Please cut where indicated and insert the label into the plastic pocket on the spine of the binder.

40 SERIES TRACTOR SERVICE

5640, 6640, 7740, 7840, 8240, 8340

Vol. 1

40564061

40 SERIES TRACTOR SERVICE

5640, 6640, 7740, 7840, 8240, 8340

Vol. 2

40564061

06900800

POWERSTAR REPAIR MANUAL CONTENTS

FOREWORD

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all equipment as well as the personal safety of the individual performing the repair.

This Repair Manual provides fault finding, overhaul and pressure testing instructions using recommended procedures and equipment. Following these instructions will ensure the safe, efficient and timely completion of the service or repair. Anyone who departs from these instructions should be aware that they do so at the risk of compromising their own personal safety and the safety of others.

Throughout this Manual you will see text in *italics*, preceded by the words **NOTE, IMPORTANT** or **WARNING.** Such text has the following significance.

NOTE: *This text stresses a correct operating procedure or technique.*

IMPORTANT: *This text stresses a correct operating technique or procedure that, if ignored, could result in damage to the tractor or equipment.*

WARNING: *This text stresses a correct operating technique or procedure that, if ignored, could result in personal injury or death to the Operator or bystanders.*

The Manual is divided into Parts, each sub–divided in turn into Chapters. Each Chapter contains information on general operating principles, detailed inspection, overhaul and where applicable, specific trouble shooting, special tools and specifications. Any reference in this Manual to right, left, rear, front, top or bottom, is as viewed from the Operator's seat, looking forward.

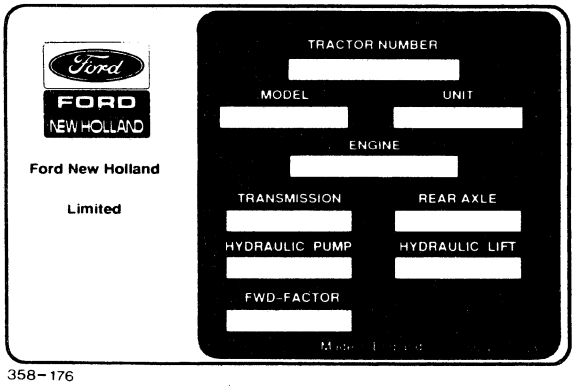
All data and illustrations in this Manual are subject to variations in build specification. This information was correct at the time of issue, but Ford New Holland policy is one of continuous improvement and the right to change specifications, equipment or design at any time, without notice, is reserved.

PRODUCTION DATE CODES AND SERIAL NUMBERS

Series 40 Tractors have an identification plate located under the right–hand hood panel.

Whenever effecting a repair or overhaul, the relevant information should be noted and used when referring to Service Bulletins and/or the Parts Catalogue.

TRACTOR IDENTIFICATION PLATE



358–176

This plate is stamped with the following information:

- **TRACTOR NUMBER** – Serial number prefixed by the letters 'BD'.
- **MODEL** – Production model code.
- **UNIT** – Production unit date code.
- **ENGINE** – Serial number and engine production date code.
- **TRANSMISSION** – Transmission production date code.
- **REAR AXLE** – Rear axle production date code.
- **HYDRAULIC PUMP** – Hydraulic pump production date code.
- **HYDRAULIC LIFT** – Hydraulic power lift production date code.
- **FWD FACTOR** – Four wheel drive factor.

KEY TO PRODUCTION DATE CODES:–

First Number YEAR	First Letter MONTH		Second Number DAY OF MONTH	Second Letter PRODUCTION SHIFT
1–1991 2–1992 3–1993 4–1994 5–1995	A–Jan. B–Feb. C–Mar. D–Apr. E–May F–June	G–July H–Aug. J–Sept. K–Oct. L–Nov. M–Dec.	01/28/29/30/31	A–Midnight B–Day C–Afternoon

Example of Production Unit Date Code 2 A 0 3 B

Year of Production (1992)	Month of Year (January)	Day of Month (Third)	Shift Period (Day)

CAB, ROPS POST AND FOUR WHEEL DRIVE AXLE IDENTIFICATION PLATES

Figure 1

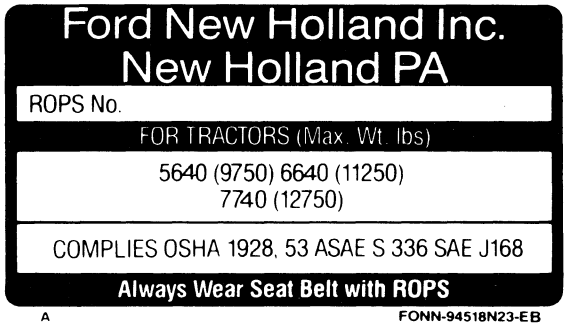


Figure 2

The cab/ROPS identification plate, Figure 1 and Figure 2, are located on the left–hand side of the "Cab" below the windscreen, or the right–hand side "ROPS" post (where fitted).

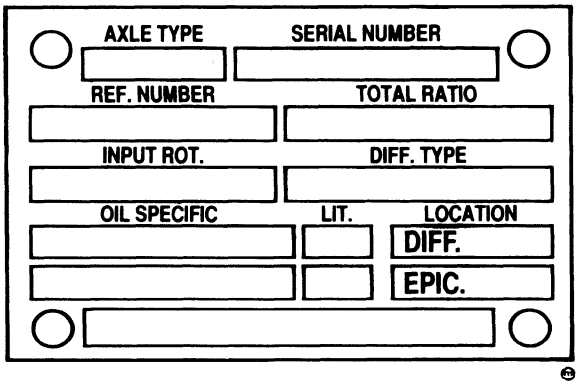


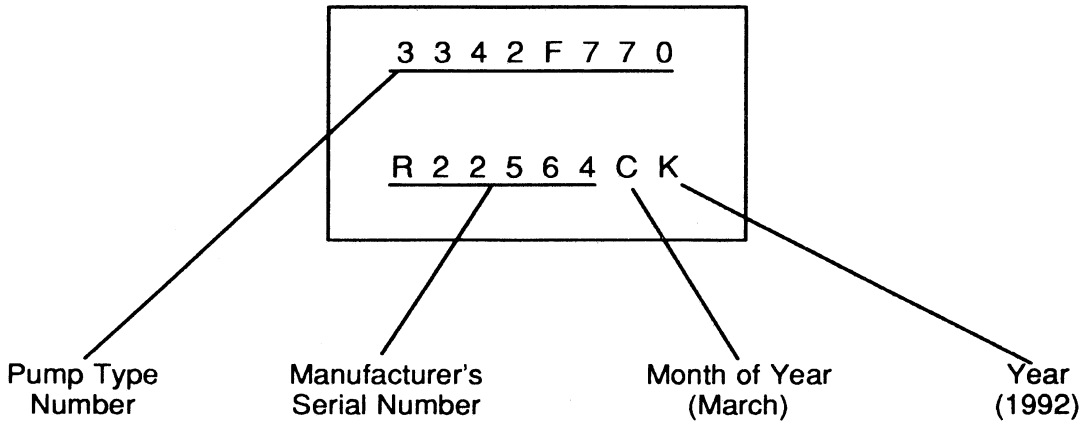
Figure 3

FUEL INJECTION PUMP DATE CODES

The fuel injection pumps carry an identification plate with the pump type number, serial number and manufacturer's production date code. The date code can be identified by reference to the following chart:

MONTH	1991 – 1994 CODE	YEAR	CODE
January	A	1991	J
February	B		
March	C	1992	K
April	D		
May	E	1993	L
June	F		
July	G	1994	M
August	H		
September	J	1995	N
October	K		
November	L	1996	O
December	M		

Example of Fuel Injection Pump Identification Plate:–



FORD

Repair Manual – Series 40 Tractors

HEALTH AND SAFETY

English
SE4853

HEALTH AND SAFETY

Contents **Page**

HEALTH AND SAFETY PRECAUTIONS

Many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health. This section lists, alphabetically, some of these hazardous operations and the materials and equipment associated with them. The precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures and the handling of materials, should be carried out with health and safety in mind.

