SECTION 1 - ENGINE AND FUEL SYSTEM

Chapter 1 - General Instructions

IMPORTANT NOTICE

All maintenance and repair operations described in this manual should be carried out exclusively by NEW HOLLAND authorized workshops. All instructions detailed should be carefully observed and special equipment indicated should be used if necessary.
Everyone who carries out service operations described without carefully observing these prescriptions will be directly responsible of deriving damages.

SHIMMING

At each adjustment, select adjusting shims, measure them individually using a micrometer and then sum up recorded values. Do not rely on measuring the whole shimming set, which may be incorrect, or on rated value indicated for each shim.

ROTATING SHAFT SEALS

To correctly install rotating shaft seals, observe the following instructions:

- Let the seal soak into the same oil as it will seal for at least half an hour before mounting;
- Thoroughly clean the shaft and ensure that the shaft working surface is not damaged;
- Place the sealing lip towards the fluid. In case of a hydrodynamic lip, consider the shaft rotation direction and orient grooves in order that they deviate the fluid towards the inner side of the seal;
- Coat the sealing lip with a thin layer of lubricant (oil rather than grease) and fill with grease the gap between the sealing lip and the dust lip of double lip seals;
- Insert the seal into its seat and press it down using a suitable tool. Do not tap the seal with a hammer or a drift;
- Take care to insert the seal perpendicularly to its seat while you are pressing it. Once the seal is settled, ensure that it contacts the thrust element if required;
- To prevent damaging the sealing lip against the shaft, place a suitable protection during installation.

O RINGS

Lubricate the O rings before inserting them into their seats. This will prevent the O rings from rolling over during mounting which will jeopardize sealing.

SEALERS

Apply Loctite Gasket Eliminator 510 or a suitable equivalent, over the mating surfaces marked with an X.
Before applying the sealer, prepare the surface as follows:

- remove possible scales using a metal brush;
- thoroughly degrease the surfaces using NEW HOLLAND DEGREASER, or a suitable equivalent.

BEARINGS

It is advisable to heat the bearings to 80 - 90°C before mounting them on their shafts and cool them down before inserting them into their seats with external tapping.

SPRING PINS

When mounting split socket spring pins, ensure that the pin notch is oriented in the direction of the effort to stress the pin.
Spiral spring pins should not be oriented during installation.

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Chapter 3 - Engine Overhaul

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SPECIFICATIONS

Type Diesel		New Holland 450T/PD
Output		108 hp / 80.5 kw (ISO TR 14396) 106.2 hp / 79.2 kw (80/1269/EEC)
No. of cylinders		4
Bore	in. (mm)	4.4 (111.8)
Stroke	in. (mm)	5.0 (127.0)
Displacement	in^3 (cm^3)	304 (4987)
Compression Ratio		17.5:1
Firing Order		1.3.4.2
Idle Speed	rev/min	700 - 800
Maximum 'No-Load' Speed	rev/min	2195 - 2245
Engine Speed at Maximum Torque	rev/min	1400
Rated Speed	rev/min	2070
Tappet Clearance (cold) Intake		0.36 - 0.46 mm (0.014 - 0.018 in)
Exhaust		0.43 - 0.53 mm (0.017 - 0.021 in)

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SAFETY RULES

PAY ATTENTION TO THIS SYMBOL



This warning symbol points out important messages involving personal safety. Carefully read the safety rules contained herein and follow advised precautions to avoid potential hazards and safeguard your safety and personal integrity.
In this manual you will find this symbol together with the following key-words:



WARNING (ATTENTION) *- it gives warning about improper repair operations and deriving potential consequences affecting the service technician's personal safety.*

DANGER: *The word "Danger" denotes a forbidden practice in connection with a serious hazard.*

TO PREVENT ACCIDENTS

Most accidents and personal injuries taking place in workshops are due from non-observance of some simple and essential prudential rule and safety precautions. For this reason, IN MOST CASES THEY CAN BE AVOIDED. It suffices to foresee possible causes and act consequently with necessary caution and care.

The possibility that an accident might occur with any type of machines should not be disregarded, no matter how well the machine in question was designed and built.

A wise and careful service technician is the best precaution against accidents.

Careful observance of this only basic precaution would be enough to avoid many severe accidents.

DANGER: Never carry out any cleaning, lubrication or maintenance operations when the engine is running.

SAFETY RULES

GENERALITIES

◊ Carefully follow specified repair and maintenance procedures.

◊ Do not wear rings, wristwatches, jewels, unbuttoned or flapping clothing such as ties, torn clothes, scarves, open jackets or shirts with open zips which could get hold into moving parts. We advise to use approved safety clothing such as anti-slipping footwear, gloves, safety goggles, helmets, etc.

◊ Never carry out any repair on the machine if someone is sitting on the operator's seat, except if they are certified operators to assist in the operation to be carried out.

◊ Never operate the machine or use attachments from a place other than sitting at the operator's seat.

◊ Never carry out any operation on the machine when the engine is running, except when specifically indicated.

◊ Stop the engine and ensure that all pressure is relieved from hydraulic circuits before removing caps, covers, valves, etc.

◊ All repair and maintenance operations should be carried out with the greatest care and attention.

◊ Service stairs and platforms used in a workshop or in the field should be built in compliance with the safety rules in force.

◊ Disconnect the batteries and label all controls to warn that the Machine is being serviced. Block the machine and all equipment which should be raised.

◊ Never check or fill fuel tanks and accumulator batteries, nor use starting liquid if you are smoking or near open flames as such fluids are flammable.

◊ Brakes are inoperative when they are manually released for maintenance purposes. In such cases, the machine should be kept constantly under control using blocks or similar devices.

◊ The fuel filling gun should remain always in contact with the filler neck. Maintain this contact until the fuel stops flowing into the tank to avoid possible sparks due to static electricity buildup.

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Chapter 2 - Data and Tooling

The following data is for general guidance. Where specific data or dimensions are required and not quoted in this section, refer to the section in the Repair Manual relating to the component under repair.

ENGINE DATA

Type Diesel		New Holland Model 450T/PD
Output		108 hp / 80.5 kw (ISO TR 14936) 106.2 hp / 79.2 kw (ECE80/1269)
No. of cylinders		4
Bore	in.	4.4
	(mm)	(111.8)
Stroke	in.	5.0
	(mm)	(127.0)
Displacement	in^3	304
	(cm^3)	(4987)
Compression Ratio		17.5:1
Firing Order		1.3.4.2
Idle Speed	rev/min	600 - 805
Maximum 'No-Load' Speed	rev/min	2350 - 2400
Engine Speed at Maximum Torque	rev/min	1400
Rated Speed	rev/min	2100
Tappet Clearance (cold) Intake		0.36 - 0.46 mm (0.014 - 0.018 in)
Exhaust		0.43 - 0.53 mm (0.017 - 0.021 in)

COOLING SYSTEM

Type		Pressurized Full Flow By-pass with Expansion Chamber
System capacity		24 Liters (Coolant 12 L Water 12 L)
Fan Belt Deflection:		10 - 16 mm (0.38 - 0.62 in)
Drive Belt Deflection Air Con Compressor		10 mm
Thermostat: Start to	Open at	82°C (180°F)
	Fully Open at	95°C (203°F)
Radiator Cap		0.90 bar (13 lb in^2)

