

ENGINE
(Cosworth '86/'88)

21A

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TECHNICAL DATA

Engine - General

Engine Code	..	..	..	..	..	..	..	..	N5A
Firing order	..	..	..	..	..	..	..	..	1-3-4-2
Bore	..	..	..	..	..	..	..	mm	90,82
Stroke	..	..	..	..	..	..	..	mm	76,95
Cubic capacity	..	..	..	..	..	..	effective	cm ³	1993
Compression ratio	..	..	..	..	..	..	..	..	8,0 : 1
Compression pressure at starter speed	..	..	..	..	..	..	..	bar	8,5
Boost (nominal)	..	..	..	..	..	..	..	bar	0,7
Idling speed	..	..	..	..	..	..	..	rev/min	850
Maximum continuous engine speed	..	..	..	..	..	..	..	rev/min	6500
Engine power	..	..	..	..	..	..	(DIN)	kW	150
							at	rev/min	6000
Torque	..	..	..	..	..	..	(DIN)	Nm	278
							at	rev/min	4500
Spark plugs	..	..	..	..	..	..	..	..	AGPR901C
Ignition point	..	..	..	..	..	..	..	..	16° BTDC at idle

Engine Lubrication

Viscosity	..	..	..	..	below -23°C to -12°C	5W/20
					below -23°C to 0°C	5W/30
					-23°C to +20°C	10W/30
					above -12°C	20W/50
Ford Specification	..	..	..	..	..	API/SF-CC
Initial fill capacity	..	..	..	..	.. with filter	Litres 3,8
Oil change interval	..	..	..	..	..	Km 10,000
Oil change capacity	..	..	..	..	without filter	Litres 3,0
					with filter change	Litres 3,4
Minimum oil pressure *	..	..	..	..	at 850 rpm	bar 1,8
					at 2000 rpm	bar 2,4

* With SAE 20W-50 oil at 80°C

Cooling System

Coolant capacity with heater circuit and overflow tank		Litres	7,5
Antifreeze - Type	 Motorcraft Super Plus 4 antifreeze		
- Specification			ESD-M97B49-A
- a 50/50 solution (by volume) should be used to top up and refill the system			

Cylinder Block

Casting mark	..	..	..	..	..	..	..	85 HM 6015 AA
Number of main bearings	..	..	..	..	..	..	..	5
Bore diameter	..	..	..	..	..	standard grade 2	mm	90,810 - 90,820
						3	mm	90,820 - 90,830
Centre main bearing width	..	..	..	..	..	..	mm	27,22 - 27,17
Main bearing shells (fitted)								
- internal diameter	..	..	..	..	..	Standard	mm	57,000 - 57,038
						Undersize 0,25	mm	56,750 - 56,788
						0,50	mm	56,500 - 56,538
						0,75	mm	56,250 - 56,288
Main bearing parent bore diameter	..	..	..	..	..	Standard	mm	60,640 - 60,620



TECHNICAL DATA (cont'd)

Crankshaft

End float	mm	0,1	-	0,254	
Main bearing journal diameter	mm	56,975	-	56,959	
		Standard			
		Undersize 0,25		56,725	- 56,709
		0,50		56,475	- 56,459
		0,75		56,225	- 56,209
Centre main bearing shoulder width	mm	32,00	-	32,05	
Thrust - half washers, thickness	mm	2,3	-	2,35	
Bearing shell to main bearing journal clearance	mm	0,025	-	0,079	
Big-end journal diameter	mm	51,993	-	51,977	
		Standard			
		Undersize 0,25		51,743	- 51,727
		0,50		51,493	- 51,477
		0,75		51,243	- 51,227
Main bearing journal length	mm	32,13	-	31,87	Including fillet
		Front centre, rear			
Main bearing shell width	mm	32,13	-	31,87	
		Intermediate bearings			
		front, centre, rear		23,24	- 23,62
		Intermediate bearings		23,24	- 23,62
Big-end bearing journal length	mm	26,0	-	26,1	Including fillet
Big-end bearing shell width	mm	19,61	-	20,00	

Cylinder Head

Cast marking		V 86 HF 6090 AA	
Valve seat angle		45°	
Valve seat width		1,5 max.	
		2,0 max.	
Valve stem bore - inlet	mm	7,000	- 7,015
Valve stem bore - exhaust	mm	8,000	- 8,015
Camshaft bearing parent bore diameter	mm	28,000	- 28,021
Distance between underside of valve guide and cylinder head mating face	mm	33,5	along CL guide
	mm	28,0	along CL guide
Cylinder head flatness - upper mating face			
Maximum permissible longitudinal bow (measured along cylinder head centre line)	mm	0,10	
		If exceeded, replace cylinder head	
Cylinder head flatness - lower mating face			
Maximum permissible lateral bow (100 mm straight-edge)	mm	0,02	
Maximum permissible longitudinal bow (100 mm straight-edge)	mm	0,02	
Maximum permissible overall longitudinal bow	mm	0,08	
(measured along cylinder head centre line)			
		If any limit exceeded, re-machine cylinder head	
Maximum material removal	mm	0,13	
Minimum cylinder head height after machining, measured between mating faces	mm	138,68	

Camshaft

Number of camshafts		2	
Number of bearings		5	
Drive		toothed belt	
Cam lift	mm	8,544	
	mm	8,544	
Cam length (heel to toe)	mm	46,802	- 46,286
	mm	46,802	- 46,286
Bearing journal diameter	mm	27,960	- 27,939
Inlet valve side front	mm	27,960	- 27,939
	mm	27,960	- 27,939
	mm	27,960	- 27,939
	mm	27,960	- 27,939
Outlet valve side front	mm	27,960	- 27,939
	mm	27,960	- 27,939
	mm	27,960	- 27,939
	mm	27,960	- 27,939
Camshaft end float		clearance in ball bearing	
Valve timing		8°	
		inlet valve opens before TDC	
		inlet valve closes after BDC	52°
		exhaust valve opens before BDC	52°
		exhaust valve closes after TDC	8°

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TECHNICAL DATA (cont'd)

Valves

Valve operation	..	..	..	..	..	..	..	O.H.C. direct
Valve clearance (cold)	..	..	..	..	..	..	.. inlet	hydraulic tappet
							exhaust	hydraulic tappet
Tappet diameter	..	..	..	..	..	..	Standard	mm 34,975 - 34,959
Tappet diameter	..	..	..	..	..	..	Oversize	mm 35,175 - 35,159
Tappet clearance in housing	..	..	..	..	..	..	Standard/Oversize	mm 0,025 - 0,057
Free spring length	..	..	..	..	..	..	..	mm 39,8
Spring force	..	..	..	..	..	..	.. valve open	N 620
							valve closed	N 257
Spring length	..	..	..	..	..	..	.. valve open	mm 23,45
							valve closed	mm 32
Valve spring wire diameter	..	..	..	..	..	..	..	mm 3,9
Number of turns	..	..	..	..	..	..	..	5,8
Valve-spring inner diameter	..	..	..	..	..	..	..	mm 21,6

Inlet Valve

Length	..	..	..	..	..	..	..	mm 105,68
Head diameter	..	..	..	..	..	..	..	mm 35,0 - 35,2
Stem diameter	..	..	..	..	..	..	Standard	mm 6,970 - 6,955
Stem/guide clearance	..	..	..	..	..	..	..	mm 0,03 - 0,06

Exhaust Valve

Length	..	..	..	..	..	..	..	mm 105,5
Head diameter	..	..	..	..	..	..	..	mm 31,0 - 31,2
Stem diameter	..	..	..	..	..	..	Standard	mm 7,960 - 7,938
Stem/guide clearance	..	..	..	..	..	..	..	mm 0,055 - 0,077



TECHNICAL DATA (cont'd)

Pistons

Diameter	..	..	..	..	..	..	Standard 2	mm	90,758 - 90,772
							3	mm	90,768 - 90,782
Clearance in bore (unused)	..	..	..	..	..	..	..	mm	0,038 - 0,062
Ring gap (fitted)	..	..	..	..	..	..	top	mm	0,4 - 0,65
							centre	mm	0,4 - 0,65
							bottom	mm	0,3 - 0,6
Ring gap position	..	..	..	..	..	..	top		120° apart
							centre		120° apart
Lower scraper ring	..	..	..	..	..	..	..		120° apart

Piston Pins

Type	..	..	..	..	..	..	..	..	fully floating
Piston pin diameter	..	..	..	..	..	..	..	mm	24,000 - 23,995
Pin retention	..	..	..	..	..	..	..	..	wire circlips

Connecting Rod

Bore diameter (without bearing shells)	..	..	..	..	..	big-end	mm	55,00 - 55,02
						small-end	mm	27,000 - 27,021
Bearing shells (fitted)								
- inside diameter	..	..	..	..	..	Standard	mm	52,006 - 52,044
						Undersize 0,25	mm	51,756 - 51,794
						0,50	mm	51,506 - 51,544
						0,75	mm	51,256 - 51,294
Bush - inside diameter	..	..	..	..	..	..	mm	24,007 - 24,013 fitted
Big-end bearing clearance	..	..	..	..	..	..	mm	0,013 - 0,067
Big-end bearing axial float	..	..	..	..	..	..	mm	0,25 - 0,09



TECHNICAL DATA (cont'd)

Tightening Torques

Cylinder Block						Nm	Note
Main bearing caps to cylinder block	..	..	..	..	..	87,5 to 101	Loctite 270
Crankshaft pulley to crankshaft	..	..	..	..	..	122 to 135	
Clutch housing to engine	..	..	..	..	..	40 to 51	
Clutch housing adaptor plate bolt	..	..	..	..	..	8,5 to 12	
Flywheel to crankshaft	..	..	..	..	..	63 to 69	
Clutch pressure plate to flywheel	..	..	..	..	..	18,5 to 21,5	
Oil pump to cylinder block	..	..	..	..	..	18,5 to 21,5	
Auxiliary shaft retainer plate to cylinder block	..	..	..	..	..	8 to 10	
Auxiliary shaft pulley to auxiliary shaft	..	..	..	..	..	44 to 49	
Con rod caps to con rod	..	..	..	..	..	55 to 60	
Sump to cylinder block	Stage 1	..	..	..	..	8 to 10	Bolts-Loctite 270 Gasket - Loctite 518
	Stage 2	..	..	..	..	8 to 10	
Water pump to cylinder block M8	..	..	..	..	..	18,5 to 21,5	
Water pump to cylinder block M10	..	..	..	..	..	40 to 48	
Water pump pulley to water pump	..	..	..	..	..	18,5 to 21,5	
Engine mounting bracket to cylinder block	..	..	..	..	..	18,5 to 21,5	
Insulator to engine mounting bracket	..	..	..	..	..	40 to 48	
Oil drain plug to sump	..	..	..	..	..	21 to 27	
Alternator bracket to cylinder block	..	..	..	..	..	58 to 79	
Alternator to bracket	..	..	..	..	..	18 to 25	
Adjustment strap to alternator	..	..	..	..	..	18 to 25	
Adjustment strap to water pump	..	..	..	..	..	18 to 25	
TDC sensor bracket studs to sump	..	..	..	..	..	4 to 6	Loctite 648 Gap between sensor and pulley tooth 0,6 to 1,0 mm
TDC sensor bracket nuts to sump	..	..	..	..	..	8 to 10	
TDC sensor bolts to bracket	..	..	..	..	..	4 to 6	Loctite 270
Distributor clamp to cylinder block	..	..	..	..	..	18,5 to 21,5	
Bolts - power steering pump to mounting bracket	..	..	..	..	..	20,5 to 25,5	
Power steering pump bracket to cylinder block	..	..	..	..	..	50 to 60	M10 socket head bolt M8 hex. head bolt - Loctite 518 on mating face M8 socket head bolt
Power steering pump support bracket to cylinder block	..	..	..	..	..	18,5 to 21,5	
Support bracket to power steering pump bracket	..	..	..	..	..	35 to 40	
Power steering pump fixture (belt tension)	..	..	..	..	..	20,5 to 25,5	
Crankshaft front seal housing to cylinder block	..	..	..	..	..	13 to 17	Fit new self locking bolts ('Scotch Grip' bolts)
Oil pick up pipe to oil pump	..	..	..	..	..	8 to 10	
Oil pick up pipe to cylinder block	..	..	..	..	..	18,5 to 21,5	
Water drain plug to cylinder block	..	..	..	..	..	25	
Sump baffle to sump	..	..	..	..	..	8 to 10	Loctite 270
Oil filter	..	..	..	..	Up to face then tighten one half to threequarters of a turn		Oil sealing ring
Oil cooler to cylinder block	..	..	..	..	..	30 - 35	Loctite 270



TECHNICAL DATA (cont'd)

Cylinder Block (cont'd)

	Nm	Note
Hollow bolt to cooler	55 to 60	
Turbocharger oil feed adaptor to main gallery	25+	Loctite
Turbocharger oil feed hose to adaptor	25+	
Oil pressure sender to adaptor	25 to 29	Loctite 518
Timing belt cover to engine - all bolts	8 to 10	

Inlet Manifold

Plenum cover to inlet manifold	8 to 10	Loctite 518
Plenum intake elbow to plenum cover	18,5 to 21,5	
Throttle body to plenum intake elbow	8 to 10	
Inlet manifold stud to inlet manifold	3,5 to 4,5	Loctite 648
Throttle cable bracket to plenum cover	18,5 to 21,5	Loctite 518
Fuel pressure regulator to bracket	8 to 10	'86 MY only
Fuel pressure regulator bracket to plenum chamber	8 to 10	
Hose clips - fuel pressure regulator	1,5 to 2	
Hose clips - worm drive	3,5 to 4,5	
Fuel rail to plenum cover	8 to 10	
Crankcase breather valve to plenum chamber	8 to 10	
Breather valve intake fitting to plenum chamber	15 to 20	Loctite 242
Air temperature sender to plenum cover	23 to 25	Loctite 518
Signal elbow to plenum cover	5 to 6	Loctite 518
Fuel pressure regulator banjo bolt	1,5 to 2	if fitted
Intake elbow stud (M6)	3,5 to 4,5	Loctite 518
Intake elbow damper assembly	8 to 10 (Back off a half turn)	Loctite 270

Exhaust Manifold

Secondary exhaust manifold to primary manifold	32 to 36	
Turbocharger to secondary exhaust manifold	40 to 48	
Exhaust downpipe to turbocharger nuts (M8)	19 to 23	
Exhaust downpipe to turbocharger nuts (M10)	35 to 47	
Oil feed adaptor to turbocharger	25 to 35	Oil
Turbocharger oil feed to adaptor	25	
Turbocharger drain pipe to turbocharger	18,5 to 21,5	
Coolant pipe banjo bolt to turbocharger	19 to 23	Oil
Turbocharger, turbine housing inlet studs (M10)	18,5 to 21,5	Oil
Turbocharger, turbine housing outlet studs (M8)	8 to 10	Oil
Turbocharger, damper friction assembly and locknut	See damper adjustment procedure contained in Operation 23 612 0	

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TECHNICAL DATA (cont'd)

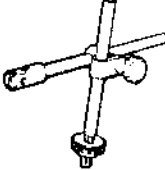
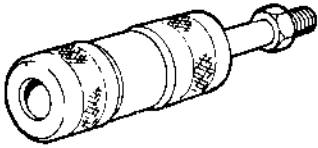
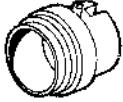
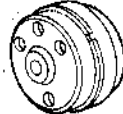
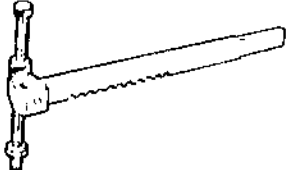
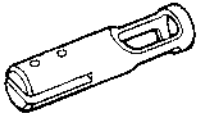
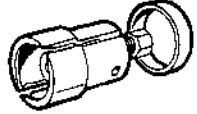
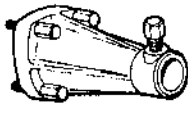
<u>Cylinder Head</u>					<u>Nm</u>	<u>Note</u>
Cam cap stud to cylinder head (M6) ..	..	..	..	..	3,5 to 4,5	Loctite 648
Cam cap stud to cylinder head (M8) ..	..	..	..	..	3,5 to 4,5	Loctite 648
Cam cap to cylinder head (M6) .	..	..	..	..	8 to 10	Loctite 270
Cam cap to cylinder head (M8) .	..	..	..	..	19 to 23	
Inlet manifold stud to cylinder head	..	..	..	..	3,5 to 4,5	Loctite 648
Cam bearing retainer screws	..	..	..	..	8 to 10	
Cam pulley to camshaft ..	..	..	..	..	59 to 63	
Idler pulley stud to cylinder head ..	..	..	..	..	4,5 to 5,5	Loctite 648
Idler pulley to cylinder head	..	..	..	..	40 to 48	
Timing belt cover pillar bolt to cylinder head ..	..	..	..	..	4,5 to 5,5	Oil
Timing belt cover pillar bolt to camshaft cover	..	..	..	..	4,5 to 5,5	Loctite
Exhaust manifold stud to cylinder head	..	..	..	..	3,5 to 4,5	Loctite 648
Thermostat housing to cylinder head	..	..	..	..	18,5 to 21,5	
Housing, coolant temperature sender to cylinder head ..	..	..	..	..	8 to 10	
Coolant temperature sender to housing	..	..	..	..	23 to 25	Loctite 518
Lifting eyes to cylinder head	..	..	..	..	18,5 to 21,5	
Cam cover to cylinder head	..	..	..	..	10 to 15	
Inlet manifold to cylinder head	..	..	..	..	18,5 to 21,5	
Exhaust manifold to cylinder head	..	..	..	..	19 to 23	
Cylinder head to cylinder block	Stage 1	..	..	..	20 to 25	
	Stage 2	..	..	..	45 to 50	
	Stage 3	..	..	..	Rotate further 170° to 180°	
Spark plug	..	..	..	..	28 to 33	
Temperature gauge sender unit to cylinder head ..	..	..	..	..	7 to 10	Loctite 518
Turbocharger damper pillar bolt (M8)	..	..	..	..	18,5 to 21,5	
Oil gallery blanking plugs to cylinder head	1/16 NPTF .	..	..	..	5 + 90°	Loctite 518
	1/8 NPTF..	..	..	..	8 to 10	Loctite 518
<u>Exhaust System</u> - left hand muffler insulator bracket bolts ..					45 to 56	
<u>Starter Motor</u> - retaining bolts					29 to 41	

Belt Tension

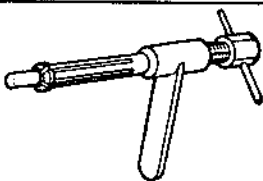
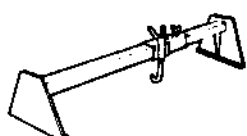
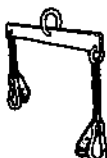
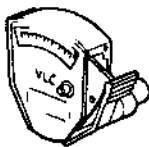
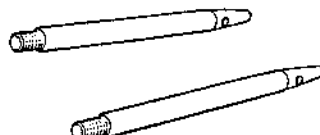
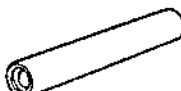
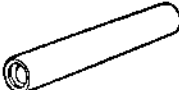
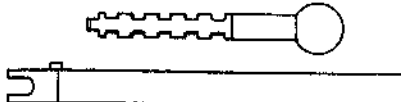
Alternator/water pump	..	..	..	..	new belt 400 to 500 N used belt 300 N
Power steering pump	..	..	..	..	new belt 450 to 550 N used belt 350 to 450 N
Timing belt (with special tool 21-113)	..	..	..	..	9,5 to 10,5 gauge reading

NOTE: A used V-belt is one that has been run for at least 10 minutes. All tensions refer to a cold belt.

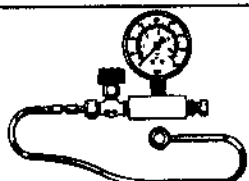
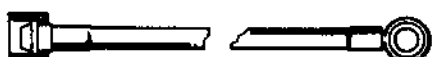
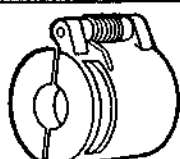
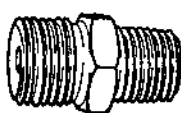
SPECIAL SERVICE TOOL RECOGNITION

	15-022-A	Dial test indicator holding fixture
	15-046	Metric dial test indicator gauge
	15-053	Slide hammer
	21-009-B	Crankshaft front oil seal installer
	21-011-D	Crankshaft rear oil seal installer
	21-023	Universal spindle (only for use in conjunction with engine stands)
	21-024	Valve spring compressor (main tool)
	21-024-06	Adaptor - valve spring compressor
	21-028-A	Crankshaft timing gear remover
	21-031-B	Engine mounting bracket (only in conjunction with 21-023 and engine stands)

SPECIAL SERVICE TOOL RECOGNITION (cont'd)

	21-036-A	Crankshaft needle roller bearing remover
	21-044-A	Crankshaft needle roller bearing installer and clutch disc locator
	21-060-A	Engine support bar
	21-068	Engine lifting tackle
	21-113	Toothed belt tension gauge
	21-128	Cylinder head alignment studs
	21-129	Installer - valve stem oil seal (exhaust)
	21-130	Installer - valve stem oil seal (inlet)
	21-142	Remover - valve stem oil seal
	21-143	Crankshaft front and rear oil seal remover

SPECIAL SERVICE TOOL RECOGNITION (cont'd)

	23-011A 011 pressure test gauge
	23-011A-09 Connecting hose
	23-023-A Remover - fuel delivery line
	Ford Part No. 6084322 Reducer fitting

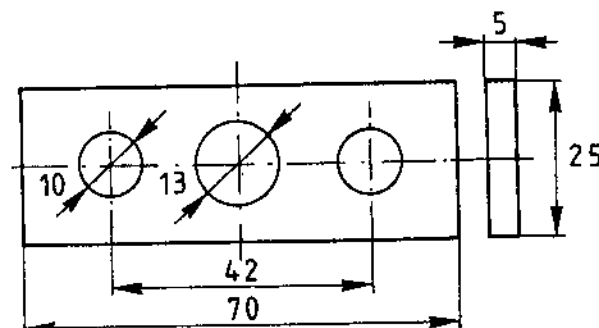
PROPRIETARY TOOLS

Compression Tester

Air line adaptor for spark plug bore.

LOCALLY FABRICATED TOOLS

Support plate - valve spring compressor



COS - 21 - 1

Fig.1. Valve spring compressor support plate.

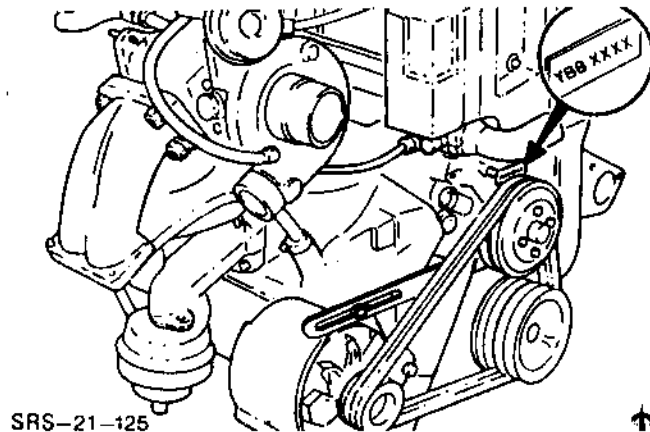
GENERAL DESCRIPTION

The high performance engine fitted to the Sierra Cosworth has been developed in collaboration with COSWORTH in England, a company well known for its high performance engines.

The FORD 2,0 litre OHC regular production cylinder block forms the basis of this engine.

The main feature of this engine is the aluminium cylinder head with its two overhead camshafts. Its four valves per cylinder and backup from an exhaust gas turbocharger provide the basis for optimum cylinder charge.

The engine is distinguished by outstanding torque characteristics even at low speeds enabling the vehicle to accelerate from 0 to 100 kph in under 7,0 secs.



SRS-21-125

Fig.2. Engine number.

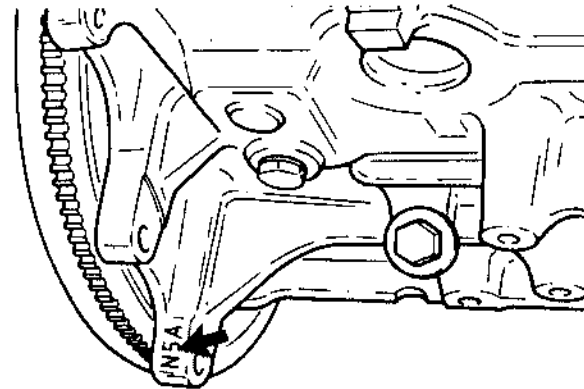
Engine Identification

The identification code and serial number must be stamped on replacement engines in such a way as to be clearly visible to an inspecting authority.

The letters and numbers must have a minimum height of 6 mm.

The engine number consists of a two-digit code for the build year and month and a five-digit serial number.

The three digit engine code indicates cubic capacity, compression ratio and model to which the engine is fitted.



SRS-21-6N

Fig.3. Engine code.

Valve Identification

The valve identification is stamped in 5 mm characters on the rear end of the cylinder head. These numbers indicate details of oversize specifications with respect to valve guide, valve seat and tappet.

IN1234567S1G1 = Inlet valve 1 to 7 seat oversize 1
guide oversize 1

IN8S2 = Inlet valve 8 seat oversize 2

EX678S1G2 = Exhaust valve 6 to 8 seat oversize 1
guide oversize 2

EX34S2G1 = Exhaust valve 3 and 4 seat oversize 2
guide oversize 1

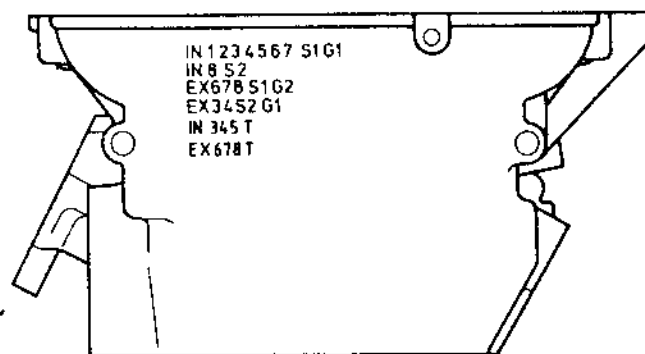
'88 Model Year only

IN 345T = Inlet tappet 3, 4 and 5 oversize

EX 678T = Exhaust tappet 6, 7 and 8 oversize

In the case of oversize tappets, this is also recorded by an 'A' being stamped on the cylinder head adjacent to the tappet bore. The tappets themselves are marked on the underside adjacent to the hydraulic plunger, '+ 0,2'.

1087



SRS-21-124N

Fig.4. Cylinder head, rear end - oversize valve identification.



GENERAL DESCRIPTION (cont'd)

Modifications

Following parts are changed or modified:

- Cylinder block - c/o Ford 2,0 cast iron block (memo: selected blocks only)
- Cylinder head and gasket - new Cosworth 16-valve design aluminium head. New gasket
- Crankshaft and bearings - new Cosworth design forged steel crankshaft and new bearings
- Flywheel - new Cosworth design steel flywheel
- Pistons and rings - new Mahle design
- Con-rods and piston pins - new Cosworth design steel rods and bolts
- Camshafts, bearings and drive - new Cosworth design
- Hydraulic tappets - new Cosworth design
- Valves, springs, and seats - new Cosworth design
- Intake manifold - new Cosworth design to suit fuel injection
- Exhaust manifold - new Cosworth design to suit turbocharger installation
- Oil pan - new Cosworth design cast aluminium sump
- Oil pump - modified Ford component
- Radiator, fan, shroud and hoses - new to suit increased engine power
- Water pump - c/o 1985 MY Ford design
- Turbocharger system - water cooled Garrett turbocharger with associated wastegate control, lubrication system and intercooler
- Engine mount
 - left hand side unique
 - right hand side c/o V6 engine

GENERAL DESCRIPTION (cont'd)

Lubrication System

The oil pump draws oil from the sump via a strainer.

Part of the oil delivered by the pump is fed into an auxiliary spray pipe system which sprays oil directly under the pistons to promote piston crown cooling.

The main oil flow, Fig.6, is fed into a heat exchanger which is coupled to the engine cooling system.

This oil to water heat exchanger, Fig.5, allows rapid warm up of the oil to its normal working temperature. It also maintains an acceptable oil temperature under all operating conditions. After the heat exchanger, the oil is directed through a full flow filter and into the main oil gallery which directly supplies the five main bearings and the eight overhead camshaft plain bearings.

The big-end bearings are supplied through diagonal drillings in the crankshaft from the front and rear main bearings.

The auxiliary shaft is directly connected to the main oil gallery. The distributor drive shaft is supplied intermittently with oil from the drilled auxiliary shaft.

A one way valve is fitted in the feed line to the cylinder head to prevent oil flowing back to the sump when the engine is stopped. This guarantees instant lubrication when the engine is started.

The oil supply to the turbocharger is taken from the main oil gallery via the oil pressure warning switch adaptor.

The oil return line from the turbocharger is connected directly into the sump via a stub pipe.

Fig.6. Lubrication circuit.

- A - Turbocharger
- B - Hydraulic valve tappets
- C - Oil cooler
- D - Piston cooling
- E - Oil retaining valve

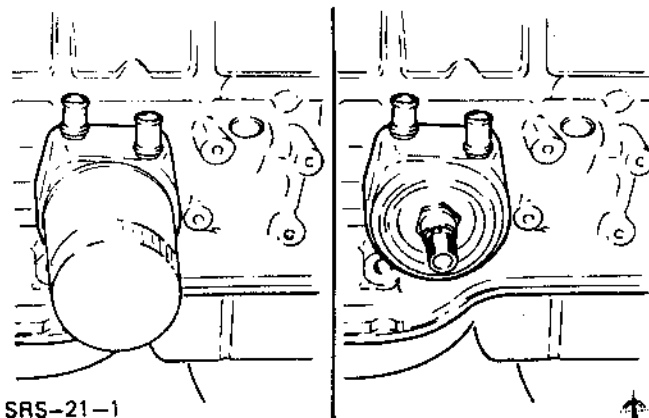


Fig.5. Oil heat exchanger/oil filter connection.

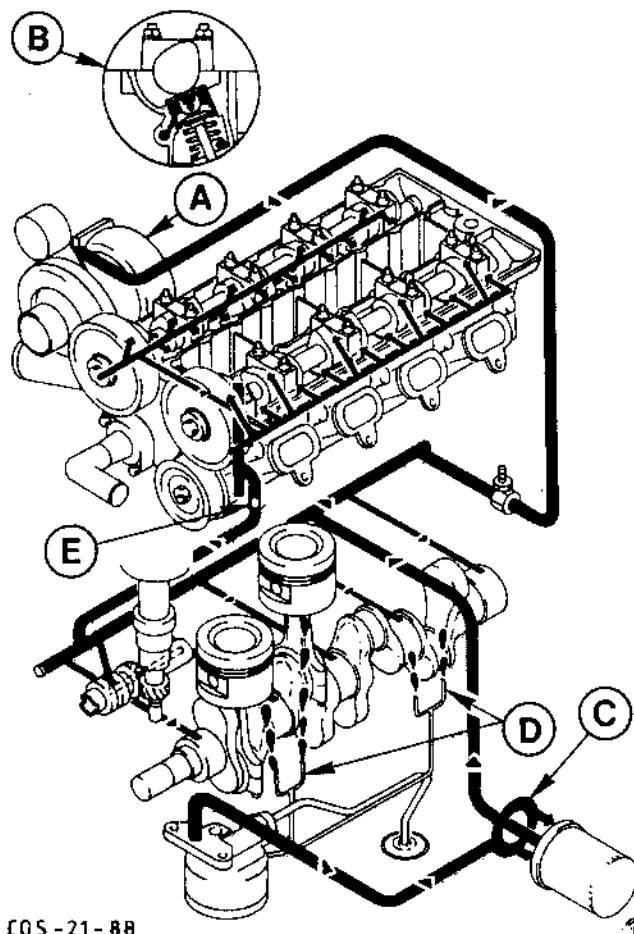


Fig.6. Lubrication circuit.

GENERAL DESCRIPTION (cont'd)

Cylinder Block

The SIERRA COSWORTH cylinder block is a standard 2.0 ltr. OHC block which has been specially selected as having only bore sizes 2 or 3. These bore sizes are stamped into the cylinder block in the cylinder sequence, Fig.7.

Flywheel

The flywheel differs from the standard 2.0 ltr. OHC engine in that it has an increased diameter, 9 retaining bolts and is balanced as an assembly with the crankshaft.

To ensure that the flywheel can only be assembled in its correct position, one of the bolt holes has an offset drilling, Fig.8.

Cylinder Head

The COSWORTH developed cast aluminium cylinder head is a double overhead camshaft design with four valves per cylinder.

The valves are arranged in V-formation, with inlet and exhaust valves lying opposite to each other and operated by their own respective camshaft.

The valves are directly actuated with hydraulic tappets and therefore require no adjustment.

Both camshafts are supported by five bearings, the front ones being ball bearings. The others are plain bearings and are machined directly into the cylinder head eliminating bearings shells.

The inlet valve camshaft has oil grooves in the journals to ensure uniform lubrication, Fig.9.

Fig.9. Cylinder head - cross section.

- A - Camshaft - exhaust side
- B - Camshaft - inlet side
- C - Hydraulic valve tappets
- D - Exhaust valves - sodium filled
- E - Valve stem oil seals
- F - Inlet valves
- G - Valve guides
- H - Valve seats

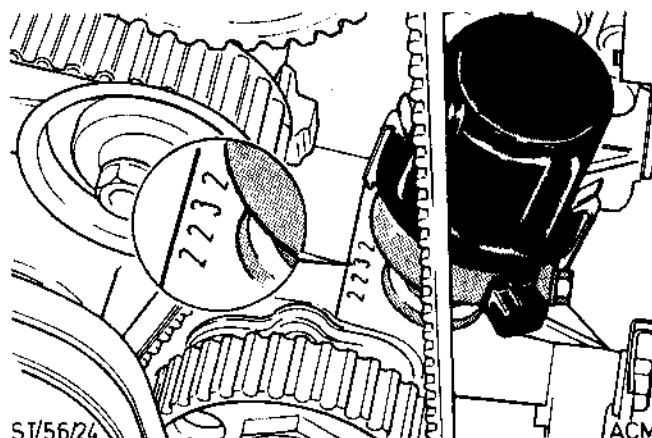


Fig.7. Cylinder bore and piston sizes.

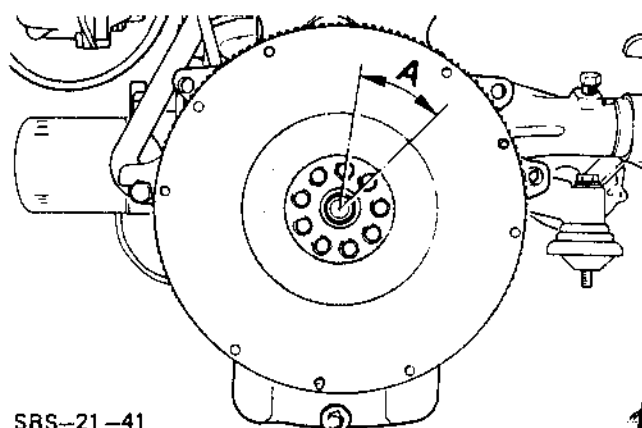


Fig.8. Flywheel.
A - Offset

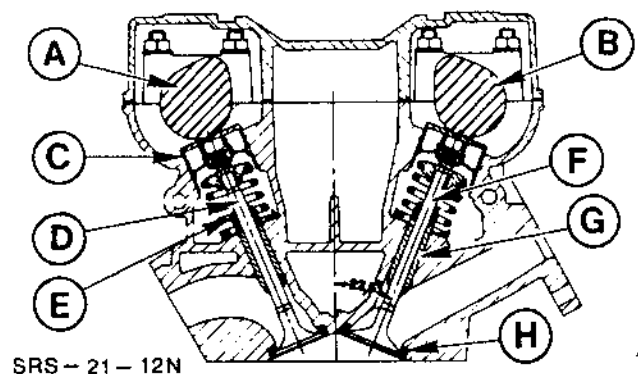


Fig.9. Cylinder head - cross section.

GENERAL DESCRIPTION (cont'd)

Camshaft Drive

On the front end of each camshaft there is a toothed pulley, both are driven by a toothed pulley wheel mounted on the front end of the crankshaft, the power being transmitted by a common toothed drive belt, Fig.10..

The belt tensioner is situated after the crankshaft pulley wheel in the direction of rotation.

The drive take off for the auxiliary drive shaft is located between the inlet camshaft pulley wheel and the crankshaft pulley wheel.

The whole of this drive mechanism is enclosed by a plastic cover (timing belt cover).

Crankshaft

The crankshaft is dimensionally identical to the OHC crankshaft but is manufactured from forged steel. It has specially hardened and moly. coated bearing journals.

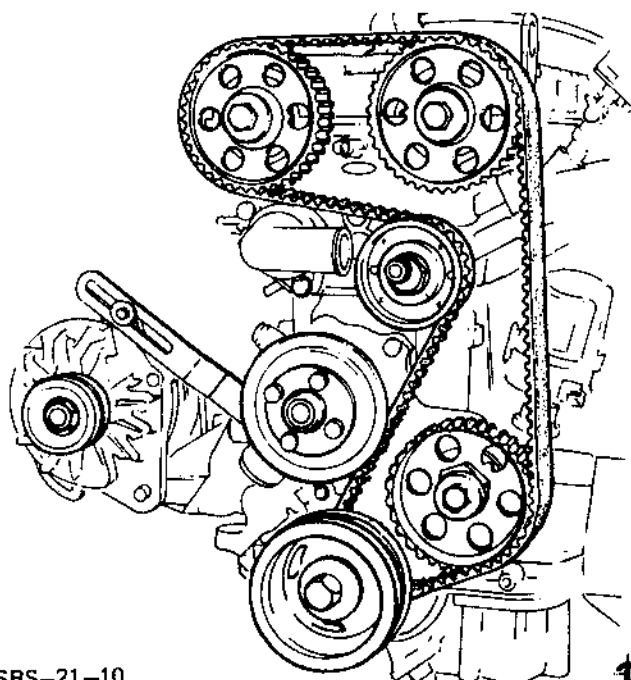
Pistons and Connecting Rods

The pistons are manufactured for COSWORTH by the Mahle company.

In the crown of the piston there is a formed combustion chamber.

Only pistons having the grade classification 2 or 3 are used. These numbers are stamped under the piston crown in the location of the arrow.

Corresponding cylinder size numbers are marked on the cylinder block.

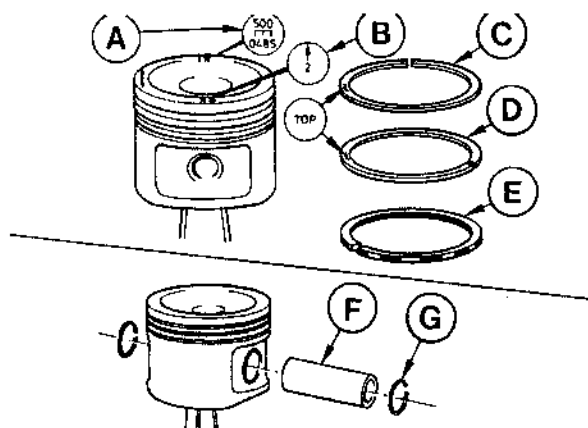


SRS-21-10

Fig.10. Toothed drive belt..

Fig.11. Piston, piston rings and piston pin.

- A - Production date and manufacturer's code
- B - Piston classification and arrow (to engine front)
- C - 1st compression ring marked 'TOP'
- D - 2nd compression ring marked 'TOP'
- E - Oil control ring
- F - Piston pin
- G - Spring ring



COS-21-87

Fig.11. Piston, piston rings and piston pin.

SERVICE AND REPAIR OPERATIONS

21 111 0 ENGINE - CHECK COMPRESSIONS

TEST EQUIPMENT REQUIRED:

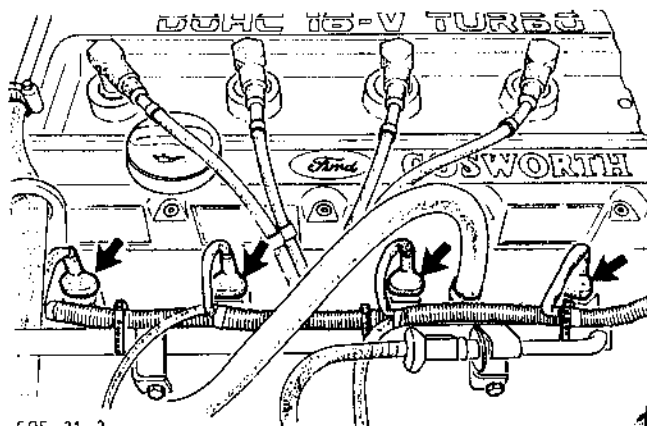
Commercially available compression tester

NOTE: In most cases, the differences in compression tester design and varying starter motor speeds only make it possible to check that the compression is uniform in all the cylinders. The actual compression pressure depends on a number of factors and can only be measured when certain preconditions apply.

