⚠ SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and decals on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.
It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.

⚠ **DANGER** : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION** : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

■ **IMPORTANT** : Indicates that equipment or property damage could result if instructions are not followed.

■ **NOTE** : Gives helpful information.

SAFETY SERVICING AND REPAIRING

(1) Before working on the machine :
- Park the machine on a firm and level ground, and set the parking brake.
- Lower the implement or mower to the ground.
- Stop the engine, and remove the key.
- Disconnect the battery's ground cable.
- Clean the work area and machine.

(2) Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.

(3) Do not wear a necktie, scarf, necklace, loose or bulky clothing when you work near machine tools or moving parts.

(4) Use tools appropriate to the work. Makeshift tools, parts, and procedures will not make good repairs.

(5) When servicing is performed together by two or more persons, take care to perform all work safely.

(6) Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.

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[1] WIRING DIAGRAM

• Main Switch

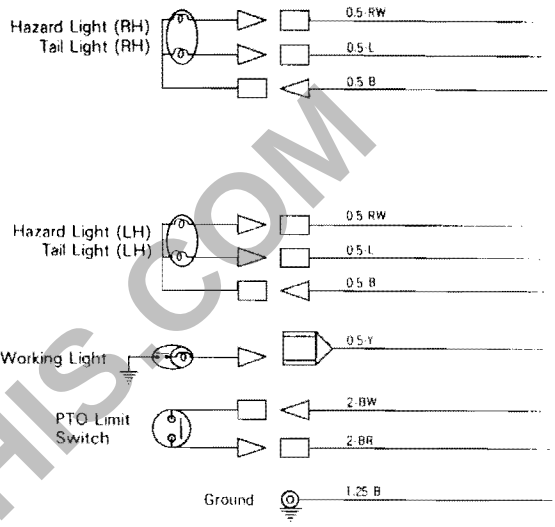
Terminal / Key Position	B	AC	ST	G
OFF	●			
ON	●	●		
START	●	●	●	●

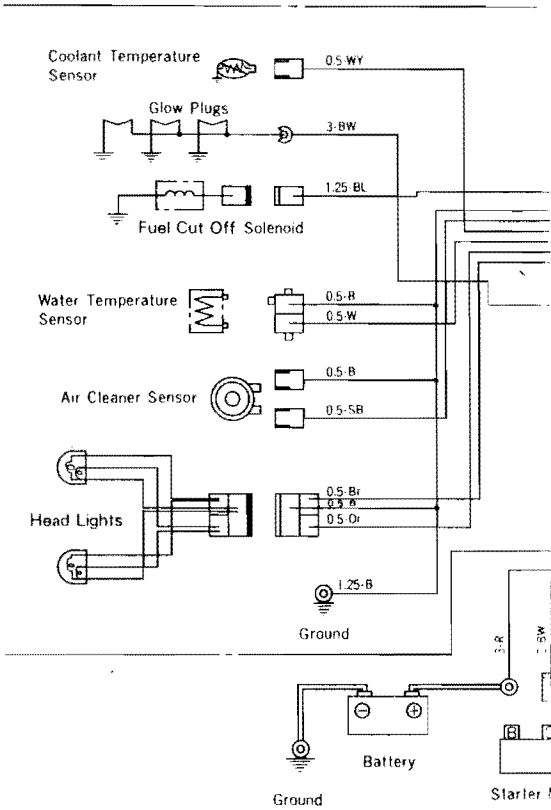
• Combination Switch

Head Light Switch					Hazard Light Switch			
	B1	T	1	2		B2	R	L
OFF	●				OFF	●		
HIGH	●	●	●		ON	●	●	
LOW	●	●		●				

• Color of Wiring

W ---------- White	WR ---------- White / Red
R ---------- Red	WY ---------- White / Yellow
L ---------- Blue	RW ---------- Red / White
Y ---------- Yellow	RL ---------- Red / Blue
B ---------- Black	RY ---------- Red / Yellow
G ---------- Green	BW ---------- Black / White
Br ---------- Brown	BL ---------- Black / Blue
Or ---------- Orange	BR ---------- Black / Red
SB ---------- Sky Blue	LY ---------- Blue / Yellow
WG ---------- White / Green	YG ---------- Yellow / Green
WB ---------- White / Black	



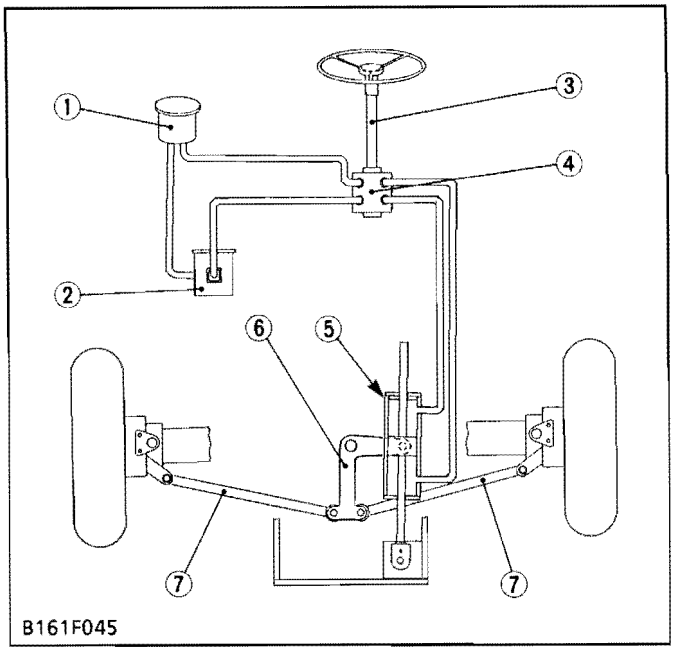


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[1] FEATURES



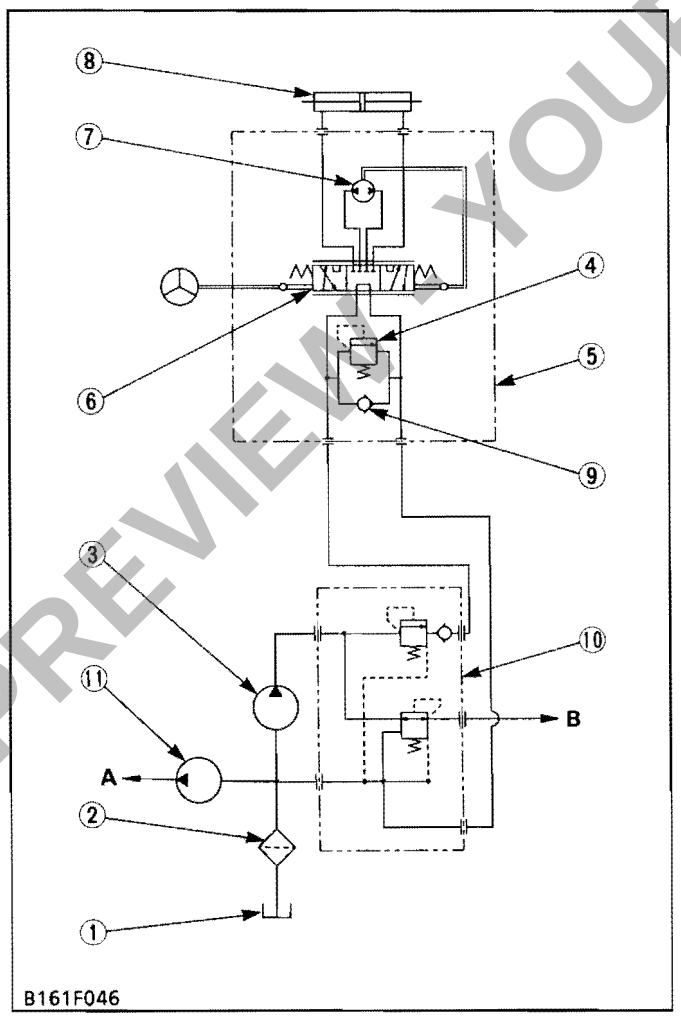
These tractors are provided with a hydrostatic power steering. The steering controller is connected to the steering cylinder with the hydraulic pipes only.

This steering is actuated by oil pressure. Accordingly, it does not have mechanical transmitting parts such as steering gear, drag link, etc.

Therefore, it is simple in construction. In these models, the non-road reaction type is used. With this type, the wheels maintain their position when the operator releases his hands from the steering wheel. Vibration at the wheels is not transmitted to the steering wheel.

(1) Transmission Case
(2) Hydraulic Pump
(3) Steering Joint
(4) Steering Controller
(5) Steering Cylinder
(6) Pitman Arm
(7) Tie-rod

[2] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM



■ Hydraulic Oil Flow

1. Power steering hydraulic pump (3), driven by the engine, sucks oil from transmission case (1), and it to steering controller (5) through the regulator valve (10).
2. The oil which has entered steering controller (5) is directed to control valve (6). As the steering wheel is turned, control valve (6) operates, and the oil passes through gerotor (7) and into steering cylinder (8). The cylinder rod then moves to control the directional movement of the front wheels.
3. Return oil from steering cylinder (8) passes through control valve (6) and back into transmission case (1).
4. When the engine is not operating, and the steering wheel is turned, gerotor (7) rotates to supply oil in the pipe to steering cylinder (8). Thus the machine can be steered manually. Under this condition, check valve (9) opens, and oil returning from the steering cylinder, which would otherwise return to transmission case (1), flows to the pipe leading to the hydraulic pump.

