Every 20 000 miles (32 000 km) or two years, whichever comes first

21 Spark plug renewal and HT component check

Note: *Spark plug renewal at this service interval is only necessary on the HCS, CVH and PTE engines. On Zetec engines, the recommended interval for spark plug renewal is every 30 000 miles or three years.*

Spark plug check and renewal

1 It is vital for the correct running, full performance and proper economy of the engine that the spark plugs perform with maximum efficiency. The most important factor in ensuring this is that the plugs fitted are appropriate for the engine. The suitable type is given in the Specifications Section at the beginning of this Chapter, on the Vehicle Emissions Control Information (VECI) label located on the underside of the bonnet (only on models sold in some areas) or in the vehicle's Owner's Handbook. If the correct type is used and the engine is in good condition, the spark plugs should not need attention between scheduled renewal intervals. Spark plug cleaning is rarely necessary, and should not be attempted unless specialised equipment is available, as damage can easily be caused to the firing ends.

2 Spark plug removal and refitting requires a spark plug socket, with an extension which can be turned by a ratchet handle or similar. This socket is lined with a rubber sleeve, to protect the porcelain insulator of the spark plug, and to hold the plug while you insert it into the spark plug hole. You will also need a set of feeler gauges, to check the spark plug electrode gap, and a torque wrench to tighten the new plugs to the specified torque **(see illustration)**.

3 To remove the spark plugs, first open the bonnet; the plugs are easily reached at the top of the engine. Note how the spark plug (HT) leads are routed and secured by clips, and on some engines, how they're positioned along the channel in the cylinder head cover. To prevent the possibility of mixing up spark plug (HT) leads, it is a good idea to try to work on one spark plug at a time.

4 If the marks on the original-equipment spark plug (HT) leads cannot be seen, mark the leads 1 to 4, to correspond to the cylinder the lead serves (No 1 cylinder is at the timing belt/chain end of the engine). Pull the leads from the plugs by gripping the rubber boot, not the lead, otherwise the lead connection may be fractured.

5 It is advisable to soak up any liquid in the spark plug recesses with a rag, and to remove any dirt from them using a clean brush, vacuum cleaner or compressed air before removing the plugs, to prevent any dirt or water from dropping into the cylinders.

Warning: Wear eye protection when using compressed air!

6 Unscrew the spark plugs, ensuring that the socket is kept in alignment with each plug - if the socket is forcibly moved to either side, the porcelain top of the plug may be broken off. If any undue difficulty is encountered when unscrewing any of the spark plugs, carefully check the cylinder head threads and tapered sealing surfaces for signs of wear, excessive corrosion or damage; if any of these conditions is found, seek the advice of a Ford dealer as to the best method of repair.

7 As each plug is removed, examine it as follows - this will give a good indication of the condition of the engine. If the insulator nose is covered with light tan to greyish-brown deposits, then the mixture is correct, and it is likely that the engine is in good condition.

8 If the tip and insulator nose are covered with hard black-looking deposits, then this is indicative that the mixture is too rich. Should the plug be black and oily, then it is likely that the engine is fairly worn, as well as the mixture being too rich.

9 If the insulator nose of the spark plug is clean and white, with no deposits, this is indicative of a weak mixture.

10 If you are renewing the spark plugs, purchase the new plugs, then check each of them first for faults such as cracked insulators or damaged threads. Note also that, whenever the spark plugs are renewed as a routine service operation, the spark plug (HT) leads should be checked as described below.

11 The spark plug electrode gap is of considerable importance as, if it is too large or too small, the size of the spark and its efficiency will be seriously impaired. The gap should be set to the value given in the Specifications Section of this Chapter. New plugs will not necessarily be set to the correct gap, so they should always be checked before fitting.

12 The spark plug gap is correct when the correct-size feeler gauge or wire gauge is a firm sliding fit between the electrodes **(see illustrations)**.

13 To adjust the electrode gap, bend open, or close up, the outer plug electrode until the correct gap is achieved **(see illustration)**. The centre electrode should never be bent, as this may crack the insulation and cause plug failure,

21.2 Tools required for changing spark plugs

21.12a Measuring a spark plug gap with a feeler gauge

21.12b Spark plug manufacturers recommend using a wire-type gauge when checking the gap - if the wire or feeler gauge does not slide between the electrodes with a slight drag, adjustment is required

21.13 To change the gap, bend the outer electrode only, and be very careful not to crack or chip the porcelain insulator surrounding the centre electrode

if nothing worse. If the outer electrode is not exactly over the centre electrode, bend it gently to align them. Special spark plug gap adjusting tools are available from motor accessory shops, or from certain spark plug manufacturers.

14 Before fitting the spark plugs, check that the threaded connector sleeves at the top of the plugs are tight, and that the plug exterior surfaces and threads are clean. Brown staining on the porcelain, immediately above the metal body, is quite normal, and does not necessarily indicate a "leak" between the body and insulator.

15 Apply a smear of copper-based grease or anti-seize compound to the threads of each plug, and screw them in by hand where possible. Take extra care to enter the plug threads correctly, as the cylinder head is of aluminium alloy.

HAYNES HiNT

It's often difficult to insert spark plugs into their holes without cross-threading them. To avoid this possibility, fit a short piece of rubber hose over the end of the spark plug. The flexible hose acts as a universal joint, to help align the plug with the plug hole. Should the plug begin to cross-thread, the hose will slip on the spark plug, preventing thread damage.

16 When each spark plug is started correctly on its threads, screw it down until it just seats lightly, then tighten it to the specified torque wrench setting. If a torque wrench is not available - and this is one case where the use of a torque wrench is strongly recommended - tighten each spark plug through *no more than* 1/4 of a turn (CVH and PTE engines) or 1/16 of a turn (HCS and Zetec engines) after it seats. HCS and Zetec engines are fitted with taper-seat spark plugs, identifiable by not having a sealing washer, and these in particular should *NEVER* be overtightened - their tapered seats mean they are almost impossible to remove if abused.

17 Reconnect the spark plug (HT) leads in their correct order, using a twisting motion on the boot until it is firmly seated on the end of the spark plug and on the cylinder head cover.