The engine should be at normal operating temperature.

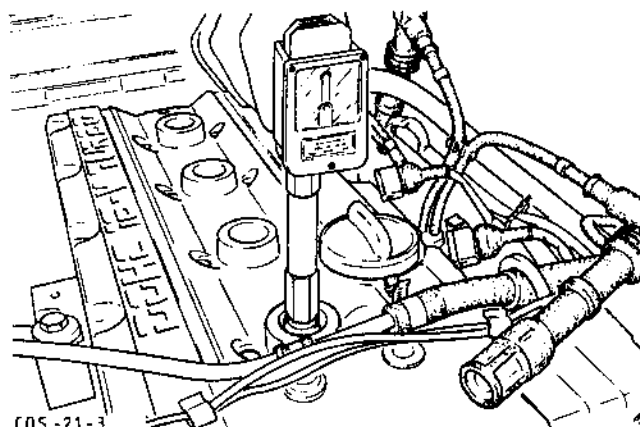
To Check

1. Disconnect the low tension cable from the ignition coil (terminal 15).
 2. Disconnect the multiplugs from the fuel injectors.
 3. Disconnect the HT leads and remove the spark plugs.
 4. Insert the graph paper in the tester. Connect the tester, pressing the rubber seal firmly into the spark plug bore of cylinder No.1.
- Crank the engine with the throttle fully opened until the pointer on the tester stops rising.
5. Vent the tester, adjust the graph paper for the next cylinder and repeat the procedure described in sub-operation 4 on 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.
 7. Connect the fuel injector multiplugs.
 8. Connect the low tension lead to the ignition coil.



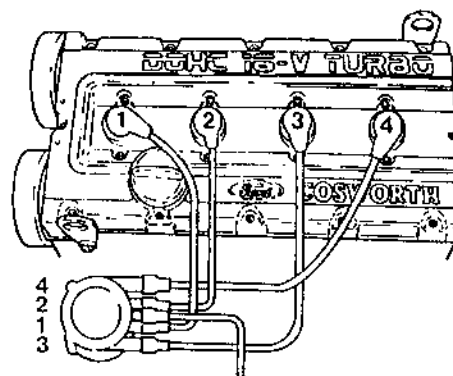
COS-21-2

Fig.12. Fuel injector multiplugs.



COS-21-3

Fig.13. Compression tester.



SRS-21-58

Fig.14. HT lead arrangement/firing order.

21 112 0 OIL PRESSURE - CHECK

SPECIAL SERVICE TOOLS REQUIRED:

Oil pressure test gauge	23-011A
Connecting hose	23-011A-09
Reducer fitting - Finis Code	6084322

NOTE: The oil pressure depends on various factors (engine speed, oil temperature, oil pump rotor clearance etc.). Measurement should always be carried out with the oil at a temperature of 80 °C. The oil pressure should be at least 1,8 bar at idle speed and 2,4 bar at 2000 rev/min. The maximum oil pressure should not exceed 5 bar at speeds above 2000 rev/min.

These values apply to SAE 20W-50 oil only.

To Check

1. Disconnect the wiring from the oil pressure switch and unscrew the switch.

NOTE: Do not disconnect the turbocharger oil feed line. The oil supply to the turbocharger must always be present when the engine is running.

2. Screw the reducer fitting, Finis Code 6084322 into the oil pressure switch bore. Connect the test gauge and hose to the reducer fitting.
3. Start the engine, check the oil pressure at idle speed and above 2000 rev/min.
4. Remove the test gauge, connecting hose and reducer fitting. Fit the oil pressure switch (for sealing compound and tightening torque see Technical Data) and connect the wiring.

If the oil pressures are not to specification, first check the oil pump and pressure relief valve as the possible source of the fault.

The following typical faults can occur:

Pressure too high at speeds above 2000 rev/min:
pressure relief valve failing to open due to dirt.

Pressure too low over the entire speed range:
oil intake strainer clogged, intake pipe loose or broken, oil pump worn etc.

Pressure too low in the lower speed range:
pressure relief valve sticking in the open position due to dirt.

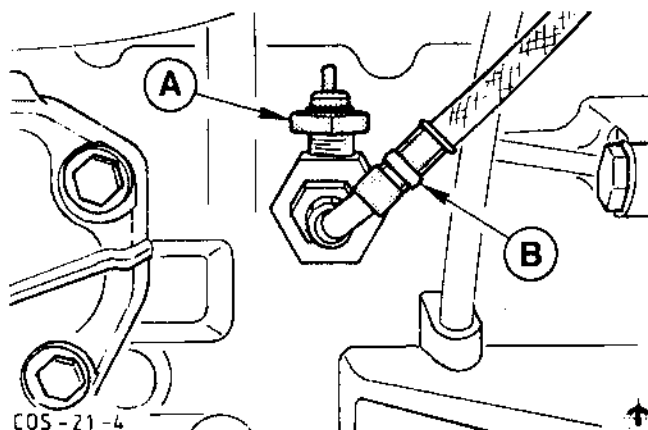


Fig.15. A - Oil pressure switch
B - Turbocharger oil feed line - do not disconnect

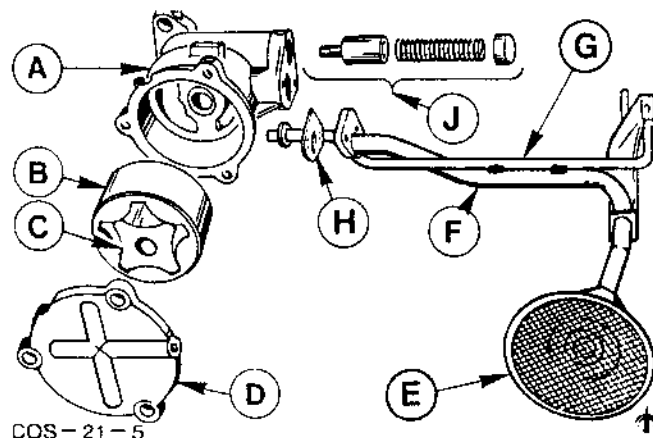


Fig.16. Oil pump - exploded view.
A - Casing
B - Outer rotor
C - Inner rotor
D - Cover
E - Oil intake strainer
F - Intake pipe
G - Spray pipe
H - Gasket
J - Pressure relief valve

21 134 0 ENGINE ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Engine lifting tackle 21-068
Remover, fuel delivery line 23-023-A

NOTE: The engine is removed without the transmission.

To Remove

1. Disconnect the battery earth cable.
2. Disconnect the radio-interference suppression cable from the hood (1 screw).
Unbolt the hood assembly from the hinges (4 bolts) and remove from vehicle.

3. Remove the air cleaner cover by detaching, Fig.18, -

- A - the air cleaner to turbocharger hose from the turbocharger
- B - the air bypass valve connecting hose from the intercooler
- C - the vacuum line from the bypass valve
- D - the solenoid control valve line from the air cleaner
- E - the engine breather hose from the air cleaner.

Unclip the air cleaner cover and remove it complete with hoses and bypass valve.

Remove the air filter element.

Remove the engine breather hose (disconnect from breather valve and cut cable straps).

4. Remove the solenoid control valve complete with lines by detaching, Fig.19:

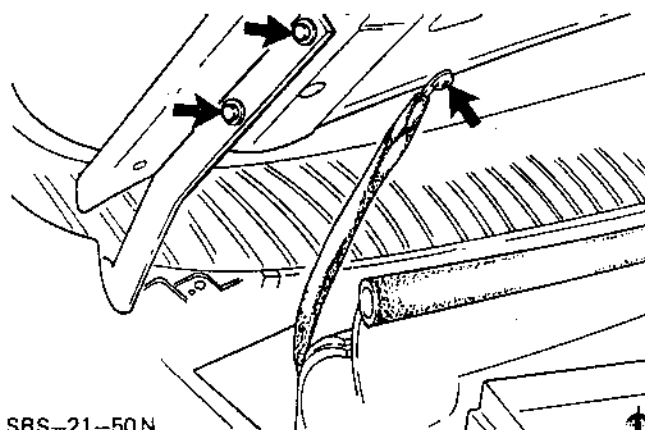
- the line to the turbocharger
- the line to the waste gate actuator
- the multiplug
- 2 screws

5. Remove the turbocharger to intercooler air hose.

6. Remove the air cleaner intake nozzle (1 clip).

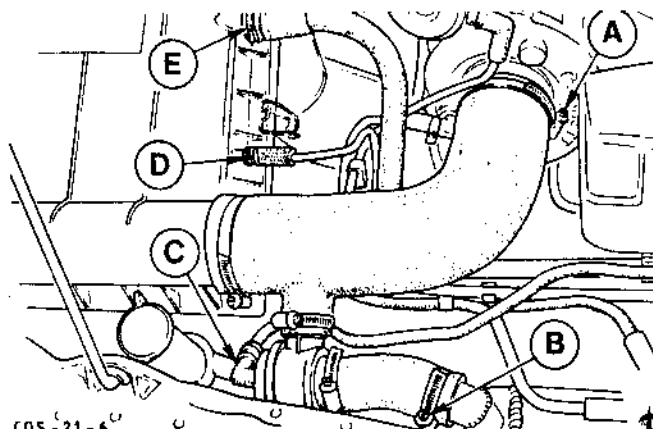
'88 Model Year only:

Remove windscreen washer reservoir filler tube.



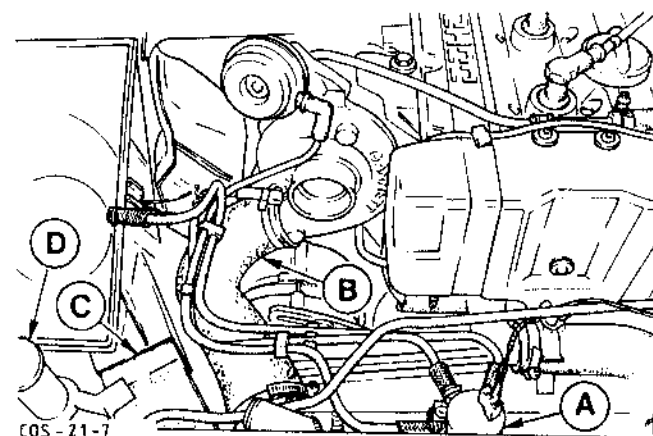
SRS-21-50N

Fig.17. Remove hood.



COS-21-6

Fig.18. Remove air cleaner cover/hoses.

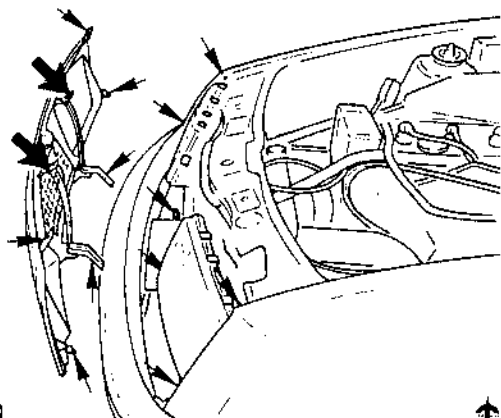


COS-21-7

Fig.19. A - Solenoid control valve
B - Turbocharger to intercooler air hose
C - Air cleaner nozzle
D - Windscreen washer filler tube, '88 MY

21 134 0

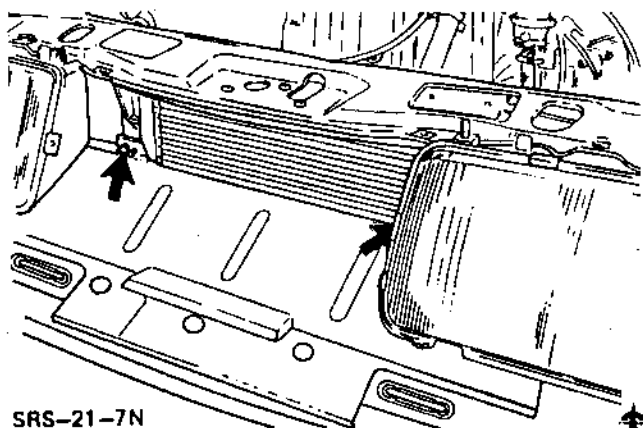
7. Remove the radiator grille.



COS-21-70

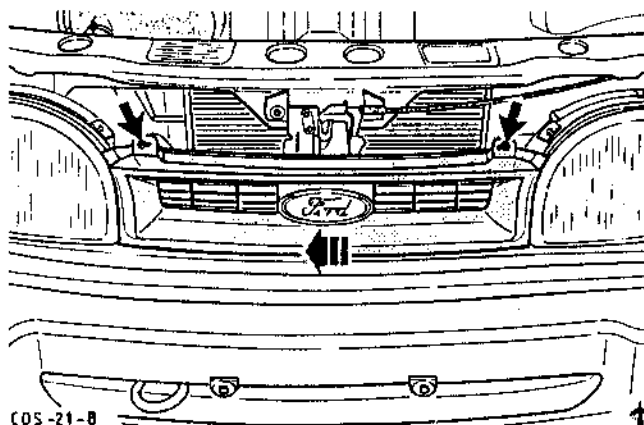
Fig.20. '86 Model Year - 2 screws, clips.

8. Detach the air guide plate from the radiator.



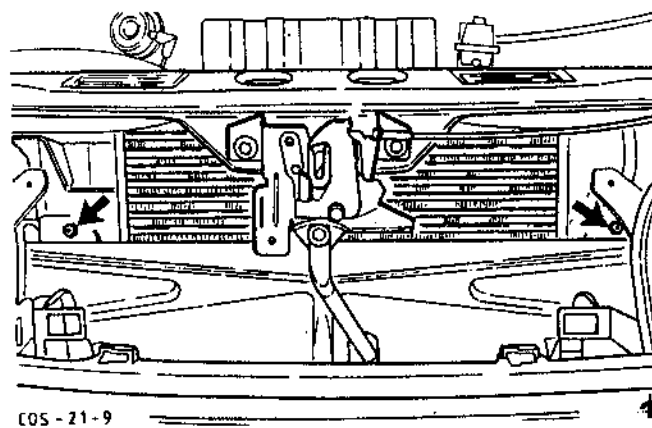
SRS-21-7N

Fig.22. '86 Model Year air guide plate attachment (2 bolts)



COS-21-8

Fig.21. '88 Model Year - 2 screws and sideways located.



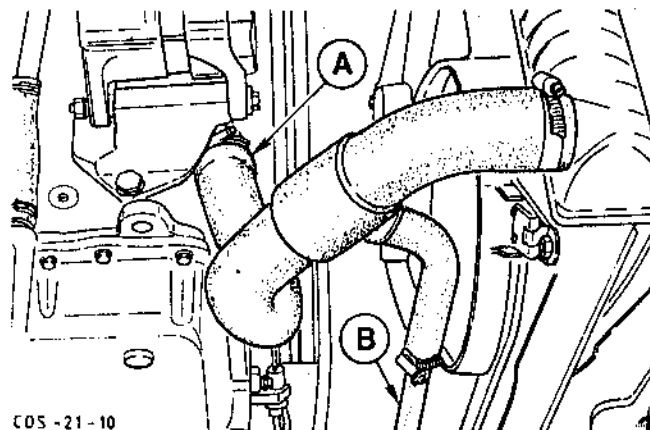
COS-21-9

Fig.23. '88 Model Year air-guide plate attachment (2 nuts)

9. Drain the coolant by detaching the lower radiator hose from the water pump.

10. Detach the upper radiator hose from the thermostat housing nozzle.

11. Detach the overflow tank hose from the coolant pipe fixed to the bottom of the radiator.



COS-21-10

Fig.24. A - Detach radiator hose from water pump
B - Coolant pipe to overflow tank

21 134 0

12. Remove the intercooler to throttle valve assembly air hose.

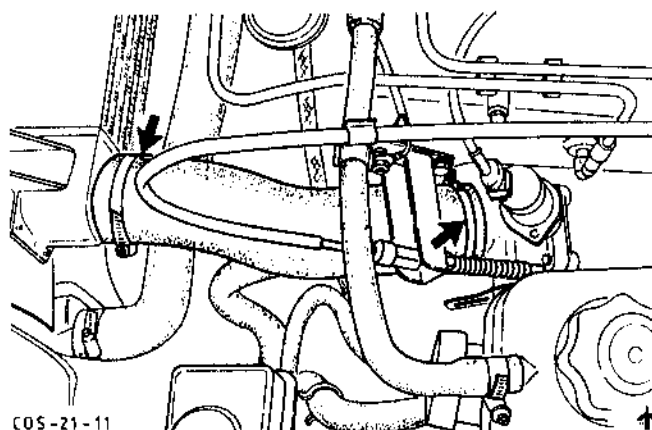


Fig.25. Air hose, throttle valve to intercooler.

13. Disconnect the radiator cooling fan and thermo sensor wiring.

14. Remove the intercooler and radiator assembly downwards (2 screws top rear, 2 screws top front, 2 screws underneath).

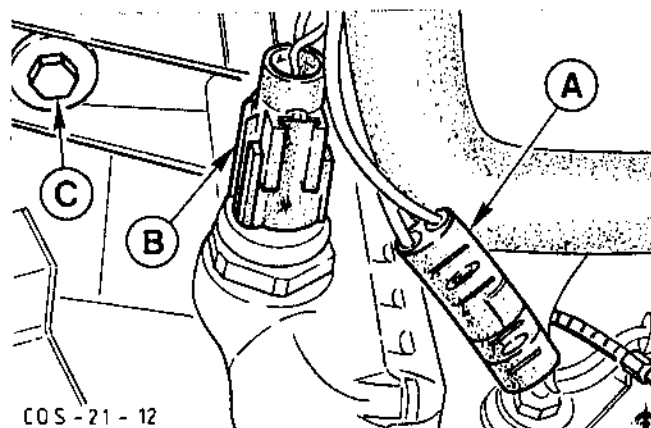


Fig.26. A - Cooling fans supply cable connector
B - Thermo sensor multiplug
C - Lower radiator retaining bolt (LH)

15. Remove the power steering pump V-belt tensioning bolts (2 bolts). Remove the V-belt and tie up oil pump with wire.

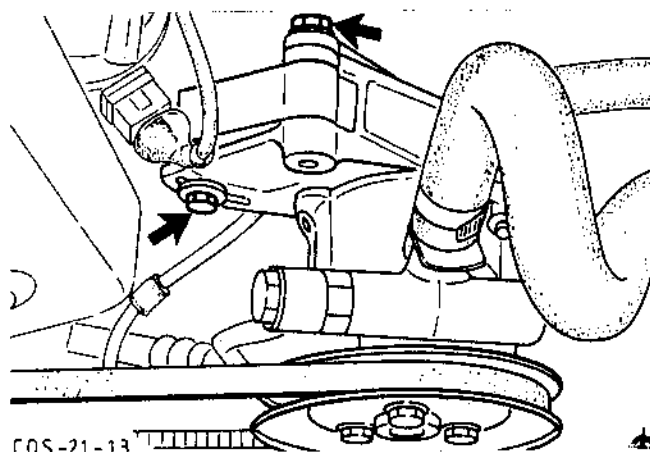


Fig.26. Power steering pump V-belt tensioning bolts.

21 134 0

16. Detach the overflow tank connecting hose from the turbocharger coolant return pipe and withdraw the hose from the lifting eye.

17. Remove the turbocharger heat shield:

'86 Model Year - 3 bolts

'88 Model Year - 1 bolt and two clips

18. Detach the heater hoses from the heater radiator.

19. Remove the throttle cable from the throttle butterfly and from bracket (1 clip).

NOTE: Do not remove throttle cable bracket from plenum cover (Loctite from initial build may fall inside plenum chamber).

20. IMPORTANT NOTE: When removing fuel lines, it must be remembered that the system remains pressurised. Take adequate safety precautions to prevent fuel spillage.

Remove the safety clip from the fuel delivery line connection to the fuel rail and using special tool 23-023-A, pull off the delivery line.

Disconnect the fuel return line from the fuel pressure regulator.

21. Detach the manifold absolute pressure (MAP) sensor line from the plenum chamber.

'86 Model Year:

Detach the bypass valve and boost pressure gauge vacuum lines from the 'T' piece near the inlet manifold and pull them clear of the engine.

'88 Model Year:

Detach the bypass valve vacuum line from the plenum chamber and remove it from the vehicle.

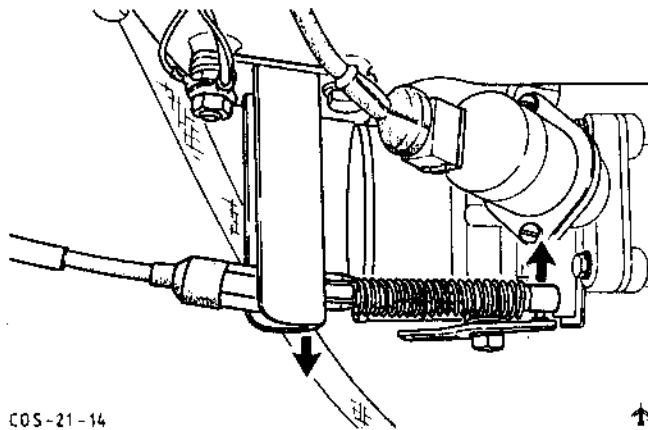


Fig.28. Remove throttle cable.

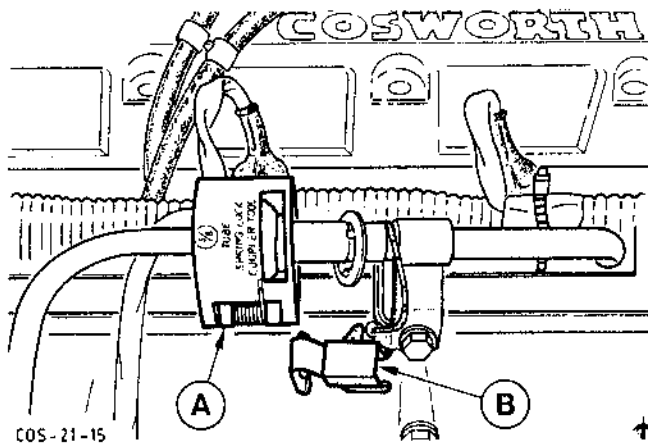


Fig.29. Remove fuel delivery line.
A - Special tool 23-023-A
B - Safety clip

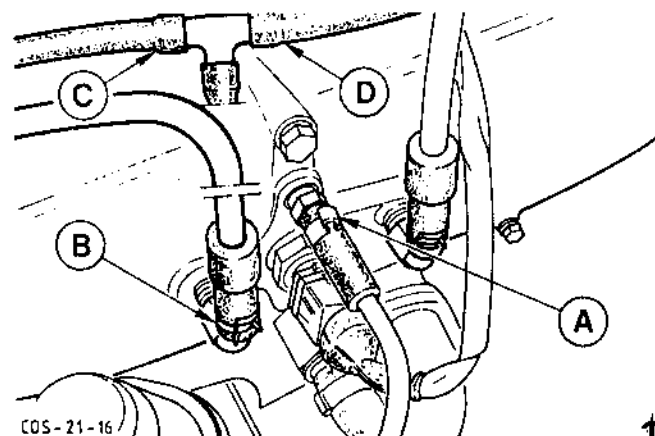


Fig.30. A - To MAP sensor
B - To bypass valve, '88 MY
C - To bypass valve, '86 MY
D - To boost pressure gauge, '86 MY

21 134 0

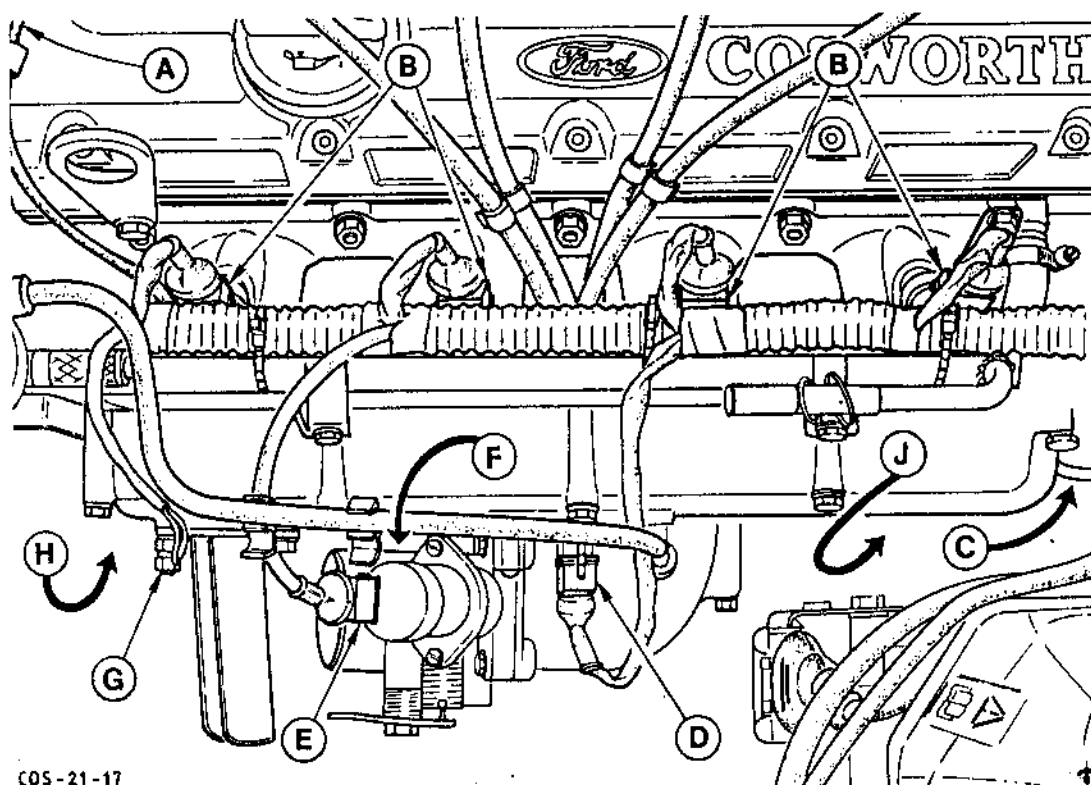


Fig.31. Disconnect wiring.

22. Disconnect wiring from, Fig.31:

- A - temperature gauge sender unit
- B - injection nozzles
- C - coolant temperature sensor
- D - air charge temperature sensor
- E - idle speed control valve
- F - throttle position sensor
- G - earth connection on throttle cable bracket
- H - engine speed/TDC sensor

- J - oil pressure switch
- alternator
- distributor
- ignition coil HT lead

Cut engine wiring loom/fuel rail cable straps and pull loom clear of engine.

23. Remove the exhaust pipe from the turbocharger.

24. Disconnect the earth cable from the clutch housing flange and unclip the battery positive cable.

25. Raise the vehicle.

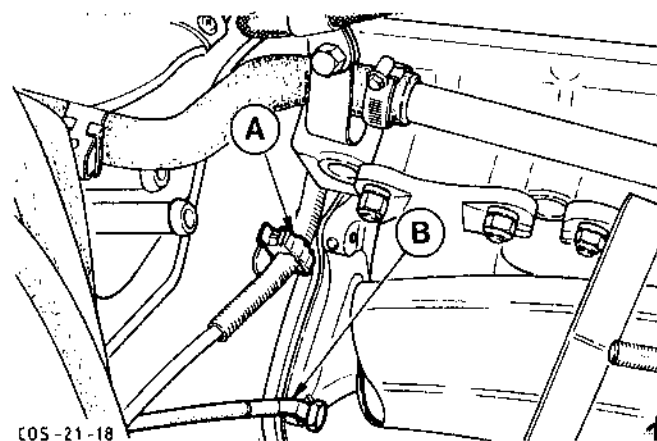


Fig.32.

21 134 0

26. Unscrew the left hand exhaust muffler insulator bracket (2 bolts). Unhook the right hand and rear muffler insulators and remove the complete exhaust system.

27. Detach starter motor wiring and remove starter (3 bolts).

28. Remove the engine bearer to crossmember nut (both sides).

29. Remove bolt from engine adaptor plate, Fig.35.

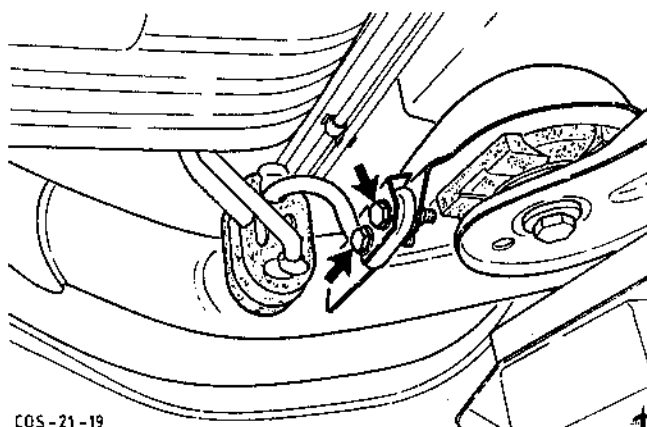
30. Pull off the clutch release lever gaiter and unhook the clutch cable from the release lever.

31. Remove the remaining clutch housing flange bolts (5 bolts) together with the battery positive cable and cable holders.

32. Lower the vehicle and support the transmission assembly.

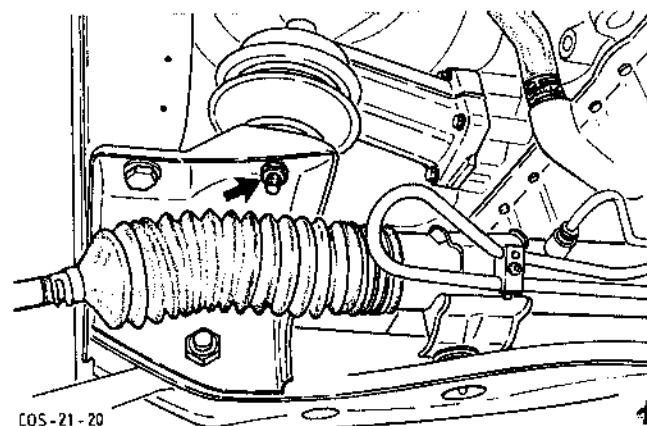
33. Attach engine lifting tackle, special tool 21-068, to the engine. Take weight of engine, pull engine forwards using the lifting tackle and lift it out of the vehicle.

NOTE: Do not pull on turbo actuator rod.



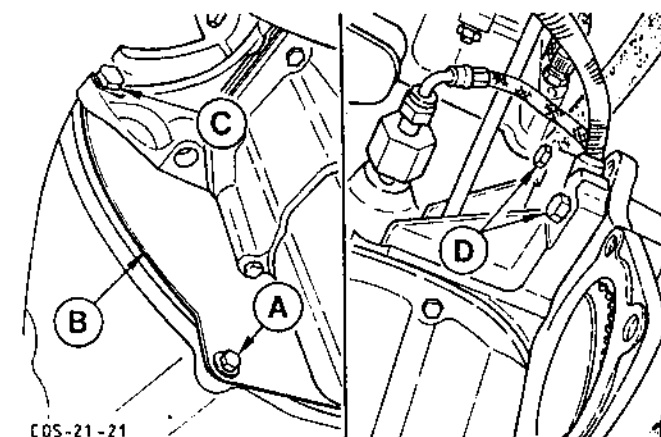
COS-21-19

Fig.33. Left hand muffler insulator bracket bolts.



COS-21-20

Fig.34. Engine bearer to crossmember nut - right hand shown.



COS-21-21

Fig.35. A - Engine adaptor plate bolt
B - Engine adaptor plate
C - Lower RH clutch housing flange bolt
D - Lower LH clutch housing flange bolts

21 134 0

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

34. If necessary, transfer the adaptor plate guide bushes from the clutch housing to the engine block, then locate adaptor plate.
35. Lightly grease transmission input shaft and install engine with engine lifting tackle 21-068. Locate engine on input shaft and slide on. Draw the engine evenly onto the clutch housing flange using two bolts.

Remove engine lifting tackle.

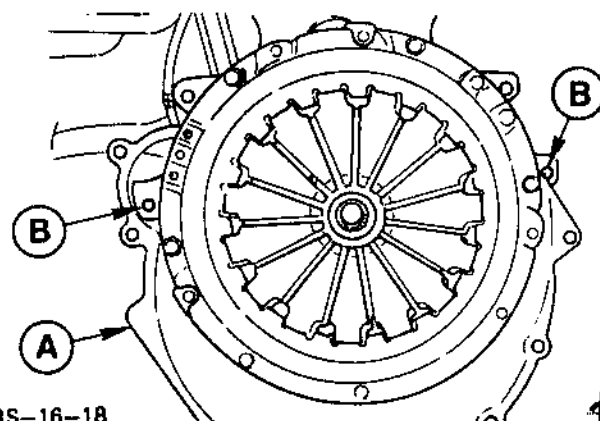
Locate both engine bearer studs in the crossmember and lower engine.

36. Install the remaining clutch housing flange bolts and uniformly tighten (install earth cable and battery positive cable/holders at the same time).
37. Fit the engine adaptor plate bolt.
38. Hook the clutch cable into the clutch release lever and fit the rubber gaiter.
39. Fit and tighten the engine bearer to crossmember nut (both sides).
40. Fit the starter motor and connect the wiring.
41. Locate the exhaust system in place, hook the rear and right hand mufflers into their insulators and fit the left hand insulator bracket bolts (2).
42. Lower the vehicle.
43. Fit the exhaust pipe to the turbocharger using new nuts (earlier models M8, later models M10).

NOTE: Models equipped with M8 should also be fitted with new nut locking plates.

44. Connect wiring to
 - temperature gauge sender unit
 - injection nozzles
 - coolant temperature sensor
 - air charge temperature sensor
 - idle speed control valve
 - throttle position sensor
 - earth connection on throttle cable bracket
 - engine speed/TDC sensor
 - oil pressure switch
 - alternator
 - distributor
 - ignition coil HT lead

Fit engine wiring loom/fuel rail cable straps ensuring that the wiring loom cannot chafe on the fuel rail clamps.



SRS-16-18

Fig.36. A - Engine adaptor plate
B - Bushes

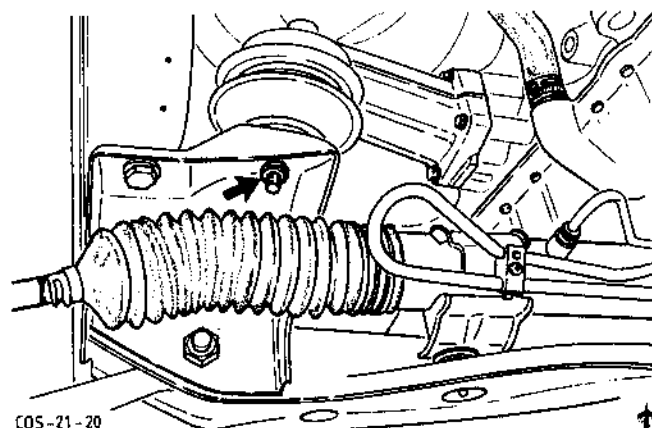


Fig.37. Engine bearer to crossmember nut - right hand shown.

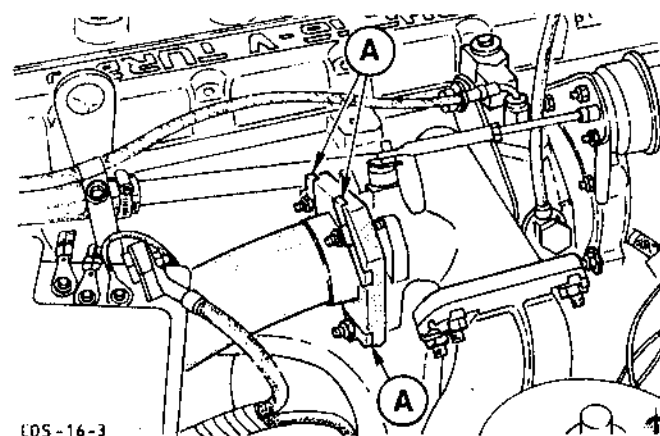


Fig.38. Tighten exhaust pipe to turbocharger
A - lock plates

21 134 0

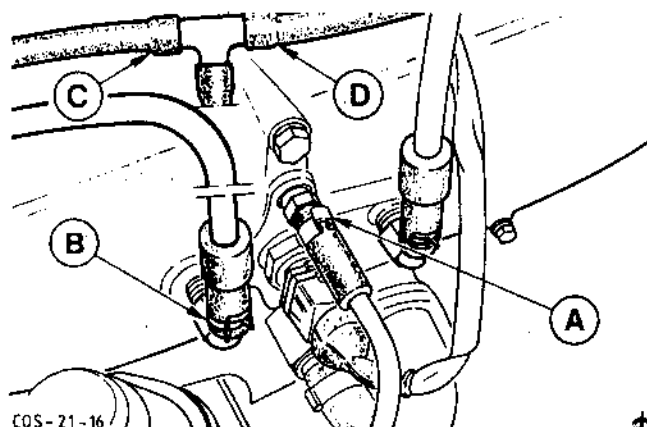
45. Fit the MAP sensor line to the plenum chamber nozzle.

'86 Model Year:

Connect the bypass valve and boost pressure gauge vacuum hoses to the 'T' piece near the inlet manifold.

'88 Model Year:

Connect the bypass valve line to the plenum chamber.



COS-21-16

Fig.39. Fit vacuum lines.

A - MAP sensor

B - Bypass valve,

'88 MY

C - Bypass valve,

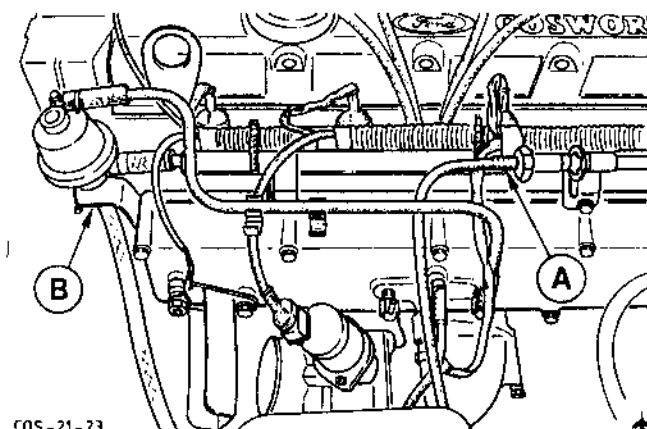
'86 MY

D - Boost pressure gauge,

'86 MY

Fig.39. Fit vacuum lines to plenum chamber.

46. Fit the fuel delivery line to the fuel rail and the fuel return line to the fuel pressure regulator.



COS-21-23

Fig.40. Fit fuel lines.

A - Delivery line

B - Return line

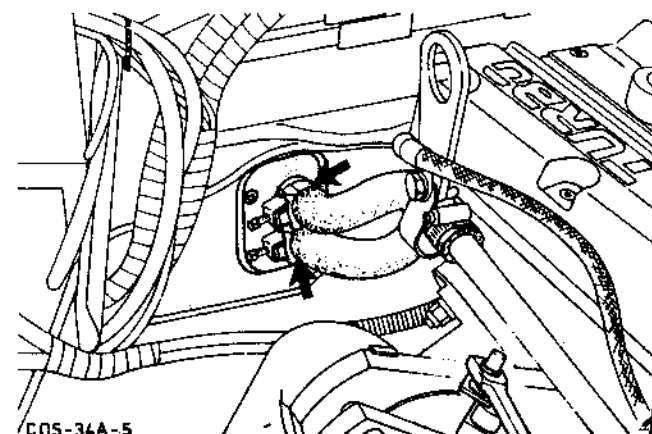
47. Fit the throttle cable to its bracket and the throttle butterfly.

48. Attach the heater hoses to the heater radiator.

49. Fit the turbocharger heat shield.

50. Push the hose from the overflow tank to turbocharger coolant return line through the lifting eye and connect it to the pipe.

51. Fit the power steering pump to its bracket, fit V-belt and adjust tension (see Technical Data).



COS-34A-5

Fig.41. Attach heater hoses.

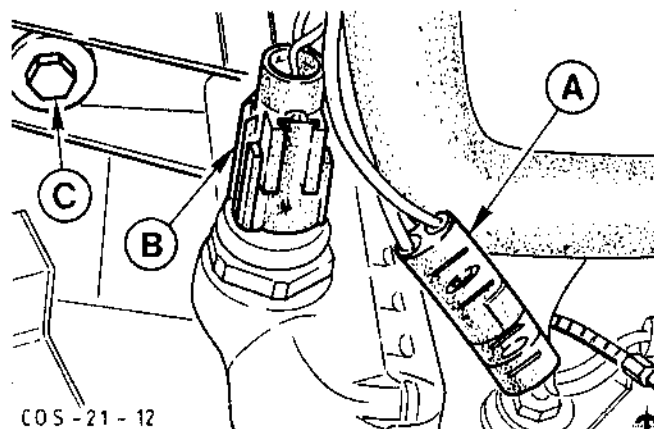
21 134 0

52. Fit the air cleaner intake nozzle in place.

53. Install the intercooler/radiator assembly (6 bolts).

Clip the air cleaner intake nozzle to the intercooler.

