770 EX
770 EX MAGNUM
Tractor Loader

SERVICE MANUAL

Part number 48190544
English
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CASE
CONSTRUCTION

Contents

INTRODUCTION

Engine 10

[10.001] Engine and crankcase 10.1

[10.254] Intake and exhaust manifolds and muffler 10.2

[10.400] Engine cooling system 10.3

Transmission 21

[21.100] Mechanical transmission hydraulic components 21.1

[21.112] Power shuttle transmission 21.2

[21.134] Power shuttle transmission external controls 21.3

[21.154] Power shuttle transmission internal components 21.4

[21.700] Torque converter 21.5

Front axle system 25

[25.100] Powered front axle 25.1

[25.102] Front bevel gear set and differential 25.2

[25.108] Final drive hub, steering knuckles, and shafts 25.3

[25.400] Non-powered front axle 25.4

Rear axle system 27

[27.100] Powered rear axle 27.1

[27.106] Rear bevel gear set and differential 27.2

[27.124] Final drive hub, steering knuckles, and shafts 27.3

Brakes and controls 33

[33.202] Hydraulic service brakes 33.1

[33.110] Parking brake or parking lock 33.2

Hydraulic systems 35

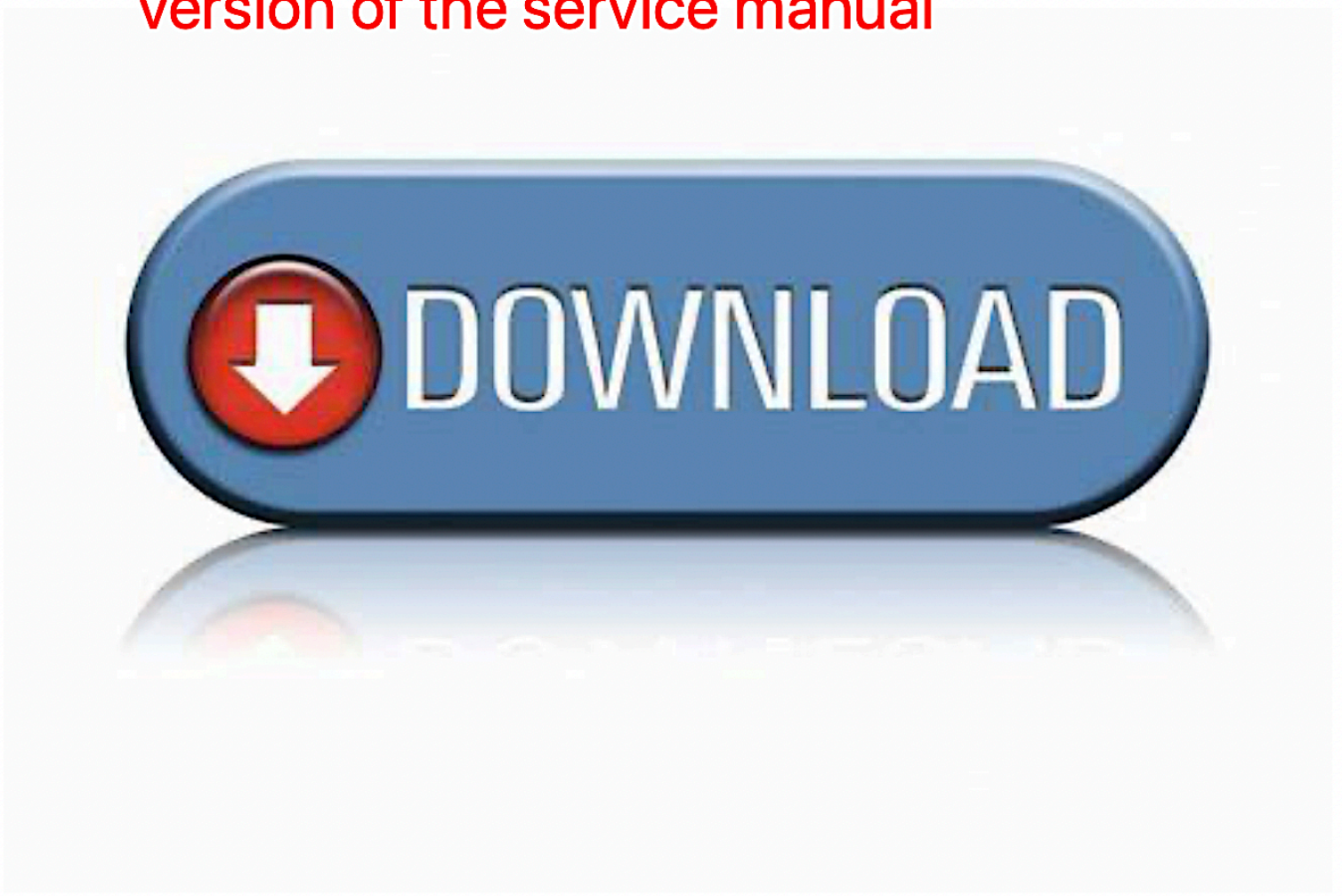
[35.000] Hydraulic systems 35.1

[35.300] Reservoir, cooler, and filters 35.2

[35.104] Fixed displacement pump 35.3
[35.359] Main control valve 35.4
[35.724] Front loader hydraulic system control 35.5
[35.701] Front loader arm hydraulic system 35.6
[35.723] Front loader bucket hydraulic system 35.7
[35.AAA] Hydraulic systems generic sub-group 35.8
Frames and ballasting 39
[39.140] Ballasts and supports 39.1
Steering 41
[41.101] Steering control 41.1
[41.200] Hydraulic control components 41.2
[41.216] Cylinders 41.3
Wheels 44
[44.511] Front wheels 44.1
[44.520] Rear wheels 44.2
[44.AAA] Wheels generic sub-group 44.3
Cab climate control 50
[50.100] Heating 50.1
[50.200] Air conditioning 50.2
Electrical systems 55
[55.100] Harnesses and connectors 55.1
[55.201] Engine starting system 55.2
[55.301] Alternator 55.3
[55.518] Wiper and washer system 55.4
Front loader and bucket 82
[82.100] Arm 82.1
[82.300] Bucket 82.2
Platform, cab, bodywork, and decals 90

[90.150] Cab 90.1
[90.154] Cab doors and hatches 90.2
[90.156] Cab windshield and windows 90.3
[90.100] Engine hood and panels 90.4

Click on the image link below for the full version of the service manual



INTRODUCTION

Safety rules

Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

