YANMAR

SERVICE MANUAL

DIESEL TRACTOR

MODEL **YM135(D), YM155(D)**

FOREWORD

■ MAKING EFFECTIVE USE OF THIS SERVICE MANUAL

This manual discusses the maintenance standards and trouble-shooting procedures to be employed from the standpoint of the repairman, in order that the tractor can perform in top condition through correct servicing procedures.

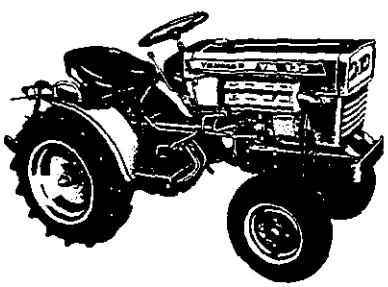
Repairs conducted by estimations or force of habit could lead to unexpected accidents and serious trouble. Always carry out repairs in a scientific and accurate manner.

■ SERIAL NUMBERS

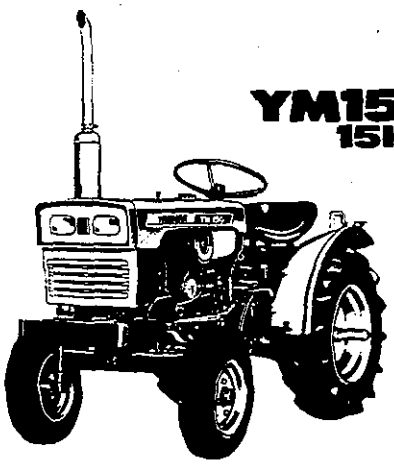
Do not limit your work merely to the actual repair work alone but always strive to carry out dependable servicing, including such efforts as noting down the servicing history of your tractor and keeping maintenance records.

In order to easily process any claims it is imperative that the full details and serial numbers of parts be clearly written on the prescribed form, and then sent to the dealer for forwarding to the manufacturer.

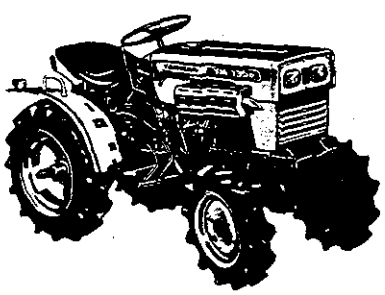
YM135
13HP



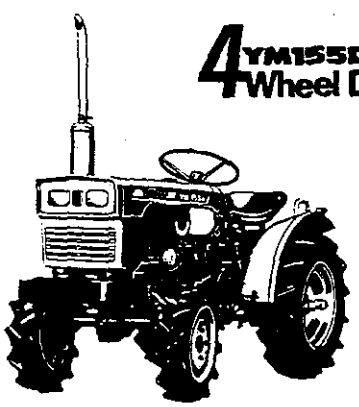
YM155
15HP



4 YM135D 13HP Wheel Drive



4 YM155D 15HP Wheel Drive



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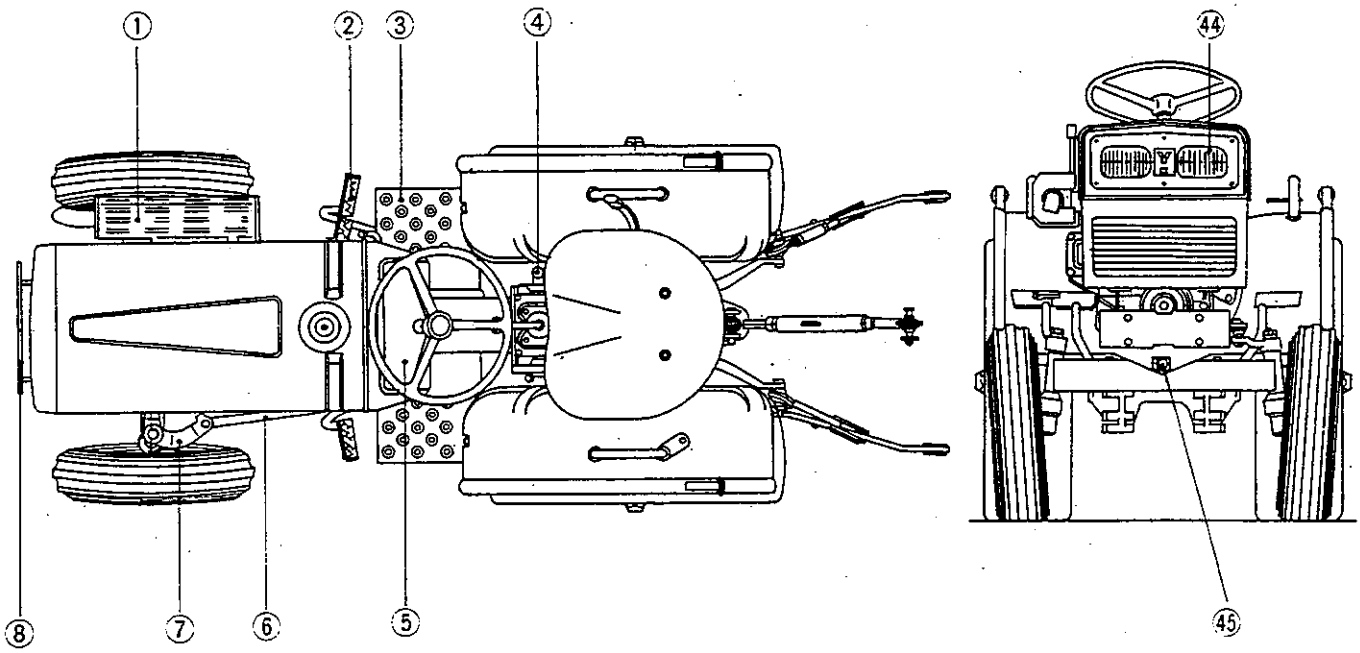
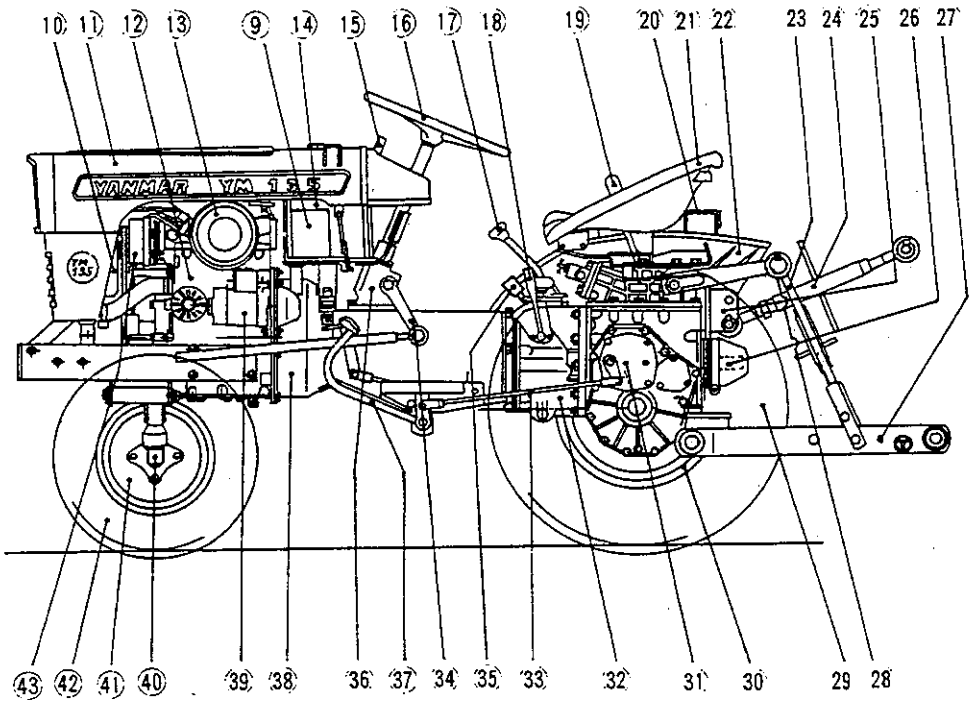
I. NOMENCLATURE

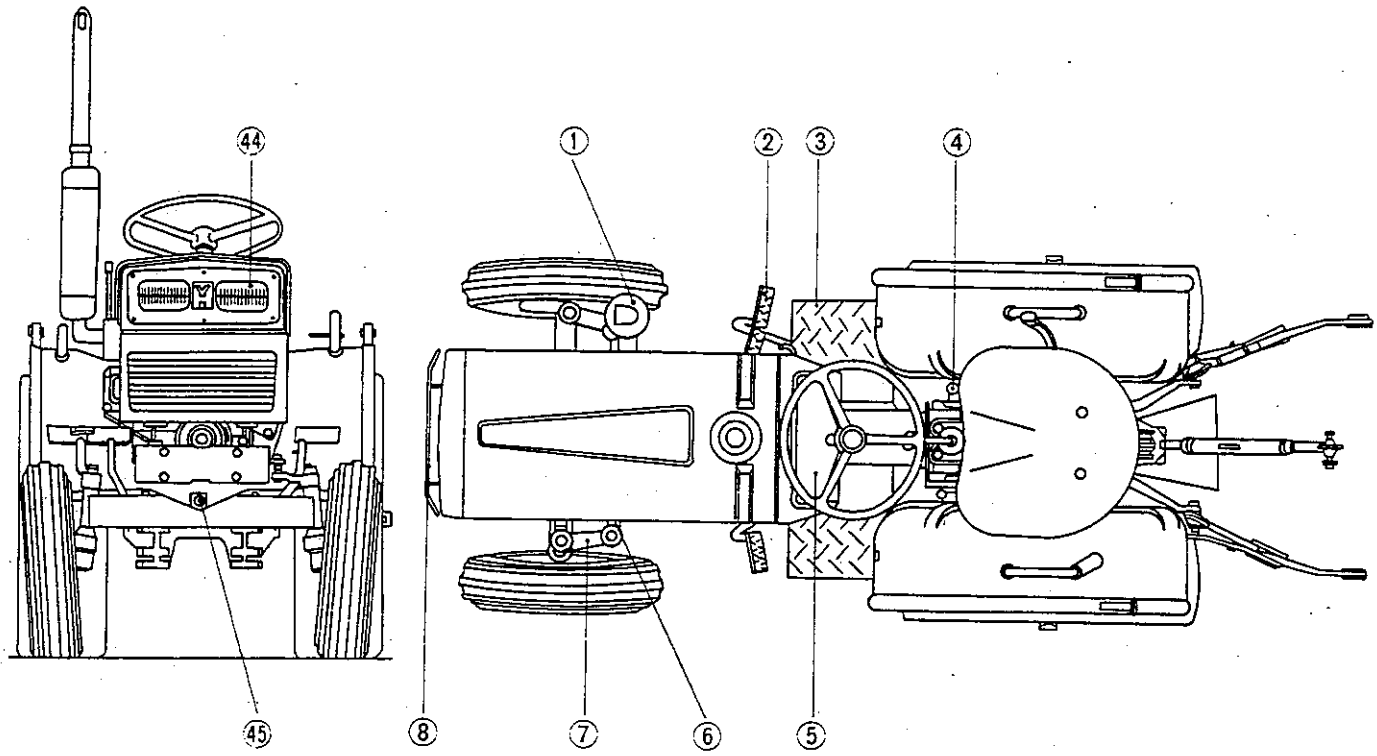
Model
YM135



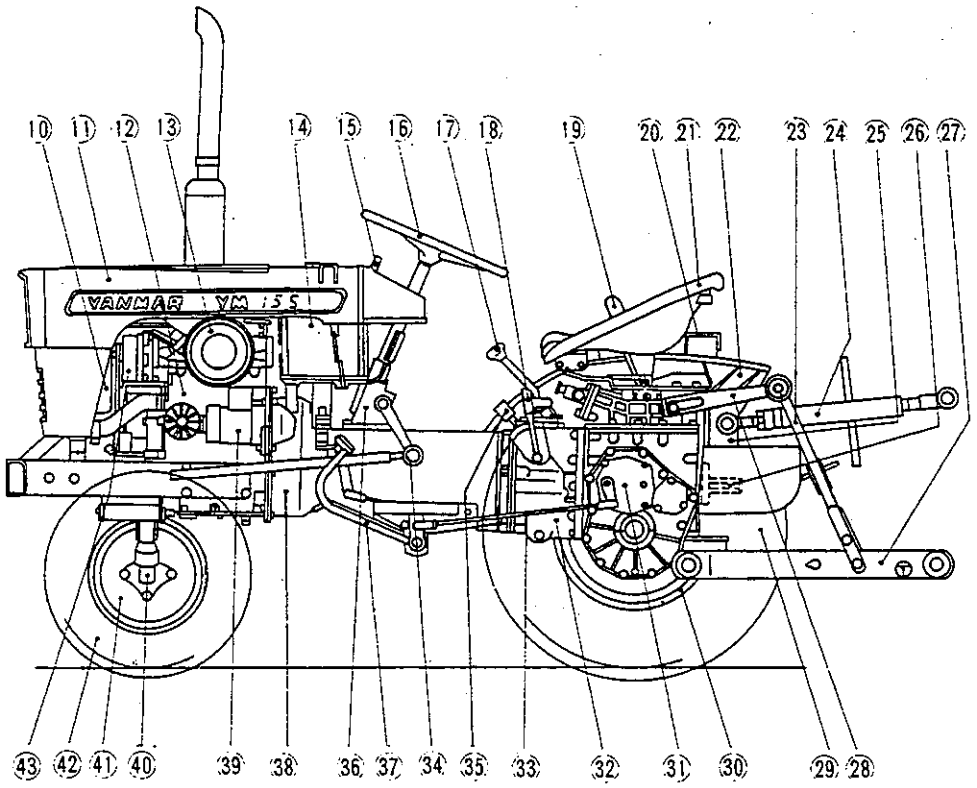


(1) Muffler
(2) Brake pedal
(3) Step
(4) Differential lock pedal
(5) Instrument panel
(6) Drag rod
(7) Knuckle arm
(8) Bumper
(9) Battery
(10) Radiator
(11) Hood
(12) Engine
(13) Air cleaner
(14) Fuel tank
(15) Throttle lever
(16) Steering wheel
(17) Gear shift lever
(18) P.T.O. shift lever
(19) Hydraulic control lever
(20) Assist bar
(21) Operator's seat
(22) Fender
(23) Lift link

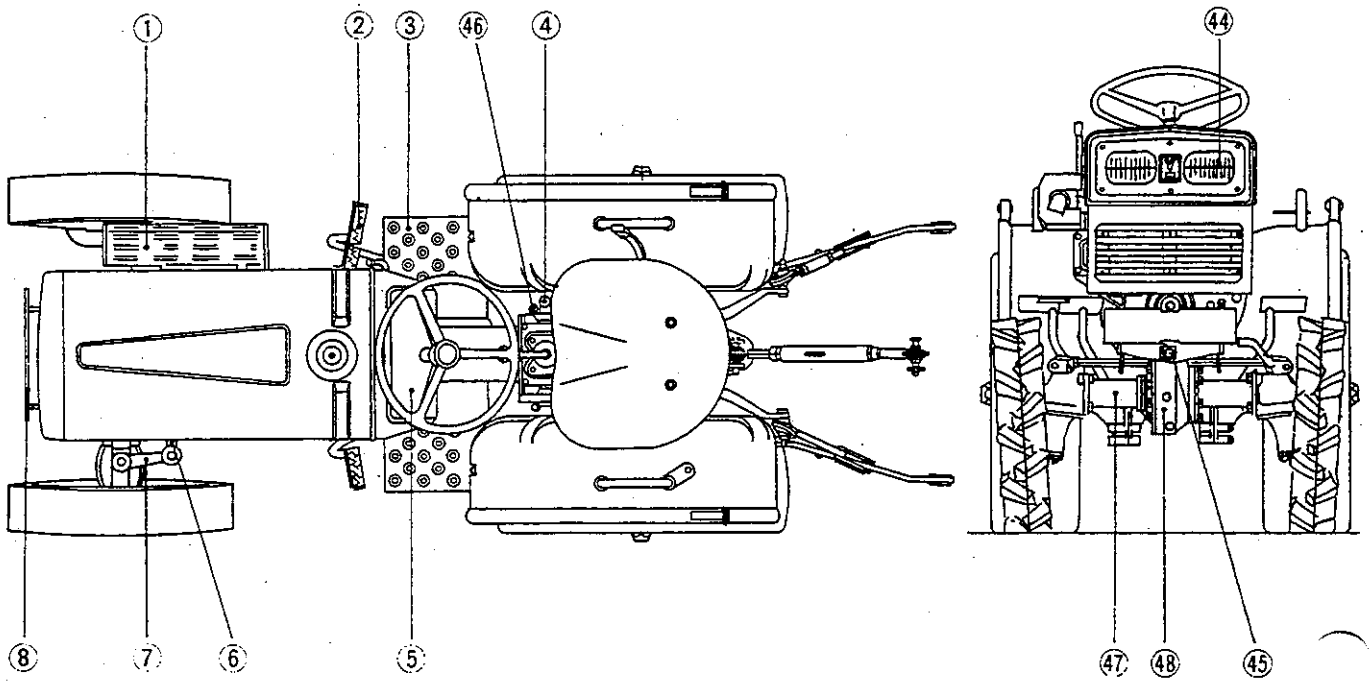
Model
YM155

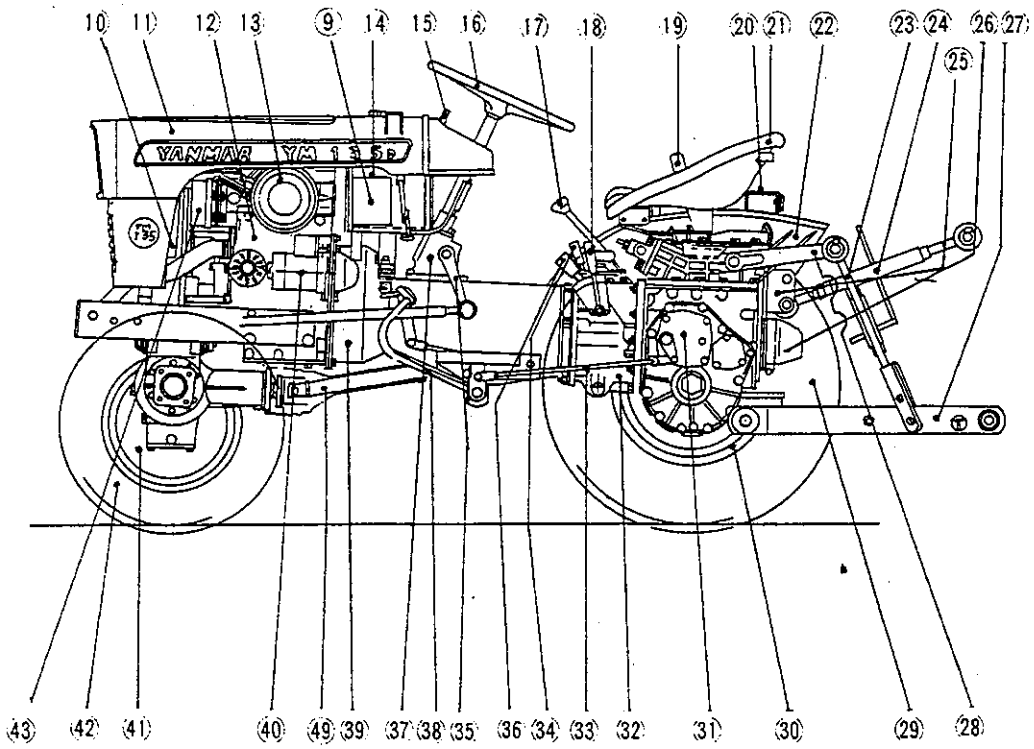


(24) Top link
(25) Top link hinge
(26) P.T.O. shaft
(27) Lower link
(28) Lift arm
(29) Rear tire
(30) Rear wheel
(31) Brake
(32) Transmission case
(33) Brake rod
(34) Pitman arm
(35) Range shift lever
(36) Steering gear box
(37) Clutch pedal
(38) Clutch housing
(39) Starter motor
(40) King-pin
(41) Front wheel
(42) Front tire
(43) A.C. Generator
(44) Headlight
(45) Front axle center-pin



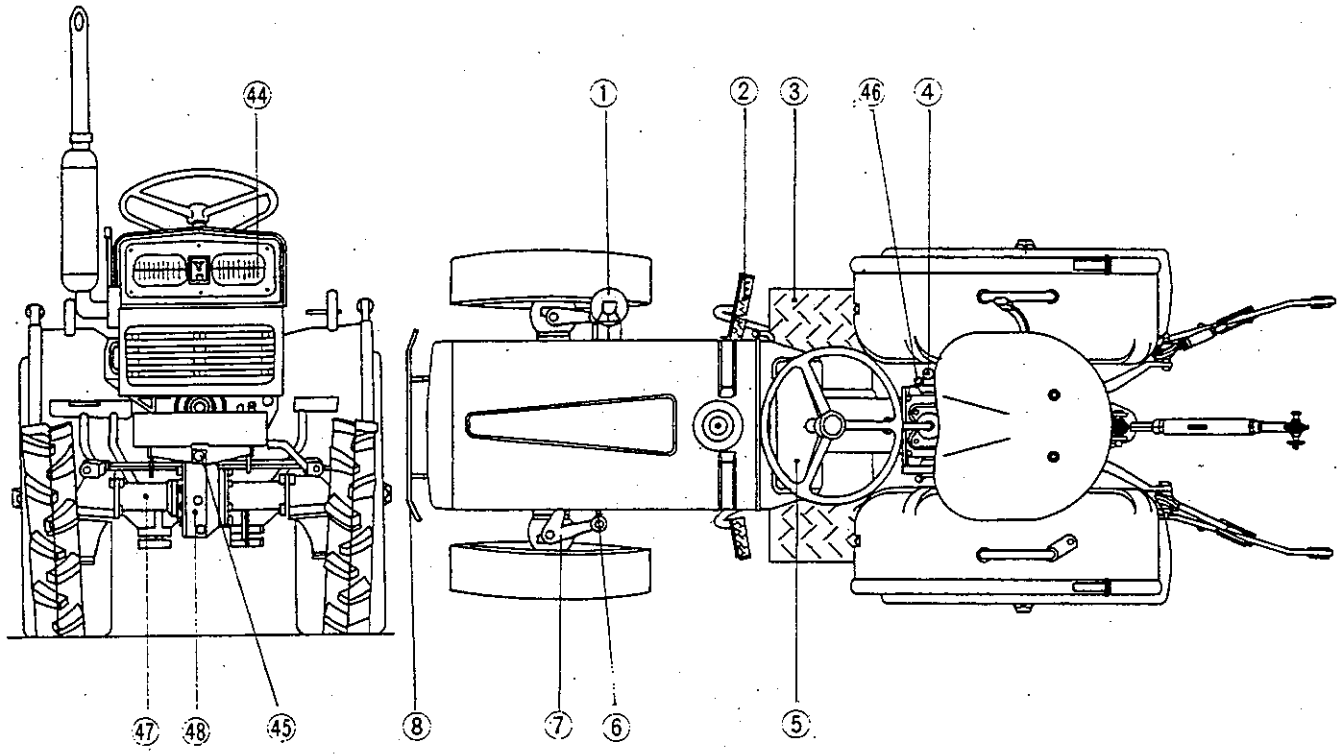
Model
YM135D



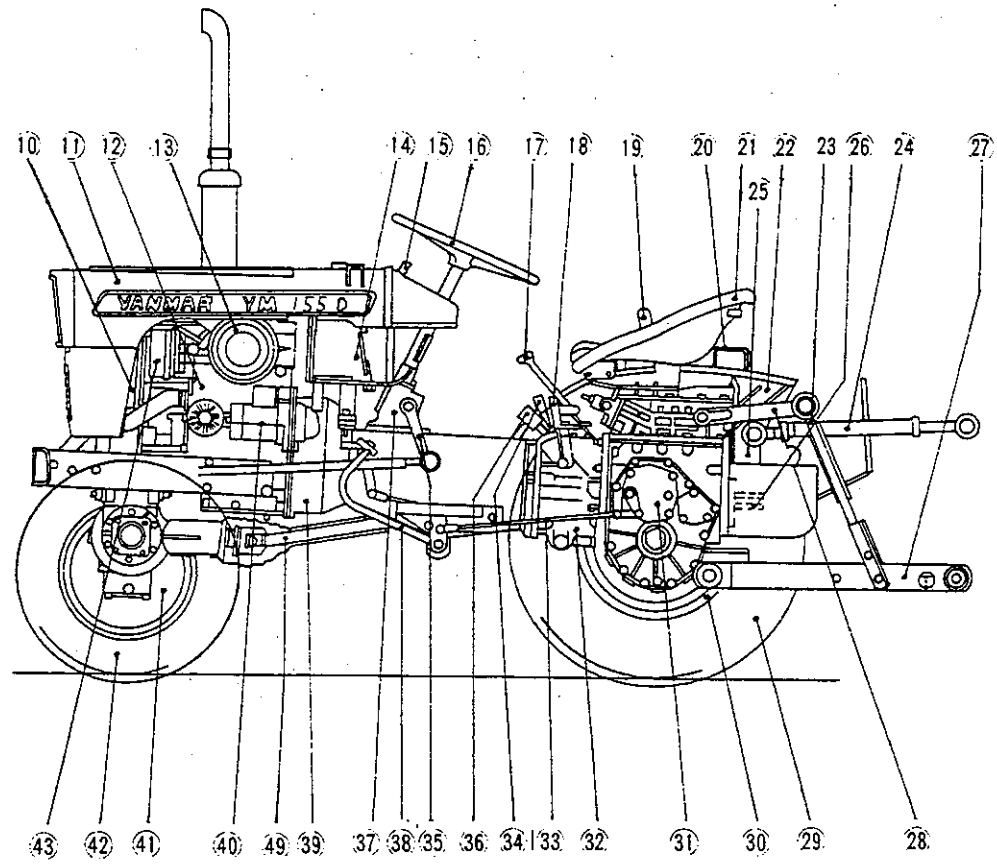


(1) Muffler
(2) Brake pedal
(3) Step
(4) Differential lock pedal
(5) Instrument panel
(6) Drag rod
(7) Nukle arm
(8) Bumper
(9) Battery
(10) Ragiator
(11) Hood
(12) Engine
(13) Air cleaner
(14) Fuel tank
(15) Throttle lever
(16) Steering wheel
(17) Gear shift lever
(18) P.T.O. shift lever
(19) Hydraulic control lever
(20) Assist bar
(21) Operator's seat
(22) Fender
(23) Lift link
(24) Top link

Model
YM155D



(25) Top link hinge
(26) P.T.O. shaft
(27) Lower link
(28) Lift arm
(29) Rear tire
(30) Rear wheel
(31) Brake
(32) Transmission case
(33) Brake rod
(34) Front wheel drive lever
(35) Pitman arm
(36) Range shaft lever
(37) Steering gear box
(38) Clutch pedal
(39) Clutch housing
(40) Starter motor
(41) Front wheel
(42) Front tire
(43) A.C. Generator
(44) Headlight
(45) Front axle center pin
(46) Range shift lever
(47) Front axle
(48) Front differential
(49) Front drive propeller



II. SPECIFICATIONS

1. SPECIFICATIONS (1)

Item					Unit	YM135	YM135D	YM155	YM155D
EN-GINE	Engine block	Engine model				2T73A		2TR13A	
		Type of engine				Diesel engine			
		Number of cylinders				2			
		Cylinder layout				Vertical in line			
		Bore x stroke			in.	2.874 x 2.953 (73mm x 75mm)		2.953 x 2.953 (75mm x 75mm)	
		Cylinder liner type				Wet type			
		Cycle				4-stroke cycle			
		Combustion chamber type				Precombustion chamber			
		Valve system				Overhead valves			
		Displacement			cu. in.	38.3 (627 cc)		40.4 (662 cc)	
		Compression ratio				23 : 1			
		Maximum output			hp/rpm	13/2700		15/2700	
		Maximum torque			ft. lbs/rpm	25.3/2400 (3.5 kg-m/2400)		28.9/2200 (4.0 kg-m/2200)	
		Engine weight			lbs	242.3 (110 kg)		253.3 (115 kg)	
		Pistion rings	Compression rings			3			
			Scraper rings			1			
		Valve timing	Intake valves	Open	degree	20° before T.D.C.			
				Closed	degree	50° after B.D.C.			
			Exhaust valves	Open	degree	50° before B.D.C.			
				Closed	degree	20° after T.D.C.			
		Valve clearances	Intake valves		in.	0.0078 (0.2mm)			
			Exhaust valves		in.	0.0078 (0.2mm)			
	Fuel system	Engine starting				Electric starting			
		Ignition				Compression ignition			
		Injection timing			degree	24°±1° before T.D.C.			
		Injection pump type				Yanmar Bosch PFR 2K			
		Injection pump plunger diameter			in.	0.2756 (7mm)			
		Injection plunger stroke			in.	0.2756 (7mm)			
		Injection valve type				Semi throttle type			
		Injection valve diameter			in.	0.1958 (5mm)			
		Injection pressure			psi	2.276 (160 kg/cm^2)			
		Injection order				1 – 2			
		Fuel				Diesel oil			
		Fuel tank capacity			U.S.gal.	2.5 (9.5 l)		4.0 (15 l)	
		Speed control method				All speed mechanical type			

SPECIFICATIONS (2)

Item					Unit	YM135 YM135D YM155 YM155D	
EN-GINE	Lubri-cating system	Lubricating pump type				Trochoid	
		Lubricating system				Force feed lubrication	
		Lubricating oil capacity			U.S.gal	0.44 (2.0 *l*)	
	Cooling system	Cooling system				Water-cooled	
		Heat dissipation method				Radiator	
	Electrical system	Starter motor type				S114-219 (Hitachi), D.C. compound motor	
		Starter motor capacity			V-KW	12—1.2	
		A.C. generator type				GP8108 (KOKUSAN) magneto revolving	
		Generator capacity			V-W	12—8.5	
		Current limiter				RS2130 (KOKUSAN)	
		Battery voltage, capacity			V-AH	12—35	
		Thermostart plug type (optional)				SH100-02 (HITACHI) magnetic valve type	
		Thermostart capacity			V-A	12—13	
CHAS-SIS	Power train	Clutch	Clutch type			Mechanical dry single plate	
			Facing (outside diam. x inside diam. x thickness		in.	7.09 x 4.92 x 0.33 (180mm x 125mm x 8.4mm)	
			Facing area		sq. in.	20.4 (132cm^2)	
			Static torque capacity		ft. lbs	97.7 (13.5 kg-m)	
		Trans-mission	Transmission type			Mechanical, constant selective mesh gears combination	
			Transmission speeds			6-speed for forward, 2-speed for reverse	
			Travel speed*	[Forward]		MPH (km/h)	MPH (km/h)
				1st		0.71 (1.14)	0.67 (1.07)
				2nd		1.20 (1.93)	1.13 (1.82)
				3rd		1.75 (2.81)	1.65 (2.65)
				4th		3.57 (5.75)	3.37 (5.43)
				5th		6.07 (9.76)	5.73 (9.22)
				6th		8.84 (14.23)	8.36 (13.43)
				[Reverse]			
				1st		0.98 (1.57)	0.92 (1.48)
				2nd		4.95 (7.97)	4.67 (7.52)
		P.T.O.*	Speed	1st		540 at 2540	540 at 2540
				2nd		770 at 2540	770 at 2540
			Shaft rotation			Clockwise viewed from rear	
			Shaft position			Rear end	
	Running gear	Differential				Differential gear	
		One-way clutch				Claw clutch	
		Front axle type				Lemoine-type supported by center pin	