'88 Model Year only:
Fit windscreen washer reservoir



COS-21-12

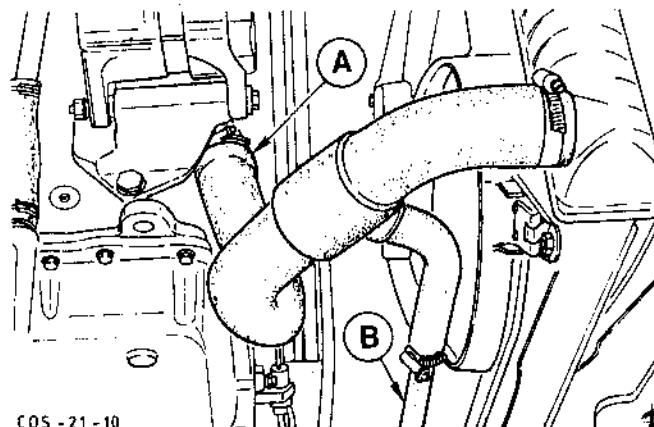
Fig.42. A - Cooling fans supply cable connector
B - Thermo sensor multiplug
C - Lower radiator retaining bolt (LH)

54. Connect the cooling fan and thermo sensor wiring.

55. Attach the overflow tank hose to the coolant pipe at the bottom of the radiator.

56. Fit the air guide plate to the radiator.

57. Install the radiator grille.



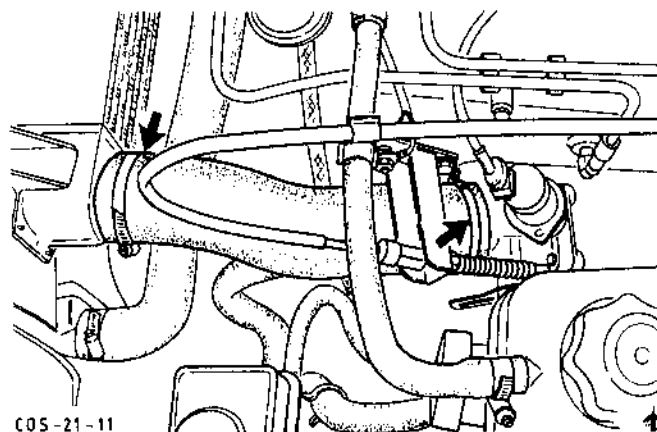
COS-21-10

Fig.43. A - Lower radiator hose from water pump
B - Coolant pipe to overflow tank

58. Attach the upper radiator hose to the thermostat housing nozzle.

59. Attach the lower radiator hose to the water pump.

60. Install the air hose from the intercooler to throttle valve assembly.



COS-21-11

Fig.44. Intercooler to throttle valve assembly hose.

21 134 0

61. Install the turbocharger to intercooler air hose.

62. Install the solenoid control valve complete with lines to the intercooler by fitting, Fig.45:

- 2 screws
- the multiplug
- the line to the waste gate actuator
- the line to the turbocharger

63. Install the air filter element, clip the air cleaner cover in place and connect, Fig.46:

- A - the air cleaner to turbocharger hose
- B - the air bypass valve to intercooler hose
- C - the vacuum line from the bypass valve
- D - the solenoid control valve line to the air cleaner
- E - the engine breather hose to the air cleaner

64. Connect the engine breather hose to the breather valve (fit cable straps).

65. Fill the cooling system (see Technical Data).

66. Top up with engine oil (see Technical Data for correct grade).

67. Fit hood.
Attach the hood earth cable.

68. Connect the battery earth cable.

69. To ensure that the oil supply to the turbocharger has been re-established before engine start up: disconnect the injector multiplugs and the low tension terminal from the ignition coil (terminal 15) and crank the engine for 10 seconds, followed by a pause then a further 10 seconds. Reconnect injector multiplugs and ignition coil and start engine.

70. With the engine at normal operating temperature, check the idle speed and CO content (values in Technical Data).

To adjust the CO content, refer to Operation 23 215 0 in this Service Microfiche.

To adjust the idle speed, refer to Condition 5 (Erratic idle/incorrect idle speed) in the Vehicle System Test Manual.

71. Recheck coolant level.

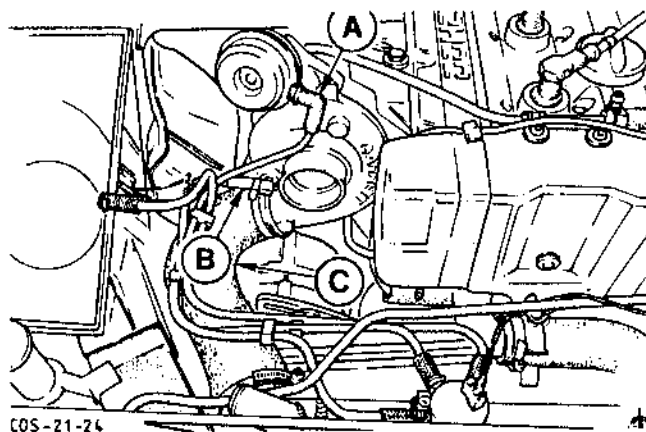


Fig.45. A - Line to waste gate actuator
B - Line to turbocharger
C - Turbocharger to intercooler air hose

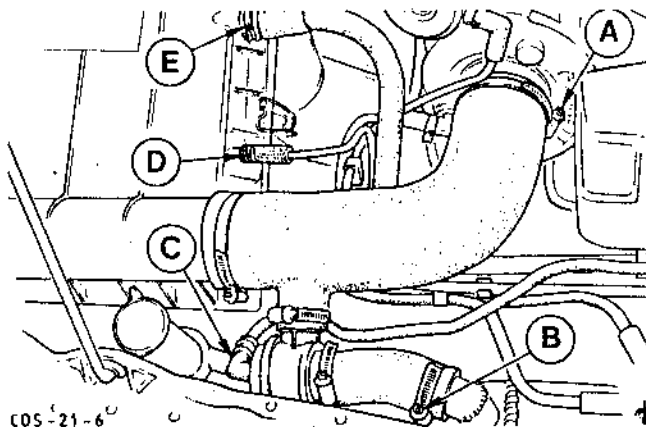


Fig.46. Fit air cleaner cover/hoses.

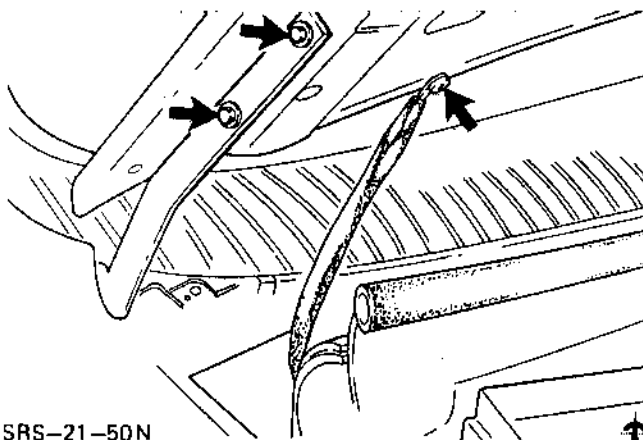


Fig.47. Fit hood.

21 134 8 ENGINE - DISMANTLE AND REASSEMBLE (Engine removed)

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft front oil seal installer ..	21-009-B
Crankshaft rear oil seal installer ..	21-011-0
Universal spindle	21-023
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve Spring compressor ..	21-024-06
Crankshaft timing gear remover ..	21-028-A
Engine mounting bracket	21-031-B
Crankshaft bearing remover ..	21-036-A
Crankshaft bearing installer and clutch disc locator	21-044-A
Toothed belt tension gauge	21-113
Cylinder head alignment studs	21-128
Installer - Valve stem oil seal (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130

To Dismantle

1. Disconnect the turbocharger coolant feed line from the thermostat housing and the heater return line from the water pump. Unclip the turbocharger coolant return line from the top of the timing belt cover.

2. Disconnect the turbocharger oil feed line from the oil pressure switch adaptor and unclip it from the cylinder head (2 clips, refit lifting eye).

Disconnect the turbocharger oil return hose from the sump stub pipe (1 hose clamp).

3. Remove the turbocharger vibration damper pillar bolt and remove the turbocharger complete with the exhaust manifold (16 nuts). Discard the exhaust manifold gaskets.

4. Remove the right hand engine mount (4 bolts).

5. Secure the engine to stand with engine mounting bracket 21-031-B and universal spindle 21-023.

6. Pull out oil dipstick. Drain engine oil. Disconnect oil dip stick holder from the cylinder head.

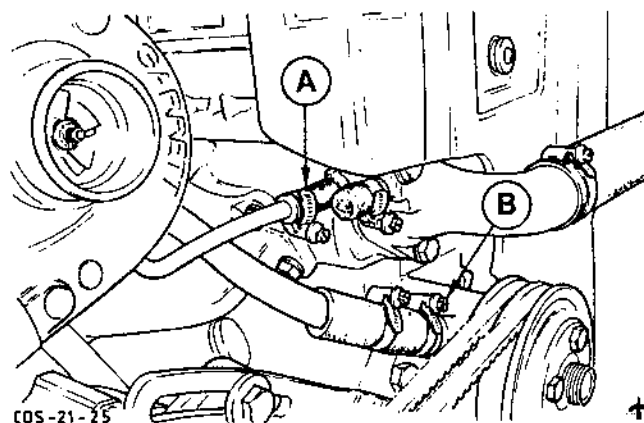


Fig.48. A - Turbocharger coolant feed line
B - Heater return line

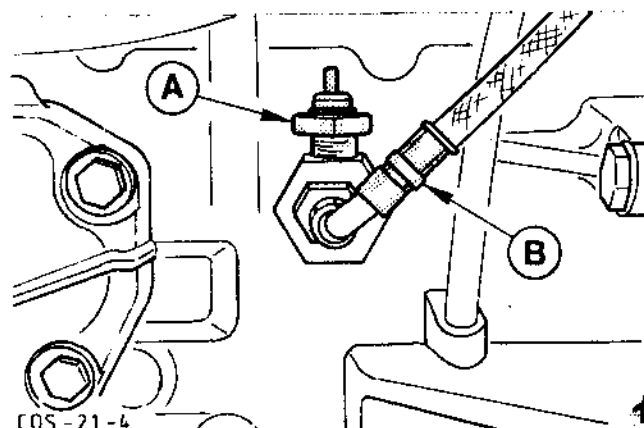


Fig.49. A - Oil pressure switch
B - Turbocharger oil feed line

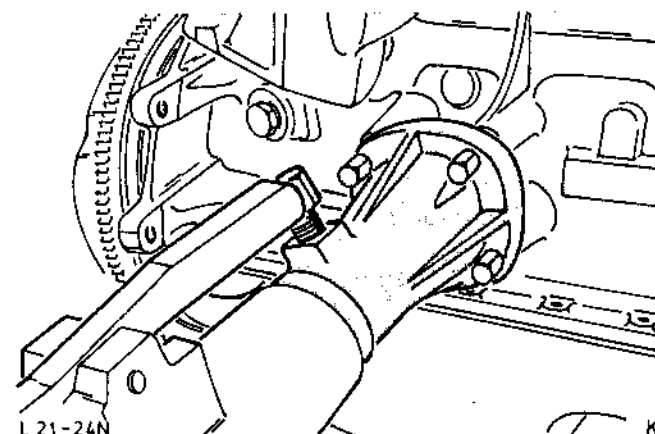


Fig.50. Engine with mounting bracket.

21 134 8

7. Remove the timing belt cover.

8. Pull the HT cables off the spark plugs, detach them from the clip on the plenum chamber and remove them together with the ignition distributor cap.

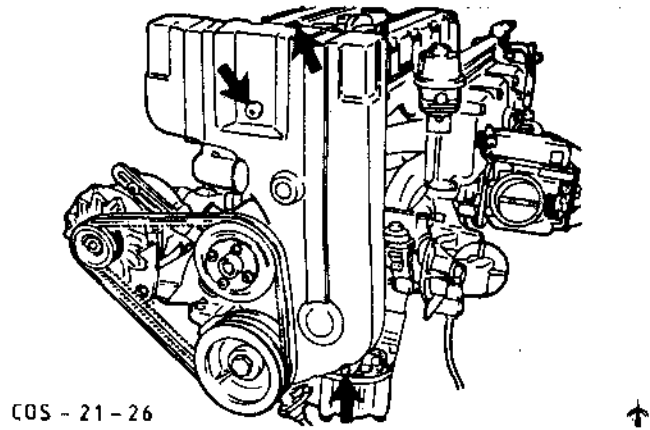


Fig.51. Remove timing belt cover.

9. Loosen the alternator adjustment strap, remove V-belt and strap.

10. Remove the alternator and bracket (4 bolts).

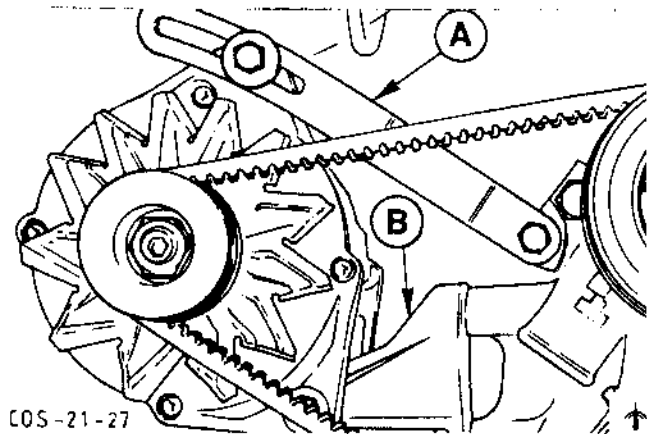


Fig.52. A - Alternator adjustment strap
B - Alternator bracket

11. Remove the cylinder head cover (20 bolts), seals and gaskets.

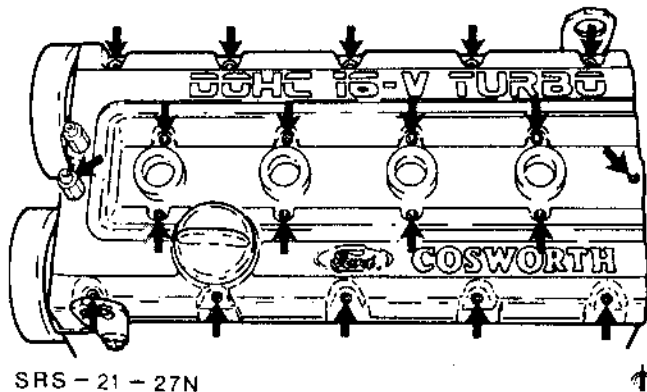
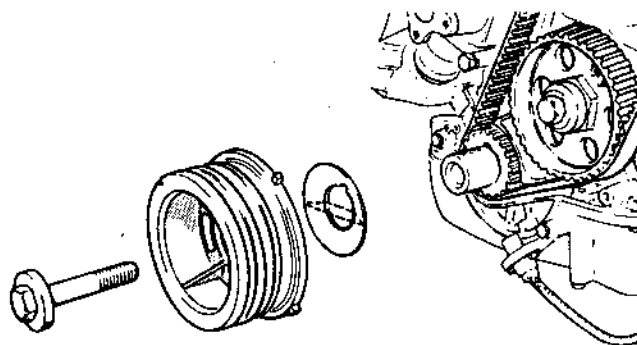


Fig.53. Cylinder head cover retaining bolts.

21 134 8

12. Remove the crankshaft V-belt pulley and thrust washer (1 bolt).

Prevent crankshaft from rotating by holding the flywheel with a suitable tool.



SRS-21-28N

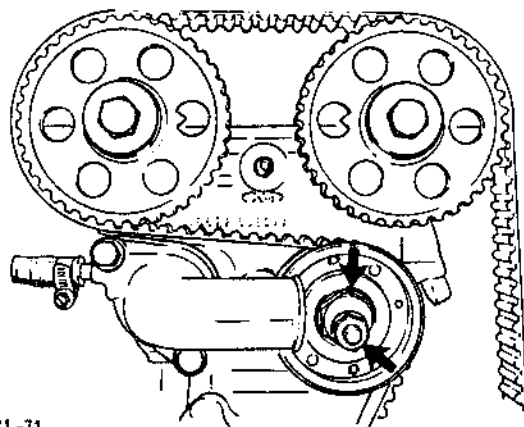


Fig.54. Remove crankshaft V-belt pulley.

13. Loosen the timing belt tensioning pulley and remove the timing belt.

NOTE: Mark running direction of timing belt before removal, in case of re-use.

14. Disconnect the coolant feed hose from the oil cooler.



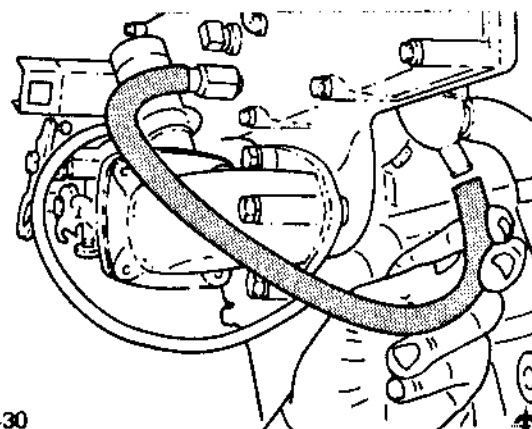
COS-21-71



Fig.55. Loosen timing belt tensioner.

15. Disconnect the vacuum hose from the engine breather valve.

16. Detach the engine breather valve (1 nut) from the plenum chamber.



SRS-21-30



Fig.56. Disconnect vacuum hose from engine breather valve.

21 134 8

17. Loosen the setting nut on the intake elbow damper and remove the engine mount nut.

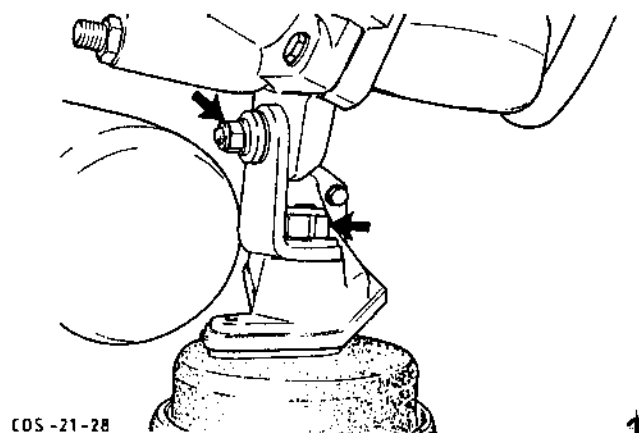


Fig.57. Intake elbow damper.
A - Setting nut
B - Engine mount nut

NOTE: Before removing the cylinder head the engine must have cooled down to about 45 °C.

18. Loosen the cylinder head bolts (10 bolts) in the sequence shown.

Remove the cylinder head bolts and washers. Take off the cylinder head complete with inlet manifold.

Remove the cylinder head gasket.

NOTE: After removing a cylinder head its mating faces must be subjected to a check for flatness as described in Operation No. 21 163 0.

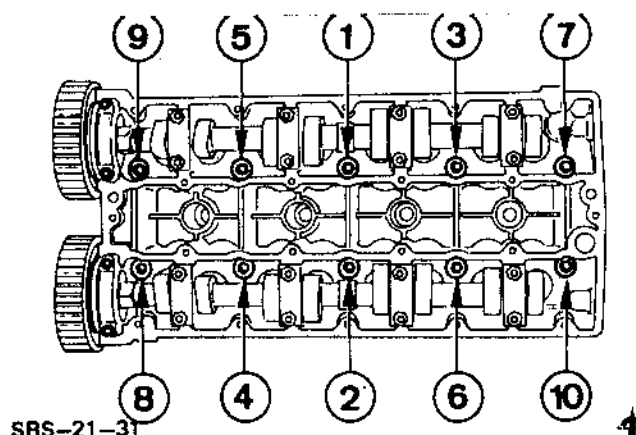


Fig.58. Cylinder head bolts loosening sequence.

19. Pull the oil separator and engine breather valve off engine.

20. Unscrew the oil pressure switch from the adaptor.

21. Remove the oil pressure switch adaptor from the cylinder block.

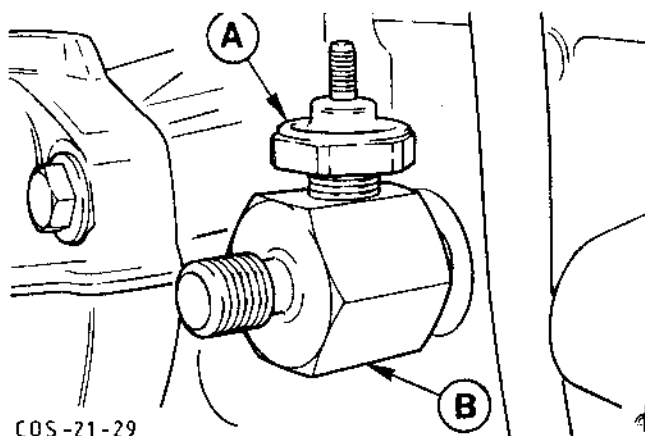


Fig.59. A - Oil pressure switch
B - Adaptor

21 134 8

22. Remove the oil filter and oil cooler.

23. Remove the ignition distributor.

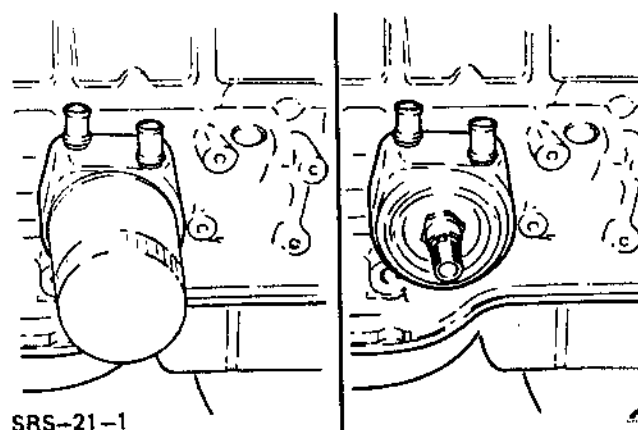


Fig.60. Remove oil filter and oil cooler.

24. Remove the engine speed/TDC sensor complete with bracket from the sump and from the clip on the power steering pump support bracket.

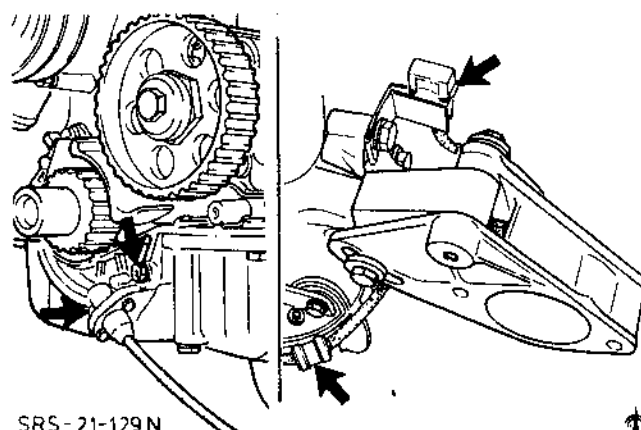


Fig.61. Remove the engine speed/TDC sensor.

25. Remove the power steering pump bracket and support bracket (2 hex. headed bolts, 3 socket headed bolts, 2 brackets) and remove sealant residue from mating faces.

26. Remove the water pump (3 bolts).

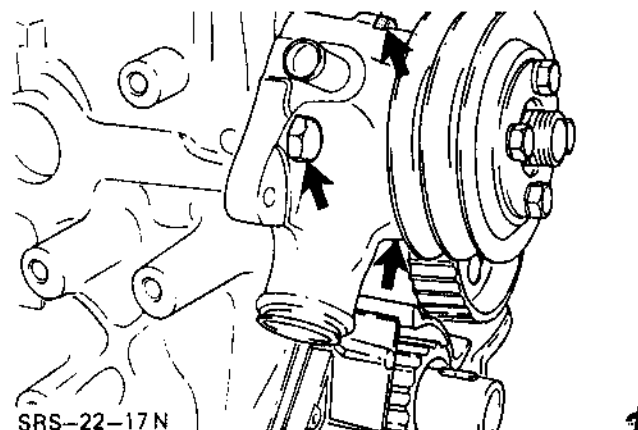


Fig.62. Remove water pump.

21 134 8

27. Remove the auxiliary shaft toothed pulley.

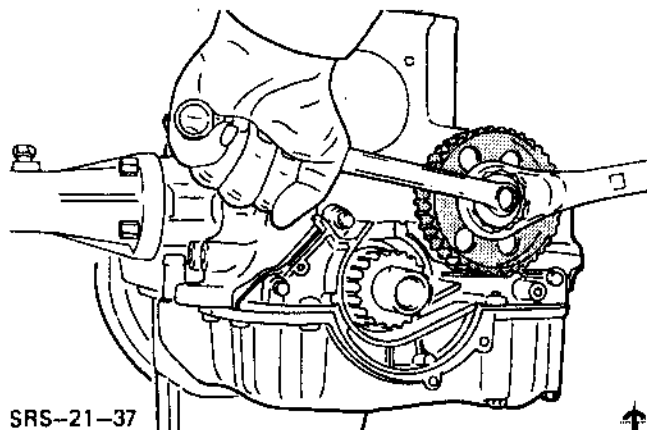


Fig.63. Remove auxiliary shaft toothed pulley.

28. Pull off the crankshaft toothed pulley, using special tool 21-028-A.

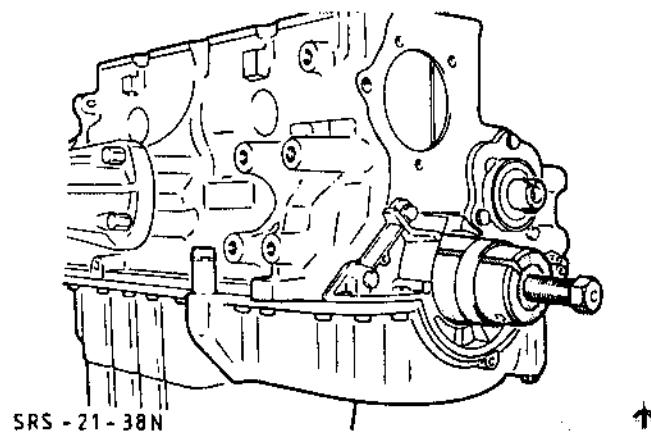


Fig.64. Pull off crankshaft toothed pulley, using special tool 21-028-A.

29. Uniformly loosen the six clutch pressure plate bolts and remove the pressure plate and clutch disc from the flywheel.

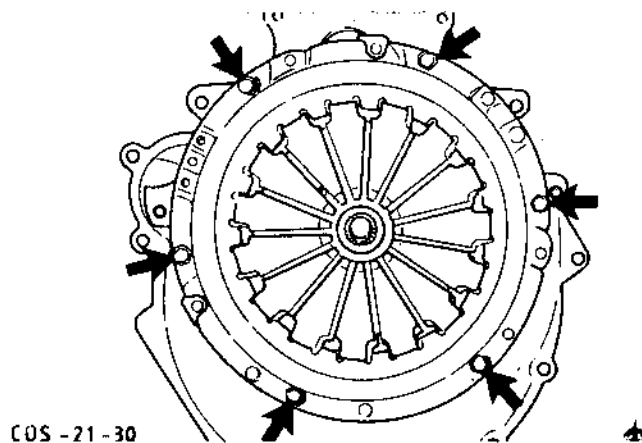


Fig.65. Clutch pressure plate.

21 134 8

30. Using special tool 21-036-A pull out the crankshaft needle roller bearing (pilot bearing).

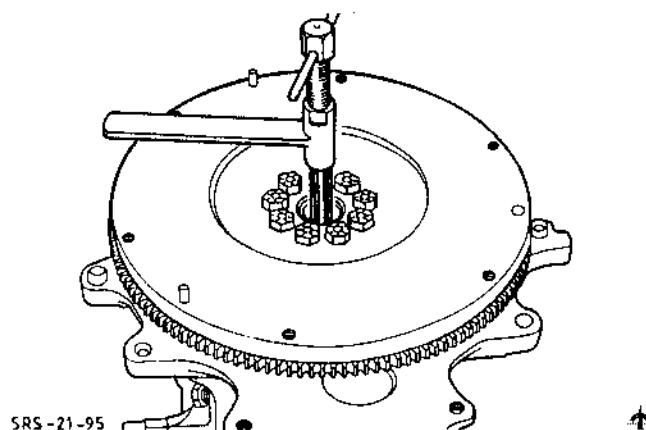


Fig.66. Using special tool 21-036-A pull out crankshaft needle roller bearing.

31. Remove the flywheel (9 bolts).

NOTE: One bolt hole has an offset drilling, therefore, mark the relative position of flywheel to crankshaft with a felt pen to assist reassembly.

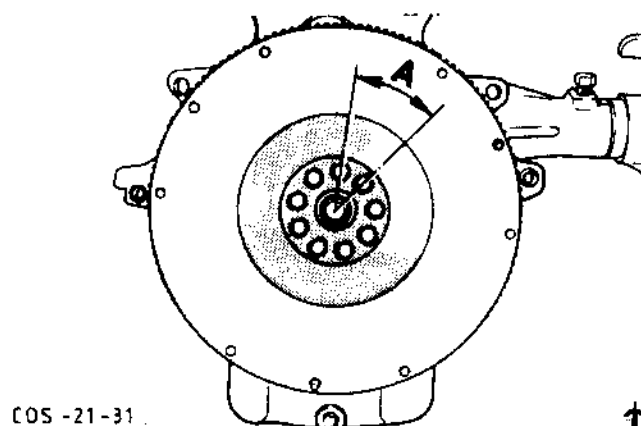


Fig.67. Remove flywheel.
A - Offset

32. Remove the oil sump (22 bolts and washers).

Discard seals and gaskets.

33. Remove the oil pump and oil pump driveshaft.

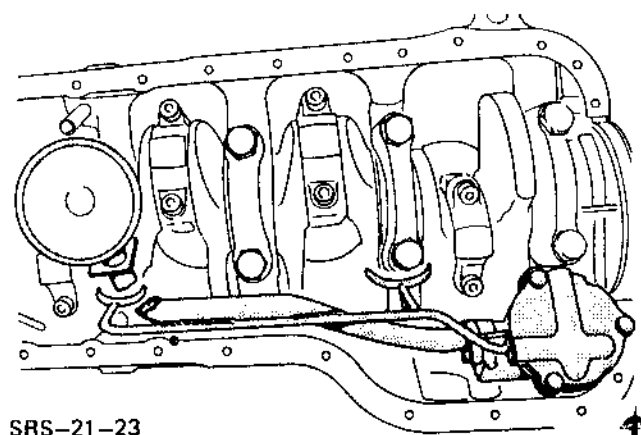


Fig.68. Remove oil pump.

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34. Remove the crankshaft front cover (4 bolts) complete with the crankshaft front oil seal.

Discard the bolts, gasket and oil seal.

35. Unscrew the auxiliary shaft cover (3 bolts).

36. Remove the auxiliary shaft retaining plate (2 screws) and pull out auxiliary shaft.

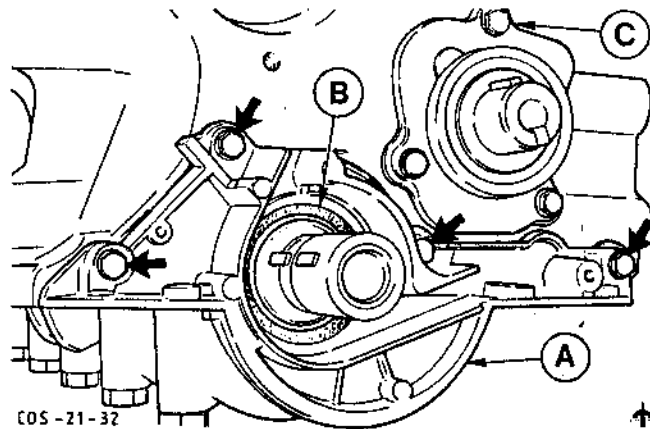


Fig.69. A - Crankshaft front cover
B - Oil seal
C - Auxiliary shaft cover

37. Remove the big-end bearing caps together with their half shells.

NOTE: Identify bearing half shells and caps for correct reassembly.

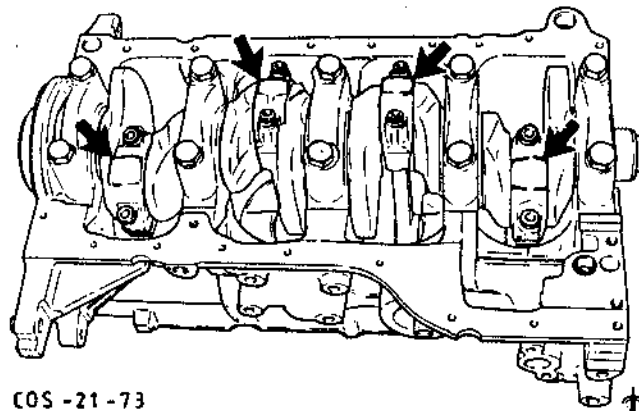


Fig.70. Remove big-end bearing caps.

38. Remove the pistons and connecting rods upwards.

NOTE: First clean the carbon from the cylinders.

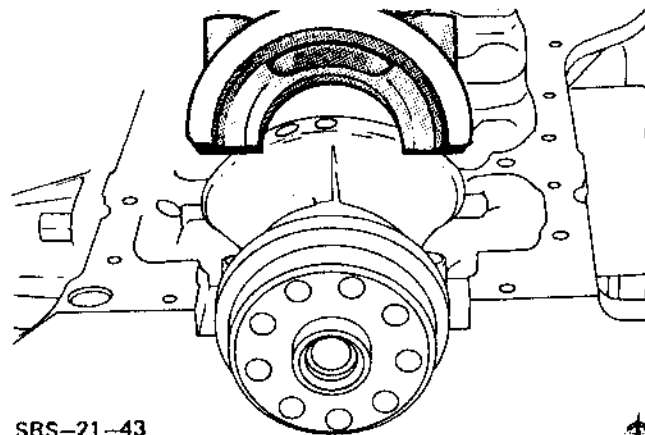


Fig.71. Remove main bearing caps.

39. Remove the main bearing caps.

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40. Remove the crankshaft and bearing shells.

Remove the crankshaft rear oil seal.

NOTE: Identify bearing shells for correct reassembly.

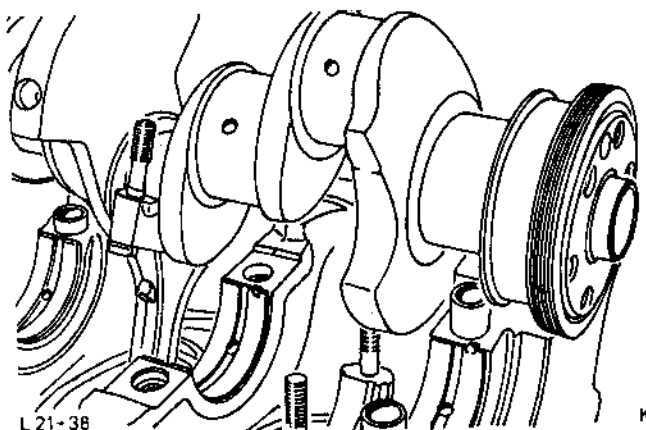


Fig.72. Remove crankshaft from cylinder block.

To Reassemble

During assembly, tighten nuts and bolts to the torque specified in Technical Data.

The extent and nature of the cleaning required before reassembly will depend on running time, the extent of any engine damage and the intended further use of individual parts.

This is particularly true of the cylinder block with its corners, angles and drillings.

Remove all blanking plugs and covers as appropriate and clean their seats with suitable cleaning agents and tools (brushes, scrapers).

In particular, the oil ways of the cylinder block and cylinder head must be free of dirt and swarf.

When press-fit blanking covers and coolant plugs have been removed, these, like all gaskets, must always be replaced whenever engine repairs are carried out.

NOTE: Before installing the following bolts, lubricate the threads and under the bolt heads with engine oil:

Main bearing bolts

Big-end bearing bolts

Flywheel bolts

Cylinder head bolts

Fig.73. Lubrication circuit.

A - Turbocharger

B - Hydraulic valve tappets

C - Oil cooler

D - Piston cooling

E - Oil retaining valve

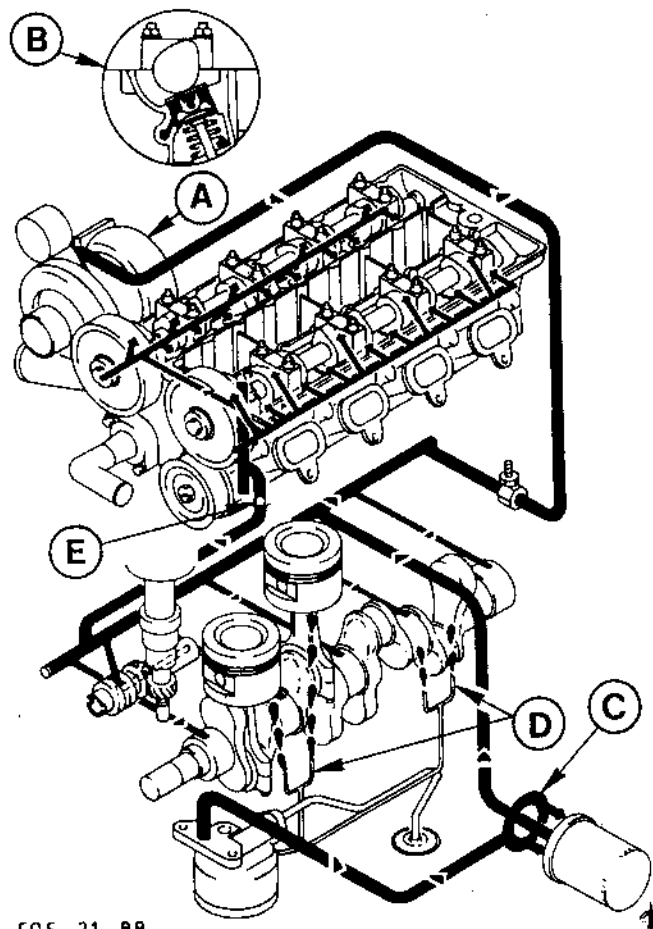


Fig.73. Lubrication circuit.

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41. Check the piston clearance in the bores as follows:

- Fit the main bearing caps without bearing shells and tighten to specified torque.
- Rotate the used cylinder block through 180° and measure cylinder bores with standard measuring instruments.
- If the measured diameter of the cylinder bore is too large in relation to the size classification of the piston previously used, the cylinder block must be overhauled or replaced. Fit new pistons of the appropriate cylinder bore size classification.

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

42. Check the main bearing clearance as follows:

The use of "PLASTIGAGE" (Type PG-1) simplifies the measurement of the bearings (even for undersize crankshafts). "PLASTIGAGE" is the brand name of a precisely calibrated plastic filament.

West German Supplier:

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

Tel: 0203/870081
Telex: 8551494

U.K. Supplier:

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

Requirements for measurements with "Plastigage":

- The bearing must be dry and clean.
- The crankshaft must not be rotated during the measuring operation.
- The measurement points should be taken at top and bottom dead centres.
- The bearing caps must not be hammered down.

Place a length of Plastigage across the width of the main bearing journal on the crankshaft and then fit the main bearing cap dry with bearing shell and torque as specified. The plastic filament will be compressed depending on the bearing clearance. Remove bearing cap.

Measure the width of the compressed plastic filament by means of the scale printed on the PLASTIGAGE pack. The reading corresponds to the bearing clearance.

Only use bolts in good condition for the crankshaft bearings. Do not tighten them in excess of the specified torque.

Each main bearing must be measured individually, without other bearing caps being fitted.

If necessary, overhaul the main bearing journals and replace the bearing shells.

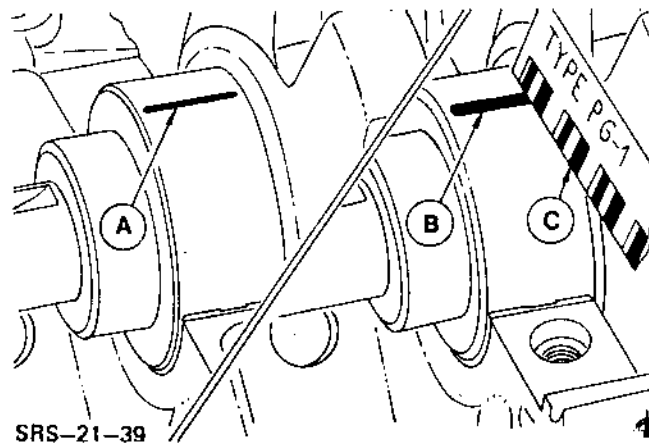


Fig.74. Measuring the bearing clearance.
A - Calibrated plastic filament
B - Squashed plastic filament
C - Measuring scale

21 134 8

Crankshaft main bearing journals

Standard diameter crankshaft main bearing journals are unmarked. When the bearing journals are 0,25 mm undersize, the crankshaft is marked with a green paint line on the first counterweight.

