



KUBOTA

Models ■ B5100D ■ B5100E ■ B6100D ■ B6100E
■ B6100HST-D ■ B6100HST-E ■ B7100D
■ B7100HST-D ■ B7100HST-E

Previously contained in Intertec's I&T Shop Service Manual No. K-2



KUBOTA

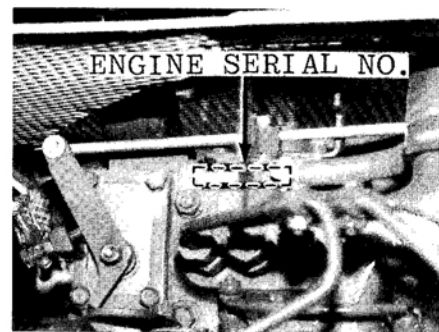
MODELS

**B5100D – B5100E – B6100D – B6100E – B6100HST-D –
B6100HST-E – B7100D – B7100HST-D – B7100HST-E**

On Models B5100D, B5100E, B6100D, B6100E and B7100D, tractor serial number is located on left side of clutch housing case as shown below.

On Models B6100HST-D, B6100HST-E, B7100HST-D and B7100HST-E, tractor serial number is located on left side of clutch housing case as shown below.

On all models, engine serial number is located on right side of engine crankcase as shown below.



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DUAL DIMENSIONS

This service manual provides specifications in both the U.S. Customary and Metric (SI) systems of measurement. The first specification is given in the measuring system perceived by us to be the preferred system when servicing a particular component, while the second specification (given in parenthesis) is the converted measurement. For instance, a specification of "0.28 mm (0.011 inch)" would indicate that we feel the preferred measurement, in this instance, is the metric system of measurement and the U.S. system equivalent of 0.28 mm is 0.011 inch.

CONDENSED SERVICE DATA

MODELS	B5100D B5100E	B6100D B6100E	B6100HST-D B6100HST-E	B7100D	B7100HST-D B7100HST-E
GENERAL					
Engine Make.....	Own	Own	Own	Own	Own
Engine Model.....	Z500-1A	D650-A	D650-AH	D750-A	D750-AH
Number of Cylinders.....	2	3	3	3	3
Bore (mm).....	68	64	64	68	68
(Inches).....	2-5/8	2-1/2	2-1/2	2-5/8	2-5/8
Stroke (mm).....	70	70	70	70	70
(Inches).....	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4
Displacement (cc).....	508	675	675	762	762
(Cubic Inches).....	31	41.2	41.2	46.5	46.5
Compression Ratio.....	22:1	22:1	22:1	22:1	22:1
TUNE-UP					
Valve Tappet Gap (Cold) (mm).....	0.15-0.20	0.15-0.20	0.15-0.20	0.15-0.20	0.15-0.20
(Inch).....	0.006-0.008	0.006-0.008	0.006-0.008	0.006-0.008	0.006-0.008
Injection Timing (BTDC).....	25°	25°	25°	25°	25°
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(PSI).....	1988	1988	1988	1988	1988
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Volts.....	12	12	12	12	12
Capacity Amp/hr.....	35	45	45	45	45
Ground Polarity.....	Negative	Negative	Negative	Negative	Negative
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CONDENSED SERVICE DATA (CONT.)

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(PSI)	1710	1710	1710	1710	1710
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(GPM)	3.1	3.1	3.1	3.1	3.1
SIZES—CLEARANCES					
Crankshaft Main Journal—					
Diameter (mm)	43.934-43.950	43.934-43.950	43.934-43.950	43.934-43.950	43.934-43.950
(Inches)	1.7297-1.7303	1.7297-1.7303	1.7297-1.7303	1.7297-1.7303	1.7297-1.7303
Bearing Clearance (mm)	0.034-0.106	0.034-0.106	0.034-0.106	0.034-0.106	0.034-0.106
(Inch)	0.0013-0.0042	0.0013-0.0042	0.0013-0.0042	0.0013-0.0042	0.0013-0.0042
Crankshaft Crankpin Journal—					
Diameter (mm)	36.959-36.975	36.959-36.975	36.959-36.975	36.959-36.975	36.959-36.975
(Inches)	1.4551-1.4557	1.4551-1.4557	1.4551-1.4557	1.4551-1.4557	1.4551-1.4557
Bearing Clearance (mm)	0.029-0.087	0.029-0.087	0.029-0.087	0.029-0.087	0.029-0.087
(Inch)	0.0011-0.0034	0.0011-0.0034	0.0011-0.0034	0.0011-0.0034	0.0011-0.0034
Side Clearance (mm)	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4
(Inch)	0.008-0.016	0.008-0.016	0.008-0.016	0.008-0.016	0.008-0.016
Crankshaft End Play (mm)	0.15-0.3	0.15-0.3	0.15-0.3	0.15-0.3	0.15-0.3
(Inch)	0.006-0.012	0.006-0.012	0.006-0.012	0.006-0.012	0.006-0.012
Camshaft Journal—					
Diameter (mm)	32.934-32.950	32.934-32.950	32.934-32.950	32.934-32.950	32.934-32.950
(Inches)	1.2966-1.2972	1.2966-1.2972	1.2966-1.2972	1.2966-1.2972	1.2966-1.2972
Bearing Clearance (mm)	0.050-0.091	0.050-0.091	0.050-0.091	0.050-0.091	0.050-0.091
(Inch)	0.0020-0.0036	0.0020-0.0036	0.0020-0.0036	0.0020-0.0036	0.0020-0.0036
Camshaft Side Clearance (mm)	0.07-0.22	0.07-0.22	0.07-0.22	0.07-0.22	0.07-0.22
(Inch)	0.0028-0.0087	0.0028-0.0087	0.0028-0.0087	0.0028-0.0087	0.0028-0.0087
Valve Stem Diameter—					
Intake and Exhaust (mm)	6.960-6.975	6.960-6.975	6.960-6.975	6.960-6.975	6.960-6.975
(Inch)	0.2740-0.2746	0.2740-0.2746	0.2740-0.2746	0.2740-0.2746	0.2740-0.2746
Valve Face Angle	45°	45°	45°	45°	45°
Valve Seat Angle	45°	45°	45°	45°	45°
Piston Pin—					
Diameter (mm)	20.002-20.011	20.002-20.011	20.002-20.011	20.002-20.011	20.002-20.011
(Inch)	0.7875-0.7878	0.7875-0.7878	0.7875-0.7878	0.7875-0.7878	0.7875-0.7878
Clearance (mm)	0.015-0.04	0.015-0.04	0.015-0.04	0.015-0.04	0.015-0.04
(Inch)	0.0006-0.0015	0.0006-0.0015	0.0006-0.0015	0.0006-0.0015	0.0006-0.0015
Piston Skirt-to-Cylinder					
Clearance (mm)	0.076-0.102	0.076-0.102	0.076-0.102	0.076-0.102	0.076-0.102
(Inch)	0.003-0.004	0.003-0.004	0.003-0.004	0.003-0.004	0.003-0.004
CAPACITIES					
Crankcase (Liters)	2.3	3.9	3.9	3.9	3.9
(U.S. Quarts)	2.4	4.1	4.1	4.1	4.1
Lubricant Type	CC or CD	CC or CD	CC or CD	CC or CD	CC or CD
Cooling System (Liters)	3	4.6	4.6	4.6	4.6
(U.S. Gallons)	0.78	1.20	1.20	1.20	1.20
Transmission/Hydraulic System—					
(Liters)	8.5	11.5	13.5	11.5	13.5
(U.S. Gallons)	2.21	3	3.6	3	3.6
Lubricant Type	See Para. 90	See Para. 90	See Para. 90	See Para. 90	See Para. 90
Front Axle Differential Case—					
(Liters)	0.5	0.5	0.5	0.7	1.5
(U.S. Quarts)	0.53	0.53	0.53	0.74	1.6
Fluid Type	SAE 80 Gear Lube	SAE 80 Gear Lube	SAE 80 Gear Lube	SAE 80 Gear Lube	SAE 80 Gear Lube
Front Axle Gear Case—					
(Liters)	0.15	0.15	0.15	0.15	0.5
(U.S. Quarts)	0.15	0.15	0.15	0.15	0.5
Fluid Type	SAE 80 Gear Lube	SAE 80 Gear Lube	SAE 80 Gear Lube	SAE 80 Gear Lube	SAE 80 Gear Lube

FRONT AXLE AND STEERING SYSTEM

Front axle is a fixed tread type. Camber angle, caster angle and king pin inclination are non-adjustable.

Front axle assembly and support frame are hinged together by a single pivot pin. Pivot pin removal can only be accomplished after removing front axle assembly and support frame as a unit as outlined in paragraph 2.

TIE RODS AND TOE-IN

All Models

1. Tie rod and drag link ends are automotive type. Steering drag link is non-adjustable and must be renewed as an assembly. Tie rod assembly is renewable as separate components. Adjust toe-in to 0-5 mm (0-0.2 inch) by shortening or lengthening tie rod.

FRONT AXLE

Two-Wheel Drive Models

2. REMOVE AND REINSTALL. Disconnect headlight wiring, then remove hood assembly. Open radiator drain cock and allow coolant to drain into a suitable container. Disconnect negative battery cable terminal from battery post. Remove air cleaner assembly, muffler and left and right side covers. Disconnect radiator hoses. Remove oil cooler lines at cooler as needed. Detach drag link (13-Fig. 1) from steering arm (17). Support tractor behind front axle, then support front axle level with floor to prevent tipping. Remove cap screws securing front axle support to engine block. Carefully move front axle assembly, support frame and radiator forward until clear of tractor. To complete disassembly, attach a suitable hoist or holding fixture to support frame, then remove set spring (12), castle nut (11) and washer (10). Withdraw pivot pin (7), then separate front axle assembly from support frame.

Installation is reverse of removal. Tighten castle nut (11) to 9.8 N·m (7 ft.-lbs.) torque. Tighten cap screws securing support frame to engine block to 48-56 N·m (35-41 ft.-lbs.) torque. Tighten drag link nut to 29-49 N·m (22-36 ft.-lbs.) torque. Replenish cooling system and transmission hydraulic fluids as needed.

Models B5100D - B6100D - B6100HST-D - B7100D

3. REMOVE AND REINSTALL. Disconnect headlight wiring, then remove hood assembly. Open radiator drain cock and allow coolant to drain in-

to a suitable container. Disconnect negative battery cable terminal from battery post. Remove air cleaner assembly, muffler and left and right side covers. Disconnect radiator hoses. Remove oil cooler lines at cooler as needed. Detach drag link from steering arm (26-Fig. 3). Support tractor behind front axle, then support front axle level with floor to prevent tipping. Loosen drive shaft protective cover band at joint case (89-Fig. 3 or 4) and remove drive

shaft from joint case. Remove cap screws securing front axle support to engine block. Carefully move front axle assembly, support frame and radiator forward until clear of tractor unit. To complete disassembly, attach a suitable hoist or holding fixture to support frame, then remove set spring (9-Fig. 3), castle nut (8) and flat washer (7). Withdraw pivot pin (3), then separate front axle assembly from support frame. Installation is reverse of removal.

Fig. 1—Exploded view of front axle, spindle and hub assembly and steering linkage used on two-wheel drive models.