⚠ DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠ WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

Safety rules

⚠ DANGER

Improper operation or service of this machine can result in an accident.
Do not operate this machine or perform any lubrication, maintenance, or repair on it until you have read and understood the operation, lubrication, maintenance, and repair information.
Failure to comply will result in death or serious injury.

D0010A

⚠ WARNING

Maintenance hazard!
Always perform all service procedures punctually at the intervals stated in this manual. This ensures optimum performance levels and maximum safety during machine operation.
Failure to comply could result in death or serious injury.

W0132A

NOTICE: *Extreme working and environmental conditions require shortened service intervals.*

Use Case fluids, lubricants, and filters for the best protection and performance of your machine. All fluids, lubricants, and filters must be disposed of in compliance with environmental standards and regulations. Contact your Dealer with any questions regarding the service and maintenance of this machine.

Use this manual with the operator's manual to understand and perform the complete service procedures. Read the safety decals and information decals on the machine. Read the Operator’s Manual and safety manual. Understand the operation of the machine before you start any service.

Before you service the machine, put a “Do Not Operate” tag on the steering wheel or over the key switch. Ensure the tag is at a location where everyone who might operate or service the machine may see clearly.

Plastic and resin parts

- Avoid using gasoline, paint thinner, etc. when cleaning plastic parts, console, instrument cluster, etc.
- Use only water, mild soap, and a soft cloth when you clean these parts.
- Using gasoline, thinners, etc. can cause discoloration, cracking, or deformation of the part being cleaned.

Safety rules - Ductile iron



⚠ DANGER

Altering cast ductile iron can cause it to weaken or break.
Before you weld, cut, or drill holes on any part of this machine, make sure that the part is not cast ductile iron.
Failure to comply will result in death or serious injury.

D0148A

Altering cast ductile iron can cause it to weaken or break. Unauthorized modifications to cast ductile iron parts can cause death or serious injury. Do not weld, cut, drill, repair, or attach items to cast ductile iron parts on this machine.