Crankshaft big-end bearing journals

Standard diameter crankshaft big-end bearing journals are unmarked. When the big-end bearing journals are 0,25 mm undersize, the crankshaft is marked with a green paint spot on the first web adjacent to the big-end bearing.

Crankshafts, the main and big-end bearing journals of which are ground undersize, have both the paint stripe and paint spot on the front side of the first web.

NOTE: Grooved bearings in block and plain bearings in cap.

Bearing shells

Standard main bearing and big-end bearing shells are unmarked. Bearing shells for undersize crankshafts or oversize cylinder blocks have corresponding inscriptions on the back (see Parts Microfilm) and in the case of production repair sizes they are colour coded on the outside edge, except in the case of main and big-end bearings intended solely for service (0,5 0,75 and 1,0 mm undersize crankshaft journals).

NOTE: Undersize bearings are for dealer repair only - not initial build.

When selecting new bearing shells, always check the Parts Microfilm and also measure, to ensure that they are of the appropriate size.

In order to remain within the specified limits of bearing clearance (see Technical Data), journals, parent bores and bearing shells must be measured individually.

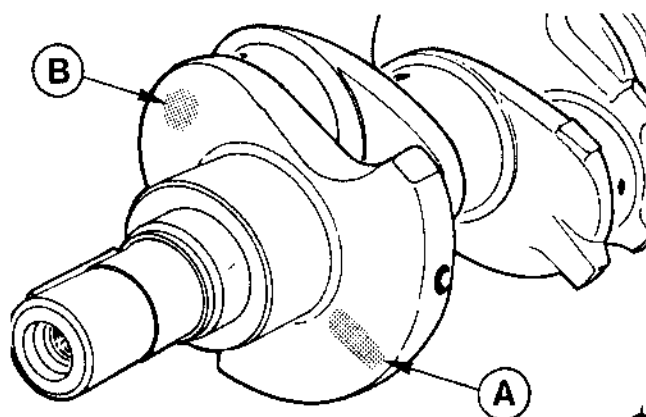


Fig.75. Paint marks on crankshaft.
A - Undersize main bearing journal
B - Undersize big-end bearing journal

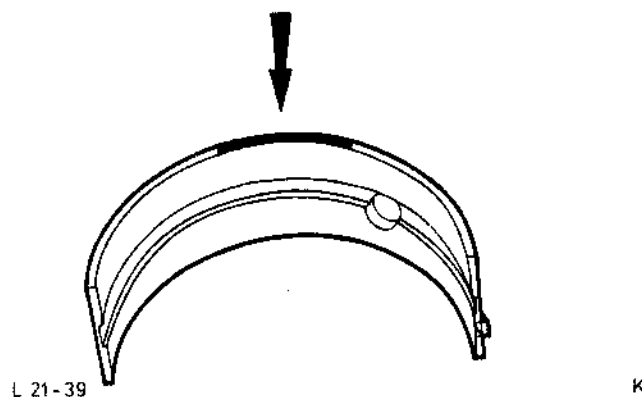


Fig.76. Bearing shell paint marking (production repair).

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43. Fit the cylinder block main bearing shells dry into the cylinder block, then lubricate them with engine oil.

44. Install the crankshaft.

NOTE: Ensure that the thrust half washers of the centre bearing are fitted in the correct position, i.e., copper coloured sides facing outwards.

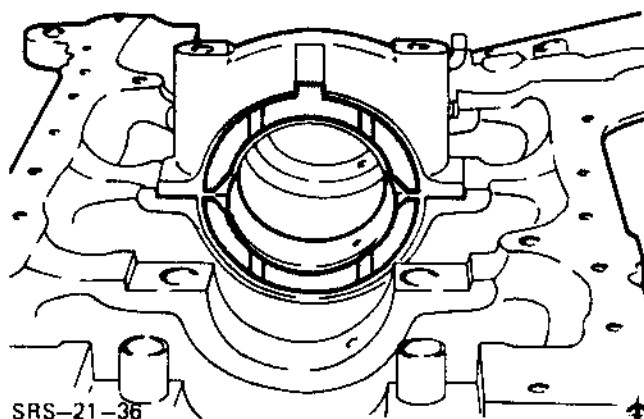


Fig.77. Thrust half washers on centre bearing.

45. Fit the main bearing caps complete with oiled bearing shells.

NOTE: First coat the contact face and sides of the rear main bearing cap with sealing compound (see Technical Data).

NOTE: Before fitting, lubricate the bearing cap bolts on the threads and under the bolt heads with engine oil.

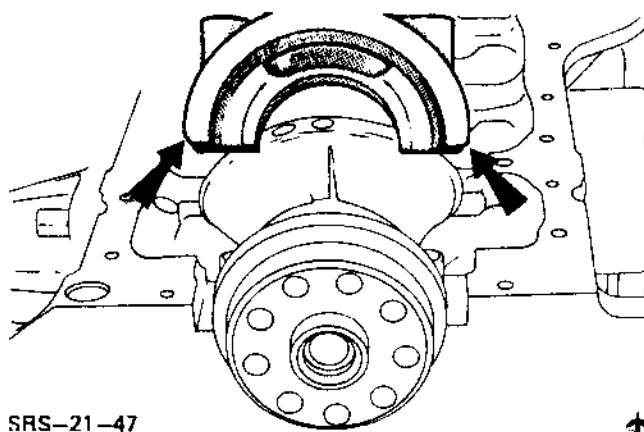


Fig.78. Coat contact face and sides of rear main bearing cap with sealing compound.

46. Check the crankshaft end float (see Technical Data) using a dial test indicator and adjust if necessary by fitting new thrust half washers.

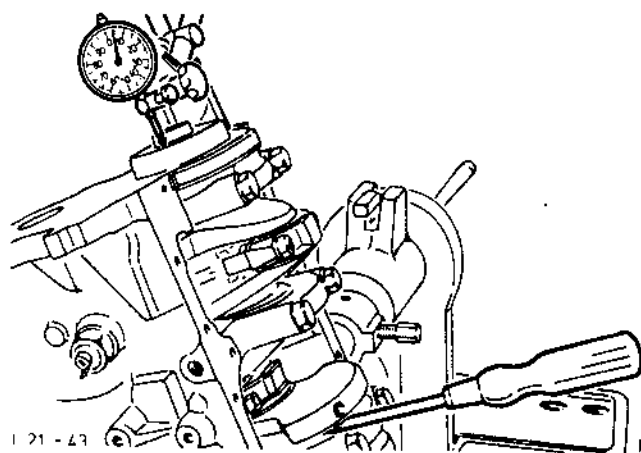
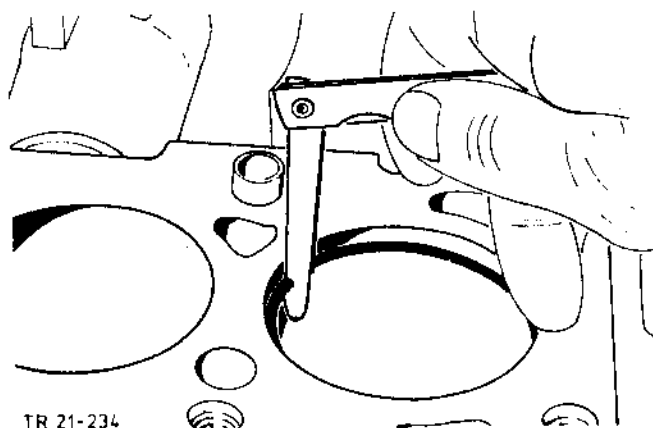


Fig.79. Check crankshaft end float.

21 134 8

47. Remove the piston rings from the pistons and check the piston ring gaps.

The stated dimensions (see Technical Data) relate to the gauge ring used in production and can be exceeded by up to 0,15 mm (0,006 in) when measured in the cylinder.



TR 21-234

Fig.80. Check piston ring gaps.

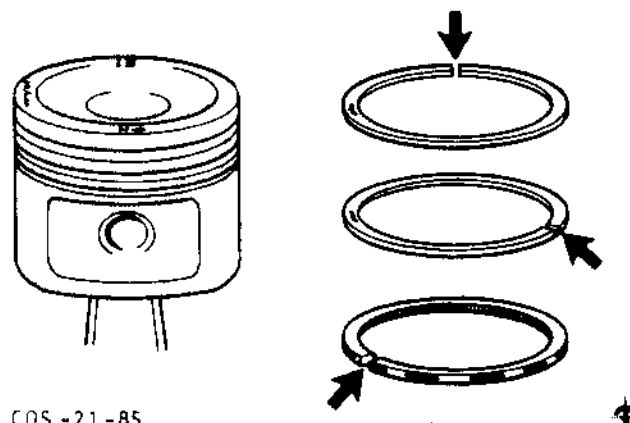
48. Fit the piston rings to piston, using standard tool (ring compressor).

For the relative positions of the piston ring gaps see Fig.81.

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

49. Compress the piston rings using a standard tool (ring compressor). Push oiled pistons into cylinder with a hammer handle, guiding the connecting rods onto the big-end bearing journals with the other hand.

NOTE: When installing the pistons, the "front" mark (arrow) must point towards the front of the engine. Use a plastic guide fork to avoid damage to big-end journals.



COS-21-85

Fig.81. Position of the piston rings gaps.

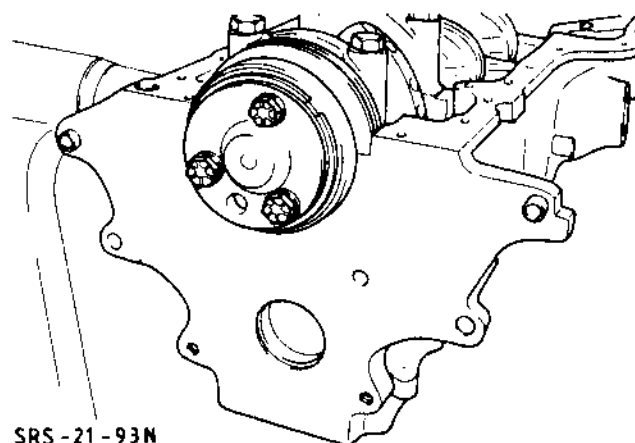
50. Fit the big-end bearing shells and measure with "PLASTIGAGE" as described in sub-operation 42. Replace the bearings shells if necessary.

51. Fit the big-end bearing caps complete with oiled bearing shells. Apply oil to thread and contact surface of big-end bearing bolts and tighten to specified torque.

Check that the connecting rods have adequate end float (0,1 mm minimum) on big-end bearing journals.

52. Lubricate the sealing lip of the new rear oil seal. Place the oil seal with the closed side facing upwards on a solid base. Position special tool 21-011-D on the oil seal and press the retaining ring downwards by hand as far as it will go.

Position the tool and oil seal on engine and draw in oil seal evenly until it butts using three flywheel retaining bolts.



SRS-21-93N

Fig.82. Draw in oil seal, using special tool 21-011-D.

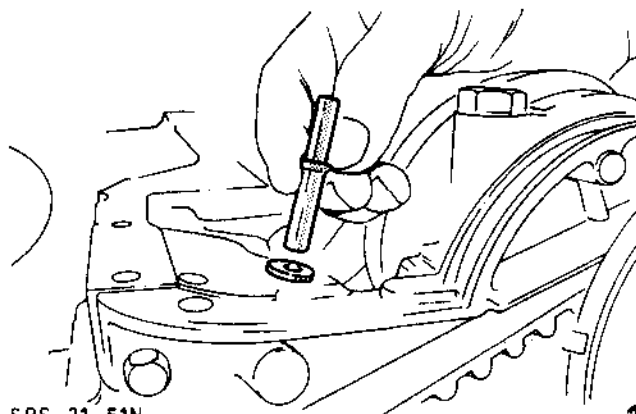
21 134 8

53. Fit the oil pump driveshaft, short side to oil pump.

54. Fit oil pump.

NOTE: When fitting a new or overhauled oil pump, it must be filled with engine oil and rotated by hand before installation.

NOTE: Rotate the crankshaft 360° by hand and check that there is clearance between the crankshaft journals and the oil spray line.



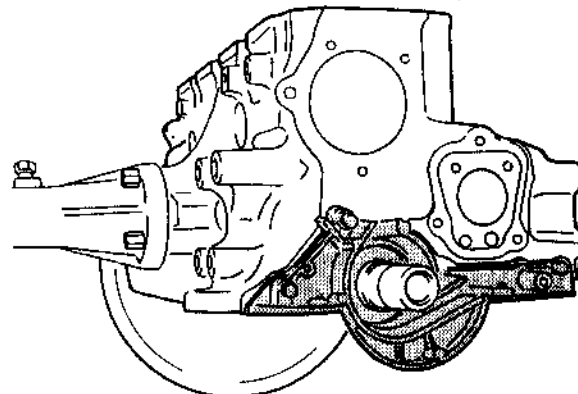
SRS-21-51N

Fig.83. Oil pump driveshaft.

55. Remove the oil seal from the crankshaft front cover.

56. Using new self locking bolts (see Technical Data) and a new gasket fit the crankshaft front cover and torque bolts to specification.

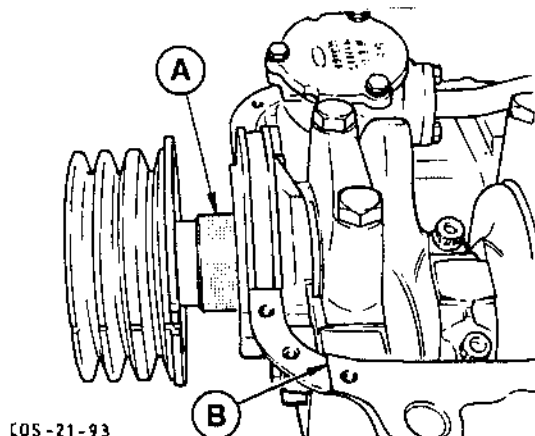
NOTE: The transition of the front cover/oil sump mating flange must be even, see Fig.85.



SRS-21-52

Fig.84. Fit the crankshaft front cover.

57. Wet the crankshaft and the new crankshaft front oil seal lip with fresh engine oil and install the seal using special tool 21-009-B in conjunction with the crankshaft V-belt pulley, the pulley retaining bolt and washer.



COS-21-93

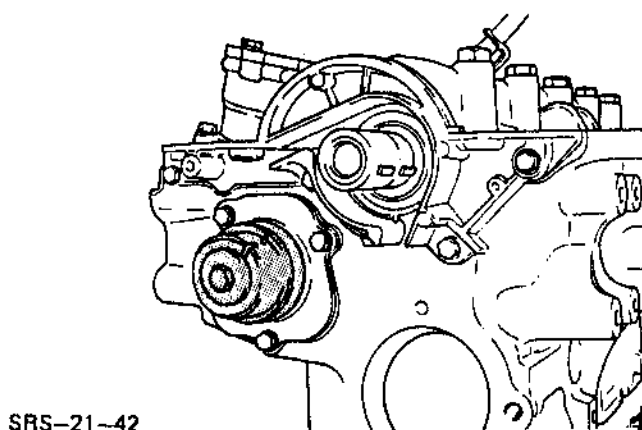
Fig.85. Fit crankshaft front oil seal

A - Special tool 21-009-B

B - Transition of front cover/sump mating flange

21 134 8

58. Fit the auxiliary shaft and its retaining plate.
59. Remove the oil seal from the auxiliary shaft front cover.
60. Loosely fit the auxiliary shaft front cover then install the new oil seal, using special tool 21-009-B, together with the original washer and a longer bolt than normal. Tighten the front cover bolts.



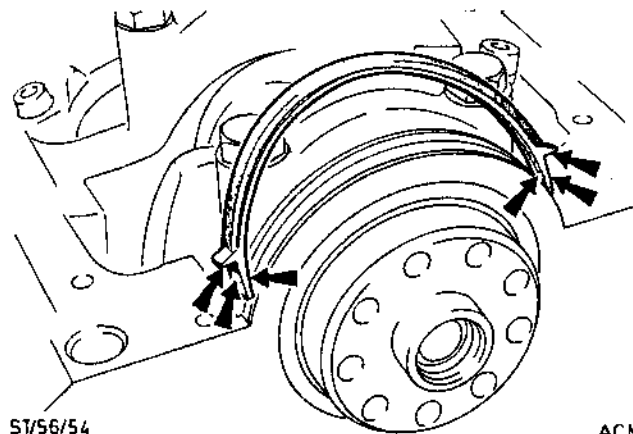
SRS-21-42

Fig.86. Fit oil seal to auxiliary shaft front cover using special tool 21-009-B.

61. Apply sealing compound (see Technical Data) to the ends of the rubber seals then insert them in the grooves of the rear main bearing cap and in the front bearing cover.

Apply sealing compound to the cylinder block mating face at the joint with the front bearing cover

Push the sump gasket under the recess in the rubber seal.



ST/56/54

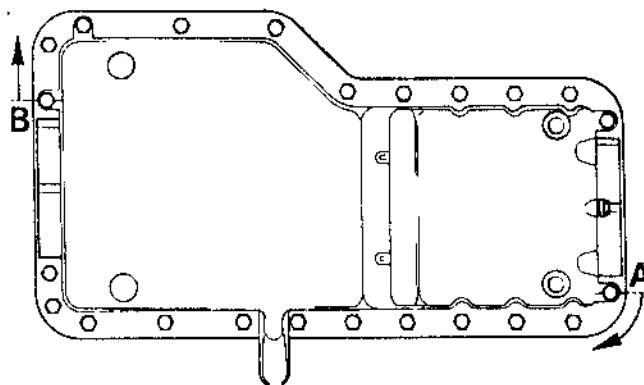
ACM

Fig.87. Apply sealing compound to rubber seals (rear main bearing cap shown).

62. Fit the oil sump, apply sealing compound (see Technical Data) to the bolts and torque the bolts to specification using the correct bolt tightening sequence as follows:

Stage 1: Starting with bolt "A"

Stage 2: Starting with bolt "B"



COS - 21 - 34

Fig.88. Sump bolt tightening sequence.

21 134 8

63. Fit the flywheel.

NOTE: Check hole spacing for correct location.
One hole has an offset drilling.

NOTE: Lubricate the bolt threads and under the
bolt heads with engine oil.

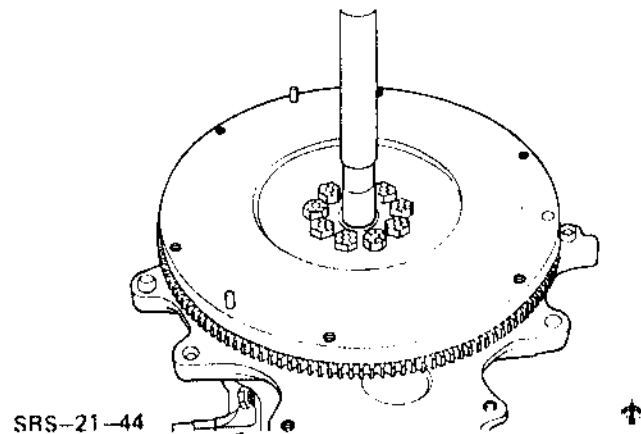
64. Install the crankshaft needle roller bearing,
(pilot bearing) using special tool 21-044-A.


Fig.89. Install crankshaft needle roller bearing,
using special tool 21-044-A.

65. Centre the clutch disc using special tool
21-044-A.

Locate the pressure plate over the dowels and
uniformly tighten the retaining bolts.

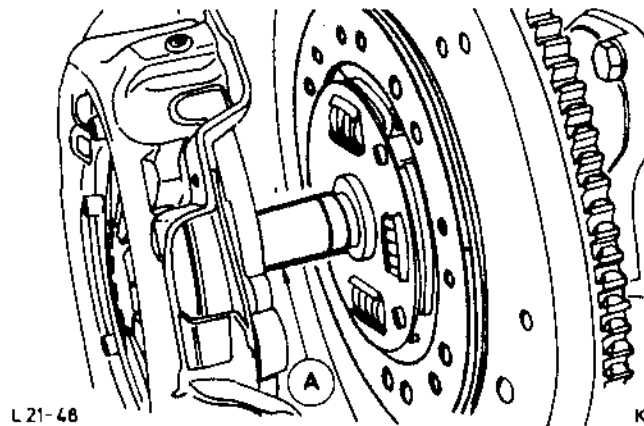


Fig.90. Centre clutch disc.
A - Special Tool 21-044-A

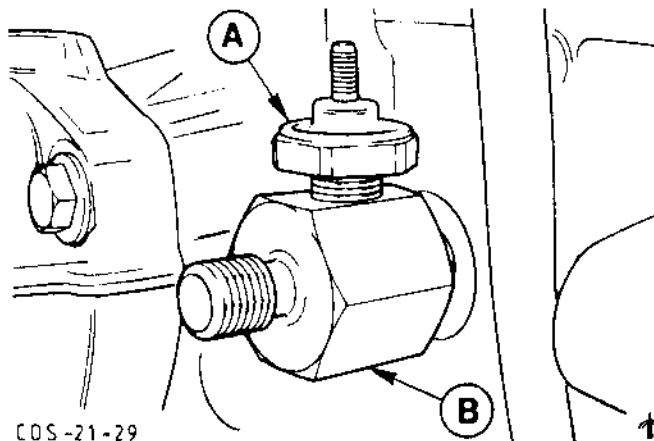
66. Using sealing compound (see Technical Data)
fit the oil pressure switch adaptor and oil
pressure switch.


Fig.91. A - Oil pressure switch
B - Adaptor

21 134 8

67. Insert the oil separator and engine breather valve as far as the stop.

68. Fit the oil cooler.

69. Fit the oil filter (screw in until it makes contact, then tighten a further threequarters of a turn.

NOTE: Lubricate rubber seal.

70. Fit the power steering pump bracket, Fig.93, with two M10 socket headed bolts 'D'. Press the bracket to the rear when tightening the bolts, see arrow, and torque to specification.

71. Fit the power steering pump support bracket, Fig.93:

- Apply sealing compound to the mating face of the support bracket 'G', do not use a gasket.
- Align the support bracket 'B' and engine speed/TDC sensor clip 'C' and screw in two M8 hex. headed bolts finger tight.
- Insert the M8 socket head bolt 'F' connecting the bracket to the support bracket and tighten.
- Tighten the two M8 hex. headed bolts.
- Torque the M8 socket head bolt 'F' and the M8 hex. headed bolts to specification.

Fig.93. Power steering pump bracket and support bracket.

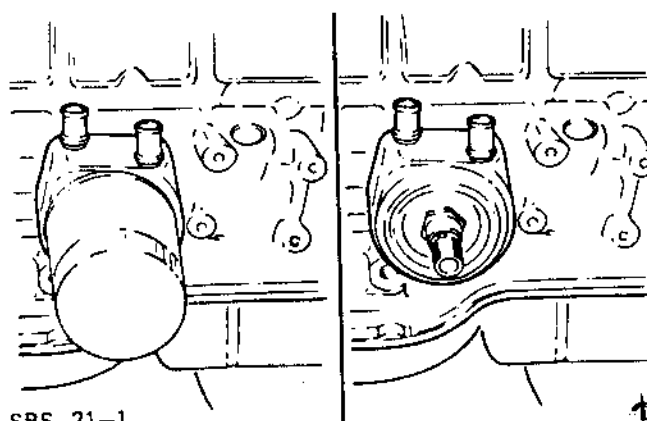
- A - Bracket
- B - Support bracket
- C - Engine speed/TDC sensor clip
- D - M10 hex. socket head bolts
- E - M8 hex. headed bolts
- F - M8 hex. socket head bolt
- G - Sealing compound (refer to Technical Data)

72. Fit the water pump and gasket. Fit the bolt with the collar (M8) on the underside of the pump.

73. Fit the auxiliary shaft toothed belt pulley. Align the pulley with the TDC mark, Fig.94.

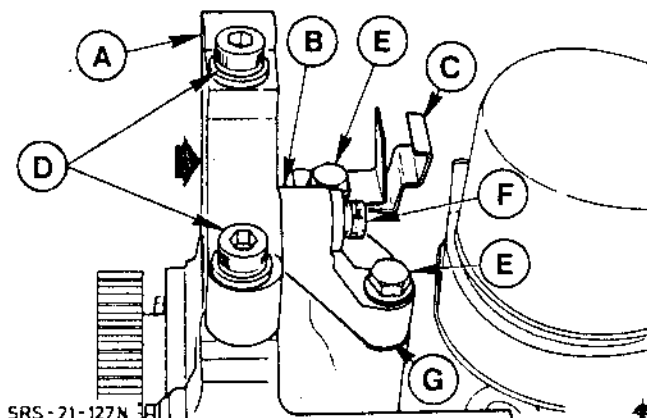
74. Fit the distributor.

NOTE: Distributor rotor arm must now align with the mark for No.1. cylinder Fig.94.



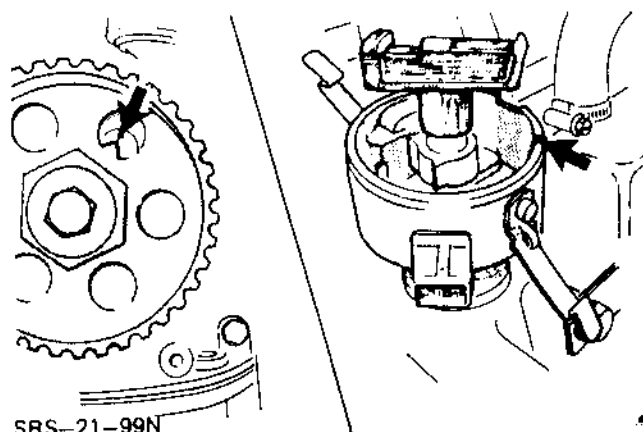
SRS-21-1

Fig.92. Fit the oil cooler and oil filter.



SRS-21-127N

Fig.93. Power steering pump bracket and support bracket.



SRS-21-99N

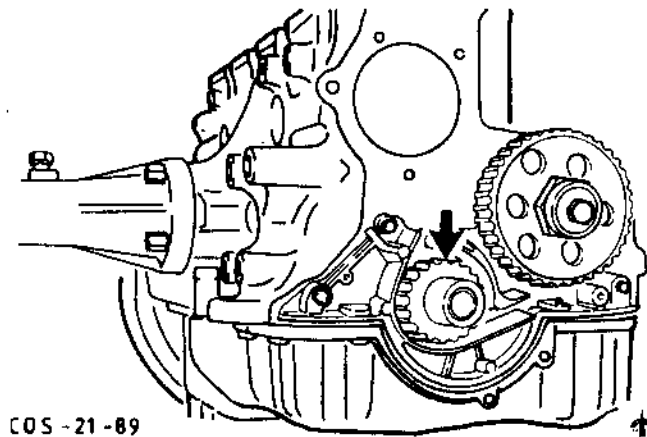
Fig.94. Auxiliary shaft and distributor rotor in TDC position.

21 134 8

75. Fit the crankshaft toothed belt pulley, side with boss facing engine.

76. Install the cylinder head alignment studs, special tool 21-128, in the cylinder block, bolt threads 7 and 8, Fig.96.

NOTE: Before refitting a cylinder head its mating faces must be subjected to a check for flatness as described in Operation No. 21 163 0.



COS-21-89

Fig.95. Install crankshaft toothed belt pulley.

77. Ensure surfaces of cylinder block, cylinder head and new cylinder head gasket are clean.

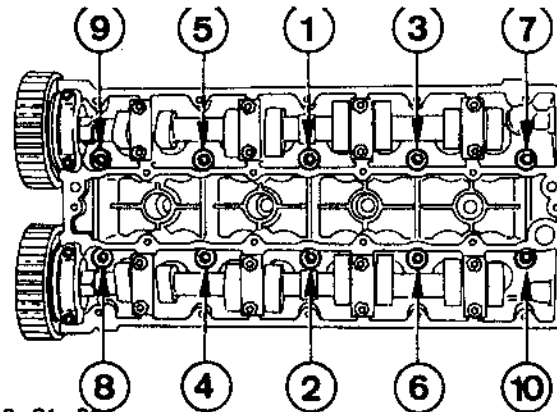
Locate the cylinder head gasket (marked TOP/OBEN) on the cylinder block.

78. Fit the cylinder head complete with inlet manifold (guide intake elbow damper bracket onto engine mount stud).

NOTE: Lubricate the retaining bolt threads, the washers and under the bolt heads with engine oil.

Insert and finger tighten the bolts, screw out the alignment studs and insert the remaining bolts.

Tighten the bolts in three stages, in the sequence shown, to the torque values as specified in Technical Data.

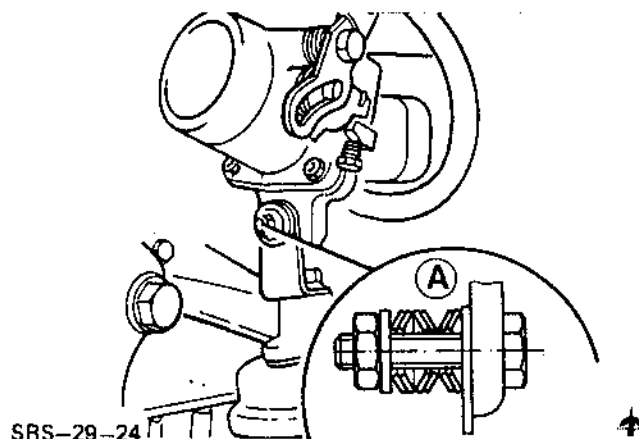


SRS-21-31

Fig.96. Cylinder head bolt tightening sequence.

79. Tighten the engine mount/intake elbow damper bracket nut.

Adjust damper: using Loctite to secure nut (see Technical Data), tighten nut to 8 - 10 Nm then loosen a half turn.



SRS-29-24

Fig.97. Intake elbow damper
A - 6 dished washers

21 134 8

80. Fit the engine breather valve (1 nut) to the plenum chamber.

81. Fit the coolant feed hose to the oil cooler.

82. Fit the vacuum hose to the engine breather valve.

83. Loosely fit the timing belt tension pulley.

84. Fit the timing belt to the crankshaft pulley only.

85. Fit the crankshaft V-belt pulley and thrust washer. The convex side of the thrust washer faces the timing belt pulley.

86. Position the crankshaft, auxiliary shaft and both camshafts on TDC mark and fit the timing belt.

NOTE: Check previous direction of running when fitting a used timing belt.

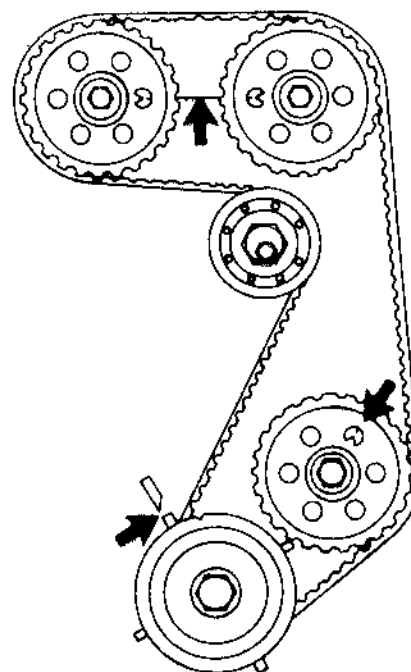
87. Adjust the timing belt tension as follows:

- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

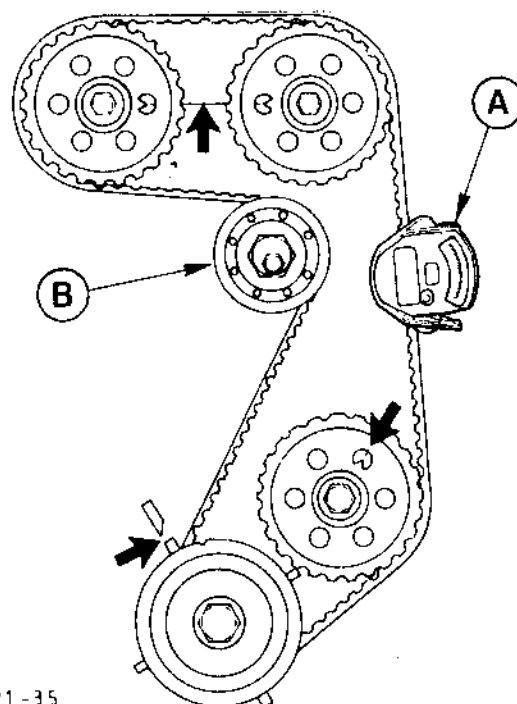
- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and if necessary repeat tensioning procedure.

Crank the engine several times in the direction of rotation and recheck the distributor at TDC.
Torque all pulleys to specification.



SRS-21-57N

Fig.98. Position crankshaft, auxiliary shaft and both camshafts on TDC mark and fit timing belt.



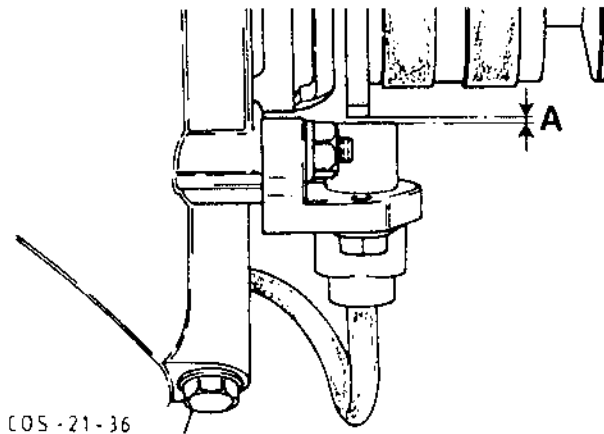
COS-21-35

Fig.99. Tension timing belt
A - Special tool 21-113
B - Tensioning pulley

21 134 8

88. Fit the engine speed/TDC sensor complete with bracket (2 nuts), attach cable to the sump (1 bolt) and clip plug to the power steering pump support bracket.

Turn crankshaft pulley until a pulley tooth is aligned with the sensor. Adjust sensor to tooth gap, 0,6 to 1,0 mm.



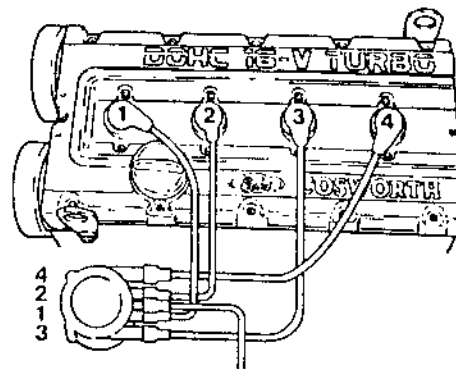
COS-21-36

Fig.100. Engine speed/TDC sensor.
A - 0,6 to 1,0 mm

89. Position the cylinder head cover gaskets, 2 rubber seals and cylinder head cover. Insert and tighten bolts to specification (20 bolts).

90. Fit the alternator together with its bracket and adjustment strap. Fit V-belt and adjust V-belt tension (see Technical Data).

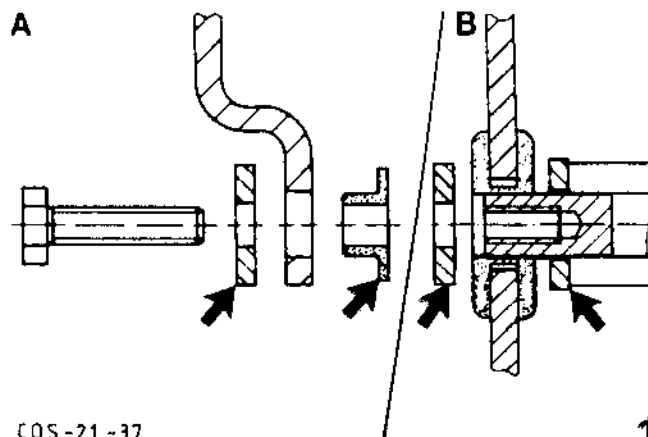
91. Fit the ignition distributor cap and HT leads. Clip the HT leads to the plenum chamber.



SRS-21-58

Fig.101. HT lead arrangement/firing order.

92. Fit the timing belt cover ensuring that the spacers are correctly located. Do not tighten top right hand screw.



COS-21-37

Fig.102. Correct timing cover spacer location.
A - Lower
B - Middle

21 134 8

93. Fit the oil dipstick holder to cylinder head, insert oil dipstick.

94. Fill engine with oil.

95. Remove engine from stand.

96. Fit the turbocharger complete with the exhaust manifold using new gaskets (16 nuts, finger tight).

NOTE: The exhaust manifold must be centred on the studs before tightening the nuts.

Install and adjust the turbocharger damper unit as described in Section 23, Repair Operation 23 612 0, Turbocharger-Remove and Install.

97. Fit the right hand engine mount.

98. Connect the turbocharger oil feed hose to the oil pressure switch adaptor, Fig.103, and clip hose to the cylinder head (2 bolts, 2 clips) together with lifting eye.

99. Connect the turbocharger oil return hose to the sump stub pipe.

100. Connect the turbocharger coolant feed line to the thermostat housing.

Clip the turbocharger coolant return line to the top of the timing belt cover and tighten screw.

Connect the heater return line to the water pump.

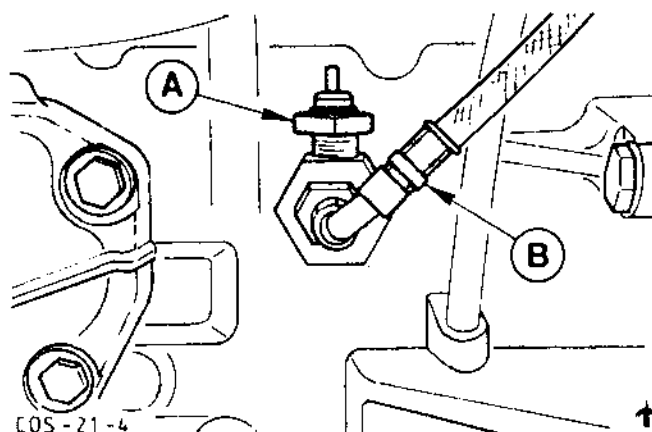


Fig.103. A - Oil pressure switch
B - Turbocharger oil feed hose

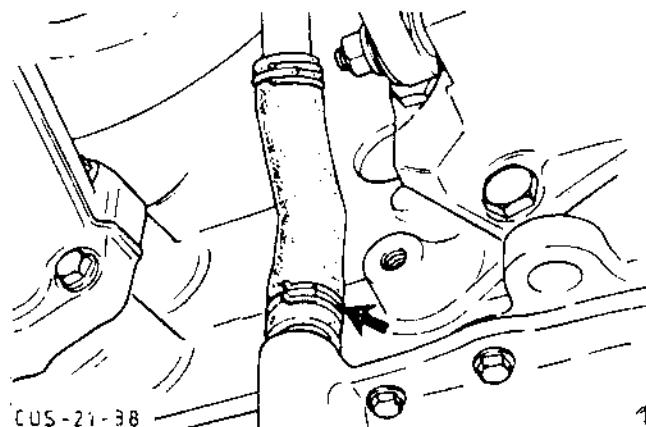


Fig.104. Connect turbocharger oil return hose.

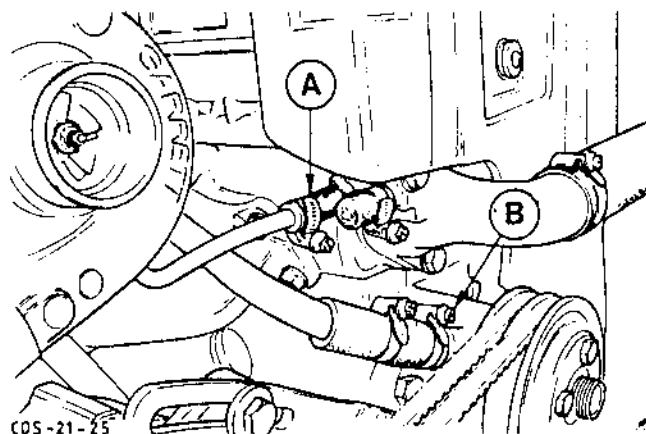


Fig.105. A - Turbocharger coolant feed line
B - Heater return line

21 154 0 SUMP - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Engine support bar 21-060-A

To Remove

1. Disconnect the battery earth cable.
2. Detach the overflow tank connecting hose from the turbocharger coolant pipe and withdraw the hose from the lifting eye.
3. Fit the engine support bar, special tool 21-060-A. Attach a chain or steel rope to the engine lifting points and slightly raise engine.
4. Raise the vehicle.
5. Detach the intermediate steering shaft from the steering spindle (1 bolt), Fig.106.
6. Detach the power steering oil cooling loop from the body (2 clamps).
'88 Model Year only:
Unclip fog light multiplug from cooling loop.