FUEL SYSTEM

Fuel	Diesel
Fuel Tank capacity	106 Liters
Injection Pump Type	Rotary
Cold Start Device	Thermostart
Excess Fuel Device	Automatic Governor
Fuel Shut Off	Solenoid
Lift Pump	Electric

TRANSMISSION

Make/Model	Clark-Hurth-T16000
Power Shift	4X2= 4 Forward and 2 Reverse Gears
Transmission Oil Capacity	18 Liters
Direction of output	Clockwise
Torque Convertor Ratio	2.31:1

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TORQUE VALUES - VARIOUS	N·m	ft. lb.	Kgf m
Main Bearing Bolts	197	145	20.0
Connecting Rod Bolts	149	110	15.2
Cylinder Head Bolts (with Engine Cold)	217	160	22.0
Intake Manifold-to-Cylinder Head	35	26	3.5
Exhaust Manifold-to-Cylinder Head	38	28	3.9
Exhaust Pipe-to-Flange	31	23	3.2
Flywheel-to-Crankshaft	197	145	20.0
Oil Pan Drain Plug	41	30	4.2
Valve Rocker Cover Bolts	24	18	2.4
Crankshaft Pulley-to-Crankshaft	224	210	23.0
Self-Locking Screw - Valve Rocker Arm	24	18	2.4
Injector Attachment Bolts	23	17	2.3
Cover Bolts	31	23	3.1
Oil Pump to Block	23	17	2.3
Water Pump-to-Cylinder Block	48	35	3.6
Water Pump Cover-to-Pump	27	20	2.8
Oil Pan-to-Cylinder Block (Cast)	38	28	3.9
Injector Line Nuts	24	18	2.4
Leak-off Tube Banjo Fitting Bolts	11	8	1.1
Injection Pump-to-Front Cover	24	18	2.4
Camshaft Idler Drive Gear-to-Block	237	175	24.0
Front Cover-to-Cylinder Block	24	18	2.4
Thermostat Housing Bolts	24	18	2.4
Camshaft Gear Bolt	69	51	7.0
Camshaft Rear Gear Plate Bolts	47	35	4.8
Oil Filter Adaptor Bolts	42	31	4.2
Oil Filter Mounting Bolt Insert	34	25	3.5
Starting Motor-to-Rear Adaptor Plate	31	23	3.2
Injection Pump-to-Gear Nut	79	58	8.0
Oil Pressure Switch Assembly	31	23	3.2
Turbocharger-to-Exhaust Manifold Nut	44	33	4.5
Fan Blade to Support Body	27	21	2.8
Crankshaft Rear Oil Seal Retainer -			
Initial Tightening	12	9	1.2
Final Tightening	23	17	2.3
Temperature Senders	20	15	2.0
Idler Pulley Bolt	54	40	5.5
Pump Connector to Block	24	18	2.4

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O RING FLAT FACE SEAL FITTING TORQUE VALUES

Nominal O.D (in.)	Tube (mm)	Dash Size	Thread Size In.	Swivel Nut Torque ft. lb.	N·m
0.250	6.35	-4	9/16-18	12	16
0.375	9.52	-6	11/16-16	18	24
0.500	12.70	-8	13/16-16	37	50
0.625	15.88	-10	1-14	51	69
0.750	19.05	-12	1 3/16-12	75	102
0.875	22.22	-14	1 3/16-12	75	102
1.000	25.40	-16	1 7/16-12	105	142
1.250	31.75	-20	1 11/16-12	140	190
1.500	38.10	-24	2-12	160	217

SEALER SPECIFICATIONS

The following sealers should be used as directed in the manual:

SEALERS	PART NUMBER	TRADE DESCRIPTION
Anaerobic sealer	82995770/1	LOCTITE GASKET ELIMINATOR 518
RTV silicone sealer	82995775/6	LOCTITE SUPERFLEX 593, 595 or 596 LOCTITE ULTRA BLUE 587 DOW CORNING SILASTIC 732 GENERAL ELECTRIC RTV 103 OR 108
Pipe sealant	82995768	PST 592 PIPE SEALANT WITH TEFLON
Thread-locking compound	82995773	LOCTITE 271 THREADLOCKER/SEALANT (red)

HARDWARE TORQUE VALUES

Check the tightness of hardware periodically.

Use the following charts to determine the correct torque when checking, adjusting or replacing hardware on the Backhoe Loader.

IMPORTANT: DO NOT use the values listed in the charts if a different torque value or tightening procedure is specified in this manual for a specific application. Torque values listed are for general use only.

Make sure fastener threads are clean and not damaged.

NOTE: *A torque wrench is necessary to properly torque hardware.*

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FAULT FINDING

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

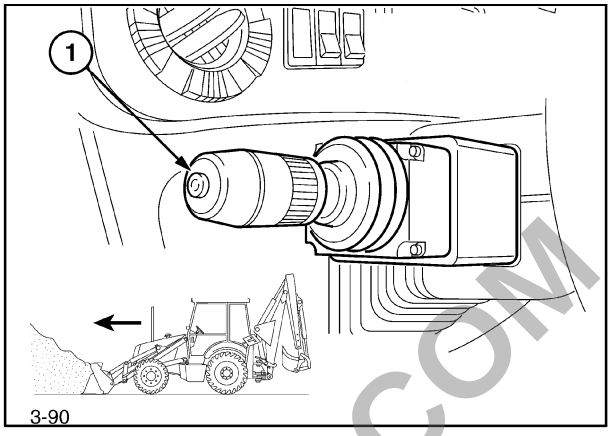
PROBLEM	POSSIBLE CAUSES	REMEDY
Engine does not develop full power	1. Clogged air cleaner	1. Clean or renew element
	2. Fuel line obstructed	2. Clean
	3. Faulty injectors	3. Clean and reset
	4. Incorrect valve lash adjustment	4. Check and reset
	5. Burnt, worn or sticking valves	5. Replace valves with 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
Oil pressure warning light fails to operate	1. Bulb burnt out	1. Renew bulb
	2. Warning Light pressure switch faulty	2. Renew pressure switch
	3. Warning light circuit faulty	3. Check and renew wiring
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

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LED Displayed Faults

If a fault is, or there have been (intermittent faults) present, a detailed fault display can be selected by placing: The Powershift lever in Neutral position and pressing the Kickdown button. The indicated fault on the LED display can then be localized by using the table below, until power down.



65

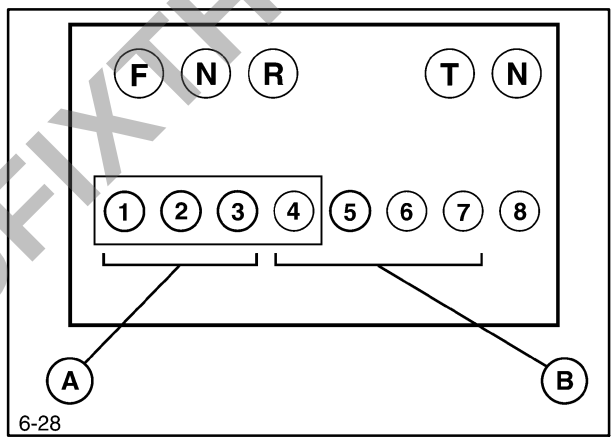
Fault Group

The faults are displayed using 2 LEDs on the 8 LED display. Faults are displayed as 3 subgroups - Group A:

Fault Sub Group A	Group Indication
Input related	LED 1 blinks red
Output related	LED 2 blinks red
Other	LED 3 blinks red

Within each group several faults are possible. The second LED's position - Group B, indicates the fault area, where the color indicates the fault type.