Spark plug (HT) lead, distributor cap and rotor arm check

18 The spark plug (HT) leads should be checked whenever the plugs themselves are renewed. Start by making a visual check of the leads while the engine is running. In a darkened garage (make sure there is ventilation) start the engine and observe each lead. Be careful not to come into contact with any moving engine parts. If there is a break in the lead, you will see arcing or a small spark at the damaged area.

19 The spark plug (HT) leads should be inspected one at a time, to prevent mixing up the firing order, which is essential for proper engine operation. Each original lead should be numbered to identify its cylinder. If the number is illegible, a piece of tape can be marked with the correct number, and wrapped around the lead (the leads should be numbered 1 to 4, with No 1 lead nearest the timing belt end of the engine). The lead can then be disconnected.

20 Check inside the boot for corrosion, which will look like a white crusty powder. Clean this off as much as possible; if it is excessive, or if cleaning leaves the metal connector too badly eroded to be fit for further use, the lead must be renewed. Push the lead and boot back onto the end of the spark plug. The boot should fit tightly onto the end of the plug - if it doesn't, remove the lead and use pliers carefully to crimp the metal connector inside the boot until the fit is snug.

21 Using a clean rag, wipe the entire length of the lead to remove built-up dirt and grease. Once the lead is clean, check for burns, cracks and other damage. Do not bend the lead sharply, because the conductor might break.

22 Disconnect the lead from the ignition coil by pressing together the plastic retaining catches (where fitted) and pulling the end fitting off the coil terminal. Check for corrosion and for a tight fit. If a meter with the correct measuring range is available, measure the resistance of the disconnected lead from its coil connector to its spark plug connector. If the resistance recorded for any of the leads exceeds the value specified, all the leads should be renewed as a set. Refit the lead to the coil, noting that each coil terminal is marked with its respective cylinder number, so that there is no risk of mixing up the leads and upsetting the firing order.

23 Inspect the remaining spark plug (HT) leads, ensuring that each is securely fastened at the distributor cap or ignition coil and spark plug when the check is complete. If any sign of arcing, severe connector corrosion, burns, cracks or other damage is noticed, obtain new spark plug (HT) leads, renewing them as a set. If new spark plug leads are to be fitted, remove and refit them one at a time, to avoid mix-ups in the firing order.

HAYNES HiNT

If new spark plug leads are to be fitted, remove the leads one at a time and fit each new lead in exactly the same position as the old one.

24 On models with distributor ignition systems, refer to Chapter 5B and remove the distributor cap then thoroughly clean it inside and out with a dry lint-free rag.

25 Examine the HT lead segments inside the cap. If they appear badly burned or pitted renew the cap. Also check the carbon brush in the centre of the cap, ensuring that it is free to move and stands proud of its holder. Make sure that there are no sign of cracks or black "tracking" lines running down the inside of the cap, which will also mean renewal if evident.

26 Inspect the rotor arm checking it for security and also for signs of deterioration as described above.

27 Refit the cap as described in Chapter 5B on completion.

22 Idle speed control valve cleaning and maintenance

Note: *The idle speed control valve may be mounted on the air cleaner, on the engine compartment bulkhead, or on the side of the inlet manifold according to valve make and year of manufacture. Valves manufactured by Weber are mounted on the air cleaner and only these valves require the periodic maintenance described below. Bulkhead and inlet manifold mounted valves are manufactured by Hitachi and are maintenance free. Refer to the warning note in Section 1 of Chapter 4C before proceeding.*

1 Remove the valve as described in Chapter 4C, Section 14.

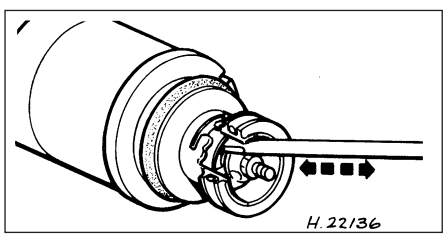
2 Immerse the valve head in a suitable container filled with clean petrol, and allow it to soak for approximately three minutes.

3 Clean the valve bore, slots and piston with petrol, using a suitable lint-free cloth, then gently move the piston up and down in its bore using a small screwdriver **(see illustration)**. Ensure that no cloth particles enter the bore, and do not use the slots to move the piston.

4 Rinse the valve again with clean petrol, then dry it using an air line (or other source of compressed air).

Warning: Wear eye protection when using compressed air!

5 Clean the mating faces of the valve and the air filter housing then refit as described in Chapter 4C, Section 14.



22.3 Gently move the idle speed control valve piston up and down in its bore using a small screwdriver (1.6 litre EFi engine)

Every 30 000 miles (48 000 km) or three years, whichever comes first

23 Coolant renewal

Note: *If the antifreeze used is Ford's own, the coolant need not be renewed for the life of the vehicle. If the vehicle's history is unknown, if antifreeze of lesser quality is known to be in the system, or simply if you prefer to follow conventional servicing intervals, the coolant should be changed periodically (typically, every 3 years) as described here. Refer also to* "Antifreeze - notes on renewal" *in this Section.*

Warning: Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Flush contaminated areas immediately with plenty of water. Don't store new coolant, or leave old coolant lying around, where it's accessible to children or pets - they're attracted by its sweet smell. Ingestion of even a small amount of coolant can be fatal! Wipe up garage-floor and drip-pan spills immediately. Keep antifreeze containers covered, and repair cooling system leaks as soon as they're noticed. Warning: Never remove the expansion tank filler cap when the engine is running, or has just been switched off, as the cooling system will be hot, and the consequent escaping steam and scalding coolant could cause serious injury.

Coolant draining

Warning: Wait until the engine is cold before starting this procedure.

1 To drain the system, first remove the expansion tank filler cap (see *"Weekly Checks"*).

2 If additional working clearance is required, raise the front of the vehicle and support it securely on axle stands (see *"Jacking and Vehicle Support"*).

23.3 Drain plug location at the base of the radiator - use a coin to unscrew the plug

3 Place a large drain tray beneath the radiator, and unscrew the radiator drain plug - you can use a small coin to do this, as the plug's slotted for this purpose **(see illustration)**. Direct as much of the escaping coolant as possible into the tray.