*(*Difference in specification depending on serial number)*

SPECIFICATIONS (3)

Item						Unit	YM135	YM135D	YM155	YM155D
CHASSIS	Running gear	Rear axle type					Semi-floating			
		Front wheel alignment	Toe-in			in.	0.16–0.32 (4–8mm)			
			Camber			degree	3°			
			Caster			degree	0°	2.5°	0°	2.5°
			Trail			in.	0	0.43 (11 mm)	0	0.43 (11 mm)
			King-pin inclination			degree	7°	6°	7°	6°
		Steering system	Steering system				Ball – screw			
			Gear ratio				15.4 : 1		18.9 : 1	
			Steering wheel diam.			in.	15.0 (380mm)		15.8 (400mm)	
			Gear box oil capacity			U.S.gal.	0.05 (0.2 *l*)			
		Tires	Front wheels	Tire size			4.50–10–2PR–FSR	5–12–2PR–FSL	4.50–10–2PR–FSR	5–12–2PR–FSL
				Tire pressure		psi	17.8 (1.25 kg/cm²)		17.8 (1.25 kg/cm²)	
				Rims			3.50B x 10GA	4JA–12	3.50 x 10GA	4JA–12
		Optional tires	Front wheels	Tire size			20x8.00–10–4PR–PD		6–12–2PR–FD	
				Tire pressure		lb/in²	24.2 (1.7 kg/cm²)		17.1 (1.20 kg/cm²)	
				Rims			6.00Ix10DT		5JA–12	
			Rear wheels	Tire size			7–16–4PR–FSL		8–16–4PR–FSL	
				Tire pressure		*psi*	25.6 (1.8 kg/cm²)		22.8 (1.6 kg/cm²)	
				Rims			5½k–16		5½k–16	
		Optional tires	Rear wheels	Tire size			27x8.50–15–2PR–PD		8–16–4PR–FD	
				Tire pressure		psi	11.4 (0.8 kg/cm²)		22.8 (1.6 kg/cm²)	
				Rims			700I x 15DT		5½K–16	
		Brakes	*Type of main brakes*				*Internal expansion mechanical brakes*			
			Parking brake type				Locking foot brake			
			Lining surface area			sq. in.	16.1 (104 cm²)			
			Lining (width x thickness x length)			in.	0.98 x 0.16 x 4.09 (25 x 4 x 104mm)			
			Brake drum diameter			in.	4.3 (110mm)			
			Method of activation				Main brakes ---------- by foot Parking brake ------- by hand			
	Lifting system	Type					Hydraulic			
		Type of hydraulic pump					Gear pump			
		Position of pump					In front of engine governor chamber			
		Pump drive					Claw coupling			
		Pump discharge capacity				U.S.gal./min	3.76 (14.2 *l*) at 2700 rpm			

SPECIFICATIONS (4)

Item				Unit	YM135	YM135D	YM155	YM155D
CHASSIS	Lifting system	Control system	Supplementary oil capacity	U.S.gal.	2.5 (9.5 *l*)	2.4 (9.0 *l*)	2.5 (9.5 *l*)	2.4 (9.0 *l*)
			Control system		Hydraulic select control			
		Cylinder	Safety valve cracking pressure	psi	1138 (80 kg/cm^2)			
			Type		Single acting			
			Bore x stroke	in.	2.36 x 3.54 (60mm x 90mm)			
			Total stroke volume	cu. in.	15.50 (254 cc)			
		Total lift height		in.	15.75 (400mm)		17.71 (450mm)	
		Total lifting power		lbs	More than 1210 (550 kg)			
		Implement fitting method			3-point hitch, category 0 and 1			
	Lighting etc.	Water temperature indicator light		V-W	12–3.4			
		Engine oil pressure indicator light		V-W	12–3.4			
		Head light		V-W	12–25/25			
		Turn signal lights (optional)		V-W	12–20			
		Work light (optional)		V-W	12–20			
		Horn		V-A	12–1.2			
		Rear reflectors			Red reflectors			
	Dimensions	Overall length: With 3-point hitch		in.	91.7" (2330mm)	93.1" (2365mm)	99.2" (2520mm)	
		Without 3-point hitch		in.	73.0" (1855mm)	74.4" (1890mm)	81.3" (2065mm)	
		Overall width		in.	35.4" (900mm)		37.6" (956mm)	
		Overall height: To steering wheel		in.	44.5" (1130mm)		45.7" (1160mm)	
		To hood		in.	37.6" (955mm)	39.2" (955mm)	42.2" (1047mm)	
		Wheel base		in.	45.7" (1160mm)	48.9" (1240mm)	48.8" (1240mm)	
		Tread	Front*	in.	26.4" (670mm)	29.3" (745mm)	28.7" (736mm)	29.3" (745mm)
			Rear	in.	23.6"–31.6" (600mm–800mm)		27.6"–33.5" (700mm–850mm)	
		Minimum ground clearance		in.	9.6" (245mm)	9.6" (245mm)	10.4" (265mm)	

*(*Difference in specification depending on serial number)*

SPECIFICATIONS (5)

	Item		Unit	YM135	YM135D	YM155	YM155D
CHASSIS	Weights	Gross weight	lbs	991 (450 kg)	1090 (495 kg)	1057 (480 kg)	1145 (520 kg)
		Front wheel load	lbs	449 (204 kg)	535 (243 kg)	480 (218 kg)	564 (256 kg)
		Rear wheel load	lbs	542 (246 kg)	555.1 (252 kg)	577 (262 kg)	582 (264 kg)
		Front weights (optional)	lbs	44.1 x 3 pcs = 132.3 (20 x 3 = 60 kg)		44.1 x 3 pcs = 132.3 (20 x 3 = 60 kg)	
		Rear wheel weights (optional)	lbs	(each wheel) 44.1 + 55.1 = 99.2 (20 + 25 = 50 kg)		(each wheel) 44.1 + 55.1 = 99.2 (20 + 25 = 50 kg)	
	Performance	Minimum turning radius	ft.	Under unlocking brakes		Under unlocking brakes	
				6.2 (1.9m)	7.2 (2.2m)	6.9 (2.1m)	7.2 (2.2m)
		Maximum grade	degree	35°		35°	
		Braking distance	ft.	11.5 (3.5m)		11.5 (3.5m)	

[DIFFERENCE IN SPECIFICATIONS]

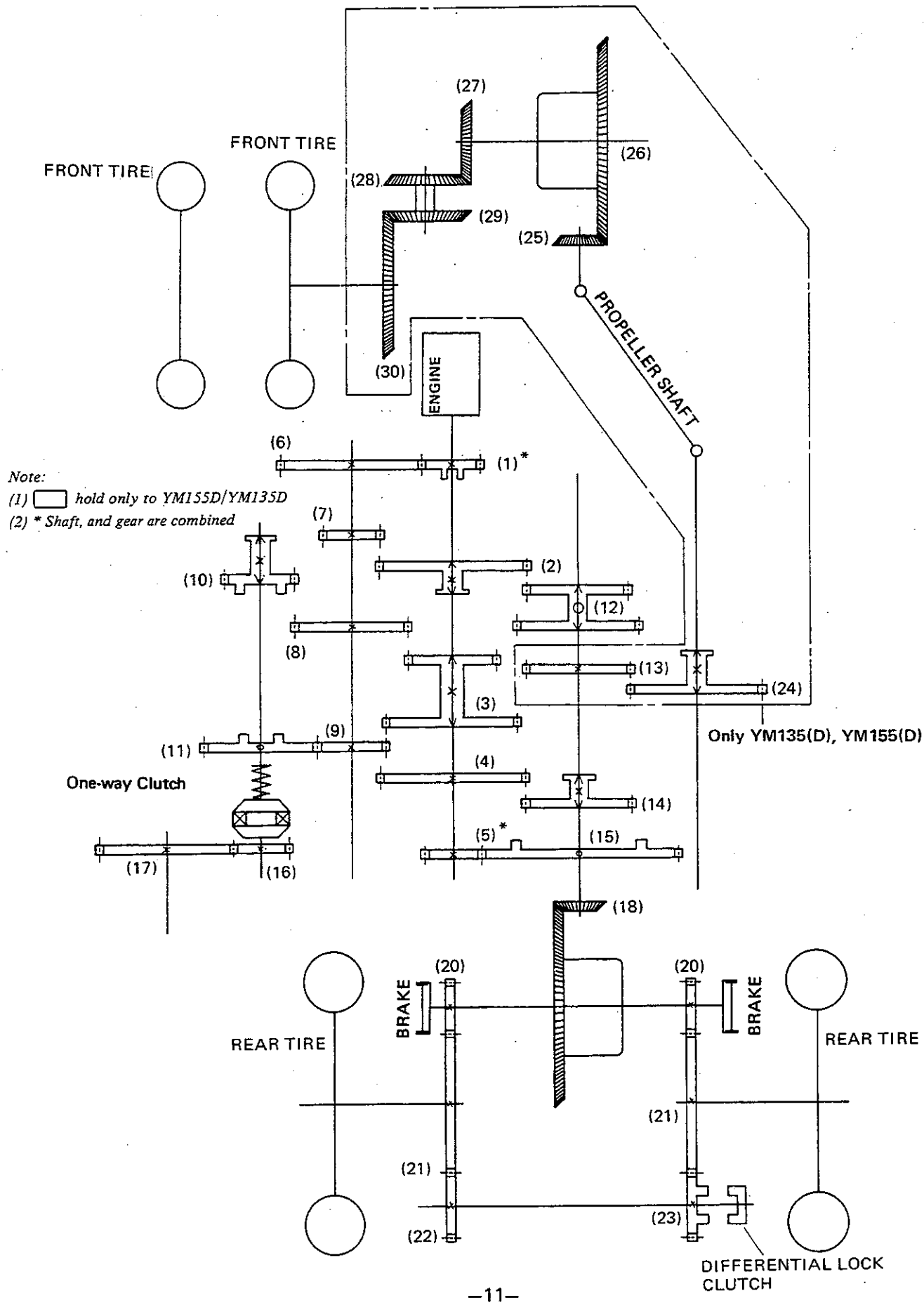
		After Serial No. 51001				Before Serial No. 51000			
Model / Dimensions		YM155	YM155D	YM135	YM135D	YM155	YM155D	YM135	YM135D
Front tread in. (mm)		28.7 (730)	29.3 (745)	26.4 (670)	29.3 (745)	28.7 (730)	28.0 (710)	26.4 (670)	26.8 (680)
Cooling capacity U.S. gal (ltr)		0.8 (3.2)				0.7 (2.6)			
Travel speed mph (km/h)	F1	0.67 (1.07)		0.71 (1.14)		0.59 (0.95)		0.63 (1.01)	
	F2	1.13 (1.82)		1.20 (1.93)		1.04 (1.67)		1.09 (1.76)	
	F3	1.65 (2.65)		1.75 (2.81)		1.58 (2.55)		1.68 (2.70)	
	F4	3.37 (5.43)		3.57 (5.75)		2.99 (4.82)		3.18 (5.11)	
	F5	5.73 (9.22)		6.07 (9.76)		5.25 (8.45)		5.56 (8.95)	
	F6	8.36 (13.43)		8.84 (14.23)		8.02 (12.91)		8.49 (13.67)	
	R1	0.92 (1.48)		0.98 (1.57)		0.75 (1.20)		0.79 (1.27)	
	R2	4.67 (7.52)		4.95 (7.97)		3.78 (6.09)		4.01 (6.45)	
P.T.O. speed, r.p.m.		540 and 770 at 2540 r.p.m. engine speed				540 and 800 at 2540 r.p.m. engine speed			
Starter motor		D.C. 12V – 1.2kW				D.C. 12V – 1.0kW			

2. POWER TRAIN (1)

NOTE: 'New' indicates those after No. 51001.
'Old' indicates those before No. 51000.

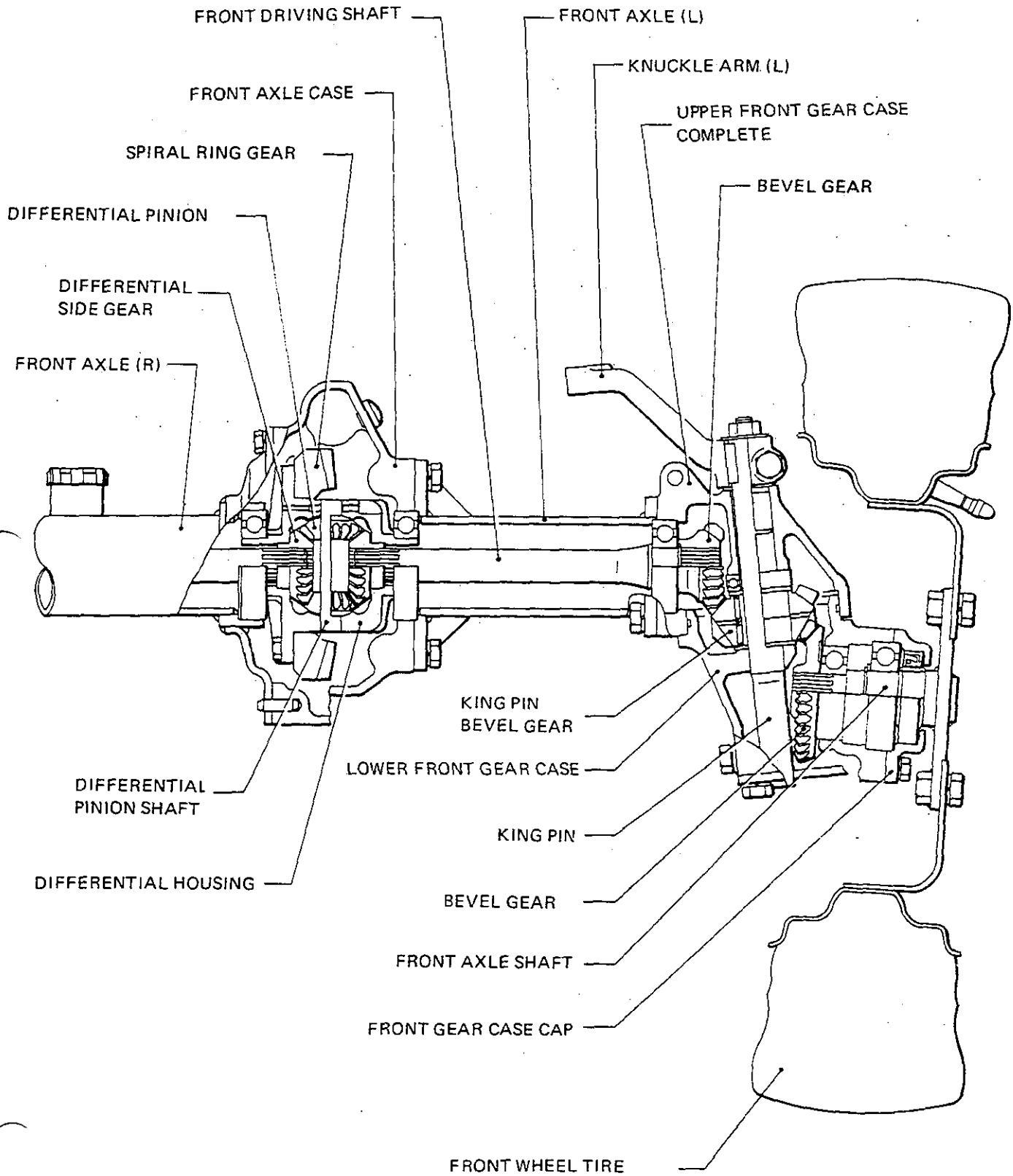
No. of gear teeth									
No.	Model / Nomenclature	YM155		YM155D		YM135		YM135D	
		New	*Old*	*New*	*Old*	*New*	*Old*	*New*	*Old*
1	Main shaft	12	12	12	12	12	12	12	12
2	1st/reverse sliding gear	25	26	25	26	25	26	25	26
3	2nd/3rd sliding gear	14/17	17/21	14/17	17/21	14/17	17/21	14/17	17/21
4	Main gear	31	31	31	31	31	31	31	31
5	Main change shaft	13	13	13	13	13	13	13	13
6	Driven gear	26	26	26	26	26	26	26	26
7	Driven gear	13	12	13	12	13	12	13	12
8	Driven gear	18	21	18	21	18	21	18	21
9	Driven gear	15	17	15	17	15	17	15	17
10	P.T.O. sliding gear	16	19	16	19	16	19	16	19
11	P.T.O. reduction gear	19	23	19	23	19	23	19	23
12	Reverse gear	14/14	13/18	14/14	13/18	14/14	13/18	14/14	13/18
13	Front driving gear	–	–	20	16	–	–	21	16
14	Low-hi sliding gear	16	16	16	16	16	16	16	16
15	Low-hi reduction gear	34	34	34	34	34	34	34	34
16	P.T.O. reduction gear	14	15	14	15	14	15	14	15
17	P.T.O. shaft gear	24	24	24	24	24	24	24	24
18	Counter shaft	6	6	6	6	6	6	6	6
19	Ring gear	38	38	38	38	38	38	38	38
20	Final reduction pinion	10	10	10	10	11	11	11	11
21	Final reduction gear	52	52	52	52	51	51	51	51
22	Differential lock shaft gear	14	14	14	14	15	15	15	15
23	Differential lock clutch gear	14	14	14	14	15	15	15	15
24	Front P.T.O. sliding gear	–	–	25	29	–	–	24	29
25	Spiral pinion shaft	–	–	6	6	–	–	6	6
26	Ring gear	–	–	38	38	–	–	38	38
27	Bevel gear	–	–	14	14	–	–	14	14
28	King pin bevel gear	–	–	28	14	–	–	28	14
29	King pin bevel gear	–	–	14	18	–	–	14	18
30	Bevel gear	–	–	20	27	–	–	20	27

POWER TRAIN (2) : YM135(D)/YM155(D) POWER TRANSMISSION STRUCTURAL DRAWING

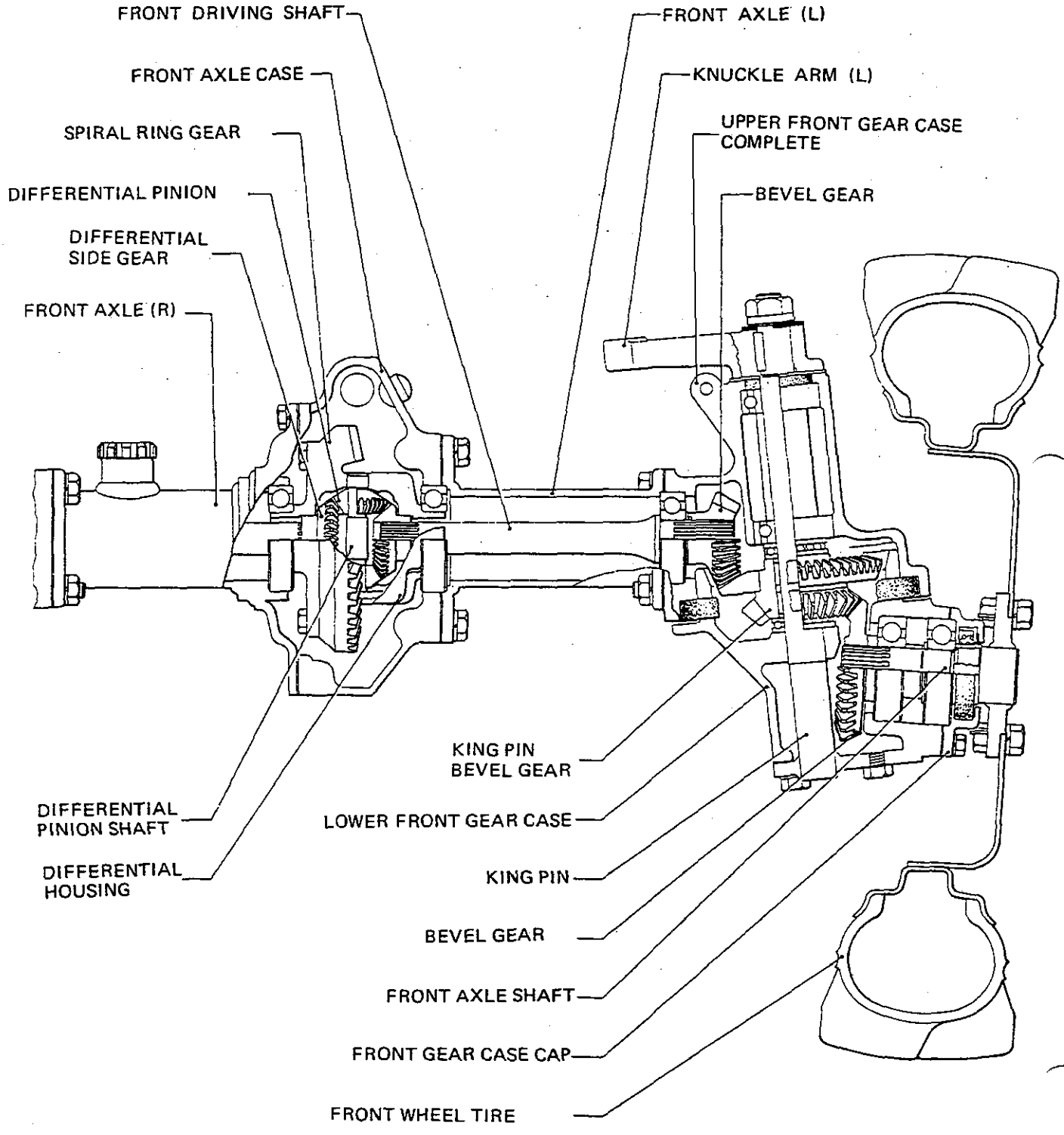


YM135(D)/YM155(D) FRONT AXLE SECTIONAL VIEW

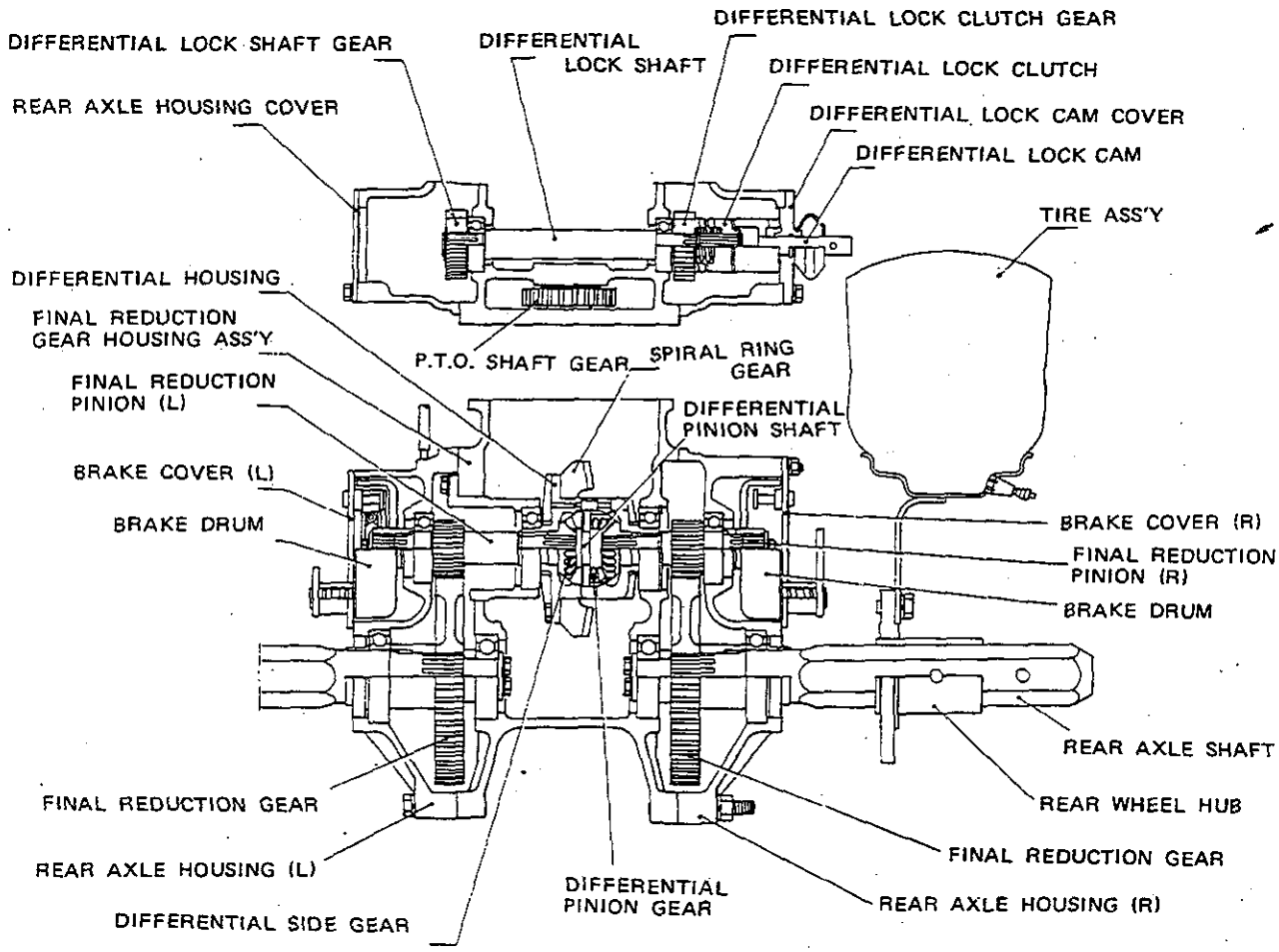
(Before Serial No. 51000)

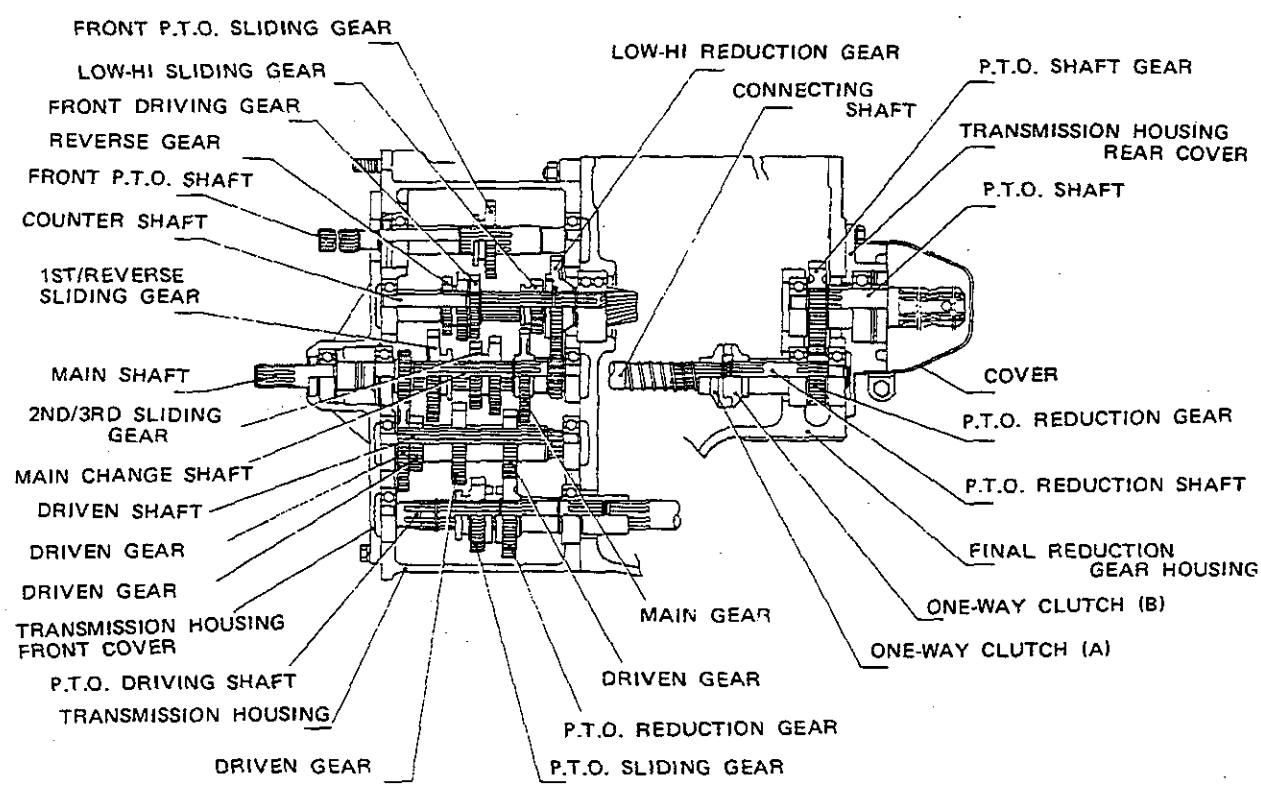


YM135(D)/YM155(D) FRONT AXLE SECTIONAL VIEW
(After Serial No. 51001)