Typically an open circuit condition is shown using an orange LED where a short circuit condition is indicated with a red LED, Figure 66.



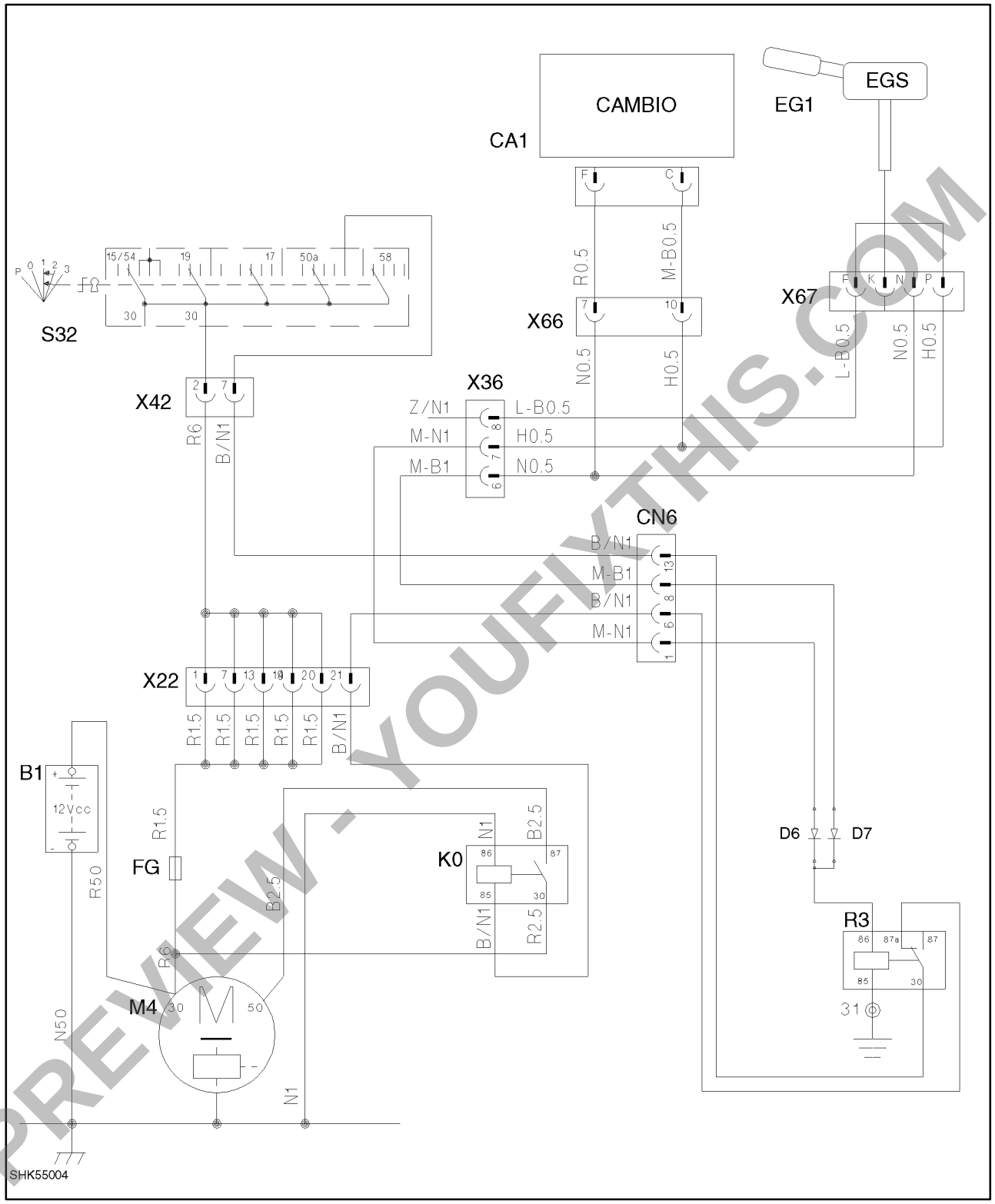
66

Once the fault code has been determined proceed to fault codes page 18.

Fault Group LED (A)	Fault Group LED (B)	Fault	Fault Code
None	None	No fault active	-
1 Red	4 Orange	Shift lever input fault	F1
1 Red	5 Orange	Speed sensor Open Circuit	F2
1 Red	5 Red	Speed sensor Short Circuit	F3
1 Red	7 Green	Battery Over voltage	F4
2 Red	4 Orange	Open circuit on one or both direction outputs	F5
2 Red	4 Red	Direction output forced to plus - Critical fault	F6
2 Red	5 Orange	Other output Open Circuit	F7
2 Red	5 Red	Other output Short Circuit	F8
2 Red	6 Orange	Modulation output Open Circuit	F9
2 Red	6 Red	Modulation output Short Circuit	F10
3 Red	5 Red	Startup Fault - Limp Home Mode Selected	F11

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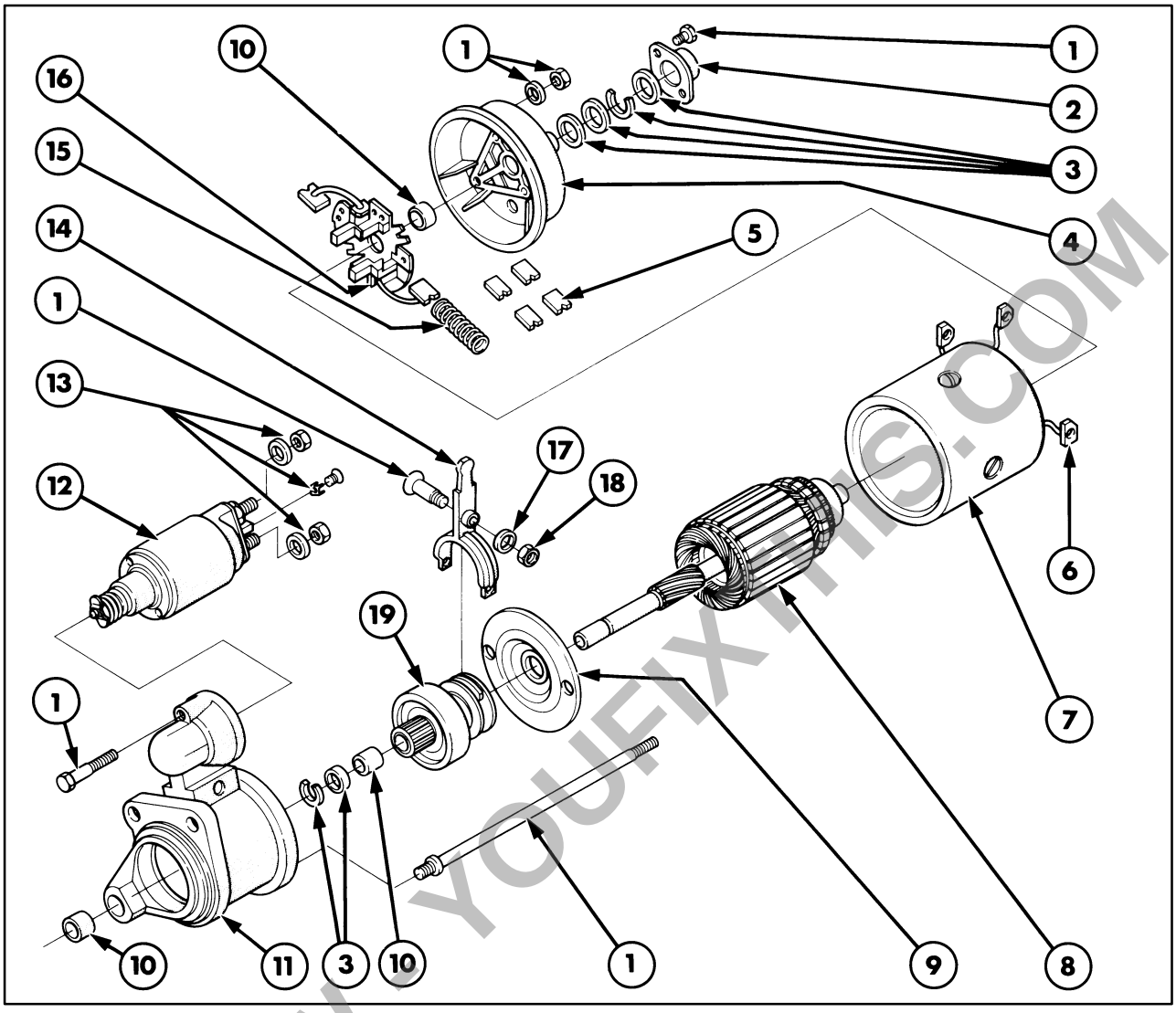
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FOLDOUT

