



ENGINE
(83 US Emission Standard)
(Sierra and Escort) 21B

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TECHNICAL DATA

Engine - 83 US

Engine - General

Emission standard	..	..	..	..	..	..	83 US
Identification code	..	..	..	..	..	..	N5C
Firing order	..	..	..	..	..	..	1-3-4-2
Bore	..	..	..	..	..	mm	90,82
Stroke	..	..	..	..	..	mm	76,95
Cubic capacity	..	..	..	..	effective	cc	1993
Compression ratio	..	..	..	..	..	..	8,0 : 1
Compression pressure	..	..	at starter motor speed	bars	..	..	8,5
Boost pressure	..	..	..	..	..	bars	0,8
Idle speed	..	..	..	..	..	rpm	900/950
Max. engine speed	..	..	..	continuous	rpm	..	6500
Power output (DIN)	..	..	..	..	..	kW	162
	..	..	..	..	at	rpm	6000
Torque (DIN)	..	..	..	..	..	Nm	290
	..	..	..	..	at	rpm	3500
Spark plugs	..	..	..	..	..	..	AGPR902P
Ignition timing	..	..	..	..	..	..	16° before TDC at idle speed

Engine Lubrication

Viscosity	..	..	..	..	..	..	5W/50
Specification	..	..	..	..	..	..	Mobil 1 or API SG/CD (synthetic oil) only
Initial fill capacity	..	..	incl. filter	litres	..	..	4,75
Oil change	..	..	interval	km	..	..	10000
	..	..	excl. filter	litres	..	..	3,7
	..	..	incl. filter	litres	..	..	4,2
Minimum oil pressure *	..	..	at 900/950 rpm	bars	..	..	1,8
	..	..	at 2000 rpm	bars	..	..	2,4

*with SAE 5W-50 oil at 80°C

Cooling System

Fill capacity incl. heater and degas tank	..	..	litres	7,5
Antifreeze - type	..	..	..	Motorcraft Super Plus 4 antifreeze
- specification	..	..	..	ESD-M97B49-A
- use a mixture of 50/50 (% by volume)	..	..	..	
when filling and topping up	..	..	..	

Cylinder Block

Cast mark	..	..	..	..	..	V 90 HM 6015 AA
Number of main bearings	..	..	..	..	..	5
Cylinder bore dia.	..	..	Standard class 2	mm	..	90,810 to 90,820
	..	..	Standard class 3	mm	..	90,820 to 90,830
Centre main bearing width	..	..	..	mm	..	27,22 to 27,17
Fitted main bearing shells	..	..	..	..	..	
- vertical inside dia.	..	..	Standard	mm	..	57,000 to 57,038
	..	..	Undersize 0,25	mm	..	56,750 to 56,788
	..	..	.. 0,50	mm	..	56,500 to 56,538
	..	..	.. 0,75	mm	..	56,250 to 56,288
Main bearing parent bore dia.	..	..	Standard	mm	..	60,640 to 60,620



TECHNICAL DATA (cont'd)

Engine - 83 US

Crankshaft

End float	.. .. .	mm	0,1 to 0,254	
Main bearing journal dia.	 Standard	mm	56,975 to 56,959	
	 Undersize 0,25	mm	56,725 to 56,709	
		mm	56,475 to 56,459	
		mm	56,225 to 56,209	
Width of centre main bearing	 Standard	mm	32,00 to 32,05	
Thickness of thrust half washers	 Standard	mm	2,3 to 2,35	
Clearance between main bearing journals and bearing shells	 Standard	mm	0,025 to 0,079	
Big end bearing journal dia.	 Standard	mm	51,993 to 51,977	
	 Undersize 0,25	mm	51,743 to 51,727	
		mm	51,493 to 51,477	
		mm	51,243 to 51,227	
Length of main bearing journals	front, centre, rear	mm	32,13 to 31,87	incl. radii
	intermediate bearings	mm	32,13 to 31,87	
Width of main bearing shells	front, centre, rear	mm	23,24 to 23,62	
	intermediate bearings	mm	23,24 to 23,62	
Length of big end bearing journals	.. .. .	mm	26,0 to 26,1	incl. radii
Width of big end bearing shells	.. .. .	mm	19,61 to 20,00	

Cylinder Head

Cast mark	.. .. .		V 89 HF 6090 AA	
Valve seat angle	.. .. .		45°	
Valve seat width	.. .. .	mm	1,5 max.	
	 inlet	mm	2,0 max.	
	 exhaust	mm	7,000 to 7,015	
Inlet valve stem bore dia.	 Standard	mm	8,000 to 8,015	
Exhaust valve stem bore dia.	 Standard	mm	28,000 to 28,021	
Camshaft bearing parent bore dia.	.. .. .	mm		
Distance between lower edge of valve guide and cylinder head mating face	 inlet	mm	33,5 on centre line	
	 exhaust	mm	28 on centre line	
Flatness of upper mating face of cylinder head	.. .. .			
Maximum permissible distortion in longitudinal direction (convexity) measured at centre	.. .. .	mm	0,10	Change cylinder head if exceeded
Flatness of lower mating face of cylinder head	.. .. .			
Maximum permissible unevenness in transverse direction (100 mm steel straight edge)	.. .. .	mm	0,02	
Maximum permissible unevenness in longitudinal direction (100 mm steel straight edge)	.. .. .	mm	0,02	
Maximum permissible distortion in longitudinal direction (concavity) measured at centre	.. .. .	mm	0,08	Rework cylinder head if exceeded
Maximum material removal	.. .. .	mm	0,13	
Minimum cylinder head height after machining, measured between mating faces	.. .. .	mm	138,68	



TECHNICAL DATA (cont'd)

Engine B3 - US

Camshafts

Number of camshafts	..	..	..	..	..	2
Number of camshaft bearings	..	..	..	..	..	5
Drive	..	..	..	..	..	By toothed belt
Cam lift	..	..	..	..	..	8,544
				Inlet	mm	8,544
				Exhaust	mm	8,544
Cam length (between heel and toe)	..	..	..	Inlet	mm	46,802 to 46,286
				Exhaust	mm	46,802 to 46,286
Camshaft bearing journal dia.	..	..	..	..	mm	27,960 to 27,936
Inlet valve side, front	..	..	..	1st bearing	mm	27,960 to 27,936
				2nd bearing	mm	27,960 to 27,936
				3rd bearing	mm	27,960 to 27,936
				4th bearing	mm	27,960 to 27,936
Exhaust valve side, front	..	..	..	1st bearing	mm	27,960 to 27,936
				2nd bearing	mm	27,960 to 27,936
				3rd bearing	mm	27,960 to 27,936
				4th bearing	mm	27,960 to 27,936
Camshaft end float	..	..	..	..	..	Ball bearing play
Valve timings	..	..	..	..	..	8°
				Inlet opens BTDC		52°
				Inlet closes ABDC		52°
				Exhaust opens BBDC		8°
				Exhaust closes ATDC		

Valves

Valve timing	..	..	..	..	..	..	Direct by OHC
Valve clearances	..	..	..	..	..	Inlet	Hydraulic tappets
	..	..	..	..	..	Exhaust	Hydraulic tappets
Bucket tappet dia.	..	..	..	..	..	Standard	mm 34,975 to 34,959
Bucket tappet dia.	..	..	..	..	..	Oversize	mm 35,475 to 35,459
Tappet clearance in housing			..	..	..	Standard/Oversize	mm 0,025 to 0,057
Free valve spring length	..	..	..	..	..	..	mm 39,8
Spring force	..	..	..	..	..	Valve open	N 620
						Valve closed	N 257
Spring height compressed	..	..	..	..	..	Valve open	mm 23,45
						Valve closed	mm 32
Valve spring wire dia.	..	..	..	..	..	..	mm 3,9
Number of coils	..	..	..	..	..	..	5,8
Valve spring inside dia.	..	..	..	..	..	..	mm 21,6

Inlet Valves

Valve length	..	..	..	..	..	mm	105,68
Valve head dia.	..	..	..	..	..	mm	35,0 to 35,2
Valve stem dia.	..	..	..	..	Standard	mm	6,970 to 6,955
Valve stem clearance in guide	..	..	..	..	..	mm	0,03 to 0,06

Exhaust Valves

Valve length	..	..	..	..	..	mm	105,5
Valve head dia.	..	..	..	..	..	mm	31,0 to 31,2
Valve stem dia.	..	..	..	..	Standard	mm	7,960 to 7,938
Valve stem clearance in guide	..	..	..	..	..	mm	0,055 to 0,077



TECHNICAL DATA (cont'd)

Engine 83 - US

Pistons

Piston dia.	..	..	..	..	Standard size 2	mm	90,758 to 90,772
					Standard size 3	mm	90,768 to 90,782
Piston clearance in bore (unused)	..	..	..	..		mm	0,038 to 0,062
Piston ring gaps (fitted)	..	..	..	..	.. upper	mm	0,4 to 0,65
					.. middle	mm	0,4 to 0,65
					.. lower	mm	0,3 to 0,6
Ring gap positions	..	..	..	..	.. upper		Offset 120° from one side expander gap
Oil control ring	..	..	..	..	.. middle		Offset 120° from opposite side of expander gap
							Offset 120° from position of gap of middle piston ring

Piston Pins

Type	..	..	..	..	..	..	..	mm	Floating
Piston pin dia.	..	..	..	..	..	..	..		24,000 to 23,995
Pin retention	..	..	..	..	..	..	..		By circlip

Connecting Rods

Bore dia. (excl. bearing shells)	..	..	..	..	big-end	mm	55,00 to 55,02
					small end	mm	27,000 to 27,021
Fitted big end bearing shells							
- vertical inside dia.	..	..	..	..	Standard	mm	52,006 to 52,044
					Undersize 0,25	mm	51,756 to 51,794
					0,50	mm	51,506 to 51,544
					0,75	mm	51,256 to 51,294
Connecting rod bush inside dia. (fitted)	..	..	..	..		mm	24,007 to 24,013
Big-end bearing clearances	..	..	..	..		mm	0,013 to 0,067
Big-end bearing axial movement	..	..	..	..		mm	0,25 to 0,09

Tightening TorquesChecking Compression Pressure (21 111 0)

Spark plugs	..	..	..	..	..	..	..	Nm	28 to 33
-------------	----	----	----	----	----	----	----	----	----------

Checking Oil Pressure (21 112 0)

Oil feed pipe to turbocharger	..	..	..	..					20 to 25
Turbocharger heat shield to bulkhead bracket and to fender bracket									9 to 11



TECHNICAL DATA (cont'd)

Engine - 83 US

Tightening Torques (cont'd)Installing Engine and Transmission Assembly (21 132 0)

	Nm
Front axle/engine crossmember to side members	71 to 95
Transmission crossmember to floor assembly	20 to 26
Torx studs in transmission output flange	70 to 90
Driveshaft to transmission output flange	70 to 85
Driveshaft to rear axle	57 to 75
Driveshaft centre bearing to floor assembly	18 to 24
Exhaust mounting bracket to transfer box	41 to 55
Left-hand exhaust mounting bracket to rear axle crossmember	45 to 56
Speedometer drive cable union nut	6 to 9
Front axle housing cover	9 to 11
Steering intermediate shaft to steering shaft	17 to 20
Stabiliser bar brackets to side members	70 to 97
Lower suspension arms to spindle carrier	70 to 90
Castellated nut of track rod to drop arm	57 to 68
Front axle assembly oil level check plug.. .. .	35 to 45
Lower engine cover to side members and to front axle/engine crossmember	18 to 22
Wheel bolts	100
Retaining bolts of engine lifting eyes	19 to 21
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10
Engine mounting nuts	70 to 90
Front exhaust pipe to turbocharger	35 to 47
Pressure pipe from steering gear to power steering pump	26 to 31
Turbocharger heat shield to bulkhead bracket and to fender bracket	9 to 11
Vent screw in thermostat housing	7 to 10

Connecting Engine to Transmission (21 134 4)

Engine/transmission flange bolts	41 to 48
Bolt securing adaptor plate to transmission	9 to 12
Starter motor	58 to 78
Driveshaft to front axle assembly drive flange	30 to 40



TECHNICAL DATA (cont'd)

Engine - 83 US

Tightening Torques (cont'd)

<u>Assembling Engine (21 134 8)</u>							<u>Nm</u>	<u>Remarks</u>
Crankshaft main bearing caps	..	..	..	..	..	..	88 to 101	Oil thread
Big-end bearing bolt to connecting rod	..	..	..	..	..	..	55 to 60	Oil thread and underside of bolt head
Oil pump to cylinder block	..	..	..	..	..	..	19 to 21	Oil thread
Crankshaft front cover	..	..	..	..	..	..	13 to 17	Use new self-locking bolts ('Scotch Grip') Oil thread
Auxiliary shaft thrust plate	..	..	..	..	..	..	13 to 17	
Auxiliary shaft front cover	..	..	..	..	..	..	13 to 17	
Sump to cylinder block	..	..	..	..	..	..	8 to 11	"Scotch Grip" Oil thread
Flywheel to crankshaft	..	..	..	..	..	..	63 to 69	
Clutch pressure plate to flywheel	..	..	..	..	..	..	19 to 21	
Auxiliary shaft toothed belt pulley	..	..	..	..	..	..	44 to 49	
Water pump bolts - M8	..	..	..	..	..	..	19 to 21	
Water pump bolts - M10	..	..	..	..	..	..	40 to 48	
Water pump V-belt pulley	..	..	..	..	..	..	19 to 21	
Knock sensor	..	..	..	..	..	..	10 to 15	
Bracket of engine speed/TDC sensor to sump (nuts) ..	..	..	..	..	..	..	8 to 10	Distance between sensor and tooth on belt pulley
Engine speed/TDC sensor studs in sump	..	..	..	..	..	..	4 to 6	
Engine speed/TDC sensor to bracket (bolts)	..	..	..	..	..	..	4 to 6	Loctite 648
Oil pressure switch in cylinder block	..	..	..	..	..	..	25 to 29	Loctite 270
Nut of oil filter/oil cooler connecting housing	..	..	..	..	..	..	30 to 35	Oil thread
Inlet union screw to oil cooler	..	..	..	..	..	..	47 to 49	Oil thread
Engine mounting bracket to cylinder block	..	..	..	..	..	..	19 to 21	
Oil filter/oil cooler connecting housing to cylinder block	..	..	..	..	..	..	30 to 32	
Oil filter	..	..	..	..	..	..	Screw on finger tight plus 1/2 to 3/4 of a turn	Lubricate seal and thread with engine oil
Cylinder head to cylinder block Stage 1	..	..	..	..	..	..	45 to 50	Oil thread and underside of bolt head
Stage 2	..	..	..	..	..	..	Turn 180° + 10° more	
Stage 3	..	..	..	..	..	..	Check for 110 Nm	
Spark plugs	..	..	..	..	..	..	28 to 33	
Engine breather valve bracket in plenum chamber	..	..	..	..	..	..	8 to 10	
Cylinder head cover	..	..	..	..	..	..	10 to 15	



TECHNICAL DATA (cont'd)

Tightening Torques (cont'd)Assembling Engine (21 134 8) (cont'd)

	Nm	Remarks
Distributor bracket	19 to 21	
V-belt pulley/vibration damper to crankshaft	190 to 200	Oil thread and underside of bolt head
Alternator bracket to cylinder block	58 to 79	
Alternator to bracket	20 to 25	
Alternator adjusting strap to cylinder block	20 to 25	
Alternator adjusting strap to alternator	20 to 25	
Toothed belt cover (all bolts)	8 to 10	
Bracket of oil dipstick tube to cylinder head	8 to 10	
Mounting bolts to power steering pump	21 to 25	
Power steering pump carrier support to cylinder block	19 to 21	M8 hexagon bolt, Loctite 518 on mating face
Power steering pump mounting carrier to cylinder block	50 to 60	M10 hexagon socket head cap screw
Power steering pump support/carrier connecting bolt ..	35 to 40	M8 hexagon socket head cap screw
Power steering pump mounting (V-belt tension)	21 to 25	
Engine mounting bracket to cylinder block	19 to 21	
Front axle assembly to sump mounting	40 to 48	
Front axle assembly mounting bracket to cylinder block	19 to 21	
Oil drain plug	21 to 27	

Additional Tightening Torques for 21 134 8

Oil intake pipe to pump	8 to 10	
Oil intake pipe to cylinder block	19 to 21	
Baffle plate to sump	8 to 10	'Scotch Grip'
Bracket for multiplugs of engine speed/TDC sensor and knock sensor	19 to 21	M8 hexagon bolt, Loctite 518 on mating face
Bush of oil cooler inlet union screw in cylinder block	30 to 35	
Coolant drain plug in cylinder block	25 to 30	

Installing Cylinder Head (21 163 0)

Engine lifting eyes to cylinder head	19 to 21	
Cylinder head to cylinder block	45 to 50	Oil thread and underside of bolt head
Stage 2	Turn $180^\circ \pm 10^\circ$ more	
Stage 3	Check for 110 Nm	



TECHNICAL DATA (cont'd)

Engine - 83 US

Tightening Torques (cont'd)Installing Cylinder Head (21 163 0) (cont'd)

	Nm	Remarks
Toothed belt tensioning pulley to cylinder head ..	40 to 48	
Cylinder head cover	10 to 15	
Spark plugs	28 to 33	
Toothed belt cover (all bolts)	8 to 10	
Front exhaust pipe to turbocharger	35 to 47	
Engine mounting nuts	70 to 90	
Self-locking nuts on throttle housing vibration damper (then slacken half a turn)	8 to 10	
Oil dipstick tube bracket to cylinder head	8 to 10	
Turbocharger heat shield to bulkhead brackets.. .. .	8 to 10	
Turbocharger heat shield to fender bracket		

Assembling Cylinder Head (21 165 5)

Camshaft front bearing caps to cylinder head (M6 x 35 bolts)	8 to 10	Oil thread
Camshaft bearing caps to cylinder head - M8	19 to 23	Oil thread
Camshaft toothed belt pulleys	59 to 63	
Coolant temperature sensor/coolant hose connecting flange	8 to 10	
Temperature gauge sender unit	7 to 10	
Connection of turbocharger oil feed pipe	17 to 21	
Toothed belt tensioning pulley to cylinder head	40 to 48	
Toothed belt cover spacer stud in cylinder head cover. ..	4,5 to 5,5	Oil thread
Toothed belt cover spacer stud to cylinder head cover ..	4,5 to 5,5	Loctite
Engine lifting eyes to cylinder head	19 to 21	
Inlet manifold (nuts and bolts) to cylinder head	19 to 21	
Exhaust manifold to cylinder head	26 to 28	
Thermostat housing to cylinder head	19 to 21	
Vent screw in thermostat housing	7 to 10	

Additional Tightening Torques for 21 165 5

Studs of camshaft bearing caps - M8	3,5 to 4,5
Stud of toothed belt tensioning pulley	4,5 to 5,5
Exhaust manifold studs	3,5 to 4,5
Coolant temperature sensor in connector	23 to 25
Oilway blanking plug 1/16 NPTF thread	5 + 90°
1/18 NPTF thread	8 to 10



TECHNICAL DATA (cont'd)

Tightening Torques (cont'd)Installing Inlet Manifold (21 183 0)

	Nm	Remarks
Inlet manifold retaining bolts	19 to 21	
Inlet manifold retaining nuts	19 to 21	
Engine mounting nuts	70 to 90	
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10	
Oil dipstick tube bracket to cylinder head	8 to 10	
Engine breather valve bracket to plenum chamber	8 to 19	

Additional Tightening Torques for 21 183 0

Plenum chamber to inlet manifold	8 to 10	
Throttle housing to plenum chamber	8 to 10	
Studs in inlet manifold	3,5 to 4,5	
Throttle cable bracket to plenum chamber	18,5 to 21,5	
Fuel pressure regulator to fuel rail	8 to 10	
Hose clips - general	3,5 to 4,5	
Fuel rail to plenum chamber	8 to 10	
Air charge temperature sensor in plenum chamber	23 to 25	Loctite 5
Air hose connections in plenum chamber	5 to 6	Loctite 5
Studs (M6) in plenum chamber elbow	3,5 to 4,5	
Vibration damper of plenum chamber elbow	8 to 10	
(then slacken half a turn)		

Installing Exhaust Manifold (21 187 0)

Turbocharger to exhaust manifold	27 to 33	"Never Seeze"
Exhaust manifold to cylinder head	26 to 28	
Alternator adjusting strap to cylinder block	20 to 25	
Alternator adjusting strap to alternator	20 to 25	
Front exhaust pipe to turbocharger	35 to 47	
Oil feed pipe to turbocharger and cylinder head	20 to 25	
Lower engine cover to front axle/engine crossmember and side members	18 to 22	
Turbocharger heat shield to fender/bulkhead brackets	9 to 11	
Vent screw in thermostat housing	7 to 10	

Additional Tightening Torques for 21 187 0

Oil feed pipe adaptor to turbocharger	17 to 21	Oil
Oil return pipe to turbocharger	18,5 to 21,5	
Coolant connector bolts to turbocharger	28 to 33	Oil
HEGO sensor in turbocharger	20 to 25	"Never Seeze"
Turbocharger flange studs in exhaust manifold	18,5 to 21,5	
Exhaust flange studs in turbocharger	18,5 to 21,5	
Vacuum hose adaptor in compressor housing	18 to 22,5	"Never Seeze"



TECHNICAL DATA (cont'd)

Engine - 83 US

V-Belt Tension

								<u>N</u>
Alternator/water pump	..	..	..	..	..	..	New Used	400 to 500 300
Power steering pump	..	..	..	..	..	..	New Used	450 to 550 350 to 450

NOTE: A V-belt is regarded as used when it has been in use for 10 minutes.
The tension figures are for a cold belt. If no gauge is available,
the V-belt should be tensioned so that the maximum deflection in the
middle of the longest span is 4 mm.

Toothed Belt Tension

Toothed belt (with Special Tool 21-113) 9,5 to 10,5 reading

NOTE: After tensioning, run the engine for 10 minutes.
Let the engine cool for 2 hours and re-check the toothed belt tension.

OilOil for Front Axle Assembly

Fill capacity 1,0 Litres
SAE-90 hypoid oil Ford specification SQM-2C9002-AA

Engine oil Fill capacity (litres) 3,6
Type: Mobil 1 or synthetic oil to API SG/CD

Power steering fluid Fill capacity (litres)
Type: Hydraulic fluid Ford specification SQM-2C9010-A

Sealers

Vent screw in thermostat housing	..	..	..	..	..	..	Not required
Front axle housing cover	..	..	..	..	..	Ford specification	WSK-M2G348-A6
Front bearing caps of camshafts	..	..	..	..	..	Ford specification	Hylosil
Ends of rubber seals of cylinder head covers	..	..	..	..	..	Ford specification	Hylosil
Crankshaft front cover	..	..	..	..	..	Ford specification	Hylosil
Crankshaft rear main bearing cap	..	..	..	..	..	Ford specification	Loctite 518
Sump mating face	..	..	..	..	..	Ford specification	Hylosil
Temperature gauge sender unit	..	..	..	..	..	Ford specification	Loctite 518

Thread Locking Compound

Torx studs in transmission output flange Loctite 270

Lubricants

'Never Seez' anti-seize compound
for spark plug threads

obtainable through:

or

Snap-on Tools Limited
Palmer House
150/154 Cross Street
Sale, Cheshire
M33 1AQ

for local Bostik supplier,
Catalogue No. NSN 165

Catalogue No. NSBT-8N, 227 g

GENERAL DESCRIPTION

Engine - 83 US

The 2,0 litre OHC in-line 4 cylinder engine of the new Sierra Cosworth 4x4 developing 161 kW (220 PS) is essentially based on the OHC in-line engine of the (rear wheel drive) Cosworth developing 149 kW (204 PS).

Two variants of this engine are available.

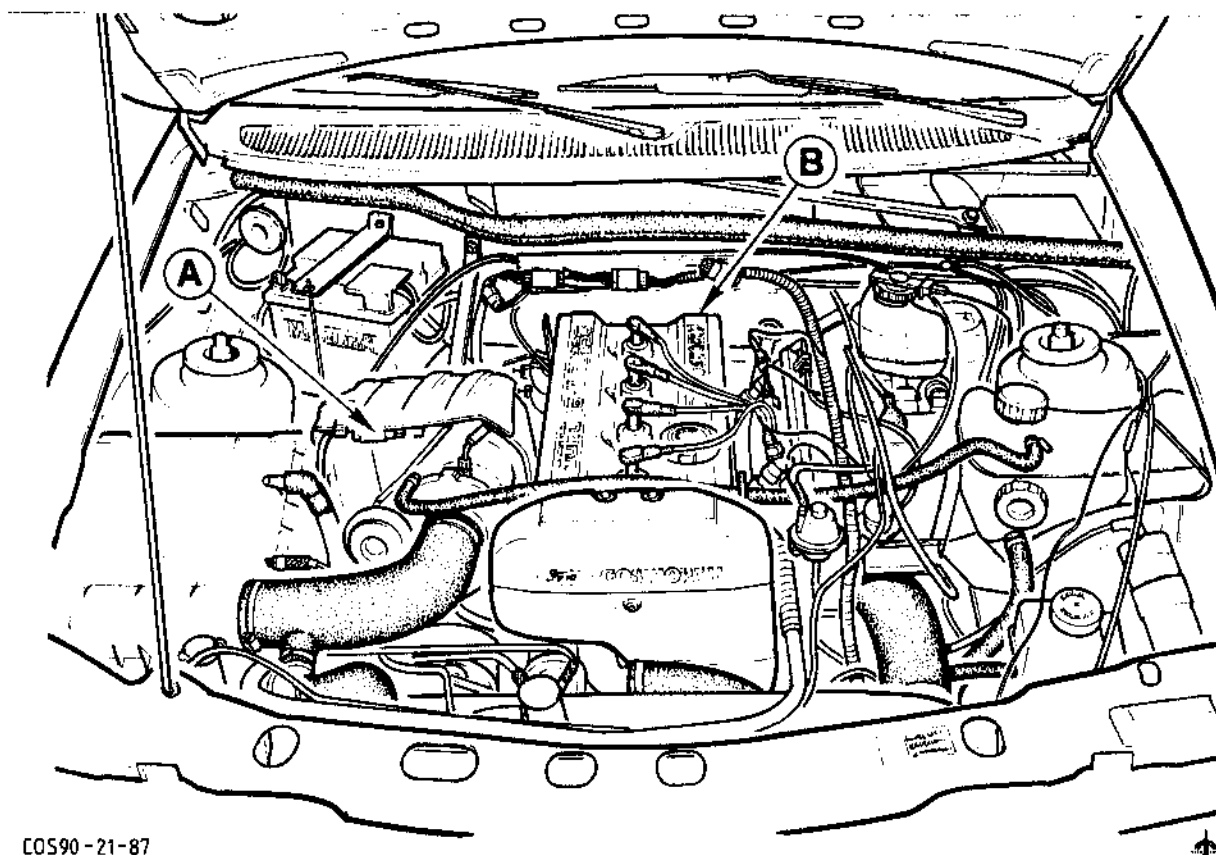
- 2,0 litre OHC engine without catalytic converter - engine code YBJ (emission standard 15.04)
- 2,0 litre OHC engine with regulated 3-way catalytic converter - engine code YBG (83 US emission standard).

In the engine compartment, engines equipped to comply with emission standard 15.04 can be recognised by the red cylinder head cover and engines equipped to comply with the 83 US emission standard can be identified by the green cylinder head cover and the HEGO sensor on the heat shield, Fig.A.

The increase in power of 12 kW (16 PS) compared with the previous model has been achieved with the following technical modifications:

- Modified turbocharger
- Larger intercooler
- Modified pistons
- Platinum spark plugs
- Modified ignition characteristics.

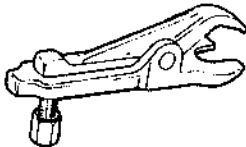
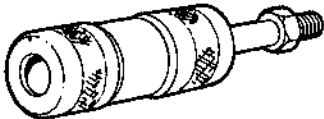
Detailed information about the new engine is to be found in the brochure entitled "SIERRA Cosworth 4x4" in the "Production Training for Technicians" series under number CG7330D 12/89. However, this training document must not be used for repair purposes because only the service microfiche is updated when required.

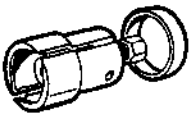
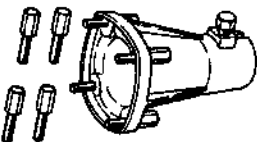
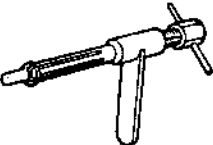
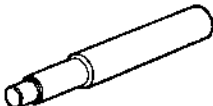
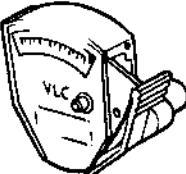


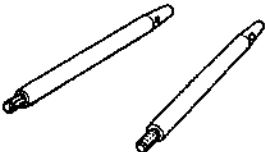
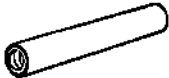
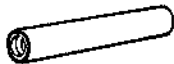
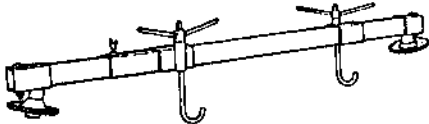
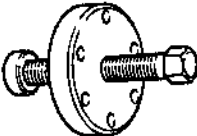
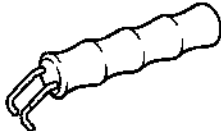
COS90-21-87

Fig.A. Engine compartment of Sierra Cosworth 4x4 equipped to comply with the 83 US emission standard.

A - Multiplug of HEGO sensor
B - Cylinder head cover.

 13-006	Ball joint separator
 15-053	Slide hammer used in conjunction with 21-142
 21-002	Socket wrench for cylinder head bolts
 21-009 B	Radial oil seal installer
 21-011 D	Crankshaft radial oil seal installer
 21-012	Socket wrench for oil pump bolts
 21-023	Universal spindle (used only in conjunction with engine stand)

 21-024	Valve spring compressor
 21-024-06	Adaptor for valve spring compressor
 21-028 A	Crankshaft toothed belt pulley remover
 21-031 B	Engine mounting bracket (used only in conjunction with engine stand and 21-023)
 21-036 A	Pilot bearing extractor
 21-044 A	Pilot bearing installer and clutch disc locator
 21-113	Toothed belt tension test gauge

 21-128	Cylinder head locating studs
 21-129 A	Valve stem oil seal installer (exhaust valves)
 21-130 A	Valve stem oil seal installer (inlet valves)
 21-140	Engine support bar
 21-142	Valve stem oil seal extractor
 21-152	Distributor shaft immobilising tool
 21-153	Crankshaft belt pulley remover
 23-027 A	Fuel pipe disconnecter

PROPREITARY TOOLS

Engine - 83 US

Compressor pressure tester

Compressed air adaptor with spark plug thread ("Hazet 3428")

Rubber sucker ("Hazet 795-2")

Torx sockets (e.g. "Hazet E11"; Stahlwille 50 TX E11")

Angle gauge

Torque wrench

Dial indicator (graduated in mm) with holding fixture (use 15-046 and 15-022 A if available)

Oil filter strap wrench

Piston ring compressor

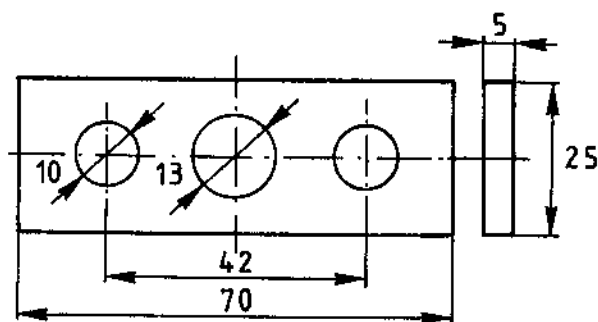
Oil pressure test gauge

Connecting hose between oil pressure test gauge and T-piece

T-piece to measure oil pressure

WORKSHOP FABRICATED TOOLS

Mounting plate for valve spring compressor



COS - 21 - 1



Fig.8. Mounting plate for valve spring compressor.

21 111 0 ENGINE - CHECK COMPRESSION

PROPRIETARY TOOLS REQUIRED:

Compression pressure tester

NOTE: Generally, differences in design of compression tester and fluctuating starter motor speeds only make it possible to check that the compression is the same in all the cylinders. The actual compression pressure depends on a number of factors and can only be measured if certain pre-conditions apply.

The engine should be at normal operating temperature.

To Check

1. Disconnect the low-tension lead from the ignition coil (terminal 15).
2. Disconnect the multiplugs from the injectors, Fig.1.
3. Disconnect the HT leads and remove the spark plugs.
4. Load the tester with a sheet of graph paper. Press the rubber seal of the tester firmly into the spark plug bore of cylinder No.1, Fig.2. With the throttle fully opened, crank the engine on the starter motor until the pointer on the tester stops rising.
5. Vent the tester, set the sheet of graph paper for the next cylinder and repeat the process as described in sub-operation 4 for the remaining cylinders.
6. Screw in the spark plugs and tighten them to the specified torque (see Technical Data). Connect the HT leads in the correct sequence (the leads are marked).
7. Connect the multiplugs to the injectors.
8. Connect the low-tension lead to the injection coil.

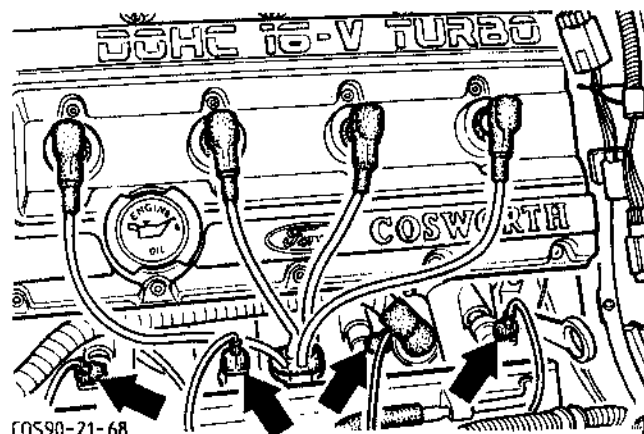


Fig.1. Multiplugs of injectors.

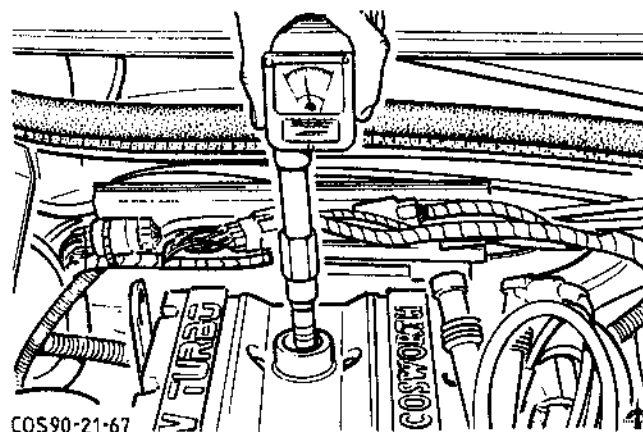


Fig.2. Compression pressure tester.

21 112 0 OIL PRESSURE - CHECK

PROPRIETARY TOOLS REQUIRED:

Oil pressure test gauge
Connecting hose - between oil pressure test gauge and T-piece
T-piece - to measure oil pressure

NOTE: The oil pressure level depends on a variety of factors (engine speeds, oil temperature, oil pump rotor clearance, etc.). The measurement should always be carried out with the oil at a temperature of 80°C. The oil pressure should be 1,8 bars at idle speed and 2,4 bars at 2000 rpm. However, the maximum pressure should not exceed 5 bars at engine speeds in excess of 2000 rpm.

To Check

1. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.1 (B).
2. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.1 (A, C, D).

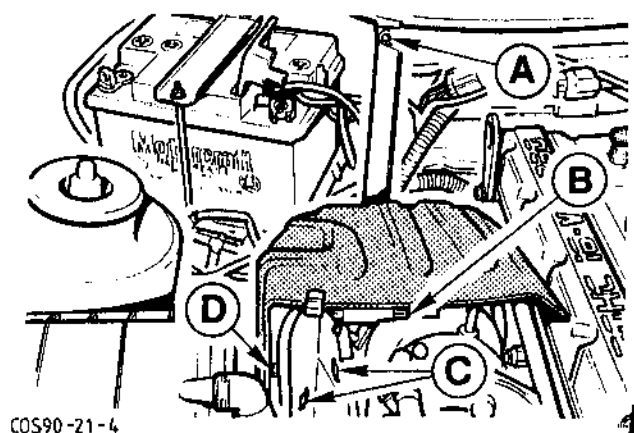


Fig.1. Turbocharger heat shield.

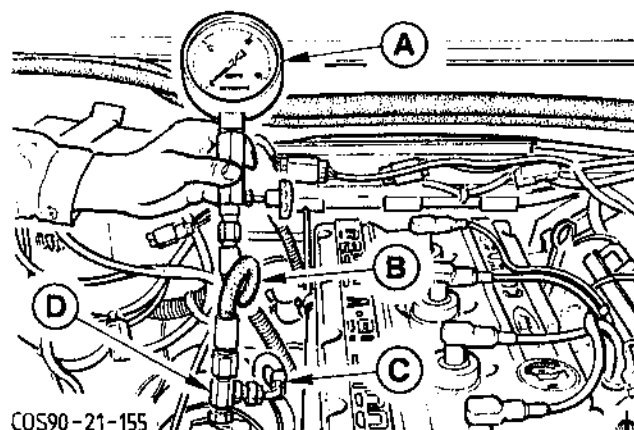


Fig.2. Proprietary tools.

3. Unscrew the oil feed pipe from the turbocharger, Fig.2 (C).
4. Screw the T-piece into the turbocharger. Screw the connecting hose to the oil pressure test gauge. Connect the connecting hose with the oil pressure test gauge and the oil feed pipe to the T-piece, Fig.2.

5. Start the engine, measure the oil pressure at idle speed and at more than 2000 rpm.
6. Remove the proprietary equipment.
7. Connect the oil feed pipe to the turbocharger.
8. Fit the turbocharger heat shield in position and push it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.3 (A, C, D).

Fig.3. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut

9. Connect the multiplug of the HEGO sensor and clip it to the heat shield, Fig.3 (B).

If the pressure is not to specification, first check the oil pump and pressure relief valve as a possible source of the fault. The following typical faults can occur:

Pressure too high at engine speeds over 2000 rpm:

Pressure relief at valve failing to open due to dirt.

Pressure too low over entire engine speed range:

Intake strainer dirty, intake pipe loose or cracked, oil pump worn, etc.

Pressure too low in lower engine speed range:

Pressure relief valve sticking open due to dirt.

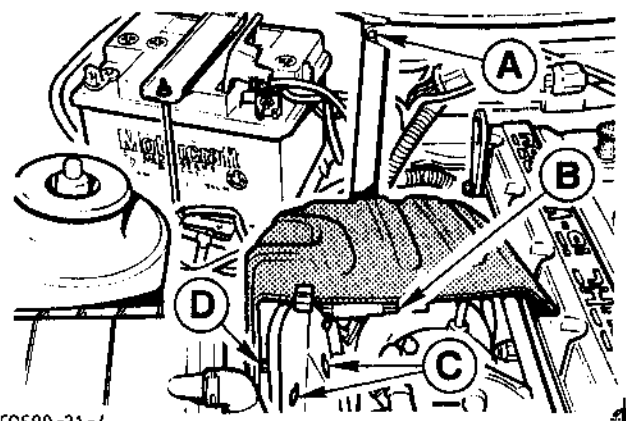


Fig.3. Turbocharger heat shield.

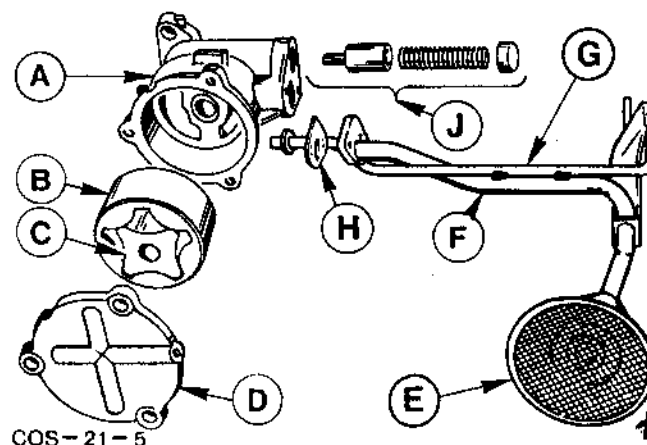


Fig.4. Oil pump - exploded view (Cosworth '86/'88 oil pump shown).

- A - Housing
- B - Outer rotor
- C - Inner rotor
- D - Cover
- E - Oil intake strainer
- F - Intake pipe
- G - Splash lubricating pipe
- H - Gasket
- J - Pressure relief valve

21 132 0 ENGINE AND TRANSMISSION ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator	13-006
Engine support bar.. .. .	21-140
Fuel pipe disconnecter	23-027 A

To Remove

NOTE: Remove the engine and transmission assembly from below. Cut the cable ties securing wiring and vacuum lines/hoses as necessary during removal.

1. Disconnect the earth cable and the starter motor positive cable from the battery. Unscrew the earth cable from the battery tray, Fig.1.
2. Pull the knob vertically upwards off the gear lever, Fig.2 (A). Prise off the cover plate. Unclip the electric window switches and disconnect the two multiplugs from the electric window switches, Fig.2 (B, E).

Fig.2. Gear lever with gaiter retaining frame.

- A - Gear lever knob
- B - Cover plate
- C - Retaining frame
- D - Screw securing retaining frame
- E - Multiplugs of electric window switches

3. Remove the retaining frame from the console (1 screw), Fig.2 (C, D).

4. Pull up the outer gear lever gaiter inside out, cut the cable tie and pull off the gaiter, Fig.3 (A, B).

Fig.3. Gaiters and retaining frame of noise damping pad.

- A - Outer gaiter
- B - Cable tie
- C - Inner gaiter
- D - Retaining frame of noise damping pad
- E - Retaining screws
- F - Noise damping pad

5. Pull off the inner gear lever gaiter, Fig.3 (C).

6. Remove the retaining frame of the noise damping pad with the damping pad (4 screws), Fig.3 (D, E, F). Support the clutch pedal.

7. Undo the front wheel bolts.

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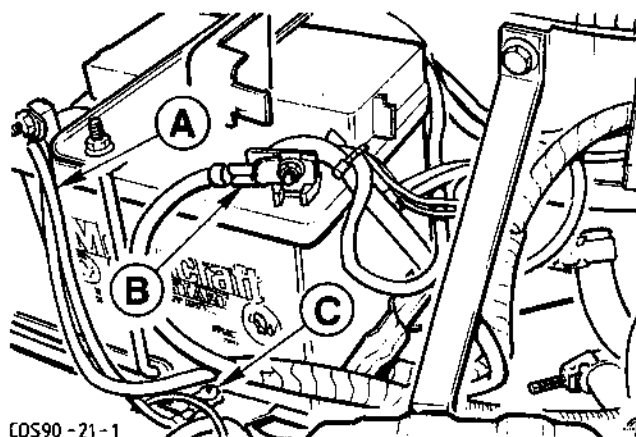


Fig.1. Battery cables.

- A - Earth cable
- B - Starter motor positive cable
- C - Earth cable to battery tray

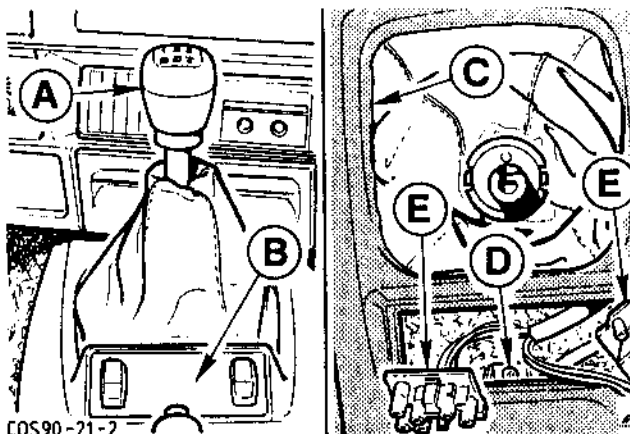


Fig.2. Gear lever with gaiter retaining frame.

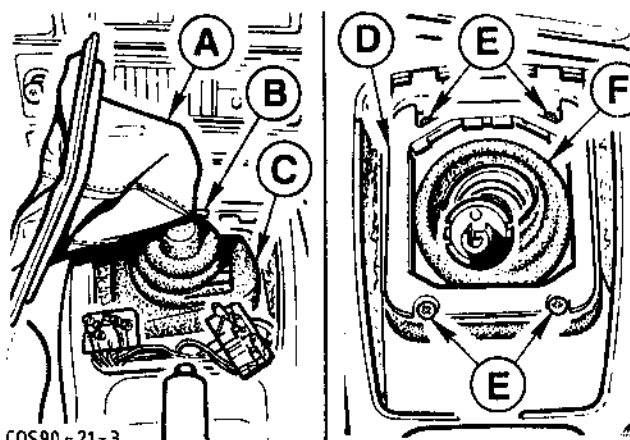
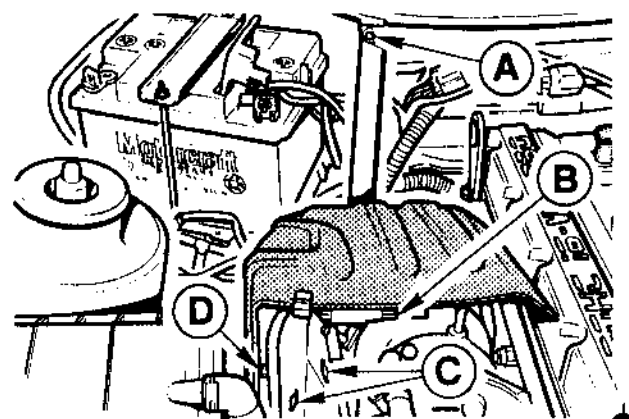


Fig.3. Gaiters and retaining frame of sound damping pad.

8. Unclip the HEGO sensor multiplug from the turbocharger heat shield and disconnect it, Fig.4 (B).
9. Unscrew the turbocharger heat shield and bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.4 (A, C, D).

Fig.4. Turbocharger heat shield.

- A - Retaining bolt
- B - HEGO sensor multiplug
- C - Heat shield clips
- D - Retaining nut

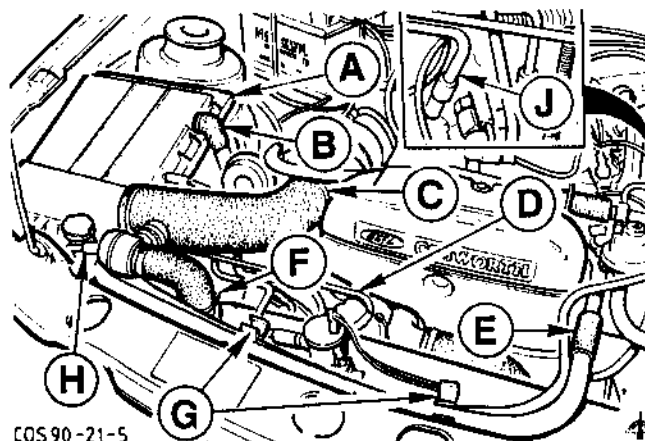


COS90-21-4

Fig.4. Turbocharger heat shield.

10. Remove the air cleaner cover with the air hoses, Fig.5:

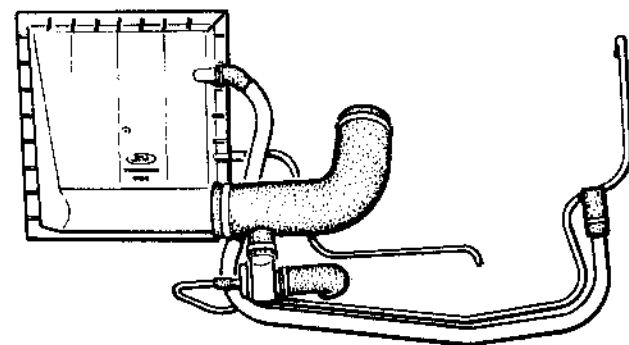
- Disconnect the air pipe to the engine breather valve at the connecting hose and unclip it from the upper crossmember. Disconnect the air pipe from the air cleaner cover at the solenoid control valve.
- Disconnect the air intake hose from the turbocharger.
- Disconnect the air hose from the by-pass valve at the intercooler.
- Disconnect the vacuum pipe from the by-pass valve at the inlet manifold air chamber and unclip it from the upper crossmember.
- Unclip the air cleaner cover (5 clips) and remove it with the air hoses/pipes.
- Remove the air cleaner element from the air cleaner casing.



COS90-21-5

Fig.5. Air cleaner cover with air hoses/pipes.

- A - Air cleaner cover
- B - To engine breather valve
- C - To turbocharger
- D - From solenoid control valve
- E - Connecting hose from engine breather valve air pipe
- F - By-pass valve to intercooler
- G - Clips
- H - Vacuum pipe from by-pass valve to inlet manifold air chamber
- J - Connection of vacuum pipe from by-pass valve



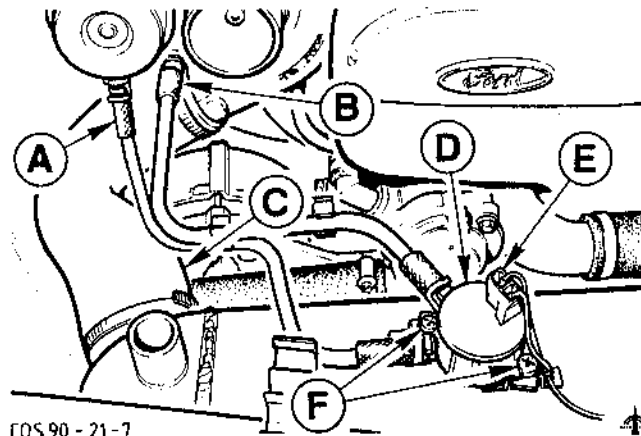
COS90-21-6

Fig.6. Air cleaner cover and air hoses/pipes removed.

11. Remove the solenoid control valve from the intercooler:
 - Disconnect the vacuum pipe of the solenoid control valve from the turbocharger diaphragm unit, Fig.7 (A), and from the turbocharger compressor casing, Fig.7 (B).
 - Disconnect the multiplug of the solenoid control valve, Fig.7 (E).
 - Unscrew the solenoid control valve (2 screws), Fig.7 (D, F), and remove it with the vacuum pipes.

Fig.7. Solenoid control valve and lower air hose to turbocharger.

- A - Vacuum pipe to diaphragm unit
- B - Vacuum pipe to compressor casing
- C - Lower air hose to turbocharger
- D - Solenoid control valve
- E - Multiplug
- F - Retaining screws



COS 90 - 21 - 7

Fig.7. Solenoid control valve and lower air hose to turbocharger.

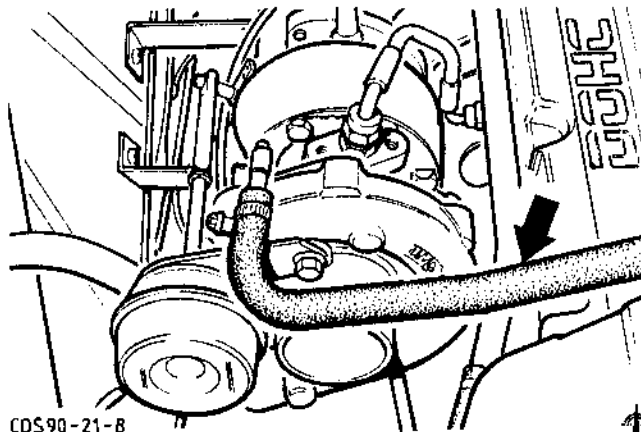
12. Disconnect the lower air hose from the turbocharger and from the intercooler, Fig.7 (C).

13. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.8, withdraw it from the engine lifting eye and place it to one side.

14. Unclip the throttle cable from the throttle linkage (1 clip). Compress two of the sprung tabs of the retaining clip using pliers and disconnect the throttle cable from the bracket, Fig.9.

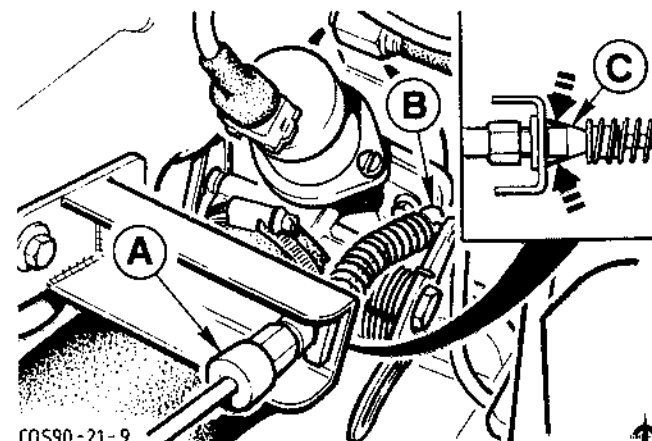
Fig.9. Disconnect throttle cable.

- A - Throttle cable
- B - Throttle linkage clip
- C - Retaining clip



COS 90 - 21 - 8

Fig.8. Coolant hose to overflow tank.



COS 90 - 21 - 9

Fig.9. Disconnect throttle cable.

15. Disconnect the air hose from the intercooler to the throttle housing, Fig.10.

16. Raise the vehicle.

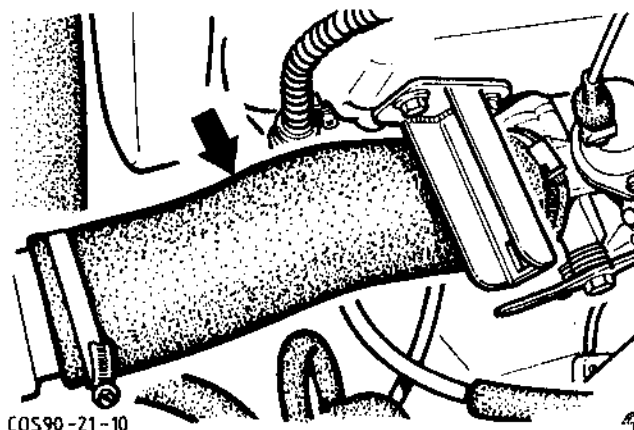


Fig.10. Air hose from intercooler to throttle housing.

17. Detach the lower engine cover from the side members and the front axle/engine crossmember on the right and left-hand sides (6 bolts), Fig.11. Remove cover.

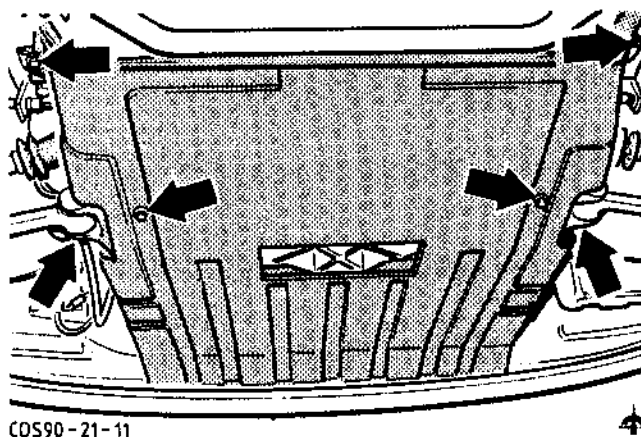


Fig.11. Retaining bolts of lower engine cover.

18. Place a clean collecting tray under the radiator. Disconnect the lower right-hand coolant hose from the radiator, Fig.12, and drain the coolant.

19. Lower the vehicle to the ground.

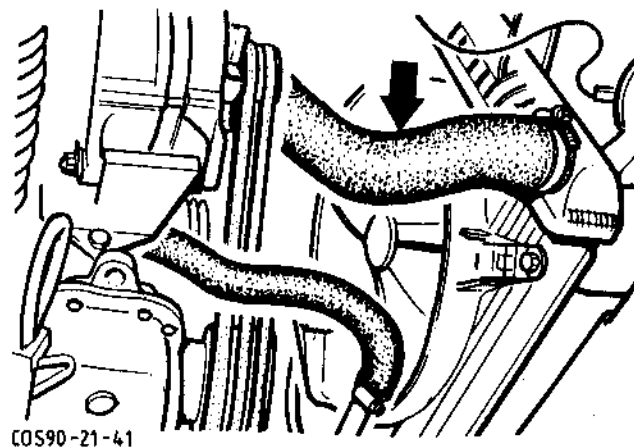


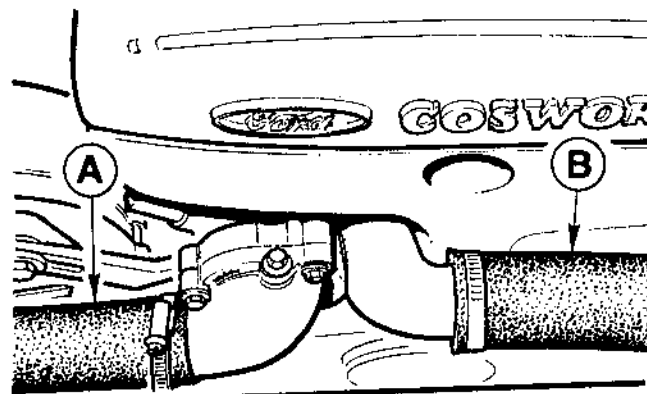
Fig.12. Lower coolant hose on radiator.

21 132 0

Engine - 83 US

20. Disconnect the coolant hoses from the thermostat housing and remove the coolant hose running to the lower right-hand connection on the radiator, Fig.13.

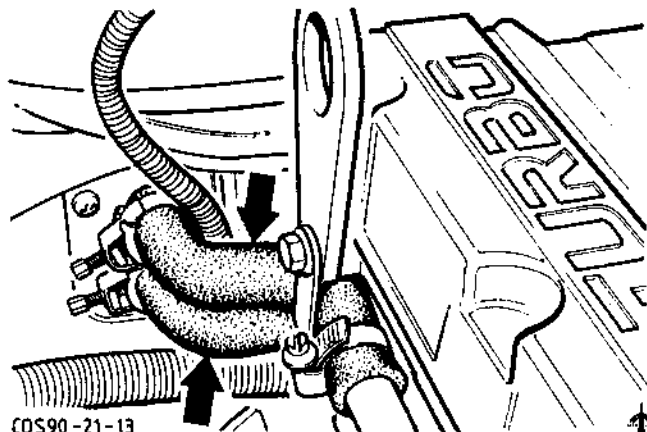
Fig.13. Coolant hoses on thermostat housing.
A - To lower right-hand connection on radiator
B - To upper left-hand connection on radiator



COS90-21-12

Fig.13. Coolant hoses on thermostat housing.

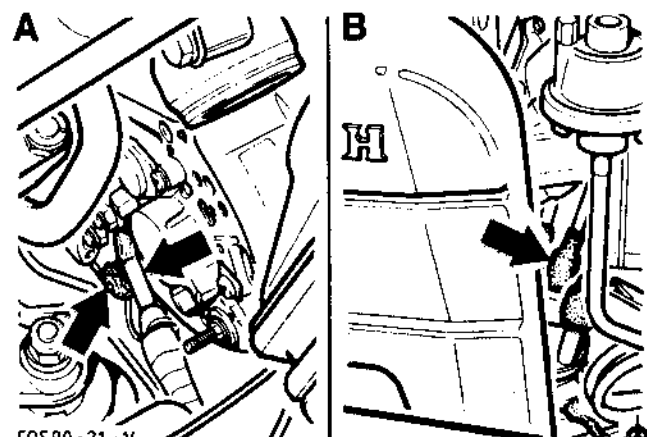
21. Disconnect the 2 coolant hoses from the heater radiator, Fig.14.



COS90-21-13

Fig.14. Coolant hoses to heater radiator.

22. Disconnect/unscrew the connector and wiring from the alternator, Fig.15 (A).



COS90-21-14

Fig.15. A - Electrical connections of alternator
B - Lead between distributor and ignition coil

23. Disconnect the high tension lead running from the ignition coil to the distributor, Fig.15 (B).

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21 132 0

Engine - 83 US

24. Disconnect the 3 engine wiring loom multiplugs and the multiplug of the reversing light switch, Fig.16.

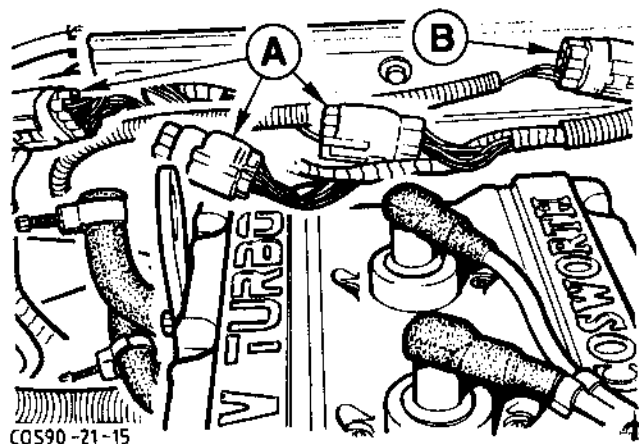


Fig.16. Multiplugs.

A - Engine wiring loom
B - Reversing light switch

25. Disconnect the fuel pipes:

- Insert the steel wire ends of Special Tool 23-027 A in the openings in the connector and press them in, pulling on the other part of the fuel feed pipe, Fig.17, and disconnect it.
- Disconnect the fuel return pipe, Fig.18, as described in sub-operation 25.

Fig.17. Fuel feed pipe.

A - Disconnect using Special Tool 23-027 A
B - Special Tool inserted (fuel pipes shown disconnected)

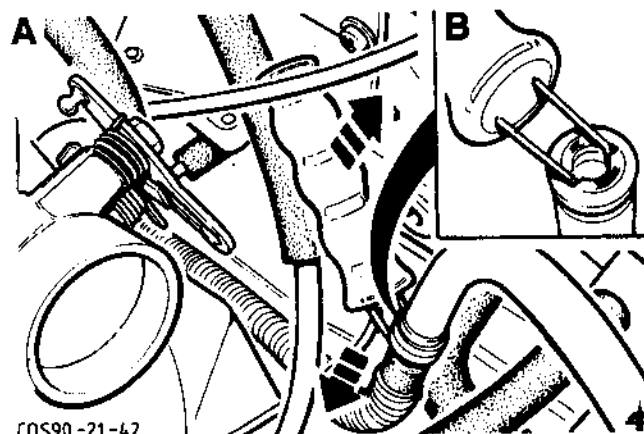


Fig.17. Fuel feed pipe.

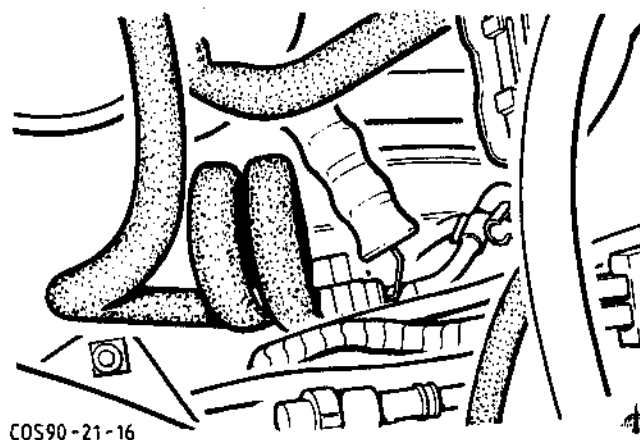
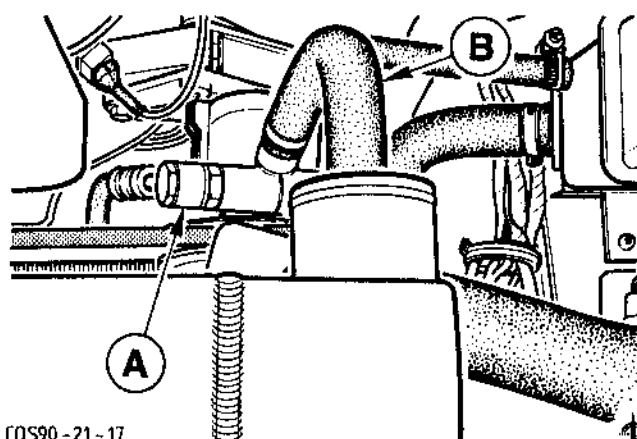


Fig.18. Disconnect fuel return pipe using Special Tool 23-027 A.

26. Disconnect the oil feed hose from the reservoir and the high pressure pipe to the steering box from the power steering pump (1 banjo bolt, 1 clip), Fig.19 (A, B).

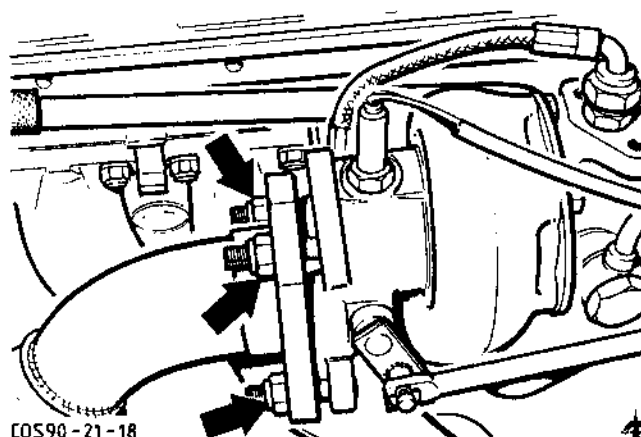


COS90-21-17

Fig.19. Power steering pump.

A - High-pressure pipe to steering box
B - Oil feed hose from reservoir

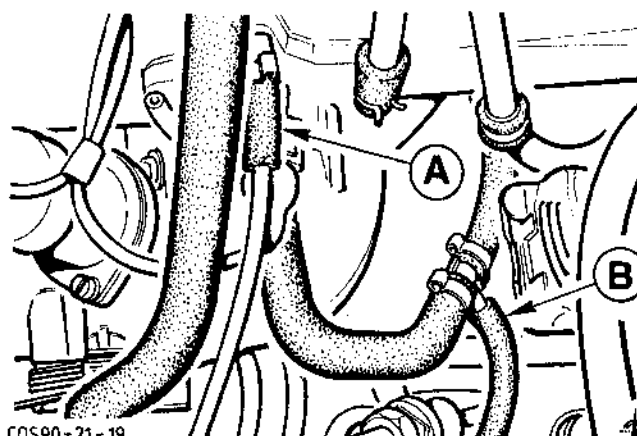
27. Unscrew the front exhaust pipe from the turbocharger (3 nuts), Fig.20.



COS90-21-18

Fig.20. Nuts securing front exhaust pipe to turbocharger.

28. Disconnect the vacuum hose to the MAP sensor from the air chamber and the carbon canister vacuum hose from the T-piece, Fig.21.



COS90-21-19

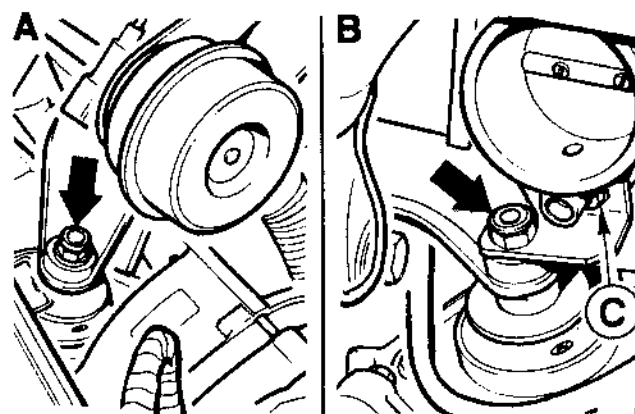
Fig.21. Vacuum hoses.

A - To MAP sensor
B - To carbon canister

29. Unscrew and remove the nut on the right-hand engine mounting. Unscrew the self-locking nut on the vibration damper on the throttle housing and unscrew and remove the nut on the left-hand engine mounting, Fig.22.

Fig.22. Nuts of engine mountings.

- A - Right
- B - Left
- C - Self-locking nut on vibration damper on throttle housing



COS90-21-20

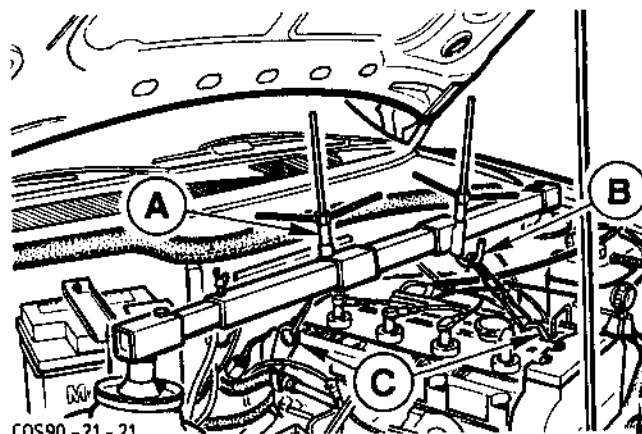
Fig.22. Nuts of engine mountings.

30. Remove the dust caps from the shock-absorber top mountings and fit engine support bar 21-140. Slacken the engine lifting eye bolts, angle the engine lifting eyes towards the engine support bar and tighten the bolts again. Attach the 2 chains to the spindles of the engine support bar and the engine lifting eyes, Fig.23. Turn the spindles on the engine support bar to take up the slack.

NOTE: Position the left-hand spindle of the engine support bar at the front and the right-hand spindle at the rear.

Fig.23. Engine support bar 21-140 in place.

- A - Right-hand spindle at rear
- B - Left-hand spindle at front
- C - Engine lifting eyes angled obliquely



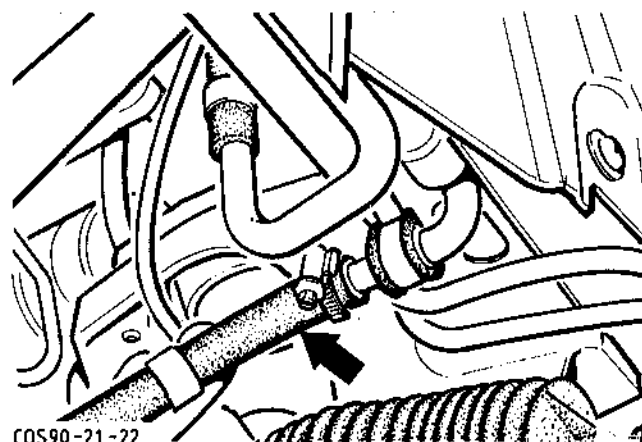
COS90-21-21

Fig.23. Engine support bar 21-140 in place.

31. Raise the vehicle.

32. Remove the front wheels.

33. Disconnect the oil hose from the power steering pump cooling circuit, Fig.24.



COS90-21-22

Fig.24. Hose to power steering pump cooling circuit.

34. Disconnect the lower hose from the water pump, Fig.25.

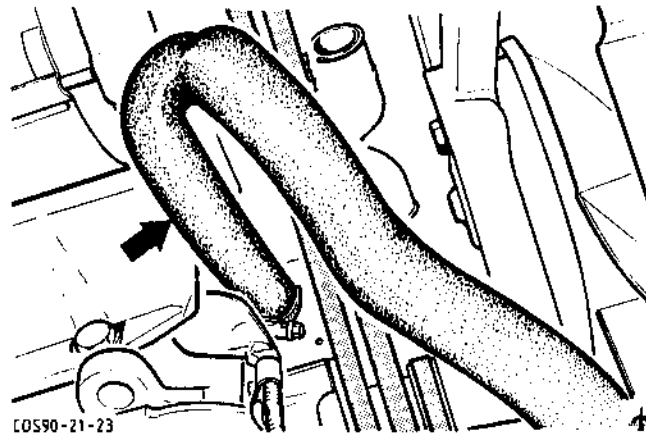


Fig.25. Lower hose to water pump.

35. Disconnect the track rod from the steering arm on both sides. Withdraw the split pin and unscrew the castellated nut on the track rod end. Press the track rod end out of the spindle carrier using Special Tool 13-006, Fig.26 (A, B, C). Remove the castellated nut and separate the track rod end from the spindle carrier.

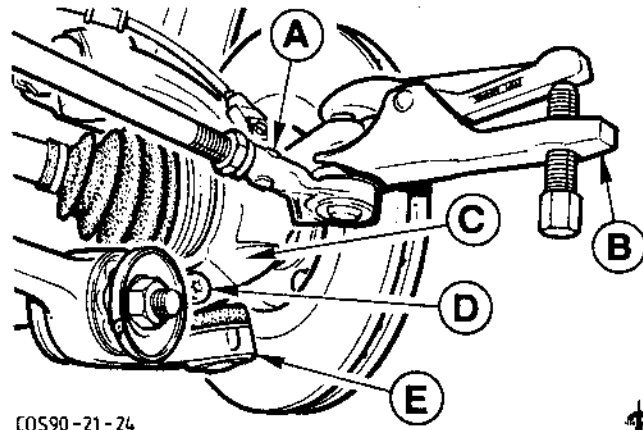


Fig.26. Front suspension (Left-hand side shown).

Fig.26. Front suspension.

- A - Track rod
- B - Special Tool 13-006
- C - Spindle carrier
- D - Lower suspension arm retaining bolt
- E - Lower suspension arm (Left-hand side shown)

36. Unscrew the Torx bolt and nut on both sides and lever the lower suspension arm downwards away from the spindle carrier, Fig.26 (C, D, E).

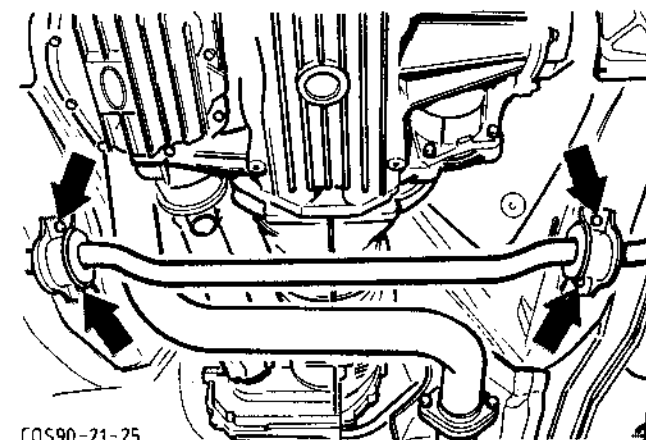


Fig.27. Retaining bolts of stabilizer bar brackets.

37. Unscrew the stabiliser bar brackets from the side members on the right and left-hand sides (4 bolts), Fig.27.

38. Disconnect the intermediate steering shaft from the steering shaft (1 pinch bolt), Fig.28.

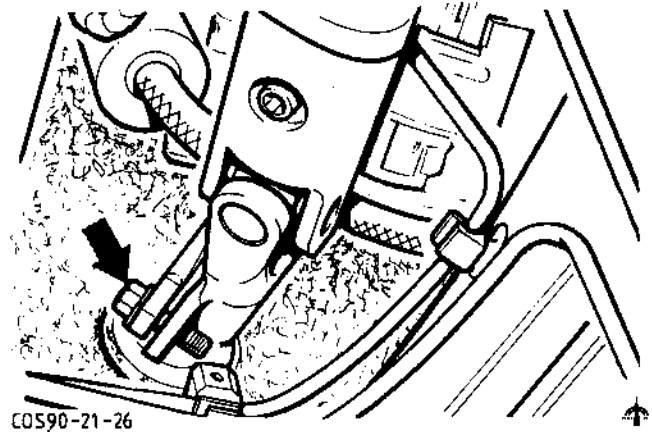


Fig.28. Bolt securing intermediate steering shaft.

39. Place a collecting tray under the front axle assembly, remove the housing cover (8 bolts), Fig.29, and drain off the oil.

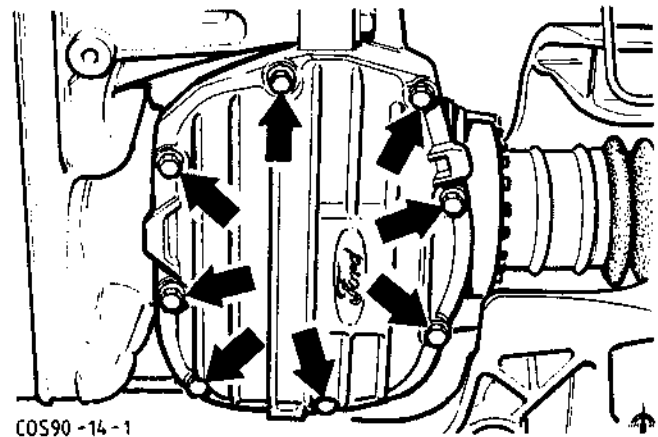


Fig.29. Bolts securing cover of front axle housing.

40. Remove the circlip securing the sideshaft in the front axle assembly, Fig.30.

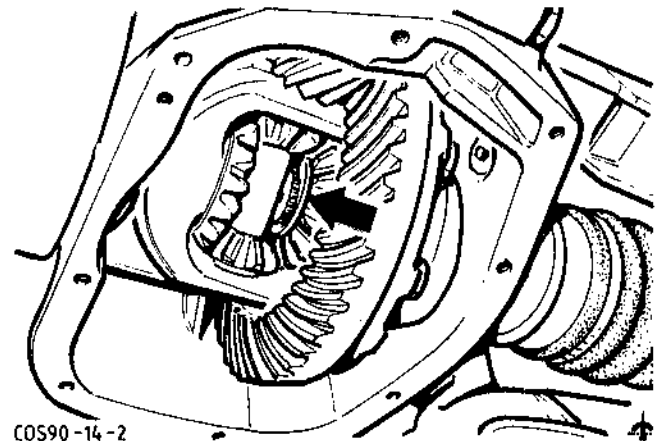


Fig.30. Circlip securing front axle shaft in front axle assembly.

41. Disconnect the brake pipes from the brackets on the left and right-hand sides (2 U-shaped retainers), Fig.31 (A, D).

Fig.31. U-shaped brake pipe retainers and half shafts.

- A - U-shaped retainer on right-hand side
- B - Sideshaft on right-hand side
- C - Sideshaft on left-hand side
- D - U-shaped retainer on left-hand side

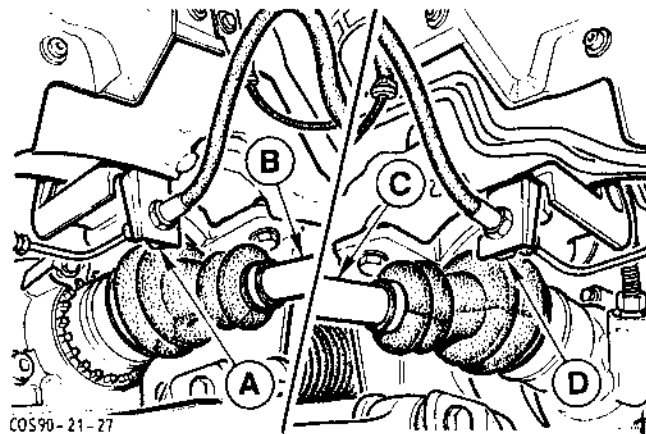


Fig.31. U-shaped brake pipe retainers and half shafts.

42. Pull the drive joint out of the front axle assembly (on the right-hand side) and out of the intermediate shaft (on the left-hand side), Fig.31 (B, C).

43. Suspend the right and left-hand sideshafts with wire, Fig.32.

NOTE: The inner drive joints must not be bent at more than 20° and the outer drive joints must not be bent at more than 45°.

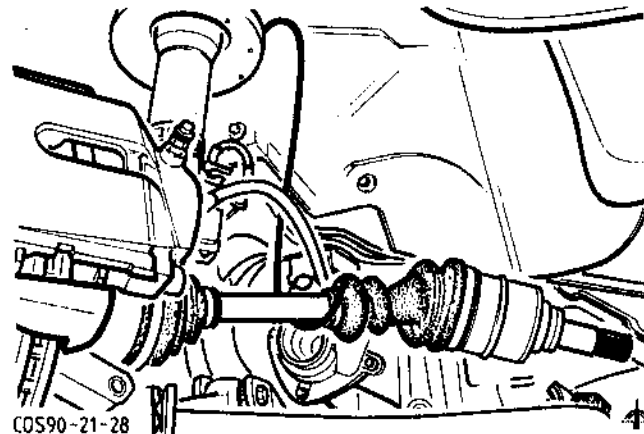


Fig.32. Sideshaft suspended (Left-hand side shown).

44. Pull the connector off the terminal on the starter motor, Fig.33 (A).

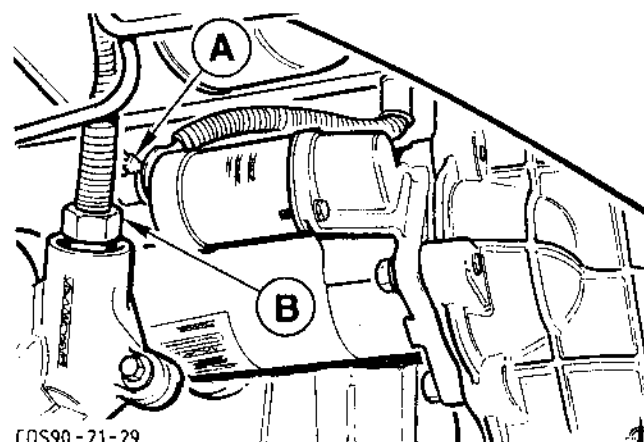


Fig.33. A - Connector on starter motor
B - Speedometer drive cable

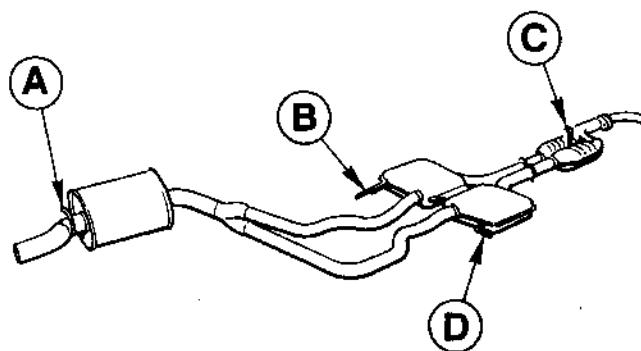
45. Unscrew the speedometer drive cable union nut from the intermediate shaft housing cover and withdraw the speedometer drive cable, Fig.33 (B).

46. Remove the exhaust system complete, Fig.34:

- Unscrew the middle left-hand exhaust mounting bracket from the rear axle crossmember (2 bolts).
- Release the exhaust system from the front, middle right and rear mountings and remove it.

Fig.34. Exhaust system mountings.

- A - Rear
B - Middle left (bolts)
C - Front
D - Middle right
(Exhaust system removed for clarity)

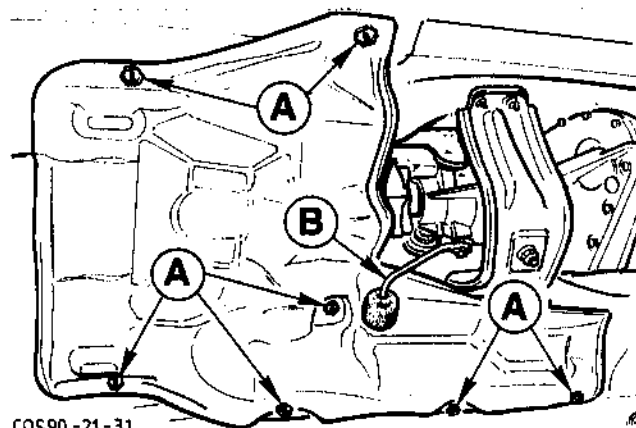


COS90-21-30

Fig.34. Exhaust mountings (exhaust system removed for clarity).

47. Unscrew the exhaust mounting bracket from the transfer box (1 bolt), Fig.35 (B).

48. Release the exhaust system heat shield from the floor assembly (7 clips), Fig.35 (A).



COS90-21-31

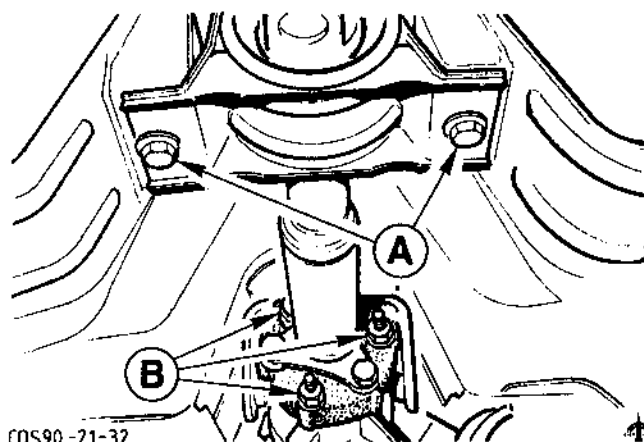
Fig.35. A - Heat shield clips
B - Exhaust mounting bracket

49. Unscrew the 3 nuts securing the driveshaft to the Torx studs on the output flange, Fig.36 (B), holding the Torx studs with a Torx wrench (see PROPRIETARY TOOLS).

Unscrew the 2 centre bearing retaining bolts and remove them with the U-shaped washers, Fig.36 (A).

Unscrew the 4 retaining bolts from the rear axle drive flange.

Remove the driveshaft complete.

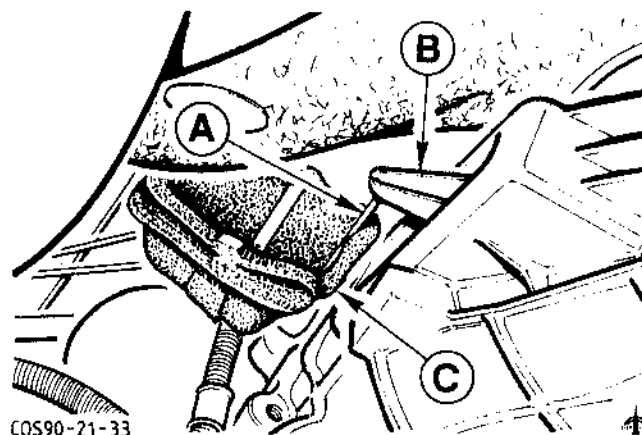


COS90-21-32

Fig.36. Driveshaft fixture.
A - Centre bearing bolts
B - Output flange nuts

50. Pull off the rubber gaiter over the clutch cable and disconnect the clutch cable from the clutch release lever, Fig.37.

51. Support the front axle/engine crossmember on a jack and disconnect it from the side members together with the brake pipe brackets (4 bolts). Remove the front axle/engine crossmember with the steering gear, lower suspension arms and stabiliser bar, Fig.38.

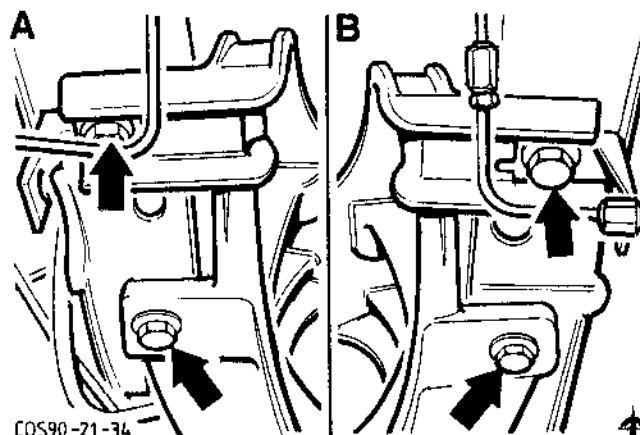


COS90-21-33

Fig.37. A - Clutch cable
B - Clutch release lever
C - Rubber gaiter

52. Support the transmission on a jack. Unscrew and remove the transmission mounting retaining nut and 2 diagonally opposed transmission crossmember retaining nuts from the floor assembly. Only slacken the remaining 2 transmission crossmember retaining nuts so that the nuts are still fully engaged on the threads on the studs, Fig.39.

53. Position a trolley under the engine and transmission assembly. Lower the vehicle until the engine and transmission assembly is resting on the trolley. Support the engine and transmission assembly on the trolley with blocks.

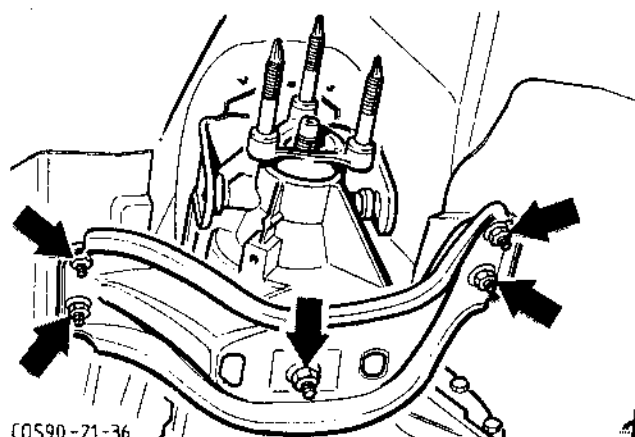


COS90-21-34

Fig.38. Retaining bolts of front axle/engine crossmember.
A - Left-hand side
B - Right-hand side

54. Unscrew the 2 transmission crossmember retaining nuts and separate the transmission crossmember from the floor assembly, Fig.39.

55. Disconnect the engine support bar from the engine lifting eyes and carefully raise the vehicle. Move the engine and transmission assembly out from under the vehicle.



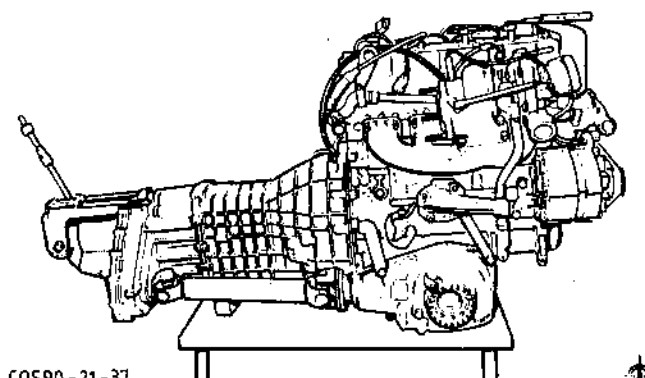
COS90-21-36

Fig.39. Transmission crossmember retaining nuts.

To Install

NOTE: When installing, tighten the nuts, bolts and hose/pipe unions as specified in Technical Data. Relay the wiring and vacuum pipes/hoses and secure them with cable ties.

56. Position the engine and transmission assembly under the vehicle on the trolley. Carefully lower the vehicle and attach the engine support bar to the engine lifting eyes.



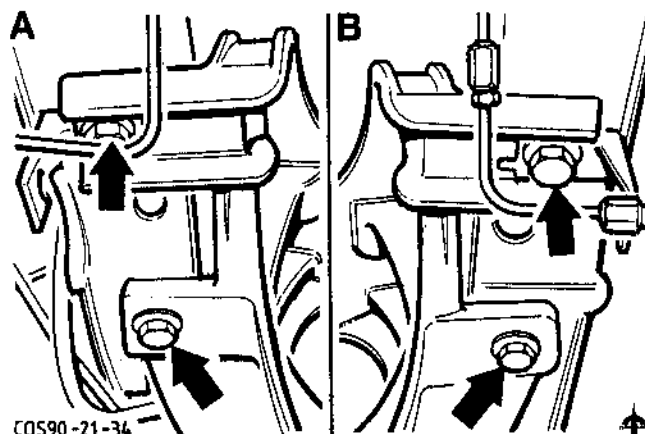
COS90-21-37

Fig.40. Engine and transmission assembly removed on trolley.

57. Fit the transmission crossmember to the floor assembly. Fit the transmission crossmember retaining nuts and tighten finger tight.

58. Raise the vehicle.

59. Locate the front axle/engine crossmember in the correct position with the aid of the jack. Guide the engine mounting studs into the engine mountings on the right and left-hand sides. Fit the engine mounting nuts and do them up finger tight. Bolt the front axle/engine crossmember to the side members, Fig.41. Remove the jack.



COS90-21-34

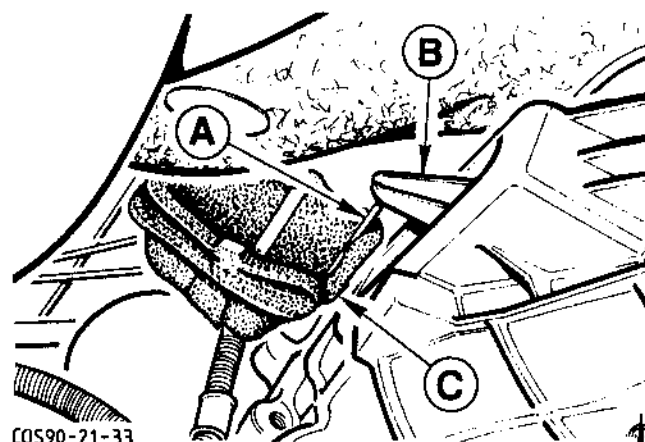
Fig.41. Retaining bolts of front axle/engine crossmember.

A - Left-hand side
B - Right-hand side

NOTE: Guide the throttle housing support bracket over the engine mounting stud.

60. Tighten the retaining nuts of the transmission crossmember and the transmission mounting.

61. Connect the clutch cable to the clutch release lever and refit the rubber gaiter over the clutch cable, Fig.42.



COS90-21-33

Fig.42. A - Clutch cable
B - Clutch release lever
C - Rubber gaiter

62. Assemble the driveshaft to the rear axle if separated.

NOTE: When assembling, guide the master spline into the double groove, Fig.43.

63. Before connecting the rubber coupling on the driveshaft to the output flange on the transmission, check that the Torx studs are seated securely in the transmission output flange by placing a torque wrench with a Torx socket (see PROPRIETARY TOOLS) on the Torx head and applying the specified torque in the tightening direction. Remove any studs which turn and refit them as described below.

- Clean the threaded drillings in the transmission output flange, Fig.44 (C), and the threads of the studs, Fig.44 (A), to remove all traces of grease and dirt.

Fig.44. Transmission output flange with Torx studs.

- A - Torx stud
B - Thread-locking compound
C - Threaded drilling

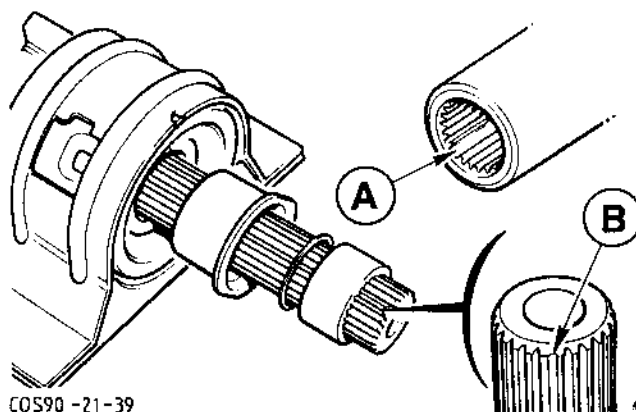
- Apply 2 drops of thread-locking compound (see Technical Data) offset at 180° on the flange-end thread of the stud, Fig.44 (B).
- Insert the stud and tighten it to the specified torque.

NOTE: The stud must be tightened completely within a maximum of 5 minutes of applying the thread-locking compound.

- Let the thread-locking compound harden for 30 minutes.

64. Locate the driveshaft in position.

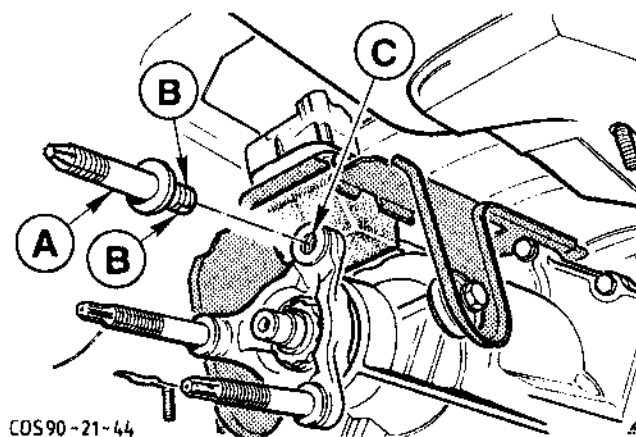
Connect the driveshaft to the transmission output flange using new nuts. Connect the driveshaft to the rear axle and fit the driveshaft centre bearing to the floor assembly, Fig.45.



COS90-21-39

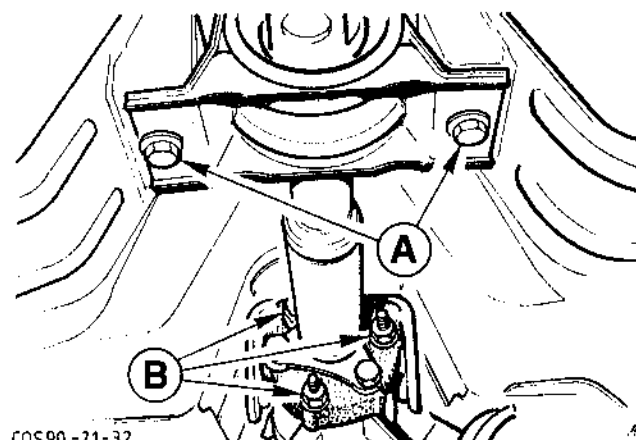
Fig.43. Driveshaft to rear axle separated.

- A - Double groove
B - Master spline



COS90-21-44

Fig.44. Transmission output flange with studs.



COS90-21-32

Fig.45. Driveshaft fixture.

- A - Centre bearing bolts
B - Output flange nuts

65. Fit the exhaust system heat shield to the floor assembly, Fig.46 (A).

66. Fit the exhaust mounting bracket to the transfer box, Fig.46 (B).

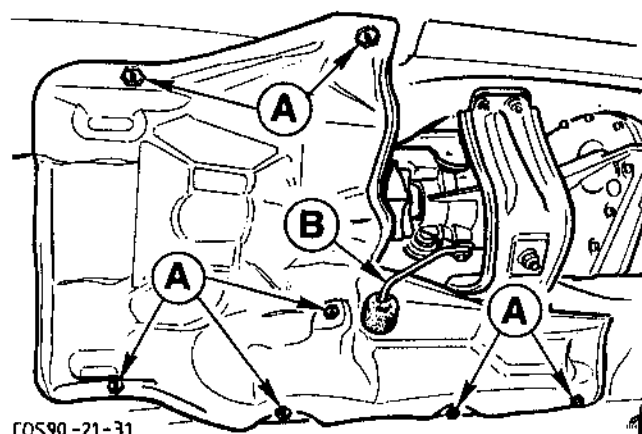


Fig.46. A - Heat shield clips
B - Exhaust mounting bracket

67. Fit the exhaust system complete, Fig.4:

- Attach the exhaust system to the rear, middle right and front mountings.
- Secure the middle exhaust mounting bracket on the left-hand side to the rear axle crossmember and suspend the exhaust system from the middle exhaust mounting bracket on the left-hand side.

Fig.47. Exhaust system mountings.

- A - Rear
- B - Middle left
- C - Front
- D - Middle right
- (Exhaust system removed for clarity)

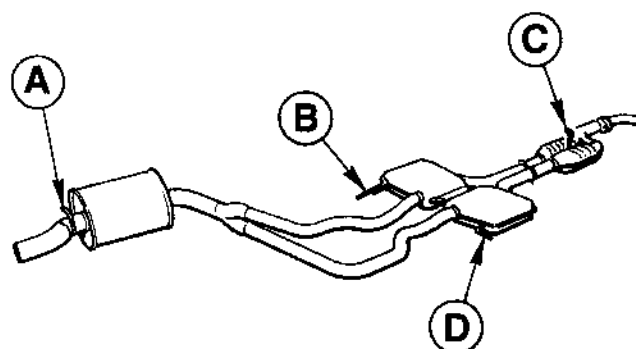


Fig.47. Exhaust system mountings
(Exhaust system removed for clarity).

68. Connect the plug to the starter motor terminal, Fig.48 (A).

69. Insert the speedometer drive cable in the intermediate shaft housing cover and fit and tighten the speedometer drive cable union nut, Fig.48 (B).

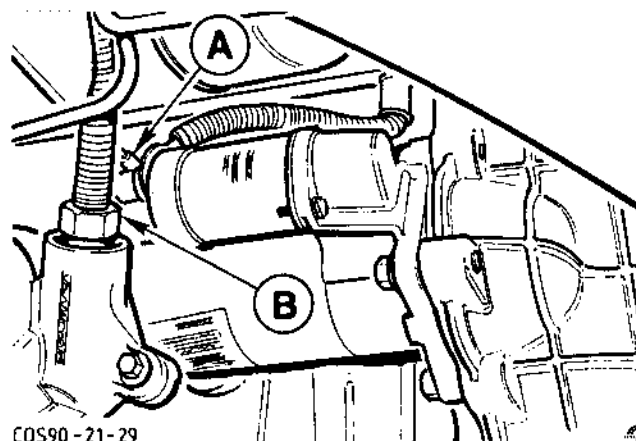


Fig.48. A - Connector on starter motor
B - Speedometer drive cable

21 132 0

Engine - 83 US

70. Insert the drive joint in the intermediate shaft (on the left-hand side) using a new circlip, Fig.49 (C).

Fig.49. U-shaped brake pipe retainer and side shaft.

- A - U-shaped retainer, right
- B - Sideshaft, right
- C - Sideshaft, left
- D - U-shaped retainer, left

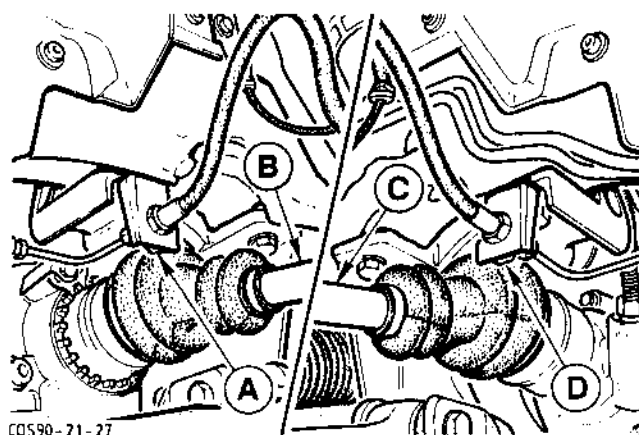


Fig.49. U-shaped brake pipe retainer and side-shaft.

71. Insert the sideshaft drive joint in the front axle assembly (right-hand side), Fig.49 (B), and secure it using a new circlip, Fig.50.

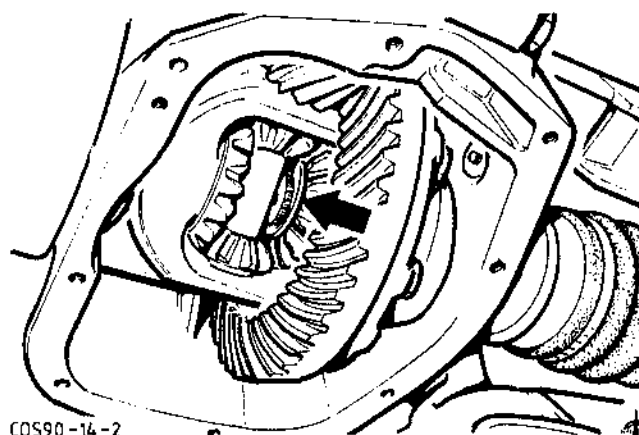


Fig.50. Circlip securing sideshaft in front axle assembly.