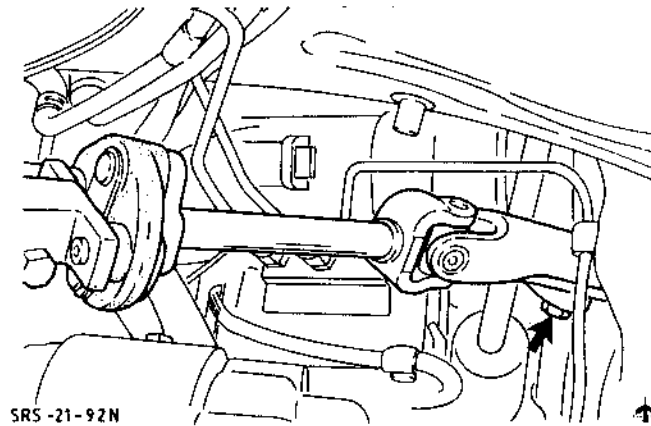


Fig.106. Detach intermediate steering shaft retaining bolt.

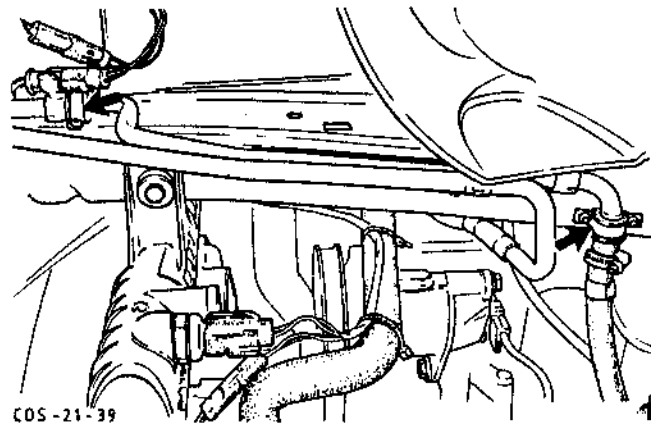


Fig.107. Power steering oil cooling loop clamps.

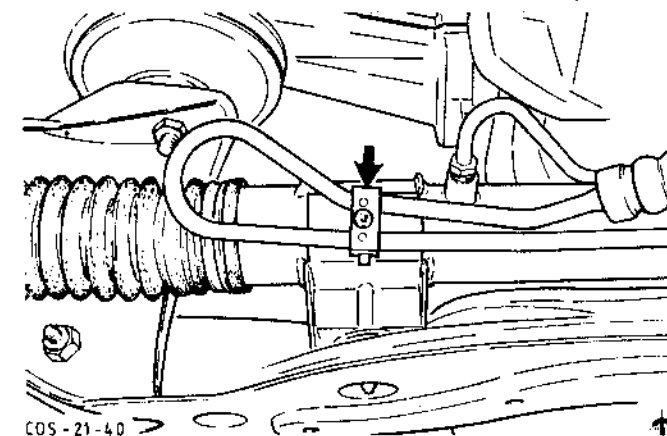


Fig.108. Detach power steering feed line clamp.

7. Detach the power steering feed line from the steering assembly (1 clamp/screw).

21 154 0

8. Remove the brake pipe/hose connection from the engine crossmember on both sides -

- '86 Model Year:
Unscrew the brake pipe from the connector, remove the two retaining clips and pull the hose out of the engine crossmember.
- '88 Model Year:
Remove the two retaining clips and slide pipe/hose connector out and clear of the engine crossmember.

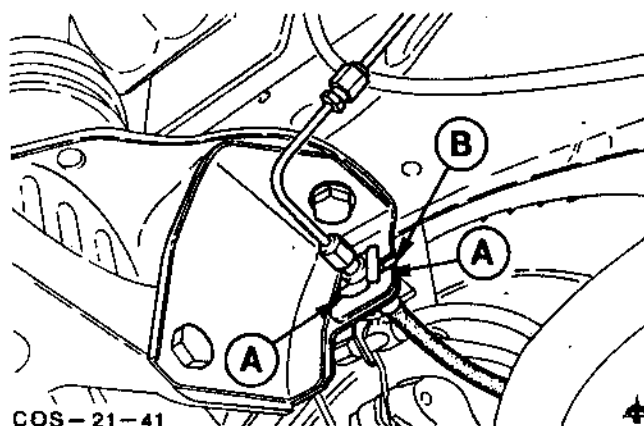


Fig.109. A - Clip
B - Slot - '88 Model Year

9. Remove the engine bearer/crossmember nut on both sides.

10. Detach the engine crossmember from the side members (2 bolts each side).

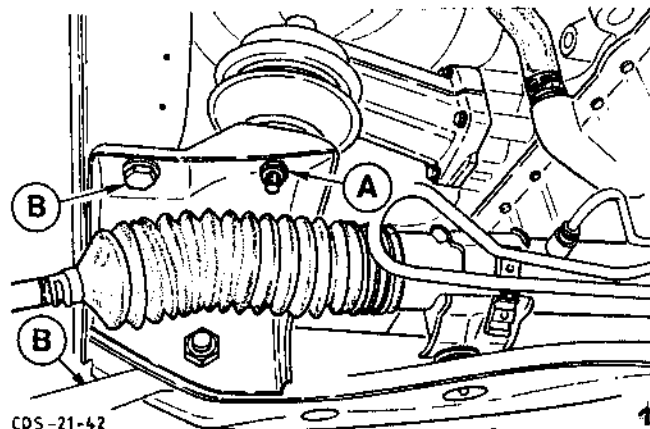


Fig.110. Remove crossmember from side member.
A = Engine bearer nut
B = Bolt

11. Remove the engine speed/TDC sensor from its holder on the sump (2 bolts) and unclip the cable from the sump (1 bolt and clip).

12. Drain the engine oil.

13. Remove the sump (22 bolts and washers).

Discard seals and gaskets.

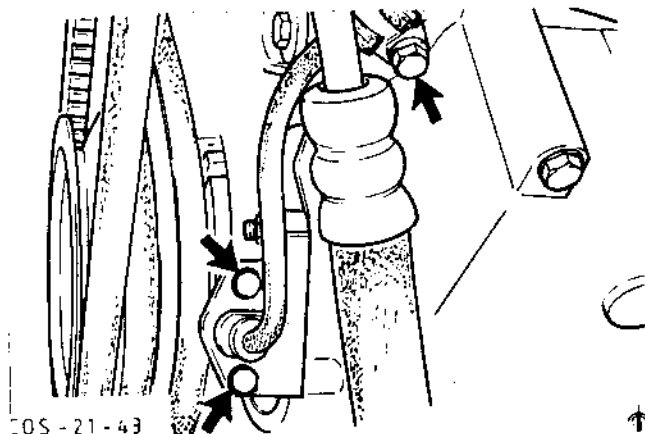


Fig.111. Detach engine speed/TDC sensor.

21 154 0

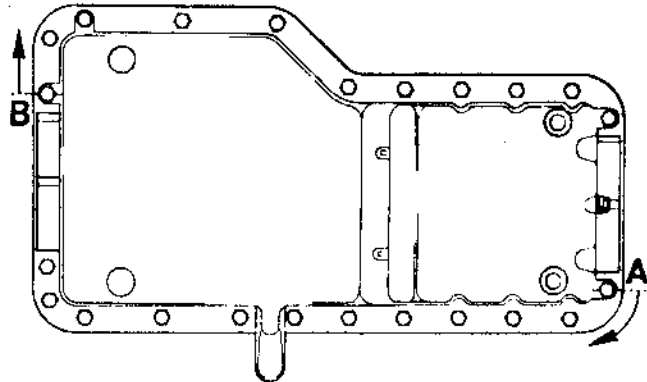
To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

14. Ensure mating faces are clean and oil free.

Apply sealing compound (see Technical Data) to the ends of the rubber seals and insert them in the grooves of the rear main bearing cap and front bearing cover.

Apply sealing compound to gaskets and stick gaskets to cylinder block ensuring correct overlap by the rubber seals.



COS - 21 - 34

Fig.112. Sump bolt tightening sequence.

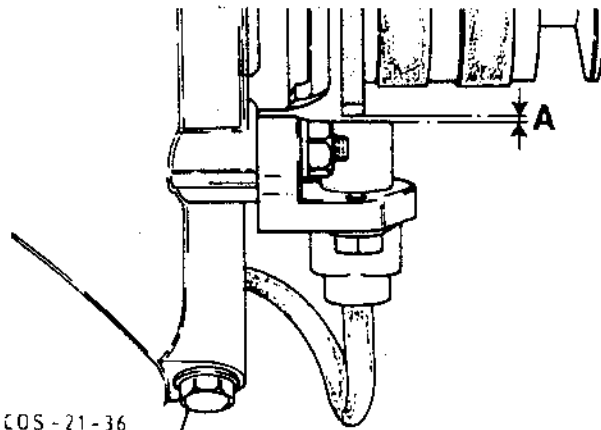
15. Apply sealing compound (see Technical Data) to the bolts and fit the sump, together with engine speed/TDC sensor cable clip. Torque the bolts to specification using the correct bolt tightening sequence as follows, Fig.112:

Stage 1: Starting with bolt 'A'

Stage 2: Starting with bolt 'B'

16. Fit the engine speed/TDC sensor to its holder.

Turn the crankshaft pulley until a pulley tooth is aligned with the sensor. Adjust sensor/tooth gap, 0,6 to 1,0 mm.

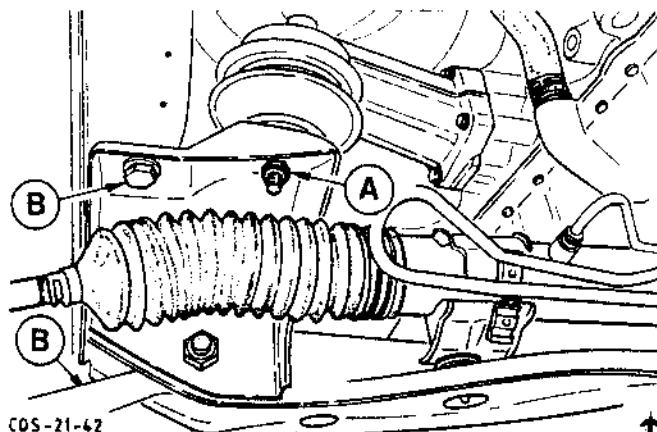


COS - 21 - 36

Fig.113. Engine speed/TDC sensor.
A - 0,6 to 1,0 mm

17. Fit the crossmember to the side members (2 bolts each side), at the same time locating the engine bearer studs.

18. Tighten the engine bearer/crossmember nut on both sides.



COS - 21 - 42

Fig.114. Fit crossmember to side member.
A - Engine bearer nut
B - Bolt

21 154 0

19. Fit the brake pipe/hose connection to the engine crossmember on both sides -

- '86 Model Year:
Insert the connector into the crossmember and secure with the clips. Connect the brake pipe to the connector.
- '88 Model Year:
Slot pipe/hose connector into crossmember and secure with clips.

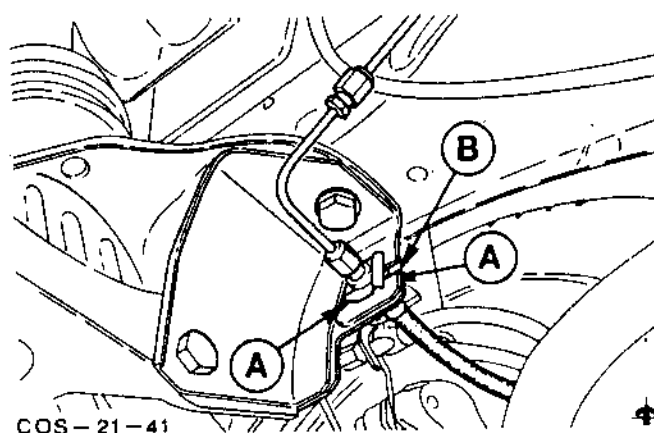


Fig.115. Fit brake pipes.

A - Clip
B - Slot - '88 Model Year

20. Fit the power steering feed line to the steering assembly (1 clamp/screw).

21. Fit the power steering oil cooling loop to the body (2 clamps), Fig.116.

'88 Model Year only:
Clip fog light multiplug to cooling loop.

22. Fit the intermediate steering shaft to the steering spindle (1 bolt), Fig.117.

23. Lower the vehicle.

24. Remove the engine support bar.

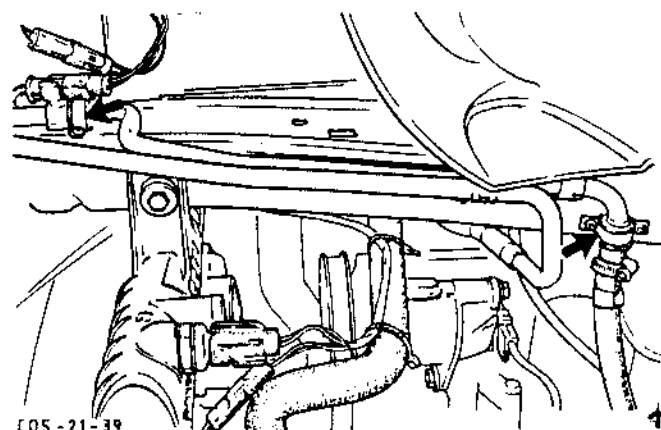


Fig.116. Fit power steering oil cooling loops to body (2 clamps).

25. Push the overflow tank to turbocharger coolant line hose through the lifting eye and connect it.

26. Fill the engine with oil.

27. Connect the battery earth cable.

28. '86 Model Year only:

Bleed the front brake circuit.
See Service and Repair Operation 12 141 0.

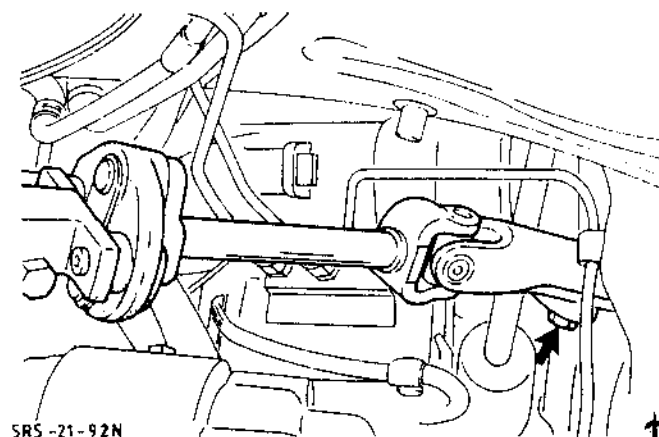


Fig.117. Fit intermediate steering shaft to steering spindle (1 bolt).

21 163 0 CYLINDER HEAD - REMOVE AND INSTALL

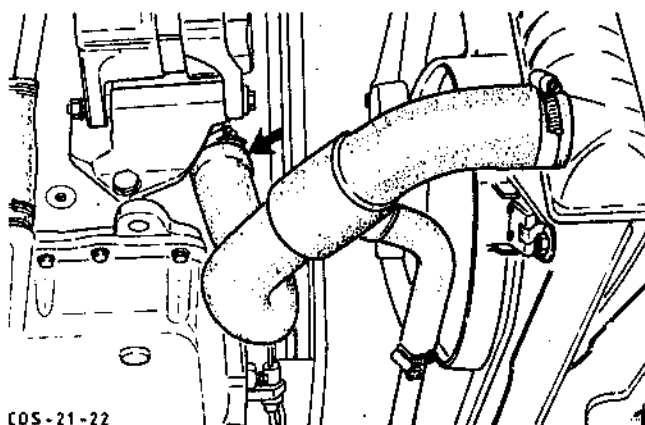
SPECIAL SERVICE TOOLS REQUIRED:

Engine lifting tackle	21-068
Belt tension gauge	21-113
Cylinder head alignment studs	21-128
Remover - fuel delivery line	23-023-A

The cylinder head is removed complete with turbocharger and inlet manifold.

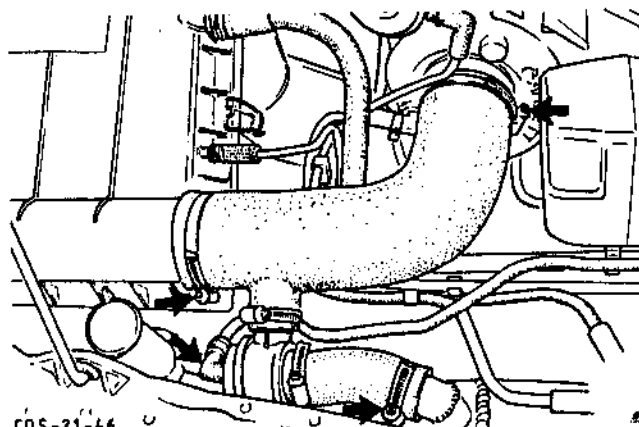
To Remove

1. Disconnect the battery earth cable.
2. Drain the coolant by detaching the lower radiator hose from the water pump.
3. Remove the turbocharger heat shield:
 - '86 Model Year - 3 bolts
 - '88 Model Year - 1 bolt, 2 clips
4. Disconnect the bypass valve connecting hose from the intercooler and the vacuum line from the bypass valve. Remove the air cleaner to turbocharger hose complete with the bypass valve.
5. Disconnect the solenoid control valve lines from the turbocharger and waste gate actuator.
6. Remove the turbocharger to intercooler air hose.



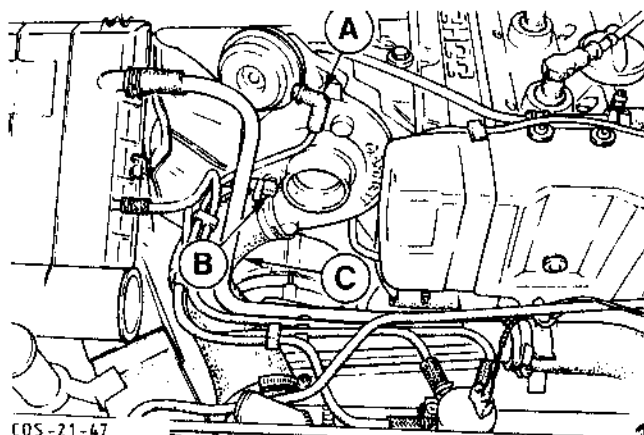
COS-21-22

Fig.118. Detach radiator hose from water pump.



COS-21-46

Fig.119. Remove air cleaner to turbocharger hose complete with bypass valve.



COS-21-47

Fig.120. A - Waste gate actuator - solenoid control valve
B - Turbocharger - solenoid control valve
C - Turbocharger to intercooler hose

21 163 0

7. Detach the overflow tank connecting hose from the turbocharger coolant return pipe and withdraw the hose from the lifting eye.
8. Remove the turbocharger coolant return pipe (1 banjo bolt, 1 clip on timing belt cover).
9. Disconnect the turbocharger coolant feed line from the thermostat housing.

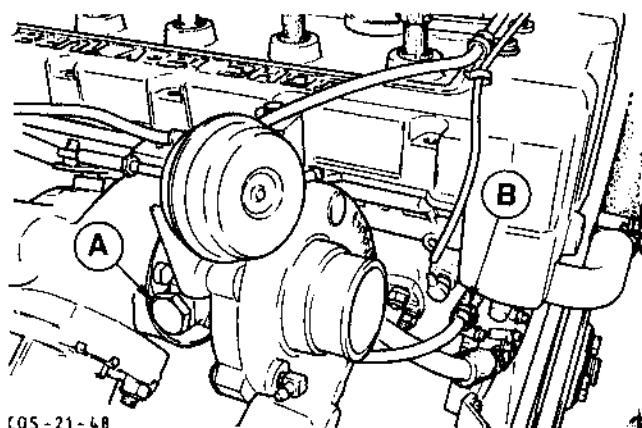


Fig.121. A - Turbocharger coolant return
B - Turbocharger coolant feed

10. Detach the upper radiator hose from the thermostat housing nozzle.
11. Disconnect the heater return line hoses from the heater and the water pump.

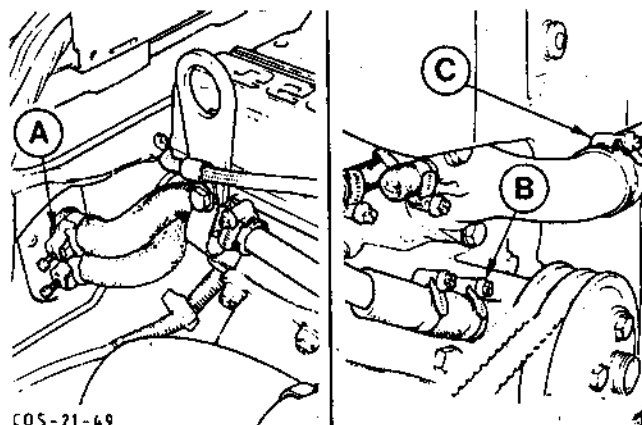


Fig.122. A - Heater return hose
B - Heater/water pump return hose
C - Upper radiator hose

12. Disconnect the exhaust pipe from the turbocharger.
If nut locking plates are fitted, bend back the tabs, remove the three nuts and lock plates and discard them.

13. Disconnect the plenum cover and air cleaner hoses from the breather valve.
Detach the breather valve from the plenum chamber (1 nut).

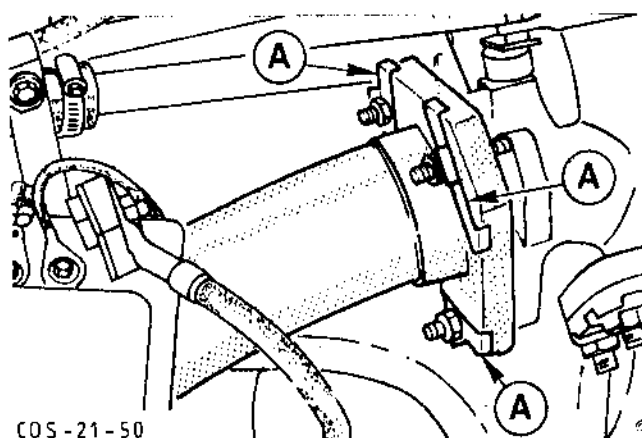


Fig.123. Disconnect exhaust pipe.
A - Lock plates

21 163 0

14. Remove the throttle cable from the throttle butterfly and from bracket (1 clip).

NOTE: Do not remove throttle cable bracket from plenum cover (Loctite from initial build may fall inside plenum chamber).

15. Remove the intercooler to throttle valve assembly air hose.

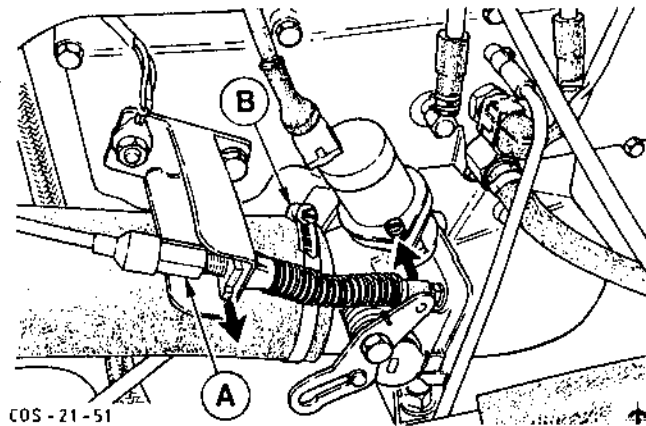


Fig.124. Remove, A - Throttle cable
B - Intercooler to throttle valve hose

16. Loosen the intake elbow damper setting nut and remove the engine mount nut.

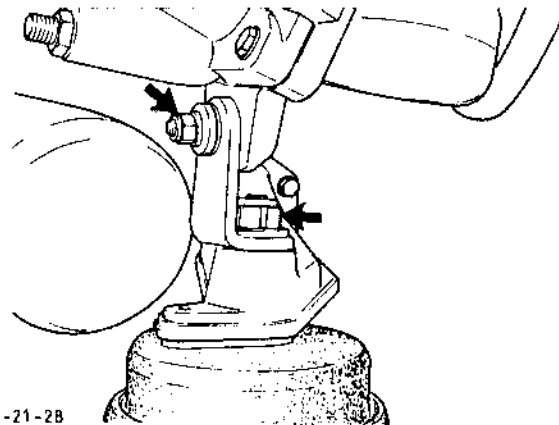


Fig.125. Intake elbow damper.
A - Setting nut
B - Engine mount nut

18. IMPORTANT NOTE: When removing fuel lines, it must be remembered that the system remains pressurised. Take adequate safety precautions to prevent fuel spillage.

Remove the safety clip from the fuel delivery line connection to the fuel rail and using special tool 23-023-A, pull off the delivery line.

Disconnect the fuel return line from the fuel pressure regulator.

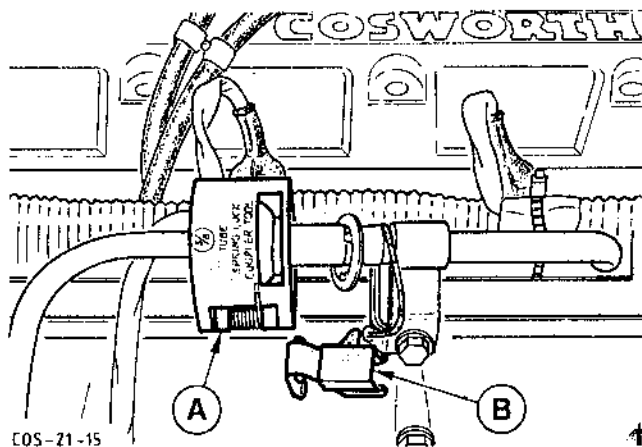


Fig.126. Remove fuel delivery line.
A - Special tool 23-023-A
B - Safety clip

21 163 0

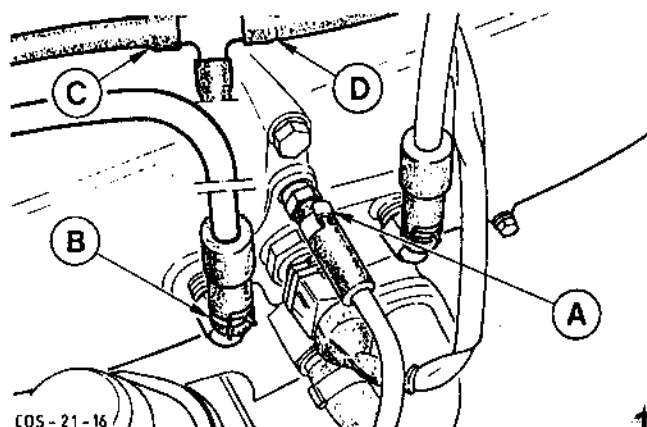
19. Detach the manifold absolute pressure (MAP) sensor line from the plenum chamber.

'86 Model Year:

Detach the bypass valve and boost pressure gauge vacuum lines from the Tee piece near the inlet manifold and pull them clear of the engine.

'88 Model Year:

Detach the bypass valve vacuum line from the plenum chamber and remove it from the vehicle.

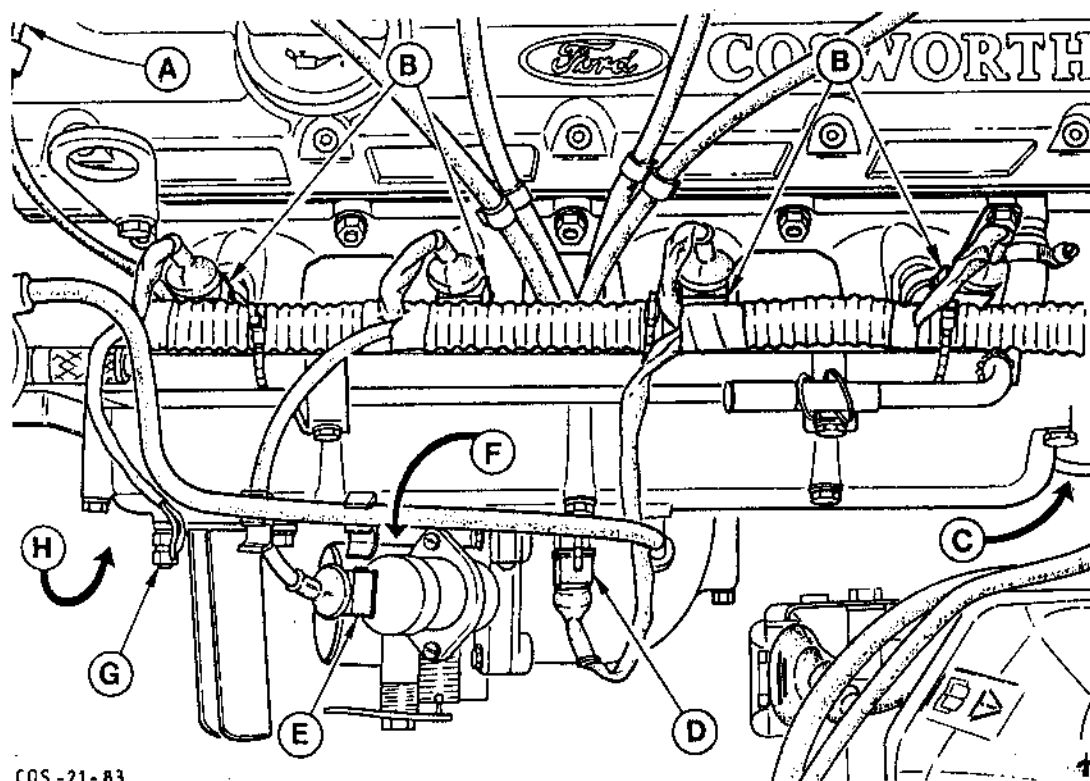


COS-21-16

Fig.127. Disconnect vacuum lines

- A - To MAP sensor
B - To bypass valve, '88 MY
C - To bypass valve, '86 MY
D - To boost pressure gauge, '86 MY

Fig.127. Disconnect vacuum lines.



COS-21-83

Fig.128. Disconnect wiring.

20. Disconnect wiring from, Fig.128:

Fig.128. Disconnect wiring.

- A - temperature gauge sender unit
B - injection nozzles
C - coolant temperature sensor
D - air charge temperature sensor
E - idle speed control valve

- F - throttle position sensor
G - earth connection on throttle cable bracket
H - engine speed/TDC sensor - distributor

Cut engine wiring loom/fuel rail cable straps and pull loom clear of engine.

21 163 0

21. Remove the oil dipstick.

22. Disconnect the coolant feed hose to the oil cooler from the cylinder head flange.

23. Remove the timing belt cover.

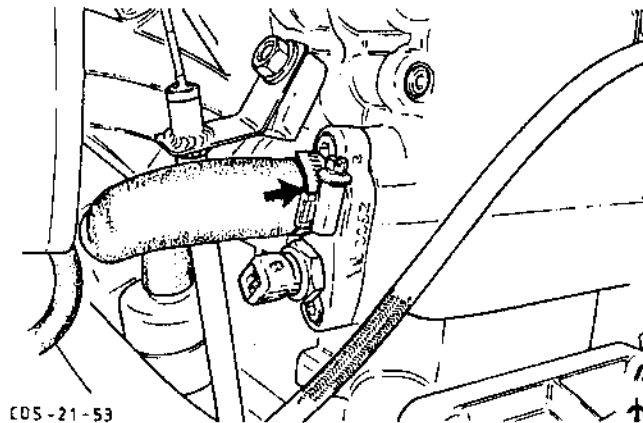


Fig.129. Coolant feed hose to oil cooler.

24. Pull the HT leads from the spark plugs, detach them from the clip on the plenum chamber and remove the distributor cap complete with HT leads.

25. Remove the cylinder head cover (20 bolts), seals and gaskets.

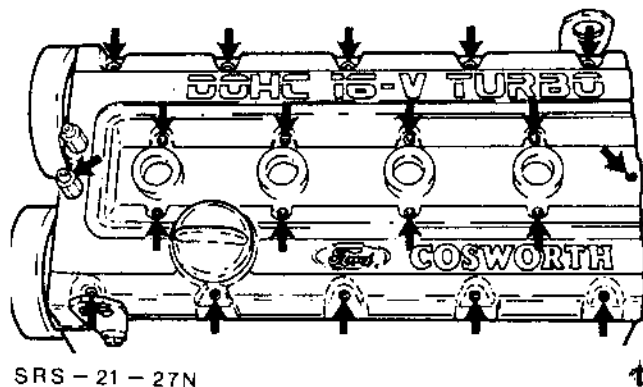
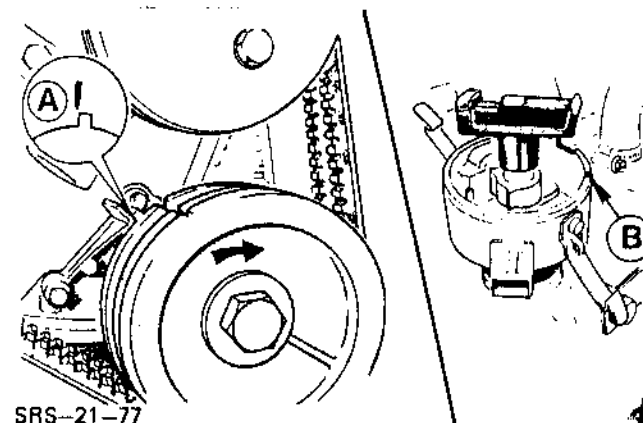


Fig.130. Cylinder head cover bolts.

26. Position No.1 cylinder piston on TDC. To do this, set crankshaft V-belt pulley and distributor rotor arm to TDC marks. Engage 1st gear and apply handbrake to block engine.

27. Loosen the timing belt tensioning pulley and remove the timing belt from the camshafts.

28. Loosen the turbocharger oil drain hose from the sump stub pipe.


Fig.131. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

21 163 0

NOTE: Before the cylinder head can be removed, the engine must have cooled down to 45 °C.

29. Loosen the cylinder head bolts (10) in the sequence shown.

Remove the cylinder head bolts and washers.

Attach engine lifting tackle, special tool 21-068 to the cylinder head eyes and using an engine removal trolley lift off the cylinder head complete with turbocharger and inlet manifold.

NOTE: If only an overhead crane is available it will be necessary to remove the hood (4 bolts 1 earth strap).

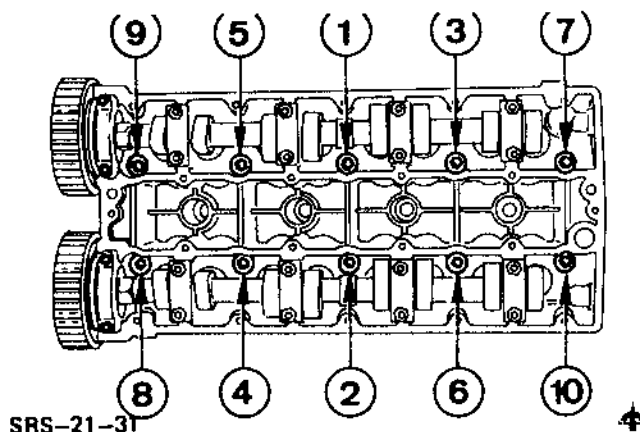


Fig.132. Cylinder head retaining bolt loosening sequence.

To Check the Cylinder Head for Flatness

Each time the cylinder head is removed it should be checked for flatness as follows:

30. Thoroughly clean the cylinder head to cylinder head cover mating face. Position a straight-edge along the cylinder head centre line and using a feeler gauge, Fig.133, check if the cylinder head is flat or convex.

If the measured bow exceed 0,10 mm the cylinder head has been subjected to overheating and cannot be reused.

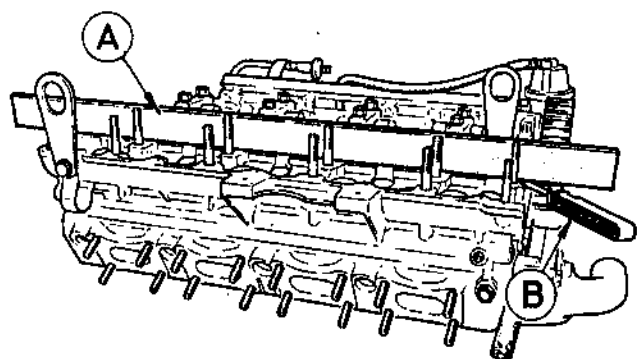


Fig.133. Check cylinder head to cylinder head cover mating face
A - Straight-edge B - Feeler gauge

31. If the bow is 0,10 mm or less, proceed to check the cylinder head at the cylinder block mating face.

32. Thoroughly clean the cylinder head to cylinder block mating face.

Using a 100 mm long straight-edge, check the cylinder head in the lateral direction between each set of retaining bolt holes (5 places) as shown by 'A' in Fig.134.

Repeat the check in the longitudinal direction between each set of retaining bolt holes (8 places) as shown by 'B' in Fig.134.

The maximum permissible deviation is 0,02 mm.

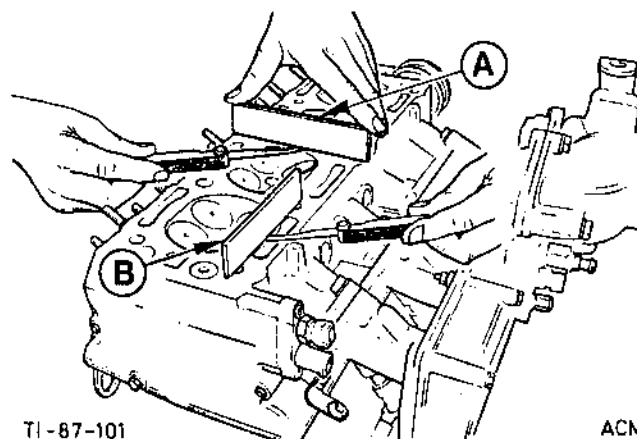


Fig.134. Check cylinder head to cylinder block mating face
A - In the lateral direction
B - In the longitudinal direction

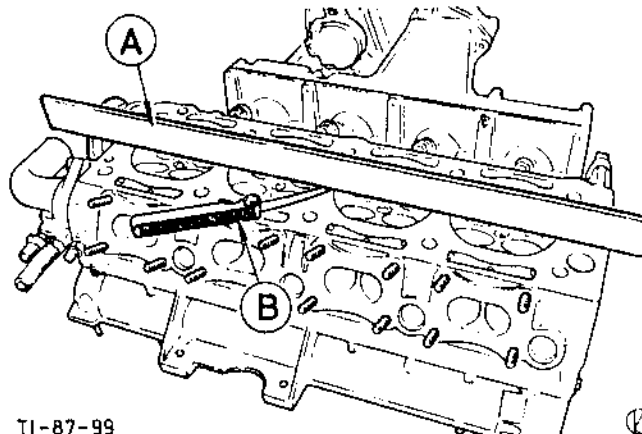
21.163 0

33. Check along the cylinder head centre line as shown in Fig.135 for overall flatness.

The maximum permissible bow is 0,08 mm.

34. If either of the maximum permissible limitations of 0,02 or 0,08 mm is exceeded, the cylinder head must be re-machined, whereby the maximum permissible material removal is 0,13 mm.

After re-machining, the cylinder head height (the distance between the upper and lower mating faces), must not be less than 138,68 mm.



TI-87-99

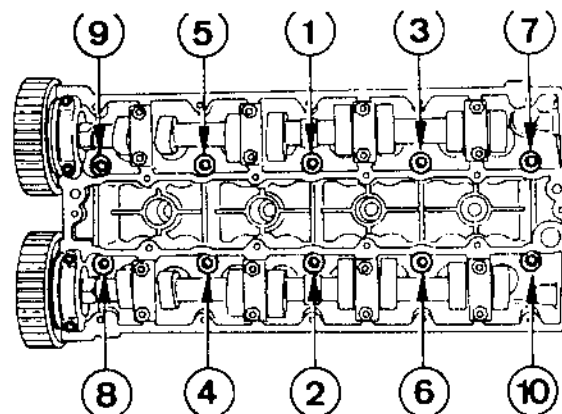
Fig.135. Check overall flatness

A - Straight-edge
B - Feeler gauge

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

35. Ensure surfaces of cylinder block, cylinder head and new cylinder head gasket are clean.
36. Install the cylinder head alignment studs, special tool 21-128, in the cylinder block, bolt threads 7 and 8, Fig.136.
37. Place the cylinder head gasket on the block (marked TOP/OBEN).



SRS-21-31

Fig.136. Cylinder head retaining bolt tightening sequence.

NOTE: Lubricate the cylinder head retaining bolt threads, the washers and under the bolt heads with engine oil.