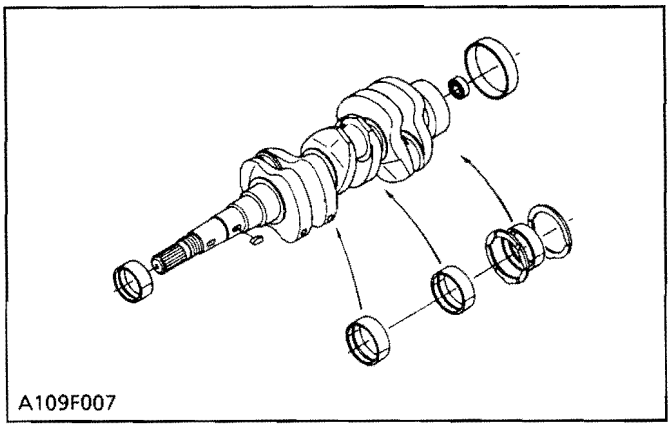
A : To Three Point Hydraulic System
B : To GST System

(1) Transmission Case
(2) Oil Filter
(3) Power Steering Hydraulic Pump
(4) Relief Valve
(5) Steering Controller
(6) Control Valve
(7) Gerotor
(8) Steering Cylinder
(9) Check Valve
(10) Regulator Valve
(11) Three Point System Hydraulic Pump

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(3) Crankshaft


A109F007

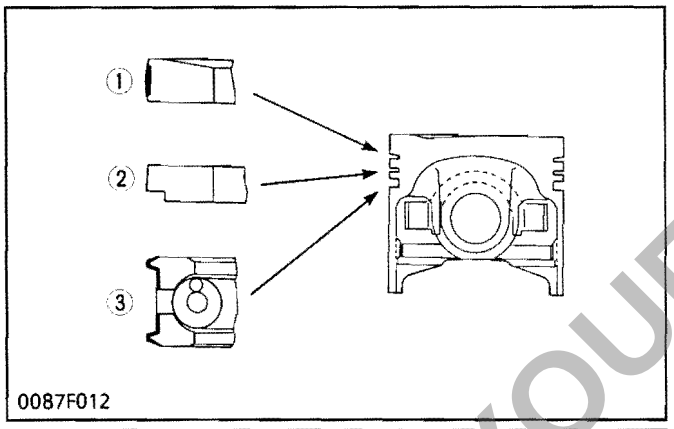
The crankshaft with the connecting rod converts the reciprocating motion of the piston into the rotating motion.

The crankshaft is made of tough special alloy steel, and the journals, pins and oil seal sliding portions are induction hardened to increase the hardness for higher wear resistance.

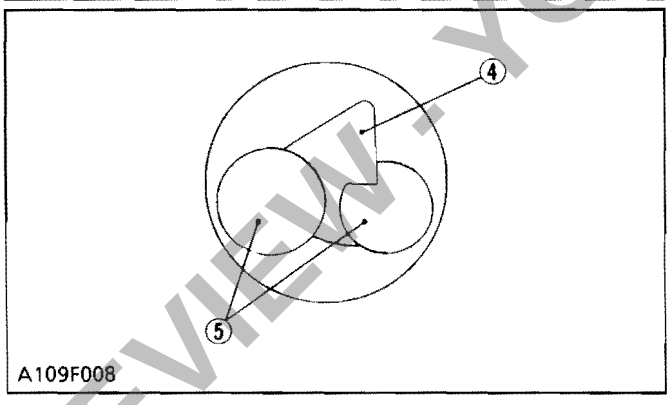
The front journal is supported by a solid type bearing, the intermediate journal by a split type, and the rear journal by a split type with thrust bearings.

The crankshaft is provided with an oil gallery, through which engine oil is fed to the crank pin portion, and lubricates it.

(4) Piston and Piston Rings



0087F012



A109F008

The piston has a slightly oval shape when cold (in consideration of thermal expansion) and a concave head.

Three rings are installed in grooves in the piston.

The top ring (1) is a keystone type, which can stand against heavy loads, and the barrel face on the ring fits well to the cylinder wall.

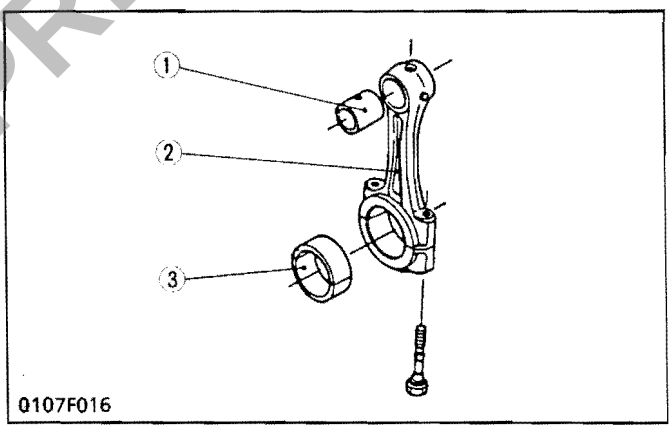
The second ring (2) is an undercut type, which effectively prevents the oil from being carried up.

The oil ring (3) has chamfered contact faces and an expander ring, which increase the pressure of the oil ring against the cylinder wall.

Several grooves are cut on the topland to help heat dissipate and to prevent scuffing.

(1) Top Ring
(2) Second Ring
(3) Oil Ring
(4) Depression
(5) Valve Recess

(5) Connecting Rod



0107F016

Connecting rod (2) is used to connect the piston with the crankshaft. The big end of the connecting rod has a crank pin bearing (3) (split type) and the small end has a small end bushing (1) (solid type).

(1) Small End Bushing
(2) Connecting Rod
(3) Crank pin Bearing

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[6] TIGHTENING TORQUES (GENERAL USE SCREWS, BOLTS AND NUTS)

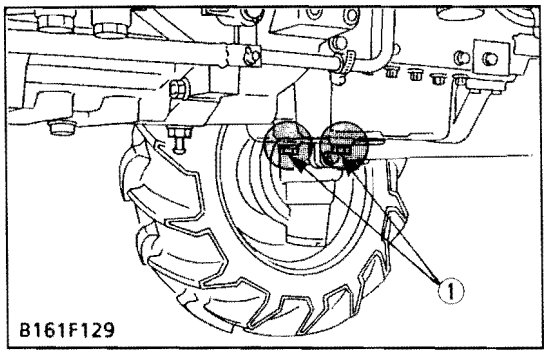
Screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

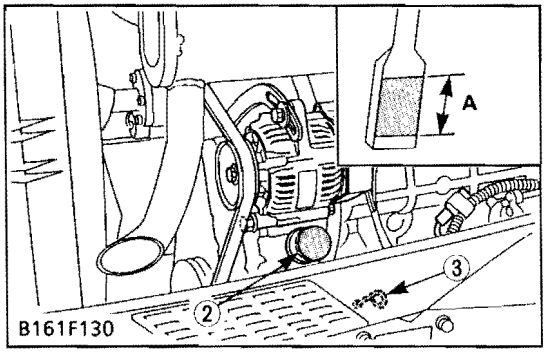
Indication on top of bolt	⟨4⟩ No-grade or 4T						⟨7⟩ 7T						⟨9⟩ 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M 6 (6 mm, 0.24 in.)	7.84 to 9.31	0.80 to 0.95	5.79 to 6.87	7.84 to 8.83	0.80 to 0.90	5.79 to 6.51	9.80 to 11.2	1.00 to 1.15	7.24 to 8.32	7.84 to 8.83	0.80 to 0.90	5.79 to 6.51	12.3 to 14.2	1.25 to 1.45	9.05 to 10.5
M 8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2	16.7 to 19.6	1.7 to 2.0	12.3 to 14.5	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.2 to 45.0	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.1 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5				77.5 to 90.1	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	103 to 117	10.5 to 12.0	76.0 to 86.8
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5				124 to 147	12.6 to 15.0	91.2 to 108				167 to 196	17.0 to 20.0	123 to 144
M16 (16mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141				196 to 225	20.0 to 23.0	145 to 166				260 to 303	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	245 to 284	25.0 to 29.0	181 to 210				275 to 318	28.0 to 32.5	203 to 235				343 to 401	35.0 to 41.0	254 to 297
M20 (20mm, 0.79 in.)	334 to 392	34.0 to 40.0	246 to 289				368 to 431	37.5 to 44.0	272 to 318				490 to 568	50.0 to 58.0	362 to 420

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(2) Check Points of Initial 50 Hours





Changing Engine Oil

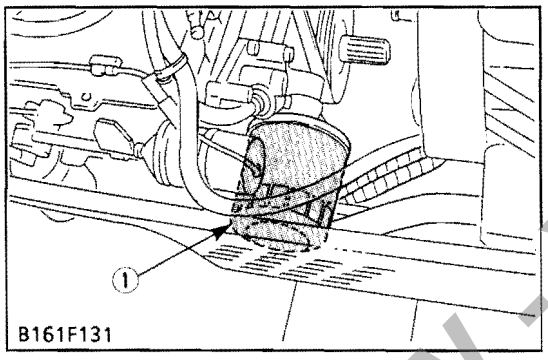
1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. To drain the used oil, remove the drain plugs (1) at the bottom of the engine and drain the oil completely.
4. Screw in the drain plug.
5. Fill new oil up to upper line on the dipstick.