System flushing

4 With time, the cooling system may gradually lose its efficiency, as the radiator core becomes choked with rust, scale deposits from the water, and other sediment (refer also to *"Antifreeze - notes on renewal"* later in this Section). To minimise this, as well as using only good-quality antifreeze and clean soft water, the system should be flushed as follows whenever any part of it is disturbed, and/or when the coolant is renewed.

5 With the coolant drained, refit the drain plug, and refill the system with fresh water. Refit the expansion tank filler cap, start the engine and warm it up to normal operating temperature, then stop it and (after allowing it to cool down completely) drain the system again. Repeat as necessary until only clean water can be seen to emerge, then refill finally with the specified coolant mixture as described below.

6 If only clean, soft water and good-quality antifreeze (even if not to Ford's specification) has been used, and the coolant has been renewed at the suggested intervals, the above procedure will be sufficient to keep the system clean for a considerable length of time. If, however, the system has been neglected, a more thorough operation will be required, as follows.

7 First drain the coolant, then disconnect the radiator top and bottom hoses. Insert a garden hose into the top hose, and allow water to circulate through the radiator until it runs clean from the bottom outlet.

8 To flush the engine, insert the garden hose into the thermostat water outlet, and allow water to circulate until it runs clear from the bottom hose. If, after a reasonable period, the water still does not run clear, the radiator should be flushed with a good proprietary cleaning agent.

9 In severe cases of contamination, reverse-flushing of the radiator may be necessary. To do this, remove the radiator (Chapter 3), invert it, and insert the garden hose into the bottom outlet. Continue flushing until clear water runs from the top hose outlet. A similar procedure can be used to flush the heater matrix.

10 The use of chemical cleaners should be necessary only as a last resort. Normally, regular renewal of the coolant will prevent excessive contamination of the system.

Coolant filling

11 With the cooling system drained and flushed, ensure that all disturbed hose unions are correctly secured, and that the radiator drain plug is securely tightened. If it was raised, lower the vehicle to the ground.

12 Prepare a sufficient quantity of the specified coolant mixture (see below); allow for a surplus, so as to have a reserve supply for topping-up.

13 Slowly fill the system through the expansion tank; since the tank is the highest point in the system, all the air in the system should be displaced into the tank by the rising liquid. Slow pouring reduces the possibility of air being trapped and forming airlocks.

14 Continue filling until the coolant level reaches the expansion tank "MAX" level line, then cover the filler opening to prevent coolant splashing out.

15 Start the engine and run it at idle speed, until it has warmed-up to normal operating temperature and the radiator cooling fan has cut in; watch the temperature gauge to check for signs of overheating. If the level in the expansion tank drops significantly, top-up to the "MAX" level line, to minimise the amount of air circulating in the system.

16 Stop the engine, allow it to cool down *completely* (overnight, if possible), then uncover the expansion tank filler opening and top-up the tank to the "MAX" level line. Refit the filler cap, tightening it securely, and wash off any spilt coolant from the engine compartment and bodywork.

17 After refilling, always check carefully all components of the system (but especially any unions disturbed during draining and flushing) for signs of coolant leaks. Fresh antifreeze has a searching action, which will rapidly expose any weak points in the system.

18 If, after draining and refilling the system, symptoms of overheating are found which did not occur previously, then the fault is almost certainly due to trapped air at some point in the system, causing an airlock and restricting the flow of coolant; usually, the air is trapped because the system was refilled too quickly. In some cases, airlocks can be released by tapping or squeezing the various hoses. If the problem persists, stop the engine and allow it to cool down completely, before unscrewing the expansion tank filler cap or disconnecting hoses to bleed out the trapped air.

Antifreeze mixture

19 If the antifreeze used is not to Ford's specification, it should always be renewed at the suggested intervals (typically, every 2 or 3 years). This is necessary not only to maintain the antifreeze properties, but also to prevent

the corrosion which would otherwise occur as the corrosion inhibitors become progressively less effective. Always use an ethylene glycol-based antifreeze which is suitable for use in mixed-metal cooling systems.

20 If the antifreeze used is to Ford's specification, the levels of protection it affords are indicated in the Specifications Section of this Chapter. To give the recommended *standard* mixture ratio for this antifreeze, 40% (by volume) of antifreeze must be mixed with 60% of clean, soft water; if you are using any other type of antifreeze, follow its manufacturer's instructions to achieve the correct ratio. It is best to make up slightly more than the system's specified capacity, so that a supply is available for subsequent topping-up.

21 Before adding antifreeze, the cooling system should be completely drained, preferably flushed, and all hoses checked for condition and security. As noted earlier, fresh antifreeze will rapidly find any weaknesses in the system.

22 After filling with antifreeze, a label should be attached to the expansion tank, stating the type and concentration of antifreeze used, and the date installed. Any subsequent topping-up should be made with the same type and concentration of antifreeze. If topping-up using antifreeze to Ford's specification, note that a 50/50 mixture is permissible, purely for convenience.

23 Do not use engine antifreeze in the windscreen/tailgate washer system, as it will damage the vehicle's paintwork. A screenwash additive should be added to the washer system in its maker's recommended quantities.

Antifreeze - notes on renewal

24 Ford state that, where antifreeze to Ford specification ESD-M97B-49-A is used, it will last the lifetime of the vehicle. This is subject to it being used in the recommended concentration, unmixed with any other type of antifreeze or additive, and topped-up when necessary using only that antifreeze mixed 50/50 with clean water. If any other type of antifreeze is added, the lifetime guarantee no longer applies; to restore the lifetime protection, the system must be drained and thoroughly reverse-flushed before fresh coolant mixture is poured in.

25 If the vehicle's history (and therefore the quality of the antifreeze in it) is unknown, owners who wish to follow Ford's recommendations are advised to drain and thoroughly reverse-flush the system before refilling with fresh coolant mixture. If the appropriate quality of antifreeze is used, the coolant can then be left for the life of the vehicle.

26 If any antifreeze other than Ford's is to be used, the coolant must be renewed at regular intervals to provide an equivalent degree of protection; the conventional recommendation is to renew the coolant every two or three years.