1. Front axle
2. Steering arm
3. Tie rod end
4. Grease fitting
5. Locknut
6. Tie rod
7. Pivot pin
8. "O" ring
9. Grease seal
10. Washer
11. Castle nut
12. Set spring
13. Drag link
14. Washer
15. Castle nut
16. Cotter key
17. Steering arm
18. Bolt
19. Lockwasher
20. Nut
21. Shim
22. Spacer
23. "O" ring
24. Bushings
25. Bearing
26. Collar
27. Grease seal
28. Key
29. Spindle
30. Grease seal
31. Bearing
32. Spacer
33. Hub

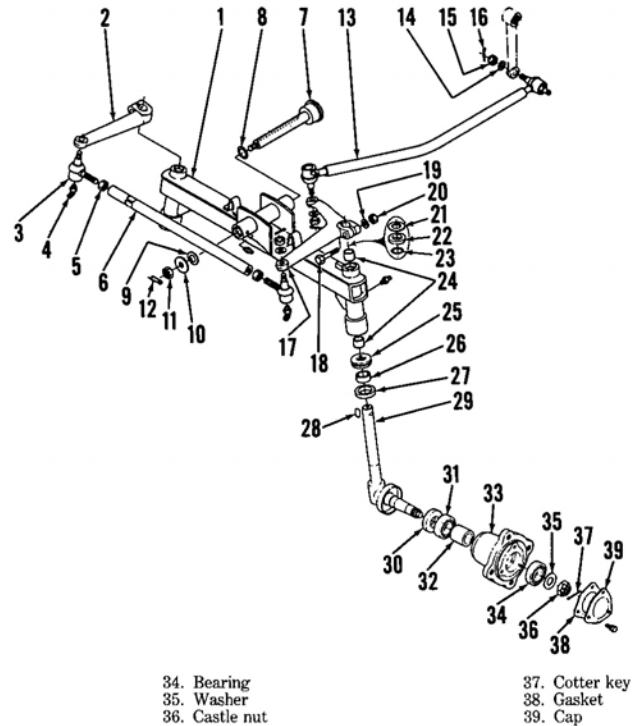
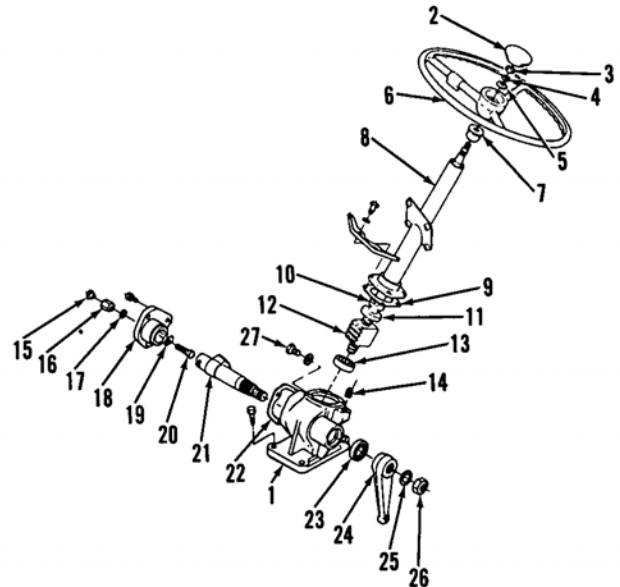


Fig. 2—Exploded view of recirculating ball nut steering gear used on all models.

1. Housing
2. Cap
3. Nut
4. Lockwasher
5. Flat washer
6. Steering wheel
7. Bushing
8. Column
9. Shim
10. Seal
11. Bearing
12. Worm gear & shaft
13. Bearing
14. Plug
15. Plug
16. Nut
17. Gasket
18. Cover
19. Shim
20. Adjusting screw
21. Sector shaft
22. Gasket
23. Seal
24. Pitman arm
25. Lockwasher
26. Nut
27. Drain plug



Tighten castle nut (8) to 9.8 N·m (7 ft.-lbs.) torque. Tighten cap screws securing support frame to engine block to 48-56 N·m (35-41 ft.-lbs.) torque. Tighten drag link nut to 29-49 N·m (22-36 ft.-lbs.) torque. Replenish cooling system and transmission/hydraulic fluid as needed.

Model B7100HST-D

4. REMOVE AND REINSTALL.

Disconnect headlight wiring, then remove hood assembly. Open radiator drain cock and allow coolant to drain into a suitable container. Disconnect negative battery cable terminal from battery post. Remove air cleaner assembly, muffler and left and right side covers. Disconnect radiator hoses. Remove oil cooler lines at cooler. Detach drag link from steering arm (26 - Fig. 5). Support tractor behind front axle, then support front axle level with floor to prevent tipping. Loosen drive shaft protective cover band at joint case (89) and remove drive shaft from joint case. Remove cap screws securing front axle support to engine block. Carefully move front axle assembly, support frame and radiator forward until clear of tractor. To complete disassembly, attach a suitable hoist or holding fixture to support frame, then remove set spring (9), castle nut (8) and flat washer (7). Withdraw pivot pin (3), then separate front axle assembly from support frame.

Installation is reverse of removal. Tighten castle nut (8) to 9.8 N·m (7 ft.-lbs.) torque. Tighten cap screws securing support frame to engine block to 48-56 N·m (35-41 ft.-lbs.) torque. Tighten drag link nut to 29-49 N·m (22-36 ft.-lbs.) torque. Replenish cooling system and transmission/hydraulic fluid as needed.

SPINDLES AND BUSHINGS

Two-Wheel Drive Models

5. Spindle shaft (29 - Fig. 1) outside diameter should be 19.948-19.980 mm (0.7854-0.7866 inch). Front axle spindle shaft bushings (24) should have an inside diameter of 20-20.051 mm (0.7874-0.7894 inch). Clearance between spindle shaft (29) and front axle spindle shaft bushings (24) should be 0.020-0.103 mm (0.0008-0.0041 inch). Spindle shaft should have no end play.

Renew all parts as needed.

If upper spindle shaft bushing (24) is renewed, press bushing below top surface of axle to provide sufficient room for "O" ring (23). Press seal (27) into position with lip of seal towards top.

Tighten castle nut (36) to 82-86 N·m (61-64 ft.-lbs.) torque.

KING PINS AND BUSHINGS

Models B5100D - B6100D - B6100HST-D - B7100D

6. **R&R AND OVERHAUL.** Bend lock tab (54 - Fig. 3) away from screw head, then remove screw (53). Withdraw lower king pin (56). Unbolt and remove steering arm (26), then withdraw upper king pin (46). Separate outer drive assembly and axle shaft from front axle.

Standard king pin bushing inner diameter is 20.020-20.053 mm (0.7882-0.7895 inch). Standard king pin outside diameter is 19.979-20.000 mm (0.7866-0.7874 inch). Recommended clearance between king pin and bushing is 0.020-0.074 mm (0.0008-0.0029 inch).

Reassembly is reverse order of disassembly. Lubricate king pins with a good quality, multi-purpose, lithium base grease, then slide into position.

NOTE: King pins should slide freely into bushing bores with just hand pressure, DO NOT drive king pins in with a hammer.

Tighten steering arm retaining screws to 39-49 N·m (29-36 ft.-lbs.).

Model B7100HST-D

7. **R&R AND OVERHAUL.** Upper support (king pin) and bushing are accessible after removing steering arm (26 - Fig. 5). Outside diameter of support (44) end should be 25.000-25.033 mm (0.9843-0.9856 inch). Bushing (42) inside diameter should be 25.050-25.085 mm (0.9862-0.9876 inch). Clearance between bushing (42) and king pin (44) should be 0.017-0.085 mm (0.0007-0.0033 inch).

The lower end of the outer drive housing is supported by support cover (72) and rotates around bearing (69). Refer to outer drive housing service section in paragraph 13 if bearing must be renewed as gear backlash may be affected.

PIVOT PIN AND BUSHINGS

All Models

8. **R&R AND OVERHAUL.** Remove front axle as previously outlined and refer to Fig. 1, 3 or 5.

Pivot pin (7 - Fig. 1 or 3 - Fig. 3 or 5) outside diameter should be 19.88-20.03 mm (0.7827-0.7886 inch). Front axle pivot pin bushings should have an inside diameter of 20.10-20.15 mm (0.7913-0.7933 inch). Clearance between pivot pin and front axle pivot pin bushings should be 0.07-0.27 mm (0.0028-0.0106 inch). Front axle-to-frame end play should be 0.02 mm (0.0008 inch).

STEERING GEAR

All Models

9. **R&R AND OVERHAUL.** Raise hood, then disconnect negative battery cable terminal from battery post. Disconnect electrical connector under instrument panel. On hydrostatic drive models so equipped, remove Speed Set knob, cover retaining cap screws and cover. Remove steering wheel cap (2 - Fig. 2), then remove nut (3), lockwasher (4) and flat washer (5). Using a suitable puller, withdraw steering wheel (6). Remove four cap screws securing instrument panel, then lift panel clear from column. Remove pitman arm securing nut (26) and lockwasher (25). Place a suitable alignment mark on sector shaft end (21) and pitman arm (24) to ensure correct repositioning during reassembly. Using a suitable puller, withdraw pitman arm (24) from sector shaft end (21). On hydrostatic drive models so equipped, remove upper rod from Speed Set cam. Remove four bolts and nuts securing steering gear assembly to tractor unit, then lift clear.

To disassemble, first remove drain plug (27) and allow oil to drain into a suitable container. Remove any existing paint, rust or burrs from pitman arm end of sector shaft. Disassemble steering gear assembly with reference to Fig. 2.

Inspect and renew any components that are excessively worn or damaged. Worm gear and shaft (12 - Fig. 2) are available only as an assembled unit and disassembly is not recommended.

End clearance of adjusting screw (20) in slot of sector shaft (21) is controlled by shim (19) which is available in five thicknesses. Install thickest possible shim when unit is assembled.

Reassembly is reverse order of disassembly. Make sure center tooth on sector shaft (21) enters center tooth space on worm gear (12). After reassembly, fill steering gear through plug hole (14) with 0.2 liter (0.2 quart) of SAE 80 gear lube, then install and tighten plug (14).

Installation of steering gear is reverse of removal. Install pitman arm (24) on sector shaft (21) while aligning marked splines. Install lockwasher (25) and nut (26); tighten nut (26) to 118-157 N·m (87-116 ft.-lbs.) torque. Reinstall instrument panel. Install steering wheel (6), flat washer (5), lockwasher (4) and nut (3). Tighten nut (3) to 29-49 N·m (22-36 ft.-lbs.) torque. With worm gear and sector shaft gear at center position, remove plug (15), loosen locknut (16) and turn adjusting screw (20) until steering wheel free movement is 10-30 mm (25/64 - 1-3/16 inches). Complete reassembly by reversing disassembly procedure.

FRONT-WHEEL DRIVE SYSTEM

(Models B5100D – B6100D – B6100HST-D – B7100D)

Front-wheel drive assembly includes drive shaft, housing, differential, axle shafts and axle hub assemblies. Front-wheel drive power is supplied through transmission assembly and controlled by manually engaging or disengaging FWD select lever.

Camber angle, caster angle and king pin inclination are non-adjustable. Rolling angle adjuster screw (1 – Fig. 3) should be adjusted to a height of 25 mm (0.9843 inch) measured from axle case (34) to top of screw head. Front wheel steering angle adjuster screw (47) (front and rear) should

be adjusted to a length of 22 mm (0.8661 inch) measured from outer drive housing (49) to top of screw head.

OUTER DRIVE ASSEMBLY

Models B5100D – B6100D – B6100HST-D – B7100D

10. R&R AND OVERHAUL. To disassemble outer drive assembly, first remove wheel from side to be serviced. Remove drain plug (51 – Fig. 3) and allow lubricant to drain into a suitable container. Remove cap screws securing outer cover (68) to outer drive housing (49), then withdraw cover with components (63, 64, 65, 66, 69 and 70).

NOTE: During removal, if gear (64) catches on bearing (61), use suitable tools and carefully drive against gear (64) forcing bearing (63) inward until approximately halfway off wheel axle (70).

Remove bearing (63), gear (64) and snap ring (65) from wheel axle (70), then separate remaining components.

Examine components for damage and excessive wear.

Reassembly is reverse order of disassembly.

NOTE: To ease installation of outer cover assembly, press bearing (63) onto wheel axle (70) only halfway. After installation, lightly tap wheel axle (70) to force bearing against shoulder.

Tighten cap screws securing outer drive cover (68) to outer drive housing (49) to 18-21 N·m (6-7 ft.-lbs.) torque. Remove plug (50) and fill axle gearcase with 0.15 liter (0.15 U.S. quart) of SAE 80 gear lube. Install and tighten plug (50). Reinstall wheel and tighten lug nuts to 63-73 N·m (46-54 ft.-lbs.) torque.