ACIDS AND ALKALIS – see Battery acids, e.g. caustic soda, sulphuric acid.

Used in batteries and cleaning materials.

Irritant and corrosive to the skin, eyes, nose and throat. Causes burns.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective gloves and goggles. Can destroy oridnary protective clothing. Do not breathe mists.

Ensure access to water and soap is readily available for splashing accidents.

ADHESIVES AND SEALERS – see Fire

Highly Flammable, Flammable, combustible.

Generally should be stored in "No Smoking" areas; cleanliness and tidiness in use should be observed, e.g. disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labelled.

Solvent based Adhesives/Sealers – See Solvents.

Follow manufacturers instructions.

Water based Adhesives/Sealers

Those based on polymer emulsions and rubber lattices may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Follow manufacturers instructions.

Resin based Adhesives/Sealers – e.g. epoxide and formaldehyde resin based.

Mixing should only be carried out in well ventilated areas as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation; dermatitis and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact. Follow manufacturers instructions.

Anaerobic, Cyanoacrylate and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturers instructions followed.

Cyanoacrylate adhesives (super–glues) must not contact the skin or eyes. If skin or eye tissue is bonded cover with a clean moist pad and get medical attention. do not attempt to pull tissue apart. Use in well ventilated areas as vapours can cause irritation of the nose and eyes.

For two–pack systems see Resin based adhesives/sealers.

Isocyanate (Polyurethane) Adhesives/ Sealers – see Resin based Adhesives.

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Any spraying should preferably be carried out in exhaust ventilated booths removing vapours and spray droplets from the breathing zone. Individuals working with spray applications should wear supplied air respirators.

ANTIFREEZE – see Fire, Solvents e.g. Isopropanol, Ethylene Glycol, Methanol.

Highly Flammable, Flammable, Combustible.

Used in vehicle coolant systems, brake air pressure systems, screenwash solutions.

Vapours given off from coolant antifreeze (glycol) arise only when heated.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze if swallowed is fatal and medical attention must be found immediately.

ARC WELDING – see Welding.

ASBESTOS – see Brake and Clutch Linings and Pads.

BATTERY ACIDS – see Acids and Alkalis.

Gases released during charging are explosive. Never use naked flames or allow sparks near charging or recently charged batteries.

BRAKE AND CLUTCH FLUIDS (Polyalkylene Glycols) – see Fire.

Combustible.

Splashes to the skin and eyes are slightly irritating. Avoid skin and eye contact as far as possible. Inhalation of vapour hazards do not

arise at ambient temperatures because of the very low vapour pressure.

BRAKE AND CLUTCH LININGS AND PADS – see Legal Aspects.

These items contain asbestos, which if inhaled may cause lung damage and in some cases, cancer.

The normal handling and fitting of these items should not cause any hazard, but any drilling, grinding or filling of friction materials may produce asbestos dust, and should only be carried out under strictly controlled conditions.

The dust in brake drums etc., contains very little asbestos but care should be taken to avoid inhalation of this dust during servicing of brakes and clutches. The use of drum cleaning units, vacuum cleaning or damp wiping is preferred to the use of air jets for "blowing–out".

The dust should be collected in a sealed plastic bag and disposed with, according to local laws and regulations.

BRAZING – see Welding.

CHEMICAL MATERIALS – GENERAL – see Legal Aspects.

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, brake fluids, oils and grease should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly inflammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life–expectancy.

DO'S

Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.

Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, poster or other instructions. Material health and safety data sheets can be obtained from Manufacturers.

Do organise work practices and protective clothing to avoid soiling of the skin and eyes; breathing vapours/aerosols/dusts/fumes; inadequate container labelling; fire and explosion hazards.

Do wash before job breaks; before eating, smoking, drinking or using toilet facilities when handling chemical materials.

Do keep work areas clean, uncluttered and free of spills.

Do store according to national and local regulations.

Do keep chemical materials out of reach of children.

DO NOTS

Do Not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals; give off toxic or harmful fumes; be explosive when mixed together.

Do Not spray chemical materials, particularly those based on solvents, in confined spaces e.g. when people are inside a vehicle.

Do Not apply heat or flame to chemical materials except under the manufacturers' instructions. Some are highly inflammable and some may release toxic or harmful fumes.

Do Not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas, pits etc.

Do Not transfer chemical materials to unlabelled containers.

Do Not clean hands or clothing with chemical materials. Chemicals, particularly solvents and fuels will dry the skin and may cause irritation with dermatitis. Some can be absorbed through the skin in toxic or harmful quantities.

Do Not use emptied containers for other materials, except when they have been cleaned under supervised conditions.

Do Not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful.

Clutch Fluids – see Brake and Clutch Fluids.

Clutch Linings and Pads – see Brake and Clutch Linings and Pads.

CORROSION PROTECTION MATERIALS
– see Solvents, Fire.

Highly flammable, flammable.

These materials are varied and the manufacturers instructions should be followed. They may contain solvents, resins, petroleum products etc. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

Cutting – see Welding.

De–Waxing – see Solvents and Fuels (Kerosene).

DUSTS

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

ELECTRIC SHOCK

Electric shocks can result from the use of faulty electrical equipment or from the misuse of equipment even in good condition.

Ensure that electrical equipment is maintained in good condition and frequently tested.

Ensure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Ensure that electric equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment which is in any way faulty. The results could be fatal.

Use reduced voltage equipment (110 volt) for inspection and working lights where possible.

Ensure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Use air operated mobile equipment where possible in preference to electrical equipment.

In cases of electrocution:–

– switch off electricity before approaching victim

– if this is not possible, push or drag victim from source of electricity using dry non–conductive material

– commence resuscitation if trained to do so

– SUMMON MEDICAL ASSISTANCE

EXHAUST FUMES

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should only be run under conditions of adequate extraction or general ventilation and not in confined spaces.

Gasolene (Petrol) Engine

There may not be adequate warning properties of odour or irritation before immediate and delayed toxic or harmful effects arise.

Diesel Engine

Soot, discomfort and irritation usually give adquate warning of hazardous fume concentrations.

FIBRE INSULATION – see Dusts.

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organisation of work practices and the use of gloves.

FIRE – see Welding, Foams, Legal Aspects.

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Ensure before using electrical or welding equipment but that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

FIRST AID

Apart form meeting any legal requirements it is desirable for someone in the workshop to be trained in first aid procedures.

Splashes in the eye should be flushed with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

Inhalation affected individuals should be removed to fresh air immediately.

If swallowed or if effects persist consult a doctor with information (label) on material used.

Do not induce vomiting (unless indicated by manufacturer).

FOAMS – Polyurethane – see Fire.

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Follow manufacturers instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems or histories of allergic diseases should not work with or near uncured materials.

The components, vapours, spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapours and spray mists must not be breathed. These materials must be applied with adequate ventilation and respiratory protection. Do not remove respirator immediately after spraying, wait until vapour/ mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes.

Smoking, open flames or the use of electrical equipment during foaming operations and until vapours/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation (see Body Section 44 Legal and Safety Aspects).

FUELS – see Fire, Legal Aspects, Chemicals – General, Solvents.

Used as fuels and cleaning agents.

