



WORKSHOP MANUAL
KUBOTA TRACTOR

B7100HST
B6100HST



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GENERAL

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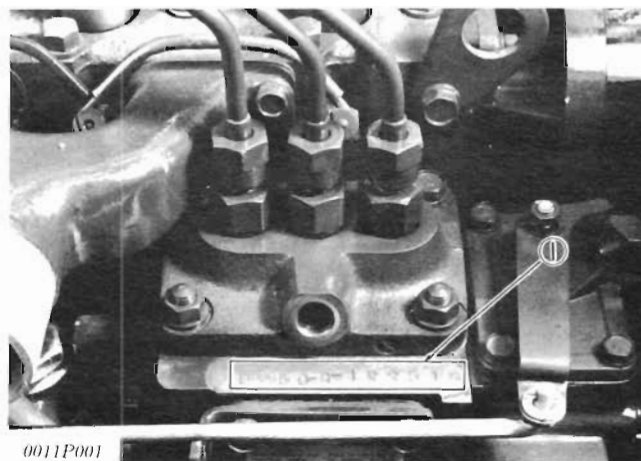
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Group 1

Tractor Identification

Serial Numbers

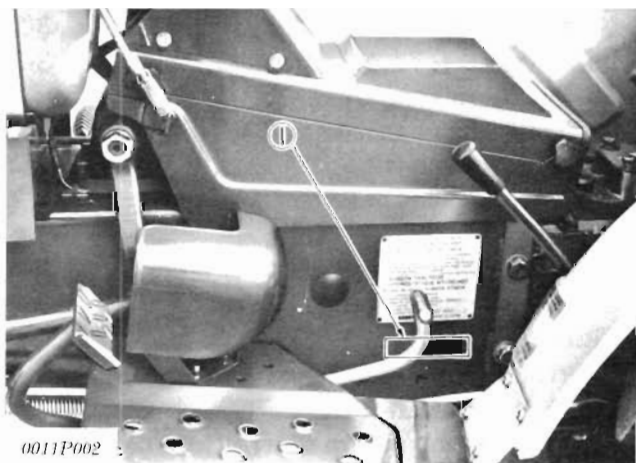
Engine Serial Number



1. Engine Serial Number

Fig. A-1 Engine Serial Number

Tractor Serial Number



1. Tractor Serial Number

Fig. A-2 Tractor Serial Number

Group 2

Specifications

General Specifications

Engine

Max. output/speed	12 kW/46.7 rps (16 HP/2800 rpm)
Max. torque/speed	50 Nm (5.1 kgf·m, 37 ft·lbs)/1800 rpm
Model	KUBOTA D750-AH
Type	Vertical, water-cooled 4 cycle diesel engine
Number of cylinders	3
Bore and stroke	68 mm x 70 mm ($2\frac{43}{64}$ in. x $2\frac{3}{4}$ in.)
Total cubic capacity	762 cm ³ (46.5 cu.in.)
Compression ratio	22
Direction of rotation	Counterclockwise, viewed from flywheel
Dimensions (Length x Width x Height)	721 mm x 697.5 mm x 631 mm ($28\frac{5}{64}$ in. x $27\frac{15}{32}$ in. x $24\frac{7}{32}$ in.)
Weight	93 kg (205 lbs.)
Combustion chamber	Spherical combustion chamber type
Fuel injection pump type (Model)	Bosch Type K Mini Pump (NP-PFR3KD50/2NP4)
Fuel injection nozzle type (Model)	Throttle Type (ND-DN12SD12)
Injection pressure	13.7 to 14.7 MPa (140 to 150 kgf/cm ² , 1988 to 2130 psi)
Injection timing	0.401 to 0.436 rad. (23° to 25°) before T.D.C.
Fuel	
Type	Diesel fuel No. 2-D (ASTM D975)
Consumption	200 g/ps·h (0.446 lbs./Hp·h)
Fuel supply pump normal operating pressure	20 kPa (0.2 kgf/cm ² , 2.8 psi)
Cooling	With pressurized radiator
Lubrication	Forced lubrication by trochoid pump and full-flow micronic oil filter with bypass valve.
Starting	Electric starter with glow plug, compression release

Clutch

Type	Dry, single plate type
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Steering

Type	Ball screw type, manual steering
Gear ratio	15.4 : 1

Transmission

Type	Hydrostatic transmission and gear shift (high, low)
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Hydrostatic Transmission (H.S.T.)

Pump

Type	Variable displacement piston pump
Displacement	0 to 45.9 ℓ/min. (0 to 12.1 U.S. gals./min.) at engine 2800 rpm
Swashplate angle	−0.28 to 0.28 rad. (−16° to 16°)

Motor

Type	Fixed displacement piston motor
Displacement	45.9 ℓ/min. (12.1 U.S. gals./min.)
Swashplate angle	0.28 rad. (16°)

Charge pump type Trochoid pump

Charge pump displacement 13.7 ℓ/min. (3.6 U.S. gals./min.) at engine 2800 rpm

Oil capacity 0.6 ℓ (0.6 U.S. qts.)

Oil filter cartridge 10 μm (0.010 mm, 0.0004 in.) meshes
(Installed with 3/4-16 UNF unified fine screw threads)

Weight 15.7 kg (34.6 lbs.)

Oil Cooler

Type Corrugated fin type radiator

Brake

Type Right and left independent with dry drum

Parking brake Hook-interlocked with main brake

Travel Speeds

At rated engine speed with 8–16 (BS) tires.

Forward

1st	0 to 5.7 km/h (0 to 3.5 mph)
2nd	0 to 14.5 km/h (0 to 9.0 mph)

Reverse

1st	0 to 3.9 km/h (0 to 2.4 mph)
2nd	0 to 10 km/h (0 to 6.2 mph)

PTO

Direction of revolution	Front, Mid	clockwise viewed from front end
	Rear	clockwise viewed from rear end
Size	Mid	involute spline SAE No. 5
	Rear	1⅜ in. 6 spline
Speed (engine speed 2800 rpm)	Front	direct to crankshaft (optional)
	Mid	2450 rpm
	Rear	540, 850 rpm

Three-point Linkage CAT. 1

Capacities

Engine crankcase 3.9 ℓ (4.1 U.S. qts.)

Radiator 4.6 ℓ (4.9 U.S. qts.)

Fuel tank 13 ℓ (3.4 U.S. gals.)

Steering gear box	0.2 ℓ (0.2 U.S. qts.)
Transmission — hydraulic system	13.5 ℓ (3.6 U.S. gals.) [include hydrostatic transmission case 0.6 ℓ (0.6 U.S. qts.)]
Front differential case	1.5 ℓ [1.6 U.S. qts.] only 4 WD
Front wheel axle case	each side 0.5 ℓ (0.5 U.S. qts.) only 4 WD

Lubricants (Oil Classification)

Engine crankcase	Engine oil API Service Class CC or CD Above 25°C (77°F) SAE 30 or 10 W-30 0 to 25°C (32° to 77°F) SAE 20 or 10 W-30 Below 0°C (32°F) SAE 10 W or 10 W-30
Transmission (hydraulic system, hydrostatic transmission)	
Hydrostatic Transmission Oil	
Maker	Brand
KUBOTA	UDT oil
Shell	DONAX-TD, DONAX-TM
Mobil	Mobil Fluid 350, 423
Exxon	Torque Fluid 56
J.I. Case	TCH Fluid
White Motor	Hydraulic Oil Type 55
Ford	Tractor Hydraulic Fluid
Steering gear box	SAE 80 Gear Oil
Front differential case	SAE 80 Gear Oil
Front wheel gear case	SAE 80 Gear Oil

Front Wheel Alignment

Kingpin inclination	4 WD 0.175 rad. (10°), 2 WD 0.140 rad. (8°)
Toe-in	0 to 5 mm (0 to $\frac{1}{4}$ in.)
Camber angle	0.035 rad. (2°)
Caster angle	4 WD 0.015 rad (50') [Tires 6-12, 8-16 BS] 2 WD 0 rad. (0°) [Tires 4.00-9, 8-16 BS]

Hydraulic System

Control type	Spool sliding, closed center type
Pump type (Model)	Gear pump (GP-OB-9.6-3127C)
Displacement	11.2 ℓ/min (11.8 U.S. qts./min) engine speed 2800 rpm
Full flow pressure	10.8 to 11.8 MPa (110 to 120 kgf/cm ² 1570 to 1710 psi) Oil temp. 40 to 45°C (104 to 113°F)
Cylinder bore x stroke	60 mm x 78 mm ($2\frac{3}{4}$ in. x $3\frac{1}{8}$ in.)
Max. lift	4410 N, (450 kgf, 1000 lbs.)

Electric System

Battery	
Model	NT80-S6L
Capacity	12 V x 45 Ah
Dimensions (length x width x height)	192 mm x 127 mm x 227 mm ($7\frac{1}{16}$ in. x 5 in. x $8\frac{1}{16}$ in.)

AC Dynamo

Nominal voltage	12 V
Maximum output	10 A, 120 W (35 A, 420 W ... Option)
Rotating direction	Clockwise, viewed from the pulley
Polarity	Negative grounding

Regulator

Type	Thyristor direct control type
Nominal voltage	14.0 to 15.0 V

Starter

Type	Magnet switch type
Nominal voltage	12 V
Nominal output	0.8 kW
Time rating	Max. 10 seconds tolerant continually revolving
Rotating direction	Clockwise, viewed from the pinion
Number of pinion teeth	9

Glow plug

Type	Sheathed type (Bar type)
Voltage, current (with one plug)	Amperage is approx. 7 A, after DC 10.5 V is applied for 30 seconds.

Glow plug controller

Amperage	20 A
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Tractor Dimensions

Items		B7100 HST-D (4WD)		
Tire size	Front	6 – 12	20.5 x 8.00 – 10	6 – 12
	Rear	8 – 16	29 x 12.00 – 15	8 – 16
Farm or Turf		Farm	Turf	Farm
Tire Brand		Goodyear	Goodyear	Bridgestone
Overall Length		2135 mm (84 ¹ / ₁₆ in.)	2100 mm (82 ³ / ₆₄ in.)	2130 mm (83 ⁵ / ₆₄ in.)
Overall Width		1040 mm (40 ⁵ / ₁₆ in.)	1140 mm (44 ⁷ / ₈ in.)	1040 mm (40 ⁵ / ₁₆ in.)
Overall Height		1190 mm (46 ²⁷ / ₃₂ in.)	1165 mm (45 ⁵ / ₆₄ in.)	1190 mm (46 ²⁷ / ₃₂ in.)
Wheel Base		1400 mm (55 ¹ / ₈ in.)	1400 mm (55 ¹ / ₈ in.)	1400 mm (55 ¹ / ₈ in.)
Minimum Ground Clearance * 1		240 mm (9 ²⁹ / ₆₄ in.)	225 mm (8 ⁵⁵ / ₆₄ in.)	240 mm (9 ²⁹ / ₆₄ in.)
Tread (Front Wheel)		845 mm (33 ¹⁷ / ₆₄ in.)	895 mm (33 ¹⁵ / ₆₄ in.)	850 mm (33 ¹⁵ / ₃₂ in.)
Tread (Rear Wheel)	1	725 mm (28 ³⁵ / ₆₄ in.)	—	660 mm (25 ⁶³ / ₆₄ in.)
	2	775 mm (30 ³³ / ₆₄ in.)	—	710 mm (27 ⁶¹ / ₆₄ in.)
	3	825 mm (32 ³¹ / ₆₄ in.)	815 mm (32 ³ / ₃₂ in.)	760 mm (29 ⁵⁹ / ₆₄ in.)
	4	—	—	870 mm (34 ¹ / ₄ in.)
Weight				570 kg (1260 lbs.)
Turning Radius with Brake				2080 mm (82 in.)

*1 to transmission case bottom

Items		B7100 HST-E (2WD)		
Tire size	Front	6.90-9	20.5 x 8.00 – 10	4.00 – 9
	Rear	8 – 16	29 x 12.00 – 15	8 – 16
Farm or Turf		Farm	Turf	Farm
Tire Brand		Goodyear	Goodyear	Bridgestone
Overall Length		2135 mm (84 $\frac{1}{16}$ in.)	2105 mm (82 $\frac{7}{8}$ in.)	2135 mm (84 $\frac{1}{16}$ in.)
Overall Width		980 mm (38 $\frac{37}{64}$ in.)	1010 mm (39 $\frac{49}{64}$ in.)	980 mm (38 $\frac{37}{64}$ in.)
Overall Height		1195 mm (47 $\frac{3}{64}$ in.)	1190 mm (46 $\frac{27}{32}$ in.)	1170 mm (46 $\frac{1}{16}$ in.)
Wheel Base		1390 mm (54 $\frac{5}{8}$ in.)	1390 mm (54 $\frac{5}{8}$ in.)	1390 mm (54 $\frac{5}{8}$ in.)
Minimum Ground Clearance *1		265 mm (10 $\frac{7}{16}$ in.)	250 mm (9 $\frac{27}{32}$ in.)	250 mm (9 $\frac{27}{32}$ in.)
Tread (Front Wheel)		770 mm (30 $\frac{5}{16}$ in.)	770 mm (30 $\frac{5}{16}$ in.)	685 mm (26 $\frac{31}{32}$ in.)
Tread (Rear Wheel)	1	725 mm (28 $\frac{35}{64}$ in.)	—	660 mm (25 $\frac{63}{64}$ in.)
	2	775 mm (30 $\frac{33}{64}$ in.)	—	710 mm (27 $\frac{61}{64}$ in.)
	3	825 mm (32 $\frac{31}{64}$ in.)	815 mm (32 $\frac{3}{32}$ in.)	760 mm (29 $\frac{59}{64}$ in.)
	4	—	—	870 mm (34 $\frac{1}{4}$ in.)
Weight				510 kg (1120 lbs.)
Turning Radius with Brake				1950 mm (77 in.)

*1 to transmission case bottom

Bolt Torques

Material Grade Nominal Dia. (mm)	Standard Bolt	Special Bolt	Special Bolt
	SS41, S20C	S43C, S48C (Refined)	SCR3, SCM 3 (Refined)
M 6	7.9 to 9.4 Nm 0.80 to 0.95 kgf·m 5.8 to 6.9 ft-lbs	9.8 to 11.3 Nm 1.00 to 1.15 kgf·m 7.2 to 8.3 ft-lbs	12.2 to 14.2 Nm 1.25 to 1.45 kgf·m 9.0 to 10.5 ft-lbs
M 8	17.6 to 20.6 Nm 1.80 to 2.10 kgf·m 13.0 to 15.2 ft-lbs	23.6 to 27.5 Nm 2.40 to 2.80 kgf·m 17.4 to 20.3 ft-lbs	29.4 to 34.3 Nm 3.00 to 3.50 kgf·m 21.7 to 25.3 ft-lbs
M10	39.2 to 45.1 Nm 4.00 to 4.60 kgf·m 28.9 to 33.3 ft-lbs	48.0 to 55.9 Nm 4.90 to 5.70 kgf·m 35.4 to 41.2 ft-lbs	60.7 to 70.6 Nm 6.20 to 7.20 kgf·m 44.8 to 52.1 ft-lbs
M12	62.8 to 72.5 Nm 6.40 to 7.40 kgf·m 46.3 to 53.5 ft-lbs	77.4 to 90.2 Nm 7.90 to 9.20 kgf·m 57.1 to 66.5 ft-lbs	102.9 to 117.7 Nm 10.50 to 12.00 kgf·m 75.9 to 86.8 ft-lbs
M14	107.9 to 125.5 Nm 11.00 to 12.80 kgf·m 79.6 to 92.6 ft-lbs	123.5 to 147.1 Nm 12.60 to 15.00 kgf·m 91.1 to 108.5 ft-lbs	166.8 to 196.2 Nm 17.00 to 20.00 kgf·m 123.0 to 144.7 ft-lbs
M16	166.8 to 191.2 Nm 17.00 to 19.50 kgf·m 123.0 to 141.0 ft-lbs	196.2 to 225.6 Nm 20.00 to 23.00 kgf·m 144.7 to 166.4 ft-lbs	259.9 to 304.0 Nm 26.50 to 31.00 kgf·m 191.7 to 224.2 ft-lbs
M18	245.1 to 284.4 Nm 25.00 to 29.00 kgf·m 180.8 to 209.8 ft-lbs	274.5 to 318.7 Nm 28.00 to 32.50 kgf·m 202.5 to 235.1 ft-lbs	343.3 to 402.0 Nm 35.00 to 41.00 kgf·m 253.2 to 296.5 ft-lbs
M20	333.4 to 392.2 Nm 34.00 to 40.00 kgf·m 245.9 to 289.3 ft-lbs	367.7 to 431.4 Nm 37.50 to 44.00 kgf·m 271.2 to 318.2 ft-lbs	490.3 to 568.8 Nm 50.00 to 58.00 kgf·m 361.6 to 419.5 ft-lbs

Bolt material grades are shown by numbers punched on the bolt heads.

Prior to tightening, be sure to check out the number as shown below:

IMPORTANT:

When tightening bolts for aluminum parts, (ex. differential gear case) tightening torques are 65% of the values shown in the table.

Punched Number	Bolt Material Grade	
None	Standard Bolts	SS41, S20C
7	Special Bolts	S43C, S48C (Refined)
9	Special Bolts	SCM3, SCR3 (Refined)

Specifications

B6100HST

General Specifications

Engine

Max. output/speed	10.4 kW/46.7 rps (14 HP/2800 rpm)
Max. torque/speed	44 Nm (4.45 kgf·m, 32 ft-lbs)/1900 rpm
Model	KUBOTA D650-AH
Type	Vertical, water-cooled 4 cycle diesel engine
Number of cylinders	3
Bore and stroke	64 mm x 70 mm (2 1/2 in. x 2 3/4 in.)
Total cubic capacity	675 cm ³ (41.2 cu. in.)
Compression ratio	22
Direction of rotation	Counterclockwise, viewed from flywheel
Dimensions (Length x Width x Height)	538 mm x 656 mm x 610 mm (21 3/16 in. x 25 5/16 in. x 24 1/16 in.)
Weight	93 kg (205 lbs.)
Combustion chamber	Turbulence combustion chamber type
Fuel injection pump type (Model)	Bosch Type K mini Pump (NP-PFR 3KD 50/2NP 4)
Fuel injection nozzle type (Model)	Throttle Type (ND-DN12SD12)
Injection pressure	13.7 to 14.7 MPa (140 to 150 kgf/cm ² , 1988 to 2130 psi)
Injection timing	0.401 to 0.436 rad. (23° to 25°) before T.D.C.
Fuel	
Type	Diesel fuel No. 2-D (ASTM D975)
Consumption	205 g/ps·h (0.446 lbs./Hp·h)
Fuel supply pump normal operating pressure ..	20 kPa (0.2 kgf/cm ² , 2.8 psi)
Cooling	Water-cooled type with pressurized radiator
Lubrication	Forced lubrication by trochoid pump and full-flow micronic oil filter with bypass valve
Starting	Electric starter with glow plug, compression release

Clutch

Type	Dry, single plate type
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Steering

Type	Ball screw type, manual steering
Gear ratio	15.4 : 1

Transmission

Type	Hydrostatic transmission and gear shift (high, low)
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Hydrostatic Transmission (H.S.T.)

Pump

Type	Variable displacement piston pump
Displacement	0 to 45.9 ℓ/min. (0 to 12.1 U.S. gals./min.) at engine 2800 rpm
Swashplate angle	-0.28 to 0.28 rad. (-16° to 16°)

Motor

Type	Fixed displacement piston motor
Displacement	45.9 ℓ/min. (12.1 U.S. gals./min.)
Swashplate angle	0.28 rad. (16°)

Charge pump type	Trochoid pump
Charge pump displacement	13.7 ℓ/min. (3.6 U.S. gals./min.) at engine 2800 rpm
Oil capacity	0.6 ℓ (0.6 U.S. qts.)
Oil filter cartridge	10 μm (0.010 mm, 0.0004 in.) meshes (Installed with 3/4-16 UNF unified fine screw threads)
Weight	15.7 kg (34.6 lbs.)

Oil Cooler

Type	Corrugated fin type radiator
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Brake

Type	Right and left independent with dry drum
Parking brake	Hook-interlocked with main brake

Travel Speeds

At rated engine speed with 7-16 (BS) tires.

Forward

1st	0 to 5.9 km/h (0 to 3.7 mph)
2nd	0 to 14.8 km/h (0 to 9.2 mph)

Reverse

1st	0 to 3.9 km/h (0 to 2.4 mph)
2nd	0 to 10 km/h (0 to 6.2 mph)

PTO

Direction of revolution	Front, Mid	clockwise viewed from front end
	Rear	clockwise viewed from rear end
Size	Mid	involute spline SAE No. 5
	Rear	1 3/8 in. 6 spline
Speed (engine speed 2800 rpm)	Front	direct to crankshaft (optional)
	Mid	2450 rpm
	Rear	540, 850 rpm

Three-point Linkage	CAT. 1
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Capacities

Engine crankcase	3.9 ℓ (4.1 U.S. qts.)
Radiator	4.6 ℓ (4.9 U.S. qts.)
Fuel tank	13 ℓ (3.4 U.S. gals.)

Steering gear box	0.2 ℓ (0.2 U.S. qts.)
Transmission — hydraulic system	13.5 ℓ (3.6 U.S. gals.) [include hydrostatic transmission case 0.6 ℓ (0.6 U.S. qts.)]
Front differential case	0.15 ℓ (0.16 U.S. qts.) only 4WD
Front wheel axle case	each side 0.5 ℓ (0.5 U.S. qts.) only 4WD

Lubricants (Oil Classification)

Engine crankcase	Engine oil API Service Class CC or CD Above 25°C (77°F) SAE 30 or 10 W-30 0 to 25°C (32° to 77°F) SAE 20 or 10 W-30 Below 0°C (32°F) SAE 10 W or 10 W-30
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Transmission (hydraulic system, hydrostatic transmission)

Hydrostatic Transmission Oil

Maker	Brand
KUBOTA	UDT oil
Shell	DONAX-TD, DONAX-TM
Mobil	Mobil Fluid 350, 423
Exxon	Torque Fluid 56
J.I. Case	TCH Fluid
White Motor	Hydraulic Oil Type 55
Ford	Tractor Hydraulic Fluid
Steering gear box	SAE 80 Gear Oil
Front differential case	SAE 80 Gear Oil
Front wheel gear case	SAE 80 Gear Oil

Front Wheel Alignment

Kingpin inclination	4WD 0.209 rad. (12°), 2WD 0.140 rad. (8°)
Toe-in	0 to 5 mm (0 to $\frac{1}{8}$ in.)
Camber angle	0.035 rad. (2°)
Caster angle	4WD 0.009 rad. (30'), [Tires 6-12, 8.3-16 GY] 2WD 0.015 rad. (50'), [Tires 6.9-9, 8.3-16 GY]

Hydraulic System

Control type	Spool sliding, closed center type
Pump type (Model)	Gear pump (GP-OB-9.6-3127C)
Displacement	11.2 ℓ/min (11.8 U.S. qts./min) engine speed 2800 rpm
Full flow pressure	10.8 to 11.8 MPa (110 to 120 kgf/cm ² , 1570 to 1710 psi) Oil temp. 40 to 45°C (104 to 113°F)
Cylinder bore x stroke	60 mm x 78 mm ($2\frac{3}{4}$ in. x $3\frac{1}{16}$ in.)
Max. lift	4410 N, (450 kgf, 1000 lbs.)

Electric System

Battery

Model	NT80-S6L
Capacity	12 V x 45 Ah
Dimensions (length x width x height)	192 mm x 127 mm x 227 mm ($7\frac{9}{16}$ in. x 5 in. x $8\frac{1}{16}$ in.)

AC Dynamo

Nominal voltage	12 V
Maximum output	10 A, 120 W (35 A, 420 W ... Option)
Rotating direction	Clockwise, viewed from the pulley
Polarity	Negative grounding

Regulator

Type	Thyristor direct control type
Nominal voltage	14.0 to 15.0 V

Starter

Type	Magnet switch type
Nominal voltage	12 V
Nominal output	0.8 kW
Time rating	Max. 10 seconds tolerant continually revolving
Rotating direction	Clockwise, viewed from the pinion
Number of pinion teeth	9

Glow plug

Type	Sheathed type (Bar type)
Voltage, current (with one plug)	Amperage is approx. 7 A, after DC 10.5 V is applied for 30 seconds.

Glow plug controller

Amperage	20 A
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Tractor Dimensions

Items		B6100HST-D (4WD)			
Tire size	Front	6 – 12	20.5 x 8.00 – 10	5 – 12	
	Rear	8.3 – 16	29 x 12.00 – 15	7.2 – 16	
Farm of Turf		Farm	Turf	Farm	
Tire Brand		Goodyear	Goodyear	Front	Bridgestone
				Rear	Goodyear
Overall Length		2130 mm (83 ⁵⁵ / ₆₄ in.)	2100 mm (82 ⁴³ / ₆₄ in.)	2105 mm (82 ⁷ / ₈ in.)	
Overall Width		1025 mm (40 ²³ / ₆₄ in.)	1120 mm (44 ² / ₃₂ in.)	1010 mm (39 ²³ / ₃₂ in.)	
Overall Height		1185 mm (46 ³¹ / ₃₂ in.)	1165 mm (45 ⁵⁵ / ₆₄ in.)	1155 mm (45 ¹⁵ / ₃₂ in.)	
Wheel Base		1400 mm (55 ¹ / ₈ in.)	1400 mm (55 ¹ / ₈ in.)	1400 mm (55 ¹ / ₈ in.)	
Minimum Ground Clearance *1		240 mm (9 ²⁹ / ₆₄ in.)	225 mm (8 ⁵⁵ / ₆₄ in.)	230 mm (9 ¹ / ₁₆ in.)	
Tread (Front Wheel)		785 mm (30 ⁵⁷ / ₆₄ in.)	825 mm (32 ³¹ / ₆₄ in.)	785 mm (30 ⁵⁷ / ₆₄ in.)	
Tread (Rear Wheel)	1	725 mm (28 ³⁵ / ₆₄ in.)	—	725 mm (28 ³⁵ / ₆₄ in.)	
	2	775 mm (30 ³³ / ₆₄ in.)	—	775 mm (30 ³³ / ₆₄ in.)	
	3	825 mm (32 ³¹ / ₆₄ in.)	815 mm (32 ³ / ₃₂ in.)	825 mm (32 ³¹ / ₆₄ in.)	
	4	—	—	—	
Weight				560 kg (1230 lbs.)	
Turning Radius with Brake			2235 mm (91 ⁵⁹ / ₆₄ in.)		

*1 to transmission case

Items		B6100HST-E (2WD)		
Tire size	Front	6.9 – 9	18 x 8.50 – 8	4.00 – 9
	Rear	8.3 – 16	29 x 12.00 – 15	7.2 – 16
Farm or Turf		Farm	Turf	Farm
Tire Brand		Goodyear	Goodyear	Goodyear
Overall Length		2130 mm (83 ⁵⁵ / ₆₄ in.)	2105 mm (82 ⁷ / ₈ in.)	2105 mm (82 ⁷ / ₈ in.)
Overall Width		1025 mm (40 ²³ / ₆₄ in.)	1120 mm (44 ³ / ₃₂ in.)	1010 mm (39 ²³ / ₃₂ in.)
Overall Height		1190 mm (46 ²⁷ / ₃₂ in.)	1170 mm (46 ¹ / ₁₆ in.)	1155 mm (45 ¹⁵ / ₃₂ in.)
Wheel Base		1390 mm (54 ⁵ / ₈ in.)	1390 mm (54 ⁵ / ₈ in.)	1390 mm (54 ⁵ / ₈ in.)
Minimum Ground Clearance * 1		260 mm (10 ²⁷ / ₆₄ in.)	240 mm (9 ²⁹ / ₆₄ in.)	230 mm (9 ¹ / ₁₆ in.)
Tread (Front Wheel)		770 mm (30 ⁵ / ₁₆ in.)	770 mm (30 ⁵ / ₁₆ in.)	685 mm (26 ³¹ / ₃₂ in.)
Tread (Rear Wheel)	1	725 mm (28 ³⁵ / ₆₄ in.)	—	725 mm (28 ³⁵ / ₆₄ in.)
	2	775 mm (30 ³³ / ₆₄ in.)	—	775 mm (30 ³³ / ₆₄ in.)
	3	825 mm (32 ³¹ / ₆₄ in.)	815 mm (32 ³ / ₃₂ in.)	825 mm (32 ³¹ / ₆₄ in.)
	4	—	—	—
Weight				500 kg (1100 lbs.)
Turning Radius with Brake			2090 mm (82 ⁹ / ₃₂ in.)	

* 1 to transmission case

Group 3

Fuel and Lubricants

Fuel

KUBOTA Diesel Engines will not perform at peak efficiency unless the fuel listed below are used:

CAUTION:

Do not fill fuel tank when engine is running or hot. Do not smoke when filling fuel tank.

Wipe dust and dirt from around filler cap before removing it. Place cap in clean area.

IMPORTANT:

Do not permit dirt or other foreign matter to enter the fuel system. This may cause hard starting, poor performance and engine damage. Always use clean fuel storage cans and funnels.

Checking and Refueling



1. Fuel Tank Cap 2. Fuel Tank

Fig. A-3 Checking and Refueling Fuel Tank

IMPORTANT:

Stop the engine before filling with fuel. Keep away from sparks and flames.

- (1) Check the fuel level. Make sure the fuel level does not fall below the prescribed lower limit.
- (2) Use grade No. 2-D fuel as defined by ASTM D975 for diesel fuel oil.

Fuel tank capacity: 13 ℓ (3.4 U.S. gals.)

NOTE:

- Always use a strainer when refueling, or dust and sand may enter to damage the fuel injection pump.
- If the fuel tank becomes empty, air enters the fuel system. If this happens, the fuel system must be vented.

Venting the Fuel System

Air must be vented when:

The fuel filter and piping are removed.

The fuel tank becomes completely empty.

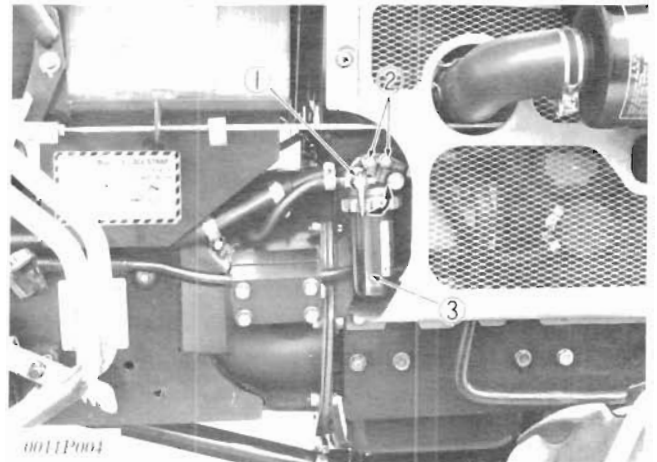
The tractor has not been used for an extended time.

Venting procedure is as follows:

IMPORTANT:

Do not perform venting when the engine is hot.

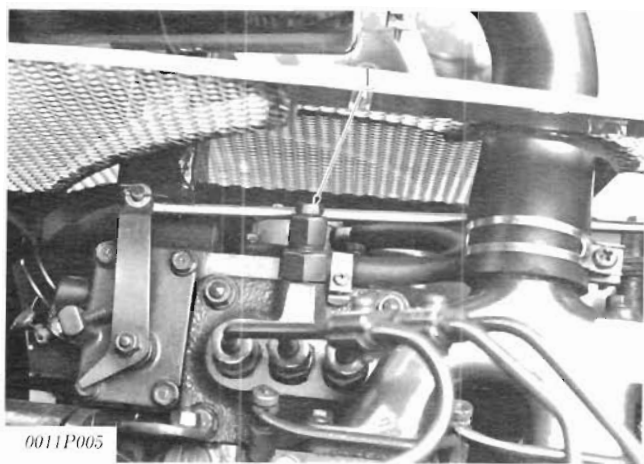
- (1) Fill the fuel tank with fuel, and open the fuel cock.



1. Fuel Cock 2. Vent Screw 3. Fuel Filter Pot

Fig. A-4 Venting Air from Fuel Filter

- (2) Twist off the air vent screw at the top of the filter by turning it twice.
- (3) When bubbles disappear from fuel coming out of the plug, twist it back on.



1. Air Vent Plug

Fig. A-5 Venting Air from Injection Pump

- (4) Open the air vent plug on the fuel injection pump.
- (5) Pull the accelerator lever back completely to stop the engine, and running the starter for about 10 seconds.

IMPORTANT:

Be sure to pull the accelerator lever completely back before run the starter.

- (6) Close the air vent plug when air bubbles disappear from the fuel flowing out.

Lubricants

Proper use of lubricating oil and grease is important to insure low upkeep costs, long tractor life, and satisfactory service.

Use only lubricants specified in this section and apply them at intervals according to the instructions in the lubrication and periodic service section.

Engine Lubricating Oil

We recommend KUBOTA Genuine Oil for use in the engine crankcase. KUBOTA Genuine Oil is compounded specifically for use in KUBOTA engines and provides superior lubrication under all conditions.

Checking Engine Crankcase Oil Level



1. Dip Stick

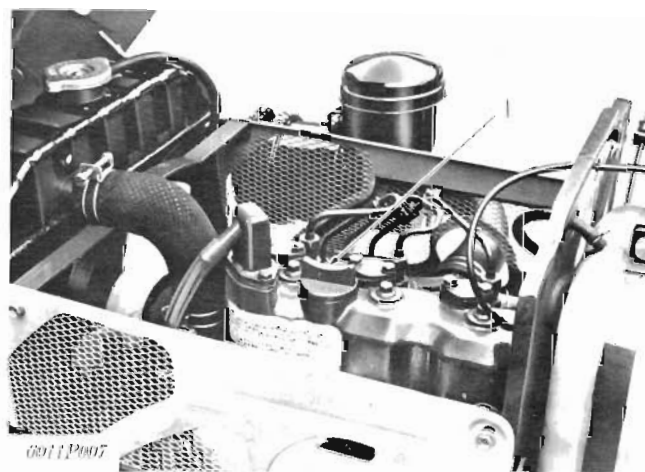
Fig. A-6 Checking Engine Crankcase Oil Level

With the tractor on level ground and the engine stopped for 5 minutes or more, remove the dip stick.

Read the engine oil level on the dip stick.

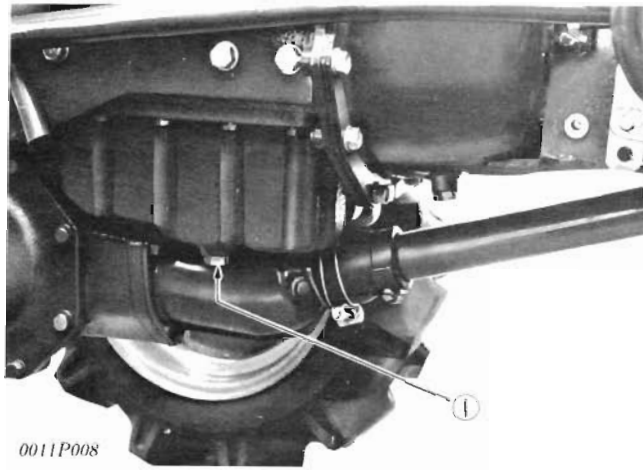
If the oil level is below the lower mark on the dip stick, add sufficient KUBOTA Genuine Engine Oil or its equivalent of the proper viscosity to bring the level to the upper marks.

Changing Engine Oil



1. Oil Port Plug

Fig. A-7 Engine Oil Port Plug



0011P008
1. Oil Drain Plug

Fig. A-8 Engine Oil Drain Plug

Drain the oil while the engine is still warm, by removing both the drain plug on the oil pan and oil cap, so that the oil may completely drain. Do not mix different brands of oil. If a different brand of oil should be employed, drain out the existing oil no matter how new it may be and then replace it. Do the same when using oil of a different viscosity.

IMPORTANT:

Before changing the oil, be sure to stop the engine.

SERVICE INTERVAL:

At initial 35 hours and then after every 75 hours.

Engine Oil Specifications

KUBOTA Genuine Oil (for diesel engines) or CC/CD class oils defined by API. It should be as follows according to temperature.

25°C (77°F) above	SAE30 or 10W-30
0° to 25°C (32°F to 77°F) . .	SAE20 or 10W-30
0°C (32°F) below	SAE10W or 10W-30

Cap. 3.9ℓ (4.1 U.S. qts.)

Changing Engine Oil Filter Cartridge



0011P006
1. Oil Filter Cartridge

Fig. A-9 Changing Engine Oil Filter Cartridge

- (1) Apply a slight coat of oil to the cartridge gasket.
- (2) Screw the new cartridge in by hand. Over tightening may cause deformation of rubber gasket.
- (3) After cartridge has been replaced, engine oil normally decreases a little. Check that the engine oil does not leak through the seal and be sure to read the oil level. Then, add engine oil up to the prescribed level.

IMPORTANT:

Be sure to stop the engine before changing the oil filter cartridge.

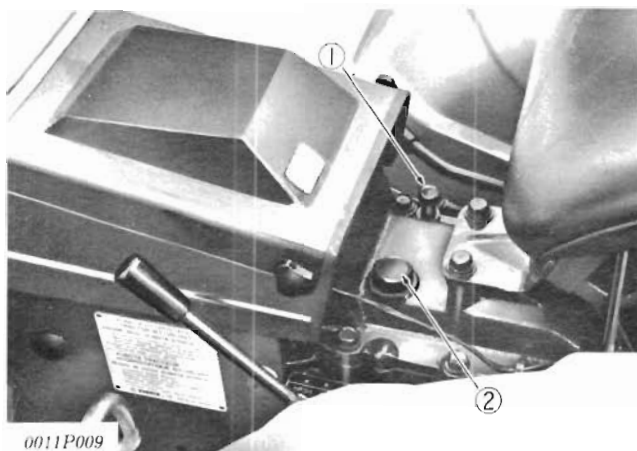
SERVICE INTERVAL:

Every 150 hours

NOTE:

To prevent serious damage to the lubricating system, replacement of element must be highly efficient. Use only a KUBOTA genuine filter or its equivalent.

Checking Transmission Oil Level



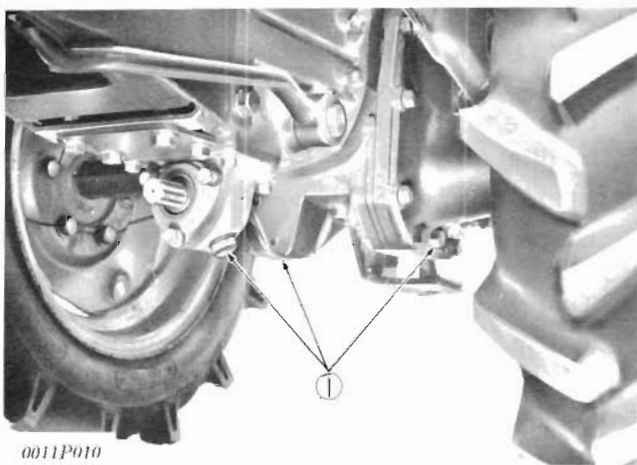
1. Dip Stick

2. Oil Port

Fig. A-10 Checking Transmission Oil Level

With the tractor on level ground, run the engine for a minute to fill the filter. Stop the engine and check the hydraulic system oil level with the dip stick. If the oil level is below the lower line on the dip stick, remove the filter cap and add KUBOTA Genuine Hydrostatic Transmission Oil or its equivalent to bring the oil level up to the upper line.

Changing Transmission Oil



1. Drain Plugs

Fig. A-11 Changing Transmission Oil

The oil in the transmission case is also used for the hydrostatic drive system.

To drain the transmission oil, place an oil pan underneath the transmission case and remove the drain plugs at the rear axle cases and mid PTO case.

After draining, disassemble and clean the strainers and change the oil filter cartridge. After reassembling fill with new hydrostatic transmission oil.

IMPORTANT:

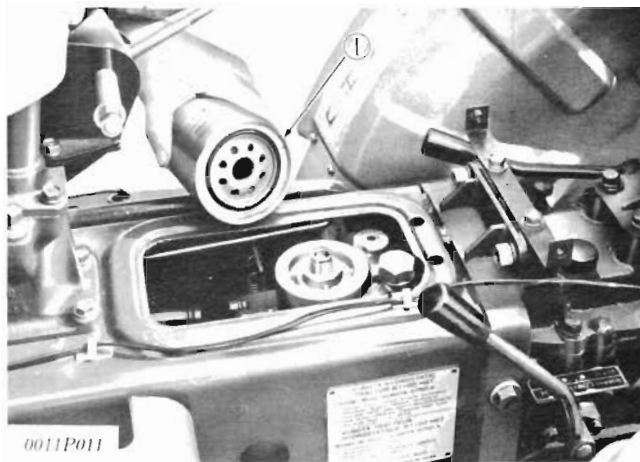
Be sure to stop the engine before changing the transmission oil.

Transmission Oil Capacity:
13.5ℓ (3.6 U.S. gals.)

IMPORTANT:

Never operate the tractor immediately after changing the transmission oil and filter cartridge. Keeping the engine at medium speed for a few minutes prevents damage to transmission.

Changing Transmission Oil Filter Cartridge



1. Oil Filter Cartridge

Fig. A-12 Changing Transmission Oil Filter Cartridge

- (1) Remove the 4 bolts which secure the cover. Detach the knob of the speed set device to remove the cover.
- (2) Remove the oil filter cartridge by using the filter wrench.
- (3) Lightly tighten the joint screw A by using a screwdriver.
- (4) Apply a slight coat of oil onto the cartridge gasket.
- (5) Screw the new cartridge in by hand. Over tightening may cause deformation of rubber gasket.
- (6) After the cartridge has been replaced, the transmission oil will decrease a little. Make sure that the transmission oil does not leak through the seal, and check the oil level.

IMPORTANT:

Be sure to stop the engine before changing the oil filters.

SERVICE INTERVAL:

At initial 50 hours and then after every 200 hours.

IMPORTANT:

To prevent serious damage to hydraulic system, replacement of filter must be a highly efficient, 10 μ m filter. Use only a KUBOTA genuine filter or its equivalent.

Cleaning Strainers

Since the fine particles in the oil can damage the component parts of the hydraulic system which is precision built to withstand high pressure, the suction pipes are provided with oil strainers at their ends. When changing transmission oil, disassemble and rinse the oil strainers with kerosene to completely clean them. For reassembly, take care not to damage any parts.

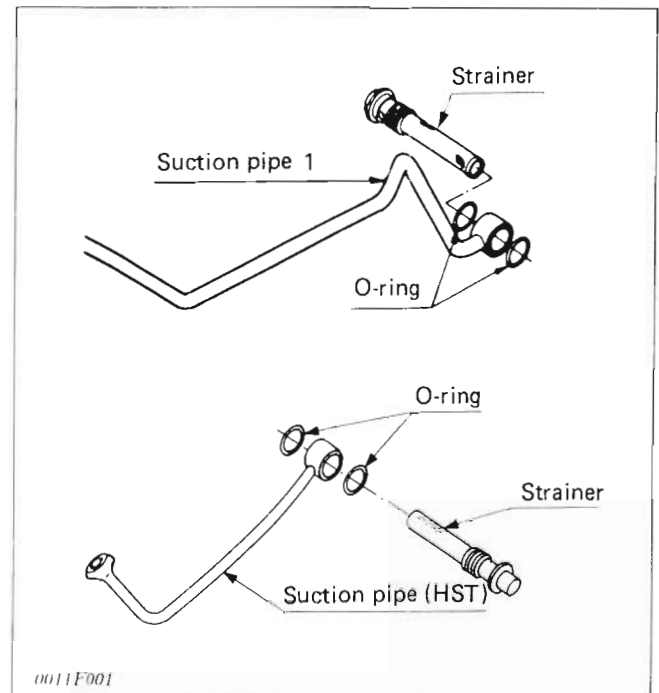


Fig. A-13

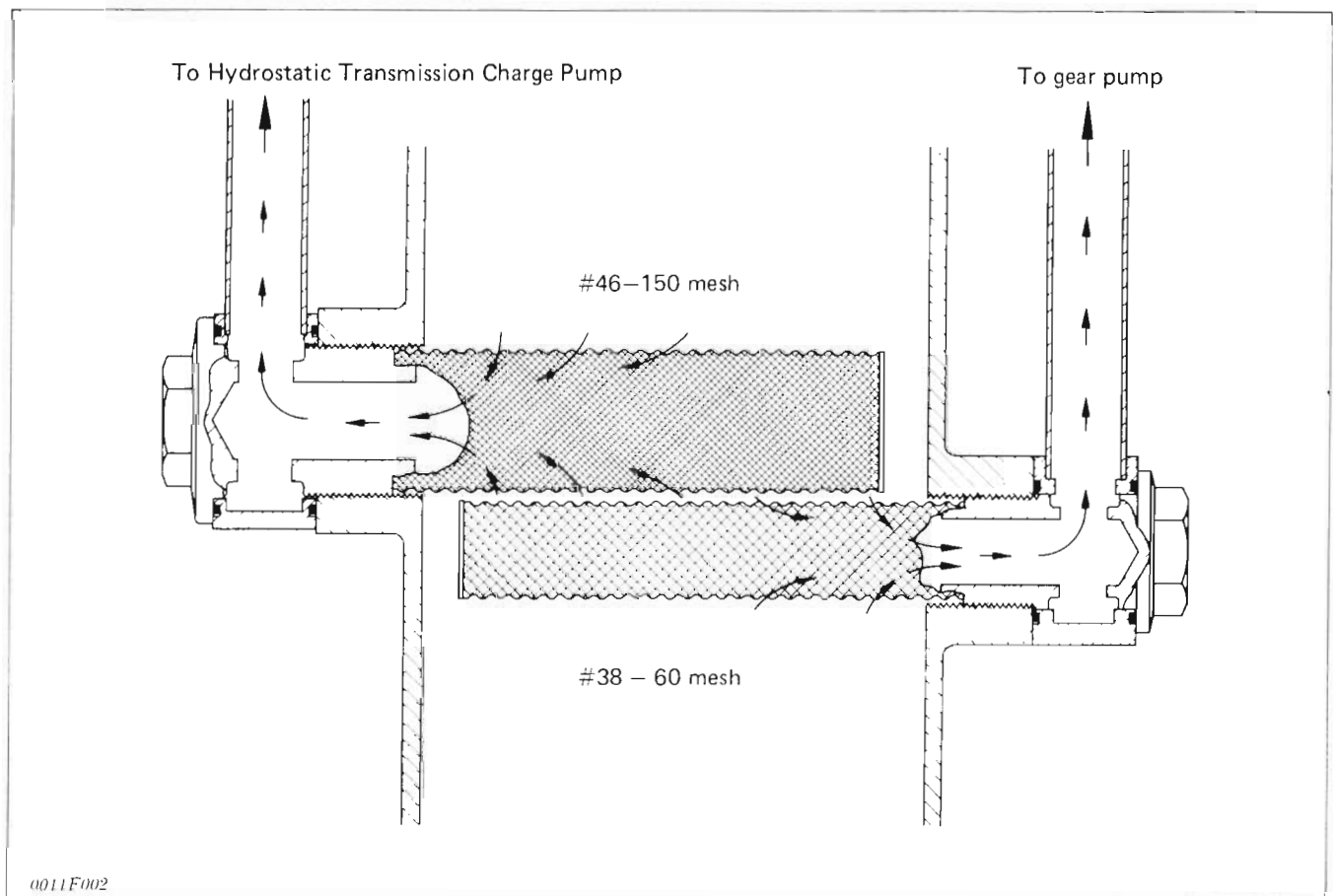
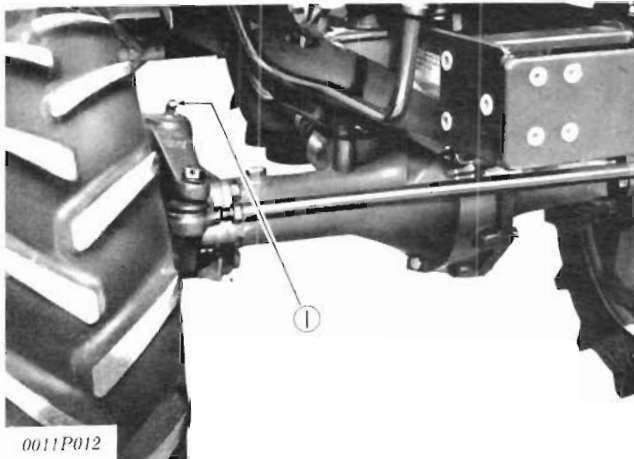


Fig. A-14 Oil Strainer Assembly

Lubricating Grease Fittings

Kingpins and Center Pin

Grease the kingpins and center pin, with the provided grease gun.

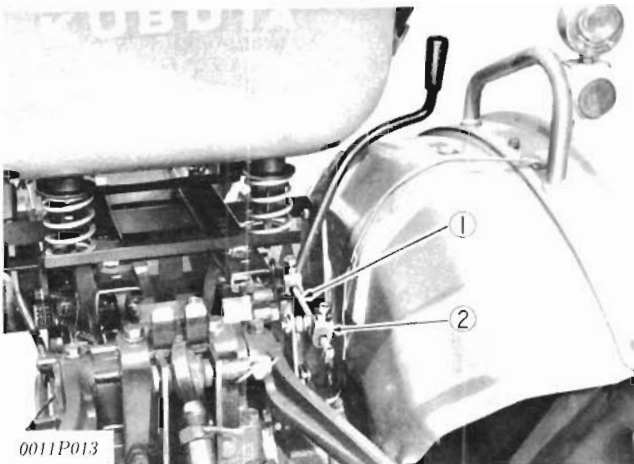


1. Kingpin

Fig. A-15 Greasing the Kingpin and Center Pin

Interlock Rod

Oil or grease the interlock rod and sliding holder.

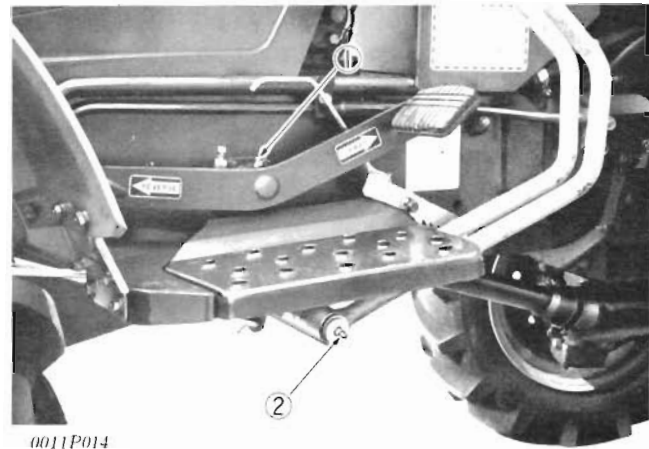


1. Interlock Rod 2. Sliding Holder

Fig. A-16 Oiling or Greasing the Interlocker Rod and Sliding Holder

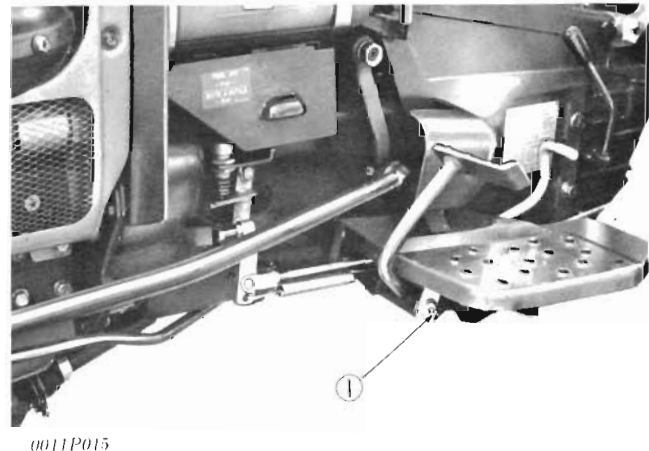
Pedal Shafts

Grease the grease nipples on both ends of the brake pedal shaft and the speed control pedal shaft.



1. Speed Control Pedal Shaft Grease Nipple 2. Brake Pedal Shaft Grease Nipple

Fig. A-17 Greasing Pedal Shafts

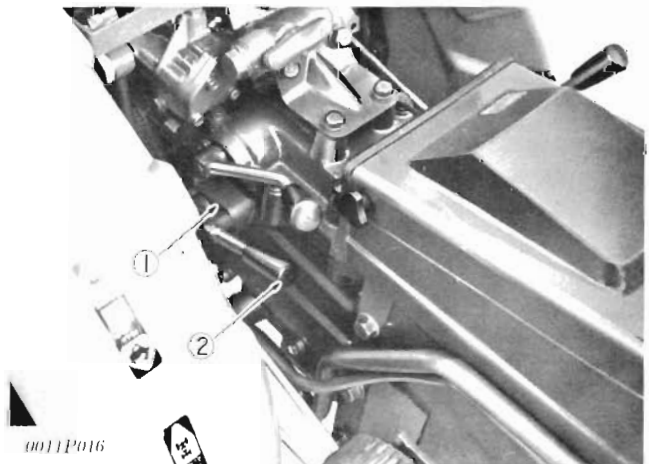


1. Pedal Shaft Grease Nipple

Fig. A-18 Greasing Pedal Shaft

Front Wheel Drive Lever (4WD)

Oil the ball race at the root of the front wheel drive lever.



1. Oil 2. Front Wheel Drive Lever

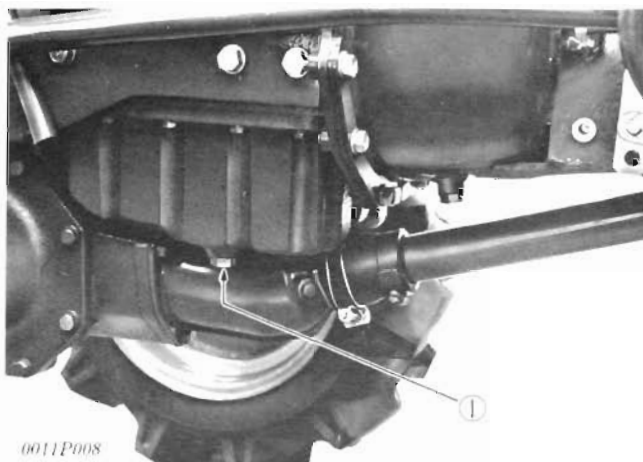
Fig. A-19 Oiling Front Wheel Drive Lever

Group 4

Separation

Separating Engine from Clutch Housing

1. Draining Engine Oil



1. Oil Drain Plug

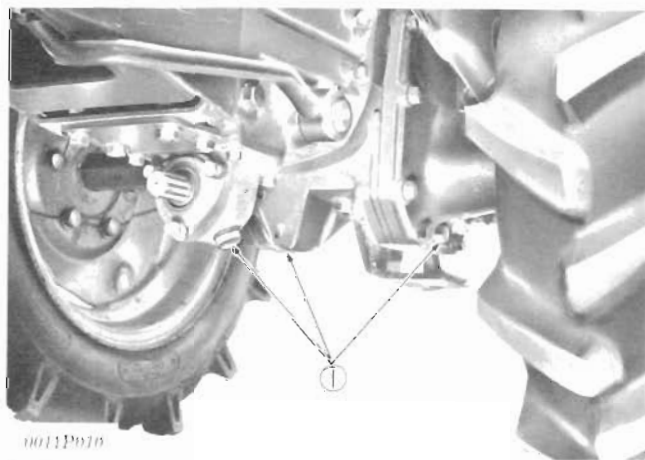
Fig. A-20 Draining Engine Oil

- (1) Loosen the drain plug on the lower left side of the engine and drain oil.

NOTE:

After draining oil, tighten the drain plug.

2. Draining Transmission Oil



1. Drain Plugs

Fig. A-21 Draining Transmission Oil

- (1) Drain oil from the drain plugs in the rear axle cases and mid PTO case.
- (2) Drain oil from the right and left front wheel gear cases.

NOTE:

After draining oil, tighten the drain plugs.

3. Removing Negative Battery Cord.

- (1) Open the bonnet (hood).
- (2) Disconnect the negative battery cord from the negative terminal.

4. Removing Air Cleaner

- (1) Remove the air cleaner assembly.

5. Removing Muffler

- (1) Detach the muffler.

6. Removing Side Covers (Right, Left)

- (1) Disconnect the lamp wiring.
- (2) Detach the side covers (Right, Left)

7. Removing Drag Link



Fig. A-22 Removing Drag Link

- (1) Remove the split pin.
- (2) Remove the nut connecting knuckle arm and drag link.
Draw out the rod end with tie-rod pin puller.

SPECIAL TOOLS:

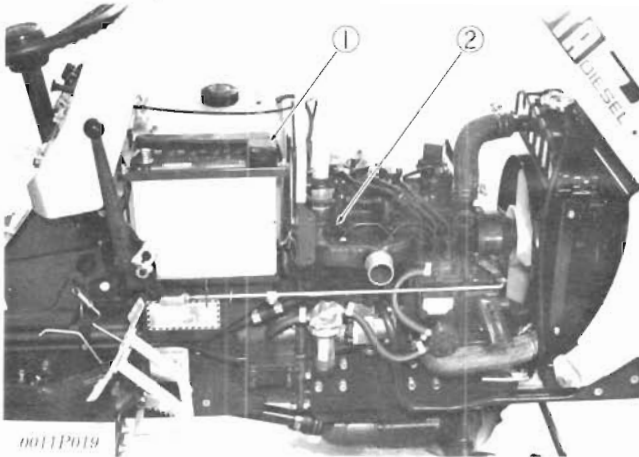
Tie-rod Pin Puller (Code No. 07916-06022)



0011P018

Fig. A-23 Tie-rod Pin Puller

8. Removing Electrical Wiring

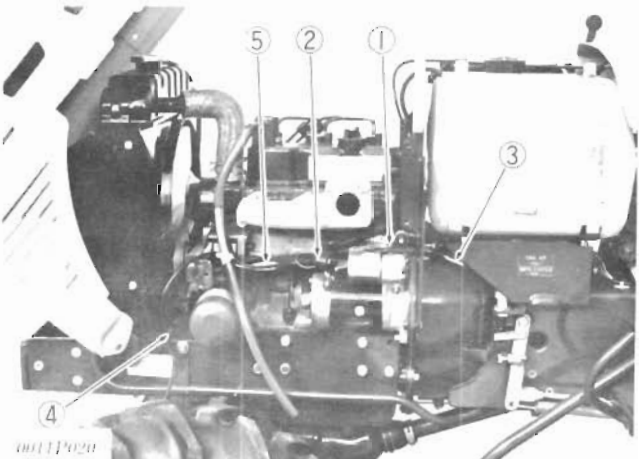


0011P019

1. Positive Battery Cord

2. Glow Plug Wiring

Fig. A-24 Removing Electrical Wiring



0011P020

1. Oil Switch Wiring

2. Starter Wiring

3. Safety Switch Cord

4. Headlight Wiring

5. Fan Dynamo Cords

Fig. A-25 Removing Electrical Wiring

- (1) Disconnect the positive battery cord.
- (2) Disconnect the glow plug wiring.
- (3) Disconnect the headlight wiring.
- (4) Disconnect the fan dynamo cord.
- (5) Disconnect the oil switch wiring.
- (6) Disconnect the starter wiring.
- (7) Disconnect the safety switch cords.

9. Removing Drive Shaft Band

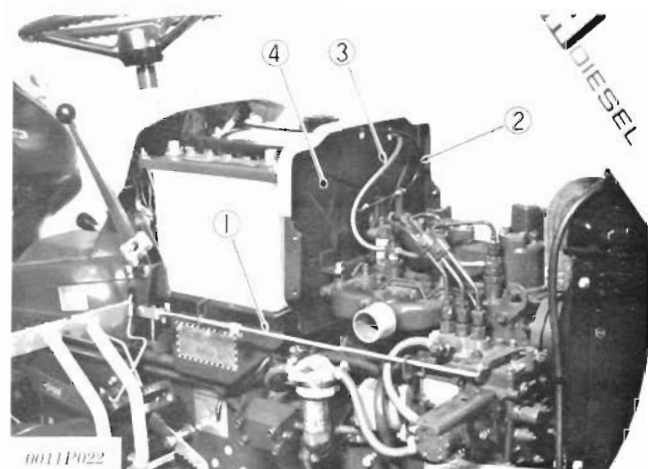


0011P021

Fig. A-26 Removing Drive Shaft Band

- (1) Loosen the drive shaft band from the tractor is right side.
- (2) After the band is loosened enough, pull it backwards.

10. Removing Heat Insulator



0011P022

1. Release Rod

2. Decompression Wire

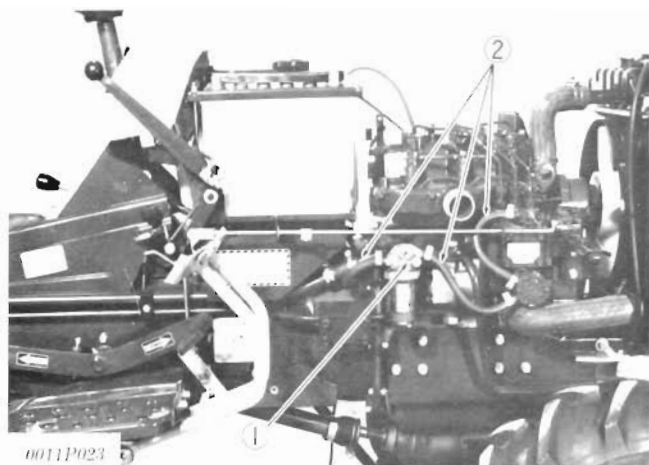
3. Overflow Pipe

4. Heat Insulator

Fig. A-27 Removing Heat Insulator

- (1) Release the release rod on the speed control lever side.
- (2) Release the decompression wire on the decompression lever side.
- (3) Disconnect the overflow pipe on the injection nozzle side.
- (4) Remove the heat insulator.

11. Removing Fuel Filter and Fuel Tank



1. Fuel Filter Cock

2. Pipe

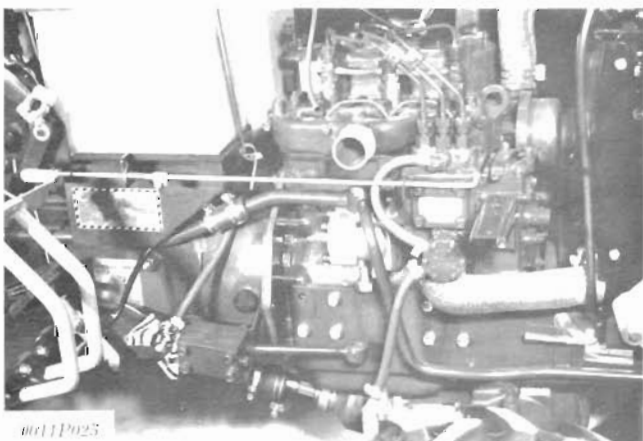
Fig. A-28 Removing Fuel Filter

- (1) Close the fuel filter cock.
- (2) Remove the pipe on the fuel filter side and plug it to prevent oil from spilling.
- (3) Open the tank band and dismount the fuel tank.

NOTE:

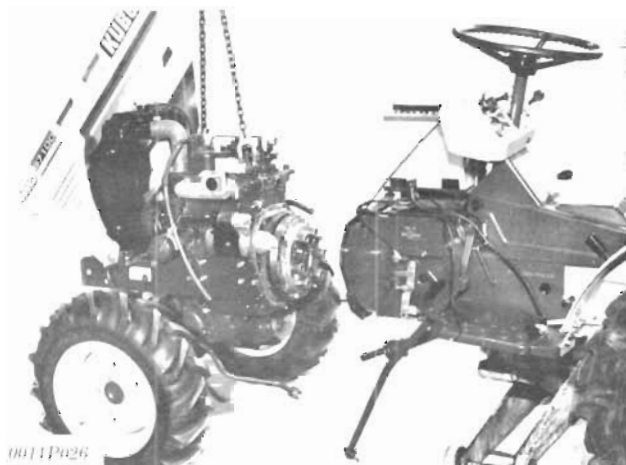
Do not spill oil in the pipes.

12. Removing Hydraulic Pipes

*Fig. A-29 Removing Hydraulic Pipes**Fig. A-30 Removing Hydraulic Pipes*

- (1) Remove the fixing bolt.
- (2) Remove the rubber joint at the center portion of the suction pipe from the pump side.
- (3) Remove the delivery pipe from the pump side.

13. Separation

*Fig. A-31 Separation*

- (1) Lift the engine and support the body with a jack.
- (2) Remove the connecting bolts and separate.

Assembling Engine and Clutch Housing**1. Assembling Engine and Clutch Housing**

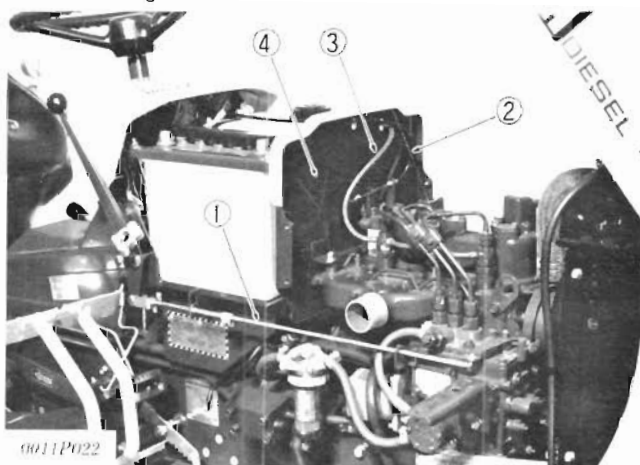
- (1) With the front wheel drive lever in neutral, join the engine and the housing case, align the splines and tighten the connection bolts.
- (2) Tighten the set bolts (7T) to 24 to 27 Nm (2.4 to 2.8 kgf·m, 17 to 20 ft-lbs).

2. Installing Hydraulic Pipes

- (1) Install the oil strainer after cleaning.
- (2) Return the O-ring to the right position.
- (3) Install the copper gaskets. If the surface is seriously damaged, replace it.

3. Installing Fuel Tank and Fuel Filter**NOTE:**

Do not spill fuel.

4. Installing Heat Insulator

- | | |
|-----------------------|-------------------|
| 1. Release Rod | 3. Overflow Pipe |
| 2. Decompression Wire | 4. Heat Insulator |

Fig. A-32 Installing Heat Insulator

- (1) When installing the wire stopper, allow play, and check to see that when the decompression lever is released, it properly disengages.
- (2) Adjust the length of the accelerator rod so that the engine idles at 1050 to 1150 rpm.
- (3) Tighten the nut so that the accelerator lever functions at 20 to 25 N (2.0 to 2.5 kgf, 4.4 to 5.5 lbs.).

5. Installing Drive Shaft Band**6. Electrical Wiring**

- (1) Connect the battery negative cord after all other electrical connections have been made.
- (2) Bend the cord clamps of each wire harness.
- (3) When connecting, check to see that no wires are short-circuited by being in contact with the tractor body.

7. Installing Drag Link

- (1) Check to see there is no dirt on the tapered surface connecting the knuckle arm and the drag link.
- (2) Tighten the drag link nut to 29 to 49 Nm (3 to 5 kgf·m, 22 to 36 ft-lbs).
- (3) Spread the split pin to each side.

NOTE:

Do not forget to fit the M10 spring washer.

8. Installing Side Cover (Right, Left)**9. Installing Muffler**

- (1) Check the muffler gasket. If defective, replace.
- (2) Install the muffler so that exhaust fumes will not be directed toward the operator.

10. Installing Air Cleaner

- (1) Install the dust cup with the "TOP" mark facing upwards.
- (2) If the element is stained with carbon or oil, clean with detergent.

11. Installing Negative Battery Cord

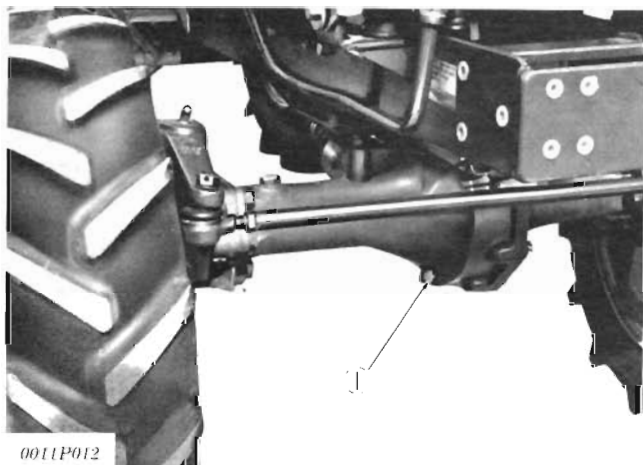
- (1) Check to see all electrical wiring is correctly done, and then connect the cord to the negative terminal.
- (2) Before connecting, clean the terminal.

12. Adding Transmission Oil

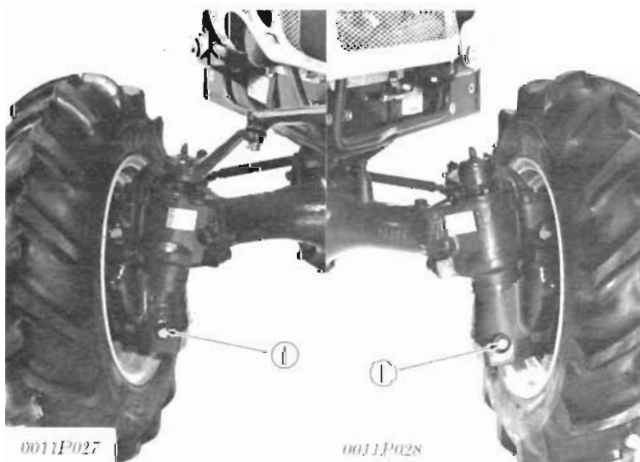
- (1) Amount of oil 13.5ℓ (3.6 U.S. gals.)

13. Adding Engine Oil

- (1) Amount of oil 3.9ℓ (4.1 U.S. qts.)

Separating Engine from Front End**1. Drain Plug***Fig. A-33 Draining Differential Gear Case Oil*

1. Draining Differential Gear Case Oil
 - (1) Drain oil from the differential gear case.
2. Draining Axle Case Oil

**1. Drain Plug***Fig. A-34 Draining Axle Case Oil*

- (1) Drain oil from the right and left axle cases.
3. Removing Bonnet (Hood)
 - (1) Open the bonnet (hood) and remove the headlight lead.
 - (2) Remove the bonnet (hood).
4. Draining Coolant
 - (1) Remove radiator cap.
 - (2) Drain coolant through the cock on the bottom of the radiator.

NOTE:

 - When the engine is warm, do not remove the cap.
 - After draining coolant, tighten the drain cock.
5. Removing Negative Battery Cord
6. Removing Air Cleaner
7. Removing Muffler
8. Removing Side Cover (See page 4-1)

9. Removing Water Pipes

- (1) Loosen the bands with a screwdriver.
- (2) Disconnect the water pipes from radiator.

10. Removing Drag Link (See page 4-1)**11. Removing Drive Shaft Band (See page 4-2)****12. Removing Hydraulic Pipes (See page 4-3)****13. Removing Front Wheel Support Mounting Bolt**

- (1) Remove the bolts fixing the front wheel support.

14. Separation**NOTE:**

Do not break the oil filter cartridge.

Assembling Engine and Front End**1. Installing Engine to Front End**

- (1) Check to see if the engine and the front wheel support are on the same level.

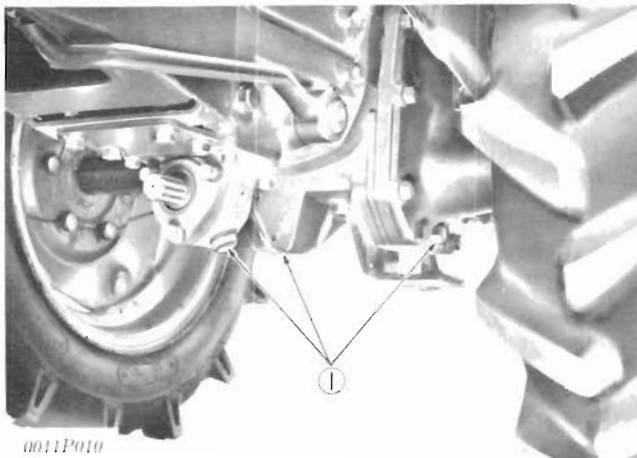
2. Installing Front Wheel Support Mounting Bolt

- (1) Tighten the mounting bolts to 48 to 56 Nm (4.9 to 5.7 kgf·m, 35 to 41 ft-lbs.)

3. Installing Hydraulic Pipes (See page 4-4)**4. Installing Drive Shaft Band****5. Installing Drag Link (See page 4-4)****6. Installing Water Pipes****7. Installing Side Cover****8. Installing Muffler****9. Installing Air Cleaner****10. Installing Negative Battery Cord****11. Installing Bonnet (Hood)****12. Adding Transmission Oil (See page 3-4)****13. Adding Engine Oil (See page 3-2)**

Separating Clutch Housing from Transmission Case

1. Draining Transmission Oil



1. Drain Plug

Fig. A-35 Draining Transmission Oil

- (1) Drain oil from the drain plugs in the rear axle cases and mid PTO case.

NOTE:

After draining oil, tighten the drain plugs.

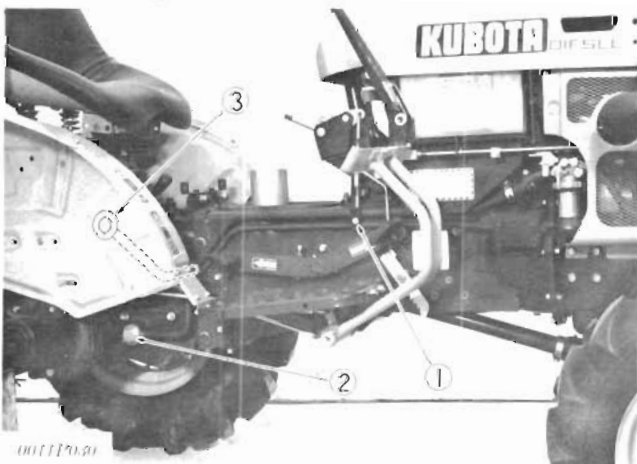
2. Removing Hydrostatic Transmission Filter Cover

- (1) Remove the four knob bolts and detach the cover.

3. Removing Battery Negative Cord

- (1) Open the bonnet (hood).
- (2) Disconnect the negative battery cord from the negative terminal.

4. Removing Hydraulic Pipes



1. Bolt

2. Strainer

3. Pipe Joint

Fig. A-36 Removing Hydraulic Pipes

- (1) Remove the bolt.
- (2) Remove the strainer at the rear of the delivery pipe.
- (3) Remove the pipe joint at the rear of the suction pipe.

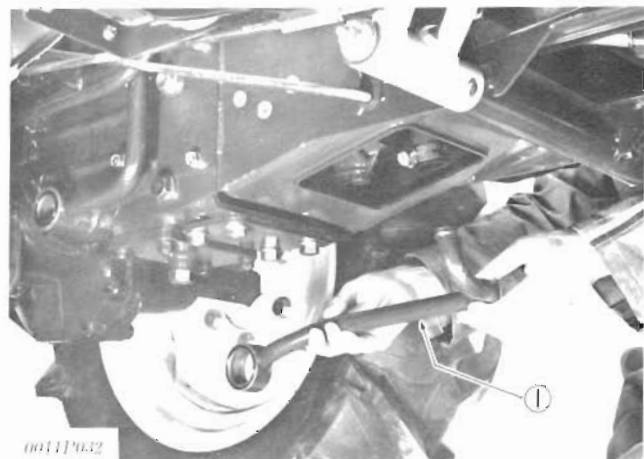
5. Removing Hydrostatic Transmission Oil Filter and Joint



1. Oil Filter Cartridge

2. Filter Joint

Fig. A-37 Removing Oil Filter and Joint



3. Suction Pipe

Fig. A-38 Removing Suction Pipe

- (1) Detach the oil filter cartridge and filter joint.
- (2) Remove the joint at the rear and the joint at the center section of the pipe which connects the hydrostatic transmission and the cooler.
- (3) Remove the suction pipe connected to the hydrostatic transmission.

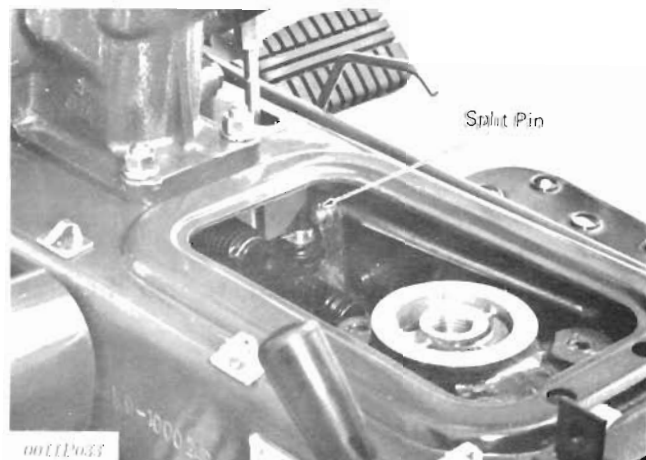


Fig. A-39 Removing Split Pin

KUBOTA

- (4) Remove the split pin connecting the speed control rod and rod guide. Disconnect them.
- 6. Removing Brake Pedal Rods (right and left)
- 7. Removing Differential Lock Shaft

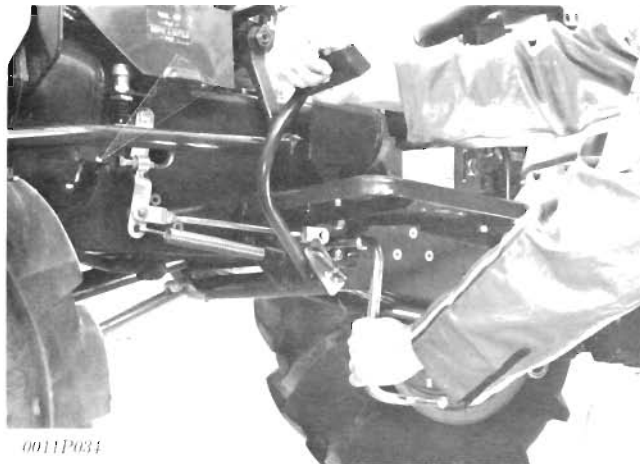


Fig. A-40 Removing Differential Lock Shaft

- (1) Disconnect the front portion of the differential lock rod.
- (2) Remove the joint pin and disconnect the differential lock lever.
- (3) Pull out the differential lock shaft while pressing the clutch pedal.

8. Removing Drive Shaft Pipe Band

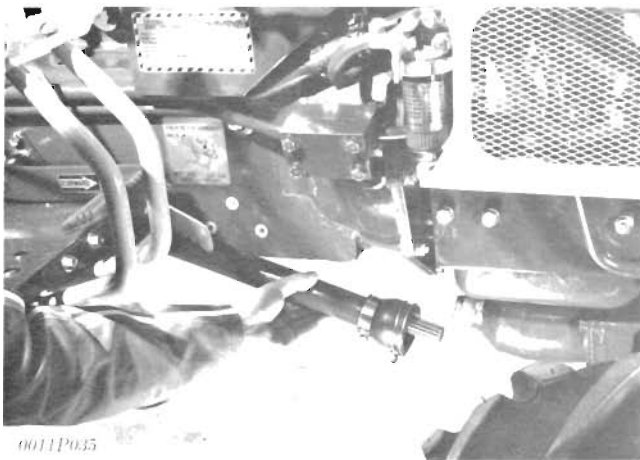
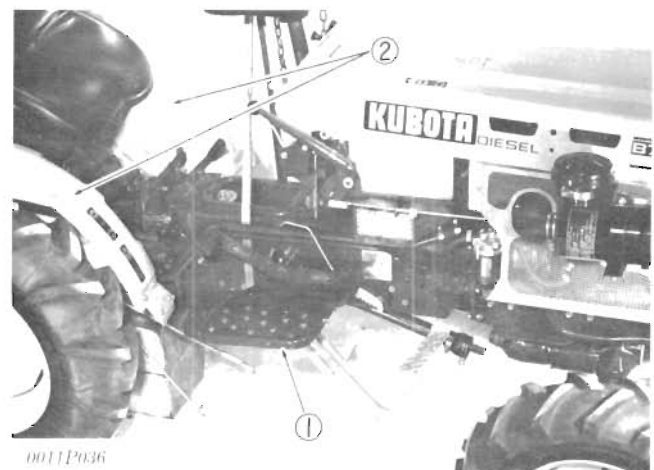


Fig. A-41 Removing Drive Shaft Pipe Band

- (1) Loosen the band and remove the drive shaft pipe from joint case.

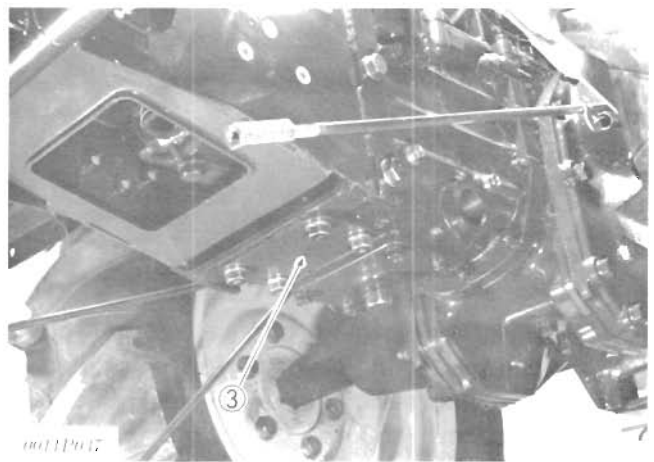
9. Separation



1. Step

2. Fender

Fig. A-42 Separation



3. Connecting Plate

Fig. A-43 Separation

- (1) Remove the four bolts which connect the step to the fender.
- (2) Remove the connecting plate, Fig. A-43.
- (3) Remove the bolts and nuts which connect the housing to the transmission case.

Group 5

Tune-up and Adjustments

Engine Tune-up

1. Checking Engine Oil Level (See page 3-2)
2. Changing Engine Oil (See page 3-2)
3. Changing Engine Oil Filter Cartridge (See page 3-3)
4. Checking Air Cleaner.



Fig. A-44 Checking Air Cleaner

- (1) Inspect air cleaner primary element. If dirty, clean by patting element with your hand or use compressed air (less than 690 kPa (7 kgf/cm², 100 psi))

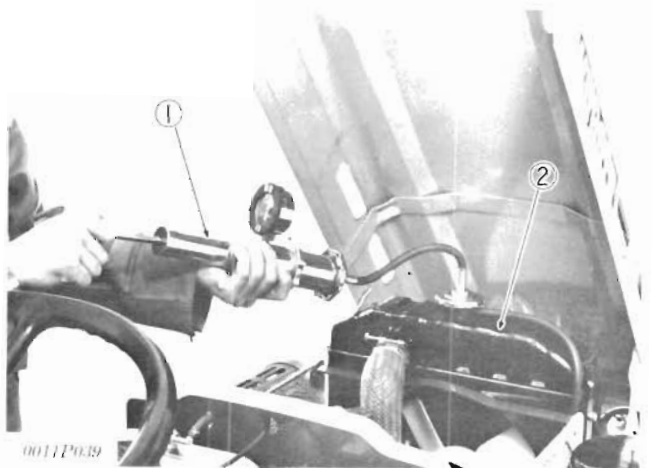
NOTE:

Do not blow air from outside of element to inside.

SERVICE INTERVAL:

Replace once a year or after every 200 hours.

5. Checking Radiator for Leaks



1. Radiator Tester

2. Radiator

Fig. A-45 Checking Radiator for Leaks

- (1) Pour the specified amount of water into the radiator.

Amount of water: 4.6ℓ (4.9 U.S. qts.)

- (2) Start engine warm-up.
- (3) Attach radiator tester. Increase water pressure to the specified pressure.

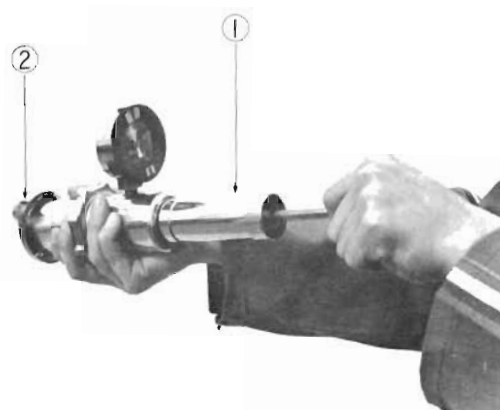
TEST EQUIPMENT: Radiator Tester (Code No. 07909-31551)



Fig. A-46 Radiator Tester

- (4) Check to see if water leaks from any part.

6. Checking Radiator Pressure Cap for Leaks.

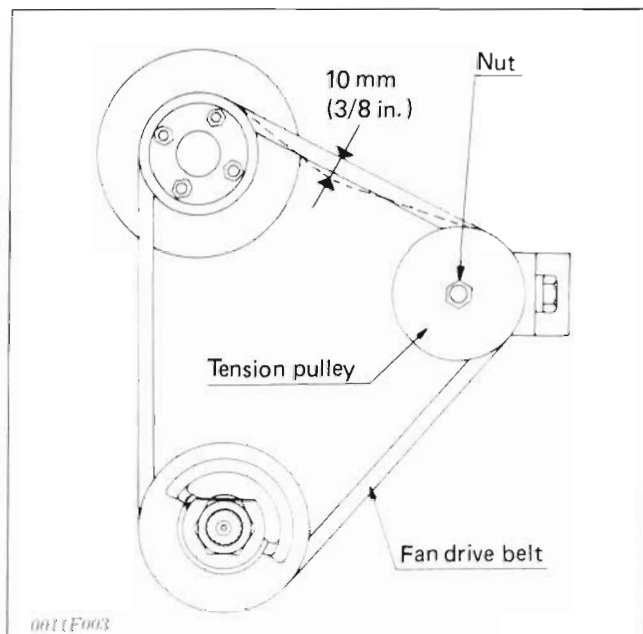


1. Radiator Tester

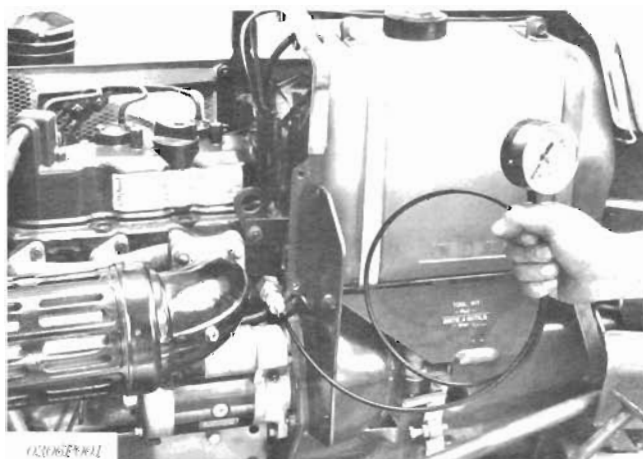
2. Radiator

Fig. A-47 Checking Radiator Pressure Cap for Leaks

- (1) Attach radiator tester to the pressure cap.
- (2) Increase to the specified pressure (88 kPa, 0.9 kgf/cm², 13 psi)
- (3) Check to see if the pressure does not decrease by more than 29 kPa (0.3 kg/cm², 43 psi) in 10 seconds.

7. Checking Tension of Fan Belt.*Fig. A-48 Checking Tension of Fan Belt*

- (1) Check to see if the belt tension allows a depression of the specified amount.
- (2) If necessary, adjust tension by tension pulley.
- (3) Fan belt should deflect 10 mm (3/8 in.) when 98 N (10 kgf, 22 lbs.) force is applied midway between fan pulley and tension pulley.

8. Checking Engine Oil Pressure*Fig. A-49 Checking Engine Oil Pressure*

- (1) Detach the muffler and side cover (left).
- (2) Detach the oil switch.
- (3) Attach the muffler after installing a pressure gauge to the oil switch mounting hole.

TEST EQUIPMENT:

Pressure Gauge (Code No. 07916-32031)

*Fig. A-50 Pressure Gauge*

- (4) Start the engine. Measure the oil pressure both at idling and at the rated speed.
- (5) If the measurement exceeds the allowable limit, check the oil pump, oilways, oil clearances and pressure regulating valve.
 - Reference value:
200 to 440 kPa (2.0 to 4.5 kgf/cm², 28 to 64 psi)
 - Allowable limit:
200 kPa (2.0 kgf/cm², 28 psi) or less at rated speed
69 kPa (0.7 kgf/cm², 10 psi) or less at idle speed

Tractor Adjustment

1. Checking Transmission Oil Level (See page 3-4)
2. Changing Transmission Oil and Filter (See page 3-4)
3. Lubricating Grease Fittings (See page 3-6)
4. Adjusting Brakes (See Section L)

If brake pedal free travel is too great or travel varies too much between the right and left pedals, loosen the turnbuckle lock nut and turn the turnbuckle in the desired direction until the proper free travel is achieved.

Moderate right and left pedal travel ranges from 10 to 30 mm (25/64 to 1-3/16 in.)

Difference of pedal free travel between right and left should be less than 4 mm (5/32 in.).

After adjustment, interlock the right and left brake pedals and then tighten the lock nut securely.

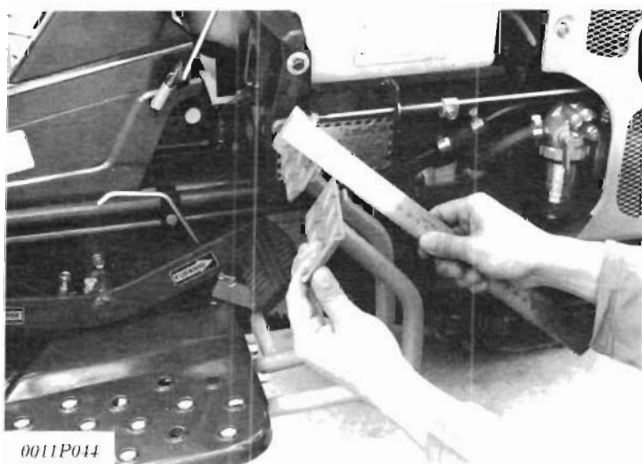


Fig. A-51 Brake Pedal Free Travel

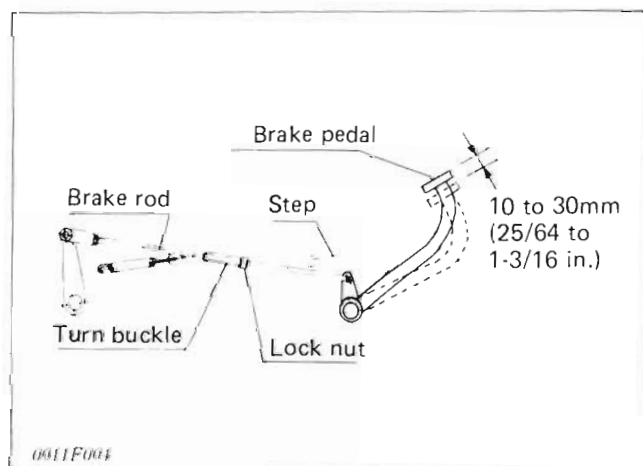
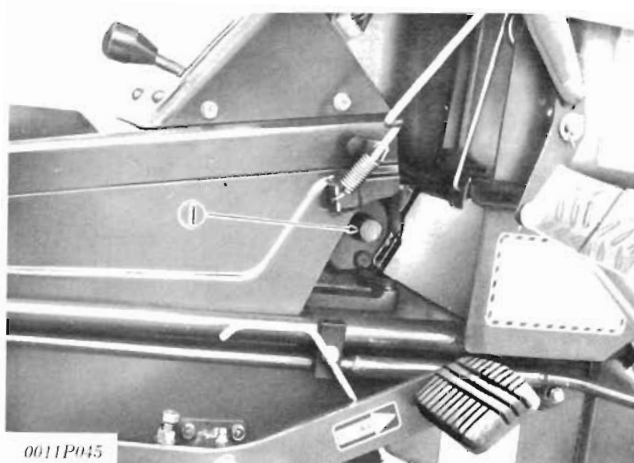


Fig. A-52 Adjusting Brakes

5. Adjusting Steering Wheel



1. Lock Nut *Fig. A-53 Lock Nut Position*

Free movement of steering wheel is 10 to 30 mm (25/64 to 1-3/16 in.).

(1) Loosen the lock nut on the steering gear box.

(2) Adjust by turning the screw with a screwdriver.

- clockwise less
- counterclockwise more

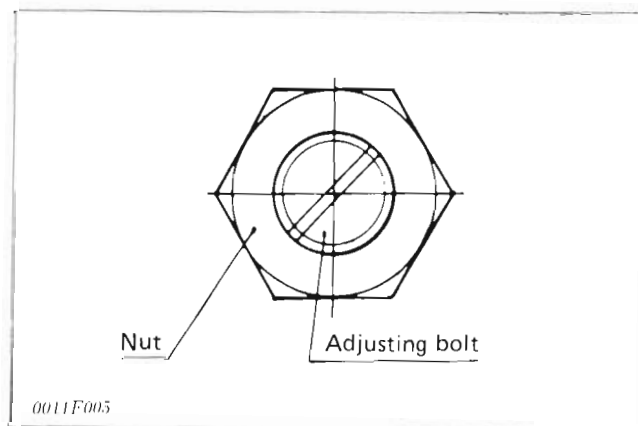


Fig. A-54 Adjusting Bolt

6. Checking Tire Pressure

Naturally tire pressure will decrease with time.

Check it daily and inflate as necessary.

Model	Tire Maker	Farm tire		Turf tire	
		Front	Rear	Front	Rear
B7100 HST-D (4WD)	Goodyear	6.2-12-4PR 140 to 210 kPa 1.4 to 2.1 kgf/cm ² 20 to 30 psi	8.3-16-4PR 120 to 150 kPa 1.2 to 1.5 kgf/cm ² 17 to 22 psi	20.5x8.00-10-4PR 140 to 250 kPa 1.4 to 2.5 kgf/cm ² 20 to 35 psi	29x12.00-15-2PR 40 to 70 kPa 0.4 to 0.7 kgf/cm ² 6 to 10 psi
		6-12-2PR 80 to 100 kPa 0.8 to 1.0 kgf/cm ² 11 to 14 psi	8-16-4PR 80 to 120 kPa 0.8 to 1.2 kgf/cm ² 11 to 17 psi		
	Bridgestone	6-12-2PR 80 to 100 kPa 0.8 to 1.0 kgf/cm ² 11 to 14 psi	8-16-4PR 120 to 160 kPa 1.2 to 1.6 kgf/cm ² 17 to 23 psi		
B7100 HST-E (2WD)	Goodyear	6.00-9 180 to 420 kPa 1.8 to 4.2 kgf/cm ² 25 to 60 psi	8.3-16-4PR 120 to 150 kPa 1.2 to 1.5 kgf/cm ² 17 to 22 psi	20.5x8.00-10-4PR 140 to 250 kPa 1.4 to 2.5 kgf/cm ² 20 to 35 psi	29x12.00-15-2PR 40 to 70 kPa 0.4 to 0.7 kgf/cm ² 6 to 10 psi
			8-16-4PR 80 to 120 kPa 0.8 to 1.2 kgf/cm ² 11 to 17 psi		
	Bridgestone	4.00-9-4PR 120 to 160 kPa 1.2 to 1.6 kgf/cm ² 17 to 23 psi	8-16-4PR 120 to 160 kPa 1.2 to 1.6 kgf/cm ² 17 to 23 psi		

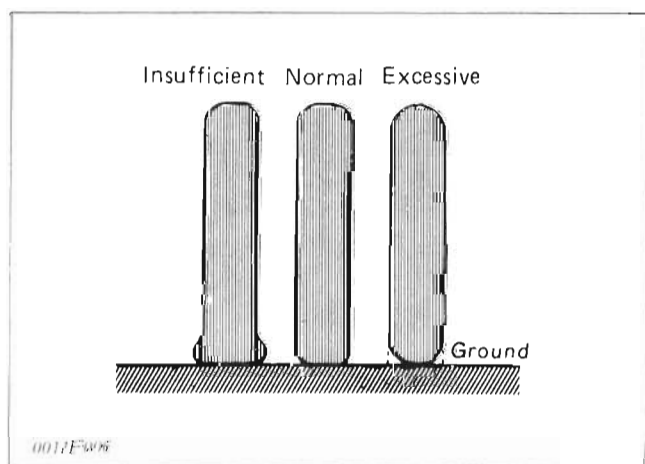


Fig. A-55 Checking Tire Pressure

7. Adjusting Rear Wheel Tread

The rear wheel is fixed to the hexagonal axle and hub by the use of a pin and set bolt.

Rear wheel tread can be changed by selecting one of the pin holes on the axle.

Adjust according to working conditions.

Type	Size·Brand	Tread (Between the center of the tires)			
Farm Tire	8-16 Bridgestone	660 mm (25 ⁶³ / ₆₄ in.)	710 mm (27 ⁶² / ₆₄ in.)	760 mm (29 ⁵⁹ / ₆₄ in.)	870 mm (34 ¹ / ₄ in.)
	8-16 Goodyear	725 mm (28 ³⁵ / ₆₄ in.)	775 mm (30 ³³ / ₆₄ in.)	825 mm (32 ³¹ / ₆₄ in.)	
Turf Tire	29x12.00-15 Goodyear	815 mm (32 ³ / ₃₂ in.)			

8. Adjusting Front Wheel Toe-in

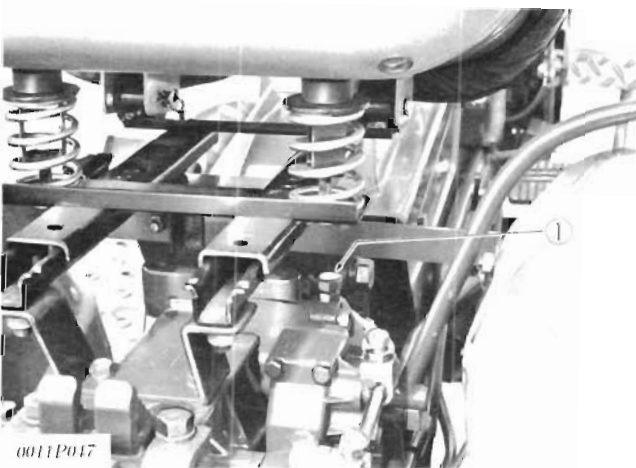


0011P016

Fig. A-56 Adjusting Front Wheel Toe-in

Adjust front wheel toe-in to 0 to 5 mm (0 to 13/64 in.), by turning the tie rod.

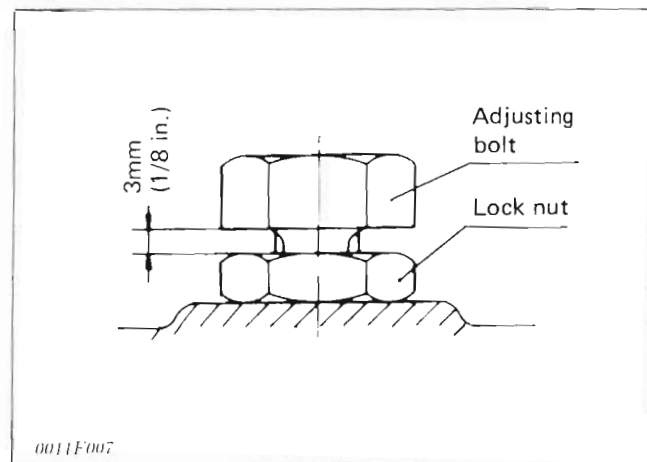
9. Adjusting Implement Lowering Speed



0011P017

1. Adjusting Bolt

Fig. A-57 Adjusting Implement Lowering Speed



0011F007

Fig. A-58 Adjusting Bolt

Implement lowering speed is adjusted in accordance with the type of the implement and operating conditions.

- (1) Loosen the lock nut of adjusting bolt on the hydraulic control valve.
- (2) Adjust the bolt.

Adjusting bolt	Lowering speed
Clockwise	Slow
Counterclockwise	High

NOTE:

The proper lowering speed of a rotary tiller is such that it takes two or three seconds to descend from the top position to the ground.

10. Checking Battery



1. Electrolyte Level

Fig. A-59 Checking Battery

Check electrolyte level. If it is lower than the indicated line, add distilled water.

ENGINE BODY

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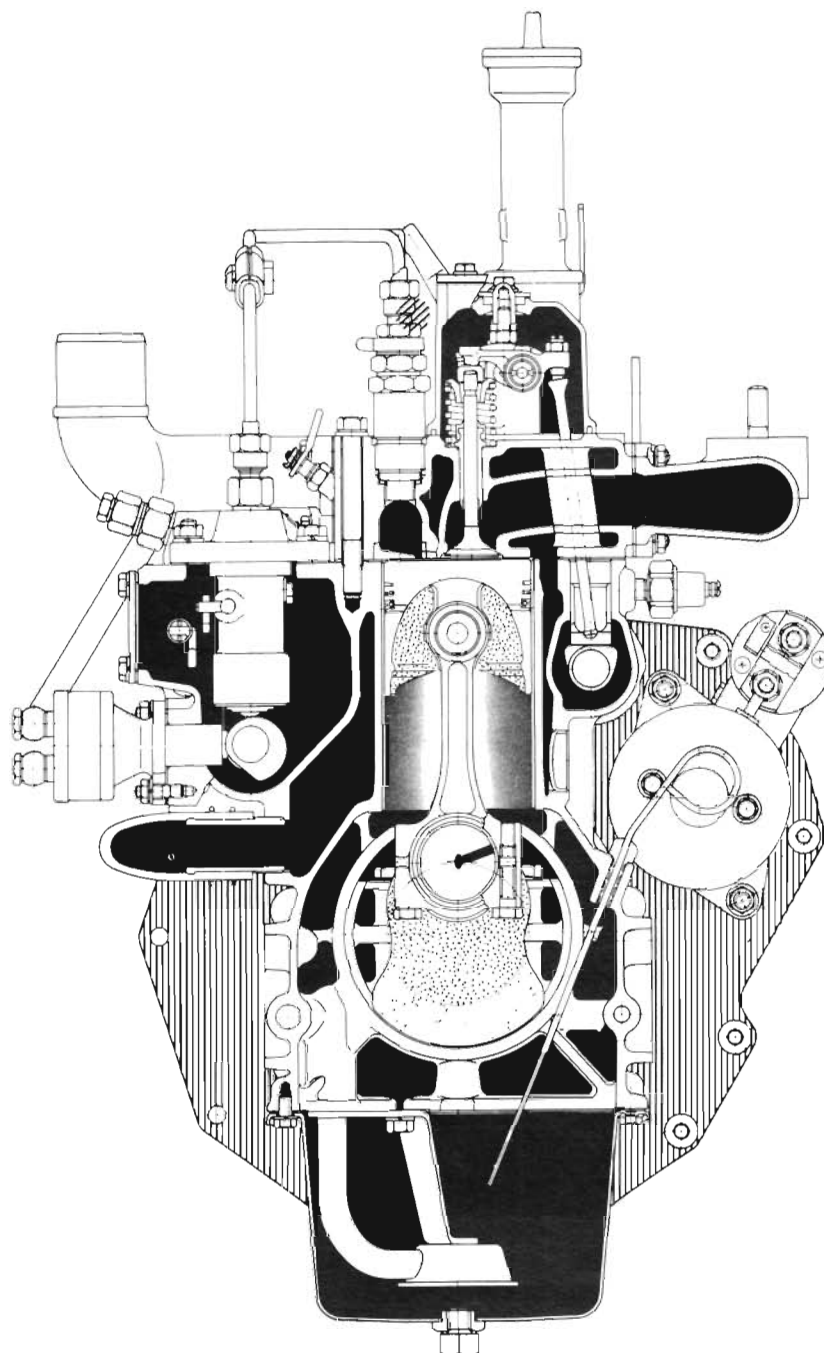
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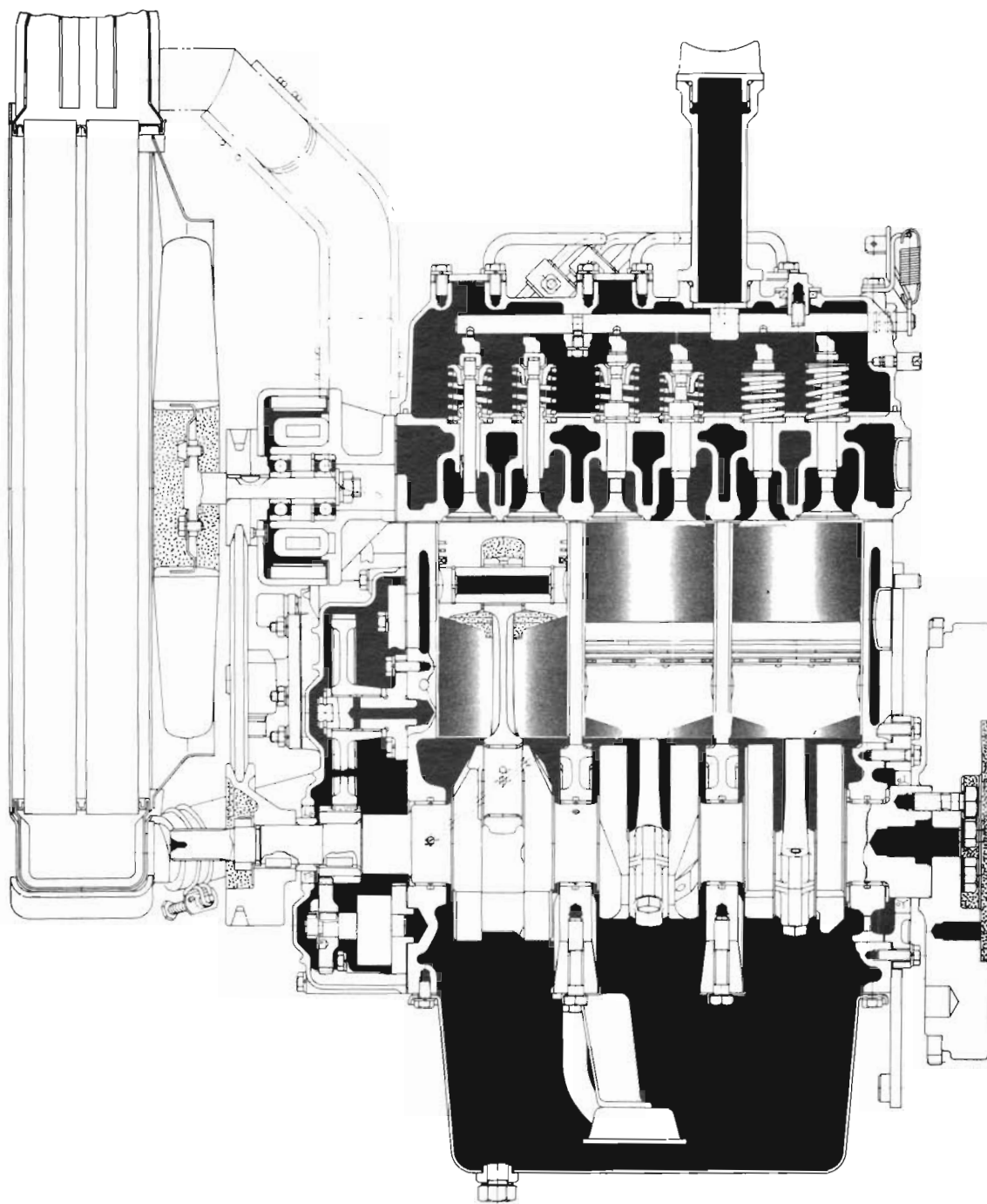
Group 1

General Description



0011F008

Fig. B-1 Engine Cross Section



0011F009

Fig. B-2 Engine Cross Section

Performance and Fuel Consumption Curves

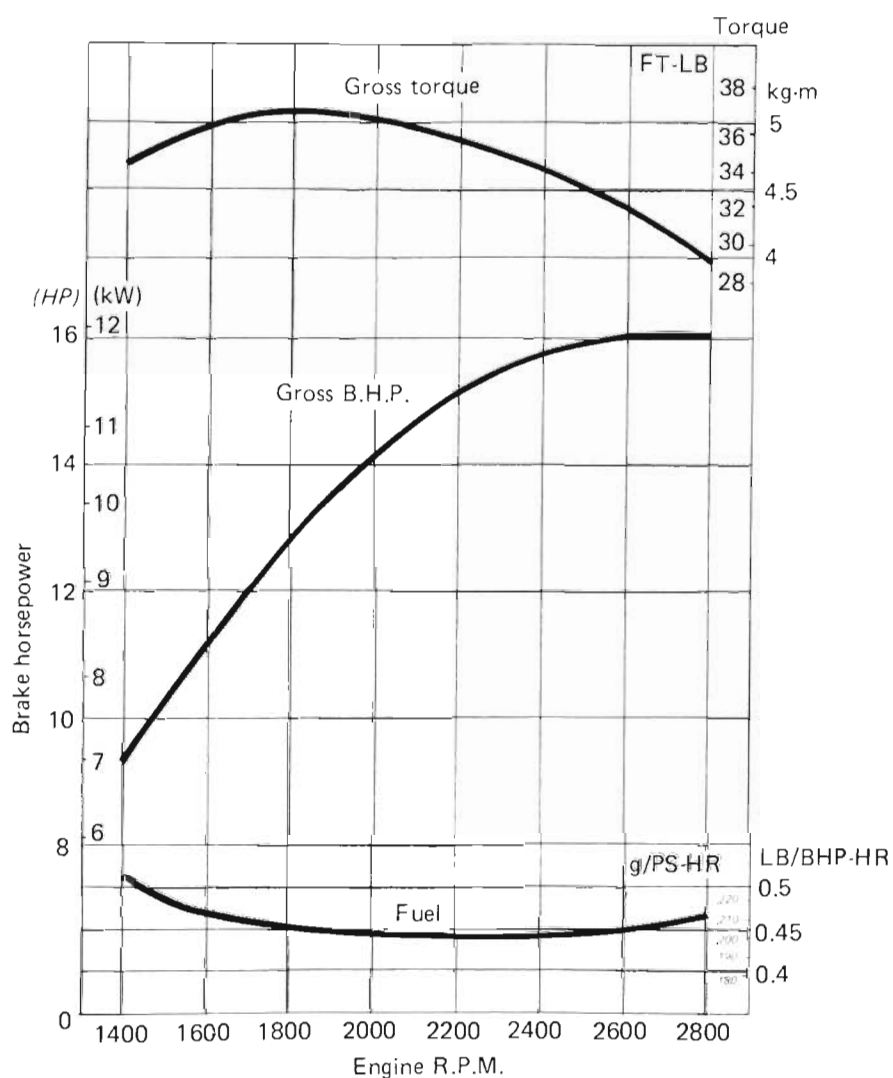


Fig. B-3 Performance and Fuel Consumption Curves

NOTES:

- (1) All performance curves are at standard atmospheric conditions of 760 mmHg (29.9 in.Hg) pressure, 20°C (68°F) temperature and 65% humidity.
- (2) Bare horsepower output: This line shows the output and torque curve without any accessories.

Performance and Fuel Consumption Curves

D650-AH

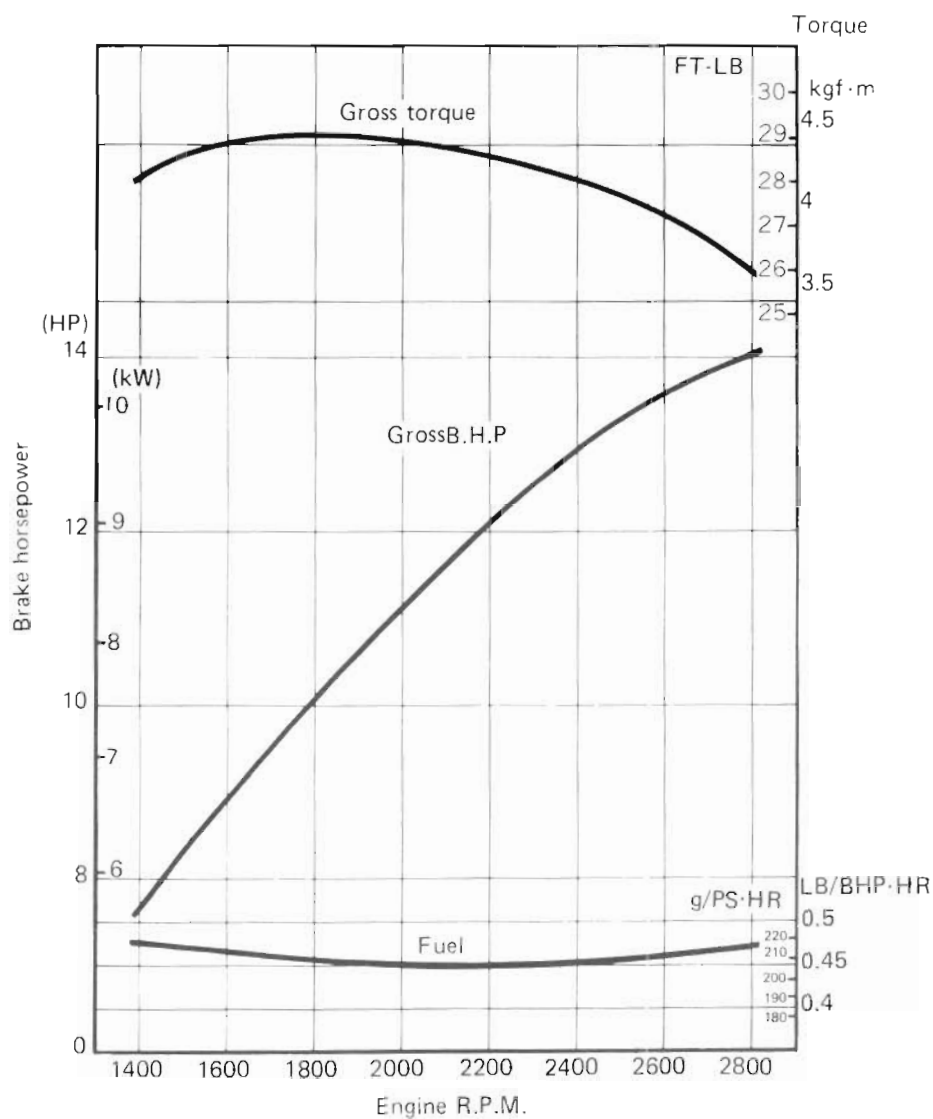


Fig. B-3-(1) Performance and Fuel Consumption Curves

NOTES:

- (1) All performance curves are at standard atmospheric conditions of 760 mmHg (29.9 in. Hg) pressure, 20°C (68°F) temperature and 65% humidity.
- (2) Bare horsepower output: This line shows the output and torque curve without any accessories.

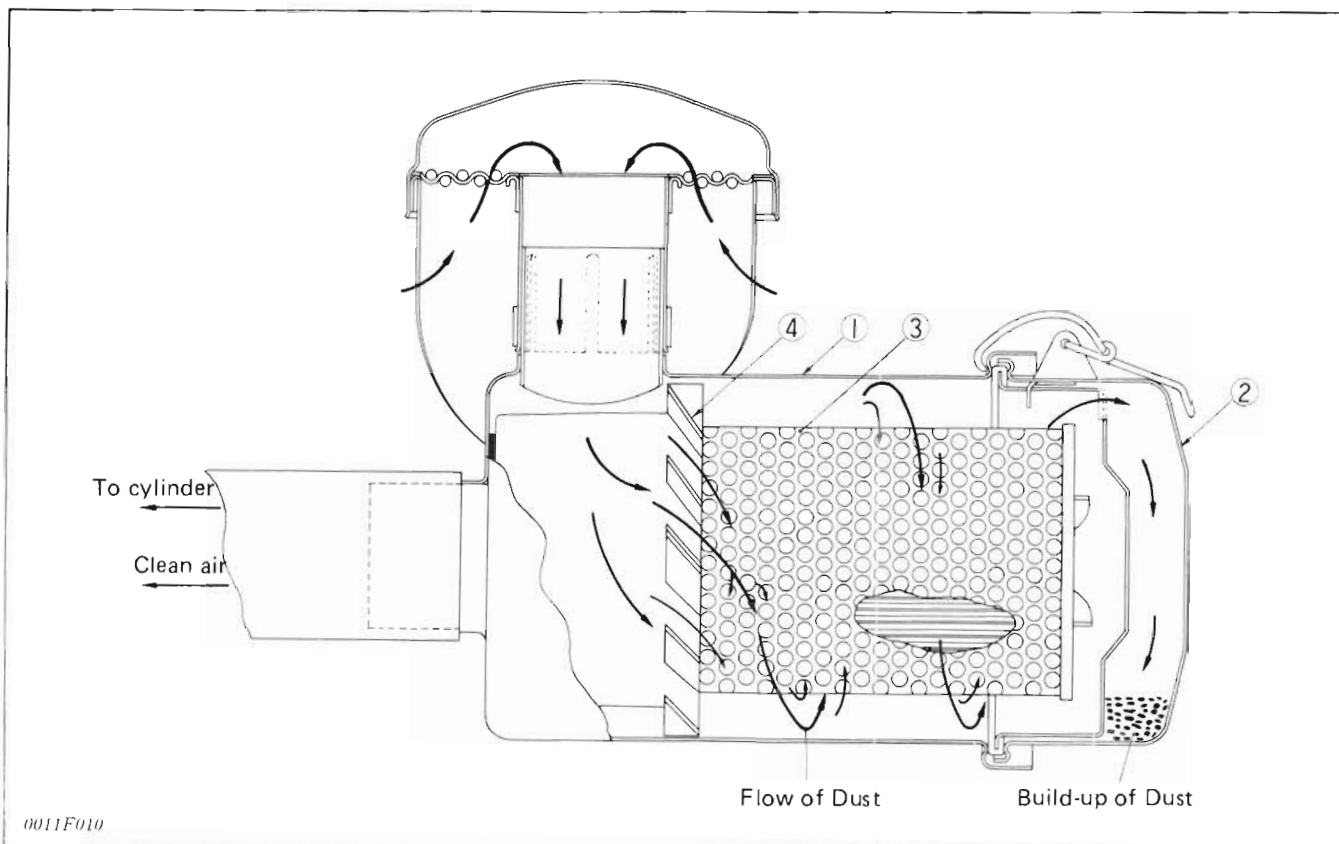
Air Cleaner

The air cleaner is a dry-cyclone type for easy maintenance.

Air is purified as follows:

Air is pulled through the element's fins (4) at high speed and flows around the inner surface of

body (1). As a result, heavier dust particles circulate around the circumference and enter the holes in the air cleaner's cover (2) where they accumulate. Minute dust, while circulating in air flow, is absorbed in the element (3) to prevent it from entering the engine.



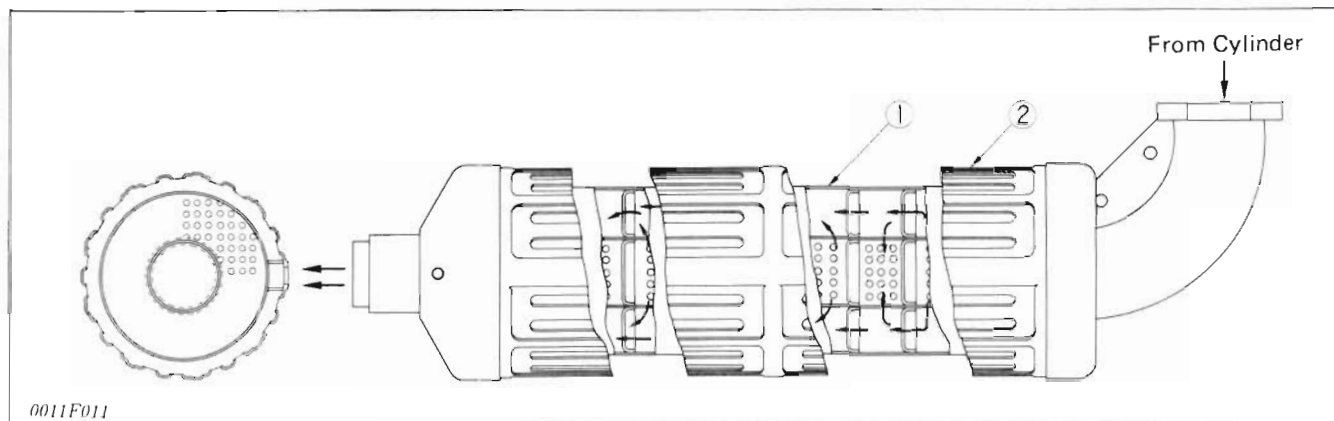
1. Body 2. Cover 3. Element 4. Fin

Fig. B-4 Air Cleaner

Muffler

The cylinder exhausts gas at high temperature and high pressure, which passes around different baffles in the muffler and then through many small

holes which decrease pressure further, absorb heat and lower exhaust noise and temperature. To protect against fire and burns, a cover (2) surrounds the outside of the muffler.



1. Body 2. Cover

Fig. B-5 Muffler

Cylinder Block

Dry-type cylinder liners are pressure-fitted into the cylinders to reduce distortion and uneven wear and provide less operating noise and lower oil consumption. To minimize noise, each cylinder has its own crank chamber. The tunnel-type cylinder block is also more durable.

Cylinder Head

Inlet and exhaust ports are of cross-flow type to prevent air expansion due to exhaust heat. The spherical combustion chambers provide a vortex flow of air which enters the combustion chamber to improve combustion and reduce fuel consumption. The sheathed type glow plug heats quickly and assures good starting.

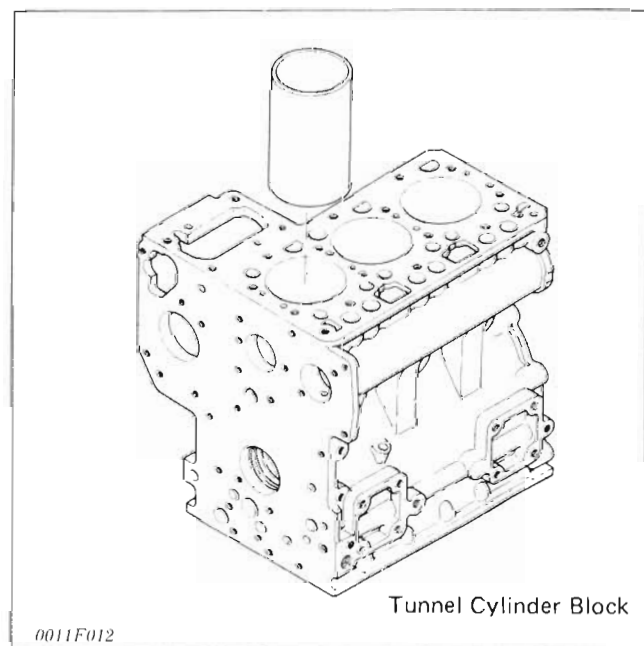
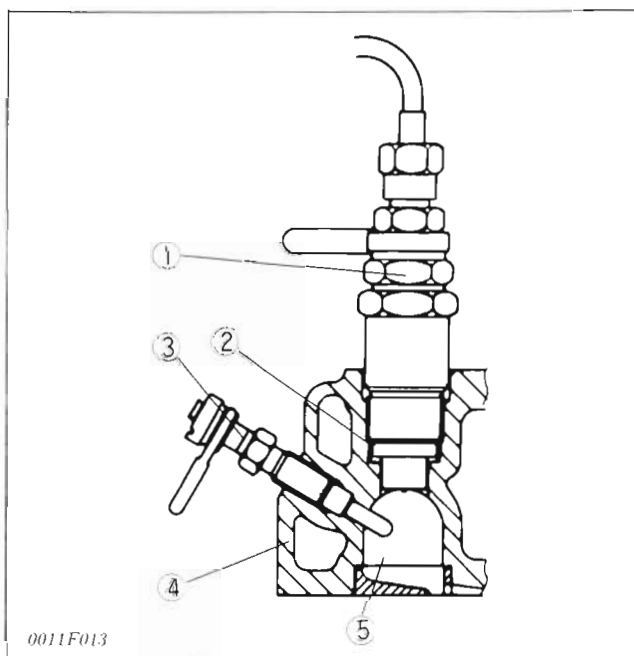


Fig. B-6 Tunnel Cylinder Block



1. Nozzle Assembly 3. Glow Plug 5. Combustion Chamber
2. Nozzle Piece Gasket 4. Cylinder Head

Fig. B-7 Combustion Chamber

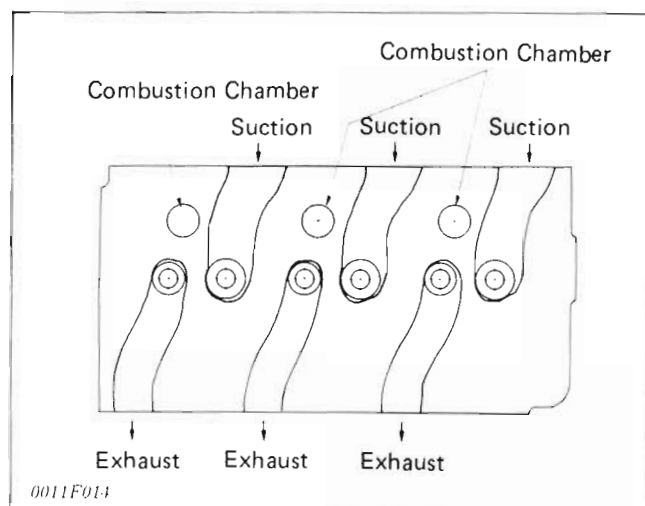


Fig. B-8 Cross-Flow Type Cylinder Head

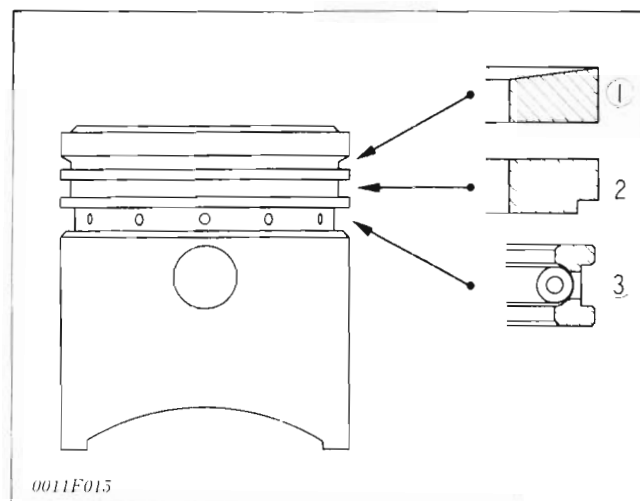
Crankshaft

The crankshaft is driven by the pistons and connecting rods, and translates its reciprocating movement into a circular movement. It also drives the oil pump, camshaft, and fuel camshaft. Crankshaft journals are supported by main bearings. Six counterweights are integrated into one unit to minimize bearing wear and lubricating oil temperature rise. Crankshaft journals and the oil seal's sliding sections are quenched and tempered to improve wear resistance.

Pistons and Piston Rings

Piston circumference has a special elliptic shape in consideration of expansion due to explosion heat. Furthermore, a rib is provided between the piston head and the piston boss to reduce distortion and to help heat radiation.

Three piston rings are used: two compression rings, and an oil ring. All have different shapes. Be careful when assembling.



1. Plated Keystone Ring 3. Coil Expander Ring
2. Undercut Ring

Fig. B-9 Piston and Piston Rings

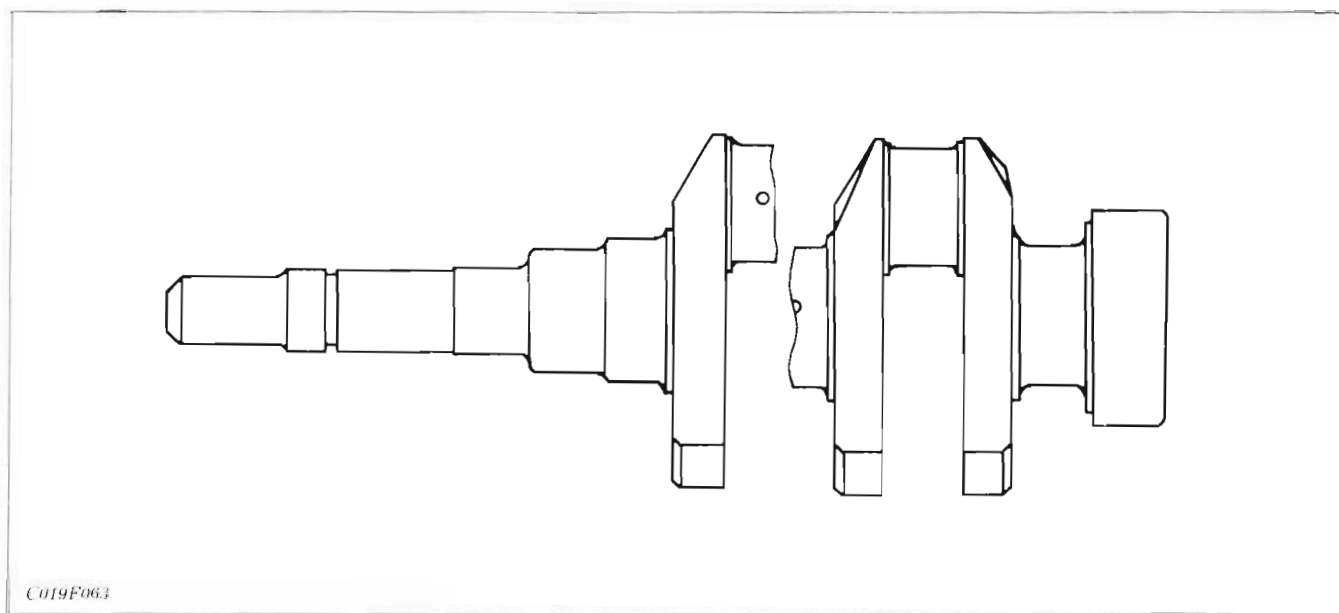
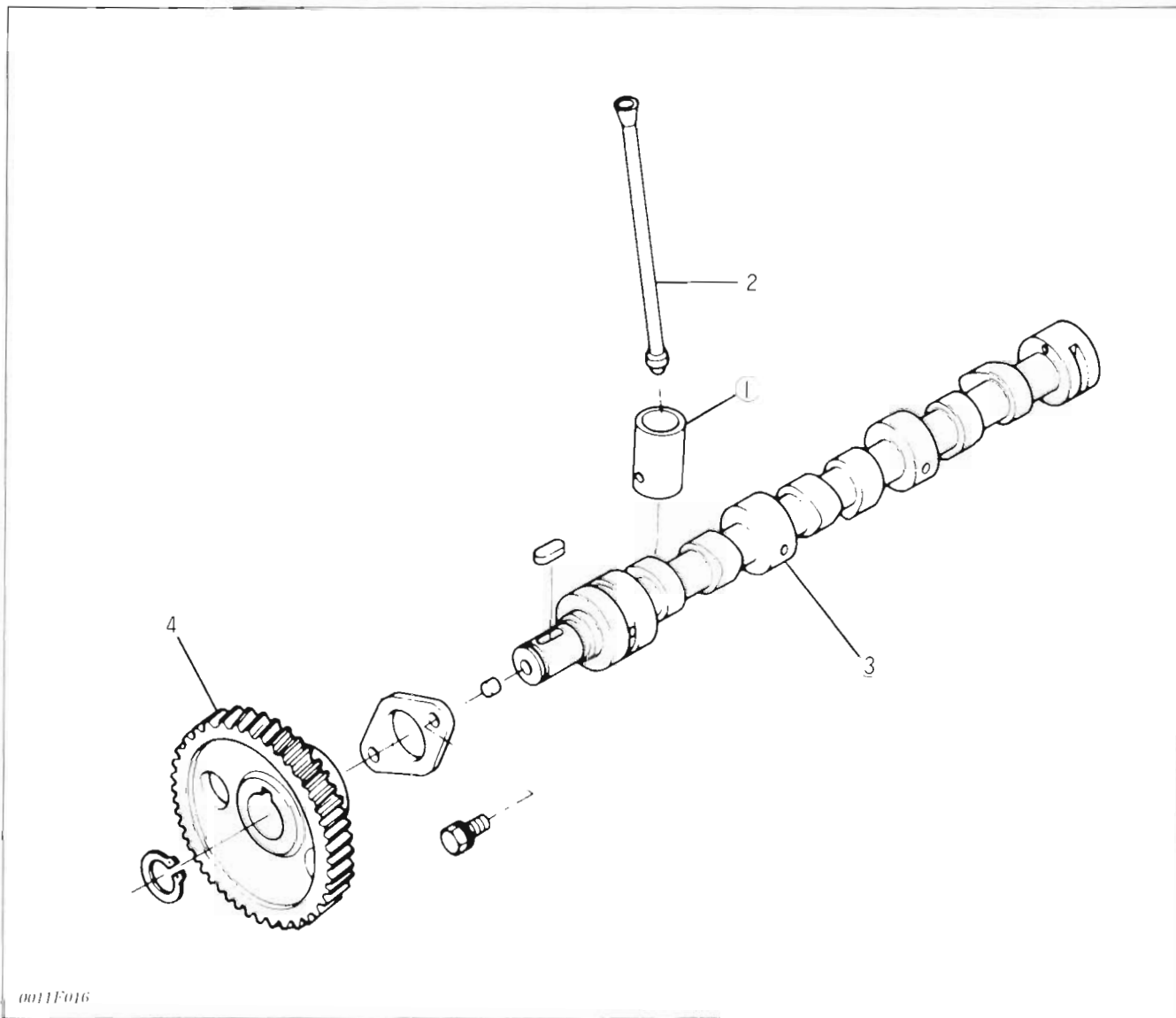


Fig. B-10 Crankshaft

Camshaft and Fuel Camshaft

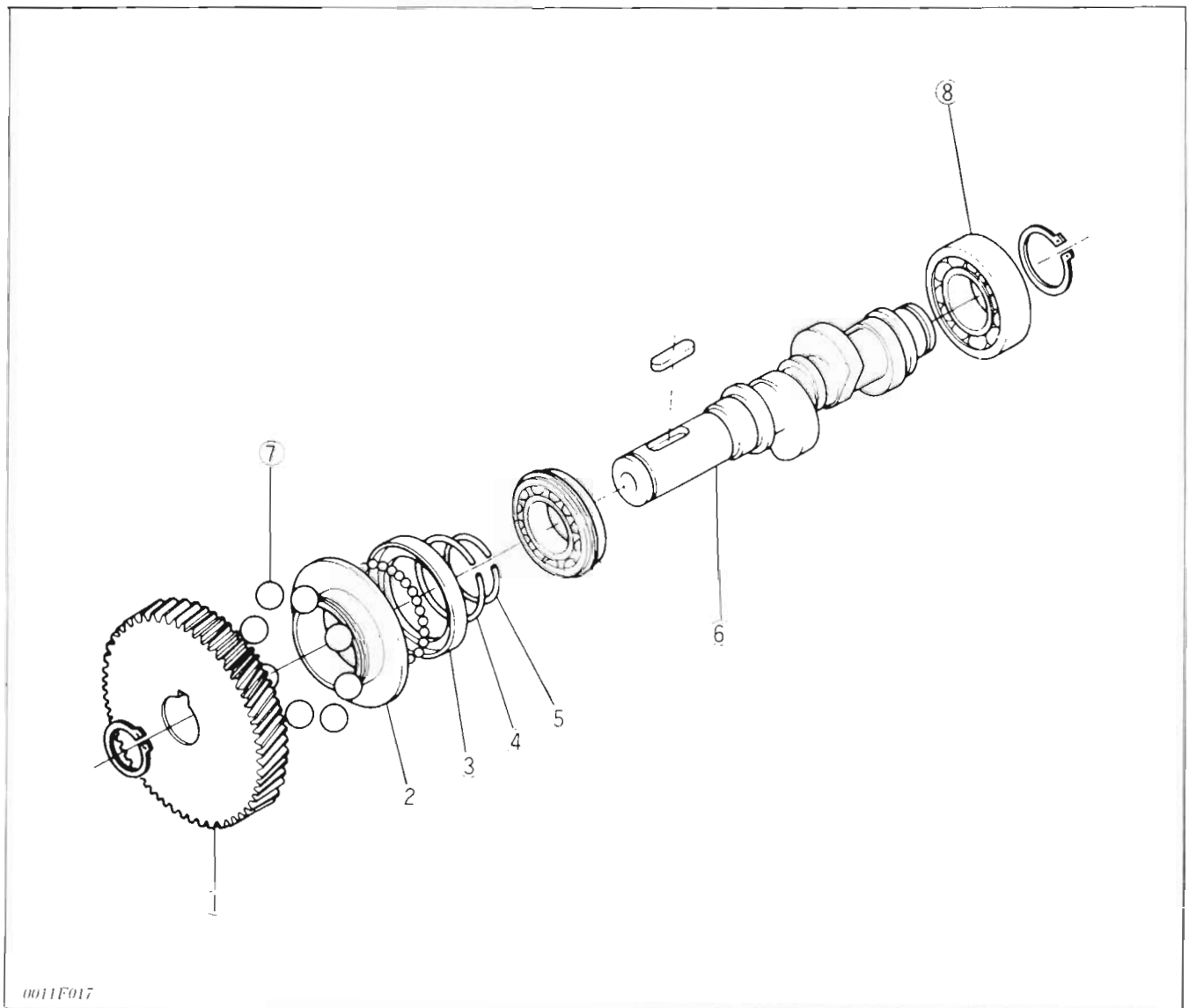
The camshaft is made of special cast iron and the journal and cam sections are chilled to resist wear. The journal section is force-lubricated. The fuel camshaft controls the reciprocating movement of the injection pump, and is equipped with a ball to

control the governor. The shaft end drives the hydraulic pump for implement lifting. Fuel camshaft is made of carbon steel and journal and cam sections are quenched and tempered to provide greater wear resistance.



1. Tappet 2. Push Rod 3. Camshaft 4. Camshaft Gear

Fig. B-11 Camshaft

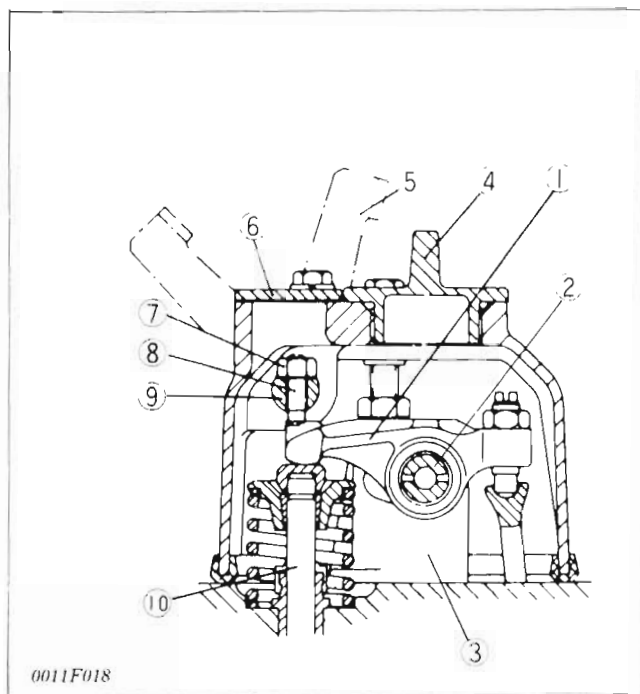


- 0011F017
- | | | | |
|------------------------|-----------------------|------------------|-----------------|
| 1. Injection Pump Gear | 3. Governor Ball Case | 5. Cir-clip | 7. Ball |
| 2. Governor Sleeve | 4. Cir-clip | 6. Fuel Camshaft | 8. Ball Bearing |

Fig. B-12 Fuel Camshaft

Rocker Arm Assembly

The rocker arm assembly includes the rocker arms, rocker arm brackets and rocker arm shaft, and converts the reciprocating movement of the cam-shaft and push rods to an open/close movement of the inlet and exhaust valves. Valve control timing must be adjusted with the screws on the rocker arms. Lubrication oil is pressurized through the bracket to the rocker arm shaft, which serves as a fulcrum so that the rocker arm bearings and the entire system are lubricated sufficiently.

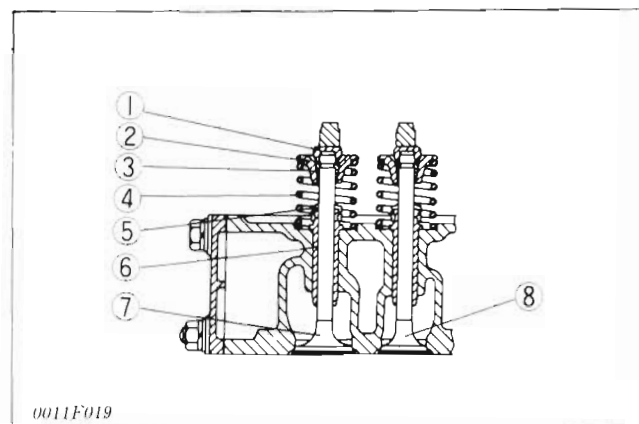


- | | |
|------------------------|-------------------------------|
| 1. Rocker Arm | 6. Decompression Window Cover |
| 2. Rocker Arm Shaft | 7. Decompression Nut |
| 3. Rocker Arm Bracket | 8. Decompression Bolt |
| 4. Oil Plug | 9. Decompression Shaft |
| 5. Decompression Lever | 10. Valve |

Fig. B-13 Rocker Arm

Inlet and Exhaust Valves

The inlet and exhaust valves and their guides are different from each other. Other parts, such as valve springs, valve spring retainers, valve spring collets, valve stem seals, and valve caps are the same for both the inlet and exhaust valves. All contact or sliding parts are quenched and tempered to resist wear.



- | | |
|--------------------------|--------------------|
| 1. Valve Cap | 5. Valve Stem Seal |
| 2. Valve Spring Retainer | 6. Valve Guide |
| 3. Valve Spring Collet | 7. Inlet Valve |
| 4. Valve Spring | 8. Exhaust Valve |

Fig. B-14 Inlet and Exhaust Valve

Troubleshooting the Engine Body

SYMPTOM	PROBLEM	SOLUTION
Engine does not start	Empty fuel tank	Refill fuel
	Defective safety switch	Adjust, repair or replace
	Discharged battery	Charge battery
	Deffective starter	Repair or replace
	Accelerator lever is not in starting position	Place in starting position
	Seized crankshaft, camshaft, piston, cylinder liner or bearing	Repair or replace seized parts
	Air leaking from cylinder head	Replace head gasket
	Worn piston ring and liner	Repair or replace
	Improper valve seat surfaces, broken valve springs or stuck valves	Repair or replace
	Defective valve timing	Reset timing gear
White or blue exhaust gas	Defective fuel system	Repair fuel system (See Fuel System)
	Too much lubricant	Reduce lubricant
	Worn or stuck piston rings and liners	Replace piston rings and repair or replace liners
	Delayed or advanced fuel injection timing	Adjust
Black or dark gray exhaust gas, insufficient engine output	Excessive load	Reduce load
	Inferior fuel	Use specified fuel
	Clogged or dirty fuel filter	Replace filter element
	Clogged air cleaner	Clean or replace element
	Delayed or advanced fuel injection timing	Adjust
	Seized engine parts	Repair and replace
	Irregular fuel injection	Repair or replace fuel injection pump
	Improper nozzle injection	Repair or replace injection nozzle

Group 2

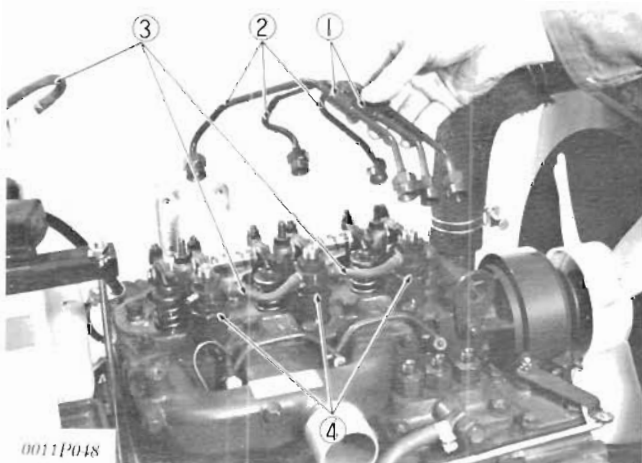
Disassembly

Cylinder Head

1. Cylinder Head Cover

- (1) Remove the head cover nuts.
- (2) Remove the head cover.

2. Injection Pipes, Nozzle Holders



1. Pipe Clamp
2. Pipe 1, 2, 3

3. Overflow Pipe
4. Nozzle Holder

Fig. B-15 Removing Injection Pipes, Nozzle Holders

- (1) Loosen the screws on the pipe clamp.
- (2) Detach the injection pipes in the order of 1, 2 and 3.
- (3) Remove the clips holding the fuel overflow pipes, and detach the pipes.
- (4) Detach the nozzle holders using a 27mm (1.063 in.) nozzle holder socket wrench.

SPECIAL TOOLS: Nozzle Holder Socket Wrench (Code No. 07916-30841)

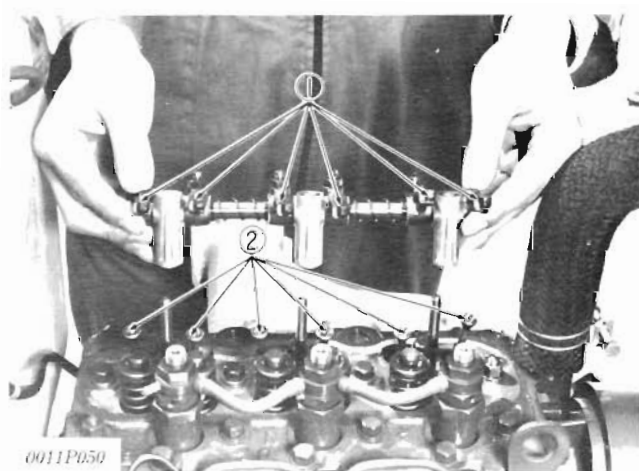


Fig. B-16 Nozzle Holder Socket Wrench

3. Fan Belt

- (1) Loosen the tension pulley shaft set nut.
- (2) Loosen the tension bolt for the tension pulley and remove the V-belt.

4. Cylinder Head

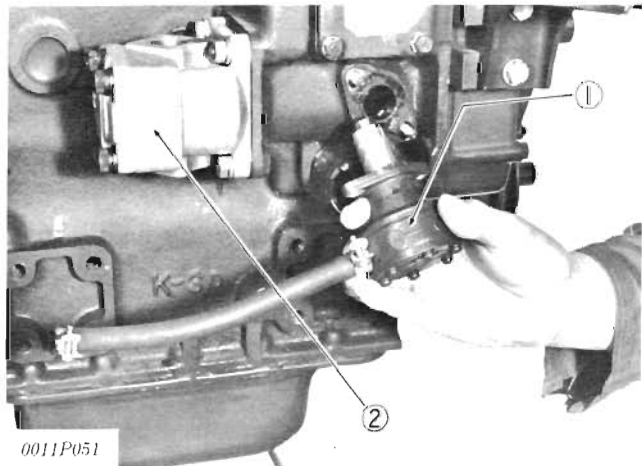


1. Rocker Arm

2. Push Rods

Fig. B-17 Removing Cylinder Head

- (1) Remove the set nuts for the rocker arm brackets, and detach the rocker arm assembly.
- (2) Remove the six push rods.
- (3) Remove the twelve cylinder head bolts and two nuts.
- (4) Remove the cylinder head.
- (5) Detach the cylinder head gasket, being careful not to scratch it.
- (6) Remove the O-ring from the periphery of the oil pipe pin on the crankcase.
- (7) Remove the six tappets from the crankcase.

