SHOP MANUAL

ALLIS - CHALMERS

MODEL 160

NOTE

Throughout this manual, it will be noted that in the course of setting end-play, pre-load or clearances to specification that certain shim thicknesses proposed for use are somewhat unusual. For example: a shim may be offered as having a thickness of 0.0039 inches. This thickness corresponds to 1/10 millimeter, just as 0.00039 is 1/100 of a millimeter. The number thirty-nine will often appear as a multiple in some shim material proposed, just as 0.00196 (5 x 0.00039) is 5/100 (0.05) millimeter. Sometimes values will be rounded-off: Instead of 0.0039, 0.004 may be used. In almost every case, tolerance allowed is sufficient so that US-produced shim stock, available from suppliers in thicknesses of 0.002, 0.004, 0.005, etc., will serve in place of the metric material.

INDEX (By Starting Paragraph)

CONDENSED SERVICE DATA

GENERAL:

Tractor Model	160
Engine Make	Perkins
Engine Model	AD 3.152
Cylinders	3
Bore, inches	3.6
Stroke, inches	5.0
Displacement, Cubic Inches	152.7
Compression Ratio	18.5 : 1
Pistons removed from?	Above
Cylinder sleeves	Dry
Main Bearings, Number of	4
Alternator, make	Delco-Remy
Starter, make	Delco-Remy
Fuel Injection Pump, make	CAV
Injection Nozzle, make	CAV
Battery	12V, Neg. Grnd.
Forward Speeds	10
Reverse Speeds	2
Fuses, lights & instruments	20 Amp

TUNE-UP

Firing Order	1-2-3
Valve Tappet Gap, Intake	0.010 Hot, 0.012 Cold
Valve Tappet Gap, Exhaust	0.010 Hot, 0.012 Cold
Intake Valve Face Angle	45°
Exhaust Valve Face Angle	45°
Low Idle RPM	725-775
High Idle RPM	2425-2475
Rated Speed RPM	2250
PTO RPM at 2160 Engine RPM	540
Injection Timing (Static)	24° BTDC
Timing Mark Location	See text
Injector Opening Pressure (New)	2750 PSI
Injector Opening Pressure (Used)	2500 PSI
Spray Hole Diameter	0.0098

SIZES-CAPACITIES-CLEARANCES:

Crankshaft Journal Diameter	2.7485-2.749
Crankpin Diameter	2.2485-2.249
Piston Pin Diameter	1.2497-1.250
Valve Stem Diameter	0.311 -0.312
Camshaft Journal Diameters:	
No. 1	1.869-1.870
No. 2	1.859-1.860
No. 3	1.839-1.840
Piston Ring Specifications	See Text, Para. 35
Connecting Rod Bearing Clearance	0.0025-0.004
Main Bearing Clearance	0.0025-0.004
Crankshaft End Play	0.002-0.015
Cooling System Capacity	8 Qts. (US)
Crankcase Capacity	6 Qts. (US)
Crankcase Capacity (With Filter)	6.5 Qts. (US)
Fuel Tank	13.5 Gals. (US)
Transmission, Final Drive & Hydraulic System	29 Qts. (US)

TORQUE VALUES—TIGHTENING TENSION

Cylinder Head Nuts	55-60 Ft.-Lbs.
Connecting Rod Nuts (plain)	65-70 Ft.-Lbs.
Connecting Rod Nuts (cadmium-plated)	45-50 Ft.-Lbs.
Main Bearing Cap Screws	110-115 Ft.-Lbs.
Flywheel Cap Screws	75 Ft.-Lbs.
Atomizer (injector) Holding Nuts	10-12 Ft.-Lbs.

FRONT SYSTEM

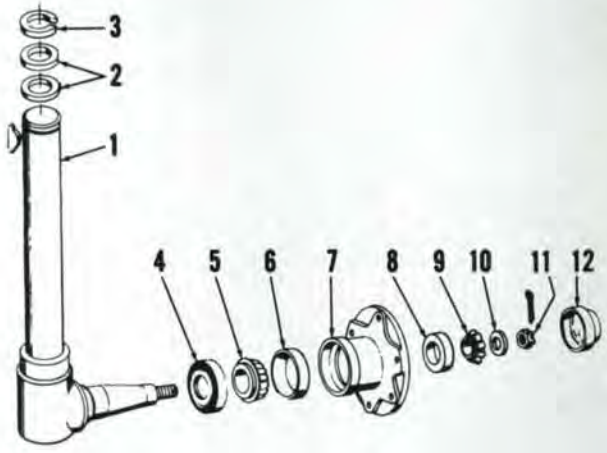

Fig. 1 — Exploded view, spindle and wheel hub.