Gasolene (Petrol).

Highly flammable.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs, e.g. through vomiting, is a very serious hazard.

Gasolene dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe smarting.

Motor gasolene may contain appreciable quantities of benzene, which is toxic upon inhalation and the concentrations of gasolene vapours must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkeness. Very high concentrations will result in rapid loss of consciousness.

Ensure there is adequate ventilation when handling and using gasolene. Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasolene storage tanks.

Gasolene should not be used as a cleaning agent. It must not be siphoned by mouth.

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs. Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapours. Exposure to mists and vapours from kerosene at elevated temperatures should be avoided (mists may arise in de–waxing). Avoid skin and eye contact and ensure there is adequate ventilation.

Gas–Oil (Diesel Fuel) – see Fuels (Kerosene).

Combustible.

Gross or prolonged skin contact with high boiling gas oils may also cause serious skin disorders including skin cancer.

GAS CYLINDERS – see Fire.

Gases such as oxygen, acetylene, carbon dioxide, argon and propane are normally

stored in cylinders at pressures of up to 2000 lb/sq. in. (13,790 kn/m^2) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases (e.g. acetylene and propane) should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

Gases – see Gas Cylinders.

Gas Sheilded Welding – see Welding.

Gas Welding – see Welding.

GENERAL WORKSHOP TOOLS AND EQUIPMENT

It is essential that all tools and equipment are maintained in good condition and the correct safety equipment used where required.

Never use tools or equipment for any purpose other than that for which they were designed.

Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiselling or sand blasting equipment.

Wear a suitable breathing mask when using sand blasting equipment, working with asbestos based materials or using spraying equipment.

Glues – see Adhesives and Sealers.

High Pressure Air, Lubrication and Oil Test Equipment – see Lubricants and Greases.

Always keep high pressure equipment in good condition and regularly maintained, particularly at joints and unions.

Never direct a high pressure nozzle at the skin as the fluid may penetrate to the underlying tissue etc. and cause serious injury.

LEGAL ASPECTS

Many laws and regulations make requirements relating to health and safety in the use of materials and equipment in workshops. Some of these laws which apply in the U.K. are listed. Similar laws exist for other territories:–

- The Factories Act (1961).
- The Asbestos Regulations (1969).
- Highly Flammable Liquids and Liquified Petroleum Gases Regulations (1972).
- Deposit of Poisonous Waste Act (1972).
- Control of Pollution Act (1974).
- Health and Safety at Work Act (1974).
- The Packaging and Labelling of Dangerous Substances Regulations (1978).
- Control of Lead Regulations (1981).

Workshops should be familiar, in detail, with these and associated laws and regulations. Consult local factory inspectorate if in any doubt.

LUBRICANTS AND GREASES

Avoid all prolonged and repeated contact with mineral oils, especially used oils. Used oils contaminated during service (e.g. routine service change sump oils) are more irritating and more likely to cause serious effects including skin cancer in the event of gross and prolonged skin contact.

Wash skin thoroughly after work involving oil. Proprietary hand cleaners may be of value provided they can be removed from the skin with water. Do not use petrol, paraffin or other solvents to remove oil from the skin.

Lubricants and greases may be slightly irritating to the eyes.

Repeated or prolonged skin contact should be avoided by wearing protective clothing if necessary. Particular care should be taken

with used oils and greases containing lead. Do not allow work clothing to be contaminated with oil. Dry clean or launder such clothing at regular intervals. Discard oil soaked shoes.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur. Used oils may only be disposed of in accordance with local regulations, e.g. in the U.K., the Control of Pollution Act.

There are publications describing the problems and advising on precautionary measures. For the U.K. these include:

SHW 295:	Effects of mineral oil on the skin
SHW 295A:	Cancer of the skin caused by oil
SHW 397:	Cautionary notice: Effects of mineral oil on the skin

Noise Insulation Materials – see Foams, Fibre Insulation.

PAINTS – see Solvents and Chemical Materials – General.

Highly Flammable, Flammable.

One Pack. Can contain harmful or toxic pigments, driers and other components as well as solvents. Spraying should only be carried out with adequate ventilation.

Two Pack. Can also contain harmful and toxic unreacted resins and resin hardening agents. The manufacturers instructions should be followed and the section of page 05–2 on resin based adhesives, isocyanate containing Adhesives and Foams should be consulted.

Spraying should preferably be carried out in exhausted ventilated booths removing vapour and spray mists from the breathing zone. Individuals working in booths should wear respiratory protection. Those doing small scale repair work in the open shop should wear supplied air respirators.

Paint Thinners – see Solvents.

Petrol – see Fuels (Gasolene).

Pressurised Equipment – see High Pressure Air, Lubrication and Oil Test Equipment.

Resistance Welding – see Welding.

Sealers – see Adhesives and Sealers.

SOLDER – see Welding.

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy–acetylene flames should not be used, as they are much hotter and will cause lead fumes to be evolved.

Some fumes may be produced by the application of any flame to surfaces coated with grease etc. and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to ensure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filing should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid indigestion of lead or inhalation of solder dust from clothing.

SOLVENTS – see Chemical Materials – General Fuels (Kerosene), Fire.

e.g. Acetone, white spirit, toluene, xylene, trichlorethane.

Used in cleaning materials, de–waxing, paints, plastics, resins, thinners etc.

Highly Inflammable, Flammable.

Skin contact will degrease the skin and may result in irritation and dematitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure to high concentrations of vapours or mists will cause eye and throat irritation, drowziness, dizziness, headaches and in the worst circumstances, unconsciousness.

Repeated or prolonged exposures to excessive but lower concentrations of vapours or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs (e.g. through vomiting) is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Ensure good ventilation when in use, avoid breathing fumes, vapours and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When the spraying material contains solvents, e.g. paints, adhesives, coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers instructions.

Sound Insulation – see Fibre Insulation, Foams.

Spot Welding – see Welding.

SUSPENDED LOADS

There is always a danger when loads are lifted or suspended. Never work under an unsupported suspended or raised load, e.g. jacked up vehicle, suspended engine, etc.

Always ensure that lifting equipment such as jacks, hoists, axle stands, slings, etc. are adequate and suitable for the job, in good condition and regularly maintained.

Never improvise lifting tackle.

Underseal – see Corrosion Protection.

WELDING – see Fire, Electric Shock, Gas Cylinders.

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at high velocity and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultraviolet radiation which may cause eye and skin burns to the welder and to other persons nearby. Gas–shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

Metal spatter will also occur and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation should always be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary, particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases where adequate ventilation cannot be provided, supplied air respirators may be necessary.

Gas Welding

Oxy–acetylene torches may be used for welding and cutting and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright and eye protection should be used, but the ultra–violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be evolved from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, E.G. BOILING OR STEAMING OUT OF FUEL TANKS.

White Spirit – see Solvents.