27 The above assumes the use of a mixture (in exactly the specified concentration) of clean, soft water and of antifreeze to Ford's specification or equivalent. It is also assumed that the cooling system is maintained in a scrupulously-clean condition, by ensuring that only clean coolant is added on topping-up, and by thorough reverse-flushing whenever the coolant is drained.

General cooling system checks

28 The engine should be cold for the cooling system checks, so perform the following procedure before driving the vehicle, or after it has been shut off for at least three hours.

29 Remove the expansion tank filler cap, and clean it thoroughly inside and out with a rag. Also clean the filler neck on the expansion tank. The presence of rust or corrosion in the filler neck indicates that the coolant should be changed. The coolant inside the expansion tank should be relatively clean and transparent. If it is rust-coloured, drain and flush the system, and refill with a fresh coolant mixture.

30 Carefully check the radiator hoses and heater hoses along their entire length; renew any hose which is cracked, swollen or deteriorated (see Section 5).

31 Inspect all other cooling system components (joint faces, etc.) for leaks. A leak in the cooling system will usually show up as white- or rust-coloured deposits on the area adjoining the leak. Where any problems of this nature are found on system components, renew the component or gasket with reference to Chapter 3.

32 Clean the front of the radiator with a soft brush to remove all insects, leaves, etc, embedded in the radiator fins. Be careful not to damage the radiator fins, or cut your fingers on them.

24 Air cleaner element renewal

1 The air cleaner filter element is located in the air cleaner assembly mounted either on top of the carburettor or CFi unit, or on the left-hand or right-hand side of the engine compartment at the front. Remove the air cleaner lid as follows according to type.

Carburettor and CFi fuel injection models

2 Undo the two or three retaining screws on the top of the air cleaner lid **(see illustration)**.

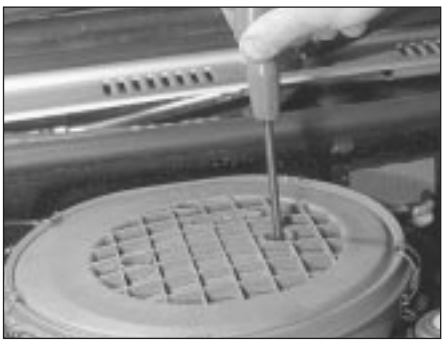
3 Release the clips, and lift off the air cleaner cover **(see illustration)**.

EFi fuel injection models

4 If the idle speed control valve is mounted on the air cleaner, disconnect the multi-plug and the air bypass hose from the valve.

5 Disconnect the flexible hose between the air cleaner lid and the air inlet duct or turbocharger air intake.

6 Release the retaining clips and lift off the air cleaner lid **(see illustration)**.



24.2 On carburettor and CFi fuel injection engines, undo the air cleaner lid retaining screws . . .

24.3 . . . then spring back the clips and lift of the lid

24.6 On EFi fuel injection engines, release the retaining clips and lift off the air cleaner lid

24.7 On SEFi fuel injection engines, disconnect the mass air flow sensor wiring multi-plug . . .

24.8 . . . slacken the hose clip and disconnect the intake hose from the air intake duct . . .

24.9 . . . then undo the retaining screws or release the clips and lift off the air cleaner lid complete with mass air flow sensor

SEFi fuel injection models

7 Disconnect the mass air flow sensor wiring multi-plug **(see illustration)**.
8 Slacken the hose clip and disconnect the flexible rubber intake hose from the black plastic air intake duct **(see illustration)**.
9 Undo the retaining screws or release the clips and lift off the air cleaner lid complete with mass air flow sensor **(see illustration)**.

All models

10 Lift out the element, and wipe out the housing **(see illustrations)**. Check that no foreign matter is visible, either in the air inlet or in the air mass meter, as applicable.
11 If carrying out a routine service, the element must be renewed regardless of its apparent condition. Note that on models so equipped, the small foam PCV filter in the rear right-hand corner of the air cleaner housing must be cleaned whenever the air filter element is renewed (see Section 25).
12 If you are checking the element for any other reason, inspect its lower surface; if it is oily or very dirty, renew the element. If it is only moderately dusty, it can be re-used after blowing it clean from the upper to the lower surface with compressed air.

Warning: Wear eye protection when using compressed air! Because it is a pleated-paper type filter, it cannot be washed or re-oiled. If it cannot be cleaned satisfactorily with compressed air, discard and renew it.
Caution: Never drive the vehicle with the air cleaner filter element removed. Excessive engine wear could result, and backfiring could even cause a fire under the bonnet.

13 Refitting is the reverse of the removal procedure. Ensure that the element and cover are securely seated, so that unfiltered air cannot enter the engine.

Air cleaner temperature control system check (carburettor models)

14 In order for the engine to operate efficiently, the temperature of the air entering the inlet system must be controlled within certain limits.
15 The air cleaner has two sources of air, one direct from the outside of the engine compartment, and the other from a shroud on the exhaust manifold. On HCS engines, a wax-controlled thermostatic valve controls a flap inside the air cleaner inlet. When the ambient air temperature is below a predetermined level, the flap admits air heated from the exhaust manifold shroud; as the ambient temperature rises, the flap opens to admit more cool air from the engine compartment until eventually it is fully open. A similar system is used on CVH engines, except that a vacuum actuator modifies any opening or closing action of the temperature sensor on the flap valve, according to the level of the inlet manifold vacuum under running conditions.

HCS engines

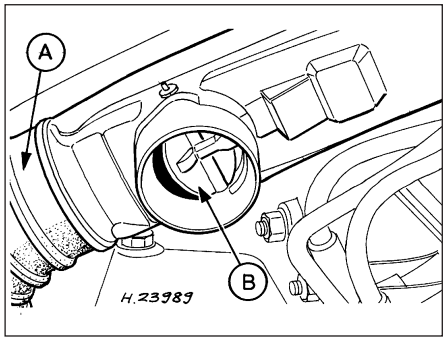
16 This check must be made when the engine is cold. Detach and remove the air cleaner inlet trunking. Examine the position of the check valve within the duct. When the underbonnet air temperature is below 28ºC, the valve must be open to allow hot air to enter the filter **(see illustration)**.
17 Refit the inlet trunking. Start the engine and run it until it reaches its normal operating temperature, then stop the engine, remove the inlet trunking and check that the valve has closed off the air passage from the exhaust and opened the main (cool) air inlet.
18 If the flap does not operate correctly, check that it is not seized. Apart from this there is no adjustment possible, and the unit should be renewed if faulty. Refit the air inlet trunking on completion.