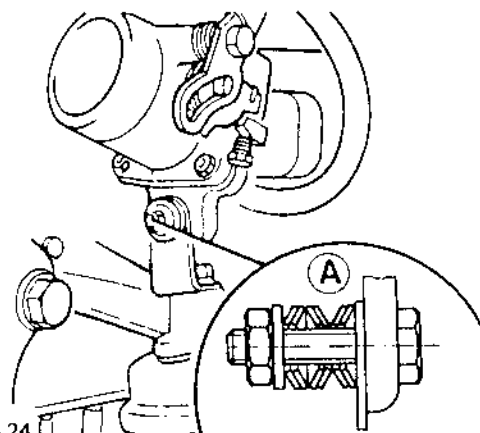
Insert and finger tighten the cylinder head bolts.

Remove the lifting tackle.

Screw out the alignment studs and fit the remaining bolts.

Tighten the bolts in three stages, in the sequence shown, Fig.136, to the torque values as specified in Technical Data.

39. Tighten the engine mount/intake elbow damper bracket nut.
Adjust damper - using Loctite to secure nut (see Technical Data), tighten nut to 8 - 10 Nm then loosen a half turn.



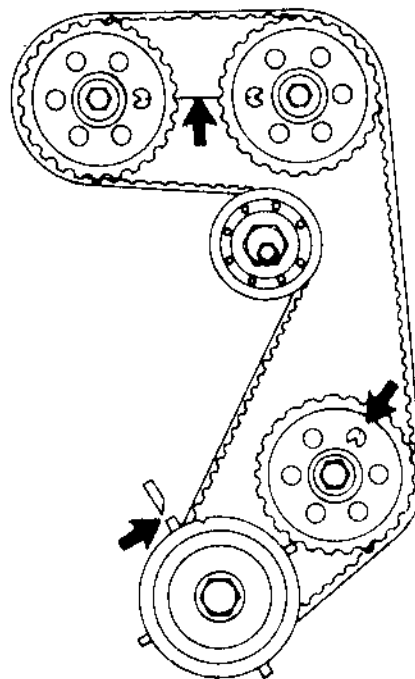
SRS-29-24

Fig.137. Intake elbow damper.
A - 6 dished washers

21 163 0

40. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC mark.

41. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N



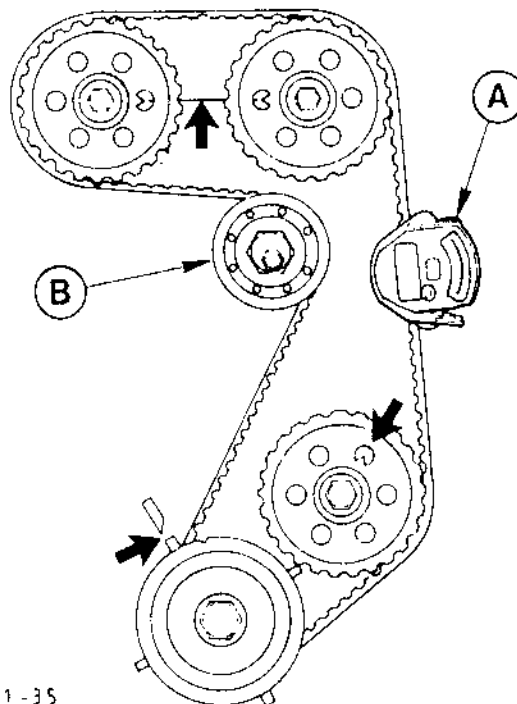
Fig.138. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

42. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



COS-21-35



Fig.139. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 163 0

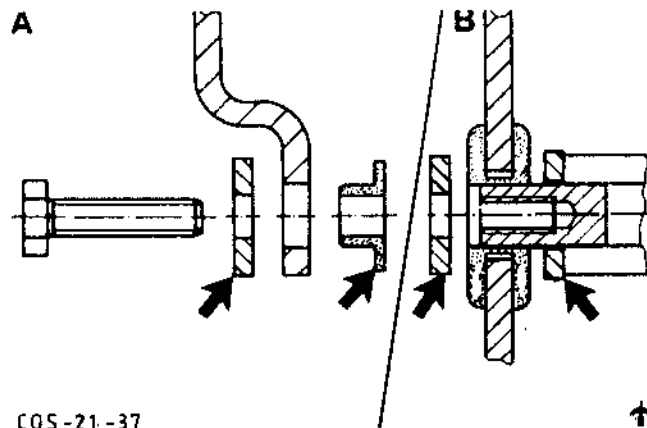
43. Position the cylinder head cover gaskets, 2 rubber seals and cylinder head cover. Insert and tighten bolts (20) to specification.
44. Fit the distributor cap and connect the HT leads to the spark plugs. Clip the HT leads to the plenum chamber.
45. Fit the timing belt cover, ensuring that the spacers are correctly located.
46. Connect the oil cooler coolant feed hose to the cylinder head flange.
47. Connect the turbocharger oil feed hose to the oil pressure switch adaptor.
48. Fit the oil dipstick.
49. Connect wiring to:
 - temperature gauge sender unit
 - injection nozzles
 - coolant temperature sensor
 - air charge temperature sensor
 - idle speed control valve
 - earth connection on throttle cable bracket
 - engine speed/TDC sensor
 - distributor

Fit engine wiring loom/fuel rail cable straps ensuring that the wiring loom cannot chafe on the fuel rail clamps.

50. Fit the MAP sensor line to the plenum chamber nozzle.

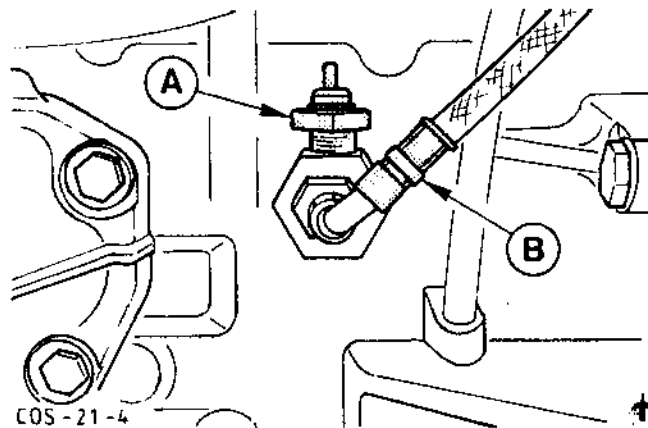
'86 Model Year:
Connect the bypass valve and boost pressure gauge vacuum hoses to the Tee piece near the inlet manifold.

'88 Model Year:
Connect the bypass valve line to the plenum chamber.



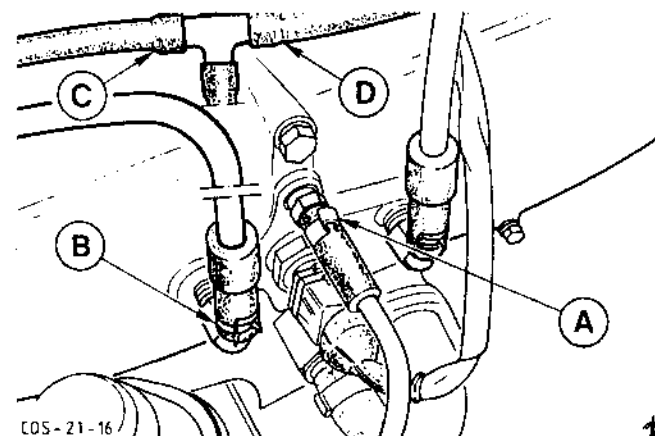
COS-21-37

Fig.140. Correct timing cover spacer location.
A - Lower
B - Middle



COS-21-4

Fig.141. A - Oil pressure switch
B - Turbocharger oil feed hose



COS-21-16

Fig.142. Fit vacuum lines.
A - MAP sensor
B - By-pass valve, '88 MY
C - By-pass valve, '86 MY
D - Boost pressure gauge, '86 MY

21 163 0

51. Fit the fuel delivery line to the fuel rail and the fuel return line to the fuel pressure regulator.

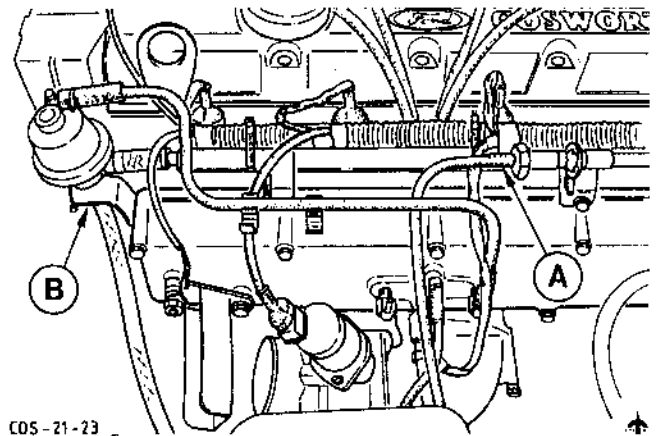


Fig.143. Fit fuel lines.
A - Delivery line
B - Return line

52. Fit the intercooler to throttle valve assembly air hose.

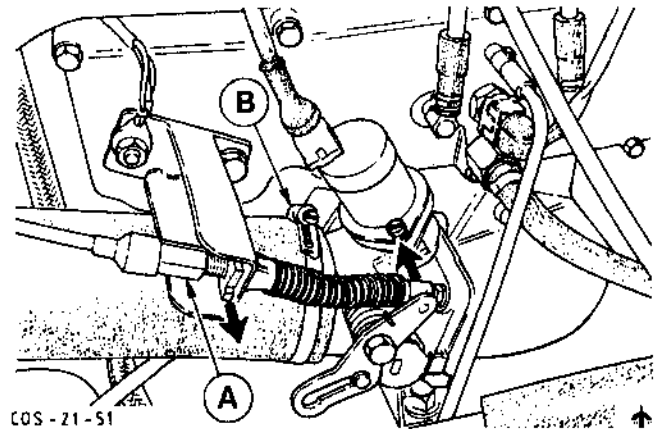


Fig.144. A - Throttle cable
B - Intercooler to throttle valve hose

54. Attach the breather valve to the plenum chamber. Connect the air cleaner and plenum cover hoses to the breather valve.
55. Connect the heater return line hoses to the heater and the water pump.
56. Attach the upper radiator hose to the thermostat housing nozzle.
57. Attach the lower radiator hose to the water pump.
58. Fit the exhaust pipe to the turbocharger using new nuts (earlier models M8, later models M10).

NOTE: Models equipped with M8 should also be fitted with new nut locking plates.

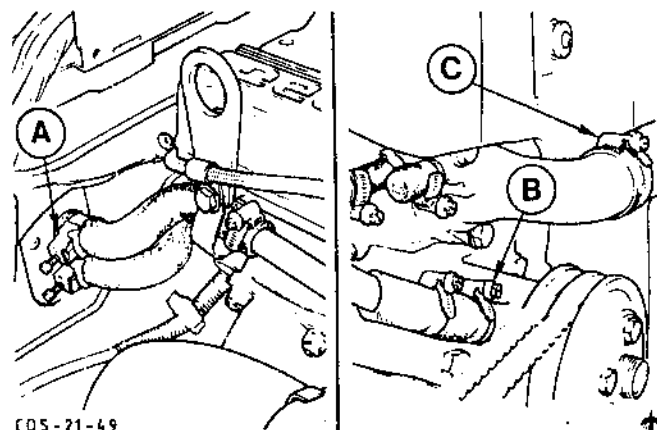


Fig.145. A - Heater return hose
B - Heater/water pump return hose
C - Upper radiator hose

21 163 0

59. Connect the turbocharger coolant feed line to the thermostat housing.
60. Fit the turbocharger coolant return pipe and clip it to the timing belt cover.
61. Push the overflow tank connecting hose through the lifting eye and connect it to the turbocharger coolant return line.
62. Fit the turbocharger to intercooler air hose.
63. Connect the solenoid control valve lines to the turbocharger and the waste gate actuator.
64. Install the air cleaner to turbocharger hose complete with the bypass valve connection to the intercooler.
65. Connect the vacuum line to the bypass valve.
66. Fit the turbocharger heat shield.
67. Fill the cooling system (see Technical Data).
68. Top up with engine oil (see Technical Data).
69. Connect the battery earth cable.
70. To ensure that the oil supply to the turbocharger has been re-established before engine start up: disconnect the injector multiplugs and the low tension terminal from the ignition coil (terminal 15) and crank the engine for 10 seconds, followed by a pause then a further 10 seconds. Reconnect injector multiplugs and ignition coil and start engine.
71. With the engine at normal operating temperature, check the idle speed and CO content (see Technical Data).

To adjust the CO content, refer to Operation 23 215 0 in this Service Microfiche.

To adjust the idle speed, refer to Condition 5 (Erratic idle/incorrect idle speed) in the Vehicle System Test Manual.
72. Recheck coolant level.

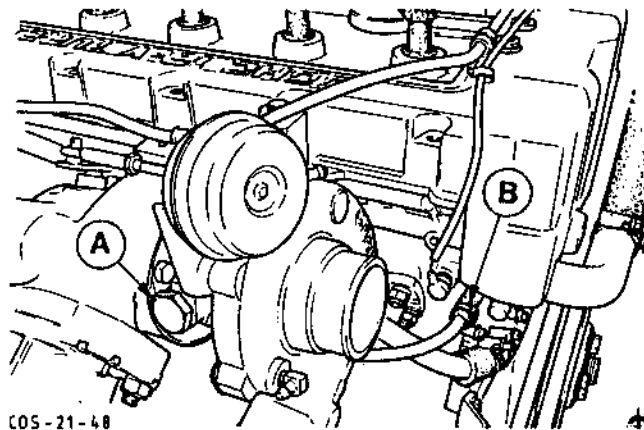


Fig.146. A - Turbocharger coolant return
B - Turbocharger coolant feed

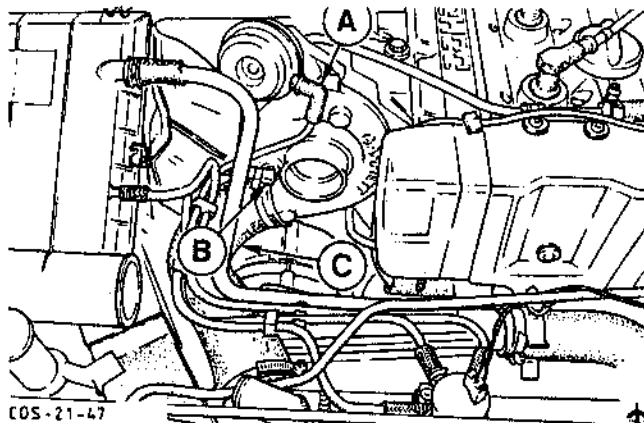


Fig.147. A - Actuator - solenoid control valve
B - Turbocharger - solenoid control valve
C - Turbocharger to intercooler hose

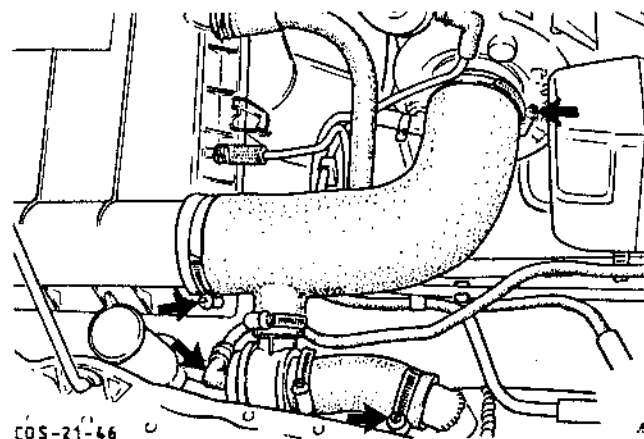


Fig.148. Fit air cleaner to turbocharger hose complete with bypass valve.

21 165 5 CYLINDER HEAD - REPLACE (Cylinder head removed)

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer	15-053
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve spring compressor ..	21-024-06
Installer - Valve stem oil seal (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130
Remover - Valve stem oil seal	21-142

LOCALLY FABRICATED TOOL:

Support plate	.. see Fig.1
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To Dismantle

1. Place two wooden blocks of the same size under the front and rear ends of the cylinder head to prevent damage to the valves.

2. Remove the turbocharger complete with exhaust manifold from the cylinder head (16 nuts) and discard the gaskets.

NOTE: This sub-operation only applies subsequent to 21 163 0, Cylinder Head - Remove and Install.

3. Remove the inlet manifold complete with plenum chamber from the cylinder head (9 nuts).

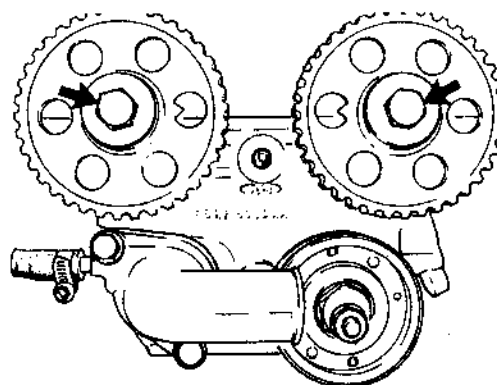
4. Remove the camshaft belt pulleys, Fig.149.

5. Remove the camshaft bearing housing locating plates, Fig.150 and remove the camshaft caps and camshafts (20 nuts).

NOTE: Remove the front caps first.

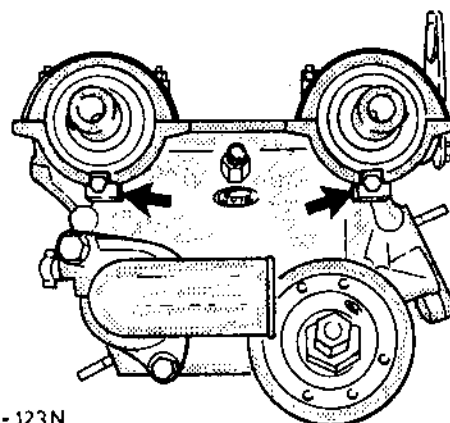
6. Remove the valve tappets with a suction tool. Store the tappets upside down and also according to removal order to ensure correct subsequent reassembly.

NOTE: Do not use a magnet.



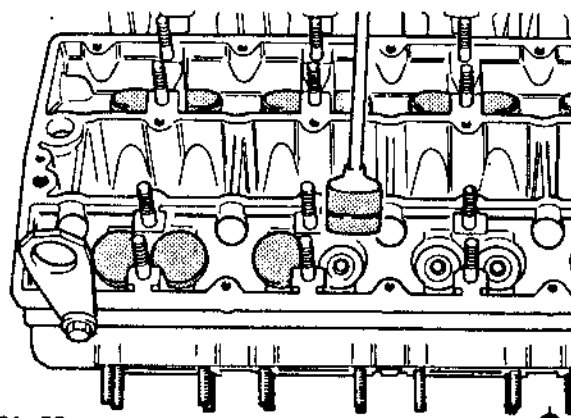
COS-21-54

Fig.149. Remove camshaft belt pulleys.



SRS-21-123N

Fig.150. Remove camshaft bearing housing locating plates.



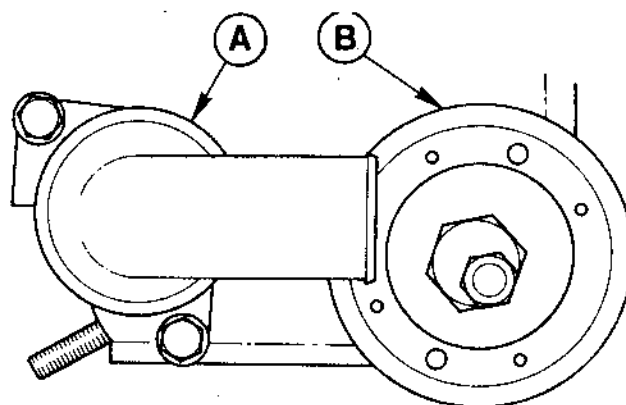
SRS-21-55

Fig.151. Remove valve tappets with suction tool.

21 165 5

7. Remove the thermostat housing and seal.

8. Remove the timing belt tensioner.

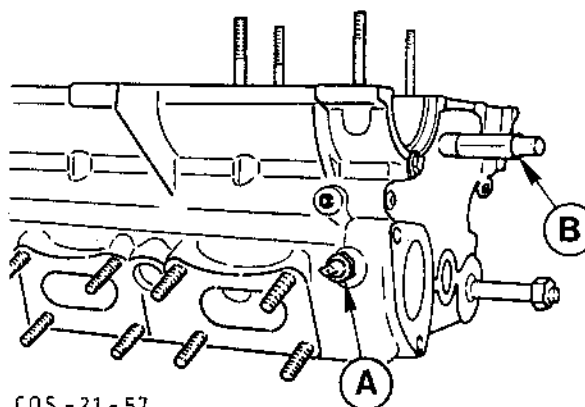


COS-21-56

Fig.152. A - Thermostat housing
B - Timing belt tensioner

9. Remove the temperature gauge sender unit.

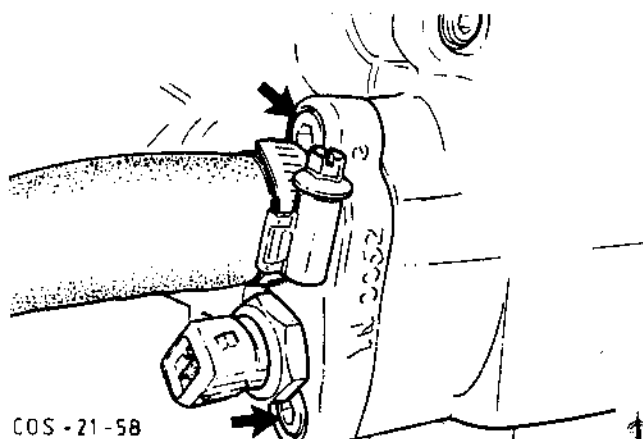
10. Remove the timing belt cover pillar bolt.



COS-21-57

Fig.153. A - Temperature gauge sender unit
B - Pillar bolt

11. Remove the coolant temperature sensor housing complete with sensor and, if fitted, the oil cooler feed hose.



COS-21-58

Fig.154. Remove coolant temperature sensor housing.

21 165 5

12. Unbolt the two lifting eyes.

13. Remove the valves:

- Using a plastic drift, tap valve spring retainers to loosen collets.
- Place suitable pieces of wood in the combustion chambers to support the valves.
- Clamp cylinder head to workbench using a piece of wood under the clamps.
- Remove the valve spring collets using special tools 21-024 and 21-024-06 together with a support plate (see Locally Fabricated Tools), Fig.155. Secure plate with nuts.

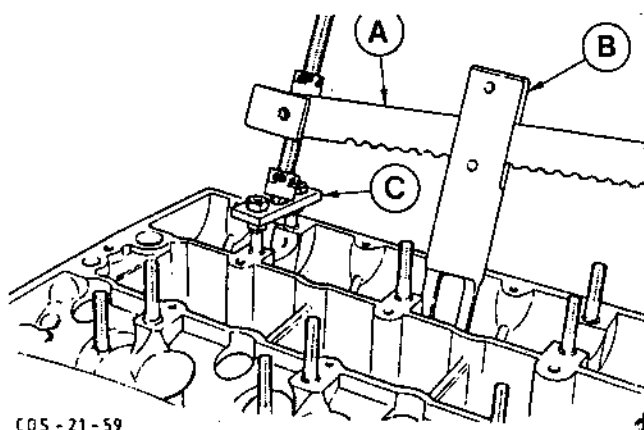
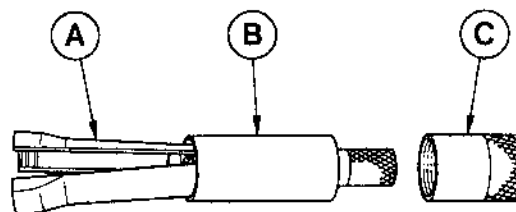


Fig.155. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated plate

- Remove valve spring retainers and springs.

- Remove the valve stem oil seals, using special tools 21-142 and 15-053:

- engage the collet jaws of special tool 21-142, Fig.156, under the oil seal
- push the sleeve over the jaws until they are closed
- screw on the sleeve nut and tighten it by hand



COS-21-90

Fig.156. Special tool 21-142

A - Collet
B - Sleeve
C - Nut

- screw the slide hammer, special tool 15-053, Fig.157, onto the collet and use the hammer to remove the oil seal, tightening the sleeve nut after each blow

- remove the lower washer

- Remove valves.

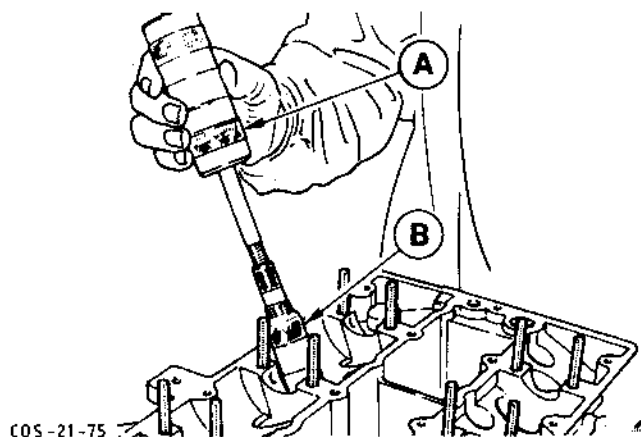


Fig.157. Remove valve stem oil seal
A - Special tool 15-053
B - Special tool 21-142

21 165 5

To Assemble

During assembly, tighten nuts and bolts to the torque specified in Technical Data.

A new cylinder head is delivered without valves.

Check to see that the tappets are compatible with the new cylinder head i. e. standard tappets to standard bores, oversize tappets to oversize bores.

Inspect all moving parts for wear and where necessary replace. Only new oil seals, O-rings and valve seals to be used.

If used valves are to be transferred to the new cylinder head, the valve heads must be re-ground on a valve grinding machine.

14. Grind in the valves to the cylinder head.

NOTE: Ensure that no grinding paste is present on the valve stem or valve guide. On completion, thoroughly clean cylinder head and valves from all traces of grinding paste.

15. Install the valves -

- Fit the valve spring lower washers.
- Oil the valve stems and guides and insert valves.
- Place suitable pieces of wood in the combustion chambers to support the valves.
- Clamp cylinder head to workbench using a piece of wood under the clamps.
- Oil the valve stem and oil seals and fit the seals using special tool 21-129 or 21-130, Fig.158, depending on whether it is an exhaust or inlet valve respectively. Take particular care when the oil seals pass the valve collet grooves.
- Emplace the valve springs and retainers and using special tools 21-024 and 21-024-06 together with the locally fabricated support plate, Fig.159, fit the collets.
- Using a plastic drift, tap valve spring retainers to ensure they are properly seated.

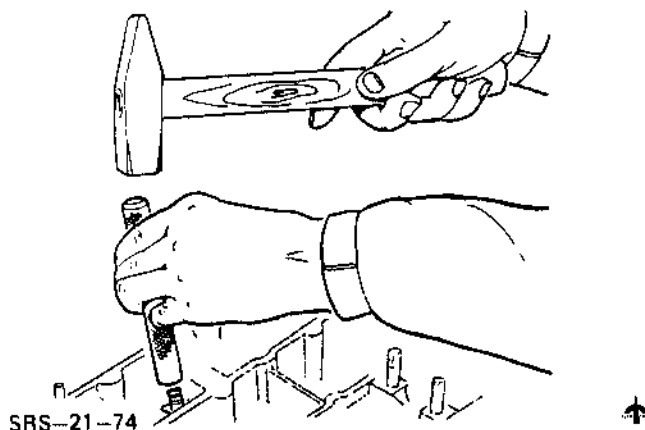


Fig.158. Fit oil seal with special tool 21-129 or 21-130.

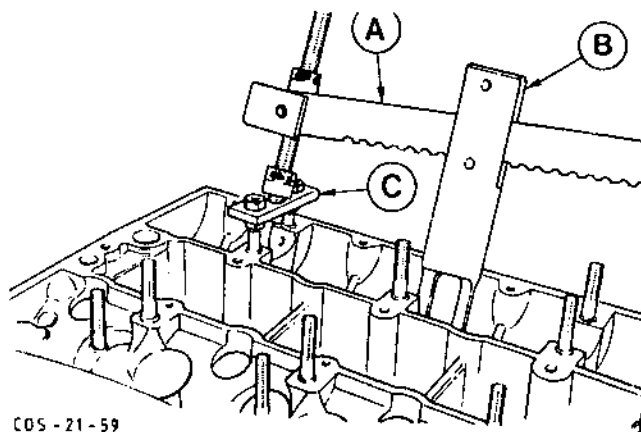


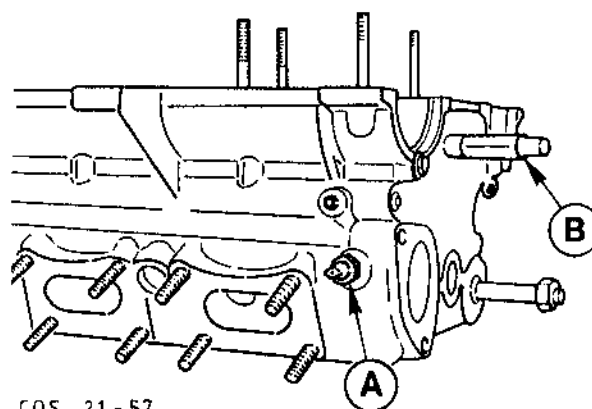
Fig.159. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated tool

21 165 5

16. Fit the two lifting eyes.

17. Fit the timing belt cover pillar bolt with sealing compound (see Technical Data) and tighten.

18. Fit the temperature gauge sender unit with sealing compound (see Technical Data).



COS-21-57

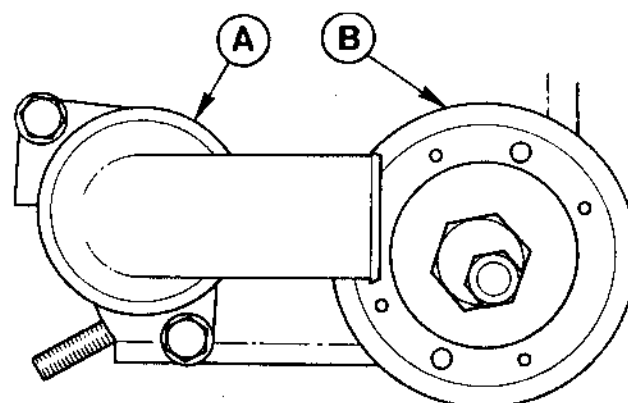
Fig.160. A - Temperature gauge sender unit
B - Pillar bolt

19. Loosely fit the timing belt tensioner.

20. Fit the thermostat housing and seal.

21. Oil and fit the tappets. Ensure correct order.

NOTE. Check tappets to ensure that no air is present (sponginess).



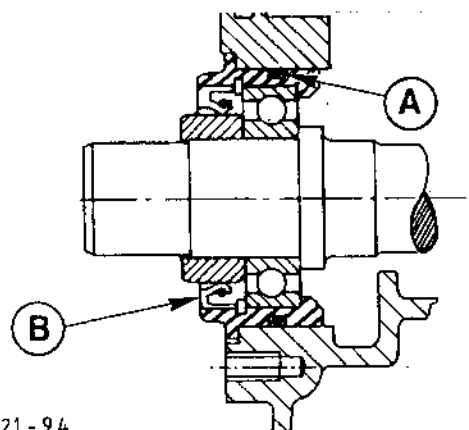
COS-21-56

Fig.161. A - Thermostat housing
B - Timing belt tensioner

22. Replace the O-rings and radial oil seals on the front camshaft bearing housings.

23. Locate the camshafts in position.

NOTE: Inlet camshaft has grooved bearing journals.



COS-21-94

Fig.162. Camshaft bearing housing
A - O-ring
B - Oil seal

21 165 5

24. Oil and fit the camshaft bearing caps 2-5 and 7-10 in the correct order.

NOTE: Cap No. 1 is on the front of the exhaust cam. Cap numbers should face inwards.

Tighten down caps 2-5 and 7-10 evenly then torque to specification.

25. Tap the front bearing housings rearwards to ensure that they are fully home. Apply sealing compound (see Technical Data) to joint faces of caps 1 and 6, fit and torque to specification.

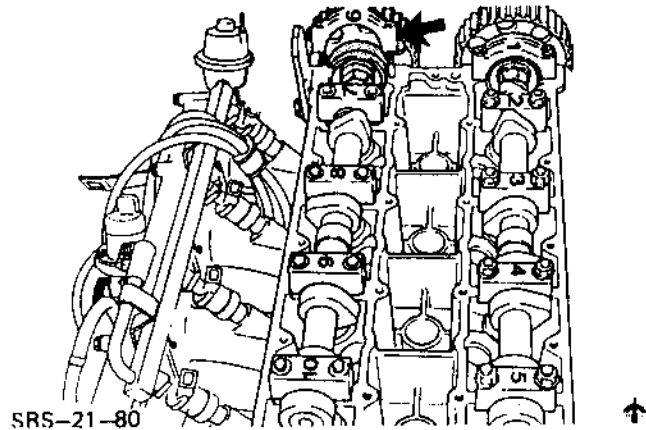
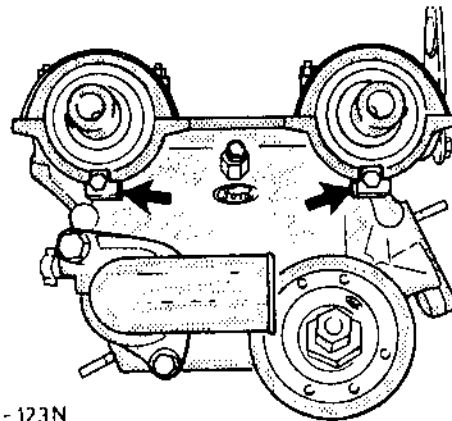


Fig.163. Inlet camshaft front bearing cap

26. Fit the camshaft bearing housing locating plates, Fig.164, and torque bolts to specification.

27. Fit the camshaft pulleys to the camshafts and torque to specification. Set the camshaft pulleys to the TDC position, Fig.165.



SRS-21-123N

Fig.164. Camshaft bearing housing locating plates.

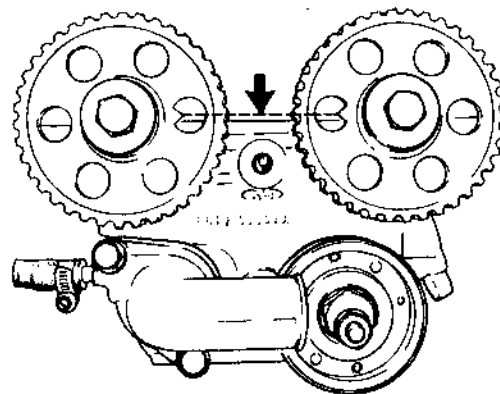
28. Fit the intake manifold complete with gasket (9 nuts and washers) and torque to specification.

29. This sub-operation only applies in conjunction with 21 163 0, Cylinder Head - Remove and Install.

Fit the turbocharger complete with exhaust manifold and gaskets (16 nuts and washers, finger tight).

NOTE: The exhaust manifold must be centred on the studs before tightening the nuts.

Install and adjust the turbocharger damper unit as described in Section 23, Repair Operation No. 23 612 0, Turbocharger - Remove and Install.



COS-21-76

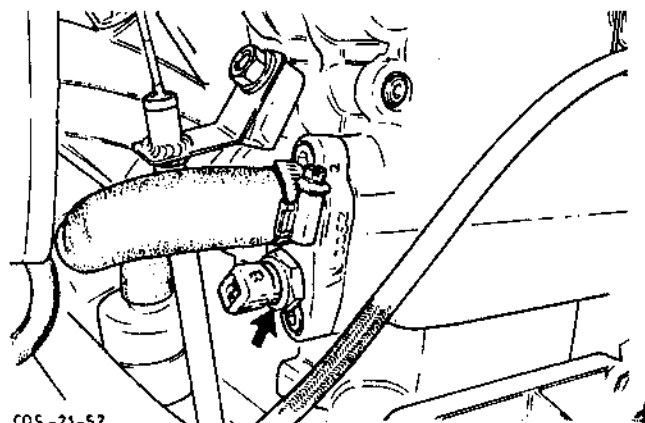
Fig.165. Set camshaft pulleys to TDC.

21 190 0 COOLANT TEMPERATURE SENSOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.
2. Raise the vehicle.
3. Disconnect the coolant temperature sensor multiplug.
4. Unscrew the coolant temperature sensor from the cylinder head intermediate flange and drain coolant into a clean container.

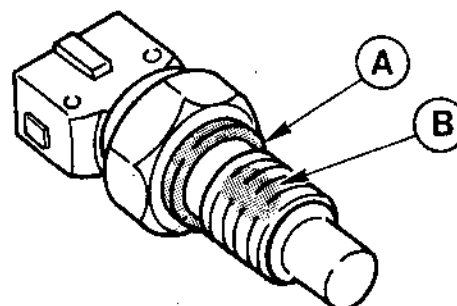


COS-21-52

Fig.166. Coolant temperature sensor location.

To Install

5. Fit a new sealing ring to the coolant temperature sensor and coat sensor threads with sealing compound (see Technical Data).
6. Fit the coolant temperature sensor to the cylinder head intermediate flange and tighten to specification (see Technical Data).
7. Connect the coolant temperature sensor multiplug.
8. Lower the vehicle.
9. Top up the cooling system (see Technical Data).
10. Connect the battery earth cable.



SRS-29-54

Fig.167. Coolant temperature sensor.
A - New sealing ring
B - Sealing compound

21 215 4 VALVE - REMOVE AND INSTALL (Cylinder head removed)

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer	15-053
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve spring compressor ..	21-024-06
Installer - Valve stem oil seal (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130
Remover - Valve stem oil seal	21-142

LOCALLY FABRICATED TOOL:

Support plate see Fig.1

1. Place two wooden blocks of the same size under the front and rear ends of the cylinder head to prevent damage to the valves.

To Remove Valve

2. • Using a plastic drift, tap valve spring retainer to loosen collets.
- Place a suitable piece of wood in the combustion chamber to support the valve.
- Clamp cylinder head to workbench using a piece of wood under the clamps.
- Remove the valve spring collets using special tools 21-024 and 21-024-06 together with a support plate (see Locally Fabricated Tools). Secure plate with nuts.
- Remove the valve spring retainer and spring.
- Remove the valve stem oil seal using special tools 21-142 and 15-053.
 - engage the collet jaws of special tool 21-142, Fig.169 under the oil seal
 - push the sleeve over the jaws until they are closed
 - screw on the sleeve nut and tighten it by hand
 - screw the slide hammer, special tool 15-053, Fig.170, onto the collet and use the hammer to remove the oil seal, tightening the sleeve nut after each blow
 - remove the lower washer.
- Remove valve.

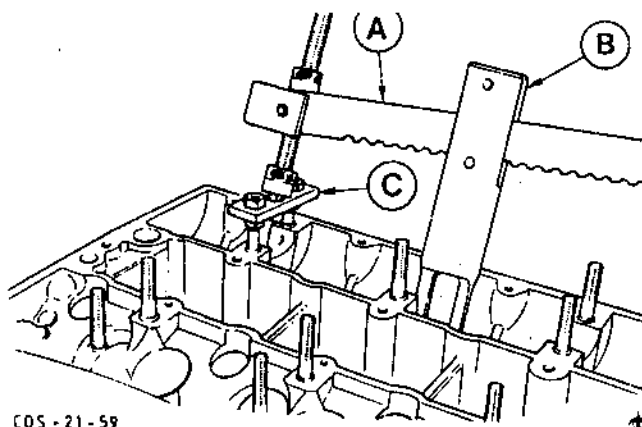


Fig.168. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated plate.

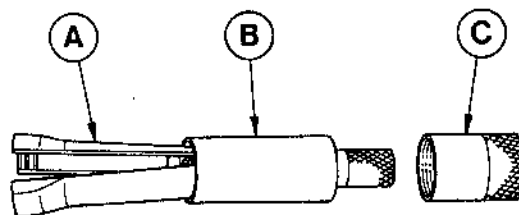


Fig.169. Special tool 21-142
A - Collet
B - Sleeve C - Nut

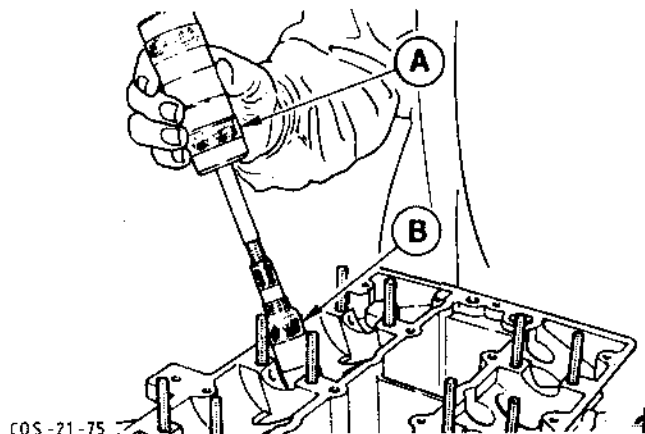


Fig.170. Remove valve stem oil seal.
A - Special tool 15-053
B - Special tool 21-142

21 215 4

3. Grind in the new valve to the cylinder head.

NOTE: Ensure that no grinding paste is present on the valve stem or valve guide.