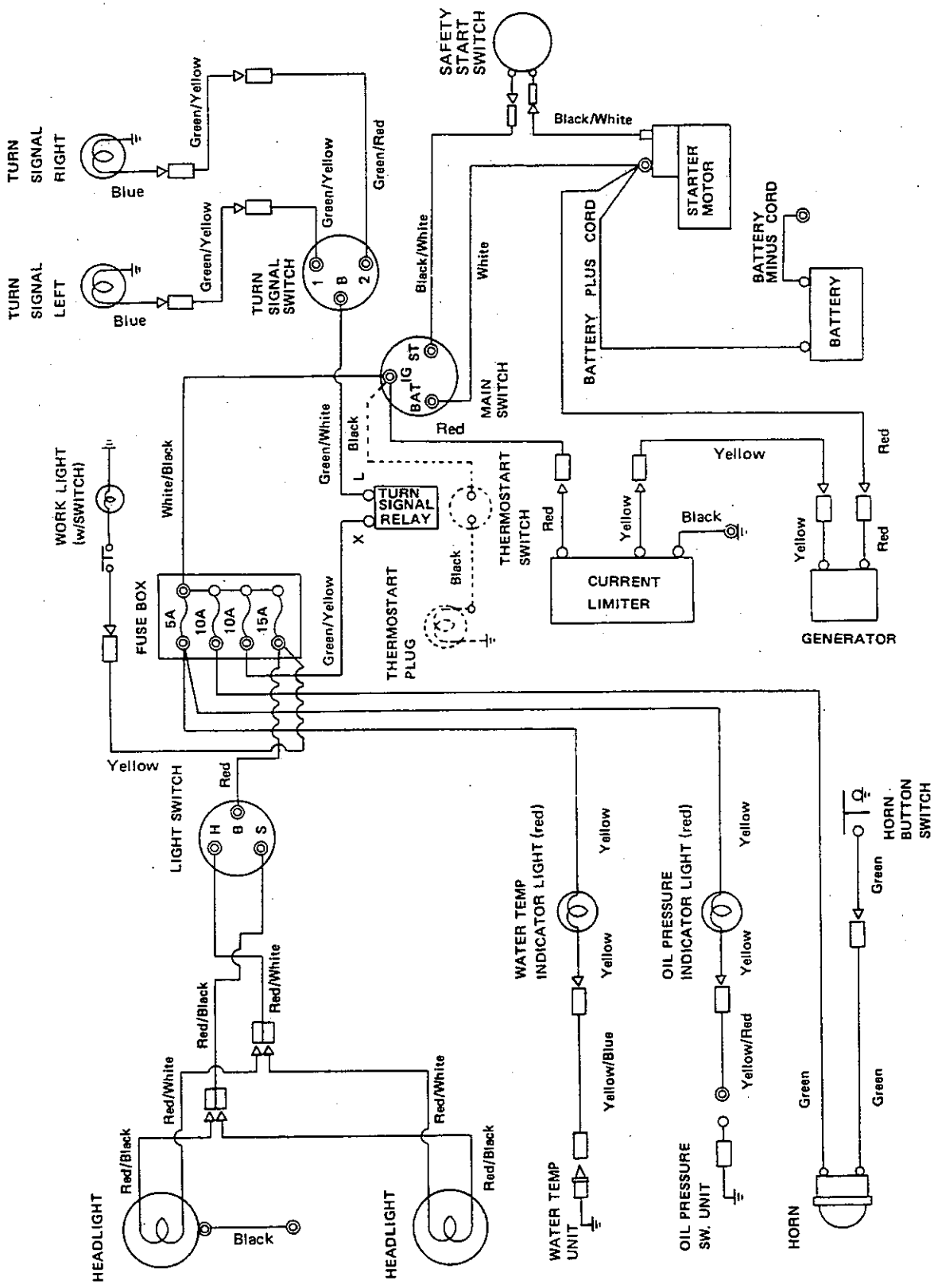
3. YM135(D)/YM155(D) TRANSMISSION SECTIONAL VIEW





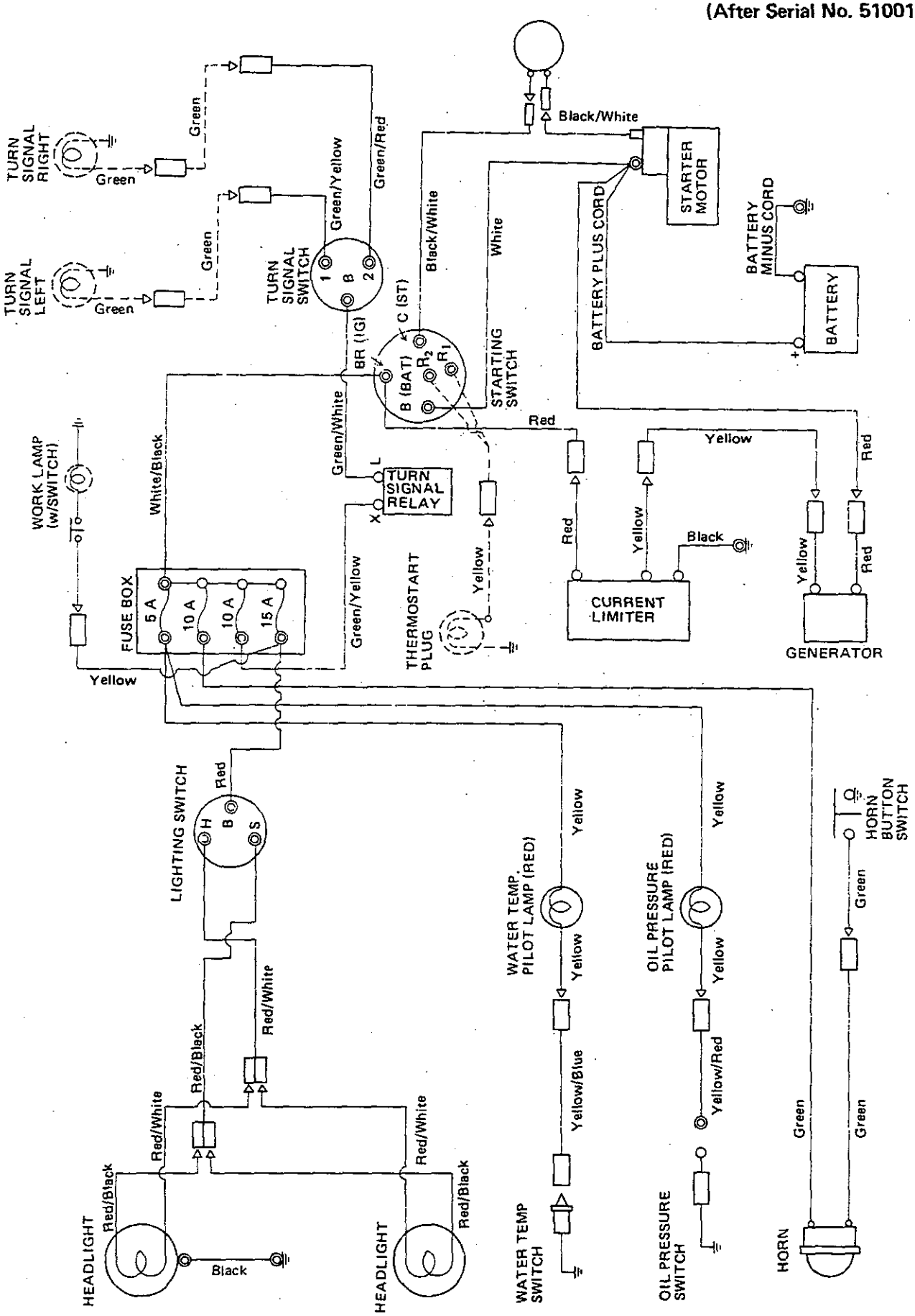
4. YM135(D)/YM155(D) ELECTRIC WIRING DIAGRAM

(Before Serial No. 510

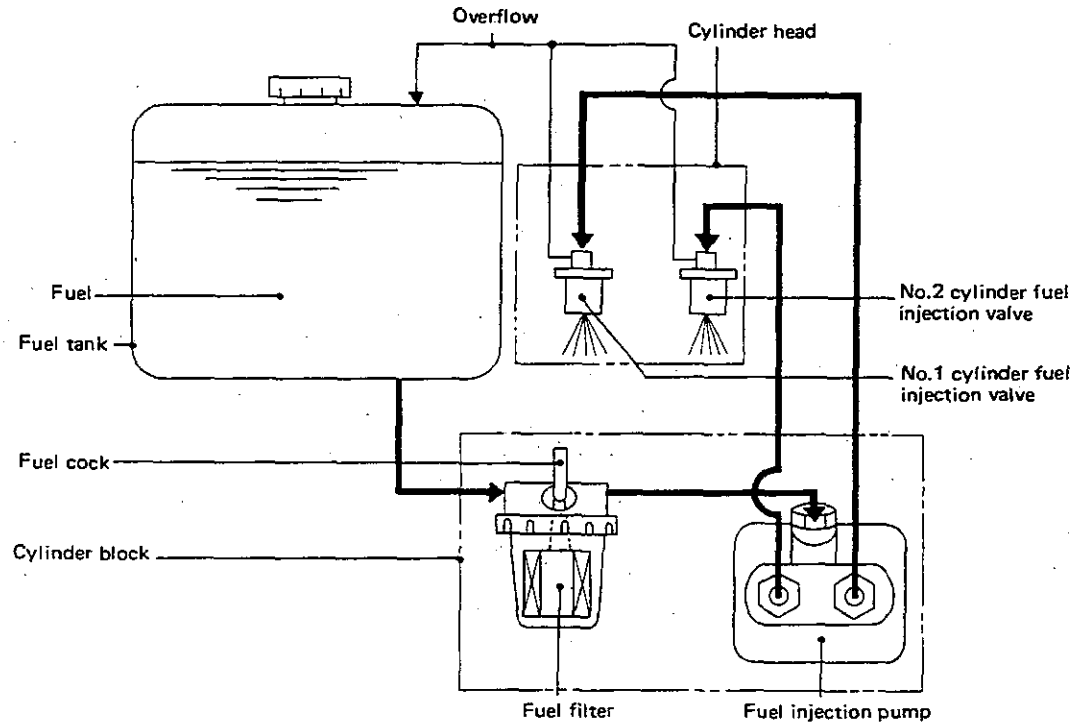


YM135(D)/YM155(D) ELECTRIC WIRING DIAGRAM

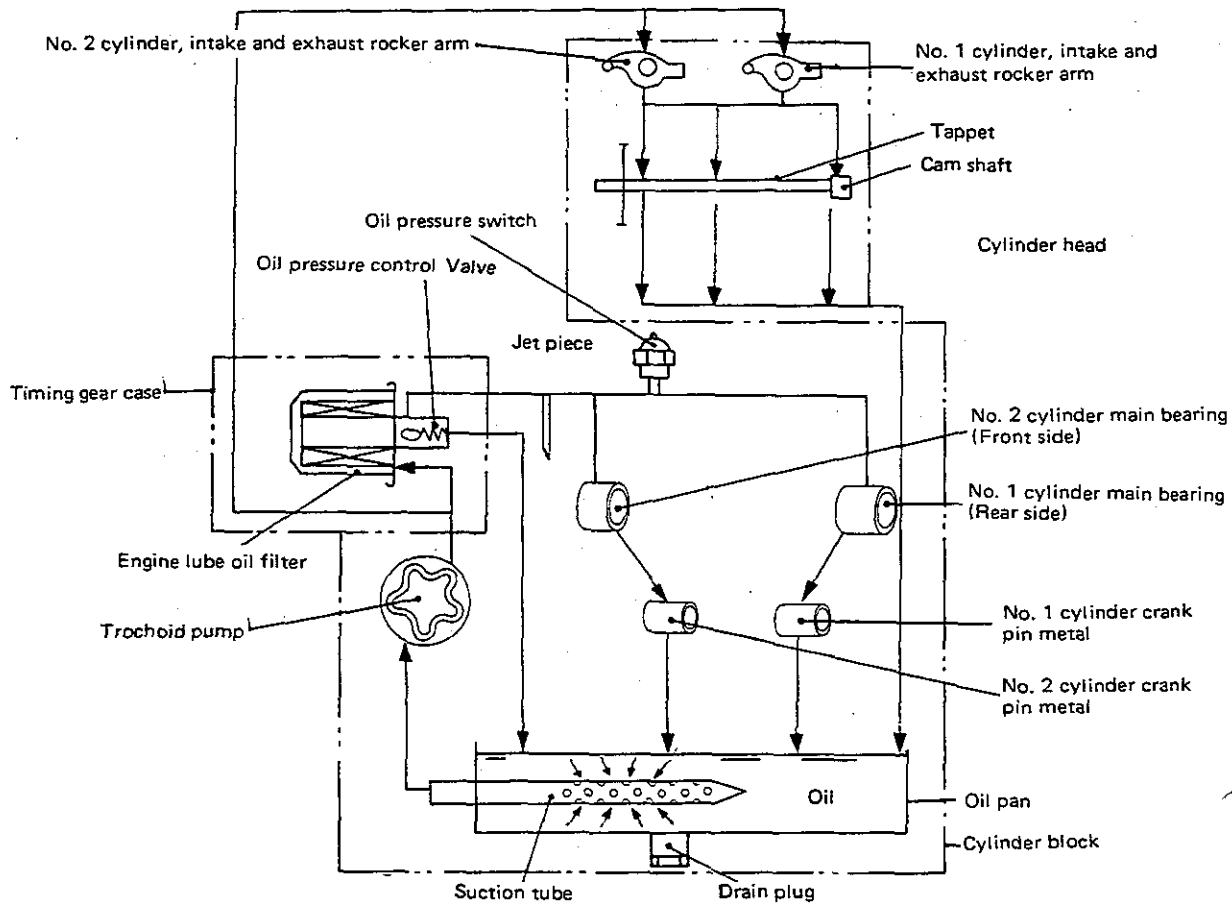
(After Serial No. 51001)



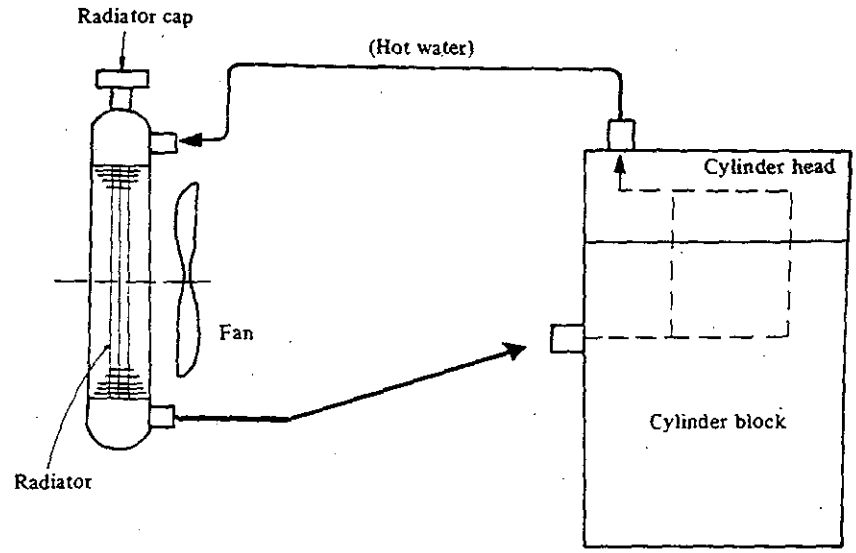
5. FUEL SYSTEM



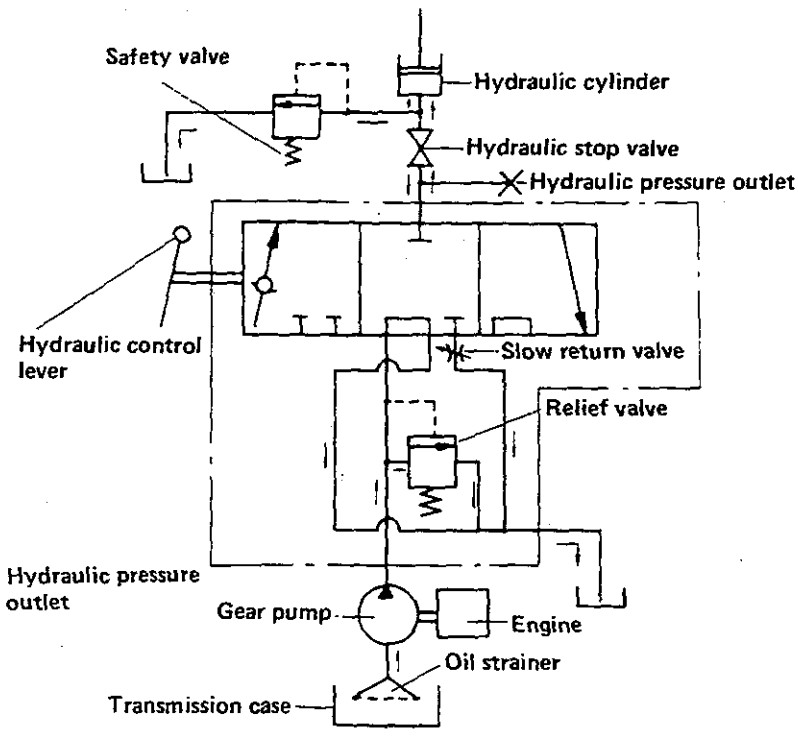
6. ENGINE LUBRICATING SYSTEM



7. COOLING SYSTEM



8. TRANSMISSION LUBE/HYDRAULIC SYSTEM



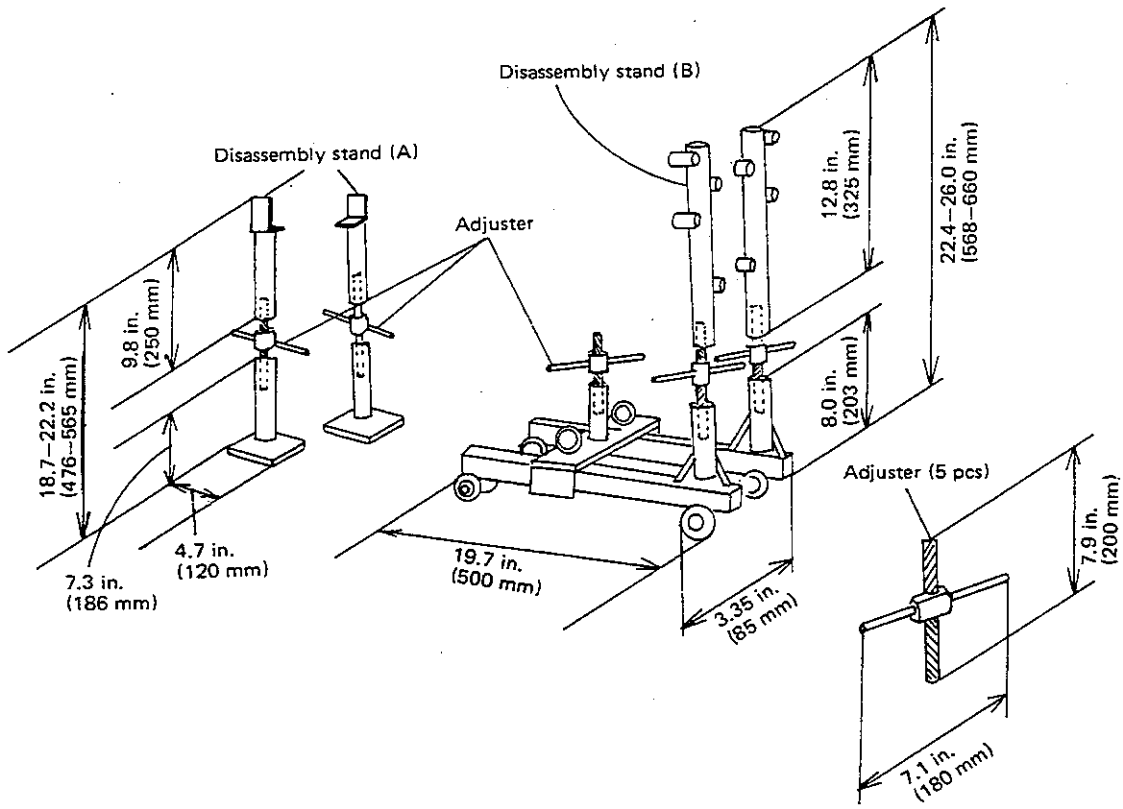
III. TRACTOR SEPARATION

NOTES:

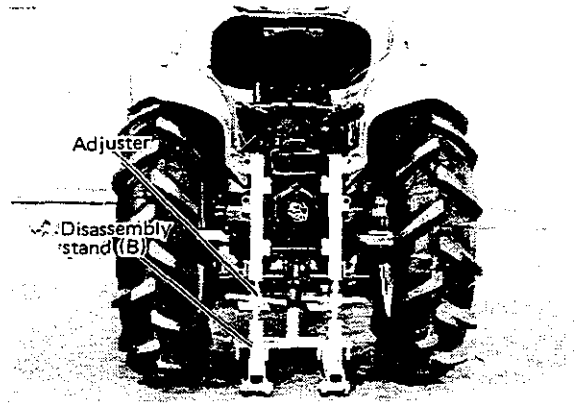
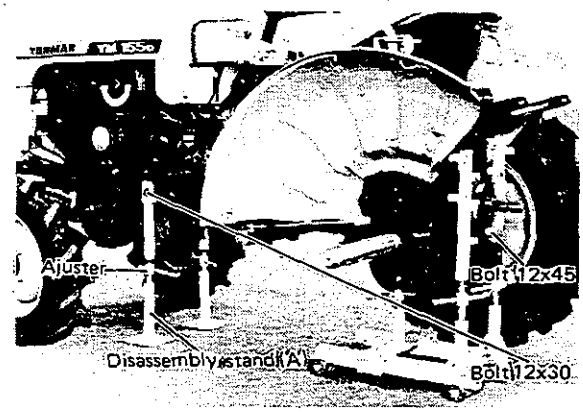
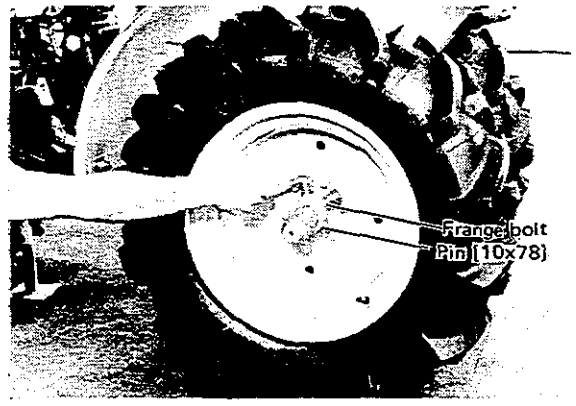
(1) Whenever heavy maintenance work such as separation or assembly is undertaken a special stand (as shown below) should be used. (Please order the stand separately if desired.)

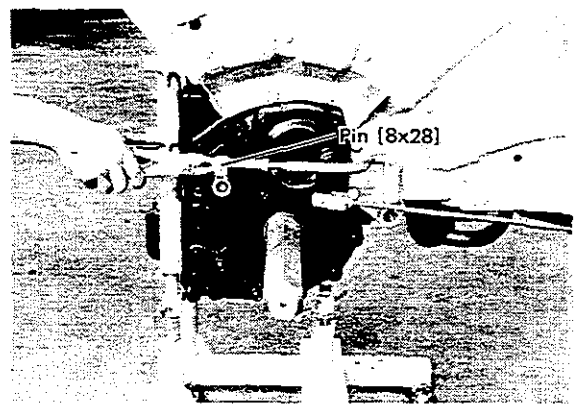
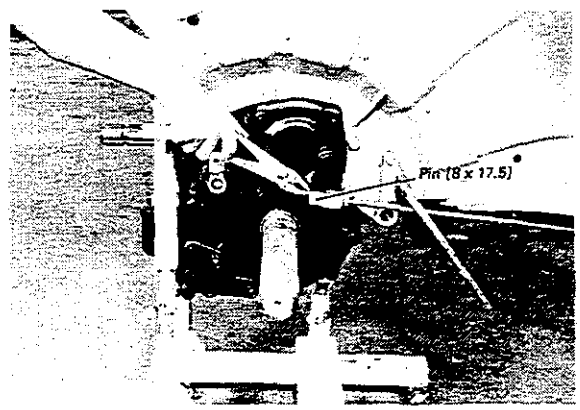
(2) The separation and assembly explanations will be made on the premise that this stand is being utilized.

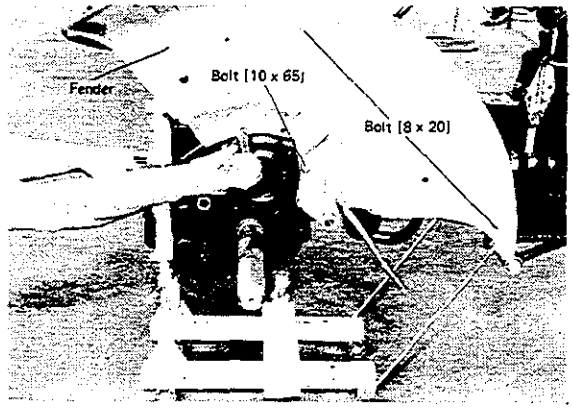
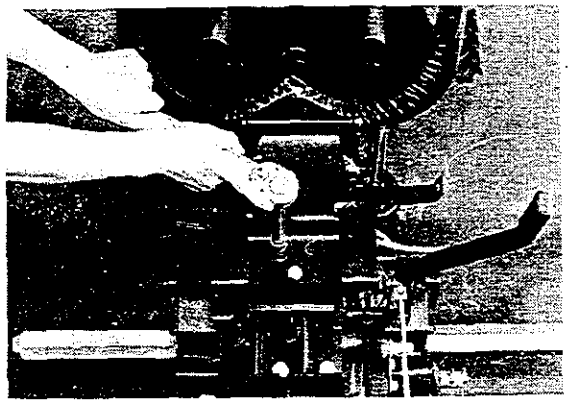
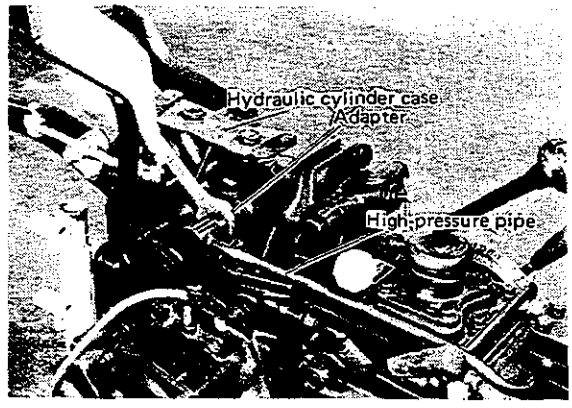
(3) A detailed diagram of the separation and assembly stand is as follows:

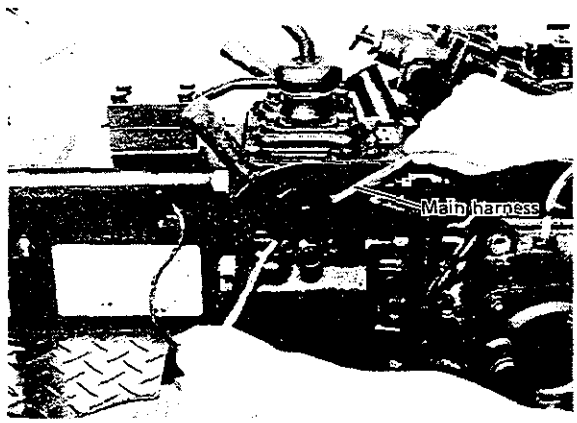
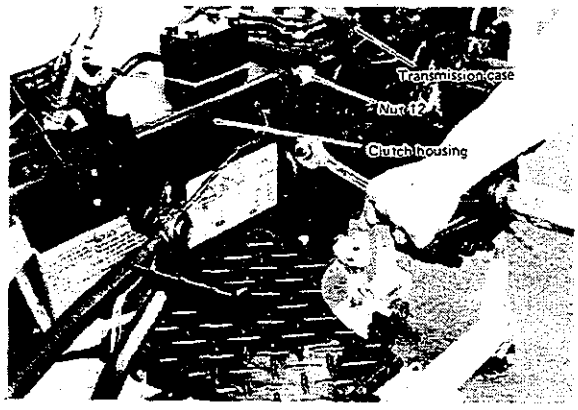


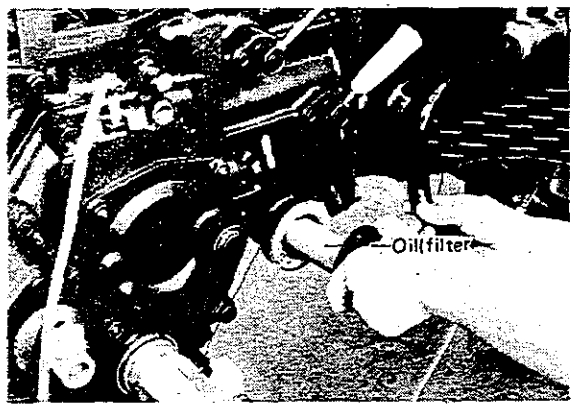
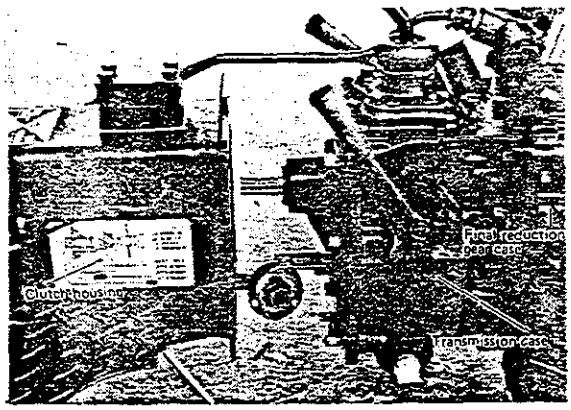
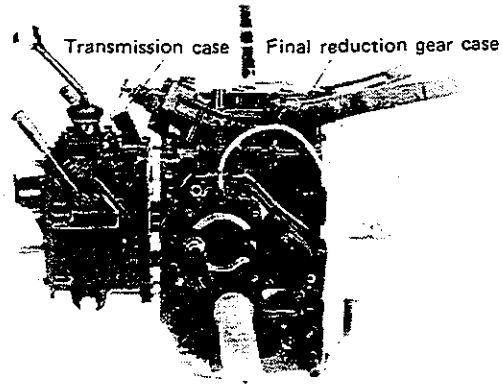
IV. DISASSEMBLY SEQUENCE

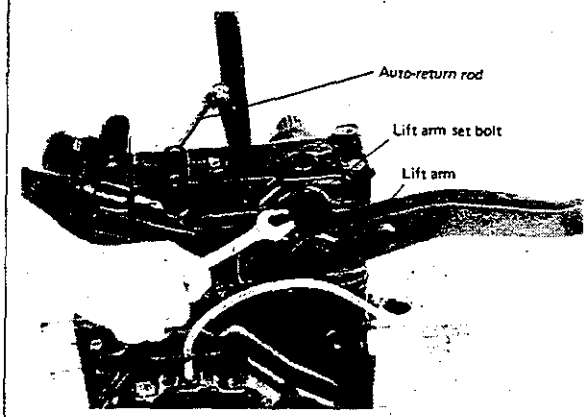
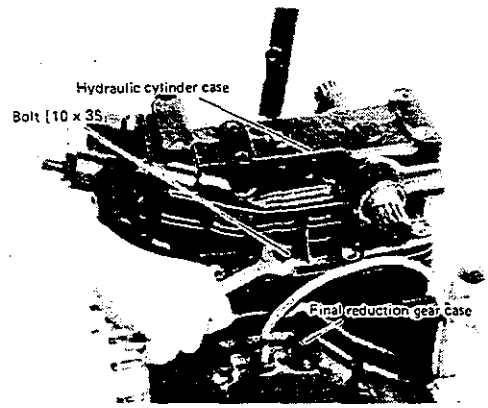
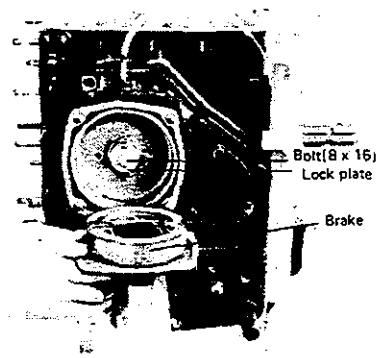
	Division	Part Name	Illustration	Caution/Remarks
1.	Installation stand	Installation stand	 	1) Utilize the top link hinge assembly bolt (12 x 45) to attach the installation stand (B). 2) Utilize the front axle bracket assembly bolt (12 x 30) to attach the disassembly stand (A). 3) Raise the rear tires by turning the adjusting bar of both stands (A) and (B). Prior to this adjustment loosen the flange bolts of the rear tire rim. 4) Be sure to adjust both stands (A) and (B) uniformly to ensure that the tractor remains level. *CAUTION: When attaching the front stand (A) be sure the front tires remain in contact with the ground.*
2.	Tires	Flange bolts Pin 10 x 78		Loosen the two flange bolts and remove the snap pin (10 x 78). The rear tire can then be removed.