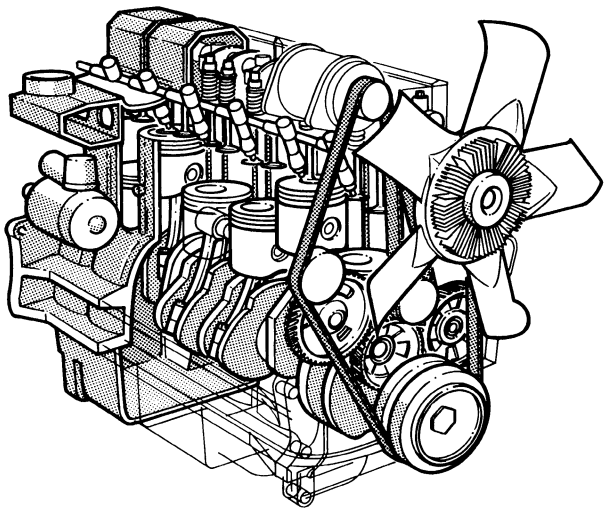
FORD

Repair Manual – Series 40 Tractors

ENGINE SYSTEM –

ENGINE & COOLING

Part 1 – Chapters 1 & 2



SE 4854
English

PART 1
ENGINE SYSTEMS
Chapter 1
DIESEL ENGINES

A. DIESEL ENGINE – DESCRIPTION AND OPERATION

MODEL		5640	6640	7740 (T)	7840	8240	8340
No of Cylinders		4	4	4	6	6	6
BORE	(ins.)	4.4	4.4	4.4	4.4	4.4	4.4
	(mm)	111.8	111.8	111.8	111.8	111.8	111.8
STROKE	(ins.)	4.4	5.0	5.0	4.4	5.0	5.0
	(mm).	111.8	127.0	127.0	111.8	127.0	127.0
DISPLACEMENT	(cu. in.)	268	304	304	401	456	456
	(cu. cm.)	4393	4983	4983	6570	7472	7472

(T) = Turbocharger

This chapter describes the overhaul and repair of the new series, direct injection diesel engines.

These engines are available in 4 or 6 cylinder naturally aspirated forms, with the 4 cylinder also being available in turbocharged form.

As these engines are of similar design and service procedures are common throughout the range. The 4 cylinder engines have a design difference in that they are fitted with a dynamic balancer assembly.

All engines feature cross flow cylinder heads, with the inlet and exhaust manifolds on opposite sides of the cylinder head. The fuel and air combustion process, takes place in the specially designed bowl in the crown of the pistons.

CYLINDER HEAD ASSEMBLY

The cylinder head incorporates valves and springs with the valve rocker arm shaft assembly bolted to the cylinder block through the cylinder head. Cylinder head retaining bolts are evenly spaced with a six point pattern around each cylinder, this ensures an even clamping load across the cylinder head area.

The intake and exhaust manifolds are bolted to the head. The intake manifold is mounted on the right hand side of the engine with the diesel injectors mounted outside the rocker cover. The exhaust manifold is mounted on the left hand side of the engine, water outlet connections and thermostat being attached to the front of the cylinder block directly behind the radiator.

Valve guides are integral in the cylinder head and valves with oversize stems are available in service. Special replaceable cast alloy valve seats are pressed into each valve port during manufacture, with oversize valve seats also available in service.

All valves are fitted with positive valve rotators, with both Intake and exhaust valves using umbrella type oil seals. Valve lash is maintained by adjustment of the self locking adjusting screw, mounted in each of the rocker arms.

CAMSHAFT ASSEMBLY

The camshaft runs in replaceable bearings, with 3 fitted in the 4 cylinder and 5 fitted in the 6 cylinder. The camshaft drive gear is in mesh with, and driven by the camshaft idler gear and crankshaft timing gear.

Camshaft end thrust is controlled by a thrust plate bolted to the block and located between the camshaft gear and the front camshaft journal.

A helical gear is mounted on the rear of the camshaft and drives the engine oil lubrication pump mounted forward of the flywheel.

CRANKSHAFT ASSEMBLY

The crankshaft is supported in the cylinder block by 5 main bearings on the 4 cylinder engine and 7 main bearings, on the 6 cylinder engine.
Two types of material are used in the manufacture of the crankshafts:–
Nodular Iron, that has rough cast crank webbs, for the 5640 & 6640 models and Steel Crankshafts, that have machine finished crank webbs, for the larger models.
End thrust is controlled by a thrust bearing incorporated in the centre main bearing of the crankshaft.

A crankshaft driven dynamic balancer is installed on the 4 cylinder engines to ensure smooth running performance during their working life. The balancer assembly is bolted to the bottom of the cylinder block and contains two meshing weighted gears. These are driven and timed from a gear heat shrunk to the crankshaft.

In addition to the internal balancer, a damper is also fitted externally to the crankshaft pulley. The six cylinder engine requires only this external damper to ensure smooth running operation. Front and rear crankshaft oil sealing is effected by one piece seals that are designed for long and durable service life.

CONNECTING RODS

Connecting rods "Teepee" (wedge) shaped at the small end have been designed to reduce the reciprocating weight at the piston end. The connecting rods are of a heavy beam construction and are assembled as a matched set to each engine, attached to the crankshaft, by means of insert–type copper/lead or aluminium tin alloy bearings.

They are retained in position by the connecting rod big end cap and secured by two bolts per rod. The small end of the connecting rod is fitted with a replaceable bronze bushing, through which the free floating piston pin is fitted. The steel pin being held in place within the piston by two snap rings.

PISTONS

Pistons of increased weight and strength, are constructed of an aluminium silicon alloy with an iron insert for the top ring. The combustion chamber being recessed into the piston crowns.
Each piston has two compression rings and one oil control ring, to reduce friction and increase positive sealing. All rings are located above the piston pin.

MANIFOLDS

The cross flow design aluminium intake, and cast iron exhaust manifolds, are on opposite sides of the cylinder head. This is designed to maintain balanced heat distribution within the cylinder head. The configuration of the manifolds also ensures minimum heat transfer to the intake manifold.

The intake manifold is connected through tubing to the air cleaner and in the rear end of the manifold a tapped hole is provided for installation of a thermostart or an ether cold starting aid.

NOTE: *On tractors where cold start equipment is not installed ensure the plug in the intake manifold is kept tight at all times. Considerable damage to the cylinder bores, may be incurred by entry of grit or other foreign material if the plug is left loose or missing. Also dirt and grit may be drawn through the air cleaner connections if they are not properly secured.*

CYLINDER BLOCK ASSEMBLY

The cylinder block is an alloy cast iron with deep cylinder skirts, and water jackets for cooling the cylinders. The cylinder bores are machined integral with the cylinder block, during the manufacturing process.

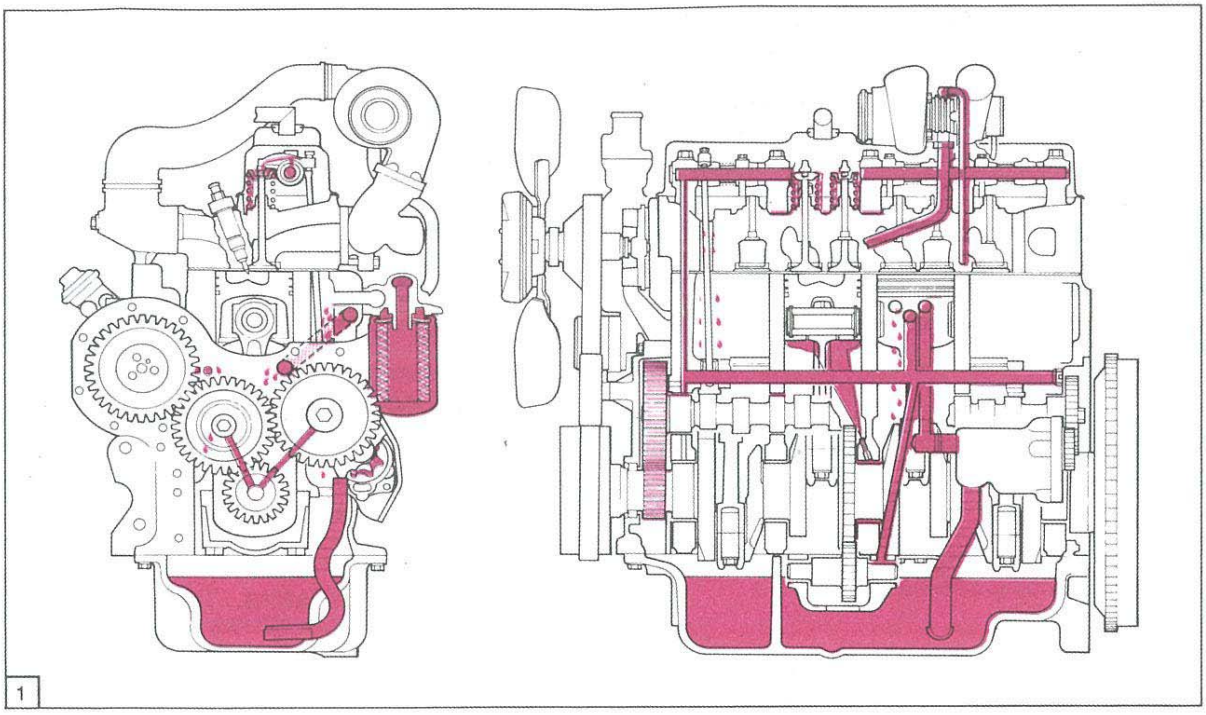
Cylinders are in line and vertical and numbered from 1 to 4 or 6, from the front to the rear of the engine. They can be bored oversize for the fitment of sleeves or oversize pistons, which are available in service.