On completion, thoroughly clean cylinder head and valve from all traces of grinding paste.

To Install Valve

4. • Fit the valve spring lower washer.

• Oil the valve stem and guide and insert valve.

• Place a suitable piece of wood in the combustion chamber to support the valve.

• Clamp cylinder head to workbench using a piece of wood under the clamps.

• Oil the valve stem and oil seal and fit the seal using special tool 21-129 or 21-130 depending on whether it is an exhaust or inlet valve respectively. Take particular care when the oil seal passes the valve collet groove.

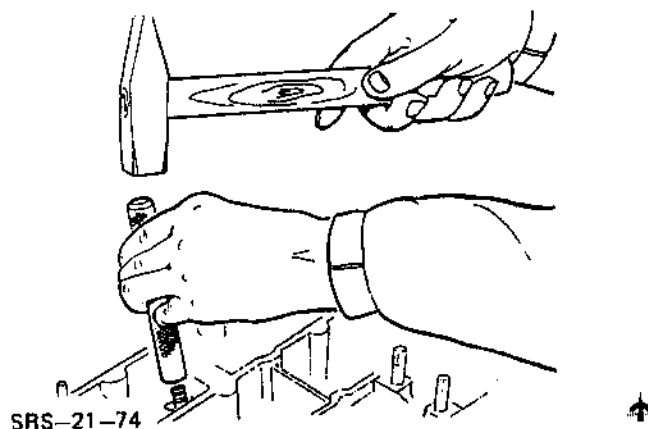


Fig.171. Fit oil seal with special tool 21-129 or 21-130.

• Emplace the valve spring and retainer and using special tool 21-024 and 21-024-06 together with the locally fabricated support plate, fit the collets.

• Using a plastic drift tap valve spring retainer to ensure that it is properly seated.

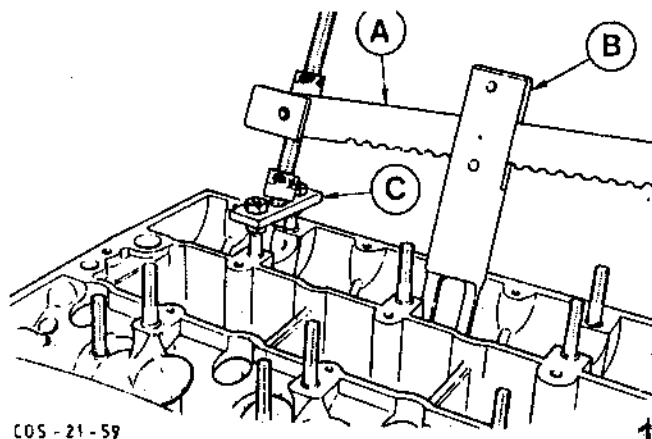


Fig.172. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated plate

21 238 0 SEALS - VALVE STEM - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer.. .. .	15-053
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve spring compressor ..	21-024-06
Belt tension gauge	21-113
Installer - Valve stem oil seal ..	
(exhaust)	21-129
Installer - Valve stem oil seal	
(inlet)	21-130
Remover - Valve stem oil seal	21-142

PROPRIETARY TOOL:

Air line adaptor for spark plug bore

LOCALLY FABRICATED TOOL:

Support plate see Fig.1

To Remove

1. Disconnect the battery earth cable.
2. '88 Model Year only:
Remove the turbocharger heat shield (1 bolt, 2 clips).
3. Disconnect the temperature gauge sender unit and unclip the cable from the timing belt cover.
4. Remove the timing belt cover (4 screws).
5. Detach the turbocharger coolant return pipe (1 banjo bolt) and lay the turbocharger coolant return pipe/hose to one side (on '88 Model Year only, also unbolt front lifting eye).
6. Detach the HT leads from the spark plugs.
7. Remove the cylinder head cover (20 bolts).
8. Release the timing belt tensioning pulley and remove the timing belt from the camshafts.

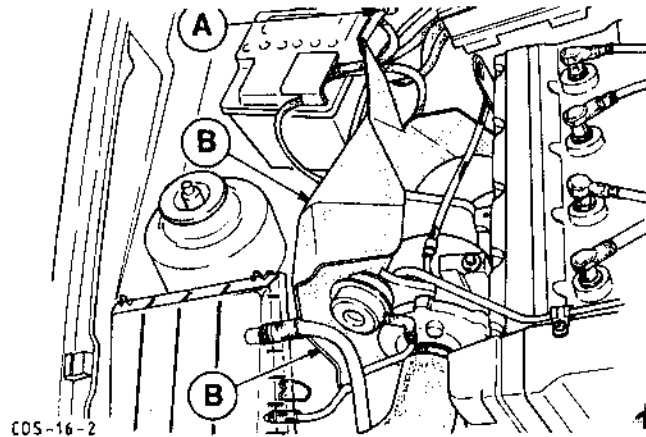


Fig.173. Remove turbocharger heat shield ('88 MY)

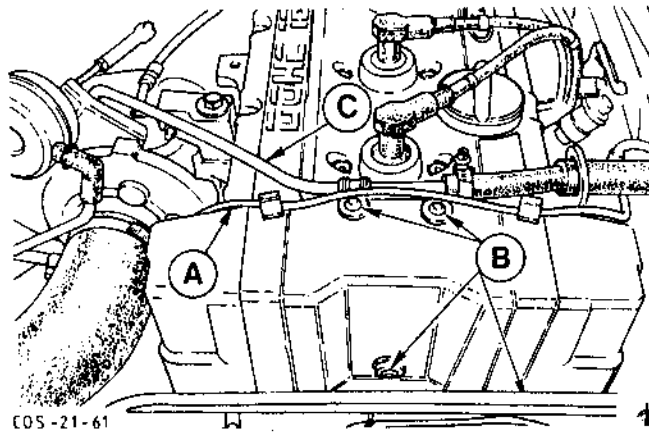
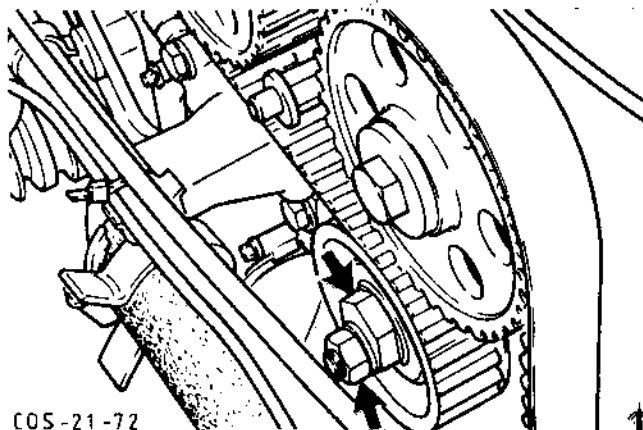
A - Bolt
B - Clips

Fig.174. A - Temperature gauge cable
B - Timing belt cover screws
C - Turbocharger coolant return pipe


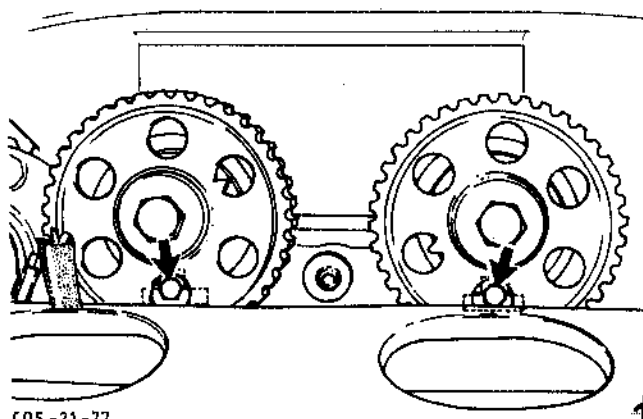
Fig.175. Release timing belt tensioning pulley.

21 238 0

9. Loosen the camshaft bearing housing locating plate screws (through the camshaft pulleys).

Remove both camshafts complete with pulleys (2 nuts per bearing cap).

NOTE: Remove the front caps first.

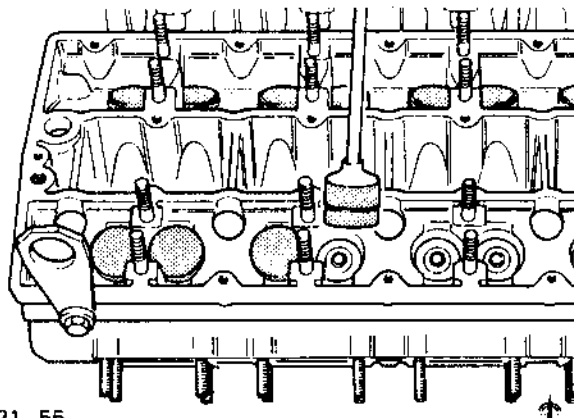


COS-21-77

Fig.176. Loosen camshaft bearing housing locating plates.

10. Withdraw the valve tappets with a rubber suction tool. Store the tappets upside down and also according to removal order to ensure correct subsequent reassembly.

NOTE: Do not use a magnet.



SRS-21-55

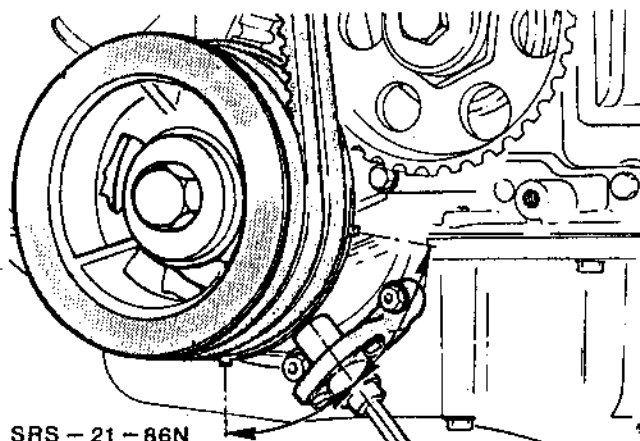
Fig.177. Remove valve tappets with suction tool.

11. Remove the spark plugs and cover holes to prevent dirt ingress.

12. Turn the crankshaft by hand until all pistons are half way up the cylinder. Engage first gear to block engine and apply handbrake.

NOTE: This is a safety precaution to prevent a valve from falling into a cylinder.

Any two crankshaft pulley teeth must be equidistant from the engine speed/TDC sensor.



SRS-21-86N

Fig.178. Position of crankshaft V-belt pulley teeth in relation to TDC sensor.

21 238 0

To Replace the Valve Stem Oil Seals.

13. Screw an air line adaptor into a spark plug thread and apply compressed air (7-10 bar).
14. Replace one valve stem oil seal as follows -
 - Using a plastic drift, tap valve spring retainer to loosen collets.
 - Remove the valve spring collets using special tools 21-024 and 21-024-06 together with a support plate (see Locally Fabricated Tools). Secure plate with nuts.
 - Remove the valve stem oil seal using special tool 21-142 and 15-053, Fig.180:
 - engage the collet jaws of special tool 21-142 under the oil seal
 - push the sleeve over the jaws until they are closed
 - screw on the sleeve nut and tighten it by hand
 - screw the slide hammer, special tool 15-053 onto the collet and use the hammer to remove the oil seal, tightening the sleeve nut after each blow.
 - Oil the valve stem and new oil seal and fit the seal using special tool 21-129 or 21-130 depending on whether it is an exhaust or inlet valve respectively. Take particular care when the oil seal passes the valve collet groove.
 - Emplace the valve spring and retainer and using special tools 21-024 and 21-024-06 together with the locally fabricated support plate, fit the collets.
 - Using a plastic drift, tap valve spring retainer to ensure that it is properly seated.
15. Repeat sub-operation 14 for the other three valves.
16. Repeat sub-operation 13 to 15 for the other three cylinders then remove the air line adaptor.

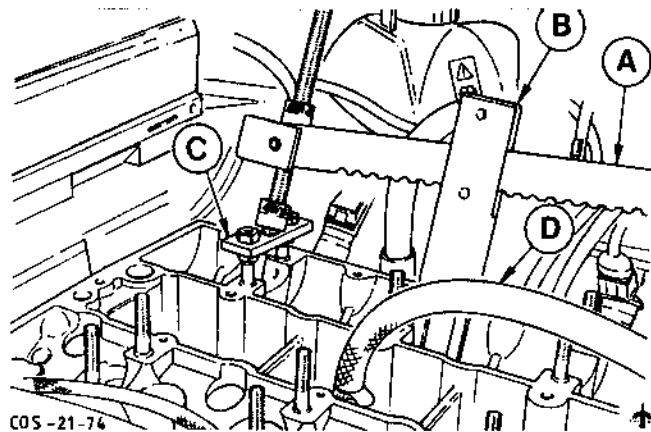


Fig.179. A - Special tool 21-024 D - Air line
B - Special tool 21-024-06 adaptor
C - Locally fabricated plate

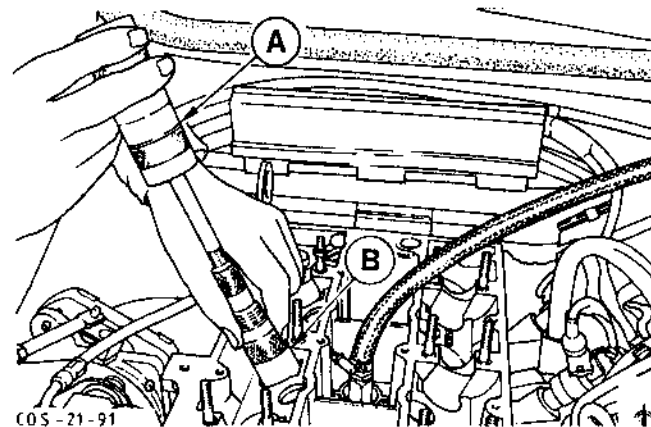


Fig.180. Remove valve stem oil seal.
A - Slide hammer, 15-053
B - Collet, nut, sleeve, 21-142

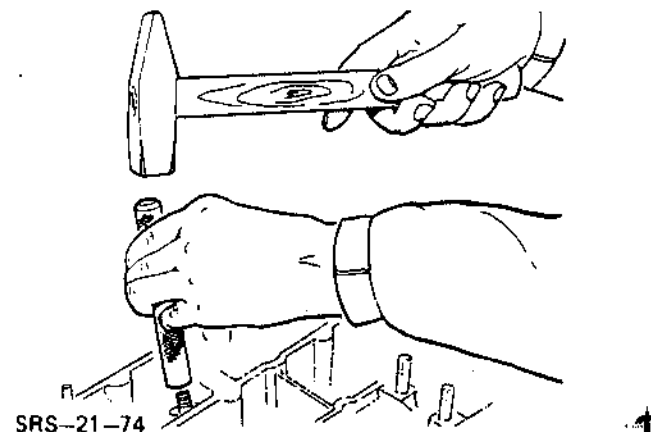


Fig.181. Fit oil seal with special tool 21-129 or 21-130.

21 238 0

To Assemble

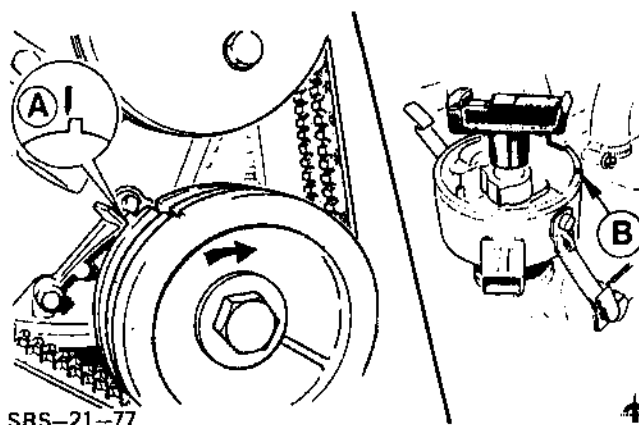
17. Oil the tappets and insert them in their original bores.

NOTE: Check tappets to ensure no air is present (sponginess)

18. Remove the distributor cap.

19. Position No.1 cylinder piston to TDC.

To do this, set crankshaft V-belt pulley and distributor rotor arm to TDC marks.



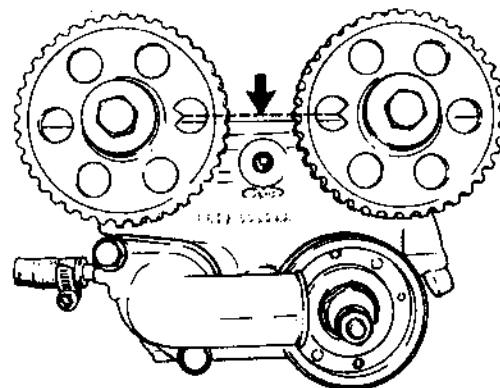
SRS-21-77

Fig.182. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

20. Fit the spark plugs and tighten to specification.

21. Locate the camshafts in position so that the pulley timing marks are facing each other.

NOTE: The inlet camshaft has grooved bearing journals.



COS-21-76

22. Oil and fit the camshaft bearing caps 2-5 and 7-10 in the correct order.

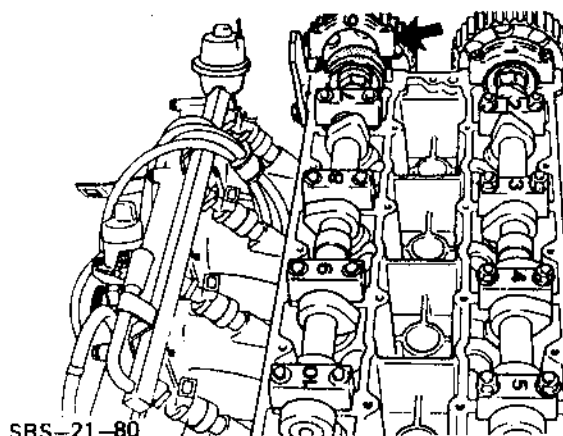
NOTE: Cap No.1 is on the front of the exhaust cam. Cap numbers should face inwards.

Tighten down caps 2-5 and 7-10 evenly.

Tap the front bearing housings rearwards to ensure they are fully home. Apply sealing compound (see Technical Data) to joint faces of caps 1 and 6 and fit them.

Torque all nuts to specification.

23. Tighten the camshaft bearing housing retaining plate bolts to specification.



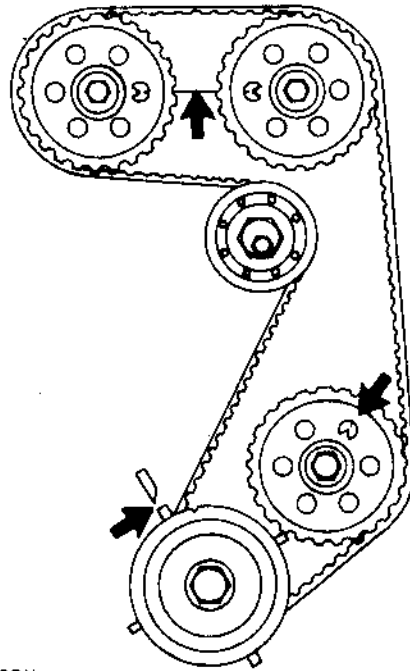
SRS-21-80

Fig.184. Inlet camshaft front bearing cap.

21 238 0

24. Check that crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC mark.

25. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

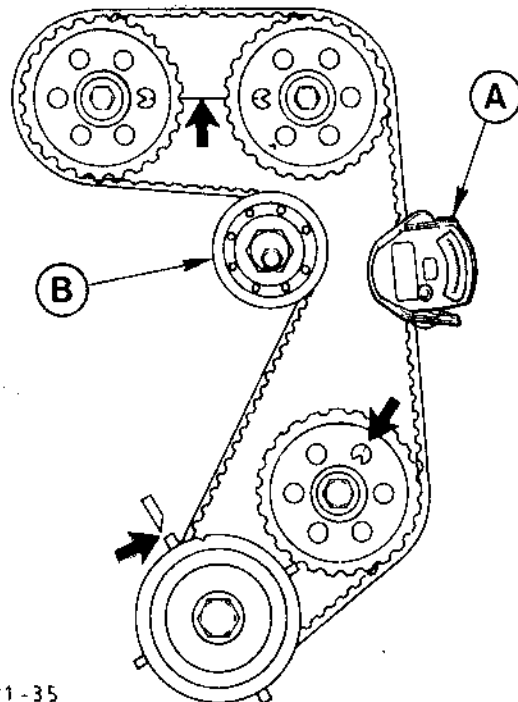
Fig.185. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

26. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



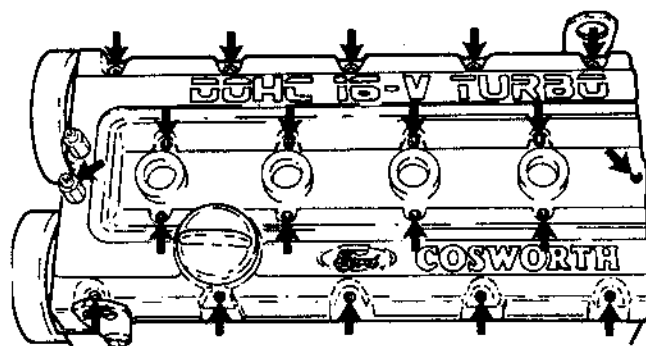
COS-21-35

Fig.186. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 238 0

27. Position the cylinder head cover gaskets, 2 rubber seals and cylinder head cover. Insert and tighten bolts (20) to specification.

28. Fit the distributor cap and connect the HT leads to the spark plugs.

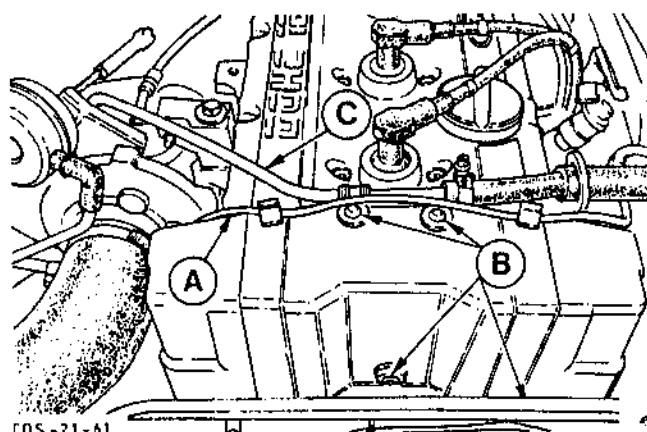


SRS - 21 - 27N

Fig.187. Fit cylinder head cover.

29. Connect the turbocharger coolant return pipe (1 banjo bolt) and on the '88 Model Year, bolt the front lifting eye in place.

30. Fit the timing belt cover, at the same time securing the turbocharger coolant return line. Ensure that the cover spacers are correctly located.



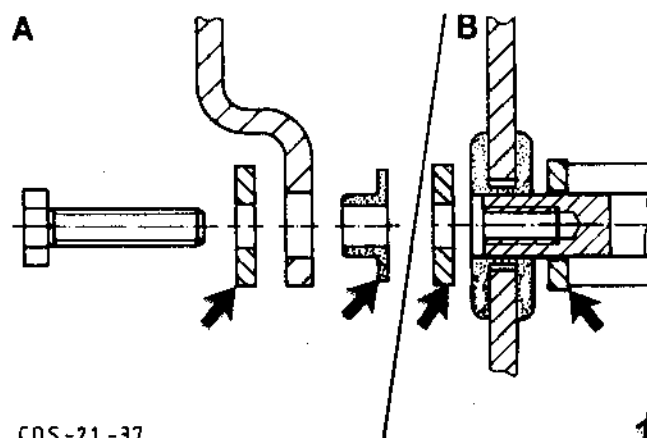
COS-21-61

Fig.188. A - Temperature gauge cable
B - Timing belt cover screws
C - Turbocharger coolant return pipe

31. Connect the temperature gauge sender unit and clip the cable to the timing belt cover.

32. '88 Model Year:
Fit the turbocharger heat shield.

33. Connect the battery earth cable.



COS-21-37

Fig.189. Correct timing cover spacer location.
A - Lower
B - Middle

21 288 0 SEAL - CAMSHAFT - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Timing belt tension gauge 21-113

To Remove

1. Disconnect the battery earth cable.
2. Unclip the temperature gauge sender unit cable from the timing belt cover and remove the cover (4 screws).
3. Remove the HT cables from the spark plugs.
4. Remove the cylinder head cover (20 bolts).
5. Remove the distributor cap.
6. Position No.1 cylinder piston on TDC. To do this, set crankshaft pulley and distributor rotor arm to TDC marks. Engage 1st gear and apply handbrake to block engine.
7. Release the timing belt tensioning pulley. Remove the timing belt from the camshafts.
8. Remove the spark plugs.

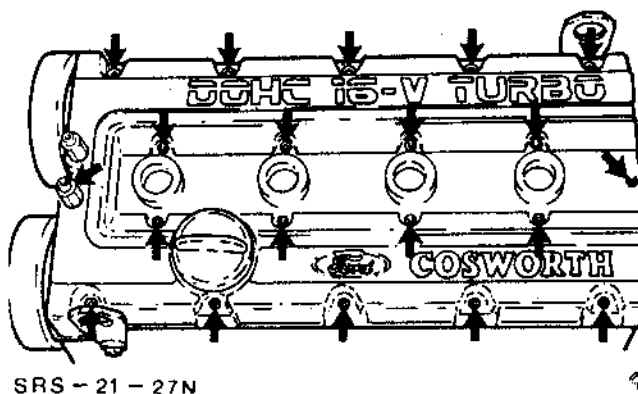


Fig.190. Cylinder head cover retaining bolts.

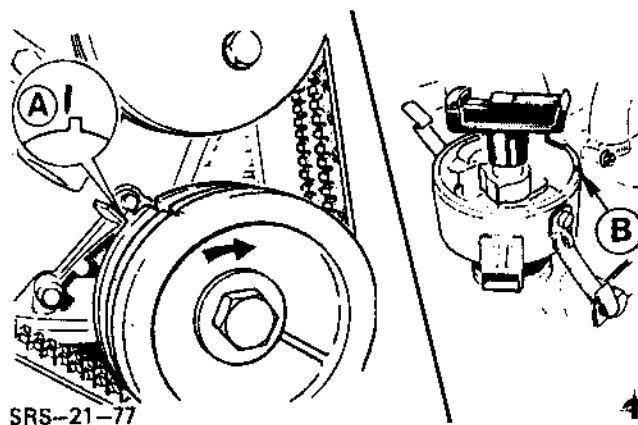


Fig.191. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

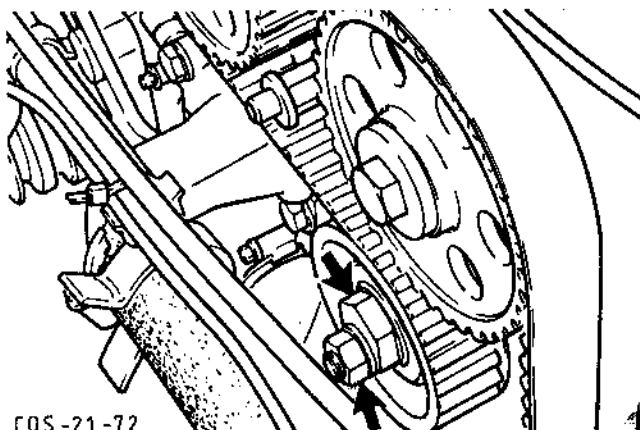
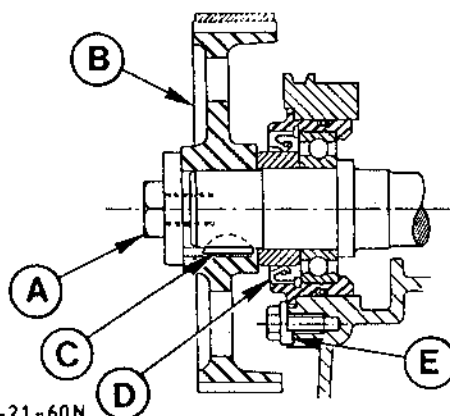


Fig.192. Release timing belt tensioning pulley.

21 288 0

9. Unscrew the camshaft belt pulley retaining bolt and remove the pulley.

10. Remove the woodruff key from the camshaft.



SRS-21-60N

Fig.193. Camshaft - Sectional view

- A - Retaining bolt
- B - Pulley
- C - Woodruff key
- D - Seal
- E - Camshaft bearing housing locating plate

11. Remove the camshaft bearing housing locating plate.

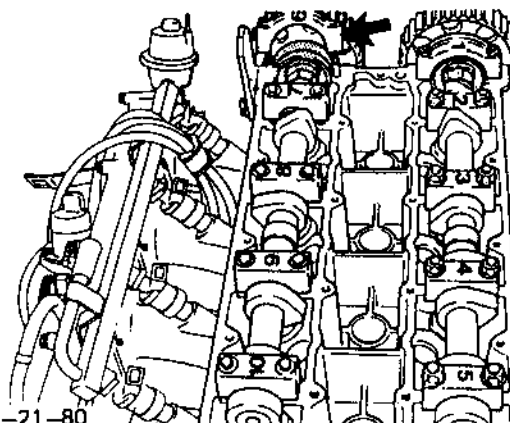
12. Slacken all the bearing caps. Remove the front camshaft bearing cap only (2 nuts).

13. Remove the bearing housing complete with bearing.

14. Remove the camshaft seal

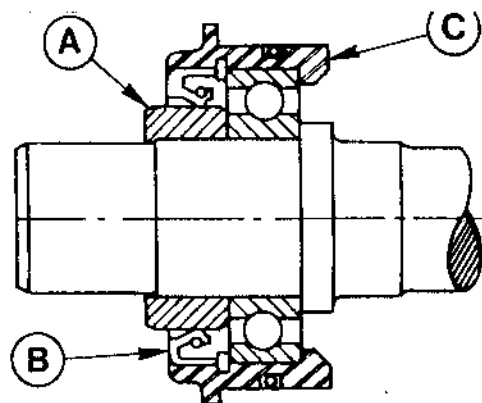
- Remove the seal race.
- Remove the seal from the bearing housing.

Fig.193. Camshaft - sectional view.



SRS-21-80

Fig.194. Inlet camshaft front bearing cap.



SRS-21-62

Fig.195. Remove camshaft seal.

- A - Seal race
- B - Seal
- C - Bearing housing

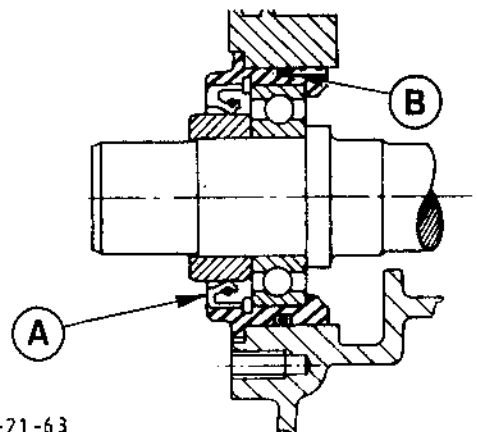
21 288 0

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

15. Fit the camshaft oil seal

- Press the oil seal evenly into the bearing housing.
- Insert the oil race.



COS-21-63

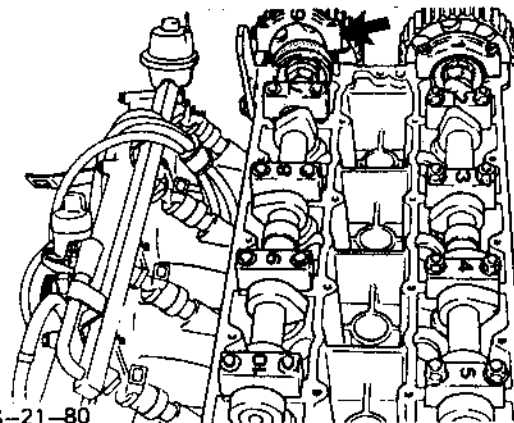


16. Replace the O-ring on the bearing housing.

Insert the bearing housing complete with bearing and tap rearwards until it is fully home.

Fig.196. A - Camshaft oil seal
B - Bearing housing O-ring

17. Apply sealing compound (see Technical Data) to the front camshaft bearing cap faces, fit the cap then torque all bearing caps to specification.



SRS-21-80

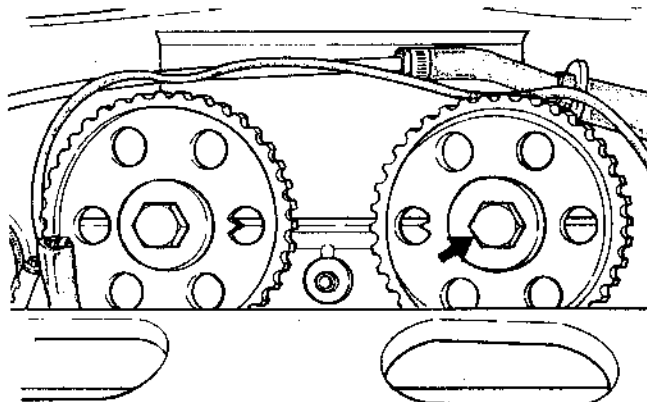


18. Fit the camshaft bearing housing locating plate and torque bolt to specification.

Fig.197. Front inlet camshaft bearing cap.

19. Insert the woodruff key into camshaft.

20. Fit the camshaft belt pulley with thrust washer and tighten bolt to specified torque.



COS-21-78

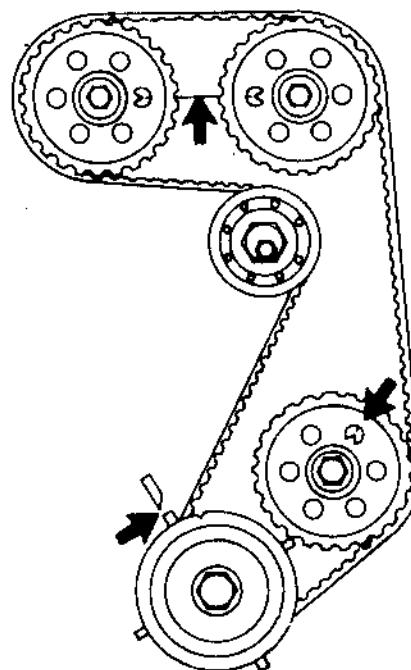


Fig.198. Camshaft toothed belt pulley.

21 288 0

21. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC mark.

22. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

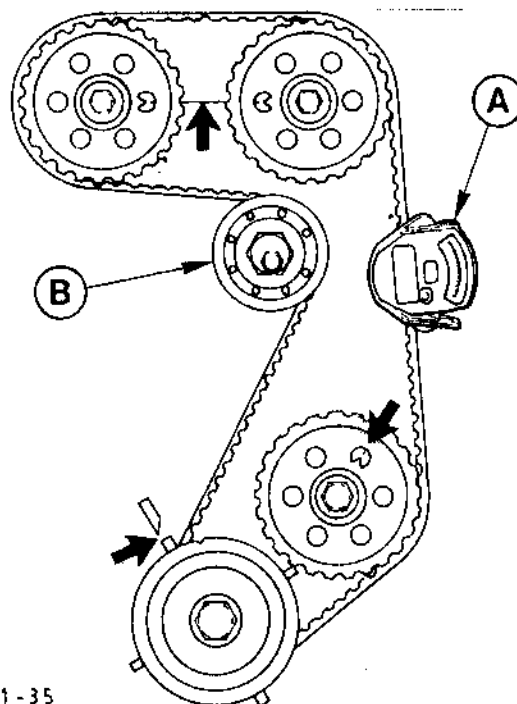
Fig.199. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

23. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



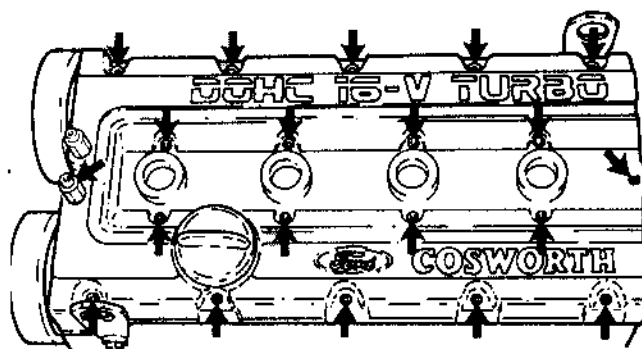
COS-21-35

Fig.200. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 288 0

24. Fit the distributor cap.

25. Fit the cylinder head cover.



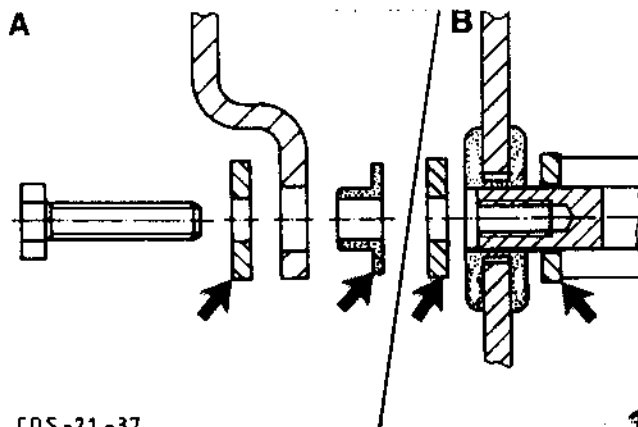
SRS - 21 - 27N

Fig.201. Fit cylinder head cover.

26. Connect the HT cables to spark plugs.

27. Fit the timing belt cover, at the same time securing the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

Clip the temperature gauge sender unit cable to the cover.

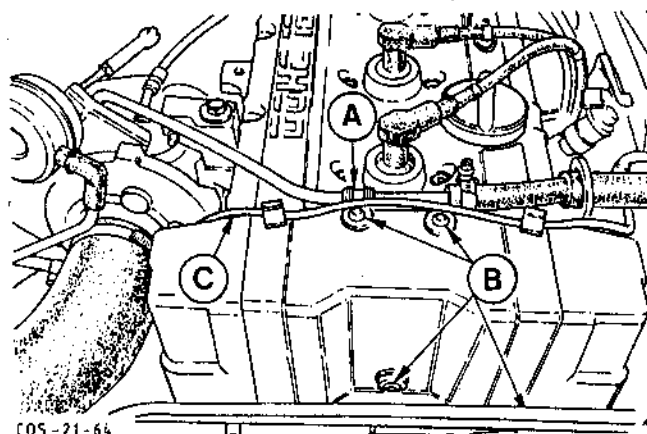


COS-21-37

Fig.202. Correct timing cover spacer location.

A - Lower
B - Middle

28. Connect the battery earth cable.



COS-21-64

Fig.203. Fit timing belt cover.

A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

21 332 0 TIMING GEARS - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft timing gear remover 21-028-A
Timing belt tension gauge.. .. 21-113

To Remove

1. Disconnect the battery earth cable.
2. Unclip the temperature gauge sender unit cable from the timing belt cover and remove the cover (4 screws).
3. Engage 1st gear and apply handbrake to block engine.
Loosen the crankshaft V-belt pulley retaining bolt.
4. Remove the distributor cap.
5. Engage neutral.
Position No. 1 cylinder piston on TDC. To do this, set crankshaft pulley and distributor rotor arm to TDC marks.
Engage 1st gear.

6. Raise the vehicle.

7. Slacken the power steering pump fixture bolts and remove the power steering V-belt.
8. Slacken the alternator adjusting strap and remove the alternator V-belts.