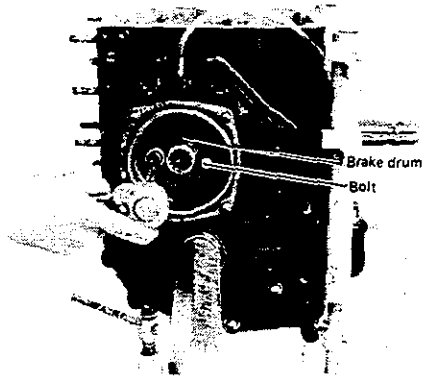
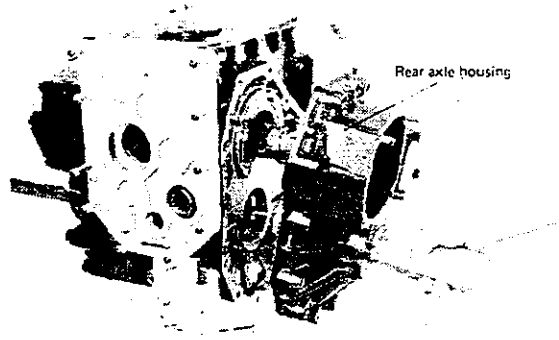
	Division	Part Name	Illustration	Caution/Remarks
3	Transmission case Gear case ass'y final reduction	Oil plug 20		• Loosen the oil plug (20) to drain the oil.
4		Pin 8 x 28 (Differential lock rod)		Pull out the cotter pin (2 x 15) and remove the pin (8 x 28).
5		Pin 8 x 17.5 (Brake rod)		Pull out the cotter pin (2 x 15) and remove the pin (8 x 17.5).

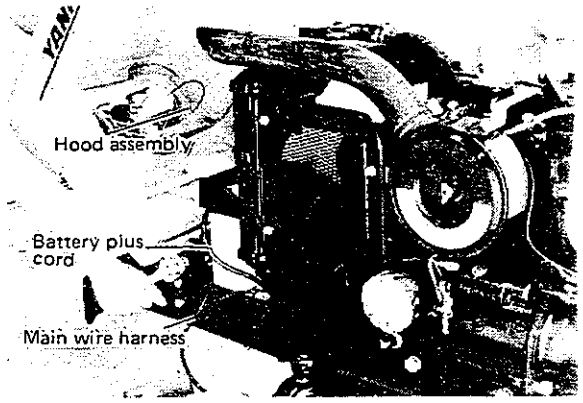
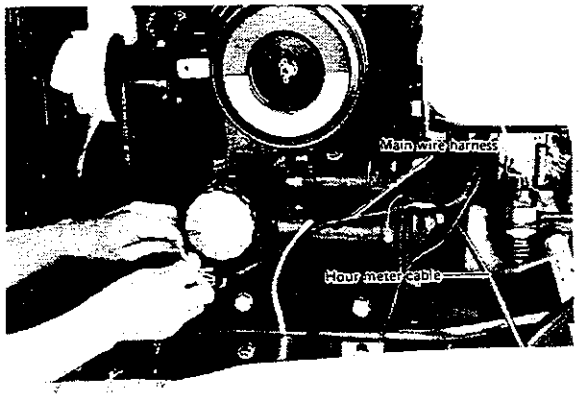
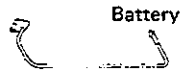
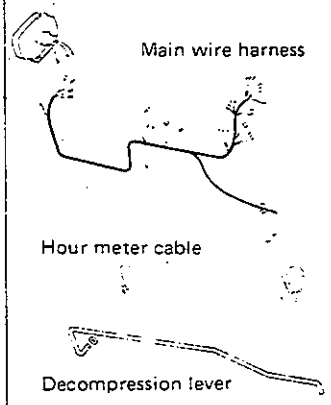
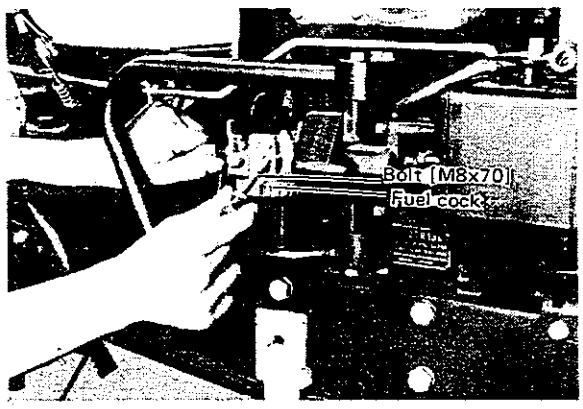
	Division	Part Name	Illustration	Caution/Remarks
6	Fender	Fender (L) (R)		Remove the four nuts from the bolts (10 x 65), the two nuts from the bolts (8 x 20), and remove the fender.
7	Seat	Operatior's seat bracket		The operator's seat can be removed by removing the two bolts (12 x 25) and the three bolts (10 x 20).
8	Trans-mission case Gear case ass'y final reduction	High-pressure pipe		Loosen the adapter, and remove the high pressure pipe from the hydraulic cylinder case.

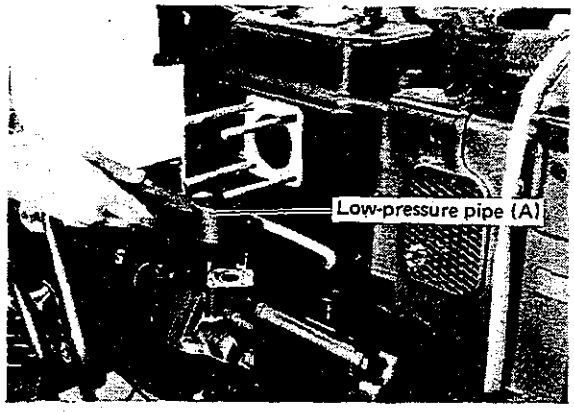
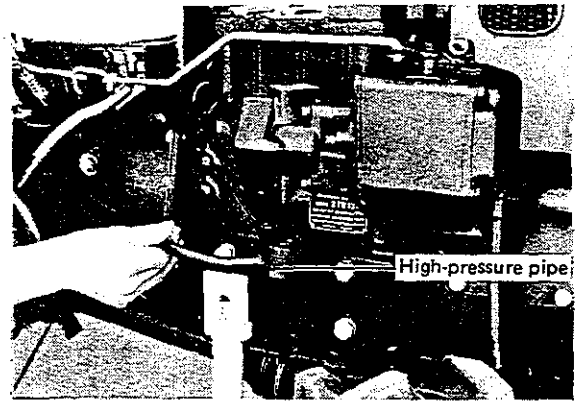
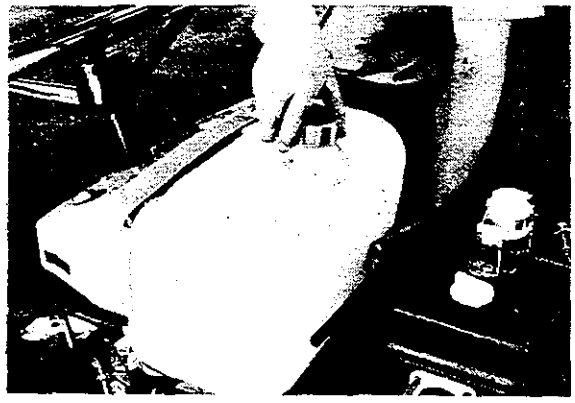
	Division	Part Name	Illustration	Caution/Remarks
9	Transmission case Gear case ass'y final reduction	Low-pressure pipe		Remove the three bolts (6 x 18) and dismantle low pressure pipe (B). Be sure not to damage the oil filter when dismantling.
10		Electric wire harness		Pull out the wire behind the clutch housing.
11		Dismantling transmission case from clutch *housing* [Procedure 1]		Remove the seven nuts (12).

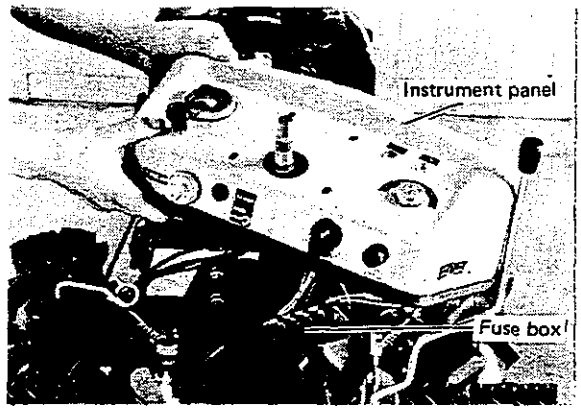
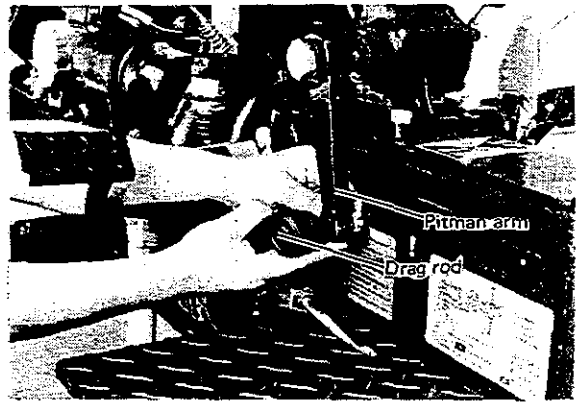
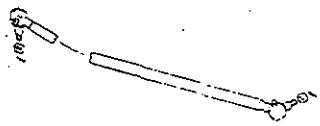
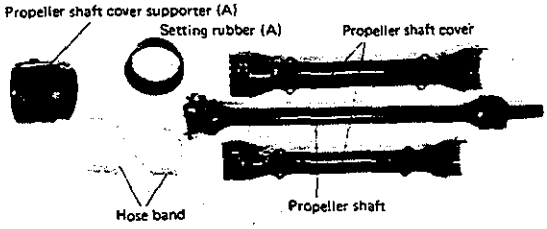
	Division	Part Name	Illustration	Caution/Remarks
12	Transmission case Gear case ass'y final reduction	Filter		Follow the same procedures as in Step 9. Place a container for oil, and remove the oil filter.
13		Dismantling the transmission case from the clutch housing [Procedure 2]		Separate the transmission case from the clutch housing. *CAUTION: Adjust the adjuster in Step 1 so the transmission case and the clutch housing are level.*
14		Separation of transmission case from final reduction gear case		Remove the ten nuts (10) and separate the transmission case from the final reduction gear case. *CAUTION:* *1) When preforming this procedure, if the nuts (on the left and right side) at the arrow mark are hard to remove due to the extruded portion, gradually remove the transmission case and remove the nuts.* *2) Attach these nuts first during assembly.*

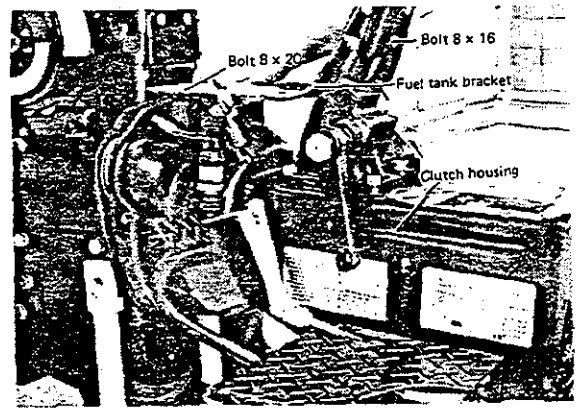
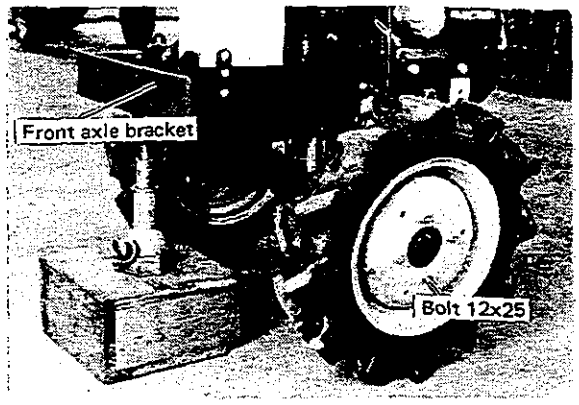
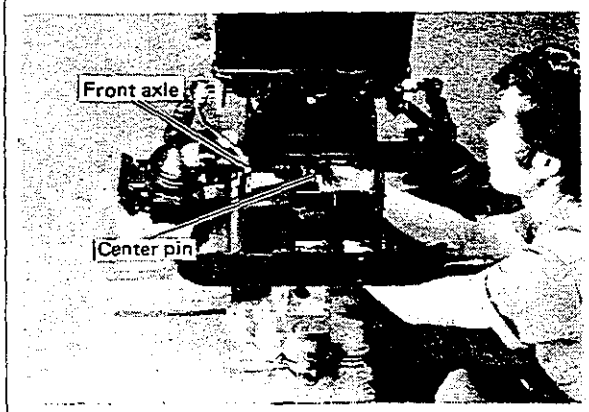
	Division	Part Name	Illustration	Caution/Remarks
15	Housing hydraulic cylinder	Lift arm (L) (R)		1) Lift arm (L) Remove the lift arm set bolt, and force off the lift arm (L). 2) Lift arm (R) a) Remove lift arm set bolt. b) Remove the two bolts (8 x 20), and dismantle the auto-return rod support. c) Lift off the lift arm (R).
16		Hydraulic cylinder housing		Remove the ten bolts (10 x 35), and separate the hydraulic cylinder housing from the final reduction gear case.
17	Brake	Brake (L) (R)		Remove the nuts (8) (on the left & right side), and remove the brake (L)·(R).

	Division	Part Name	Illustration	Caution/Remarks
18	Brake	Brake drum		1) Remove the bolt (8 x 16) lock plate, washer, and lock plate. 2) Drive the bolt into the brake drum to remove it. *NOTE: For Step 2) use an M8 bolt with a thread length over 1 in (25 mm).* *For example, hydraulic adaptor cover fixing bolt [M8 x 45]*
19	Gear case ass'y, final reduction	Rear axle housing (L) (R)		1) Loosen oil plug (10) and drain the oil. 2) Remove the 8 bolts (10 x 60), and the (12 x 60) bolt, and the two nuts (12). 3) Use a plastic hammer to loosen the flanged part and bolt parts. Remove with the rear axle shaft as the base.

	Division	Part Name	Illustration	Caution/Remarks
20	Hood, Electric parts Engine parts	Hood ass'y Main wire harness Hour meter cable [YM155D, YM155 only] Decompression lever	 	  *CAUTION:* *1) Before removing the main wire harness, first dismantle the battery plus (+) cord and the battery ground cord.* *2) When removing the main wire harness, it is recommended for ease of handling not to remove the connection in the instrument panel.* 
21	F. O. filter	Fuel cock		Pull out the bolt (M8 x 70), and remove the fuel cock.

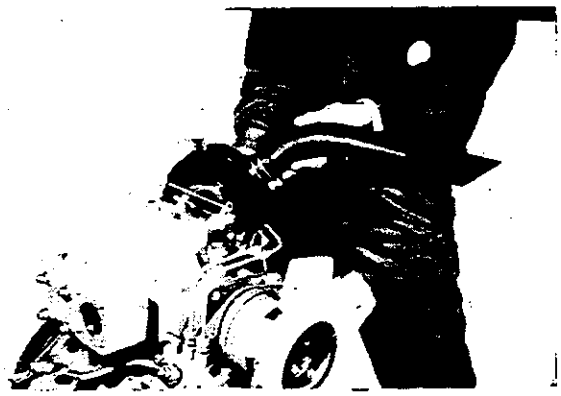
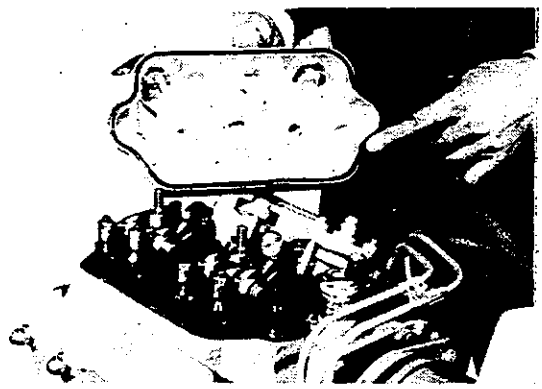
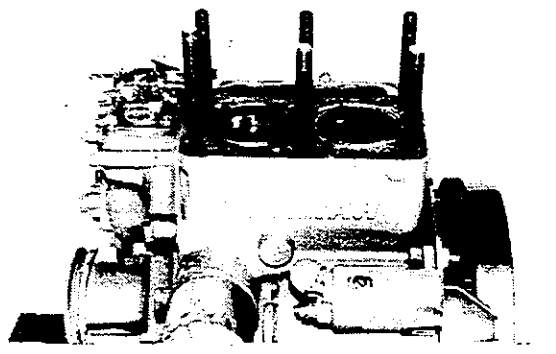
	Division	Part Name	Illustration	Caution/Remarks
22	Hydraulic pump	Low-pressure pipe		Remove the 3 bolts (6 x 45) and take out the low-pressure pipe (A).
23		High-pressure pipe		Remove the 4 bolts (6 x 45) and take out the high-pressure pipe.
24	F. O. tank	Fuel oil tank		Loosen the 4 nuts (8) to remove the fuel oil tank band, and dismantle the fuel oil tank. *NOTE:* *1) Remove the cock ass'y with the fuel oil tank connected.* *2) Photo shows the procedure for the YM155(D), the fuel tank is different from that of the YM135(D), but the disassembling procedure remains the same.*

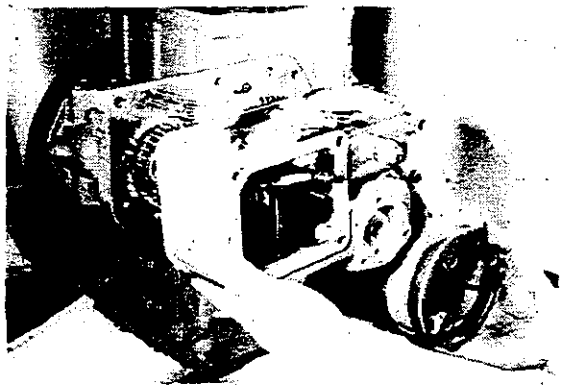
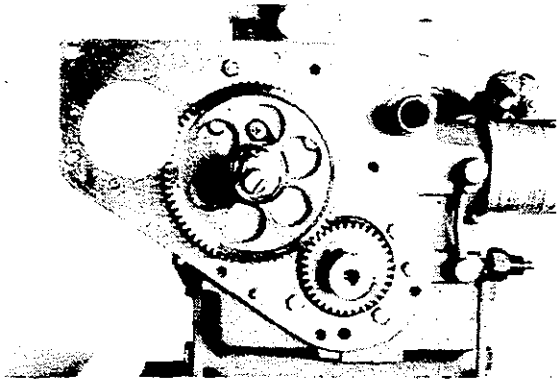
	Division	Part Name	Illustration	Caution/Remarks
25	Instrument panel	Instrument panel		Remove the instrument panel in the following sequence: 1) Steering wheel cap 2) Lock nut (14 x 1.5) 3) Steering wheel 4) Fuse box, 2 screws (5 x 10) 5) Current limter, 4 screws (6 x 16) 6) Remove the instrument panel without removing the *main wire harness.*
26	Steering	Drag-rod		When removing the drag-rod, use two plastic hammers and strike the pitman arm end from both sides. 
27	Front drive	**Propeller shaft ass'y [YM155D, YM135D only]**		Remove the propeller shaft in the following order: 1) Loosen the hose band and shift the setting rubber backward. 2) Remove the 4 bolts (6 x 10), and remove the propeller shaft cover. 3) Take out the 4 bolts (6 x 16) to shift the propeller shaft cover supporter (A) backward. 4) Remove the 4 bolts (8 x 20) to remove the propeller shaft.

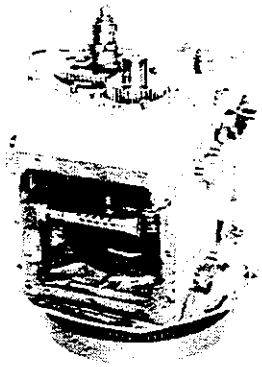
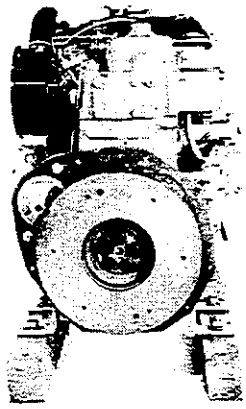
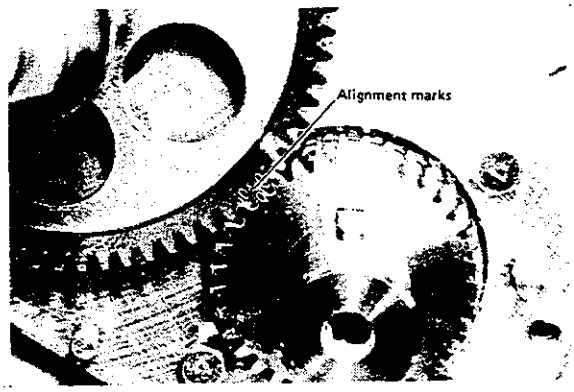
	Division	Part Name	Illustration	Caution/Remarks
28	Clutch housing	1) Separating from engine clutch housing 2) Fuel oil tank bracket		1) Remove the 2 nuts (10) and 7 bolts (8 x 16) to separate the engine from the clutch. 2) Remove the 2 bolts (8 x 20) as shown in the photo, togehter with 4 bolts (8 x 16), to remove the fuel tank bracket.
29	Front axle	Front tire Front axle	 	1) Jack up the front axle bracket top and raise the front tires from the ground. 2) Remove the 4 bolts (12 x 25), and remove the front tires. 3) Place a stand under the front axle, so that the center pin is not subjected to any load. 4) Take out the castle nut (16) and extract the center pin. 5) Remove the front axle. *NOTE: Photo shows the procedure for YM155D and YM135D, but the same disassembling procedure is used for the YM155 and YM135.*

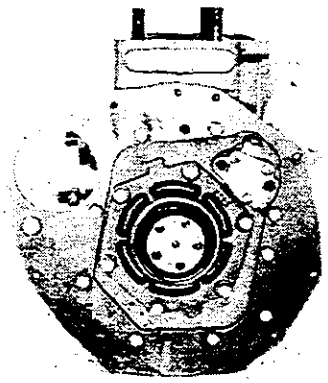
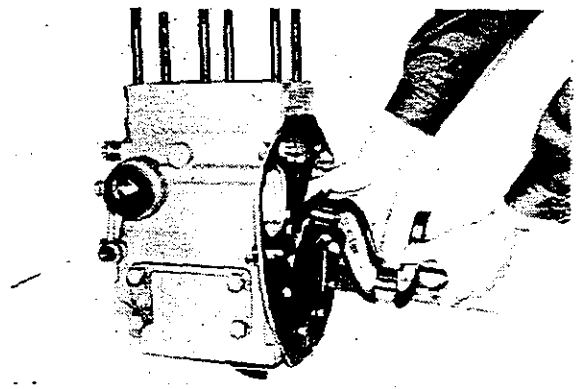
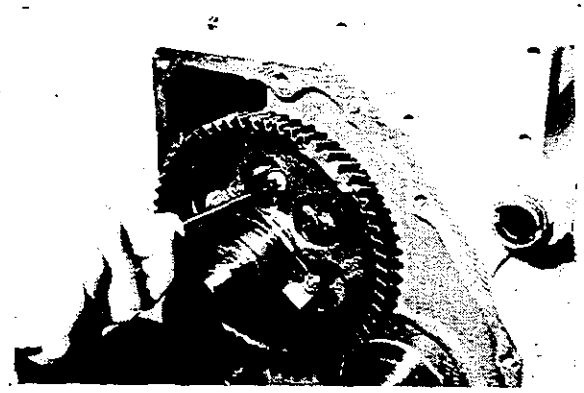
V. ENGINE DISASSEMBLY

Complete disassembly of the engine should be carried out in the following sequence:

	Item	Illustration	Explanation
1	Radiator and air cleaner		1) Drain coolant from radiator and cylinder block. 2) Detach radiator hose. 3) Detach radiator with front axle as an assembly.
2	Cylinder head		1) Drain lube oil. 2) Remove fan belt. 3) Detach generator and starter motor. 4) Remove air cleaner and rocker arm cover. 5) Detach fuel and lube oil pipes. 6) Detach rocker arm assembly. 7) Remove push rods. 8) Remove cylinder head nuts. (Do not forget the nut in the intake manifold.) 9) Remove cylinder head gasket.
			

Items		Illustration	Explanation
3	Gear case		1) Remove fuel injection pump room cover; detach governor linkage. 2) Remove crankshaft pulley. Remove the crank gear by using two slot screwdrivers. Do not use a gear puller. 3) Detach gear case. *Note: The hydraulic pump and tachometer gear unit are not detached from the gear case but are removed as a unit. When assembling, remove the hydraulic pump and tachometer gear unit to make fitting easier.*
			
4	Fuel injection pump		1) Injection control rod is set to the notch. on the fuel pump room and the fuel pump is removed. 2) Check the thickness and number of the injection timing adjustment shims at this time. 3) Remove the lube oil dipstick.

Item		Illustration	Explanation
5	Piston assemblies		1) Turn the cylinder block on its side (with the fuel pump below.) 2) Remove under cover of cylinder block. 3) Detach lube oil inlet tube. 4) Remove rod bolts. *Caution: Clearly mark for later reference which is No. 1 piston and which is No. 2 piston.*
6	Flywheel		1) Remove the bolts (5 pcs). 2) Remove flywheel.
7	Gears		1) Remove crankshaft gear. 2) Remove hydraulic pump driven gear, using a gear puller. 3) Remove lube oil pump. *Caution: Since the lube oil pump-driven gear and shaft are secured with a tapered pin driven in and press-fitted, do not disassemble them.*

Item		Illustration	Explanation
8	Crankshaft		1) Remove main bearing housing. 2) Remove crankshaft. *Caution: Be careful not to drop the thrust bearing.*
			
9	Camshaft		1) Remove stopper. Remove the bearing weights. 2) Remove camshaft. 3) Remove tappets.

VI. ENGINE CONSTRUCTION AND MAINTENANCE

1. CYLINDER LINERS

Cylinder liners must provide a good fit with pistons and piston rings, provide good heat dissipation, and must also have ample wear resistance.

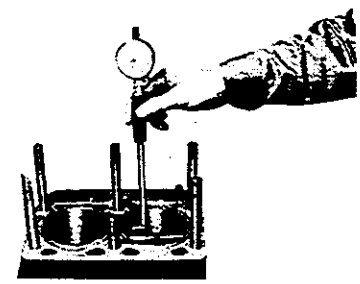
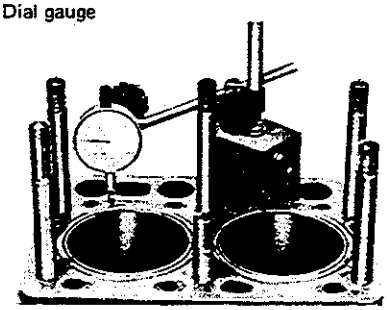
The 2TR13A, 2T73A engine employs wet type cylinder liners made of special cast iron.

(1) Visual Inspection

The cylinder liner should be replaced when there are visible scratches, traces of rust, or corrosion.

(2) Inspecting by Testing Equipment

[Unit: in (mm)]

	Item	Standard dimension	Replacement limit	Testing equipment
1.	Inner diameter of cylinder liner			Cylinder gauge 
	■ YM135(D)	2.8740–2.8752 ($73^{+0.030}_{0}$)	0.0066 (0.17)	
	■ YM155(D)	2.9527–2.9539 ($75^{+0.030}_{0}$)	0.0066 (0.17)	
2.	Roundness	Within 0.0008 (0.02)	0.0039 (0.1)	Cylinder gauge
3.	Projection of cylinder liner	0.0019–0.0051 (0.05–0.13)	–	Dial gauge 

NOTES:

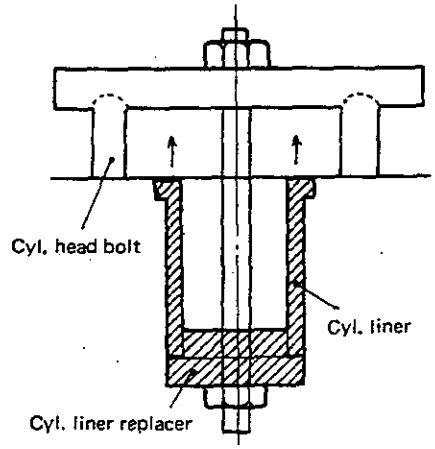
(1) Measure the inner diameter of the cylinder liner in the axial direction of the crankshaft and in the direction of the piston at the following places: a) at the upper part of the liner [1.1811 in. (30 mm) below the top of the liner], b) at the center of the liner, and c) at the lower part of the liner.

(2) Whether the roundness of the cylinder liner is within the allowable limits is determined by studying the differences in readings obtained in Item 1.

(3) The cylinder liner projection is necessary in order to reduce distortion of the cylinder liner and also to provide a good fit with the gasket when the cylinder head is tightened. Accordingly, check to see that the required projection is provided.

(3) Replacing Cylinder Liners

Cylinder liners – judged to be unacceptable by visual inspection and inspection by testing equipment – are replaced in the following procedure:



a) Extract the cylinder liner with a cylinder liner replacer.

b) Clean the grooves provided for the rubber packing of the liner.

c) Replace the liner rubber packings with a new one.

d) Coat the liner with water-proofing paint.

e) Remove the cylinder liner and insert a new liner.

f) After it has been inserted, inspect it using the procedures previously described to ascertain that there is no contraction of the liner.