Before you weld, cut, or drill holes on any part of this machine, make sure the part is not cast ductile iron. See your dealer if you do not know if a part is cast ductile iron.

The following items are examples of cast ductile iron parts. There may also be other parts made of cast ductile iron that are not on the list below.

- two-wheel drive steering link
- dump links
- front axle
- swing tower
- bucket linkage
- Air-Conditioning (A/C) compressor mounting bracket

Do not make any unauthorized modifications. Consult an authorized dealer before making any changes, additions, or modifications to this machine.

Safety rules - Ductile iron



⚠ DANGER

Improper operation or service of this machine can result in an accident.
Any unauthorized modifications made to this machine can have serious consequences. Consult an authorized dealer on changes, additions, or modifications that may be required for this machine. Do not make any unauthorized modifications.
Failure to comply will result in death or serious injury.

D0030A

Before you weld, cut, or drill holes on any part of this machine, make sure the part is not cast ductile iron. See your dealer if you do not know if a part is cast ductile iron. The following are cast ductile iron parts:

- two wheel drive steering link
- dump links
- front axle
- bucket linkage
- Air conditioning (A/C) compressor mounting bracket

Unauthorized modifications to cast ductile iron parts can cause injury or death. Welding, cutting, or drilling can cause cast ductile iron to break. Do not weld, cut, or drill to repair or to attach items to cast ductile iron parts on this machine.

SERVICE MANUAL

Engine

770EX Magnum
770EX

Engine - General specification

General specifications (For 770 EX/EX Magnum)

General specifications	770 EX	770 EX Magnum
Make	IVECO	
Type	4 stroke, diesel, turbocharged aftercooler, direct injection, water cooled	
Power	**76 Hp**	**86 Hp**
No of cylinders	4	
Bore	**104 mm** (**4 in**)	
Stroke	**115 mm** (**5 in**)	
Cubic capacity	**3908 cm³** (**238 in³**)	
Compression ratio	18:01	
Firing order	1-3-4-2	
Idle speed	**1000 RPM**	
Maximum no load speed	**2450 RPM**	
Rated speed	**2200 RPM**	

Engine block (For 770 EX/EX Magnum)

Engine block	Dry type pre fitted liner with collar
Cylinder liner seat diameter in engine block	**106.850 – 106.900 mm** (**4.207 – 4.209 in**)
Cylinder sleeve O-D	**107.020 – 107.050 mm** (**4.213 – 4.215 in**)
Interference between liners and seats in block	**0.12 – 0.20 mm** (**0.005 – 0.008 in**)
Liner O-D oversize	**0.200 mm** (**0.008 in**)
Cylinder liner inner diameter	**104.00 – 104.024 mm** (**4.09 – 4.095 in**)
Maximum ovality and taper due to wear	**0.120 mm** (**0.005 in**)
Liner inner diameter oversize	**0.400 – 0.800 mm** (**0.016 – 0.031 in**)

Camshaft bush seat diameters (For 770 EX/EX Magnum)

• Front	**54.780 – 54.805 mm** (**2.157 – 2.158 in**)
• Intermediate C33	**54.280 – 54.305 mm** (**2.137 – 2.138 in**)
• Rear	**53.780 – 53.805 mm** (**2.117 – 2.118 in**)
Tappet seat bore diameter	**15.000 – 15.018 mm** (**0.591 – 0.591 in**)
Tappet oversize	**0.100 mm** (**0.004 in**) **0.200 mm** (**0.008 in**) **0.300 mm** (**0.012 in**)
Main bearing seat bore diameter	**84.200 – 84.230 mm** (**3.315 – 3.316 in**)

Cylinder head (For 770 EX/EX Magnum)

Valve guide seat bore diameter in head	**13.950 – 13.983 mm** (**0.549 – 0.551 in**)
Valve guide oversize	**0.200 mm** (**0.008 in**)
Valve stand-in	**0.700 – 1.000 mm** (**0.028 – 0.039 in**)
• Maximum stand-in permitted	**1.300 mm** (**0.051 in**)
Injector standout	**0.050 – 0.700 mm** (**0.002 – 0.028 in**)
• Max stand-out permitted	**1.000 mm** (**0.039 in**)
Original cylinder head height	**92 mm** (**4 in**)
Maximum head dressing allowed	**0.500 mm** (**0.020 in**)