Removing Pumps**1. Fuel Pump, Hydraulic Pump**

1. Fuel Pump 2. Hydraulic Pump

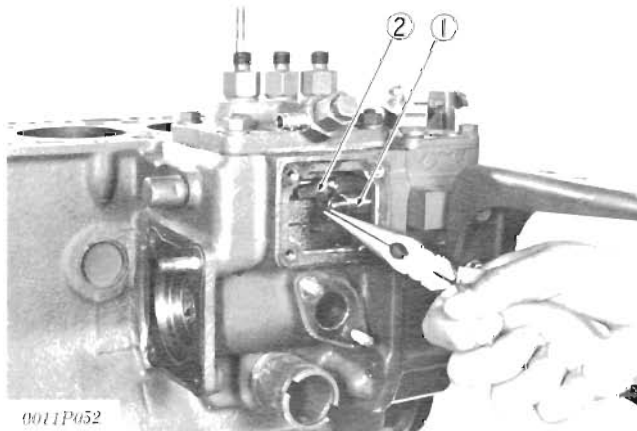
Fig. B-18 Removing Fuel Pump, Hydraulic Pump

(1) Detach the fuel pump.

(2) Detach the hydraulic pump.

NOTE: Do not hit the cap of idling limit apparatus.

(3) Remove the injection pump cover.

2. Injection Pump

1. Governor Spring 2. Fork Lever

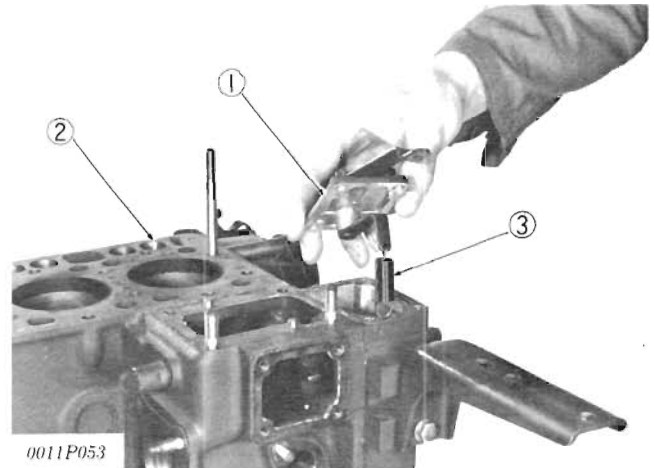
Fig. B-19 Removing Governor Spring

(1) Remove one end of the governor spring from the fork lever and leave it there.

(2) Remove the nuts and bolts holding the injection pump.

(3) Detach the injection pump. To prevent the pump rack from being caught, detach the pump along the removal groove.

NOTE: Count the number of the fuel injection timing adjusting shims.

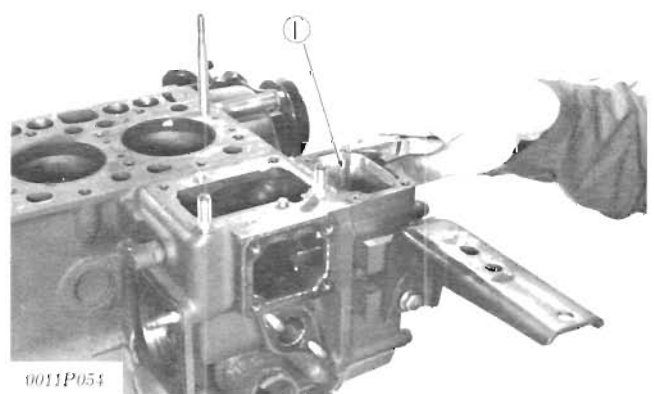
Removing Gear Case, Camshaft, and Oil Pump**1. Speed Control Lever**

1. Speed Control Plate 3. Governor Spring
2. Crankcase

Fig. B-20 Speed Control Lever

(1) Remove the four bolts holding the speed control plate.

(2) Lift the plate to detach.

2. Start Spring

1. Start Spring

Fig. B-21 Removing Start Spring

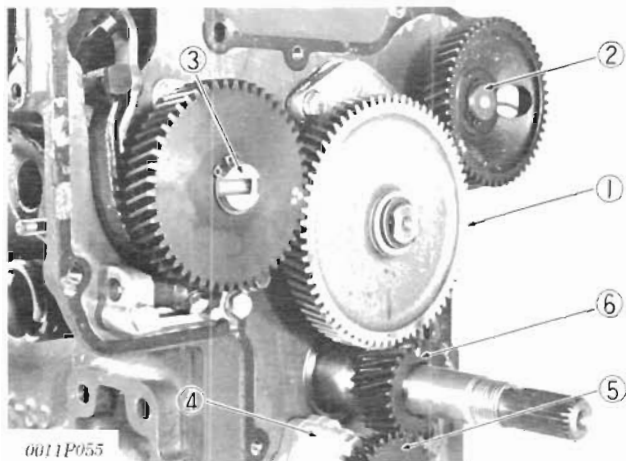
(1) Remove the start spring near the gear case with a pair of cutting pliers.

3. Gear Case

- (1) Remove the fan drive pulley with a puller.
- (2) Remove the gear case.

NOTE: Make sure there are three O-rings inside the gear case.

4. Camshaft, Oil Pump



- | | |
|------------------|------------------------|
| 1. Idler Gear | 4. Oil Pump |
| 2. Camshaft | 5. Oil Pump Drive Gear |
| 3. Fuel Camshaft | 6. Crank Gear |

Fig. B-22 Removing Camshaft, Oil Pump

- (1) Remove the idler gear.
- (2) Remove the camshaft stopper.
- (3) Remove the camshaft by drawing out the cam gear.
- (4) Remove the fuel camshaft stopper.
- (5) Remove the fork lever holder and fork lever assembly.
- (6) Draw out the fuel camshaft and the injection pump gear.
- (7) Set a gear puller on the oil pump drive gear. Draw out the gear.
- (8) Remove the oil pump.
- (9) Remove the crank gear with a gear puller.

Removing Piston and Crankshaft

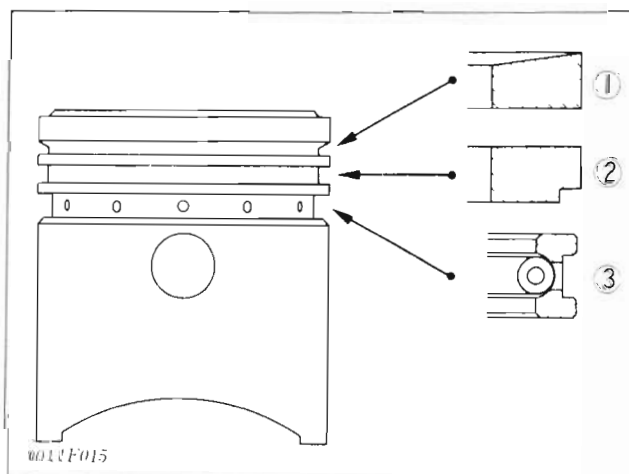
1. Piston

- (1) Remove the eighteen oil pan mounting bolts, and detach the oil pan.
- (2) Detach the oil filter, being careful of the O-ring.
- (3) Remove the connecting rod bolts and large end metal, turn the crankshaft by 180°, and bring the piston to top dead center.
- (4) Draw out the piston upward by lightly tapping it from the bottom of the crankcase with the handle of a hammer.
- (5) After drawing the piston out, attach a tag to each piston indicating its number.



Fig. B-23 Indicating Piston Number

2. Piston Rings

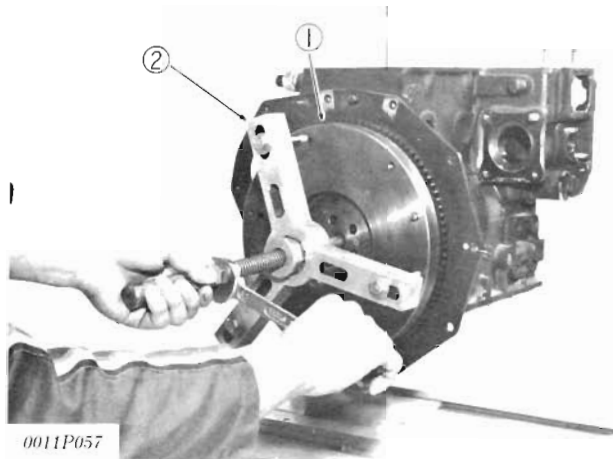


- | | |
|-------------------------|-----------------------|
| 1. Plated Keystone Ring | 3. Coil Expander Ring |
| 2. Undercut Ring | |

Fig. B-24 Piston Rings

- (1) Remove the piston rings.

3. Flywheel



1. Flywheel 2. Flywheel Puller

Fig. B-25 Removing Flywheel

- (1) Set Flywheel Puller, and remove the fly-wheel.

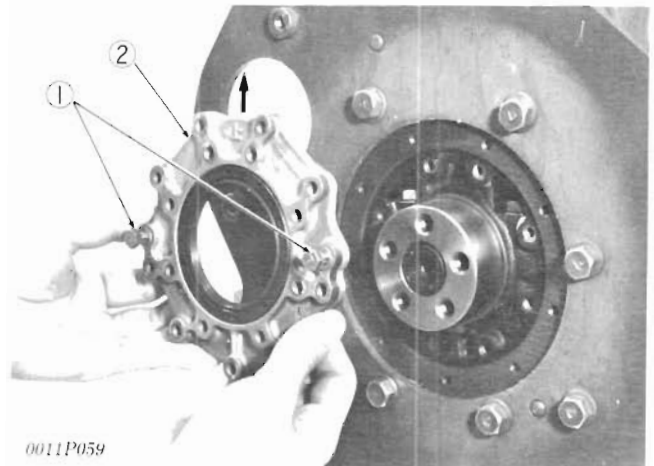
SPECIAL TOOL: Flywheel Puller
(Code No. 07916-06041)



0011P058

Fig. B-26 Flywheel Puller

4. Bearing Case Cover



1. Lifting Bolt 2. Bearing Case Cover

Fig. B-27 Removing Bearing Case Cover

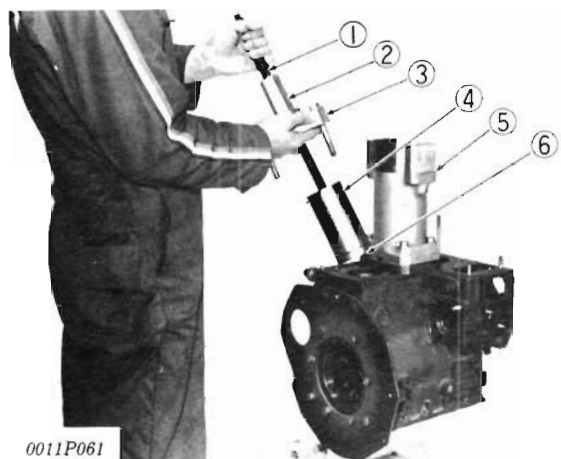
- (1) Remove the bearing case cover mounting bolts.
- (2) Screw the two removed bolts into the right and left holes of the bearing case cover, to pull off the cover by lifting it up.

5. Crankshaft

1. Main Bearing Case Assembly 1
2. Main Bearing Case Assembly 2
3. Main Bearing Case Assembly 3*Fig. B-28 Removing Crankshaft*

- (1) Detach the bearing case bolts 2 under the crankcase.
- (2) Draw out the crankshaft from the back of the crankcase by lightly tapping it with a copper hammer.
- (3) Detach the main bearing cases, being careful with the side and crankshaft metals.

6. Cylinder Liner



- | | |
|---------------------|-------------------------|
| 1. Center Bolt | 4. Cylinder Liner |
| 2. Nut | 5. Liner Centering Base |
| 3. Bearing Receiver | 6. Pulling-Out Adaptor |

Fig. B-29 Pulling-Out Cylinder Liner

- (1) Grind the cylinder head mounting surface with an oil stone.
- (2) Set the dry liner centering base and adaptor on the frame head.

SPECIAL TOOLS: Dry Liner Changer
(Code No. 07916-30042)



Fig. B-30 Dry Liner Changer

- (3) Set the dry liner centering base.
- (4) Set the bearing cradle on the liner centering base with the bearing on top.
- (5) Insert the pulling-out adaptor coupling, and fix the center bolt.
- (6) Contact the pulling-out adaptor with the bottom of the liner from the bottom of the crankcase.
- (7) Pull out the liner by turning the nut with a ratchet handle.

Group 3

Servicing

Cylinder Head

1. Checking Compression

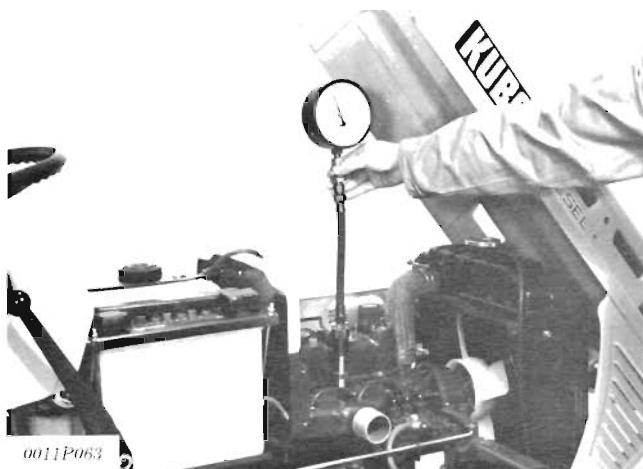


Fig. B-31 Checking Compression

- (1) Warm up the engine.
- (2) Detach the air cleaner and the nozzle holders of all cylinders.
- (3) Attach compression tester to the cylinder to be measured.

TEST EQUIPMENT: Compression Tester
(Code No. 07909-30202)



Fig. B-32 Compression Tester

IMPORTANT: For the test, use a fully charged battery and the specified valve clearance.

- (4) Run the engine with the starter at engine speed 200 to 250 rpm and read the constant maximum on the tester. Repeat the test at least twice. (Run the engine for 5 to 10 seconds for each test.)

•Reference value:

2.7 to 3.1 MPa (28 to 32 kgf/cm², 398 to 454 psi)

•Allowable limit:

2.4 Mpa (24 kgf/cm², 341 psi)

When the reading is below the allowable limit, pour a small amount of oil through the nozzle holder hole, and test again.

- (1) If the pressure recovers to the standard level after a while, the possible cause of the inadequate pressure is wearing or adhesion of piston rings. Check related points.
- (2) If the pressure does not recover, it may be because of cylinder head or valve problems. Check related points.
If there is a difference in compression of more than 10 percent (%) among the cylinders, trace the cause of pressure variation and take corrective measures.

2. Checking Distortion of Cylinder Head Surface



Fig. B-33 Checking Distortion of Cylinder Head Surface

- (1) Clean the surface of the cylinder head.
- (2) Place a straight edge on the four sides and diagonal lines of the cylinder head to check surface straightness.

- (3) Insert a feeler gauge between the straight edge and the cylinder head surface.
- (4) The maximum thickness that can be inserted is the amount of distortion.
 - Allowable limit:
0.05 mm (0.002 in.) per 100 mm (4 in.)
- NOTE:** Do not place a straight edge on the combustion chamber.
- (5) If the measurement exceeds the allowable limit, correct with a surface grinder.

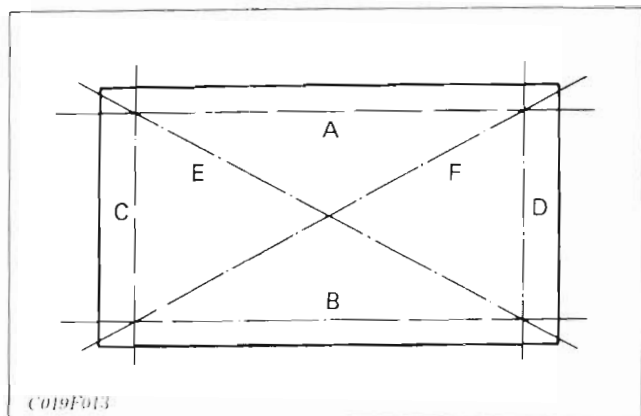


Fig. B-34 Checking Cylinder Head Surface

3. Checking Valve Seat Width

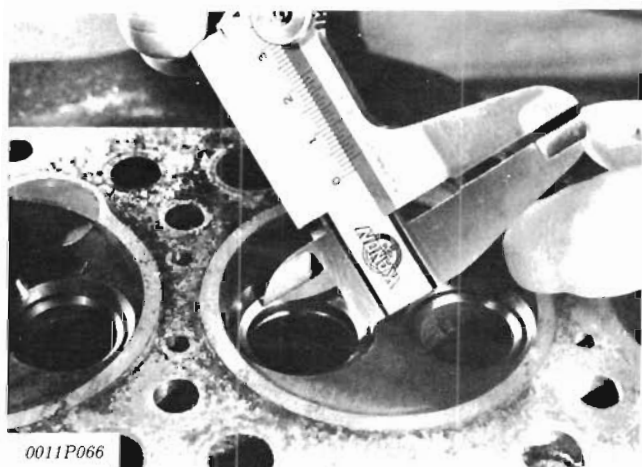


Fig. B-35 Checking Valve Seat Width

- (1) Clean the valve seat surface.
- (2) Measure the width of the seat using a pair of vernier calipers.
- (3) Apply red lead on the valve to check if the seat is scratched or dented.
 - Reference value:
2.12 mm (0.083 in.)

To correct the dimensions of the valve seat using a valve seat cutter, follow the steps below.

- (1) Clean the valve seat surface.
- (2) Use a 45° cutter suitable for the valve guide

and the valve seat.

- (3) Grind the upper surface of valve seat with 15° cutter so that the valve seat fits to the valve center (so as to ensure $a = b$ as shown in the figure).

NOTE:

- After correcting the valve seat, check for valve recessing.

A 45° cutter (1) Valve

B 15° cutter (2) Corrected surface of valve seat

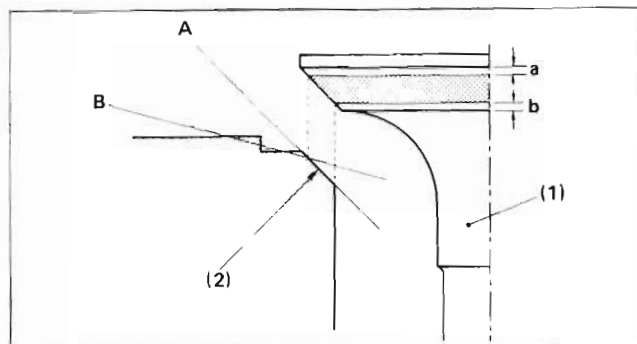
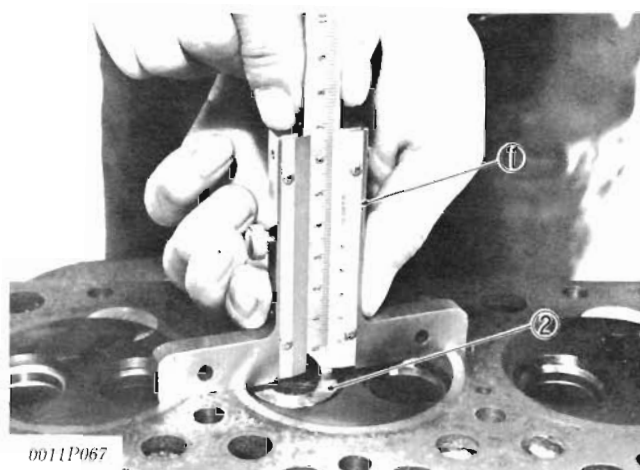


Fig. B-36 How to Repair the Valve Seat

4. Checking Valve Recess



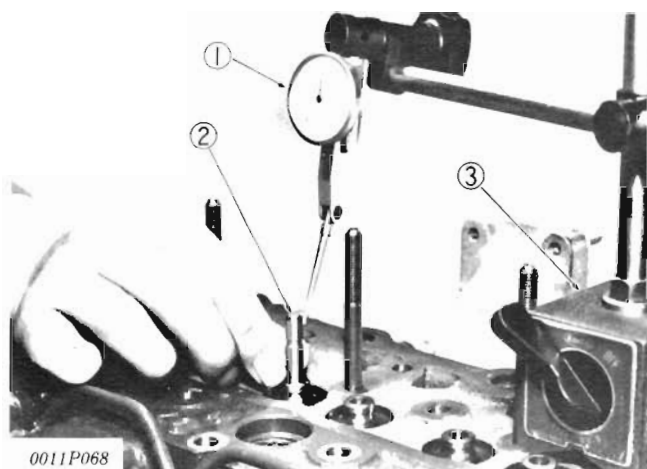
1. Depth Gauge

2. Valve

Fig. B-37 Checking Valve Recess

- (1) Clean the face of the valve.
 - (2) Measure the recess with a depth gauge.
- If a valve seat is reground many times, it will recede too far and the valve spring will stretch and lose its tension. When the valve recess becomes more than the reference value, place a washer of appropriate thickness under the spring.
- Reference value:
0.9 to 1.1 mm (0.035 to 0.043 in.)
 - Allowable limit:
1.3mm (0.051 in.)

5. Checking Stem Guide Clearance



1. Lever Test 2. Valve Stem 3. Magnetic Base

Fig. B-38 Checking Stem Guide Clearance

- (1) Remove carbon from the valve guide.
- (2) After making sure that the valve stem is straight, insert the valve into the valve guide.
- (3) Measure the stem guide clearance with a dial gauge.
- (4) If the measurement exceeds the allowable limit, replace the stem guide and the valve.
 - Reference value:
0.035 to 0.065 mm (0.0014 to 0.0026 in.)
 - Allowable limit:
0.1 mm (0.004 in.)

NOTE:

When replacing valve guides, make sure that they are installed on the proper sides.

6. Checking Valve Spring Free Length

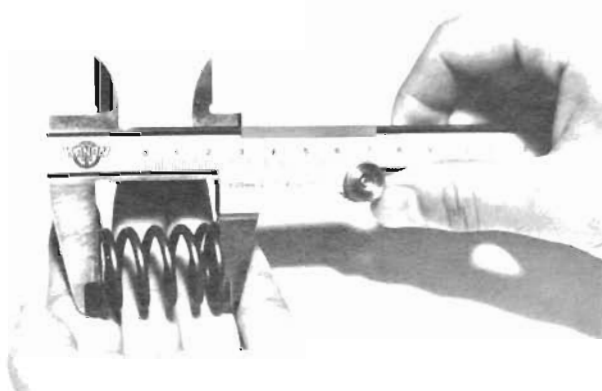


Fig. B-39 Checking Valve Spring Free Length

- (1) Measure the spring with a pair of vernier calipers.

- (2) If the measurement exceeds the allowable limit, replace.

- Reference value:
35.1 to 35.6 mm (1.382 to 1.402 in.)
- Allowable limit:
34.8 mm (1.37 in.)

7. Checking Valve Spring Inclination

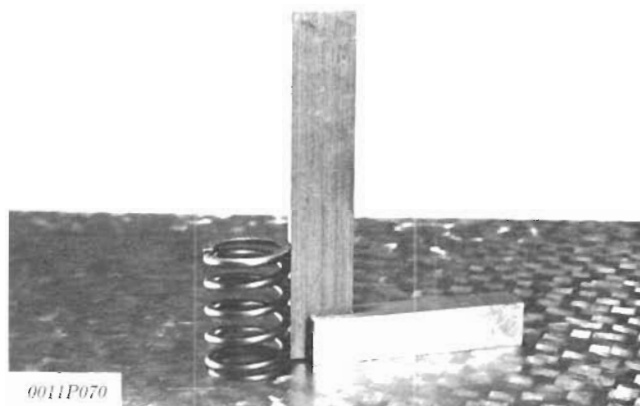


Fig. B-40 Checking Valve Spring Inclination

- (1) Put the spring on a surface plate, place a square on the side of the spring, and check to see if the entire side is in contact with the square.
- (2) Rotate the spring and measure the maximum B. (See the illustration below.)

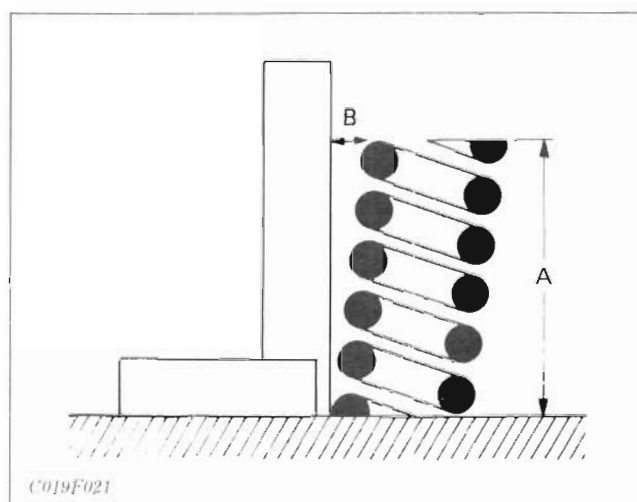


Fig. B-41 How to Measure Valve Spring Inclination

- (3) The flat surface at the end of the spring coil must be at least $\frac{2}{3}$ more than the full circumference.
- (4) Check the entire surface of the spring for scratches.

- (5) If the measurement exceeds the allowable limit, replace the valve spring.

- Allowable limit:
1.3 mm (0.051 in.)

Spring inclination is expressed by B in relation to A, where A is the free length of the spring which is placed on a surface plate and B is the distance between the top of the spring and the vertical line.

8. Checking Valve Spring Tension



0011P071

Fig. B-42 Checking Valve Spring Tension

- (1) Place the spring on a spring tester and compress it to the same degree that it is actually compressed in the engine.

TEST EQUIPMENT: Spring Tester



0011P072

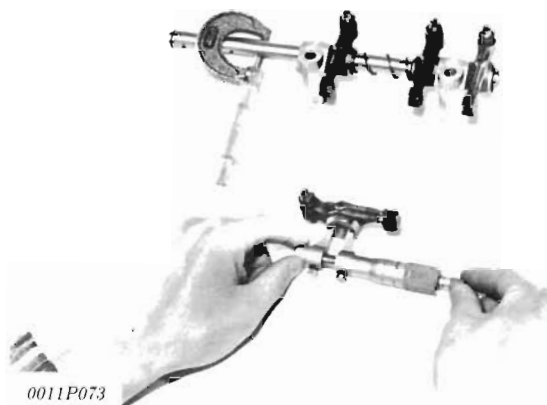
Fig. B-43 Spring Tester

- (2) Read the compression load on the gauge.

- (3) If the measurement exceeds the allowable limit, replace the valve spring.

- Reference value
74 N/31 mm
(7.5 kgf/31 mm 16.5 lbs./1.22 in.)
- Allowable limit
63 N/31 mm
(6.4 kgf/31 mm 14.1 lbs./1.22 in.)

9. Checking Oil Clearance between Rocker Arm Shaft and Bushing



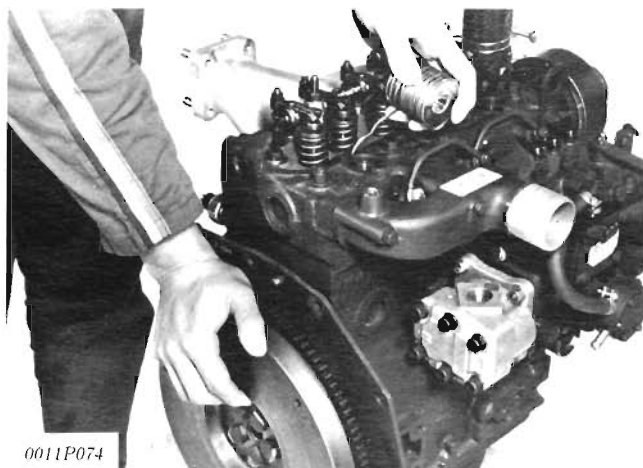
0011P073

Fig. B-44 Checking Oil Clearance between Rocker Arm Shaft and Bushing

- (1) Measure the inside diameter of the rocker arm bushings.
(2) Measure the outside diameter of the rocker arm shaft and then calculate the clearance.
(3) If the measurement exceeds the allowable limit, replace the bushing.

- Rocker arm shaft O.D.:
10.973 to 10.984 mm (0.4320 to 0.4324 in.)
- Rocker Arm bushing I.D.:
10.997 to 11.038 mm (0.4330 to 0.4346 in.)
- Reference value:
0.013 to 0.065 mm (0.0005 to 0.0026 in.)
- Allowable limit:
0.12 mm (0.0047 in.)

10. Checking Top Clearance



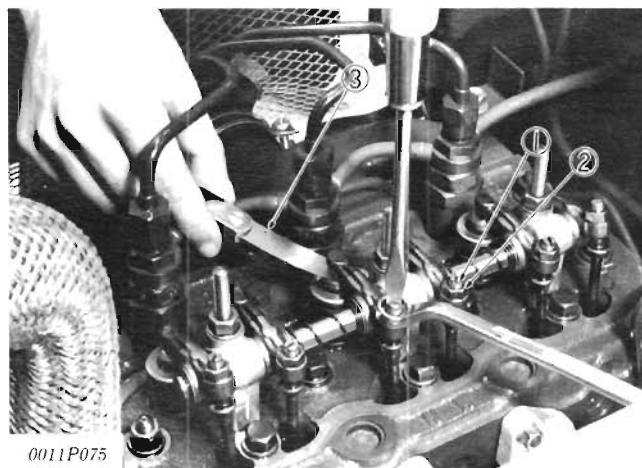
0011P074

Fig. B-45 Checking Top Clearance

- (1) Remove the nozzle holder.
- (2) Lower the piston in the cylinder to be measured.
- (3) Insert a high-quality fuse from the nozzle holder hole. Be careful not to let the fuse touch the valve surface.
- (4) Rotate the engine by hand.
- (5) Take the fuse out carefully.
- (6) Measure the place where the fuse was crushed with a set of vernier calipers.
- (7) If the measurement is not within the reference value, adjust by inserting a shim between the cylinder head and the gasket.

- Reference value
0.6 to 0.8 mm (0.0237 to 0.0315 in.)

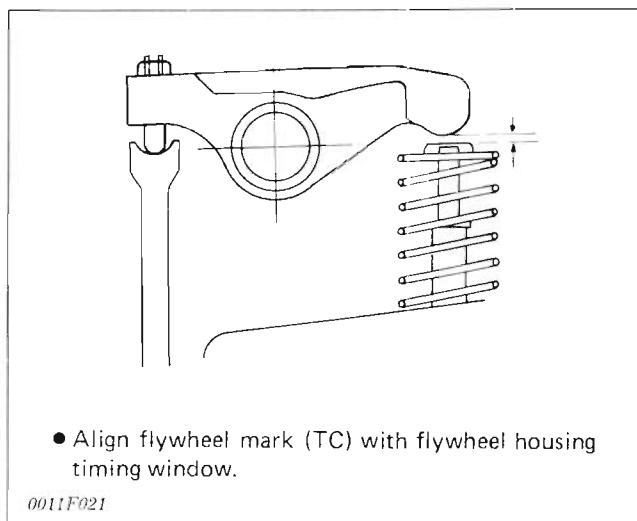
11. Checking Valve Clearance



0011P075

1. Adjusting Screw
2. Rock Nut
3. Feeler Gauge

Fig. B-46 Checking Valve Clearance



- Align flywheel mark (TC) with flywheel housing timing window.

0011F021

Fig. B-47 Valve Clearance

- (1) Measure and adjust the clearance with a feeler gauge after aligning each cylinder with the top dead center of compression.
- (2) Adjust them in their injection order.
(1 → 2 → 3)

NOTE: Measure and adjust when cold.
0.145 to 0.185 mm (0.0057 to 0.0073 in.)
Valve clearances other than reference value may cause output fluctuation, excessive noise, or valve or piston breakage.

12. Adjusting Compression Release

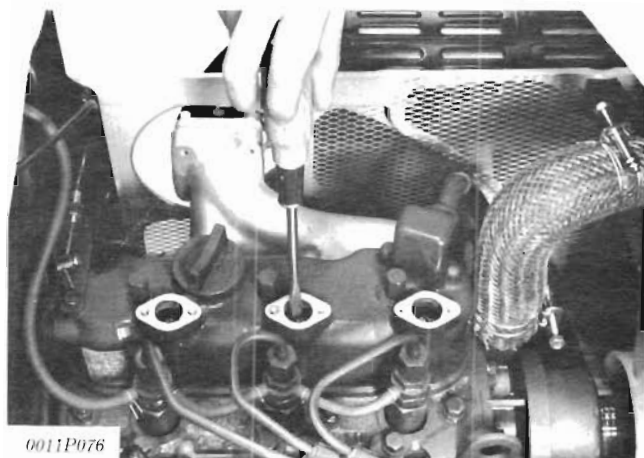
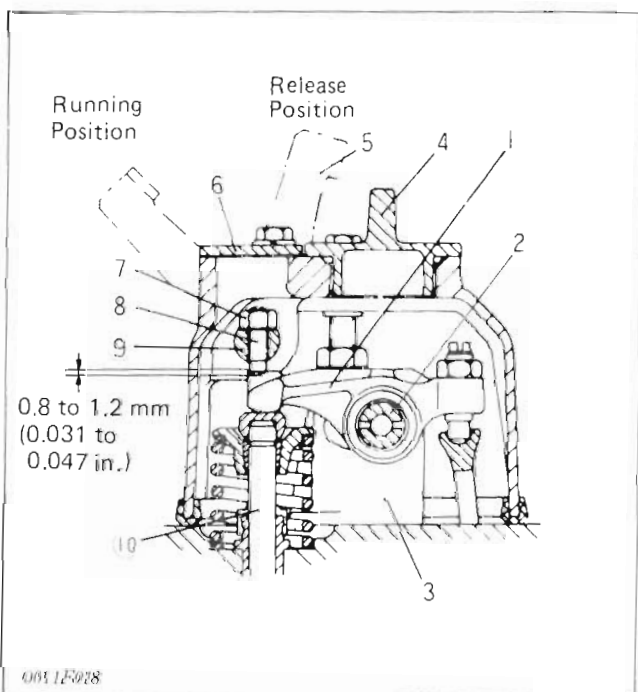


Fig. B-48 Adjusting Compression Release (1)



- | | |
|------------------------|-------------------------------|
| 1. Rocker Arm | 6. Decompression Window Cover |
| 2. Rocker Arm Shaft | 7. Decompression Nut |
| 3. Rocker Arm Bracket | 8. Decompression Bolt |
| 4. Oil Plug | 9. Decompression Shaft |
| 5. Decompression Lever | 10. Valve |

Fig. B-49 Adjusting Compression Release (2)

- (1) Close the exhaust valve completely.
- (2) Remove the decompression window cover from the head cover.
- (3) Pull the decompression lever.
- (4) Reduce the valve clearance to zero by means of the compression release adjustment bolt. Reach through the port to gain access to the bolt. Then, screw the bolt in 1 to 1.5 turns and tighten the lock nut.

IMPORTANT: After adjustment, turn the crankshaft by hand and make sure the valve and the piston are not in contact with each other.

- Reference value:
0.8 to 1.2 mm (0.031 to 0.047 in.)

13. Checking Air Cleaner Element



Fig. B-50 Checking Air Cleaner Element

- (1) How to clean with compressed air:
Directly blow compressed air of less than 686 Kpa (7 kgf/cm², 99 psi) through the element from its inside.
- (2) How to clean using solution:
Add 15g (½ oz.) KUBOTA genuine element detergent to 1 liter (1 U.S.qts.) water. Let the element soak in the solution for 15 minutes and then wash it well in the solution. Rinse well in clean water and dry.

NOTE: To remove dirt and dust, use compressed air.

SERVICE INTERVAL:

- | | |
|-------------|---------------------------------|
| Clean ... | Every 100 to 200 hours |
| Replace ... | Every 6 cleanings or every year |

Timing Gears and Camshaft

1. Checking Cam Heights of Intake and Exhaust

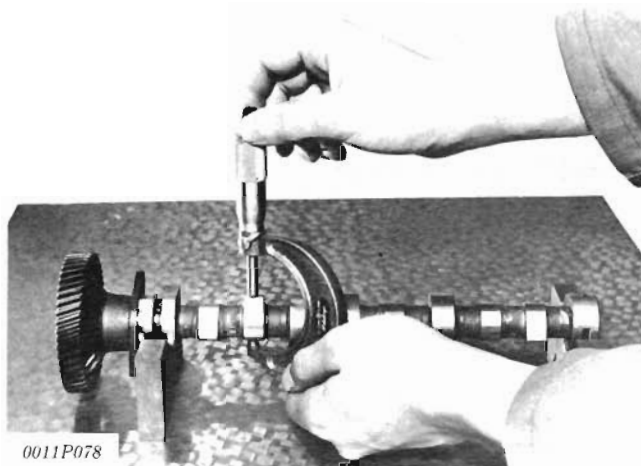


Fig. B-51 Checking Cam Heights

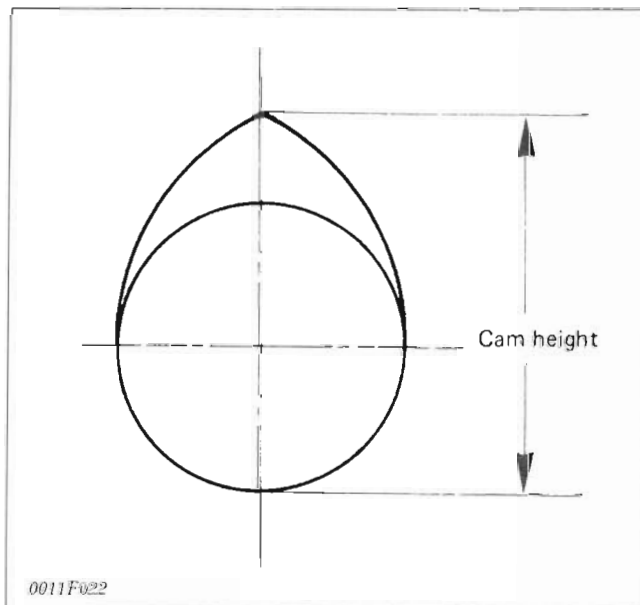


Fig. B-52 Cam Height Measuring Points

- (1) Measure the height of cam at its highest point with a micrometer.
- (2) If the measurement exceeds the allowable limit, replace the camshaft.
 - Reference value:
26.88 mm (1.0583 in.)
 - Allowable limit:
26.83 mm (1.0563 in.)

2. Checking Camshaft Alignment

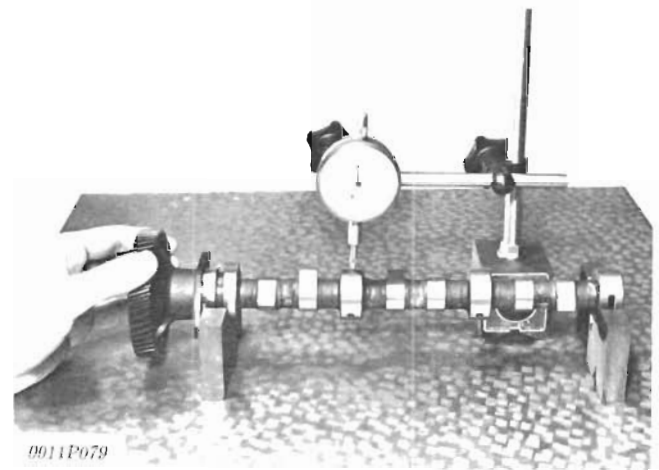


Fig. B-53 Checking Camshaft Alignment

- (1) Place the camshaft on V-blocks.
- (2) Attach a dial gauge to the journal.
- (3) While slowly rotating the camshaft, read the dial gauge. The camshaft flexure is a half of the reading.
- (4) If the measurement exceeds the allowable limit, replace the camshaft.
 - Allowable limit:
0.08 mm (0.0031 in.)

3. Checking Wear of Fuel Camshaft Cams



Fig. B-54 Checking Wear of Fuel Camshaft Cams

- (1) Place the fuel camshaft on V-blocks.
- (2) Measure the cam height with a micrometer.
- (3) If the measurement exceeds the allowable limit, replace the camshaft.
 - Reference value:
30.93 to 31.07 mm (1.2177 to 1.2233 in.)
 - Allowable limit:
30.87 mm (1.2154 in.)

5. Checking Clearance between Idle Gear Shaft and Idle Gear Bushings

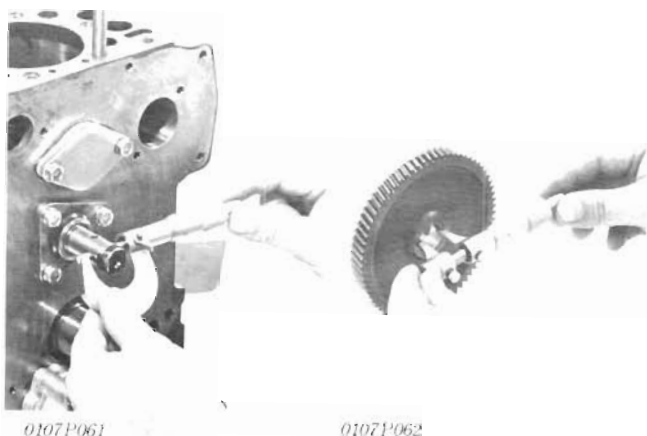


Fig. B-79 Checking Clearance between Idle Gear Shaft and Idle Gear Bushings

- (1) Measure the idle gear shaft O.D. with an outside micrometer.
- (2) Measure the idle gear bushings I.D. with an inside micrometer, and calculate the clearance.
- (3) If the clearance exceeds the allowable limit, replace the bushing.
 - Reference value:
0.016 to 0.045 mm (0.0007 to 0.0017 in.)
 - Allowable limit:
0.1 mm (0.0039 in.)

[Engine serial number: 407507 and beyond]

- Reference value:
0.020 to 0.054 mm (0.0008 to 0.0021 in.)
- Allowable limit:
0.1 mm (0.0039 in.)

4. Checking Backlash of Idler Gear

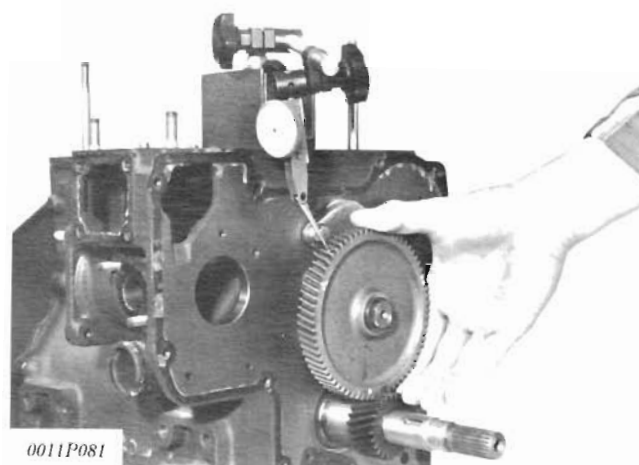


Fig. B-55 Checking Backlash of Idler Gear

- (1) Install a lever-type indicator between the gear teeth.
- (2) Read the indicator while manually moving the gear.
- (3) If the measurement exceeds the allowable limit, replace the gear.
 - Reference value:
0.04 to 0.12 mm (0.002 to 0.005 in.)
 - Allowable limit:
0.2 mm (0.008 in.)

Pistons and Connecting Rods

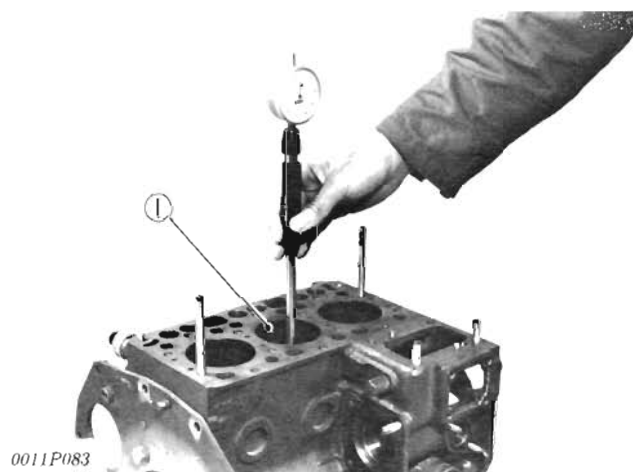
1. Checking Inside Diameter of Piston Bosses



Fig. B-56 Checking Inside Diameter of Piston Bosses

- (1) Measure the piston bosses with an inside micrometer.
- (2) If the measurement exceeds the allowable limit, replace the piston.
 - Reference value:
20.00 to 20.01 mm (0.7874 to 0.7878 in.)
 - Allowable limit:
20.04 mm (0.7890 in.)

2. Checking Wear of Cylinder Liners



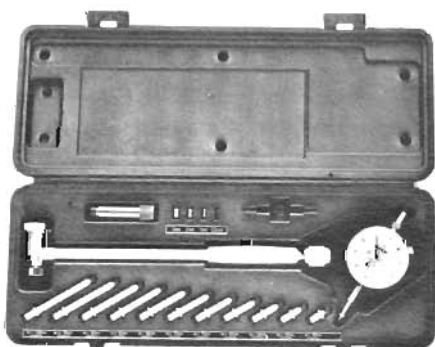
0011P083

1. Cylinder Liner

Fig. B-57 Checking Wear of Cylinder Liners

- (1) Set a cylinder gauge and adjust it to the reference value of the cylinder liner with an outside micrometer.

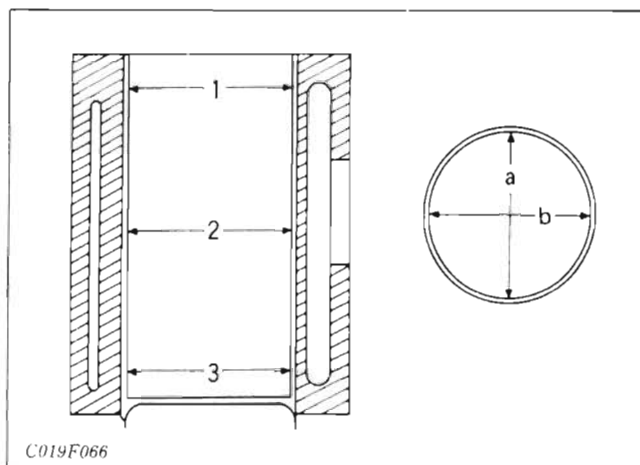
TEST EQUIPMENT: Cylinder Gauge



0011P084

Fig. B-58 Cylinder Gauge

- (2) To determine maximum wear, measure the diameters at six points on the cylinder liner with the cylinder gauge.



C019F066

1. Top
2. Middle
3. Bottom (Skirt)
- a. Perpendicular to the piston pin
b. In Parallel to the piston pin

Fig. B-59 Measuring Points of Cylinder Liner

- Reference value:
68.000 to 68.019 mm (2.6772 to 2.6779 in.)
- Allowable limit:
68.15 mm (2.6831 in.)

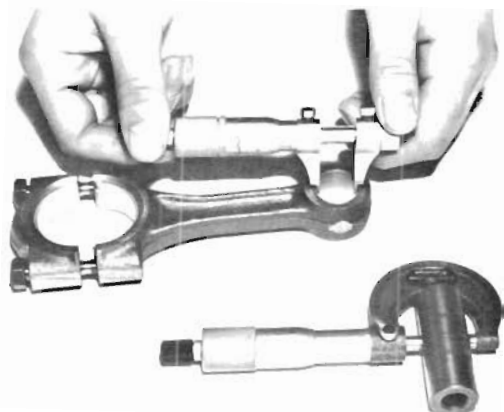
NOTE: When the cylinder liner is worn beyond the allowable limit, bore and hone it by 0.5mm (0.0197 in.).

Finish dimensions of cylinder liner
Hone to 1.2 to 2 μ R max ($\nabla \nabla \nabla$)

Use oversized pistons and piston rings for cylinder liners which have been bored and honed to oversizes.

	D750-AH	
Oversize	0.5mm (0.0197 in.)	
Part name	Piston 05	Piston ring 05 assembly
Code number	15261-2191-1	15271-2109-1
Mark	050S	

3. Checking Clearance between Piston Pin and Bushing

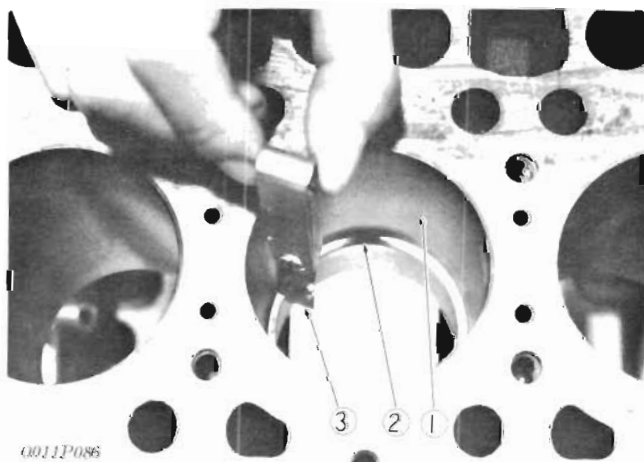


0011P085

Fig. B-60 Checking Clearance between Piston Pin and Bushing

- (1) Measure the piston pin with an outside micrometer.
- (2) Measure the inside diameter of connecting rod small end bushing with an inside micrometer. Calculate the clearance.
- (3) If the measurement exceeds the allowable limit, replace the connecting rod small end bushing.
 - Reference value:
0.014 to 0.038 mm (0.0006 to 0.0015 in.)
 - Allowable limit:
0.15 mm (0.006 in.)

4. Checking Piston Ring Gaps



0011P086

1. Cylinder Liner 2. Piston Ring 3. Feeler Gauge

Fig. B-61 Checking Piston Ring Gaps

- (1) Put the piston ring in the cylinder.
- (2) Turn the piston upside down and push the ring into the cylinder with the piston head.
- (3) Insert a feeler gauge into the piston ring gap.

- (4) If the measurement exceeds the allowable limit, replace the piston ring.

- Reference value:
 - *1st, 2nd Ring
0.25 to 0.40 mm (0.010 to 0.016 in.)
 - *Oil Ring
0.20 to 0.40 mm (0.008 to 0.016 in.)
- Allowable limit:
1.25 mm (0.049 in.)

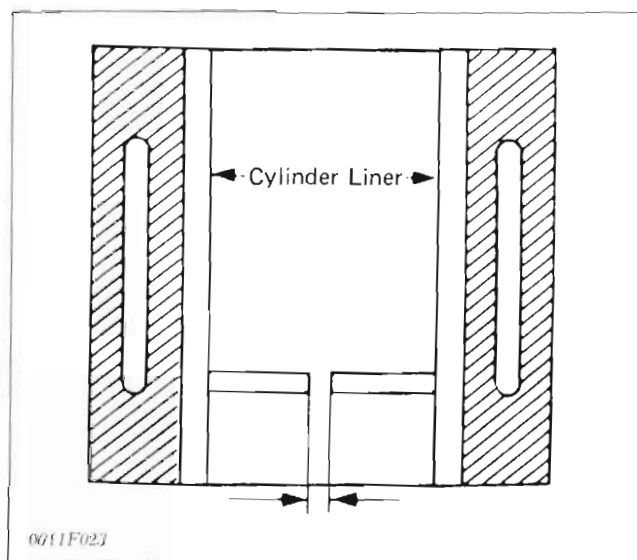


Fig. B-62 Piston Ring Gap

5. Checking Side Clearance of Ring in Groove



0011P087

Fig. B-63 Checking Side Clearance of Ring in Groove

- (1) Remove the piston ring from the piston.
- (2) Place the ring in its groove as shown in Fig. B-63, and measure the clearance.

- (3) If the measurement exceeds the allowable limit, replace the ring.

●Reference value:

*2nd Ring

0.085 to 0.112 mm (0.0033 to 0.0044 in.)

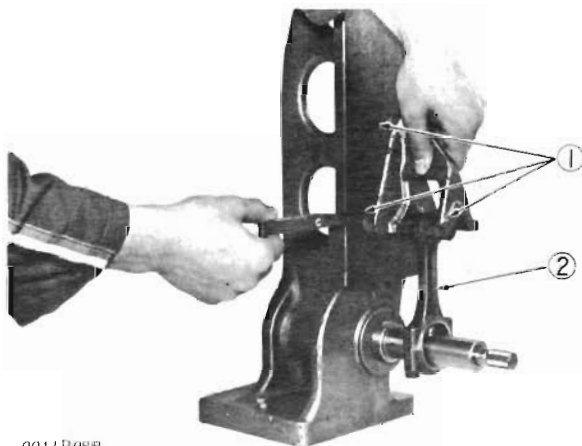
*Oil Ring

0.020 to 0.052 mm (0.0008 to 0.0020 in.)

●Allowable limit:

0.50 mm (0.020 in.)

6. Checking Connecting Rod Alignment



0011P088

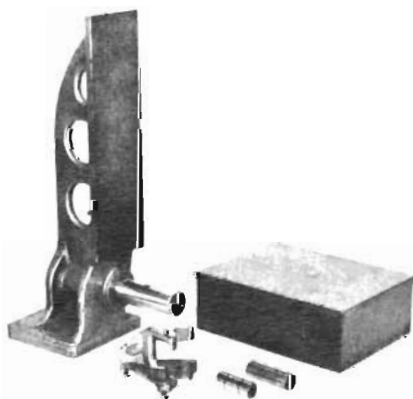
1. Measuring Point

2. Connecting Rod

Fig. B-64 Checking Connecting Rod Alignment

- (1) Remove the crank pin bushing and tighten the rod bolts.
- (2) Attach the connecting rod to a connecting rod aligner.

TEST EQUIPMENT: Connecting Rod Aligner



0011P089

Fig. B-65 Connecting Rod Aligner

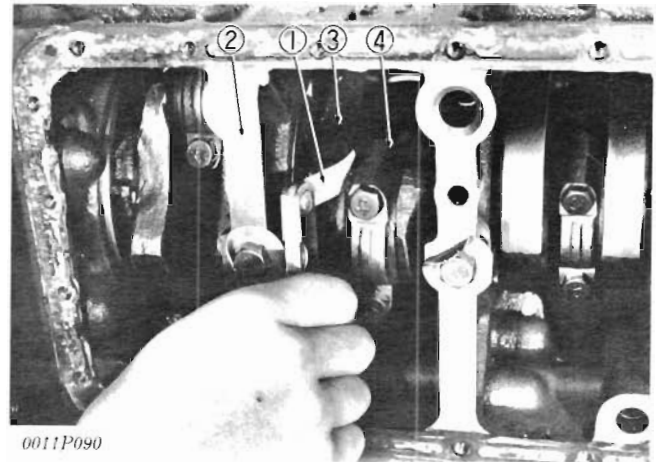
- (3) Place the gauge on the piston pin. Measure the gap between the pin of the gauge and the flat surface of the aligner.

- (4) If the measurement exceeds the allowable limit, replace the connecting rod.

●Allowable limit:

0.05 mm (0.0020 in.)

7. Checking Axial Clearance of Connecting Rod



0011P090

1. Feeler Gauge

2. Crankcase

3. Crankshaft

4. Connecting Rod

Fig. B-66 Checking Axial Clearance of Connecting Rod

- (1) Move the connecting rod large-end completely to either side.
- (2) Insert a feeler gauge between the connecting rod and crankshaft, and measure the clearance.
- (3) If the measurement exceeds the allowable limit, replace the connecting rod.
 - Reference value:
0.2 to 0.4 mm (0.008 to 0.016 in.)
 - Allowable limit:
0.5 mm (0.020 in.)

Crankshaft

1. Checking Crankshaft Alignment

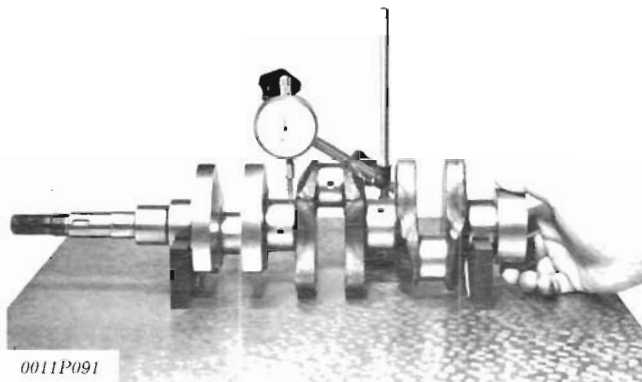


Fig. B-67 Checking Crankshaft Alignment

- (1) Place V-blocks on the surface plate to support the journals at both ends of the crankshaft.
- (2) Attach a dial gauge at the center of the journal.
- (3) Read the dial gauge deflection while rotating the crankshaft slowly. Crankshaft flexure is a half of the reading.
- (4) If the measurement exceeds the allowable limit, replace the crankshaft.
 - Allowable limit:
0.08 mm (0.003 in.)

2. Checking Wear of Crank Journal and Crankpin

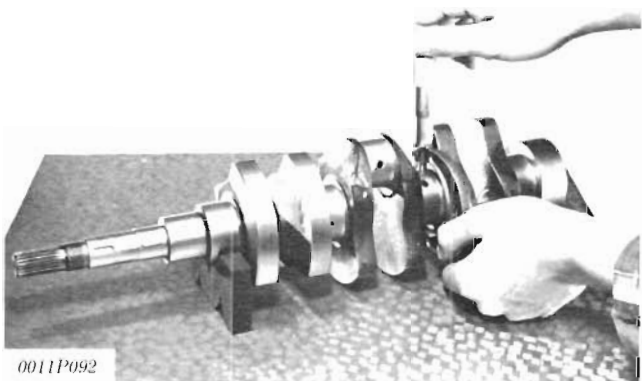


Fig. B-68 Checking Wear of Crank Journal and Crankpin Bearing 1

- (1) Measure the crankshaft journal and the crankpin with an outside micrometer.

- (2) If the measurement exceeds the allowable limit, replace the crank journal bearing 1 (undersize).
(See page 3-14)

- Reference value:
(pin)
36.959 to 36.975 mm (1.4551 to 1.4557 in.)
(journal)
43.934 to 43.950 mm (1.7297 to 1.7303 in.)

3. Checking Oil Clearance between Crankshaft Journals and Bearings 2

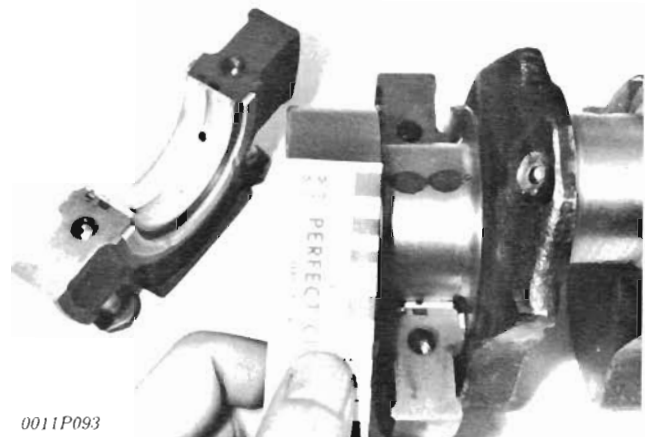


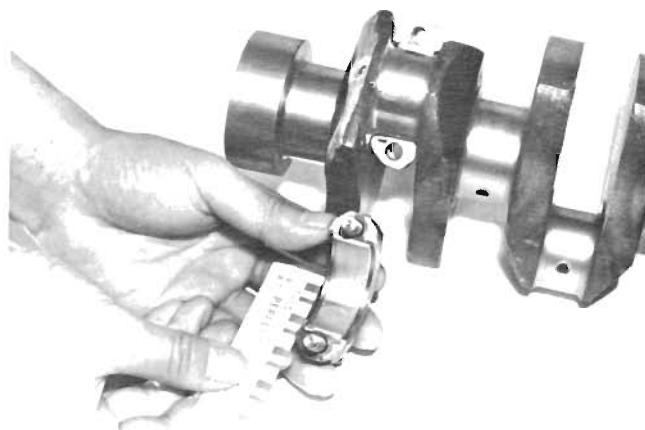
Fig. B-69 Checking Oil Clearance between Crankshaft Journals and Bearings

- (1) Attach a press gauge on the crankshaft bearing with grease.
- (2) Tighten the crankshaft bearing case onto the crankshaft journal to the specified torque.
NOTE: Fix the crankshaft so it does not turn, when tightening the bolt.

- (3) Remove the bearing case gently and measure the width of the press gauge with a sheet gauge (paper).
- (4) If the measurement exceeds the allowable limit, replace the crank journal bearings 2 (undersize). (See page 3-14)

- Reference value:
Crankshaft journal and bearing 1:
0.034 to 0.106 mm (0.0013 to 0.0042 in.)
Crankshaft journal and bearing 2:
0.034 to 0.092 mm (0.0013 to 0.0036 in.)
• Allowable limit:
0.2 mm (0.008 in.)

4. Checking Oil Clearance between Crankpins and Bearings.

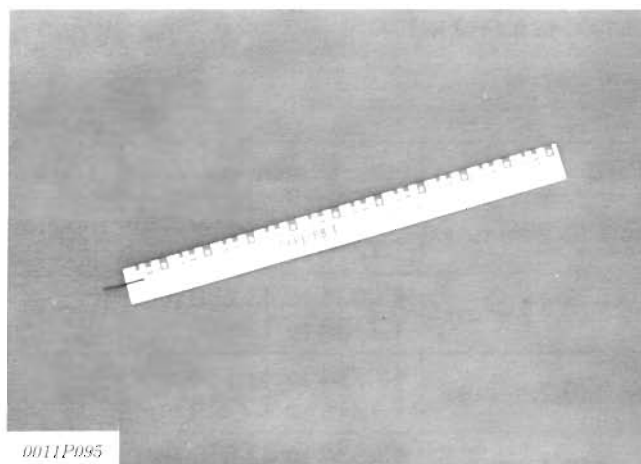


0011P094

Fig. B-70 Checking Oil Clearance between Crankpins and Bearings

- (1) Attach a press gauge on the crankpin bearing with grease.

TEST EQUIPMENT: Press Gauge

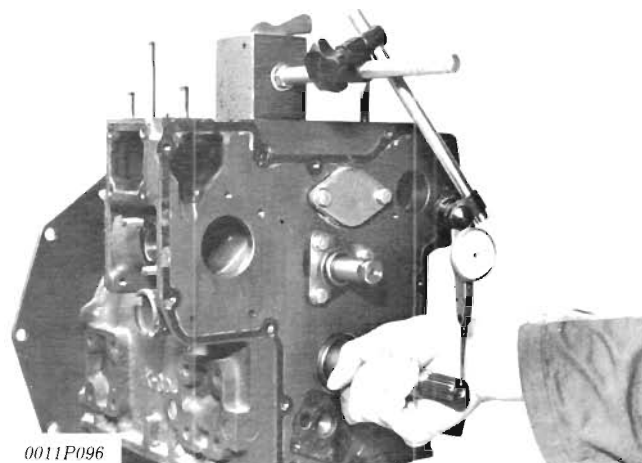


0011P095

Fig. B-71 Press Gauge

- (2) Tighten the connecting rod onto the crankpin to the specified torque.
- (3) Remove the large end-cap gently, and measure the width of the press gauge with a sheet gauge (paper).
- (4) If the measurement exceeds the allowable limit, replace the crankpin bearing (under-size). (See page 3-14)
 - Reference value:
0.029 to 0.087 mm (0.0011 to 0.0034 in.)
 - Allowable limit:
0.20 mm (0.008 in.)

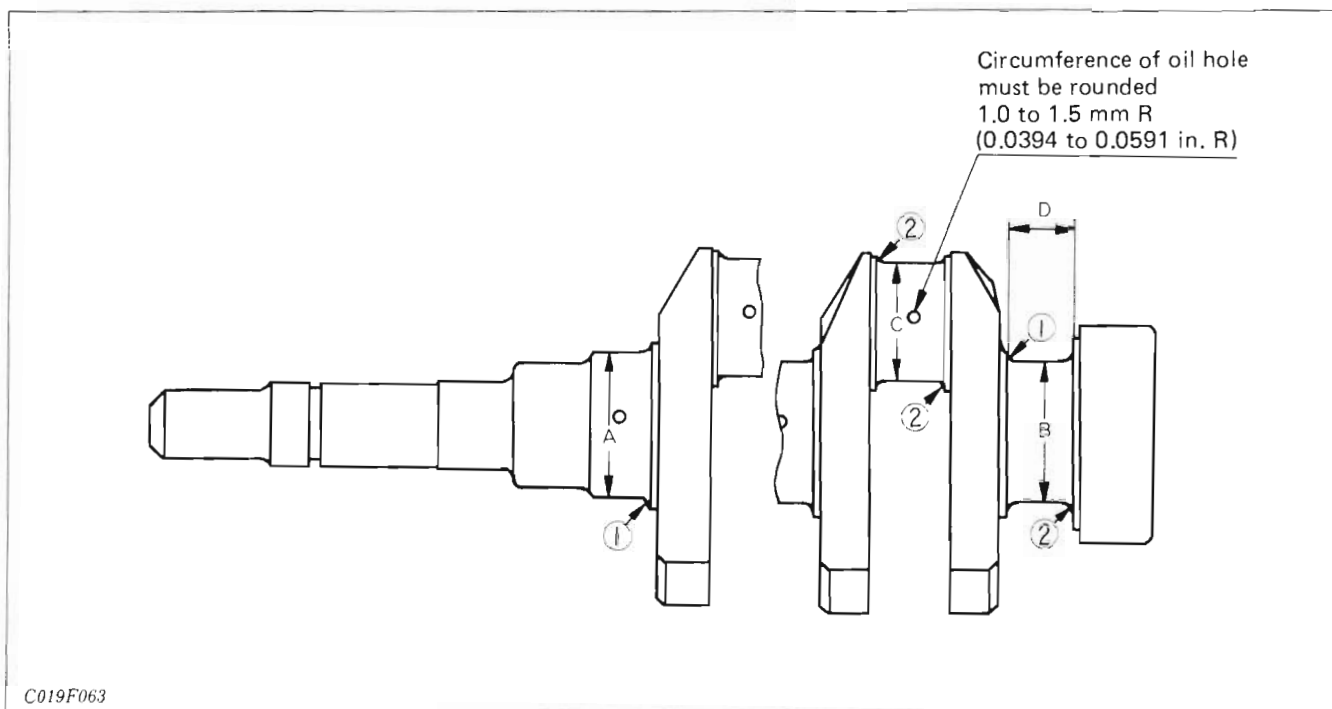
5. Checking End Play of Crankshaft



0011P096

Fig. B-72 Checking End Play of Crankshaft

- (1) Set a lever type indicator at the top of the crankshaft.
- (2) Measure by pushing and pulling the front end of the crankshaft manually.
- (3) If the measurement exceeds the allowable limit, replace the crank side bearing (over-size). (See page 3-14)
 - Reference value:
0.15 to 0.31 mm (0.0059 to 0.0122 in.)
 - Allowable limit:
0.5 mm (0.02 in.)



1. 2.8 to 3.2 mm (0.1102 to 0.1260 in.) 2. 3.3 to 3.7 mm (0.1300 to 0.1457 in.)

Fig. B-73 Undersize and Oversize

	Size	Code Number	Name of Parts	Dimension	Mark
A	0.2 mm 0.008 in.	15261-2391-1	Crank Journal Bearing 1 (0.2 minus)	43.743 to 43.750 mm 1.7218 to 1.7224 in.	020US
	0.4 mm 0.016 in.	15261-2392-1	Crank Journal Bearing 3 (0.4 minus)	43.534 to 43.550 mm 1.7139 to 1.7146 in.	040US
B	0.2 mm 0.008 in.	15261-2393-1	Crank Journal Bearing 2 (0.2 minus)	43.734 to 43.750 mm 1.7218 to 1.7224 in.	020US
	0.4 mm 0.016 in.	15261-2394-1	Crank Journal Bearing 2 (0.4 minus)	43.534 to 43.550 mm 1.7139 to 1.7146 in.	040US
C	0.2 mm 0.008 in.	15261-2297-1	Crank Pin Bearing (0.2 minus)	36.759 to 36.775 mm 1.4472 to 1.4478 in.	020US
	0.4 mm 0.016 in.	15261-2298-1	Crank Pin Bearing (0.4 minus)	36.559 to 36.575 mm 1.4393 to 1.4400 in.	040US
D	0.2 mm 0.008 in.	15261-2395-1	Crank Side Bearing (0.2 plus)	24.20 to 24.25 mm 0.9528 to 0.9547 in.	020OS
		15261-2397-1	Crank Side Bearing (0.2 plus)		
	0.4 mm 0.016 in.	15261-2396-1	Crank Side Bearing (0.4 plus)	24.40 to 24.45 mm 0.9606 to 0.9626 in.	040OS
		15261-2398-1	Crank Side Bearing (0.4 plus)		

Group 4

Assembly

Assembling Cylinder Head

1. Tappets, O-ring, Gasket

- (1) Apply a thin coat of engine oil to the tappets before installing.
- (2) Install the O-ring.
- (3) Before installing the cylinder head gasket, make sure there is no foreign matter on the cylinder head or in the cylinder.

2. Cylinder Head

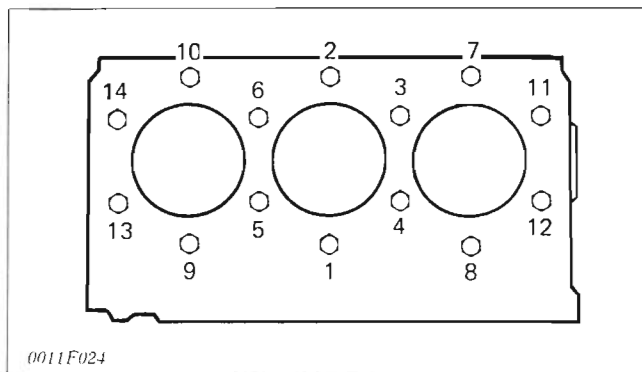


Fig. B-74 Cylinder Head Tightening Order

- (1) Tighten the set bolts to 42 to 47 Nm (4.3 to 4.8 kgf·m, 31 to 35ft-lbs).
- (2) Tighten the bolts and nuts in a diagonal sequence starting from the center. Tighten them uniformly, or the head may become deformed in the long run.
- (3) Tighten the bolts and nuts after applying sufficient oil.

3. Push Rods

- (1) Before inserting the push rods into the tappets, check to see if their ends are properly engaged with the grooves.

4. Rocker Arm

- (1) Before installing the rocker arm bracket, make sure that there are no metallic particles on the surface on which the assembly is to be mounted.
- (2) Tighten the bolts to 17 to 21 Nm (1.7 to 2.1 kgf·m, 12 to 15ft-lbs).

5. Fan Belt

- (1) Check that the V-belt is placed correctly (so that letters on the belt can be read from your side), and that there is no oil or grease on the belt.
- (2) Adjust tension of the V-belt.

6. Nozzle Holders

- (1) Install the nozzle holders after confirming that there are no metallic particles or foreign matter on the surface on which they are to be installed.
- (2) Tighten the nozzle holders to 29 to 49 Nm (3.0 to 5.0 kgf·m, 22 to 36 ft-lbs).

SPECIAL TOOLS: Nozzle holder socket wrench (See page 2-1)

7. Injection Pipes

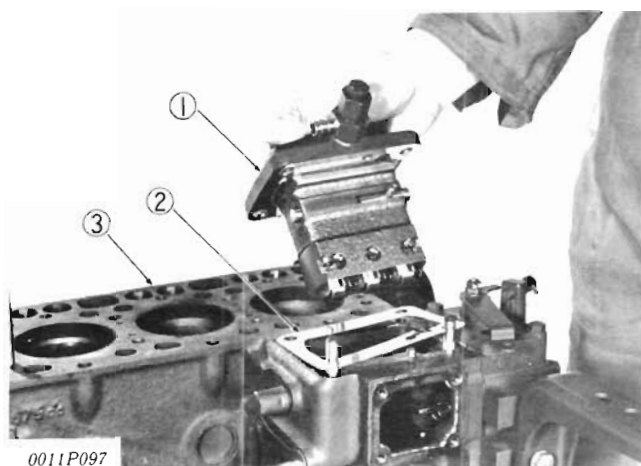
- (1) Blow compressed air into the pipes to eliminate dust.
- (2) Tighten the retaining nuts to 15 to 25 Nm (1.5 to 2.5 kgf·m, 11 to 18 ft-lbs).

8. Cylinder Head Cover

- (1) Make sure the gasket is not defective.
- (2) To prevent valve stems seizure, apply engine oil to the valve guides and valve stems.

Assembling Injection Pump and Fuel Pump

1. Injection Pump



1. Injection Pump
2. Injection Pump Shim
3. Crankcase

Fig. B-75 Assembling Injection Pump

- (1) Install the injection pump shims after applying a non-drying adhesive.
- (2) Install the injection pump by aligning the control rack with the indicated position.

IMPORTANT: Addition or reduction of one shim delays or advances the injection timing by 0.0262 rad. (15°).

2. Governor Spring

- (1) After hooking the governor spring on the fork lever, bend the end of the spring so that it will not come off easily.

3. Injection Pump Cover

- (1) Before installing the pump cover gasket, apply a non-drying adhesive to it.

4. Gear Pump

5. Fuel Pump

- (1) Install the fuel pump gasket after applying a non-drying adhesive to it.

NOTE: Be careful about the installation direction of the pump.

Assembling Gear Case, Camshaft and Oil Pump

1. Crank Gear

- (1) Make sure that the key is on the crankshaft.

NOTE: Heat the crank gear to about 99°C (210°F), and fit on the crankshaft.

2. Oil Pump

- (1) Tighten the bolts to 10 to 12 Nm (1.0 to 1.2 kgf-m, 7.2 to 8.6 ft-lbs).

3. Oil Pump Drive Gear

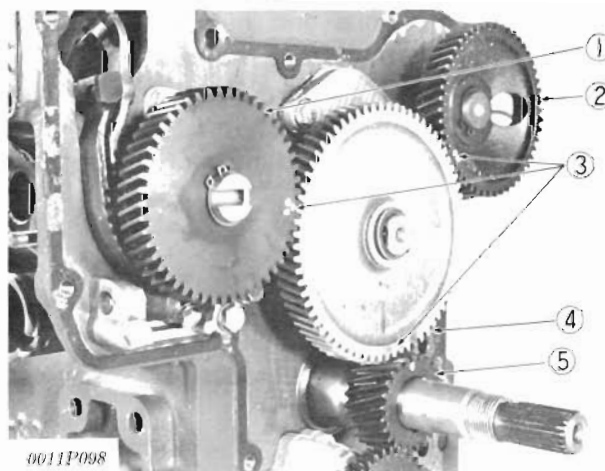
4. Fuel Camshaft, injection Pump Gear

- (1) Apply a thin film of engine oil to each part, and reassemble so that the drive groove at the end of the fuel camshaft engages with the drive shaft of the hydraulic gear pump.
- (2) Install the fork lever holder and crankcase after cleaning their contact surfaces.
- (3) Install the fork lever so that it will not hit the governor sleeve, and so that equal space is provided on both sides of the lever.
- (4) Install the fuel camshaft stopper.

5. Camshaft, Cam Gear

- (1) Apply a thin film of engine oil to the camshaft before installation.
- (2) Install the camshaft stopper.

6. Idle Gear



1. Injection Pump Gear
2. Cam Gear
3. Mating Mark
4. Idler Gear
5. Crank Gear

Fig. B-76 Installing Idler Gear

- (1) Make sure each gear is aligned with its mark:
 - Idler gear and crank gear
 - Idler gear and camshaft gear
 - Idler gear and injection pump gear
- (2) Tighten the idler gear shaft mounting bolts to 10 to 12 Nm (1.0 to 1.2 kgf·m), 7.2 to 8.7 ft-lbs).

7. Crankshaft Oil Slinger

Assembling Piston and Crankshaft

1. Cylinder Liner

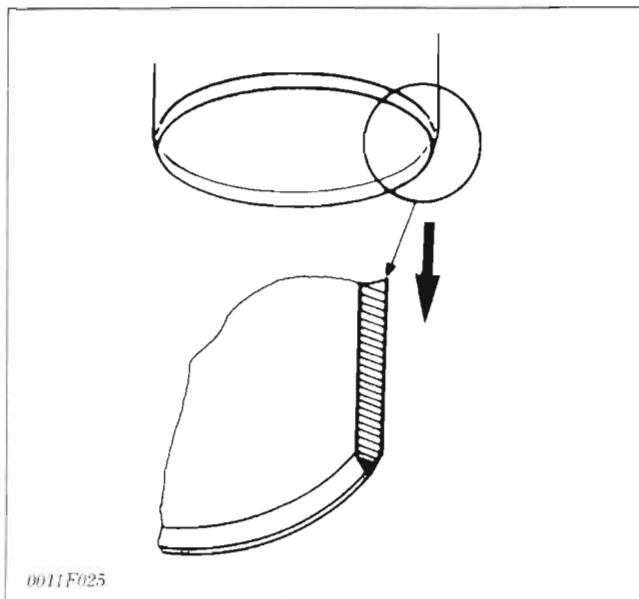


Fig. B-77 How to Insert Cylinder Liner

- (1) Clean and oil the frame holes into which new liner is to be fitted.
- (2) Clean and lubricate the outside surface of the liner to be force-inserted.
- (3) Insert the liner with its most-chamfered end downward.
- (4) After inserting, bore and hone to the standard size.

2. Main Bearing Case

- (1) Clean the oil holes in the main bearing case.
NOTE: Align the direction of the main bearing case and main bearing, when reassembling.

- (2) Tighten the mounting bolts of the bearing case.

Bolts 1: 20 to 24 Nm (2.0 to 2.4 kgf·m, 15 to 17 ft-lbs).

Bolts 2: 30 to 34 Nm (3.0 to 3.5 kgf·m, 22 to 25 ft-lbs).

3. Crankshaft

- (1) Before installing, clean the oil holes in the crankshaft with compressed air.

4. Bearing Case Cover Bolts

- (1) Tighten the bolts to 10 to 11 Nm (1.0 to 1.1 kgf·m, 7.2 to 8.0 ft-lbs).

5. Bearing Case Cover

- (1) Make sure that there are no scratches on the oil seal lip. Apply a thin film of engine oil, and install.

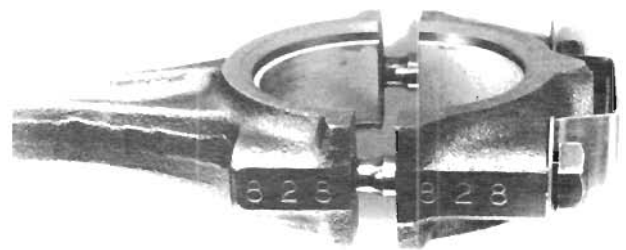
NOTE: Be sure to check the top mark on the cover.

6. Flywheel

- (1) Apply a thin film of grease to the dry bearing and oil seal at the back of the crankshaft.
- (2) Check the connection between the flywheel and the clutch cover.
- (3) Check the ring gear for any uneven wear, lack or crack of teeth.
- (4) Make sure that there are no metallic particles left on the flywheel mounting surface.
- (5) Tighten the flywheel bolts to 54 to 59 Nm (5.5 to 6.0 kgf·m, 40 to 43 ft-lbs).

7. Piston

- (1) Install the piston rings with their gaps at an angle of 120° or 180° to each other.
(Place the top ring so that its gap is on the opposite side of the combustion chamber.)
- (2) Press the rings to the piston securely with a piston ring compressor, and set them into the cylinder, being careful about the cylinder number and the position of the connecting rod. (Connecting rods must be installed with their numbers facing toward the fuel injection pump.)



0011P099

Fig. B-78 Connecting Rod Marks

- (3) Put the crankpin bearings on the connecting rod large-end. Apply a thin film of engine oil to each bearing, and tighten the connecting rod bolts to 26 to 30 Nm (2.7 to 3.1 kgf·m, 20 to 22 ft·lbs).

Group 5

Specifications

(R.V.) Reference Value	O.D. Outside Diameter
(A.L.) Allowable Limit	I.D. Inside Diameter

Cylinder Head

Cylinder head surface distortion	Less than 0.05 mm per 100 mm	(0.002 in. per 4 in.)
Gasket thickness	When tightened 1.05 to 1.15 mm	(0.0413 to 0.0453 in.)
Gasket shim thickness	0.2 mm	(0.0079 in.)
Top clearance (R.V.)	0.6 to 0.8 mm	(0.0237 to 0.0315 in.)
Pressing out piston above cylinder block face at TDC (R.V.)	0.25 to 0.55 mm	(0.010 to 0.022 in.)
Head bolts and nuts tightening torque (M8 x 1.25)	42 to 47 Nm (4.3 to 4.8 kgf·m, 31 to 35 ft-lbs) [Apply engine oil on the bolts before tightening]	

Valve

Valve seat width	2.12 mm	(0.083 in.)
	[Valve seat thickness 1.5 mm (0.059 in.)]	
Valve seat angle	0.785 rad.	(45°)
Valve stems O.D. (Inlet, Exhaust)	6.960 to 6.975 mm	(0.2740 to 0.2746 in.)
Valve guides I.D. (Inlet, Exhaust)	7.010 to 7.025 mm	(0.2760 to 0.2766 in.)
Clearance between valve stems and guides (R.V.)	0.035 to 0.065 mm	(0.0014 to 0.0026 in.)
(A.L.)	0.1 mm	(0.004 in.)
	[Valve guide bore should be reamed after being inserted into the cylinder head.]	
Valve recessing (R.V.)	0.9 to 1.1 mm	(0.035 to 0.043 in.)
(A.L.)	1.3 mm	(0.051 in.)
Valve clearance (Inlet, Exhaust) (R.V.)	0.145 to 0.185 mm	(0.0057 to 0.0073 in.)
	[When cold]	

Valve Spring

Free length (R.V.)	35.1 to 35.6 mm	(1.382 to 1.402 in.)
(A.L.)	34.8 mm	(1.37 in.)

Spring pressure

(R.V.)	74N/31 mm	(7.5 kgf/31 mm, 16.5 lbs./1.22 in.)
(A.L.)	63N/31 mm	(6.4 kgf/31 mm, 14 lbs./1.22 in.)
[Load and length when installed]		

Tilt

(A.L.)	1.3 mm	(0.051 in.)
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Valve Timing

Inlet valves

Opens	(R.V.)	0.349 rad.	(20°) before T.D.C.
[T.D.C. . . . Top Dead Center]			
Closes	(R.V.)	0.785 rad.	(45°) after B.D.C.
[B.D.C. . . . Bottom Dead Center]			

Exhaust valves

Opens	(R.V.)	0.873 rad.	(50°) before B.D.C.
Closes	(R.V.)	0.262 rad.	(15°) after T.D.C.

Compression

Compression pressure

(R.V.)	2.7 to 3.1 MPa	(28 to 32 kgf/cm ² , 398 to 454 psi)
(A.L.)	2.4 MPa	(24 kgf/cm ² , 341 psi)
[Engine 200 to 250 rpm with starter]		

Valve Rocker Arms

Rocker arm shaft O.D.

(R.V.)	10.973 to 10.984 mm	(0.4320 to 0.4324 in.)
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Rocker arm bushing I.D.

(R.V.)	10.997 to 11.038 mm	(0.4330 to 0.4346 in.)
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Clearance between rocker arm shafts
and bushings

(R.V.)	0.013 to 0.065 mm	(0.0005 to 0.0026 in.)
(A.L.)	0.12 mm	(0.0047 in.)

Compression release adjustment	0.8 to 1.2 mm	(0.031 to 0.047 in.)
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Camshaft

Camshaft journal O.D.

(R.V.)	32.934 to 32.950 mm	(1.2966 to 1.2972 in.)
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Camshaft bearing I.D.

(R.V.)	33.000 to 33.025 mm	(1.2992 to 1.3002 in.)
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Clearance between camshaft bearing
journals and bearing

(R.V.)	0.050 to 0.091 mm	(0.0020 to 0.0036 in.)
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Camshaft alignment

(A.L.)	0.08 mm	(0.0031 in.)
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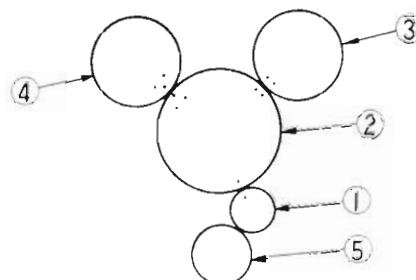
Cam lift	(R.V.)	5 mm	(0.197 in.)
Cam height	(R.V.)	26.88 mm	(1.0583 in.)
	(A.L.)	26.83 mm	(1.0563 in.)

Fuel Camshaft

Cam height	(R.V.)	30.93 to 31.07 mm	(1.2177 to 1.2233 in.)
	(A.L.)	30.87 mm	(1.2154 in.)

Timing Gears

Number of teeth	
1. Crank gear	25
2. Idle gear	69
3. Cam gear	50
4. Injection pump gear	50
5. Oil pump drive gear	33



Backlash	(R.V.)	0.04 to 0.12 mm	(0.002 to 0.005 in.)
	(A.L.)	0.2 mm	(0.008 in.)

Clearance between idle gear shaft and idle gear bushings

(R.V.)	0.016 to 0.045 mm	(0.0007 to 0.0017 in.)
(A.L.)	0.1 mm	(0.0039 in.)

[Engine serial number: 407507 and beyond]

(R.V.)	0.020 to 0.054 mm	(0.0008 to 0.0021 in.)
(A.L.)	0.1 mm	(0.0039 in.)

Cylinder Liners

Type Dry

Cylinder liner I.D.

(R.V.)	68.000 to 68.019 mm	(2.6772 to 2.6779 in.)
(A.L.)	68.15 mm	(2.6831 in.)
	[050 oversize liner 68.500 to 68.519 mm (2.6969 to 2.6976 in.)]	

Piston clearance

(R.V.)	0.055 to 0.094 mm	(0.0022 to 0.0037 in.)
	[At piston skirt]	

Height above block surface

(R.V.)	-0.025 to 0.025 mm	(-0.001 to 0.001 in.)
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Piston Rings

Ring gap

Top ring, 2nd ring

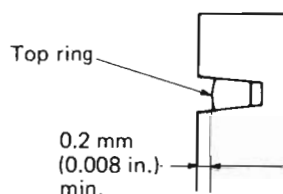
(R.V.)	0.25 to 0.40 mm	(0.010 to 0.016 in.)
(A.L.)	1.25 mm	(0.049 in.)

Oil ring

(R.V.)	0.20 to 0.40 mm	(0.008 to 0.016 in.)
(A.L.)	1.25 mm	(0.049 in.)

Ring in groove side clearance

2nd ring. (R.V.)	0.085 to 0.112 mm	(0.0033 to 0.0044 in.)
Oil ring (R.V.)	0.020 to 0.052 mm	(0.0008 to 0.0020 in.)



[0.5 mm (0.02 in.) oversize top ring surface should be 0.2 mm (0.008 in.) below piston side surface.]

Piston and ring oversizes	0.5 mm	(0.02 in.)
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Pistons

Piston standard O.D.	68 mm	(2.677 in.)
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Piston boss I.D.

(R.V.)	20.000 to 20.013 mm	(0.7874 to 0.7879 in.)
(A.L.)	20.04 mm	(0.789 in.)

Piston pin O.D.	20.002 to 20.011 mm	(0.7875 to 0.7878 in.)
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Clearance between piston pin and bosses

(R.V.)	-0.011 to 0.011 mm	(-0.0004 to 0.0004 in.)
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Crankshaft

Crankshaft alignment

(A.L.)	0.08 mm	(0.003 in.)
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Crank-pin bearing width

(R.V.)	15.87 to 16.13 mm	(0.625 to 0.635 in.)
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Crank-pin bearing thickness

(R.V.)	1.485 to 1.498 mm	(0.0586 to 0.0590 in.)
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Crank-pin bearings I.D.			
	(R.V.)	37.004 to 37.046 mm	(1.4568 to 1.4585 in.)
Crank-pin O.D.			
	(R.V.)	36.959 to 36.975 mm	(1.4551 to 1.4557 in.)
Clearance between crank-pins and bearings (Oil clearance)			
	(R.V.)	0.029 to 0.087 mm	(0.0011 to 0.0034 in.)
	(A.L.)	0.2 mm	(0.008 in.)
		[Under-sized bearing +0.25 mm (+0.0098 in.)]	
Crankshaft bearing 1, 2 width			
	(R.V.)	17.87 to 18.13 mm	(0.7035 to 0.7138 in.)
Crankshaft journal O.D.			
	(R.V.)	43.934 to 43.950 mm	(1.7297 to 1.7303 in.)
Crankshaft bearing 1 I.D.			
	(R.V.)	43.984 to 44.040 mm	(1.7317 to 1.7339 in.)
		[Undersized bearing +0.2 mm (+0.0079 in.), +0.4 mm (+0.0157 in.)]	
Crankshaft bearing 2 I.D.			
	(R.V.)	43.984 to 44.026 mm	(1.7317 to 1.7333 in.)
		[Undersized bearing +0.2 mm (+0.0079 in.), +0.4 mm (+0.0157 in.)]	
Clearance between crankshaft journal and bearing 1 (Oil clearance)			
	(R.V.)	0.034 to 0.106 mm	(0.0013 to 0.0042 in.)
	(A.L.)	0.2 mm	(0.008 in.)
Clearance between crankshaft journal and bearing 2 (Oil clearance)			
	(R.V.)	0.034 to 0.092 mm	(0.0013 to 0.0036 in.)
	(A.L.)	0.2 mm	(0.008 in.)
Crankshaft end play			
	(R.V.)	0.15 to 0.31 mm	(0.0059 to 0.0122 in.)
	(A.L.)	0.5 mm	(0.02 in.)
Crank bearing case bolt 1 tightening torque (M7 x 1.0)		20 to 24Nm	(2.0 to 2.4 kgf·m, 15 to 17 ft-lbs)
		[Apply engine oil on the bolts before tightening]	
Crank bearing case bolt 2 tightening torque (M8 x 1.25)		30 to 34 Nm	(3.0 to 3.5 kgf·m, 22 to 25 ft-lbs)
Connecting Rod			
Small end I.D. (without bushing)			
	(R.V.)	22.000 to 22.021 mm	(0.8661 to 0.8670 in.)
Small end width			
	(R.V.)	21.8 to 21.9 mm	(0.858 to 0.862 in.)
Clearance between piston pin and small end bushings			
	(R.V.)	0.014 to 0.038 mm	(0.0006 to 0.0015 in.)
	(A.L.)	0.15 mm	(0.006 in.)

Large end I.D. (without bushings)			
	(R.V.)	40.000 to 40.020 mm	(1.5748 to 1.5756 in.)
Large end width			
	(R.V.)	21.8 to 21.9 mm	(0.858 to 0.862 in.)
Rod alignment			
	(A.L.)	0.05 mm	(0.002 in.)
Axial clearance between crank arm and large end			
	(R.V.)	0.2 to 0.4 mm	(0.008 to 0.016 in.)
	(A.L.)	0.5 mm	(0.020 in.)
Rod bolt tightening torque (M7 x 0.75)		26 to 30 Nm	(2.7 to 3.1 kgf·m, 20 to 22 ft-lbs)
		[Apply engine oil on the bolts before tightening]	

Flywheel

O.D. (R.V.)	245 mm	(9.65 in.)
Tightening torque	54 to 59 Nm	(5.5 to 6.0 kgf·m, 40 to 43 ft-lbs)

Specifications

B6100HST

Cylinder Head

Cylinder head surface distortion	Less than 0.05 mm per 100 mm	(0.002 in. per 4 in.)
Gasket thickness	When tightened 1.05 to 1.15 mm	(0.0413 to 0.0453 in.)
Gasket shim thickness	0.2 mm	(0.0079 in.)
Top clearance (R.V.)	0.6 to 0.8 mm	(0.0237 to 0.0315 in.)
Pressing out piston above cylinder block face at TDC (R.V.)	0.25 to 0.55 mm	(0.010 to 0.022 in.)
Head bolts and nuts tightening torque (M8 x 1.25)	42 to 47 Nm (4.3 to 4.8 kgf·m, 31 to 35 ft-lbs) [Apply engine oil on the bolts before tightening]	

Valve

Valve seat width	2.12 mm	(0.083 in.)
	[Valve seat thickness 1.5 mm (0.059 in.)]	
Valve seat angle	0.794 rad.	(45.5°)
Valve stems O.D. (Inlet, Exhaust)	6.960 to 6.975 mm	(0.2740 to 0.2746 in.)
Valve guides I.D. (Inlet, Exhaust)	7.010 to 7.025 mm	(0.2760 to 0.2766 in.)
Clearance between valve stems and guides (R.V.)	0.035 to 0.065 mm	(0.0014 to 0.0026 in.)
(A.L.)	0.1 mm	(0.004 in.)
	[Valve guide bore should be reamed after being inserted into the cylinder head.]	
Valve recessing (R.V.)	0.9 to 1.1 mm	(0.035 to 0.043 in.)
(A.L.)	1.3 mm	(0.051 in.)
Valve clearance (Inlet, Exhaust) (R.V.)	0.145 to 0.185 mm	(0.0057 to 0.0073 in.)
	[When cold]	

Valve Spring

Free length (R.V.)	35.1 to 35.6 mm	(1.382 to 1.402 in.)
(A.L.)	34.8 mm	(1.37 in.)

Spring pressure

(R.V.)	74N/31 mm	(7.5 kgf/31 mm, 16.5 lbs./1.22 in.)
(A.L.)	63N/31 mm	(6.4 kgf/31 mm, 14 lbs./1.22 in.)
[Load and length when installed]		

Tilt

(A.L.)	1.3 mm	(0.051 in.)
------------------	--------	-------------

Valve Timing

Inlet valves

Opens (R.V.)	0.349 rad.	(20°) before T.D.C. [T.D.C. . . . Top Dead Center]
Closes (R.V.)	0.785 rad.	(45°) after B.D.C. [B.D.C. . . . Bottom Dead Center]

Exhaust valves

Opens (R.V.)	0.873 rad.	(50°) before B.D.C.
Closes (R.V.)	0.262 rad.	(15°) after T.D.C.

Compression

Compression pressure

(R.V.)	2.7 to 3.1 MPa	(28 to 32 kgf/cm ² , 398 to 454 psi)
(A.L.)	2.4 MPa	(24 kgf/cm ² , 341 psi)
[Engine 200 to 250 rpm with starter]		

Valve Rocker Arms

Rocker arm shaft O.D.

(R.V.)	10.973 to 10.984 mm	(0.4320 to 0.4324 in.)
------------------	---------------------	------------------------

Rocker arm bushing I.D.

(R.V.)	10.997 to 11.038 mm	(0.4330 to 0.4346 in.)
------------------	---------------------	------------------------

Clearance between rocker arm shafts
and bushings

(R.V.)	0.013 to 0.065 mm	(0.0005 to 0.0026 in.)
(A.L.)	0.12 mm	(0.0047 in.)

Compression release adjustment	0.8 to 1.2 mm	(0.031 to 0.047 in.)
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Camshaft

Camshaft journal O.D.

(R.V.)	32.934 to 32.950 mm	(1.2966 to 1.2972 in.)
------------------	---------------------	------------------------

Camshaft bearing I.D.

(R.V.)	33.000 to 33.025 mm	(1.2992 to 1.3002 in.)
------------------	---------------------	------------------------

Clearance between camshaft bearing
journals and bearing

(R.V.)	0.050 to 0.091 mm	(0.0020 to 0.0036 in.)
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Camshaft alignment

(A.L.)	0.08 mm	(0.0031 in.)
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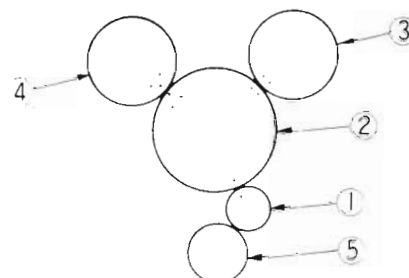
Cam lift	(R.V.)	5 mm	(0.197 in.)
Cam height	(R.V.)	26.88 mm	(1.0583 in.)
	(A.L.)	26.83 mm	(1.0563 in.)

Fuel Camshaft

Cam height	(R.V.)	30.93 to 31.07 mm	(1.2177 to 1.2233 in.)
	(A.L.)	30.87 mm	(1.2154 in.)

Timing Gears

Number of teeth	
1. Crank gear	25
2. Idle gear	69
3. Cam gear	50
4. Injection pump gear	50
5. Oil pump drive gear	33



Backlash	(R.V.)	0.04 to 0.12 mm	(0.002 to 0.005 in.)
	(A.L.)	0.2 mm	(0.008 in.)

**Clearance between idle gear shaft and
idle gear bushings**

(R.V.)	0.016 to 0.045 mm	(0.0007 to 0.0017 in.)
(A.L.)	0.1 mm	(0.0039 in.)

[Engine serial number: 407507 and beyond]

(R.V.)	0.020 to 0.054 mm	(0.0008 to 0.0021 in.)
(A.L.)	0.1 mm	(0.0039 in.)

Cylinder Liners

Type	Dry		
Cylinder liner I.D.	(R.V.)	64.000 to 64.019 mm	(2.5197 to 2.5204 in.)
	(A.L.)	64.15 mm	(2.5256 in.)
		[050 oversize liner 64.500 to 64.519 mm (2.5394 to 2.5401 in.)]	
Piston clearance	(R.V.)	0.069 to 0.089 mm	(0.0027 to 0.0035 in.)
		[At piston skirt]	
Height above block surface	(R.V.)	-0.025 to 0.025 mm	(-0.001 to 0.001 in.)

Piston Rings

Ring gap

Top ring, 2nd ring

(R.V.)	0.25 to 0.40 mm	(0.010 to 0.016 in.)
(A.L.)	1.25 mm	(0.049 in.)

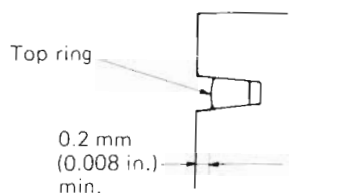
Oil ring

(R.V.)	0.20 to 0.40 mm	(0.008 to 0.016 in.)
(A.L.)	1.25 mm	(0.049 in.)

Ring in groove side clearance

2nd ring,(R.V.) 0.085 to 0.112 mm (0.0033 to 0.0044 in.)

Oil ring(R.V.) 0.020 to 0.052 mm (0.0008 to 0.0020 in.)



[0.5 mm (0.02 in.) oversize top ring
surface should be 0.2 mm (0.008 in.)
below piston side surface.]

Piston and ring oversizes0.5 mm (0.02 in.)

Pistons

Piston standard O.D. 64 mm (2.5197 in.)

Piston boss I.D.

(R.V.)	20.000 to 20.013 mm	(0.7874 to 0.7879 in.)
(A.L.)	20.04 mm	(0.789 in.)

Piston pin O.D. 20.002 to 20.011 mm (0.7875 to 0.7878 in.)

Clearance between piston pin and bosses

(R.V.)	−0.011 to 0.011 mm	(−0.0004 to 0.0004 in.)
--------	--------------------	-------------------------

Crankshaft

Crankshaft alignment

(A.L.)	0.08 mm	(0.003 in.)
--------	---------	-------------

Crank-pin bearing width

(R.V.)	15.87 to 16.13 mm	(0.625 to 0.635 in.)
--------	-------------------	----------------------

Crank-pin bearing thickness

(R.V.)	1.485 to 1.498 mm	(0.0586 to 0.0590 in.)
--------	-------------------	------------------------

Crank-pin bearings I.D.

(R.V.)	37.004 to 37.046 mm	(1.4568 to 1.4585 in.)
--------	---------------------	------------------------

Crank-pin O.D.

(R.V.)	36.959 to 36.975 mm	(1.4551 to 1.4557 in.)
--------	---------------------	------------------------

Clearance between crank-pins and bearings
(Oil clearance)

(R.V.)	0.029 to 0.087 mm	(0.0011 to 0.0034 in.)
(A.L.)	0.2 mm	(0.008 in.)
	[Under-sized bearing +0.25 mm (+0.0098 in.)]	

Crankshaft bearing 1, 2 width

(R.V.)	17.87 to 18.13 mm	(0.7035 to 0.7138 in.)
--------	-------------------	------------------------

Crankshaft journal O.D.

(R.V.)	43.934 to 43.950 mm	(1.7297 to 1.7303 in.)
--------	---------------------	------------------------

Crankshaft bearing 1 I.D.

(R.V.)	43.984 to 44.040 mm	(1.7317 to 1.7339 in.)
	[Undersized bearing +0.2 mm (+0.0079 in.), +0.4 mm (+0.0157 in.)]	

Crankshaft bearing 2 I.D.

(R.V.)	43.984 to 44.026 mm	(1.7317 to 1.7333 in.)
	[Undersized bearing +0.2 mm (+0.0079 in.), +0.4 mm (+0.0157 in.)]	

Clearance between crankshaft journal
and bearing 1 (Oil clearance)

(R.V.)	0.034 to 0.106 mm	(0.0013 to 0.0042 in.)
(A.L.)	0.2 mm	(0.008 in.)

Clearance between crankshaft journal
and bearing 2 (Oil clearance)

(R.V.)	0.034 to 0.092 mm	(0.0013 to 0.0036 in.)
(A.L.)	0.2 mm	(0.008 in.)

Crankshaft end play

(R.V.)	0.15 to 0.31 mm	(0.0059 to 0.0122 in.)
(A.L.)	0.5 mm	(0.02 in.)

Crank bearing case bolt 1 tightening

torque (M7 x 1.0)	20 to 24Nm	(2.0 to 2.4 kgf-m, 15 to 17 ft-lbs)
	[Apply engine oil on the bolts before tightening]	

Crank bearing case bolt 2 tightening

torque (M8 x 1.25)	30 to 34 Nm	(3.0 to 3.5 kgf-m, 22 to 25 ft-lbs)
--------------------	-------------	-------------------------------------

Connecting Rod

Small end I.D. (without bushing)

(R.V.)	22.000 to 22.021 mm	(0.8661 to 0.8670 in.)
--------	---------------------	------------------------

Small end width

(R.V.)	21.8 to 21.9 mm	(0.858 to 0.862 in.)
--------	-----------------	----------------------

Clearance between piston pin and
small end bushings

(R.V.)	0.014 to 0.038 mm	(0.0006 to 0.0015 in.)
(A.L.)	0.15 mm	(0.006 in.)

Large end I.D. (without bushings)	(R.V.)	40.000 to 40.020 mm	(1.5748 to 1.5756 in.)
Large end width	(R.V.)	21.8 to 21.9 mm	(0.858 to 0.862 in.)
Rod alignment	(A.L.)	0.05 mm	(0.002 in.)
Axial clearance between crank arm and large end	(R.V.)	0.2 to 0.4 mm	(0.008 to 0.016 in.)
	(A.L.)	0.5 mm	(0.020 in.)
Rod bolt tightening torque (M7 x 0.75)		26 to 30 Nm	(2.7 to 3.1 kgf·m, 20 to 22 ft-lbs)
		[Apply engine oil on the bolts before tightening]	
Flywheel			
O.D. (R.V.)		245 mm	(9.65 in.)
Tightening torque		54 to 59 Nm	(5.5 to 6.0 kgf·m, 40 to 43 ft-lbs)

LUBRICATING SYSTEM

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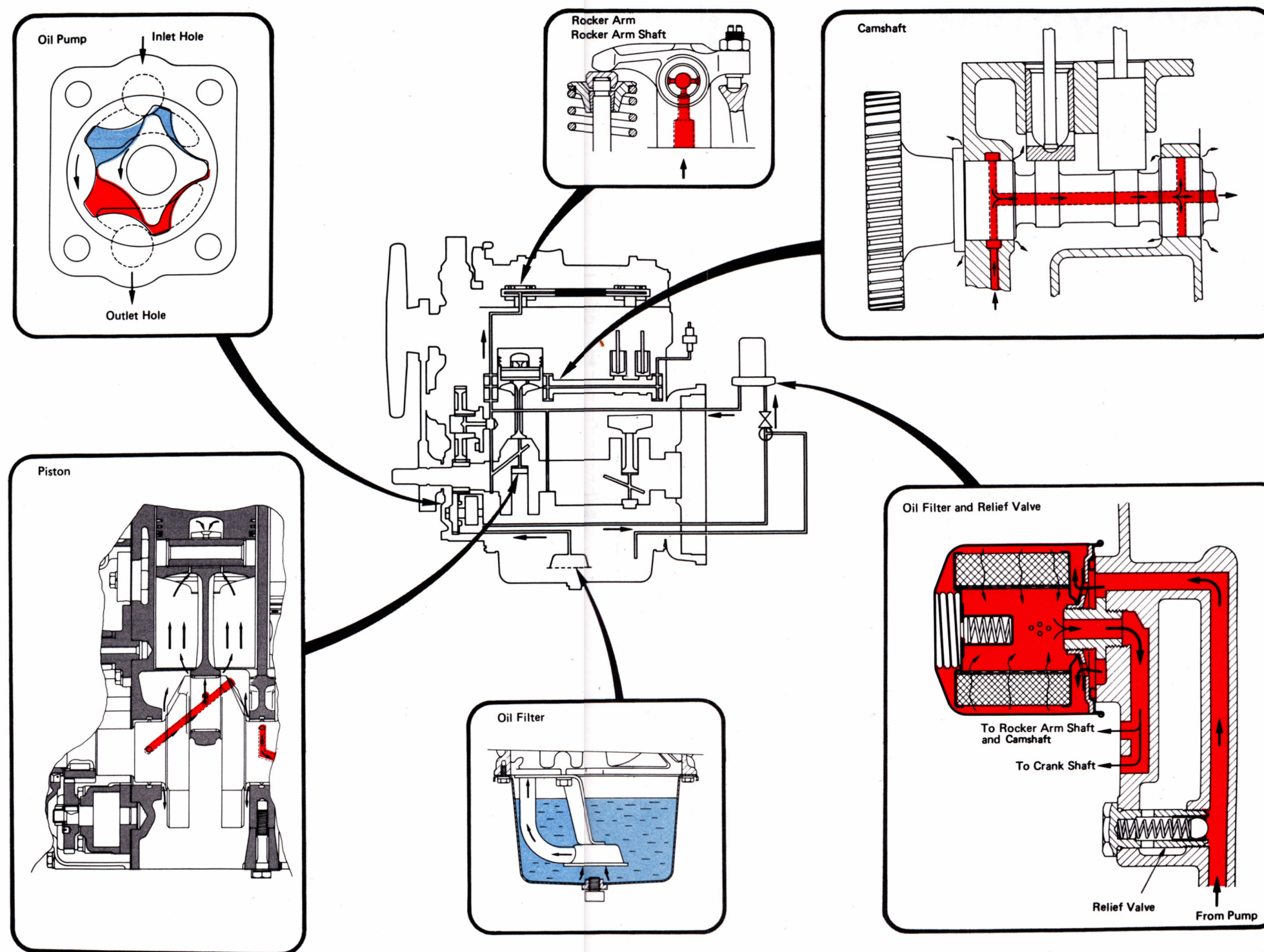
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Oil Filter Cartridge, Relief Valve (Regulating Valve)	2-2
Oil Pump (Trochoid Pump)	2-3

Group 3 Specifications

Group 1

General Description



0011F206

Fig. C-1 Engine Oil Lubricating System

Lubricating System

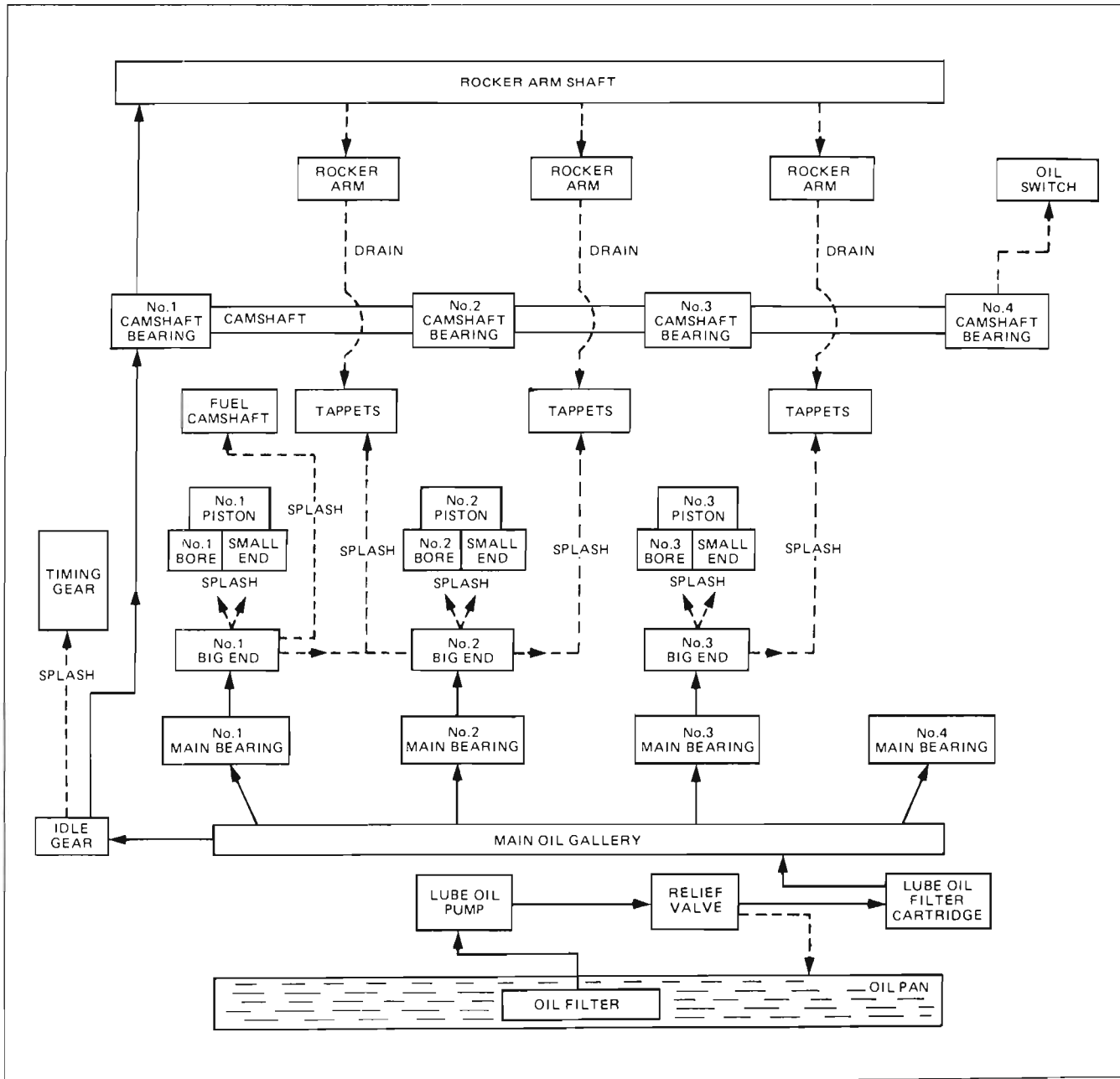
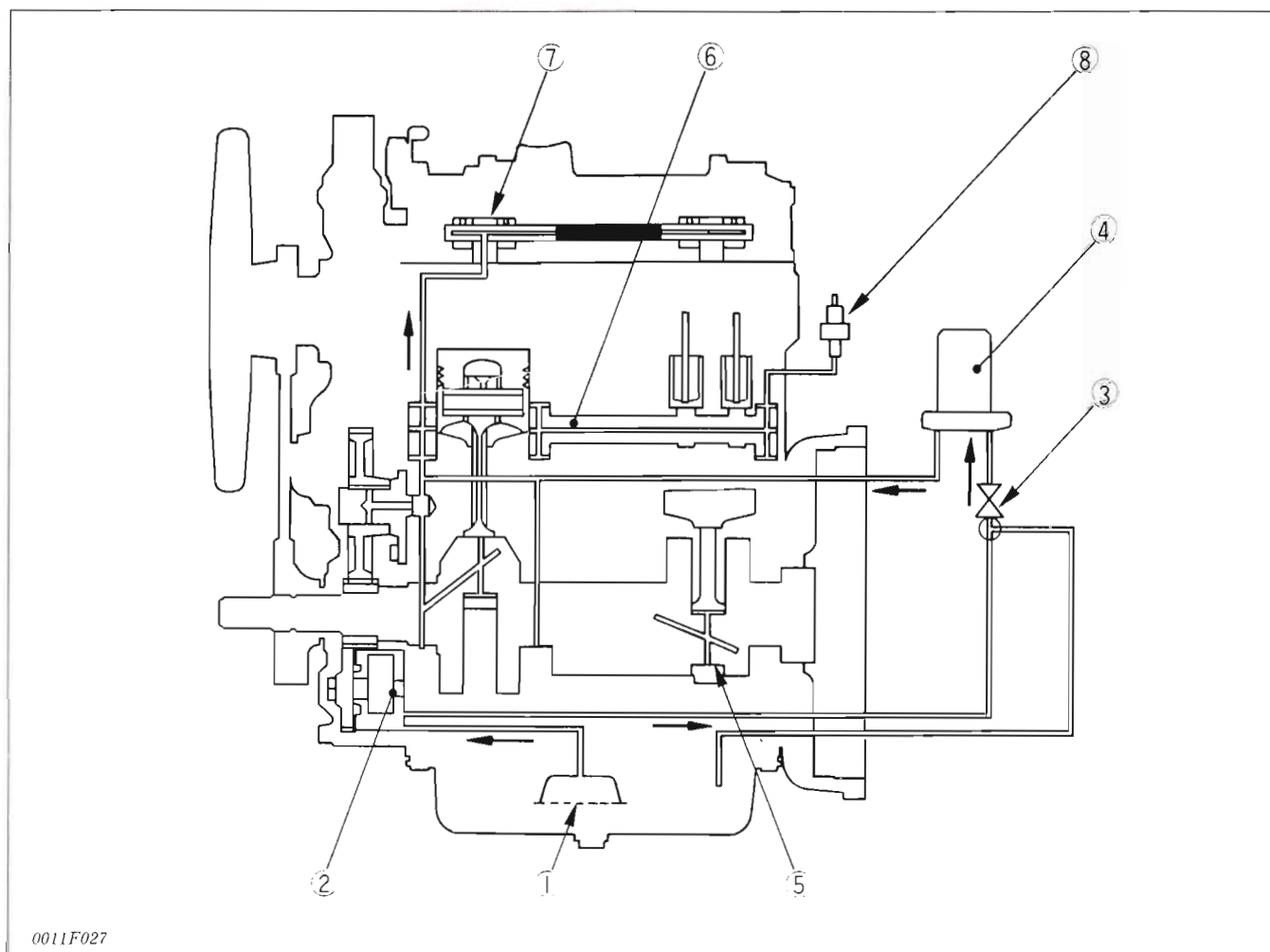


Fig. C-2 Engine Oil Flow



0011F027

- | | | | |
|---------------|-------------------------|---------------------|---------------------|
| 1. Oil Filter | 3. Relief Valve | 5. Crankpin Bearing | 7. Rocker Arm Shaft |
| 2. Oil Pump | 4. Oil Filter Cartridge | 6. Camshaft | 8. Oil Switch |

Fig. C-3 Lubricating System

The engine lubricating system consists of a trochoid oil pump, oil filter cartridge, relief valve (oil pressure regulating valve), oil switch and oil filter. The trochoid oil pump suctions lubricating oil through oil filter and the oil flows down to the filter cartridge where it is further filtered and the pressure regulating valve installed in the gear case regulates the oil pressure at 196 to 441 KPa (2.0 to 4.5 kgf/cm², 28 to 64 psi).

From the filter, one part of the lubricating oil will be fed through crankshaft passage to the crankpin bearing and the remainder of oil will be fed through the frame to the rocker arm shaft. An oil pressure switch is provided on the way for watching the oil pressure. If the oil pressure falls below 50 KPa (0.5 kgf/cm², 7.1 psi), the oil warning lamp on the dash board will be light warning the operator. In case the oil warning lamp should stay on while engine is running at normal revolution, shut the engine off immediately and check the causes of the pressure drop.

Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Excessive oil consumption	Leakage due to defective oil seal or gasket	Replace
	Worn or stuck piston rings	Replace
	Leakage due to worn valve stems and valve guides	Replace valves and valve guides
Fuel mixed with oil	Fuel leakage due to worn plunger of injection pump	Replace pump element or injection pump
Water mixed with oil	Improperly installed or broken cylinder head gasket	Install properly or replace
	Blow hole in crank case or cylinder head	Replace crank case or cylinder head
Low Oil Pressure	Low oil level	Supply oil
	Clogged oil filter or oil filter cartridge	Clean or change it.
	Improper oil classification	Change to proper classification oil.
	Relief valve failure	Repair or replace
	Excessive clearance between inner and outer rotors	Replace
High Oil Pressure	Improper oil classification	Change proper classification oil
	Clogged oil lines	Repair or replace
	Relief valve failure	Repair or replace
Oil Sludge and Dilution	Improper operation and servicing	Clean and change to proper oil

Group 2

Servicing

Checking Oil Pressure

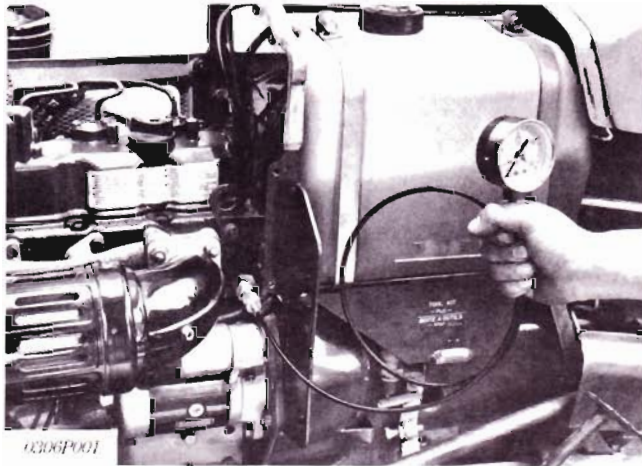


Fig. C-4 Checking Oil Pressure

- (1) Detach the oil switch.
 - (2) Attach a pressure gauge to the oil switch mounting hole and then replace the muffler.
- TEST EQUIPMENT:** Pressure Gauge
(Code No. 07916-32031)



00477068

Fig. C-5 Pressure Gauge

- (3) Start the engine. Measure the oil pressure both at idle (1000 to 1150 rpm) and at the rated speed (2800 rpm).

- (4) If the measurement is not within the reference value, check the oil pump, oil passages, clearances and pressure relief valve.

- Reference value:

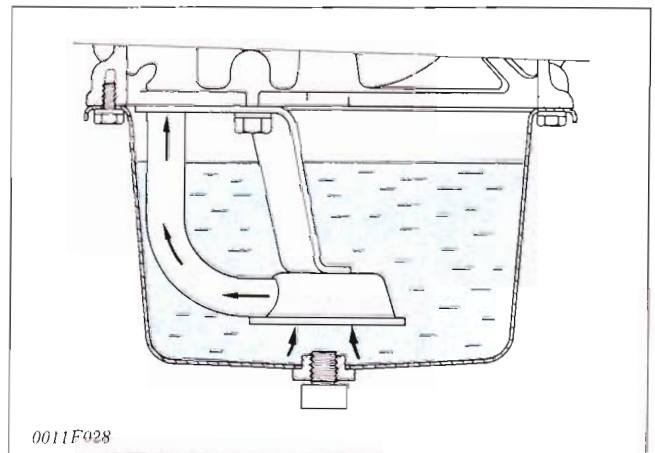
At rated speed: 196 to 441 kPa (2.0 to 4.5 kgf/cm², 28 to 64 psi)

- Allowable limit:

At idle speed 69 kPa (0.7 kgf/cm², 10 psi)

At rated speed: 196 kPa (2 kgf/cm², 28 psi)

Oil Filter



0011F028

Fig. C-6 Oil Filter

It is not necessary to remove oil filter in disassembling, but if the filter is dirty, rinse it in light oil or kerosene.

Oil Filter Cartridge, Relief Valve (Regulating Valve)

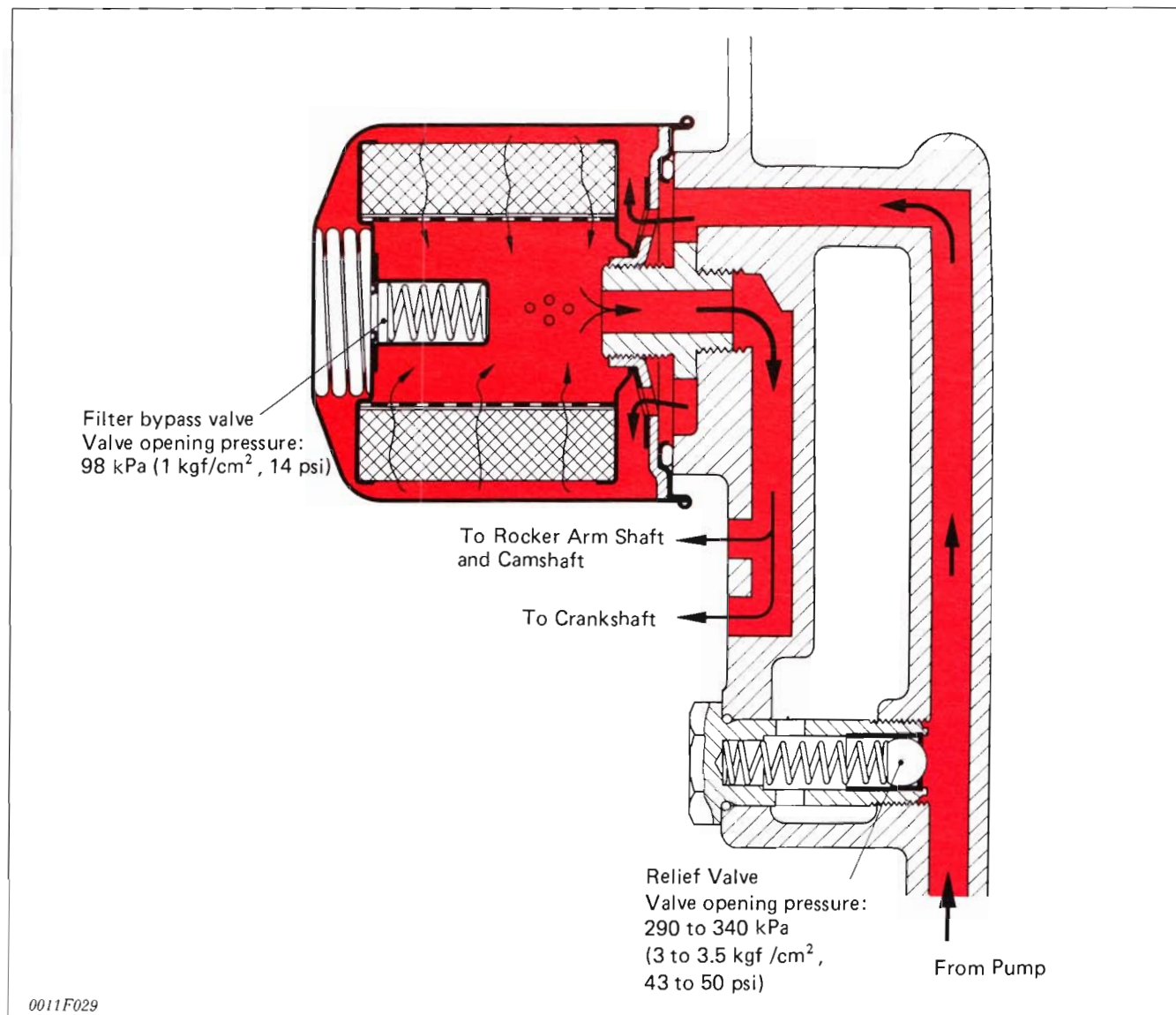
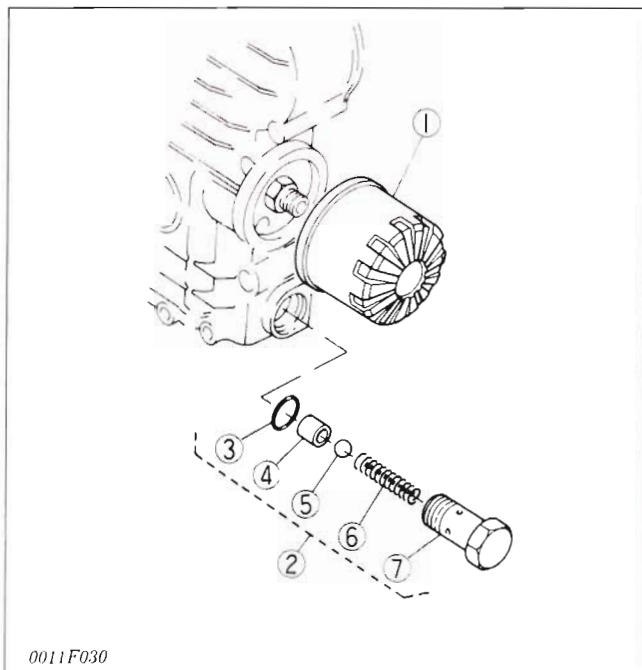


Fig. C-7 Oil Filter Cartridge

The relief valve prevents damage to the lubrication system. It drains oil to the oil pan when oil pressure exceeds the specified limit.

The filter bypass valve causes the oil to go directly to the main oil gallery if the oil filter element is clogged.



- | | |
|--------------------------|-----------------------|
| 1. Oil Filter Cartridge | 5. Ball |
| 2. Relief Valve Assembly | 6. Spring |
| 3. O Ring | 7. Relief Valve Body. |
| 4. Valve Seat | |

Fig. C-8 Oil Filter Cartridge and Relief Valve

Filter bypass valve:

Valve opening pressure ... 98 kPa (1 kgf/cm², 14 psi)

Relief valve:

Valve opening pressure ... 290 to 340 kPa (3 to 3.5 kgf/cm², 43 to 50 psi)

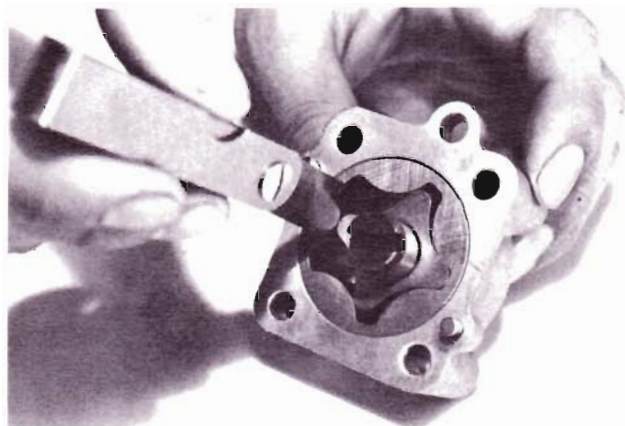
When disassembling the oil filter, use the filter wrench.

When installing it, apply oil on the oil seal and tighten it by hand.

Remove the relief valve and check it for proper operation.

Oil Pump (Trochoid Pump)

1. Rotor Lobe Clearance



0011P100

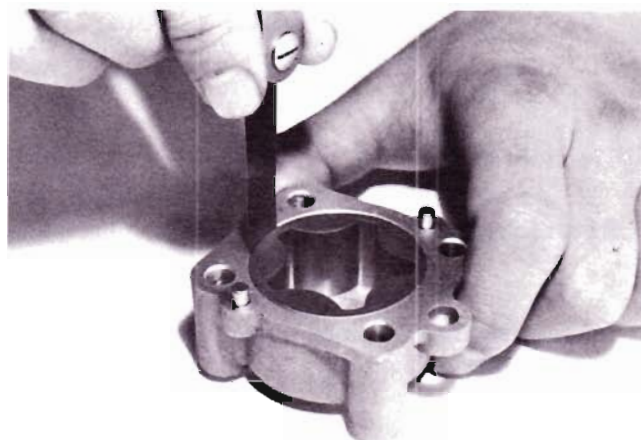
Fig. C-9 Checking Rotor Lobe Clearance

(1) Insert a feeler gauge into the gap between the inner and outer rotors and measure the clearance.

(2) If the measurement exceeds the allowable limit, replace the oil pump.

- Reference value
0.11 to 0.15 mm (0.0043 to 0.0059 in.)
- Allowable limit
0.2 mm (0.0079 in.)

2. Radial Clearance between Outer Rotor and Pump Body



0011P101

Fig. C-10 Checking Radial Clearance

(1) Insert a feeler gauge into the gap between the oil pump body and the outer rotor and measure the clearance.

(2) If the measurement exceeds the allowable limit, replace the oil pump.

- Reference value
0.07 to 0.15 mm (0.0028 to 0.0059 in.)
- Allowable limit
0.25 mm (0.0098 in.)

Group 3

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Oil Pump

Oil Pressure

(R.V.)	200 to 440 kPa	(2.0 to 4.5 kgf/cm ² , 28 to 64 psi) at rated speed
(A.L.)	200 kPa (2 kgf/cm ² , 28 psi) or less at rated speed 69 kPa (0.7 kgf/cm ² , 10 psi) or less at idle speed [0° to 25°C (32° to 77°F), Engine oil SAE 20]	

Trochoid tooth width

(R.V.)	19.98 to 20.000 mm	(0.7866 to 0.7874 in.)
------------------	--------------------	------------------------

Rotor lobe clearance

(R.V.)	0.11 to 0.15 mm	(0.0043 to 0.0059 in.)
(A.L.)	0.20 mm	(0.0079 in.)

Radial clearance between outer rotor and pump body

(R.V.)	0.07 to 0.15 mm	(0.0028 to 0.0059 in.)
(A.L.)	0.25 mm	(0.0098 in.)

Pump capacity.	13.8 ℓ/min. [At pump 2000 rpm]	(3.65 U.S. gals./min.)
------------------------	-----------------------------------	------------------------

Oil Filter

Bypass valve opening pressure

(R.V.)	98 kPa	(1 kgf/cm ² , 14 psi)
------------------	--------	----------------------------------

Relief Valve

Valve opening pressure

(R.V.)	290 to 340 kPa	(3.0 to 3.5 kgf/cm ² , 43 to 50 psi)
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COOLING SYSTEM

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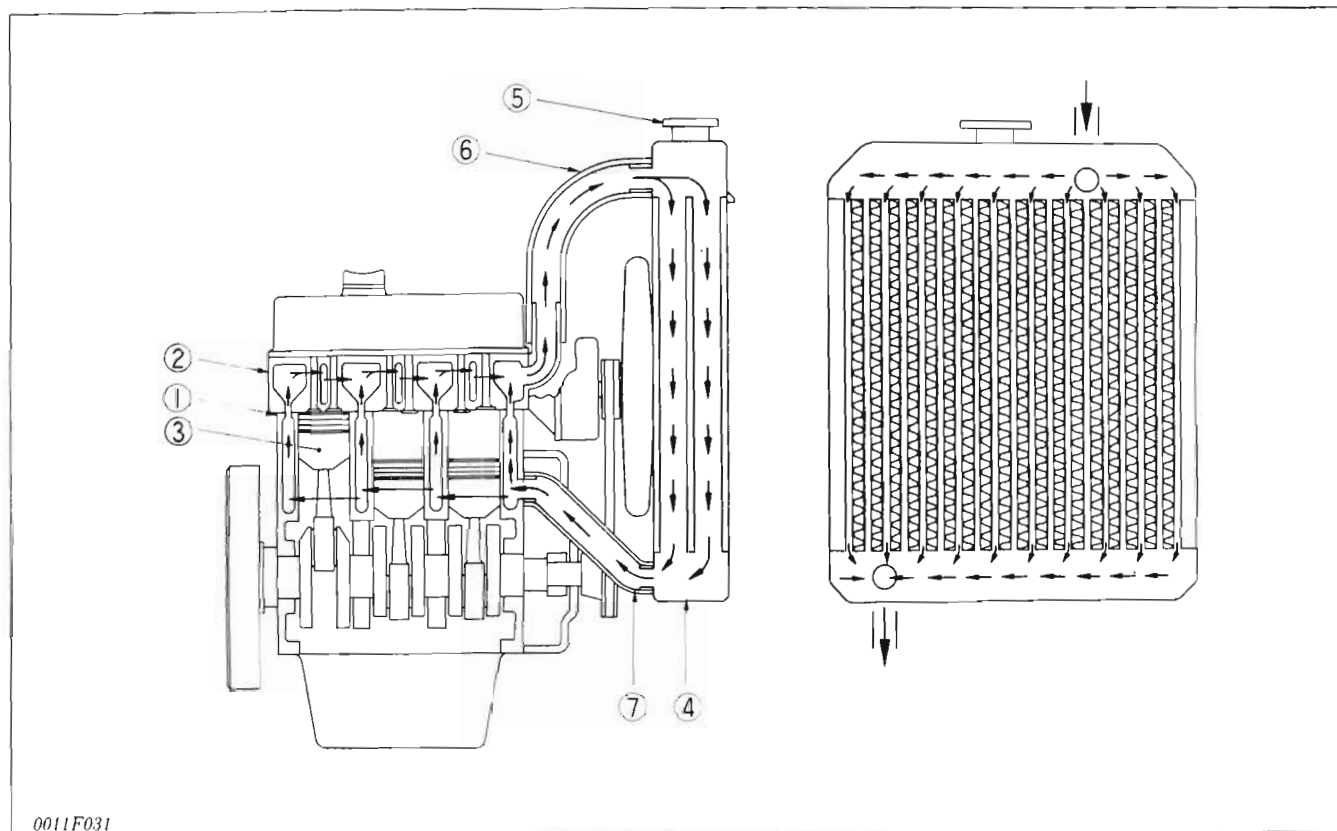
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Checking Opening Pressure of Radiator Cap	2-1

Group 3 Specifications

Group 1

General Description

Cooling System



1. Crankcase
2. Cylinder Head

3. Piston
4. Radiator

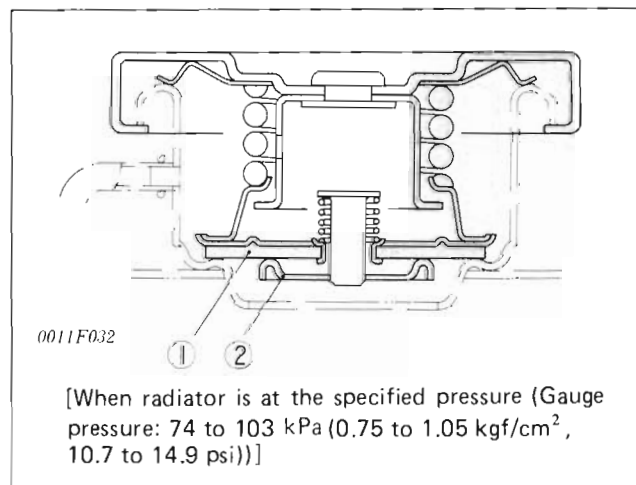
5. Radiator Cap
6. Water Pipe

7. Water Pipe

Fig. D-1 Cooling System

This engine is water-cooled and is equipped with a radiator.

Water which absorbs heat in the crankcase and cylinder head water jacket, is fed to the upper side of the radiator where it is cooled as it flows through the radiator passages before it is returned to the crankcase. This cooling is done by convection and no special unit is required.



1. Pressure Valve

2. Vacuum Valve

Fig. D-2 Radiator Cap (in specified pressure)

The radiator cap is a pressure type, which opens the pressure valve to reduce internal pressure when internal pressure is increased beyond a certain point due to increase in water temperature. When water temperature is reduced (and its volume is reduced) pressure in the radiator becomes negative, and the vacuum valve opens and introduces air into the radiator to prevent distortion of the radiator. The normal valve actuating pressure of the radiator cap is 88 kPa (0.9 kgf/cm², 13 psi).

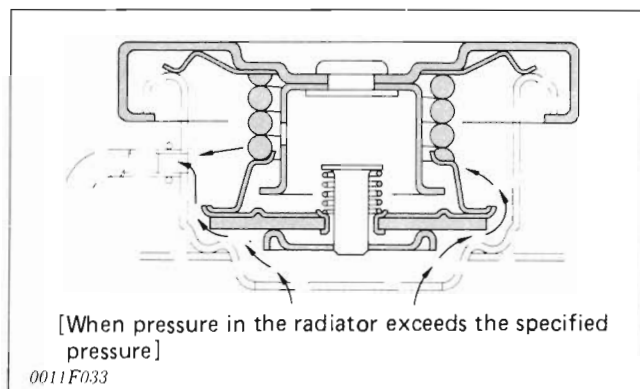


Fig. D-3 Radiator Cap (upper specified pressure)

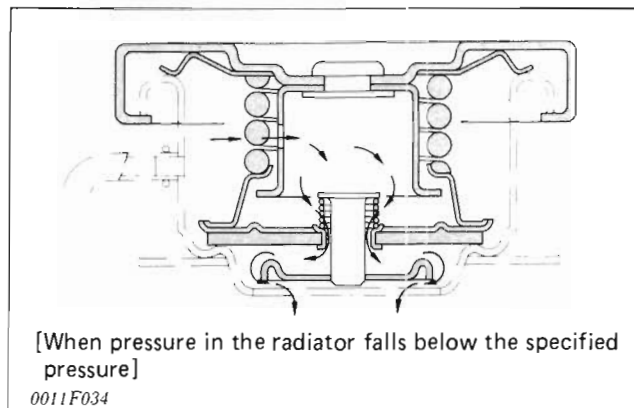


Fig. D-4 Radiator Cap (lower specified pressure)

Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Engine overheating	Insufficient water	Add water
	Clogged radiator net or radiator fins	Clean
	Rusty radiator	Clean by flushing or replace
	Water leakage from pipes	Tighten connections or replace pipes
	Loose fan belt	Tension properly or replace

Group 2

Servicing

Checking Radiator Water Tightness



1. Radiator Tester 2. Radiator

Fig. D-5 Checking Radiator Water Tightness

- (1) Pour the specified amount (4.6ℓ, 4.9 U.S.qts.) of water into the radiator.
- (2) Warm up the engine.
- (3) Attach a radiator tester. Increase to the specified pressure 137 kPa (1.4 kgf/cm², 20 psi).

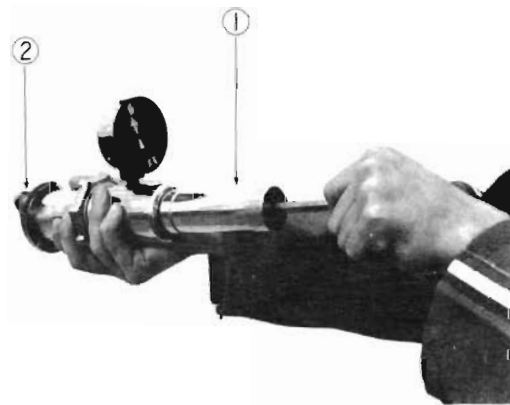
SPECIAL TOOL: Radiator Tester (Code No. 07909-31551)



0011P040

Fig. D-6 Radiator Tester

Checking Opening Pressure of Radiator Cap



1. Radiator Tester 2. Radiator Cap

Fig. D-7 Checking Opening Pressure of Radiator Cap

- (1) Attach a radiator tester to the radiator cap.
- TEST EQUIPMENT:** Radiator Tester
- (2) Apply the specified pressure 88 kPa (0.9 kgf/cm², 12.8 psi).
- (3) Check to see if the pressure drops by 29 kPa (0.3 kgf/cm², 4.3 psi) or more in 10 seconds.

- (4) Check to see if water leaks from any part.

Group 3

Specifications

(R.V.) Reference Value

Radiator (Engine)

Type Corrugated fin type with louver

Cap opening pressure

(R.V.) 88 kPa (0.9 kgf/cm², 13 psi)

Water tightness

(R.V.) 140 kPa (1.4 kgf/cm², 20 psi)**Fan Belt**

Belt sag under load of 90N (9 kgf, 20 lbs.). . . . 10 mm (3/8 in.)

FUEL SYSTEM

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Fuel System

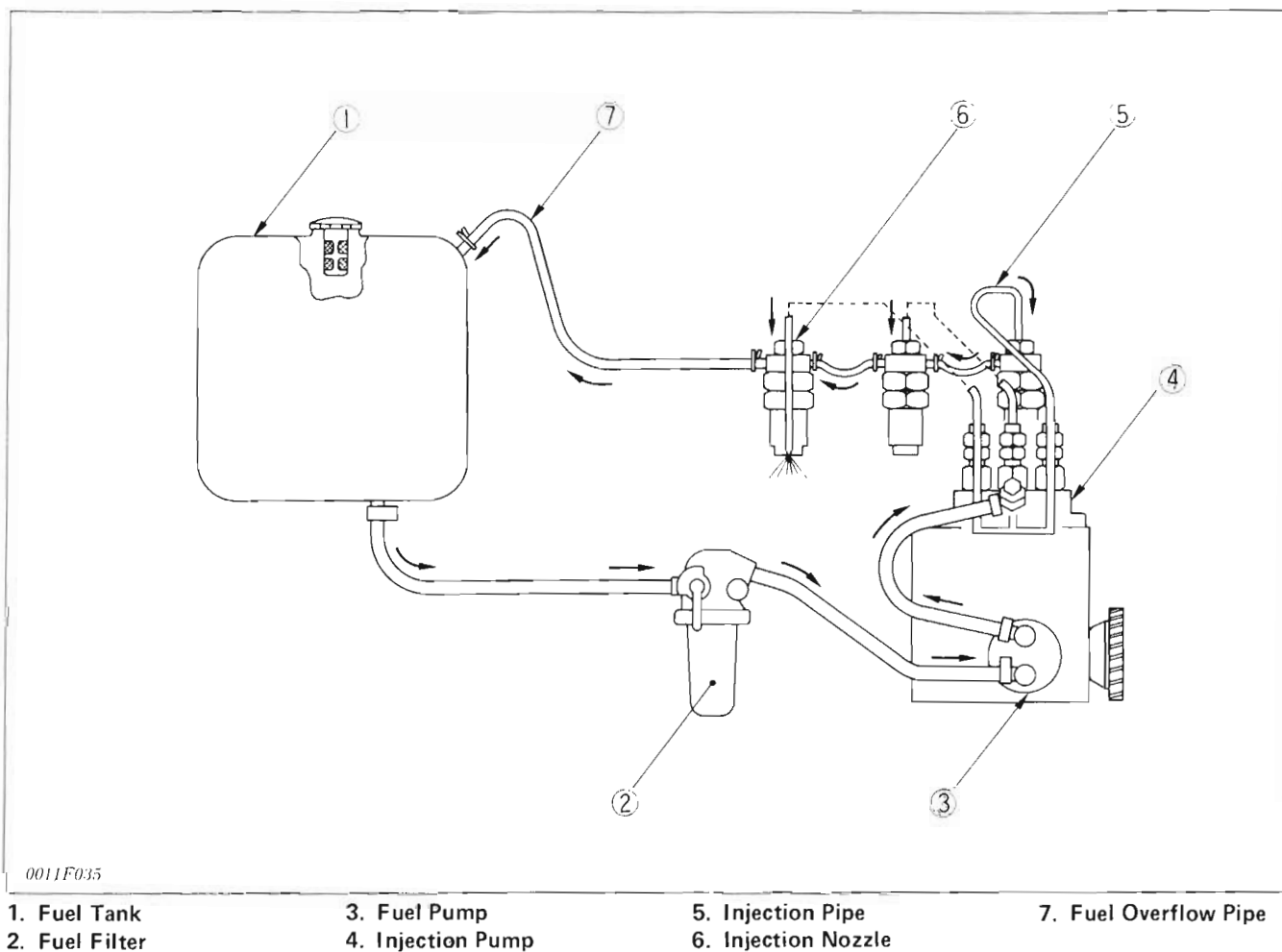


Fig. E-1 Fuel System

While the engine is running, fuel is fed from the fuel tank (1) through the fuel filter (2) to the fuel pump (3), which delivers it to the injection pump (4). The injection pump then feeds the fuel through the injection pipe (5), to the nozzles (6)

which inject it to the cylinder for combustion. Any fuel leaking from nozzles is collected in the fuel overflow pipe (7) which drains into the tank (1).

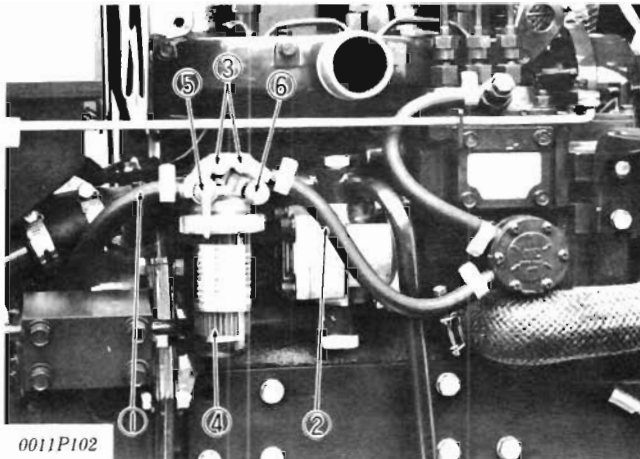
Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Engine does not start	Clogged fuel pipe or fuel filter	Clean or replace
	Fuel leakage due to loose injection pipe nuts	Tighten nuts
	Defective fuel supply pump	Repair or replace
	Improper injection timing	Adjust
	Worn fuel camshaft	Replace
	Clogged injection nozzles	Clean
	Worn or broken delivery valve springs	Repair or replace injection pump
	Worn or stuck plunger of injection pump	Repair or replace injection pump
	Fork lever 1 disconnected from control rack	Repair or replace
Irregular engine revolution	Clogged or dirty fuel filter	Replace filter element
	Mixing air in injection pump	Vent air
	Fuel leakage due to loose injection pipe nut	Tighten nuts
	Stuck plunger or delivery valve	Repair or replace injection pump
	Broken plunger spring	Replace
	Worn or stuck tappet roller	Repair or replace injection pump
	Irregular injection pressure	Repair or replace injection nozzle
Engine will not stop	Stuck or clogged injection nozzle	Repair or replace
	Fork lever 1 disconnected from control rack	Repair or replace
	Stuck control rack	Repair or replace injection pump

Group 1

Fuel Filter

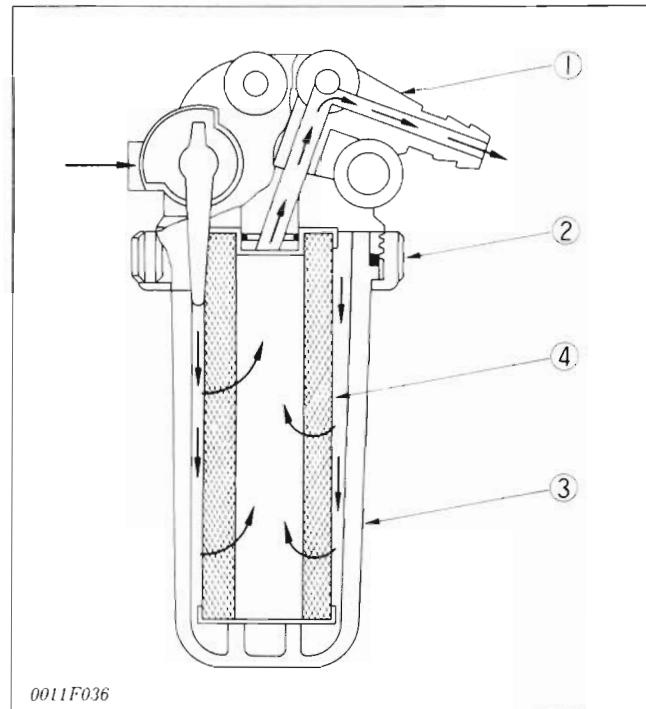
General Description



- | | | |
|----------------|-------------------|---------------|
| 1. Inlet Hose | 3. Air Vent Plug | 5. Cock Lever |
| 2. Outlet Hose | 4. Filter Element | 6. Bolt |

Fig. E-2 Fuel Filter Mounting Diagram

A fuel filter is used to prevent dirty fuel from reaching the injection pump and injection nozzles. The filter element will require occasional replacement to maintain an adequate flow of fuel to the injection pump. The frequency of this service will vary according to the cleanliness of available fuel and the care used in storage.