72. Fit the cover to the front axle housing using the appropriate sealer (see Technical Data for specification), Fig.51.

73. Fit the brake pipes to the brackets on the left and right-hand sides and secure them with the U-shaped retainers, Fig.49 (A, D).

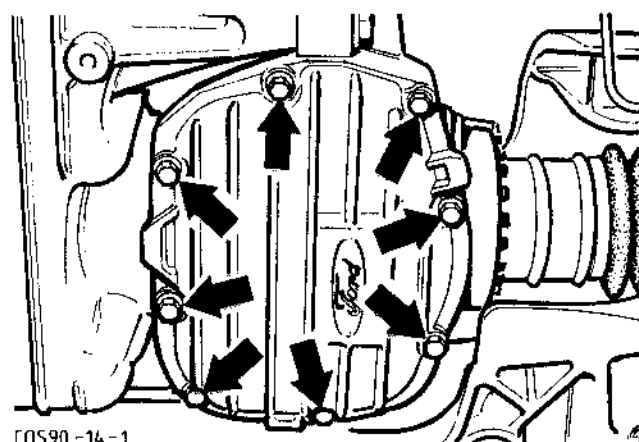


Fig.51. Retaining bolts of cover of front axle housing.

74. Centre the steering wheel and the steering gear. Connect the intermediate steering shaft to the steering shaft, Fig.52.

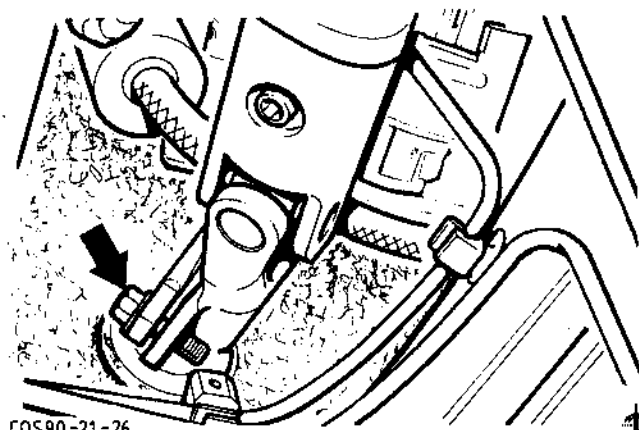


Fig.52. Bolt securing intermediate steering shaft.

75. Fit the stabiliser bar brackets to the side members on the left and right-hand sides, Fig.53.

NOTE: Make sure the rubber bushes are seated correctly.

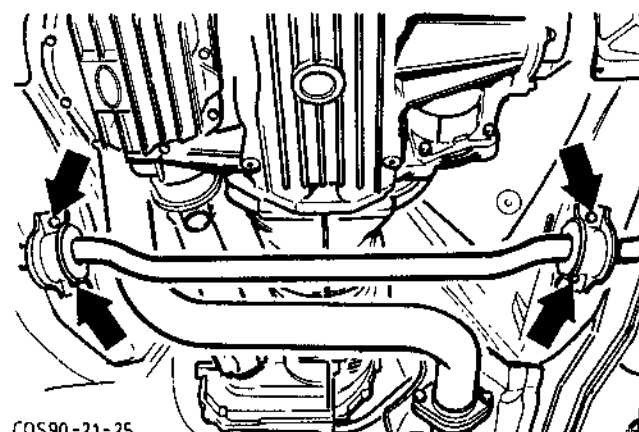


Fig.53. Retaining bolts of stabiliser bar brackets.

76. Fit the lower suspension arm to the spindle carrier (on both sides), Fig.54.

77. Connect the track rod to the steering arm. Fit the castellated nut on the track rod end, tighten and lock it using a new split pin (on both sides).

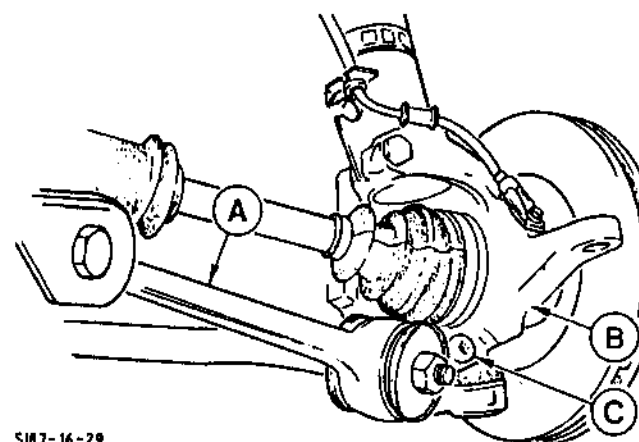


Fig.54. A - Lower suspension arm
B - Spindle carrier
C - Torx bolt and nut

21 132 0

Engine - 83 US

78. Connect the lower hose to the water pump, Fig.55.

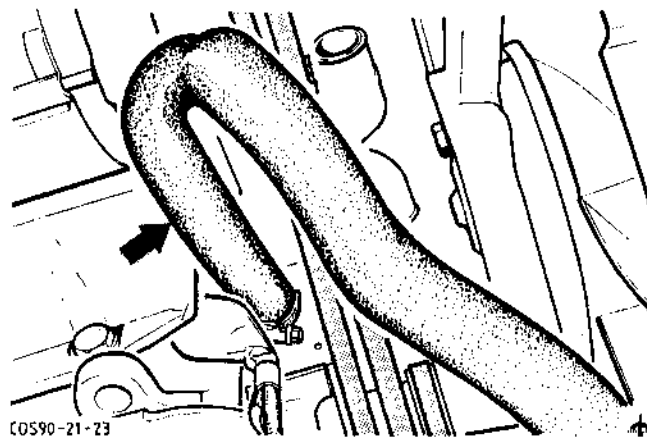


Fig.55. Lower hose to water pump.

79. Connect the lower right-hand coolant hose to the radiator, Fig.56.

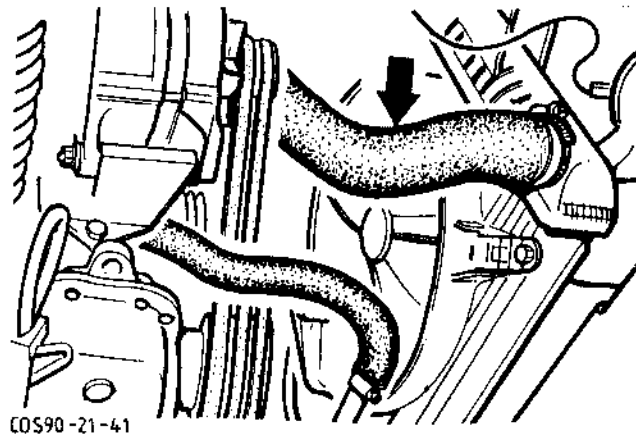


Fig.56. Lower coolant hose to radiator.

80. Connect the oil hose to the power steering pump cooling circuit, Fig.57.

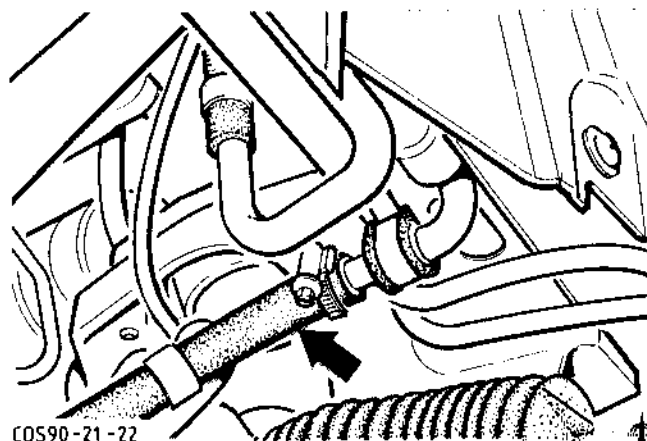


Fig.57. Oil hose to power steering pump cooling circuit.

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81. Fill the front axle assembly with oil (see Technical Data for quantity and specification), Fig.58.

82. Fit the front wheels.

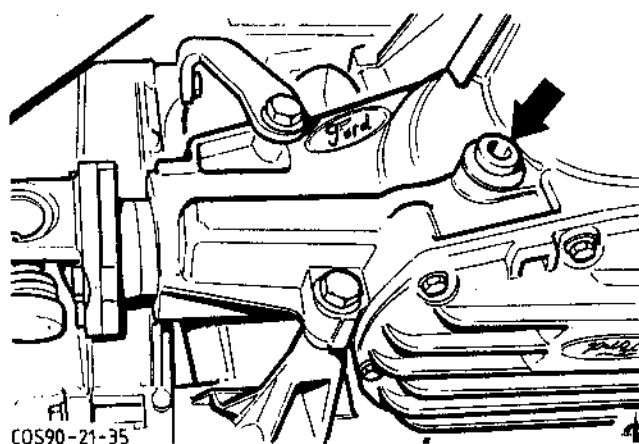


Fig.58. Front axle assembly filler plug.

83. Fit the lower engine cover to the side members and the front axle/engine crossmember, Fig.59.

84. Lower the vehicle to the ground and secure the front wheels.

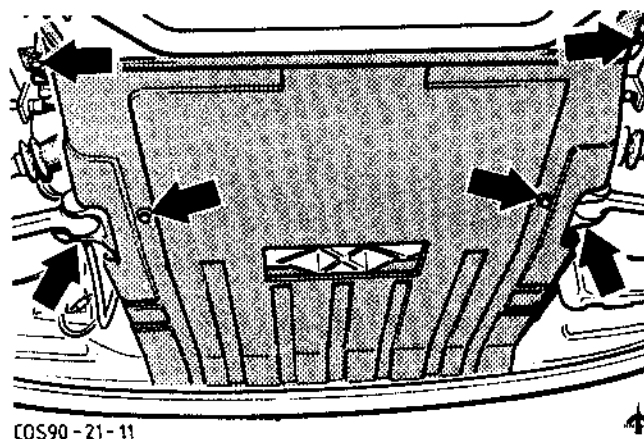


Fig.59. Retaining bolts of lower engine cover.

85. Unscrew the spindles on the engine support bar and disconnect the chains. Remove the engine support bar. Slacken the engine lifting eye retaining bolts, align the engine lifting eyes vertically and tighten the retaining bolts. Refit the dust caps to the shock absorber top mountings, Fig.60.

- Fig.60. Engine support bar 21-140 in place.
A - Right-hand spindle at rear
B - Left-hand spindle at front
C - Engine lifting eyes angled obliquely

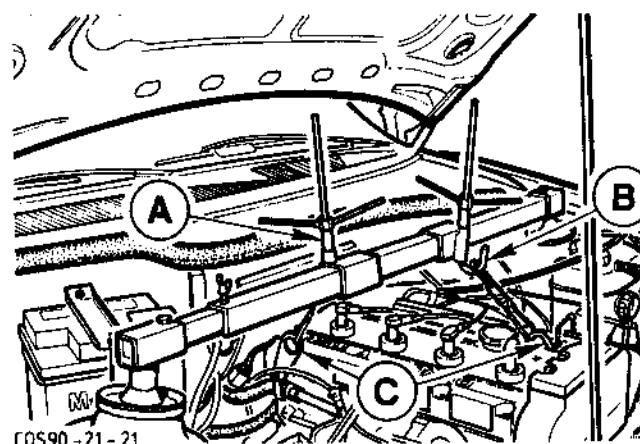


Fig.60. Engine support bar 21-140 in place.

86. Fit a new self-locking nut on the vibration damper on the throttle housing but do not tighten it.

Tighten the 2 engine mounting nuts, Fig.61 (A, B, C).

Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken it half a turn.

NOTE: Make sure the spring washers are fitted correctly, Fig.61 (D).

Fig.61. Nuts of engine mountings and vibration damper.

- A - Right
- B - Left
- C - Self-locking nut on vibration damper on throttle housing
- D - Arrangement of spring washers

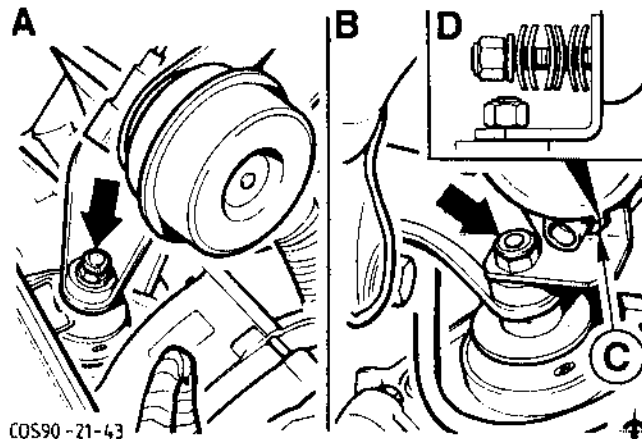


Fig.61. Nuts of engine mountings and vibration damper.

87. Connect the vacuum hose running to the MAP sensor to the air chamber and the vacuum hose of the carbon canister to the T-piece, Fig.62.

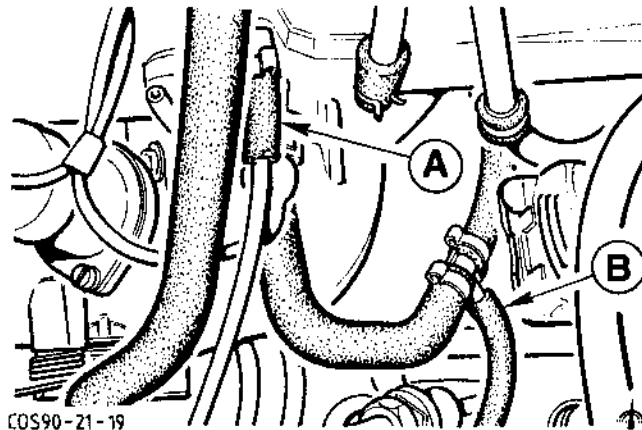


Fig.62. Vacuum hoses.
A - To MAP sensor
B - To carbon canister

88. Fit the front exhaust pipe to the turbocharger, Fig.63.

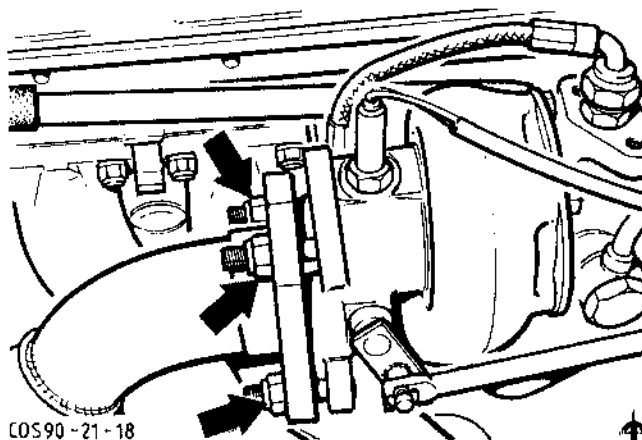
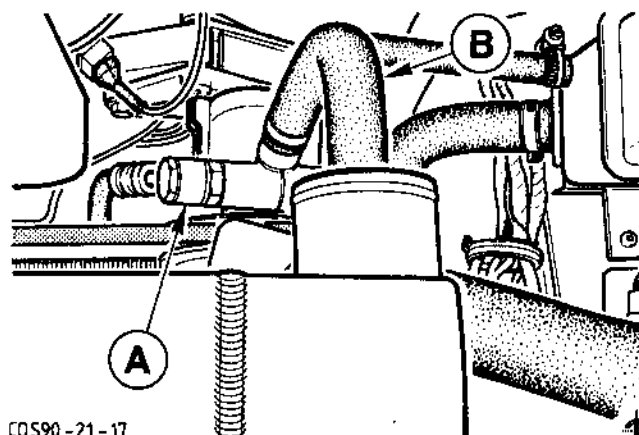


Fig.63. Nuts securing front exhaust pipe to turbocharger.

21 132 0

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89. Connect the oil feed hose from the reservoir and the high-pressure pipe from the steering box to the power steering pump, Fig.64.

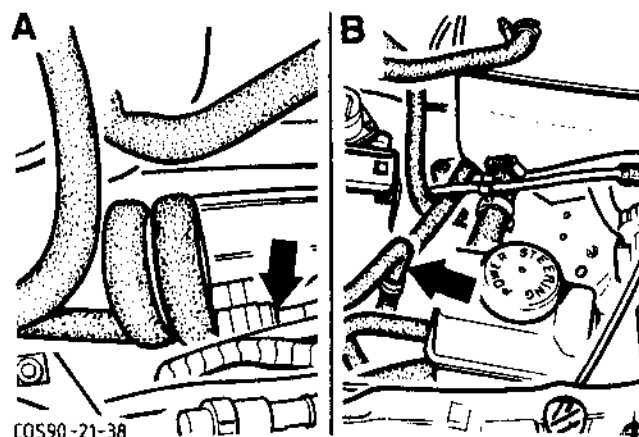


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Fig.64. Power steering pump.

A - High-pressure pipe to steering box
B - Oil feed hose from reservoir

90. Connect the fuel feed pipe and fuel return pipe, Fig.65.

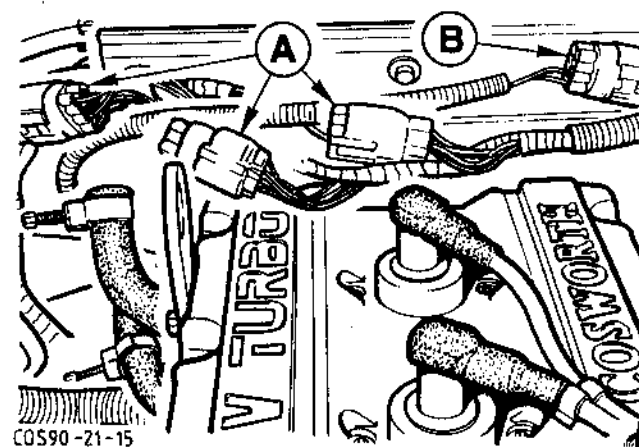


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Fig.65. Fuel pipes connected.

A - Feed pipe
B - Return pipe

91. Connect the 3 multiplugs of the engine wiring loom and the multiplug of the reversing light switch, Fig.66.



COS90-21-15

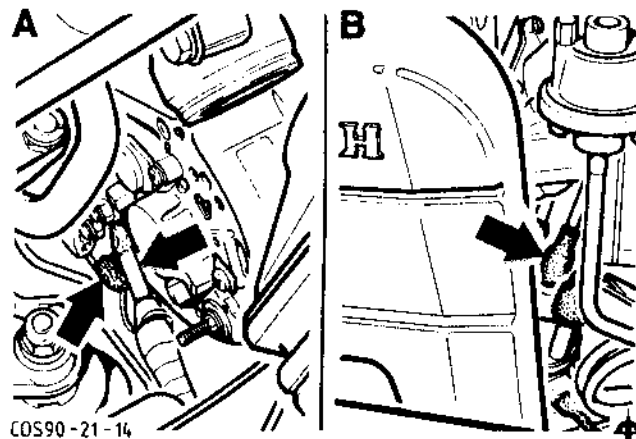
Fig.66. Multiplugs.

A - Engine wiring loom
B - Reversing light switch

21 132 0

Engine - 83 US

92. Connect the high tension lead from the ignition coil to the distributor, Fig.67 (B).



93. Connect the connector and wiring to the alternator, Fig.67 (A).

Fig.67. A - Electrical connections on alternator
B - Lead between distributor and ignition coil

94. Connect the 2 coolant hoses to the heater radiator, Fig.68.

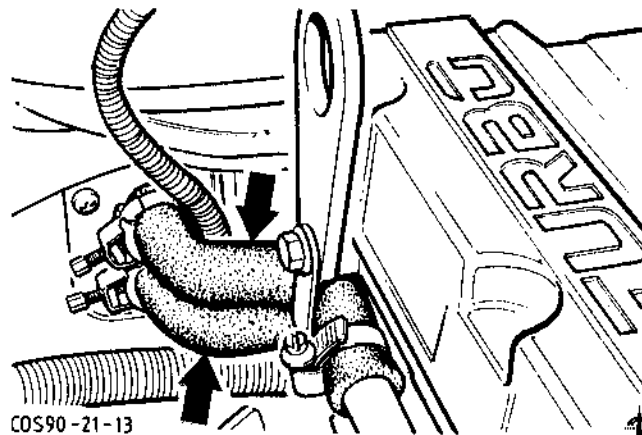


Fig.68. Coolant hoses on heater radiator.

95. Connect the coolant hoses to the thermostat housing, Fig.69.

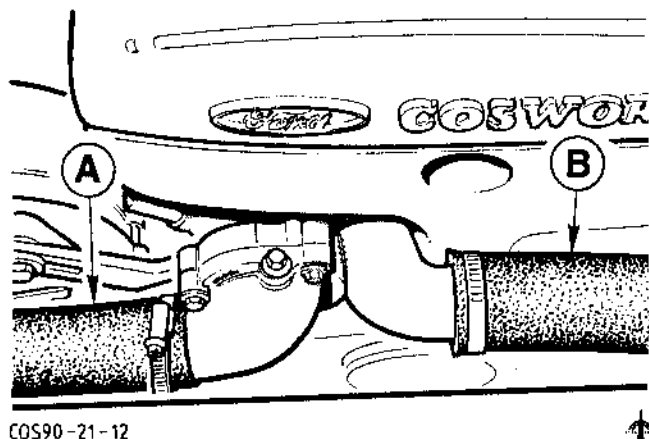


Fig.69. Coolant hoses on thermostat housing.
A - To lower right connection on radiator
B - To upper left connection on radiator

96. Connect the air hose running from the intercooler to the throttle housing, Fig.70.

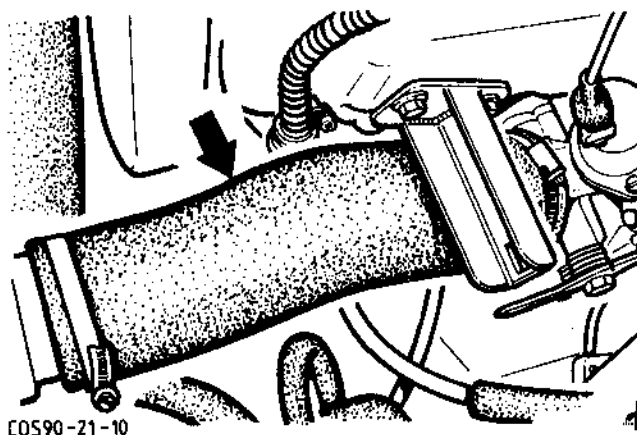


Fig.70. Air hose from intercooler to throttle housing.

97. Guide the throttle cable and retaining clip into the opening in the throttle cable bracket and clip it in place. Clip the throttle cable to the throttle linkage, Fig.71.

NOTE: Position the sprung locking tabs vertically to facilitate removal.

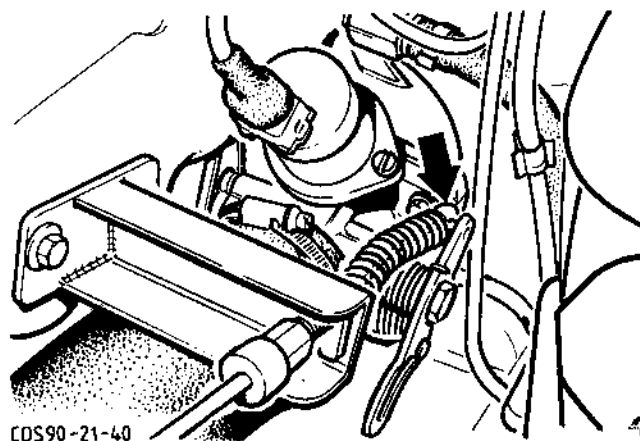


Fig.71. Throttle cable fixture.

98. Run the coolant hose to the degas tank through the engine lifting eye and connect it to the connector on the turbocharger, Fig.72.

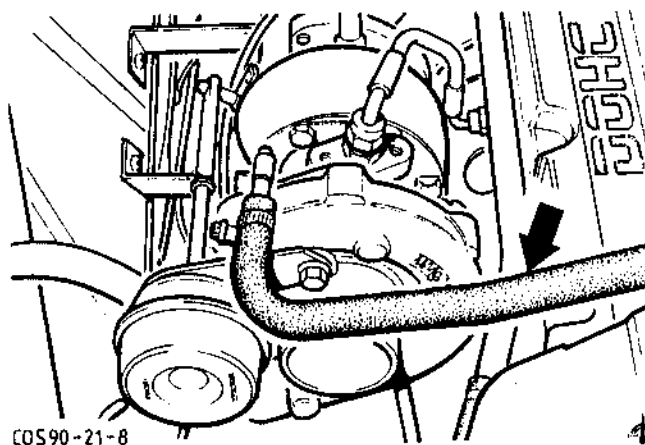


Fig.72. Coolant hose to degas tank.

21 132 0

Engine - 83 US

99. Connect the lower air hose to the turbocharger and to the intercooler, Fig.73 (C).

Fig.73. Solenoid control valve and lower air hose to turbocharger.

- A - Vacuum pipe to diaphragm unit
- B - Vacuum pipe to compressor casing
- C - Lower air hose to turbocharger
- D - Solenoid control valve
- E - Multiplug
- F - Retaining screws

100. Fit the solenoid control valve to the intercooler:

- Fit the solenoid control valve and vacuum hoses to the intercooler, Fig.73 (D, F).
- Connect the vacuum pipe of the solenoid control valve to the turbocharger diaphragm unit, Fig.73 (A), and to the turbocharger compressor casing, Fig.73 (B).
- Connect the multiplug of the solenoid control valve, Fig.73 (E).

101. Fit the air cleaner cover with the air hoses, Fig.75.

- Place the air cleaner element in the air cleaner casing.
- Fit the air cleaner cover and air hoses/pipes to the air cleaner casing and clip it in place.
- Connect the vacuum pipe from the by-pass valve to the inlet manifold air chamber and clip it to the upper crossmember.
- Connect the air hose from the by-pass valve to the intercooler.
- Connect the air intake hose to the turbocharger.
- Connect the air pipe from the engine breather valve to the connecting hose and clip it to the upper crossmember. Connect the air pipe from the air cleaner cover to the solenoid valve.

Fig.75. Air cleaner cover and air hoses.

- A - Air cleaner cover
- B - To engine breather valve
- C - To turbocharger
- D - From solenoid control valve
- E - Connecting hose from engine breather valve air pipe
- F - By-pass valve to intercooler
- G - Clips
- H - Vacuum pipe from by-pass valve to inlet manifold air chamber
- J - Connection of vacuum pipe from by-pass valve

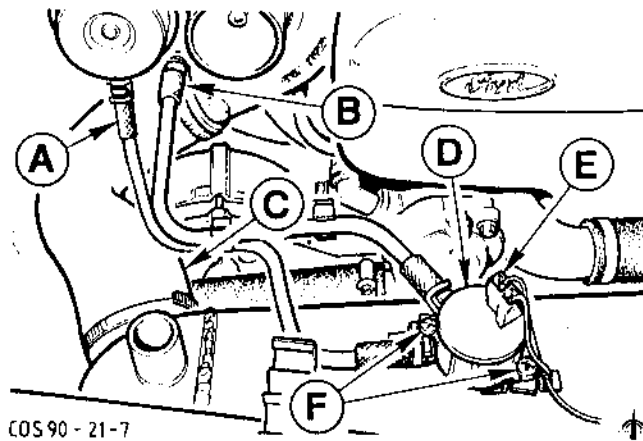


Fig.73. Solenoid control valve and lower air hose to turbocharger.

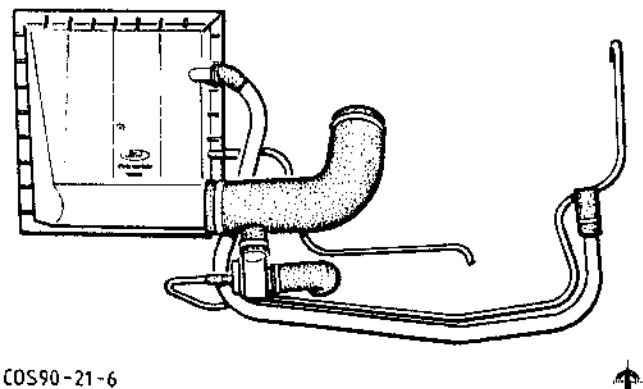


Fig.74. Air cleaner cover and air hoses/pipes removed.

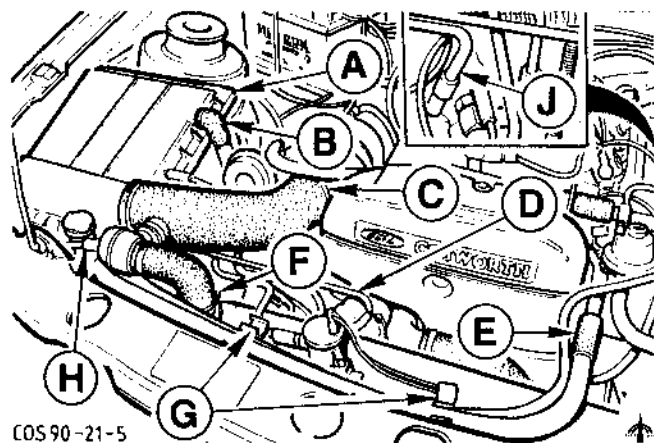


Fig.75. Air cleaner cover with air hoses/pipes.

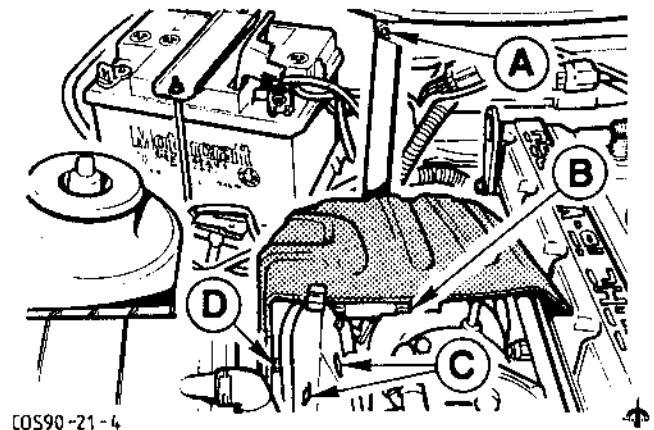
21 132 0

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102. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.76 (A, C, D).

Fig.76. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut

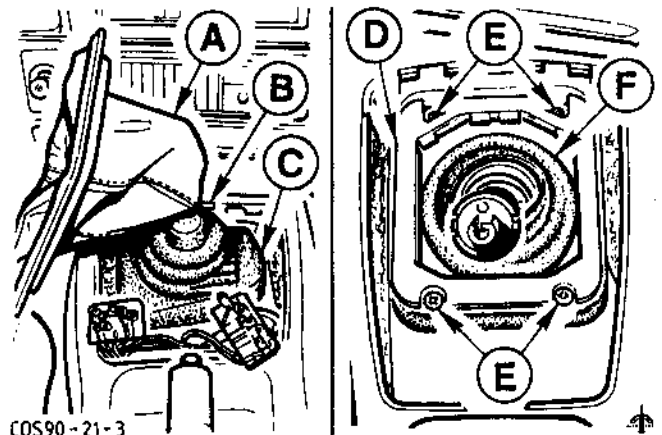


COS90-21-4

103. Connect the multiplug of the HEGO sensor and clip to the heat shield, Fig.76 (B).

Fig.76. Turbocharger heat shield.

104. Slip the noise damping pad retaining frame and damping pad over the gear lever and secure them, Fig.77 (D, E, F).



COS90-21-3

Fig.77. Gaiters and noise damping pad retaining frame.

- A - Outer gaiter
- B - Cable tie
- C - Inner gaiter
- D - Noise damping pad retaining frame
- E - Retaining screws
- F - Noise damping pad

105. Slip the inner gear lever gaiter over the gear lever and pull it down onto the retaining frame, Fig.77 (C).

106. Fit the outer gear lever gaiter over the gear lever and pull it up inside out. Secure the gaiter with a cable tie and pull it down into position, Fig.77 (A, B).

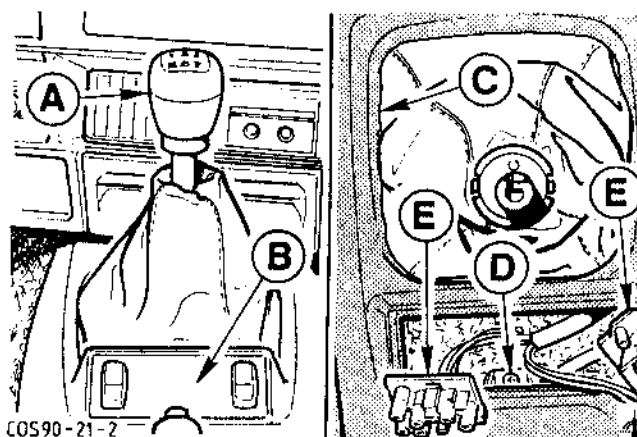
107. Fit the retaining frame to the console, Fig.78 (C, D).

Fig.78. Gear lever with gaiter retaining frame.

- A - Gear lever knob
- B - Cover plate
- C - Retaining frame
- D - Screw securing retaining frame
- E - Multiplugs of electric window switches

108. Connect the 2 multiplugs of the electric window switches and clip the switches into the cover plate.

Fit the cover plate in the retaining frame and refit the gear lever knob, Fig.78 (A, B, E). Remove the support from under the clutch pedal.



COS90-21-2

Fig.78. Gear lever with gaiter retaining frame.

109. Connect the earth cable and the starter motor positive cable to the battery. Screw the earth cable to the battery tray, Fig.79.

110. Fill the cooling system up to the MAX mark in the overflow tank (see Technical Data for quantity and specification), unscrewing the bleed screw on the thermostat housing to allow air to escape from the cooling system, Fig.80.

Apply sealer (see Technical Data for specification), insert and tighten the bleed screw.

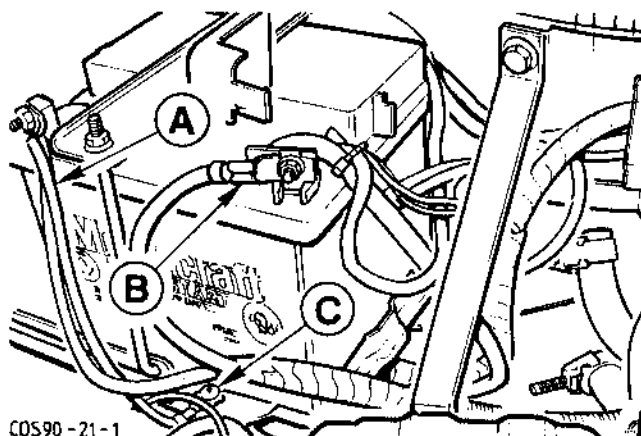
NOTE: Fill the cooling system slowly so that air bubbles can escape.

111. Check the engine oil level and top up with oil as necessary (see Technical Data for specification).

112. Fill the power steering reservoir and bleed the system as indicated in Operation 13 416 1 (see Technical Data for quantity and specification).

113. Start the engine and run it up to normal operating temperature. Check all the coolant/oil hose connections for leaks and top up with coolant and oil as necessary.

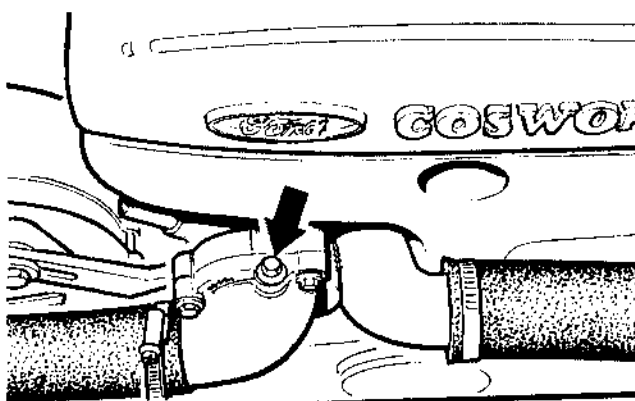
114. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.



COS90-21-1

Fig.79. Battery cables.

- A - Earth cable
- B - Starter motor positive cable
- C - Earth cable to battery tray



COS90-21-45

Fig.80. Cooling system bleed screw on thermostat housing.

21 134 8 ENGINE ASSEMBLY - DISMANTLE AND REASSEMBLE (Engine Removed)

SPECIAL SERVICE TOOLS REQUIRED:

Socket wrench for cylinder head bolts	21-002
Radial oil seal installer	21-009 B
Crankshaft rear oil seal installer ..	21-011 D
Socket wrench for oil pump bolts ..	21-012
Universal spindle	21-023
Crankshaft toothed belt pulley remover	21-028 A
Engine mounting bracket.. ..	21-031 B
Pilot bearing extractor.. ..	21-036 A
Pilot bearing installer and clutch disc locator	21-044 A
Toothed belt tension test gauge ..	21-113
Cylinder head locating studs ..	21-128
Distributor immobilising tool ..	21-152
Crankshaft belt pulley remover ..	21-153

PROPRIETARY TOOLS:

Dial test indicator (graduated in mm) with holding fixture - use 15-046 with 15-022 A if available.

Oil filter strap wrench
Piston ring compressor
Angle gauge

To Dismantle

1. Remove the front axle assembly, Fig.1:
 - Unscrew the retaining bolt of the rear bracket/engine mounting,
 - Unscrew the retaining bolts of the front axle assembly and remove the 2 brackets,
 - Withdraw the front axle assembly from the sump.
2. Unscrew the remaining 3 bolts from the engine mounting and remove the engine mounting, Fig.2 (A).
3. Secure the engine on an assembly stand using mounting bracket 21-031 B and universal spindle 21-023, Fig.2 (B).

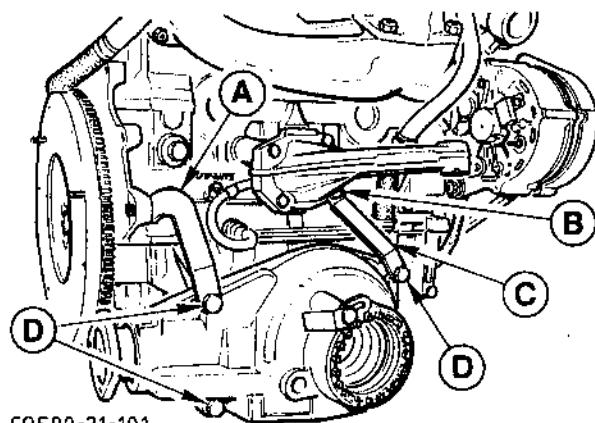


Fig.1. Front axle assembly.

- A - Front bracket
- B - Retaining bolt of bracket/engine mounting
- C - Rear bracket
- D - Retaining bolts of front axle assembly

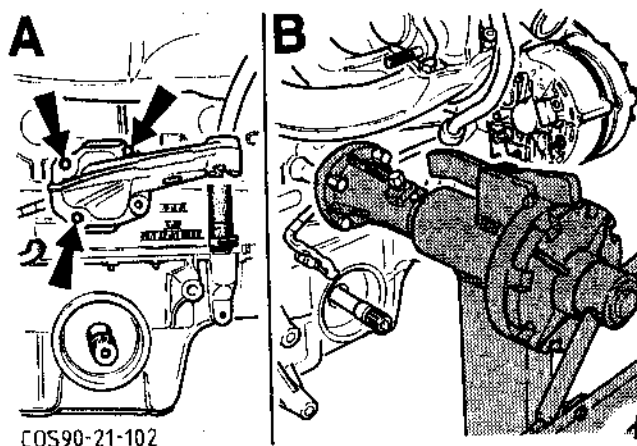
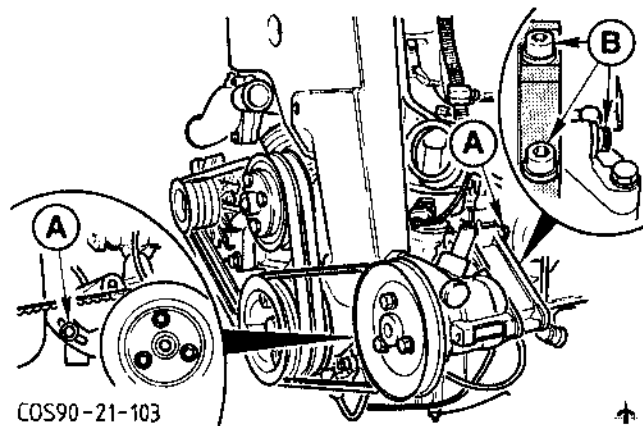


Fig.2. A - Retaining bolts of engine mounting
B - Engine on assembly stand

4. Drain off the engine oil, withdraw the oil dipstick and detach the bracket from the oil dipstick tube (1 bolt).

Remove the oil filter using a proprietary strap wrench.

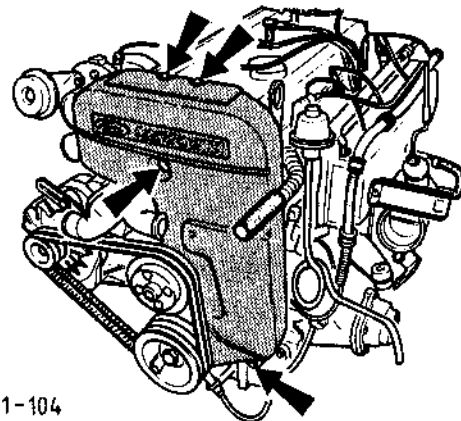


COS90-21-103

5. Slacken the 2 hexagon bolts, Fig.3 (A), loosen the V-belt of the power steering pump and remove it. Detach the power steering pump and bracket (2 hexagon bolts), Fig.3 (A). Detach the carrier from the power steering pump (3 bolts), Fig.3 (B).

Fig.3. Retaining bolts.

A - Power steering pump
B - Carrier

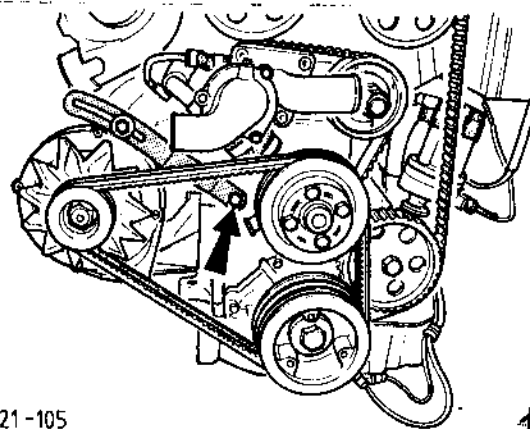


COS90-21-104

6. Remove the toothed belt cover from the cylinder head/cylinder block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.4.

Fig.4. Retaining bolts of toothed belt cover.

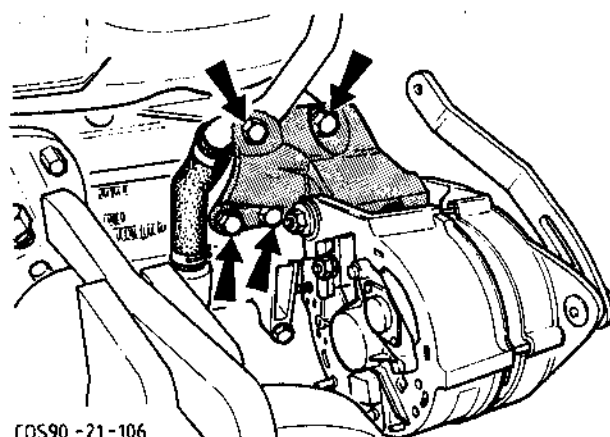
7. Loosen the alternator V-belt and remove it. Remove the adjusting strap retaining bolt from the cylinder block, Fig.5.



COS90-21-105

Fig.5. Retaining bolt of alternator adjusting strap.

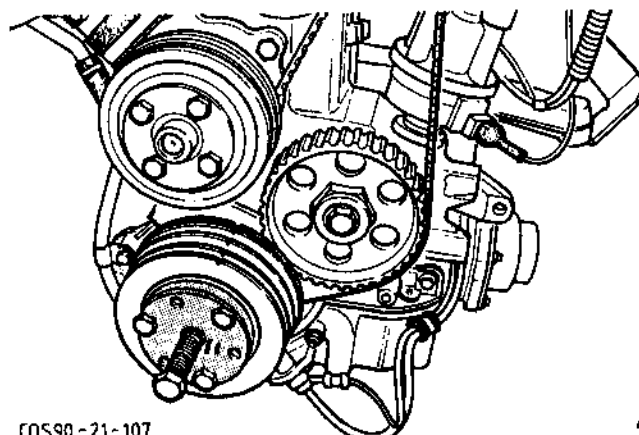
8. Remove the alternator and bracket from the cylinder head (4 bolts), Fig.6.



COS90-21-106

Fig.6. Retaining bolts of alternator bracket.

9. Unscrew and remove the retaining bolt with the washer and pull off the crankshaft vibration damper/V-belt pulley using Special Tool 21-153, Fig.7.



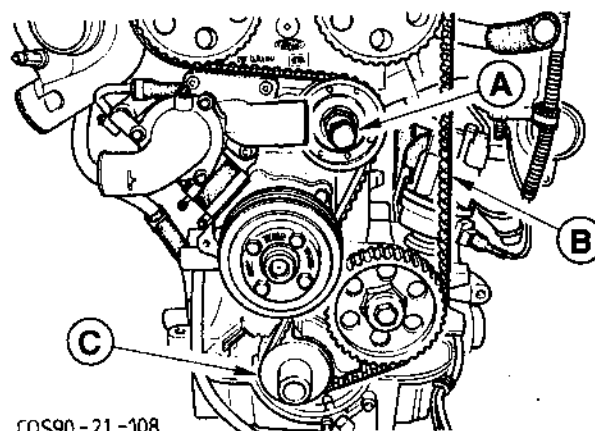
COS90-21-107

Fig.7. Pull off crankshaft vibration damper/V-belt pulley using Special Tool 21-153.

10. Remove the thrust washer from the crankshaft, Fig.8 (C).

NOTE: If the toothed belt is to be used again, mark the direction in which it runs before removing it.

Release the toothed belt tensioning pulley and remove the toothed belt, Fig.8 (A, B).



COS90-21-108

Fig.8. Toothed belt.
A - Retaining bolt of tensioning pulley
B - Toothed belt
C - Thrust washer

11. Disconnect the plug from the oil pressure switch, Fig.9.

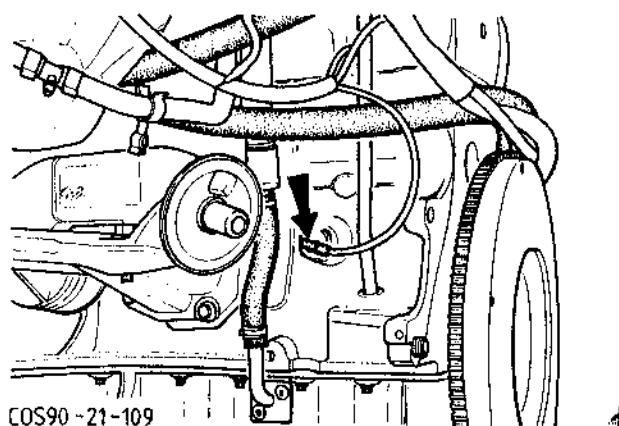


Fig.9. Plug of oil pressure switch.

12. Disconnect the multiplugs from the engine speed/TDC sensor, knock sensor and distributor, Fig.10.

Fig.10. Multiplugs.

- A - Distributor
- B - Knock sensor
- C - Engine speed/TDC sensor

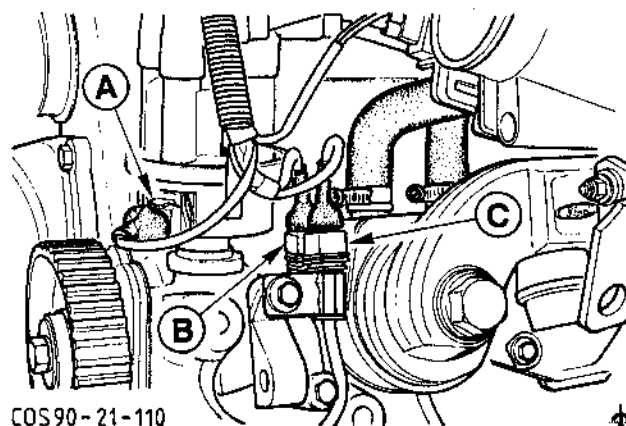


Fig.10. Multiplugs.

13. Disconnect the coolant hose at the rear from the cylinder head connecting flange, Fig.11.

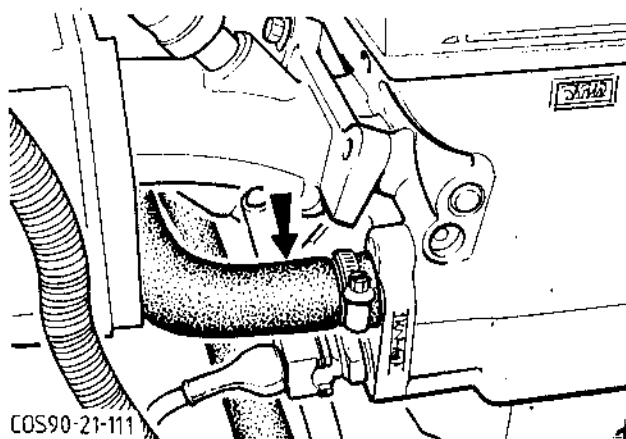


Fig.11. Coolant hose to cylinder head connecting flange at rear.

14. Disconnect the spark plug connectors from the spark plugs, unclip the distributor cap and remove it with the HT leads.

15. Remove the cylinder head cover (20 bolts), Fig.12.

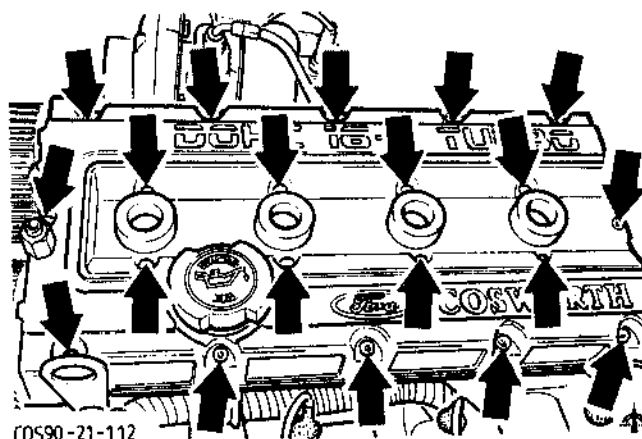


Fig.12. Retaining bolts of cylinder head cover.

16. Detach the engine breather valve bracket from the inlet manifold (1 nut), Fig.13, and disconnect the hose from the engine breather valve.

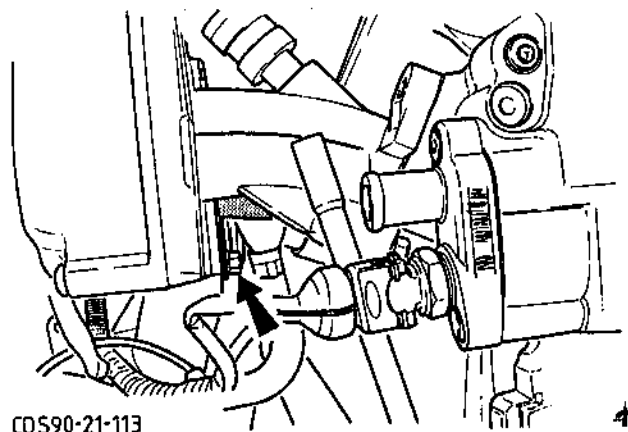


Fig.13. Retaining nut of engine breather valve bracket.

