

12.28a Cylinder head bolt tightening sequence

Note: View from rear of vehicle

25 As the cylinder head is such a heavy and awkward assembly to refit with manifolds, it is helpful to make up a pair of guide studs from two 10 mm (thread size) studs approximately 90 mm long, with a screwdriver slot cut in one end - two old cylinder head bolts with their heads cut off would make a good starting point. Screw these guide studs, screwdriver slot upwards to permit removal, into the bolt holes at diagonally-opposite corners of the cylinder block surface (or into those where the locating dowels are fitted); ensure that approximately 70 mm of stud protrudes above the gasket.

26 Refit the cylinder head, sliding it down the guide studs (if used) and locating it on the dowels. Unscrew the guide studs (if used) when the head is in place.

27 Fit the new cylinder head bolts dry (*do not* oil their threads); carefully enter each into its hole and screw it in, by hand only, until finger-tight.

28 Working progressively and in the sequence shown, use first a torque wrench, then an ordinary socket extension bar and an angle gauge, to tighten the cylinder head bolts in the stages given in the Specifications Section of this Chapter (**see illustrations**).

Note: Once tightened correctly, following this procedure, the cylinder head bolts do not require check-tightening, and must **not** be re-torqued.

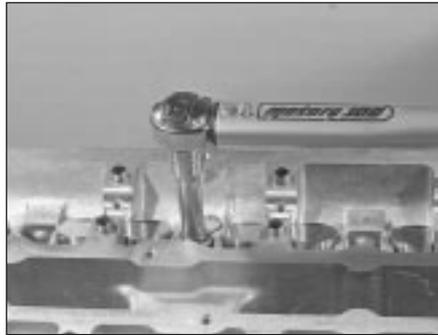
29 Refit the hydraulic tappets (if removed), the camshafts, their oil seals and sprockets (see Sections 11, 10 and 9, as appropriate). Temporarily refit the crankshaft pulley, and rotate the crankshaft clockwise to return the pulley notches to the TDC position described in Section 3.

30 Refit the earth lead to the lifting eye

31 Refit the timing belt and covers, checking the camshaft alignment (valve timing) and setting the timing belt tension, as described in Section 8.

32 The remainder of reassembly is the reverse of the removal procedure, noting the following points:

- Tighten all fasteners to the torque wrench settings specified.
- Refill the cooling system, and top-up the



12.28b Tightening cylinder head bolts (Stages 1 and 2) using torque wrench . . .



12.28c . . . and to Stage 3 using angle gauge

engine oil (see Chapter 1 and "Weekly Checks").

- Check all disturbed joints for signs of oil or coolant leakage, once the engine has been restarted and warmed-up to normal operating temperature.
- If the power steering hoses where disconnected, bleed the system as described in Chapter 10 after reconnection.

13 Sump - removal and refitting



Removal

Note: The full procedure outlined below must be followed, so that the mating surfaces can be cleaned and prepared to achieve an oil-tight joint on reassembly, and so that the sump can be aligned correctly; depending on your skill and experience, and the tools and facilities available, it may be that this task can be carried out only with the engine removed from the vehicle. Note that the sump gasket must be renewed whenever it is disturbed.

1 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1).

2 Drain the engine oil, then clean and refit the engine oil drain plug, tightening it to the specified torque wrench setting. Although not strictly necessary as part of the dismantling procedure, owners are advised to remove and discard the oil filter, so that it can be renewed with the oil (see Chapter 1).

3 Refer to Chapter 5A and remove the starter motor.

4 Remove the auxiliary drivebelt cover (see Chapter 1).

5 Unplug the electrical connector(s) to disconnect the oxygen sensor.

6 Unscrew the nuts to disconnect the exhaust system front downpipe from the manifold, then either unhook all the system's rubber mountings and withdraw the complete exhaust system from under the vehicle, or remove only the downpipe/catalytic converter (see Chapter 4E for details).

7 Unscrew the sump-to-transmission bolts, also any securing the engine/transmission lower adapter plate.

8 Progressively unscrew the sump retaining bolts. Break the joint by striking the sump with the palm of the hand, then lower the sump and withdraw it with the engine/transmission lower adapter plate (where fitted); note the presence of any shims between the sump and transmission.

9 Remove and discard the sump gasket; this must be renewed as a matter of course whenever it is disturbed.

10 While the sump is removed, take the opportunity to remove the oil pump pick-up/strainer pipe and to clean it (see Section 14).

Refitting

11 On reassembly, thoroughly clean and degrease the mating surfaces of the cylinder block/crankcase and sump, then use a clean rag to wipe out the sump and the engine's interior. If the oil pump pick-up/strainer pipe was removed, fit a new gasket and refit the pipe, tightening its screws to the specified torque wrench setting. Fit the new gasket to the sump mating surface so that the gasket fits into the sump groove (**see illustration**).

