

FORD 2720 RANGE 4 & 6 CYLINDER DIESEL ENGINES

Naturally aspirated industrial or marine engines

- 2722 — 4 Cyl. 4,150 litre (254 cu in)
- 2723 — 6 Cyl. 5,950 litre (363 cu in)
- 2725 — 6 Cyl. 6,220 litre (380 cu in)

Turbocharged industrial or marine engines

- 2726T — 6 Cyl. 5,950 litre (363 cu in)
- 2726TG — 6 Cyl. 5,950 litre (363 cu in)
- 2726TM — 6 Cyl. 5,950 litre (363 cu in)
- 2728T — 6 Cyl. 5,950 litre (363 cu in)

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HEALTH & SAFETY

WARNING: The following health and safety recommendations should be carefully observed.

Carrying out certain operations and handling some substances can be dangerous or harmful to the operator if the correct safety precautions are not observed. Some such precautions are recommended at the appropriate points in this book.

Whilst it is important that these recommended safety precautions are observed, care near machinery is always necessary, and no list can be exhaustive. Always be on your guard!

The following recommendations are for general guidance:

1. Always wear correctly fitting protective clothing which should be laundered regularly.

Loose or baggy clothing can be extremely dangerous when working on running engines or machinery.

Clothing which becomes impregnated with oil or other substances can constitute a health hazard due to prolonged contact with the skin even through underclothing.

2. So far as practicable, work on or close to engines or machinery only when they are stopped. If this is not practicable, remember to keep tools, test equipment and all parts of the body well away from the moving parts of the engine or equipment — fans, drive belts and pulleys are particularly dangerous.

IMPORTANT: The electric cooling fan used on some installations is actuated automatically when the coolant reaches a specified temperature. For this reason, care should be taken to ensure that the ignition/isolating switch is OFF when working in the vicinity of the fan as an increase in coolant temperature may cause the fan suddenly to operate.

3. Avoid contact with exhaust pipes, exhaust manifolds and silencers when an engine is, or has recently been running; these can be very hot and can cause severe burns.

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4. Many liquids used in engines or vehicles are harmful if taken internally or splashed into the eyes. In the event of accidentally swallowing gasoline (petrol), oil, diesel fuel, anti-freeze, battery acid, etc, do NOT encourage vomiting and OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.

Wear protective goggles when handling liquids which are harmful to the eyes; these include ammonia and battery acid. If any of these substances are splashed in the eyes, wash out thoroughly with clean water and OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.



Some components on your engine and transmission, such as gaskets and friction surfaces (clutch discs or automatic transmission brake bands), may contain asbestos.

Breathing asbestos dust is dangerous to your health. You are therefore advised to have any maintenance or repair operations on such components carried out by a Ford Dealer. If, however, service operations are to be undertaken on parts containing asbestos, the essential precautions listed below must be observed.

- Work out of doors or in a well ventilated area.
- Dust found on the vehicle or produced during work on the vehicle should be removed by extraction not by blowing.
- Dust waste should be dampened, placed in a sealed container and marked to ensure safe disposal.
- If any cutting, drilling etc. is attempted on materials containing asbestos the item should be dampened and only hand tools or low speed power tools used.

For your further guidance, Ford and Motorcraft replacement parts which contain asbestos are progressively being identified by this symbol. If you are in any doubt, please consult your Ford Dealer.



FOREWORD

This book contains operating and maintenance instructions for the complete range of engines listed on the title page.

The life of your engine unit and the delivery of the high performance built into it will depend on the care it receives throughout its life. It is the operator's responsibility to ensure that the engine is correctly operated and that the maintenance operations outlined in this book are carried out regularly after the specified hours of operation have been reached. We consider it to be in your interests to enlist the aid of an authorised Ford Dealer not only when repairs are required but also for regular maintenance.

Regular maintenance will result in minimal operating costs.

Industrial engines manufactured by Ford Motor Company Ltd., England, are available through Ford Dealers and supervising Ford Companies throughout the world. When in need of parts or service, contact your local Authorised Dealer. In overseas territories, in the event of difficulties, communicate directly with the supervising Ford Company in your area whose address appears at the end of this book.

Always quote the engine serial number when ordering parts or entering into correspondence. This is stamped on the Service Identification Plate.

Where the terms 'Right' or 'Left' occur in this publication, they refer to the respective sides of the engine when viewed from the rear or flywheel end.

Pistons and valves are numbered from the front or timing cover end of the engine commencing at No. 1.

You may find that your engine assembly includes optional equipment not specifically covered in the following text. Nevertheless, the maintenance procedures outlined in this book still apply to your engine.

FORD MOTOR COMPANY LTD.
ENGLAND

SERVICE IDENTIFICATION PLATE — NATURALLY ASPIRATED ENGINES

This plate is fixed on the top surface of the engine rocker cover. Positions 1 to 11 on the plate refer to various engine details as listed.

Ford		Industrial Power Products		MODEL	
CAPACITY	FUEL SYS	R.P.M.	H'D	BLOCK	
2	8 9 10	5	6	7	1
SER No / DATE	BUILD No				
3	4				
SPECIAL EQUIPMENT				11	

1. Engine Model Identification
2. Engine Capacity in Litres
3. Engine Serial Number/Date
4. Selective Build Number indicates the complete engine specification. The digit to the extreme right-hand side, is the Build Chart Issue Number
5. Engine Operating rpm. An asterisk denotes speed set by customer
6. Cylinder Head Type:—
7. Block Type:—
A — Standard with Standard 28,5 Nm PTO
B — Standard with Heavy Duty 142 Nm PTO
8. Injection Pump Manufacturer
A CAV/Simms
B Bosch
9. Type of Governor fitted to Injection Pump
A General Purpose
B Class 'A'
C Automotive
D Combine Harvester
10. Special Injection Equipment fitted
11. This box is provided for Equipment Manufacturers' use when extra equipment is fitted outside the Ford Motor Company. Reference should be made to the Equipment Manufacturer for any information or parts required.

ORIGINAL ENGINE BUILD DATA PLATE — NATURALLY ASPIRATED ENGINES

This plate is fixed to the flywheel housing of the engine and will indicate for each particular engine the dimensions in millimetres of:—


- The diameter of the crankshaft main journals.
- The diameter of the crankshaft main bearing bore in the cylinder block.
- The diameter of the crank pins. These aluminium plates will be colour coded light blue, orange, green or black depending on the crankshaft/cylinder block dimensions. The example shown below would be in light blue.

The original engine build data plate is also stamped with the engine type and build date code as shown.

The following example illustrates the way in which the build date code is derived.


Day of Month — 16 / A / 87 A
 Month _____
 Year _____
 Shift _____

A = Jan. E = May I = Sept.
 B = Feb. F = June J = Oct.
 C = March G = July K = Nov.
 D = April H = Aug. L = Dec.

2725E	16/A/87 A
	
ORIGINAL ENGINE BUILD DATA	
<input type="radio"/> CRANK MAINS	75,95
<input type="radio"/> BLOCK MAINS	80,44
<input type="radio"/> CRANK PINS	66,42
<input type="radio"/>	

SERVICE IDENTIFICATION PLATE — TURBOCHARGED ENGINES

This plate is fixed to the top surface of the engine rocker cover. Positions 1 to 11 on the plate refer to various engine details as listed.

		Industrial Power Products		MODEL	
CAPACITY	FUEL SYS	R.P.M.	H'D	BLOCK	
2	8 9 10	5	6	7	1
SER No / DATE	BUILD No				
3	4				
SPECIAL EQUIPMENT					11

1. Engine Model Identification

2. Engine Capacity in Litres

3. Engine Serial Number/Date

4. Selective Build Number indicates the complete engine specification. The digit to the extreme right-hand side, is the Build Chart Issue Number

5. Engine Operating rpm. An asterisk denotes speed set by customer

6. Cylinder Head Type:—

7. Block Type:—

A — Standard with Standard 28,5 Nm PTO

B — Standard with Heavy Duty 142 Nm PTO

C — Intercooled with Standard 28,5 Nm PTO

8. Injection Pump Manufacturer

A CAV/Simms

B Bosch

9. Type of Governor fitted to Injection Pump

A General Purpose

B Class 'A'

C Automotive

D Combine Harvester

10. Special Injection Equipment fitted

11. This box is provided for Equipment Manufacturers' use when extra equipment is fitted outside the Ford Motor Company. Reference should be made to the Equipment Manufacturer for any information or parts required.

OPERATING CONTROLS

Stop Control

To stop the engine, pull out the stop control; this is connected to the stop control lever on the injection pump and when operated, cuts off the supply of fuel to the injectors — refer to Figs 1 and 2.

Engine Speed Control

This can be set to any speed within the governed range. The control is connected to the governor control lever on the injection pump — refer to Fig. 1.

Excess Fuel Device — refer to Fig. 2

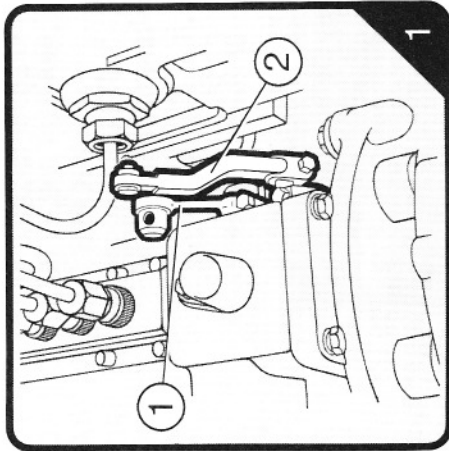
This device permits additional fuel to be supplied by the injection pump to assist in starting the engine from cold; it is fully automatic in operation on injection pumps with automotive or general purpose governing.

The manually operated excess fuel button is situated at the front of the fuel injection pump — see Fig. 2.

To operate, push the excess fuel button inwards and move the governor control lever to the maximum speed position. The button will spring out to the normal running position automatically when the engine starts. Do not attempt to wedge the button in as this will reduce engine power output.

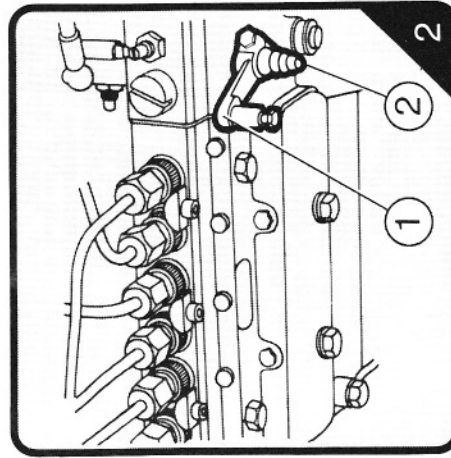
Clutch

Always ensure that the clutch (where fitted) is fully engaged when the equipment is operating normally; partial engagement will result in excessive wear of the release bearing and clutch lining.