2. PISTONS

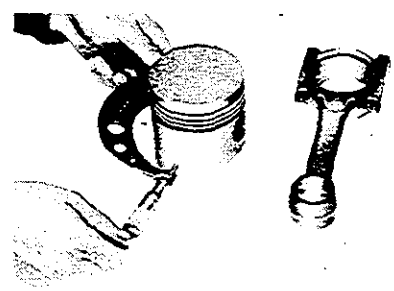
The oval type pistons are made from LOW-X material (Aluminum alloy) which has good heat dissipation properties.

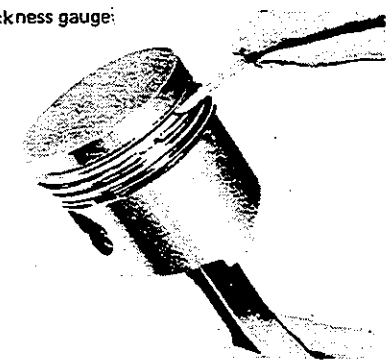
(1) Visual Inspection

Check the pistons for scoring or cracks. Also check the piston ring grooves for chips or any wear in their edges.

(2) Inspecting by Testing Equipment

[Unit: in (mm)]

	Item	Standard dimension	Replacement limit	Testing equipment
1.	Outer diameter of piston			Micrometer
	■ YM135(D)	2.8697–2.8709 ($73^{-0.078}_{-0.109}$)	-0.0078 (-0.2)	
	■ YM155(D)	2.9484–2.9496 ($75^{-0.078}_{-0.109}$)	-0.0078 (-0.2)	
2.	Clearance between piston and cylinder	0.0043–0.0068 (0.108–0.173)	0.0118 (0.3)	

	Item	Standard dimension	Replacement limit	Testing equipment
3.	Piston ring grooves clearance:—			Thickness gauge: 
	No. 1	0.0019—0.0033 (0.050—0.085)	0.0078 (0.2)	
	No. 2	0.0008—0.0022 (0.020—0.055)	0.0079 (0.2)	
	No. 3	0.0008—0.0022 (0.020—0.055)	0.0079 (0.2)	
	No. 4	0.0008—0.0022 (0.020—0.055)	0.0059 (0.15)	

NOTES:

(1) Measure the outer diameter of the piston at the piston skirt section, at right angles to the axis of the piston pin.

(2) Measure the clearance between the piston and the cylinder liner by comparing the outer diameter of the piston and the inner diameter of the cylinder liner. The clearance is the difference between the minimum clearance figure obtained and the outer diameter of the piston.

(3) Replacing Pistons

(3.1) Disassembly

a) Detach the two piston pin retaining rings;

b) Heat up the piston to 176° – 212°F (80° – 100°C);

c) Remove the piston pin by tapping it with a lead bar and a hammer.

(3.2) Assembly

a) Fit in one of the piston pin retaining rings;

b) Heat up the piston to 176° – 212°F (80° – 100°C);

c) Fit the piston pin in position;

d) Fit in the remaining piston pin retaining ring.

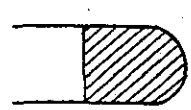
After assembly check to make sure that the piston and connecting rod move freely.

3. PISTON RINGS

The piston rings have Teflon® coatings in order to achieve good break-in properties.

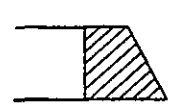
The piston rings are as follows:

- No.1 ring



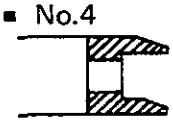
Barrel face type:
Provides and maintains good sealing properties and carbon crushing properties; also prevents carbon sticking. Is chrome plated to achieve good wear-resisting properties.

- No.2 & 3



Taper face type:
Provides and maintains good sealing properties and oil scraping effects.

- No.4



Bevel cutter type:
An oil ring, in which the emphasis is upon oil scraping effects, is used.

(1) Visual Inspection

Check rings for uneven wear or abnormal wear.

(2) Inspecting by Testing Equipment

[Unit: in (mm)]

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Piston ring grooves and ring clearance	*[Refer to section on pistons]*			
2.	Piston ring end clearance:— No. 1 No. 2 No. 3 No. 4	0.0078—0.0157 (0.2—0.4)	0.0591 (1.5)	Thickness gauge	

NOTES:

(1) To measure the piston ring end clearance, the cylinder liner is placed on a surface table, the ring is fitted in the skirt section, and after making sure that the ring is not askew, the end clearance is measured with a thickness gauge.

(2) When the piston rings are being fitted in the piston, be sure that the marking on the ring is facing up.

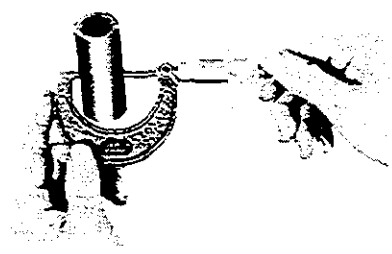
4. PISTON PIN

(1) Visual Inspection

Check to make sure that there are no traces of scoring, or uneven wear.

(2) Inspecting by Testing Equipment

[Unit: in (mm)]

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Inner diameter of piston pin hole	0.9053—0.9058 $(23^{+0.008}_{-0.005})$	—	Cylinder gauge	
2.	Clearance between piston pin diameter and piston pin holes	+0.0003— -0.0001 (+0.008— -0.004)			

5. CONNECTING RODS

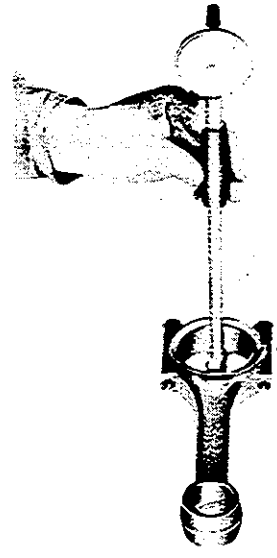
The connecting rods are stamp forged, and the big end sides have square cuts. The small end bushings are made of sintered copper and lead alloy, and the large end side has kelmet bearings.

(1) Visual Inspection

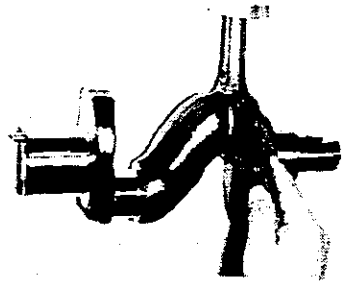
The bushings are checked to see whether there is any scoring or peeling.

(2) Inspecting by Testing Equipment

[Unit: in (mm)]

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Rod alignment	0—0.0020 (0—0.05)		Connecting rod analyzer	
2.	Inner diameter of small-boss bushings (after assembly)	0.9064—0.9070 ($23^{+0.038}_{+0.025}$)	0.0039 (0.1)	Cylinder gauge	
3.	Clearance between piston pin and small end bushings *	0.0010—0.0019 (0.025—0.049)	0.0043 (0.11)		
4.	Inner diameter of big end bushings *	1.8503—1.8520 ($47^{+0.042}_{0}$)	0.0039 (0.10)	Cylinder gauge	
5.	Clearance between big end and crank-shaft *	0.0014—0.0037 (0.036—0.095)	0.0078 (0.2)		

(*Refer to Note on following page)

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
6.	Connecting rod side play *	0.0059–0.0138 (0.15–0.35)		Thickness gauge	

(*Refer to Note below)

NOTES:

(1) To replace the small end bushings, press-fit in new bushings. During the operation be sure that there is no peeling or contraction of the bushings. Measure the inner diameters after the new bushings have been press-fitted in position. If the diameter is too small, it should be corrected, using a reamer. When press-fitting new bushings into position, be sure to align the oil passages of the bushings with those of the connecting rod.

(2) The clearance referred to in Item 3 above is the difference between the outer diameter of the piston pin and the inner diameter of the bushings obtained by measurements.

(3) The measurements referred to in Item 4 above are to be taken after tightening the connecting rod bolts to a torque of 33 – 36 ft-lb (4.5 – 5.0 kg-m).

(4) The clearance referred to in Item 5 above is the difference between the inner diameter of the big end bearing and the outer diameter of the crankshaft obtained by measurements conducted using an oil clearance gauge and/or a cylinder gauge.

As in the case of Item 4, the measurements are to be taken after the bolts have been tightened to the prescribed torque.

(5) The measurements referred to in Item 6 are to be taken using a thickness gauge, after first securing the connecting rods to the crankshafts and tightening the bolts to the prescribed torque and then moving the connecting rod to one side.

(6) At least 75% of the total area of the crankshaft bushings must be in contact with the crankshaft itself.

6. CRANKSHAFT

The crankshaft used in the engine is a solid two-throw type, stamp forged and equipped with balance weights.

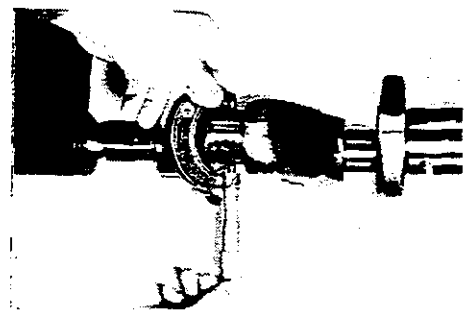
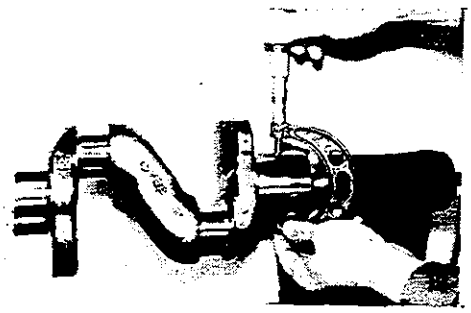
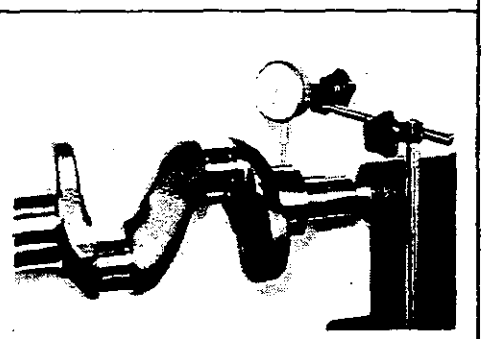
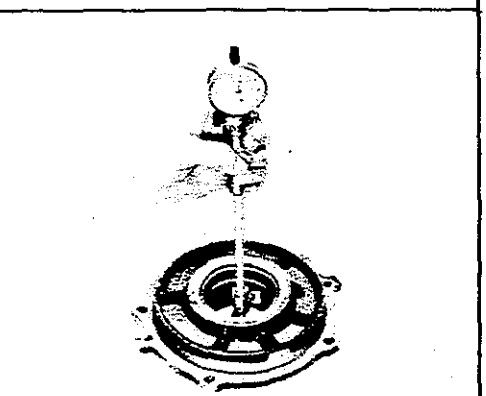
Extra overlap is provided at the journal sections and pin sections, for increased durability of the crankshaft.

(1) Visual Inspection

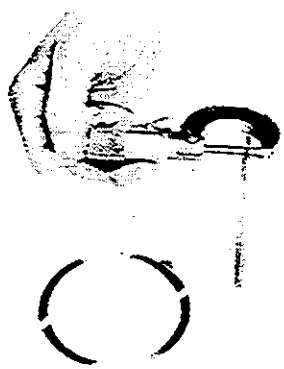
Check the crankshaft visually to see whether there are any traces of scoring, marring, or cracks.

(2) Inspecting by Testing Equipment

Unit: in (mm)

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Outer diameter of crank pin	1.8484–1.8489 ($47^{-0.036}_{-0.050}$)	-0.0031 (-0.08)	Micrometer	
2.	Outer diameter of crank journal	2.5570–2.5576 ($65^{-0.036}_{-0.050}$)	-0.0035 (-0.09)	Micrometer	
3.	Deflection of crankshaft	Less than 0.0008 (0.02)		Dial gauge	
4.	Inner diameter of main bushings	2.5590–2.5609 ($65^{+0.049}_{0}$)	0.0039 (0.1)	Cylinder gauge	

Unit: in. (mm)

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
5.	Clearance between outer diameter of crank journal and inner diameter of main bushings	0.0014—0.0039 (0.036—0.099)	0.0079 (0.2)		
6.	Thickness of thrust bearings	0.1161—0.1142 ($2.95^{0}_{-0.05}$)	0.1083 (2.75)	Micrometer	
7.	Crankshaft end play	0.004—0.008 (0.1--0.2)	0.0157 (0.4)	Dial gauge	
8.	Roundness of main bushings	0.0004 (0.01)			

NOTES:

(1) After conducting the measurements given in Item 1 above, be sure to measure the clearance between the crank pin bearings and the crank pin. (Refer to Item 5 in the section on measurements on the connecting rods for the prescribed dimensions).

(2) If, after measuring the crankshaft for deflection, it is found that machining of the crankshaft is necessary, do not forget to adjust the fillet sections of the crank pins after the machining is completed. Measure the deflection by placing the crankshaft on a supporting stand.

(3) Item 5 will be the difference between Item 2 and Item 4 obtained through measurements.

(4) Measuring of end play is conducted after the crankshaft has been fitted into position as prescribed.

(5) The roundness of the main bushings is checked by measuring the inner diameter in two directions at right angles to each other and comparing the two readings obtained.

(3) Replacing the Main Bushing

Whenever the readings for the main bushings exceed the repairable limit, they must be replaced.

When fitting the main bushings in the main bushings housing and cylinder block, observe the following points:

a) To extract and insert bushings, always use the bushings removing and installing tools.

b) When inserting new bushings, be sure that the oil passages are aligned.

c) After the new bushings have been installed, measure the inner diameter of the main bushing to check that they are properly aligned, and not contracted.

7. CAMSHAFT

A single, integrated camshaft, incorporating the intake and exhaust cams, and the fuel cam, is used.

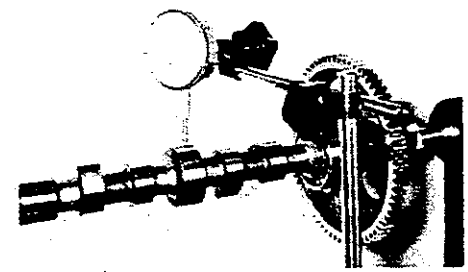
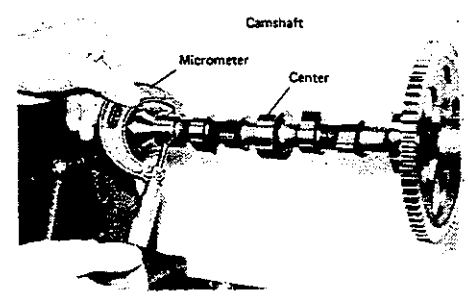
The fuel cam has straight flank and convex curves while the intake and exhaust cams have parabolic acceleration curves, in order to reduce the shock of inertia force, this also serves to effectively reduce noise.

(1) Visual Inspection

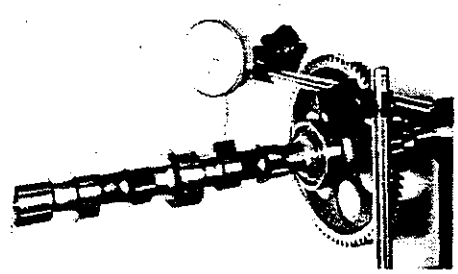
Check the crankshaft for marring or uneven wear. Be sure that the supporting function correctly, and that no abnormal noises are generated.

(2) Inspecting by Testing Equipment

Unit: in (mm)

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Camshaft — check for distortion	Less than 0.002 (0.05)		Dial gauge	
2	Outer diameter of camshaft:—			Micrometer	
	Flywheel side	1.1787–1.1795 ($30^{-0.040}_{-0.061}$)	-0.0039 (-0.1)		
	Center	1.6505–1.6515 ($42^{-0.050}_{-0.075}$)			

Unit: in (mm)

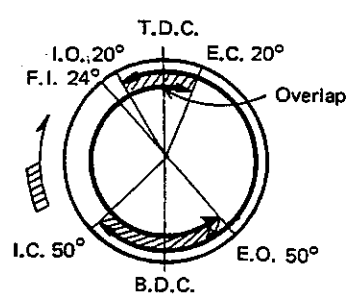
	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
3.	Clearance between outer diameter of camshaft bearing and cylinder block:				
	Flywheel side	0.0015–0.0031 (0.04–0.081)	0.0059 (0.15)		
	Center	0.0020–0.0039 (0.05–0.10)	0.0059 (0.15)		
4.	Cam heights:				
	Intake No. 1 Intake No. 2	1.3779 (35.0)			
	Exhaust No. 1 Exhaust No. 2	1.3779 (35.0)			
	Fuel cam No. 1 Fuel cam No. 2	1.7716 (45.0)			

NOTES:

(1) To conduct the measurements referred to in Item 1 above, the camshaft is secured to a supporting stand, and the amount of run-out is measured using a dial gauge.

(2) The cam journal clearance referred to in Item 3 is the difference in the readings obtained by measurements of the two components taken using a micrometer and a cylinder.

(3) Valve timing and fuel injection timing is shown below.



(4) The clearance between the tappets and tappet guides referred to in Item 6 above is the difference between the readings for the components taken using a micrometer and a cylinder gauge.

(5) Replacement of the camshaft ball bearing is conducted by first removing the old bearing by a puller and press-fitting the new ones in position.

8. CYLINDER HEAD

A cylinder head integrating two cylinders into one and made by high precision quality casting is used.

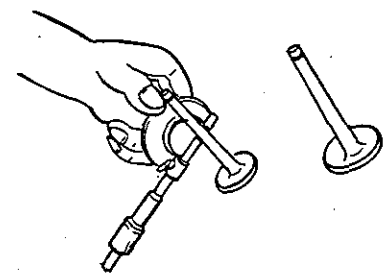
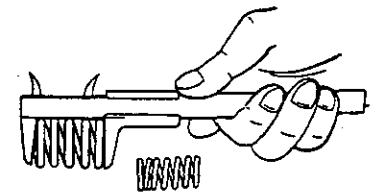
Both the intake ports and the exhaust ports are integrated in the cylinder head, and overall engine design and construction has been simplified by eliminating manifolds.

(1) Visual Inspection

The surface of the head is checked to see if there are any traces of coolant or gas leakage. The inside of the head is checked to ascertain that it is not clogged up anywhere by accumulated debris and that there is no corrosion.

(2) Inspecting by Testing Equipment

Unit: in (mm)

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Inner diameter of valve guides (after assembly)	Intake: 0.2755–0.2761 ($7^{+0.015}_{+0}$) Exhaust: 0.2763–0.2775 ($7^{+0.020}_{+0.050}$)	0.0031 (0.08)	Wire gauge	*[Check that the reading is within the standard dimension]*
2.	Outer diameter of valve stems	0.2736–0.2740 ($7^{-0.040}_{-0.050}$)	–0.0039 (–0.1)	Micrometer	
3.	Clearance between valve guide and valve stem	Intake: 0.0015–0.0025 (0.040–0.065) Exhaust: 0.0017–0.0027 (0.045–0.070)	0.0059 (0.15)		
4.	Valve seat width: Intake / Exhaust	0.0696 (1.77)	0.0984 (2.5)	Calipers	
5.	Amount of valve sinkage	–	0.0197 (0.5)	Calipers	
6.	Valve springs: Inclination	–	2 degrees		
	Free length	1.4370 (36.5)	1.6142 (41)	Calipers	
7.	Valve seat angle. intake/exhaust	90 degrees			

NOTES:

(1) Measure the inner diameter of the valve guides after they have been fitted into position. A press must be used to press-fit the valve guides into position when they are replaced.

If there is insufficient clearance between the valve guides and the valve stems, clearance should be increased to the prescribed dimension by using a reamer.

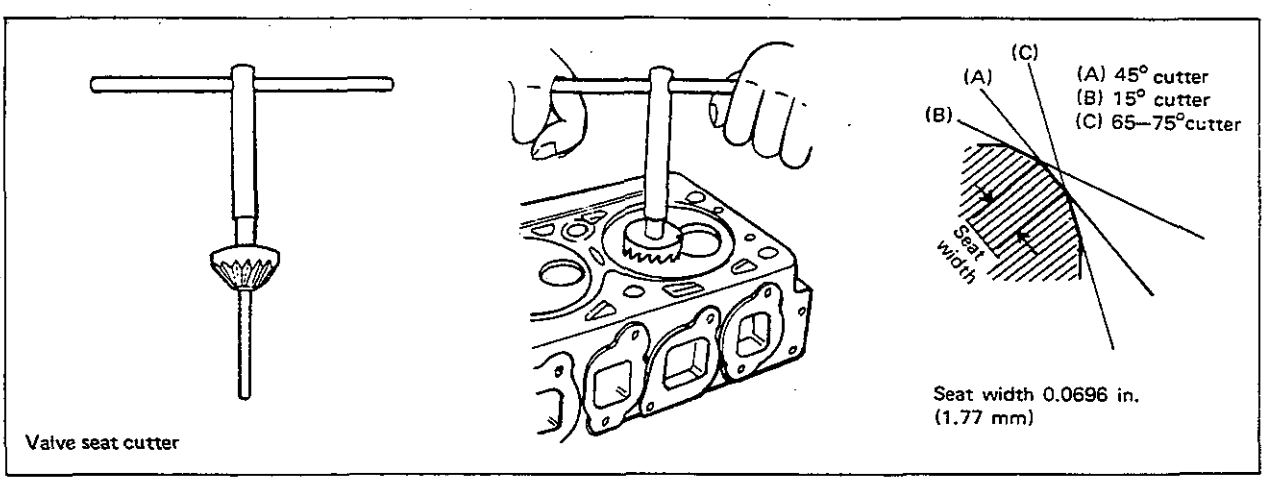
Before the intake & exhaust valves are installed, coat the valve stems with lub oil.

(2) The width of the valve seats is measured by a pair of calipers, and if corrections are necessary, the prescribed valve cutter must be used.

- *Outer diameter of valve:*
  Intake (32±0.1) 1.0590–1.0669
  Exhaust (27±0.1) 1.2559–1.2637

After the valve seats have been dressed using the seat cutters, the valves are lapped.

i) Lapping should be done by using valve lapping compound powder.
ii) The finishing of the seat should be done by oil lapping.
iii) When fitting the valves back in position, do not mix up the valves for No. 1 cylinder with those of the No. 2 cylinder. All valves are marked prior to shipment from the factory whether they are intake or exhaust valves, and also whether they are for the No. 1 or No. 2 cylinders.



Valve seat cutter

9. COMBUSTION CHAMBERS

The combustion chambers consist of Yanmar's patented special swirl type pre-combustion chambers. They improve combution performance and contribute to achieving low fuel consumption.

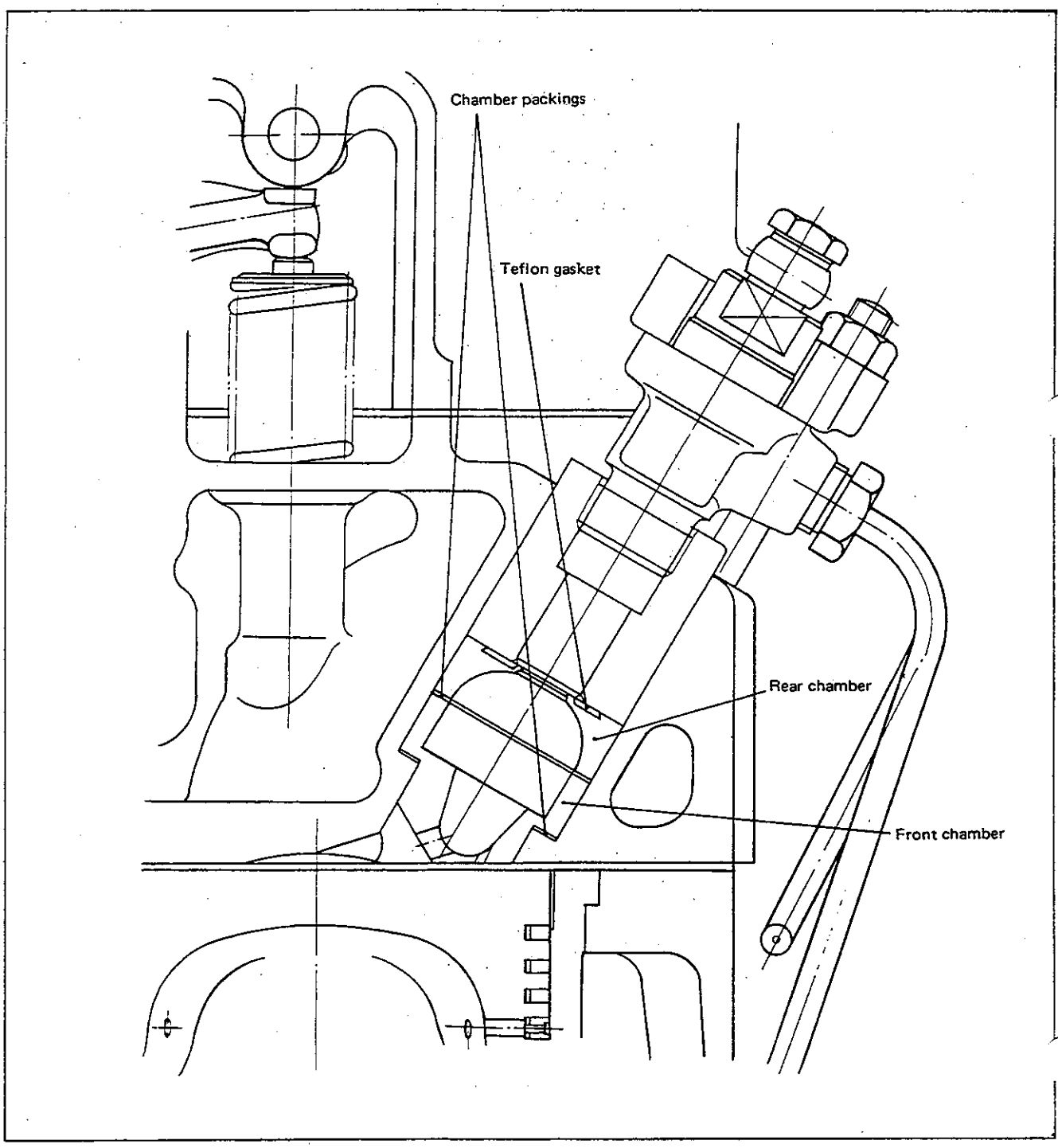
(1) Visual Inspection

Check the combustion chambers to see that the injection ports are not clogged or that carbon deposits have not formed.

(2) Points to Bear in Mind in Assembling the Combustion Chambers

When assembling the combustion chamber, carry out the work in the following sequence. Note that the front chamber has front and rear sides.

a) Chamber packing
b) Front chamber
c) Chamber packing
d) Rear chamber
e) Teflon® gasket



10. ROCKER ARM ASSEMBLY

Independent rocker arm supports are provided for each of the cylinders. Lubrication of the rocker arm is carried out by forced lubrication — lube oil fed under pressure from the lube oil pump.

(1) Visual Inspection

Check the rocker arm support, the shaft, and the rocker arm bushings for cracks.

(2) Inspecting by Testing Equipment

Unit: in (mm)

	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Outer diameter of rocker arm shaft	0.5504—0.5511 ($14^{-0.018}_{0}$)	-0.0039 (-0.1)	Micrometer	
2.	Inner diameter of rocker arm bushings	0.5518—0.5525 ($14^{+0.034}_{+0.026}$)	0.0039 (0.1)	Cylinder gauge	
3.	Clearance between rocker arm shaft and inner diameter of rocker arm bushings	0.0006—0.0020 (0.016—0.052)	0.0059 (0.15)		
4.	Length of push rods	6.5157 (165.5)	-0.0787 (-2)	Calipers	

NOTES:

(1) The rockers arm bushings are press-fitted in position and when they are to be replaced they should again be press-fitted. After they have been fitted, measure them to be sure they are not croocked nor is there any contraction.

(2) Place the push rod on a surface table to check them for straightness.

(3) Align the oil-port when replacing bushings

11. INJECTION PUMP AND INJECTION VALVE

An integrated fuel pump, a Bosch PFR2K type manufactured by Yanmar, is used for the No. 1 and No. 2 cylinders.

The nozzles are of semi-throttle type, to achieve lower combustion noise (low rpm knocking) without impairing engine starting performance.

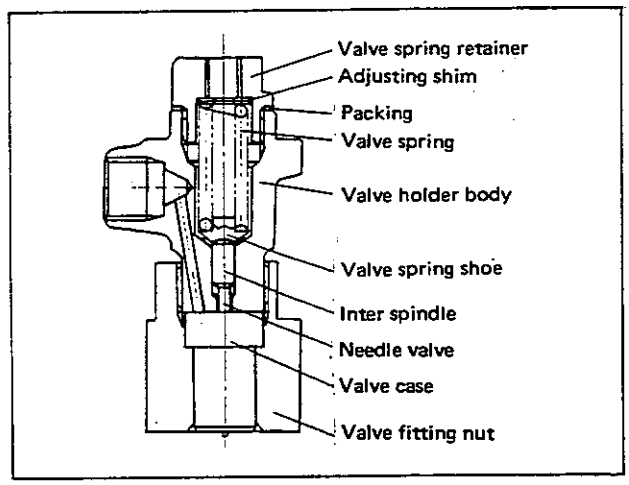
(1) Inspecting by Testing Equipment

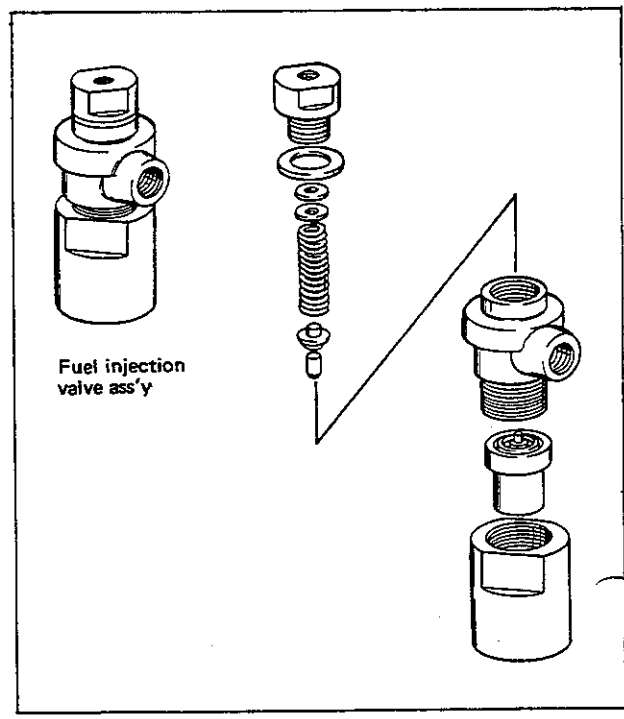
	Item	Standard dimension	Replacement limit	Testing equipment	Illustration
1.	Injection valve opening pressure	2276 psi (160 kg/cm^2)	1707 psi (120 kg/cm^2)		
2.	Injection volume	2TR13A; 23cc 1000st (at 1350 rpm) of cam shaft 2T73A: 22cc/ 1000st (at 1250 rpm)		Pump tester	
3.	Dispersion of discharge volume	±0.5cc/1000st		Pump tester	
4.	Injection timing	FID b.T.D.C. 24 degrees	±1 degree		

(2) Disassembly, Assembly, Adjusting

(2.1) Fuel Injection Valves

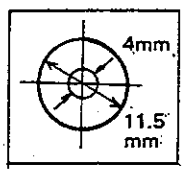
a) The injection valves are built as shown in the illustration below.