- | | |
|-------------------|---------------|
| 1. Cock Body | 3. Filter Cup |
| 2. Retaining Ring | 4. Element |

Fig. E-3 Fuel Filter

Fuel pumped by the fuel pump from the fuel tank is filtered by the fuel filter between the tank and pump to eliminate foreign matter and protect injection pump and nozzles.

When fuel enters the filter, it passes through the filter element's circumference toward the center for filtering.

The maximum filtration granular size of this element is 48 μm (0.048 mm, 0.0019 in.), and general size is from 10 to 20 μm (0.01 to 0.02mm, 0.0004 to 0.0008 in.).

Removal and Installation

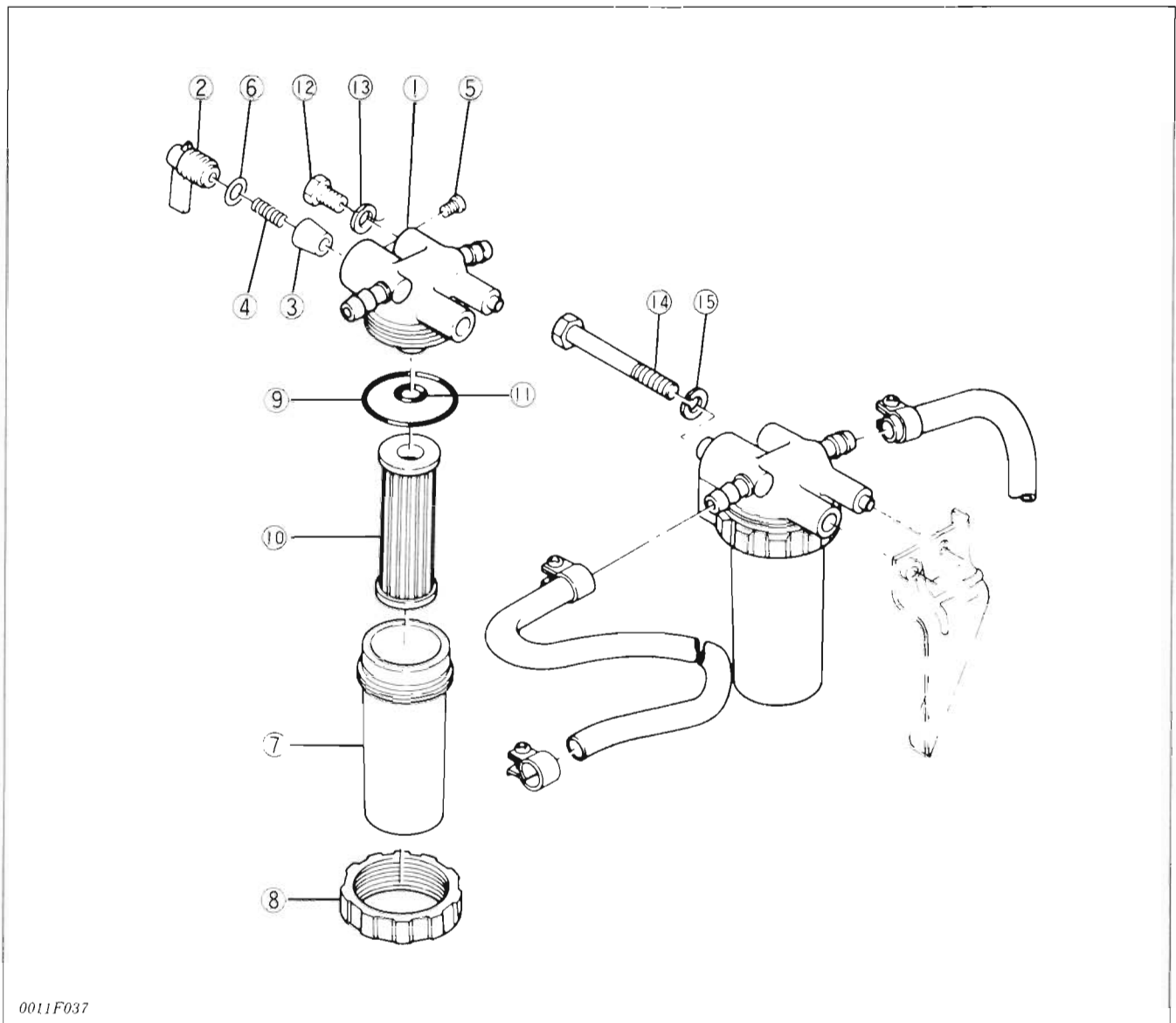
To remove the fuel filter assembly:

1. Disconnect inlet hose and plug the disconnected

end to prevent the loss of fuel.

2. Disconnect the outlet hose at filter

3. Remove the filter housing attaching bolt.



1. Cock Body
2. Cock Lever
3. Taper Valve

4. Valve Spring
5. Lever Screw
6. Lever O-ring

7. Filter Cup
8. Retaining Ring
9. Filter O-ring

10. Filter Element
11. Filter O-ring
12. Air Vent Plug

13. O-ring
14. Bolt
15. Spring Washer

Fig. E-4 Fuel Filter

It may be necessary at some time to repair the filter housing because of fuel leakage from around the cock lever or breather plug.

Use the above illustration as a guide for replacing

parts.

To install the filter assembly, reverse the removal steps given above.

Replacing Filter Element

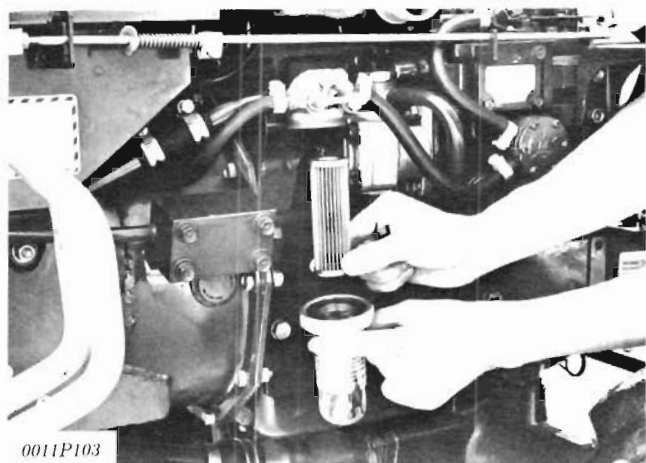


Fig. E-5 Fuel Filter Mounting Diagram

Before replacing the filter element, shut-off the fuel supply to the filter by turning the fuel cock lever straight up and do the following:

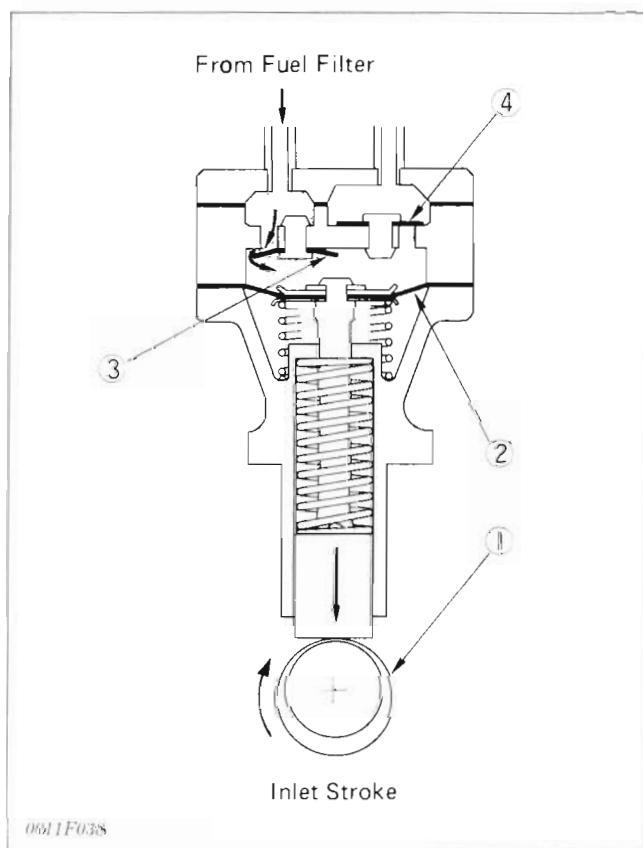
1. Loosen retaining ring from filter housing.
2. Remove filter cup and O-ring from filter housing.
3. Remove filter element and O-ring and then install a new element in its place.
4. Thoroughly clean filter cup. Be sure that O-ring seal is in good condition and install on filter cup.
5. Install filter cup, being careful not to over-tighten retaining ring.
6. Turn on fuel supply.
7. Open vent plug on filter. Tighten plug when fuel flows free of bubbles.

Group 2

Fuel Pump

General Description

Filtered fuel is forcibly pulled from the tank by the fuel pump and fed under pressure to the injection pump. Inlet and discharge pressures are produced by a vertical movement of the diaphragm (2) which is caused by the special cam (for pump) of the fuel camshaft. Fuel is suctioned on the downward stroke, and discharged on the upward stroke. A system of two valves allows fuel to flow in only one direction.



- | | |
|------------------|-----------------|
| 1. Fuel Camshaft | 3. Inlet Valve |
| 2. Diaphragm | 4. Outlet Valve |

Fig. E-6 Inlet Stroke

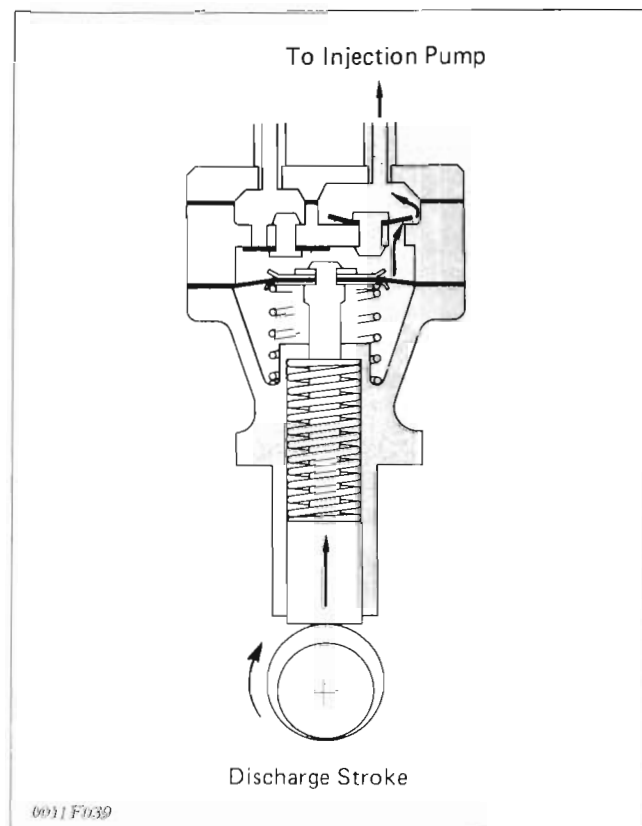


Fig. E-7 Discharge Stroke

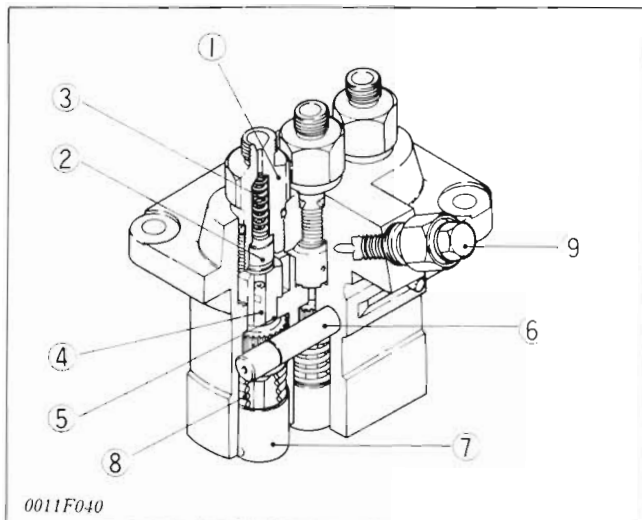
Group 3

Fuel Injection Pump

General Description

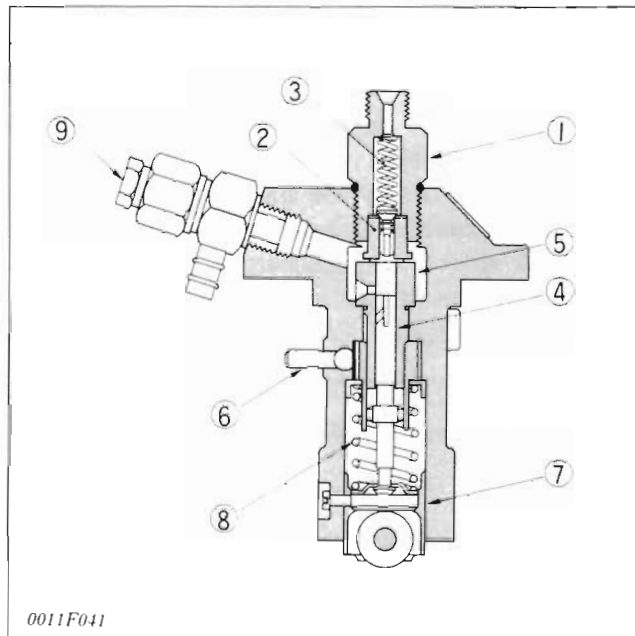
The fuel injection pump plunger is reciprocated by a special camshaft which is driven by the crankshaft through a system of gears.

Camshaft rpm is 1/2 of crankshaft rpm.



- | | |
|--------------------------|-------------------|
| 1. Delivery Valve Holder | 6. Control Rack |
| 2. Delivery Valve | 7. Tappet |
| 3. Delivery Valve Spring | 8. Plunger Spring |
| 4. Plunger | 9. Air Vent Screw |
| 5. Cylinder | |
- Pump Element

Fig. E-8 Fuel Injection Pump



- | | |
|--------------------------|-------------------|
| 1. Delivery Valve Holder | 6. Control Rack |
| 2. Delivery Valve | 7. Tappet |
| 3. Delivery Valve Spring | 8. Plunger Spring |
| 4. Plunger | 9. Air Vent Screw |
| 5. Cylinder | |
- Pump Element

Fig. E-9 Fuel Injection Pump

Delivery Valve

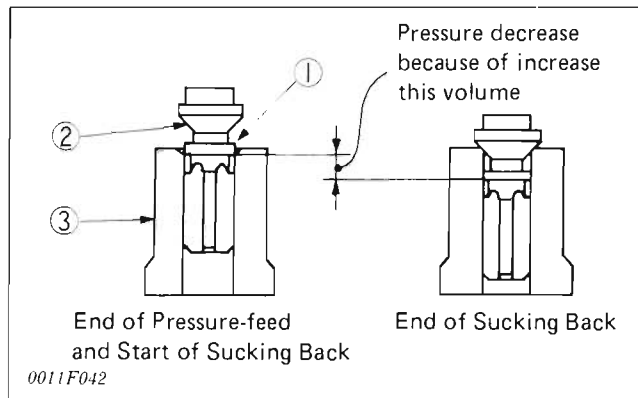
The delivery valve is composed of the valve and the valve seat. It performs two functions:

(1) Reverse flow prevention

If the circuit between the delivery chamber and the nozzle is always closed, a time lag will occur between pressure-feed start of valve element and start of nozzle injection. This, in turn, will prevent injection from stopping properly until after completion of pressure-feed.

To eliminate this time lag, the valve lowers on completion of pressure-feed and the relief valve contacts the valve seat, and break the circuit between the injection pipe and plunger.

(2) Reverse suction



1. Relief Valve
2. Seat
3. Delivery Valve Seat

Fig. E-10 Delivery Valve

After the relief valve contacts delivery valve seat, this valve lowers a little. Since the relief valve breaks the circuit, pressure in the injection pipe's reduced as the valve lowers, preventing fuel dropping from the nozzle.

ump Element

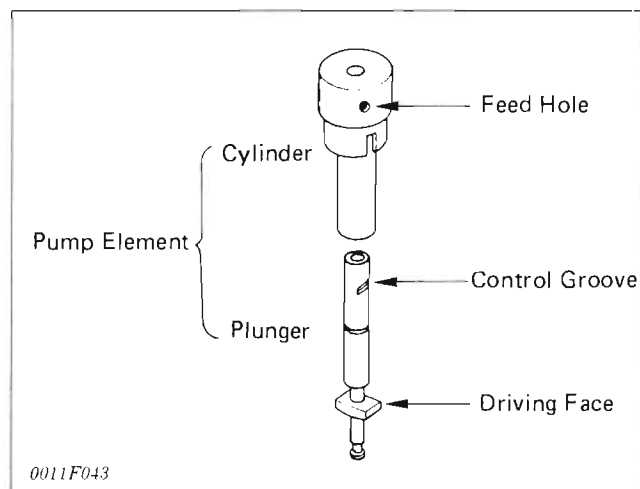


Fig. E-11 Pump Element

The pump element is composed of a cylinder and a plunger. Their contact surfaces are precision finished to provide a high injection pressure even at low speeds. The cylindrical surface of the plunger has slanted groove, which are called control groove, and a connecting hole for plunger head.

Control Rack

This is connected directly to the governor fork in the engine body. It is connected with the plunger by pinion to change injection volume.

Tappet

The tappet converts rotating movement of the camshaft into a reciprocating movement to drive plunger. A roller is used where it contacts the cam to reduce friction.

Fuel Pressure-feed

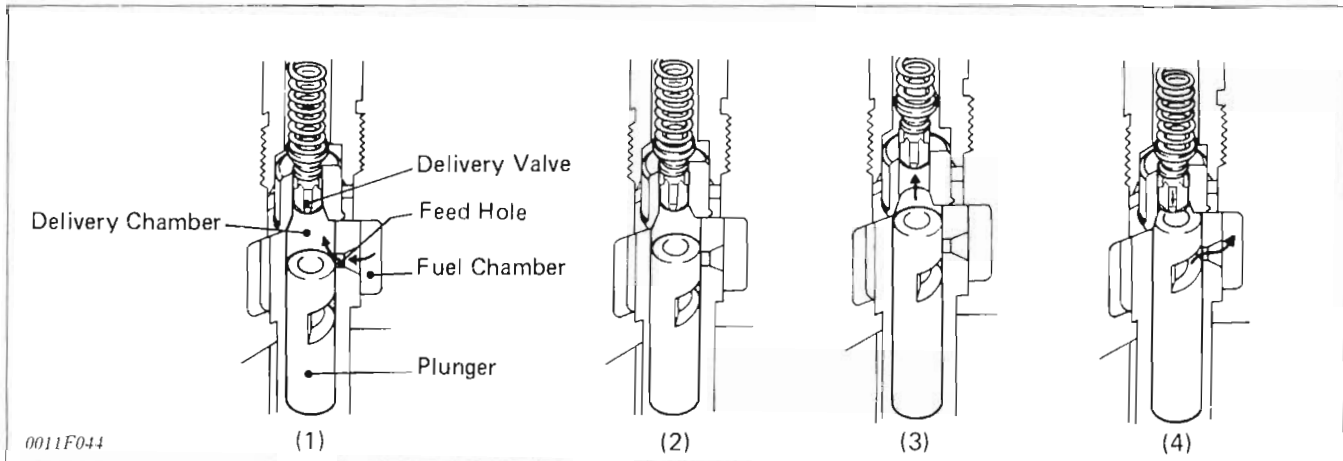


Fig. E-12 Pressure-feed Start to Completion

(1) Bottom dead center of plunger

At bottom dead center, fuel enters the delivery chamber through the fuel chamber and the feed hole. (Fuel chamber is always full fed by the fuel pump.)

(2) Pressure-feed start

(3) Pressure-feed process

Plunger is pushed up by camshaft to close the feed hole, and fuel pressurization starts. As the plunger moves up, pressure increases until

it opens the delivery valve. Then fuel is pressure-fed through the injection pipe and nozzle into the combustion chamber.

(4) Completion of pressure-feed

When plunger moves further up, the control groove and feed hole meet. Pressurized fuel in the delivery chamber is returned through the plunger's center hole, control groove, and feed hole to the fuel chamber. Then pressure falls and pressure-feed is completed.

Injection Control

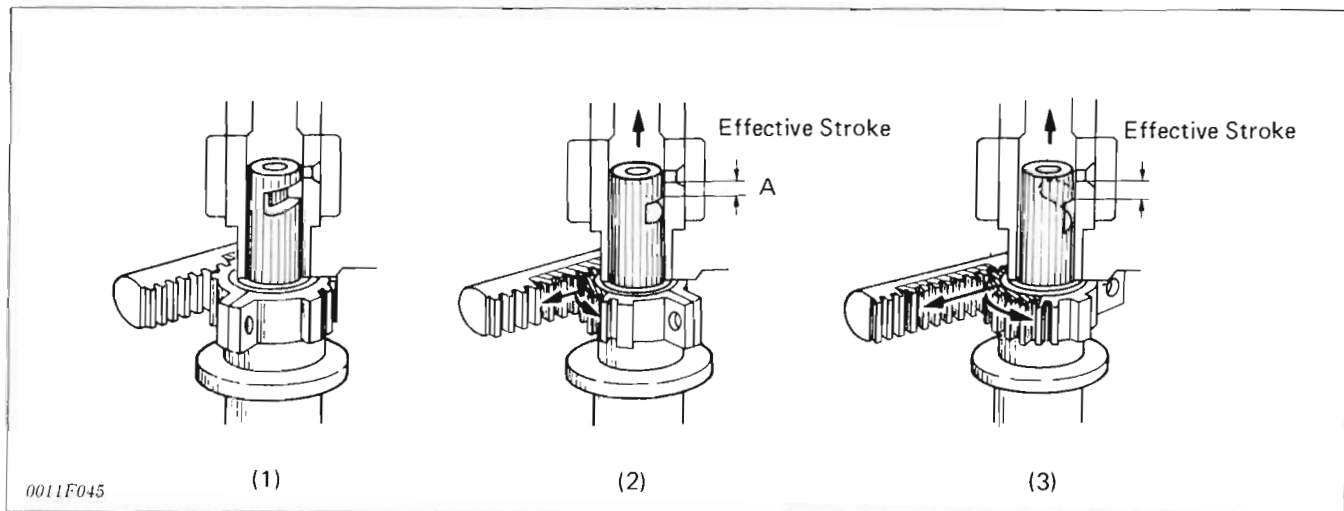


Fig. E-13 Injection Control

(1) Injection "zero"

The feed hole meets the control groove before it is closed by the plunger top. Therefore, fuel is not pressurized, and is not injected even if the plunger moves up.

(2) Injection "medium"

When the plunger is rotated a certain amount in the direction of the arrow by the control

rack, stroke A is effective until the feed hole meets the control groove and fuel is injected as the stroke amount.

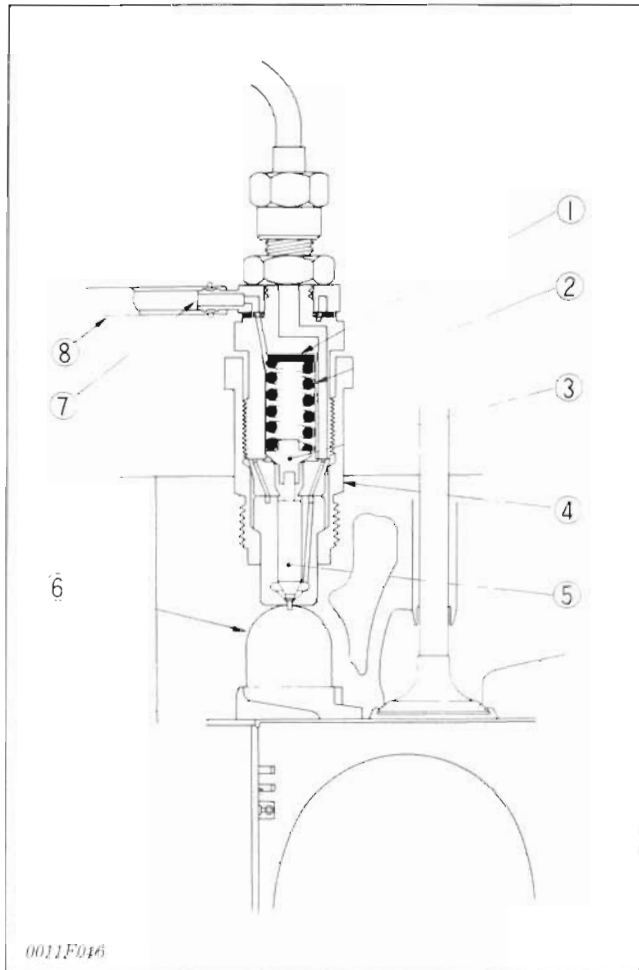
(3) Injection "maximum"

When the plunger is rotated by the control rack to the maximum amount (in the direction of the arrow), effective stroke reaches maximum and maximum injection is provided.

Group 4

Nozzle

General Description



- | | |
|---------------------|-------------------------|
| 1. Adjusting Washer | 5. Needle Valve |
| 2. Nozzle Spring | 6. Combustion Chamber |
| 3. Push Rod | 7. Fuel Overflow Nipple |
| 4. Nozzle Nut | 8. Fuel Overflow Pipe |

Fig. E-14 Injection Nozzle

This throttle-type nozzle provides 13.7 to 14.7 MPa (140 to 150 kgf/cm², 1990 to 2130 psi) injection pressure.

Fuel fed from the pump is pressurized to push the needle valve (5) up and the fuel is then injected. That is, fuel pressure makes the needle valve reciprocate and fuel mist enters the combustion chamber (6) for combustion. Since the needle valve (5) is pressed by the nozzle spring through the push rod (3), injection pressure can be controlled by increasing or decreasing the number of adjusting washers (1).

0.1 mm (0.0039 in.) change in adjusting washer thickness corresponds to approx. 980 kPa (10 kgf/cm², 142 psi) change in injection pressure. Leaked fuel is passed from nozzle holder center through the fuel overflow nipple (7) and the fuel overflow pipe (8) to the fuel tank.

Group 5

Governor

General Description

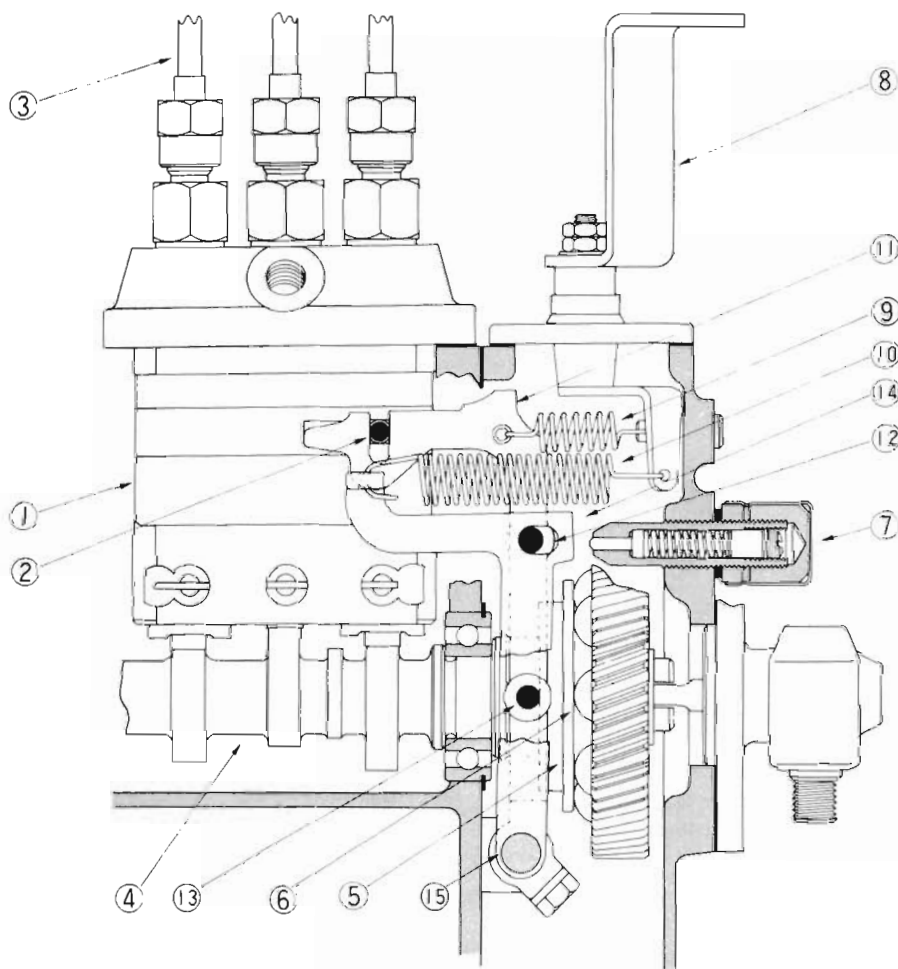
The governor controls engine output according to applied load to maintain engine speed.

Operating principle:

The ball's centrifugal force, which changes accord-

ing to engine speed, and the tension of the governor spring, which determines the control rack position, are balanced to keep engine speed at a constant level.

Function During Engine Operation



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- | | | | |
|-------------------|----------------------------------|----------------------|----------------------|
| 1. Pump Injection | 5. Governor Sleeve | 9. Start Spring | 13. Fork Lever Pin 2 |
| 2. Control Rack | 6. Governor Ball | 10. Governor Spring | 14. Fork Lever 2 |
| 3. Delivery Pipe | 7. Fuel Limit Apparatus Assembly | 11. Fork Lever 1 | 15. Fork Lever Shaft |
| 4. Fuel Camshaft | 8. Speed Control Lever | 12. Fork Lever Pin 1 | |

Fig. E-15 Function During Engine Operation

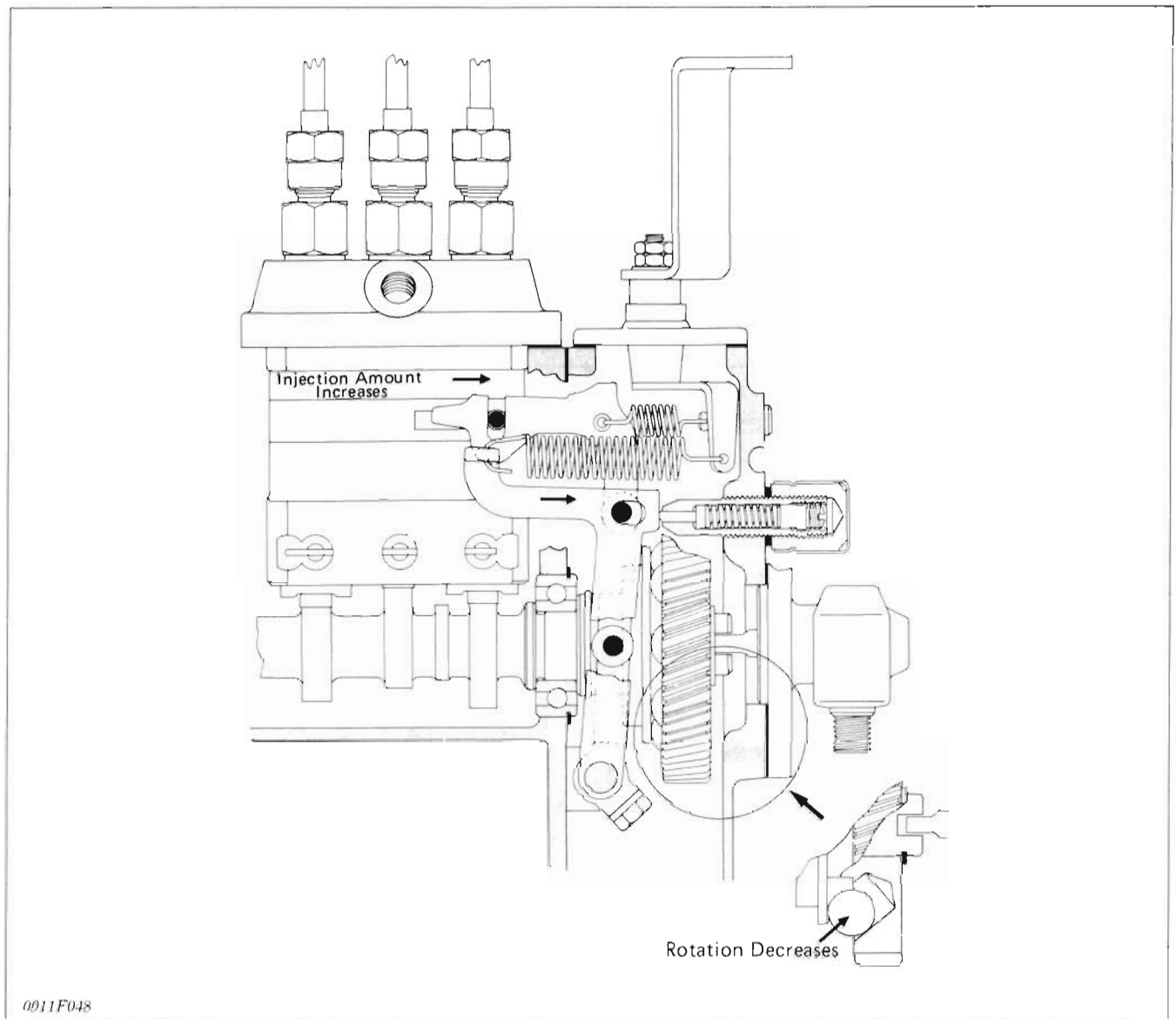


Fig. E-16 Functions when the load is increased

When the speed control lever (8) is set at its maximum position as shown in Fig. E-15, tension of the governor spring (10) is applied through fork lever 2 (14) and fork lever 1 (11) to the control rack (2) to set it at the maximum position. But, the governor balls (6) in the camshaft (4) push back fork levers 1 (11) and 2 (14), through governor sleeve (5) by their centrifugal force. The control rack is stopped at the position where the ball's pushing force and the governor spring (10)

tension are balanced. Then, when load to the crankshaft is increased, camshaft rotating speed is reduced and the spring tension overcomes the ball's centrifugal force.

As a result, injection is increased as shown in Fig. E-16. When the load is decreased, the camshaft speed is increased and then injection is decreased due to fork lever movement and the engine speed is kept constant approximately.

Functions at Engine Start

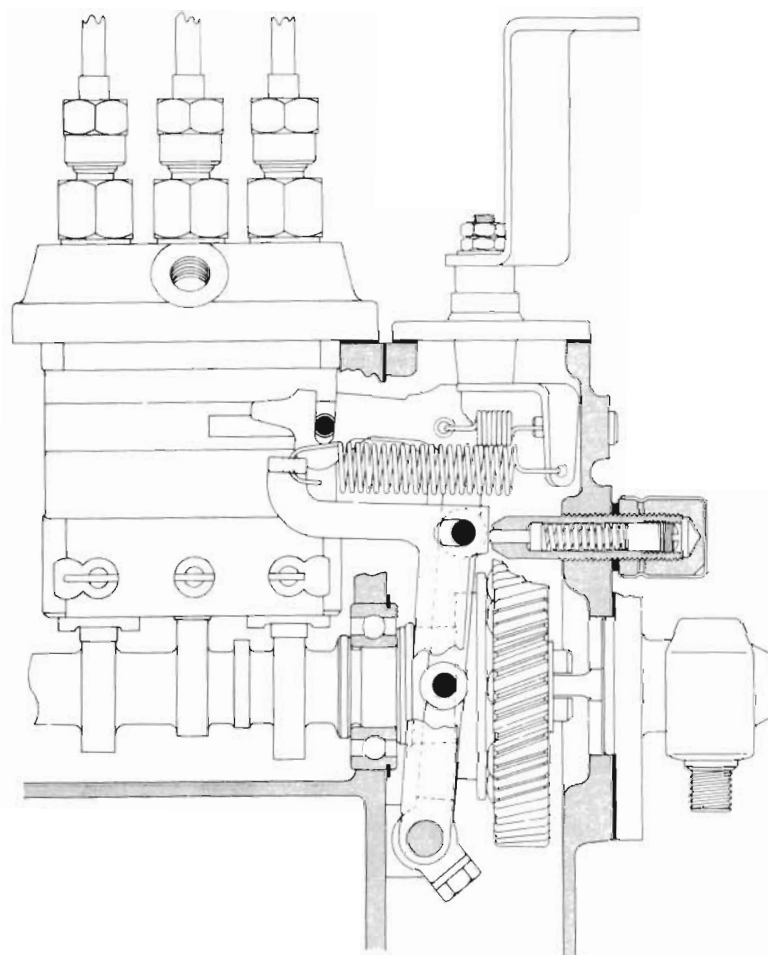


Fig. E-17 Functions at Engine Start

For easy starting, more fuel is injected than during running at the same setting position of speed control lever.

When the engine is started with the speed control lever at its maximum position, the fork lever 2 (14) is stopped where it contacts with the fuel limit apparatus assembly (7). And the fork lever 1 (11) is started to move from the position where the rack is pulled in direction of fuel injection increase by

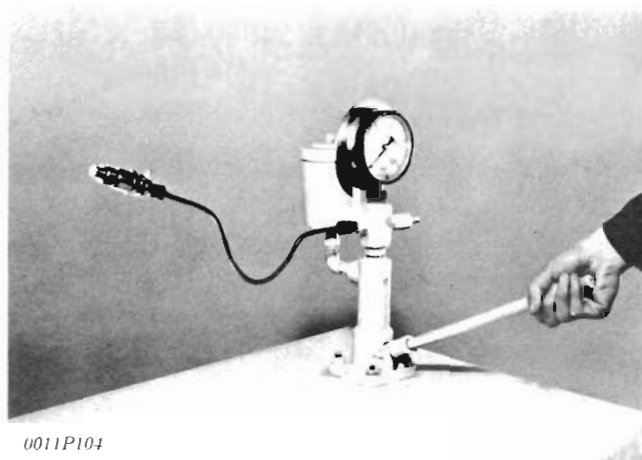
start spring (9). This amount of injection increase corresponds to the long hole distance of fork lever 2 (14) engaging the fork lever pin 1 (12).

At the engine start, the ball (6) is forced out, but injection rate returns to the set value immediately, because start spring (9) tension is weak. The engine can be started under the same conditions at any setting of the speed control lever.

Group 6

Servicing

Checking Nozzle Opening Pressure



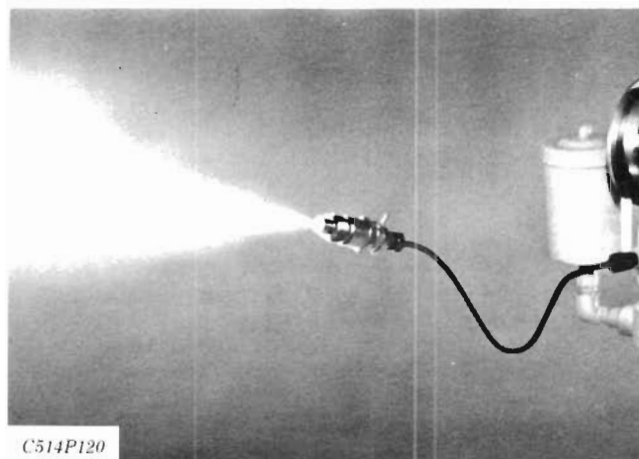
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Fig. E-18 Checking Nozzle Opening Pressure

- (1) Move the tester handle up and down to prime fuel.
Measure the pressure of fuel gushing out from the nozzle tip.
 - (2) If the measurement is not within the reference value, adjust with the adjustment washer inside the nozzle holder.
An increase of every 0.1 mm (0.004 in.) of washer thickness causes an approximate 980 kPa (10 kgf/cm² 142 psi) increase in fuel injection pressure.
- Reference value
13.7 to 14.7 MPa (140 to 150 kgf/cm² 1990 to 2130 psi).

CAUTION: Be careful not to contact directly with the injected spray since it will harm any cells.

Shape of Spray Across Nozzle Tip



C514P120

Fig. E-19 Shape of Spray Across Nozzle Tip

- (1) Attach the nozzle to a Nozzle Tester and shoot it in the air. Check the shape of the spray.

TEST EQUIPMENT: Nozzle Tester

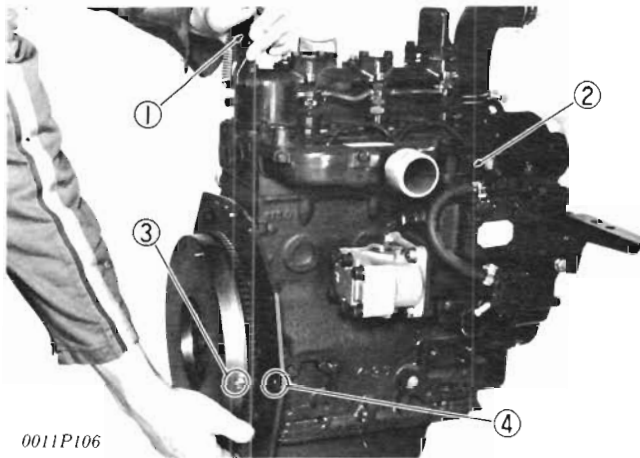


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Fig. E-20 Nozzle Tester

- (2) If the shape is not acceptable, replace the nozzle tip.

Checking Injection Timing

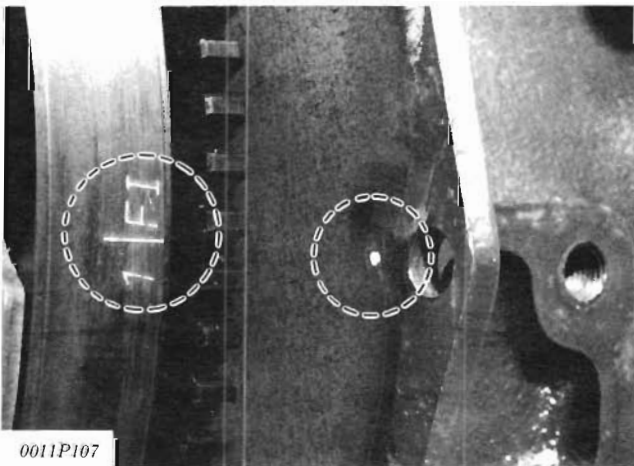


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- | | |
|------------------------|------------|
| 1. Decompression Lever | 3. FI Mark |
| 2. Injection Pump | 4. Mark |

Fig. E-21 Checking Injection Timing

- (1) Check fuel injection timing of the cylinder approaching the expansion stroke by manually turning the engine flywheel.
- (2) Check if fuel is injected at the moment the FI mark on the flywheel.



0011P107

Fig. E-22

- (3) If fuel injection timing is improper, adjust with shims to change the position of the injection pump. If injection is too late take off shim. Each shim will cause proceeding of 0.026 rad. (1.5°).
 - Shim thickness:
0.12 to 0.18 mm (0.0047 to 0.0071 in.)
 - Reference value
Before TDC (Top Dead Center) 0.401 to 0.436 rad. (23° to 25°) (at the beginning of static injection)

Group 7

Specifications

(R.V.) Reference Value

Fuel Tank

Capacity 13 ℓ (3.4 U.S. gals.)

Fuel Supply Pump

Normal operating pressure

(R.V.) 20 kPa (0.2 kgf/cm², 2.8 psi)**Injection Pump**

Injection timing (Static)

(R.V.) 0.401 to 0.436 rad (23° to 25°) before TDC
Flywheel circumference
[2.1 mm (0.083 in.)] = [0.0174 rad. (1°)]

Injection order 1 → 2 → 3

Injection pressure

(R.V.) 13.7 MPa (140 kgf/cm², 1988 psi)

Plunger O.D.

(R.V.) 5 mm (0.197 in.)

Plunger stroke

(R.V.) 7 mm (0.276 in.)

Pump displacement

(R.V.) 15.2 to 15.8 mm³/rev (9.28 x 10⁻⁴ to 9.64 x 10⁻⁴ cu.in./rev)

Injection pump to engine tightening

torque 24 to 27 Nm (2.4 to 2.8 kgf·m, 17 to 20 ft-lbs)

Injection Nozzle

Nozzle number x I.D.

(R.V.) 1 x 1 mm (1 x 0.04 in.)

Nozzle angle

(R.V.) 0.21 rad. (12°)

Opening pressure

(R.V.) 13.7 to 14.7 MPa (140 to 150 kgf/cm², 1988 to 2130 psi)

Nozzle holder to engine tightening

torque 29 to 49 Nm (3 to 5 kgf·m, 22 to 36 ft-lbs)

Nozzle nut to nozzle holder tightening

torque 79 to 98 Nm (8 to 10 kgf·m, 58 to 72 ft-lbs)

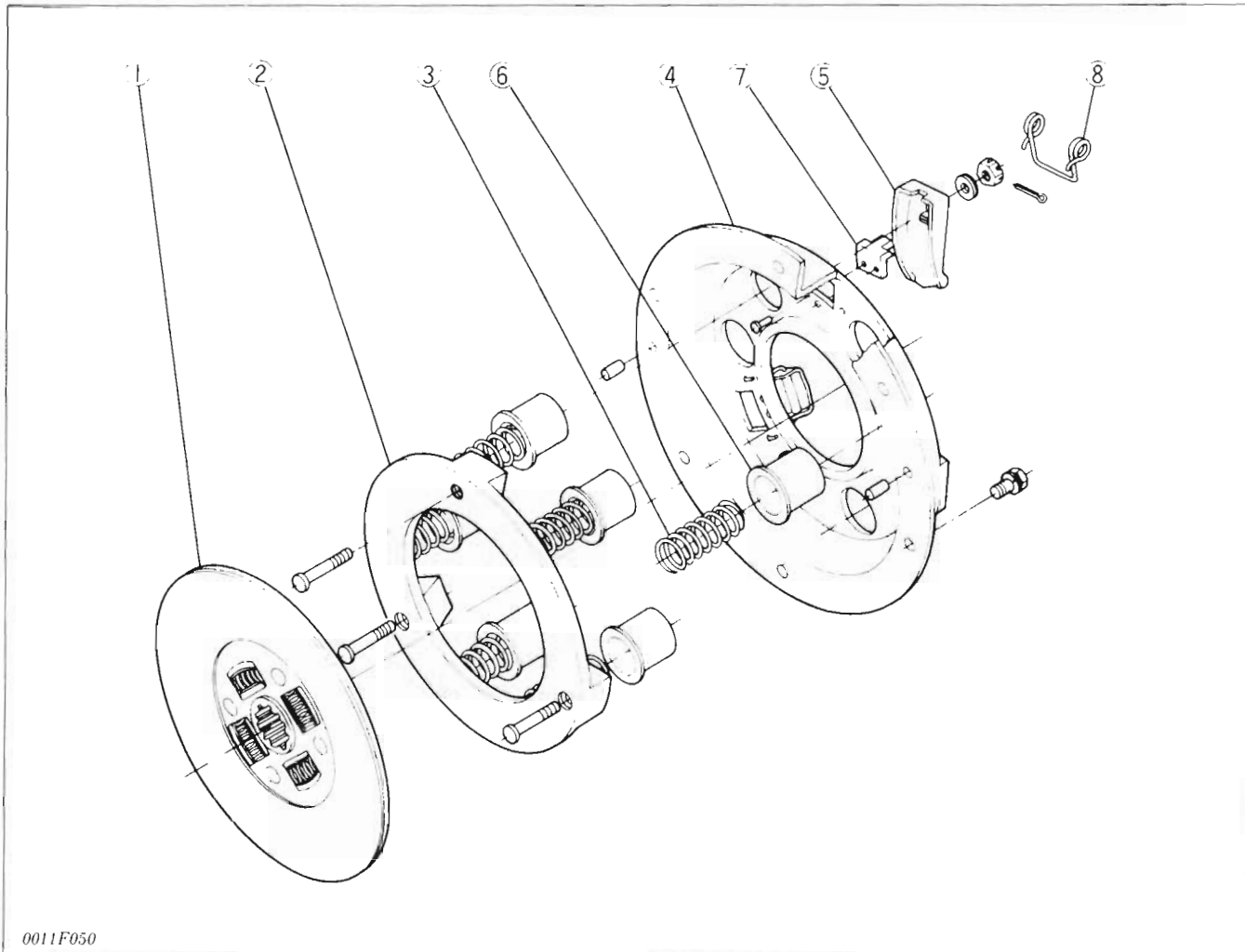
CLUTCH

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Group 1

General Description



1. Clutch Disk
2. Pressure Plate

3. Pressure Spring
4. Clutch Cover

5. Release Lever
6. Pressure Spring Cap

7. Lever Seat
8. Return Spring

Fig. F-1 Clutch

The clutch unit transmits engine power to the transmission or stops power transmission for stopping or changing speed. Its performance must satisfy the following three requirements:

1. Smooth engagement and speed change
2. Low vibration and noise
3. Durability

The dry, single-disk clutch used on the B7100 HST is simple structure and easy to check, adjust, and repair. It performs all power transmission

functions for travelling and PTO.

The clutch unit is composed of the clutch body, which directly engages and disengages power, and operating mechanism.

The clutch cover is connected to the flywheel which is connected to the engine crankshaft. Inside the cover, the pressure plate, pressure spring, and clutch disk are assembled. The clutch disk is installed to the propeller shaft connecting to the transmission.

Operating Mechanism

The clutch operating mechanism controls clutch engagement and disengagement. It consists of a pedal which cuts power transmission when pressed, a rod, a lever, a release fork, a release bearing

holder and thrust ball bearing (which pressed the release lever of the clutch body). For added safety at engine start, a safety switch is provided in the mechanism to prevent starting if the pedal is not pressed.

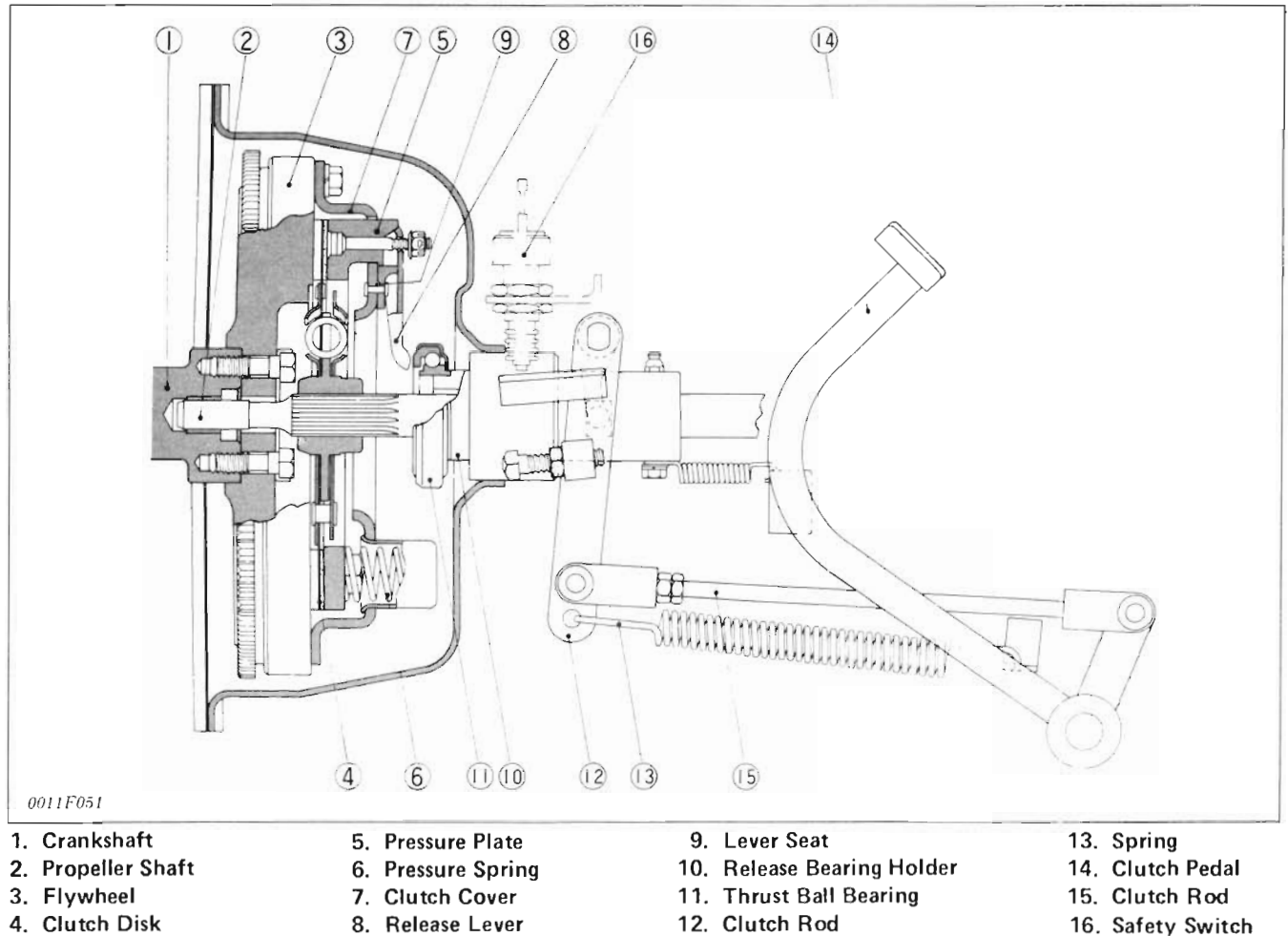


Fig. F-2 Clutch System

Power transmission path during clutch engagement:

The clutch is rotated by the flywheel (3). In the clutch cover (7), a disk (4) is provided between the pressure plate (5) and flywheel. The disk is connected to the propeller shaft (2) and the spline. When the pedal (14) is not pressed, the six pressure springs (6) located between the clutch cover (7) and pressure plate (5) cause the pressure plate (5) to press the disk (4) against the flywheel (3).

As a result, pressure plate (5) rotation is transmitted to the disk (4) by friction and power is transmitted to the transmission through the propeller shaft.

Power transmission path during clutch disengagement:

When the clutch pedal is pressed, the thrust ball bearing (11) presses the three release levers (8) and separates the pressure plate (5) from the disk (4) by using the lever seat (9) as the fulcrum.

As a result, friction between the disk and pressure plate and flywheel is released and power transmission stops.

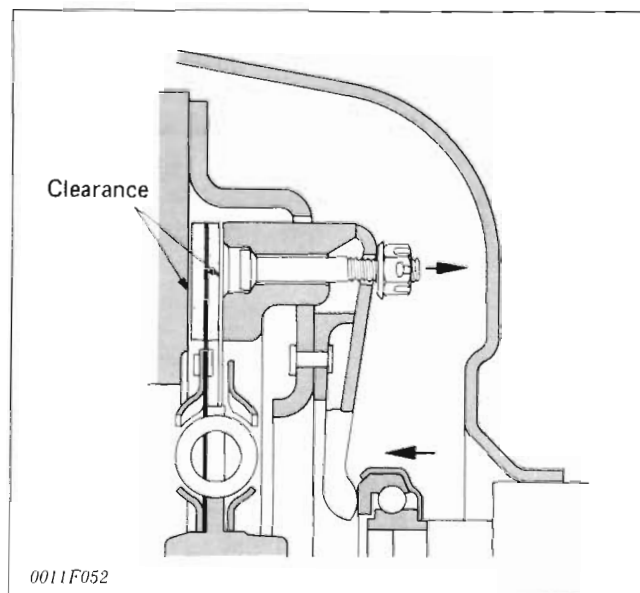


Fig. F-3 Condition of Clutch Disengagement

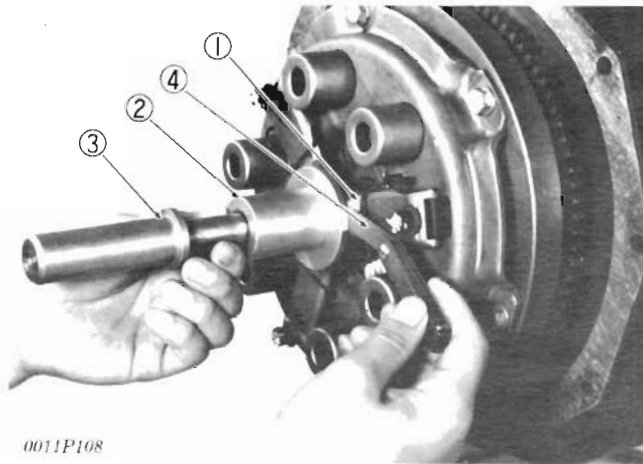
Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Clutch drags	Defective clutch adjusting bolt	Adjust
	Worn clutch release fork or bearing	Replace
	Rusted pressure plate or flywheel	Remove rust
	Worn and shaken splines of clutch disk	Replace disk
Clutch slips	Defective clutch adjusting rod	Adjust
	Worn or carbonized clutch disk	Replace disk
	Oil on clutch disk and pressure plate	Check and repair
	Broken pressure spring	Replace spring

Group 2

Servicing

Checking Height of Release Lever



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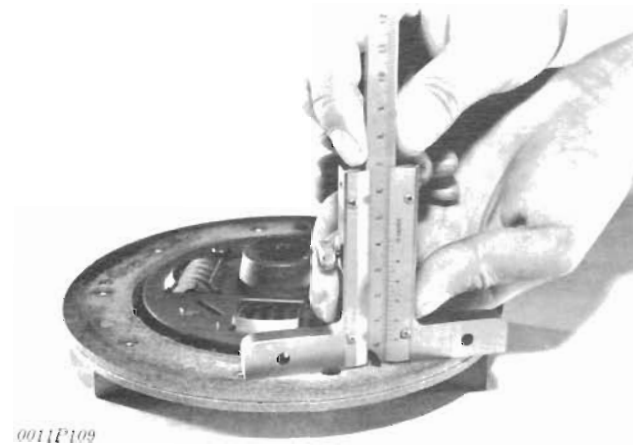
1. Release Lever
2. Gauge Ring

3. Center Tool
4. Feeler Gauge

Fig. F-4 Checking Height of Release Lever

- (1) Give the gauge ring slightly pressing against the boss of the clutch disk and adjust the height of release lever.
- (2) Keep the differences among the heights of the three release levers within 0.3 mm (0.012 in.).
- (3) Remove the cotter pin at the release lever bolt, and adjust the height by means of the lever nut.

Checking Clutch Disk



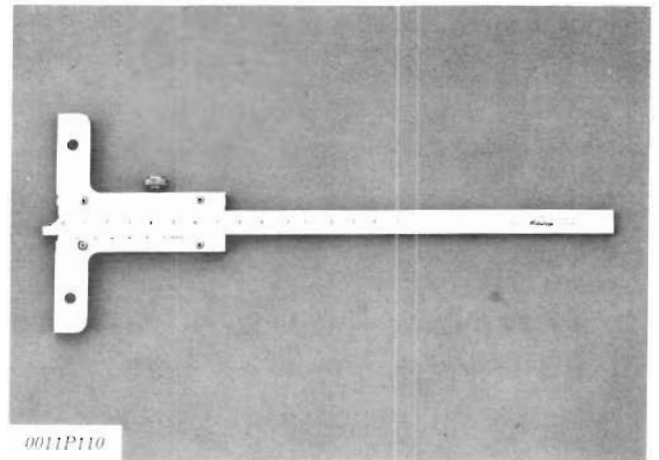
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1. Depth Gauge

Fig. F-5 Checking Clutch Disk

- (1) Measure the distance from the clutch disk surface to the top of the rivets.

TEST EQUIPMENT : Depth Gauge



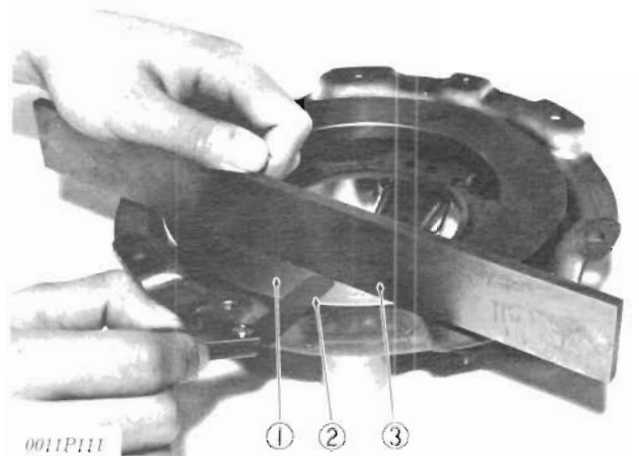
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Fig. F-6 Depth Gauge

- (2) If the measurement exceeds the allowable limit, replace.

• Allowable limit: 0.1 mm (0.004 in.)

Checking Wear, Scratches and Cracks on Pressure Plate



0011P111

1. Pressure Plate 2. Feeler Gauge 3. Straightedge

Fig. F-7 Checking Pressure Plate

- (1) Check to see that there is no wear, scratches or cracks on the pressure plate where the clutch disk is mounted, and where the release levers are attached.

- (2) If there is any flaw on the pressure plate, remove it with sandpaper or replace it.

Checking Clutch Pedal Free Travel

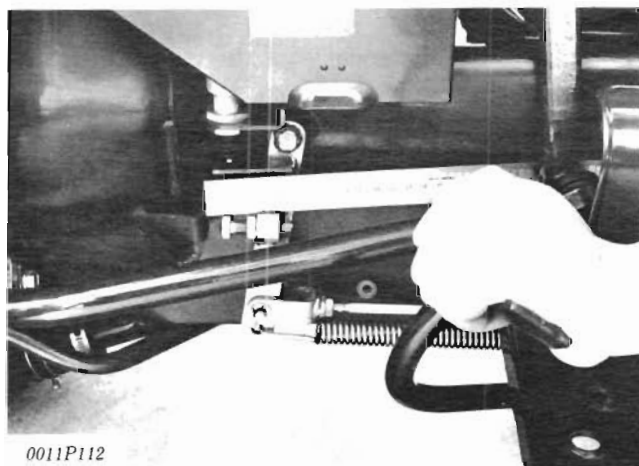


Fig. F-8 Checking Clutch Pedal Free Travel

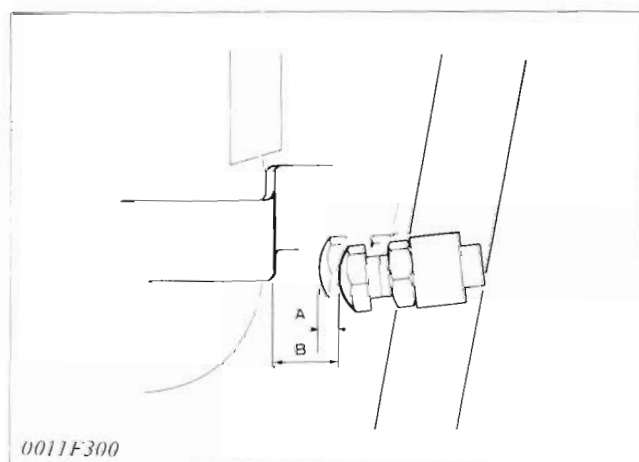


Fig. F-9 Checking Clutch Pedal Free Travel

- (1) Measure the free travel by pressing the pedal by hand.
- (2) Adjust by altering the length of the clutch rod.
- Reference value
 - At the adjusting bolt: 2 to 4 mm
[A in Fig. F-9] (0.079 to 0.157 in.)
 - At the pedal edge: 15 to 30 mm
(19/32 to 1-3/64 in.)
 - Distance B between adjusting bolt and stopper: 11 mm
(0.433 in.)

Group 3

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Clutch	(R.V.)	2 to 4 mm	(0.079 to 0.157 in.)
	Pedal free travel	[At the adjusting bolt]	
	(R.V.)	15 to 30 mm	(19/32 to 1-3/64 in.)
		[At the pedal edge]	
Clutch disk hub spline backlash	(R.V.)	0.01 to 0.05 mm	(0.0004 to 0.0020 in.)
		[At the clutch disk edge]	
Clutch disk wears out	(A.L.)	0.1 mm	(0.004 in.) from rivet head
Height of release levers	(R.V.)	44.8 to 46.2 mm	(1.764 to 1.819 in.)
		[From flywheel surface]	
Difference between three release levers	(R.V.)	0 to 0.3 mm	(0 to 0.012 in.)

TRANSMISSION

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Group 1

General Description

The transmission consists of the hydrostatic transmission and gear transmission in order to obtain suitable travel speed and PTO shaft speed for work purpose.
Power is transmitted through two systems, the run-

ning system and the PTO system.
Engine power is inputted to the pump shaft of the Hydrostatic Transmission, and power is then supplied to the running system and PTO system.

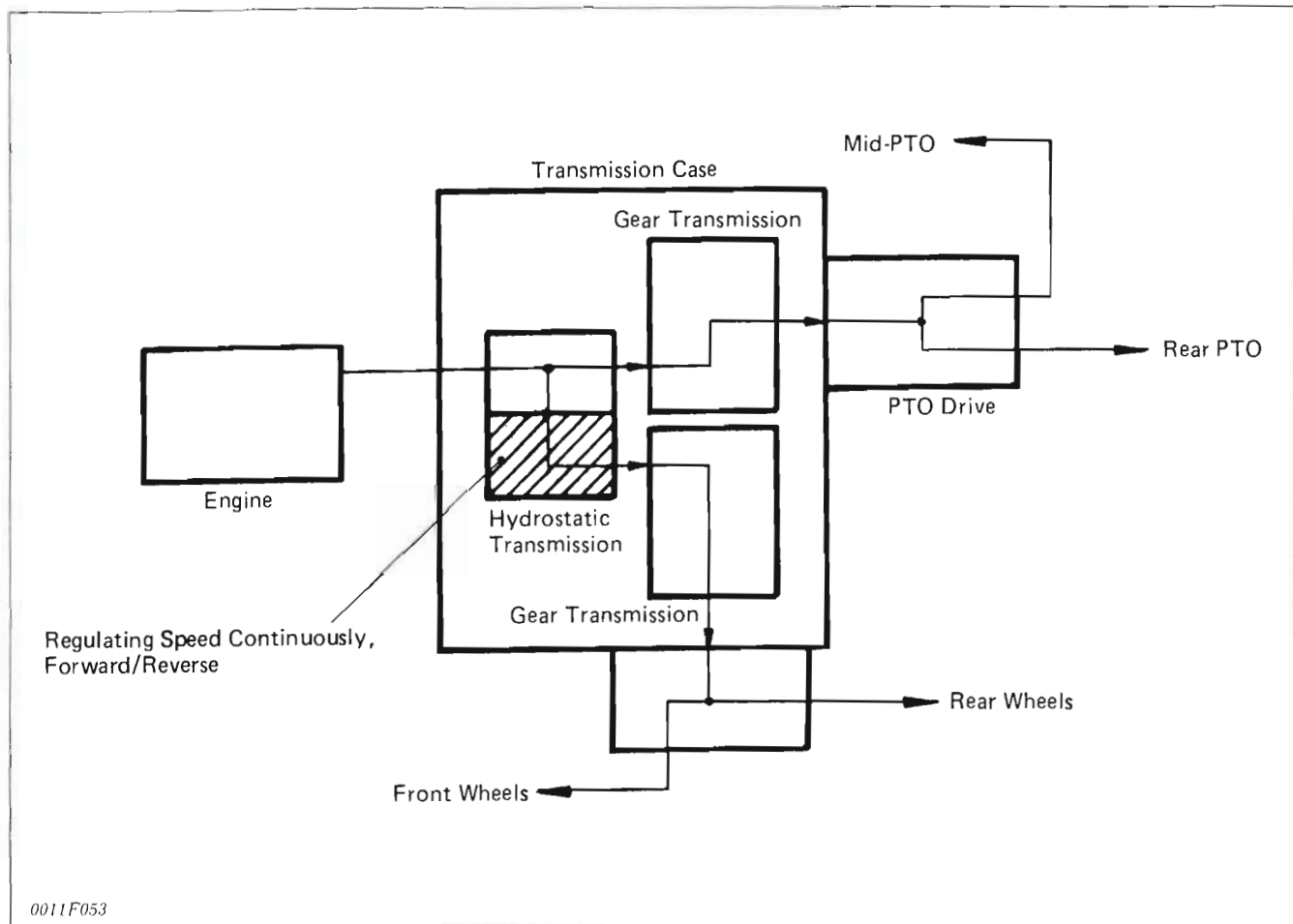


Fig. G-1 Power Transmission

Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Tractor will not run	Broken transmission gears	Replace
	Broken one way clutch or spring	Replace
	Unable to engage high-low shift	Repair or replace parts of high-low shift
	Defective hydrostatic transmission	Repair hydrostatic control linkage and hydrostatic transmission (See Hydrostatic Transmission)
Noisy transmission	Broken or worn transmission gears	Replace
	Broken or worn bearings	Replace
Rear PTO shaft does not turn	Broken gears	Replace
	Broken shift fork	Replace
	Disengaged shift arm	Engage shift arm with shift fork
	Broken or worn ball stopper spring	Replace

Group 2

Gear Transmission

To select the most suitable speeds for different kinds of work, Model B7100 HST-E transmission has two levers for high-low shift and PTO transmission. Model B7100 HST-D transmission has three levers for high-low shift, front drive connection, and PTO. The levers are manually operated in a sliding mesh system.

Drive System

Hydrostatic transmission can be changed while engine is running in both forward and reverse. Power from the transmission is then transmitted to the drive system and the wheels.

Gearing and speeds in forward and reverse:

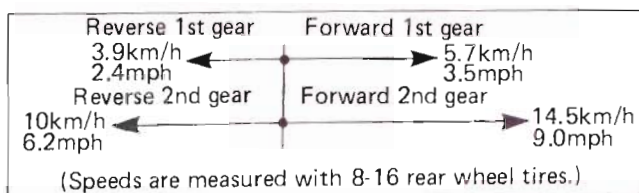
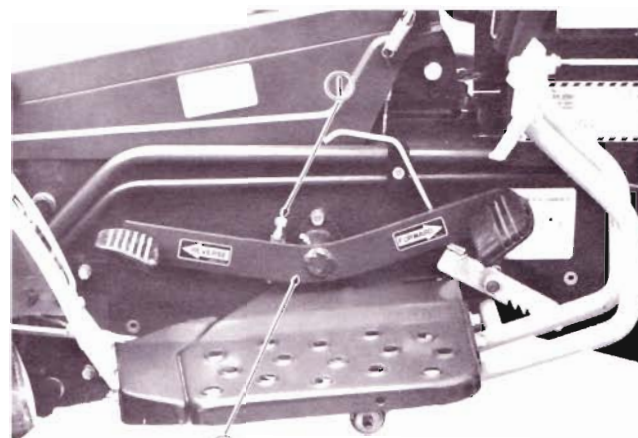


Fig. G-2 Gearing and Speeds

The maximum reverse speed is kept lower than the maximum forward speed by the adjusting bolt in the speed control pedal section for added safety.

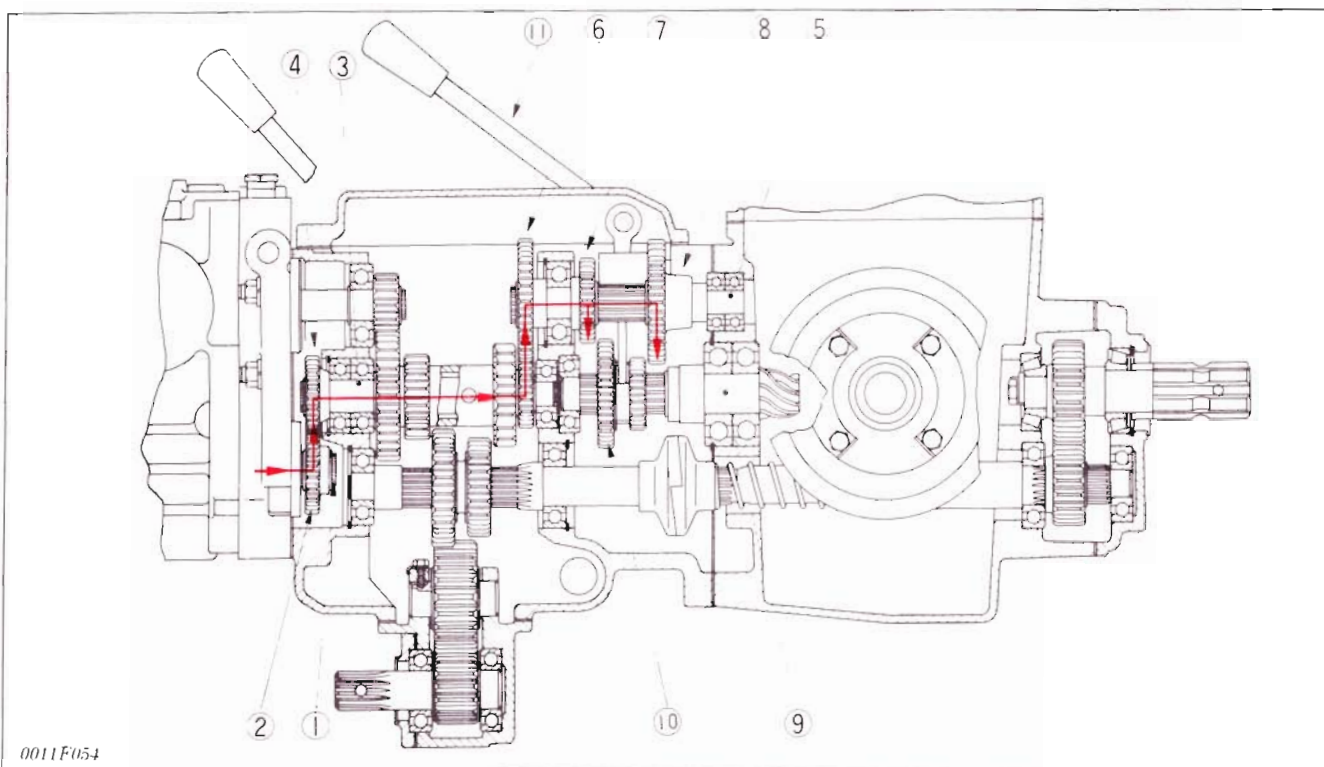


1. Adjusting Bolt

2. Speed Control Pedal

Fig. G-3 Speed Control Pedal

Neutral



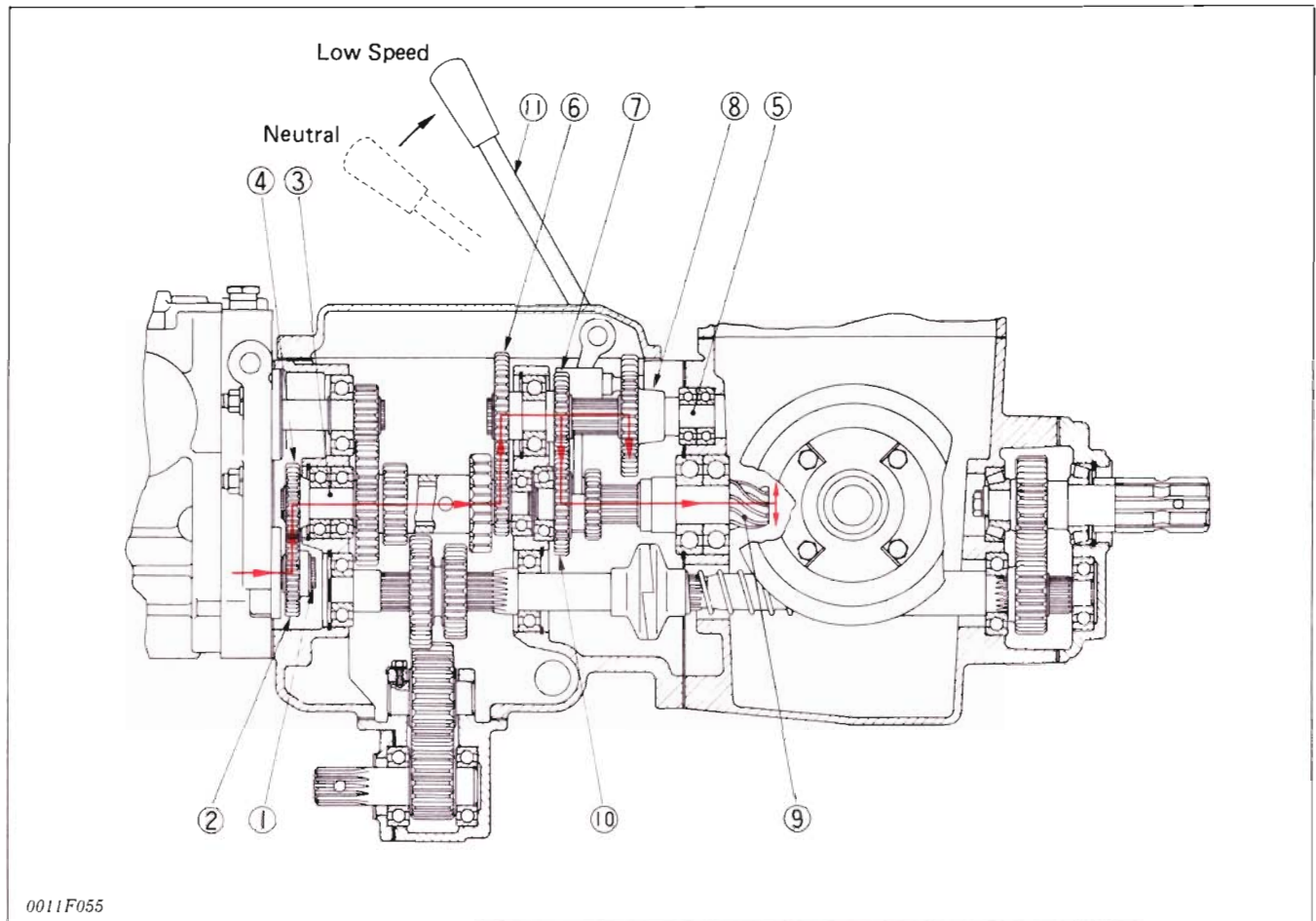
1. Output Shaft 3. 2nd Shaft (11T) 5. 4th Shaft 7. Gear (15T) 9. Spiral Bevel Pinion 11. High-Low Shift Lever
2. Gear (16T) 4. Gear (14T) 6. Gear (24T) 8. Gear (23T) 10. Gear (20-12T)

Fig. G-4 Neutral

When the high-low shift lever (11) is set to Neutral position, power is transmitted as follows.
Output shaft (1), Gear (16T) (2) → Gear (14T) (4)
→ 2nd Shaft (11T) (3) → Gear (24T) (6) → 4th

Shaft (5) → Gear (15T) (7), Gear (23T) (8). Power is stopped at Gear (15T) (7) and Gear (23T) (8), rear wheels do not rotate.

Low Speed Traveling



1. Output Shaft
2. Gear (16T)
3. 2nd Shaft (11T)

4. Gear (14T)
5. 4th Shaft
6. Gear (24T)

7. Gear (15T)
8. Gear (23T)
9. Spiral Bevel Pinion

10. Gear (20-12T)
11. High-Low Shift Lever

Fig. G-5 Low Speed Traveling

When the high-low shift lever is set for low speed operation, power is transmitted from 4th shaft (5),

gear (15T) (7), gear (20T) (10) spiral bevel pinion (9), to rotate wheels at a low speed.

High Speed Traveling

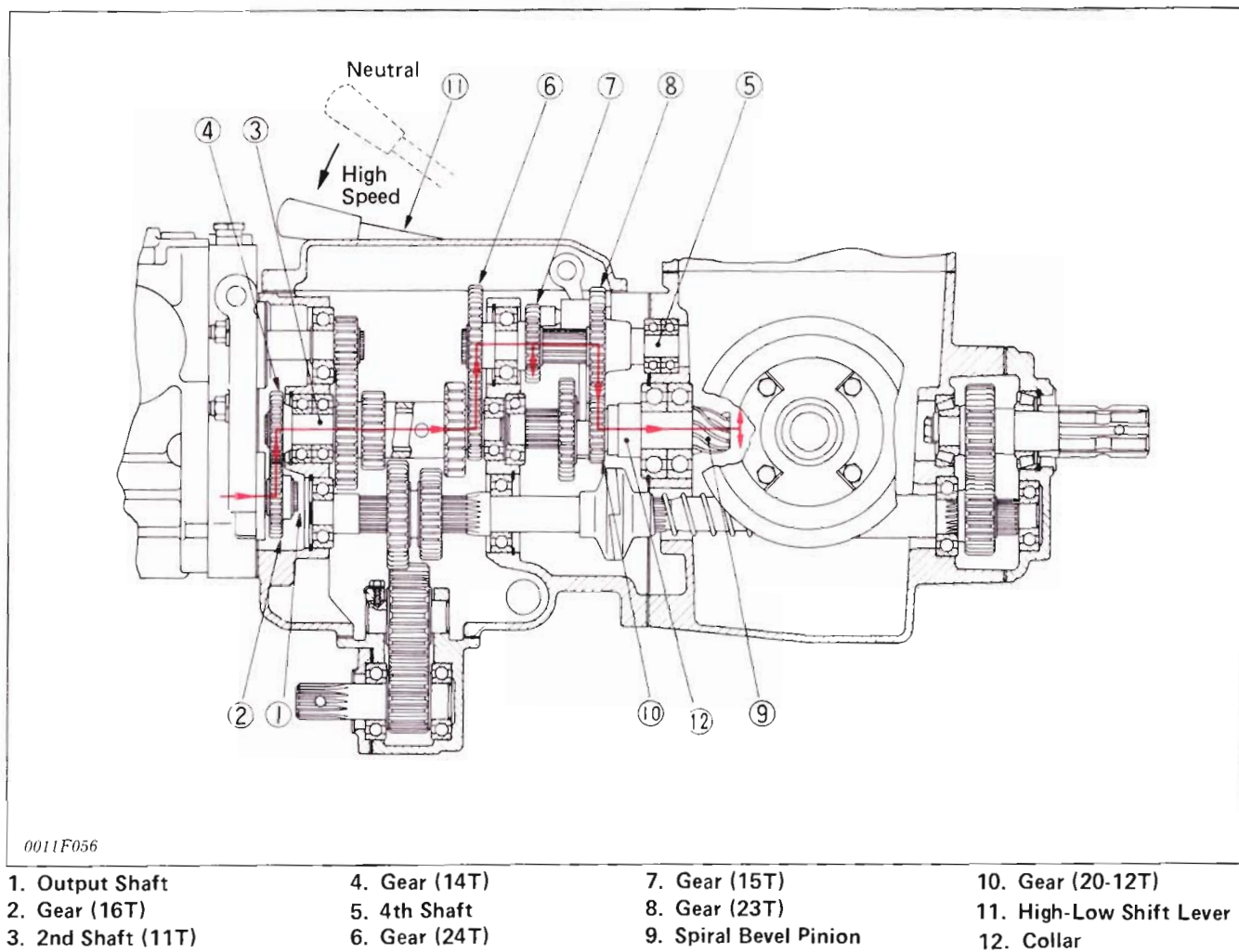


Fig. G-6 High Speed Traveling

When the high-low shift lever is set for high speed operation, power is transmitted from 4th shaft,

gear (23T) (8), gear (12T) (10), and spiral bevel pinion (9) to rotate rear wheels at high speed.

Front Wheel Drive Mechanism (D type only)

Instead of collar (12) (Fig. G-6) on the spiral bevel pinion shaft of the Etype, there is a gear (16T) (15). When the front drive lever (20) is turned on/off,

the gear (24T) (17) of the front wheel drive shaft (16) engages or disengages with gear (16T) (15) to control drive of front wheels.

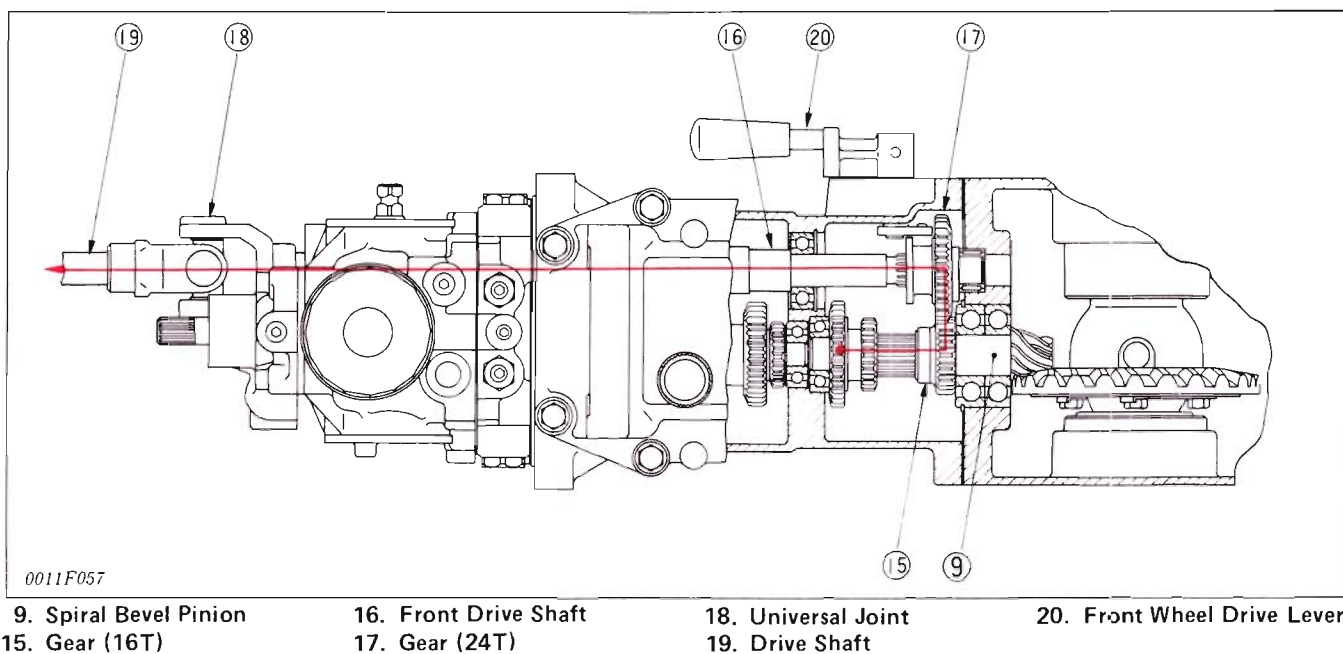


Fig. G-7 Front Drive Lever is ON:

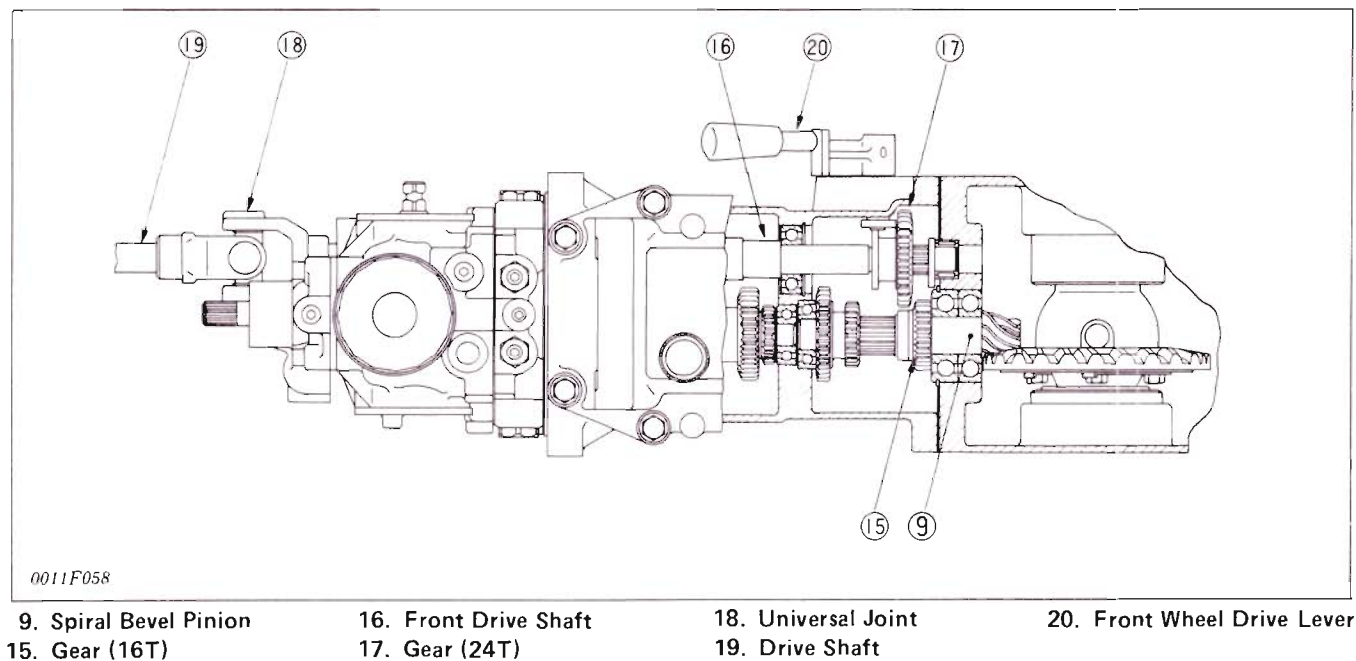


Fig. G-8 Front Drive Lever is OFF:

PTO Transmission

The PTO transmission is transmitted the same speed as the engine speed directly from hydrostatic transmission pump shaft. Two rear PTO speeds and

one mid-PTO speed are available by changing the gear combination. The rear PTO is mainly used for the rotary mower, lime sower, broadcaster, etc. The mid-PTO is used for the mid-mount mower.

When Rear PTO is in Neutral

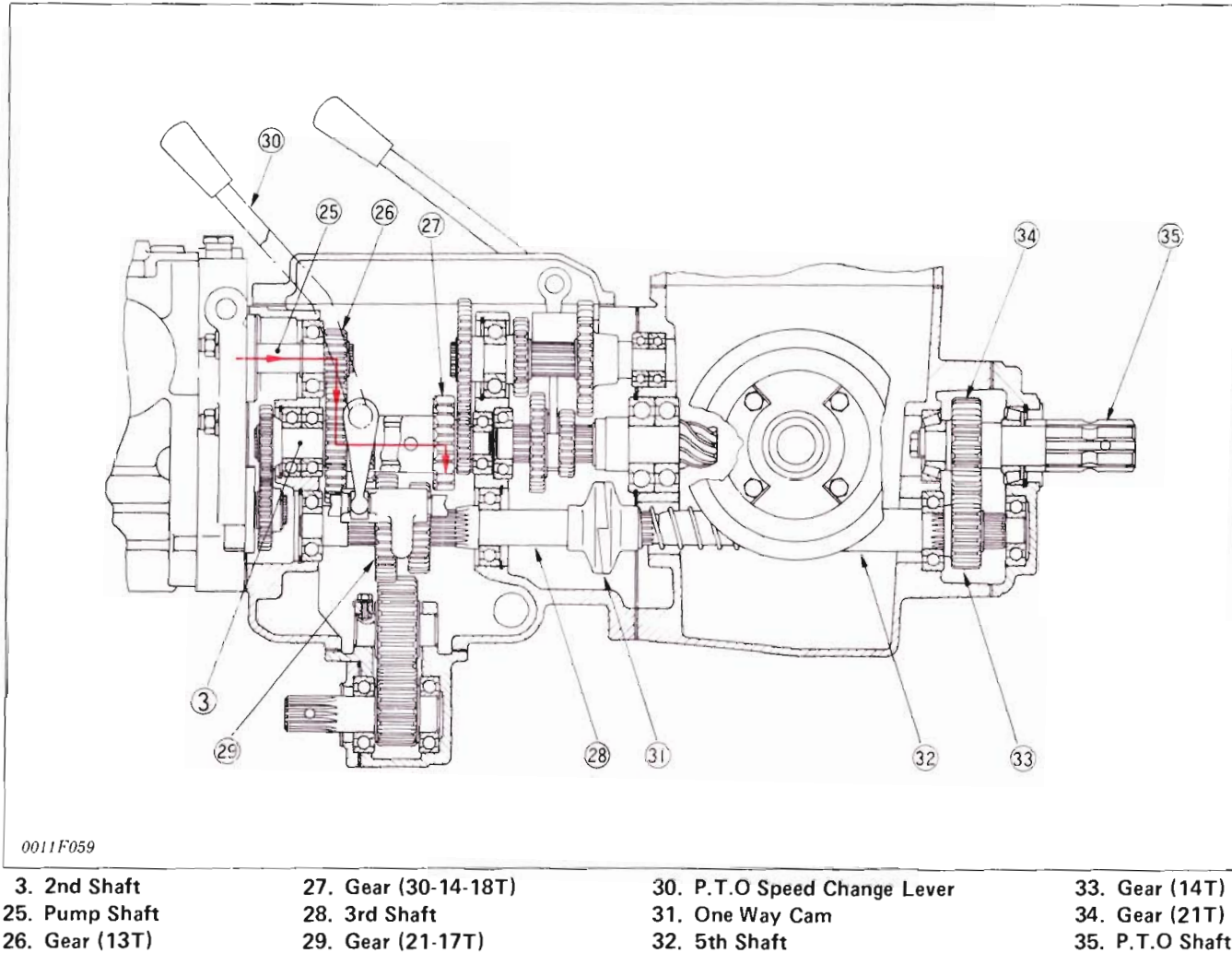
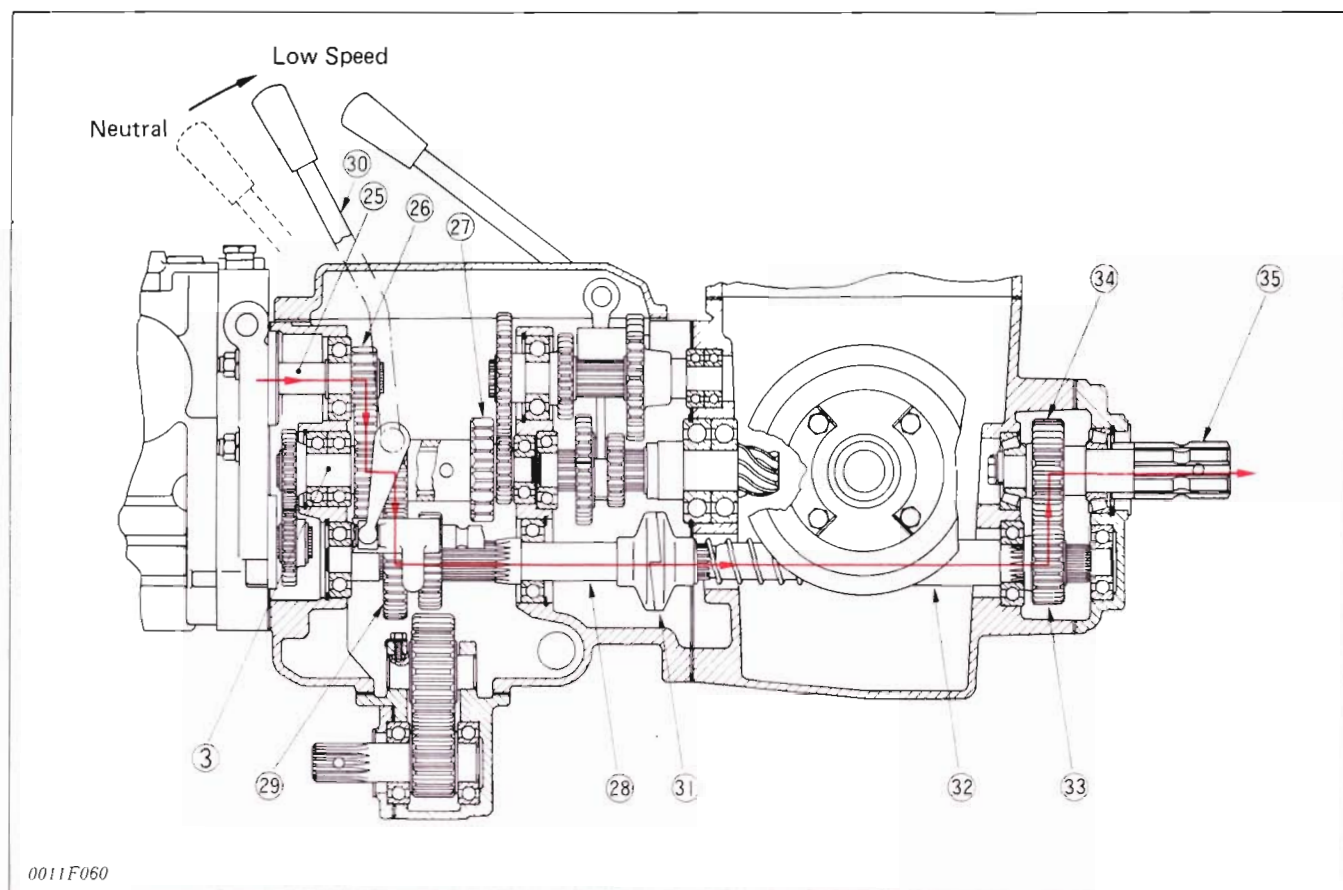


Fig. G-9 PTO at Neutral:

When rear PTO is set to neutral, power is transmitted from pump shaft (25) and gear (13T) (26) to gears (30T, 14T and 18T) (27). The power is not transmitted afterwards. Therefore, PTO shaft (35) does not rotate. Gears (30T - 14T - 18T) (27)

are assembled on the 2nd shaft (3), however, needle bearings are placed between them. Since needle bearings are placed between the two, gear (27) and 2nd shaft (3) are free each other.

Rear PTO at Low Speed



0011F060
3. 2nd Shaft
25. Pump Shaft
26. Gear (13T)

27. Gear (30-14-18T)
28. 3rd Shaft
29. Gear (21-17T)

30. P.T.O Speed Change Lever
31. One Way Cam
32. 5th Shaft

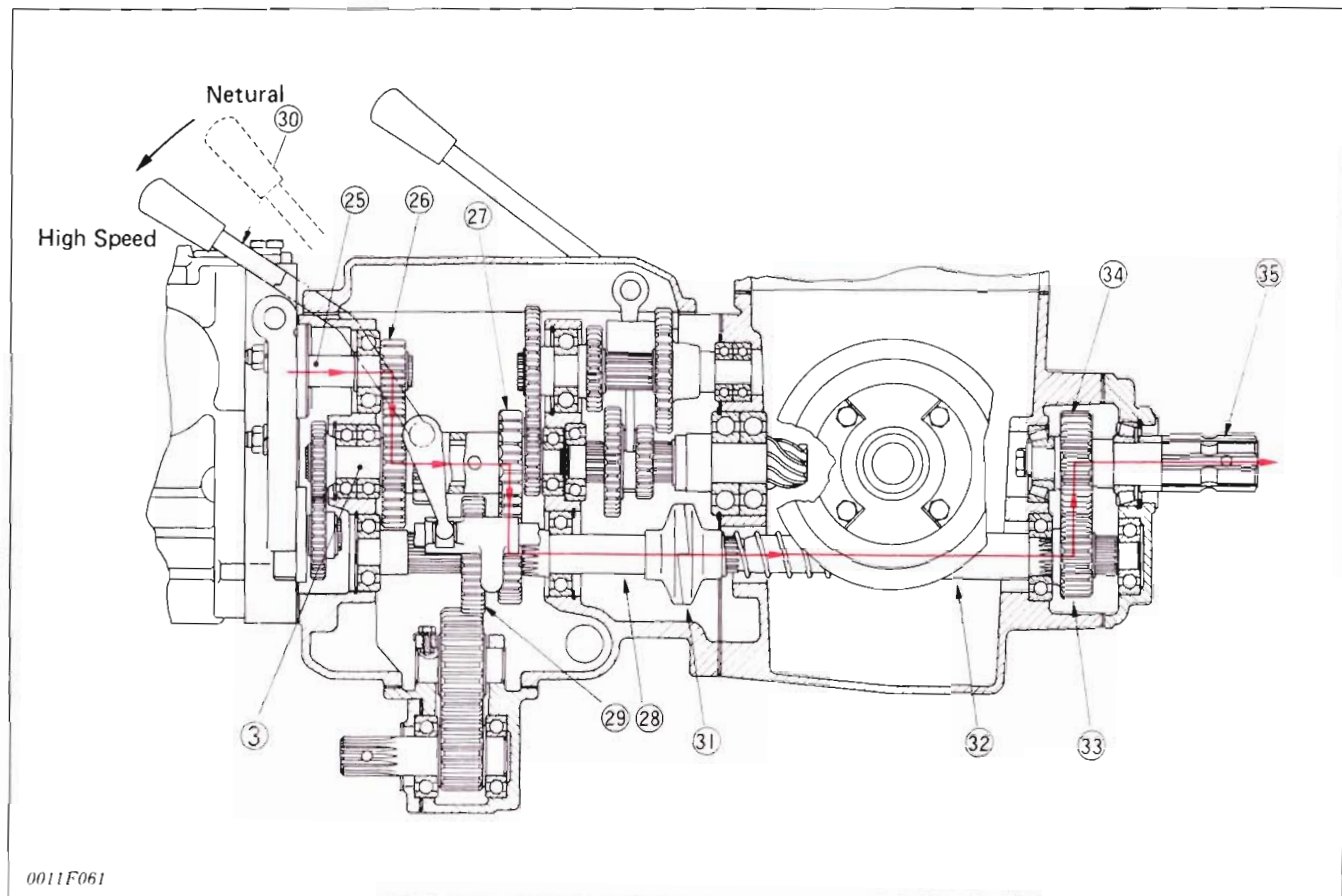
33. Gear (14T)
34. Gear (21T)
35. P.T.O Shaft

Fig. G-10 PTO at Low Speed

When PTO speed change lever (30) is set for low speed operation, gear (21T) of gears (21T - 17T) (29) on the 3rd shaft (28) is engaged with gear

(14T) (27) on the 2nd shaft (3), transmitting power to the rear PTO. (PTO speed is 540 rpm at an engine speed of 2800 rpm.)

Rear PTO at High Speed



- | | | |
|----------------------|----------------------------|----------------|
| 3. 2nd Shaft | 28. 3rd Shaft | 32. 5th Shaft |
| 25. Pump Shaft | 29. Gear (21-17T) | 33. Gear (14T) |
| 26. Gear (13T) | 30. PTO Speed Change Lever | 34. Gear (21T) |
| 27. Gear (30-14-18T) | 31. One Way Cam | 35. PTO Shaft |

Fig. G-11 PTO at High Speed

When PTO speed change lever is set for high speed operation, gear (17T) of gear (21T - 17T) (29) is engaged with gear (18T) (27) assembled on the 2nd shaft (3) to provide power to rear PTO. (Rear PTO speed is 850 rpm at an engine speed of 2800 rpm.)

One-way Clutch Cam

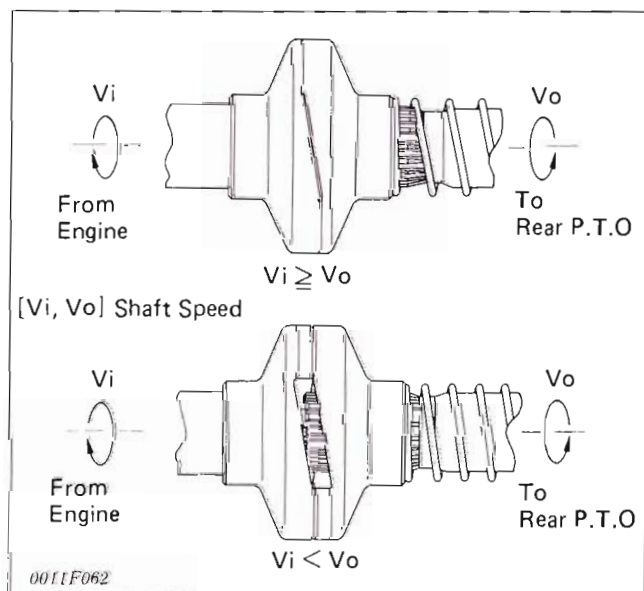
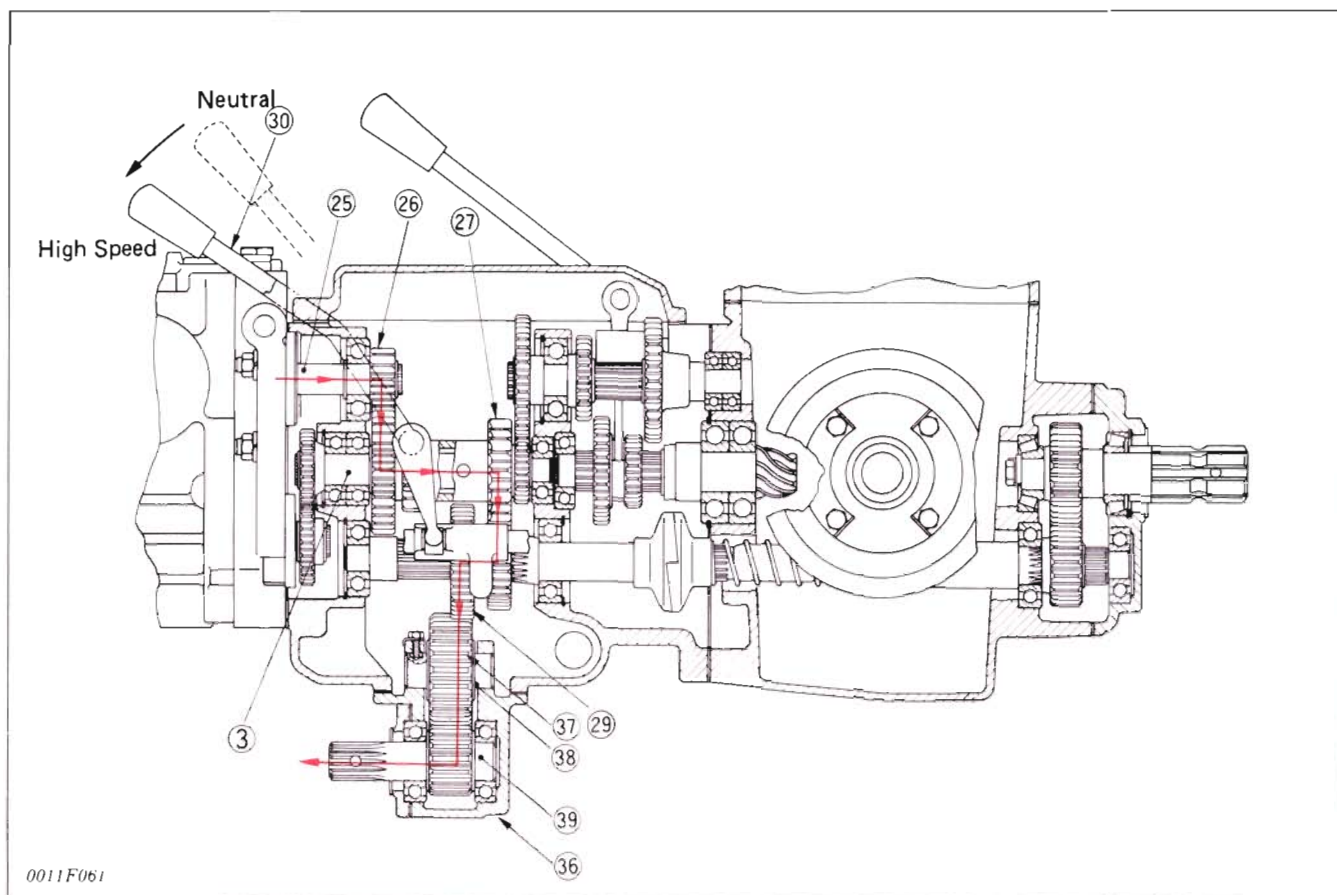


Fig. G-12 One Way Clutch Cam

During transmission of engine power to the rear PTO, if implement rotating speed exceeds engine speed for some reason, troubles, such as change in running speed, will occur. To prevent this, a one-

way clutch is provided to prohibit reverse drive when rear PTO speed exceeds engine speed. It is composed of a pair of slant cams which are closed-ly contacted by spring tension.

Mid PTO Drive



3. 2nd Shaft
25. Pump Shaft
26. Gear (13T)
27. Gear (30-14-18T)

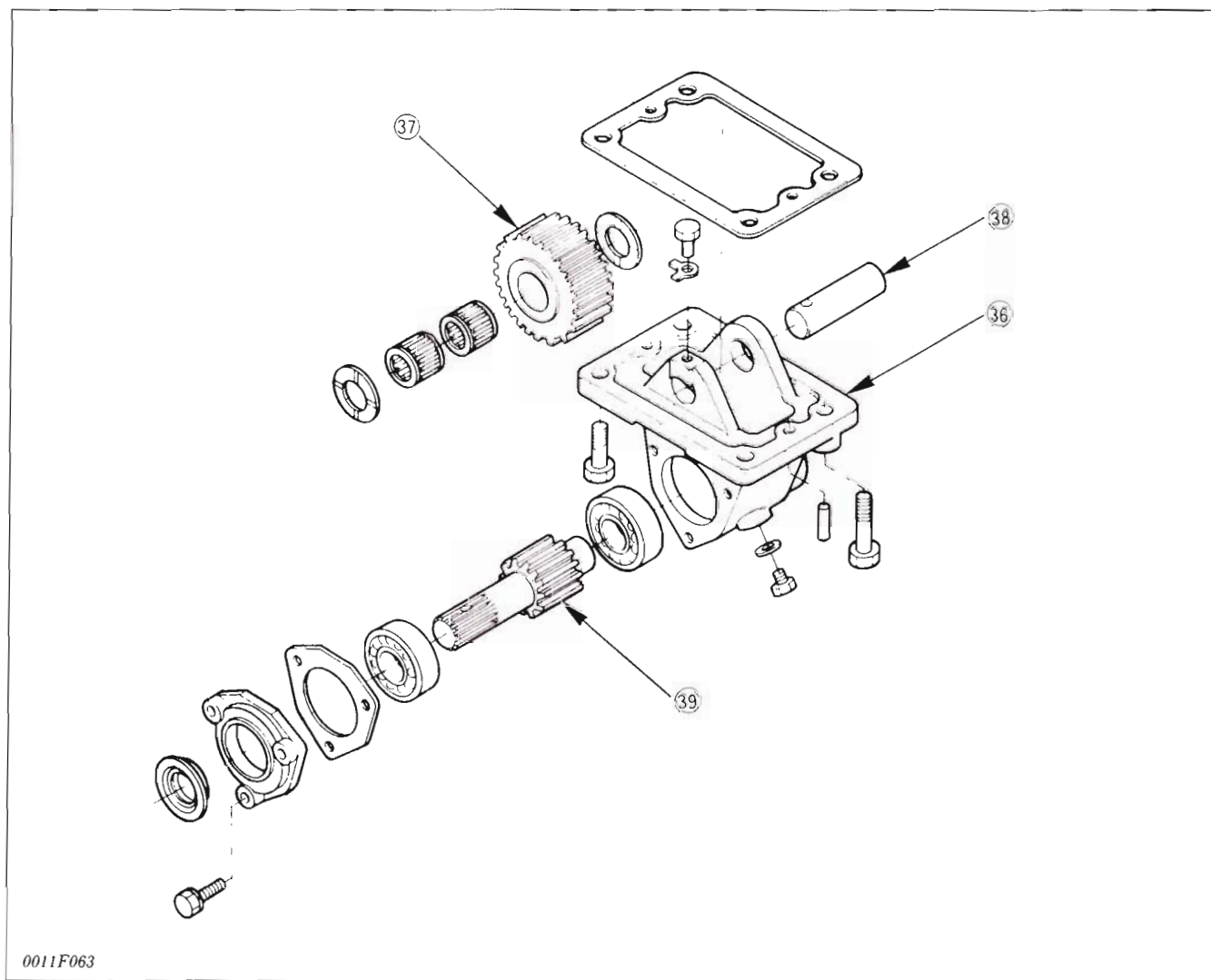
29. Gear (21-17T)
30. PTO Speed Change Lever
36. Drive Case
37. Gear (24T)

38. Counter Shaft
39. Shaft (11T)

Fig. G-13 Mid-PTO Drive

When PTO speed change lever (30) is set for high speed operation, the mid-PTO transmits power from gear (21T) of gears (21T - 17T) (29) on 3rd shaft (28) to gear (24T) (37) and to gear (11T)

(39) of the counter shaft (38) in the mid-PTO assembly. (Mid-PTO speed is 2450 rpm at an engine speed of 2800 rpm.)



36. Drive Case

37. Gear (24T)

38. Counter Shaft

39. Shaft (11T)

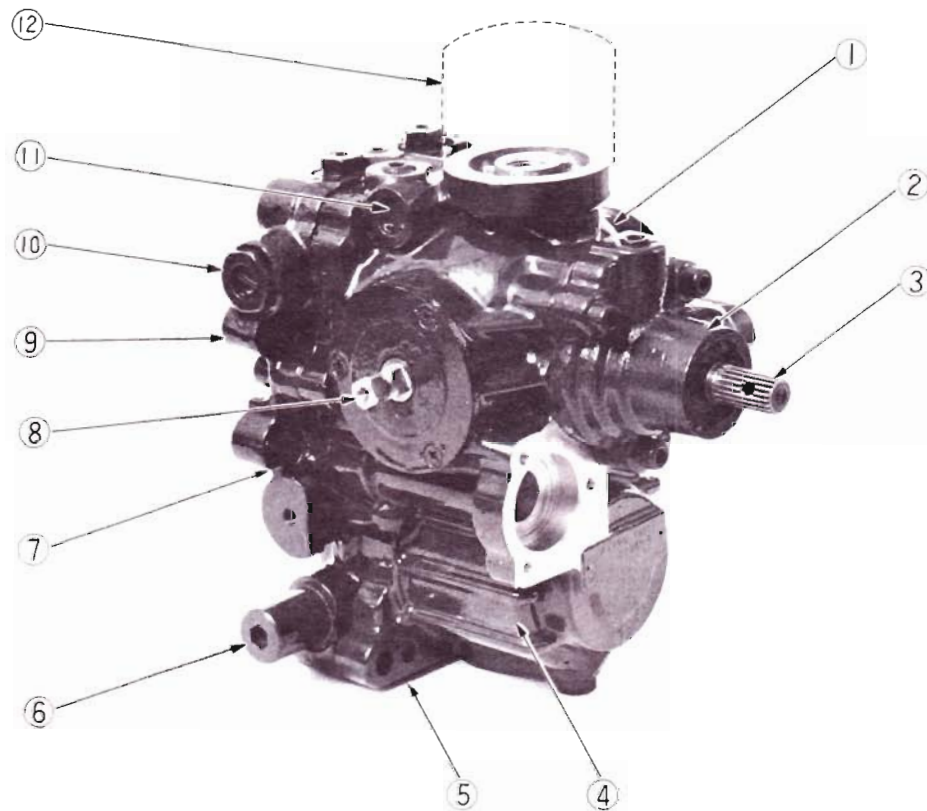
Fig. G-14 Mid-PTO Components

Group 3

Hydrostatic Transmission

Structure and Operation

1. Structure



0011P114

- 1. Variable Displacement Piston Pump
- 2. Charge Pump
- 3. Input Shaft
- 4. Fixed Displacement Piston Motor

- 5. Case
- 6. High Pressure Relief Valve
- 7. Output Shaft
- 8. Trunnion Shaft

- 9. Port Block
- 10. Neutral Valve
- 11. Charge Relief Valve
- 12. Oil Filter Cartridge

Fig. G-15 Hydrostatic Transmission

Hydrostatic transmission consists of variable displacement piston pump, fixed displacement piston

motor, charge trochoid pump, and valve system (Fig. G-15).

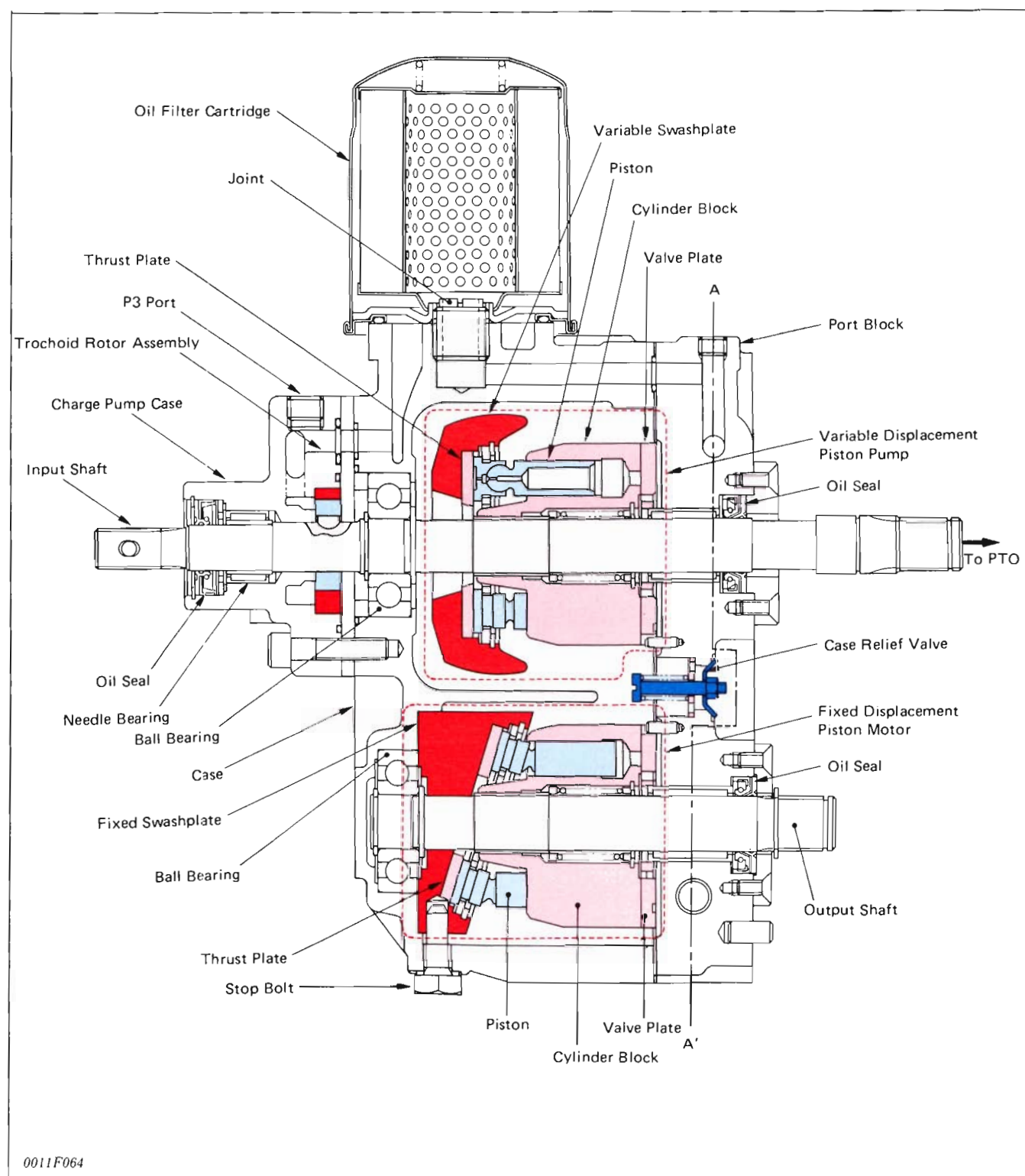


Fig. G-16 Piston Pump and Piston Motor

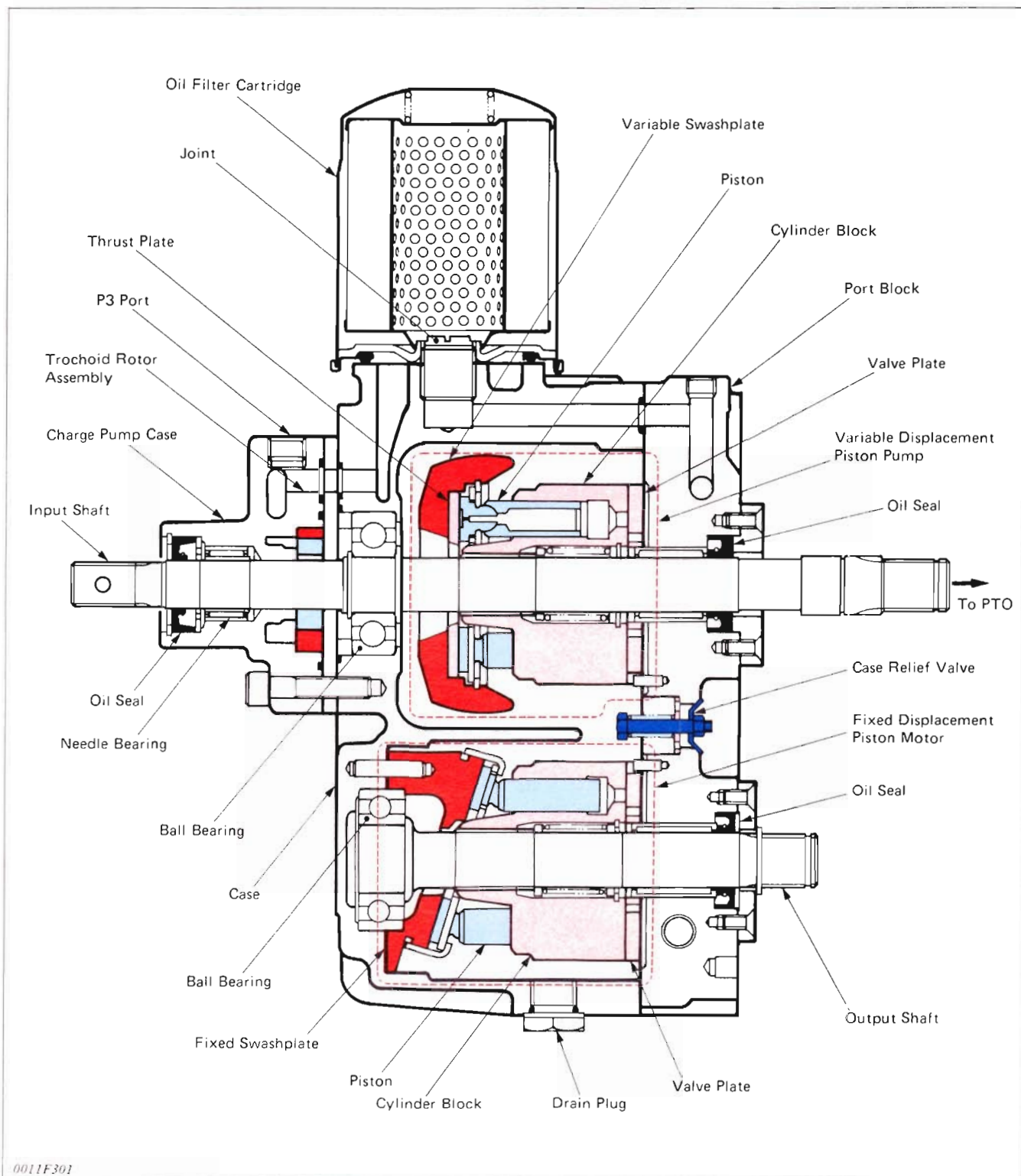


Fig. G-16-(1) Piston Pump and Piston Motor

■ Tractors with serial numbers shown below have hydrostatic transmission (TYPE II) described in Fig. G-16-(1).

- B7100HST-D (4WD) — Serial No. 51742 and beyond.
- B7100HST-E (2WD) — Serial No. 11906 and beyond.
- B6100HST-D (4WD) — Serial No. 50127 and beyond.
- B6100HST-E (2WD) — Serial No. 11140 and beyond.

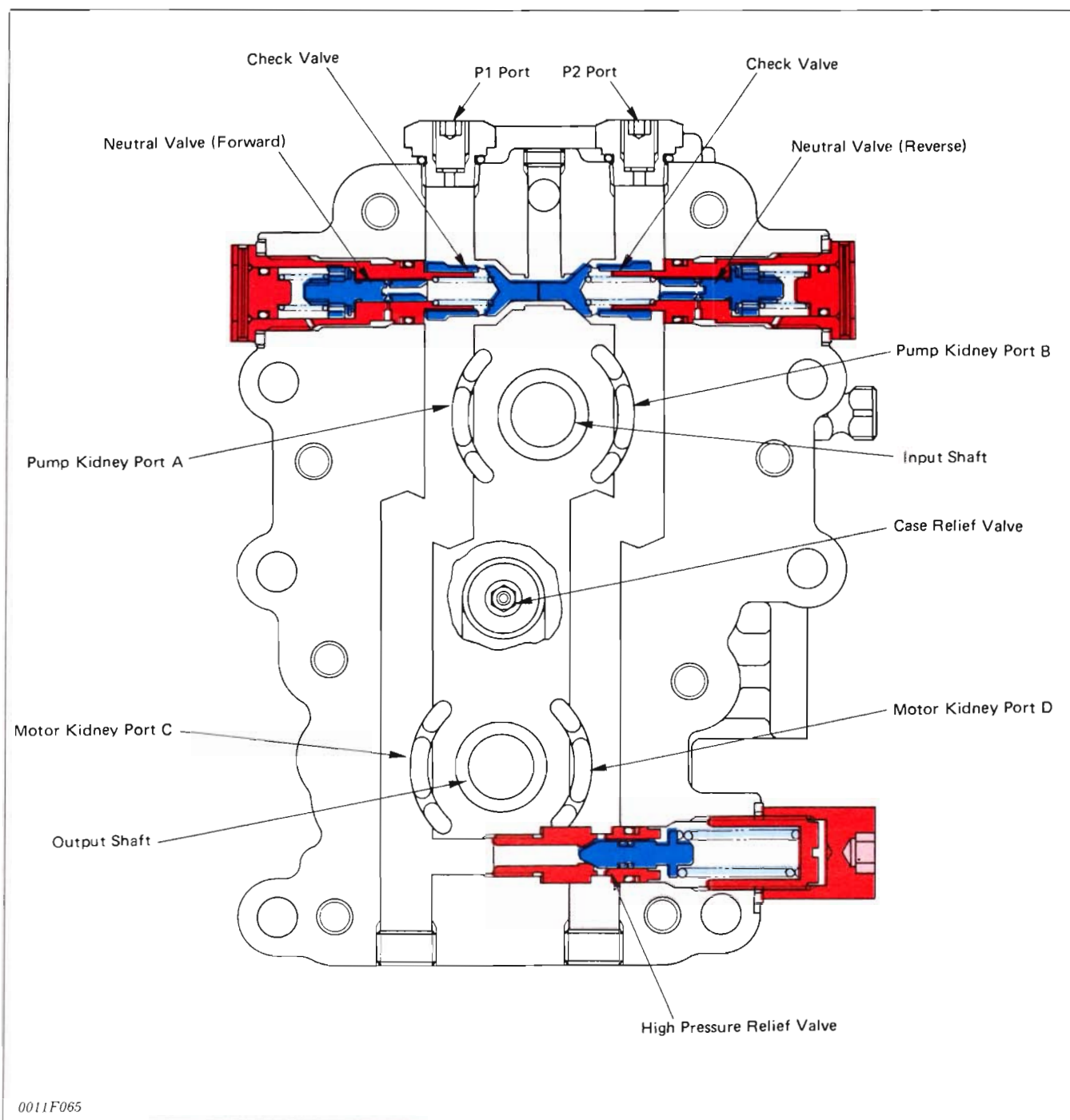


Fig. G-17 Viewed from the back (A-A' cut)

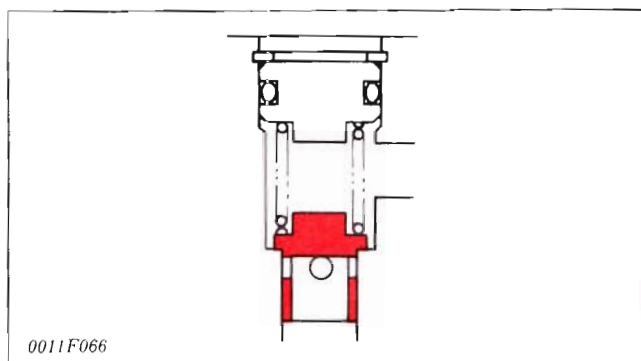


Fig. G-18 Charge Relief Valve

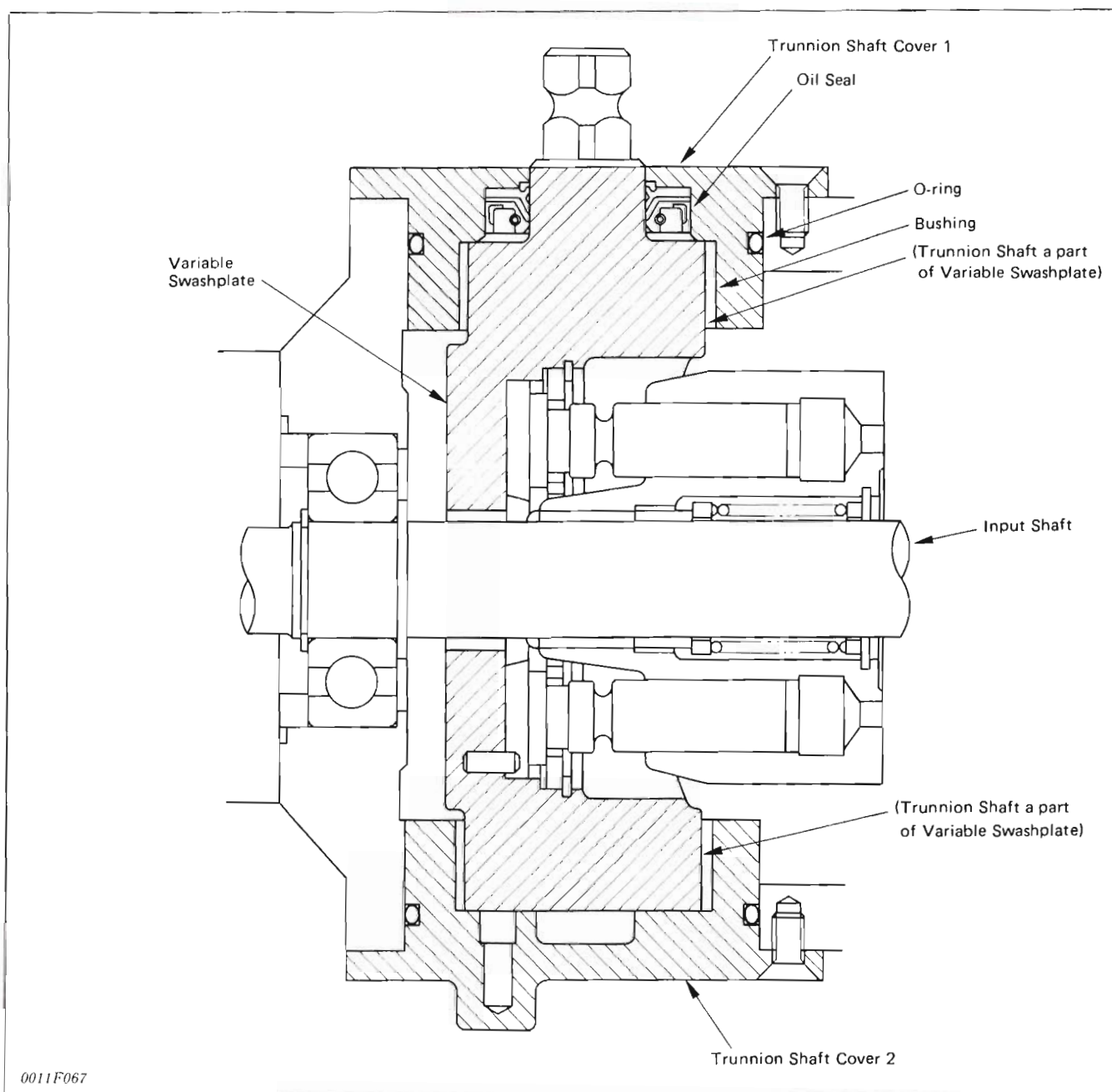


Fig. G-19 Trunnion Shaft

2. Fundamental of operation

The variable displacement piston pump is connected to the input shaft, which rotates the cylinder block (Pump). When the speed control pedal is stepped on, the rod and neutral holder which are connected to the pedal are moved, then the variable swashplate is tilted by the neutral holder

to cause the nine pistons to reciprocate, feeding high-pressure oil. The variable swashplate and the valve plate do not revolve. (Fig. G-20) The fixed displacement motor is revolved by high-pressure oil fed from the variable displacement pump, then the rotating power is transmitted to the output shaft.

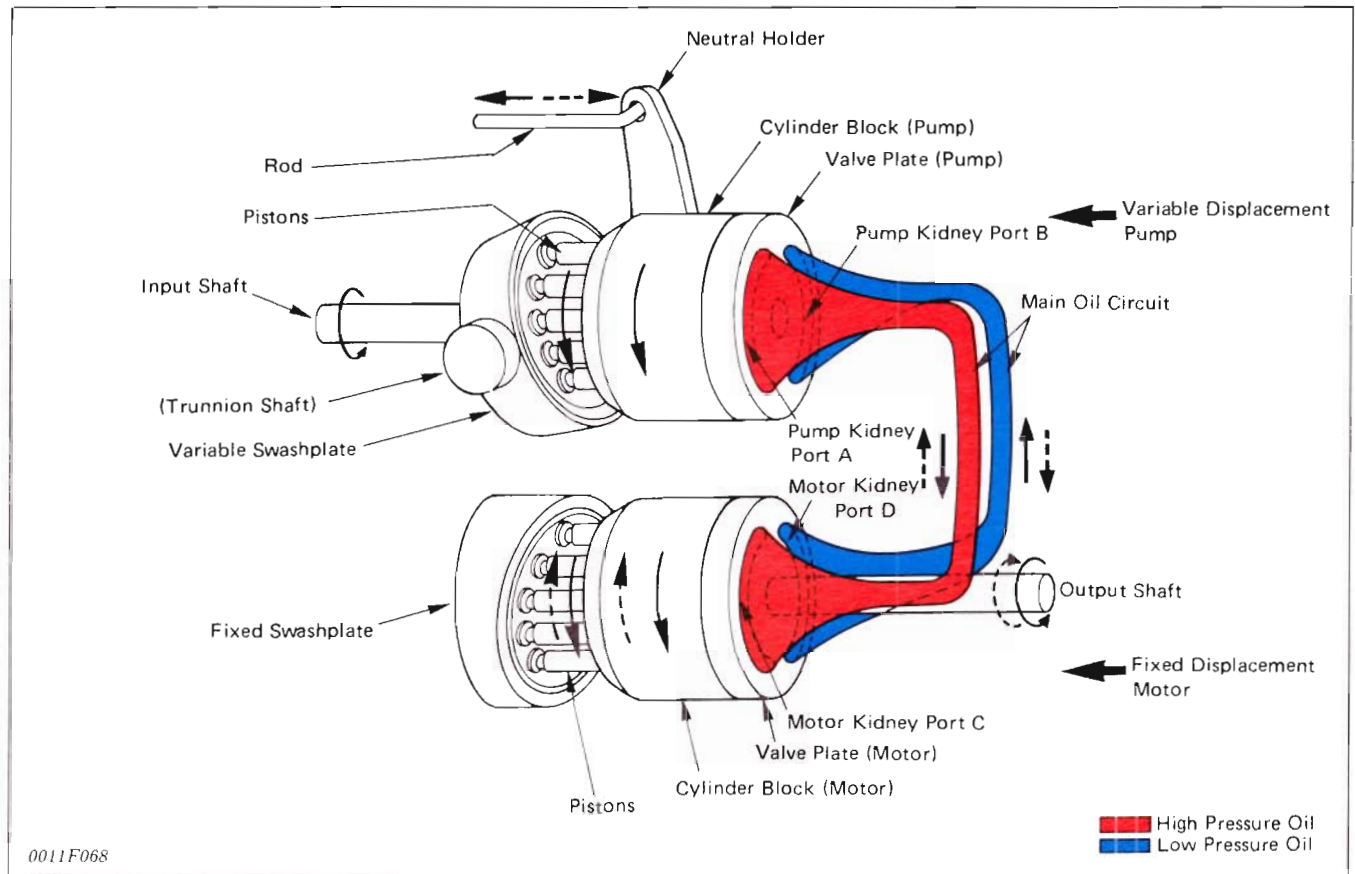


Fig. G-20

The charge pump supplements oil insufficiency caused by leakage in the piston pump or piston motor. The charge pump has an additional function of feeding oil to the cooler.

Neutral, forward operation, reverse operation and their speed depend on inclination of variable swashplate connecting with neutral holder.

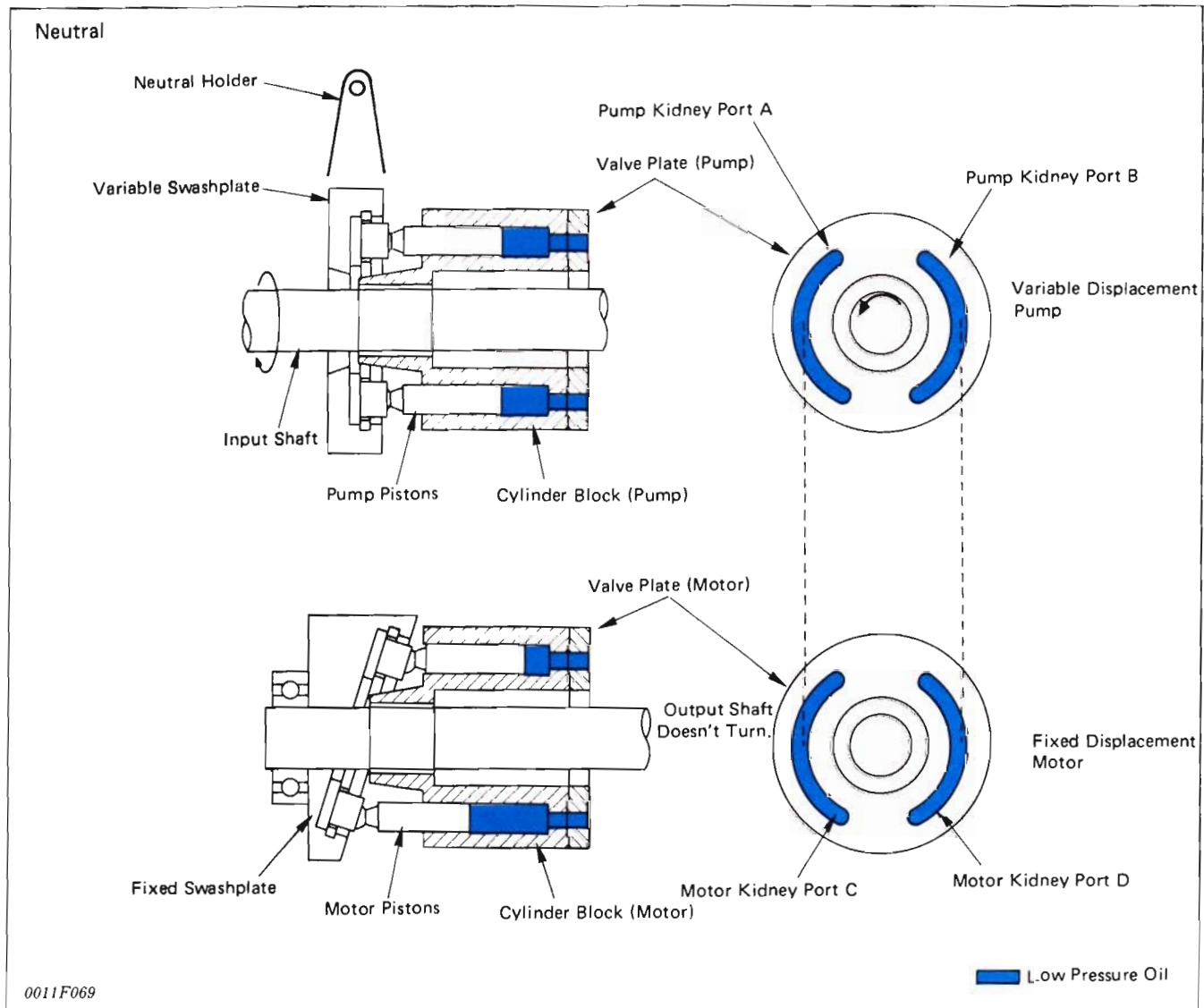


Fig. G-21 Neutral

In neutral position, the pump pistons only revolve with the cylinder block (pump) but do not move

axially. Therefore, there is no oil flow in the circuit and the motor does not revolve.

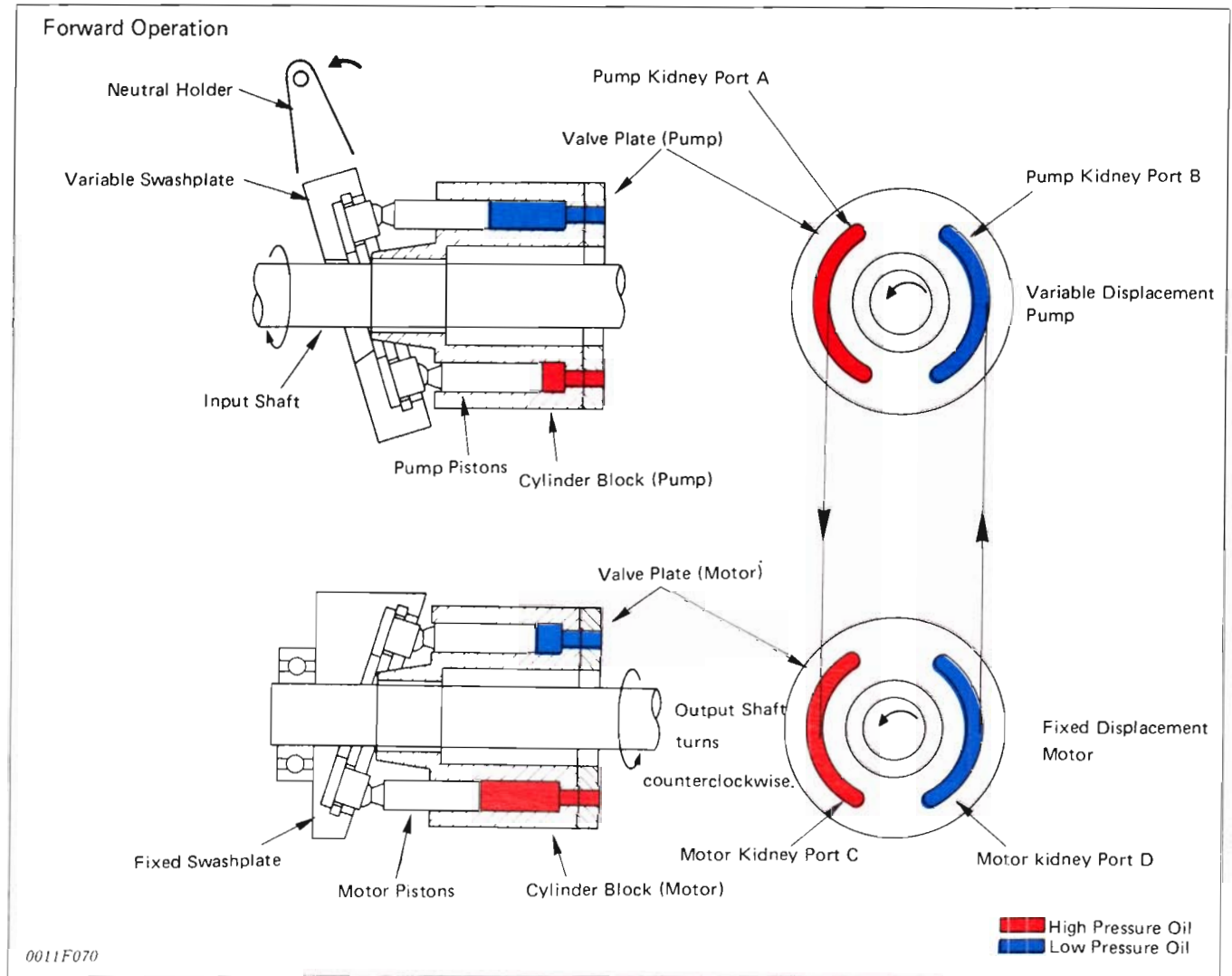


Fig. G-22 Forward Operation

Forward operation is obtained by tilting the variable swashplate as shown in Fig. G-22.

The pump pistons revolve with the cylinder block and reciprocate in the axial direction to draw oil from the pump kidney port B and to push out oil at the pump kidney port A. Then the oil enters the motor kidney port C and presses the motor pistons in the cylinder block (motor).

The pistons slide on the inclined plane and revolve (Fig. G-23), causing the output shaft to turn counterclockwise. Oil pressure rises in proportion to an increase in load applied to the output shaft.