Exhaust valves (For 770 EX/EX Magnum)

Valve head diameter	**41.00 – 41.25 mm** (**1.61 – 1.62 in**)
Valve stem diameter	**7.985 – 8.000 mm** (**0.314 – 0.315 in**)
Face angle	45° 30'±7'
Tappet clearance (Cold)	**0.300 mm** (**0.012 in**)
Cam lift	**6.1277 mm** (**0.2412 in**)
Valve lift	**10.8679 mm** (**0.4279 in**)

Intake valves (For 770 EX/EX Magnum)

Valve head diameter	**43.300 – 45.500 mm** (**1.705 – 1.791 in**)
Valve stem diameter	**7.985 – 8.000 mm** (**0.314 – 0.315 in**)
Face angle	60° 30'±7'
Tappet clearance (cold)	**0.300 mm** (**0.012 in**)
Cam lift	**5.8885 mm** (**0.2318 in**)
Valve lift	**10.4437 mm** (**0.4112 in**)

Valve springs (For 770 EX/EX Magnum)

Number per valve	1
Free length	**44.600 mm** (**1.756 in**)
Length loaded at **26.1 – 28.9 kg** (**57.5 – 63.7 lb**)	**34.000 mm** (**1.339 in**)
Length loaded at **51.2 – 56.5 kg** (**112.9 – 124.6 lb**)	**23.800 mm** (**0.937 in**)

Valve timing (For 770 EX/EX Magnum)

Intake opening (before top dead centre)	15°
Intake closing (after bottom dead centre)	45°
Exhaust opening (before bottom dead centre)	56°
Exhaust closing (after top dead centre)	26°

Valve inserts (For 770 EX/EX Magnum)

Valve guide OD	**13.933 – 14.016 mm** (**0.549 – 0.552 in**)
Valve guide oversize	**0.200 mm** (**0.008 in**)
Valve guide interference fit in housing cylinder head	**0.0050 – 0.0500 mm** (**0.0002 – 0.0020 in**)
Valve guide fitted ID after reaming	**8.023 – 8.043 mm** (**0.316 – 0.317 in**)
Valve stem clearance in guide	**0.0230 – 0.0580 mm** (**0.0009 – 0.0023 in**)
Maximum wear clearance	**0.130 mm** (**0.005 in**)
Maximum valve stem eccentricity over one revolution with stylus on sealing face	**0.030 mm** (**0.001 in**)

Engine - Torque

Tightening torques

Description	Thread size	Torque	Angle
Capscrew, cylinder head (C1)	**M12 x 1.25**	**40 N·m** (**354 lb in**)	130°±5 + 140°± 5
Capscrew, main bearing caps (C2)	**M14 x 1.25**	**80 N·m** (**708 lb in**)	90°
Capscrew, timing cover and case (C3)	**M12 x 1.25**	**40 N·m** (**354 lb in**)	-
Capscrew, connecting rod caps (C4)	**M11 x 1.25**	**40 N·m** (**354 lb in**)	60°
Capscrew, flywheel (C5)	**M12 x 1.25**	**40 N·m** (**354 lb in**)	60°

Description	Thread size	Torque	Angle
Capscrew, rocker shaft bracket (C6)	**M8 x 1.25**	**25 N·m** (**221 lb in**)	-
Nut, crankshaft pulley hub (C7)	**M30 x 1.5**	**300 N·m** (**2655 lb in**)	-
Capscrew, fan and alternator drive pulley (C8)	**M12 x 1.25**	**49 N·m** (**434 lb in**)	-
Nut, injection pump shaft gear (C9)	**M12 x 1.25**	**64 N·m** (**566 lb in**)	-
Nuts, injection pump to support (C10)	**M12 x 1.25**	**23 N·m** (**204 lb in**)	-
Retaining screws, additional weights (C11)	**M12 x 1.25**	**110 N·m** (**974 lb in**)	-
Injector clamp nut	**M8**	**18 N·m** (**159 lb in**)	-
Sheet metal oil pan	**M10 x 1.25**	**35 N·m** (**310 lb in**)	-