CVH engines

19 This check must be made when the engine is cold. Disconnect the main air inlet duct, and visibly check that the flap to the hot-air inlet is closed (i.e. open to the passage of cold air).
20 Start the engine, and check that with the

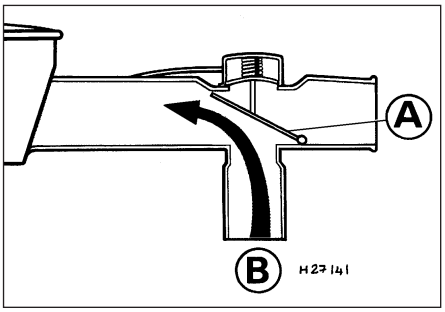
24.10a Removing the air filter element on carburettor engine models . . .

24.10b . . . and on EFi and SEFi fuel injection engine models



24.16 Air cleaner inlet and flap valve on the HCS engine

A Main air cleaner inlet (cool air)
B Warm air duct (flap open)



24.20 Air cleaner inlet and flap valve on the CVH engine

A Flap open (cool air inlet closed)
B Warm air inlet

25.5 Crankcase ventilation system filter on CVH engines

25.13 The crankcase ventilation system foam filter is located in the air cleaner housing on Zetec engines

engine idling, the hot-air inlet is open to allow warm air from the exhaust manifold area to enter the air cleaner. If the flap operates as described, it is functioning correctly **(see illustration)**.

21 If the flap fails to operate as described, check the condition of the vacuum pipe and its connections, and check that the flap valve has not seized. If these are in order, either the temperature sensor or vacuum actuator is faulty, and a new air cleaner assembly must be obtained. Refit the main air duct on completion.

25 Emission control system check

General

1 Of the emission control systems that may be fitted, only the crankcase ventilation system and the evaporative emission control systems require regular checking, and even then, the components of these systems require minimal attention.

2 Should it be felt that the other systems are not functioning correctly, the advice of a dealer should be sought.

Crankcase ventilation system

3 The function of the crankcase ventilation system is to reduce the emission of unburned hydrocarbons from the crankcase, and to minimise the formation of oil sludge. By ensuring that a depression is created in the crankcase under most operating conditions, particularly at idle, and by positively inducing fresh air into the system, the oil vapours and "blow-by" gases collected in the crankcase are drawn from the crankcase, through the air cleaner or oil separator, into the inlet tract, to be burned by the engine during normal combustion.

4 On HCS engines, the system consists of a vented oil filler cap (with an integral mesh filter) and a hose connecting it to the oil separator/engine breather valve connector on the underside of the air cleaner housing. A further hose leads from the adapter/filter to the inlet manifold.

5 On CVH engines, a closed-circuit type crankcase ventilation system is used, the function of which is basically the same as that described for the HCS engine types, but the breather hose connects directly to the rocker cover. A separate filter is fitted in the hose to the rocker cover in certain applications **(see illustration)**.

6 The system fitted to the PTE engines is similar to that used on the earlier (CVH) engines on which these engines are based, but with revisions to the hose arrangement to suit the remotely sited air cleaner and fuel injection system layout.

7 On Zetec engines, the crankcase ventilation system main components are the oil separator mounted on the front (radiator) side of the cylinder block/crankcase, and the Positive Crankcase Ventilation (PCV) valve set in a rubber grommet in the separator's left-hand upper end. The associated pipework consists of a crankcase breather pipe and two flexible hoses connecting the PCV valve to a union on the left-hand end of the inlet manifold, and a crankcase breather hose connecting the cylinder head cover to the air cleaner assembly. A small foam filter in the air cleaner prevents dirt from being drawn directly into the engine.

8 Check that all components of the system are securely fastened, correctly routed (with no kinks or sharp bends to restrict flow) and in sound condition; renew any worn or damaged components.

9 On HCS engines, remove and inspect the oil filler cap to ensure that it is in good condition, and not blocked up with sludge.

10 Disconnect the hoses at the cap, and clean the cap if necessary by brushing the inner mesh filter with petrol, and blowing through with light pressure from an air line. Renew the cap if it is badly congested.

11 If oil leakage is noted, disconnect the various hoses and pipes, and check that all are clear and unblocked. Remove the air cleaner lid, and check that the hose from the cylinder head cover to the air cleaner housing is clear and undamaged.

12 Where fitted, the PCV valve is designed to allow gases to flow out of the crankcase only, so that a depression is created in the crankcase under most operating conditions, particularly at idle. Therefore, if either the oil separator or the PCV valve are thought to be blocked, they must be renewed (see Chapter 4E). In such a case, however, there is nothing to be lost by attempting to flush out the blockage using a suitable solvent. The PCV valve should rattle when shaken.

13 While the air filter element is removed (see Section 24), wipe out the housing, and on Zetec engines, withdraw the small foam filter from its location in the rear right-hand corner of the housing **(see illustration)**. If the foam is badly clogged with dirt or oil, it must be cleaned by soaking it in a suitable solvent, and allowed to dry before being refitted.

Evaporative emission control systems

14 Refer to the checks contained in Chapter 4E.

26 Automatic transmission fluid renewal

1 The automatic transmission fluid should only be changed when the transmission is cold.

2 Position the vehicle over an inspection pit, on vehicle ramps, or jack it up and securely support it on axle stands, but make sure that it is level.

3 Place a suitable container beneath the drain plug on the transmission sump pan. Remove the transmission fluid dipstick to speed up the draining operation.

4 Thoroughly clean the area around the drain plug in the transmission sump pan, then unscrew the plug and allow the fluid to drain into the container.