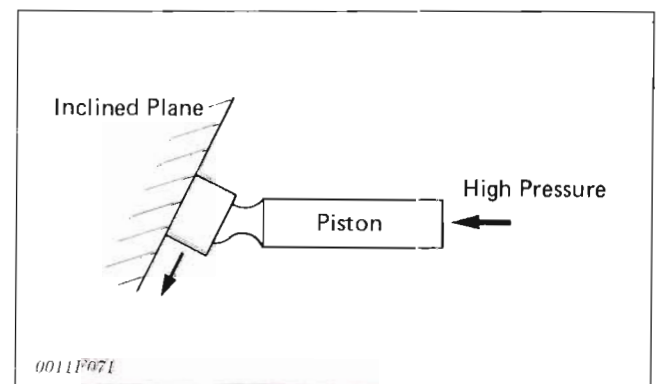


Fig. G-23

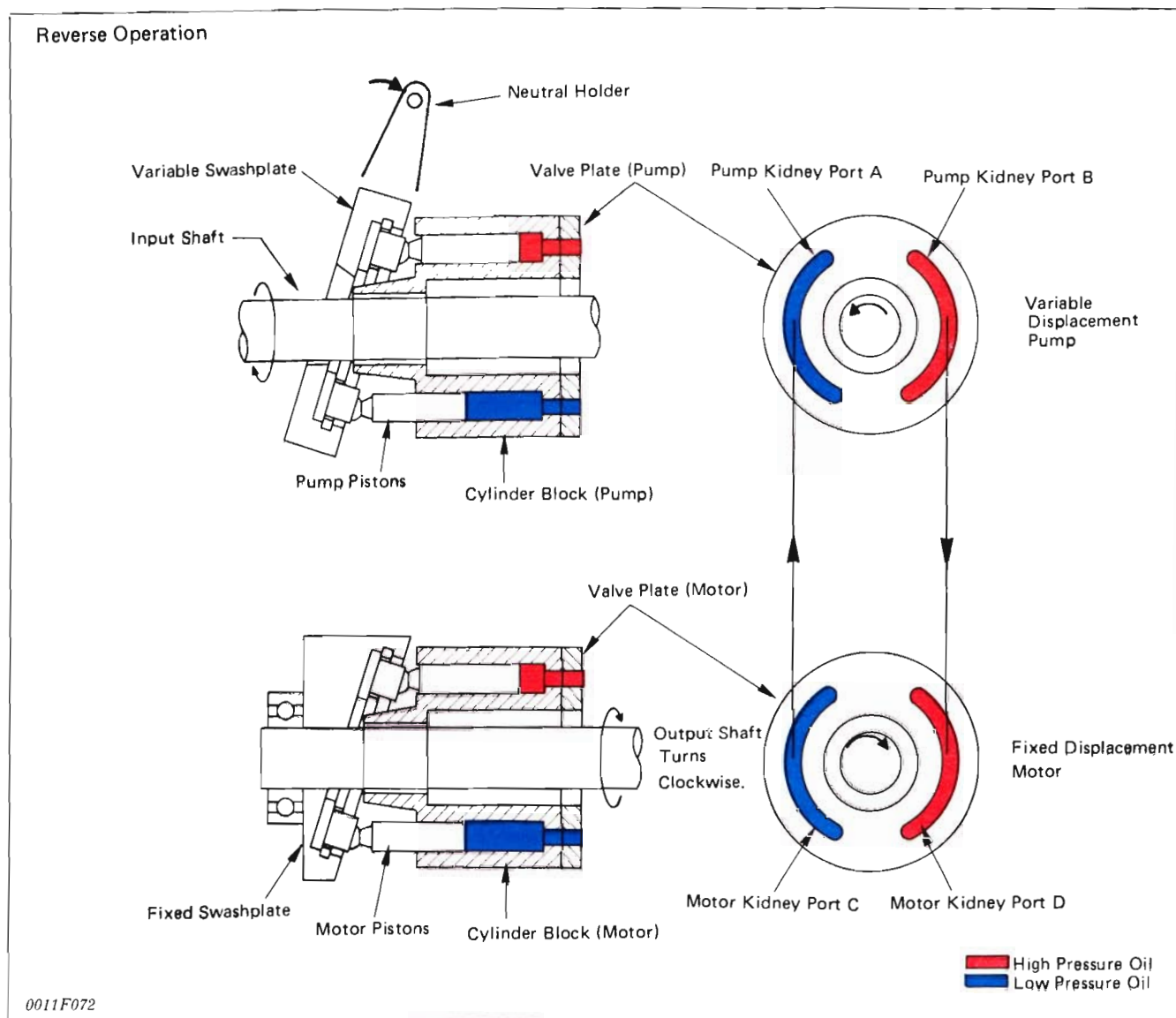


Fig. G-24 Reverse Operation

Reverse operation is obtained by tilting the variable swashplate as shown in Fig. G-24. In this operation, oil flows in the opposite direc-

tion of forward operation and the output shaft thus rotates clockwise.

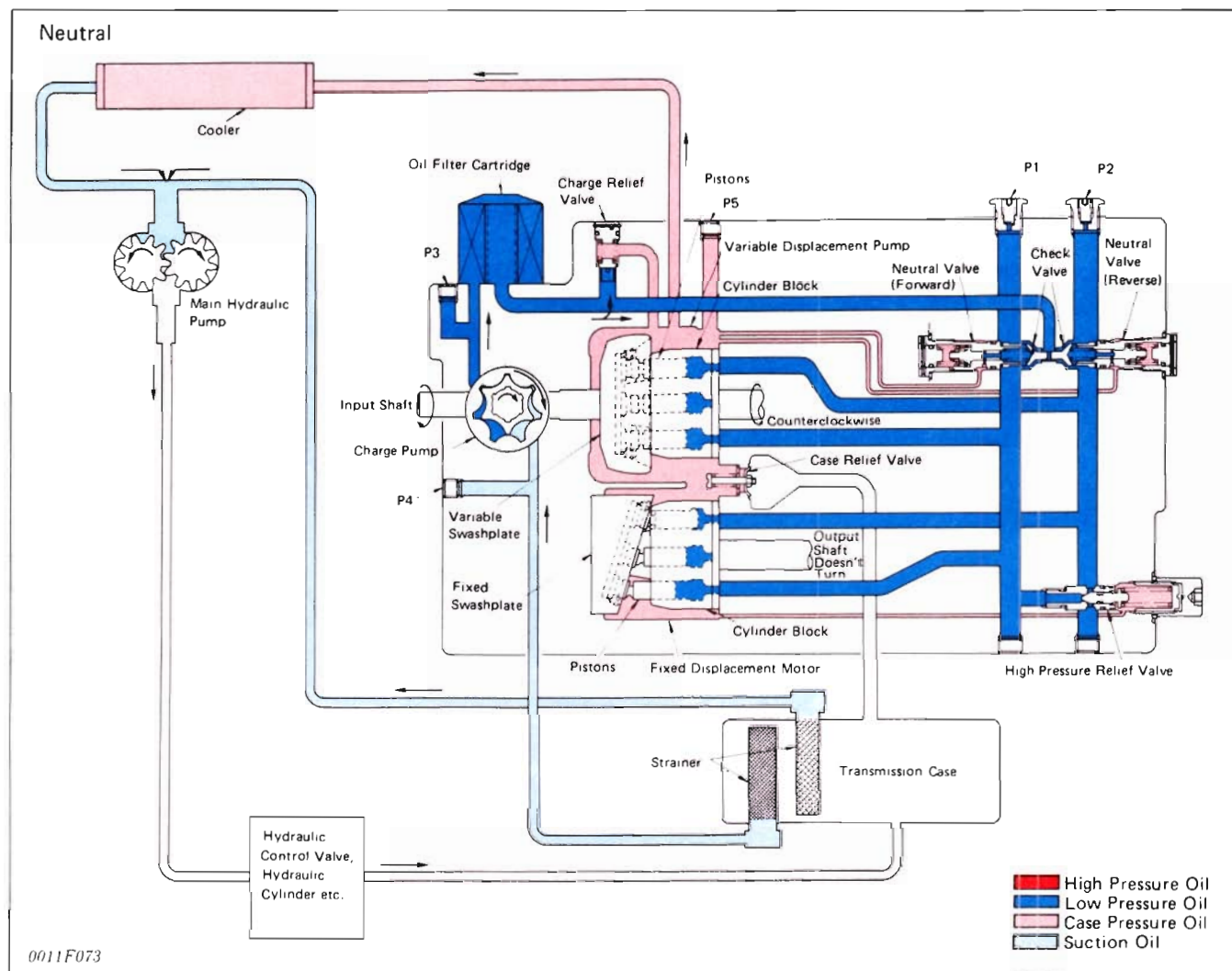


Fig. G-25 Oil Flow in Neutral

3. Oil Flow of Hydraulic System

Neutral

In neutral position, the variable displacement pump does not supply oil to the fixed displacement motor, and there is no oil flow between the pump and motor.

The charge pump always revolves in combination with the input shaft to draw oil from the transmission case and feeds through check valves to the main oil circuit. The charge oil aids smooth operation of the pump and motor. The rest of charge oil is passed through the charge relief valve to the case.

Then oil passes from the case through the cooler to the main hydraulic pump, then returns through the hydraulic control valve and hydraulic cylinder to the transmission case (Fig. G-25).

The check valves are open in neutral position, the neutral valves are also open and drain some of the oil in the main oil circuit into the case. The high pressure relief valve is closed.

Reference

- P1 ... Port to check high pressure (forward)
- P2 ... Port to check high pressure (reverse)
- P3 ... Port to check charge pressure
- P4 ... Port to check vacuum
- P5 ... Port to check case pressure

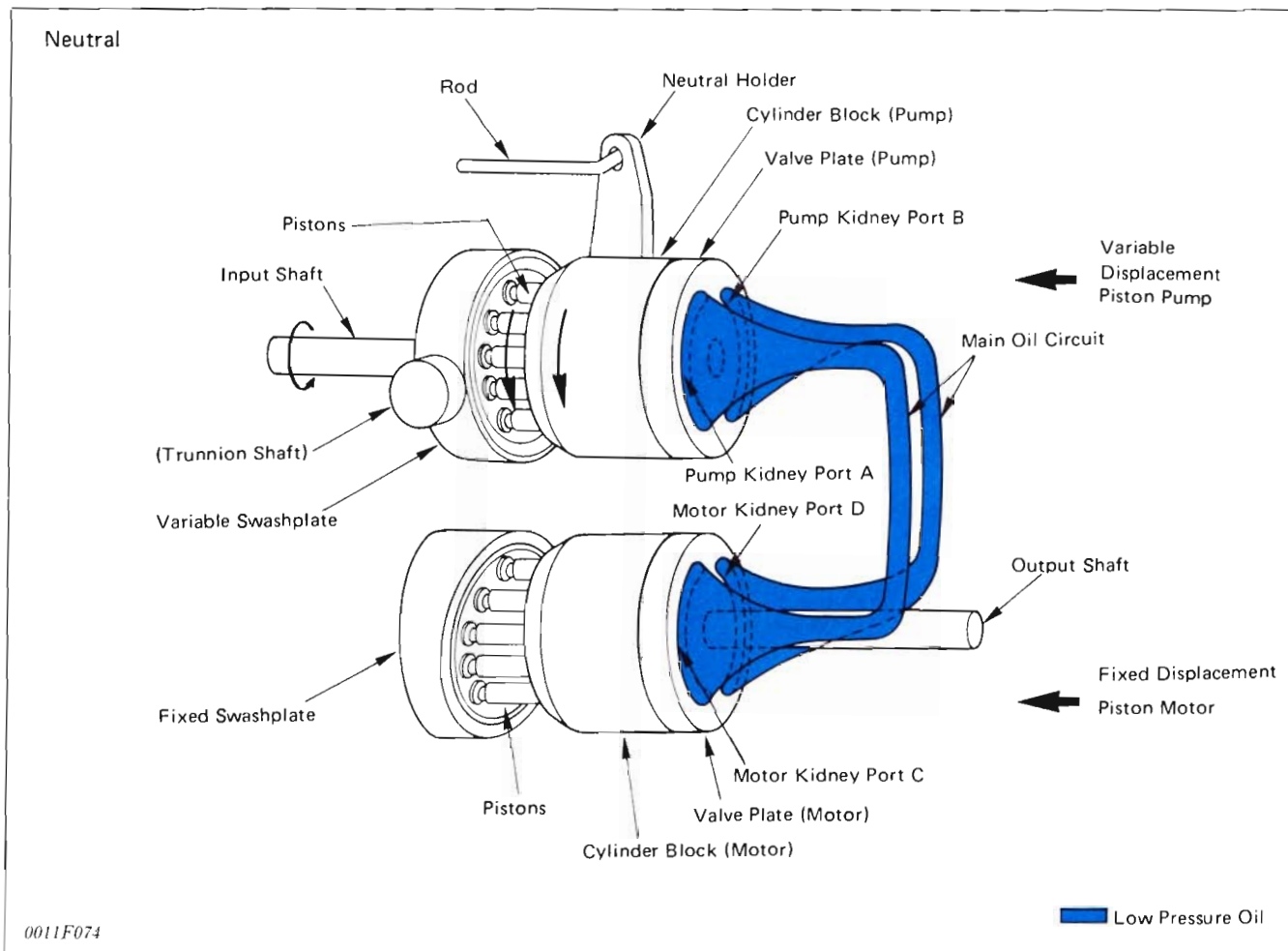


Fig. G-26 Neutral

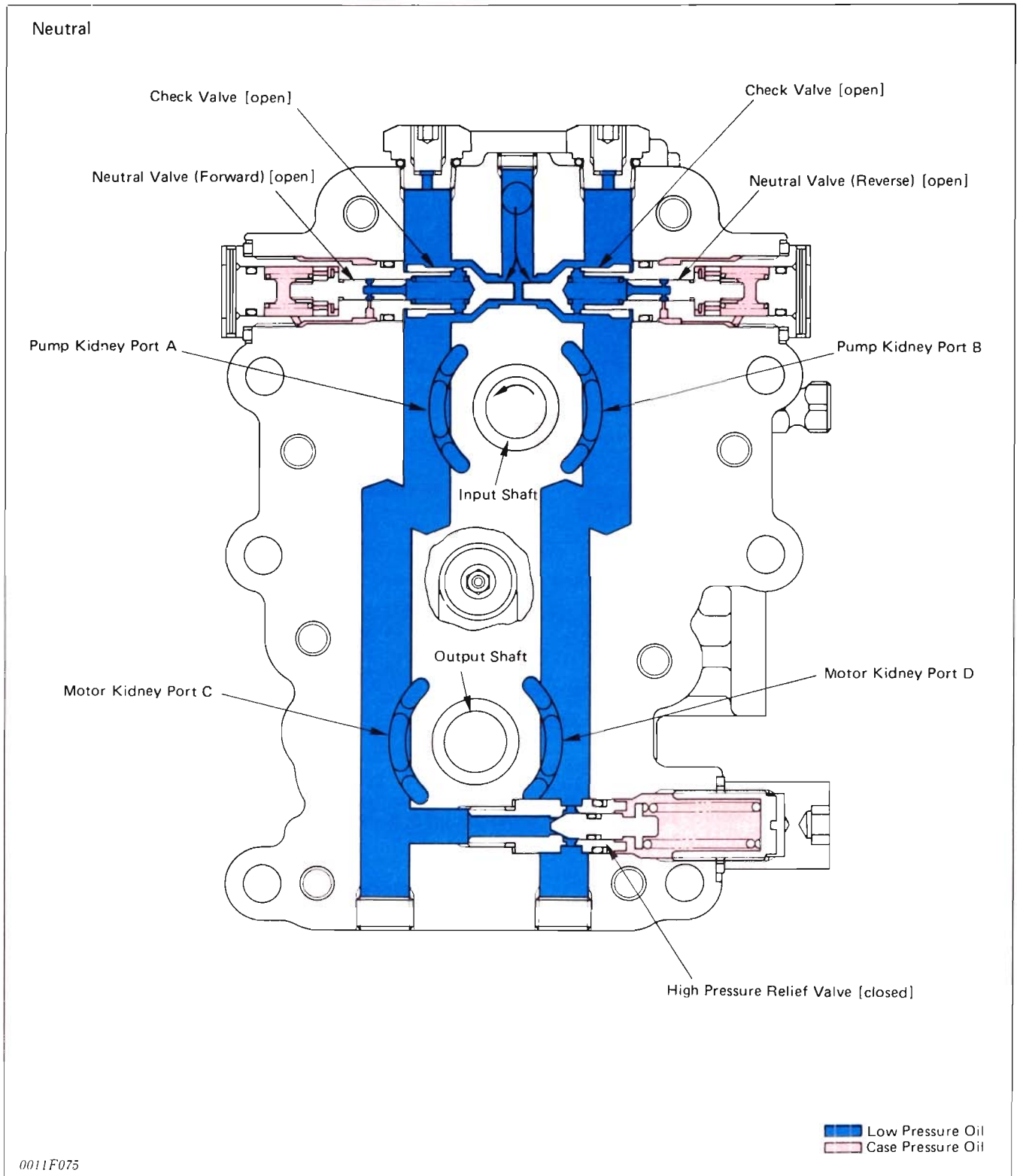


Fig. G-27 Valves Functions in Neutral

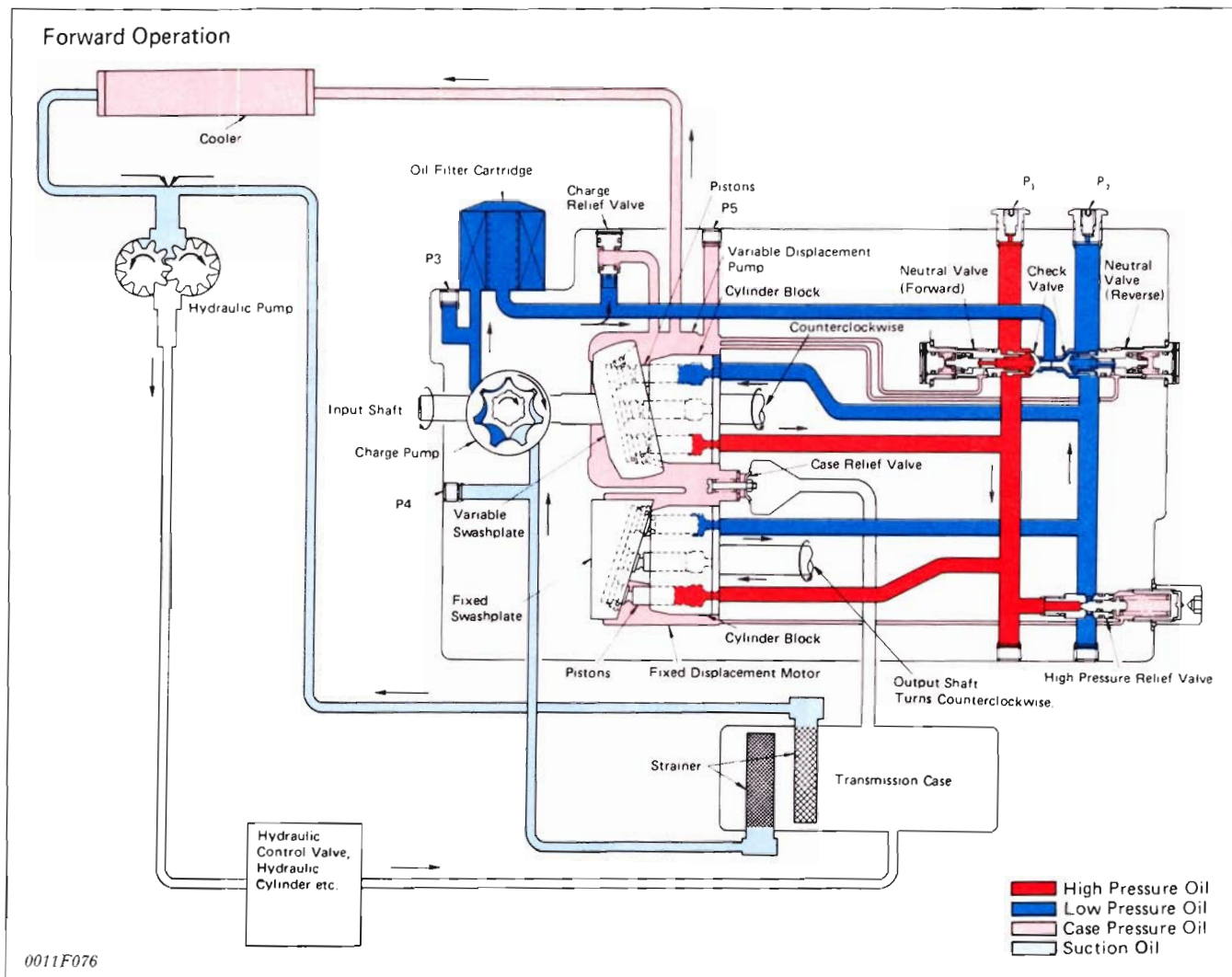


Fig. G-28 Oil Flow in Forward Operation

Forward Operation

When the variable swashplate is tilted as shown in Fig. G-28, the variable displacement pump feeds out oil to the fixed displacement motor to revolve it.

The check valve on the high pressure side is closed and that on the low pressure side is open to allow oil from the charge pump to supply to the low pressure side.

The neutral valve is closed at approx. 880 kPa (9kgf/cm², 128 psi). Therefore, the neutral valve on the high pressure side is closed and that on the low pressure side is open.

Under normal conditions, the high pressure relief valve is closed. When an abnormally great load is applied, the high pressure relief valve opens to keep the pressure on the high pressure side at 22.5 to 24.5MPa (230 to 250kgf/cm², 3270 to 3560 psi), for to protect the system. High pressure oil passes through the high pressure relief valve and flows into the low pressure side.

IMPORTANT: The high pressure relief valve must not be kept in operation with an overload for more than 10 seconds. Otherwise, oil temperature in the circuit would rise abnormally to cause abnormal operation, resulting in hydrostatic transmission breakdown.

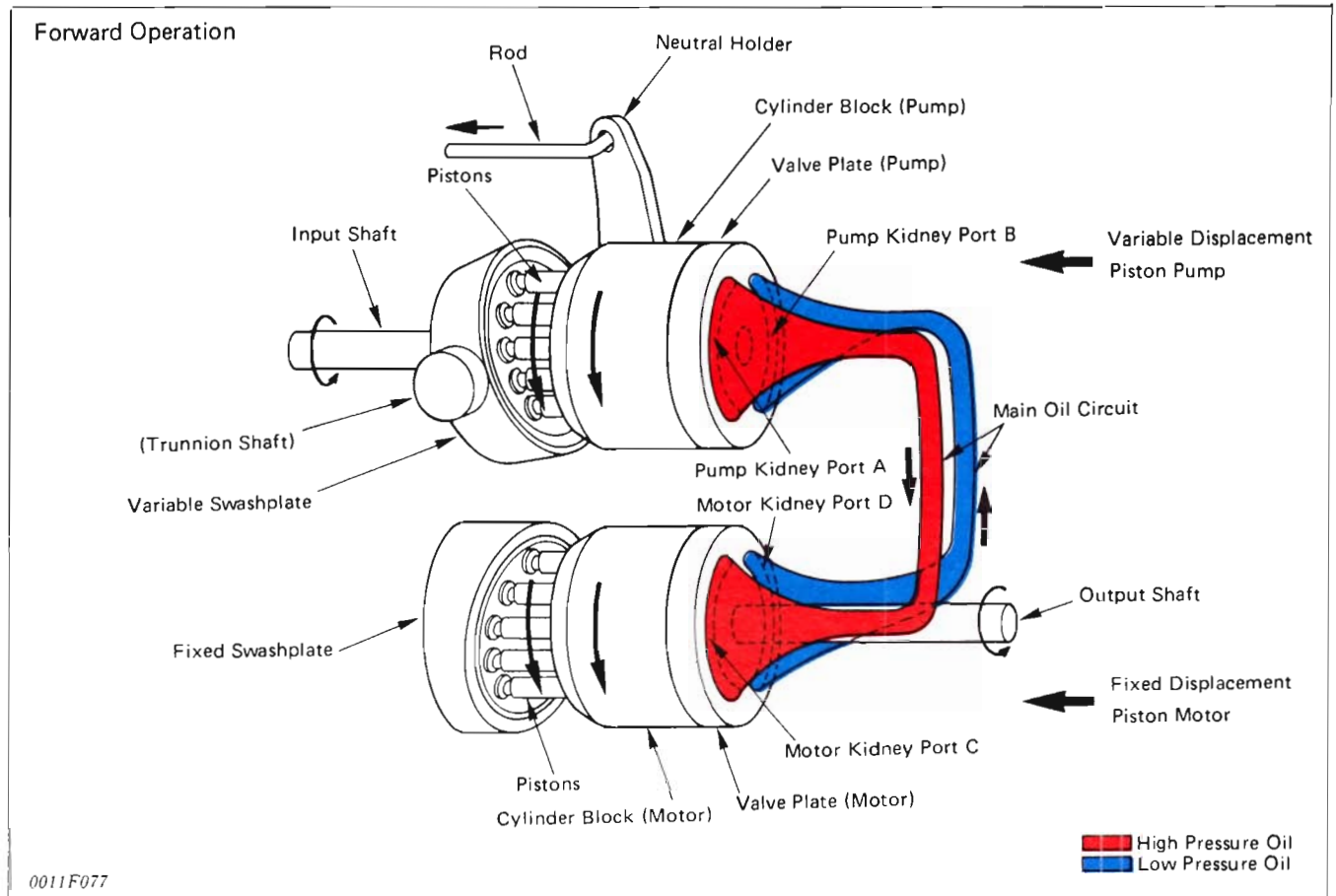


Fig. G-29 Forward Operation

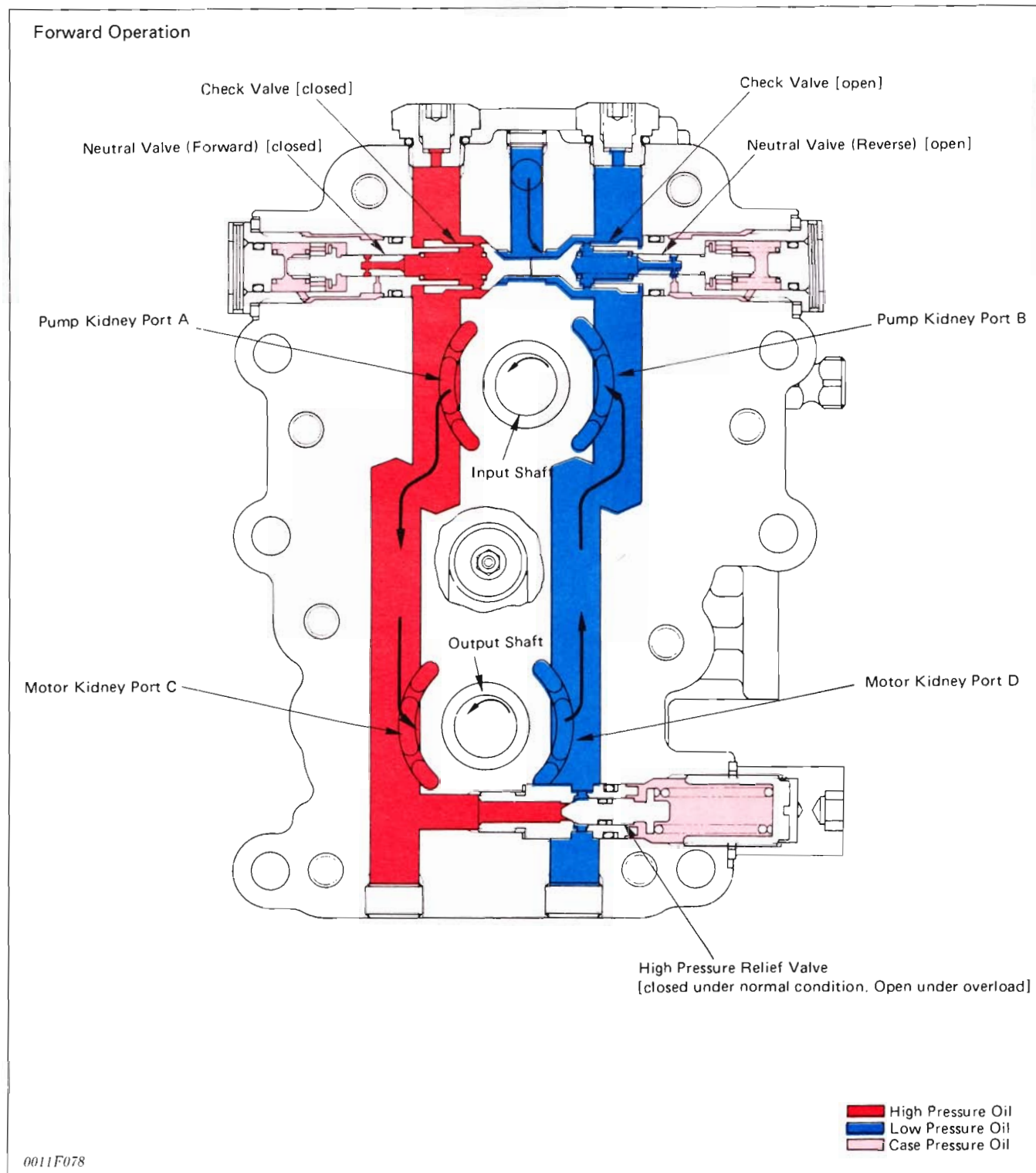


Fig. G-30 Valve Functions in Forward Operation

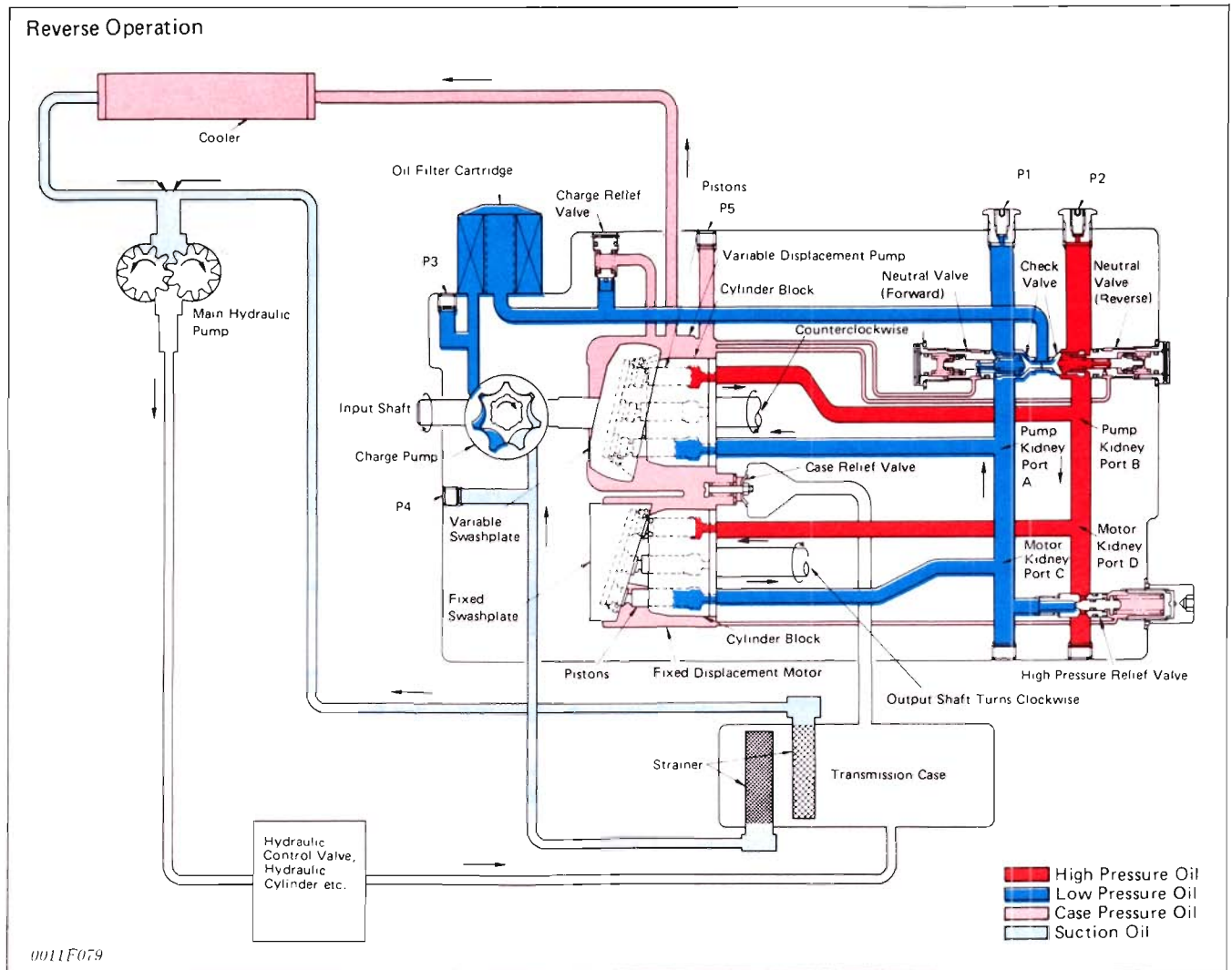


Fig. G-31 Oil Flow in Reverse Operation

Reverse Operation

Reverse operation is obtained by tilting the variable swashplate as shown in Fig. G-31.

The direction of oil flow is opposite to that in forward operation. The fixed displacement motor and the output shaft turn clockwise. The check valve

and the neutral valve (reverse) on the high pressure side are closed, while the other check valve and the neutral valve (forward) are open. The high pressure relief valve, which also works in forward operation, closes under normal conditions and opens under overload.

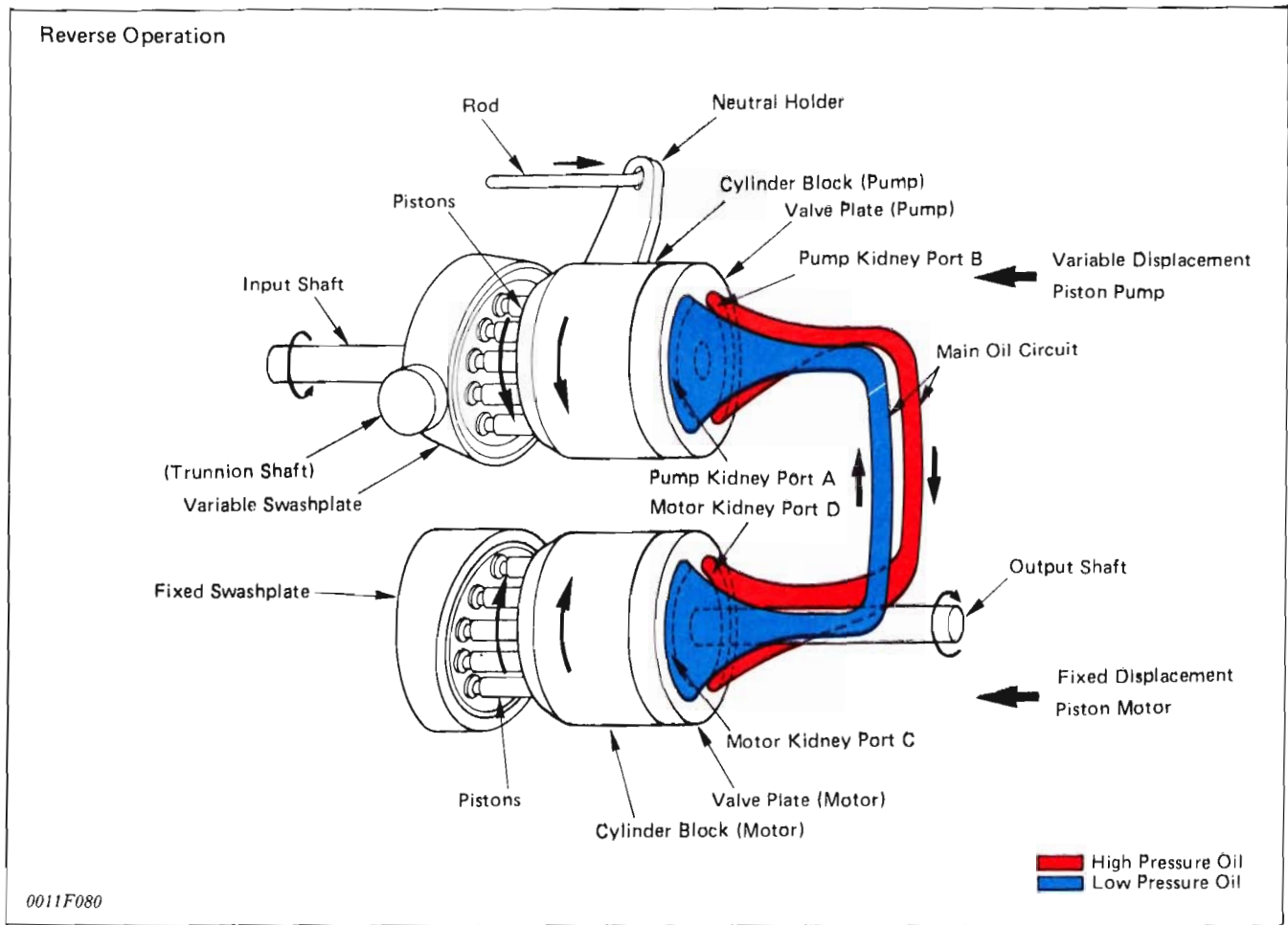


Fig. G-32 Reverse Operation (1/2)

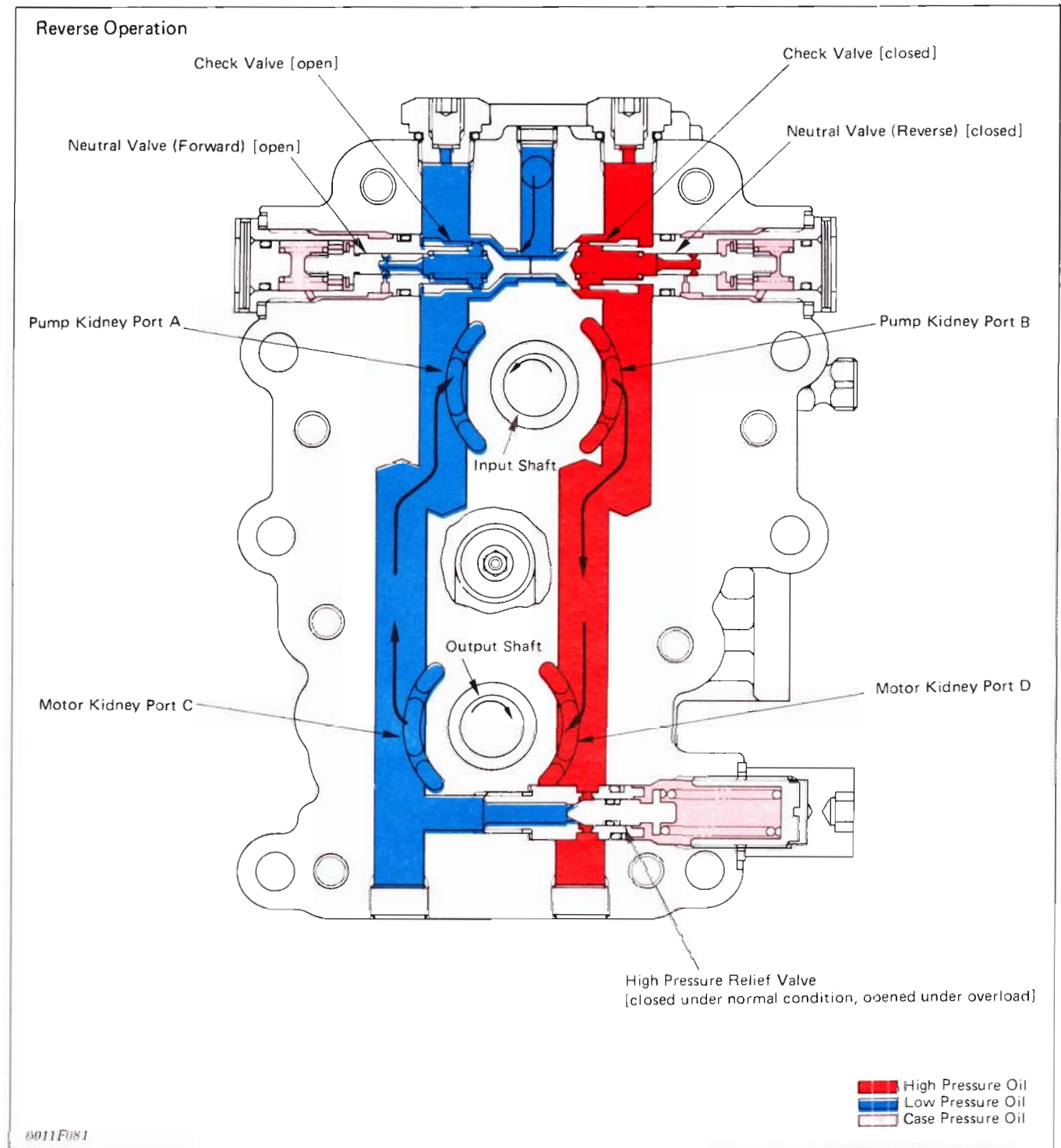


Fig. G-33 Valve Functions in Reverse Operation

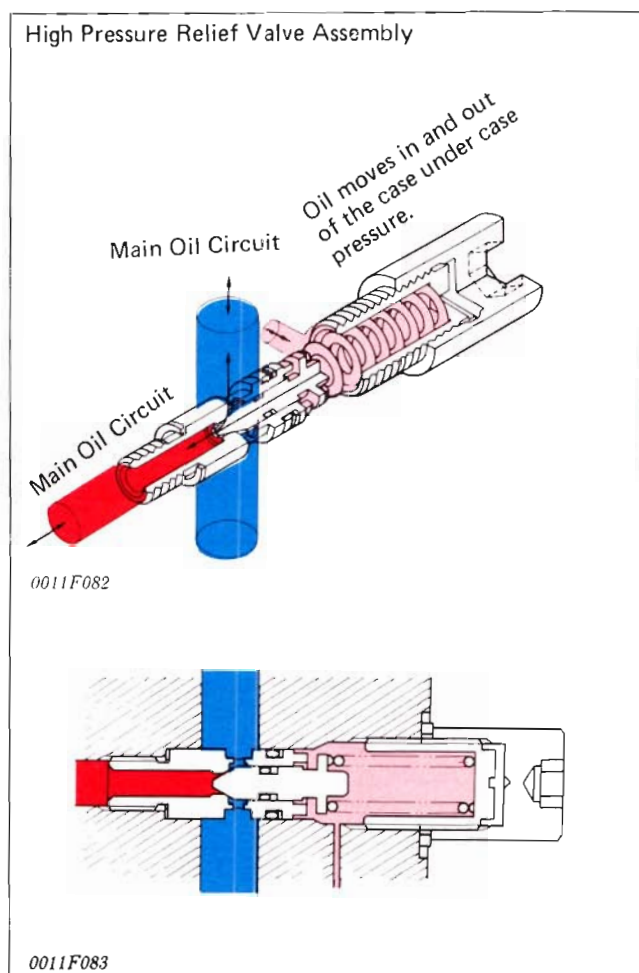


Fig. G-34 High Pressure Relief Valve

The high pressure relief valve set the maximum pressure of the main oil circuit to protect the hydrostatic transmission from being broken by abnormally high pressure. Only one relief vave is used for both the forward and reverse operations.

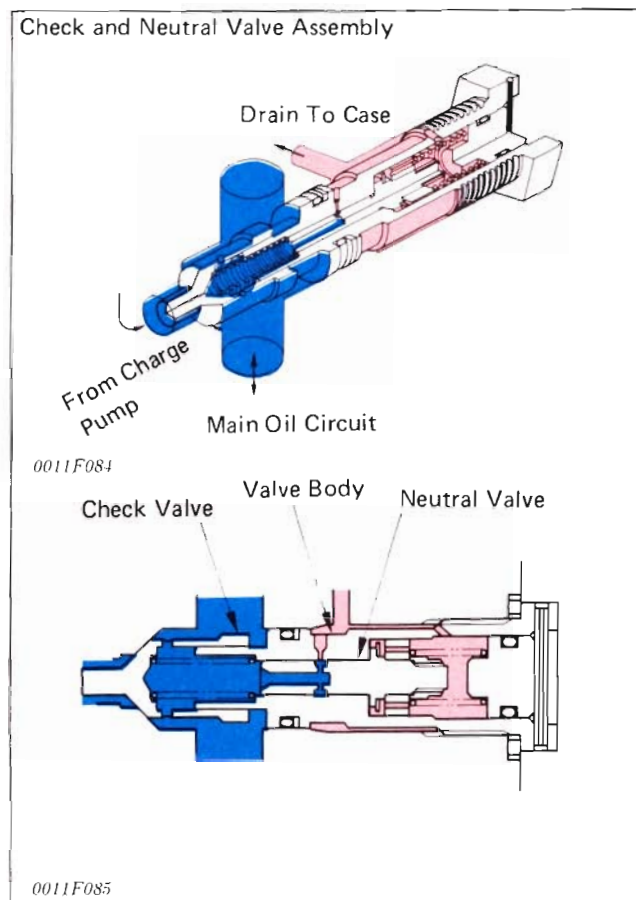


Fig. G-35 Check and Neutral Valve

When the check valve on the low pressure side is open, oil is fed from the charge pump to the low pressure side of the main oil circuit to compensate for oil leakage from the valve plate and pistons. The check valve on the high pressure side is closed to prevent oil leakage in the main oil circuit. The neutral valve drains oil to the case to hold neutral when the pressure in the main oil circuit is less than approx. 880 kPa (9 kgf/cm², 128 psi).

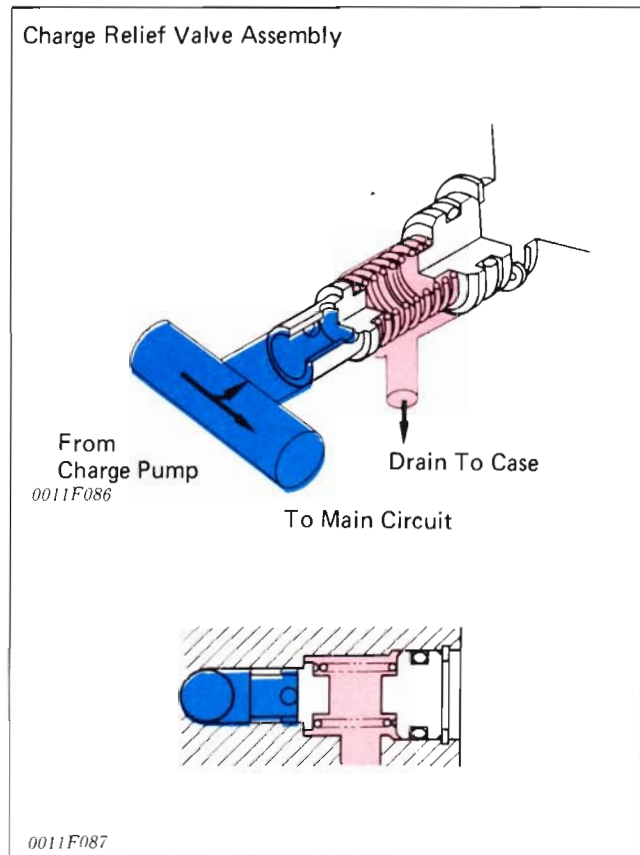


Fig. G-36 Charge Relief Valve

The charge relief valve drains the rest of the oil to the case, which has been used for compensating oil shortage in the main oil circuit.

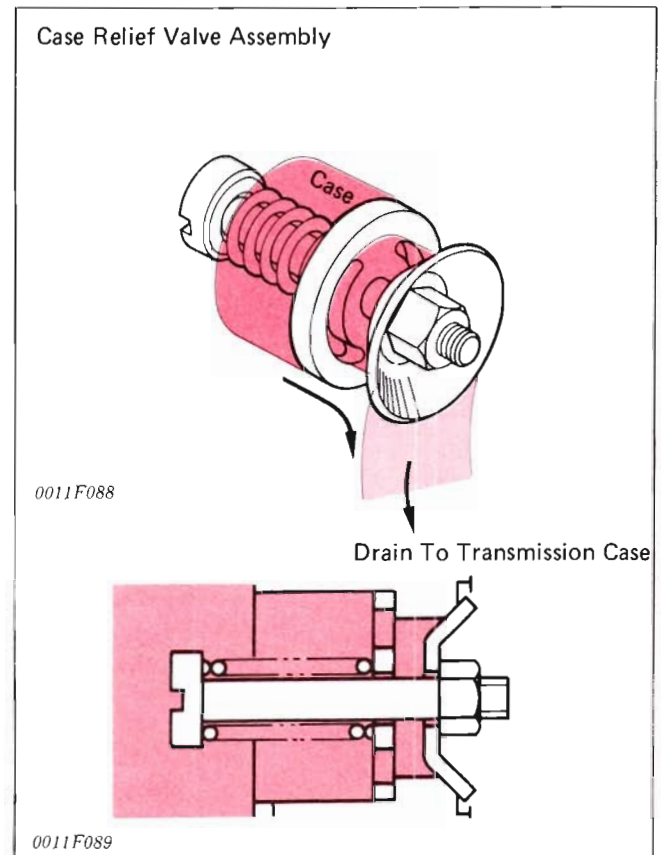
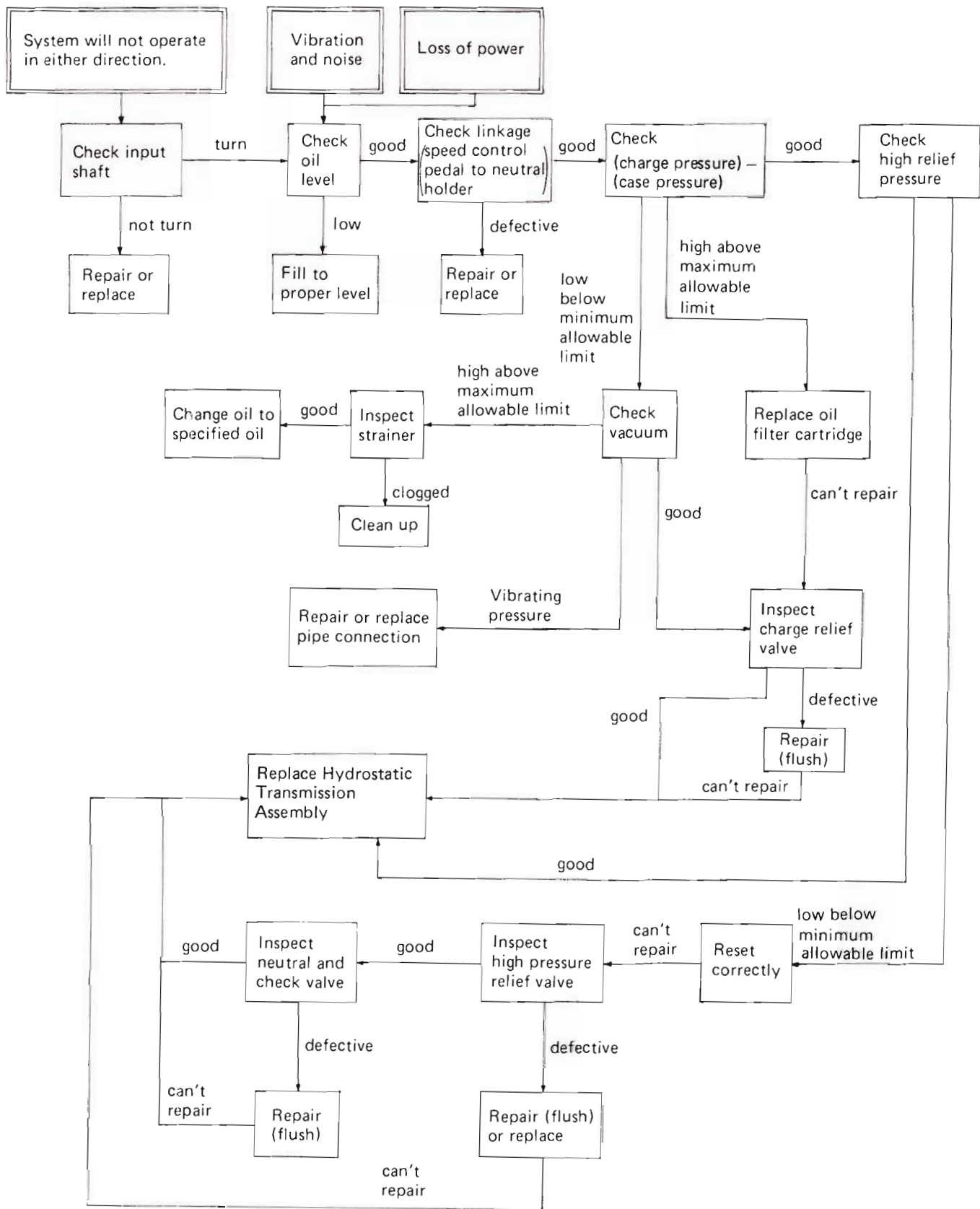
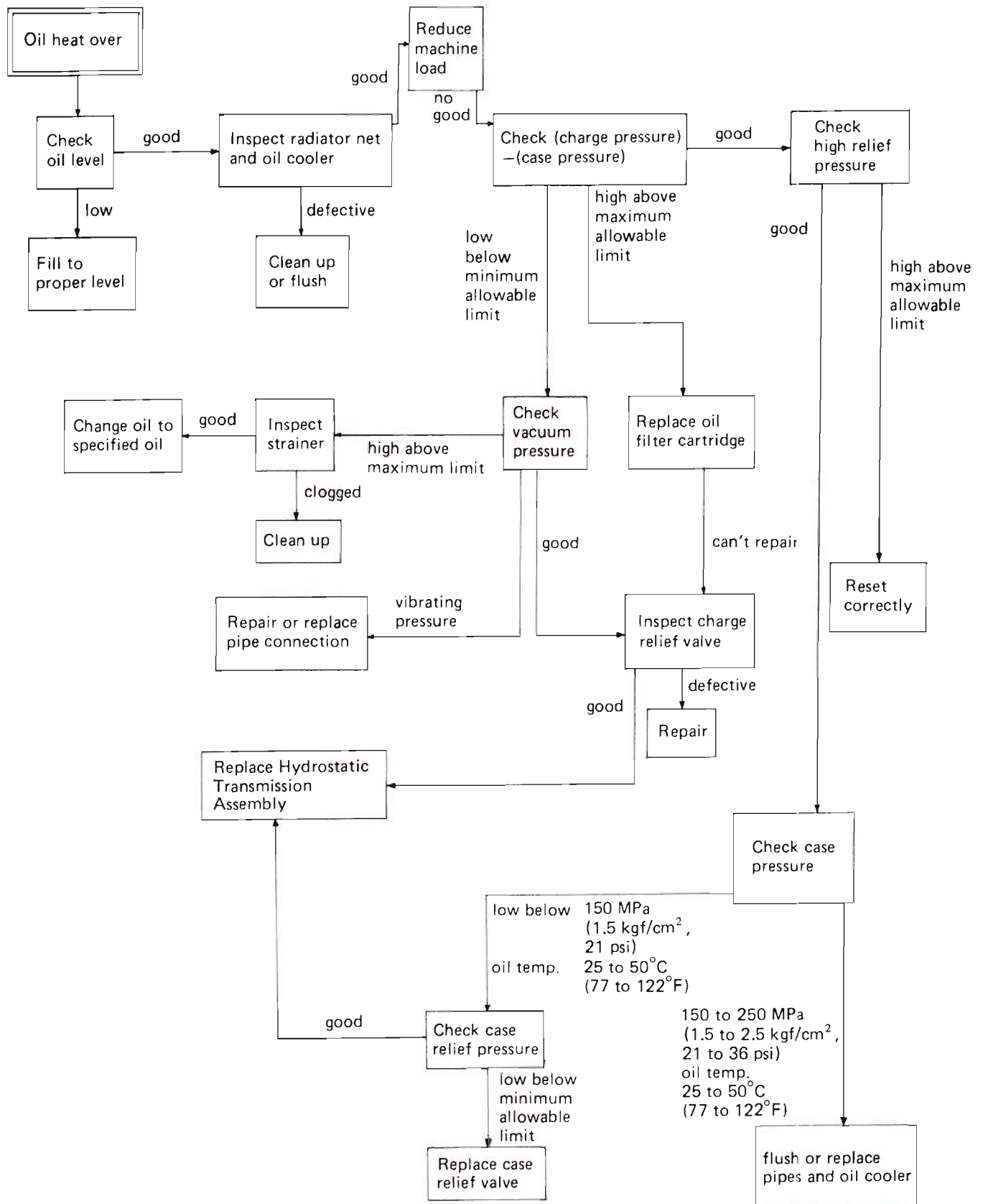


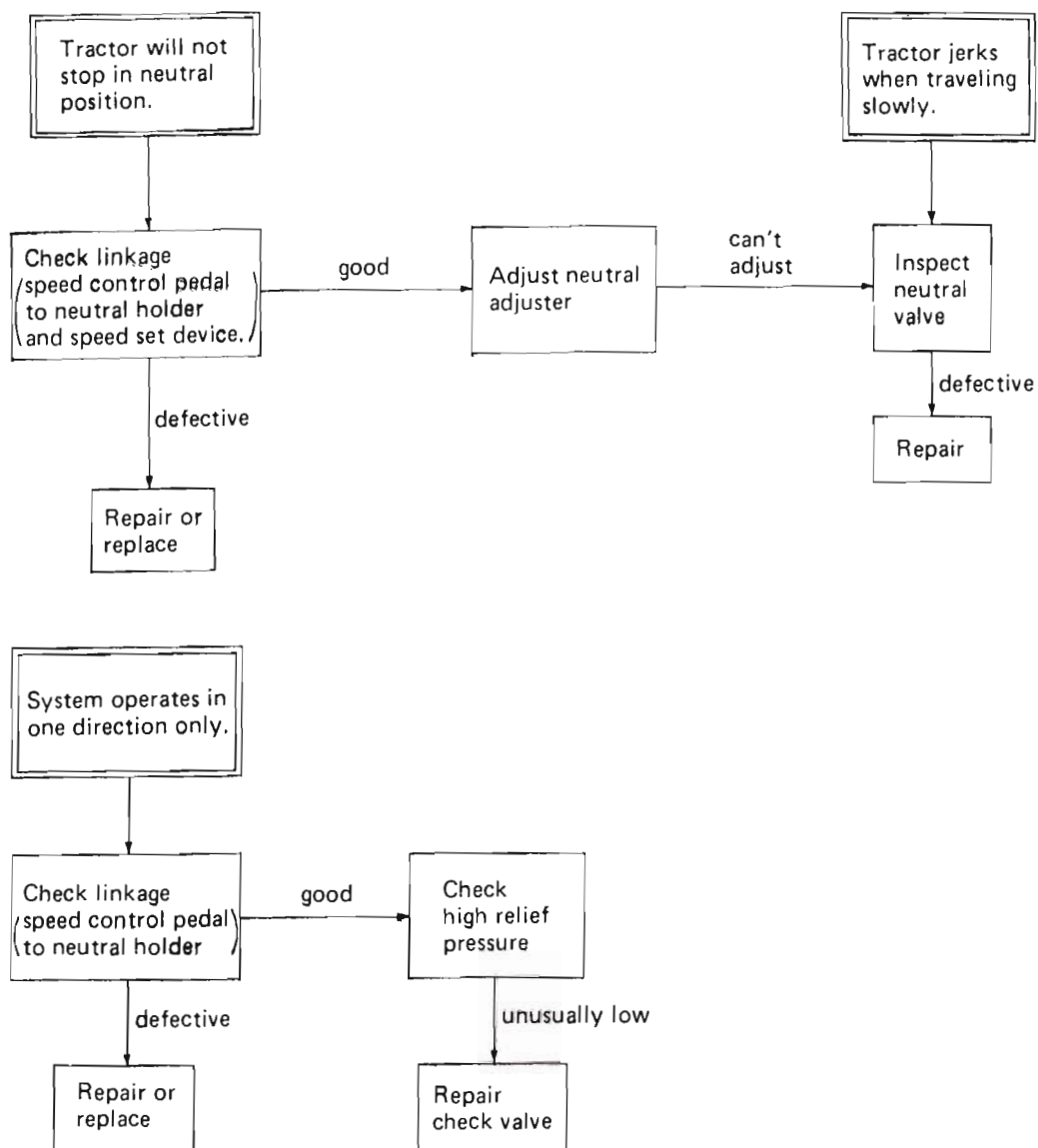
Fig. G-37 Case Relief Valve

The case relief valve drains oil to the transmission case when case pressure reaches approx. 200 kPa (2kgf/cm², 28 psi). This case relief valve sets pressure to feed case oil to the cooler, and prevents oil leakage from the oil seals in the hydrostatic transmission.

Troubleshooting (Each pressure is shown as "Specifications")

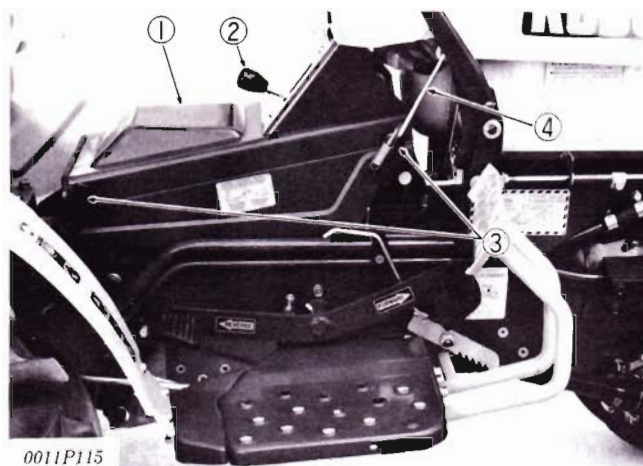






Checking Pressure

Removing Sub Cover



- 1. Sub Cover
- 2. Grip
- 3. Bolts (4 pieces)
- 4. Bonnet Latch

Fig. G-38 Removing Sub Cover

Remove the bonnet latch (4), grip (2) and bolts (3), then remove the sub cover (1).

2. Measurement of Hydrostatic Transmission pressure

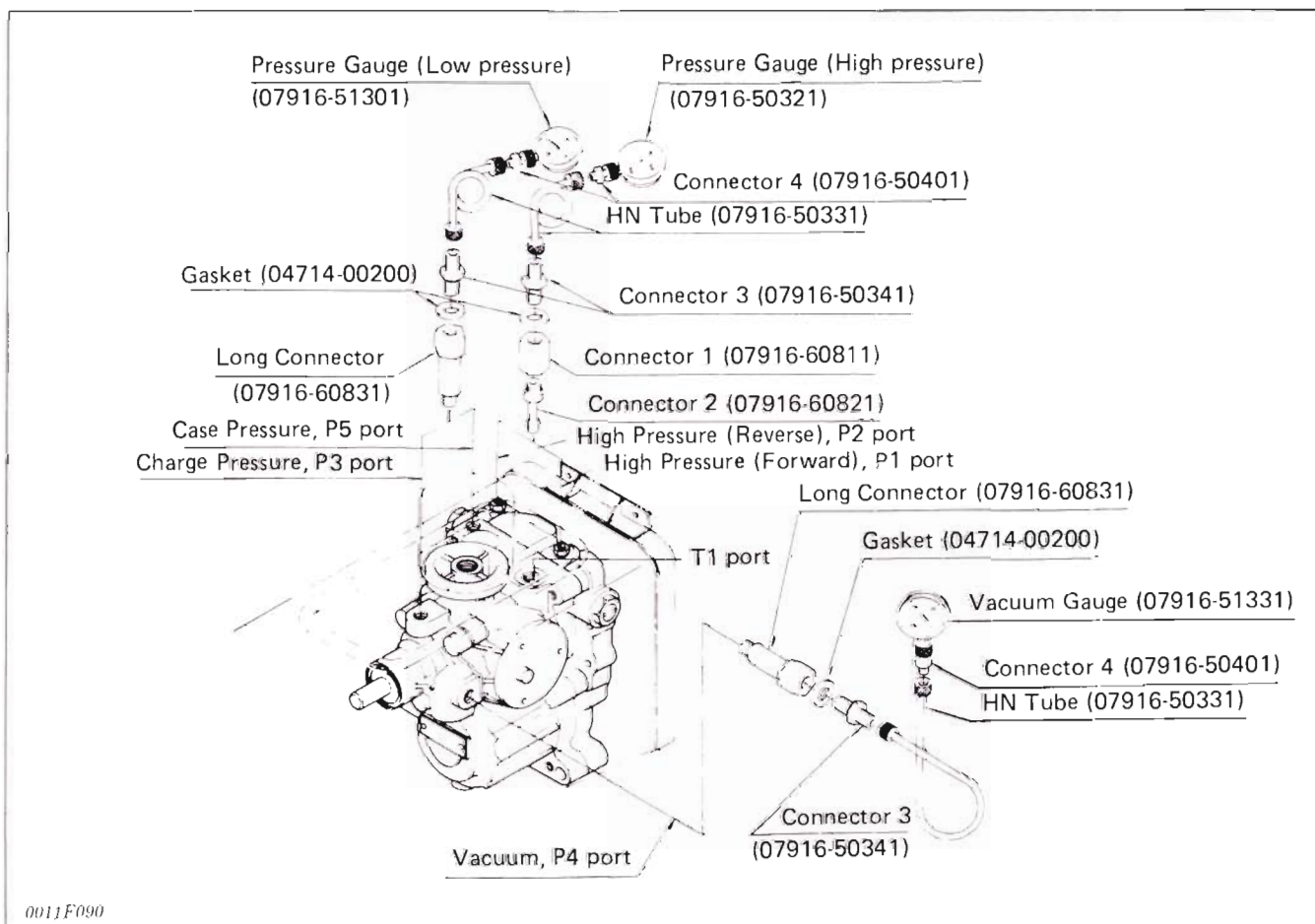


Fig. G-39 Measurement of Hydrostatic Transmission Pressure

3. High Relief Pressure



(Forward)

Fig. G-40 Checking High Relief Pressure (Forward)



(Reverse)

- | | |
|---|------------|
| 1. High Pressure Gauge
max. capacity is more than 30MPa
(300kgf/cm ² , 4260 psi) | 3. P1 Port |
| 2. Connectors 1, 2, 3. | 4. P2 Port |

Fig. G-41 Checking High Relief Pressure (Reverse)

Remove the M10 plug (hex. socket head plug) from the P1 port (3) (Forward), or P2 port (4) (Reverse), Fig. G-40, G-41.

Install the connector 2 on the M10 side to the P1 port. Fit connectors 1, 3 and gasket each other, and install them on the connector 2.

Install the HN tube, connector 4 and pressure gauge (High pressure).

CONDITION:

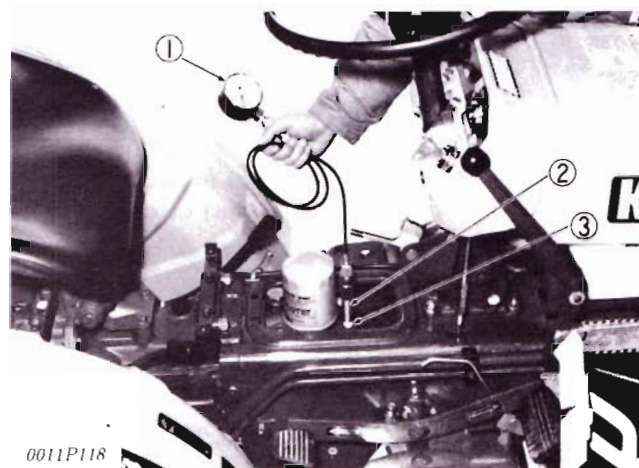
Measure high pressure in sufficient space, and with the parking brake fully engaged, and high-low gear shift lever in high. Engine speed 2800 to 3000 rpm. Oil temp. 25 to 50°C (77 to 122°F). Depressing the speed control pedal approx. 10mm (25/64 in.) from the neutral position. This is equivalent to

trunnion angle 0.087 rad. (5°). Complete measuring as quickly as possible, less than 10 sec. of relief. Make sure that there is a gasket between the M10 plug and PF 3/8 plug seat. High relief pressure must be 21.6 to 25.5 MPa (220 to 260 kgf/cm², 3130 to 3700 psi).

NOTE:

P1, P2 port plug (M10 x 1.5 hex. socket head plug) tightening torque ... 20 to 25 Nm (2.0 to 2.5 kgf-m, 15 to 18 ft-lbs).

4. Charge Pressure



1. Low Pressure Gauge max. capacity 2MPa (20 kgf/cm², 284 psi)
2. Long Connector
3. P3 Port

Fig. G-42 Checking Charge Pressure

Remove the PT 1/4 plug from the P3 port (3). Be careful not to allow tape pieces to enter the HST case. Fit connector 3 and gasket to long connector (2). Apply sealing tape to the PT 1/4 external thread of the long connector (2).

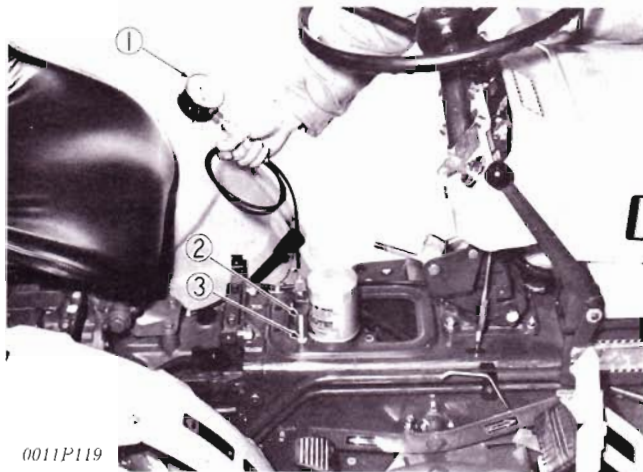
CONDITION:

High-low gear shift and speed control pedal in neutral. Parking brake engaged. Engine speed 2800 to 3000 rpm.

NOTE:

When installing the PT 1/4 plug (P3 port), be sure to apply sealing tape carefully to the PT 1/4 plug (P3 port). Tightening torque ... 9 to 11 Nm (0.9 to 1.1 kgf-m, 6.5 to 8.0 ft-lbs)

5. Case Pressure



1. Low Pressure Gauge 2. Long Connector 3. P5 Port

Fig. G-43 Checking Case Pressure

Remove the PT 1/4 plug from the P5 port. Apply sealing tape to the PT 1/4 external thread of the long connection. Install long connector and low pressure gauge to the P5 port.

CONDITION:

Same manner as measuring case pressure.

6. Case Relief Pressure

After measuring the case pressure, continuously measure the case relief pressure.

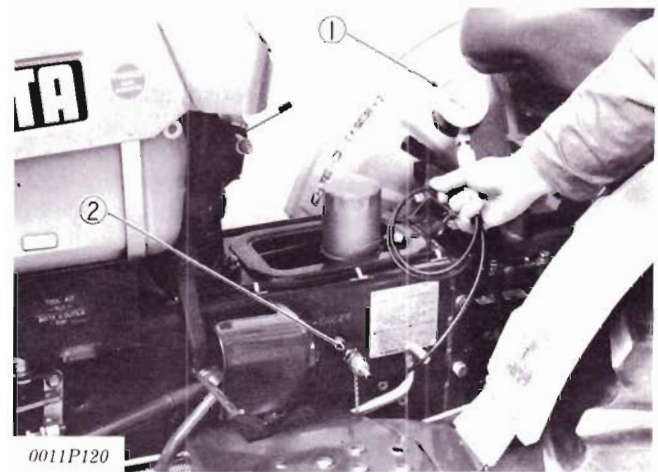
When measuring the case relief pressure, close the T1 port with PF 3/8 screw after removing joint.

NOTE:

When installing the PT 1/4 plug, apply sealing tape carefully to the PT 1/4 plug (P5 port).

Tightening torque . . . 9 to 11 Nm (0.9 to 1.1 kgf-m, 6.5 to 8.0 ft-lbs)

7. Vacuum



1. Vacuum Gauge max. capacity -760mmHg (-30in.Hg)
2. Long connector

Fig. G-44 Checking Vacuum

Remove the PT 1/4 plug (P4 port). Be careful not to allow tape pieces to enter the HST case. Apply sealing tape to the PT 1/4 external thread of the long connector. Install the long connector and vacuum gauge to the P4 port.

CONDITION:

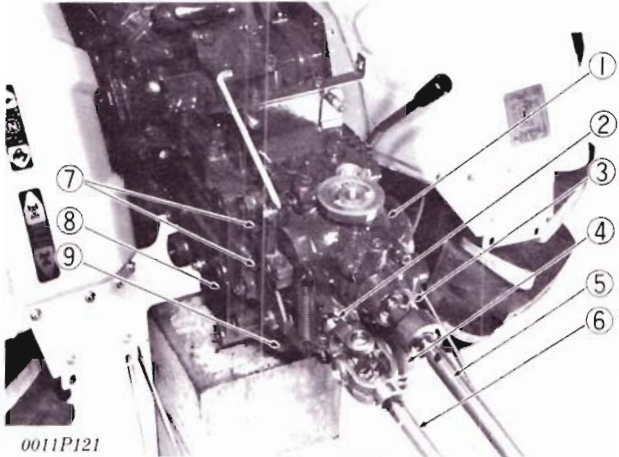
Same manner as measuring case pressure.

NOTE:

When installing the PT 1/4 plug (P4 port), be sure to apply sealing tape carefully to the PT 1/4 plug (P4 port). Tightening torque . . . 9 to 11 Nm (0.9 to 1.1 kgf-m, 6.5 to 8.0 ft-lbs)

Disassembly Hydrostatic Transmission

1. Separating Clutch Housing from Transmission Case Refer to "Separation".
2. Separating Hydrostatic Transmission from Transmission Case.

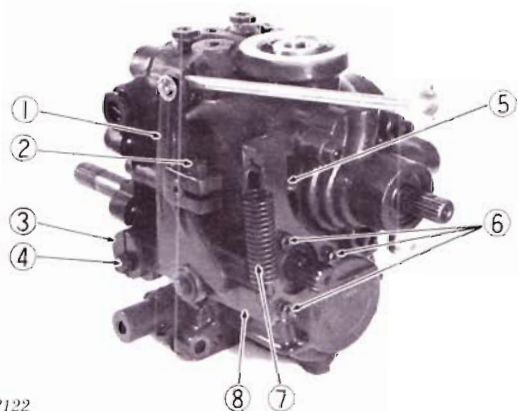


- | | |
|-----------------------------|---------------------------|
| 1. Hydrostatic Transmission | 6. Drive Shaft (only 4WD) |
| 2. Spring Pin (only 4WD) | 7. Nuts (4 pieces) |
| 3. Joint Pin | 8. Transmission Case |
| 4. Hose, 27 x 19 | 9. Bolts (2 pieces) |
| 5. Propeller Shaft | |

Fig. G-45 Separating Hydrostatic Transmission

Remove the joint pin (3) which connects the hydrostatic transmission (1) and the propeller shaft (5). In the case of 4WD, remove the spring pin (2) of the drive shaft (6) and remove the drive shaft (6). Then remove four nuts (7) and two bolts (9) from the hydrostatic transmission (1) and transmission case (8).

3. Removing Neutral Holder



- | | |
|---------------------|-----------------------|
| 1. Neutral Holder | 5. Spring Holder |
| 2. Bolt | 6. Bolts (3 pieces) |
| 3. Neutral Adjuster | 7. Spring |
| 4. Bolt | 8. Neutral Holder Arm |

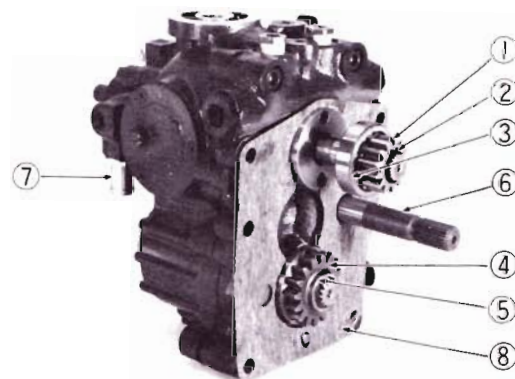
Fig. G-46 Removing Neutral Holder

IMPORTANT:

Be sure to make alignment marks on the neutral adjuster (3) and neutral holder arm (8) so the neutral position can be adjusted after reassembly.

Remove bolts (6) fixing the spring holder (5) from the hydrostatic transmission. Remove bolt (4) from the neutral adjuster (3), and remove bolt (2) which is fixing the neutral holder (1). Pull out the neutral holder (1).

4. Removing gears and Bearing



0011P123

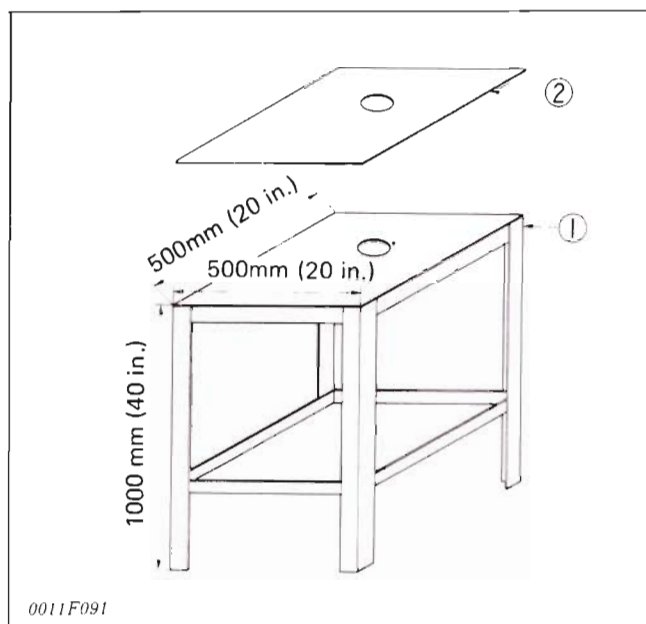
- | | |
|------------------------|---------------------|
| 1. Gear (13T) | 5. External Circlip |
| 2. External Circlip | 6. Shaft 1 |
| 3. Ball Bearing (6304) | 7. Joint |
| 4. Gear (16T) | 8. Gasket |

Fig. G-47 Removing Gears and Bearing

Remove the external circlip (2) fixing the 13-teeth gear (1), remove the gear (1) and ball bearing (3). Remove the external circlip (5) fixing the 16-teeth gear (4) and pull out the shaft 1 (6) in the forward direction. Remove the joint (7) and gasket (8).

5. Making Repair Table

Make repair table as shown in Fig. G-48, G-49, to facilitate hydrostatic transmission disassembly and assembly.



1. Table

2. Rubber Plate (Vinyl Plate)

Fig. G-48 Making Repair Table (1/2)

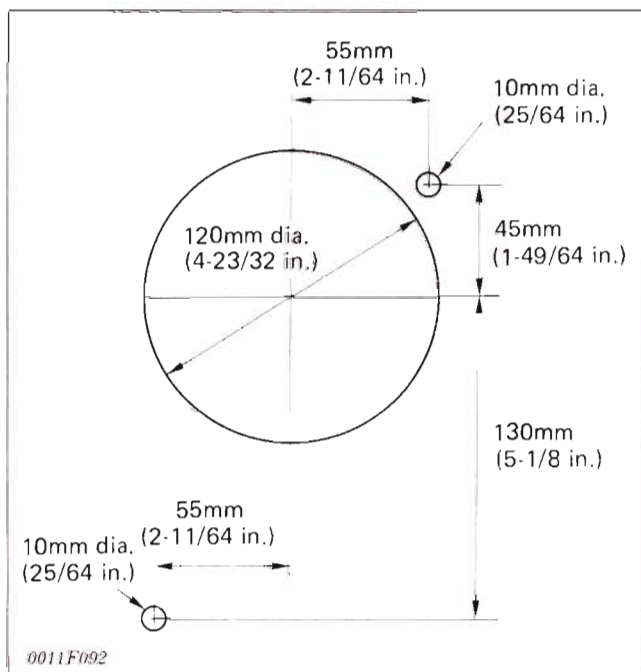
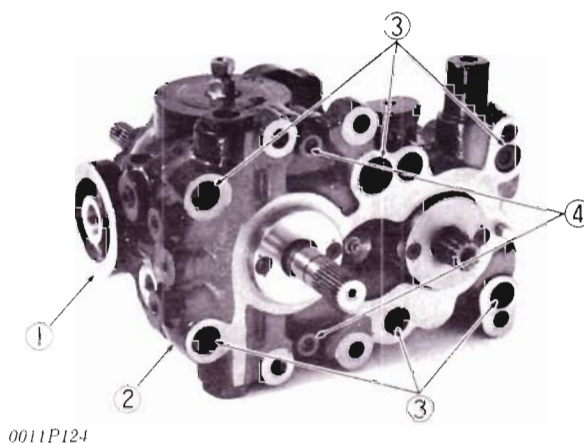


Fig. G-49 Making Repair Table (2/2)

IMPORTANT:

For assembly and disassembly, use a clean repair table. Wash the outside of the hydrostatic transmission. The hydrostatic transmission interior contains many high precision parts, thus, utmost care must be paid to prevent dust entry.

6. Removing Port Block



1. Case

2. Port Block

3. Bolts (6 pieces)

4. Bolts (2 pieces)

Fig. G-50 Removing Port Block

Remove the bolts (3) and (4) from the port block (2). See Fig. G-50.

Separate the port block (2) from the case (1).

7. Removing Charge Pump and Input Shaft



1. Charge Pump Case

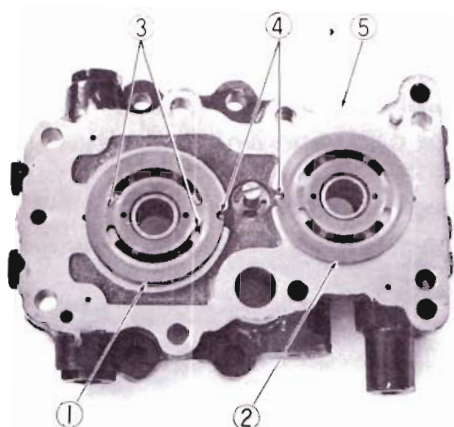
2. Input Shaft

3. Bolts (3 pieces)

Fig. G-51 Removing Charge Pump and Input Shaft

Remove bolt (3) from the charge pump case (1). Lay the case and tap the rear end of the input shaft (2) with a wood hammer to separate the input shaft (2) and the charge pump from the hydrostatic transmission. Remove two knock pins.

8. Removing Valve Plates



0011P126

1. Valve Plate (Pump)
2. Valve Plate (Motor)
3. Two Notches
4. Ancor Pins
5. Port Block

Fig. G-52 Removing Valve Plates

IMPORTANT:

The valve plates (1) and (2) may be fixed and seized on the port block (5). Be careful not to drop them.

Pushing the valve plates (1), (2) onto the anchor pins (4), remove the valve plates smoothly. The valve plate with two notches is assembled on the pump side, and the other one with no notch is assembled in the motor side.

- Identify the hydrostatic transmission, TYPE I or TYPE II, referring to the following tables.

• Hydrostatic Transmission TYPE I

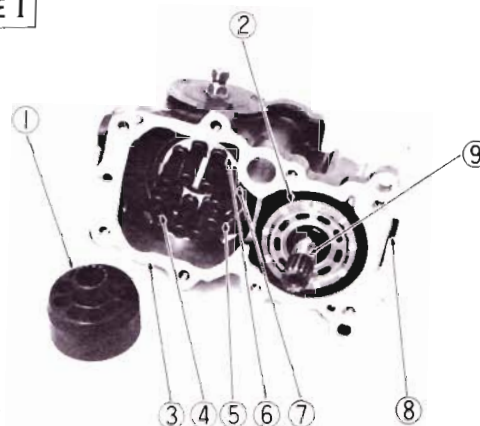
Model	Tractor Serial No.
B7100HST-D (4WD)	10001 to 13559 50001 to 51741
B7100HST-E (2WD)	10001 to 11905
B6100HST-D (4WD)	10002 to 10822 50001 to 50126
B6100HST-E (2WD)	10002 to 11139

• Hydrostatic Transmission TYPE II

Model	Tractor Serial No.
B7100HST-D (4WD)	51742 and beyond
B7100HST-E (2WD)	11906 and beyond
B6100HST-D (4WD)	50127 and beyond
B6100HST-E (2WD)	11140 and beyond

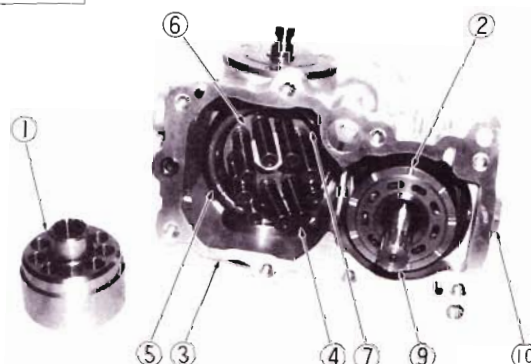
9. Removing Cylinder Block Assembly

TYPE I



0011P127

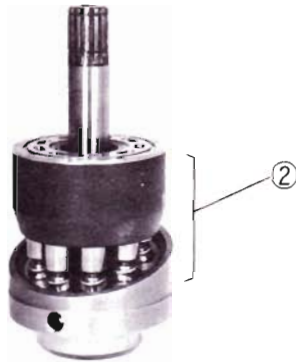
TYPE II



0306P002

1. Cylinder Block (Pump)
2. Cylinder Block Assembly (Motor)
3. Case
4. Pistons
5. Variable Swashplate
6. Retainer Plate
7. Internal Cir-clip
8. Stop Bolt (TYPE I only)
9. Output Shaft
10. Drain Plug (TYPE II only)

Fig. G-53 Removing Cylinder Block Assembly

TYPE I

0011P128

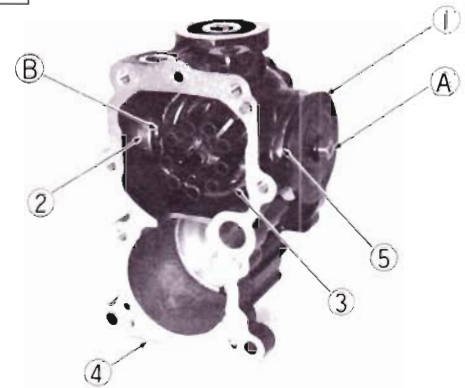
TYPE II

0306P003

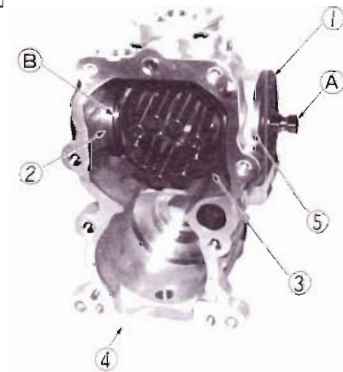
Fig. G-54 Cylinder Block Assembly (Motor)

Carefully remove the cylinder block (pump) (1) from the case (3). Be careful not to jar or damage to the pistons (4) and cylinder block (1). Remove the internal cir-clip (7), then remove pistons (4) and retainer plate (6). Remove the thrust plate which is attached to the variable swashplate (5). Remove the stop bolt (8) (TYPE I only), grasp the output shaft (9) and tap the case (3) with a plastic hammer to remove the cylinder block assembly (motor) (2).

10. Removing Variable Swashplate (Pump)

TYPE I

0011P129

TYPE II

0306P004

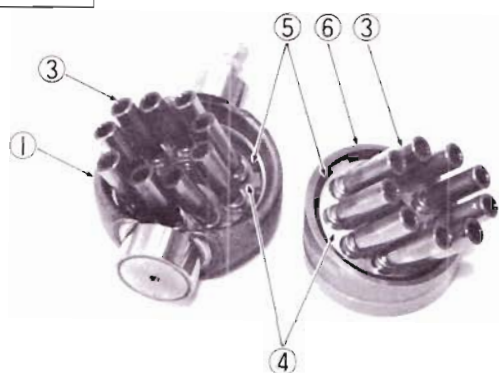
- | | |
|---------------------------|-----------|
| 1. Trunnion Shaft Cover 1 | 4. Case |
| 2. Trunnion Shaft Cover 2 | 5. O-ring |
| 3. Variable Swashplate | |

Fig. G-55 Removing Variable Swashplate (Pump)

Remove each three screws of the trunnion shaft covers 1(1) and 2(2). Tap section A of the variable swashplate (3) (shown in Fig. G-55) with a plastic hammer to remove the trunnion shaft cover (2). Then tap section B of the variable swashplate (3) with a plastic hammer to remove the trunnion shaft cover (1).

11. Removing Pistons, Retainer Plates and Thrust Plates

TYPE I



0011P130

TYPE I



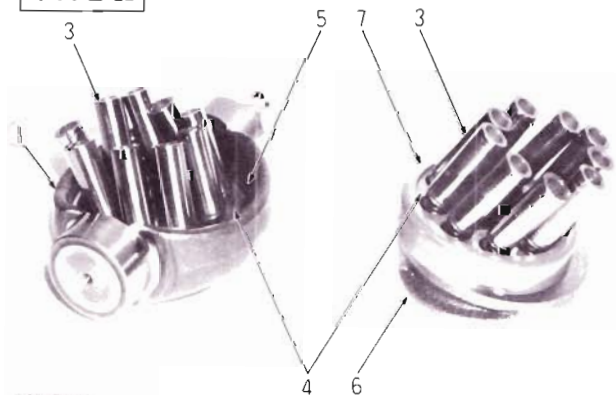
0011P131

- | | |
|------------------------|-----------------------|
| 1. Variable Swashplate | 4. Retainer Plates |
| 2. Thrust Plates | 5. Internal Cir-clips |
| 3. Pistons | 6. Fixed Swashplate |

Fig. G-56

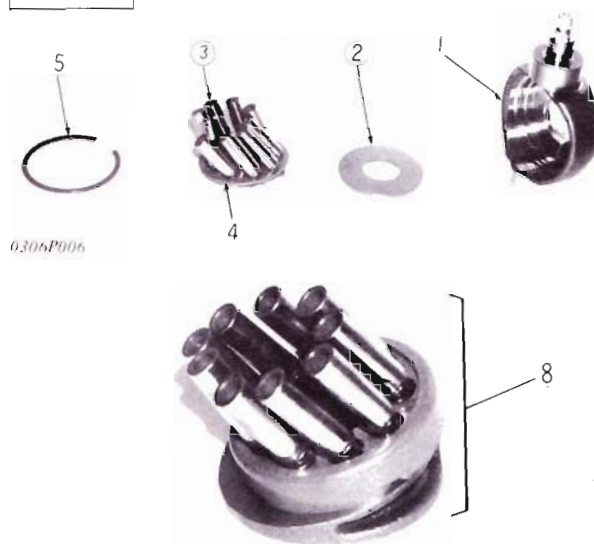
Remove internal cir-clips (5) holding the retainer plate (4). Store pump parts and motor parts separately.

TYPE II



0306P005

TYPE II



0306P007

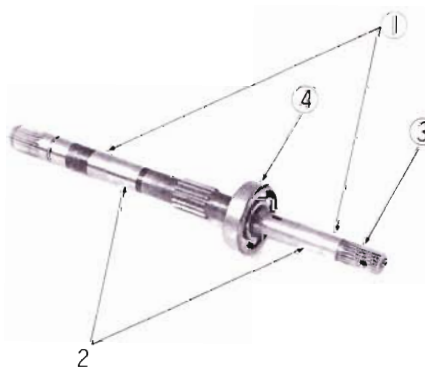
- | | |
|------------------------|----------------------|
| 1. Variable Swashplate | 5. Internal Cir-clip |
| 2. Thrust Plate | 6. Fixed Swashplate |
| 3. Pistons | 7. Retainer Holder |
| 4. Retainer Plates | 8. Assembly (Motor) |

Fig. G-57

Remove internal cir-clip (5) holding the retainer plate (4) [Assembly (Pump) only]. Store pump parts and motor parts separately.

Inspection

1. Inspecting Input Shaft



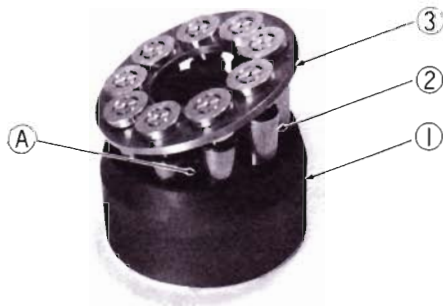
0011P132

- | | |
|--------------------|-----------------|
| 1. Seal Surfaces | 3. Input Shaft |
| 2. Bearing Surface | 4. Ball Bearing |

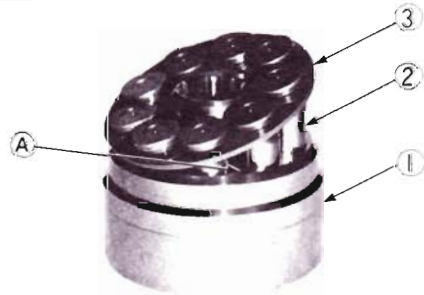
Fig. G-58 Inspecting Input Shaft

Separate the input shaft (3) with ball bearings (4) from the charge pump case for inspection. Inspect the seal surfaces (1) and the bearing surface (2). If any damage or abnormalities are found in the shaft, replace it.

2. Inspecting Cylinder Block Bores and Pistons

TYPE I

0011P133

TYPE II

0306P008

1. Cylinder Block 2. Pistons (9 pieces) 3. Retainer Plate

Fig. G-59 Inspecting Cylinder Block Bores and Pistons

Lift all pistons (2) carefully to check whether the pistons (2) slide smoothly in the bores of the cylinder block (1). (Fig. G-59) If there are scratches on the pistons or cylinder block bores, replace them.

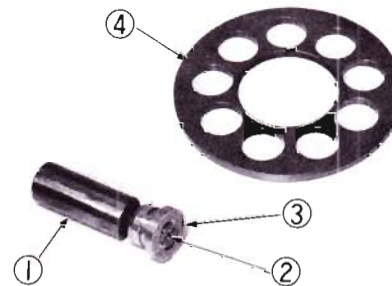
IMPORTANT:

Fit pump-side pistons with the pump-side cylinder block, and motor-side pistons with the motor-side cylinder block. Each pistons and cylinder block are matched.

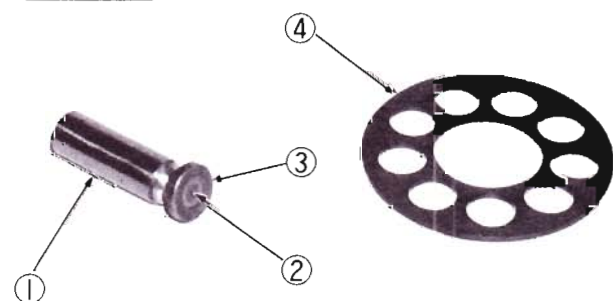
When replacing pistons or cylinder blocks, specify the following mark of X, Y, or Z.

Surface A: Marked with X Group X
No mark Group Y
Marked with Z Group Z

3. Inspecting Piston Slippers and Retainer Plates

TYPE I

0011P134

TYPE II

0306P009

1. Barrel 2. Lubricant Hole 3. Slipper 4. Retainer Plate

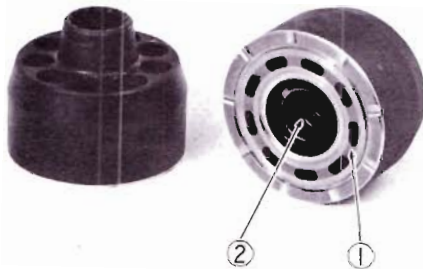
Fig. G-60 Inspecting Piston Slippers and Retainer Plates

Replace piston if the barrel (1) is scratched, or if the slipper (3) is worn down to 2.90mm (0.114 in.) or less thickness.

Inspect the lubricant hole (2) for clogging. If clogged, blow with a high-pressure air.

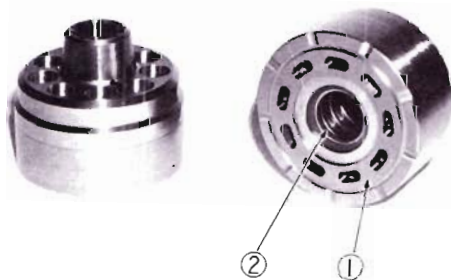
4. Inspecting Cylinder Block Face

TYPE I



0011P135

TYPE II



0306P010

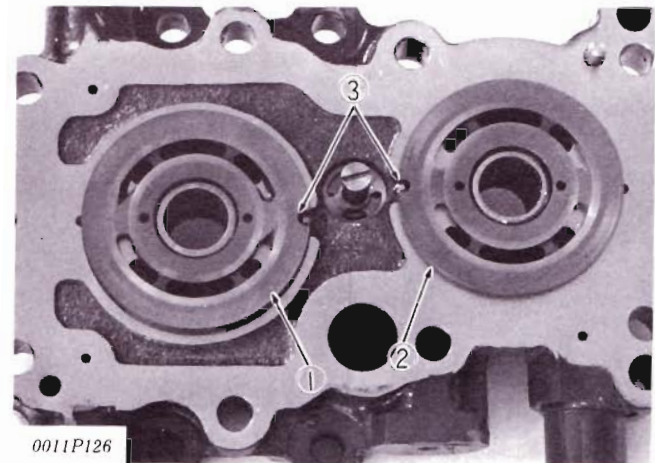
1. Polished Face of Cylinder Block 2. Spring

Fig. G-61 Inspecting Cylinder Block Face

Inspect the polished face of cylinder block (1). (Fig. G-61)

If there are scratches on the face, replace the cylinder block. Inspect the spring (2) and replace it if broken.

5. Inspecting Valve Plates



0011P126

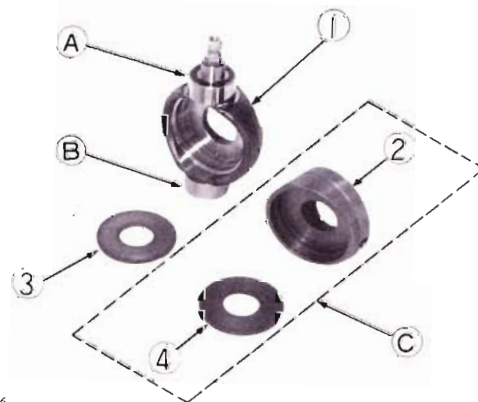
1. Valve Plate (Pump) 3. Anchor Pins
2. Valve Plate (Motor)

Fig. G-62 Inspecting Valve Plates

Clean valve plates (1) and (2) and dry them with compressed air. Inspect the valve plates for scratches, excessive wear and corrosion. Worn valve plates will reduce pump efficiency.

To check valve plate wear, run a finger nail over the plate surface. If heavily worn, replace the plate. Check valve plates (1) and (2), and anchor pins (3) for proper engagement. Remove the valve plate and check for foreign particles.

6. Inspecting Swashplates and Thrust Plates



0011P136

1. Variable Swashplate A. B. Turnnion Shafts
2. Fixed Swashplate [part of variable swashplate (1)]
3. Thrust Plate C. Fixed Swashplate and Thrust
4. Thrust Plate Plate [TYPE I only]

■ TYPE I

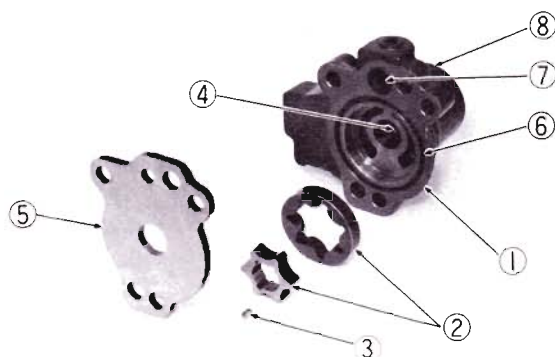
Inspect the turnnion shafts (A) (B) [part of variable swashplate (1)] for scratches and heavy wear. Inspect the thrust plates (3) and (4) for scratches and abnormal wear. If necessary, replace it.

■ TYPE II

Inspect the trunnion shafts (A) (B) [part of variable swashplate (1)] for scratches and heavy wear.

Inspect the thrust plate (3) for scratches and abnormal wear. If necessary, replace it.

7. Inspecting Charge Pump



0011P137

- | | |
|----------------------------|-------------|
| 1. Charge Pump Case | 5. Plate |
| 2. Trochoid Rotor Assembly | 6. O-ring |
| 3. Woodruff Key | 7. O-ring |
| 4. Needle Bearing | 8. Oil Seal |

Fig. G-64 Inspecting Charge Pump

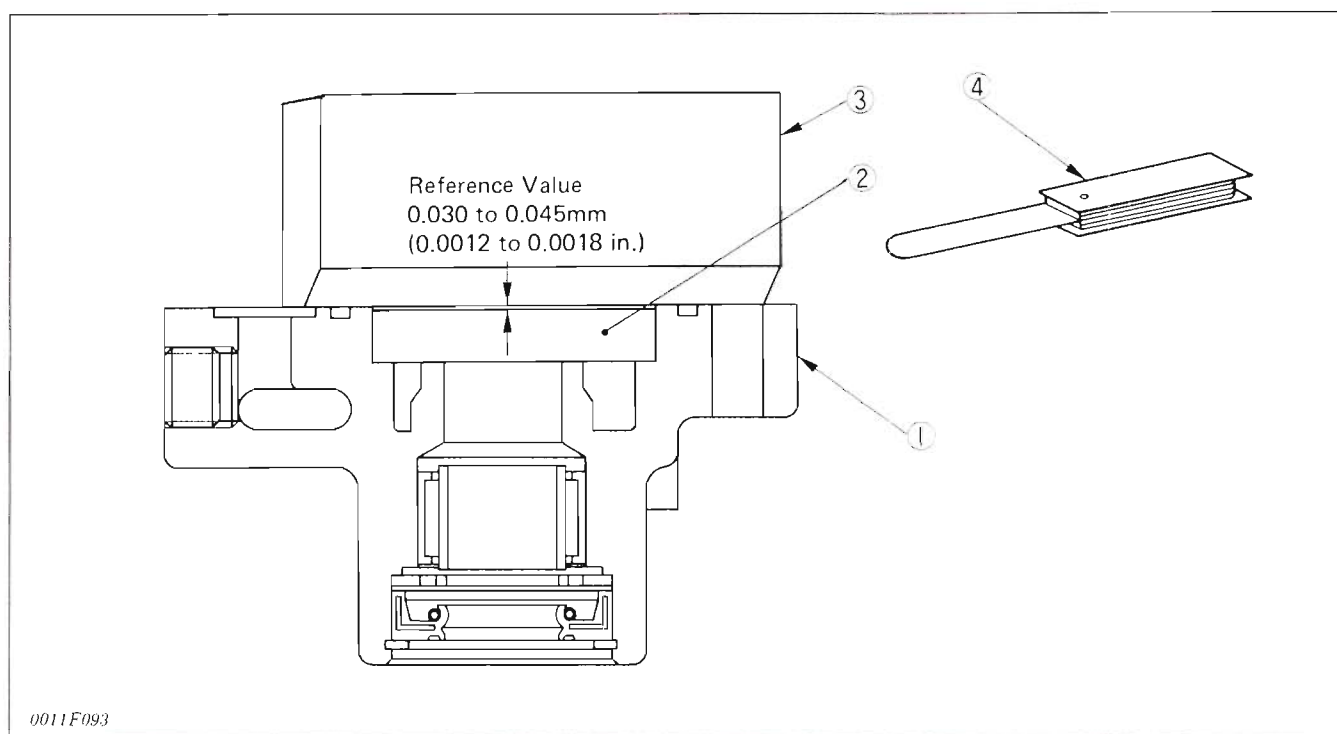
Inspect the charge pump case (1) and the trochoid rotor assembly (2) for scratches and wear. Inspect the needle bearing (4) for abnormal wear.

If scratches or abnormal wear are found, replace the entire charge pump.

Replace the new O-rings (6) and (7) and oil seal (8) at each reassembly. Grind precision surfaces of the plate (5) and the charge pump case (1) with very fine oil stone.

For measurement of side-clearance of the trochoid rotor, see Fig. G-65.

Each part must be cleaned by compressed air before measurement.

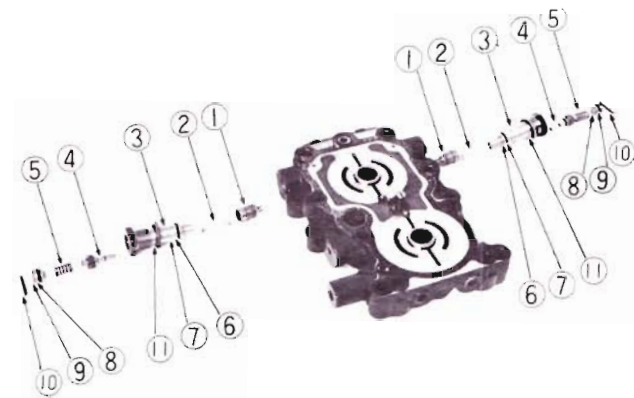


0011F093

- | | | | |
|---------------------|----------------------------|-----------------|-----------------|
| 1. Charge Pump Case | 2. Trochoid Rotor Assembly | 3. Straightedge | 4. Feeler Gauge |
|---------------------|----------------------------|-----------------|-----------------|

Fig. G-65 Measurement side-clearance of trochoid rotor

8. Inspecting Neutral and Check Valves



0011P138

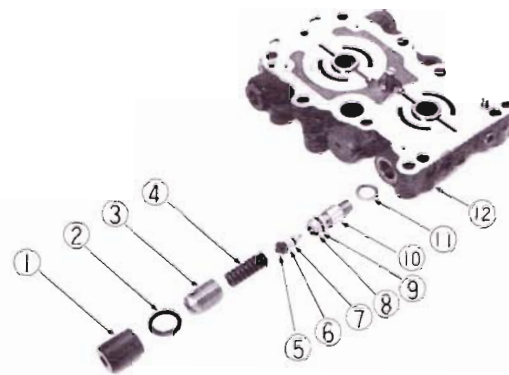
- | | |
|-------------------|-----------------------------------|
| 1. Check Valves | 7. Backup Rings |
| 2. Springs | 8. O-rings |
| 3. Valve Bodies | 9. Caps |
| 4. Neutral Valves | 10. Spring Pins |
| 5. Springs | 11. Bonded Seals |
| 6. O-rings | (3 to 10: Neutral Valve Assembly) |

Fig. G-66 Inspecting Neutral and Check Valves

Remove the neutral valve assemblies and the check valves to insure that the check valves (1) and the neutral valves (4) slide smoothly along the valve bodies (3). Inspect the check valves (1) surface for heavy scratches. Inspect the holes of the neutral valves (4) and valve bodies (3) for clogging. If necessary, unclog them with compressed air.

Inspect the O-rings (6) and backup rings (7) of the valve bodies (3) for scratches. Inspect the springs (2) and (5) for breakage or ineffectiveness. Replace the new bonded seals (11) when reassembling.

9. Inspecting High Pressure Relief Valve



0011P139

- | | | |
|----------------|-----------------|-----------------|
| 1. Cap Nut | 5. Poppet Valve | 9. O-ring |
| 2. Bonded Seal | 6. Backup Ring | 10. Valve Seat |
| 3. Set Bolt | 7. O-ring | 11. Seat Gasket |
| 4. Spring | 8. Backup Ring | 12. Port Block |

[1 to 11: High Pressure Relief Valve Assembly (Parts no. 66204-83601)]

Fig. G-67 Inspecting High Pressure Relief Valve

IMPORTANT:

To maintain set pressure of the relief valve, remove the cap nut (1), measure the height of the set bolt (3) from the port block (12) and record it. Make alignment marks on the set bolt (3) and the port block (12).

To remove the valve seat (10), use the valve seat driver (special tool) shown in Fig. G-68.

Inspect the poppet valve (5) for scratches or damage. Inspect the valve seat (10) hole for clogging. Inspect the O-rings (7) and (9) and backup rings (6) and (8) for damage.

Inspect the spring (4) for breakage or ineffectiveness. If any abnormalities are found, replace the highpressure relief valve assembly. When assembling, replace the new bonded seal (2).

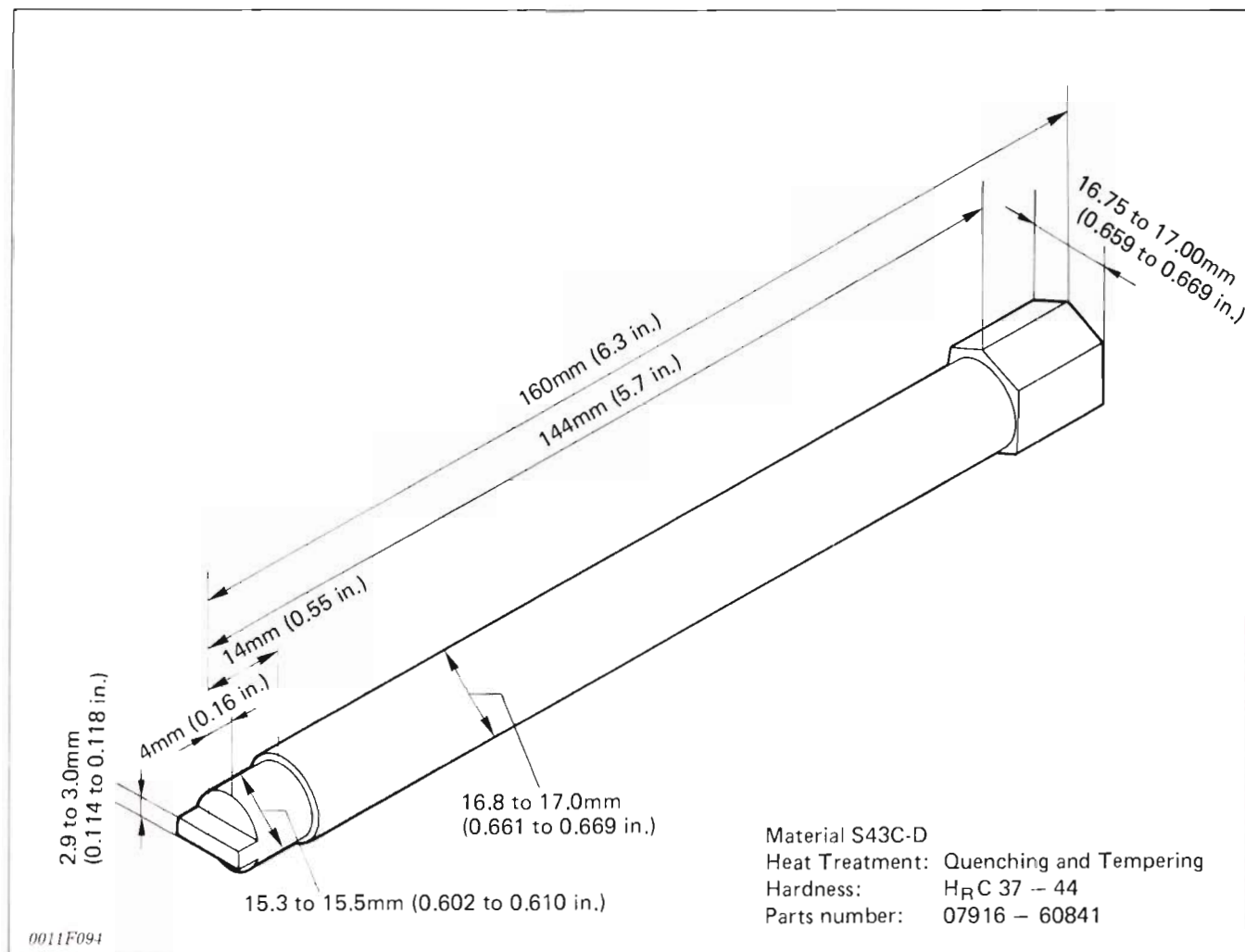
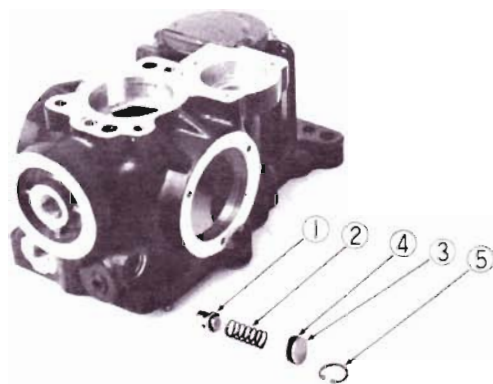


Fig. G-68 Valve Seat Driver (Special Tool)

10. Inspecting Charge Relief Valve

Inspect the valve (1) for scratches. Inspect the spring (2) for breakage or ineffectiveness. Inspect O-ring (4) for damage.

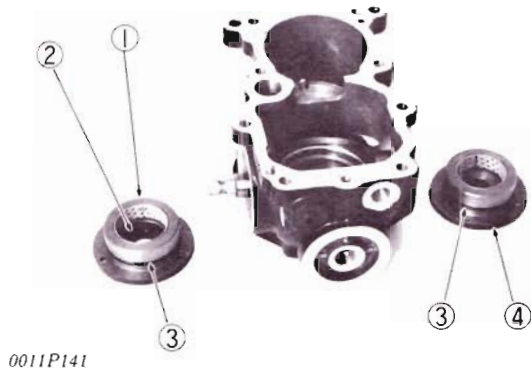


0011P110

- | | | |
|-----------|------------------|----------------------|
| 1. Valve | 3. Spring Holder | 5. Internal Cir-clip |
| 2. Spring | 4. O-ring | |

Fig. G-69 Inspecting Charge Relief Valve

11. Inspecting Trunnion Shaft Covers

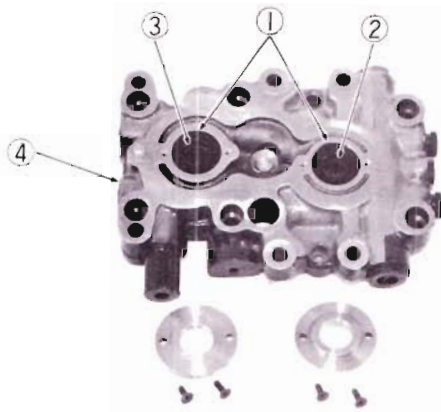


1. Trunnion Shaft Cover 1 (with bushing)
2. Oil Seal
3. O-rings
4. Trunnion Shaft Cover 2 (with bushing)

Fig. G-70 Inspecting Trunnion Shaft Covers

Inspect the trunnion shaft cover (1) and (2) for scratches and heavy wear, and replace if necessary. Inspect the oil seal (2) and O-rings (3) for damage, and replace them if necessary.

12. Inspecting Oil Seals and Bearings in Port Block



1. Oil Seals
2. Needle Bearing (Pump side)
3. Needle Bearing (Motor side)
4. Port Block

Fig. G-71 Inspecting Oil Seals and Bearings in Port Block

Inspect the oil seals (1) for damage. Inspect the needle bearings (2) and (3) for wear and the roller for jolt. If there are any suspicion of bearing defects, they should be replaced: When reassembling, always replace new oil seals for reducing cost and improving performance.

Assembly

After all parts are washed and inspected, apply hydrostatic transmission oil to worked surfaces.

1. Installing Seals and Bearings

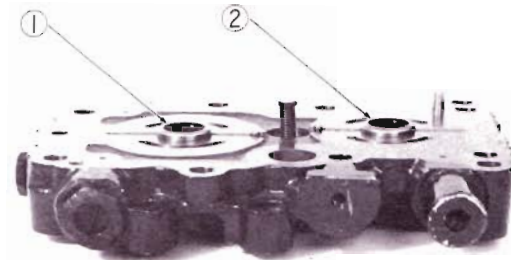


Fig. G-72 Installing Bearings to Port Block

1. Needle Bearing (input shaft)
2. Needle Bearing (output shaft)

Fig. G-72 Installing Bearings to Port Block

Press the new needle bearings (1) and (2) into the port block so that the maked side of the needle bearing is 3.5mm (9/64 in.) above the worked surface.

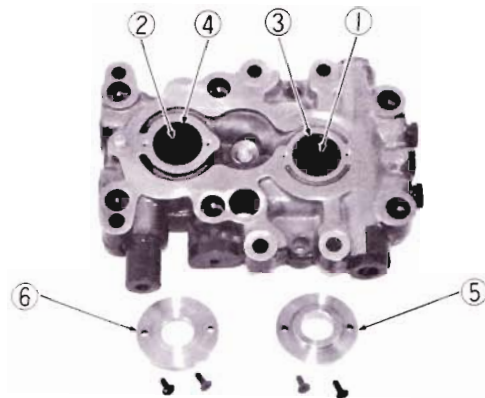


Fig. G-73 Installing Oil Seals to Port Block

3. Oil Seal (input shaft)
4. Oil Seal (output shaft)
5. Flange 1
6. Flange 2

Fig. G-73 Installing Oil Seals to Port Block

Use the flange 1 (5) for pressing the new oil seal (3) so that it is 3mm (1/8 in.) low below the worked surface. Apply a thin coat of grease to section (A) (Fig. G-74).

Press the new oil seal (4) so that it is 0.5 mm (1/64 in.) above the worked surface. Apply a thin coat of grease to section (B) (Fig. G-74).

Mount and fix the flange 2 (6) with two screws. Oil seal (3) and oil seal (4) are identical.

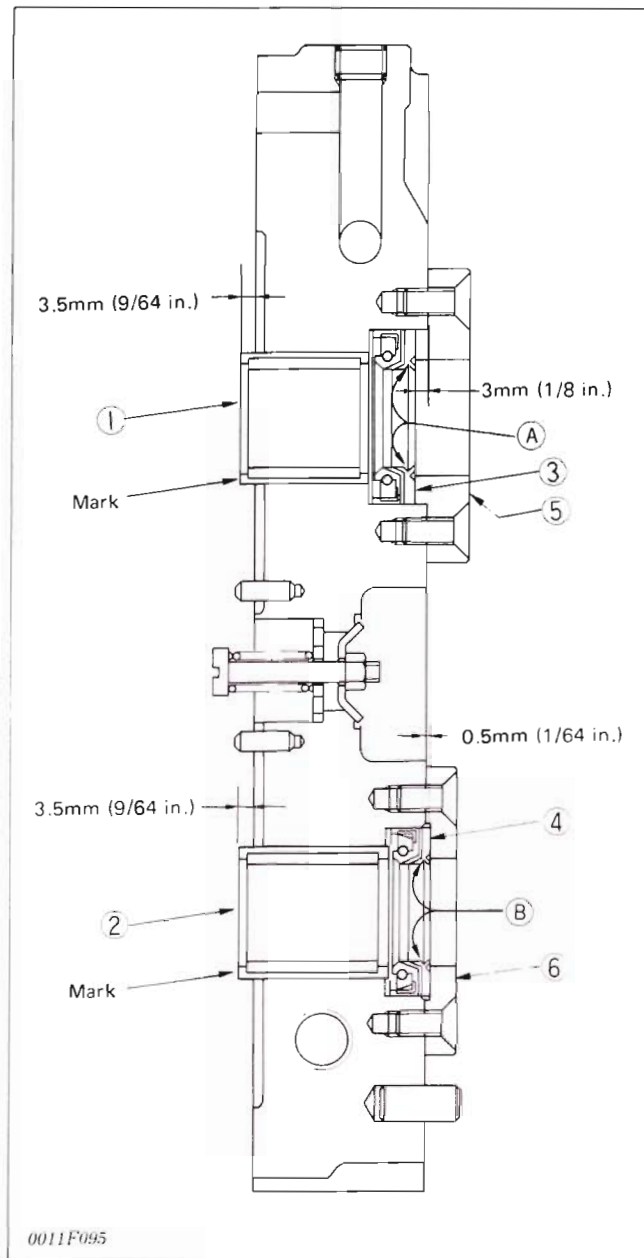
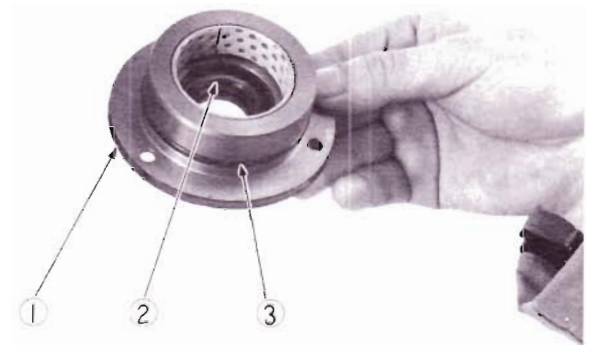
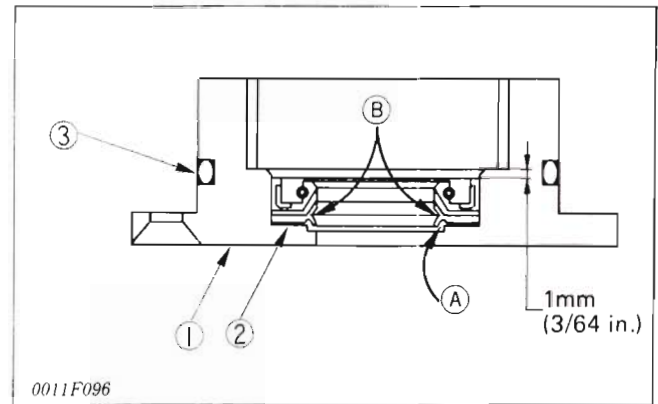


Fig. G-74 Port Block



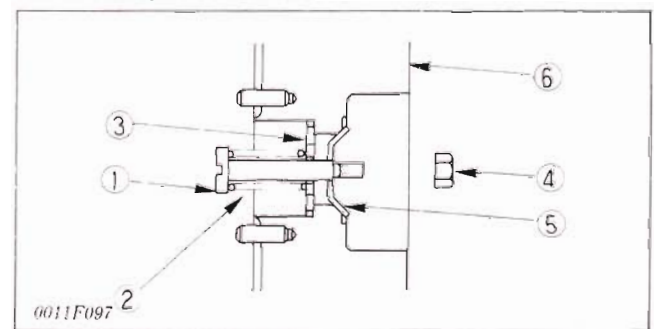
1. Trunnion Shaft Cover 1 2. Oil Seal 3. O-ring

Fig. G-75 Installing Oil Seal into Trunnion Shaft Cover 1.

Press the new oil seal (2) into the trunnion shaft cover 1 (1) so that it is 1mm (3/64 in.) low below the surface (Fig. G-75).

Allow clearance in section (A). Be sure to apply a thin coat of grease to section (B). After applying grease to the O-ring (3), install it in the trunnion shaft cover 1 (1).

2. Installing Case Relief Valve

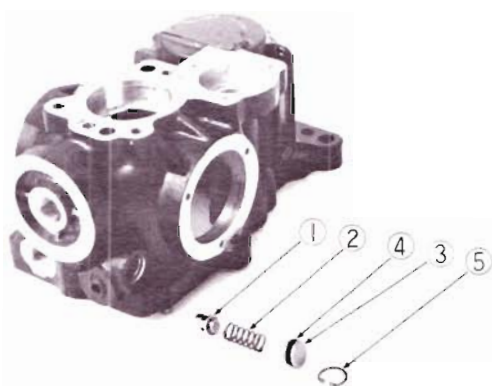


1. Bolt 3. Plate 5. Lock Nut
2. Spring 4. Valve 6. Port Block

Fig. G-76 Installing Case Relief Valve

Tighten the bolt (1) and the lock nut (5) completely. When they are completely tightened, the threaded part of the bolt (1) will extend 3 to 3.5mm (1/8 to 9/64 in.) from the lock nut (5).

3. Installing Charge Relief Valve



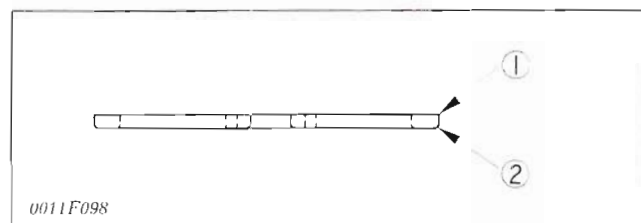
0011P140

- | | | |
|-----------|------------------|----------------------|
| 1. Valve | 3. Spring Holder | 5. Internal Cir-clip |
| 2. Spring | 4. O-ring | |

Fig. G-77 Installing Charge Relief Valve

Place cleaned valve (1), spring (2) and spring holder (3) (with O-ring (4)) in the case and fix them with the internal cir-clip (5).

NOTE: The cir-clip must be positioned with its sharp edge (1) facing outward. (Fig. G-78).

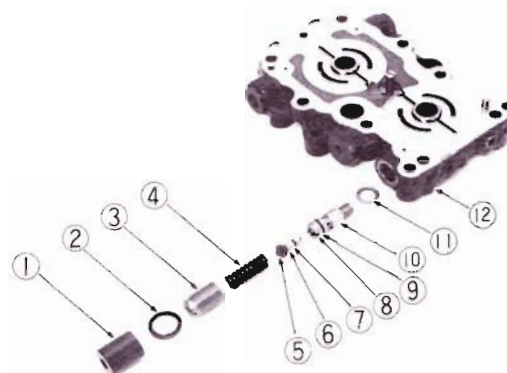


0011F098

- | | |
|---------------|-----------------|
| 1. Sharp Edge | 2. Rounded Edge |
|---------------|-----------------|

Fig. G-78 Installing Direction of Cir-clip

4. Installing High Pressure Relief Valve



0011P139

- | | | |
|----------------|-----------------|---------------------|
| 1. Cap Nut | 5. Poppet Valve | 9. O-ring |
| 2. Bonded Seal | 6. Backup Ring | 10. Valve Seat |
| 3. Set Bolt | 7. O-ring | 11. Gasket (Copper) |
| 4. Spring | 8. Backup Ring | 12. Port Block |

Fig. G-79 Installing High Pressure Relief Valve

Place the back-up rings (6, 8) and the O-rings (7, 9) in the grooves of the poppet valve (5) and valve seat (10). Assemble parts as shown in Fig. G-79.

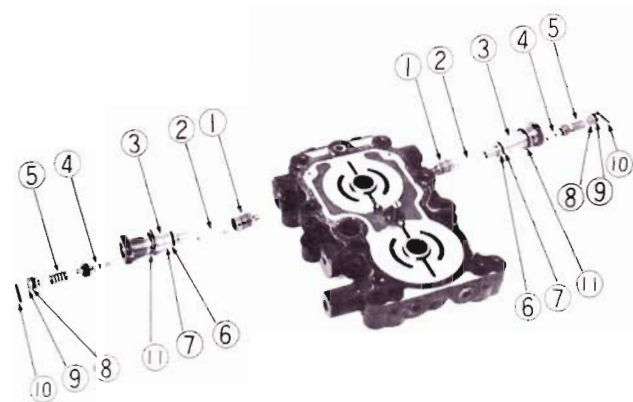
IMPORTANT: The height of the set bolt (3) from the port block (12) must be the same as before disassembly. Align the alignment marks and set. (See "Inspecting High Pressure Relief Valve")

Insert the bonded seal (2) and tighten the cap nut (1) to a torque of 59 to 69 Nm (6 to 7 kgf·m, 43 to 51 ft-lbs).

NOTE: If the height of the set bolt (3) is not known, to set high relief pressure first temporarily tighten the set bolt (3) and assemble the hydrostatic transmission to the tractor.

After completely the tractor assembly, set high relief pressure making use of a pressure gauge by adjusting the set bolt (3). See "Checking High Relief Pressure". Set Pressure: 22.5 to 24.5 MPa (230 to 250 kgf/cm², 3270 to 3560 psi).

5. Installing Neutral and Check Valves



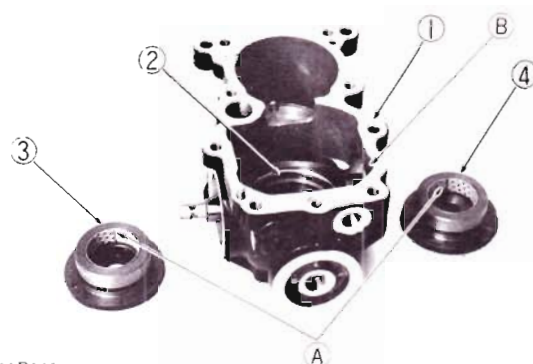
0011P138

- | | | |
|-------------------|-----------------|-----------------|
| 1. Check Valves | 5. Springs | 9. Caps |
| 2. Springs | 6. O-rings | 10. Spring Pins |
| 3. Valve Bodies | 7. Backup Rings | 11. Banded Seal |
| 4. Neutral Valves | 8. O-rings | |

Fig. G-80 Installing Neutral and Check Valves

Clean the parts with clean hydrostatic transmission oil. Insert the O-rings (6) and the back-up rings (7) into the grooves of the valve bodies (3). Insert the O-rings (8) into the grooves of the caps (9). Referring to Fig. G-80, attach the neutral and check valve assembly to the port block. The two assemblies are identical. It is recommend to replace the bonded seal (11) when reassembling.

6. Installing Variable Swashplate and Covers



0011P141

- | | |
|------------------------|---------------------------|
| 1. Case | 3. Trunnion Shaft Cover 1 |
| 2. Variable Swashplate | 4. Trunnion Shaft Cover 2 |

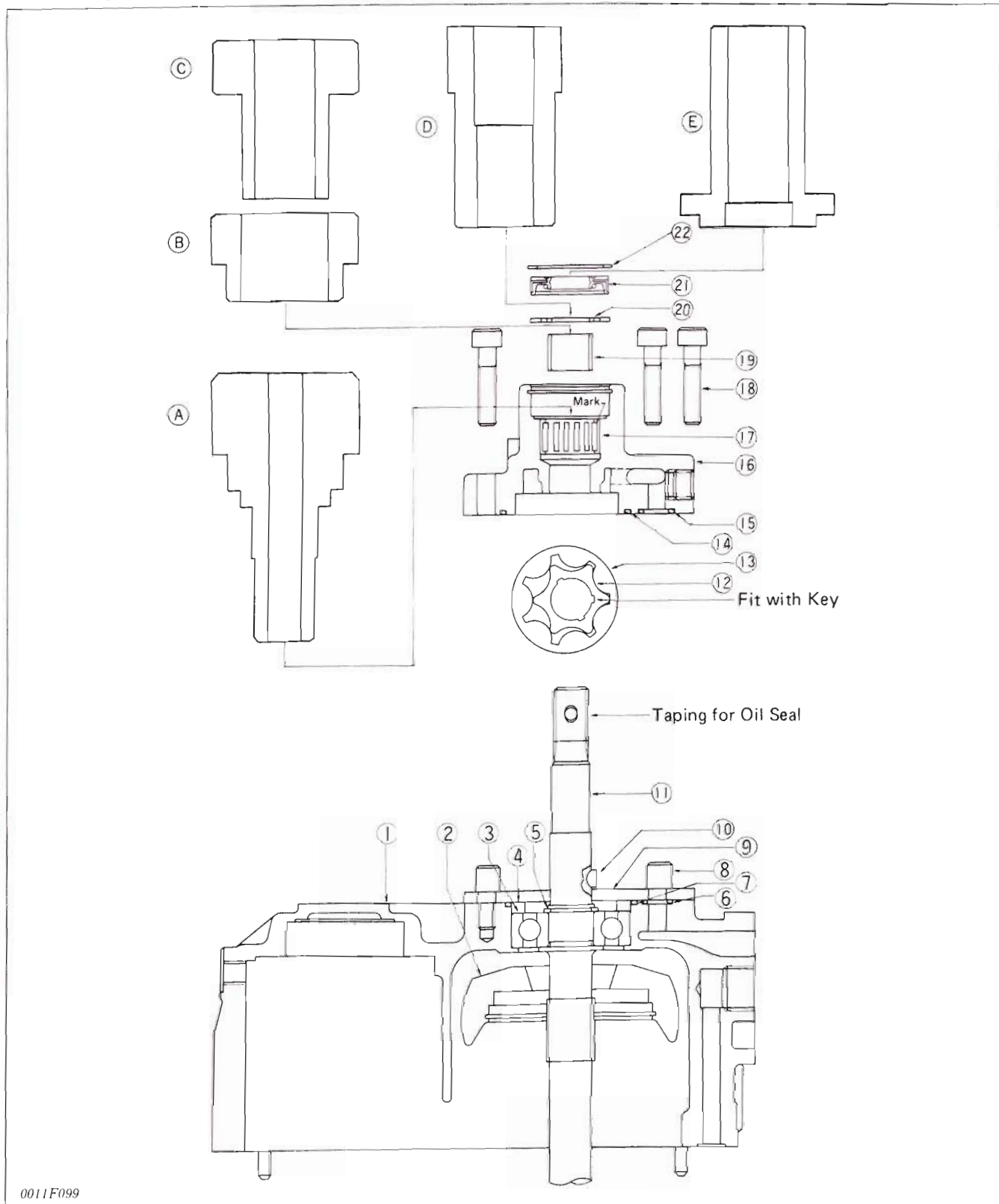
Fig. G-81 Installing Variable Swashplate and Covers

Insert the variable swashplate (2) into the case (1).

IMPORTANT: The trunnion shaft covers 1 (3) and 2 (4) should be assembled so that their bushing seams (A) as shown in Fig. G-81, faces toward the working surface (B) of the case (1).

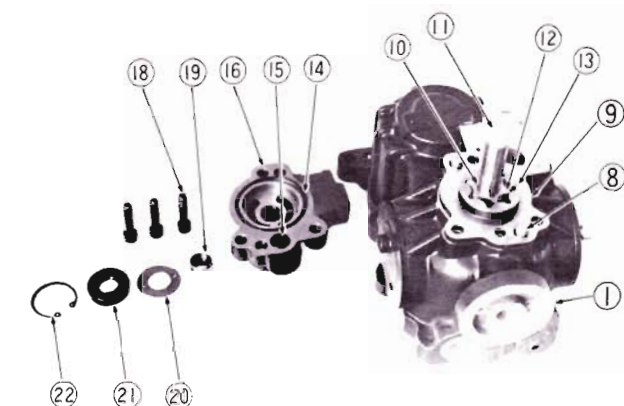
Tighten the trunnion shaft covers 1 (3) and 2 (4) on the case (1) with the three screws.

7. Installing Input Shaft and Charge Pump



- | | | | | |
|------------------------|--------------------------|-----------------|----------------------|-----------------------|
| 1. Case | 6. O-ring | 11. Input Shaft | 16. Charge Pump Case | 21. Oil Seal |
| 2. Variable Swashplate | 7. O-ring | 12. Inner Rotor | 17. Needle Bearing | 22. Internal Cir-clip |
| 3. Ball Bearing | 8. Knock Pins (2 pieces) | 13. Outer Rotor | 18. Bolts (3 pieces) | |
| 4. Collar | 9. Plate | 14. O-ring | 19. Inner Race | |
| 5. External Cir-clip | 10. Woodruff Key | 15. O-ring | 20. Plate | |

Fig. G-82 Installing Input Shaft and Charge Pump (1/2)



0011P145

Fig. G-83 Installing Input Shaft and Charge Pump (2/2)

After placing the variable swashplate (2) in a horizontal position, insert the input shaft (11) with ball bearing (3) into the case (1). Place the collar (4) on the ball bearing (3). Apply grease to the O-rings (6) and (7) and then insert them. Put the knock pin (8) in the case (1). Polish the worked surface of the plate (9) with a fine oil stone, align it with the knock pin and assemble. Polish the woodruff key (10) with a fine oil stone and insert it into the key groove of the input shaft (11).

IMPORTANT: Be sure to fit the key (10) into the key groove (as shown in Fig. G-82) of the inner rotor (12).

Align and assemble the outer rotor (13) and the inner rotor (12).

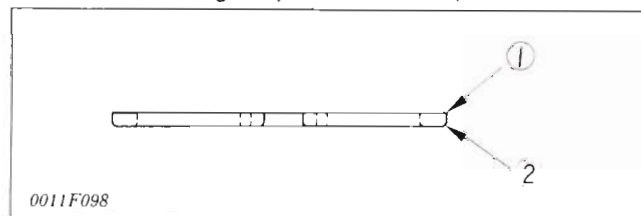
Press the needle bearing (17) into the charge pump case (16) with the special tool (A) so that the mark is on the upper side.

Apply grease to the O-rings (14) and (15) and insert them into the grooves of the charge pump case (16). Then put them on the trochoid rotor assembly (12) (13). Tighten bolts (18) lightly to charge pump case (16).

Press the inner race (19) onto input shaft (11) with special tools (B) (C). Press the plate (20) with special tool (D). After taping on the spline of input shaft (11), press the oil seal (21) with the special tool (E). The depth from the top of the charge pump case (16) should be 4mm (5/32 in.).

Attach the internal cir-clip (22) with the sharp edge of its circumference facing upwards as shown in Fig. G-84.

Tighten the three bolts (18) to torque of 11 to 14 Nm (1.1 to 1.4kgf·m, 8 to 10 ft-lbs).



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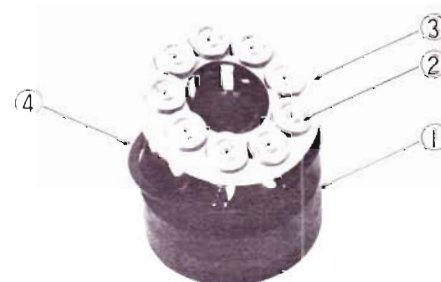
1. Sharp Edge

2. Rounded Edge

Fig. G-84 Installing Direction of Cir-clip

Make the special tools shown in Fig. G-87.

8. Assembling Cylinder Blocks and Pistons



0011P146

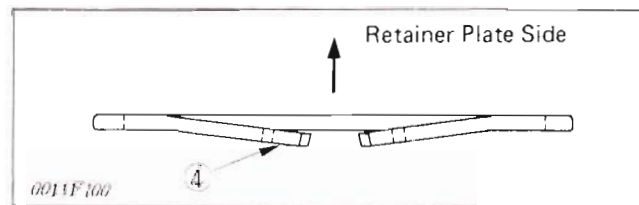
1. Cylinder Blocks

3. Retainer Plates

2. Pistons

4. Internal Cir-clip

Fig. G-85 Assembly of Cylinder Blocks and Pistons



0011F100

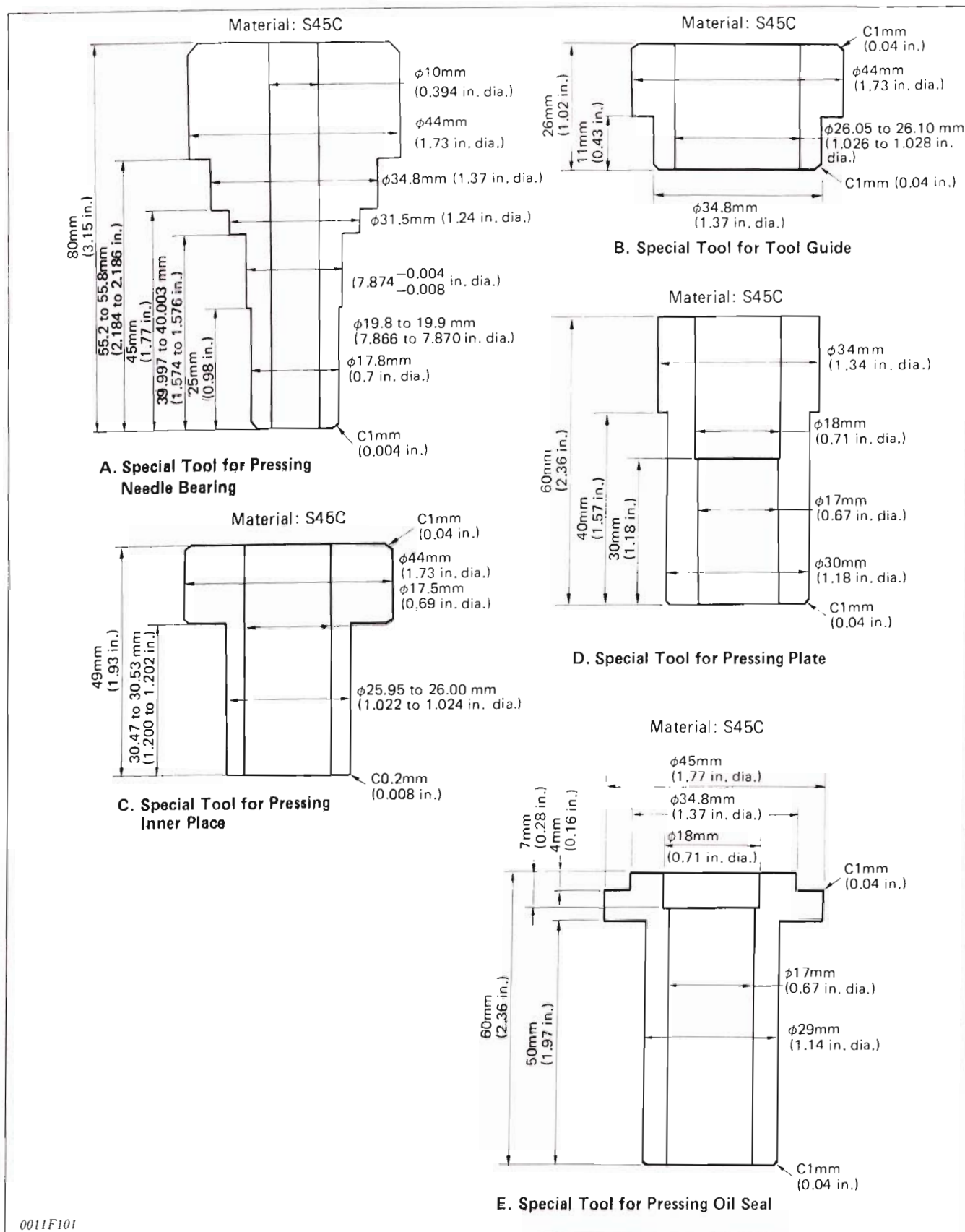
Fig. G-86 Direction of Cir-clip

Place the internal cir-clip on the cylinder block (1) so that the unwarp side of the cir-clip faces toward the retainer plate (3), as shown in Fig. G-86. Insert the pistons lubricated with clean hydrostatic transmission oil into the retainer plate, and then attach the entire unit to the cylinder block as shown in Fig. G-85.

There is no special piston-to-bore position. Each piston should move in the bores freely.

IMPORTANT: Do not exchange the cylinder block pistons on the pump side with those on the motor side. Pistons and cylinder blocks are matched.

Making Special Tools for Charge Pump



0011F101

Fig. G-87 Special Tool Specifications

9. Installing Cylinder Block Assembly (Pump)

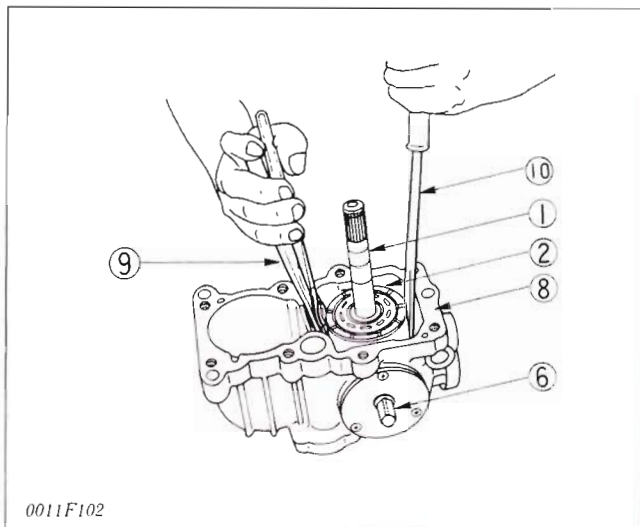
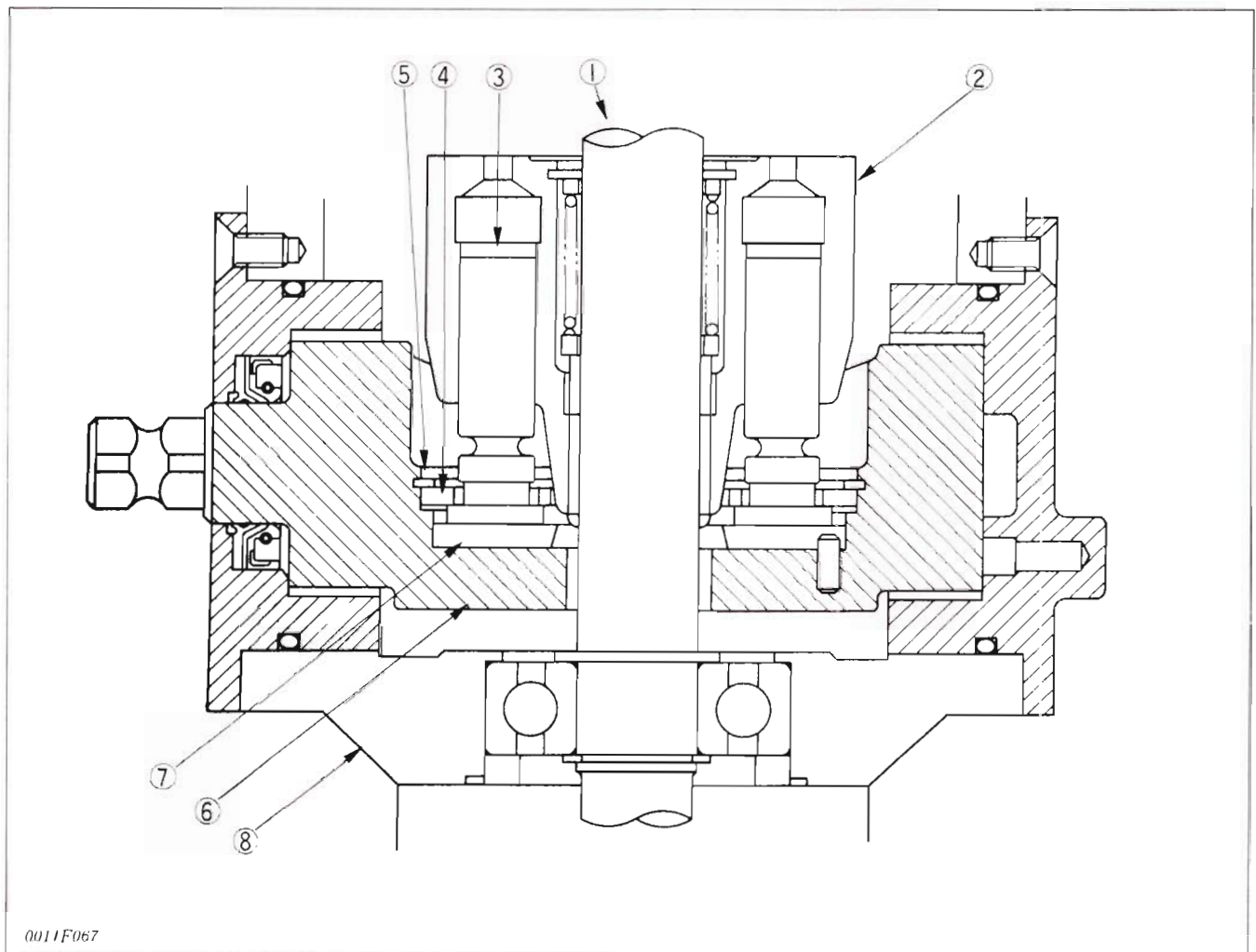


Fig. G-88 Installing Cylinder Block Assembly (Pump)

Apply clean hydrostatic transmission oil to the slipper of pistons (3) and the thrust plate (7), then insert the cylinder block assemblies (2, 3, 4, 5) into the input shaft (1).

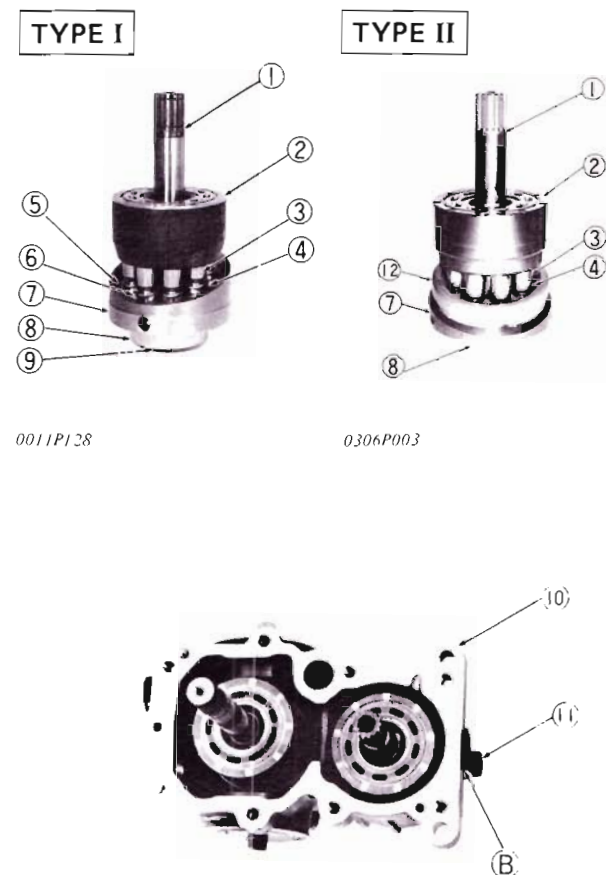
Use a screwdriver (10) to press down the internal cir-clip (5) and use snap ring pliers (9) to place the internal cir-clip (5) into the swashplate (6) groove. For easier insertion of the cir-clip into the groove, squeeze with snap ring pliers and start insertion from the side opposite to the opening.



