DESCRIPTION AND OPERATION – ENGINE COMPONENTS

The engines are a 4 cylinder (TT 75A) and 3 cylinder (TT 60A), naturally aspirated. Both 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 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 replacable. Special replacable cast alloy valve seats are pressed into each valve port during manufacturing. No over size 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 bushings. 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.

A helical gear is integral on rear of cam shaft, and drives the engine oil lubrication pump mounted forward of the flywheel.

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 inline and vertical and numbered from 1 to 3 or 4 from front of the engine to the 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 TT 75A and 4 main bearings in the TT 60A engine.

The crankshaft is manufactured from steel with machined finished crankwebs

End thrust is controlled by a thrust bearing incorporated in the center main bearing of the crankshaft in TT 75A engine and in the second main bearing from flywheel side in TT 60A engine.

A dynamic balancer is fitted and driven by crankshaft 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 “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 aluminium silicon alloy with notch type combustion chamber being recessed in to 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 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 hose to air cleaner.

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SECTION 09 -- HYDRAULIC SYSTEMS

BOOK 2 - 84154803

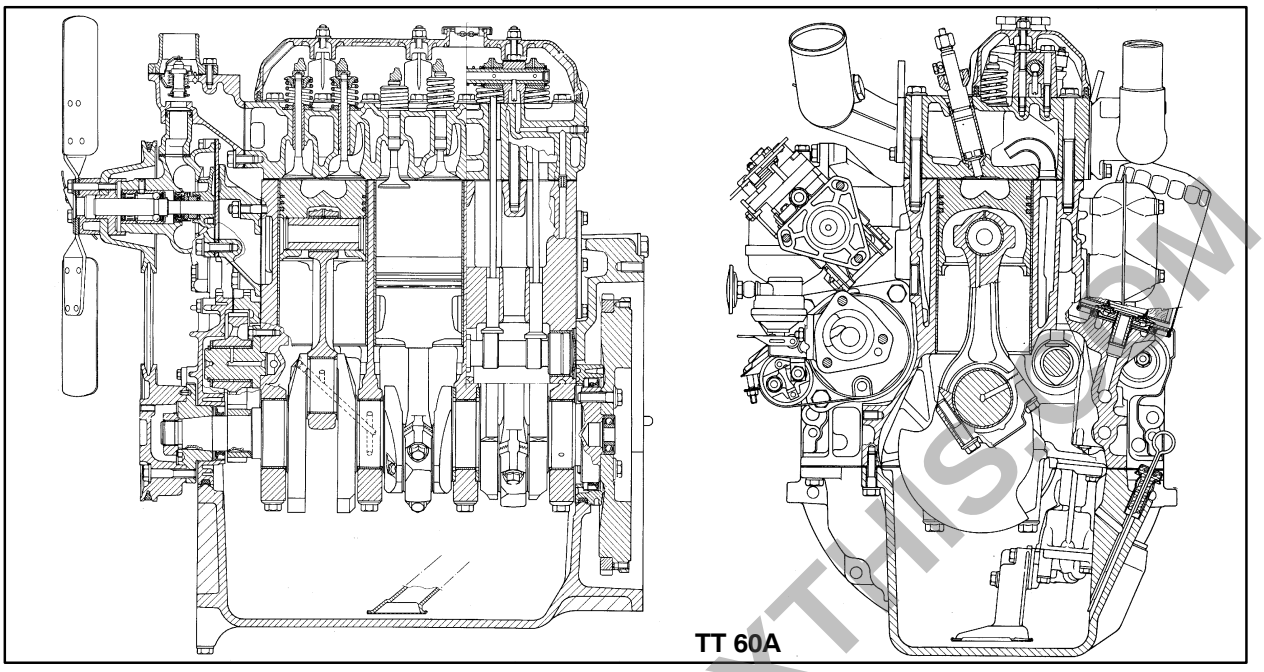
Chapter 1 – Hydraulic Systems

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	Introduction and Circuit Identification	2
	Pump	2
	Filter	2
	Mechanical Hydraulic Lift Assembly	3
	Remote Control Valve	4
	Open Center Hydraulic Circuit and Mechanical Lift	5
	Schematic View of Hydraulic System	5
	Hydraulic Circuit Diagram	6

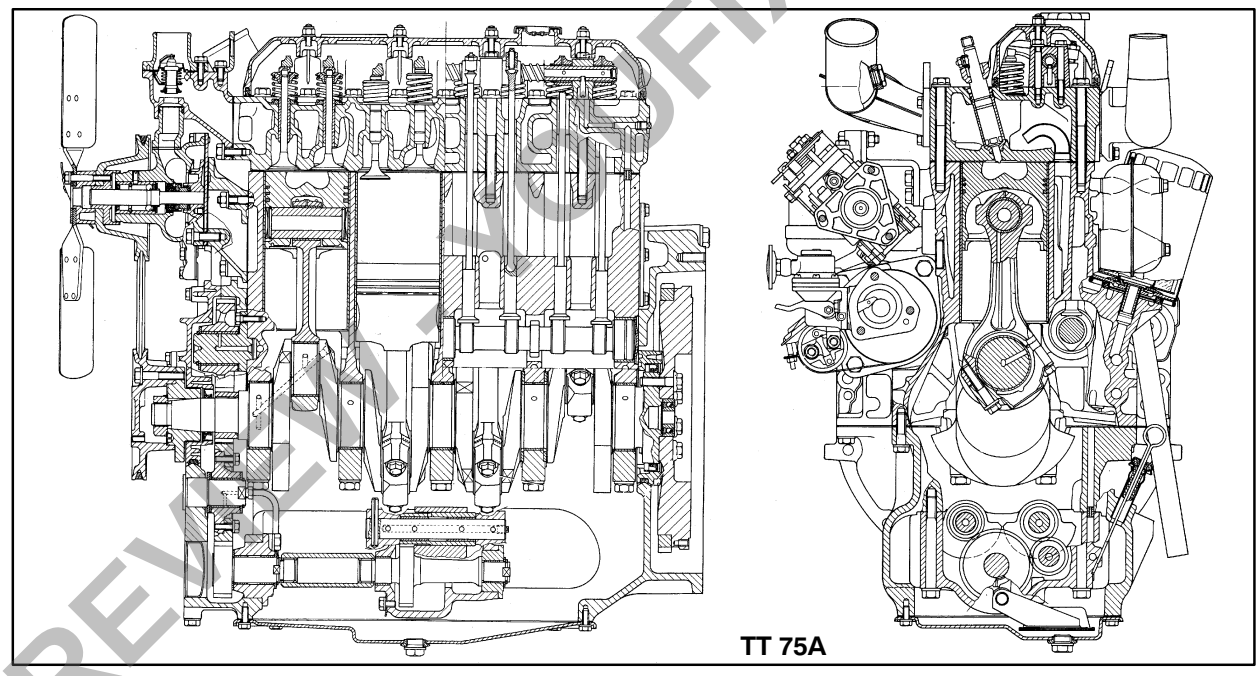
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TT 60A

1



TT 75A

2

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.