■ IMPORTANT

- **When using an oil of different manufacture or viscosity from the previous one, remove all of the old oil. Never mix two different types of oil.**
- **Use the proper SAE Engine Oil according to ambient temperatures. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)**

[A] Oil level is acceptable within this range.

(1) Drain Plug
(2) Oil Inlet Plug
(3) Dipstick



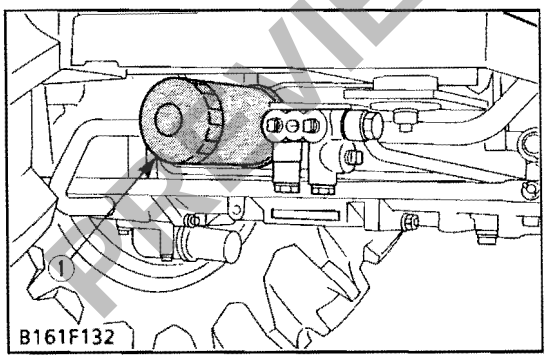
(1) Engine Oil Filter Cartridge

Replacing Engine Oil Filter Cartridge

1. Remove the engine oil filter cartridge (1).
2. When installing, apply the clean engine oil slightly to the rubber gasket.
3. Tighten the filter cartridge (1) quickly until it contacts the mounting surface. Tighten filter cartridge (1) by hand an additional 1/2 turn only.
4. After the new cartridge has been replaced the engine oil level normally decreases a little. Add engine oil to proper level. Check for oil leaks around filter gasket.

■ IMPORTANT

- **To prevent serious damage to the engine, replacement oil filter cartridge must be highly efficient. Use only a genuine KUBOTA filter.**



(1) Hydraulic Oil Filter Cartridge

Replacing Hydraulic Oil Filter Cartridge

1. Remove the hydraulic oil filter cartridge (1).
2. When installing, apply the clean transmission oil slightly to the rubber gasket.
3. Tighten the hydraulic oil filter cartridge (1) quickly until it contacts the mounting surface. Tighten hydraulic oil filter cartridge (1) by hand an additional 1/2 turn only.
4. After the new cartridge has been replaced, the transmission fluid level normally decreases a little. Add KUBOTA SUPER UDT fluid to proper level. Check for oil leaks around filter gasket.

■ IMPORTANT

- **To prevent serious damage to the hydraulic system, replacement oil filter cartridge must be highly efficient. Use only a genuine KUBOTA filter.**

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	• No fuel	Replenish fuel	–
	• Air in the fuel system	Bleed	G-24
	• Water in the fuel system	Change fuel and repair or replace fuel system	–
	• Fuel pipe clogged	Clean	–
	• Fuel filter clogged	Change	G-20
	• Excessively high viscosity of fuel or engine oil at low temperature	Use the specified fuel or engine oil	G-8
	• Fuel with low cetane number	Use the specified fuel	G-8
	• Fuel leak due to loose injection pipe retaining nut	Tighten nut	1-S17
	• Incorrect injection timing	Adjust	1-S45
	• Fuel camshaft worn	Replace	1-S28
	• Injection nozzle clogged	Clean	1-S46, S47
	• Injection pump malfunctioning	Repair or replace	1-S26, S47
	• Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	• Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S15
	• Improper valve timing	Correct or replace timing gear	1-S28
	• Piston ring and cylinder worn	Replace	1-S36, S41
	• Excessive valve clearance	Adjust	1-S16
Starter Does Not Run	• Battery discharged	Charge	9-S7
	• Starter malfunctioning	Repair or replace	9-S11 to S14
	• Main switch malfunctioning	Repair or replace	9-S8, S9
	• Shuttle limit switch or PTO limit switch improperly adjusted or defective	Repair ro replace	9-S9
	• Starter relay defective	Replace	9-S9
	• Wiring disconnected	Connect	9-M1, M2
Engine Revolution Is Not Smooth	• Fuel filter clogged or dirty	Change	G-20
	• Air cleaner clogged	Clean or change	G-17
	• Fuel leak due to loose injection pipe retaining nut	Tighten nut	1-S17
	• Injection pump malfunctioning	Repair or replace	1-S26, S47
	• Incorrect nozzle injection pressure	Adjust	1-S46
	• Injection nozzle stuck or clogged	Repair or replace	1-S17, S47
	• Governor malfunctioning	Repair	1-S26, S28
Either White or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to the specified level	1-S10
	• Piston ring and cylinder worn or stuck	Repair or replace	1-S36, S41
	• Incorrect injection timing	Adjust	1-S45
	• Deficient compression	Adjust top clearance	1-S15
Either Black or Dark Gray Exhaust Gas Is Observed	• Overload	Lessen the load	–
	• Low grade fuel used	Use the specified fuel	G-8
	• Fuel filter clogged	Change	G-20
	• Air cleaner clogged	Clean or change	G-17
	• Deficient nozzle injection	Repair or replace the nozzle	1-S17, S47

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SPECIFICATIONS

Model			L2900		
			2WD	4WD	4WD-GST
Maximum PTO power			18.7 kW (25.0 HP)*		
Engine NET power			22.2 kW (29.7 HP)*		
Engine	Model		D1503-L- A		
	Type		Indirect injection, Vertical, Water-Cooled, 4-cycle diesel engine		
	Number of cylinders		3		
	Bore and stroke		83 × 92.4 mm (3.3 × 3.6 in.)		
	Total displacement		1499 cm³ (91.5 cu.in.)		
	Rated revolution		45.0 r/s (2700 rpm)		
	Combustion chamber		Spherical type (E-TVCS)		
	Fuel injection pump		Bosch type mini pump (PFR3M)		
	Governor		Centrifugal ball mechanical governor		
	Injection nozzle		Throttle type		
	Injection timing		Before T.D.C. 0.314 rad (18°)		
	Injection order		1-2-3		
	Injection pressure		13.73 MPa (140 kgf/cm², 1991 psi)		
	Compression ratio		23 : 1		
	Lubricating system		Forced lubrication by trochoidal pump		
	Cooling system		Pressurized radiator, Forced circulation with water pump		
	Starting system		Electric starting with cell starter 12 V, 1.2 kW		
	Alternator		12 V, 480 W (40 AMPS)		
	Battery		490- Cold cranking Amps at –18 °C (– 0.4 °F)		
	Fuel		Diesel fuel No. 1 [below – 10 °C (14 °F)] Diesel fuel No. 2 [above – 10 °C (14 °F)]		
	Lubricating oil		CC or CD (API grade)		
	Weight (Dry)		176 kg (388 lbs)		
Capacities	Fuel tank		35.0 ℓ (9.2 U.S.gals., 7.7 Imp.gals.)		
	Engine crankcase		3.5 ℓ (3.7 U.S.qts., 3.1 Imp.qts.)		
	Engine coolant		7.0 ℓ (7.4 U.S.qts., 6.2 Imp.qts.)		
	Transmission case		39.0 ℓ (10.3 U.S.gals., 8.6 Imp.gals.)		
	Front axle case		—	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)	
Dimensions with Std. tires)	Overall length (without 3P)		2820 mm (111.0 in.)		
	Overall length (with 3P)		3060 mm (120.5 in.)		
	Overall width (minimum tread)		1325 mm (52.2 in.)		
	Overall height (Top of ROPS)		2110 mm (83.1 in.)		
	Overall height (Top of steering wheel)		1515 mm (59.6 in.)		
	Wheel base		1675 mm (65.9 in.)	1670 mm (65.7 in.)	
	Min. ground clearance (Under transmission)		355 mm (14.0 in.)		
	Crop clearance		375 mm (14.8 in.)	380 mm (15.0 in.)	
	Tread	Front mm (in.)	960 (37.8), 1060 (41.7) 1160 (45.7), 1260 (49.6)	1105 (43.5)	
		Rear mm (in.)	1035 (40.7), 1120 (44.1), 1220 (48.0), 1305 (51.4), 1405 (55.3)		

Note : * Manufacturer's estimate

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[7] MAINTENANCE CHECK LIST

No.	Check point	Indication on hour meter (Change or check every interval shown below)																After purchase		Reference page
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	2 years	
1	Greasing	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-14
2	Engine starting system checking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-15
3	Wheel bolt torque checking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-16
4	Battery condition checking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-15
5	Engine oil changing	◎	○		○		○		○		○		○		○		○			G-12
6	Air cleaner element cleaning ★		○		○		○		○		○		○		○		○			G-17
7	Fuel filter element cleaning		○		○		○		○		○		○		○		○			G-17
8	Fan belt tension adjustment		○		○		○		○		○		○		○		○			G-18
9	Clutch pedal free travel adjustment		○		○		○		○		○		○		○		○			G-18
10	Brake pedal free travel adjustment		○		○		○		○		○		○		○		○			G-18
11	Engine oil filter cartridge replacement	◎			○				○				○				○			G-12
12	Hydraulic oil filter cartridge replacement	◎			○				○				○				○			G-12
13	Radiator hose and clamp checking				○				○				○				○			G-19
14	Power steering oil line checking				○				○				○				○			G-19
15	Fuel line checking				○				○				○				○			G-20
16	Toe-in adjustment				○				○				○				○			G-19
17	Transmission fluid changing	◎							○								○			G-13
18	Front axle case oil changing	◎							○								○			G-13
19	Front axle pivot adjustment	◎							○								○			G-14
20	Fuel filter element replacement								○								○			G-20
21	Greasing (2WD front wheel hub)								○								○			G-20
22	Engine valve clearance adjustment																○			G-21
23	Air cleaner element replacement																	○		G-22
24	Radiator hose and clamp replacement																		○	G-22
25	Power steering oil line replacement																		○	G-22
26	Fuel line replacement																		○	G-23

Note : The jobs indicated by ◎ must be done by all means 50 hours after the break-in respectively.
The jobs indicated by ☆ service as required.
★ Air cleaner should be cleaned more often in dusty conditions than in normal conditions.