The oil pan which is attached to the bottom of the cylinder block, is the reservoir for the engine oil lubrication system. An aluminium engine front cover is attached to the front engine adapter plate and covers all of the timing gear assembly.

TIMING GEARS

The crankshaft timing gear is heated and press fitted on to the front of the crankshaft, to a high degree of accuracy during manufacturing. This enables precise timing being maintained during the life of the engine.
The crankshaft gear drives the camshaft idler gear which is attached to the front of the cylinder block. The idler gear then drives the camshaft and the injection pump via meshing helical gears.
The camshaft gear is bolted to the front of the camshaft, and is keyed to maintain position of the gear on the camshaft. All gears can be checked for timing by observing the punch marks on the gears.

LUBRICATION SYSTEM



Engine Lubrication System With Turbocharger Fitted

Engine Oil Flow

Lubrication of the engine, Figure 1, is maintained by a rotor type oil pump mounted in the rear of the engine block, forward of the flywheel on the left hand side of the engine. The oil pump is driven from the rear of the camshaft and draws oil from the engine oil pan through a tube and screen assembly.

A spring loaded relief valve is integral with the oil filter body mounted on the left hand side of the engine block and prevents over pressurisation of the system.

The spin on type oil filter mounted externally to its support housing on the left hand side of the engine, allows easy access at service intervals. Oil flows from the filter to the main oil gallery which runs the length of the cylinder block, which also intersects the camshaft follower chamber.

The main gallery also supplies oil to the crankshaft main bearings, connecting rods, big ends and small ends. The underside of the pistons and pins, are lubricated by oil pressure jets mounted adjacent to each main journal housing.

The camshaft drive gear bushing is pressure lubricated through a drilled passage from the front main bearing. The gear has small oil passages machined on both sides allowing excess oil to escape.

Timing gears are lubricated by splashed oil from the cam follower chamber and the pressure lubricated camshaft drive gear bushing.

On 4 cylinder engines the dynamic balancer is lubricated, through a drilled passage, from the cylinder block crankshaft thrust bearing web to the balancer housing. Oil flows through the balancer housing to the drilled balancer gear shafts and onto the bushings in the balancer gears.

An intermittent flow of oil is directed to the valve rocker arm shaft assembly via a drilled passage in the cylinder block. This is located vertically above above No.1 camshaft bearing and aligns to a hole in the cylinder head. The rotation of the camshaft allows a controlled intermediate flow of lubrication.

The turbocharger where fitted, is supplied with oil from the oil filter support housing mounted on the left hand side of the engine.

DIESEL ENGINE STRIPDOWN

In the following procedures and illustrations the engine in the main is shown removed from the tractor.

However, there are certain operations that can be performed with the engine still in the tractor, or separated at the connection to the front axle support, or separated from the transmission housing.

The engine overhaul procedure initially describes the assembly process for rebuilding an engine using all new components. Following this section are defined headings which describe detailed repair specifications and procedures, where components are suitable for re–use.

Where overhaul of components is required without engine being removed from the tractor refer to the following headings and the relevant paragraphs in the main overhaul procedure.

Operations or repairs that can be performed with the engine still in the tractor.

1. Cylinder head and associated inlet and exhaust components.
2. Fuel injection pump and related parts.
3. Water pump, thermostat and associated components.
4. Oil pump relief valve.
5. Oil pan and gasket.
6. Turbocharger.

Operations or repairs that can be performed with the engine separated from the front axle.

1. Front timing cover/timing gear removal.
2. Oil pan removal for access to crankshaft and balancer, bearing shells, piston removal and oil pump suction tubing.
3. Front pulley and damper assembly.

Operations or repairs that can be performed with the engine separated from the transmission housing and with oil pan removed.

1. Crankshaft rear oil seal and carrier removal (with oil pan removed).
2. Oil pump and drive gear removal.

B. FAULT FINDING

IMPORTANT: *When effecting a repair the cause of the problem must be investigated and corrected to avoid repeat failures.*

The following table lists problems and their possible causes with recommended remedial action.

PROBLEM	POSSIBLE CAUSES	REMEDY
Engine does not develop full power	1. Clogged air cleaner	1. Clean or renew element
	2. Fuel line obstructed	2. Clean
	3. Faulty injectors	3. Clean and reset
	4. Incorrect valve lash adjustment	4. Check and reset
	5. Burnt, worn or sticking valves	5. Replace valves with new or oversize and/or machine the valve guide bores
	6. Blown head gasket	6. Check head flatness and fit new gasket
	7. Incorrect fuel delivery	7. Check injectors and pump
	8. Low cylinder compression	8. Renew piston rings or re–bore/re–sleeve as necessary

PROBLEM	POSSIBLE CAUSES	REMEDY
Engine knocks	1. Diluted or thin oil	1. Check crankshaft bearings for damage, change as required. Drain and refill with specified oil and renew filter. Ascertain cause of dilution
	2. Insufficient oil supply	2. Check oil level and top up as necessary. Overhaul or renew pump as necessary. Check oil filter is not clogged
	3. Low oil pressure	3. Overhaul pump or relief valve as necessary
	4. Excessive crankshaft end play	4. Install new thrust bearing liner
	5. Flywheel or ring gear run–out excessive	5. Skim flywheel or fit new ring gear
	6. Excessive connecting rod or main bearing clearance	6. Install new bearing inserts and/or re–grind crankshaft
	7. Bent or twisted connecting rods	7. Renew connecting rods
	8. Crankshaft journals out–of–round	8. Re–grind crankshaft and fit undersize bearing inserts
	9. Excessive piston–to–cylinder bore clearance	9. Re–bore/re–sleeve block and fit new pistons
	10. Excessive piston ring clearance	10. Fit new pistons and rings
	11. Broken rings	11. Fit new rings, check bore and pistons for damage
	12. Excessive piston pin clearance	12. Fit new piston or pin
	13. Piston pin retainer loose or missing	13. Install new retainer and check bore/pistons for damage
	14. Excessive camshaft play	14. Install new thrust plate
	15. Imperfections on timing gear teeth	15. Renew timing gear
	16. Excessive timing gear backlash	16. Renew timing gear