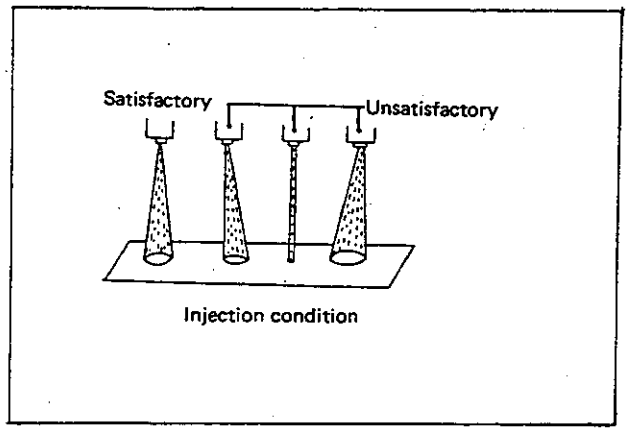


b) Injection pressure is adjusted by varying the thickness of the adjusting shims. Every 0.0039 in. (0.1 mm) of shims provides approximately 142 psi (10 kg/cm²) variation in the pressure.
Be sure to use shims which have holes in their centers.

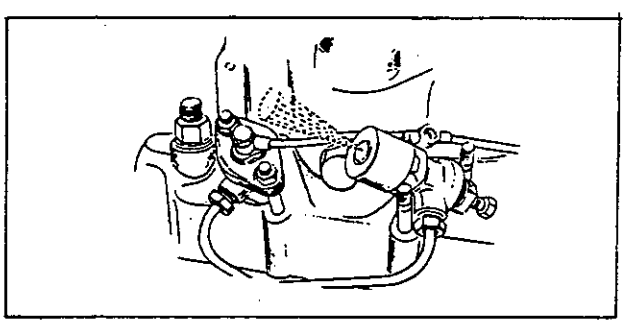
[Adjusting Shim]



t	Part No.	Q'ty/unit
0.1 mm	110250-53400	1
0.2	110250-53410	1
0.3	110250-53420	1
0.5	110250-53430	2



c) The injection pressure 2,276 psi (160 kg/cm²) is of course important, but be sure to check the fuel is injected correctly as shown below:



(2.2) Fuel Injection Pump

a) Measure the injection volume of each cylinder.

b) Measure the pressure to be generated. (more than 7,112.5 psi/500 kg/cm²)

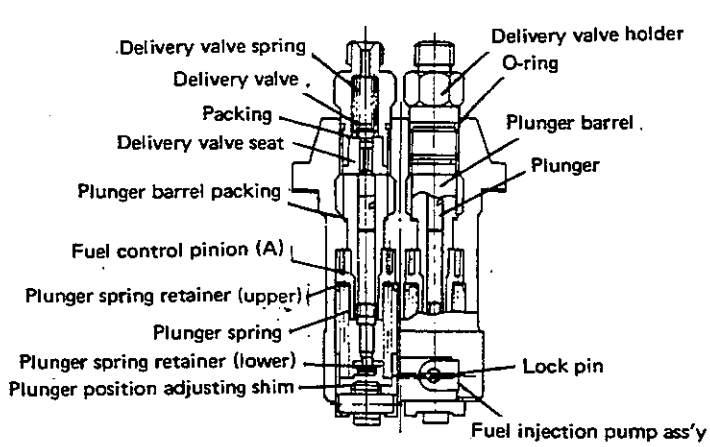
c) Whenever any of the plungers have to be replaced because of wear, the disassembly and assembly work is carried out in the following sequence.

Plunger diameter and cam lift:
0.2756 in x 0.2756 in (7ϕ x 7 mm)

DISASSEMBLY SEQUENCE

[NO. 1 CYLINDER]

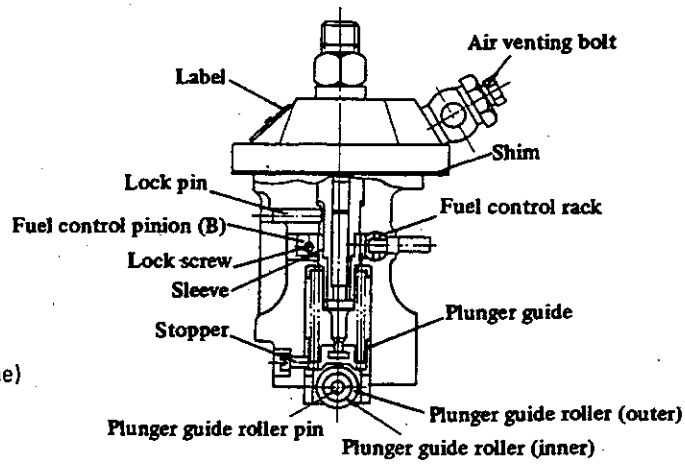
1. Plunger guide roller pin
2. Plunger guide roller
3. Plunger guide
4. Plunger position adjusting shim
5. Plunger and plunger spring retainer
6. Plunger spring
7. Plunger spring retainer
8. Fuel control pinion (A)
9. Delivery valve holder

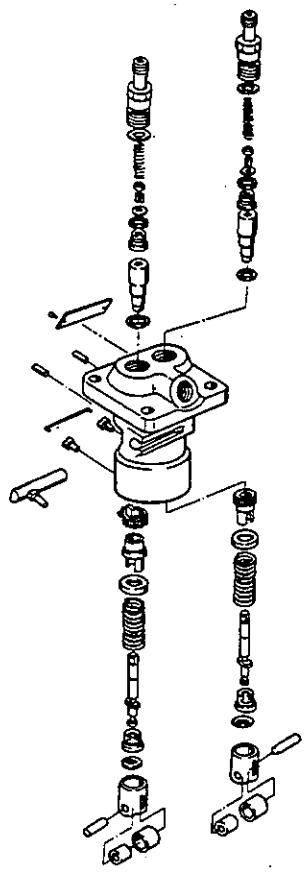


10. O-ring, for delivery valve holder
11. Delivery valve spring
12. Delivery valve
13. Delivery valve seat (including packing)
14. Plunger barrel
15. Plunger barrel packing

[NO. 2 CYLINDER]

16. Fuel control pinion screw (Check scribed line)
17. Plunger guide roller pin
18. Same procedure as (3 to 7).
19. Sleeve
20. Same procedure as (8 to 15)
21. Fuel control pinion (B)
22. Rack.





When disassembling the fuel injection pump, do not mix-up the parts for the No. 1 cylinder and No. 2 cylinder. Keep the parts for each cylinder on different trays.

[Points to Bear in Mind in Assembly]

(1) Do not mix up components for the No. 1 cylinder and No. 2 cylinder.

(2) During assembly, clean each component before fitting into position.

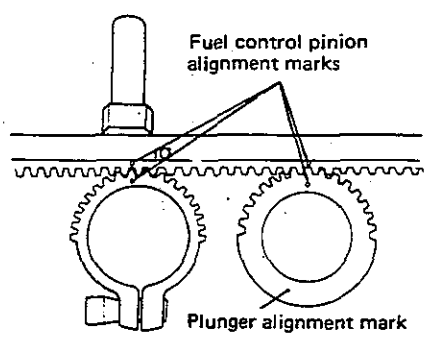
(3) After assembly, make sure that the rack moves freely without resistance.

(4) Be sure to align all assembly markings and scribed lines.

ASSEMBLY SEQUENCE

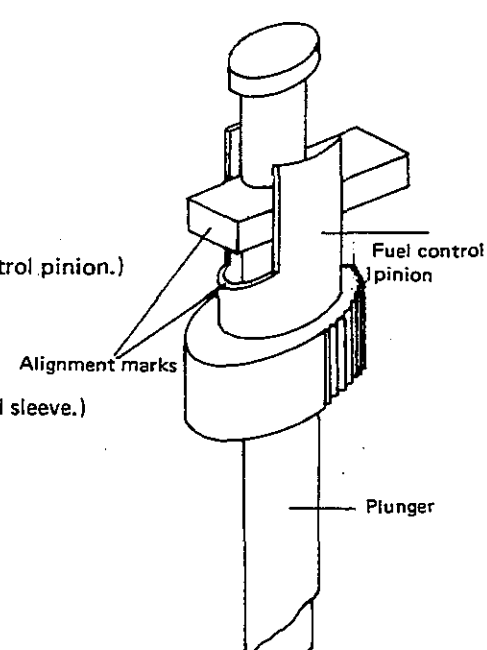
[NO. 1 CYLINDER]

1. Plunger barrel packing
2. Plunger barrel
3. Delivery valve seat and packing
4. Delivery valve
5. Delivery valve holder O-ring. (Torque: 30—32.6 ft.lbs/4—4.5 kg-m)
6. Delivery valve holder
7. Rack (Make sure that the rack is fitted in the correct direction.)
8. Fuel control pinion (A). (Line up alignment marks.)
9. Plunger spring retainer. (Check which side should be up.)
10. Plunger spring
11. Plunger (Line up alignment marks)
12. Plunger spring lower retainer
13. Plunger position adjusting shim. (Adjust the plunger to close the port of barrel by the shim(s) in which pre-fit volume is 0.098" (2.5 mm).)
14. Plunger guide
15. Plunger guide roller



[NO. 2 CYLINDER]

16. Fuel control pinion (B). (Line up alignment marks on rack and control pinion.)
17. Plunger barrel
18. Same procedure as 3 to 6.
19. Fuel control sleeve. (Line up scribed lines on control pinion (B) and sleeve.)
20. Same procedure as 9 to 15.
21. Rocker pin



After assembling the fuel injection pump, measure the rack motion resistance. Motion resistance should be less than 0.132 lbs (60 g), measured by a spring scale, or when rack is placed in the vertical position it should be capable of moving its full distance of travel freely by its own weight.

12. GOVERNOR

The speed control system consists of a mechanical, centrifugal weight, all-speed governor. The governor weights are fitted to a gear on the hydraulic oil pump drive device. By a sleeve at the end of the hydraulic oil pump motion travel through the governor lever and linkage to move the rack of the fuel pump. In addition, this engine is equipped with a torque spring to increase the amount of fuel supplied as necessary.

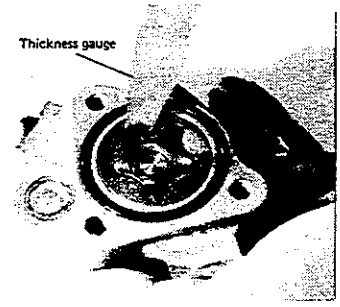
13. LUBRICATING OIL PUMP

(1) Pump

A trochoid pump is used for the lubricating oil pump.

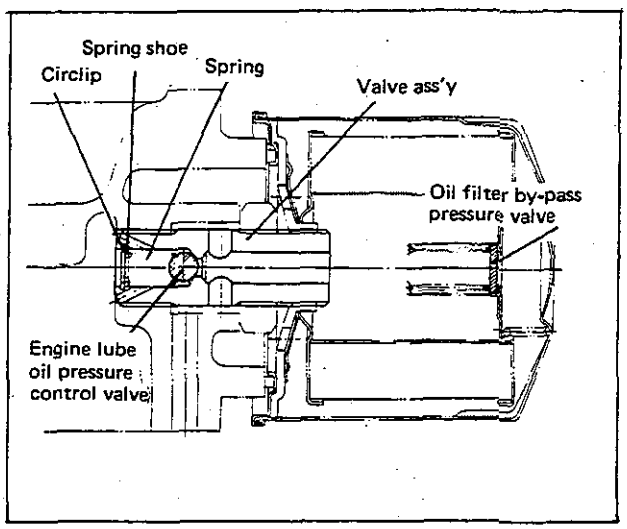
[Inspecting by Testing Equipment]

Unit: in (mm)

Item	Standard dimension	Replacement limit	Testing equipment	Illustration
Clearance between outer rotor and body	0.0020—0.0041 (0.050—0.105)	0.0059 (0.15)	Thickness gauge	
Clearance between body and inner, outer rotors	0.0024—0.0039 (0.10—0.06)	0.0051 (0.13)	Square gauge Thickness gauge	
Claarance between outer rotor and inner rotor	0.0020—0.0041 (0.050—0.105)	0.0059 (0.15)	Thickness gauge	

(2) Lube Oil Pressure

Oil pressure control valve:
21.34–35.56 psi (1.5–2.5 kg/cm²)



Oil filter by-pass pressure valve activating pressure:
17.07–11.38 psi (1±0.2 kg/cm²)

Lube oil pressure control valve is fitted on lube oil filter.

14. COOLING SYSTEM

(1) Radiator

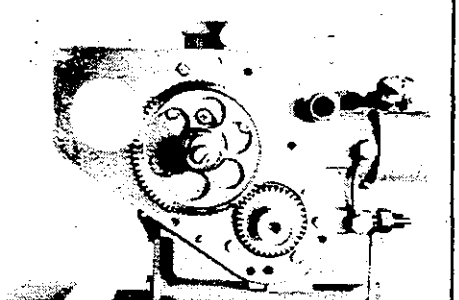
The radiator is pressurized at 12.8 psi (0.9 kg/cm²). Apply pressure to the cooling system to test whether there are any leaks in the system.

15. GEARS

(1) Measuring Backlash

Fit each of the gears in position, and measure their respective backlash readings.

Unit: in. (mm)

Item	Standard dimension	Replacement limit	Testing equipment	Illustration
Backlash	0.0031–0.0063 (0.08–0.16)	0.0118 (0.3)	Dial gauge Fuse Mircometer	

(2) Visual Inspection

Check the gear tooth faces for pitting and if any gear shows severe pitting replace it.

(3) Tachometer Gear Unit (only model 2TR13A engine)

Check to make sure that the gear unit functions smoothly.

16. OIL SEALS, O-RINGS AND BALL BEARINGS

(1) Oil Seals

- Crankshaft — fitted on both ends
  Flywheel side — main bearing housing
  Gear side — gear case

(2) O-Rings

- Decompression shaft
- Regulator handle shaft

(3) Ball Bearings

- Camshaft
- Hydraulic pump driven gear shaft

VII. ENGINE ASSEMBLY

Chapter V covered maintenance and servicing of various parts of the engine. During engine assembly the following points should be observed:

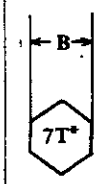
(1) All packings should be replaced with new ones.

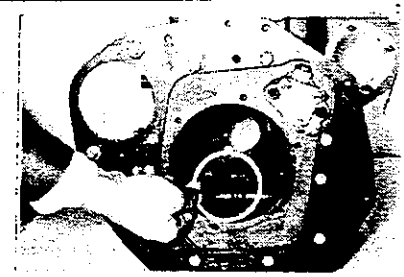
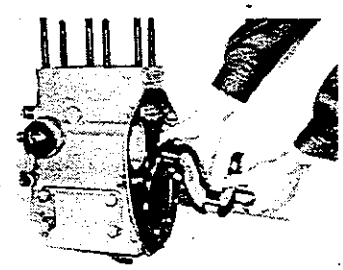
All residues of the old packings should be completely removed.

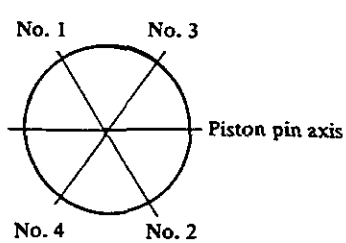
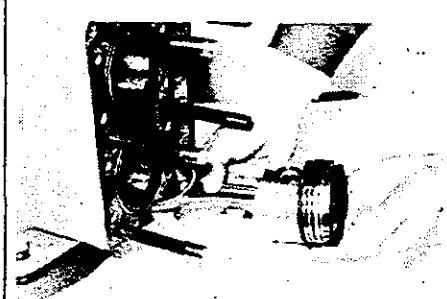
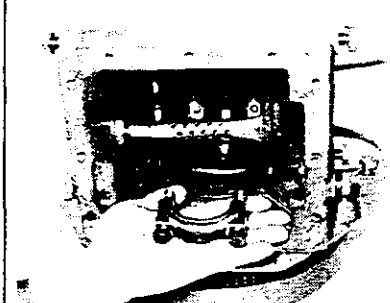
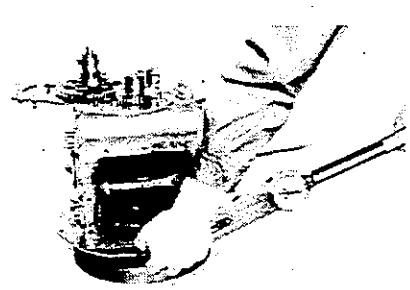
(2) All packings should be coated with appropriate sealants.

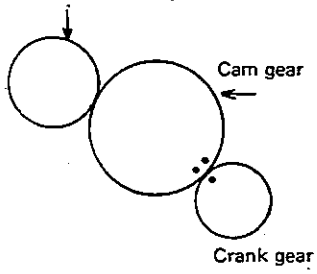
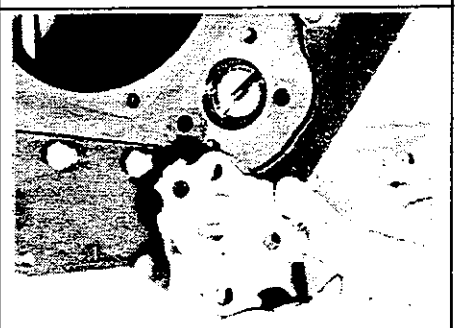
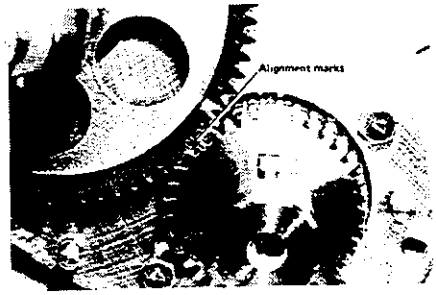
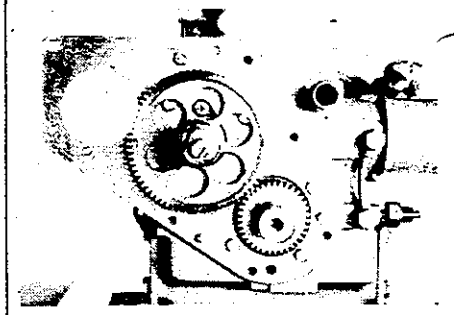
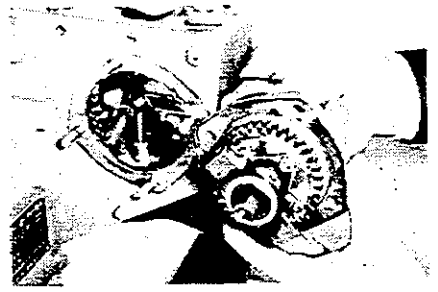
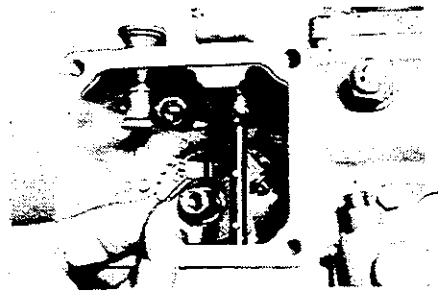
(3) Refer to the following charts for tightening torque specifications. Note, however, that torque specifications for the more important bolts and nuts will be provided in the sections on their assembly.

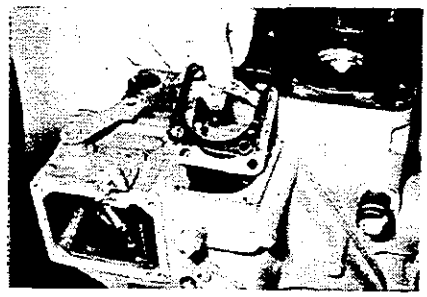
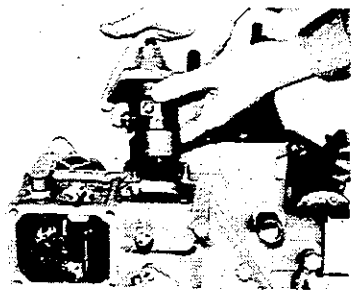
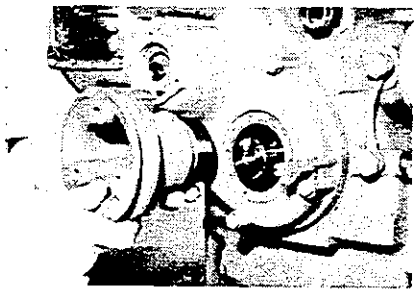
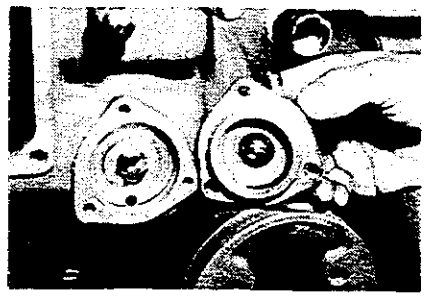
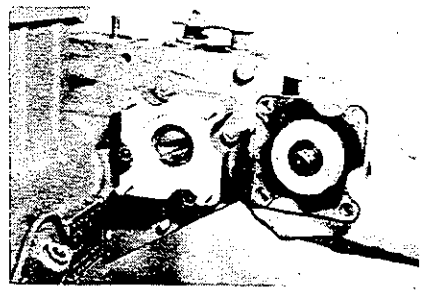
A	B	C	D	
Effective diameter of bolt	Width across flats of bolts and nuts	4T (Mild steel)	7T (Hard steel)*	*Remark
M5	0.3150 in. (8 mm)	2.2 – 2.9 ft.lbs (0.3 – 0.4 kg-m)		
M6	0.3937 in. (10 mm)	3.6 – 5.1 ft.lbs (0.5 – 0.7 kg-m)	5.8 – 8.7 ft. lbs (0.8 – 1.2 kg-m)	
M8	0.5118 in. (13 mm)	9 – 12 ft.lbs (1.3 – 1.7 kg-m)	17 – 22 ft.lbs (2.3 – 3.0 kg-m)	
M10	0.6693 in. (17 mm)	18 – 24 ft.lbs (2.5 – 3.2 kg-m)	33 – 43 ft.lbs (4.5 – 6.0 kg-m)	
M12	0.7480 in. (19 mm)	33 – 43 ft.lbs (4.5 – 6.0 kg-m)	58 – 72 ft.lbs (8.0 – 10 kg-m)	
M14	0.8661 in. (22 mm)	51 – 61 ft.lbs (7.0 – 8.5 kg-m)	87 – 108 ft.lbs (12 – 15 kg-m)	
M16	0.9449 in. (24 mm)	80 – 100 ft.lbs (11 – 14 kg-m)	123 – 152 ft.lbs (17 – 21 kg-m)	
M18	1.0630 in. (27 mm)	116 – 137 ft.lbs (16 – 19 kg-m)	174 – 210 ft.lbs (24 – 29 kg-m)	
M20	1.1811 in. (30 mm)	159 – 195 ft.lbs (22 – 27 kg-m)	239 – 297 ft.lbs (33 – 41 kg-m)	

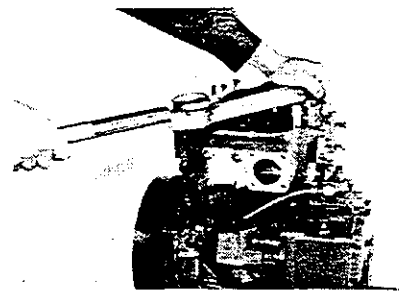
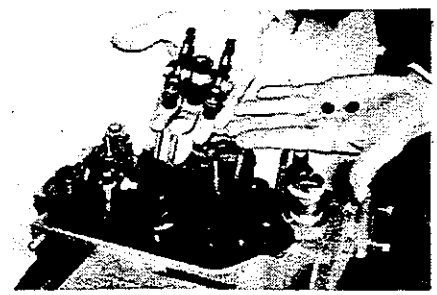


Item		Description	Tightening torque [ft.lbs (kg-m)]	Illustration
1.	Camshaft	Cylinder block is placed on its side with fuel injection pump below: 1) Tappets 2) Camshsaft 3) Camshaft stoper screw		
2.	Crankshaft	Take care not to get front and rear sides of thrust bearing mixed up: 1) Crankshaft 2) Main bearing housing Ascertain that crankshaft turns readily by hand. Crankshaft side gap	14.7–18.1 (2–2.5) 0.0039–0.0079in (0.1–0.2mm)	 

Item		Description	Tightening torque [ft.lbs (kg.m)]	Illustration
2.	Crankshaft			
3.	Flywheel	1) Mounting flange 2) Flywheel	47–50 (6.5–7.0)	
4.	Piston	Cylinder block is stood on its end with flywheel end below. 1) Piston assemblies (No. 1 & No. 2) (using a piston ring insertion tool) a) Staggering piston ring ends.  *[Apply coating of lube oil and fit piston in.]* b) Assembly is fitted in position with marking on big end. c) Do not mix up the No. 1 and No. 2 cylinders. d) Mark on rod cap is aligned with large-boss end (Match same marks) 2) Lube oil inlet pipe. 3) Cylinder block undercover.	33–36 (4.5–5.0)	  

Item		Description	Tightening torque [ft.lbs (kg-m)]	
5.	Gears	1) Lube oil pump: The lube oil pump is provided in the camshaft side (flywheel side) 2) Align matching marks on the crankshaft gear and camshaft gear. Hydraulic pump drive gear  		    

Item		Description	Tightening torque ft-lbs (kg-m)	Illustration
6.	Fuel injection pump	Set up the cylinder block in the normal position. Fuel oil pump: ○ Fit rack to notch and attach pump in position. ○ Insert injection timing control shims to prescribed thickness. The following should be done before the next step: ○ Lube oil pipe; Two points on the cylinder block ○ Lube oil pressure switch ○ Lube oil dipstick		 
7.	Gear case	1) Fit in the gear case while leading regulator spring and governer linkage towards fuel injection pump compartment. 2) Coat oil seal with lube oil, and push-fit the crankshaft V-pulley, taking care not to damage lip section of oil seal. 3) Lube oil pressure control valve and lube oil filter. 4) V-pulley: to crankshaft 5) Hour meter gear unit 6) Hydraulic pump		  

Item		Description	Tightening torque ft-lbs (kg-m)	Illustration
8.	Adjusting amount of fuel injection	1) Loosen the injection control (loosen to the point where governor lever will not come into contact with it even when lever is moved all the way in the increase direction, i.e., to the left). 2) Loosen the governor linkage coupling bolt and move linkage all the way in the increase direction, i.e., to the left, and then tighten coupling bolt. 3) Align mark on the rack with datum level of pump by moving injection control shaft towards the gear case. 4) Lock injection control. 5) Attach supplementary oil inlet. 6) Attach fuel injection pump cover.		
9.	Cylinder head	1) Fit gasket, taking care that the correct side is up (Side with strips should be visible). 2) Push rods. 3) Cylinder head 4) Rocker arm assembly 5) Lube oil pipe. [Loosen the adjustment screw before attaching the rocker arm]	114–116 (15.5–16.0)	  

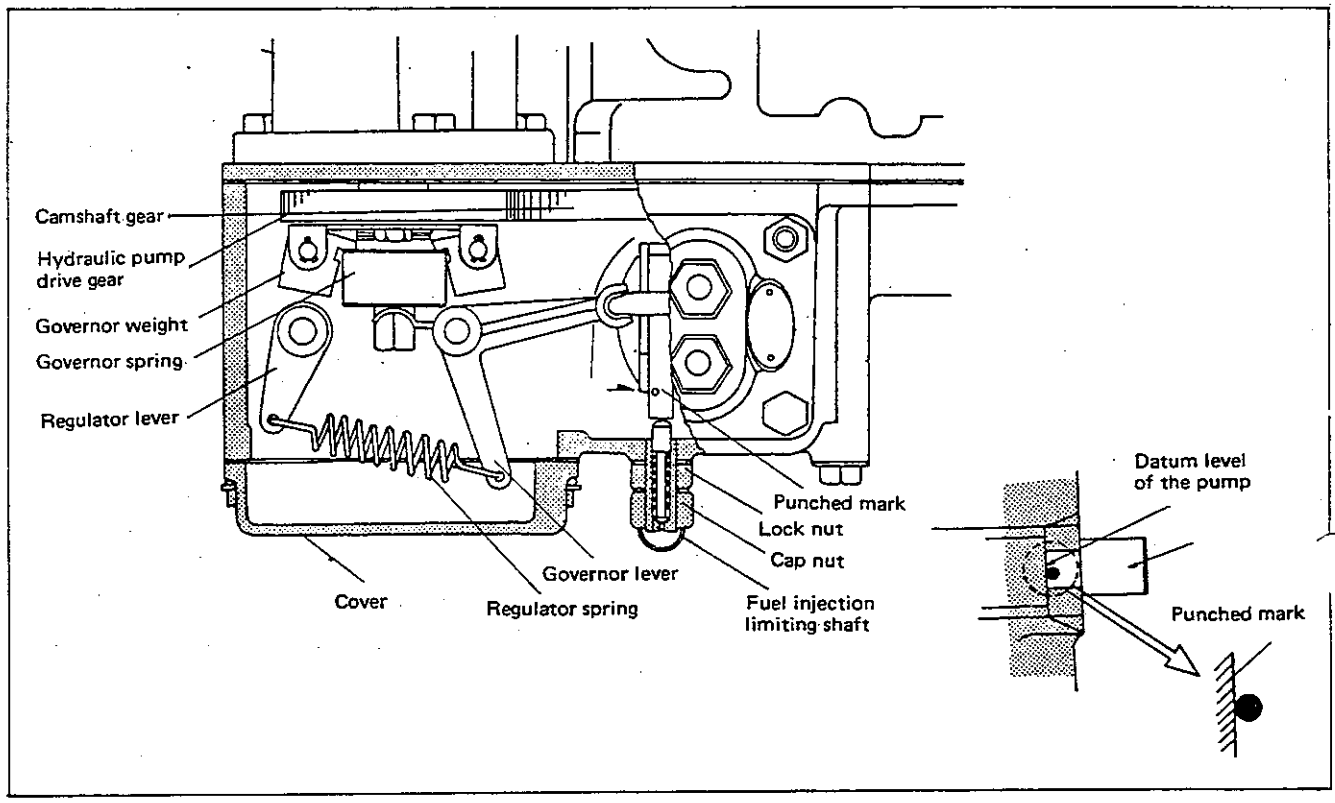
Item		description	Tightening torque ft-lbs (kg-m)	Illustration
10.	Valve clearance	1) No. 1 cylinder (flywheel side cylinder) is set to the TDC where there is compression. [The TDC where there is compression is the point when the stamped mark of the crankshaft/V-pulley is aligned with the pointer of the gear case, and neither intake nor exhaust valves move.] 2) The adjusting screw is loosened, clearance is adjusted to 0.0078 in. (0.2 mm) (for both intake and exhaust), and after adjustment, tightened once again. 3) The valves for No. 2 cylinder are also adjusted to clearances of 0.0078 in (0.2 mm) after turning the engine exactly 180° from the TDC for No. 1 cylinder where there is compression.		 
11.	Radiator	1) A.C. generator 2) Cooling fan [The fan belt should be tightened to the point where it may be pressed down by the fingers 0.4—0.6 in (10—15 mm) at a point midway between the generator pulley and the fan shaft.] 3) Radiator front axle bracket 4) Starter motor 5) Air cleaner 6) Exhaust muffler		

VIII. ENGINE ADJUSTMENTS

This chapter will discuss those places which require adjustment after the engine has been assembled.