Injection Pump Controls

1. Stop Lever
2. Speed Control Lever



Injection Pump Controls

1. Stop Lever
2. Excess Fuel Device (manually operated type)

Isolating Switch

An isolating switch is usually fitted which connects the engine starter motor and other electrical equipment to the battery; Fig. 3 shows a typical example.

The switch can be moved to any of the four positions shown by rotating the key. These positions are:—

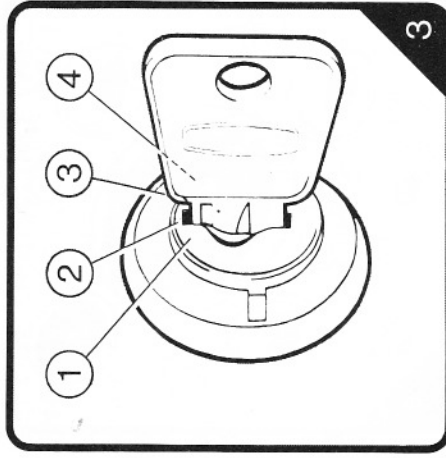
1. Auxiliary Circuits — When moved to this position the auxiliary electrical equipment such as radios, heater fans, can be operated without also connecting the starting circuit with the battery.

2. Off — When set to this position, the switch disconnects the auxiliary electrical equipment and the starting circuit from the battery. The key can be removed from the switch when it is in this position; this will help to prevent unauthorised operation of the engine.

NOTE: Returning the switch will not stop the engine. To stop the engine use the stop control.

3. Excite Alternator — If an alternator is fitted to your engine, and the switch is set to this position the alternator is given initial excitation via the battery. This switch position will also connect the auxiliary circuits as described previously.

4. When moved to this position the starter solenoid is energised and the starter motor cranks the engine. The switch, when released, automatically returns to position 3.



Typical Isolating Switch

1. Auxiliary Circuits
2. Off
3. Excite Alternator
4. Start

INSTRUMENTS

Your Ford Powered Equipment will have been fitted with instruments selected by the manufacturer. The types of instruments most likely to be encountered are detailed here. A typical instrument panel is shown in Fig. 4.

Ammeter

This instrument registers the charging current which is being passed to the battery from the alternator. It also registers a discharge equivalent to the amount of current being used by the electrical equipment when the alternator is not charging.

Tachometer

The tachometer indicates the actual engine running speed in crankshaft revolutions per minute.

Hourmeter

This instrument records the number of hours of operation which the engine has completed at the rated rpm. It is frequently combined with the tachometer and is used to determine when an engine service operation is required. If no hourmeter is fitted, a log should be kept.

Oil Pressure Gauge

The oil pressure gauge registers the lubricating system pressure in bar (kgf/cm² or lbf/in²) and should be frequently observed to ensure that the system is functioning correctly.

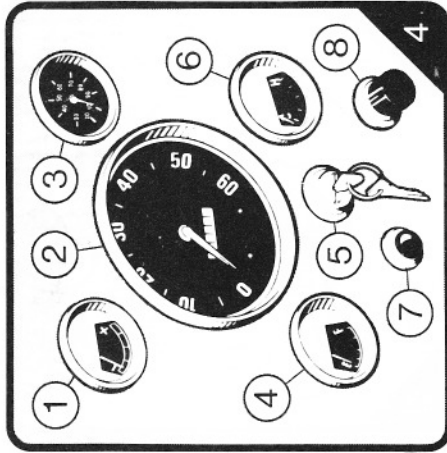
Fuel Gauge

This instrument indicates the quantity of fuel oil in the fuel tank.

IMPORTANT:- SHOULD THE ENGINE STOP THROUGH RUNNING OUT OF FUEL, THEN THE FUEL SYSTEM SHOULD BE BLED AS DESCRIBED ON PAGE 26.

Temperature Gauge

The temperature gauge enables a close check to be kept on the coolant temperatures.



Typical Instrument Panel

1. Ammeter
2. Combined tachometer/hourmeter
3. Oil pressure gauge
4. Fuel gauge
5. Isolation switch
6. Temperature gauge
7. Charge indicator light
8. Pre-heat button

Pre-Heat Button

This control (see Fig. 4) energises the 'Thermostat' heater plugs which are standard equipment on all turbocharged engines. One or two 'Thermostat' plugs are available as optional equipment on naturally aspirated engines.

Non-Electric Cold Start Aids

These should be operated in accordance with the manufacturers instructions. Do NOT use ether cold start aids while 'Thermostat' heater plugs are energised.

CAUTION: It is dangerous to use cold start aids containing ether with turbocharged engines.

Charge Indicator Light

If an alternator is fitted to your engine, a charge indicator light will also be fitted. The light will glow when the isolating switch is in position 3 (see Fig. 4) with the engine stationary and will therefore serve as a reminder either to turn the isolating switch to the "OFF" position or to start the engine. Once the engine has started, the charge indicator light should cease glowing.

BEFORE OPERATING THE ENGINE

Before operating a new engine, all controls should be studied carefully in order that their functions may be thoroughly understood.

On installations where a radiator is fitted, check that the coolant level is 13 to 25mm (0.5 to 1.0 in) below the neck of radiator filler. The radiator should be filled with the correct proportion of Motorcraft Anti-freeze Super-Plus and soft water — refer to page 32.

Refit the filler cap and fully tighten.

UNDER NO CIRCUMSTANCES MAY THE ENGINE BE STARTED WITHOUT LIQUID IN THE COOLING SYSTEM.

Ensure that the battery is fully charged and, if necessary, top up with distilled water — refer to page 34.

Check fuel level in fuel tank and, where fitted, the thermostat fuel reservoir.

Check the oil level in injection pumps having Class A or combine harvester governing — refer to page 18.

Check that the oil level in the engine is up to the 'full' or 'max' mark on the dipstick; on naturally aspirated engines, top up as necessary with the correct type and grade of oil — refer to page 16. On turbocharged engines, the engine oil level should be checked again after the engine has been run for a few minutes.

The engine must be started in accordance with the appropriate starting instructions (pages 12 to 14).

Seasonal Lay-up with Turbocharged Engines

If the lay-up period is longer than four weeks, the start up procedure detailed on page 13 must be followed. Checks of coolant level, fuel tank level and battery condition must also be carried out as previously described.

STARTING NATURALLY ASPIRATED ENGINES

Before engaging the starter motor:-

1. Where possible, disconnect the driven equipment.
2. Ensure that stop control is fully disengaged.

To Start a Warm Engine

1. Set the engine speed control lever at approximately the mid-point of its travel.

2. Turn the isolating switch key to 'start' position, and release it immediately the engine starts.

NOTE:- If the engine fails to start, adopt the procedure for normal cold starting.

3. Set the engine speed control lever to the desired position.

To Start from Cold — Engines not fitted with additional cold starting equipment

1. Engage the excess fuel device if an automatic excess fuel device is not fitted.

NOTE: On engines fitted with fuel injection pumps having automotive or general purpose governing, the excess fuel device is automatically engaged.

2. Set the speed control lever to the maximum speed position.

3. Turn the isolating switch key to the 'start' position. As soon as the engine starts, release the key. If the engine fails to start within 30 seconds, release the key. Operate the switch again after allowing sufficient time for all moving parts to stop.

4. When the engine has started, set the speed control lever to the desired position.

To Start From Cold — Engines fitted with 'Thermostat'

1. Engage the excess fuel device — Class A and combine harvester pumps only.

2. Set speed control lever to maximum speed position.

3. Turn the isolating switch key to position 3 (see Fig. 4), then press the pre-heat button for 20 seconds.

4. Turn the key to position 4 to start the engine.

5. If the engine fires continuously, release the switch key, when it will automatically return to position 3, but during this period keep the pre-heat button depressed until the engine has run up to maximum rpm.

6. If the engine does not fire continuously after 10 seconds, release the switch key but keep the pre-heat button depressed for 10 seconds before again turning key to position 4.

If the engine fails to fire after 10 seconds repeat the cycle once more. If there is no indication that the engine will fire after carrying out the above procedure three times, return the switch key to position 2, and check the following:

- (a) That the thermostat fuel reservoir has sufficient fuel oil. Refill if necessary. The reservoir is automatically kept filled when the engine is running but may be emptied during prolonged starting attempts.

NOTE: Cranking the engine beyond the 30 seconds cranking or 3 cycles with the cold start aid starved of fuel may result in damage to the heater unit. Care should therefore be taken to time these operations accurately.

- (b) Check 'Thermostat' electrical connections. If the engine fires, but has not reached self sustained speed after cranking for 30 seconds, cranking may continue for a further 30 seconds. Any cranking periods beyond those specified may overheat the starter motor.

STARTING TURBOCHARGED ENGINES

Recommended Start-up Procedure
Serious damage to the turbocharger bearing can result from inadequate lubrication if the following recommendations are not observed.

Prior to the first start after a turbocharger has been newly installed or if for any reason, the oil supply to the turbo-charger has been disconnected, you should ensure that the turbocharger housing is filled with engine oil before reconnecting the oil feed pipe.

In the above circumstances, or in cases where the engine is being started for the first time after an oil change or after a period of 4 weeks or more without use, the following procedure should be used:

1. Fully pull out the stop control.
2. Crank the engine with the starter motor for 15 seconds.
3. Push the stop control fully in.
4. Start the engine and allow to idle (1000 rpm maximum).
5. Observe the oil pressure gauge or oil pressure warning light. If oil pressure is not registered on the gauge, or if the oil pressure warning light is not extinguished in the first few seconds of idling, stop the engine immediately and contact your dealer.

On every start up the engine should be allowed to idle (1000 rpm maximum) for 30 seconds before operating on load, to ensure an adequate oil supply to the turbocharger bearing. The engine should also be allowed to idle without load for two minutes before shut-down to enable the oil to dissipate the heat from the turbocharger bearing.

NOTE: Standby Generator and Alternator Sets.
Because standby generator and alternator sets make fewer starts and stops than other industrial applications the idling requirement of the stop/start procedure can be waived without undue risk of reduced life.

However, the recommended start-up procedure must be carried out for engines which have been inoperative for periods of four weeks or more.

Thermostats are fitted as standard equipment on Turbocharged engines. It is recommended that the starting aid is used on every initial engine start. If, however, the engine has been 'shut down' for less than one hour, the thermostat operation can be waived. Where possible, disconnect the driven equipment before starting.