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⑨ Part No. 35260-3491-3

⚠CAUTION 35260-34913⑨

TO AVOID PERSONAL INJURY:

1. Read and understand the operator's manual before operation.
2. Before starting the engine, make sure that everyone is at a safe distance from the tractor and that the PTO is OFF.
3. Do not allow passengers on the tractor at any time.
4. Before allowing other people to use the tractor, have them read the operator's manual.
5. Check the tightness of all nuts and bolts regularly.
6. Keep all shields in place and stay away from all moving parts.
7. Lock the two brake pedals together before driving on the road.
8. Slow down for turns, or rough roads, or when applying individual brakes.
9. On public roads use SMV emblem and hazard lights if required by local traffic and safety regulations.
10. Pull only from the drawbar.
11. Before dismounting, lower the implement, set the parking brake, stop the engine and remove the key.

⑪ Part No. TA040-4957-1
Stay clear of engine fan and fanbelt.

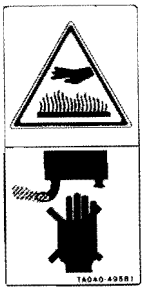


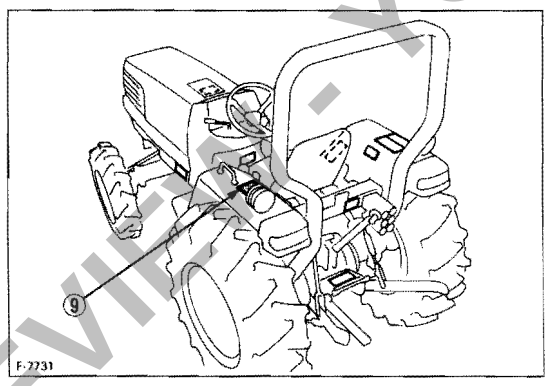
⑩ Part No. TA040-3015-1

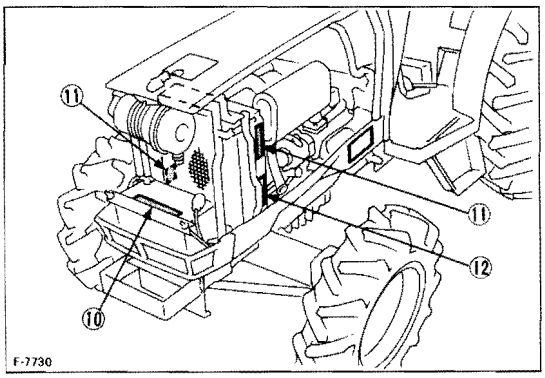
DANGER EXPLOSIVE GASES
Cigarettes, flames or sparks could cause battery to explode. Always shield eyes and face from battery. Do not charge or use booster cables or adjust post connections without proper instruction and training.
KEEP VENT CAPS TIGHT AND LEVEL

POISON CAUSES SEVERE BURNS
Contains sulfuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately.
KEEP OUT OF REACH OF CHILDREN A334

⑫ Part No. TA040-4958-1
Do not touch hot surface like muffer, etc.



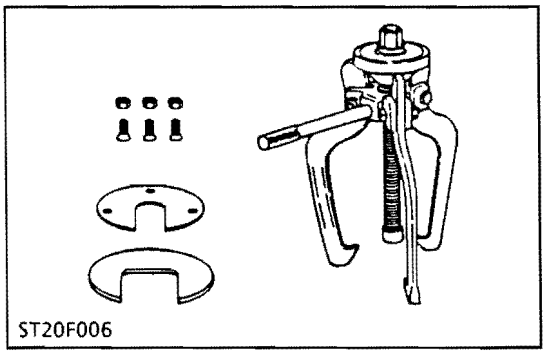




B161F002

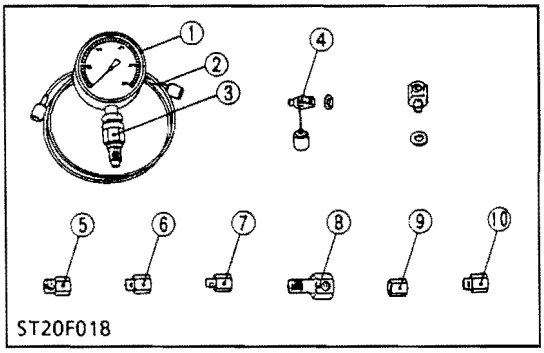
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ST20F006

Steering Wheel Puller

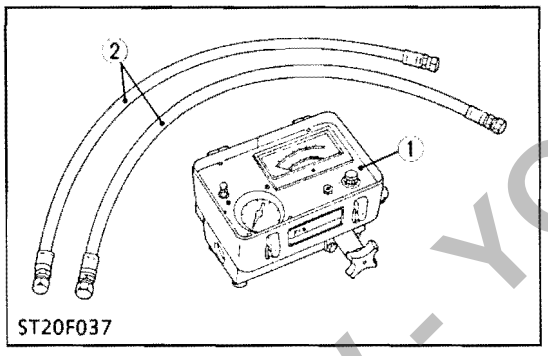
Code No : 07916-51090
Application : This allows easy removal of steering wheel without damaging steering shaft.


ST20F018

Relief Valve Pressure Tester

Code No : 07916-50045
Application : This allows easy measurement of relief set pressure for all tractor models.

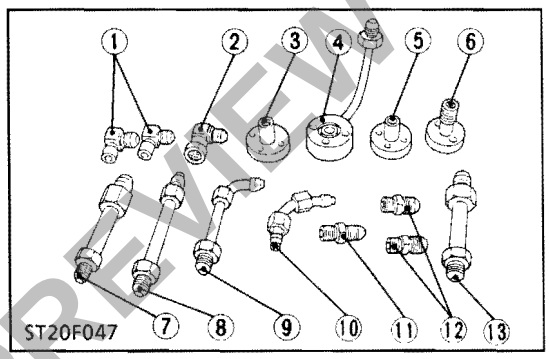
(1) Gauge (07916-50321)
(2) Cable (07916-50331)
(3) Threaded Joint (07916-50401)
(4) Threaded Joint (07916-50341)
(5) Adaptor **B** (M18 × P1.5) (07916-50361)
(6) Adaptor **C** (PS3/8) (07916-50371)
(7) Adaptor **D** (PT1/8) (07916-50381)
(8) Adaptor **E** (PS3/8) (07916-50392)
(9) Adaptor **F** (PF1/2) (07916-62601)
(10) Adaptor **58** (PT1/4) (07916-52391)


ST20F037

Flowmeter

Flowmeter Code No : 07916-52791
Hydraulic Test Hose Code No : 07916-52651 (1 pc.)
Application : This allows easy testing of hydraulic system.

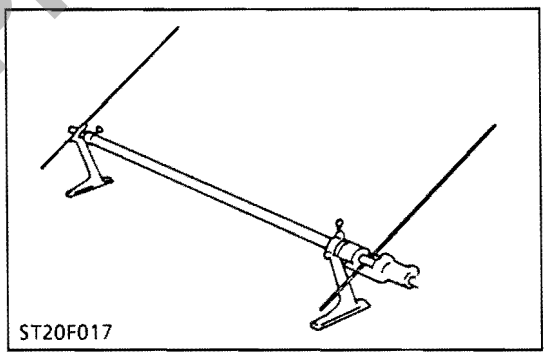
(1) Flow Meter
(2) Hydraulic Test Hose


ST20F047

Adaptor Set

Code No : 07916-54031
Application : Use for checking hydraulic pumps.

(1) Adaptor **52**
(2) Adaptor **53**
(3) Adaptor **54**
(4) Adaptor **61**
(5) Adaptor **62**
(6) Adaptor **63**
(7) Adaptor **64**
(8) Adaptor **65**
(9) Adaptor **66**
(10) Adaptor **67**
(11) Adaptor **68**
(12) Adaptor **69**
(13) Hydraulic Adaptor **1**


ST20F017

Toe-in Gauge

Code No : 07909-31681
Application : This allows easy measurement of toe-in for all tractor models.