PROBLEM	POSSIBLE CAUSES	REMEDY
Engine overheats	1. Hose connection leaking or collapsed	1. Tighten hose connection, renew hose if damaged
	2. Radiator cap defective or not sealing	2. Renew radiator cap
	3. Radiator leakage	3. Repair/renew radiator
	4. Improper fan belt adjustment	4. Re–adjust fan belt
	5. Radiator fins restricted	5. Clean with compressed air
	6. Faulty thermostat	6. Renew thermostat
	7. Internal engine leakage	7. Check for source of leakage, renew gasket or defective parts
	8. Water pump faulty	8. Overhaul water pump
	9. Exhaust gas leakage into cooling system	9. Renew cylinder head gasket, check head for damage or distortion
	10. Coolant aeration	10. Tighten all connections and check coolant level is correct. Ensure cylinder head gasket has not blown
	11. Cylinder head gasket improperly installed	11. Renew cylinder head gasket
	12. Hot spot due to rust and scale or clogged water jackets	12. Reverse flush entire cooling system
	13. Obstruction to radiator air flow	13. Remove the obstruction
	14. Extended engine idling	14. Do not allow engine to idle for long periods
	15. Oil cooler tube blocked	15.Clean
	16. Radiator core tubes blocked	16. Check free flow

PROBLEM	POSSIBLE CAUSES	REMEDY
Low oil pressure	1. Engine oil level low	1. Top up as necessary
	2 Wrong grade of oil	2. Drain and refill with correct grade of oil
	3 Blocked oil pump sump screen	3. Clean pump screen
	4 Oil pressure relief valve faulty	4. Fit new relief valve
	5 Oil pump worn	5. Renew Oil Pump
	6 Excessive oil pump rotor and shaft assembly clearance	6. Overhaul pump
	7 Excessive main or connecting rod bearing clearance	7. Install new bearings inserts and / or re–grind crankshaft
Excessive oil consumption	1. Engine oil level too high	1. Reduce oil level
	2. External oil leaks	2. Renew gaskets and seals where necessary. Check mating surfaces for damage or distortion
	3. Worn valves, valve guides or bores	3. Renew
	4. Cylinder head gasket leaking	4. Renew gasket. Check head for damage or distortion
	5. Oil loss past the pistons and rings	5. Renew rings and/or re–bore/ re–sleeve block as necessary
	6. Oil cooler leak	6. Repair/renew oil cooler assembly
Engine tends to keep firing after fuel is shut off	1. Air cleaner dirty or restricted	1. Clean or renew element
	2. Oil leak on compressor side of turbocharger where fitted	2. Overhaul turbocharger
Oil pressure warning light fails to operate	1. Bulb burnt out	1. Renew bulb
	4. Warning light pressure switch faulty	2. Renew pressure switch
	5. Warning light circuit faulty	3. Check and renew wiring

PROBLEM	POSSIBLE CAUSES	REMEDY
Excessive exhaust smoke	1. Oil leak on compressor or turbine side of turbocharger where fitted	1. Overhaul turbocharger
	2. Exhaust leak on exhaust manifold side of turbocharger where fitted	2. Fit new gasket
	3. Air cleaner dirty or restricted	3. clean
	4. Excessive fuel delivery	4. Overhaul injection pump and injectors
Water temperature gauge fails to reach normal operating temperature	1. Faulty temperature sender	1. Renew sender switch
	2. Incorrect or faulty thermostat	2. Renew thermostat
	3. Faulty water temperature gauge	3. Renew temperature gauge

C. 4&6 CYLINDER DIESEL ENGINE – DISASSEMBLY AND OVERHAUL

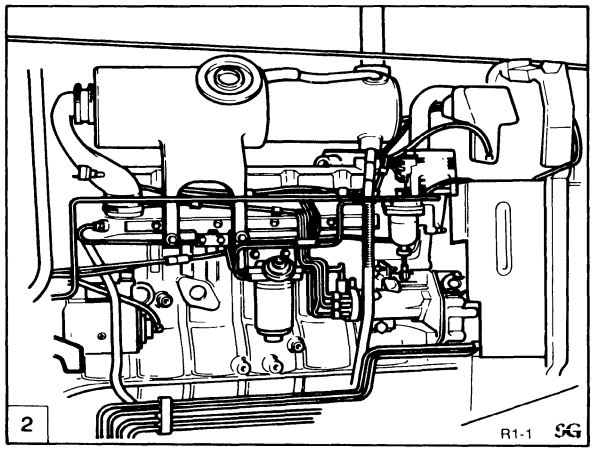
Dismantle the engine following conventional techniques, or by referring to the following removal procedure, referring to the "Specification" section as necessary.

NOTE: *All gaskets, seals and 'O' rings must be replaced with new, upon re–assembly. Where new sealant is to be applied, refer to "Engine Specifications".*

CYLINDER HEAD, VALVES AND RELATED PARTS

NOTE: *The cylinder head can be removed with the engine installed in the tractor.*

1. Disconnect the battery.
2. Remove the engine side panels.
3. Drain the coolant from the radiator and engine block.
4. Shut off heater hose taps, then disconnect and plug heater hoses (where fitted).
5. Remove the radiator top hose.
6. Remove exhaust muffler and exhaust extension pipe.
7. Remove the air cleaner pre cleaner.
8. Remove the air cleaner to intake manifold tube and hoses.
9. Shut–off fuel tank tap, disconnect low pressure fuel lines and remove inlet manifold (cap all exposed openings).



Right Hand View of Engine

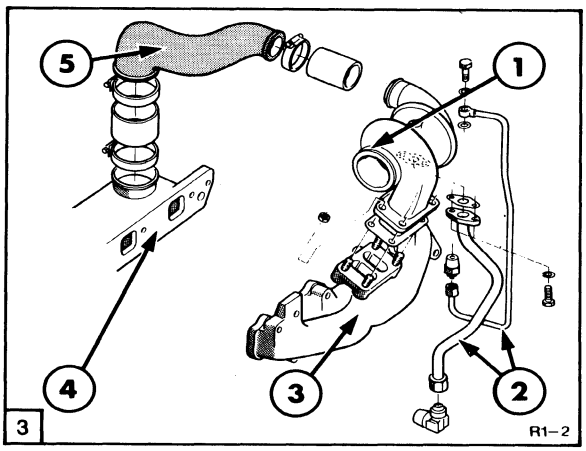
10. Disconnect and remove injector fuel pipes from the fuel injection pump (cap all exposed openings).

11. Disconnect thermostart fuel pipe on the intake manifold (cap exposed opening).

12. Disconnect and remove the rocker cover ventilation tube.

13. Remove the alternator.

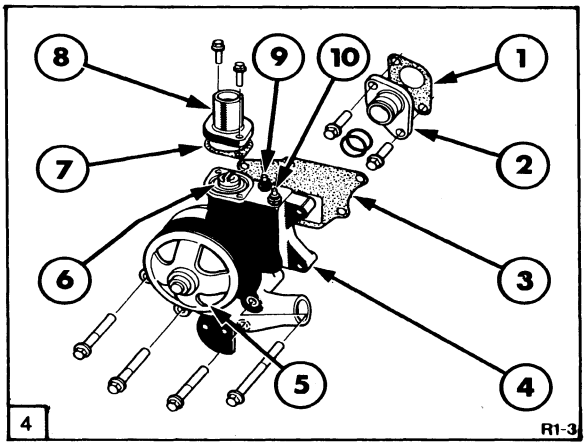
14. Disconnect all loom connections on engine harness and secure clear of the engine.



Turbocharger Assembly

1. TurboCharger Housing
2. Oil Feed/Return Tubes
3. Exhaust Manifold
4. Inlet Manifold
5. Inlet Hoses/tubes

15. Remove the turbocharger assembly, Figure 3, ensuring all openings are capped to prevent dirt ingress. For additional information on the turbocharger refer to, Fuel Systems, Part 2.