17. Detach the turbocharger oil return hose from the sump, Fig.14 (A).

18. Disconnect the connecting hose running from the thermostat housing at the water pump (1 hose clip), Fig.14 (B).

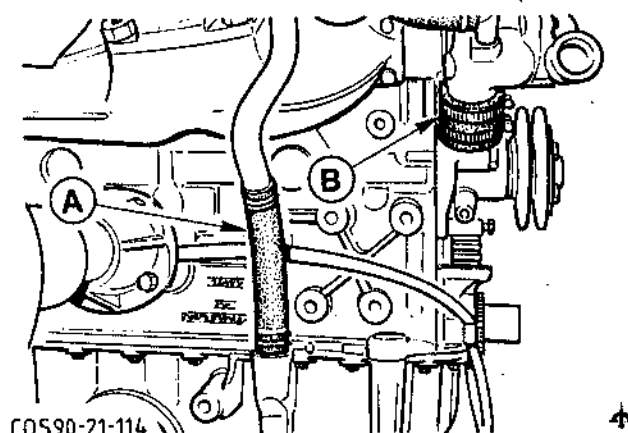


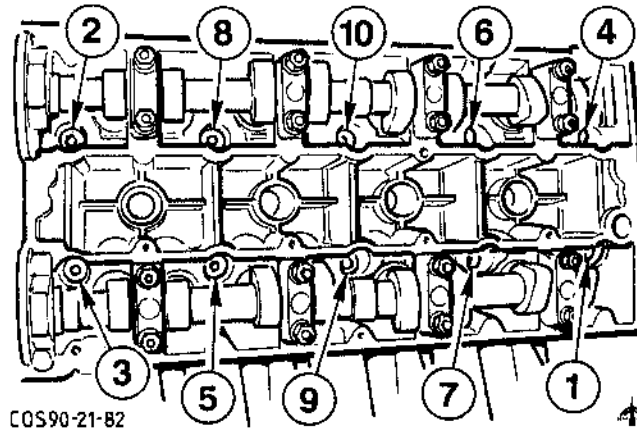
Fig.14. A - Turbocharger oil return hose
B - Coolant hose from thermostat housing to water pump

19. Remove the spark plugs.

20. NOTE: The engine must have cooled down to below 45°C before the cylinder head is removed.

Unscrew the 10 cylinder head bolts using Special Tool 21-002, Fig.15.

Remove the cylinder head bolts with the washers. Lift off the cylinder head complete with the inlet and exhaust manifolds and the turbocharger, Fig.16.



COS90-21-82

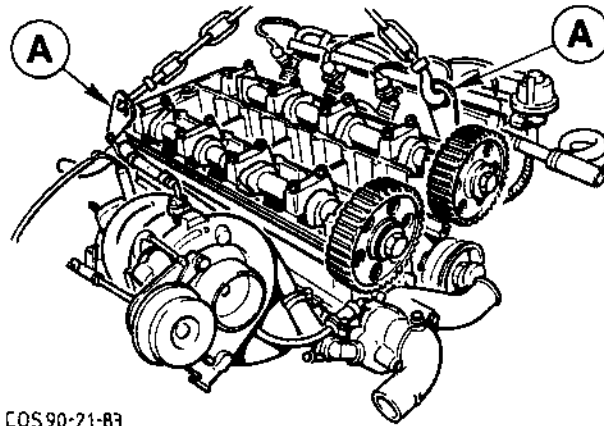
Fig.15. Cylinder head bolt slacking sequence.

Check the flatness or distortion of the cylinder head

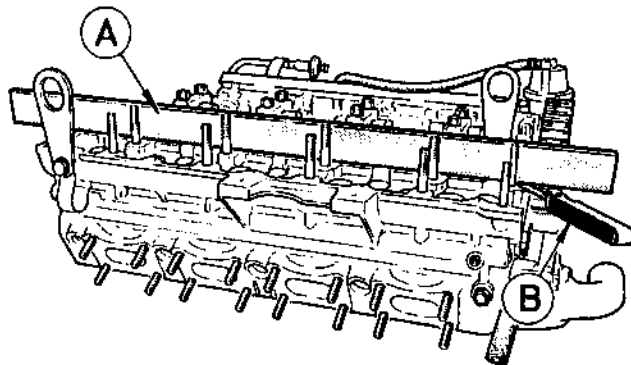
Whenever a cylinder head is removed, the flatness of the faces mating with the cylinder block and the cylinder head cover must be checked as follows:

21. Carefully clean the face mating with the cylinder head cover. Place a steel straight edge along the centre line in the longitudinal direction and check the flatness or convex distortion with a feeler gauge, Fig.17.

NOTE: If the distortion is more than 0,1 mm, the cylinder head has overheated and cannot be used again. If the distortion is 0,1 mm or less, check the face mating with the cylinder block.



COS90-21-83

Fig.16. Cylinder head suspended and lifted off.
A - Lifting eyes set at an angle


TI-87-100

Fig.17. Check flatness of face mating with cylinder head cover.
A - Steel straight edge
B - Feeler gauge

22. Carefully clean the mating face. Using a 100 mm long steel straight edge, check the flatness in the transverse direction between the holes for the retaining bolts (5 measuring points), Fig.18 (A). Check the flatness in the longitudinal direction between the holes for the retaining bolts (8 measuring points), Fig.18 (B).

Fig.18. Check flatness of face mating with cylinder head.

A - In transverse direction
B - In longitudinal direction

NOTE: The maximum permissible deviation is 0,02 mm.

23. Check the flatness or concave distortion in the longitudinal direction along the centre line, Fig.19.

NOTE: The maximum permissible deviation is 0,08 mm.

If the maximum deviations of 0,02 and 0,08 mm are exceeded, the mating face must be skimmed, removing a maximum of 0,13 mm of material.

The minimum cylinder head height (distance between the 2 mating faces) must not be less than 138.68 mm.

24. Loosen the nut on the oil cooler inlet union screw. Remove the engine mounting/connecting housing bolt, Fig.20.

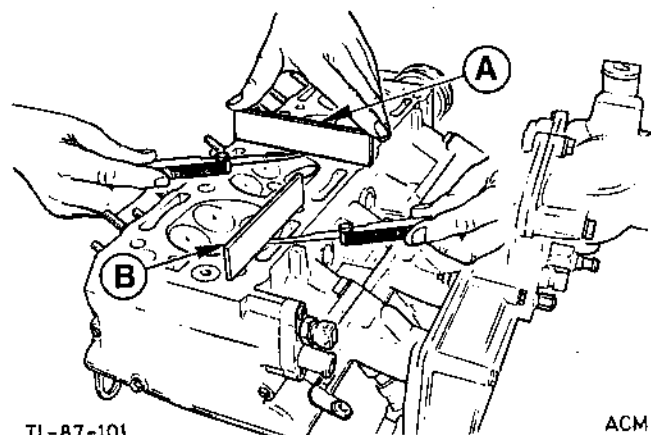


Fig.18. Check flatness of face mating with cylinder block.

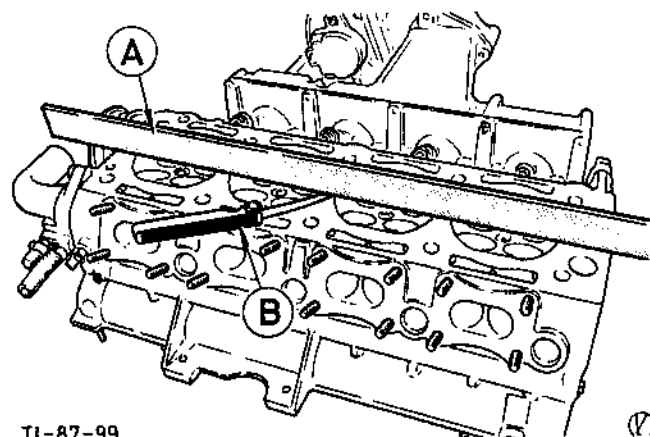


Fig.19. Measure distortion in longitudinal direction.

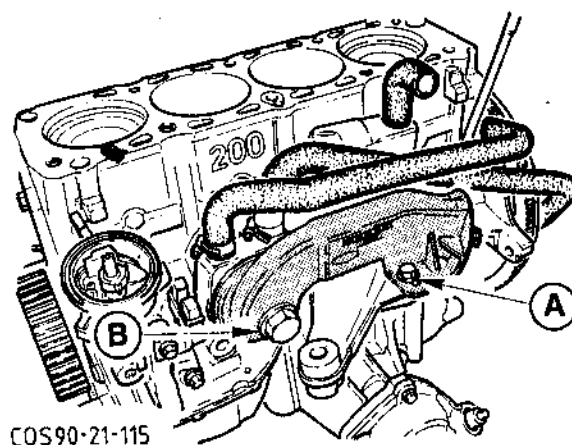
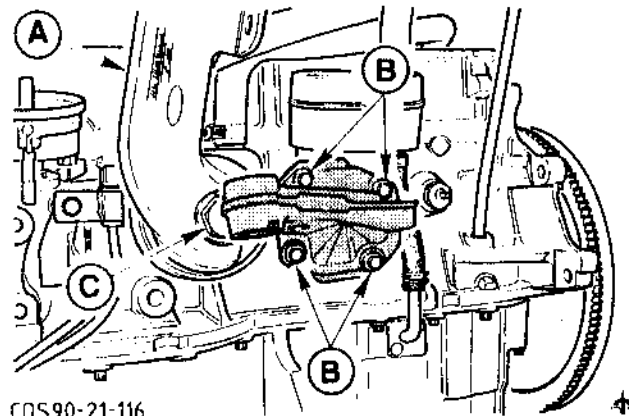


Fig.20. Oil filter/oil cooler connecting housing.
A - Bolt in engine mounting
B - Nut on oil cooler inlet union screw

25. Swing the oil filter/oil cooler connecting housing up. Detach the engine mounting (4 bolts). Detach the oil filter/oil cooler connecting housing (1 nut). Unscrew the inlet union screw and remove the oil cooler complete with the coolant hoses, Fig.21.

Fig.21. Oil filter/oil cooler connecting housing and engine mounting.

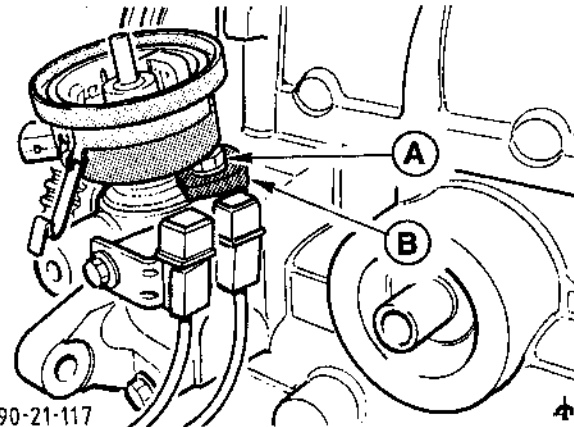
- A - Connecting housing swung up
B - Retaining bolts of engine mounting
C - Nut on oil cooler inlet union screw



COS90-21-116

Fig.21. Oil filter/oil cooler connecting housing and engine mounting.

26. Unscrew the retaining bolt, remove the clamping plate and withdraw the distributor, Fig.22.



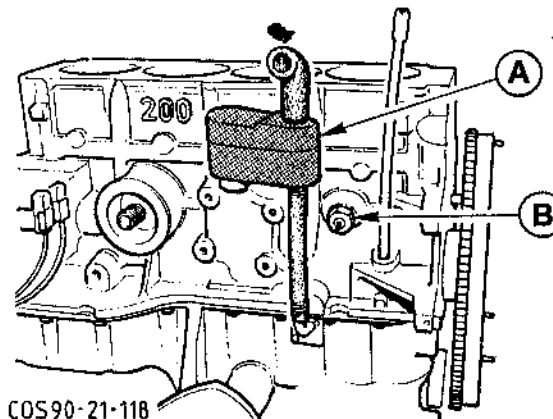
COS90-21-117

Fig.22. Distributor.

- A - Retaining bolt
B - Clamping plate

27. Remove the oil separator with the lower breather hose from the cylinder block/sump, Fig.23 (A).

28. Remove the oil pressure switch, Fig.23 (B).



COS90-21-118

Fig.23. A - Oil separator
B - Oil pressure switch

29. Detach the bracket for the multiplugs of the knock sensor and the engine speed/TDC sensor from the power steering pump support (1 bolt). Detach the power steering pump support from the cylinder block (1 bolt), Fig.24 (C).

Fig.24. Knock sensor and engine speed/TDC sensor.

- A - Retaining bolts of cable brackets
B - Retaining nuts of engine speed/TDC sensor
C - Retaining bolts of oil pump mounting support
D - Knock sensor

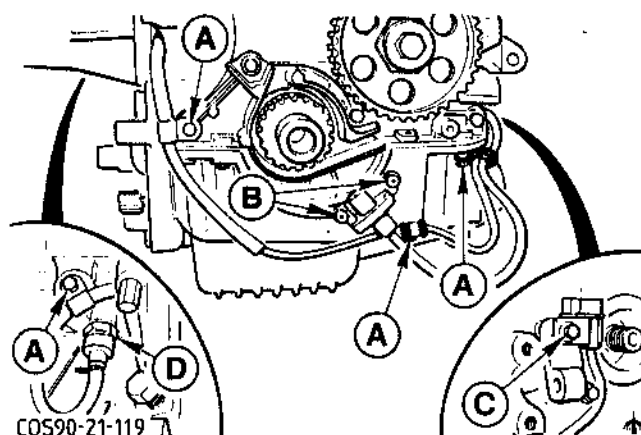


Fig.24. Knock sensor and engine speed/TDC sensor.

30. Remove the knock sensor from the cylinder block, Fig.24 (D), detach the engine speed/TDC sensor from the sump, Fig.24 (B). Detach the cable brackets from the sump, front cover and cylinder block, Fig.24 (A), and remove the sensor with the cable.

31. Remove the water pump V-belt pulley (4 bolts) and the water pump (3 bolts, 1 bolt with a spacer sleeve), Fig.25.

Fig.25. Water pump.

- A - Retaining bolts of V-belt pulley
B - Retaining bolts

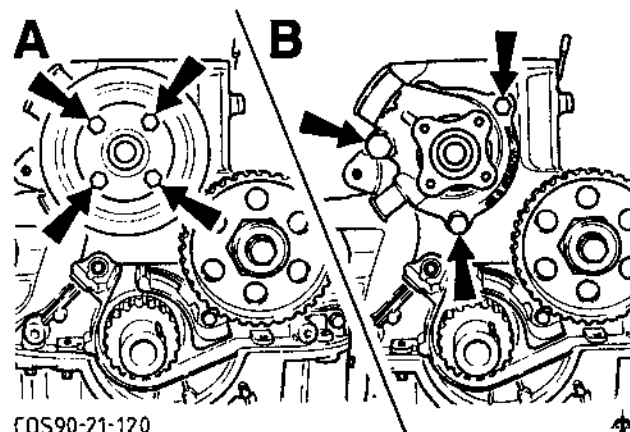
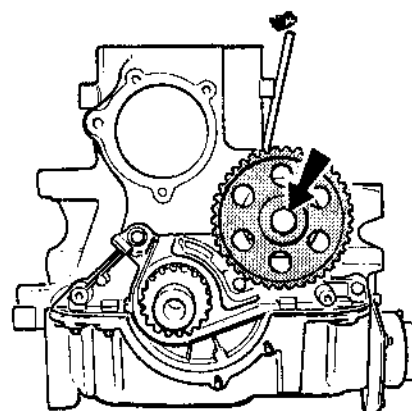


Fig.25. Water pump.

32. Remove the auxiliary shaft toothed belt pulley (1 bolt), Fig.26.



COS90-21-121

Fig.26. Retaining bolt of auxiliary shaft toothed belt pulley.

33. Pull off the crankshaft toothed belt pulley using Special Tool 21-028 A, Fig.27.

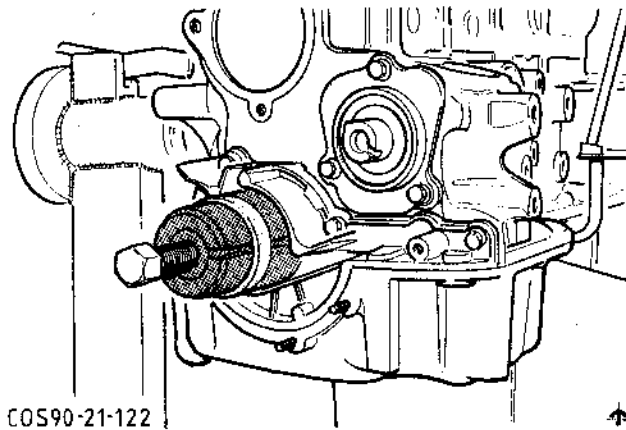


Fig.27. Pull off crankshaft toothed belt pulley using Special Tool 21-028 A.

34. Remove the auxiliary shaft front cover (3 bolts) and the auxiliary shaft thrust plate (2 bolts), Fig.28.

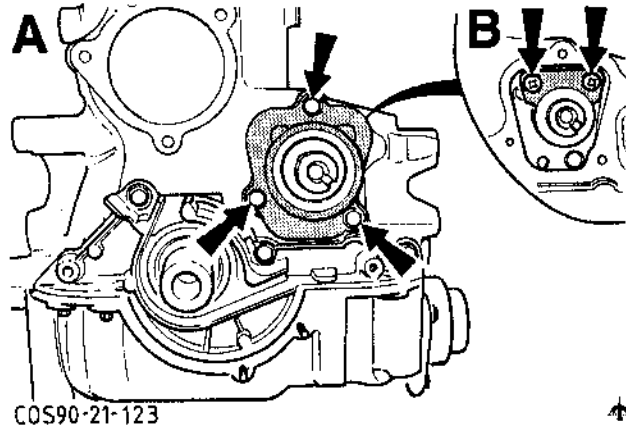


Fig.28. Auxiliary shaft.
A - Retaining bolts of cover
B - Retaining bolts of thrust plate

35. Remove the clutch pressure plate and clutch disc (6 bolts).

36. Extract the pilot bearing from the crankshaft using Special Tool 21-036 A, Fig.29.

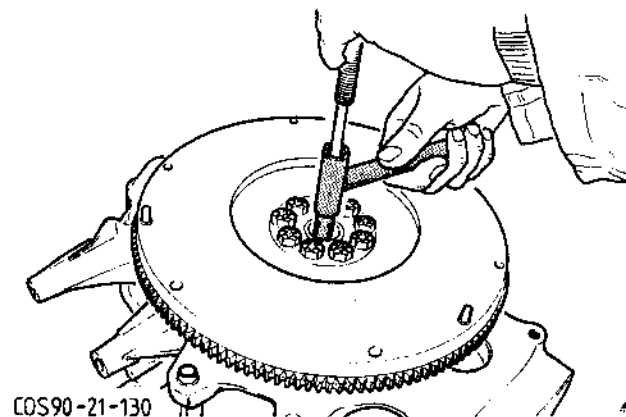


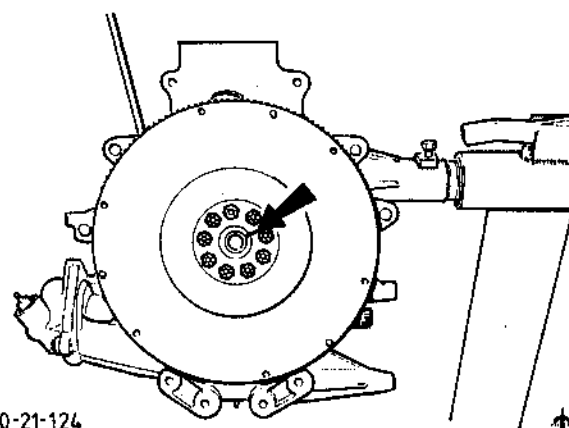
Fig.29. Extract pilot bearing using Special Tool 21-036 A.

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37. Remove the flywheel (9 bolts).

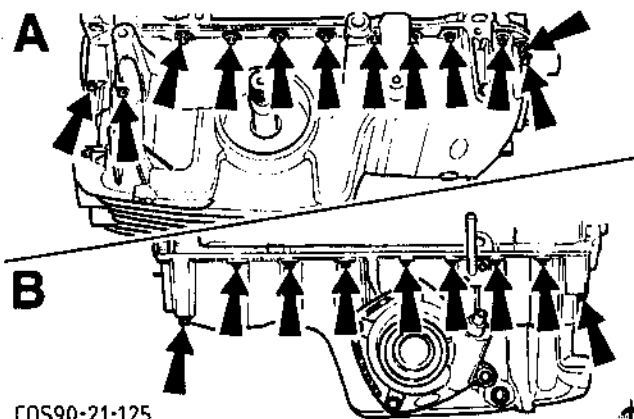
NOTE: Mark the position of the crankshaft in relation to the flywheel before removing it as the retaining bolts are arranged symmetrically, Fig.30.



COS90-21-124

Fig.30. Mark showing position of flywheel on crankshaft.

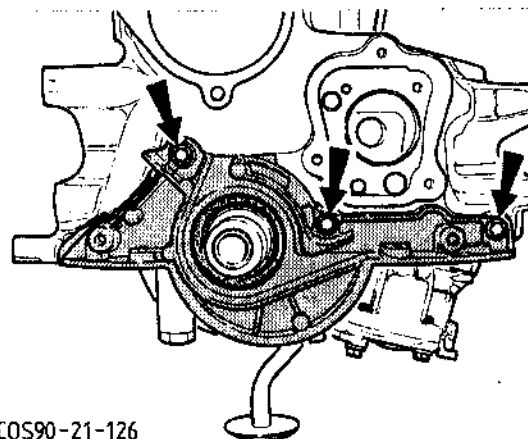
38. Remove the sump (21 bolts), Fig.31.



COS90-21-125

Fig.31. Retaining bolts of sump.
A - Right-hand side
B - Left-hand side

39. Remove the crankshaft front cover (3 bolts), Fig.32.



COS90-21-126

Fig.32. Retaining bolts of crankshaft front cover.

40. Remove the oil pump complete with the intake pipe and oil pipes using Special Tool 21-012 (3 bolts), Fig.33.

41. Extract the oil pump driving shaft, Fig.34.

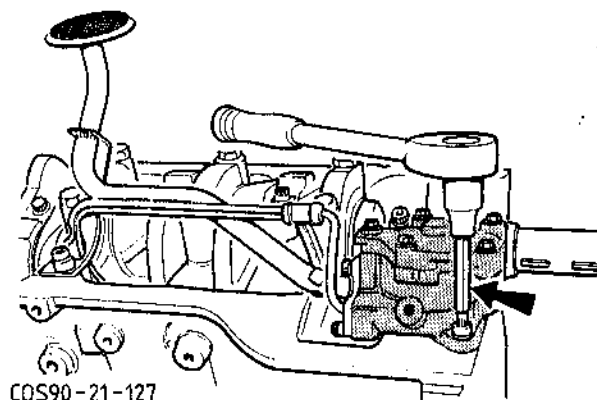


Fig.33. Remove oil pump using Special Tool 21-012.

42. Unscrew the big-end bearing caps and remove them with the bearing shells, Fig.35 (A).

NOTE: Check the markings on the bearing shells and mark the big-end bearing caps and the associated bearing shells.

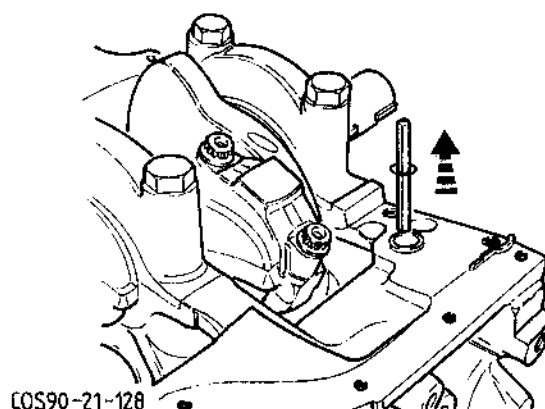


Fig.34. Oil pump driving shaft.

43. Lift out the pistons and connecting rods.

44. Remove the main bearing caps from the cylinder block, Fig.35 (B). Remove the crankshaft with the bearing shells and remove the crankshaft rear oil seal.

NOE: Mark the bearing shells to ensure they are refitted correctly.

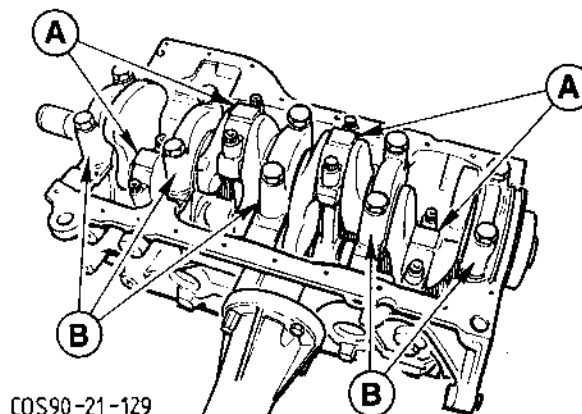


Fig.35. A - Big-end bearing caps
B - Main bearing caps

To Reassemble

NOTE: When reassembling, tighten the nuts and bolts as specified in Technical Data.

Parts that can be used again should be cleaned thoroughly before refitment. This is particularly true of the cylinder block with its corners, angles and holes. Remove all the blanking plugs and covers as appropriate and clean their seats using suitable cleaning agents and tools (brushes, scrapers). In particular, the oilways, e.g. of the cylinder block, cylinder head, etc., must be free of dirt and swarf. If press-fit blanking covers and water plugs or other seals are removed, these must always be renewed.

NOTE: When reassembling the engine, oil the thread and the underside of the head of the following bolts:

Main bearings bolts
Big-end bearing bolts
Flywheel bolts
Cylinder head bolts

45. Measure the clearance of the pistons in the cylinder bores

- a) Fit the main bearing caps without the bearing shells and tighten them down to the specified torque.
- b) Swivel the old cylinder block through 180° and measure the cylinder bores using a conventional gauge.
- c) If the measured cylinder bore diameter is too much for the class of piston, overhaul or change the cylinder block. Fit the cylinder block with new pistons of the appropriate standard class for the cylinder.

The specified piston-to-bore clearance applies to unused pistons. With used pistons the clearance is greater due to distortion.

46. Measure the clearance of the crankshaft main bearings

The use of "PLASTIGAGE" (type PG-1) eliminates the need to measure the bearings (even with undersize crankshafts) and makes selection of the required bearing shells much easier.

"PLASTIGAGE" is the brand name of a precisely calibrated plastic thread, Fig.36 (A).

West German Supplier:

K.H. Ern/Motorenteile GmbH
Vinckeweg 16
D-4100 Duisburg 13 (Ruhrort)

U.K. Supplier:

Replacement Service Limited
30 Euston Street
Freemans Industrial Estate
Leicester
LE2 7ST

- The bearing must be dry and clean.
- The crankshaft must not be turned during the measuring operation.
- The measuring point should be right next to the respective dead centre position.
- Do not hammer the bearing caps down.

Lay a length of "PLASTIGAGE" along the crankshaft main bearing journal across the bearing. Fit the main bearing cap dry with the bearing shell and tighten it down to the specified torque. The plastic thread is compressed to a greater or lesser degree depending on the bearing clearance. Remove the bearing cap again.

Check the width of the squashed plastic thread against the scale printed on the "PLASTIGAGE" pack. The measurement corresponds to the bearing clearance, Fig.36 (B, C).

Always make sure that the bolts used to secure the crankshaft bearings are in good condition. Do not tighten them beyond the specified torque.

Measure each main bearing one at a time, without the remaining bearing caps being fitted.

Overhaul the main bearing journals and renew the bearing shells as necessary.

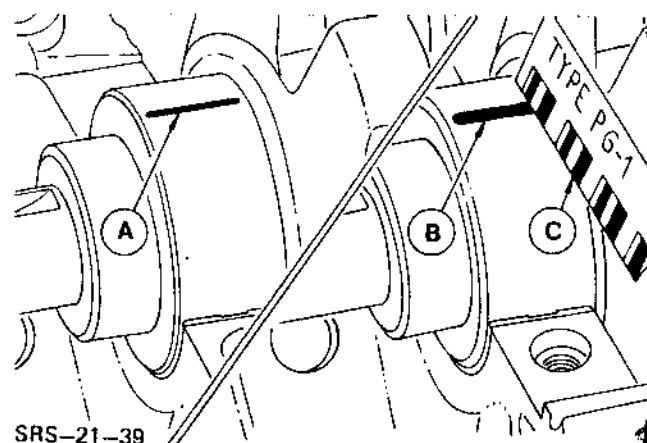


Fig.36. Measuring bearing clearance.
A - Calibrated plastic thread
B - Squashed plastic thread
C - Measuring scale

Crankshaft Main Bearing Journals

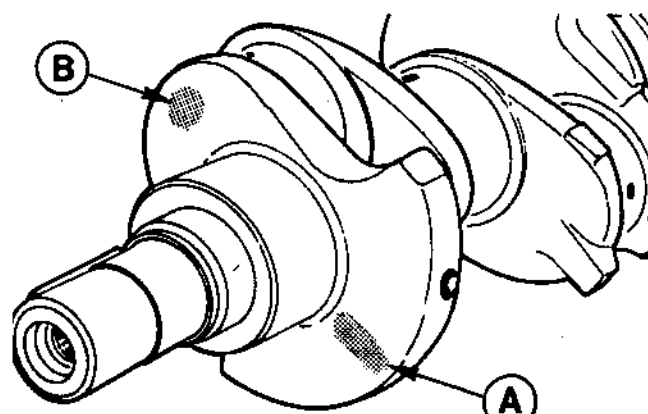
The crankshaft main bearing journals are unmarked.

NOTE: Only standard crankshafts are fitted in production. 0,25 and 0,5 mm oversize crankshafts are available for service (see Parts Microfiche).

Crankshaft Big-End Bearing Journals

The crankshaft big-end bearing journals are unmarked.

NOTE: The grooved bearing shells go in the cylinder block and the smooth bearing shells in the bearing caps.



COS-21-33

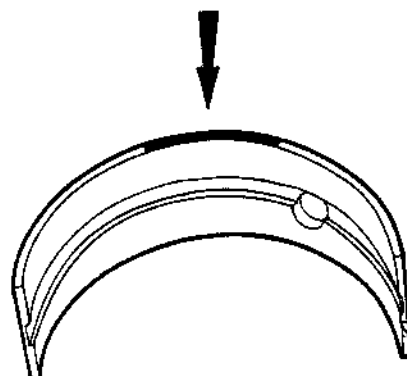
Fig.37. Crankshaft paint marks (eliminated).
A - Undersize main bearing journals
B - Undersize big-end bearing journals

Bearing shells

Standard main and big-end bearings shells have no paint marks. Bearing shells for undersize crankshafts have appropriate inscriptions on the back (see Parts Microfiche) and, in the case of production repair sizes, paint marks, with the exception of the pure service main and big-end bearing shells (0,5/0,75 and 1,0 mm undersize crankshaft journals), Fig.38.

When selecting new bearing shells, always check they are the right ones by referring to the Parts Microfiche and measure them.

Bearing journals and bores and bearing shells must be measured one at a time to remain within the limits of the specified bearing clearance (see Technical Data).



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Fig.38. Bearing shell paint marks (production repair size).

47. Fit the cylinder block main bearing shells dry then lubricate them with engine oil.

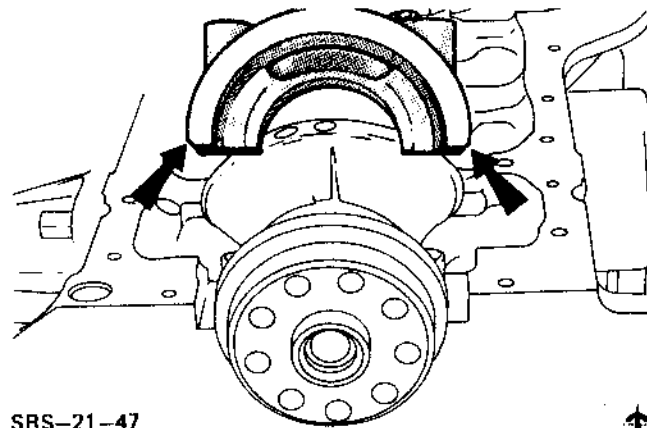
48. Fit the crankshaft.

NOTE: Fit the thrust half rings of the guide bearing the right way round, i.e. with the copper-coloured side facing outwards.

49. Oil the bearing shells and fit the main bearing caps.

NOTE: First coat the seating face and the sides of the rear main bearing cap with sealer (see Technical Data), Fig.39.

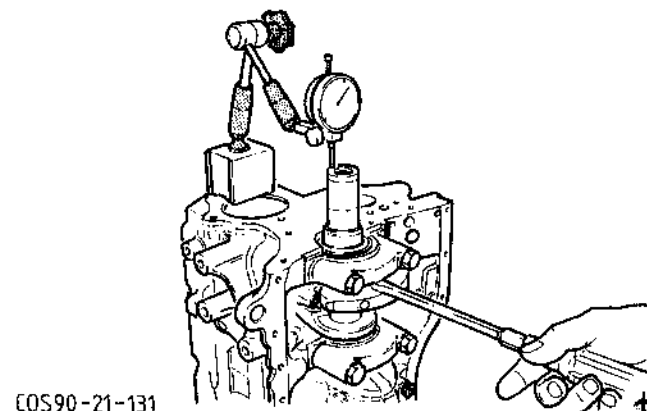
NOTE: Oil the thread and the underside of the head of all the bearing cap bolts.



SRS-21-47

Fig.39. Coat seating face and sides of rear main bearing cap with sealer.

50. Check the crankshaft end float (see Technical Data), using an ordinary dial indicator, Fig.40, and rectify as necessary with thrust half rings or flanged bearing shells (see Parts Microfiche).



COS90-21-131

Fig.40. Check crankshaft end float.

51. Remove the piston rings from the pistons and place back in the corresponding bores to check the piston ring gaps, Fig.41.

Before fitting the pistons, check the piston ring gaps. The indicated figures (see Technical Data) are for the gauge ring used in production and may be exceeded by 0,15 mm when measured in the cylinder.

52. Fit the piston rings offset on the pistons using a conventional piston ring installer.

The piston ring gaps should be positioned as shown in Fig.42.

NOTE: The first and the second piston rings are marked "TOP".

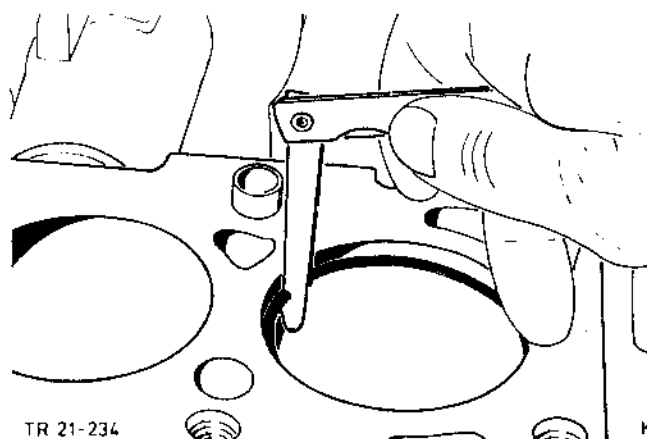


Fig.41. Check piston ring gaps.

53. Compress the piston rings using a conventional tool (piston ring compressor). Press the pistons into the cylinders using the handle of a hammer, guiding the connecting rods onto the big-end bearing journals with the other hand.

NOTE: The pistons must be fitted with the front mark (arrow) pointing towards the front of the vehicle. Use a plastic guide fork to avoid damaging the big-end bearing journals.

54. Fit the big-end bearing shells and measure the clearances using "PLASTIGAGE" as described in sub-operation 46. Change the bearing shells if necessary.

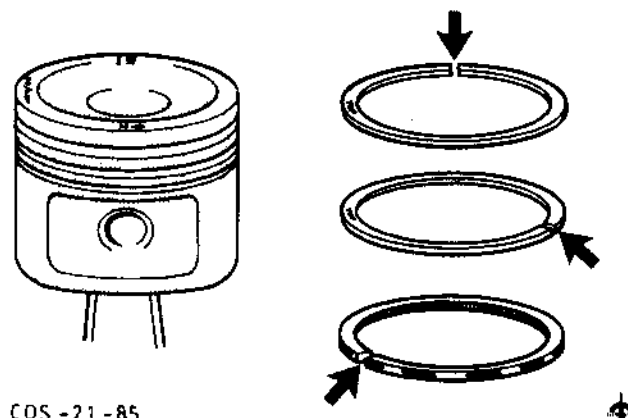


Fig.42. Position of piston ring gaps.

55. Fit the big-end bearing caps complete with oil bearing shells. Oil the thread and the contact face of the big-end bearing bolts and tighten them to the specified torque.

Check that the connecting rods have sufficient axial movement on the bearing journal (at least 0,1 mm).

56. Lubricate the sealing lip of the new rear radial oil seal with oil. Place the oil seal (with the closed side facing upwards) on a solid surface. Place Special Tool 21-011 D over the seal and press the retaining ring down by hand as far as it will go.

Apply the Special Tool with the oil seal to the engine and draw the oil seal in uniformly as far as the stop using 2 flywheel retaining bolts.

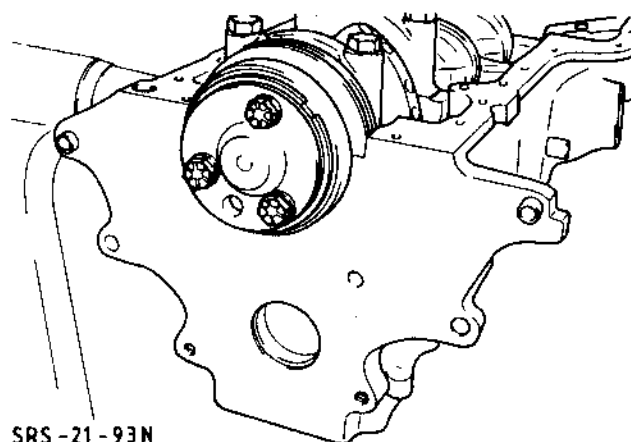


Fig.43. Draw in radial oil seal using Special Tool 21-001 D.

57. Insert the oil pump driving shaft with the short side towards the oil pump, Fig.44.

58. Fit the oil pump complete with the intake pipe and the oil pipes using Special Tool 21-012 (3 bolts), Fig.45.

NOTE: When using an overhauled or a new oil pump, this must be filled with engine oil and turned over by hand before it is fitted.

NOTE: Turn the crankshaft through 360° by hand and check that the oil spray pipe is clear of the crankshaft.

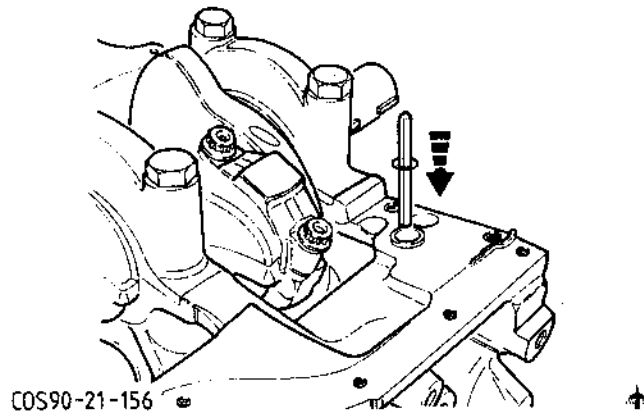


Fig.44. Oil pump driving shaft.

59. Remove the radial oil seal from the crankshaft front cover and discard.

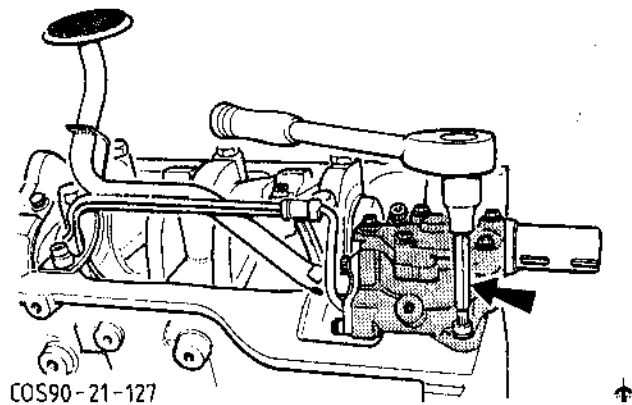


Fig.45. Fit oil pump using Special Tool 21-012.

60. Fit the crankshaft front cover and tighten the bolts to the specified torque (see Technical Data for sealer).

NOTE: The mating surfaces of the front cover and sump flange must be smooth.

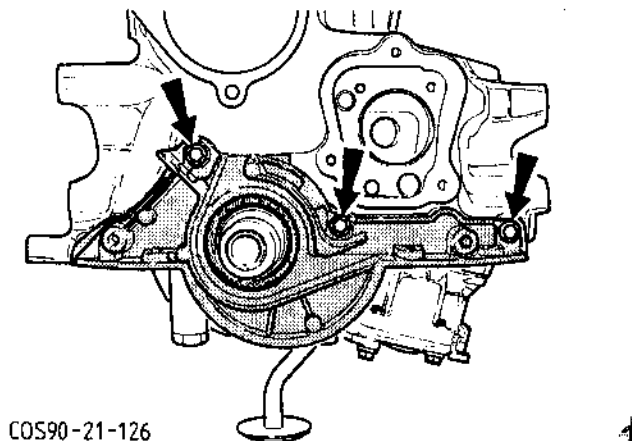


Fig.46. Retaining bolts of crankshaft front cover.

62. Lubricate the crankshaft journal and the sealing lip of the new front cover oil seal with clean engine oil.

Draw in the new front cover oil seal using Special Tool 21-009 B and the bolt and washer of the crankshaft V-belt pulley, Fig.47.

63. Fit the auxiliary shaft with the thrust plate, Fig.48 (B).

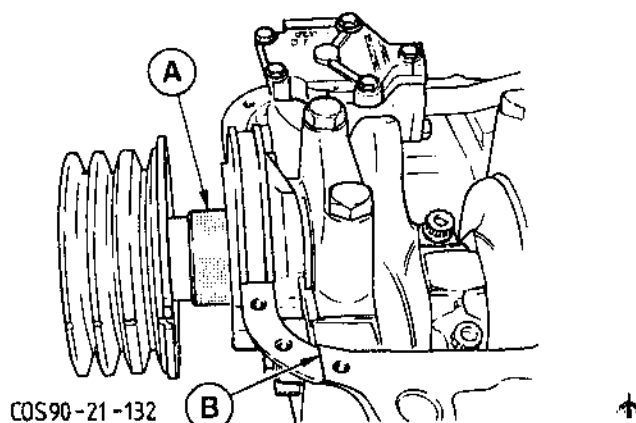


Fig.47. Fit front cover radial oil seal.

A - Special Tool 21-009 B
B - Contact point of front cover and sump

Fig.48. Auxiliary shaft.

A - Draw in radial oil seal using Special Tool 21-009 B
B - Thrust plate

64. Remove the radial oil seal from the auxiliary shaft front cover and discard.

65. Fit the auxiliary shaft front cover loosely and install a new radial oil seal using Special Tool 21-009 B. Do this using a longer bolt (than the original bolt) with the original washer.
Tighten the front cover retaining bolts.

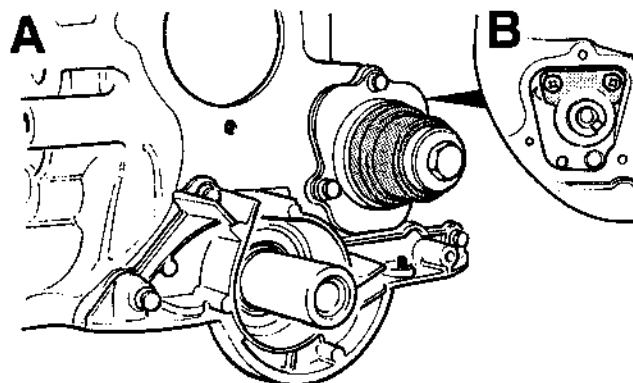


Fig.48. Auxiliary shaft.

66. Smear the ends of the rubber seals with sealer (see Technical Data) and insert them in the slot in the rear main bearing cap and the front cover, Fig.49.

Smear the cylinder block mating face with sealer at the contact point with the front cover.
Slide the sump gasket under the cut out in the rubber seal.

67. Coat the sump mating face with sealer s (see Technical Data). Locate the sump and the cable clip of the engine speed/TDC sensor in position. Screw in the bolts and tighten them to the specified torque.

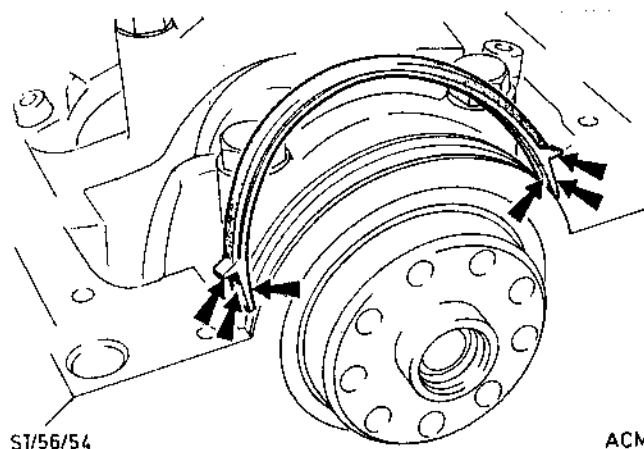


Fig.49. Smear ends of rubber seal of rear main bearing with sealer.

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Engine - 83 US

68. Fit the flywheel in the marked position, Fig.50 (B).

NOTE: Use new bolts.

69. Fit the pilot bearing using Special Tool 21-044 A, Fig.50 (A).

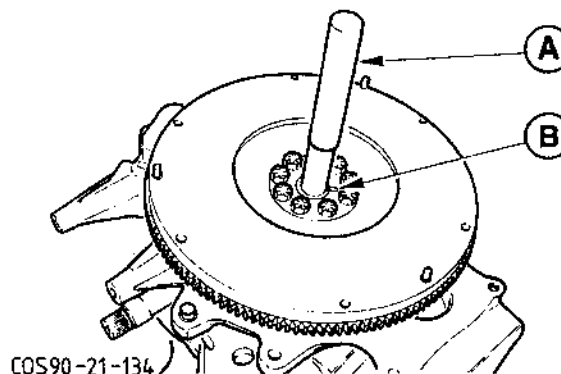
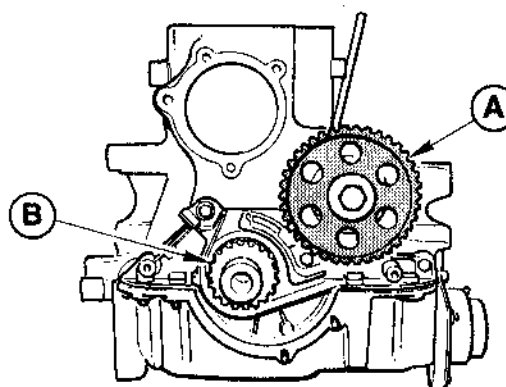


Fig.50. A - Fit pilot bearing using Special Tool 21-044 A
B - Marking

70. Fit the clutch pressure plate and clutch disc, centering the clutch disc using Special Tool 21-044 A.

71. Fit the auxiliary shaft toothed belt pulley, Fig.51 (A).

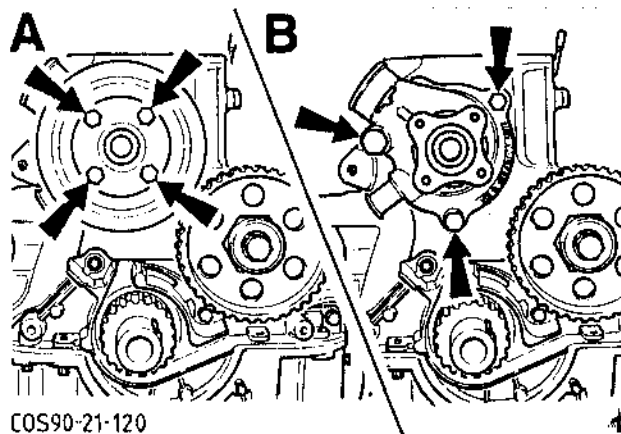


COS90-21-135

Fig.51. Toothed belt pulleys.
A - Auxiliary shaft
B - Crankshaft

72. Fit the crankshaft toothed belt pulley with the chamfered side facing the engine, Fig.51 (B).

73. Fit the water pump (3 bolts, 1 with a spacer sleeve), Fig.52 (B).



COS90-21-120

Fig.52. Water pump.
A - Retaining bolt of V-belt pulley
B - Retaining bolts

74. Fit the water pump V-belt pulley (4 bolts), Fig.52 (A).

75. Locate the wiring of the knock sensor and the engine speed/TDC sensor in position. Screw the knock sensor into the cylinder block and fit the engine speed/TDC sensor to the sump, Fig.53 (B, C). Fit the cable brackets to the sump, front cover and cylinder block, Fig.53 (A).

Fig.53. Knock sensor and engine speed/TDC sensor.
A - Retaining bolts of cable brackets
B - Retaining nuts of engine speed/TDC sensor
C - Knock sensor

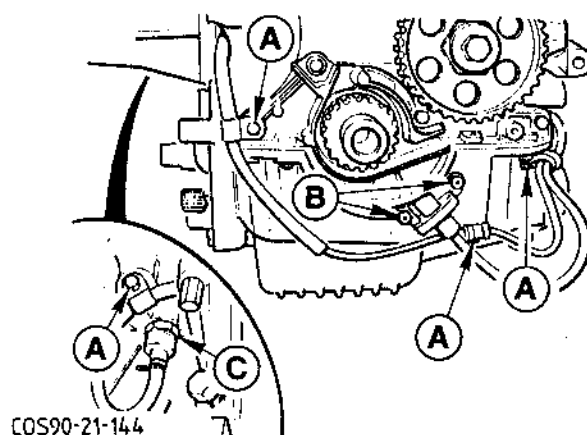


Fig.53. Knock sensor and engine speed/TDC sensor.

76. Fit the oil pressure switch, Fig.54 (B). Fit the oil separator with the lower breather hose to the cylinder block/sump, Fig.54 (A).

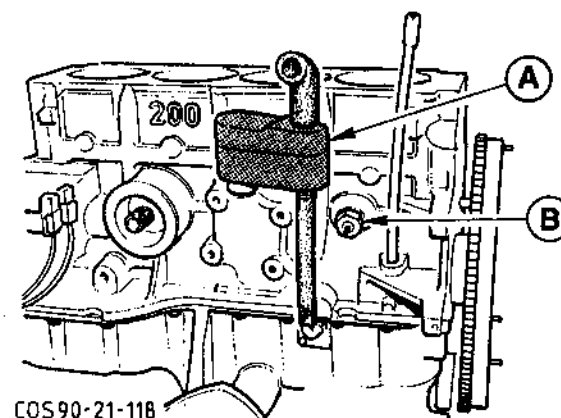


Fig.54. A - Oil separator
B - Oil pressure switch

77. Fit the distributor in conjunction with Special Tool 21-152 and align it roughly as shown in Fig.55.

Fit the clamping plate and the retaining bolt but do not tighten.