OUTER DRIVE HOUSING, AXLE SHAFTS AND AXLE CASE

Models B5100D – B6100D – B6100HST-D – B7100D

11. R&R AND OVERHAUL. Remove outer drive assembly as outlined in paragraph 10. Remove drain plug (13 – Fig. 3) on Model B5100D and plug (95 – Fig. 4) on all other models and allow lubricant to drain into a suitable container. Detach tie rod end (32 – Fig. 3) from steering arm (26). Remove cap screws securing dust cover (71), felt seal (72), dust seal (73), dust seal holder (74)

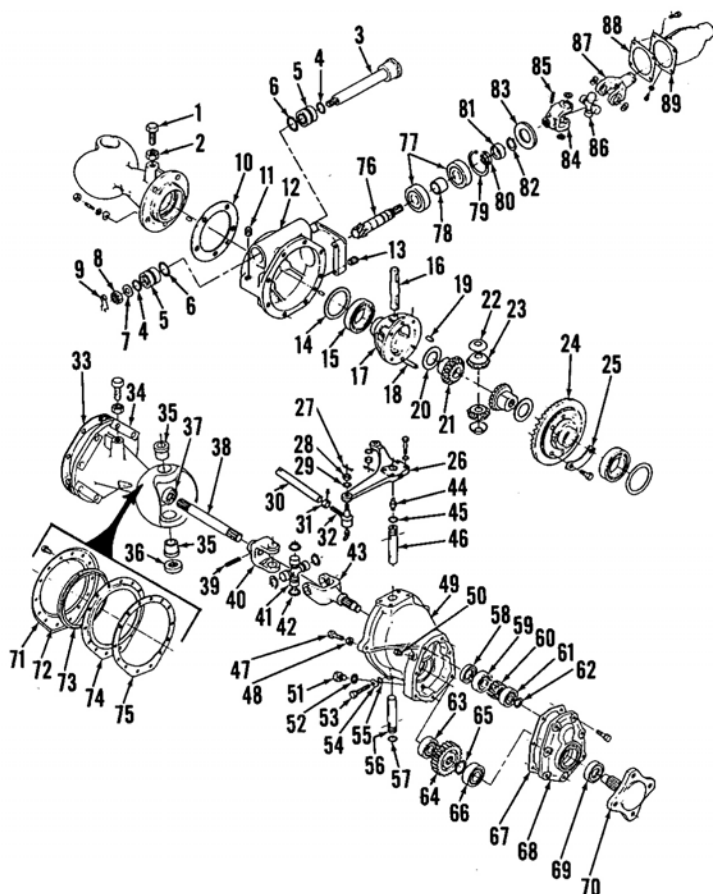


Fig. 3—Exploded view of front-wheel drive axle used on Model B5100D. Front-wheel drive axle used on Models B6100D, B6100HST-D and B7100D is similar except for pinion gear assembly and location of differential drain plug (see Fig. 4).

- | | | | |
|-----------------------|---------------------|-------------------------|----------------------|
| 1. Adjuster screw | 24. Bevel ring gear | 46. King pin | 68. Outer cover |
| 2. Locknut | 25. Lock plate | 47. Adjuster screw | 69. Oil seal |
| 3. Pivot pin | 26. Steering arm | 48. Locknut | 70. Wheel axle |
| 4. "O" ring | 27. Cotter key | 49. Outer drive housing | 71. Dust cover |
| 5. Bushing | 28. Castle nut | 50. Fill plug | 72. Felt seal |
| 6. "O" ring | 29. Washer | 51. Drain plug | 73. Dust seal |
| 7. Flat washer | 30. Tie rod | 52. Gasket | 74. Dust seal holder |
| 8. Castle nut | 31. Locknut | 53. Retainer screw | 75. Gasket |
| 9. Set spring | 32. Tie rod end | 54. Lock tab | 76. Bevel pinion |
| 10. Gasket | 33. Gasket | 55. Gasket | 77. Bearings |
| 11. Fill plug | 34. Axle case | 56. King pin | 78. Spacer |
| 12. Center case | 35. Bushing | 57. "O" ring | 79. Snap ring |
| 13. Drain plug | 36. Bearing | 58. Oil seal | 80. Collar |
| 14. Shim | 37. Oil seal | 59. Bearing | 81. Bushing |
| 15. Bearing | 38. Axle shaft | 60. Gear | 82. Snap ring |
| 16. Cross-shaft | 39. Pin | 61. Bearing | 83. Oil seal |
| 17. Differential case | 40. Yoke | 62. Snap ring | 84. Yoke |
| 18. Pin | 41. Universal joint | 63. Bearing | 85. Pin |
| 19. Pin | 42. Clip | 64. Gear | 86. Universal joint |
| 20. Thrust washer | 43. Yoke shaft | 65. Snap ring | 87. Yoke |
| 21. Side gear | 44. Grease fitting | 66. Bearing | 88. Gasket |
| 22. Thrust washer | 45. "O" ring | 67. Gasket | 89. Joint case |
| 23. Spider gear | | | |

and gasket (75), then slide components toward center. Remove snap ring (62), then slide bearing (61) and gear (60) from yoke shaft (43). Bend lock tab (54) away from head of retainer screw (53) and remove screw (53) with lock tab (54) and gasket (55). Withdraw king pin (56). Unbolt and remove steering arm (26), then withdraw king pin (46). Lift outer drive housing (49) from axle case (34). Slide components (71 through 75) off axle case. Withdraw axle shaft assembly (38 through 43). Remove cap screws securing axle case (34) to center case (12) and separate components. Use care not to allow differential assembly to fall free from center case.

Inspect all components for damage and excessive wear. Inspect universal joint (41) for binding, roughness, excessive wear or any other damage. Renew all parts as needed.

Reassembly is reverse of disassembly. Tighten cap screws securing right side axle case to center case to 48-56 N·m (35-41 ft.-lbs.) torque. Tighten cap screws securing left side axle case to center case to 24-27 N·m (17-20 ft.-lbs.) torque. Tighten cap screws retaining steering arm (26) to 39-49 N·m (29-36 ft.-lbs.) torque. Tighten tie rod end nut to 29.5-49.2 N·m (22-36 ft.-lbs.) torque. Complete reassembly as outlined in paragraph 10. Remove plug (11) and refill differential case with 0.5 liter (0.53 U.S. quart) of SAE 80 gear lube on Models B5100D, B6100D and B6100HST-D and 0.7 liter (0.74 U.S. quart) of SAE 80 gear lube on Model B7100D. Install and tighten plug (11).

DIFFERENTIAL AND BEVEL GEAR ASSEMBLY

Models B5100D – B6100D – B6100HST-D – B7100D

12. R&R AND OVERHAUL.

Remove outer drive housing, king pins, axle shafts and left axle case as outlined in paragraph 11. Lift differential and bevel ring gear assembly (14 through 25–Fig. 3) from center case (12). Loosen drive shaft protective cover band at joint case (89–Fig. 3 or 4) and remove drive shaft from joint case. Use a suitable punch and hammer to drive pin (85) from yoke (84). Withdraw yokes (84 and 87) with universal joint (86) as a unit. On Model B5100D, remove joint case (89–Fig. 3), gasket (88), seal (83) and snap ring (79), then withdraw bevel pinion assembly. On Models B6100D, B6100HST-D and B7100D, remove cap screws securing joint case (89–Fig. 4) and retaining plate (91), then withdraw bevel pinion assembly.

To disassemble bevel pinion assembly on Model B5100D, remove snap ring (82–Fig. 3), then complete disassembly

with reference to Fig. 3. To disassemble bevel pinion assembly on Models B6100D, B6100HST-D and B7100D, place bevel pinion (76–Fig. 4) in a suitable holding fixture, then remove nut (94) from pinion shaft. Complete disassembly with reference to Fig. 4.

Inspect components for damage and excessive wear. Renew all parts as needed. Bevel pinion (76–Fig. 3 and 4) and bevel ring gear (24–Fig. 3) must be renewed as a matched set.

Reassembly is reverse order of disassembly. On Models B6100D, B6100HST-D and B7100D, tighten nut (94–Fig. 4) to 98-147 N·m (72-108 ft.-lbs.) torque.

To separate differential and bevel ring gear assembly, first bend tabs of lock plate (25–Fig. 3) away from screw heads, then remove cap screws securing bevel ring gear (24) to differential case (17). Use a suitable mallet and tap bevel ring gear (24) from differential case (17). Withdraw keys (18 and 19) and cross-shaft (16) from differential case (17), then separate components (20 through 23) from case (17). Use a suitable puller and associated tools to withdraw bearings (15) from differential case (17).

Inspect components for damage and excessive wear. Renew all components as needed. Bevel ring gear (24) and bevel pinion (76–Fig. 3 and 4) must be renewed as a matched set.

Reassembly is reverse order of disassembly. Lubricate components with a light film of SAE 80 gear lube prior to installation. Tighten cap screws securing bevel ring (24) to differential case (17) to 29-34 N·m (22-25 ft.-lbs.), then bend tabs of lock plate (25) over to secure screws.

Shims (14–Fig. 3) are used to adjust backlash between bevel ring gear and bevel pinion gear. Recommended backlash is 0.1-0.2 mm (0.004-0.008

inch). Shims (14) are available in thicknesses of 0.2, 0.3 and 0.5 mm (0.008, 0.012 and 0.020 inch). Recommended pinion shaft end play is zero. Shims are available for Models B6100D, B6100HST-D and B7100D to adjust mesh position. After adjustment, add shims behind retainer plate (91–Fig. 4) until zero end play is attained.

Reassemble outer drive housing, king pins, axle shafts and left axle case as outlined in paragraph 11.

FRONT-WHEEL DRIVE SYSTEM (Model B7100HST-D)

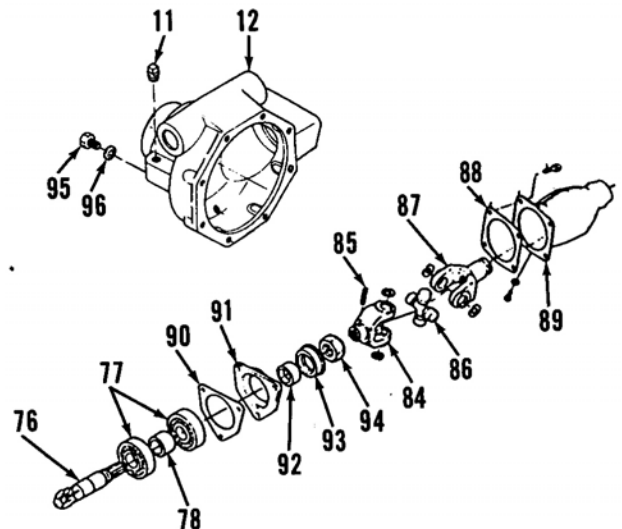
Front-wheel drive assembly includes drive shaft, housing, differential, axle shafts and axle hub assembly. Front-wheel drive power is supplied through transmission assembly and controlled by manually engaging or disengaging FWD select lever. Camber angle, caster angle and king pin inclination are non-adjustable. Rolling angle adjuster screw (1–Fig. 5) should be adjusted to a height of 25 mm (0.98 inch) measured from axle case (35) to top of screw head. Front wheel steering angle adjuster screw (56) (front and rear) should be adjusted to a length of 22 mm (0.86 inch) measured from outer drive housing (58) to top of screw head.

OUTER COVER, OUTER DRIVE HOUSING, GEARCASE AND DRIVE COMPONENTS

13. R&R AND OVERHAUL. Remove wheel from side to be serviced. Remove drain plug (62–Fig. 6) and

Fig. 4—Exploded view of bevel pinion gear assembly and differential case of the type used on Models B6100D, B6100HST-D and B7100D. Refer to Fig. 3 for identification of parts except for the following.

- 90. Gasket
- 91. Retaining plate
- 92. Bushing
- 93. Seal
- 94. Nut
- 95. Drain plug
- 96. Gasket



allow lubricant to drain into a suitable container. Detach tie rod end (32—Fig. 5) from steering arm (26). Remove cap screws securing gearcase (48) to axle case (34 or 35). Place a suitable drain pan under end of axle case, then lift complete outer drive assembly from axle case and place on a suitable work bench to complete disassembly. Note shims (47) located between axle case and gear-

case. Extract axle shaft (96) with components (38, 39 and 40).

Remove cap screws retaining steering arm (26) to outer drive housing (58), then separate arm from support end (44). Remove cap screws securing support (44) to gearcase (48) and separate. Remove cap screws securing lower support cover (72) to outer drive housing (58), then withdraw cover along with

gear (68) and bearing (69). Note shims (70). Using a suitable mallet, tap shaft (55) from bottom side to separate outer drive housing (58) from gearcase (48). Remove cap screws securing outer cover (82) to outer drive housing (58), then withdraw outer cover (82) assembly. Complete disassembly of components with reference to Fig. 5.

Reassembly is reverse order of disassembly. Install new "O" rings and gasket (81). Be sure to install seal (54—Fig. 7) with lip facing towards top and seal (65) with lip facing towards bottom.