Engine - Sealing

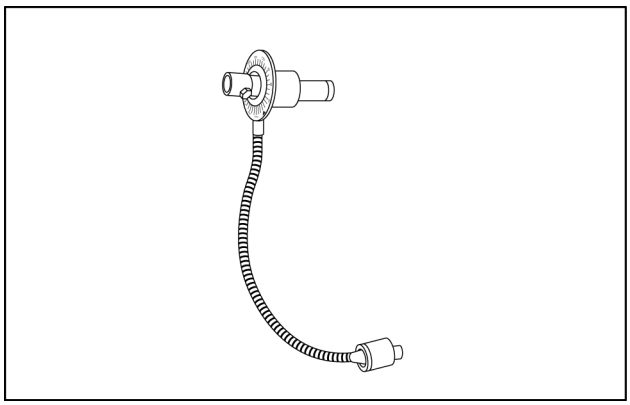
Sealants

Description	Specification
Adopter for oil filter (S1)	**LOCTITE® 270**
Adopter for tachometer cable (S2)	**LOCTITE® 243™**
Flywheel housing to engine block (S3)	**LOCTITE® 510™**
Timing gear case studs (S4)	**LOCTITE® 270**
Timing gear cover dowel pin (S5)	**LOCTITE® 270**
Starter motor to flywheel housing (S6)	**LOCTITE® 510™**
Allen plug in cylinder head thermostat housing (S7)	**LOCTITE® 243™**
Cylinder head exhaust manifold studs (s8)	**LOCTITE® 270**
Oil sump to engine block (S9)	Loctite - 5699
Silencer mounting studs on exhaust manifold (S10)	Loctite - 77164
Flywheel bolt (S11)	**LOCTITE® 243™**

Engine - Special tools

ATTENTION: *Operations described in this section of the manual must be performed using the following tools to work safely and achieve the best technical results.*

380000304 Angular torquing gauge



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Engine - Static description

The S8000 is a 4 cylinder turbo charged and after cool diesel engine.

It features a cross flow cylinder head, 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 bowel 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.

The intake and exhaust manifolds are bolted to the head, the intake manifold is mounted on the right side of the engine, with the diesel injectors mounted outside the rocker cover.

The exhaust manifold is mounted on the left 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 inserted into the cylinder head, and replaceable.

Special replaceable cast alloy valve seats are pressed into each valve port during manufacturing.

No oversize valve seats on guides are available. All valves are fitted with positive value rotators, valve clearance is maintained by adjustment of the self locking adjusting screw, mounted in each of the rocker arms.

Camshaft assembly

The camshaft runs in 3 replaceable bushes.

The camshaft drive gear is in mesh with and driven by the camshaft idler gear which is driven by the 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.

Cylinder block assembly

The cylinder block is an alloy cast iron with deep cylinder skirts & water jackets for cooling the cylinders.

The cylinder bores are machined integral with the cylinder block, during the manufacturing process.

Cylinders are in line, vertical and numbered 1 to 4 from radiator to the engine rear.

The oil sump, which is attached to the bottom of the cylinder block, is the reservoir for the engine oil lubrication system.

A cast iron engine front cover and front plate is attached to the front of the engine and covers all of the timing gear assembly.

Crankshaft assembly

The crankshaft is supported in the cylinder block by 5 main bearings in **76 Hp**/ **86 Hp** engines.

The crankshaft is manufactured from steel with machined finished crank webs. End thrust is controlled by a thrust bearing incorporated in the center main bearing of the crankshaft.

Connecting rods

Connecting rods “wedge” shaped at the small end has been designed to reduce the reciprocating weight at the piston end.

The connecting rods are heavy beam construction and are assembled as a matched set to each engine, attached to the crankshaft, by means of insert type 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 are constructed of an aluminum silicon alloy with notch type combustion chamber being recessed in the piston crowns.

Each piston has two compression rings and one oil control ring, to reduce the friction and increase positive seating. All rings are located above the piston pin.