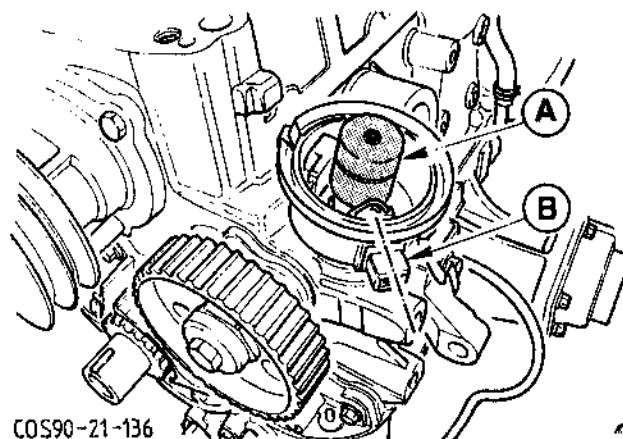
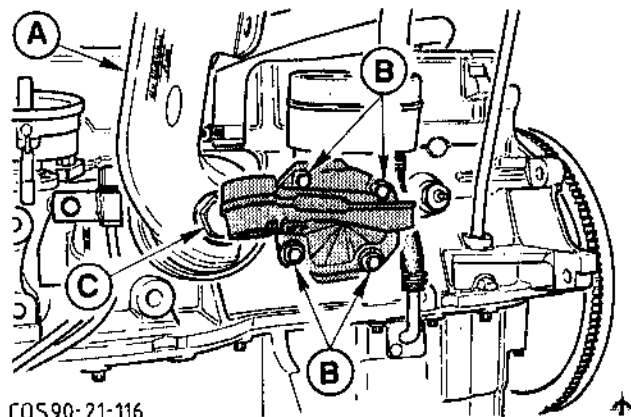


Fig.55. Distributor fitted.
A - Special Tool 21-152
B - Multiplug connector aligned.

78. Fit the oil cooler complete with the coolant hoses (1 inlet union screw), Fig.56 (C).

Fig.56. Oil filter/oil cooler connecting housing and engine mounting.
 A - Connecting housing swung up
 B - Retaining bolts of engine mounting
 C - Nut on oil cooler inlet union screw



COS90-21-116

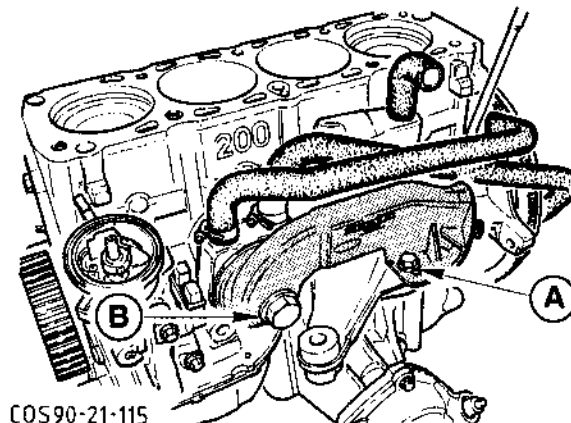
Fig.56. Oil filter/oil cooler connecting housing and engine mounting.

79. Fit the oil filter/oil cooler connecting housing on the oil cooler inlet union screw in the nut and swing it up, Fig.56 (A).

Fit the engine mounting to the cylinder block (4 bolts), Fig.56 (B).

Fit the connecting housing to the engine mounting (1 bolt), Fig.57 (A).

Tighten the nut on the oil cooler inlet union screw, Fig.57 (B).



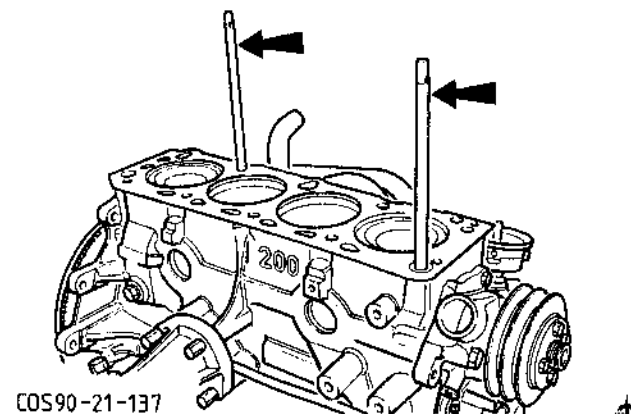
COS90-21-115

Fig.57. Oil filter/oil cooler connecting housing.
 A - Bolt in engine mounting
 B - Nut on oil cooler inlet union screw

80. Fit the oil filter (after it makes contact tighten a further half to three-quarters of a turn.

NOTE: Lubricate the rubber seal with oil.

81. Screw in the cylinder head locating studs, Special Tool 21-128, into the tapped holes in the cylinder head, Fig.58.



COS90-21-137

Fig.58. Cylinder head locating studs inserted.

82. Make sure that the mating faces of the cylinder block and cylinder head and the new gasket are clean. Place the cylinder head gasket on the cylinder block (marked "TOP/OBEN").

83. Fit the cylinder head complete with the inlet and exhaust manifolds and turbocharger and connect the thermostat housing/water pump connecting hose at the same time.

NOTE: Before inserting the cylinder head bolts, lubricate the U-shaped washers, the thread and the underside of the head of the bolts with engine oil.

Insert the bolts and screw them in finger tight. Unscrew the locating studs and insert the remaining bolts.

Tighten the cylinder head bolts to the specified torque in 2 stages (see Technical Data) in the indicated sequence, Fig.59.

84. Turn the cylinder head bolts $180^\circ + 10^\circ$ more in the same sequence using Special Tool 21-002 and a proprietary angle gauge, and note the tightening torque obtained.

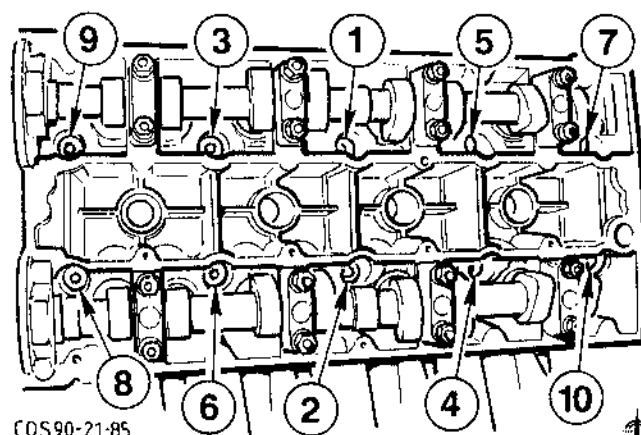
NOTE: A tightening torque of less than 115 Nm is not acceptable and bolts with a torque below this figure must be changed. When all the bolts have been tightened, check that no bolt can be turned any more applying a torque of 110 Nm.

85. Fit the spark plugs and tighten them to the specified torque.

86. Secure the thermostat housing/water pump connecting hose, Fig.60.

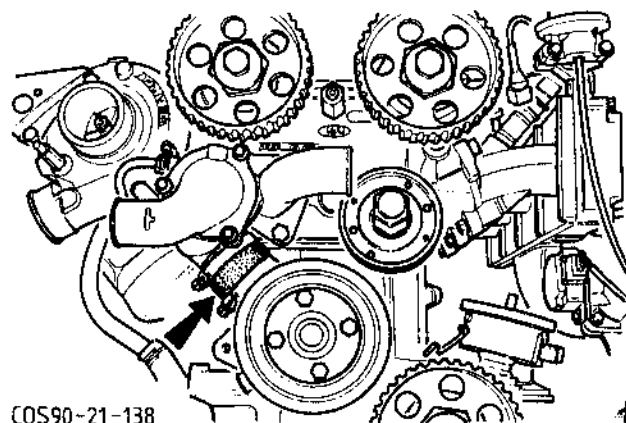
87. Connect the turbocharger oil return hose to the sump.

88. Fit the engine breather valve bracket to the inlet manifold and connect the hose to the engine breather valve, Fig.61.



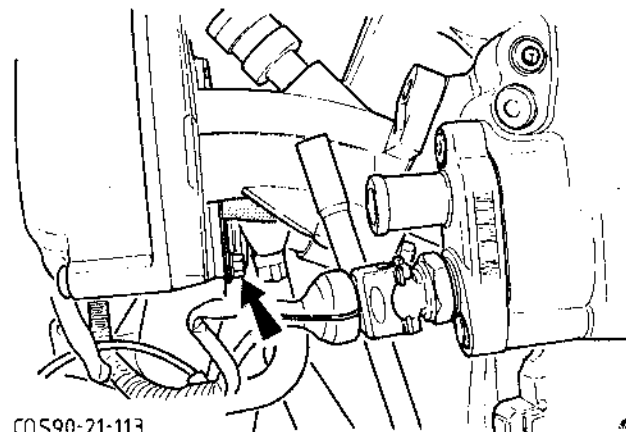
COS90-21-85

Fig.59. Cylinder head bolt tightening sequence.



COS90-21-138

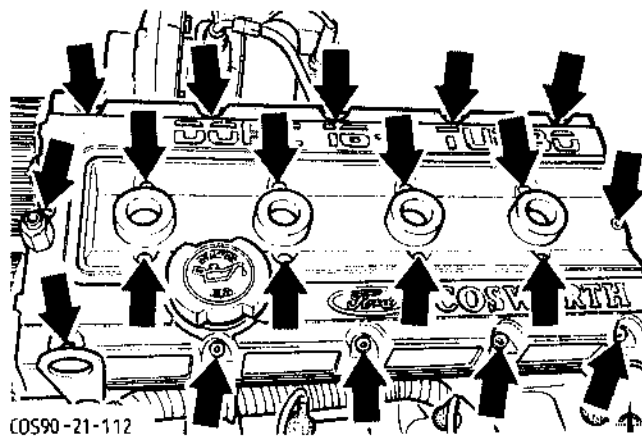
Fig.60. Coolant hose from thermostat housing to water pump fitted.



COS90-21-113

Fig.61. Retaining nut of engine breather valve bracket.

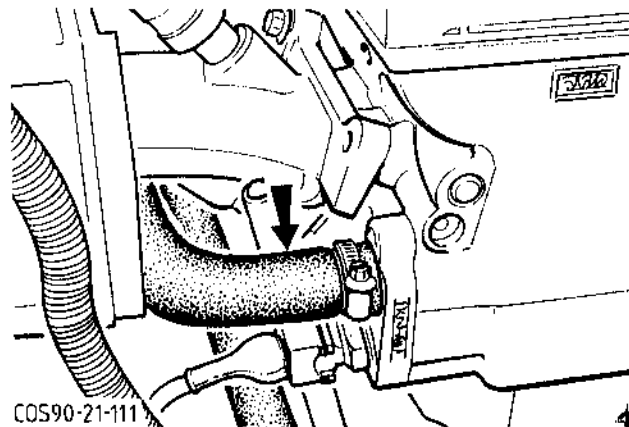
89. Fit the cylinder head cover (20 bolts), Fig.62.



COS90-21-112

Fig.62. Retaining bolts of cylinder head cover.

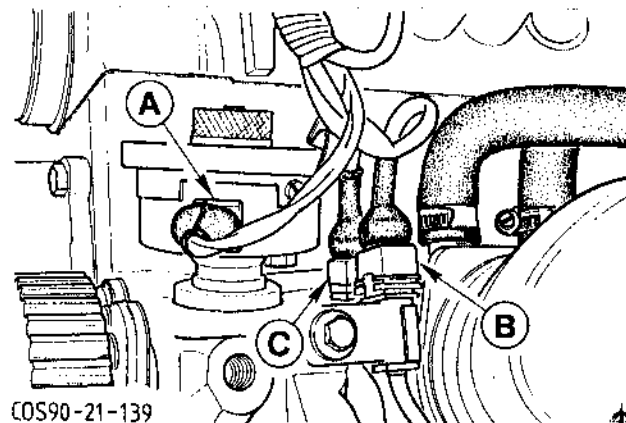
90. Connect the coolant hose to the cylinder head connecting flange at the rear, Fig.63.



COS90-21-111

Fig.63. Coolant hose to cylinder head connecting flange at rear.

91. Connect the multiplugs of the engine speed/TDC sensor, knock sensor and distributor, Fig.64.



COS90-21-139

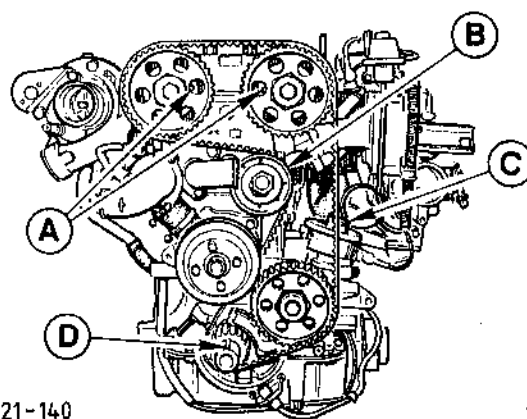
Fig.64. Multiplugs.
A - Distributor
B - Engine speed/TDC sensor
C - Knock sensor

92. Connect the plug to the oil pressure switch.

93. Fit and tension the toothed belt:

- Align the crankshaft and the 2 camshafts on the TDC marks, Fig.65 (A, D).
- Fit the toothed belt and turn the tensioning pulley towards the toothed belt in a clockwise direction by hand and tighten the retaining nut of the tensioning pulley, Fig.65 (B).

NOTE: When using the original toothed belt, note the direction in which it runs.



COS90-21-140

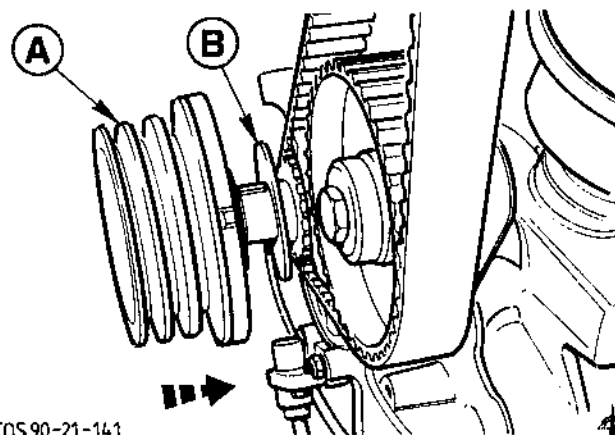
Fig.65. Toothed belt fitted.

Fig.65. Toothed belt fitted.

- A - TDC position on camshaft toothed belt pulleys
- B - Tensioning pulley
- C - Special Tool 21-152
- D - TDC position of crankshaft

- Fit the thrust washer on the crankshaft with the curved side facing inwards and fit the crankshaft vibration damper/V-belt pulley, Fig.66.
- Turn the engine 2 revolutions in the normal direction of rotation and then turn it back 1 complete revolution to the TDC position.

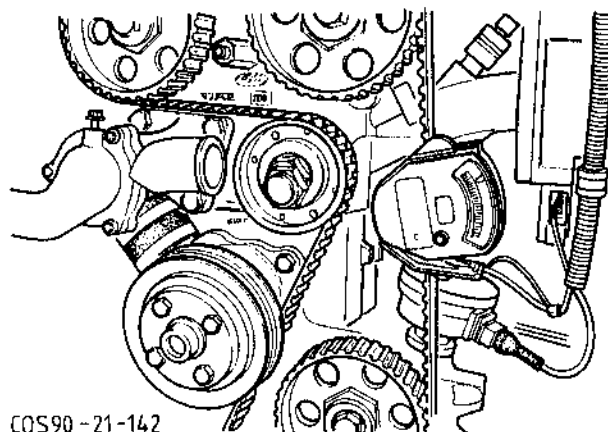
NOTE: Do not turn it beyond the TDC position.



COS90-21-141

Fig.66. A - Crankshaft vibration damper/V-belt pulley
B - Thrust washer

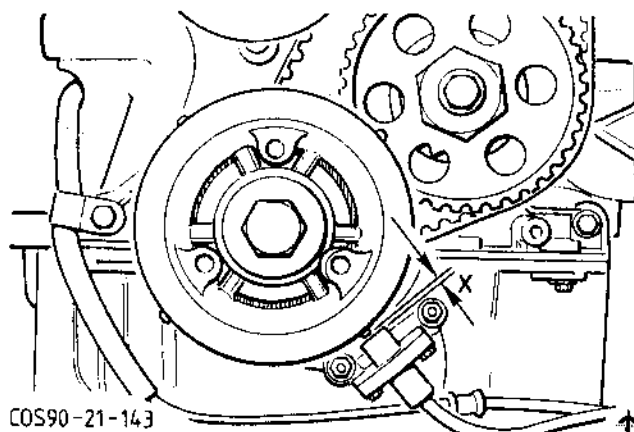
- Check the toothed belt tension using Special Tool 21-113 on the longest span, Fig.67. Turn the tensioning pulley to adjust the tension to specification (see Technical Data). Tighten the retaining nut of the tensioning pulley.
- Re-check the toothed belt tension and the TDC positions and repeat the tensioning operation if necessary.



COS90-21-142

Fig.67. Check toothed belt tension using Special Tool 21-113.

94. Turn the crankshaft until a tooth on the V-belt pulley lines up with the sensor. Set the distance between the sensor and the tooth to 0,6 to 1,0 mm, Fig.68.

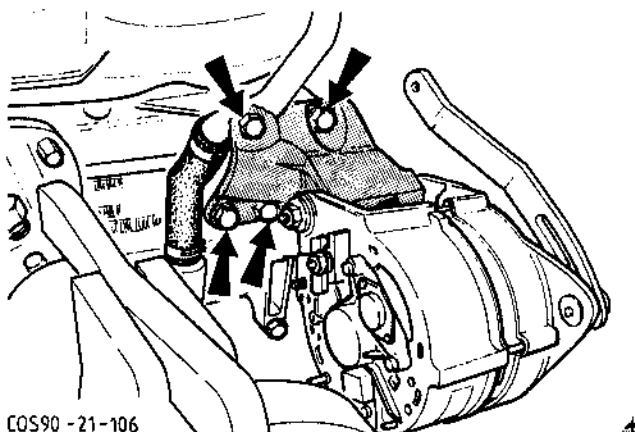


COS90-21-143

Fig.68. Engine speed/TDC sensor setting.
X = 0,6 to 1,0 mm

95. Fit the rotor arm. Fit the distributor cap with the HT leads, route the HT leads and connecting them to the spark plugs.

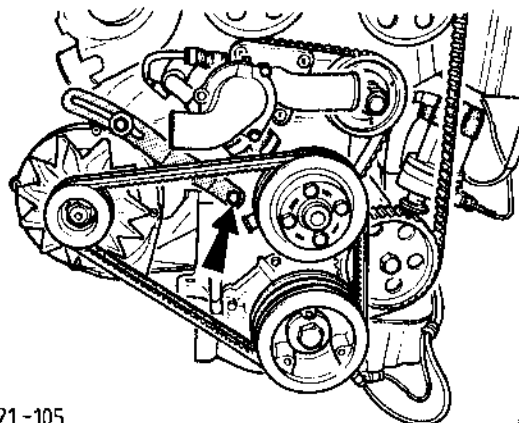
96. Fit the alternator and bracket to the cylinder block, Fig.69.



COS90-21-106

Fig.69. Retaining bolts of alternator bracket.

97. Fit the alternator adjusting strap to the cylinder block. Fit the V-belt and tension it (see Technical Data), Fig.70.



COS90-21-105

Fig.70. Retaining bolt of alternator adjusting strap.

98. Fit the toothed belt cover, Fig.71.
99. Fit the bracket of the oil dipstick tube and insert the oil dipstick.
100. Fit the power steering pump mounting carrier, Fig.72 (A), with the 2 hexagon socket head cap screws, Fig.72 (D). Press the carrier to the rear while tightening the screws. Tighten the screws to the specified torque.

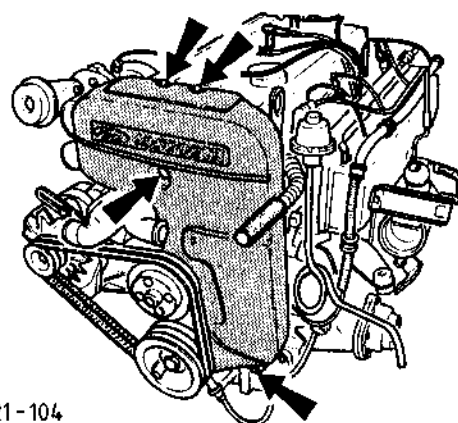
Fig.72. Power steering pump mounting carrier and carrier support (Cosworth '86/'88 shown).
A - Mounting carrier
B - Carrier support
C - Clip of engine speed/TDC sensor
D - Hexagon socket head cap screws
E - Hexagon bolts
F - Hexagon socket head cap screws
G - Mating face

101. Fit the power steering pump carrier support, Fig.72.

- Smear the mating face (G) under the carrier support with sealer (see Technical Data). Do not use a paper gasket.
- Locate the carrier support (B) together with the bracket for the multiplugs of the knock sensor and the engine speed/TDC sensor in position and screw in the 2 hexagon bolts (E) finger tight.
- Insert the hexagon socket head cap screw (F) to connect the carrier and support.
- Tighten the 2 hexagon bolts (E) until just tight.
- Tighten the hexagon socket head cap screw (F) to the specified torque.
- Torque the hexagon bolts (E) to the specified torque.

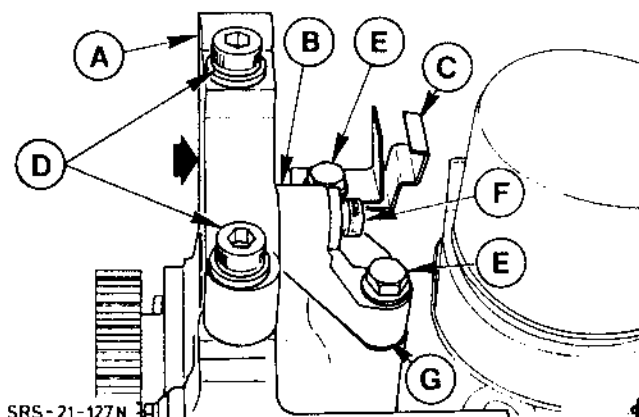
102. Fit the power steering pump and bracket, Fig.73.

103. Fit the V-belt of the power steering pump and tension it (see Technical Data).



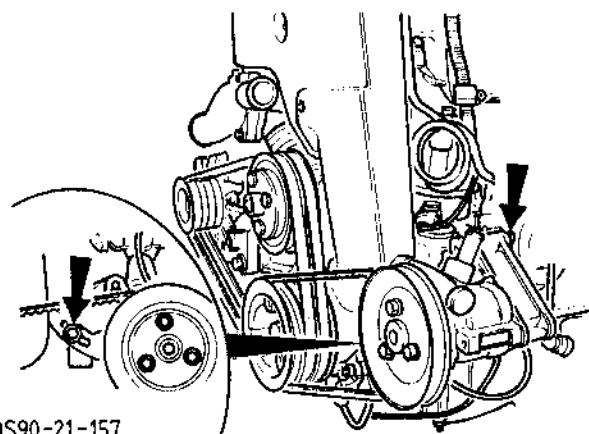
COS90-21-104

Fig.71. Retaining bolts of toothed belt cover.



SRS-21-127N

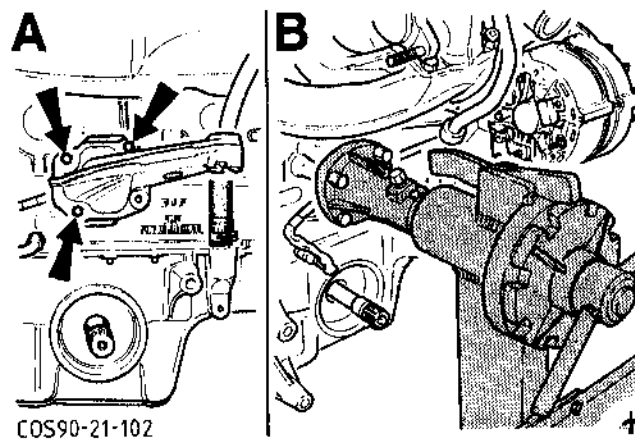
Fig.72. Power steering pump mounting carrier and carrier support (Cosworth '86/'88 shown).



COS90-21-157

Fig.73. Retaining bolts of power steering pump.

104. Remove the engine from the assembly stand, Fig.74 (B).



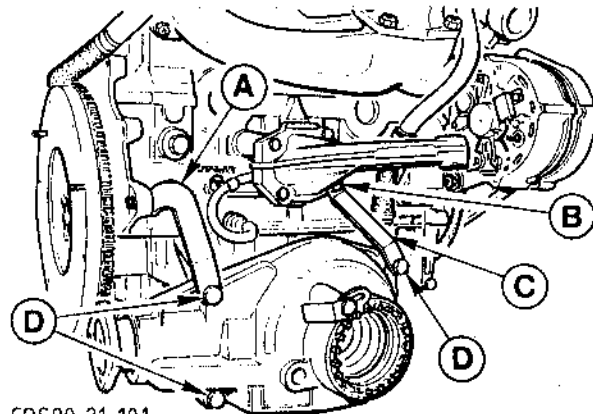
COS90-21-102

Fig.74. A - Retaining bolts of engine mounting
B - Engine on assembly stand

105. Secure the engine mounting with the 3 bolts, Fig.74 (A).

106. Fit the front axle assembly and brackets to the sump/cylinder block, Fig.75.

NOTE: Use a new 'O'-ring.



COS90-21-101

Fig.75. Front axle assembly.

107. Fit the oil drain plug with a new seal. Fill up with engine oil (see Technical Data for quantity and specification).

- A - Front bracket
B - Rear bracket
C - Retaining bolt of bracket/engine mounting
D - Retaining bolts of front axle assembly

21 163 0 CYLINDER HEAD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Socket wrench	21-002
Toothed belt tension test gauge ..	21-113
Cylinder head locating studs ..	21-128
Fuel pipe disconnecter	23-027 A

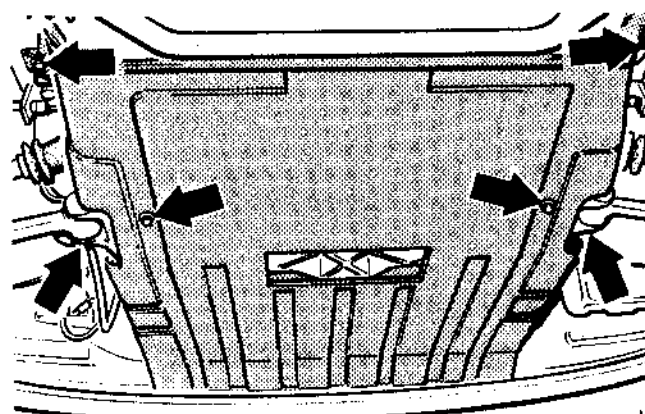
NOTE: The engine must be allowed to cool completely before removing the cylinder head with the turbocharger and inlet manifold.

To Remove

1. Disconnect the battery earth cable.
2. Raise the vehicle.
3. Detach the engine cover from the side members and the front axle/engine crossmember on the left and right-hand sides (6 bolts), Fig.1. Remove the cover.
4. Place a clean collecting tray under the radiator. Disconnect the lower right-hand side coolant hose from the radiator, Fig.2, and drain off the coolant.
5. Lower the vehicle to the ground.
6. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.3 (B).
7. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.3 (A, C, D).

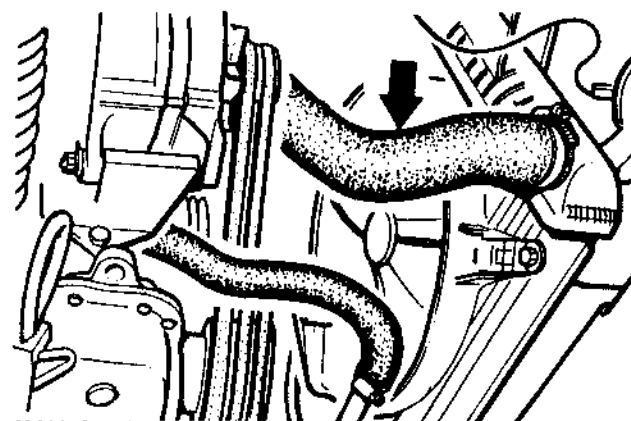
Fig.3. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut



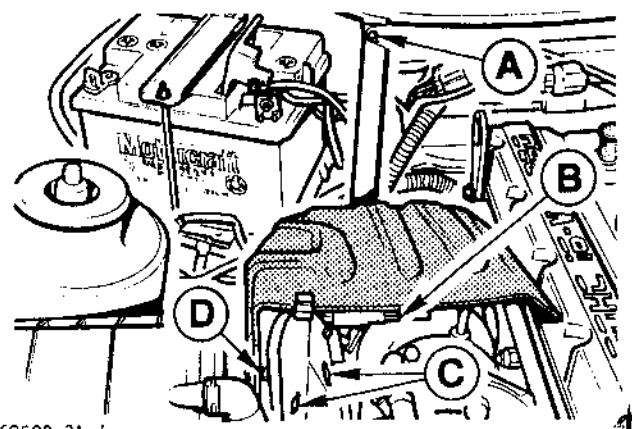
COS90-21-11

Fig.1. Retaining bolts of lower engine cover.



COS90-21-41

Fig.2. Lower coolant hose on radiator.



COS90-21-4

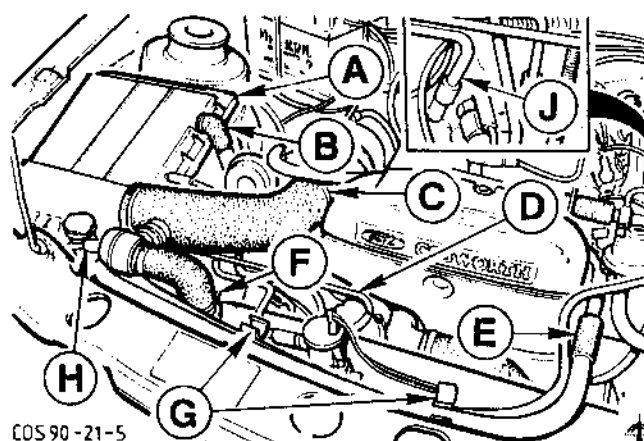
Fig.3. Turbocharger heat shield.

8. Remove the air cleaner cover with the air hoses, Fig.4:

- Disconnect the air pipe to the engine breather valve at the connecting hose and unclip it from the radiator grille panel. Disconnect the air pipe from the air cleaner cover at the solenoid control valve.
- Disconnect the intake air hose from the turbocharger.
- Disconnect the air hose from the by-pass valve at the intercooler.
- Disconnect the vacuum pipe from the by-pass valve at the inlet manifold plenum chamber and unclip it from the radiator grille panel.
- Unclip the air cleaner cover (5 clips) and remove it with the air hoses/pipes.
- Remove the air cleaner element from the air cleaner casing.

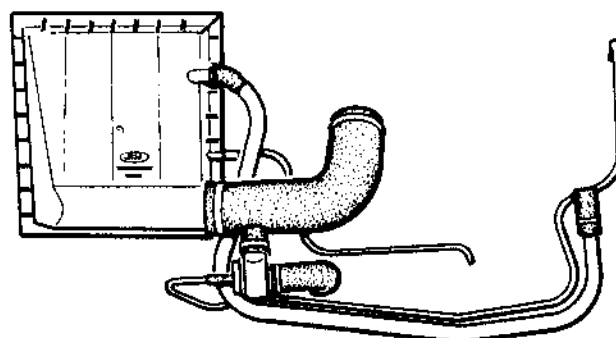
Fig.4. Air cleaner cover with air hoses/pipes.

- A - Air cleaner cover
- B - To engine breather valve
- C - To turbocharger
- D - From solenoid control valve
- E - Connecting hose of engine breather valve air pipe
- F - By-pass valve to intercooler
- G - Clips
- H - Vacuum pipe from by-pass valve to inlet manifold plenum chamber
- J - Connection of vacuum pipe from by-pass valve



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Fig.4. Air cleaner cover with air hoses/pipes.



COS90-21-6

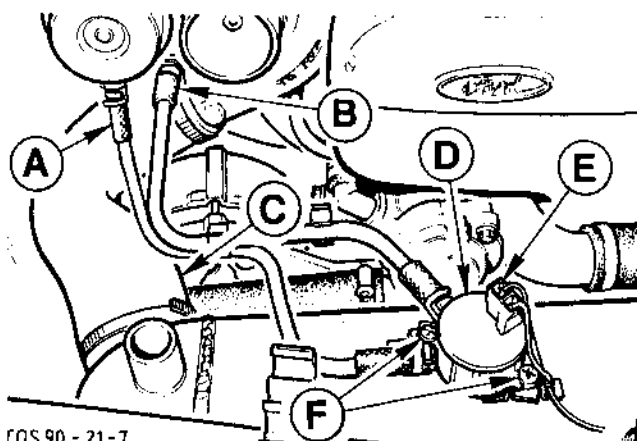
Fig.5. Air cleaner cover and air hoses/pipes removed.

9. Remove the solenoid control valve from the intercooler:

- Disconnect the solenoid control valve vacuum pipe from the turbocharger diaphragm unit, Fig.6 (A), and from the turbocharger compressor housing, Fig.6 (B).
- Disconnect the solenoid control valve multiplug, Fig.6 (E).
- Remove the solenoid control valve retaining screws Fig.6 (D, F), and remove it with the vacuum pipes.

Fig.6. Solenoid control valve and turbocharger lower air hose.

- A - Vacuum pipe to diaphragm unit
- B - Vacuum pipe to compressor housing
- C - Turbocharger lower air hose
- D - Solenoid control valve
- E - Multiplug
- F - Retaining screws



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Fig.6. Solenoid control valve and lower air hose.

10. Disconnect the lower air hose from the turbocharger, Fig.6 (C).

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11. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.7, withdraw it from the engine lifting eye and place it to one side.

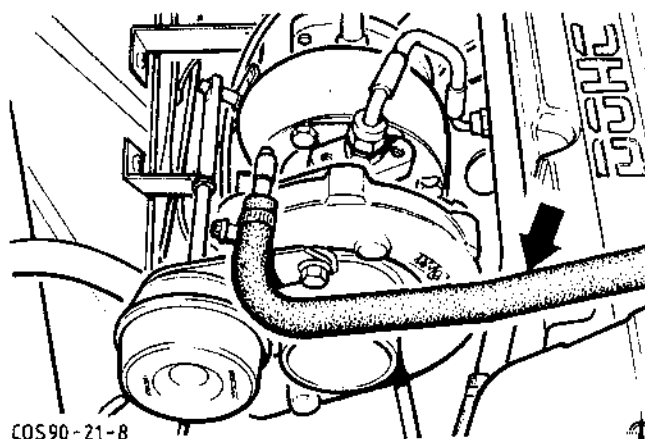


Fig.7. Coolant hose to degas tank.

12. Unclip the throttle cable from the throttle linkage (1 clip). Compress the 2 sprung lugs of the retaining clip using pliers and detach the throttle cable from the bracket, Fig.8.

Fig.8. Detach throttle cable.

- A - Throttle cable
- B - Throttle linkage clip
- C - Retaining clip

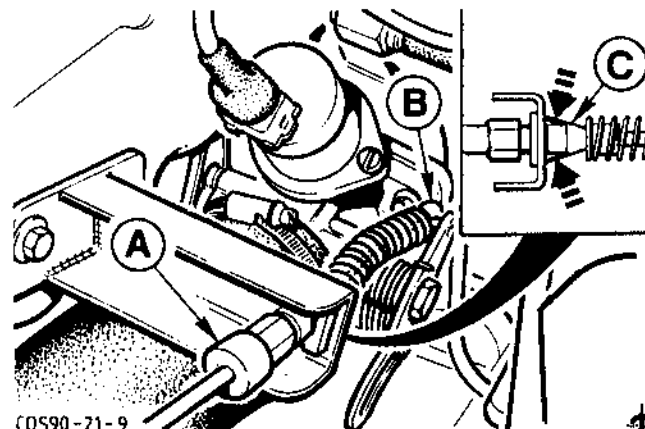


Fig.8. Detach throttle cable.

13. Disconnect the air hose from the intercooler to the throttle housing, Fig.9.

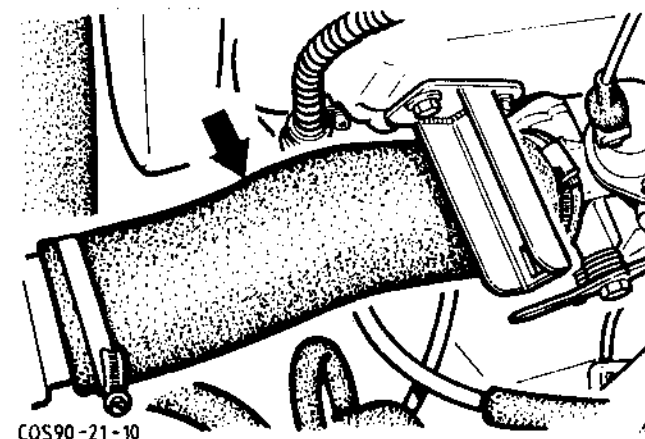
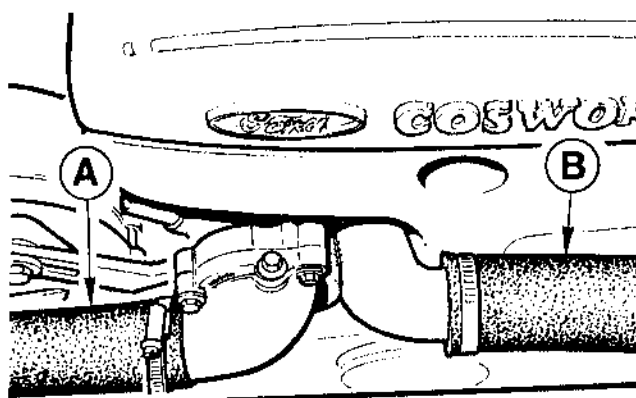


Fig.9. Air hose from intercooler to throttle housing.

14. Disconnect the coolant hose from the thermostat housing and dismantle and remove the coolant hose to the lower right-hand side of the radiator, Fig.10.



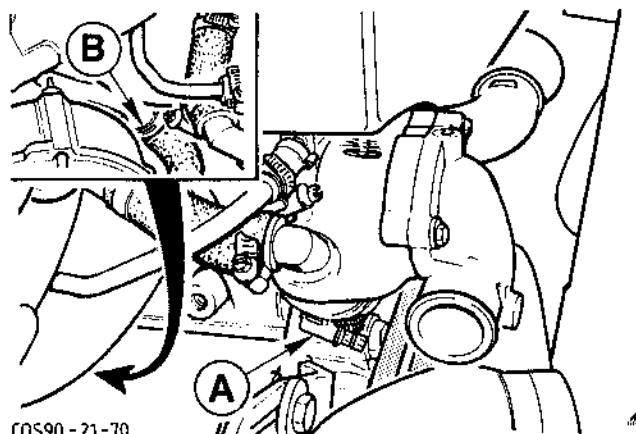
COS90-21-12

Fig.10. Coolant hoses on thermostat housing.
A - To lower right-hand side of radiator
B - To upper left-hand side of radiator

15. Release the upper hose clip on the coolant hose between the thermostat housing and the water pump, Fig.11 (A).

Fig.11. Hose clips on coolant hose and oil return hose.

- A - Upper hose clip on coolant hose between thermostat housing and water pump
- B - Hose clip on turbocharger oil return hose

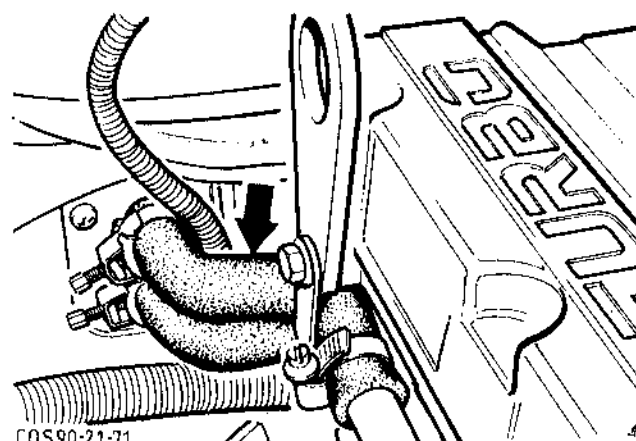


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Fig.11. Hose clips on coolant hose and oil return hose.

16. Move the hose clip of the turbocharger oil return hose down on the hose, Fig.11 (B).

17. Disconnect the upper coolant hose from the heater radiator, Fig.12.



COS90-21-71

Fig.12. Upper coolant hose to heater radiator.

21 163 0

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18. Disconnect the 3 engine wiring loom multiplugs, Fig.13.

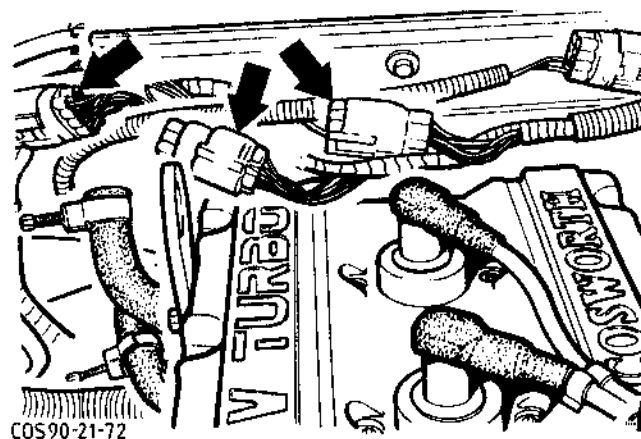


Fig.13. Engine wiring loom multiplugs.

19. Disconnect the distributor multiplug. Disconnect the multiplugs of the knock sensor and the engine speed/TDC sensor, Fig.14.

Fig.14. Multiplugs on distributor.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

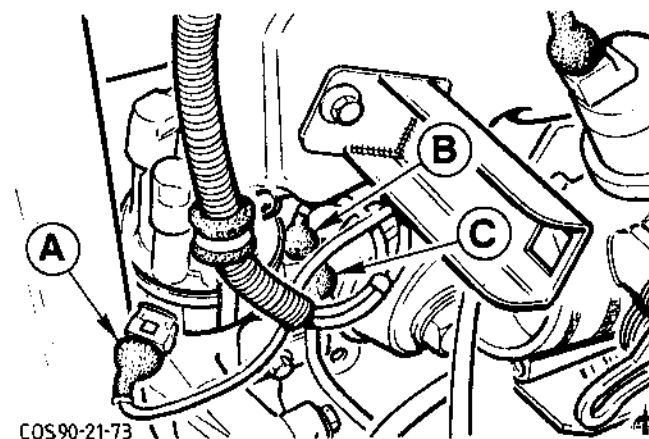


Fig.14. Multiplugs on distributor.

20. Disconnect the plug from the oil pressure switch, Fig.15.

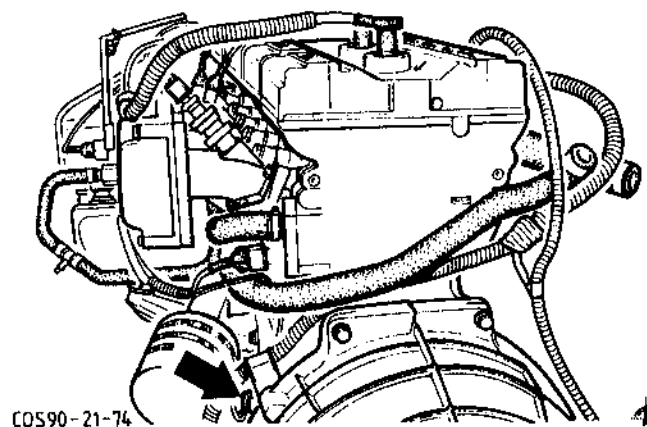


Fig.15. Oil pressure switch plug.
(shown with engine removed)

21. Disconnect the fuel pipes:

- Insert the steel wire ends of Special Tool 23-027 A in the openings in the pipe coupling and press in. Pull on the other part of the fuel feed pipe, Fig.16. and separate the coupling.
- Disconnect the fuel return pipe Fig.17, as described for the feed pipe.

Fig.16. Fuel feed pipe.

- A - Disconnect using Special Tool 23-027 A
- B - Special Tool inserted (fuel pipe shown disconnected)

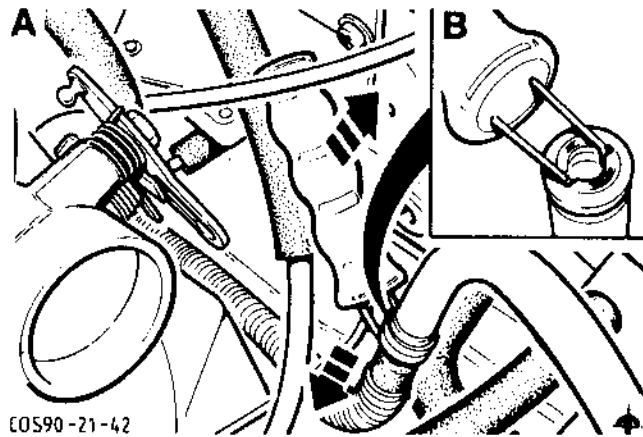


Fig.16. Fuel feed pipe.

- ## 22. Remove the oil dipstick and detach the bracket of the oil dipstick tube from the cylinder head (1 bolts), Fig.18 (A, C)

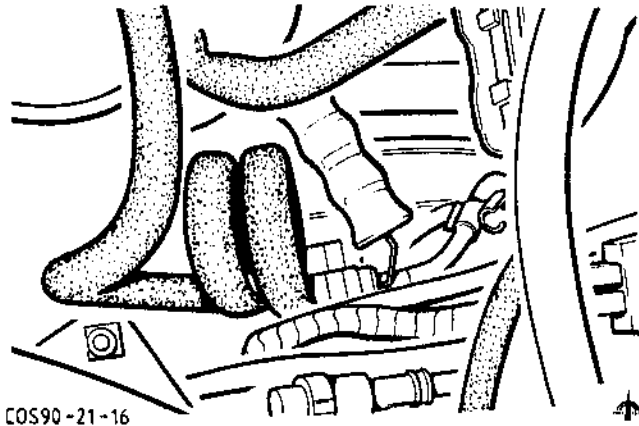


Fig.17. Disconnect the fuel feed pipe using Special Tool 23-017 A.

- ## 23. Disconnect the coolant hose to the oil cooler from the cylinder head, Fig.18 (B).

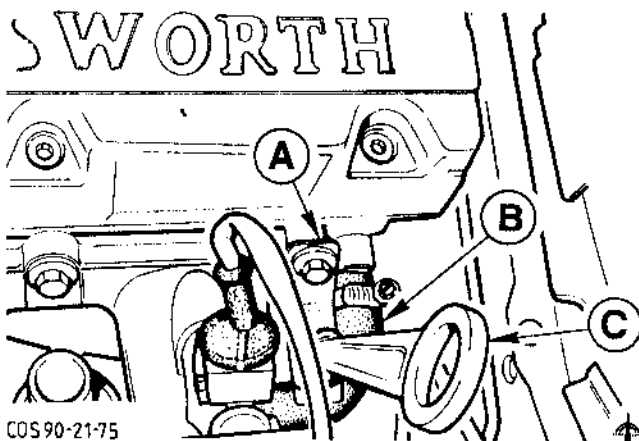


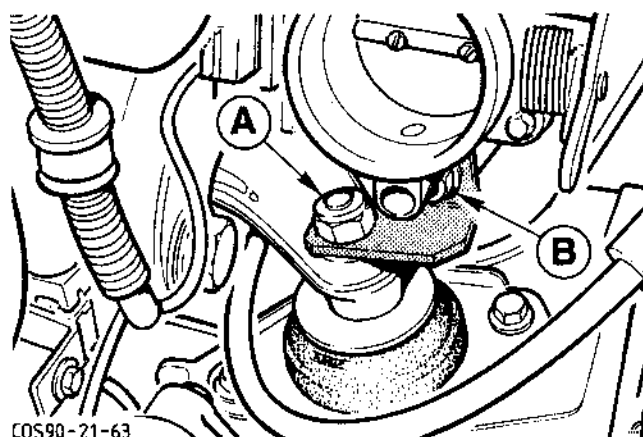
Fig.18. A - Bracket of oil dipstick tube
B - Coolant hose to oil cooler
C - Oil dipstick

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Engine - 83 US

24. Unscrew the self-locking nut on the throttle housing vibration damper, Fig.19. Release and unscrew the nut on the engine mounting (on the left-hand side).

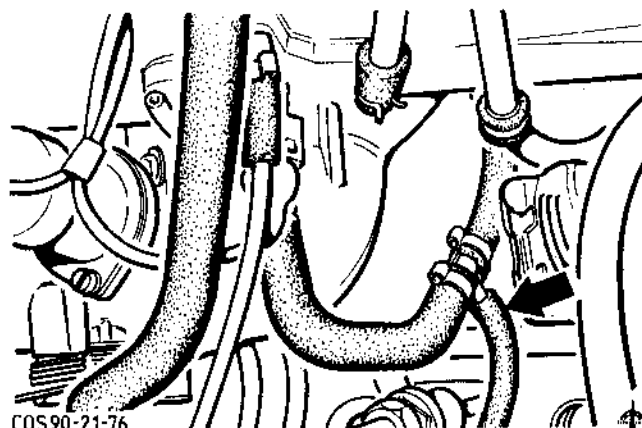
Fig.19. Throttle housing vibration damper.
A - Engine mounting nut
B - Self-locking nut with spring washers



COS90-21-63

Fig.19. Throttle housing vibration damper.

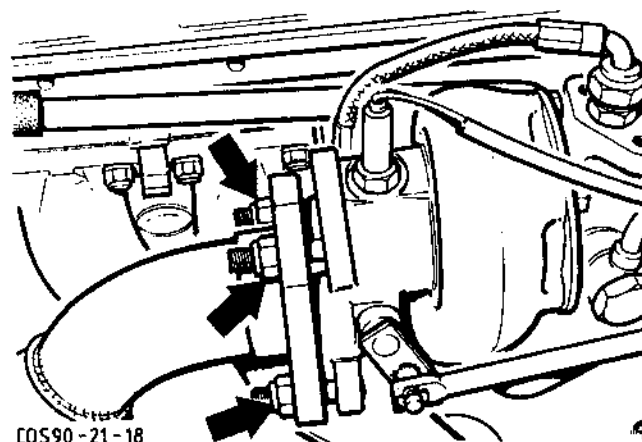
25. Disconnect the carbon canister vacuum hose from the T-piece, Fig.20.



COS90-21-76

Fig.20. Vacuum hose to carbon canister.

26. Disconnect the front exhaust pipe from the turbocharger (3 nuts), Fig.21.



COS90-21-18

Fig.21. Retaining nuts on front exhaust pipe.

27. Remove the toothed belt cover from the cylinder head/block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.22.

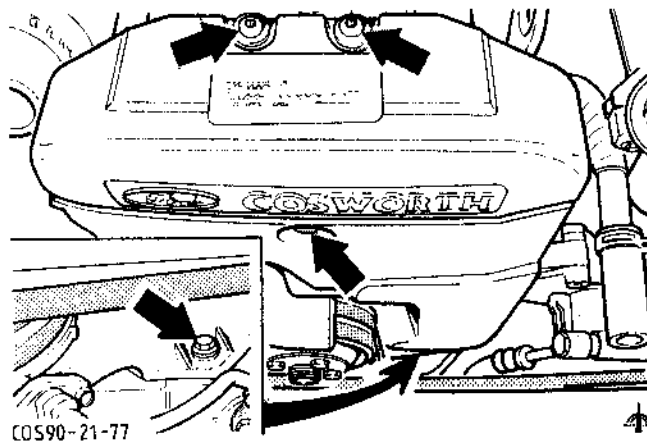


Fig.22. Retaining bolts of toothed belt cover.
(inset shows detail from below)

28. Turn the crankshaft in the normal direction of rotation using a proprietary socket wrench until the 2 camshaft toothed belt pulleys line up on the TDC mark, Fig.23.

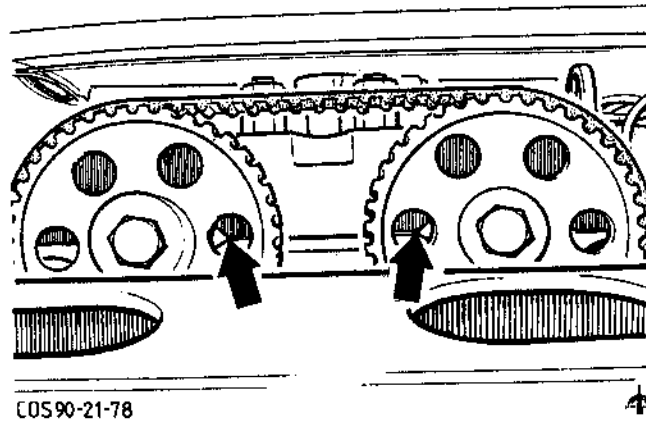


Fig.23. Camshaft toothed belt pulleys lined up to TDC marks.