1. Spindle assembly
2. Thrust washers
3. Snap ring
4. Kit, seal wear
5. Inner bearing cone
6. Inner bearing cup
7. Hub assembly
8. Outer bearing cup
9. Outer bearing cone
10. Washer
11. Wheel nut
12. Cap

1. **WHEEL ASSEMBLY.** Conventional steel disc wheels are reversible on hubs. Wheel bearings should be cleaned and repacked with No. 2 wheel bearing grease after each 500 hours operation. To adjust, tighten axle spindle nut until a distinct drag is felt, loosen nut one castellation and install new pin. Always renew seal assembly (4—Fig. 1) when bearings are repacked.

2. **AXLE ADJUSTMENTS.** Front wheel tread is adjustable from 52 to 72 inches in 4 inch increments with the wheels dished in and from 57 to 77 inches with the wheels dished out. L&R tie rod extensions (10—Fig. 2) are grooved at 2-inch intervals to correspond to hole spacing in spindle support bars (14) for ease in realignment; however, it is advisable to check and reset toe-in at $\frac{1}{16}$ to $\frac{1}{8}$-inch whenever front wheel tread is changed. Adjust at tie rod end (11) when required.

3. **SPINDLE BUSHINGS.** With tractor front supported, remove front wheels, snap ring (3—Fig. 1), steering arm (13—Fig. 2) and Woodruff key. Spindle can then be pushed down in support tube and removed. Drive bushings (15) from tube bore and drive or press in new bushings until flush with tube ends. Spindle bushings are furnished pre-sized and reaming is not normally required. Reinstall thrust washers (2—Fig. 1) on spindle and reassemble. A single grease fitting, located at a midpoint of the spindle support tube, eliminates the need for aligning bushings with lube ports.

4. **FRONT SUPPORT BUSHINGS.** Axle pivot pin bushings (5—Fig. 2) are renewable. New bushings are presized and require no reaming. Defective bushings may be pressed or driven from support (4) when front axle is removed.

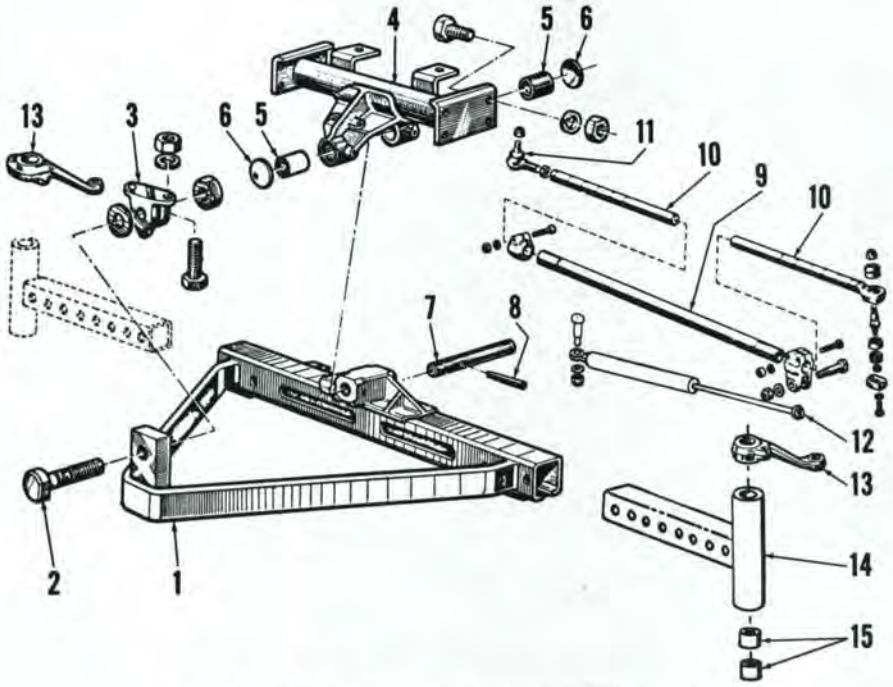

Fig. 2—Front axle, tie rod, front support and associated parts.