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ENGINE BOLT TORQUE SPECIFICATIONS

Description	Thread size	Torque	Angle
Capscrew, cylinder head	M12	40 N·m	130° ± 5 + 140° ± 5
Capscrew, main bearing caps	M14	80 N·m	90°
Capscrew, timing cover and case	M8	25 Nm (18 ft-lbs)	–
Capscrew, connecting rod caps	M11	40 N·m	60°
Capscrew, flywheel	M12	40 N·m	60°
Nut, crankshaft pulley hub	M30	300 N·m (221 ft-lbs)	–
Capscrew, injection pump shaft gear	M12	74 N·m (55 ft-lbs)	–
Nuts, injection pump to support	M8	25 N·m (18 ft-lbs)	–
Capscrew, camshaft flange	M8	25 N·m (18 ft-lbs)	–
Capscrew, oil pan TT60A TT75A	 M10 M8	 54 N·m (41 ft-lbs) 25 N·m (18 ft-lbs)	–
Capscrew, oil pump	M8	25 N·m (18 ft-lbs)	–

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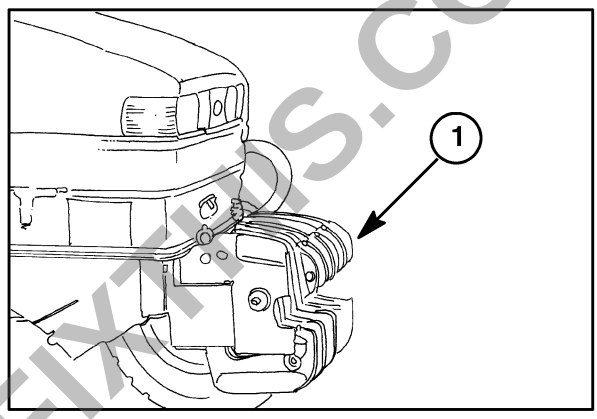
ENGINE REMOVAL – INSTALLATION

SEPARATING ENGINE FROM TRANSMISSION HOUSING

⚠ WARNING ⚠

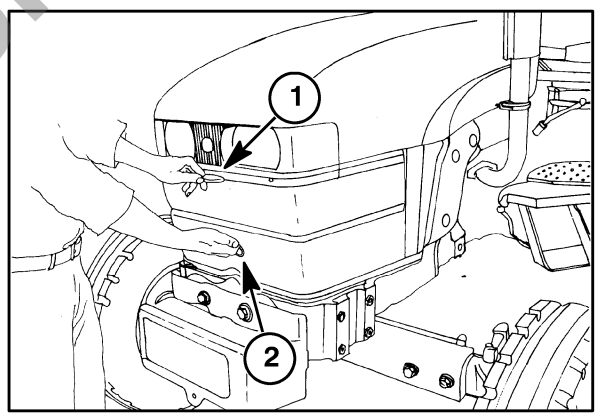
Handle all components with the greatest care. Do not insert hands or fingers between the parts. Wear suitable protection clothing, including goggles, gloves and footwear.

1. Remove front ballast weights, 1, if installed.



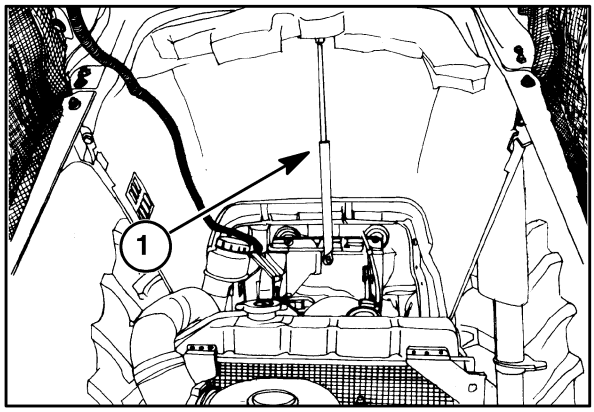
6

1. Slide the lock, 1, to right, Hold and lift the handle, 2, to raise the hood.



7

2. To maintain the hood in the raised position, a gas strut, 1, is provided underside the hood.



8

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TROUBLESHOOTING

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

IMPORTANT: *When attending a repair the cause of the problem must also 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 replace element
	2. Fuel line obstructed	2. Clean
	3. Faulty injectors	3. Clean and reset
	4. Incorrect valve clearance 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 install new gasket
	7. Incorrect fuel delivery	7. Check injectors and pump
	8. Low cylinder compression	8. Replace piston rings or rebore/resleeve as necessary
Oil pressure warning light fails to operate	1. Bulb burnt out	1. Replace bulb
	2. Warning Light pressure switch faulty	2. Replace pressure switch
	3. Warning light circuit faulty	3. Check and replace wiring
Excessive exhaust smoke	1. Exhaust leak on exhaust manifold	1. Install new gasket
	2. Air cleaner dirty or restricted	2. Clean
	3. Excessive fuel delivery	3. Overall injection pump and injectors

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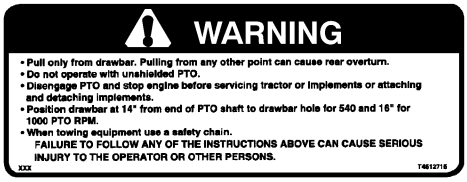
ENGINE		TT75A	TT60A
Make		Iveco	
Type		8045.05.700	8035.05.700
Gross horse power		75	55
Number of cylinders		4	3
Bore	mm	104	
	in	4.10	
Stroke	mm	115	
	in	4.53	
Cubic capacity	cm^3	3908	2931
	in^3	238.5	179.0
Compression ratio		18:1	
Firing order		1-3-4-2	1-2-3
Idle speed	RPM	650 ± 25	
Maximum no-load speed	RPM	2750-2790	
Rated speed	RPM	2500 ± 50	
Tappet clearance			
Intake, Exhaust (cold)	mm	0.45 ± 0.05	
	in	0.018± 0.002	
Intake, Exhaust (hot)	mm	0.45 ± 0.05	
	in	0.012 ± 0.002	