To Start From Cold

1. Check that the stop control is pushed right in.
2. Engage the excess fuel device — class A and combine harvester pumps only.
3. Set the engine speed control lever to the fully open position.
4. Turn the isolating switch key to position 3, then press the pre-heat button for 20 seconds.
5. Turn the key to position 4 to start the engine.
6. If the engine fires continuously, release the key, when it will automatically return to position 3, but during this period keep the pre-heat button depressed until the engine has run up to maximum rpm.
7. If the engine does not fire continuously after 10 seconds, stop cranking but keep the pre-heat button depressed for 10 seconds before turning the key to position 4. If the engine fails to fire after 10 seconds repeat the cycle once more. If there is no indication that the engine will fire after carrying out the above procedure three times, return the key to position 2, and check the following:
 - (a) That the thermostat fuel reservoir has sufficient fuel oil. Refill if necessary. The reservoir is automatically kept filled when the engine is running but may be emptied during prolonged starting attempts.

NOTE: Cranking the engine beyond the 30 seconds cranking or 3 cycles with the cold start aid starved of fuel may result in damage to the heater unit. Care should therefore be taken to time these operations accurately.

(b) Check 'Thermostat' electrical connections. If the engine fires, but has not reached self sustained speed after cranking for 30 seconds, cranking may continue for a further 30 seconds. Any cranking periods beyond those specified may overheat the starter motor.

8. Allow engine to idle for a minimum of thirty seconds after starting from cold, BEFORE operating on load. This is to ensure an adequate supply of oil to the turbocharger bearings.

To Restart When Warm

1. Check that the stop control is pushed right in.
2. Set the engine speed control lever at approximately the mid-point of its travel.
3. Operate the isolating switch key and release it immediately the engine starts.
4. Set the engine speed control lever to the desired position.

NOTE:- If the engine fails to start, adopt the procedure for normal cold starting as previously described.

STOPPING ALL ENGINES

The engine should always be allowed to slow idle for approximately two minutes before stopping, especially after extended periods of full load and full speed operation; this is particularly important in the case of turbocharged engines.

1. Pull out the stop control (Fig. 1 or 2) until engine stops, then return control to closed position.
2. Move the isolating switch key to the 'OFF' position.

RUNNING-IN PROCEDURE

DO NOT OPERATE YOUR NEW ENGINE AND/OR HEAVY DUTY P.T.O. (WHERE FITTED) ON FULL LOAD OR AT HIGH SPEEDS IMMEDIATELY. EXCESSIVE WEAR, OR DAMAGE MAY RESULT.

Check the instruments frequently and keep the coolant and oil filled to their recommended levels.

For the first 15 hours DO NOT operate the engine under full load or full speed conditions.

After completing the first 50 hours running carry out the maintenance instructions summarised on page 15.

LUBRICATION AND MAINTENANCE

The importance of correct lubrication, periodic inspection and adjustment cannot be over-emphasised. On it will depend, to a very large extent, the service that the engine will give.

Detailed instructions regarding this maintenance are given in the following pages. Your Authorised Ford Dealer will be pleased to carry out this regular maintenance for you.

The various maintenance operations are listed under the heading 'Summary of Regular Maintenance'.

WARNING

Diesel fuel can be injurious to the skin. Before servicing any part of the engine containing diesel fuel, apply a good quality barrier cream to the hands and forearms. Wash hands and arms thoroughly on completion of the work.

SUMMARY OF REGULAR MAINTENANCE

When carrying out any of the following operations, any fault or malfunction should be reported immediately to the supervisor or person responsible for engine overhaul or repair.

Operation No.	Description of Operation	Page
---------------	--------------------------	------

- | | | |
|----|--|----|
| 1. | Check condition and tension of drive belt(s) and adjust as necessary | 20 |
| 2. | Clean fuel lift pump pre-filter (where fitted) | 25 |
| 3. | Check engine oil level and top up if necessary | 17 |

- | | | |
|----|--|----|
| 4. | Check radiator coolant level and top up if necessary | 22 |
|----|--|----|

- | | | |
|----|--|----|
| 5. | Check cold start equipment operation, including manual excess fuel operation, where fitted | 12 |
|----|--|----|

- | | | |
|----|--|----|
| 6. | Check air induction system trunking for leaks, damage, chafing or restrictions (includes checking air cleaner restriction indicator, where fitted) | 23 |
|----|--|----|

- | | | |
|----|---------------------------------------|---|
| 7. | Check engine for oil or coolant leaks | — |
|----|---------------------------------------|---|

- | | | |
|----|---|----|
| 8. | Check fuel system for leaks | — |
| 9. | Check hot and cold starting and engine stop control equipment | 12 |

- | | | |
|-----|--|----|
| 10. | Check visually for exhaust smoke | — |
| 11. | Check all instruments, controls and warning lights | 10 |

- | | | |
|-----|--|----|
| 12. | Check valve clearances and adjust if necessary | 18 |
|-----|--|----|

- | | | |
|-----|-------------------------|----|
| 13. | Change engine oil | 16 |
| 14. | Renew engine oil filter | 17 |

- | | | |
|-----|---|----|
| 15. | Change fuel injection pump oil (Class A and combine pumps only) | 18 |
|-----|---|----|

- | | | |
|-----|---|----|
| 16. | Change air cleaner oil if applicable and clean the removable type gauze element | 24 |
|-----|---|----|

- | | | |
|-----|--|----|
| 17. | Check engine idling speed. Adjust if necessary | 22 |
|-----|--|----|

- | | | |
|-----|----------------------------|----|
| 18. | Renew fuel filter elements | 26 |
|-----|----------------------------|----|

Operation No.	Description of Operation	Page
---------------	--------------------------	------

- | | | |
|-----|---|---|
| 19. | Check exhaust system for leaks, damage and insecurity | — |
|-----|---|---|

- | | | |
|-----|--|---|
| 20. | Check engine coolant and heater hoses by flexing for signs of leakage or deterioration | — |
|-----|--|---|

- | | | |
|-----|---|---|
| 21. | Check engine mounting bolt torques — refer to vehicle/equipment manufacturers | — |
|-----|---|---|

- | | | |
|-----|--|----|
| 22. | Renew air cleaner element (Paper type) | 23 |
|-----|--|----|

- | | | |
|-----|---|----|
| 23. | Change/flush out cooling system coolant. Replace anti-freeze (at least every 2 years) | 33 |
|-----|---|----|

- | | | |
|-----|----------------------|----|
| 24. | Clean fuel lift pump | 24 |
|-----|----------------------|----|

MAINTENANCE SCHEDULES

(a) Daily:

Check engine oil and coolant levels (operations 3 & 4). In extremely dusty conditions, check dust bowl (or, where fitted, indicator) on paper element type air cleaners or condition of oil bath type cleaners (operations 16 & 22).

(b) After the first 50 hours running:

Carry out operations 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 & 12.

After every 200 hours running:

Carry out operations 1, 13, 14, 15, 16 & 24.

After every 600 hours running:

Carry out operations 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 & 21.

After every 1200 hours running:

Carry out operations 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 & 23.

After every 3600 hours running:

It is recommended that the engine cooling system thermostat(s) are renewed.

REGULAR MAINTENANCE OPERATIONS

Recommended Lubricants — All Engines Except 2726TG

The oil used must meet API (American Petroleum Institute) Specification SF/CD and should be of the viscosity shown on the chart (Fig. 5) to suit the prevailing ambient air temperature.

For good fuel consumption at ambient air temperatures from -20°C to $+30^{\circ}\text{C}$, Ford/Motorcraft Super Motor Oil SAE 10W-30 is recommended for all year round use.

For continual use at low ambient air temperatures below -20°C , the use of Motor Oil SAE 5W-30 is recommended.

For continual use at high ambient air temperatures above $+30^{\circ}\text{C}$, the use of Ford/Motorcraft Super Motor Oil SAE 15W-40 is recommended.

Recommended Lubricants — 2726TG Engine Only

The oil used must meet Specification SHPD (Super High Performance Diesel) or the European Specification CCMCD3 and must be of a suitable viscosity as shown on the chart (Fig. 5) to suit the ambient temperature range.

Oils meeting these specifications are available from the major oil companies. A list of such oils appears on the inside rear cover of this handbook.

Lubricating oil cleanliness is vital for the successful operation of your engine. The oil should be stored under the cleanest possible conditions.

When changing or topping-up engine oil, use only clean receptacles. Do not allow the oil to come into contact with rubber hoses on the engine.

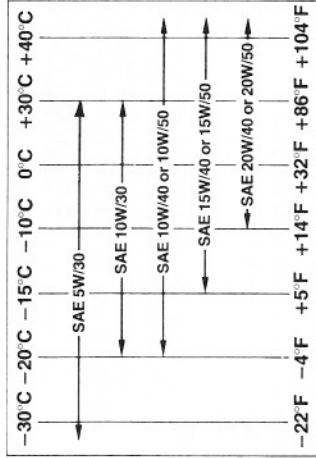


Fig. 5 — Oil Viscosity Chart

Used Engine Oils

WARNING: Prolonged and repeated contact may cause serious skin disorders including dermatitis and skin cancer.

Avoid excessive contact — wash thoroughly after contact. Keep out of the reach of children.

PROTECT THE ENVIRONMENT: It is illegal to pollute drains, water courses or soil. Use authorised facilities for disposal. If in doubt, contact your Local Authority for advice.

Change Engine Oil

1. Warm the engine to normal operating temperature.
 2. Make sure that the equipment is standing level and that the engine is stopped.
 3. Obtain a sufficiently large draining pan to accommodate the engine oil (see 'Service Oil Fill Capacity' in General Specifications).
 4. Remove the oil filler cap from the rocker cover, remove the drain plug from the oil pan and drain the oil into the draining pan.
- NOTE:** Modern high performance oils have a cleaning action on the engine which has the effect of rapidly darkening the new oil. Dark oil does not necessarily indicate inadequate oil changes.
5. Replace the drain plug(s), fill the oil pan with the correct quantity of oil (see 'General Specifications') and run the engine.

IMPORTANT: IN THE CASE OF TURBOCHARGED ENGINES, REFER TO 'RECOMMENDED START-UP PROCEDURE' IN THE 'STARTING TURBOCHARGED ENGINES' SECTION ON PAGE 13.

6. Check the oil level as described in the following section.

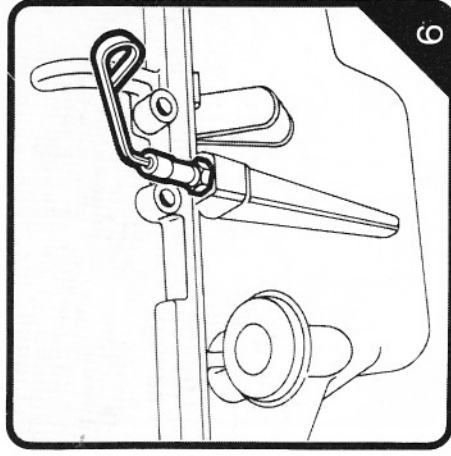
Check Engine Oil Level

1. Make sure the equipment is standing level and that the engine is stopped.
2. Pull out the dipstick (Fig. 6 or 7) and wipe with a clean rag.
3. Insert the dipstick fully and again remove it. At no time should the level of the oil fall below the 'safe' mark on the dipstick.
4. If necessary, top up to the dipstick 'full' mark with an approved type and grade of oil — refer to page 16.