For detailed servicing and adjustments of individual components, refer to Chapter V.

1. GOVERNOR LINKAGE



(1) Remove the fuel pump chamber cover.

(2) Remove the cap nut and loosen the lock nut.

(3) Lightly move the governor lever as far to the left as possible so that the fuel injection rack touches the fuel injection limiting shaft.

(4) Free the governor lever. At the same time screw the fuel injection limiting shaft in.

(5) Lock the fuel injection limiting shaft when the end of the punched mark on the rack is lined up with the datum lever of the pump.

(6) Attach the fuel pump chamber cover.

2. VALVE CLEARANCE

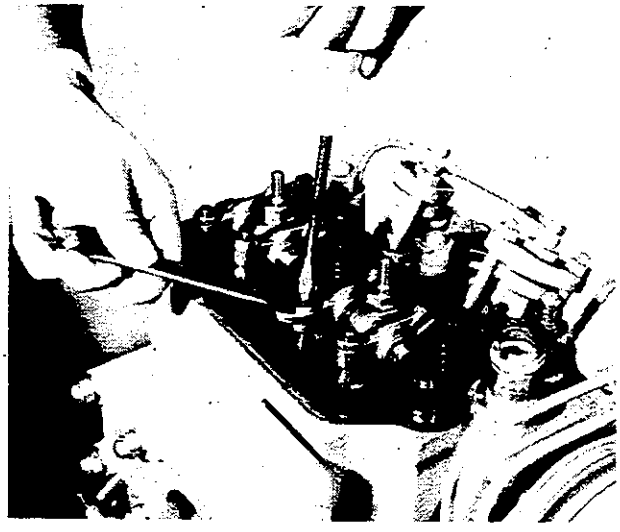
(1) No. 1 cylinder (flywheel side cylinder) is set to the TDC position where there is compression. (This is done by lining up the stamped mark on the crankshaft pulley with the indication pointer on the gear case.)

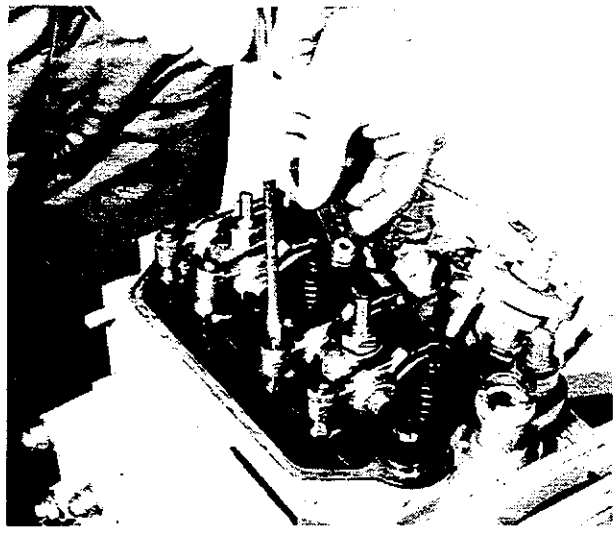
(2) The valve clearance adjusting screws are loosened.

(3) A thickness gauge 0.0078 in. (0.2 mm) is inserted and the adjusting screws are adjusted so that both intake and exhaust valves have tha sam amount of clearance, and then the adjustin screws are locked.

(4) The flywheel is now turned exactly 180° from this position clockwise (that is, the TDC position at which there is compression in the other cylinder).

(5) The procedures described in (2) and (3) are repeated for No. 2 cylinder to adjust the valve clearances to 0.0078 in. (0.2 mm).





3. FUEL INJECTION TIMING

The timing of the injections from the fuel pump delivery valve is checked in the following order with fuel being fed to the fuel pump by a hand oiler.

(1) The No. 1 cylinder is set to the TDC position where there is compression.

(2) The flywheel is moved back and forth in small increments.

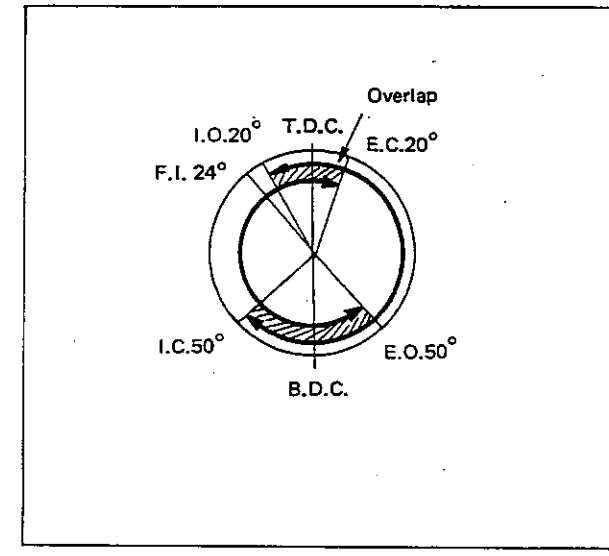
(3) The flywheel is stopped at the very moment that fuel is discharged from the delivery valve.

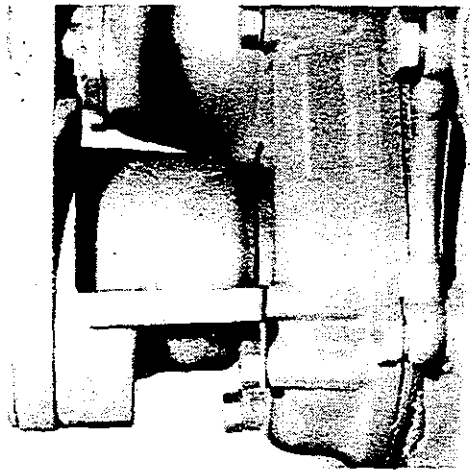
(4) The angle between the stamped mark on the crankshaft V-pulley and the indicating pointer on the gear case at the time fuel is discharged is checked.

(5) Correct fuel injection delivery timing is when the stamped marking and the pointer are lined up, which is 24 degree before TDC.

(6) If the fuel injection timing is lagging, the timing is adjusted by removing the shim(s), and if it is ahead, add the shim(s).

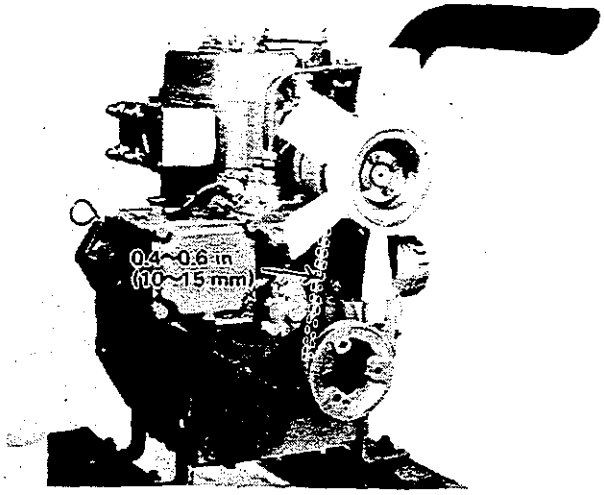
Every 0.0039 in. (0.1 mm) shim provides approximately 1 degree of variation.





4. FAN BELT TENSION

Loosen the charging generator mounting bolt and the belt adjusting bolt, and adjust the fan belt tension so that there is 0.4 – 0.6 in. (10 to 15 mm) of play at a point midway between the fan pulley and the generator pulley, and then tighten each of the bolts.



5. AIR VENTING (Bleeding)

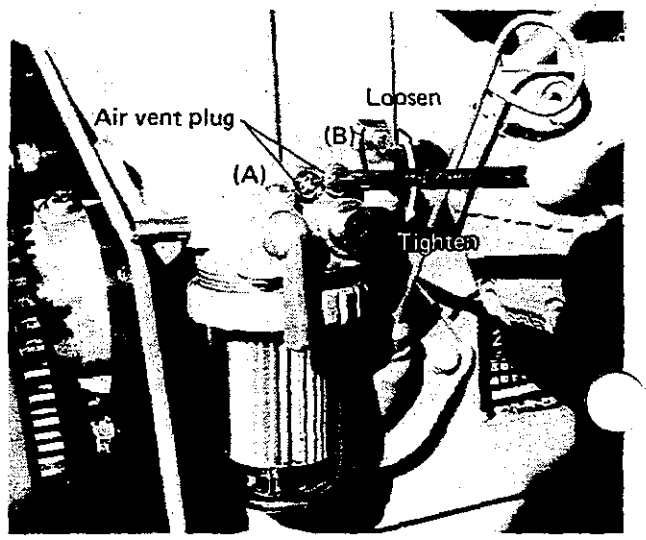
(1) Put fuel into the fuel tank.

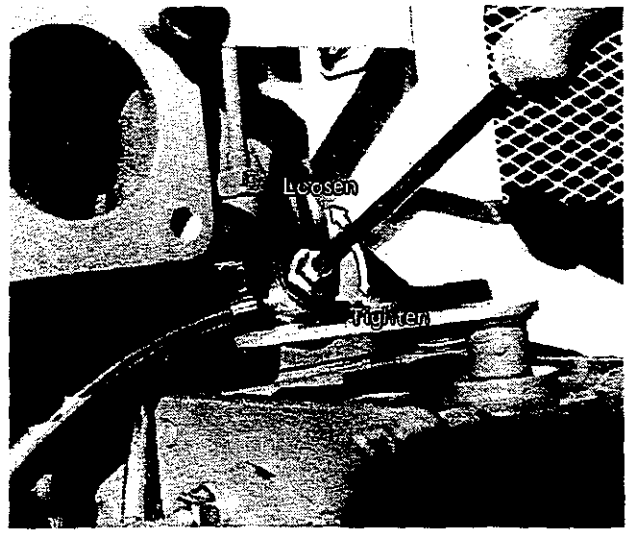
(2) Loosen the air venting plug (A) of the fuel filter, allow fuel to flow from the plug until the fuel flowing out is free of air bubbles, and then tighten the air venting plug.

(3) Carry out the same procedure given in (2) with the air venting plug (B).

(4) Loosen the air venting plug of the fuel pump in the same manner as described in (2) to release any air.

(5) Loosen the injection valve side of the fuel injection pipes.





(6) Put the shift levers in neutral, the throttle lever in running position, move the decompression lever, and then turn the engine with the starter motor.

(7) As soon as fuel starts reaching the No. 1 and No. 2 cylinders from the injection valve side, tighten the fuel injection pipes for each cylinder.

(8) Move the decompression lever once again and turn the starter motor. If a spurting sound which indicates injection is taking place is heard, the venting is completed.

6. OTHER MEASUREMENTS AND INSPECTIONS.

(1) Lube oil pressure: 21.34—35.56 psi (1.5—2.5 kg/cm^2)

Attach a pressure gauge to the fitting of the lube oil pressure switch and measure lube oil pressure.

(2) Top clearance: 0.030—0.022 in. (0.67±0.1 mm)

a) Extract the combution chamber (rear and front), insert fuse rod through nozzle mounting port, and turn flywheel.

b) Squash the fuse between the cylinder head and the piston crown.

c) Measure the thickness of the squashed fuse using a micrometer.

IX. ELECTRICAL EQUIPMENT

The Model YM155(D)/YM135(D) tractors are fitted with the following electrical systems:

(1) Starting system

(2) Charging system

(3) Lighting system

(4) Safety system

System	Component	Capacity	
		After Serial No. 51001	Before Serial No. 51000
Charging system	Battery	12V–35AH	12V–35AH
	Charging generator	(GP8180) 12V–8.5A	(GP8106) 12V–8.0A
	Current limiter	(RS2130) 14.5V	(RS2133) 15.5V
Starting system	Starter motor	(S114-219) 12V–1.2kW	(S114–196) 12V–1.0kW
Lighting system	Headlights	12V–25/25W	12V–25/25W
	Work lights (optional)	12V–20W	12V–20W
Others	Engine oil pressure indicator light	12V–3.4W	12V–3.4W
	Water temperature indicator light	12V–3.4W	12V–3.4W
	Turn signal lights (optional)	12V–20W	12V–20W
	Horn (MF-12)	1.2A	1.2A
	Thermostart (optional) (SH100-02)	12V–13A	12V–13A

1. BATTERY

(1) Specifications

Item	Specifications
Model	Y60-S4LP – YM155, 155D Y60-S4P – YM135, 135D
Capacity	35AH (20-hour rate)
Voltage	12V
Electrolyte specific gravity	1.260/68°F (20°C) at full charge
Charging current	3.5A

(2) Battery Description

The open circuit voltage of a battery measured across its terminals is 2.0 ~ 2.15 volts per cell, and neither the size of the battery nor its number of plates has anything to do with its voltage.

The capacity of a battery is the amount of electricity that can be discharged from a fully charged battery at a constant flow until it reaches its ra discharged terminal voltage.

There are two ways of expressing the capacity

of a battery: by its 'Ampere Hour' electrical capacity (AH) or its 'Watt Hour' electrical capacity (WH). Generally speaking, the 'Ampere Hour Capacity' is used.

Electrical capacity (AH) = discharge current (A) x hours of discharge (H) required for battery to reach discharged terminal voltage

The capacity of a battery will vary according to its discharge current rate, the ambient temperature during discharge, and the time and manner in which the battery is used.

The capacity will also vary according to the temperature of the electrolyte during discharge. The higher the temperature, the larger the capacity; and the lower the temperature, the lower the capacity.

When starting the engine, the battery discharges at a very high current flow rate. Accordingly, it can be readily understood that starting is more difficult when the ambient temperature is very low, because the capacity of the battery is lowered. In addition, the viscosity of the engine oil also increases as the temperature drops.

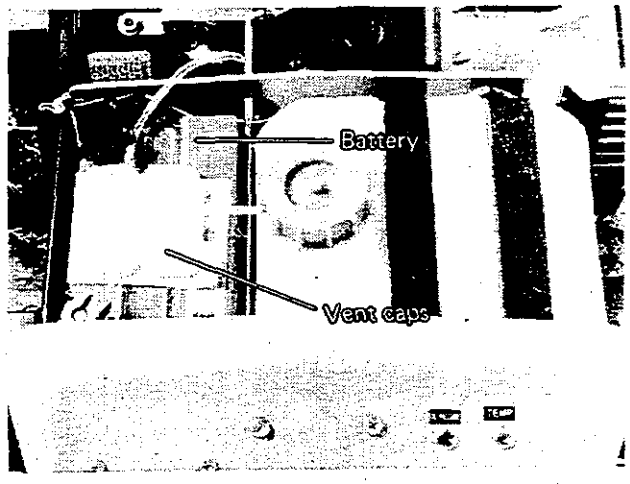
(3) Inspection of the Battery

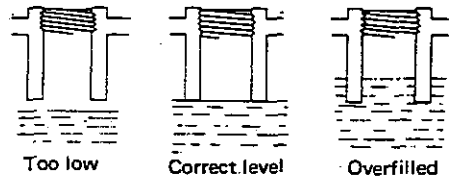
a) Electrolyte Capacity

The water content of the electrolyte will evaporate during use, or will be reduced in volume because of electrolysis. If there is insufficient electrolyte, the battery is liable to sustain damage, and it there is too much, the electrolyte will overflow and damage the body and other parts of the tractor.

Accordingly, the level of the electrolyte in the battery should be inspected regularly, and replenished with distilled water when insufficient. The level of the electrolyte should be sufficient so that the separators of the plates are not exposed.

If the plates are exposed to the atmosphere, sulfation will ensue, and it will no longer be possible to recharge the battery.





b) Specific Gravity

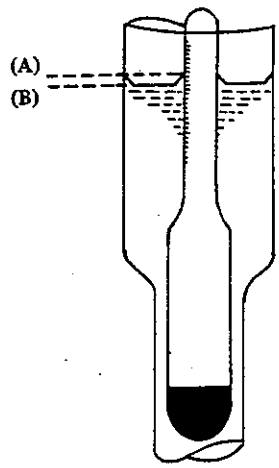
The specific gravity of the electrolyte of a battery varies according to the temperature.

The specific gravity should be adjusted to the specific gravity at 68°F (20°C).

Specific gravity	Condition		
1.260	100%	Charged condition	Usable as is.
1.220	75		
1.160	50	Usable limit	Recharge immediately.
1.090	25	Discharged	
1.080	10		
1.050	0	Fully discharged	

Use a hydrometer to get the specific gravity reading:

Insert the hydrometer into one of the battery holes and suck up enough electrolyte into the glass tube so that the float moves freely. Be sure to hold the glass tube vertically; the reading at (A) is the specific gravity



2. GENERATOR & CURRENT LIMITER

(1) Specifications

Generator: GP8108 (KOKUSAN)
Current limiter: RS 2130 (KOKUSAN)

1) Rotating direction	Clockwise (viewed from flywheel side)
2) Operational rotation	1000 rpm – 5000 rpm
3) Allowable rotation	12,000 rpm
4) Charging perofrmance	More than 8.5A/14 at 4000 rpm
5) Rotation for initial charging	Less than 1500 rpm

(2) Structure

Name: 8-8 pole magneto revolving type generator
Components:

a) Stator (armature windings)

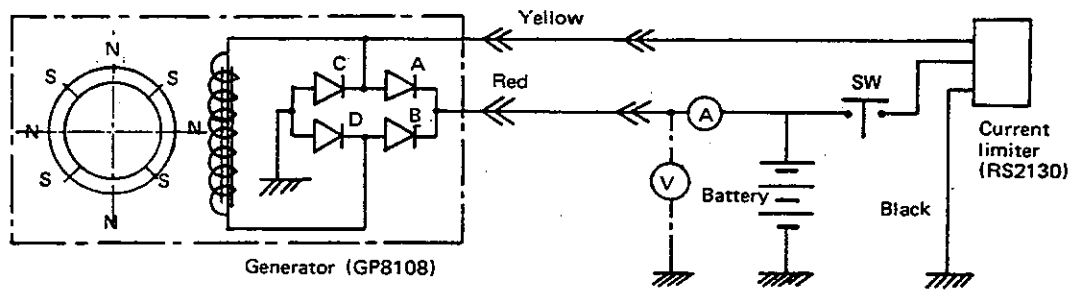
i) Each coil is connected in series. Wire conductors are wound around an 8 pole armature core.

ii) An aluminum die cast plate has rectifying diodes attached to it.

b) Flywheel

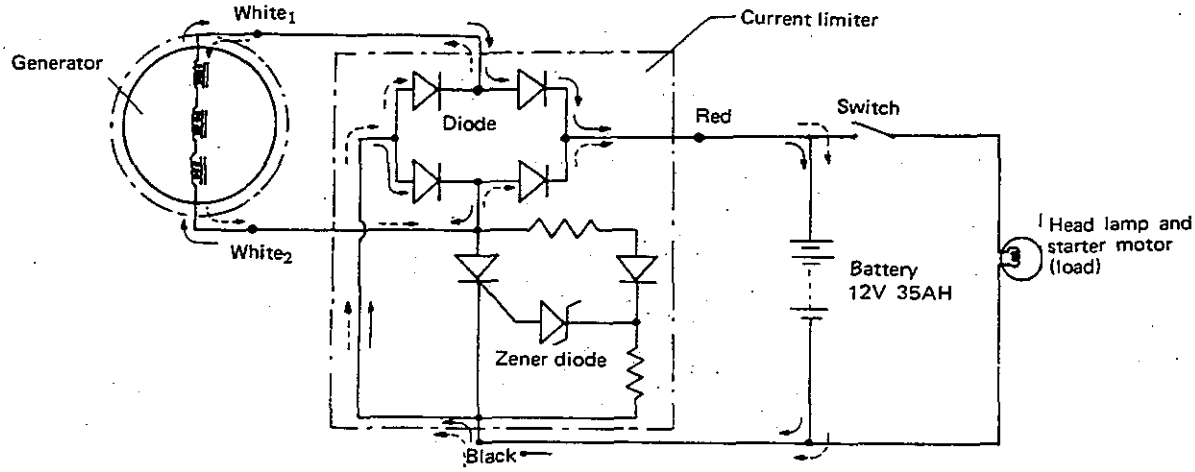
The throttled plate flywheel has a ferrite magnet attached to it, and the pulley, shaft and bearings are pressed in.

(3) Connecting Diagram

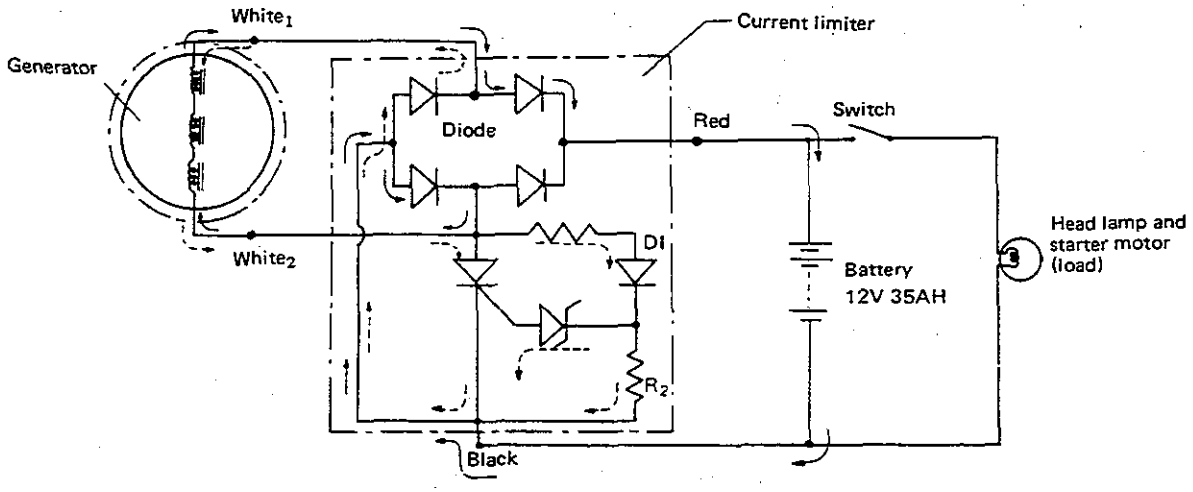


Connecting Diagram (GP8108, RS2130)

(4) Description of Motions



Circuit Without the Current Limiter Operated and Too Much Charging Current Flowing



Circuit With the Current Limiter Operated and Too Little Charging Current Flowing

AC electricity, generated by the generator, is rectified in a full wave to DC electricity [red cord: positive (+); and black cord: negative (−)] through four diodes. When it becomes higher than the battery voltage, it is charged into the battery. When the current being charged increases with the high speed applied, ½ of an AC waveform generated is cut to adjust the current being charged by the action of resistors and zener diodes in the current limiter.

3. INSPECTION AND CHARACTERISTICS

(1) Performance test of the generator coupling with current limiter connected as shown on p. 67.

Condition between	Normal	Abnormal	Causes
charge current voltage of battery terminal	1) More than 7A at 14V (without current limiter)	1) Current: more than 7A Voltage: more than 15.5V	Current limiter is not operating properly.
	2) 7–2A at 14–15.5V (with current limiter)	2) No charging current	Current limiter and generator are not operating properly.
		3) Charging current noted but voltage of battery terminal is low	Battery

(2) Separate inspection of generator
(Refer to diagram on p. 72)

[On Performance]

		Normal	Abnormal	Causes
1.	Tester indication at: non-load voltage [between lead (+) (red) and generator body unit] Operated [N = 400 rpm]	Approx. more than 28V, DC	Approx. less than 28V, DC	1) Diode is bad 2) Open circuit in armature coil
2.	Continuity check by testor [between lead (red) and grounding]	Continuity No continuity	Continuity Continuity	Diode is bad
			No continuity No continuity	Diode is bad Break of lead
	[Diode check]			
	Diode A–lead (red)	No continuity Continuity	Continuity (no continuity) Continuity (no continuity)	
	Diode B–lead (red)	No continuity Continuity	Continuity (no continuity) Continuity (no continuity)	Diode is bad (break or short circuit)
	Diode C–grounding	Continuity No continuity	Continuity (no continuity) Continuity (no continuity)	
	Diode D–grounding	Continuity No continuity	Continuity (no continuity) Continuity (no continuity)	
	[Armature coil] Diode terminal A–B	Continuity	No continuity	Break of circuit

		Normal	Abnormal	Causes
3.	[Insuration resistance] at: 500V Mega tester Lead (red)—grounding	More than 3MΩ	Less than 3MΩ	Bad insulation at armature coil

Rotating Condition of the Flywheel

	Normal	Abnormal	Causes
Flywheel rotated manually	Magnetic stress felt 8 times per rotation. Rotates comparatively smooth.	Noise accompanies rotation	Bearing is bad Distortion of the flywheel
		No magnetic stress is felt. Light rotation	Lowering, or failure of magnetic energy of flywheel

4. CAUTIONS DURING HANDLING AND ASSEMBLY

	Cautions	Resulting Problems
1.	Do not improperly wire to battery, Confirm (+) & (–), and coloring of leads	Short-circuit of battery 1) Burning of generator diode 2) Burning of generator coil 3) Burning of current limiter
2.	Do not operate at less than the specified speed	Burning of generator coil Failure of current limiter
3.	Do not tighten belt too tight	Broken pulley & bearing of generator
4.	Avoid shocks and large stresses on the peripheral of the flywheel	Distortion of the flywheel
5.	Do not hang lead wire	Break of lead wire
6.	Do not operate out of the specified assembly condition (engine operation must always be under specified wind speed condition by cooling fan)	Burning of current limiter & generator
7.	Do not pour water into the generator unit	Short-circuits of generator Damage to bearing
8.	During assembly and disassembly, the shaft tightening torque: 250 kg-cm to 300 kg-cm.	Damages to flywheel by the loosening of screws
9.	Use rated or genuine Yanmar part for the replacement of bearings	Damages to bearings
10.	Use genuine Yanmar parts for the replacement of generator diodes	Burning of diodes

5. INSTRUCTIONS FOR DISASSEMBLY AND ASSEMBLY

(Refer to diagram on p. 72)

[Disassembly]

(1) Remove hexagon nut (c);
(with attaching the top of the shaft (*side); do not put stress on the flywheel)

(2) Dismantle the flywheel (a);
(lightly tap the top of the shaft with a wooden hammer)

(3) Separate the lead wire from each diode terminal (A, B, C, D) with a soldering iron;
(do not apply the soldering iron to the terminals for a long time or it will damage the diodes)

(4) Remove the set screws (h), and proceed to diodes.

(5) Remove the set screw (d), and remove armature coil (e).

[Assembly]

Follow the instructions above reversely.

6. MAINTENANCE AND INSPECTION

(1) Do not keep the unit in storage under dusty, damp, and high temperature conditions.

(2) In case dust, dirt, water, oil, etc. are deposited on the generator and lead connections, clean the necessary parts before use.

(3) Keep the appropriate belt tension, to avoid belt slippage.

[Current Limiter]

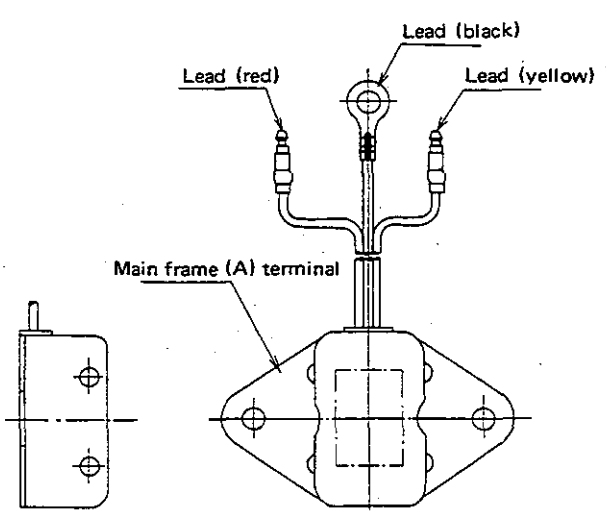
This is used coupled with the generator. Refer to the section on the generator, for the specifications, diagram, and handling instructions.

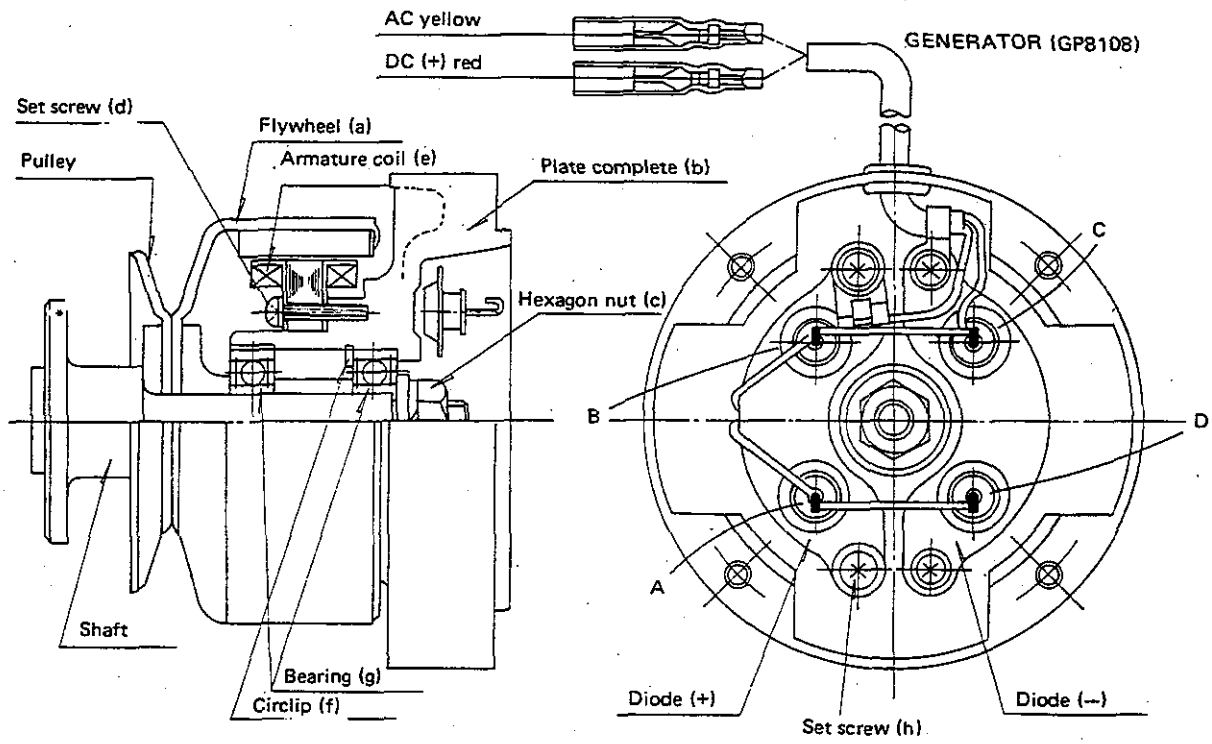
Current limiter forms one unit contained in resin mold. In the case of a failure, replace current limiter as a unit.