1. Axle assembly
2. Pivot bolt
3. Pivot bearing
4. Front support
5. Bushings
6. Plugs
7. Pivot pin
8. Roll pin
9. Tie rod
10. Tie rod extension
11. Tie rod end (adjustable)
12. Power steering ram
13. Steering arms
14. Spindle support assembly
15. Spindle bushings

FRONT SPLIT

5. Detachment (splitting) of the front wheels, axle support and radiator assembly from tractor is a preliminary step to repair procedures which demand unrestricted access to the engine for engine removal or for engine work which does not call for removal of flywheel or crankshaft. The following procedures will apply:

First, remove hood, support tractor under flywheel housing, drain coolant and remove radiator hoses. Disconnect cables and remove battery. Disconnect air cleaner duct at partition forward of radiator and flex tube (filter indicator) from air cleaner duct. Remove radiator brace cap screw from top of thermostat cover casting. Drain power steering fluid by separating reservoir to pump tube at coupling located between power steering pump and engine block and collect fluid in a container placed below the axle. Then, remove the tube at reservoir end and set aside. The two remaining flexible lines may then be separated at reservoir fittings, capped or taped off. Remove pins from each end of power steering ram (12—Fig. 2) and secure cylinder with wire hangers from engine front support brackets to prevent damage to hydraulic lines and fittings. Remove power steering tube support brackets from right hand frame rail. Release drive belt tension and unbolt power steering pump from left frame rail and secure to engine for protection. Unbolt engine front mounts (one bolt each side) from frame rails. Attach hoist to front assembly so it will not tip, remove three cap screws which attach each frame rail to flywheel housing and roll front assembly forward and away from tractor.

STEERING SYSTEM

Model 160 tractors utilize a hydrostatic steering system which is without direct mechanical linkage between the steering wheel and the tractor front wheels. The control valve unit (Fig. 5 & 6) contains a rotary metering motor, a commutator feed valve sleeve and a selector valve spool. Should power steering failure occur due to engine stoppage, belt breakage or trouble within the power steering system itself, the metering motor becomes a rotary pump which drives the power steering cylinder to provide steering control. A check valve in the control valve housing allows recirculation of fluid between the control valve and the steering cylinder (ram) for manual operation.

Primary power for steering is supplied by a belt-driven gear pump mounted on the front inboard end of the left engine frame rail, with the power steering system independent of all other hydraulics.

TROUBLE SHOOTING

6. Should failure or malfunction occur in the power steering system, refer to the following paragraphs before attempting adjustments or repairs.

Irregular or "Sticky" steering. If irregular power flow or a binding "sticky" feeling is noted with the tractor halted and the engine operating at rated speed, or, if the wheel continues to rotate when turned and released, probable cause is contaminated hydraulic fluid. If trouble does

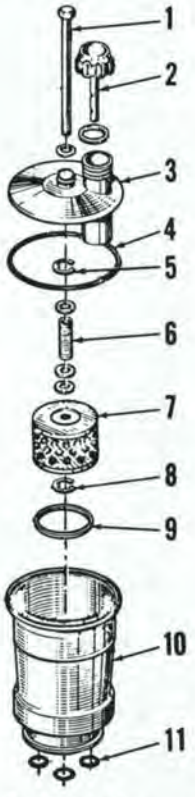

Fig. 3 — Exploded view, power steering reservoir.

1. Cover screw w/washer
2. Dipstick, incl. seal
3. Cover
4. Cover seal
5. Snap ring
6. Spring, w/washers
7. Filter assembly
8. Snap ring
9. Filter seal
10. Reservoir assembly
11. Tube fitting seals

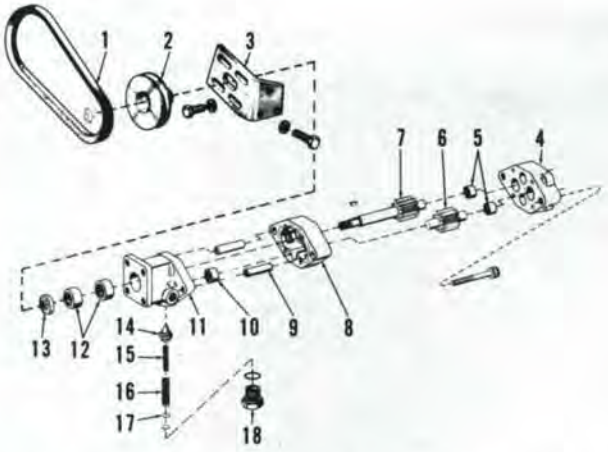

Fig. 4—Exploded view of power steering pump.

1. Drive belt
2. Pulley
3. Pump support
4. Cover assembly
5. Needle bearings (2)
6. Idler gear & shaft
7. Drive shaft & gear
8. Gear plate
9. Dowel pin (2)
10. Needle bearing
11. Pump body
12. Needle bearings (2)
13. Oil seal
14. Pressure relief valve
15. Spring, inner
16. Spring, outer
17. Shims (as required)
18. Valve plug & gasket

not clear up after renewal of disposable filter (7—Fig. 3) in the power steering fluid reservoir, drain and refill the system with new fluid. Should this procedure not solve the problem the steering valve should be removed and overhauled as outlined in paragraphs 11 and 12.