Tighten cap screws securing outer cover (82—Fig. 5) to outer drive housing (58) to 48-56 N·m (35-41 ft.-lbs.) torque. Tighten cap screws securing support cover (72) to outer drive housing (58) to 24-27 N·m (17-20 ft.-lbs.) torque. Tighten cap screws securing support (44) to gearcase (48) to 24-27 N·m (17-20 ft.-lbs.) torque. Tighten cap screws securing gearcase (48) to axle case (34 or 35) to 77-90 N·m (57-67 ft.-lbs.) torque.

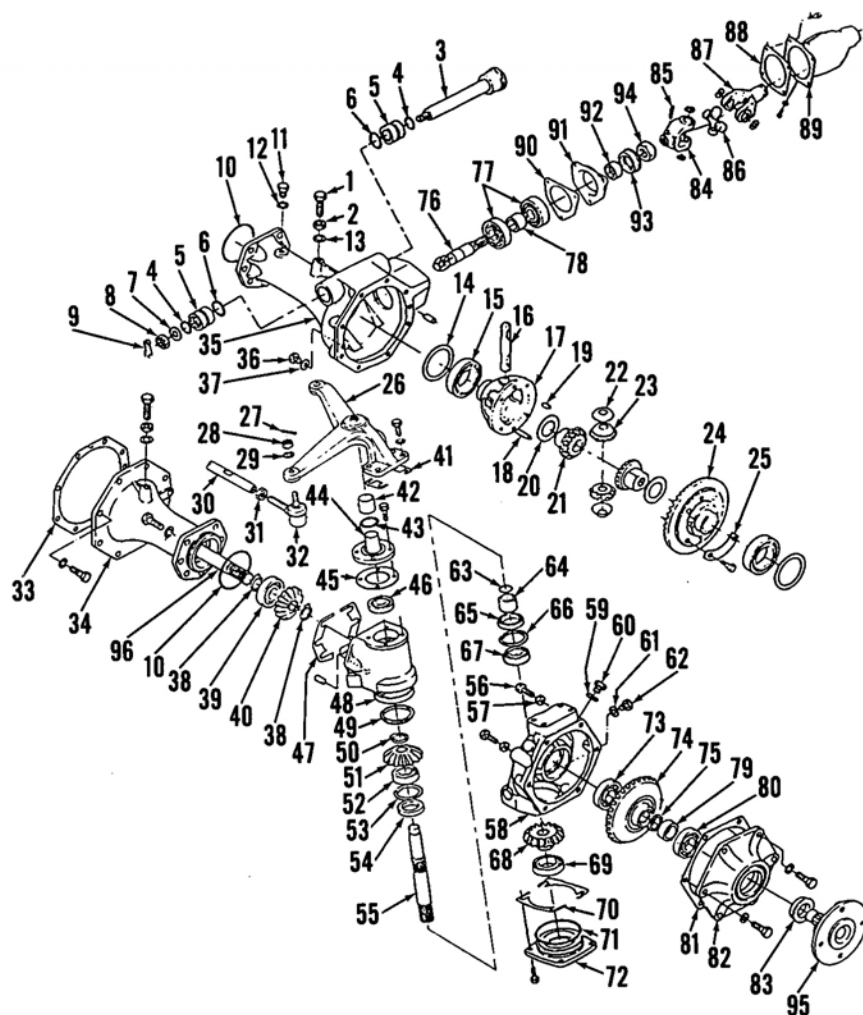


Fig. 5—Exploded view of front-wheel drive axle used on Model B7100HST-D.

- | | | | |
|-----------------------|---------------------|-------------------------|---------------------|
| 1. Adjuster screw | 25. Lock plate | 49. Dust seal | 73. Bearing |
| 2. Locknut | 26. Steering arm | 50. Snap ring | 74. Gear |
| 3. Pivot pin | 27. Cotter key | 51. Gear | 75. Collar |
| 4. "O" ring | 28. Castle nut | 52. Bearing | 76. Bevel pinion |
| 5. Bushing | 29. Washer | 53. Snap ring | 77. Bearings |
| 6. "O" ring | 30. Tie rod | 54. Seal | 78. Spacer |
| 7. Flat washer | 31. Locknut | 55. Shaft | 79. Spacer |
| 8. Castle nut | 32. Tie rod end | 56. Adjuster screw | 80. Bearing |
| 9. Set spring | 33. Gasket | 57. Locknut | 81. Gasket |
| 10. "O" ring | 34. Left axle case | 58. Outer drive housing | 82. Outer cover |
| 11. Fill plug | 35. Right axle case | 59. Gasket | 83. Seal |
| 12. Gasket | 36. Drain plug | 60. Fill plug | 84. Yoke |
| 13. Lockwasher | 37. Gasket | 61. Gasket | 85. Pin |
| 14. Shim | 38. Snap ring | 62. Drain plug | 86. Universal joint |
| 15. Bearing | 39. Bearing | 63. "O" ring | 87. Yoke |
| 16. Cross-shaft | 40. Gear | 64. Sleeve | 88. Gasket |
| 17. Differential case | 41. Shim | 65. Seal | 89. Joint case |
| 18. Pin | 42. Bushing | 66. Snap ring | 90. Gasket |
| 19. Pin | 43. "O" ring | 67. Bearing | 91. Retaining plate |
| 20. Shim | 44. Support | 68. Gear | 92. Bushing |
| 21. Side gear | 45. Gasket | 69. Bearing | 93. Seal |
| 22. Thrust washer | 46. Bearing | 70. Shim | 94. Nut |
| 23. Spider gear | 47. Shim | 71. "O" ring | 95. Wheel axle |
| 24. Bevel ring gear | 48. Gearcase | 72. Support cover | 96. Axle shaft |

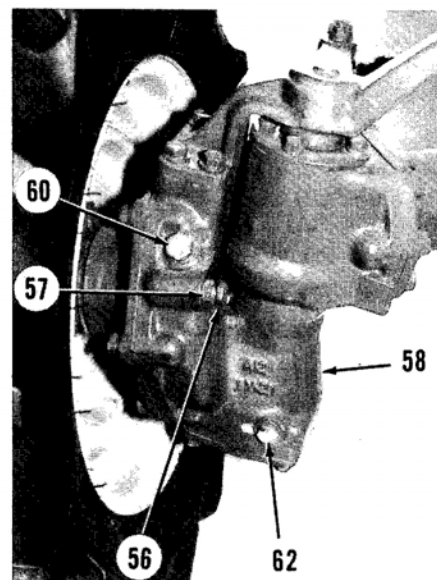


Fig. 6—View showing fill plug (60), drain plug (62), steering angle adjuster screw (56) and locknut (57) located in outer drive housing (58) on Model B7100HST-D.

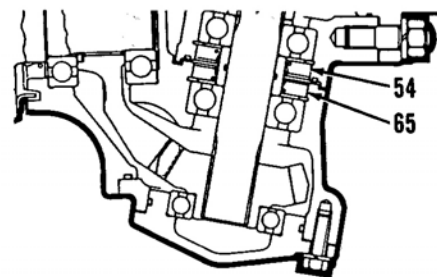


Fig. 7—Install seals (54 and 65) with lips facing as shown.

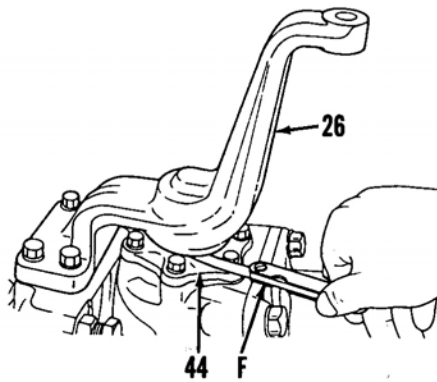


Fig. 8 - View showing procedure for measuring clearance between steering arm (26) and support (44) using feeler gage (F). Refer to text.

Backlash between gears (40 and 51) and (68 and 74) should be 0.10-0.30 mm (0.004-0.012 inch). Adjustment shims (47 or 70) are available in thicknesses of 0.2, 0.3 and 0.5 mm (0.008, 0.012 and 0.020 inch). Clearance between steering arm (26) and support (44) should be 0-0.2 mm (0-0.008 inch) measured as shown in Fig. 8. Adjustment shims (41-Fig. 5) are available in thicknesses of 0.2, 0.3 and 0.5 mm (0.008, 0.012 and 0.020 inch).

Replenish lubricant in front axle differential case as needed. Remove fill plug (60-Fig. 6) and fill front axle gearcase with 0.5 liter (0.5 U.S. quart) of SAE 80 gear lube, then reinstall and tighten plug (60).

DIFFERENTIAL AND BEVEL GEAR ASSEMBLY

14. R&R AND OVERHAUL. Remove outer cover, outer drive housing, gearcase and drive components as outlined in paragraph 13. Remove drain plug (36-Fig. 9) and allow lubricant to drain into a suitable container. Remove cap screws securing left axle case. (34-Fig. 5), then separate axle cases (34 ar. 35). Use care not to allow differential assembly to fall free when axle cases are separated. Lift differential and bevel ring gear assembly (14 through 25) from

axle case (35). Remove cap screws securing joint case (89) and retaining plate (91), then withdraw bevel pinion assembly.

To separate bevel pinion assembly, place bevel pinion (76) in a suitable holding fixture, then remove nut (94) from pinion shaft. Complete disassembly with reference to Fig. 5.

Inspect components for excessive wear and damage.

Renew defective parts. Bevel pinion (76) and bevel ring gear (24) must be renewed as a matched set.

Reassembly is reverse order of disassembly. Renew oil seal (93). Tighten nut (94) to 98-147 N·m (72-108 ft.-lbs.) torque.

To separate differential and bevel ring gear assembly, first bend tabs of lock plate (25) away from screw heads, then remove cap screws securing bevel ring gear (24) to differential case (17). Use a suitable mallet and tap bevel ring gear (24) from differential case (17). Withdraw keys (18 and 19) and cross-shaft (16) from differential case (17), then separate components (20 through 23) from case (17).

Use a suitable puller and associated tools to withdraw bearings (15) from differential case (17). Inspect components for excessive wear and damage.

Measure outside diameter of side gear (21) and inside diameter of differential case (17). Clearance should be 0.025-0.066 mm (0.0010-0.0026 inch). Measure outside diameter of cross-shaft (16) and inside diameter of spider gear (23). Clearance should be 0.016-0.052 mm (0.0006-0.0020 inch).

Renew all components as needed. Bevel ring gear (24-Fig. 5) and bevel pinion (76) must be renewed as a matched set.

Reassembly is reverse order of disassembly. Lubricate components with a light film of SAE 80 gear lube prior to installation. Tighten cap screws securing bevel ring gear (24-Fig. 5) to differential case (17) to 29-34 N·m (22-25 ft.-lbs.), then bend tabs of lock plate (25) over to secure screws. Tighten

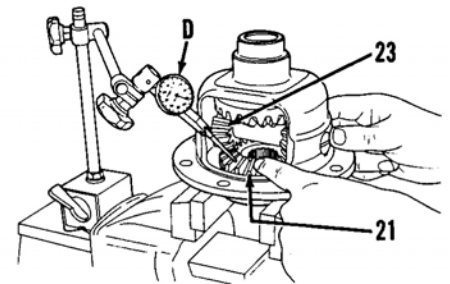


Fig. 12 - View showing procedure for checking backlash between side gear (21) and spider gear (23) using dial indicator (D). Refer to text.

cap screws securing left axle case (34) to right axle case (35) to 48-56 N·m (35-41 ft.-lbs.) torque.

Shim (20-Fig. 5) is used to adjust backlash between side gear (21) and spider gear (23). Mount differential assembly in a suitable holding fixture and measure backlash as shown in Fig. 12. Recommended backlash is 0.20-0.25 mm (0.0079-0.0098 inch). Shims (20-Fig. 5) are available in thicknesses of 0.8, 1.0 and 1.2 mm (0.031, 0.039 and 0.047 inch). Shims (14) are used to adjust backlash between bevel pinion gear. Recommended backlash is 0.1-0.2 mm (0.004-0.008 inch). Shims (14) are available in thicknesses of 0.2, 0.3 and 0.5 mm (0.008, 0.012 and 0.020 inch). Recommended pinion shaft end play is zero. Shims are available to adjust mesh position. After adjustment, add shims under retainer plate until zero end play is attained.

Reassemble outer cover, outer drive housing, gearcase and drive components as outlined in paragraph 13. Remove plug (11-Fig. 9) and refill differential case with 1.5 liters (1.6 U.S. quarts) of SAE 80 gear lube. Reinstall and tighten plug (11).