12 If the sump is being refitted with the engine/transmission still connected and in the vehicle, proceed as follows:

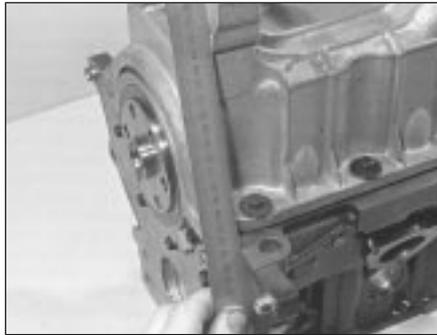
- Check that the mating surfaces of the sump, the cylinder block/crankcase and



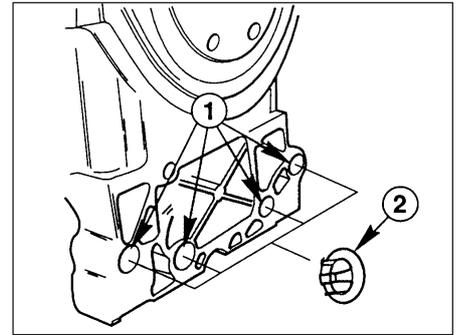
13.11 Ensure gasket is located correctly in sump groove



13.13a Apply sealant (arrowed) as directed when refitting sump



13.13b Checking alignment of sump with cylinder block/crankcase



13.13c Sump-to-cylinder block/crankcase alignment shims

1 Fitting points on sump 2 Shim

the transmission are absolutely clean and flat. Any shims found on removal of the sump must be refitted in their original locations.

- b) Apply a thin film of suitable sealant (Ford recommend Hylsil 102) to the junctions of the cylinder block/crankcase with the oil pump and the crankshaft left-hand oil seal carrier. Without delay - the sump bolts must be fully tightened within 10 to 20 minutes of applying the sealant - offer up the sump and engine/transmission lower adapter plate, and refit the bolts, tightening them lightly at first.
- c) Ensuring that the engine/transmission lower adapter plate is correctly located, firmly press the sump against the transmission, and tighten the transmission-to-sump (ie, engine) bolts to the specified torque wrench setting.
- d) Without disturbing the position of the sump, and working in a diagonal sequence from the centre outwards, tighten the sump bolts to the specified torque wrench setting.
- e) Proceed to paragraph 14.

13 If the sump is being refitted with the engine and transmission separated (in or out of the vehicle), proceed as follows:

- a) Apply a thin film of suitable sealant (Ford recommend Hylsil 102) to the junctions of the cylinder block/crankcase with the oil pump and the crankshaft left-hand oil

seal carrier (see illustration). Without delay - the sump bolts must be fully tightened within 10 to 20 minutes of applying the sealant - offer up the sump to the cylinder block/crankcase, and insert the sump bolts, tightening them lightly at first.

- b) Using a suitable straight edge to check alignment across the flat-machined faces of each, move the sump as necessary so that its left-hand face - including any shims found on removal - is flush with that of the cylinder block/crankcase (see illustration). Without disturbing the position of the sump, and working in a diagonal sequence from the centre outwards, tighten the sump bolts to the specified torque wrench setting.
- c) Check again that both faces are flush before proceeding; if necessary, unbolt the sump again, clean the mating surfaces, and repeat the full procedure to ensure that the sump is correctly aligned.
- d) If it is not possible to achieve exact alignment by moving the sump, shims are available in thicknesses of 0.25 mm (colour-coded yellow) or 0.50 mm (colour-coded black) to eliminate the discrepancy (see illustration).

14 The remainder of reassembly is the reverse of the removal procedure, noting the following points.

- a) Tighten all fasteners to the torque wrench settings specified.

b) Always renew any self-locking nuts disturbed on removal.

- c) Refill the cooling system (see Chapter 1).
- d) Refill the engine with oil, remembering that you are advised to fit a new filter (see Chapter 1).
- e) Check for signs of oil or coolant leaks once the engine has been restarted and warmed-up to normal operating temperature.

14 Oil pump - removal, inspection and refitting



2C

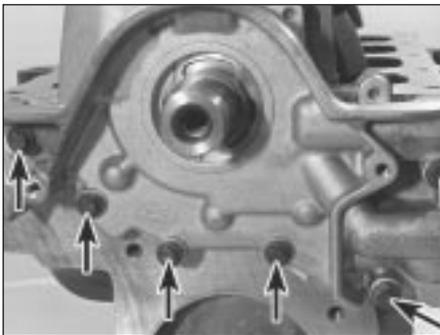
Removal

Note: While this task is theoretically possible when the engine is in place in the vehicle, in practice, it requires so much preliminary dismantling, and is so difficult to carry out due to the restricted access, that owners are advised to remove the engine from the vehicle first. Note, however, that the oil pump pressure relief valve can be removed with the engine in situ - see paragraph 8.

- 1 Remove the timing belt (see Section 8).
- 2 Withdraw the crankshaft sprocket and the thrustwasher behind it, noting which way round the thrustwasher is fitted (see Section 9).
- 3 Remove the sump (see Section 13).
- 4 Undo the screws securing the oil pump pick-up/strainer pipe to the pump, then unscrew the nut and withdraw the oil pump pick-up/strainer pipe. Discard the gasket.
- 5 Unbolt the pump from the cylinder block/crankcase (see illustration). Withdraw and discard the gasket, and remove the crankshaft right-hand oil seal. Thoroughly clean and degrease all components, particularly the mating surfaces of the pump, the sump, and the cylinder block/crankcase.

Inspection

6 Unscrew the Torx screws, and remove the pump cover plate; noting any identification marks on the rotors, withdraw the rotors (see illustration).



14.5 Unscrew bolts (arrowed) to remove oil pump



14.6 Withdrawing oil pump inner rotor



14.9a Unscrew threaded plug - seen through right-hand wheel arch . . .



14.9b . . . to withdraw oil pressure relief valve spring and plunger



14.12 Use new gasket when refitting oil pump

7 Inspect the rotors for obvious signs of wear or damage, and renew if necessary; if either rotor, the pump body, or its cover plate are scored or damaged, the complete oil pump assembly must be renewed.

8 The oil pressure relief valve can be dismantled, if required, without disturbing the pump. Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the front right-hand roadwheel and auxiliary drivebelt cover (see Chapter 1) to provide access to the valve.

