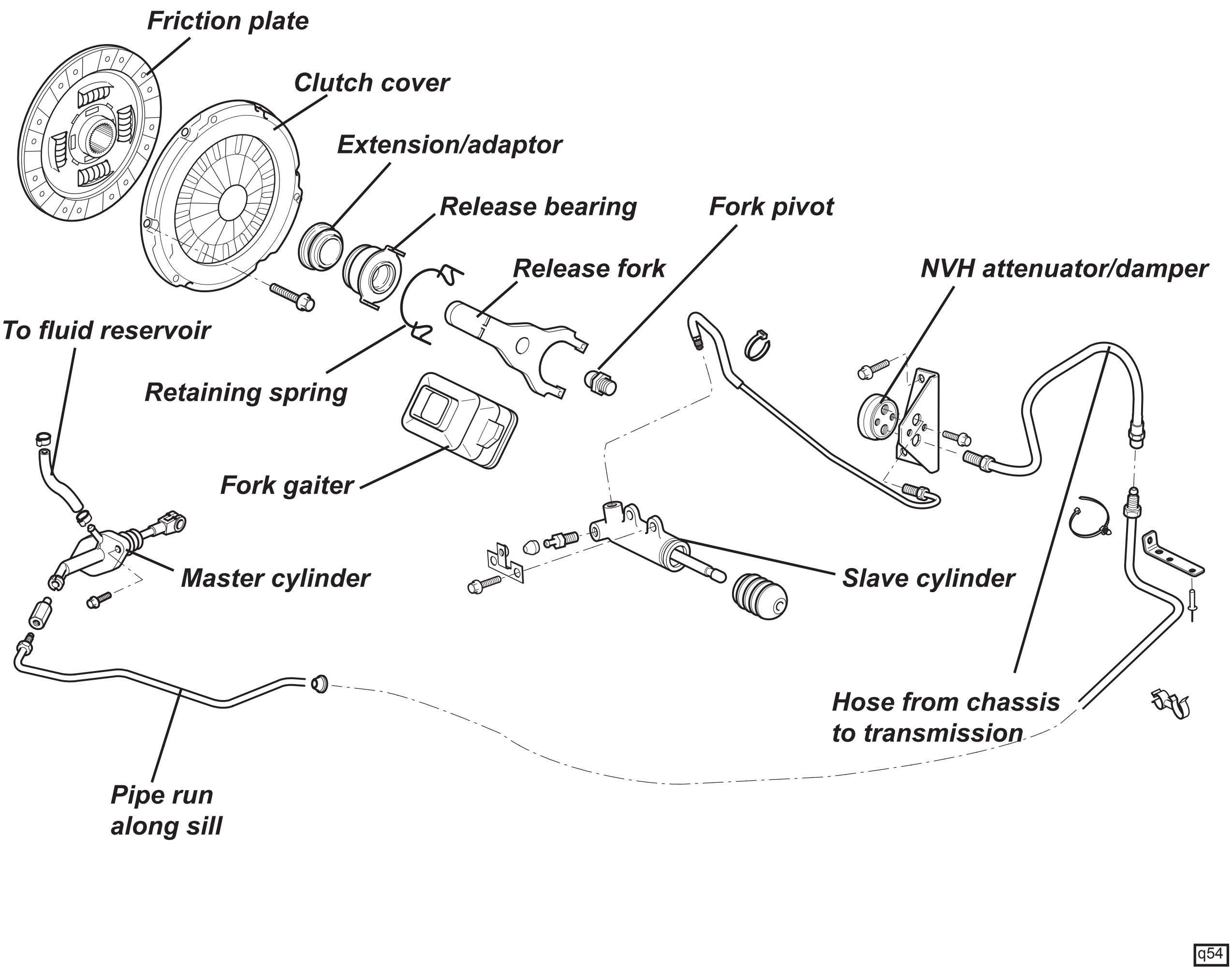
Note: If fitting a new cylinder barrel/vehicle lock set, please inform Lotus Aftersales department of the new 5-digit lock number using the A4-A-5304 NOTIFICATION – LOCK/ALARM REPLACEMENT form which is available to download on the Lotus Dealer Portal.

CLUTCH

SECTION QA



Clutch System General Layout



QA.1 - GENERAL DESCRIPTION

The Lotus Exige S uses a CMS C500 cast iron flywheel bolted to the rear end of the engine crankshaft, secured with 8 bolts and located by a dowel pin. Sandwiched between the flywheel and crankshaft is a steel plate carrying the starter ring gear, and also secured to the periphery of the flywheel with 6 screws.

The driving surfaces of the clutch assembly comprise the rear face of the flywheel, and a corresponding surface on a pressure plate carried by the spring diaphragm clutch cover which is bolted to the periphery of the flywheel. The driven element, constitutes a single, dry, double sided friction plate, splined to the gearbox input shaft, and sandwiched between the flywheel and pressure plate.

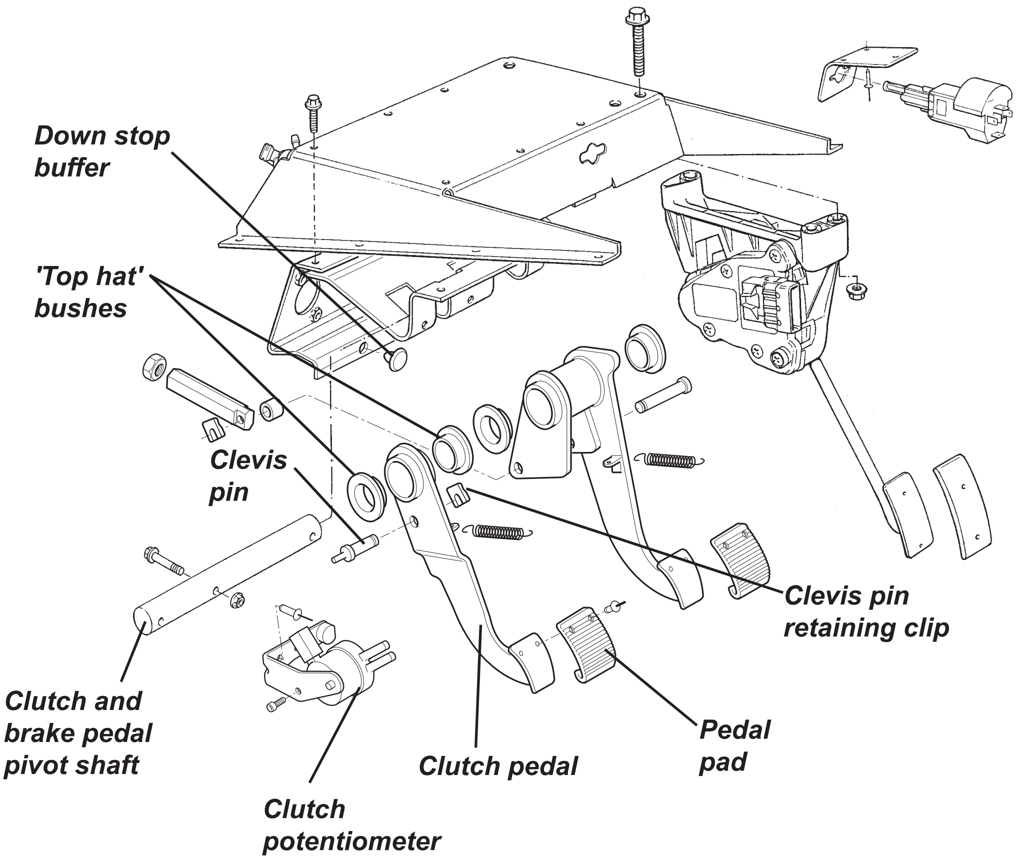
The diaphragm spring between the clutch cover and pressure plate serves to clamp the friction plate between the pressure plate and flywheel and provide the drive connection between engine and gearbox. The gearbox input shaft, on which the friction plate is free to slide axially, is 'overhung' from the gearbox, with no spigot bearing in the rear end of the crankshaft.

The hydraulic clutch release mechanism uses a master cylinder fixed to the pedal box and operated by the clutch pedal, and a slave cylinder bolted to the left hand side of the clutch housing operating a release fork pivoted on a ball pin inside the housing to apply an axial thrust to the release bearing.

The release bearing surrounds the gearbox input shaft and transmits the thrust via a ball bearing race and separate distance piece to the ends of the diaphragm spring fingers. This action releases the clamping action of the spring outer rim, serving to disengage the drive.

No routine adjustment of the clutch or release mechanism is required. The clutch slave cylinder is self adjusting, with the 'rest' position of the piston dependent on the thickness, or degree of wear, of the friction plate. As wear of the friction plate takes place, and its thickness is reduced, the slave cylinder piston is pushed progressively further back on the return stroke with a corresponding rise in the reservoir fluid level.

QA.2 - CLUTCH PEDAL

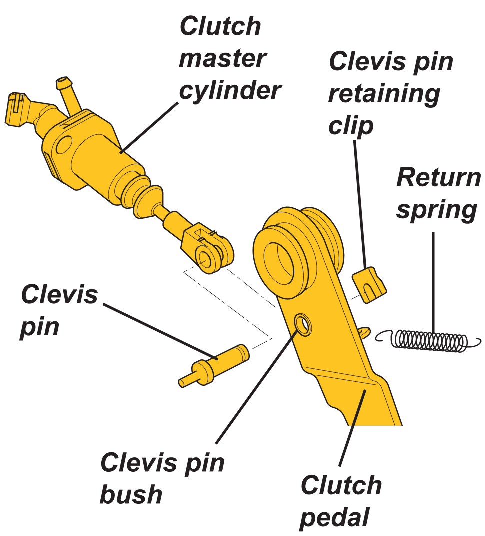


The clutch pedal is fabricated from steel plate, with an extruded footpad keyed, rivetted to the bottom of the pedal. Synthetic 'top hat' bushes are used to provide maintenance free articulation on the steel pivot shaft, with a metal bearing inserted into an aperture of the pedal to support the clevis pin controlling the clutch master cylinder yoke and clutch potentiometer actuation pin.

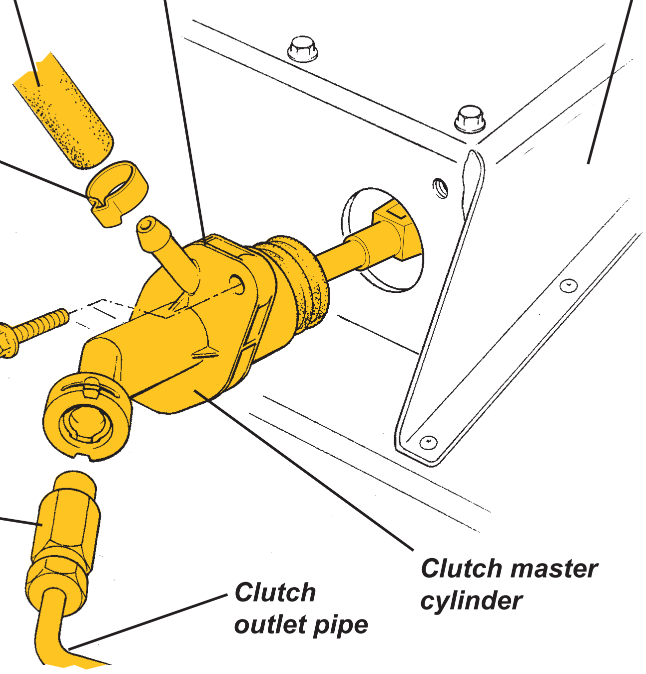
Note that the two synthetic bearing rings may be replaced with the pedal 'in-situ', by using a suitable bolt with clamp washers to press the rings into position. Each bush has an outer diameter chamfer at one end to aid insertion.

The master cylinders one piece plastic pushrod/mounting yoke is fitted either side of the clutch pedal, retained with a clevis pin which passes through either side of the mounting yoke and secured in place with a metal clip.

The master cylinder pushrod is captive in the end of the master cylinder, and uses an integral clevis to connect to the pedal and control the pedal up position as the master cylinder 'tops' out. A downstop buffer is provided on the pedal box flange.



QA.3 - CLUTCH MASTER CYLINDER, SLAVE CYLINDER, CLUTCH DAMPER & HYDRAULIC LINES



Master Cylinder
The clutch master cylinder is mounted on the pedal box. The cylinder is not equipped with its own fluid reservoir, but instead is linked via hose to the adjacent brake fluid reservoir.

An adaptor is screwed onto the end of metal clutch pipe allow fitment onto the plastic master cylinders 'quick fit' outlet pipe connection.

There is no provision for any servicing of the master cylinder, and if found to be faulty, the unit should be replaced.

Removal:

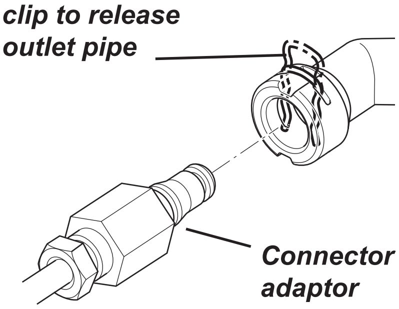
1. Remove the front clamshell (see sub-section BT.6). and remove the RH or LH radiator upper outlet duct as required to gain access to the clutch master cylinder.

2. Clean the master cylinder and surrounding area with methylated spirit. **Do not use petrol or paraffin.**

   Note: Take all necessary precautions to guard against contamination of painted surfaces with brake fluid.

3. Disconnect and immediately plug and cap the hose connection to the fluid reservoir.

4. Release the output pipe connection by gently pushing the outlet pipe adaptor into the master cylinder and then pushing in the sprung loaded retaining clip on the end of the hose connection to release the pipe/adaptor from the cylinder.



6. From inside the footwell, remove the clutch potentiometer; refer to sub-section QA.5 for further information.

7. Release the spring clip securing the clevis pin connecting the master cylinder pushrod/yoke to the clutch

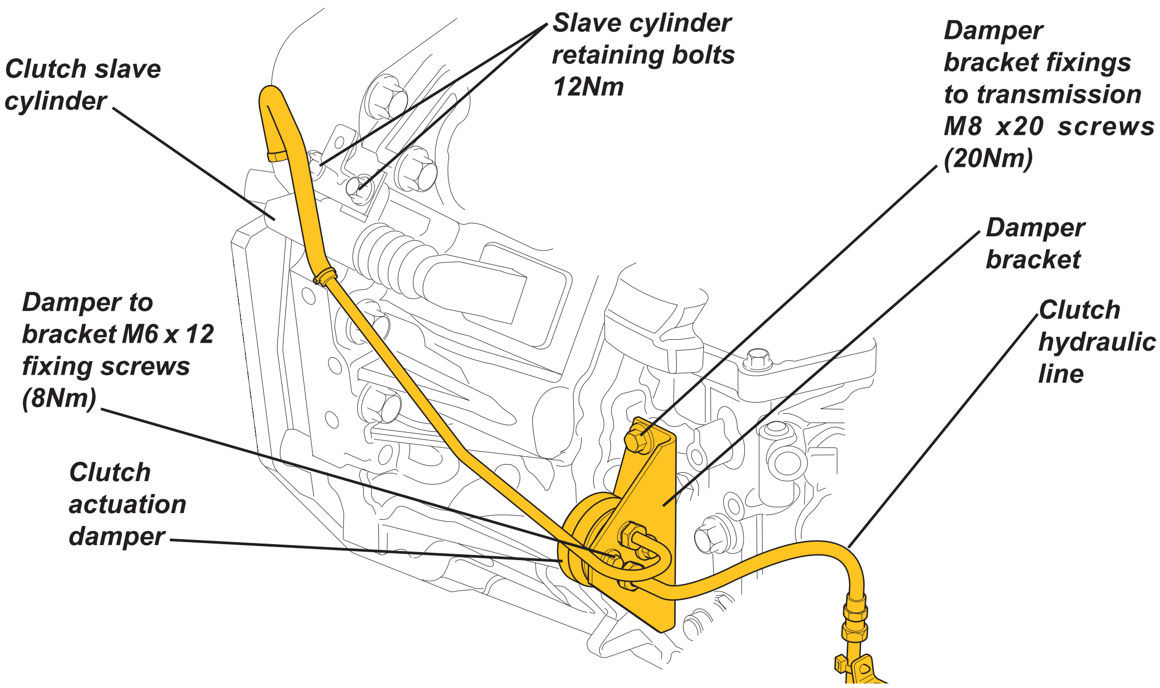
pedal and withdraw the pin.

7. Remove the M8 x 25 bolts (2) securing the cylinder to the pedal box and withdraw the cylinder from the pedal box.

Refitment:
Is the reverse of the removal procedure.

- Refit the pedal box fixings and torque to 25 Nm.
- Renew the Oetiker clip securing the reservoir hose to master cylinder then refit the hose onto the master cylinder inlet port **THE HOSE SHOULD BE PUSHED ONTO THE PORT DRY - DO NOT USE ANY CHEMICALS OR LUBRICANTS TO AID FITMENT AS THIS COULD CAUSE FLUID CONTAMINATION WHICH MAY RESULT IN AN INAFFECTIVE CLUTCH PEDAL.**
- Refit the outlet pipe adaptor onto the clutch master cylinders 'quick fit' connection.
- Bleed the hydraulic system of air, refer to sub-section QA.4 for further information.

Slave Cylinder



The slave cylinder is secured to the left hand side of the clutch housing by two M8 x 20 screws into tapped holes. The cylinder is protected from radiated heat from the front catalytic converter by an aluminium heat shield, part of which may be bent back to allow improved access to the slave cylinder bleed nipple.

A clutch damper is fitted in the fluid line between the flexible rubber hose fixed to the chassis and solid metal pipe to the clutch slave cylinder.

The damper contains a flexible diaphragm to smoothen pressure pulsations in the line caused by frequencies generated by the crankshaft that are isolated from rest of chassis via engine mounts etc, but when the clutch pedal depressed the frequency can travel through the clutch cover, release bearing, slave cylinder and through the fluid line up to the clutch pedal.

These pulsations give the symptoms of a ‘roaring’ noise and vibration which can be felt through the clutch pedal when it is depressed at high revs, typically 5000 rpm.

⚠ Do not attempt to bleed the clutch hydraulic system when the catalytic converter is hot - spilled hydraulic fluid could initiate a fire. Wait until the engine and converter is cool to the touch.

To replace the slave cylinder

Removal:
- Remove the rear undertray; refer to service notes section AN.2 for further information.

- From underneath the vehicle, disconnect the clutch pipe union at the slave cylinder and immediately seal the open end of the pipe and the cylinder port.

- Release the two M8 fixing bolts and withdraw the cylinder.

- Take all necessary precautions to guard against contamination of painted surfaces with brake fluid.

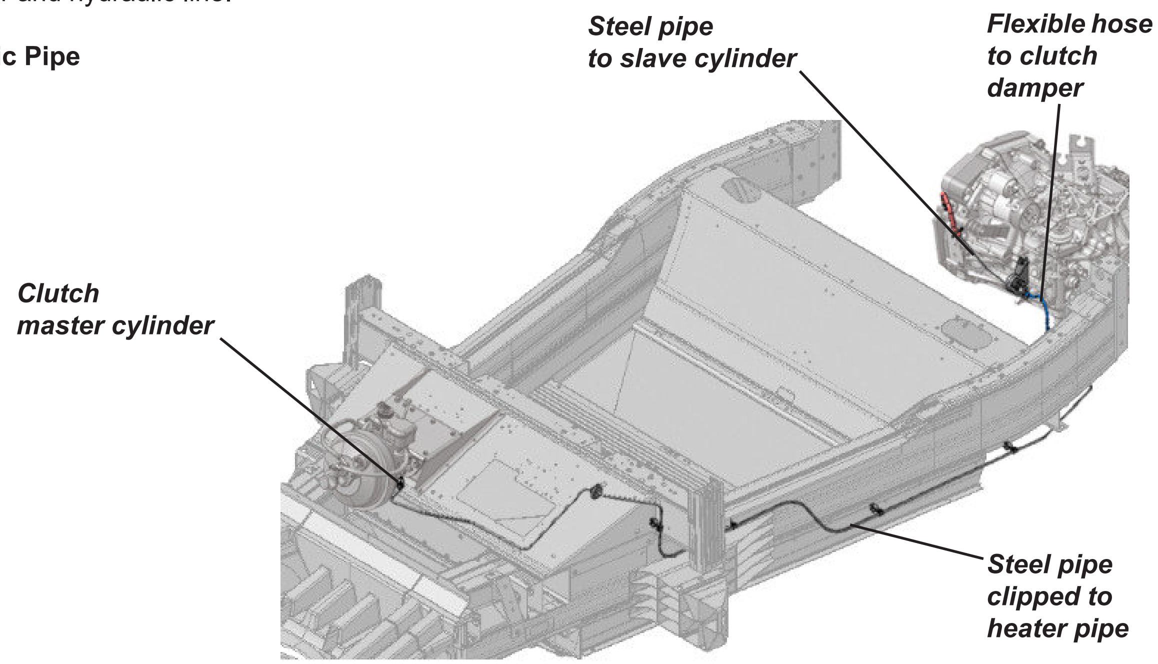
Refitment/replacement:
Is the reversal of removal.
- Refit the two M8 bolts securing the slave cylinder to the bell housing, torque to 12 Nm.

- Re-connect the clutch pipe union to the cylinder, torque to 16 Nm.

- Bleed the system of air, refer to sub-section QA.4 for further information.

- Finally, ensure that the heat shield is returned to its original shape in order adequately to protect the slave cylinder and hydraulic line.

Hydraulic Pipe



A 2-part rigid steel pipe is used to convey the hydraulic fluid from the master cylinder to the left hand front corner of the engine bay, with different length and profiled pipes being used for LH and RH drive vehicles to allow for the alternative master cylinder positioning.

The pipe is routed down the LH 'A' post to run along the outside of the chassis LH main siderail, within the composite sill member, and is supported, together with other pipes and hoses in foam blocks. A flexible hose is used to connect the rear end of the chassis pipe to an NVH clutch damper mounted on the transmission. A short rigid pipe then connects the damper to the slave cylinder.

QA.4 - CLUTCH BLEEDING PROCEDURE

⚠ Do not attempt to bleed the clutch hydraulic system when the catalytic converter is hot - spilled hydraulic fluid could initiate a fire. Wait until the engine and converter is cool to the touch.

- If the clutch fluid is to be renewed, or an hydraulic component replaced, the system should be bled of air using the following procedure:
- Remove the rear undertray - see service notes section AN.2 for further information.
- Using only a fresh supply of DOT 4 non-mineral type brake fluid, top up the brake/clutch reservoir as necessary - also see service notes section JM.3 for further information.
- If the reservoir needs topping up, first clean around the cap to reduce the possibility of contamination before unscrewing the cap; it is not necessary to disconnect the level sensor cables. Take suitable precautions to guard against damage to paintwork caused by brake fluid dripping from the level sensor.
- From underneath the engine bay, fit a suitable bleed tube and container to the slave cylinders bleed nipple then open the nipple.
- Using conventional manual techniques, or low air pressure applied to the reservoir, bleed the system from slave cylinder bleed nipple in turn until no air bubbles can be seen then tighten the bleed nipple to 5 Nm.
- Test the operation of the clutch pedal, if the pedal operation is spongy repeat the process until an acceptable pedal action is obtained,
- Top up the fluid level in the reservoir (but do not overfill) then replace the filler cap securely.
- Refit the undertray

QA.5 - CLUTCH POTENTIOMETER

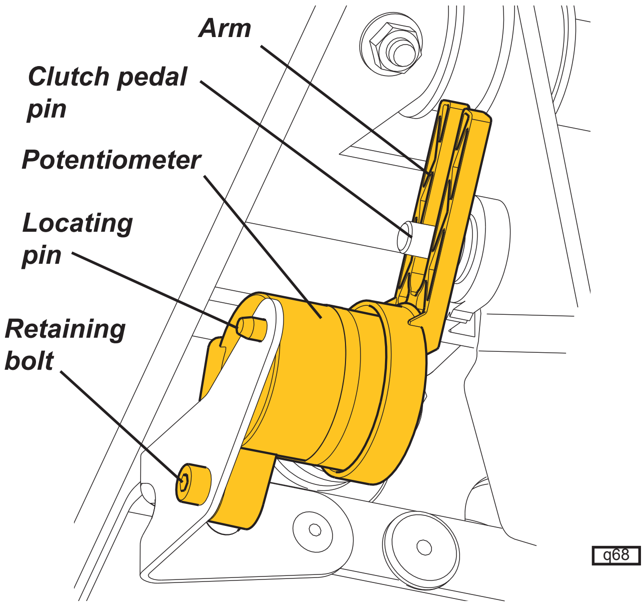
Clutch pedal travel is monitored by the potentiometer module. The module comprises of a pronged arm which rotates around the main body of the potentiometer body which is fixed in place to the pedal box.

The potentiometer bodies relative position on the pedal box is set by an integral locating pin and is further retained in position with an M4 bolt tightened to 4Nm.

The potentiometer arm is held in its relative position to the potentiometer body and clutch pedal by the master cylinder clevis pin.

Movement of clutch pedal rotates the arm relative to the position of the potentiometer body.

Data on clutch pedal position is used by the engine management system for:



- Cruise Control operation
- Gearchange fuel cut off (To assist rapid smooth gearchanges).
- Start inhibit function on specific market vehicles.

Please see Service Notes Section EMQ for Diagnostic Trouble Codes (DTC) associated with the clutch potentiometer.

Please Note: If Cruise Control is disabled without driver intervention but the service light has not been illuminated check that the potentiometer is secure to the pedal box bracket.

QA.5 - CLUTCH ASSEMBLY

The clutch assembly comprises the friction plate, clutch cover assembly (pressure plate/diaphragm spring/cover) and release bearing. For access to the clutch assembly, the complete power unit must first be removed from the chassis; refer to service notes section EM.6 and FK.6 for further information.

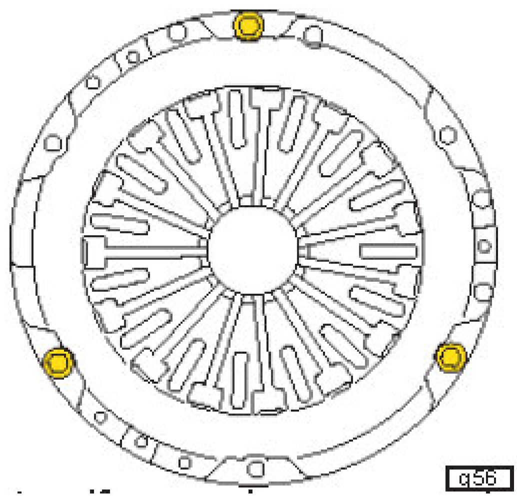
The clutch cover is secured to the flywheel by 6 x M8 bolts and located by 3 dowels. Unless the cover is to be renewed, first match mark the cover to the flywheel before gradually loosening the 6 bolts in an even pattern, to release the clamp load without distorting the clutch cover. Finally, remove the bolts and withdraw the cover from the flywheel dowels making provision to capture the friction plate which will also be released.

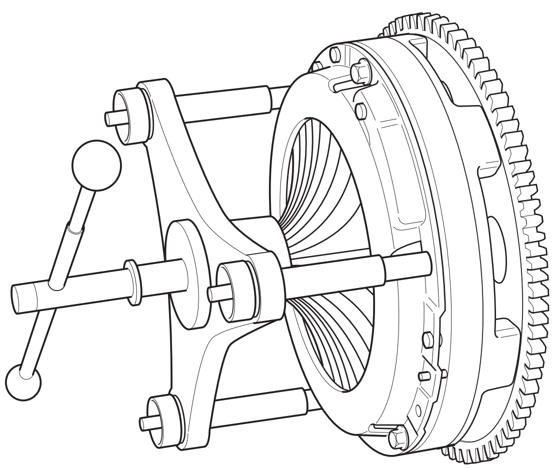
Inspection & Replacement:

1. *Clutch cover:* Check the surface of the pressure plate for excessive scoring or discolouration through overheating. Check the fingers of the diaphragm spring for excessive wear at the release bearing contact surface and for even height. If the cover is accidentally dropped, the setting or balance of the assembly could be disturbed; replacement of the cover is recommended.

   Apply a suitable thread locking compound to three of the clutch cover retaining screws, and retain the clutch cover with these three screws, tightening **only by hand** sufficiently to hold the centre plate in position when the mandrel is removed.

   On re-assembly, thoroughly degrease the friction surfaces of the flywheel and pressure plate before using a centralising mandrel to position the centre plate (ensuring it is the correct way round - refer to markings on the plate) whilst the clutch cover is located.





   To ensure that the most uniform spring pressure is applied to the plate, with minimum distortion of the diaphragm fingers, it is essential that a proprietary clutch cover compressor tool is used.

   Remove the centre plate mandrel, and fit the compressor tool to the flywheel using the remaining 3 fixing points for the clutch cover.

   Wind in the compressor to contact the spring fingers. From this point, further tightening of the compressor will progressively reduce the gap between the clutch cover and the flywheel.

   Continue compression until this gap is reduced to zero. Apply a further 2 complete turns (equivalent to 3mm axial travel) to preload the diaphragm spring before evenly tightening the three clutch cover retaining screws to a final torque of 20 Nm.

   Release the compressor, and remove from the flywheel. Apply thread lock to the remaining three clutch cover screws before fitting and progressively tightening to 20 Nm.

2. *Friction plate:* Check the cush drive springs for breakage or cracking of the hub. Examine the condition of the friction material for signs of oil contamination, scorching, or any other damage. Measure the depth of material on both sides of the plate from the friction surface to the head of the rivets;
Minimum service depth = 0.3 mm.

   If any of these inspections are failed, or if there was an issue with clutch judder, the friction plate should be renewed.

3. *Release bearing & fork:* Be aware of the extension/adaptor which may or may not be retained in the release bearing. Unclip the release bearing from the fork, and check the bearing for discernible play, noise or rough feeling, and renew if there is any doubt. Check the arm for undue wear on any of the contact surfaces and for cracks. Check the condition of the release fork pivot ball.

   Apply sparing quantities of Molybdenum Disulphide (MoS2) grease to the contact points of the release fork fingers, pivot socket, and pushrod socket. Also apply sparingly to the input shaft splines, or use the special grease provided with a new friction plate. Fit the fork through the housing aperture and grommet, locate on the pivot ball, slide the release bearing over the input shaft and clip to the release fork arms. Insert the spigot on the extension/adaptor into the release bearing.

4. *Flywheel:* Check the friction surface of the flywheel for excessive scoring or discolouration through overheating. Using a dial test indicator, measure the axial run-out at the centre of the flywheel friction surface.
Maximum runout: 0.15 mm.
If necessary, renew the flywheel:

   - Lock the flywheel ring gear and progressively release the eight bolts securing the flywheel to the crankshaft and withdraw, noting the loose spacer ring between the ring gear plate and the crankshaft flange.

   - If necessary, release the six bolts securing the ring gear to the front of the flywheel. When re-fitting, ensure that the ring gear plate swages face towards the flywheel. Use an appropriate alignment mandrel to ensure concentricity of the ring gear to the flywheel before tightening the 6 securing bolts to 30 Nm.

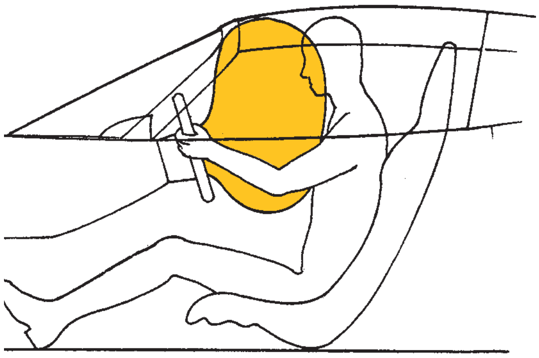
   - When re-mounting the assembly to the crankshaft, ensure the spacer ring is fitted between the ring gear plate and crankshaft, with the dimple on the spacer locating in the crankshaft flange dowel hole.

   - Ensure scrupulous cleanliness of all mating surfaces before locating the flywheel onto the crankshaft and fitting the 8 bolts to which Permabond A130 (A912E7033) has been applied to the threads.

   - Progressively tighten the bolts in a diagonal sequence, locking the ring gear before finally torque tightening to 65 Nm.

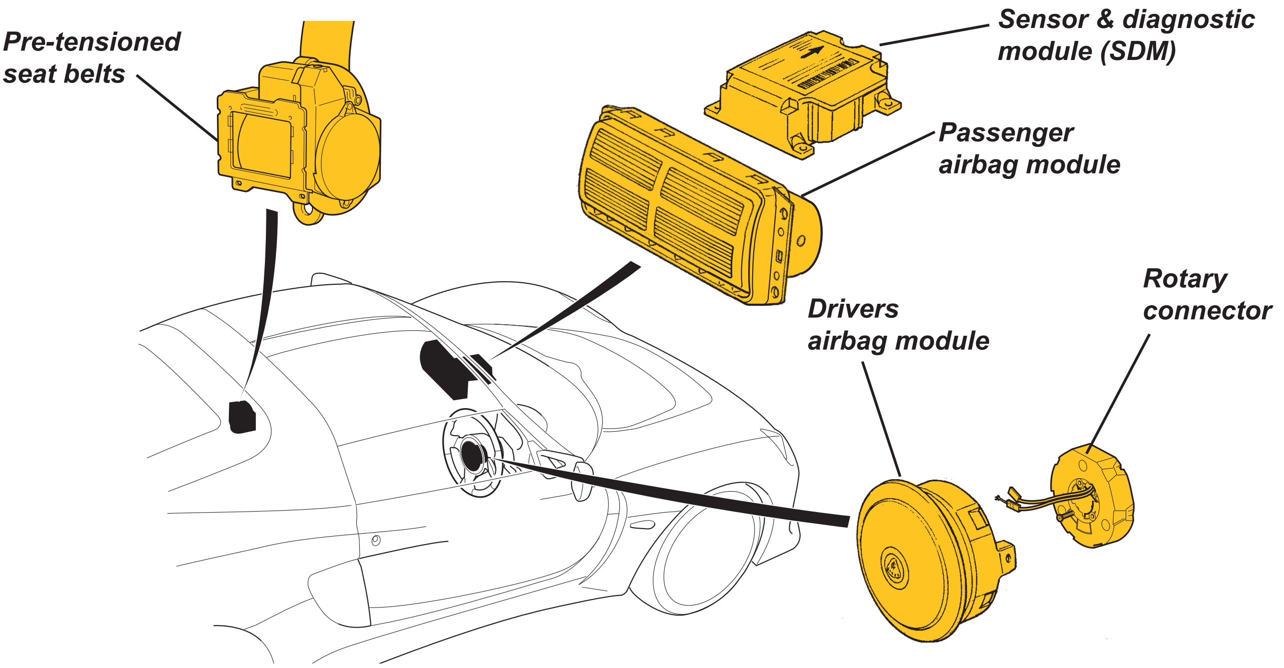
Re-assembly:
Fit the transmission assembly to the engine (see service notes section FK.6), ensuring that the extension/adaptor is correctly located in the release bearing and refit the power unit; refer to service notes section EM.6.

SUPPLEMEN TARY RESTRAINT SYSTEM - SRS (AIRBAGS)



SECTION WC

WC.1 - GENERAL DESCRIPTION



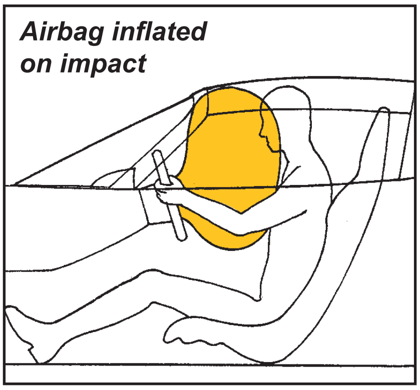
Supplementary Restraint System (SRS) Main Components & Location (RHD shown)

The airbag Supplementary Restraint System (SRS) comprises driver and passenger frontal airbags and pyrotechnic seat belt pre-tensioners for both the driver and passenger. The airbag system is supplemental to the seat belts, and does not render the seat belts redundant. Seat belts have proven to be the single most effective safety device, and should be worn at all times by both driver and passenger, no matter how short the journey. Properly worn seat belts also ensure that the seat occupant is in the best position for full effectiveness of the airbag.

⚠ WARNING Airbags inflate with great force, in a fraction of a second, and if a vehicle occupant is too close to the airbag (less than 10 inches {250 mm}) or incorrectly positioned, they could be killed or seriously injured.

The SRS is designed to operate when the vehicle is involved in a frontal, or near frontal collision, and the impact (rate of deceleration) as detected by a vehicle mounted sensor, is sufficient to warrant airbag and seat belt tensioning protection to both occupants.

The airbag for the driver is housed in the centre of the steering wheel, and that for the passenger in the front of the fascia. When triggered, both bags inflate in a fraction of a second to form a cushion for the driver's and passenger's upper bodies. The bags then deflate very rapidly to minimise any obstruction to the driver.



Initiated at the same time as the airbags is a pyrotechnic device on each seat belt reel assembly, which uses a rack and pinion mechanism in order to apply a tightening force to the belt reel and remove any slack from the belt. The force sustained by the belt and its user is then controlled by a torsion bar within the belt reel to limit the deceleration force to which the occupant is subjected.

Note that the SRS will deploy only in moderate to severe frontal and near frontal collisions, and is not designed to be triggered in rollover, rear or low speed frontal collisions, or in some types of side impacts.

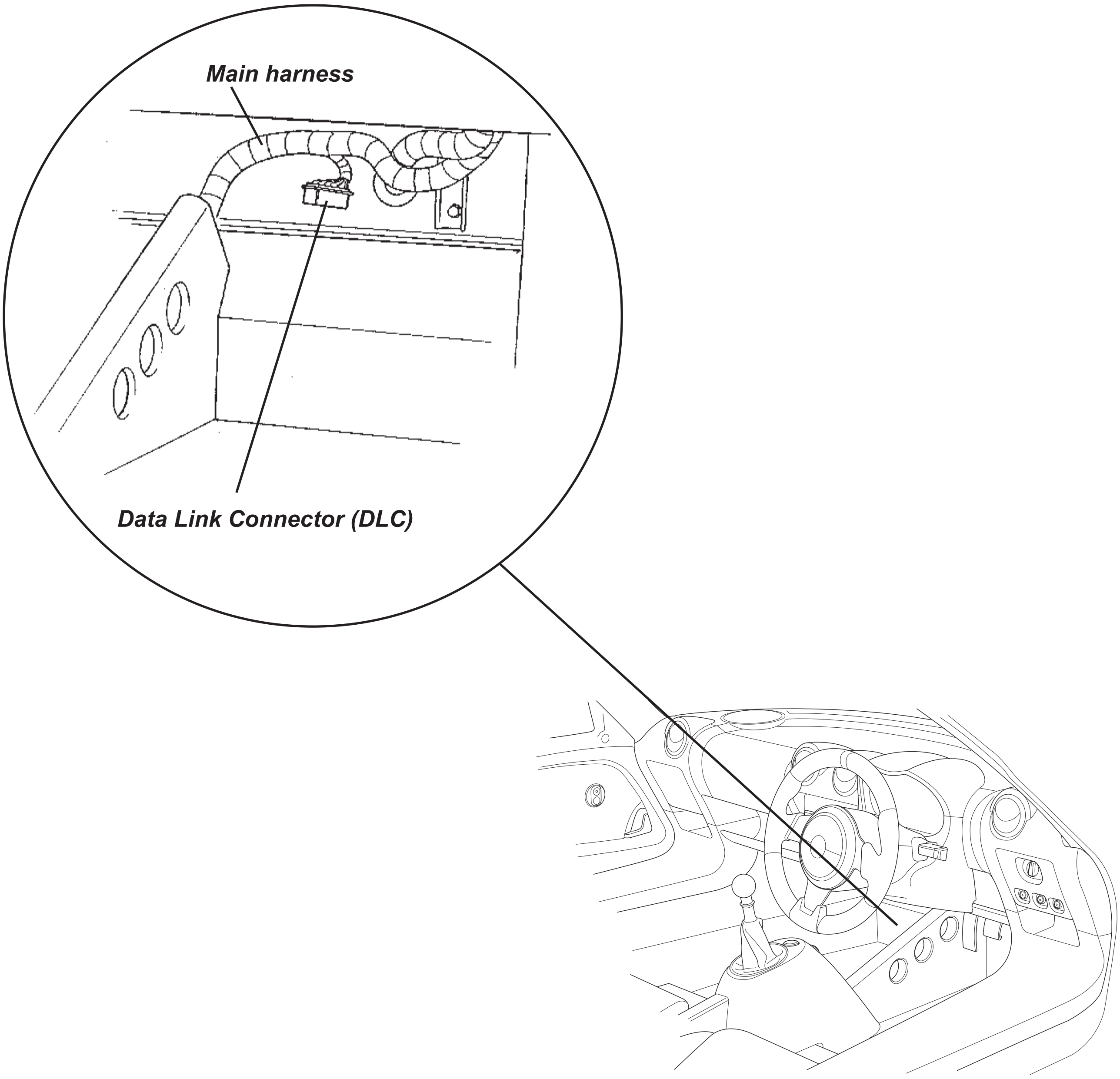
The system incorporates a self-diagnostic facility, which continuously monitors the SRS electrical circuits for faults, and if necessary, lights a tell tale lamp in the instrument cluster. Most components of the SRS will require replacement after an airbag deployment.

WC.2 - AIRBAG TELL TALE

A tell tale lamp in the instrument cluster will light for 6 seconds following ignition switch on, and then go out. If the lamp remains lit, or comes on at any other time, a fault in the airbag system is indicated.

⚠ WARNING: If the airbag tell tale does not operate as described above, a fault in the SRS system is indicated. The airbags may not inflate correctly or at all, or may inflate without warning. The system should be interrogated using Lotus TechCentre, and diagnosed and rectified without delay.

WC.3 - DATA LINK CONNECTOR (DLC)



In order to provide for communication with the SRS Sensing and Diagnostic Module (SDM), Lotus TechCentre may be plugged into the special 16 terminal harness connector socket, known as a Data Link Connector, located off the main harness and accessible from the passenger footwell. Communication with engine management and anti-lock brakes is also available via this connector.

WC.4 - TROUBLE CODES

All the time the ignition is switched on, the Sensing and Diagnostic Module (SDM) continuously monitors the resistance of various parts of the SRS electrical circuit, and compares these values with pre-programmed tolerance bands to enable it to recognise 'faults' in the system and light the airbag tell tale lamp in the instrument cluster. If such a fault is detected, the SDM stores a 'Trouble Code' for that particular type of fault in its memory.

i). Current (Present) Codes - Faults that are currently being detected. Current codes are stored in the SDM Random Access Memory (RAM), which will be cleared if the vehicle battery is disconnected.

ii). History (Not present) Codes - All faults detected since the last time faults were cleared from the memory using the Lotus Scan tool. History codes are stored in the SDM Electronically Erasable Programmable Read Only Memory (EEPROM) and are not cleared if the battery is disconnected.

Vehicle crash data is also stored in coded form in the SDM and is not erasable. New SDMs are supplied only against V.I.N. and on exchange with the old unit.

Diagnosing SRS Fault Codes Using Lotus TechCentre
It should be understood that any SRS DTC displayed on Lotus TechCentre (or any other diagnostic tool), **does not** necessarily mean that the specific module(s) associated with that fault code description are faulty and require replacement.

Example:

DTC	***Description***
0031	Fault in front drivers side airbag - resistance too low

It should not be presumed that the fault is specifically the drivers airbag and that it now requires replacement, but rather any module or connection contained within that entire circuit including the driver's airbag back to the SRS ECM (Electronic Control Module) is in question.

A DTC may also be generated because of:

- An unplugged harness connector.
- A damaged wire within any of the wiring harnesses going to that sensor.
- A corroded or damaged pin/terminal within any of the harness multi-plug connector(s) within the circuit or even a faulty SRS ECM itself.

SRS SDM's, airbag modules and sensors are designed to be extremely robust and manufactured to very exacting standards and in the majority, SRS faults are normally caused by poor electrical connections.

Refer to any relevant circuit diagrams within the service notes to identify all associated voltage feeds, earth points, terminals, pin outs, modules and harness connections etc contained within the circuit(s) which may be a potential cause of failure.

If any fault code displayed within Lotus TechCentre indicates that there may be a potential SRS system fault within the driver's airbag system, then the following course of action is recommended.

Diagnostic Route Recommended if Drivers Airbag Module DTC is Generated
1. Select the SDM (Sensor & Diagnostic Module) Live Data screen in Lotus TechCentre and if a high resistance reading * indicates a driver's airbag circuit fault then the following diagnostic route is recommended in the first instance to determine the cause of the problem.

   Note: A resistance reading of 9.96 Ω on TechCentre indicates an open circuit, typical SRS module/circuit resistance values of between 2.2 Ω - 3.5 Ω for Exige S are acceptable.

3. Follow the safety procedure detailed in sub-section WC.6 to temporarily disable the airbag system.

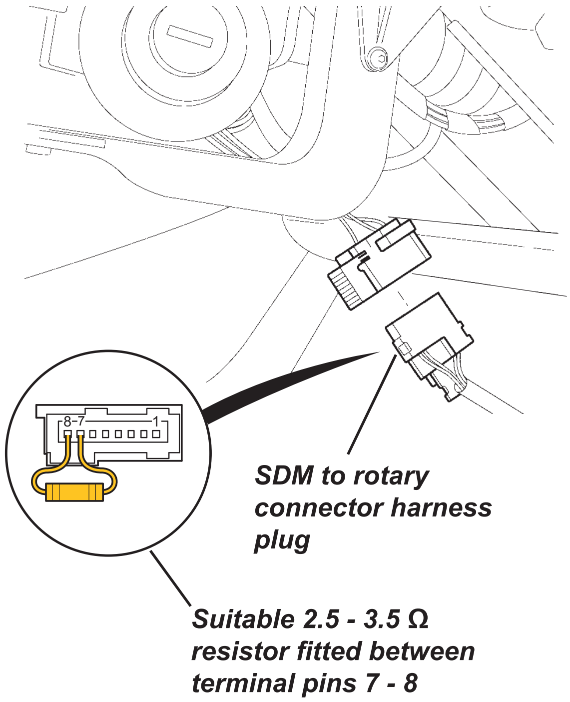
4. With the multi-plug of the rotary connector disconnected from the main vehicle harness, inspect the terminals at each connector and ensure that they have not been opened up thereby possibly causing an open circuit.

5. Check the continuity between the main harness rotary connector to the SRS SDM module to ensure the resistance readings are within the acceptable range.

   The wire identifications for the connector at the main harness are:

Terminal/Cavity	Wire I/D	Colour
7	298	Red/Green
8	297	Red/Blue

   Refer to service notes section MVA, Exige S CCT diagrams, sheet E1 for further information.



6a. High readings would indicate either an open circuit in the wiring between in the main vehicle harness to SDM module or faulty SDM module.

   If high resistance values are displayed then further investigate fault finding of the SDM module and associated wiring harness will be required, refer to sub-section WC.8 for further information.

6b. If the terminals do not appear to have opened up and the resistance readings are within the acceptable range then temporarily fit a suitable 2.5 - 3.5 ohm resistor across pins 7 & 8 of the main vehicle harness rotary spring connector plug as shown in the right hand illustration. This will simulate the correct airbag resistances values.

7. Reconnect the vehicle battery.

8. Clear the codes using Lotus TechCentre.

9. Exit the SRS system screens in Lotus TechCentre and go back to the main menu.

10. Turn the ignition on;

11. If the airbag tell tale within the instrument pack extinguishes after 6 seconds and the DTC codes are cleared (once Lotus TechCentre is directed back into the SRS menu) then this indicates that the fault is after this connector (within the clock spring / airbag connections or airbag itself) & not within the main harness / SDM module side of the circuit.

12. If the airbag tell tale fails to extinguish and the DTC codes are re-generated then further investigation of the integrity of the harness, connectors and its terminals of the clock spring to SRS SDM module is required, refer to sub-section WC.8 for further information.

   Note: The majority of driver's airbag DTC code generation have been eventually diagnosed as the pins within the connector housing on the airbag side of the clock spring being forced & bent if the airbag connector has not been engaged carefully or due to an internal break within the clock spring assembly.

WC.5 - DIAGNOSTIC SCANNER TOOL- LOTUS TECHCENTRE

In order to provide for communication with the airbag SDM, engine management system ECU and anti-lock brake system, a PC loaded with 'Lotus TechCentre' software may be plugged into the Data Link Connector.

A Vehicle Communication Device (T000T1472F) is used to connect the vehicle to the laptop Lotus TechCentre. All system interrogation and diagnosis are carried out via the Lotus TechCentre.

The minimum specification of the laptop computer for installation of the Lotus TechCentre is as follows:

- Processer 1.70 Ghz;
- 1 GB RAM;
- 40 GB HDD;
- CDRW DVD ROM;
- WIN XP PRO or VISTA;
- USB interface;
- Ethernet or Wireless LAN

Amongst the operations available using the 'Lotus TechCentre' tool are:

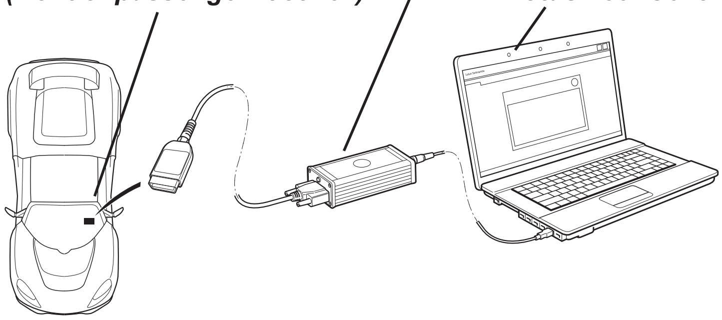
- Reading of Trouble Codes
- Clearing of Trouble Codes
- Reading live data

Note that this laptop should be dedicated soley to the Lotus TechCentre, with no other software installed. This diagnostic software is designed primarily for use by trained Lotus technicians, and is available as a CD under part number T000T1510F (version 4) or later supercessions. A monthly (Lotus Dealers) or annual (non-Lotus dealers) licence and support fee will also be levied, providing access to Lotus TechCentre Technical Support phoneline on ***0870 9493 668***, and e-mail on ***lotus.support.uk@omitec.com***

Also required is a unique 18 character licence/registration key without which Techcentre will not function. This key is non transferable to other PC's.

TechCentre Connection
Connection to the car is made via the Vehicle Communication Device (VCD) and the Data Link Connector (DLC) located at the front of the passenger footwell.

The yellow connector lead is used to connect the VCD to the car, and a USB lead connects the VCD to the laptop PC.



Power for the VCD is taken from the vehicle battery via the DLC and when powered, a blue tell tale on the unit will light. Should updated firmware be available for the VCD (usually downloaded as part of an online update) TechCentre will automatically update the VCD and display a message to confirm. The VCD, under part number T000T1472F is supplied in a black plastic carry case containing the following:

- VCD
- 16 Pin Yellow connector lead (VCD to Vehicle)
- USB lead (VCD to PC)
- USB extension lead (VCD to PC)

Use of TechCentre
Instructions for using the TechCentre are available in the 'Technical Information' section displayed on programme start up.

WC.6 - SAFETY PRECAUTIONS, SHIPPING, STORAGE & DISPOSAL

⚠ WARNING: The SDM can maintain sufficient voltage to cause an airbag deployment for up to 20 seconds after the battery has been disconnected. Before working on the airbag system, or in close proximity to an airbag, first take the following precautions to temporarily disable the airbag system:

Disabling procedure:

1. Before disconnecting the battery, use the Lotus TechCentre to read any stored trouble codes.

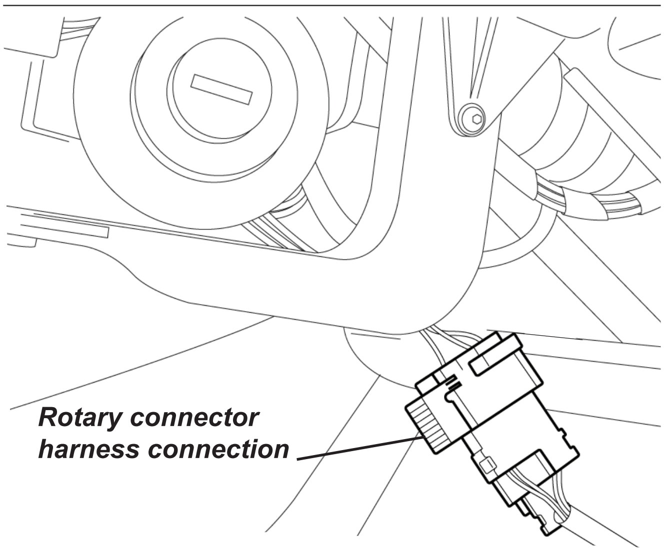
2. Turn off the ignition.

3. Disconnect the negative (earth) lead from the battery and tape back to ensure that no contact with the battery negative terminal can be made; refer to service notes section MV.10 for further information.

4. Wait for 30 seconds.

5. Remove the upper and lower steering column cowl trims; refer to service notes section VE.4 for further information. Locate the yellow harness connector alongside the steering column near the column upper fixing. Unplug this connector.

   Note that the connector is fitted with 'shorting bars' which automatically interconnect the high and low terminals of the airbag to prevent accidental deployment caused by a voltage differential.



When service work has been completed, reconnect the harness plug and secure with its locking feature, and reconnect the battery. Ensure the airbag tell tale lights for a few seconds with ignition and then goes out.

Storage:
- Airbag modules and SDMs should not be stored at temperatures above 176°F (80°C).
- Airbag modules and SDMs should not be stored in damp conditions.
- Do not store airbag module or SDM boxes more than two high.
- Always store and handle airbag modules and SDMs in an upright position. Never store SDMs upside down.

Sensor & Diagnostic Module (SDM):
The SDM is calibrated specifically to the Exige S, and is mounted on a dedicated bracket to the scuttle beam. Never use an SDM from another vehicle, or modify its mounting to the Exige.

⚠ WARNING: Handle the SDM with great care. Never strike or jar the SDM as this could cause airbag deployment and result in personal injury or improper operation of the SRS.
- All module and mounting bracket bolts must be correctly installed and tightened to assure proper security and operation.
- Never power up the SRS when the SDM is not properly mounted and secured, since the SDM is easily triggered when not attached, and could result in deployment causing personal injury.
- Do not use or attempt to repair a damaged SDM.

Inflator Module:
Live (Undeployed) Inflator Modules: Special care is necessary when handling and storing a live (undeployed) inflator module. In the unlikely event of accidental deployment, the rapid gas generation produced during deployment of the air bag could cause violent movement of the inflator module or surrounding objects, and result in personal injury.

⚠ WARNING: When carrying a live inflator module, make sure the bag and trim cover are pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury.

- **When placing a live inflator module on a bench or other surface, always face the bag and trim cover upwards, away from the surface. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment. Otherwise, personal injury may result.**
- **Never carry the inflator module by the wires or connector on the underside of the module.**
- **Do not use or attempt to repair a damaged inflator module, and NEVER apply any electrical power to the module except as specified in the diagnostic procedures.**

Inflator Module Shipping Procedures for Live (Undeployed) Inflator Modules:
The transportation of uninstalled inflator modules is regulated by the Hazardous Materials Regulations of the U.S. Dept, of Transportation (DOT) and most state governments.

Special procedures are required for transportation. Lotus recommends that the dealers and repair shops check with the hazardous material section of their respective state police authority for applicable shipping requirements.

For all shipments on public roads, the DOT has classified the uninstalled inflator module as a flammable solid under a special exemption process. It should always be shipped and stored in the approved cardboard container in which it is purchased. The container should be marked with “Flammable Solid , n.o.s., UN1325, DOT-E8236” and labelled with the specified red and white flammable solid label.

Each shipping location must have a copy of the exemption on file. A shipping paper (e.g., a customer receipt) must accompany each shipment and identify the module as “Flammable Solid, n.o.s., UN1325, DOT-E8236”. Transportation, storage and handling of the module should be in accordance with the exemption and the requirements for a DOT flammable solid. Do not expose the module to heat, open flame, impact, friction, or electrical charge.

Inflator Module Scrapping Procedures:

⚠ WARNING: Failure to follow proper SRS inflator module disposal procedures can result in airbag deployment which may cause personal injury. Undeployed inflator modules must not be disposed of through normal refuse channels. The undeployed inflator module contains substances that can cause severe illness or personal injury if the sealed container is damaged during disposal. Disposal in any manner inconsistent with proper procedures may be a violation of federal, state and/or local laws.

Reference should be made to the local State authority for the correct disposal procedures for deployed inflator modules.

Vehicle Scrapping Procedures:
Some vehicles equipped with SRS that have live (undeployed) inflator modules may have to be scrapped because they have completed their useful life, or have been severely damaged in a non-deployment type accident. The following procedure should be followed when scrapping a vehicle with an undeployed module.

1. Follow the safety procedure detailed in sub-section WC.6 to turn off the ignition, disconnect the battery and unplug the yellow 4-way connector to the inflator module, alongside the steering column.
2. Follow the procedure detailed in sub-section WC.11 to gain access to the passenger airbag module.
3. At the driver's airbag harness alongside the steering column, cut the harness side of the SRS wiring approx. 3 to 6 inches from the yellow connector.
4. Splice 2 wires at least 20 feet long to the red/blue and the red/green coloured cables in this connector block.
5. Reconnect the yellow 4-way connector block now equipped with 2 x 20ft long cables.
6. Check that the inflator module is secured to the steering wheel.
7. Remove all loose objects from the front seat.
8. Ensure no one is in the vehicle.
9. Stretch wires away from car to their full length.

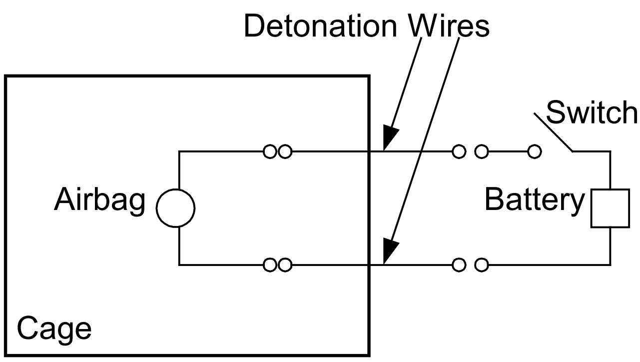
Airbag Activation/Disposal Procedure

Items Required
2 People.
2 Pairs Heat proof gloves.
2 Pairs Eye protection glasses.
2 Pairs Ear defenders.
Explosion container – a container to constrain the sudden inflation of the bag, may be mesh e.g. metal stillage, but requires a lid.
Sandbags, - to keep lid closed.
12 volt power supply.
Various air bag & seat belt wiring connectors / small crocodile clips.
10 meters Detonation wire
Paint marker pen
Dustbin / recycling container.

Weather Conditions.
Calm, clear, dry day with very little wind.
Place power supply upwind of explosion.

Location.
Any isolated area.

Procedure.



· Circuit diagram as shown.
· Make sure the power supply is turned off and is situated the length of the detonation wires away from the airbag.
· Only detonate ONE at a time.
· Ensure the detonation wires are disconnected from the power supply.
· Place 1 airbag into the explosion container and connect the detonation wires. Do not snag wires.
· Secure lid with sandbags.
· Put on your Eye & Ear protection.
· Connect the detonation wires to the power supply, doesn't matter on polarity.
· Turn the power supply on.
· ***AIRBAG WILL DETONATE AND INFLATE.***
· Turn power supply off and disconnect detonation wires from the power supply.
· Put on your heatproof gloves.
· Remove the airbag from the explosion container and disconnect the detonation wires.
· Mark-up and place the detonated airbag into the recycling container.
· Repeat this procedure as many times as required.

10. Apply 12 volts across the wires to deploy the air bag.
11. Do not touch the inflator module area for 20 minutes due to the heat generated during deployment.
12. Wear gloves and safety glasses to handle the deployed air bag. Wash your hands with mild soap and water afterwards.
13. Repeat steps 3 to 12 for the passenger airbag, splicing the 20ft cables into the two wires connecting the SDM to the airbag.

Deployed Inflator Modules:

⚠ WARNING: Safety precautions must be observed when handling a deployed inflator module. After deployment, the air bag surface may contain a white packing powder used to ease deployment, together with a small amount of sodium hydroxide dust, a by-product of the sodium azide reaction during deployment that can be irritating to the skin if left on for an extended period of time. Always wear gloves and safety glasses when handling a deployed inflator module, and wash your hands with a mild soap and water afterwards.

Inspections Required After an Accident:
All SRS system components, including harnesses and brackets, must be inspected after an accident. If any are damaged or bent, they must be replaced even if a deployment did not occur. If the SRS was deployed, the following components MUST be renewed even if there is no visible damage to the parts:
Driver airbag module;

Passenger airbag module;
Sensor & Diagnostic Module (SDM);
Driver and passenger pyrotechnic seat belt assemblies;
Rotary connector;
Passenger airbag mounting brackets (2);
Passenger airbag shute (2);
Passenger airbag door assembly (trim panel);
Dash panel upper extrusion.

Inspect the steering column for damage or telescoping (see service notes section HK.3) and column mounting brackets for damage.

Inspect the chassis scuttle beam in the area of the passenger airbag mounting brackets for damage or distortion. Inspect the SRS wiring harness and connectors for damage or any signs of overheating.

Do not attempt to repair the steering column or chassis or any of the above mentioned components. Service is by replacement only.

⚠ WARNING: Proper operation of the SRS system requires that any repairs to the vehicle structure return it to its original production configuration. Deployment, or any visible damage to the SRS components and/or their respective mounting brackets requires replacement, not repair.

WC.7 - THEORY OF OPERATION

The key components of the Supplementary Restraint System (SRS) are the following:
- Sensor & Diagnostic Module (SDM);
- Driver airbag module;
- Passenger airbag module;
- Rotary connector;
- Seat belt pre-tensioners.

Sensor & Diagnostic Module (SDM):
The SDM is the main electronic control unit (ECU) of the SRS, whose function is to detect rates of forward deceleration, and when interpreted as a collision accident requiring supplementary occupant protection, the SDM triggers as a single set, the driver and passenger airbags and both seat belt pre-tensioners.

Additional functions are to maintain an energy reserve in case of vehicle battery power interruption, operation of a dash mounted tell tale lamp, and a electronic diagnostic and event recording facility accessible via Lotus TechCentre.

The unit is mounted by a dedicated bracket to the top of the passenger side scuttle beam, accessible after removal of the fascia top.

The following functionality is provided by the SDM;
- Sensing of frontal impact crash events and vehicle specific discrimination between non-deployment and deployment-requiring events as well as the deployment of the frontal airbags and seat belt pre-tensioners.
- In case of a required deployment, timely activation of the activation current for the deployment loops.
- Detection of electrical system faults which may influence the readiness of the system to deploy, or increase the probability of an inadvertent deployment by:
  - continuous electrical monitoring of all deployment circuits (without any effect on the readiness of the system);
  - continuous monitoring of the supply voltage and the lamp circuitry (dependent on lamp driver activation status);
  - SDM self test;
  - activation of a tell tale lamp in case of a detected system fault.

- Fault storage and 'Crashrecording' within EEPROM ('crashrecording': recording of system parameters (e.g. fault status in deployment events).
- Diagnostic communication using an ISO9141 protocol.

Frontal Impact Sensing and Deployment:
The SDM contains an integrated accelerometer which provides a nearly linear proportional electrical representation of the acceleration experienced by the vehicle along the longitudinal axis. This signal is amplified and filtered to reduce unwanted electronic noise and to compensate for offset drifts. The filtered signal is then digitized to provide an input for evaluation by the crash algorithm. As soon as the crash algorithm detects that pre-defined thresholds have been exceeded, the SDM activates both airbags and both seat belt pre-tensioners.

To enhance system reliability under normal driving conditions, an additional electromechanical 'safing' sensor is included to ensure that the SRS is armed only when significant deceleration occurs. In order to protect against undesired deployments in case of severe EMI, humidity or accelerometer fault, the deceleration condition monitoring by the safing sensor occurs in addition to, and independent of, the crash algorithm.

Neither the seat belt pre-tensioners nor the airbags will be activated by the SDM as long as the diagnostic mode is active.

Fault Display:
The following conditions lead to a fault display in the form of continuous illumination of the airbag tell tale.
- One or more trouble codes requiring tell tale lamp activation in the 'historic' and 'present' condition are

stored in the SDM's EEPROM.

- One or more trouble codes requiring tell tale lamp activation in the 'present' condition only are stored in the SDM's EEPROM, the condition of which is, or has been, 'present' in the current operating cycle. For all faults requiring four consecutive incidents for a trouble code to be set, the 'present' condition and fault display will be activated already after two consecutive events if the related trouble code has already been stored in a previous operating cycle.
- Faults concerning the voltage supply (overvoltage/undervoltage) will lead to tell tale activation only until the regular voltage range has been reached again (turn-off delay max. 5s after return from undervoltage and max. 20s after return from overvoltage). There are no related trouble codes.
- The airbag tell tale will not be activated due to SRS warning lamp related faults.
- The tell tale will be activated immediately after entering the diagnostic mode, or on deployment of the SRS.

Excluding the exceptions stated above, it is not possible to switch off the tell tale other than by resetting the fault codes stored in the EEPROM. This is not possible after an airbag deployment - the SDM must be renewed.

The following delays apply for the detection and display of faults. The delays apply from the extinguishing of the tell tale, following the ignition switch on bulb check period:

1 to 5 secs	- for external deployment circuit faults and overvoltage supply.
12 to 20 secs	- for undervoltage supply.
up to 15 secs	- for SDM internal faults.

The tell tale will be activated without SDM intervention in the following situations:

- the minimum voltage of 8.0 V has not been exceeded after switching on the ignition.
- the energy reserve (in SDM) has run low, which may be caused by supply voltages below 7.8 V.
- the watchdog has interfered.

Power Supply & Grounding:
The nominal supply voltage of +12 volts is derived from terminal 5 when the ignition is switched on. The SDM internal ground (terminal 7) must be securely connected to the vehicle chassis ground. To provide redundant grounding, the SDM housing is internally connected to the ground connector pin.

Supply Voltage Range:
The SDM is designed to operate within the following voltage ranges:

System fault detection, SDM self test:	Min. 8.0 V; max. 16.0 V
Below 10.0 V:	System readiness may be delayed by 3 s.
Below 9.0 V:	System readiness may be delayed by 10 s.

System fault detection and SDM self test are reduced as long as an under voltage condition is detected, which could already apply for supply voltages below 10.5 V.

Activation of airbags:	Min. 8.0 V; max. 16.0 V.
Activation of seat belt pre-tensioners:	Min. 10.0 V; max. 16.0 V.

Energy Reserve:
Energy reserve capacitors within the SDM are provided to allow SRS deployment if the vehicle battery power supply is interrupted during the time of vehicle impact. The capacitors provide full support of the acceleration sensing and airbag initiation capability for a minimum of 150 ms after a loss of external power supply, provided that before the loss, the SDM had been supplied with:
at least 10.0 V for at least 10 s; or
at least 9.0 V for at least 13 s; or
at least 8.0 V for at least 20 s.

The capacitors will be discharged down to a point where no initiation of airbags is possible within a max. of 20 s after removal of the power supply.

WC.8 - SENSOR & DIAGNOSTIC MODULE (SDM)

⚠ WARNING: The SDM must be replaced after SRS deployment. Do not attempt to repair or reuse. The SDM is mounted on a bracket riveted to the top of the passenger side scuttle beam, and is accessible only after removal of the fascia (dash) top panel.

Removal:

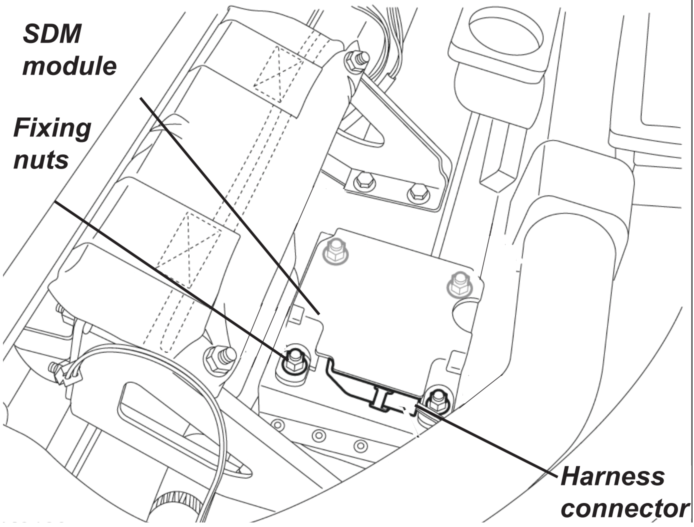
1. Follow the safety procedure detailed in sub-section WC.6 to temporarily disable the airbag system.

2. Remove the dash top fascia refer to service notes section VE.8 for further information.

3. Unplug the harness connector from the SDM. Release the four retaining nuts, and earth connection, then withdraw the sensor and diagnostic module from its mounting bracket.

Refitment:

Refitment is the reversal of the removal procedure. Fit the SDM module and tighten the four M6 nuts to 8 Nm.

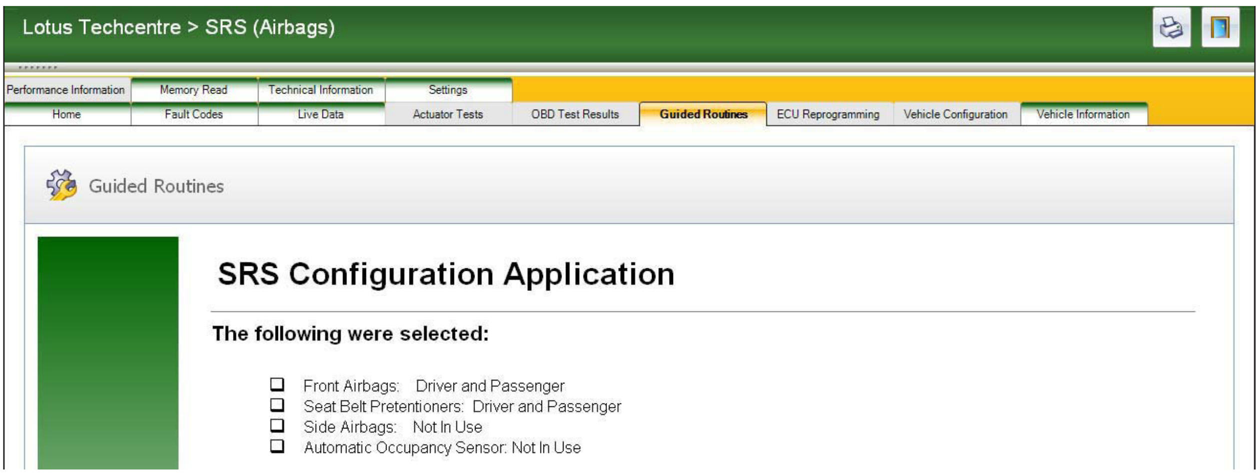


Ensure that the tether strap bracket for the airbag trimmed door has been secured before the fascia top panel is fitted, and that new push fasteners for the airbag door will be required. Use Lotus TechCentre to configure airbag system.

The SDM unit has additional functionality not required for the Exige. If the unit is removed or replaced then its configuration must be checked or reprogrammed as necessary using Lotus TechCentre.

From the home screen select:
System - SRS (Airbags)
Select 'Guided Routines' tab
Select Configuration – Reprogram or ECU renewal option as applicable
Follow the instruction prompts located at the RH bottom of the screen
When configuring select:
Front airbags = Driver and Passenger
Automatic Occupancy Sensor fitted = Not in use
Which Seat Belt Pretensioners are Fitted = Driver and Passenger
Which Side Airbags are Fitted = Not in use

Example of TechCentre screens for SRS configuration



WC.9 - DRIVER AIRBAG MODULE

⚠ WARNING: Safety precautions must be observed when handling a deployed airbag. After deployment, the airbag surface may contain a white packing powder used to ease deployment, together with a small amount of sodium hydroxide dust, a by-product of the sodium azide reaction during deployment that can be irritating to the skin if left on for an extended period of time. Always wear gloves and safety glasses when handling a deployed inflator module, and wash your hands with a mild soap and water afterwards.

The driver's airbag (or inflator module) is housed in the hub of the steering wheel, beneath a moulded trim cover designed to hinge open in the event of deployment. The module comprises:

- an inflatable fabric bag;
- an inflator (canister of gas generating material)
- an initiator (or 'squib')

When the vehicle suffers a forward deceleration of sufficient magnitude to close both the safing sensor and integrated accelerometer within the SDM, current flows through the deployment loop of both the driver and passenger airbag module initiators and ignites the gas generating material. Each bag inflates in a fraction of a second, the driver's bag bursting open the steering wheel centre trim cover, and then deflates via vents in the bag, with the whole cycle taking less than one second. The airbag is designed for a single deployment, and must then be renewed.

In order to help prevent unwanted deployment of the driver's airbag when servicing the steering column or other SRS components, a shorting bar is incorporated in the airbag side of the 4-way harness connector plug located alongside the steering column. The shorting bar operates when the connector is unplugged, to short across the feed and return connections to the airbag. Thus, if a positive feed, or earth is inadvertently applied to the connector terminals, both sides of the inflator module will be subject to the same electrical potential, and no deployment will occur.

Removal:

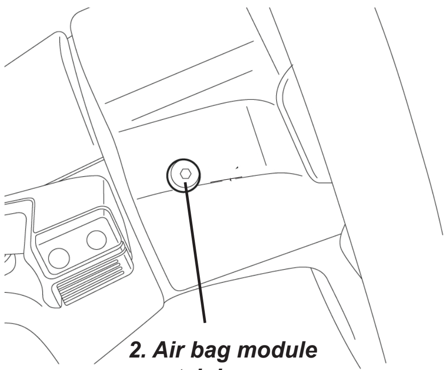
⚠ WARNING: The following procedures must be followed in the order listed to temporarily disable the airbag system whilst working in the immediate vicinity of an airbag. Failure to follow this procedure could cause unintended airbag deployment, resulting in personal injury and unnecessary airbag system repairs.

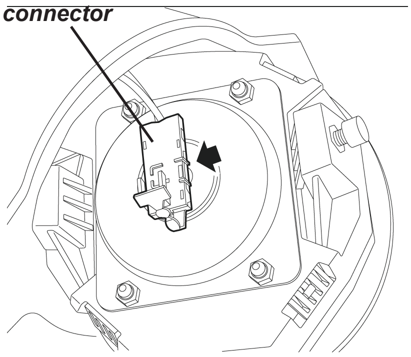
1. Follow the safety procedure detailed in sub-section WC.6 to temporarily disable the airbag system.

2. On the reverse side of the steering wheel, locate and remove the two socket head screws, accessible via holes in the plastic shroud around the steering wheel hub.

3. Withdraw the airbag module and disconnect the yellow harness connector.

⚠ WARNING: When carrying a live airbag module, make sure the bag and trim cover are pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. When placing a live airbag module on a bench or other surface, always face the bag and trim cover upwards, away from the surface. This is necessary so that a free space is provided to allow the airbag to expand in the unlikely event of accidental deployment.





Note: If a driver's airbag is deployed, refer to steering section HK.3 to determine whether the steering column telescoping mechanism has been activated, and if necessary, renew the column assembly.

Refitment:
Is the reversal of refitment except:

- Mate the new airbag yellow connector plug with the harness plug in the steering wheel hub, and locate the module into the steering wheel. Fit the two socket head retaining screws and tighten to 7Nm.

- When all service work is complete, connect the harness plug alongside the steering column, and reconnect the battery. Turn on the ignition and check that the airbag tell tale lights for a few seconds and then goes out.

WC.10 - ROTARY CONNECTOR

⚠ WARNING: The rotary connector MUST be replaced after SRS deployment even if there is no visible damage.

The rotary connector is a device which fits between the steering wheel and column, and allows the steering wheel to turn whilst maintaining electrical continuity to the airbag module and horn buttons. The assembly consists of an annular housing fitted over the top end of the steering column, and containing a coil of four wires. The wires are:

- +ve feed to the inflator module (switched by the safing sensor);
- ground to the inflator module (switched by the microprocessor accelerometer);
- input to the horn buttons;
- output from the horn buttons.

The steering column side of the device is fitted with a 4 way connector block which plugs into the SRS harness. The steering wheel side of the device has two 2-way connector plugs, one for the airbag module, and one for the horn buttons. The coil housing is constructed in two parts, with the outer part fixed to the outer (stationary column, and the inner part keyed to the inner (rotating) column.

The two parts of the coil housing slide inside of each other in such a way as to allow the steering wheel to be rotated through its full travel, lock to lock, whilst maintaining an unbroken feed to each of the four circuits in the steering wheel hub, via the continuous wires in the coils.

In order to help prevent unwanted deployment of the air bag when servicing the steering column or other SIR components, a shorting bar is incorporated in the rotary connector side of the 4-way SRS harness connector plug. This shorting bar operates when the connector is unplugged, to short across the feed and return connections to the inflator module. Thus, if a positive feed, or earth is inadvertently applied to the connector terminals, both sides of the inflator module will be subject to the same potential, and no deployment will occur.

When servicing the rotary connector, it is most important that the correct orientation of the connector is maintained on refitment, or the connector will run out of travel and be broken.