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FUEL SYSTEM

Item		Factory Specification	Allowable Limit
Injection Pump	Injection Timing	0.30 to 0.33 rad. 17 to 19° before T.D.C.	–
Pump Element	Fuel Tightness	–	14.7 MPa 150 kgf/cm^2 2133 psi
Delivery Valve	Fuel Tightness	10 seconds or more for pressure falling from 14.7 to 13.7 MPa from 150 to 140 kgf/cm^2 from 2133 to 1990 psi	5 seconds for pressure falling from 14.7 to 13.7 MPa from 150 to 140 kgf/cm^2 from 2133 to 1990 psi
Injection Nozzle	Injection Pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm^2 1991 to 2133 psi	–
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130 kgf/cm^2 , 1849 psi), the valve seat must be fuel tightness.	–

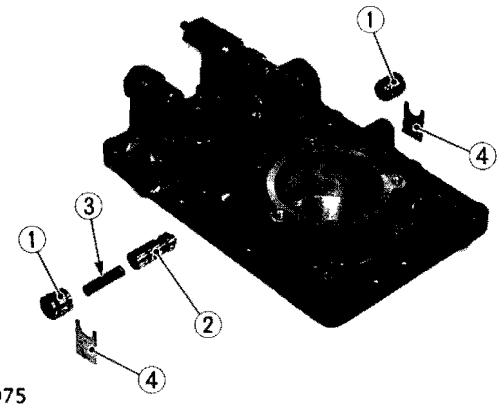
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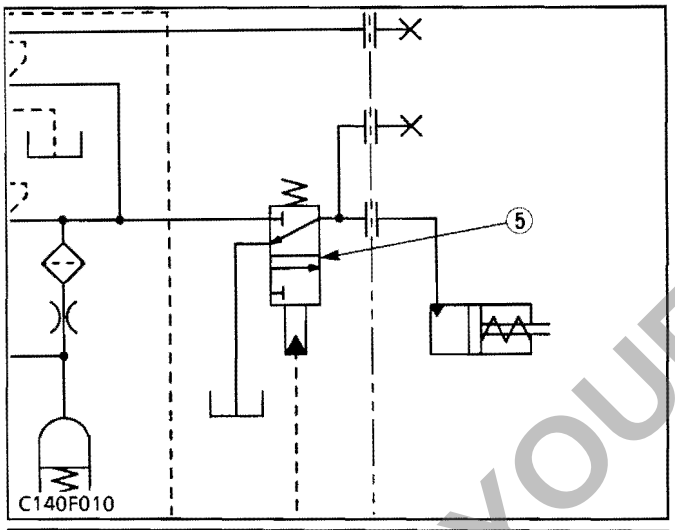
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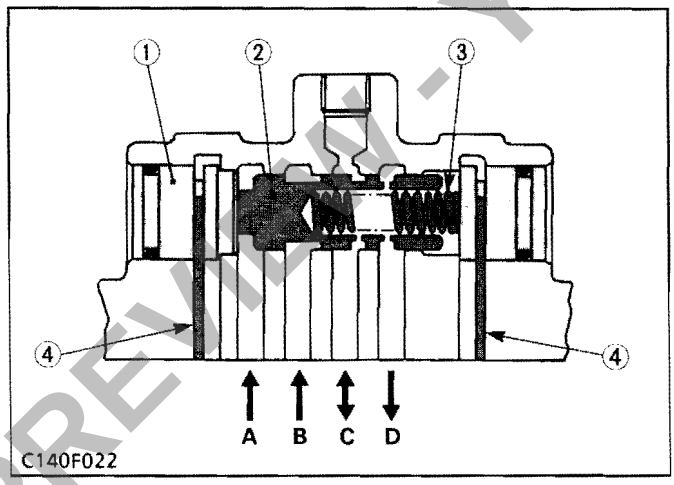
(4)-10 Clutch Valve



C143P075



C140F010



C140F022

■ Function

The clutch valve (5) changes the flow of the oil flowing to the clutch pack to carry out **"ENGAGED" / "DISENGAGED"** of the clutch pack.

■ Oil Flow

Except for the gear shifting, when the pilot circuit is pressurized, the oil of the pilot circuit flows in from the A-port to push the spool (2) to the right. Therefore, the oil from the modulate valve flows in from the B-port, flows out from the C-port, and flows to the clutch pack.

When the pilot circuit pressure is not built from the start to the end of gear shifting, the spool (2) is pushed to the left by the spring (3) to cut the oil flow from the modulate valve of the B-port, stopping the oil flow to the clutch pack.

Furthermore, the oil of the clutch pack flows in from the C-port, drained from the D-port, and the clutch pack is disengaged.

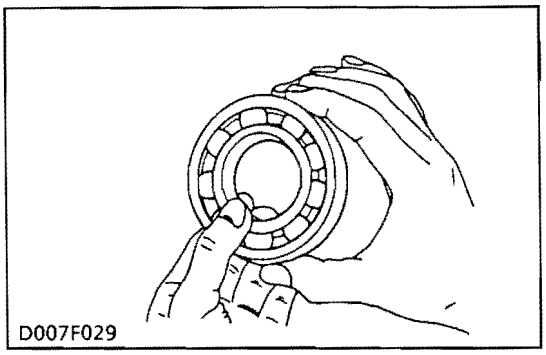
A : A-Port
From Pilot Circuit
B : B-Port
From Shift Piston H-L
C : C-Port
To Clutch Pack or From Clutch Pack
D : D-Port
To Tank

(1) Plug
(2) Spool
(3) Spring
(4) Stop Plate
(5) Clutch Valve

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SERVICING


D007F029

Checking Bearing

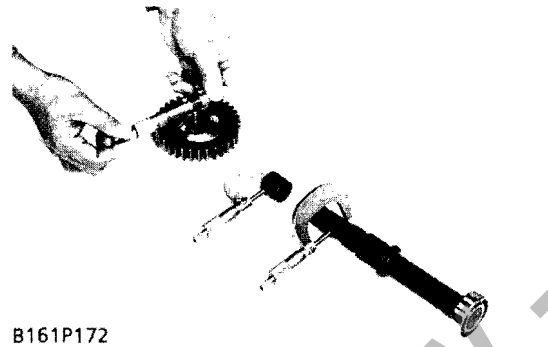
1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.


B161P121

Clearance between Shift Fork and Shifter Groove

1. Measure the width of shift fork.
2. Measure the shifter groove width, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.8 mm 0.031 in.


B161P172

Clearance between Gear and Shaft

1. Measure the shaft O.D. (rubbing surface).
2. Measure the gear I.D. (rubbing surface).
3. Measure the O.D. of the two needles installed diagonally in the needle bearing.
4. Calculate the clearance.
   (Clearance = Gear I.D. – {(2 × needle O.D.) + shaft O.D.})
5. If the clearance exceeds the allowable limit, replace them.

Clearance between gear and shaft	Factory spec.	0.021 to 0.054 mm 0.00083 to 0.00213 in.
	Allowable limit	0.1 mm 0.004 in.

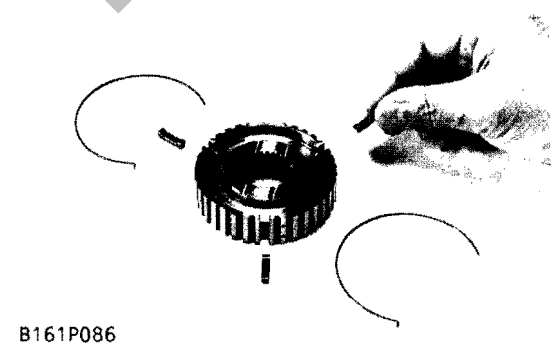
Checking Contact between Coupling and Shifter

1. Check to see if there is any flaw or wear on the spline of the coupling and shifter, and the key groove on the coupling.
2. Engage the shifter with the coupling, and check that they slide smoothly.
3. Similarly, check that there is any flaw or wear on the gear splines.
4. If there is any defect, replace them.


B161P085

Flaw on Synchronizer Key and Spring

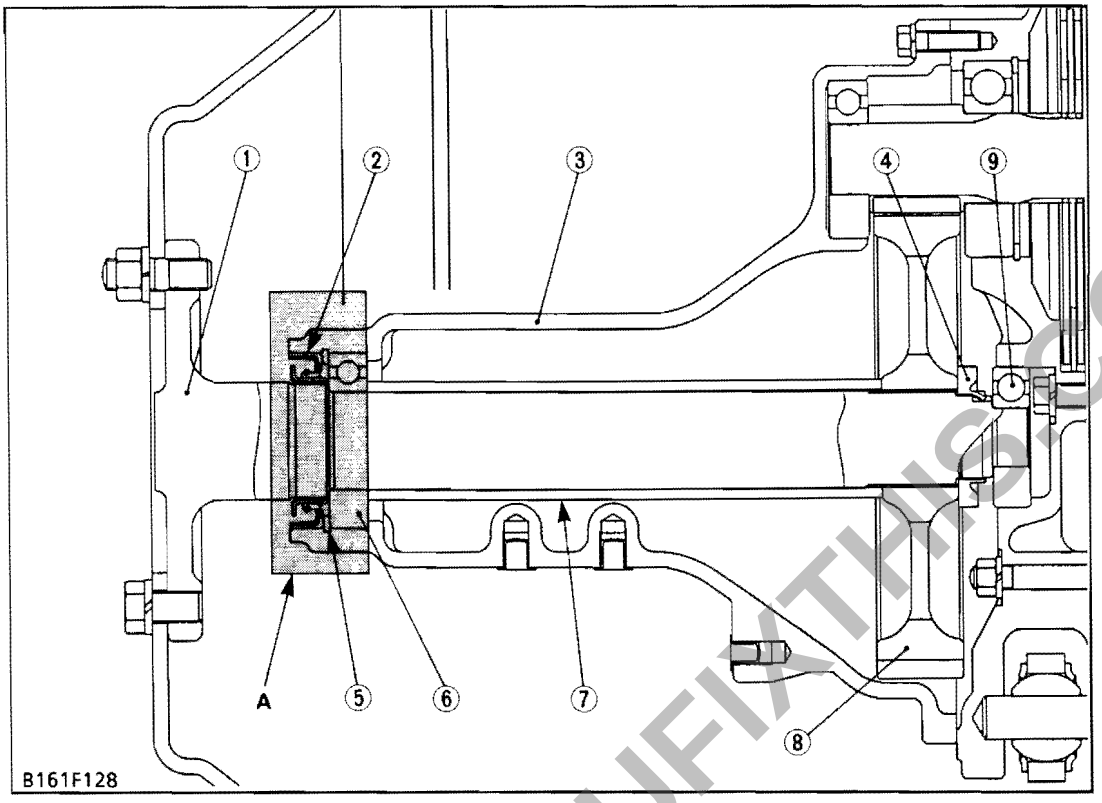
1. Check the projection in the center of the synchronizer key for wear.
2. Check the spring for fatigue or wear on the area where the spring contacts with the keys.
3. If there is any defect, replace them.