- | | | | | |
|--------------------------|-------------------|------------------------|-----------------|-----------------------|
| 1. Input Shaft | 3. Pistons (Pump) | 5. Internal Cir-clip | 7. Thrust Plate | 9. Snap Ring Pliers |
| 2. Cylinder Block (Pump) | 4. Retainer Plate | 6. Variable Swashplate | 8. Case | 10. Minus Screwdriver |

Fig. G-89 Installing Cylinder Block Assembly (Pump)

10. Installing Cylinder Block Assembly (Motor)



0011P128

0306P003

0011P147

- | | |
|------------------------------------|------------------------------------|
| 1. Output Shaft | 7. Fixed Swashplate |
| 2. Cylinder Block (Motor) | 8. Ball Bearing |
| 3. Pistons (Motor) | 9. External Cir-clip (TYPE I only) |
| 4. Retainer Plate | 10. Case |
| 5. Internal Cir-clip (TYPE I only) | 11. Stop Bolt (TYPE I only) |
| 6. Thrust Plate (TYPE I only) | 12. Retainer Holder (TYPE II only) |

Fig. G-90 Installing Cylinder Block Assembly (Motor)

■ TYPE I

Place the thrust plate (6) into the fixed swashplate (7) and place on them the previously assembled cylinder block (2), pistons (3), and internal cir-clip (5).

Insert the internal cir-clip (5) into the groove of the fixed swashplate (7), and fix it firmly. Place the entire unit on the output shaft (1) as shown in Fig. G-90.

Tap and insert the cylinder block assembly [(1) ~ (9)] into the case (10) with a plastic hammer so that the hole (A) aligns with hole (B).

Insert a screwdriver through hole (B) into hole (A) and move it to the right and left to check that the output shaft (1) rotates properly. Insert the stop bolt (11) into holes (A) and (B) and tighten it to a torque of 16 to 21 Nm (1.6 to 2.1 kgf-m, 12 to 15 ft-lbs).

Apply new hydrostatic transmission oil to the polished surfaces of the cylinder blocks.

■ TYPE II

Insert the assembly [piston (3), retainer holder (12) and fixed swashplate (7)] into the cylinder block (2).

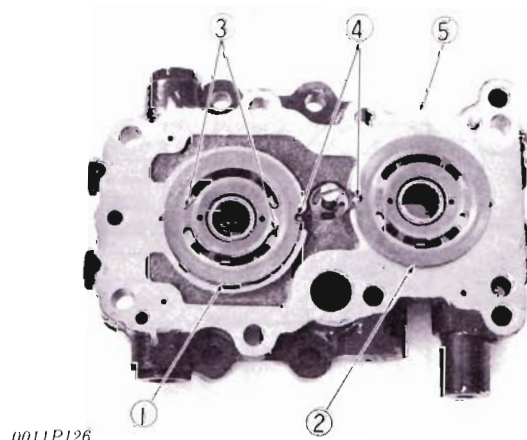
Place the entire unit on the output shaft (1) as shown in Fig. G-90.

Tap and insert the cylinder block assembly [output shaft (1), cylinder block (2), pistons (3), fixed swashplate (7) and retainer holder (12)] into the case (10) with a plastic hammer.

NOTE:

When installing the cylinder block assembly, align the hole of the fixed swashplate (7) to the dowel pin of the case (10).

11. Installing Valve Plates



0011P126

- | | |
|------------------------|----------------|
| 1. Valve Plate (Pump) | 4. Anchor Pins |
| 2. Valve Plate (Motor) | 5. Port Block |
| 3. Two Notches | |

Fig. G-91 Installing Valve Plates

Install the valve plate (pump) (1) with two notches (3) to the port block (5). Next install the no-notch valve plate (motor) (2) as shown in Fig. G-91.

Then check that the valve plates (1) and (2) are tightly fitted by trying to move them by hand.

12. Installing Port Block

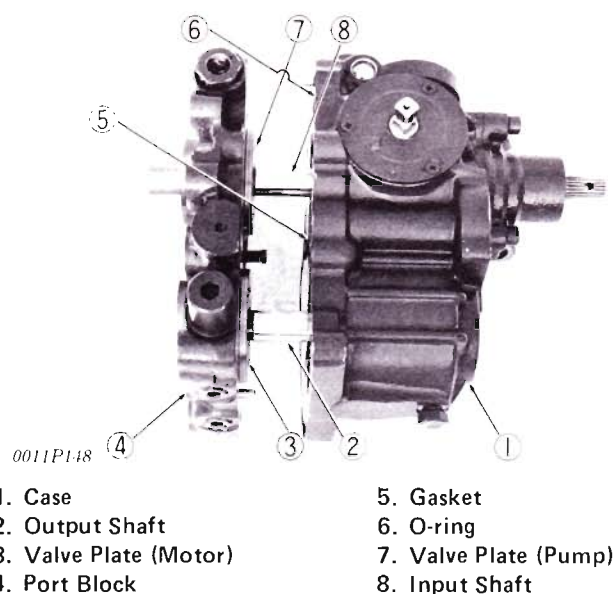


Fig. G-92 Installing Port Block

Place the gasket (5) on the case (1) with O-ring (6). Wind one turn of thin tape over the spline sections of the input shaft (8) and the output shaft (2) to protect the oil seals from damage. Insert the port block (4) into the input shaft (8) and output shaft (2) as shown in Fig. G-92.

Check that the valve plates (3), (7) are properly positioned. Check that the port block (4) floats over the case (1) and that it will float up when a hand is removed after pressing it.

Tighten the two short bolts and six long bolts to fix the port block (4) to the case (1).

Tightening Torque 23 to 27 Nm (2.3 to 2.8 kgf-m, 17 to 20ft-lbs).

Check that the input shaft (8) and output shaft (2) rotate smoothly.

13. Installing Gears and Bearing

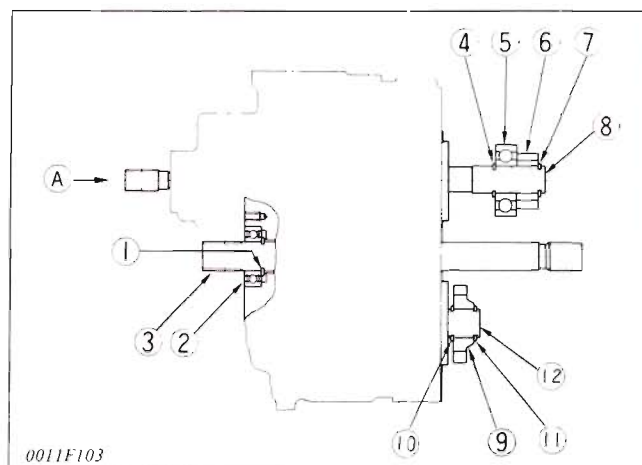
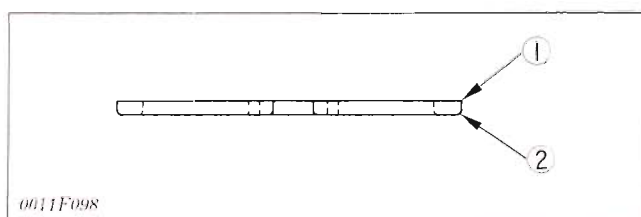


Fig. G-93 Installing Gears and Bearing

Assemble the gears and bearings to the hydrostatic transmission.

NOTE: Place cir-clip so that its sharp edge (1) (Fig. G-94) faces the direction that can not be removed. The sharp edge (1) of the external cir-clips (4), (10) must face to the left. And that of cir-clips (1), (7), (11) must face to the right.

IMPORTANT: When carrying or assembling the hydrostatic transmission, do not exert a force in direction (A) to the input shaft (8) (Fig. G-93). Never drop it or the cir-clip might fall out.



1. Sharp Edge

2. Rounded Edge

Fig. G-94 Installing Direction of Cir-clip

Group 4

Hydrostatic Control Linkage

Structure and Function

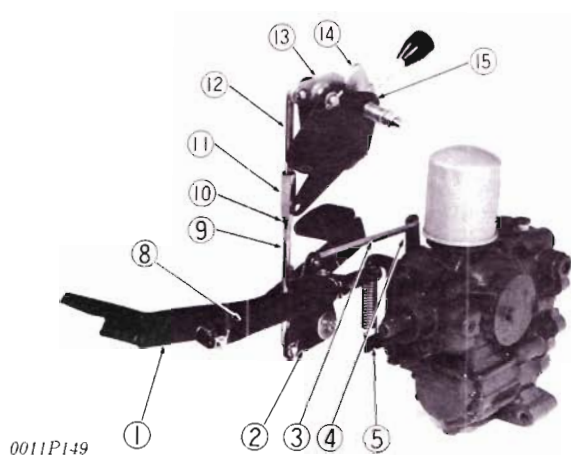


Fig. G-95

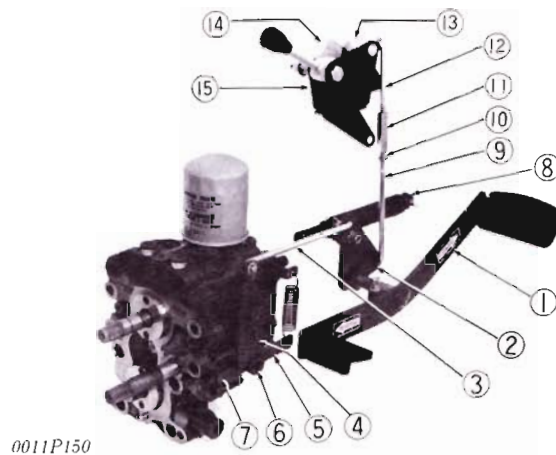
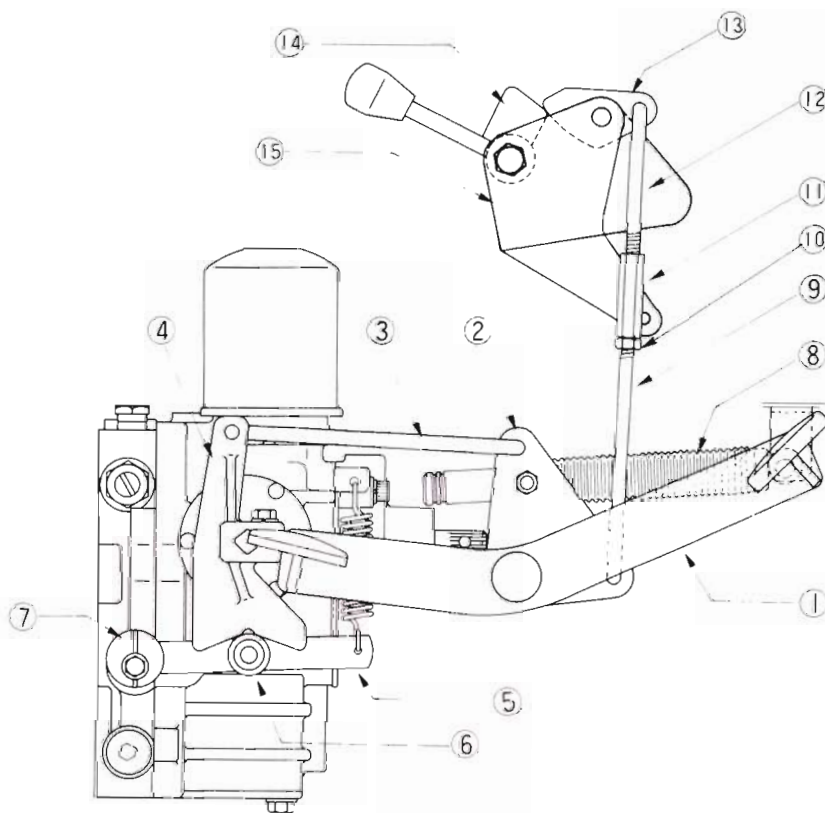


Fig. G-96



0011F104

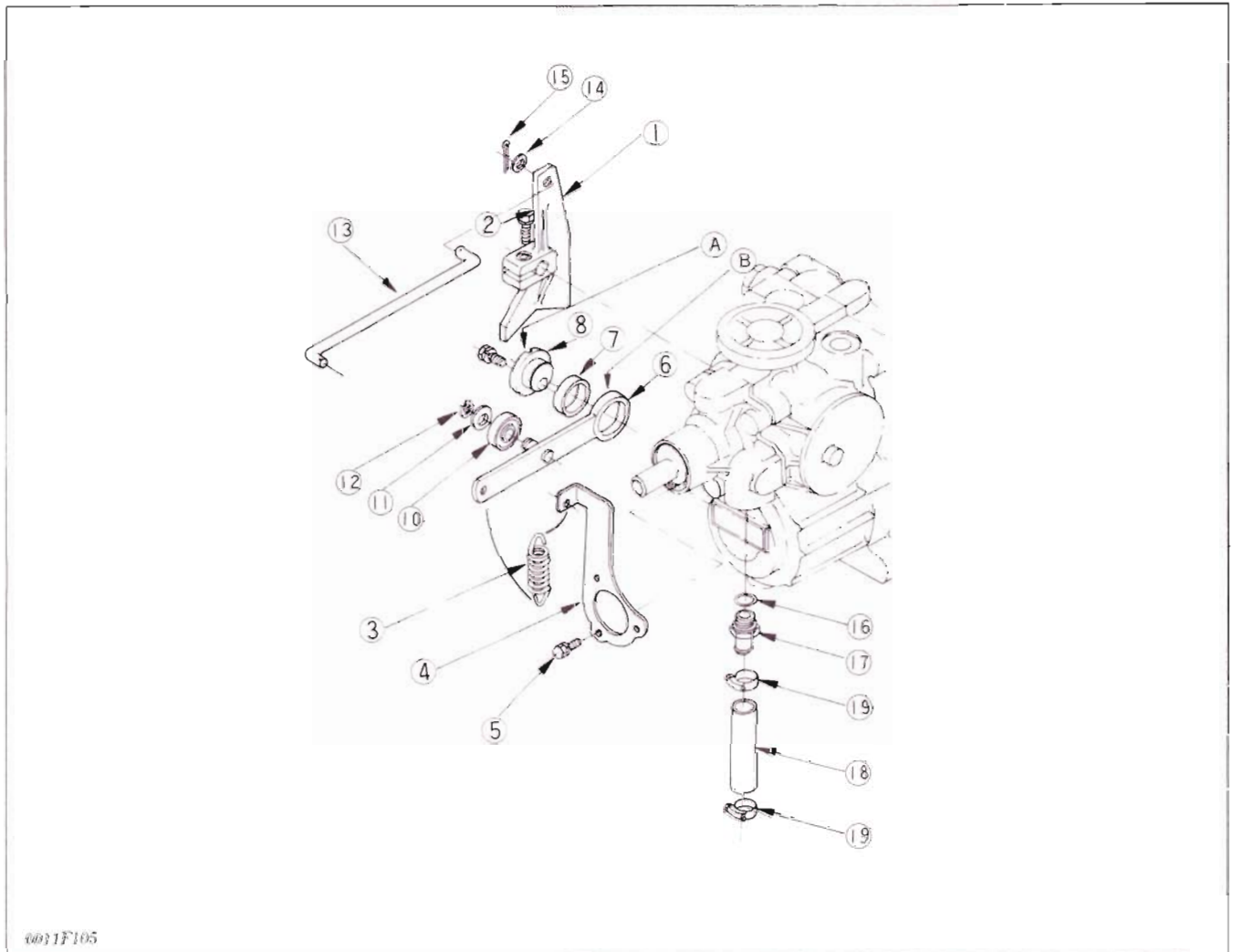
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|------------------------|-----------------------|---------------------|----------------|-------------------|
| 1. Speed Control Pedal | 4. Neutral Holder | 7. Neutral Adjuster | 10. Locknut | 13. Cam |
| 2. Rod Guide | 5. Neutral Holder Arm | 8. Damper | 11. Turnbuckle | 14. Lever |
| 3. Speed Control Rod | 6. Needle Bearing | 9. Lower Rod | 12. Upper Rod | 15. Lever Support |
- {(9) – (15) Speed Set Device}

Fig. G-97 Hydrostatic Control Linkage

The hydrostatic control linkage is constructed to assure smooth hydrostatic transmission operation. The damper (8) is provided for safety in the case of sudden operation and changeover from forward to reverse. When the front side of the speed control pedal (1) is stepped on, forward operation is obtained. When the rear side of the speed control pedal is stepped on, reverse operation is obtained.

The needle bearing (6) attached to the neutral holder arm (5) is pressed on the cam section of the neutral holder (4), and neutral holder (4) is returned to the previously set neutral position when the speed control pedal is released. The speed set device [(9) to (15)] is to set a certain forward speed. It is used, for example, to turn by using the brake.

Assembling Neutral Holder and Hose



1. Neutral Holder	5. Bolts (3 pieces)	9. Bolt	13. Speed Control Rod	17. Joint
2. Bolt	6. Neutral Holder Arm	10. Ball Bearing (6000 ZZ)	14. Plain Washer	18. Hose, 27 x 19
3. Spring	7. Bushing	11. Plain Washer	15. Split Pin	19. Band, 27 (2 pieces)
4. Spring Holder	8. Neutral Adjuster	12. External Cir-clip	16. O-ring	

Fig. G-98 Assembling Neutral Holder and Hose

NOTE: When inserting the neutral holder arm (6) into the bushing (7), apply grease inside the bushing.

Insert the bushing (7) and neutral adjuster (8) into the neutral holder arm (6) and lightly bolt them to the hydrostatic transmission.

Securely insert and bolt the neutral holder (1) into the trunnion shaft section.

Assemble the spring holder (4) with three bolts and hook the spring to the spring holder (4) and neutral holder arm (6).

IMPORTANT: When tightening the bolt (9), in order to set neutral position align the alignment marks precisely on the neutral holder arm (6) (B) and the neutral adjuster (8) (A).

Tightening torque: 19 to 32 Nm (1.9 to 3.3 kgf·m, 14 to 24 ft-lbs).

When alignment marks isn't known, refer to "Adjusting Neutral Position."

Insert the speed control rod (13) into the neutral holder (1), use a plain washer (14), insert and bend the split pin (15).

Assemble the O-ring (16) and joint (17) into the inlet port of the charge pump in hydrostatic transmission, and place the hose (18) and band (19) over the joint.

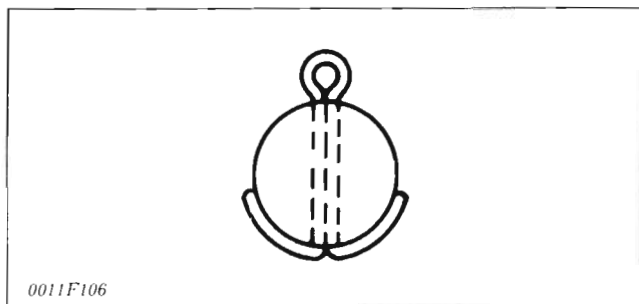
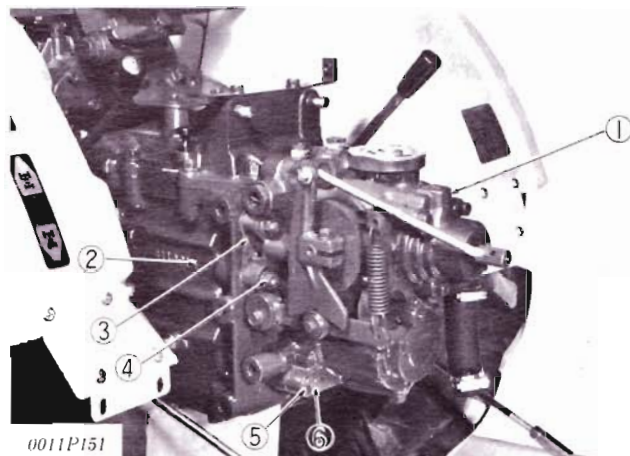


Fig. G-99 Bending to anchor type

Joint to Transmission Case



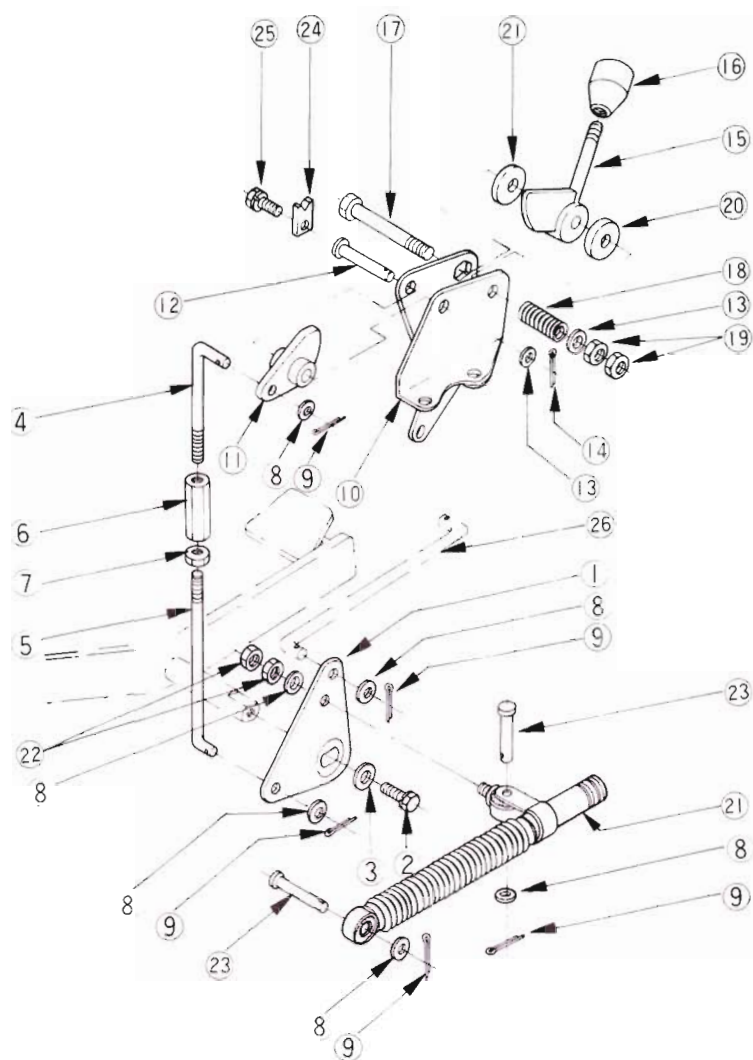
- | | |
|-----------------------------|------------------------------|
| 1. Hydrostatic Transmission | 4. Nuts (4 pieces) |
| 2. Transmission Case | 5. Spring Washers (6 pieces) |
| 3. Gasket | 6. Bolts (2 pieces) |

Fig. G-100 Join to Transmission Case

With the gasket (3), assemble the hydrostatic transmission (1) to the transmission case (2).

Tightening torque: 48 to 56 Nm (4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)

Assembling Speed Set Device and Damper



0011F107

1. Rod Guide
2. Bolt
3. Plain Washer
4. Upper Rod
5. Lower Rod
6. Turnbuckle

7. Nut
8. Plain Washers
9. Split Pins
10. Lever Support
11. Cam
12. Joint Pin

13. Plain Washers
14. Split Pin
15. Lever
16. Grip
17. Bolt
18. Spring

19. Nuts
20. Plates
21. Damper
22. Nuts
23. Joint Pins
24. Retainer Plate

25. Bolt
26. Speed Control Rod

Fig. G-101 Assembling Speed Set Device and Damper

Adjusting Neutral Position

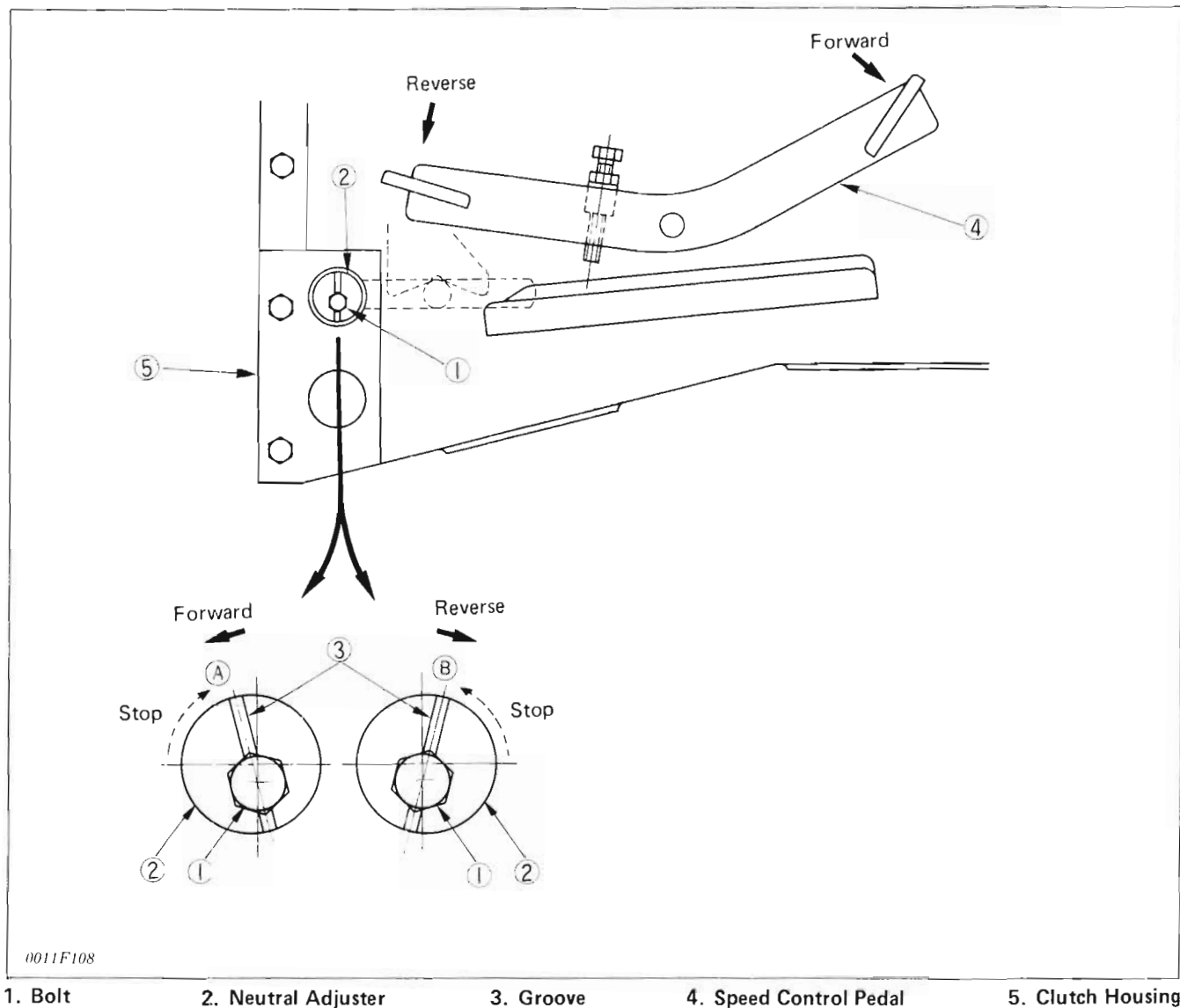


Fig. G-102 Adjusting Neutral Position (1/2)

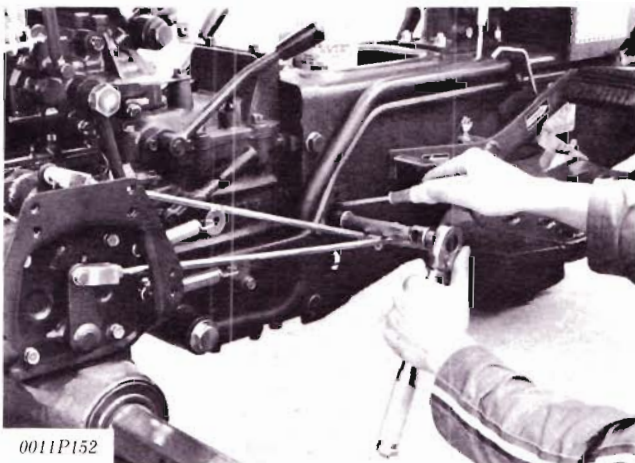


Fig. G-103 Adjusting Neutral Position (2/2)

PRECAUTION: Set the front wheel drive lever to the 2-wheel drive position and lift the rear wheels. Engine speed is low idling.

IMPORTANT: Be sure to put the long groove side (3) upward same as Fig. G-103.

Loosen the bolt (1) and turn the groove (3) counter-clockwise with a screw driver. When the rear wheels turn forward, return the groove (3) clockwise until the rear wheels completely stop. Mark the position of the groove (3) on the clutch housing (5) where the rear wheels stop as (A).

Then turn the groove (3) clockwise further to allow the rear wheels to turn in the reverse direction. And return the groove (3) counterclockwise until the rear wheels completely stop. Mark the position of the groove (3) on the clutch housing (5) where the rear wheels stop as (B).

Set the neutral adjuster where the groove (3) is right in the center between (A) and (B), and tighten the bolt (1).

Tightening torque: 19 to 32 Nm (1.9 to 3.3 kgf·m, 14 to 24 ft-lbs).

Lower down the rear wheels and make sure that the wheels stop automatically after depressing the forward pedal and reverse pedal. If the wheels turn in the forward direction, turn the groove (3) clockwise a little. If the wheels turn in the reverse direction, turn the groove (3) counterclockwise a little.

Adjusting Speed Set Device

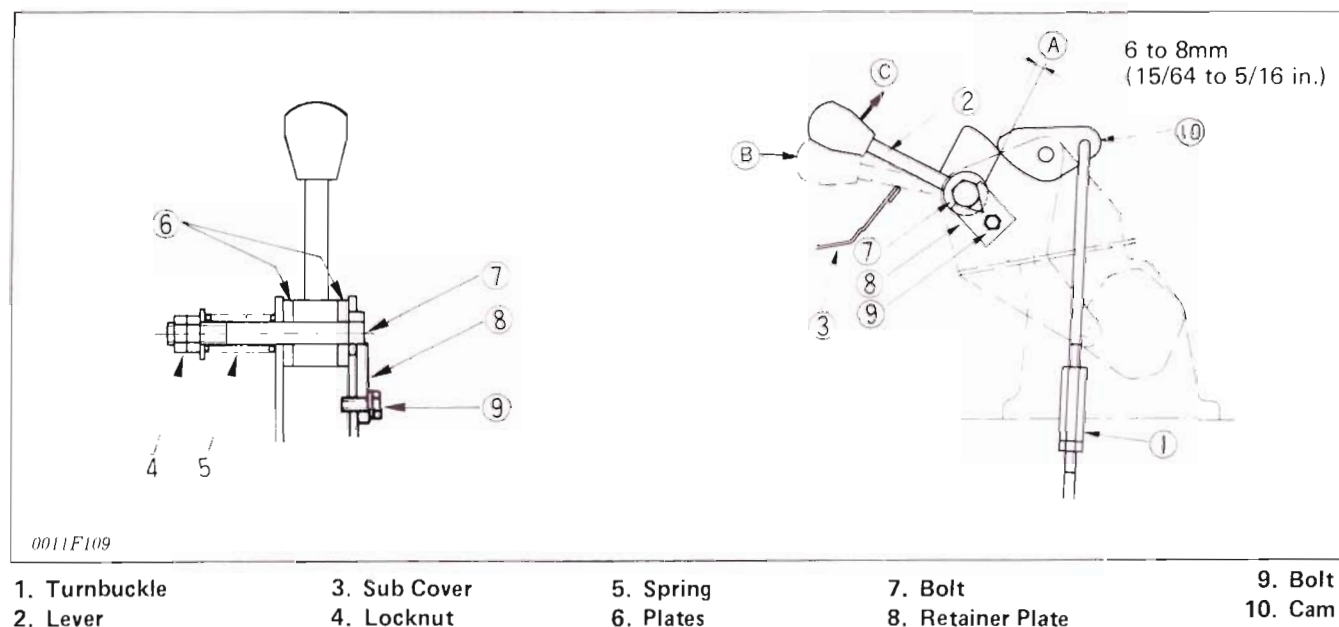


Fig. G-104 Adjusting Speed Set Device

Adjust the turnbuckle (1) so that (A) lies between 6 and 8mm (15/64 and 5/16 in.).

Loosen the locknut (4), adjust the spring (5) length so that the lever (2) operating force in the direction of (C) is 25 to 30N (2.5 to 3.0 kgf, 5.5 to 6.6 lbs.), and retighten the locknut (4).

NOTE: Don't allow oil, water or dust to stick to the plates (6) surface.

If there is excessive play in the lever (2), loosen the bolt (9), and adjust retainer plate (8) so that the play reduces until the head of the bolt (7) doesn't turn when the lever (2) is operated.

After assembling the sub cover (3), put the lever (2) at position (B) (shown in Fig. G-104) and step on the speed control pedal (1) reverse side to make sure that the cam (10) does not contact the lever (2).

Group 5

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Transmission (Gear)

Gear backlash

(R.V.)	0.1 to 0.2 mm	(0.004 to 0.008 in.)
(A.L.)	0.4 mm	(0.016 in.)

Spline backlash between gear and shaft

(R.V.)	0.030 to 0.078 mm	(0.0012 to 0.0031 in.)
(A.L.)	0.2 mm	(0.008 in.)

Shift fork width

(R.V.)	6.8 to 6.9 mm	(0.268 to 0.272 in.)
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Shift gear groove width

(R.V.)	7.0 to 7.1 mm	(0.276 to 0.280 in.)
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Shift fork side clearance in shifter groove

(R.V.)	0.1 to 0.3 mm	(0.004 to 0.012 in.)
(A.L.)	0.6 mm	(0.024 in.)

Shift fork spring free length

(R.V.)	22 mm	(0.866 in.)
(A.L.)	20 mm	(0.787 in.)

Transmission case to hydrostatic transmission

case tightening torque 48 to 56 Nm (4.9 to 5.7 kgf-m, 35 to 41 ft-lbs)

Transmission case to clutch housing

tightening torque 61 to 107 Nm (6.2 to 10.9 kgf-m, 45 to 79 ft-lbs)

Transmission case to differential gear

case tightening torque (M8) 19 to 32 Nm (1.9 to 3.3 kgf-m, 14 to 24 ft-lbs)

(M10) 25 to 39 Nm (2.5 to 4.0 kgf-m, 18 to 29 ft-lbs)

Mid PTO case to transmission case

tightening torque (M10) 48 to 56 Nm (4.9 to 5.7 kgf-m, 35 to 41 ft-lbs)

Hydrostatic Transmission

Model HVFD-16C4-M

Maker Kayaba Industry Co. Ltd.

Clearance between piston and cylinder

block bore

(R.V.)	0.02 mm	(0.0008 in.)
(A.L.)	0.04 mm	(0.0016 in.)

Piston slipper thickness

(R.V.)	3.00 mm	(0.118 in.)
(A.L.)	2.90 mm	(0.114 in.)

High pressure relief valve set bolt	1 turn	7.6 MPa (76.6 kgf/cm ² , 1102 psi)
	1 mm (0.04 in.) . . .	4.14 MPa (42.2 kgf/cm ² , 600 psi)
High pressure relief valve spring		
Free length(R.V.)	40 mm	(1.575 in.)
Compressed length and load(R.V.)	(1) 34.0 mm at 612 N (62.4 kgf) (1.339 in. at 137.6 lbs.) (2) 32.5 mm at 764 N (78.0 kgf) (1.280 in. at 172.0 lbs.) [Compressed length and load (A.L.) Within -15% load at each set length, Tilt (A.L.) 0.0174 rad. (1°) The following is all same]	
Charge relief valve spring		
Free length(R.V.)	23 mm	(0.906 in.)
Compressed length and load(R.V.)	(1) 17 mm at 23.2 N (2.37 kgf) (0.669 in. at 5.22 lbs.) (2) 13 mm at 38.7 N (3.95 kgf) (0.512 in. at 8.71 lbs.)	
Check valve springs		
Free length(R.V.)	30.06 mm	(1.183 in.)
Compressed length and load(R.V.)	(1) 21 mm at 1.47 N (0.150 kgf) (0.827 in. at 0.331 lbs.) (2) 17 mm at 2.13 N (0.217 kgf) (0.669 in. at 0.478 lbs.)	
Neutral valve springs		
Free length(R.V.)	15.93 mm	(0.627 in.)
Compressed length and load(R.V.)	(1) 13.5 mm at 16.7 N (1.7 kgf) (0.531 in. at 3.75 lbs.) (2) 9.5 mm at 44.1 N (4.5 kgf) (0.374 in. at 9.92 lbs.)	
Case relief valve springs		
Free length(R.V.)	25.95 mm	(1.022 in.)
Compressed length and load(R.V.)	(1) 20 mm at 29.4 N (3.00 kgf) (0.787 in. at 6.61 lbs.) (2) 17.5 mm at 41.7 N (4.26 kgf) (0.689 in. at 9.39 lbs.)	
Spring in cylinder block		
Free length(R.V.)	40.16 mm	(1.581 in.)
Compressed length and load(R.V.)	23.3 mm at 186 N (19 kgf) (0.917 in. at 41.9 lbs.)	

High relief pressure

(R.V.)	22.5 to 24.5 MPa	(230 to 250 kgf/cm ² , 3270 to 3560 psi)
(A.L.)	min. to max.	
	21.6 to 25.5 MPa	(220 to 260 kgf/cm ² , 3130 to 3700 psi)
Engine	2800 to 3000 rpm	
Trunnion angle	0.070 to 0.087 rad. (4 to 5°)	
	(Depress speed control pedal approx. 10 mm (25/64 in.))	
Oil temp.	25 to 50°C (77 to 122°F)	

[Charge pressure] — [Case pressure]

Oil temperature 25°C (77°F)

(R.V.)	440 to 580 kPa	(4.5 to 5.9 kgf/cm ² , 64 to 84 psi)
(A.L.)	min. to max.	
	410 to 610 kPa	(4.2 to 6.2 kgf/cm ² , 60 to 88 psi)
	[Engine 2800 to 3000 rpm]	

Oil temperature 50°C (122°F)

(R.V.)	420 to 560 kPa	(4.3 to 5.7 kgf/cm ² , 61 to 81 psi)
(A.L.)	min. to max.	
	390 to 590 kPa	(4.0 to 6.0 kgf/cm ² , 57 to 85 psi)
	[Engine 2800 to 3000 rpm]	

Case relief pressure

(R.V.)	170 to 230 kPa	(1.7 to 2.3 kgf/cm ² , 24 to 32 psi)
(A.L.)	min. to max.	
	150 to 250 kPa	(1.5 to 2.5 kgf/cm ² , 21 to 36 psi)
Engine	2800 to 3000 rpm	
Oil temp.	25 to 50°C (77 to 122°F)	
	All oil is relieved. (Clogged TI port)	

Vacuum

Oil temperature 30°C (86°F)

(R.V.)	120 mmHg	(4.7 in.Hg)
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Oil temperature 50°C (122°F)

(R.V.)	60 mmHg	(2.4 in.Hg)
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Oil temperature 80°C (176°F)

(R.V.)	35 mmHg	(1.4 in.Hg)
(A.L.)	max. 220 mmHg	(8.7 in.Hg)
	[Engine 2800 to 3000 rpm]	

Tightening torque

Port block to case	23 to 27 Nm	(2.3 to 2.8 kgf·m, 17 to 20 ft-lbs)
Charge pump case	11 to 14 Nm	(1.1 to 1.4 kgf·m, 8 to 10 ft-lbs)
Fixed swashplate stop bolt	16 to 21 Nm	(1.6 to 2.1 kgf·m, 12 to 15 ft-lbs)
Trunnion shaft cover 1, 2	2 to 2.5 Nm	(0.20 to 0.26 kgf·m, 1.4 to 1.9 ft-lbs)
P3 port plug, P4 port plug, P5 port plug (PT 1/4)	9 to 11 Nm	(0.9 to 1.1 kgf·m, 6.5 to 8.0 ft-lbs)
P1 port plug, P2 port plug (M10 x 1.5)	20 to 25 Nm	(2.0 to 2.5 kgf·m, 15 to 18 ft-lbs)
P1 port plug seat, P2 port plug seat (PF 3/8)	49 to 59 Nm	(5 to 6 kgf·m, 36 to 43 ft-lbs)
High pressure relief valve seat	24 to 29 Nm	(2.4 to 3.0 kgf·m, 17 to 22 ft-lbs)
High pressure relief valve cap nut	59 to 69 Nm	(6 to 7 kgf·m, 43 to 51 ft-lbs)
Neutral valve body	34 to 39 Nm	(3.5 to 4.0 kgf·m, 25 to 29 ft-lbs)
Case relief valve	1.7 to 2.3 Nm	(0.17 to 0.23 kgf·m, 1.2 to 1.7 ft-lbs)

TO THE READER

In this section, the altered points of New HYDROSTATIC TRANSMISSION from the previous HST are explained separately in two items, "Mechanism" and "Servicing".

The serial number of tractors, new HST has been affected, is as follows.

B6100HST (2WD)	above 20001
B6100HST (4WD)	above 60001
B7100HST (2WD)	above 20001
B7100HST (4WD)	above 60001

The previous and new HST are not interchangeable. When the new HST is mounted on the previous B7100HST·B6100HST, the propeller shaft and ball joint assembly also should be replaced with new types.

As for the items which are not explained in this section, refer to Workshop Manual for B6100HST·B7100HST.

All information, illustrations and specifications contained in this manual are based on the latest production information available at the time of publication.

The right is reserved to make changes in all information at any time without notice.

Nov. '90

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G TRANSMISSION(MECHANISM)

[1] TRAVELING SYSTEM

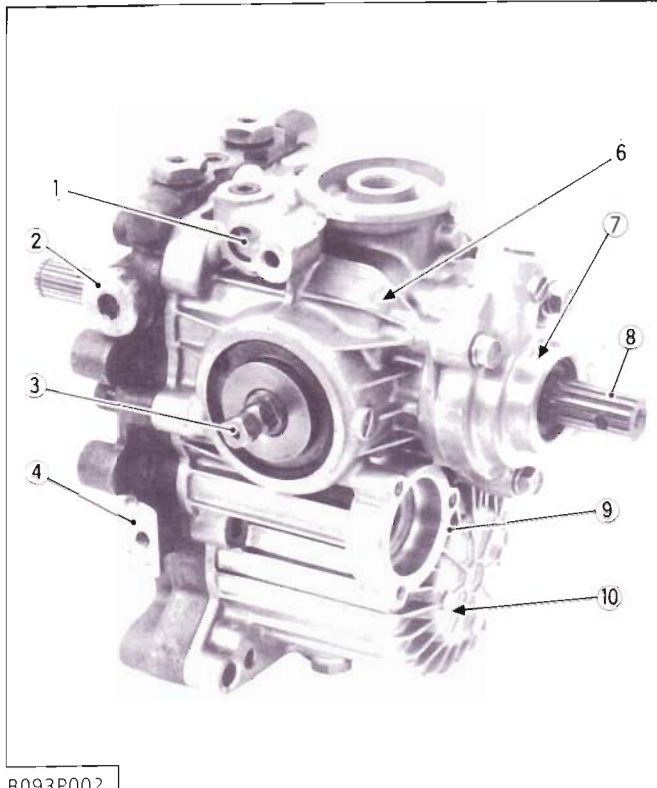
(2) Hydrostatic Transmission

■ NOTE

- Tractor serial number B6100HST-E above 20001
B6100HST-D above 60001
B7100HST-E above 20001
B7100HST-D above 60001

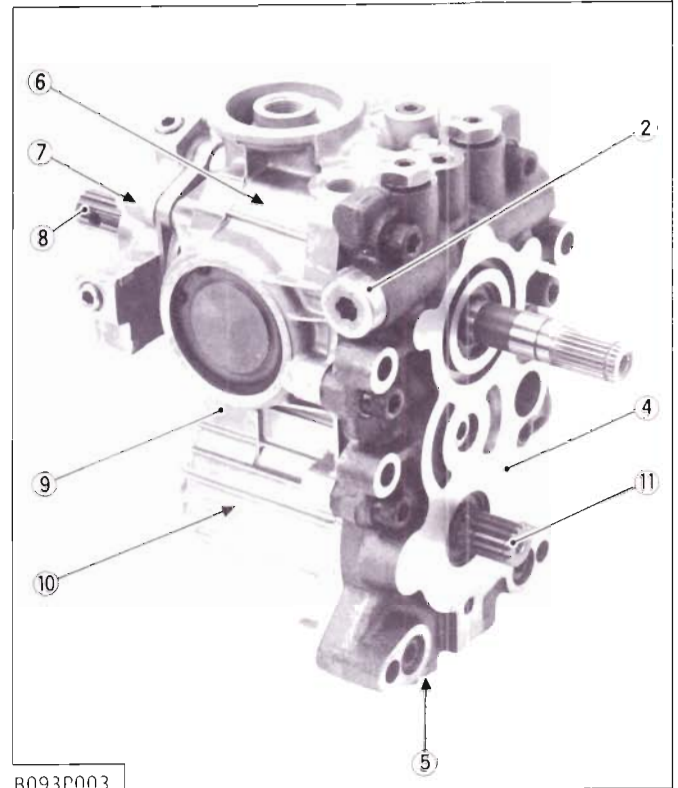
■ B6100HST-B7100HST

1. Structure



B093P002

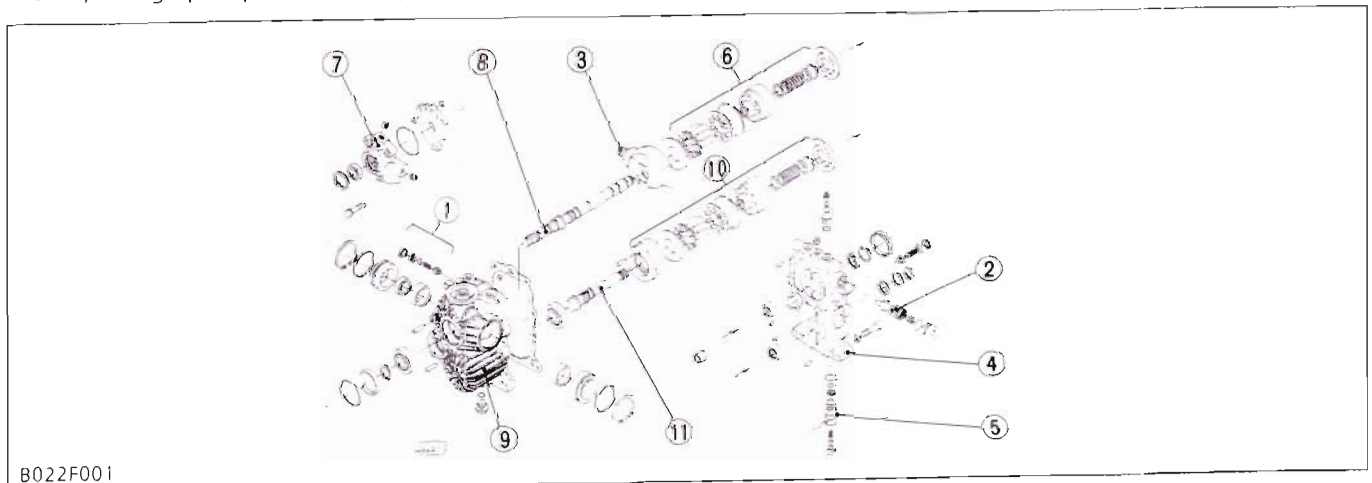
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|--|----------------------|
| (1) Charge Relief Valve | (3) Transition Shaft |
| (2) Check and High Pressure Relief Valve | (4) Port Block |
| | (5) Neutral Valve |



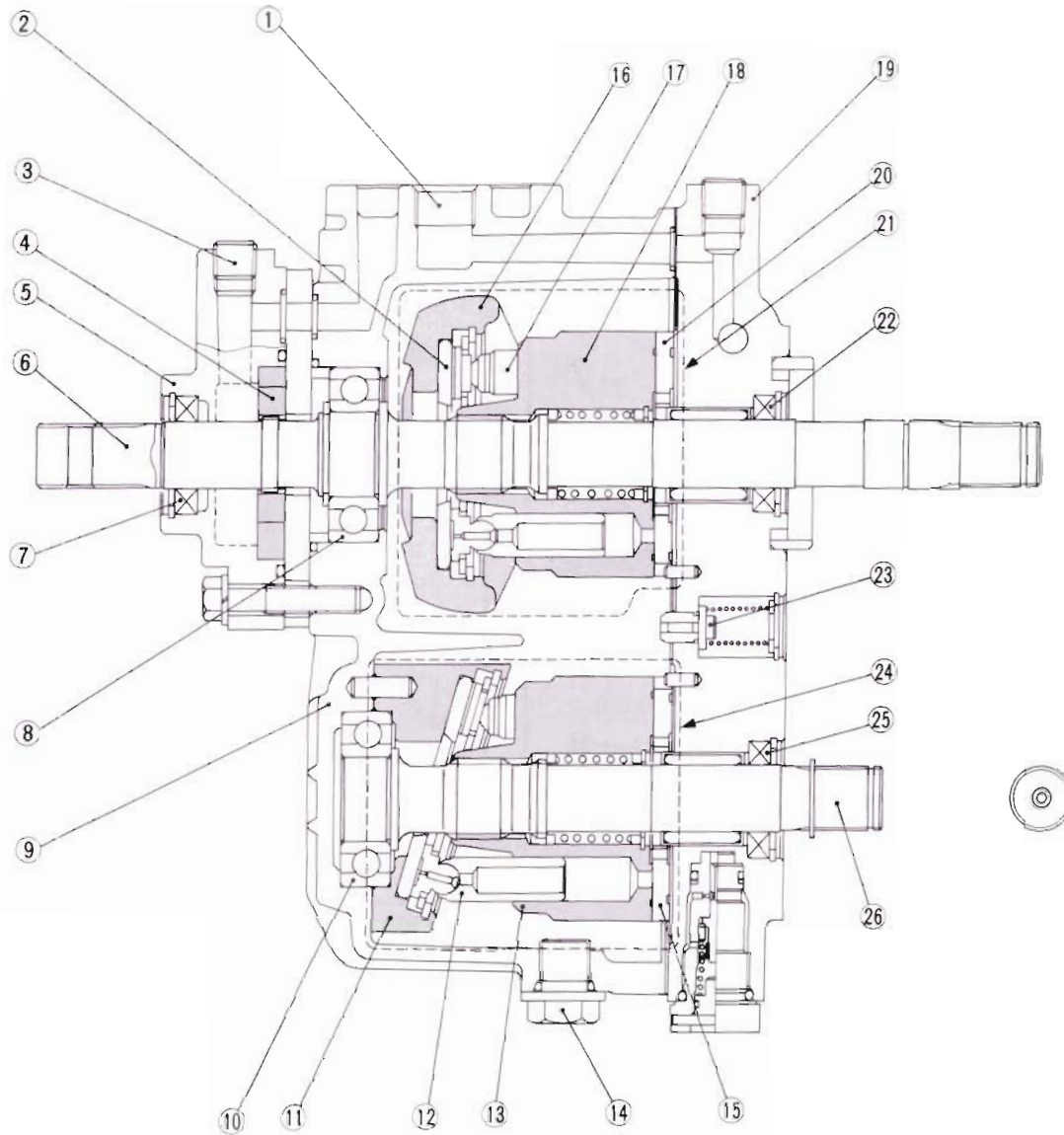
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|---------------------------------------|--------------------------------------|
| (6) Variable Displacement Piston Pump | (9) Case |
| (7) Charge Pump | (10) Fixed Displacement Piston Motor |
| (8) Input Shaft | (11) Output Shaft |

Hydrostatic transmission is composed of a variable displacement piston pump, fixed displacement piston motor, charge pump and valve system.

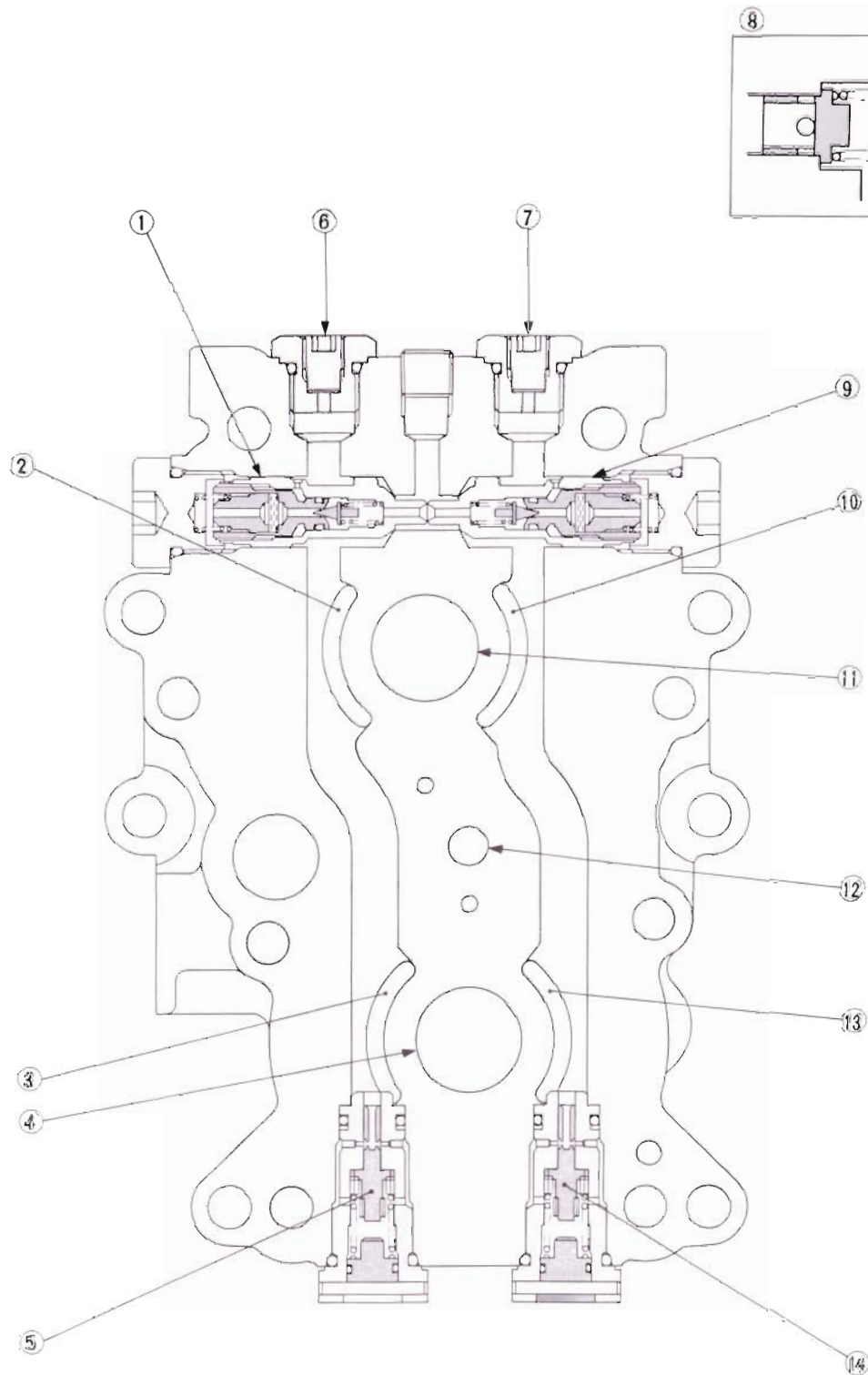


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B093F006

- | | | | |
|-----------------------------|-----------------------|----------------------------|--------------------------------|
| (1) Oil Outlet | (8) Ball Bearing | (16) Variable Swashplate | (22) Oil Seal |
| (2) Thrust Plate | (9) Case | (17) Piston | (23) Case Relief Valve |
| (3) P3 Port | (10) Ball Bearing | (18) Cylinder Block | (24) Fixed Displacement Piston |
| (4) Trochoid Rotor Assembly | (11) Fixed Swashplate | (19) Piston Block | Motor |
| (5) Charge Pump Case | (12) Piston | (20) Valve Plate | (25) Oil Seal |
| (6) Input Shaft | (13) Cylinder Block | (21) Variable Displacement | (26) Output Shaft |
| (7) Oil Seal | (14) Drain Plug | Piston Pump | |
| | (15) Valve Plate | | |



8093A007

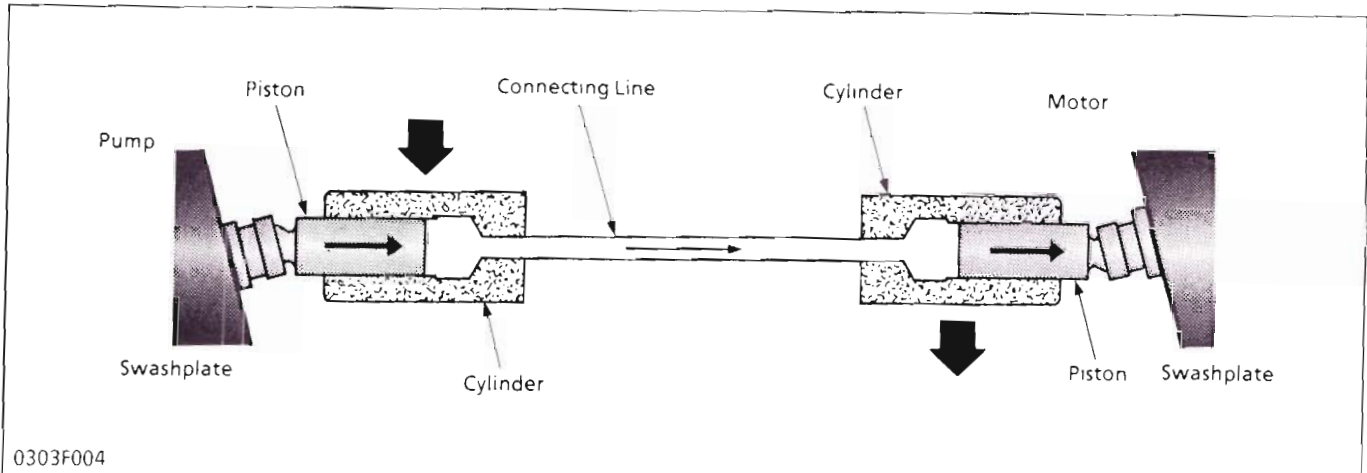
- (1) Check and High Pressure
Relief Valve (Forward)
(2) Pump Kidney Port A
(3) Motor Kidney Port C

- (4) Output Shaft
(5) Neutral Valve (Forward)
(6) P1 Port
(7) P2 Port

- (8) Charge Relief Valve
(9) Check and High Pressure
Relief Valve (Reverse)
(10) Pump Kidney Port B

- (11) Input Shaft
(12) Case Relief Valve
(13) Motor Kidney Port D
(14) Neutral Valve (Reverse)

2. Pump and Motor



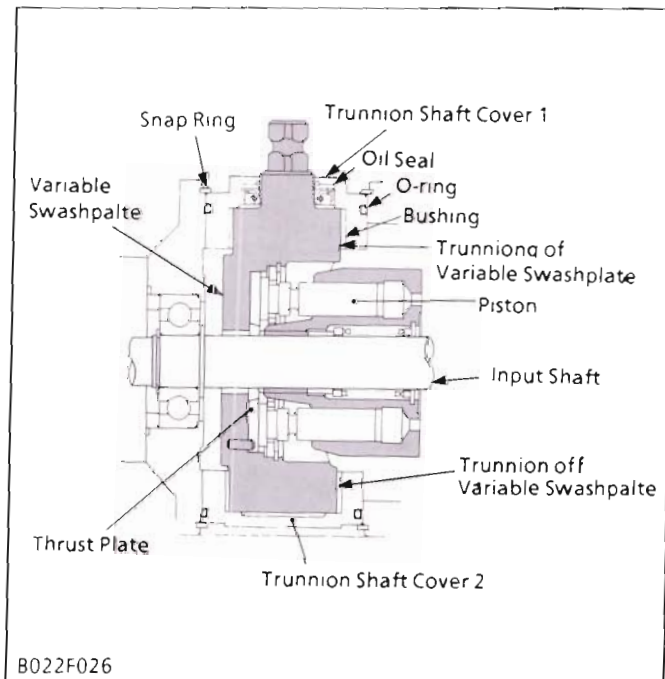
Pump and motor cylinder, each containing pistons, are connected by lines. Cylinders and lines are filled with oil. Pistons ride against swashplates located in pump and motor.

In the pump, as the cylinder rotates, pistons move across the sloping face of swashplate and slide in or out of their cylinder bores.

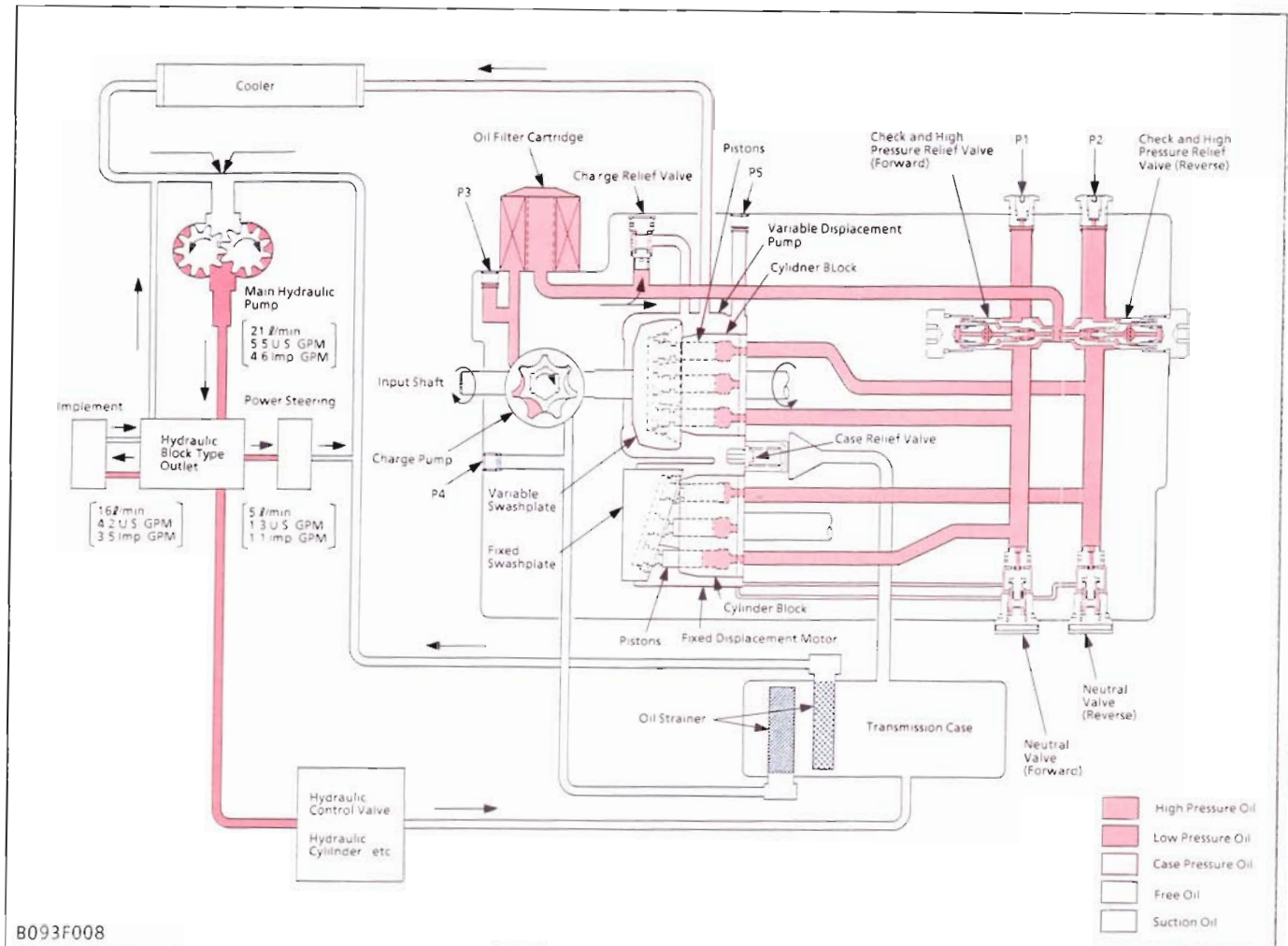
The oil, forced out by the pump pistons, causes the motor pistons to slide out of their cylinder bores. In the motor, sliding out of the cylinder and moving across the sloping face of swashplate, the pistons rotate the cylinder.

3. Variable Swashplate

This pump is variable displacement one. The angle of its swashplate can be varied so that the volume and pressure of oil pumped by the pistons can be changed or the direction of oil flow can be reversed. The swashplate is moved around the trunnion shaft with the neutral holder, by stepping on the speed control pedal linked to the neutral holder.



4. Oil Flow and Valves



P1: Port for checking high pressure (forward)
 P2: Port for checking high pressure (reverse)
 P3: Port for checking case pressure

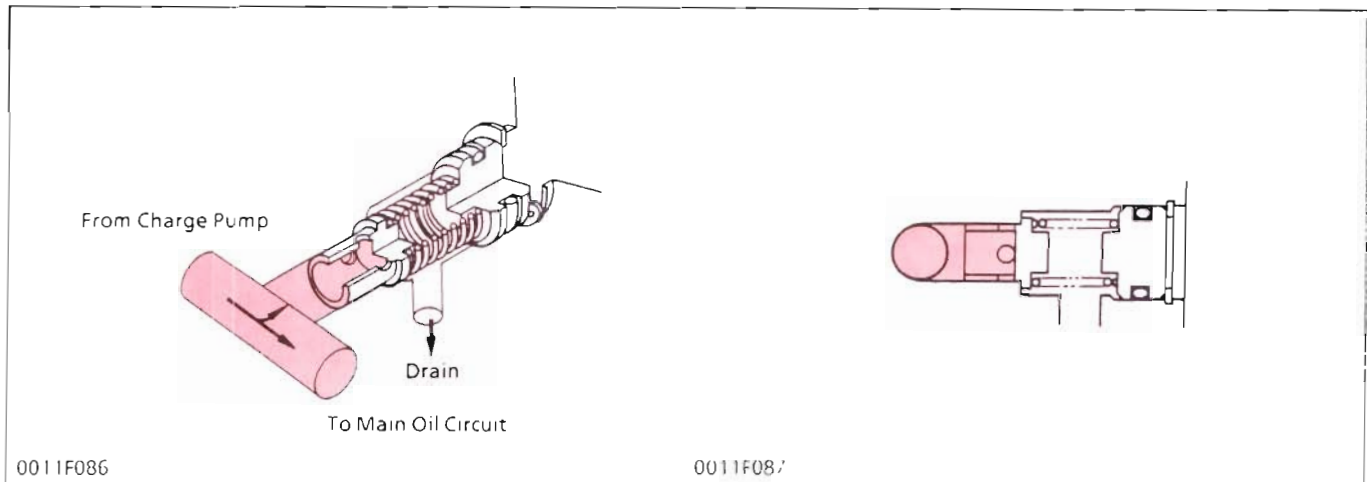
P4: Port for checking vacuum
 P5: Port for checking case pressure

The pump and motor are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts of the case. Then oil in the main oil circuit of the hydrostatic transmission needs to be supplied a want. So all of oil fed from the main hydraulic pump flows to the hydrostatic transmission for charging.

Only return oil from the hydraulic cylinder drops to the transmission case

The charge oil aids smooth operation of piston pump and motor. The rest of the oil passes through the charge relief valve into the case. Then the oil passes to the main hydraulic pump through a cooler.

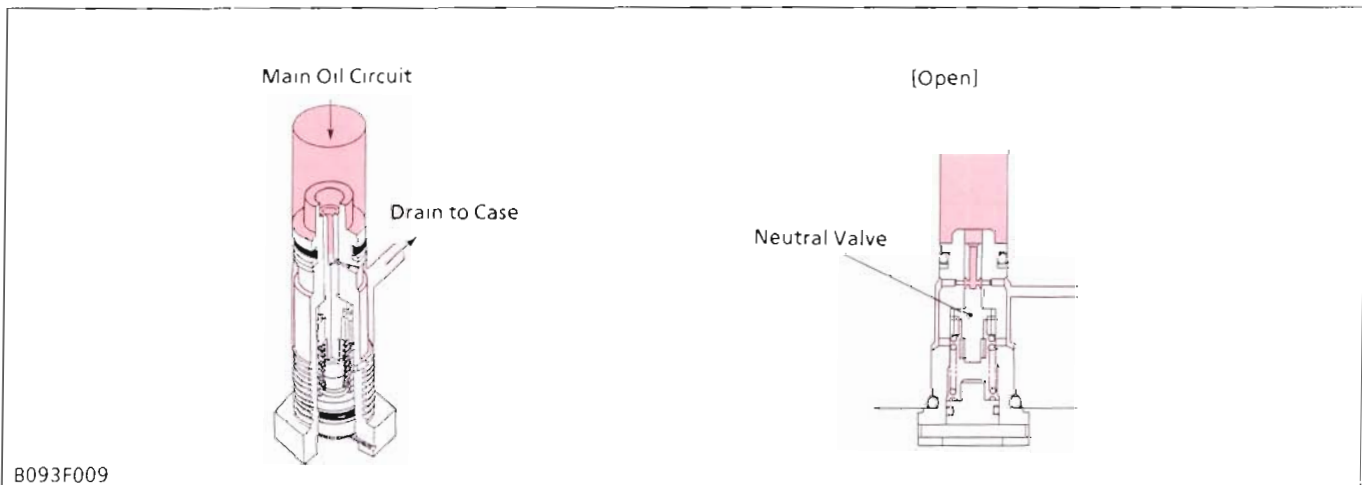
■ Charge Relief Valve



While pumped and filtered oil flows into the main oil circuit through the check valves, excessive oil passes to the case through the charge relief valve

Oil temperature	Valve operating pressure
50°C (122°F)	392 to 588 kPa (4.0 to 6.0 kgf/cm ² , 57 to 85 psi) more than case pressure

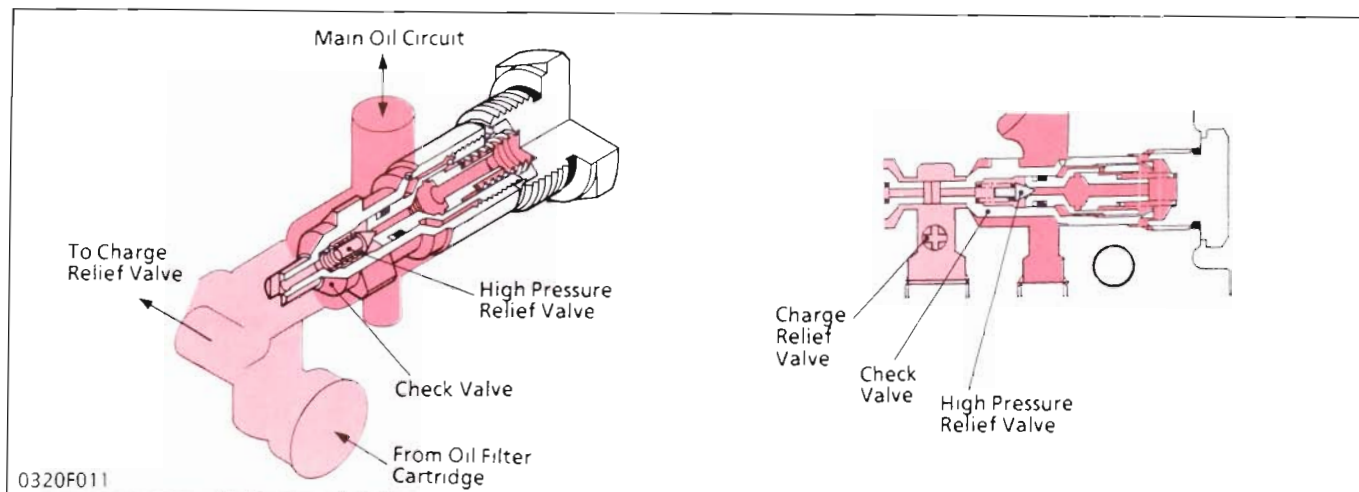
■ Neutral Valve



The neutral valves in the main oil circuit lines are open and pass the oil to the case when in neutral, and the oil pressure in their lines becomes low. And when the oil pressure in the high pressure line increases to a specified pressure, the neutral valve closes.

Oil temperature	Valve operating pressure	
50°C (122°F)	Close	2.45 to 3.73 MPa (25 to 38 kgf/cm ² , 356 to 540 psi)
	Open	1.47 MPa (15 kgf/cm ² , 213 psi)

■ Check and High Pressure Relief Valve



The check and high pressure relief valves monitor the oil pressure in each line of the main oil circuit.

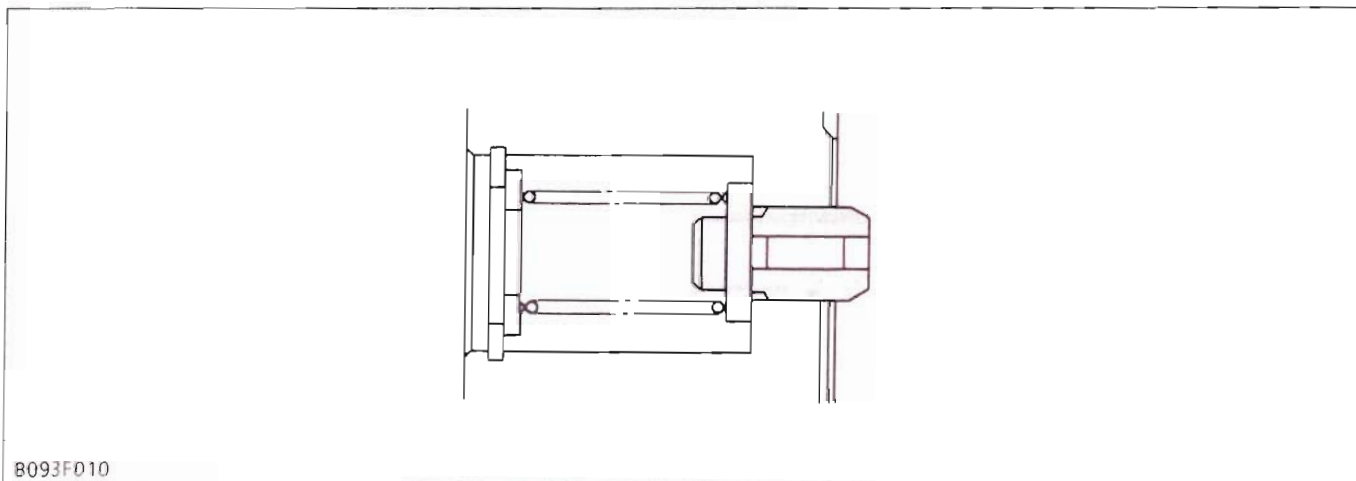
In neutral, both valves are open and charging oil enters into the main oil circuit through the valves.

At normal operation, the check valve in the high pressure side is closed and it pushes and opens the another one.

When excessively high pressure is built up in one line, the high pressure relief valve located in this line is open and the oil flows into another line.

Oil temperature	Relief valve operating pressure
50 °C (122 °F)	24.0 to 25.0 Mpa (245 to 255 kgf/cm ² , 3485 to 3627 psi)

■ Case Relief Valve

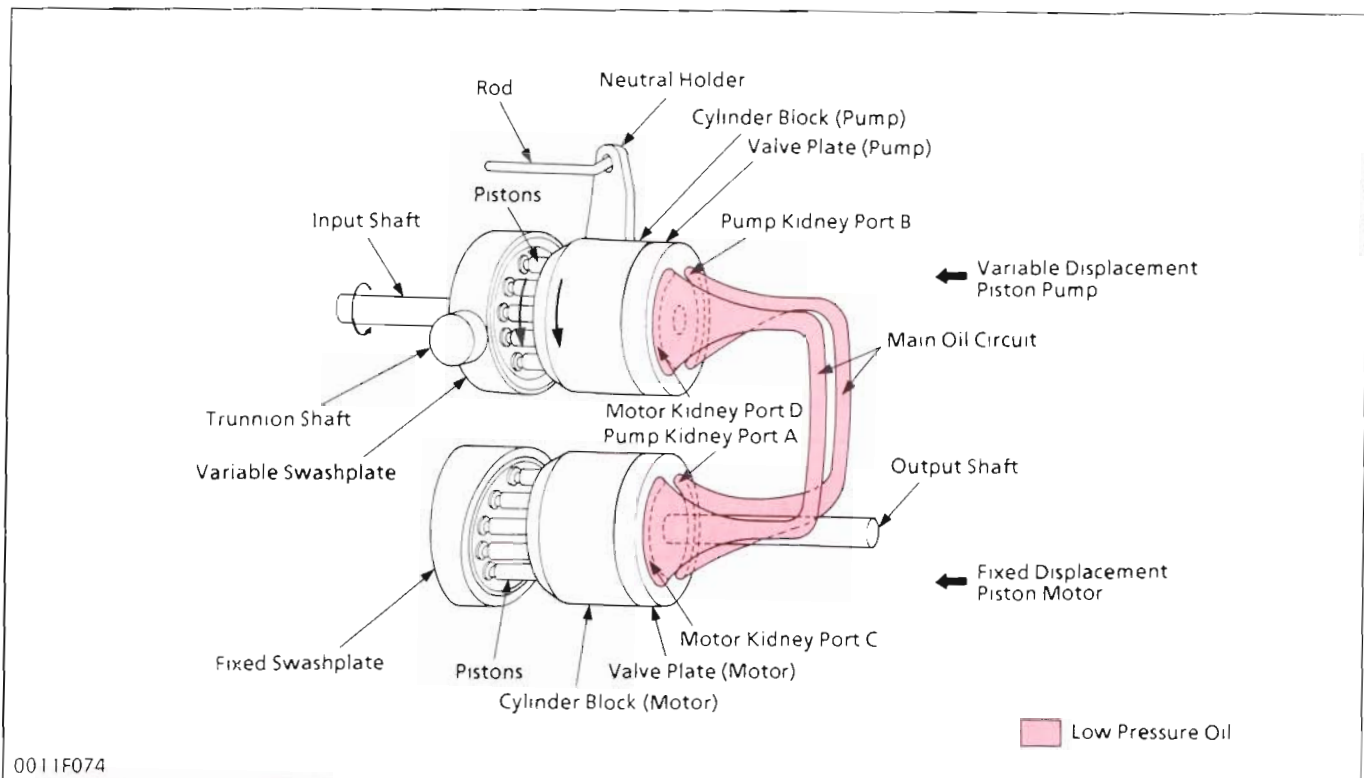


The case relief valve monitors the oil pressure in the hydrostatic transmission case. When the oil pressure rises, it opens and flows the oil directly to the transmission case, so that the oil may not leak against the sealings.

Oil temperature	Valve operating pressure
50 °C (122 °F)	98 to 294 kpa (1 to 3 kgf/cm ² , 14 to 43 psi)

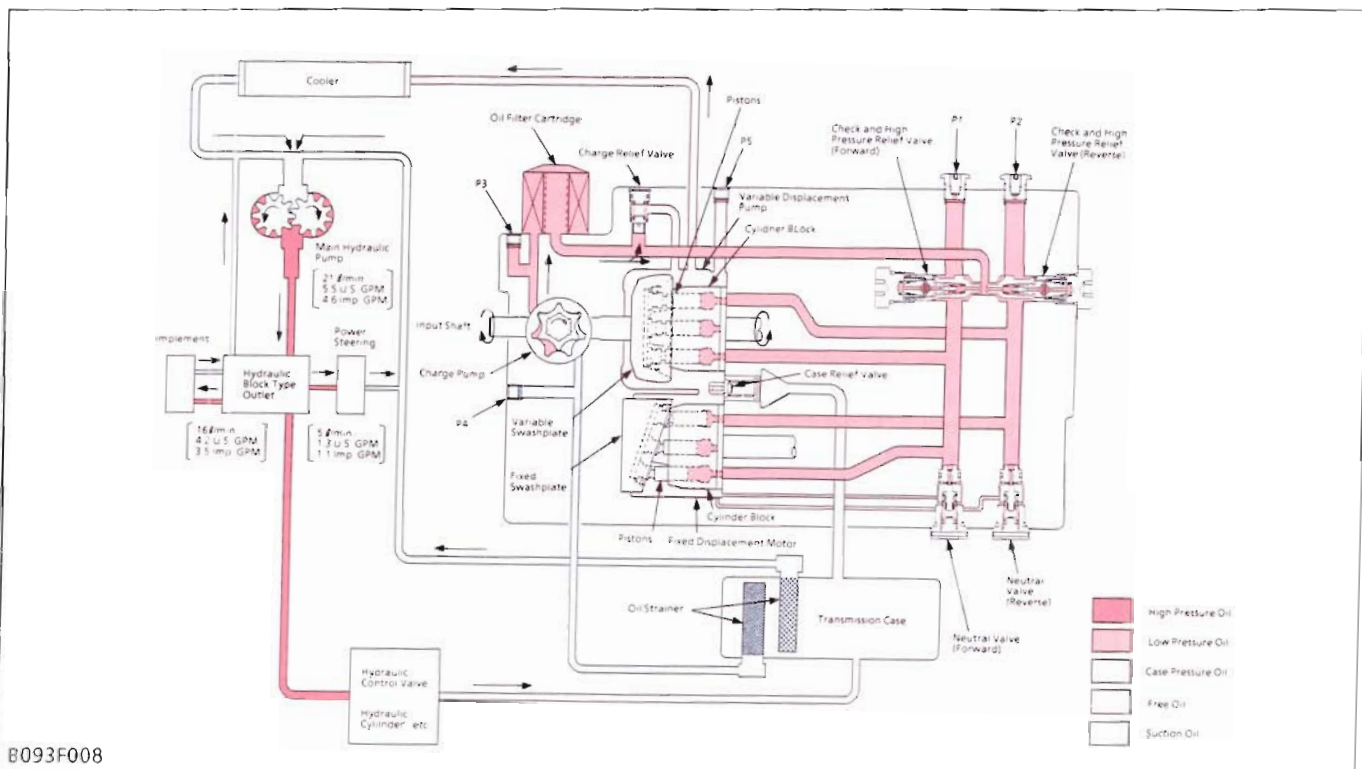
5. Operation

■ Neutral

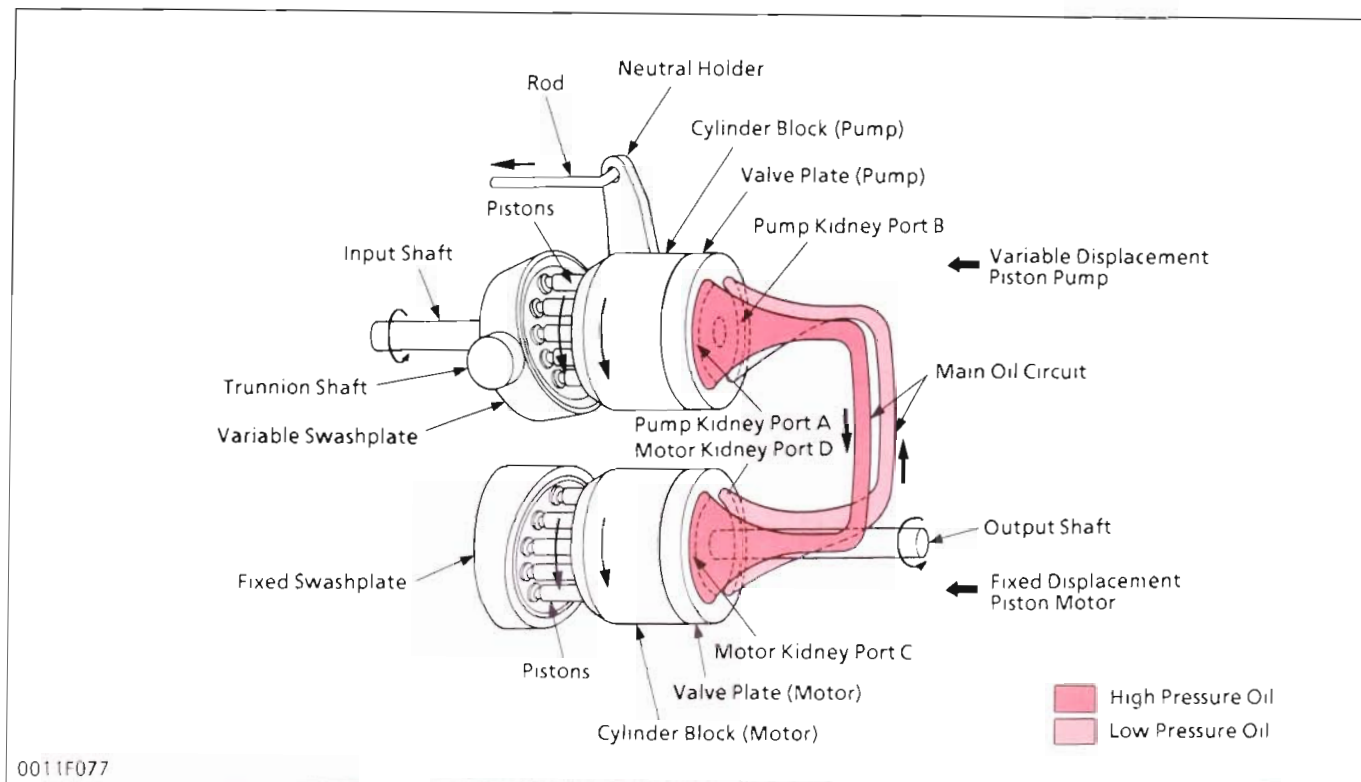


When the speed control pedal is in neutral, the variable swashplate is at right angles to the pump pistons and they only rotate with cylinder block without reciprocating. Since the oil is not being

pumped to the motor, the cylinder block in the motor is stationary and the output shaft does not move



■ Forward

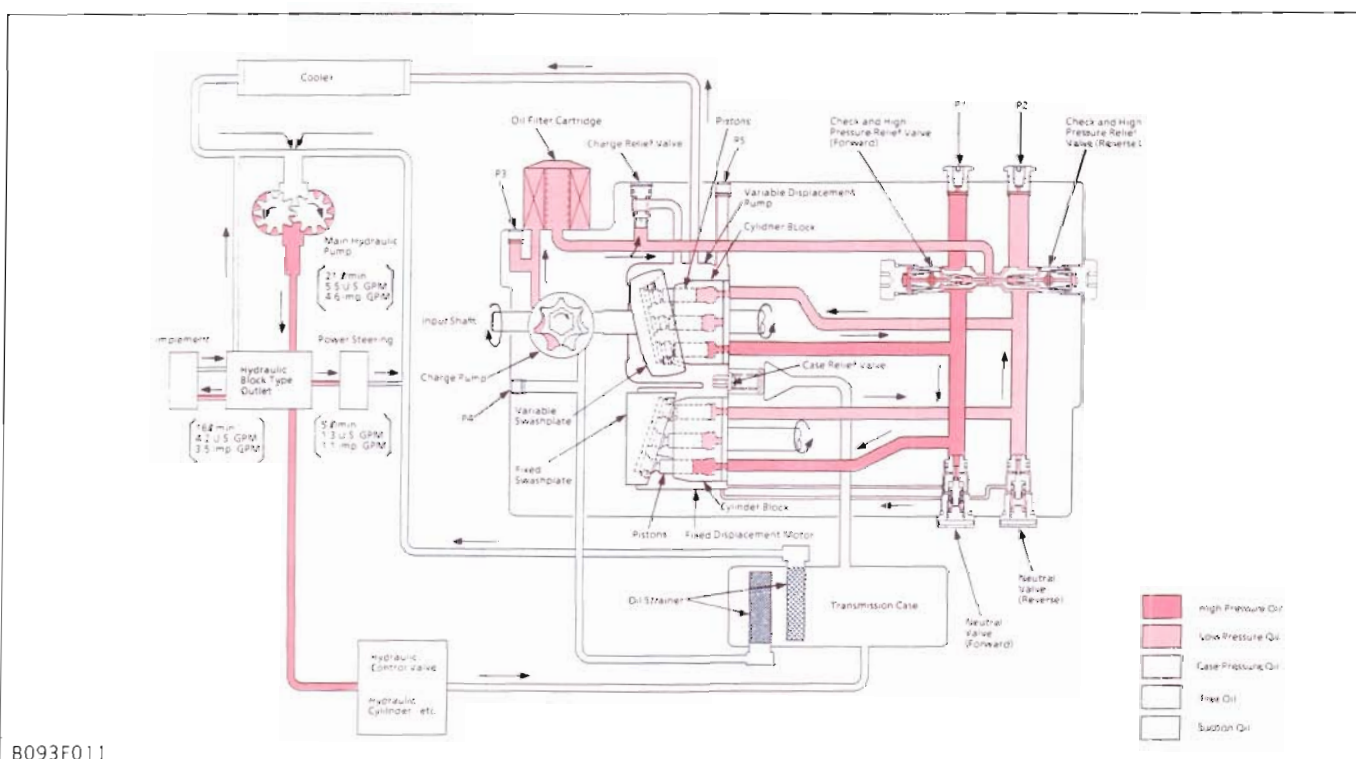


When the speed control pedal is stepped on and in forward, the variable swashplate is tilted as shown in figure above.

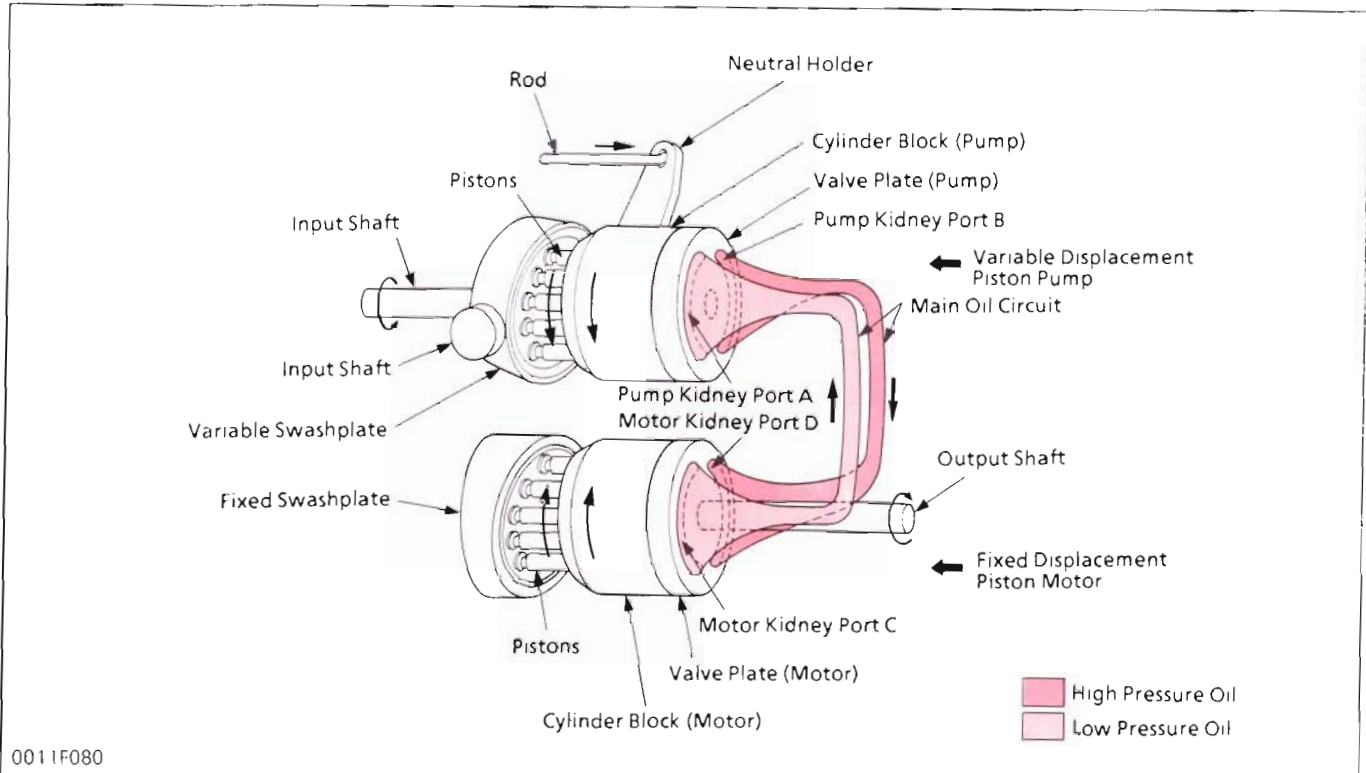
As the pump cylinder block rotates with the input shaft, oil is forced out of pump kidney port A at high pressure. As pressure oil enters motor kidney port C, the pistons, which align with port C, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine forward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor kidney port D at low pressure and returns to the pump.



■ Reverse

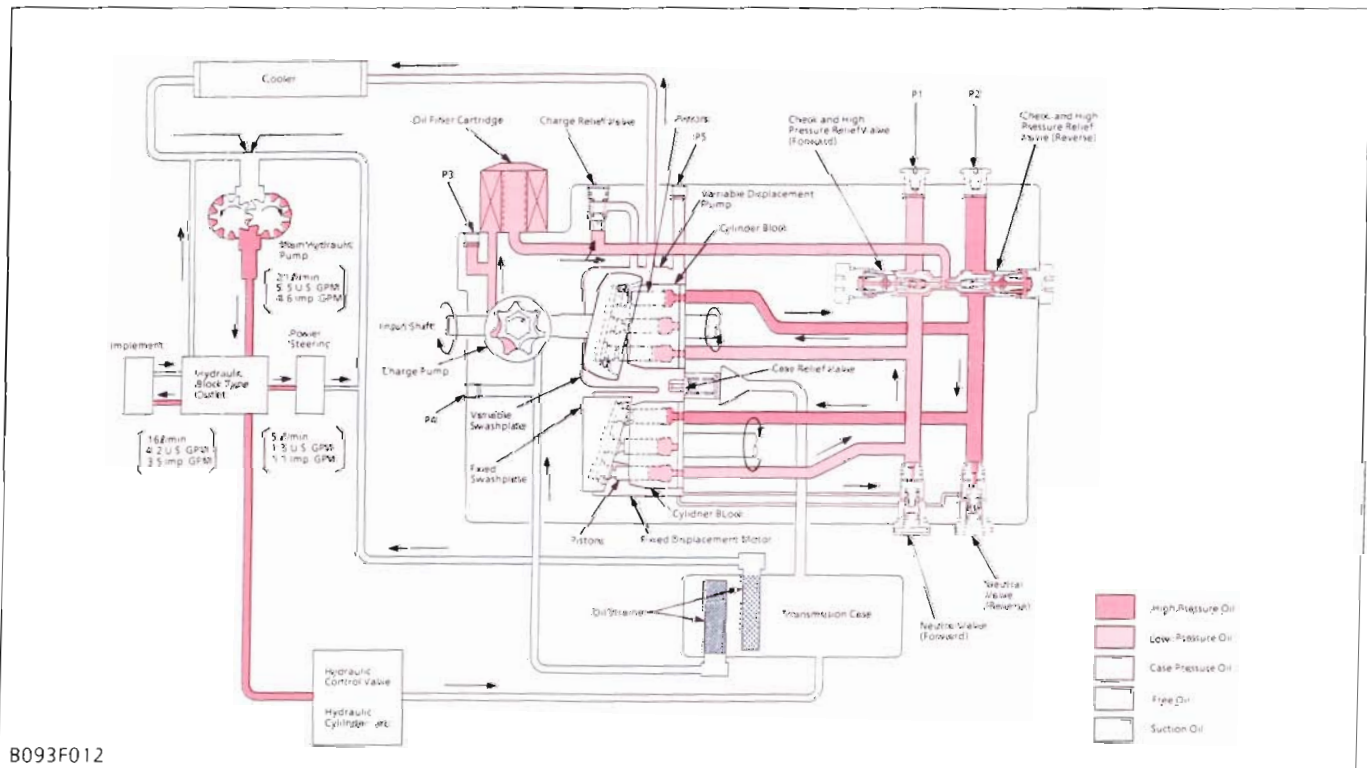


When the speed control pedal is stepped on and in reverse, the variable swashplate is tilted as shown in figure above.

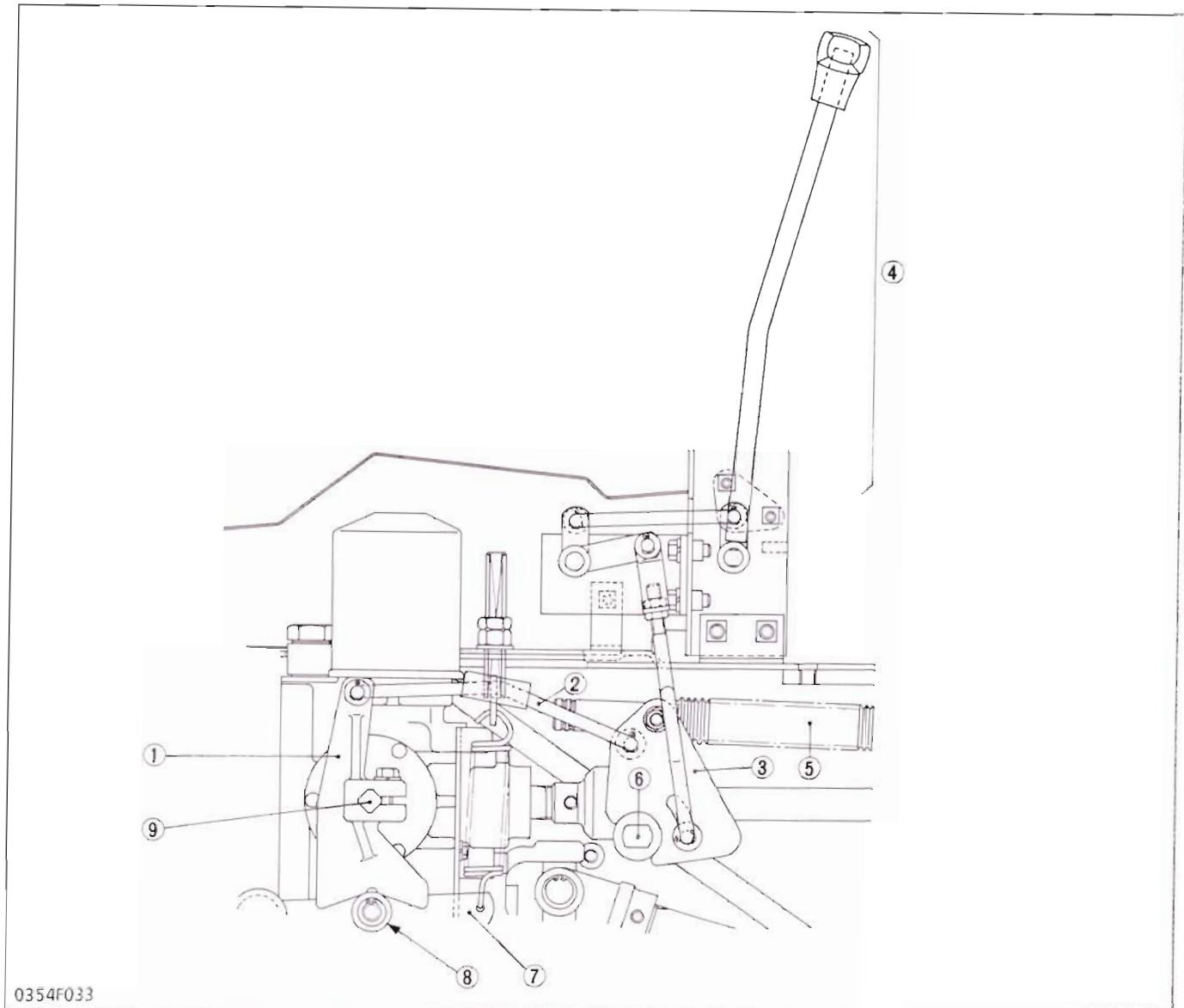
As the pump cylinder block rotates with the input shaft, oil is forced out of pump kidney port B at high pressure. As pressure oil enters motor kidney port D, the pistons, which align with port D, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine rearward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor kidney port C at low pressure and returns to the pump.



6. Control Linkage



0354F033

(1) Neutral Holder
(2) Speed Control Rod
(3) Rod Guide

(4) Speed Set Device
(5) Damper

(6) Speed Control Pedal Shaft
(7) Neutral Holder Arm

(8) Roller
(9) Trunnion Shaft

The speed control pedal and the trunnion shaft (9) of variable swashplate are linked with the rod guide (3), the speed control rod (2) and the neutral holder (1). As the front footrest of the pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear footrest increases reverse speed.

The roller (8) on the neutral holder arm (7) hanged with spring seats the detent of the neutral holder (1) so that the neutral holder returns to neutral.

Then, the swashplate is returned to neutral with the neutral holder, when the pedal is released. The damper (5) connected to the rod guide (3) restricts the movement of the linkage to prevent abrupt operation or reversing.

The speed set device (4) linked to the rod guide (3) enables the linkage not to return to neutral and to keep a certain forward speed while the speed control pedal (6) is released.

G TRANSMISSION(SERVICING)

NOTE

- Tractor serial number B6100HST-E above 20001
B6100HST-D above 60001
B7100HST-E above 20001
B7100HST-D above 60001

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Speed Set Lever	Force (See page BS.3-3)	29.4 to 34.3 N 3.0 to 3.5 kgf 6.6 to 7.7 lbs.	—
Check and High Pressure Relief Valve	Setting Pressure [Relief Valve]	24.0 to 25.0 Mpa 245 to 255 kgf/cm ² 3485 to 3627 psi (Oil temperature at 50°C, 122°F)	—
	Spring Length (short) [Relief Valve]	(free) 12.4 mm 0.488 in. load 41.84 N, 4.27 kgf, 9.41 lbs 10.5 mm 0.413 in.	—
	Spring Length (long) [Check Valve]	(free) 18.2 mm 0.717 in. load 3.43 N, 0.35 kgf, 0.77 lbs 14.5 mm 0.571 in.	—
Case Relief Valve	Setting Pressure	98 to 294 kPa 1 to 3 kgf/cm ² 14 to 43 psi (Oil temperature at 50°C, 122°F)	—
Case Relief Valve Spring	Spring Length	(free) 23.0 mm 0.906 in. load 29.4 N, 3.0 kgf, 6.6 lbs 15.0 mm 0.591 in.	—
Charge Relief Valve	Setting Pressure	392 to 558 kPa 4.0 to 6.0 kgf/cm ² 57 to 85 psi more than case pressure (Oil temperature at 50°C, 122°F)	—
Piston to Bore	Clearance	0.02 mm 0.0008 in.	0.04 mm 0.0016 in.
Slipper	Thickness	3.00 mm 0.118 in.	2.90 mm 0.114 in.

SERVICING SPECIFICATIONS (Continued)

Item		Factory Specification	Allowable Limit
Vacuum	Setting Pressure	120 mmHg (Oil temperature at 25°C, 77°F)	—
		60 mmHg (Oil temperature at 50°C, 122°F)	—
		35 mmHg (Oil temperature at 80°C, 176°F)	220 mmHg (Oil temperature at 80°C, 176°F)
Neutral Valve	Setting Pressure	Close 2.45 to 3.73 Mpa [25 to 38 kgf/cm ² , 356 to 540 psi] Open 1.47 Mpa [15 kgf/cm ² , 213 psi] (Oil temperature at 50°C, 122°F)	—
	Spring Length	(free) 18.4 mm 0.7244 in load 43.2 N, 4.4 kgf, 9.7 lbs 13.9 mm 0.5472 in	— —

TIGHTENING TORQUES

Item	N·m	kgf·m	ft·lbs
Neutral Adjuster	18.6 to 32.3	1.9 to 3.3	13.7 to 23.9
Charge Pump	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Motor Swashplate	15.7 to 20.6	1.6 to 2.1	12 to 15
Port-block	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
High Relief Valve Seat	23.5 to 29.4	2.4 to 3.0	17.4 to 21.7
High Relief Valve Cap Nut	58.8 to 68.6	6.0 to 7.0	43.4 to 50.6
Neutral Valve	53.9 to 63.7	5.5 to 6.5	39.8 to 47.0
Plug (Drain)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Plug (P1, P2)	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Plug (P1, P2) PT 3/8	29.4 to 39.2	3.0 to 4.0	21.7 to 28.9
Plug Seat (P1, P2)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Plug (P3, P4, P5)	8.8 to 10.8	0.9 to 1.1	6.5 to 8.0
HST Case to Transmission Case	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Mid PTO Case Bearing Holder	13.7 to 19.6	1.4 to 2.0	10.1 to 14.5
Case Cover to Case			
Mid PTO Case to Transmission Case	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Rear Cover Mounting Screw	39.2 to 64.7	4.0 to 6.6	28.9 to 47.7
PTO Shaft Screw	18.6 to 32.4	1.9 to 3.3	13.7 to 23.9

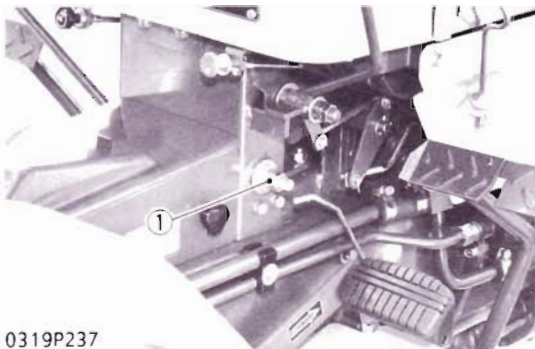
NOTE

- Tractor serial number B6100HST-E above 20001
B6100HST-D above 60001
B7100HST-E above 20001
B7100HST-D above 60001

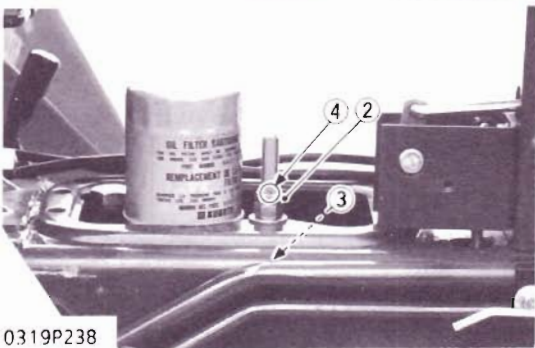
CHECKING, DISASSEMBLING AND SERVICING

[1] SPEED SET DEVICE

DISASSEMBLING AND ASSEMBLING



0319P237



0319P238

Speed Set Lever

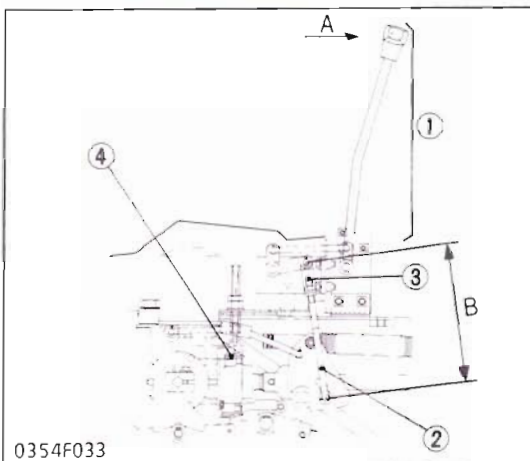
- Measure the force to move the speed set lever (A) forward at its top (grip).
- If the force is not within the factory specification, turn the nut (1) to adjust.

Force to move the lever	Factory spec	29.4 to 34.3 N 3.0 to 3.5 kgf 6.6 to 7.7 lbf
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(When reassembling)

- After installing the spring (3), align the head of nut (2) with the punched mark (4)

- (1) Nut (3) Spring
(2) Nut (4) Punched Mark



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Setting Length of Lower Rod

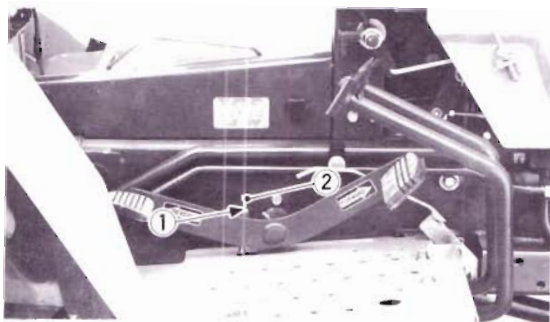
- Measure the length "B".
- If the measurement is not within the factory specifications, adjust with the yoke (3) of the lower rod (2)

Setting length of lower rod	Factory spec	178 mm 7.0 in
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- (1) Speed Set Lever (3) Yoke
(2) Lower Rod (4) Spring

[2] HYDROSTATIC TRANSMISSION

CHECKING AND ADJUSTING



0319P239

Reverse Speed

1. Lift the rear of the tractor so that the rear wheels are off the ground.
2. Set the engine speed at 2800 rpm and depress the differential lock pedal.
3. If the rear wheels do not turn within the factory specifications, loosen the lock nut (1) and adjust the bolt (2).

Rear wheel rpm	Factory spec	67 to 71 rpm (Engine at 2800 rpm)
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(1) Lock Nut

(2) Bolt



0319P239

0319P240

Neutral

1. Lift the rear of the tractor so that the rear wheels are off the ground and run the engine at low idling and drive only rear wheels.
2. Depress the one end of speed control pedal and release, and do the same at the other end
3. If the rear wheels do not stop turning, adjust as following procedure.

NOTE

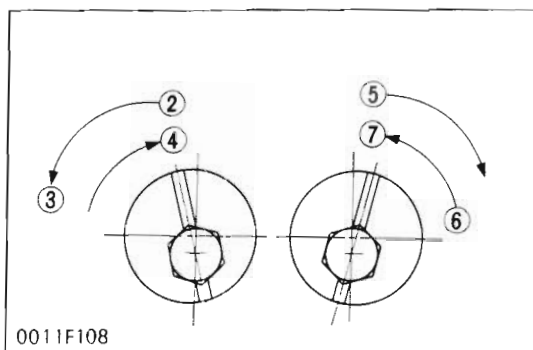
- Loosen the screw and be sure to place the neutral adjuster with its longer groove upward.

Adjusting Neutral

1. Rotate the neutral adjuster counterclockwise so that the rear wheels turn forward
2. Then rotate it clockwise until wheels stop completely.
3. Put a mark on the clutch housing aligning the groove on neutral adjuster.
4. Rotate the neutral adjuster clockwise so that the rear wheels turn reverse
5. Then rotate it counterclockwise until wheels stop completely.
6. Put a mark on the clutch housing aligning the groove on neutral adjuster
7. Hold the neutral adjuster so that its groove is at the middle of the marks and tighten the screw

NOTE

- When the wheels tend to turn forward, rotate the neutral adjuster clockwise.
- When the wheels tend to turn reverse, rotate the neutral adjuster counterclockwise.

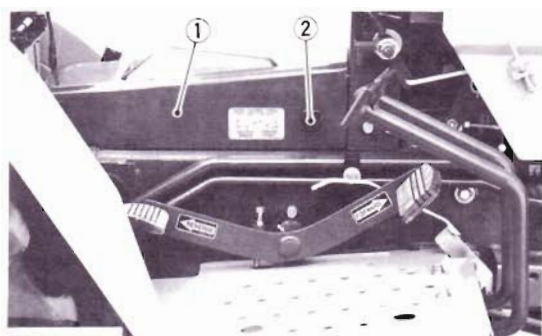


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0319P241

Tightening torque	Neutral adjuster to case	19 to 32 N m 1.9 to 3.3 kgf m 13 to 24 ft lbf
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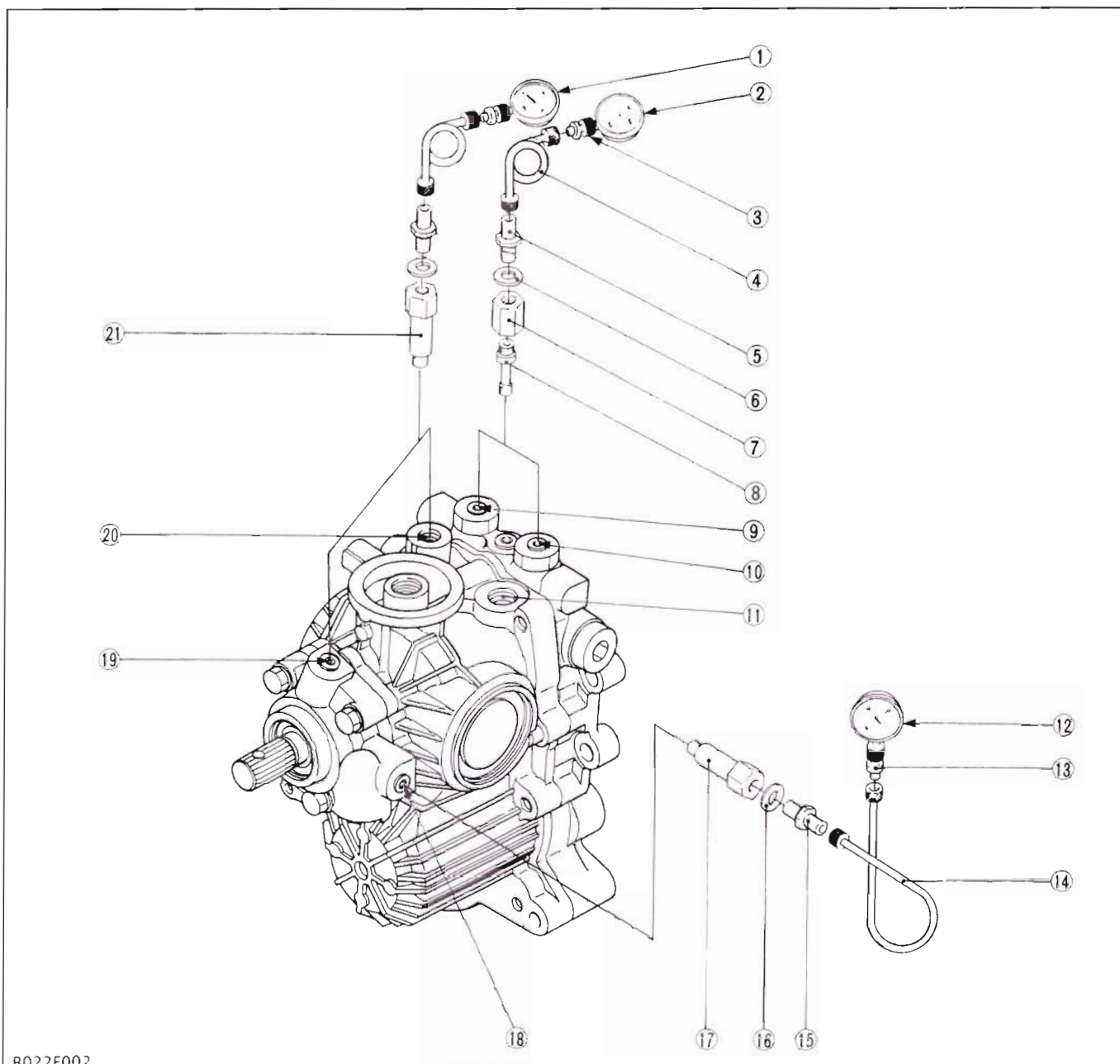
0319P239

Oil Pressure in Hydrostatic Transmission

1. Clean and clear the work area, and fully engage the parking brake.
2. Remove the knob screws (2) and sub cover (1).
3. Measure the following oil pressures using Hydrostatic Transmission Testing Kit (Code No. 07916-52040) as instructed.

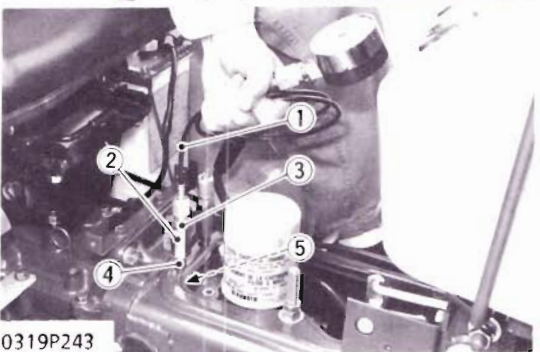
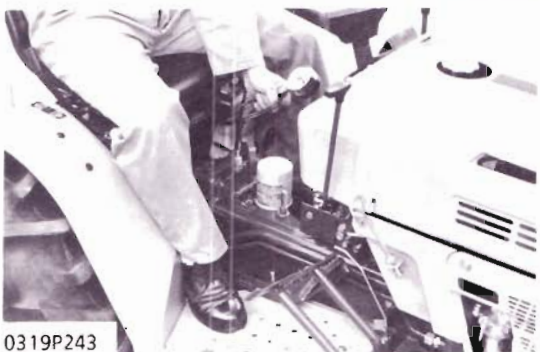
(1) Sub Cover

(2) Knob Screw



B022F002

- | | | |
|--|---|-----------------------------------|
| (1) Pressure Gauge (07916-51301) | (7) Connector 1 (07916-60811) | (14) Cable (07916-50331) |
| (2) Pressure Gauge (High Pressure) (07916-50322) | (8) Connector 2 (07916-60821) | (15) Thread Joint (07916-50341) |
| (3) Threaded Joint in Relief Valve Pressure Tester (07916-50401) | (9) High Pressure (Reverse), P2 port | (16) Gasket (04714-00200) |
| (4) Cable (07916-51331) | (10) High Pressure (Forward), P1 port | (17) Long Connector (07916-60831) |
| (5) Thread Joint (07916-50341) | (11) T1 port | (18) Vacuum, P4 port |
| (6) Gasket (04714-00200) | (12) Vacuum Gauge (07916-51331) | (19) Charge Pressure, P3 port |
| | (13) Threaded joint in Relief Valve Pressure Tester (07916-50401) | (20) Case Pressure, P5 port |
| | | (21) Long Connector (07916-60831) |



High Relief Pressure

1. Remove the M 10 hex socket head plug from P1 (6) or P2 (5) port (P1 is for forward and P2 is for reverse).
2. Install connector 2 (4) to P1 (forward) or P2 (reverse) port.
3. Assemble connector 1 (2) and threaded joint (3) with the gasket between them.
4. Install the assembled connector 1 (2) and threaded joint (3) to connector 2 (4).
5. Install the cable (1), threaded joint in relief valve set pressure tester and high pressure gauge to threaded joint (3) in order.
6. Run the engine at 2800 rpm.
7. Place the high-low shift lever in high.
8. Depress the speed control pedal approx. 10 mm (0.39 in.) which rotates the trunnion shaft 0.087 rad (5.0°).

High relief pressure (Oil temperature at 50°C, 122°F)	Factory spec	24.0 to 25.0 MPa 245 to 255 kgf/cm ² 3085 to 3625 psi
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■ IMPORTANT

- Measure quickly so that the relief valve may not be in operation more than 10 seconds.

■ NOTE

- High pressure gauge is 30 MPa (300 kgf/cm², 4260 psi) full scale.

(When reassembling)

- Install the M 10 plug to the port with the gasket laying on its seat

Tightening torque	Plug (P1, P2 port)	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14 to 18 ft·lb
	Plug seat (P1, P2 port)	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lb

(1) Cable

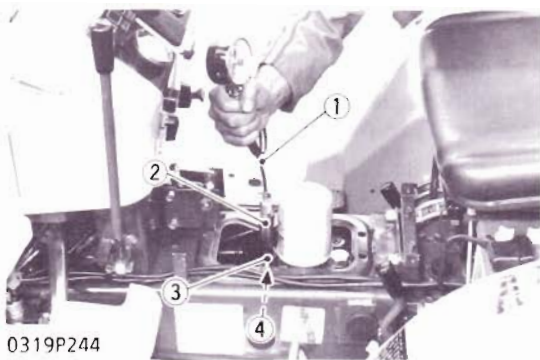
(2) Connector 1

(3) Threaded Joint

(4) Connector 2

(5) P2 Port

(6) P1 Port



(1) Cable (3) Long Connector
(2) Threaded Joint (4) P5 Port

Case Relief Pressure

1. Remove the PT 1/4 plug from P5 port (4), with care not to allow any particle of sealing tape enter into the port.
2. Install the long connector (3) to P5 port with sealing tape on its thread.
3. Install the threaded joint (2) to long connector with the gasket between them.
4. Install the cable (1), threaded joint in relief valve set pressure tester and low pressure gauge to threaded joint in order.
5. Run the engine at 2800 rpm.
6. Place the high-low shift lever in neutral.
7. Release the speed control pedal to set in neutral.
8. After measuring the case pressure, remove the eye joint from T1 port and plug the port with PF 3/8 screw to measure the case relief pressure.

Case relief pressure (Oil temperature at 50°C, 122°F)	Factory spec	98 to 294 kPa 1 to 3 kgf/cm ² 14 to 43 psi
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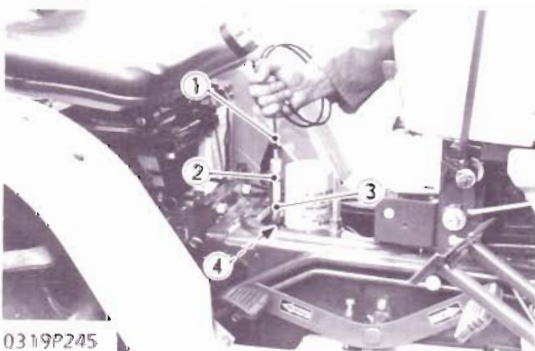
NOTE

- Low pressure gauge is 2 MPa (20 kgf/cm², 284 psi) full scale.

(When reassembling)

- Install the PT 1/4 plug to the P3 port with the sealing tape on its thread

Tightening torque	Plug (P5 port)	8.8 to 10.8 N·m 0.9 to 1.1 kgf·m 6.5 to 7.9 ft·lbs
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(1) Cable (3) Long Connector
(2) Threaded Joint (4) P3 Port

Charge Pressure

1. Remove the PT 1/4 plug from P3 port (4), with care not to allow any particle of sealing tape enter into the port.
2. Install the long connector (3) to P3 port with sealing tape on its thread.
3. Install the threaded joint (2) to long connector with the gasket between them.
4. Install the cable (1), and threaded joint in order.
5. Run the engine at 2800 rpm.
6. Place the high-low shift lever in neutral.
7. Release the speed control pedal to set in neutral.

Charge pressure (Oil temperature at 50°C, 122°F)	Factory spec	392 to 558 kPa 4.0 to 6.0 kgf/cm ² 57 to 85 psi
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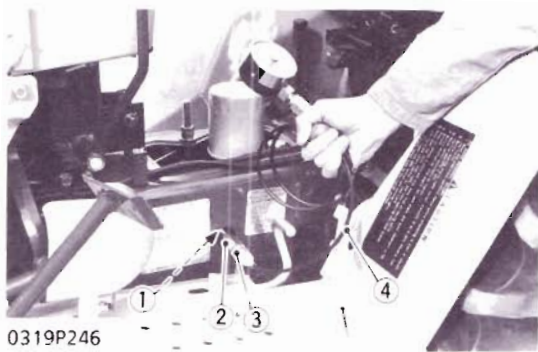
NOTE

- Low pressure gauge is 2 MPa (20 kgf/cm², 284 psi) full scale.

(When reassembling)

- Install the PT 1/4 plug to the P3 port with the sealing tape on its thread

Tightening torque	Plug (P3 port)	8.8 to 10.8 N·m 0.9 to 1.1 kgf·m 6.5 to 7.9 ft·lbs
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0319P246

- (1) P4 Port (2) Long Connector (3) Threaded Joint (4) Cable

Vacuum

1. Remove the PT 1/4 plug from P4 port (1), with care not to allow any particle of sealing tape enter into the port.
2. Install the long connector (2) to P4 port with sealing tape on its thread.
3. Install the threaded joint (3) to long connector with the gasket between them.
4. Install the cable (4), threaded joint in relief valve set pressure tester and vacuum gauge to threaded joint (3) in order.
5. Run the engine at 2800 rpm.
6. Place the high-low shift lever in neutral.
7. Release the speed control pedal to set in neutral.

Vacuum (Oil temperature)	Factory spec	120 mm Hg (at 25°C, 77°F) 60 mm Hg (at 50°C, 122°F) 35 mm Hg (at 65°C, 145°F)
	Allowable limit	220 mm Hg (at 80°C, 176°F)

NOTE

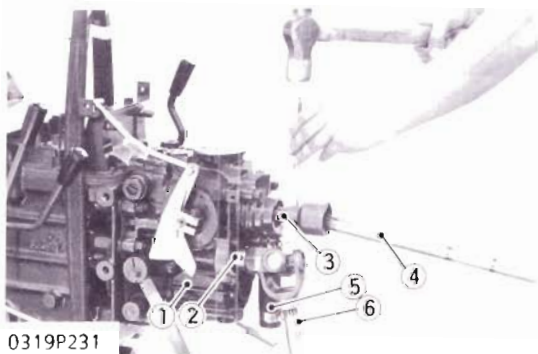
- Vacuum gauge is 760 mm Hg (30 in. Hg) full scale.

(When reassembling)

- Install the PT 1/4 plug to the P4 port with the sealing tape on its thread

Tightening torque	Plug (P3 port)	8.8 to 10.8 N·m 0.9 to 1.1 kgf·m 6.5 to 7.9 ft·lb
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DISASSEMBLING AND ASSEMBLING



0319P231

- (1) HST (2) Front Wheel Drive Shaft (3) 1st Shaft (4) Propeller Shaft (5) Hose (6) Drive Shaft

Hydrostatic Transmission

1. Remove the propeller shaft (4) from the 1st shaft (3).
2. Remove the drive shaft (6) from the front wheel drive shaft (2). (4WD type only)
3. Loosen the hose clamp and remove the hose (5).
4. Remove the HST mounting screws, and remove the HST (1).

(When reassembling)

- After inserting the spring pin into the 1st shaft and drive shaft, lock the spring pin with a wire
- Be sure to replace the gasket with a new one

Tightening torque	HST mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lb
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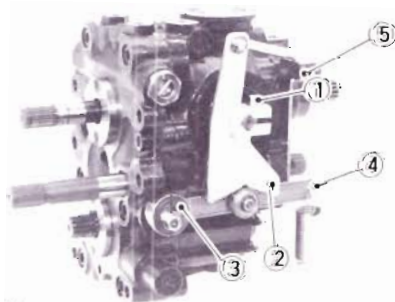
Neutral Holder

1. Place parting marks on the neutral adjuster (3) and the neutral holder arm (4).
2. Remove the screws and spring holder (5).
3. Remove the screw and the neutral holder arm (4).
4. Remove the screw (1) and pull out the neutral holder (2).

(When reassembling)

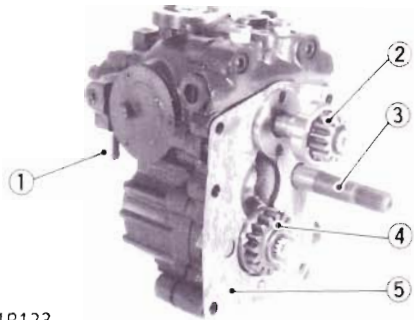
- Aligning the parting marks, install the neutral adjuster and the neutral holder arm

Tightening torque	Neutral holder arm mounting screw	18.6 to 32.4 N·m 1.9 to 3.3 kgf·m 14 to 24 ft·lb
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0319P256

- (1) Screw (2) Neutral Holder (3) Neutral Adjuster (4) Neutral Holder Arm (5) Spring Holder



0011P123

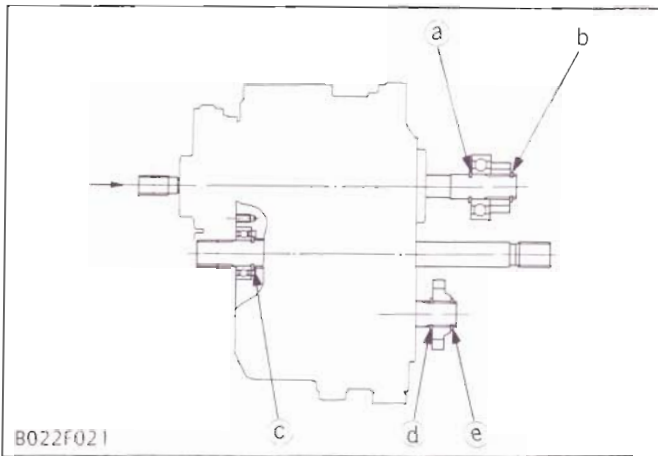
- (1) Hose Joint
(2) 14T Gear
(3) Front Wheel Drive Shaft 1
(4) 16T Gear
(5) Gasket

Front Wheel Drive Shaft 1 and Gears

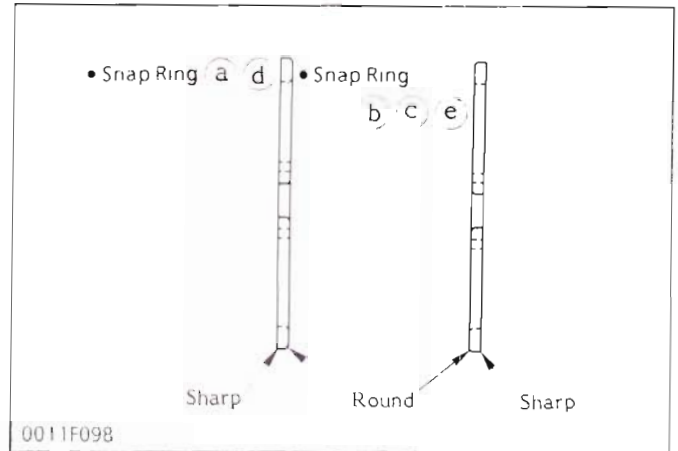
1. Pull out the front wheel drive shaft 1 (3) forward
2. Remove the external snap ring and 14T gear (2).
3. Remove the external snap ring and 16T gear (4)
4. Remove the hose joint (1) and gasket (5).

(When reassembling)

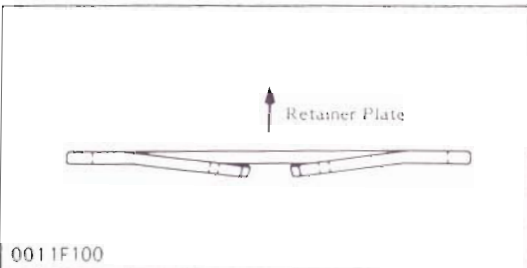
- Install the snap ring with its rounded edge facing the gear or bearing so that its sharp edge in the groove keeps itself in place against the force



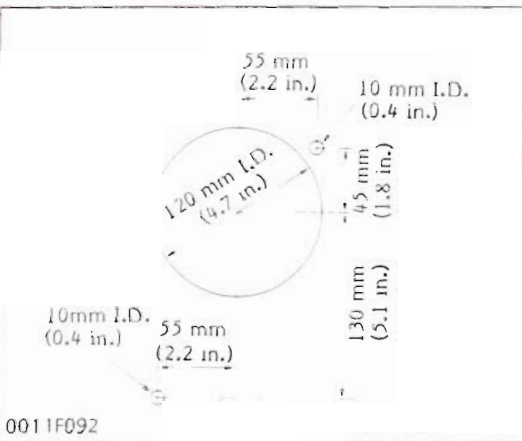
B022F021



0011F098



0011F100



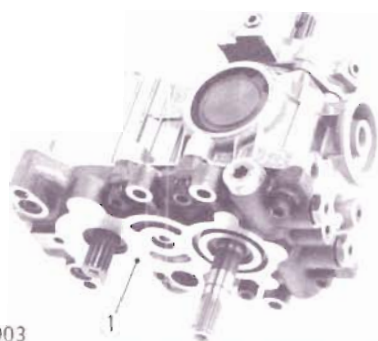
0011F092

Repair-stand for Assembling and Disassembling

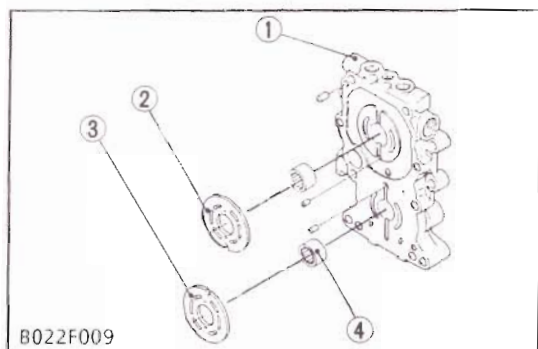
- 1 To facilitate disassembling and assembling, make a repair stand as shown in the figure

■ IMPORTANT

- Clean the repair-stand and the outside of the hydrostatic transmission case.
- Hydrostatic transmission is composed of many precision parts and they have highly finished or polished surface.
- Take extreme care to prevent damage or dirt during disassembling and assembling.
- Coat hands with hydrostatic transmission oil before handling the parts to minimize the possibility of rust.
- Clean the parts and coat them with hydrostatic transmission oil before assembling.



B093P003



B022F009

Port Block

1. Remove the port block mounting screws, and tap the front of port block (1) with a soft hammer to separate from the case

(When reassembling)

- Cover the splines of each shaft with thin tape to protect the sealing lip
- Install port block with gasket, O-ring and valve plate in place

■ IMPORTANT

- Valve plates (2), (3) may stick to the port block, but they are not fixed. Take care not to drop them.
- Valve plates are not interchangeable. Valve plate of the pump has two notches and the valve of the motor has no notches.

Tightening torque	Port block to case	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
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- (1) Port Block
(2) Pump Valve Plate

- (3) Motor Valve Plate
(4) Needle Bearing

Motor Cylinder Block

1. Hold the output shaft (1) and slightly tap the rear of case flange with a soft hammer to separate the motor cylinder block assembly
2. Slide out the motor cylinder block (2) with pistons (3), retainer plate (4) and retainer holder (5).

(When reassembling)

- Aligning the hole on the swashplate to the dowel pin in the case, and install the output shaft assembly in the case

- (1) Output Shaft
(2) Motor Cylinder Block
(3) Piston

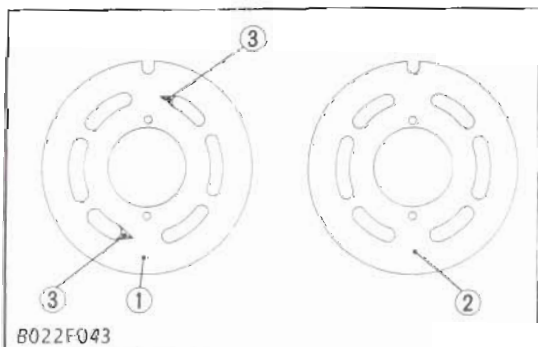
- (4) Retainer Plate
(5) Retainer Holder



0011P147



0306P003

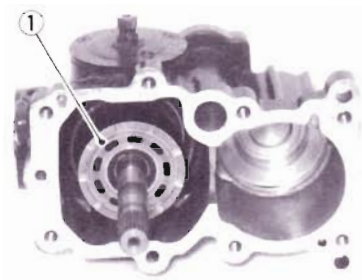


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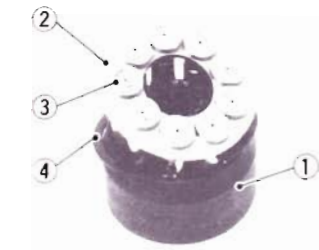
■ IMPORTANT

- Valve plate of the pump (with two notches) should be mounted on the pump side of the port block.
- The notch side of pump valve plate should be directed to the side of the pump cylinder block.

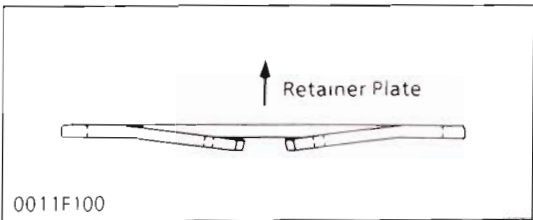
- (1) Pump Valve Plate
(2) Motor Valve Plate
(3) Notch



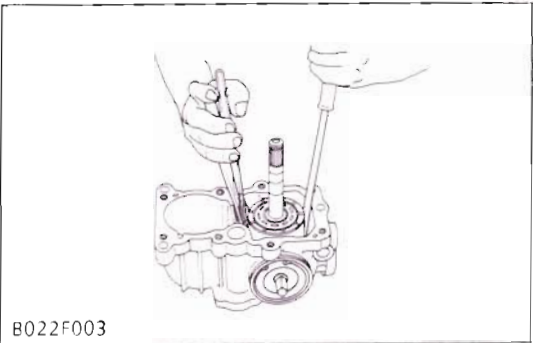
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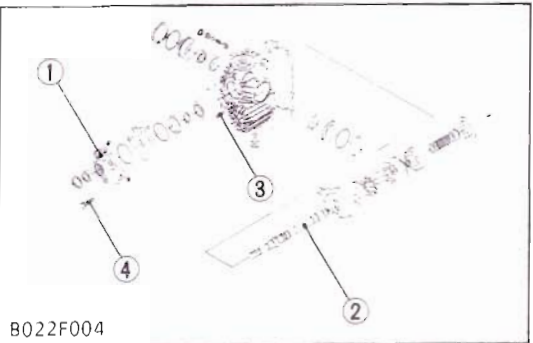
0011P146



0011F100



B022F003



B022F004

Pump Cylinder Block

1. Remove the internal snap ring retaining the retainer plate of pump
2. Slide out pump cylinder block (1) with pistons (3) retainer plate (2) and internal snap ring (4).
3. Draw out the thrust plate from the variable swashplate

(When reassembling)

- Check that internal snap ring (4) faces correct in the direction, and install it to pump swashplate
- Squeeze the snap ring (4) and slip into the hole its are first by pushing down with a screwdriver to fit surely

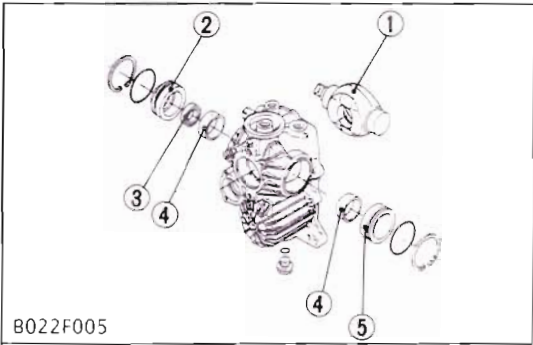
- | | |
|-------------------------|---------------|
| (1) Pump Cylinder Block | (3) Piston |
| (2) Retainer Plate | (4) Snap Ring |

Charge Pump and Input Shaft

1. Remove the screws (4) for retaining the charge pump case (1)
2. Tapping the rear end of the input shaft (2) with a soft hammer, separate the charge pump case (1) with the input shaft (2) from the case
3. Remove two dowel pins (3)

Tightening torque	Charge pump case to case	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lb
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- | | |
|----------------------|---------------|
| (1) Charge Pump Case | (3) Dowel Pin |
| (2) Input Shaft | (4) Screw |

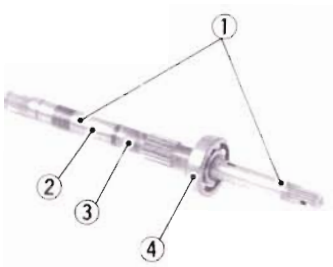


Cover "A", "B" and Trunnion Shaft

- 1. Remove the internal snap ring
- 2. Tap the trunnion shaft (1) using a soft hammer to create a clearance between the case and the cover "A" (2)
Then, pry the cover "A" (2) open with a screw-driver Pry the cover "B" (5) in the same way
- 3. Pull out the trunnion shaft (1).

- (1) Trunnion Shaft
- (2) Cover A
- (3) Oil Seal
- (4) Seam of Bearing
- (5) Cover B

SERVICING

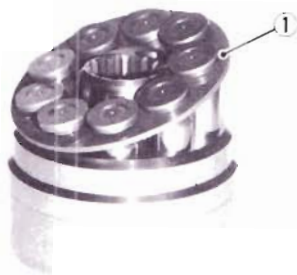


Input Shaft

- 1. Pull out input shaft (3) with the bearing on it from the charge pump case.
- 2. Check the seal surface (1), the bearing surface (2) and the bearing (4).
- 3. If the shaft is rough or grooved, replace.
- 4. If the bearing is worn, replace

- (1) Seal Surface
- (2) Bearing Surface
- (3) Input Shaft
- (4) Bearing

0011P132



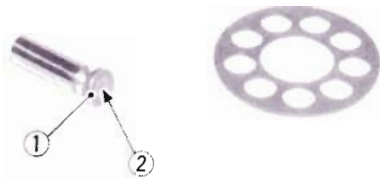
Cylinder Block Bore and Pistons

- 1. Lift all the pistons gently with the retainer plate (1).
- 2. Check the pistons for their free movement in the cylinder block bores.
- 3. If the piston or the cylinder block bore is scored, replace the cylinder block assembly.

Clearance between piston and bore	Factory spec	0.02 mm 0.0008 in
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- (1) Retainer Plate

0306P008



0306P009

Piston Slipper and Retainer Plate

1. Check the slipper (1) for flatness.
2. If rounded, replace.
3. Measure the thickness of piston slipper
4. If the measurement is less than the allowable limit, replace.
5. Check the lubricant hole (2) for clogging.
6. If clogged, open hole with compressed air

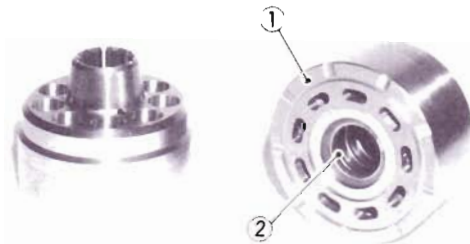
Thickness of slipper	Factory spec	3.00 mm 0.118 in
	Allowable limit	2.90 mm 0.114 in

(1) Piston Slipper

(2) Lubricant Hole

Cylinder Block Face

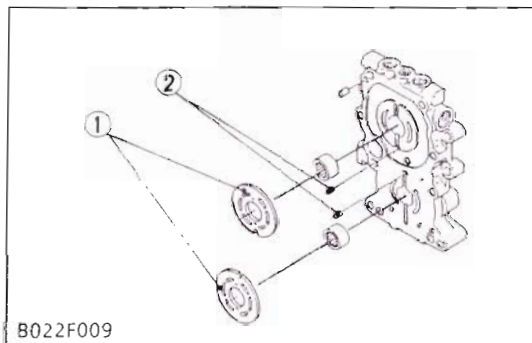
1. Check the polished face (1) of cylinder block for scoring
2. If scored, replace the cylinder block assembly
3. Check the spring (2) for breakage.
4. If broken, replace the cylinder block assembly.



(1) Polished Face

(2) Spring

0306P010



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Valve Plate

1. Check the engagement of the valve plate (1) and the dowel pin (2)
2. Pushing the valve plate against the dowel pin, lift it to remove
3. Check the valve plate for foreign particles
4. Clean the valve plate and dry with compressed air
5. Check the valve plate for scratches, wear and erosion
6. If worn or scored, replace

■ NOTE

- Run a fingernail across the valve plate surface. If worn, it will be felt. After checking, coat them with hydrostatic transmission oil.

(1) Valve Plate

(2) Dowel Pin

Swashplate and Thrust Plate

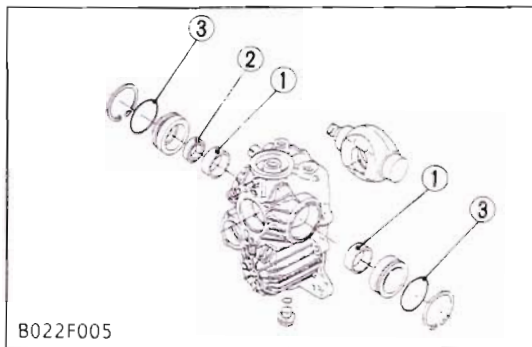
1. Check the bearing surface of trunnion shaft (1) for scratches and excessive wear
2. If worn or scored, replace
3. Check the thrust plate (2) for scratches and excessive wear.
4. If worn or scored, replace



(1) Bearing Surface

(2) Thrust Plate

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Trunnion Shaft Cover

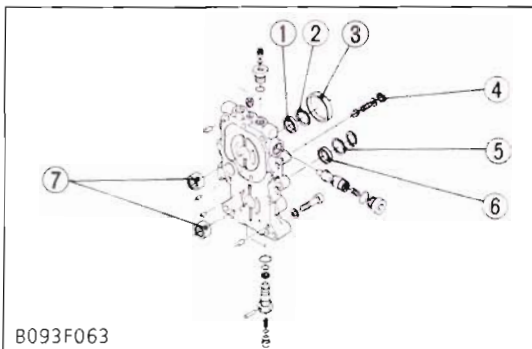
1. Check the bearings (1) for scratches and excessive wear
2. If worn or scored, replace.
3. Check the oil seal (2) and the O-ring (3) for damage.

NOTE

- After checking, coat the bearing with hydrostatic transmission oil, and the oil seal lip and the O-ring with grease.

(1) Bearing
(2) Oil Seal

(3) O-ring



Oil Seal and Bearing

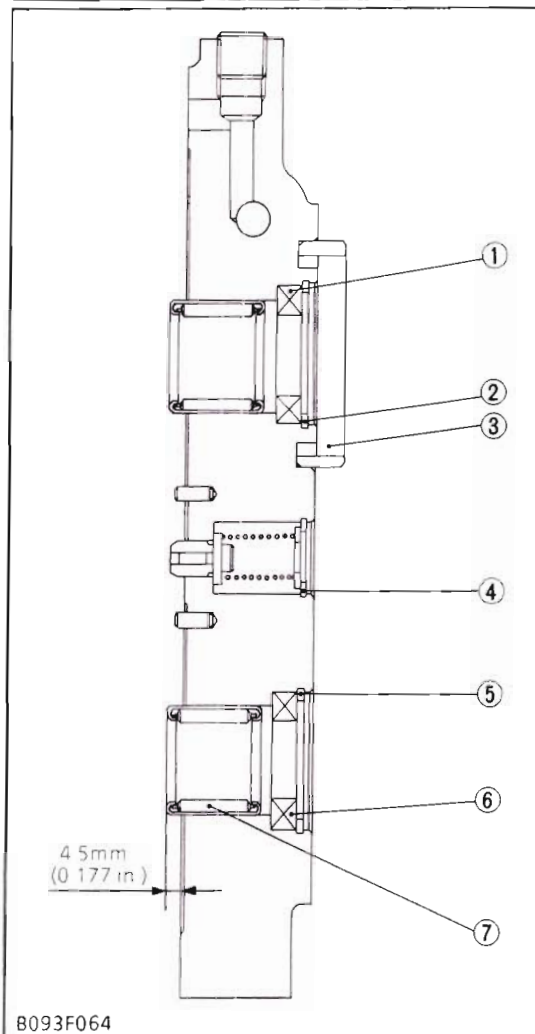
1. Remove the collar (3) and internal snap ring (2), (5) and check the oil seals (1), (6) for damage.
2. Check the bearings (7) for wear
3. If the bearings are worn, replace.

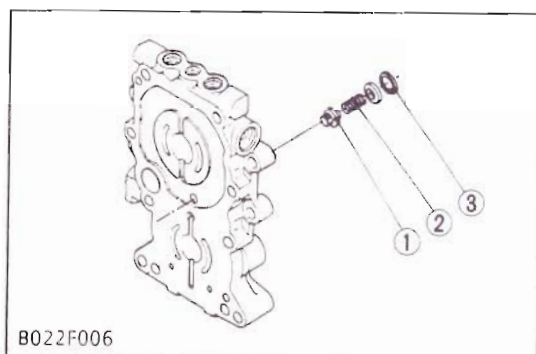
NOTE

- After checking, coat the bearing with hydrostatic transmission oil and the oil seal lip with grease.
- When replacing the bearing, press it in the port block so that its mark faces outside and 4.5 mm (0.177 in.) of it remains above the machined surface.
- When reassembling, always replace the oil seal as follows.