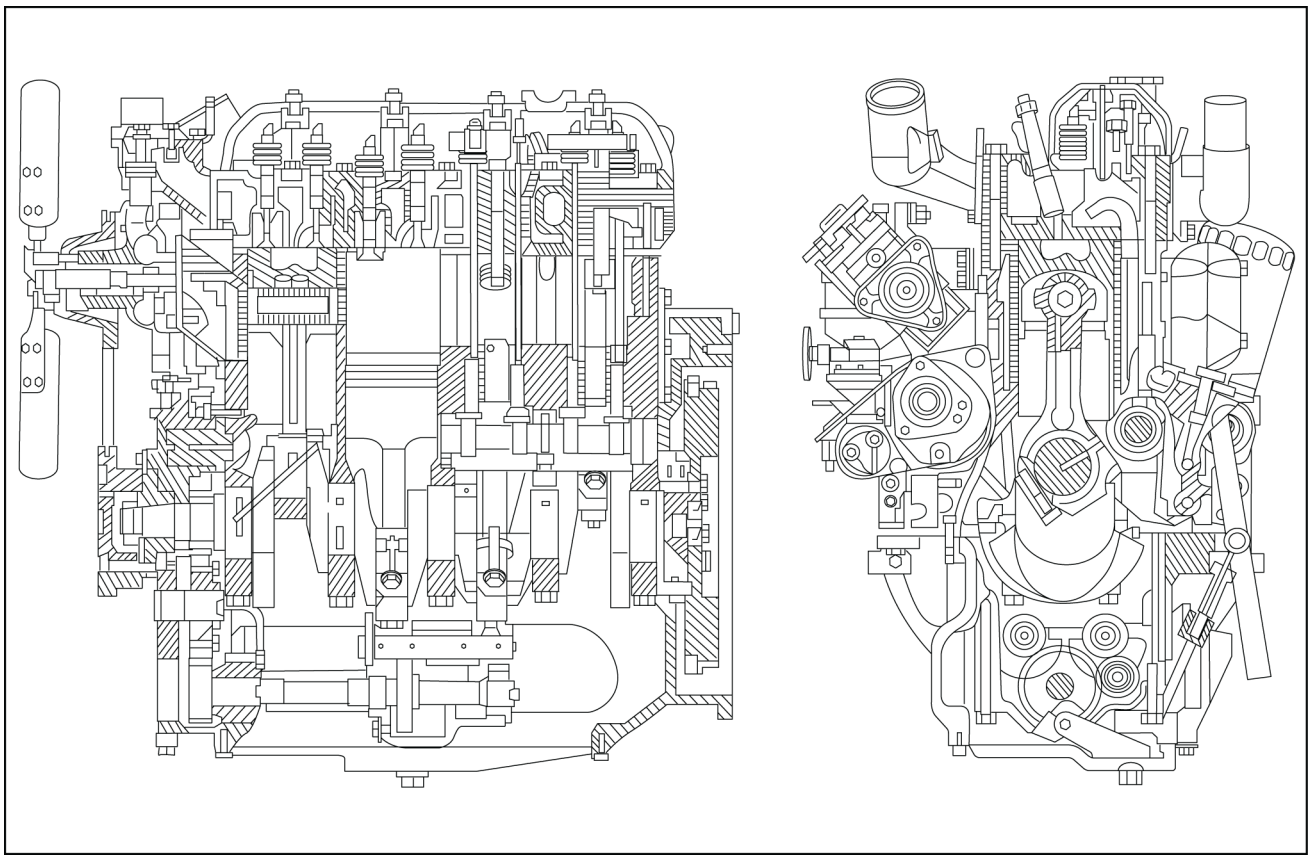
Manifolds

The cross flow design aluminum 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 hose to air cleaner.



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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 idler gear, which is attached to the front of 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 shaft and is keyed to maintain position of the gear on the camshaft.

Lubrication system

Lubrication of the engine is maintained by a gear type oil pump mounted on the front end of the crank shaft.

The pump drains oil from the engine oil sump through a tube and screen assembly.

A spring loaded relief valve is integral with the oil filter and prevents over pressurization of the system.

A spin on type oil filter is mounted externally to its support housing on the left hand side of the engine.

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.