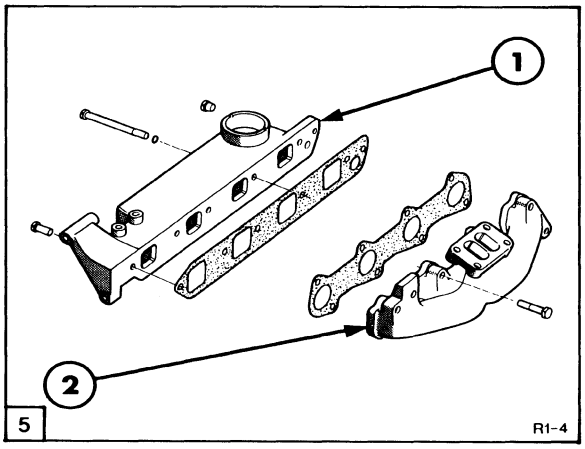


Water Pump Assembly

1. Gasket
2. Connector & 'O' rings
3. Pump Gasket
4. Pump Body
5. Pulley Assembly
6. Thermostat
7. Gasket
8. Thermostat Housing
9. Temperature Sender
10. Temperature Sender

16. Where applicable remove the water pump from the engine, Figure 4. For more information refer to cooling system, Part 1, Chapter 2.

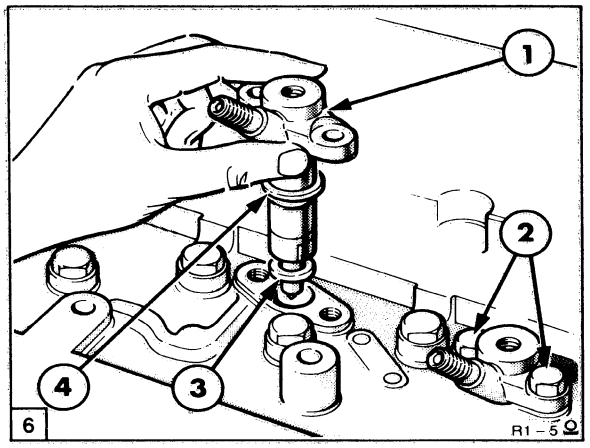
17. Remove the water pump connector from the engine cylinder head.



Manifold Assembly

1. Inlet Manifold
2. Exhaust Manifold

18. Loosen and remove the manifold bolts and remove the exhaust manifold and gasket. Repeat for the inlet manifold and gasket, Figure 5.

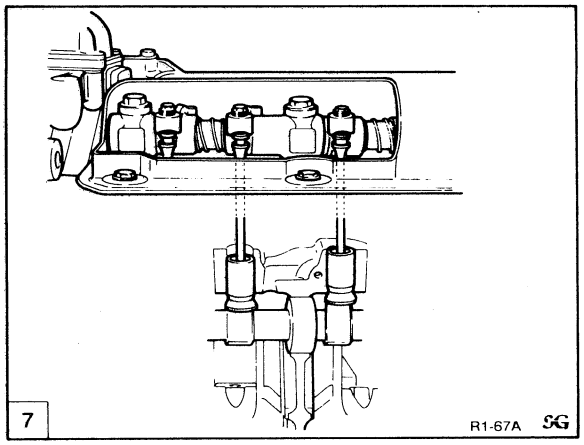


Injector Removal

1. Fuel Injector
2. Mounting Bolts
3. Copper Washer
4. Cork Washer

19. Clean area surrounding the fuel injectors, hold leak off pipe at each injector and carefully disconnect, Figure 6.

20. Remove the rocker cover and gasket.



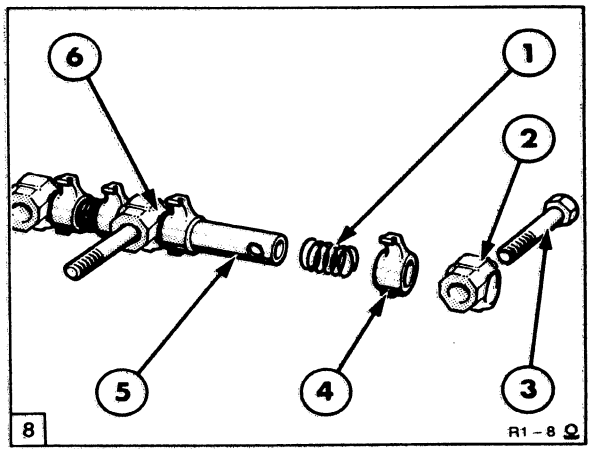
Push Rod Installation

21. Check push rods for concentricity, by rotating the rods with the valve closed and identify any bent rods, Figure 7.

ROCKER SHAFT DISASSEMBLY

NOTE: *Leave bolts in the rocker shaft supports during removal as they retain the support on the shaft.*

1. Remove the cylinder head bolts which pass through the rocker shaft supports, Figure 8.



Rocker Shaft Assembly

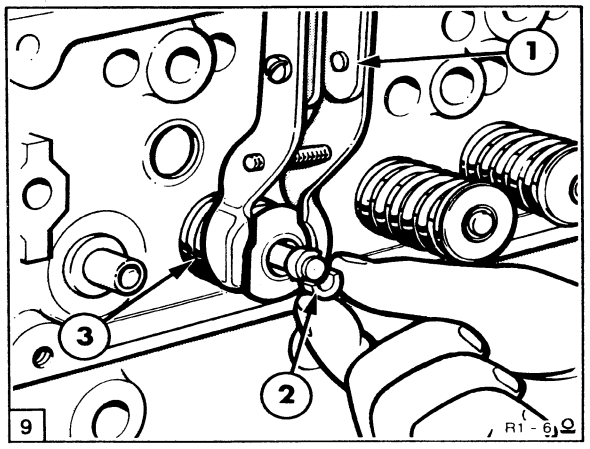
1. Spring
2. Shaft Support
3. Retaining Bolt
4. Rocker Arm
5. Shaft
6. Spacer

2. Loosen the rocker shaft retaining bolts, which also serve as head bolts evenly and alternately and remove the rocker shaft assembly.

3. Remove push rods in turn and place in a numbered rack to maintain the same position for re–assembly.

4. Remove remaining cylinder head bolts working inwards from the end of the cylinder head, alternately to the centre of the cylinder head.