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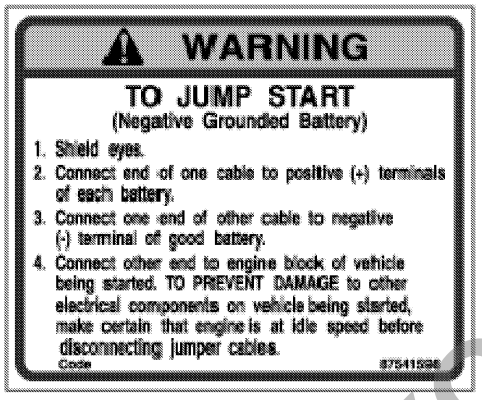
SAFETY DECALS

1



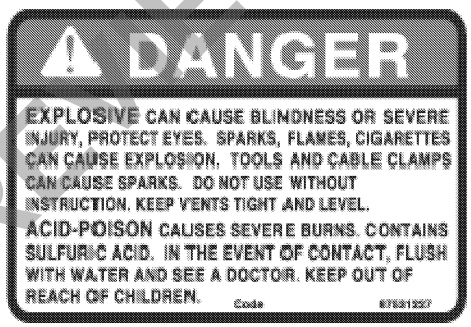
WARNING: Pull Only From Drawbar
PART NO: 86532904
LOCATION: PTO Shield

2



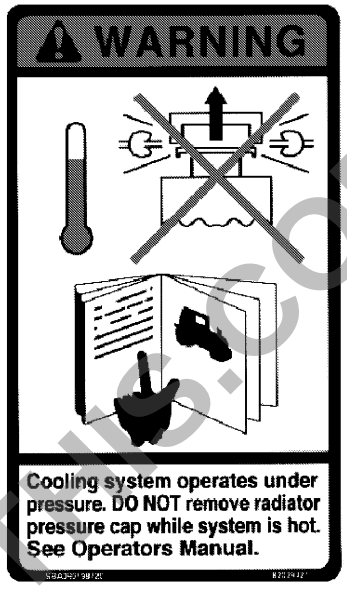
WARNING: To Jump Start
PART NO: 87541598
LOCATION: Top Side of Battery Holder

3



DANGER: Explosive can cause blindness
PART NO: 87531227
LOCATION: Top Side of Battery Holder

4



WARNING: Cooling System Under Pressure
PART NO: 82029421
LOCATION: Air Cleaner

5



DANGER: Start Engine only from Operator's Seat
PART NO: 87541599
LOCATION: On Starter motor

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SECTION 02 -- ENGINE

BOOK 1 - 84154802

Chapter 1 – Engine System (Continued)

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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 dermatitis 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 vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and in the worst circumstances, unconsciousness.

Repeated or prolonged exposures to excessive but lower concentrations of vapors 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, vapors 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.

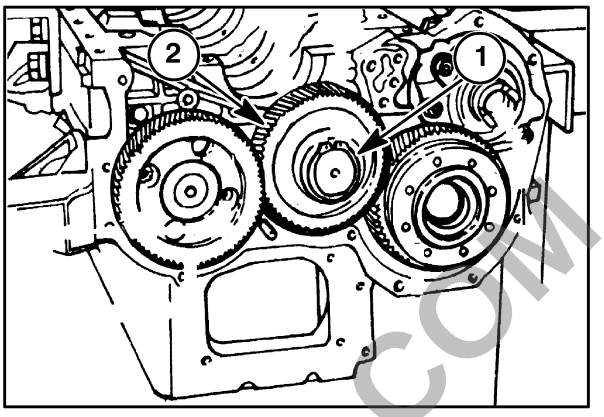
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IDLER GEAR

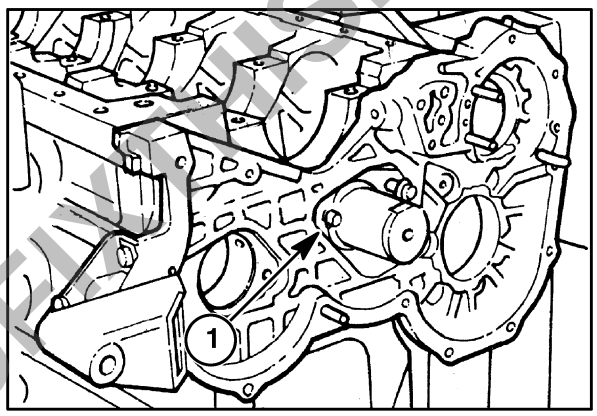
Removal

1. Remove snap ring and spacer, 1, and idler gear, 2, from the hub.



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2. Remove three bolts, 1, and remove hub from the rear cover.

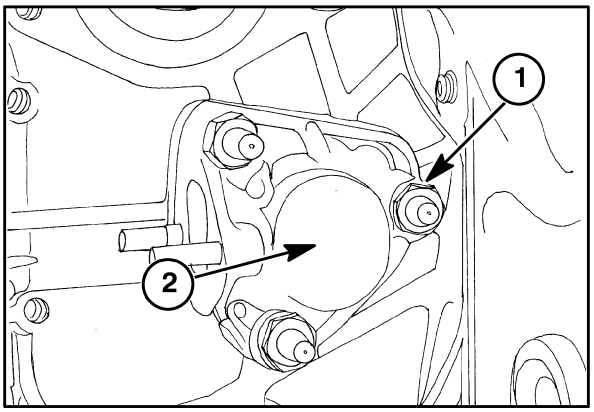


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FUEL PUMP DRIVE GEAR

Removal

1. Remove three nuts, 1, and remove feed pump along with supporting bracket, 2, from the rear side of timing gear case.



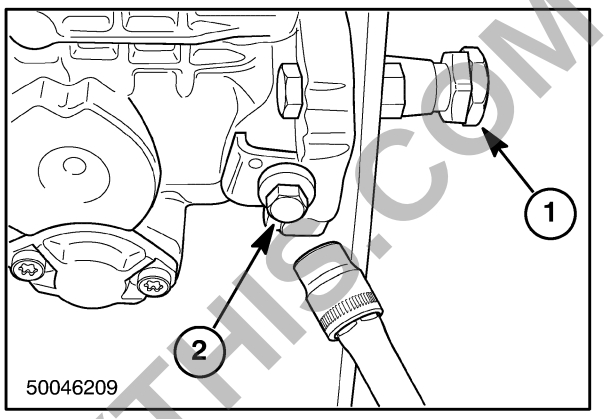
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Model	Timing at Top Dead Center (PMS)
TT 60A	1.47 mm at PMS ± 0.03 mm
TT 75A	1.47 mm at PMS ± 0.03 mm

18. Remove the jamnuts, 1, from the end of the pump shaft while watching the dial indicator needle to be sure the needle does not move. If the dial indicator needle moves this indicates the shaft turned and you will need to reset it. The lock-timing screw, 2, will hold the pump driveshaft at this setting as long as you use caution when installing the pump onto the engine.
19. Disconnect the 12-volt battery jumper wires.
20. Remove the dial indicator and timing tool adapter. Loosely install the plunger access plug at this time because the pump to engine timing will need to be verified after the pump is mounted to the engine.
21. Remove the injection pump from the mounting plate. Pump is ready to be installed on the engine.