Removal:

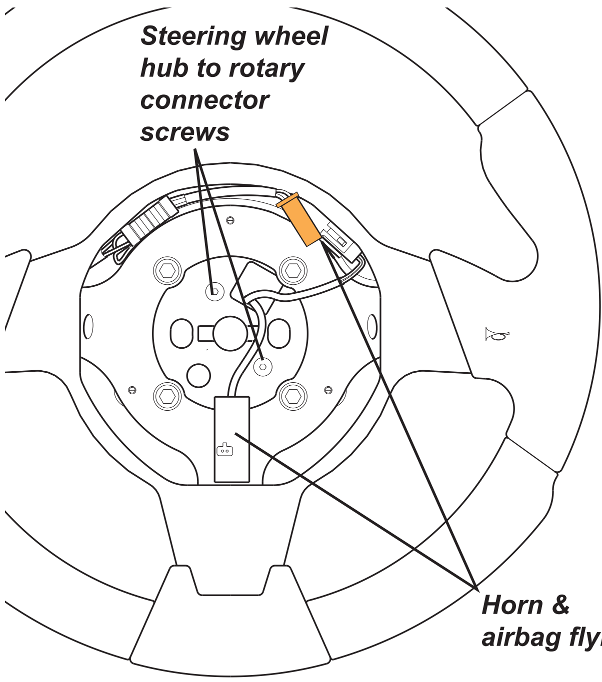
1. Follow the safety procedure detailed in sub-section WC.6 to temporarily disable the airbag system.

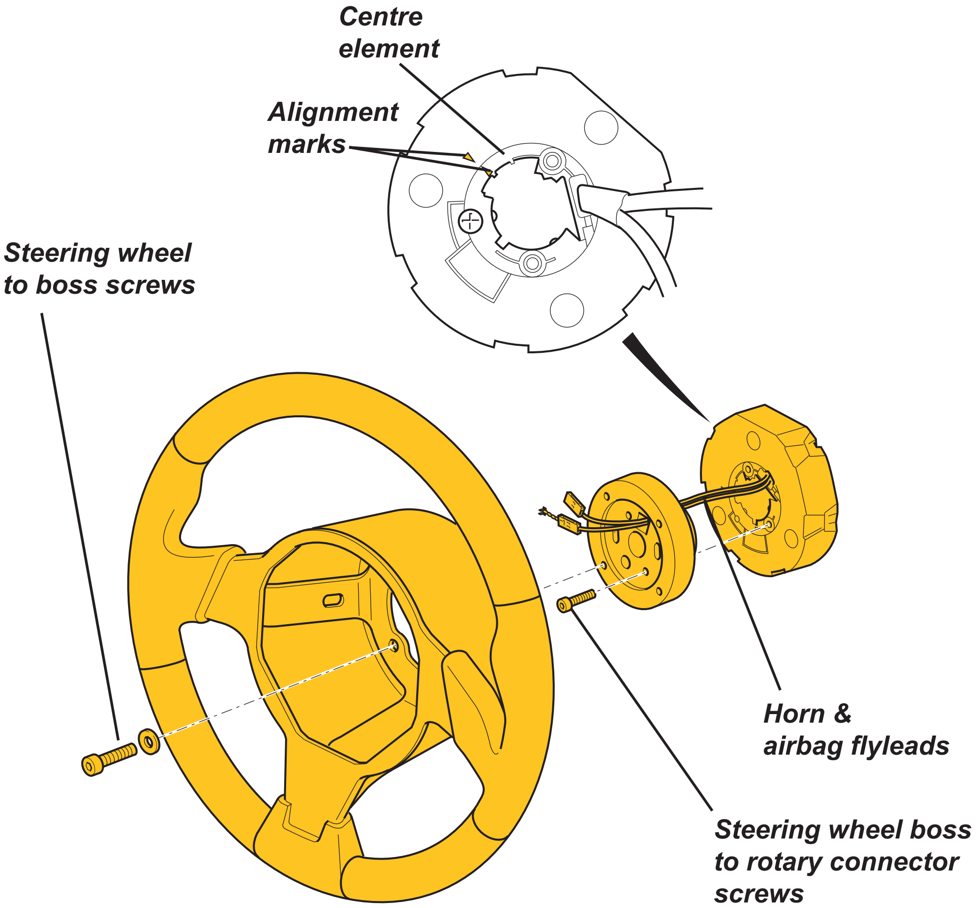
2. Remove the airbag module from the steering wheel (see sub-section WC.9).

3. Remove the steering wheel; refer to service notes section HK.2 for further information.

4. With the steering wheel removed, release the M6 x 12 screws and washers (4) securing the steering wheel to the hub, or alternatively release the two countersunk screws retaining the rotary connector to the steering wheel hub.

   Note: Which ever method is used ensure that the horn and airbag flyleads attached to the rotary connector are carefully feed through the access hole in the main body of the steering wheel.





Refitment:

On refitment, feed the airbag and horn connector plugs on the rotary connector through the hole in the steering wheel hub, and secure the unit to the hub with the two countersunk screws. If necessary, refit the steering wheel to the hub and secure with the four screws. Mate the horn buttons harness connector plug.

Before fitting the wheel/hub/rotary connector assembly to the column, the rotary connector must be centralised:

Centralisation procedure:
Turn the rotary connector centre element fully counter clockwise until tight, then turn clockwise approximately 2.5 turns until the arrow marks on the two parts of the rotary connector are aligned.

Make sure the front wheels are pointing straight ahead, and fit the assembly onto the column with the hub to column match marks (made on disassembly) aligned, and engage the spring loaded pin on the column switch housing with the slot in the rotary connector.

Fit a new locking tab washer, followed by the steering wheel nut, and torque tighten to 25 Nm (18.5 lbf.ft). Bend up the locking tabs to secure.

Mate the airbag harness connector plug and fit the airbag module into the steering wheel. Retain with the two socket head screws and tighten to 7Nm.

Refit the column shrouds, and when all service work is complete, mate the horn/airbag connector to the vehicle harness (clipping the connector to the column) and reconnect the battery. Check that the airbag tell tale lights for a few seconds with ignition, and then goes out.

WC.11 - PASSENGER AIRBAG MODULE

⚠ WARNING: Safety precautions must be observed when handling a deployed airbag. After deployment, the airbag surface may contain a white packing powder used to ease deployment, together with a small amount of sodium hydroxide dust, a by-product of the sodium azide reaction during deployment that can be irritating to the skin if left on for an extended period of time. Always wear gloves and safety glasses when handling a deployed inflator module, and wash your hands with a mild soap and water afterwards.

The passenger's airbag (or inflator module) is housed within the passenger side of the fascia, mounted on a bracket to the scuttle beam, and arranged to deploy via an aperture in the dash panel covered by a trimmed 'door'. The door is designed to break away in the event of airbag deployment, but is tethered to the dash by two restraining straps. The airbag module comprises:

- an inflatable fabric bag;
- an inflator (canister of gas generating material)
- an initiator (or 'squib')

When the vehicle suffers a forward deceleration of sufficient magnitude to close both the safing sensor and integrated accelerometer within the SDM, current flows through the deployment loop of both the driver and passenger airbag module initiators and ignites the gas generating material. Each bag inflates in a fraction of a second, the passenger's bag bursting through the dash panel 'door', and then deflates via vents in the bag, with the whole cycle taking less than one second. The airbag is designed for a single deployment, and must then be renewed.

⚠ WARNING: The harness connector for the passenger's airbag is accessible only after removing the fascia top panel, so care should be taken to avoid working in close proximity to the airbag door in case of unintended deployment.

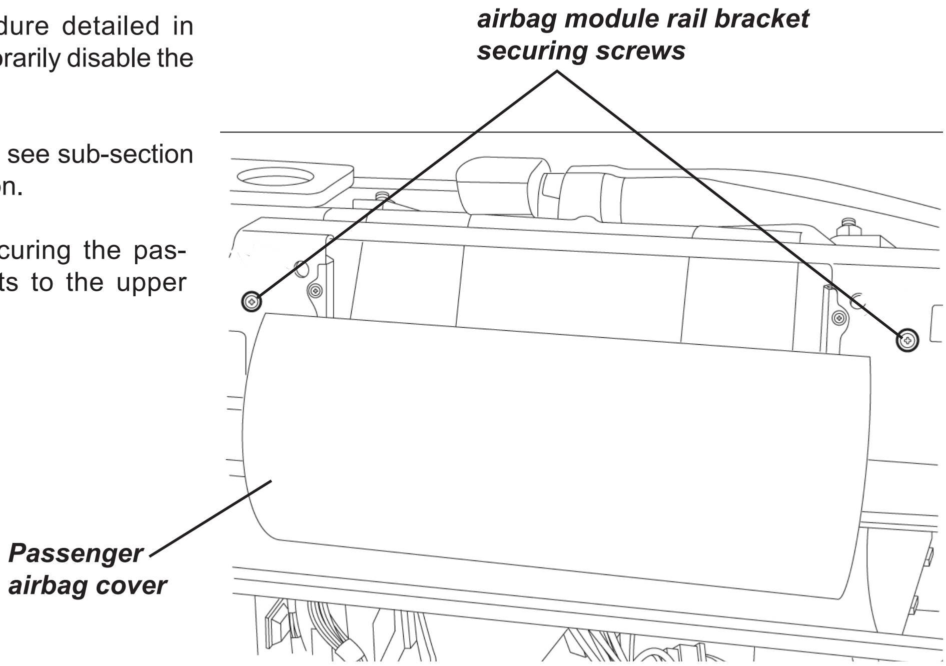
Removal:

⚠ WARNING: The following procedures must be followed in the order listed to temporarily disable the airbag system whilst working in the immediate vicinity of an airbag. Failure to follow this procedure could cause unintended airbag deployment, resulting in personal injury and unnecessary airbag system repairs.

1. Follow the safety procedure detailed in sub-section WC.6 to temporarily disable the airbag system.

2. Remove the SDM module, see sub-section WC.8 for further information.

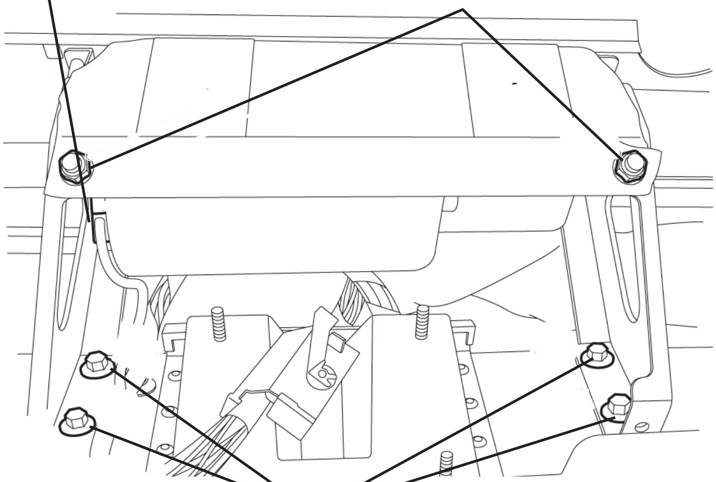
3. Remove the 2 screws securing the passenger airbag rail brackets to the upper dashboard panel.



4.From the right hand end of the passenger airbag module, pull out the security tag and unplug the harness connector.

5.Release the two nuts and remove the airbag door tether strap bracket from the module mounting bracket.

6.Release the four nuts securing the passenger airbag dash brackets, and withdraw the module and brackets from the dashboard beam.

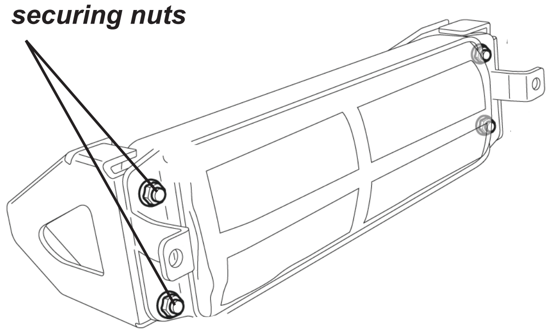


⚠ WARNING: The only permitted repair to the airbag door and tether strap assembly is the replacement of the plastic retaining clips which secure the door to the dashboard. If the clips are broken, they MUST be replaced ONLY by the correct Lotus supplied parts. Do not attempt to fix the door in position by any other means.

After SRS deployment, the airbag door assembly MUST be replaced even if there is no visible damage.

7. Remove the 4 nuts securing the rail brackets and dashboard mounting brackets to the airbag assembly.

⚠ WARNING: When carrying a live airbag module, make sure the bag and trim cover are pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. When placing a live airbag module on a bench or other surface, always face the bag and trim cover upwards, away from the surface. This is necessary so that a free space is provided to allow the airbag to expand in the unlikely event of accidental deployment.



Note: If an airbag deployment has occurred, the chassis scuttle beam, airbag mounting bracket, dash extrusions and all associated parts must be carefully examined for distortion and renewed where necessary.

⚠ WARNING: Proper operation of the SRS system requires that the vehicle structure remains in its original production configuration. Any damage to the SRS components and/or their respective mounting brackets, including the chassis, requires replacement, not repair.

Refitment:
Is the reverse of removal except if necessary, fit the airbag mounting and rail brackets to the airbag module, and tighten the four M6 nyloc nuts to 6 Nm.

- Fit the airbag module with its brackets to the scuttle beam, and tighten the four M8 fixing bolts to 15 Nm.

- Fit the SDM module, tighten the four M6 nuts to 8 Nm.

- Fit the airbox door tether strap bracket to the airbag module mounting bracket, and tighten the two nuts to 10 Nm.

- Plug in the harness connector into the RH side of the module and retain with the security tag.

- Refit the fascia top panel; refer to service notes section VE.8 and VE.12 for further information.

• Refit the column shrouds, and when all service work is complete, mate the horn/airbag connector to the vehicle harness (clipping the connector to the column) and reconnect the battery. Check that the airbag tell tale lights for a few seconds with ignition, and then goes out.

WC.12 - SEAT BELT PRE-TENSIONERS

⚠ WARNING: Failure to comply with the instructions, safety standards and operating procedures as described in this section, may cause vehicle damage and/or personal injury.

Both driver and passenger seat belt assemblies must be replaced after SRS deployment. Do not attempt to repair or reuse.

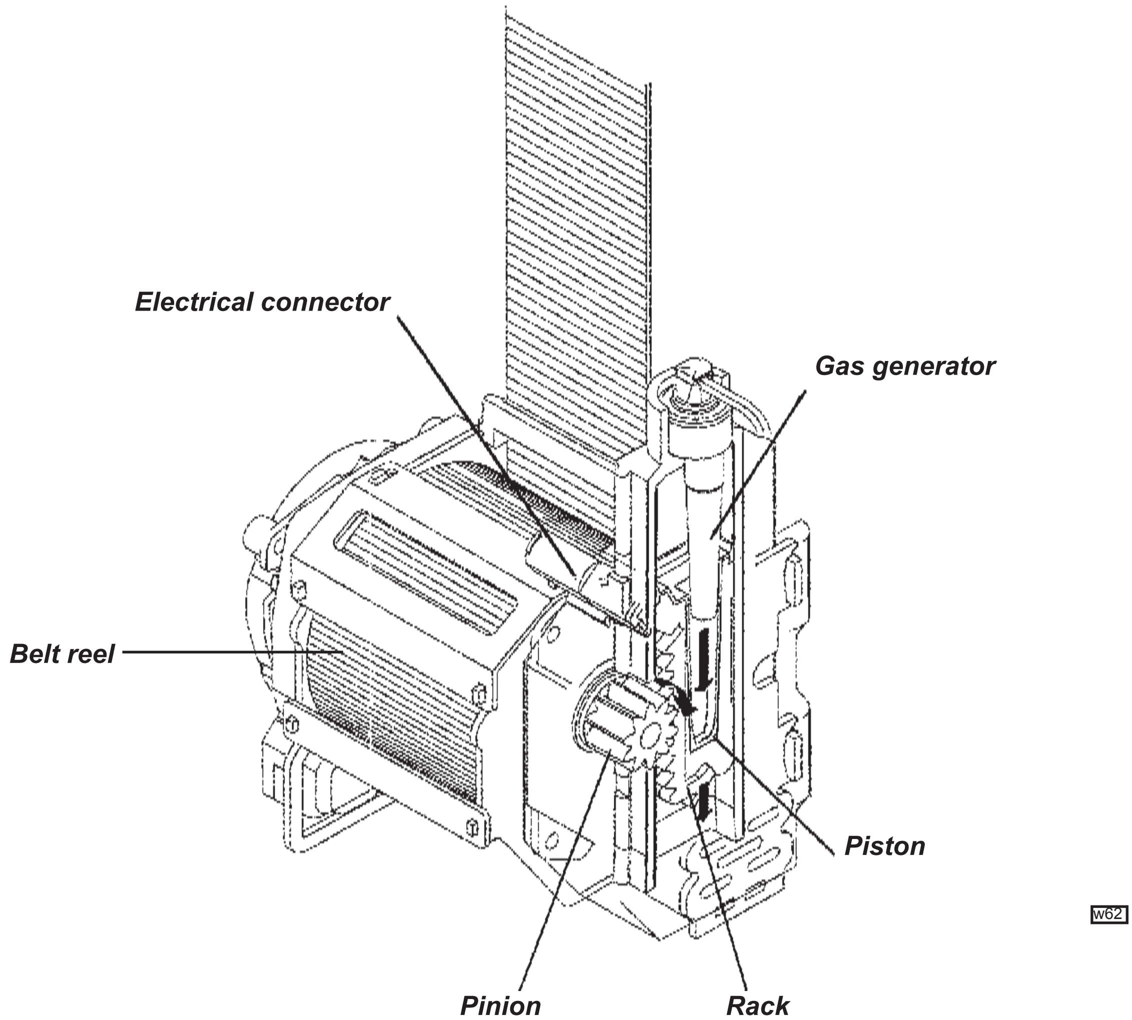
Device Operation

The seat belt pre-tensioners are triggered together with the airbags, and use a pyrotechnic device on each seat belt reel assembly, to operate a rack and pinion mechanism which applies a tightening force to the belt reel to remove any slack from the belt. Under normal operation, the rack is fully raised and disengaged from the pinion, allowing normal spooling of the reel for belt withdrawal and retraction.

When airbag/pre-tensioner triggering conditions apply, the SDM signals ignition of the gas generator, the pressure from which forces the piston and toothed rack downwards, causing rotation of the pinion gear and a re-winding of the seat belt webbing. The force sustained by the belt and its user is then controlled by a torsion bar within the belt reel to limit the deceleration force to which the occupant is subjected during the crash event.

The belt pre-tensioning mechanism is designed to operate only once, such that both belt assemblies should be renewed after airbag/seat belt pre-tensioner deployment. Activation of the pyrotechnic mechanism is indicated by the belt reel being locked, and allowing neither extraction nor retraction of the belt.

⚠ WARNING: Following an impact in which the pre-tensioning element is activated, the seat belt assembly is rendered inoperable. The car should not be driven until the belt assembly has been renewed.



Removal of Seat Belt Assembly

⚠ WARNING: Before removing or refitting a pyrotechnic seat belt assembly, the ignition key should be withdrawn, and the battery leads disconnected from both positive and negative terminals, and isolated to ensure that accidental contact cannot occur.

Each seat belt reel assembly is secured, via a spacer block, to the seat belt mounting bracket/roof hoop by a single bolt. Note that an orientation tang is incorporated on the belt reel which engages with a hole in the spacer, and that the spacer is keyed to the mounting bracket by a roll pin.

Preparation:

a. Before disconnecting the battery, use the Lotus TechCentre to read any stored trouble codes.

b. Turn off the ignition.

c. Disconnect the negative (earth) lead from the battery and tape back to ensure that no contact with the battery negative terminal can be made; refer to service notes section MV.10 for further information.

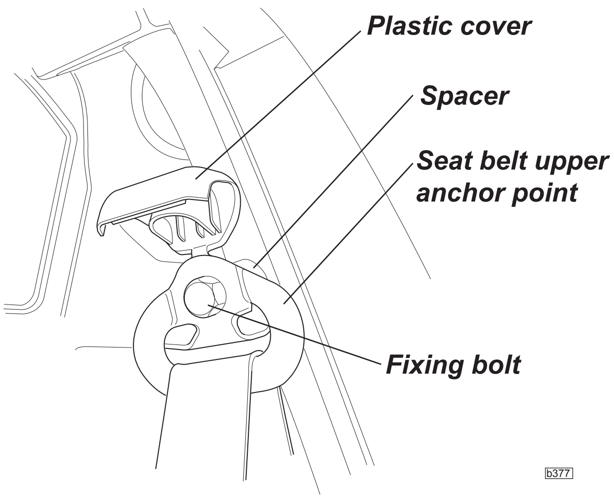
Removal:

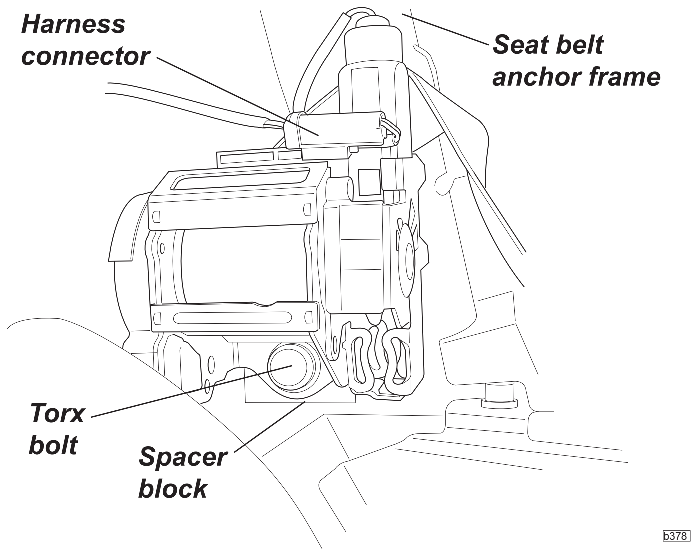
1. Remove rear bulkhead trim; refer to service notes section VE.11 for further information.

2. Hinge up the plastic cover and release the bolt securing the seat belt upper anchor point to the seat belt anchor frame, noting the 5mm spacer.

3. Allow at least one minute from disconnecting the battery before disconnecting the electrical connector from the gas generator on the seat belt assembly.

4. Release the Torx head fixing bolt and withdraw the belt reel assembly and spacer block.





Refitment:
Is the reverse of removal except:

⚠ WARNING: Before removing or refitting a pyrotechnic seat belt assembly, the ignition key should be withdrawn, and the battery leads disconnected from both positive and negative terminals, and isolated to ensure that accidental contact cannot occur.

Each seat belt reel assembly is secured, via a spacer block, to the seat belt mounting bracket/roof hoop by a single bolt. Note that an orientation tang is incorporated on the belt reel which engages with a hole in the spacer, and that the spacer is keyed to the mounting bracket by a roll pin.

1. Fit the seat belt reel assembly and alloy spacer to the bracket on the mounting frame, with the spacer block located by its roll pin into the hole in the bracket, and the belt reel tang located in the upper hole in the spacer. Fit and tighten the single Torx head fixing bolt (discarding the cardboard retaining washer if fitted) to 45 Nm. Plug the harness connector plug into the gas generator on the belt assembly.

2. Fit the belt upper anchorage point to the seat belt anchor frame with the 5mm spacer interposed, and tighten the special shouldered bolt to 45 Nm. Check that the anchorage point is free to pivot. Clip the plastic cover into position.

3. Refit the cabin rear bulkhead trim panel and previously removed interior trim components.

4. Refit the cup holder, connecting the power socket, and liner.

5. Refit the seats and fit the seat belt to the seat frame with the 10mm spacer between belt and seat. Tighten the special shouldered bolt to 33 Nm (24 lb/ft). Check that the belt eye is free to pivot.

6. Reconnect the battery, turn on the ignition, and check that the airbag tell tale lamp lights for a few seconds and then goes out.

Safety Standard
The pre-tensioning function is energised via pyrotechnic materials, therefore manipulation, handling and storage MUST be performed to the specified procedures as described to avoid any occurrence of injury to the operator or damage to the pre-tensioning unit.

In normal conditions, the pre-tensioner assembly can only be activated through the action of the electric ignition control during impact. During the activation phase of the pyrotechnic charge, small gas quantities are developed. The main constituent of the gases is Nitrogen:

Note! This gas is not toxic.
- **The pre-tensioner assemblies must be protected against exposure;**
- **To temperatures over 90°C (195°F) at contact with surfaces**
- **90°C during 106 hrs.**
- **From sparks and naked flames.**

⚠ WARNING: If exposed to temperatures in excess of 140°C, self-ignition of the pyrotechnic charge of the gas generator may occur. Exposure to temperatures in excess of 165°C, self-ignition of the pyrotechnic charge will occur.

Also, if exposed to temperatures between 90°C (285°F) and 165°C (330°F), deterioration of the pyrotechnic charge ignition is possible. The consequences of this could be failure to activate at prescribed levels. The pre-tensioner must be protected against stresses, shocks and dropping. Pre-tensioners that have been subjected to such treatment must be discarded and returned to the supplier with accompanying paperwork describing the reasons for return.

Never store pre-tensioner assemblies with other flammable or combustible materials. Gas generators MUST be prevented from coming into contact with acid, water, grease and heavy metals: Contact with

these substances may cause toxic or dangerous gases, or explosive mixtures.

Any residual fuel of the gas generator, not burned during ignition, is slightly flammable. The unit, therefore, must never be disassembled, damaged or the parts manipulated. Any advertising or demonstrations of the pre-tensioner assembly should only be carried out using inert pre-tensioners (without the pyrotechnic charge). The base of the pre-tensioner must be painted green, with visible and indelible wording, stating **'Inert Assembly'. It must incorporate the KSS logo, signed with indelible ink by the person responsible for the supply of the product.**

⚠ WARNING: Never disassemble the pre-tensioner or any of it's components!

Transportation of belt with pre-tensioner
Transport on road vehicles should be carried out with the assemblies stored in the luggage compartment. Never transport in the passenger compartment. Never transport the pre-tensioner manually or holding it by the webbing: this can result in damage to the assembly.

Storage of belt with pre-tensioner
Belts with pre-tensioning elements should be stored in containers or boxes that can be locked with a key, and ventilated. They MUST be stored in an area free from flames and heat sources. On completion of work, or during work break periods, pre-tensioner belts should be returned to the storage container and locked with a key.

Disposal of belts with pre-tensioner
Charged pre-tensioners to be scrapped and not fitted to a car must be activated. This should be carried out only by the belt manufacturers, or specialised workshops.

Vehicle disposal
Charged pre-tensioners fitted to a vehicle MUST be removed before the vehicle is dismantled for scrapping. If the pre-tensioner is not activated during an accident, the device must be considered as still to be in a 'charged' condition.

General safety instructions/dangers for health
- When handling activated pre-tensioners, use safety glasses and vinylic or nitrylic protection gloves.
- After handling a loaded pre-tensioner, wash hands with soap and water.
- There is no danger of exposure to propellants in the sealed system. The propellant mix is in a solid state, therefore no inhalation is possible, even if the gas generator cartridge is broken.
- Avoid skin contact and do not ingest the propellant.

First aid
Ingestion: Help the person vomit if conscious. Call a physician.
Skin contact: Wash immediately with soap and water. Call a physician.
Eyes: *Wash the eyes immediately with running water for a minimum of 10 minutes. Call a physician.*
Inhalation: Take the person immediately to fresh air. Call a physician.

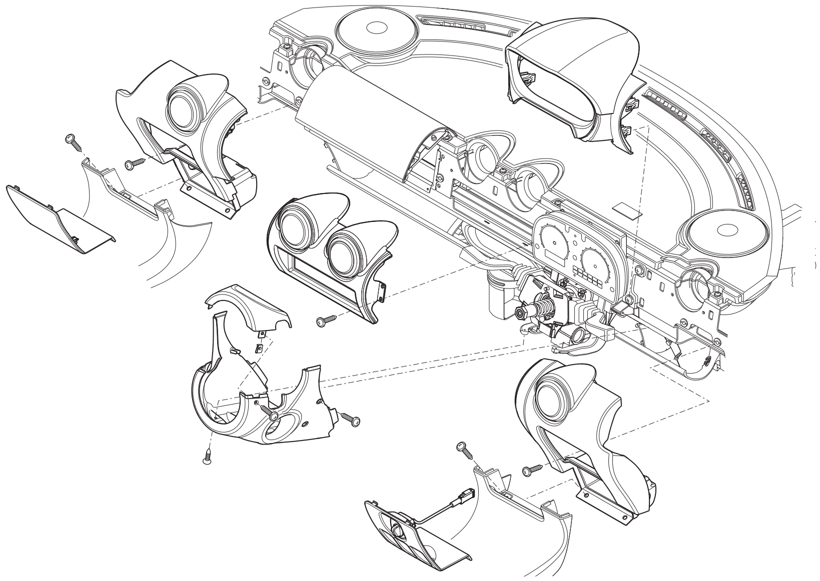
General notice
Storage, transport, dismantling and/or recycling of the pre-tensioner shall be carried out according to the legal and local regulations, taking account also of directives for masonry, fire fighting, transport, environmental protection and the safety and health of all staff.

⚠ WARNING: The seat belt pre-tensioner devices fitted on the Lotus Elise are designed and calibrated specifically for this particular model. Pre-tensioners must not be adapted, re-used or installed on any other vehicle - they must only be fitted to the prescribed vehicle with specific homologation continuity.

Any attempt to re-use, adapt or install pre-tensioners on a different vehicle can cause severe or fatal injuries to the occupants during normal operation as well as the result of an accident.

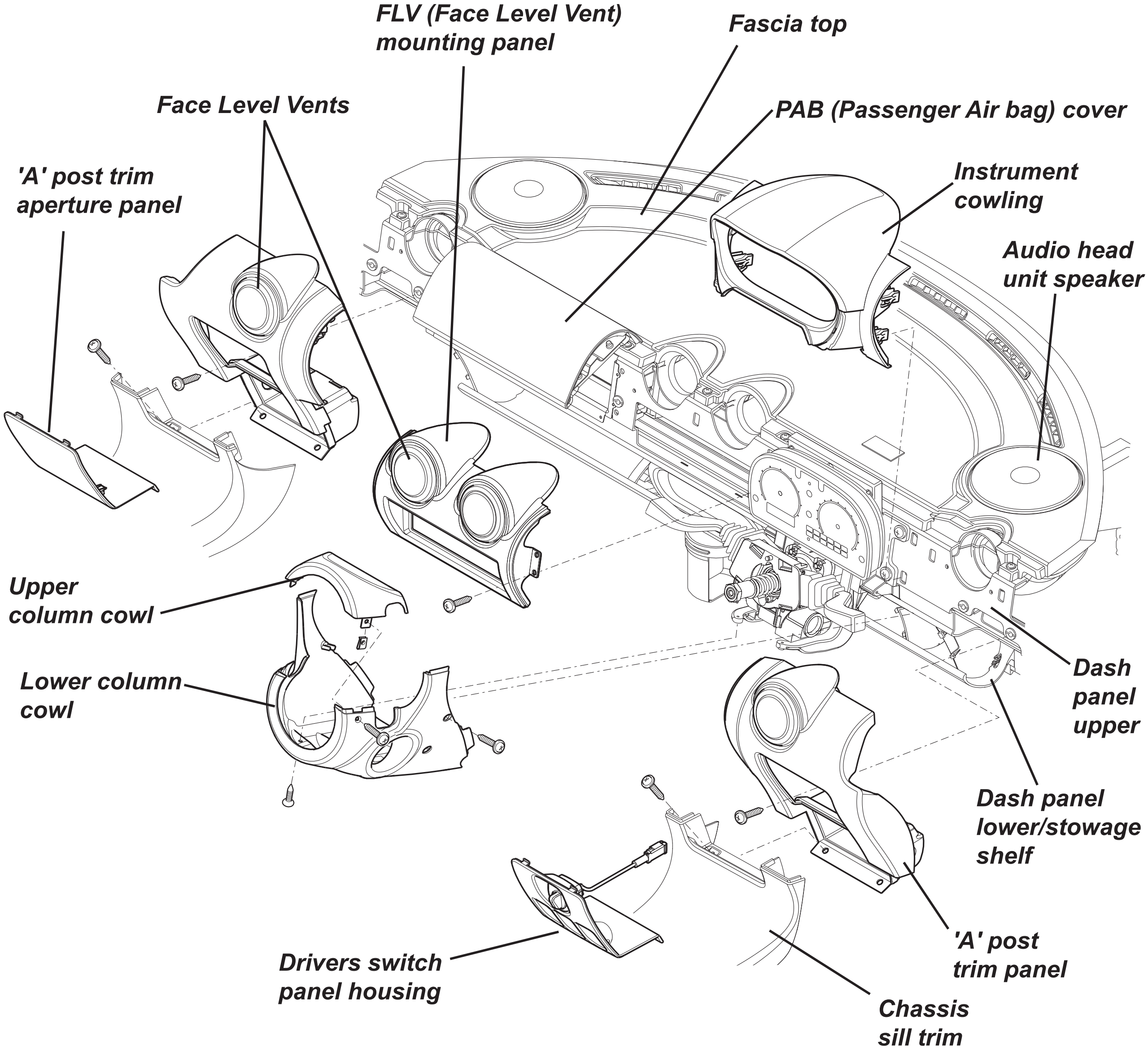
INTERIOR TRIM

SECTION VE



	Sub-Section	Page

RHD FASCIA STRUCTURE (*LHD symmetrically opposite*)



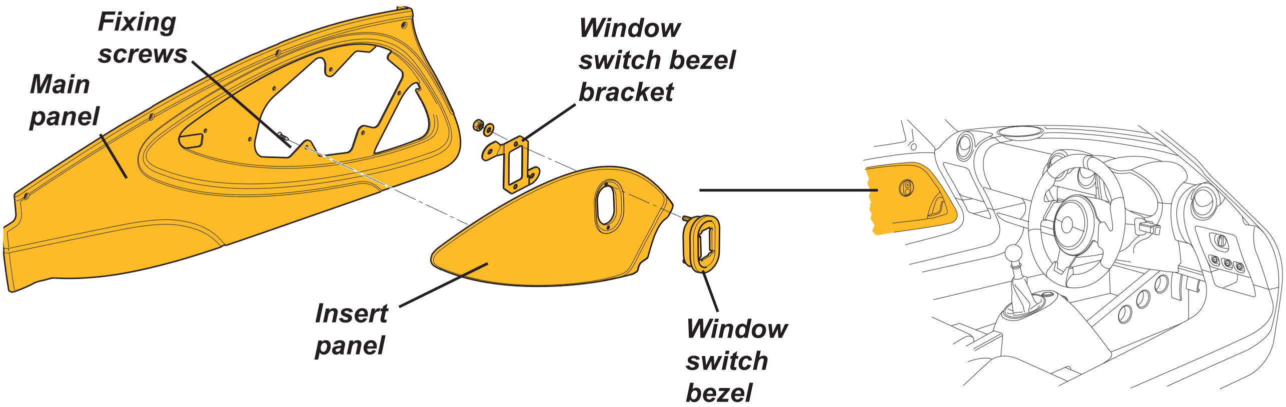
Interior trim philosophy

Exige S interior trim panels are constructed of light weight/strong composite materials to achieve a suitable aesthetical balance for a sports car interior whilst remaining practical and functional for every day road use.

Where possible trim components have be designed so that the same part will fit both RHD and LHD vehicles an example being the RH and LH 'A' post trims either of which can accommodate the driver's exterior lighting controls.

To achieve a level of individuality for the discerning driver, many of the panels are available covered in various materials/colours/pattern and stitching options.

VE.1 - DOOR TRIM PANEL

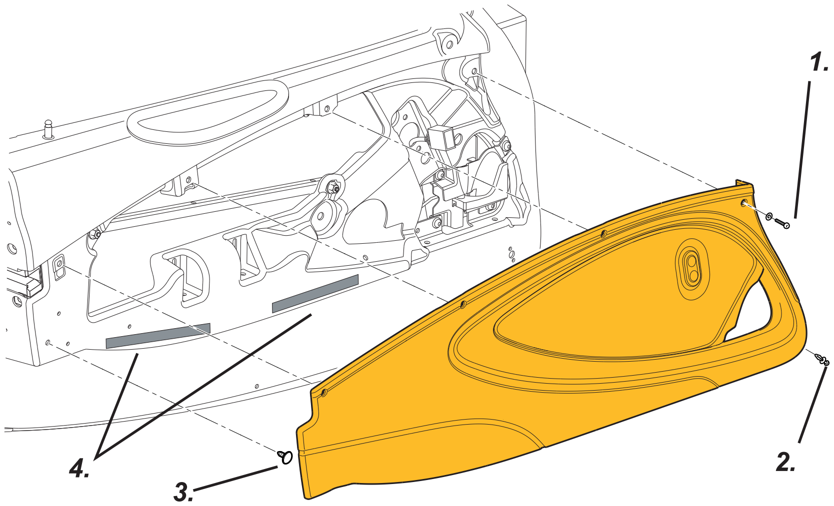


The door trim panel assembly consists of a main plastic ABS (Acrylonitrile Butadiene Styrene) panel covered in either various coloured leather or suedetex material options. An insert panel assembly is fitted into the middle of the main panel, made of SRIM (Structural Reaction Injection Moulding); using a polyurethane resin and glass reinforcement covered in high density polyether foam which again is covered in either various coloured leather or suedetex material options. A bezel bracket fitted to its rear side to accommodate the electric window switch.

The insert panel is fixed to the outer side of the main panel with pozi - drive screws which are fitted through from the rear side of the main panel into threaded inserts moulded into the insert panel.

The door trim panel is secured to the door shell by:

1. M5 x 20 button cap headed screws (4) positioned along the top of the panel.
2. Drive lock rivet (1) positioned lower front of the panel.
3. Trim clip (1) positioned within the lower rear of the panel.
4. Velcro strips (2) attached to the lower inside of the main panel and door shell.



Removal:
1. Release the M5 x 20 button cap headed screws (4) securing the panel to the top of the door shell.

2. Prise the drive lock rivet out of the lower front of the panel.

3. Prise the rear trim clip away from the door shell using a suitable trim tool.

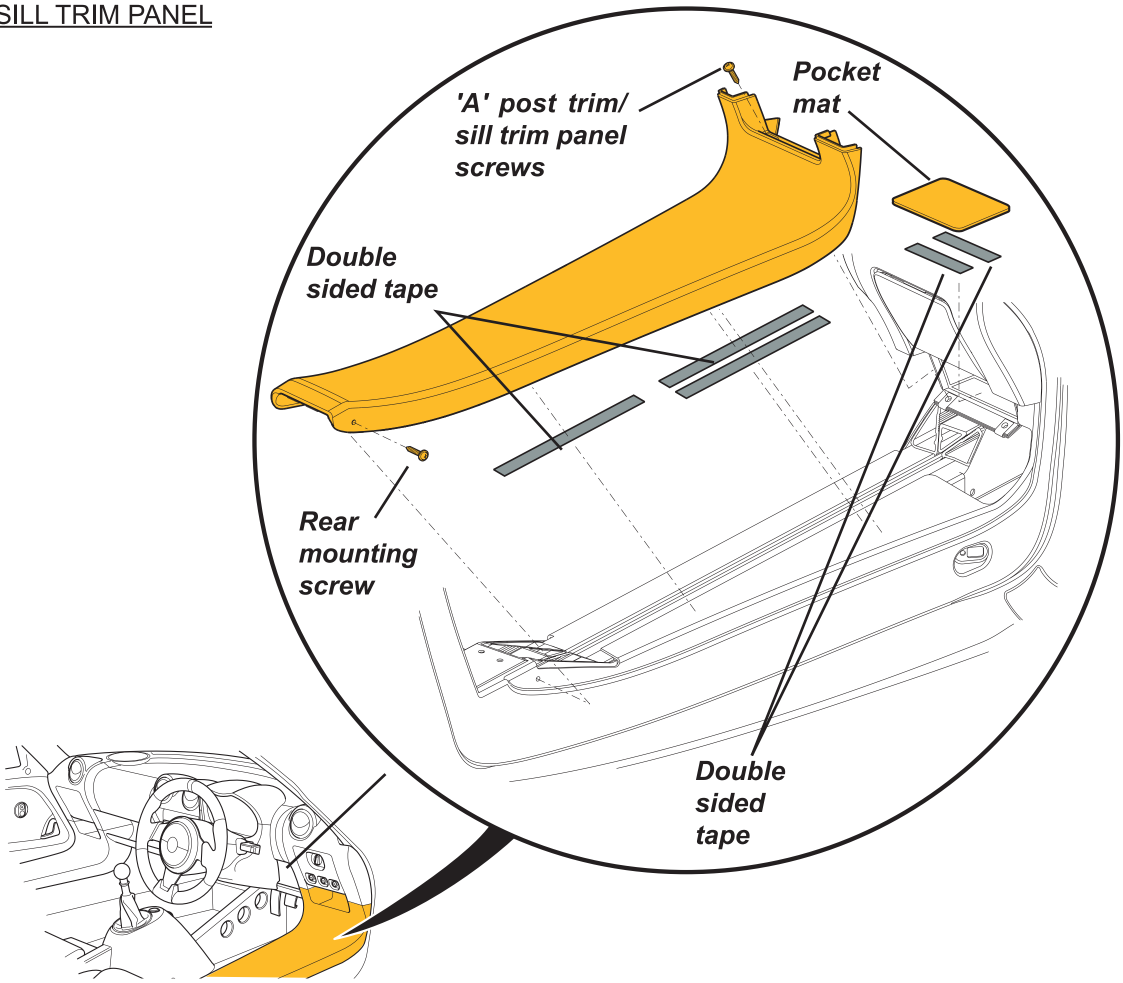
4. Carefully pull the door trim panel away from the door shell releasing it from Velcro retaining strips.

5. Disconnect the window switch flylead connector from the door harness connector.

6. The door panel can now be removed from the vehicle.

Refitment:
Is the reversal of removal.

VE.2 - SILL TRIM PANEL



The sill trim panel is secured to the outboard side of the chassis side rail by No. 6 x ½ self tapping screw (1) located at the rear lower edge.

It is also fixed by No. 6 x ¾ self tapping screw (2) to the front of the chassis onto a bracket also used to secure the lower section of the 'A' post trim panel.

Additional security is provided by the use of 3 x 75 mm of double sided tape located on the underside of the sill trim adhering it to the uppermost section of the chassis side rail.

Removal:

1. Remove the pocket sill mat (fixed with double sided tape) to gain access to the No 6 x ¾ self tapping screw (2) securing the trim to the front 'A' post panel/front chassis support bracket.

2. Release the front screws (2) and rear 6 x ½ self tapping screw (1) securing the trim to the front and rear of the chassis side rail.

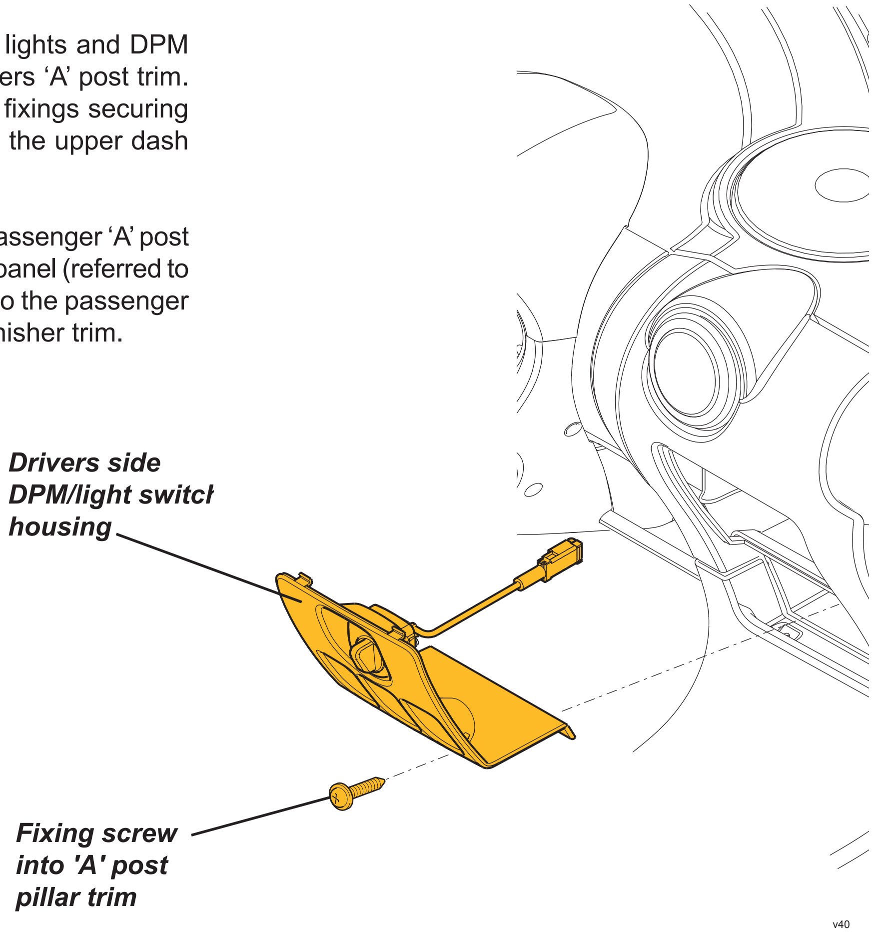
3. Using both hands, carefully prise the trim panel upwards to overcome the adhesive bond of the double sided tape securing it to the chassis side rail.

Refitment:
Is the reverse of removal, the condition of the double sided tape originally fitted should be assessed and re-newed if necessary.

VE.3 - PASSENGER 'A' POST TRIM PANEL APERTURE COVER/DRIVERS SWITCH PANEL HOUSING

The panel housing for the external lights and DPM switches is mounted within the drivers 'A' post trim. The panel housing also covers the fixings securing the upper section of 'A' post trim to the upper dash panel.

To prevent the fixings securing the passenger 'A' post trim from being exposed, a blanking panel (referred to as the aperture panel) is also fitted to the passenger side of the fascia as an aesthetic finisher trim.



Removal (driver's or passenger side):
Release the No. 8 x 3/4" self tapping screws (2) securing the lower section of the trim panel to the 'A' post trim.

Passenger side:
1. Pull the lower section of the trim dowwards to release the two upper integrally moulded mounting tabs away from the 'A' post trim.

2. The panel can now be withdrawn from the fascia assembly.

Driver's side:
1. Pull the lower section of the trim outwards to release the two upper integrally moulded mounting tabs away from the 'A' post trim.

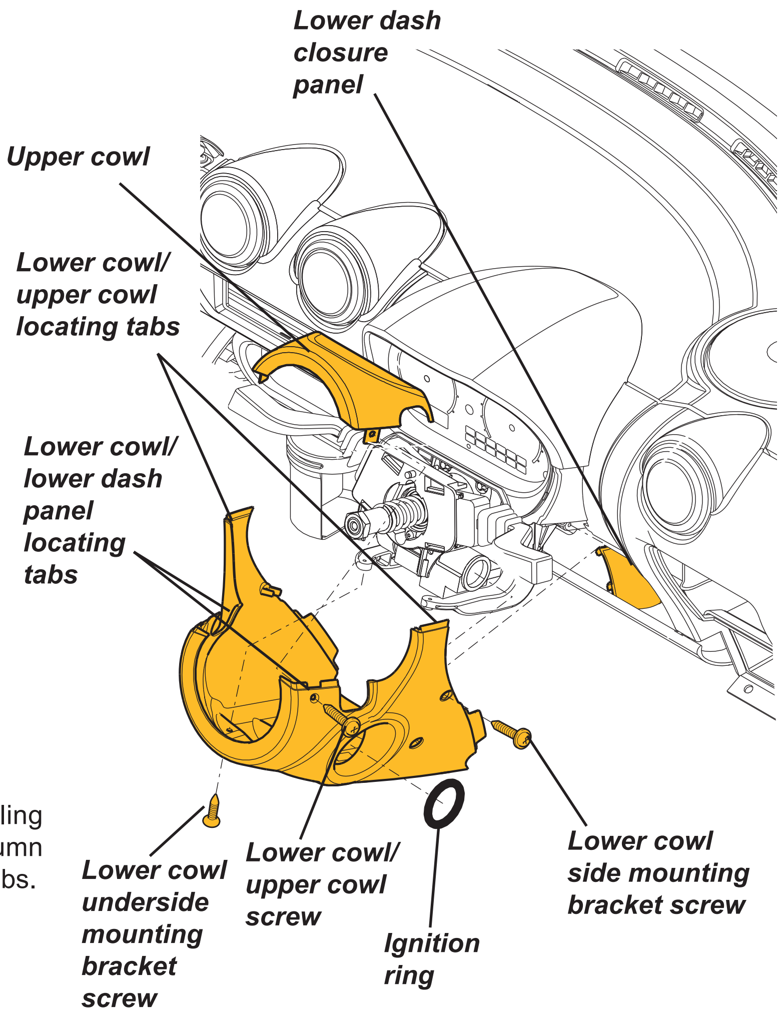
2. Disconnect the flyleads securing the external lighting and DPM switches to their main harness connectors.

The panel complete with the switches can now be withdrawn from the fascia assembly.

Refer to service notes section MV.6 for further information on removing the switches from the panel trim.

Refitment:
Is the reverse of removal.

VE.4 - UPPER AND LOWER COLUMN COWL TRIMS



The upper column cowl can be removed independently of the lower cowling.

Removal of the lower cowling requires the upper cowl to be removed as it is held in place to the lower cowl by self tapping screws which fix into spire nuts fitted onto lower cowl integral mounting tabs.

To remove upper cowling:

1. Release the No6 x ½" pozi-csk-s/t screw (2) located either side of the cowling forward of the column switches securing it to the lower cowling.

2. Release locating tabs (3) securing the upper cowling to the lower cowling.

3. The upper column cowling can now be withdrawn from the steering column.

To refit:
Reverse of removal except that the cowling should be fitted correctly around the column switch gaiters and lower cowling locating tabs.

To remove lower cowling:
1. Remove upper cowling, (see above).

2. Release the No8 x ¾" flg-pozi screw (2) located either side of the cowling rearward of the column switches screwed directly into the outer sides of the column cowl mounting brackets.

3. Release the No6 x ½" pozi-csk-s/t screw (2) located underneath the lower cowl base screwed directly into the front under sides of the column cowl mounting brackets.

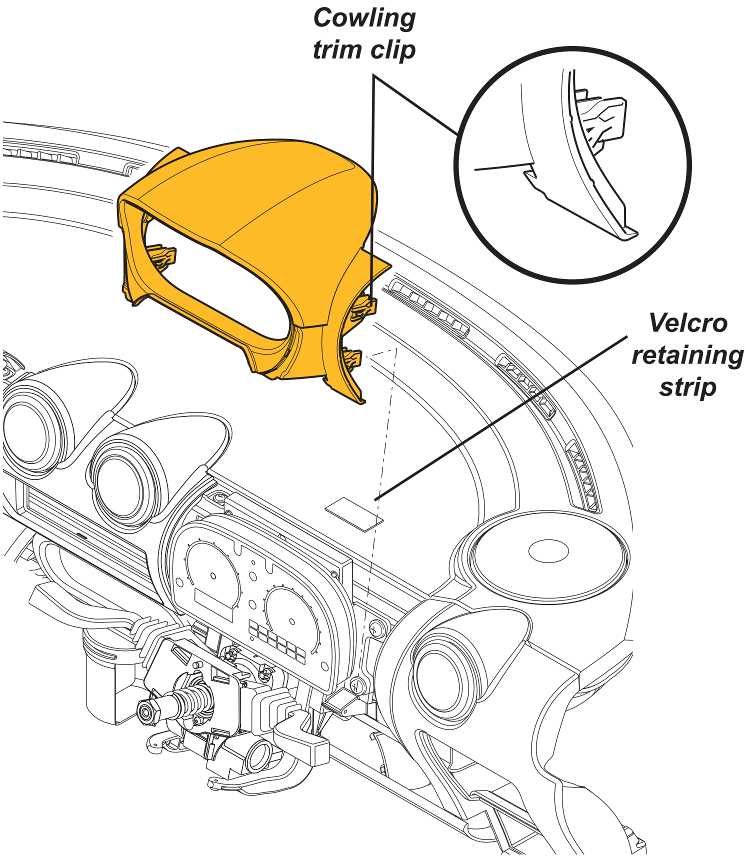
4. Slide out the plastic ring positioned around the ignition barrel.

5. The lower cowling can no be manoeuvred around the ignition lock assembly and withdrawn from the steering column.

6. Disconnect the Instrument panel illumination button and Engine Protection Valve Override Switch (If fitted) flyleads from the main vehicle harness connectors; refer to service notes section MV.5 & MV.7 for further information.

To refit:
Reverse of removal except that:
- The cowling should be fitted correctly around the column switch gaiters and cowl closure panels on the lower dash.
- Locate the screws into the front fixing point between indicator stalk position and forward edge of cowl.
- Wind in a few threads.
- Locate the screws on the underside of cowling into the mounting brackets and wind in a few threads.
- Set the gaps between the upper and lower cowlings and tighten all fixings in place in the same order as they were started.

VE.5 - INSTRUMENT PACK COWLING TRIM



Removal:

1. Remove the upper and lower column cowl trims; refer to sub-section VE.4 for further information.

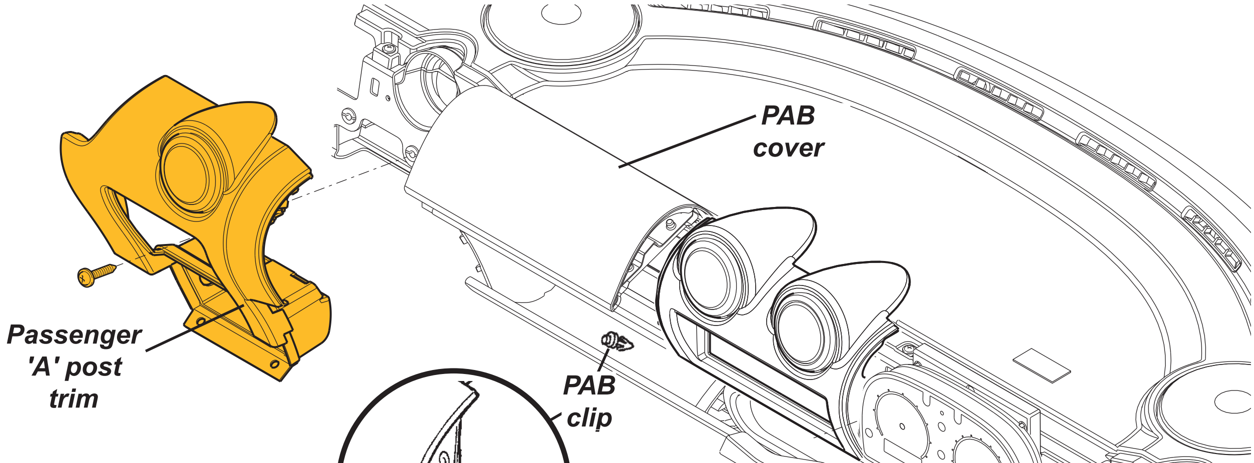
2. Pull the instrument shroud backwards to release the four spring clips from their apertures in the dash panel.

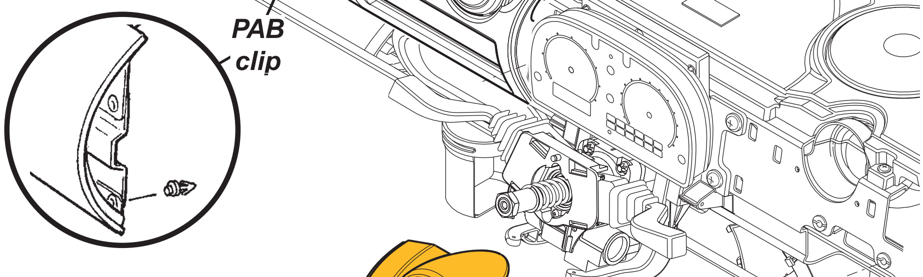
Note: Care should be taken when removing the cowling as the underside of the cowling is also affixed to the fascia top with a strip of velcro, also ensure to collect all 4 retention clips some of which may have detached from the cowling and remained in the upper dash.

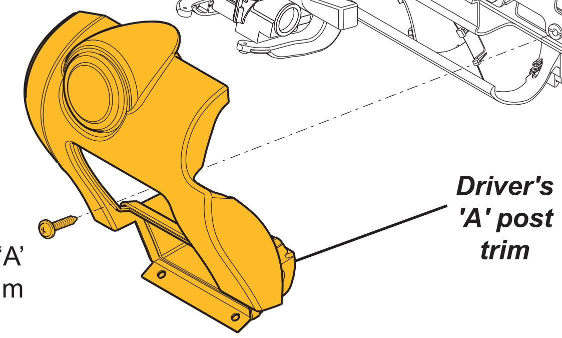
Refitment:

Is the reverse of removal, the condition of the velcro tape originally fitted should be assessed and renewed if necessary.

VE.6 - 'A' POST TRIM PANELS







Removal/driver's side panel:
1. Remove the door sill trim panel; refer to sub-section VE.2 for further details.

2. Remove the drivers switch panel housing; refer to sub-section VE.3 for further details.

3. Remove the instrument cowling; refer to sub-section VE.5 for further details.

4. Release the No8 X x ¾” flg-pozi screw (2) securing the ‘A’ post trim to the upper dashboard panel. The ‘A’ post trim with FLV can now be withdrawn from the fascia.

Refitment:
Is the reverse of removal,

Removal/passenger side:
1. Pull the PAB (Passenber Air Bag) door away from the upper dash panel, which action will require the four retaining clips to be renewed. Refer to sub-section VE.12 for further information.

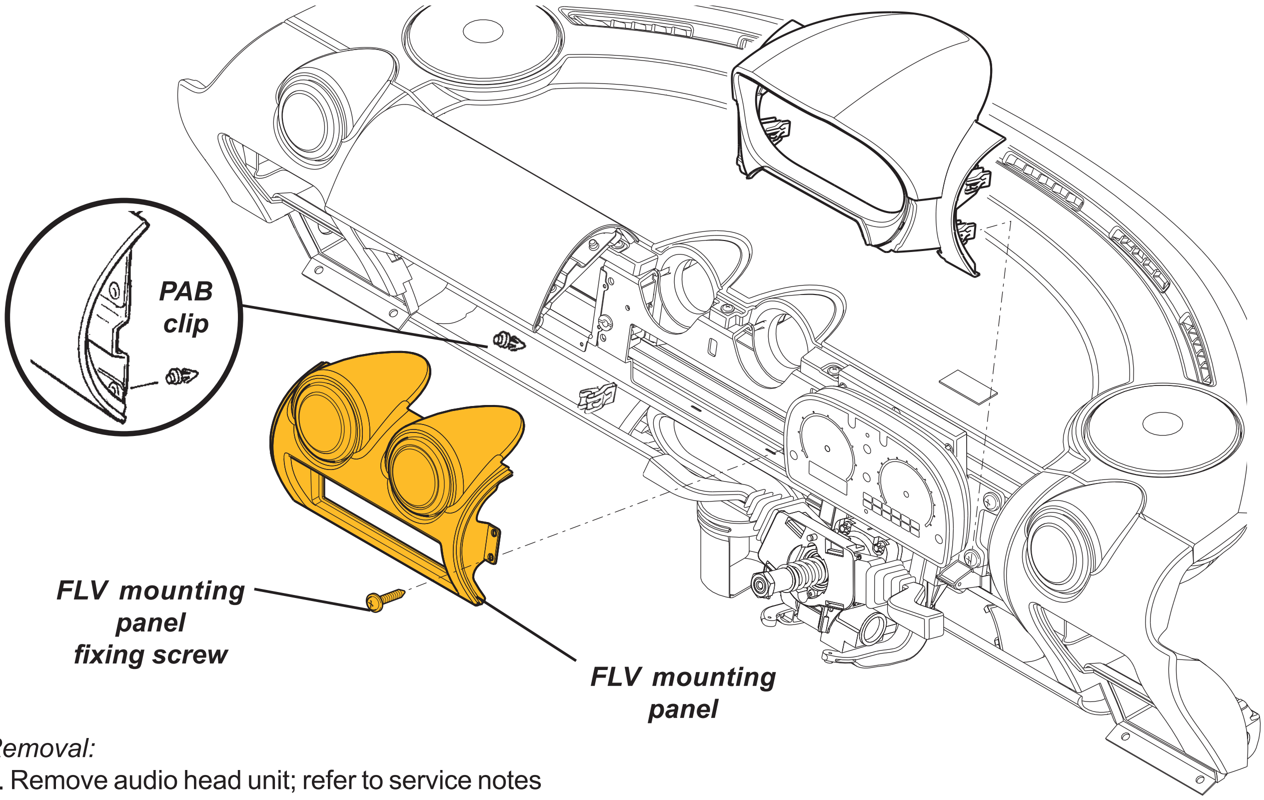
2. Remove the door sill trim panel; refer to sub-section VE.2 for further details.

3. Remove the passenger 'A' post trim panel aperture cover; refer to sub-section VE.3 for further details.

4. Release the No8 X x ¾” flg-pozi screw (2) securing the ‘A’ post trim to the upper dashboard panel.

Refitment:
Is the reverse of removal, except:
Refer to sub-section VE.12 for fitment procedure of passenger airbag cover panel.

VE.7 - FLV (FACE LEVEL VENT) MOUNTING PANEL



Removal:

1. Remove audio head unit; refer to service notes section MV.15 for further details.

2. Remove the instrument pack cowling trim; refer to sub-section VE.5 for further details.

3. Pull the PAB (Passenber Air Bag) door away from the upper dash panel, which action will require the four retaining clips to be renewed. Refer to sub-section VE.12 for further information.

4. Release the No8 X x ¾” flg-pozi screw (3) securing the FLV mounting panel to the upper dashboard panel.

5. Pull the FLV mounting panel backwards to release the single spring clip from the aperture in the dash panel located centrally between the HVAC centre ducts.

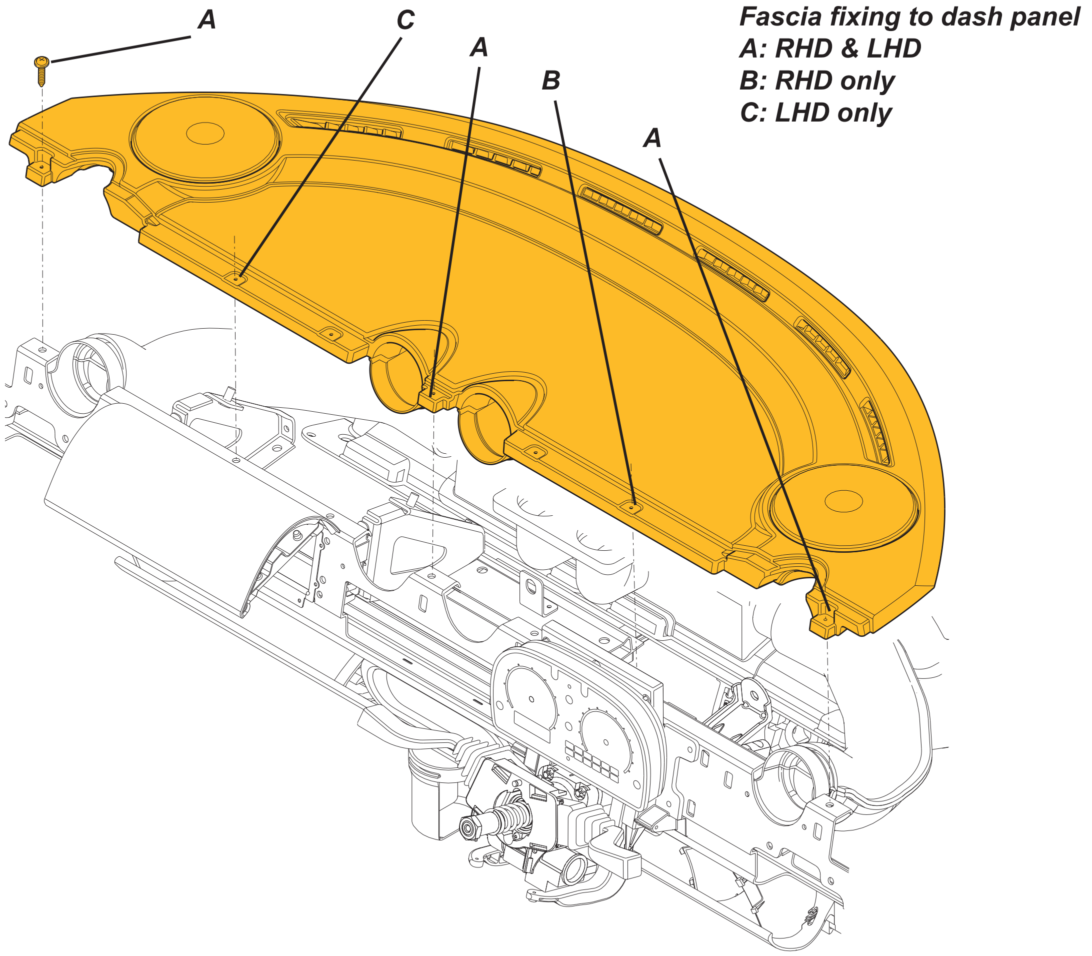
The FLV mounting panel can now be withdrawn from the fascia.

Note: Ensure to collect the retention clip which may have detached from the cowling and remained in the upper dash panel.

Refitment:

Is the reverse of removal, except:
Refer to sub-section VE.12 for fitment procedure of passenger airbag cover panel.

VE.8 - FASCIA TOP PANEL



⚠ WARNING: The airbag Sensor & Diagnositic Module can maintain sufficient voltage to cause an airbag deployment for up to 20 seconds after the battery has been disconnected. Before working on the airbag system, or in close proximity to an airbag, Refer to service notes section WC.5 with information and precautions on how to temporarily disable the airbag system:

Removal:

1. Remove the driver and passenger 'A' post trims; refer to sub-section VE.6 for further details.

2. Pull the PAB (Passenber Air Bag) door away from the upper dash panel, which action will require the four retaining clips to be renewed. Refer to sub-section VE.12 for further information.

3. Remove the FLV (Face Level Vent) mounting panel: refer to sub-section VE.6 for further details.

4. Release the No8 X x ¾” flg-pozi screw (4) securing the facia top panel to the upper dashboard panel.

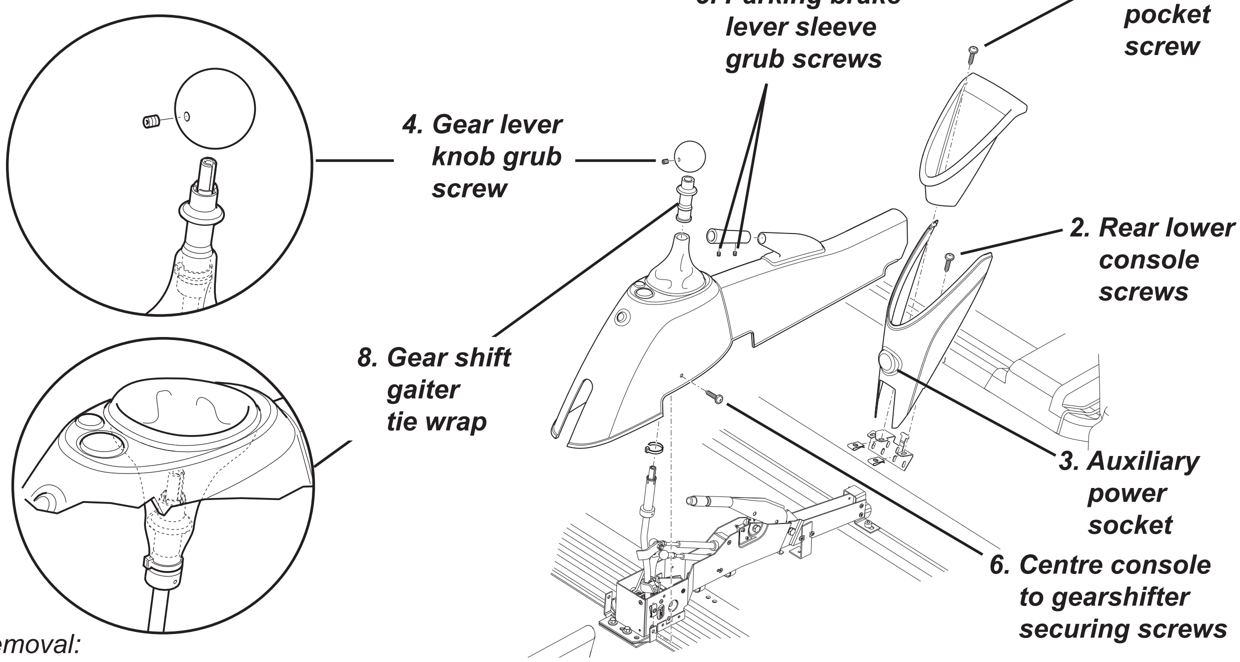
5. Lif the panel and withdraw rearwards to disengage the two spigots from the base of the windscreen surround.

6. Disconnect the speaker cables.

The fascia top panel can now be removed from the vehicle.

Refitment:
Is the reversal of removal except:
Refer to sub-section VE.12 for fitment procedure of passenger airbag cover panel.

VE.9 - CENTRE CONSOLE



Removal:

1. Release the No. 6 x 3/8" screw (1) securing the stowage pocket to trim shroud and remove.

2. Release the No. 6 x 3/8", screw (2) securing the rear lower console to its retaining bracket.

3. Disconnect the auxiliary 12 volt DC power socket from its main harness connector, the lower console can now be withdrawn from the cabin.

4. Release the grub screw in the front face of the gear lever knob, and unscrew the knob.

5. Pull the parking brake lever fully upwards and release the two grub screws in the underside of the lever sleeve and withdraw the sleeve, the parking brake should remain in the fully upwards position.

6. Release the pan head screw and washer (2) securing either side of the front centre console to the gearshift/ parking brake assembly.

7. Carefully lift the rear of the console assembly so that the parking brake gaiter and console can clear the parking brake lever.

8. Continue to raise the console assembly to turn the end of the gear shifter gaiter inside out exposing the tie wrap securing it to the lift tube. Cut the tie wrap and pull the console and gaiter off of the lift tube.

The console can now be withdrawn from the vehicle cabin.

Note: dependant on the parking brake cable adjustment, it may be necessary to disconnect one side of the parking brake cable to allow sufficient lever travel to lift off the centre console, refer to service notes section JM.7 for further details

9. Once the console has passed over the parking brake lever, disconnect the central door locking, hazard lamp and heated rear window switches from their main harness connections.

The console can now be withdrawn from the cabin, take care to prevent scratching the shroud on seat belt fixings or seat runners.

Refitment:
Is the reverse of removal.

VE.10 - SEAT RUNNERS & SEATS

The passenger seat position is fixed for maximum safety, and both seats have a non-adjustable backrest angle, Cushion density and contours of both seats have been anatomically designed to optimise comfort and minimise fatigue .

To adjust the fore/aft position of the driver's seat, raise the lift bar beneath the front of the seat, and slide to the position required. Ensure that the catch is fully engaged after adjustment by attempting to slide the seat with the lift bar released.

Seat mounting

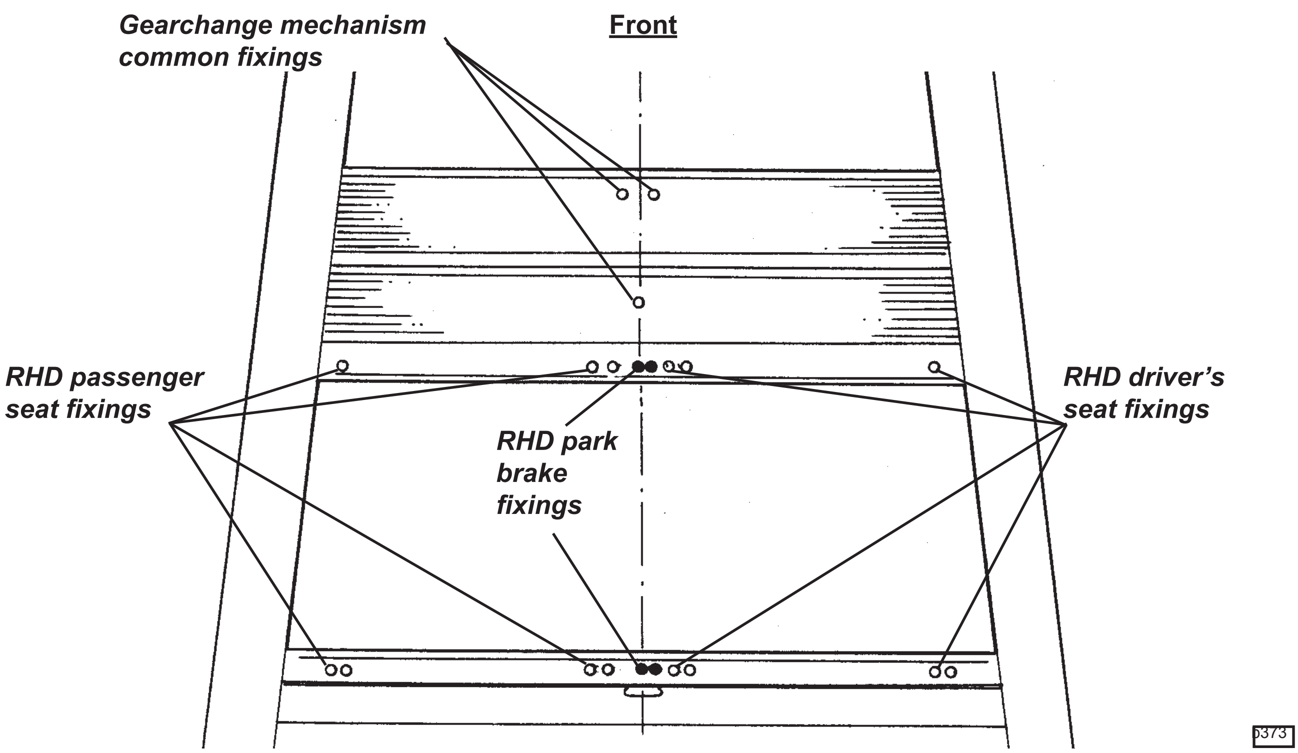
In order to allow sufficient space for the driver's seat to be mounted on sliding runners and provide some fore/aft positional adjustment, the parking brake, gearchange mechanism and cabin centre divide are offset to the passenger side, with the passenger seat using a fixed position mounting frame.

The driver's seat runners and passenger's seat frame are secured to the chassis tub using thread inserts in the seat front crossmember, and at the rear of the cabin floor.

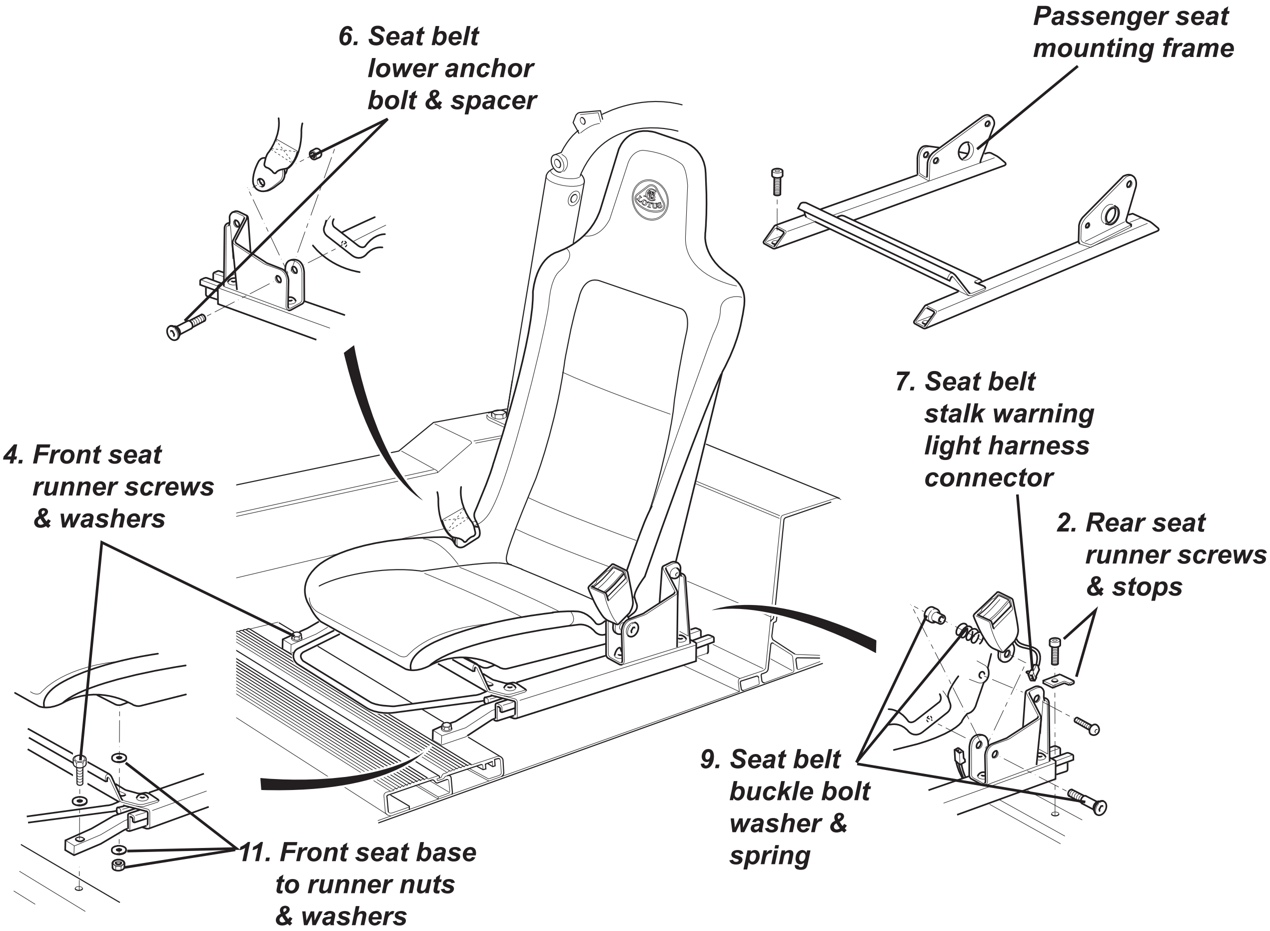
The chassis is built with both LHD and RHD seat fixings, with the driver's seat runners using the inboard most fixings, and the passenger seat frame the outboard.