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Starter Motor - Exploded View 60

1. Stud and Bolt Kit
2. End Cap
3. Collar and Ring Assembly, Drive Thrust
4. Brush End Plate Assembly
5. Brush Assembly
6. Brush Assembly
7. Field Coils and Housing Assembly
8. Armature
9. Center Bearing Plate
10. Bushing
11. Housing Assembly
12. Solenoid Assembly
13. Solenoid Hardware Kit
14. Lever Assembly
15. Brush Spring
16. Brush Holder Assembly
17. Washer
18. Nut
19. Drive Assembly

DISASSEMBLY

With reference to Figure 60.

1. Support the starting motor in a soft jawed vice.

2. Disconnect the thick braided wire from the field coil housing to the solenoid assembly.

3. Remove the three screws from the front housing assembly and withdraw the solenoid assembly. Note that the plunger will remain in the drive engagement lever.

4. Remove the solenoid plunger from the drive engagement lever by gripping the plunger and lifting up the front end and releasing it from the drive engagement lever.

5. Remove the two end housing nuts and the two screws retaining the end cap and brush plate to the end housing. Remove the ‘C’ clip and armature shaft end play shims and withdraw the end housing, leaving the brush gear on the commutator. Remove the thin metal washer from the commutator end of the armature.

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ENGINE DISASSEMBLY

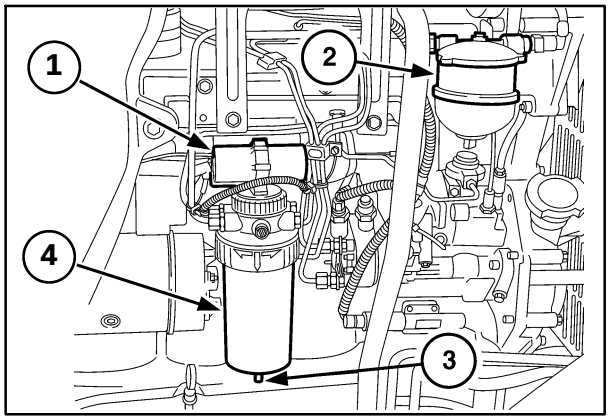
Cylinder Head, Valves, And Related Parts

Cylinder head removal

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

Remove or disconnect the following components to allow removal of the cylinder head:-

- Drain the engine coolant into a clean receptacle.
- Disconnect/remove the air cleaner, air cleaner tubes and muffler assembly.
- Disconnect low pressure fuel lines to the filters, injector leak off tube, Thermostart feed tube, lift pump and filter (1) and (4), injector to injection pump high pressure tubes, (cap all exposed openings), and sedimentation/water separator (2).
- Disconnect and remove the rocker cover ventilation tube.



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NOTE: *Removal of the radiator will greatly assist water pump removal.*

- Remove the engine fan belt guards, the fan belt, alternator and water pump.

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CONTROLS AND INSTRUMENTS, Figure 8.

1. Direction Indicators, Main beam Selection, Front Windscreen Wiper stalk and Front Windscreen Washer Control
2. Foot Throttle Pedal
3. Loader Lever (with integrated Transmission Disconnect Switch and Horn Switch)
4. Heater Control Panel / Air Conditioning (when fitted)
5. Key Start
6. Side Mounted Instrument Panel
7. Parking Brake
8. Hand Throttle Lever
9. Stabilizer Leg Levers
10. Air Flow Direction Outlet
11. Hydraulically Extendible Dipper, H.E.D Operating Pedal (Optional Equipment)
12. Backhoe Control Lever Patterns
    Standard:
    2 Lever - Cross Pattern with Horn Button

    Optional:
    2 Lever - Cross Pattern - ISO
    2 Lever - Diagonal Pattern
13. Hammer Operating Pedal (Optional Equipment)
14. Air Flow Direction Outlet
15. De Luxe Seat with Document Pouch to the rear
16. Spare Auxiliary Socket / Blanking Plug
17. Radio Placement / Miscellaneous Objects Holder
18. Drink Holder
19. Independent Brake Pedals and Pedal Latch

WARNING

When travelling on the road the brake pedals must be latched together for straight line braking.
If the pedals are not latched pressure applied to one pedal only, could result in the machine veering severely to the left or right hand side.

20. Hazard Flasher Button
21. POWER SHIFT 4X2 - Transmission Forward / Reverse and Gear Selection Lever
22. Air Flow Direction Outlet
23. Steering Wheel (Adjustable)
24. Front Instrument Panel
25. Air Flow Direction Outlet
26. Key Operated - Steering Selection Switch:
    1= Standard Steering
    2= Double steering
    3= Crab Steering

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DESCRIPTION AND OPERATION

The engine is a 4 cylinder and Turbocharged.

The engine 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 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.

The exhaust valves are fitted with positive valve rotators with all 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 3 replaceable bearings. 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. The crankshaft is manufactured from nodular cast iron with machined finished crank webs. End thrust is controlled by a thrust bearing incorporated in the center main bearing of the crankshaft.

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 (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 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 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 to the Turbocharger and in the rear end of the manifold a tapped hole is provided for installation of a thermostart or an ether cold starting aid (North America Only).

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 dust 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 - 4 from the front to the rear of the engine. They can be bored oversize for the fitment of sleeves, which are available in service.

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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 and front plate is attached to the front of the engine 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.

LUBRICATION SYSTEM

Lubrication of the engine, figure 38, is maintained by a rotor type oil pump mounted in the rear of the engine block, behind the flywheel. 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 pressurization of the system.