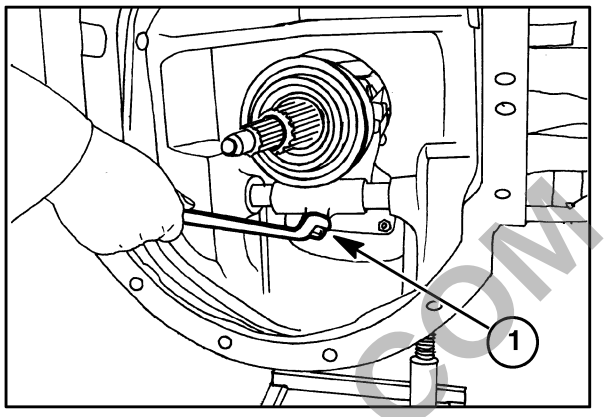
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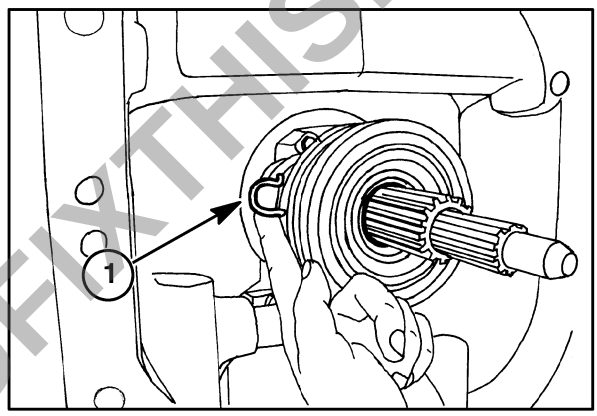
3. Secure one lock screw, 1, into the transmission and PTO fork.

   Install Loctite 242 on threads and torque lock screw to 160 N·m (118 ft-lbs).



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4. Install the release bearing, 1, and secure the forks to the release bearing with a clip, 2.
5. Reinstall transmission to engine as described in Section 10.



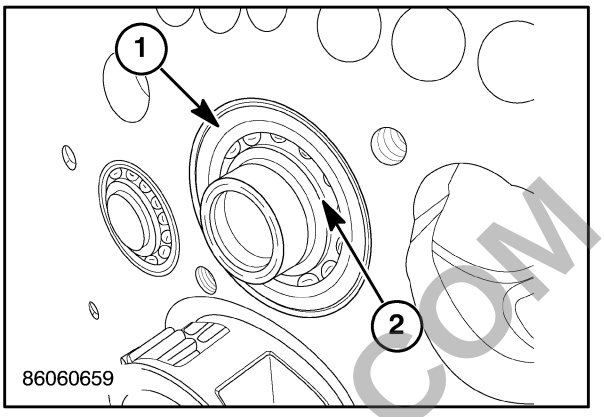
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6. Install a new bearing, 1, into rear of the housing until bearing is flush with the rear housing.

NOTE: *Make sure the inner race of the bearing, 2, is installed with the larger face against the driven gears.*



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7. Install washer, 1, followed by snap ring, 2.

NOTE: *If there is not enough room to install the snap ring, 2, use a mallet at the front of the shaft to push the shaft rearward and allow snap ring to fit in place.*

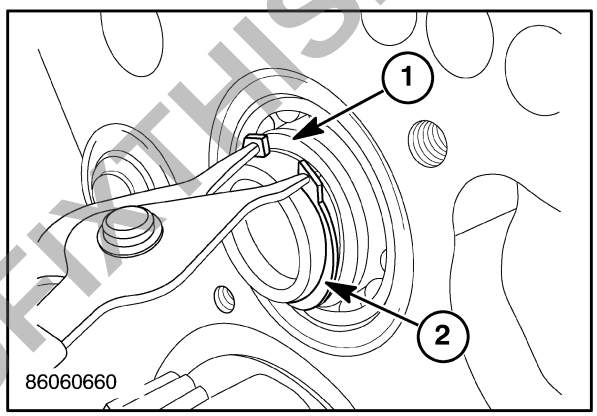
8. Adjust the end play by shimming with washer, 1.

End Play Specification

- 0 – 0.127 mm (0 – 0.005 in)

Shim Sizes

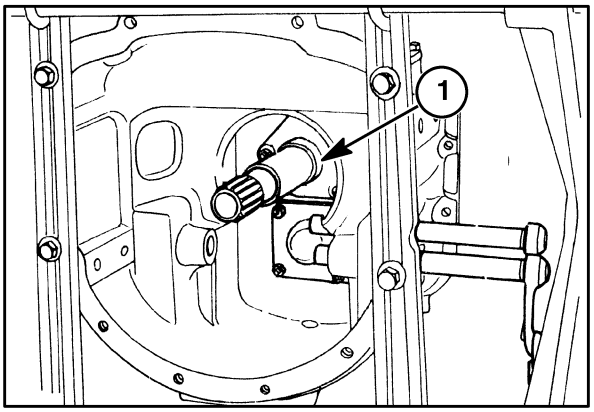
- 3.7 mm (0.145 in)
- 4.0 mm (0.157 in)
- 4.3 mm (0.169 in)



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9. Install the front oil seal cover, 1, complete with gasket/sealants, making sure that the rear bearing is in perfect allignment.

NOTE: *Check oil seal for damage before installing front cover.*

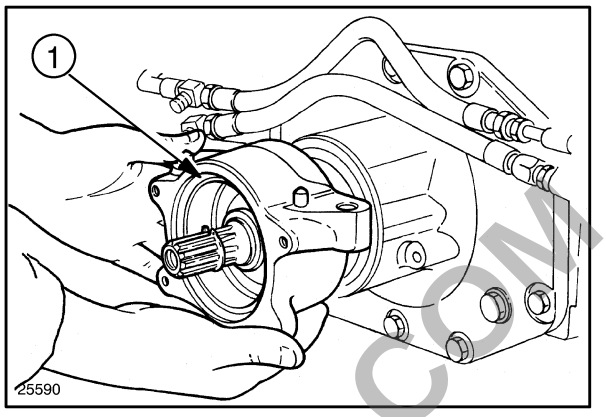


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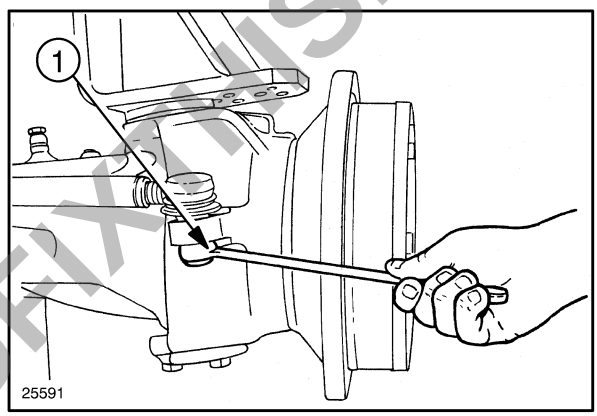
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3. Remove the rear support, 1, of the front axle; remove the front support and the thrust washer.