9 Unscrew the threaded plug, and recover the valve spring and plunger (see illustrations). If the plug's sealing O-ring is worn or damaged, a new one must be obtained, to be fitted on reassembly.

10 Reassembly is the reverse of the

dismantling procedure; ensure the spring and valve are refitted the correct way round, and tighten the threaded plug securely.

Refitting

11 The oil pump must be primed on installation, by pouring clean engine oil into it, and rotating its inner rotor a few turns.

12 Using grease to stick the new gasket in place on the cylinder block/crankcase, and rotating the pump's inner rotor to align with the flats on the crankshaft, refit the pump and insert the bolts, tightening them lightly at first (see illustration).

13 Using a suitable straight edge and feeler gauges, check that the pump is both centred exactly around the crankshaft, and aligned squarely so that its (sump) mating surface is exactly the same amount - between 0.3 and 0.8 mm - below that of the cylinder block/crankcase on each side of the crankshaft (see illustration). Being careful not to disturb the gasket, move the pump into the correct position, and tighten its bolts to the specified torque wrench setting.

14 Check that the pump is correctly located; if necessary, unbolt it again, and repeat the full procedure to ensure that the pump is correctly aligned.

15 Fit a new crankshaft right-hand oil seal (see Section 15).

16 Using grease to stick the gasket in place on the pump, refit the pick-up/strainer pipe, tightening its screws and nut to their specified torque wrench settings (see illustration).

17 The remainder of reassembly is the reverse of the removal procedure, referring to the relevant text for details where required.

15 Crankshaft oil seals - renewal



Note: Don't try to prise these seals out without removing the oil pump or seal carrier - the seals are too soft, and the amount of space available is too small, for this to be possible without considerable risk of damage to the seal housing and/or the crankshaft journal. Follow exactly the procedure given below.

Right-hand seal

1 Remove the oil pump (see Section 14).

2 Drive the oil seal out of the pump from behind (see illustration).

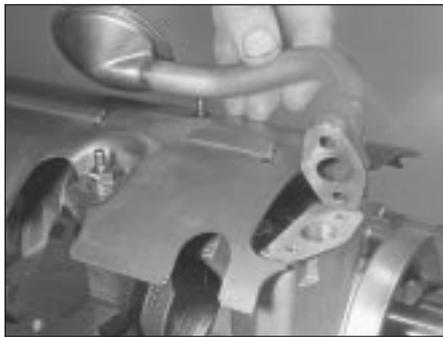
3 Clean the seal housing and crankshaft, polishing off any burrs or raised edges, which may have caused the seal to fail in the first place.

4 Refit the oil pump (see Section 14). Grease the lips and periphery of the new seal, to ease installation.

5 To fit a new seal, Ford recommend the use of their service tool 21-093A, with the crankshaft pulley bolt, to draw the seal into place; an alternative can be arranged using a socket of suitable size, with a washer to match the crankshaft pulley bolt (see illustration).



14.13 Oil pump must be positioned accurately



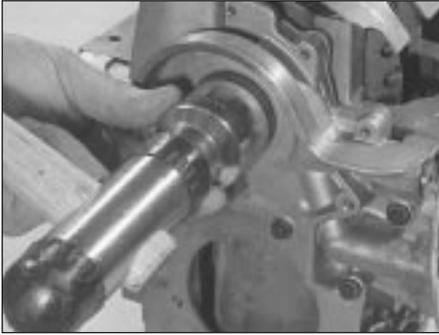
14.16 Use new gasket when refitting oil pick-up pipe to pump



15.2 Driving out crankshaft right-hand oil seal



15.5 Socket of correct size can be used to replace Ford service tool, drawing new seal into place as described



15.6 If seal is tapped into place as shown, exercise great care to prevent seal from being damaged or distorted

6 If such tools are not available, press the seal squarely into place by hand; tap it in until it is flush with the pump housing, using a soft-faced mallet and a socket with an outside diameter only slightly smaller than the seal's (see illustration). This approach requires great care, to ensure that the seal is fitted squarely, without distortion or damage.

7 Wash off any traces of oil. The remainder of reassembly is the reverse of the removal procedure, referring to the relevant text for details where required. Check for signs of oil leakage when the engine is restarted.

Left-hand seal

8 Remove the transmission (see the relevant Part of Chapter 7).

9 Where appropriate, remove the clutch (Chapter 6).

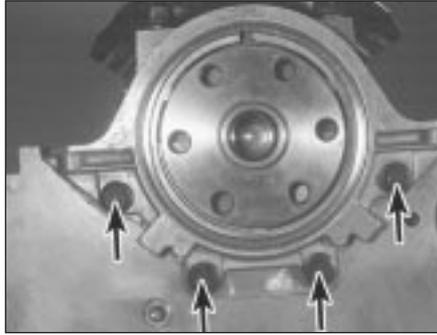
10 Unbolt the flywheel/driveplate (see Section 17).

11 Remove the sump (see Section 13).

12 Unbolt the oil seal carrier (see illustration). Remove and discard its gasket.

13 Supporting the carrier evenly on wooden blocks, drive the oil seal out of the carrier from behind (see illustration).

14 Clean the seal housing and crankshaft, polishing off any burrs or raised edges, which may have caused the seal to fail in the first place. Clean also the mating surfaces of the cylinder block/crankcase and carrier, using a



15.12 Unscrew bolts (arrowed) to remove crankshaft left-hand oil seal carrier . . .

scraper to remove all traces of the old gasket - be careful not to scratch or damage the material of either - then use a suitable solvent to degrease them.