(1) Oil Seal
(2) Internal Snap Ring
(3) Collar
(4) Internal Snap Ring

(5) Internal Snap Ring
(6) Oil Seal
(7) Needle Bearing





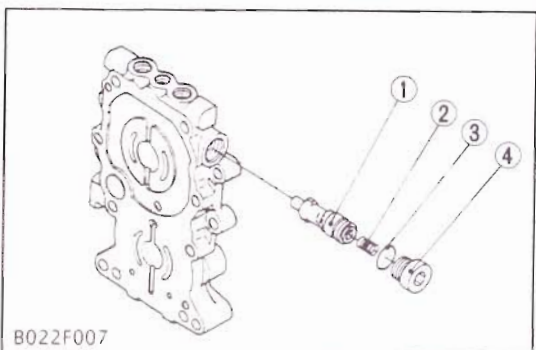
Case Relief Valve

1. Check the valve and the spring for excessive wear and breakage.
2. If worn or broken, replace

Length of valve spring	Factory spec	23.0 mm, 0.906 in (free)
		15.0 mm, 0.591 in (load 29.4 N, 3.00 kgf, 6.67 lbs)

(1) Case Relief Valve
(2) Spring

(3) Internal Snap Ring



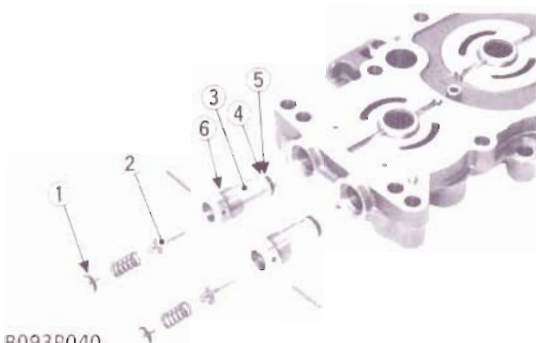
(1) Valve
(2) Spring

(3) O-ring
(4) Cap Nut

Check and High Pressure Relief Valve

1. Check the valve (1) for scratches and damage
2. Check the valve seat in the port block for damage
3. Check the spring (2) for breakage and wear
4. If anything unusual, replace the check and high pressure relief valve complete assembly

Length of valve spring	Factory spec	18.2 mm, 0.717 in (free)
		14.5 mm, 0.571 in (load 3.43 N, 0.35 kgf, 0.77 lbs)
Length of valve spring	Factory spec	12.4 mm, 0.488 in (free)
		10.5 mm, 0.413 in (load 41.27 N, 4.27 kgf, 9.41 lbs)
Tightening torque	Cap nut	53.9 to 63.7 N·m 5.5 to 6.5 kgf·m 39.8 to 47.0 ft·lb



(1) O-ring
(2) Neutral Valve
(3) Valve Body

(4) Backup Ring
(5) O-ring
(6) O-ring

Neutral Valve

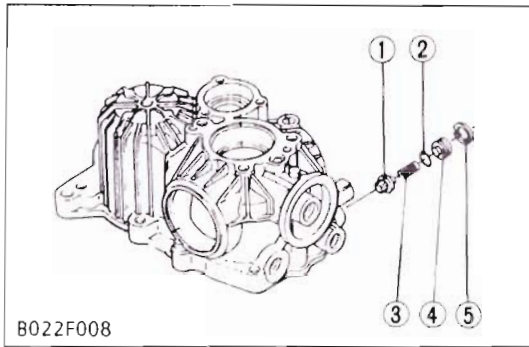
1. Remove the valve assembly and disassemble it
2. Check the neutral valve (2) for their free movement on or in the valve body (3)
3. If the valve surface is scored, replace
4. Check the holes of the valve body (3) and the neutral valve (2) for clogging.
5. If clogged, open hole with compressed air.
6. Check the O-rings (1), (5) and the backup ring (4) for scratches and damage
7. Check the springs for breakage and wear
8. If anything unusual, replace

Length of valve spring	Factory spec	18.4 mm, 0.7244 in (free)
		13.9 mm, 0.5472 in (load 43.2 N, 4.4 kgf, 9.7 lbs)

NOTE

- When reassembling, replace the O-ring and the backup rings.

Tightening torque	valve body to case	53.9 to 63.7 N·m 5.5 to 6.5 kgf·m 39.8 to 47.0 ft·lb
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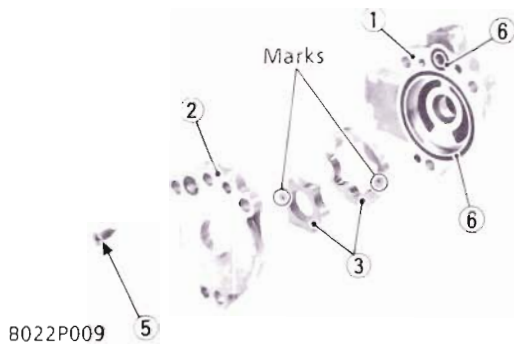
- (1) Valve
(2) O-ring
(3) Spring
(4) Spring Holder
(5) Snap Ring

Charge Relief Valve

1. Remove the internal snap ring (5) and draw out the spring holder (4) after pushing it a several time.
2. Check the spring (3) for breakage and wear.
3. Check the O-ring (2) for damage.
4. If anything unusual, replace.

NOTE

- Install the internal snap ring with its sharp edge facing outside.



Charge Pump

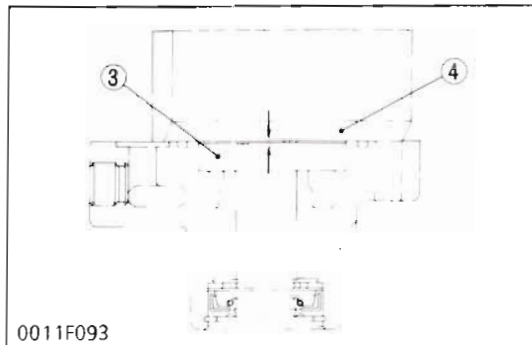
1. Check the charge pump case (1), the plate (2) and the gerotor set (3) for scratches and wear
2. If scratched or worn, replace the charge pump complete assembly.
3. Measure the side clearance referring to the figure.
4. If the clearance exceeds the factory specification, replace the charge pump complete assembly

Side clearance	Factory spec	0.030 to 0.060 mm 0.0012 to 0.0024 in.
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NOTE

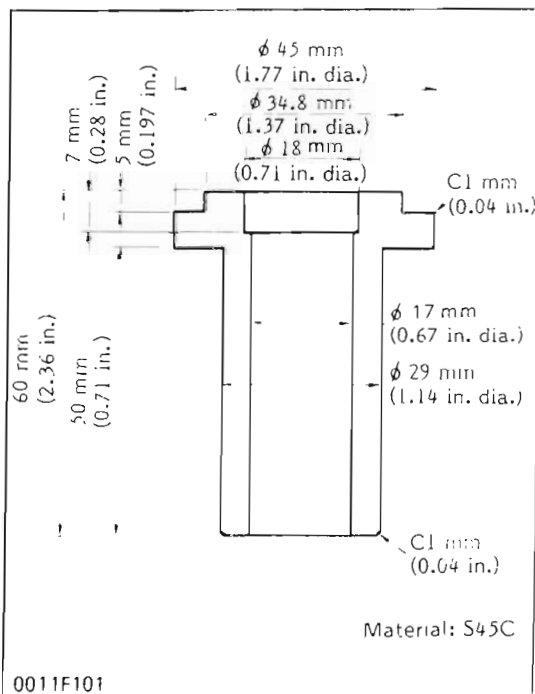
- When reassembling, replace the O-rings (6) and the oil seals, and grind the surface of the plate (2) and the charge pump case (1) with finest oil stone.

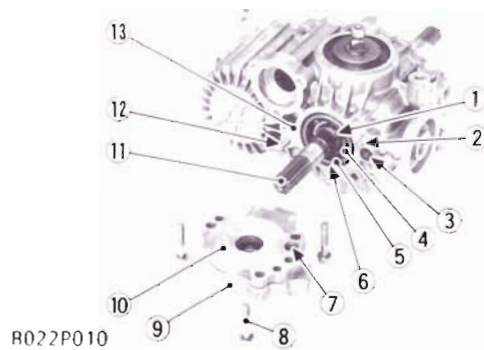
- (1) Charge Pump Case
(2) Plate
(3) Gerotor Set
(4) Straight Edge
(5) Screw
(6) O-ring



Special Tool A for Pressing Oil Seal

1. Make the special tools shown in figure and reassemble the charge pump according to following directions.





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Reassembling

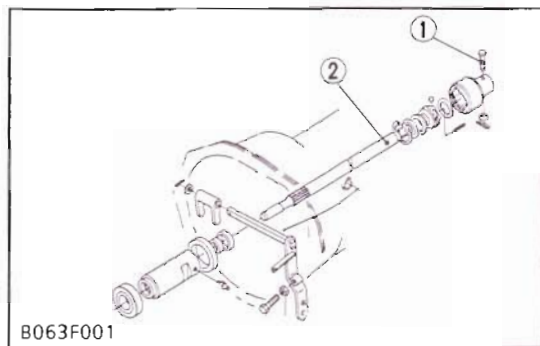
1. Place the swashplate in neutral and install the input shaft (11) to the case (13) with the bearing (4) on it.
2. Install the collar (5) on the bearing (4).
3. Coat the O-rings (3), (6) with hydrostatic transmission oil and install them on the case (13).
4. Install the dowel pins (2), (12).
5. Press the oil seal in the charge pump case, using the special tool A, until it is 4 mm (0.157 in.) below the machined surface.
6. Install the internal snap ring with its sharp edge facing outside.
7. Coat the O-rings with hydrostatic transmission oil and install them on the charge pump case (9).
8. Install the gerotor set on the charge pump case and set the plate (10) to it.
9. Set the screw (7) and tighten it, aligning each hole on the plate to each hole on the charge pump case, each other.
10. Install this charge pump assembly to the input shaft, aligning the gerotor splines to the shaft splines and two holes to two dowel pins.
11. Tighten three screws (8).

Tightening torque	Charge pump case to case	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs
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- | | |
|------------------------|----------------------|
| (1) External Snap Ring | (8) Screw |
| (2) Dowel Pin | (9) Charge Pump Case |
| (3) O-ring | (10) Plate |
| (4) Bearing | (11) Input Shaft |
| (5) Collar | (12) Dowel Pin |
| (6) O-ring | (13) Case |
| (7) Screw | |

NOTE IN REPLACEMENT OF PREVIOUS HST WITH NEW TYPE

- When mounting new HST on previous B7100HST-B6100HST, replace the propeller shaft, spring pin and ball joint assembly with new types and add the back shaft collar on the input shaft.
- Refer to "Disassembly Hydrostatic Transmission" on page G-section 3-26 and page S.3-8 in case of the replacement of the previous HST with new type.

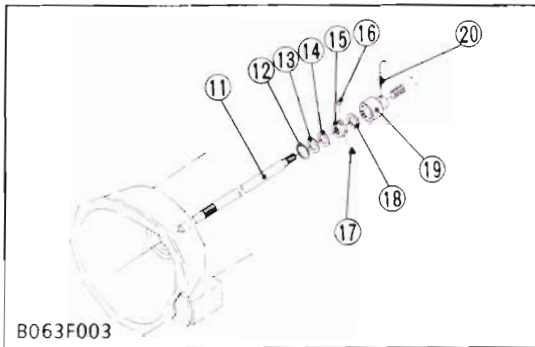
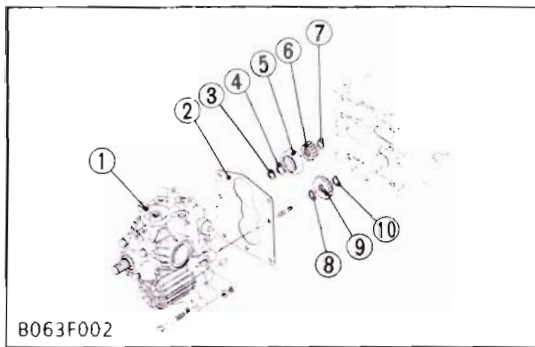


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Disassembling Previous Hydrostatic Transmission

1. Remove the joint pin (1) and the propeller shaft (2).
2. Remove the spring pin of the drive shaft and drive shaft.
3. Remove four nuts and two bolts from the hydrostatic transmission and transmission case.
4. Remove the neutral holder assembly and HST gasket.
5. Pull out the front wheel drive shaft 1 forward.
6. Remove the external snap ring, 16T gear and the external snap ring.
7. Remove the inlet pipe joint and HST gasket.

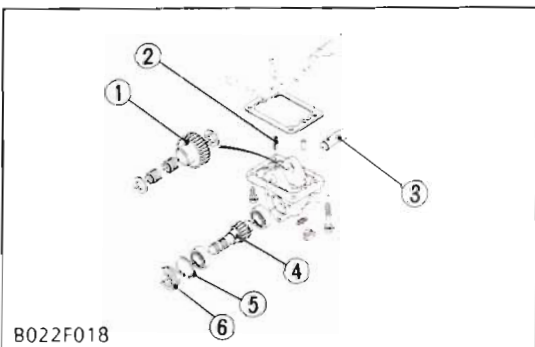
- | | |
|---------------|---------------------|
| (1) Joint Pin | (2) Propeller Shaft |
|---------------|---------------------|



Assembling New Hydrostatic Transmission

1. Set the neutral holder assembly and the front wheel drive shaft 1 to new HST (1).
2. Install the external snap ring (3), back shaft collar (4), ball bearing (5), 13T gear (6) and the external snap ring (7) on the input shaft.
3. Install the external snap ring (8), 16T gear (9) and the external snap ring (10) on the HST output shaft.
4. Install the HST gasket (2) and HST (1) to the transmission case and tighten the HST mounting screws and nuts.
5. Install the inlet pipe joint and hose on HST and tighten the hose clamp.
6. Reconnect the drive shaft with the front wheel drive shaft. (4WD only)
7. Install the retainer (13), gasket (14) and the inner ball coupler (15) on the new type of the propeller shaft (11) and set the spring pin (17) to fix the coupler (15) with it.
8. Mount the ball (16) on the coupler and insert it into the outer ball coupler (19) with the gasket (18) and set the internal snap ring (12) to the coupler (19).
9. Reconnect new propeller shaft with the input shaft by the spring pin (20).

- | | |
|-------------------------|-------------------------|
| (1) HST | (11) Propeller Shaft |
| (2) Gasket | (12) Internal Snap Ring |
| (3) External Snap Ring | (13) Retainer |
| (4) Back Shaft Collar | (14) Gasket |
| (5) Ball Bearing | (15) Inner Ball Coupler |
| (6) 13T Gear | (16) Ball |
| (7) External Snap Ring | (17) Spring Pin |
| (8) External Snap Ring | (18) Gasket |
| (9) 16T Gear | (19) Outer Ball Coupler |
| (10) External Snap Ring | (20) Spring Pin |



- | | |
|----------------|--------------------|
| (1) 24T Gear | (4) 11T Gear Shaft |
| (2) Spring Pin | (5) Snap Ring |
| (3) Shaft | (6) Oil Seal |

Mid-PTO

1. Separate the mid-PTO case from the transmission case.
2. After tapping the spring pin (2) into the shaft (3), remove the shaft (3) and the 24T gear (1).
3. Remove the oil seal (6) and the external snap ring (5).
4. Draw out the 11T gear shaft (4) with the bearing on it.

Tightening torque	Plug	32.5 to 36.2 N·m 4.5 to 5.0 kgf·m 44 to 49 ft-lbs
	Mid-PTO case to transmission case	48.0 to 55.9 N·m 4.9 to 5.7 kgf·m 35 to 41 ft-lbs

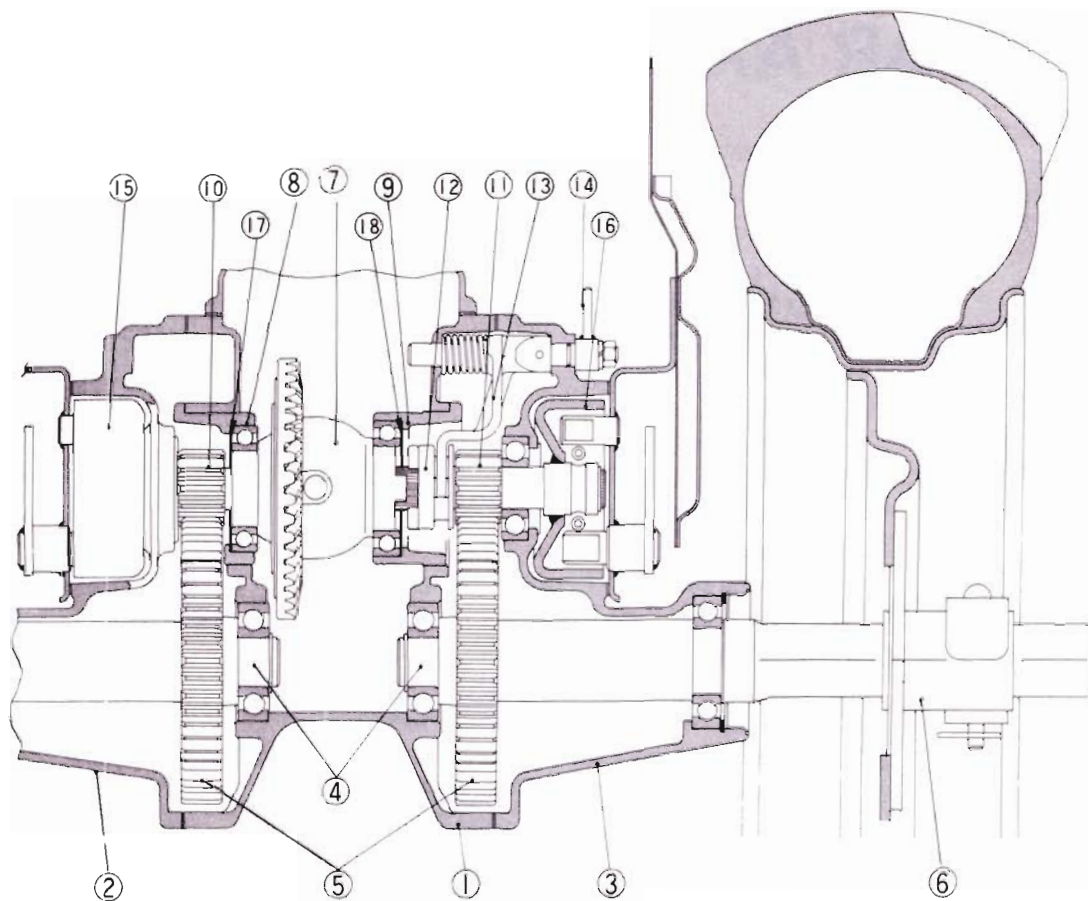
REAR AXLE, DIFFERENTIAL

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Group 1

General Description



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- | | | |
|----------------------|--|---------------------------------|
| 1. Differential Case | 7. Differential Assembly | 13. Differential Lock Fork |
| 2. Axle Case (Left) | 8. Differential Bearing Holder (Left) | 14. Differential Lock Lever |
| 3. Axle Case (Right) | 9. Differential Bearing Holder (Right) | 15. Brake Assembly (Left) |
| 4. Rear Axle | 10. Differential Gear Shaft (Left) | 16. Brake Assembly (Right) |
| 5. Spur Gear (55T) | 11. Differential Gear Shaft (Right) | 17. Differential Side Shim 3, 4 |
| 6. Wheel Hub | 12. Differential Lock Clutch | 18. Differential Side Shim 5, 6 |

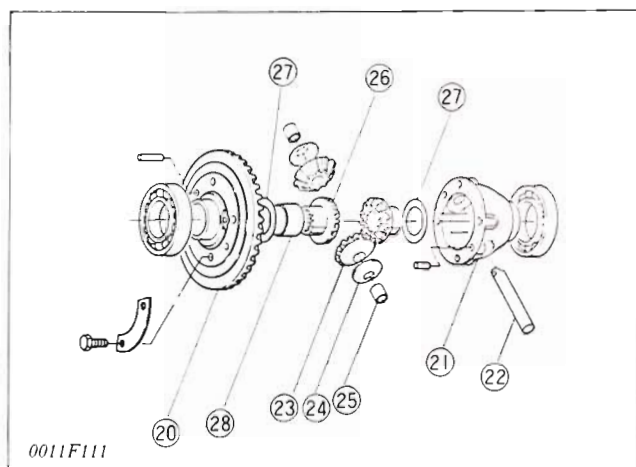
Fig. H-1 Rear Axle (viewed from back)

The rear axles are semifloating type, therefore the rear axles support about 60% of tractor weight as well as transmitting the engine torque. Each differential gear shaft (10) (11) is equipped with the left and right independent brake system. The differential gear case (1) connected to the transmission case and the axle cases (2) and (3) form a single unit. Power transmission and power control are made by the differential (7), brakes (15), (16) and the axles (4) inside the unit.

The shaft speed controlled by the transmission, more reduced to approx. 1/6.2 (6/37) by the differential pinion and spiral bevel gear (20), and further reduced to 1/4.9 (12/55) by the differential gear shafts (10) and (11) and axle gears (5). As a result, its speed is reduced to approx. 1/28.3 at the differentials and the rear axles, before being transmitted to the rear wheels. To control backlash between the spiral pinion and the spiral bevel gear (20), shim 3, 4 (17) and shim 5, 6 (18) are used.

To control backlash between the differential pinion (23) and the differential side gear (26), shims 1, 2 and 3 (27) are used.

To stop differential function and improve traction, differential lock clutch (12) engaged to differential gear shaft (right) (11) is slid and connected to the differential case (21).



- | | |
|-------------------------------|----------------------------|
| 20. Spiral Bevel Gear | 25. Bushing |
| 21. Differential Case | 26. Differential Side Gear |
| 22. Differential Pinion Shaft | 27. Shim 1, 2, 3 |
| 23. Differential Pinion | 28. Bushing |
| 24. Pinion Thrust Collar | |

Fig. H-2 Differential

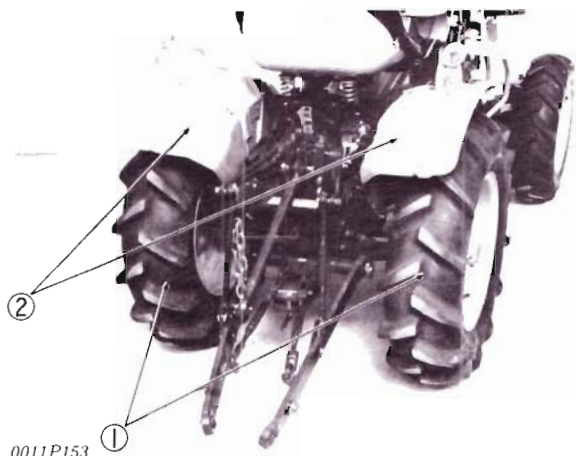
Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Noisy differential	Broken or worn bearings	Replace
	Broken or worn bushing	Replace
	Broken or worn pinion thrust collars	Replace
	Improper backlash adjustment	Adjust
	Insufficient oil	Add oil
	Broken or worn gears or pinions	Replace
Differential does not operate	Stuck bushing or thrust collars (Insufficient oil)	Repair or replace (Add oil)
	Differential lock engaged	Repair
	Worn return spring	Replace
Differential unable to lock	Broken or worn differential lock clutch	Replace
	Worn differential lock fork cam	Replace

Group 2

Disassembly

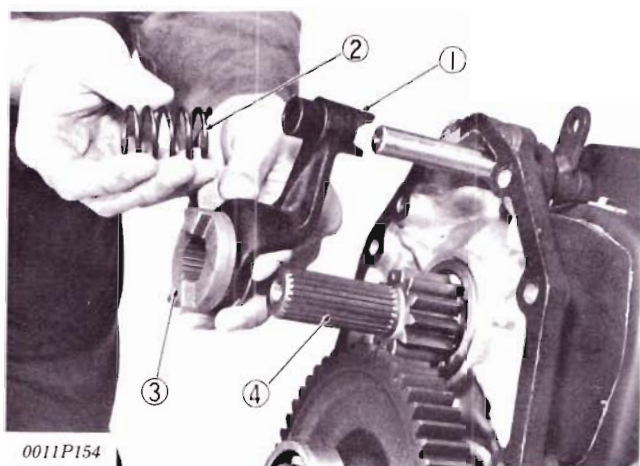
Rear Axle



1. Rear Wheels (right and left) 2. Fenders (right and left)

Fig. H-3 Rear Wheels and Fenders

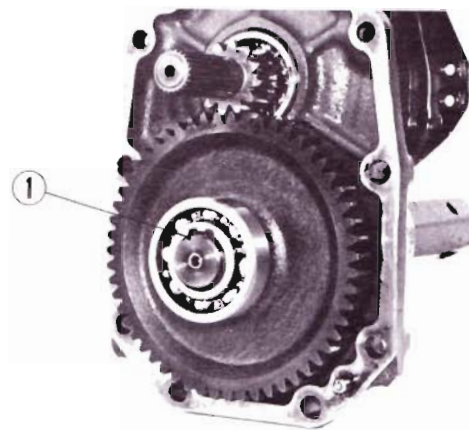
- (1) Remove the rear wheels (right and left).
- (2) Remove the fenders (right and left).
- (3) Disconnect the brake rods and the differential rod.
- (4) Remove the set bolts and detach the rear axle case.



1. Differential Lock Shift Fork 3. Differential Lock Clutch
2. Spring 4. Differential Gear Shaft

Fig. H-4 Differential Lock Clutch and Shift Fork

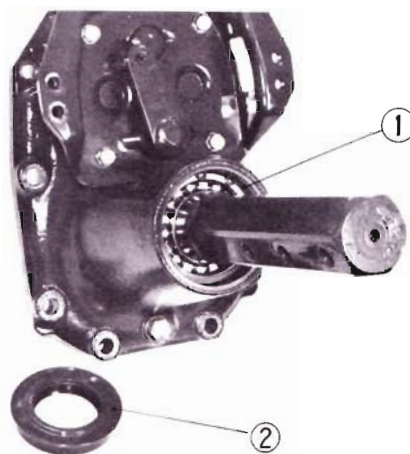
- (5) Remove the differential lock spring, shift fork and clutch.



1. External Circlip

Fig. H-5 Detaching Axle Gear (55T)

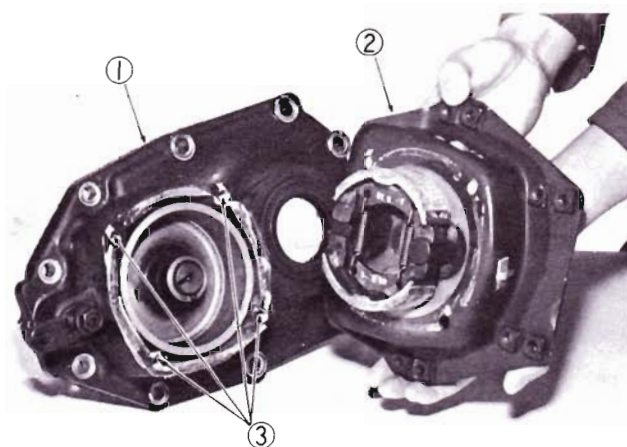
- (6) Remove the external circlip, and ball bearing with puller.
- (7) Detach the gear (55T).



1. External Circlip
2. Oil Seal

Fig. H-6 Detaching Rear Axle

- (8) Remove the oil seal (2) and the external circlip (1), and pull out the rear axle.

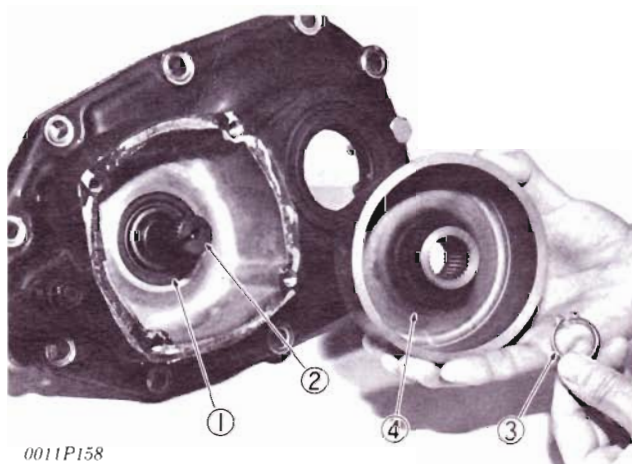


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- | | |
|----------------|---------------------------|
| 1. Axle Case | 3. Mounting Bolt Position |
| 2. Brake Cover | |

Fig. H-7 Removing Brake Cover

(9) Remove the four bolts and brake cover.



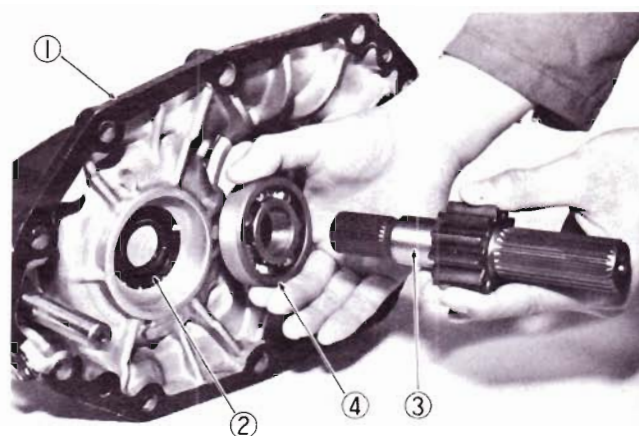
0011P158

- | | |
|----------------------------|---------------------|
| 1. Oil Seal | 3. External Circlip |
| 2. Differential Gear Shaft | 4. Brake Drum |

Fig. H-8 Removing Brake Drum

(10) Remove the external circlip.

(11) Draw out the brake drum from the differential gear shaft.



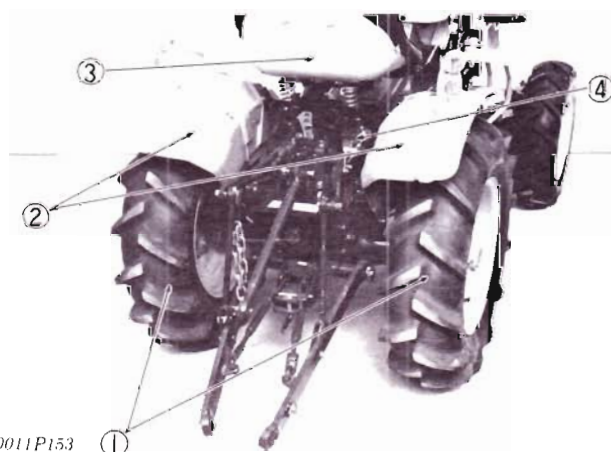
0011P159

- | | |
|--------------|----------------------------|
| 1. Axle Case | 3. Differential Gear Shaft |
| 2. Oil Seal | 4. Ball Bearing (6305) |

Fig. H-9 Removing Differential Gear Shaft

(12) Draw out the differential gear shaft from the inside of the axle case by slightly tapping it with a plastic hammer.

Differential Gear

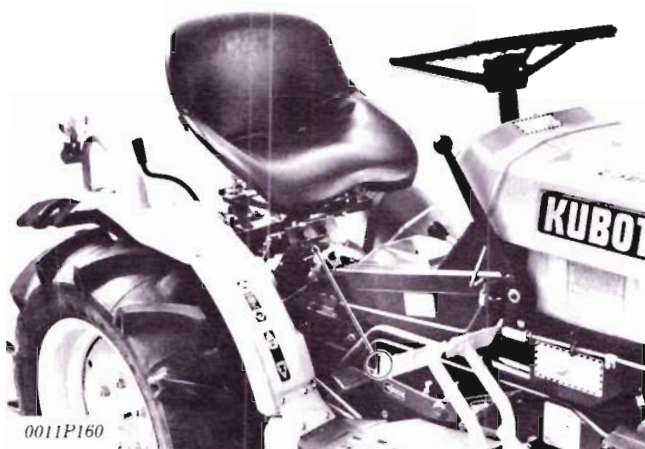


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- | | |
|----------------|------------------|
| 1. Rear Wheels | 3. Seat |
| 2. Fenders | 4. Control Valve |

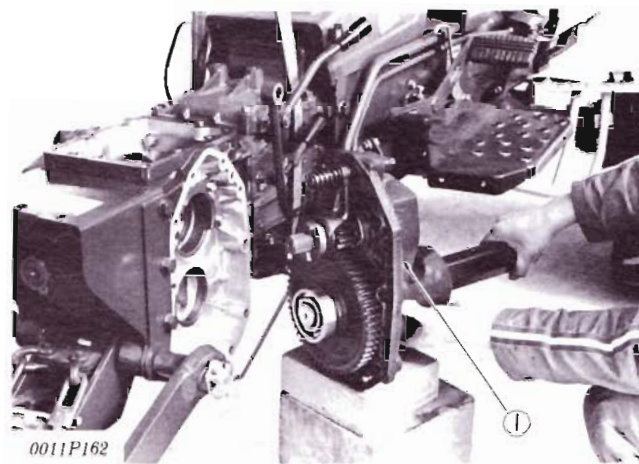
Fig. H-10 Removing Rear Wheels and Fenders

(1) Remove rear wheels (right and left).
 (2) Remove fenders (right and left).
 (3) Remove the seat.



1. Directional Valve

Fig. H-11 Removing Directional Valve

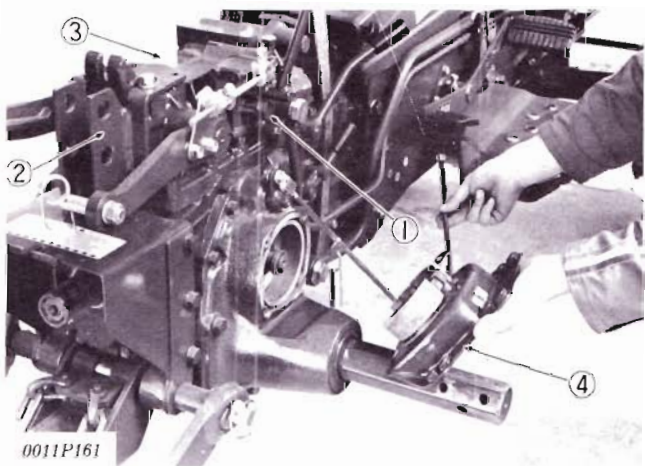


1. Rear Axle Case

Fig. H-13 Removing Rear Axle Case

(4) Remove the directional valve and bracket.

(8) Remove the rear axle case.



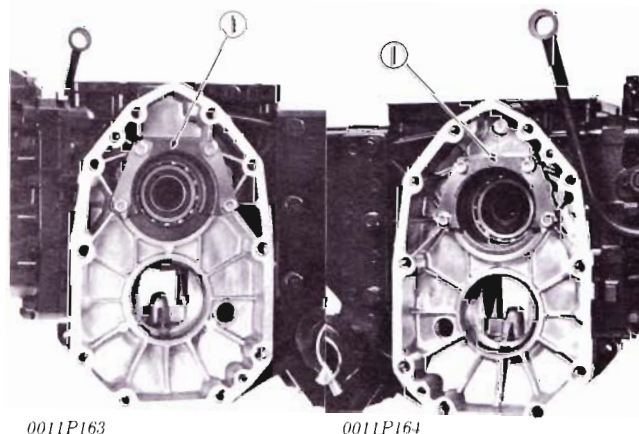
1. Control Valve

2. Top Link Bracket

3. Rear Case Cover

4. Brake Case Cover

Fig. H-12 Removing Brake Case



1. Bearing Holder (left)

Fig. H-14

Bearing Holder (left)

1. Bearing Holder (right)

Fig. H-15

Bearing Holder (right)

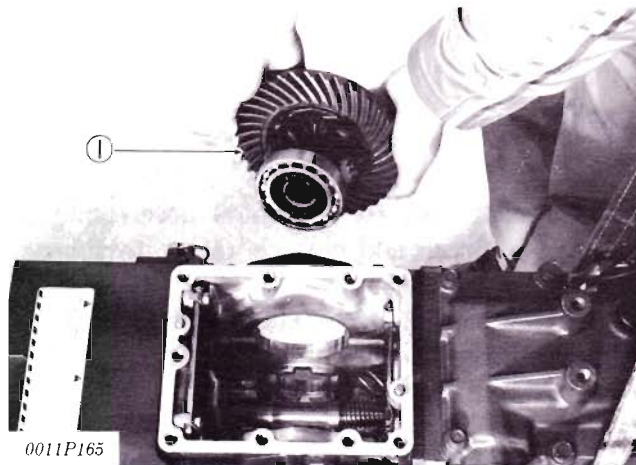
(5) Remove the control valve.

(6) Remove the top link bracket and then dismount the rear case cover.

(7) Remove the brake.

(9) Remove the bearing holder (left) and the differential side shim.

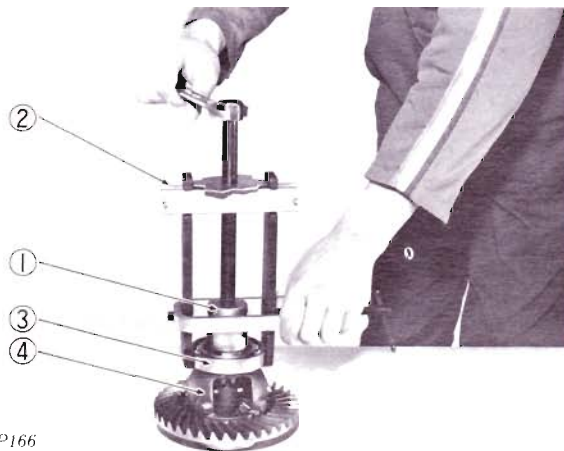
(10) Remove the bearing holder (right) and the differential side shim.



1. Differential Gears

Fig. H-16 Removing Differential Gears

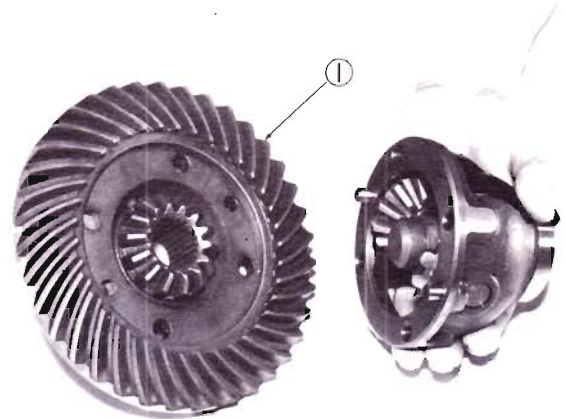
- (11) Remove the differential gears.



1. Strap
2. Special Puller
3. Ball Bearing
4. Differential Case

Fig. H-17 Removing Bearing from Differential Case

- (12) Use the special puller for bearing removal with strap of 30mm (1-3/16 in.) diameter at the end of the differential case to remove right and left bearings.

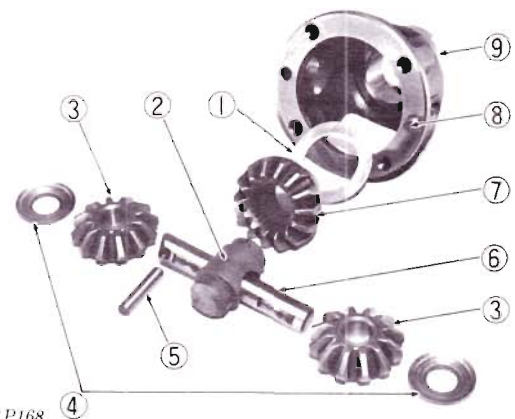


0011P167

1. Spiral Bevel Gear (37T)

Fig. H-18 Removing Spiral Bevel Gear (37T)

- (13) Remove two lock plate and bolts.
(14) Detach the spiral bevel gear from the differential case by slightly tapping the periphery (circumference) of the bevel gear with a plastic hammer.



0011P168

1. Differential Side Shim
2. Differential Thrust Collar
3. Differential Pinion
4. Pinion Thrust Collar
5. Parallel Pin
6. Differential Pinion Shaft
7. Differential Side Gear
8. Knock Pin
9. Differential Case

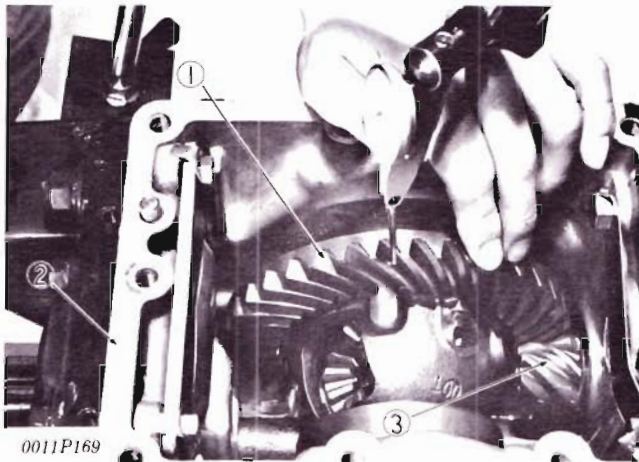
Fig. H-19 Disassembling Differential Case

- (15) Draw out the straight pin holding the differential pinion shaft from the differential case.
(16) Remove the differential pinion shaft.
(17) Remove the differential pinions, thrust collar and side gear.

Group 3

Servicing

Checking Backlash between Spiral Bevel Gear and Pinion

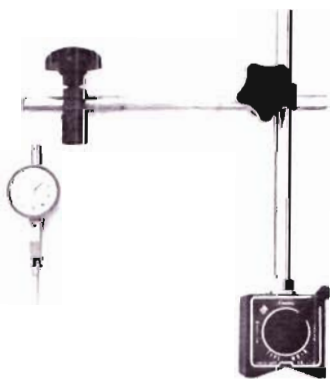


1. Spiral Bevel Gear (37T) 3. Spiral Bevel Pinion
2. Differential Gear Case

Fig. H-20 Checking Backlash between Spiral Bevel Gear and Pinion

- (1) Set a magnetic base on the transmission case.
- (2) Set a lever type indicator between teeth of the spiral bevel gear and measure the backlash.

TEST EQUIPMENT: Lever Type Indicator



0011P170

Fig. H-21 Lever Type Indicator

- (3) When measuring, fix the spiral bevel pinion. Adjust backlash and gear contact with shims.

- Reference value
0.1 to 0.2 mm (0.004 to 0.008 in.)
- Allowable limit
0.4 mm (0.016 in.)

Checking Backlash between Differential Pinion and Side Gear

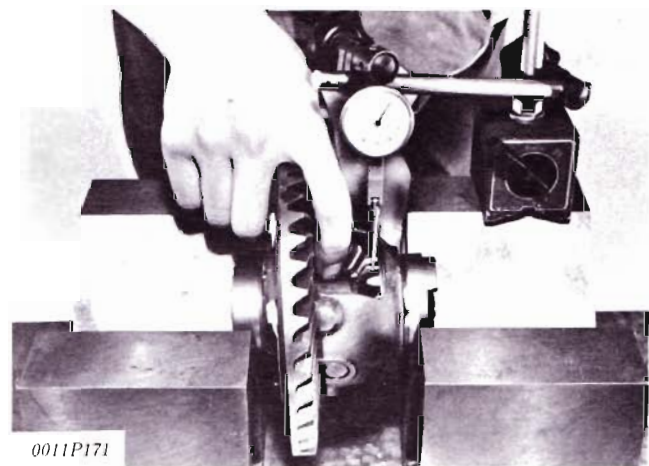
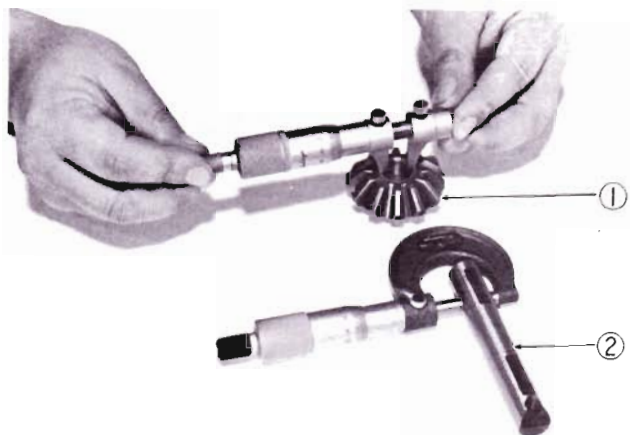


Fig. H-22 Checking Backlash between Differential Pinion and Side Gear

- (1) Set the right and left differential gear shafts to the differential gear, and place them on V-blocks on the surface plate.
 - (2) Measure the backlash by placing a lever type indicator between gear teeth.
 - (3) If the measurement exceeds the allowable limit, adjust with shims.
- Reference value
0.15 to 0.30 mm (0.006 to 0.012 in.)
 - Allowable limit
0.4 mm (0.016 in.)

Checking Clearance between differential Pinion Shaft and Bushing



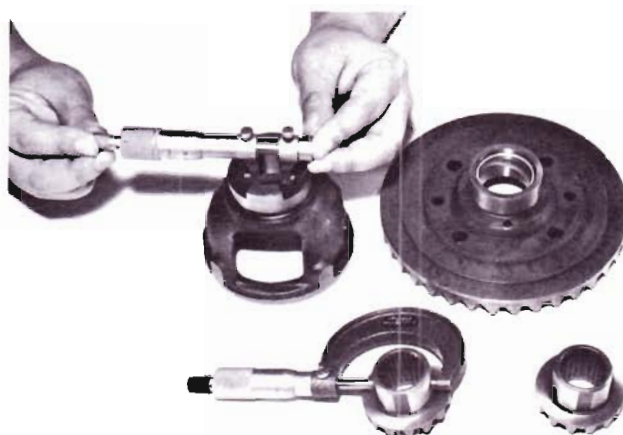
0011P172

1. Differential Pinion 2. Differential Pinion Shaft

Fig. H-23 Checking Clearance between Differential Pinion Shaft and Bushing

- (1) Clean the surface of the differential pinion shaft, and measure the outer diameter vertically and horizontally each at two locations.
- (2) Clean the inside of the bushing and measure the inner diameter vertically and horizontally with an inside micrometer.
- (3) If the measurement exceeds the allowable limit, replace.
 - Reference value
 0.016 to 0.045 mm (0.0006 to 0.0018 in.)
 Shaft O.D.: 13.973 to 13.984 mm
 (0.5502 to 0.5506 in.)
 Bushing I.D.: 14.000 to 14.018 mm
 (0.5512 to 0.5519 in.)
 - Allowable limit
 0.25 mm (0.01 in.)

Checking Clearance between Differential Side Gear and Case

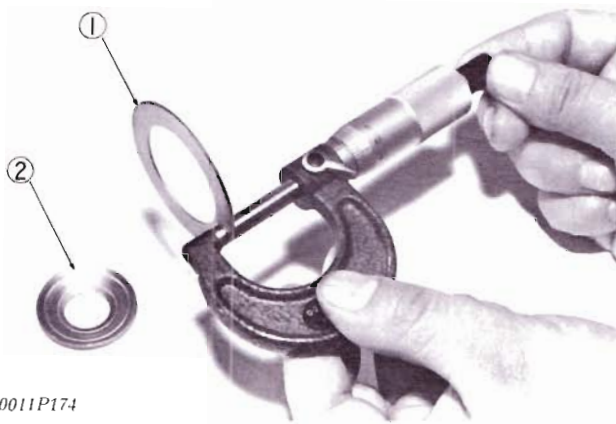


0011P173

Fig. H-24 Checking Clearance between Differential Side Gear and Case

- (1) Clean the surface of the shaft of the differential side gear and measure the outer diameter vertically and horizontally with a micrometer.
- (2) Clean the inside of the differential case and spiral bevel gear, and measure the inner bushing diameter vertically and horizontally with an inside micrometer.
- (3) If the measurement exceeds the allowable limit, replace.
 - Reference value
 0.025 to 0.066 mm (0.0010 to 0.0026 in.)
 Side Gear O.D.: 31.959 to 31.975 mm
 (1.2582 to 1.2589 in.)
 Bushing, Case I.D.: 32.000 to 32.025 mm
 (1.2598 to 1.2608 in.)
 - Allowable limit
 0.25 mm (0.01 in.)

Checking Thickness of Differential Side Gear Shim and Differential Pinion Gear Thrust Shim



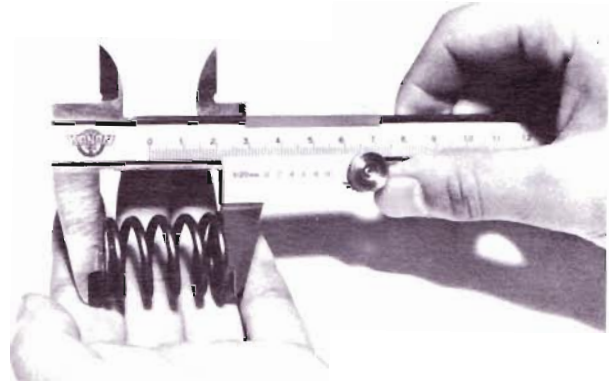
0011P174

1. Differential Side Shim 2. Pinion Thrust Collar

Fig. H-25 Checking Thickness of Differential Side Gear Shim and Differential Pinion Gear Thrust Shim

- (1) Clean the surface of shims and collars, and then measure their thickness with a micrometer.
- (2) If they worn excessively, replace.
 - Reference value
 - Shim 1: 0.7 to 0.8 mm (0.0276 to 0.0315 in.)
 - Shim 2: 0.9 to 1.0 mm (0.0367 to 0.0394 in.)
 - Shim 3: 1.1 to 1.2 mm (0.0433 to 0.0472 in.)
 - Collar : 0.9 to 1.0 mm (0.0367 to 0.0394 in.)

Checking Free Length of Differential Lock Return Spring



0011P069

Fig. H-26 Checking Free Length of Differential Lock Return Spring

- (1) Remove it, and measure the free length with a vernier caliper.
- (2) If it worn excessively, replace.
 - Reference value
 - 40 mm (1.5748 in.)

Group 4

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Differential Gear

Differential lock pedal free travel		
(R.V.)	4 to 8 mm	(5/32 to 5/16 in.)
Differential side gear shaft O.D.		
(R.V.)	31.959 to 31.975 mm	(1.2582 to 1.2589 in.)
Differential case I.D. (right side) and Bushing I.D. (left side)		
(R.V.)	32.000 to 32.025 mm	(1.2598 to 1.2608 in.)
Clearance between differential side gear and case (or bushing)		
(R.V.)	0.025 to 0.066 mm	(0.0010 to 0.0026 in.)
(A.L.)	0.25 mm	(0.01 in.)
Differential pinion shaft O.D.		
(R.V.)	14.966 to 14.984 mm	(0.5892 to 0.5899 in.)
Bushing (fitted) I.D.		
(R.V.)	15.000 to 15.018 mm	(0.5906 to 0.5913 in.)
Clearance between differential pinion shaft and bushing		
(R.V.)	0.016 to 0.052 mm	(0.0006 to 0.0020 in.)
(A.L.)	0.25 mm	(0.01 in.)
Backlash between differential pinion and differential side gear		
(R.V.)	0.15 to 0.30 mm	(0.006 to 0.012 in.)
(A.L.)	0.4 mm	(0.016 in.)
Backlash between spiral bevel pinion and bevel gear		
(R.V.)	0.1 to 0.2 mm	(0.004 to 0.008 in.)
(A.L.)	0.4 mm	(0.016 in.)
Rear cover to differential gear case tightening torque (M10)	39 to 45 Nm	(4.0 to 4.6 kgf·m, 29 to 33 ft-lbs)
Rear axle case to differential case tightening torque (M10)	48 to 56 Nm	(4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)
(M12)	77 to 90 Nm	(7.9 to 9.2 kgf·m, 57 to 67 ft-lbs)
Rear case cover to chain bracket tightening torque. (M12)	41 to 47 Nm	(4.2 to 4.8 kgf·m, 30 to 35 ft-lbs)

Rear case cover to differential

gear case tightening torque (M10) 25 to 29 Nm (2.6 to 3.0 kgf·m, 19 to 22 ft-lbs)

Rear Axle

End play of rear axle

(A.L.)	2 mm	(0.079 in.)
[Replace bearing if it is more than 2 mm (0.079 in.)]		

Rear wheel drive gear backlash

(R.V.)	0.1 to 0.2 mm	(0.004 to 0.008 in.)
(A.L.)	0.5 mm	(0.02 in.)

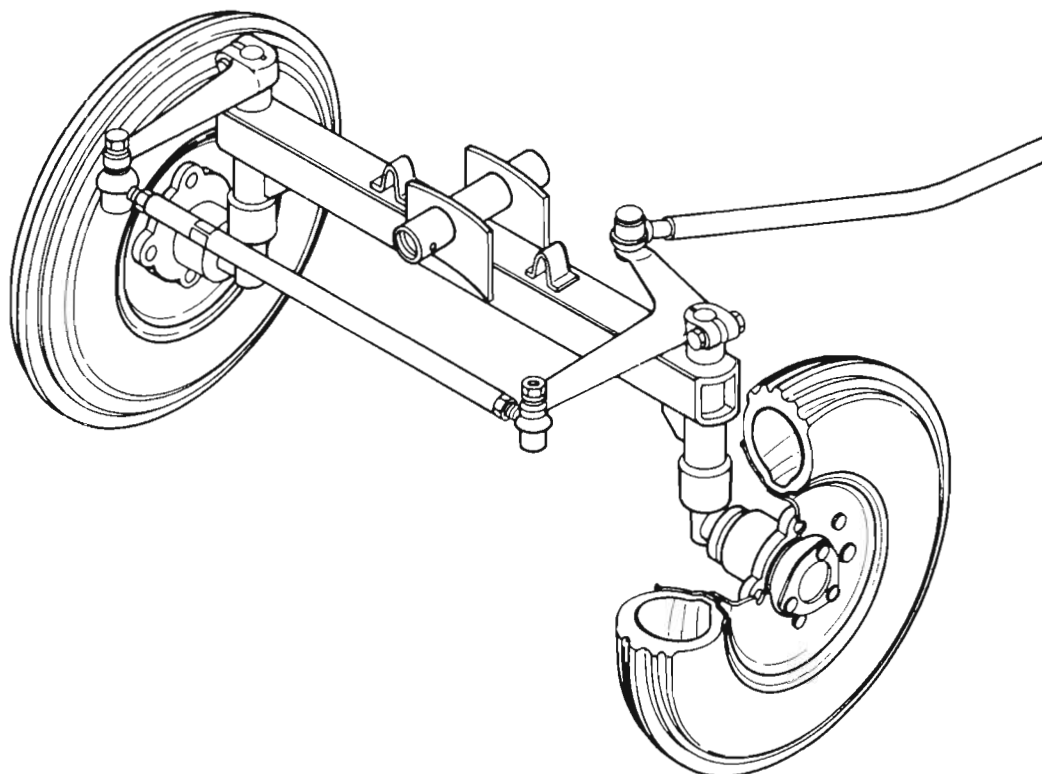
FRONT AXLE

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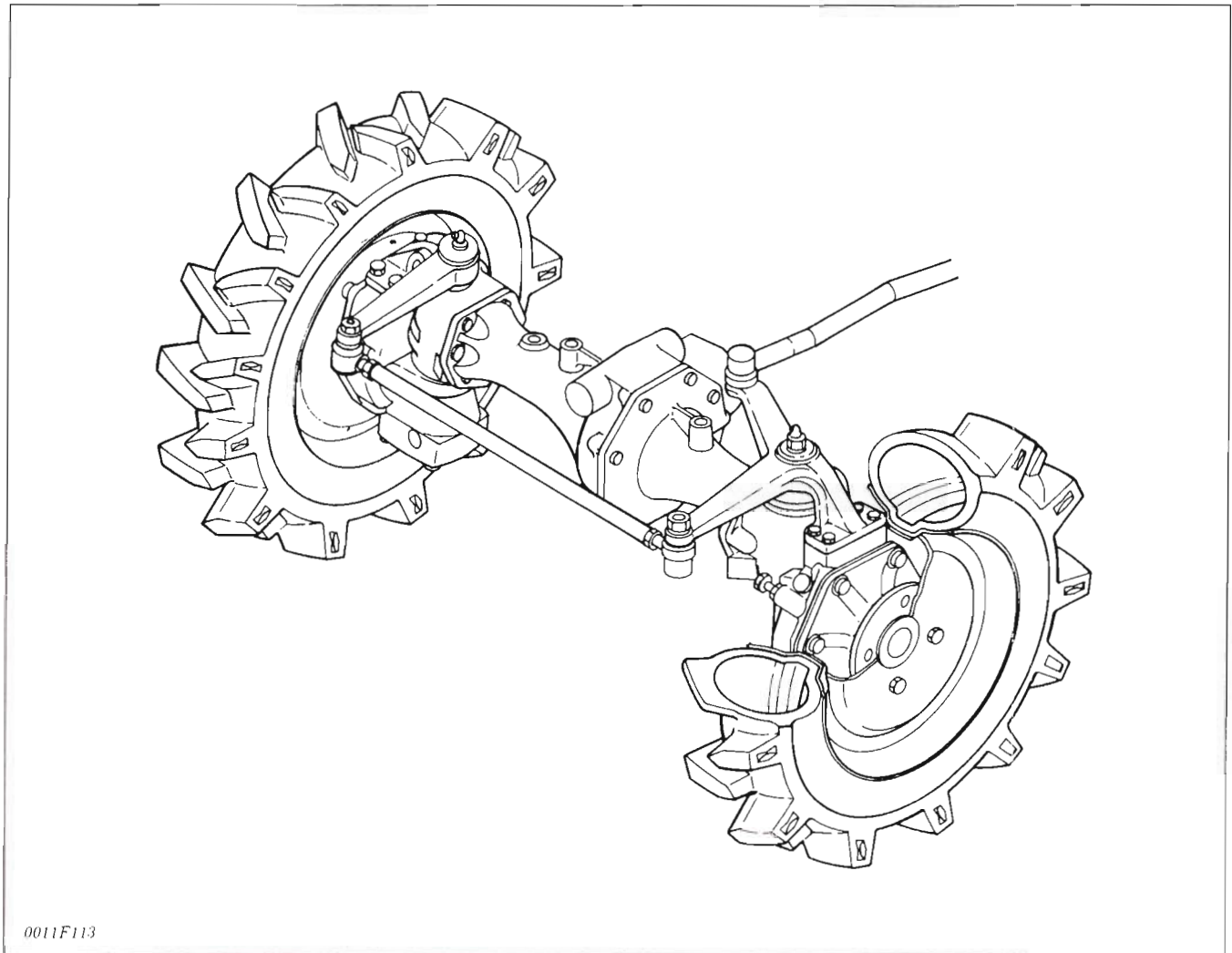
Group 1

General Description



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Fig. 1-1 Appearance of 2-Wheel Drive Front Axle

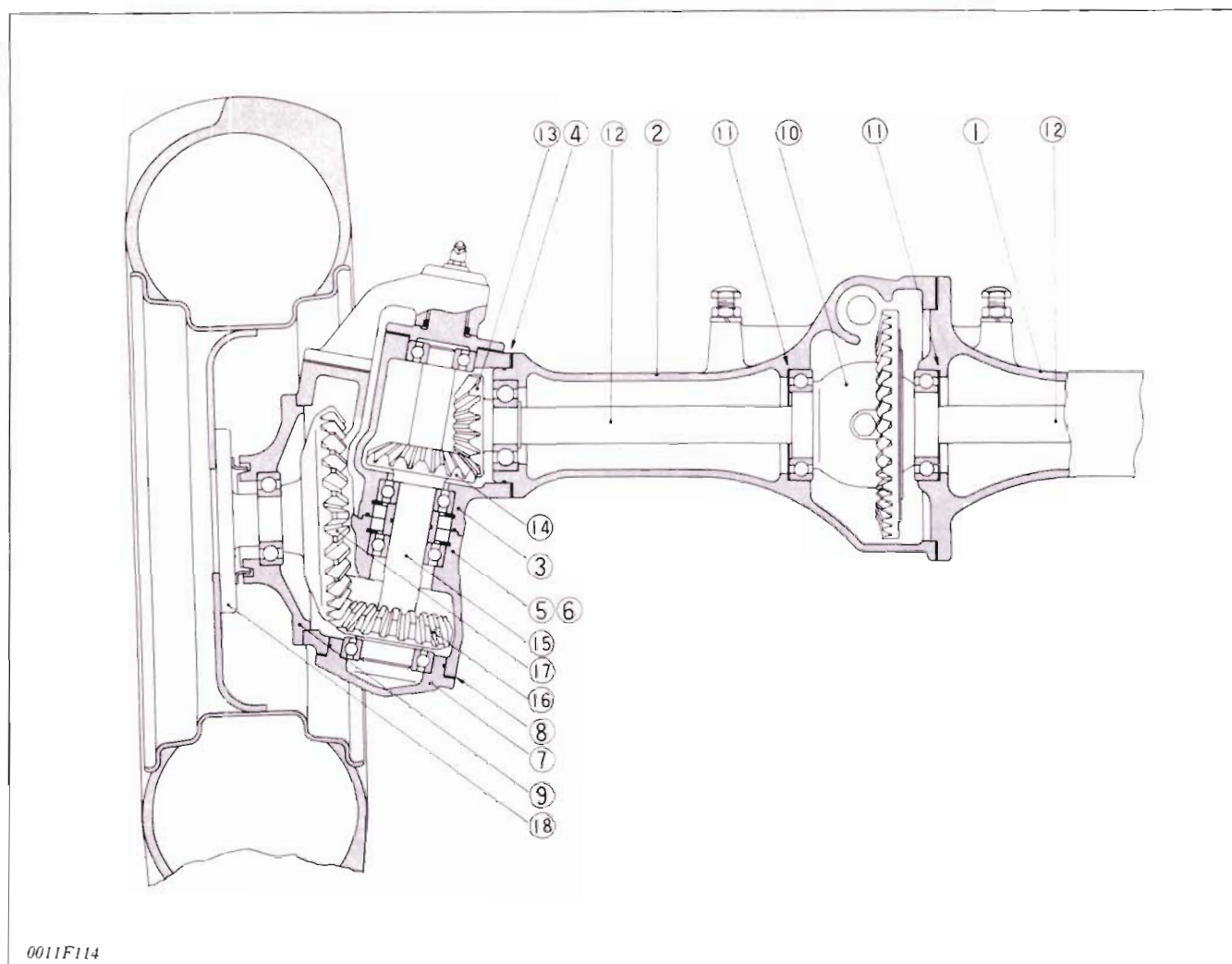


0011F113

Fig. 1-2 Appearance of 4-Wheel Drive Front Axle

Different types of front axles are used for 2-wheel and 4-wheel drive. The E-type is used for tractors with free-running front wheels and the D-type is used for tractors with powered front wheels. Both

support the front of the tractor and perform a steering function. Their construction and weight are quite different, however.



- | | | | |
|---------------------------|----------------------------|--------------------------------|----------------------|
| 1. Front Axle Arm (Left) | 6. Front Axle Case (Right) | 11. Differential Side Shim 3.4 | 16. Bevel Gear (16T) |
| 2. Front Axle Arm (Right) | 7. Bevel Support Cover | 12. Shaft | 17. Bevel Gear (31T) |
| 3. Bevel Gear Case | 8. Shim 4, 5, 6 | 13. Bevel Gear (13T) | 18. Front Wheel Hub |
| 4. Shim 1, 2, 3 | 9. Front Axle Cover | 14. Bevel Gear (14T) | |
| 5. Front Axle Case (Left) | 10. Front Differential | 15. Bevel Gear Shaft | |

Fig. 1-3 4-Wheel Drive Front Axle

4-wheel drive front axle construction:

Major visible parts are the left and right ends of the left front axle arm (1) and right front axle arm (2), the bevel gear case (3) and the left and right front axle cases (5) and (6) and the front axle cover. Power is transmitted from the front differential assembly (10) through shaft (12), bevel gear (13), bevel gear (14), bevel gear shaft (15), bevel gear (16), bevel gear (17), and axle hub (18) to the wheels. Wheels revolution is controlled by the transmission, reduced to approx. 1/6.2 (6/37)

by the differential pinion and the spiral bevel gear (20), and to approx. 1/1.07 (13/14) by (13) and (14). As a result, wheels revolution is reduced to approx. 1/12.8 before it is transmitted to the front wheels. Shims (diff. side 3, 4) (11) are used to adjust backlash between the spiral bevel pinion and spiral bevel gear (20).

Shims 1, 2, 3 (4) and shims 4, 5, 6, (8) are used to adjust backlash between bevel gears (13) and (14), and (16) and (17).

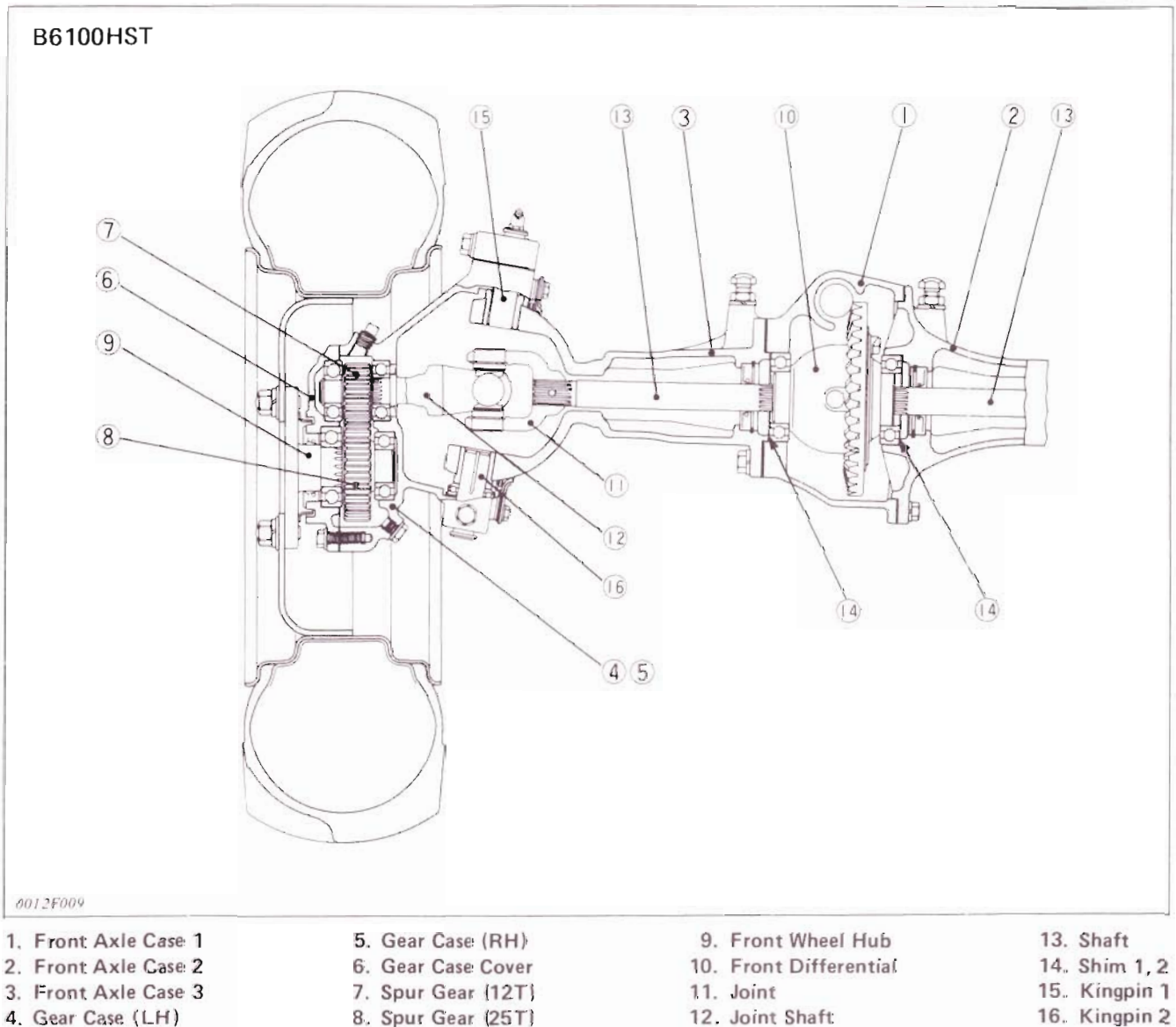


Fig. 1-3-(1) 4-Wheel Drive Front Axle (B6100HST)

4-wheel drive front axle construction:

Major visible parts are the front axle case 1 (1), the front axle case 2 (2), the front axle case 3 (3), the left and right gear case (4) (5), and gear case cover (6).

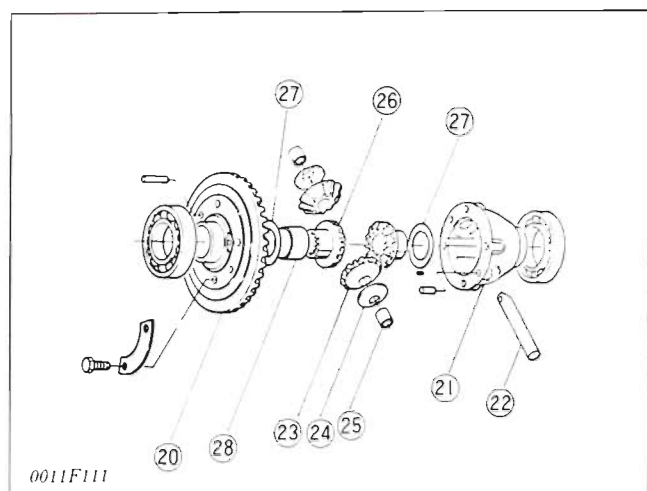
Power is transmitted from the front differential assembly (10) through shaft (13), joint (11), joint shaft (12), spur gear (12T) (7), spur gear (25T) (8), and front wheel hub (9) to the wheels.

Wheels revolution is controlled by the transmission,

reduced to a ratio approx. 1/6.2 (6T/37T) by the differential pinion (6T) and the spiral bevel gear (37T), and to approx. 1/2.08 (12T/25T) by the spur gear (12T) and the spur gear (25T).

As a result, wheels revolution is reduced to a ratio approx. 1/12.8 before it is transmitted to the front wheels.

Shims (diff. side 1, 2) (14) are used to adjust backlash between the spiral bevel pinion and spiral bevel gear.



- | | |
|-------------------------------|----------------------------|
| 20. Spiral Bevel Gear | 25. Bushing |
| 21. Differential Case | 26. Differential Side Gear |
| 22. Differential Pinion Shaft | 27. Shim 1.2.3 |
| 23. Differential Pinion | 28. Bushing |
| 24. Pinion Thrust Collar | |

Fig. 1-4 Front Differential

Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Front axles do not turn (only 4WD)	Broken or worn shifter	Replace
	Broken gear (24T) in the transmission case	Replace gear
	Missing or broken spring pin of universal joint	Replace spring pin
	Broken front differential gears or bevel gears	Repair and replace

Group 2

Disassembly



Fig. I-5 Removing Center Pin

- (1) Remove center pin stop spring.
- (2) Remove slotted nut.
Tightening torque for slotted nut:
9.8 Nm (1.0 kgf-m, 7.2 ft-lbs).
- (3) Remove center pin, and remove front wheel axle frame.

WHEN REASSEMBLING:

Apply chassis grease to the center pin.

- (4) Remove left and right from front wheels.
- (5) Remove tie rod end from knuckle arm.
Tightening torque for slotted nut on the tie rod end:
18 to 34 Nm (1.8 to 3.5 kgf-m, 13 to 25 ft-lbs).

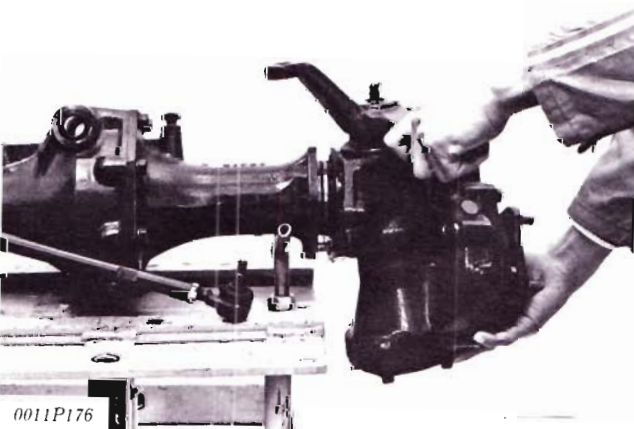


Fig. I-6 Separating Front Axle Arm

- (6) Separate front axle arm and bevel gear case.

NOTE: Be careful that the right number of O-rings and shims are used between front axle arm and bevel gear case.

- Shim thickness: 0.2, 0.3 and 0.5 mm
(0.008, 0.012 and 0.020 in.)



Fig. I-7 Removing Knuckle Arm Support

- (7) Remove knuckle arm support.



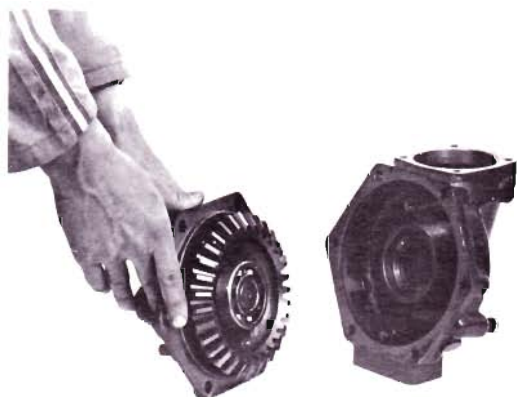
Fig. I-8 Removing Bevel Support Cover

- (8) Remove bevel support cover.

NOTE: Be careful that the right number of O-rings and shims are used between bevel support cover and front axle case.

- Shim thickness: 0.2, 0.3 and 0.5 mm
(0.008, 0.012 and 0.020 in.)

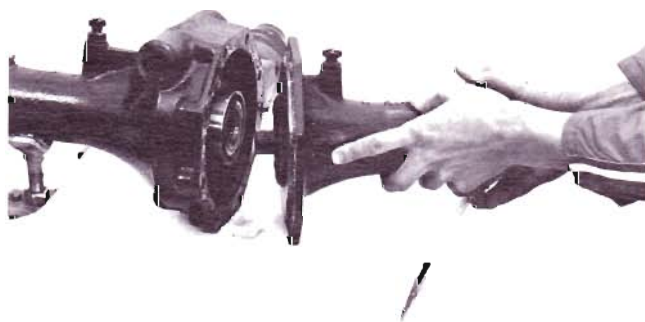
- (9) Tap bevel gear shaft on its bottom to separate bevel gear case and front axle case.



0011P179

Fig. I-9 Removing Front Axle Cover

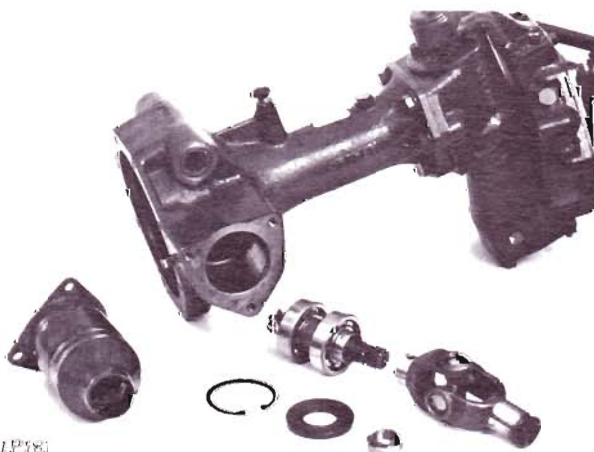
- (10) Remove front axle cover from front axle case.



0011P180

Fig. I-10 Removing Front Axle Arm (Left)

- (11) Remove front axle arm (left).
(12) Remove differential assembly.



0011P181

Fig. I-11 Removing Joint Case

- (13) Remove joint case.
(14) Pull out spring pin and remove universal joint.
(15) Remove nut for front drive pinion shaft and remove oil seal.
Tightening torque for self-locking nut:
98 to 147 Nm (10 to 15 kgf·m, 72 to 108 ft-lbs).
Locking positions: 2 places separated by 180°
(16) Punch out front drive pinion shaft.

Group 3

Servicing

Checking Clearance between Center Pin and Bushing



Fig. I-12 Checking Clearance between Center Pin and Bushing

- (1) Measure center pin diameter with an outside micrometer.
 - Center pin diameter:
19.88 to 20.03 mm (0.7827 to 0.7886 in.)
- (2) Measure center pin bushing inner diameter with an inside micrometer to obtain the proper clearance.
 - Center pin bushing inner diameter:
20.10 to 20.15 mm (0.7913 to 0.7933 in.)
- (3) If the measurement exceeds the allowable limit, replace.
 - Reference value:
0.07 to 0.27 mm (0.0028 to 0.0106 in.)
 - Allowable limit:
Center Pin O.D. 19.70 mm (0.7756 in.)
Bushings I.D. 20.40 mm (0.8031 in.)

Checking Clearance between Knuckle Arm and Knuckle Arm Support

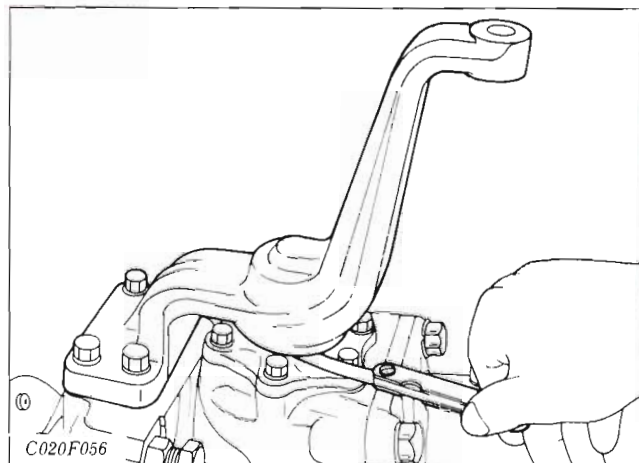


Fig. I-13 Checking Clearance between Knuckle Arm and Knuckle Arm Support

- (1) Tighten knuckle arm to the specified torque.
- (2) Measure the clearance between knuckle arm and knuckle arm support.
- (3) Adjust clearance at knuckle arm with shims.

NOTE:

- Shim thickness:
0.2, 0.3, 0.5 mm (0.008, 0.012, 0.020 in.)
- Reference value:
0 to 0.2 mm (0 to 0.008 in.)

Checking Clearance between Differential Case and Side Gear

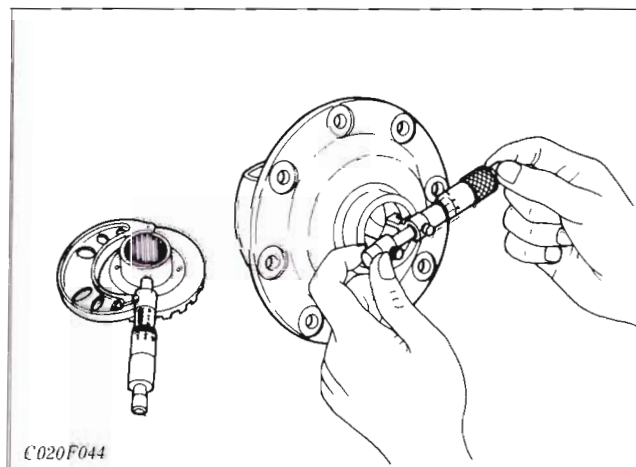


Fig. I-14 Checking Clearance between Differential Case and Side Gear

- (1) Measure the diameter of the differential side gear with an outside micrometer.
- (2) Measure the inside diameter of the differential case with an inside micrometer. Then, take the difference for the clearance.
- (3) If the clearance exceeds the allowable limit, replace.
 - Reference value:
0.025 to 0.066 mm (0.0010 to 0.0026 in.)
 - Allowable limit:
0.25 mm (0.01 in.)

Checking Clearance between Differential Pinion Shaft and Pinion Gear Bushing

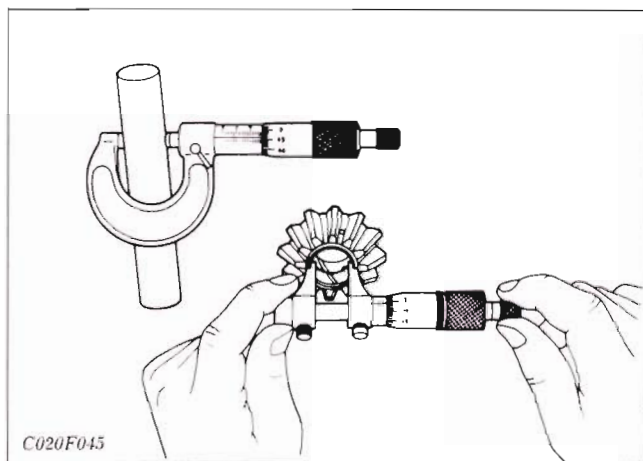


Fig. I-15 Checking Clearance between Differential Pinion Shaft and Pinion Gear Bushing

- (1) Measure the pinion shaft diameter with an outside micrometer.
- (2) Measure the inside diameter of the pinion gear bushing with an inside micrometer. Then, take the difference for the clearance.
- (3) If the clearance exceeds the allowable limit, replace.
 - Reference value:
0.016 to 0.052 mm (0.0006 to 0.0020 in.)
 - Allowable limit:
0.25 mm (0.01 in.)

Checking Backlash between Differential Pinion and Side Gear

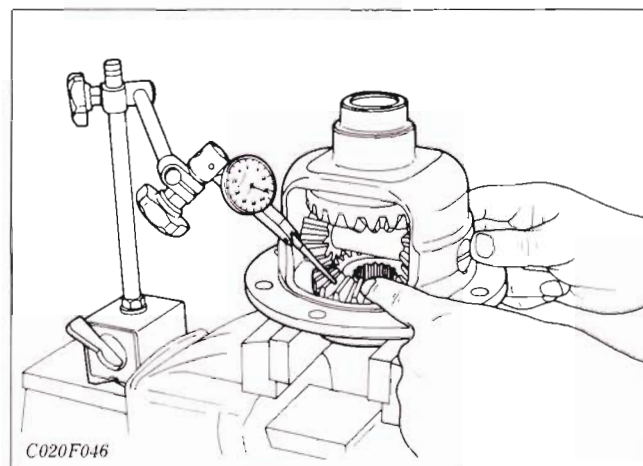


Fig. I-16 Checking Backlash between Differential Pinion and Side Gear

- (1) Clamp the differential case in a vise.
- (2) Push the differential pinion and side gear toward the differential case.
- (3) Set a lever-type indicator on one of the tooth faces of the differential side gear.
- (4) Clamp the mating differential pinion gear.
- (5) Measure the backlash by turning the gear to be measured.
- (6) If the backlash exceeds the allowable limit, replace pinion thrust collars and the side gear shims.

NOTE: Tooth contact must be more than 35%.

- Differential side washer:
0.8, 1.0, 1.2 mm (0.031, 0.039, 0.047 in.)
- Reference value:
0.20 to 0.25 mm (0.0079 to 0.0098 in.)
- Allowable limit:
0.4 mm (0.016 in.)

Checking Backlash between Spiral Bevel Pinion and Bevel Gear

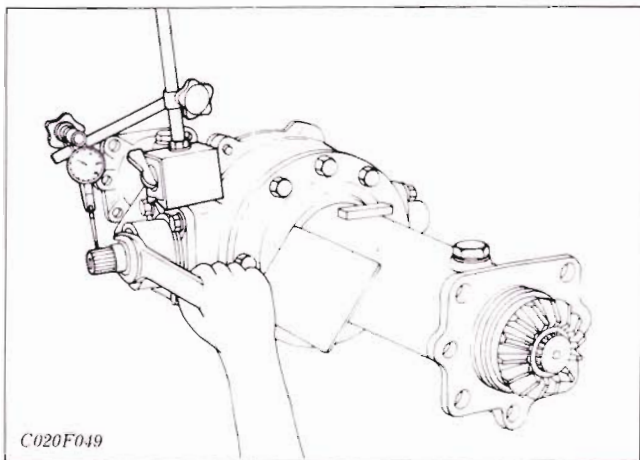


Fig. I-17 Checking Backlash between Spiral Bevel Pinion and Bevel Gear

- (1) Insert screwdriver into drain plug hole in the differential gear case to keep bevel gear stationary.
- (2) Place the lever tester on the spiral bevel pinion.
- (3) Move spiral bevel pinion to measure.
- (4) If the measurement exceeds the allowable limit, adjust.

How to adjust

- When backlash is small:
Remove shims from the spiral bevel gear side and add shims in the opposite side.
 - When backlash is great:
Add shims on the spiral bevel gear side and remove shims from the opposite side.
- Shim thickness:
0.2, 0.3, 0.5 mm (0.008, 0.012, 0.020 in.)
- Reference value:
0.1 to 0.2 mm (0.004 to 0.008 in.)
 - Allowable limit:
0.4 mm (0.016 in.)

Checking Bevel Gear Backlash in Bevel Gear Case

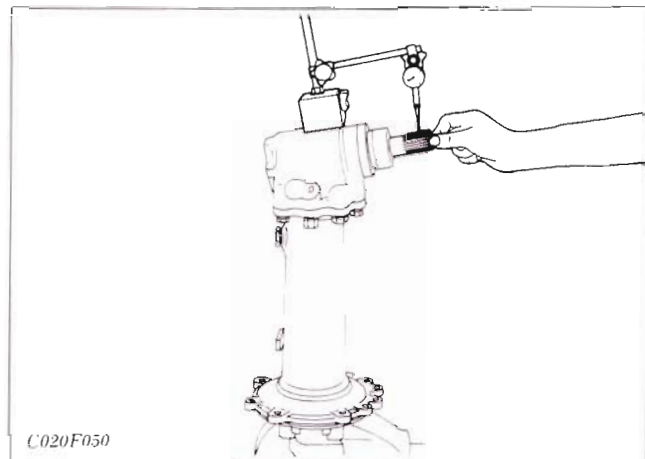


Fig. I-18 Checking Bevel Gear Backlash in Bevel Gear Case

- (1) Secure transmission shaft so that it does not move.
- (2) Place lever tester on the bevel gear shaft.
- (3) Move bevel gear shaft by hand and measure.
- (4) Adjust backlash using shims at the front wheel axle support.
- (5) If the measurement exceeds the allowable limit, adjust.
 - Shim thickness:
0.2, 0.3, 0.5 mm (0.008, 0.012, 0.020 in.)
 - Reference value:
0.10 to 0.30 mm (0.004 to 0.012 in.)
 - Allowable limit:
0.4 mm (0.016 in.)

Checking Bevel Gear Backlash in Front Axle Case

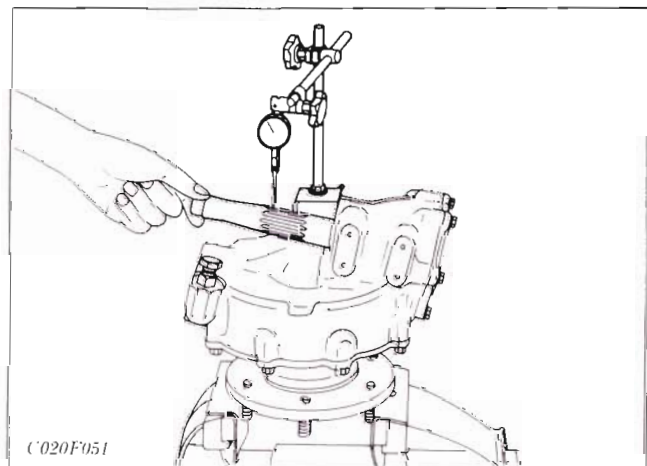


Fig. I-19 Checking Bevel Gear Backlash in Front Axle Case

- (1) Secure the axle so that it does not move.
- (2) Place lever tester on bevel gear shaft
- (3) Move bevel gear shaft by hand and measure.
- (4) If the measurement exceeds the allowable limit, replace.
- (5) Make an adjustment with shims in the bearing case.
 - Reference value:
0.10 to 0.30 mm (0.04 to 0.012 in.)
 - Allowable limit:
0.4 mm (0.016 in.)

Checking Clearance between Knuckle Arm Support and Bushing

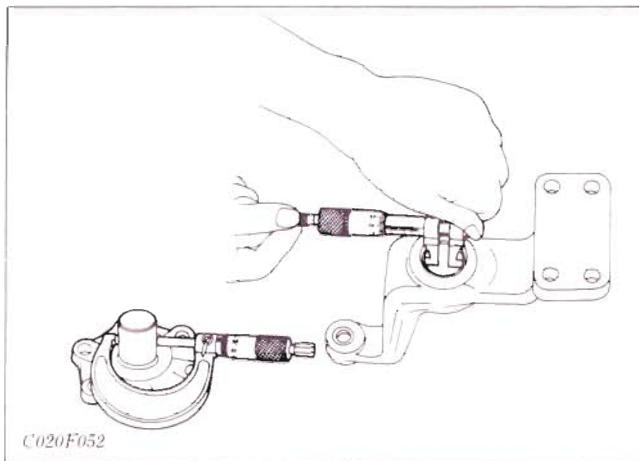


Fig. I-20 Checking Clearance between Knuckle Arm Support and Bushing

- (1) Measure knuckle arm support outside diameter with an outside micrometer.
- (2) Measure knuckle arm bushing inside diameter with an inside micrometer and calculate the clearance.
- (3) If measurement exceeds the allowable limit, replace.
 - Reference value:
 - Knuckle Arm Support O.D.
25.000 to 25.033 mm (0.9843 to 0.9856 in.)
 - Knuckle Arm Bushing I.D.
25.050 to 25.085 mm (0.9862 to 0.9876 in.)
 - Clearance
0.017 to 0.085 mm (0.0007 to 0.0033 in.)
 - Allowable limit:
 - Knuckle Arm Support O.D.
24.80 mm (0.9764 in.)
 - Knuckle Arm Bushing I.D.
25.30 mm (0.9961 in.)

Group 4

Specifications

(R.V.) Reference Value
(A.L.) Allowable Limit

Front Axle (B7100HST-D, 4WD)

Knuckle arm support (knuckle pin) O.D.		
(R.V.)	25.000 to 25.033 mm	(0.9843 to 0.9856 in.)
(A.L.)	24.80 mm	(0.9764 in.)
Bushing I.D.		
(R.V.)	25.050 to 25.085 mm	(0.9862 to 0.9876 in.)
(A.L.)	25.30 mm	(0.9961 in.)
Clearance between knuckle arm support and bushing		
(R.V.)	0.017 to 0.085 mm	(0.0007 to 0.0033 in.)
Shift fork width		
(R.V.)	11.7 to 11.9 mm	(0.461 to 0.469 in.)
Shift gear groove width		
(R.V.)	12.0 to 12.1 mm	(0.472 to 0.476 in.)
Side clearance of shift fork in shifter groove		
(R.V.)	0.1 to 0.4 mm	(0.004 to 0.016 in.)
(A.L.)	0.6 mm	(0.023 in.)
Backlash between spiral bevel pinion and bevel gear		
(R.V.)	0.1 to 0.2 mm	(0.004 to 0.008 in.)
(A.L.)	0.4 mm	(0.016 in.)
Differential pinion shaft O.D.		
(R.V.)	24.75 to 24.90 mm	(0.9744 to 0.9803 in.)
Bushing I.D.		
(R.V.)	24.987 to 25.000 mm	(0.9837 to 0.9843 in.)
Clearance between differential pinion shaft and bushing		
(R.V.)	0.016 to 0.052 mm	(0.0006 to 0.0020 in.)
(A.L.)	0.25 mm	(0.01 in.)
Differential gear reducing ratio	6/37	
Differential side gear O.D.		
(R.V.)	31.959 to 31.975 mm	(1.2582 to 1.2589 in.)
Differential case I.D.		
(R.V.)	32.000 to 32.025 mm	(1.2598 to 1.2608 in.)
Clearance between differential side gear and case		
(R.V.)	0.025 to 0.066 mm	(0.0010 to 0.0026 in.)
(A.L.)	0.25 mm	(0.01 in.)

Backlash between differential side gear and pinion gear

(R.V.)	0.20 to 0.25 mm	(0.0079 to 0.0098 in.)
(A.L.)	0.4 mm	(0.016 in.)

Center pin O.D.

(R.V.)	19.88 to 20.03 mm	(0.7827 to 0.7886 in.)
(A.L.)	19.70 mm	(0.7756 in.)

Bushing I.D.

(R.V.)	20.10 to 20.15 mm	(0.7913 to 0.7933 in.)
(A.L.)	20.40 mm	(0.8031 in.)

Clearance between center pin and bushing

(R.V.)	0.07 to 0.27 mm	(0.0028 to 0.0106 in.)
--------	-----------------	------------------------

Front axle arm end play

(R.V.)	0.2 mm	(0.008 in.)
(A.L.)	1 mm	(0.04 in.)
	[Adjustable]	

Nut for front drive pinion shaft tightening

torque.....(M22) 98 to 147 Nm (10 to 15 kgf·m, 72 to 108 ft-lbs)

Spiral bevel gear to differential case

tightening torque.....(M8) 29 to 34 Nm (3.0 to 3.5 kgf·m, 22 to 25 ft-lbs)

Front axle arm LH to RH tightening

torque.....(M10) 48 to 56 Nm (4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)

Front axle arm to bevel gear case tightening

torque.....(M12) 77 to 90 Nm (7.9 to 9.2 kgf·m, 57 to 67 ft-lbs)

Bevel gear case to knuckle arm support

(knuckle pin) tightening torque.....(M8) 24 to 27 Nm (2.4 to 2.8 kgf·m, 17 to 20 ft-lbs)

Front axle case to front axle cover

tightening torque.....(M10) 48 to 56 Nm (4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)

Bearing case (bevel support cover) tightening

torque.....(M8) 24 to 27 Nm (2.4 to 2.8 kgf·m, 17 to 20 ft-lbs)

Spiral bevel gear adjusting shim thickness

(R.V.)	0.2 mm, 0.3 mm, 0.5 mm	(0.008 in., 0.012 in., 0.020 in.)
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Differential side gear adjusting shim thickness

(R.V.)	0.8 mm, 1.0 mm, 1.2 mm	(0.031 in., 0.039 in., 0.047 in.)
--------	------------------------	-----------------------------------

Bevel gear case adjusting shim thickness

(R.V.)	0.2 mm, 0.3 mm, 0.5 mm	(0.008 in., 0.012 in., 0.020 in.)
--------	------------------------	-----------------------------------

Bearing case (bevel support cover) adjusting shim thickness

(R.V.)	0.2 mm, 0.3 mm, 0.5 mm	(0.008 in., 0.012 in., 0.020 in.)
--------	------------------------	-----------------------------------

Front Axle (B7100HST-E, 2WD)

Center pin O.D.

(R.V.)	19.88 to 20.03 mm	(0.7827 to 0.7886 in.)
(A.L.)	19.70 mm	(0.7756 in.)

Bushing (fitted) I.D.

(R.V.)	20.10 to 20.15 mm	(0.7913 to 0.7933 in.)
(A.L.)	20.40 mm	(0.8031 in.)

Clearance between center pin and bushing

(R.V.)	0.07 to 0.27 mm	(0.0028 to 0.0106 in.)
--------	-----------------	------------------------

Front axle frame end play

(R.V.)	0.02 mm	(0.0008 in.)
(A.L.)	1mm	(0.04 in.) [Adjustable]

Kingpin (knuckle shaft) O.D.

(R.V.)	19.948 to 19.980 mm	(0.7854 to 0.7866 in.)
(A.L.)	19.80 mm	(0.7795 in.)

Bushing (fitted) I.D.

(R.V.)	20.000 to 20.051 mm	(0.7874 to 0.7894 in.)
(A.L.)	20.30 mm	(0.7992 in.)

Clearance between kingpin (knuckle shaft)
and bushing

(R.V.)	0.020 to 0.103 mm	(0.0008 to 0.0041 in.)
--------	-------------------	------------------------

Knuckle shaft end play

(R.V.)	0 mm	(0 in.)
--------	------	---------

Front wheel support to engine

tightening torque. (M10)	48 to 56 Nm	(4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)
Front wheel tightening torque. (M12)	63 to 73 Nm	(6.4 to 7.4 kgf·m, 46 to 54 ft-lbs)
Front wheel hub nut tightening torque.	82 to 86 Nm	(8.4 to 8.8 kgf·m, 61 to 64 ft-lbs)

Specifications

B6100HST

Front Axle (B6100HST-D, 4WD)

King pin O.D.	(R.V.) 19.979 to 20.000 mm	(0.7866 to 0.7874 in.)
	(A.L.) 19.70 mm	(0.7756 in.)
Bushing I.D.	(R.V.) 20.020 to 20.053 mm	(0.7882 to 0.7895 in.)
	(A.L.) 20.30 mm	(0.7992 in.)
Clearance between king pin and bushing	(R.V.) 0.020 to 0.074 mm	(0.0008 to 0.0029 in.)
Shift fork width	(R.V.) 11.7 to 11.9 mm	(0.461 to 0.469 in.)
Shift gear groove width	(R.V.) 12.0 to 12.1 mm	(0.472 to 0.476 in.)
Side clearance of shift fork in shifter groove	(R.V.) 0.1 to 0.4 mm	(0.004 to 0.016 in.)
	(A.L.) 0.6 mm	(0.023 in.)
Backlash between spiral bevel pinion and bevel gear	(R.V.) 0.1 to 0.2 mm	(0.004 to 0.008 in.)
	(A.L.) 0.4 mm	(0.016 in.)
Differential pinion shaft O.D.	(R.V.) 13.973 to 13.984 mm	(0.5501 to 0.5506 in.)
Differential pinion I.D.	(R.V.) 14.000 to 14.018 mm	(0.5512 to 0.5519 in.)
Clearance between differential pinion shaft and differential pinion	(R.V.) 0.016 to 0.045 mm	(0.0006 to 0.0018 in.)
	(A.L.) 0.25 mm	(0.0098 in.)
Differential gear reducing ratio	6/37	
Differential side gear O.D.	(R.V.) 29.947 to 29.960 mm	(1.1790 to 1.1795 in.)
Differential case I.D.	(R.V.) 30.000 to 30.021 mm	(1.1811 to 1.1819 in.)
Clearance between differential side gear and case	(R.V.) 0.040 to 0.074 mm	(0.0016 to 0.0029 in.)
	(A.L.) 0.25 mm	(0.0098 in.)

Backlash between differential side gear and pinion gear	(R.V.) 0.13 to 0.33 mm	(0.0051 to 0.0130 in.)
	(A.L.) 0.4 mm	(0.016 in.)
Center pin O.D.	(R.V.) 19.88 to 20.03 mm	(0.7827 to 0.7965 in.)
	(A.L.) 19.70 mm	(0.7756 in.)
Bushing I.D.	(R.V.) 20.10 to 20.15 mm	(0.7913 to 0.7933 in.)
	(A.L.) 20.40 mm	(0.8031 in.)
Clearance between center pin and bushing	(R.V.) 0.07 to 0.27 mm	(0.0028 to 0.0106 in.)
Front axle arm end play	(R.V.) 0.2 mm	(0.008 in.)
	(A.L.) 1 mm	(0.04 in.)
Nut for front drive pinion shaft tightening torque	(M22) 98 to 147 Nm (10 to 15 kgf·m, 72 to 108 ft-lbs)	
Spiral bevel gear to differential case tightening torque	(M8) 29 to 34 Nm (3.0 to 3.5 kgf·m, 22 to 25 ft-lbs)	
Front axle case 1 to front axle case 2 tightening torque	(M8) 24 to 27 Nm (2.4 to 2.8 kgf·m, 17 to 20 ft-lbs)	
Front axle case 1 to front axle case 3 tightening torque	(M10) 48 to 56 Nm (4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)	
Front gear case to front gear case cover	(M8) 18 to 21 Nm (0.8 to 1.0 kgf·m, 6 to 7 ft-lbs)	
Spiral bevel gear adjusting shim thickness	(R.V.) 0.2 mm, 0.5 mm	(0.008 in., 0.020 in.)
Differential side gear adjusting shim thickness	(R.V.) 1.0 mm, 1.2 mm	(0.039 in., 0.047 in.)

Front Axle (B6100 HST-E, 2WD)

Center pin O.D.	(R.V.) 19.88 to 20.03 mm	(0.7827 to 0.7886 in.)
	(A.L.) 19.70 mm	(0.7756 in.)
Bushing (fitted) I.D.	(R.V.) 20.10 to 20.15 mm	(0.7913 to 0.7933 in.)
	(A.L.) 20.40 mm	(0.8031 in.)
Clearance between center pin and bushing	(R.V.) 0.07 to 0.27 mm	(0.0028 to 0.0106 in.)

Front axle frame end play

(R.V.)	0.02 mm	(0.0008 in.)
(A.L.)	1 mm	(0.04 in.) [Adjustable]

Kingpin (knuckle shaft) O.D.

(R.V.)	19.948 to 19.980 mm	(0.7854 to 0.7866 in.)
(A.L.)	19.80 mm	(0.7795 in.)

Bushing (fitted) I.D.

(R.V.)	20.000 to 20.051 mm	(0.7874 to 0.7894 in.)
(A.L.)	20.30 mm	(0.7992 in.)

Clearance between kingpin (knuckle shaft)
and bushing

(R.V.)	0.020 to 0.103 mm	(0.0008 to 0.0041 in.)
--------	-------------------	------------------------

Knuckle shaft end play

(R.V.)	0 mm	(0 in.)
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Front wheel support to engine

tightening torque (M10) 48 to 56 Nm (4.9 to 5.7 kgf · m, 35 to 41 ft-lbs)

Front wheel tightening torque (M12) 63 to 73 Nm (6.4 to 7.4 kgf · m, 46 to 54 ft-lbs)

Front wheel hub nut tightening torque 82 to 86 Nm (8.4 to 8.8 kgf · m, 61 to 64 ft-lbs)

TIRES, FRONT ALIGNMENT

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Group 1 General Description

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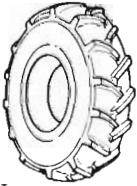
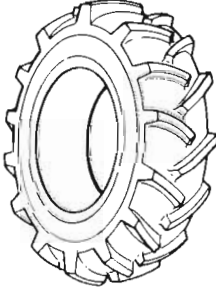

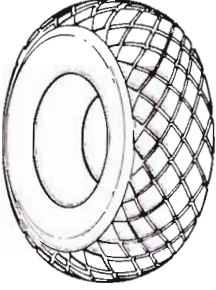
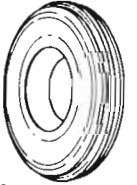
Group 2 Specifications

Group 1

General Description

Tires

Either farm tires (AG) or turf tires can be used for both D-type and E-type tractors.

Model	Farm Tire		Turf Tire	
	Front	Rear	Front	Rear
B7100HST-D	 0011F115	 0011F117	 0011F118	 0011F119
B7100HST-E	 0011F116			

Tread Adjustment

Tire tread can be adjusted for different kinds of work.

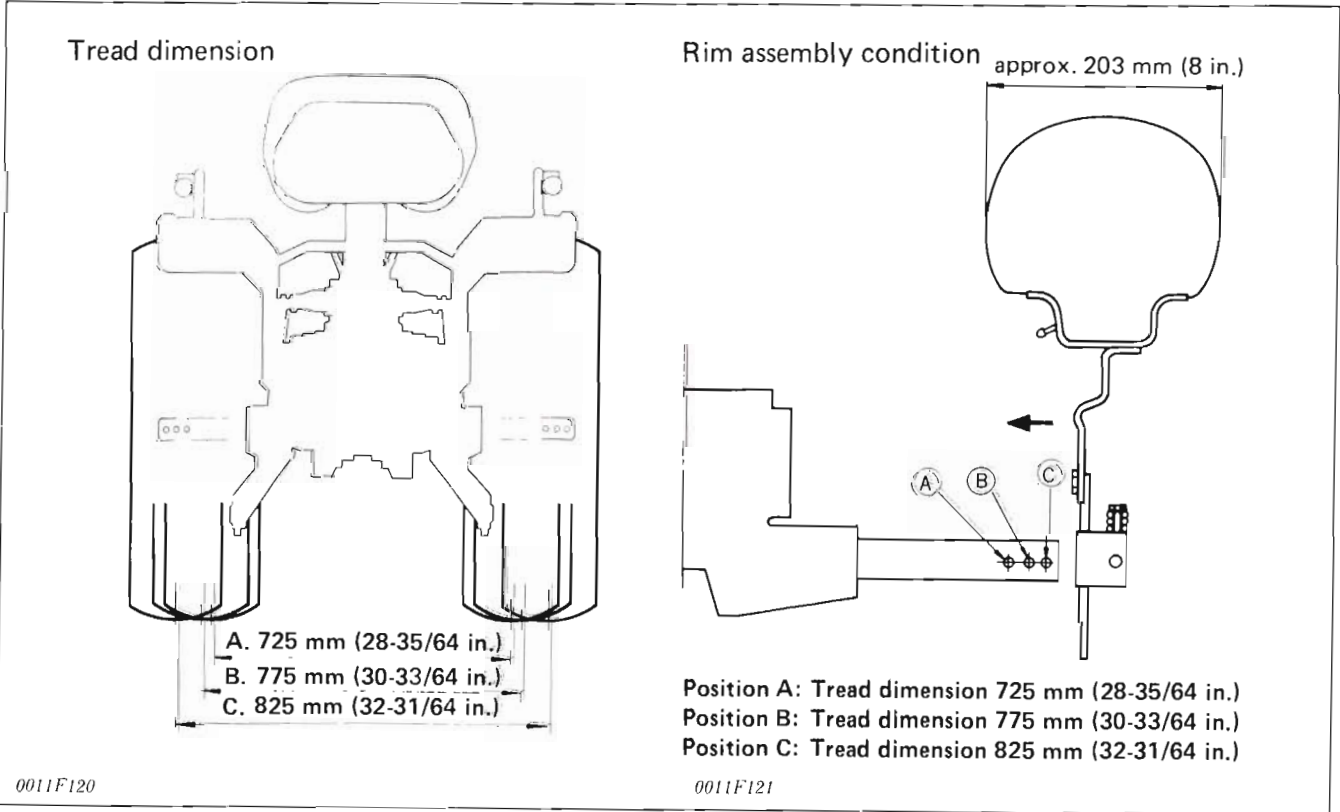
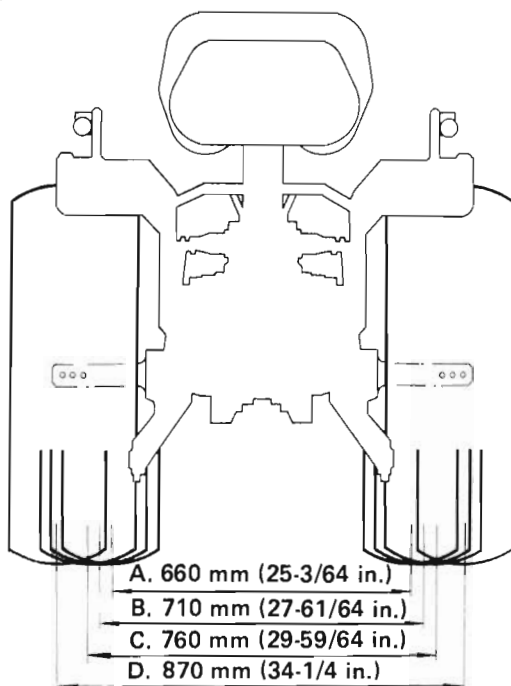


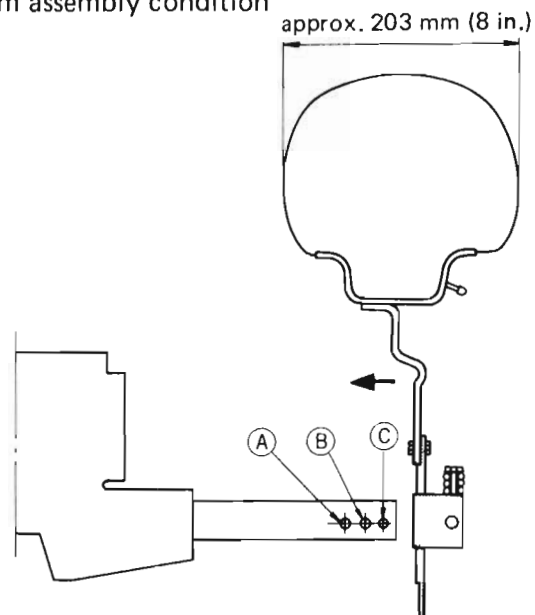
Fig. J-1 Farm Tires (Goodyear 8-16)

Tread dimension



0011F122

Rim assembly condition



Position A: Tread dimension 660 mm (25-63/64 in.)

Position B: Tread dimension 710 mm (27-61/64 in.)

Position C: Tread dimension 760 mm (29-59/64 in.)

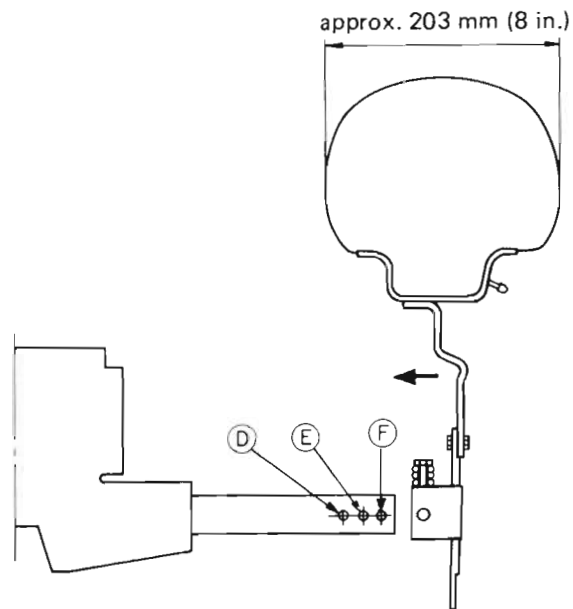
0011F123

Note:

The hole of position (D) is identical with position (A).

Tread dimensions differ depending on hub mounting direction.

In the hub position shown in right side of Fig. J-2, only position (D) can be used.



Position D: Tread dimension 870 mm (34-1/4 in.)

Position E: Do not use.

Position F: Do not use.

0011F124

Fig. J-2 Farm Tires (Bridgestone 8-16)

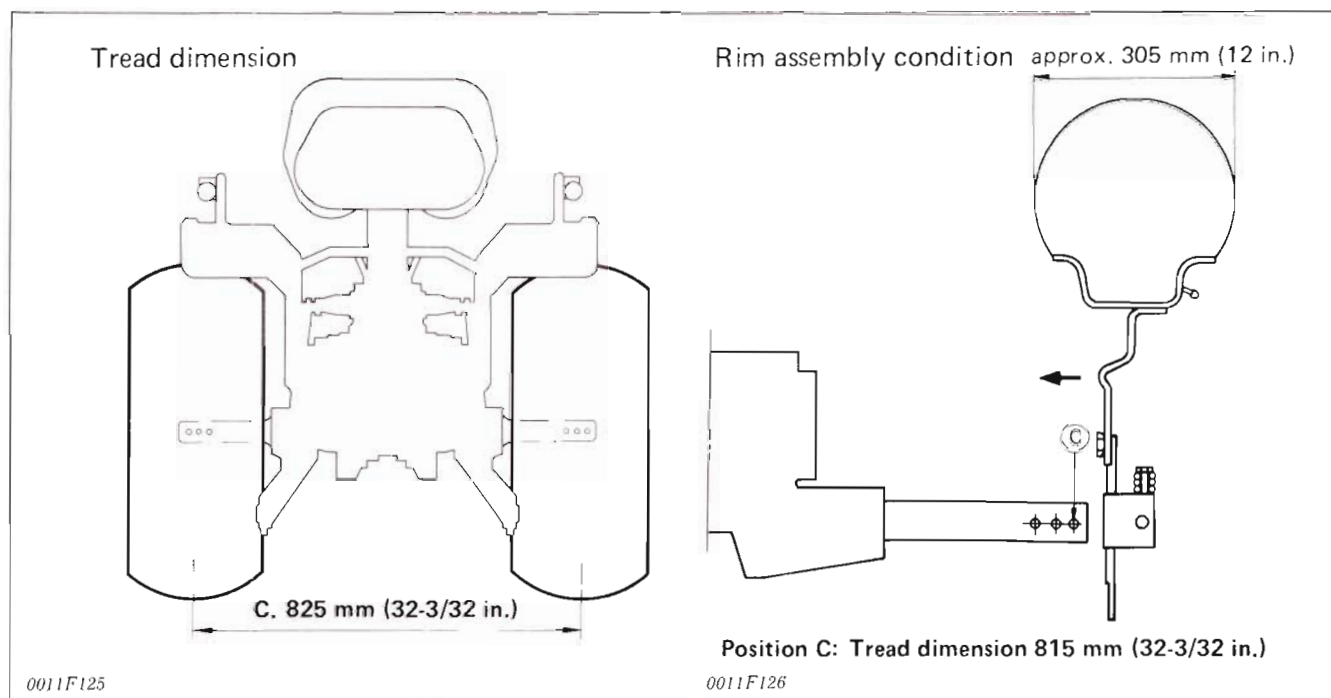


Fig. J-3 Turf Tires (Goodyear 29x12.00-15)

Wheel Weights

When drive power is insufficient for heavy trailers or when front-rear-balance must be adjusted

because of an implement, weights can be attached to the wheels.

Code No.		Weight
BL551	SUITCASE FRONT BUMPER WEIGHT	24.9 kg 55 lbs.
BL551-B	BOLT KIT	2.3 kg 5 lbs.
B8054	FRONT WHEEL WEIGHT SET WITH TWO WHEEL WEIGHTS (One per wheel). Not for use with turf tires.	36.3 kg 80 lbs.
B8054-B	BOLT KIT	0.9 kg 2 lbs.
B8056	REAR WHEEL WEIGHT SET WITH TWO WHEEL WEIGHTS (One per wheel). Not for use with turf tires.	42.2 kg 93 lbs.
B8056-B	BOLT KIT	1.4 kg 3 lbs.

Front Wheel Alignment

Front wheel alignment depends upon camber angle, caster angle, king pin inclination, and toe-in. These four elements constantly change due to shocks during travelling. If, however, they are set properly, they interact to provide the following:

1. Excellent small-radius steering.
2. Stable steering-wheel operation.
3. Steering wheel becomes self-restoring.
4. Less tire wear.

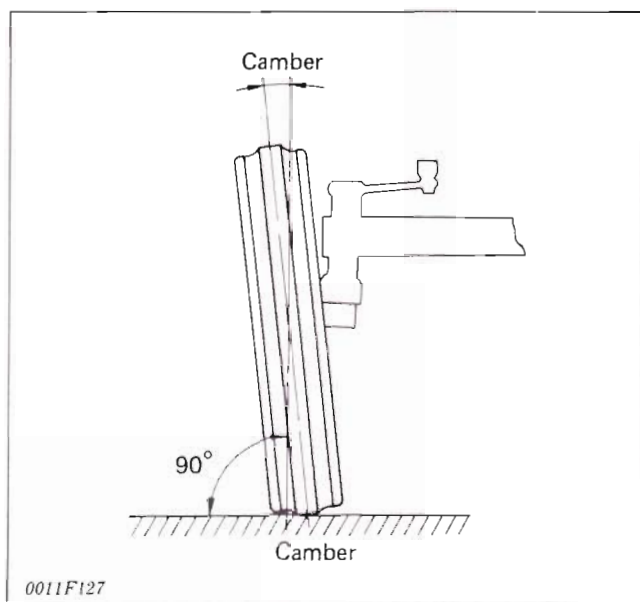


Fig. J-4 Camber Angle

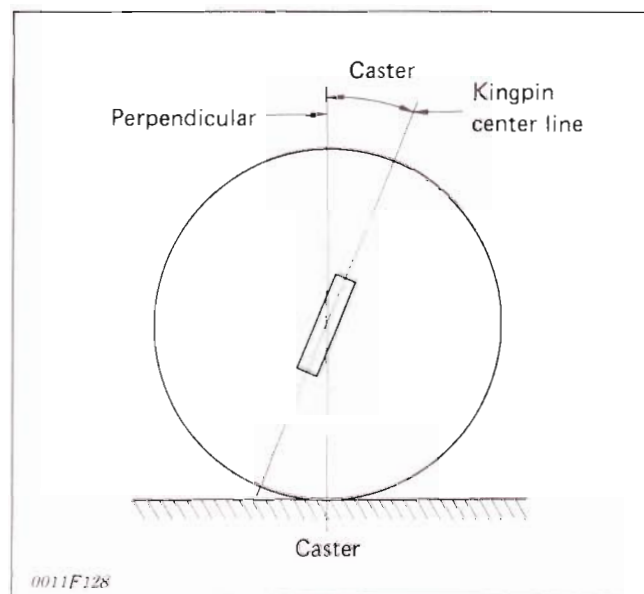


Fig. J-5 Caster Angle

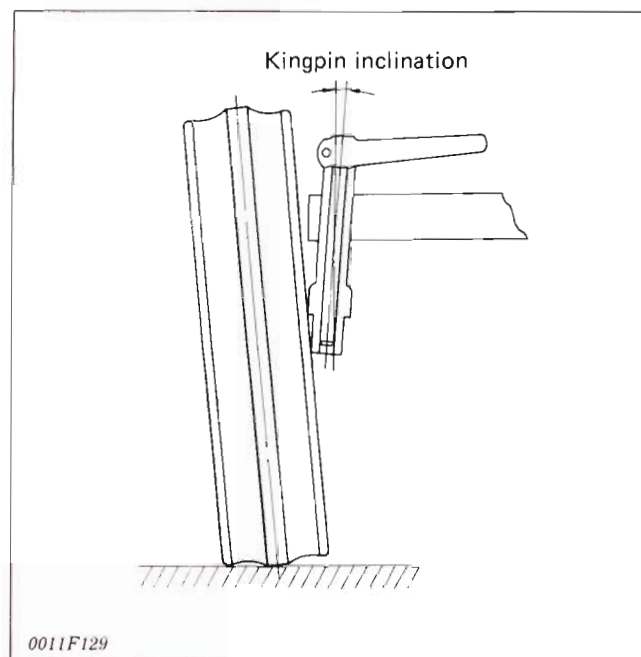


Fig. J-6 Kingpin Inclination

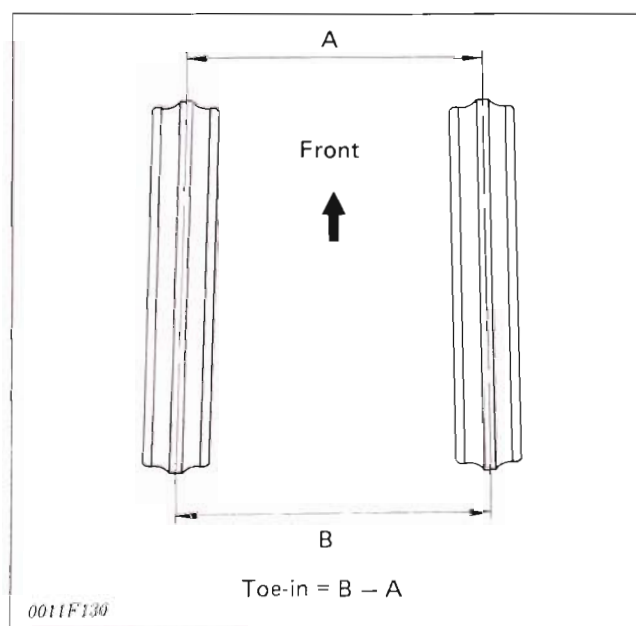
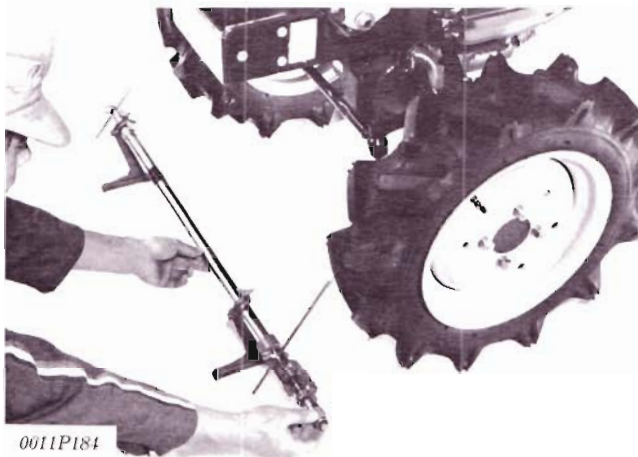


Fig. J-7 Toe-in

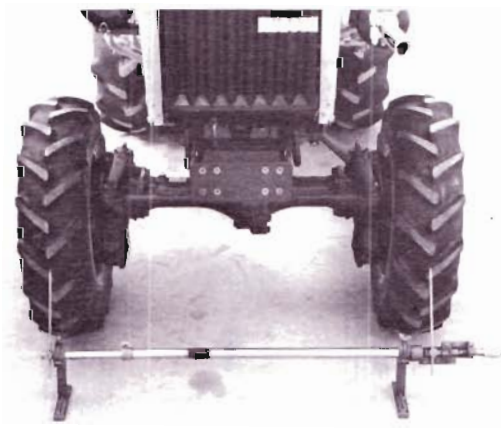
For this tractor, camber angle, caster angle, and kingpin inclination are fixed at the best positions. The toe-in can be adjusted according to steering tie rod length.

Checking Toe-in



0011P184

Fig. J-8 Checking Toe-in (1)



0011P046

Fig. J-9 Checking Toe-in (2)

- (1) Equalize the pressure of right and left tires.
- (2) Place the tractor on a horizontal base with the front wheels pointing straight ahead.
- (3) Measure the distances between the two front wheels at their front and rear, and calculate the difference.
- (4) If the measurement exceeds the reference value, adjust by turning the tierod.
 - Reference value:
0 to 5 mm (0 to 0.2 in.)

Checking Tire Pressure



0011P185

Fig. J-10 Checking Tire Pressure

Measure tire pressure, with a pressure gauge.

- Reference value: See specifications.

Checking Rolling Angle



0011P186

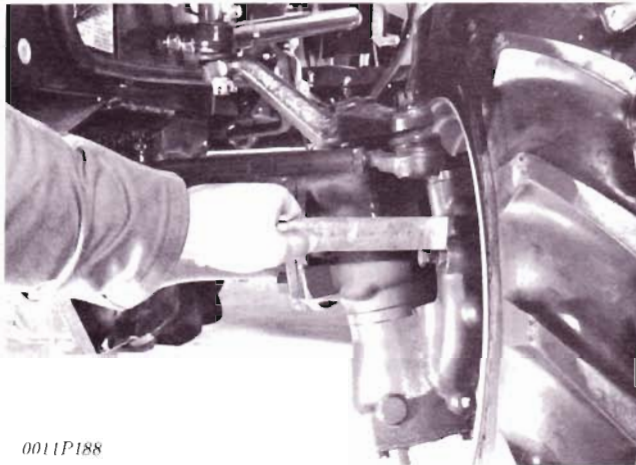
0011P187

Fig. J-11 Checking Rolling Angle

- (1) Measure the length of the adjusting bolts at the top of the right and left front axle arms with a set of inside calipers.
- (2) If adjusting bolt length is outside the reference value, adjust by loosening the lock nut.
 - Reference value:
25 mm (0.9843 in.)

NOTE: With the front axle straight (where the tractor advances straight forward), use an angle gauge on the tierod, to adjust the rolling angle to each 0.14 rad. (8°).

Checking Front Wheel Steering Angle



0011P188

Fig. J-12 Checking Front Wheel Steering Angle

- (1) With a scale measure the length of the adjusting bolts on the front axle case.
 - (2) If it is outside the reference value, loosen the lock nut, and adjust with adjusting bolts.
 - (3) There are two adjusting bolts, one on the front and one on back of the front axle case. Make sure to measure both of them.
 - Reference value:
Bolt length 22 mm (55/64 in.)
- NOTE:** Improper bolt length may cause improper front wheel steering angle.

Group 2

Specifications

Tire Inflation Pressure

B7100HST-D (4WD)

Tire Maker.	Goodyear	
Farm tire	Front.	6.2-12-4PR 140 to 210 KPa (1.4 to 2.1 kgf/cm ² , 20 to 30 psi)
	Rear	6-12-2PR 80 to 100 KPa (0.8 to 1.0 kgf/cm ² , 11 to 14 psi)
		8.3-16-4PR 120 to 150 KPa (1.2 to 1.5 kgf/cm ² , 17 to 22 psi)
Turf tire	Front.	8-16-4PR 80 to 120 KPa (0.8 to 1.2 kgf/cm ² , 11 to 17 psi)
	Rear	20.5 x 8.00-10-4PR 140 to 250 KPa (1.4 to 2.5 kgf/cm ² , 20 to 35 psi)
		29 x 12.00-15-2PR 40 to 70 KPa (0.4 to 0.7 kgf/cm ² , 6 to 10 psi)
Tire Maker.	Bridgestone	
Farm tire	Front.	6-12-2PR 80 to 100 KPa (0.8 to 1.0 kgf/cm ² , 11 to 14 psi)
	Rear	8-16-4PR 120 to 160 KPa (1.2 to 1.6 kgf/cm ² , 17 to 23 psi)

B7100HST-E (2WD)

Tire Maker.	Goodyear	
Farm tire	Front.	6.90-9 180 to 420 KPa (1.8 to 4.2 kgf/cm ² , 25 to 60 psi)
	Rear	8.3-16-4PR 120 to 150 KPa (1.2 to 1.5 kgf/cm ² , 17 to 22 psi)
		8-16-4PR 80 to 120 KPa (0.8 to 1.2 kgf/cm ² , 11 to 17 psi)
Turf tire	Front.	20.5 x 8.00-10-4PR 140 to 250 KPa (1.4 to 2.5 kgf/cm ² , 20 to 35 psi)
	Rear	29 x 12.00-15-2PR 40 to 70 KPa (0.4 to 0.7 kgf/cm ² , 6 to 10 psi)
Tire Maker.	Bridgestone	
Farm tire	Front.	4.00-9-4PR 120 to 160 KPa (1.2 to 1.6 kgf/cm ² , 17 to 23 psi)
	Rear	8-16-4PR 120 to 160 KPa (1.2 to 1.6 kgf/cm ² , 17 to 23 psi)

Front Alignment

Toe-in	0 to 5 mm	(0 to 13/64 in.)
Camber angle.	0.035 rad. (2°)	
Caster angle.	0.015 rad. (50')	
	[B7100HST-D (4WD)	F. tire 6-12 BS]
	0 rad. (0°)	R. tire 8-16 BS]
	[B7100HST-E (2WD)	F. tire 4.00-9 BS]
		R. tire 8-16 BS]
Kingpin inclination	0.175 rad. (10°)	
	[B7100HST-D (4WD)]	
	0.140 rad. (8°)	
	[B7100HST-E (2WD)]	

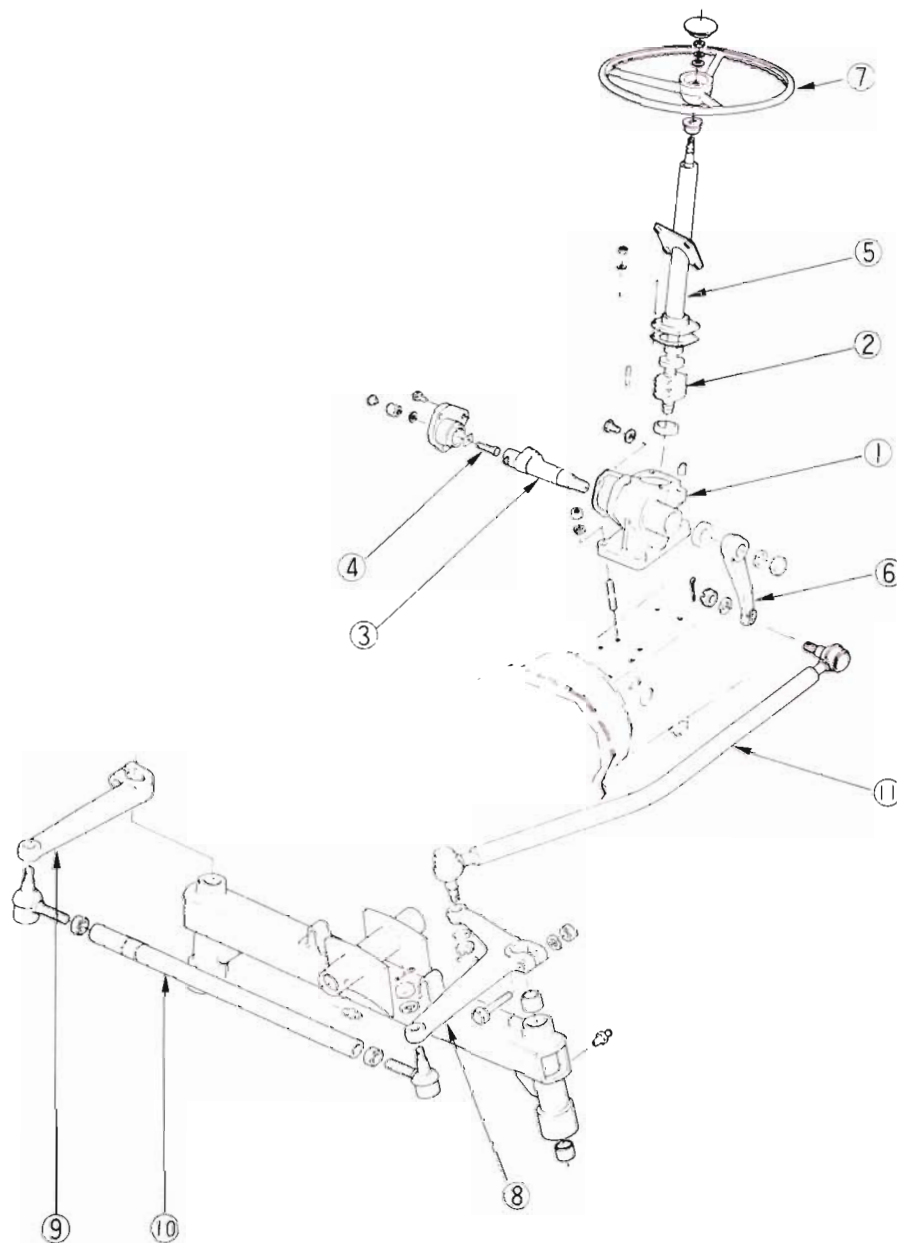
STEERING

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Group 1

General Description



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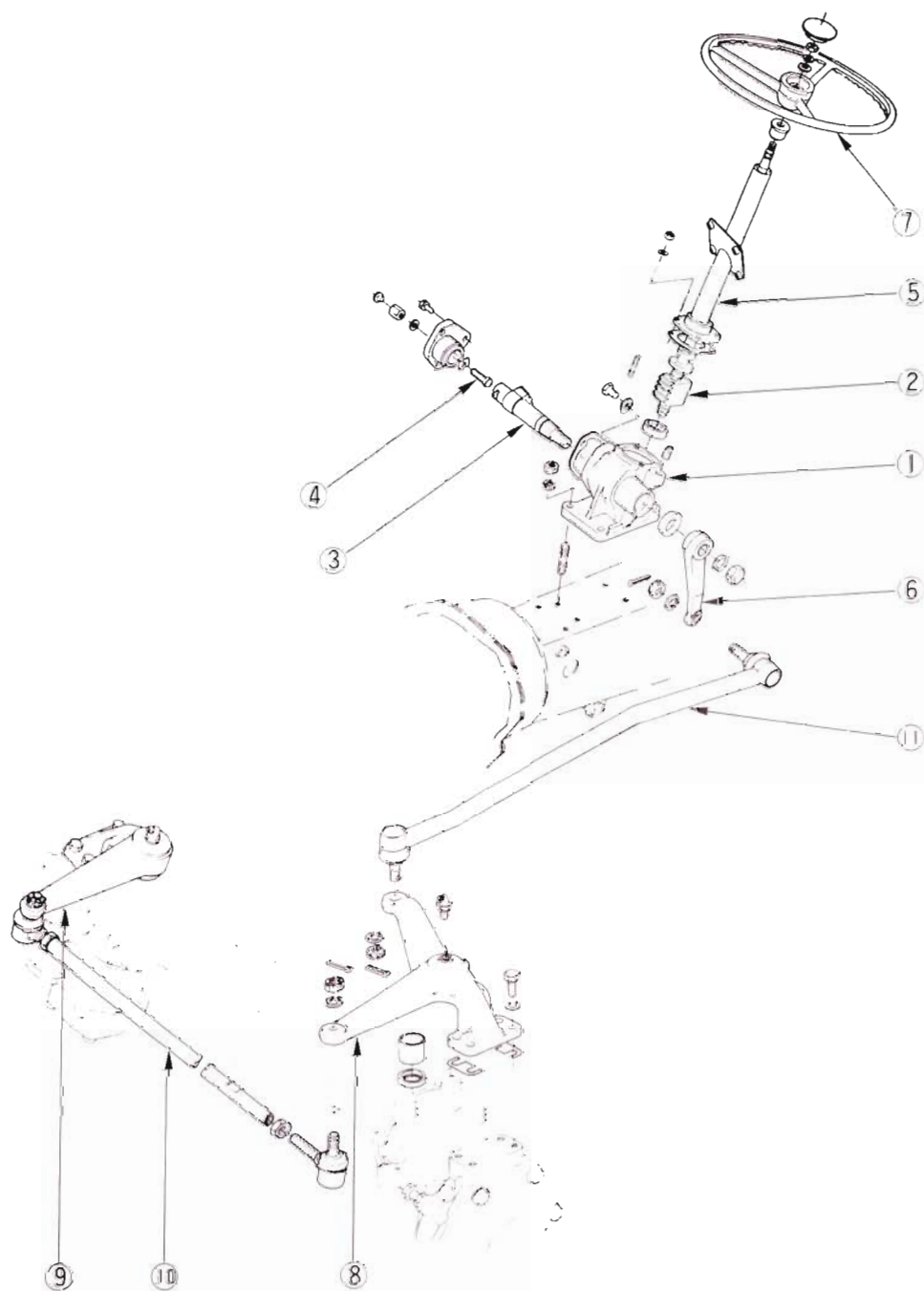
- 1. Steering Gear Case
- 2. Ball Nut
- 3. Sector Shaft

- 4. Adjusting Screw
- 5. Steering Post
- 6. Pitman Arm

- 7. Steering Wheel
- 8. Knuckle Arm (Left)
- 9. Knuckle Arm (Right)

- 10. Tie Rod
- 11. Drag Link

Fig. K-1 Steering (2-Wheel Drive)



0011F132

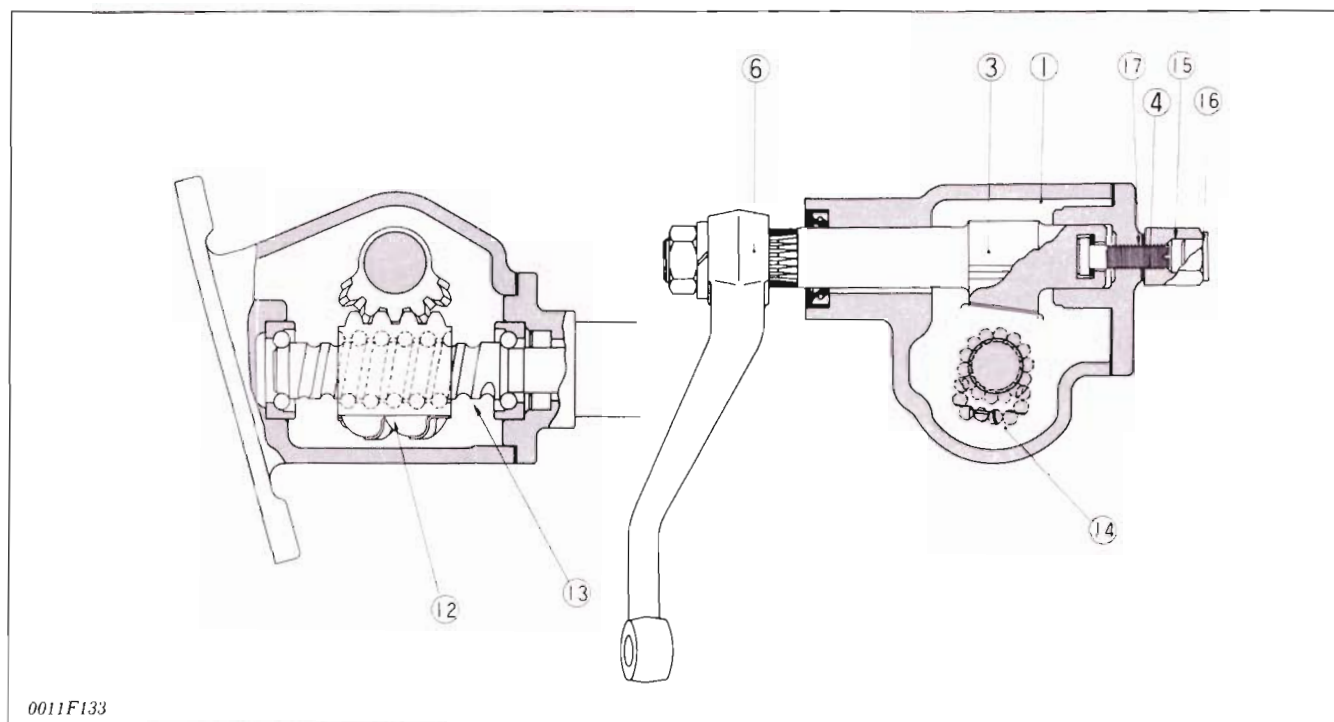
Fig. K-2 Steering (4-Wheel Drive)

Movement of the steering wheel (7) is reduced in the steering gear case (1) and transmitted through the pitman arm (6), drag link (11), and knuckle arm (8) to the front wheels.

The right front wheel is steered by tie rod (10) in the same manner as above.

E-type and D-type linkage components are different.

Steering Gear



12. Rack
13. Column Shaft

14. Ball
15. Nut

16. Plug
17. Gasket

Fig. K-3 Steering Gear

The rack (18) and the column shaft (19) are screw-engaged to change rotating force of the steering wheel into the oscillating force of the pitman arm (6) connecting with sector shaft (3). Balls (14) are provided in the screw groove to reduce steering force. When the steering wheel is turned, balls

circulate in the groove. The sector shaft position can be fine-adjusted in the axle direction with a screw to control steering wheel play. To reduce play, turn the screw (4) clockwise, and to increase play, turn the screw (4) counterclockwise.

Troubleshooting

SYMPTOM

Tractor can not be steered

PROBLEM

Broken steering gear box
Disconnected linkage
Worn or missing ball stud of drag link or tie rod end

SOLUTION

Repair or replace
Repair
Replace drag link assembly or tie rod end

Heavy steering

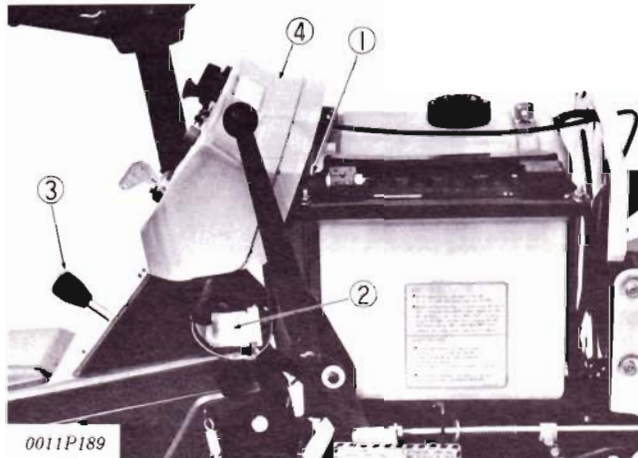
Improper adjustment of steering wheel free movement (too small)

Adjust

Group 2

Disassembly

SPECIAL TOOL: Steering Wheel Puller
(Code No. 07916-51090)



1. Negative Cord
2. Coupler
3. Speed Set Knob
4. Cover

Fig. K-4

- (1) Disconnect the negative battery cord from the negative terminal.
- (2) Disconnect the coupler under the panel.
- (3) Remove the speed set knob.
- (4) Remove the four knob bolts and the cover.

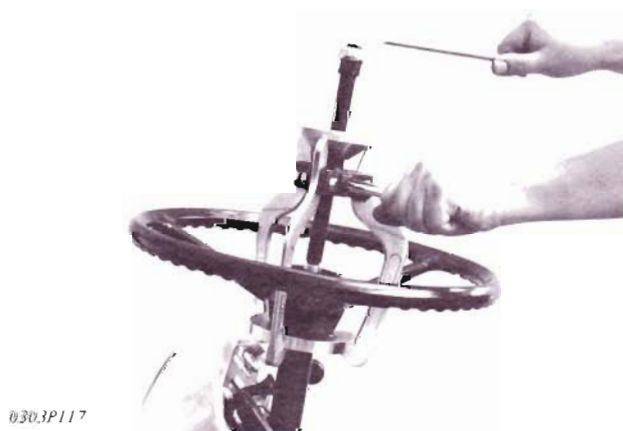


Fig. K-5 Removing Steering Wheel

- (5) Remove the steering wheel cap and loosen the the steering shaft nut.
Set steering wheel puller on the wheel, and pull it out by screwing in the puller bolt and tapping the wheel with a hammer.

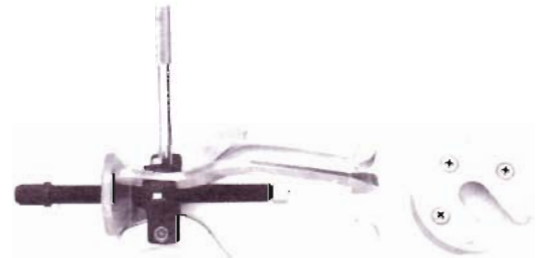


Fig. K-6 Steering Wheel Puller

- (6) Remove the four bolts holding the panel.

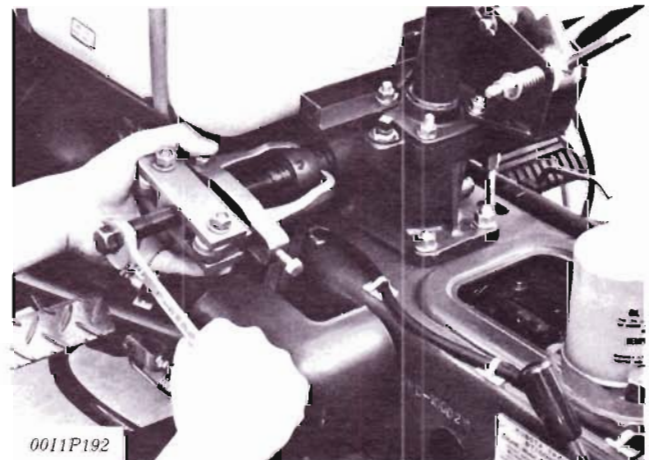
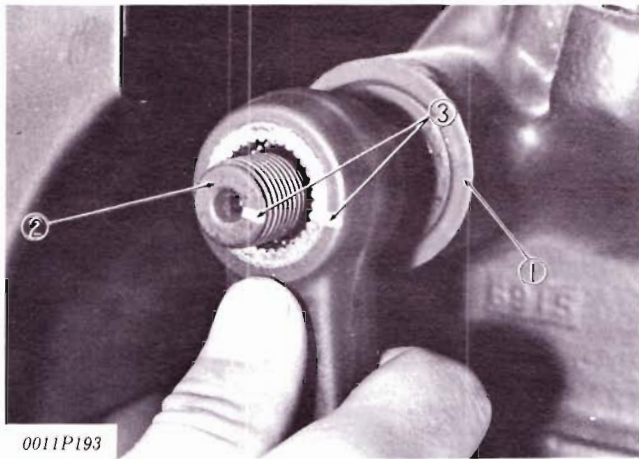


Fig. K-7

- (7) Remove the sector shaft nut and set pitman arm puller on the pitman arm which is attached to the sector shaft. Remove the pitman arm by screwing in the puller bolt and lightly tapping the arm with a hammer.

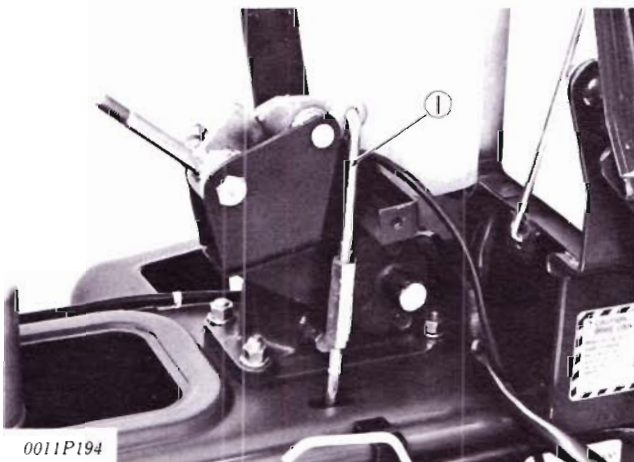


1. Steering Gear Case
2. Sector Shaft
3. Alignment Mark

Fig. K-8 Marking

WHEN REASSEMBLING:

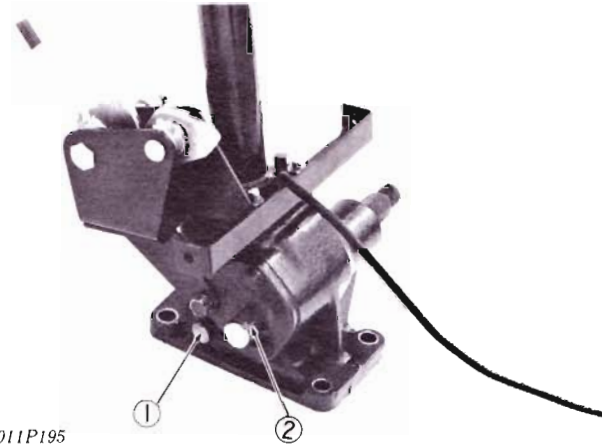
Attach the pitman arm after checking to see if the alignment mark on the arm aligns with the mark on the sector shaft. Tighten the pitman arm to 118 to 157 Nm (12 to 16 kgf-m, 87 to 116 ft-lbs.).



1. Upper Rod

Fig. K-9 Disconnecting Upper Rod

- (8) Disconnect the upper rod from cam.
- (9) Remove the four bolts holding the steering gear.



1. Bolt Painted Red
2. Nut

Fig. K-10 Draining Oil

- (10) On the side of the steering gear case remove the bolt which is painted red, and drain oil.

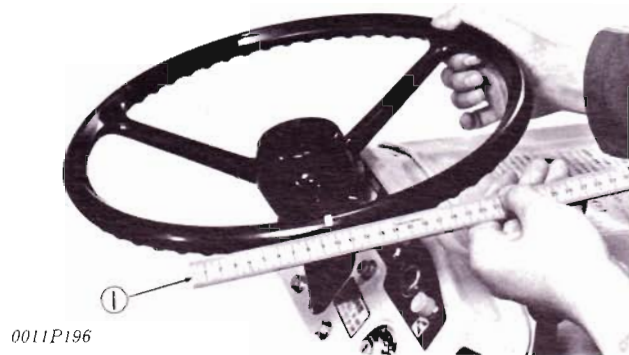
IMPORTANT: Removal of the upper bolts may quicken oil drainage.