If the driver's seat is removed from the car, or the runners separated, it is most important to maintain the correct configuration on re-assembly. The spring loaded lift bar must engage the same latch slot in each runner. Any misalignment or incorrect positioning may inhibit full fore/aft seat position adjustment, and/or may not allow secure engagement of the lift bar latches.

RHD shown (LHD symmetrically opposite)



Drivers Seat and runner removal



Preparation
Remove hard top, see service notes section BT.1 for further information. To prevent potential damage to the interior trims and seat during removal, fit protective covers to the side sill trims and seat assembly before removal.

Removal:
1. Using the seats lift bar, move the seat forward.

2. Release the 2 M8 x 20 cap head screws securing the rear of the LH and RH seat runner to the chassis floor and collect the seat rail runner stops.

3. Move the seat rearwards.

4. Release the 2 M8 x 25 screws and washers securing the front of the LH and RH seat runner to the chassis floor.

5. Carefully raise the seat and disconnect any harness multi-plugs (such as drivers seat belt stalk harness if fitted).

6. Release the bolt and spacer securing the seat belt lower anchor point to the seat frame.

7. Carefully raise the seat and disconnect any harness multi-plugs (such as drivers seat belt stalk harness if fitted).

8. The seat and runner assembly can now be removed from the vehicle.

9. Release the bolt, washer and spring securing the seat belt buckle to seat frame and remove.

10. Release the 2 M8 x 12 button headed screws securing the LH and RH runner assembly to the rear of the seat base.

11. Release the 2 M8 nyloc nuts securing the LH and RH runner assembly to the front of the seat base, (note that there are washers fitted to either side the front runner to seat mounting plate).

12. The runner assembly can now be removed.

Refitment

Refitment is reverse procedure to removal except.

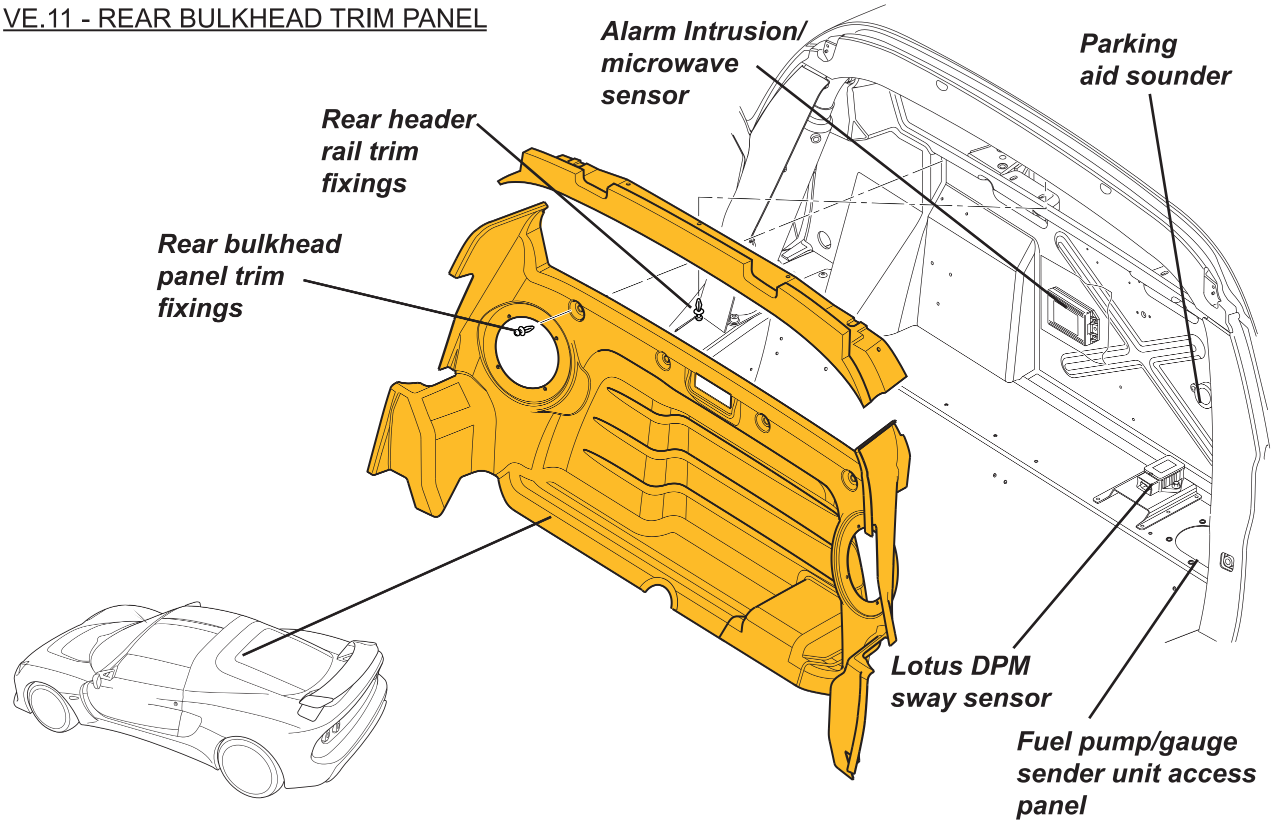
- Fit all 4 runner to seat frame fixings in finger tight then tighten to 15Nm, check that the runners slide freely before refitting seat assembly back into the vehicle*.

- Refit the seat belt stalk, bolt, washer and spring in the correct order and tighten to 33Nm.

- Place seat back into the vehicle and refit the bolt and spacer in the correct order securing the seat belt lower anchor point to the seat frame and tighten to 33Nm.

- Fit all 4 runner to floor mount screws in finger tight, ensure the seat moves freely on the runners before tightening all 4 fixings to 25Nm.

VE.11 - REAR BULKHEAD TRIM PANEL



Access to certain components such as the Lotus DPM (Dynamic Performance Management) sway sensor, alarm micro-wave intrusion sensor, parking aid sounder module and fuel pump/gauge sender unit access panel require the rear bulkhead trim panel to be removed.

Preparation:

⚠ WARNING: Before working near, removing or refitting a pyrotechnic seat belt assembly, the ignition key should be withdrawn, and the battery leads disconnected from both positive and negative terminals, and isolated to ensure that accidental contact cannot occur.

Removal:
1. Remove both driver and passenger seats; refer to sub-section VE.10 for further information.

2. Remove the rear lower console; refer to sub-section VE.9 for further information.

3. Remove the interior lamp assembly; refer to service notes section MV.6 for further information.

4. Release the LH/RH bolts securing the upper seat belt anchor points to the seat belt anchor frame, ensuring to collect the 5mm spacers; refer to service notes section WC.12 for further information.

5. Release the header rail trim to bulkhead panel fixings (5) and remove from the cabin area.

6. Release the bulkhead trim panel to bulkhead panel plastic fasteners (4) and pull the trim slightly forward to gain access to the rear speaker to main harness connectors.

7. Disconnect the speaker wires and withdraw the panel from the cabin area.

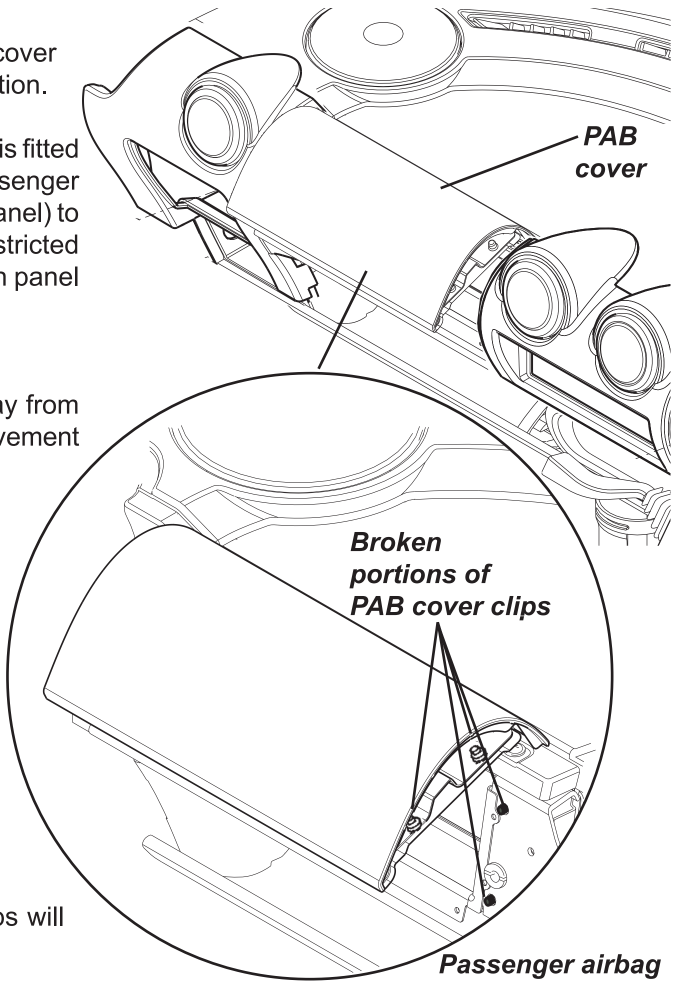
Refitment:
Is the reversal of removal.

VE.12 - PAB (PASSENGER AIR BAG) COVER

To remove or refit certain dashboard trim panels it is necessary to partially remove the PAB (Passenger Air Bag) Cover to gain access to additional hidden trim fixings or to allow enough clearance for those panels to be withdrawn from the dashboard panel.

The cover is fixed to the upper dash panel using 4 cover clips which are designed to break upon airbag inflation.

One end of a fabric curtain with integral tether straps is fitted to the rear of the cover, the other is bolted to the passenger airbag module bracket (under the dashboard facia panel) to ensure that upon airbag inflation, cover travel is restricted even though the 4 clips securing it to the upper dash panel are now broken.

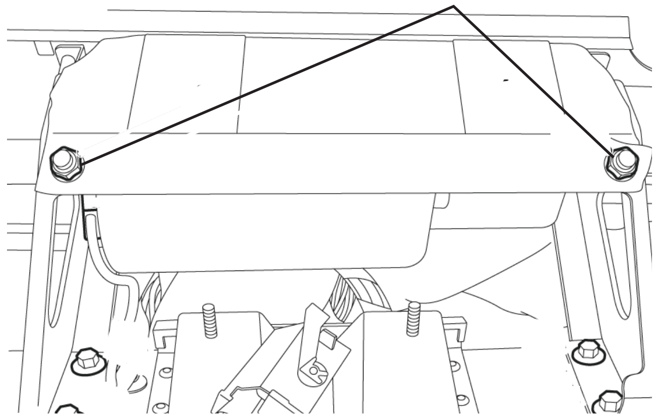


To detach from upper dashboard extrusion:
Carefully pull the lower edge of the PAB cover away from the dashboard upper panel in a slow progressive movement to break its 4 retaining clips.

Access to the FLV (Face Level Vent) mounting panel fixings is now possible as well as being able to withdraw the inner side of the passenger side 'A' post trim if required.

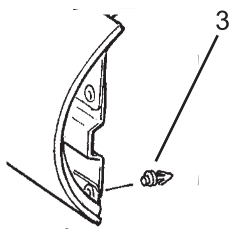
Note: the PAB cover cannot be fully removed from the vehicle without removing the upper tether nuts which requires the removal of the upper fascia panel; refer to sub-section VE.8 and service notes section WC.11 for further information.

Refitment:
Is the reverse of removal except that new PAB clips will be required.



1 Carefully wind threaded portion of new PAB clips into 4 holes on cover assembly ensuring pressure is applied to main clip section.

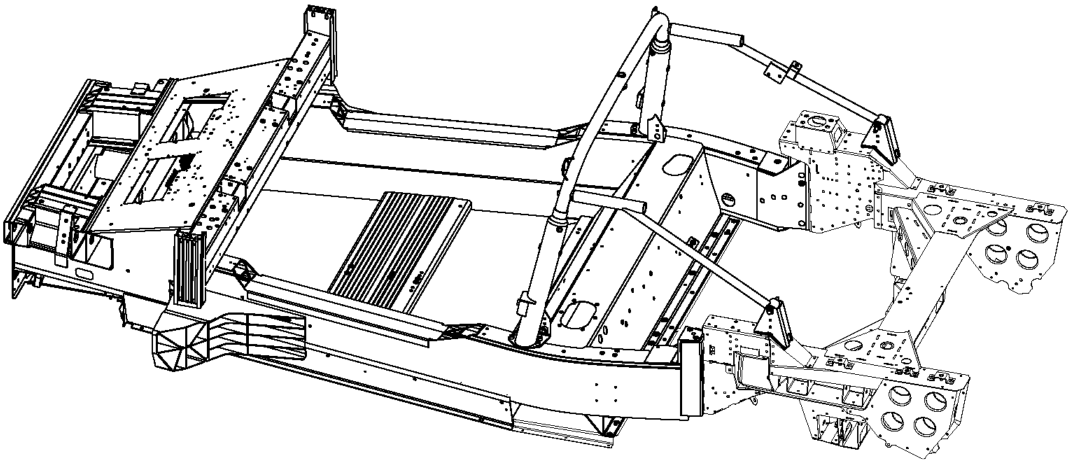
2 Turn each clip until the surface of the main clip section lightly touches the inner surface of the cover & slight resistance is felt.



3 Turn each clip a further 180º-270º degrees clockwise to fully secure in position.

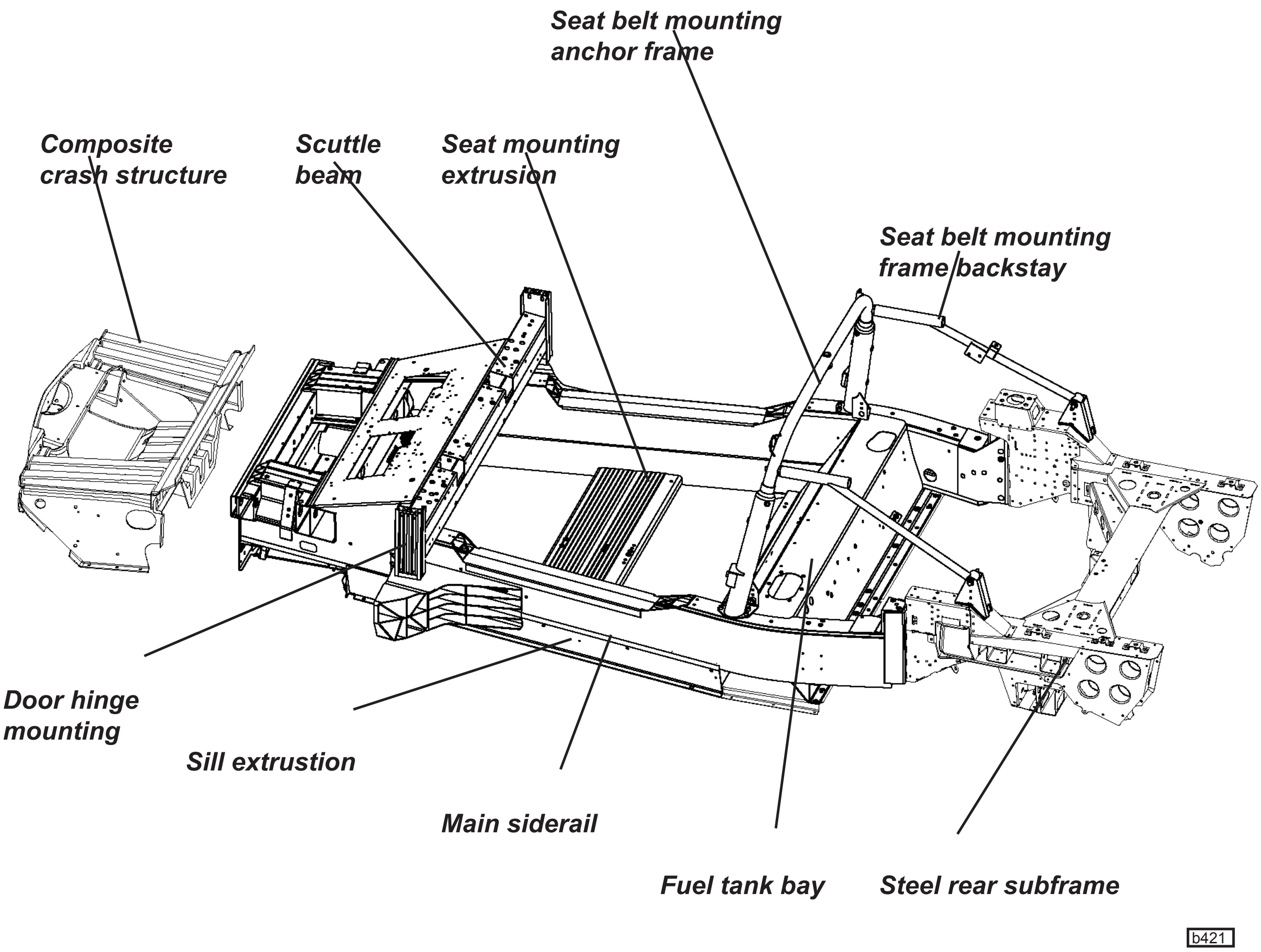
4 Position the airbag door over the opening in the dash and locate the plastic clips into mating holes in the upper dash panel. Once correctly aligned with holes, firmly press cover clips into holes on extrusion to fully secure.

CHASSIS



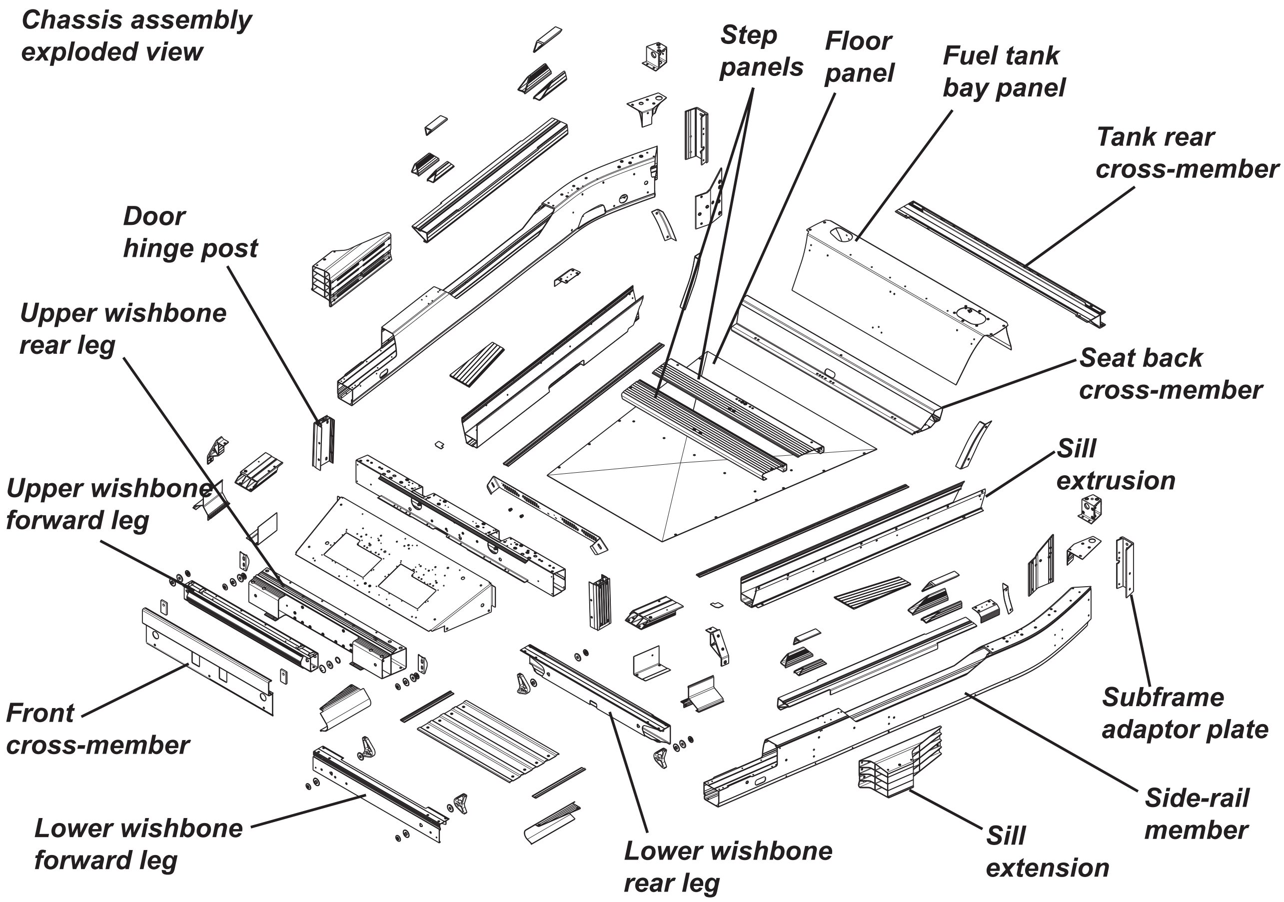
SECTION AQ

AQ.1 - GENERAL DESCRIPTION



The chassis frame of the Lotus Exige S 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 subframe bolting to the rear of the engine bay to provide rear suspension mountings and rear body support.

A tubular steel seat belt mounting frame is bolted to the top of the chassis structure and incorporates a roof hoop for additional occupant protection. The cabin rear bulkhead, body sills (inc. '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 outer body clamshells are each constructed from glass fibre composite mouldings, fixed to the body and chassis structure with threaded fasteners to facilitate service access and economic repair.



Two main chassis side-rail extrusions run along each side of the passenger compartment between the front and rear suspension mountings, splaying outwards towards the rear before curving inwards around the fuel tank bay and terminating at each side of the engine bay in a vertical section to provide engine mounting platforms and a flange to which the rear subframe is attached. To enhance cockpit access, the height of the siderails is reduced in the door area, and internal reinforcement added in order to maintain beam strength and torsional rigidity.

Running along the underside of the side-rails from the front suspension cross-member to the fuel tank bay are sill extrusions which carry the cockpit floor panel. The single skin floor panel is swaged for stiffness, and is reinforced by a ribbed transverse extrusion running across the inside of the tub, which also provides for the seat mountings. Behind the passenger cell, the siderails are linked by a pair of transverse crossmembers which are used in conjunction with a folded sheet upper panel to form an open bottomed fuel tank cell with a detachable, screw fixed, closing panel with swaged lightening holes. Note that this lower panel contributes to the structural integrity of the chassis, such that the vehicle should not be operated without it fitted.

The rear ends of the side-rails are joined behind the engine bay by a galvanised sheet steel fabricated subframe which provides mountings for the rear suspension pivots and damper abutment, engine rear stabiliser and exhaust muffler.

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. Five interlinked extruded floor sections together with additional extrusions connect the transverse beams to form an open topped space to house the heater/a.c. unit. An extruded scuttle beam links the tops of the siderails at the front of the cockpit, and is reinforced by a panel extending to the steering rack crossmember. These elements are used to mount the steering column and pedal box, with a vertical extrusion fixed to each end of the scuttle beam to carry 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.

Servicing and Repairs

The bonded and riveted alloy chassis structure described above is considered a non-serviceable single unit, jig built to fine tolerances, to which no structural repairs are approved. Superficial, cosmetic, or non-structural localised damage may be cosmetically 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, rear subframe and the seat belt mounting frame together with jig bonded composite rear bulkhead, body sills, windscreen frame and crash structure. Also included are the radiator feed and return pipes in the chassis side-rails, and those pipes and cables routed through the sills, including the heater and a.c. pipes, battery cable, clutch and brake pipes, and brake servo and oil cooler hoses.

AQ.2 - CHASSIS STRAIGHTNESS CHECK

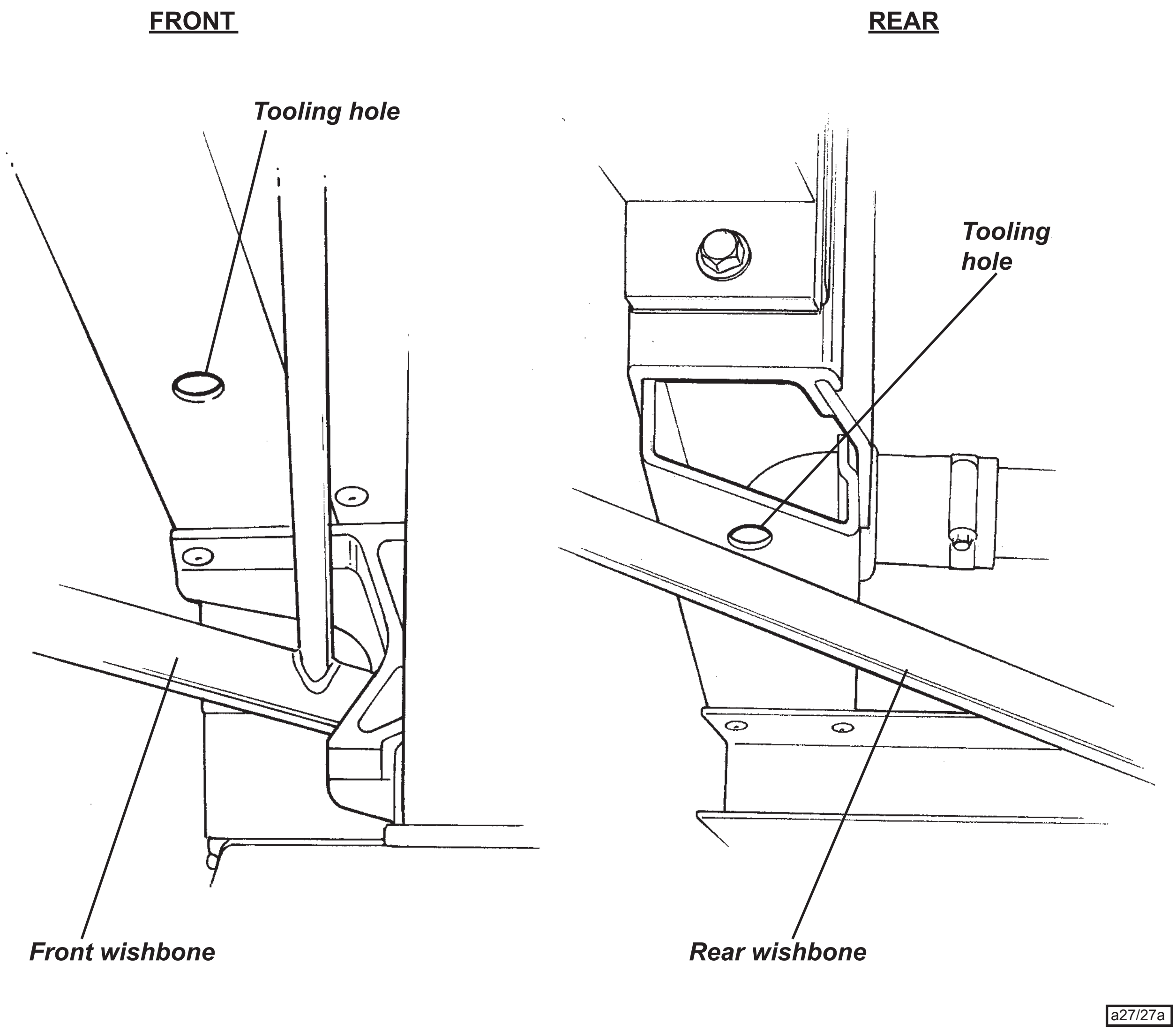
In the absence of visual damage, the chassis may be checked for twist or distortion by utilising the tooling holes in the underside of the main side rails. If computer processed laser measuring equipment is not available, manual checks can be made with reference to an accurately level ground plane, e.g. 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.

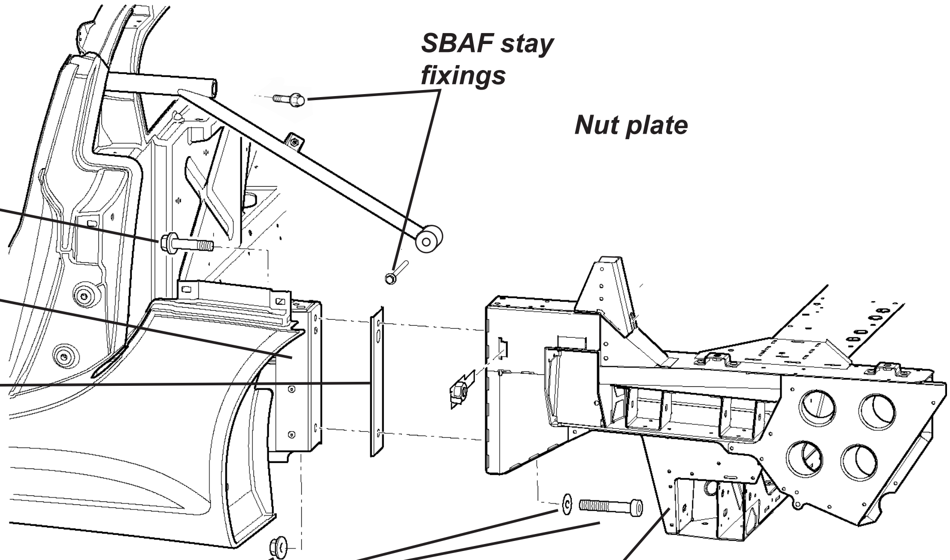
3. Measure the deviation of the fourth dimension from the other three.
   Maximum service deviation = ± 2.0 mm.

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.



AQ.3 - REAR SUBFRAME

The rear ends of the chassis side-rails are linked by a fabricated sheet steel subframe which provides mountings for the rear body section, rear suspension pivots, engine rear stabiliser, exhaust muffler and seat belt mounting frame struts. The subframe is secured to the side-rails by two M12 bolts at each side, with an anti-corrosion shim plate interposed.



Removal:

1. Remove the rear clamshell; refer to service notes section BT.7 for further information.
2. Remove the powertrain assembly; refer to service notes section EM.6 for further information.
3. Disconnect the inertia switch harness plug at the RH seat belt anchor frame.
4. Remove exhaust heatshields and rear silencer.
5. Release the M10 x 100 bolts securing LH and RH rear lower wishbone brackets to the rear chassis cross member
6. Release any harnesses or wires attached to the subframe that are part of the main vehicle harness assembly and ensure that they are positioned such that no damage will be incurred when the subframe is withdrawn from the chassis.
7. Disconnect the bodyside front to rear LH and RH brake pipes from the rear to flexi hose connector pipes and cap all exposed ends.
8. Ensure all previously detached hoses and pipes are positioned such that no damage will be incurred when the subframe is withdrawn from the chassis.
9. Release the M10 x 60 bolts and M10 flanged nuts securing LH & RH SBAF (Seat Belt Anchor Frame) stays to subframe brackets.
10. Release and discard the M10 x 35 patch bolts securing the LH & RH SBAF stays to the SBAF/rear bulkhead panel and withdraw both stays.
11. Ensure rear subframe is supported before removing chassis fixing bolts.

12. From the upper rear of the LH & RH chassis flanges, release and discard the M12 x 65 hex flange headed patch bolts securing the chassis to the subframes integral mounting brackets and remove the bolts nut plate fixings from their slots located in the side of subframe.

13. From the lower rear of the LH & RH chassis flanges and lower rear of the subframe mounting brackets, release the M12 x 60 socket headed bolts, washers M12 flange head nuts.

    The subframe with any remaining ancillary components still attached can be withdrawn from the chassis, collect the anti-corrosion shim plates which have now been released from between the two assemblies.

    Any ancillary components remaining on the subframe can be removed and refitted to a new subframe as required.

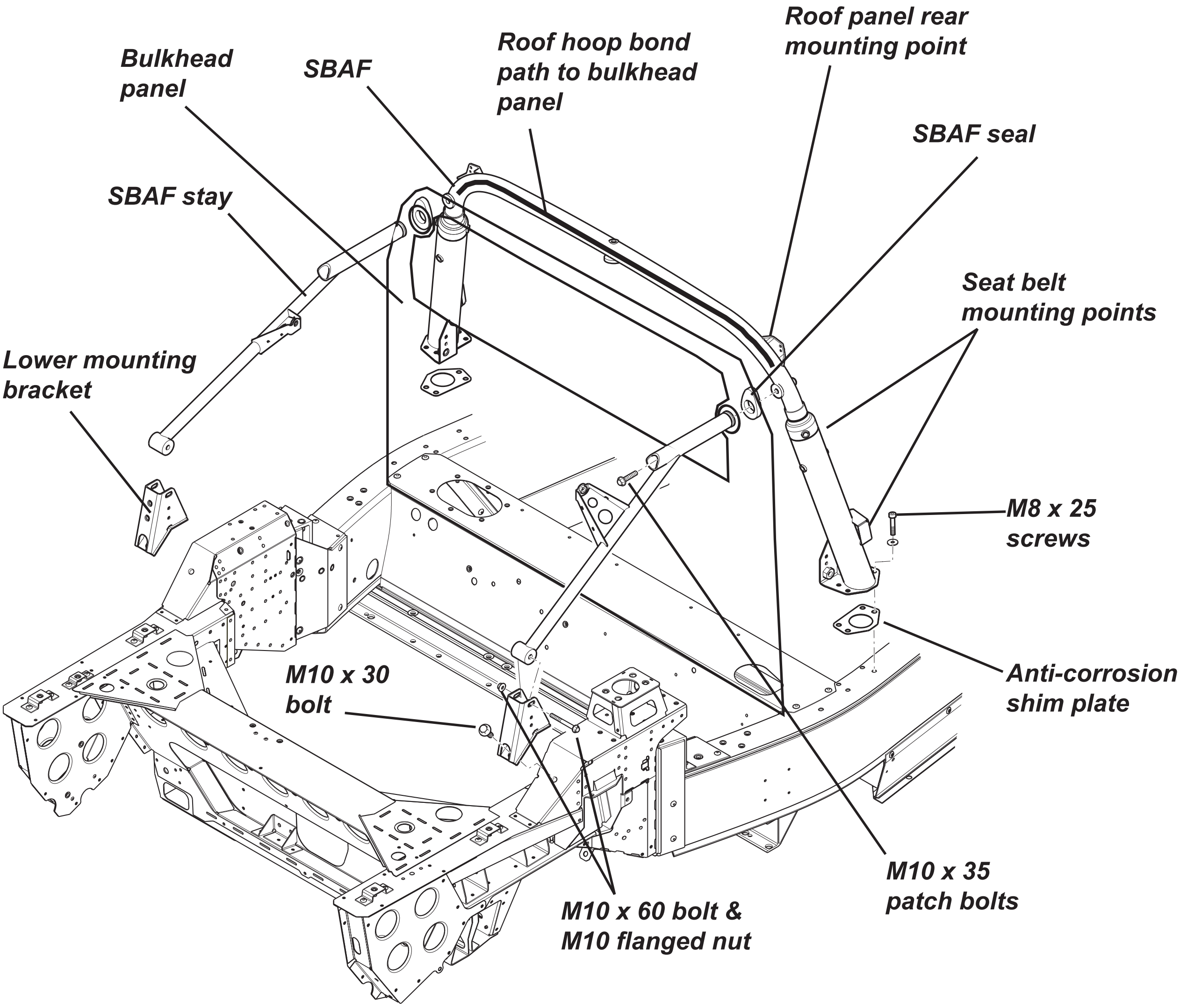
Refitment:
Is the reverse of removal except:

- Prior to fitment ensure all wires, harnesses, hoses and pipes are positioned such that no damage will be incurred when the subframe is fitted.
- Fit new M12 x 65 hex flange headed patch bolts to the upper rear of the LH & RH chassis flanges,
- Fit the anti-corrosion shim plates to the exposed shank of the upper mounting bolts previously fitted.
- Position the subframe to the rear of chassis and raise to required height such that the mating faces of the chassis and subframe are approximately level.
- Manoeuvre the subframe forwards towards chassis.
- If lower rear suspension wishbones are attached, engage front wishbone mounting brackets to rear chassis cross member.
- Refit nut plates to subframe upper LH & RH mounting points.
- Adjust height of subframe as required; locate previously fitted LH & RH upper subframe bolts protruding from chassis flanges into subframe upper mounting points and screw in the first few threads into the nutplates.
- Refit the M12 x 60 socket headed bolts and washers into the subframe mounting brackets, feeding them through into the lower chassis flange mounting points. Once through apply Permabond A130 to the bolt threads before refitting the M12 nuts.
- Progressively tighten the upper subframe to chassis fixings.
- Progressively tighten the lower subframe to chassis fixings.
- Tighten all four bolts to 86 Nm.
- Renew the M10 x 35 patch bolts securing the SBAF stay to the anchor frame/rear bulkhead panel
- Refit the M10 x 60 bolts and M10 flanged nuts securing the SBAF stays to the subframe brackets and tighten all 4 fixings to the 50 Nm.

  Continue re-assembly in reverse order to disassembly.

  Note: A full suspension and geometry check and adjustments as necessary will also be required.

AQ.4 - SEAT BELT ANCHOR FRAME



A tubular steel SBAF (Seat Belt Anchor Frame) provides mounting points for the driver and passenger seat belt reels and their upper anchorage points, rear mounting points for the outer hard top roof panel and also incorporates a roof hoop for additional occupant protection.

It is fixed to the top of the LH/RH chassis side-rails by four M8 x 25 socket headed capped screws at each side, anti-corrosion shim plates are interposed between the mounting bases of the SBAF and side-rails.

It is positioned to the cockpit side of the rear bulkhead panel; the roof hoop section is bonded to the interior face of the bulkhead panel directly above the cabin rear window.

Apertures in the bulkhead panel allow the upper mountings of the LH/RH SBAF stays (located in the engine bay) to be fixed directly onto bosses on the roof hoop. Flexible seals are fitted between the bosses and interior face of the bulkhead panel.

The lower mountings of the SBAF stays are fixed to brackets bolted to the rear subframe.

The SBAF stays increase the rigidity to the SBAF assembly as well as providing further mounting points for ancillary components such as tailgate struts, air cleaner casing, inertia switch etc.

SBAF removal:
The main SBAF and bulkhead panel is fitted to the chassis prior to fitment of the bonded sill/'B' panels and cannot be removed from the vehicle without performing extremely invasive actions such as cutting/deforming or completely removing the one or both of the sills and rear bulkhead panels.

SBAF stay removal:
The SBAF stays may be removed by releasing the M10 x 35 patch bolts (securing it to the roof hoop bosses and M10 x 60 bolts and flanged nuts securing the lower end of the stay to the subframe mounting brackets.

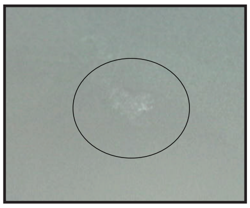
Both upper and lower bolts are torqued to 50 Nm but if disturbed, t is recommended to discard renew the upper M10 x 35 patch bolts.

AQ.5 - SUPERFICIAL COSMETIC REPAIRS

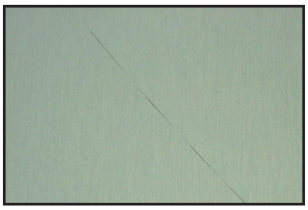
Dependant upon the vehicle trim options selected, the interior cabin's aluminium sill extrusions as well as the footwell and floor pan area may be left exposed. Over time general scuffing/wear and tear may occur to these surfaces.

Exposed areas may also be vulnerable to accidental damage such as:

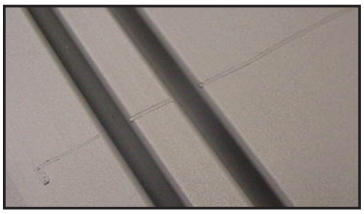
Description	*Damage Category*
1. Blemishes	A
2. Scratches	A or B
3. Cuts	B
4. Indents and grazes.	B



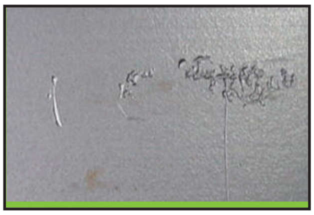
1. Blemish



2. Scratch to surface



3. Cut to surface



4. Indents & grazes

Superficial, cosmetic, or non-structural localised types of damage to the chassis anodised surfaces such as those listed above may be cosmetically repaired.

Type A category damage (Stop filler not required)
Chassis preparation:
Rub flat with 240 then 600 free cut paper

Type B category damage (Stop filler required)

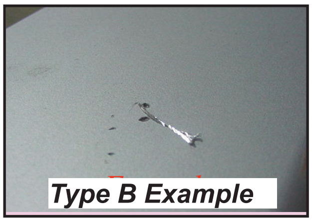
Chassis preparation:

1. Rub down surrounding damaged area.

2. Clean area.

3. Lightly bevel edge of repair with a router and abraded dry with 240 free cut paper, fill repairs with u-pol to stop filler and allow to dry.

4. Rub flat with 240 free cut paper and finish with 600 free cut paper to remove any heavy scratches.

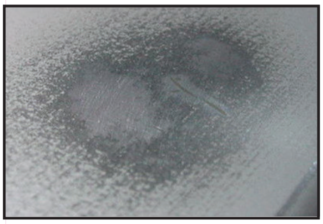


Type B Example

1. Rub down

2. Clean

3. Stop filler



4. Rub down

5. Mask off

6. Respray

Chassis preparation for paint:

Thoroughly degrease area with DuPont 3290 using wipe on wipe off method.

5. Mask off area/panel as required.

Chassis Colour

Lotus Paint Code	*Colour*	*DuPont Code*
B35	New Aluminium	BS97

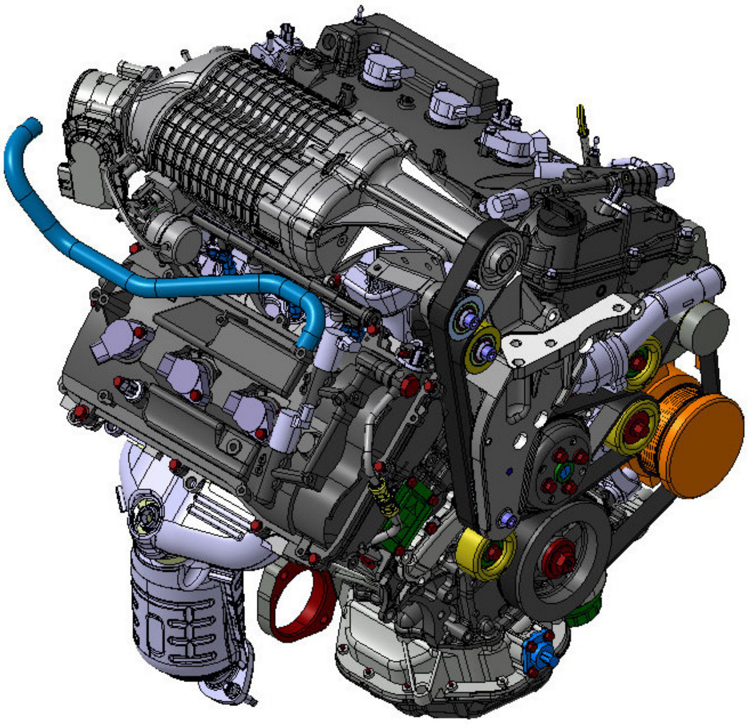
Mix paint as per DuPont specification.

6. Apply paint in several light coats allowing each coat to dry before applying the next until the repaired area is covered.

Please note: Basic principles of re-spraying apply as on any body panel, i.e. fade out or if necessary complete panel spray to a joint line.

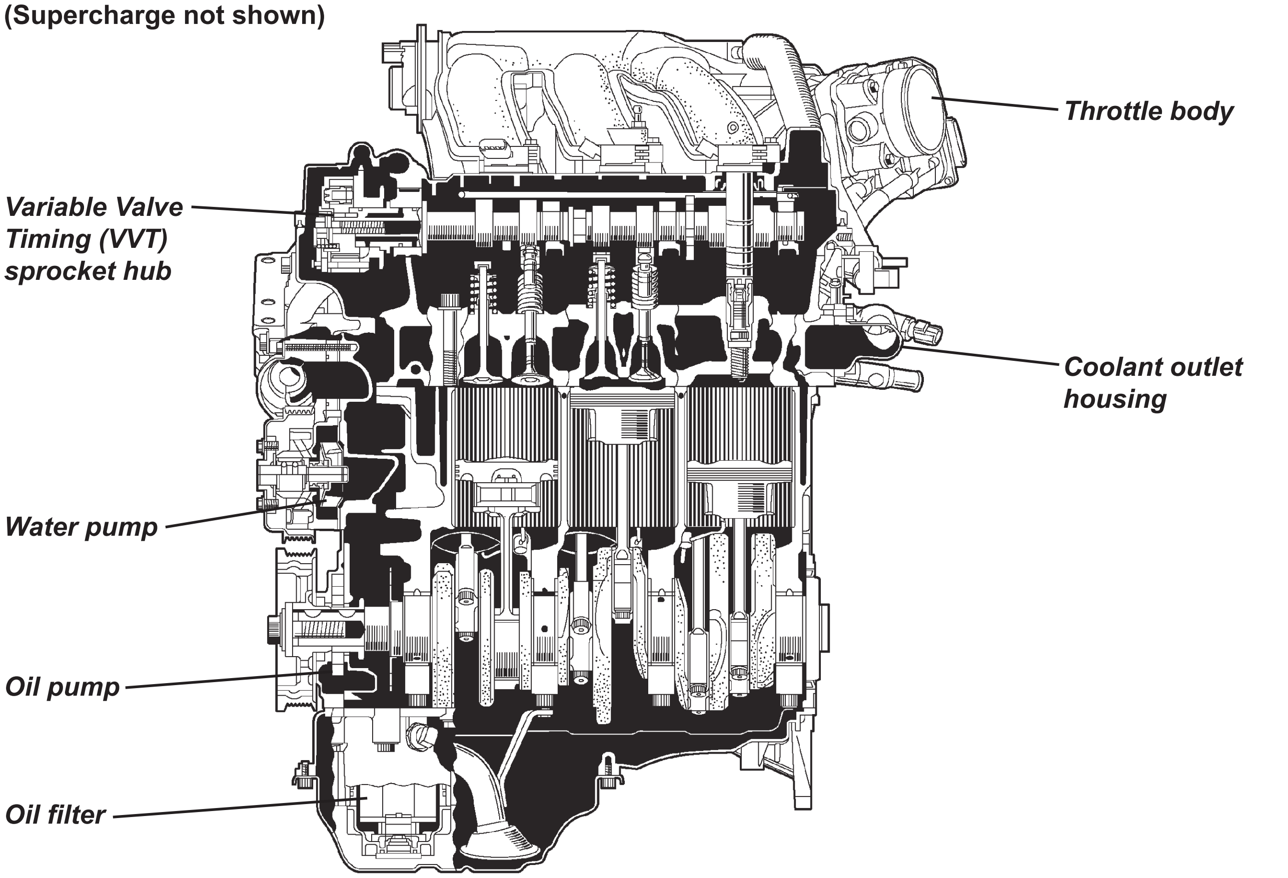
ENGINE

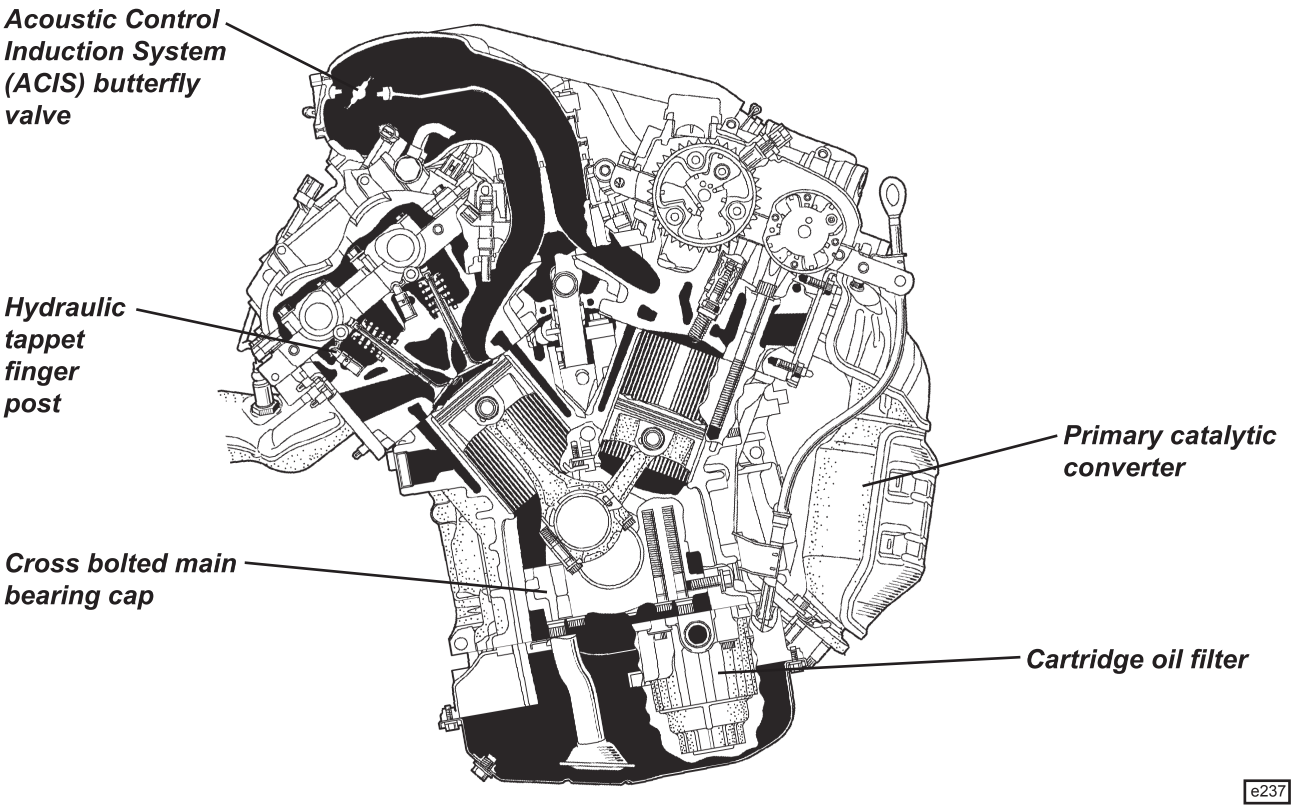
SECTION EM



General Layout

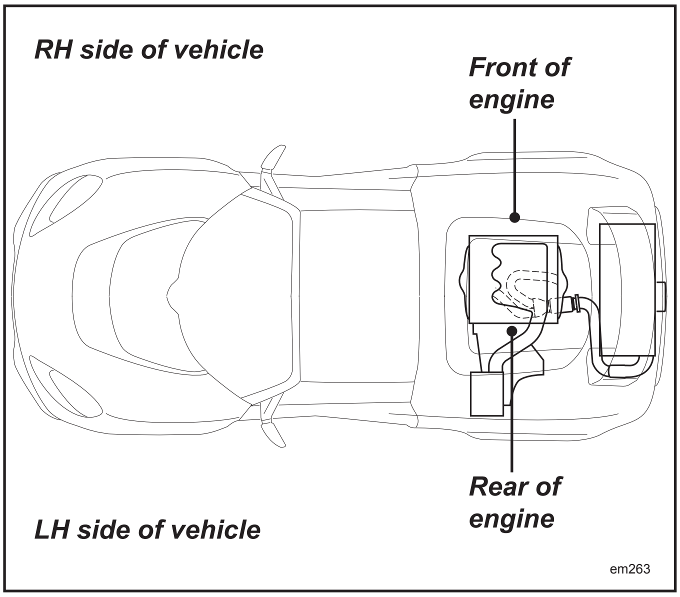
(Supercharge not shown)

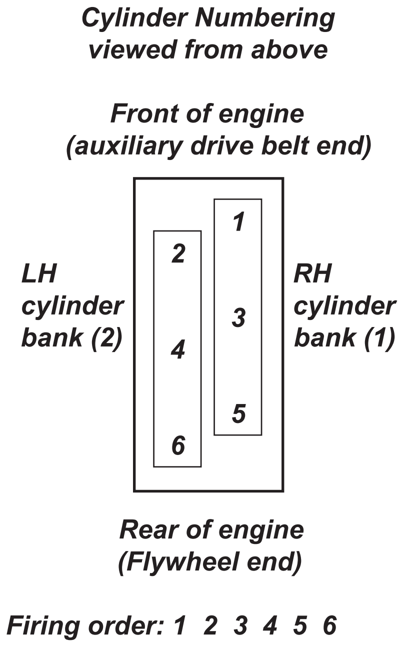




EM.1 - INTRODUCTION

Terminology
The powertrain of the Exige '12MY is mounted transversely, with the crankshaft of the engine running parallel to the rear axle line. The front of the engine is to the right of the engine bay and the rear to the left. When referring to powertrain components, this logic will be used, e.g. the left hand side of the engine is towards the front of the engine bay.





General Description
The 2GR-FE engine fitted to the Exige '12MY is supplied by Toyota, and comprises a 3.5 litre 60° V6 unit mounted transversely (front of the engine towards the right) in the 'mid engine' position between the cabin and rear wheel axis. The cylinder block/crankcase and cylinder heads are cast in aluminium alloy with the block featuring an open deck construction and integral cast-in iron liners. The forged steel crankshaft runs in 4 main bearings, with each of the 3 crankpins accommodating two forged steel connecting rods, those of the RH cylinder bank foremost. Each cylinder head houses twin overhead camshafts operating two inlet and two exhaust valves per cylinder, via roller followers mounted in steel fingers, the pivot posts of which provide for zero valve clearances by hydraulic means. The bifurcated ports are arranged with the inlets positioned inside the 'V' and the exhaust ports outboard. The inlet camshafts are driven by a single roller chain from the crankshaft nose, with each exhaust cam driven by a short, link chain from its neighbouring inlet camshaft.

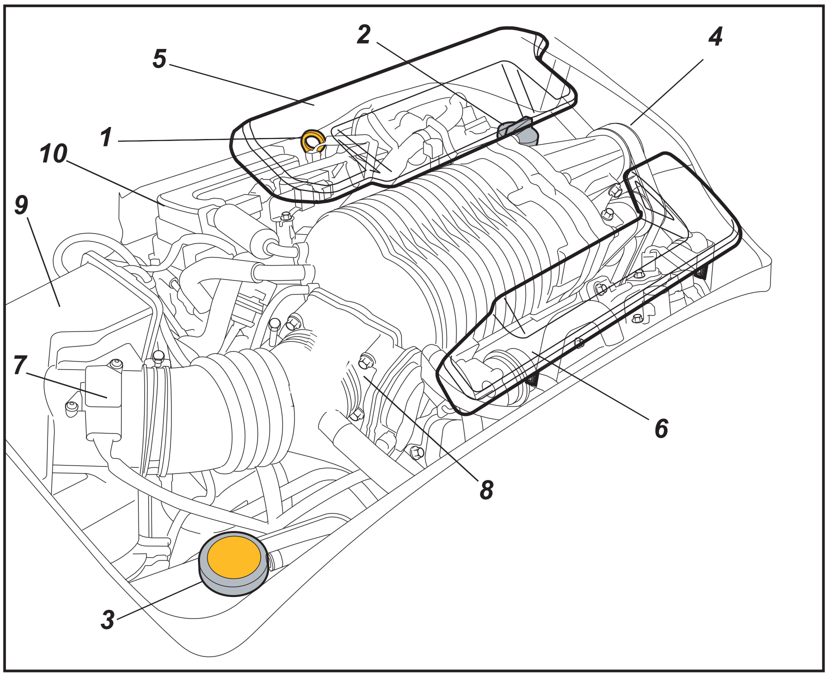
In order to optimise power, economy, emissions and noise, the engine control system includes; dual VVT-i (Variable Valve Timing - intelligent) to provide phase shifting of both inlet and exhaust valve timing; ETCS - i (Electronic Throttle Control System - intelligent) to facilitate traction control, skid control and cruise control; AICS (Air Intake Control System) to reduce intake noise in the low to mid range of engine speed without sacrificing efficiency at high engine speed. The engine management system is programmed by Lotus using the T6 controller.

The engine is mated to a type EA60 6-speed manual transmission supplied by Toyota and modified by Lotus fitting lower ratio Lotus gearsets for 3rd, 4th, 5th and 6th speeds, to provide closer gear steps and a more sporting drive characteristic.

The powertrain unit is installed in the engine bay with transmission on the left hand side. Primary mountings for the power unit pick up off the front of the engine and to the top rear of the transmission case, and connect with the suspension towers on the rear subframe via voided elastic isolators. Secondary engine steady mountings are used to control powertrain roll under drive torque and inertia effects, and are fitted low down on either side of the block, attaching to the chassis rear crossmember and to the subframe via elastic isolators.

Engine bay layout

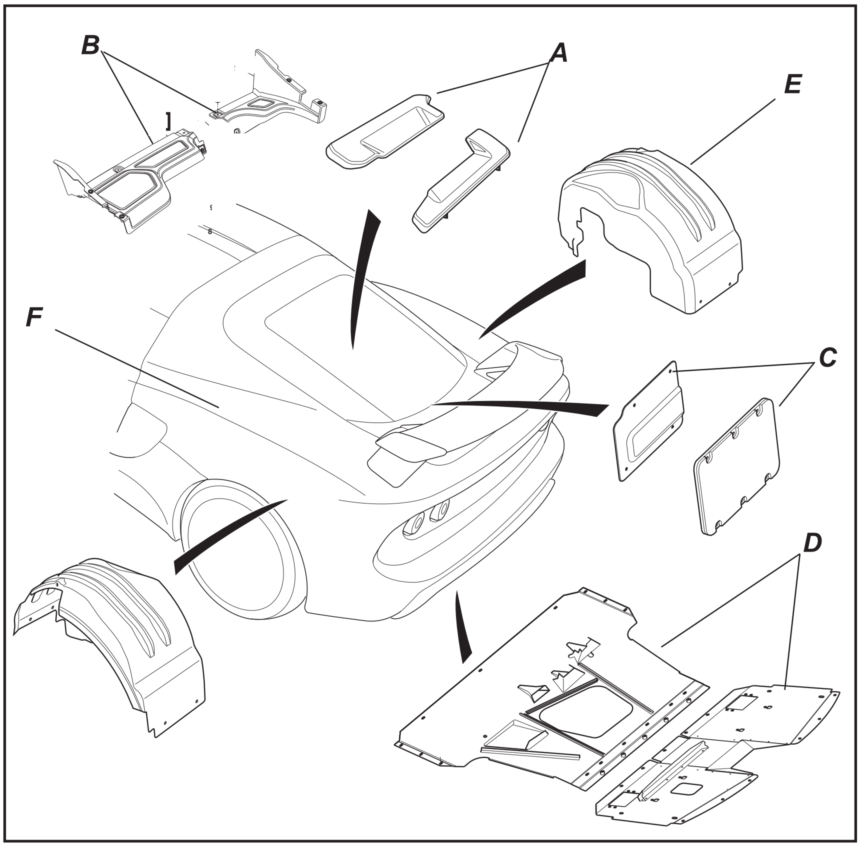
1. Engine oil dipstick
2. Engine oil filler cap
3. Engine coolant header tank
4. Supercharger pulley cover
5. Front engine cover panel
6. Rear engine cover panel
7. Air flow sensor
8. Throttle body
9. Air filter upper airbox casing
10. Left hand cylinder bank (2)



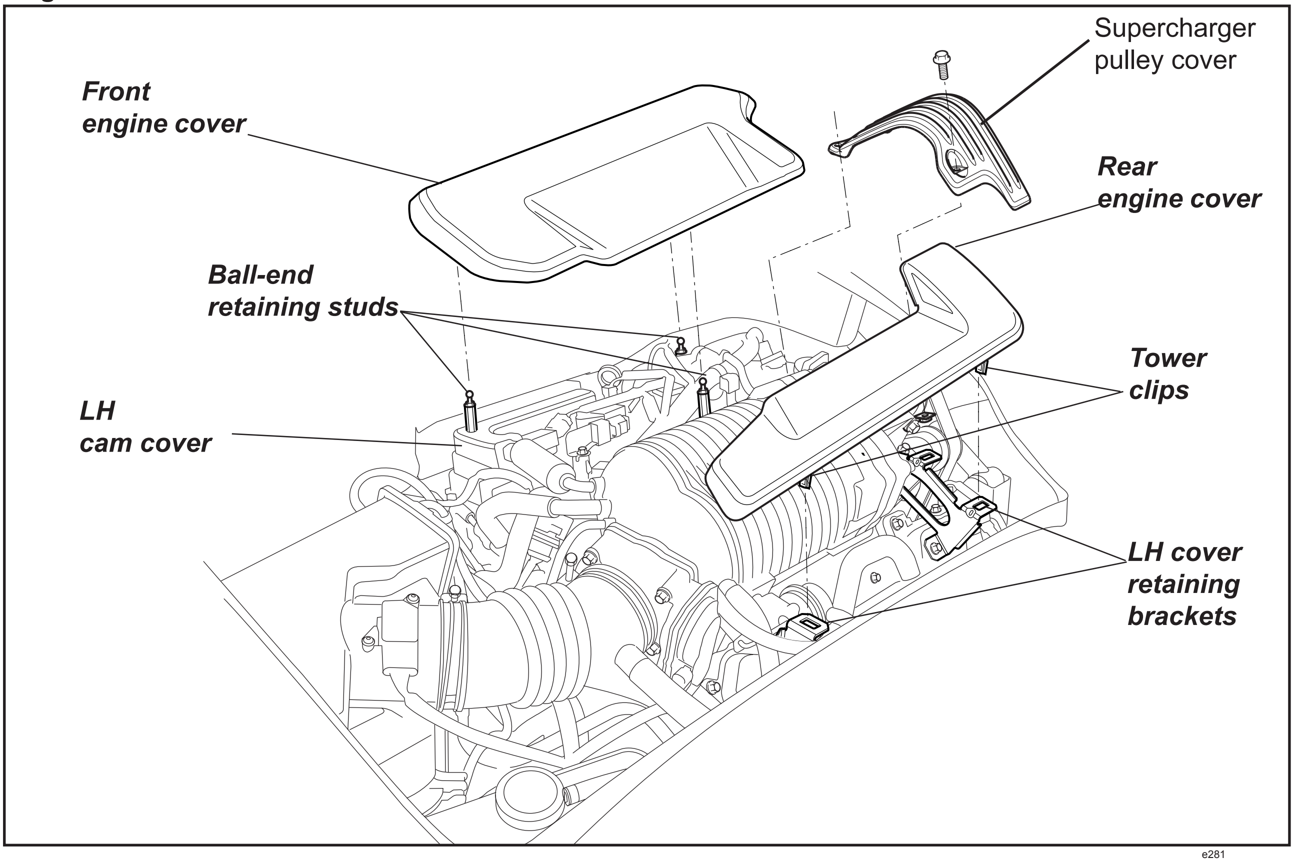
EM.2 - ENGINE ANCILLARY COMPONENT ACCESS

Certain inspection, removal and refitment procedures may require the removal of one or more of the panels as listed below:

A. Front & rear engine covers - see page 5.
B. Engine bay panels - see page 6.
C. Rear access panel - see page 6.
D. Rear undertray – see service notes section AN.2
E. Rear wheelarch liner – see service notes section BT.5



Engine Cover Panels



3 composite covers are provided as cosmetic finishers for the engine and referred to as:

Front engine cover: fitted to LH cylinder bank (2)
Rear engine cover: fitted to RH cylinder bank (1)
Supercharger pulley cover

Front engine cover panel
The front cover is retained to the LH cylinder bank by 3 integral rubber sockets that push fit onto 3 retaining 'ball end' studs that are screwed into LH camshaft cover.

To remove, simply pull the panel upwards to release it from the retaining studs, when refitting, locate all 3 rubber sockets onto the studs, and press down.

Rear engine cover panel
The rear cover is retained to the RH cylinder bank by tower clips which fix 3 protrusions underside of the panel to 3 rectangular holes within retaining brackets fixed to the RH camshaft cover.

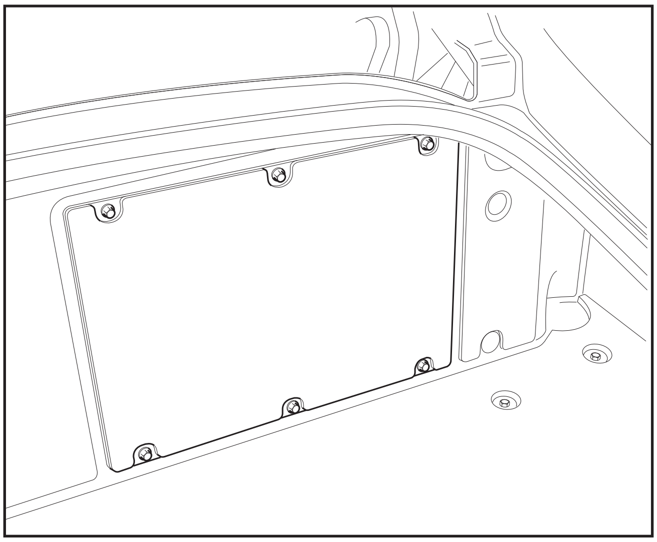
It is possible that by pulling the panel directly upwards that the tower clips may be disturbed and drop into the engine bay. Therefore it is recommended to lift the panel up from the RH side of the vehicle to begin with so that you can hold the clips, preventing them from becoming displaced.

Supercharger pulley cover
Retained to brackets by M6 x 20 skt cap hd scew (2).

Engine Access Panel

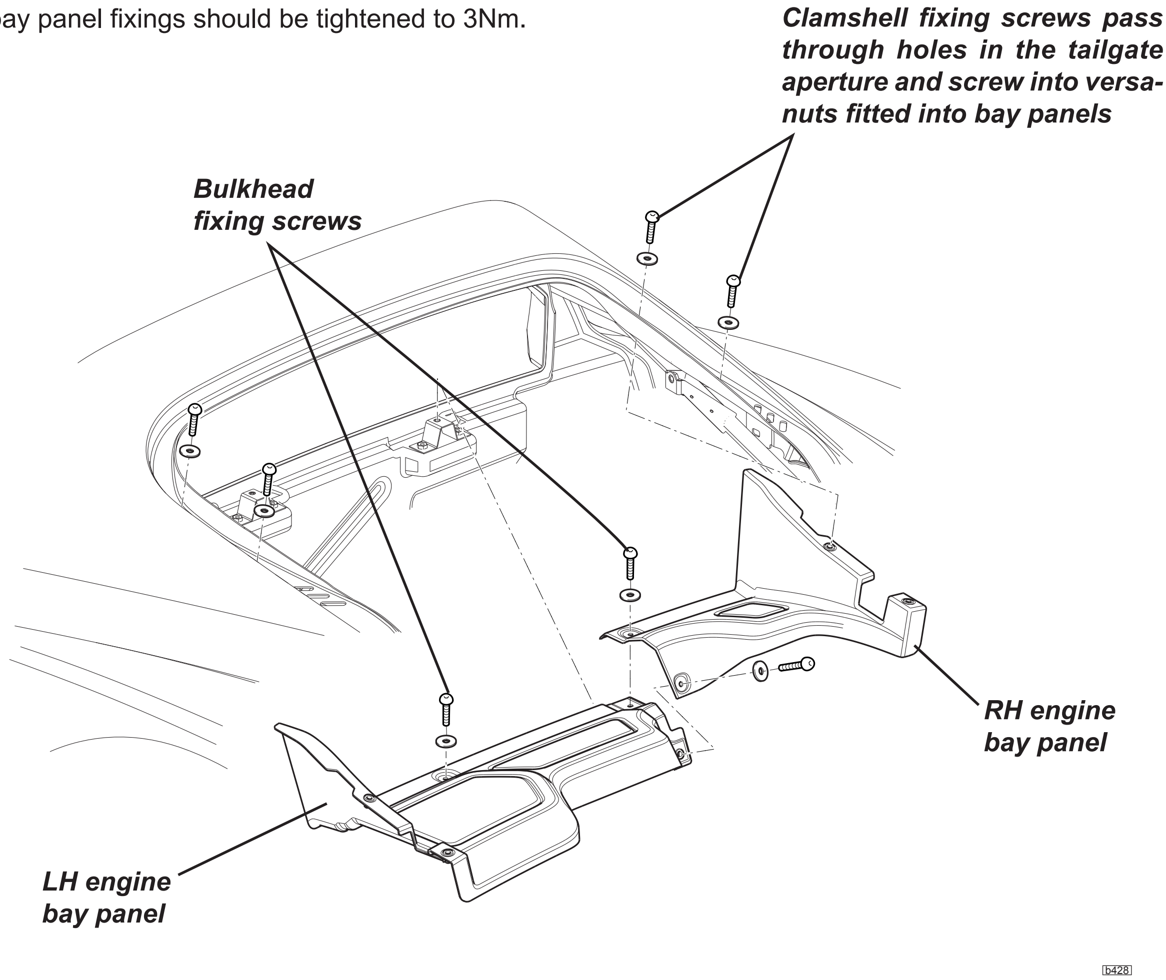
Located in the rear luggage compartment behind the carpet, this panel can be removed to gain access to the spark plugs in the RH cylinder bank.

To remove
Remove the 6 x MX fixings to remove the access panel from the luggage compartment, then remove the 4 M6 x 14 screws that retain the detachable section of the heatshield to bootbox heatshield assembly.



Engine Bay Panels
LH and RH engine bay panels are fixed to the clamshell around the tailgate aperture as well as to brackets fixed to the rear bulkhead panel using M6 x 20 button socket headed screws (7).

All engine bay panel fixings should be tightened to 3Nm.



EM.3 - ENGINE OIL MAINTENANCE

WARNING

- **Engine oil is hazardous to your health and may be fatal if swallowed.**
- **Prolonged and repeated contact with used engine oil may cause serious skin disorders, including dermatitis and cancer.**
- **Use protective gloves to avoid contact with skin as far as possible and wash skin thoroughly after any contact.**
- **Take all suitable precautions to guard against scalding from hot oil and hot surfaces.**
- **Keep out of reach of children.**

Engine Oil Level Check

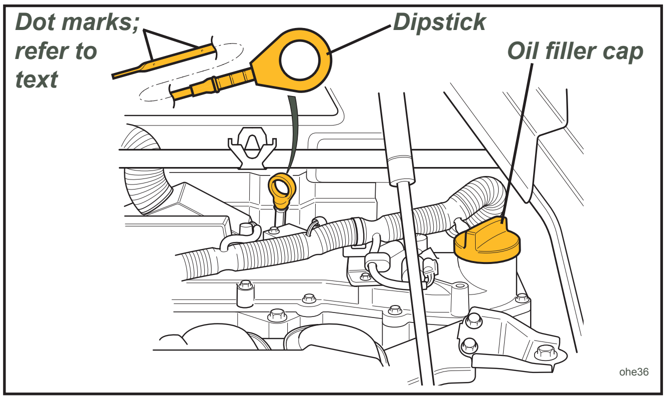
The engine oil level should be checked regularly, such as every two or three fuel stops. It is especially important to keep a check on the oil level during the car's first 1,000 miles (1,600 km), as the oil consumption will be prone to some variance until the engine components have bedded in.

The best time to check the level is before starting a cold engine, or alternatively, when the oil is warm, such as during a fuel stop. Ensure that the car is parked on a level surface and that a few minutes have elapsed since stopping the engine to allow oil to drain back into the sump. If the engine is run but stopped before reaching normal running temperature, the oil will not readily drain back into the sump, and the dipstick will display an artificially low reading.

Dipstick: The dipstick is identifiable by its yellow loop handle, and is located at the right hand front of the engine.

WARNING

If access to the dipstick is required when the engine is hot, be aware of many hot surfaces including the ducting adjacent to the dipstick itself. Wear appropriate protective clothing to prevent burn injuries.



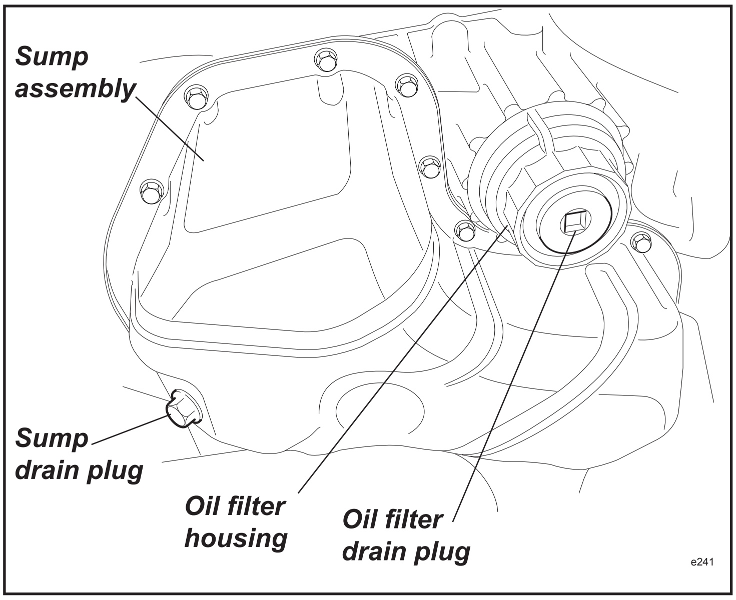
Remove the front engine cover, see sub-section EM.2, withdraw the dipstick, and wipe with a paper towel. Replace the dipstick, if necessary feeding the flexible stem into the tube using the towel, before pressing firmly to ensure that the handle is fully seated. Withdraw the dipstick again to inspect the oil level.

The level should lie between the two dots on the lower end of the dipstick. For optimum engine protection, maintain the level towards the top mark, and do not allow to fall below the mid-point. If driving on a closed circuit track, or exploiting maximum cornering capability, it is especially important to maintain at the upper marking. Adding approximately ½ litre will raise the level from the mid-point to the upper mark.

Topping Up: If topping up is necessary, first remove the engine cover. Unscrew the oil filler cap and add a suitable quantity of the recommended engine oil (see Service Notes section TDV) taking care not to spill any oil onto engine or electrical components; use a funnel if necessary.

The difference between the top and bottom marks on the dipstick is equivalent to approximately 1.5 litre. Allow several minutes for the oil to drain through to the sump before re-checking the oil level. Do NOT overfill, or lubrication will be degraded and consumption increased as the oil becomes churned and aerated. The catalytic converters may also be damaged by high oil content in the exhaust gas. Refit the filler cap and front engine cover.

Engine Oil Drain Plug & Filter



The engine oil drain plug is located in the base of the pressed steel sump.

The cartridge type oil filter is mounted at the front of the engine

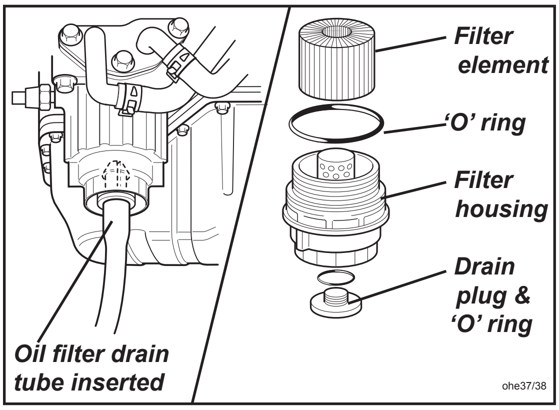
The drain plug and oil filter are only accessible only from beneath with the rear undertray removed.

Engine Oil & Filter Change

WARNING
- **Engine oil is hazardous to your health and may be fatal if swallowed.**
- **Take all suitable precautions to guard against scalding from the hot oil.**
- **Prolonged and repeated contact with used engine oil may cause serious skin disorders, including dermatitis and cancer.**
- **Use protective gloves to avoid contact with skin as far as possible and wash skin thoroughly after any contact.**
- **Keep out of reach of children.**

Sump Drain plug
Remove the plug to drain the sump immediately after a run when the oil is warm and the impurities are still held in suspension. Allow the oil to drain completely, clean the drain plug, fit a new sealing ring, refit the drain plug and tightening securely. Refill with the recommended lubricant (see Section TDV) via the oil filler on the camshaft cover, to the top mark on the dipstick, allowing several minutes for the oil to drain through to the sump before checking the level. Take care not to overfill. Refit the oil filler cap securely, and check the oil level again when the engine is fully warm.