15 Use grease to stick the new gasket in place on the cylinder block/crankcase, then offer up the carrier (see illustration).

16 Using a suitable straight edge and feeler gauges, check that the carrier is both centred *exactly* around the crankshaft, and aligned squarely so that its (sump) mating surface is exactly the same amount - between 0.3 and 0.8 mm - below that of the cylinder block/crankcase on each side of the crankshaft (see illustration). Being careful not to disturb the gasket, move the carrier into the correct position, and tighten its bolts to the specified torque wrench setting.

17 Check that the carrier is correctly located; if necessary, unbolt it again, and repeat the full procedure to ensure that the carrier is correctly aligned.

18 Ford's recommended method of seal fitting is to use service tool 21-141, with two flywheel bolts to draw the seal into place. If this is not available, make up a guide from a thin sheet of plastic or similar, lubricate the lips of the new seal and the crankshaft shoulder with grease, then offer up the seal, with the guide feeding the seal's lips over the crankshaft shoulder (see illustration). Press the seal evenly into its housing by hand only,



15.13 . . . and ensure that carrier is properly supported when driving out used oil seal - note notches provided in carrier for drift

and use a soft-faced mallet gently to tap it into place until it is flush with the surrounding housing.

19 Wipe off any surplus oil or grease; the remainder of the reassembly procedure is the reverse of dismantling, referring to the relevant text for details where required. Check for signs of oil leakage when the engine is restarted.

16 Engine/transmission mountings - inspection and renewal



Inspection

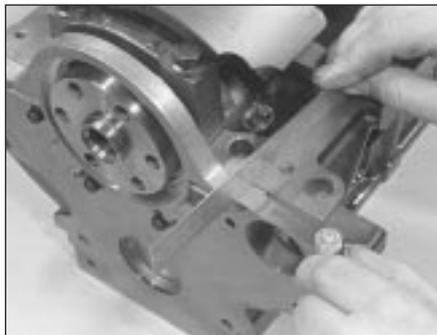
1 The engine/transmission mountings seldom require attention, but broken or deteriorated mountings should be renewed immediately, or the added strain placed on the driveline components may cause damage or wear.

2 During the check, the engine/transmission must be raised slightly, to remove its weight from the mountings.

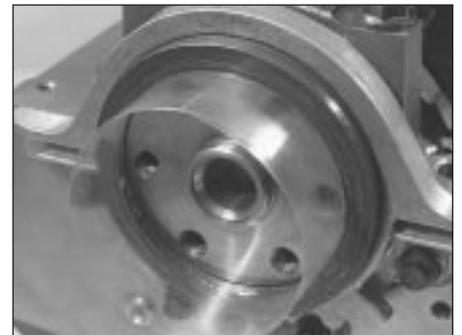
3 Chock the rear wheels then jack up the front of the car and support it on axle stands (see *Jacking and Vehicle Support*). Position a jack under the sump, with a large block of wood between the jack head and the sump, then carefully raise the engine/transmission just enough to take the weight off the mountings.



15.15 Use new gasket when refitting left-hand oil seal carrier



15.16 Oil seal carrier must be positioned accurately



15.18 Using guide made from thin sheet of plastic to slide oil seal lips over crankshaft shoulder

4 Check the mountings to see if the rubber is cracked, hardened or separated from the metal components. Sometimes, the rubber will split right down the centre.

5 Check for relative movement between each mounting's brackets and the engine/transmission or body (use a large screwdriver or lever to attempt to move the mountings). If movement is noted, lower the engine and check-tighten the mounting fasteners.

Renewal

6 The engine mountings can be removed if the weight of the engine/transmission is supported by one of the following alternative methods.

7 Either support the weight of the assembly from underneath using a jack and a suitable piece of wood between the jack saddle and the sump or transmission (to prevent damage), or from above by attaching a hoist to the engine. A third method is to use a suitable support bar with end pieces which will engage in the water channel each side of the bonnet lid aperture. Using an adjustable hook and chain connected to the engine, the weight of the engine and transmission can then be taken from the mountings.

Engine front right-hand mounting

8 This mounting consists of a two-piece bracket bolted to the inner wing panel, connected by the bonded-rubber mounting itself to a (Y-shaped) bracket, bolted (via the alternator mounting bracket) to the cylinder block (see illustration).

9 Unscrew the three bolts securing the front right-hand mounting bracket to the alternator mounting bracket.

10 Unscrew the bolts securing the mounting bracket to the inner wing panel and chassis rail and withdraw the mounting assembly.



16.8 Engine front right-hand mounting

Engine rear right-hand mounting

11 This mounting consists of the bonded-rubber mounting secured to the inner wing panel by a (horizontal) bolt, accessible from within the wheel arch, and a (vertical) stud, the retaining nut of which is accessible from the engine compartment. The mounting is bolted to a bracket, which is in turn bolted to the cylinder block.

12 Unbolt the mounting from the body by unscrewing first the single nut (and washer) immediately to the rear of the timing belt cover, then the bolt in the wheel arch.

13 Unbolt the mounting from the cylinder block bracket and withdraw the mounting assembly.

Transmission bearer and mountings

14 On XR2i models, remove the front suspension crossmember as described in Chapter 10.

15 Unscrew and remove the two nuts securing the mountings (front and rear) to the transmission bearer

16 Support the transmission bearer, then undo and remove the four retaining bolts from the floorpan, two at the front and two at the rear, and lower the transmission bearer from the vehicle. Note plate fitment, as applicable, for reassembly.