CYLINDER HEAD DISASSEMBLY

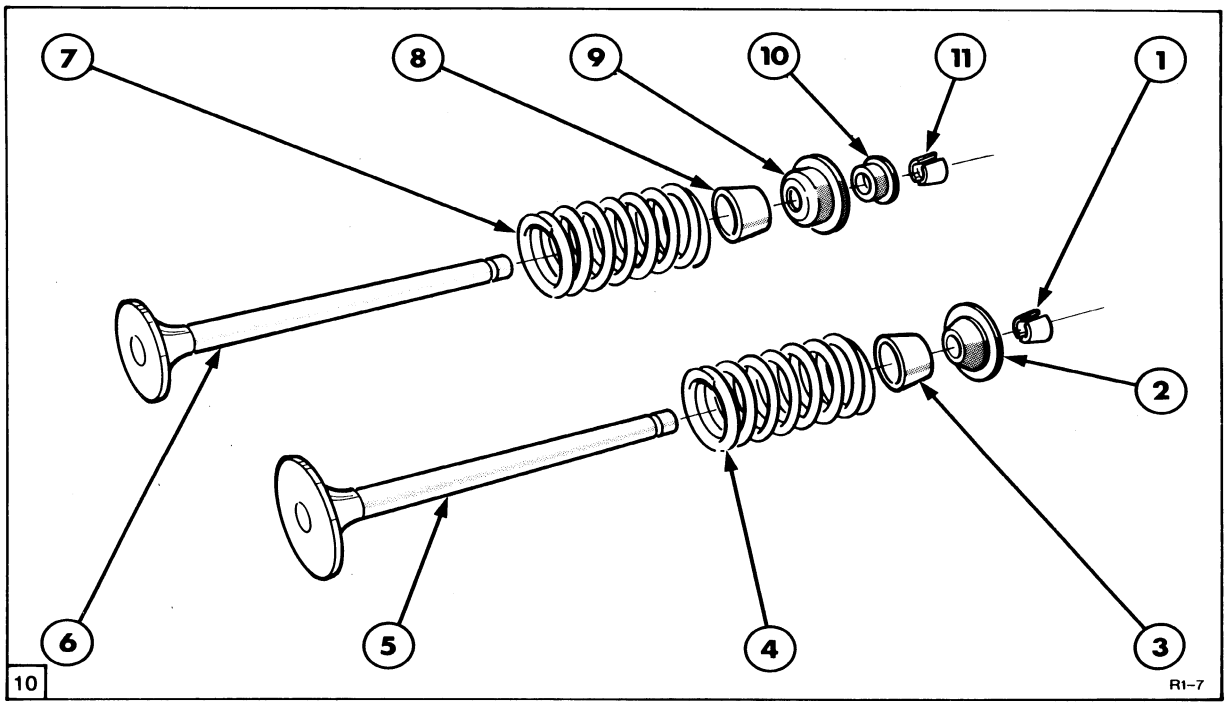


Valve Removal

1. Valve Spring Compressor
2. Retainer Locks
3. Valve Springs

1. Using a valve spring compressor remove the retainer locks, springs, seals and rotators and place in a numbered rack, Figure 9.

2. Clean the cylinder head and remove carbon deposits from around the valve heads.



Valve Assemblies

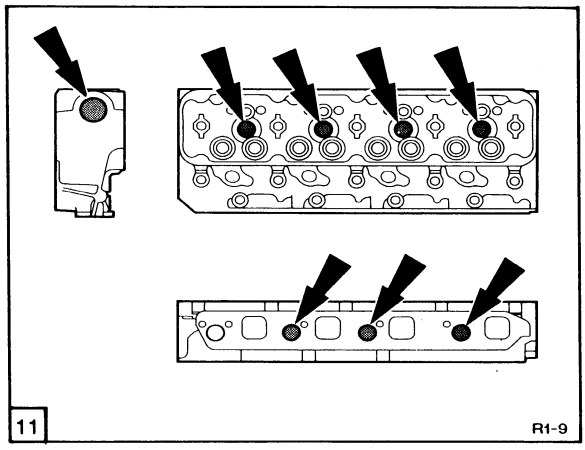
Intake Valve

1 Valve Spring Lock
2. Spring Rotator
3. Seal
4. Spring
5. Valve

Exhaust Valve

6. Valve
7. Spring
8. Seal
9. Spring Rotator
10. Spring Rotator
11. Valve Spring Lock

Inspection and Repair, Cylinder Head



Core Plug Installation

1. Cylinder head core plugs if discoloured (rusty), or leaking require changing. Before fitting new plugs remove all old sealer from the cylinder head. Apply sealant G, see "Specifications", to the new plug mating faces, and drive the new plugs into location, Figure 11.

Core plugs required, 4 Cylinder Head:–

4 off, in the top and 1 off, in the rear of the cylinder head.
3 off, in the Intake face.

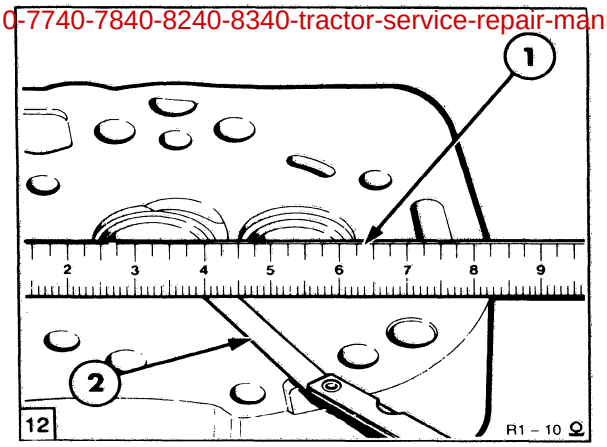
Core plugs required, 6 Cylinder Head:–

6 off, In the top and 1 off, in the rear of the cylinder head.
5 off, in the intake face.

2. Scrape all gasket surfaces clean and wash cylinder head in a suitable solvent, also cleaning valve guide bores.

NOTE: *Ensure injector washers have been removed prior to cleaning.*

3. Inspect cylinder head for nicks and burrs on mating face remove using a suitable abrasive and ensure faces are clean after repair.



Cylinder Head Flatness
1. Straight Edge 2. Feeler Gauge

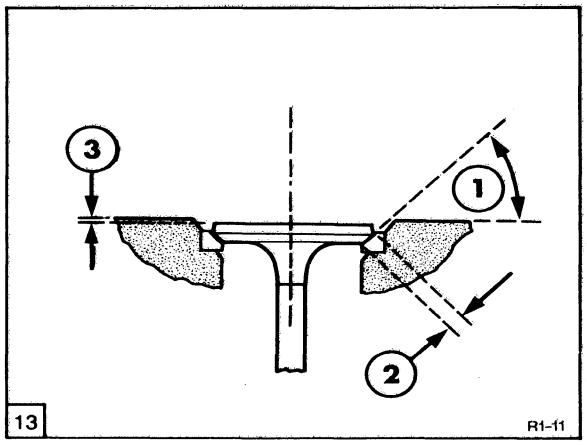
4. Using a special tool with a straight edge and feeler gauges, check flatness of cylinder head in all directions does not exceed,
0.001 in (0.03mm) in any 1 in (25.4mm), or 0.005 in (0.127mm) overall limit, Figure 12.

5. If the cylinder head has been resurfaced, determine that all head bolt faces will seat by placing the cylinder head less gasket, on the cylinder block and installing the cylinder head bolts hand tight.

6. Ensure rocker shaft supports are fitted with long bolts. Using a feeler gauge, check clearance between underside of bolt heads and cylinder head or rocker shaft support.

7. If a 0.010 in (0.25mm) feeler gauge can be inserted under the bolt head the bolt has bottomed. Therefore the cylinder block thread must be increased using a 9/16–13 UNC–2A Thread tap. Identify the bolt heads and ensure they are reinstalled in the bolt holes they were checked in.

VALVE INSERTS



Valve Seat Dimensions
1. Valve Seat Angle
2. Valve Seat Width
3. Valve Head Face to Cylinder Head Depth

NOTE: *Refacing the valve seat should always be co–ordinated with refacing of the valve to ensure a compression tight fit.*

1. Examine the valve seat inserts and reface if pitted, renew if loose or damaged.

2. To install a new valve insert, the cylinder head must be counter bored, as dimensioned in the chart below. The new insert must be chilled in dry ice prior to installation.

Insert Oversize	Counter Bore in Cylinder Head	
	Exhaust valve insert	Intake valve insert
0.010 in (0.25mm)	1.739–1.740 in (44.17–44.20mm)	1.969–1.970 in (50.01–50.04mm)
0.020 in (0.58mm)	1.749–1.750 in (44.42–44.45mm)	1.979–1.980 in (50.27–50.29mm)
0.030 in (0.76mm)	1.759–1.760 in (44.68–44.70mm)	1.989–1.990 in (50.52–50.55mm)