Oil Filter
The oil filter housing incorporates a drain plug to minimise potential oil spillage;
Removal:



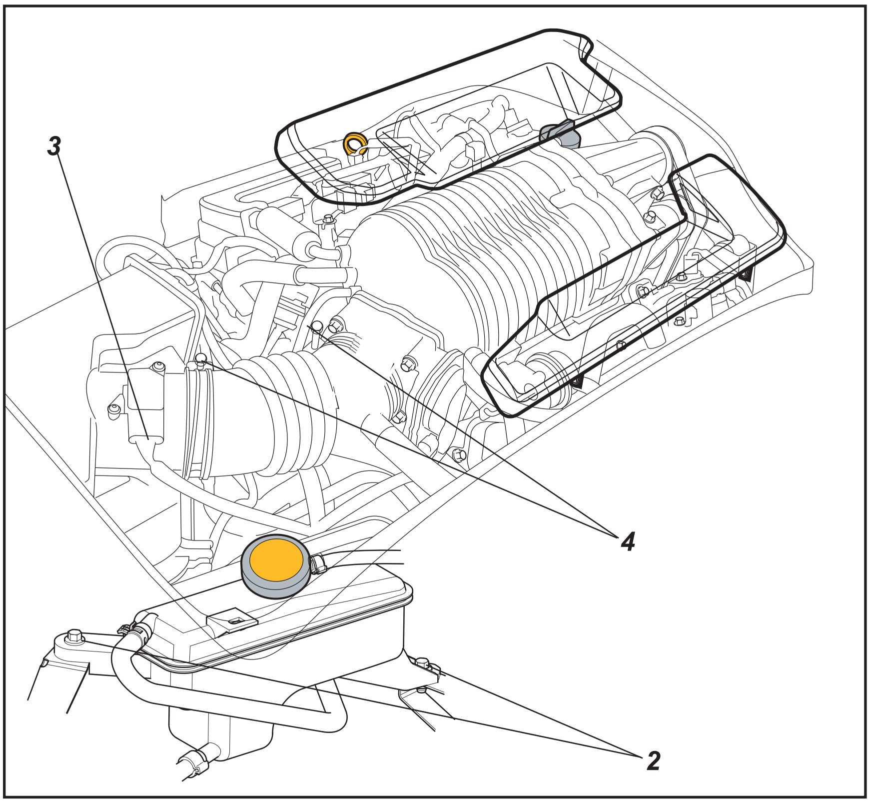
- Unscrew the drain plug (square socket) from the filter housing cap and catch the small amount of oil released in a rag.
- Connect a length of 15mm i.d. hose to the drain pipe supplied with the new filter. Insert the pipe into the base of the filter housing with the 'O' ring on the top side of the tube flange, and push upwards until it clicks into position and opens the spring loaded drain valve. Collect the draining oil.
- Remove the drain tube by pulling sideways and down.
- Using special tool T000T1441F, unscrew the cap from the filter housing. Discard the filter element and filter cap 'O' ring.

Renewal:

- Thoroughly clean the filter cap, filter housing and drain plug.
- Fit the new 'O' ring supplied with the new filter element into the cap groove, and lubricate with engine oil. Fit the new filter element into the cap, and install the filter and cap into the housing, ensuring that the 'O' ring does not become displaced.
- Using special tool T000T1441F, torque tighten the cap to 25 Nm. Check that there is no clearance between cap and housing.
- Lubricate the small 'O' ring supplied with the new filter with engine oil, and fit into the groove in the filter housing Fit the filter drain plug and tighten to 13 Nm.
- Check the oil level (see sump drain plug information on previoius page) before starting the engine and restricting to idle speed until the oil pressure tell tale is extinguished. Check for oil leaks with the engine running. Stop the engine when fully warm and re-check oil level.

Refill with the recommended lubricant (see Section TDV) via the oil filler on the camshaft cover, to the top mark on the dipstick, allowing several minutes for the oil to drain through to the sump before checking the level. Take care not to overfill. Refit the oil filler cap securely, and check the oil level again when the engine is fully warm.

EM.4 - AIR CLEANER ELEMENT INSPECTION/REPLACEMENT



Inspection/removal

1. Remove the LH engine bay panel to gain access to the forward most airbox overcentre clips, see page 6.

2. Release the 2 M6 x 16 screws (torque 20Nm) securing the coolant reservoir tank to its left and right hand brackets and position to one side to gain assess to the rearmost airbox overcentre clips.

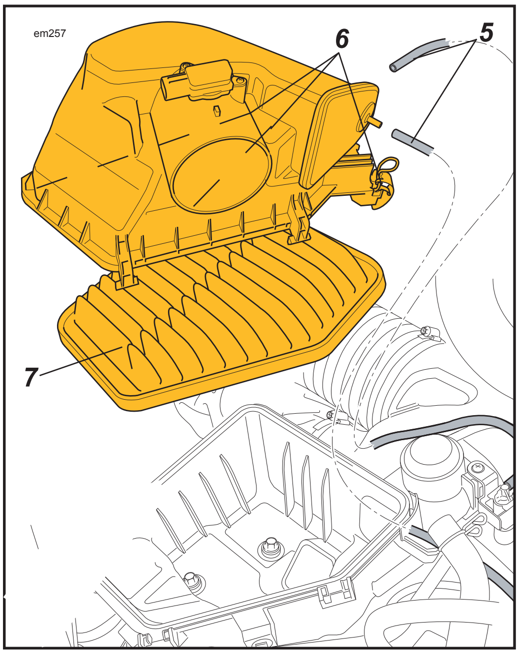
3. Unplug the harness connector from the airflow sensor located on the top of the airbox casing.

4. Release the clamps securing the convoluted intake hose from both the throttle body inlet and airbox cover outlet and remove.

5. Release the two vacuum hoses from the airbox reservoir, one from the intake tract, the other from the intake flap valve solenoid.

6. Release the 3 overcentre clips on the airbox.

7. Unhook the airbox cover from the base and withdraw. Thoroughly clean the cover.

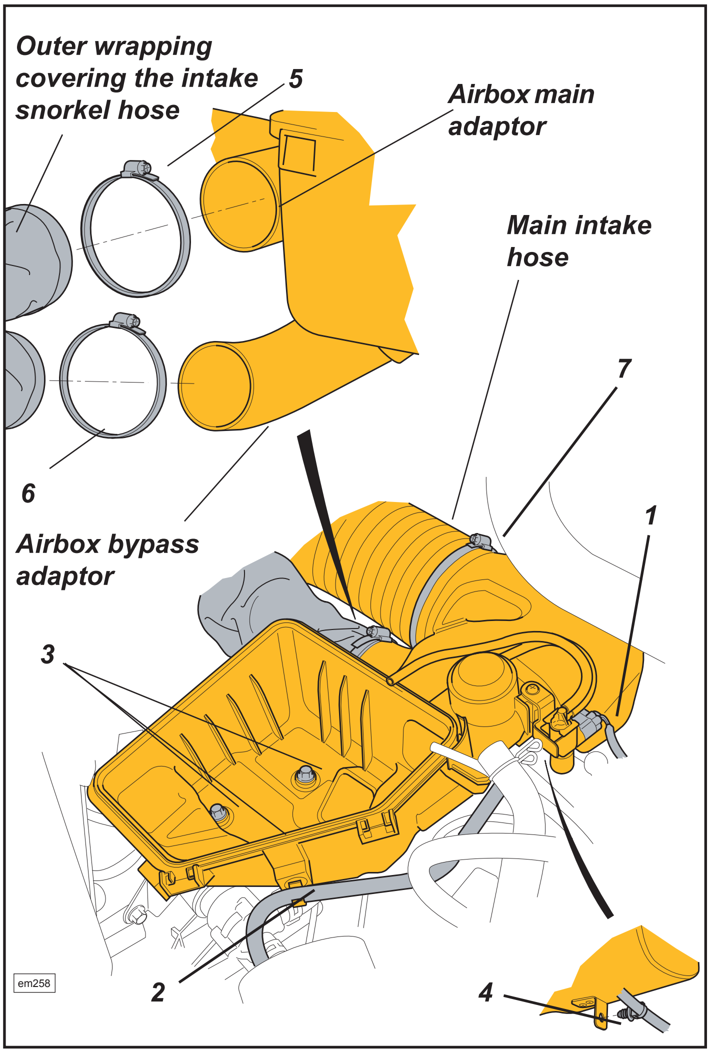


Clean around the airbox base before removing the element, taking care to avoid contaminating the base unit with dust or dirt.

Refitment/replacement

Re-assembly in reverse order to removal.

Airbox casing
Removal
After removing the upper airbox casing and air filter.



1. Disconnect the harness to the intake flap valve solenoid.

2. Release the fuel hose from the clip retaining it to the side of the lower case.

3. From within the lower case, release and remove the 3 M8x30 screws securing it to its mounting bracket.

4. It should now be possible to pull the case slightly upwards allowing enough access to detach the fuel hose at its firtree fastener clip which is attached to a bracket located underneath the base of the casing.

5. From above, release the hose clip securing the intake snorkel hose to the airbox main adaptor chamber, and remove the hose.

6. From underneath, release the hose clip securing the intake snorkel hose to the airbox bypass adaptor, and remove the hose.

7. If necessary release the hose clip from the main intake hose and remove the hose from the main adaptor chamber.

Note: Only necessary if the hose is attached to any other ancillary components in the engine bay, but if not it can be withdrawn with the lower case.

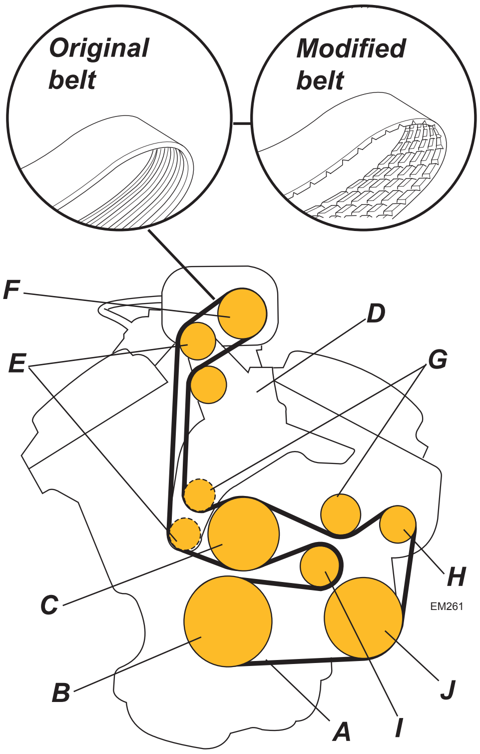
The lower case can now be removed.

Refitment
Reverse of removal but Ensure that the outer wrapping covering the intake snorkel hose is pushed back away from both ends of the hose. This will ensure that the wrapping does not foul the airbox and adaptor inlets when being refitted which may prevent positive fitment of the hose.

EM.5 - AUXILIARY DRIVE BELT

A single serpentine multi-rib auxiliary belt* is used to transfer drive from the crankshaft nose pulley to the engine ancillary components shown below. An automatic type belt tensioner is provided in the form of an idler pulley mounted on a spring loaded arm. At each service interval, the whole length of the belt, on both the inside and outside surfaces should be examined for any evidence of perishing, cracking, chafing, splitting, tearing, delamination, contamination or other indications of undue wear or deterioration. In any cases of doubt, the belt should be renewed.

**Note: The serpentine belt originally fitted at start of production was upgraded as a running change to a modified belt incorporating grooves running at acute angles to its ribs providing greater grip between the internal and external surfaces of the pulleys. Also refer to Technical Service Bulletin TSB 2013/12 for additional information.*



Drive belt schematic

A. Drive belt
B. Crankshaft pulley
C. Waterpump pulley
D. Idler pulley bracket
E. Internal idler pulleys
F. Supercharger pulley
G. External Idler pulleys
H. Alternator pulley
I. Drive belt tensioner pulley
J. Air conditioning pump pulley

Auxiliary Belt Replacement

Preparation:

Due to the limited clearance between the lowest idler pulley and engine cover the drive belt cannot be removed without first separating the idler bracket assembly from the engine timing cover.

Because of the limited clearance between the engine and subframe, the bracket cannot be withdrawn from the engine bay unless the rear clamshell is removed.

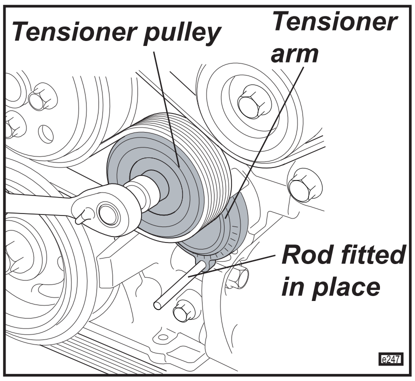
The procedure shown below can be used in circumstances where no other repairs are being performed requiring either engine or rear clamshell removal. A height adjustable transmission jack is also required, which is used in conjunction with a ramp so that the idler bracket bolts can be accessed from the RHR wheelarch area at a comfortable working height.

Removal:

1. Remove the RH rear wheelarch liner and rear undertray, see service notes section BT.5 and AN.2 for further information.

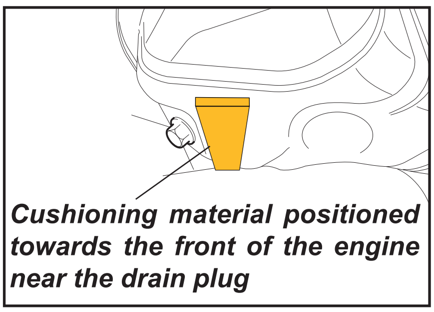
2. Remove the engine, supercharger pully cover and engine bay panels; refer to sub-section EM.2 for further information.

3. From underneath the vehicle use a 14mm hexagonal socket and long bar, rotate the tensioner pulley counter-clockwise to relieve the tension on the belt.



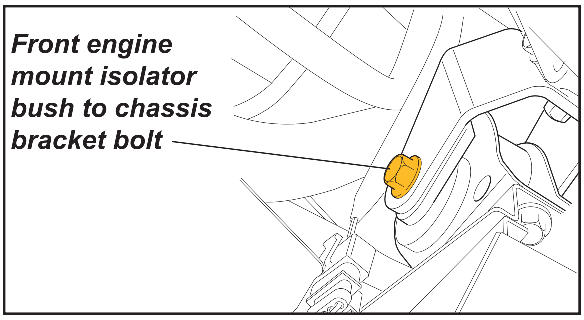
4. Align the hole in the tensioner arm with the corresponding drilling in the baseplate and insert a 5mm rod or hex key to hold the tensioner in the released position.

5. From underneath the vehicle, position a suitable jack under the engine sump assembly, use a suitable material between the jack and the front of the sump to act as a cushion carefully, then raise the jack until it just supports the engine.



Note: place the cushion material near the drain plug area as this area of the sump is reinforced and should not distort providing only a sensible pressure is placed upon it.

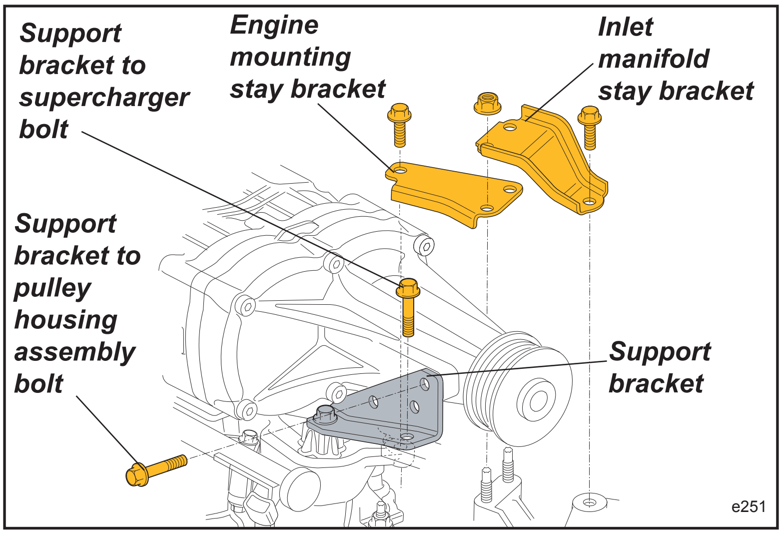
6. From underneath the vehicle release the bolt securing the front engine mount isolator bush to the chassis bracket (torque 68Nm).



7. Remove the inlet manifold and engine mounting stay brackets securing the inlet manifold to the RH engine mounting assembly (bolt & nut torques are 25 Nm).

8. Remove the bolt securing the supercharger support bracket to the front of the supercharger pulley and the lower bolt securing the bracket to idler bracket assembly.

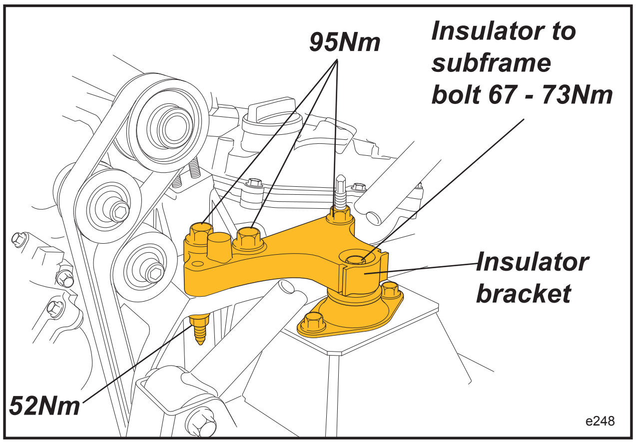
9. Partially remove the drive belt by pulling it away from the accessible upper and lower pulleys.



10. Remove the M10 x 80 bolt securing insulator bracket to subframe mount. 67 - 73Nm.

11. Remove the 2 nuts and 2 M12 x 55 bolts securing the insulator to the engine idler pulley assembly and remove the insulator bracket.

12. Using the jack previously placed underneath the engine, carefully raise the engine slightly until all 6 heads of the idler bracket to engine bolts become accessible from the RH wheelarch area using a socket and ratchet.

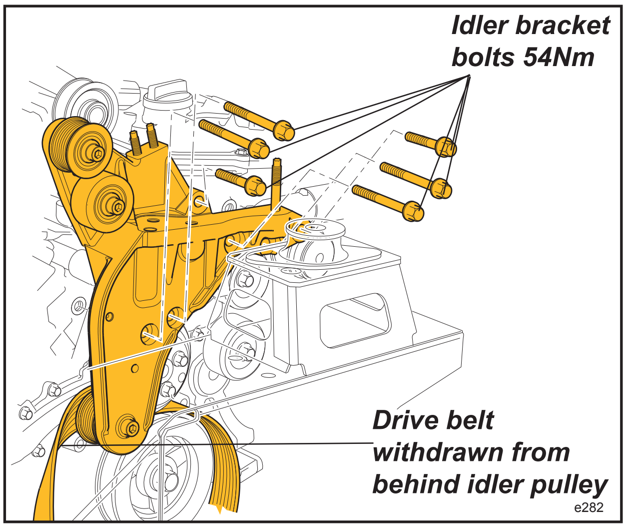


13. Release the 6 bolts securing the idler bracket to the engine timing cover and withdraw them from the engine bay via the wheelarch area.

Note: the bolts used are of varying lengths, (the 4 longest having sealant compund applied) when removing please take note of the bolt removed with regards to its mounting position so upon refitment of the idler bracket the bolts are refitted back into the same position.

14. Carefully pull the idler bracket as far as possible away from the engine.

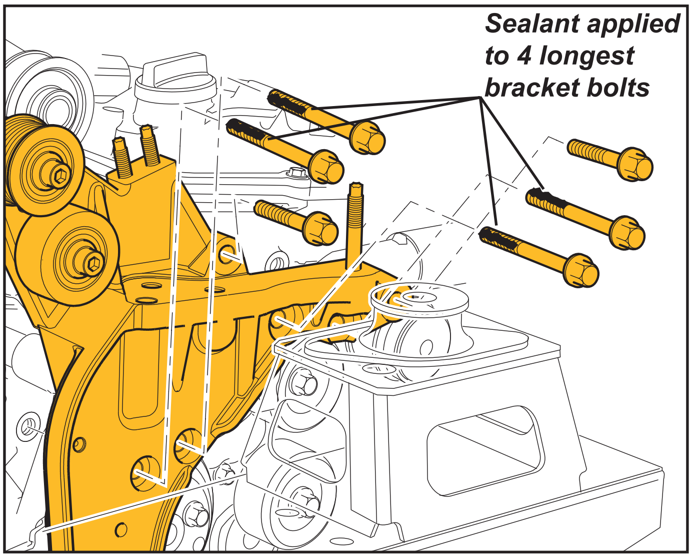
15. With the idler bracket moved forward it is now possible to feed the drivebelt out from between the lower idler pulley and engine timing cover assembly.



Refitment:
Reverse procedure of removal except;

- Ensure the new belt is fitted the correct way around the lower idler pulley before fitting the idler bracket against the engine timing cover,

- Apply a small quantity of Loctite 5910 silicone sealant or equivalent to the threads of the 4 longest idler bracket bolts that pass through the timing cover into the cylinder heads as shown in RH illustration.



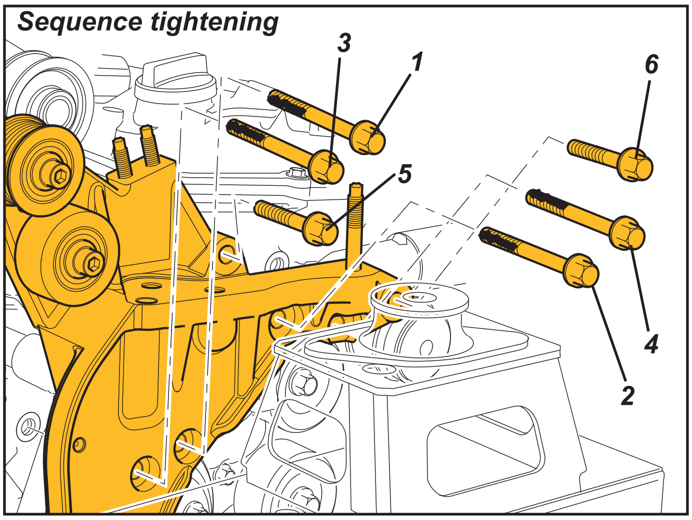
- Refit the 6 bolts (hand tight) into the idler bracket in the sequence shown in the RH illustration.

- Refit the drive belt around the lower pulleys and water pump, ensure the belt is still free to move between the bracket and timing cover.

- Fully tighten the 6 bracket bolts (torque 54Nm) in the sequence shown in the RH illustration.

- Feed the belt around the remaining upper idler bracket and supercharger pulleys.

- Rotate the tensioner pulley counter-clockwise once more to relieve the tension on the belt and remove the 5mm rod or hex key to holding the tensioner in the released position.



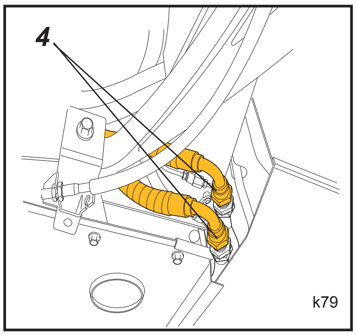
- Turn the engine over by hand for 2 revolutions and check the belt is running free and clear of the idler bracket, timing cover and any other ancillary components.

- Run the engine and ensure there are no abnormal noises/vibrations etc, then refit all ancillary components previously removed.

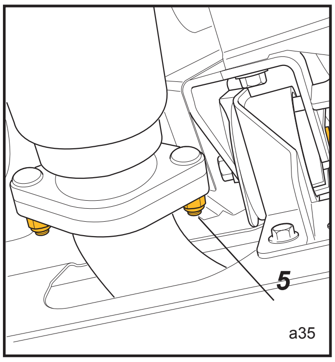
EM.6 - ENGINE REMOVAL/REPLACEMENT

The engine and/or transmission can be removed only as a combined unit, and should be lifted out from above after removing the rear clamshell:

1. *Preparation:*
   - De-pressurise fuel system, see Service Notes section LD.4).
   - Remove both rear wheels, the diffuser and engine undertray, see Service Notes section AN.2.
   - Remove the rear clamshell, see Service Notes section BT.7.
   - Remove the engine, supercharger pully cover and engine bay panels; refer to sub-section EM.2 for further information.
   - Ensure the main harness is positioned to one side so that it cannot foul against the transmission as it is being raised up from the subframe when the powertrain assembly is being removed.

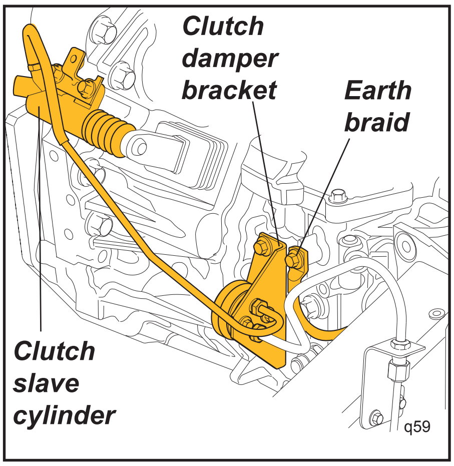


2. *Airbox:* Remove the complete intake airbox together with trunking (see sub-section EM.3).



3. *Drain fluids:*
   - *Transmission:* Drain the transmission oil and disconnect the reverse light switch connection at the main harness, see Service Notes section FK.4.
   - *Cooling system:* Drain the cooling system at the auxiliary coolant radiator and engine block drain cock, see Service Notes section K.R.2.
   - *Air conditioning system:* De-pressurise (see Service Notes section PK.4).

4. Disconnect the oil cooler feed and return hoses from either the sandwich plate assembly or at the RH sill where they connect to the sill pipes (torque to 40Nm).

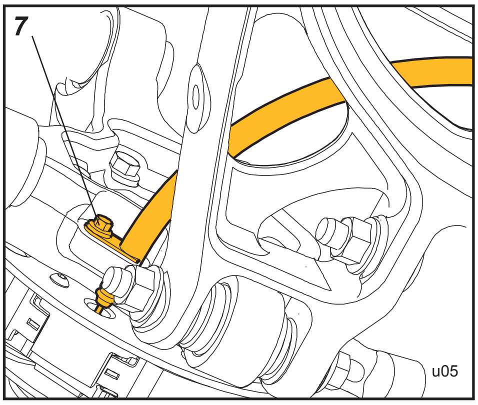


5. *Exhaust:* Release the fixings securing the downpipe to the rear silencer extension pipe (torque 45Nm).

6. *Clutch release:* Remove the 3 M8 x 20 (torqued to 20Nm) securing the clutch damper bracket to the transmission. Remove the 2 M8 bolts (torqued to 12 Nm) securing the clutch slave cylinder to the bell housing. Pull the clutch slave cylinder and the bracket and aside without disturbing the hydraulic line.

   Also release the screw securing the earth braid to the transmission.

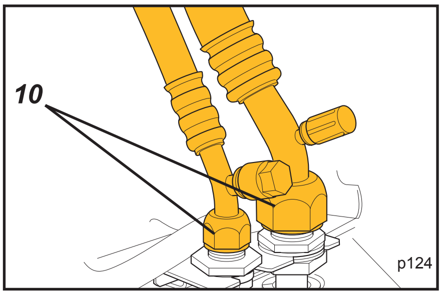
7. Release the M6 x 12 screw securing the outer handbrake cables to the rear hubs then disconnect the parking brake cable from the brake backplates. See Service Notes section JM.7 for further information.



8. *Gearchange cables:* Release the gearchange cables from the transmission levers and abutment brackets. Release any cable guides and restraints, see Service Notes section FK.3.

9. *Driveshafts and hub carriers:*
   Remove both LH and RH driveshafts, see Service Notes section FK.5.

10. *A.C.:* Disconnect the high and low pressure a.c. compressor hoses from the compressor pipes at the RH sill area and plug all ports.

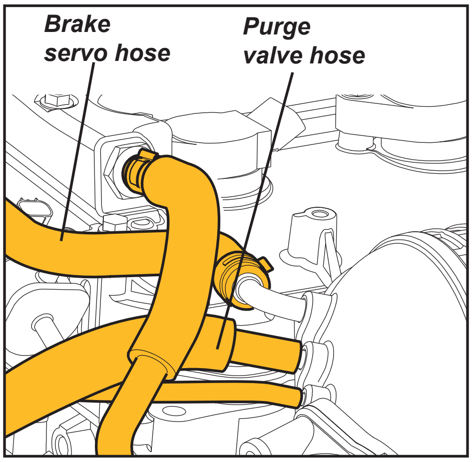


11. Disconnect the rear positive post to starter solenoid cable.

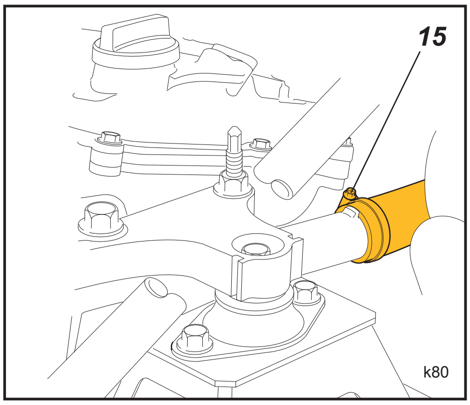
12. *Brake servo vacuum hose:* Disconnect from the supercharger, and secure all plumbing aside.

13. *Purge pipe:* Release the charcoal canister purge pipe from the supercharger inlet plenum.

14. *Fuel pipe:* After checking that the fuel system is de-pressurised, and taking suitable precautions to absorb residual fuel, disconnect the fuel feed pipe from the fuel rail, see Service Notes section LD.4.

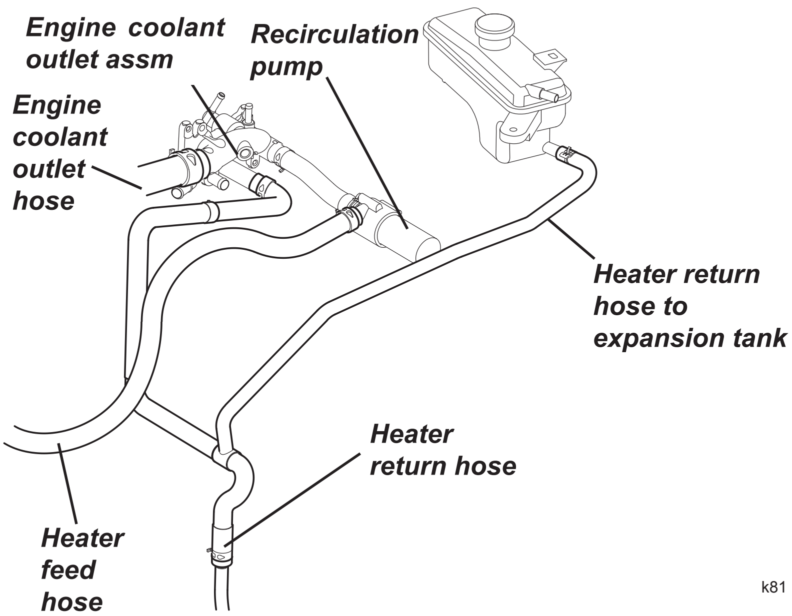


15. Disconnect the radiator return hose from the thermostat housing.

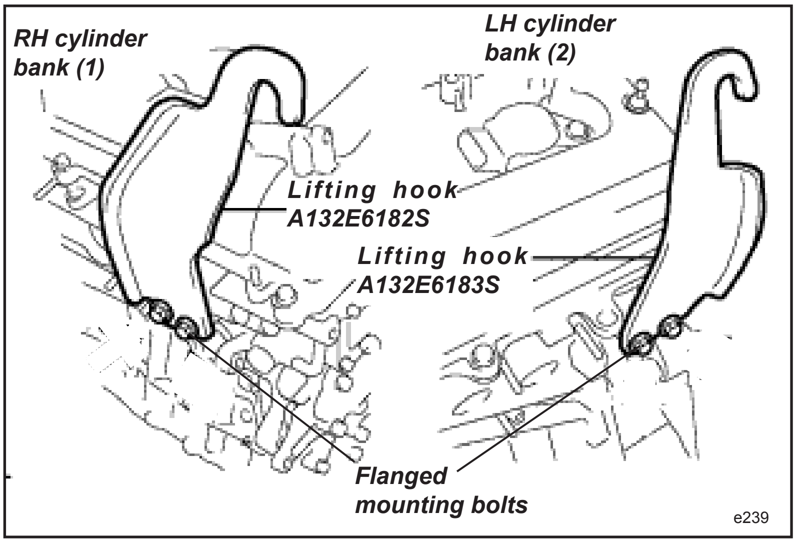


17. At the engine water outlet assembly disconnect:

- Radiator feed hose.
- Heater return hose.
- Recirculation pump to heater hose and disconnect multiplug connector to main harness.
- Heater return hose to expansion tank.

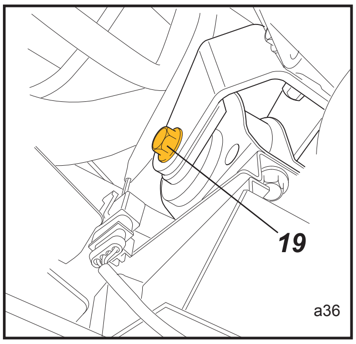


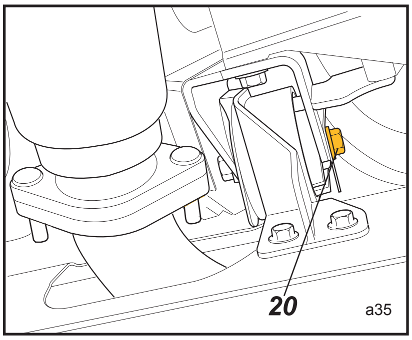
18. *Hooks:* Fit lifting hooks A132E6182S and A132E6183S with mounting bolts A132E6184S to the RH front and LH rear of the engine and support the powertrain on a hoist.



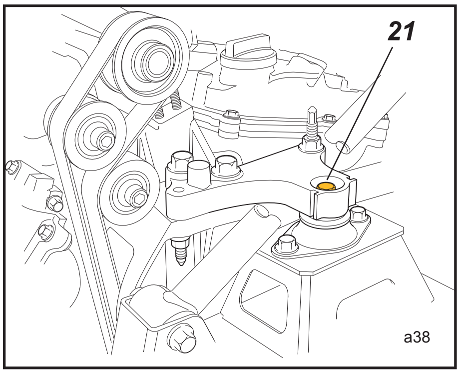
19. Release the bolt securing the front engine mount isolator bush to the chassis bracket (torque 68Nm).

20. Release the bolt securing the rear transmission insulator bush to the engine mount located at the rear of the subframe (torque 68Nm).



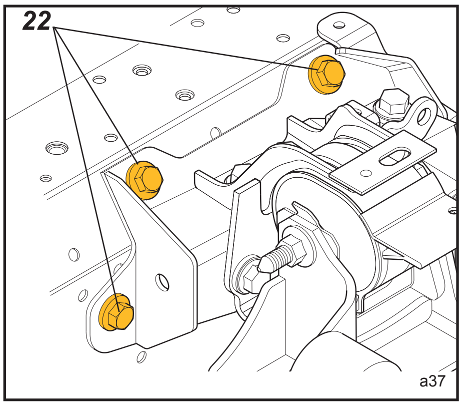


21. At the right hand side of the engine, remove the M10 x 80 bolt securing insulator bracket to subframe mount. (Torque 67 - 73Nm).



22. At the left hand side of the engine, remove the M10 x 25 (4) screws securing the LH engine mounting bracket to the subframe. (Torque 43 - 47Nm) .

23. *Hoist:* Carefully hoist the powertrain away from the chassis, seperate the exhaust downpipe from the rear silencer extension pipe then constantly check for any other remaining attachments or snagging. Place the unit on a flat surface and support securely using wooden chocks as necess



Powertrain Replacement

To refit the powertrain, reverse the removal procedure, with the following notes:

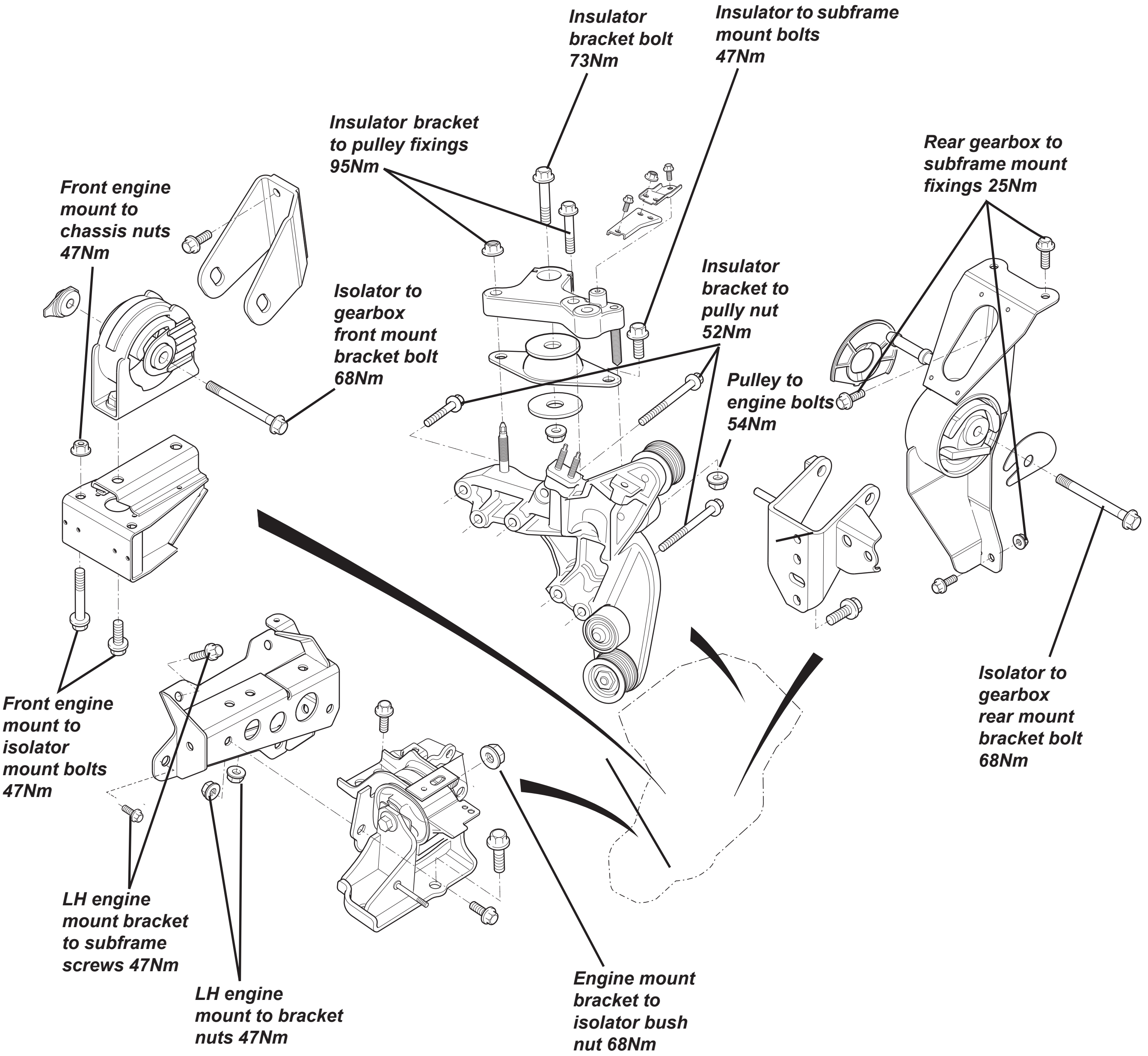
- Torque tighten the engine isolator bolts only when all four mountings are secured and the hoist is released, refer to sub-section EM.7 on following page for torque figures.

- Re-charge the air conditioning system (see section PK.4), refill the cooling systems, and transmission and engine lubrication.

- After re-assembly of the rear suspension, check camber and wheel alignment.

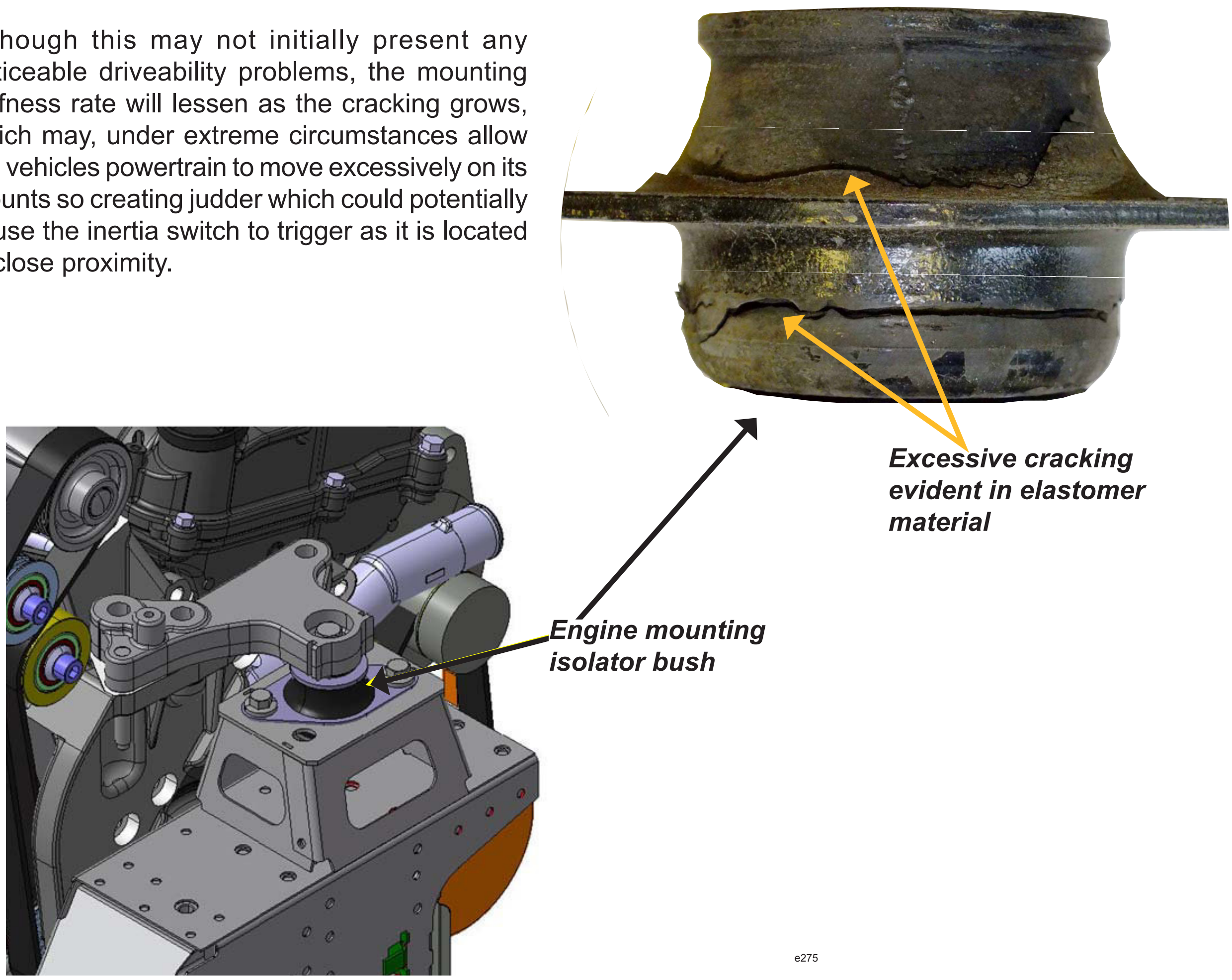
EM.7 - ENGINE MOUNTS

Engine Mounting Overview



Due to the high dynamic loads placed on the engine mountings (especially if the vehicle is frequently used on a test track etc), cracking of the elastomer material of the RH engine mounting isolator bush may occur.

Although this may not initially present any noticeable driveability problems, the mounting stiffness rate will lessen as the cracking grows, which may, under extreme circumstances allow the vehicles powertrain to move excessively on its mounts so creating judder which could potentially cause the inertia switch to trigger as it is located in close proximity.



If any elastomer cracking is visible in either the upper or lower sections of the mount it should be changed as it will degrade more quickly once cracking has been initiated. If any elastomer cracking is visible in the upper section it is most likely that the lower section will have already failed.

It is recommended to inspect RH engine mount at each routine 9,000 mile/12 month service interval when performing an unscheduled check to reset the launch control function. If any cracking is evident then the mount should be renewed.

Bush Inspection
With adequate illumination the isolator bushes upper section can be examined in situ with the engine cover removed.

The lower section is more difficult to see in situ though it can be examined using an endoscope or bore scope. Alternatively it can be viewed from the RHS once the rear wheelarch liner has been removed.

Bush Renewal
To remove and replace the mount requires removal of the under tray, the SBAF (Seat Belt Anchor Frame) rear RH stay and rear RH wheelarch liner. It is not necessary to remove the rear clamshell. The RHS of the engine should be supported on a wheel lift jack as the bolts are removed and during replacement of the mount.

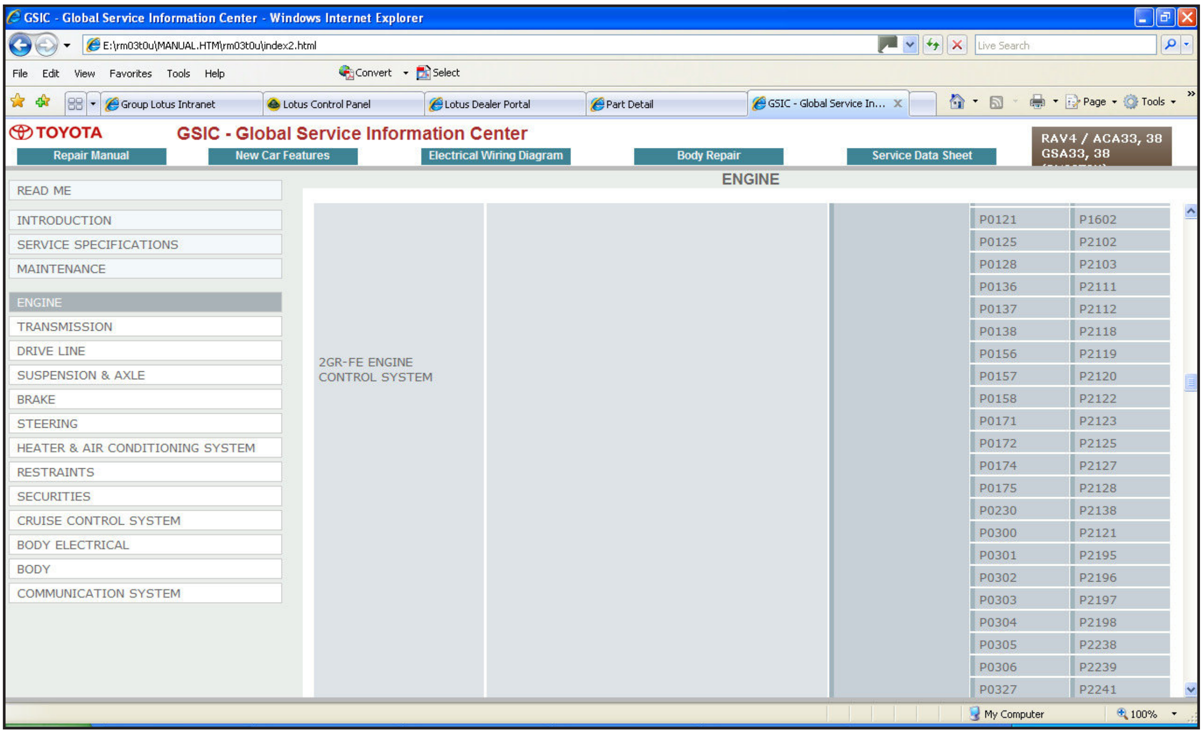
EM.8 - ENGINE SPECIAL TOOLS

Engine Lifting Hook, RH	A132E6182S
Engine Lifting Hook, LH	A132E6183S
Engine Lifting Hook Bolts	A132E6184S
Wrench Adaptor, oil filter cap	T000T1511S

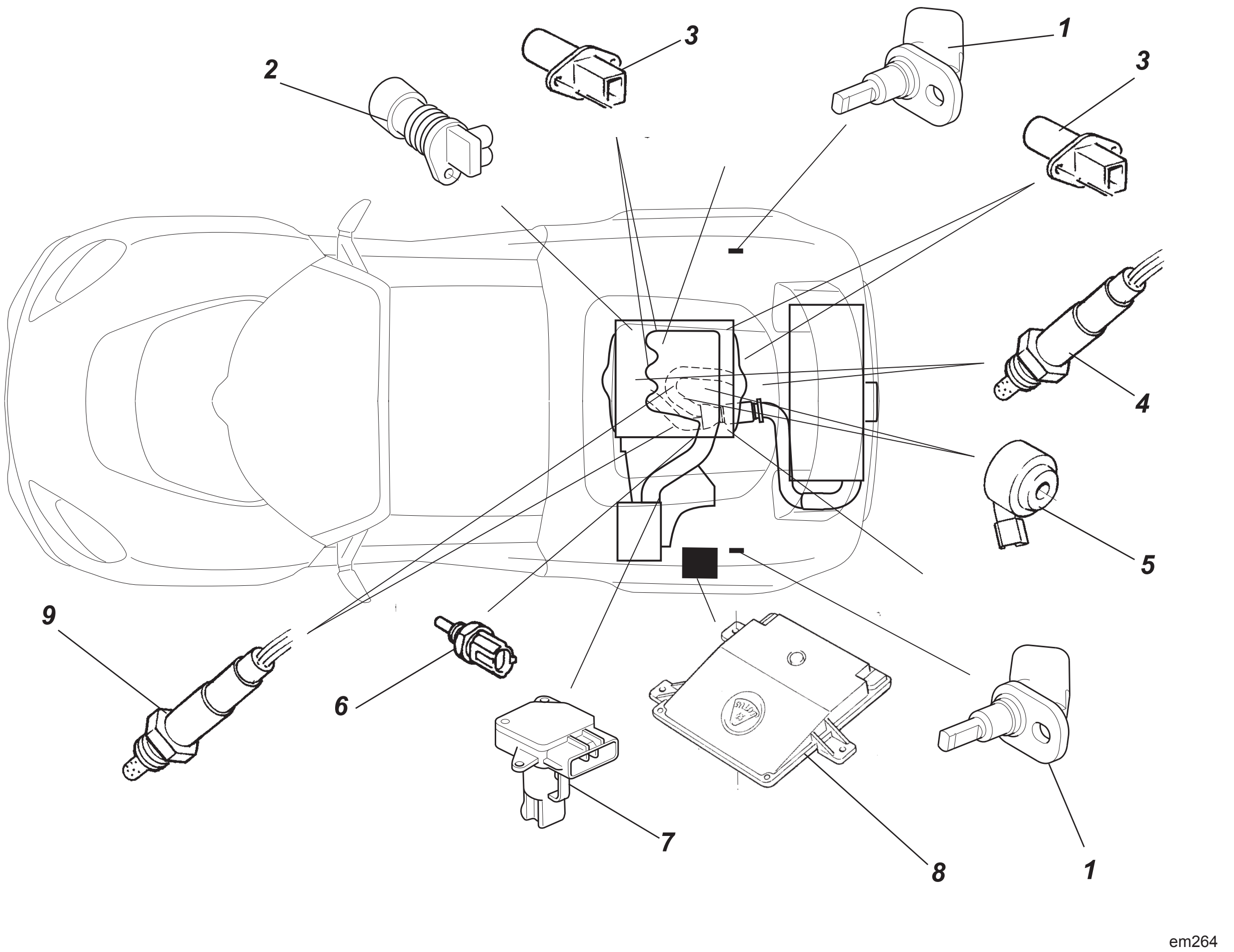
EM.9 - ENGINE REPAIR

Engine repair information is contained on CD T000T1516F (Toyota SC03T0U) and by following the links:

Insert disc the the Global Service Information Centre will open up the select 'Engine' and from the menu section relating to the 2GR-FE engine, select topic required. Be aware of installation differences for the Lotus application.



EM.10 - ENGINE MANAGMENT COMPONENT LOCATION

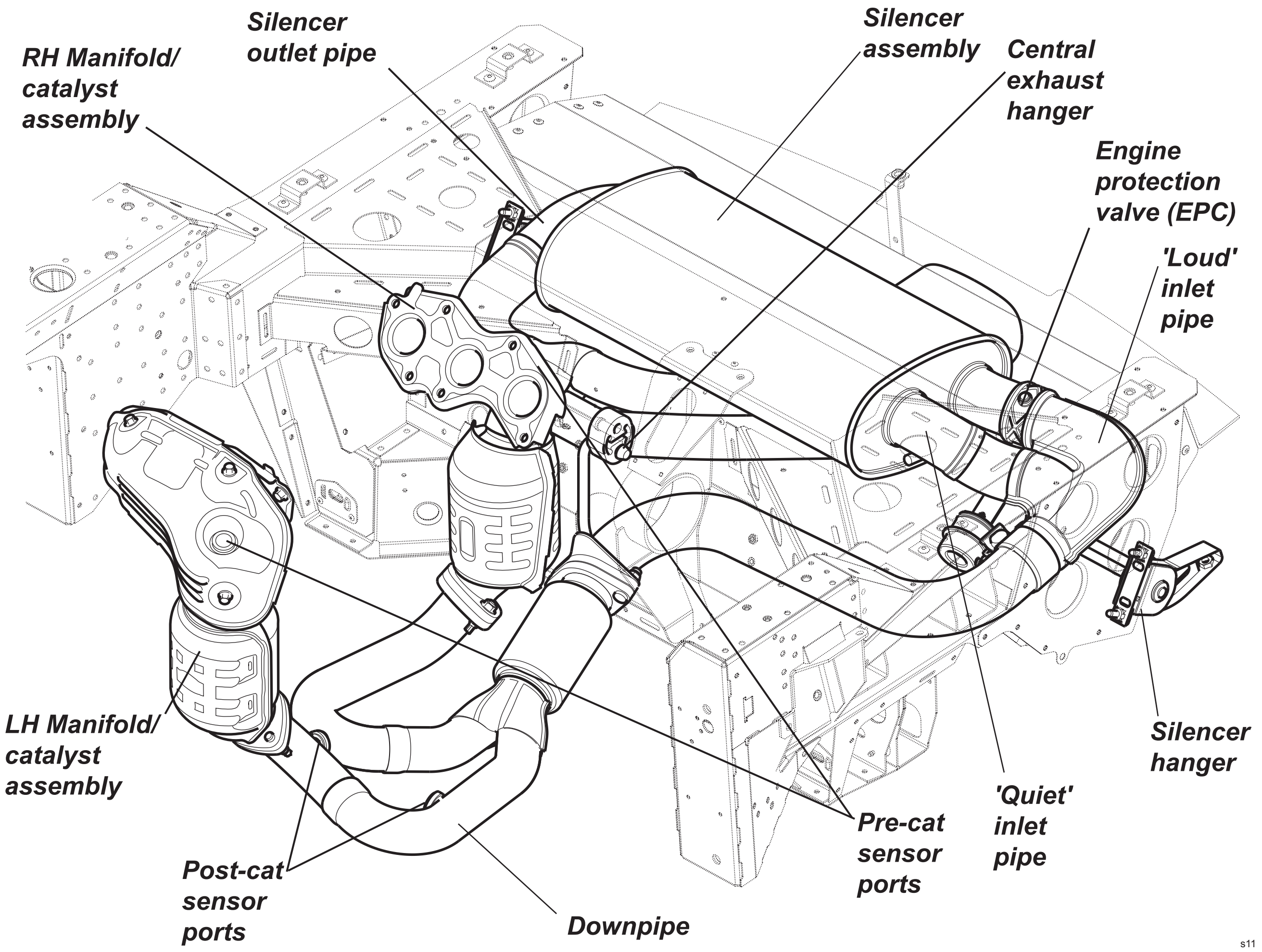


Key to engine management component location drawing

1. Wheel speed sensors.
2. Crankshaft position sensor.
3. Camshaft position sensor.
4. Pre-catalyst oxygen sensors.
5. Knock sensor.
6. Coolant temperature sensor.
7. Air intake flow meter.
8. Electronic Control Module (ECM).
9. Post-catalyst oxygen sensor.

Further information regarding the location of engine management sensors and diagnostic codes is available in section EMR. Refer to CD: T000T1516F for replacement procedures for any engine management component that is attached to the engine assembly.

EM.11 - EXHAUST SYSTEM



An exhaust manifold with integral catalytic converter is bolted onto both cylinder heads.

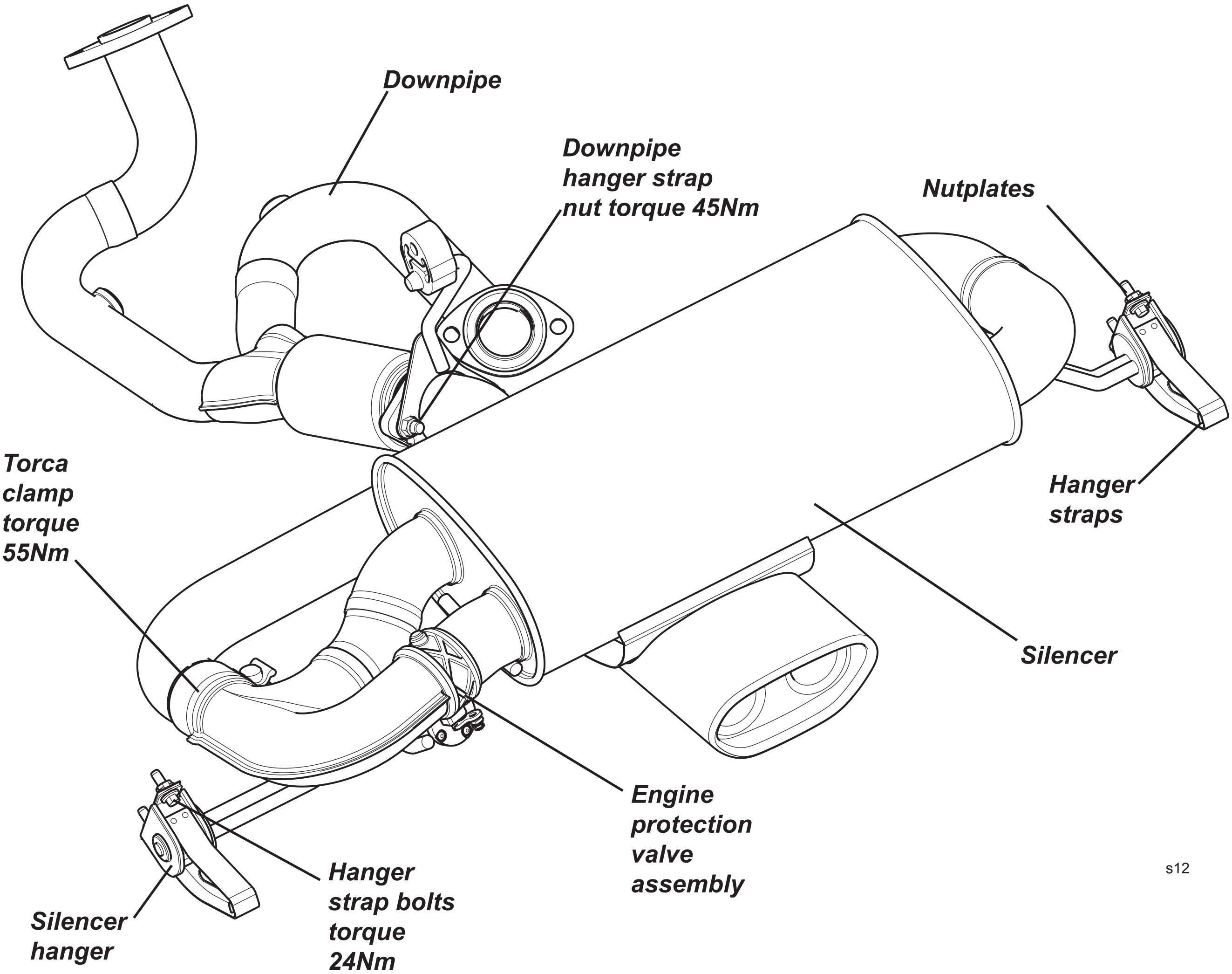
Pre-cat O2 sensors are bolted onto the top surface of both manifolds.

Post-cat sensors are bolted into a twin branch downpipe routed underneath the engines sump assembly which links both manifolds to a single exhaust silencer inlet which in turn branches into 2 separate inlet pipes (1 loud and 1 quiet) before entering the silencer body.

Exhaust gases flowing through the 'quiet' inlet pipe enter the resonator chambers of exhaust silencer before exiting via a single outlet pipe which in turn branch off into 2 tailpipes

Exhaust gases flowing into the 'loud' inlet pipe are normally restricted from entering the silencer by an integral flap valve assembly referred to as the Engine Protection Valve which in normally defaulted to the closed position. See section EM.11 for further information.

Exhaust Silencer



Removal
Remove the undertray/diffuser assembly – see AN.2.

Disconnect the engine protection valves vacuum hose from the actuator and position it away from any potentially hot components that may damage it.

Loosen the downpipe to silencer Torca clamp bolt

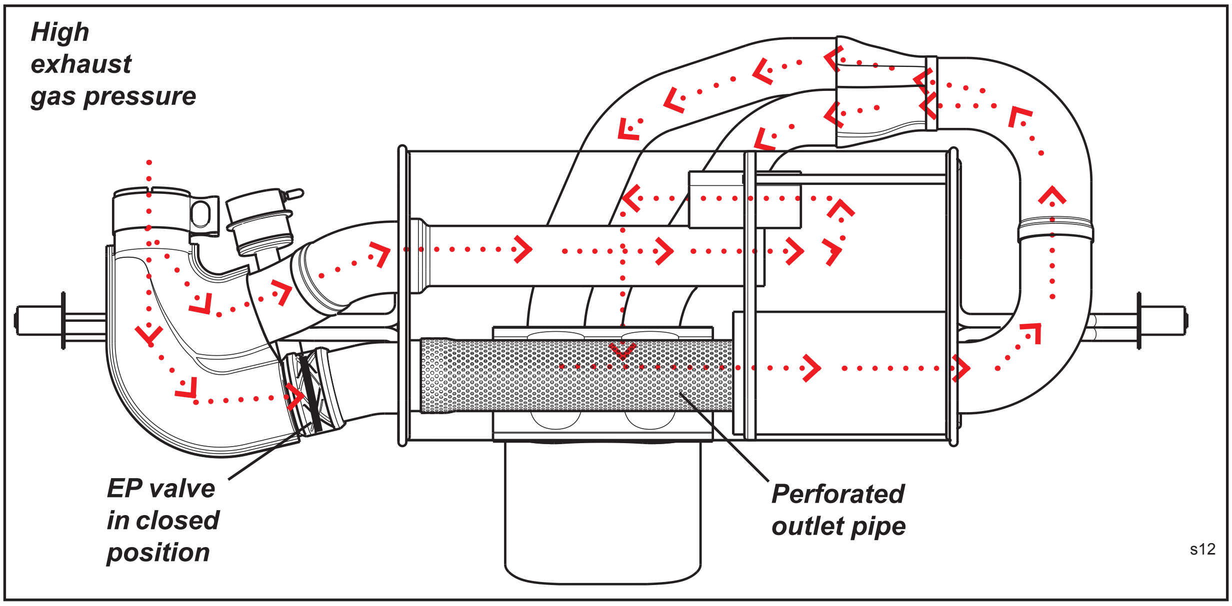
Taking care to support the silencer, remove the 4 M8 x 20 bolts securing the exhaust hanger straps to the subframe and retrieve their nutplates positioned on the other side of the subframe.

If necessary use a twisting/pulling motion to free the silencer from the downpipe and remove from the vehicle.

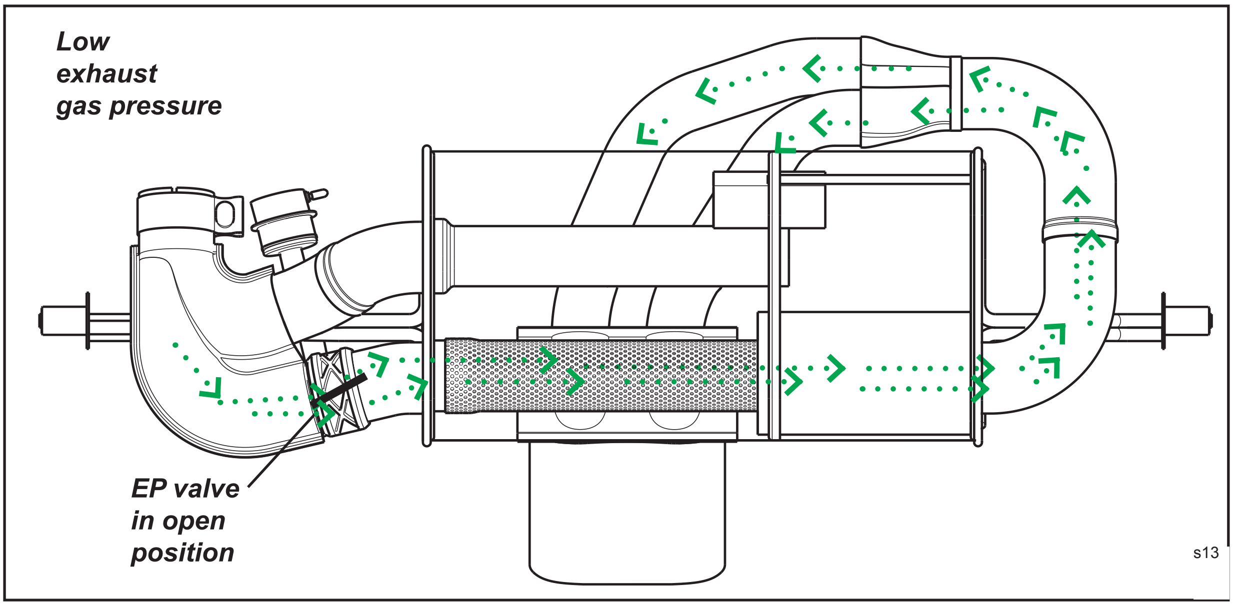
Refitment
Is the reverse of removal, please see illustration above for specific torque tightening figures.

EM.12 - ENGINE PROTECTION VALVE

The exhaust features two silencing routes for exhaust gases to flow through, depending upon the type of driving and mode selected.



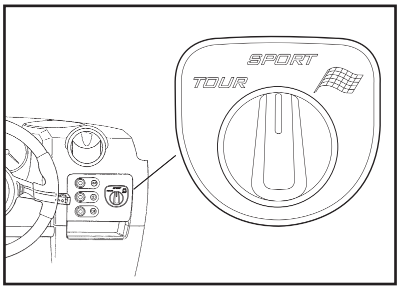
The exhausts primary flow path is through a multi chamber silencing system designed to reduce noise emissions from the exhaust gas. This silencing system generates excessive back pressure at higher engine rpm (and power) which could damage the engine. Therefore, Lotus has engineered a second flow path (by-pass system) that is controlled by a valve.



When this valve is open the exhaust gas passes through only a small part of the silencing system before exiting the tailpipes and with the reduced back pressure this offers, allows the engine to safely generate full power. This valve is known as the Engine Protection Valve (EP Valve).

The operation of this EP Valve is controlled by the engine management system, via a solenoid controlled vacuum system. The EP valve is sprung open, and during normal usage the vacuum is applied to the valve to close it. The vacuum generated in the intake system is stored in a vacuum reservoir in the air intake cleaner until it is needed.

The 3 or 4 mode Lotus DPM switch, when activated, will change to operation parameters of the valve, allowing it to be open more of the time. This switch is not intended for normal usage.

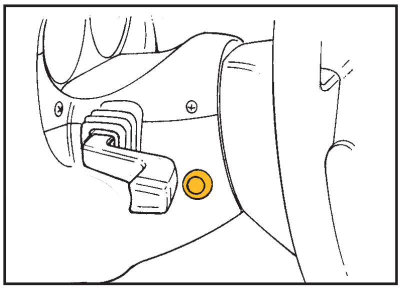


The EP valve has a spring to ensure that it fails open, to protect the engine, in the case of disrupted vacuum feed to the valve.

Nominally the valve remains closed up to 4700 rpm in normal operation, however it is open all the time when the Lotus DPM mode switch is activated past 'Sport' mode.

EP (Engine Protection) Valve Override Switch (If fitted)

The EP valve may be returned to the closed position whilst the vehicle is in ‘Race’ or Lotus DPM 'Off' mode by a momentary press of the override switch located on the left hand side of the steering column console. This may be required if driving the vehicle on a noise restricted track.



Alternatively if pressed whilst in ‘Tour’ or ‘Sport’ mode, the EP valve will open regardless of the vehicle road speed.

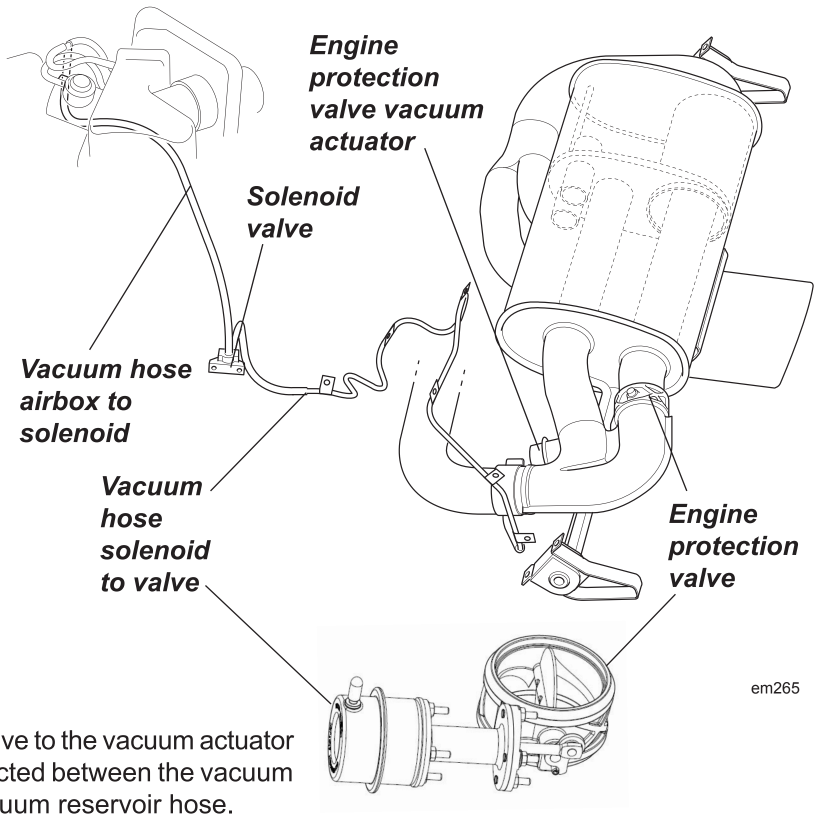
Note: Even if overridden, the EP valve will automatically open if the engine speed exceeds 5500rpm to reduce excessive exhaust back pressure. The EP valve will return to the closed position when the ignition is switched off.

Engine Protection Valve
The EP valve flap housing is integrally mounted to the exhaust systems bypass pipe and is not serviceable. Failure of the flap valve will require the renewal of the exhaust silencer assembly.

Testing the EP Flap
Before testing ensure that the exhaust is not hot and use any personal protective equipment as required.

The EP flap should be free to rotate within the bypass assembly. Disconnect the vacuum hose from the actuator and using light finger pressure attempt to rotate the flaps spindle arm. The spindle/flap should be free to turn within the bypass housing. If excessive force is required to rotate the flap within the housing then the rear silencer assembly will require replacement.

Solenoid Valve
The valve is mounted to the inner rear LH of the rear subframe by 2 M5 screws. The unit is powered via the rear ignition relay and activated by the Engine Control Unit (ECU).



Vacuum is drawn through the solenoid valve to the vacuum actuator assembly via a hose and ‘T’ piece connected between the vacuum switching valve to the air intake box vacuum reservoir hose.

Vacuum generated by the intake system overcomes the spring pressure within the vacuum actuator assembly closing the flap within the Exhaust Protection (EP) valve.

Vacuum Testing the Actuator
- Disconnect the vacuum hose from the actuator assembly.
- Connect a suitable vacuum tester to the actuator vacuum port and apply vacuum.
- The valve must close with a vacuum of less than -450mb applied to the actuator.
- The valve should remain closed with the vacuum applied.

If the actuator fails to operate the EP valve or fails to retain vacuum then it must be replaced.

If the EP valve and actuator are operating normally other sources of minor vacuum leaks or failure must be investigated such as:

- Inadequate sealing of the vacuum hoses or air intake plenum.
- Incorrect operation of the vacuum solenoid valve.
- Incorrect operation of the vacuum switching valve.

Actuator Valve Replacement

In the event that it is necessary to renew the original production vacuum actuator an Aftersales service level replacement is available which can bolted directly onto the valve housing, (please see exhaust section of Service Parts List for part number).

- Remove the rear undertray/diffuser assembly (see introduction section for further information).

- Ensure you are wearing appropriate personal protection equipment suitable for working around a potentially hot exhaust system.

- Remove the ‘E’ clip securing the actuator pushrod to the valves rod lever arm (please retain safely as it will be refitted to service level assembly).

- Disconnect the vacuum hose from the actuator and position it away from any potentially hot components that may damage it.

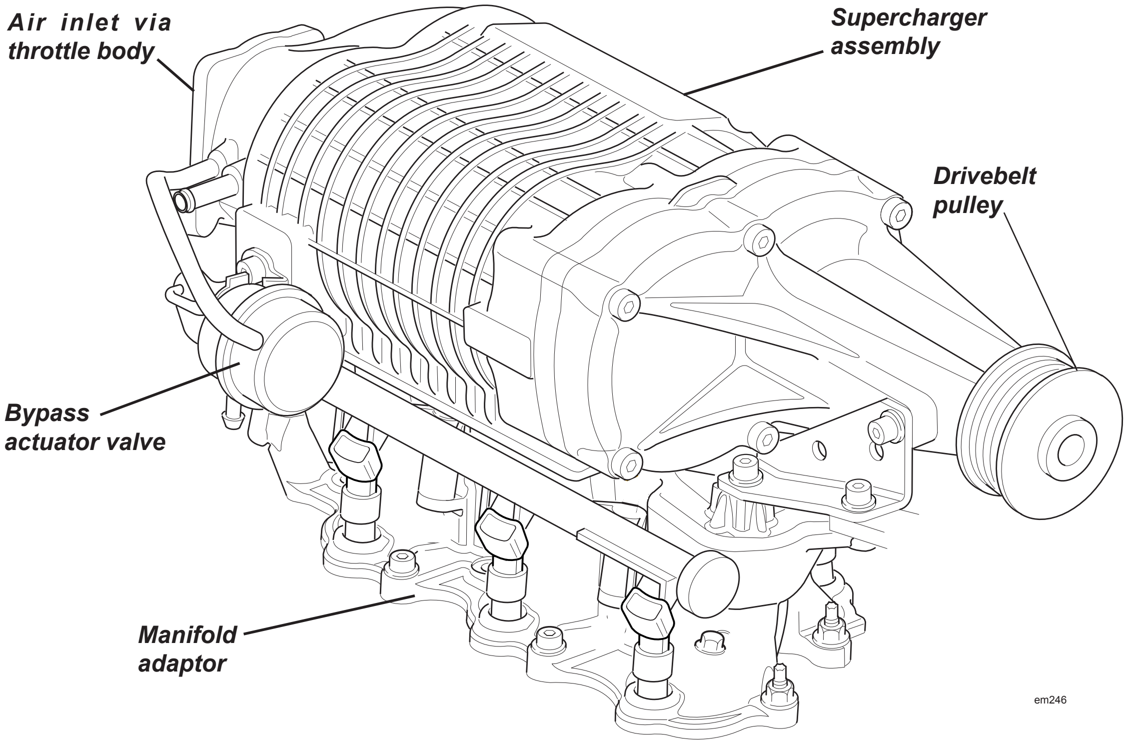
- Remove the 3 M4 nuts securing the vacuum actuator assembly to the extension housing and remove.

- Discard the old actuator valve.

Refit the service replacement valve

Refitment is reverse of removal.

EM.13 - SUPERCHARGER



The Exige S is equipped with a Harrop HTV1320 supercharger package utilising Eaton TVS technology™ .The supercharger is supplied with a lower manifold adaptor bolted to the engine cylinder heads.

Boost pressure is regulated to a maximum of 0.5 bar by a vacuum controlled integral by-pass actuator valve. The supercharger,

The net power output is 345 bhp @ 7000 rpm with 400 Nm of torque @ 4500 rpm. The supercharger is driven via an increased length auxiliary drive belt with modified bracket/idler assembly fitted to the engine to accommodate the revised pulley configuration.

The supercharger assembly cannot be serviced or repaired. The only items that can be replaced are the vacuum bypass valve, valve hose, inlet manifold adaptor and adaptor gasket. Failure of the supercharger assembly will require its complete replacement.

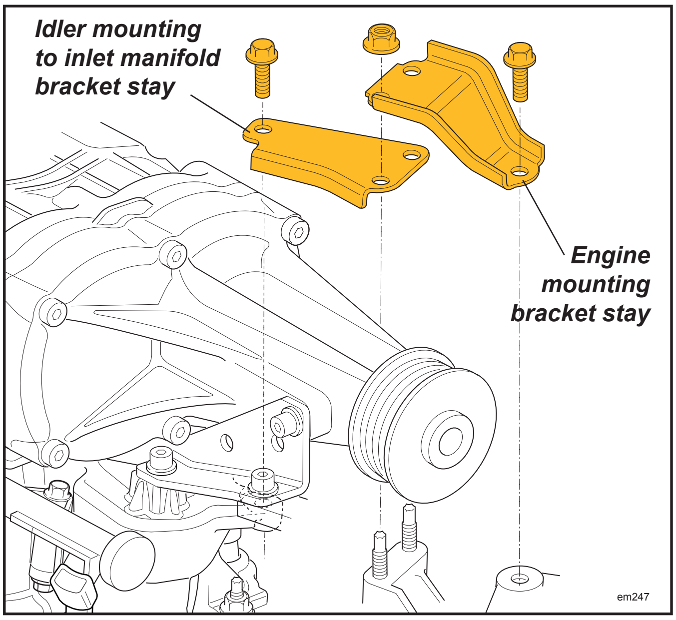
Supercharger Remove/Refit

Preparation:
Remove the engine, supercharger pully cover and engine bay panels; refer to sub-section EM.2 for further information.