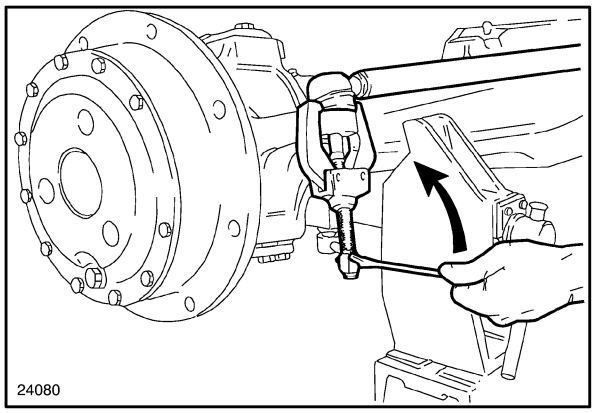
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4. Remove the two tie rod retaining bolts, 1.



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5. Using a removal tool, withdraw the pins from their bores in the stub axle housing.

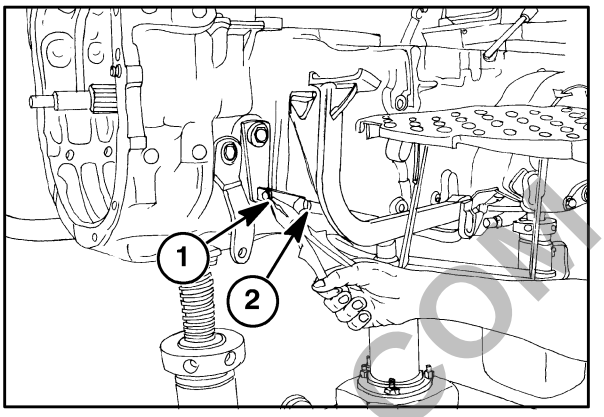


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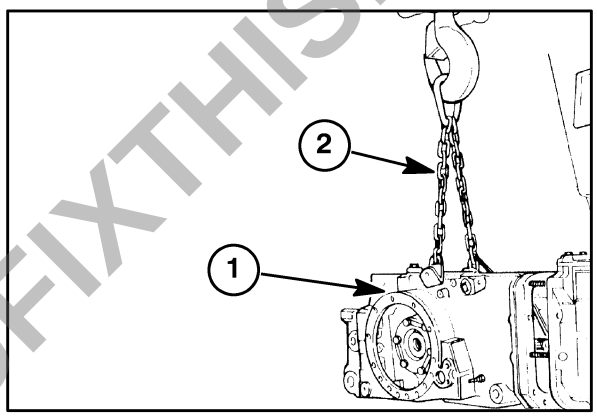
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19. Remove circlip, 1, and disconnect clutch pedal linkages, 2.



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20. Remove the brake pedal, brake linkages as explained in Section 33.
21. Connect the rear wheel drive housing, 1, to a suitable hoist using chain with hooks, 2.
22. Loosen the bolts and nuts securing the rear wheel drive housing to transmission housing and detach slowly with all due care to avoid damaging the PTO drive shaft. Place the housing on a flat wooden surface or mount it on rotary stand.
23. Remove the PTO assembly from the housing as detailed in Section 31.



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Repair and Inspection

1. Clean all parts in a suitable solvent and allow to air dry.
2. Check all parts for damage or excessive wear. Repair or replace as necessary.

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FINAL DRIVE HOUSING

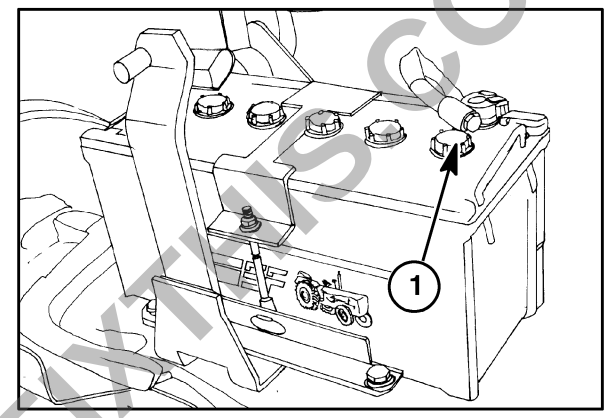
Removal

⚠ WARNING ⚠

Handle all components with the greatest care. Do not insert hands or fingers between the part. Wear suitable protection clothing, includes goggles, gloves and front wear.

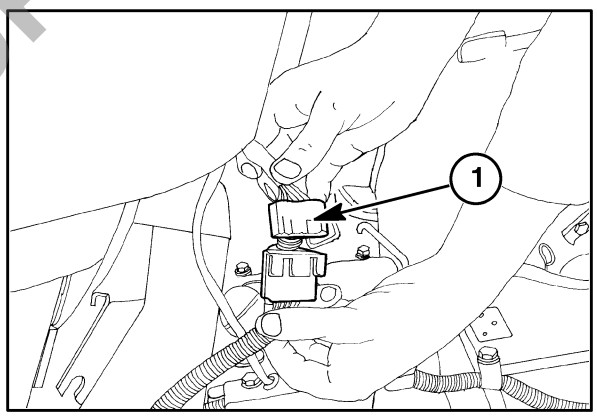
Remove the rear axle housing as follows:

1. Detach the negative cable, 1, from the battery and insulate.



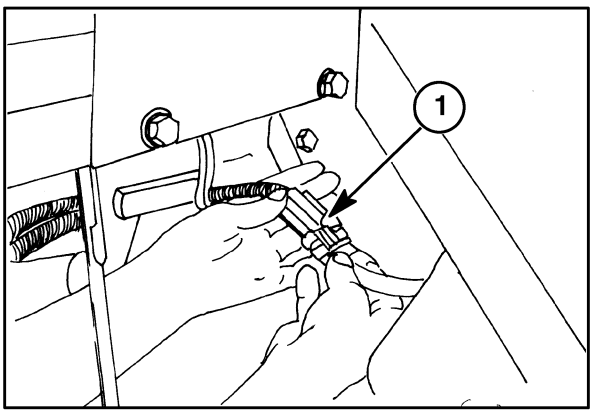
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2. Detach rear electric connection, 1, under the console.