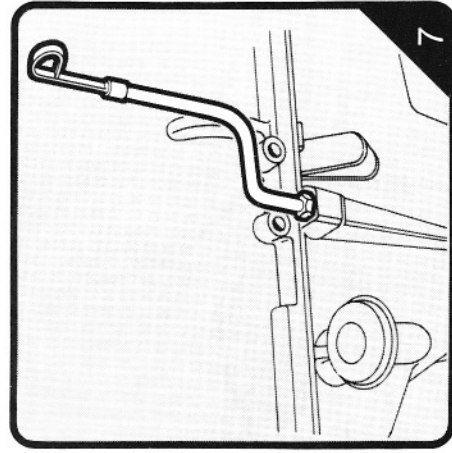
NOTE: In the case of turbocharged engines which have not run for a period of four weeks or more, start the engine as detailed under 'Recommended Start-up Procedure' on page 13. Stop the engine after it has run for a few minutes, allow time for the oil to settle and check oil level again.

Change Engine Oil Filter

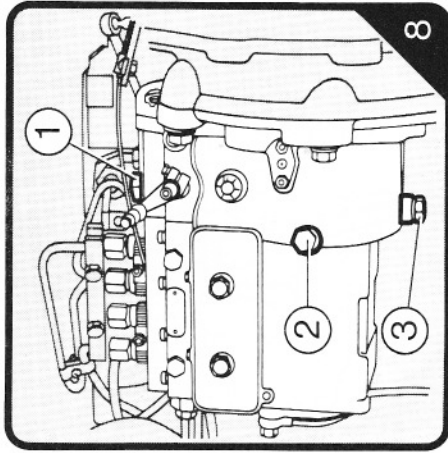
1. Using a suitable strap wrench, unscrew and discard the filter canister.
2. Thoroughly clean oil filter housing face.
3. Pre-fill the new filter with clean engine oil of the correct type and grade — refer to page 16. Apply a thin film of clean engine oil to oil filter sealing gasket.
4. Screw on new oil filter canister until sealing gasket abuts the filter head and tighten a further $\frac{1}{2}$ turn.
5. Run engine and check for any leaks from oil filter.
6. Stop engine, allow oil to settle and top up as necessary.



Engine Oil Dipstick



Engine Oil Dipstick



Injection Pump Oil Plugs

1. Filler Plug
2. Level Plug
3. Drain Plug

Change Injection Pump Oil

THIS PROCEDURE APPLIES ONLY TO COMBINE HARVESTER AND GENERATOR SET ENGINES.

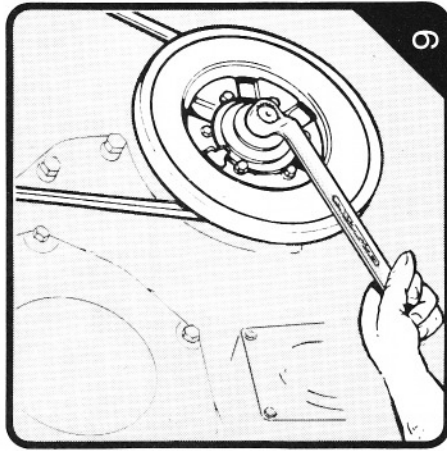
1. Clean the exterior of the injection pump around the filler plug, level plug and drain plug areas (Fig. 8).
2. Remove the drain plug and drain the oil.
3. Remove the filler plug and level plug.
4. Replace the drain plug.
5. Add engine oil through the filler orifice, until oil reaches the level plug orifice.
6. Replace the level plug and filler plug.

Cylinder Head Retaining Bolts

The cylinder head retaining bolts must NOT be re-torqued.

Adjust Valve Clearances

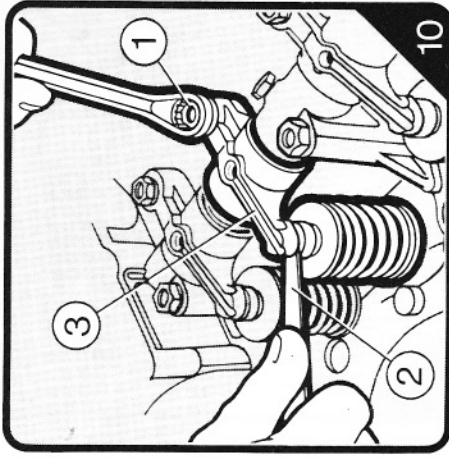
1. Run the engine until normal operating temperature is reached. Stop the engine.
2. Disconnect the breather pipe from the rocker cover.
3. Unscrew the rocker cover retaining screws and remove the rocker cover.
4. Pull out the stop control and turn the engine, using a suitable tool (Fig. 9) until numbers 1 and 6 valves (4 cyl. engines) or 1 and 4 valves (6 cyl. engines) are fully opened by their respective rocker arms.
5. Insert the correct thickness feeler blade (specified against 'Valve Clearances' in the General Specifications) between the valve stem



Turning the Engine for Valve Adjustment

cap and rocker arm of No. 3 valve (4 cyl. engines) or No. 9 valve (6 cyl. engines) as shown in Fig. 10.

6. Turn the valve clearance adjusting screw until the feeler blade is lightly caught between the rocker arm and valve stem cap but so that the blade can still be removed with slight resistance.
7. Select the appropriate feeler blade and repeat the procedure for No. 8 valve (4 cyl. engines) or No. 12 valve (6 cylinder engines).
8. Rotate the engine and, following the sequence given in the appropriate following table, adjust each of the remaining valves in turn.



Adjusting Valve Clearances

1. Adjusting Screw
2. Feeler Blade
3. Rocker Arm

4 Cylinder engines

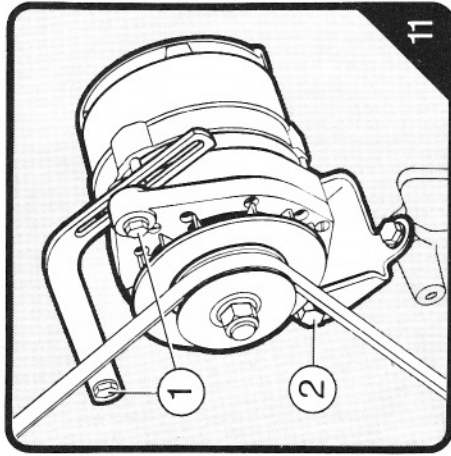
Valves Fully Open	Valves to Adjust
1 and 6	3 and 8
2 and 4	5 and 7
3 and 8	1 and 6
5 and 7	2 and 4

6 Cylinder engines

Valves Fully Open	Valves to Adjust
1 and 4	9 and 12
8 and 10	3 and 5
2 and 6	7 and 11
9 and 12	1 and 4
3 and 5	8 and 10
7 and 11	2 and 6

9. Replace the rocker cover ensuring that the rocker cover gasket is in good condition and is correctly positioned. Tighten the retaining screws.

10. Reconnect the rocker cover breather pipe.



Alternator Drive Belt Adjustment

1. Adjusting Bolts
2. Mounting Bolts

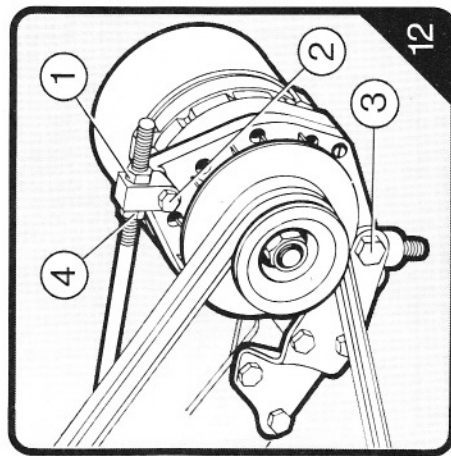
Drive Belt(s) Adjustment
Various combinations of drive belts are used depending on the electrical and cooling equipment fitted to the engine. Adjustments can be made as detailed in the following applications:

1. Single or Twin Belt Drive to Alternator & Water Pump — Water Pump Mounted Fan
 - (a) Slacken the alternator mounting and adjusting bolts — see Fig. 11.
 - (b) Move alternator to obtain the specified belt tension — refer to 'General Specifications'.
 - (c) Tighten the adjusting bolt, then the mounting bolts and check that the belt tension is still as specified.

2. Single Belt Drive to Alternator & Water Pump — Turbocharged Marine Engines Without Fans
 - (a) Slacken the alternator mounting and adjusting bolts — see Fig. 12.
 - (b) Move alternator to obtain the specified belt tension — refer to 'General Specifications'.
 - (c) Tighten the adjusting bolt, then the mounting bolts and check that the belt tension is still as specified.

3. Twin Belt Drive to Alternator & Water Pump — Intercooled Marine engine Without Fan
 - (a) Slacken locking nut, adjusting bolts and mounting bolts — see Fig. 12.
 - (b) Turn adjusting nut to obtain the specified belt tension — refer to 'General Specifications'.
 - (c) Tighten locking nut, adjusting bolts and mounting bolts and check that belt tension is still as specified.

4. High Level Fan
 - (a) Slacken fan bearing housing securing bolts — see Fig. 13.
 - (b) Slacken locknuts and turn adjusting bolts to obtain the required belt tension.



Alternator Drive Belt Adjustment

1. Locking Nut
2. Adjusting Bolts
3. Mounting Bolts
4. Adjusting Nut

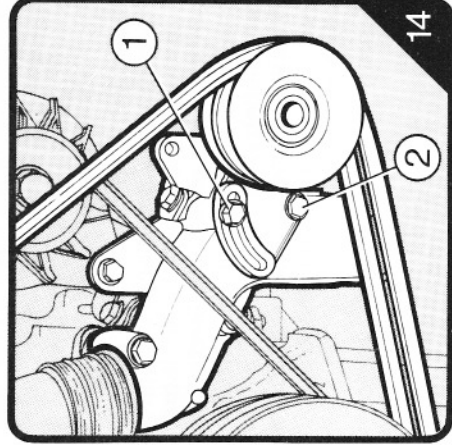
- (c) Tighten securing bolts and check that belt tension is still correct. Tighten locknuts.