17 To remove the mountings from the transmission, unscrew the upper bolt and lower stud (front mounting) or the three nuts (rear mounting) and withdraw the relevant mounting and bracket assembly from the transmission.

All mountings

18 Refitting of all mountings is a reversal of removal. Make sure that the original sequence of assembly of washers and plates is maintained.

19 Do not fully tighten any mounting bolts until they are all located. As the mounting bolts and nuts are tightened, check that the mounting rubbers do not twist.

17 Flywheel/driveplate - removal, inspection and refitting



Removal

1 Remove the transmission (see the relevant Part of Chapter 7).

2 Where appropriate, remove the clutch (Chapter 6).

3 Use a centre-punch or paint to make

alignment marks on the flywheel/driveplate and crankshaft, to ensure correct alignment during refitting.

4 Prevent the flywheel/driveplate from turning by locking the ring gear teeth, or by bolting a strap between the flywheel/driveplate and the cylinder block/crankcase. Slacken the bolts evenly until all are free.

5 Remove each bolt in turn, and ensure that new replacements are obtained for reassembly; these bolts are subjected to severe stresses, and so must be renewed, regardless of their apparent condition, whenever they are disturbed.

6 Noting the reinforcing plate (automatic transmission models only), withdraw the flywheel/driveplate; do not drop it - it is very heavy.

Inspection

7 Clean the flywheel/driveplate to remove grease and oil. Inspect the surface for cracks, rivet grooves, burned areas and score marks. Light scoring can be removed with emery cloth. Check for cracked and broken ring gear teeth. Lay the flywheel/driveplate on a flat surface, and use a straight edge to check for warpage.

8 Clean and inspect the mating surfaces of the flywheel/driveplate and the crankshaft. If the crankshaft left-hand seal is leaking, renew it (see Section 15) before refitting the flywheel/driveplate.

9 While the flywheel/driveplate is removed, clean carefully its inboard (right-hand) face, particularly the recesses which serve as the reference points for the crankshaft speed/position sensor. Clean the sensor's tip, and check that the sensor is securely fastened.

Refitting

10 On refitting, ensure that the engine/transmission adapter plate is in place (where necessary), then fit the flywheel/driveplate to the crankshaft so that all bolt holes align - it will fit only one way - check this using the marks made on removal. Do not forget the reinforcing plate (automatic transmission models).

11 Lock the flywheel/driveplate by the method used on dismantling. Working in a diagonal sequence to tighten them evenly, and increasing to the final amount in two or three stages, tighten the new bolts to the specified torque wrench setting.

12 The remainder of reassembly is the reverse of the removal procedure, referring to the relevant text for details where required.

Chapter 2 Part D: Engine removal and overhaul procedures

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Degrees of difficulty

Easy , suitable for novice with little experience 	Fairly easy , suitable for beginner with some experience 	Fairly difficult , suitable for competent DIY mechanic 	Difficult , suitable for experienced DIY mechanic 	Very difficult , suitable for expert DIY or professional 
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Specifications

HCS engines

Cylinder head

Maximum permissible gasket surface distortion (measured over full length)	0.15 mm
Valve seat angle (inlet and exhaust)	45°
Valve seat width (inlet and exhaust)	1.18 to 1.75 mm*

*The inlet and exhaust valves have special inserts which cannot be recut using conventional tools.

Valves - general

	Inlet	Exhaust
Valve length	103.7 to 104.4 mm	104.2 to 104.7 mm
Valve head diameter:		
1.0 and 1.1 litre engines	32.90 to 33.10 mm	28.90 to 29.10 mm
1.3 litre engines	34.40 to 34.60 mm	28.90 to 29.10 mm
Valve stem diameter	7.0 mm	7.0 mm
Valve stem-to-guide clearance	0.020 to 0.069	0.046 to 0.095

Cylinder block

Cylinder bore diameter:	
1.0 and 1.1 litre engines:	
Standard class 1 (or A)	68.68 to 68.69 mm
Standard class 2 (or B)	68.69 to 68.70 mm
Standard class 3 (or C)	68.70 to 68.71 mm
Oversize 0.5 mm	69.20 to 69.21 mm
Oversize 1.0 mm	69.70 to 69.71 mm
1.3 litre engines:	
Standard class 1	73.94 to 73.95 mm
Standard class 2	73.50 to 73.96 mm
Standard class 3	73.96 to 73.97 mm
Oversize 0.5 mm	74.50 to 74.51 mm
Oversize 1.0 mm	75.00 to 75.01 mm

2D•2 Engine removal and overhaul procedures

Pistons and piston rings

Piston diameter:

1.0 and 1.1 litre engines:

Standard class 1 (or A)	68.65 to 68.66 mm
Standard class 2 (or B)	68.66 to 68.67 mm
Standard class 3 (or C)	68.67 to 68.68 mm
Standard (service)	68.67 to 68.70 mm
Oversize 0.5 mm	69.16 to 69.19 mm
Oversize 1.0 mm	69.66 to 69.69 mm

1.3 litre engines:

Standard class 1	73.91 to 73.92 mm
Standard class 2	73.92 to 73.93 mm
Standard class 3	73.93 to 73.94 mm
Oversize 0.5 mm	74.46 to 74.49 mm
Oversize 1.0 mm	74.96 to 74.99 mm

Piston-to-cylinder bore clearance	0.015 to 0.050 mm
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Piston ring end gap - installed:

Top compression ring	0.25 to 0.45 mm
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Second compression ring:

1.0 and 1.1 litre engines	0.25 to 0.45 mm
1.3 litre engines	0.45 to 0.75 mm
Oil control ring	0.20 to 0.40 mm

Piston ring-to-groove clearance:

Compression rings	0.20 mm (maximum)
Oil control ring	0.10 mm (maximum)

Ring gap position:

Top compression ring	Offset 180° from oil control ring gap
Second compression ring	Offset 90° from oil control ring gap
Oil control ring	Aligned with gudgeon pin

Gudgeon pin

Length:

1.0 and 1.1 litre engines	58.6 to 59.4 mm
1.3 litre engines	63.3 to 64.6 mm

Diameter:

White colour code	18.026 to 18.029 mm
Red colour code	18.029 to 18.032 mm
Blue colour code	18.032 to 18.035 mm
Yellow colour code	18.035 to 18.038 mm

Clearance in piston	0.008 to 0.014 mm
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Interference fit in connecting rod	0.016 to 0.048 mm
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Crankshaft and bearings

Main bearing journal diameter:

1.0 and 1.1 litre engines:

Standard	56.990 to 57.000 mm
Standard (with yellow line)	56.980 to 56.990 mm
0.254 mm undersize (with green line)	56.726 to 56.746 mm
0.508 mm undersize (service)	56.472 to 56.492 mm
0.762 mm undersize (service)	56.218 to 56.238 mm

1.3 litre engines:

Standard	56.980 to 57.000 mm
0.254 mm undersize (with green line)	56.726 to 56.746 mm
0.508 mm undersize (service)	56.472 to 56.492 mm
0.762 mm undersize (service)	56.218 to 56.238 mm

Main bearing journal-to-shell running clearance:

1.0 and 1.1 litre engines	0.009 to 0.046 mm
1.3 litre engines	0.009 to 0.056 mm

Crankpin (big-end) bearing journal diameter:

Standard	40.99 to 41.01 mm
0.254 mm undersize	40.74 to 40.76 mm
0.508 mm undersize	40.49 to 40.51 mm
0.762 mm undersize	40.24 to 40.26 mm

Crankpin (big-end) bearing journal-to-shell running clearance	0.006 to 0.060 mm
---------------------------------------------------------------------	-------------------

Crankshaft endfloat	0.100 to 0.250 mm
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Thrustwasher thickness:

Standard	2.80 to 2.85 mm
Oversize	2.99 to 3.04 mm

Camshaft

Endfloat 0.02 to 0.19 mm

Torque wrench settings

	Nm	lbf ft
Main bearing cap	95	70
*Crankpin (big-end) bearing cap bolts:		
Stage 1	4	3
Stage 2	Angle-tighten a further 90°	
Engine-to-transmission bolts	41	30

*New bolts must be used

Note: Refer to Part A of this Chapter for remaining torque wrench settings.

CVH and PTE engines

Cylinder head

Maximum permissible gasket surface distortion (measured over full length) 0.15 mm

Camshaft bearing bore diameters in cylinder head (standard):

Bearing 1	44.783 to 44.808 mm
Bearing 2	45.033 to 45.058 mm
Bearing 3	45.283 to 45.308 mm
Bearing 4	45.533 to 45.558 mm
Bearing 5	45.783 to 45.808 mm

Camshaft bearing bore diameters in cylinder head (oversize):

Bearing 1	45.188 to 45.163 mm
Bearing 2	45.438 to 45.413 mm
Bearing 3	45.668 to 45.663 mm
Bearing 4	45.938 to 45.913 mm
Bearing 5	46.188 to 46.163 mm

Valve tappet bore diameter (standard) 22.235 to 22.265 mm

Valve tappet bore diameter (oversize) 22.489 to 22.519 mm

Valve seat angle (inlet and exhaust) 44° 30' to 45° 30'

Valve seat width (inlet and exhaust) 1.75 to 2.32 mm*

*The cylinder head has valve seat rings on the exhaust side. These valve seats cannot be recut with conventional tools.

Valves - general

	Inlet	Exhaust
Valve length:		
1.4 litre engine	136.29 to 136.75 mm	132.97 to 133.43 mm
1.6 litre engine	134.54 to 135.00 mm	131.57 to 132.03 mm
Valve head diameter:		
1.4 litre engine	39.90 to 40.10 mm	33.90 to 34.10 mm
1.6 litre engine	41.90 to 42.10 mm	36.90 to 37.10 mm
Valve stem diameter (standard)	8.025 to 8.043 mm	7.999 to 8.017 mm
Valve stem diameter (0.2 mm oversize)	8.225 to 8.243 mm	8.199 to 8.217 mm
Valve stem diameter (0.4 mm oversize)	8.425 to 8.443 mm	8.399 to 8.417 mm
Valve stem-to-guide clearance	0.020 to 0.063 mm	0.046 to 0.089 mm

Cylinder block

Cylinder bore diameter:

1.4 litre engine:	
Standard 1	77.22 to 77.23 mm
Standard 2	77.23 to 77.24 mm
Standard 3	77.24 to 77.25 mm
Standard 4	77.25 to 77.26 mm
Oversize A	77.51 to 77.52 mm
Oversize B	77.52 to 77.53 mm
Oversize C	77.53 to 77.54 mm
1.6 litre engine:	
Standard 1	79.94 to 79.95 mm
Standard 2	79.95 to 79.96 mm
Standard 3	79.96 to 79.97 mm
Standard 4	79.97 to 79.98 mm
Oversize A	80.23 to 80.24 mm
Oversize B	80.24 to 80.25 mm
Oversize C	80.25 to 80.26 mm

2D•4 Engine removal and overhaul procedures

Pistons and piston rings

Piston diameter (production):