Steering Cylinder "Hesitates". If power steering ram appears to pause in motion when steering wheel is being turned steadily, it is likely that air is trapped in the cylinder. Use bleeding procedure described in paragraph 7.

Slow Steering. If steering response seems slow, flow rate (volume) is probably at fault. Design volume of the power steering pump is 7.5 GPM at 2250 engine RPM. Check may be made with an in-line flow meter or by using the following procedure:

Time the rate of travel of steering ram from left to right extremes with front wheels resting on the ground and compare against the travel time with front end jacked up. Use low engine speed. A considerable difference in elapsed time indicates low flow volume and pump will require overhaul as in paragraph 10.

Loss of Power. If steering boost power seems low, probable cause is inadequate system pressure. Check and adjust setting of relief valve (14—Fig. 4) in steering pump as detailed in paragraph 8. If this by-pass pressure check indicates no problem, then pressure loss is due to piston seal failure in the steering cylinder (ram) which will require overhaul. See paragraphs 15 & 16.

Overheating. If system operates extremely hot, install a high pressure gage as outlined in paragraph 8 and find the neutral position of the control valve by rotating wheel slowly in each direction, halting at point of lowest pressure reading. Control valve is then at its neutral point. Turn steering wheel to a limit stop, hold a second or two and release, observing the pressure gage. If pressure does not fall back very close to the neutral reading, a binding control shaft or foreign material between the valve spool and sleeve are likely causes for the overheated condition.

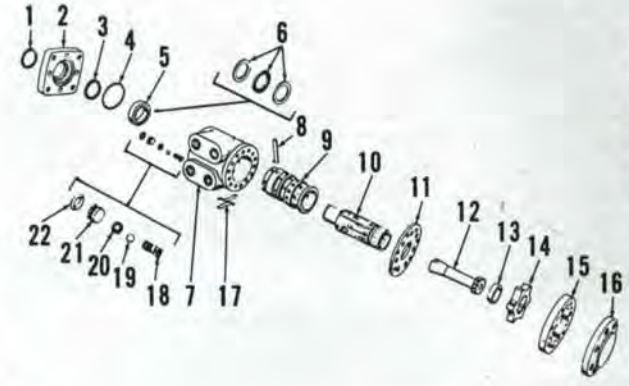

Fig. 5—Exploded view of steering control valve. Tractor may have either locator (5) or thrust bearing assembly (6) installed. Centering springs (17) are installed in two packs of three each, arched back-to-back.

1. Seal
2. Mounting plate
3. Quad ring seal
4. "O" ring
5. Locator bushing
6. Bearing assembly
7. Valve body
8. Centering pin
9. Sleeve
10. Valve spool
11. Plate
12. Drive shaft
13. Spacer
14. Rotor (Gerotor)
15. Ring (Gerotor)
16. End cap
17. Centering springs (6)
18. Valve spring
19. Check valve ball
20. Valve seat
21. Plug
22. "O" ring

Fig. 6—View of steering control valve identifying inlet and outlet ports with locations and functions.

BLEEDING

7. This system is usually self-bleeding; however, if air is trapped, turning the wheel back and forth through several full strokes of the cylinder will release such trapped air. If this procedure fails, repeat with ram connections loosened slightly to provide an escape outlet.

TESTS AND ADJUSTMENTS

8. To locate the cause of malfunction in the steering system, it is necessary to measure line pressure of fluid by using a high pressure (minimum 3500 psi) hydraulic test gage. The tester inlet should be connected "teed in" to the line between the steering valve "IN" port (Fig. 6) and the pump outlet. With test gage so installed, engine speed regulated at 2250 RPM and fluid at normal operating temperature, the pressure relief valve in the pump should open (by-pass) at 1000-1200 psi. To obtain this by-pass reading, turn steering gear to extreme left or right limit and hold just long enough for a gage reading—one or two seconds. Holding the by-pass position more than momentarily will cause rapid overheating of the system and possible damage. Removal or addition of one shim (17—Fig. 4) will change relief pressure by approximately 50 psi. If system pressure does not respond satisfactorily to shim changes, need for overhaul of pump is indicated. See paragraph 10.

PUMP

9. A belt-driven gear pump mounted inside the frame rail at left front of engine is the pressure source for the power steering system. See Figure 4.