29. Hold the eccentric and release the lock nut. Turn the eccentric and slacken the toothed belt, Fig.24. Remove the toothed belt.

NOTE: Mark the direction in which the toothed belt runs.

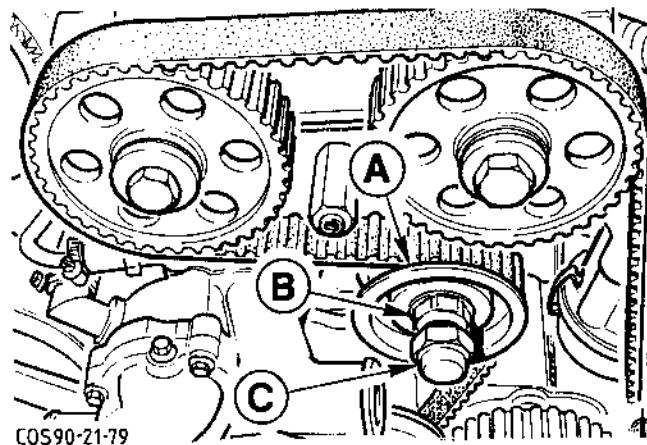


Fig.24. Toothed belt tensioning pulley.
A - Tensioning pulley
B - Eccentric
C - Locknut

30. Disconnect the spark plug connectors from the spark plugs and remove the spark plugs. Disconnect the ignition coil lead from the distributor cap. Pull the HT leads with the rubber guide downwards out of the HT lead bracket and remove the distributor cap and rotor arm, Fig.25.

Fig.25. Distributor and leads.

- A - Bracket for HT leads with rubber guide
- B - Ignition coil lead
- C - Distributor cap

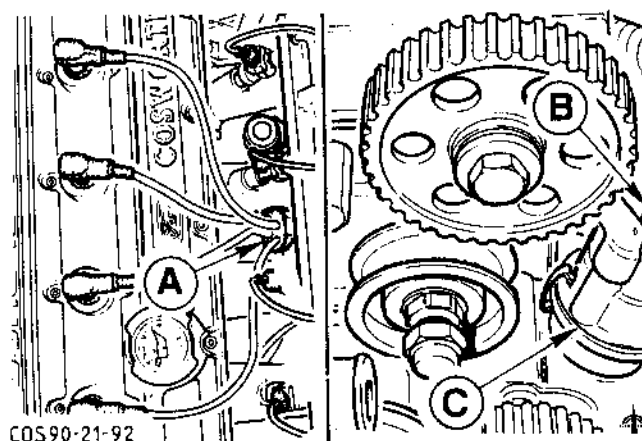


Fig.25. Distributor and leads.

31. Remove the cylinder head cover from the cylinder head (20 hexagon socket head bolts), Fig.26.

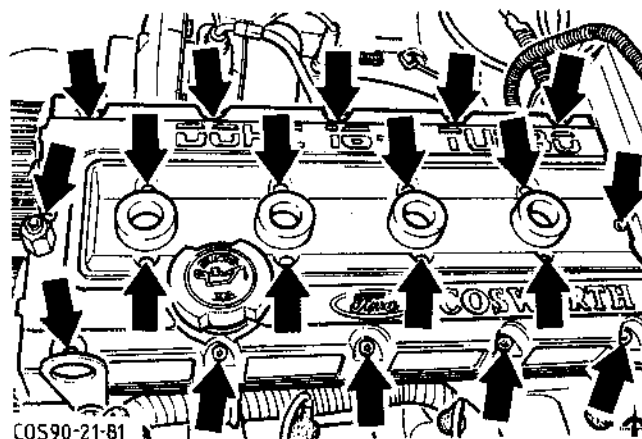


Fig.26. Retaining bolts of cylinder head cover.

32. Loosen the bolts of the engine lifting eyes, angle the engine lifting eyes towards the centre of the cylinder head and tighten the bolts again, Fig.28 (A).

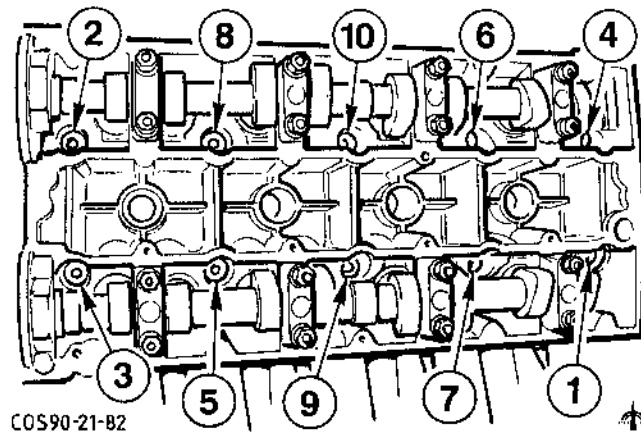


Fig.27. Cylinder head bolt loosening sequence.

33. Unscrew the 10 cylinder head bolts in the indicated loosening sequence using Special Tool 21-002, and remove them, Fig.27.

NOTE: The engine must be allowed to cool to below 45°C before the cylinder head bolts are undone.

34. Attach the hooks on the chain to the engine lifting eyes. Lift the cylinder head complete with the turbocharger and inlet manifold off the cylinder block using a hoist, Fig.28, disconnect the oil pipe from the turbocharger oil return hose, the thermostat housing connector from the coolant hose and the hose from the oil separator.

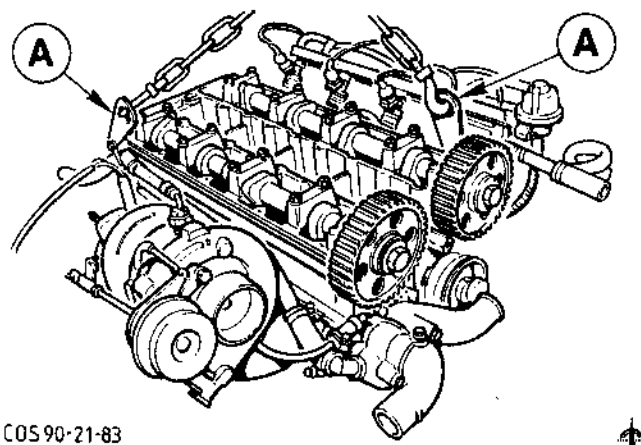


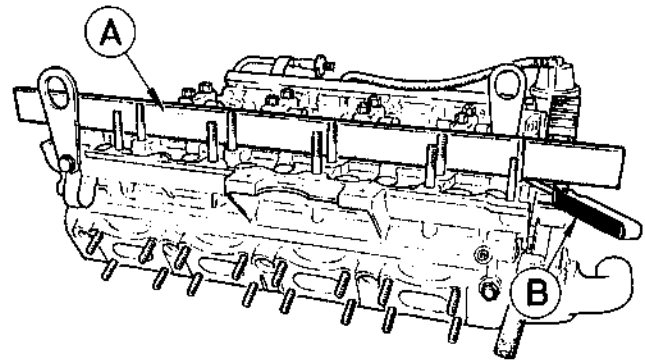
Fig.28. Cylinder head suspended and lifted clear.
A - Lifting eyes angled

Check the flatness or distortion of the cylinder head

Whenever a cylinder head is removed, the flatness of the faces mating with the cylinder block and cylinder head cover must be checked as follows:

35. Carefully clean the face mating with the cylinder head cover. Place a steel straight edge along the centre line in the longitudinal direction and check the flatness or convex distortion with a feeler gauge, Fig.29.

NOTE: If the distortion is more than 0,1 mm, the cylinder head has overheated and cannot be used again.
If the distortion is 0,1 mm or less, check the face mating with the cylinder block.



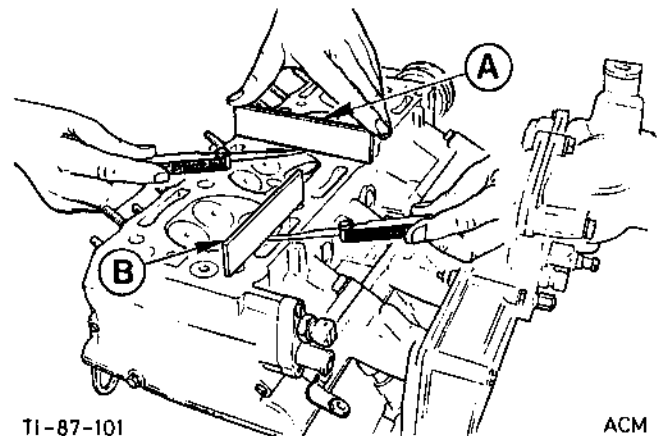
TI-87-100

Fig.29. Check flatness of face mating with cylinder head cover.

A - Steel straight edge
B - Feeler gauge

36. Carefully clean the mating face. With a 100 mm long steel straight edge, check the flatness in the transverse direction between the holes for the retaining bolts (5 points), Fig.39 (A). Check the flatness in the longitudinal direction between the holes for the retaining bolts (8 points), Fig.30 (B).

NOTE: The maximum permissible deviation is 0,02 mm.



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ACM

Fig.30. Check flatness of face mating with cylinder block.

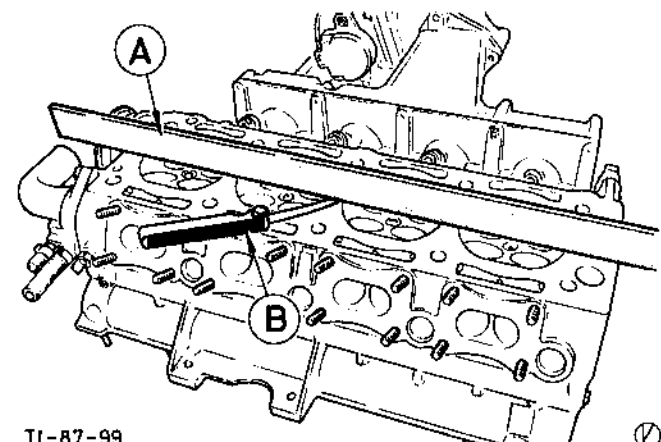
A - In transverse direction
B - In longitudinal direction

37. Check the flatness or concave distortion in the longitudinal direction along the centre line, Fig.31.

NOTE: The maximum permissible deviation is 0,08 mm.

If the maximum figures of 0,02 mm and 0,08 mm are exceeded, the mating face must be skimmed, removing a maximum of 0,13 mm of material.

The minimum cylinder head height (distance between the 2 mating faces) must not be less than 138.68 mm.



TI-87-99

Fig.31. Measure distortion in longitudinal direction.

To Install

NOTE: When installing, tighten the nuts and bolts as specified as in Technical Data.
Make sure that the mating faces of the cylinder head/block and the new gasket are clean.

38. Screw the locating studs, Special Tool 21-128, onto the tapped holes for the cylinder head bolts and fit the cylinder head gasket, Fig.32 (A, B).

39. Lift the cylinder head using a hoist and lower it onto the cylinder block, guiding the locating studs into the corresponding holes in the cylinder head.

NOTE: Guide the supporting bracket of the throttle housing vibration damper onto the engine mounting stud. Connect the turbocharger oil return hose to the oil pipe and secure it with the hose clip. Connect the coolant hose running to the water pump to the connector on the thermostat housing and secure it with the hose clip. Connect the engine breather hose to the oil separator connector, Fig.32 (C, D, E, F).

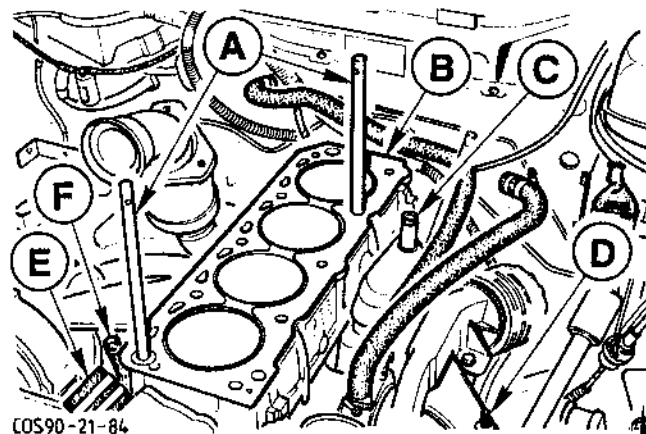


Fig.32. Cylinder head removed.

- A - Special Tool 21-128
- B - Cylinder head gasket
- C - Oil separator connector
- D - Engine mounting stud
- E - Coolant hose to water pump
- F - Turbocharger oil return hose

40. Disconnect the hooks on the chain from the cylinder head lifting eyes and remove the hoist. Straighten the lifting eyes and secure them.

41. Fit new cylinder head bolts and tighten finger tight, unscrew the locating studs and fit the last 2 cylinder head bolts.

NOTE: Before fitting the cylinder head bolts, lubricate the U-shaped washers and the underside of the head and thread of the bolts with engine oil.

42. Tighten the cylinder head bolts in the specified sequence using Special Tool 21-002 (see Technical Data), Fig.33.

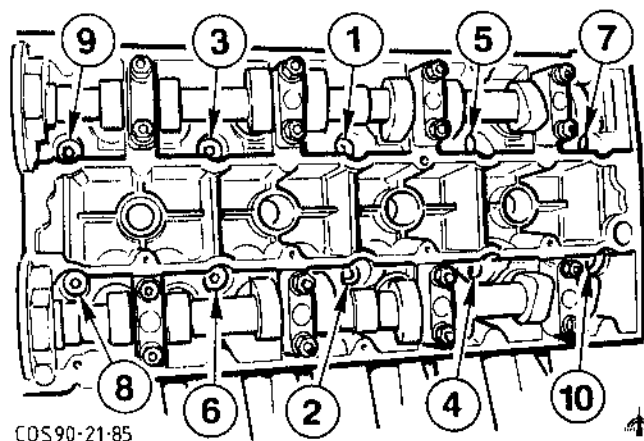


Fig.33. Cylinder head bolt tightening sequence.

43. Then turn the cylinder head bolts through a further $180^\circ + 10^\circ$ in the same sequence using Special Tool 21-002 and a proprietary angle gauge and note the tightening torque obtained, Fig.34.

NOTE: A tightening torque of less than 115 Nm is not acceptable and bolts with a torque below this figure must be changed. When all the bolts have been tightened, check that no bolt can be turned any further applying a torque of 110 Nm.

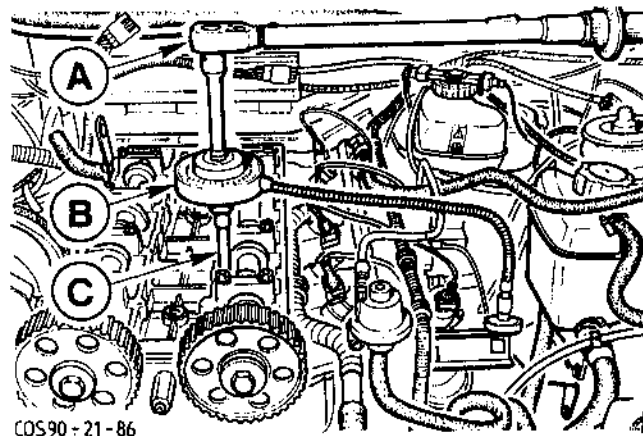


Fig.34. Tighten cylinder head bolts further.

Fig.34. Tighten cylinder head bolts further.

- A - Torque wrench
- B - Proprietary angle gauge
- C - Special Tool 21-002

44. Check that the crankshaft vibration damper/V-belt pulley is in the TDC position, Fig.35.

Fig.35. Crankshaft vibration damper/V-belt pulley in TDC position.

- A - Tooth on cylinder block
- B - Notch in V-belt pulley
- C - Cam on V-belt pulley

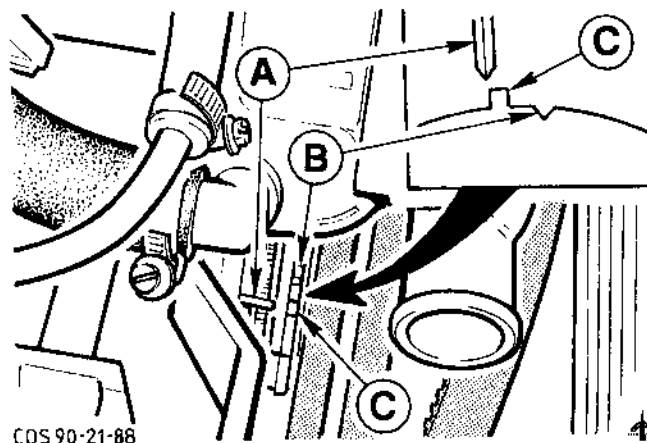
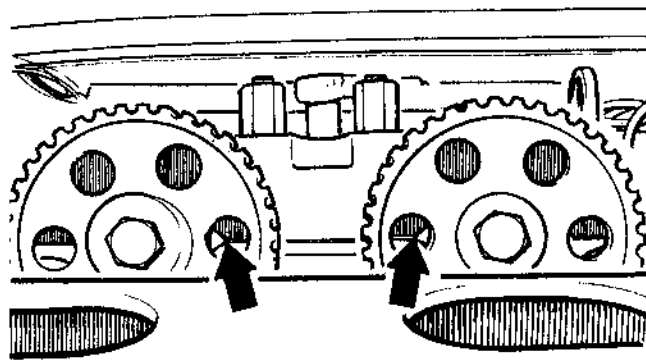


Fig.35. Crankshaft vibration damper/V-belt pulley TDC position.

45. Turn the 2 camshaft toothed belt pulleys to the TDC position, Fig.36.

46. Working in an anti-clockwise direction, fit the toothed belt starting at the distributor shaft.

NOTE: Note the direction in which the toothed belt runs.



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Fig.36. Camshaft toothed belt pulleys in TDC position.

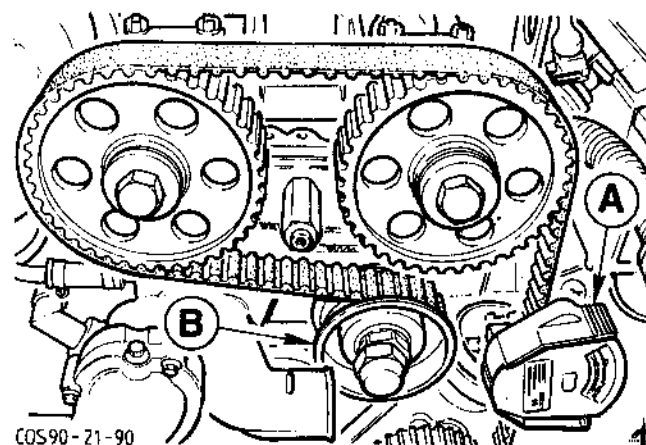
47. Adjust the toothed belt tension as follows:

- Turn the toothed belt tensioning pulley in a clockwise direction towards the toothed belt by hand and tighten the toothed belt tensioning pulley lock nut.
- Turn the engine several revolutions in the normal direction of rotation then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

Check the toothed belt tension by applying Special Tool 21-113 to the longest span of the toothed belt, Fig.37.
If necessary, adjust the toothed belt tensioning pulley until the specified tension is obtained (see Technical Data).

Re-check the toothed belt tension and the TDC positions and repeat the tensioning operation if necessary.



COS90-21-90

Fig.37. Tension toothed belt.

A - Special Tool 21-113

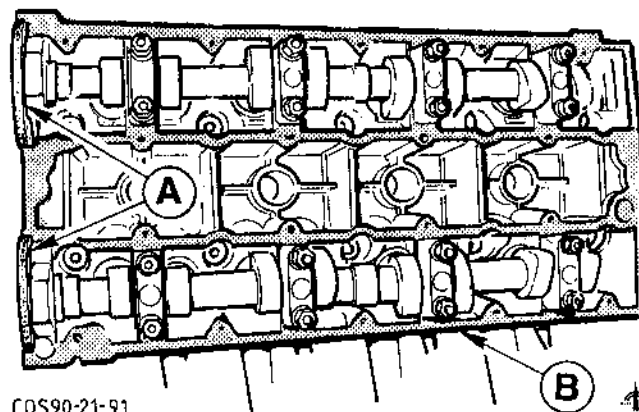
B - Toothed belt tensioning pulley

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48. Place the cylinder head cover gasket on the cylinder head and the 2 rubber seals on the front camshaft bearing caps, Fig.38.

NOTE: Coat the ends of the rubber seals with sealer (see Technical Data).

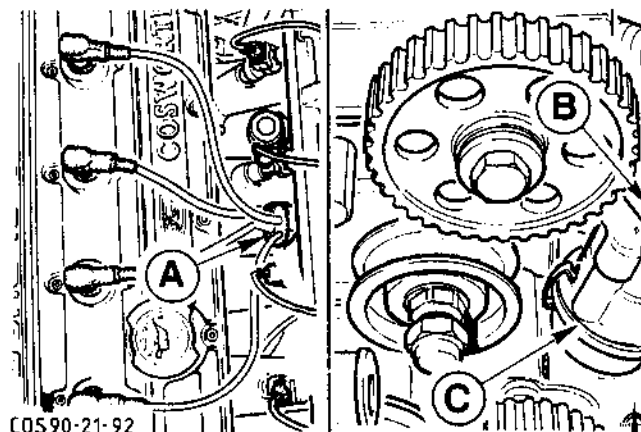


COS90-21-91

Fig.38. A - Rubber seals
B - Cylinder head cover gasket

49. Fit the cylinder head cover, screw in the 20 hexagon socket head bolts and tighten them.

50. Fit the spark plugs and tighten them to the specified torque. Fit the rotor arm in the distributor. Fit the distributor cap with the HT leads and connect the ignition coil lead to the connection on the distributor cap. Run the HT leads from below between the inlet manifold and cylinder head, insert the rubber guide in the bracket and connect the spark plug connectors to the spark plugs, Fig.39.



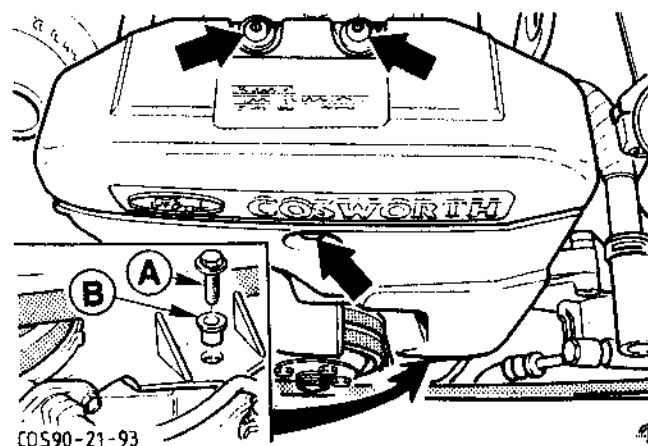
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Fig.39. Distributor and leads.

Fig.39. Distributor and leads.

- A - Bracket for HT leads with rubber guide
B - Ignition coil lead
C - Distributor cap

51. Fit the toothed belt cover to the cylinder head/block, Fig.40.



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Fig.40. Retaining bolt of toothed belt cover.
(detail shown from below)
A - Bolt
B - Bush

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52. Connect the front exhaust pipe to the turbocharger, Fig.41.

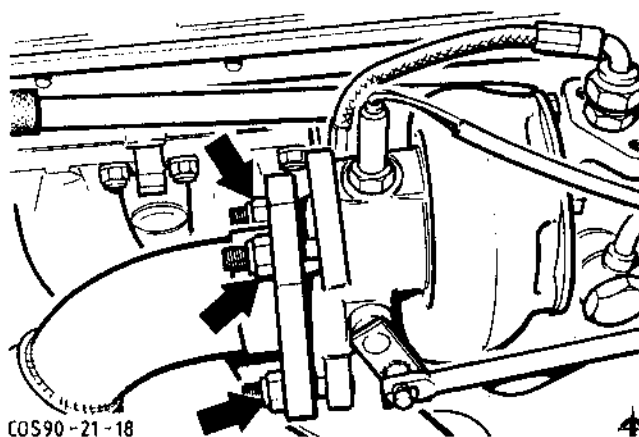


Fig.41. Retaining nuts of front exhaust pipe.

53. Connect the carbon canister vacuum hose to the T-piece, Fig.42.

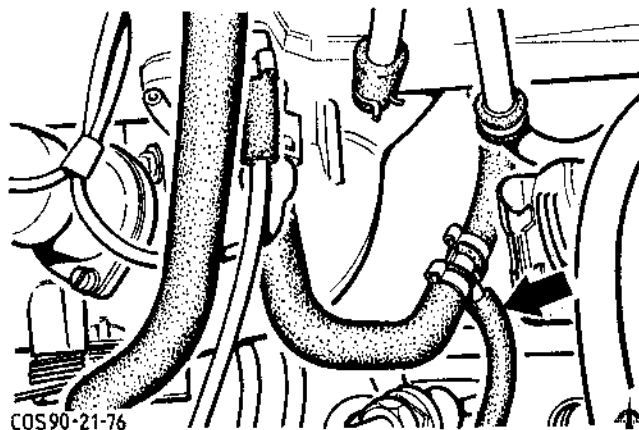


Fig.42. Vacuum hose to carbon canister.

54. Fit a new self-locking nut on the throttle housing vibration damper, but do not tighten it. Tighten the nut on the engine mounting. Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken it half a turn, Fig.43.

NOTE: Note the arrangement of the spring washers.

- Fig.43. Throttle housing vibration damper.
A - Engine mounting nut
B - Self-locking nut
C - Arrangement of spring washers

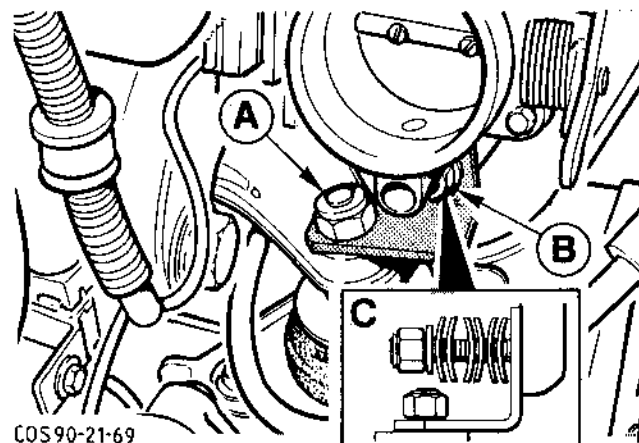


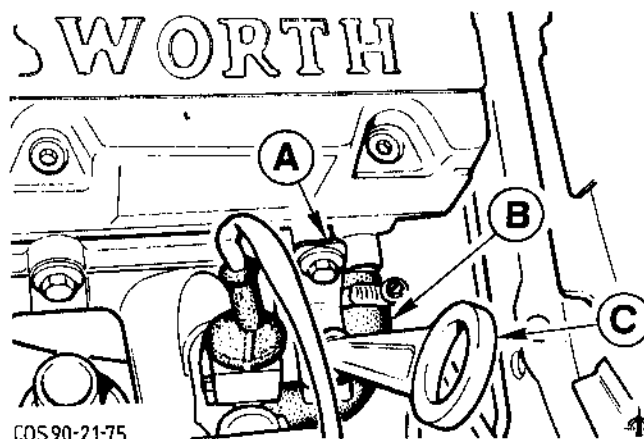
Fig.43. Throttle housing vibration damper.

21 163 0

Engine - 83 US

55. Connect the coolant hose running to the oil cooler to the cylinder head, Fig.44 (B).

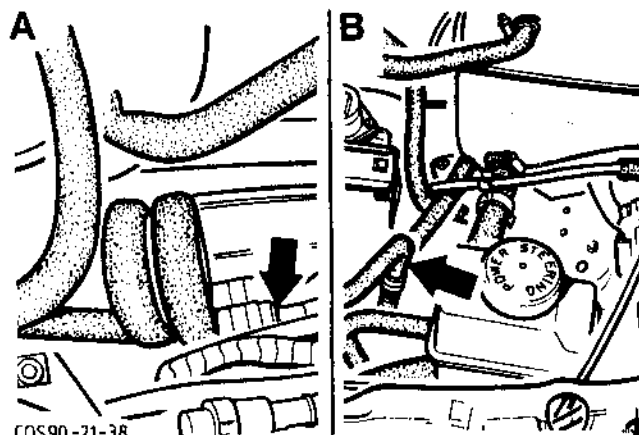
56. Fit the bracket of the oil dipstick tube to the cylinder head and insert and oil dipstick, Fig.44 (A, C).



COS90-21-75

Fig.44. A - Oil dipstick tube bracket
B - Coolant hose to oil cooler
C - Oil dipstick

57. Connect the fuel feed pipe and the fuel return pipe, Fig.45.

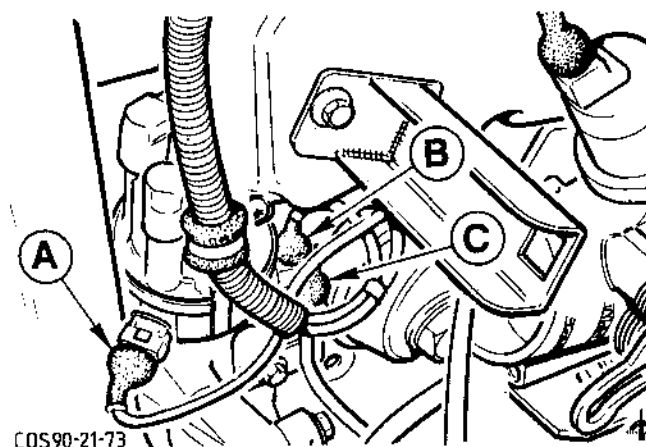


COS90-21-38

Fig.45. Fuel pipes connected.
A - Fuel pipe
B - Return pipe

58. Connect the plug of the oil pressure switch.

59. Connect the distributor multiplug and connect the multiplugs of the knock sensor and the engine speed/TDC sensor, Fig.46.



COS90-21-73

Fig.46. Multiplugs on distributor.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

21 163 0

Engine - 83 US

60. Connect the 3 engine wiring loom multiplugs, Fig.47.

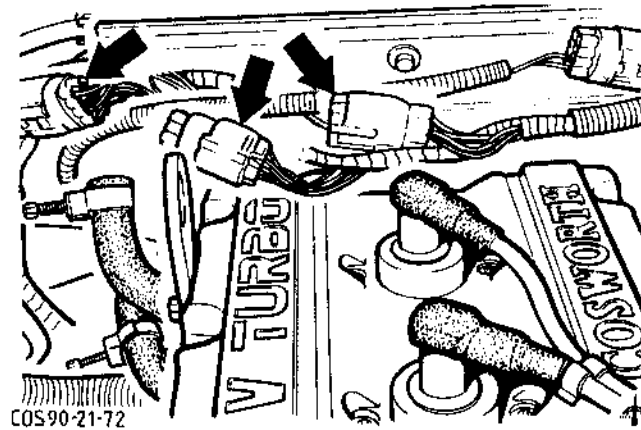


Fig.47. Engine wiring loom multiplugs.

61. Connect the upper coolant hose to the heater radiator, Fig.48.

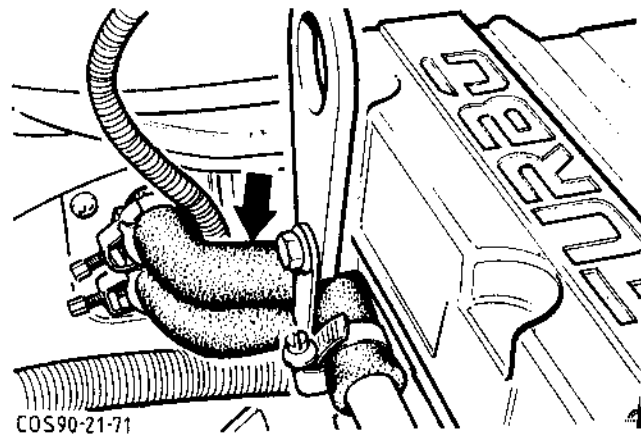


Fig.48. Upper coolant hose to heater radiator.

62. Connect the coolant hose to the thermostat housing. Fit the coolant hose running to the lower right-hand side of the radiator and connect it to the thermostat housing, Fig.49.

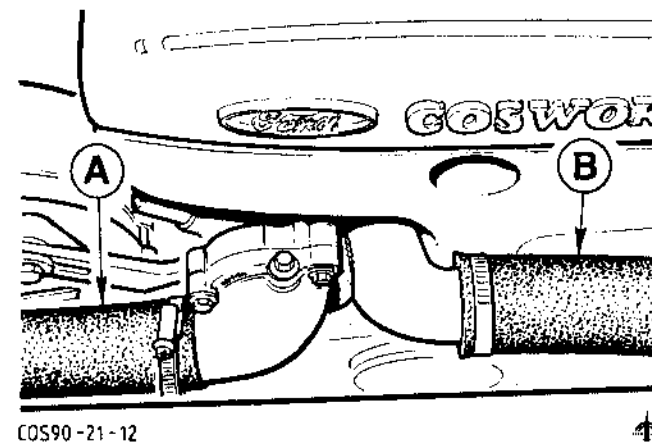


Fig.49. Coolant hoses on thermostat housing.
A - To lower right-hand side of radiator
B - To upper left-hand side of radiator

21 163 0

Engine - 83 US

63. Connect the air hose from the intercooler to the throttle housing, Fig.50.

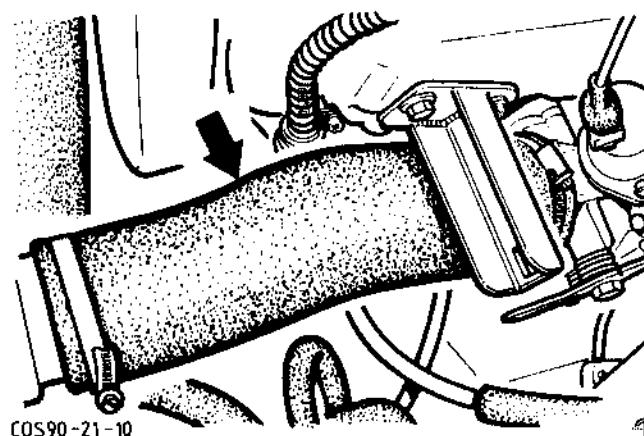


Fig.50. Air hose from intercooler to throttle housing.

64. Guide the throttle cable and retaining clip into the opening in the throttle cable bracket and clip it in place. Clip the throttle cable to the throttle linkage, Fig.51.

NOTE: Position the sprung lugs vertically to facilitate removal.

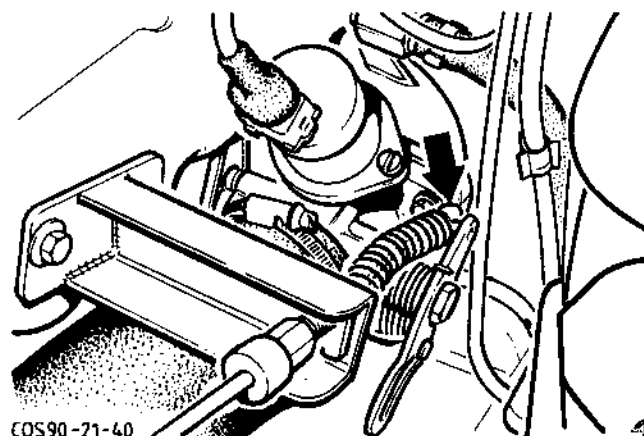


Fig.51. Throttle cable fixture.

65. Pass the coolant hose running to the degas tank through the engine lifting eye and connect it to the turbocharger connector, Fig.52.

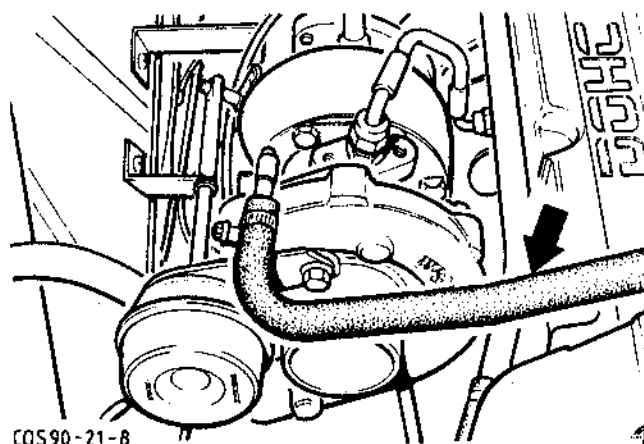
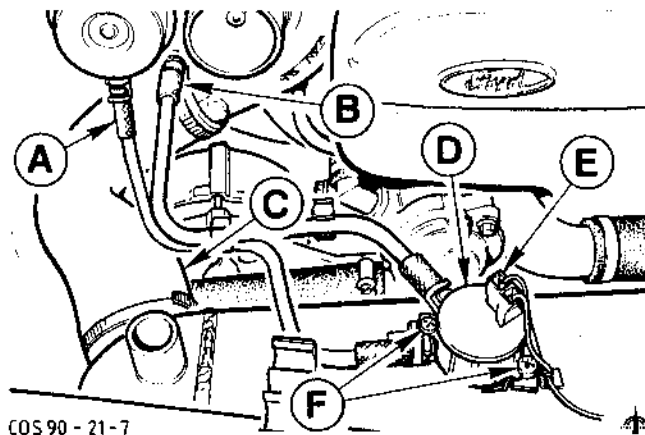


Fig.52. Coolant hose to degas tank.

66. Connect the lower air hose to the turbocharger and to the intercooler, Fig.53 (C).

Fig.53. Solenoid control valve and turbocharger lower air hose.

- A - Vacuum pipe to diaphragm unit
- B - Vacuum pipe to compressor housing
- C - Turbocharger lower air hose
- D - Solenoid control valve
- E - Multiplug
- F - Retaining screws



COS 90 - 21-7

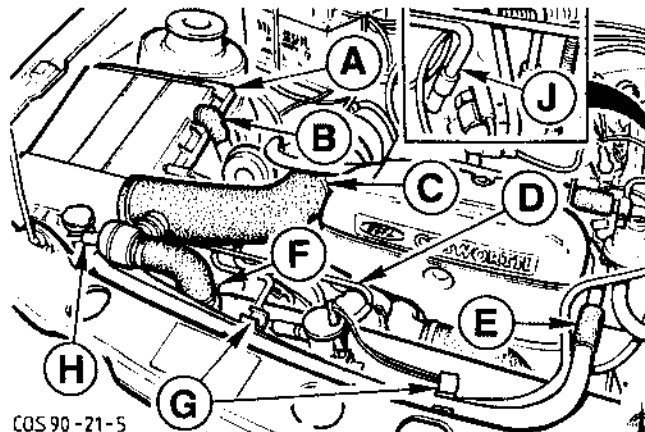
67. Fit the solenoid control valve to the intercooler:

- Fit the solenoid control valve and vacuum hoses to the intercooler, Fig.53 (D, F).
- Connect the solenoid control valve vacuum pipe to the turbocharger diaphragm unit, Fig.53 (A), and to the turbocharger compressor housing, Fig.53 (B).
- Connect the solenoid control valve multiplug, Fig.53 (E).

Fig.53. Solenoid control valve and turbocharger lower air hose.

68. Fit the air cleaner with the air hoses, Fig.54:

- Place the air cleaner element in the air cleaner casing.
- Fit the air cleaner cover with the air hoses/pipes on the air cleaner casing and clip it in place.
- Connect the vacuum pipe from the by-pass valve to the inlet manifold plenum chamber and clip it to the radiator grille panel.
- Connect the air hose from the by-pass valve to the intercooler.
- Connect the intake air hose to the turbocharger.
- Connect the air pipe running to the engine breather valve to the connecting hose and clip it to the radiator grille panel. Connect the air pipe from the air cleaner cover to the solenoid valve.



COS 90 - 21-5

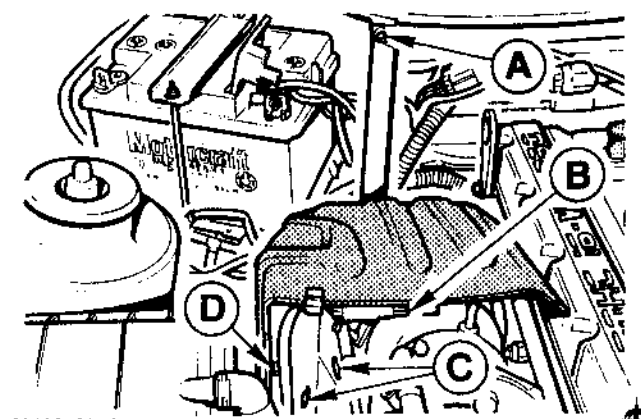
Fig.54. Air cleaner cover with air hoses/pipes.

- A - Air cleaner cover
- B - To engine breather valve
- C - To turbocharger
- D - From solenoid control valve
- E - Connecting hose of engine breather valve air pipe
- F - By-pass valve to intercooler
- G - Clip
- H - Vacuum pipe from by-pass valve to inlet manifold plenum chamber
- J - Connecting vacuum pipe from by-pass valve

69. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.55 (A, C, D).

Fig.55. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut



COS90-21-4

Fig.55. Turbocharger heat shield.

70. Connect the multiplug of the HEGO sensor and clip it to the heat shield, Fig.55 (B).
71. Connect the earth cable and the starter motor positive cable to the battery. Screw the earth cable to the battery tray, Fig.56.

72. Fill the cooling system up to the MAX mark on the degas tank (see Technical Data for quantity and specification). Unscrew the vent screw on the thermostat housing to allow air to escape from the cooling system. Smear the vent screw with sealer (see Technical Data for specification), refit and tighten, Fig.57.

NOTE: Introduce the coolant slowly so that air bubbles can escape.

73. Check the engine oil level and top up as necessary (see Technical Data for quantity and specification).

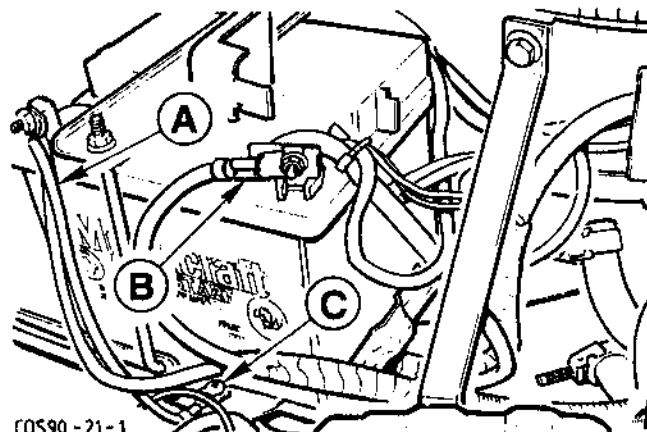
74. Start the engine and run it up to normal operating temperature. Check all the coolant/oil hose connections for leaks and tighten as necessary. Top up with coolant and oil as necessary.

75. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.

76. Raise the vehicle.

77. Fit the lower engine cover to the side members and the front axle/engine crossmember on the left and right-hand sides.

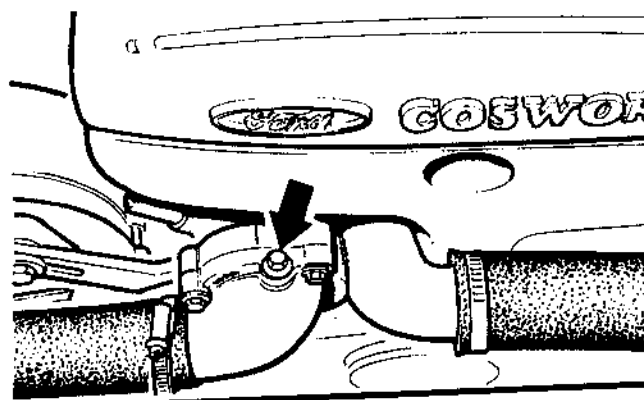
78. Lower the vehicle to the ground.



COS90-21-1

Fig.56. Battery cables.

- A - Earth cable
- B - Starter motor positive cable
- C - Earth cable to battery tray



COS90-21-45

Fig.57.

21 165 5 CYLINDER HEAD - REPLACE (Cylinder Head Removed)

SPECIAL SERVICE TOOLS REQUIRED:

Valve spring compressor	21-024
Adaptor for valve spring compressor	21-024-06
Valve stem oil seal installer (exhaust valves)	21-129 A
Valve stem oil seal installer (inlet valves)	21-130 A

WORKSHOP FABRICATED TOOLS:

Mounting plate (see Fig.B in Technical Data)

To Dismantle

1. Place 2 blocks of wood of the same size under the front and rear ends of the cylinder head to avoid damage.

2. Remove the thermostat housing, Fig.1:

- Disconnect the turbocharger coolant return hose (1 hose clip).
- Unscrew the vent screw from the thermostat housing.
- Unscrew the 3 retaining bolts and remove the thermostat housing with the coolant pipe.

3. Remove the exhaust manifold, Fig.2:

- Unscrew the turbocharger oil feed pipe from the cylinder head (1 union nut).
- Unscrew the retaining nuts (16) and remove the exhaust manifold with the turbocharger.
- Remove the 4 gaskets.

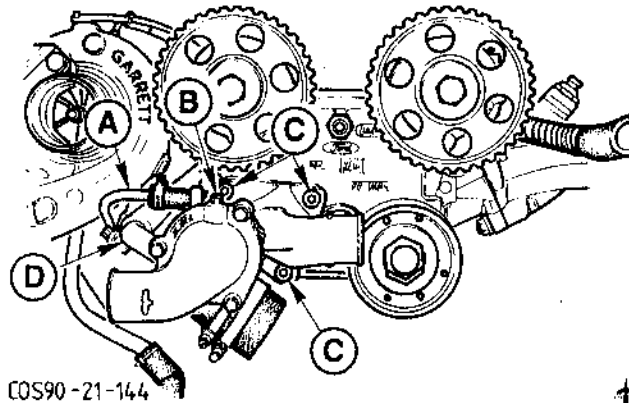


Fig.1. Thermostat housing.

- A - Turbocharger coolant return hose
- B - Vent screw
- C - Retaining bolts
- D - Coolant pipe

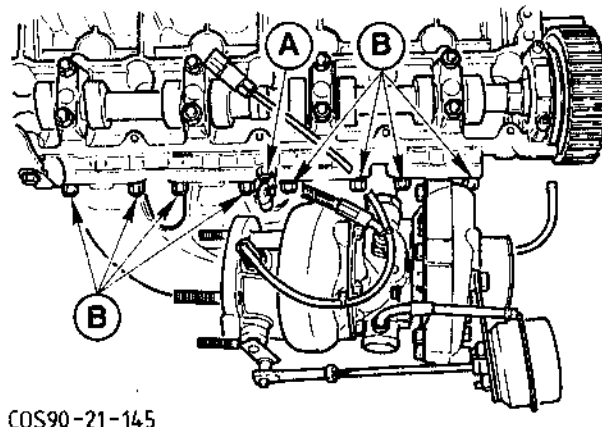


Fig.2. A - Turbocharger oil pipe

- B - Exhaust manifold upper retaining nuts

4. Remove the inlet manifold, Fig.3:

- Disconnect the multiplug from the engine coolant temperature sensor and the plug from the temperature gauge sender unit.
- Unscrew the upper retaining bolts (4), unscrew the lower retaining nuts (4) and remove the inlet manifold.

Fig.3. Inlet manifold (shown from below).

- A - Retaining bolts
- B - Multiplug of engine coolant temperature sensor
- C - Plug of temperature gauge sender unit
- D - Retaining nuts

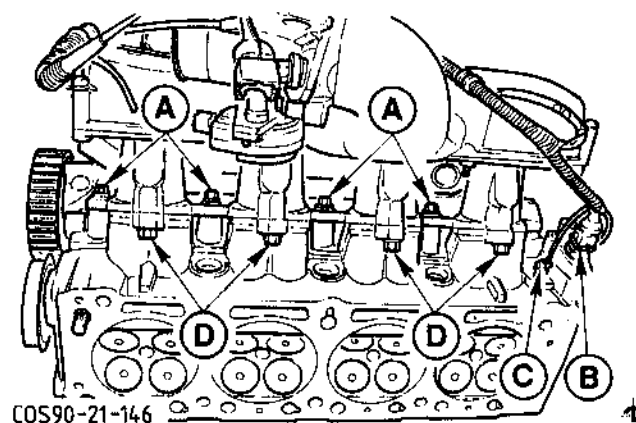
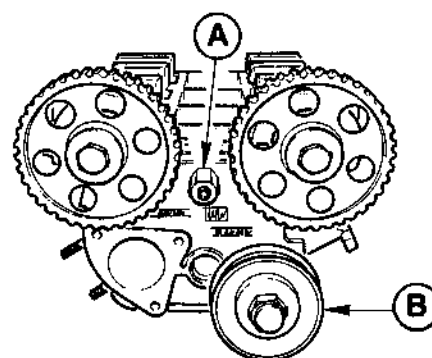


Fig.3. Inlet manifold (shown form below).

5. Remove the engine lifting eyes (2 bolts).

6. Unscrew the tensioning pulley nut and remove the tensioning pulley, Fig.4 (B).

7. Unscrew the toothed belt cover spacer stud, Fig.4 (A).


Fig.4. A - Toothed belt cover spacer stud
B - Tensioning pulley

8. Unscrew the connector of the turbocharger oil feed pipe, Fig.5 (A).

Fig.5. Parts attached to cylinder head.

- A - Connector of turbocharger oil feed pipe
- B - Temperature gauge sender unit
- C - Coolant hose connecting flange with engine coolant temperature

9. Unscrew the temperature gauge sender unit, Fig.5. (B).

10. Detach the coolant hose connecting flange with the engine coolant temperature sensor, Fig.5 (C).

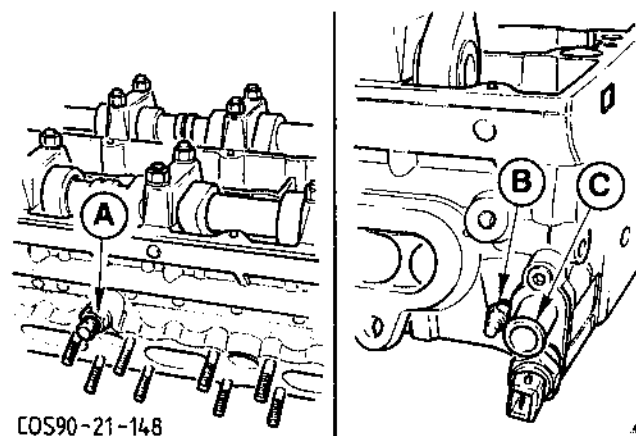


Fig.5. Parts attached to cylinder head.

11. Remove the camshafts, Fig.6:

- Release the toothed belt pulley retaining bolt, holding the camshaft with the aid of an open-ended wrench.
- Unscrew the retaining bolts and remove the toothed belt pulleys.
- Release the 8 nuts of the 4 rear bearing caps and the 2 hexagon socket head bolts of the front bearing cap of each camshaft uniformly. Unscrew the nuts, remove the washers and bearing caps. Unscrew the bolts and lift off the front bearing caps vertically.

NOTE: The bearing caps are numbered.

- Lift off the camshafts vertically.

NOTE: Do not transpose the camshafts for the inlet and exhaust valves.