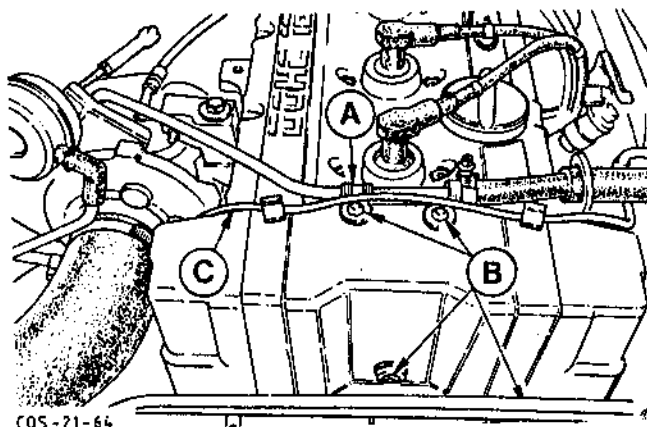


Fig.204. A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

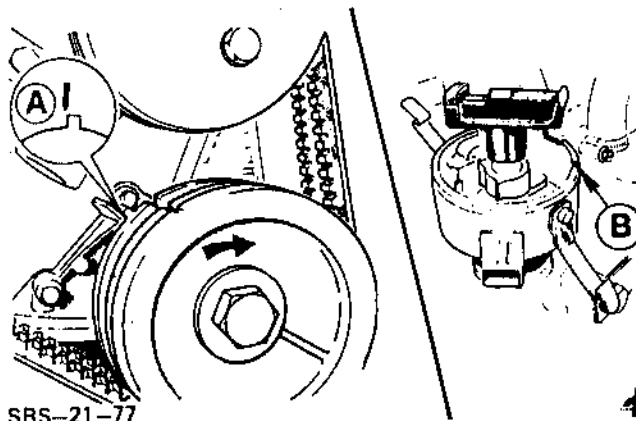


Fig.205. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

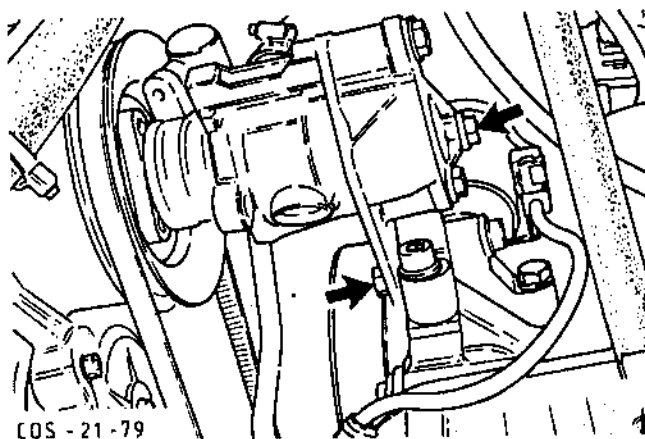


Fig.206. Slacken power steering pump bolts.

21 332 0

9. Remove the crankshaft V-belt pulley and thrust washer.

10. Loosen the crankshaft, auxiliary shaft and camshaft pulley retaining bolts, Fig.209.

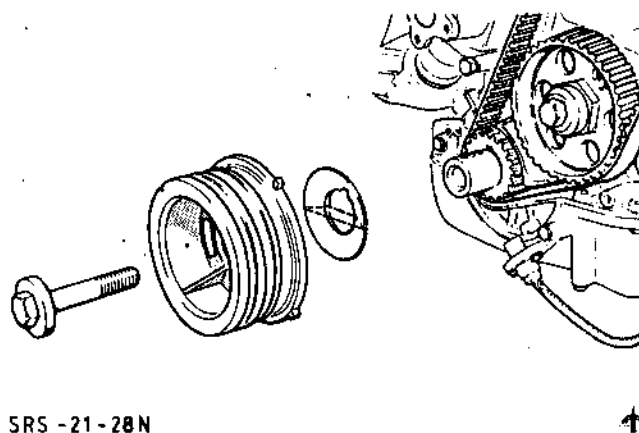


Fig.207. Remove crankshaft V-belt pulley.

11. Release the timing belt tensioning pulley.

Remove the timing belt.

NOTE: If timing belt is to be re-used, mark running direction.

12. Remove the crankshaft toothed belt pulley by hand. If necessary, use special tool 21-028-A.

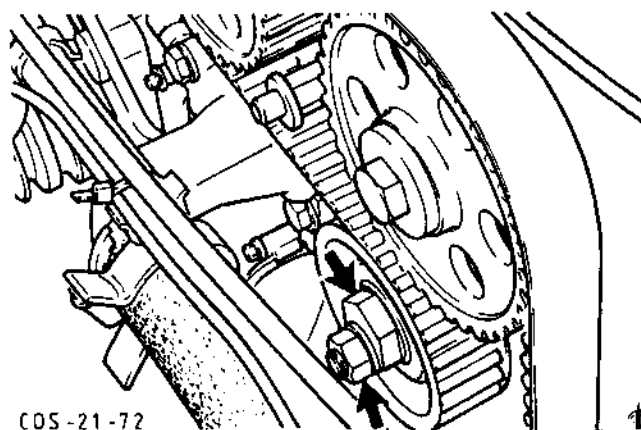


Fig.208. Release timing belt tensioning pulley.

13. Remove the auxiliary shaft toothed belt pulley.

14. Remove the camshaft toothed belt pulleys.

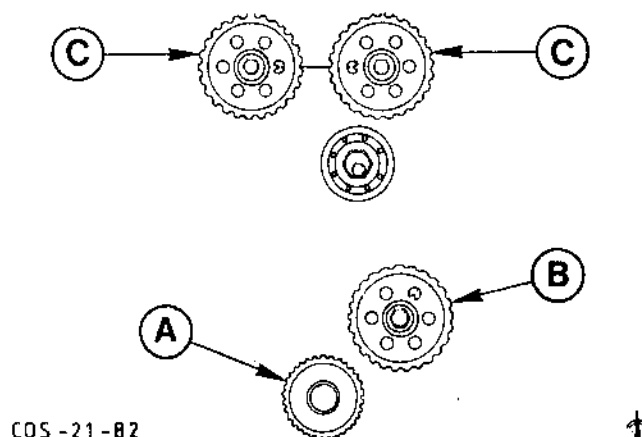


Fig.209. Remove the toothed belt pulleys.
A - Crankshaft toothed belt pulley
B - Auxiliary shaft toothed belt pulley
C - Camshaft toothed belt pulley

21 332 0

To Install

During installation, tighten all nuts and bolts to the torque specified in Technical Data.

15. Fit the camshaft toothed belt pulleys.

16. Fit the auxiliary shaft toothed belt pulley.

17. Fit the crankshaft toothed belt pulley, side with boss facing engine. Torque to specification. Fit the toothed belt to the crankshaft only.

18. Fit the crankshaft V-belt pulley and thrust washer. The thrust washer convex side faces the timing belt pulley.

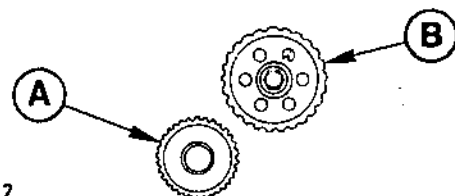
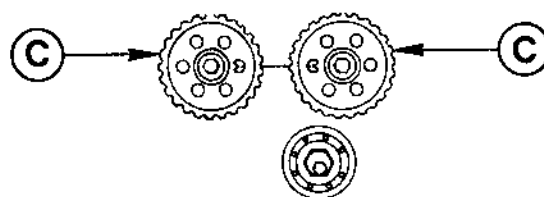
19. Fit the alternator V-belts onto the V-belt pulleys (crankshaft, water pump and alternator). Push the alternator away from engine and tighten adjustment strap bolts.

For V-Belt tension, refer to Technical Data.

20. Fit the power steering V-belt onto the V-belt pulleys (crankshaft, power steering pump). Push the power steering pump away from engine and tighten the pump fixture bolts (2).

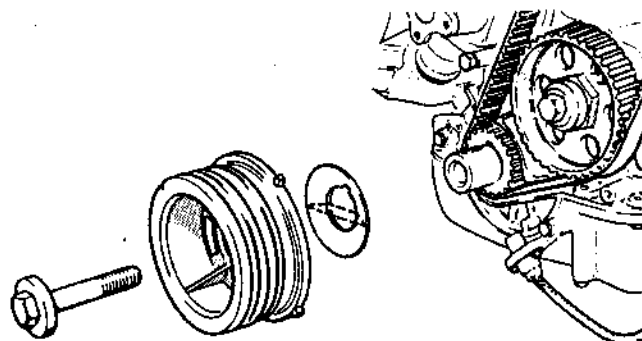
For V-belt tension, refer to Technical Data.

21. Lower the vehicle.



COS-21-82

Fig.210. A - Crankshaft toothed belt pulley
B - Auxiliary shaft toothed belt pulley
C - Camshaft toothed belt pulley



SRS-21-28N

Fig.211. Fit thrust washer and crankshaft V-belt pulley.

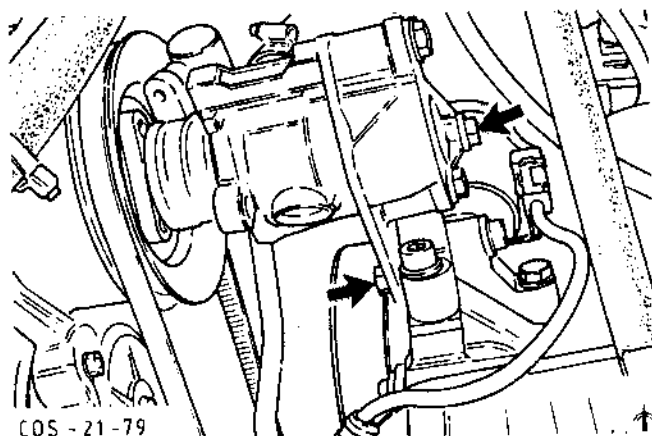
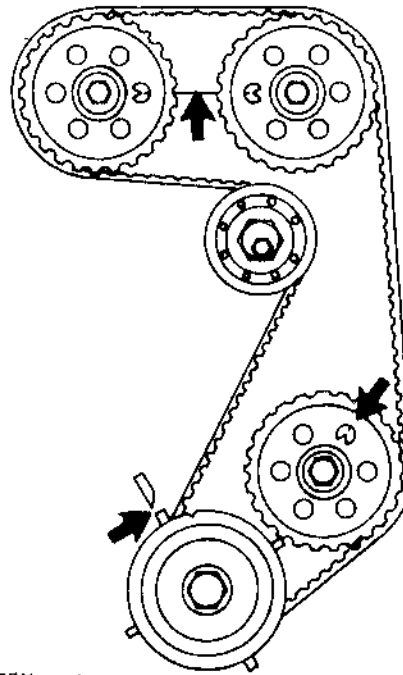


Fig.212. Power steering pump V-belt tension bolts.

21 332 0

22. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC marks.

23. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

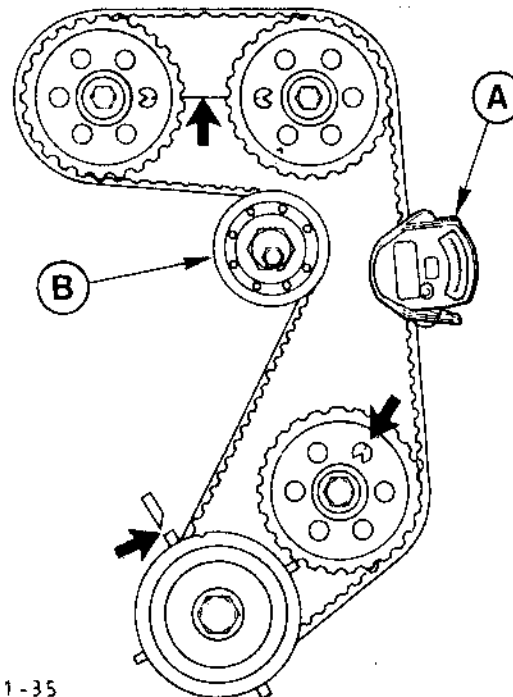
Fig.213. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

24. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



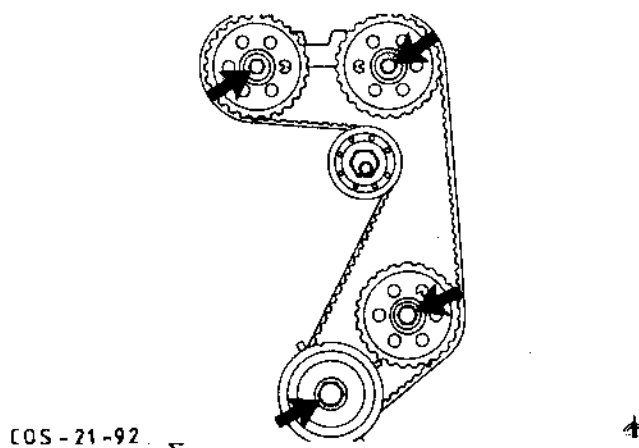
COS-21-35

Fig.214. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 332 0

25. Torque the crankshaft, auxiliary shaft and camshaft pulley retaining bolts to specification.

26. Fit the distributor cap.

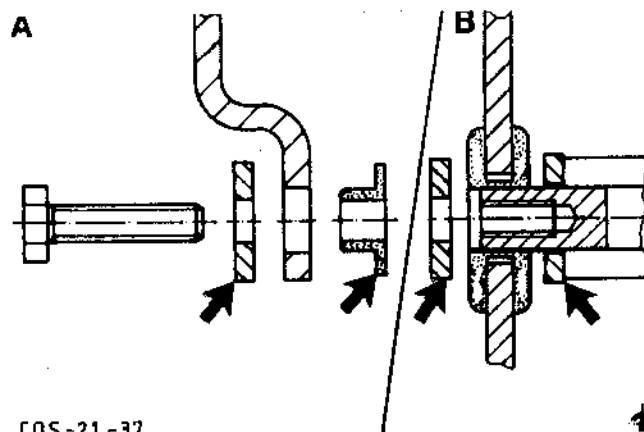


COS-21-92

Fig.215. Torque bolts to specification.

27. Fit the timing belt cover, at the same time secure the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

Clip the temperature gauge sender unit cable to the cover.

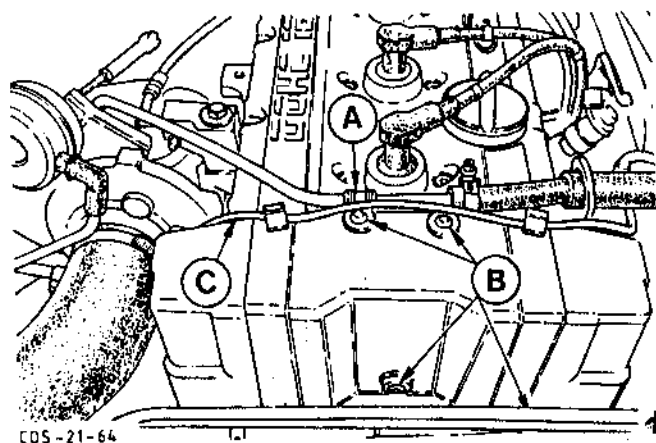


COS-21-37

Fig.216. Correct timing cover spacer location.

A - Lower
B - Middle

28. Connect the battery earth cable.



COS-21-64

Fig.217. Fit timing belt cover.

A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

21 467 0 SEAL - CRANKSHAFT FRONT - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft timing gear remover ..	..	21-028-A
Belt tension gauge ..	..	21-113
Crankshaft front seal remover ..	..	21-143

To Remove

1. Disconnect the battery earth cable.

2. Unclip the temperature gauge sender unit cable from the timing belt cover and remove the cover (4 screws).

3. Engage 1st gear and apply handbrake to block engine.

Loosen the crankshaft V-belt pulley retaining bolt.

4. Remove the distributor cap.

5. Engage neutral.

Position No.1 cylinder piston on TDC. To do this, set crankshaft pulley and distributor rotor arm to TDC marks.

Engage 1st gear.

6. Release the timing belt tensioning pulley. Remove the timing belt.

NOTE: If timing belt is to be re-used, mark running direction.

7. Raise the vehicle.

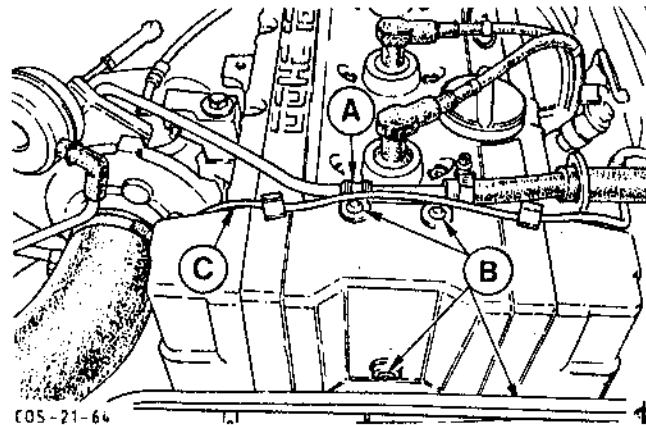


Fig.218. A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

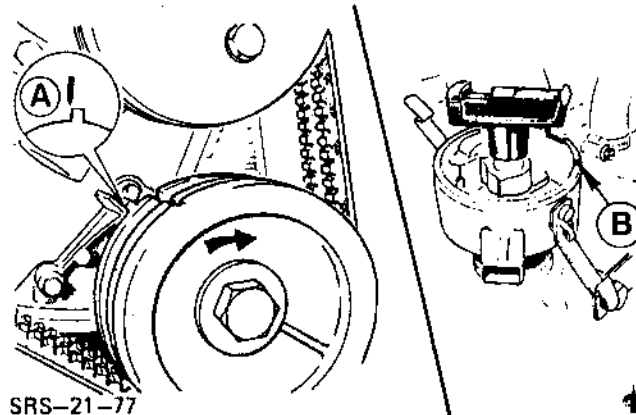


Fig.219. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

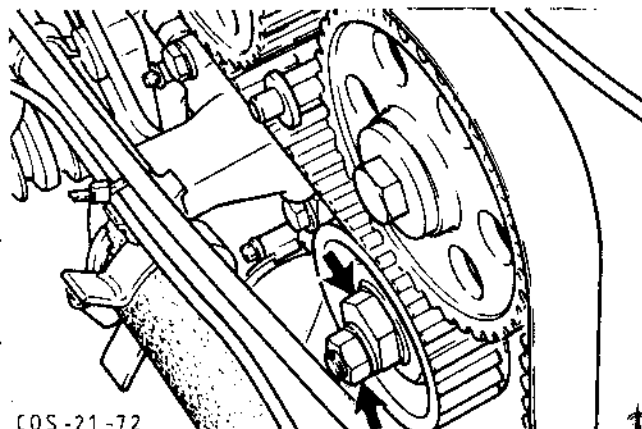


Fig.220. Release timing belt tensioning pulley.

21 467 0

8. Remove the radiator lower bolts (2) push the radiator forwards and secure with wire.

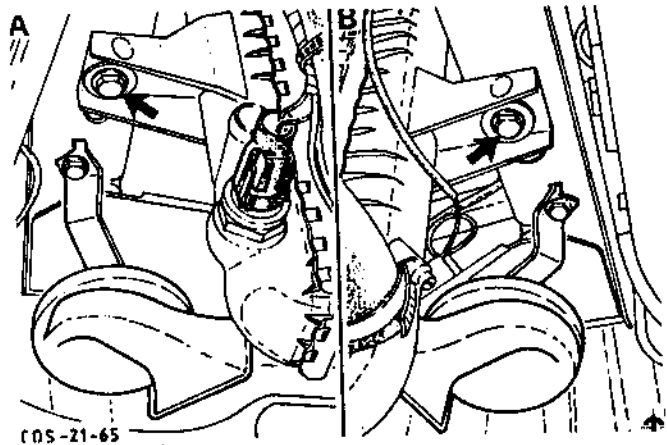


Fig.221. Radiator lower bolts.
A - Left side
B - Right side

9. Slacken the power steering pump fixture bolts and remove the power steering V-belt.

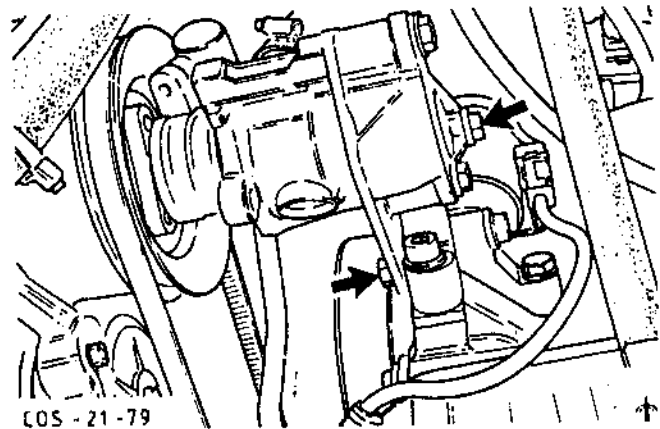


Fig.222. Slacken power steering pump bolts.

11. Remove the crankshaft V-belt pulley and thrust washer.

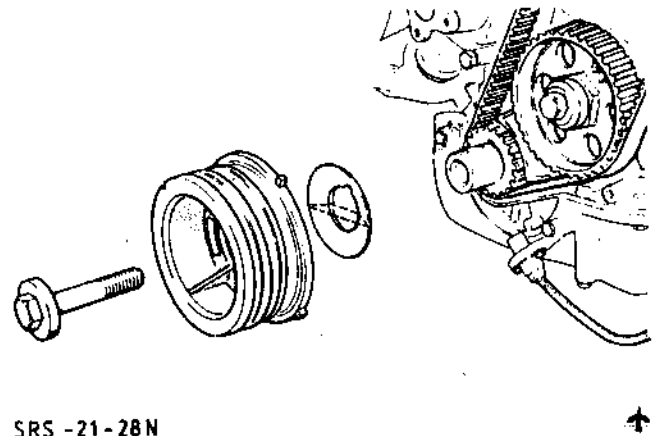


Fig.223. Remove crankshaft V-belt pulley.

21 467 0

12. Remove the crankshaft toothed belt pulley.
If necessary, use special tool 21-028-A.

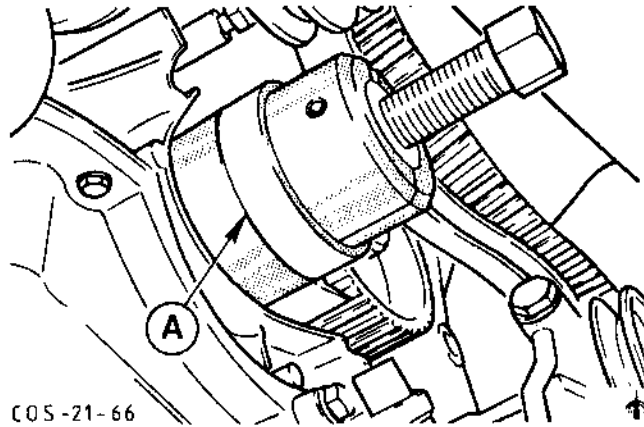


Fig.224. Remove crankshaft toothed belt pulley.
A - special tool 21-028-A

13. Remove the crankshaft front radial oil seal using special tool 21-143, Fig.225.

Insert the remover 'A', into the oil seal.
Engage the lever 'B', into the remover and working round the oil seal, remove it in stages.

To Install

During installation, tighten all nuts and bolts to the torque specified in Technical Data.

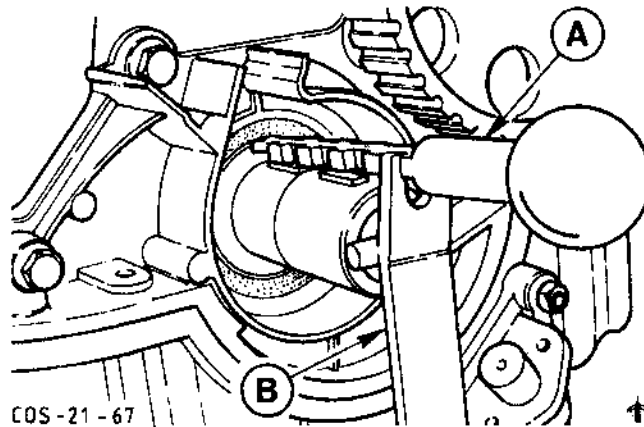


Fig.225. Remove crankshaft front oil seal using special tool 21-143
A - Remover B - Lever

14. Wet the crankshaft and the new oil seal lip with fresh engine oil and install the seal using special tool 21-009-B in conjunction with the crankshaft V-belt pulley, the pulley retaining bolt and washer.

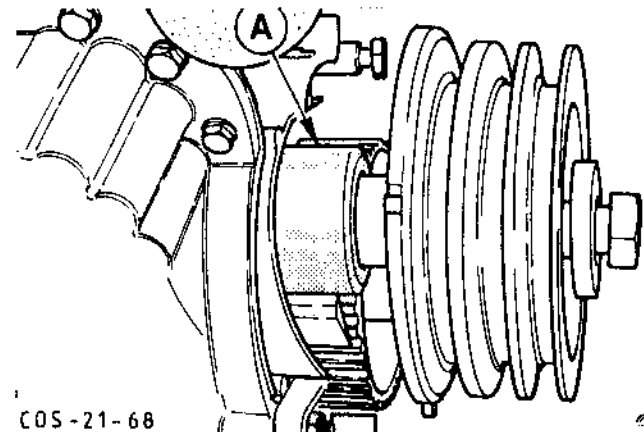


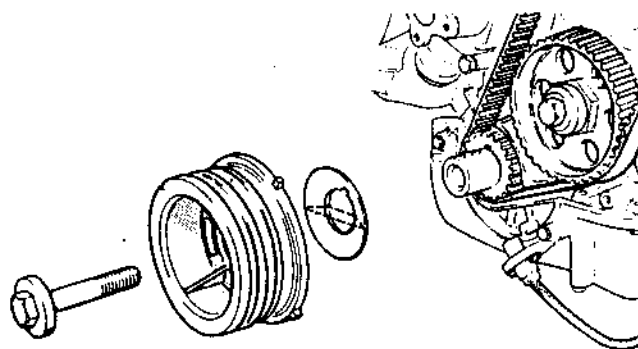
Fig.226. Install crankshaft front oil seal.
A - special tool 21-009-B

21 467 0

15. Fit the crankshaft toothed belt pulley, side with boss facing engine.

Fit the timing belt to the crankshaft only.

16. Fit the crankshaft V-belt pulley and thrust washer. The thrust washer convex side faces the timing belt pulley.



SRS -21-28N



Fig.227. Fit thrust washer and crankshaft V-belt pulley.

17. Fit the alternator V-belts onto the V-belt pulley (crankshaft, water pump and alternator). Push the alternator away from engine and tighten adjustment strap bolts. For V-belt tension, refer to Technical Data.

18. Fit the power steering V-belt onto the V-belt pulleys (crankshaft, power steering pump).

Push the power steering pump away from engine and tighten the pump fixture bolts (2).

For V-belt tension, refer to Technical Data.

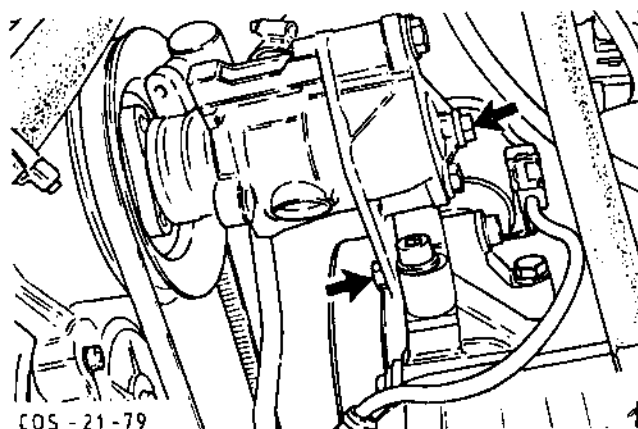


Fig.228. Power steering pump V-belt tension bolts.

19. Fit and tighten the radiator lower bolts (2).

20. Lower the vehicle.

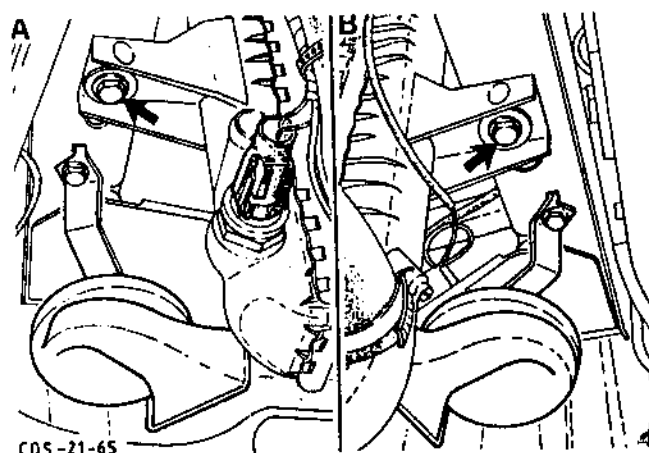
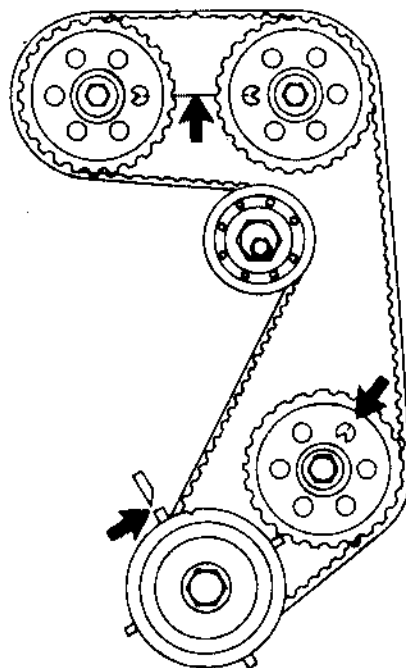


Fig.229. Radiator lower bolts.
A - Left side
B - Right side

21 467 0

21. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC marks.

22. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

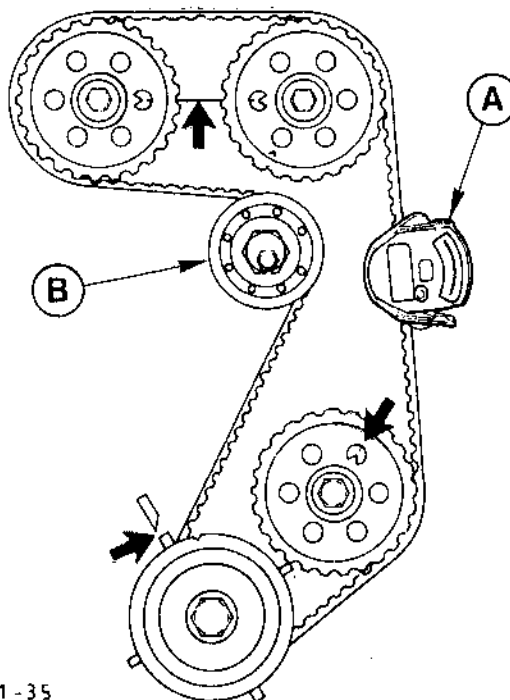
Fig.230. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

29. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



COS-21-35

Fig.231. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 467 0

24. Torque the crankshaft V-belt pulley retaining bolt to specification.

25. Fit the distributor cap.

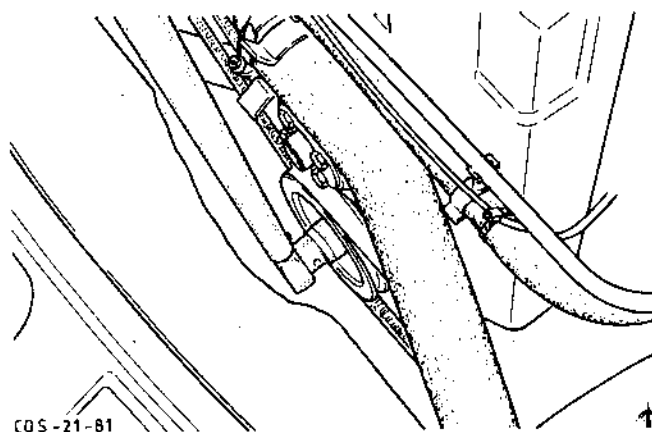


Fig.232. Torque crankshaft V-belt pulley to specification.

26. Fit the timing belt cover, at the same time secure the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

Clip the temperature gauge sender unit cable to the cover.

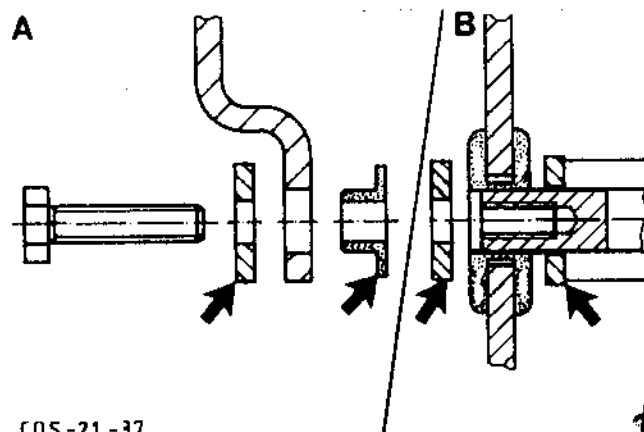


Fig.233. Correct timing cover spacer location.
A - Lower
B - Middle

27. Check the engine oil level and top up if necessary.

28. Connect the battery earth cable.

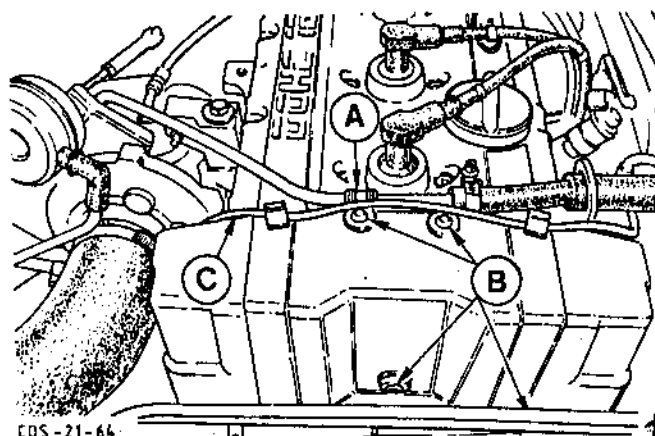


Fig.234. Fit timing belt cover.
A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

21 468 4 SEAL-CRANKSHAFT REAR - REPLACE (Engine or transmission removed)

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft rear oil seal installer ..	21-011-D
Clutch disc locator	21-044-A
Crankshaft rear oil seal remover ..	21-143

To Remove

1. Loosen the clutch pressure plate bolts (6) uniformly and remove the pressure plate and clutch disc from the flywheel.

2. Remove the flywheel (9 bolts).

NOTE: One bolt has an offset drilling, therefore, mark the relative position of flywheel to crankshaft with a felt pen to assist reassembly.

3. Extract the radial oil seal using special tool 21-143, Fig.235.
Insert the remover 'A', into the oil seal. Engage the lever 'B', into the remover and working round the oil seal, remove it in stages.

To Install

During installation, tighten all bolts to the torque specified in Technical Data.

4. Lubricate the new radial oil seal lip and crankshaft with fresh engine oil.
Place the oil seal with the closed side facing upwards on a solid base. Position special tool 21-011-D on the oil seal and press the retaining ring downwards by hand as far as it will go.

Position the tool and oil seal on engine and using three flywheel retaining bolts, draw in oil seal until it butts.

5. Align the flywheel locating bolt holes and fit the flywheel.

NOTE: Lubricate the bolt threads and under the bolt heads with engine oil.

6. Centre the clutch disc using special tool 21-044-A.
Locate the pressure plate over the dowels and uniformly tighten the retaining bolts.

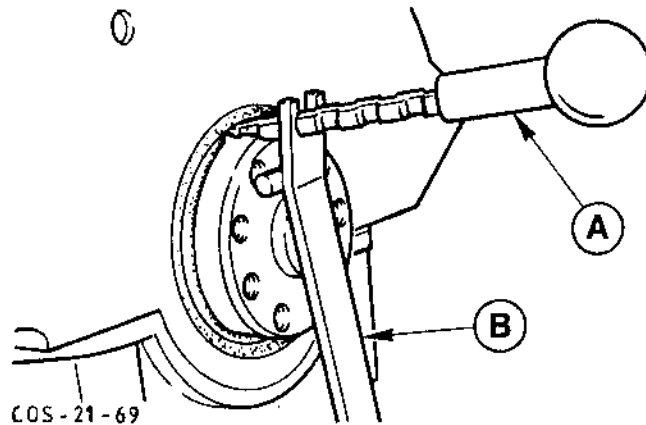


Fig.235. Extract radial oil seal using special tool 21-143
A - Remover B - Lever

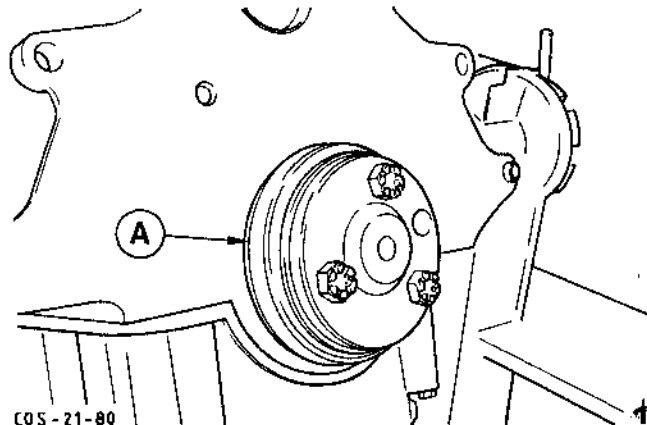


Fig.236. Install radial oil seal.
A - special tool 21-011-D

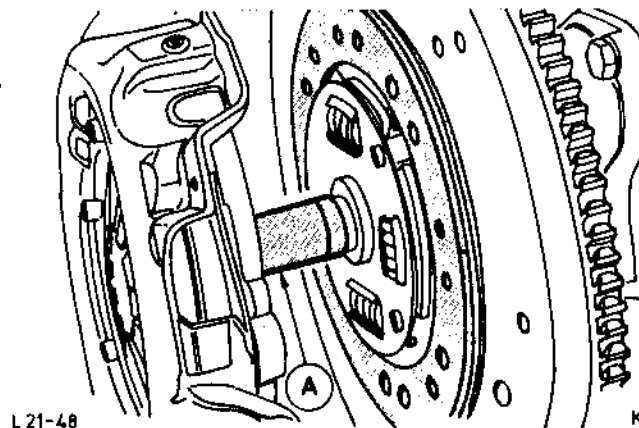


Fig.237. Centre clutch disc.
A - Special tool 21-044-A

21 505 5 PISTON - REPLACE (one) (piston and connecting rod assembly removed)

SPECIAL SERVICE TOOLS REQUIRED: NONE

General Description

The piston and piston pin form a unit and can only be renewed together.

If one cylinder has to be bored oversize by 0,5 mm, the remaining cylinder bores must also be bored oversize by the same amount. If this is not done imbalance problems will be experienced, as the piston for a 0,5 mm oversize bore could weigh as much as 10 g more.

The first and second piston rings are marked "TOP".

To Remove

1. Remove the spring ring, using a small screwdriver.

For this purpose the piston has a small cut-out on the right hand side piston pin bore. Rotate spring ring and then hook out exposed end with screwdriver.

2. Press out the piston pin.
3. Remove the piston from the connecting rod.

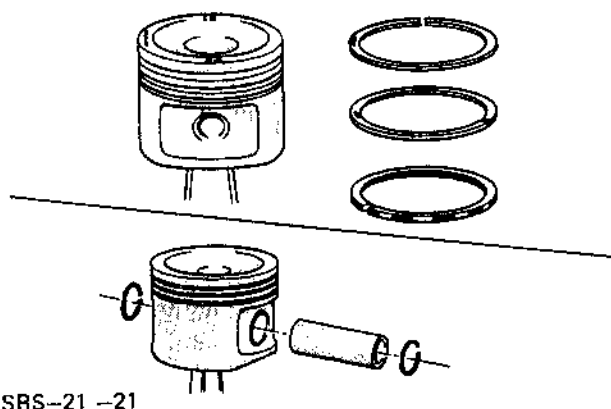
To Install

NOTE: The connecting rods have 3 grades and are marked on the cap:

Standard ..	..	..	S or no mark
Light ..	..	..	L
Heavy ..	..	..	H

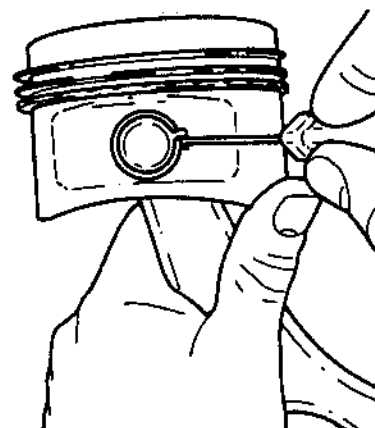
4. Connect the piston and connecting rod with the piston pin.
5. Install spring ring.

NOTE: Spring ring ends must face towards the piston rings.



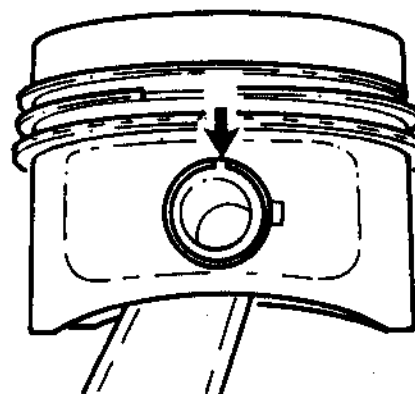
SRS-21 -21

Fig.238. Piston, piston rings and piston pin.



SRS-21-119

Fig.239. Remove spring ring with a small screwdriver.



COS-21-B6

Fig.240. Position of spring ring gap.