ENGINE

All Models

18. REMOVE AND REINSTALL. Drain engine oil and transmission/hydraulic system fluid into suitable containers. Remove front axle assembly as outlined in paragraph 2 for all two-wheel drive models, paragraph 3 for Models B5100D, B6100D, B6100HST-D and B7100D and paragraph 4 for Model B7100HST-D. Detach electrical wiring at engine starter, oil pressure sending unit, glow plugs and alternator. Remove starter. Disconnect fuel leak-off line from rear injector, close fuel shut-off valve at fuel filter, then disconnect fuel supply line from fuel pump. Remove line connecting fuel tank to fuel filter at

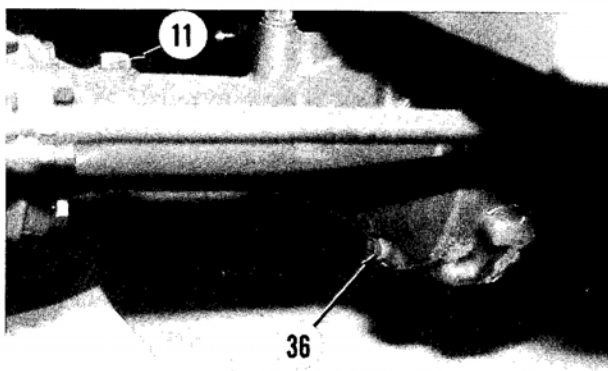


Fig. 9 - Note location of front-axle drain plug (36) and fill plug (11) used on Model B7100HST-D.

filter port and plug openings to prevent fuel spillage. Remove fuel filter assembly and fuel tank. Disconnect throttle linkage and compression release cable. Remove heat insulator plate located at rear of engine. Remove hydraulic fluid supply lines; note copper washers and "O" rings when disassembling. Attach a suitable hoist or holding fixture to engine assembly and support rear of tractor with a suitable jack. Remove the eight cap screws connecting engine to clutch housing. Pull engine along with clutch assembly straight forward to separate engine from clutch housing.

Reassembly is reverse order of disassembly. Tighten the eight cap screws securing engine to clutch housing to 19.7-29.5 N·m (15-22 ft.-lbs.) torque. Reinstall front axle assembly as outlined in appropriate paragraph. Replenish engine oil and transmission/hydraulic fluid with quantity and grade of lubri-

cant as noted in CONDENSED SERVICE DATA TABLE. Bleed fuel system as outlined in paragraph 36.

COMPRESSION PRESSURE

All Models

19. Compression pressure should be 2.7-3.1 MPa (398-454 psi). Allowable minimum pressure is 2.4 MPa (341 psi).

VALVE TAPPET GAP

All Models

20. **ADJUSTMENT.** Valve tappet gap should be adjusted with engine cold and piston at top dead center on compression stroke. Remove rocker cover and turn rocker arm adjusting screws so valve gap for both valves is 0.15-0.20 mm (0.006-0.008 inch).

COMPRESSION RELEASE

All Models

21. **ADJUSTMENT.** All models are equipped with a compression release. The compression release holds the exhaust valves open slightly when compression release lever (9—Fig. 13) is rotated to applied position by actuator cable.

To adjust compression release, rotate engine crankshaft so piston in cylinder being adjusted is at top dead center on compression stroke. Remove cover (3), loosen locknut (6) and back out adjusting screw (7). Pull out actuator knob to rotate compression release lever to engaged position. Turn adjusting screw (7) until it contacts exhaust rocker arm, then turn screw an additional 1½ turns. Tighten locknut and adjust remaining cylinders. Check operation of

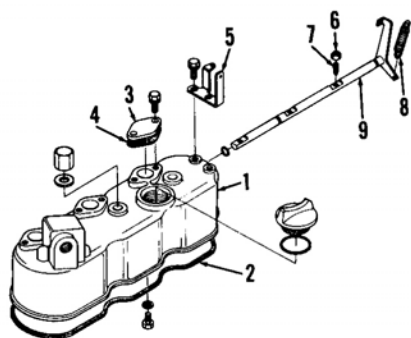


Fig. 13—View of valve cover and compression release components.

- | | |
|----------------|------------------------------|
| 1. Valve cover | 7. Compression release screw |
| 2. Gasket | 8. Spring |
| 3. Cover | 9. Compression release shaft |
| 4. Gasket | |
| 5. Bracket | |
| 6. Locknut | |

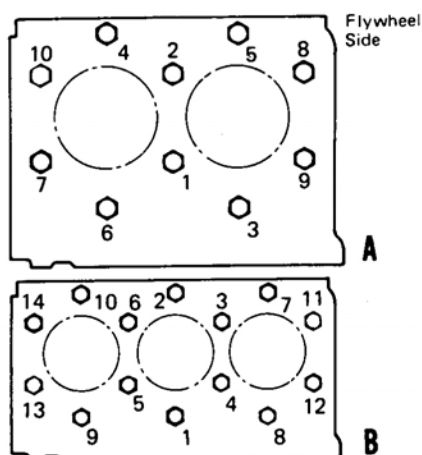


Fig. 14—Follow sequence in diagram A when tightening cylinder head fasteners on two-cylinder models or diagram B on three-cylinder models.

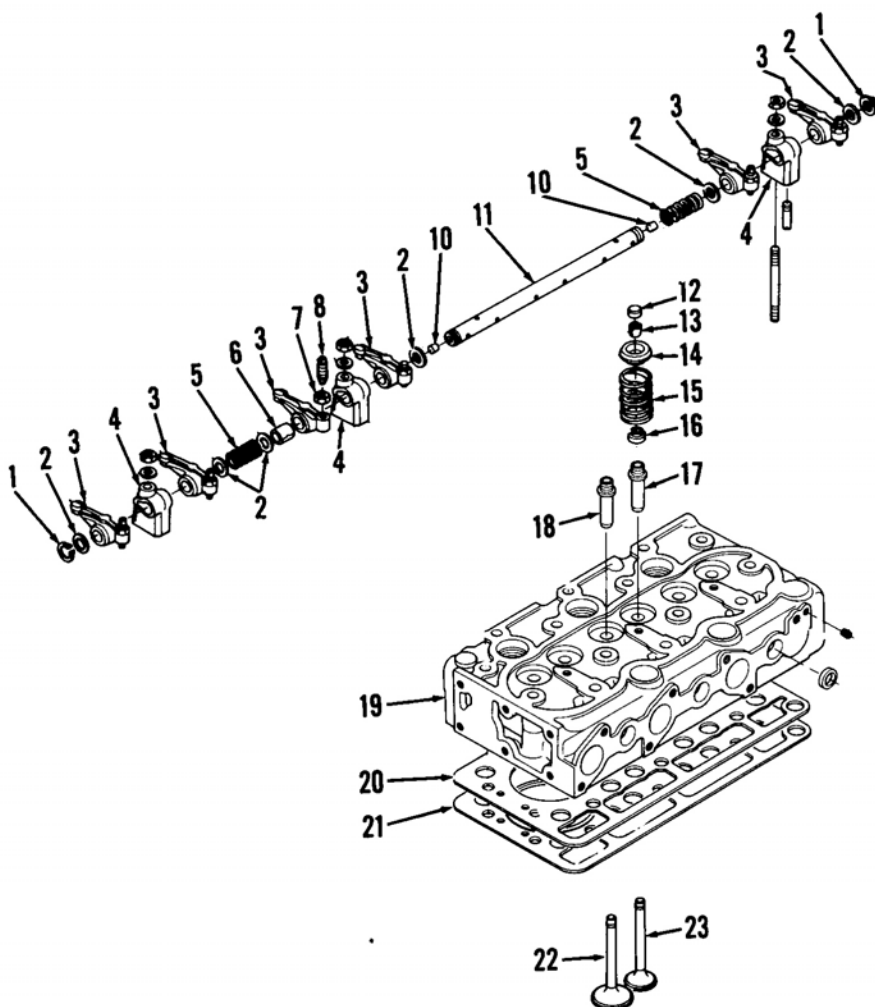


Fig. 15—Exploded view of cylinder head and valve train.

- | | | |
|----------------|--------------------|-------------------------|
| 1. Snap ring | 8. Adjusting screw | 17. Exhaust valve guide |
| 2. Washer | 9. Set screw | 18. Intake valve guide |
| 3. Rocker arm | 10. Rocker shaft | 19. Cylinder head |
| 4. Shaft stand | 11. Valve cap | 20. Shim |
| 5. Spring | 12. Retainer keys | 21. Gasket |
| 6. Bushing | 13. Retainer | 22. Intake valve |
| 7. Locknut | 14. Spring | 23. Exhaust valve |
| | 15. Seal | |

compression release being sure exhaust valves do not contact pistons.

CYLINDER HEAD

All Models

22. R&R AND OVERHAUL. To remove cylinder head, drain coolant from radiator and cylinder block. Disconnect battery ground wire. Disconnect electrical wiring at glow plugs, alternator and any other location that will obstruct cylinder head removal. Remove radiator hose from cylinder head water outlet. Remove air cleaner and exhaust manifold. Disconnect compression release cable. Remove fan belt. Remove high pressure fuel lines to all injector nozzles, disconnect fuel leak-off line from rear injector, then remove injectors. Be sure to cover all openings in fuel lines and fuel passages to prevent entrance of dirt. Remove rocker arm cover. Unbolt rocker arm assemblies, then withdraw rocker arms, stands and push rods. Loosen cylinder head retaining screws evenly one-half turn at a time to prevent warpage, then remove screws and lift cylinder head from block.

Check flatness of head surface using a straightedge placed along sides and across mating surface. Insert a feeler gage between straightedge and surface. Maximum allowable distortion is 0.05 mm (0.002 inch) per 100 mm (4 inches). If distortion is beyond limit, then head must be resurfaced. If head is resurfaced, check valve-to-piston clearance as outlined in following paragraph.

To check valve-to-piston clearance, install head and gasket with valves and springs installed but with injectors removed. Tighten head fasteners to 42-47 N·m (31-35 ft.-lbs.) torque following sequence shown in Fig. 14. Using a suitable measuring gage such as soft solder or Plastigage, insert gage between each valve and piston crown while rotating crankshaft through top dead center. Minimum allowable valve-to-piston clearance is 0.6 mm (0.024 inch). Clearance may be increased by installing a shim gasket (20—Fig. 15) between cylinder head (19) and head gasket (21). Shim gasket thickness is 0.2 mm (0.0079 inch).

Reverse removal procedure to reinstall cylinder head. Refer to Fig. 14 for cylinder head tightening sequence.

Tighten cylinder head securing cap screws to 42-47 N·m (31-35 ft.-lbs.) torque. Tighten rocker arm stands to 16.7-20.6 N·m (12-15 ft.-lbs.) torque. Tighten injector nozzle nut to 29.4-49.0 N·m (22-36 ft.-lbs.) torque. Adjust valve tappet gap as outlined in paragraph 20. Adjust compression release as outlined in paragraph 21.

VALVE SYSTEM

All Models

23. Both valves ride directly in cylinder head. Maximum allowable clearance between valve stem and valve guide is 0.035-0.065 mm (0.0014-0.0026 inch). Valve guide diameter should be 7.010-7.025 mm (0.2760-0.2766 inch) while valve stem diameter should be 6.960-6.975 mm (0.2740-0.2746 inch).

Valves seat directly in head. Valve seat and face angles are 45 degrees. Valve seat width should be 2.1 mm (0.083 inch). When depth of valve head from cylinder head surface exceeds 1.1 mm (0.043 inch), then head surface should be machined.

Valve springs are interchangeable. Valve spring free length should be 35.1-35.6 mm (1.382-1.402 inches) while installed height is 31 mm (1.22 inches). Valve spring pressure at installed height should be 74 Newtons (16.5 lbs.) with a minimum allowable pressure of 63 Newtons (14 lbs.).

Rocker arm bushings (6—Fig. 15) are renewable. Bushing ID should be 10.997-11.038 mm (0.4330-0.4346 inch). Rocker shaft OD should be 10.973-10.984 mm (0.4320-0.4324 inch). Maximum allowable clearance between shaft and rocker arm bushing is 0.12 mm (0.0047 inch).

TIMING GEARS AND COVER

All Models

24. REMOVE AND REINSTALL. To remove timing gear cover, remove cover just below injection pump and detach governor spring (5—Fig. 16) from governor arm (7). Detach control linkage to control lever (2). If radiator obstructs crankshaft pulley removal, then drain coolant and relocate radiator. Remove fan belt and fan, then unscrew crankshaft pulley nut and using a suitable puller, remove crankshaft pulley. Unscrew and remove timing gear cover.