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3. Detach electric connection, 1, between left and right side fenders.



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SPECIFICATIONS

Type	
Service Brake	Wet disc acting on differential axle shafts
Parking Brake	Wet disc acting on differential axle shafts
Control	
Service Brake	Mechanical, Independant pedal control (or latched for joint operation)
Parking Brake	Mechanical, Hand lever, with pawl release (Sector fitted on right side of transmission housing)
No. of Discs per side	
TT 75A	4
TT 60A	3
Brake oil specification *(Common for Transmission and Brakes)*	Ambra Multi G 134
Service Brake/ Parking brake Disc Material	Organic compound
Nominal Brake disc thickness	4.65 - 4.8 mm (0.183 - 0.188 in)
Service/Parking brakes disc discard thickness	4.30 mm (0.169 in)
Brake pedal free play	35-45 mm (1.37 - 1.77 in)
Brake pedal support	
RH pedal I.D	40.000 - 40.025 mm (1.574 - 1.575)
Bushing thickness	1.968 - 1.932 mm (0.077 - 0.076 in)
RH pedal bushing fitted I.D. (without reaming)	36.064 - 36.161 mm (1.419 - 1.423 in)
RH pedal bushing/housing clearance (max.)	0.097 mm (0.0038 in)
RH pedal bushing/housing interference (max.)	0.097 mm (0.0038 in)
LH pedal shaft diameter	36.000 - 35.961 mm (1.417 - 1.415 in)
Clearance between LH pedal shaft and RH pedal bushing	0.103 - 0.161 mm (0.004 - 0.006 in)
LH pedal I.D	36.025 - 36.087 mm (1.418 - 1.420 in)
Clearance between LH pedal shaft and housing	0.064 - 0.087 mm (0.0025 - 0.0034 in)
LH brake shaft bushing fitted I.D. (without reaming)	22.052 - 22.137 mm (0.868 - 0.871 in)
LH brake bushing fitted	25.000 - 25.021 mm (0.984 - 0.985 in)
Bushing thickness	1.442 - 1.474 mm (0.0567 - 0.0580 in)
LH pedal bushing/housing clearance (max.)	0.064 mm (0.0025 in)
LH pedal bushing/housing interference (max.)	0.085 mm (0.0033 in)
Handbrake shaft diameter	21.967 - 22.000 mm (0.865 - 0.866 in)
LH brake bushings	0.052 - 0.170 mm (0.002 - 0.006 in)
Diameter of bushing housing in transmission casing	40.000 - 40.025 mm (1.574 - 1.576 in)
I.D. of LH brake shaft support bushing in transmission casing (without reaming)	36.064 - 36.161 mm (1.419 - 1.423 in)
Bushing thickness	1.932 - 1.968 mm (0.076 - 0.077 in)
Clearance between bushings and transmission casing (max.)	0.097 mm (0.0038 in)
Interference between bushings and transmission casing	0.103 - 0.161 mm (0.004 - 0.006 in)

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RELIEF VALVE TEST

With or Without Rear Remote Valves

SPECIAL TOOLS

- Banjo Bolt Fitting – **380002742**

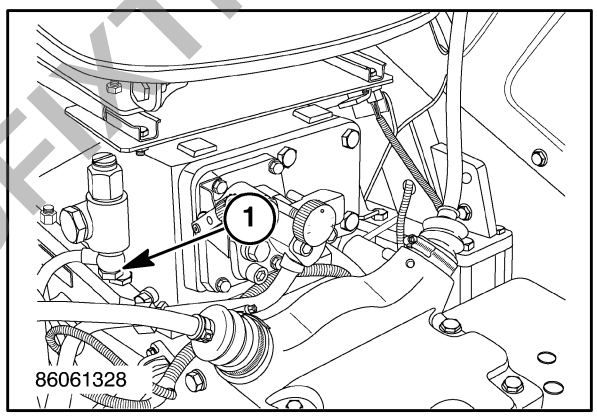
IMPORTANT: *Prior to testing, attach the hitch to an unmovable object.*

IMPORTANT: *For safety, chain the front axle down!*

⚠ WARNING ⚠

Leaks of pressurized hydraulic fluid can penetrate the skin and cause severe injuries. Tighten all of the connections before starting the engine. If hydraulic fluid has penetrated the skin, seek medical attention immediately!

1. Remove the banjo bolt, 1, at the relief valve on the right hand side of the hydraulic lift assembly.

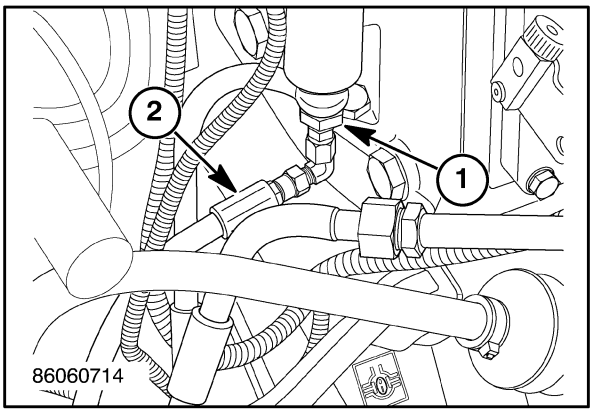


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2. Install special tool **380002742,** 1.
3. Attach hose and gauge assembly, 2, to special tool end. Run tractor and verify no leaks are present before continuing.

NOTE: *If a special tool is not available, take removed banjo bolt and drill out center to install a 1/8" pipe fitting and adapt to fit to the hose and gauge assembly.*

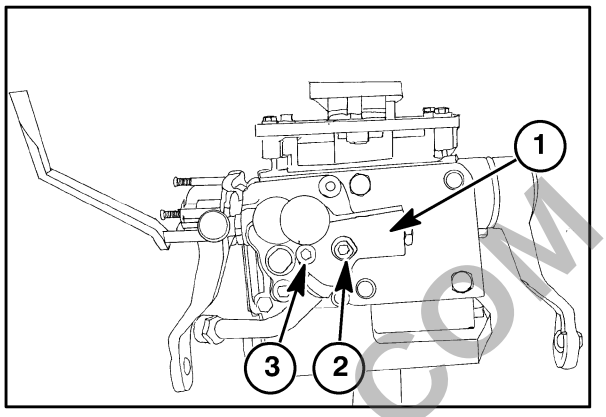
4. Start tractor and set engine rpm's at idle.
5. Raise Hitch and verify that the gauge reads between 186 bar– 191 bar (2700–2770 psi).
6. If the pressure is not within range, proceed to **Setting Relief Valve** section.