To remove:
1. Depressurise the fuel system (see sub-section LD.3).

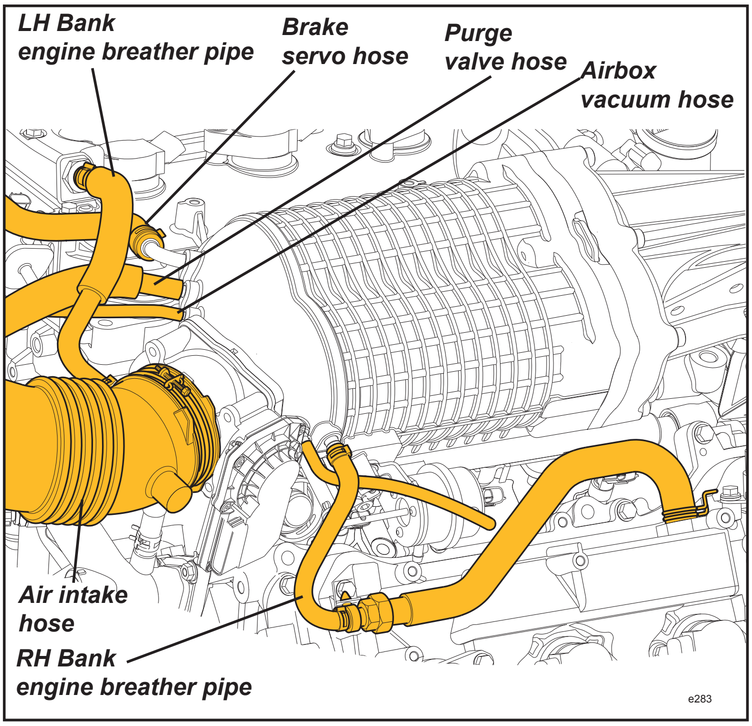
2. Remove auxiliary drive belt from supercharger pulley (see sub-section EM.5).

3. Remove the stay brackets securing the inlet manifold to the RH engine mounting assembly (bolt & nut torques are 25 Nm).



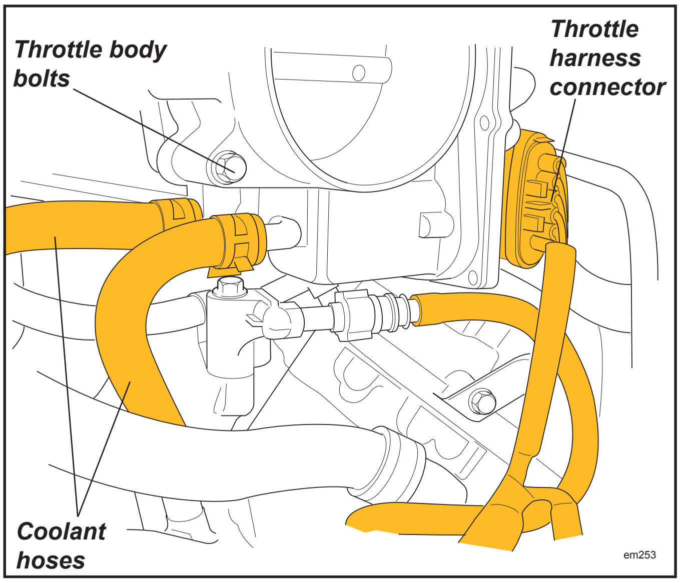
4. From the intake side of the supercharger plenum disconnect:

- Engine breather pipe to the LH cylinder head bank 2.
- Engine breather pipe to the RH cylinder head bank 1.
- Purge valve hose.
- Vacuum hose to airbox.
- Air intake hose to throttle body (also disconnecting RH cylinder head bank 1 engine breather pipe.
- Braking system servo hose.



5. Remove the 4 x M8 bolts (torque to 10 Nm) securing the throttle body to supercharger and pull the assembly away from the supercharger. (This will avoid unnecessarily disrupting of the coolant system by disconnecting the bypass hoses attached to the underside of the throttle body),

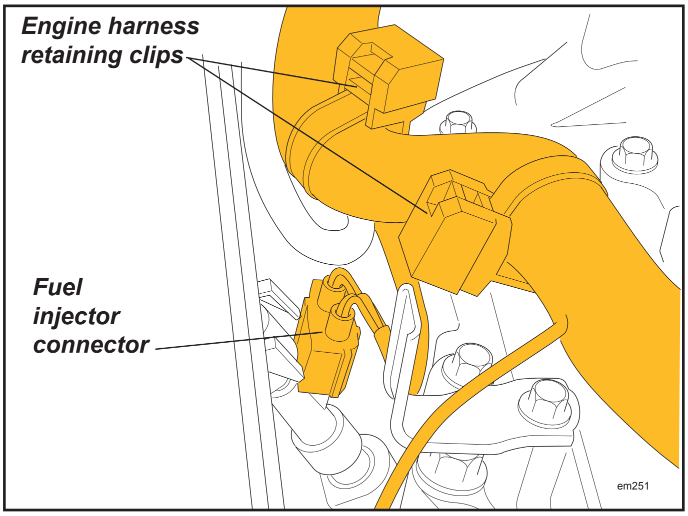
6. Disconnect the fuel pipe at the fuel injector rail (see sub-section LN.8 and Toyota CD disc T000T1516F for full procedural information).



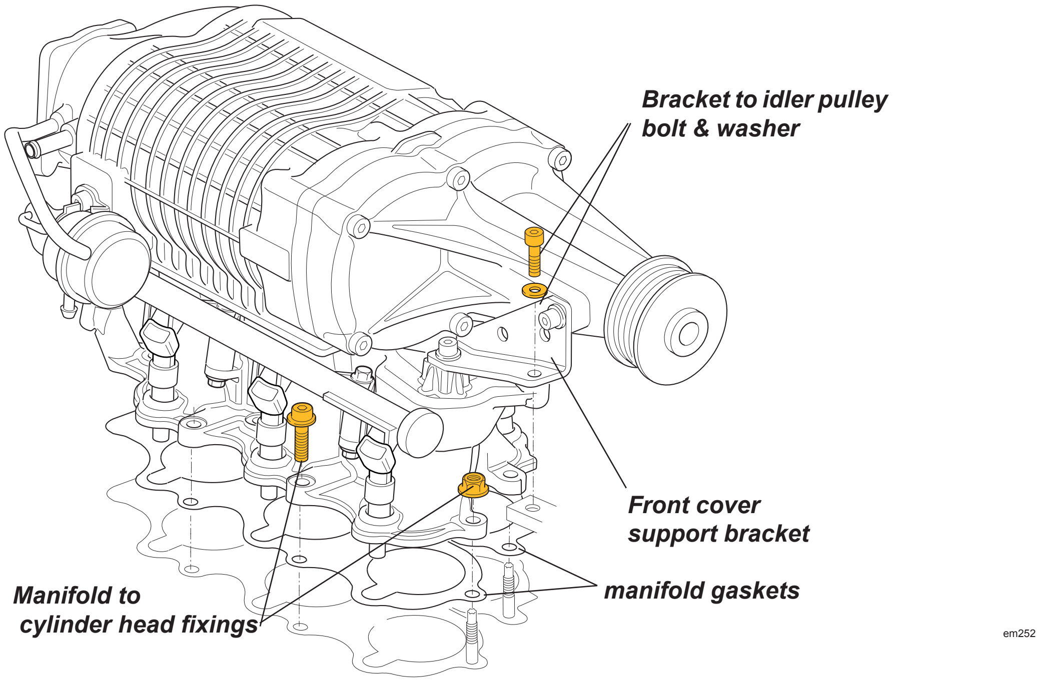
7. Disconnect the 6 fuel injector connectors and pull the engine harness off of its retaining clips on the LH cylinder head and move out of the way from the supercharger/manifold area.

8. Remove the M8 flanged bolt (torque to 20 Nm) securing front cover support bracket to idler pulley assembly.

9. Uniformly loosen and remove the 4 bolts and 6 nuts securing the inlet manifold to the cylinder heads.



10. Remove the supercharger/inlet manifold assembly.

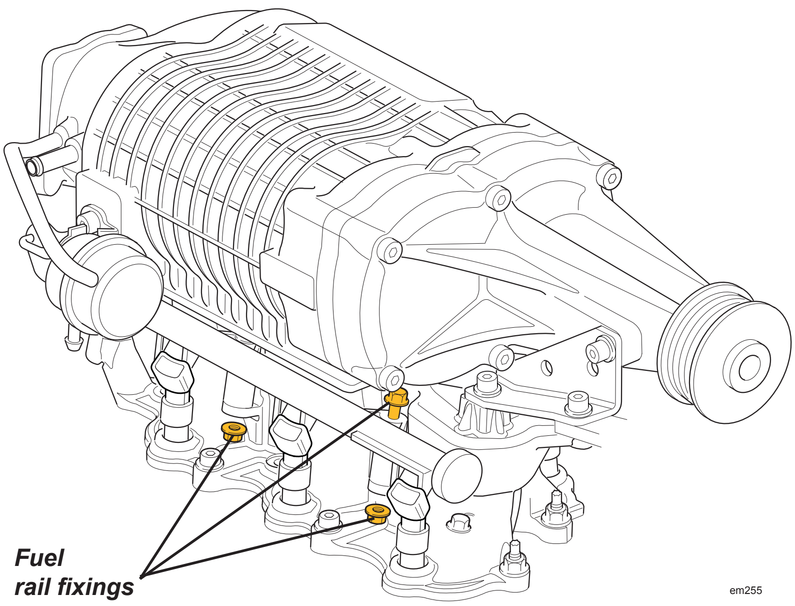


To refit:

Refit is the reverse of removal except:

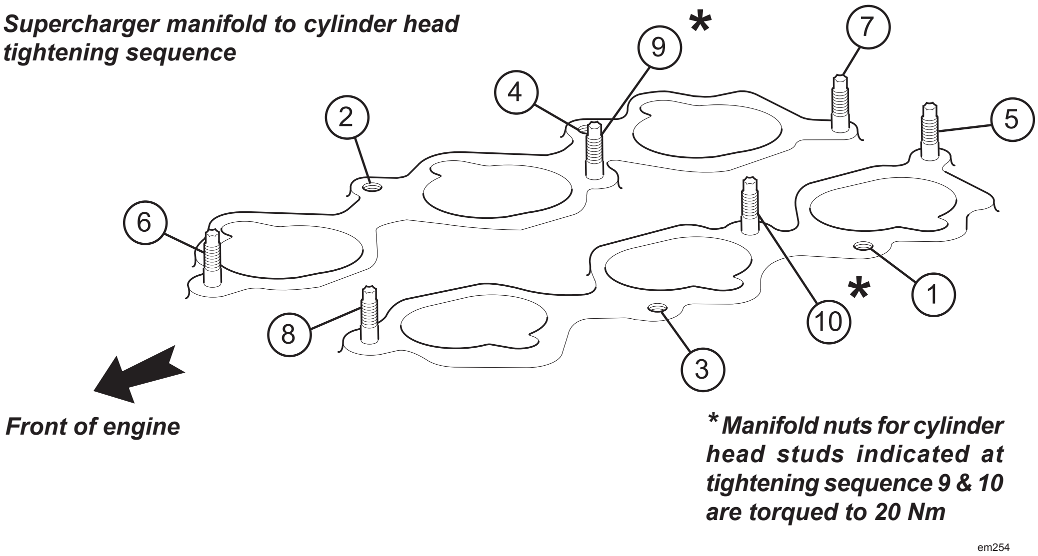
If fitting a new supercharger, transfer the support bracket to new assembly. (Torque the fixings to 20 Nm)

- Fit a new fuel injector insulator into each manifold adaptor injector port and transfer the fuel injectors & rails to the new assembly.
- Place the fuel rails and injectors into position on the manifold adaptor placing the injectors into position in their respective injector ports.
- Retain the fuel rail into position onto the manifold adaptor with their fixings (but do not tighten at this stage).
- With the fuel rail and injectors in position, ensure that the injectors can rotate smoothly. If not, reinstall the injectors with new 'O' rings.



- Tighten fuel rail fixings to 16 Nm.
- Remove the inlet manifold gaskets from cylinder head, ensure the mating faces of cylinder head and manifold adaptor are clean and free from debris and fit new gaskets.
- Install the supercharger assembly on the cylinder heads.

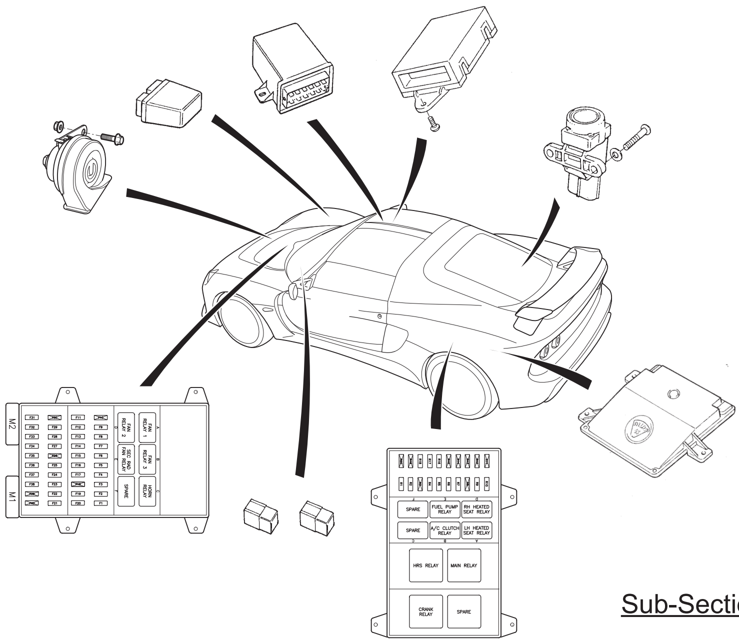
- Install the manifold carefully into position uniformly tightening the 4 manifold bolts and 4 outer nuts to 25 Nm, the 2 inner manifold nuts are torqued to 20 Nm. (Tightening sequence pattern shown below).



- Refit other auxiliary components in reverse order that they were previously removed.

ELECTRICS

SECTION MV



MV.1 VEHICLE SECURITY ALARM

The Lotus Exige S is fitted as standard with a PFK 457 immobiliser/alarm which includes the following features:

- Lotus branded transmitter key.
- U.K. approval to Thatcham category 1.
- 'Dynamic coding' of the transmitter keys; Each time the transmitters are used, the encrypted rolling code is changed to guard against unauthorised code capture.
- Passive activation of immobiliser, central locking and alarm system.
- Ingress protection using sensing switches on the latches of both doors, the front body access panels, and the engine lid/tailgate.
- Selectable cockpit intrusion sensing using a microwave sensor.
- Self powered siren to maintain protection if the vehicle battery is disconnected.
- Personal protection by 'on demand' activation of the siren.
- Emergency alarm override and transmitter key programming using an alarm/owner specific Personal Identification Number (PIN).

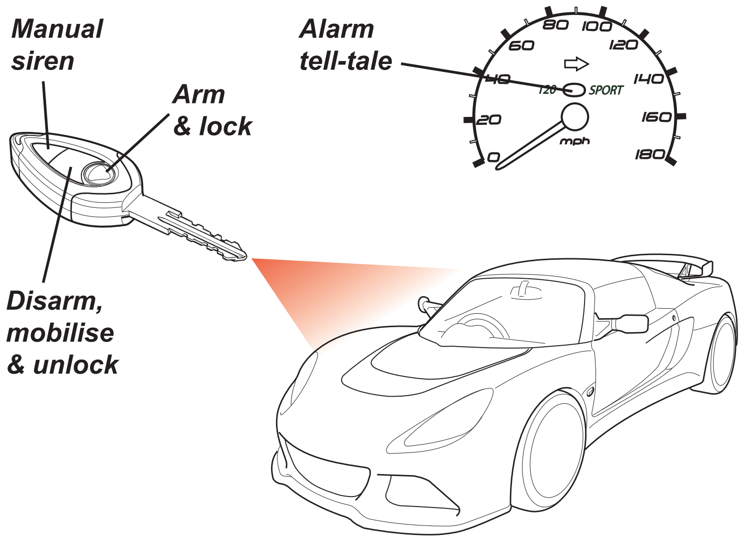
Transmitter Keys

Two Lotus designed and badged transmitter keys are provided with the car, and combine a mechanical key blade with a three button transmitter unit incorporated into the key head.

Note: the transmitter is detacheable from the key head allowing either one or both to be renewed as service replacements.

The mechanical key operates the ignition switch, emergency manual door locks and fuel filler cap.

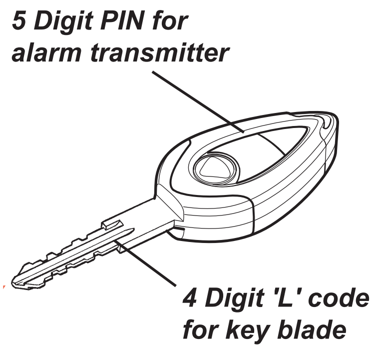
The transmitter operates the electronic immobiliser, alarm system and the central locking.



The two transmitter keys should be kept separate, and a replacement obtained immediately after any loss to ensure that a spare is always available.

Key/Alarm PIN Identification

The 4-digit code for the mechanical key, the unique serial number of the immobiliser/alarm, and the vehicle owner's 5-digit alarm Personal Identification Number (PIN), are supplied on plastic tags attached to the key ring of a new vehicle.



In order to allow replacement transmitter keys to be programmed, it is essential that these numbers are recorded and kept safely by the owner with the vehicle documents.

It is also recommended that the dealer stress this issue to their customers and, in the interests of customer service, keep a record in their own database.

Obtaining Key or Alarm Identification Numbers

In the event that the customer has not retained the plastic tags with key/alarm details and dealer records have not been kept, then the information can be obtained from the Lotus Cars Aftersales Department using Archive

Search - Security Codes Form number A4-A-5301.

The form lists details of information required to complete a successful search as well as costs for the services and contact details within the Lotus Aftersales Department, the form can be downloaded from the Lotus Dealer Portal at: http://dealers.lotuscars.com. From the homepage go to the Aftersales category and select the form from the 'Download Form Documents' section.

Replacement Keys
Uncut Keys: Additional or replacement keys may be purchased uncut/uncoded from the Lotus Aftersales Department under part number A120H0008S and will be supplied with a blank mechanical blade for copy cutting to an existing key.

Cut Keys: Alternatively, for authorised Dealers and Repairers reporting directly to the Lotus Cars Aftersales Department, a key cut to its 4 digit 'L' key code may be ordered from Bolton Lock Company, using Lotus Key Cutting/Transmitter order form LSL482 the form can be downloaded from the Lotus Dealer Portal at: http://dealers.lotuscars.com. This can also be downloaded from the Lotus Dealer Portal, from the homepage go to the Aftersales category and select the latest version of the form from the 'Download Form Documents' section.

Note: Authorised Dealers and Repairers reporting to a Lotus Distributor should contact their relevant parts personnel to order cut keys

Vehicle Lock Set Renewal
The complete vehicle lock set can be renewed whilst still retaining the original alarm systems 5-digit PIN. Lock sets can be obtained directly from the Lotus Cars Aftersales Department, refer to the Lotus Service Parts List for the latest/correct part number(s).

A replacement lock set will have a new 4 digit 'L' key code, please ensure to retain this new number on any relevant database, inform the vehicle owner of the new number as well as the Lotus Cars Aftersales Department using Notification - Lock/Alarm Replacement Form number A4-A-5304. This can also be downloaded from the Lotus Dealer Portal, from the homepage go to the Aftersales category and select the latest version of the form from the 'Download Form Documents' section.

Replacement Transmitter Fobs
A replacement transmitter fob can be obtained directly from the Lotus Cars Aftersales Department, refer to the Lotus Service Parts List for the latest/correct part number.

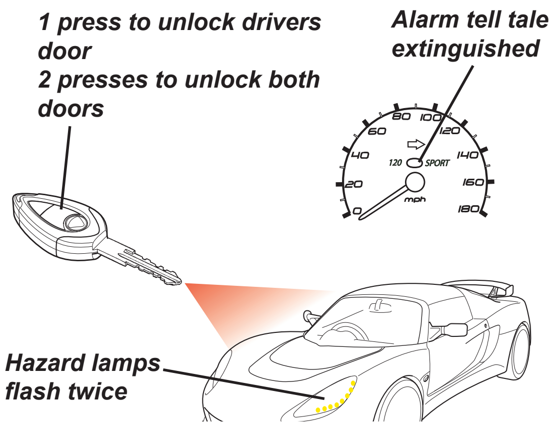
Note: this will require matching to the vehicles alarm system using the 5-digit PIN,

Further information of all key and alarm fob availability as well as any specific ordering procedures can be obtained by downloading the 'Key & Alarm Transmitter Guide' document number LSL483. The latest version can also be downloaded from the Lotus Dealer Portal.

Alarm Operation

Disarming the Alarm/Unlocking: When approaching the car, it is likely that the vehicle is locked and the alarm armed. The alarm red tell tale lamp in the speedometer face will flash once every 3 seconds.

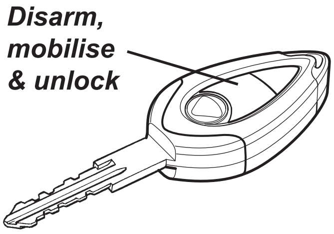
To disarm the alarm and unlock the doors:
- Press the central, unlock, button on the transmitter key. The first press will unlock just the driver's door. Two presses in quick succession will unlock both the driver and passenger doors.
- This command will be acknowledged by a double flash of the hazard lamps.
- The engine will be mobilised (see below).
- The interior lamp will fade on, and remain lit for up to 2 minutes (if set to the 'courtesy' position).
- The alarm tell tale will be extinguished.



If a door is not opened within 2 minutes, the doors will passively re-lock and the alarm system re-arm.

Passive Immobilisation
In order to provide a measure of automatic vehicle security, independent of any driver initiative, the system will 'passively' immobilise the engine's cranking and fuel pump circuits after the ignition has been turned off for 40 seconds, or a similar period has elapsed since the last mobilising command.

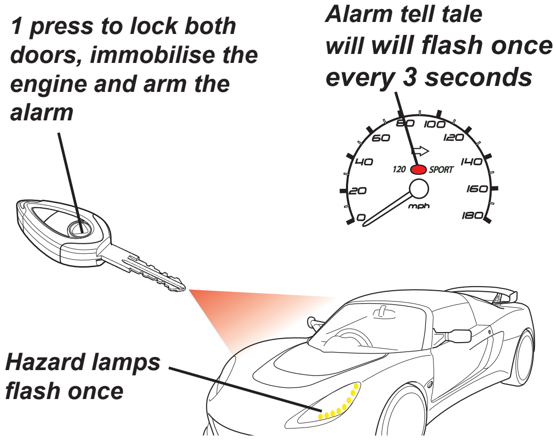
With the ignition off, the alarm tell tale will indicate that immobilisation is in effect by briefly flashing every second. With ignition on, immobilisation is indicated by a continuously lit tell tale.



To mobilise the car (i.e. allow engine starting) with ignition on or off, press once the transmitter centre button; the alarm tell tale will be extinguished.

Arming the Alarm/Locking the Doors
To lock the doors and arm the alarm, remove the ignition key, close both doors, and check that the engine lid/tailgate and body front access panel are secure:

- Press once the raised logo button on the transmitter fob.
- This command will be acknowledged by a single flash of the hazard lamps.
- Both doors will be locked, the engine immobilised and the alarm system armed. A settling period of 40 seconds must expire before the ingress sensors become active.
- The alarm tell tale will repeatedly triple flash.



Note:
i) If the system is armed when a door is not fully shut, three **triple** beeps will sound as a warning and the doors will not be locked. Opening a door will *not* trigger the alarm.
ii) If the system is armed when the engine lid/tailgate or the front access panel is not fully closed, three warning **double** beeps will be heard, and the doors will not be locked. Opening a door in this instance *will* trigger the alarm.
iii) If one transmitter is used to disarm the alarm, and a second transmitter to re-arm, a system test mode will be initiated, and operational variations will occur. Allow an undisturbed period of 2 minutes to elapse to restore normal operation.

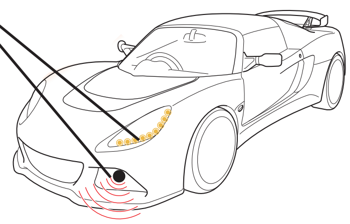
When fully armed, and after the settling period of 40 seconds has expired, the alarm will be triggered by any of the following actions:

- Interruption of the car battery power supply or siren cables.
- Energising the ignition circuit ('hot wiring').
- Opening a door;
- Opening the engine lid/tailgate or a front access panel.
- Movement detected within the cabin (unless de-selected).

If the alarm is triggered, the hazard warning lamps will flash and the siren sound for a period of approximately 30 seconds before closing down and resetting, ready for any further triggering input.

If a trigger is continuously present (e.g. door left open), the alarm will repeat for a maximum of eight 30 second cycles before excluding the triggering sensor for the remainder of the armed period.

To silence the siren, press once the central, disarm button on the transmitter key. If necessary, press a second time to disarm the alarm.



Alarm Tell Tale Summary

Tell tale off;	Alarm disarmed, engine mobilised.
Tell tale on;	Immobilised with ignition on.
Brief flash every second;	Immobilised with ignition off.
1 flash every 3 seconds.	Alarm armed.

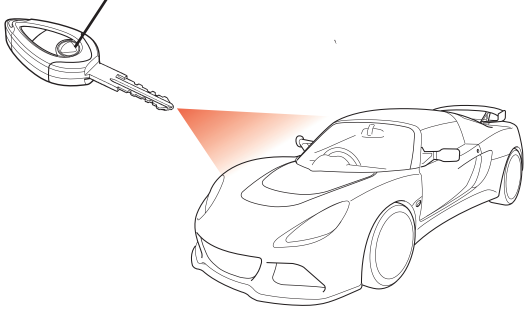
Cockpit Intrusion/Interior Movement Sensor
A microwave sensor is mounted behind the cabin rear bulkhead trim panel, and is able to detect substantial physical movement within the cockpit, and trigger the alarm. Microwave transmissions are blocked by metal objects, so it is important not to shield the signal by placing such items on the bulkhead ledge.

Disabling the Interior Movement Sensor
If an animal is to be left in the vehicle, or if for any other reason it is desired to exclude the interior movement sensor when the alarm is set,

Disabling procedure:
- Press once the transmitter logo button in the normal way to set the alarm, and then press a second time (within 2 seconds) to exclude the interior movement sensor.

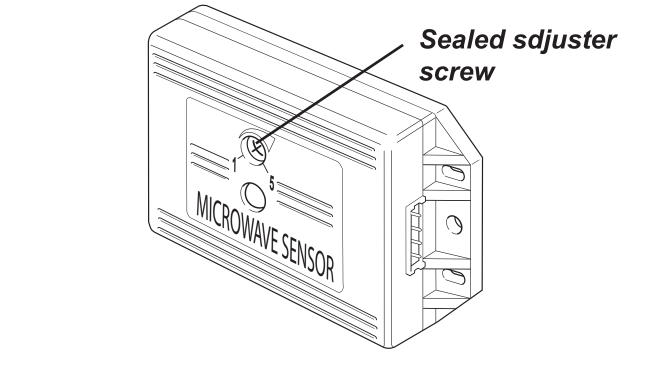
- A single beep will be heard as confirmation.

Note: This exclusion will be automatically cancelled when the alarm is disarmed.



Microwave Sensor
The sensitivity of the sensor is factory set for the Exige, and the adjustment screw has been sealed and so cannot be adjusted.

The sensor is accessible after removal of the cabin rear bulkhead trim panel, refer to service notes section VE.11 for further information



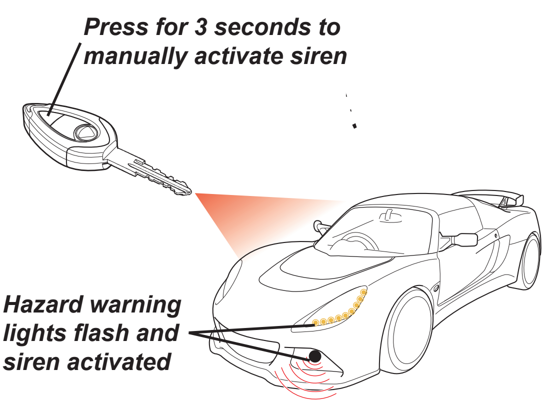
INTERIOR MOVEMENT SENSOR

Manual Activation of Siren
If desired it is possible to manually activate the siren at any time when the ignition is off.

- Press for 3 seconds the transmitter auxiliary (3rd) button.

- The siren will sound, and the hazard lamps flash for a period of 30 seconds.

- To stop the siren, press once any of the transmitter buttons.



Note: Manual siren activation will not affect the status of the alarm arming.

Transmitter Key Battery Replacement
The transmitter keys will normally operate within a range of 5 metres from the car, but this may be reduced by the presence of other radio signals in the vicinity.

The transmitters are powered by a long life 3V Lithium battery, type CR2032, which with normal use should last for 3 years.

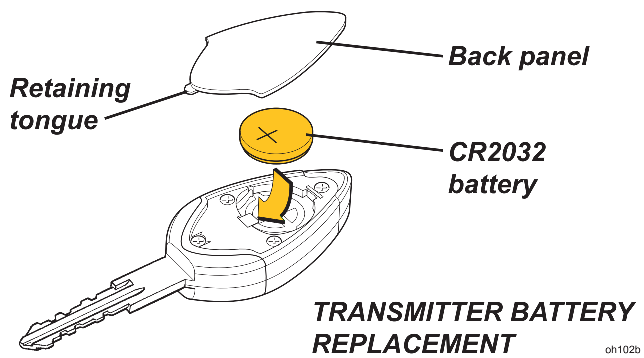
To ensure continuity of operation, it is recommended to renew the batteries every 12 months

To replace battery:
- Using a small screwdriver, prise open the back panel of the key case using the slot by the keyring hole.

- Remove the old battery and wait for 10 seconds before inserting the new battery with +ve sign uppermost, and holding the battery only by the periphery.

- Refit the back panel, engaging the retaining tongue, and pressing firmly to engage the clip.

- The transmitter should now operate normally.



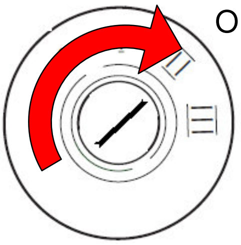
TRANSMITTER BATTERY REPLACEMENT

Disconnecting the Vehicle Battery
In order to prevent the alarm being triggered, before disconnecting the vehicle battery, ensure that the alarm is disarmed. Please refer to sub-section MV.10 for futher information.

Emergency Disarming/Mobilising
If the key head transmitters are lost or damaged, the alarm system owner's 5-digit alarm PIN may be used to disarm the alarm and start the engine **provided that** the cabin is accessible, and a correct mechanical key blade is available.

Note that if the alarm is armed, accessing the cabin, or turning on the ignition will trigger the alarm until completion of this emergency process.

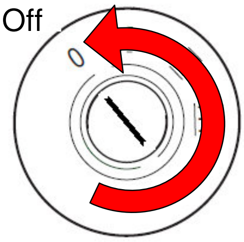
Emergency procedure:



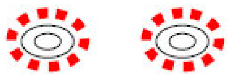
On

Turn on the ignition. The alarm tell tale will light.

Off

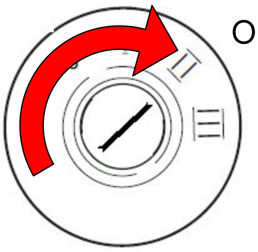


Within 10 seconds, turn the ignition off; the tell tale will begin to flash. After a number of flashes corresponding to the first digit of the PIN, for example, 23121.



= 23121

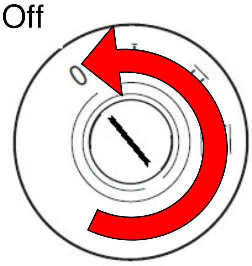
1 2



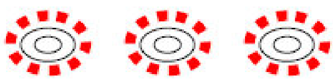
On

Turn on the ignition

Off



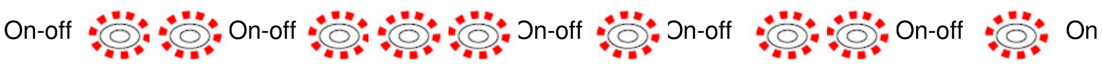
Turn off the ignition and after a number of flashes corresponding to the second digit of the PIN, turn on the ignition.



= 23121

1 2 3

Repeat this process until all 5 digits have been completed.



2 3 1 2 1

If the PIN is entered correctly, the alarm will now be overridden and the engine mobilised.

Note that 10 flashes correspond to a zero digit.

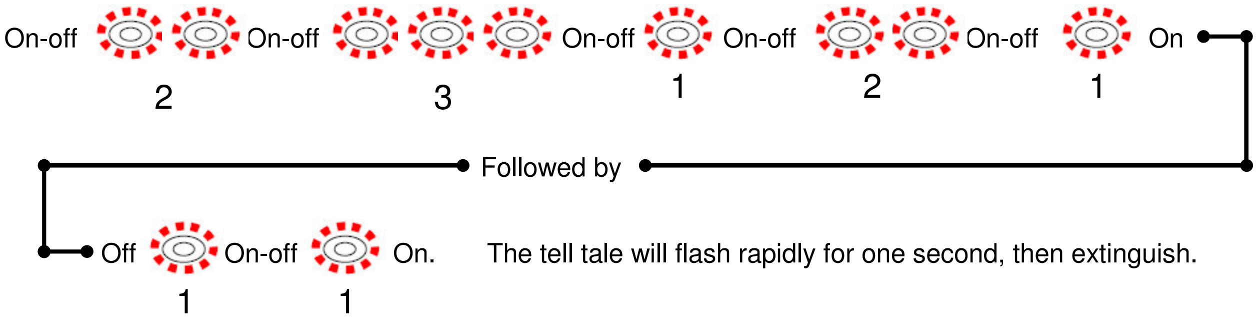
Programming Additional Transmitters
A maximum of 6 transmitters may be programmed to the car, any thereafter overwriting the first to have been programmed.

Their are 2 steps to the programming procedure which are:

1. Setting the vehicle alarm system into emergency disarming/mobilising mode as shown on previous page
2. Programming additional transmitters

Procedure:

Enter the PIN as detailed in the emergency disarming process previous, followed by the additional two digits 1, 1.



The tell tale will flash rapidly for one second, then extinguish.

Within 8 seconds, press any button on the transmitter to be programmed.
The tell tale will then pulse rapidly and the siren will beep.
Within 10 seconds press any button on the next transmitter to be programmed (if applicable), and repeat this process for all remaining transmitters.
When all transmitters have been programmed, wait for 10 seconds, or turn off the ignition.

Note that 10 flashes correspond to a zero digit.

To disable a lost or stolen transmitter from the system, use the above procedure to programme 6 transmitters, if necessary repeatedly reprogramming the same transmitter if less than 6 programmed transmitters are to be used.

Trigger Report Back and Feature Selection

A facility is provided to identify the source of an alarm triggering event (trigger report back), as well as allowing certain features of the system to be selected or de-selected. The same procedure described above to input a PIN is used, but in this case to input the programming code '123'; the tell tale will then flash rapidly for 1 second, then remain lit. Commencing within 10 seconds, continue this procedure to input the two digits of the feature code, after which the tell tale will flash rapidly for 1 second then beep once or twice to indicate the new status of that feature; one for 'ON', twice for 'OFF'. Selection will alternate each time that feature code is entered. Note that within 10 seconds, a second feature code (or repeat) may be selected from this point by entering only the 2-digit code. To exit programme mode, simply wait for 10 seconds.

Feature	*Code*	*Default*	*1 Beep*	*2 Beeps*
Revert to defaults	123 00			
Trigger report back	123 11	see below		
Unlock with ignition	123 33	OFF	ON	OFF
Lock with ignition	123 34	OFF	ON	OFF
Selective door unlock	123 41	ON	ON	OFF
Audible tones*	123 61	OFF	ON	OFF
Lock with auto re-arm	123 87	ON	ON	OFF
Door open audible warning	123 88	ON	ON	OFF

* When selected, a single beep will sound when the alarm is armed, and a double beep when disarmed. To silence for a single activation, press briefly the transmitter auxiliary (3rd) button prior to pressing the arm or disarm button.

Trigger report back: After the code 12311 has been entered, the tell tale flashes out a code(s) to indicate the source of the alarm trigger:

No. of flashes	*Triggering sensor*
1	Microwave movement sensor
2	Door, bonnet or boot lid
3	Ignition energisation
4	Manual siren activation

Quick Test

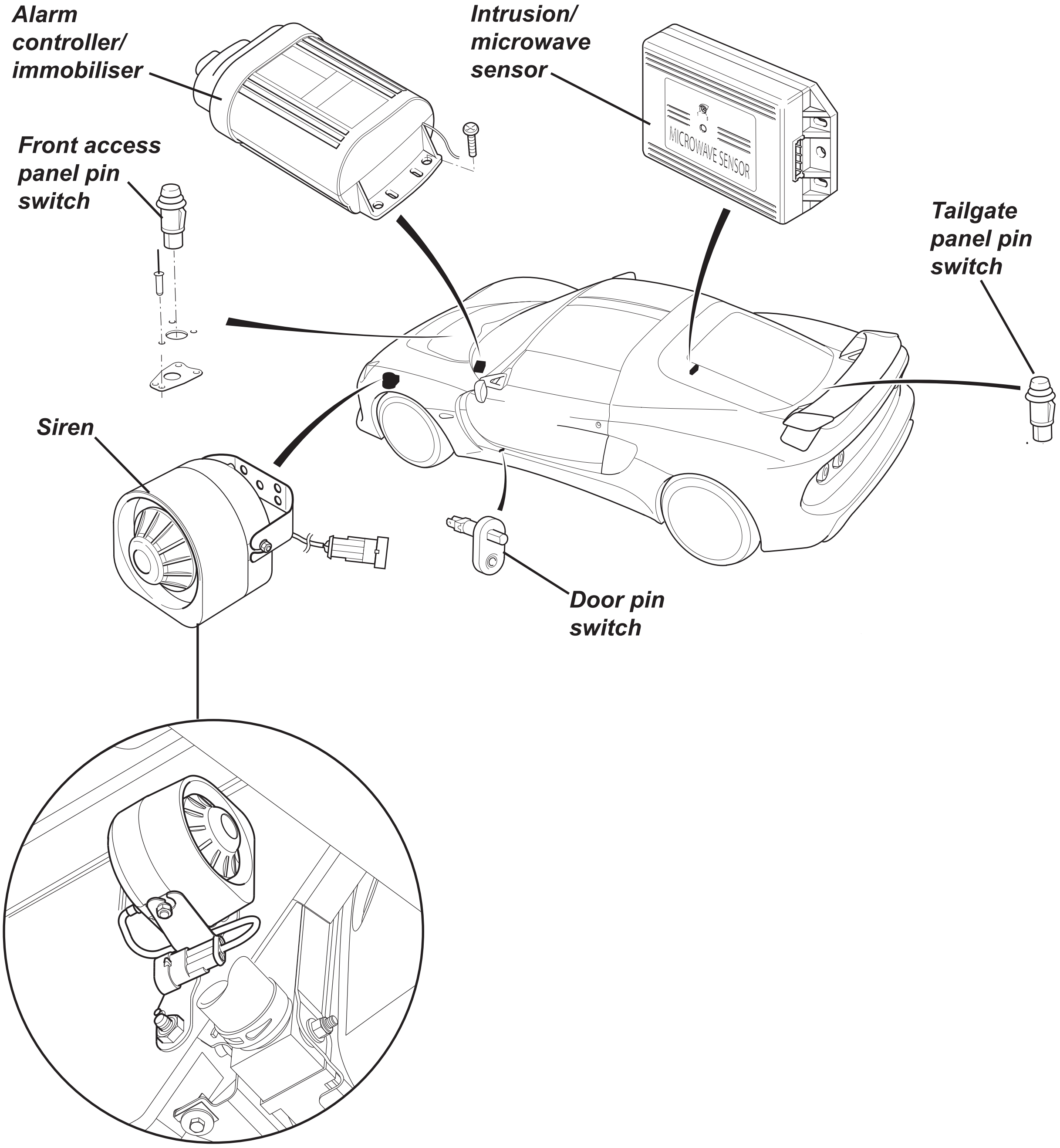
To facilitate testing of the alarm system, the unit can be placed into a 'Quick Test' mode by arming the alarm with one transmitter key, and disarming with another. In this mode, the system will shorten the siren time to 2 seconds, the immobiliser arm time to 5 seconds, and the settling time to zero. To exit this mode, simply wait for 2 minutes without any further inputs.

Note that in Quick Test mode, any movement detected by the microwave sensor will trigger only the tell tale and not the siren. The 2 minute timer will not be extended.

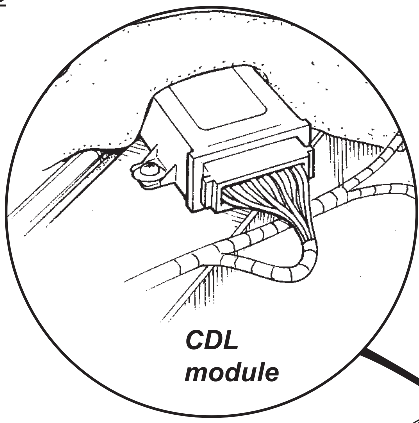
Component Location

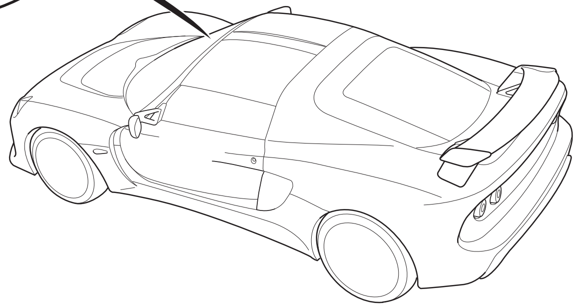
The alarm system components are located as follows:

- Electronic Controller/Immobiliser: Mounted on top of the scuttle beam at LH extreme end. Accessible after removal of fascia top.
- Siren Unit: Mounted on LH underside of inner crash structure. Accessible only after removal of front undertray.
- Microwave Sensor: Mounted centrally on cabin rear bulkhead, beneath trim panel.
- Engine Lid Sensor: Mounted on luggage compartment bulkhead, alongside latch.
- Front Access Panel Sensor: Mounted on brackets fixed to topshell at outboard edge of aperture.
- Central Door Locking: Mounted on top of the scuttle beam at RH extreme end. Accessible after removal of fascia top, see next page for details.



MV.2 - CENTRAL DOOR LOCKING

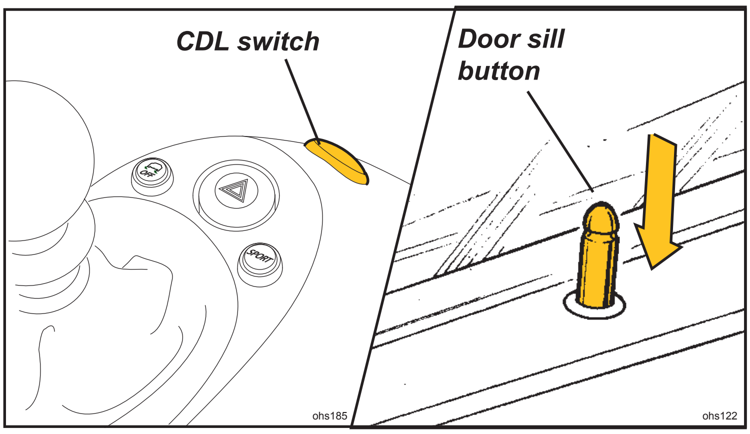




The CDL (Central Door Locking) module is mounted on the top of the scuttle beam at the extreme end on the RH side, accessible after removal of the fascia top trimmed panel and face level vent trunking. Refer to servide notes section VE.8 for futher information.

A battery feed for the CDL system is provided from the main fusebox, fuse number 34 (7.5A).

The central door locking (CDL) operates on the driver's and passenger's doors in conjunction with the security alarm system, which includes CDL circuitry in the PFK 457 alarm controller. See sub-section MV.1 for information on locking the vehicle and alarm activation.



If it is desired to lock the doors from inside the vehicle, a CDL rocker switch is provided on the front of the gear lever shroud which should be pressed to the right to lock both doors with or without the ignition switched on.

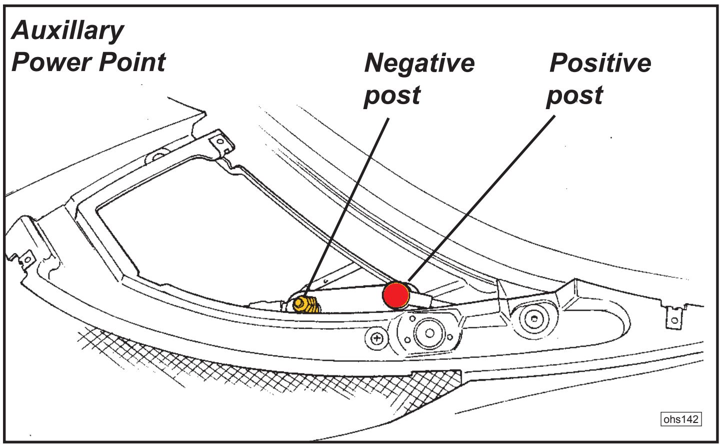
Alternatively, the doors can be locked individually by depressing the button at the rear end of each door sill. Note that whichever locking method is used, the doors will be 'deadlocked' such that the interior door release handles are inoperative.

See sub-section MV.1 for information on unlocking the vehicle and alarm de-activation. Alternatively, from inside the car, press to the left the rocker switch on the gear lever shroud to unlock both doors, or raise the sill button on each door.

Note that in the event of a vehicle collision which causes the safety inertia switch to be tripped, the doors will automatically be unlocked.

Notes:

- In the event of a flat vehicle battery, the central door locking will not operate.
- The doors can be unlocked from outside only after removing the front clamshell access panel, (see service notes section BT.2 for further information) and providing a 12 volt supply to the auxiliary power point.
- To lock the car with a flat or disconnected battery, use the mechanical key in each exterior door button to disconnect each release button from the latch. This technique does not 'deadlock' the interior release handles, but does allow continued key access to the car until restoration of battery power.

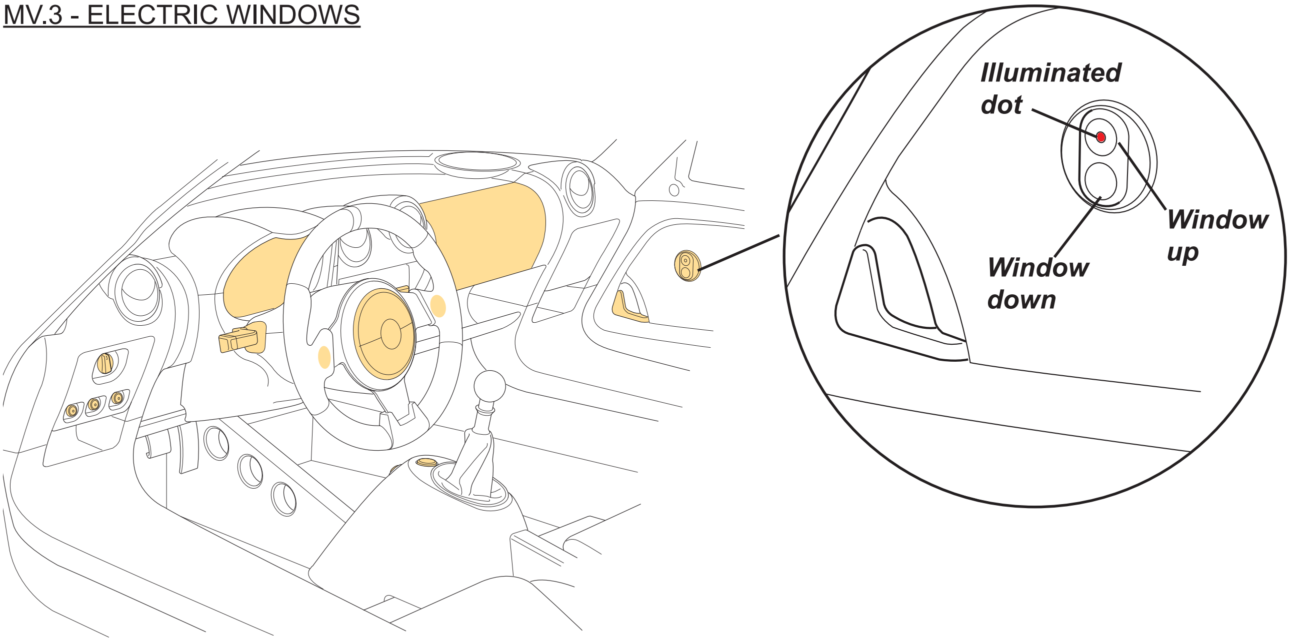


- To deadlock the car with a flat vehicle battery, or without the use of the transmitter or mechanical key, close and lock one door using the sill button, and for the second door, hold the exterior release button pressed in and depress the sill button before closing the door. Access is now available only on restoration of electrical power.

Door Locking Actuator

A CDL actuator is screw fixed to the door shell below the latch mechanism, and uses a link rod which passes through the innermost hole on the latch lever, before continuing upwards to the door sill button. For replacement details, refer to sub-section BT.12.

MV.3 - ELECTRIC WINDOWS



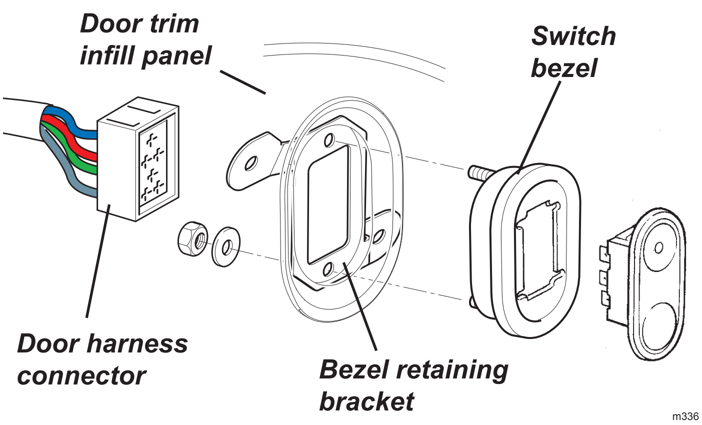
Switches for the electric windows are mounted in the front of the door trim infill panels, and are operative only with the ignition switched on. To help locate the switches in the dark, an illuminated dot is provided in the 'up' button which glows amber when the lights are switched on.

To lower a window, switch on the ignition and press the lower, dished end of the switch in the relevant door. Release the switch to stop window movement. To raise a window, press the upper, domed end of the switch. The electric window lift mechanismuses an electric motor and winder drum driving a steel cable around top and bottom guide pulleys to a lift block. The window glass is fixed to the lift block which is guided by a vertical rail.

The door harnesses to support CDL and electric windows are routed to the scuttle area via a grommet in the 'A' post area ahead of the door hinge post. Power for the window motors is provided via two 20A fuses from the main fusebox, (F6 drivers, F7 passengers).

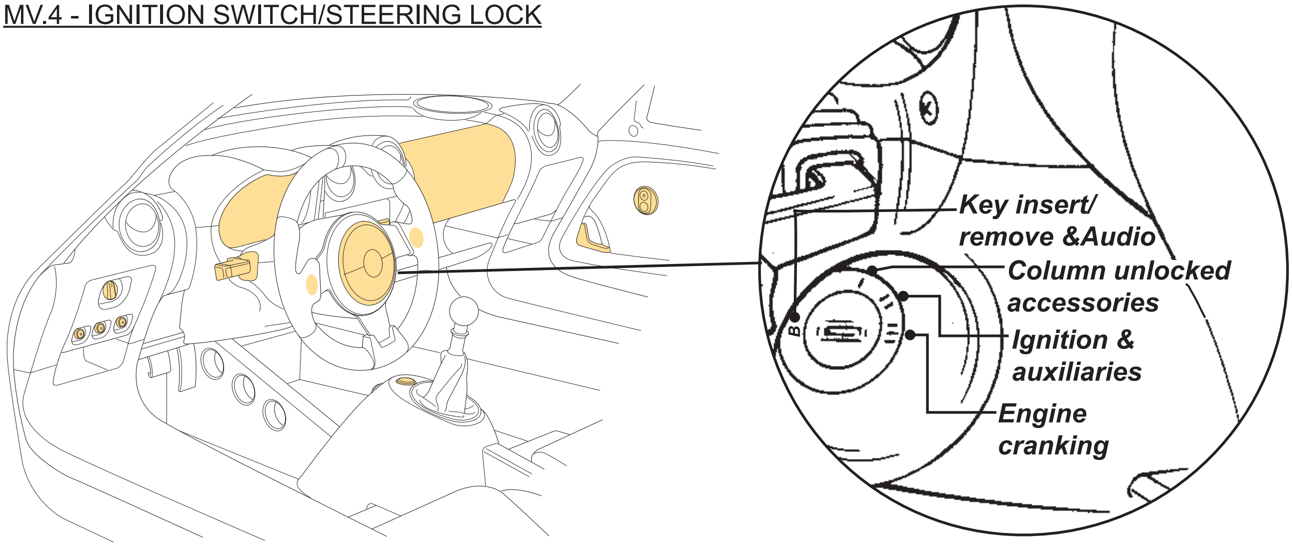
Also refer to section BT.11 for additional information on the electric door window motor and mechanism.

The window switch is fitted within a plastic bezel, retained with integral spring clips. The bezel is in turn fixed to a retaining bracket clamped to the rear surface of the door trim insert panel.



Although it may be possible to remove the switch from the bezel in situ, the door harness may restrict how far the switch can be withdrawn, therefore the door trim, complete with infill panel and switch should be removed from the door and the door harness connector disconnected from the back of the switch. The switch can then be removed from the bezel trim. Refer to service notes section VE.1 for further information on door trim panel removal.

MV.4 - IGNITION SWITCH/STEERING LOCK



Ignition Switch/Steering Lock
Located on the right hand side of the steering column. With the key out of the switch, the steering column is locked, and the following electrical circuits will function:

- Locking and alarm system.
- Horns.
- Hazard warning lamps.
- Sidelamps and headlamps.
- Interior lamps.
- Automatic operation of cooling fans and re-circulation pump.

B With the key inserted into the switch at position 'B', the audio system is available in addition to the above.

I To unlock the steering, turn the key clockwise to the 'I' position. If the key is reluctant to turn, wriggle the steering wheel to ease the load on the steering lock. At this 'accessories' position, the following electrical circuits will function in addition to those above:

- Door windows.
- Windscreen wiper and washer.
- Interior fan.
- Cabin auxiliary power socket.

II Turn further clockwise to the 'ignition' position to activate all remaining electrical systems (note that some circuits require the engine to be running). Refer also to automatic immobilisation details in sub-section MV.1.

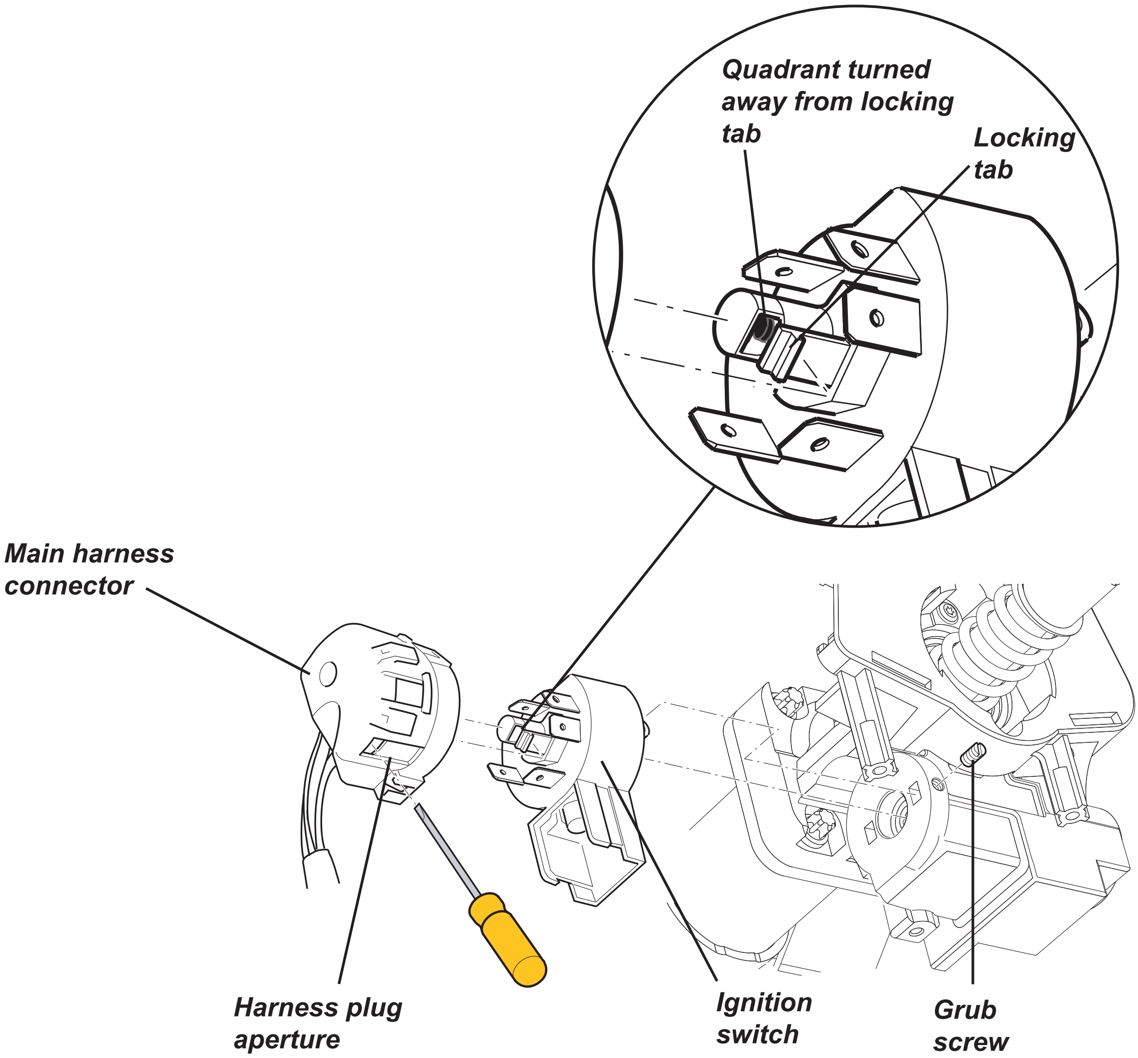
III Ensure the key is fully pushed in the lock and turn further clockwise to 'III' against spring pressure to operate the starter motor. As soon as the engine starts, allow the key to return to position 'II'

DO NOT leave the ignition switched on for long periods without the engine running, since although the engine ignition system itself draws no current when the engine is stopped, a battery drain will occur through other circuits even when auxiliary equipment is not being used. For security reasons, and to guard against battery drain, always remove the key when leaving the car.

⚠ WARNING:
- **Do not push or tow the car unless the key is first used to unlock the column and is then left in the lock.**
- **Never withdraw the key until the vehicle is stationary.**
- **To reduce the risk of theft, or danger to a child remaining in the vehicle, always remove the key when leaving a parked car.**

Ignition Switch

To reduce the risk of unwanted attempts of bypassing the ignition circuit, the main harness connector to the switch can only be removed (without causing damage) with the key inserted into the lock barrel and turned to position ‘I’



Removal:

Remove the upper and lower steering column shrouds, refer to service note section VE.4 for further information.

Turn the key to position 'I',

Note: Turning the key rotates an internal shaft within the switch. A quadrant on the end of the shaft is now turned away from the side of the switches integral harness plug connector locking tab. This allows the locking tab to be pushed in releasing it from the harness connector retaining lug.

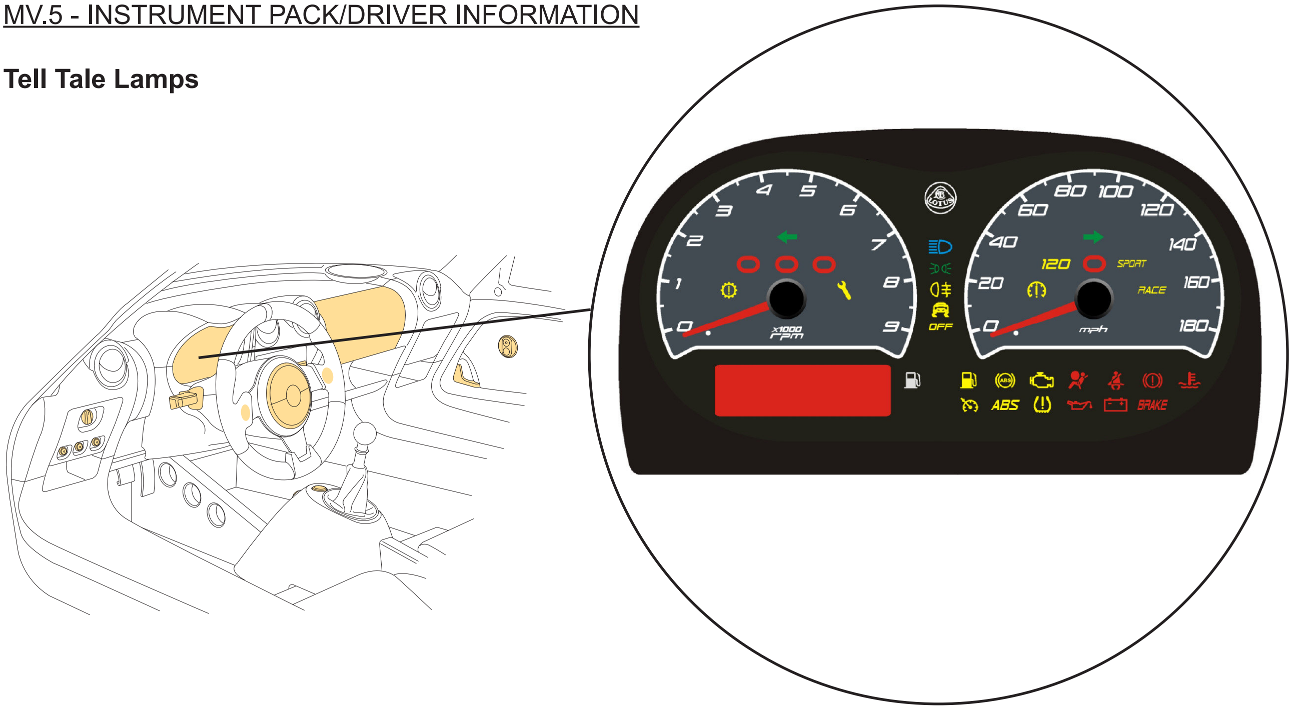
Using a suitable screwdriver, carefully feed it into the aperture in the harness plug as shown in the illustration.

Carefully push the screwdriver against the locking tab whilst gently pulling the harness plug away from the switch.

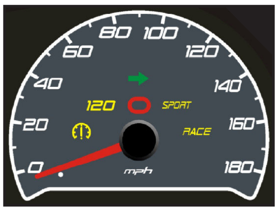
The switch can now be removed by releasing the grub screw retaining it to the column housing.

MV.5 - INSTRUMENT PACK/DRIVER INFORMATION

Tell Tale Lamps



A block of tell tale lamps is incorporated into the instrument cluster to indicate the operational status of various systems.



Speedometer
Displays road speed in either MPH or km/h according to market.

Tachometer
Indicates engine speed in revolutions per minute. Three red tell tale lamps in the tachometer illuminate in sequence at high rpm (dependant of gear engaged) to warn that the maximum engine speed is being approached.

The Exige S maximum continuous engine speed is limited to 6600 rpm once normal running temperature is reached. Very short bursts up to 6800 rpm are allowed during maximum acceleration through the lower gears (or 7200 rpm in Sport mode).

A 6400 rpm rev limit is imposed on a cold engine to protect against possible damage. The use of wide throttle openings and/or high rpm before normal running temperature has been reached will result in premature wear and should be avoided.

NOTICE: The use of wide throttle openings and/or high rpm before normal running temperature has been reached should be avoided. The engine management system graduates the maximum engine speed for a cold engine, in order to reduce possible damage and wear from a delinquent driving style.
- Do not run the engine continuously at its maximum speed.
- The engine is not protected from over speeding caused by erroneous or premature down changing, the consequences of which could be catastrophic failure not covered by the New Vehicle Warranty.
- Use of maximum engine speed and this tell tale facility should be restricted to occasions when maximum acceleration is required. Overuse will compromise powertrain service life.

Recalibration of Instrument Display

The speedo and tacho needle 'zero' positions will occur during a three second period following ignition switch on, but if a needle becomes 'stranded' outside of the re-calibration range, the following procedure should be followed.

With the vehicle stationary;

- Remove fuse F15 located in the main fusebox;
- Open driver's door;
- Press and hold trip reset button on column shroud;
- Turn on ignition;
- Turn off ignition and refit fuse F15.

Tell Tale Lamps

In order to check that the warning systems are operative, all the tell tale lamps (except the 'security' tell tale; see Vehicle Security Alarm) should light for about six seconds following ignition switch on. If any lamp should fail to light, it is possible that the bulb or warning circuit may be faulty.

If a tell tale light fails to illuminate following ignition switch on, flashes constantly or is permanently lit whilst driving, then this may indicate a fault in the operation of the system concerned.

Do not ignore any illuminated warning lights.

High RPM Tell Tales

Warns that the maximum engine speed is being approached in the current gear. As maximum rpm is approached the tell tales will light in the following left to right sequence:

- one red light
- two red lights
- three rapidly flashing lights

When exploiting maximum acceleration, gearchange upshifts should be made immediately the three flashing lights appear.

NOTICE: Use of maximum engine speed and this tell tale facility should be restricted to occasions when maximum acceleration is required. Overuse will compromise powertrain service life.

Left/Right Hand Turn Indicators

Illuminates when the turn indicators are operating or hazard lights are turn on. If the indicators stay on or flash fast, check the operation of the indicator lamps immediately.

Rear Fog Lamp Tell Tale

Illuminates whenever the rear fog lamps are operating (see rear fog lamp switch).

Side lamp Tell Tale

Illuminates whenever the side lamps are operating, and will remain illuminated when the dip and main beams are activated.

Main Beam Tell Tale

Illuminates whenever the headlamp main beams are operating.

120 Km/h Tell Tale (Market specific)

Security Alarm Tell Tale

The security tell tale is sited in the speedometer face, and indicates the status of the immobiliser and alarm. For full details of the vehicle security system, refer to sub-section MV.1.

'Sport' Mode Tell Tale
Illuminates whenever ‘Sport’ mode has been selected**,** refer to sub-section MV.7 for further details.

'Race' Mode Tell Tale
Illuminates whenever ‘Race’ mode has been selected - *applicable to 'Race' pack models only,* refer to sub-section MV.7 for further details.

Electrical Fault Tell Tale
The Engine Control Module (ECM) is also used to manage various related electrical systems, and is able to detect certain types of fault, which may or may not be apparent to the driver. If such a fault is detected, which has no detrimental effect on exhaust emissions (see MIL tell tale information).

Lotus Dynamic Performance Management (Lotus DPM)
Whilst driving the tell tale may flicker amber, indicating that the Lotus DPM has been triggered and electronic intervention is taking place; the tractive limit has been reached and driving style should be modified accordingly. See Service Notes section JM.10 and sub-secton MV.7 for further information. If however the warning lamp illuminates constantly, a fault has been detected, and (Lotus DPM) will not be enabled.

Lotus Dynamic Performance Management (Lotus DPM) 'Off'
This lamp will glow amber if the (Lotus DPM) has been manually switched off, and sub-secton MV.7 for further information.

> ⚠ **WARNING: (Lotus DPM) should always be active when driving on public roads in normal conditions.**

Low Fuel Level
Will illuminate when only a single segment of the fuel gauge bar graph remains, representing approximately 5 litres the amber tell tale will flash. Refuel at the next opportunity.

Cruise Control
Illuminates whenever cruise control is in standby mode or enabled.

Anti-lock Braking System (ABS)
If the lamp remains lit, or comes on whilst driving, a fault in the ABS is indicated. However the vehicle retains conventional servo-assisted braking. Heavy braking, or braking on slippery surfaces may cause one or more wheels to lock and result in reduced steering response and possible loss of control.

The car may continue to be driven with appropriate care and anticipation, but should be checked and repaired at the earliest opportunity. Also refer to Service Notes section JM.10 for further information.

Malfunction Indicator Lamp (MIL)
The engine Malfunction Indicator Lamp (MIL) is provided to warn the driver that the engine management system has detected a fault which may result in increased noxious emissions from the exhaust. In order to minimise emissions and potential engine damage, various operational limitations may automatically be applied.

i) If the MIL lights continuously whilst driving, immediately reduce speed and adopt a moderate driving style. Seek Lotus dealer advice without delay and avoid all unnecessary journeys.

ii) If the MIL flashes, an engine misfire has been detected which is likely to cause overheat damage to the catalytic converter.

Slow down immediately and be prepared to stop.
- If the MIL then stops flashing, and is lit continuously, proceed with caution and seek dealer advice.
- If the MIL continues to flash, stop the vehicle as soon as it is safe to do so, and switch off the engine. Seek Lotus dealer advice.

NOTICE: Continuing to drive the car with a flashing MIL may cause overheat damage to the catalytic converters and surrounding bodywork.

⚠ WARNING: Continuing to drive the car with a flashing MIL may cause an engine bay fire.

Tyre Pressure Monitoring System

Also referred to as TPMS, for limited markets only. Will indicate when if any tyre pressure fall below 75% of the recommended value.

Oil Pressure

Illuminates to warn of low oil pressure and should extinguish as soon as the engine is started. If the lamp fails to go out after engine start up, or comes on when the engine is running, stop the engine immediately and do not restart until the cause has been investigated and rectified.

NOTICE: Continuing to run the engine with the oil tell tale lit could cause major engine damage or seizure.

⚠ WARNING: Continuing to run the engine with the oil tell tale lit could result in loss of car control and a crash. You or others could be killed or seriously injured.

Airbag

The tell tale will illuminate for approximately 6 seconds following ignition switch on. If the lamp remains lit, or comes on at any other time, a fault in the airbag or pre-tensioned seat belt system is indicated, which should be rectified without delay.

⚠ WARNING: If the airbag tell tale is lit, the airbags may not inflate correctly in a crash, or may inflate without warning; or the pre-tensioning seat belts may not perform correctly. To reduce potential injury to driver and passenger, the airbag system should be repaired as soon as possible.

Battery Charging

If it lights any time when the engine is running, the battery is not being charged, which may be due to a broken auxiliary drive belt, or an electrical fault. Stop the car as soon as safely possible and turn off the engine. The auxiliary belt also drives the engine water pump, without which function the engine will overheat very quickly.

⚠ WARNING: Do not, under any circumstances, allow the battery to become completely discharged by continuing to drive, as this may result in the vehicle being stranded in a dangerous position.

Seat Belt

The lamp will flash for about 6 seconds following ignition switch on as a reminder that both driver and passenger should always wear their seat belts, no matter how short the journey. The lamp will continue to flash if the driver's seat belt is not fastened accompanied by a warning buzzer if the vehicle speed exceeds 13mph (20kph).

The tell tale and buzzer will remain active until the driver's seat belt has been fastened. Variations may apply dependent on local market legislation.

Brakes

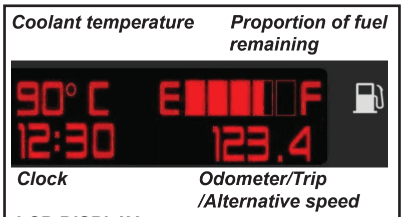
This tell tale will illuminate with the ignition switched on whenever the parking brake is applied. Each time the parking brake is released, check that the tell tale is extinguished.

With the parking brake released, if the tell tale should light at any time after the check period, stop the car immediately, as the circuit has detected a dangerously low level of brake fluid in the master cylinder reservoir. The car should not be driven until the fault has been identified and rectified.

⚠ WARNING: If the tell tale remains lit when the parking brake has been released, the footbrake may not be working properly. Stop the car immediately if it is safe so to do, and do not continue until the fault has been rectified. Continuing to drive could cause a crash and result in death or serious injury.

Coolant Temperature
The initial tell tale illumination colour is blue until the engine coolant reaches normal operating temperature at which time the tell tale will extinguish. The tell tale will then illuminate red in colour if coolant temperatures exceeds 113°C in order to prompt closer monitoring of high temperatures. Also see Service Notes section KR for further information on engine cooling.

LCD DISPLAY
A liquid crystal display (LCD) panel is located within the instrument panel in order to display fuel level, coolant temperature, total mileage, trip functions and alternative speed. The panel is blank until the ignition is switched on.



LCD DISPLAY
(Non SPS option shown)

Auto Shutdown
After 20 minutes of inactivity and with the key in the ignition off position (see page 26), the (LCD) display will automatically power itself down. The display will power up when the ignition is turned to the on position or if certain driver operated controls are activated such as the side lamps (The alarm tell tale will still continue to illuminate even if the pack has powered down).

Fuel Contents Display
An indication of the level of fuel in the tank is displayed in the form of a bar graph to the right hand top of the (LCD) panel. When completely full (approximately 43.5 litres {9.6 U.K. gal}), the display will display six red segments. As the fuel level falls, the segments will gradually disappear from the right hand side of the display. The remaining segments represent an approximation of the remaining fuel.

NOTICE: Do not allow the tank to run completely dry, as this could damage the catalytic converter and fuel pump. Any such consequence would not be covered by the New Vehicle Warranty.

Coolant Temperature Display
The engine coolant temperature is not displayed until it reaches 70°C. At that time the coolant temperature tell tale (blue in colour during engine warm up) will extinguish and the temperature display will appear at the upper left hand of the (LCD).

If the displayed temperature exceeds 113°C, the coolant temperature tell tale will illuminate red in colour in order to prompt closer monitoring of high temperatures and will continue to display coolant temperature up to 120°C.

Note: The running temperature will fluctuate a certain amount as the operating conditions change, and during periods of idling or in heavy traffic, the temperature may rise to over 100°C, with the cooling fans switching on at half speed at approximately 98°C and at full speed at approximately 103°C.

As the pressurised cooling system has a boiling point of over 120°C, only if the temperature approaches this level need there be any cause for concern. If this should occur, allow the engine to idle for a few minutes whilst monitoring the temperature, and if it continues to rise, switch off and seek qualified assistance.

NOTICE: After a heavy snowfall, ensure that the radiator cooling outlet grilles in the front body are cleared of snow before driving the car, or overheating may occur.

Odometer
An odometer (total distance recorder) reading is displayed at the bottom right hand corner of the panel, and is calibrated in the same units (miles or kilometres) as is the speedometer.

Trip Distance/Speed Display/Odometer
Note: The display will always default to the alternative speed display option when the ignition is initially turned on regardless of the last option selected during the previous drive cycle. The bottom right portion of the LCD panel may be cycled through the following displays:

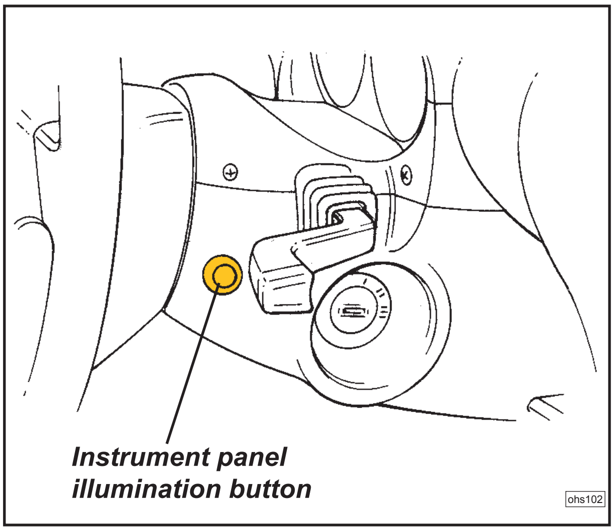
- Trip distance.
- Digital road speed in alternative units to those indicated by the analogue instrument (either mph or km/h).
- Odometer.

To cycle, one at a time, through these three displays, briefly press the instrument panel illumination button on the right hand side of the steering column shroud,

Note: This button also adjusts the brightness of the instrument and heater/air conditioning and panel illumination if held pressed when road speed is selected.

Trip distance: Units displayed are common to the analogue speedometer scale, and range from 000.0 to 999.9.

To reset to zero; when the trip function is displayed, press the button on the column shroud for longer than 1 second.



Clock
Time clock setting: To adjust the 24 hour time clock cycle the instrument panel illumination button until the Odometer reading is displayed. Press the panel illumination button on the column shroud again for longer than 1 second. The hour display will then flash.