Refer to Fig. 17 for proper alignment of timing marks on crankshaft, idler, camshaft and injection pump camshaft gears. Backlash between any two gears should be 0.04-0.12 mm (0.002-0.005 inch). Refer to appropriate sections for gear service.

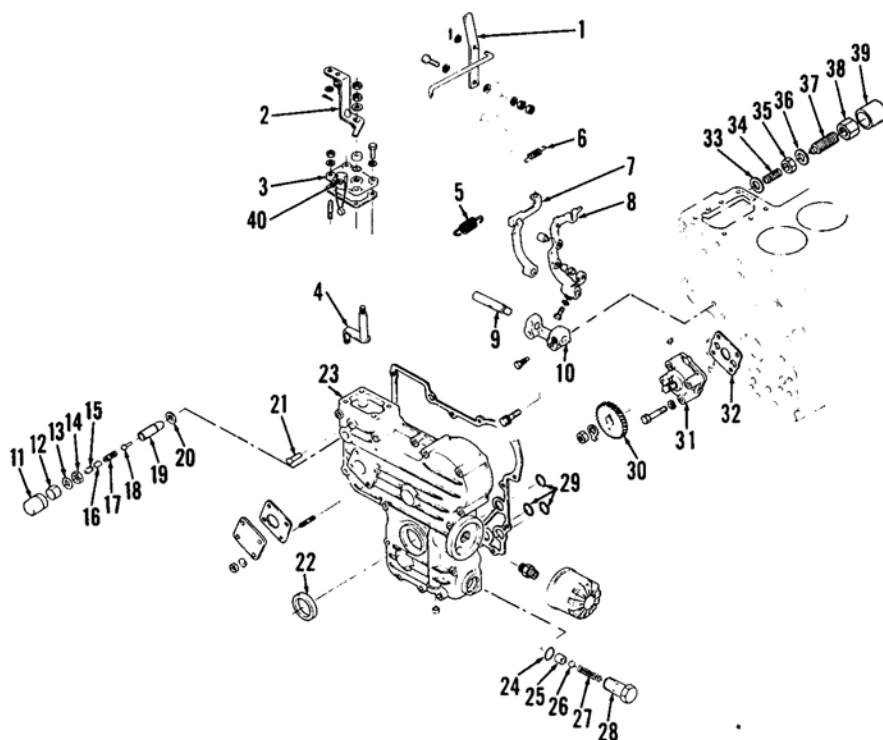


Fig. 16—Exploded view of timing gear cover and associated components. Be sure "O" rings (29) are in place when installing cover (23).

- | | | | |
|---------------------|---------------------------------|------------------------------------|---------------------------|
| 1. Speed control | 12. Cap nut | 21. Start spring pin | 31. Oil pump |
| 2. Control lever | 13. Gasket | 22. Seal | 32. Gasket |
| 3. Plate | 14. Locknut | 23. Timing gear cover | 33. Gasket |
| 4. Control arm | 15. Maximum fuel limiting screw | 24. "O" ring | 34. Spring |
| 5. Governor spring | 16. Spacer | 25. Oil pressure relief valve seat | 35. Locknut |
| 6. Start spring | 17. Spring | 26. Relief valve ball | 36. Gasket |
| 7. Governor arm | 18. Pin | 27. Spring | 37. Low idle speed screw |
| 8. Pump control arm | 19. Maximum fuel limiting body | 28. Valve body | 38. Cap nut |
| 9. Pivot pin | 20. Gasket | 29. "O" rings | 39. Cap |
| 10. Pivot block | | 30. Pump gear | 40. High idle speed screw |
| 11. Cap | | | |

When installing timing gear cover, be sure the three "O" rings (29—Fig. 16) are in place. Tighten timing cover screws to 9.8-11.3 N·m (7-8 ft.-lbs.) torque. Tighten crankshaft pulley nut to 137.3-156.9 N·m (101-115 ft.-lbs.) torque.

PISTON AND ROD UNITS

All Models

25. REMOVE AND REINSTALL.

Piston and connecting rod are removed as a unit after removing oil pan, oil pickup and cylinder head. Unscrew rod cap retaining screws, detach rod cap and extract piston and rod.

Note that numbers are stamped on sides of rod and cap and should be on same side when assembled. Install piston and rod units so numbers on rod and cap are toward fuel injection pump side of engine. Tighten rod screws to 26-30 N·m (20-22 ft.-lbs.) torque.

PISTON AND RINGS

All Models

26. All models are equipped with two compression rings and an oil control ring surrounding an aluminum, cam-ground piston. Piston and rings are available in 0.5 mm (0.02 inch) oversize.

Standard piston diameter measured at skirt perpendicular to piston pin is 64 mm (2.52 inches) on Models B6100D, B6100E, B6100HST-D and B6100HST-E and 68 mm (2.68 inches) on Models B5100D, B5100E, B7100D, B7100HST-D and B7100HST-E. Piston-to-cylinder clearance should be 0.069-0.089 mm (0.0027-0.0035 inch) on Models B6100D,

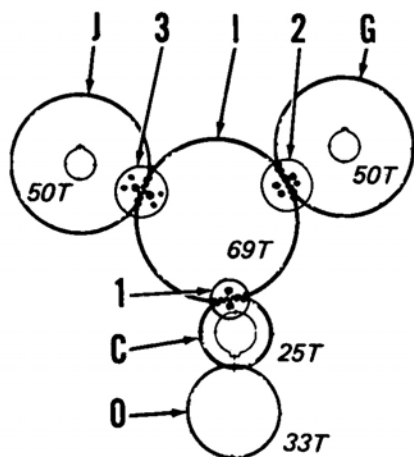
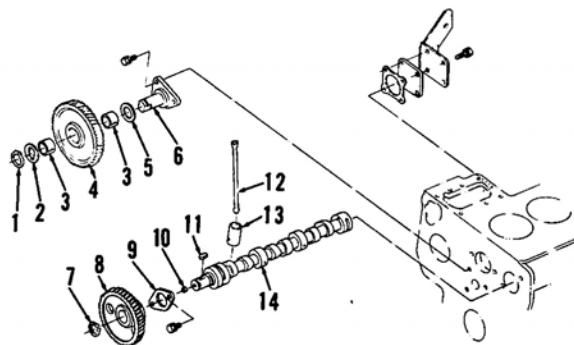


Fig. 17—Diagram of drive gears showing proper alignment of timing marks. Note three marks (3) on injection pump gear (J) and idler gear (I); two marks (2) on camshaft gear (G) and idler gear (I); single marks on crankshaft gear (C) and idler gear (I). No marks are used on oil pump gear (O).

Fig. 18—Exploded view of camshaft and idler gear assemblies.

1. Snap ring
2. Slotted washer
3. Bushing
4. Idler gear
5. Washer
6. Idler shaft
7. Snap ring
8. Gear
9. Retainer
10. Plug
11. Key
12. Push rod
13. Tappet
14. Camshaft



B6100E, B6100HST-D and B6100HST-E and 0.055-0.094 mm (0.0022-0.0037 inch) on Models B5100D, B5100E, B7100D, B7100HST-D and B7100HST-E.

Piston pin boss inner diameter should be 20.000-20.013 mm (0.7874-0.7879 inch) for all models with wear limit of 20.04 mm (0.789 inch).

Piston ring end gap is 0.25-0.40 mm (0.0098-0.0158 inch) for compression rings and 0.20-0.40 mm (0.0078-0.0158 inch) for oil control ring on all models. Maximum wear limit for any ring is 1.25 mm (0.0492 inch). The top compression ring is a keystone type and side clearance is not measured. Side clearance for second compression ring should be 0.085-0.112 mm (0.0033-0.0044 inch) and for oil control ring should be 0.020-0.052 mm (0.0008-0.0020 inch).

PISTON PIN

All Models

27. A full floating piston pin is used on all models. Piston pin OD should be 20.002-20.011 mm (0.7875-0.7878 inch). Clearance between pin and piston bosses should be 0.011 mm (0.0004 inch) interference to 0.011 mm (0.0004 inch) loose. Clearance between pin and connecting rod bushing should be 0.014-0.038 mm (0.0006-0.0015 inch).

CONNECTING ROD AND BEARINGS

All Models

28. Connecting rods are equipped with a renewable bushing in the small end and insert type bearings in the big end. Inner diameter of big end bearing should be 37.004-37.046 mm (1.4568-1.4585 inches) while clearance between bearing and crankpin should be 0.029-0.087 mm (0.0011-0.0034 inch). Bearings are available in 0.25 mm (0.0098 inch) undersize.

Small end bushing inner diameter is 20.025-20.040 mm (0.788-0.789 inch). Clearance between piston pin and bush-

ing is 0.014-0.038 mm (0.0006-0.0015 inch).

Tighten connecting rod cap screws to 26-30 N·m (20-22 ft.-lbs.) torque.

CAMSHAFT

All Models

29. R&R AND OVERHAUL. To remove camshaft, remove cylinder head as outlined in paragraph 22 and timing gear cover as outlined in paragraph 24, then remove tappets. Unscrew camshaft retainer plate (9—Fig. 18) and withdraw camshaft from cylinder block. If necessary, press camshaft gear (8) off camshaft (14).

Camshaft lobe height should be 26.88 mm (1.0583 inches) with a wear limit of 26.83 mm (1.0563 inches). Camshaft bearing journal diameter should be 32.934-32.950 mm (1.2966-1.2972 inches) while inner diameter of renewable camshaft bearings is 33.000-33.025 mm (1.2992-1.3002 inches). Clearance between camshaft journal bearing should be 0.050-0.091 mm (0.0020-0.0036 inch). With camshaft supported in V-blocks at outer bearing journals, maximum allowable runout measured at either center bearing journal is 0.08 mm (0.0031 inch).

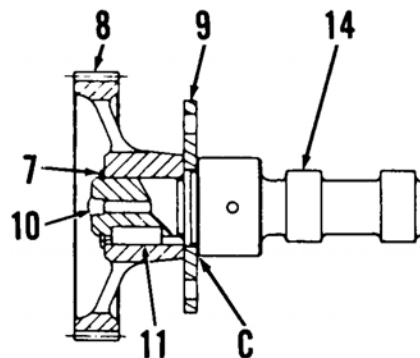


Fig. 19—Install gear (8) on camshaft (14) so there is 0.07-0.22 mm (0.0028-0.0087 inch) clearance (C) between retainer (9) and side of front camshaft journal. Refer to legend in Fig. 18 for identification of remaining components.

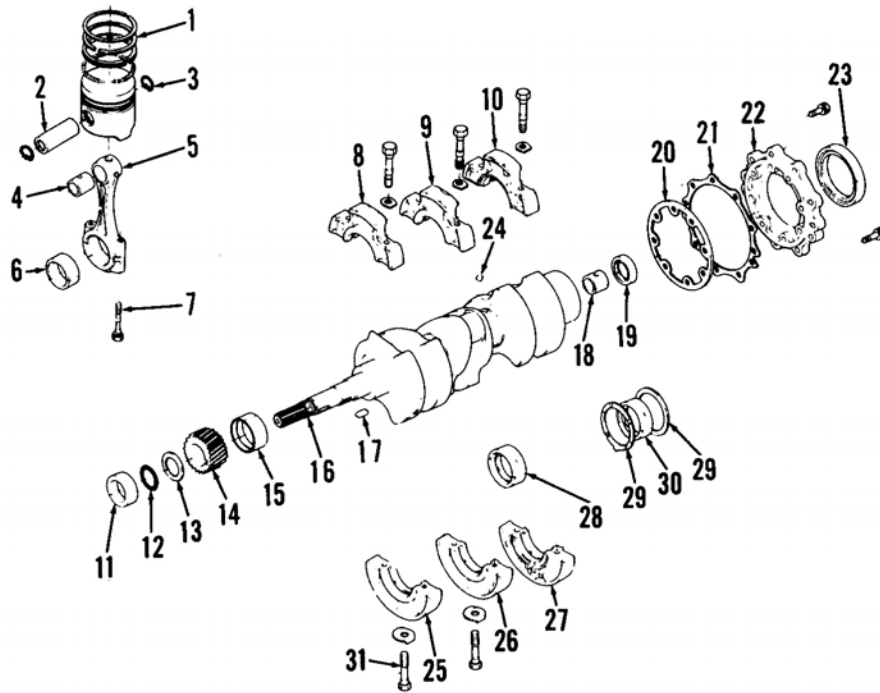


Fig. 20—Exploded view of piston, rod and crankshaft assembly.