5 When all the fluid has drained (this may take quite some time) clean the drain plug, then refit it together with a new seal and tighten it securely.

6 Place a funnel with a fine mesh screen in the dipstick tube, and fill the transmission with

the specified type of fluid. It is essential that no dirt is introduced into the transmission during this operation.

7 Depending on the extent to which the fluid was allowed to drain, it is possible that the amount of fluid required when filling the transmission may be more than the specified amount (see *"Lubricants, fluids and tyre pressures"*). However, due to fluid remaining in the system, it is more likely that less than the specified amount will be required. Add about half the specified amount, then run the engine up to its normal operating temperature and check the level on the dipstick. When the level approaches the maximum mark, proceed as detailed in Section 20 to check the level and complete the final topping-up as described.

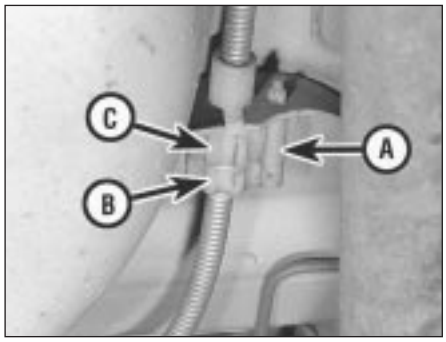
27 Handbrake adjustment

1 Chock the front wheels then jack up the rear of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Fully release the handbrake.

2 Check that the handbrake cables are correctly routed and secured by the retaining clips at the appropriate points under the vehicle.

3 The handbrake is checked for adjustment by measuring the amount of movement possible in the handbrake adjuster plungers. These are located on the inside face of each rear brake backplate **(see illustration)**. The total movement of the two plungers combined should be between 0.5 and 2.0 mm. If the movement measured is outside of this tolerance, the handbrake is in need of adjustment. Adjustment is made altering the position of the in-line cable adjuster sleeve.

27.3 Handbrake adjustment plunger located on the inside face of each rear brake backplate



27.5 Handbrake cable adjuster locking pin (A), locknut (B) and adjuster sleeve (C)

4 When adjustment to the handbrake is necessary, a new adjustment sleeve locking pin will be required, and this must therefore be obtained before making the adjustment.

5 To adjust the handbrake, first ensure that it is fully released, then firmly apply the footbrake a few times to ensure that the rear brake adjustment is taken up by the automatic adjusters. Extract the locking pin from the adjuster sleeve **(see illustration)**, then turn the sleeve to set the combined movement of the plungers within the tolerance range specified (0.5 to 2.0 mm). Turn the locking nut by hand as tight as is possible (two clicks) against the adjustment sleeve. Now grip the locknut with a suitable wrench, and turn it a further two clicks (maximum).

6 Secure the adjustment by inserting the new lock pin.

7 Check that the operation of the handbrake is satisfactory, then lower the vehicle to the ground, apply the handbrake and remove the chocks from the front wheels.

28 Front wheel alignment check

Refer to Chapter 10, Section 29.

Every 40 000 miles

29 Timing belt renewal

Refer to Chapter 2, Part B or C as applicable.

Every 60 000 miles

30 Fuel filter renewal

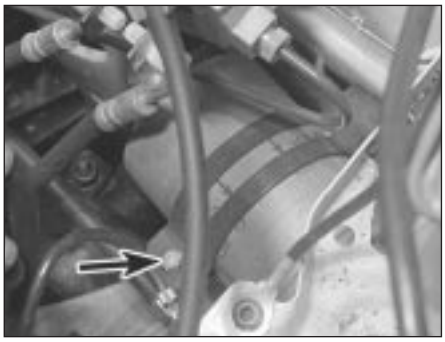
Warning: Petrol is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke, or allow open flames or bare light bulbs, near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present. While performing any work on the fuel system, wear safety glasses, and have a suitable (Class B) fire extinguisher on hand. If you spill any fuel on your skin, rinse it off immediately with soap and water.

1 On fuel injection engines, an in-line fuel filter is provided in the fuel pump outlet line. The filter is located in the engine compartment either below and behind the battery, or on the left-hand side of the engine compartment bulkhead. The renewal procedure is the same for both locations. The filter performs a vital role in keeping dirt and other foreign matter out of the fuel system, and so must be renewed at regular intervals, or whenever you have reason to suspect that it may be clogged. It is always unpleasant working under a vehicle - pressure-washing or hosing clean the underbody in the filter's vicinity will make working conditions more tolerable, and will reduce the risk of getting dirt into the fuel system.

2 Depressurise the fuel system as described in the relevant Part of Chapter 4.

3 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1), then position a suitable container beneath the fuel filter to catch escaping fuel. Have a rag handy to soak

30.5 Releasing the fuel pipe unions from the filter on models with quick-release couplings



30.6a Fuel filter location below battery showing clamp bolt (arrowed). Note fuel flow direction arrows on filter body

30.6b Removing the bulkhead mounted fuel filter. Clamp bolt (arrowed)

up the fuel when the feed and outlet pipe unions are disconnected.

4 On models without quick-release couplings on the fuel lines, slowly slacken the fuel feed pipe union allowing the pressure in the fuel pipe to reduce. When the pressure is fully released, disconnect the fuel feed and outlet pipe unions.

5 On models with quick-release couplings on the fuel lines, release the fuel feed and outlet pipe unions from the filter, by squeezing together the protruding locking lugs on each union, and carefully pulling the union off the filter stub **(see illustration)**. Where the unions are colour-coded, the feed and outlet pipes cannot be confused; where both unions are the same colour, note carefully which pipe is connected to which filter stub, and ensure that they are correctly reconnected on refitting.

6 Noting the arrows and/or other markings on the filter showing the direction of fuel flow (towards the engine), slacken the filter clamp bolt and withdraw the filter from the car **(see illustrations)**. Note that the filter will still contain fuel; care should be taken, to avoid spillage and to minimise the risk of fire.

7 On installation, slide the filter into its clamp so that the arrow marked on it faces the correct way, then reconnect and tighten the pipe unions or slide each pipe union on to its (correct) respective filter stub, and press it down until the locking lugs click into their groove. Tighten the clamp bolt carefully, until the filter is just prevented from moving; do not overtighten, or the filter casing may be crushed.