An integral radiator/engine oil cooler is fitted. Oil flows from the filter to main oil gallery, which runs the length of the block and intersects the camshaft follower chamber.

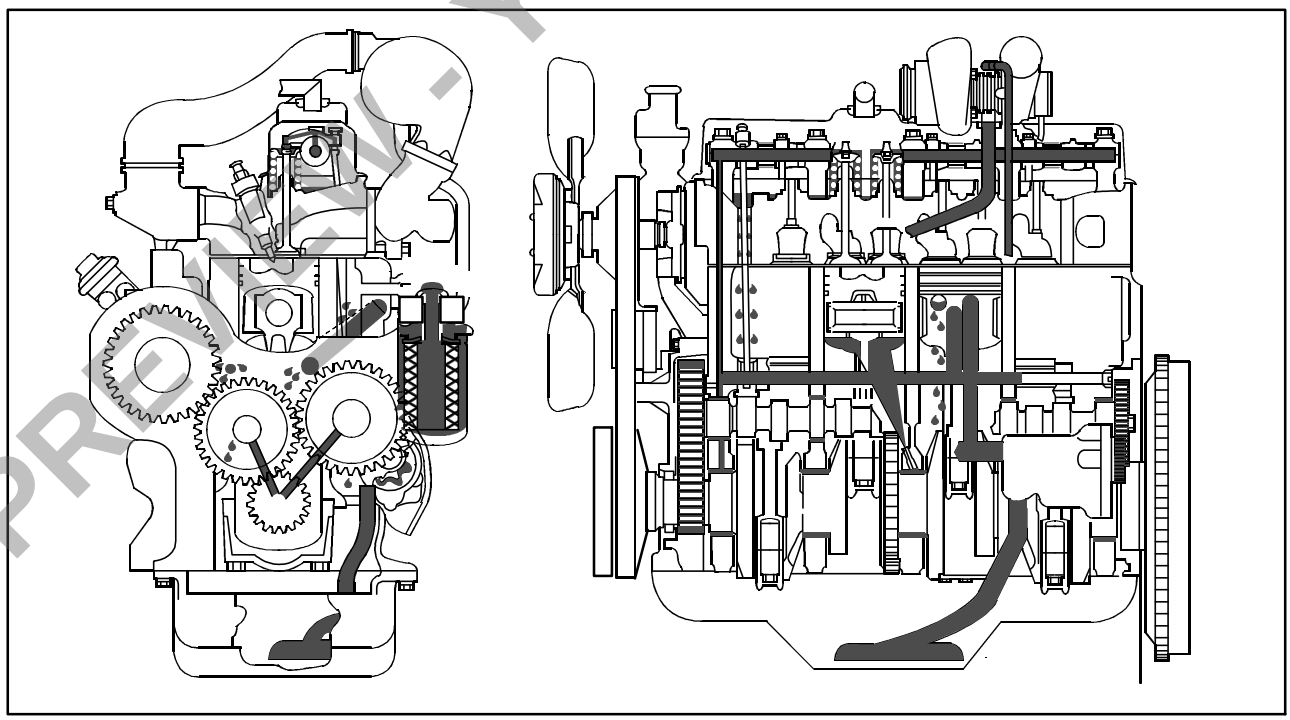
The main gallery also supplies oil to the crankshaft main bearings, connecting rods, big ends, small ends. The underside of the pistons and pins, are lubricated by oil pressure jets mounted adjacent to each main journal housing.

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.

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



Engine Oil Flow

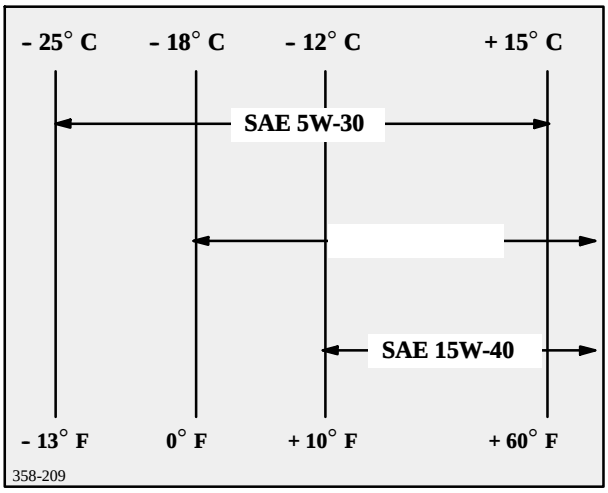
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FUEL, LUBRICANTS AND COOLANTS

ENGINE



Engine oil must at minimum meet A.P.I. (American Petroleum Institute) engine service classifications SH/SJ.

NOTE: *In areas where prolonged periods of extreme temperatures are encountered, local lubricant practices are acceptable, such as the use of SAE 5W in extreme cold temperatures or the use of SAE 50 in extreme high temperatures.*

The engine oil change period is shown in Section 4. Locally available fuel may have a high sulphur content, in which case the oil change period should be adjusted as follows:

Sulphur Content %	**Oil Change Period**
Below 0.5	Normal
0.5 - 1.0	Half the Normal
1.0 - 1.3	One-quarter Normal

The use of fuel with a sulphur content above 1.3% is not recommended.

APPLICATION AND RECOMMENDED FLUIDS	SPECIFICATION	QUANTITY
Engine -		
NH Super Premium 15W-40	API CG-4/SH/SJ	17 liters (4.5 gals)
NH Super Premium 10W-30	API CG-4/SH/SJ	(including filter)
Fuel -		
Diesel Fuel	–6°C (20°F) and above - No. 2 Diesel Fuel Cetane - 45 (min.) –6°C (20°F) and below - No. 1 Diesel Fuel Cetane - 50 (min.)	106 liters (28 gals)
Transmission Power Shuttle -		
2WD -		
NH 134D Hydraulic Oil	Use of NH F200 recommended in extreme cold temperatures, below –18°C (0°F).	17 liters (4.5 gals)
NH F200 Hydraulic Oil		
4WD -		18 liters (4.75 gals)
NH 134D Hydraulic Oil		
NH F200 Hydraulic Oil		
Transmission Power Shift -		18 liters (4.75 gals)
Automatic Transmission Fluid	Ford Mercon GM Dextron II	

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◊ Use exclusively specified towing points for towing the Machine. Connect parts carefully. Ensure that foreseen pins and/or locks are steadily fixed before applying traction. Do not stop near towing bars, cables or chains working under load.

◊ To transfer a failed Machine, use a trailer or a low loading platform trolley if available.

◊ To load and unload the machine from the transportation mean, select a flat area providing a firm support to the trailer or truck wheels. Firmly tie the machine to the truck or trailer platform and block wheels as required by the forwarder.

◊ For electrical heaters, battery-chargers and similar equipment use exclusive auxiliary power supplies with a efficient ground to avoid electrical shock hazard.

◊ Always use lifting equipment and similar of appropriate capacity to lift or move heavy components.

◊ Pay special attention to bystanders.

◊ Never pour gasoline or diesel oil into open, wide and low containers.

◊ Never use gasoline, diesel oil or other flammable liquids as cleaning agents. Use non-flammable non-toxic proprietary solvents.

◊ Wear protection goggles with side guards when cleaning parts using compressed air.