- (11) Remove the nut with rubber plug and side cover bolts. Tighten the adjusting screw on the sector shaft with a screwdriver, and you can remove the side cover.

Group 3

Servicing

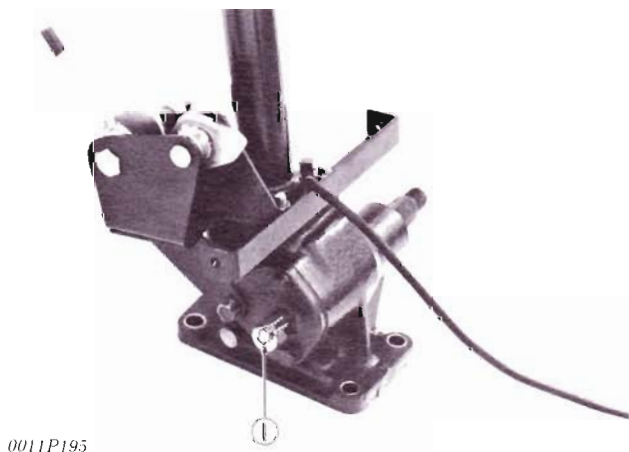
Adjusting Free Movement of Steering Wheel



1. Scale

Fig. K-11 Measuring Free Movement of Steering Wheel

- (1) Measure the free movement with a scale.
- (2) If the free movement exceeds the reference value, remove the rubber cap on the steering gear case side cover.



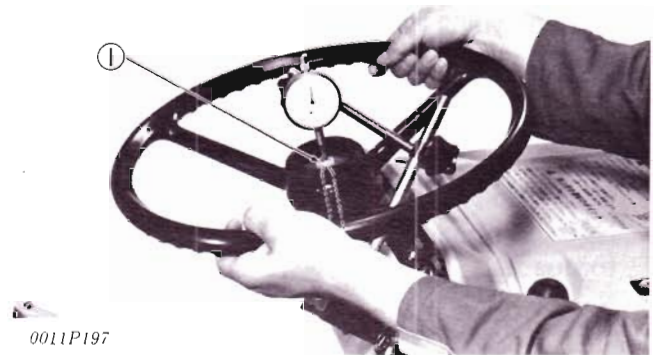
1. Adjusting Screw

Fig. K-12 Adjusting Free Movement

Loosen the lock nut, and adjust by turning the adjusting screw.

- Reference value:
10 to 30 mm (25/64 to 1-3/16 in.)

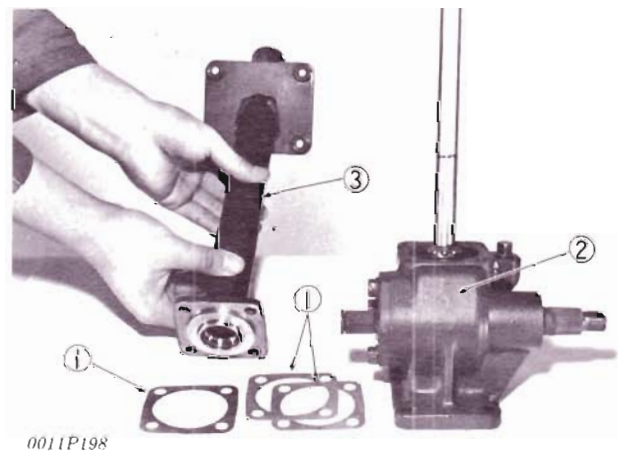
Checking End Play of Steering Shaft



1. Steering Shaft

Fig. K-13 Checking End Play

- (1) Remove the steering wheel cap and set a dial gauge on the steering post.
 - (2) By moving the steering wheel up and down, measure the gap between it and the thrust bearing.
 - (3) If the measurement exceeds the allowable limit, adjust with shims.
- Allowable limit:
0.3 mm (0.012 in.)



1. Shim

2. Steering Gear Case

3. Steering Post

Fig. K-14 Adjusting by Shims

Group 4

Specifications

(A.L.) Allowable Limit

Steering Wheel

Free movement	10 to 30 mm	(25/64 to 1-3/16 in.)
O.D.	385 mm	(15-5/32 in.)
Nut tightening torque (M12)	29 to 49 Nm	(3 to 5 kgf·m, 22 to 36 ft-lbs)

Steering Gear

Type	Ball-screw type	
Gear ratio	1/15.1	
Nuts, gear box to housing tightening torque (M10)	39 to 65 Nm	(4.0 to 6.6 kgf·m, 29 to 48 ft-lbs)

Pitman Arm

Nut, pitman arm to sector shaft tightening torque (M16)	118 to 157 Nm	(12 to 16 kgf·m, 87 to 116 ft-lbs)
---	---------------	------------------------------------

Drag Link End, Tie-rod End Ball Joint

Nut tightening torque (M10)	29 to 49 Nm	(3 to 5 kgf·m, 22 to 36 ft-lbs)
Ball joint end axial movement (A.L.)	0.3 mm	(0.012 in.)

Knuckle Arm

Nut, knuckle arm to kingpin tightening torque (2WD) (M10)	39 to 45Nm	(4.0 to 4.6 kgf·m, 29 to 33 ft-lbs)
Bolts, knuckle arm to front axle case tightening torque (4WD) (M10)	48 to 56 Nm	(4.9 to 5.7 kgf·m, 35 to 41 ft-lbs)

BRAKES

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Group 3 Servicing	
Checking Brake Pedals Free Travel	3-1
Checking Wear of Brake Lining	3-1
Checking Wear of Brake Drum	3-1
Group 4 Specifications	

Group 1

General Description

Two independent brakes are provided for the right and left rear wheels on this tractor. They are connected to the two brake pedals which are controlled by the operator's right foot.

The brakes can be operated in two ways.

The first is independent operation of right and left pedals to actuate the right and left brakes separately.

This is used for turning in a small radius.

The other way is simultaneous use of the right and left pedals. The pedals are locked together so that when either the right or left pedal is pressed both brakes simultaneously actuate. This is used to stop or reduce speed while travelling on a road.

IMPORTANT:

While travelling on pavement or road, the brake pedals must be locked together for safety.

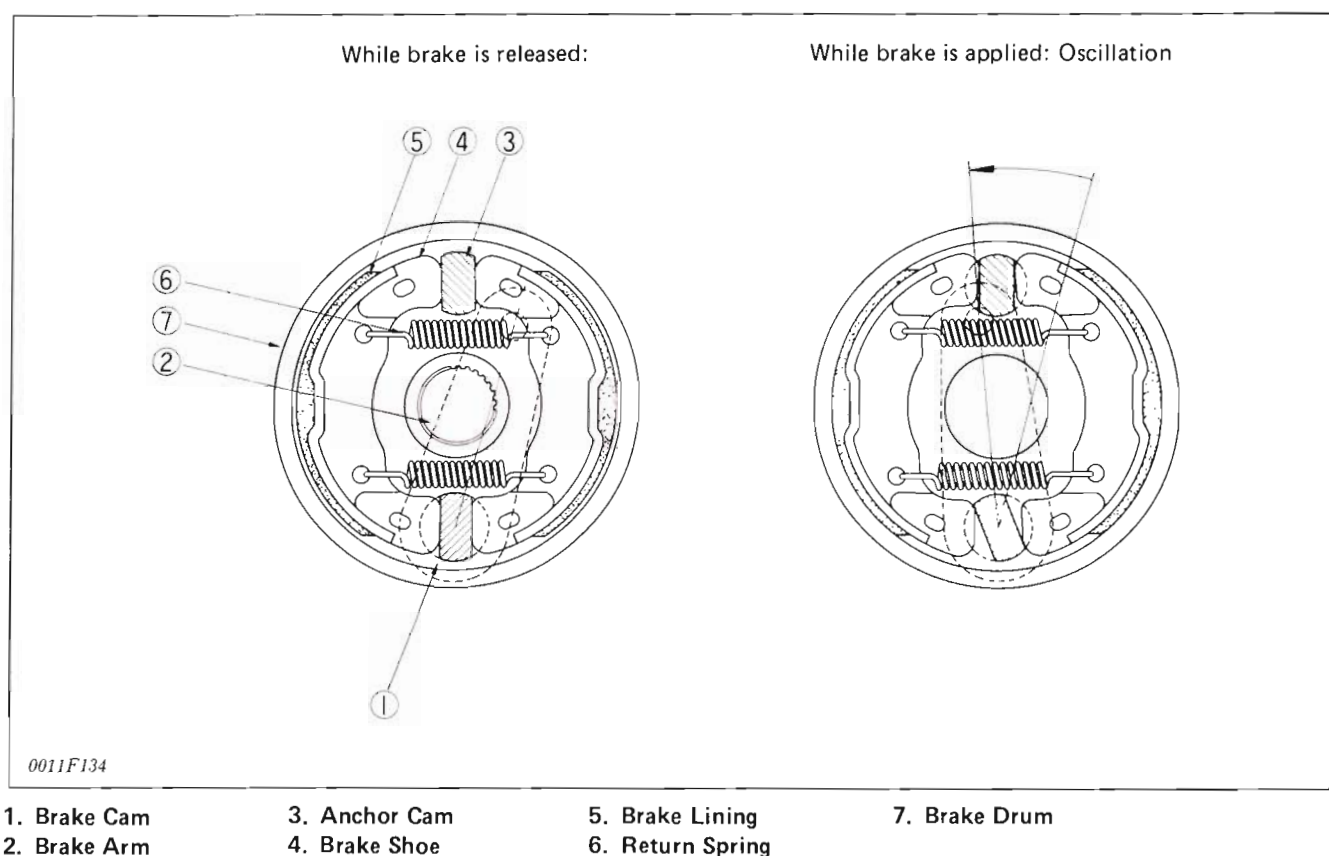
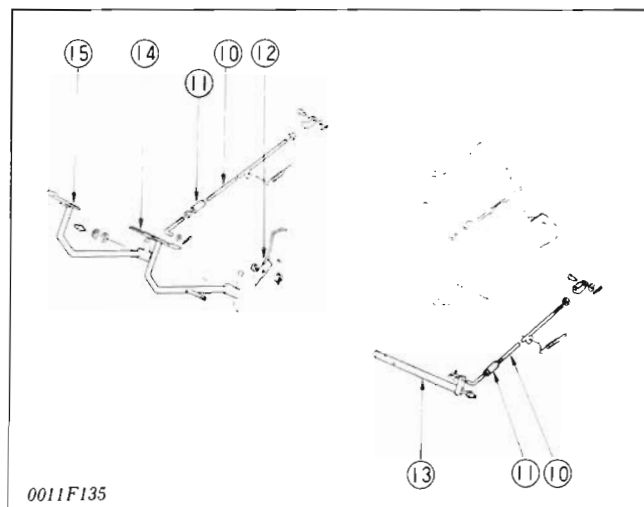


Fig. L-1 Brake Construction

The brake shoes (4) lined and supported by the brake cover are tightly assembled inside the brake drum which rotates with the differential gear shaft. When a brake pedal is pressed, the brake cam (1)

which is integrated with the brake arm (2) turns to press the surface of the brake shoe onto the drum surface, restraining the rotation of the differential gear shaft.



10. Brake Rod
11. Turnbuckle
12. Brake Lock Lever
13. Brake Pedal Shaft
14. Brake Pedal (Left)
15. Brake Pedal (Right)

Fig. L-2 Brake Linkage

Right and left brake pedals are independent of each other, and operated by the operator's right foot either separately or together.

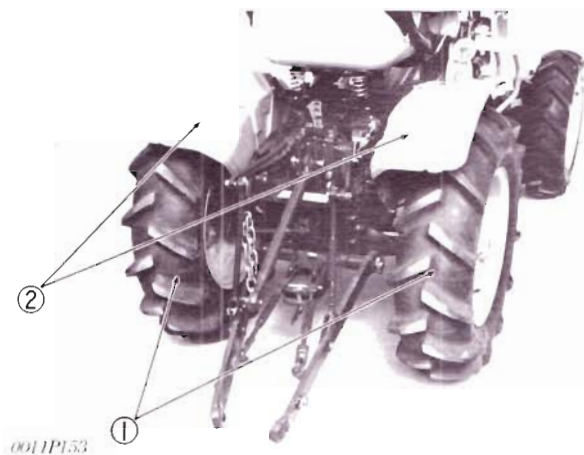
Brake pedal play is adjusted with the turnbuckle (11) attached to the rod (10).

Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Brakes don't operate	Incorrect adjustment of linkage	Adjust
	Oil on brake shoe	Replace oil seal and clean shoe
	Worn brake shoe	Replace
Heavy brake pedal	Rusted brake pedal shaft	Remove rust
	Rusted brake cam	Remove rust

Group 2

Disassembly

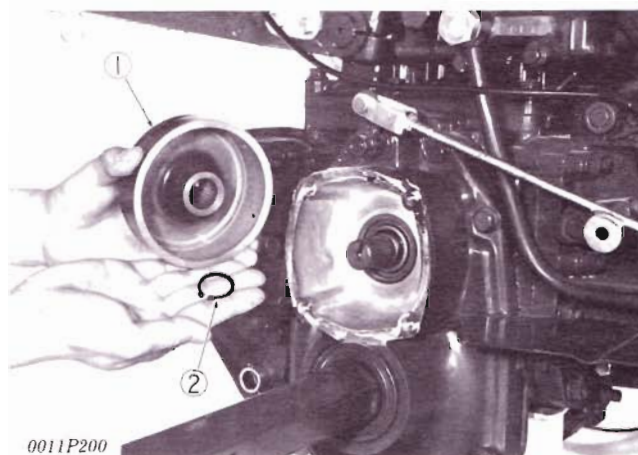


1. Rear Wheels

2. Fenders

Fig. L-3 Removing Tires and Fenders

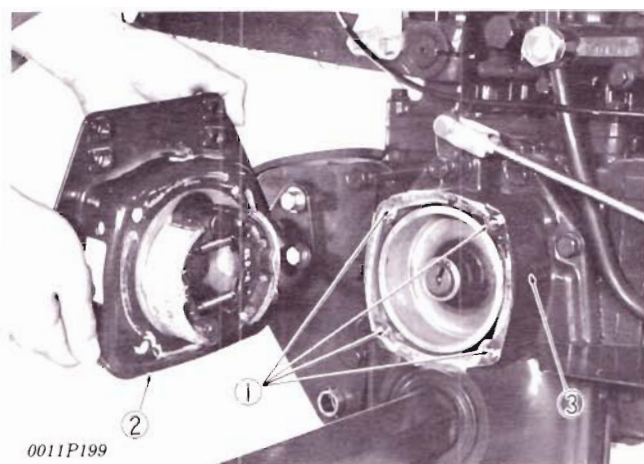
- (1) Remove the rear tires (right and left).
- (2) Remove the fenders (right and left).



1. Brake Drum

2. External Circlip

Fig. L-5 Removing Brake Drum



1. Mounting Bolt Position

3. Axle Case

2. Brake Cover

Fig. L-4 Removing Brake Cover

- (3) Remove the brake rod.
- (4) Remove the brake cover.
- (5) Remove the brake drum.

Group 3

Servicing

Checking Brake Pedals Free Travel

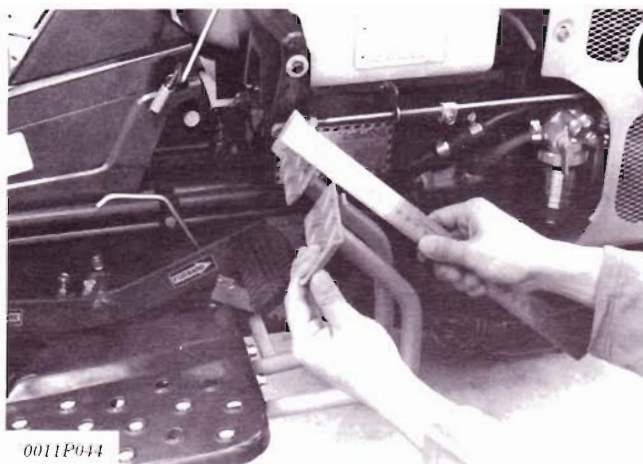


Fig. L-6 Checking Brake Pedal Free Travel

- (1) Remove the brake lock so that the free travel of right and left brake pedals can be measured separately.
- (2) While pressing the a pedal down lightly by hand, measure pedal free travel (the amount of movement before the brakes are applied).
- (3) If free travel is excessive, adjust by turning the turnbuckle on the brake rod.
- (4) Equalize right and left brake pedal free travel.
 - Reference value:
10 to 30 mm (25/64 to 1-3/16 in.)
 - Difference between right and left:
less than 4 mm (5/32 in.)

Checking Wear of Brake Lining

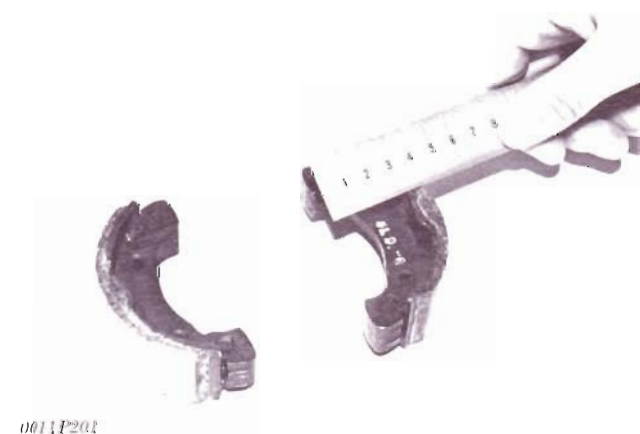


Fig. L-7 Checking Wear of Brake Lining

- (1) Measure the brake lining thickness with a set of vernier calipers.
- (2) Check if the lining is stained badly with oil, seizing, deteriorated or hardened. If so, replace.
 - Allowable limit:
2.5 mm (0.0984 in.)

Checking Wear of Brake Drum

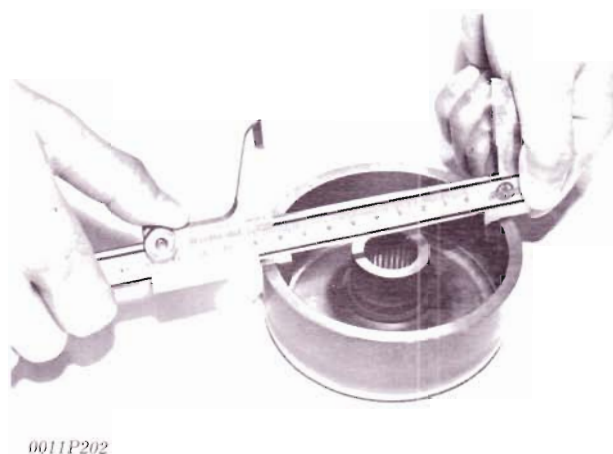


Fig. L-8 Checking Wear of Brake Drum

- (1) Measure inside diameter of brake drum with vernier calipers.
- (2) If the measurement exceeds the allowable limit, replace.
 - Reference value:
95.0 to 95.1 mm (3.740 to 3.744 in.)
 - Allowable limit:
97 mm (3.819 in.)

Group 4

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Brakes

Pedal free travel

(R.V.)	10 to 30 mm	(25/64 to 1-3/16 in.)
(Maintenance limit)	40 mm	(1-37/64 in.)
	[under load of 39 to 59 N (4 to 6 kgf, 9 to 13 lbs.)]	

Difference of pedal free travel between

right pedal and left one	less than 4 mm	(0.16 in.)
	[under load of 39 to 59 N (4 to 6 kgf, 9 to 13 lbs.)]	

Brake drum I.D.

(R.V.)	95.0 to 95.1 mm	(3.740 to 3.744 in.)
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Brake shoe thickness

(R.V.)	3.0 mm	(0.118 in.)
(A.L.)	2.5 mm	(0.098 in.)

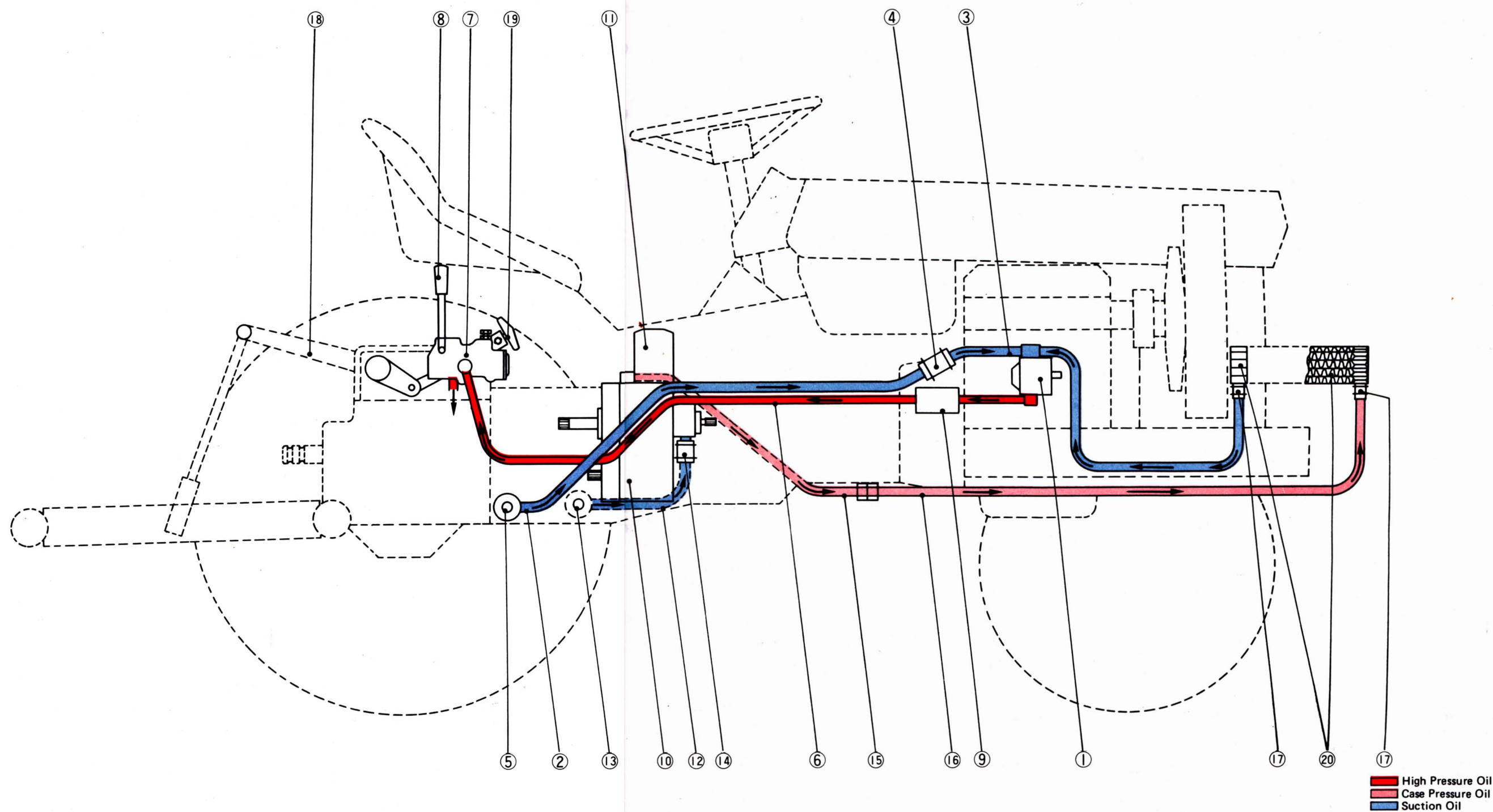
HYDRAULIC SYSTEM

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Group 1

General Description



0011F136

1. Gear Pump
2. Suction Pipe 1
3. Suction Pipe 2

4. Hose 27 x 19
5. Strainer
6. Delivery Pipe

7. Control Valve Assembly
8. Control Lever
9. Hydraulic Block

10. Hydrostatic Transmission Assembly
11. Oil Filter Cartridge
12. Suction Pipe (HST)

13. Strainer
14. Hose
15. Pipe 1

16. Pipe 2
17. Hose 23 x 15
18. Lift Arm

19. Grip
20. Oil Cooler

Fig. M-1 Hydraulic System

This tractor's hydraulic system is composed of two main systems. One is the implement operating system and the other is the hydrostatic transmission operating system.

The implement operating system is provided with a hydraulic cylinder which moves the three-point linkage up and down. It is powered by a gear pump attached to the engine.

The hydrostatic transmission operating system is used for tractor travelling. It is located at the approx. center of the body and a special oil cooler for it is provided in front of the engine radiator.

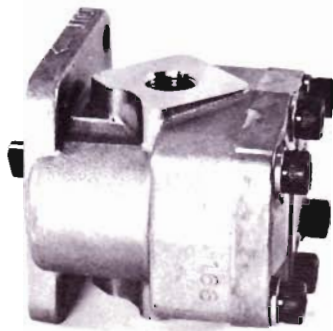
For the Hydrostatic Transmission System, refer to the TRANSMISSION Section. In this section, major hydraulic units are described.

Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Unable to lift implement	Insufficient hydrostatic transmission oil	Replenish
	Clogged oil filter	Clean
	Obstructed hydraulic pipe	Clean
	Excessive load	Reduce load
	Improper adjustment or relief valve	Adjust
	Defective gear pump	Repair or replace
	Improper position of directional valve	Turn grip to lifting position
	Defective control valve	Repair or replace
	Broken O-ring at hydraulic piston or cylinder cap	Replace O-ring
Implement drops at center position	Scratched control valve spool or body	Repair or replace control valve
	Broken hydraulic piston O-ring	Replace O-ring
	Scratched hydraulic cylinder	Repair or replace
Lifting too slow	Low oil temperature	Warm up oil
	Loose inlet pipe connection and allows air to enter	Tighten fast
	Clogged oil filter	Clean
	Insufficient hydrostatic transmission oil	Replenish
	Defective gear pump	Repair or replace
	Scratched relief valve	Replace
	Improper adjustment of adjusting bolt	Loosen and adjust

Group 2

Hydraulic Pump



0011P203

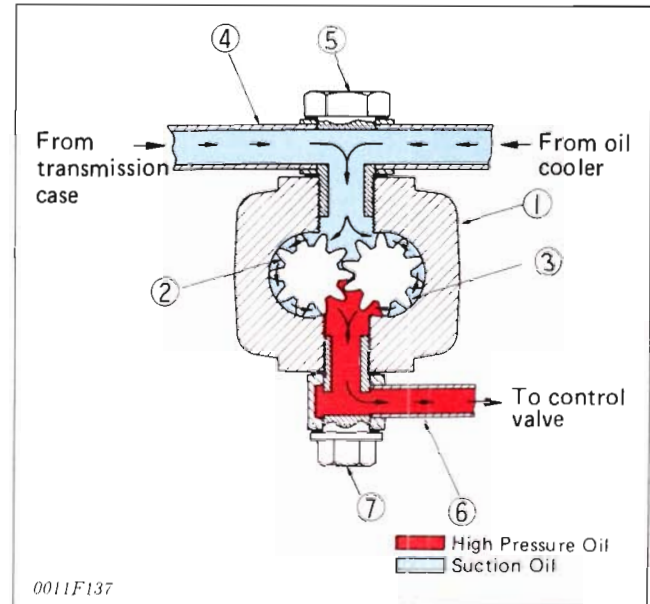
Fig. M-2 Hydraulic Pump



0011P204

Fig. M-3 Hydraulic Pump Components

The pump body (1) uses a pair of gears, one is a drive gear (2) which drives the driven gear (3). When the drive gear is driven, in the direction of the arrow, by the engine's fuel camshaft, oil is sucked and discharged. When the hydraulic system is operated by control valve, a load is applied to the implement, and high pressure is generated as shown in Fig. M-4.



- | | |
|---------------|-------------------|
| 1. Pump Body | 5. Eye Joint Bolt |
| 2. Drive Gear | 6. Delivery Pipe |
| 3. Idler Gear | 7. Eye Joint Bolt |
| 4. Inlet Pipe | |

Fig. M-4 Hydraulic Pump Operation

*Pressure balance system

The pressure balance system minimizes gear side pressure to improve efficiency. Oil on the delivery side (high pressure) presses the bushing onto the gears to automatically control clearance. At high pressure, leakage does not increase.

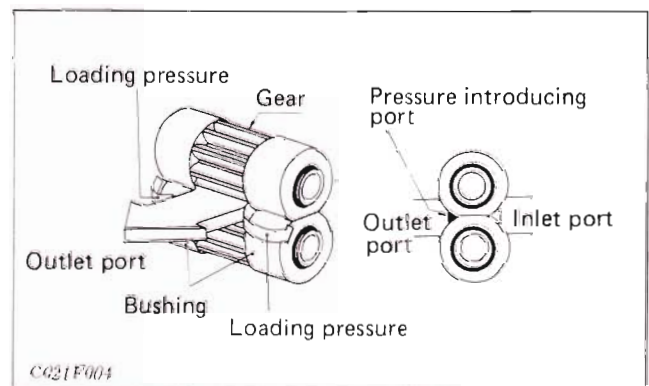
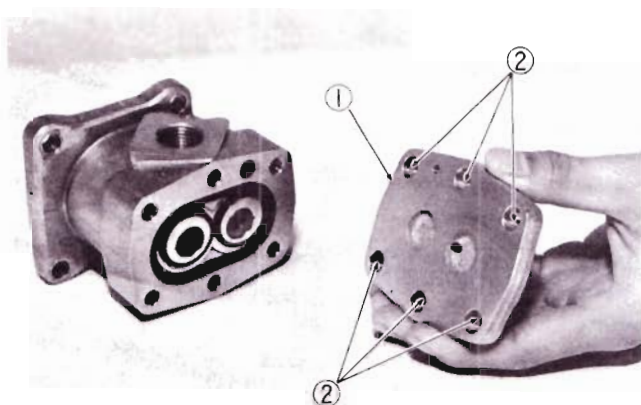


Fig. M-5 Pressure Balance System

Disassembly



0011P205

1. End Cover

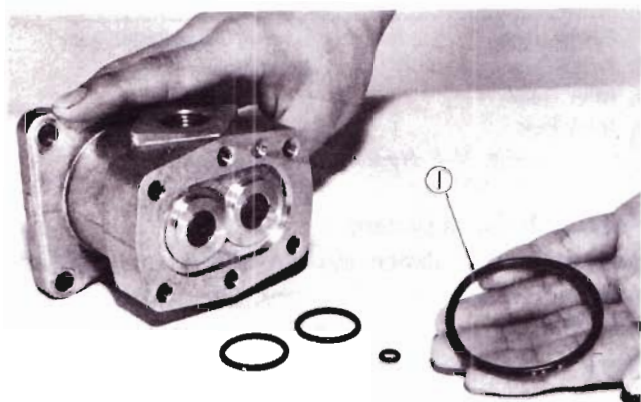
2. Mounting Bolt Position

Fig. M-6 Removing End Cover

(1) Remove the end cover.

When reassembling, check that O-ring is properly fitted, before attaching the end cover.

Make sure the drive shaft can turn smoothly.



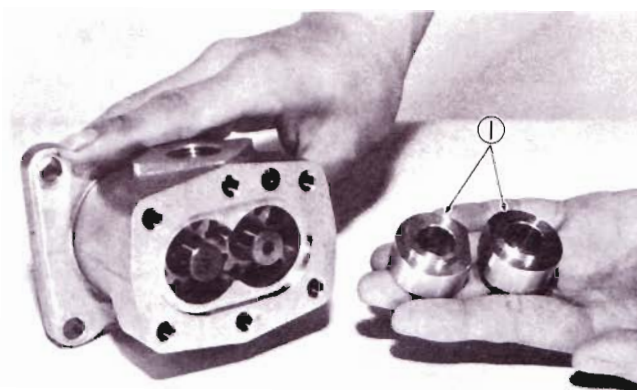
0011P206

1. O-ring

Fig. M-7 Removing O-rings

(2) Remove the O-rings.

(One on the cover side and two on the bushing side)

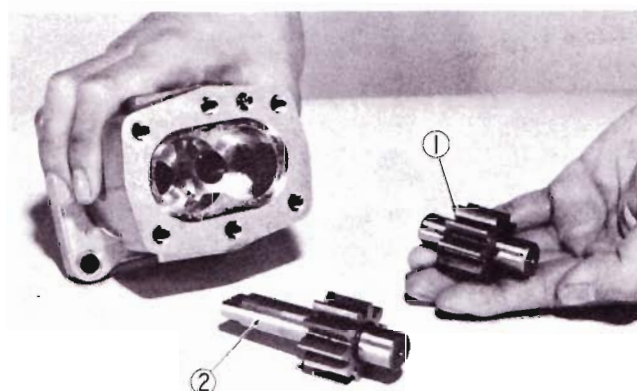


0011P207

1. Bushing

Fig. M-8 Removing Bushings

(3) Remove the bushings



0011P208

1. Idler Gear

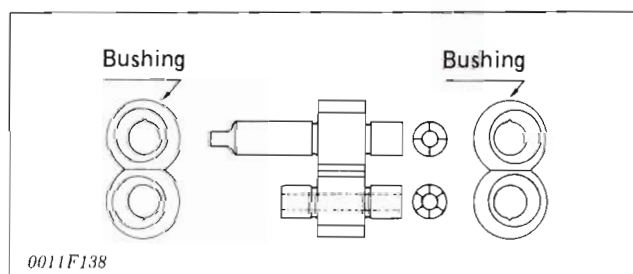
2. Drive Shaft

Fig. M-9 Removing Gears

(4) Remove the idler by lightly tapping the drive shaft with a plastic hammer.

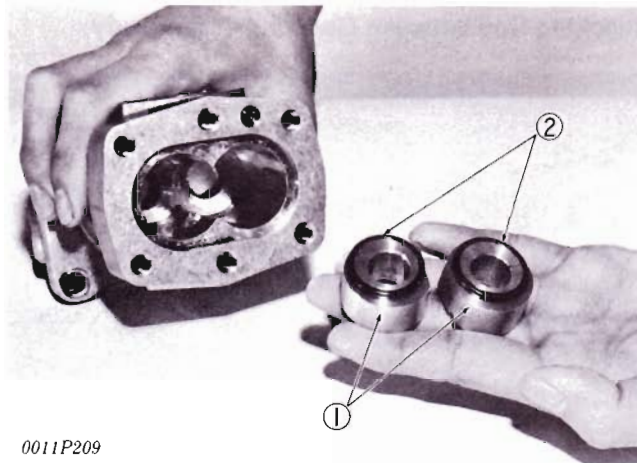
When reassembling,

- Make sure that bushing assembling direction and position are correct.
- Make sure that idler gear direction is correct.



0011F138

Fig. M-10 Bushing Direction



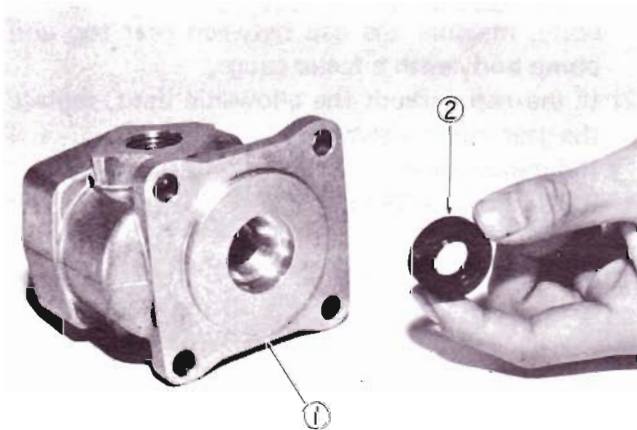
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1. Bushing

2. O-ring

Fig. M-11 Removing

(5) Remove the bushings and O-rings.



0011P210

1. Body

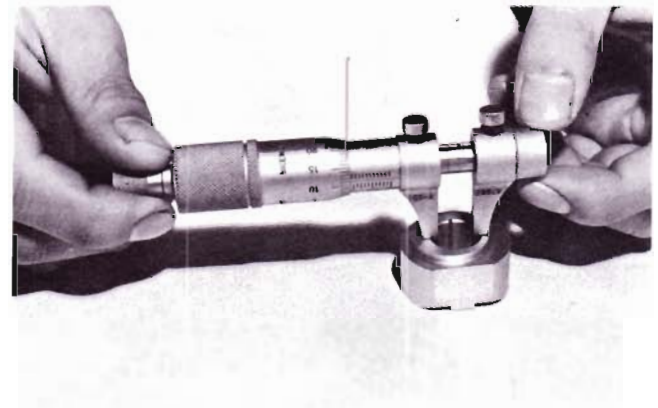
2. Oil Sealing

Fig. M-12

(6) Remove the oil seal from the gear pump body. When reassembling, check that the direction of installation of the oil seal is correct (the side with the number must be outside).

Servicing

Checking Wear of Bushing

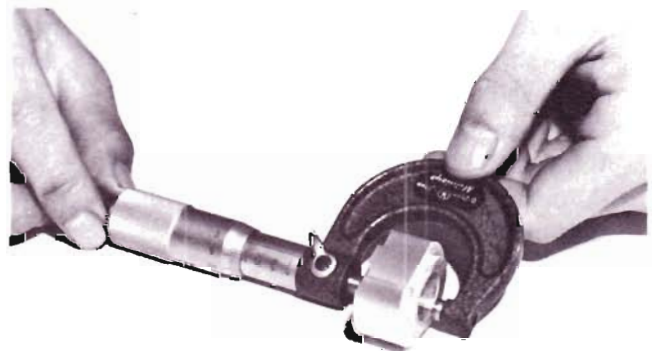


0011P211

Fig. M-13 Checking Wear of Bushing

- (1) Measure the inner diameter of the bushing with an inside micrometer.
 - Reference value:
14.00 to 14.02 mm (0.5512 to 0.5520 in.)

Checking Length and Thickness of Bushing

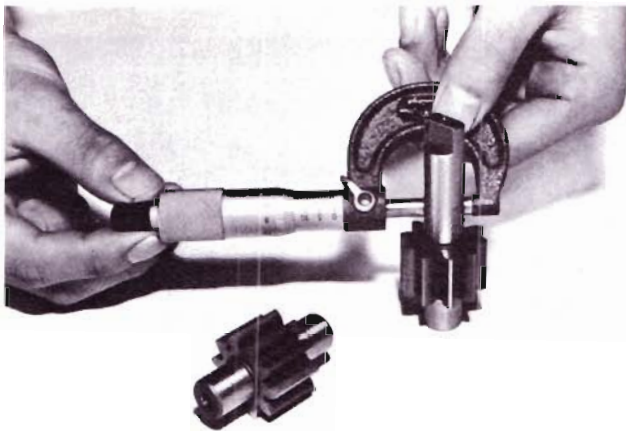


0011P212

Fig. M-14 Checking Length and Thickness of Bushing

- (1) With an outside micrometer measure the length and thickness of the bushing.
- (2) If the bushing is scratched or extremely worn, replace the gear pump assembly.
 - Reference value:
14 mm (0.5512 in.)

Checking Wear of Drive Shaft and Idler Shaft

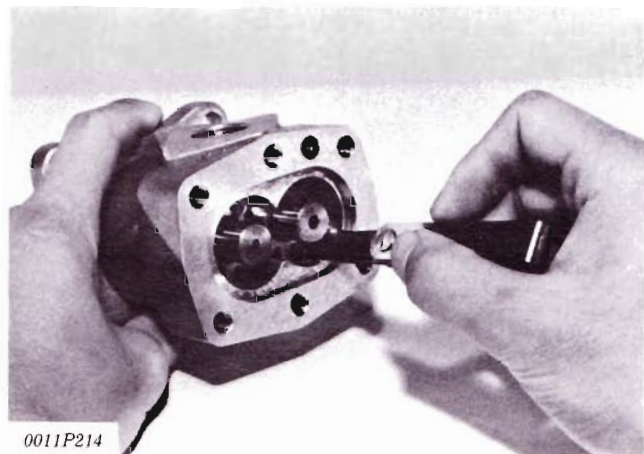


0011P213

Fig. M-15 Checking Wear of Drive Shaft and Idler Shaft

- (1) Measure the diameters of the drive shaft and idler shaft where they contact their respective bushings.
- (2) If the shafts are seriously scratched or extremely worn, replace the gear pump assembly.
 - Reference value:
13.95 to 13.98 mm (0.5492 to 0.5504 in.)
- (3) Measure the clearance between bushing and drive shaft or idler shaft. If it exceeds allowable limit, replace gear pump assembly.
 - Reference value:
0.02 to 0.07 mm (0.0008 to 0.0028 in.)
 - Allowable limit:
0.15 mm (0.006 in.)

Checking Gap between Gear and Pump Body



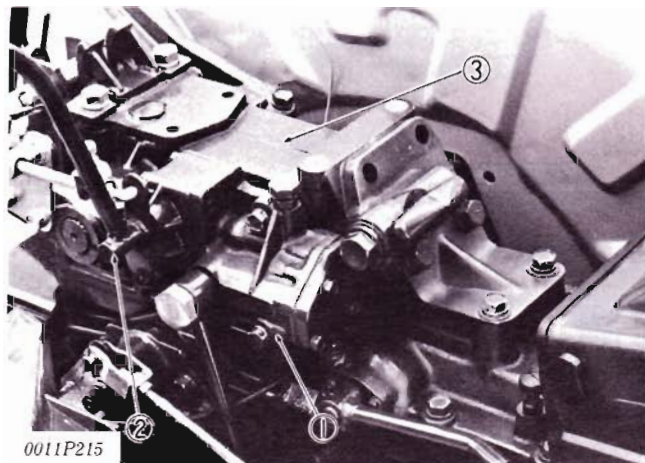
0011P214

Fig. M-16 Checking Gap between Gear and Pump Body

- (1) With drive shaft and idler set in the pump body, measure the gap between gear top and pump body with a feeler gauge.
- (2) If the gap exceeds the allowable limit, replace the gear pump assembly.
 - Reference value:
0.02 mm (0.0008 in.)
 - Allowable limit:
0.05 mm (0.0020 in.)

Group 3

Control Valve and Cylinder



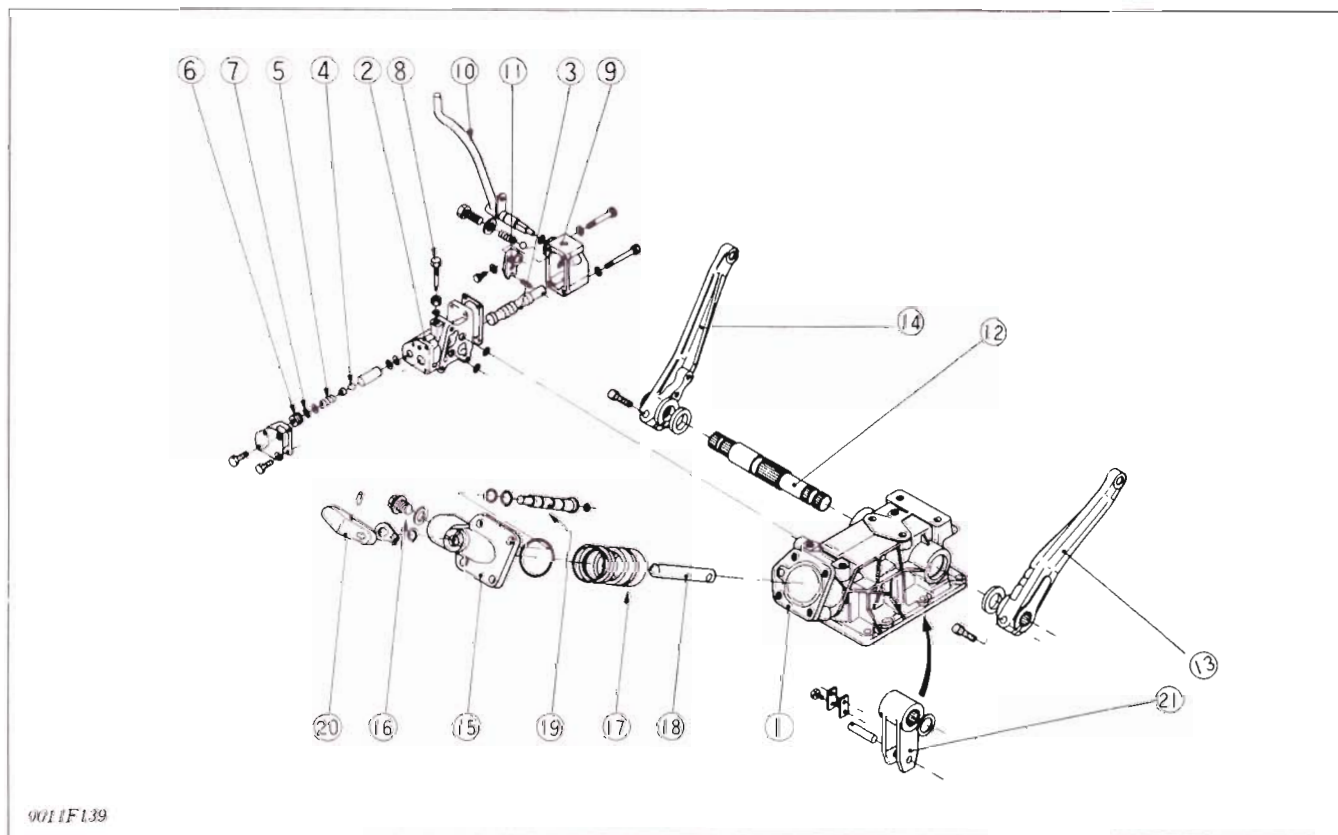
1. Control Valve
2. Control Lever

3. Cylinder (Integrated)

Fig. M-17

The control valve controls the direction of pressurized oil from the gear pump and the direction of returning oil from cylinder for lifting. The valve limits the maximum pressure of the hydraulic circuit by means of a built-in relief valve (4) to prevent damage.

The hydraulic piston (17) is located at the rear case cover (1) to which the control valve is attached. The control valve and hydraulic circuit are also connected to the piston. This cylinder unit operates the three-point linkage at the rear of the tractor.



1. Rear Case Cover
2. Valve Body
3. Spool
4. Relief Valve Ball
5. Spring

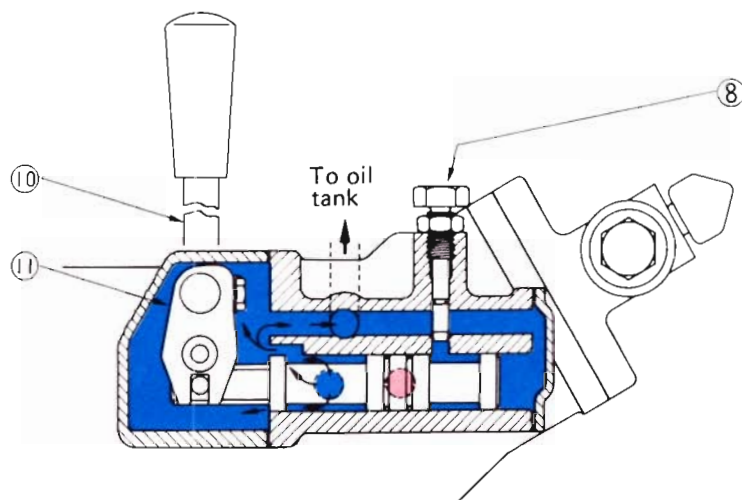
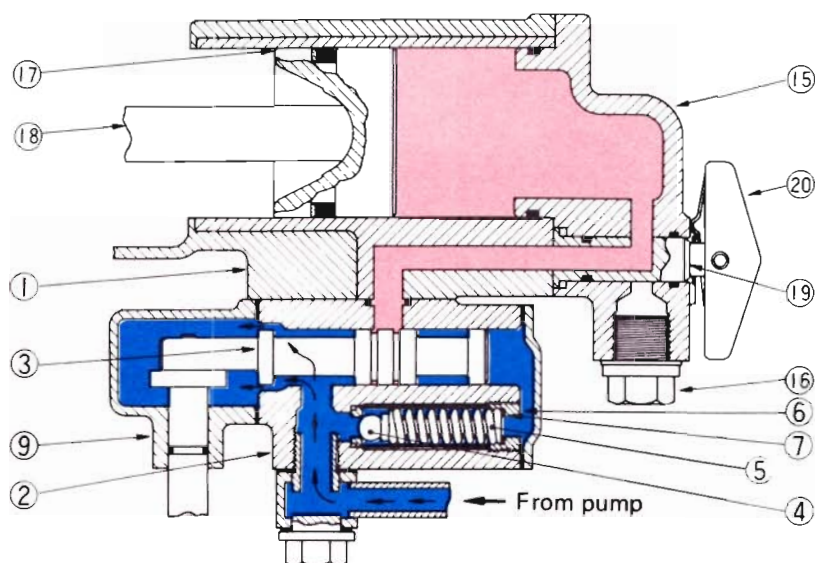
6. Adjusting Screw
7. Shim
8. Adjusting Bolt
9. Valve Cover
10. Control Lever

11. Valve Guide Arm
12. Hydraulic Shaft
13. Lift Arm (Right)
14. Lift Arm (Left)
15. Cylinder Cap

16. Plug
17. Hydraulic Piston
18. Hydraulic Piston Rod
19. Sub Spool
20. Grip
21. Hydraulic Arm

Fig. M-18 Components of Control Valve and Hydraulic Cylinder

Oil circuit during neutral



Case Pressure Oil
Low Pressure Oil

1. Rear Case Cover
2. Valve Body
3. Spool

4. Relief Valve Ball
5. Spring
6. Adjusting Screw

7. Shim
8. Adjusting Bolt
9. Valve Cover

10. Control Lever
11. Valve Guide Arm
15. Cylinder Cap

Fig. M-19 Oil Circuit During Neutral

With the hydraulic control lever at neutral, oil is pressure-fed from the pump through the space between the valve body (2) and the spool (3) big end to the body cover (9). It then returns to the return port of the valve body (2). The return port opens into the transmission case which also serves as an oil tank. Therefore, oil fed from the pump is not at high pressure. Oil in the cylinder is passed

through the sub-spool (19) inside the cylinder cap (15), rear case cover (1) to the spool chamber of the valve body (2) and closed by the large end of the spool (3). Then oil in the cylinder is prevented from flowing in either direction and the piston (17) stops. When this happens, oil pressure increases to support the weight of the rear implement.

Oil circuit when lift arm moves upward

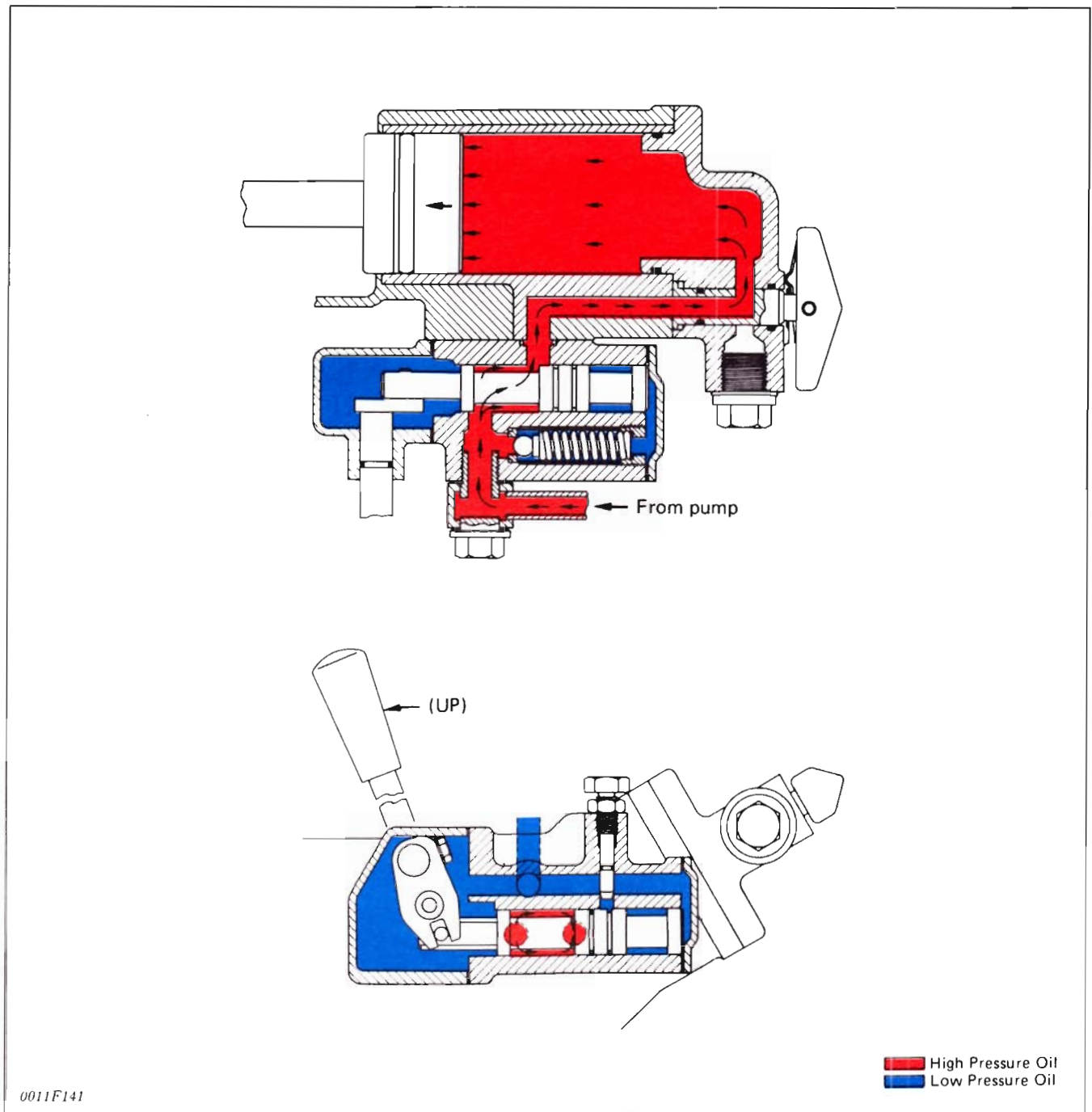
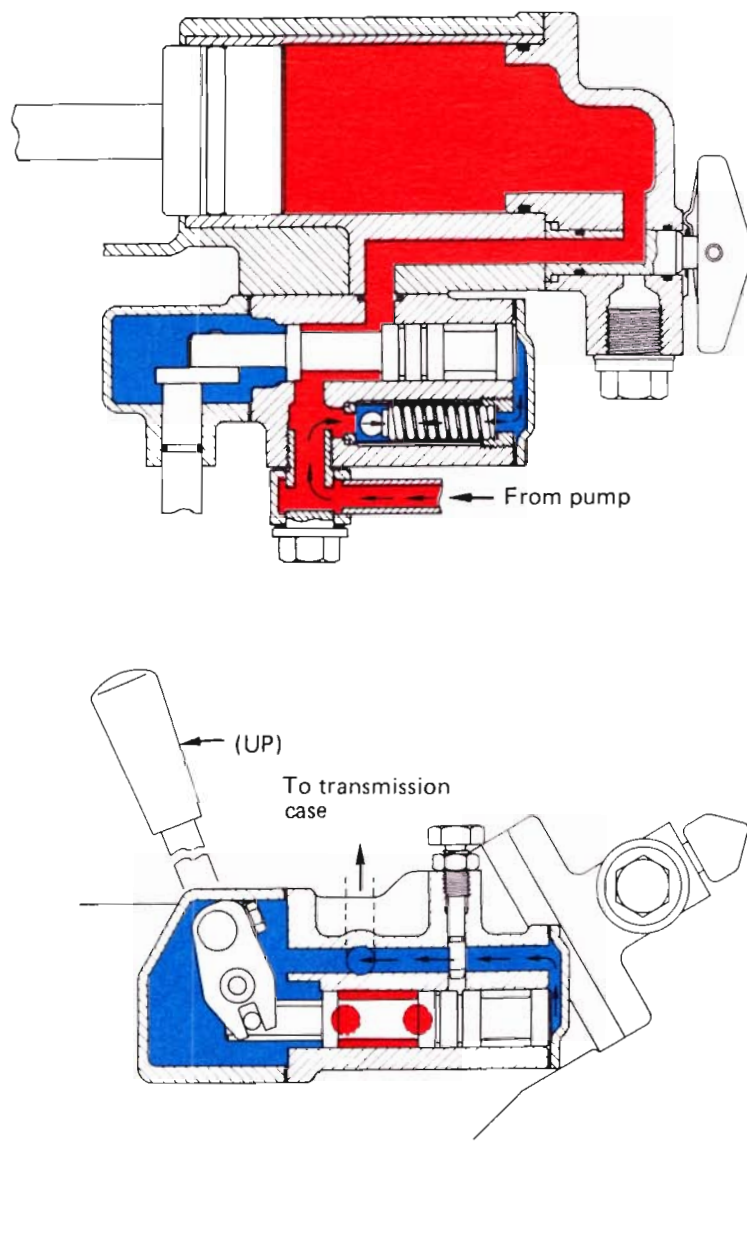


Fig. M-20 Oil Circuit When Lift Arm Moves Upward

With the hydraulic control lever is at UP, oil pressure-fed from the pump passes through the small end of the spool (3) inside the valve body (2) as shown by the arrows in Fig. M-20 to the rear

case cover (1) and the cylinder, pressing the piston. The piston is moved against the weight of the rear implement.

Oil circuit when piston is overloaded.



0011F142

Fig. M-21 Oil Circuit When Position is Overloaded

With the hydraulic control lever at UP and after the piston reaches the stroke end or when an overload is applied to the piston, oil fed from the pump cannot enter the cylinder, and internal pressure raises. When the internal pressure reaches the set pressure, 10.8 to 11.8 MPa (110 to 120 kgf/cm², 1570 to 1710 psi), a ball (4) is pressed against the relief spring (5) to allow oil to flow from the clearance between the ball and seat to maintain the

internal pressure at a constant level. Discharged oil is routed to the transmission case. When spring tension exceeds the set value by a large margin, other hydraulic units or mechanical units may malfunction. When the spring tension is too low, on the other hand, implement lifting capacity is reduced. Therefore, the spring must be set precisely. Spring tension is adjusted by shims.

Oil circuit when lift arm moves downward

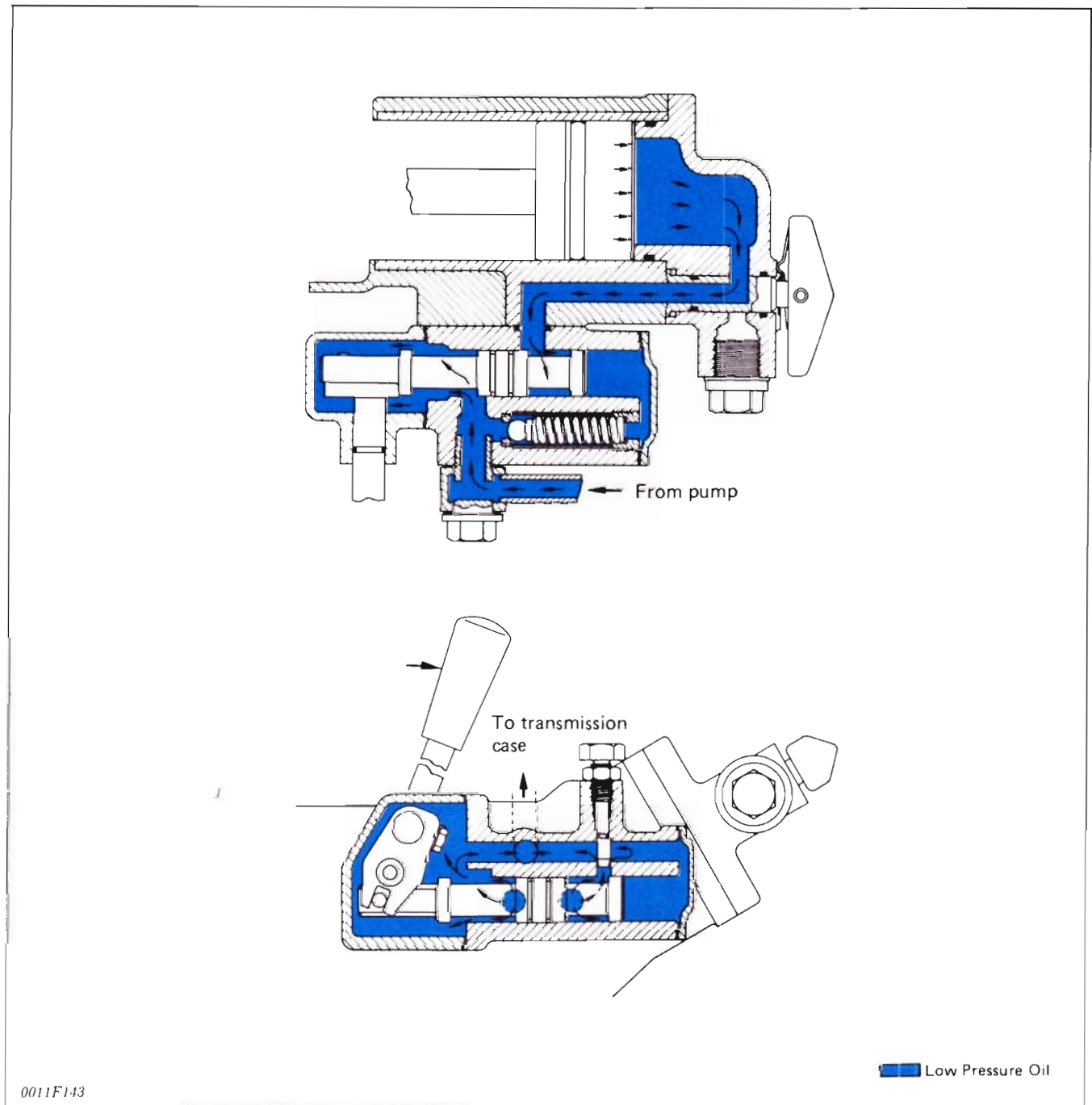


Fig. M-22 Oil Circuit When Lift Arm Moves Downward

With the hydraulic control lever at DOWN, oil fed from the pump passes from the clearance between the valve body (2) and spool (3) large end to body cover (9) and then returns to the return port of the valve body (2) as shown in Fig. M-22.

Oil in the cylinder flows from the cylinder cap (15) through the spool (3) and the clearance between the drop adjusting bolt (8) and body to the return port.

Therefore oil from the pump and oil from the piston flow directly into the transmission case, and the piston is contracted by the implement weight applied to the lift arm.

The drop adjusting bolt (8) tip is tapered. When it is screwed in, return oil flow from the cylinder becomes less, and when it is loosened, return flow increases. In this way dropping speed of the implement can be adjusted.

Hydraulic Power Take-off Circuit to Other Implements.

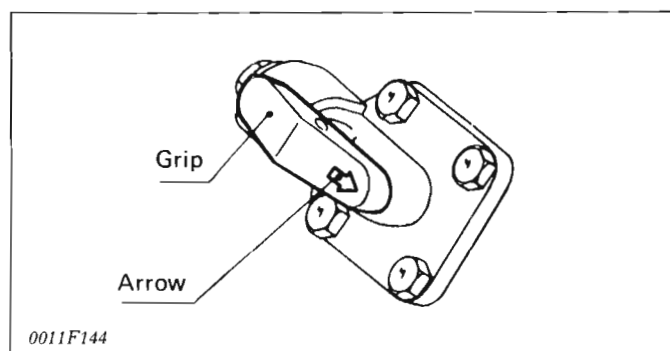


Fig. M-23 When Lift Arm is Operating:

The oil circuits described above are for controlling lift arm movement. Hydraulic power can be easily taken off to drive another implement via the grip

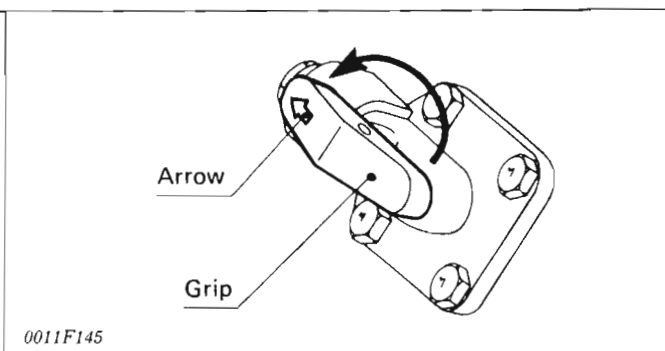
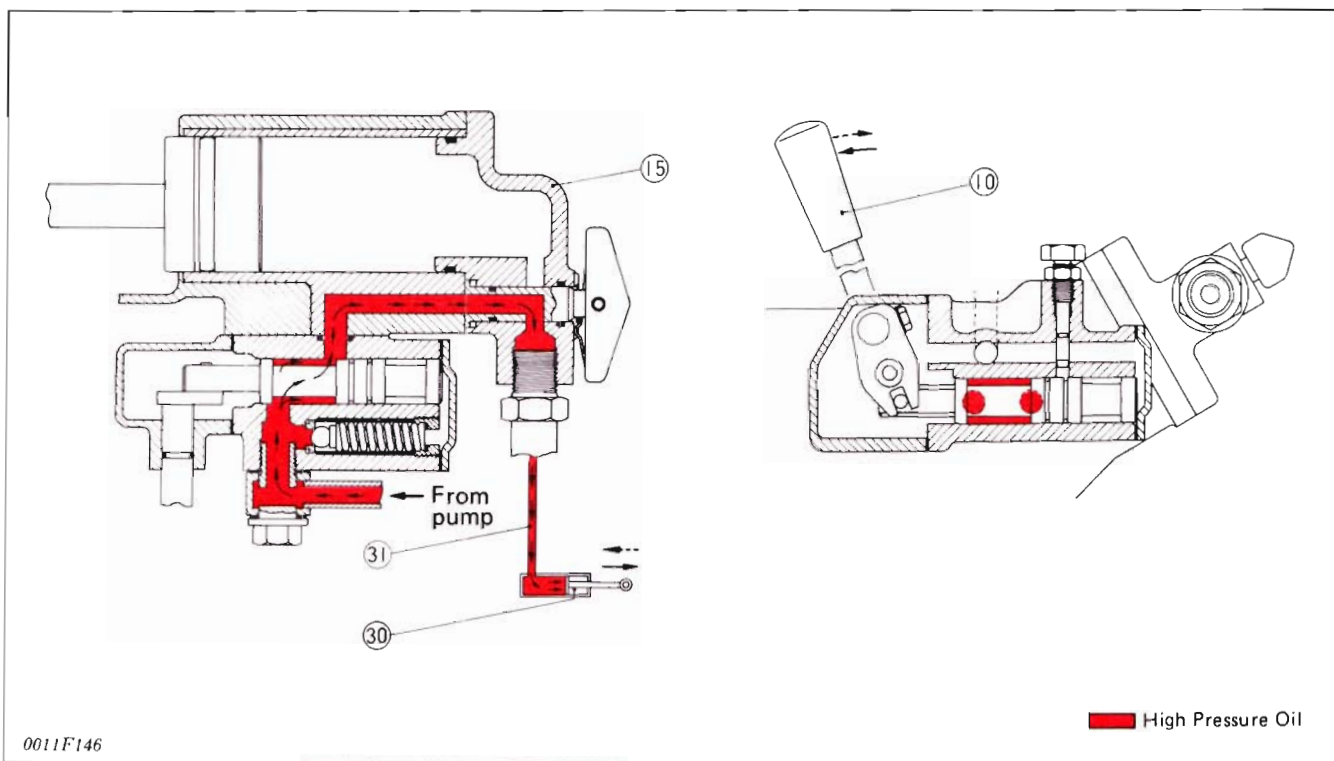


Fig. M-24 When Implement is Operating:

attached to the cylinder cap. The hydraulic circuit for implements which use this hydraulic power must be cleaned before attachment.



30. Implement Cylinder (Single Action)

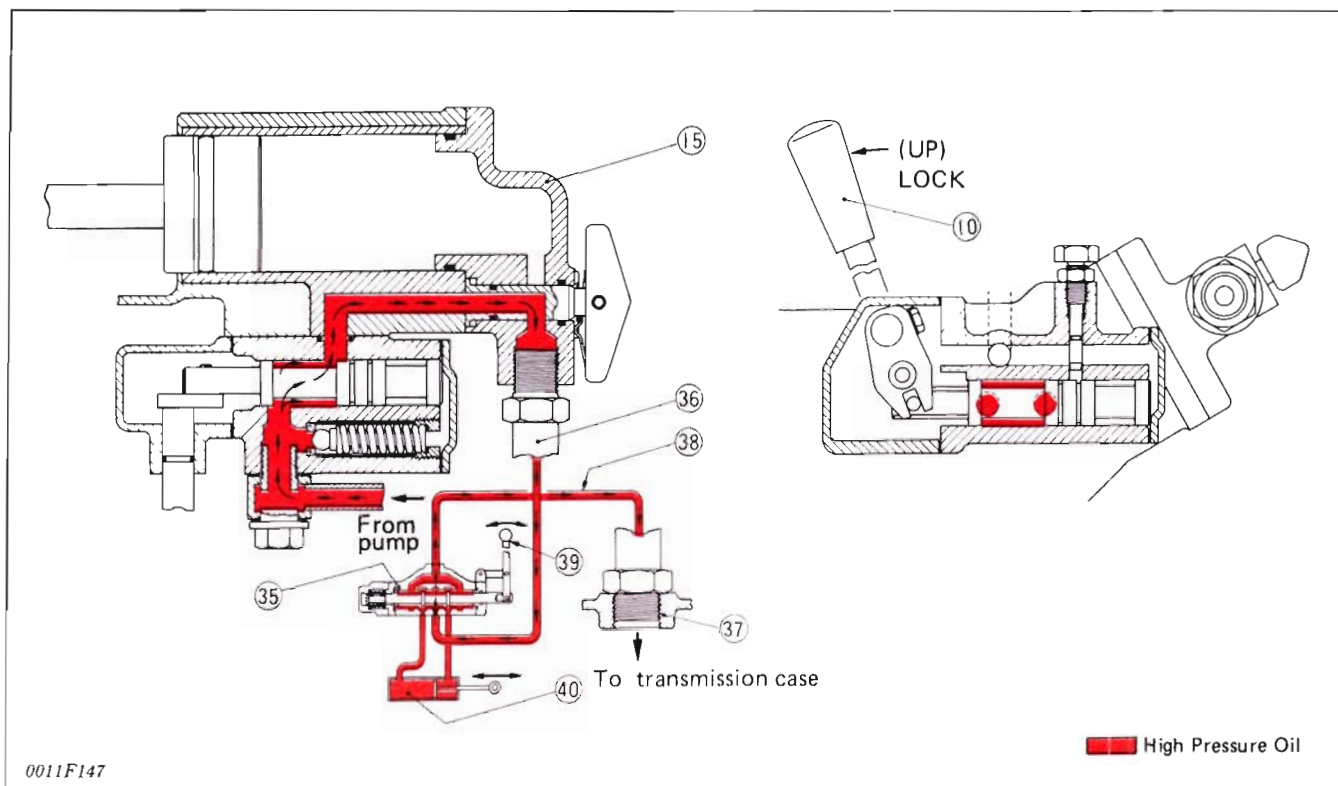
31. Delivery Hose

Fig. M-25 Hydraulic Take-off to Single Action Cylinder

When implement cylinder is operated in the single action-mode, remove the plug (16) and connect the implement single action cylinder (30) and the cylinder cap (15) with delivery hose (31) (Cylinder

cap side screw: PS 1/2).

Operation can be controlled with the tractor control lever (10).



35. Implement Control Valve
36. Delivery Hose

37. Front Case Cover
38. Return Hose

39. Control Lever
40. Implement Cylinder (Double Action)

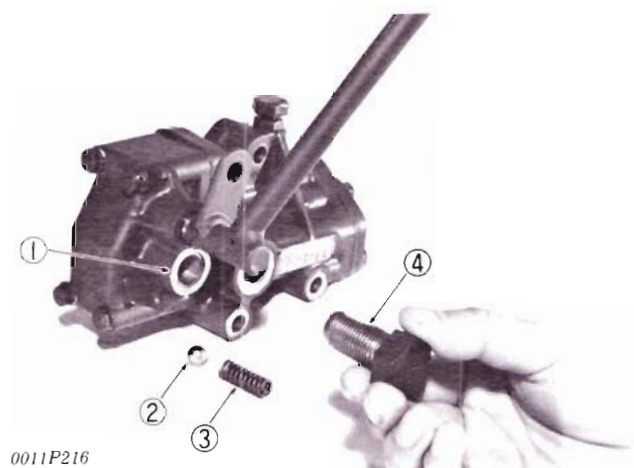
Fig. M-26 Hydraulic Take-off to Double Action Cylinder

When the implement cylinder is operated in the double action mode, remove the plug (16) and connect the control valve (35) on the implement side and tractor cylinder cap (15) with delivery hose (36). (Cylinder cap side screw: PS 1/2)
Remove the oil supply plug from the front case

cover (37) on the transmission case, and connect the return hose (38) from the control valve on the implement side. (Front case cover screw: PF 1/2)
When the control lever (39) on the implement side is operated while the tractor control lever (10) is at UP, the piston is reciprocated.

Disassembly

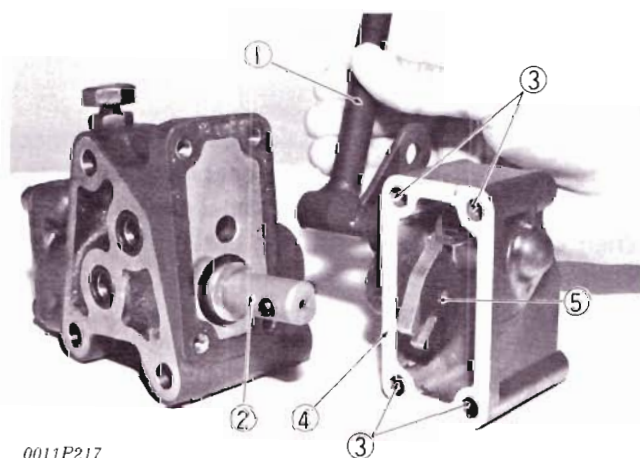
Control Valve



- 0011P216
- 1. Gasket
 - 2. Ball
 - 3. Ball Stopper Spring
 - 4. Bolt

Fig. M-27 Removing Control Lever and Bolt

- (1) Remove control lever and bolt.
- (2) Remove valve cover.

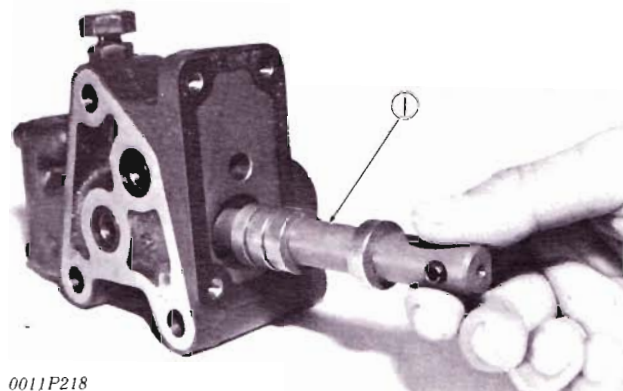


- 0011P217
- 1. Control Lever
 - 2. Spool
 - 3. Mounting Bolt Position
 - 4. Valve Cover
 - 5. Valve Guide Arm

Fig. M-28 Removing Valve Cover

When reassembling, install the valve cover so that the spring pin of the spool engages with the groove of the valve guide arm.
Tighten the valve guide arm bolts (11T) to 9.8 to 17.7 Nm (1.0 to 1.8 kgf-m, 7.2 to 13.0 ft-lbs).

- (3) Draw out the spool from the valve body.



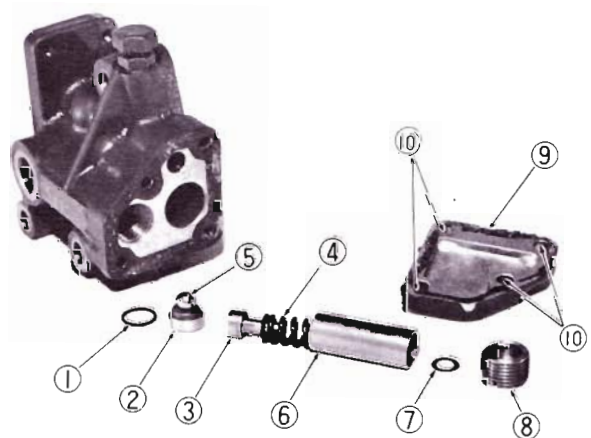
0011P218

- 1. Spool

Fig. M-29 Drawing Out the Spool

When, reassembling, apply a little gear oil to the spool and install it slightly. Then, check if the spool moves smoothly.

- (4) Remove the bolts holding the relief cover.



0011P219

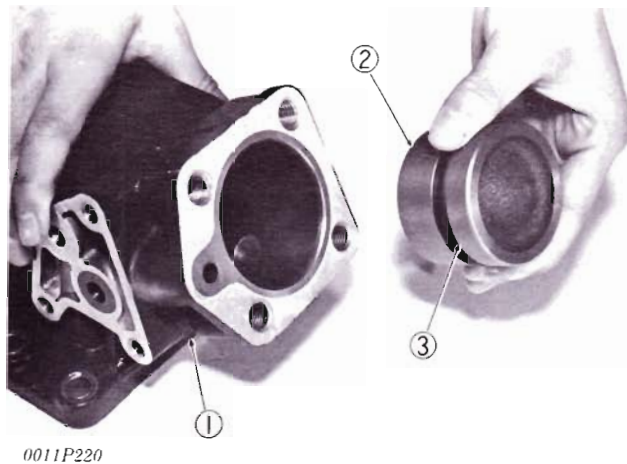
- 1. O-ring
- 2. Valve Seat
- 3. Spring Holder
- 4. Spring
- 5. Ball
- 6. Collar
- 7. Plain Washer, Shim
- 8. Relief Adjustment Screw
- 9. Relief Cover
- 10. Mounting Bolt Position

Fig. M-30 Removing Relief Valve

Before removal, check how much the adjusting screw is projecting from the surface of the valve body.

- (5) Remove the adjusting screw and ball.
- (6) Remove the valve seat.

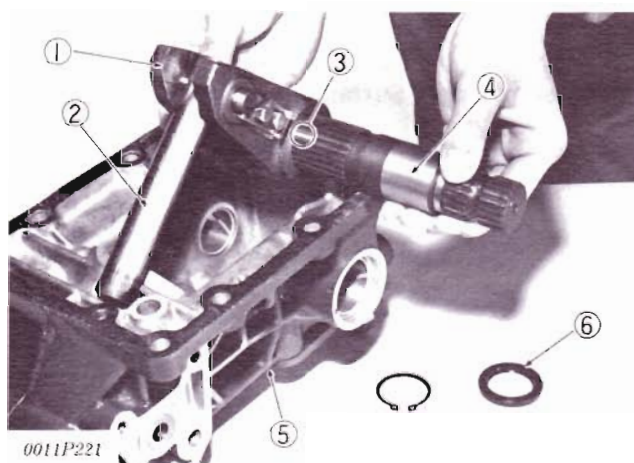
When reassembling, set the relief pressure adjusting screw to the same tightness as before disassembly.

Hydraulic Cylinder

1. Rear Case Cover 3. O-ring
2. Hydraulic Piston

Fig. M-31 Removing Piston

- (1) Remove the hydraulic cylinder cap.
When reassembling, apply oil to the O-ring.
- (2) Remove the hydraulic piston from the rear case cover by pushing it up from the bottom of the cover.
When reassembling, set the hydraulic piston from the cylinder cap side.



1. Hydraulic Arm 4. Hydraulic Arm Shaft
2. Hydraulic Piston Rod 5. Rear Case Cover
3. Alignment Mark 6. Oil Seal

Fig. M-32 Removing Hydraulic Arm Shaft

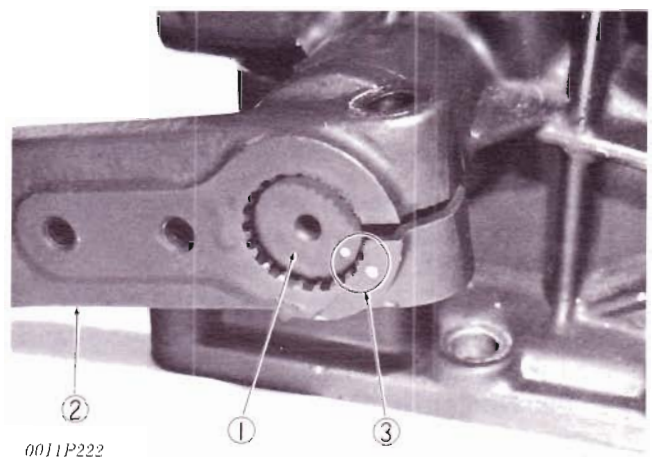
- (3) Remove the bolts holding the right and left lift arms.
- (4) Detach the lift arms from the arm shaft.
- (5) Remove the hydraulic arm shaft by lightly tapping it with a plastic hammer.
Then, detach the lift arm.

When reassembling, lubricate the bushing before installing the hydraulic arm shaft.

Apply grease to the lip of the oil seal.

Install lift arm and arm shaft with their alignment marks aligned, and then set the external circlip.

Check the alignment marks as shown below.

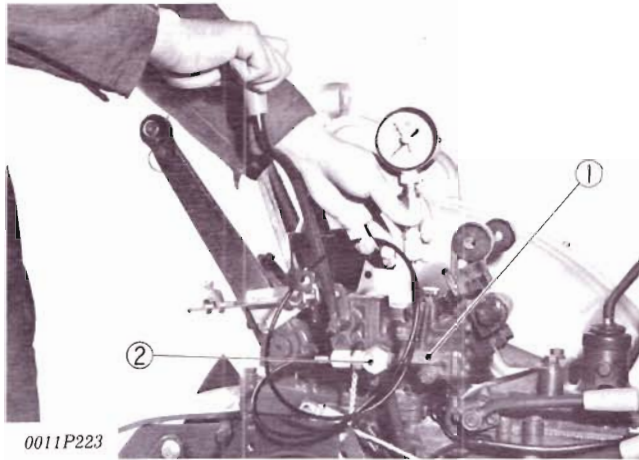


1. Hydraulic Arm Shaft 3. Alignment Mark
2. Lift Arm

Fig. M-33 Checking Alignment Mark

Servicing

Checking Relief Valve Set Pressure



1. Control Valve 2. Adapter

Fig. M-34 Checking Relief Valve Set Pressure

- (1) Replace the hydraulic delivery pipe with an oil pressure gauge.

SPECIAL TOOL: Pressure Gage
Code No. 07916-50041

- (2) Start the engine, actuate the relief valve, and read the gauge.
- (3) If the reading is outside the reference value, remove the hydraulic cylinder cap, turn it by 90°, remove the relief cover, and adjust with shims.

- Reference value:
10.8 to 11.8 MPa
(110 to 120 kgf/cm², 1570 to 1710 psi)
- NOTE:** • Adding one 0.3 mm (0.0118 in.) shim will increase the relief valve set pressure by 780 to 980 KPa (8 to 10 kgf/cm², 110 to 140 psi).

- Excessively high relief pressure may cause trouble.
- Excessively low pressure may lower the hydraulic lifting capacity.

Checking Implement Lowering Speed Adjusting Bolt

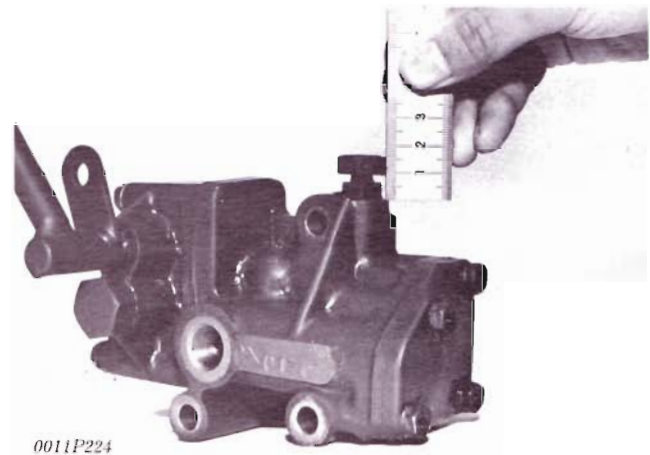


Fig. M-35 Checking Implement Lowering Speed Adjusting Bolt

- (1) Measure the distance with vernier calipers or scale.
- (2) If the distance exceeds the reference value, loosen the lock nut and adjust.

- Reference value:
3 mm (1/8 in.)

An implement should lower all the way in 3.8 to 4.2 seconds at 15°C (59°F) atmospheric temperature.

Inspection of Spool Surface



Fig. M-36 Inspecting Spool Surface

- (1) Check if there are any scratches on the spool surfaces.
- (2) If there are scratches, check to see if they catch when you pass your fingernail over them.
- (3) If they do, replace spool and valve body.

NOTE: Replace valve body and spool together as a pair.

Checking Contact between Relief Valve Holder and Ball



0011P226

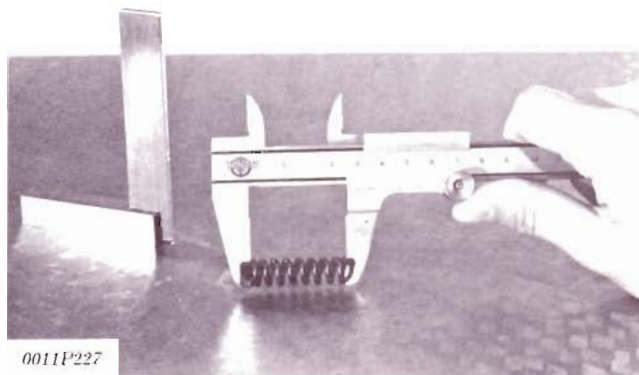
1. Valve Seat Surface

Fig. M-37 Checking Contact between Relief Valve Holder and Ball

- (1) If the contact surface between relief valve holder and ball is extremely worn, or there is possibility of oil leakage, replace.

NOTE: Replace relief valve holder and ball together as a pair.

Checking Damper and Deformation of Relief Valve Spring

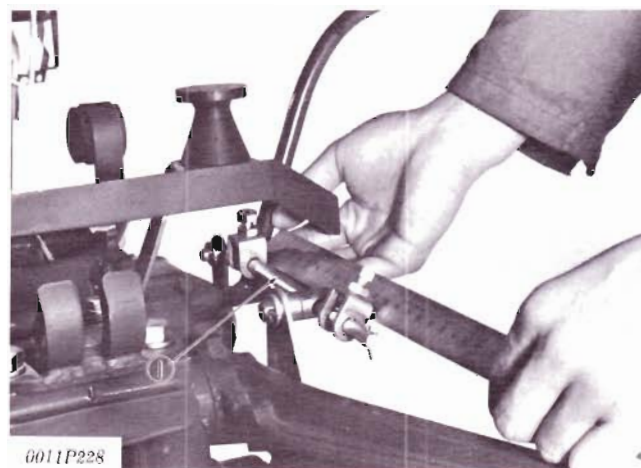


0011P227

Fig. M-38 Checking Damper and Deformation of Relief Valve Spring

- (1) Put a square on the surface plate and place the relief valve spring next to it.
- (2) Check if they are in proper contact with each other over the entire length of the spring.
- (3) Measure the relief valve spring with vernier calipers.
 - Reference value:
37.7 to 38.3 mm (1.484 to 1.508 in.)

Checking Interlocker Position

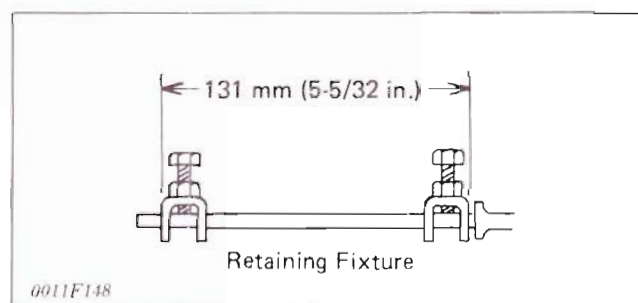


0011P228

1. Retaining Rod

Fig. M-39 Checking Interlocker Position

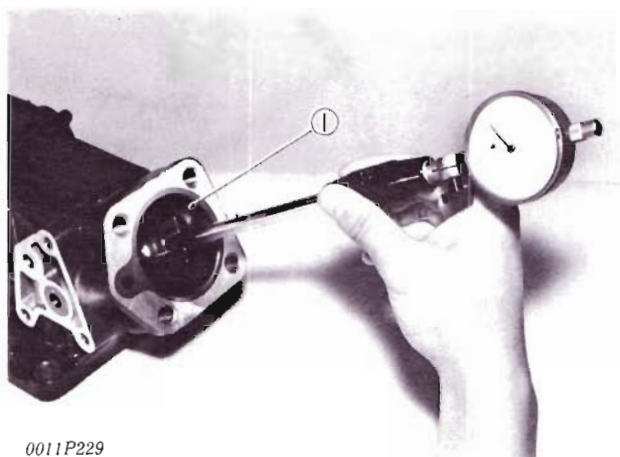
- (1) Completely fit one end of the retaining fixture to the front of the retaining rod and then secure.
- (2) Fix the other retaining rod 131 mm (5⁵/₃₂ in.) away from the other retaining rod. The distance varies according to work.



0011F148

Fig. M-40 Retaining Fixture

Checking Wear of Hydraulic Cylinder



0011P229

1. Hydraulic Cylinder

Fig. M-41 Checking Wear of Hydraulic Cylinder

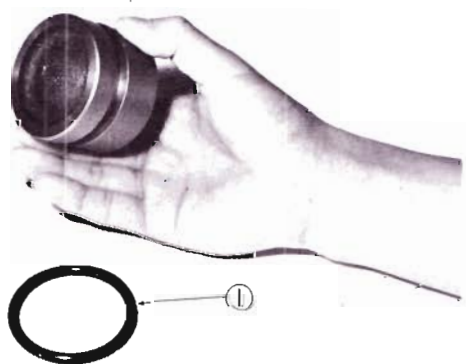
- (1) Clean the inside of the hydraulic cylinder, and measure wear with a cylinder gauge.

TEST EQUIPMENT: Cylinder Gauge

- (2) If the measurement exceeds the allowable limit, replace.

- Reference value:
60.06 to 60.10 mm (2.365 to 2.366 in.)
- Allowable limit:
60.15 mm (2.368 in.)

Checking Hydraulic Piston and O-ring



0011P230

1. O-ring

Fig. M-42 Checking Hydraulic Piston and O-ring

- (1) Visually check if there are scratches or deformations on the surface of the hydraulic piston and O-ring.

Checking Wear of Hydraulic Arm Shaft Bushing



0011P231

Fig. M-43 Checking Wear of Hydraulic Arm Shaft Bushing

- (1) Measure the inside diameter of the hydraulic arm shaft bushing vertically and horizontally.

- (2) If the measurement exceeds the allowable limit, replace.

- Reference value:
Large end dia.
31.97 to 32.04 mm (1.2587 to 1.2614 in.)
Small end dia.
27.97 to 28.04 mm (1.1012 to 1.1039 in.)
- Allowable limit:
Large end dia.
32.4 mm (1.276 in.)
Small end dia.
28.4 mm (1.118 in.)

Checking Hydraulic Arm Shaft



Fig. M-44 Checking Hydraulic Arm Shaft

- (1) Measure the outside diameter of the hydraulic arm shaft vertically and horizontally.
 - Reference value:
 - Large end dia.
31.92 to 31.95 mm (1.2567 to 1.2579 in.)
 - Small end dia.
27.94 to 27.96 mm (1.1000 to 1.1079 in.)
- (2) Take the clearance between arm shaft and bushing. If it exceeds the allowable limit, replace bushing.
 - Reference value:
0.01 to 0.09 mm (0.0004 to 0.0035 in.)
 - Allowable limit:
0.5 mm (0.020 in.)

Checking Lift Arm Play

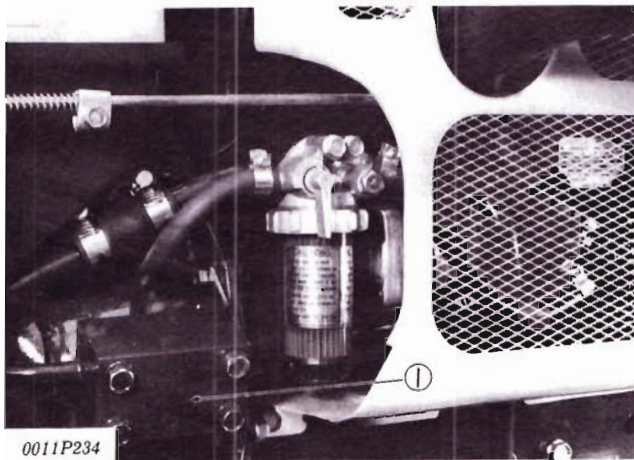


Fig. M-45 Checking Lift Arm Play

- (1) Raise the lift arm to its upper limit by actuating the hydraulic power system.
- (2) Move the arm by hand upwards from the back, and check how much it may be moved up.
- (3) If the play is outside the reference value, adjust with the interlocker.
- (4) Play increases if the front interlocker is moved backwards.
 - Reference value:
25 to 35 mm (63/64 to 1-3/8 in.) for the upper limit of the lift arm

Group 4

Hydraulic Block



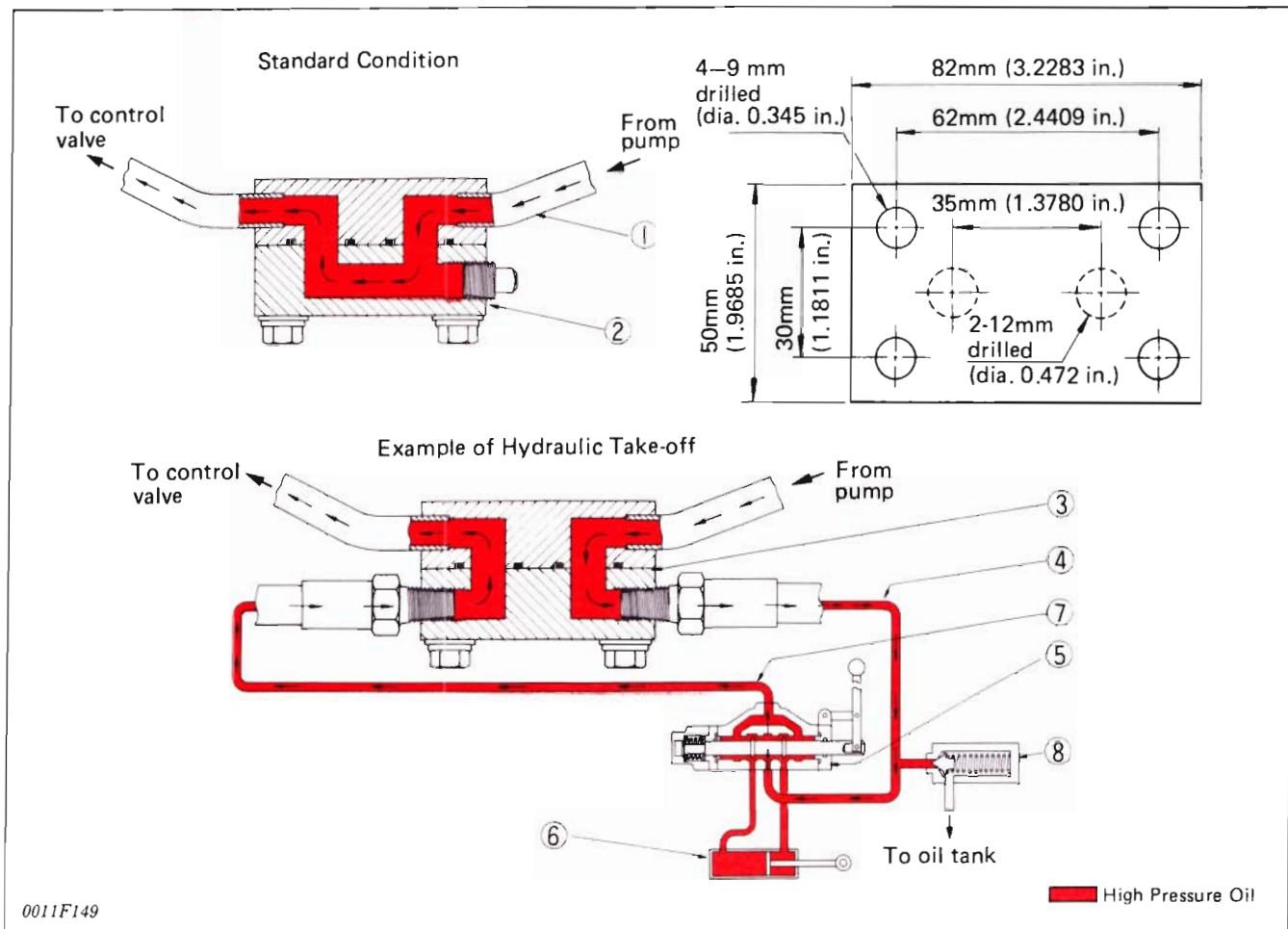
1. Hydraulic Block

Fig. M-46 Hydraulic Block

When hydraulic power is used with the control valve and the three-point linkage and if other hydraulic power is required simultaneously, hydraulic power can be taken off from the hydraulic block integrated with the delivery pipe.

Hydraulic power take-off

- Remove the block cover (2) of the delivery pipe and replace it with the implement hydraulic cover (3).
- Connect the cover front mounting with the delivery pipe (4) which leads to the implement, and connect the rear mounting with the return pipe from the implement.



1. Delivery Pipe
2. Hydraulic Cover

3. Hydraulic Cover (Implement)
4. Delivery Pipe (Implement)

5. Valve (Implement)
6. Cylinder (Implement)

7. Return Hose (Implement)
8. Relief Valve (Implement)

Fig. M-47 Method of Hydraulic Power Take-Off in Hydraulic Block

Precautions

- a. Implement oil circuit must be cleaned before setting.
- b. The implement pressure control valve (5) must be a type which will return oil relieved by the relief valve directly to the transmission case. If the valve is a type which returns oil to the return pipe (7), when the three-point linkage system is operated simultaneously with the hydraulic block, the three-point linkage-side relief pressure and block-side relief pressure

will be added together and the gear pump and other units may be damaged.

- c. Relief pressure of the implement relief valve must be set at a max. of 11.8 MPa (120 kgf/cm², 1710 psi).

IMPORTANT:

When installing the implement to the hydraulic block, drain oil in the implement, and don't mix that oil and hydrostatic transmission oil if possible.

Group 5

Oil Filter

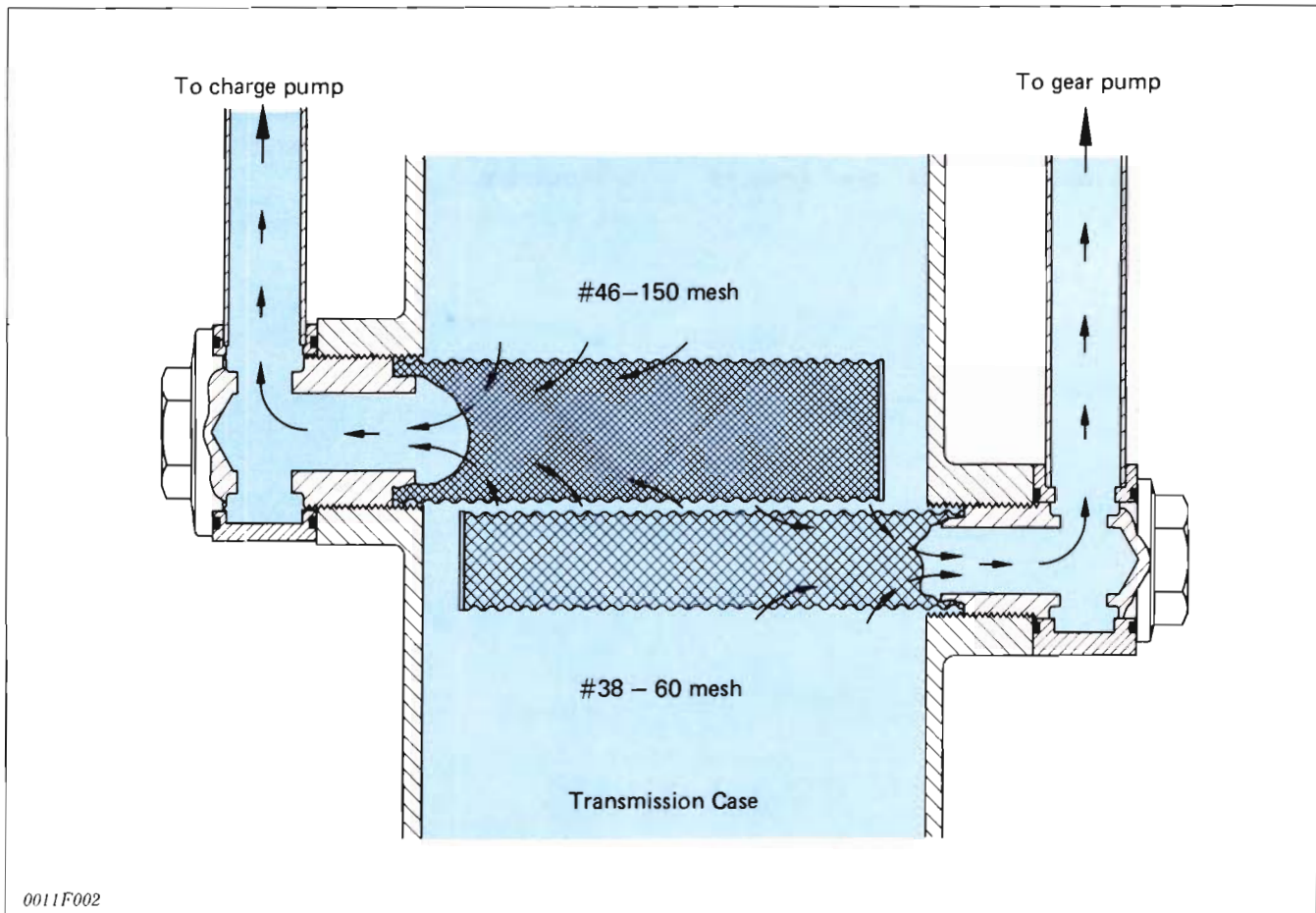


Fig. M-48 Oil Filter

Two oil filters are provided in the transmission case. One is connected to the Hydrostatic transmission charge pump, and the other is connected to the gear pump (which is the source of operating hydraulic power for the implement).

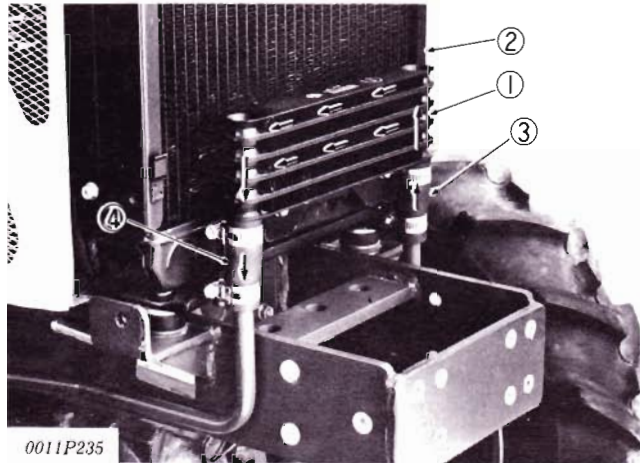
The Hydrostatic transmission side filter has a very

fine mesh because the Hydrostatic transmission can be damaged by foreign matter and impurities in the oil.

Be careful not to damage the filters when cleaning them with light oil.

Group 6

Oil Cooler



- 1. Oil Cooler
- 2. Radiator
- 3. Inlet (From hydrostatic transmission)
- 4. Outlet (To gear pump)

Fig. M-49 Oil Cooler

When hydraulic power is used, oil temperature will rise. Heat is produced because of friction between hydraulic units due to pressure generation and friction between the molecules of the oil itself.

With three-point linkage or implement operation of the tractor, generated heat is radiated naturally from the transmission case and piping, keeping oil temperature from rising excessively.

On a tractor with an hydrostatic transmission, which produces a lot of heat, however, the tank capacity is too small for sufficient natural heat radiation. Therefore, a special oil cooler is provided in front of the engine radiator to utilize the air blown by the fan.

Group 7

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Hydraulic Pump

Clearance between gear tip and body

(R.V.) 0.02 mm (0.0008 in.)

(A.L.) 0.05 mm (0.002 in.)

Shaft O.D.

(R.V.) 13.95 to 13.98 mm (0.5492 to 0.5504 in.)

Bushing I.D.

(R.V.) 14.00 to 14.02 mm (0.5512 to 0.5520 in.)

Clearance between gear shaft and bushing

(R.V.) 0.02 to 0.07 mm (0.0008 to 0.0028 in.)

(A.L.) 0.15 mm (0.006 in.)

Hydraulic System

Cylinder I.D.

(R.V.) 60.06 to 60.10 mm (2.365 to 2.366 in.)

(A.L.) 60.15 mm (2.368 in.)

Cylinder axial injuries

Depth (A.L.) 0.05 mm (0.002 in.)

Width (A.L.) 0.10 mm (0.004 in.)

Arm shaft O.D.

Large side (R.V.) 31.92 to 31.95 mm (1.2567 to 1.2579 in.)

Small side (R.V.) 27.94 to 27.96 mm (1.1000 to 1.1008 in.)

Bushing I.D.

Large side (R.V.) 31.97 to 32.04 mm (1.2587 to 1.2614 in.)

(A.L.) 32.4 mm (1.276 in.)

Small side (R.V.) 27.97 to 28.04 mm (1.1012 to 1.1039 in.)

(A.L.) 28.4 mm (1.118 in.)

Oil clearance between arm and bushing

Large side (R.V.) 0.02 to 0.12 mm (0.0008 to 0.0047 in.)

Small side (R.V.) 0.01 to 0.10 mm (0.0004 to 0.0039 in.)

(A.L.) 0.5 mm (0.020 in.)

Rod pin O.D.

(R.V.) 11.957 to 11.984 mm (0.4707 to 0.4718 in.)

Oil Cooler

Type Corrugated fin type radiator

Capacity 0.1 ℓ (0.1 U.S. qts.)

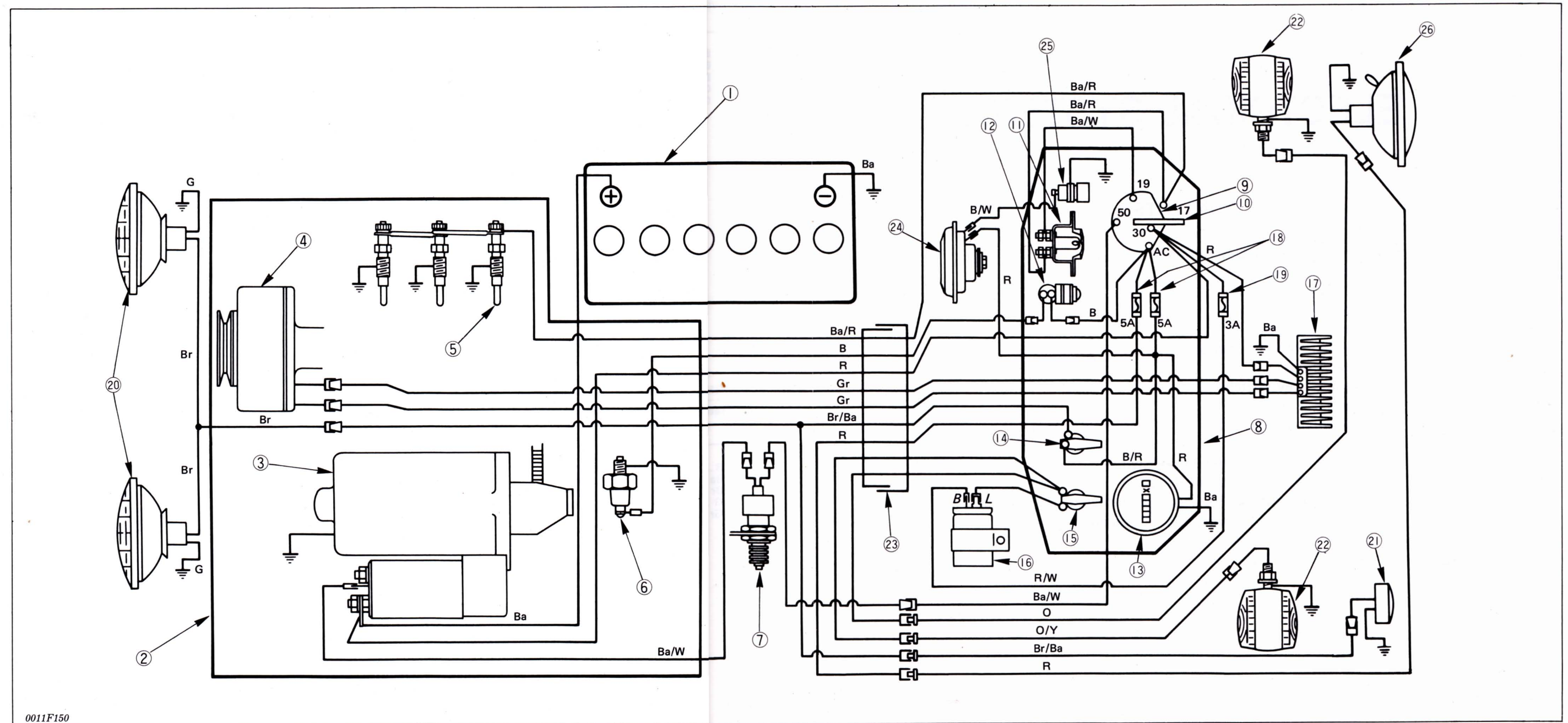
ELECTRICAL SYSTEM

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Group 1

General Description



1. Battery (12V-45AH)
2. Engine Body
3. Starter
4. AC Dynamo
5. Glow Plug
6. Oil Switch

7. Safety Switch (12V-15A)
8. Meter Panel
9. Key Switch
10. Key

11. Glow Plug Lamp (20A)
12. Oil Lamp (12V-3.4W)
13. Hourmeter
14. Headlight Switch (12V-5A)
15. Hazard Switch
16. Hazard Unit (12V-43W)

17. Regulator
(Regulated voltage: 14 to 15V)
18. Fuse (5A)
19. Fuse (3A)
20. Headlight (12V-15W)
21. Taillight

22. Hazard Lamp (12V-15W)
23. Coupler
24. Horn (12V-1.5AH) [option]
25. Horn Switch (3A) [option]
26. Work Light [option]

Fig. N-1 Electrical System

The electrical system of this tractor is composed a number of different function circuits making use of a 12V battery. The battery supplies power to all

circuits. The battery also powers the starter which consumes a great deal of power. A charging system is used to charge the battery while the engine is

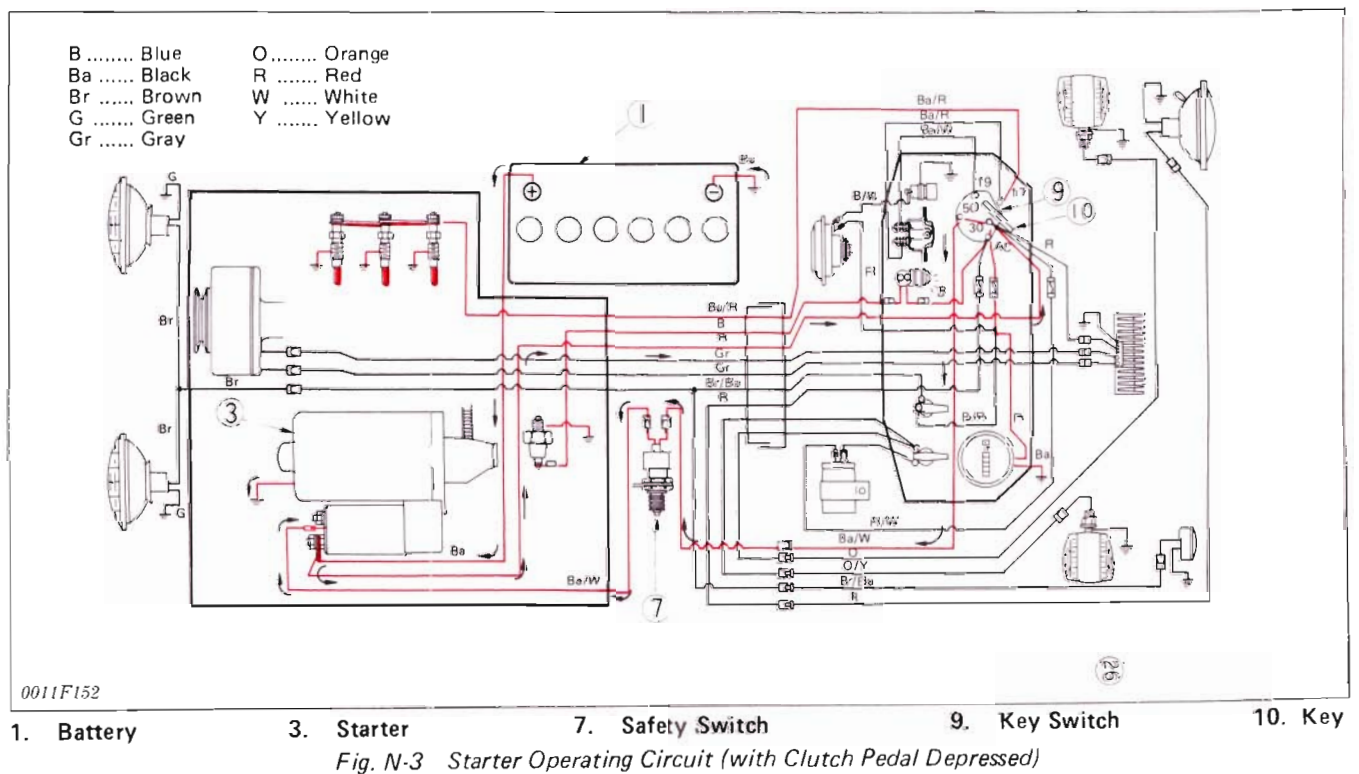
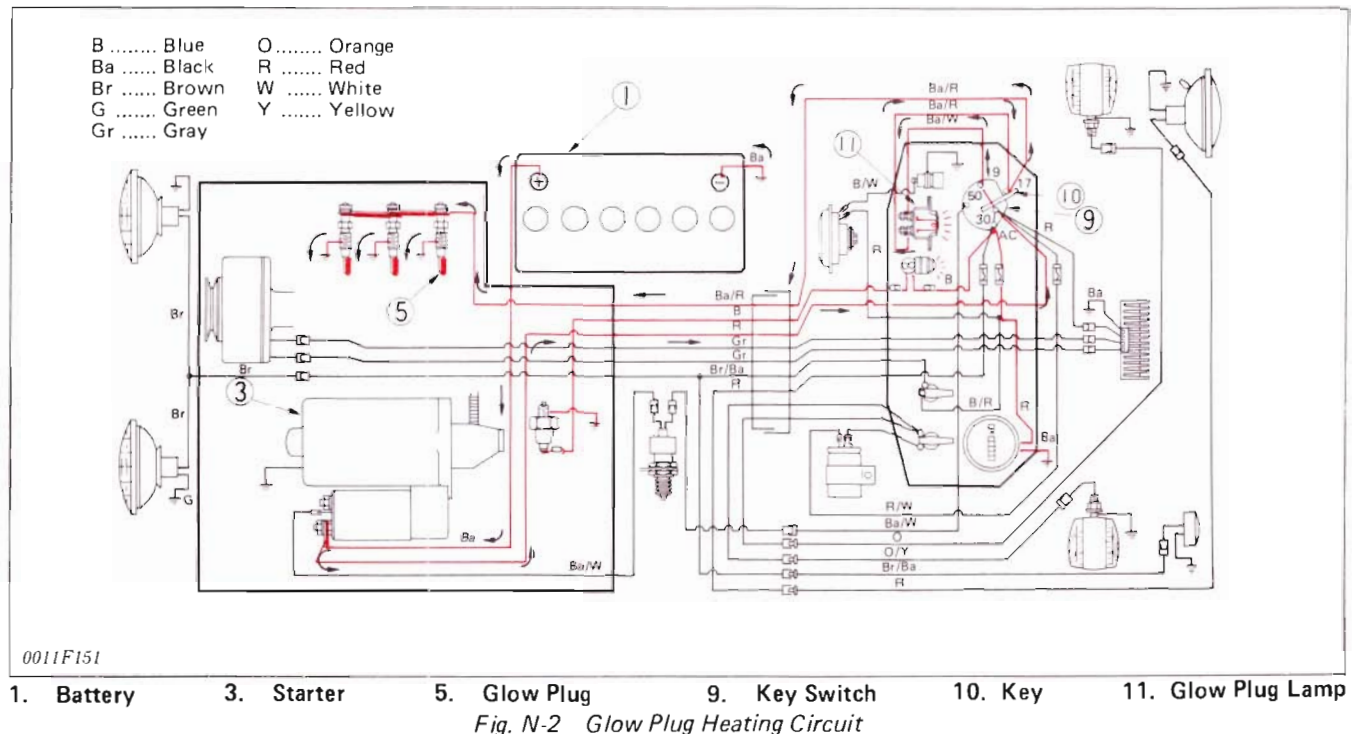
running and supplies power to the all circuits. The control system consists of various lights and meters for monitoring tractor functions. All circuits are

controlled by switches on the meter panel in front of the operator seat.

Cranking System

The engine is a diesel engine and is started in the following sequence:

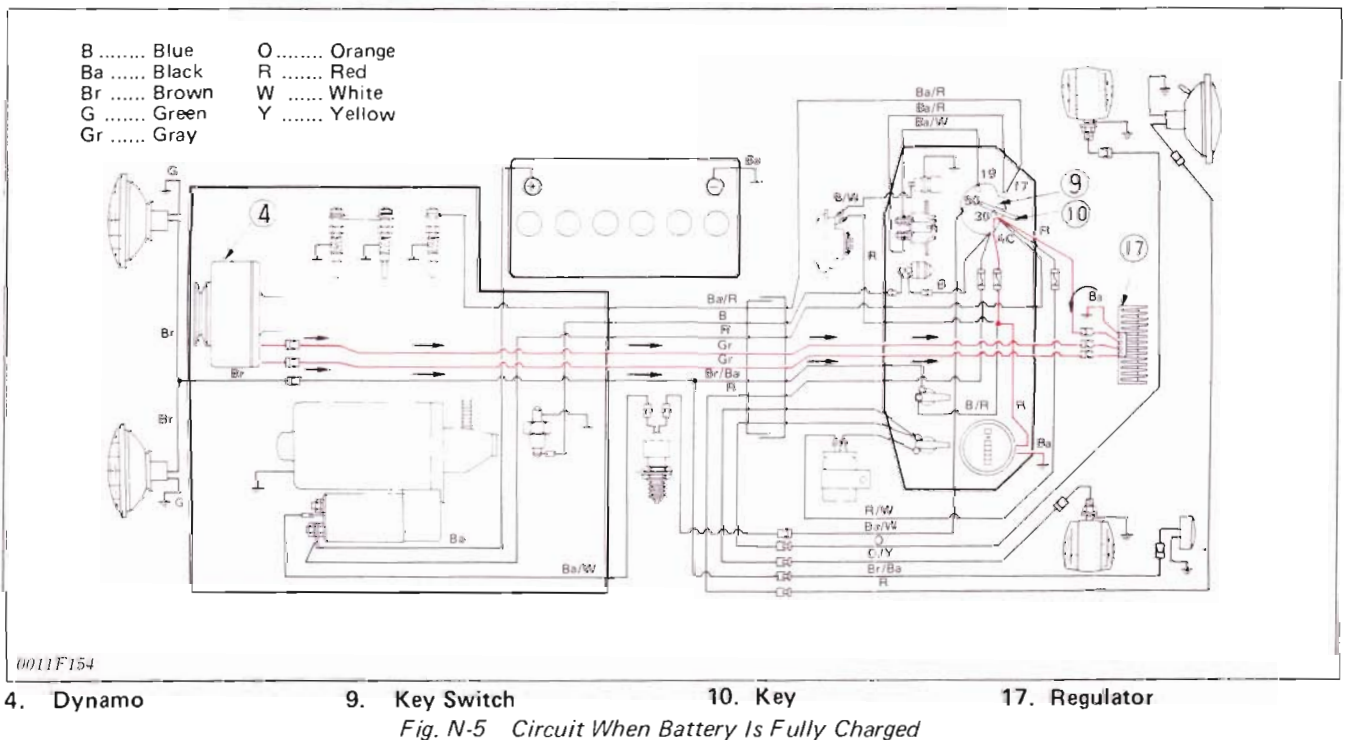
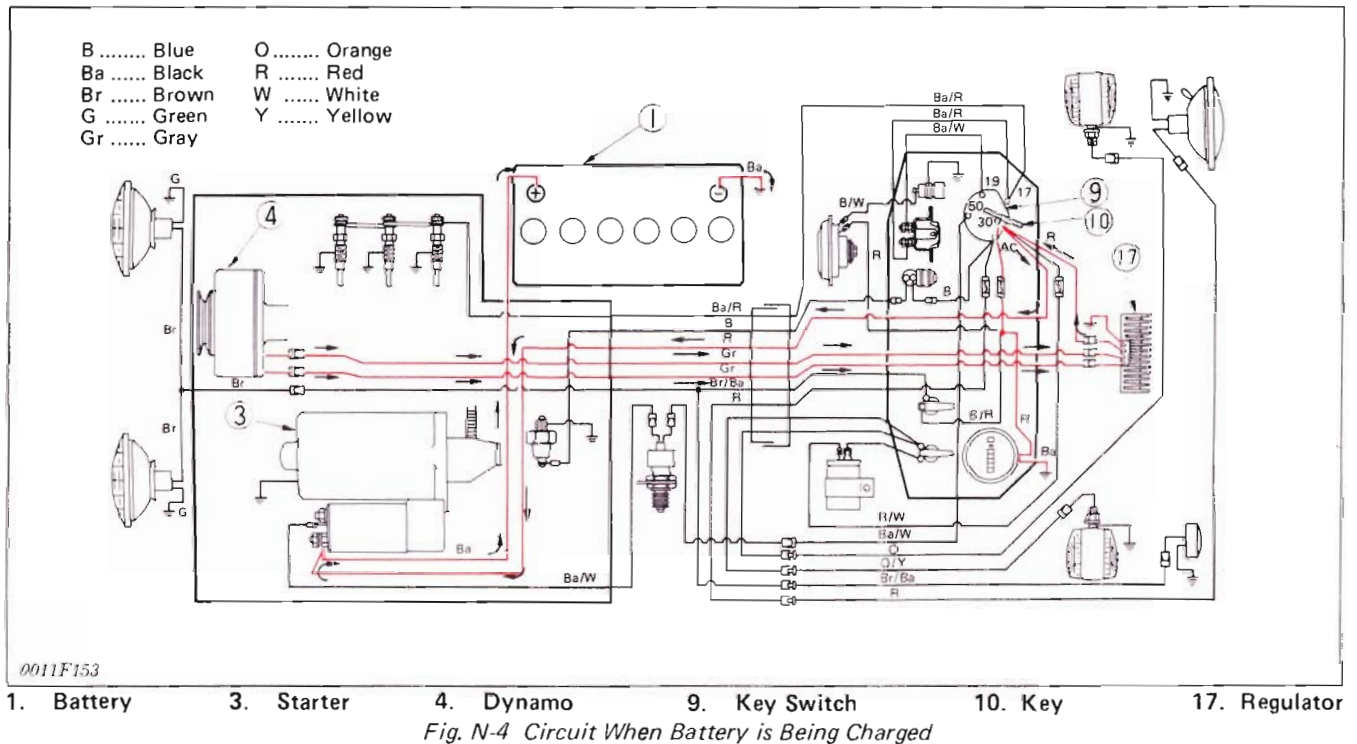
Glow plug is heated. → Clutch pedal is depressed.
(Conduction of safety switch) → Starter is operated.



Charging System

The charging system is composed of the dynamo which generates AC power, and the regulator which performs rectification and voltage regulation. The AC dynamo generates AC current as it is driven by the engine. Generated voltage depends on the

engine speed. The regulator converts this AC current into DC current and at the same time, provides a constant output voltage. The AC dynamo charges the battery and supplies DC power to the circuits through the regulator.

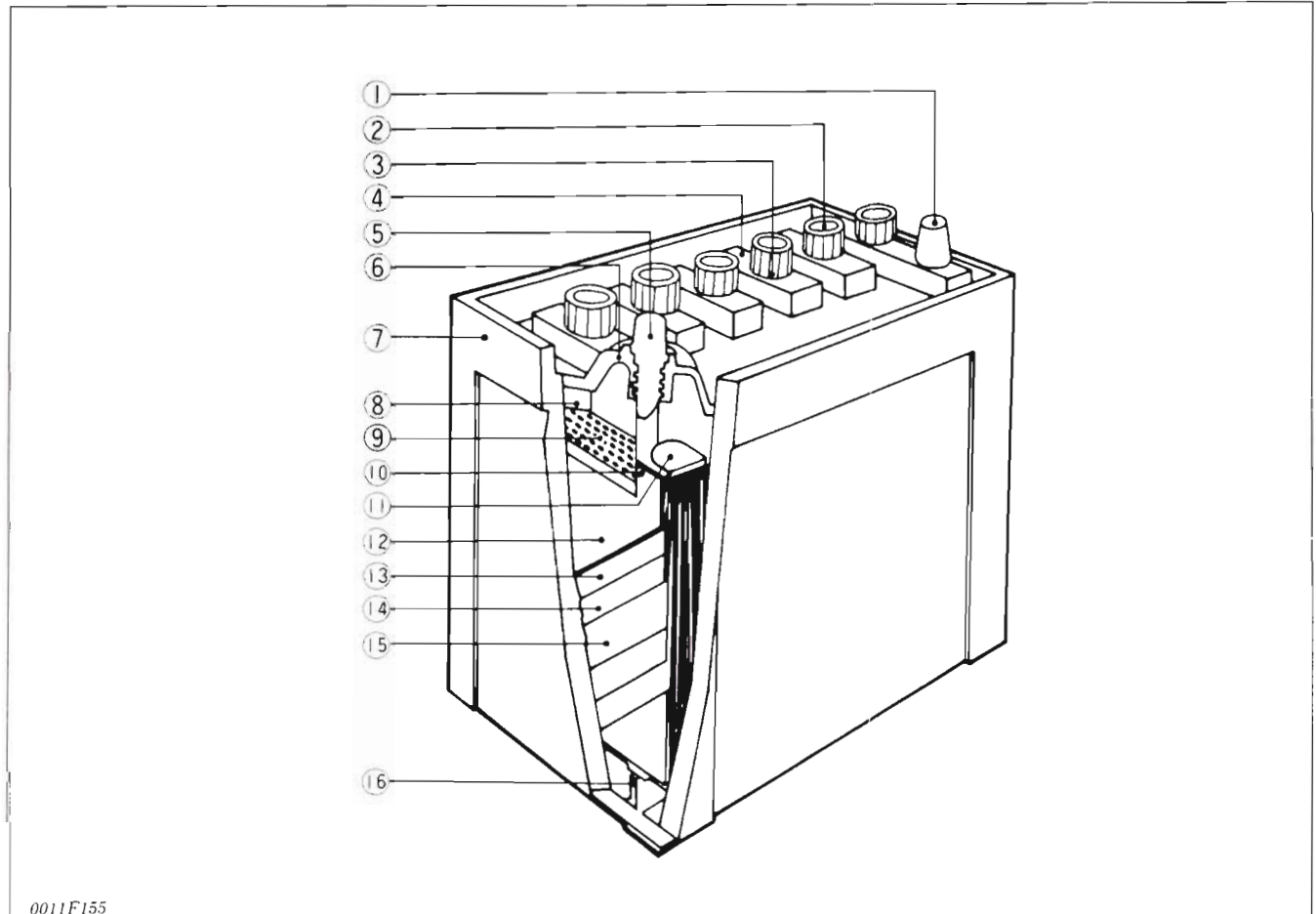


Troubleshooting

SYMPTOM	PROBLEM	SOLUTION
Quick battery discharge	Defective dynamo	Repair or replace
	Disconnected wire harness (especially to regulator)	Check and connect
	Defective regulator	Replace
	Defective battery	Replace
	Low electrolyte level	Replenish distilled water and charge battery
Glow indicator (lamp) does not glow	Discharged or defective battery	Charge or replace
	Disconnected wire harness (Key switch to glow plug indicator or battery)	Check and connect
	Defective glow plug indicator	Replace
	Defective key switch	Replace
Starter does not turn	Safety switch does not operate	Step on clutch pedal
	Defective adjustment or defective safety switch	Adjust properly or replace
	Discharged battery	Charge battery
	Disconnected wire harness (starter to battery or key switch)	Check and connect
	Defective starter (motor or magnet switch, etc.)	Repair or replace
	Defective key switch	Repair or replace
	Seized engine parts	Repair engine
Headlights or hazard lamps do not light	Broken bulbs	Replace
	Blown fuse	Replace
	Disconnected wire harness (light switch to lights)	Check and connect
	Broken light switch or hazard lamp switch	Repair or replace

Group 2

Battery



0011F155

- | | | | |
|----------------------|---------------------------------|--------------------|--------------------|
| 1. Positive Terminal | 5. Negative Terminal | 9. Splash Guard | 13. Separator |
| 2. Vent Plug | 6. Cover | 10. Pole | 14. Glass Mat |
| 3. Port Gasket | 7. Battery | 11. Strap | 15. Positive Plate |
| 4. Sealing Compound | 8. Upper Liquid Level Indicator | 12. Negative Plate | 16. Element Rest |

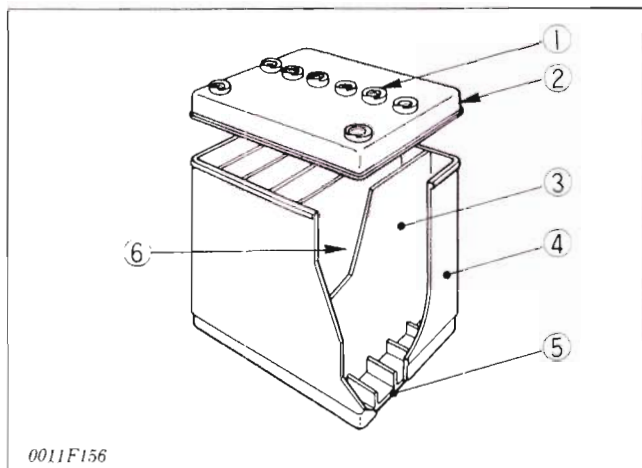
Fig. N-6 Battery Construction

The battery converts electrical energy into chemical energy and stores it (charging). Electric energy is then released when required (discharging).

This process of charging/discharging can be constantly repeated.

Structure and Function

Battery Jar

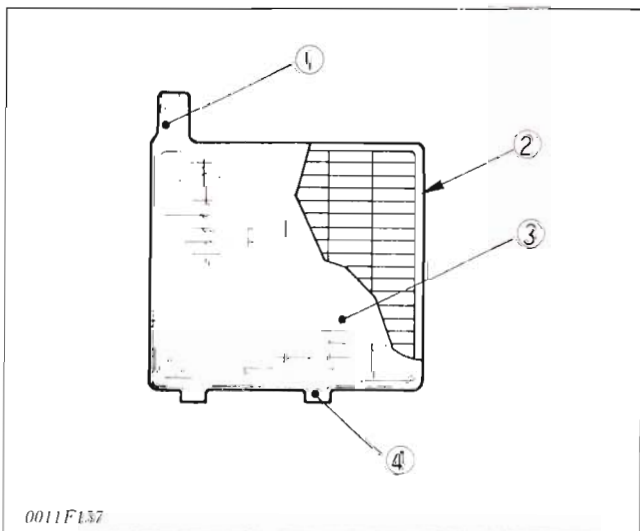


1. Liquid Port
2. Cover
3. Separator
4. Battery Jar
5. Element Rest (for plate group)
6. Cell

Fig. N-7 Battery Jar, Cover

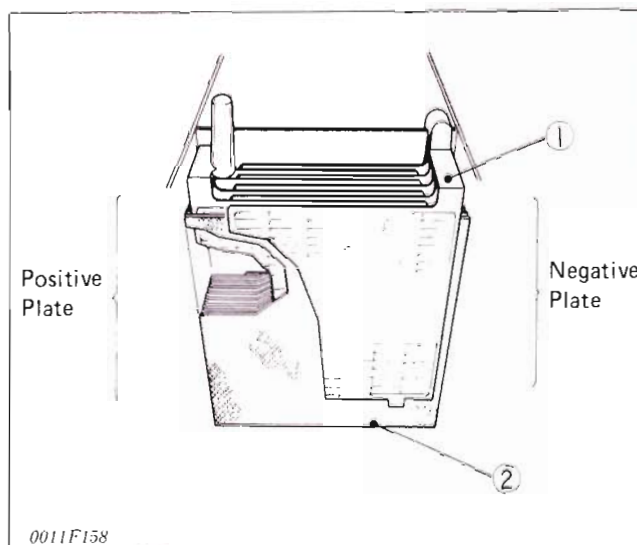
A battery jar is a receptacle containing electrolyte and pole plates. Each small chamber (cell) of a battery jar includes a pair of pole plate groups. Cells are connected in series. That is, the positive pole plates of a cell are connected to the negative pole plates of the next cell. As a result, the total voltage of all cells is the battery voltage. A completely charged cell provides approx. 2V, therefore, a 6-cell battery provides 12V.

Positive and Negative Pole Plates



1. Projection (electrical terminal)
2. Grid (anti-corrosive lead alloy)
3. Active Material (storing DC electricity)
4. Foot

Fig. N-8 Plates (positive and negative)

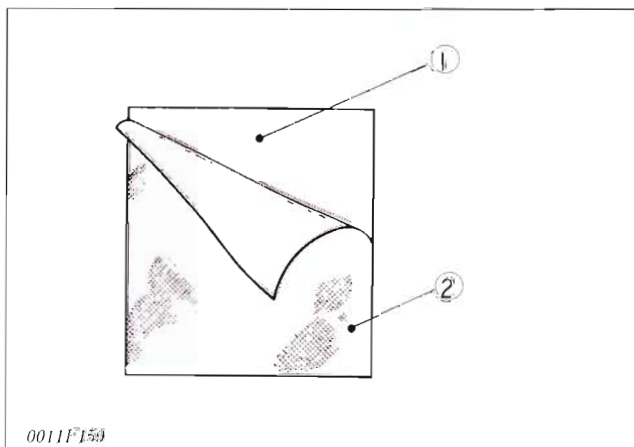


1. Strap
2. Separator, Glass Mat

Fig. N-9 Group of of Plates (elements)

The pole plates are made of lead and antimony. The positive pole plates are made of lead dioxide (chocolate color), and the negative pole plates are made of spongy lead (gray blue) and have extremely fine holes in them to allow the electrolyte to permeate and diffuse. Each cell contains a specific number of sets with negative and positive pole plates.

Separator



1. Separator
(preventing shorts between positive and negative plates)
2. Glass Mat
(To protect active material on positive plates from dropping and to protect separators from being oxidized.)

Fig. N-10 Separator, Glass Mat

A separator is inserted between positive and negative pole plates to prevent them from contacting. It is spongy to allow electrolyte to permeate through it and diffuse.

Separators are generally made of synthetic resins or glass fibers.

Electrolyte

Electrolyte is a mixture of distilled water and sulfuric acid. It is transparent, colorless and odorless. Specific gravity is 1.26 at 20°C (68°F) when

fully charged (1.28 in cold weather).

The pole plates are completely immersed in the electrolyte, and active material and electrolyte react chemically to charge and discharge electricity.

Discharge

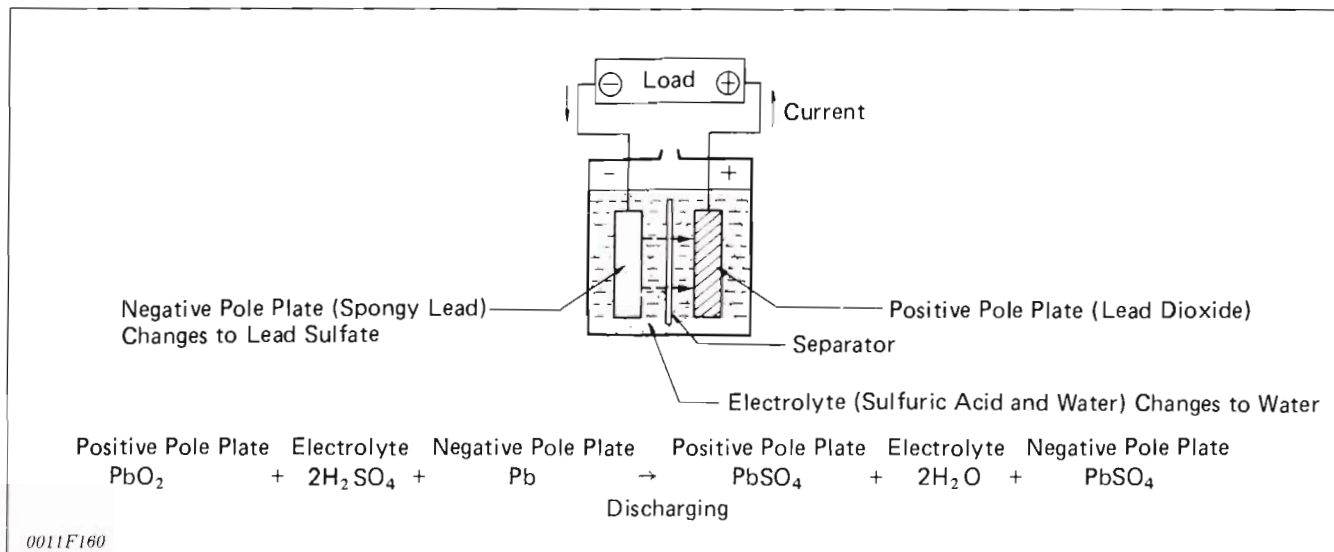


Fig. N-11 Chemical Change During Discharge

When the engine is started or a light is turned on (discharge), the sulfate radical in the electrolyte reacts with the positive and negative pole plates to form lead sulfate. As a result, the sulfate radical in the electrolyte decreases to decrease concentration (specific gravity).

The positive and negative pole plates and electrolyte

change as follows:

- Positive Pole Plates (Lead Dioxide) → Lead Sulfate
- Negative Pole Plates (Spongy Lead) → Lead Sulfate
- Electrolyte (Sulfuric Acid Solution) → Water

Charge

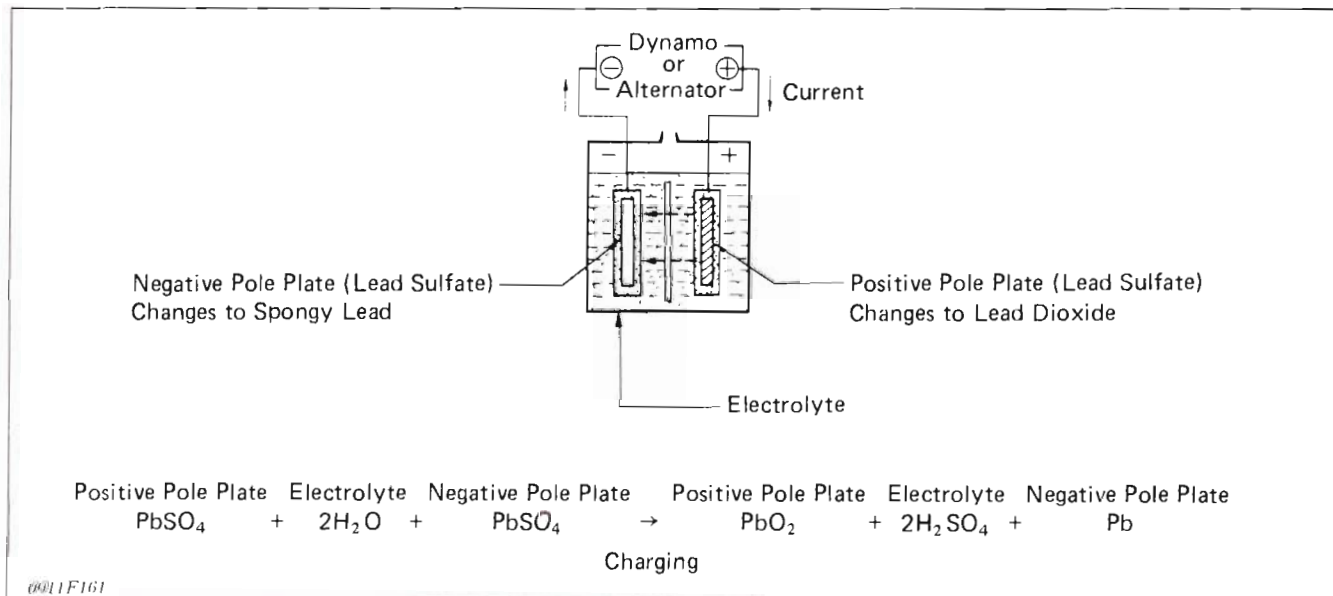


Fig. N-12 Chemical Changes During Charging

When an external DC current is applied to a discharging battery (i.e., when the battery is being charged), the sulfate radical which had chemically combined with pole plates is extracted from the pole plates to return to the electrolyte. As a result, positive and negative pole plates are returned to lead dioxide and spongy lead.

The sulfate radical in the electrolyte is supplied from the pole plates to increase the specific gravity of the electrolyte and to increase the voltage between positive and negative pole plates.

Near the completion of charging, some of charging current begins to electrolyze the water in the dilute sulfuric acid, generating oxygen from the positive pole plates and hydrogen from the negative pole plates. The positive and negative pole plates and electrolyte change as follows:

- Positive Pole Plate (Lead Sulfate) → Lead Dioxide
- Negative Pole Plate (Lead Sulfate) → Spongy Lead
- Electrolyte (Water) → Sulfuric Acid Solution

Temperature Effects and Self-discharging

Battery voltage is affected by the temperature of the electrolyte. Chemical reaction is accelerated at higher temperatures, and decelerated at lower temperatures (voltage drops).

If a battery is left unused for a long period, a chemical reaction occurs in the battery causing it to discharge slowly. This is referred to as "self-discharge". Self-discharge is accelerated at high temperatures. If a battery is left unused for an extended period, it must be periodically recharged.

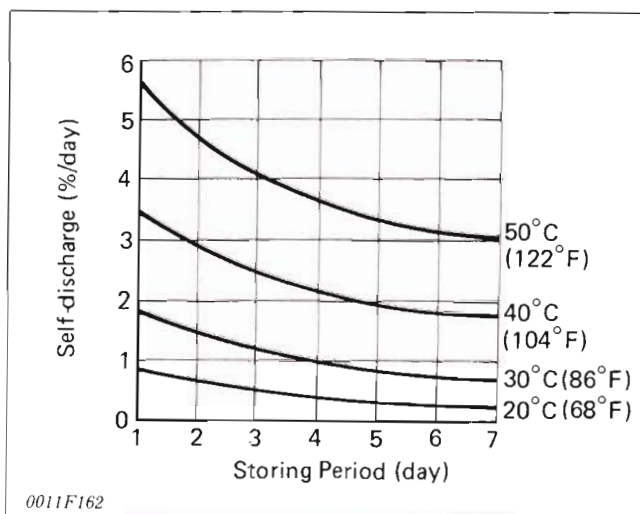


Fig. N-13 Change in Self-discharge (example)

Gas Generation During Charging

When the battery is almost fully charged, some of charging current is consumed to electrolyze the water in the electrolyte. As a result, oxygen gas is generated from the positive pole plates and hydrogen gas from the negative pole plates.

After the battery is fully charged, all charging current is consumed for electrolyzation and heat generation.

Battery Voltage

When a discharged battery is charged with a constant current, battery voltage first gradually increases and then rapidly increases as gas generation becomes more active. After some time, however, the voltage stabilizes (final charge voltage). On the contrary, when a battery is discharged at a constant level, the voltage begins to decrease gradually, then it suddenly decreases rapidly (final discharge voltage). The final discharge voltage is generally approx. 1.7 to 1.8 V/cell.

If its voltage reaches the final discharge voltage, the battery can not be charged.

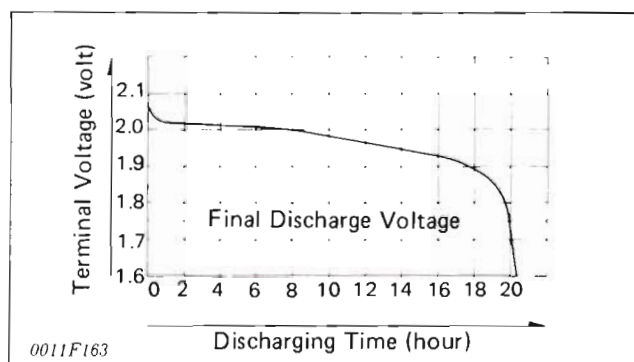


Fig. N-14 Discharging Curve

Battery Capacity

Battery capacity is defined as the amount of electric energy (amperage x time) which a fully charged battery delivers until its voltage drops to the final discharge voltage. Generally it is defined as how many amperes can be discharged for 20 hours (20-hour rate capacity).

Therefore, the 45 AH capacity of this tractor's battery means it can discharge a 2.25A current continuously for 20 hours.

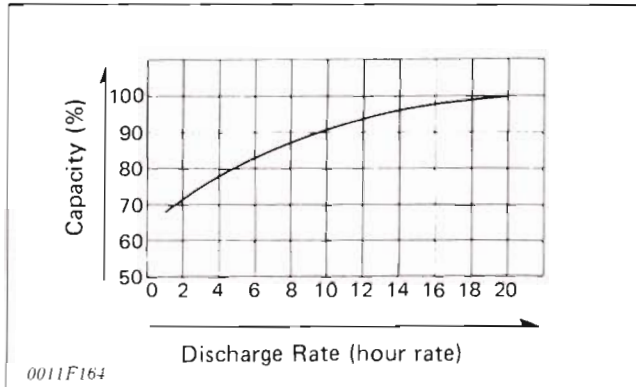


Fig. N-15 Relationship between Discharge Rate and Capacity

Specific Gravity and Charge Condition of Electrolyte

The specific gravity of the electrolyte provides an indication of the amount of electric energy stored in the battery.

Specific gravity increases with an increase of the sulfate radical in the electrolyte. It is also affected by temperature. Relationship between specific gravity and charge condition is shown below using 20°C (68°F) as reference.