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22. Secure delivery piping to control valve, 1, with one M10 x 1.25 x 45 mm Allen screw, 2, and one M10 x 1.25 x 85 mm Allen screw, 3. Torque Allen screws to 56 N·m (41 ft-lbs).
23. Install hydraulic lift assembly onto tractor as described in the chapter.



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LIFT ARM SHAFT (CROSS SHAFT)

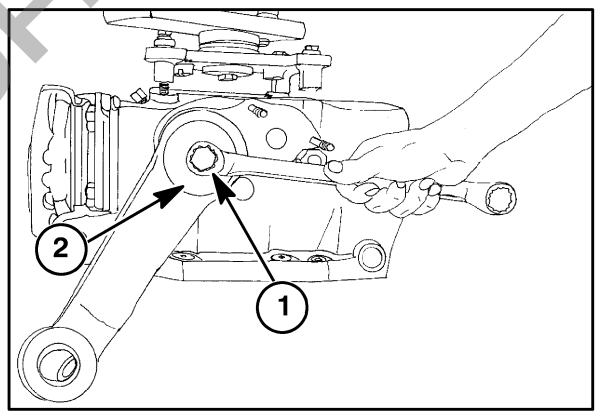
Disassembly

⚠ WARNING ⚠

Handle all components with the greatest care. Do not insert hands or fingers between the parts. Wear suitable protection clothing, including goggles, gloves and footwear.

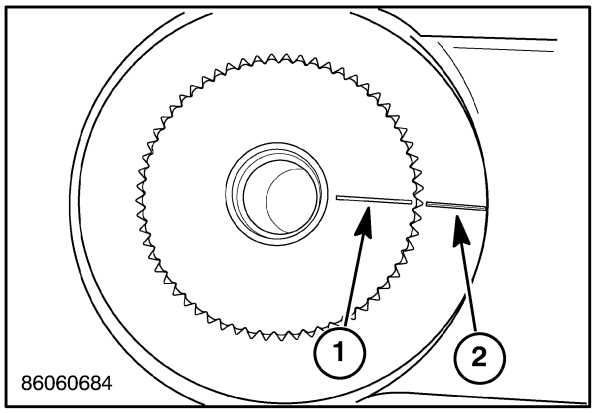
Proceed as follows:

1. Remove lift assembly from tractor as described earlier. Remove bolt, 1, and thrust plate, 2, from both sides of the lift arm.



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IMPORTANT: *Before removing the lift arms, use a hammer with a chisel and mark a line on the shaft, 1, and the lift arm, 2, as shown.*

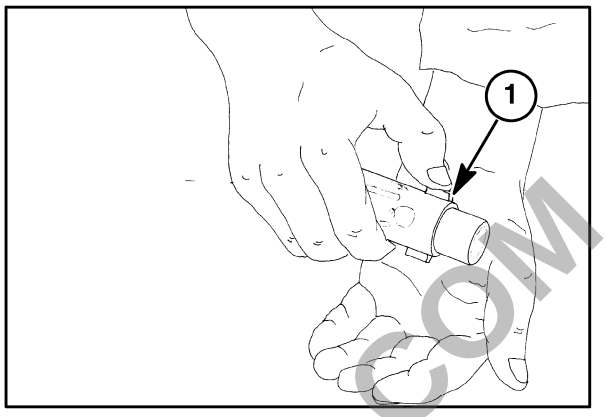


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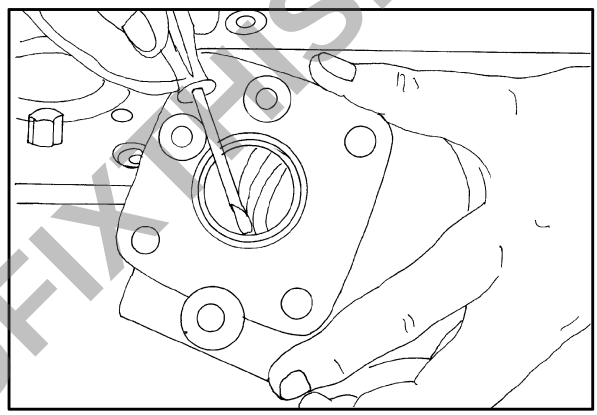
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14. Press the neutral position springs, 1, out of their slots in the spool.



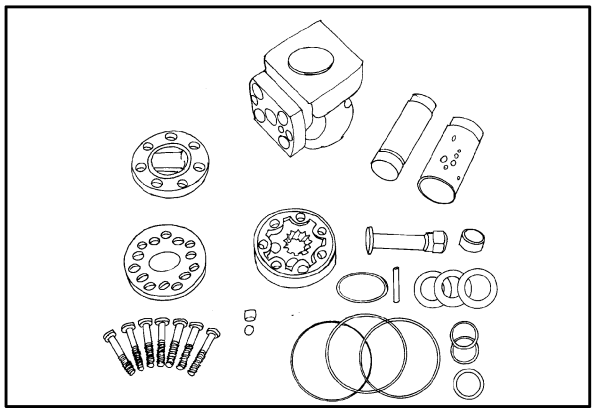
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15. Remove dust seal and O-ring/kin-ring/Roto Glyd.



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16. The steering unit OSPB is now completely dismantled.



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SPINDLE ASSEMBLY

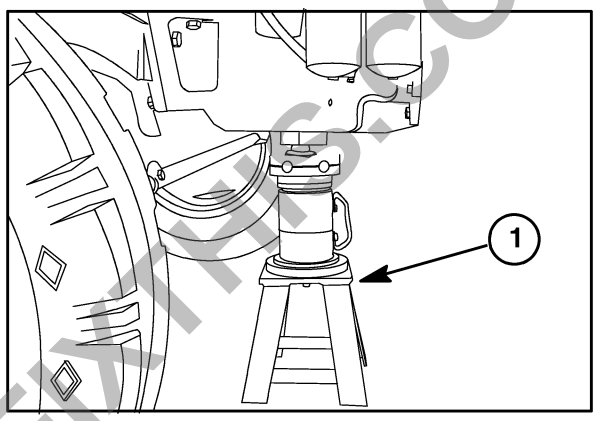
Removal

WARNING

Handle all components with greatest care. Do not insert hands and fingers between the parts. Wear suitable protection clothing, including goggles, gloves and foot wear. Failure to comply could result in death or serious bodily injury.