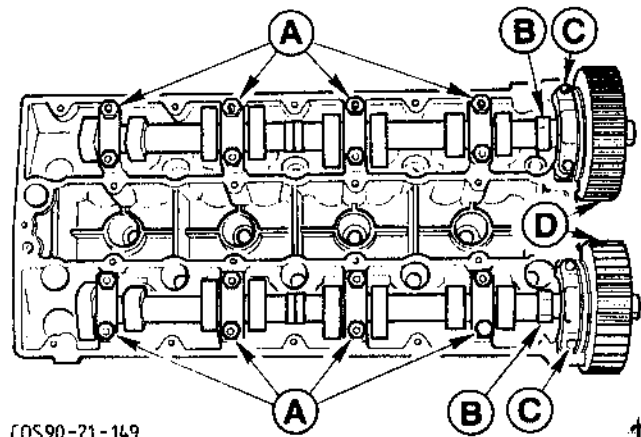


Fig.6. Camshafts.

- A - Bearing caps with nuts
- B - Hexagon
- C - Front bearing caps with cylinder head bolts
- D - Toothed belt pulleys

- # 12. Withdraw the hydraulic bucket tappets from the cylinder head using a proprietary rubber sucker, Fig.7. Stand the bucket tappets on their upper ends.

NOTE: Do not use a magnet.

- # 13. Transfer the exhaust manifolds studs (16) or fit new studs.

- # 14. Transfer the tensioning pulley stud or fit a new stud.

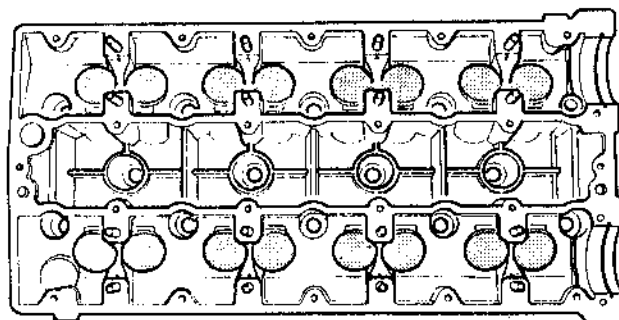


Fig.7. Bucket tappets.

To Reassemble

When reassembling tighten the nuts and bolts as specified in Technical Data.

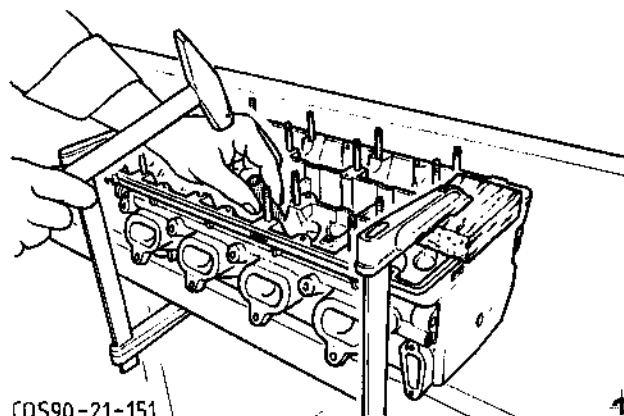
A new cylinder head is supplied without the valves. Always fit new valves.

Check that the bucket tappets are compatible with the new cylinder head, e.g. standard bucket tappets go with standard bores, oversize bucket tappets go with oversize bores.

Check all the moving parts for wear and renew as necessary. Renew all the seals.

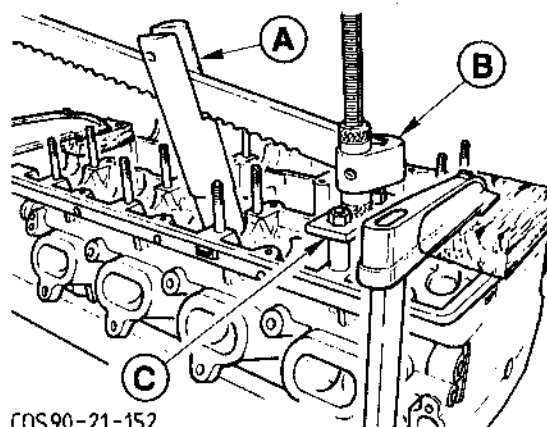
15. Fit the valves:

- Fit the lower spring retainers.
- Oil the valve stem and guides and insert the valves.
- Place suitably shaped blocks of wood in the combustion chambers to support the valves.
- Secure the cylinder head to the work bench using screw clamps. Place pieces of wood between the clamps and the cylinder head.
- Mask the valve collet grooves with adhesive plastic tape. Oil the valve stems and valve stem oil seals with clean engine oil. Fit the valves using Special Tool 21-129 A (exhaust valves) and 21-130 A (inlet valves). Carefully fit the valve stem oil seals, Fig.8.
- Fit the mounting plate, Fig.9 (C), (see WORKSHOP FABRICATED TOOLS) to Special Tool 21-024.
- Screw 2 flat nuts (M8, DIN 936) onto 2 camshaft bearing studs as far as the end of the thread by hand or fit 2 suitable spacer sleeves. Fit Special Tool 21-024 with the mounting plate and secure it with 2 further flat nuts.
- Fit the valve springs and valve spring retainers. Compress the valve springs using Special Tools 21-024 and 21-024-06. Insert the valve spring collets, Fig.9.
- Make sure the valve spring collets are seated correctly by tapping the valve spring retainers using a plastic drift.



COS90-21-151

Fig.8. Fit valve stem oil seals using Special Tool 21-129 A or 21-130 A.



COS90-21-152

Fig.9. Fit valve spring collets.

A - Special Tool 21-024-06

B - Special Tool 21-024

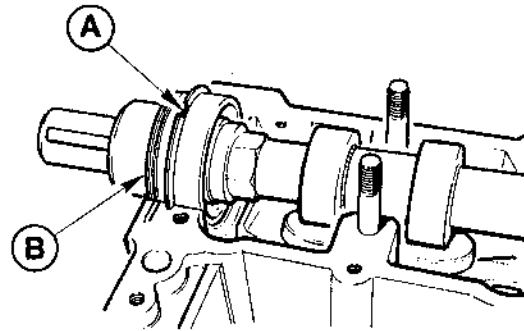
C - Workshop fabricated mounting plate

16. Lubricate the bucket tappets with engine oil and insert them. Note the sequence.

NOTE: After fitment, check that no air is trapped under the tappets.

Lubricate new camshaft radial oil seals with oil and slide them onto the camshafts as far as the stop by hand, Fig.10 (B).

17. Place the 2 camshafts in the cylinder head. The gap in the camshaft retaining ring must be at the top, Fig.10 (A).



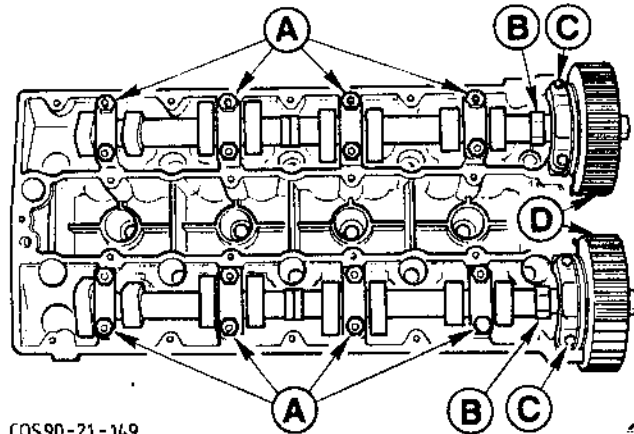
COS90-21-153

Fig.10. A - Gap in camshaft retaining ring
B - Radial oil seal

18. Oil the camshaft bearing caps and fit them in the correct sequence, starting with the front bearing caps (1 and 6). Tighten them down uniformly to the specified torque, Fig.11.

Coat the mating faces of the front bearing caps with sealer (see Technicia Data), Fig.12.

NOTE: Bearing caps 1 to 5 go on the exhaust side and bearing caps 6 to 10 on the inlet side. Bearing caps 1 and 6 are to be found at the front toothed belt pulley end. The bearing cap numbers face towards the inside.



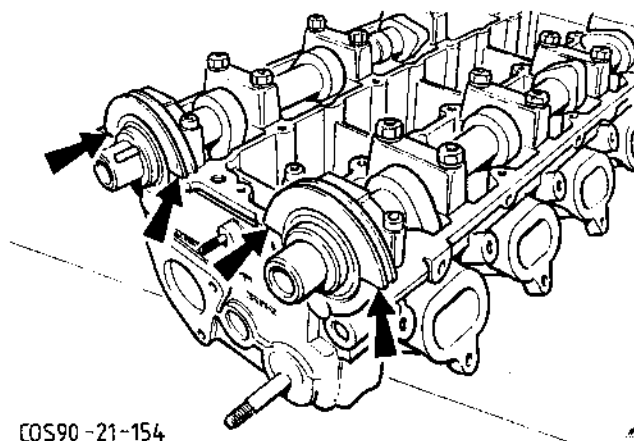
COS90-21-149

Fig.11. Camshafts

Fig.11. Camshafts.

- A - Bearing caps with nuts
- B - Hexagon
- C - Front bearing caps with cylinder head bolts
- D - Toothed belt pulley

19. Fit the camshaft toothed belt pulleys. Hold the camshaft by the hexagon while tightening the bolt, Fig.11 (B, D).



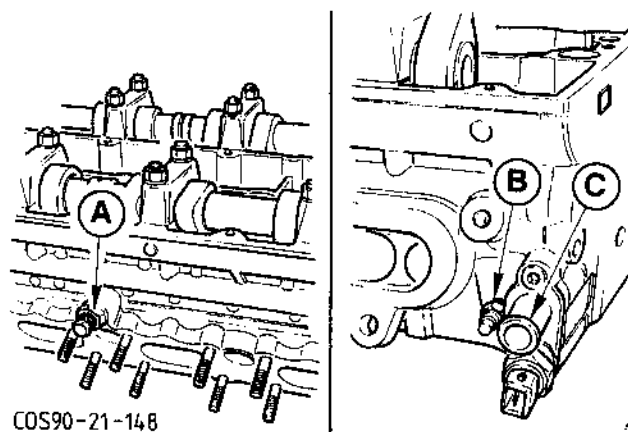
COS90-21-154

Fig.12. Mating faces of front bearing caps

20. Fit the coolant hose connecting flange with the engine coolant temperature sensor, Fig.13 (C).

Fig.13. Parts attached to cylinder head.

- A - Connector of turbocharger oil feed pipe
- B - Temperature gauge sender unit
- C - Coolant hose connecting flange with engine coolant temperature sensor



COS90-21-148

21. Apply sealer (see Technical Data) and screw in the temperature gauge sender unit, Fig.13 (B).

Fig.13. Parts attached to cylinder head.

22. Screw in the connector of the turbocharger oil feed pipe, Fig.13 (A).

23. Fit the toothed belt tensioning pulley, Fig.14. (B).

24. Fit the toothed belt cover spacer stud, Fig.14. (A).

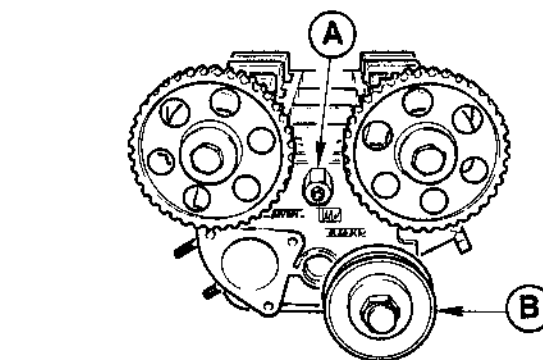
25. Fit the engine lifting eyes.

26. Fit the inlet manifold, Fig.15:

- Fit a new gasket
- Locate the inlet manifold in position.
- Screw in the upper retaining bolts and screw on the lower retaining nuts.
- Connect the multiplug of the engine coolant temperature sensor and the plug of the temperature gauge sender unit.

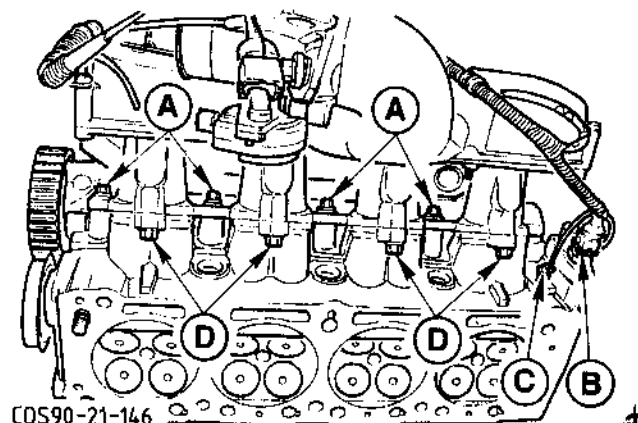
Fig.15. Inlet manifold (shown from below).

- A - Retaining bolts
- B - Multiplug of engine coolant temperature sensor
- C - Plug of temperature gauge sender unit
- D - Retaining nuts



COS90-21-147

Fig.14. A - Toothed belt cover spacer stud
B - Tensioning pulley



COS90-21-146

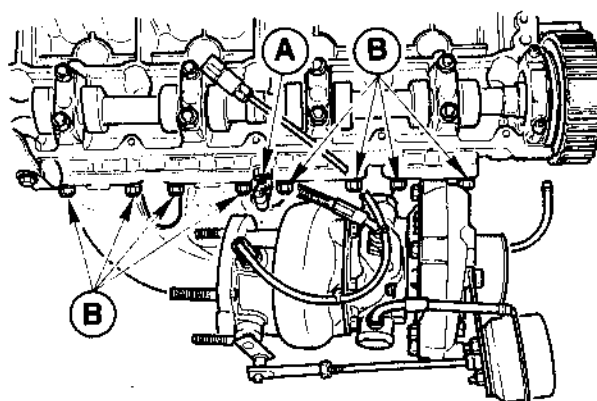
Fig.15. Inlet manifold (shown from below).

27. Fit the exhaust manifold, Fig.16:

- Fit the 4 gaskets.

NOTE: The metal-coated side must face the exhaust manifold.

- Locate the exhaust manifold and turbocharger in position.
- Screw on new retaining nuts.
- Connect the turbocharger oil feed pipe.



COS90-21-145

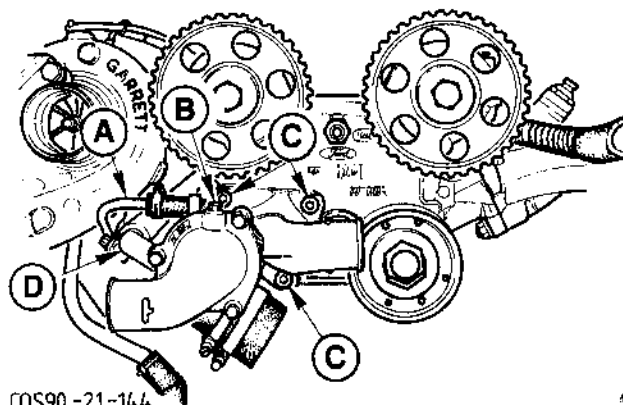
Fig.16. A - Turbocharger oil feed pipe
B - Upper retaining nuts of exhaust manifold

28. Fit the thermostat housing, Fig.17:

- Locate the thermostat housing and coolant pipe in position and secure them.
- Screw in the vent screw.
- Connect the turbocharger coolant return hose.

Fig.17. Thermostat housing.

- A - Turbocharger coolant return hose
- B - Vent screw
- C - Retaining bolts
- D - Coolant pipe



COS90-21-144

Fig.17. Thermostat housing.

21 183 0 INLET MANIFOLD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Fuel pipe disconnecter 23-027 A

To Remove

1. Disconnect the battery earth cable.
2. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.1, and place it to one side.
3. Unclip the throttle cable from the throttle linkage (1 clip). Compress the 2 sprung lugs of the retaining clip using pliers and detach the throttle cable from the bracket, Fig.2.

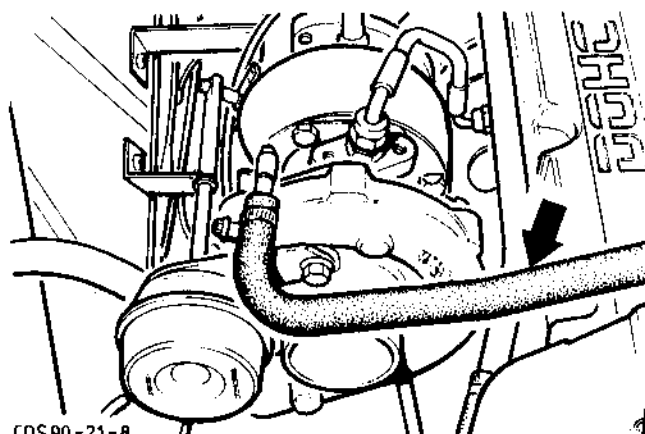
Fig.2. Detach throttle cable

- A - Throttle cable
B - Clip on throttle linkage
C - Retaining clip

4. Detach the bracket of the engine breather valve hose, disconnect the hose from the engine breather valve connection and place it to one side. Unscrew the retaining nut of the engine breather valve bracket on the inlet manifold, Fig.3, and pull the engine breather valve down out of the bracket.

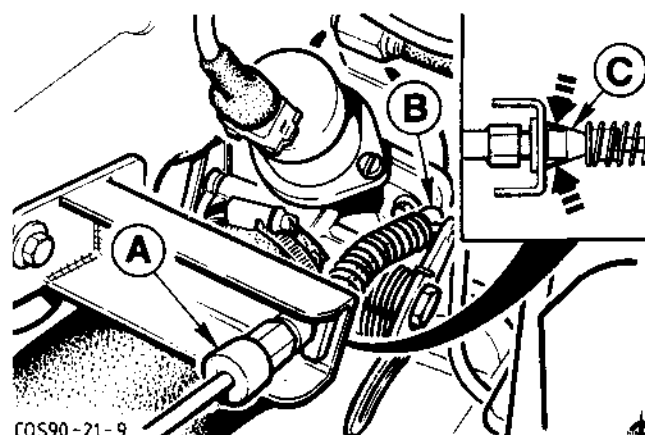
Fig.3. Hose between engine breather valve and oil separator.

- A - Bracket
B - Connector on engine breather valve
C - Retaining nut on engine breather valve bracket (shown with cylinder head removed)



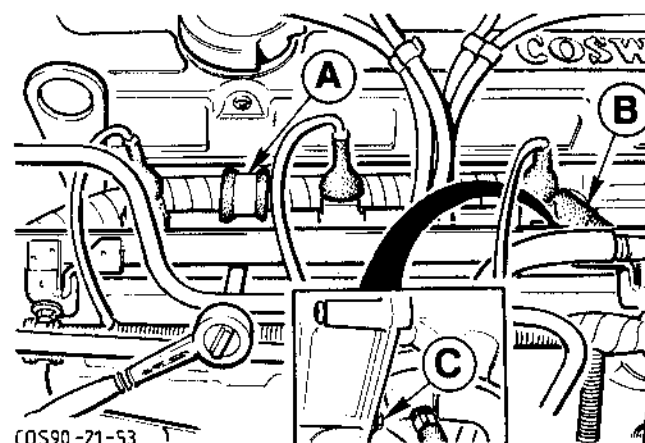
COS90-21-8

Fig.1. Coolant hose to degas tank.



COS90-21-9

Fig.2. Detach throttle cable.



COS90-21-53

Fig.3. Hose between engine breather valve and oil separator (shown with cylinder head removed)

5. Disconnect the HT leads from the spark plugs. Disconnect the ignition coil lead from the distributor cap. Pull the HT leads with the rubber guide down out of the HT lead bracket and remove the distributor cap and rotor arm, Fig.4.

Fig.4. Distributor and leads.

- A - Bracket for HT leads with rubber guide
- B - Ignition coil lead
- C - Distributor cap

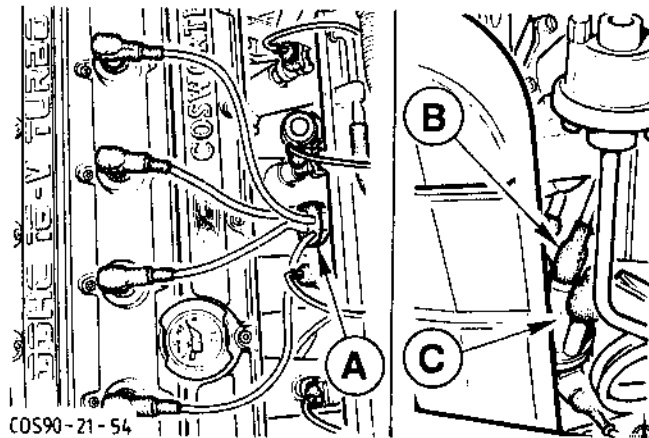


Fig.4. Distributor and leads.

6. Disconnect the vacuum pipes/hose to the by-pass valve, to the MAP sensor and to the carbon canister from the plenum chamber, Fig.5.

Fig.5. Vacuum pipes/hose.

- A - To by-pass valve
- B - To MAP sensor
- C - To carbon canister/engine breather valve

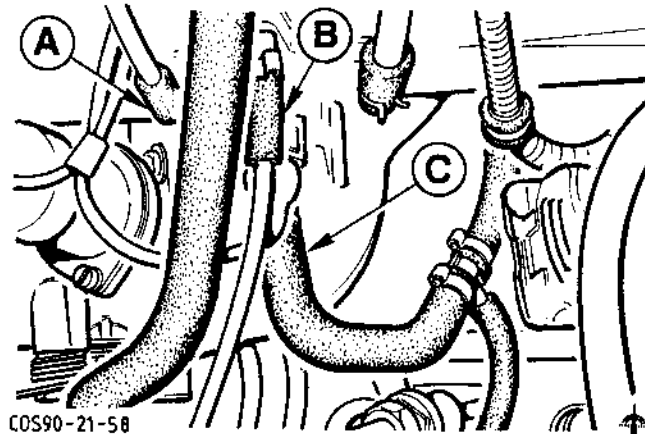


Fig.5. Vacuum pipes/hose

7. Remove the oil dipstick and detach the bracket of the oil dipstick tube from the cylinder head (1 bolt), Fig.6.

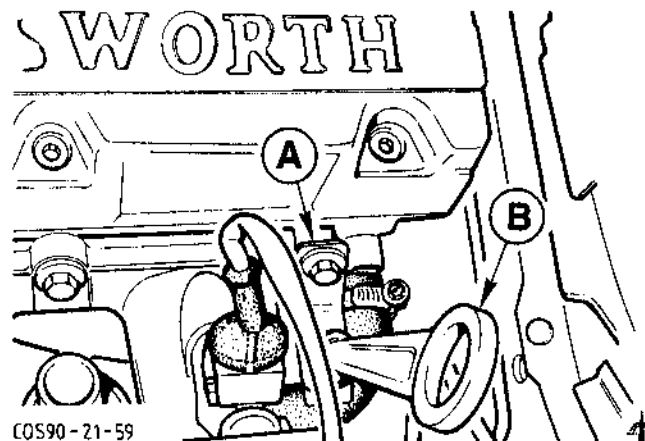
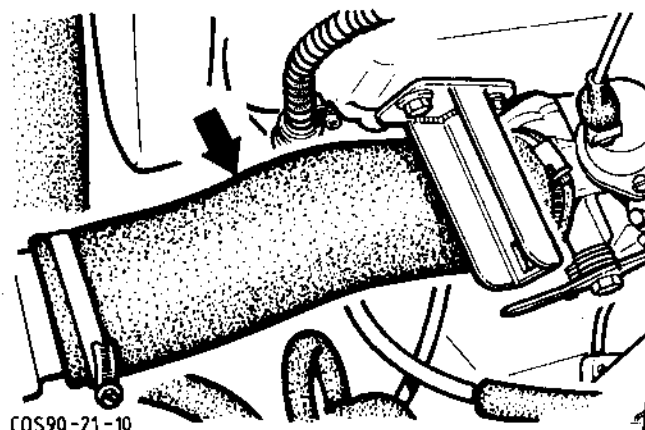


Fig.6. A - Bracket of oil dipstick tube
B - Oil dipstick

8. Disconnect the air hose from the intercooler to the throttle housing, Fig.7.

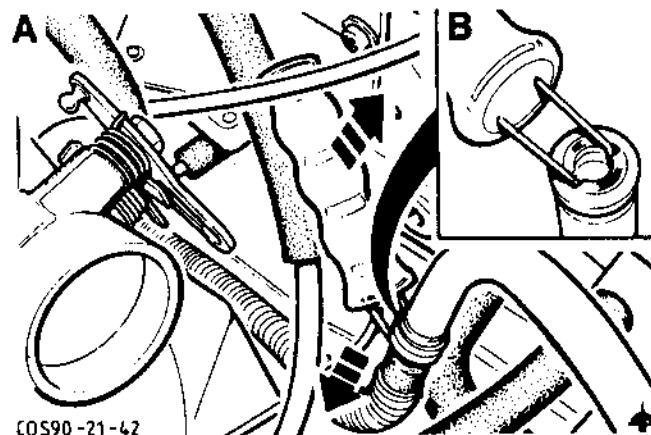


COS90-21-10

Fig.7. Air hose from intercooler to throttle housing.

9. Disconnect the fuel pipes:

- Insert the steel wire ends of Special Tool 23-027 A in the openings in the pipe coupling and press in while pulling on the other part of the fuel feed pipe, Fig.8, and disconnect the coupling.



COS90-21-42

Fig.8. Fuel feed pipe.

- A - Disconnect using Special Tool 23-027 A
- B - Special Tool inserted (fuel pipes shown disconnected)

Fig.8. Fuel feed pipe.

- Disconnect the fuel return pipe, Fig.9, as described for the feed pipe.



COS90-21-16

Fig.9. Disconnect fuel return pipe using Special Tool 23-027 A.

10. Disconnect the 3 engine wiring loom multiplugs, Fig.10.

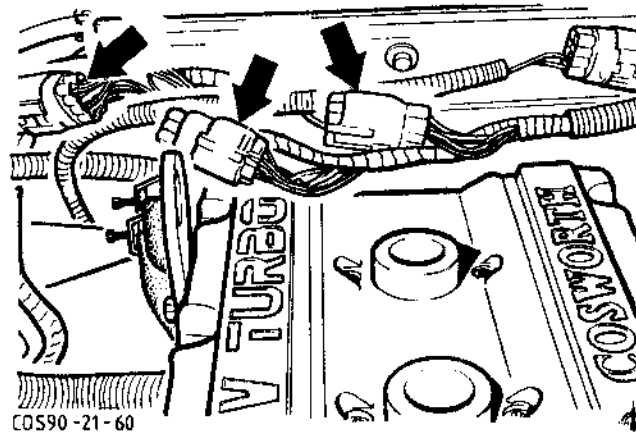


Fig.10. Engine wiring loom multiplug on bulkhead.

11. Disconnect the distributor multiplug, the knock sensor multiplug and the engine speed/TDC sensor multiplug from the distributor, Fig.11.

Fig.11. Multiplugs on distributor.

- A - Distributor
- B - Knock sensor
- C - Engine speed/TDC sensor

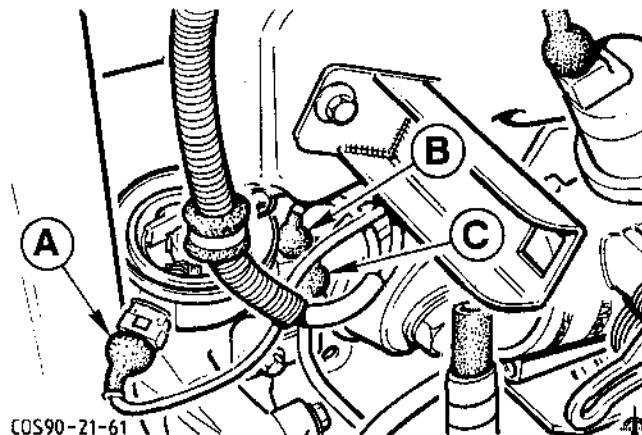


Fig.11. Multiplug on distributor.

12. Disconnect the plug/multiplug from the temperature gauge sender unit, engine coolant temperature sensor and oil pressure switch, Fig.12.

Fig.12. Plugs/multiplugs.

- A - Temperature gauge sender unit
- B - Engine coolant temperature sensor
- C - Oil pressure switch
(shown with engine removed)

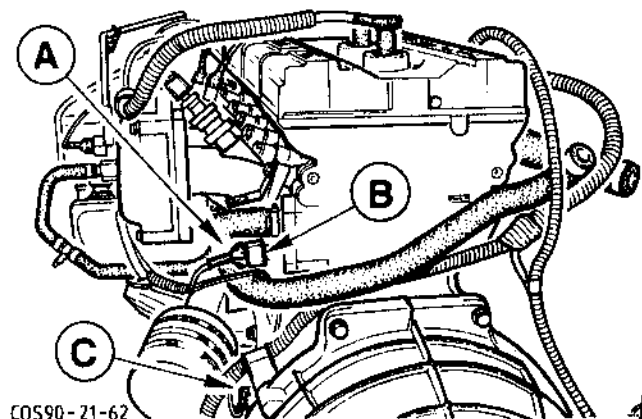


Fig.12. Plugs/multiplugs (shown with engine removed).

13. Release the nut on the (left-hand side), engine mounting and unscrew it. Release the self-locking nut on the throttle housing vibration damper, Fig.13.

Fig.13. Throttle housing vibration damper.
A - Nut on engine mounting
B - Self-locking nut with spring washers

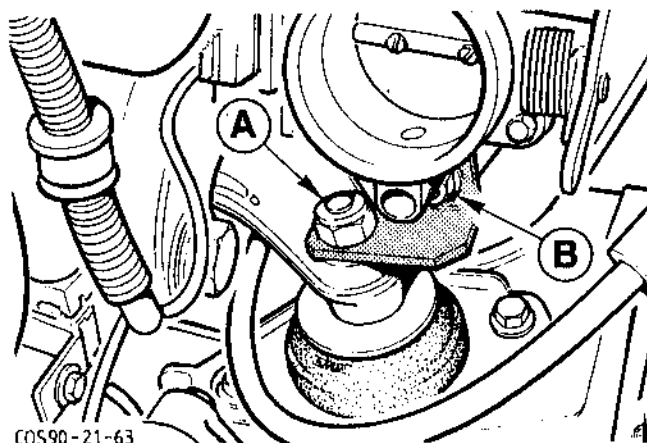


Fig.13. Throttle housing vibration damper.

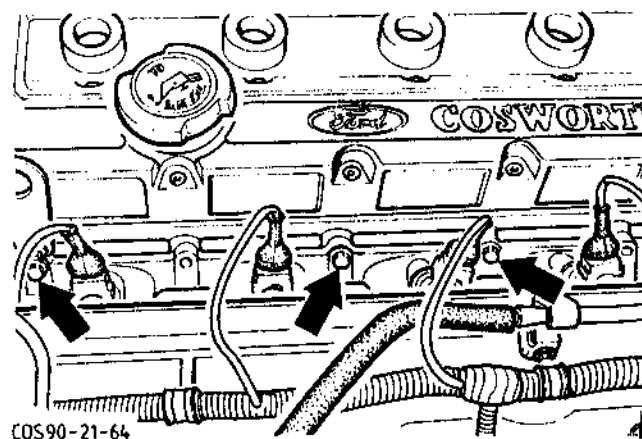


Fig.14. Retaining bolts of inlet manifold.

14. Remove the inlet manifold:

- Remove the remaining 3 inlet manifold retaining bolts, Fig.14.
- Remove the 4 inlet manifold retaining nuts from below, Fig.15.
Remove the inlet manifold complete with the wiring from the cylinder head.

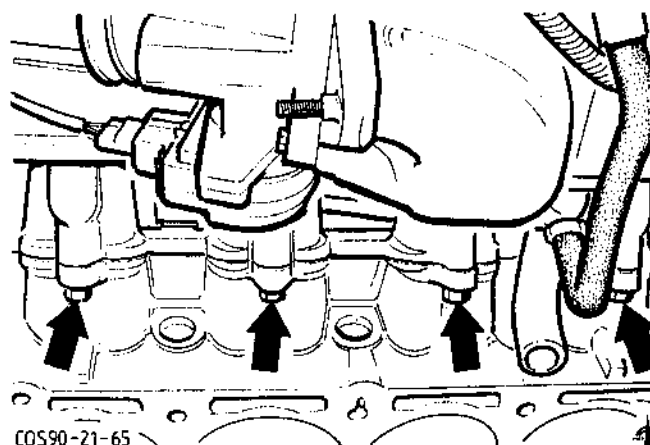


Fig.15. Retaining nuts of inlet manifold, (shown with cylinder head removed).

21 183 0

Engine - 83 US

To Install

NOTE: When installing tighten the nuts, bolts and pipe unions as specified in Technical Data.

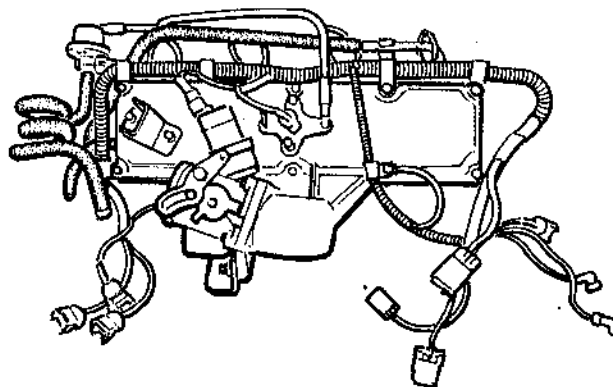
15. Fit a new inlet manifold gasket to the cylinder head.

Locate the inlet manifold in position and connect the plug of the oil pressure switch. Fit the engine breather valve in the bracket.

NOTE: Guide the throttle housing support bracket onto the engine mounting stud.

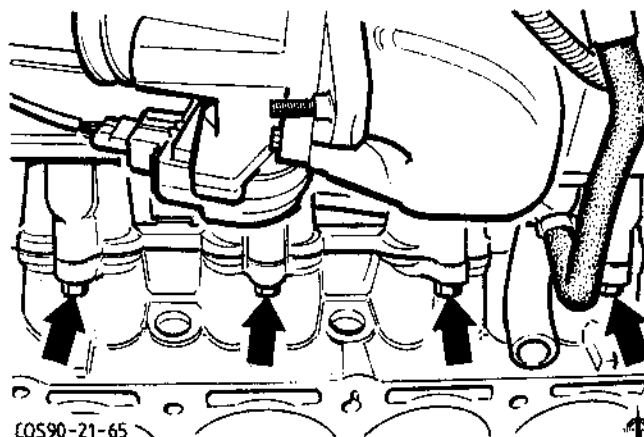
16. Secure the inlet manifold to the cylinder head at the bottom (4 nuts), Fig.17.

17. Secure the inlet manifold to the cylinder head at the top (3 bolts), Fig.18.



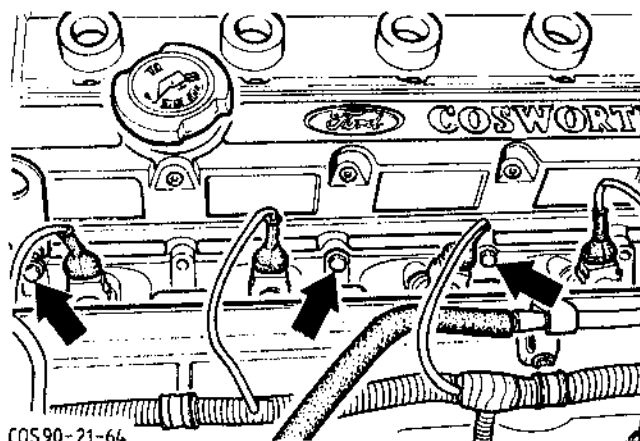
COS90-21-66

Fig.16. Inlet manifold removed.



COS90-21-65

Fig.17. Retaining nuts of inlet manifold, (shown with cylinder head removed).



COS90-21-64

Fig.18. Retaining bolts of inlet manifold.

18. Screw a new self-locking nut to the throttle housing vibration damper but do not tighten it. Tighten the nut on the engine mounting, Fig.19 (A, B). Tighten the self-locking nut to a torque of 8 to 10 Nm and then release it half a turn.

NOTE: Note the arrangement of the spring washers, Fig.19 (C).

Fig.19. Throttle housing vibration damper.

- A - Nut on engine mounting
- B - Self-locking nut
- C - Arrangement of spring washers

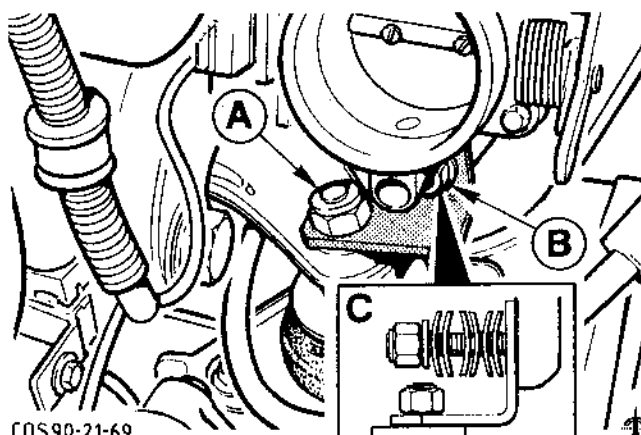


Fig.19. Throttle housing vibration damper.

19. Connect the distributor multiplug, the knock sensor multiplug and the engine speed/TDC sensor multiplug to the connections on the distributor following the numbers marked, Fig.20.

Fig.20. Multiplugs on distributor.

- A - Distributor
- B - Knock sensor
- C - Engine speed/TDC sensor

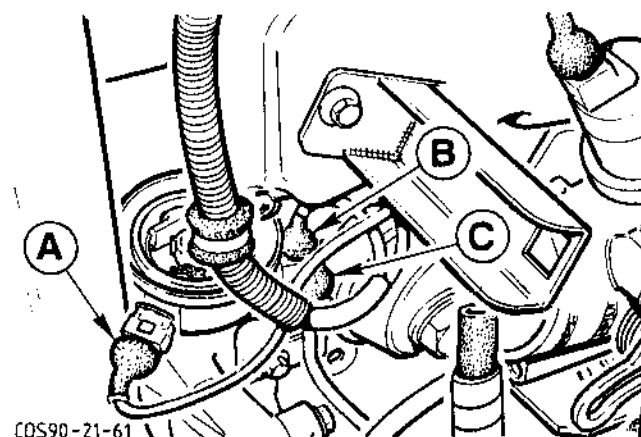


Fig.20. Multiplug on distributor.

20. Connect the multiplugs of the temperature gauge sender unit and engine coolant temperature sensor.

21. Connect the 3 engine wiring loom multiplugs, Fig.21.

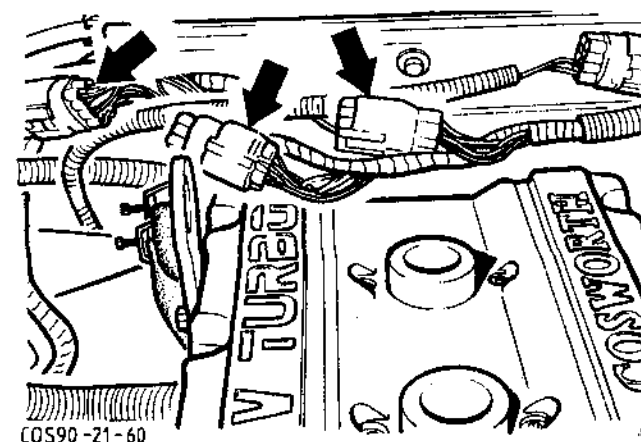


Fig.21. Engine wiring loom multiplugs on bulkhead.

22. Connect the fuel feed pipe and the fuel return pipe, Fig.22.

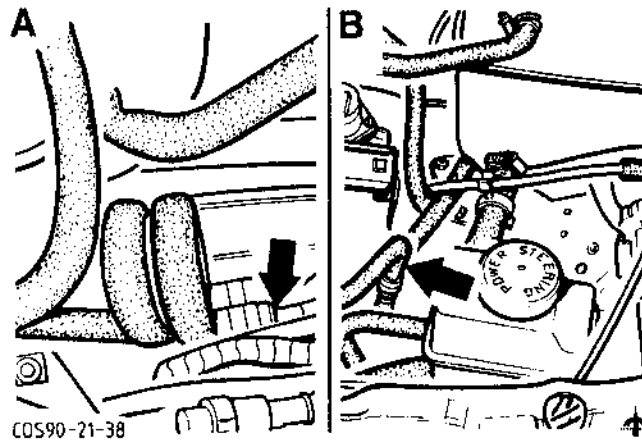


Fig.22. Fuel pipes connected.
A - Feed pipe
B - Return pipe

23. Connect the air hose from the intercooler to the throttle housing, Fig.23.

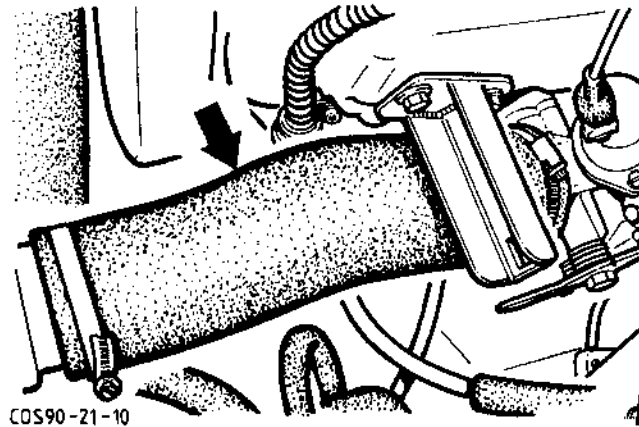


Fig.23. Air hose from intercooler to throttle housing.

24. Fit the bracket of the oil dipstick tube to the cylinder head and insert the oil dipstick.

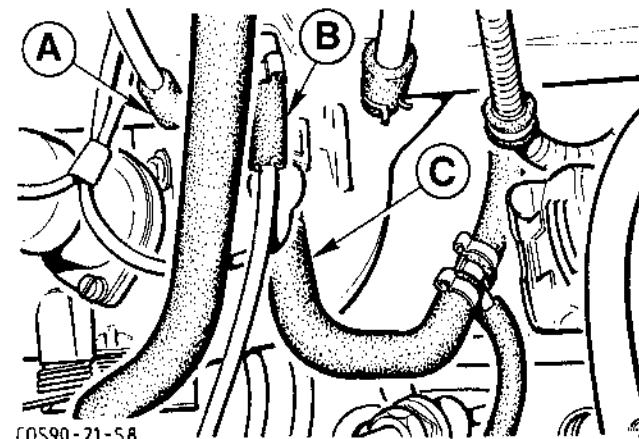


Fig.24. Vacuum pipes/hose.
A - To by-pass valve
B - To MAP sensor
C - To carbon canister/engine breather valve

Fig.24. Vacuum pipes/hose.

26. Fit the rotor arm in the distributor, fit the distributor cap with the HT leads and connect the ignition coil lead to the connection on the distributor cap. Run the HT leads up between the inlet manifold and the cylinder head, fit the rubber guide in the bracket and connect the spark plug connectors to the spark plugs, Fig.25.

Fig.25. Distributor and leads.

- A - Bracket for HT leads with rubber guide
- B - Ignition coil lead
- C - Distributor cap

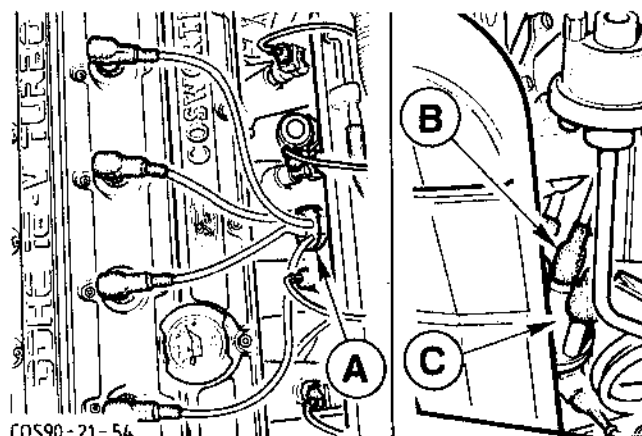


Fig.25. Distributor and leads.

27. Tighten the retaining nut securing the engine breather valve bracket to the inlet manifold. Connect the air pipe to the engine breather valve connector and attach it to the cylinder head with the bracket, Fig.26.

Fig.26. Hose between engine breather valve and oil separator.

- A - Bracket
- B - Connector on engine breather valve
- C - Retaining nut securing engine breather valve bracket (shown with cylinder head removed)

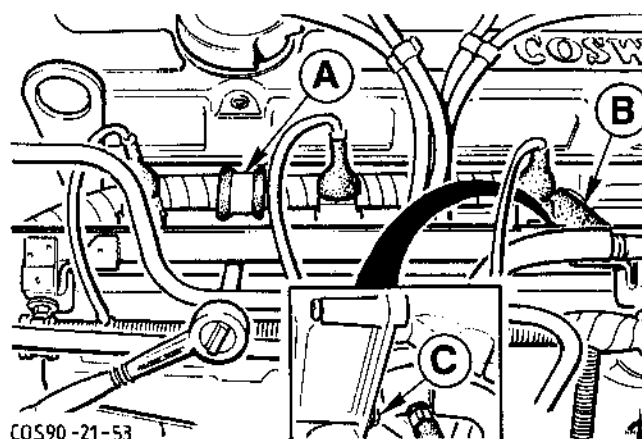


Fig.26. Hose between engine breather valve and oil separator (shown with cylinder head removed).

28. Guide the throttle cable and retaining clip into the opening in the throttle cable bracket and clip it in place. Clip the throttle cable to the throttle linkage.

NOTE: Position the sprung lugs vertically to facilitate removal.

29. Connect the coolant hose running to the degas tank to the turbocharger connector.

30. Fill the cooling system with coolant up to the MAX mark on the degas tank (see Technical Data for quantity and specification) unscrewing the vent screw in the thermostat housing to allow air to escape from the cooling system. Apply sealer (see Technical Data for specification) and tighten the vent screw.

NOTE: Fill up with coolant slowly to allow air bubbles to escape.

31. Connect the battery earth cable.

32. Start the engine and run it up to normal operating temperature. Check the coolant hose connections for leaks and tighten as necessary.

33. Check the engine tuning settings as specified at normal operating temperature and rectify as necessary.

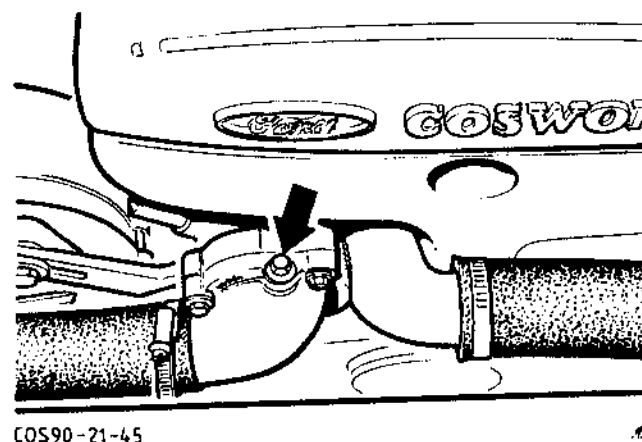


Fig.27. Cooling system vent screw in thermostat housing.

21 187 0 EXHAUST MANIFOLD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.
2. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.1 (B).

Fig.1. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut

3. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.1 (A, C, D).

4. Disconnect the intake air hose from the turbocharger, air cleaner and by-pass valve, Fig.2.

5. Disconnect the solenoid control valve vacuum pipe from the turbocharger diaphragm unit and from the turbocharger compressor housing, Fig.3. (A, B).

Fig.3. Solenoid control valve and turbocharger lower air hose.

- A - Vacuum pipe to diaphragm unit
- B - Vacuum pipe to compressor housing
- C - Turbocharger lower air hose

6. Disconnect the turbocharger lower air hose to the intercooler from the turbocharger, Fig.3 (C).

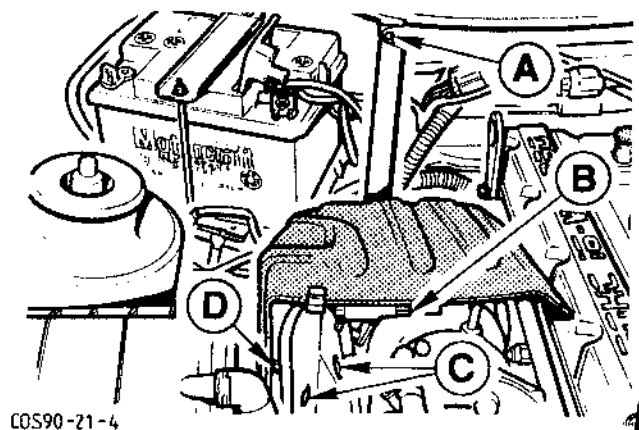


Fig.1. Turbocharger heat shield.

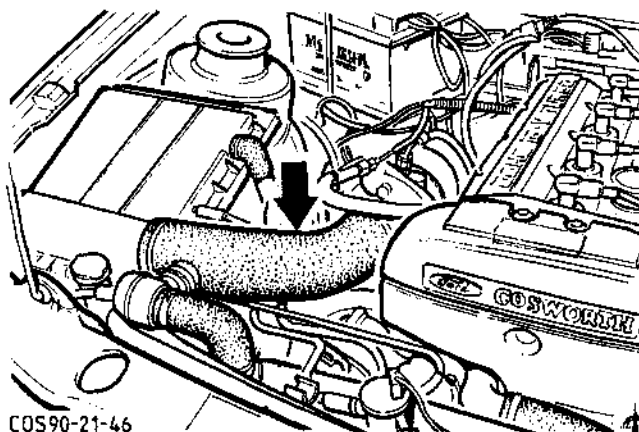


Fig.2. Turbocharger intake air hose to air cleaner/by-pass valve.

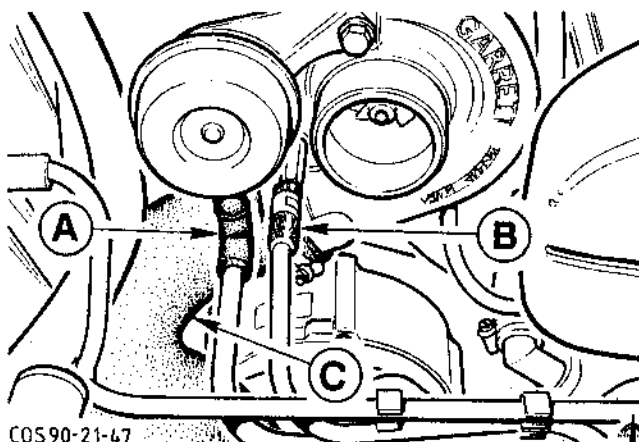


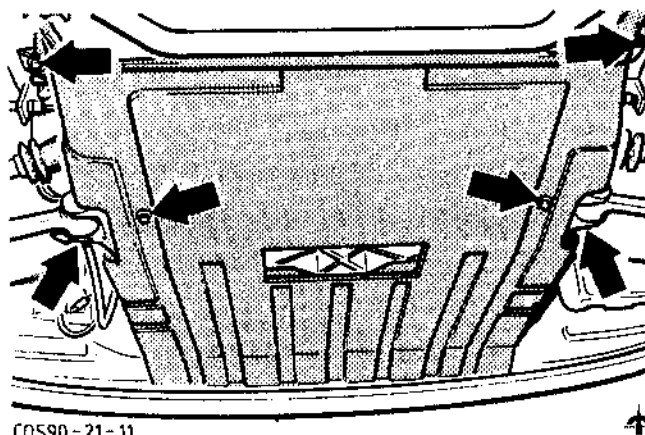
Fig.3. Solenoid control valve and turbocharger lower air hose.