◊ Do not exceed a pressure of 2.1 bar, in accordance with local regulations.

◊ Do not run the engine in a closed building without proper ventilation.

◊ Do not smoke, use open flames, cause sparks in the nearby area when filling fuel or handling highly flammable liquids.

◊ Do not use flames as light sources when working on a machine or checking for leaks.

◊ Move with caution when working under a Machine, and also on or near a Machine. Wear proper safety accessories: helmets, goggles and special footwear.

◊ During checks which should be carried out with the engine running, ask an assistant to sit at the operator's seat and keep the service technician under visual control at any moment.

◊ In case of operations outside the workshop, drive the Machine to a flat area and block it. If working on an incline cannot be avoided, first block the Machine carefully. Move it to a flat area as soon as possible with a certain extent of safety.

◊ Ruined or plied cables and chains are unreliable. Do not use them for lifting or trailing. Always handle them wearing gloves of proper thickness.

◊ Chains should always be safely fastened. Ensure that fastening device is strong enough to hold the load foreseen. No persons should stop near the fastening point, trailing chains or cables.

◊ The working area should be always kept CLEAN and DRY. Immediately clean any spillage of water or oil.

◊ Do not pile up grease or oil soaked rags, as they constitute a great fire hazard. Always place them into a metal container.
Before starting the Machine or its attachments, check, adjust and block the operator's seat. Also ensure that there are no persons within the Machine or attachment operating range.

◊ Do not keep into your pockets any object which might fall unobserved into the Machine's inner compartments.

◊ Whenever there is the possibility of being reached by ejected metal parts or similar, use protection eye mask or goggles with side guards, helmets, special footwear and heavy gloves.

◊ Wear suitable protection such as tinted eye protection, helmets, special clothing, gloves and footwear whenever it is necessary to carry out welding procedures. All persons standing in the vicinity of the welding process should wear tinted eye protection. NEVER LOOK AT THE WELDING ARC IF YOUR EYES ARE NOT SUITABLY PROTECTED.

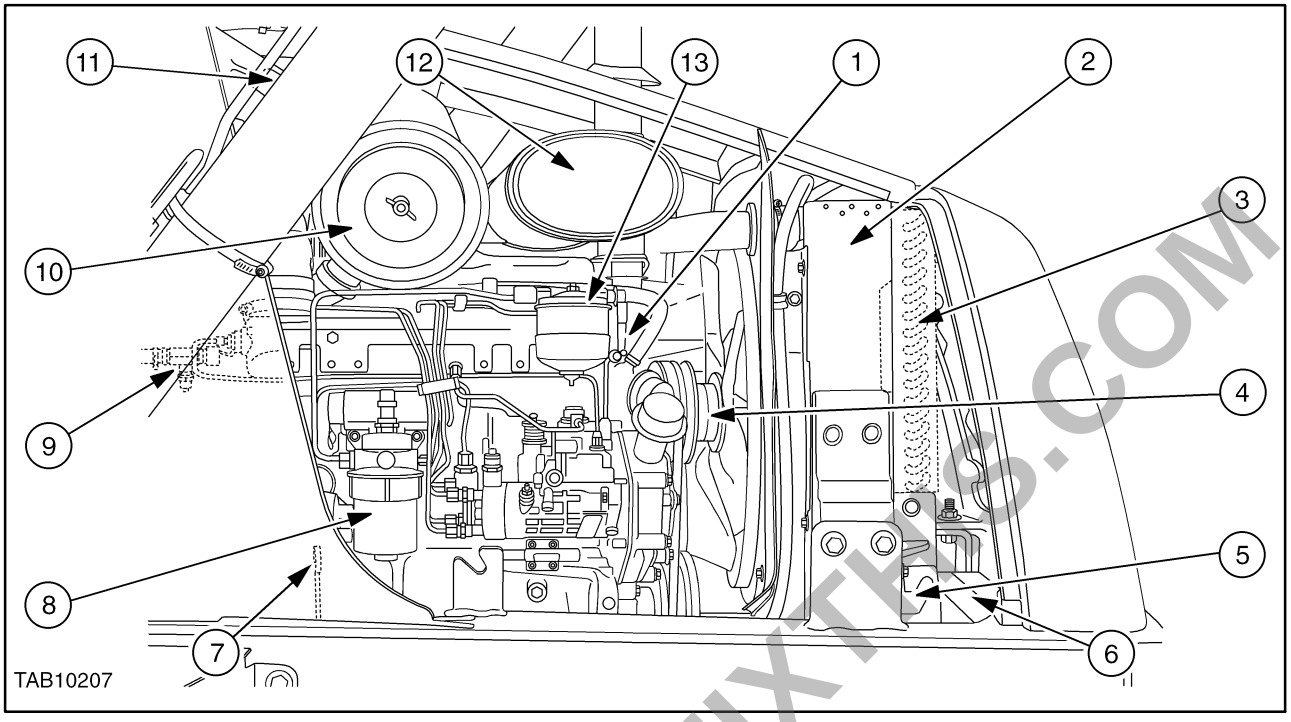
◊ Metal cables with the use get frayed. Always wear adequate protections (heavy gloves, eye protection, etc.)

◊ Handle all parts with the greatest caution. Keep your hands and fingers far from gaps, moving gears and similar. Always use approved protective equipment, such as eye protection, heavy gloves and protective footwear.

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DESCRIPTION AND OPERATION



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Right Hand View of Engine

1. Thermostat
2. Coolant Radiator
3. Air Conditioning Condenser (when fitted)
4. Water Pump
5. Transmission Oil Cooler
6. Battery
7. Engine Oil Level Dipstick
8. Fuel Filter with Electric Lift Pump
9. Cold Start Electro Valve
10. Air Cleaner
11. Coolant Recovery Tank
12. Muffler
13. Fuel Sedimenter/Separator

FUEL SYSTEM

The diesel fuel system consists of a fuel tank, mechanical or electric lift pump, fuel filter/sediment separator, D.P. 203 series fuel injection pump, fuel injectors and inter-connecting fuel lines. A dry type air cleaner removes dirt and contaminants from the air intake.

DP203

The fuel is drawn from the fuel tank, through the sediment separator and fuel filter by the electric lift pump, and then fed into the injector pump.

The transfer pump delivers fuel to the 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 via a fitting on the fuel injection pump governor control housing to the fuel tank by means of the injector leak-off line.

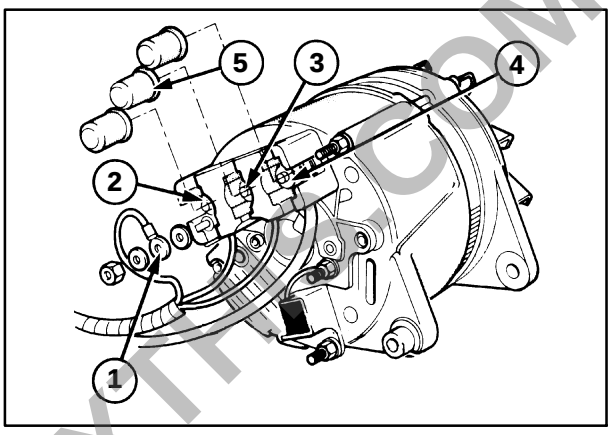
On all models the excess fuel that leaks past the needle valve of the injectors is directed back into the fuel tank at the filler neck by means of the injection leak-off line.