- Repeated brief presses of the button will increment the hour figure. Pressing the button for longer then 1 second will store the hour setting and start the minute display flashing.
- Further brief button presses will increment the minute figure.
- When the correct time is displayed, press the button for longer than 1 second to store the setting and start the clock.

Instrument Panel Illumination Button

Removal:
1.Remove the upper and lower steering column shrouds, refer to service note section VE.4 for further information.

2.Disconnect the main harness multiplug connector from the instrument panel illumination button lead.

3.Release the switch retaining nut from the rear of the lower steering column shroud panel, allowing the switch/ harness to be withdrawn from the front of the panel.

Refitment:
Is the reverse of removal.

Instrument Pack Serviceability and Applications
Instrument packs are supplied as either MPH or KPH part numbers with the unit of speed printed onto its face. It is a sealed non-serviceable component pre-installed with non-erasable base software to make them compatible with any Exige model by VIN range and options fitted.

Instrument pack removal/renewal
If it is necessary to remove or renew an instrument pack then it is highly recommended that before removing the existing unit that you note down its variant code and current mileage, as this information will have to be downloaded onto the replacement pack using the Lotus TechCentre vehicle configuration screens.

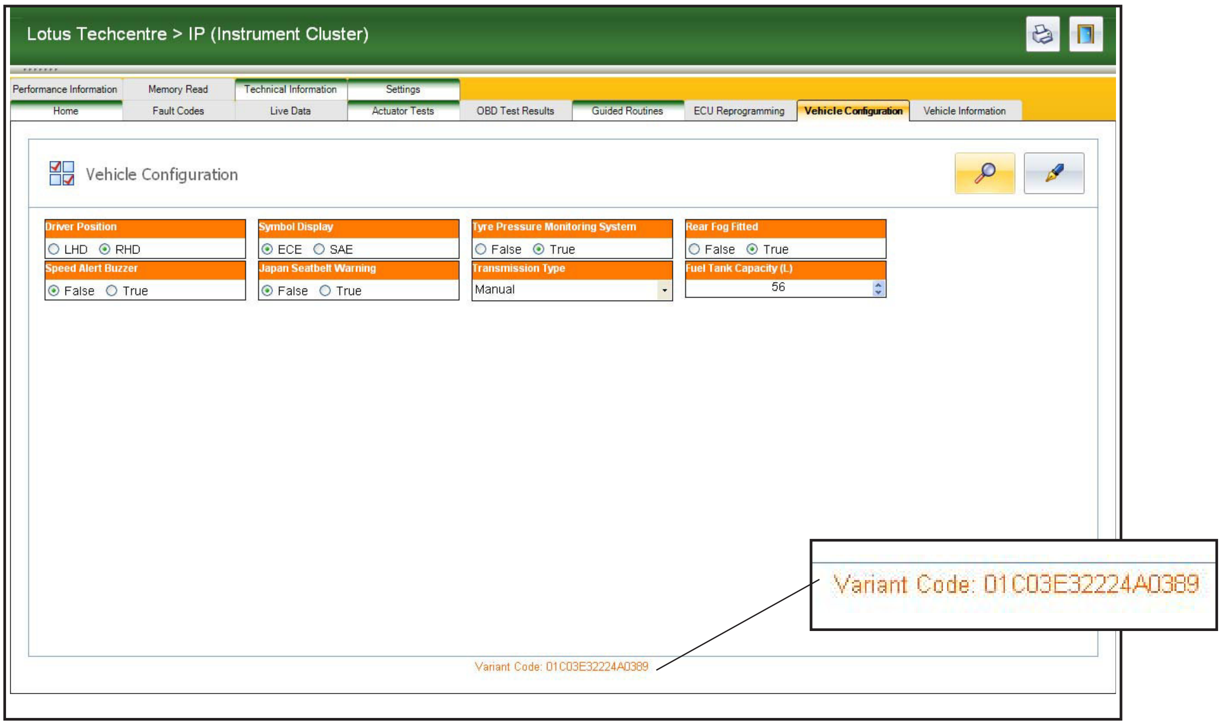
Note: Even if the instrument pack is only being removed to gain access to other ancillary components it is still advisable to note its variant code as a precautionary measure.

Note: Although it is possible to manually enter the variant coding from the option screens available there is a risk of making an error if this option is selected which may affect the display and or functionality of the instrument pack.

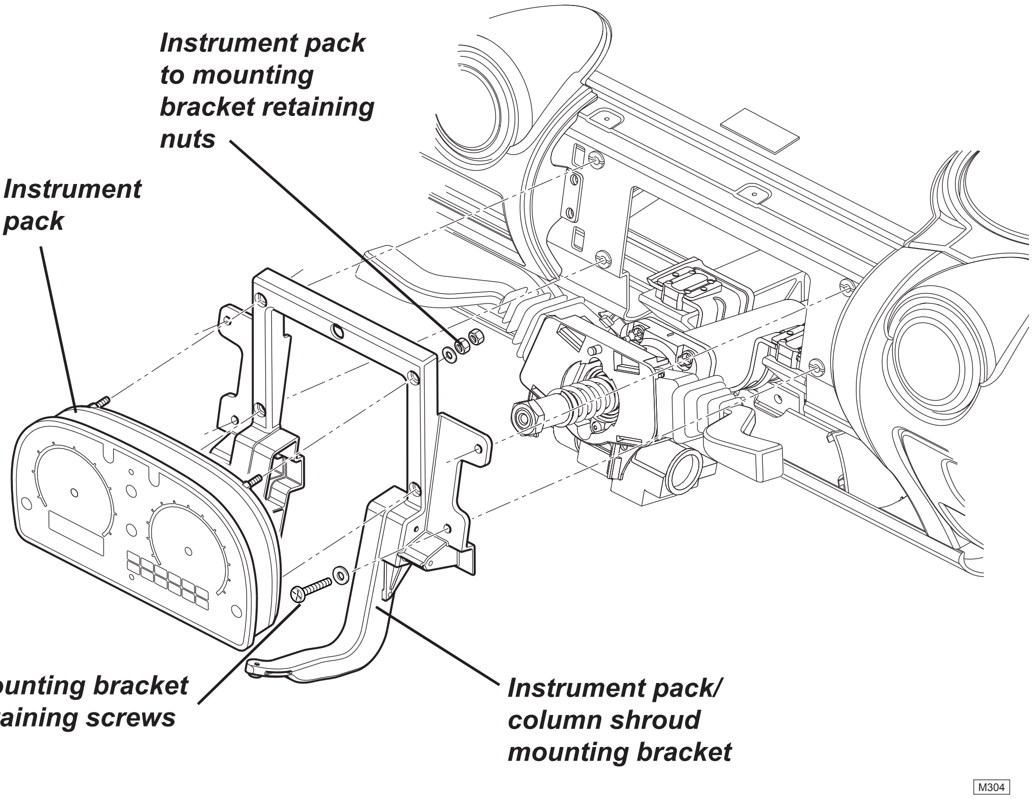
If the variant coding has not been recorded or if the instrument pack will not communicate with Lotus TechCentre then it is advised to contact Lotus Cars Technical Publication Department stating the full vehicle VIN requesting the variant code information.

Although vehicle mileage can be reset using Lotus TechCentre, to prevent potential abuse a limitation to this function has been imposed, once the mileage/kilometre display on the odometer exceeds 50 miles or 75 kilometres the odometer reading can no longer be altered.

Instrument cluster configuration screen as viewed using Lotus TechCentre



INSTRUMENT PACK REMOVAL
(Steering wheel removed for clarity)



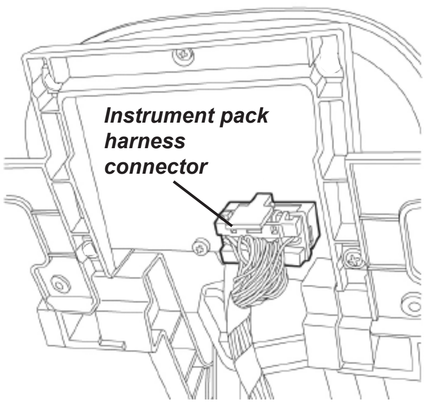
Removal:

1. Carefully pull the instrument pack cowling/shroud away from the dashboard to release the retention spring clips (4) from their apertures in the dash panel, refer to service note section VE.5 for further information.

2. Remove the No. 8 x 3/4" self tapping screws and M6 washers (4) securing the instrument pack/column shroud mounting bracket to the dashboard.

3. Carefully withdraw the instrument pack and mounting bracket away from the dashboard area, disconnect the main harness multiplug connector from the rear of the instrument pack.

4. The assembly can now be fully withdrawn from the vehicle and the instrument pack detached from the bracket by releasing the M4 nuts and washers (4) securing the instrument pack to the mounting bracket.

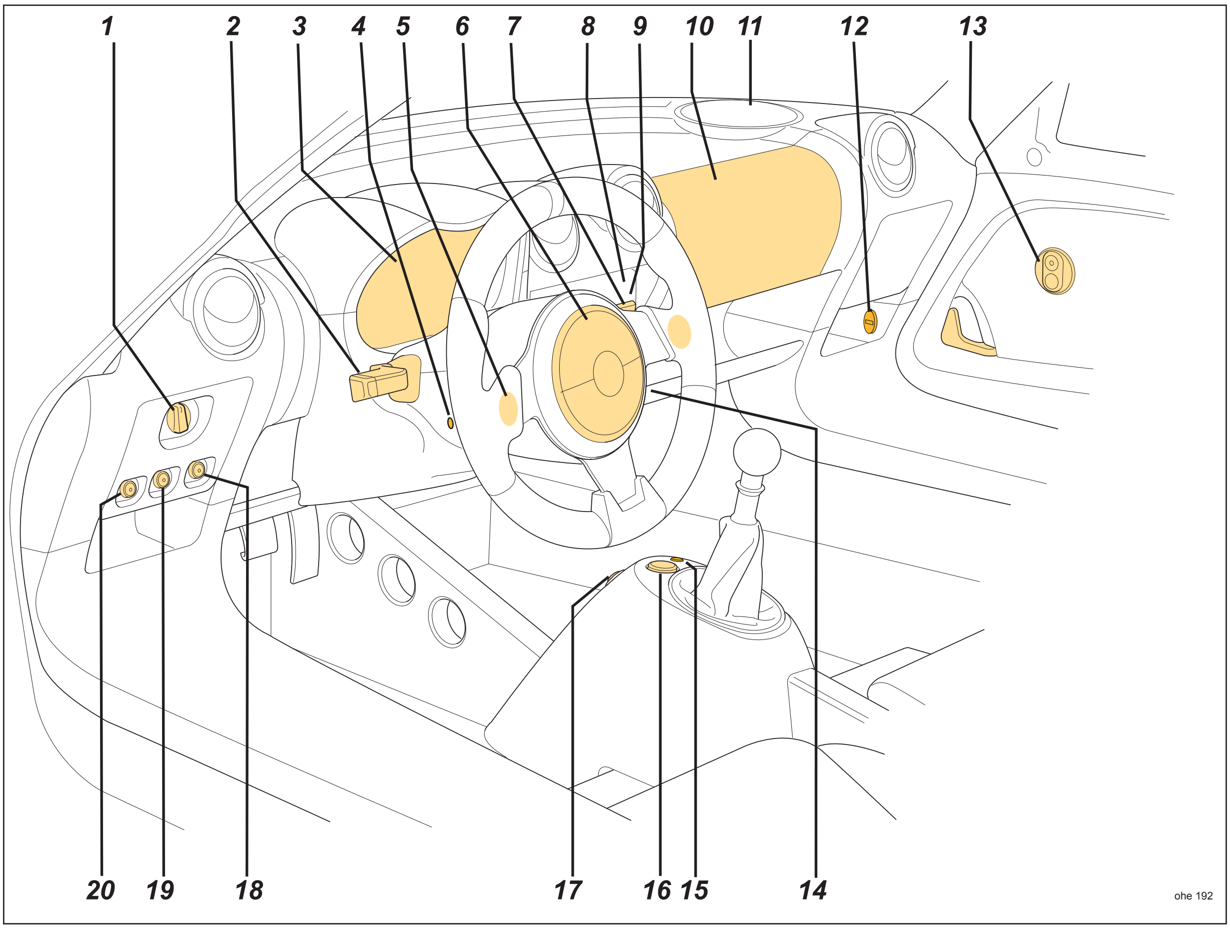


Note: If the steering wheel is still in situ the instrument pack and mounting bracket will have to be lifted up and manoeuvred around the steering wheel to withdraw it from the vehicle.

Refitment:
Is the reverse of removal, except that it may be necessary to reset mileage and variant code if the instrument pack has been renewed, please see previous page for details.

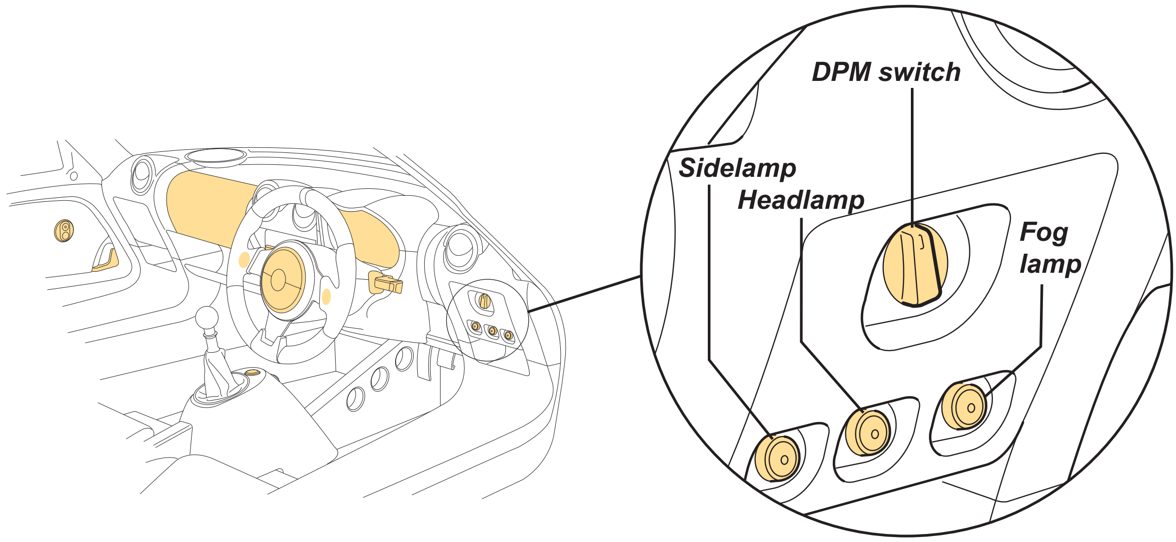
MV.6 - SWITCHES & INSTRUMENTS

DRIVING AREA CABIN LAYOUT (LHD SHOWN)



1. Lotus DPM (Dynamic Performance Management) mode switch
2. Headlamp Dipswitch/Flasher/Turn/Indicators/Cruise control column switch
3. Instrument panel
4. Engine protection valve override switch (where fitted)
5. Horn switch
6. Driver's airbag - Refer to service notes section WC.9 for further information
7. Wash/wipe control column switch
8. I.C.E (In Car Entertainment) system
9. HVAC (Heating, Ventilation & Air Condition) controls - Refer to service notes section PK.2 for further information
10. Passenger Air Bag - Refer to service notes section WC.11 for further information
11. Speaker
12. Auxiliary power socket - 5 Volt DC USB
13. Door window switch
14. Instrument panel illumination (opposite side to item 4)
15. Heated rear window switch - Refer to service notes section PK.2 for further information
16. Hazard warning light switch
17. Interior CDL (Central Door Locking) switch
18. Rear fog lamp switch
19. Headlamp switch
20. Sidelamp switch

Lotus DPM (Dynamic Performance Management) & Lighting Switches



Lighting functions are controlled by a horizontal row of three push button switches mounted in a switch panel housing trim within the fascia, outboard of the steering column. Each switch is pressed once to switch on, and pressed a second time to switch off. A symbol is positioned on the head of each switch to indicate its function.

The light switches are illuminated with the ignition on and become brighter when pressed.

Sidelamp switch
Positioned outermost, this switch functions with or without ignition, and switches on the sidelamps. A tell tale in the switch button lights up green to indicate when the circuit is active. Note that the headlamps must be off before the sidelamps can be switched off

Headlamp Switch
The centre switch functions with or without ignition, and switches on the headlamps together with the sidelamps if not already selected by the sidelamps switch. The steering column lever switch (see later) is used to select main beam or dip. Pressing the switch a second time will switch off the headlamps, but leave on the sidelamps.

Rear Fog Lamp Switch - If Fitted
The innermost switch controls the two rear fog lamps (where fitted), and may be selected only after first switching on the ignition, and then the headlamps. A tell tale in the switch button lights up amber to indicate when the circuit is active.

Note that the switch will default 'off' whenever the headlamps or ignition are switched off, requiring reselection if lamp activation is again desired.

In some territories, rear fog lamps may be used legally only in conditions of ‘seriously reduced visibility’.

Be aware that indiscriminate or forgetful use of the rear fog lamps can cause distraction and discomfort to following traffic.

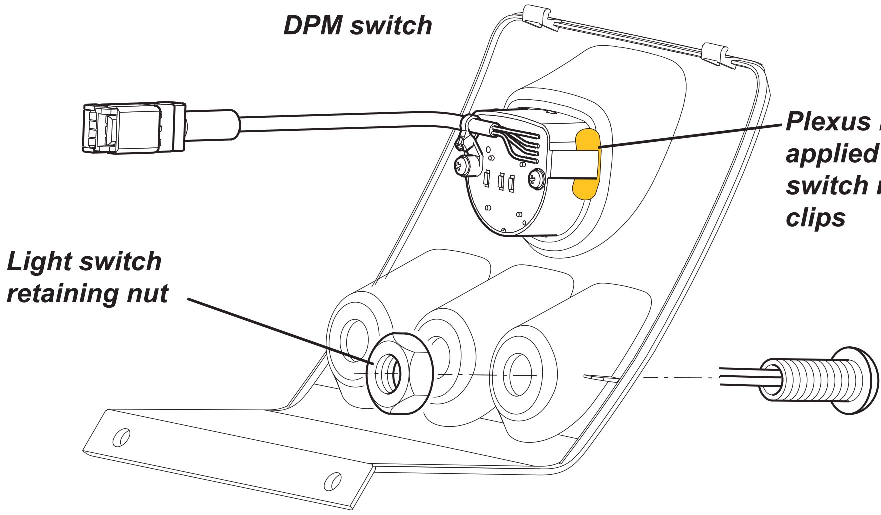
Lotus DPM (Dynamic Performance Management) switch
The Lotus DPM switch has 3 or 4 driver selectable modes which are controlled from the Lotus DPM switch positioned outboard of the steering column.

Daytime Running Lamps (DRL)
When the engine is started, the front sidelamps will automatically be activated as daytime running lamps, with the front sidelamps operating with an increased intensity. When the ignition is turned off, the DRLs will switch off automatically unless manually selected.

If the sidelamp switch is activated whilst the engine is running the front DRLs will revert to their sidelamp functionality and operate with a reduced intensity.

Lights On' Warning
A 'lights on' reminder buzzer will sound if the lights are on when the ignition is switched off and the driver's door is opened. The buzzer is located within the instrument pack and cannot be replaced without renewing the complete pack assembly.

Light Switches



Removal:
Remove the switch panel housing, see service notes section VE.3 for further information.

The light switches can be removed from the panel housing trim by releasing the relevant switch retaining nut from the rear of the panel, allowing the switch/harness to be withdrawn from the front.

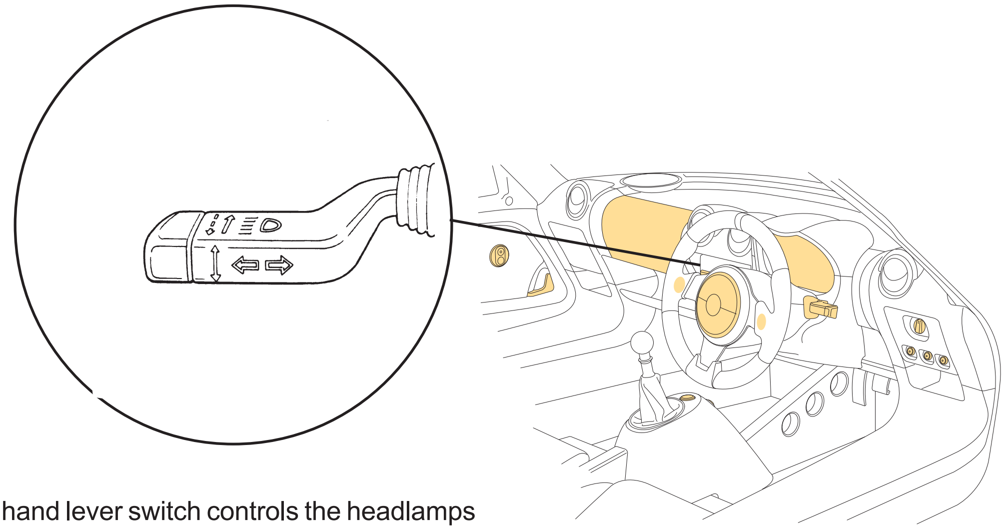
Refitment:
Is the reversal of removal.

Lotus DPM (Dynamic Performance Management) Switch
The DPM switch is retained to the panel with the aid of a small quantity of Plexus MA300 adhesive which is applied under the switches integral retention clips pushing them outwards so forcing the switch tight against the panel.

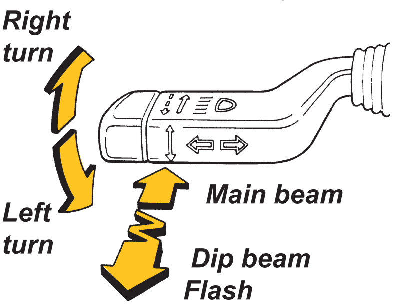
Removal:
To remove the separate the switch from the panel will require the plexus to be carefully cut away from the retention clips before it can be withdrawn.

Refitment:
Is the reverse of removal but requires a small quantity of Plexus MA 300 adhesive (2.5ML) to be applied under each retaining lug once the switch has been fitted in the panel housing.

Headlamp Dipswitch/Flasher/Turn Indicators



The steering column left hand lever switch controls the headlamps main beam/dip, headlamp flash and turn indicators.



Headlamp Dipswitch: To switch on the headlamps, press the headlamp switch in the fascia outboard of the steering column, (see previous pages).

The left hand lever switch is then used to select main or dip beam.

Main beam is obtained with the lever furthest forward, away from the steering wheel, and dip beam with the lever moved back towards the wheel. The main beam tell tale lamp in the instrument panel lights when main beam is operating.

Note: When main beam is selected, the dip beam lamps remain lit.

Headlamp Flasher: The headlamp flasher is operative at all times. If the lever is pulled towards the steering wheel against spring pressure, the headlamp main beams will light.

Turn Indicators: The turn indicators operate only with the ignition switched on. Move the lever down to indicate a left hand turn, and up for a right hand turn. The switch will be cancelled when the steering wheel is returned to the straight ahead position. For convenience, when signalling a lane change, lightly pressing the switch up or down will allow its return under spring action.

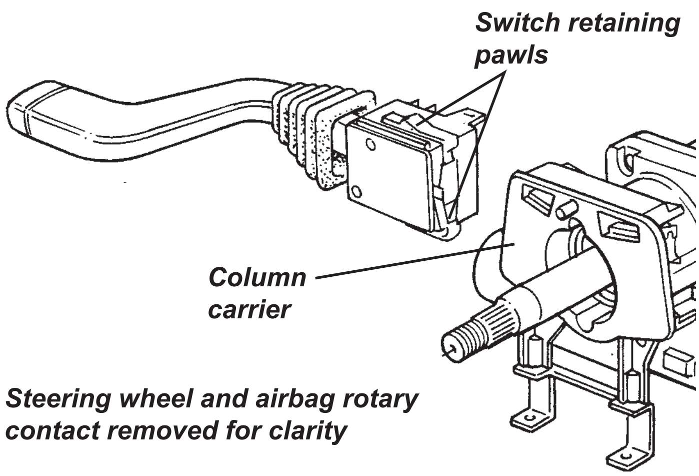
Switch removal *(Cruise control and RH wash/wipe switch similar)*

Removal:
1. Remove the upper and lower steering column shrouds, refer to service note section VE.4 for further information.

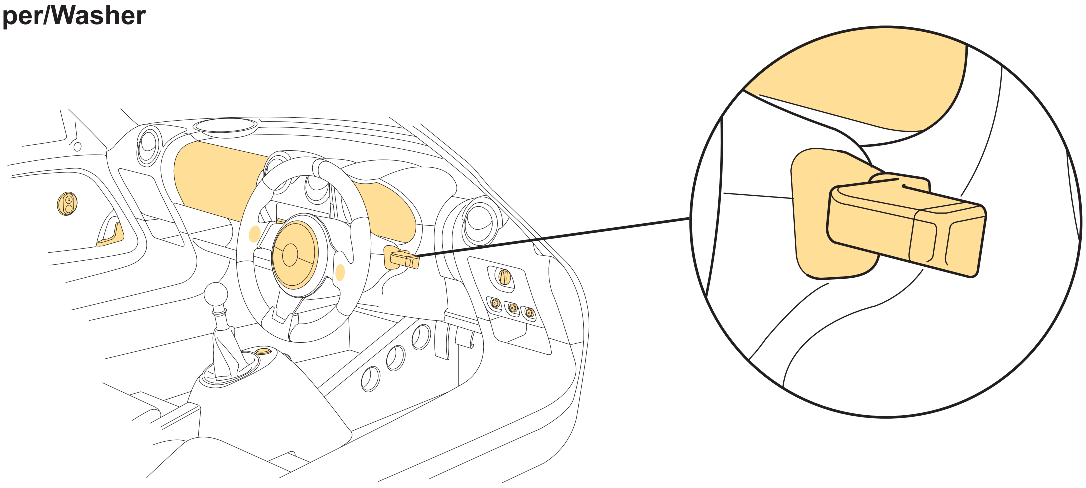
2. Disconnect the main harness multiplug connector from the column switch connector.

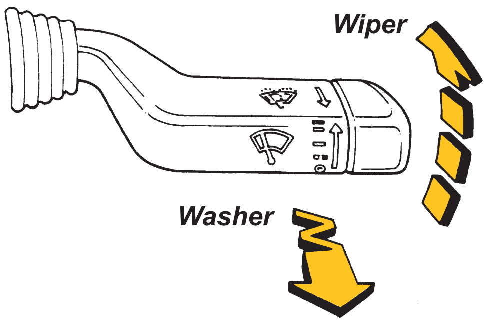
3. Squeeze the upper and lower switch retaining pawls and slide the switch out of the column carrier.

Refitment:
Is the reversal of removal.



Windscreen Wiper/Washer





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

Never use the wiper on a dry screen.

Windscreen Wiper: The wiper is controlled by the up/down position of the lever switch, which operates as follows:

O Moved fully down, the wiper is switched off.

-- Move up to the first position for intermittent wipe. The wiper will make one sweep about every five seconds.

— Select the next position for normal wiper operation.

= Move fully upwards for quick wipe, to be used only in heavy rain.

Windscreen Washer: Two windscreen washer jets are provided, one each side of the wiper spindle. Pulling the control lever towards the steering wheel will operate both the washer pump and the wiper. When the switch is released, the wiper will continue for a further four sweeps.

Switch Removal:
See Headlamp Dipswitch/Flasher/Turn Indicator information on removal and refit procedure.

Cruise Control
Cruise control is available as an optional fitment with the control buttons added to the headlamp dip/flasher/turn Indicator switch.

Caution: Cruise control should be used only when conditions are favourable; on straight, dry, open roads with light traffic.

The cruise control system is incorporated into the engine ECU programme and selected as an available option within the variant coding options using Lotus TechCentre

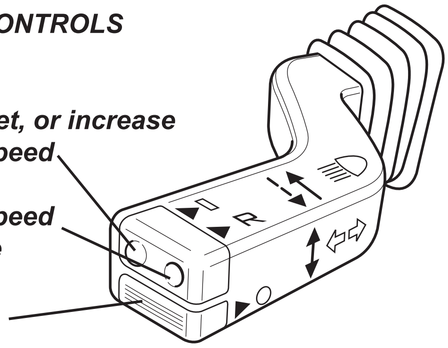
Cruise control allows the maintenance of a selected vehicle speed above 30 mph (50 km/h), without having to use the accelerator pedal. The tell tale lamp in the gear lever shroud is lit whenever cruise control is active.

Operating cruise control
An upper rocker switch to set the speed, and a lower push button to switch off the cruise control.

Setting the vehicle speed
To engage cruise control, the vehicle must be travelling at 30 mph (50 km/h) or more.

Accelerate to the desired cruising speed and then press once the 'I' end of the rocker switch with the raised pip.

CRUISE CONTROLS
(if fitted)



Cruise control will engage and the set speed maintained when the accelerator is released (road gradient and winds permitting).

The accelerator may be used to increase speed temporarily without affecting the setting.

Cancelling cruise control
Cruise control automatically disengages when the foot or parking brakes are applied, a gearchange is made, or when the vehicle's speed falls below 30 mph (50 km/h). To disengage it manually, press once the 'O' button.

Resuming a set speed
Caution: The resume function should be used only if the driver is aware of, and wants to return to, the set speed.

To resume cruising after braking, changing gear or slowing below 30 mph (50 km/h), press once the 'R' switch.

Changing the set speed
When cruise control is operating, press and hold the 'I' end of the rocker switch to accelerate the car. Release the switch when the desired new speed is attained. Alternatively, repeated brief presses of the switch will increase the setting by 1 mph (1.5 km/h) increments. Pressing the 'R', dimpled end of the switch will reduce the set speed in like manner.

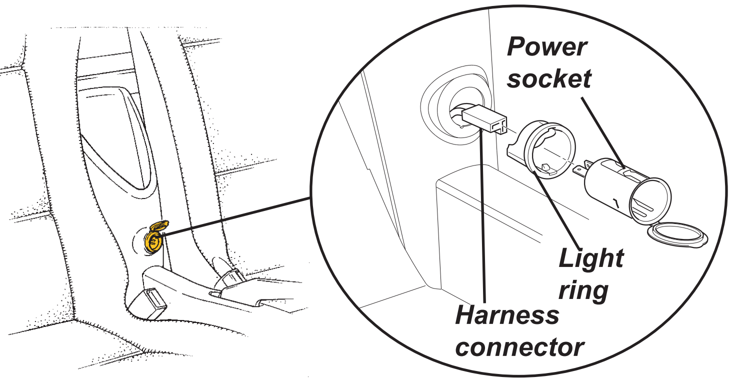
Alternatively, the car may manually be accelerated or braked to the desired new speed, and the 'I' switch pressed once to set cruise at that speed.

Set speed cancellation
The set speed will be reset to zero when:
- The vehicle is stopped or;
- The parking brake is applied or;
- Reverse gear is selected or;
- The ignition is turned off.

Switch Removal:
See Headlamp Dipswitch/Flasher/Turn Indicator information on removal and refit procedure.

Auxiliary Power Sockets & Courtesy Lamp

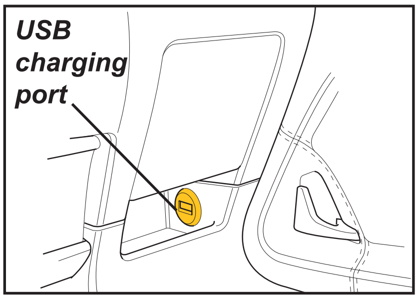
12 Volt DC
An auxiliary power socket is fitted in the centre trim shroud on the rear bulkhead. The socket is operative at all times, and is provided with a protective hinged flap.



The socket allows the use of a standard cigarette lighter element or other electrical accessories requiring this type of fitting. The maximum current draw should not exceed 15 amps.

Removal:
The socket can be removed by carefully withdrawing it from the trim shroud, if the socket will not pull away without potentially damaging the shroud then release the No. 6 x 3/8" screw securing the Stowage Pocket to trim shroud so that it can be pushed out instead,

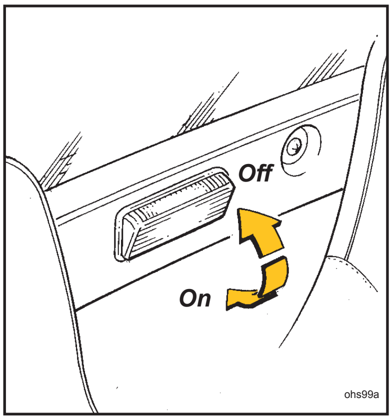
5 Volt DC (If fitted)
An additional USB charging port is fitted in the passenger storage pocket and is active with the key in the ignition.



The socket allows electrical accessories to be charged or powered that can use a USB type adaptor lead. The maximum current draw should not exceed 1 amp.

Courtesy lamp
The courtesy lamp is sited centrally in the rear bulkhead trim. Its 12V 5W bulb receives power from fuse F37 in the front fuse box and has 4 illumination modes which are controlled by rotating the lamp lens within its housing.

Mode:	Lens position
Instant permanent illumination	***Central***



Contacts within the lamp unit illuminate the bulb instantly to full power (with or without ignition) by completing the circuit directly to earth.

Courtesy mode illumination or extinguish by door opening/closing	***Fully downwards***

Contacts within the lamp unit are switched to complete the circuit through either the driver or passenger door pin switches. When either door is opened the contacts in the pin switch close, completing the circuit and illuminating the lamp instantly to full power.

Illumination by alarm de-activation or ignition switch off driver/passenger door closed	***Fully downwards***

The courtesy light will fade on and remain on for 2 - minutes after the alarm of ignition is switched off.

A wiring splice in the harness between the lamp and door pin switch is connected to pin terminal 11 of the alarm immobiliser unit which is located under the instrument panel.

Alarm activation or ignition switch off signals a MOFSET (Metal-Oxide Semiconductor Field-Effect Transistor) within the immobiliser unit which allows the lamp to gradually earth through the immobiliser increasing illumination from 0-100% power over a 2 - minute time period at a power rate increase of 2.3 second intervals remaining on for 2 - minutes.

Once the 2 - minute timer has expired the courtesy light will fade off at the same rate as illumination.

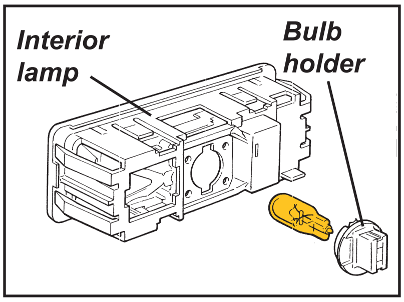
If the ignition is turned on or the alarm is armed within 2 minutes of courtesy light activation, the timer is automatically cancelled and the light faded off.

Permanently off ***Lens Fully upwards***
Contacts within the lamp unit are switched open circuit

Lamp removal;
1.Carefully ease the assembly out of the rear bulkhead trim.

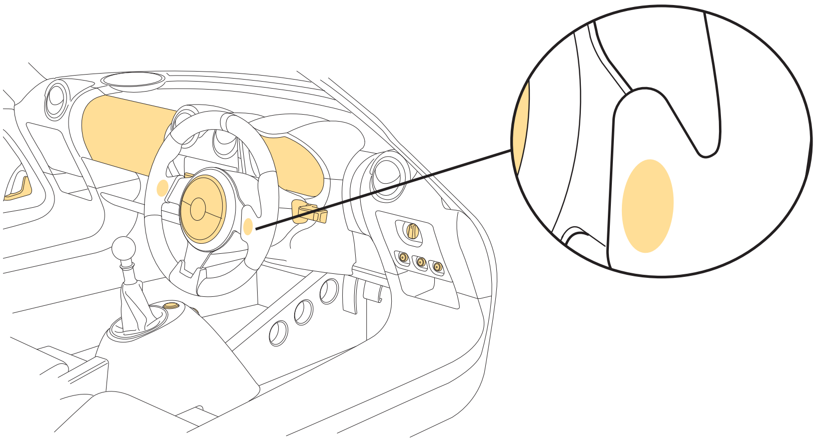
2.Disconnect main harness connector from terminals.

3.Twist bulb holder and withdraw from lamp housing to gain access to the bulb.



Refitment;
Is the reverse procedure to removal.

Horn
The horn, which functions at all times, is operated by a button embossed with a bugle symbol in each of the steering wheel horizontal spokes.



Power to the horn buttons is fed through the airbag clock spring assembly, supplied via a relay located in the main fuse box.

The horn buttons are integral to the steering wheel and are non-serviceable, requiring the renewal of the steering wheel if faulty.

Depressing either of the two horn buttons earths out the circuit, switching the contacts in relay and activating the horn.

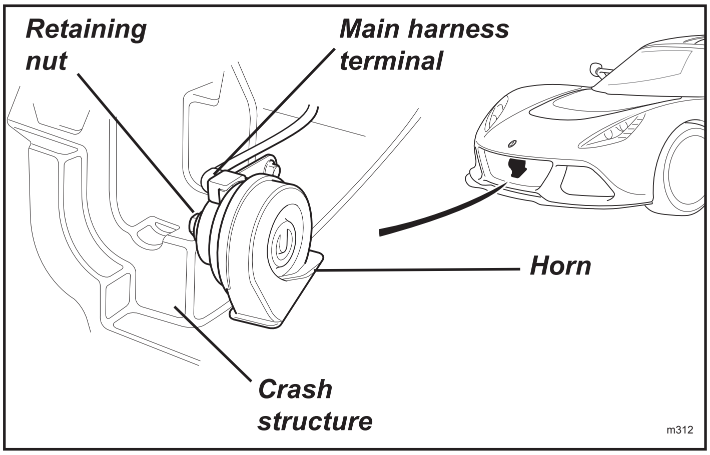
The horn is secured by a mounting strap to the RH inner crash structure.

Horn replacement:
1.Remove the front clamshell Centre intake grille - see Service Notes Section BT.16 for further information.

2.Disconnect the main harness electrical connector from the horn terminal

3.Release and remove the M10 nut securing the horn to it crash structure mounting strap

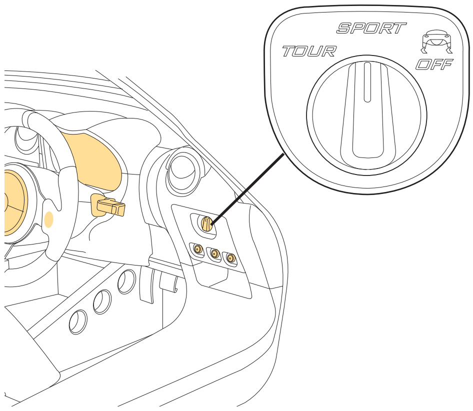
4.The horn can now be withdrawn from the vehicle.



Refitment:
Is the reverse of removal.

MV.7 - LOTUS DPM (DYNAMIC PERFORMANCE MANAGEMENT) OPTIONS

3 Mode Lotus DPM Switch
The standard Lotus DPM (Dynamic Performance Management) system has 3 driver selectable modes which are controlled from the Lotus DPM switch positioned outboard of the steering column above the light switches.



Note: Lotus DPM ‘Off’ mode can only be selected whilst the engine is running, but can be activated either whilst the vehicle is being driven or is stationary.

⚠ WARNING: Be aware that selecting Sport Mode and/or Lotus DPM 'Off' will alter the handling characteristics of the car. Drivers should exercise caution until familiarity has been gained in a controlled safe environment.

Lotus DPM Mode Settings

TOUR
1. Lotus DPM fully activated (see Service Notes Section JM.10 for further details).
2. Exhaust active valve will only open at high throttle/RPM applications (see Service Notes Section EM.12 for further details).
3. Maximum continuous engine speed restricted to 6600rpm.

SPORT
1. Reduction in Lotus DPM settings allowing increased power induced wheel slippage thresholds and no throttle reduction on understeer.
2. Exhaust active valve now open whilst engine idling, closes at low engine speeds and reopens from medium throttle applications/engine speeds.
3. Maximum continuous engine speed increased to 7000rpm.

Lotus DPM 'Off'
1. Lotus DPM de-activated.
2. Exhaust active valve is permanently open regardless of throttle position.
3. Engine idle speed increased to 900rpm, maximum continuous engine speed increased to 7000rpm.

Mode Selection

'Sport' Mode
Rotate the switch clockwise from the 'Tour' setting, the amber ‘SPORT’ tell tale in the instrument panel will be illuminated.

The vehicle will immediately engage 'Sports' Mode.

Note: if selected whilst driving, this may cause the exhaust active valve to open without increased throttle pedal depression as well a reduction in the Lotus DPM system functionality.

The Lotus DPM tell tale will flash when electronic intervention is taking place indicating that the systems tractive limit has been reached.

To Switch Off 'Sport' Mode
Rotate the switch back to the ‘Tour’ position.

Note: ‘Sport’ mode can be activated even if the engine is not running, therefore if the engine is turned off whilst in 'Sport' mode the vehicle will revert back to ‘Sport’ Mode when the engine is restarted.

Lotus DPM 'Off' Mode
Rotate the switch fully clockwise from either the 'Tour' or 'Sport' setting. Hold the switch for at least one second in the Lotus DPM 'off' position and then release, the switch will return to the 'Sport' position.

The Lotus DPM 'Off' lamp within the instrument panel will now be illuminated. See sub-section MV.5 for further details.

Note: if selected whilst driving, the vehicle will immediately engage Lotus DPM 'Off' Mode, the exhaust active valve will open regardless of the throttle pedal position and the Lotus DPM system will be immediately disabled.

To Cancel Lotus DPM 'Off' Mode
Rotate the switch back to the 'Tour' setting.

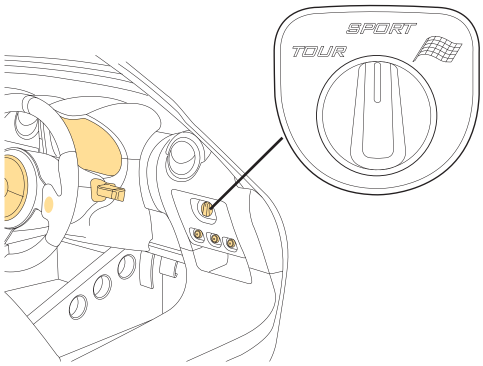
Note: If the engine is turned off whilst in Lotus DPM 'Off' mode the vehicle will revert to 'Sport' mode when the engine is restarted.

⚠ WARNING: (Lotus DPM) should always be active when driving on public roads in normal conditions.

'Sport' Mode from Lotus DPM 'Off' Mode
Turn the switch from its 'Sport' to 'Tour' position then return it back to the 'Sport' mode position setting.

4 Mode Lotus DPM Switch

The factory ‘Race Pack’ option is equipped with a 4 mode selectable switch which also includes Lotus Launch Control. These modes are controlled from the Lotus DPM switch positioned outboard of the steering column above the light switches.



Note: 'Race' and Lotus DPM ‘Off’ modes can only be selected whilst the engine is running, but can be activated either whilst the vehicle is being driven or is stationary.

Note: To fully optimise the Exige's set-up for track day usage in dry conditions, it is recommended that the combination of 'Race' Pack suspension and optional Pirelli PZero Trofeo tyres are fitted. This set-up will fully utilise the characteristics of the DPM setting ‘Race Mode’.

⚠ WARNING: Be aware that selecting 'Sport', 'Race' or Lotus DPM 'Off', will alter the handling characteristics of the car. Drivers should exercise caution until familiarity has been gained in a controlled safe environment.

⚠ WARNING: Under no circumstances should Lotus Launch Control be employed on the public road.

Mode Settings

TOUR

1. Lotus DPM fully activated (see Service Notes Section JM.10 for further details).
2. Exhaust valve will only open at high throttle applications (see Service Notes Section EM.12 for further details).
3. Maximum continuous engine speed restricted to 6600rpm.

SPORT

1. Reduction in Lotus DPM settings increasing power induced wheel slippage thresholds and no throttle reduction on understeer.
2. Exhaust active valve now open whilst engine idling, closes at low engine speeds and reopens from medium throttle applications/engine speeds.
3. Maximum continuous engine speed increased to 7000rpm.

'Race' Mode

1. For dry condition track use only. Optimised traction and corner exit characteristics with reduced Electronic Stability Control (ESC) intervention.
2. The exhaust valve is now permanently open regardless of throttle position or engine speed.
3. Engine idle speed increased to 900rpm, maximum continuous engine speed increased to 7000rpm.

Lotus DPM 'Off' Mode

1. Lotus DPM de-activated.
2. The exhaust active valve is permanently open regardless of throttle position or engine speeds.
3. Engine idle speed increased to 900rpm and maximum continuous engine speed increased to 7000rpm.

Launch Control Mode

1. Lotus DPM optimised for launch control.
2. The exhaust active valve is permanently open regardless of throttle position or engine speeds.
3. Engine idle speed increased to 900rpm and maximum continuous engine speed increased to 7000rpm.

Mode Selection
'Sport' Mode
Rotate the switch clockwise from the 'Tour' setting, the amber ‘SPORT’ tell tale lamp in the instrument panel will be illuminated.
The vehicle will immediately engage 'Sport' mode.

Note: if selected whilst driving, this may cause the exhaust active valve to open without increased throttle pedal depression as well a reduction in the Lotus DPM system functionality.

The Lotus DPM tell tale will flash when electronic intervention is taking place indicating that the systems tractive limit has been reached.

To Switch Off 'Sport' Mode
Rotate the switch back to the ‘Tour’ mode position.

Note: If the engine is turned off whilst still in 'Sport' mode the vehicle will revert to ‘Sport’ Mode when the engine is restarted.

'Race' Mode
Rotate the switch clockwise from either the 'Tour' or ‘Sport’ setting. Hold the switch for at least one second in the 'Race' mode position and then release, the switch will return to the 'Sport' position.

The amber 'RACE' and Lotus DPM ‘Off’ tell tale lamps within the instrument panel will now be illuminated. See sub-section MV.5 for further details.

Note: if selected whilst driving, the vehicle will immediately engage Lotus 'Race' mode, the exhaust active valve will open regardless of the throttle pedal position as well a reduction in the Lotus DPM system functionality.

To Switch Off 'Race' Mode
Rotate the switch back to the ‘Tour’ position setting.

Note: If the engine is turned off whilst still in ‘Race’ mode the vehicle will revert to ‘Sport’ Mode when the engine is restarted.

⚠ WARNING: (Lotus DPM) should always be active when driving on public roads in normal conditions.

Selecting 'Sport' from 'Race' Mode
Turn the switch from the ‘Sport’ to ‘Tour’ position then return it back to the ‘Sport’ mode position setting.

Lotus DPM 'Off' Mode
Note: The vehicle must already be in ‘Race’ mode to activate the Lotus DPM ‘Off’ mode.

Ensure the clutch pedal is in the fully up position and rotate the switch fully clockwise from the ‘Sport' position and hold for at least one second in the Lotus DPM ‘off’ position and then release, the switch will return to the 'Sport' mode position.

The ‘RACE’ tell tall lamp will extinguish but the Lotus DPM ‘Off’ tell tale lamp will continue to be illuminated. See sub-section MV.5 for further details.

Note: if selected whilst driving, the vehicle will immediately engage Lotus DPM ‘Off’ Mode, the exhaust active valve will open regardless of the throttle pedal position and the Lotus DPM system will be immediately disabled.

Cancelling Lotus DPM 'Off' Mode
Rotate the switch back to the ‘Tour’ mode position. If the engine is turned off whilst still in Lotus DPM ‘Off’ mode the vehicle will revert to 'Sport' mode when the engine is restarted.

Lotus Launch Control

Launch Control is a technique designed to produce the fastest possible race starts.

⚠ WARNING: Under no circumstances should this track feature be used on the public road.

NOTICE: The extreme loads associated with launch controlled starts will eventually result in a reduction of the transmission (and any associated components) lifespan.

Always allow the clutch to cool and recover before repeating a launch controlled start.

To ensure the continued reliability of the transmission system whilst continuing to offer protection under the standard terms and conditions of the Limited Vehicle Warranty, the Lotus DPM system will not exceed a total of 20 controlled launches without the need to reset the launch control system.

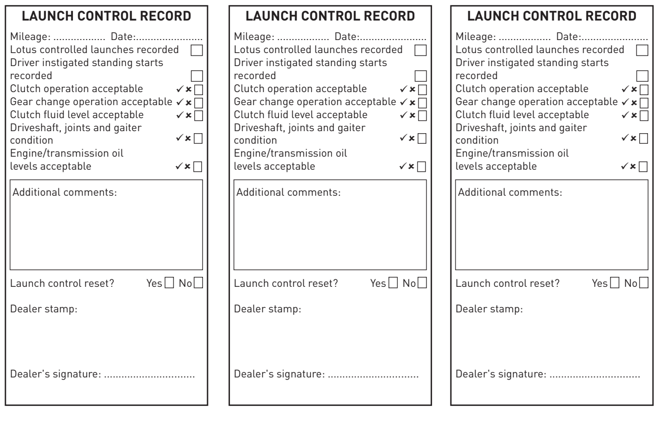
The launch control system can only be reset using designated Lotus computerised diagnostic equipment.

The system is only reset after a dealer vehicle inspection, which may also include any rectification or repair work deemed necessary to safely perform any further controlled launches.

Once the system is reset the launch control section of the maintenance booklet is signed and stamped by the dealer so that another 20 controlled launches can be performed.

Note: There may be a charge associated with this resetting procedure, as well any rectification or repair work required which can be attributed as a direct result of driver abuse.

Extract from maintenance booklet found in owner's handbook pack


LAUNCH CONTROL RECORD

Mileage: .... Date:......................
Lotus controlled launches recorded ☐
Driver instigated standing starts recorded ☐
Clutch operation acceptable ✓✗☐
Gear change operation acceptable ✓✗☐
Clutch fluid level acceptable ✓✗☐
Driveshaft, joints and gaiter condition ✓✗☐
Engine/transmission oil levels acceptable ✓✗☐
Additional comments:
Launch control reset? Yes☐ No☐
Dealer stamp:
Dealer's signature: ....

LAUNCH CONTROL RECORD

Mileage: .... Date:......................
Lotus controlled launches recorded ☐
Driver instigated standing starts recorded ☐
Clutch operation acceptable ✓✗☐
Gear change operation acceptable ✓✗☐
Clutch fluid level acceptable ✓✗☐
Driveshaft, joints and gaiter condition ✓✗☐
Engine/transmission oil levels acceptable ✓✗☐
Additional comments:
Launch control reset? Yes☐ No☐
Dealer stamp:
Dealer's signature: ....

LAUNCH CONTROL RECORD

Mileage: .... Date:......................
Lotus controlled launches recorded ☐
Driver instigated standing starts recorded ☐
Clutch operation acceptable ✓✗☐
Gear change operation acceptable ✓✗☐
Clutch fluid level acceptable ✓✗☐
Driveshaft, joints and gaiter condition ✓✗☐
Engine/transmission oil levels acceptable ✓✗☐
Additional comments:
Launch control reset? Yes☐ No☐
Dealer stamp:
Dealer's signature: ....

20

For further information please refer to the 'OBLIGATIONS OF OWNERS' and 'WARRANTY NOTES' sections of the New Vehicle Warranty manual which is included as a separate publication contained within the owner's handbook pack.

Note: As from the time of the last dealer visit, a cumulative total of all the controlled launches as well as manually instigated vehicle standing starts will be displayed in the vehicles maintenance record book. Also see the Engine Data Recording section on page 64 for further information. This book is also included as a separate publication contained within the owner's handbook pack.

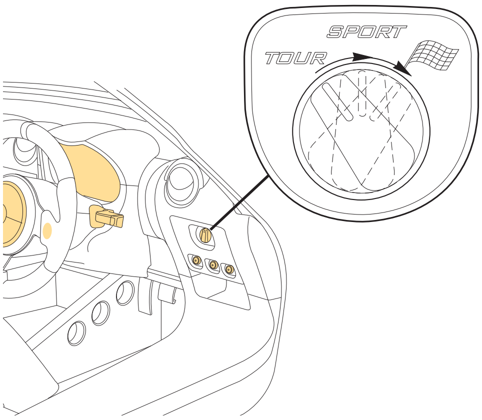
Note: The repair or replacement of any transmission components required as a result of damage or premature wear will not be covered under the terms of the Limited Vehicle Warranty once the Lotus DPM system has recorded in excess of 100 Lotus controlled launches.

Therefore it is highly recommended that the total number of controlled launches performed to date is taken into account before any further launch attempts are considered.

Note: The repair or replacement of any transmission components required as a result of damage or premature wear will not be covered under the terms of the Limited Vehicle Warranty if any driver instigated manual standing start launches have been recorded.

For a full explanation of the terms and conditions of the Lotus Limited Vehicle Warranty, please refer to the separate warranty manual contained within the owner's handbook pack.

Activating Launch Control
Note: Launch control can only be activated if the Lotus DPM system is currently set to 'Race' mode



1. With clutch pedal depressed and the Lotus DPM system currently set to 'Race' mode, rotate the switch clockwise from the 'Sport' mode position and hold for at least one second in the 'Race/ Launch' mode position and then release.

The switch will return to the 'Sport' mode position.

Launch Control Preparation
To perform the best possible race start whilst also ensuring powertrain wear is limited, the engine and Lotus DPM systems will carry out the various checks before allowing the vehicle to perform a controlled launch.

Vehicle parameters required to perform a Lotus DPM assisted controlled launch:

- Vehicle must be stationary.

- Engine coolant temperature must be between 80˚C and 110˚C.

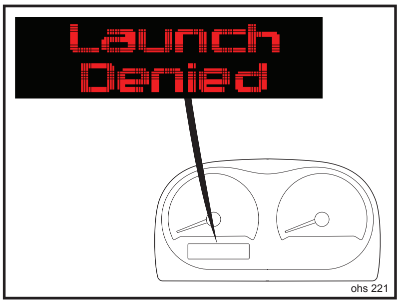
- Steering wheel must be in the straight ahead position.

- A Lotus controlled launch has not been performed within the last 2 minutes.

- There are no system faults present causing in either the MIL (Malfunction Indicator Light) or Lotus DPM tell tale lamps to be illuminated, see sub-section MV.5 for further information.

- Current vehicle mileage is in excess 500 miles / 805 km.

Unless all of these conditions are within the set tolerance ranges the LCD screen will show the RH message for 2 seconds before returning back the standard display.



If all of the conditions are within the set tolerance ranges then the LCD screen will display this message.

2. To proceed with launch mode rotate the switch clockwise once more from the 'Sport' mode position and hold for at least one second in the 'Race/Launch' mode position and then release.

The LCD display will then display this flashing message.

Note: There are no limitations on how many times the vehicle can be put into launch mode.

3. Engage first gear and apply full throttle. This will set the maximum engine speed to match the launch controlled rev-limited maximum engine speed (3500 rpm approx).

NOTICE: Do not attempt a launch controlled start in any gear other than first.

Note: Full throttle must be applied within 1 second of the engine speed being raised up to or above the launch controlled rev-limited speed otherwise launch control will be aborted and the 'Launch Denied' message will be displayed.

To protect the exhaust catalysts from overheating, the Lotus DPM system will cancel launch mode if the engine speed is held at or above the launch controlled rev-limited maximum for a cumulative time of more than 10 seconds.

4. Rapidly release the clutch and maintain full throttle throughout the transition from ‘Launch’ to ‘Race’ mode until the first gear change is required.

NOTICE: Do not attempt to slip the clutch during a controlled launch start as overheating or damage to the clutch mechanism may occur.

A controlled launch can be cancelled before completing stage 2 by releasing the clutch pedal, or at any stage by turning the Lotus DPM switch to either the ‘ Sport’ or ‘Tour’ mode.

The Lotus DPM system will return to ‘Race’ mode once the launch procedure has been carried out and the driver makes the first gear change.

Repeat steps 1- 4 to carry out another controlled launch (waiting for at least 2 minutes to elapse since the previous launch).

Launch control functionality is inhibited after 20 Lotus controlled launches have been performed,

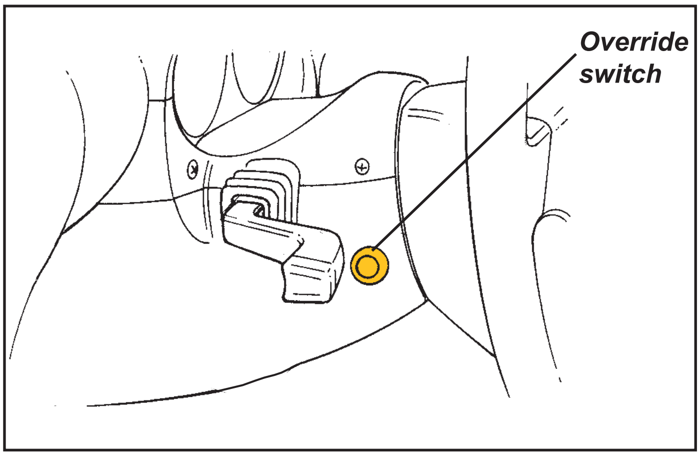
If any further controlled launches are attempted then the LCD display will display the this message and an audible buzzer will sound.

The launch control system must be reset by a Lotus dealership to permit a further 20 controlled launches to be performed.

Engine Protection Valve Override Switch *(If fitted)*

The EP valve may be returned to the closed position whilst the vehicle is in ‘Race’ or Lotus DPM 'Off' mode by a momentary press of the override switch located on the left hand side of the steering column console.

This may be required if driving the vehicle on a noise restricted track. Alternatively if pressed whilst in ‘Tour’ or ‘Sport’ mode, the EP valve will open regardless of the vehicle road speed.

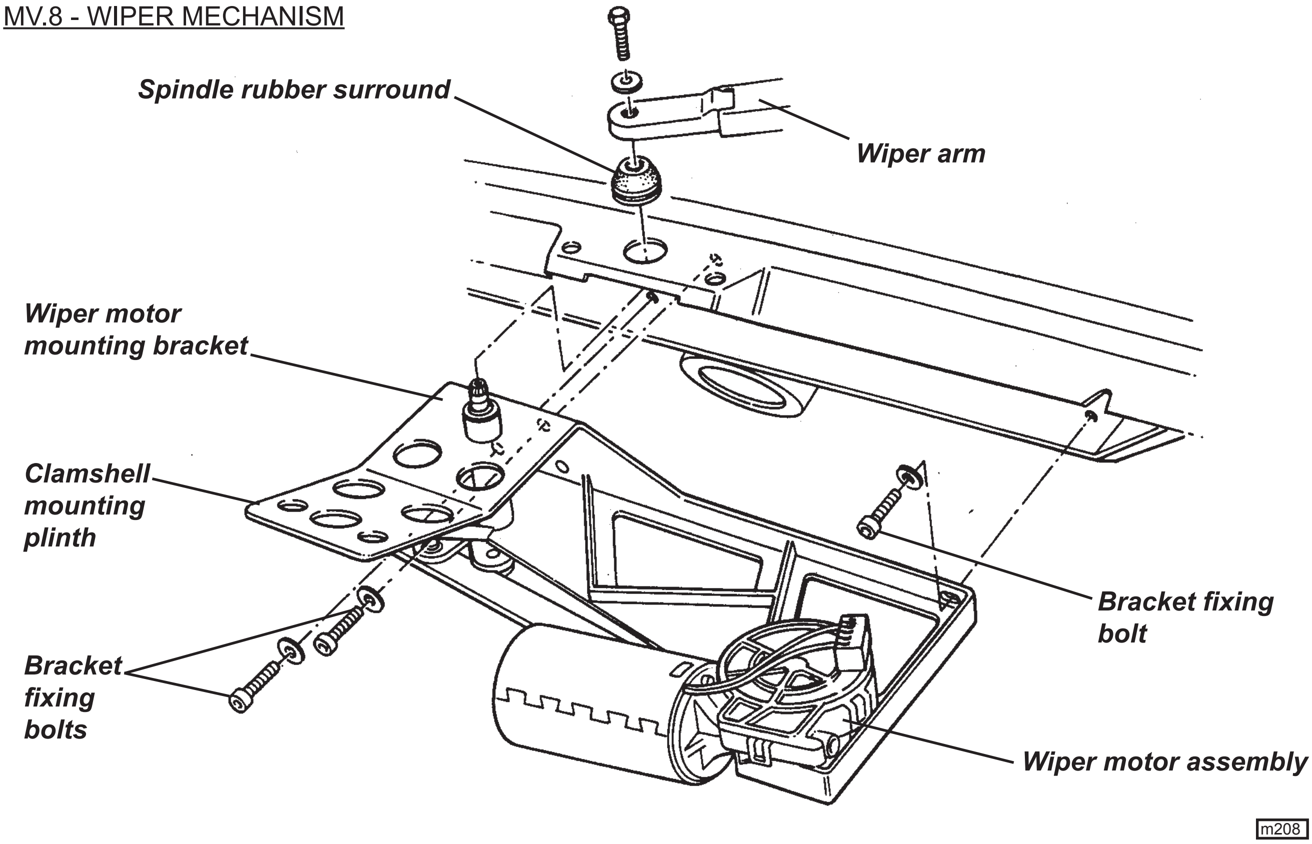


A corresponding “EX.OPEN” or “EX.SHUT message will also be momentarily shown by overriding the fuel gauge display within the instrument panel.

Note: Even if overridden, the EP valve will automatically open if the engine speed exceeds 5500rpm to reduce excessive back pressure.

The EP valve will return to the closed position when the ignition is switched off.

MV.8 - WIPER MECHANISM



The windscreen wiper mechanism comprises a uni-directional motor with an external rotary link, a connecting rod, and a pair of actuating links which join the connecting rod to the arms of the wiper spindle. This mechanism provides the wiper with a motion which is slowed at each end of its travel in order to ease the inertia loads during direction changes, to the benefit of refinement and durability.

The motor and wheelbox are mounted on a single fabricated steel bracket which is bolted to the windscreen scuttle panel.

To remove the wiper mechanism:

1. Remove the front clamshell (see sub-section BT.6).

2. Carefully place the main fuse box with bracket assembly and place to one side ensuring that no unnecesary strain is placed on the wiring harness or connections. See sub-section MV.12 for further information.

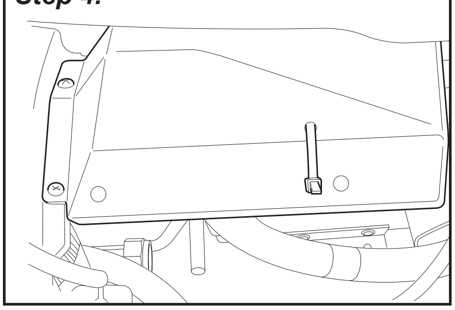
3. Remove the ducting between heater/a.c. unit and air distribution unit.

4. Remove the wiper motor protective cover by releasing the two screws into the windscreen buttress and cable tie securing the cover to the wiper motor and withdraw from the vehicle.

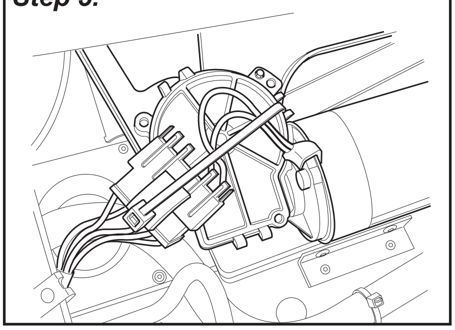
5. Disconnect the harness plug from the motor (cutting cable tie if fitted),

6. Disconnect the washer tubing from the washer jets and position hose to one side.

Step 4.



Step 5.



7. Lift up the wiper arm nut cover and lift the wiper arm away from the windscreen

8. Mark the position of the wiper arm in relation to the wiper spindle

9. Remove the nut securing the wiper arm, gently moving the arm to release it from taper of the wiper spindle.

10. Remove the wiper arm from the spindle, and the spindle rubber surround.

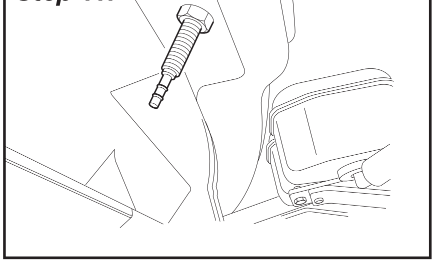
11. Release the nuts securing the washer jets to the windscreen frame and remove them (this may be necessary to ensure the motor and mounting frame can be withdrawn from the vehicle.

12. Release the three screws securing the motor mounting bracket to the windscreen frame - one at each side of the spindle, one at the motor end, and withdraw the complete mechanism from the car.

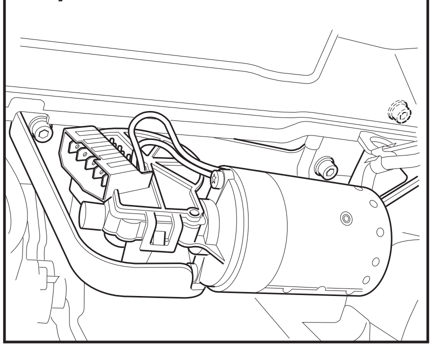
13. If the motor is separated from the mechanism, the position of the rotary link should be marked against the motor shaft for reference when re-fitting. The motor should be in the 'park' position before fitting and the mechanism at full travel so that the rotary link and connecting rod are aligned in the fully extended position.

14. Re-assemble in the reverse order to removal, torque tightening the bracket bolts to 20 Nm.

Step 11.

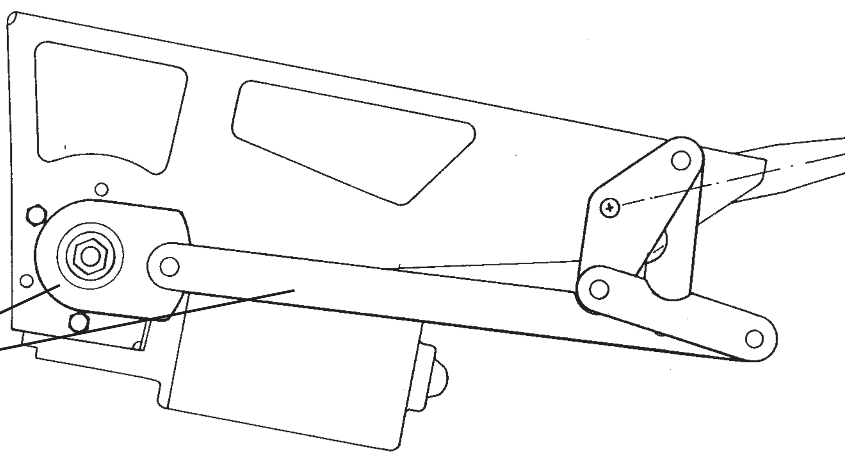


Step 12.



Step 13.

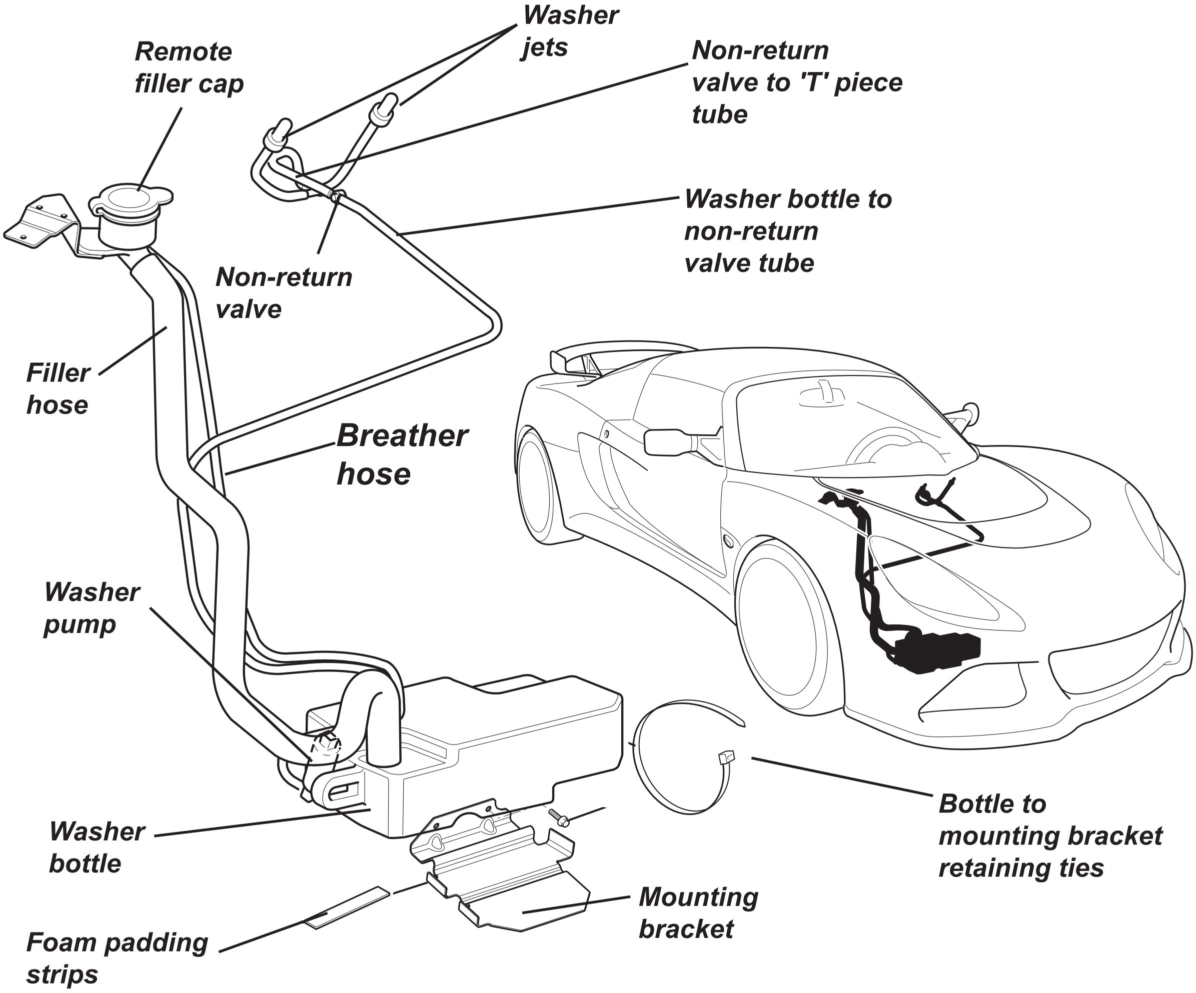
RHD Shown
(LHD symmetrically opposite)



Wiper linkage in full travel position

m209

Washer motor/bottle



The windscreen washer bottle is located on the underside of the crash structure, supported by a mounting bracket which is fixed with M6 x 16 screws (2) to the vehicle chassis.

The washer bottle is additionally retained to the mounting bracket by two tie wraps fixed around the bottle and bracket. Foam strips are fitted between the underside of the bottle and bracket.

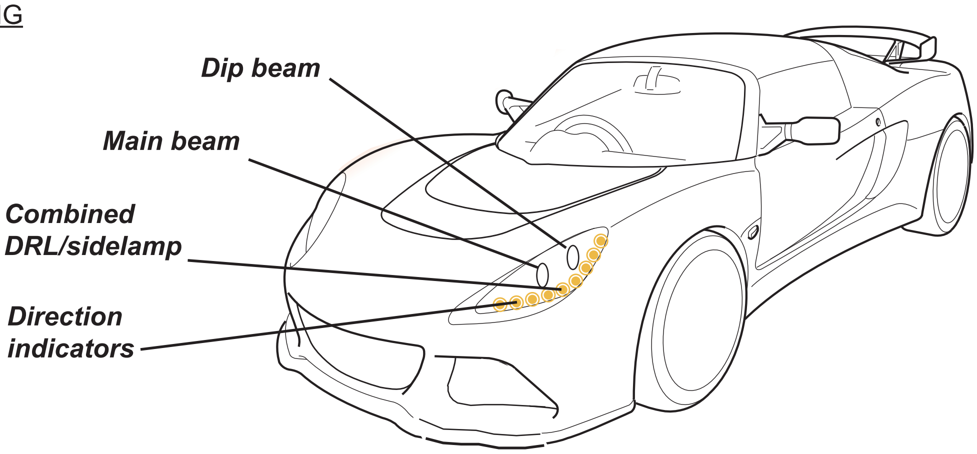
The washer motor is push fitted into a grommet at the RH side of the bottle

The remote reservoir filler hose, breather and washer tubing are routed between RH outside of the crash structure and wheelarch liner, passing through an aperture in the side of the crash structure and then connected the washer bottle/motor.

Access to the washer motor/bottle will require the removal of the front under shield, see service notes section AN.3 for additional information.

A non return valve is fitted in the tubing line near to the ‘T’ piece connector joining the left and right washer jets.

MV.9 EXTERIOR LIGHTING

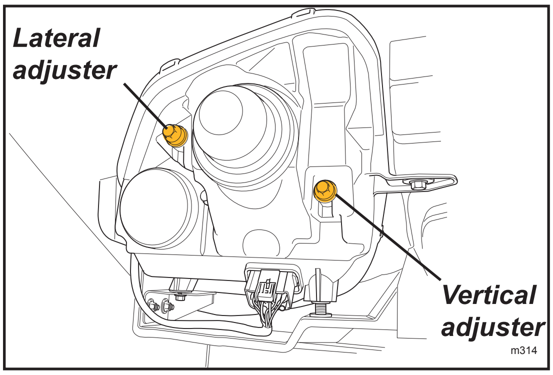


Headlamps
The headlamp assemblies incorporate halogen main and dip beam lamps with replaceable bulbs, LED amber string direction indicators and an LED white string of DRLs (Daytime Running Lamps)/side lamps (which can only be renewed as part of the complete headlamp assembly). The lamp components are enclosed in a polypropylene housing and protected by a polycarbonate clear lens cover.

When the engine is started, the front sidelamps will automatically be activated as daytime running lamps, with the front sidelamps operating with an increased intensity. When the ignition is turned off, the DRLs will switch off automatically unless manually selected.

If the sidelamp switch is activated whilst the engine is running the front DRLs will revert to their sidelamp functionality and operate with a reduced intensity.

Alignment:
The alignment relationship between high and low beam lamps is fixed, but two adjusters are provided on the back of the headlamp housing by which the whole lamp unit may be adjusted.

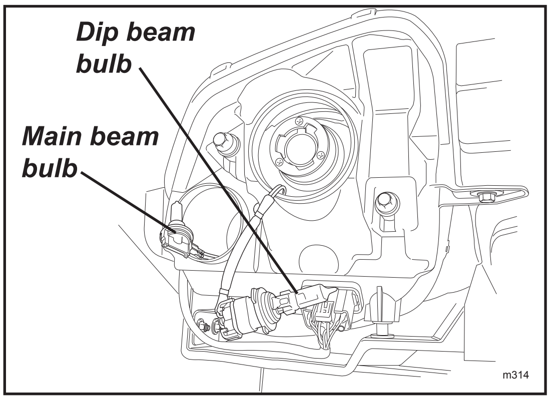


Adjustment:
If adjustment to headlamp alignment is required, remove the access cover in the wheelarch liner, see Service Notes section BT.5 for further information.

To adjust the beam laterally, turn the outboard hexagonal adjuster screw. Optimum setting is 0%.
To adjust the beam vertically, turn the inboard adjuster screw. Optimum setting is -1.2%.

Bulb replacement:
Preparation: Remove the access cover in the wheelarch liner, see Service Notes section BT.5 for further information.

Dip beam bulb: Remove the protective boot from the back of the inboard lamp, twist the bulb holder counterclockwise, and withdraw from the lamp. Prise open the retaining barbs to allow the harness plug to be disconnected. Replace the 12V 60W type HB3A bulb, and reassemble in reverse order to disassembly.



Main beam bulb: Remove the protective boot from the back of the outboard lamp, withdrawing the bulb is similar to the above except that the harness connection uses separate spade terminals (may be connected either way round). The main beam bulb is 12V 65W type H9B.

Headlamp beam masking
The headlamp assemblies are not fitted with any internal masking facility. Therefore if it is necessary to drive a RHD vehicle in an opposite drive hand territory the low beam 'kick up' bias should be masked to prevent dazzle.

Proprietary adaptor kits such as 'Eurolites Headlamp Beam Adaptors' can be purchased from many different motorists stores and used for a limited time period on the headlamp assemblies.

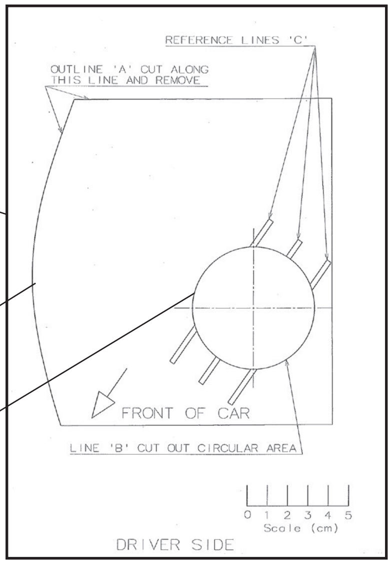
The correct positioning of any adaptor is critical to ensure that only the dipped headlamps 'kick up' bias beam is masked without affecting the its horizontal beam pattern.

Lotus has produced beam converter templates that will aid in the fitting of suitable masking/adaptor kits, ensuring that they are positioned correctly on the headlamp lens so masking the 'bias' beam pattern area without disrupting the horizontal pattern.

Template information:

Part Number	Description	Qty
LSL 604	Beam converter template, driver's side - RHD	1
LSL 605	Beam converter template, passenger's side - RHD	1

The above template part numbers are available to download and print from the Lotus Dealer Portal. From the homepage go to - Miscellaneous Technical Information>Instructional Guides.