NOTE: The water pump drive belt can be adjusted by moving the alternator — refer to application No. 1 (Fig. 11).

5. 'Low-Loss' Fan Drive & Water Pump
 - (a) Slacken idler pulley adjustment and mounting bolts — see Fig. 14.
 - (b) Position idler pulley to obtain the specified fan belt tension — refer to 'General Specifications'.
 - (c) Tighten adjusting bolt and mounting bolt and check that belt tension is still as specified.

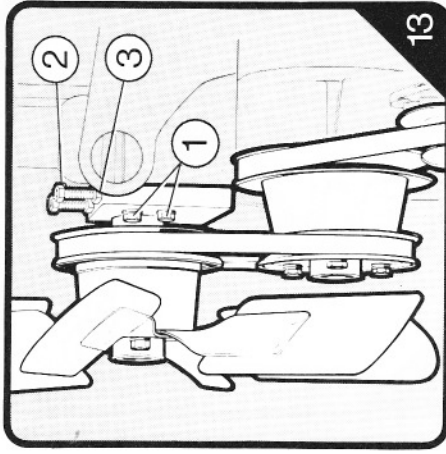
NOTE: The water pump drive belt can be adjusted by moving the alternator — refer to application No. 1 (Fig. 11).

6. Single or Twin Belt Drive to Water Pump — No Alternator Fitted
 - (a) Slacken idler pulley adjustment and mounting bolts — see Fig. 14a.
 - (b) Position idler pulley to obtain the specified fan belt tension — refer to 'General Specifications'.
 - (c) Tighten adjusting bolt and mounting bolt and check that belt tension is still as specified.



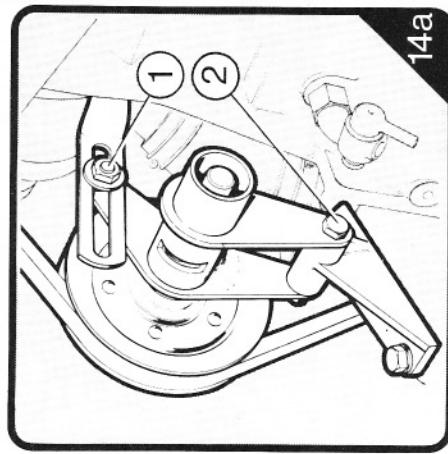
Drive Belt Adjustment — 'Low-Loss' Fan Drive Water Pump

1. Adjusting Bolt
2. Mounting Bolt



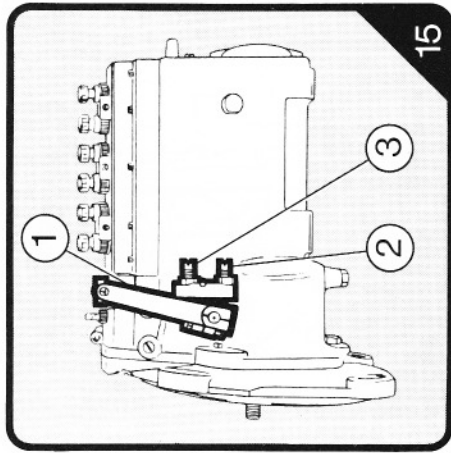
Drive Belt Adjustment — High Level Fan

1. Fan Bearing Housing Securing Bolts
2. Adjusting Bolts
3. Locknuts



Drive Belt Adjustment — No Alternator Fitted

1. Adjusting Bolt
2. Mounting Bolt



Idling Speed Adjustment

1. Speed Control Lever
2. Maximum Speed Stop Screw
3. Idling Stop Screw

Idling Speed Adjustment

1. Start and run the engine until normal operating temperature is reached.
2. With the engine running, slacken the idling adjustment screw locknut (Fig. 15).
3. Adjust the idling speed screw until the engine is idling at the speed specified by the vehicle/equipment manufacturer, then tighten locknut.
4. Operate the speed control lever to ensure a constant return to this setting.

NOTE:- If the engine is very new it may idle unevenly initially. Do not increase the idling speed setting to compensate.

ON NO ACCOUNT SHOULD THE MAXIMUM SPEED STOP BE INTERFERED WITH.

Check Radiator Coolant Level — Open System

Refer to page 30 for a description of open and sealed radiators.

1. Allow the engine to cool down until the back of the hand can be held against the cylinder head without discomfort.
2. Remove the filler cap SLOWLY. If there is liquid in the header tank, the system may be refilled with safety. If not, allow the engine to cool down completely before topping up.
3. Top-up with coolant to 13 to 25 mm (0.5 to 1 in) below the filler neck. Soft water should preferably be used. If the system has been previously filled with an anti-freeze solution, top up with a similar solution of the same concentration — refer to page 32 for information on mixing anti-freeze and corrosion inhibitor.
4. Replace the filler cap and turn down tightly.

Empty the Air Cleaner Dust Cap and/or Renew Paper Element

1. Slacken off the clamp screw and remove the clamp and dust cup — see Fig. 16.

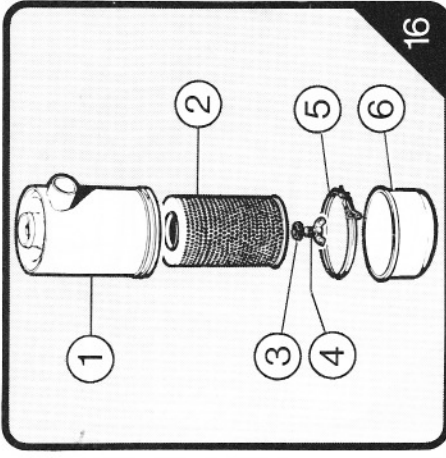
NOTE:- On some air cleaners, the dust cap is retained by a moulded plastic knob which must be unscrewed.

2. Empty all dust from the cup.
3. Remove the wing nut and washer and extract the element from the air cleaner body.
4. Clean the element by directing the compressed air nozzle up and down the pleats on the inside of the element. Maintain a reasonable distance between the nozzle and element.
5. Check the condition of the element by placing a bright light inside. The slightest hole in the element will render it unfit for further use. Replace by a new element if necessary.
6. Insert the element in the air cleaner body, replace the washer and screw on and tighten the wing nut.
7. Replace the dust cup and clamp.

NOTE:- The level of dust in the cup should not be allowed to build up excessively; empty more frequently than specified if necessary.

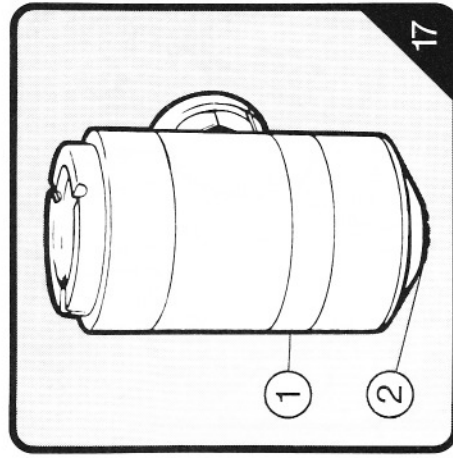
If a restriction indicator is fitted (Fig. 17) the air cleaner should be serviced when the red signal shows.

A type now in common use has a red signal that automatically locks in the fully exposed position, indicating the need for air cleaner service. After the element is cleaned or replaced, the indicator is reset by pressing the rubber button at the base of the body.



Paper Element Air Cleaner

1. Body
2. Element
3. Washer
4. Wing Nut
5. Clamp
6. Dust Cup

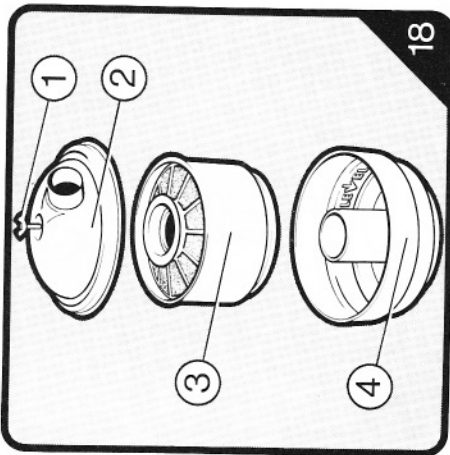


Air Cleaner Restriction Indicator

1. Red Signal
2. Reset Button

Clean the Air Cleaner Element — Engine Mounted Oil Bath Type

1. Slacken clips securing air cleaner hose and remove hose.
2. Remove wing bolt (Fig. 18) and detach complete air cleaner assembly from engine.
3. Detach cover and lift out filter element. Wash element in gasoline and allow to dry.
4. Dip element in new engine oil and leave to drain.
5. Wash out air cleaner body with gasoline, stand body on level surface and fill with new engine oil to the level mark.
6. Fit filter element in body and replace cover.
7. Fit air cleaner assembly on the engine and secure with the wing bolt.
8. Replace hose and tighten clips.



Oil Bath Air Cleaner

1. Wing Bolt
2. Cover
3. Filter Element
4. Air Cleaner Body

Clean Fuel Lift Pump — Plunger Type

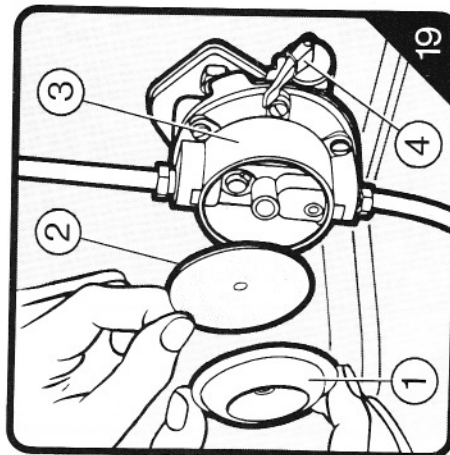
1. Turn off the fuel supply.
2. Disconnect the fuel outlet pipe.
3. Remove the connector and primer plunger assembly and sealing washers (Fig. 20).
4. Withdraw the valves and clean and examine them.
5. Unscrew the retaining plug, remove the sealing washer and withdraw the spring plunger and rod.
6. Thoroughly clean the pump body.
7. Replace the valves, springs, connector, plunger assembly and seals, also plunger rod and sleeve, plug and seal.
8. Bleed the fuel system (page 26).
9. Run the engine and check to see that no fuel is leaking from the pump.

Fuel Lift Pump — Plunger Type

1. Primer Plunger Assy.
2. Seal
3. Spring
4. Valve Optional
5. Valve
6. Body
7. Plunger Sleeve
8. Spring
9. Seal
10. Plug
11. Plunger Rod
12. Connector

Clean Fuel Lift Pump — Diaphragm Type

1. Turn off fuel supply tap.
2. Unscrew the centre bolt and remove the cover and gauze filter — see Fig. 19.
3. Clean the pump, filter and cover thoroughly in fuel oil. Check that the filter is in good condition.
4. Replace the filter, cover and centre bolt.
5. Bleed the fuel system (Page 26).
6. Run the engine and check to see that no fuel is leaking from the pump.