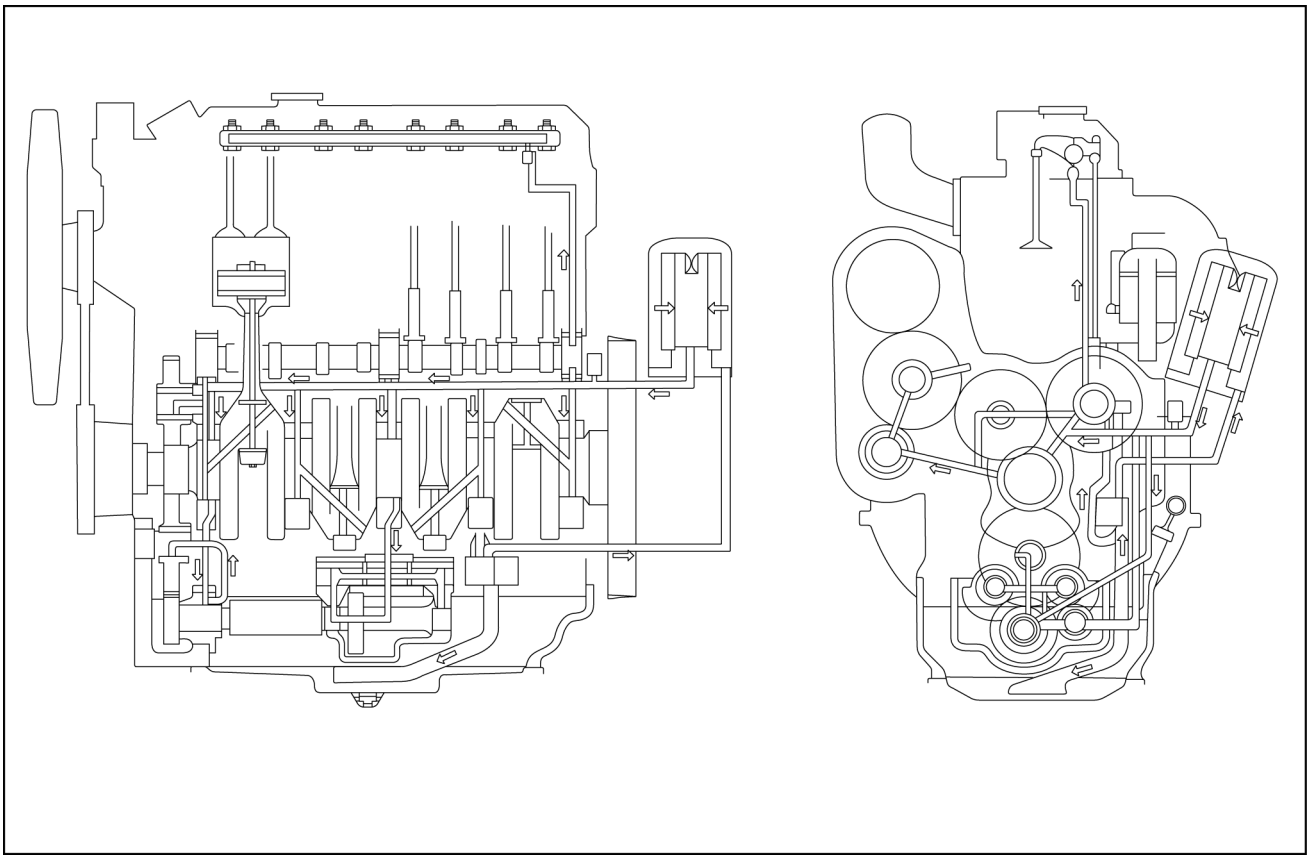
The main gallery also supplies oil to the crankshaft main bearings, connecting rods both big and small ends and timing gear bushes.

The inner side of the pistons and pins are lubricated by oil pressure jets (piston cooling nozzle).

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

An intermittent flow of oil is directed to the value rocker arm shaft assembly via a drilled passage in the cylinder block.

This is located vertically above No. 3 camshaft bearing and aligns to a hole in the cylinder head. The rotation of the camshaft allows a controlled intermediate flow of lubrication.



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Cooling system

The function of the water pump mounted at the front of the engine, is to maintain a continuous flow of water around the cooling system inside the engine.

This is essential to ensure correct engine temperature, and performance, during vehicle operation.

The pump is driven by a ‘V’ belt from the crankshaft pulley, when the engine is running.

The cooling system for the new generation of engines, is of recirculating bypass type with full length water-jackets for the bottom tank of the radiator by the water pump, which passes the coolant to the cylinder block.