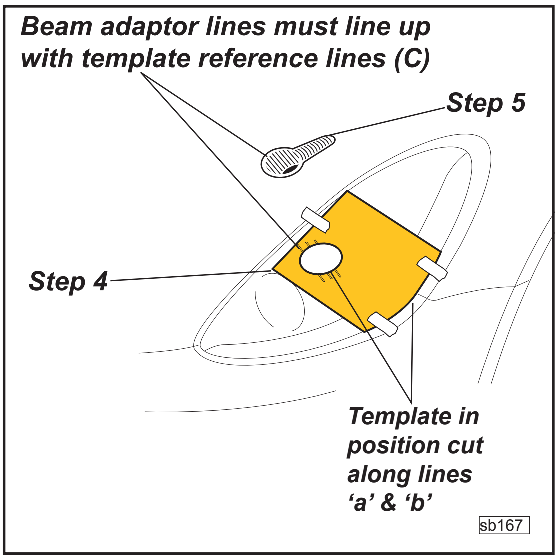
Masking procedure:
1. Cut along contour line (A) and remove this portion of the template.

2. Cut out the circular area (B) of the template.

3. Clean the lenses and activate the lamps per the Beam Adaptor manufacturer's recommendations which can be found in the included fitting kit.

4. Lay the 'Drivers Side' template onto the driver's side headlamp lens using the inner line of the black 'frame' as a guide. Hold in place on the lens with 3 small pieces of masking tape.

5. Peel off the backing paper from the circular section of the beam adaptor and position centrally inside the circular area of the template ensuring the adaptor lines are in the same orientation as the reference lines 'C' on the template.

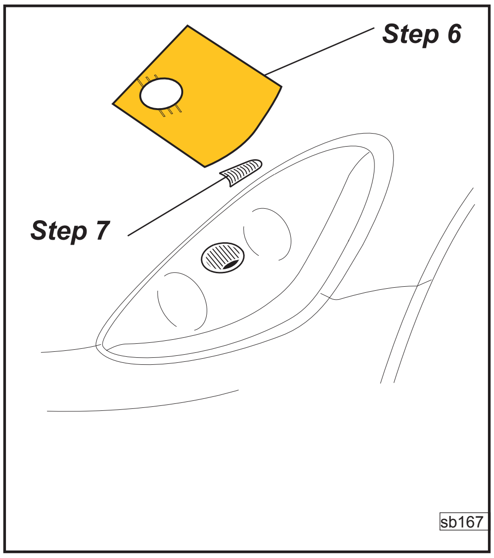


6. Remove the template.

7. Tear off the tail portion of the beam adaptor

Repeat the process using the ‘Passenger Side’ template for the passenger side headlamp.

For removal of the Beam Adaptors, follow the adaptor manufacturer’s instructions and recommendations.



Note: Self adhesive beam adaptors should be used for as minimum of period as possible, and removed as per the manufacturers recommendations.

Continued use of adaptors or their improper removal may, under extreme circumstances, cause irreversible marking of the headlamp lens which will not be considered a Lotus manufacturing defect and not liable under the vehicles limited vehicle warranty.

It is recommended to replace the vehicles headlamp assemblies to LHD units for continued use in an opposite hand drive territory.

Headlamp *removal:*
Remove the headlamp access panel from within the wheelarch liner area; see Service Notes section BT.5 for further information.

1. Disconnect the main harness connector from the headlamp terminal.

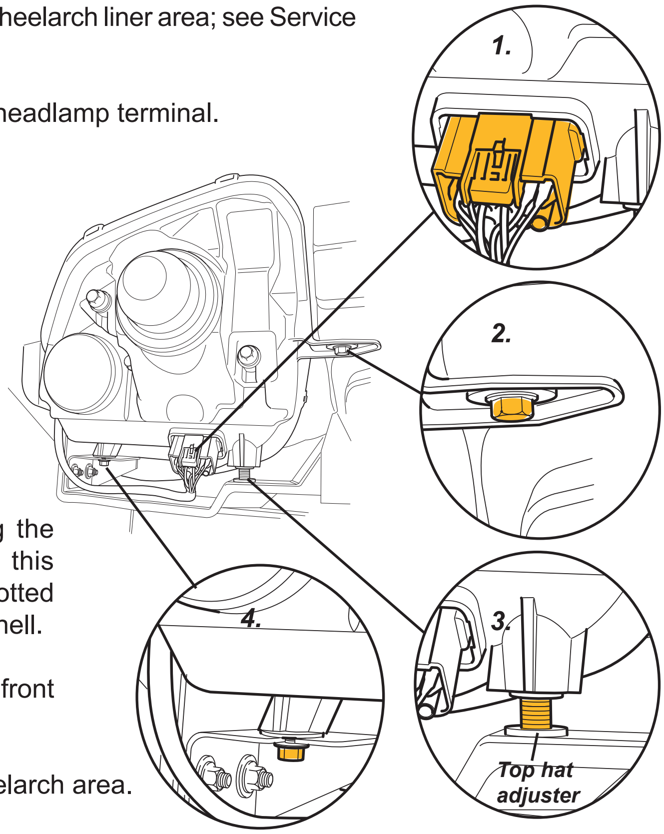
2. Remove the M6 x 14 bolt and washer securing the headlamp upper outboard mount to the clamshell (note, there may also be spacers fitted between the headlamp mounting lug and clamshell).

3. Remove the M6 x 16 bolt fitted into the headlamp brass 'top hat' mounting adjuster which can be wound in and out of the headlamp to align the headlamp lens to the clamshell.

4. Remove the M6 x 14 bolt and washer securing the headlamp to the crash structure bracket. (Note this bracket can also be moved up and down on its slotted apertures to align the headlamp lens to the clamshell.

5. Remove the M6 x 12 bolt and washer securing the front of the headlamp to the clamshell (not illustrated).

The headlamp can now be withdrawn from the wheelarch area.



Refitment:
Is the reverse of removal except that headlight positioning (as per steps 2,3 & 4) may have to be adjusted to ensure that it is sitting flush with the profile of the clamshell, and adjust beam alignment if required as shown on the previous page.

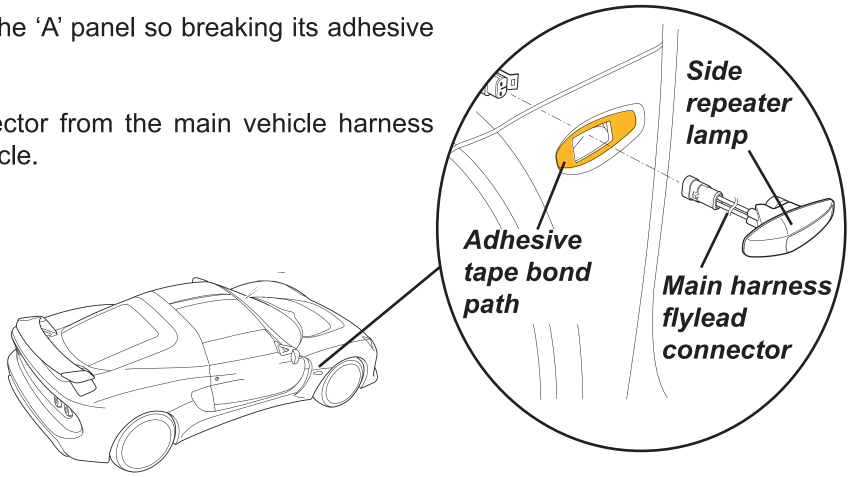
Side repeater lamps
Located within the door hinge cover ‘A’ panels, the side repeater lamps flash in unison with the front and rear indicator lamps. Using LED’s (Light Emitting Diodes) the lamps are not serviceable and must be replaced as a complete assembly in the event of failure.

Removal:
It is retained to the ‘A’ panel by an adhesive backing which is integral to the rear body mounting face of the lamp.

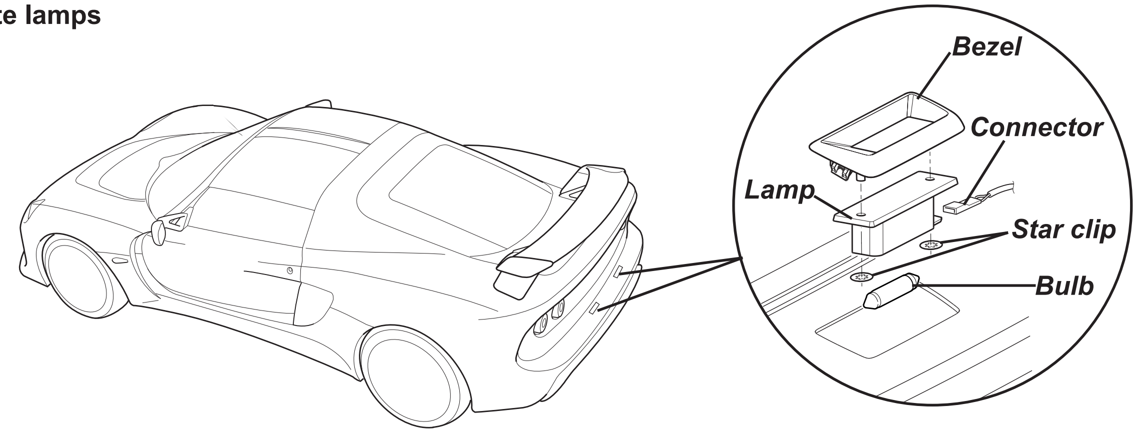
Carefully prise the lamp away from the ‘A’ panel so breaking its adhesive bond.

Disconnect the lamps flylead connector from the main vehicle harness multiplug and withdraw from the vehicle.

Refitting:
Is the reverse of removal.



Licence plate lamps

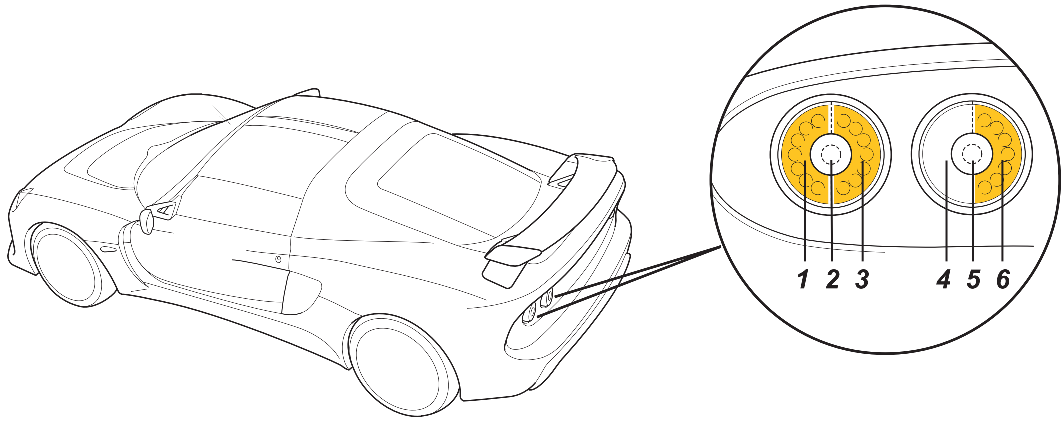


Removal:
Withdraw the lamp assembly away from the bumper by carefully prising the lamp bezel away from the rear bumper releasing it from its integral securing clips.

Bulb removal:
The festoon bulb can then be removed from its electrical connections within the transparent lamp housing.

Lamp renewal:
The lamp can be separated from the bezel by carefully removing the star clips from the lamp housing securing posts.

LED Rear Lamps



The rear lamp clusters incorporate LEDs (Light Emitting Diodes) in the annular segments of the lamps. The central elements continue to use filament bulbs.

The LEDs are extremely durable and are serviced only by lamp cluster replacement. The turn indicators in the centre of the outboard lamps, and the reverse lamps in the centre of the inboard units, use W16W bayonet fitting filament bulbs in twist release holders.

Lamp Configuration - filament bulb & LED types (LH lamps shown)

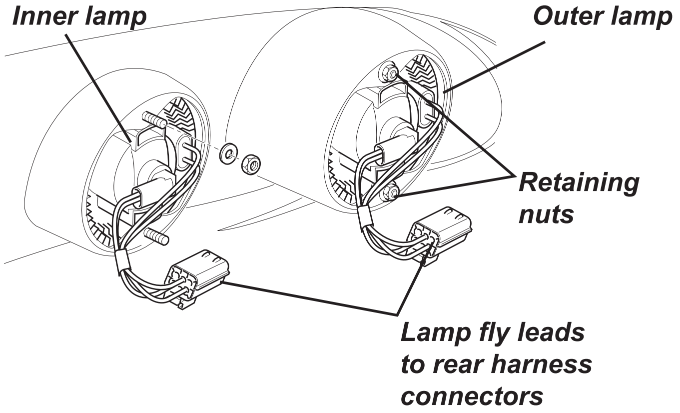
Outboard lamp

Function	Bulb type
1. Tail and brake lamp	LED
2. Direction indicator	Capless 12V 16W W16W
3. Tail and brake lamp	LED

Inboard lamp

Function	Bulb type
4. Not used	N/A
5. Reverse lamp	Capless 12V 16W W16W
6. Rear fog lamp	LED

Lamp security
Integral studs fitted to the rear lamps fix them to the rear transom panel.



Removal:
Remove the applicable lamp cover located within the rear luggage compartment.

Disconnect the harnesses of both ballast modules at their multi-plug connections to the RH & LH outer lamp fly leads.

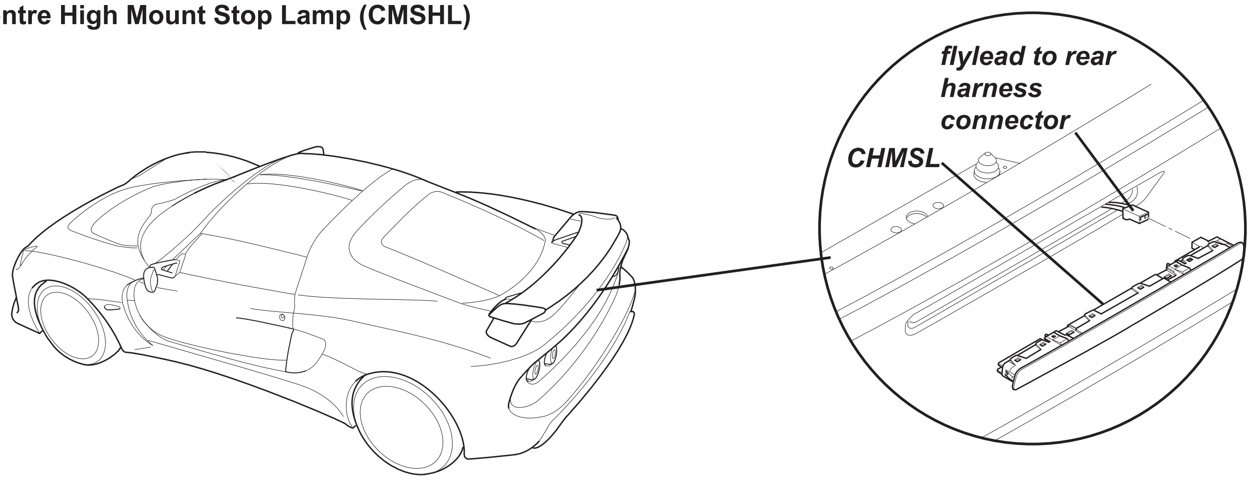
Disconnect the rear harness within the luggage compartment to the lamp(s) fly lead multi-plug connector.

Remove the M5 nyloc nuts and M5 washers securing the lamp(s) to the transom panel.

The lamp(s) can now be withdrawn away from the transom panel.

Refitment:
Is the reverse of removal, ensure the lamps are fitted in the correct rotation.

Centre High Mount Stop Lamp (CMSHL)



Located within rear clamshell above the transom panel, it illuminates in unison with the brake lamps.

Using LED’s (Light Emitting Diodes) the lamp is not serviceable and must be replaced as a complete assembly in the event of failure.

Removal:
It is retained to the clamshell panel with integral clips moulded into the CHMSL body.

Prising it out directly from the clamshell may break the integral clips. It is recommended to remove the tailgate latch cover to gain access to the rear of the CHMSL so that its integral clips can be pushed in allowing the lamp to be withdrawn out of the clamshell.

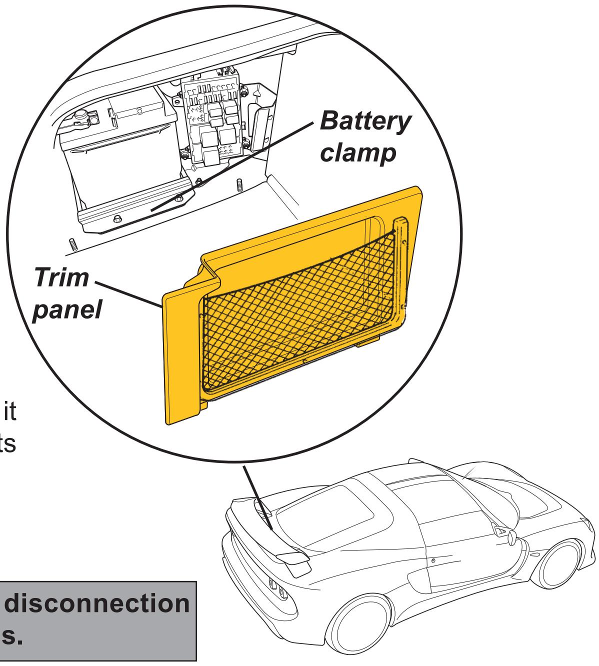
Refitment:
Is the reverse of removal.

MV.10 - BATTERY, BATTERY CABLES & EARTHING POINTS

Battery

⚠ WARNING: POISON/DANGER - CAUSES SEVERE BURNS - KEEP OUT OF REACH OF CHILDREN. Contains sulphuric acid - avoid contact with skin, eyes or clothing. If in contact with skin or eyes; flush with copious amounts of water. Remove contaminated clothing. Seek immediate medical attention. If ingested; seek immediate medical attention . Do not induce vomiting or give fluids to drink. Batteries produce explosive gases. Keep sparks, flames and cigarettes away. Ventilate when charging or using in enclosed space. Always shield eyes when working near batteries.

Battery location
The 72 Ah VARTA BLUE dynamic battery (Varta part number 572409068) is located at the left hand of the rear luggage compartment.



Battery maintenance
Inspection or topping up of the electrolyte is not required, but at intervals specified in the Maintenance Schedule, the battery terminals should be checked for security and condition, and protected with petroleum jelly.

Battery access
Remove the left hand compartment trim panel by pulling it away from the luggage compartment releasing it from its velcro fixings.

Disconnecting the battery

⚠ WARNING: Failure to follow the correct battery disconnection procedure detailed below could result in serious burns.

- Ensure that all electrical loads (e.g. lights) are switched off.
- If the car is fitted with security coded audio equipment, check that the code is available for entering after battery reconnection.
- Wait for at least **30 MINUTES** after switching off the ignition to allow the engine management system to adjust the setting of some components ready for re-starting.
- Ensure the alarm is disarmed. If the battery is disconnected when armed, the alarm will be triggered.
- Disconnect the negative (earth; black; '-') battery cable first, and re-connect last.

⚠ WARNING: If the battery positive terminal is inadvertently earthed (e.g. when using a spanner) whilst the negative terminal is still connected, the resultant short circuit, with heavy sparking and current flow, could cause serious burns and/or a fire.

Battery reconnection
Refit the battery, with the terminals outboard, by reversing the removal procedure. Remember to push on the breather pipe (if applicable), and note the polarity symbols marked on the battery case before reconnecting the battery cables as detailed below.

vi. Check again that all electrical loads are switched off.
vii. Connect the positive battery cable first, followed by the negative (earth) cable.
viii. Be aware that the vehicle security alarm may be triggered by the action of battery re-connection. Have the alarm transmitter key ready to disarm the alarm (see 'Vehicle Security Alarm').
ix. After reconnection, a change in the engine performance characteristics may be noted for a period whilst the computer controlled engine management system 're-learns' some of its settings.
x. If necessary, enter the security code into audio equipment.

Battery removal
Disconnect the battery terminals, see 'Disconnecting the Battery' and pull off the breather pipe (if applicable). Release the M6 x 16 hex flg, screw (2) securing the clamp bracket at the base of the battery, and manoeuvre the battery out of the luggage compartment.

⚠ WARNING: When lifting the battery out of, or into the car, be aware of the considerable weight and take all appropriate precautions to safeguard personal health. Injury can result from improper lifting technique. Keep the battery upright, and protect from sharp knocks and shocks. The plastic case is easily damaged by careless handling.

Battery charging
Under conditions of normal daily use, it should not be necessary to use an external battery charger. In a low usage conditions, however, it is important to maintain the charge state of the battery using a trickle charger, or an automatic battery management conditioner such as that available through Lotus Dealers.

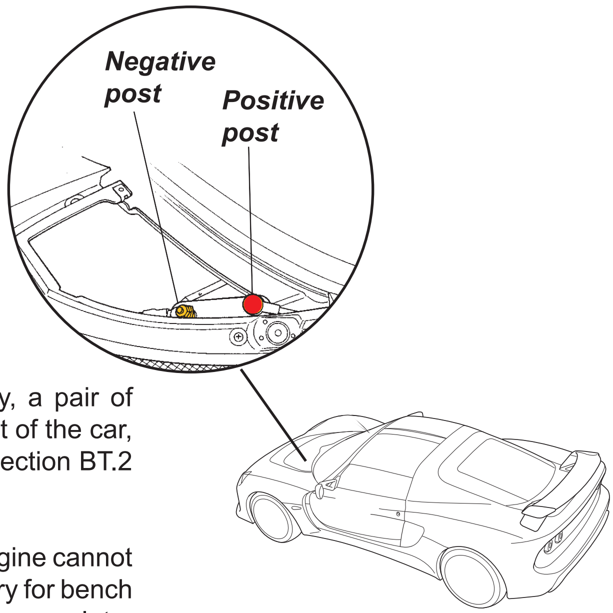
Note: A battery conditioner will maintain a fully charged battery, but cannot recharge if the battery becomes discharged. Starting difficulties may be encountered after an unattended period of 3 weeks. A battery conditioner is able to continuously monitor battery charge state and switch on and off automatically in order to maintain the battery in a fully charged condition without danger of damage through overcharging.

If the battery becomes discharged to the extent that the car cannot be started, the recommended course of action is to fit a substitute battery whilst the original battery is trickle charged. If, in an emergency, the car has to be 'jump' started, the subsequent conditions of car use may not allow for sufficient alternator charging of the battery to achieve a fully charged state.

The battery should be trickle charged by external means until 12.8 volts is recorded, this process may take 24 hours or longer. Putting the battery into service at a lower state of charge will reduce the time period for which the car can be parked without subsequent starting concerns. A battery left in a fully discharged state for a prolonged period, may not be recoverable to its original condition. A discharged battery is also vulnerable to freezing of the electrolyte, which could result in a damaged casing.

⚠ WARNING: Hydrogen gases generated by the battery could cause an explosion, resulting in severe personal injuries. Charge the battery in a well ventilated area. Never charge a frozen battery. It may explode because of gas trapped in the ice. Allow a frozen battery to thaw out first. If you get electrolyte, which is an acid, in your eyes or on your skin, immediately rinse with cold water for several minutes and call a doctor.

'Jump' Starting



Auxiliary Power Posts
Access to the battery in the rear luggage compartment is available only after opening the engine cover lid/tailgate via the release handle on the cabin rear bulkhead.

If the car is centrally locked, and then the vehicle battery becomes discharged power must be restored before the doors may be opened and the battery accessed.

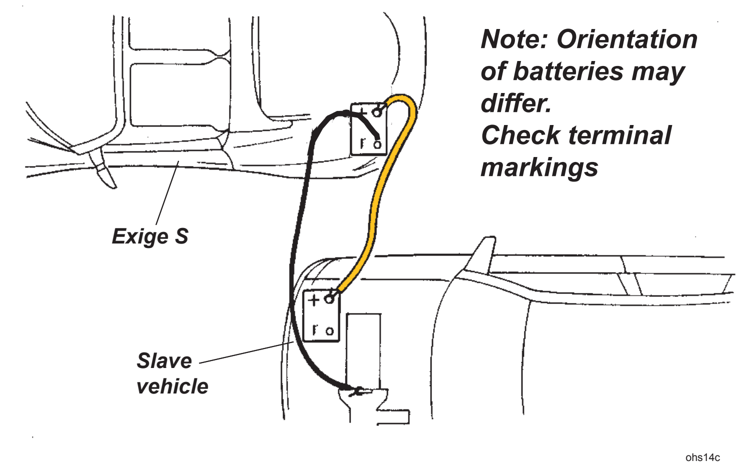
To facilitate the connection of an auxiliary power supply, a pair of secondary battery posts are provided at the left hand front of the car, beneath the front body access cover, see service notes section BT.2 for further information.

If the battery becomes discharged to the extent that the engine cannot be started, the recommended action is to remove the battery for bench charging, and/or fit a substitute battery until this process is complete.

If this option is unavailable, the car may, in an emergency, be 'jump started' from a second vehicle with 12V negative earth electrics, but be aware that such a process can cause damage to vulnerable electronic controllers, which would not be covered by the New Vehicle Warranty.

⚠ WARNING: It is most important that the correct procedure is followed in order to reduce the risk of damage to either car's electrical system, and most importantly, to minimise the danger of a spark induced battery explosion. Check that the slave car also has a 12V NEGATIVE EARTH electrical system.

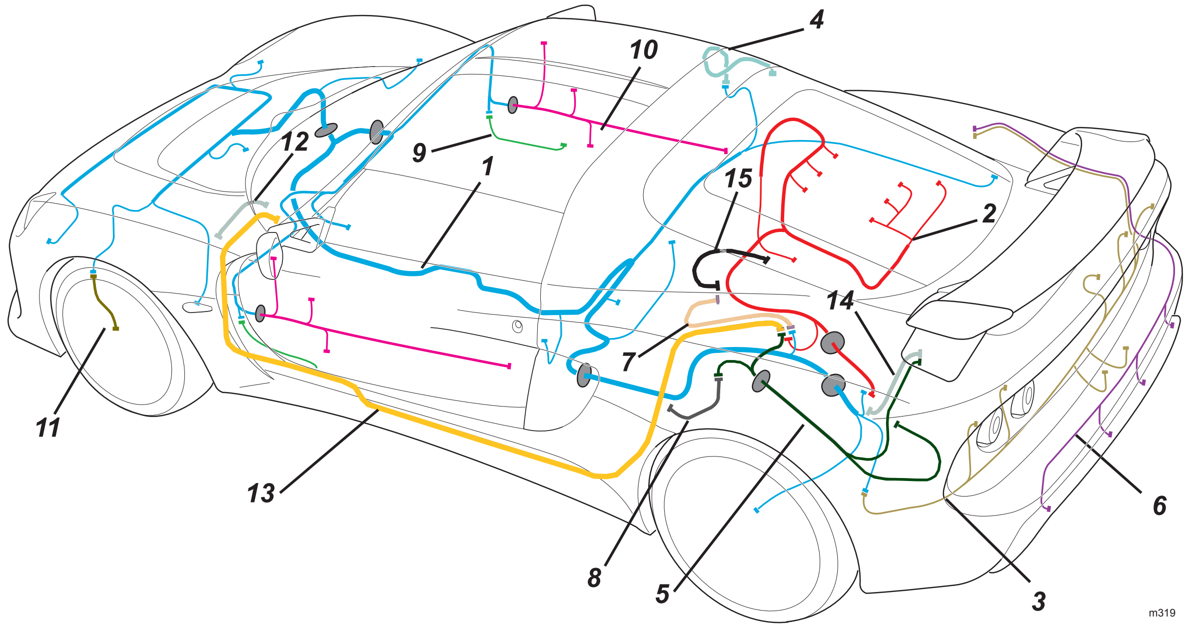
JUMP STARTING



'Jump' Starting Procedure
- With the engine of the slave car running at a fast idle, use one jumper cable (red) to connect the positive (+) terminal of one battery to the positive terminal of the other battery.
- Take care to avoid inadvertently earthing the free end of this cable to the metal body or chassis of either car.
- Connect one end of the other jumper cable (black) to the negative (-) terminal of the discharged battery.
- A spark will occur when the other end of this cable (the final connection) is connected to an earth on the slave car. This connection should therefore be made to an earthing point well away from the battery, and from any fuel vapour area or moving parts. An engine hanger bracket is often ideal.
- Start the disabled vehicle in the usual way, and run at a fast idle.
- A spark will occur at the first disconnection of a jumper cable, so it is essential that the first disconnection is made from the slave car earth. Both batteries (especially the discharged one) will be 'gassing' heavily at this time, and if the first disconnection is made at a battery terminal, there is a danger that the hydrogen gas may be ignited by the spark with a resultant explosion.
- Have the cause of the flat battery investigated and rectified, and trickle charge the battery as detailed above.

⚠ WARNING: Both the final connection and the first disconnection should be made away from the battery to reduce the risk of explosion. Causing an electrical short circuit could result in serious personal injury and/or vehicle damage. Use only jumper cables of adequate cross-section, fitted with completely insulated alligator clamps. The cables must be long enough to allow that neither cars nor cables touch each other.

MV.11 - HARNESS ROUTING



1. Main harness
2. Engine harness
3. Rear harness
4. Tailgate harness
5. Battery harness
6. Parking aid harness
7. Rear positive stud to starter motor cable
8. Gearbox to chassis earth cable
9. Courtesy switch jumper harness
10. Door harness
11. Wheel Speed Sensor extension lead
12. CDL power up negative cable
13. Front positive stud to rear positive stud cable
14. ECU plate to battery negative cable
15. Engine to starter earth earth

The main harness runs from the main fusebox/relay station at the passenger side of the front services compartment, and divides into three branches; one running forwards across the front of the chassis well to feed the interior fan motor, heater/a.c. functions, radiator fans and ABS controller, and then round the front of the crash structure to supply the horn and front lights. A second branch connects to the radiator fans

The third branch runs rearwards through the scuttle where it divides again to run across the dash top, picking up on the positive post, and supplying the instrument pack and switchgear and under dash relays.

The harness then runs along the cockpit centre tunnel to the rear of the cabin, over the top of the fuel tank bay, and through a grommet at the left hand rear corner of the cabin.

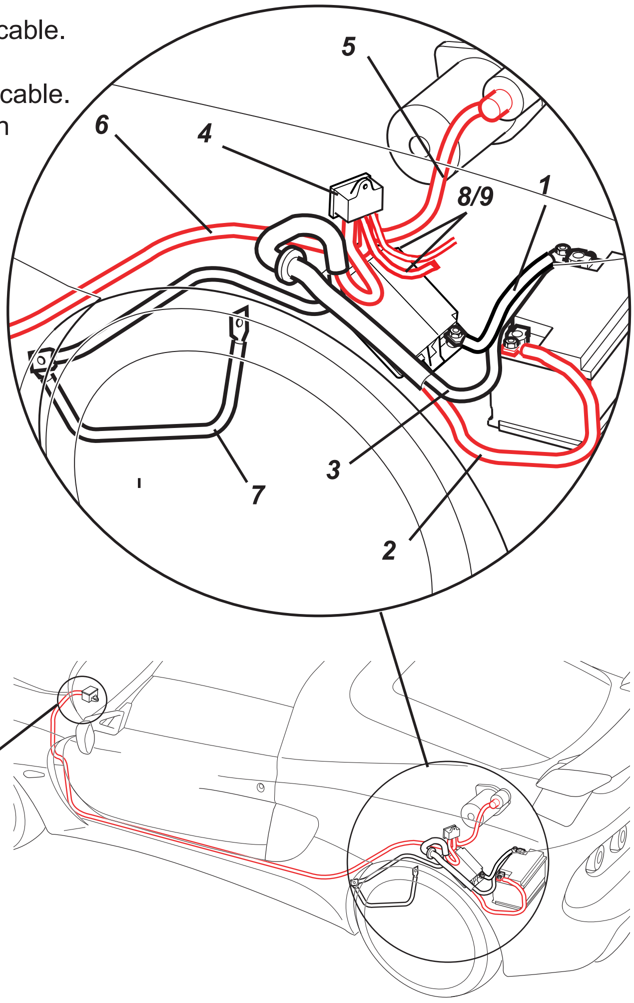
At the left hand front corner of the engine bay, one branch continues rearwards through a rear clamshell grommet to connect with the rear lighting harness, rear fusebox and engine ECU routed inside the clamshell.

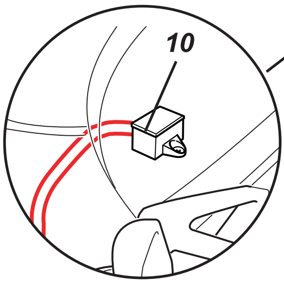
Another branch runs across the engine bay/cabin bulkhead to the tailgate harness.

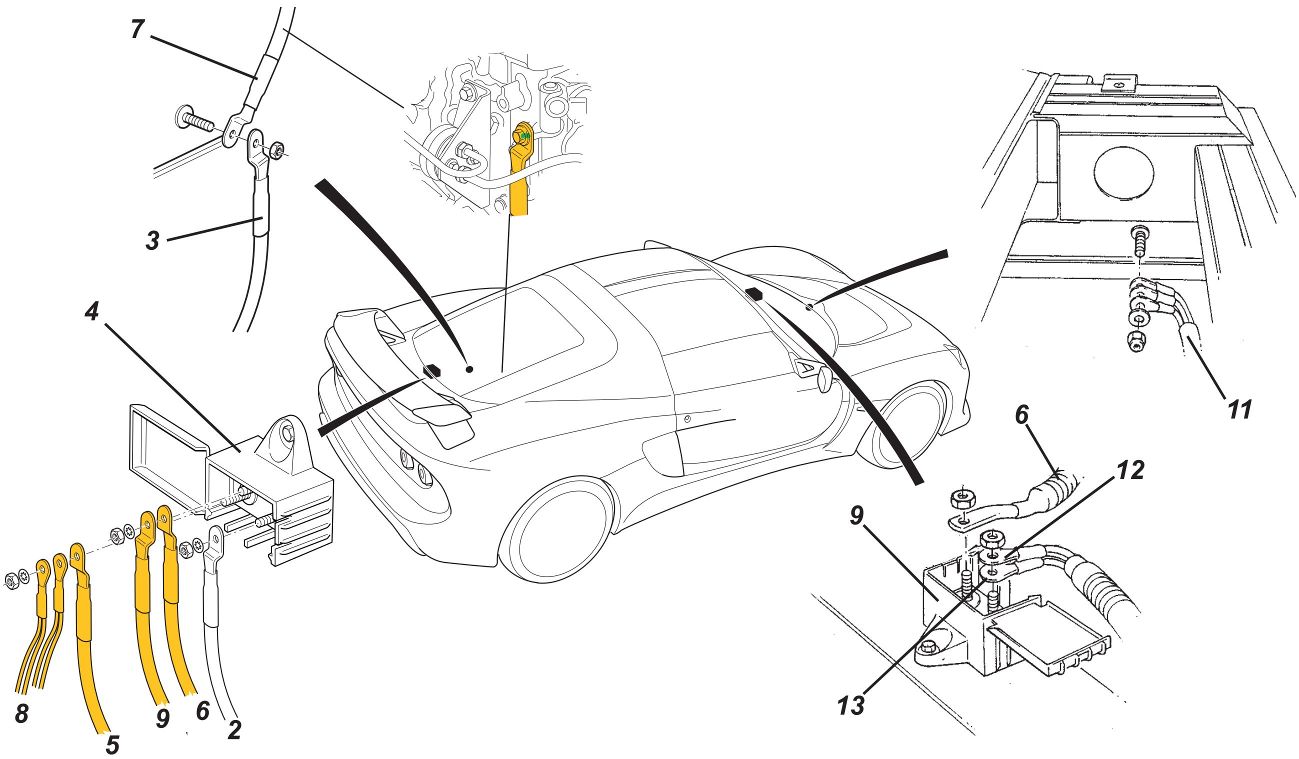
The same main vehicle harness is fitted to both RHD and LHD models, with the harness direction reversed at applicable areas to accommodate the connection of driver controls, instruments panels, fuse boxes, electronic throttles etc.

Battery cables; positive & negative posts

1. Battery negative to ECU mounting plate earth earth cable.
2. Battery positve terminal to rear positive post cable.
3. Battery negative terminal to chassis rear earth point cable.
4. Rear positive binding post on underside of wheelarch panel.
5. Rear positive post to starter solenoid cable.
6. Rear positive post to front positive post cable (running along LH side chassis rail to binding post on scuttle).
7. Chassis earth to engine earth cable (bolted to transmission casing).
8. Main & start relay in rear fusebox feed cable.
9. Positive feed cable for selected mini fuses in rear fusebox.
10. Front positive binding post on scuttle (under dash top fascia panel).
11. Chassis front earth mounting stud located on inner chassis in HVAC climate chamber.
12. Ignition switch positive cable and M1/M2 maxi fuse feeds in main fusebox.
13. Positive feed cable for selected fuses in main fusebox.

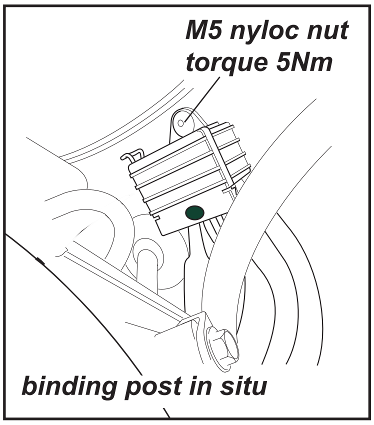






Battery positive cables

The main battery positive cable runs from the battery and is fixed to one of the three studs fitted to the binding post which is mounted on the underside of the LHR wheelarch panel,



The three binding post studs are attached to a common single plate, allowing any cables attached to any of the three studs to draw current from the battery.

Binding post power distribution

Outboard stud
Main positive cable from battery

Central stud
Rear positive post to front positive post cable (running along LH side chassis rail to binding post on scuttle).
Feed cables for main & start relays in rear fusebox.

Inboard stud
Starter motor cable
Positive feed cables for selected mini fuses in rear fusebox.

Binding post
The binding post studs/plate are contained within a plastic housing which has an integral mounting hole allowing it to be fixed to a stud bonded onto the underside of the boot box panel.

Access to the binding post requires the removal of the LHR wheelarch liner; refer to service notes section BT.5 for further information.

Cable access/removal
Preparation:
To ensure that there is no possibility of inadvertently earthing any of the positive cables whilst carrying out the procedure shown below, disconnect the vehicle battery, ensuring 30 minutes have elapsed since removing keys from ignition switch; refer to sub-section MV.10 for further information.

Removal:
Unclip the cover of the positive binding post to access the 6 cable eyelets and M8 fixing nuts.

Release the M8 nut(s) securing the cable(s) eyelet to the post stud(s) as required and remove the cable from the binding post stud.

Refitment:
Is the reverse of removal except

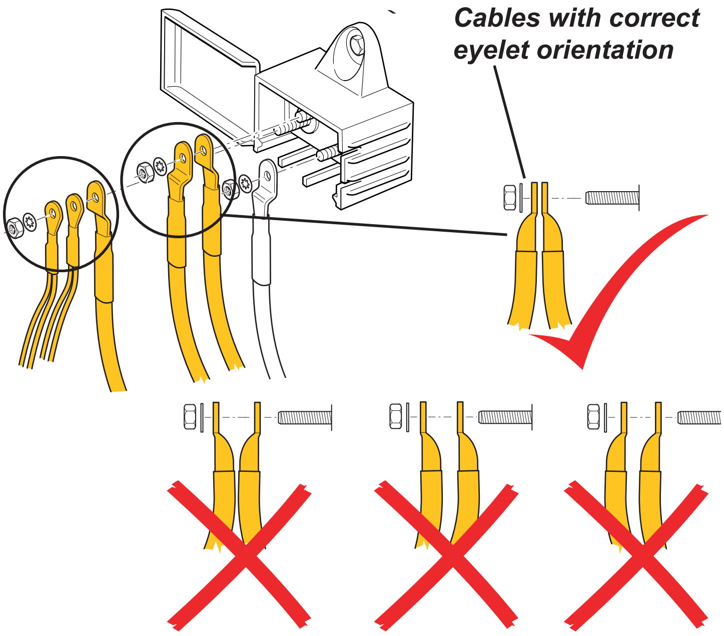
Once refitted, check the alignment of the cables ensuring that they are not kinked or fouling on any body panels or ancillary components

Refit the M8 securing nut(s) on the post stud(s) and torque tighten to 11Nm

Apply anti-corrosion compound to the nuts and threads of the 3 positive post studs.

Refit the binding post cover

Important Note
If 2 cables are secured to the same positive post stud, ensure that their cable eyelets are placed 'back to back' to ensure correct harness to post stud clamping is achieved.

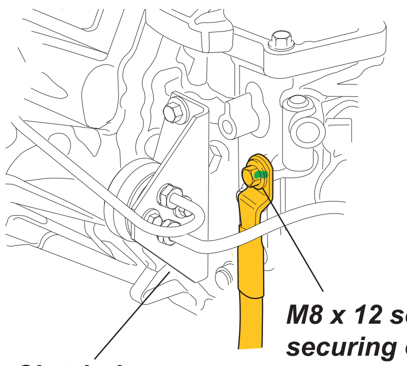


Incorrect orientation of adjoining power cable eyelets may result in insecure cable attachment which may cause poor, non-start or the engine failing to turn-over with the ignition key.

These concerns may duplicate the same conditions as a disconnected battery therefore not generating any fault codes that could assist with any fault finding diagnosis.

Battery negative cables
2 earth cables connect to the battery earth terminal, one connects to a binding post mounted on the engine ECU plate, the other to a chassis earth point on the inside surface of the LH chassis rail at the side of the engine bay, accessible from beneath.

From here, an earth braid connects the transmission casing to provide engine earthing, (also see illustrations on previous page).



A second earth point is used at the front of the chassis to provide for front mounted components, and is located within the front services compartment on the inside surface of the chassis LH siderail, (see illustrations on previous page). Each chassis earth point uses an M8 threaded insert and on some cars, a special stepped washer which must be fitted the correct way round in order to contact the chassis (anodisation removed around insert).

The chassis and cable earth terminals should be coated with an anti-corrosion compound.

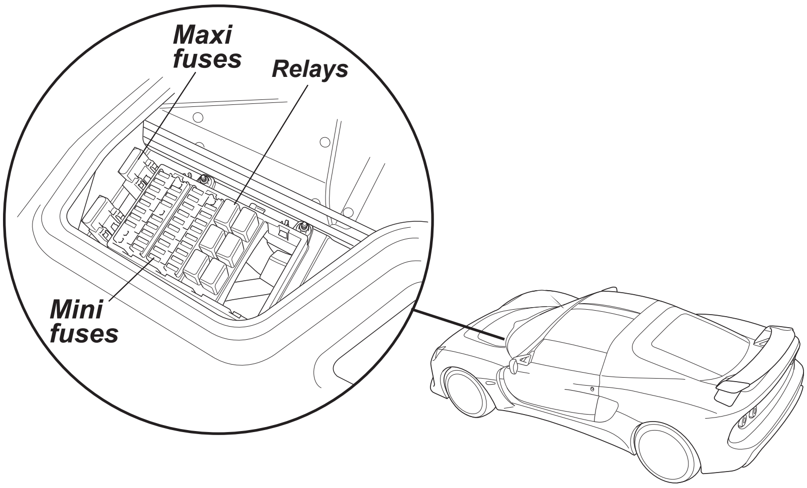
The engine earth braid is mounted vertically downwards from its eyelet and is fixed to the transmission case adjacent the clutch damper bracket by an M8 x 12 screw and washer securing torqued to 16Nm.

MV.12 - FUSE & RELAY STATION LOCATIONS, FUSE RATINGS, INERTIA SWITCH & SWITCH PACK

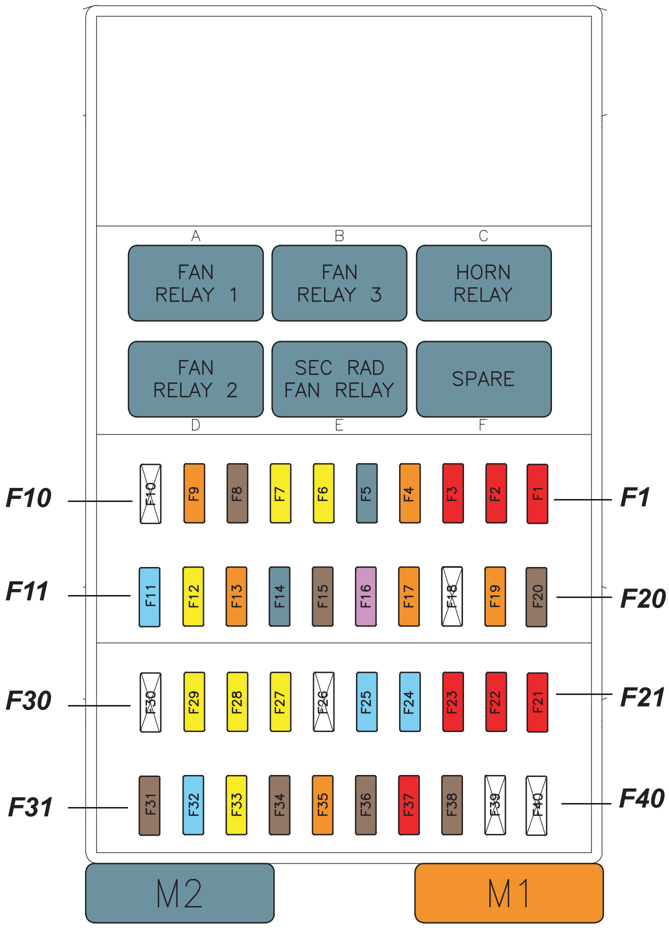
Main Fusebox

The main fusebox is located in the front services compartment on the passenger side and is an integral part of the main harness. The fuse box contains 40 'mini' and 2 'maxi' type fuses which are numbered and coloured according to their amperage rating, and may be pulled out from their slots using the fuse extractor tool provided on the fusebox lid. Relays for specific vehicle electrical services are also contained within the fuse box

For access, remove the front body access panel, see service notes section BT.2 for further details and unclip the fusebox lid.



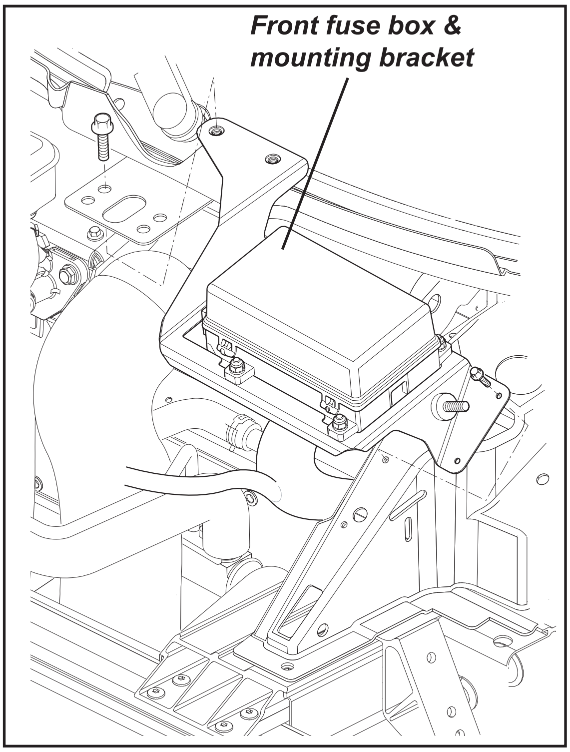
Slot	Rate	Circuit
1.	10A	Ignition services
2.	10A	ABS
3.	10A	Stop lamps
4.		Spare
5.	2A	Parking sensor buzzer
6.	20A	Driver's window motor
7.	20A	Pass. window motor
8.	7.5A	Direction indicators
9.	5A	Day time running lamps
10.		Spare
11.	15A	Wiper motor
12.	20A	Interior fan
13.		Spare
14.	2A	USB charge connector
15.	7.5A	Radio/Instrument pnl. key in
16.	3A	ECU/start, fuel pump & HRS relays
17.	5A	Reverse lamp/parking snsrs.
18.		Spare
19.	5A	Alternator ign
20.	7.5A	AC clutch
21.	10A	Sidelamp/rear fog lamp
22.	10A	LH dip beam
23.	10A	RH dip beam
24.	15A	LH main beam
25.	15A	RH main beam
26.		Spare
27.	20A	Rad fan 2 fast
28.	20A	Rad fans 1&2 slow/fan1 fast
29.	20A	Sec rad fan
30.		Spare
31.	7.5A	Horn
32.	15A	Hazards
33.	20A	Aux power socket
34.	7.5A	CDL
35.	5A	OBD
36.	7.5A	Radio / switch pack module
37.	10A	Alarm & interior lamp
38.	7.5A	Instrument pnl. h/lamp flash
39.		Spare
40.		Spare
M1	40A	ABS main power 1
M2	25A	ABS main power 2



Fuse box re-positioning
Note: Fuse box removal from the vehicle is impractical as it is integral to the main vehicle harness.

Certain repair operations such as windscreen wiper motor and HVAC module investigation/removal will require the fuse box to be re-positioned to gain sufficient access.

The main fusebox casing is retained within a bracket, which in turn, is secured to the windscreen frame and windscreen wiper mounting bracket.



Fuse box bracket

Removal:
Release the M8 x 20 screws (2) securing the front fuse box bracket to the windscreen wiper mounting frame.

Release the M6 x 16 screws (2) securing the fuse box bracket to the windscreen frame.

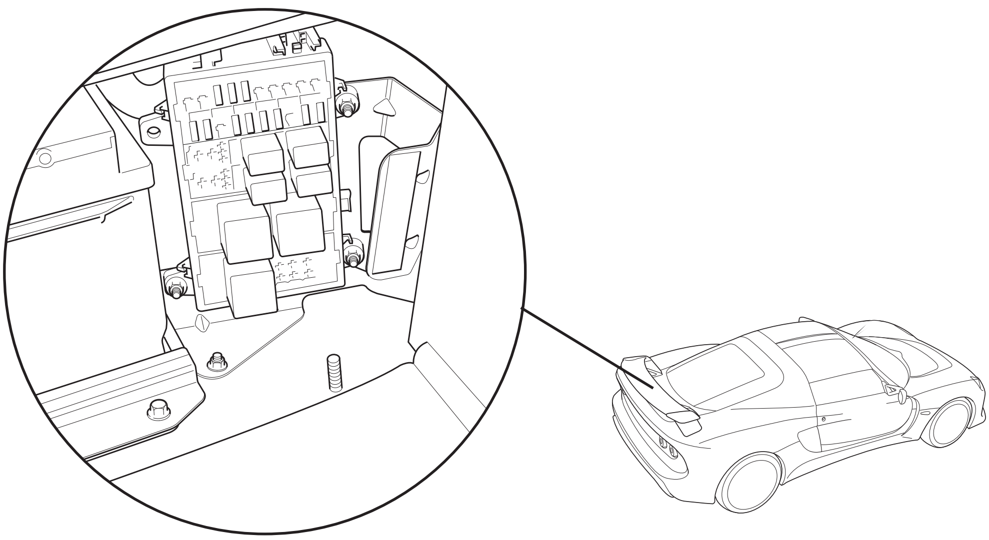
Carefully lift the fuse box with bracket assembly and place to one side ensuring that no unneccesary strain is placed on the wiring harness or connections.

Refitment:
Is the reverse procedure of removal.

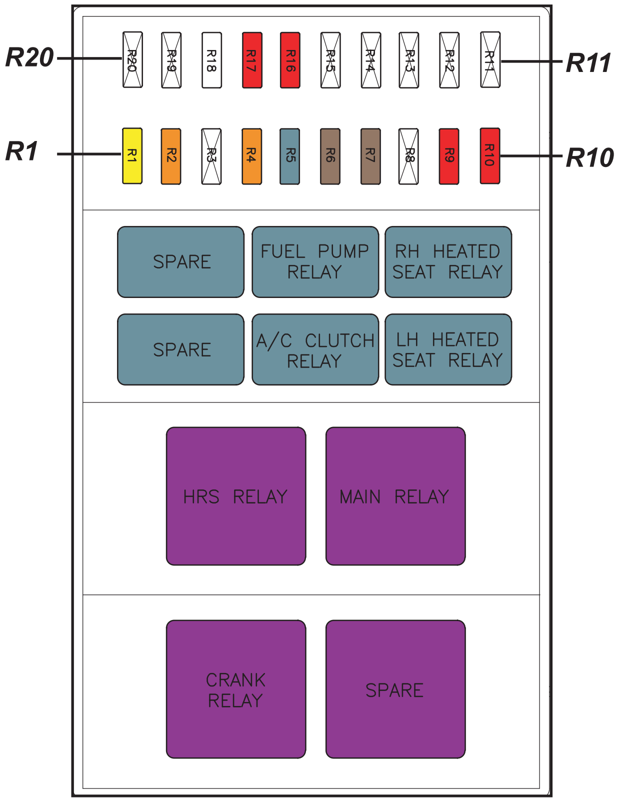
Rear Luggage Compartment Fusebox
Additional fuses and relays are located at the left hand of the rear luggage compartment next to battery and is an integral part of the main harness.

To gain access, remove the left hand storage compartment trim panel by pulling it away from the luggage compartment releasing it from its velcro fixings.

The fuse box contains 'mini' type fuses as well as relays for specific vehicle electrical services. The fuses may be pulled out from their slots using the fuse extractor tool provided on the fusebox lid.



Slot	*Rate*	*Circuit*
1	20A	Fuel pump
2	5A	Alternator sense
3		Spare
4	5A	HRS SW LED
5	2A	Hot soak pump
6	7.5A	02 heaters
7	7.5A	VIM, VVT, PURGE, ACIS, CVCV, A/C VALVE
8		Spare
9	10A	Coils
10	10A	INJ'S / ECU PWR Fan relays, HTD seat relays
11		Spare
12		Spare
13		Spare
14		Spare
15		Spare
16	10A	LH heated seat
17	10A	RH heated seat
18	20A	HRS
19		Spare
20		Spare



Fuse box re-positioning

Apart from fuse/relay removal or refitment it is not normally necessary to disturb the rear fusebox assembly.

Only repair operations requiring the removal of the rear clamshell will require the fuse box to be re-positioned to allow the main harness to be withdrawn from the luggage compartment area.

The rear fusebox consists of separate plastic terminal block housings to locate relevant circuit fuses and relays. Integral slots at the sides of the block housings locate them into a plastic frame which is in turn, secured to a bracket fixed to the luggage compartment floor panel.

The terminal block/frame assembly cannot pass through the clamshell aperture as one piece but must be partially dismantled to allow the individual housing blocks to be fed through from the luggage compartment to the engine bay.

Dismantling procedure:

1. Release the M6 screws securing the fusebox frame to the luggage bay bracket.

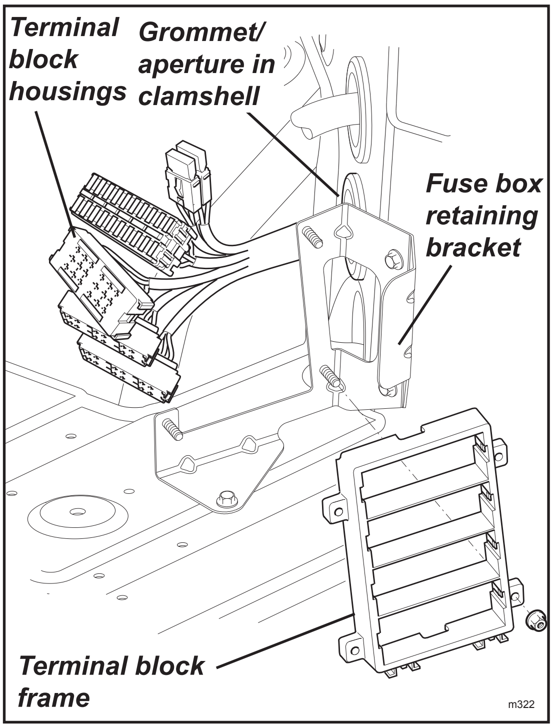
2. Carefully pull the fusebox forward withdrawing it away from the bracket retaining studs.

3. Unclip the housing blocks from the frame.

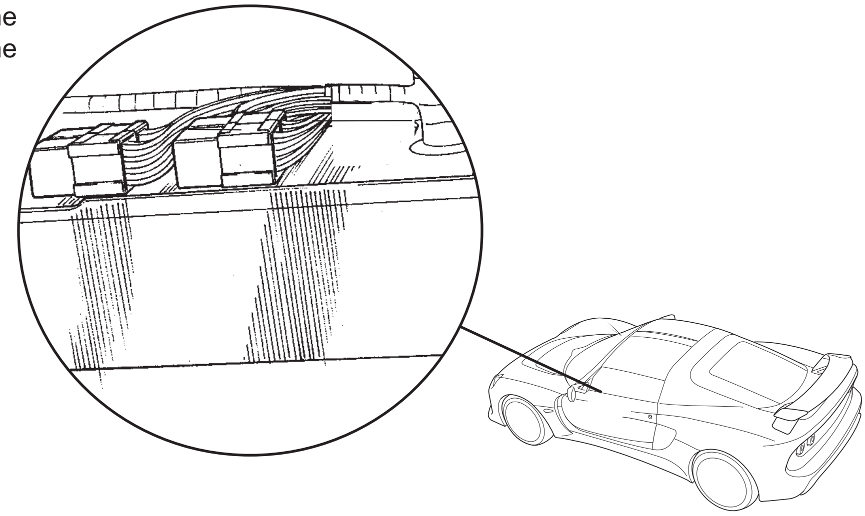
4. Taking great care not to place undue strain on the harness wiring or connections to the fusebox, feed the individual housing blocks/main harness grommet through the luggage compartment aperture into the engine bay, positioning safely away from any heat, grease, oil contamination or sharp edges.

Refitting procedure:

Is the reverse of removal.

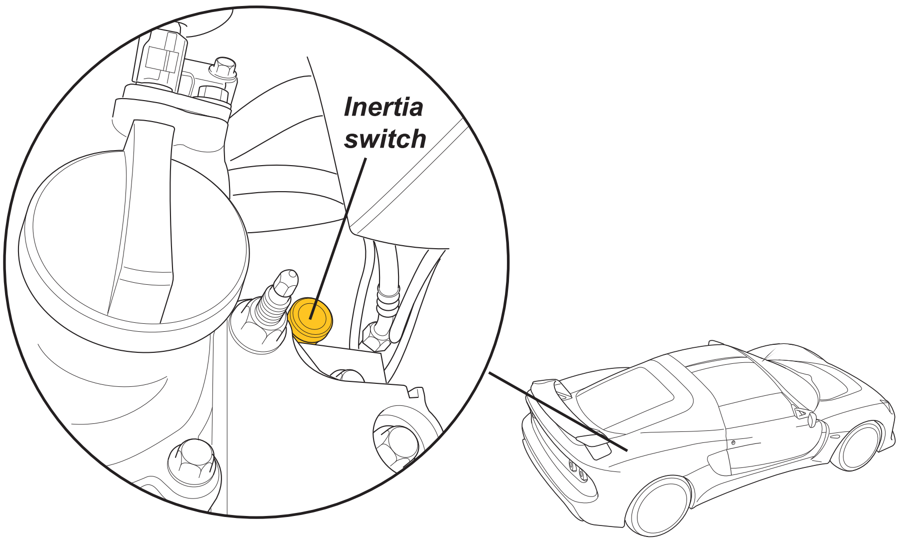


Footwell sited relays
A wiper motor module relay and turn/hazard relay are secured to the main wiring harness just ahead of the scuttle beam and accessible from the passenger footwell.



Saftey inertia switch
The safety inertia switch is designed to operate on impact, typified by vehicle collision, to switch off the fuel pump, and thus minimise any fire hazard. The central door locking will also be triggered to unlock the doors.

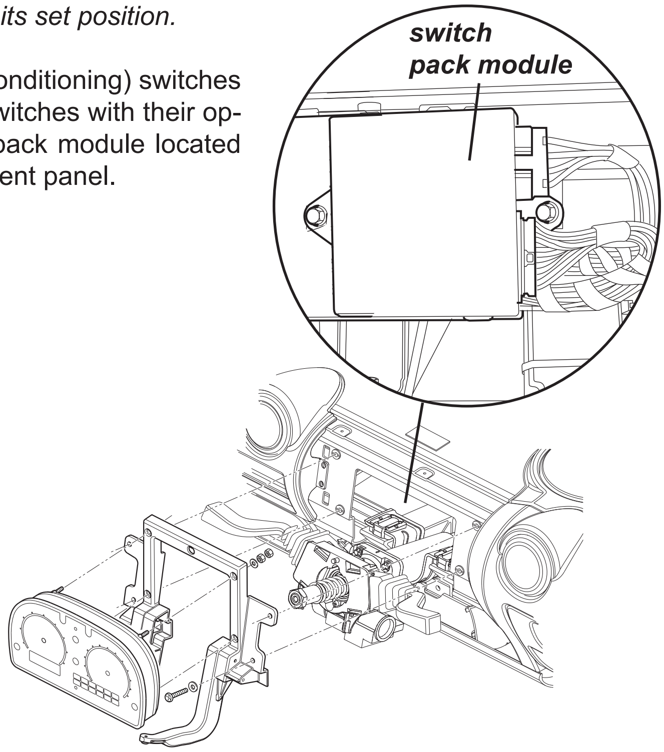
The inertia switch is mounted at the right hand of the engine bay on the rear subframe in front of the engine and inboard of the rear body panel. Although accessible it is not highly visible so it may be necessary to use a torch to locate it. The switch is reset by pressing the rubber diaphragm button on the top of the unit.



Switch pack module
Many driver operated controls are activated by 'momentary'* type switch buttons. When depressed they switch the applicable relay(s) located within the fuse boxes or their relevant control modules to activate/de-activate the vehicle function selected.

**A momentary type switch is only engaged whilst it is being depressed, as opposed to a typical "on/off" switch, which latches in its set position.*

External light and HVAC (Heating Ventilation & Air Conditioning) switches are also operated by momentary type push button switches with their operating functionality being controlled by the switch pack module located underneath the dashboard panel, behind the instrument panel.



Removal:
If the fascia top panel has not been removed for any other repair then the switch pack can be accessed for diagnosis or replacement by removing the instrument panel, see sub-section MV.5 for further information.

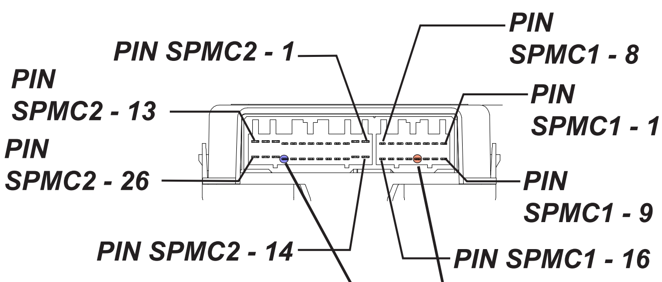
Once the instrument panel has been removed the switch pack can be withdrawn from the dashboard by releasing the M4 x 12 pan head screws and washers (2) securing it to the chassis scuttle panel.

Refitment:
Is the reverse of removal.

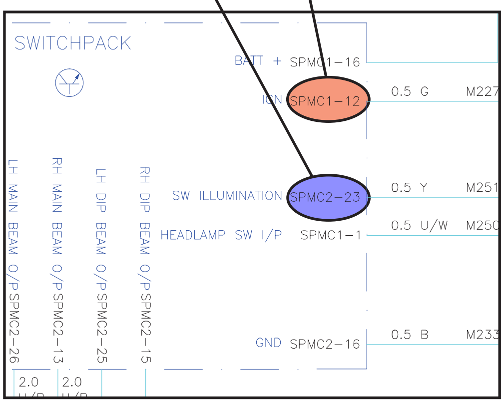
Harness connection and 'Pin out' identification
The switch pack is connected to the main vehicle harness by 2 connector blocks. Connector block 'A' which has 26 terminal pin outs and connector block 'B' which has 16 terminal pin outs.

The terminal pin outs are not identified on the actual unit but are referred in the relevant service note circuit diagrams as:

Connector block 'A' - SPMC2 (Pin outs 1 - 26)
Connector block 'B' - SPMC1 (Pin outs 1 - 16)



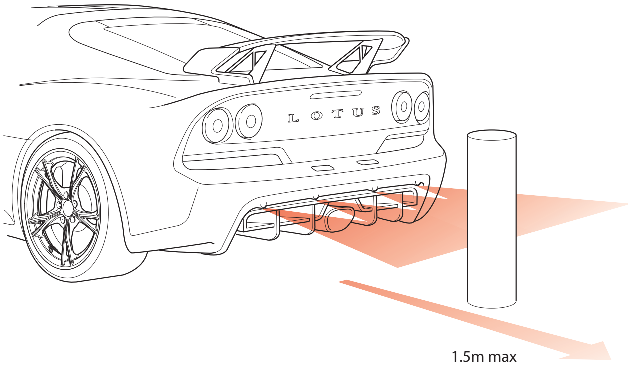
Example of EMS pin information as displayed in an Exige S Circuit Diagram



MV.13 - REVERSE PARK SENSOR SYSTEM *(if fitted)*

Operating principle

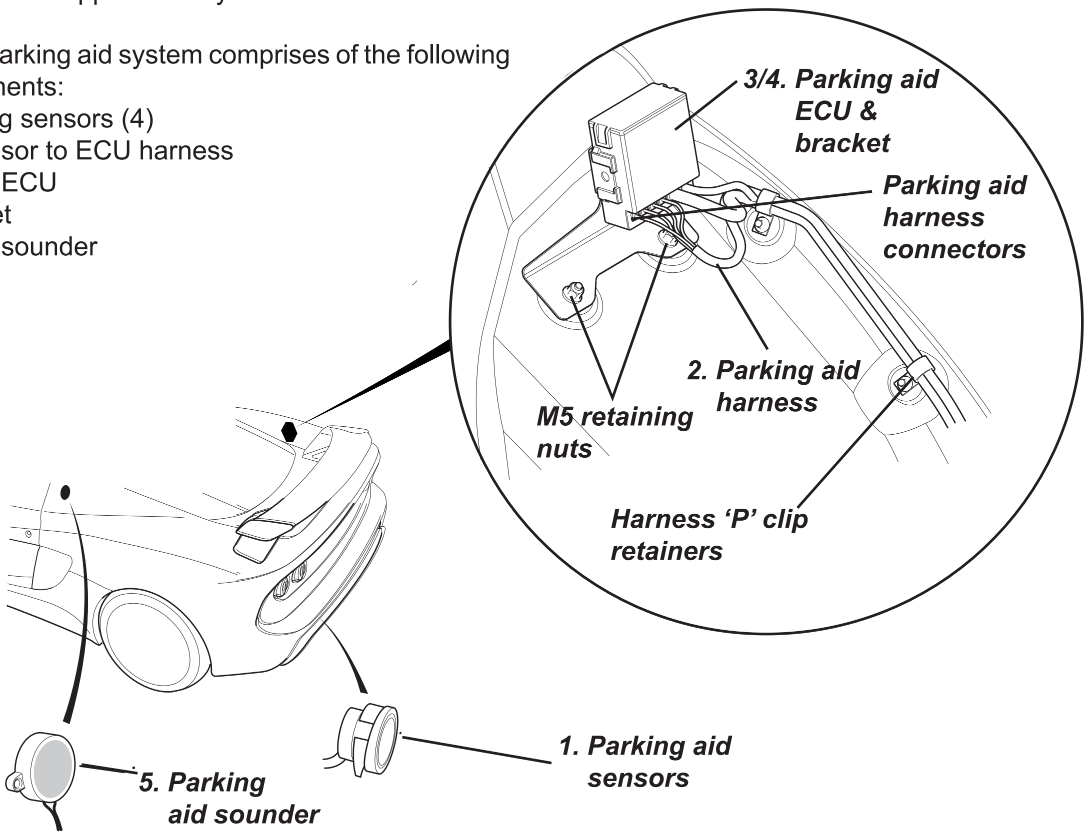
When reverse gear is selected the 4 ultrasonic sensors fitted within the rear diffuser trim will detect any potential objects that are within a 1.5 metre range of the rear of the vehicle.



The driver is alerted to any potential objects and their proximity to the rear of the vehicle by the frequency of the audible beep produced by a sounder (located behind the rear bulkhead trim panel) which increases in frequency as the distance to the object is reduced, becoming a continuous tone at approximately 300mm.

The reverse parking aid system comprises of the following major components:

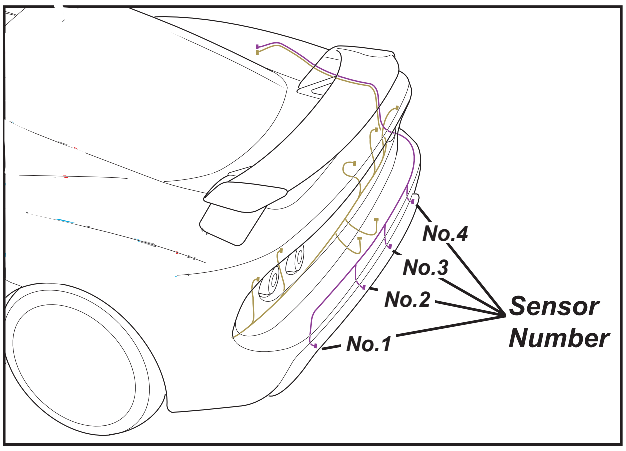
- Rear parking sensors (4)
- Parking sensor to ECU harness
- Parking aid ECU
- ECU bracket
- Parking aid sounder



Each parking sensor consists of an ultrasonic proximity detector fitted within a black coloured protective housings which are pushed into apertures machined in the rear diffuser housing.

Each sensor is connected to its correspondingly labelled parking aid harness connector plug labelled (1 - 4).

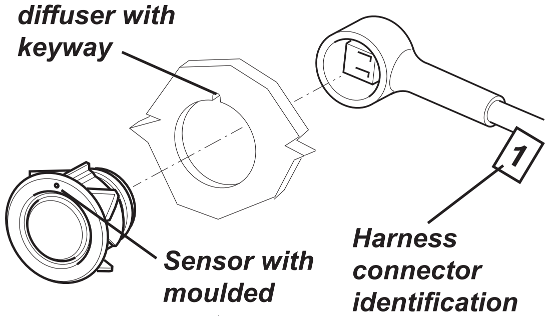
Viewed from the rear of the vehicle, sensor 1 is fitted to the outboard LHS diffuser aperture, through to sensor 4 fitted to the RHS outboard aperture.



A small keyway is machined at the top of each sensor aperture which corresponds to the sensors locating tab which ensures it is mounted to its correct orientation within the diffuser trim.

When mounted to the correct orientation the small spot moulded on the sensor should be positioned vertically upwards.

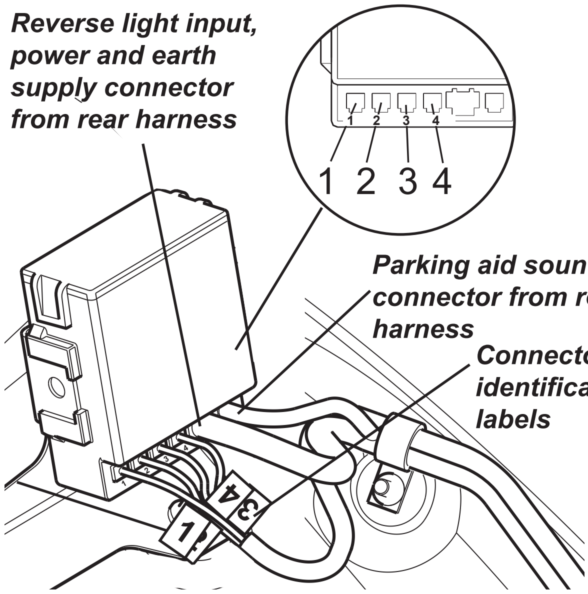
The parking aid harness is fitted to the underside of the clamshell and routed behind the diffuser trim and retained with panel mounted edge clips. The harness enters the luggage compartment from the underneath of the RH side of the boot box panel.



Once inside the luggage compartment area, it is secured to 'P' clips along with the rear vehicle harness, it then branches off into its 4 individual parking sensor harnesses/2 way connectors which can be identified by their number labels (1 - 4) which are taped to the 4 individual main core wires in the harness.

Parking aid ECU removal:

1. Carefully pull back the boot carpet from the RHR wheelarch area, taking care not to damage the carpet when passing it over tyre weld canister bracket.
2. The parking module/bracket and wiring are now visible, but do **NOT** attempt to remove the harness connectors whilst the module is still attached to clamshell.
3. Unclip the parking sensor and rear harnesses from the two 'P' clips securing them to the inner wheelarch panel.
4. Release the M5 nyloc nuts (2) securing the module bracket to the wheelarch.



5. With the parking sensor and rear harnesses still connected to the module, lift the complete assembly off of the 2 M5 retaining studs (fixed to the wheelarch) and place it into the boot area.
6. The 4 parking sensor black 2 way connectors can be identified by their number labels (1 - 4) which are taped to the 4 individual main core wires in the harness.
7. Use a small pair of long nose pillars to ease the connectors from the module one at a time. **DO NOT** pull on the wiring harness.

Once all harness connectors are unplugged, the ECU can be withdrawn from the vehicle.

Refitment:

Is the reverse of removal

Refit the connectors to the module in the correct order, i.e., with the number label on the harness corresponding to the molded number on the module housing.

NOTE: Failure to connect the sensor harnesses correctly could result in inaccurate/misleading readings being produced by the ultrasonic sensors.

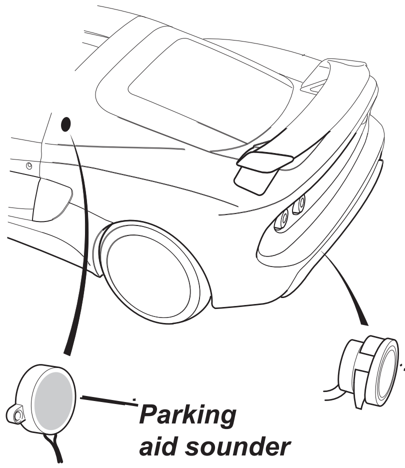
Parking aid sounder

Removal:
The sounder is attached to the LH inboard side bulkhead panel by double sided tape.

Removal of the rear bulkhead trim panel is required to gain access to the sounder; refer to service notes section VE.11 for further information.

Gently pull the sounder away from the bulkhead/double sided tape and disconnect sounder flylead from the main harness connector plug.

Refitment:
A new piece of double sided tape will be required to adhere it back onto the panel.



The bond area of the bulkhead panel should be cleaned with a dampened Scotchbrite pad and acetone solution to ensure an adequate abrasion of the bond path, then using paper sufficiently dampened with acetone, wipe residue from panel & then dry wipe with clean paper.

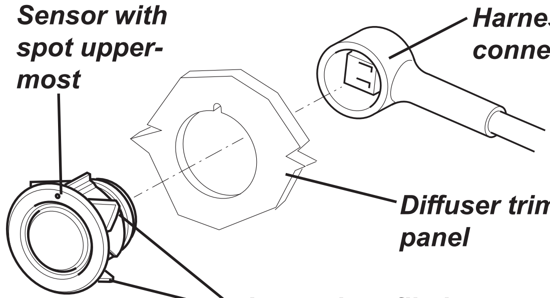
Apply new double sided tape to the panel and refit the sounder.

Parking aid sensor

Removal:
The sensors are fitted with profiled retention clips which are designed to fold inwards whilst being pushed through the diffuser apertures and spring outwards once positioned behind the trim.

This means that removing the sensors by attempting to prise them away from the diffuser panel will result in damage to both the sensor and the panel.

The sensors clips must be folded inwards from behind the diffuser to ensure that no tool marks are made on panel.



Note: Unless great care is taken the sensors cannot be removed without damaging their integral retaining clips.

Refitting:
Connect the parking harness connector to the terminal at the back of the sensor.

Ensuring the moulded spot on the sensor face is vertically uppermost, push the sensor back into the diffuser panel.

If all other components for the parking aid system are connected, test the system is now op¬erating correctly.

MV.14 - ECM (ELECTRONIC CONTROL MODULE)

The T6 Electronic Control Modules (ECM) is a non serviceable unit incorporating microprocessors which process the inputs in real time, not only from the engine management sensors but various other sensors and modules within the vehicle such as the instrument pack, alarm system, Anti Lock Braking system (ABS) and Tyre Pressure Monitoring System (TPMS if fitted) etc.

Firmware and calibration
At the time of assembly the vehicles ECM is downloaded with the relevant firmware and calibration also referred to as its EMS programme or .CRP file. This ensures that the functionality of the ECM is correct in relation to its model, model year and the territory the vehicle is being sold into.

Vehicle configuration and variant code

The ECM is then ‘configured’ dependant on the additional options that the vehicle should be equipped with such as but not limited to fitment of such items as:

• Sports, Race and Launch Mode options
• Tyre pressure Monitoring System (TPMS) (GCC cars only)
• Heated front seats
• Reverse park sensor
• Speed Alert Buzzer (GCC cars only)
- 'S' or Roadster body options

The selection of the relevant options will produce a 'variant code' for the vehicle which can be viewed in the EMS vehicle configuration screen using Lotus TechCentre and is also stored in the vehicles build book stored at Lotus Cars.