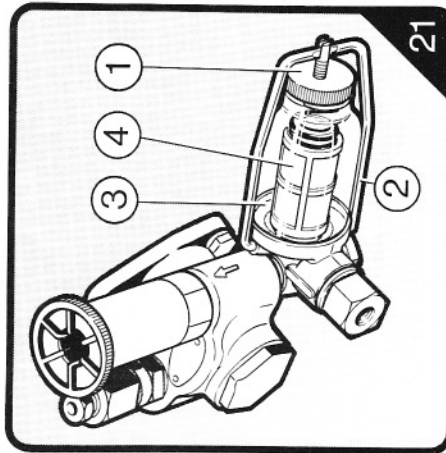


Fuel Lift Pump

1. Cover
2. Gauze Filter
3. Pump Body
4. Priming Lever

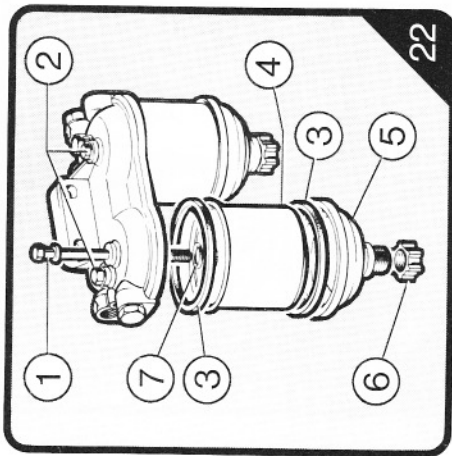
Clean Pre-Filter Unit

1. Fully slacken off the knurled clamping knob (Fig. 21) and swing the 'stirrup' to one side.
2. Remove glass bowl and detach filter element.
3. Wash filter element and bowl thoroughly in clean fuel oil and dry bowl with non-fluffy rag.
4. Place filter element in glass bowl, spring first, then assemble bowl to housing, ensuring that the element spigot enters the recess in the housing.
5. Swing 'stirrup' into position and tighten clamp knob sufficiently to ensure a good seal. Do not overtighten.
6. Bleed the fuel system (page 26).
7. Run the engine and check for fuel leaks.



Pre-Filter Unit

1. Knurled Clamping Knob
2. 'Stirrup'
3. Glass Bowl
4. Filter Element



Fuel Filter

1. Securing Bolt
2. Bleed Screws
3. Seal
4. Filter Element
5. Bowl
6. Drain Cap
7. Seal

Renew Fuel Filter Elements

1. Turn off the fuel supply tap.
2. Unscrew the securing bolts (Fig. 22) and remove the filter bowls and elements.
3. Discard the elements and upper and lower sealing rings.
4. Wash out the bowls with clean fuel oil. Do not use a cloth.
5. Unpack the new elements and sealing rings.
6. Fit the new sealing rings to the filter head and filter bowls.
7. Assemble the elements and filter bowls to the filter head. Replace and tighten the securing bolts.
8. Bleed the fuel system (page 26).
9. Run the engine and check to see that no fuel oil is leaking from the filter body.

Bleed the Fuel System

1. Ensure that there is sufficient fuel in the tank and that the fuel supply tap is turned on.
2. Open the bleed screw on the inlet side of the filter (Fig. 22).
3. Operate the priming lever or plunger on the fuel lift pumps (Figs. 19 and 20) until a flow of fuel, free from air, is expelled from the screw.
4. Close the inlet bleed screw.
5. Open the bleed screw on the outlet side of the filter (Fig. 22).
6. Repeat operation 3.
7. Close the outlet bleed screw.

FAULT FINDING:

ENGINE WILL NOT START

Starter does not crank engine

- Battery run down;
- Lead disconnected;
- Faulty starter switch;
- Faulty isolation switch;
- Faulty starter motor.

Starter cranks engine slowly

- Battery partly run down;
- Terminal(s) loose;
- Connections dirty;
- Wrong grade engine oil;
- Faulty starter motor.

Starter cranks engine normally

- MECHANICAL
- Injection timing incorrect;
- Poor cylinder compression;
- Blocked air cleaner (where fitted).

FUEL SYSTEM

Fuel Not Reaching Injection Pump

- Insufficient fuel in tank;
- Blocked fuel pipeline;
- Faulty lift pump;
- Restricted fuel filter;
- Air leaks in pipeline.

Fuel Reaching Injection Pump

- Air in fuel system;
- Control rod sticking;
- Excess fuel device inoperative (where applicable);
- Faulty Injectors.

GENERAL MAINTENANCE INFORMATION

Refuelling

The fuel injection equipment is made to very accurate limits and therefore even the smallest particle of dirt entering the system will destroy its efficiency by causing scoring or premature wear on the highly finished parts.

Ensure that scrupulous cleanliness is observed when handling the fuel system components and also the fuel.

At all times take care that water is not allowed to contaminate the fuel oil.

Whenever the fuel system is disconnected at any point fit suitable blanking plugs.

If the fuel pipes are disconnected or in the event of the engine running out of fuel, the system should be bled as described on page 26.

It is important to use a fine gauze filter and a clean, dry, rust-free funnel when refuelling.

After drawing fuel from the storage tank ensure that the tap is not leaking and clean up any fuel which may have been spilt. Fuel oil does not evaporate and will collect dust and dirt if allowed to remain.

Try to make a practice of refuelling in a sheltered position. Always wipe the fuel tank around the filler cap before and after filling and immediately replace the cap.

FUEL

Faulty injector(s).

Insufficient water.
Insufficient lubricating oil;
Fan belt slack or broken;
Blocked radiator tubes (where applicable);
Thermostat sticking;
Injection timing incorrect;
Water pump needs attention;
Engine needs top overhaul.

Faulty injector(s);
Air in system

Bearings worn;
Piston slap;
Sticking valve rocker(s);
Broken valve spring(s);
Injection timing incorrect.

Incorrect Pump Timing;
Faulty injector(s);
Faulty pump.

Maximum stop screw out of adjustment;
Faulty boost control unit;
Excess fuel device faulty (where fitted)
Poor compression.

Faulty injector(s);
Air in system;
Faulty pump.

Sticking valve(s);
Sticking piston rings;
Engine needs top overhaul;
Broken injector pipe.

Air in system;
Faulty lift pump;
Fuel filter restricted;
Insufficient fuel in tank.

Valve(s) sticking;
Governor idling setting incorrect.

Air in system;
Faulty lift pump;
Fuel filter restricted;
Faulty injector(s);
Insufficient fuel in tank;
Dirty air cleaner;
Control Rod Sticking;
Stop control pulled out slightly.

Sticking valve(s);
Worn piston rings and bores;
Incorrect valve clearance;
Sticking piston rings;
Injection timing incorrect;
Engine overheating.

Air in system;
Fuel filter restricted;
Faulty injector(s);
Faulty lift pump;
Insufficient fuel in tank;
Faulty pump.

Governor idling setting incorrect;
Injection timing incorrect;
Sticking valve(s);
Broken valve spring(s).

ENGINE OVERHEATS

ENGINE KNOCKS

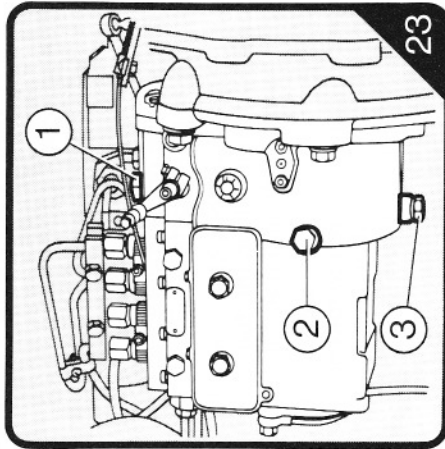
EXHAUST EMITS EXCESSIVE SMOKE

ENGINE MISFIRES

ENGINE STARTS AND STOPS

ENGINE DOES NOT GIVE FULL POWER

ENGINE IDLES IMPERFECTLY



Injection Pump Oil Level Check

1. Filler Plug
2. Level Plug
3. Drain Plug

Check Injection Pump Oil Level
This does not apply to automotive and G.P. governed pumps.

1. Clean the exterior of the injection pump around the filler plug and level plug areas (Fig. 23).
2. Remove filler plug and level plug.
3. Add engine oil through the filler orifice, as necessary, until oil reaches the level plug orifice.
4. Replace the level plug and filler plug.

SEALED RADIATOR SYSTEM

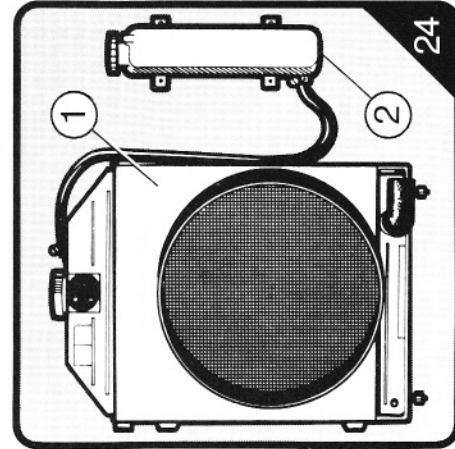
This system is similar to the Open Type except that an expansion tank is connected by a pipe to the radiator filler neck (Fig. 24). The system is filled with an anti-freezing mixture and sealed on original installation; it requires far less attention than the open radiator system.

At the intervals recommended by the manufacturer of the cooling system, the coolant should be drained, the condition of the hoses and connections checked and the system refilled with a mixture of antifreeze and water.

Refer to the following text for the recommended concentrations.

Several types of radiators are available. The actual type fitted will have been selected to suit the engine duty and the ambient temperature of the surrounding air.

If the radiator grilles become clogged, they should be cleaned otherwise the engine will overheat.



Sealed Cooling System

1. Radiator
2. Expansion Tank

Cooling System

Under no circumstances may the engine be started without liquid in the cooling system.

Two basic types of cooling system are used:

- (a) Radiator and Fan (Industrial)
- (b) Raw Water (Marine)

The industrial engine is fitted with either an 'Open' or 'Sealed' radiator system.

OPEN RADIATOR SYSTEM

This consists of a radiator, fan, water pump and thermostat. The system requires regular attention and the level of the coolant in the radiator should be kept 'topped up'. If the engine is in continuous use in hot weather the coolant level should be checked several times daily.