- | | | |
|---------------------------------------|------------------|--|
| 1. Piston rings | 11. Spacer | 23. Seal |
| 2. Piston pin | 12. "O" ring | 24. Plug |
| 3. Retainer | 13. Oil slinger | 25. Lower bearing carrier half, front |
| 4. Bushing | 14. Gear | 26. Lower bearing carrier half, middle |
| 5. Connecting rod | 15. Bearing | 27. Lower bearing carrier half, rear |
| 6. Bearing | 16. Crankshaft | 28. Main bearing |
| 7. Screw | 17. Key | 29. Thrust washers |
| 8. Upper bearing carrier half, front | 18. Bushing | 30. Rear main bearing |
| 9. Upper bearing carrier half, middle | 19. Seal | 31. Locator screw |
| 10. Upper bearing carrier half, rear | 20. Gasket | |
| | 21. Gasket | |
| | 22. Seal carrier | |

When installing camshaft gear on camshaft, first install retainer (9). Heat camshaft gear to approximately 80°C (176°F) and push gear onto camshaft until there is 0.07-0.22 mm (0.0028-0.0087 inch) clearance between retainer and side of camshaft journal as shown in Fig. 19. Refer to paragraph 24 to properly align camshaft gear timing marks during installation.

CRANKSHAFT AND BEARINGS

All Models

30. R&R AND OVERHAUL.

Remove engine as outlined in paragraph 18. To remove crankshaft, remove pistons and rods, timing gear cover, crankshaft gear, flywheel and seal carrier (22—Fig. 20). Free bearing carriers (25, 26 and 27) by unscrewing locating screws (31—Fig. 20 or 21). Carefully withdraw crankshaft and bearing carrier assembly out rear of cylinder block. Note that bearing carriers are a tight fit in cylinder block to prevent oil loss between oil passages in block and bearing carriers. Remove screws securing bearing carrier halves and separate halves from crankshaft. Note that main

bearing carriers are not interchangeable.

Standard main journal diameter is 43.934-43.950 mm (1.7297-1.7303 inches). Main bearing clearance for front bearing (15—Fig. 20) should be 0.034-0.106 mm (0.0013-0.0042 inch) while clearance for all other bearings should be 0.34-0.92 mm (0.0013-0.0036 inch). Main bearings are offered in 0.20 and 0.40 mm (0.0079 and 0.0157 inch) undersizes.

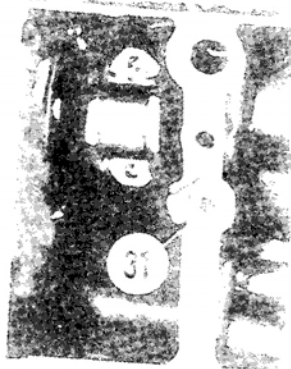


Fig. 21—View showing location of locating screw (31) which secures bearing carrier to block.

Crankshaft end play should be 0.15-0.31 mm (0.0059-0.0122 inch) and is controlled by thrust washers (29) which are available in 0.20 and 0.40 mm (0.0079 and 0.0157 inch) oversizes. Install thrust washers so grooved side is away from bearing carrier.

Standard size of crankpin journals is 36.959-36.975 mm (1.4551-1.4557 inches). Rod bearings are offered in 0.20 and 0.40 mm (0.0079 and 0.0157 inch) under-size.

To reinstall crankshaft, reverse removal procedure. Tighten rear bearing carrier screws to 19.6-23.5 N·m (15-18 ft.-lbs.) torque and screws of center bearing carriers to 29.4-34.3 N·m (21-26 ft.-lbs.) torque. Tighten carrier locating screws (31) to 29.4-34.3 N·m (21-26 ft.-lbs.) torque. Install seal carrier so top mark is towards head surface and tighten screws in a diagonal pattern to 9.8-11.8 N·m (7-9 ft.-lbs.) torque.

Reassembly is reverse order of removal. Reinstall piston and rod units as outlined in paragraph 25. Tighten timing cover screws to 9.8-11.3 N·m (7-8 ft.-lbs.). Tighten flywheel cap screws as outlined in paragraph 33. With reference to paragraph 18, reinstall engine in reverse order of removal.

CYLINDER LINER

All Models

31. REMOVE AND REINSTALL.

All models are equipped with dry type cylinder liners. Use suitable removal and installation tools to renew defective liners. Install cylinder liner so distance from top of liner to cylinder block head surface is plus or minus 0.025 mm (0.001 inch).

Standard inner diameter of cylinder liner is 64.000-64.019 mm (2.5197-2.5204 inches) on Models B6100D, B6100E, B6100HST-D and B6100HST-E and 68.000-68.019 mm (2.6772-2.6779 inches) on Models B5100D, B5100E, B7100D, B7100HST-D and B7100HST-E. The cylinder liner may be bored for 0.5 mm (0.02 inch) oversize piston installation.

OIL PUMP

All Models

32. R&R AND OVERHAUL. To remove oil pump, first remove timing gear cover as outlined in paragraph 24, then unscrew and remove pump.

Clearance between inner and outer rotor measured as shown in Fig. 22 should be 0.11-0.15 mm (0.0043-0.0059 inch) with an allowable limit of 0.20 mm (0.0079 inch). Clearance between outer

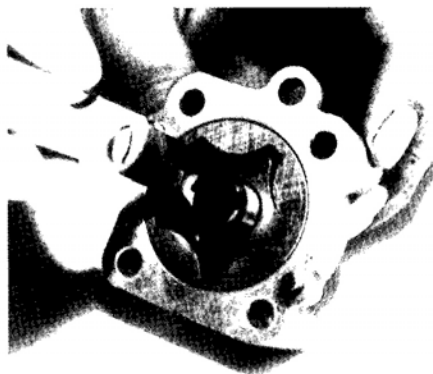


Fig. 22—Measure clearance between inner and outer oil pump rotors as shown. Desired clearance is 0.11-0.15 mm (0.0043-0.0059 inch).

rotor and pump body measured as shown in Fig. 23 should be 0.07-0.15 mm (0.0028-0.0059 inch) with an allowable limit of 0.25 mm (0.0098 inch). Individual pump components are not available; pump must be serviced as a complete unit.

Oil pressure relief ball (26—Fig. 16) and spring (27) are located in timing gear cover. Oil pump unrestricted delivery pressure should be 200-400 kPa (28-64 psi). Relief valve opening pressure is 290-340 kPa (43-50 psi) and is non-adjustable. Tighten screws securing pump to 9.8-11.8 N·m (7-9 ft.-lbs.) torque.

FLYWHEEL

All Models

33. REMOVE AND REINSTALL.

Separate engine from clutch housing as outlined in paragraph 52. Remove cap screws securing flywheel to rear of crankshaft.

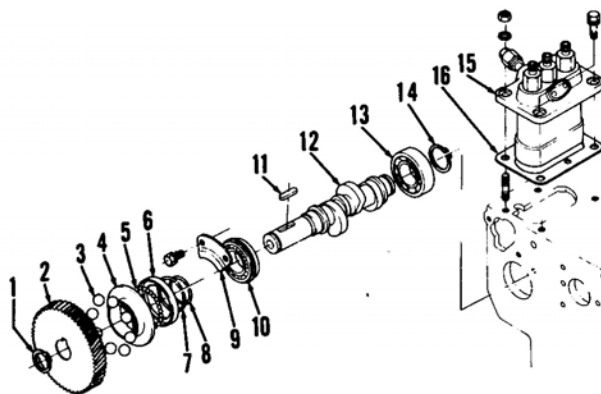
Retaining cap screws should be tightened to 53.9-58.8 N·m (40-43 ft.-lbs.) torque. Flywheel runout and wobble should not exceed the limit of



Fig. 23—Measure clearance between outer rotor and oil pump body as shown. Desired clearance is 0.07-0.15 mm (0.0028-0.0059 inch).

Fig. 24—Exploded view of injection pump camshaft and governor components.

1. Snap ring
2. Gear
3. Large governor balls (8)
4. Sleeve
5. Small governor balls (30)
6. Governor case
7. Retainer ring
8. Retainer ring
9. Bearing retainer
10. Bearing
11. Key
12. Injection pump camshaft
13. Bearing
14. Snap ring
15. Injection pump
16. Shim gasket



0.15 mm (0.0059 inch). Readjust flywheel position if measured reading is beyond limit. With reference to paragraph 52, reinstall engine to clutch housing in reverse order of removal.

GOVERNOR

All Models

34. R&R AND OVERHAUL. All models are equipped with a flyball type governor mounted on front end of fuel injection pump camshaft. Refer to Figures 16 and 24 for exploded views of governor mechanism. Ball movement against governor sleeve (4—Fig. 24) actuates control arm (8—Fig. 16) which is connected to fuel injection control rack. Flyball movement is balanced by governor spring (5).

Governor components are accessible after removing timing gear cover as outlined in paragraph 24. Inspect components and renew any which are excessively worn or damaged.

Low idle speed for all models is 750-800 rpm and is adjusted by turning idle speed screw (37—Fig. 16). High idle speed and maximum fuel limiting screws are sealed and should be adjusted by qualified personnel only. High idle speed should be 3000 rpm on Models B5100D and B5100E and 2800 rpm for all other models. Turn high idle speed screw (40) for adjustment.

Maximum fuel limiting stop should be set to prevent excessive smoke level at slight overload. To make adjustment, remove seal cap, loosen jam nut and turn spring housing (19) in to lower smoke level or out to raise smoke level.

DIESEL FUEL SYSTEM

Because of extremely close tolerances and precise requirements of all diesel components, it is of utmost importance that only clean fuel is used and careful maintenance be practiced at all times. Unless necessary special tools are available, service on injectors and injection pumps should be limited to removal, installation and exchange of complete assemblies. It is impossible to recalibrate an injection pump or reset an injector without proper specifications, equipment and training.

FUEL FILTERS AND LINES

All Models

35. OPERATION AND MAINTENANCE. Filter life depends upon careful maintenance as well as hours of operation and condition of operation. Necessity for careful filling with **CLEAN** No. 2 diesel fuel (No. 1 diesel fuel may be used when conditions are -10°C (15°F) or below) cannot be overstressed. To minimize contamination of

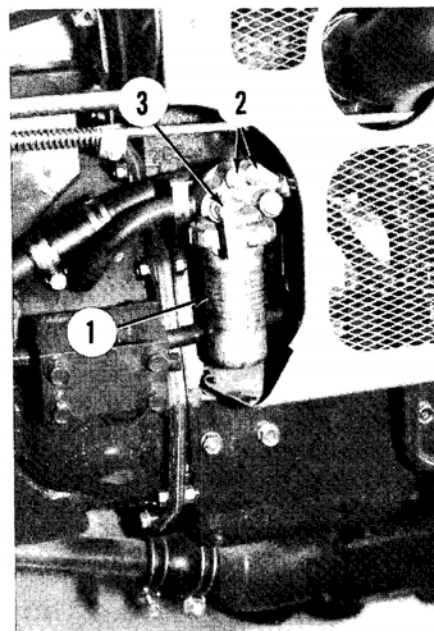


Fig. 25—View showing fuel filter pot (1), bleeding screws (2) and fuel shut-off valve (3).

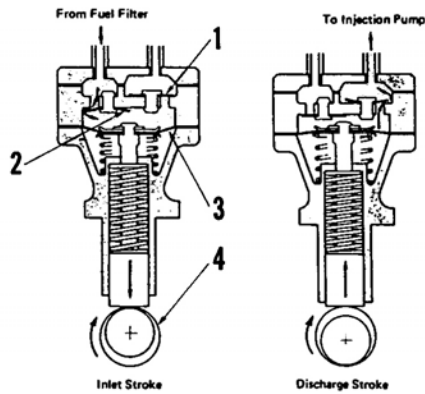


Fig. 25A—Cross-sectional views of fuel pump showing operation on inlet and discharge stroke.

- | | |
|----------------------|------------------|
| 1. Outlet reed valve | 3. Diaphragm |
| 2. Inlet reed valve | 4. Fuel camshaft |

diesel fuel system, the following precautions are recommended.

Fill fuel tank after use and before storage, to eliminate presence of humid air in tank and reduce contamination due to condensation.