B161P086

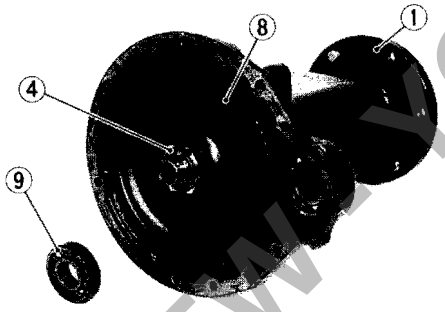
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(2) Disassembling Rear Axle



(1) Rear Axle
(2) Oil Seal
(3) Rear Axle Case
(4) Lock Nut
(5) Internal Snap Ring
(6) Ball Bearing
(7) Spacer
(8) Gear
(9) Ball Bearing



0329P104

[A] Oil Seal Portion

(1) Rear Axle
(4) Lock Nut
(8) Gear
(9) Ball Bearing

Rear Axle

1. Remove the ball bearing (9) with a puller.
2. Remove the stake of lock nut (4).
3. Secure the rear axle (1) in a vise and remove the lock nut.
4. Take out the gear (8) and spacer (7).
5. Tap out the rear axle (1).

(When reassembling)

- Apply grease to the oil seal (2) and install it.
- Replace the lock nut with new one, and after tightening it to specified torque, stake it firmly.
- Assemble the oil seal (2) with correct direction. (See figure above **(A)** portion.)

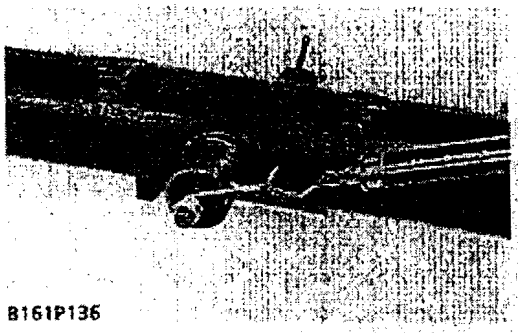
Tightening torque	Lock nut	196 to 245 N·m 20 to 25 kgf·m 145 to 181 ft-lbs

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Per Service Bulletin # SB01-47 10-17-01

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B161P136

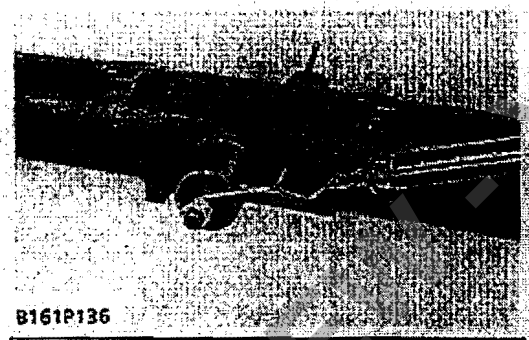
Turning Force of Spiral Bevel Pinion Shaft (Pinion Shaft Only)

1. Install the spiral bevel pinion shaft assembly to the front axle case.
2. Wind a string around the spiral bevel pinion shaft and attach spring balance to the tip of the string.
3. Slowly pull the spring balance in a direction at right angle to the spiral bevel pinion shaft to measure the turning force.
4. If the turning force is not within the factory specifications, adjust with the lock nut.

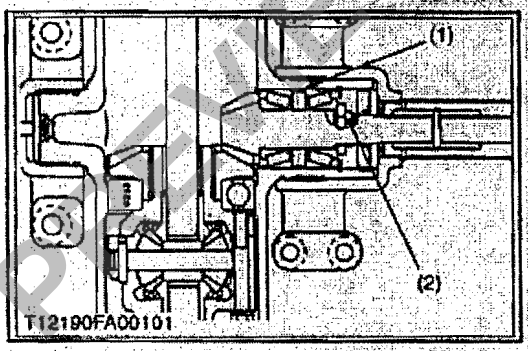
Turning force	Factory spec.	98.1 to 117.7 N 10 to 12 kgf 22.0 to 26.5 lbs

■ NOTE

- The turning torque is figured by multiplying the radius (distance from the center of the spiral bevel pinion shaft to a point on the circumference from which the string is pulled) by the reading on the spring balance.
- After turning torque adjustment, be sure to stake the lock nut.



B161P136



T12190FA00101

Turning Force of Spiral Bevel Pinion Shaft (Pinion Shaft Only)

1. Install the spiral bevel pinion shaft assembly to the front axle case.
2. Wind a string around the spiral bevel pinion shaft and attach spring balance to the tip of the string.
3. Slowly pull the spring balance in a direction at right angle to the spiral bevel pinion shaft to measure the turning force.
4. If the turning force is not within the factory specifications, adjust with the lock nut.

* **If the turning torque is not able to adjust by lock nut (2), change the thickness of collar (1) and adjust with lock nut (2) again.**

(Reference)

- **Standard size of collar (1) : 10.0 mm (0.394 in.) of thickness**

Turning force	Factory spec.	98.1 to 117.7 N 10 to 12 kgf 22.0 to 26.5 lbs

■ NOTE

- The turning torque is figured by multiplying the radius (distance from the center of the spiral bevel pinion shaft to a point on the circumference from which the string is pulled) by the reading on the spring balance.
- After turning torque adjustment, be sure to stake the lock nut.

(1) Collar (2) Lock Nut

W1010660

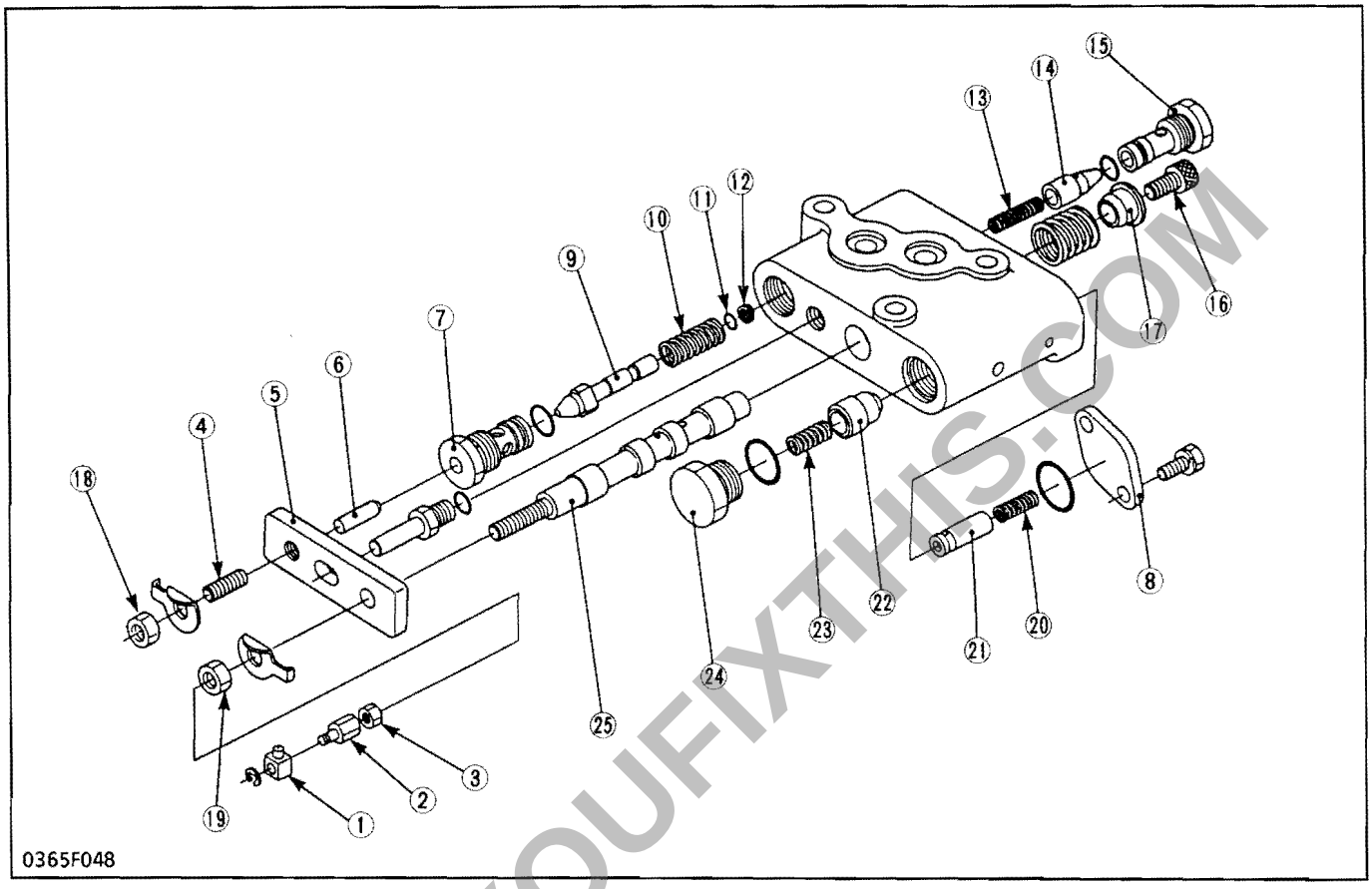
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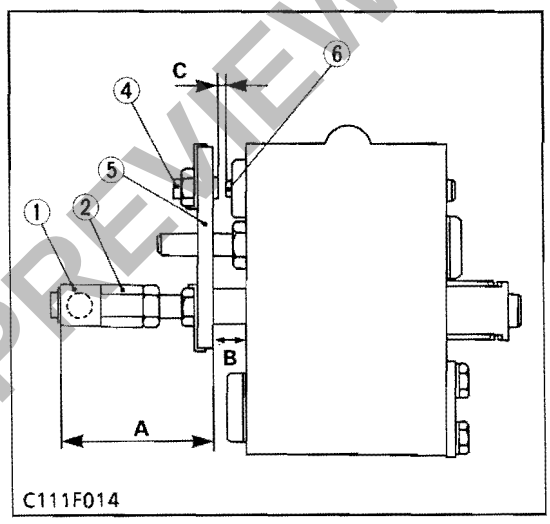
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Disassembling Position Control Valve