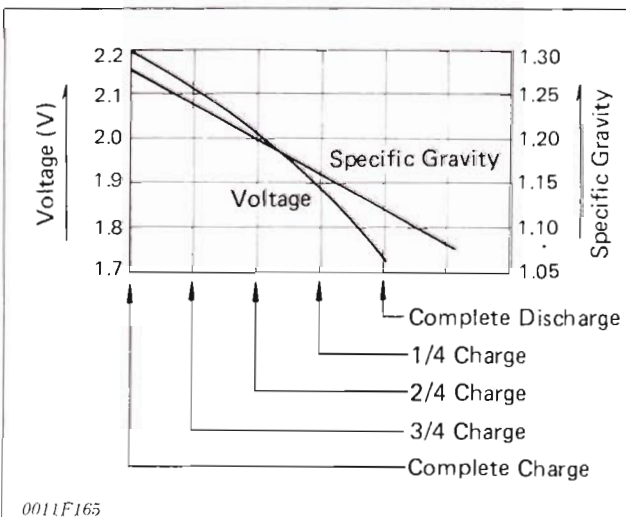


Fig. N-16 Specific Gravity and Battery Charging Condition

Servicing

Checking Battery Terminal and Bolt Tightness

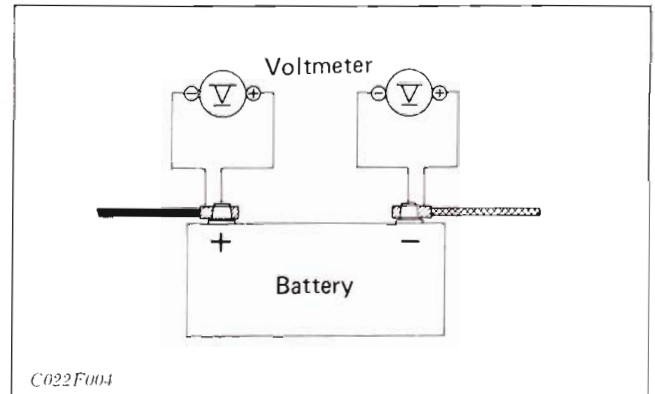


Fig. N-17 Checking Battery Terminal and Bolt Tightness

- (1) Activate an electrical load, such as headlights.
- (2) Connect battery (+) terminal to voltmeter (+) terminal, and (+) cord to voltmeter (-) terminal.

Under normal conditions, the voltmeter will indicate 0V.

- (3) Check battery (-) terminal in the same manner as above. Under normal conditions, the voltmeter will indicate 0V.
- (4) If the voltmeter does not show the reference value 0V, clean terminals and retighten the mounting bolts.

- Allowable limit: 0.1 V

NOTE: If starter does not operate, test with a circuit tester.

TEST EQUIPMENT: Circuit Tester

Cleaning Battery



C022P002

Fig. N-18 Cleaning Battery

- (1) Clean the battery surface, which is sometimes stained by electrolyte gas coming through the air vent.

Checking Electrolyte Level

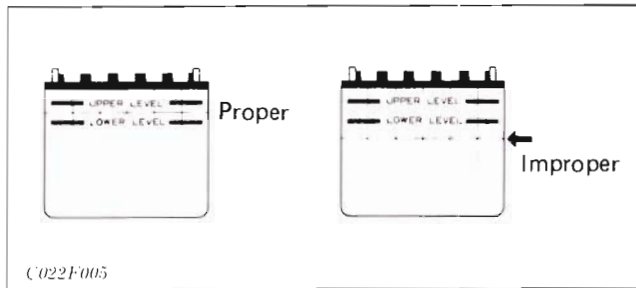


Fig. N-19 Checking Electrolyte Level

- (1) Electrolyte is reduced by electrolysis during charging and by natural evaporation. Therefore, check the quantity of electrolyte periodically.
- (2) Add distilled water until electrolyte reaches to the specified level.

Checking Battery Condition

Checking with a Hydrometer



Fig. N-20 Checking with a Hydrometer

- (1) Suction electrolyte into the transparent tube holding the specific gravity meter. Then, read the specific gravity.

TEST EQUIPMENT : Hydrometer

Specific Gravity	Battery Conditions		
1.260	100%	Charged	Usable
1.230	75%		
1.200	50%	Allowable limit	Must be recharged immediately
1.170	25%		
1.140	10%	Discharged	
1.110	0%	Totally discharged	

(At an electrolyte temperature of 20°C, 68°F)

- (2) Specific gravity slightly varies with temperature. Therefore, reading of specific gravity meter must be adjusted. Electrolyte specific gravity is reduced by 0.0007 (0.0004) with an increase of 1°C (1°F) in temperature, and is increased by 0.0007 (0.0004) with a decrease of 1°C (1°F). Therefore, using 20°C (68°F) as reference, measured specific gravity must be adjusted by the following formula:

$$\text{Specific gravity at } 20^{\circ}\text{C} = \text{Measure valve} + 0.0007 \times (\text{Electrolyte temperature} - 20^{\circ}\text{C})$$

$$\text{Specific gravity at } 68^{\circ}\text{F} = \text{Measured value} + 0.0004 \times (\text{Electrolyte temperature} - 68^{\circ}\text{F})$$

NOTE:

- Reading of specific gravity meter must be taken at the highest liquid level.
- Hold the hydrometer at eye level.
- Hold the hydrometer upright.
- Do not hold the hydrometer above the electrolyte port.

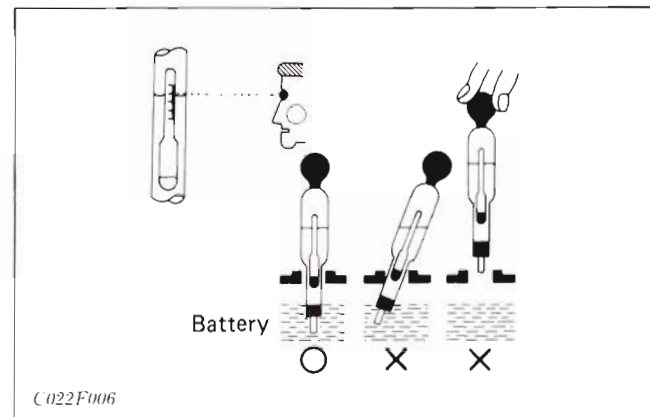


Fig. N-21 Precautions for Checking

Checking with a Battery Tester



Fig N-22 Checking with a Battery Tester

- (1) Connect battery tester cords to battery (+) and (−) terminals, set the tester dial for the capacity of the battery to be tested, and keep the switch button pressed for approx. 5 seconds. Read the indication needle.

● Reference value:

- 75% or more Good
- 45% to 75% Needs recharging
- 45% or less Needs recharging or replacement

TEST EQUIPMENT : Battery Tester

Checking Before and After Storage

- (1) After charging fully, store the battery in a well-ventilated place out of direct sunlight.
- (2) A battery in storage must be recharged monthly. This is because even in storage it self-discharges by approx. 0.5% per day.

● Reference value

Temperature	Self-discharging rate
30°C (86°F)	Approx. 1.0% per day
20°C (68°F)	0.5% per day
10°C (50°F)	0.25% per day

- (3) When storing the battery mounted on the tractor, disconnect the negative cable from the terminal.

Recharging

Slow Charging



C022P006

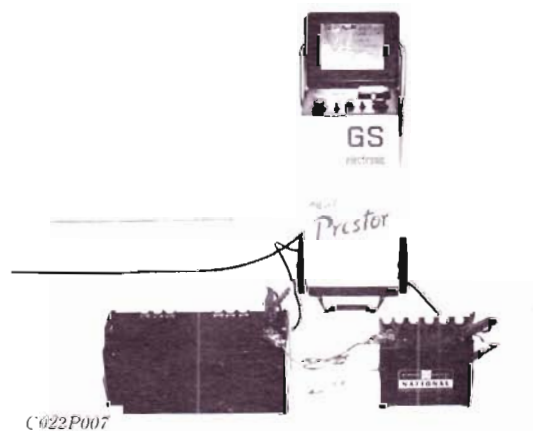
Fig. N-23 Slow Charging

PRECAUTION: When charging a battery mounted on a tractor, disconnect the negative cable from its terminal.

- (1) Add distilled water if electrolyte is insufficient. The level of electrolyte should be slightly lower than the specified level, otherwise charging will cause overflow.
- (2) Connect battery and charging unit properly. The red cord of the charger must be connected to the battery (+) terminal, and black cord of the charging unit must be connected to the battery (−) terminal.
- (3) Charging current must be 1/10 to 1/20 of battery electric capacity.
- (4) Electrolyte temperature must not exceed 45°C (113°F) during charging. If it exceeds 45°C (113°F), lower the charging current or stop charging for a while.
- (5) During charging, electrolyte generates gas. Therefore, remove all port caps.
- (6) Charging time

$$\text{Charging time} = \frac{\text{Discharging current rate (AH)}}{\text{Charging current (A)}} \times (1.2 \text{ to } 1.5)$$
- (7) When charging different capacity batteries at the same time, charging current must be set for the smallest capacity battery.

Quick Charging



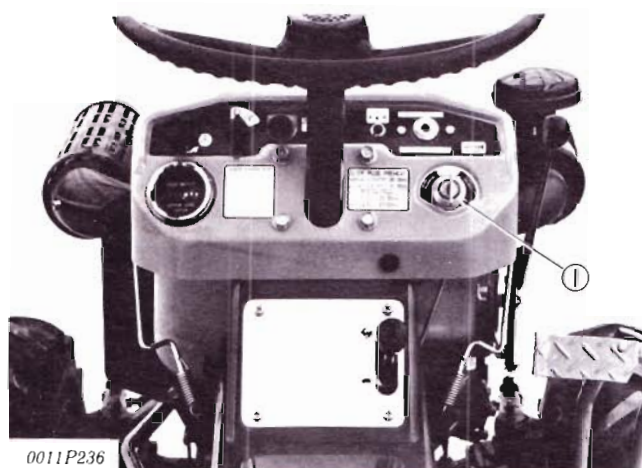
C022P007

Fig. N-24 Quick Charging

- (1) Determine the proper charging current and charging time with the tester attached to the quick charger.
 - (2) Determine the proper charging current as 1/1 the battery capacity. If the battery capacity exceeds 50AH, however, consider 50A as the maximum.
- (Precaution for handling a quick charger)
- Operation with a quick charger differs according to the type. Consult the instruction manual and use accordingly.

Group 3

Key Switch



1. Key Switch

Fig. N-25

Power is supplied to the circuits from the battery when the engine stops and from the dynamo when the engine rotates, depending on the position of key switch.

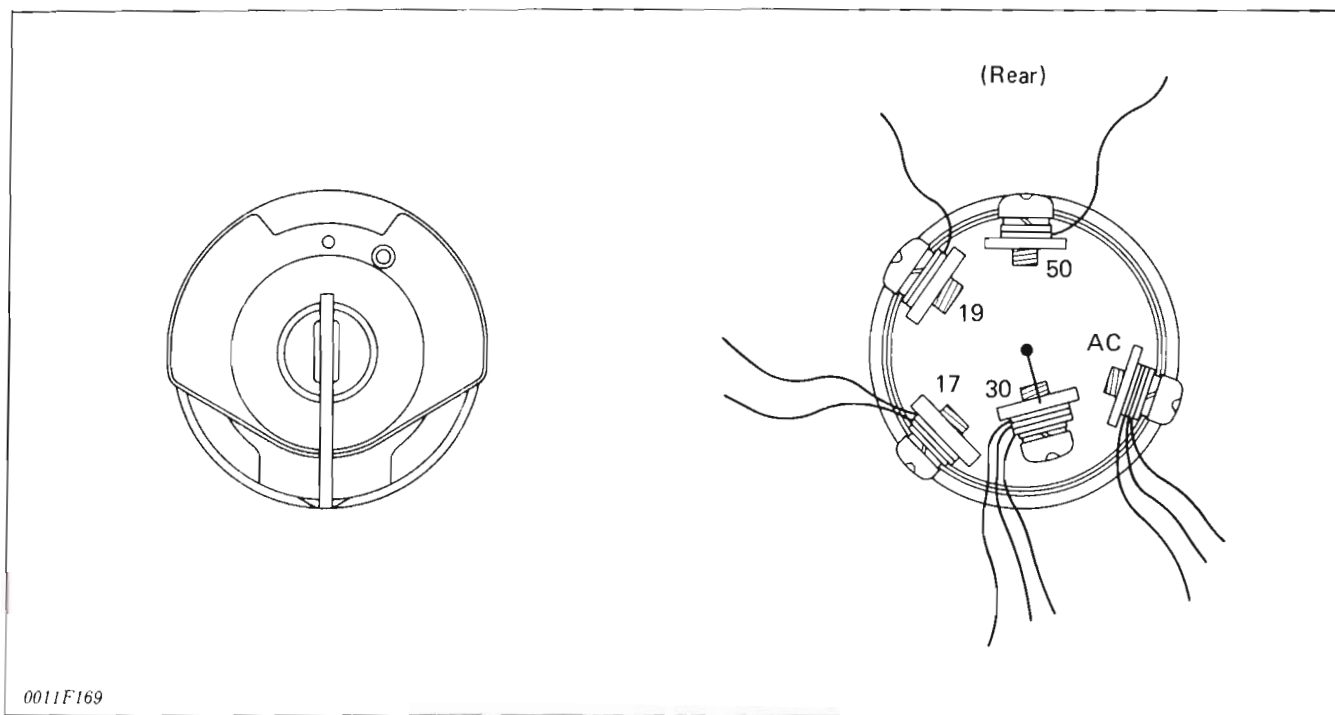


Fig. N-26 Key Position: OFF

The glow plug and glow plug indicator are on while the key is held at the left side and the battery current flows from terminal No. "30" to terminal No. "19". Simultaneously, the current flows from terminal No. "30" to the "AC" terminal to light

the engine oil pressure lamp and activate the hourmeter. After preheating is completed and the key is released, the key will return to OFF by the action of a spring.

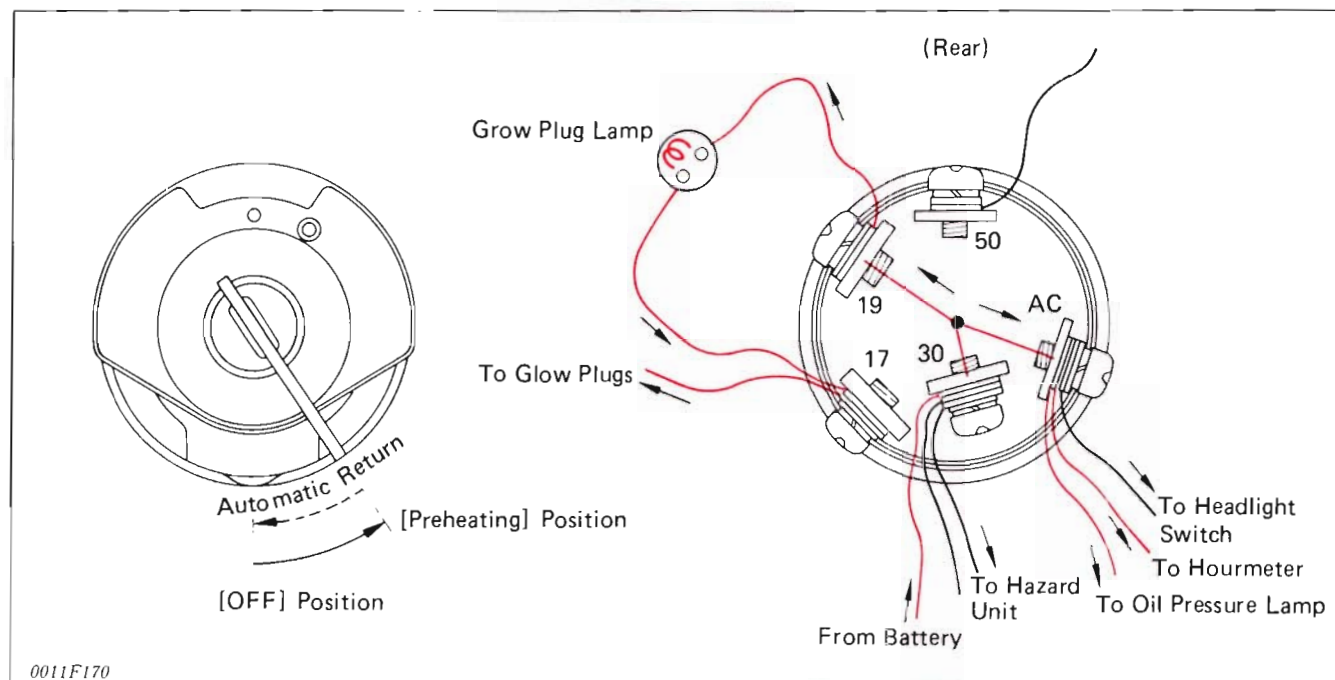


Fig. N-27 Key Position: Preheating

To operate the starter, turn the key to the right through the ON position "⊙". Then, battery current flows from terminal No. "30" to terminal No. "50", for activating the starter. Simultaneously, the battery current flows from terminal No. "30" to terminal No. "17" to heat the glow plug,

and from terminal No. "30" to the "AC" terminal to activate the hourmeter and light the oil pressure lamp.

After the engine is started, release the key and the key will return to the ON position "⊙" by the action of a spring.

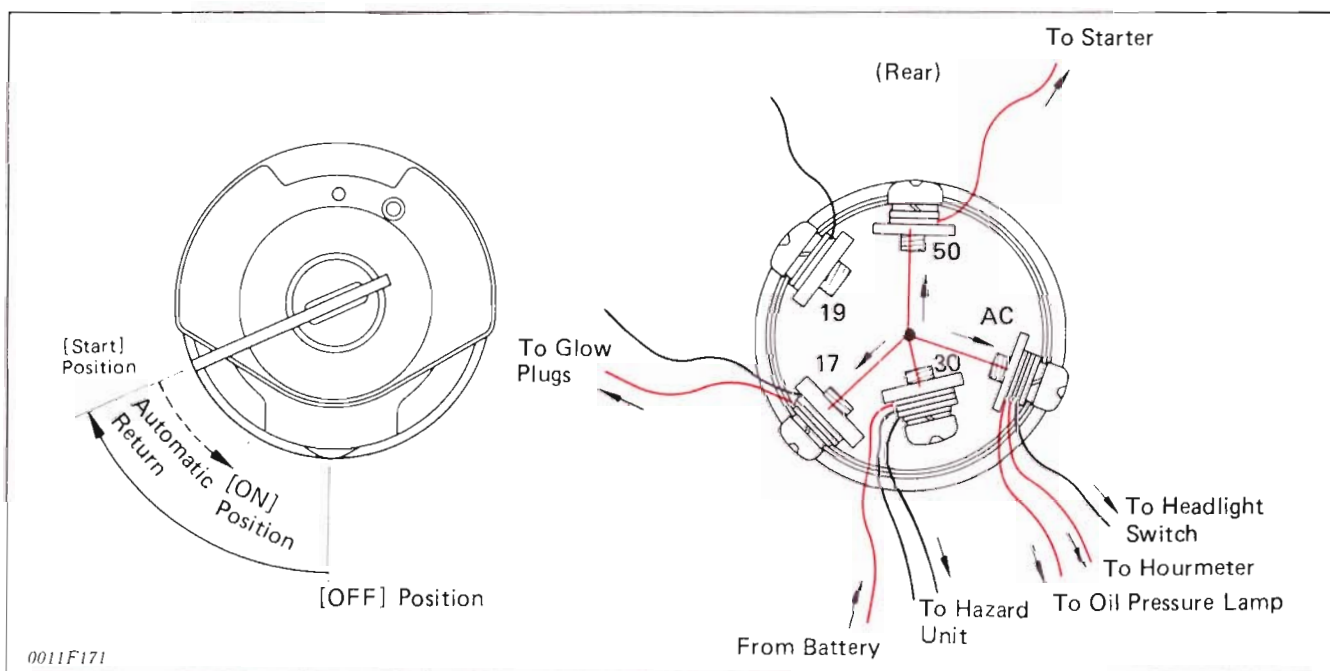


Fig. N-28 Key Position: START

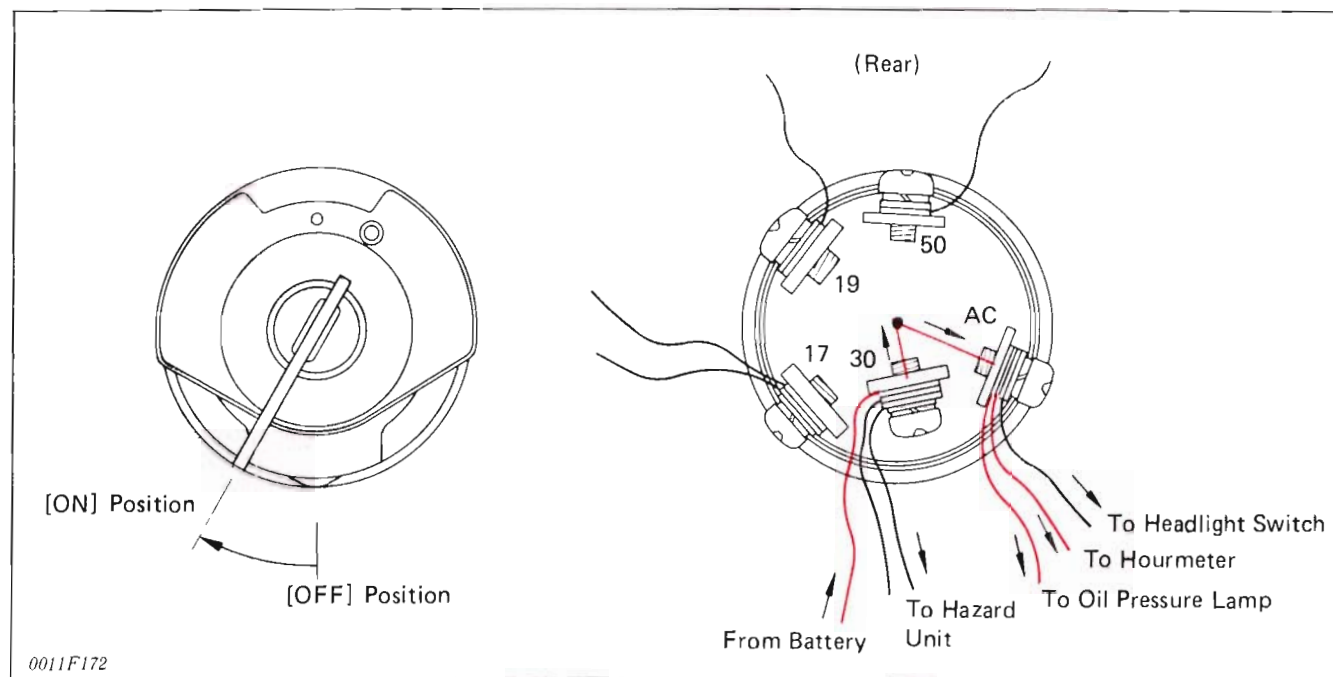


Fig. N-29 Key Position: ON

Rated current of each terminal

No. "17" and No. "19": 30A

No. "50": 12A

"AC": 10A

Group 4

Starter

The magnet-switch type starter is composed of two main sections.

The first section converts battery current into mechanical rotation to turn the engine crankshaft. It is composed of the field coil, armature, brush,

commutator, pinion, overrunning clutch, etc.

The second section allows the pinion and flywheel to engage together and current to flow through the motor section. It is composed of the pull-in coil, holding coil, plunger, drive lever, contact plate, etc.

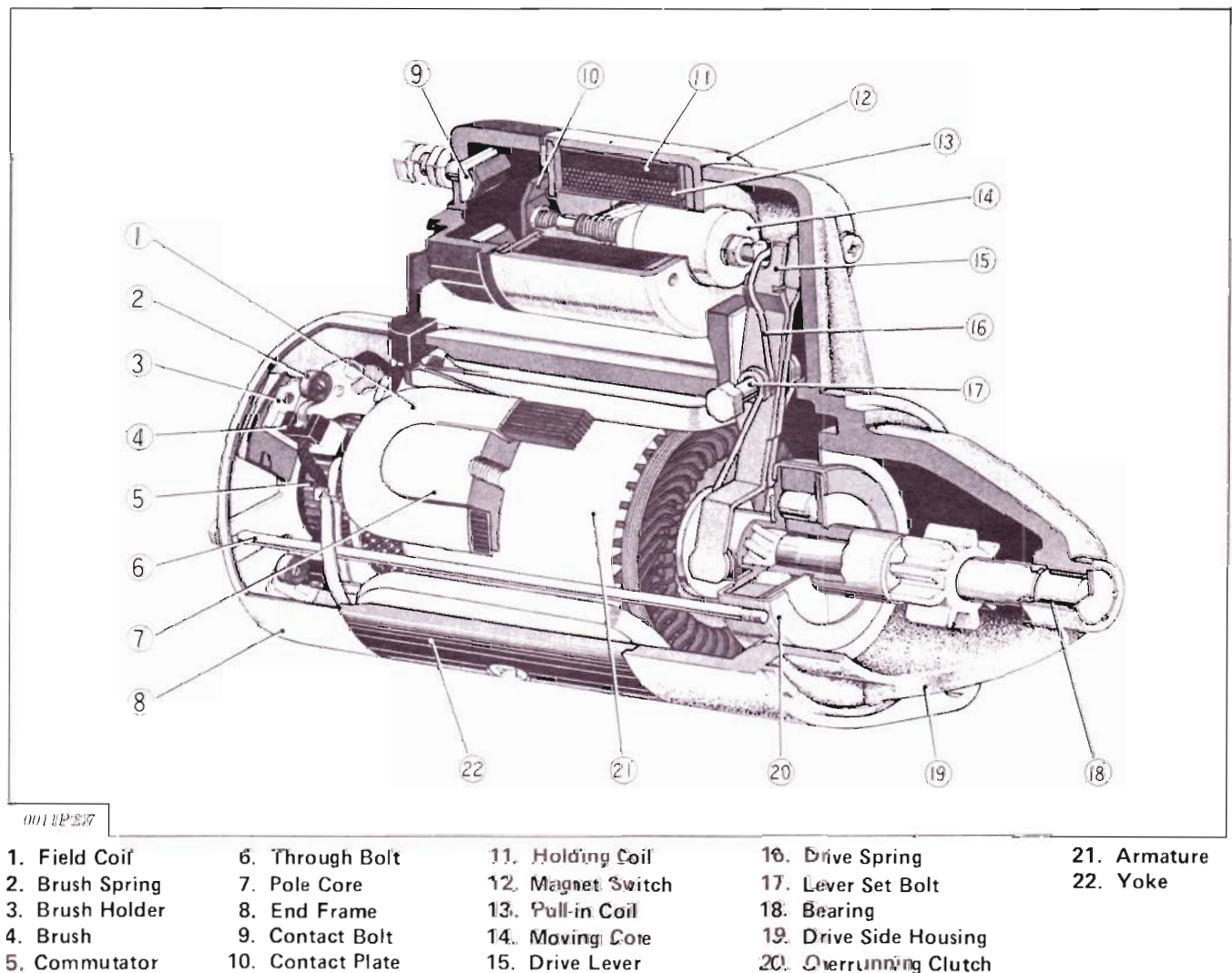
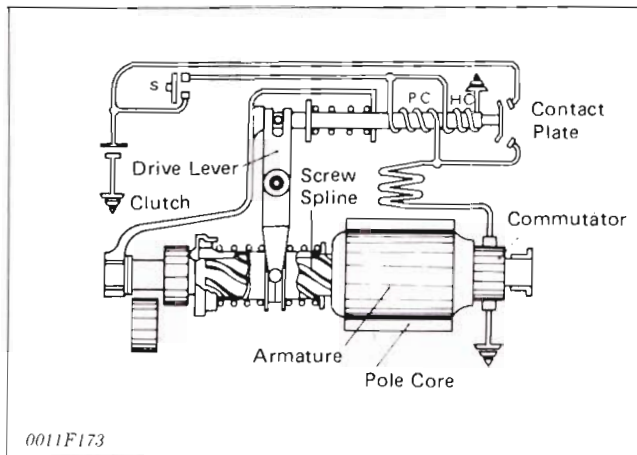


Fig. N-30 Construction



PC: Pull-in Coil HC: Holding Coil S: Switch

Fig. N-31 Starter Circuit

When Key Switch Is On:

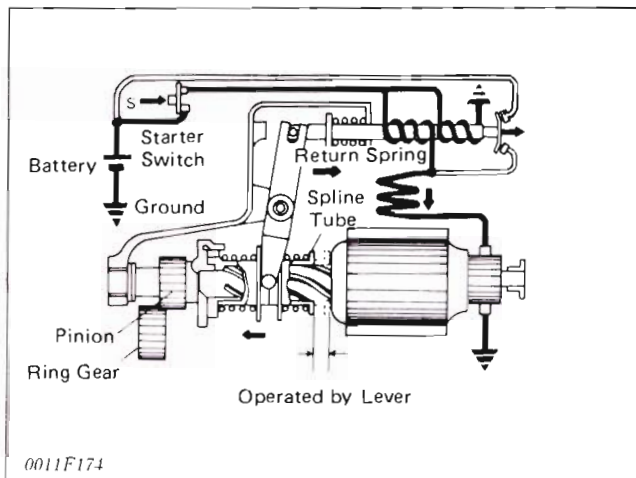


Fig. N-32 When Key Switch Is On:

When the key switch is turned on, a current flows from the battery through the pull-in coil in the magnet switch section to the holding coil, energizing the plunger to pull it in.

At this time, the pinion moves by the drive lever to engage with the ring gear.

When Contact Plate Is Closed:

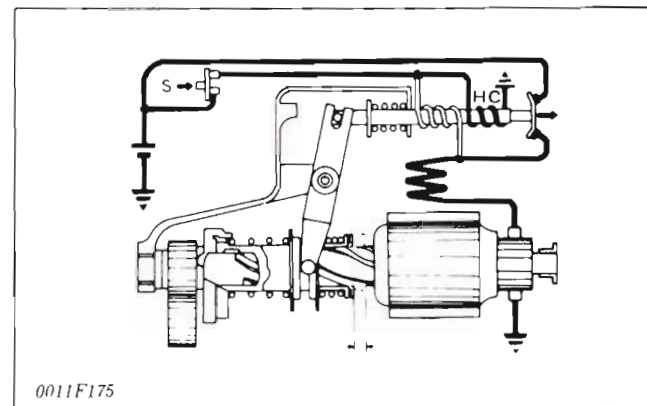


Fig. N-33 When Contact Plate Is Closed.

When the contact plate is closed, a large current flows through the motor section to generate a large mechanical power which turns the engine crankshaft.

At this time, the pinion is moved forward by the screw spline for more contact.

Since the pull-in coil ends are short-circuited by the contact plate, the plunger is held only by the force of the holding coil.

When Key Switch Is Released:

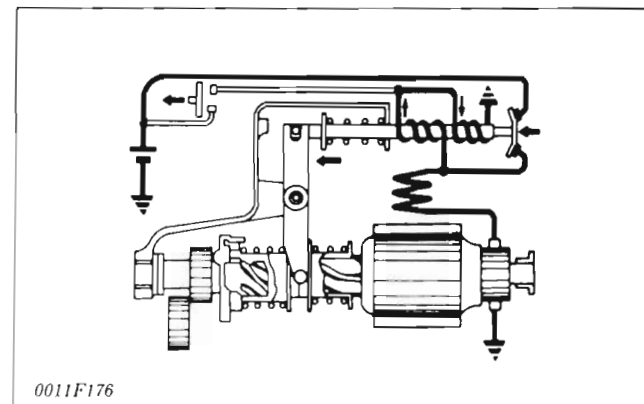
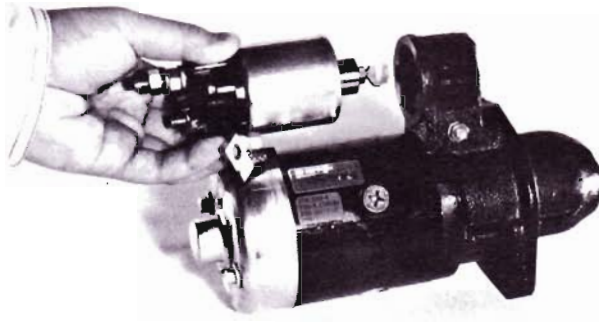


Fig. N-34 When Key Switch Is Released:

When the key switch is released, a current flows instantaneously through the pull-in coil in the opposite direction as shown in Fig. N-34. Therefore, the forces of the holding coil and pull-in coil are balanced. As a result, the plunger is returned by the return spring. Simultaneously, the pinion is disengaged from the ring gear, the contact plate is disconnected, and the starter is promptly stopped by the armature brake.

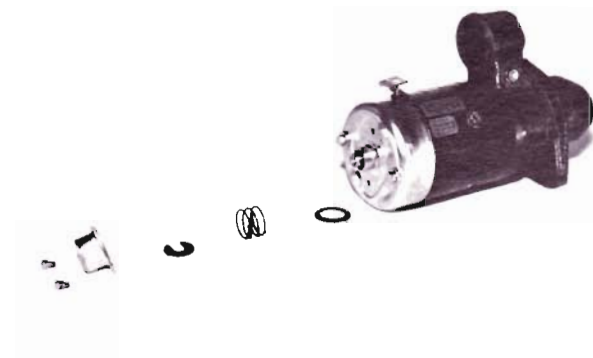
Disassembling Starter



C022P062

Fig. N-35 Removing Magnet Switch

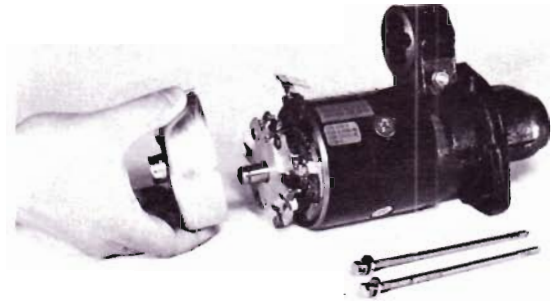
- (1) Remove the connecting lead.
- (2) Remove the set screws.
- (3) Detach the magnet switch by lifting it up while taking care that it does not contact the drive lever.



C022P063

Fig. N-36 Removing Armature Brake

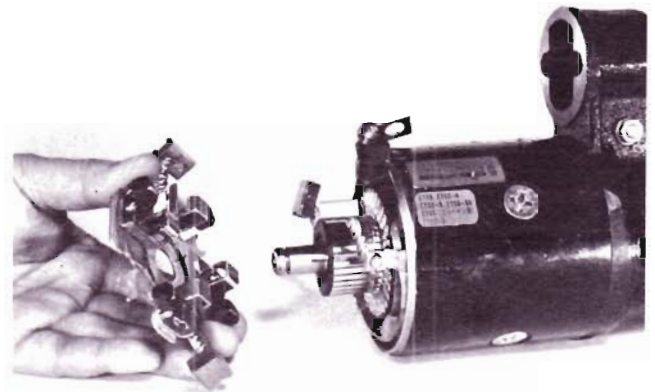
- (4) Remove the end frame cap.
- (5) Remove the washers.
- (6) Remove the brake spring.
- (7) Remove the gasket.



C022P065

Fig. N-37 Removing End Frame

- (8) Remove the through bolts.
- (9) Remove the end frame.



C022P066

Fig. N-38 Removing Brush Holder

- (10) Draw out the brush from the holder while holding the spring up.
- (11) Take off the brush holder.

NOTE:

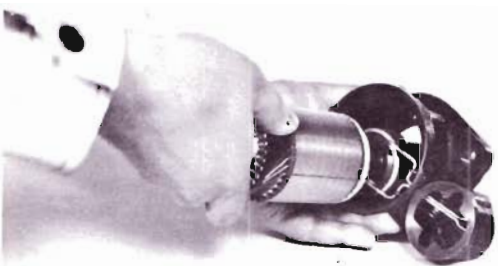
- Be sure not to mistake the direction and position of the spring.
- Do not contact the body with the positive brush's lead.



C022P067

Fig. N-39 Removing Yoke

(12) Draw out the yoke from the drive end frame.



C022P068

Fig. N-40 Removing Armature

(13) Remove the set bolt from the drive lever.
(14) Draw out the armature from the drive end frame.



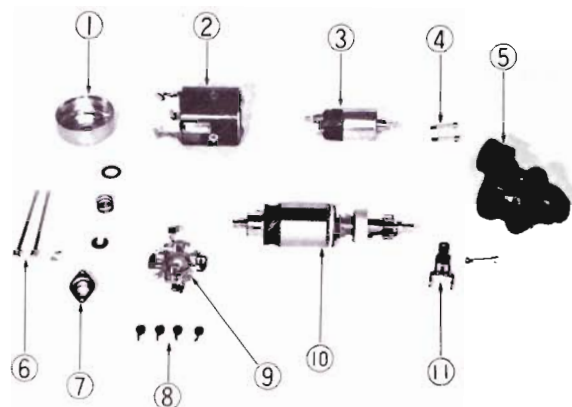
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Fig. N-41 Detaching Drive Lever

(15) Detatch the drive lever.

CAUTION:

- Be sure not to mistake the installation direction of the drive lever.



0011P238

- | | |
|--------------------|------------------|
| 1. End Frame | 7. End Frame Cap |
| 2. Yoke | 8. Brush Spring |
| 3. Magnet Switch | 9. Brush Holder |
| 4. Screw | 10. Armature |
| 5. Drive End Frame | 11. Drive Lever |
| 6. Through Bolt | |

Fig. N-42 Disassembling Starter

Servicing**Checking procedure**

Checking Battery → Checking Wiring → Checking Safety Switch

Starter no-load test → Checking Motor
→ Checking Magnet Switch

Checking Safety Switch

C022P041

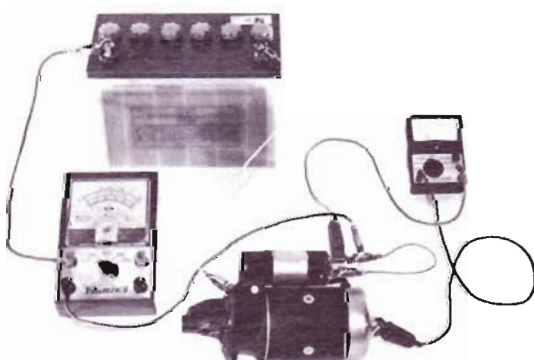
Fig. N-43 Checking Safety Switch

- (1) Remove the safety switch lead.
- (2) Connect the circuit tester to the safety switch side lead.

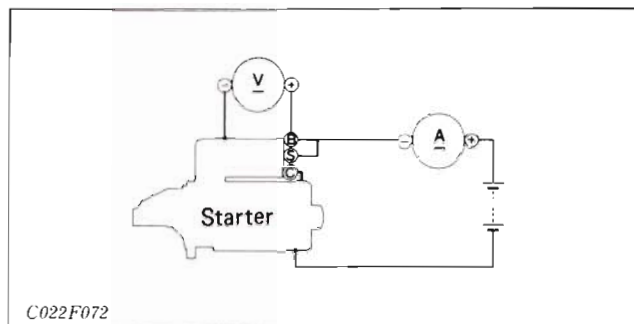
TEST EQUIPMENT : Circuit Tester

- (3) Measure the resistance while depressing the clutch pedal.
- (4) If the safety switch is defective, replace it.

- Reference value: 0Ω

No-load Testing

C022P042

Fig. N-44 No-load Testing

C022F072

Fig. N-45 Wiring for No-load Testing

- (1) Connect the ammeter's positive probe to the battery's positive terminal and the negative probe to the starter's "B" terminal.
- (2) Connect the battery's negative terminal to the starter body.
- (3) Connect the voltmeter's positive probe to the starter's "B" terminal and the negative probe to the starter body.
- (4) Set a tachometer.
- (5) Connect the starter's "B" terminal to the magnet switch's "S" terminal.
- (6) Check to see that magnet switch actuation results in the specified speed, current and voltage.

- Reference value:

Speed: 5000rpm or more

Current: 50A or more

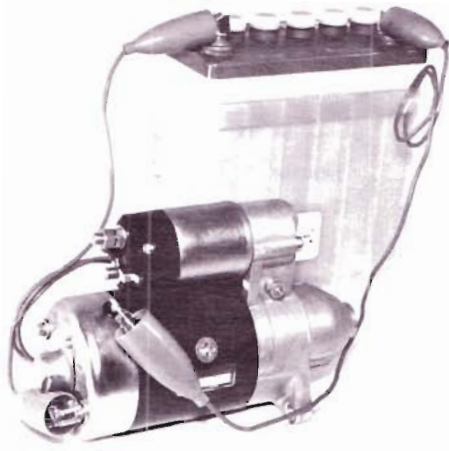
Voltage: 11V

TEST EQUIPMENT: Tachometer,
Circuit Tester

NOTE:

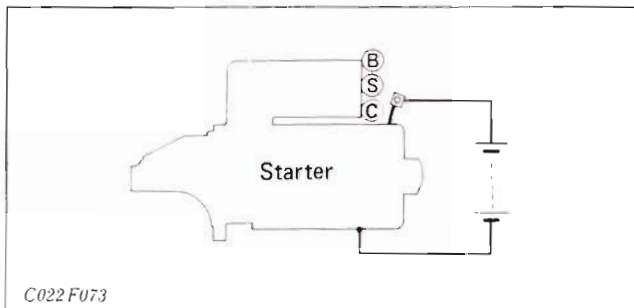
- Use a fully charged battery.
- Use an ammeter and lead of more than 200A capacity because large current flows when the starter runs.

Testing Motor



0011P239

Fig. N-46 Testing Motor

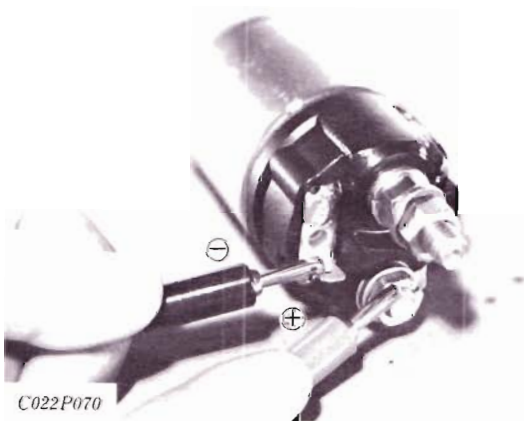


C022F073

Fig. N-47 Wiring for Testing Motor

- (1) Remove the connecting lead from the starter's "C" terminal and connect it directly to the battery's positive terminal. Then connect the battery's negative terminal to the starter body.
- (2) If the starter runs normally, the magnet switch is defective; if not, the motor is defective.

Checking Pull-in Coil (Attraction Test)

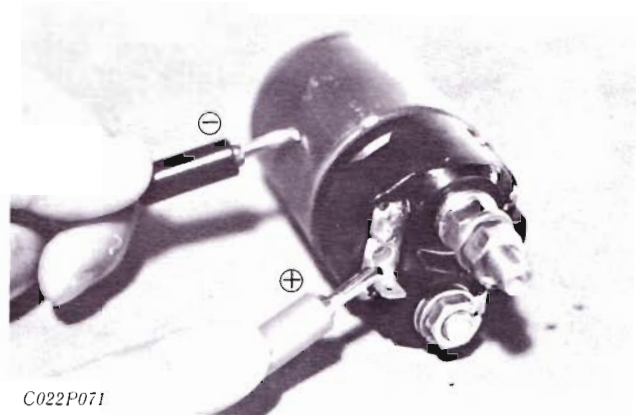


C022P070

Fig. N-48 Checking Pull-in Coil

- (1) Apply 1/2 the rated voltage across "S" terminal and "C" terminal.
- (2) If the plunger is attracted strongly, the pull-in coil is normal; if not, it is defective.

Checking Holding Coil

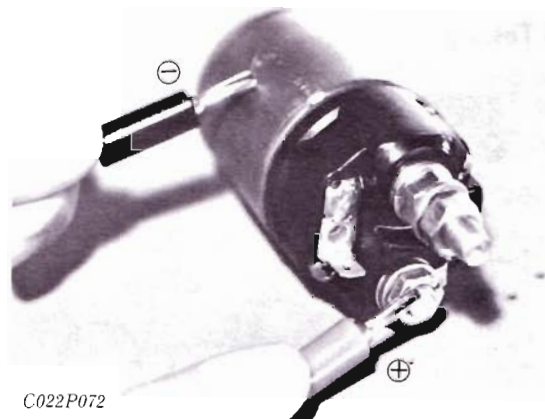


C022P071

Fig. N-49 Checking Holding Coil

- (1) Apply 1/2 the rated voltage across "S" terminal and the body, push the plunger in by hand, and release your hand.
- (2) If the plunger is maintained in the attracted position, the holding coil is good; if not, it is defective.

Checking Return of Magnet Switch Plunger



C022P072

Fig. N-50 Checking Return of Magnet Switch Plunger

- (1) Apply the rated voltage across "C" terminal and body, push the plunger in by hand, and release your hand.
- (2) If the plunger returns immediately, it is good; if not, it is defective.

Checking Pinion Gap

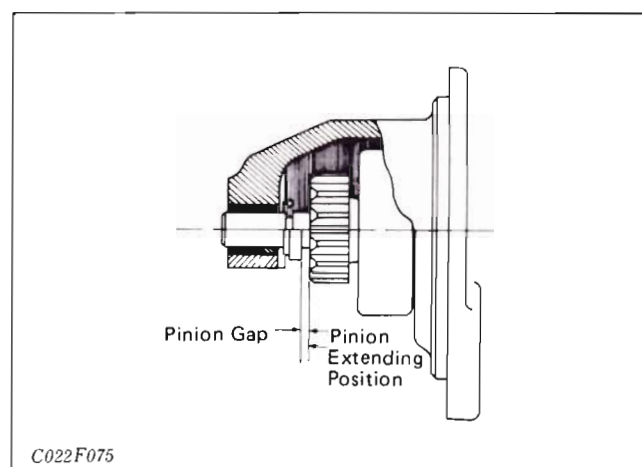


Fig. N-51 Checking Pinion Gap

- (1) Disconnect the connecting lead from "C" terminal.
 - (2) Energize the magnet switch and measure the gap between the pinion tip and the stop collar.
 - (3) To adjust the gap, change the length of the magnet switch joint to the specified one.
- Reference value:
0.1 to 0.4mm (0.0039 to 0.0157 in.)

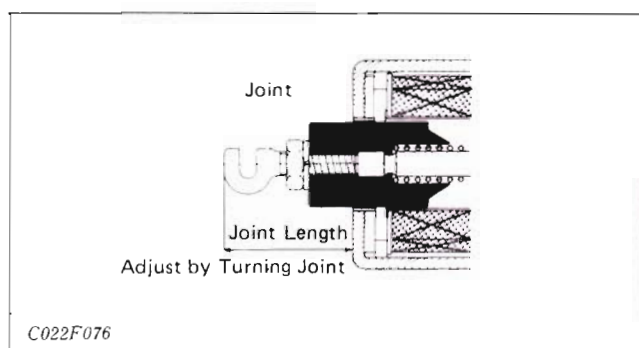


Fig. N-54 Adjusting Pinion Gap

Checking Clearance Between Shaft and Bushing

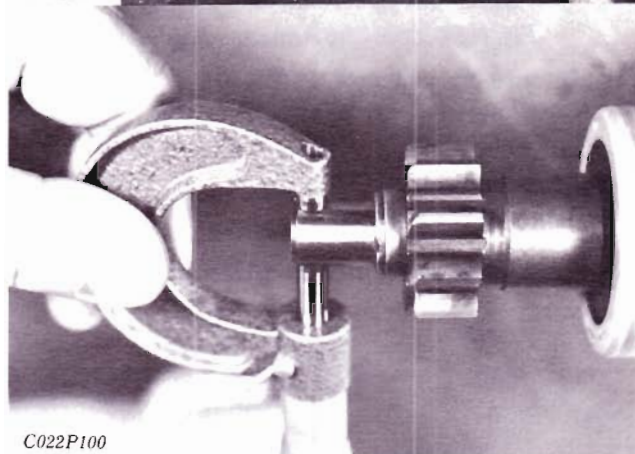
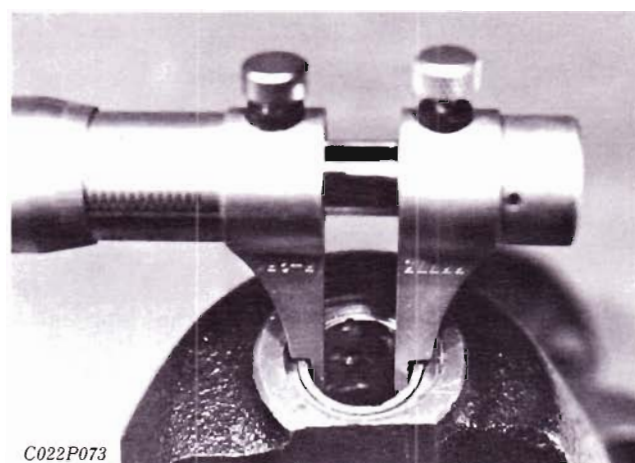


Fig. N-53 Checking Clearance between Shaft and Bushing

- (1) Measure the inside diameters of the bearing bushings on the side of the drive and commutator.
- (2) Measure the drive-side and commutator-side shaft diameters and calculate the clearance.
- (3) If the clearance exceeds the allowable limit, use an undersize bushing.

- Reference value:

	Drive side	Commutator side
Shaft dia.	12.50mm 0.4921 in.	12.50mm 0.4921 in.
Bearing bushing inside dia.	12.54mm 0.4937 in.	12.56mm 0.4945 in.

- Allowable limit:
Clearance 0.2mm (0.0079 in.)

Checking Armature Alignment

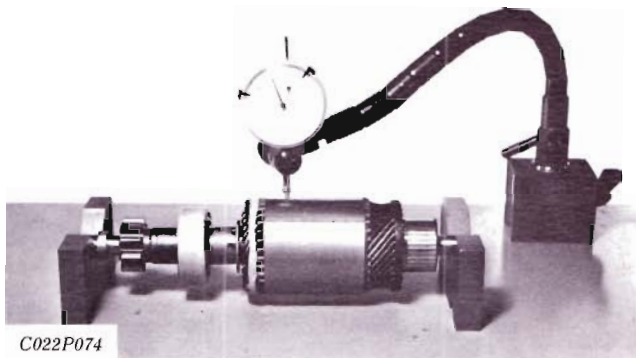


Fig. N-54 Checking Armature Alignment

- (1) Measure the amount of flexure; if the measurement exceeds the allowable limit, replace. Carefully check to see if the core is scratched.
- Allowable limit:
0.1mm (0.0039 in.)

Checking Armature Coil Short-circuit



Fig. N-55 Checking Armature Coil Short-circuit

- (1) Rotate the armature while touching it with a steel block.
- (2) If the steel block starts to vibrate or to be attracted somewhere on the armature, this suggests that the coil contains a layer short at that point.
- (3) If it is defective, replace.

TEST EQUIPMENT: Armature Tester

Checking Armature Coil Breakage

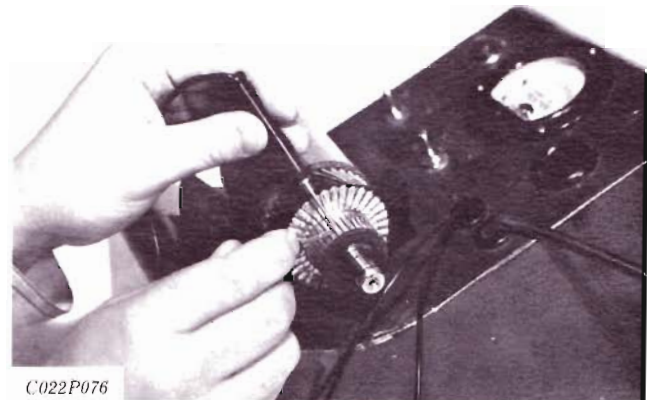


Fig. N-56 Checking Armature Coil Breakage

- (1) Check conduction across each pair of segments adjacent to the commutator.
- (2) If it is conducting, the armature coil is good; if not, it is defective.
- (3) If not conducting, replace.

Checking Armature Coil Grounding

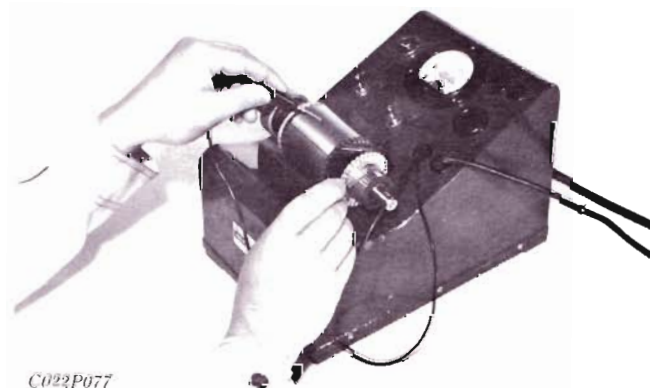
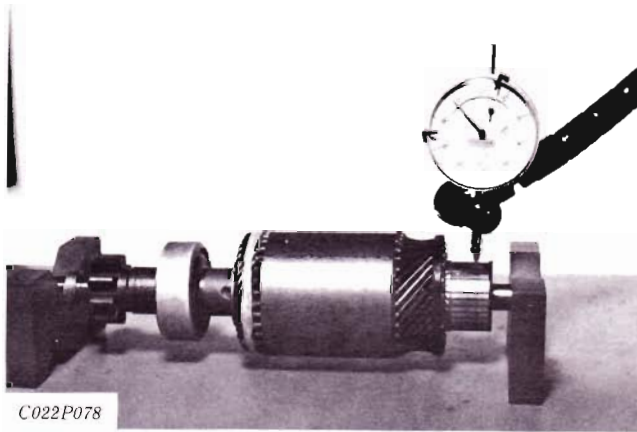


Fig. N-57 Checking Armature Coil Grounding

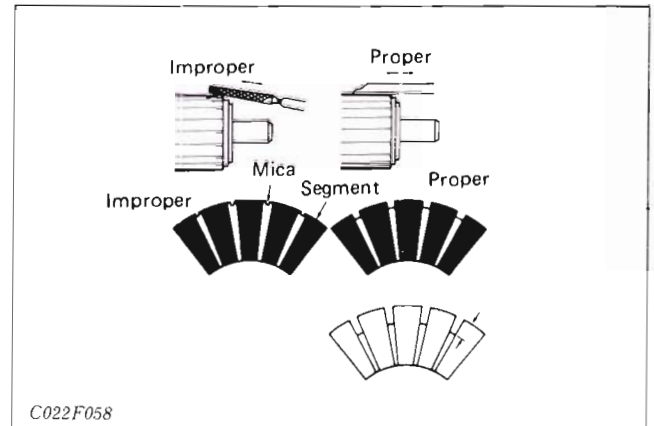
- (1) Check conduction across the commutator and core shaft. If it is not conducting, the coil is good; if it is conducting, the coil is defective.
- (2) If conducting, replace.

Checking Uneven Wear of Commutator*Fig. N-58 Checking Uneven Wear of Commutator*

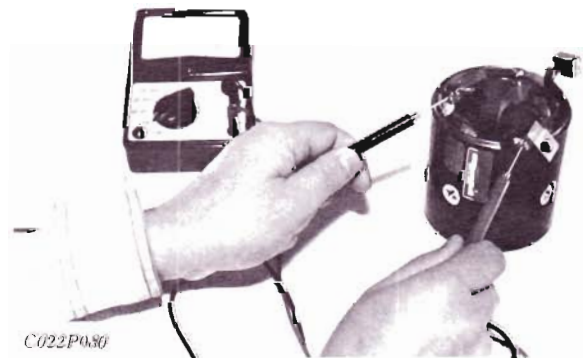
- (1) Check to see if the deflection exceeds 0.2mm (0.0079 in.).
 - (2) Check to see if the brush contact surface is worn unevenly.
 - (3) Correct it with a lathe to less than 0.05mm (0.0020 in.).
 - (4) If the correction reduces the commutator diameter by more than 3mm (0.118 in.) above the reference outside diameter, replace the commutator.
- Reference value:
Less than 0.2mm (0.0079 in.)

Checking Staining or Burning of Commutator*Fig. N-59 Correcting Commutator*

- (1) Check to see if the commutator surface is stained or burnt.
- (2) If it is locally burnt, correct with fine sandpaper.

Checking Mica (undercut)*Fig. N-60 Correcting Mica*

- (1) Check to see if the mica has sunk below the allowable limit.
 - (2) If it is below the allowable limit, correct with a saw blade to reference value. Since the correction produces burrs on the corner of the segment, chamfering should be executed.
- Reference value:
0.5 to 0.8mm (0.0197 to 0.0315 in.)
 - Allowable limit:
0.4mm (0.0157 in.)

Checking Field Coil Breakage*Fig. N-61 Checking Field Coil Breakage*

- (1) To check conduction, place the tester probes onto the lead and brush. If it is conducting, the coil is good; if it is not, the coil is defective.
- (2) If not conducting, replace.

Checking Insulation between Field Coil and Yoke

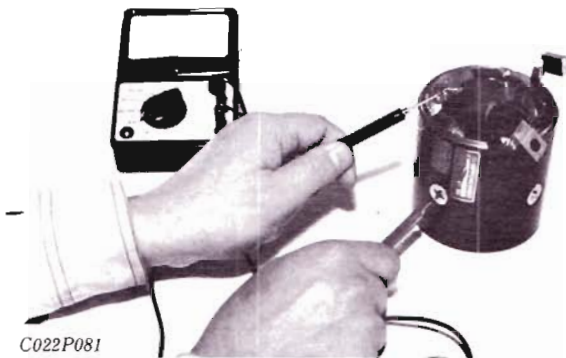


Fig. N-62 Checking Insulation

- (1) Place the tester probes on the field coil and yoke. If it is not conducting, the insulation is good; if it is conducting, the insulation is defective.
- (2) If conducting, replace.

Checking Wear of Brush

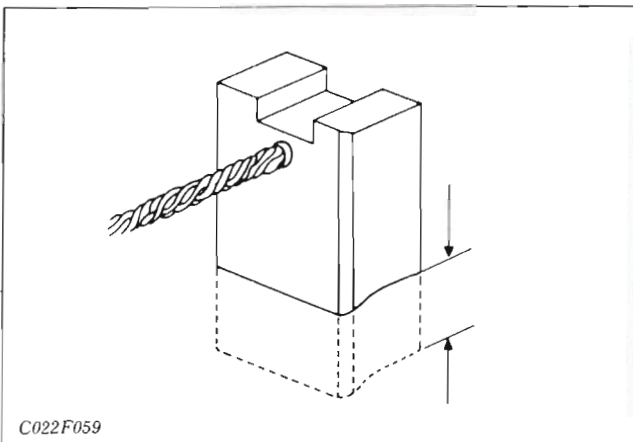


Fig. N-63 Checking Wear of Brush

- (1) Check to see that the brush has worn down more than 1/3 of the standard dimensions.
 - (2) If it wears down more than the allowable limit, replace.
- Reference value:

length:	16mm (0.6299 in.)
width:	12mm (0.4724 in.)
thickness:	7mm (0.2756 in.)
 - Allowable limit:

Wear 1/3 of the standard length or more
5.33mm (0.210 in.)

Checking Brush Spring Pressure

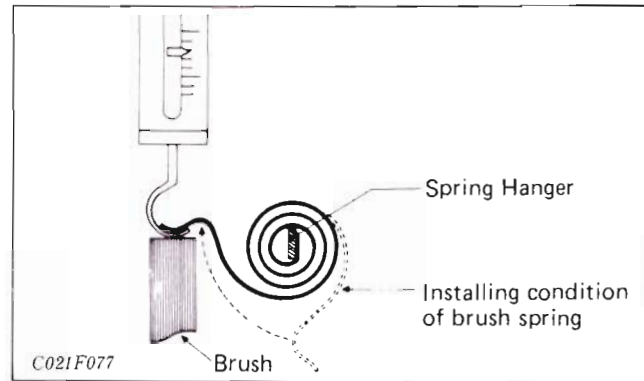


Fig. N-64 Checking Brush Spring Pressure

- (1) Measure the tension with a new brush in place.
 - (2) Replace if the tension is under the reference value.
- Reference value:
9.8N (1 kgf, 2.2 lbs.)

Checking Brush Holder

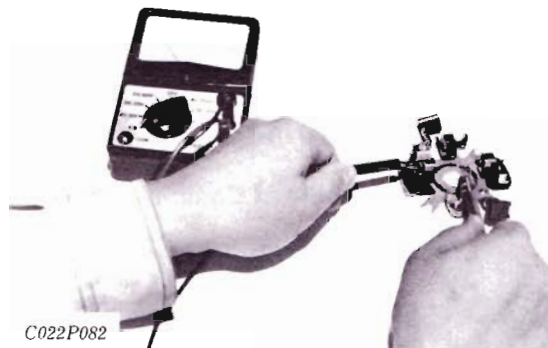


Fig. N-65 Checking Brush Holder

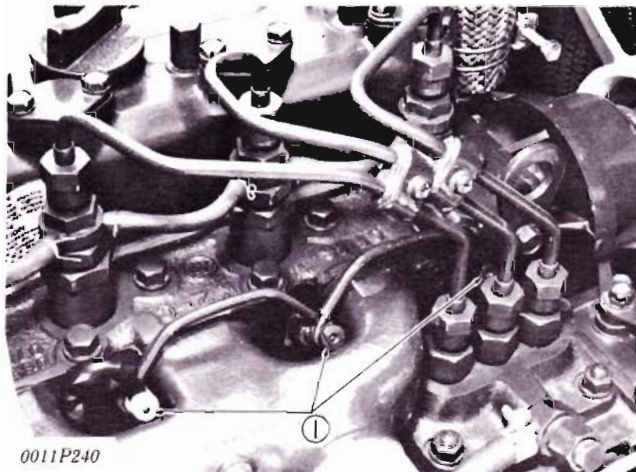
- (1) Check the insulation of the positive brush holder.
 - (2) Replace if defective.
- Reference:

The positive brush holder is made of an insulation material.
--

Group 5

Glow Plug and Safety Switch

Glow Plug



1. Glow Plugs

Fig. N-66

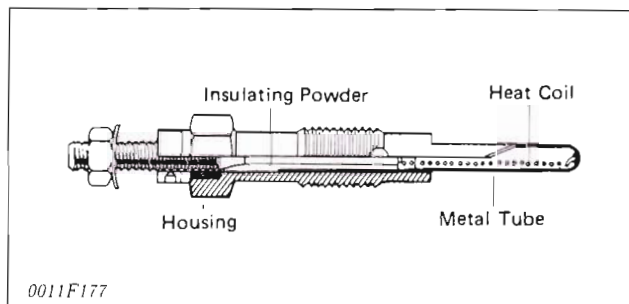
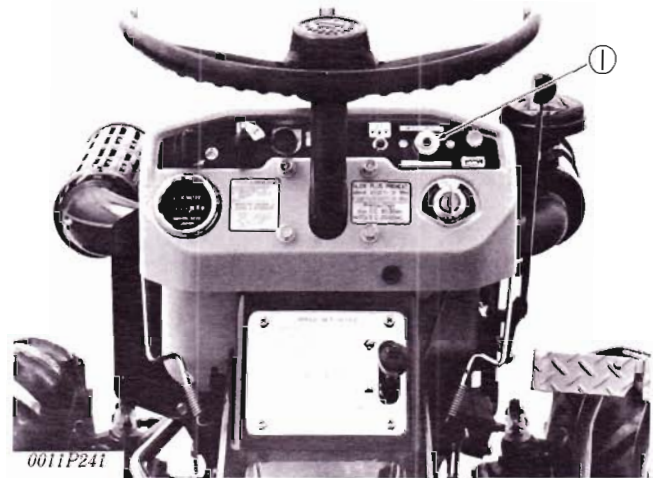


Fig. N-67 Construction of Bar Glow Plug



1. Glow Plug Lamp

Fig. N-68

A glow plug is used for each pre-combustion chamber of the cylinder head to make starting easier. (A three-cylinder engine, therefore, has three glow plugs.)

A glow plug lamp is provided on the meter panel to confirm glow plug condition.

Safety Switch

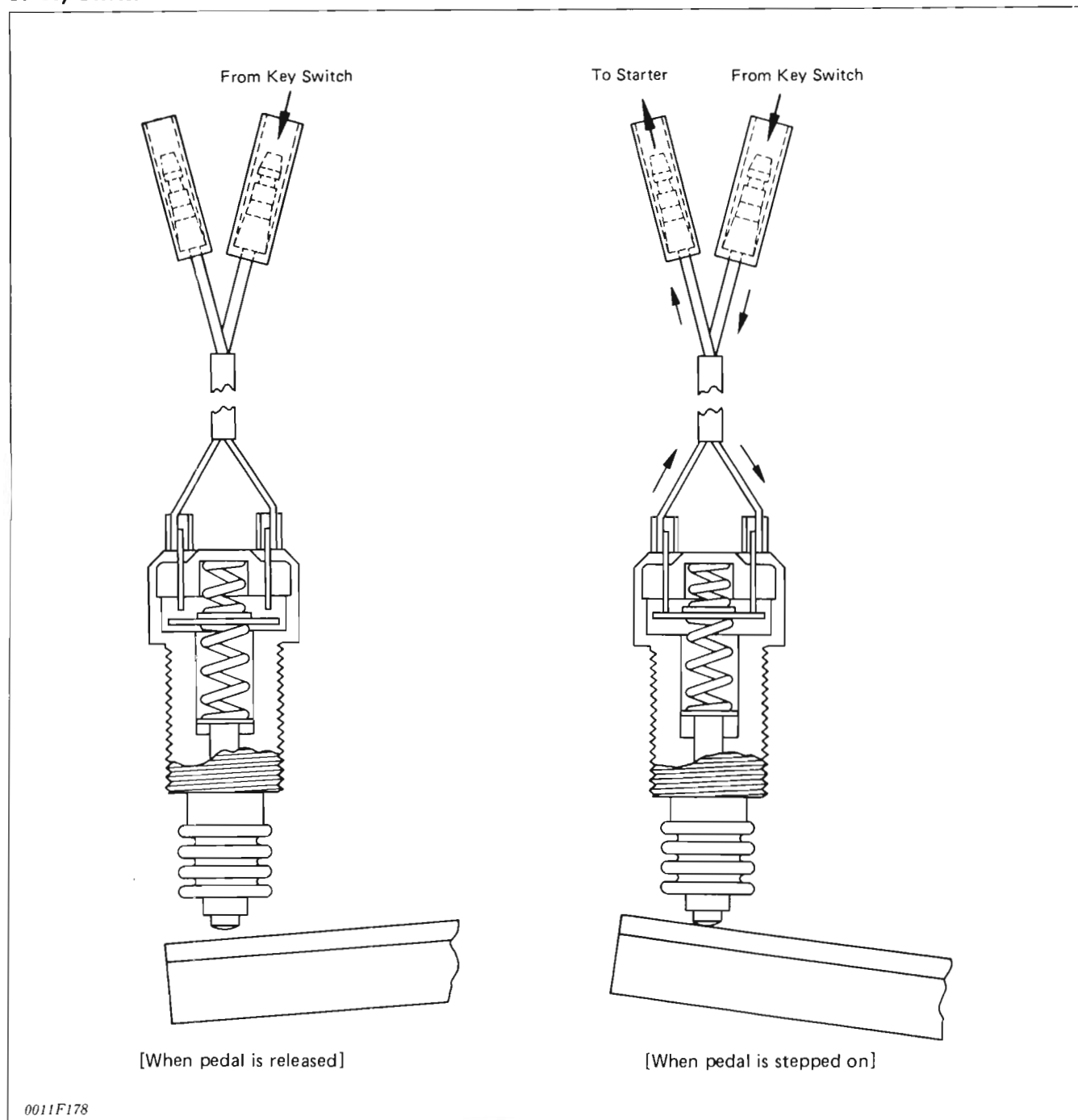


Fig. N-69 Safety Switch Operation

For safe starting, the safety switch prevents current from flowing to the starter if the clutch pedal is not depressed.

Group 6

AC Dynamo and Regulator

AC Dynamo

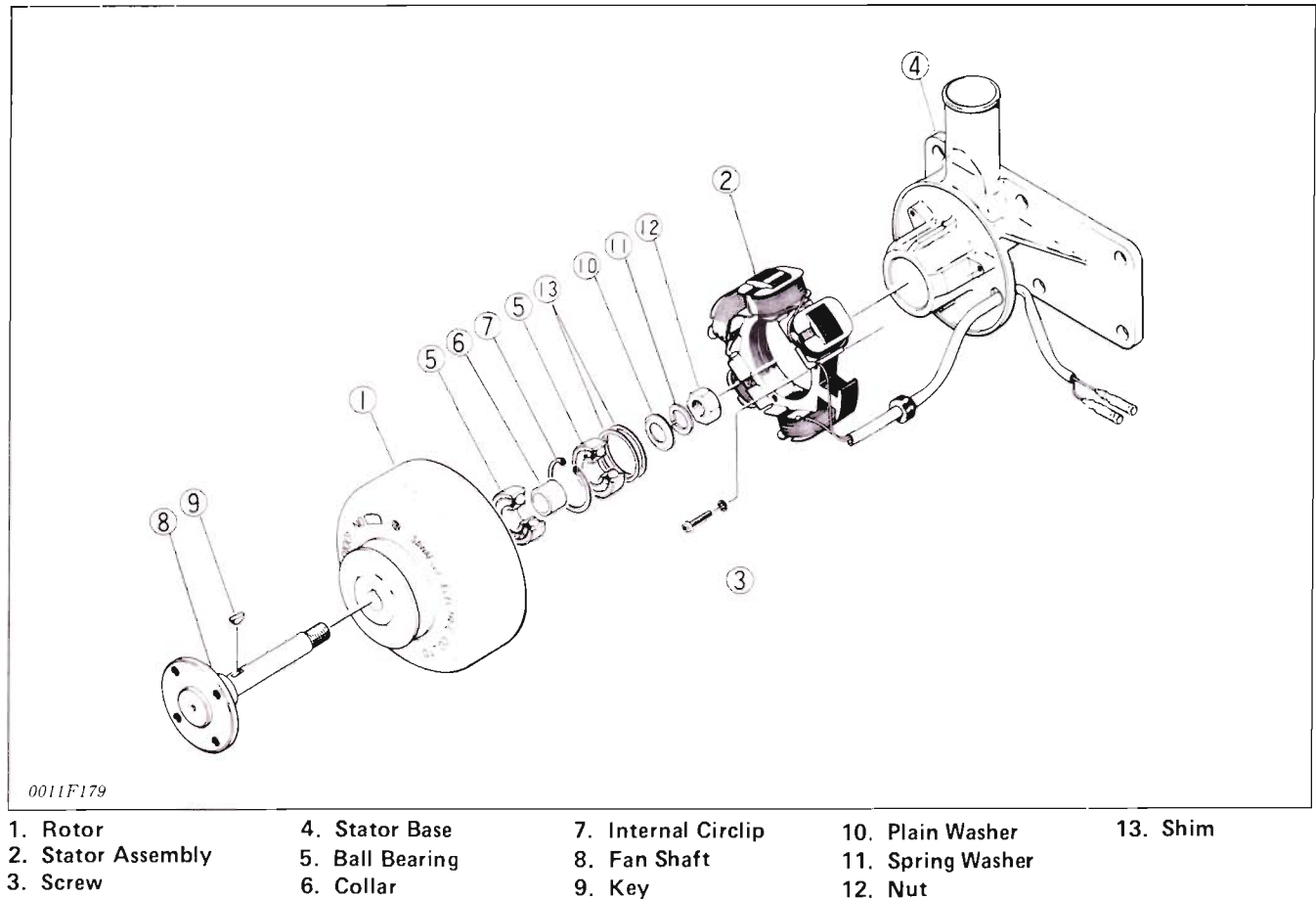


Fig. N-70 AC Dynamo

This AC dynamo (Code No.15372-6401-1) is an 8-8 pole rotating magnet type generator. It is simple in construction, consisting of a stator and rotor. The rotor is made up of eight permanent magnet pole pieces assembled on a shaft and rotates on the center of the stator around which eight electro-

magnetic coils are provided for. AC dynamo produces higher voltage in slow speed rotation, compared with DC generator, and charges electric current to the battery during engine idling. Accordingly, there is no fear of battery failure.

Regulator

The regulator performs rectification and voltage regulation. On this tractor, all these functions are controlled by the electronic circuit.

The regulator converts AC current into DC current which flows through the power consuming circuits and the battery, and also charges the battery. If, however, the battery voltage exceeds a certain level, the DC current is cut off from the charging circuit to prevent overcharging.



0011P242

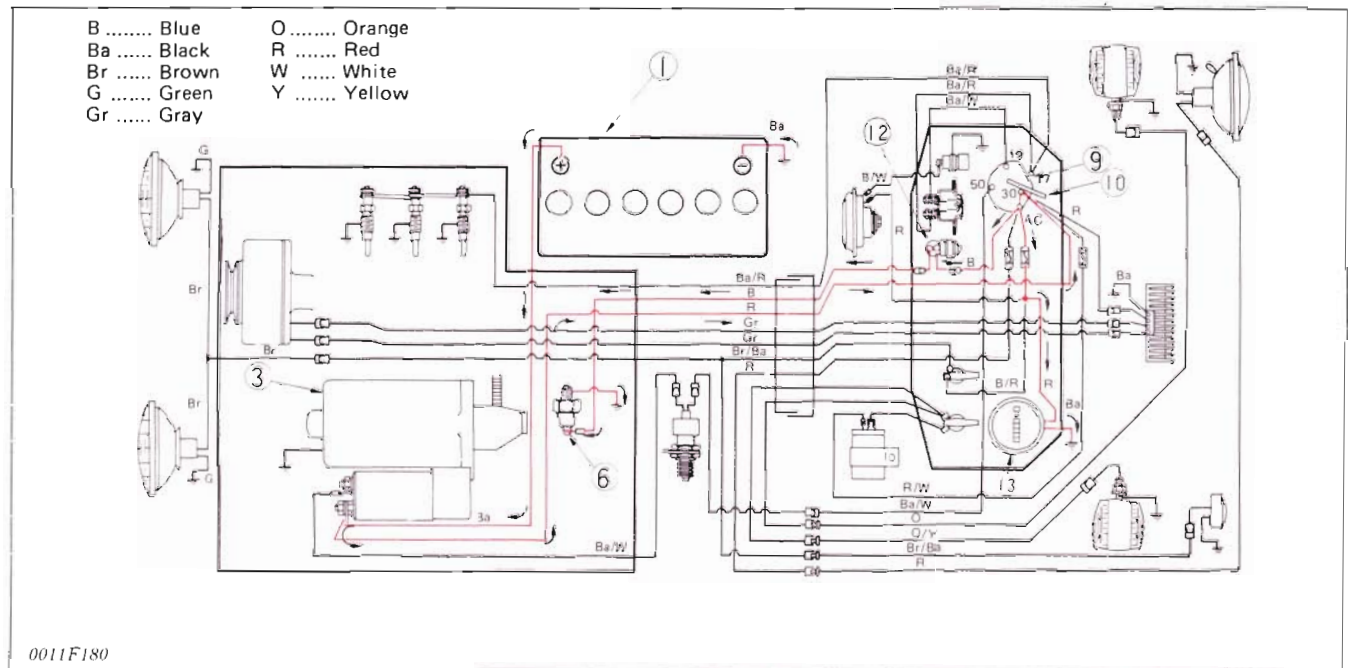
Fig. N-71 Regulator

Group 7

Hourmeter, Headlights, Hazard Lamps

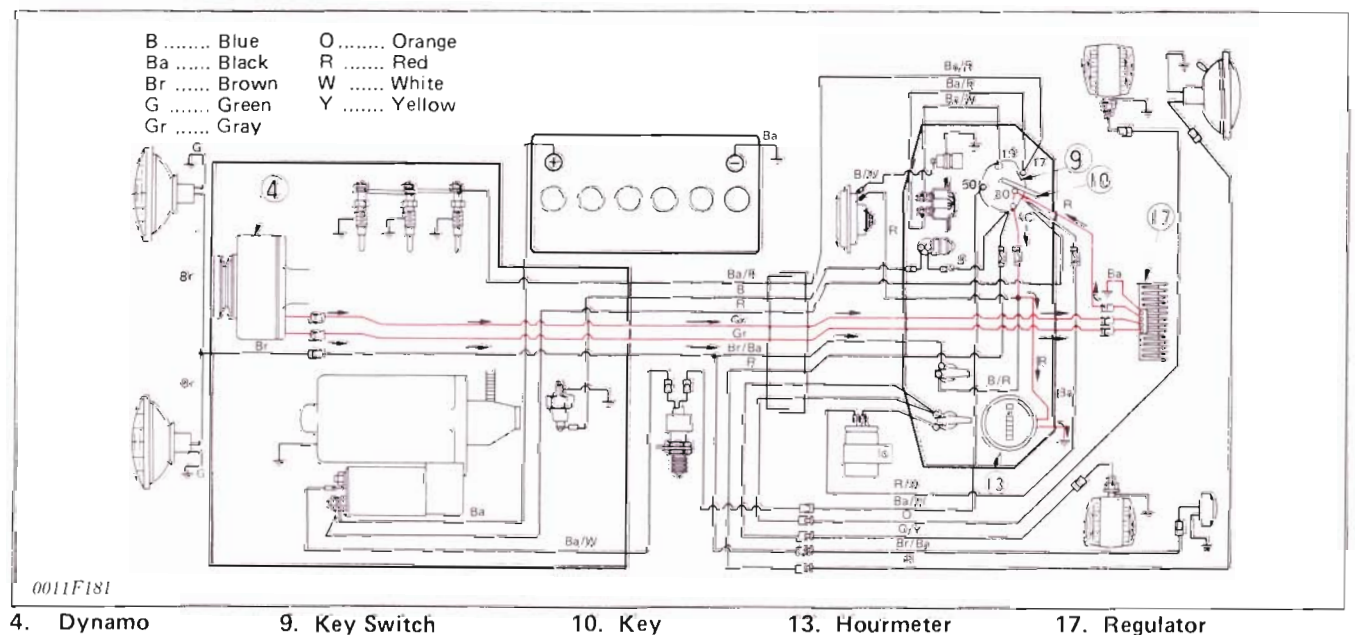
When the key switch is turned ON, the hourmeter starts operating. On/off of headlights and hazard lamps is controlled by switches.

These units receive power from the AC dynamo when the engine is running, and from the battery when the engine stops.



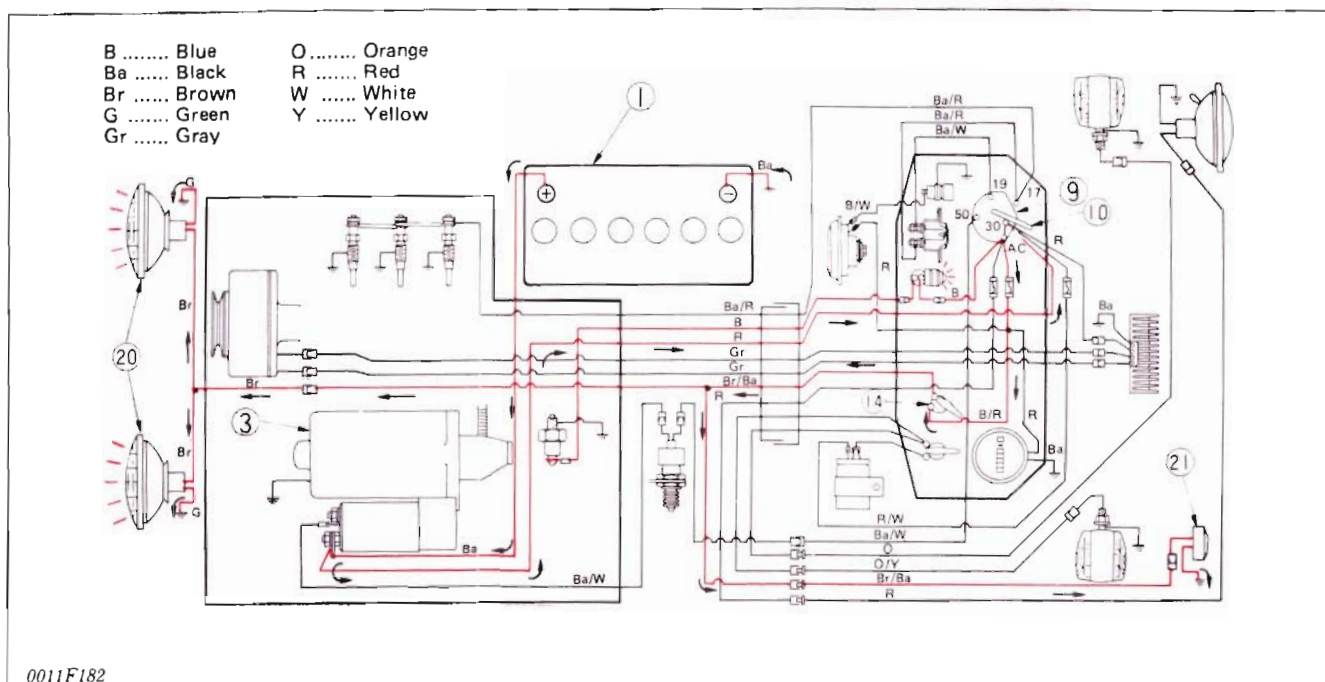
1. Battery 6. Oil Switch 10. Key 13. Hourmeter
3. Starter 9. Key Switch 12. Oil Lamp

Fig. N-72 Hourmeter Circuit when Engine is Stopped (Key Switch "ON")



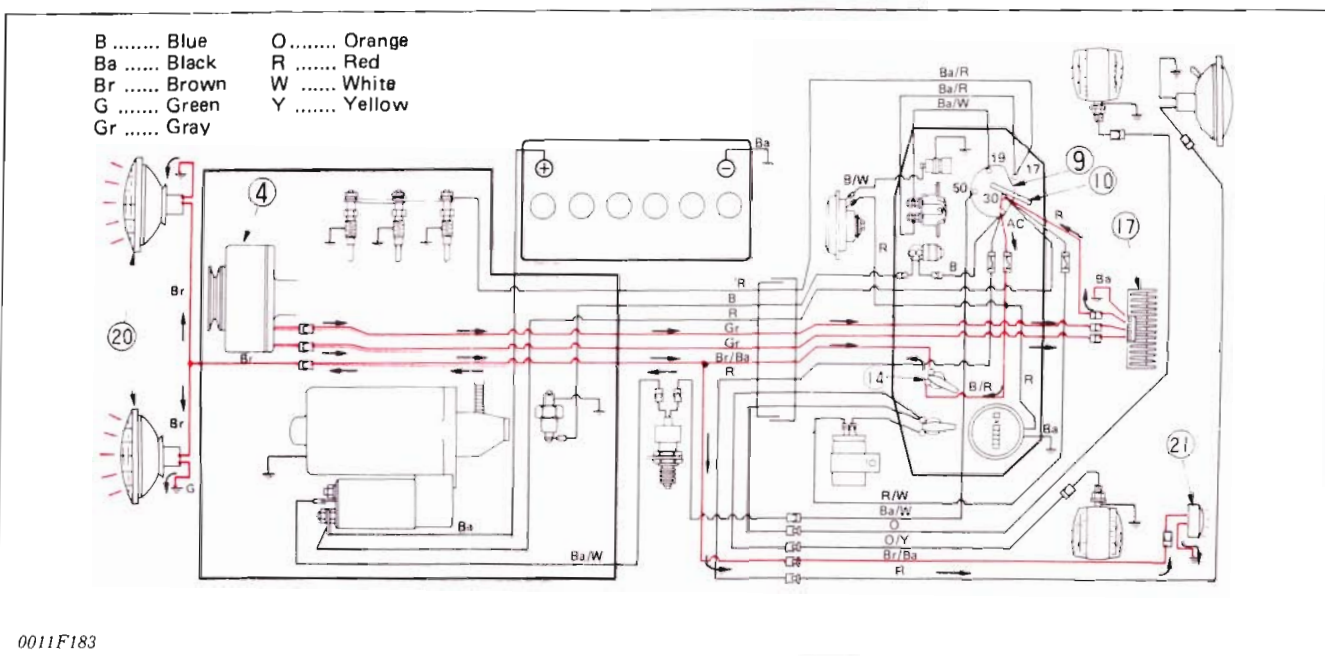
4. Dynamo 9. Key Switch 10. Key 13. Hourmeter 17. Regulator

Fig. N-73 Hourmeter Circuit when Engine is Rotating



1. Battery 9. Key Switch 14. Headlight Switch 21. Taillight
3. Starter 10. Key 20. Headlight

Fig. N-74 Headlight and Taillight Circuit when Engine is Stopped (Key Switch "ON")



4. Dynamo 10. Key 17. Regulator 21. Taillight
9. Key Switch 14. Headlight Switch 20. Headlight

Fig. N-75 Head light and Taillight Circuit when Engine is Rotating

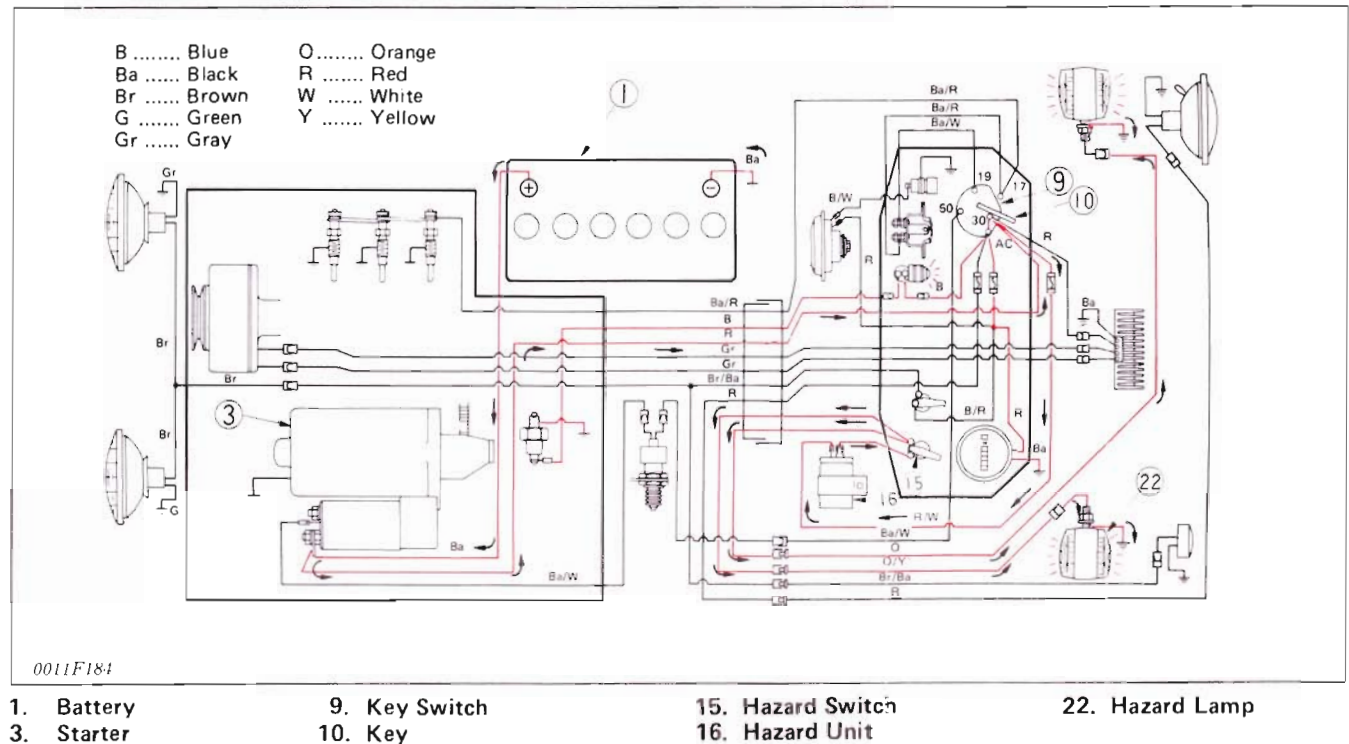


Fig. N-76 Hazard Lamp Lighting Circuit when Engine is Stopped (Key Switch "ON")

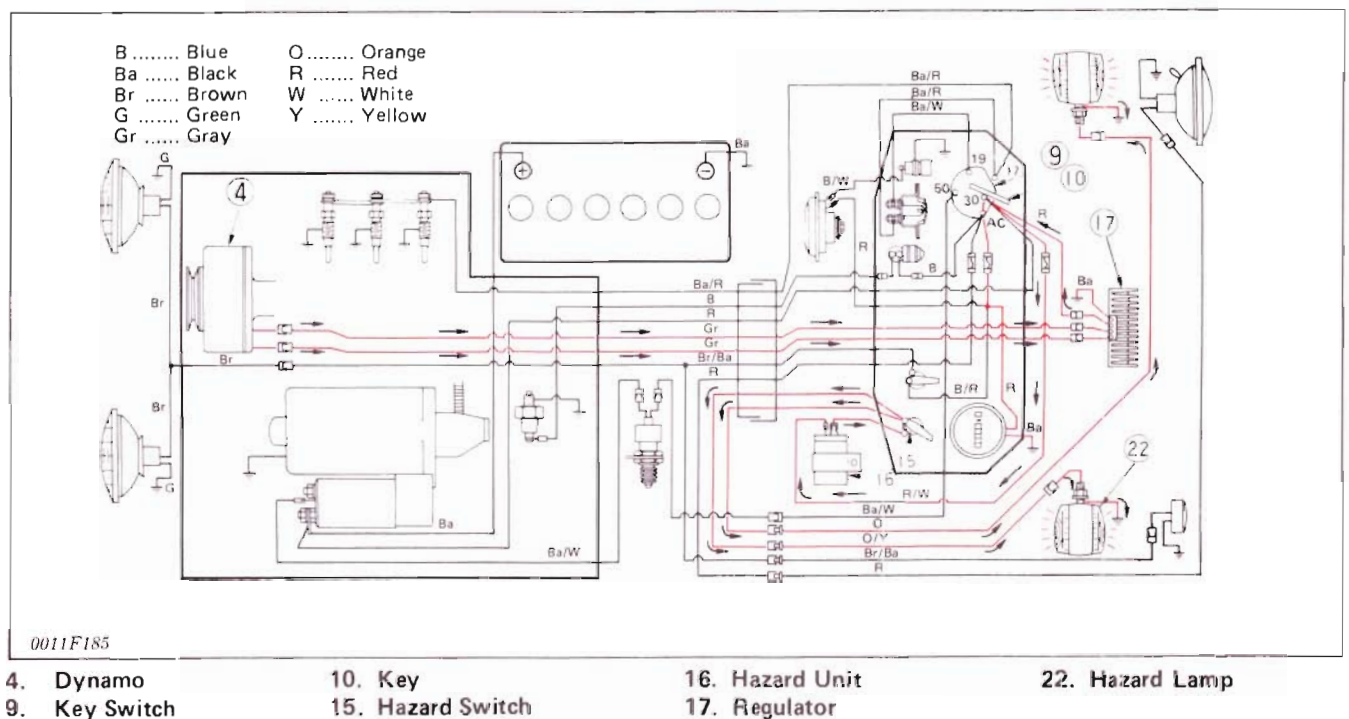


Fig. N-77 Hazard Lamp Lighting Circuit when Engine is Rotating

Horn, Work Lamp (Option)

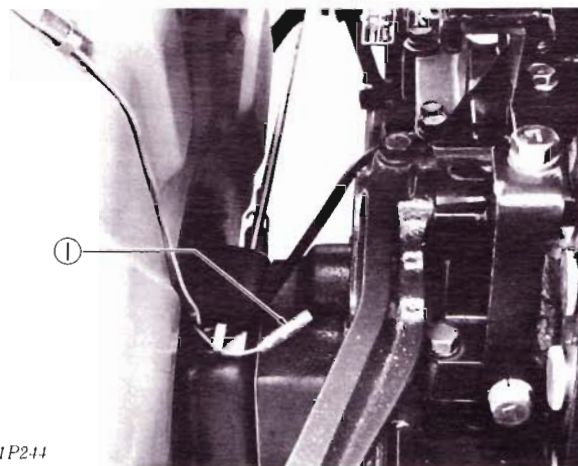
A horn and work lamp are available optionally.



0011P243

1. Horn Switch

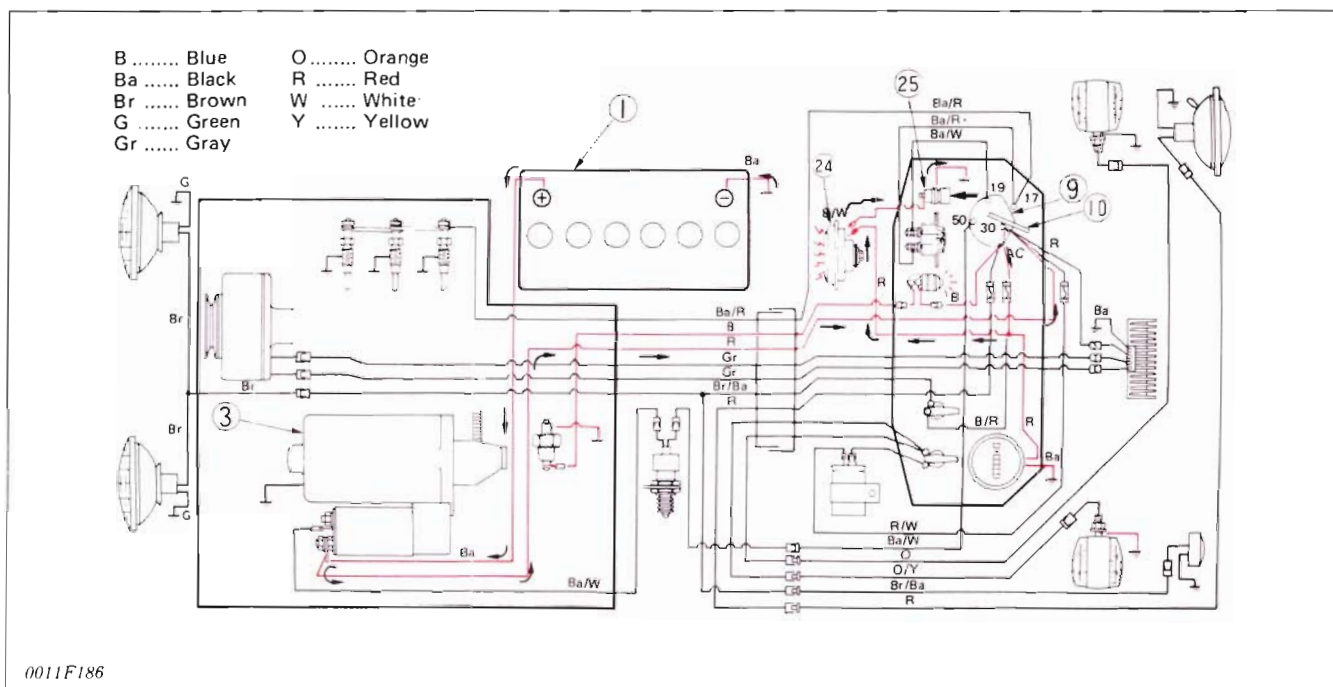
Fig. N-78 Horn



0011P244

1. Work Lamp Coupler

Fig. N-79 Work Lamp Coupler



0011F186

1. Battery 3. Starter 9. Key Switch 10. Key 24. Horn (option) 25. Horn Switch (option)

Fig. N-80 Horn Operating Circuit when Engine is Stopped (Key Switch "ON")

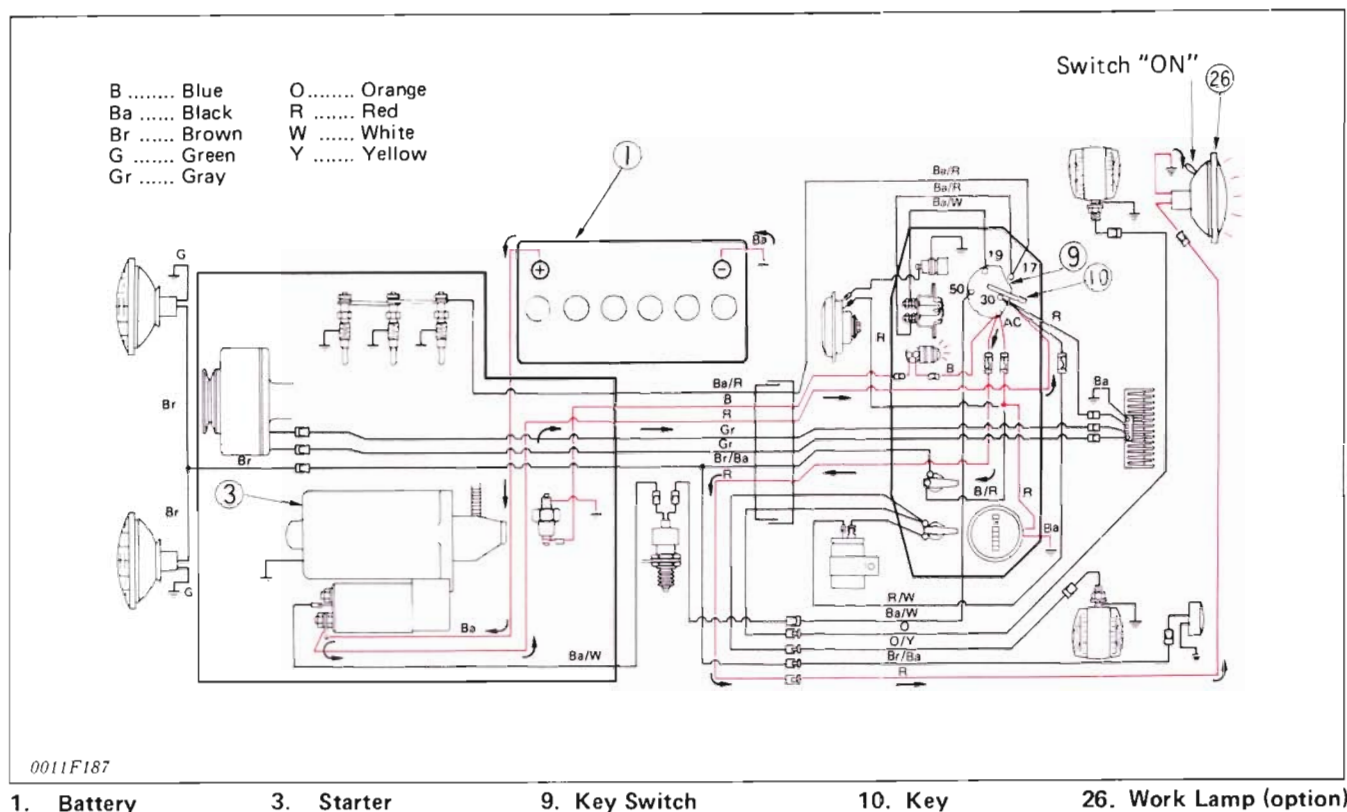


Fig. N-81 Work Lamp Operating Circuit when Engine is Stopped (Key Switch "ON")

Group 8

Large Capacity AC Dynamo (Option) Installation

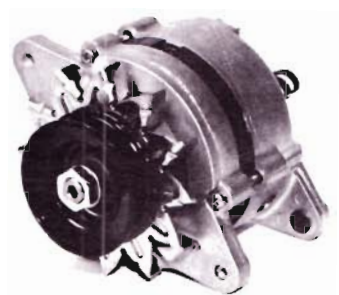
An optional AC dynamo with a larger capacity than the standard one can be attached to the tractor.

Kit parts No. 66704-82502

Standard 12V, 10A

Option 12V, 35A

If the optional AC dynamo is adopted, a suitable regulator and accessory parts also must be employed.



0011P245

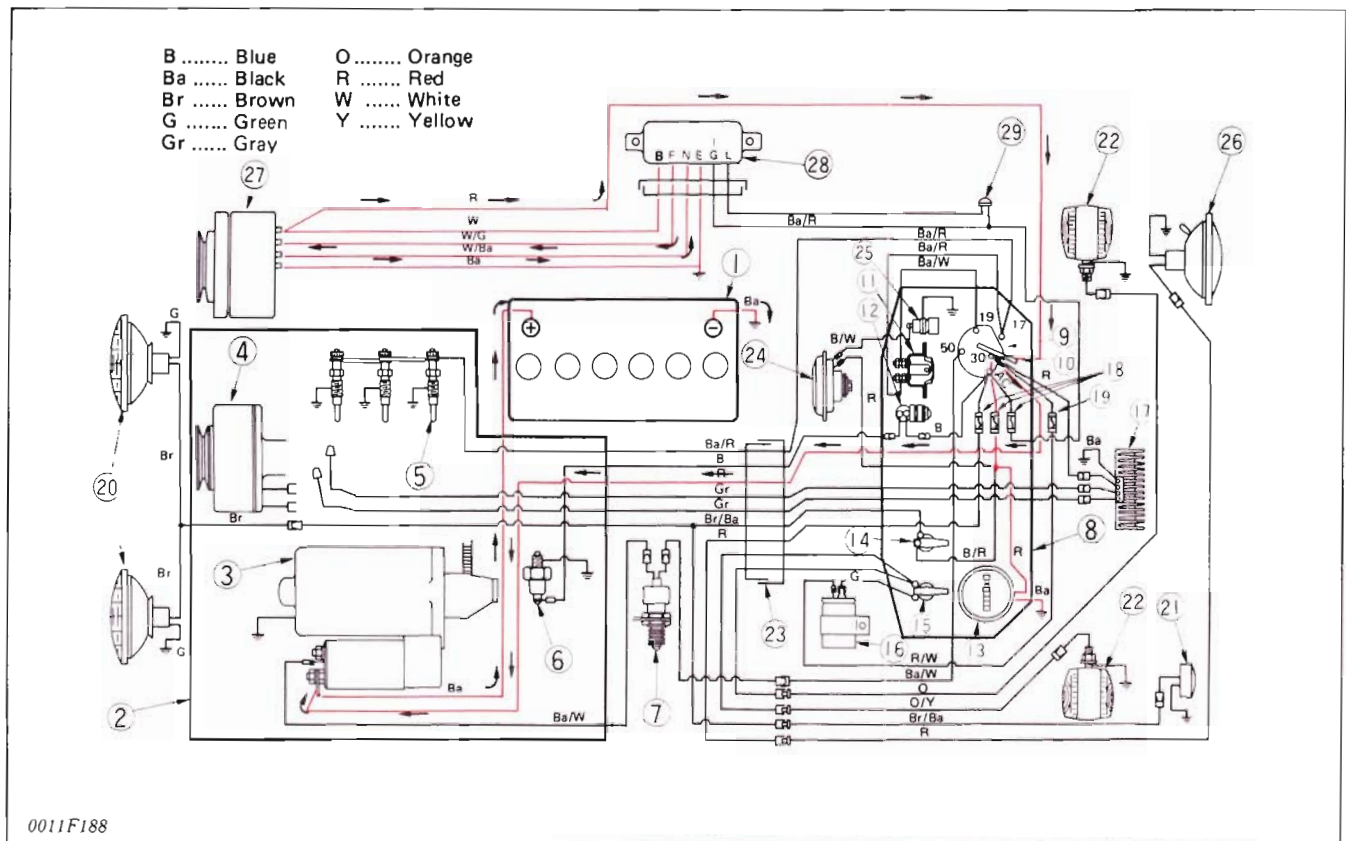
Fig. N-82 AC Dynamo



0011P246

Fig. N-83 Regulator

Stop the function of the standard AC dynamo and regulator and arrange the circuits for the optional AC dynamo and its regulator, which provides power to the circuits.



- | | | |
|----------------------------|--------------------------------|-----------------------------------|
| 1. Battery (12V-45AH) | 10. Key | 20. Headlight (12V-15W) |
| 2. Engine Body | 11. Glow Plug Lamp (20A) | 21. Taillight |
| 3. Starter | 12. Oil Lamp (12V-3.4W) | 22. Hazard Lamp (12V-15W) |
| 4. AC Dynamo | 13. Hourmeter | 23. Coupler |
| 5. Glow Plug | 14. Headlight Switch (12V-5A) | 24. Horn (12V-1.5AH) [option] |
| 6. Oil Switch | 15. Hazard Switch | 25. Horn Switch (3A) [option] |
| 7. Safety Switch (12V-15A) | 16. Hazard Unit (12V-43W) | 26. Work Light [option] |
| 8. Meter Panel | 17. Regulator | 27. AC Dynamo [option] |
| 9. Key Switch | (Regulated voltage: 14 to 15V) | 28. Regulator (Regulated voltage: |
| | 18. Fuse (5A) | 13.8V to 14.8V) [option] |
| | 19. Fuse (3A) | 29. Charge Lamp |

Fig. N-84 Large Capacity AC Dynamo Circuit (while battery is charged)

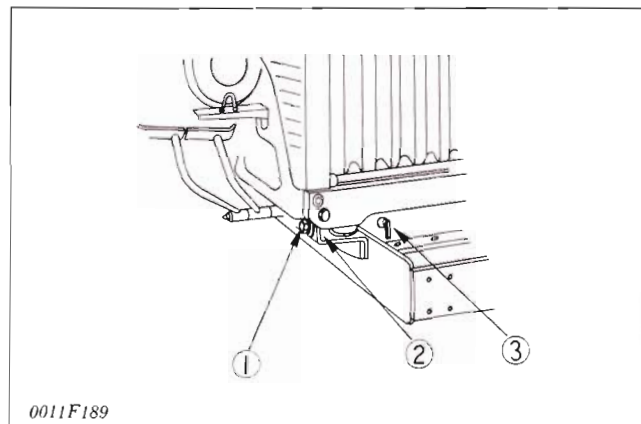
How to Install the Large Capacity AC Dynamo Kit (Option)

Preparation for Work

- (1) Hand Drill
- (2) 7mm (9/32 in.) drill

Removing Exterior Parts

- (1) Removing Bonnet and Draining Water

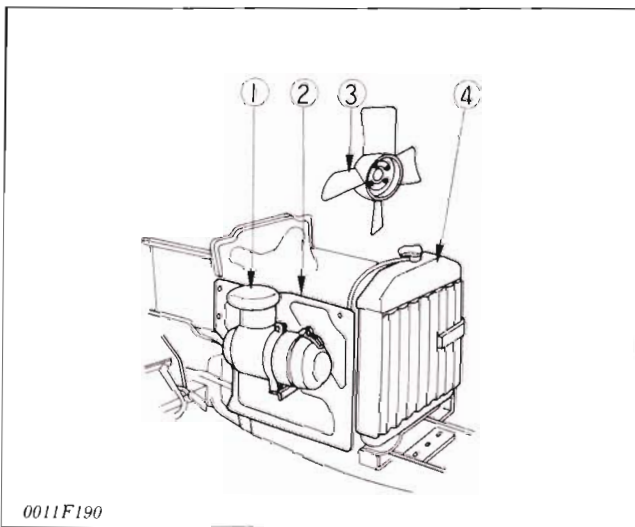


1. Bolts
2. Snap Pins
3. Drain Cock

Fig. N-85 Removing Bonnet and Draining Water

Unlock the bonnet latches from the bonnet. After removing the snap pin (2), remove the bolts (1), and then remove the bonnet. Drain cooling water from drain cock (3).

- (2) Removing Air Cleaner, Side Cover RH, Radiator, and Fan

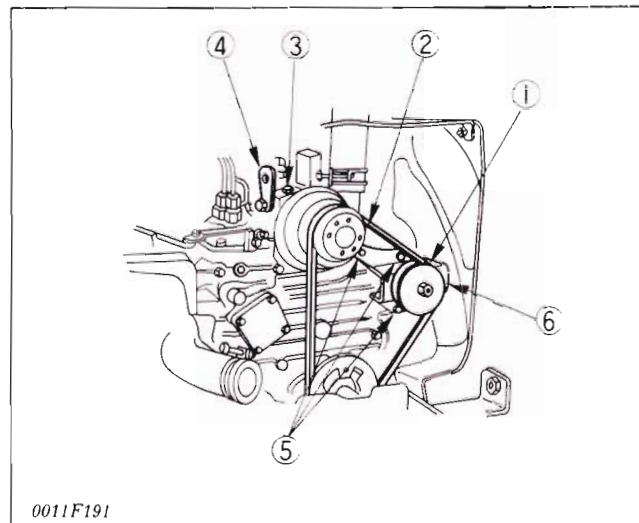


1. Air Cleaner Assembly
2. Side Cover RH
3. Fan
4. Radiator

Fig. N-86 Removing Accessories

Remove the air cleaner assembly (1), side cover RH (2), radiator (4), and fan (3).

- (3) Removing Fan Belt and Tension Pulley Assembly



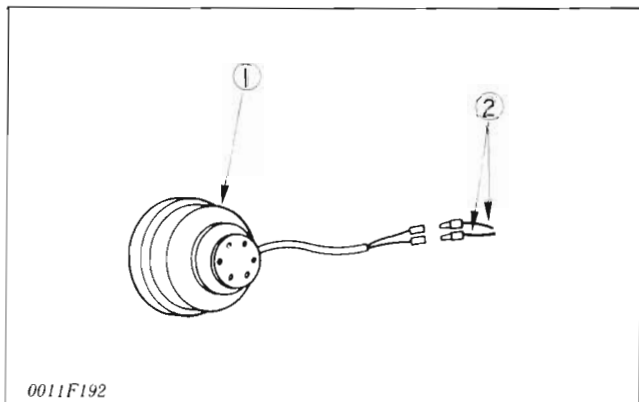
1. Tension Pulley Assembly
2. Fan Belt
3. Engine Head Bolt
4. Engine Hook
5. Bolts (3 pieces)
6. Bolt

Fig. N-87 Removing Fan Belt and Tension Pulley Assembly

Loosen the tension bolt, then remove the fan belt. Remove the tension pulley assembly. Bolts (5) cannot be used when attaching the AC dynamo kit. Bolt (6) can be used when assembling them.

Remove the engine head bolt (3) and engine hook (4).

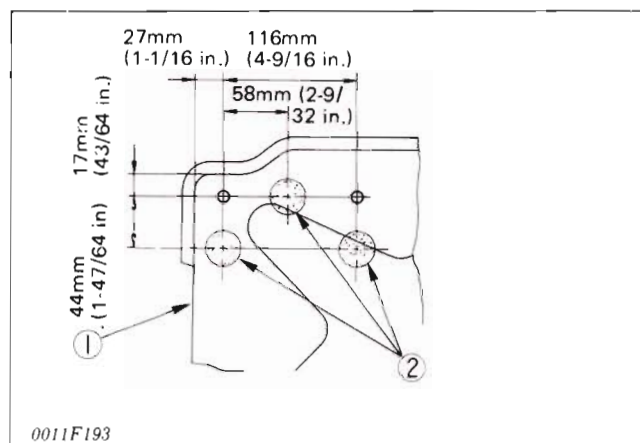
- (4) Detaching wires and removing battery



1. AC Dynamo
2. Wires

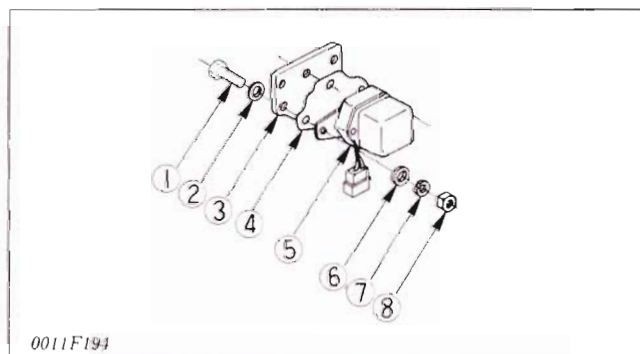
Fig. N-88 Detaching Wires

Detach the two wires from the AC dynamo. Remove the battery.

Assembling AC Dynamo Kit**(1) Drilling the Heat Insulator (Cover)**

1. Heat Insulator (Cover) 2. Sponge Cushion
Fig. N-89 Measurement of Drilling and Installation of
Sponge Cushion

In order to attach the regulator, drill the heat insulator (cover) (1), and install the sponge cushions (2) according to the measurements, Fig. N-89.

(2) Assembling Regulator and Regulator Cover

- | | |
|--|------------------------------|
| 1. Bolts (3 pieces) . . . M6 (thread dia. 15/64 in.)
ℓ = 22mm (55/64 in.) | 4. Regulator Cover |
| 2. Plain Washers (6 pieces) | 5. Regulator |
| 3. Rubber Cushion | 6. Spring Washers (3 pieces) |
| | 7. Nuts (3 pieces) |

[All parts are included in "AC Dynamo Kit".]

Fig. N-90 Assembling Regulator and Regulator Cover

Assemble the regulator (5), regulator cover (4) and rubber cushion (3) with three sets of bolts (1), nuts (7) and etc. (2)(6).

- Reference:
Meaning of bolt's length

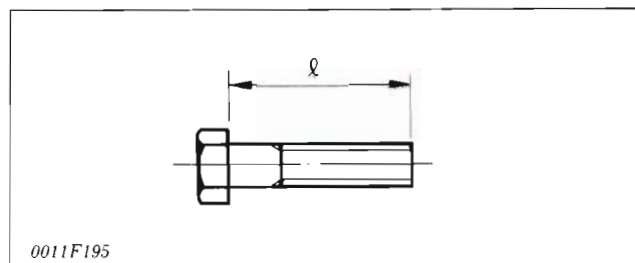
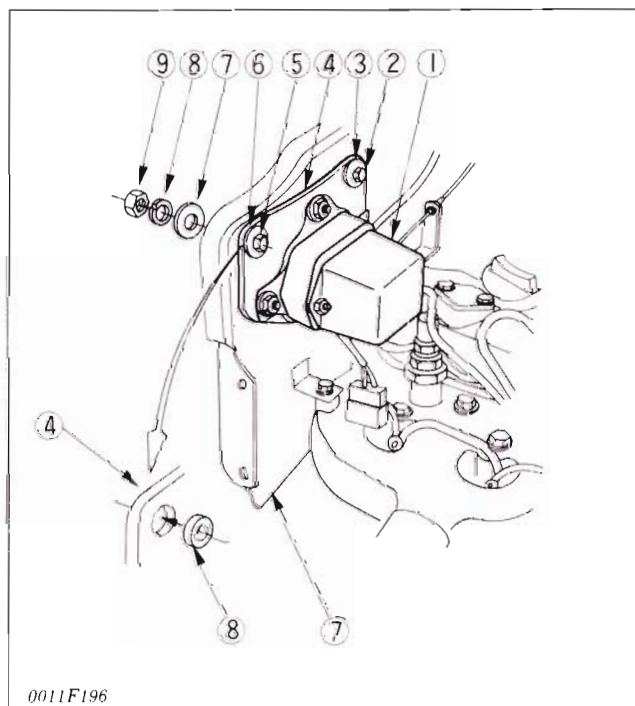


Fig. N-91 Bolt's Length

(3) Installing Regulator

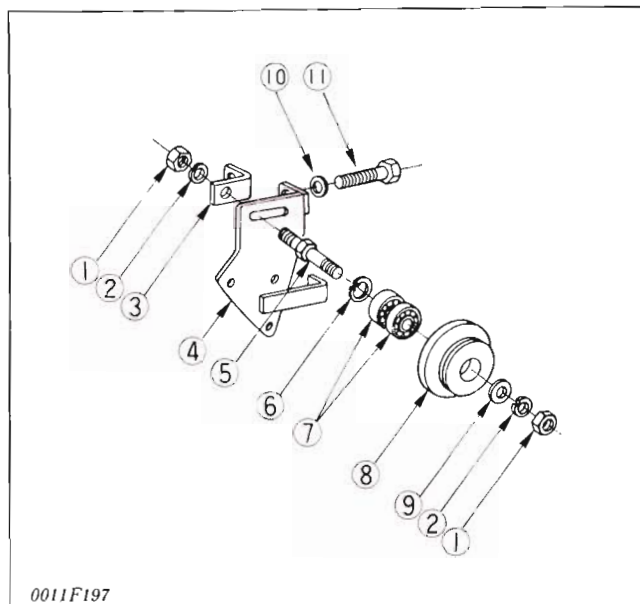
- | |
|--|
| 1. Regulator |
| 2. Bolts (2 pieces) . . . M6 (thread dia. approx. 15/64 in.)
ℓ = 22mm (approx. 55/64 in.) |
| 3. Plain Washers (4 pieces) . . . dia. 22mm (approx. 55/64 in.) |
| 4. Rubber Cushion |
| 5. Spring Washers (2 pieces) |
| 6. Nuts (2 pieces) . . . M6 |
| 7. Heat Insulator (Cover) |
| 8. Collars (2 pieces) |

[All parts are included in "AC Dynamo Kit".]

Fig. N-92 Installing Regulator

insert the two collars (8) to the rubber cushion (4), then install the regulator (1) on the heat insulator (cover) (7), Fig. N-92.

(4) Assembling Tension Pulley

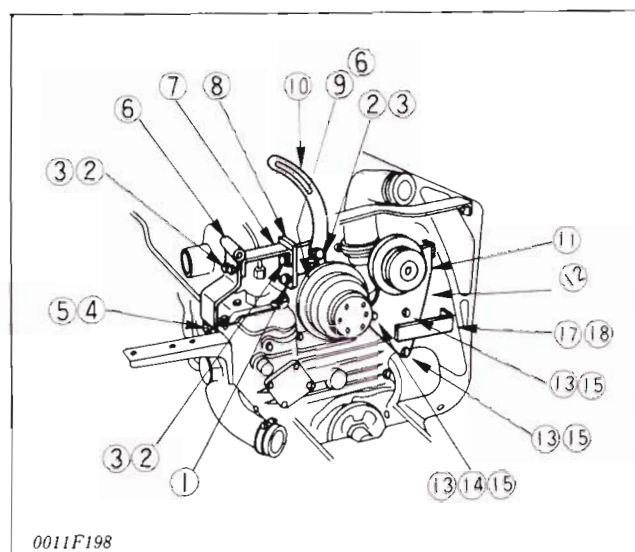


- | | |
|------------------------------|-----------------------------|
| 1. Nuts (2 pieces) . . . M10 | 9. Plain Washer . . . dia. |
| 2. Spring Washers | 22mm (approx. 55/64 in.) |
| 3. Tension Adjusting Plate | 10. Plain Washer . . . dia. |
| 4. Tension Pulley Support | 18mm (approx. 45/64 in.) |
| 5. Tension Pulley Shaft | 11. Tension Bolts . . . M8 |
| 6. Internal Cir-clip | (thread dia. approx. |
| 7. Ball Bearing | 5/16 in.) ℓ = 70mm |
| 8. Tension Pulley | (approx. 2-3/4 in.) |
- [All parts are included in "AC Dynamo Kit".]

Fig. N-93 Assembling Tension Pulley

Press the ball bearings (7) into the tension pulley (8), and fix them with internal circlip (6) as shown in Fig. N-95. Assemble tension pulley shaft (5) and tension pulley (8). Loosely assemble tension adjusting plate (3), tension pulley support (4) and tension pulley shaft (5). Insert the tension bolt (11) a little way into tension adjusting plate (3) through the tension pulley support (4).

(5) Installing Dynamo Stay and Tension Pulley Assembly



1. Bolt (with spring washer) . . . M8 (thread dia. approx. 5/16 in.) ℓ = 20mm (approx. 25/32 in.)
2. Bolts (4 pieces) . . . M8 (thread dia. approx. 5/16 in.) ℓ = 20mm (approx. 25/32 in.)
3. Spring Washers (4 pieces)
4. Bolts (2 pieces) . . . M6 (thread dia. approx. 15/64 in.) ℓ = 18mm (approx. 45/64 in.)
5. Spring Washers (2 pieces)
6. Dynamo Support
7. Stay
8. Bracket
9. Head Bolt . . . M8 (thread dia. approx. 5/16 in.) ℓ = 83mm (approx. 3-17/64 in.)
10. Dynamo Stay
11. Tension Pulley
12. Tension Pulley Support
13. Bolts (3 pieces) . . . M6 (thread dia. approx. 15/64 in.) ℓ = 70mm (approx. 2-3/4 in.)
14. Plain Washer . . . dia. 13mm (approx. 33/64 in.)
15. Spring Washer
16. Spring Washer
17. Bolt (with spring washer)
18. Plain Washer

[These parts (1 to 14) are included in "AC Dynamo Kit"]

Fig. N-94 Installing Dynamo Stay and Tension Pulley Assembly

Remove the lower two bolts holding injection pump cover. Install the dynamo support (6) on the injection pump cover with two bolts (4) and spring washers (5). Install the stay (7) on the dynamo support (6) with bolts (2) and spring washers (3).

Install bracket (8) on cylinder head with bolt (1) and head bolt (9) and spring washer (16). Then tighten the bolt (2) with spring washer (3).

Head bolt (9) tightening torque. . . 42 to 47 Nm (4.3 to 4.8kgf.m, 31 to 35 ft-lbs)

Bolts (1), (2) tightening torque . . . 24 to 27 Nm (2.4 to 2.8 kgf-m, 17 to 20 ft-lbs)
 Bolts (4) tightening torque . . . 9.8 to 11.3 Nm (1.00 to 1.15 kgf-m, 7.2 to 8.3 ft-lbs)
 Loosely install the dynamo stay (10). Install the tension pulley support (12) as shown in Fig. N-94. Be sure to use a plain washer (14) when

tightening the bolt (13).

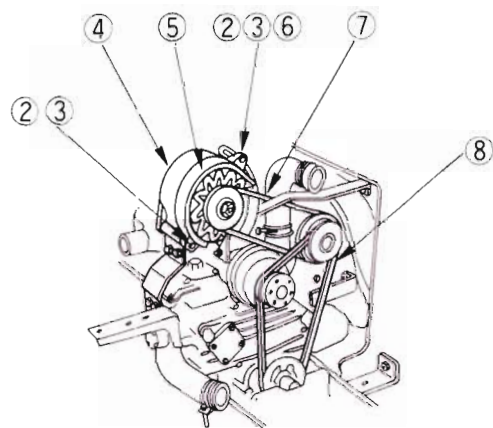
Bolts (13) tightening torque . . . 9.8 to 11.3 Nm (1.00 to 1.15 kgf-m, 7.2 to 8.3 ft-lbs)

Tighten the bolt (17) to the tension pulley support (12) through the muffler stay and side cover LH from outside.

(6) Installing AC Dynamo and Fan Belts

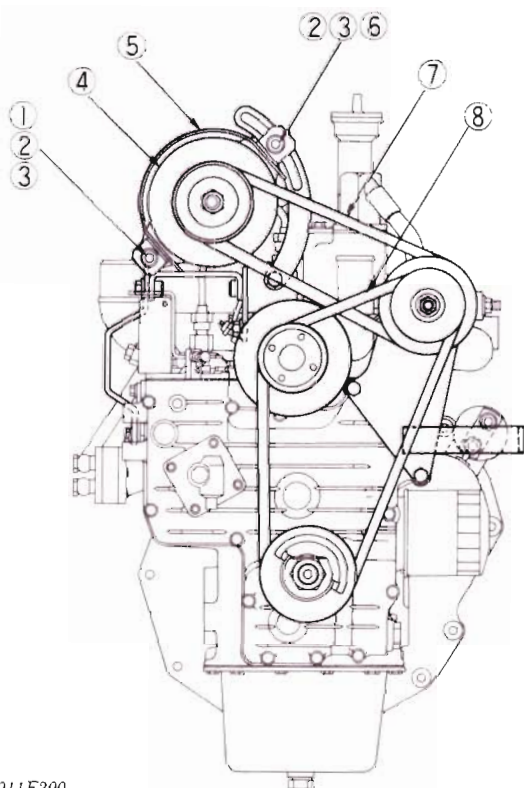
Install the dynamo assembly (4) and dynamo cover (5). Loosely tighten the bolts (1), (6) in order to adjust tension of fan belts later. Install fan belts (7), (8).

1. Bolt . . . M8 (thread dia. approx. 5/16 in.)
ℓ = 105mm (approx. 4-9/64 in.)
 2. Plain Washers (2 pieces) . . . dia. 18mm (approx. 45/64 in.)
 3. Spring Washers (2 pieces)
 4. AC Dynamo Assembly
 5. Dynamo Cover
 6. Bolt . . . M8 (thread dia. approx. 5/16 in.)
ℓ = 35mm (approx. 1-3/8 in.)
 7. Fan Belt . . . FM1281 (short one)
 8. Fan Belt . . . FM 1331 (long one)
- [All parts are included in "AC Dynamo Kit".]



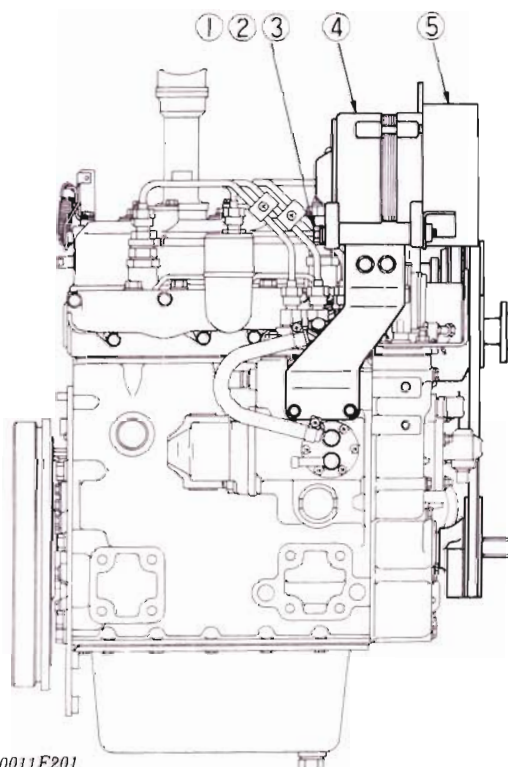
0011F199

Fig. N-95 Installing AC Dynamo and Fan Belts (1/3)



0011F200

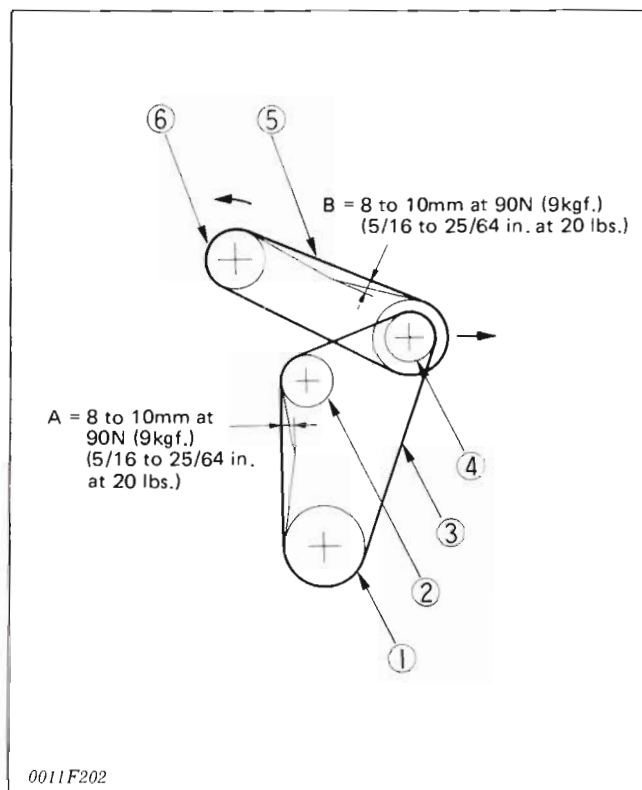
Fig. N-96 Installing AC Dynamo and Fan Belts (2/3)



0011F201

Fig. N-97 Installing AC Dynamo and Fan Belts (3/3)

(7) Adjusting fan belt tension

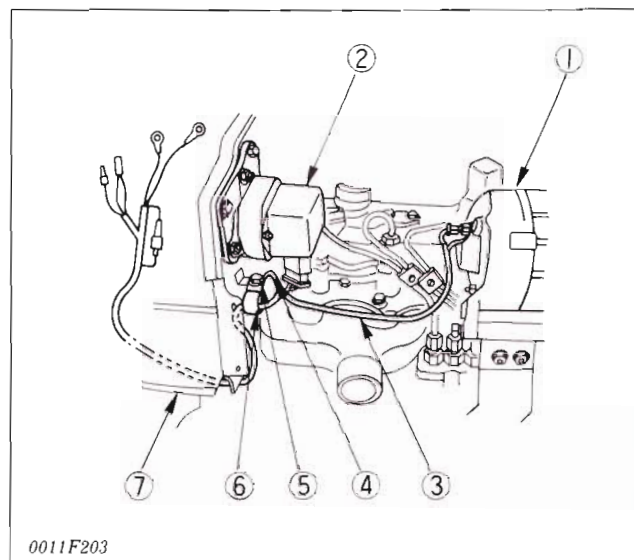


- | | |
|------------------------|-------------------|
| 1. Fan Drive Pulley | 4. Tension Pulley |
| 2. Fan Pulley (Dynamo) | 5. Fan Belt |
| 3. Fan Belt | 6. Dynamo Pulley |

Fig. N-98 Adjusting Fan Belt Tension

Adjust tension of fan belt (3) with the tension pulley (4) as shown in Fig. N-98. Then adjust tension of fan belt (5) with dynamo pulley (6) and tighten bolts of dynamo support, dynamo stay and AC dynamo to dynamo stay, Fig. N-97, Fig. N-94.

(8) Wiring AC Dynamo and Regulator



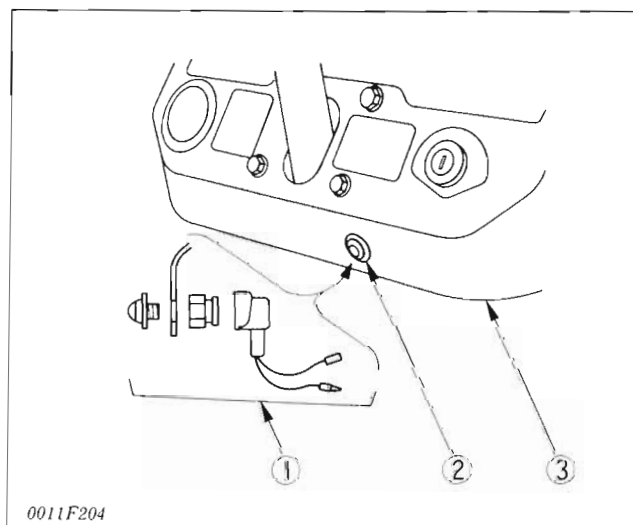
- | | |
|--|--------------------|
| 1. AC Dynamo Assembly | 5. Cord Clamp |
| 2. Regulator | 6. Bolt |
| 3. Wire Harness | 7. Battery Bracket |
| 4. Ground Wire
(included in wire harness (3)) | |

[These parts ((1) to (5)) are included in "AC Dynamo Kit"]

Fig. N-99 Wiring AC Dynamo and Regulator

Connect the wire harness (3) with AC dynamo assembly (1) and regulator (2). Remove bolt (6). Then install cord clamp (5) and ground wire (4) with bolt (6). Fix the wire harness (3) with cord clamp (5). After that, pass the another end of wire harness (3) under the battery bracket (7).

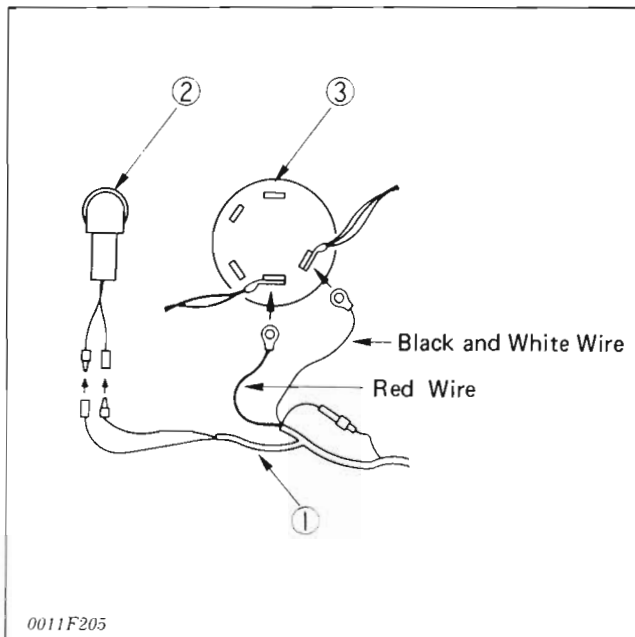
(9) Installing Charge Lamp



- | | | |
|-------------------------|---------|----------|
| 1. Charge Lamp Assembly | 2. Plug | 3. Panel |
|-------------------------|---------|----------|
- [Charge lamp assembly is included in the "AC Dynamo Kit".]

Fig. N-100 Installing Charge Lamp

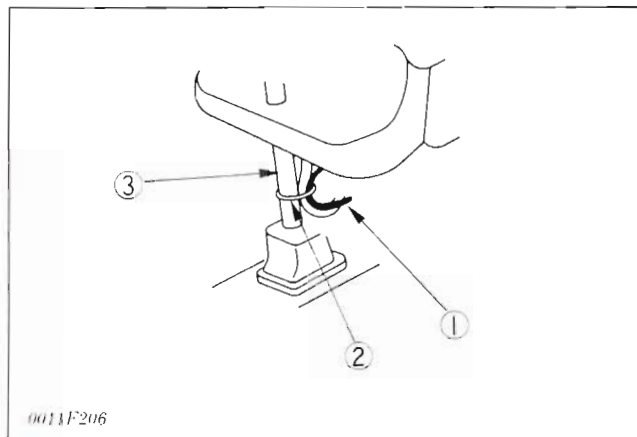
After removing plug (2) from panel (3), install the charge lamp assembly (1) as shown in Fig. N-100.

(10) Wiring of Key Switch and Charge Lamp

1. Wire Harness 3. Key Switch
2. Charge Lamp Assembly

Fig. N-101 Wiring of Key Switch and Charge Lamp

Connect the wire harness (1) to key switch (3) and charge lamp (2) as shown in Fig. N-101.

(11) Securing Wire Harness to Steering Post

1. Wire Harness 2. Band 3. Steering Post

Fig. N-102 Securing Wire Harness to Steering Post

Secure the wire harness (1) to steering post (3) with band (2), Fig. N-102.

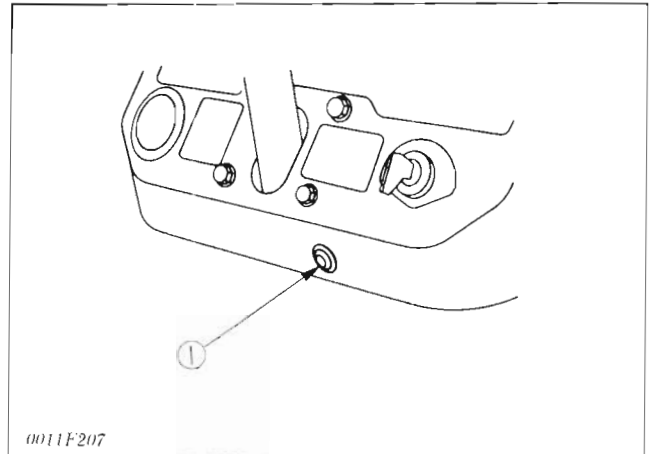
Reassembling Exterior Parts

Place the battery on the battery bracket. Install the side cover RH and air cleaner assembly.

Install the fan and radiator, and connect the water pipes.

Attach the bonnet (hood).

Fill the radiator with water.

Checking Operation

1. Charge Lamp

Fig. N-103 Checking Operation

Make sure the charge lamp (1) lights when key is turned to "ON".

Make sure the charge lamp (1) goes off when the engine starts.

Group 9

Specifications

(R.V.) Reference Value

(A.L.) Allowable Limit

Battery

Specific gravity of electrolyte at 20°C (68°F)

100% charged 1.280

50% charged 1.210

Discharged. 1.120

Weight without electrolyte 9 kg

Weight with electrolyte 12.5 kg

Handling of Dry Battery

Specific gravity of 1.28 to 1.20 (at 20°C,

68°F) after resupplying electrolyte

(19.8 lbs.)

(27.6 lbs.)

Glow Plug

Resistance 1.35 to 1.65 ohm

Glow Indicator (Lamp)

Allowable current 20A, 10V

AC Dynamo

Output current

Nominal 10A, 12V

Actual 8.5A, 14V/4250 rpm

Rotor coil total resistance 0.18 ohm at 25°C (77°F)

Revolution of charging start 1800 rpm

Regulator

No-load regulating voltage 14.0 to 15.0V

Starter

Number of teeth

Pinion 9

Ring gear. 98

No-load test

Voltage at 11V

Current 50A or less

Speed 5000 rpm or more

Commutator O.D.

(R.V.) 28.0 mm (1.1024 in.)

(A.L.) 27.0 mm (1.0630 in.)

Mica undercutting

(R.V.) 0.5 to 0.8 mm (0.0197 to 0.0315 in.)

(A.L.) 0.2 mm (0.0079 in.)

Brush

Length.....(R.V.)	16 mm	(0.6299 in.)	more
(A.L.)	10.5 mm	(0.4134 in.)	
Width	12 mm	(0.4724 in.)	
Thickness	7 mm	(0.2756 in.)	

Safety Switch

Allowable current	15A, 12V	
Stroke	10 mm	(25/64 in.)
Stroke till switch on	2 mm	(5/64 in.)

Hourmeter Electrical type

Lighting Switch

Allowable current	5A, 12V
-------------------------	---------

Dual Beam Headlight Bulbs

Power consumption.....	15W, 12V
------------------------	----------

Hazard Unit

Allowable current	43W, 12V
Cycle.....	60 to 85 C/Min.
Operating voltage	10 to 14V
Bulbs power consumption.....	15W, 12V

Horn (Option)

Power consumption.....	18W, 12V
------------------------	----------

Horn Button (Option)

Allowable current	3A	
Stroke.....	1.5 mm	(1/16 in.)

High Power Dynamo Kit (Option)

AC Dynamo		
Nominal output.....	12V, 35A, 420W	
Regulator		
No-load regulating voltage.....	13.7 to 14.7V	

WORKSHOP MANUAL INTRODUCTION

INTRODUCTION AU MANUEL D'ATELIER

EINFÜHRUNG WERKSTATTANLEITUNG

The following Workshop Manuals are available through your local Kubota Distributor.

- NOTE**
- Letters in parentheses after the code numbers represent the language used for the manuals. (e: English, f: French, d: German, a: Arabic)
 - * Engine section included.

Les manuels d'atelier suivants sont disponibles chez votre fournisseur local KUBOTA.

- NOTA**
- Les lettres entre parenthèses, après les numéros de référence, représentent la langue dans laquelle est écrit le manuel. (e: Anglais, f: Français, d: Allemand, a: Arabe)
 - * Comprend la partie du moteur.

Die folgenden Werkstattanleitungen stehen bei Ihrem örtlichen KUBOTA-Händler zur Verfügung:

- ANMERKUNG**
- Die nach den Code-Nr. angegebenen Buchstaben weisen auf die Sprache der Handbücher hin. (z.B.: e: Englisch, f: Französisch, d: Deutsch, a: Arabisch)
 - * Der Motorteil ist enthalten.

[Tractor] [Tracteur] [Traktor]

* B5100-B6100-B7100.....	Code No. 07909-70010-9 (e,f)	* L3750-L4150.....	Code No. 07909-60331-0 (For France) (f)
* B5100-6100-B7100.....	Code No. 07909-60325-0 (s)	* L3750-L4150.....	Code No. 07909-60335-0 (For Canada) (f)
B7100HST.....	Code No. 07909-70303-0 (For Europe) (e,f)	* L2250-L2550-L2850.....	Code No. 07909-60329-1 (e)
* B7100HST-B6100HST.....	Code No. 07909-70306-4 (For U.S.A.) (e)	* L2250-L2550-L2850.....	Code No. 07909-60336-0 (For France) (f)
* B5200-B6200-B7200.....	Code No. 07909-70319-1 (B6200HST-B7200HST) (e)	* L2250-L2550-L2850.....	Code No. 07909-60337-0 (For Canada) (f)
* B5200-B6200-B7200.....	Code No. 07909-70323-0 (B6200HST-B7200HST) (f)	M4500-M5500.....	Code No. 07909-70030-6 (M6500-M7500) (e)
B8200(Including BF300).....	Code No. 07909-70302-1 (e,f)	M4500-M5500.....	Code No. 07909-70309-0 (M7500(A/AC Type)) (e)
BF300.....	Code No. 07909-70701-1 (e,f)	M4500-M5500.....	Code No. 07909-70322-0 (M7500(A/AC Type)) (s)
B8200HST.....	Code No. 07909-70320-0 (e,f)	M4950-M5950 N6950-M7950 (For U.S.A.).....	Code No. 07909-70310-0 (e)
* L185-L245-L295.....	Code No. 07909-70020-9 (e,f)	(For Canada).....	Code No. 07909-70311-1 (e)
* L185-L245-L295.....	Code No. 07909-70020-0 (s)	(For Canada).....	Code No. 07909-60333-0 (f)
L245H.....	Code No. 07909-70021-2 (e,f)	(For Oceania).....	Code No. 07909-70312-0 (e)
* L175-L225.....	Code No. 07909-70022-0 (e,f)	(For North Europe).....	Code No. 07909-70318-0 (e)
L345-L345-II.....	Code No. 07909-70023-2 (e,f)		
L235-L275.....	Code No. 07909-70301-1 (e,f)	* M8950.....	Code No. 07909-60326-0 (e)
L355SS.....	Code No. 07909-70305-0 (e,f)	* M8950.....	Code No. 07909-60334-0 (For Canada) (f)
L405.....	Code No. 07909-70313-0 (e)	* M4030-M5030-M6030.....	Code No. 07909-60338-0 (M7030-M8030) (e)
* L3350-L3750-L4150.....	Code No. 07909-70321-4 (e)	IC69-79 89.....	Code No. 07909-60322-0 (INTEGRAL CABIN) (e)

[Tiller, Power Tiller] [Motoculteur] [Einachsschlepper]

T120-T320-T420.....	Code No. 07909-70080-0 (e,f)	* AT55.....	Code No. 07909-60602-0 (e)
T420C-T620-T720.....			
T250-T350.....	Code No. 07909-70081-0 (e,f)	* AT70S.....	Code No. 07909-60603-0 (e)
T450-T550-T650-T750.....	Code No. 07909-70082-0 (e,f,d)	* TF40-TF45-TF55.....	Code No. 07909-60604-0 (f)
* AT25.....	Code No. 07909-60601-0 (e)	K75M-K75R-K80M.....	Code No. 07909-70100-0 (e)
		K80MB-K80R.....	

[Others] [Autres] [Anderes]

G SERIES.....	Code No. 07909-70314-0 (For U.S.A.) (e,f)	SERIES KGP-SERIES KDP.....	Code No. 07909-70124-0 (f)
G SERIES.....	Code No. 07909-70315-0 (For Europe) (e,f)	SERIES KDP-S-SERIES KTP.....	
KGP SERIES-KDP SERIES.....	Code No. 07909-70111-2 (e)	KGP-D30.....	Code No. 07909-60140-0 (e)
KDP-S SERIES-KTP SERIES.....		KHP-2000-KHP-3000.....	Code No. 07909-60131-0 (e)

[Diesel Engine] [Moteur diesel] [Dieselmotoren]

Z751-B-Z851-B.....	Code No. 07909-70070-3 (e)	GA-ER-KND-ET-EA SERIES.....	Code No. 07909-70090-3 (e)
DH1101-B-D1301-B.....			
V1501-B-V1701-B.....		ER650DI SERIES.....	Code No. 07909-70114-0 (e)
S2200-B-S2600-B.....		ER750DI SERIES.....	
D1102-B-D1302-B-D1402-B.....	Code No. 07909-70073-4 (e,f,d)	ER850DI SERIES.....	
V1502-B-V1702-B-V1902-B.....		ER950DI SERIES.....	
D650-B-D750-B-D850-B.....	Code No. 07909-70076-5 (e,f,d)	ZB500C-1-B-ZB600C-1-B.....	Code No. 07909-70075-1 (e,f,d)
DH850-B-D950-B.....			
Z500-B-Z600-B-ZH600-B.....	Code No. 07909-70101-5 (e,f,d)	ER1200 SERIES-KND1200.....	Code No. 07909-70105-2 (e,f)
		ER1400 SERIES.....	
Z751-B-Z851-B.....	Code No. 07909-70102-1 (e,f,d)	ER1500 SERIES-KND1500.....	Code No. 07909-70106-2 (e,f)
		ER1700DI SERIES-KND1700DI.....	
D3000-B-D3200-B.....	Code No. 07909-70103-4 (e,f,d)	ER1900DI SERIES-KND1900DI.....	
V4000-B-V4300-B.....		ER2200DI SERIES-KND2200DI.....	
V4300-T TURBOCHARGER.....	Code No. 07909-70113-0 (e)	KND2800-KND3200.....	Code No. 07909-70104-1 (e,a)
V1100-B-VH1100-B-V1200-B.....	Code No. 07909-70107-2 (e,f,d)	EA300 SERIES.....	Code No. 07909-60132-0 (e,f,d)
		EA400 SERIES.....	
S2200-B-S2600-B-S2800-B.....	Code No. 07909-70108-1 (e,f,d)	RK50 SERIES-RK60 SERIES.....	Code No. 07909-60133-0 (e)
		RK70 SERIES-RK80 SERIES.....	
Z400-B-Z430-B-D600-B.....	Code No. 07909-70109-1 (e,f,d)	RK95 SERIES-RK105 SERIES.....	
D640-B-V800-B.....		RK125 SERIES.....	

[Gasoline Engine] [Moteur à essence] [Benzinmotoren]

GS130-GS160-GS200-GS280.....	Code No. 07909-70074-2 (e,f,d)
GN2900-H-GN4000-H.....	
GS160-3 SERIES.....	Code No. 07909-70117-0 (e,f,d)
GS200-3 SERIES.....	

[Kerosene Engine] [Moteur à kérozène] [Kerosinmotoren]

KS160-KS200-KS300.....	Code No. 07909-60129-0 (e)
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[Generator] [Générateur] [Stromerzeuger]

A450(A400)-A1000(A800).....	Code No. 07909-70110-0	* GV-3150-50-B.....	Code No. 07909-60141-0
A1400(A1200)-A2100(A1800)	(e)	GV-3170-60-B.....	(e)
A3000(A2500)-A3500(A3050)			
G-3100S.....	Code No. 07909-70123-0	* GV-3150-50-B.....	Code No. 07909-60142-0
	(e)	GV-3170-60-B.....	(a)
G-8500SD.....	Code No. 07909-70125-0	* A4300-A4300(B).....	Code No. 07909-60143-0
	(e)		(c)
* A4300(B)-A5000(B).....	Code No. 07909-60130-0	* A2200(U.S.A.).....	Code No. 07909-60144-0
	(e)	A2200X(U.S.A.).....	(e)
* A4300-3-220-FR.....	Code No. 07909-60134-0	* A3000(U.S.A.).....	Code No. 07909-60145-0
A4300B-3-220-FR.....	(f)	A3200-A3200X(U.S.A.).....	(e)
		A3500-A3500X.....	
* A3700K(B).....	Code No. 07909-60135-0	* A800-3-A1200-3.....	Code No. 07909-60148-0
	(e)		(c)
* A3700K(B).....	Code No. 07909-60135-0	* G5500S.....	Code No. 07909-60149-0
	(a)		(e)
* A500(U.S.A.).....	Code No. 07909-60137-0	* NA500-NA600.....	Code No. 07909-60151-0
A650(U.S.A.).....	(e)		(c)
* ASK SERIES.....	Code No. 07909-60138-0		
	(e)		

[Welder] [Machine à souder] [Schweißer]

FS-200(B)-FS-250(B).....	Code No. 07909-60146-0	FS-150.....	Code No. 07909-60147-0
	(e)		(e)

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