At this time a self adhesive label is also attached to the casing of the ECM. The label displays an actual label part number and homologation number which will identify the ECM assembly in relation to:

• Model Year
• Engine type, induction system and power output
• Designated vehicle territory
• Calibration number
• Vehicle designation i.e., Elise, Evora etc

ECM protection
EMS programme: To protect the ECM from subsequent incorrect programming which could cause poor, nonstarting or engine performance issues etc, the EMS programme initially downloaded at the factory cannot be overwritten with any other programme. The only EMS reprogramming possible is to update the ‘level’ of the existing programme already installed in the ECM.

In the event that the EMS programme downloaded into the ECM that does not match its existing programme then the vehicle will fail to start, the (Malfunction Indicator Light) MIL will illuminate and a fault code will be stored in the ECM.

Variant code: (Also see Technical Service Bulletin TSB 2012/17) new functionality for Lotus TechCentre was introduced from version V4.16.00 in November 2012 to prevent unauthorised variant code alteration in relation to:

• Exige S: Launch mode race mode (so that these options cannot be altered from the original production specification).
• Exige Roadster: Speed limiter (ensuring that maximum vehicle speed is limited for soft top models).

The current release of Techcentre will look for the three data bits in the variant code data string to be set to a certain value to then ask for the pass code function from Lotus. These three functions are as follows:

• *Race Mode -True*
• *Launch Mode -True*
• *Speed Limiter -False*

At the time of first issue of Service Note section MV, Lotus TechCentre will not allow the user to input any of these options into the existing Exige S/Roadster ECU without a pass code from Lotus Cars Aftersales.

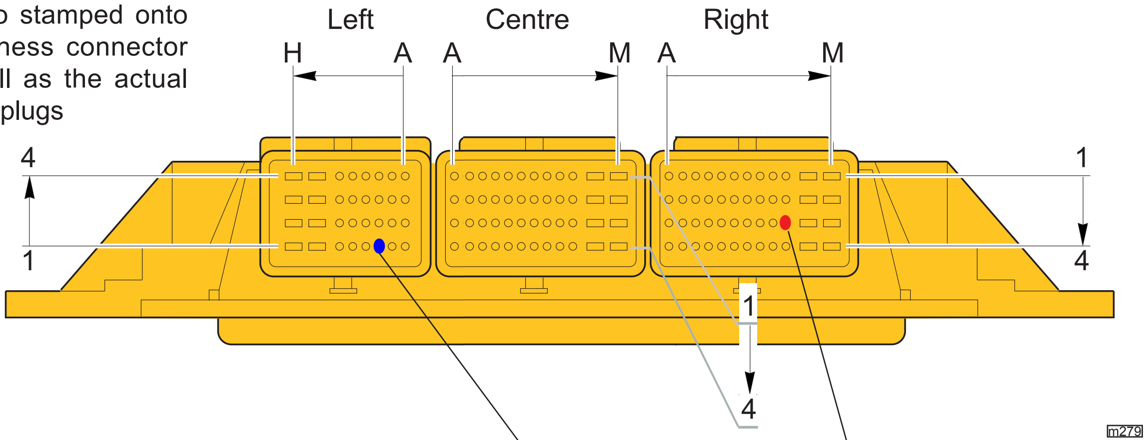
If it becomes necessary to renew the ECU then use LSL618 Exige S Pre-Variant Coded ECM Order Form as shown in Lotus Technical Service Bulletin TSB 2013/01, so that you receive a pre-programmed/variant coded ECU for the vehicle.

If for any reason an existing ECM losses its existing variant code then contact your nominated FSE for further information (Note - this may require Lotus TechCentre to be connected to the vehicle at the time of contact to obtain specific ECM information).

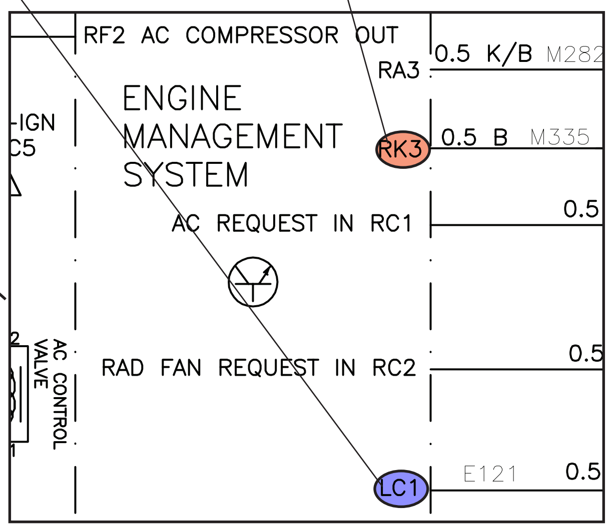
Harness connection and 'Pin out' identification
The ECM uses 3 harness connector blocks. The engine harness has 2 multi-plug connectors which connect to the central and left blocks (as viewed with the ECM in situ), with the vehicles main harness multi-plug connecting to the right block (as viewed in situ). All harness connection information to the ECM is identified on the relevant circuit diagrams by:

Block: L – Left, C – Centre and R – Right
Row: 1 – 4
Column: A – M (Note: The letter 'I' is not used, therefore A - M comprises of only 12 columns in the centre and right blocks).

Column and Row numbers and digits are also stamped onto the ECM harness connector blocks as well as the actual harness multi-plugs

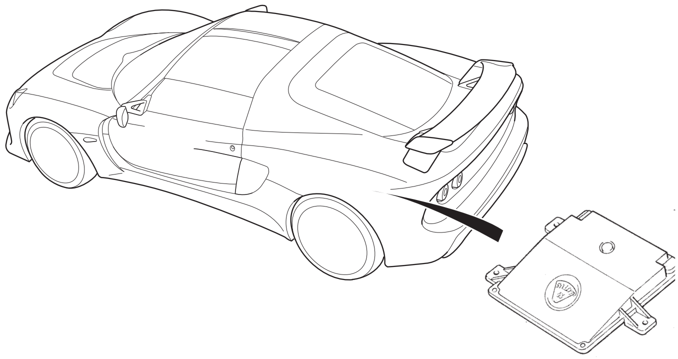


Example of EMS pin information as displayed in an Elise Circuit Diagram



ECM location
The ECM is located to the left hand side of the luggage compartment on the inner wheelarch panel positioned in front of the battery, behind the rear fusebox assembly.

It is retained by a bracket with 3 integral studs that pass through machined holes within the ECM and fixed retained with 3 nuts.



To remove the ECM:
Note: If it is necessary to renew an ECM then it is highly recommended that before removing the existing unit that you note down its current firmware calibration (Program or .CRP file number) and the variant code which can be obtained from the Lotus TechCentre vehicle information and EMS configuration screens.

Before removing the ECM print out the vehicles performance history using TechCentre and file with the vehicles existing records or job card for future reference. This procedure should also be carried out before uploading a new programme as action of downloading a new level programme will delete the existing performance history.

Please note: Lotus Cars may request a copy of a vehicles performance history in the event of a warranty enquiry which is related to potential powertrain abuse.

Note: Do not disconnect the battery or ECM harness connectors for at least 30 minutes after switching off the ignition to allow the engine management system and associated sensors to shut down in the correct sequence.

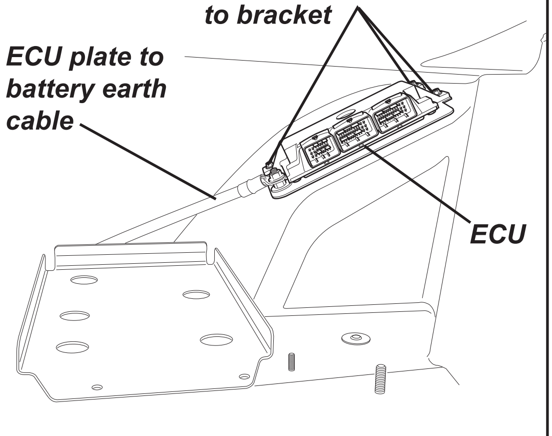
1. Remove the vehicle battery, see sub-section MV.10 for further information.

2. Reposition the rear fusebox to gain access to the ECU, see sub-section MV.12 for further information.

3. Unclip and detach the 2 Engine and 1 Vehicle harness connectors from the ECU.

4. Release the 3 nuts securing the ECM to its wheelarch bracket.

The ECU can now be withdrawn from the vehicle.



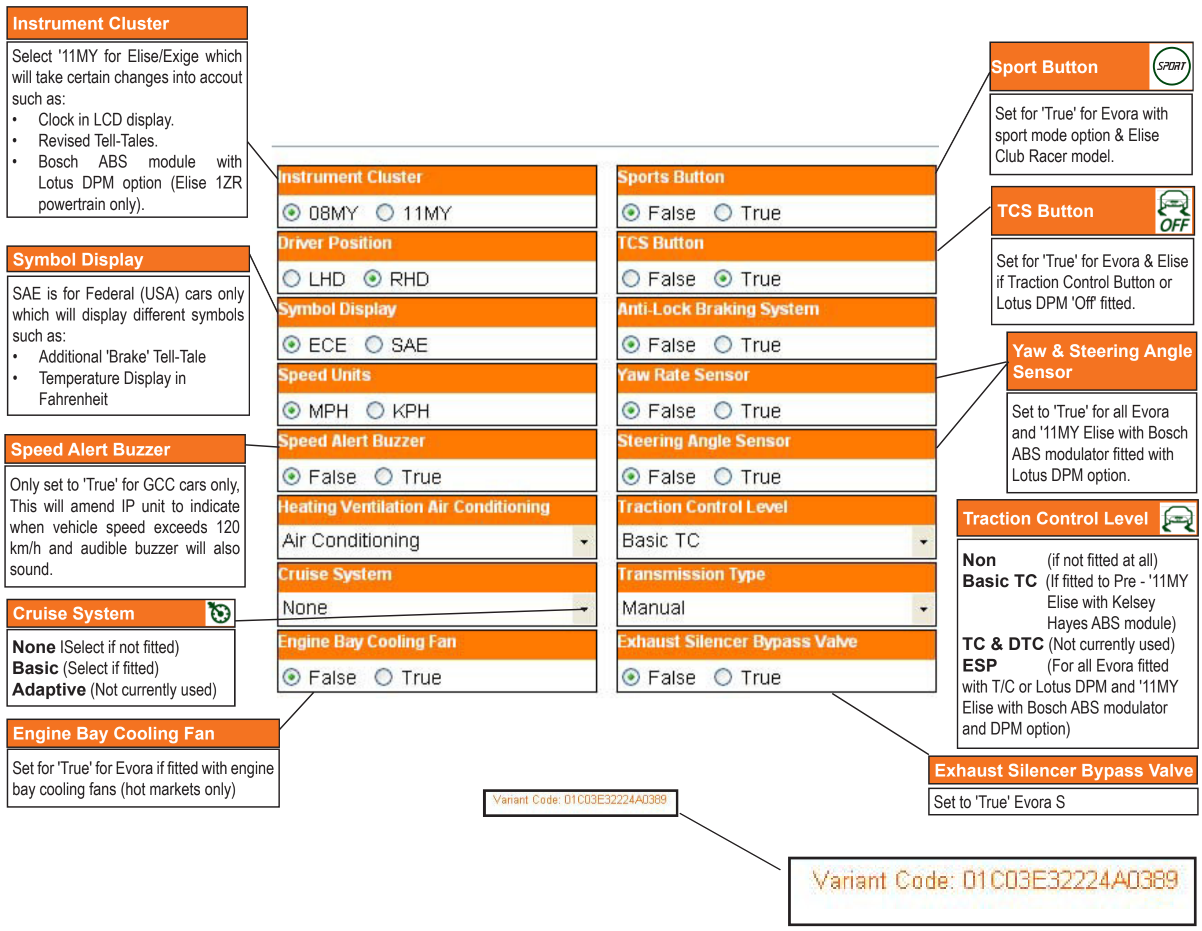
Battery and fusebox removed for clarity

To refit the ECM:
Reverse procedure from removal except for:

Check for any illuminated tell tales that may be displayed on the instrument pack and using Lotus TechCentre interrogate the ECM for any live or pending codes and erase.

Variant coding
Note: Although the ECM cannot be fully variant coded by the dealer using Lotus TechCentre at this time (see page 59 for details), screen prints of variant code information are shown on the following page for reference.

ECM configuration screen 1 of 2 as shown on Lotus TechCentre



Note: Although it is possible to manually enter the variant coding from the option screens available there is a risk of making an error if this option is selected which may affect the display and or functionality of the instrument pack.

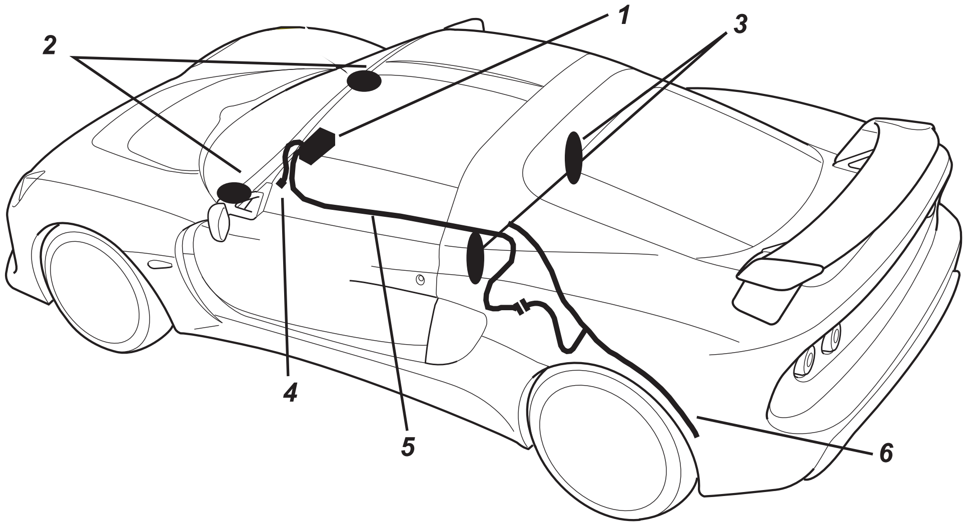
If the variant code has been recorded then it is recommended to use the guided routine option available on Lotus TechCentre.

If the variant coding has not been recorded or if the ECM will not communicate with Lotus TechCentre then it is advised to contact Lotus Cars Technical Publication Department stating the full vehicle VIN requesting the variant code information.

For further information see the 'Lotus TechCentre User Guide', which can be downloaded from the Lotus Dealer Portal at: http://dealers>Aftersales>Miscellanous Technical Information>TechCentre Information.

MV.15 - IN CAR ENTERTAINMENT

The Exige S may be specified with various audio equipment options. All cars are fitted with a main wiring harness which includes:



1.An ISO 16-way connector located behind the standard ISO size single DIN aperture in the dash panel/central face level vent panel trim to accommodate the current specification head unit.

2.Speaker wiring under dash panel for front speakers mounted in the LH/RH side fascia top panel.

3.Speaker wiring behind rear bulkhead trim panel for LH/RH rear speakers.

4.iPod adaptor lead plugged into the rear of audio head unit with the lead connector end terminating at the dashboard trinket tray.

5.Antenna cable connected to the rear of audio head unit, running along the centre of the cabin under the gear lever/handbrake tunnel trim and terminating at the engine bay bulkhead panel area.

6.An analogue di-pole aerial connected to the antenna cable which is routed and fixed to the inner surface of the LH clamshell wheelarch panel.

Front speakers

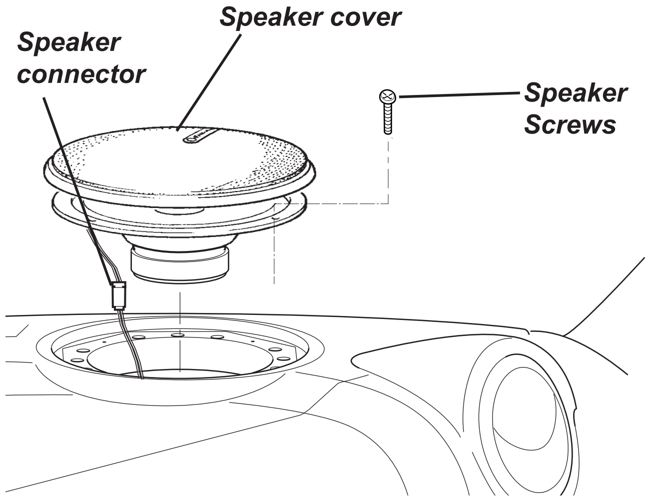
Specifications:
Alpine SPE - 1002 2-way co-axial; 75W max; 15W RMS; 4 ohms impedance; Frequency response 55Hz - 25kHz; Sensitivity 90dB / W (1m).

Removal:
1.Carefully prise of the speaker grille.

2.Using a suitable stubby or angled screwdriver release the screws (4) securing the speaker to the dash top fascia.

3.Raise the speaker away from the dash top, disconnect the speaker harness connector and withdraw the speaker.

Refitment:
Is the reverse of removal.



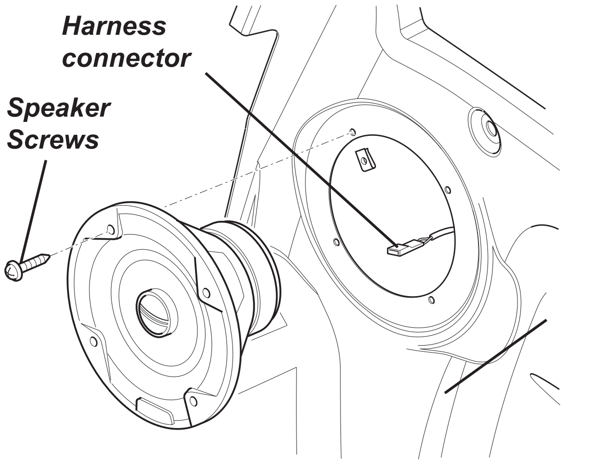
Rear speakers

Specifications:
Alpine SPG-13C2 2-way; 200w max; 50W RMS; 4 ohms impedance; Frequency response: 82 Hz to 20 kHz: Sensitivity: 87.5dB / W (1m).

Removal:
1. Release the screws (4) securing the speaker to the bulkhead trim panel.

2. Pull the speaker away from the panel, disconnect the speaker harness connector and withdraw the speaker.

Refitment:
Is the reverse of removal.



Head unit
The dashboard and FLV (Face Level Vent) trim panel is designed to accept a standard single DIN (180 x 50 mm panel) size head unit and will utilise the mounting sleeve supplied with the unit to retain it in the dashboard.

At time of first publication of this service notes section the specified audio head unit for the Exige S is the Alpine CDE-171RR Radio/CD Player but this may be subject to change in the event of product obsolescence or future specification updates.

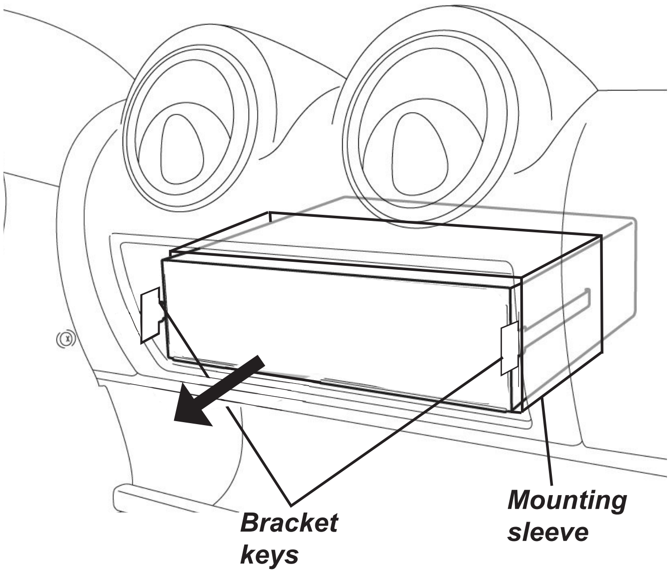
Certain markets i.e., Japan etc, may also have audio unit variations to ensure that they are compliant with their markets and requirements.

Removal:
1. Remove the unit's detachable front panel.

2. Insert the bracket keys (supplied with the unit) between the radio and mounting sleeve along the guides located either side of the unit to release it from its retaining tabs.

3. The unit can now be released from the mounting sleeve.

4. Withdrawn the radio from the FLV trim, disconnect the main harness connector and antenna cable from the rear of the unit.



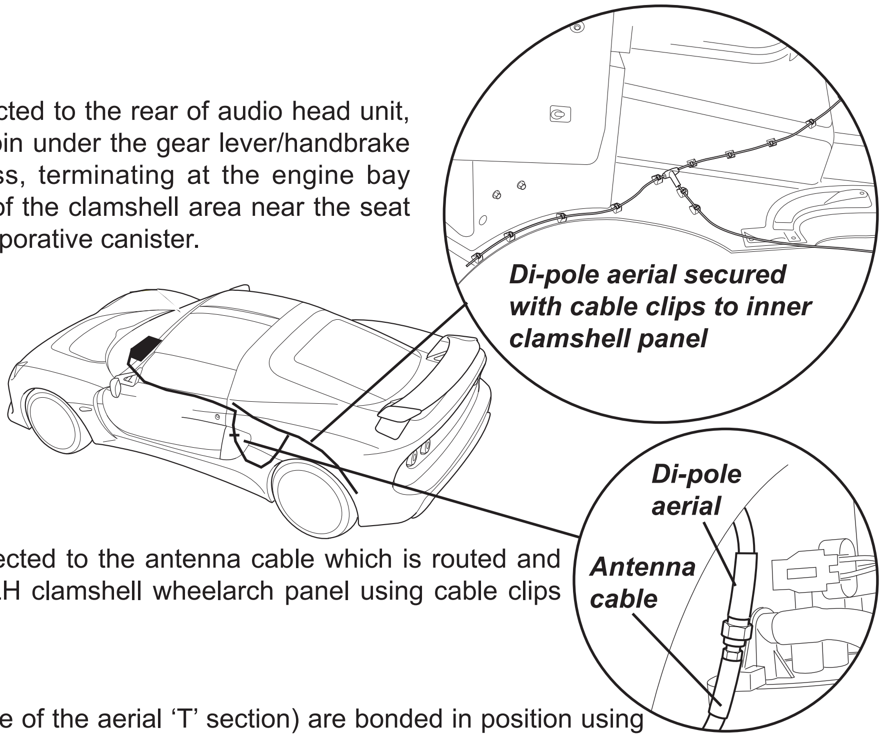
Refitment:
To prevent placing undue pressure on metal plate that retains its detachable front panel it is recommended to refit the unit with the front panel in place.

Connect the main harness connector to the terminal plug on the rear of the unit, ensuring that all other dashboard harness wiring is positioned away from the mounting sleeve so it cannot potentially become trapped when refitting the unit.

Slide the unit back into the dashboard/mounting sleeve until it clicks indicating that the units retaining tabs are locked in place and is now secure in the dashboard.

Antenna/aerial cables

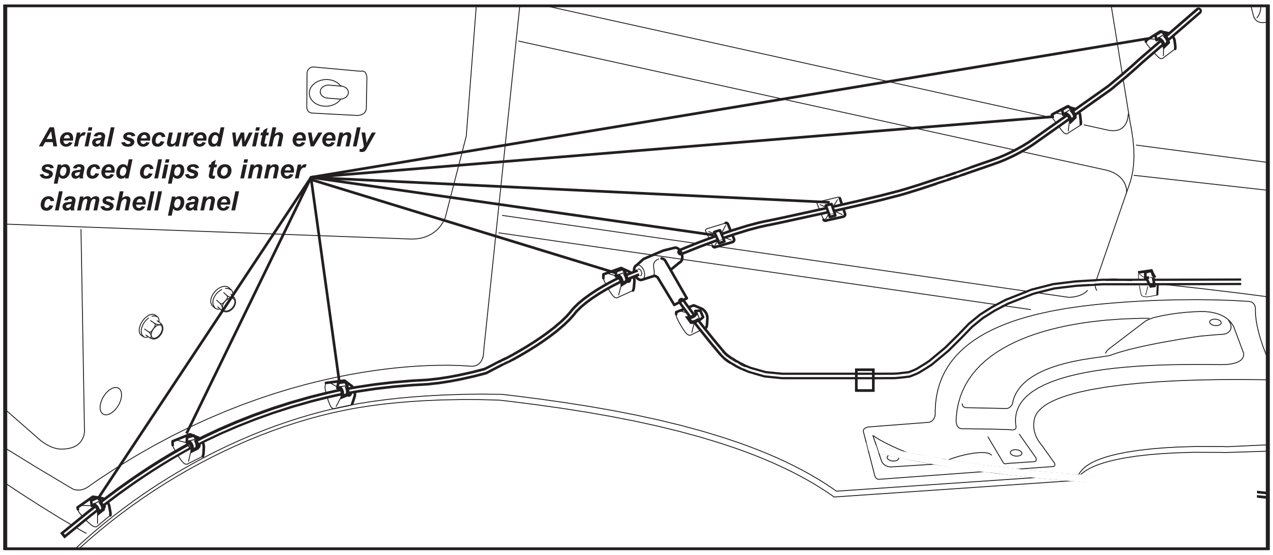
Antenna cable
The radio antenna cable is connected to the rear of audio head unit, routed along the centre of the cabin under the gear lever/handbrake tunnel trim with the main harness, terminating at the engine bay bulkhead panel area at the NSR of the clamshell area near the seat belt anchor frame and the fuel evaporative canister.



Di-pole aerial
The analogue di-pole aerial connected to the antenna cable which is routed and fixed to the inner surface of the LH clamshell wheelarch panel using cable clips bonded to panel.

Cable clips
8 evenly spaced clips (4 either side of the aerial 'T' section) are bonded in position using Loctite - 480 ensuring that aerial path runs in a straight line from the rear of the inner wheelarch up to the upper front of the clamshell by the rear seat belt anchor frame backstay.

3 Slightly larger clips are used to support the aerial from the 'T' section to the antenna connector; again the positioning of these clips is critical to ensure satisfactory radio reception. In the event that the either the aerial and or cable clips are renewed, it is essential that the aerial is routed correctly and any replacement cable clips are bonded back into their original positions.



Di-pole aerial removal:
1.Disconnect the di-pole aerial from the antenna cable.

2.Remove the NSR wheelarch liner, refer to service notes section BT.5 for further information.

3.Release the aerial from the cable clips.

Refitment:
Is the reverse of removal.

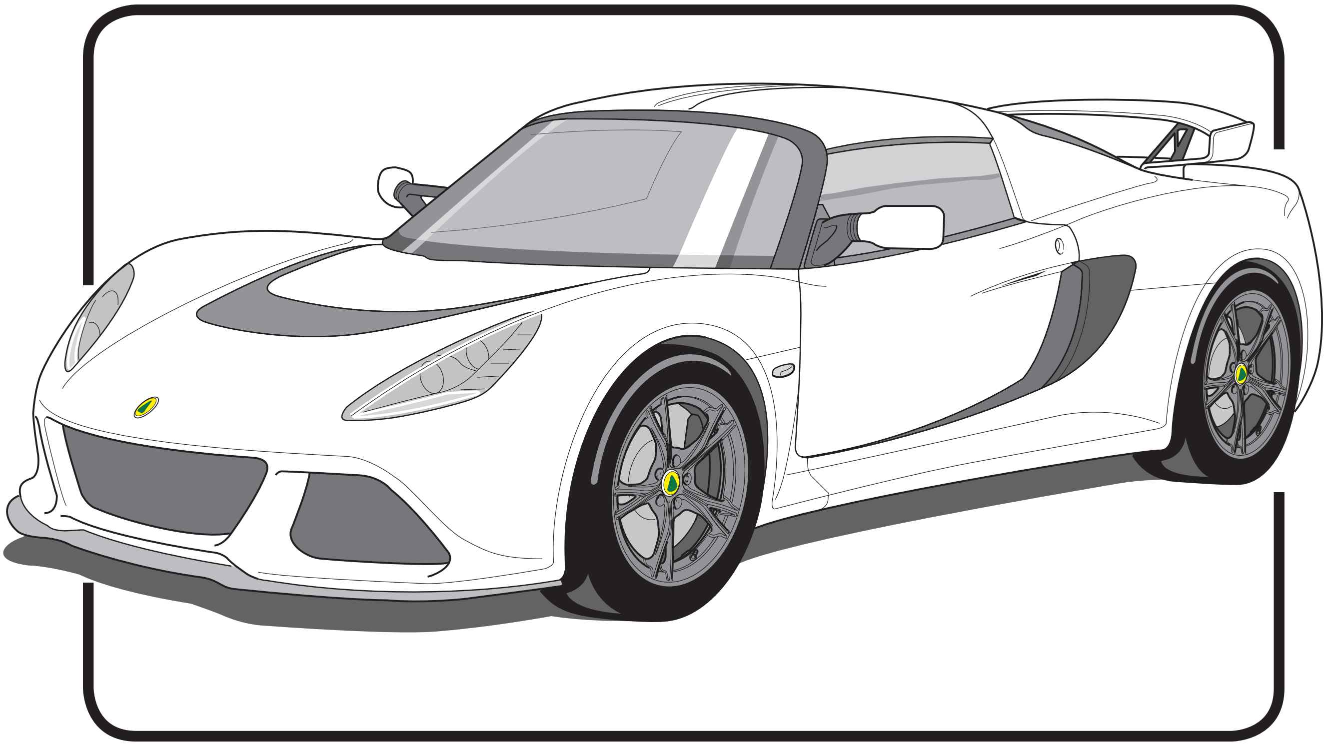
SERVICE NOTES

EXIGE S

SECTION AN

INTRODUCTION

2012 Model Year Onwards with 2GR-FE Engine



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Part number A138T0327J

Updated 27th November 2013

CONTENTS

EXIGE S; 2012 M.Y. ONWARDS; WITH 2GR-FE ENGINE

INTRODUCTION

SECTION AN

Publication Part Number A138T0327J

PLEASE READ THESE TERMS CAREFULLY BEFORE USING THIS PUBLICATION

This publication has been designed for use by Lotus Dealers familiar with general workshop safety procedures and practices. Take all appropriate action to guard against injury to persons or damage to property.

It is also assumed that any other persons using this publication has the relevant technical experience to utilize a workshop manual, as well as the use of adequate technical facilities and the necessary personal protective equipment and tools needed to carry out diagnostic procedures, tear downs and rebuild procedures in a safe and competent manner.

The information enclosed in this publication are provided "as is." There is no warranty either expressed or implied, provided by Lotus cars regarding any of the information provided within these service notes, including the implied warranties of merchantability and fitness for a particular purpose.

Lotus policy is one of continuous product improvement, and the right is reserved to alter specifications at any time without notice.

Whilst every care has been taken to ensure correctness of information, it is impossible to guarantee complete freedom from errors or omissions, or to accept liability arising from such errors or omissions, but nothing herein contained shall affect your statutory rights.

HOW TO USE THIS MANUAL

To rationalise the information contained within the service notes, the removal, refitment and/or replacement information contained within each section has been divided into specific assembly areas or ‘function groups’ of the vehicle.

Example:

Description area of the vehicle	Service notes section
Front suspension	CJ
Rear suspension	DI
Fuel system	LD

Each section is then divided into further sub-sections displaying information on specific components relevant to that sub assembly i.e., CJ.7 – spring/damper assembly.

When applicable ‘General Description’ information is displayed at the beginning of each section listing any relevant features or functions of the complete assembly or sub assembly components.

Step by step component removal information is first displayed, with refitment information being described as *‘Reversal of removal’* unless additional procedures are necessary.

Specific torque tightening figures shown in Nm are displayed next to any relevant fixings noted.

Where applicable fixings are described by size and description i.e., M10 x 85 bolt or M10 nyloc nut.

Many removal/refitment procedures for individual specific components within an assembly may incur repeat operations that have already been described within another sub-section of the service notes.

Therefore when this occurs, to avoid duplication of information and to limit the size of the service notes; a procedural step may contain the phrase *'See section XX.X'*.

Referring to that section will display additional relevant strip down information applicable to the repair being carried out.

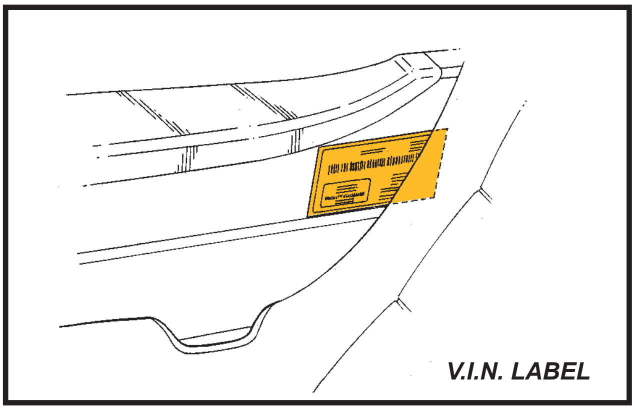
VEHICLE IDENTIFICATION NUMBER & ENGINE NUMBER

The V.I.N. comprises 17 characters, coded in accordance with European Economic Community (EEC) and National Highway Traffic Safety Association (NHTSA) directives. For change point identification in Service Notes, Service Bulletins and Service Parts Lists, typically, only characters 10 (model year), 11 (plant), 12, (build type) and 14 to 17 (serial number) will be quoted.

Both V.I.N. and engine 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 plate should be disregarded in this context as it may not accurately reflect vehicle age, and may also be changed during the car’s life.

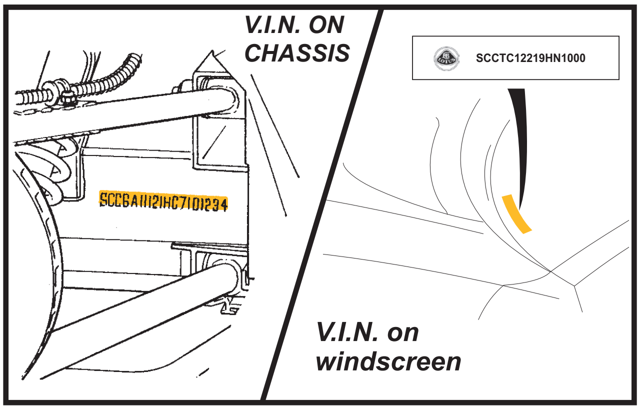
V.I.N. Locations

Printed on a label stuck to the inside of the chassis sideframe alongside the driver's seat



Stamped on the chassis in the right hand front wheelarch area, viewable with the front wheels turned to right full lock,

Windscreen: Viewable from the outside of the vehicle, located on a plate positioned between the left hand front .edge of the dashboard and inside of the windscreen

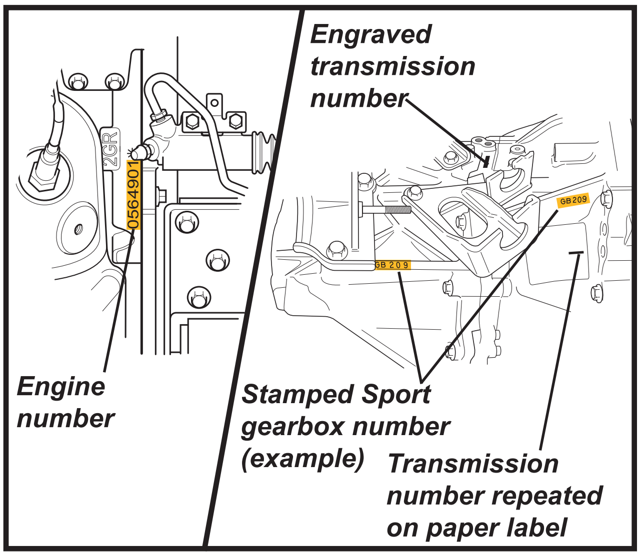


Engine/Transmission Numbers

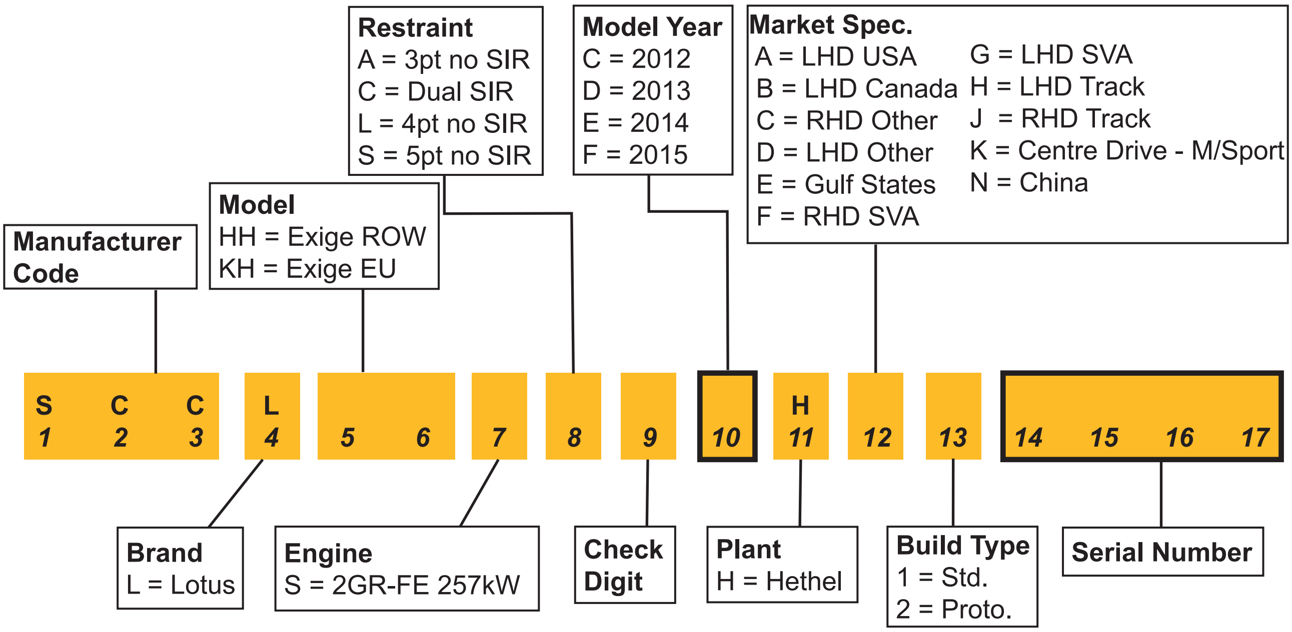
The engine number is stamped on the left hand rear flange of the cylinder block, alongside the clutch housing joint face. It is viewable only from beneath after removal of the engine bay undertray and release of a heatshield fixing.

The transmission serial number is engraved on the top surface of the transmission front case, alongside the jointline with the rear case. Typical example: A7H05232

Sport transmissions may be identified by a secondary gearbox serial number stamped on both the front and rear casings in the locations shown. Standard transmissions have no secondary number.



V.I.N. DECODER


Restraint
A = 3pt no SIR
C = Dual SIR
L = 4pt no SIR
S = 5pt no SIR
Model Year
C = 2012
D = 2013
E = 2014
F = 2015
Market Spec.
A = LHD USA
B = LHD Canada
C = RHD Other
D = LHD Other
E = Gulf States
F = RHD SVA
G = LHD SVA
H = LHD Track
J = RHD Track
K = Centre Drive - M/Sport
N = China
Model
HH = Exige ROW
KH = Exige EU
Manufacturer Code
S C C L
1 2 3 4 5 6 7 8 9 10
H
11 12 13 14 15 16 17
Brand
L = Lotus
Engine
S = 2GR-FE 257kW
Check Digit
Plant
H = Hethel
Build Type
1 = Std.
2 = Proto.
Serial Number

MODEL HISTORY MILESTONES (does not include all special editions)

Exige S Introduction: August 2012
First Production VIN = SCCLHHSC0CHD10491
VIN character 5&6 model = HH (Exige ROW) or KH = (Exige EU)
VIN character 7 engine type = S (2GR-FE, Supercharged 257 kW)
Vehicle/Engine Type Number = 138

As per the previous 1.8 2ZZ powertrain Exige, hand laid Single piece front and rear clamshells are utilised, with only the door shells remaining as common exterior panels fitted to both the Elise and Exige. Similar to previous Exige models the rear body clamshell incorporates the rear window shroud, to which is hinged a 'fastback' style tailgate panel with a Heated Rear Window (HRW) glass screen. The Centre High Mounted Stop Lamp (CHMSL) is also integrated into the rear transom. The centre composite rear aerofoil (wing) is attached to the tailgate using two aluminium uprights. A separate air splitter panel is also fitted beneath the front edge of the clamshell nose. The hard top roof fitted to the Exige S has been designated as a permanently fixed integral body panel of the vehicle and so to deter removal the roof brackets are secured with tamper-proof torx type fixings.

Similar to the ‘11MY onwards Elise, the front body access panel is retained at each corner with integral pegs that locate into mounting blocks fixed to the clamshell. But instead of using a threaded fastener to secure the centre of the panel, it is held instead using a latch mechanism with a release lever located at the rear edge of the panel just below the wiper arm for easy access.

Front suspension: The Exige S utilises the same suspension uprights, ball joints and inner pivot bushes as the current Elise, but are mounted in modified upper and lower wishbones with dedicated Exige part numbers for the Bilstein dampers Eibach springs and 21.5 mm OD anti-roll bar assembly. The front hub units also have dedicated '138' type numbers as the road wheels are now mounted on 5 bolts instead of 4 as per the current Elise and previous Exige models.

Rear suspension: The suspension comprises of an upper fabricated steel wishbone with the lower wishbone being of a forged aluminium construction similar in design to the Evora. Both the upper and lower wishbone inner pivot bushes are carried over from the Evora. Unlike previous Elise and Exige models, both upper and lower wishbones utilise the same spherical outer bush to hub carrier principal as the Evora. Similar to all other ‘small platform’ variants, rear wheel alignment is set using toe control link assemblies, but with the inner and outer ball joints being replaced with spherical through bushes to manage the increased lateral forces applied to the vehicle.

Engine: Uses the type 2GR-FE V6 supercharged engine as fitted on the current Evora S models, with the supercharger being driven via a shorter length auxiliary drive belt as well as a modified bracket/idler assembly to compensate for the removal of the PAS (Power Assisted Steering) pump.

Exhaust: Carried over from ‘12MY Evora with the main/under-floor catalytic converter replaced with a link pipe joining the exhaust downpipe to the silencer assembly, the rear silencer is also fitted with an active exhaust/ EP (Engine Protection) valve.

Transmission & Clutch: Utilises the same 6 speed manual type EA60 gearbox as the Evora, but is only available with the sports ratio gearing. The clutch, flywheel and clutch damper assembly are also carried over from the Evora S.

Wheels & Tyres: New Front 17” Rear 18” cast wheels are available in both black and diamond cut designs. Standard tyres are Pirelli Corsa with Pirelli P Zero Trofeo tyres available as part of the ‘Race Pack’ option.

Steering: Unchanged from ‘12MY Elise except for the track rod ends that are longer in length to compensate for the wider front track as compared to previous Elise and Exige models.

Brakes: Similar to the Lotus Evora the Exige S braking system comprises of a four piston calliper at each wheel, with a cable actuated parking brake using brake shoes operating in drums incorporated into the rear discs. Ventilated cross drilled discs are fitted as standard with optional 2-piece cross drilled discs fitted as part of the

'Race' pack option. The Bosch ESP 8.1 brake module as used on all current Lotus product is fitted to control the Lotus Dynamic Performance Management (Lotus DPM) system.

Engine cooling: A secondary auxiliary coolant radiator/fan assembly is positioned ahead of the left hand front road wheel and to the left hand side of the standard engine cooling radiator.

Engine Oil Cooling: Additional engine oil cooling is provided with the fitment of a single front mounted oil/air cooler radiator which is positioned ahead of the right hand front road wheel and to the right hand side of the central engine coolant radiator.

Electrical: PFK 457 Alarm/Immobiliser system fitted as standard as is a Heated Rear Screen (HRS), the revised switch panel configuration replaces the engine start button with either the 3 or 4 position Lotus DPM switch, as per pre-2008 models, engine cranking is now controlled by the ignition switch. Heated front seats, 5 volt DC USB auxiliary charging socket and rear parking aid sensors are available as order options.

For further information please refer to Technical Service Bulletin TSB 2012/12.

Lotus Racing Exige Cup: January 2013
From VIN DH_10447 Onwards.
VIN characters: Same as the 'S' production models.
Officially debuted at Autosport 2013 International Racing Car Show, it is designed to compete in the Lotus Cup series,

Differences compared to standard Exige include: A Lotus Racing build plate mounted on the passenger's side inner sill to confirm the vehicle final assembly was completed at the Lotus Racing headquarters.

Engine fitted of an internally baffled sump assembly and modified engine breather system to accommodate an external oil catch tank. Increase in the power to weight ratio achieved by the reduction in the vehicles unladen weight by removal of NVH trims, radio, speakers, alarm and SRS system.

Onboard fire extinguisher and battery isolator system fitted as standard.

Non-airbag steering wheel and 3 point non-pyrotechnic seat belts fitted as standard removable steering wheel and 4 point harness supplied as dealer fit. 'T45' seat belt anchorage frame with 'A' frame kit is fitted as standard.
Suspension: 2-way adjustable Nitron spring damper assemblies with separate reservoirs are fitted all round.

Wheels & Tyres: Production cast black five Y-spoke wheel rims fitted with the standard Pirelli P Corsa road tyres.

Rear towing strap fitted and the front grille modified to allow fitment over the front towing eye to comply with track day and race regulations.

Body: N/S rear clamshell modified to accept fitment of flange bezels for the external battery isolator and on-board fire extinguisher switches.

Decals & badges: 'LOTUS' lettering in Cool Grey pantone colouring on the upper surface of rear wing and Union Jack decals fitted to the end caps. 'V6 Cup' logo on both sill panels below the doors and OSR transom panel and an 'Exige' badge also in Cool Grey fitted to NSR transom panel.

Paint: Front clamshell below LH/RH intake grilles, front access cover, rear transom panel, tailgate, hardtop, rear wing, end caps and uprights are finished in 'soft feel' water borne matt black finish paint. Door mirror end caps are finished in silver.
Interior: Driver's and passenger's seat are carbon fibre HANS compliant race seats 'V6 Cup' embroidery to the seat back. Door panels, dash panel and centre console are also re-trimmed.

Please refer to TSB 2013/20 for further information.

Exige S Roadster: August 2013
From VIN DHC10852 Onwards.
VIN characters: Same as the 'S' Coupe production models.

To exploit the pleasures of open top motoring Lotus has introduced the Exige S Roadster.

Body: As per the current Exige S except for the standard factory fitment of the Elise style fabric soft top roof (with the hard top roof panel now an additional order option) and deletion of the front splitter and rear aerofoil.

Paint: The side air intake panels and door mirror plinths are finished in the same colour as the body on the Exige S Roadster (compared to black finish on the Exige S).

Powertrain: 2GR-FE V6 powertrain carried over from the Exige S but the top speed is electronically limited to 145 mph / 233 km/h by the ECM (Electronic Control Module) restricting the throttle from opening fully when information is received via the wheel speed sensors that maximum road speed is being approached.

Suspension: Carried over from the Exige S but the reduced down force generated by the body panels (due to removal of the front splitter and rear aerofoil) requires minor revisions to re-align both the front and rear axle responses to ensure the ride and handling performance is comparable to the Exige S. This is achieved by a revision of the front and rear camber angles compared to the Exige S as well as increasing both the diameter and material thickness of the rear anti-roll bar to 19.5mm diameter to increase overall roll bar stiffness, (the internal diameter of the anti-roll bar bushes are also correspondingly increased).

Wheels: A silver version of the Exige S cast gloss black wheels are fitted as standard
Brakes: Carried over from the Exige S as well as all brake calliper colour options but with the addition of silver callipers which are exclusive to the Roadster.
Interior trim: Carried over from the Exige S, but features quilted trim finishing's to the seats and door insert panels on both the Premium and Premium Sports Pack interior trim options (quilted elements not currently available on the Exige S).

Please refer to TSB 2013/13 for further information

AN.1 - JACKING/LIFTING POINTS

Care must be taken when using a lifting jack or hoist to position the device only 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 C are used.

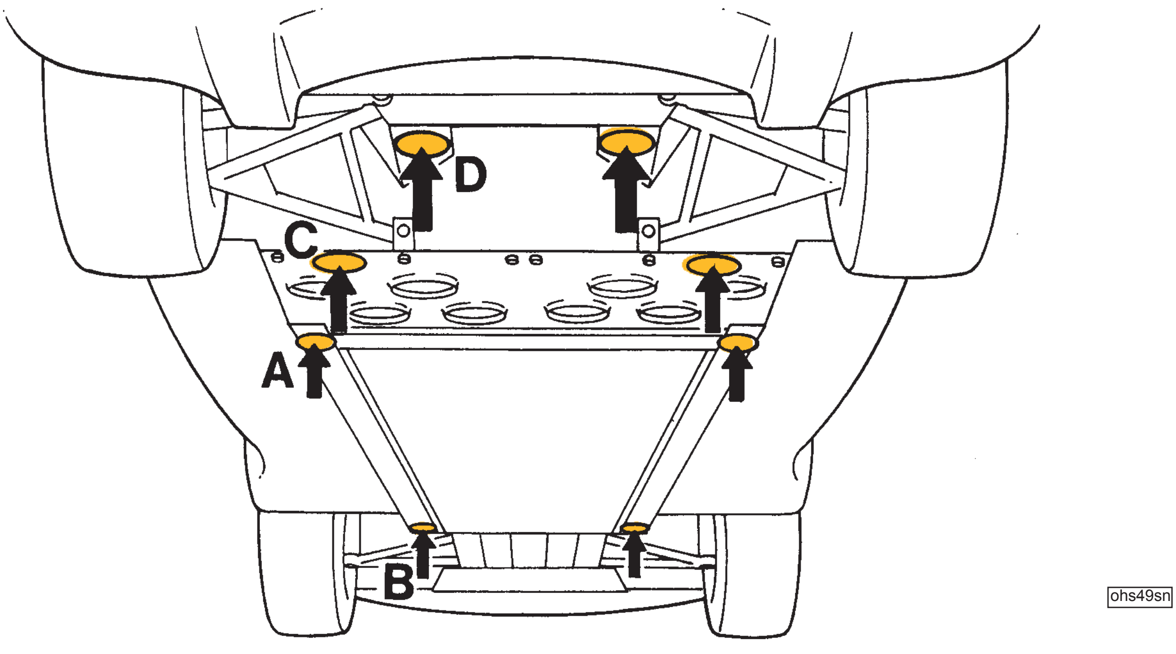
A; Identified by a blue sticker. Beneath crossmember ahead of fuel tank bay. To be used one side at a time for wheel changing - lifts both wheels on one side. *Do not use with a four point garage lift.*

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.



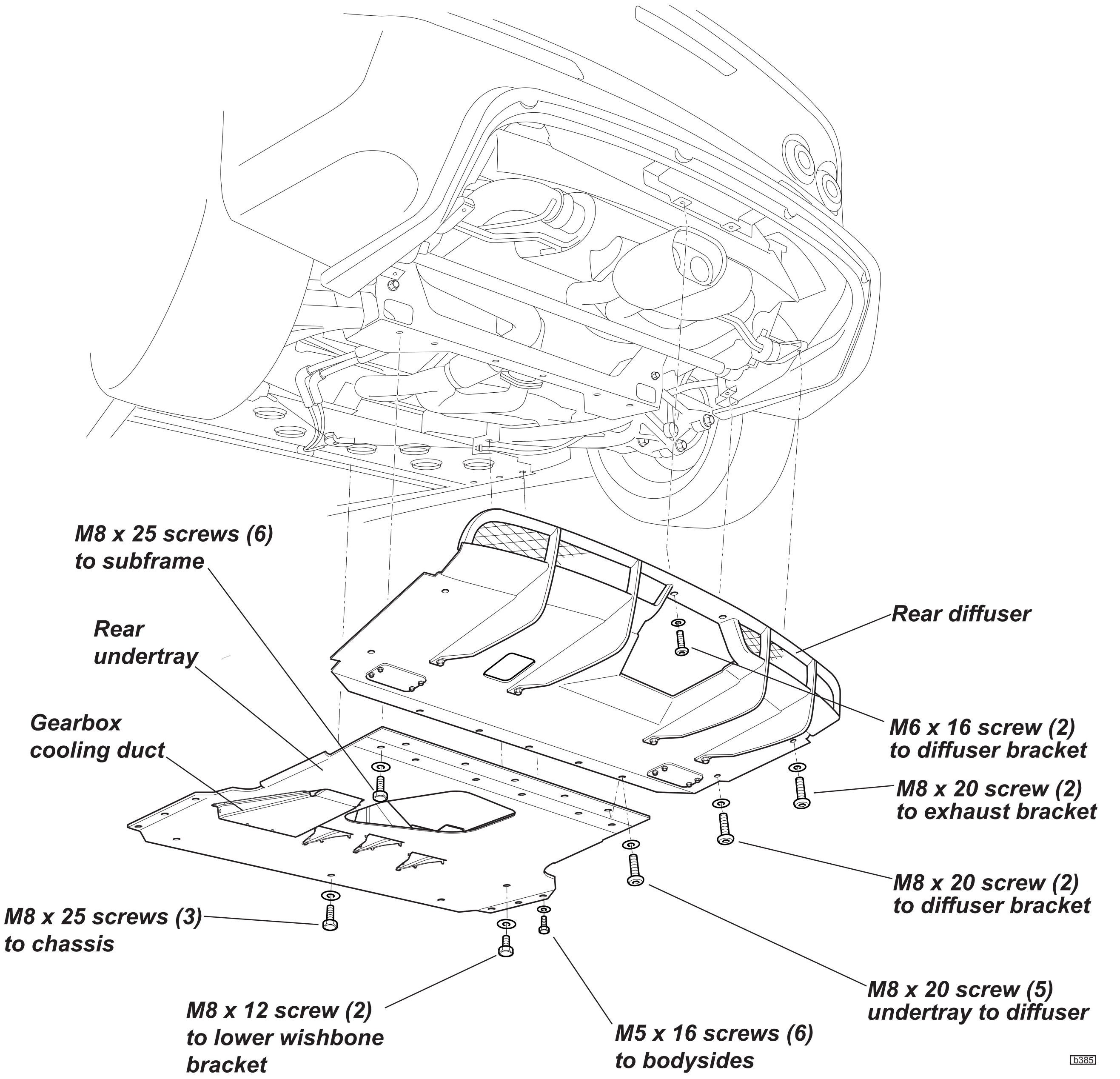
AN.2 - ENGINE BAY UNDERTRAY/DIFFUSER

For certain service operations, it may by necessary to remove the engine bay undertray and/or diffuser panel. The panels contribute to the aerodynamic performance of the car, and also help to keep the engine bay clean.

Do not run the car without the panels fitted. The undertray and diffuser assembly panel are fixed to the vehicle using M5, M6 and M8 sized fixing screws, which are bolted directly into the vehicles chassis and subframe or retained by the use of single use speed fixings also referred to as ‘spire nuts’.

Note: To ensure its security, any speed fixings used to retain the undertray screws must be renewed before refitting the undertray/ diffuser assembly onto the vehicle.

All M5 screws tightened to a torque of 5 Nm
All M6 screws tightened to a torque of 8 Nm
All M8 screws tightened to a torque of 20 Nm.



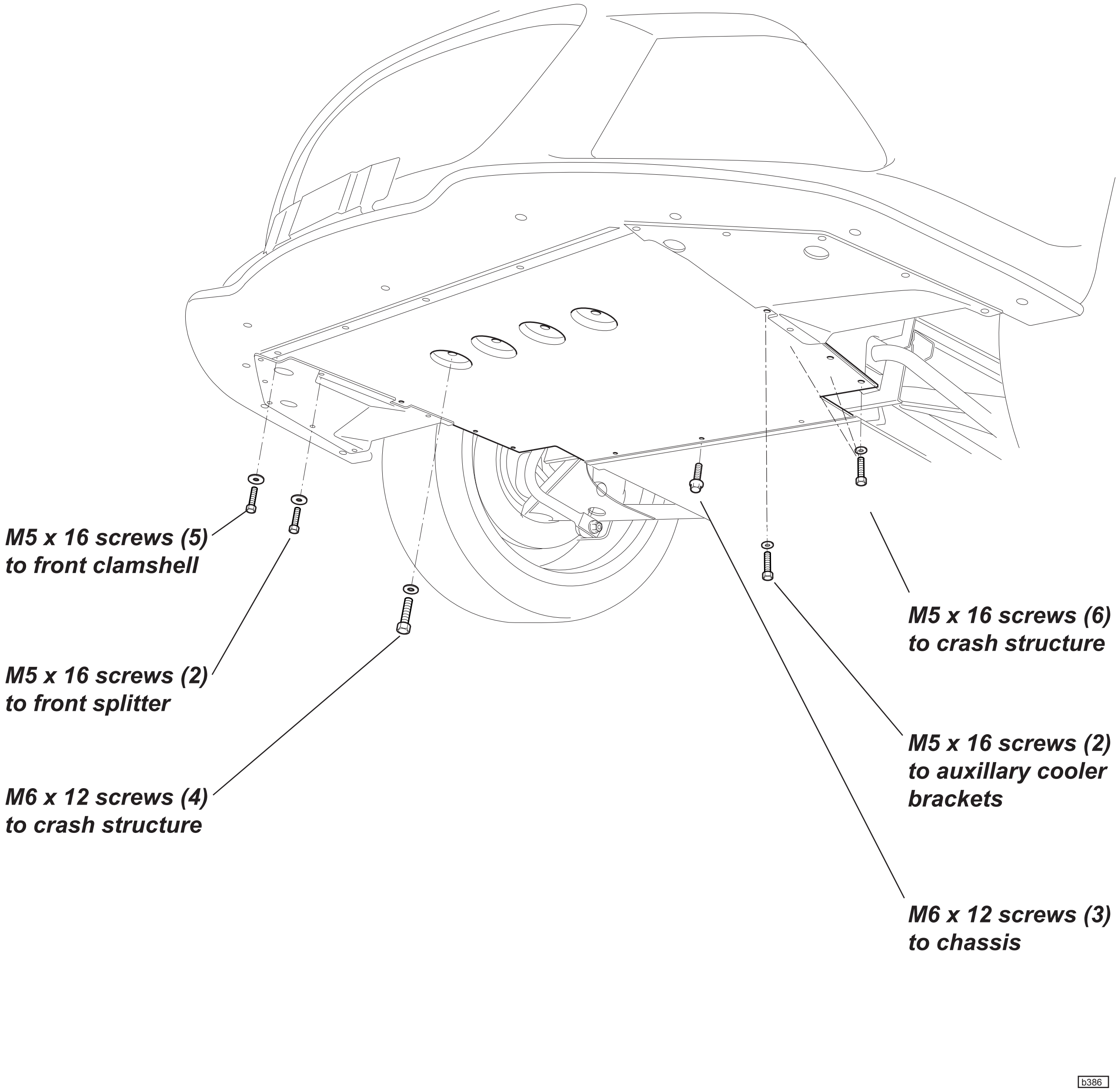
AN.3 - FRONT UNDERSHIELD

For certain service operations, it may by necessary to remove the front undershield. The panel contributes to the aerodynamic performance of the car, aids the rigidity of the front clamshell panel and retains the auxiliary radiator brackets in situ. Do not run the car without the panels fitted.

The undershield panel is fixed to the vehicle using M5 and M6 sized fixing screws, which are either bolted directly into the vehicles chassis and crash structure or retained by the use of single use speed fixings also referred to as 'spire nuts'.

Note: To ensure its security, any speed fixings used to retain the undershield screws must be renewed before refitting the assembly back onto the vehicle.

All M5 screws tightened to a torque of 5 Nm
All M6 screws tightened to a torque of 8 Nm

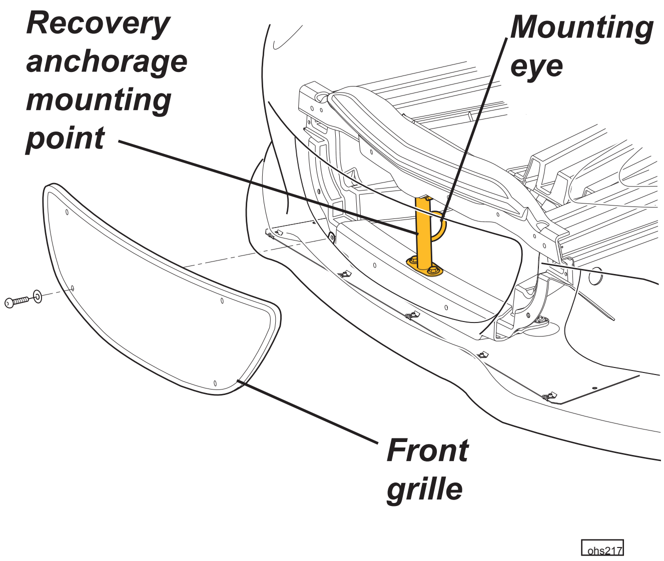


AN.4 - VEHICLE RECOVERY

Recovery Anchorage Mounting Point
A recovery anchorage mounting point is fitted behind the centre front radiator air intake grille. The mounting point is provided to aid vehicle recovery, such as winching onto a flatbed car transporter, but only when the car is able to roll freely.

When required, remove the grille by unscrewing its 4 fixing screws using a T25 Torx 'T' bar wrench. Once removed, fasten suitable towing equipment around the mounting point ensuring that it also passes through semicircular mounting eye. This will limit the movement of the towing equipment and prevent accidental damage to the bodywork whilst manoeuvring the vehicle.

Only in an emergency should the car be towed using this anchorage mounting, and then only for the shortest distance necessary, during which time the following precautions must be taken:



Use only towing equipment designed specifically for this purpose, or damage to the car may be caused, or you could be killed or seriously injured.

Ensure that the key is used to unlock the steering column, and is then left in the lock. Never withdraw the key until the car is stationary. The steering column will lock when the key is withdrawn.

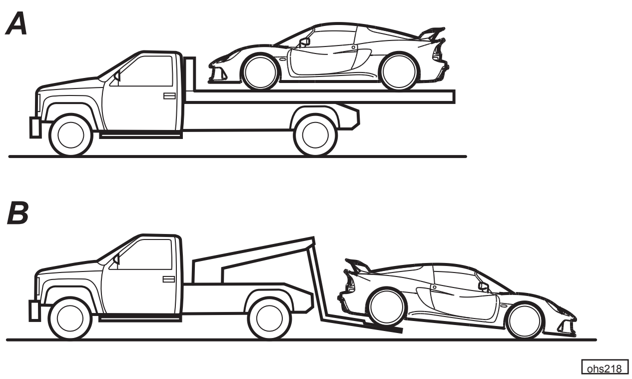
Before being towed:
• Release the parking brake and ensure that the transmission is in neutral.
• Comply with all local legislation applicable to cars being towed.
• Do not use the recovery eye to secure the car on a transporter. (see 'Car Tie- Down' below).

Car Tie-Down
When moving a car by transporter or trailer, the car should be secured only by chocking and strapping around the road wheels.
Attaching restraints around suspension linkages or chassis or body components may cause damage.

Vehicle Recovery
The recommended method of recovery for any model is the use of a flat bed transporter as shown in illustration B.

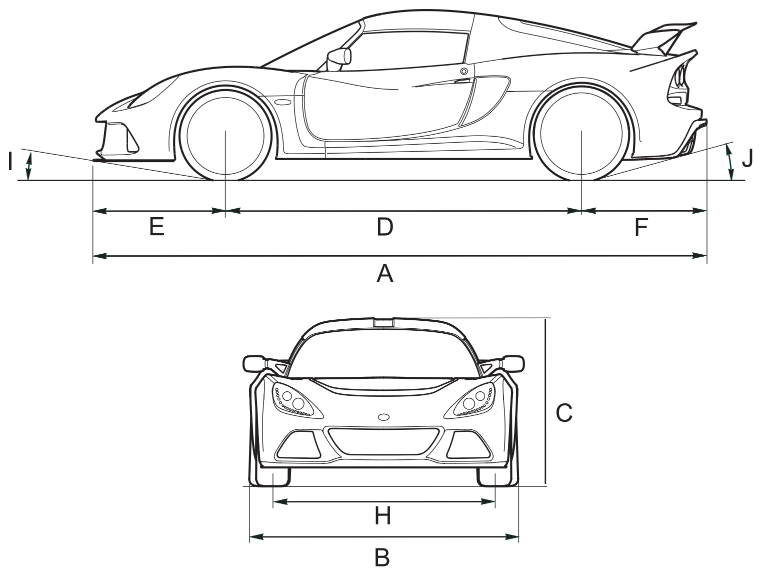
Never use the recovery eye to tow the vehicle.

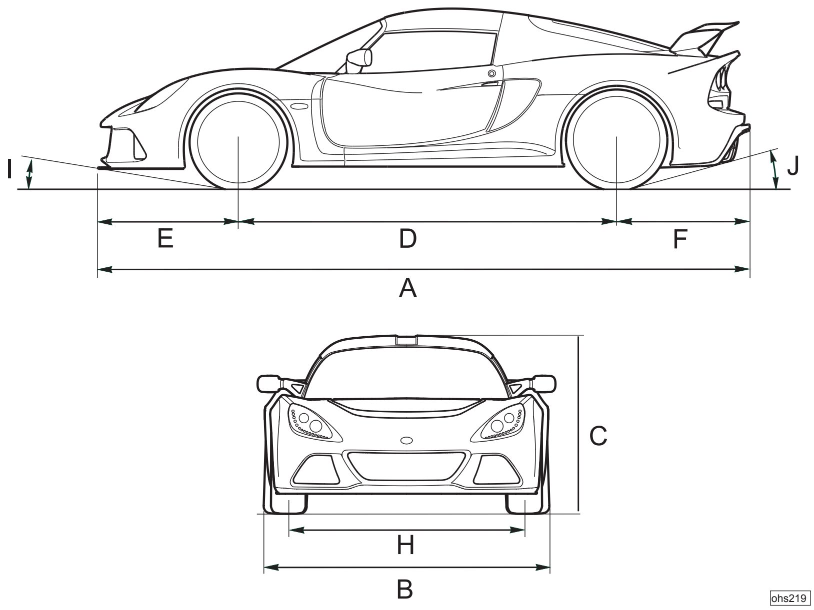
To prevent causing serious damage to the transmission; always tow the vehicle with the free wheels (non driving wheels) rotating on the ground, see illustration A.



TECHNICAL DATA - VEHICLE - EXIGE S & EXIGE ROADSTER

SECTION TDV





DIMENSIONS

		Exige S	Exige Roadster
A. Overall length		4084 mm	4067mm
B. Overall width	- excl. mirrors	1802 mm	
	- incl. mirrors	1933 mm	
C. Overall height (mid-unladen)		1129 mm	
D. Wheelbase		2370 mm	
E. Front overhang		888 mm	863mm
F. Rear overhang		834 mm	
G. Ground clearance (mid-laden)			
	- front	125mm	
	- rear	136mm	
H. Track	- front	1499 mm	
	- rear	1584 mm	
I. Approach (ramp) angle front		7.6°	9.12°
J. Approach (ramp) angle rear		15.0°	
Turning circle (between kerbs)		10.6 m	

Roadster dimensions listed where different from Exige S

WEIGHTS

Unladen weight

Total	1176 kg	>	includes full
Front	419 kg	>	full
Rear	757 kg	>	fuel tank

Maximum weight

Total	1426 kg	>	includes
Front	515 kg	>	occupants
Rear	911 kg	>	& luggage

Trailer towing Not permissible

CAPACITIES, STANDARDS & APPROVED PRODUCTS

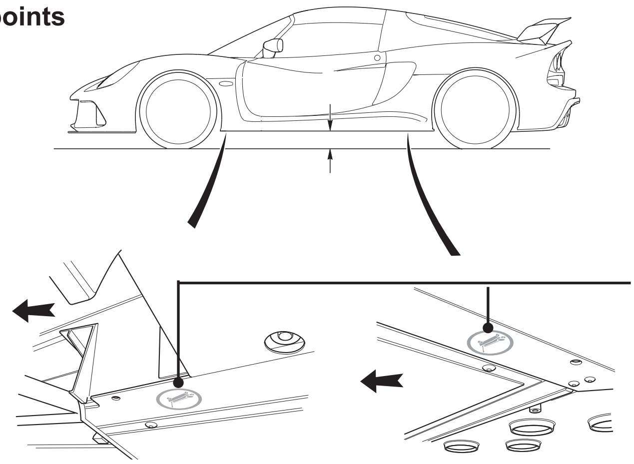
Please see service notes section OJ for information on fluid change intervals as well as track use conditions.

Engine oil		
Engine oil - dry		9.6 litre **Engine oil capacity is 6.1 litres but super-charged cars fitted with a front mounted oil cooler contain an additional 4 litres of oil. This oil is not drained during routine servicing.*
	Viscosity: ambient above -20°C	SAE 5W/40 (Fully synthetic)
	Quality Standard	API SL/CF; ACEA A3/B3-04
	High/low dipstick mark difference	1.5 litre
Transmission oil		2.4 litre
	Viscosity	SAE 75W/80
	Quality Standard	API GL-4
	Approved product	Havoline Multigear MTF **HD** 75W-80 (semi-synthetic)
Brake system hydraulic fluid		450 cc
	Type	Non-mineral (non-petroleum) hydraulic fluid
	Specification	DOT 4
	Approved product	PETRONAS Tutela Top 4 brake fluid
Clutch system hydraulic fluid		130 cc
	Type	Non-mineral (non-petroleum) hydraulic fluid
	Specification	DOT 4
	Approved product	PETRONAS Tutela Top 4 brake fluid
Coolant/Antifreeze		17 litre (includiing 50% concentration of 8.5 litres of antifreeze)
	Antifreeze Type	Ethylene glycol with OAT corrosion inhibitors
	Colour	Red
	Approved product	PETRONAS Paraflu Up
Air Conditioning Refrigerant		0.450 kg
	Type	R134a
Washer bottle Fluid		3.5 litre
	Approved product	PETRONAS Tutela SC35 windscreen washer fluid Mixed as per the manufacturers recommen-dations as an insufficient concentration may result in the vehicles windscreen washers freezing in severe conditions.
Fuel tank		43.5 litre
Boot/luggage compartment capacity		98 litre

WHEELS & TYRES

Road Tyres	
Type - Std.	Pirelli P-Corsa
- Opt.	Pirelli P Zero Trofeo
Size - Front	205/45 ZR17 - 88Y
- Rear	265/35 ZR18 - 97Y (std.) 93Y (opt.)
Pressure (cold)	
- Front - Std. & Opt.	2.2 bar (31.9 psi)
- Rear - Std. & Opt.	2.6 bar (38 psi)
Winter Tyres	
Type - Front	Pirelli 210 SottoZero Serie II
- Rear	Pirelli 240 SottoZero Serie II
Size - Front	205/45 R17 - 88V M+S
- Rear	235/40 R18 - 95V M+S
Pressure (cold)	
- Front	2.3 bar (33 lb/in²)
- Rear	2.6 bar (36 lb/in²)
Tyre studding	Not permitted
Tyre chains	RUD-matic Classic R48493 snow chains, fitted only on the rear, and only on the approved winter tyres.
Road Wheels	
Type	Cast alloy 5-bolt fixing
Size - Front	7.5J x 17H2 ET26.3
- Rear	9.5J x 18H2 ET35
Inset - Front	+ 26.0 mm
- Rear	+ 35.0 mm
PCD (Pitch Circle Diameter)	
Size - Front	110.0 ± 0.1 mm
- Rear	114.3 ± 0.1 mm
Centre spigot hole diameter	
Size - Front	65.14 mm
- Rear	68.14 mm
Winter Wheels	
Type	Cast alloy 5-bolt fixing
Size - Front	7.5J x 17H2 ET26.3
- Rear	8.0J x 18H2 ET14.4
Inset - Front	+ 26.0 mm
- Rear	+ 14.4 mm
Wheel Bolt Torque	105 Nm (77 lbf.ft)

Chassis ride height points



FRONT SUSPENSION

Type

Independent. Upper and lower fabricated light weight steel wishbones; co-axial coil spring/telescopic damper unit; tubular anti-roll bar.

Geometry

Mid-laden ride height (2 x 75 kg occupants + full fuel tank)

- set car to this height before measuring geometry:
  - front 130 mm below front end of chassis siderail
  - rear 136 mm below rear end of chassis siderail

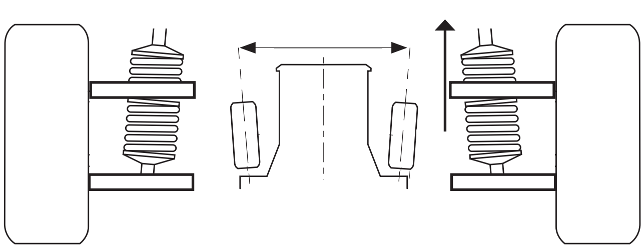
Applicable vehicles:
Exige S
Exige Roadster

(Figures for both Sport & Race models, see section CJ & DI for further information).

Total toe

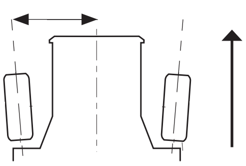
Optimum - 0.06° (Toe out)

Tolerance range ± 0.06°



Toe out

Max. side/side difference 0.06°



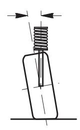
Camber

Optimum - 0.40° *Exige S*

Optimum - 0.20° *Exige Roadster*

Tolerance range ± 0.10°

Max. side/side 0.20°

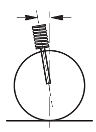


Caster (Exige S & Roadster)

Optimum 3.20°

Tolerance range ± 0.30°

Max. side/side 0.40°



REAR SUSPENSION

Type: Independent. Upper fabricated lightweight steel wishbones and lower aluminium forged lower wishbones; co-axial coil spring/telescopic damper unit; tubular anti-roll bar.

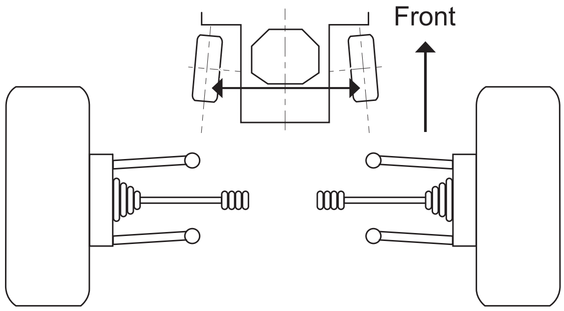
Geometry

Mid-laden ride height (2 x 75 kg occupants + full fuel tank)
- set car to this height before measuring geometry:
  - front 130 mm below front end of chassis siderail
  - rear 136 mm below rear end of chassis siderail

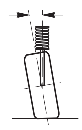
Applicable vehicles:
Exige S
Exige Roadster

(Figures for both Sport & Race models, see section CJ & DI for further information).

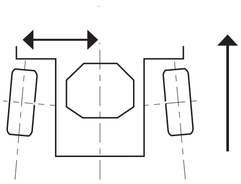
Total toe
Optimum + 0.60° (Toe in)
Tolerance range ± 0.04°



Camber
Optimum - 1.90° *Exige S*
Optimum - 2.10° *Exige Roadster*
Tolerance range ± 0.15°
Max. side/side 0.20°



Toe in
Max. side/side difference ± 0.08°



ELECTRICAL

Light Bulbs	*Wattage*	*Type*
Headlamps		
- Dip Beam	60	HB3A
- Main Beam	65	H9B
Rear turn indicators	16	W16W capless
Reverse lamp	16	W16W capless
Licence plate lamps	5	W5W
Interior lamp	5	W5W

Note that all other lamps are long life LED type, serviced only by lamp replacement.

System voltage/polarity		12V negative earth
Alternator		100A
Battery (service replacement)	- type	Varta L3B (T6) 572409068
	- rating	72 Ah

TRANSMISSION

Type - Manual

Designation	6 speed manual type EA60
Differential	Open bevel gear

Gear ratio table ('opt' refers to Sport ratio set please see Service Notes Section FK.1 for further information).

Gear ratio table (Refers to sport ratio set)

Gear	Internal ratio	Final drive	mph/1000rpm	km/h/1000rpm
1	3.54	3.78	5.6	9.1
2	1.91	3.78	10.4	16.7
3	1.41	3.78	14.1	22.8
4	1.09	3.78	18.2	29.4
5	0.97	3.24	23.9	38.5
6	0.86	3.24	27	43.5
Rev	3.83	3.24		

CLUTCH

Type	Single dry plate. Diaphragm spring cover. Hydraulic release, self adjusting
Friction plate diameter	228 mm
Friction plate clamped thickness - new	8.0 mm
Damper springs	4 off
Hub material	Sintered steel
Clamp load - new	8350N

BRAKES

Brake discs	Cast iron, curved vane ventilated, or optional cross-drilled. Rear discs incorporate parking drums
Disc dimensions - front	332 x 32 mm
- rear	332 x 26 mm. 185 mm drum
Minimum thickness - front	32 mm
-	24 mm
Callipers	A.P. Racing, aluminium alloy body, 4 pistons in opposed pairs. Common casting front/rear
Piston size - front	Leading; 36.00 mm. Trailing; 31.75 mm
- rear	Leading; 31.75 mm. Trailing; 28.40 mm
Operation	Tandem master cylinder with dual diaphragm vacuum servo and Bosch ESP 8.1 ESP Anti-lock system
Parking brake	Cable operated drum brakes incorporated into rear discs

STEERING

Type	Manual rack and pinion
Turns, lock to lock	2.8
Gear ratio	15.8:1

FUEL CONSUMPTION (mpg (l/100km))

EC/715/2007	- urban	19.5 (14.5)
	- extra urban	37.2 (7.6)
	- combined	28.0 (10.1)
	CO_2 emissions (g/km)	236