(1) Spool Joint 2
(2) Spool Joint 1
(3) Lock Nut
(4) Set Screw
(5) Plate 1
(6) Push Rod
(7) Plug 2
(8) Plate 2
(9) Poppet 2
(10) Spring 2
(11) O-ring
(12) Back-up Ring
(13) Spring
(14) Poppet 1
(15) Plug 1
(16) Screw
(17) Spring Holder
(18) Nut 1
(19) Nut 2
(20) Spring
(21) Poppet 3
(22) Unload Poppet
(23) Spring
(24) Unload Plug
(25) Spool



■ It is possible to disassemble as shown in the figure above.

■ **IMPORTANT**

- **Set screw (4) and spool joint 1 (2) are adjusted to very close accuracy. Do not disassemble them or cause them to be out of order unless necessary.**
  If disassembled due to unavoidable reasons, be sure to make the following adjustments before assembling.

■ **Dimensions for assembling spool joint 1 (2)**

1. Turn and adjust the spool joint 1 (2) so that the dimension (A) between the spool joint 2 (1) and the plate 1 (5) is 47.5 mm (1.87 in.).
2. After the adjustment, be sure to adjust the position control feedback rod.

■ **Dimensions for assembling set screw (4)**

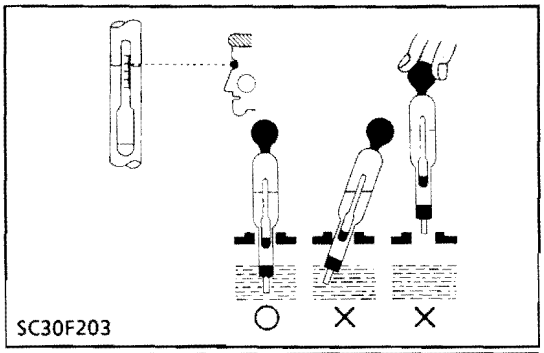
1. Set the dimension (B) between the plate 1 (5) and the valve body to 16.0 mm (0.63 in.).
2. Turn and adjust the set screw (4) so that the clearance (C) between the set screw (4) and the push rod (6) is 0.1 to 0.2 mm (0.0039 to 0.0079 in.).

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0321P303



SC30F203

Specific Gravity	State of Charge
1.260 Sp. Gr.	100 % Charged
1.230 Sp. Gr.	75 % Charged
1.200 Sp. Gr.	50 % Charged
1.170 Sp. Gr.	25 % Charged
1.140 Sp. Gr.	Very Little Useful Capacity
1.110 Sp. Gr.	Discharged

At an electrolyte temperature of 20 °C (68 °F)

Battery Specific Gravity

⚠ CAUTION

- **Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water.**

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.
2. When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in **(Reference)** below.
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.

■ NOTE

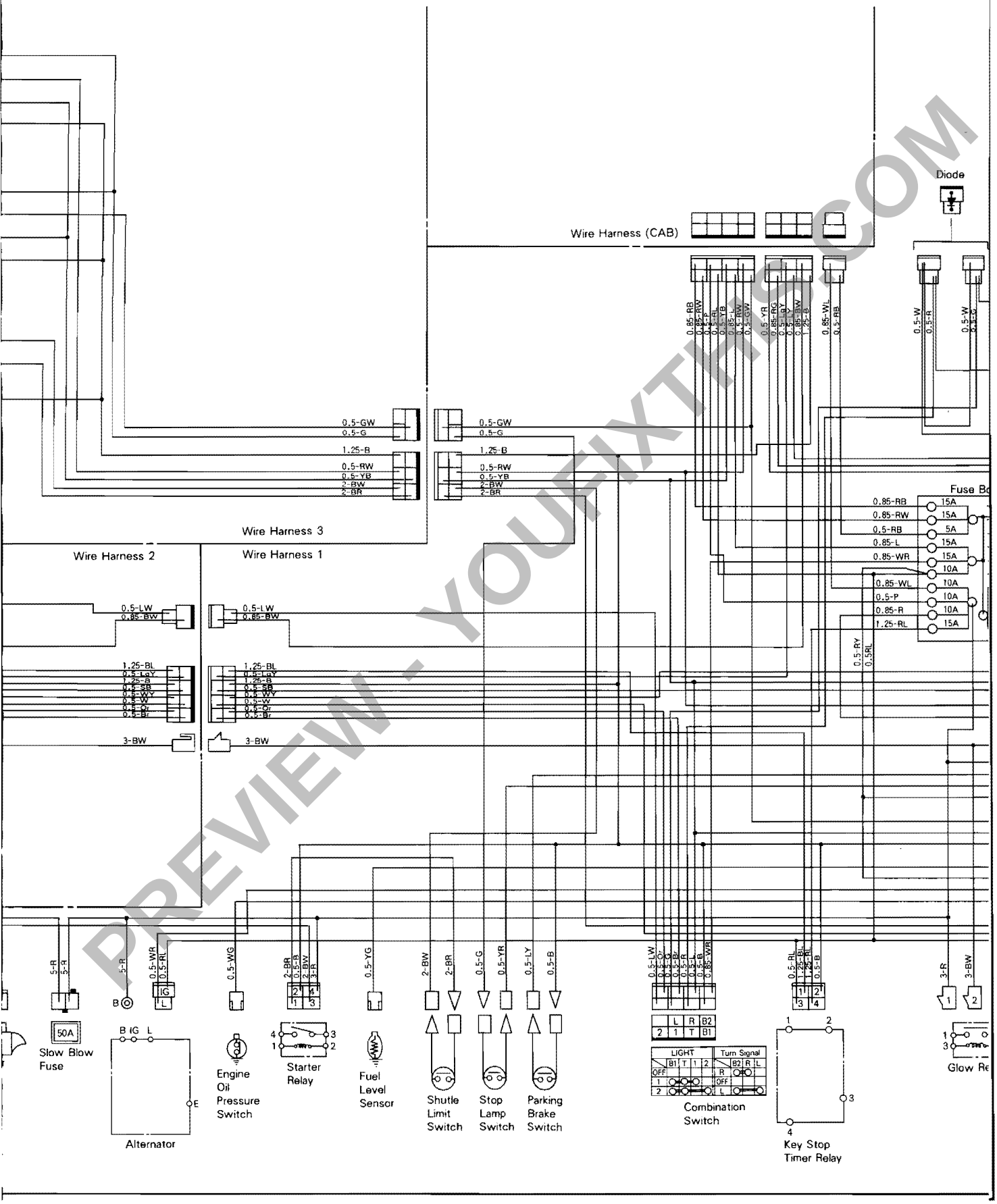
- **Hold the hydrometer tube vertical without removing it from the electrolyte.**
- **Do not suck too much electrolyte into the tube.**
- **Allow the float to more freely and hold the hydrometer at eye level.**
- **The hydrometer reading must be taken at the highest electrolyte level.**

(Reference)

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).
  Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :
  - Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature – 20 °C)
  - Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature – 68 °F)

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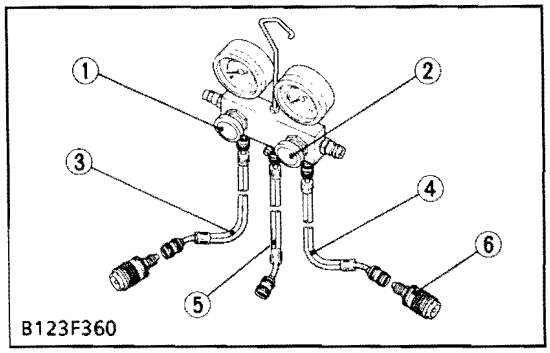
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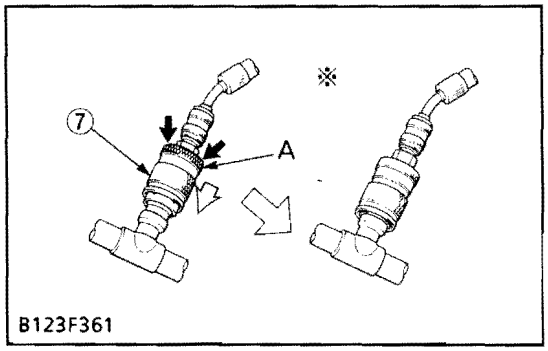
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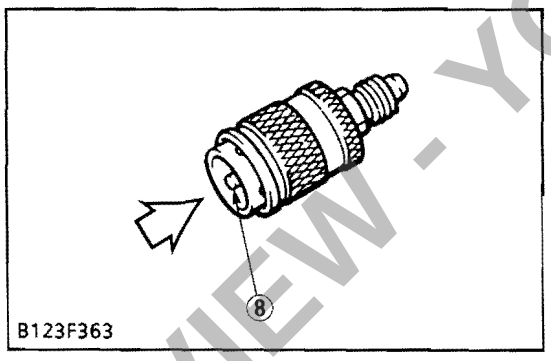
(2) Refrigerant Charging Hose