RAW WATER (MARINE) SYSTEM

The raw water pump, mounted on the front PTO, circulates the water through the following components: charge air cooler (where fitted), gearbox oil cooler, engine oil cooler and heat exchanger. No fan is used.

The fresh water circuit may be either an 'open' or 'sealed' type.

ANTIFREEZE SOLUTIONS

In territories where freezing conditions may occur, the coolant should consist of a mixture of 50% plain water and 50% Motorcraft Antifreeze Super Plus. This antifreeze contains additional corrosion inhibitors designed to provide lasting protection for the engine.

Only this antifreeze, or proprietary antifreeze meeting Ford Specification SSM-97B-9103-A should be used when topping-up or refilling the cooling system.

'Motorcraft Antifreeze Super-Plus' has long life characteristics and if the concentration is kept to a maximum of 50% it will provide adequate frost protection and inhibiting for up to two years.

In territories where the ambient temperature is such that no protection against freezing is required, it is recommended that a 25% concentration of 'Motorcraft Antifreeze Super-Plus' is used. This will protect water pumps, core plugs, thermostat housings and radiators against corrosion for up to one year when used at this concentration.

The antifreeze concentration in a cooling system can be determined by using a suitable hydrometer.

A reading of 1080 represents a 50% anti-freeze concentration.

A reading of 1040 represents a 25% anti-freeze concentration.

A reading of 1000 represents plain water.

WARNING: Antifreeze contains

Monoethylene Glycol and other constituents which are toxic if taken internally and can be absorbed in toxic amounts on repeated or prolonged skin contact. Persons using antifreeze are recommended to adhere to the following precautions:

1. Antifreeze must never be taken internally. If antifreeze is swallowed accidentally, medical advice should be sought immediately.
2. Precautions should be taken to avoid skin contact with antifreeze. In the event of accidental spillage onto the skin, antifreeze should be washed off as soon as practicable. If clothing is splashed with antifreeze, it should be removed and washed before being worn again, to avoid prolonged skin contact.
3. For regular and frequent handling of antifreeze, protective clothing (plastic or rubber gloves, boots and impervious overalls or aprons) must be used to minimise skin contact.

DRAINING AND CLEANING THE SYSTEM

When draining the system remove the filler cap and open the two drain cocks, one under the radiator, (in the case of industrial application) or under the water cooled exhaust manifold (in the case of marine application), the other on the cylinder block beneath the alternator. If the flow ceases probe the cocks carefully to dislodge any sediment that may be causing a temporary blockage.

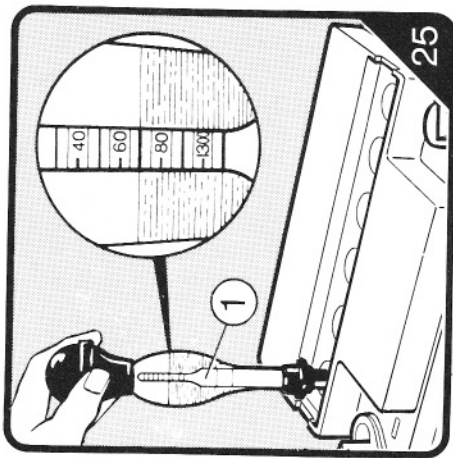
Flush the system through with a hose until clean water emerges; allow all water to drain out, then close the drain cocks before refilling the system.

Fill the system slowly, to avoid air locks.

NOTE:- When refilling the cooling system on engines fitted with water cooled manifolds, the engine should be run slowly for half an hour with the pressure cap removed to allow any air locks in the cooling system to disperse.

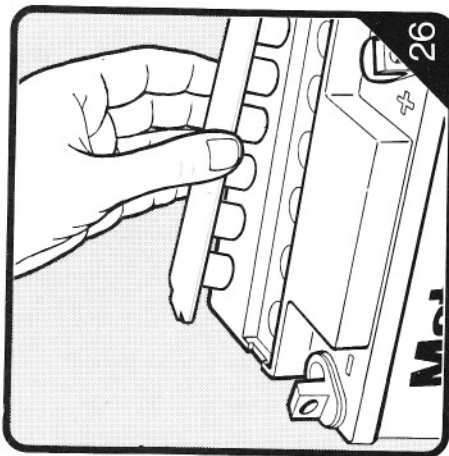
NOTE:- Disconnecting the hose from the manifold outlet connection will also assist in expelling any trapped air.

Run engine and check hose connections for leaks. Check and, if necessary, top up coolant.



Checking Battery Specific Gravity

1. Float must be moving freely



Battery Vent Cover Removal

Electrical System

Engines used for industrial applications employ a negative earth return wiring system.

Engines used in marine applications employ an insulated return wiring system.

BATTERY CHARGING

Distilled water for battery use should be kept in clean, covered vessels of glass, china, rubber or lead.

If the battery is allowed to stand in frosty weather in an unduly discharged condition there is the possibility that it may freeze, causing damage to the container. Take care, therefore, to keep the battery as fully charged as possible — specific gravity 1,275 at 21°C (70°F) since then it is unlikely to be affected by frost. (Fig. 26).

Special precautions should be taken when operating in cold climates to prevent the battery state from falling below the conditions indicated by the following specific gravities:

- 1,200 specific gravity at -18°C (0°F)
- 1,245 specific gravity at -29°C (-20°F)
- 1,265 specific gravity at -35°C (-30°F)

Check Battery Electrolyte Level

1. Remove battery vent cover (Fig. 27) and check that the electrolyte level is 6 to 9 mm (0,25 to 0,37 in) above the tops of the separators.

Some batteries have translucent cases; the electrolyte level in these should be between the 'min.' and 'max.' marks.

2. If necessary top-up with distilled water.

NOTE:- In cold weather distilled water should only be added immediately before running the engine.

3. Replace battery vent cover and press down firmly.
Before carrying out the next operation, put on protective goggles and impervious gloves; protective goggles are particularly important if using a wire brush to clean the battery terminals.

4. Wipe the exterior of the battery and the terminals with a rag moistened with ammonia.

5. Ensure that the electrical connections are clean and tight and coat the terminals with petroleum jelly to protect them from corrosion.

GENERAL PRECAUTIONS

Do NOT disconnect the battery leads while the engine is running.

Do NOT remove the plug from the rear of the alternator or (where a separate regulator is fitted) from the regulator when the engine is running.

CAUTION:- Since explosive hydrogen gas is always present, sparks or flames should not be allowed near the battery. When using battery 'jumper' cables, the cables should always be attached to the booster battery first to reduce the possibility of sparks near a charged battery. The positive (+) terminals of the batteries must be connected through one cable (usually red), and the negative (-) terminals connected through the other cable. If this procedure is not followed, extensive damage may be done to the charging system.

After starting do not disconnect the 'jumper' leads while the engine is running at over 1 000 rpm (or fast idle).

GENERAL SPECIFICATIONS

NATURALLY ASPIRATED ENGINES

Engine Model number	4 Cylinder diesel 2722	6 Cylinder diesel 2723	6 Cylinder diesel 2725
Type	Overhead valve (Direct Injection Diesel)	Direct Injection Diesel	Direct Injection Diesel
Bore	107 mm (4,22 in)	105 mm (4,125 in)	107 mm (4,22 in)
Stroke	115 mm (4,52 in)	115 mm (4,52 in)	115 mm (4,52 in)
Capacity	4,150 l (254 cu in)	5,950 l (363 cu in)	6,220 l (380 cu in)
Compression Ratio	16,1:1	16,1:1	16,1:1
Firing order	1 2 4 3	1 5 3 6 2 4	1 5 3 6 2 4
Max. Power Output in kW to BS 5514/DIN 6271 (except 2728T)	Intermittent 58,5 at 2600 rpm	76,2 at 2500 rpm	90 at 2600 rpm
	Continuous 52,8 at 2600 rpm	68,8 at 2500 rpm	81,4 at 2600 rpm
Valve clearance (hot & cold)			
Inlet	0,38mm	0,38mm	0,38mm
Exhaust	0,38mm	0,38mm	0,38mm
Oil pressure (min.)	2,8 bar	2,1 bar	2,1 bar
2000 rpm	3,2 bar	2,9 bar	2,9 bar
Oil Temperature (max.)	125°C (257°F)	125°C (257°F)	125°C (257°F)
Service Oil Fill Capacity (including filter)			
Engine with Front Well Oil Pan	9,1 litre (16pt)	13,6 litre (24pt)	13,6 litre (24pt)
Engine with Rear Well Oil Pan	9,1 litre (16pt)	13,6 litre (24pt)	13,6 litre (24pt)
Engine with Shallow Oil Pan	9,1 litre (16pt)	17,2 litre (30pt)	17,2 litre (30pt)
Engine with High Inclination Oil Pan	11,7 litre (20,6pt)	21,2 litre (37,3pt)	21,2 litre (37,3pt)
Oil filter capacity	1 litre (1,76pt)	1 litre (1,76pt)	1 litre (1,76pt)
Engine coolant capacity			
Less Radiator	8,23 litre (14,5pt)	9,95 litre (17,5pt)	9,95 litre (17,5pt)
Fresh Water Circuit			
Optimum operating temperature	99°C (210,2°F)	99°C (210,2°F)	99°C (210,2°F)
Fan belt tension	13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.	13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.	13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.

* 2728T Max. Power to BS AU 141a/DIN 70020.

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TURBOCHARGED ENGINES

6 Cylinder diesel 2726T	6 Cylinder diesel 2726TG	6 Cylinder diesel 2726TM	6 Cylinder diesel 2728T
Overhead valve (Direct Injection Diesel)	Overhead valve (Direct Injection Diesel)		
105mm (4,125 in)	105mm (4,125 in)	105mm (4,125 in)	105mm (4,125 in)
115mm (4,52 in)	115mm (4,52 in)	115mm (4,52 in)	115mm (4,52 in)
5,950 l (363 cu in)	5,950 l (363 cu in)	5,950 l (363 cu in)	5,950 l (363 cu in)
15,45:1	15,45:1	15,45:1	14,7:1
1 5 3 6 2 4	1 5 3 6 2 4	1 5 3 6 2 4	1 5 3 6 2 4
107,5 at 2400 rpm	87 at 1500 rpm 97 at 1800 rpm 79 at 1500 rpm 88 at 1800 rpm	107 at 2400 rpm	149 at 2450 rpm*
97,1 at 2400 rpm		97,4 at 2400 rpm	135,5 at 2450 rpm*
0,46mm	0,46mm	0,46mm	0,46mm
0,46mm	0,46mm	0,46mm	0,46mm
2,1 bar	2,1 bar	2,1 bar	2,65 bar
2,9 bar	2,9 bar	2,9 bar	3,1 bar
125°C (257°F)	125°C (257°F)	125°C (257°F)	110°C (230°F)
13,6 litre (24pt)		13,6 litre (24pt)	
17,2 litre (30pt)	17,2 litre (30pt)	17,2 litre (30pt)	19 litre (33,5pt)
21,2 litre (37,3pt)	21,2 litre (37,3pt)	21,2 litre (37,3pt)	2 litre (3,52pt)
1 litre (1,76pt)	1 litre (1,76pt)	1 litre (1,76pt)	
9,95 litre (17,5pt)	9,95 litre (17,5pt)	9,95 litre (17,5pt)	
99°C (210,2°F)	99°C (210,2°F)	99°C (210,2°F)	99°C (210,2°F)
13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.	13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.	13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.	13mm (0,5 in) total free movement measured at mid-point on longest span between pulleys.