1.4 litre engine:	
Standard 1	77.190 to 77.200 mm
Standard 2	77.200 to 77.210 mm
Standard 3	77.210 to 77.220 mm
Standard 4	77.220 to 77.230 mm
Oversize A	77.480 to 77.490 mm
Oversize B	77.490 to 77.500 mm
Oversize C	77.500 to 77.510 mm
1.6 litre carburettor engine and turbocharged engine:	
Standard 1	79.910 to 79.920 mm
Standard 2	79.920 to 79.930 mm
Standard 3	79.930 to 79.940 mm
Standard 4	79.940 to 79.950 mm
Oversize A	80.200 to 80.210 mm
Oversize B	80.210 to 80.220 mm
Oversize C	80.220 to 80.230 mm
1.6 litre EFI (non-turbo) fuel injection engine:	
Standard 1	79.915 to 79.925 mm
Standard 2	79.925 to 79.935 mm
Standard 3	79.935 to 79.945 mm
Standard 4	79.945 to 79.955 mm
Oversize A	80.205 to 80.215 mm
Oversize B	80.215 to 80.225 mm
Oversize C	80.225 to 80.235 mm
Piston-to-cylinder bore clearance:	
1.4 litre engine	0.020 to 0.040 mm
1.6 litre carburettor engine and turbocharged engine	0.020 to 0.040 mm
1.6 litre EFI (non-turbo) fuel injection engine	0.015 to 0.035 mm
Piston ring end gaps - installed:	
Compression rings	0.30 to 0.50 mm
Oil control rings:	
1.4 litre engine	0.40 to 1.40 mm
1.6 litre carburettor engine and turbocharged engine	0.40 to 1.40 mm
1.6 litre EFI (non-turbo) fuel injection engine	0.25 to 0.40 mm

Gudgeon pins

Length:

1.4 litre engine	63.000 to 63.800 mm
1.6 litre carburettor engine	66.200 to 67.000 mm
1.6 litre EFI (non-turbo) fuel injection engine	63.000 to 63.800 mm
1.6 litre turbocharged engine	63.600 to 64.400 mm
Diameter:	
White colour code	20.622 to 20.625 mm
Red colour code	20.625 to 20.628 mm
Blue colour code	20.628 to 20.631 mm
Yellow colour code	20.631 to 20.634 mm
Clearance in piston	0.005 to 0.011 mm
Interference fit in connecting rod	0.013 to 0.045 mm

Crankshaft and bearings

Main bearing journal diameter:

Standard	57.98 to 58.00 mm
0.25 mm undersize	57.73 to 57.75 mm
0.50 mm undersize	57.48 to 57.50 mm
0.75 mm undersize	57.23 to 57.25 mm
Main bearing journal-to-shell running clearance	0.011 to 0.058 mm
Crankpin (big-end) bearing journal diameter:	
Standard	47.89 to 47.91 mm
0.25 mm undersize	47.64 to 47.66 mm
0.50 mm undersize	47.39 to 47.41 mm
0.75 mm undersize	47.14 to 47.16 mm
1.00 mm undersize	46.89 to 46.91 mm
Crankpin (big-end) bearing journal-to-shell running clearance	0.006 to 0.060 mm
Crankshaft endfloat	0.09 to 0.30 mm
Thrustwasher thickness:	
Standard	2.301 to 2.351 mm
Oversize	2.491 to 2.541 mm

Torque wrench settings	Nm	lbf ft
Main bearing caps	95	70
Crankpin (big-end) bearing caps	33	24
Engine-to-transmission bolts	41	30

Note: Refer to Part B of this Chapter for remaining torque wrench settings.

Zetec engines

Cylinder head

Maximum permissible gasket surface distortion	0.10 mm
Valve seat included angle	90°
Valve guide bore	6.060 to 6.091 mm

Valves - general

	Inlet	Exhaust
Valve length	96.870 to 97.330 mm	96.470 to 96.930 mm
Valve head diameter:		
1.6 litre engine	26.0 mm	24.5 mm
1.8 litre engine	32.0 mm	28.0 mm
Valve stem diameter	6.028 to 6.043 mm	6.010 to 6.025 mm
Valve stem-to-guide clearance	0.017 to 0.064 mm	0.035 to 0.081 mm

Cylinder block

Cylinder bore diameter:	
1.6 litre engine:	
Class 1	76.000 to 76.010 mm
Class 2	76.010 to 76.020 mm
Class 3	76.020 to 76.030 mm
1.8 litre engine:	
Class 1	80.600 to 80.610 mm
Class 2	80.610 to 80.620 mm
Class 3	80.620 to 80.630 mm

Pistons and piston rings

Piston diameter	
1.6 litre engine:	
Class 1	75.975 to 75.985 mm
Class 2	75.985 to 75.995 mm
Class 3	75.995 to 76.005 mm
1.8 litre engine:	
Class 1	80.570 to 80.580 mm
Class 2	80.580 to 80.590 mm
Class 3	80.590 to 80.600 mm
Oversizes - all engines	None available
Piston-to-cylinder bore clearance	Not specified
Piston ring end gaps - installed:	
Compression rings	0.30 to 0.50 mm
Oil control ring:	
1.6 litre engine	0.25 to 1.00 mm
1.8 litre engine	0.38 to 1.14 mm

Gudgeon pin

Diameter:	
White colour code/piston crown marked "A"	20.622 to 20.625 mm
Red colour code/piston crown marked "B"	20.625 to 20.628 mm
Blue colour code/piston crown marked "C"	20.628 to 20.631 mm
Clearance in piston	0.010 to 0.016 mm
Interference fit in connecting rod	0.011 to 0.042 mm