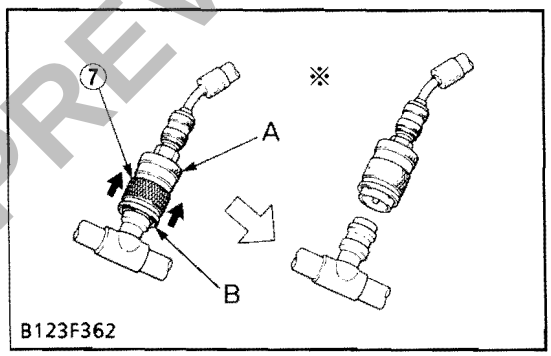
(1) **LO** Pressure Side Valve
(2) **HI** Pressure Side Valve
(3) Blue Hose
(4) Red Hose
(5) Green Hose
(6) Quick Disconnect Adaptor



(7) Sleeve ※ CLICK



(8) Pusher



(7) Sleeve ※ CLICK

The charging hoses are classified into three colors. Each charging hose must be handled as follows:

- The air conditioner manufacture recommends that the blue hose (3) is used for the **LO** pressure side (suction side), the green hose (5) for refrigeration side (center connecting port) and the red hose (4) for **HI** pressure side (discharged side).

(When connecting)

- Push the quick disconnect adaptor (6) into the charging valve, and push on part **A** until a click is heard.

■ NOTE

- **When connecting, push carefully so the pipe doesn't bend.**
- **When connecting the quick disconnect connector, should the sleeve (7) move before the quick link connector can be connected to the charging valve, move the quick sleeve to its original position and try again.**
- **When some refrigerant remains in the charging hose at the time of connection, it may be difficult to connect the quick link connector. In this case, perform the operation after removing any residual pressure in the hose. (Remove the residual pressure by pushing the pusher (8).)**

(When removing)

- While holding on to part **A** of the quick disconnect adaptor, slide part **B** up.

■ NOTE

- **After removing the adaptor, ensure to cap the quick disconnect adaptor service valve.**

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[3] LUBRICANTS

Place	Capacity	Lubricants
Gear box	0.75 ℓ 0.79 U.S.qts. 0.66 Imp.qts.	SAE 90 gear oil
Universal joint	Until grease overflows	SAE multi-purpose type grease
Front gauge wheel bracket	Until grease overflows	
Front and rear gauge wheels	Until grease overflows	
Three spindle shafts	Until grease overflows	
Belt tension pivot	Until grease overflows	
Tension pulley	Until grease overflows	

[4] TIGHTENING TORQUES (GENERAL USE SCREWS, BOLTS AND NUTS)

Screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

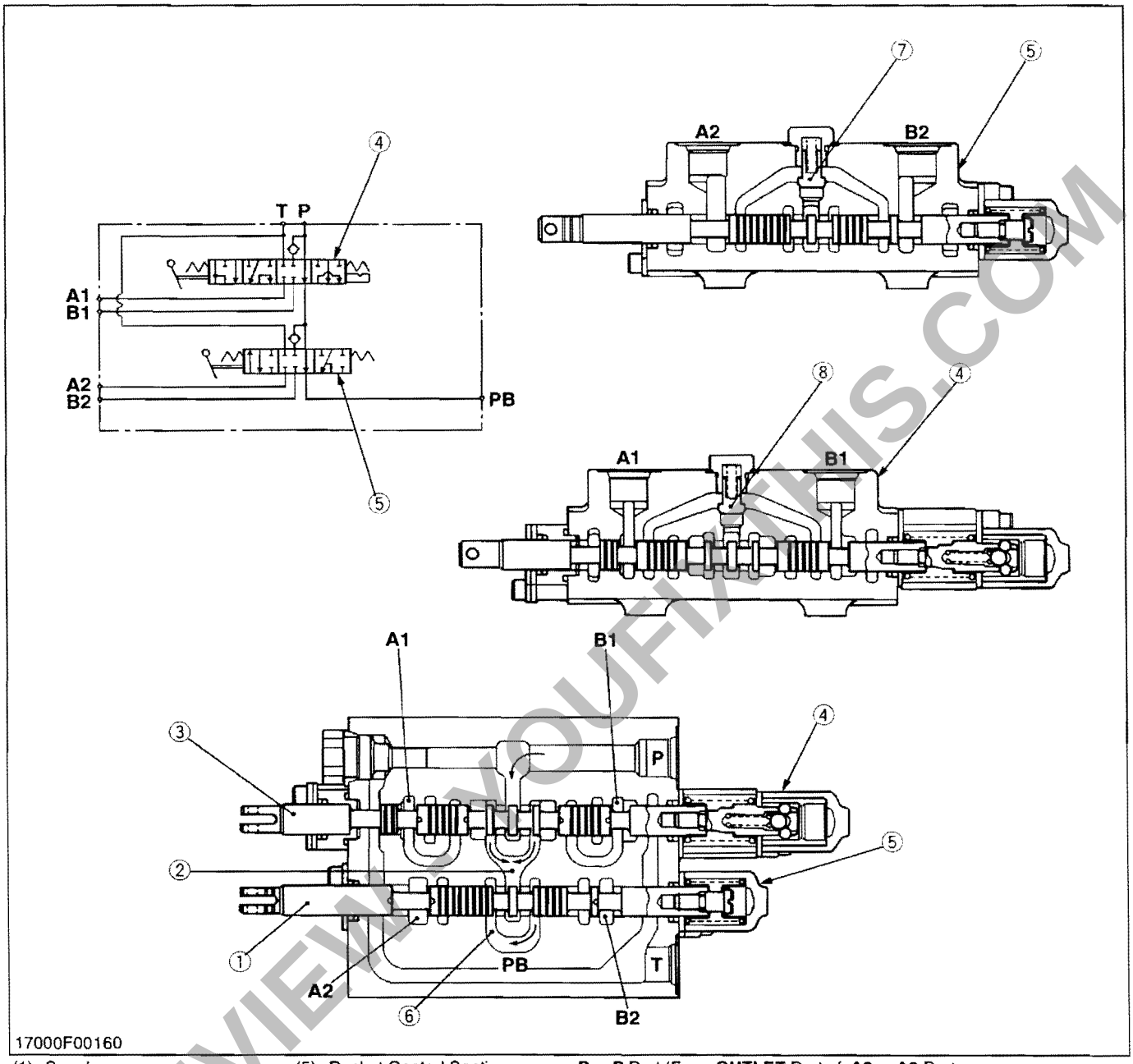
Grade / Unit / Nominal Diameter	No-grade or 4T * (⬡ or ④)			7T * (⑦)		
	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M 6	7.85 to 9.32	0.80 to 0.95	5.79 to 6.87	9.81 to 11.28	1.00 to 1.15	7.24 to 8.32
M 8	17.65 to 20.59	1.80 to 2.10	13.0 to 15.2	23.54 to 27.46	2.40 to 2.80	17.4 to 20.2
M10	39.23 to 45.11	4.00 to 4.60	29.0 to 33.2	48.05 to 55.90	4.90 to 5.70	35.5 to 41.2
M12	62.76 to 72.57	6.40 to 7.40	46.3 to 53.5	77.47 to 90.22	7.90 to 9.20	57.2 to 66.5
M14	107.9 to 125.5	11.0 to 12.8	79.6 to 92.5	123.6 to 147.1	12.6 to 15.0	91.2 to 108
M16	166.7 to 191.2	17.0 to 19.5	123 to 141	196.1 to 225.6	20.0 to 23.0	145 to 166
M18	245.2 to 284.4	25.0 to 29.0	181 to 210	274.6 to 318.7	28.0 to 32.5	203 to 235
M20	333.4 to 392.3	34.0 to 40.0	246 to 289	367.7 to 431.5	37.5 to 44.0	272 to 318

* The figures on the table above are indicated the top of screw or bolt.

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■ Neutral



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(1) Spool
(2) **PB** Passage 1
(3) Spool
(4) Boom Control Section
(5) Bucket Control Section
(6) **PB** Passage 2
(7) Load Check Valve
(8) Load Check Valve

P : **P** Port (From **OUTLET** Port of Hydraulic Block)
T : **T** Port (To **TANK** Port of Hydraulic Block)
A1 : **A1** Port
A2 : **A2** Port
B1 : **B1** Port
B2 : **B2** Port
PB : **PB** Port (To **INLET** Port of Hydraulic Block)

1. Pressure-fed oil from the hydraulic pump is delivered into **P** port.
2. As the load check valve (7), (8) are kept closed in the neutral position, oil flows along the notched section of the spools (1), (3) to the **PB** port through the **PB** passage 1 (2) and 2 (6).
3. Then the oil is fed to the three point hydraulic system from the **PB** port.

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