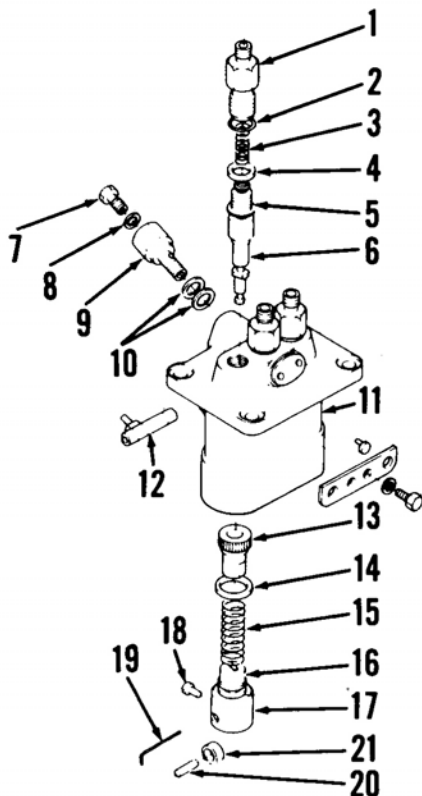


Fig. 26—Exploded view of fuel injection pump.

- | | |
|--------------------------|--------------------|
| 1. Delivery valve holder | 12. Control rack |
| 2. "O" ring | 13. Control sleeve |
| 3. Spring | 14. Washer |
| 4. Shim | 15. Spring |
| 5. Delivery valve assy. | 16. Spring seat |
| 6. Plunger | 17. Tappet |
| 7. Air bleed screw | 18. Guide pin |
| 8. Gasket | 19. Pin |
| 9. Adapter | 20. Pin |
| 10. Gaskets | 21. Roller |
| 11. Pump body | |

Remove filter pot (1—Fig. 25) and drain off any water at least every 100 hours (more often if trouble is suspected). Rinse out inside of pot and filter element with kerosene.

NOTE: If filter element is severely contaminated, renewal is suggested.

Check fuel lines for aging or leaks. Tighten all clamps periodically. Fuel lines should be renewed at least every two years unless damage is noted earlier.

36. BLEED FUEL SYSTEM. The fuel system should be bled if fuel tank is allowed to run dry, if fuel lines, filter or other components within the system have been disconnected or removed, or if engine has not operated for a long period of time. If engine fails to start or if it starts, then stops, the cause could be air in the system, which should be removed by bleeding.

To bleed fuel system, make sure fuel tank has a sufficient amount of fuel, then open fuel shut-off valve (3—Fig. 25). Unscrew bleeding screws (2) two to three turns. Allow fuel to drain from bleed screw until air-free fuel appears, then tighten bleed screws. Open air bleed screw (7—Fig. 26) and place throttle lever in fully closed position. Turn engine over for approximately 10 seconds, then close screw (7) when air bubbles disappear from fuel. Disconnect high pressure fuel lines from injectors. Rotate engine, then reconnect fuel lines when air-free fuel flows from fuel lines.

FUEL PUMP

All Models

36A. Fuel pump mounts to right side of engine beneath injection pump assembly. Fuel pump is driven by a cam on the fuel camshaft. A diaphragm and two reed valves are used to draw fuel into pump chamber on the downward stroke and discharged on the upward stroke. Valves allow fuel to flow only in one direction. A cross-sectional view of pump operation is shown in Fig. 25A. Pump normal operating pressure is 20 kPa (2.8 psi).

INJECTION PUMP

All Models

37. INJECTION PUMP TIMING. Start of injection should occur at 25° BTDC, or when "FI" flywheel timing mark aligns with end plate timing mark as shown in Fig. 27.

To check timing, disconnect fuel pressure lines from injection pump. Make sure fuel system is properly bled.

Move throttle control to full open position. Pull decompressor knob out and turn engine slowly until wetness appears at one of the disconnected fittings. Look through inspection window, timing marks should be aligned.

To adjust ignition timing, remove injection pump as outlined in following paragraph and add or delete shims (16—Fig. 24). Each shim alters timing approximately 1½ crankshaft degrees. Add shims to retard timing or delete shims to advance timing.

38. REMOVE AND REINSTALL.

While noting position of each screw, remove the four injection pump cover securing screws. Lightly tap cover with a suitable mallet to remove. Use a pair of pliers and unhook governor spring from lever arm leaving spring in housing. Remove cap screws and nuts retaining injection pump. Withdraw injection pump, care must be used when control rod is separated from control arm.

The injection pump should be tested and overhauled by a shop qualified in diesel injection pump repair.

The injection pump tappets are actuated by lobes on injection pump camshaft (12—Fig. 24). Inspect camshaft each time injection pump is removed.

Installation is reverse order of removal. Tighten pump retaining cap screws and nuts to 24-27 N·m (17-20 ft.-lbs.) and refer to previous section to adjust injection pump timing.

INJECTOR

All Models

WARNING: Fuel emerges from injector with sufficient force to penetrate the skin. When testing injector, keep yourself clear of nozzle spray.

39. REMOVE AND REINSTALL. Before removing an injector, or loosening injector lines, thoroughly clean in-

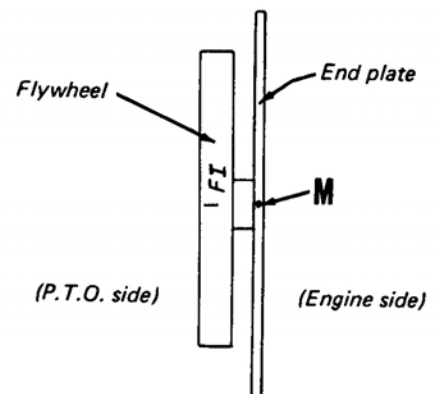


Fig. 27—View of "FI" injection timing mark on flywheel and timing mark (M) on end plate. Refer to text.

tor, lines and surrounding area using compressed air and a suitable solvent.

To remove injector unit, first remove high pressure line leading from injection pump to injector. Disconnect bleed line by removing nut and banjo fitting, or by pulling line(s) from banjo nipple fitting (2—Fig. 28). With pressure and bleed-back lines removed, unscrew injector from its mounting position on cylinder head.

When installing injector, make sure that machined seating surface in cylinder head is completely clean and free from carbon build-up. Use a new copper washer underneath injector nozzle and tighten injector carefully to 29-49 N·m (22-36 ft.-lbs.) torque.

40. TESTING. A complete job of testing and adjusting the injector requires use of special test equipment. Only clean, approved testing oil should be used in tester tank. Nozzle should be tested for opening pressure, seat leakage and spray pattern. When tested,

nozzle should open with a high-pitched buzzing sound, and cut off quickly at end of injection with a minimum of seat leakage and a controlled amount of back leakage.

Before conducting test, operate tester lever until fuel flows, then attach injector. Close valve to tester gage and pump tester lever for a few quick strokes to be sure nozzle valve is not stuck, and that possibilities are good that injector can be returned to service without disassembly.

41. OPENING PRESSURE. Open valve to tester gage and operate tester slowly while observing gage reading. Opening pressure should be 13.7 MPa (1988 psi).

Opening pressure is adjusted by adding or removing shims in shim pack (5—Fig. 28). Adding or removing one 0.1 mm (0.004 inch) thickness shim will change opening pressure approximately 980 kPa (142 psi).

42. SEAT LEAKAGE. Nozzle tip should not leak at a pressure less than 12.7 MPa (1846 psi). To check for leakage, actuate tester lever slowly and as gage needle approaches suggested test pressure, observe nozzle tip. Hold pressure for 10 seconds; if drops appear or nozzle tip becomes wet, valve is not seating and injector must be disassembled and overhauled as outlined in paragraph 44.

NOTE: Leakage of tester valve or connections will cause a false reading, showing up in this test as fast leakback. If a series of injectors fail to pass this test, the tester rather than injector units should be suspected.

43. SPRAY PATTERN. Spray pattern should be well atomized and slightly conical, emerging in a straight axis from nozzle tip. If pattern is wet, ragged or intermittent, nozzle must be overhauled or renewed.

44. OVERHAUL. Hard or sharp tools, emery cloth, grinding compound or other than approved solvents or lapping compounds must never be used. An approved nozzle cleaning kit is available through a number of specialized sources.

Wipe all dirt and loose carbon from exterior of nozzle and holder assembly. Refer to Fig. 28 for exploded view and proceed as follows:

Secure pressure fitting (4) in a soft-jawed vise or holding fixture and remove nozzle nut (10). Place all parts in clean calibrating oil or diesel fuel as they are removed, using a compartmented pan and using extra care to keep parts from each injector together and separate from other units.

Clean exterior surfaces with a brass wire brush, soaking in an approved carbon solvent, if necessary, to loosen hard carbon deposits. Rinse parts in clean diesel fuel or calibrating oil immediately

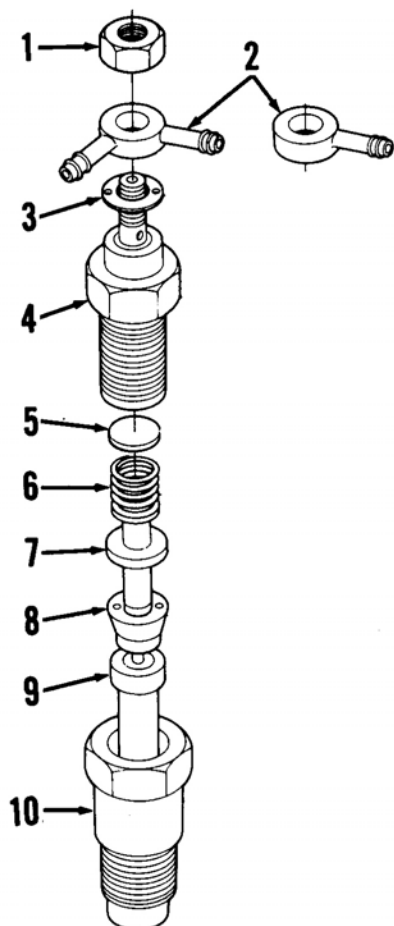


Fig. 28—Exploded view of injector.

- | | |
|---------------------|-------------------|
| 1. Nut | 6. Spring |
| 2. By-pass fitting | 7. Pressure pin |
| 3. Washer | 8. Spacer |
| 4. Pressure fitting | 9. Nozzle & valve |
| 5. Shim | 10. Nozzle nut |

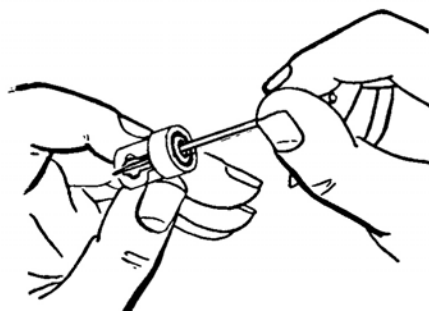


Fig. 29—Use a pointed hardwood stick to clean spray hole as shown.

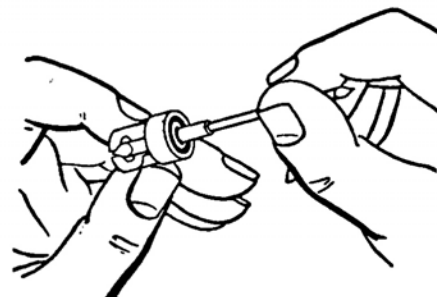


Fig. 31—Clean valve seat using brass scraper as shown.

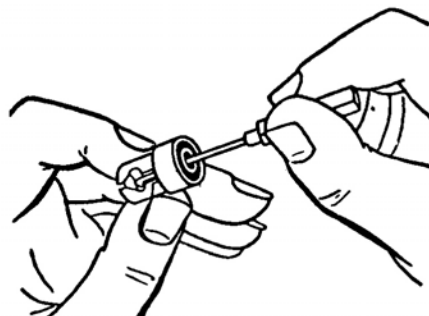


Fig. 30—Use hooked scraper to clean carbon from pressure chamber.

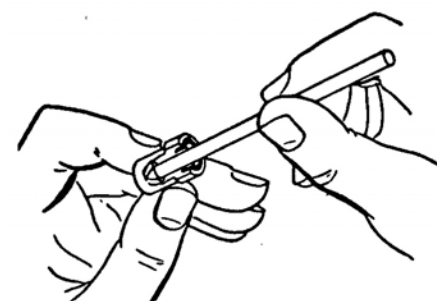


Fig. 32—Polish seat using polishing stick and mutton tallow.