8 Refit the fuel pump fuse and reconnect the battery earth terminal, then switch the ignition on and off five times, to pressurise the system. Check for any sign of fuel leakage around the filter unions before lowering the vehicle to the ground and starting the engine.

Every 3 years

31 Brake fluid renewal

The procedure is similar to that for the bleeding of the hydraulic system as described in Chapter 9, except that the brake fluid reservoir should be emptied by syphoning, and allowance should be made for the old fluid to be removed from the circuit when bleeding a section of the circuit.

Chapter 2 Part A:
HCS engine in-car repair procedures

Contents

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 

2A

Specifications

General

Engine type	Four-cylinder, in-line overhead valve
Engine code:	
1.0 litre carburettor models	TLB
1.1 litre carburettor models	GUE or GUD
1.1 litre CFi fuel injection models	G6A
1.3 litre carburettor models	JBC
1.3 litre CFi fuel injection models	J6B
Capacity:	
1.0 litre models	999 cc
1.1 litre models	1118 cc
1.3 litre models	1297 cc
Bore:	
1.0 and 1.1 litre models	68.68 mm
1.3 litre models	73.96 mm
Stroke:	
1.0 litre models	67.40 mm
1.1 and 1.3 litre models	75.48 mm
Compression ratio:	
Carburettor models	9.5:1
CFi fuel injection models	8.8:1
Firing order	1-2-4-3 (No 1 cylinder at timing chain end)
Direction of crankshaft rotation	Clockwise (seen from right-hand side of vehicle)

Valves

Valve clearance (cold):	
Inlet	0.20 mm
Exhaust	0.30 mm

Lubrication

Engine oil type/specification	See *"Lubricants, fluids and tyre pressures"*
Engine oil capacity	See *"Lubricants, fluids and tyre pressures"*
Oil pressure:	
At idle speed	0.60 bars
At 2000 rpm	1.50 bars
Oil pump clearances:	
Outer rotor-to-body	0.14 to 0.26 mm
Inner rotor-to-outer rotor	0.051 to 0.127 mm
Rotor endfloat	0.025 to 0.06 mm

Torque wrench settings

	Nm	lbf ft
Camshaft thrust plate bolts	5	4
Camshaft sprocket bolt	18	13
Crankshaft pulley bolt	115	85
Rocker shaft pedestal bolts	43	32
Flywheel bolts	67	49
Sump:		
Stage 1	7	5
Stage 2	9	7
Stage 3 (with engine warm)	9	7
Oil pressure switch	14	10
Cylinder head bolts (may be re-used once only):		
Stage 1	30	22
Stage 2	Angle-tighten a further 90º	
Stage 3	Angle-tighten a further 90º	
Timing chain tensioner	8	6
Timing chain cover	9	7
Crankshaft rear oil seal housing	18	13
Rocker cover bolts	5	4
Oil pump	18	13
Oil pump cover	9	7
Engine mountings:		
Engine mounting (right-hand):		
Bolt to body (in wheel arch)	41 to 58	30 to 43
Nut to body (by suspension strut)	41 to 58	30 to 43
Bracket to cylinder block	54 to 72	40 to 53
Rubber insulator to bracket	71 to 95	52 to 70
Transmission mounting fasteners	Refer to Chapter 7A or 7B	

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

1 General information

How to use this Chapter

This Part of Chapter 2 is devoted to repair procedures possible while the engine is still installed in the vehicle, and includes only the Specifications relevant to those procedures. Similar information concerning the 1.4 and 1.6 litre CVH and PTE engines, and the 1.6 and 1.8 litre Zetec engines, will be found in Parts B and C of this Chapter respectively. Since these procedures are based on the assumption that the engine is installed in the vehicle, if the engine has been removed from the vehicle and mounted on a stand, some of the preliminary dismantling steps outlined will not apply.

Information concerning engine/transmission removal and refitting, and engine overhaul, can be found in Part D of this Chapter, which also includes the Specifications relevant to those procedures.

Engine description

The engine is an overhead valve, water-cooled, four cylinder in-line design, designated HCS (High Compression Swirl). The engine is mounted transversely at the front of the vehicle together with the transmission to form a combined power unit.

The crankshaft is supported in three or five shell-type main bearings. The connecting rod big-end bearings are also split shell-type, and are attached to the pistons by interference-fit gudgeon pins. Each piston is fitted with two compression rings and one oil control ring.

The camshaft, which runs on bearings within the cylinder block, is chain-driven from the crankshaft, and operates the valves via pushrods and rocker arms. The valves are each closed by a single valve spring, and operate in guides integral in the cylinder head.

The oil pump is mounted externally on the crankcase, incorporates a full-flow oil filter, and is driven by a skew gear on the camshaft. On carburettor versions, the fuel pump is also driven from the camshaft, via an eccentric lobe.

Repair operations possible with the engine in the car

The following work can be carried out with the engine in the car:

a) Compression pressure - testing.
b) Cylinder head rocker cover - removal and refitting.
c) Valve clearances - adjustment.
d) Rocker shaft assembly - removal, inspection and refitting.
e) Cylinder head - removal and refitting
f) Cylinder head and pistons - decarbonising.
g) Crankshaft pulley - removal and refitting.
h) Crankshaft oil seals - renewal.
i) Timing chain, sprockets and tensioner - removal, inspection and refitting.
j) Oil filter renewal.
k) Oil pump - removal and refitting.
l) Sump - removal and refitting.
m) Flywheel - removal, inspection and refitting.
n) Engine/transmission mountings - inspection and renewal.

Note: *It is possible to remove the pistons and*

connecting rods (after removing the cylinder head and sump) without removing the engine. However, this is not recommended. Work of this nature is more easily and thoroughly completed with the engine on the bench, as described in Chapter 2D.