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Description and Operation

The alternator is mounted high at the front of the engine and is driven from a crankshaft pulley via a 'vee' drive belt. The alternator contains integral regulators.



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70 Amp Alternator

1. Ground (Earth) Connection
2. Engine Speed Sensor Connection (W Terminal)
3. Warning Lamp (D+ terminal)
4. Output Connection (B+ Terminal)
5. Protective Terminal Sleeve

Alternator Operation

With reference to Figure 66.

When the key start switch is turned on a small current flows from the battery through the rotor field wiring. The circuit is made via the charge indicator warning lamp, alternator terminal 'D+' the rotor field winding, the alternator regulator and ground.

At this stage the warning light is illuminated and the rotor partially magnetized.

When the engine is started and the partially magnetized rotor revolves within the stator windings a 3-phase alternating current is generated. A constant portion of the generated current is converted to direct current by the three field diodes incorporated in the rectifier pack.

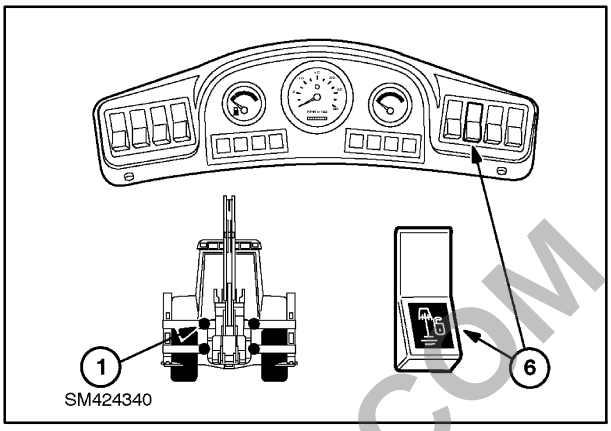
This direct current is fed back to supplement the current flowing through the rotor field winding.

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S1 SIDE SHIFT LOCK SWITCH

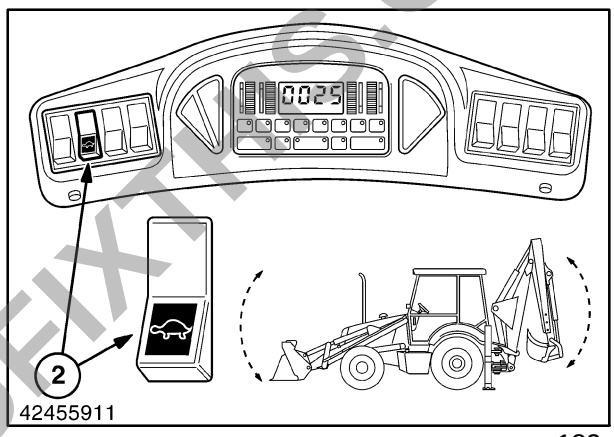
Continuity should be found between Pin 1 and 5.



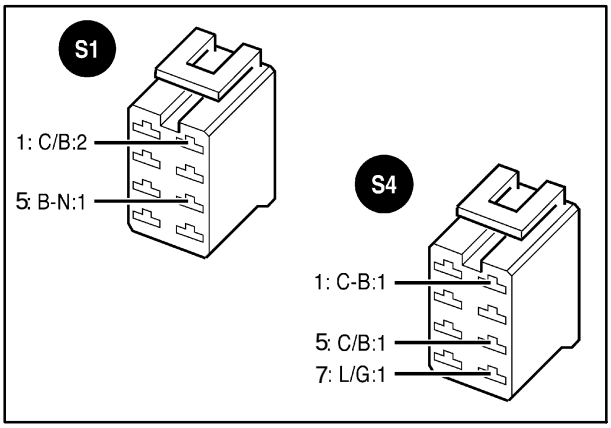
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S4 HIGH-LOW FLOW SWITCH (OPS)

Continuity should be found between Pin 1 and 5.



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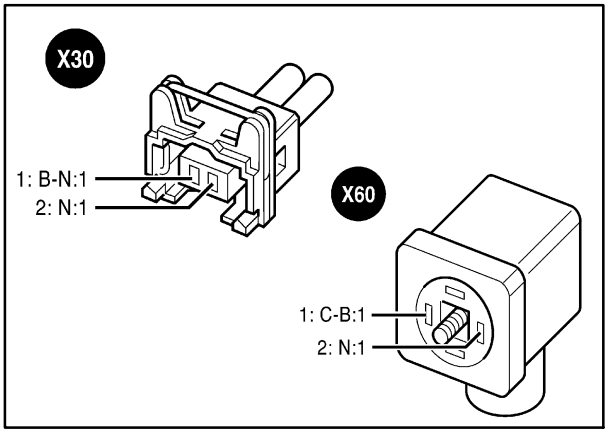
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X30 SIDE SHIFT LOCK SOLENOID LINK

X60 HIGH-LOW FLOW SOLENOID

When switch is operated 12V should be found at Pin 1.

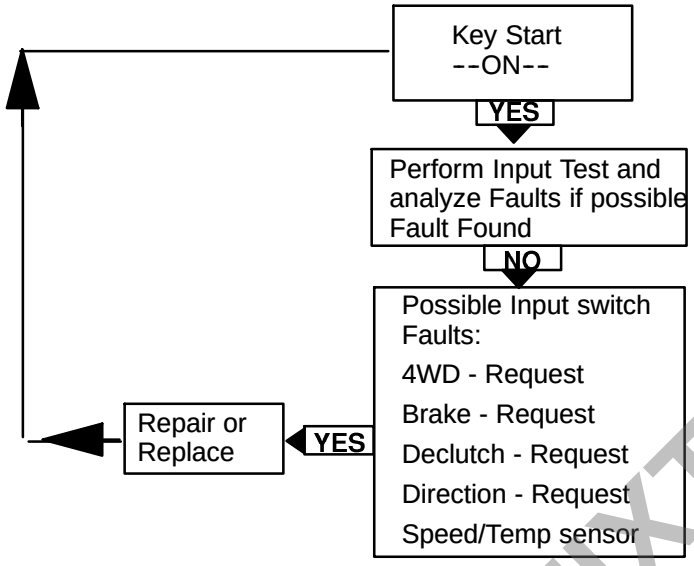
The resistance of the solenoid should be 9.7



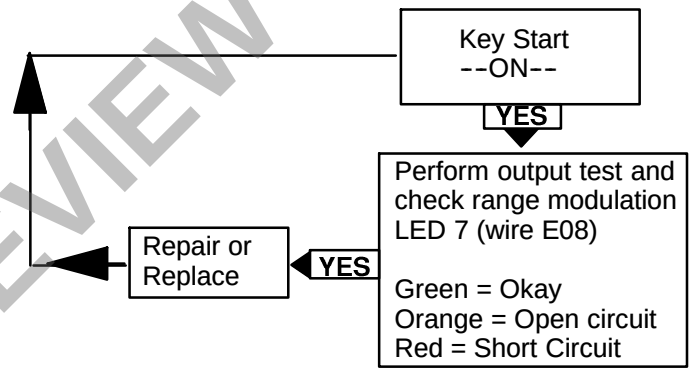
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FAULT CODE - F12