Crankshaft and bearings

Main bearing journal standard diameter	57.980 to 58.000 mm
Main bearing journal-to-shell running clearance	0.011 to 0.058 mm
Main bearing shell undersizes available	0.02 mm, 0.25 mm
Crankpin (big-end) bearing journal standard diameter	46.890 to 46.910 mm
Crankpin (big-end) bearing journal-to-shell running clearance	0.016 to 0.070 mm
Big-end bearing shell undersizes available	0.02 mm, 0.25 mm
Crankshaft endfloat	0.090 to 0.310 mm

Torque wrench settings	Nm	lbf ft
Main bearing cap bolts and nuts	80	59
Crankpin (big-end) bearing cap bolts:		
Stage 1	18	13
Stage 2	Angle-tighten a further 90°	
Piston-cooling oil jet/blanking plug Torx screws	9	7
Cylinder block and head oilway blanking plugs:		
M6 x 10	9	7
M10 x 11.5 - in block	23	17
1/4 PTF plug - in block	24	18
Engine-to-transmission bolts	41	30

Note: Refer to Part C of this Chapter for remaining torque wrench settings.

1 General information

Included in this Part of Chapter 2 are details of removing the engine/transmission from the car and general overhaul procedures for the cylinder head, cylinder block/crankcase and all other engine internal components.

The information given ranges from advice concerning preparation for an overhaul and the purchase of replacement parts, to detailed step-by-step procedures covering removal, inspection, renovation and refitting of engine internal components.

After Section 6, all instructions are based on the assumption that the engine has been removed from the car. For information concerning in-car engine repair, as well as the removal and refitting of those external components necessary for full overhaul, refer to Part A, B or C of this Chapter (as applicable) and to Section 6. Ignore any preliminary dismantling operations described in Part A, B or C that are no longer relevant once the engine has been removed from the car.

2 Engine/transmission removal - preparation and precautions

If you have decided that an engine must be removed for overhaul or major repair work, several preliminary steps should be taken.

Locating a suitable place to work is extremely important. Adequate work space, along with storage space for the car, will be needed. If a workshop or garage is not available, at the very least, a flat, level, clean work surface is required.

If possible, clear some shelving close to the work area and use it to store the engine components and ancillaries as they are removed and dismantled. In this manner the components stand a better chance of staying clean and undamaged during the overhaul. Laying out components in groups together with their fixing bolts, screws etc will save time and avoid confusion when the engine is refitted.

Clean the engine compartment and engine/transmission before beginning the removal procedure; this will help visibility and help to keep tools clean.

On three of the engines covered in this manual (CVH, PTE, and Zetec), the unit can only be withdrawn by removing it complete with the transmission; the vehicle's body must be raised and supported securely, sufficiently high that the engine/transmission can be unbolted as a single unit and lowered to the ground; the engine/transmission unit can then be withdrawn from under the vehicle and separated. On all engines, an engine hoist or A-frame will be necessary. Make sure the equipment is rated in excess of the combined weight of the engine and transmission.

The help of an assistant should be available; there are certain instances when one person cannot safely perform all of the operations required to remove the engine from the vehicle. Safety is of primary importance, considering the potential hazards involved in this kind of operation. A second person should always be in attendance to offer help in an emergency. If this is the first time you have removed an engine, advice and aid from someone more experienced would also be beneficial.

Plan the operation ahead of time. Before starting work, obtain (or arrange for the hire of) all of the tools and equipment you will need. Access to the following items will allow the task of removing and refitting the engine/transmission to be completed safely and with relative ease: an engine hoist - rated in excess of the combined weight of the engine/transmission, a heavy-duty trolley jack, complete sets of spanners and sockets as described in "Tools and working facilities" at the rear this manual, wooden blocks, and plenty of rags and cleaning solvent for mopping up spilled oil, coolant and fuel. A selection of different sized plastic storage bins will also prove useful for keeping dismantled components grouped together. If any of the equipment must be hired, make sure that you arrange for it in advance, and perform all of the operations possible without it beforehand; this may save you time and money.

Plan on the vehicle being out of use for quite a while, especially if you intend to carry out an engine overhaul. Read through the whole of this Section and work out a strategy

based on your own experience and the tools, time and workspace available to you. Some of the overhaul processes may have to be carried out by a Ford dealer or an engineering works - these establishments often have busy schedules, so it would be prudent to consult them before removing or dismantling the engine, to get an idea of the amount of time required to carry out the work.

When removing the engine from the vehicle, be methodical about the disconnection of external components. Labelling cables and hoses as they removed will greatly assist the refitting process.

Always be extremely careful when lifting the engine/transmission assembly from the engine bay. Serious injury can result from careless actions. If help is required, it is better to wait until it is available rather than risk personal injury and/or damage to components by continuing alone. By planning ahead and taking your time, a job of this nature, although major, can be accomplished successfully and without incident.

3 Engine - removal and refitting (HCS engines)



Warning: Petrol is extremely flammable, so take extra precautions when disconnecting any part of the fuel system.

Don't smoke, or allow naked flames or bare light bulbs, in or near the work area, and don't work in a garage where a natural-gas appliance (such as a clothes dryer or water heater) is installed. If you spill petrol on your skin, rinse it off immediately. Have a fire extinguisher rated for petrol fires handy, and know how to use it.

Note: Read through the entire Section, as well as reading the advice in the preceding Section, before beginning this procedure. The engine is removed separately from the transmission and is lifted upwards and out of the engine compartment.

Removal

- 1 On fuel injection engines, refer to Chapter 4B and depressurise the fuel system.
- 2 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1).