2 Compression test - description and interpretation

1 When engine performance is down, or if misfiring occurs which cannot be attributed to the ignition or fuel systems, a compression test can provide diagnostic clues as to the engine's condition. If the test is performed regularly, it can give warning of trouble before any other symptoms become apparent.
2 The engine must be fully warmed-up to normal operating temperature, the oil level must be correct and the battery must be fully charged. The aid of an assistant will also be required.
3 On fuel injection engines, refer to Chapter 12 and remove the fuel pump fuse from the fusebox. Now start the engine and allow it to run until it stalls.
4 Disable the ignition system by disconnecting the multi-plug from the DIS or E-DIS ignition coil. Remove all the spark plugs with reference to Chapter 1 if necessary.
5 Fit a compression tester to the No 1 cylinder spark plug hole - the type of tester which screws into the plug thread is to be preferred.
6 Arrange for an assistant to hold the accelerator pedal fully depressed to the floor, while at the same time cranking the engine over for several seconds on the starter motor. Observe the compression gauge reading. The compression will build up fairly quickly in a healthy engine. Low compression on the first stroke, followed by gradually-increasing pressure on successive strokes, indicates worn piston rings. A low compression on the first stroke which does not rise on successive strokes, indicates leaking valves or a blown head gasket (a cracked cylinder head could also be the cause). Deposits on the underside of the valve heads can also cause low compression. Record the highest gauge reading obtained, then repeat the procedure for the remaining cylinders.
7 Due to the variety of testers available, and the fluctuation in starter motor speed when cranking the engine, different readings are often obtained when carrying out the compression test. For this reason, actual compression pressure figures are not quoted by Ford. However, the most important factor is that the compression pressures are uniform in all cylinders, and that is what this test is mainly concerned with.
8 Add some engine oil (about three squirts from a plunger type oil can) to each cylinder through the spark plug holes, and then repeat the test.
9 If the compression increases after the oil is added, it is indicative that the piston rings are definitely worn. If the compression does not increase significantly, the leakage is occurring at the valves or the head gasket. Leakage past the valves may be caused by burned valve seats and/or faces, or warped, cracked or bent valves.
10 If two adjacent cylinders have equally low compressions, it is most likely that the head gasket has blown between them. The appearance of coolant in the combustion chambers or on the engine oil dipstick would verify this condition.
11 If one cylinder is about 20 percent lower than the other, and the engine has a slightly rough idle, a worn lobe on the camshaft could be the cause.
12 On completion of the checks, refit the spark plugs and reconnect the HT leads and the ignition coil plug. Refit the fuel pump fuse to the fusebox.

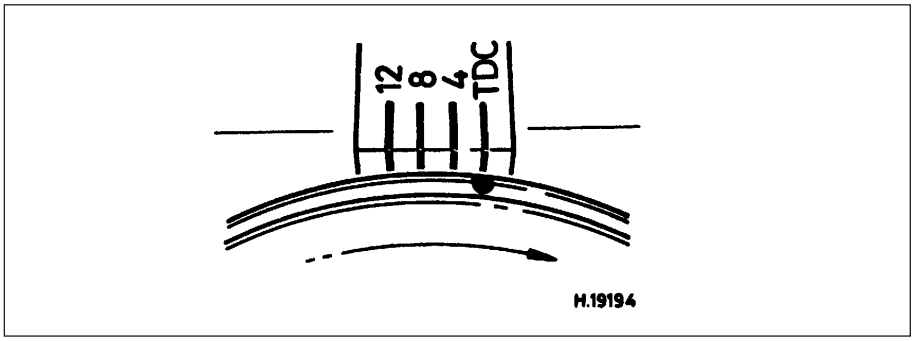
3 Top Dead Centre (TDC) for No 1 piston - locating

1 Top dead centre (TDC) is the highest point of the cylinder that each piston reaches as the crankshaft turns. Each piston reaches its TDC position at the end of its compression stroke, and then again at the end of its exhaust stroke. For the purpose of engine timing, TDC at the end of the compression stroke for No 1 piston is used. On the HCS engine, No 1 cylinder is at the crankshaft pulley/timing chain end of the engine. Proceed as follows.
2 Ensure that the ignition is switched off. Disconnect the HT leads from the spark plugs, then unscrew and remove the plugs as described in Chapter 1.
3 Turn the engine over by hand (using a spanner on the crankshaft pulley) to the point where the timing mark on the crankshaft pulley aligns with the TDC (0) mark or TDC reference pointer on the timing cover **(see illustration)**. As the pulley mark nears the timing mark, the No 1 piston is simultaneously approaching the top of its cylinder. To ensure that it is on its compression stroke, place a finger over the No 1 cylinder plug hole, and feel to ensure that air pressure exits from the cylinder as the piston reaches the top of its stroke.
4 A further check to ensure that the piston is on its compression stroke can be made by first removing the air cleaner (refer to the relevant Part of Chapter 4), then unbolting and removing the rocker cover, so that the movement of the valves and rockers can be observed.
5 With the TDC timing marks on the crankshaft pulley and timing cover in alignment, rock the crankshaft back and forth a few degrees each side of this position, and observe the action of the valves and rockers for No 1 cylinder. When No 1 piston is at the TDC firing position, the inlet and exhaust valve of No 1 cylinder will be fully closed, but the corresponding valves of No 4 cylinder will be seen to rock open and closed.
6 If the inlet and exhaust valves of No 1 cylinder are seen to rock whilst those of No 4 cylinder are shut, the crankshaft will need to be turned one full rotation to bring No 1 piston up to the top of its cylinder on the compression stroke.
7 Once No 1 cylinder has been positioned at TDC on the compression stroke, TDC for any of the other cylinders can then be located by rotating the crankshaft clockwise (in its normal direction of rotation), 180º at a time, and following the firing order (see Specifications).

4 Cylinder head rocker cover - removal and refitting

Removal

1 Where necessary for access, remove the air cleaner as described in the relevant Part of Chapter 4.
2 Detach the HT leads from the spark plugs. Pull on the connector of each lead (not the lead itself), and note the order of fitting.
3 Remove the engine oil filler cap and breather hose (where fitted).
4 Unscrew the four retaining bolts, and lift the rocker cover clear of the cylinder head. Remove the gasket.



3.3 Timing mark on the crankshaft pulley aligned with the TDC (0) mark on the timing cover