This coolant then flows through cored passages to cool the cylinder walls.

Passages in the cylinder head gasket allow coolant to flow from the cylinder block, into the cylinder head cored passages also conduct the coolant to the fuel injector nozzle locations before reentering the water pump below the thermostat.

The thermostat is located in the top of the water pump body, and controls the flow of the water as required by temperature changes.

NOTE: *A faulty thermostat may cause the engine to operate at too high (hot) or low (cold) on operating temperature. If not replaced this could result in a damaged engine or impaired engine performance.*

When the thermostat is closed a recirculating bypass is provided to allow the coolant to recirculate from block to the head for a faster warm-up.

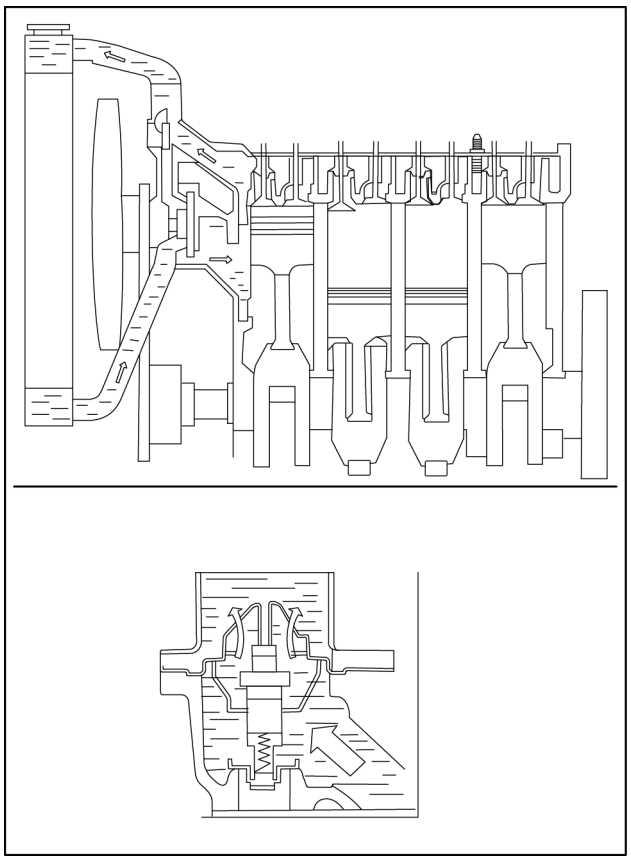
Once the engine has reached its normal operating temperature, the thermostat will open and allow water to be drawn through the radiator by the pump action.

Cooled water then returns to the engine system.

Cooling occurs as the coolant passes down through the radiator cores, which are exposed to the air as it is drawn through the radiator by the fan.

NOTE: *Do not operate an engine without a thermostat. The cooling system incorporates a drain plug, on the left hand side of the cylinder block. The cap on the radiator is a system pressure cap and should not be removed unless refilling the system from empty or for top up of coolant.*

The engine cooling fan is mounted on a pump pulley which is belt driven from the crankshaft.



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Fuel system

The diesel fuel system consists of fuel tank, water separator filter, lift pump, fuel filters, Bosch rotary type fuel injection pump, fuel injectors, and interconnecting tubes and lines.

The fuel injection pump is pressure fed from the lift pump.

Fuel flows from the fuel tank to the sediment separator (incorporated in lift pump), through the lift pump, then through the primary fuel filter and then to secondary fuel filter.

From the filter the fuel passes to the fuel injection pump to supply fuel at high pressure to each injector and also provides extra fuel which lubricates and cools the injection pump.

This extra fuel is recirculated to the fuel tank, by means of the injector leak-off line.

Fuel shutoff (Injection pump)

Fuel injection pump is equipped with an electrically operated fuel shutoff solenoid is energized by operation of the ignition switch mounted in the instrument panel.

With the ignition is switched “OFF” a spring loaded plunger in the solenoid (held in position by the spring), prevents fuel flowing into the pump from the main fuel feed port.

With the ignition switched “ON” the magnetized plunger is energized by an internal coil and is drawn up into the body of the solenoid.

Fuel is then allowed to flow through the open port and into the pump.

Lift pump

A diaphragm type fuel lift pump is located between tank and primary fuel filter.