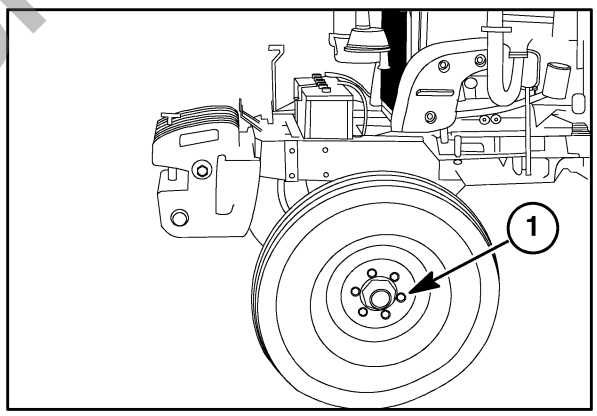
Swivel pins can be removed and overhauled with the front axle on the tractor Proceed as follows for each wheel:

1. Safely block rear wheels.
2. Jack up front tractor and place a stationary stand, 1, under the sump.



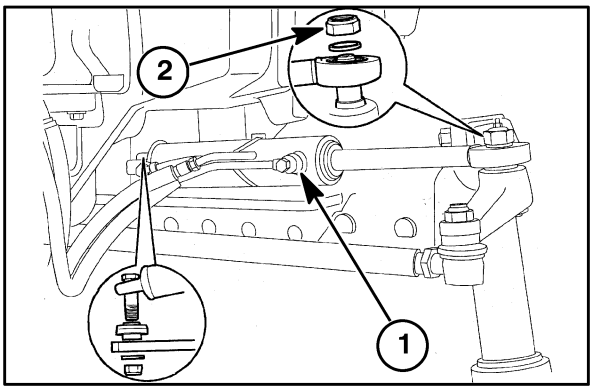
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3. Loosen retaining bolts, 1, and remove front wheels.



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4. Remove the hydraulic cylinder, 1, control lever retaining bolt, 2.
5. Remove the hydraulic cylinder from the tractor.



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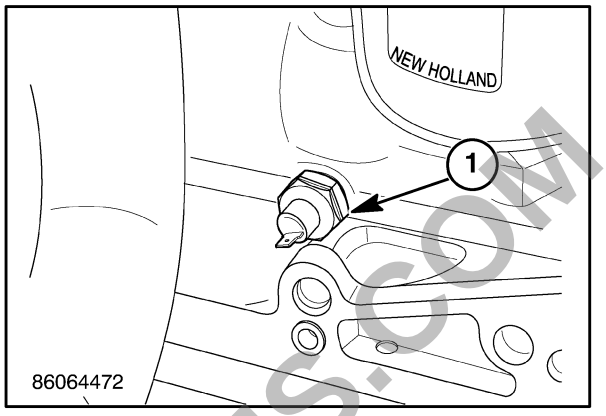
ENGINE SENSORS

ENGINE OIL PRESSURE SENDER

Description

The oil pressure sender, 1, is located on the bottom left side of the engine. The switch opens under normal oil pressure (above 6 PSI) and closes when oil pressure is low (3 - 6 PSI) to complete the ground circuit of the oil pressure warning light.

When the ground circuit is completed, the oil pressure warning light illuminates on the instrument panel when the key switch is turned to the “ON” position and goes out when the engine is started. If the light does not go out after the engine has started, first check the engine oil level. If oil level is correct, check for a malfunctioning sender or engine oil pump.

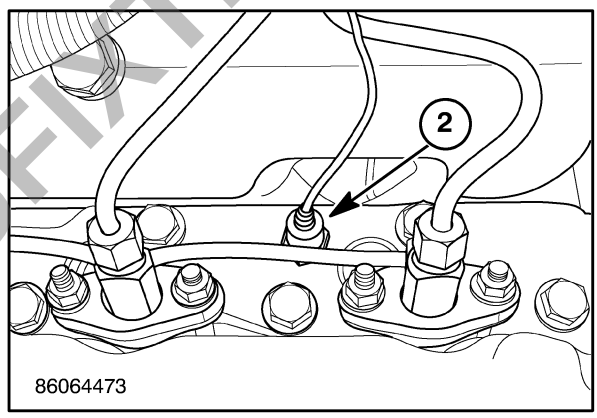


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ENGINE COOLANT TEMPERATURE SENDER

Description

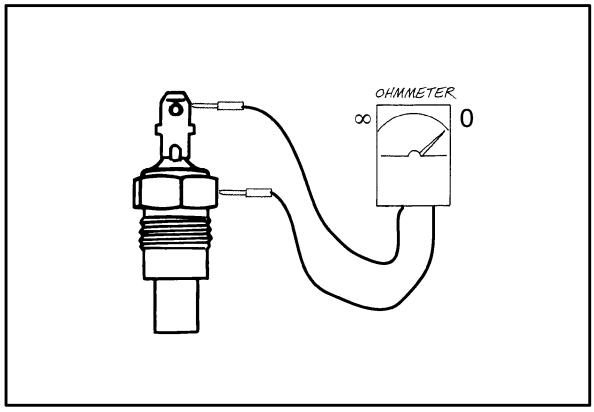
The coolant temperature sender, 2, is located at the right side of the engine cylinder head. This sender regulates a variable resistance to ground, which translates into the movement of the temperature gauge.



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Testing

Coolant Temperature	Sender Resistance
40°C (104°F)	525 ± 35
50°C (122°F)	237 ± 23
120°C (248°F)	38 ± 4



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HAZARD LIGHTING CIRCUIT

1. Current starts at the battery, and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link to the #1, 15 amp fuse.

Fuse Functions

1. The #1, 15-amp fuse, sends current to the #2 terminal of the hazard light switch.

Hazard Light Switch

1. When the hazard light switch is place in the “ON” position, terminals #2 and #5 are connected.
2. Terminal #5 sends current in two directions:
   - Terminal #2 of the flasher cutoff relay
   - Terminal #2 of the hazard/turn flasher module

Flasher Cutoff Relay

1. The flasher cutoff relay is not energized, when not energized terminals #2 and #5 are connected.
2. Terminal #5 of the flasher cutoff relay sends current to terminal #1 of the hazard/turn flasher module.

Hazard/Turn Flasher Module

1. When terminals #1 and #2 are supplied with current and terminal #6 has a ground source supplied, the following terminals send out pulsating current:
   - Terminal #3 (Left hazard light circuit)
   - Terminal #4 (Right hazard light circuit)
2. Terminal #3 supplies pulsating current to the left hazard light, terminal #13 of the instrument panel and terminal #1 of the trailer socket.
3. Terminal #4 supplies pulsating current to the right hazard light, terminal #14 of the instrument panel and terminal #3 of the trailer socket.
4. With ground source supplied to hazard lights and instrument panel, the hazard lights and instrument panel indicator lights flash on and off.

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