TIGHTENING TORQUES

	Nm	kgf m	lbf ft
Oil Pan Drain Plug(s)	47 to 54	4,8 to 5,5	35 to 40
Alternator Adjusting & Mounting Bolts	16 to 20	1,7 to 2,0	12 to 15
Idler Pulley Adjusting & Mounting Bolts	16 to 20	1,7 to 2,0	12 to 15
Injection Pump Filler Plug, Level Plug & Drain Plug	4,0 to 6,8	0,4 to 0,7	3 to 5
Fuel Lift Pump Centre Bolt	9,5 to 13,5	1,0 to 1,4	7 to 10
Fuel Filter Element Retaining Bolt	6,8 to 9,5	0,7 to 1,0	5 to 7
Fuel Filter Bleed Screws	6,8 to 9,5	0,7 to 1,0	5 to 7
Injection Pump Bleed Screws	4,0 to 6,8	0,4 to 0,7	3 to 5
Rocker Cover Retaining Screws	4,0 to 5,5	0,4 to 0,6	3 to 4

FORD OVERSEAS COMPANIES AND DISTRICT OFFICES

Ford service facilities are available in nearly every country of the world. Service in each country is covered by a network of Authorized Ford Dealers. As these are too numerous to mention here, we have restricted the following list to overseas Ford Companies together with District Offices and the areas they supervise.

FORD IN EUROPE

D
Ford of Europe Inc.
Industrial Products Sales
MW/GS-2
PO Box 714444
5000 Cologne 71
Telephone (0221) 719-4117
Telex 8 885 40 1 VED

Ford-Werke AG
D-5000 Köln 71
West Germany
Telephone (0221) 719-7371
Telex 8 885 40 1 VED

GB
Ford Motor Company Limited
Parts Distribution Centre
Royal Oak Way South
Daventry Northants NN11 5NT, England
Telephone Daventry (03272) 71111
Telex 995511 FORDTAG

IRE
Henry Ford & Son Limited
Marina
Cork, Ireland
Telephone Cork (021) 965500
Telex 26164 A FORDE 1 (Parts)

F
Ford France SA
344 Avenue Napoleon Bonaparte
BP 307, France
F-92506 Rueil-Malmaison
Telephone (014) 732600
Telex FORD A 203213F

NL
Ford Nederland BV
Hemweg 201, Postbus 795
1000 AT Amsterdam, Netherlands
Telephone (020) 148805-540911
Telex 15149 FMPDC NL (Parts)

B
Ford Motor Company
(Belgium) NV
Parts Distribution Centre
Postbus 37
B-2030 Antwerp, Belgium
Telephone (031) 413352
Telex 31430 A FOMOC B

S
Ford Motor Company AB
Fullvaktsvägen 11, Box 27303
S-10254 Stockholm, Sweden
Telephone (08) 7828500
Telex 19451 FORDST S

DK
Ford Motor Company A/S
Sluseholmen 1
DK-2450 Copenhagen SV, Denmark
Telephone (01) 310510
Telex 22218A FORD DK

N
Ford Motor Norge A/S
N 1410 Kolbotn, Norway
Telephone (02) 808080
Telex 19182 DEPOT N (Parts)

SF
O/Y Ford A/B
Henry Fordin Katu 6
PO Box 46
SF-00101 Helsinki 10, Finland
Telephone (80) 649011
Telex 121347 FORDP SF

A
Ford Motor Company
(Austria) KG
Furbergstraße 51, PO Box 2
A 5021 Saizburg, Austria
Telephone (0662) 24581
Telex 633201 A FORD A

CH
Ford Motor Company
(Switzerland) SA
Kurvenstraße 35
CH-8021 Zurich, Switzerland
Telephone (01) 3631110
Telex 52230A FORD CH

E
Ford Espana SA
Paseo de la Castellana 135
8 planta Madrid 16, Spain
Telephone (01) 2799500 or 2706700
Telex 42352 FORD E

P
Ford Lusitana SARL
Apartado 2248
R Rosa Araujo 2
1106 Lisbon Codex, Portugal
Telephone (01) 539141
Telex 122 18 LISPOR P

I
Ford Italiana SpA
Parts Distribution Centre
Via della Maggiona, 29
Angolo Via Campo Bello
00040 Pomezia-Rome, Italy
Telephone (06) 911900
Telex 611106 FORD PI

FORD WORLDWIDE

Argentina
Ford Motor Argentina SA
Casilla Correo 696
Correo Central
1000 Buenos Aires Argentina
Phone: (01) 394 1017

Australia
Ford Motor Company of Australia Ltd.
Private Bag 2
Campbellfield
Victoria 3061
Australia
Phone: (03) 3597913

Brazil
Ford Willys Do Brazil SA.
Caixa Postal 5064
Sao Paulo, Brazil
PhoneL (011) 457 7744

Canada
Ford Motor Company of Canada Ltd.
PO Box 20
Oakville, Ontario, Canada
PhoneL (416) 8452511

Mexico
Ford Motor Company SA
Paseo de la Reforma
Apartado 39 Bis.
Mexico 14DF, Mexico
Phone: (05) 525 9200

New Zealand
Ford Motor Company of New Zealand Ltd.
Private Bag
Auckland, New Zealand
Phone: (09) 2780920

South Africa
SAMCOR (Pty) Ltd.
PO Box 411
Pretoria, South Africa
Phone: (012) 831121

Taiwan
Ford Lio Ho Motor Co. Ltd.
PO Box 12
Chung Li, Taiwan ROC
Phone: (034) 553131

Malaysia
Amim Holdings Sdn. Bhd.
GPO Box 12612
Kuala Lumpur, Malaysia
Phone: (03) 591601

USA
Ford Motor Company
3000 Schaefer Road
Dearborn, Michigan 48121, USA
Phone: (313) 3232090

Venezuela
Ford Motor de Venezuela SA
Apartado 354
Valencia, Venezuela
Phone: (041) 213881

Eastern Bloc/
Middle East/Africa
Ford of Europe Inc.
Ford International
Export Sales
Central Region
Trafford House
Station Way
Basildon
Essex SS16 5XX
England
Phone: (0268) 703147

SUPERVISING THE FOLLOWING COUNTRIES

Afghanistan
Algeria
Andorra
Angola
Ascension Is.
Bahrain
Bangladesh
Benin
Bulgaria
Burundi
Burkina Faso
Cameroon
Cape Verde Is.
Central African Republic
Ceuta/Melilla
Chad
Congo
Cyprus
Czechoslovakia
Djibouti
Egypt
Equatorial Guinea
Ethiopia
Gabon
Gambia
Ghana
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Israel
Ivory Coast
Jordan
Kenya
Kuwait
Lebanon
Liberia
Libya
Malawi
Malagasy Republic
Mali
Malta
Mauritania
Mauritius
Morocco
Mozambique
Niger
Nigeria
Oman
Pakistan
Poland
Qatar
Reunion
Rumania
Russia
Rwanda
Saint Helena
Sao Tome & Principe
Saudi Arabia
Senegal
Seychelles
Sierra Leone
Somalia
Spanish North Africa
Sudan
Syria
Tanzania
Togo
Tunisia
Turkey
Uganda
United Arab Republic
Upper Volta
Yemen Peoples Republic
Yemen Peoples Republic —
Sena
Yugoslavia
Zambia
Zaire
Zimbabwe

Caribbean, Central &
South America
Ford International
Export Sales
Latin-America Regional Office
4901 NW, 17th Way
Fort Lauderdale, Florida 33309
USA.

Aruba
Bahamas
Barbados
Belize
Bermuda
Bolivia
Bonaire NA
Cayman
Chile
Colombia
Costa Rica
Curacao NA
Dominica
Dominican Republic
Ecuador
El Salvador
Grand Bahama Is.
Grenada
Guadeloupe
Guatemala
Guayana
Guayane Francaise
Haiti
Honduras
Jamaica
Martinique
Netherlands Antilles
Nicaragua
Japan
Korea
Laos
Marianas Is.
Maldives Is.
Nauru
Nepal
New Caledonia
New Guinea
Norfolk Is.
Philippines

Far East/Oceania
Ford International
Export Sales
Level 6
468 St. Kilda Road
Melbourne, Victoria 3004
Australia
Phone: (03) 2672744

Panama
Paraguay
Peru
Puerto Rico
St. Kitts
St. Lucia
St. Pierre et Miquelon
St. Vincent
Surinam
Tortola
Trinidad
U.S. Virgin Is.
Singapore
Society Is.
Solomon Is.
Sri Lanka
Tahiti
Thailand
Tonga
Vanuatu
Western Samoa

LUBRICATING OILS FOR 2726TG ENGINES

2726TG engines must use Super S3 Quality Multigrade Motor Oils. These are Super High Performance Diesel (SHPD) Oils and meet European Specification CCMCD3. The following lubricating oils are suitable for the 2726TG:-

AGIP	Agip Sigma Turbo
ARAL	Aral Multi Turboral Plus
ASEOL	Aseol Turbo SHPD 15-96
AVIA	Avia Multigrade HDC Plus
BP	BP Vanallus C 3 Extra BP VISO Diesel
CALTEX	Caltex RPM Delo 450 Oil
CASTROL	Castrol Turbomax Deusol Turbomax
CHEVRON	Chevron Delo 450 Motor Oil Multigrade
ELF	Elf Multiperformance 4 D
EXXON/ESSO	Diesel Motor Oil 500
GULF	Gulf Turbo Diesel
MOBIL OIL	Mobil Delvac 1400 Super
MOTUL	Motul Traffic
SHELL	Shell Myrina Shell Myrina T *) Shell Myrina X *)
SUN OIL	Sunfleet Super HPD
TEXACO	Ursa Super TD Multigrade Dieseltex T Lubroviscol Turbo-Diesel Lubroviscol Turbo Extra D
TOTAL	Total Rubia TIR
VALVOLINE	Valvoline All Fleet Extra Valvoline Super HDS LD
VEEDOL	Veedol Turbostar

*) Different Viscosity grades