21 187 0

Engine - 83 US

7. Raise the vehicle.

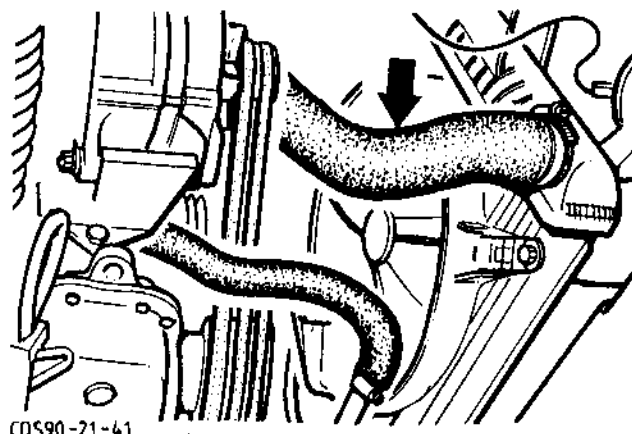
8. Detach the lower engine cover from the side members and the front axle/engine crossmember on the left and right-hand sides, Fig.4 and remove cover.



COS90-21-11

Fig.4. Retaining bolts of lower engine cover.

9. Place a clean collecting tray under the radiator. Disconnect the lower right-hand side coolant hose from the radiator, Fig.5, and drain off the coolant.

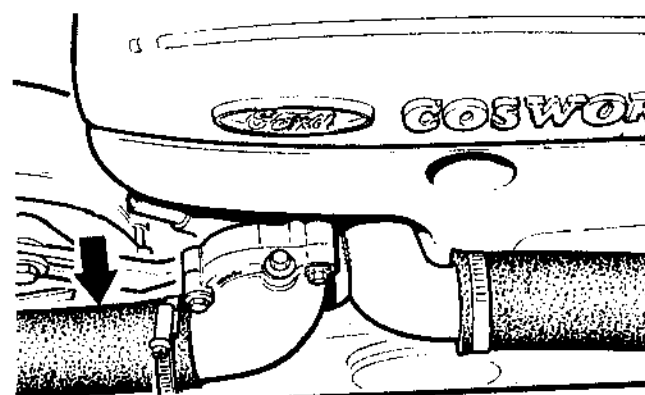


COS90-21-41

Fig.5. Lower right-hand side coolant hose to radiator.

10. Lower the vehicle to the ground.

11. Disconnect the coolant hose running to the lower right-hand side of the radiator from the thermostat housing and remove it, Fig.6.



COS90-21-55

Fig.6. Coolant hose from thermostat housing to lower right-hand side of radiator.

21 187 0

Engine - 83 US

12. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.7 (A).

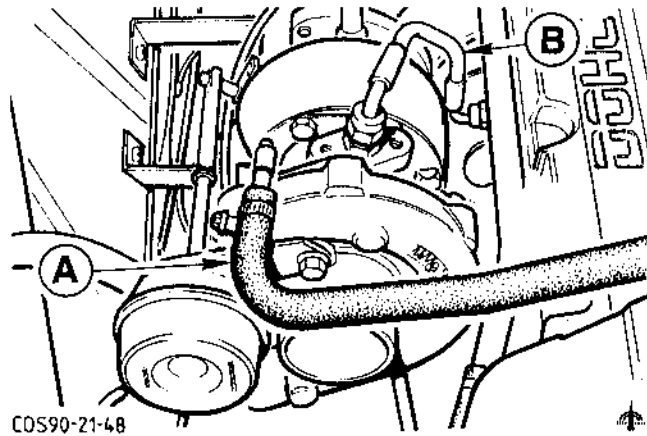


Fig.7. A - Coolant hose
B - Oil feed pipe

13. Unscrew the oil feed pipe from the turbocharger and the cylinder head (2 union nuts) and remove it, Fig.7 (B).

14. Disconnect the coolant pipe to the turbocharger from the hose connector on the thermostat housing, Fig.8 (B).

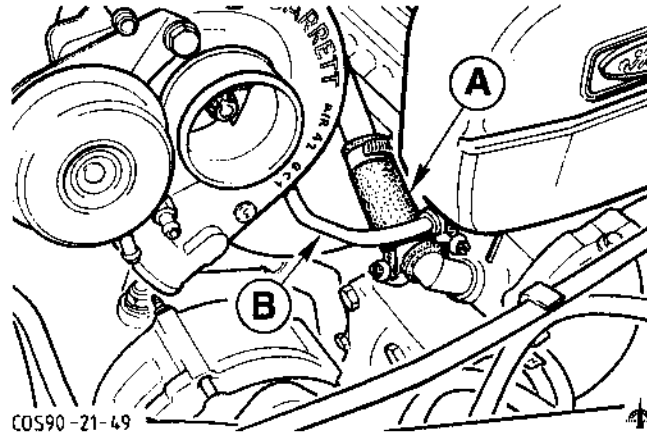


Fig.8. Coolant hose/pipe to thermostat housing.
A - To heater radiator
B - To turbocharger

Fig.8. Coolant hose/pipe to thermostat housing.

15. Disconnect the coolant hose/pipe from the heater radiator at the thermostat housing, Fig.8 (A).

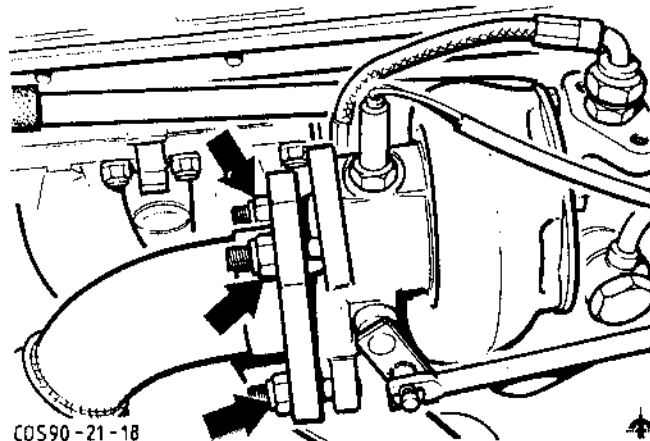


Fig.9. Front exhaust pipe to turbocharger retaining nuts.

16. Disconnect the front exhaust pipe from the turbocharger (3 nuts), Fig.9.

17. Loosen the clamp bolt of the alternator adjusting strap, remove the V-belt and press the alternator downwards, Fig.10.

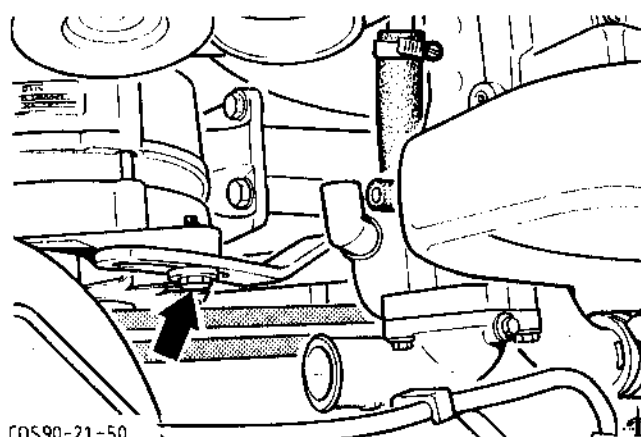


Fig.10. Clamp bolt of alternator adjusting strap.

18. Move the hose clip of the turbocharger oil return hose down on the hose, Fig.11.

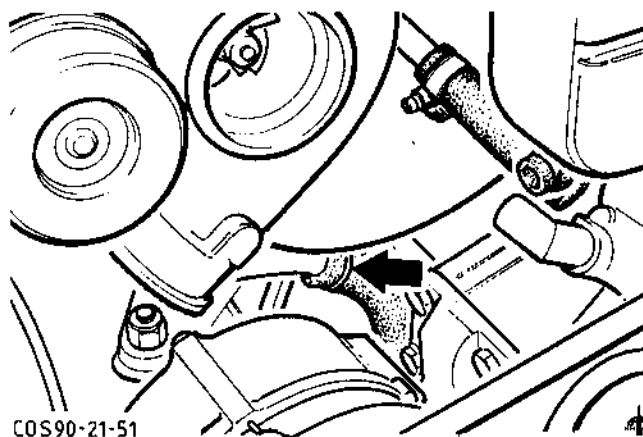


Fig.11. Hose clip of turbocharger oil return hose.

19. Detach the exhaust manifold from the cylinder head (16 nuts with washers) and lift it out with the turbocharger, Fig.12, withdraw the oil pipe from the turbocharger oil return hose.

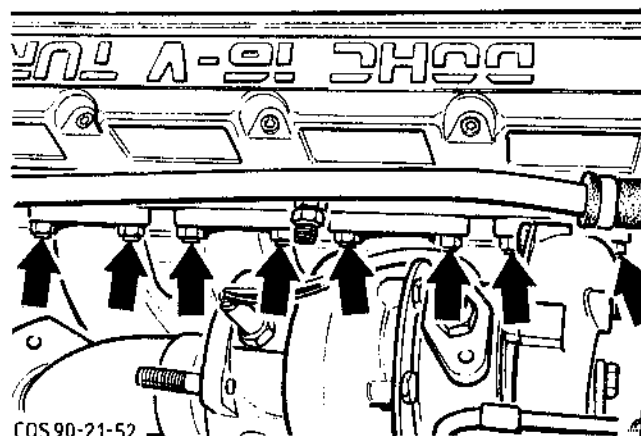


Fig.12. Retaining nuts of exhaust manifold.
(8 upper retaining nuts shown)

21 187 0

Engine - 83 US

20. Remove the turbocharger complete from the exhaust manifold (4 nuts), Fig.13.

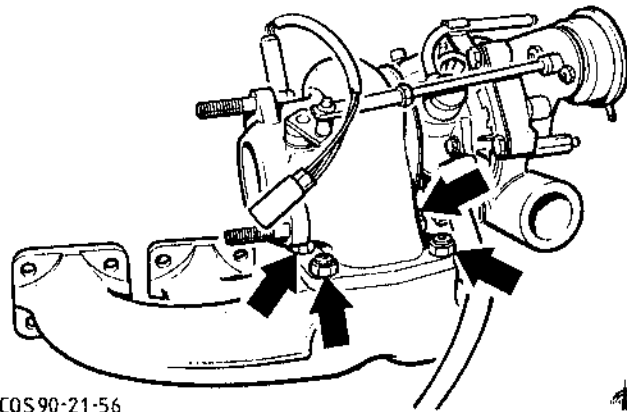
To Install

NOTE: When installing, tighten the nuts, bolts and pipe unions as specified in Technical Data.

21. Fit the turbocharger complete to the exhaust manifold, Fig.13.

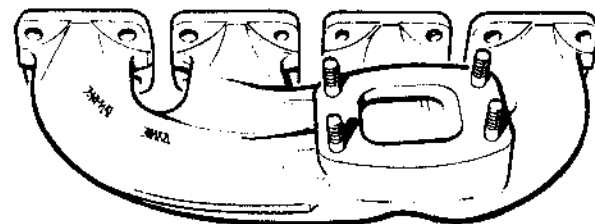
22. Fit new exhaust manifold gaskets to the cylinder head. Locate the exhaust manifold and turbocharger in position, connect the oil return hose to the oil pipe and secure it with the hose clip. Secure the exhaust manifold to the cylinder head, Fig.15.

23. Fit the alternator V-belt and tension it (see Technical Data for V-belt tension).



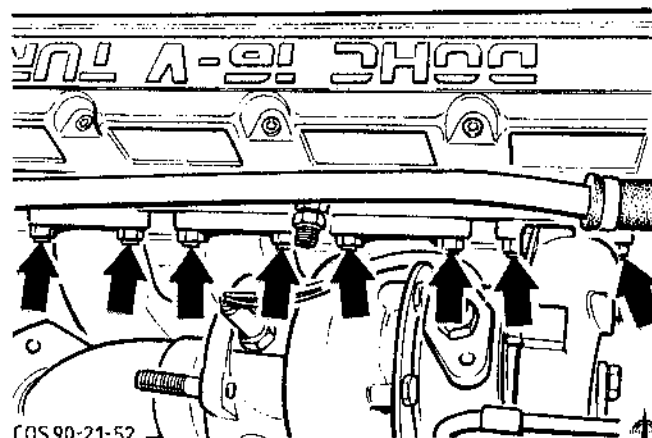
COS90-21-56

Fig.13. Retaining nuts of turbocharger.
(exhaust manifold and turbocharger removed)



COS90-21-57

Fig.14. Exhaust manifold removed.



COS90-21-52

Fig.15. Retaining nuts of exhaust manifold.
(8 upper retaining nuts shown)

21 187 0

Engine - 83 US

24. Connect the front exhaust pipe to the turbocharger, Fig.16.

25. Connect the coolant hose/pipe from the heater radiator to the thermostat housing, Fig.17 (A).

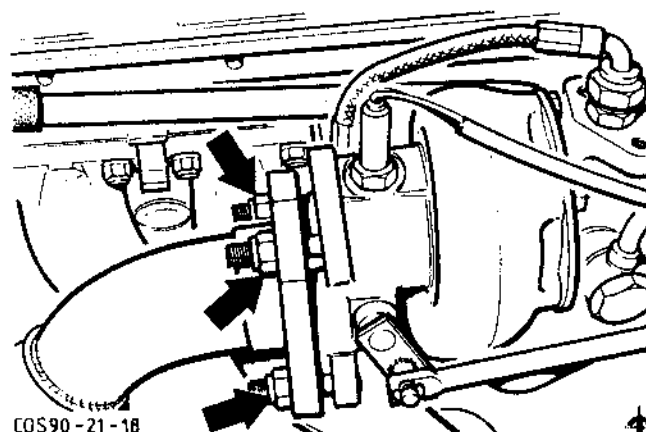


Fig.16. Front exhaust pipe to turbocharger retaining nuts.

- Fig.17. Coolant hose/pipe to thermostat housing.
A - To heater radiator
B - To turbocharger

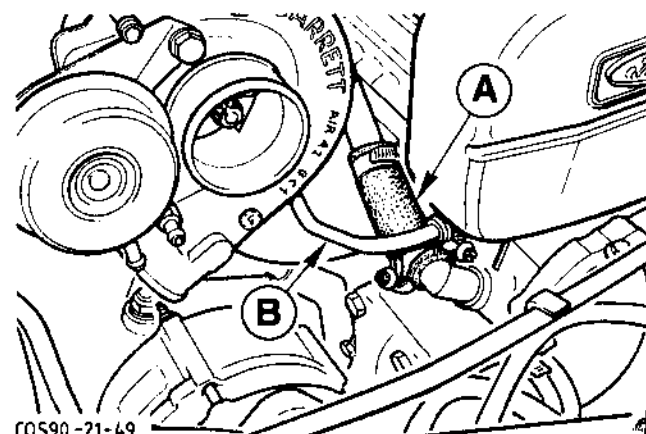


Fig.17. Coolant hose/pipe to thermostat housing.

26. Connect the coolant pipe running to the turbocharger to the hose connector on the thermostat housing, Fig.17 (B).

27. Connect the oil feed pipe to the turbocharger and the cylinder head, Fig.18 (B).

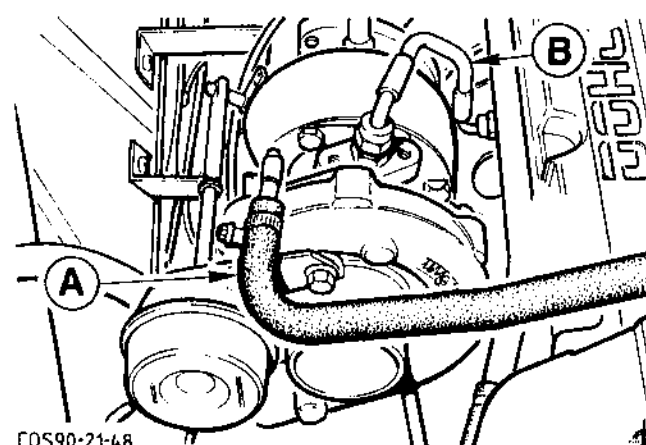


Fig.18. A - Coolant hose
B - Oil feed pipe

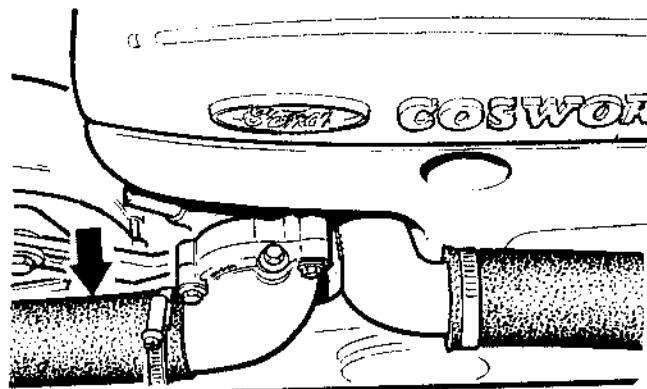
28. Connect the coolant hose running to the degas tank to the connector on the turbocharger, Fig.18 (A).

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21 187 0

Engine - 83 US

29. Fit the coolant hose leading to the lower right-hand side of the radiator and connect it to the thermostat, Fig.19.

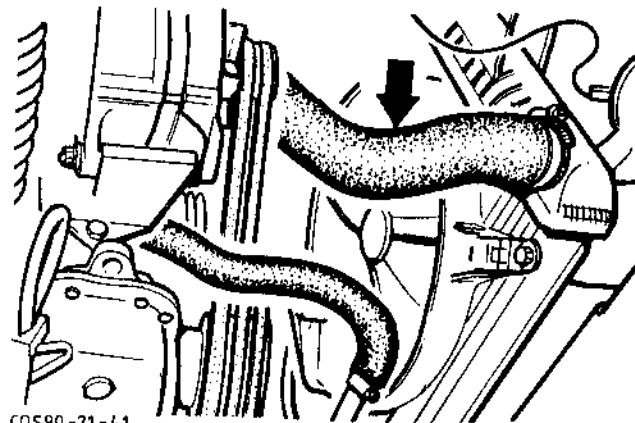


COS90-21-55

30. Raise the vehicle.

Fig.19. Coolant hose from the thermostat housing to lower right-hand side of radiator.

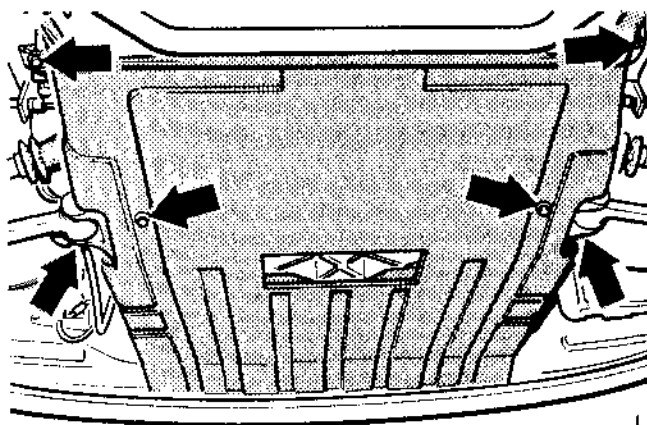
31. Connect the lower right-hand side coolant hose to the radiator, Fig.20.



COS90-21-41

Fig.20. Lower right-hand side coolant hose to radiator.

32. Secure the lower engine cover to the side members and the front axle/engine crossmember, Fig.21.



COS90-21-11

Fig.21. Retaining bolts of lower engine cover.

33. Connect the turbocharger lower air hose running to the intercooler at the turbocharger, Fig.22 (C).
34. Connect the solenoid control valve vacuum pipe to the turbocharger diaphragm unit and to the turbocharger compressor housing, Fig.22 (A, B).

Fig.22. Solenoid control valve and turbocharger lower air hose.
A - Vacuum pipe to diaphragm unit
B - Vacuum pipe to compressor housing
C - Turbocharger lower air hose

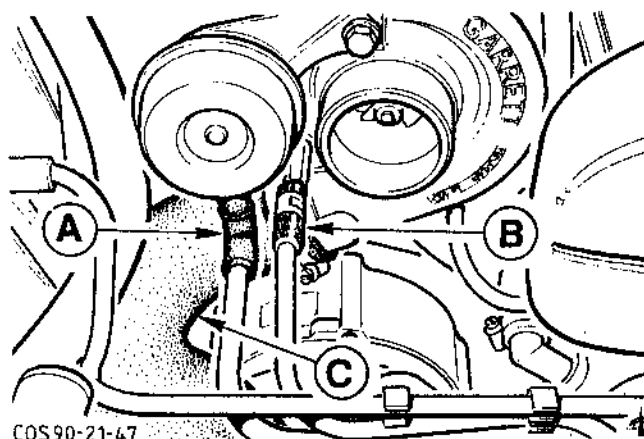
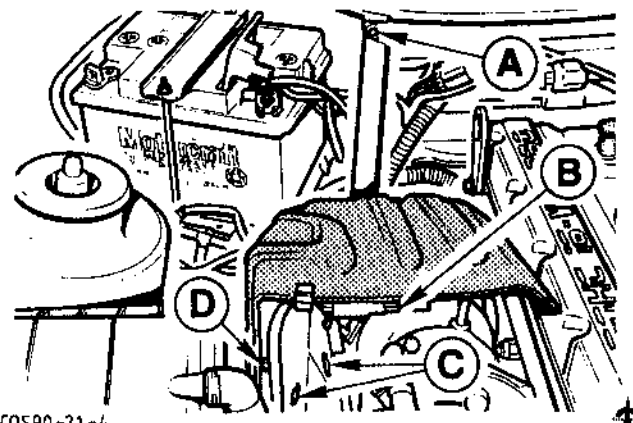


Fig.22. Solenoid control valve and turbocharger lower air hose.

35. Connect the intake air hose to the turbocharger, air cleaner and by-pass valve.
36. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.23 (A, C, D).

Fig.23. Turbocharger heat shield.
A - Retaining bolts
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut



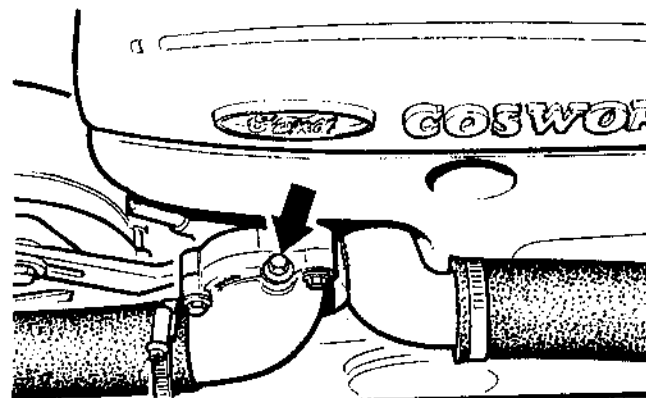
COS90-21-4

Fig.23. Turbocharger heat shield.

37. Connect the multiplug of the HEGO sensor, Fig.23 (B), and clip it to the heat shield.
38. Fill the cooling system with coolant up to the MAX mark on the degas tank (see Technical Data for quantity and specification). Unscrew the vent screw in the thermostat housing to allow air to escape from the cooling system, Fig.24.
Apply sealer (see Technical Data for specification) and screw in the vent screw securely.

NOTE: Fill up with coolant slowly to allow air bubbles to escape.

39. Connect the battery earth cable.
40. Start the engine and run it up to normal operating temperature. Check the coolant hose connections for leaks and tighten as necessary.



COS90-21-45

Fig.24. Cooling system vent screw in thermostat housing.

21 238 0 SEALS - VALVE STEM - REPLACE (A11)

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer	15-053
Valve spring compressor	21-024
Adaptor for valve spring compressor	21-024-06
Toothed belt tension test gauge ..	21-113
Valve stem oil seal installer (exhaust valve)	21-129 A
Valve stem oil seal installer (inlet valve)	21-130 A
Valve stem oil seal extractor	21-142

PROPRIETARY TOOLS:

Compressed air adaptor with spark plug thread
("Hazet 3428")
Rubber sucker ("Hazet 795-2")

WORKSHOP FABRICATED TOOLS:

Mounting plate for valve spring compressor
(see Fig.8 in Technical data).

To Remove

1. Disconnect the battery earth cable.
2. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.1 (B).
3. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.1 (A, C, D).

Fig.1. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut

4. Remove the toothed belt cover from the cylinder head/block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.2.
5. Disconnect the spark plug connectors from the spark plugs and place them to one side.
6. Disconnect the coolant hose to the degas tank from the connector on the turbocharger, Fig.3, pull it out of the engine lifting eye and place it to one side.

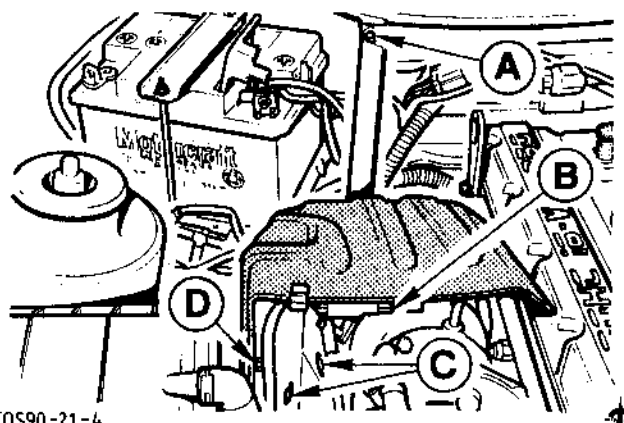


Fig.1. Turbocharger heat shield.

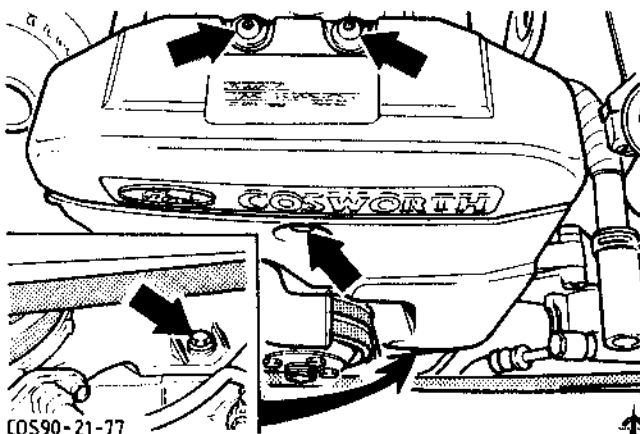


Fig.2. Retaining bolts of toothed belt cover (inset shows detail from below).

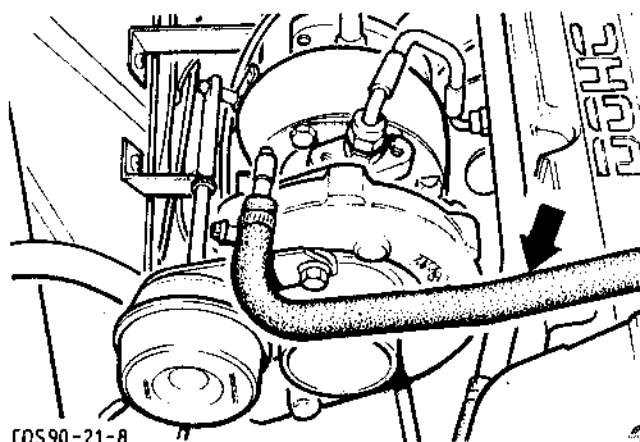
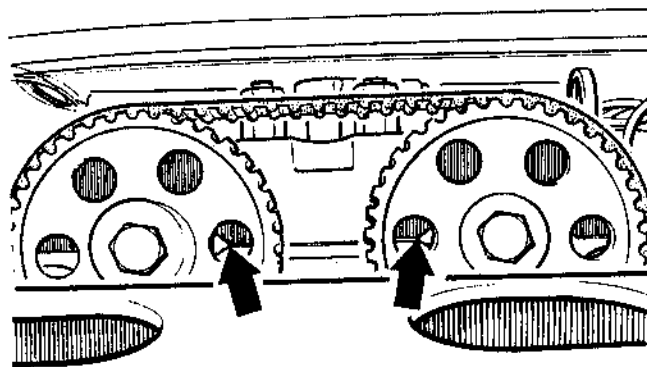


Fig.3. Coolant hose to degas tank.

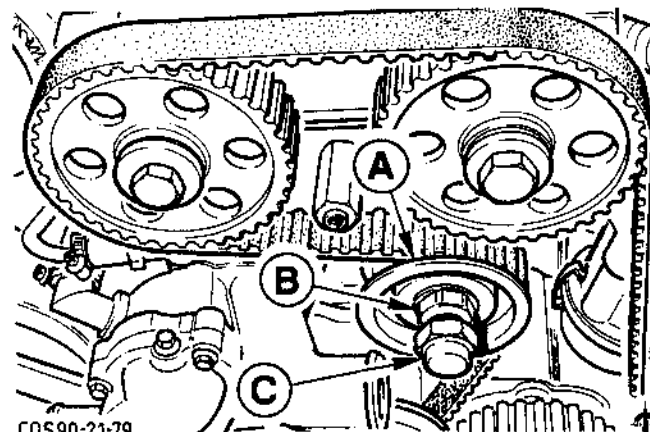
7. Remove the distributor cap from the distributor and place it to one side.



COS90-21-78

Fig.4. Camshaft toothed belt pulleys lined up on TDC marks.

8. Turn the crankshaft in the normal direction of rotation using a proprietary socket wrench until the 2 camshaft toothed belt pulleys line up on the TDC marks, Fig.4.



COS90-21-79

Fig.5. Toothed belt tensioning pulley.

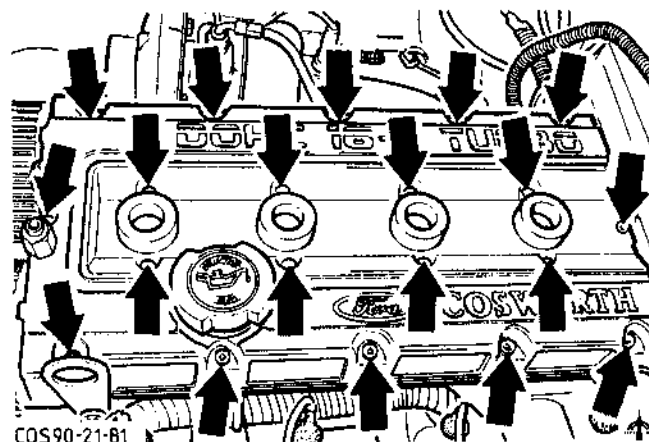
9. Hold the eccentric and release the lock nut. Turn the eccentric and slacken the toothed belt, Fig.5. Remove the toothed belt:

NOTE: Mark the direction in which the toothed belt runs.

Fig.5. Toothed belt tensioning pulley.

- A - Tensioning pulley
- B - Eccentric
- C - Lock nut

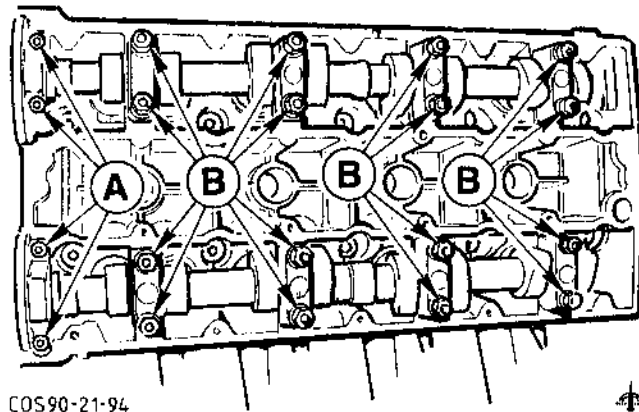
10. Remove the cylinder head cover (20 hexagon socket head bolts), Fig.6.



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Fig.6. Retaining bolts of cylinder head cover.

11. Release the 8 nuts of the 4 rear bearing caps and the 2 hexagon socket head bolts of the front bearing cap of each camshaft uniformly, unscrew the nuts and remove the washers and bearing caps. Remove the bolts and lift off the front bearing caps vertically, Fig.7.
Lift off the camshafts with the toothed belt pulleys vertically.



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12. Remove the hydraulic bucket tappets from the cylinder head using a proprietary rubber sucker, Fig.8.
Stand the bucket tappets on their upper end in the order in which they are removed to ensure that the tappets are refitted in their original positions.

Fig.7. Fixture of camshafts.

A - Hexagon socket head bolts
B - Nuts

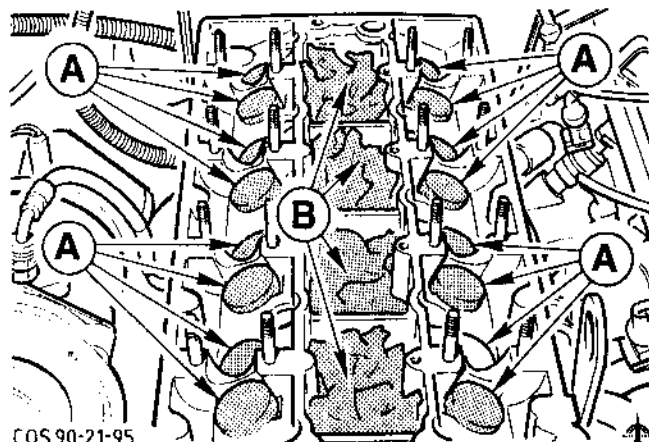
NOTE: Do not use a magnet.

13. Unscrew the spark plugs and block the bores with clean rags to prevent the ingress of dirt, Fig.8.

14. Turn the crankshaft by hand until all the pistons are at mid-stroke. Immobilise the engine (by engaging 1st gear) and apply the handbrake.

NOTE: No valves can drop into the cylinders with the pistons in this position.

The engine speed/TDC sensor must be in the middle of 2 cams on the V-belt pulley.



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Fig.8. A - Hydraulic tappets
B - Clean rags

15. Screw a proprietary compressed air adaptor into the spark plug tapped hole and connect it to the compressed air supply (7 to 10 bars), Fig.9 (D).
16. Release the valve spring collets by tapping the spring retainers using a plastic drift.
17. Secure the mounting plate, Fig.9 (C), (see WORKSHOP FABRICATED TOOLS) to Special Tool 21-024.
18. Screw 2 flat nuts (M8, DIN 936) onto 2 camshaft bearing studs as far as the end of the thread by hand or fit 2 suitable spacer sleeves. Fit Special Tool 21-024 with the mounting plate and secure it with 2 more flat nuts.

NOTE: For the exhaust valves secure Special Tool 21-024 with the mounting plate on the exhaust side and vice versa (except for cylinder No.4).

19. Compress the valve springs of the cylinder being supplied with compressed air using Special Tools 21-024 and 21-024-06 and remove the valve spring collets, Fig.9 (A, B). Remove the valve spring retainers and valve springs.

20. Remove the valve stem oil seal using Special Tools 21-142 and 15-053, Fig.10:

- Fit the clamping jaws of Special Tool 21-142 under the valve stem oil seal.
- Slide the sleeve over the clamping jaws until the clamping jaws are closed and the clamping nut can be screwed on.
- Tighten the clamping nut by hand.
- Screw the slide hammer, Special Tool 15-053, into the clamping jaws and draw out the valve stem oil seal.
- Adjust the clamping nut after each blow.

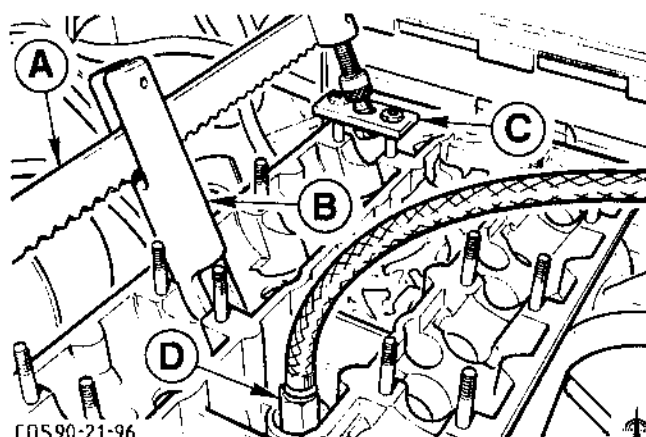


Fig.9. Remove valve spring collets.
A - Special Tool 21-024
B - Special Tool 21-024-06
C - Workshop fabricated mounting plate
D - Compressed air adaptor

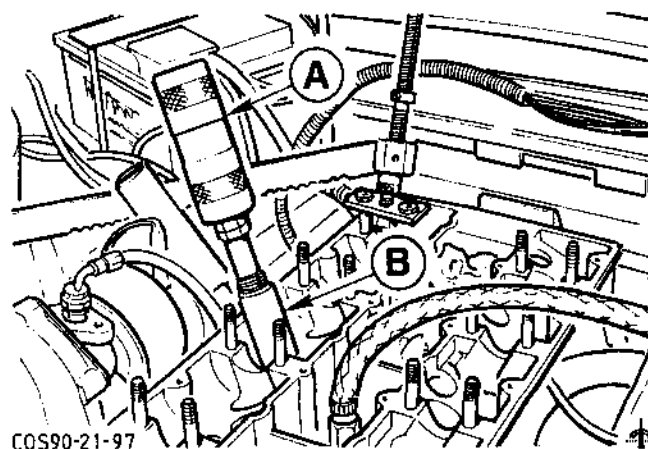


Fig.10. Remove valve stem oil seals.
A - Special Tool 15-053
B - Special Tool 21-142

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21. Mask the valve collet grooves with adhesive plastic tape.
Lubricate the valve stems and valve stem oil seals with clean engine oil. Fit the valve stem oil seals using Special Tool 21-129 A (for the exhaust valves) and 21-130 A (for the inlet valves), Fig.11.

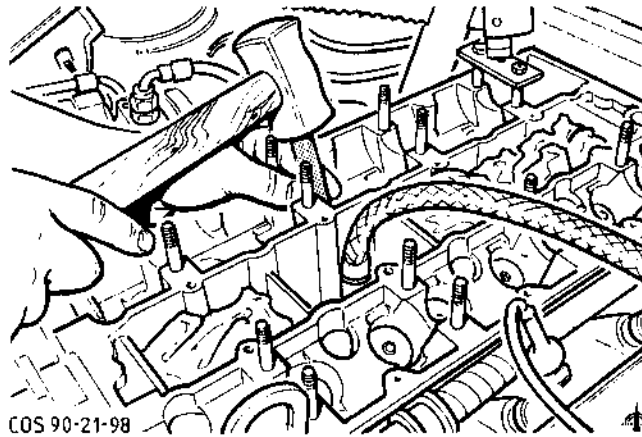


Fig.11. Fit valve stem oil seals using Special Tool 21-0129 A or 21-130 A.

22. Fit the valve springs and valve spring retainers. Compress the valve springs using Special Tools 21-024 and 21-024-06. Fit the valve spring collets.

NOTE: Make sure the valve spring collets are seated correctly by tapping the valve spring retainers using a plastic drift.

23. Repeat sub-operations 15 to 22 for the other 3 cylinders, moving Special Tools 21-024 and 21-024-06 and the mounting plate each time for improved leverage.

NOTE: For the valves of cylinder No.4 apply the lever of Special Tool 21-024 to Special Tool 21-024-06.
Secure the mounting plate and Special Tool 21-024 on the exhaust side to compress the valve springs on the inlet side and vice versa, Fig.12.

Fig.12. Remove valve spring collets of cylinder No.4.

- A - Special Tool 21-024 attached on exhaust side and 21-024-06 inserted on inlet side
- B - Special Tool 21-024 applied to 21-024-06

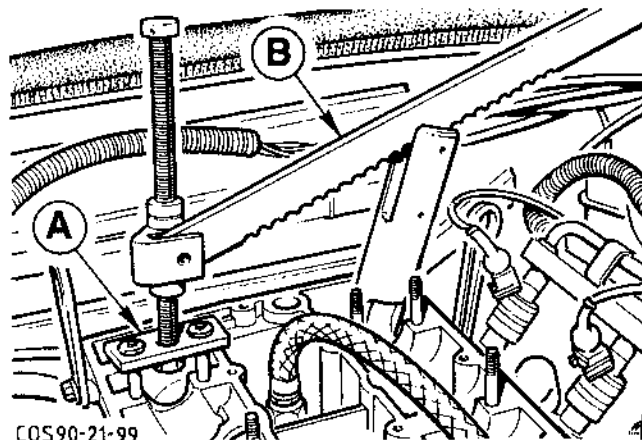


Fig.12. Remove valve spring collets of cylinder No.4.

24. Remove the 2 Special Tools with the mounting plate and the compressed air adaptor.

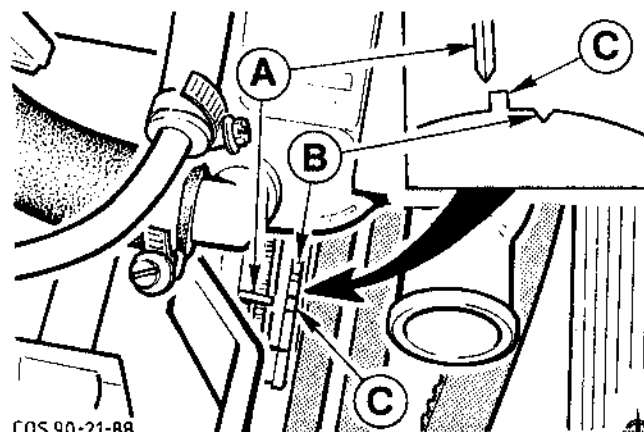
21 238 0

Engine - 83 US

25. Lubricate the bucket tappets with oil and refit them in their original positions.

NOTE: Make sure that no air is trapped under the bucket tappets.

26. Release the handbrake, move the gear lever to the neutral position and turn the crankshaft V-belt pulley to the TDC position, Fig.13.



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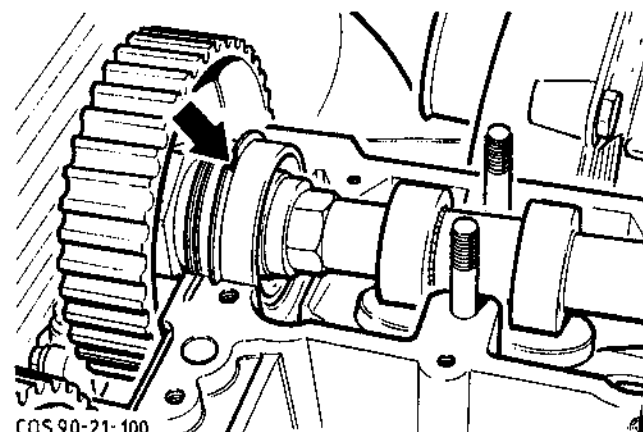
Fig.13. Crankshaft V-belt in TDC position.

Fig.13. Crankshaft V-belt pulley in TDC position.

- A - Tooth on cylinder block
- B - Notch in V-belt pulley
- C - Tooth on V-belt pulley

27. Fit the 2 camshafts in the cylinder head so that the TDC marks of the toothed belt pulleys face one another. The gap in the camshaft retaining ring must be at the top, Fig.14.

NOTE: The camshaft for the inlet valves can be identified by the oil grooves in the camshaft bearings.



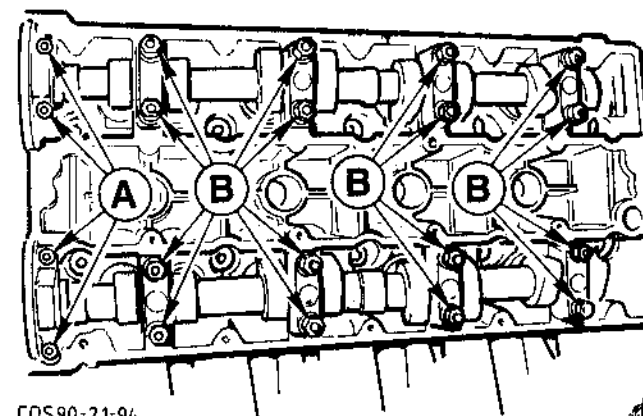
COS 90-21-100

Fig.14. Gap in camshaft retaining ring.

28. Oil the camshaft bearing caps and fit them in the correct sequence, starting with the front bearing caps (1 and 6), and tighten them down to the specified torque (see Technical Data). Remove the rags, Fig.15.

Coat the mating faces of the front bearing caps with sealer (see Technical Data).

NOTE: Bearing caps 1 to 5 are located on the exhaust side and bearing caps 6 to 10 on the inlet side. Bearing caps 1 and 6 are located at the front toothed belt pulley end. The bearing cap numbers face inwards.



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Fig.15. Fixture of camshafts.

- A - Hexagon socket head bolts
- B - Nuts

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29. Fit the spark plugs and tighten them to the specified torque.

30. Fit the toothed belt in an anti-clockwise direction, starting at the distributor shaft.

NOTE: Note the direction in which it runs.

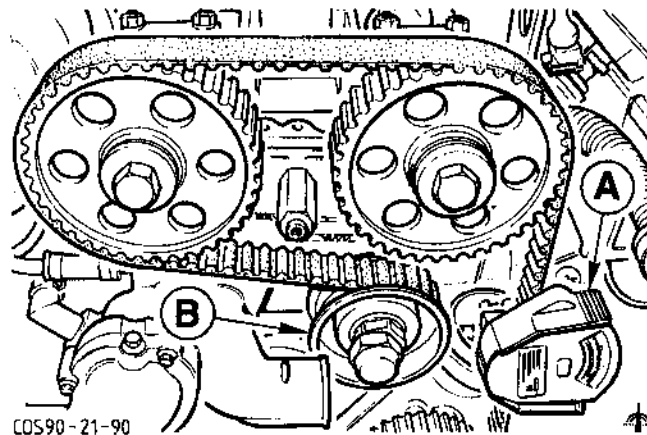
31. Adjust the toothed belt tension as follows:

- Turn the tensioning pulley towards the toothed belt in a clockwise direction by hand and tighten the lock nut of the toothed belt tensioning pulley.
- Turn the engine several revolutions in the normal direction of rotation and then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

Check the toothed belt tension applying Special Tool 21-113 to the longest span of the toothed belt, Fig.16.
If necessary, adjust the toothed belt tensioning pulley until the specified tension is obtained (see Technical Data).

Check the toothed belt tension and the TDC positions again and repeat the tensioning process if necessary.

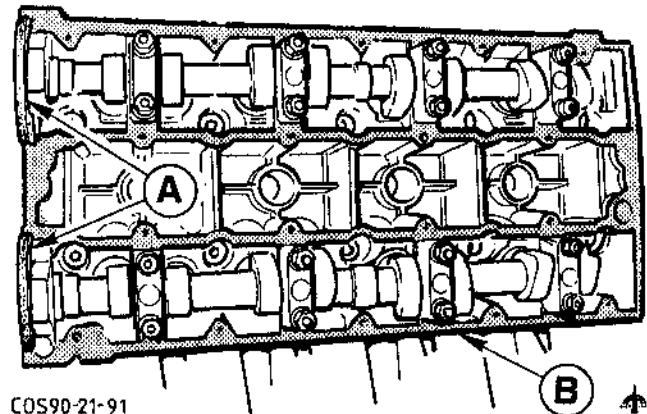


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Fig.16. Tension toothed belt.

A - Special Tool 21-113

B - Toothed belt tensioning pulley



COS90-21-91

Fig.17. A - Cylinder head cover gasket

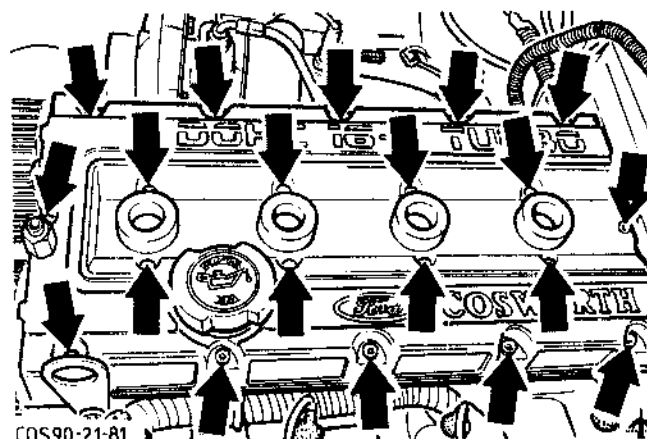
B - Rubber seals

32. Place the cylinder head cover gasket on the cylinder head and place the 2 rubber seals on the camshaft front bearing caps, Fig.17.

NOTE: Smear the ends of the rubber seals with sealer (see Technical Data).

33. Fit the cylinder head cover, insert the 20 hexagon socket head bolts and tighten them to the specified torque (see Technical Data), Fig.18.

34. Fit the distributor cap to the distributor and connect the spark plug connectors to the spark plugs.



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Fig.18. Retaining bolts of cylinder head cover.

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Engine - 83 US

35. Pass the coolant hose to the degas tank through the engine lifting eye and connect it to the connector on the turbocharger, Fig.19.

36. Fit the toothed belt cover, Fig.20.

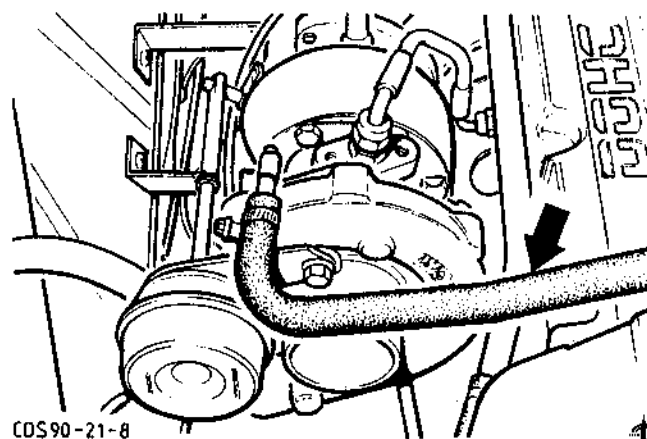


Fig.19. Coolant hose to degas tank.

37. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.21 (A, C, D).

Fig.21. Turbocharger heat shield.

- A - Retaining bolt
- B - Multiplug of HEGO sensor
- C - Heat shield clips
- D - Retaining nut

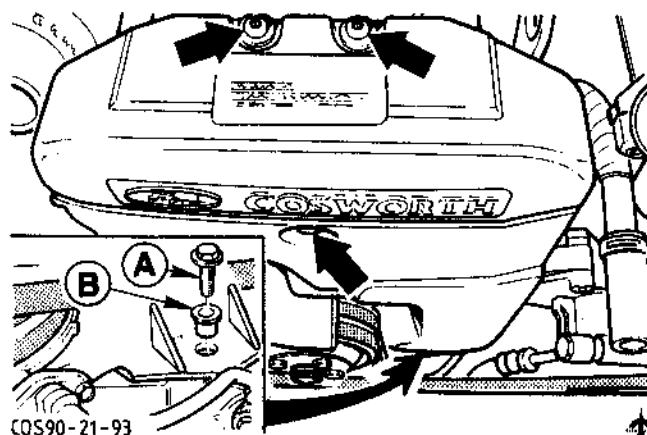


Fig.20. Retaining bolts of toothed belt cover (detail shown from below).

- A - Bolt
- B - Bush

38. Connect the multiplug of the HEGO sensor and clip it to the heat shield, Fig.21. (B).

39. Connect the battery earth cable.

40. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.

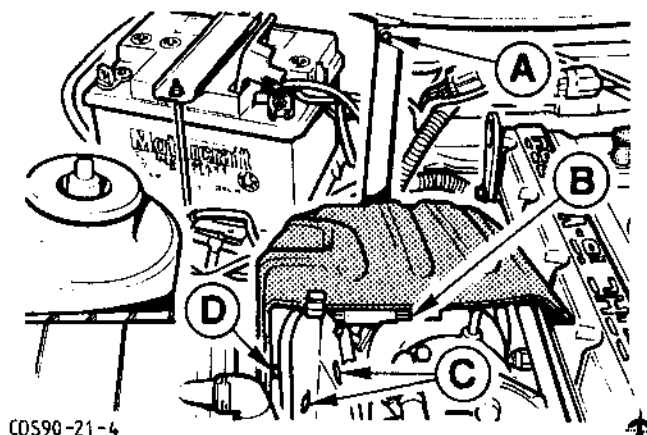


Fig.21. Turbocharger heat shield.