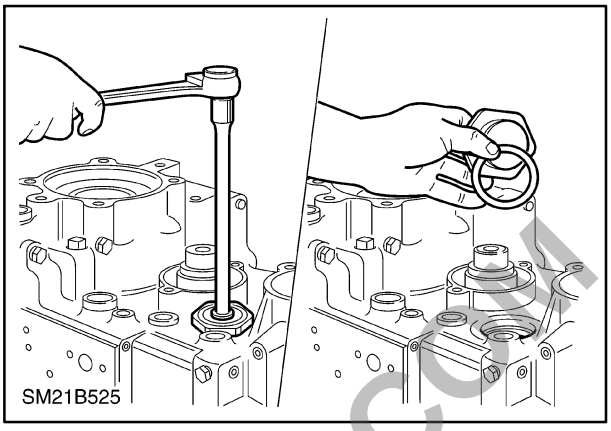
FAULT CODE - F13



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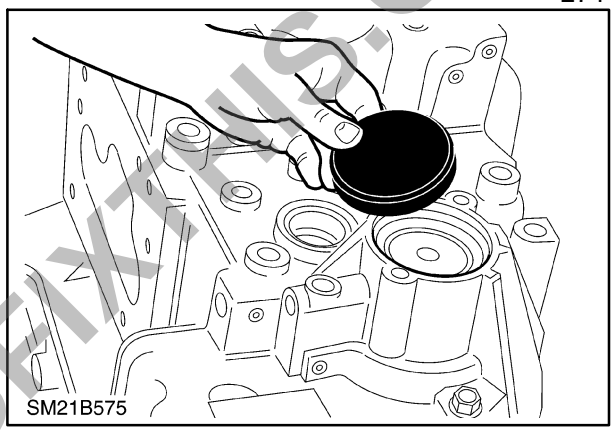
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Tighten plug to 13.6 - 20.3 N·m (10 - 15 lb. ft.).



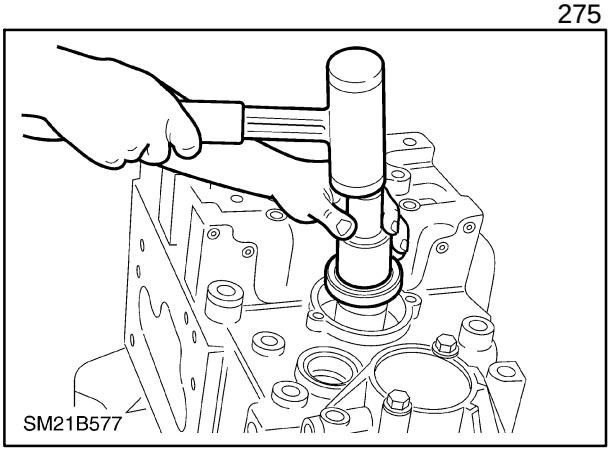
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Position FWD bore plug and tap bore plug into place.



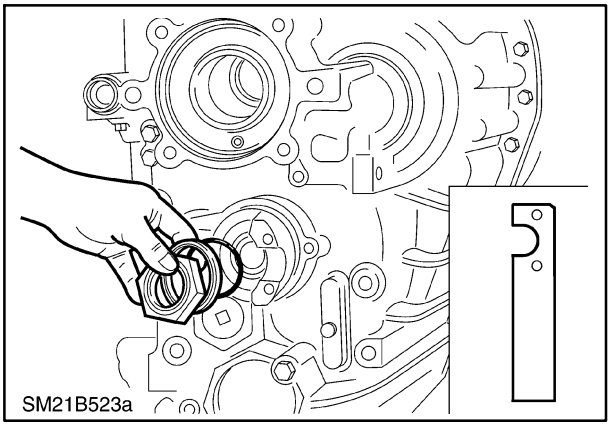
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Position upper output seal and tap seal into place.



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Install upper output flange, O ring, washer and nut and tighten nut to 339 - 407 N·m. (205 - 300 lb. ft.).



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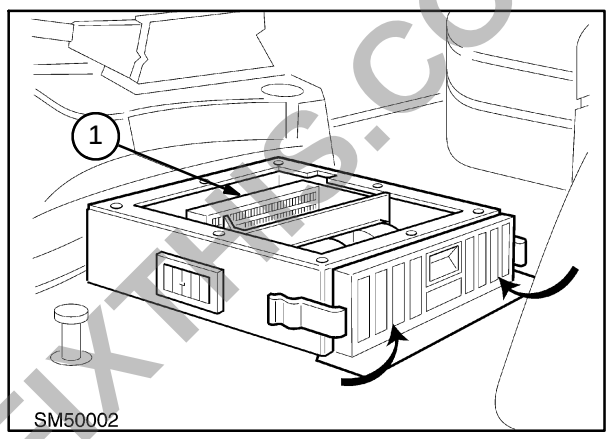
The filter elements are made of specially treated paper with a sealing strip bonded to the outer face.

Clean all of the elements by blowing with compressed air from the clean side through to the dirty side. The compressed air should not exceed 2 bar (30 lb/in^2) and the air line nozzle should be at least 300 mm (12 in) from the element.

Heater Radiator

The heater radiator (1) is fitted in a housing under the cab seat for central displacement of warm or cold air flow.

IMPORTANT: *Too ensure a good flow of air through the heater radiator the filter should be cleaned more frequently when operating in extremely dusty conditions.*



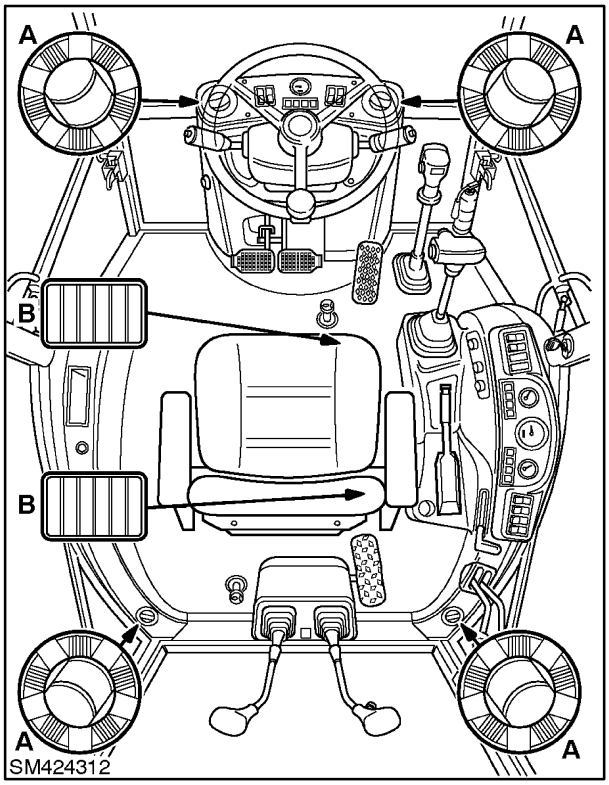
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Air Flow Vents

Air flow vents are connected to the heater housing and receive air from the blower motor, to direct warm or cold air onto the windscreen and side windows or to the cab interior as required.

Each vent may be swivelled and adjusted to control the flow of air.

To open a vent, press one side of the disc and turn it, as required, to direct the air flow.



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