[Inspection of Current Limiter]

Check the continuity between the red lead and black lead with a tester.

Normal	Continuity noted / No continuity	
Abnormal	Continuity noted / Continuity noted	No continuity / No continuity





7. STARTER MOTOR

(1) Specifications

Item		Specifications	
		Before serial No. 51000	After serial No. 51001
Manufacturer		HITACHI	←
Manufacturer's code		S114-196	S114-219
Yanmar's code		124060-77010	124060-77011
Output/weight kW/lbs (kW/kg)		1.0/11.22 (1.0/5.1)	1.2/13.2 (1.3/6)
Direction of rotation (viewed from pinion side)		Clockwise	Clockwise
Mesh method		Magnetic shift	←
Light running	Terminal voltage (V)/current (A)	12/less than 60	←
	Speed (rpm)	Over 7000	Over 6000
Lock torque	Terminal voltage (V)/current (A)	5/less than 330	5/less than 540
	Torque (kg-m)	Over 6.50 ft-lb (Over 0.9 kg-m)	Over 11.56 ft-lb (Over 1.6 kg-m)
Type of clutch		Over-running	←
Pinion	Diametric pitch or module/No. of gear teeth	DP$\frac{10}{12}$/11	←
	Drive voltage (V)	Less than 8	←
Brush	Spring tension	3.52 lbs (1.6kg)	←
	Standard length/wear limit in. (mm)	0.630/0.157 (16/4)	←

Item			Specifications	
			Before serial No. 51000	After serial No. 51001
Magnetic switch resistance at 20°C	Series/Shunt (Ω)		0.324/0.694	←
Commutator	Outer diameter	Standard outer diameter/minimum length	1.575 in/0.079 in (40 mm/2 mm)	
	Difference between maxium diameter and minimum diameter	Correctable limit/correction precision	0.0157 in/0.0020 in (0.4 mm/0.05 mm)	
	Depth of mica between commutator bars	Correctable limit/correction precision	0.0079 in/0.0197–0.0315 in. (0.2/0.5–0.8 mm)	
Standard dimensions	Brush side bearing	Shaft diameter/hole diameter	0.4909–0.4902 in/0.4932–0.4921 in. ($12.5^{-0.032\ mm}_{-0.050\ mm}$/$12.5^{+0.027\ mm}_{0}$)	
	Pinion slide section	Shaft diameter/hole diameter		
	Pinion side bearing	Shaft diameter/hole diameter		
L dimension			0.0118–0.0591 in (0.3–1.5 mm)	
Ground polarity			Negative	

(2) Description of Starter Motor

The major components of the starter motor are the magnetic switch section, the motor proper section, and the pinion section. The magnetic switch section has a plunger which activates a shift lever to engage and disengage the pinion, and also open and close the main contacts to start and stop the starter motor.

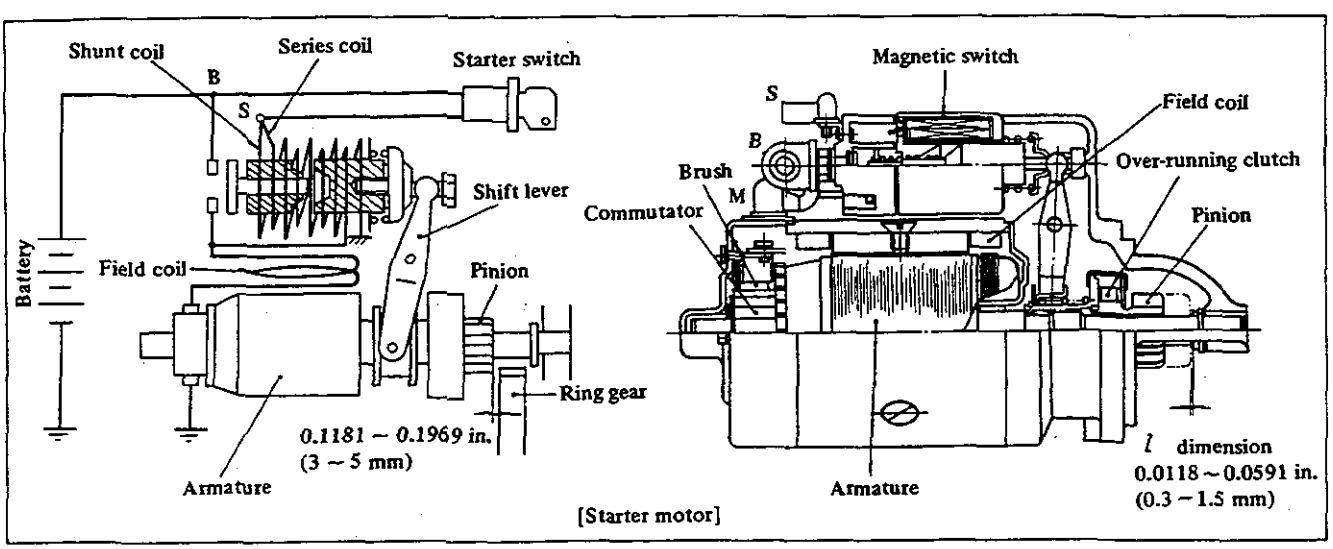
The over-running clutch is provided in order to cut off the motive power from the engine when the engine starts up.

(3) Inspection and Maintenance

a) Pinion

1) The pinion will spring out when the magnetic switch is closed.

2) Push the pinion that has sprung out towards the motor to eliminate any axial play, and measure the clearance between the end of the pinion and the pinion stopper.



[Starter motor]

If the clearance *l* is incorrect, it should be corrected by removing and refitting the adjusting plate of the magnetic switch mount.

b) Brushes

1) Brush Spring Tension

Put the brushes in their respective brush holder and measure the spring tension with a spring balancer. Tension should be more than 3.52 lbs (1.6 kg).

2) Length of Brushes

Standard brush length is 0.630 in. (16 mm). If any of them are worn out by more than 0.157 in. (4 mm), it should be replaced with a new one.

After replacing, check that the new brush moves smoothly in the brush holder, and that the end of the brush makes even contact with the commutator surface. If the contact is uneven, correct it.

3) Brush Holder Continuity Test

Carry out a continuity test between the insulated brush holder and the ground.

There should be no continuity.

c) Armature

1) Measuring Shaft Straightness

Place the shaft upon an end supporting stand, and measure the straightness of the shaft.

If it is distorted by more than 0.0031 in. (0.08 mm), it should be corrected.

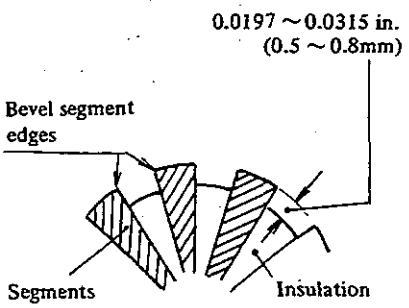
2) Commutator

If the surface is burnt or pitted, it should be polished using #500—#600 sandpaper.

If it is out-of-round by more than 0.0078 in. (0.2 mm), it should be turned down on a lathe.

3) Depth of Mica between Commutator Bars

The amount of under-cut of the insulation (mica between commutator bar segments) should be between 0.0197—0.0315 in. (0.5—0.8 mm). Be sure to bevel the edges of the bar segments.



4) Ground Test

Check conductivity between the commutator and the shaft. If conductivity is indicated, there is a short, so replace.

5) Insulation Test

Shorts in the armature coil are checked with a "growler tester." A "growler tester" is an iron piece applied to the armature core and the armature while the latter is rotated. If the iron piece starts vibrating or "growling", it is an indication that there is a short, and that replacement is necessary.

d) Field Coil

1) Continuity Test

Check the continuity between the terminals of the field coil. If there is no continuity, it is an indication that there is a break in the winding, so it should be replaced.

2) Ground Test

Check the continuity between either of the terminals of the field coil and the yoke. If there is continuity, it means that the field coil is grounded somewhere and is therefore defective.

e) Magnetic Switch

1) Continuity Test for Shunt Coil/Series Coil

Continuity of the shunt coil is checked by taking a reading between its S-terminal and the body of the magnetic switch. If there is no continuity, then there is a break in the shunt coil winding.

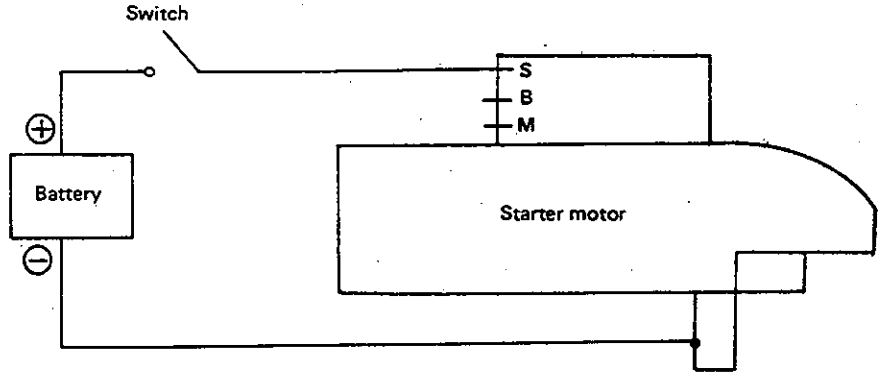
Continuity of the series coil is checked between the S-terminal and the M-terminal.

If there is no continuity, there is a break in the series coil winding.

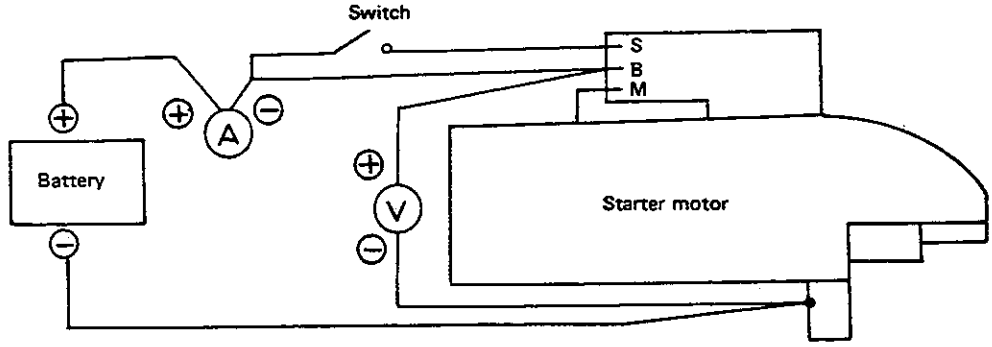
f) Performance Test

1) Connections for Continuity Measurement of Dimension *l*.

2) No-Load Performance Test



The diagram above shows connections to be made for the purpose of measuring dimension *l*.



No-load performance test is conducted using the circuitry shown above. Readings obtained must meet rated specifications.

V: DC voltmeter
A: DC ammeter (25A)

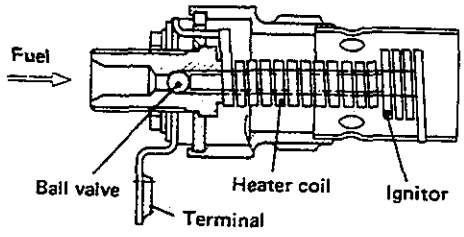
8. THERMOSTART (Optional)

(1) Specifications

Item	Specifications
Type	SH100-02 (Hitachi) magnetic valve type
Voltage	12V
Current flow	13A

(2) Description of the Thermostart

The thermostart is a starting aid for use in low ambient temperatures. It ignites and burns fuel in the intake manifold to warm the air intake and improve starting qualities. The thermostart, unlike glow plugs, is not exposed to the combustion heat of the engine during operation and therefore provides outstanding durability, and since its electricity requirement is lower than that of glow plugs, the load on the battery is reduced.



a) Thermostart switch is set to ON. This activates the heater coil.

b) Valve stem moves. This opens the ball valve.

c) Fuel flows through ball valve, and volatilizes because of heat from heater coil.

d) Volatilized fuel is ignited by ignitor.

e) Setting thermostart switch to OFF position will switch off the electricity and the heater will cool off. This will close the ball valve.

f) Fuel will cease to flow. Fuel is stored in header tank, and is fed to thermostart plug by gravity.

(3) Using the Thermostart

a) Throttle lever is set to STOP position.

b) Decompression lever is operated.

c) Clutch pedal is depressed, and starter motor is operated for five seconds (until lube oil indicating light goes out).

d) Restore decompression lever to position providing compression.

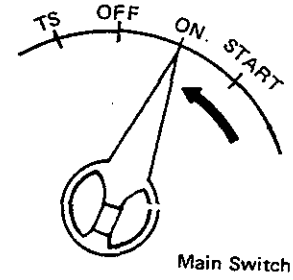
e) Open the throttle about halfway.

f) Press the thermostart switch for 5 ~ 10 seconds. OR

i) Turn the main switch to the "TS" position for 5 ~ 10 seconds.

ii) Then turn the starter motor.

g) As soon as the engine starts up, switch off the thermostart, and of course, remove your hand from the starter key switch (the main switch will automatically move from the START to the ON position).



Main Switch

9 TURN SIGNAL LIGHTS (OPTIONAL)

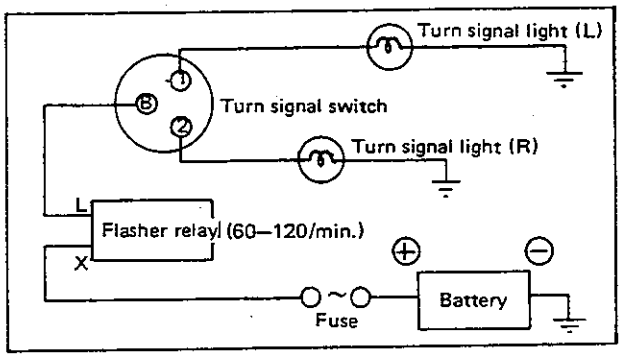
(1) Specifications

Item	Specifications
Flasher relay	12V-23W heat band snap type
Signal lights	12V-20W

(2) Description of the Turn Signal Lights

The turn signal light system is composed of the turn signal switch, the flasher relay, and the signal lights.

The flasher relay, a heat band snap type, opens and closes a pair of contact points through expansion resulting from a rise in temperature of a heat band.



10. WATER TEMPERATURE INDICATOR LIGHT

(1) Specifications

Item	Specifications
Water temperature indicator light	12V – 3.4 W
Water temperature sensor unit:	
Activating temperatire	ON at 248°±5.4°F (120°±3°C) OFF at 233.6°±5.4°F) (112°±3°C)
Electrical capacity	12V – 7A

(2) Description of the Water Temperature System

A sensor consisting of a substance with a high heat expansion rate is fitted at the tip of the unit, and goes ON when the water temperature reaches 248°F (120°C).

Therefore, it is quite normal for the water temperature indicator light to stay off even if the starting switch is set to the ON position, as long as the engine is cold.

11. ENGINE LUBE OIL PRESSURE INDICATOR LIGHT

(1) Specifications

Item	Specifications
Oil pressure switch	Activating pressure 2.84 psi (1 kg/cm^2)
Lube oil pressure indicator light	12V – 3.4W

(2) Description of the Lube Oil Pressure Indicator Light

As described earlier in Chapter V, Section 13 and Chapter VII, Section 11, the lube oil pressure regulating valve, which is fitted inside the lube oil filter (cartridge type) is adjusted to 21.34 – 35.56 psi (1.5 – 2.5 kg/cm^2), while the relief valve is set to activate at a pressure of 17.07 – 11.38 psi (1 ± 0.2 kg/cm^2).

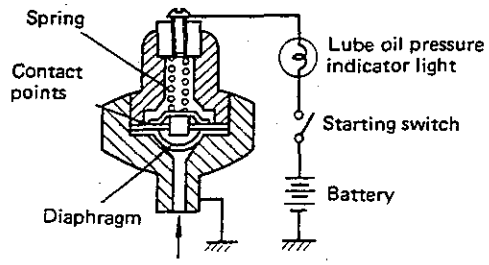
The lube oil switch is fitted in the lower part of the cylinder block, to the left of the lube pipe. It is activated when the lube oil pressure drops, which simultaneously turns on the indicator light.

The oil pressure forces the diaphragm upwards to open the contact points, so that when pressure is normal, the indicator light remains OFF.

When the oil pressure drops, the contact points close to allow electricity to flow to turn ON the indicator light.

Thus, when the starting switch is moved to the ON position, the indicator light goes ON since

there is no oil pressure, but once the engine starts up and pressure rises, the light will go OFF.



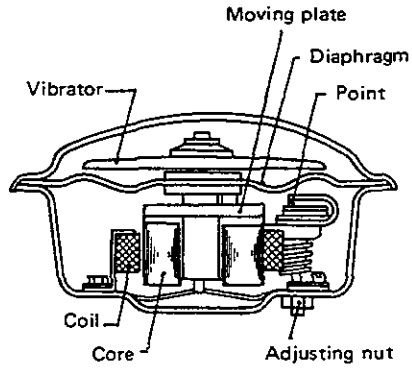
12. HORN

(1) Specifications

Horn	12V–1.2A

(2) Description of the Horn

When the horn button is depressed, electricity flows through the coil of the horn, the core of the coil is magnetized, the moving plate is drawn towards the core, and the diaphragm that is coupled to the plate moves and opens the contact points. The flow of current is therefore cut off. Through a repetition of this cycle, the vibrator vibrates to generate sound.



13. LIGHTS

(1) Headlights

The headlights are high-low beam dual filament bulbs. Switching between low and high beams is accomplished by the lighting switch.

Headlights: 12V – 25W/25W

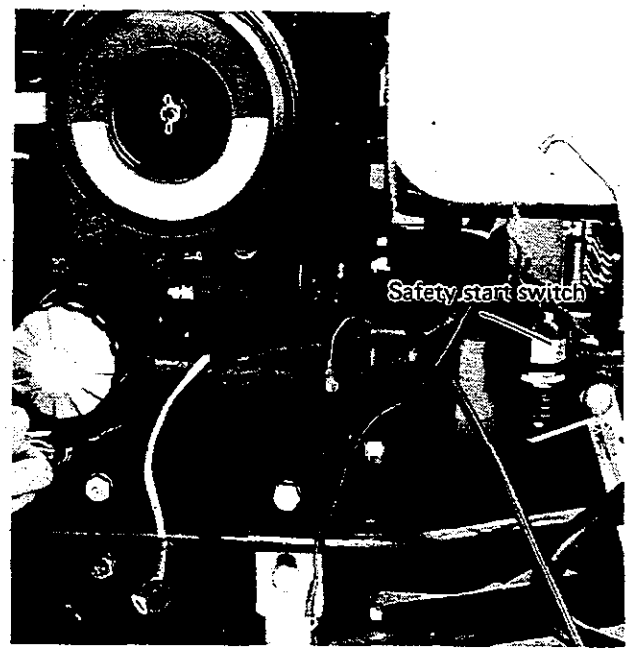
(2) Work Light (Optional)

The work light is fitted to the rear part of the left fender.

Work light: 12V – 20W

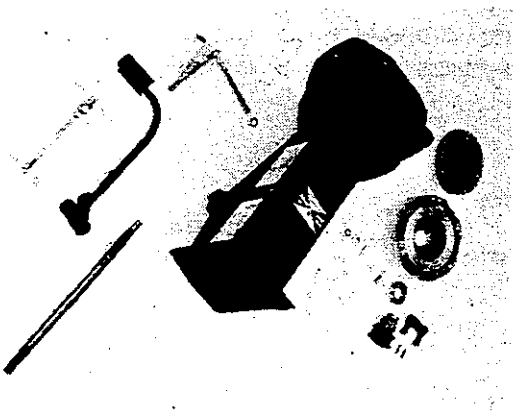
14. SAFETY START SWITCH

The safety start switch is provided for added safety of the tractor and prevention of accidents. When the clutch pedal is depressed, disengaging the clutch, the safety switch incorporated in the starter motor system circuit closes to facilitate starting of the tractor.



X. TRACTOR CONSTRUCTION AND MAINTENANCE

1. CLUTCH AND RELEVANT ITEMS



The clutch serves to engage or disengage the power generated by the engine with the power train, and also serves as a shock absorber protecting the power train and the engine from being subjected to excessive loads.

The clutch fitted on this tractor is a dry, single plate type diaphragm clutch. It can be operated with light pressure and it provides positive engaging and disengaging of the motive power, yet it is also endowed with more than ample durability and capacity.

(1) Specifications

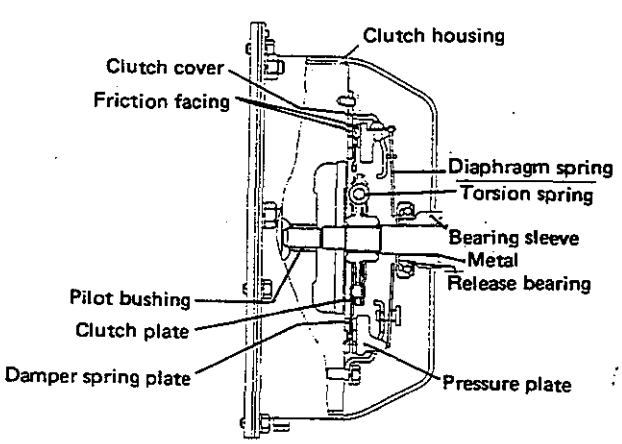
Item	Specifications	
	YM135, YM135D	YM155, YM155D
Type	Mechanical, dry single plate	
Friction disc	Woven type containing wire	Semi-mold type containing wire
Friction disc (outer diameter x inner diameter x thickness)	7.09 x 4.92 x 0.33 in. (180 x 125 x 8.4 mm)	
Friction disc surface area	20.4 sq. in. (132 cm^2)	
Static torque capacity	97.7 ft.lbs (13.5 kg-m)	
No. of clutch plates	1	
No. of friction discs	2	
Clutch spring	Diaphragm type	
No. of torsion springs	4	6
Release bearing	Oilless bearing	
Clutch activation	Mechanical	

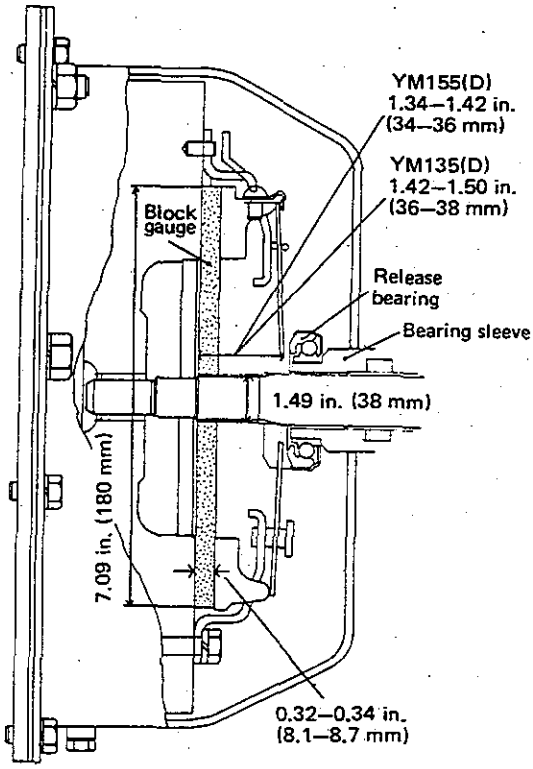
(2) Operating Principle

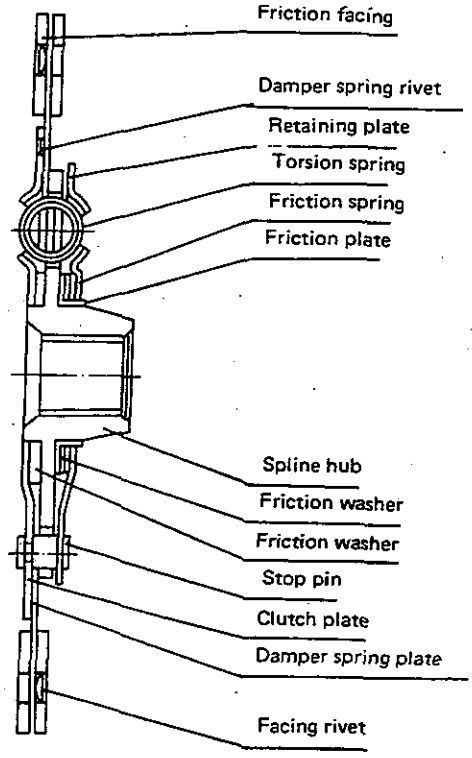
When the clutch pedal is depressed, the bearing sleeve is moved through a clutch pedal consisting of the clutch rod, the clutch release shaft, and the clutch shift yoke.

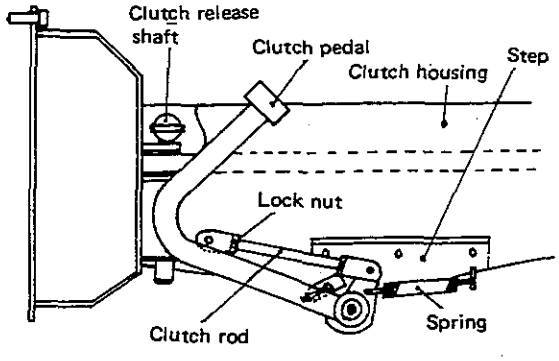
The release bearing moves the diaphragm spring (release lever), weakening the pressure of the diaphragm spring, to disengage the motive power of the engine from the power train.

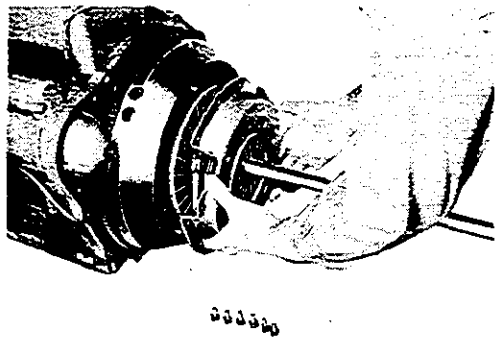
The torsion springs serve to prevent chattering or jerks when starting, and also smoothen the transmission of torque.









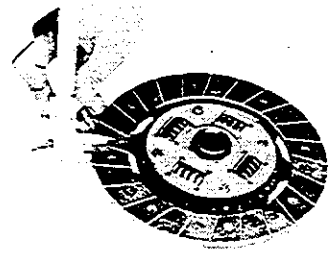
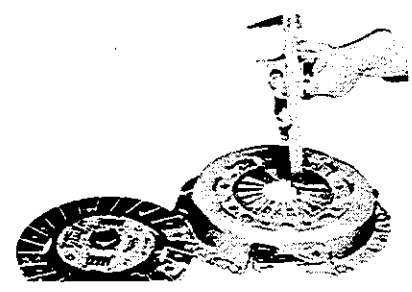


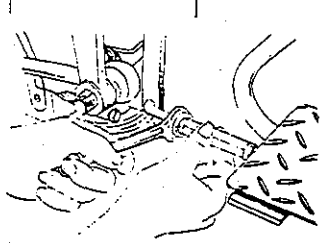
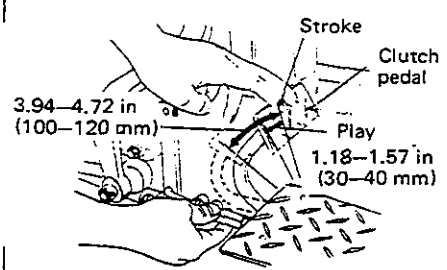
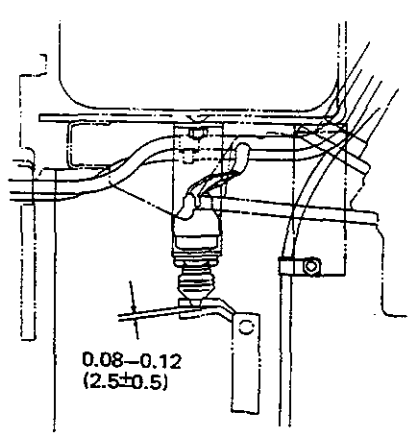
3) Visual Inspection

- Check the friction disc for traces of scoring, glazing, burning, discoloring, or oil adherence.
- Check the torsion springs for wear or breakage.
- Check the damper plate for wear.
- Check the splines for wear.
- Check the pressure plate for distortion of friction surface, scratches, or ridge formations.
- Check the release bearing for traces of burning or looseness.

(4) Inspecting by Testing Equipment

Unit: inch (mm)

	Item	Standard specification	Replacement limit	Testing equipment	Illustration
1.	Friction disc thickness	0.13–0.14 (3.5±0.1)		Calipers	
2.	Depth of rivet head	0.06 (1.5)	0.012 (0.3)	Calipers	
3.	Thickness of assembled clutch disc: [When assembled] [Under pressure]	 0.32–0.34 (8.4±0.3) 0.31 (7.8)	 0.29 (7.4) –	 Calipers	
4.	Disc play: Axial Radial	Within 0.01 (0.3) –	0.03 (0.7) 0.04 (1.0)	Dial gauge	
5.	Friction disc flatness	–	Within 0.016 (0.4)	Dial gauge	
6.	Pressure plate flatness	Within 0.003 (0.07)	0.008 (0.2)	Dial gauge	
7.	Flywheel flatness	Within 0.003 (0.07)	0.008 (0.2)	Dial gauge	
8.	Play in direction of rotations between main drive shaft and disc splines	0.003–0.007 (0.07–0.17)	0.012 (0.3)	Dial gauge	
9.	Main drive shaft end diameter	0.5880–0.5887 ($15^{-0.047}_{-0.065}$)	–	Micrometer	
10.	Inner diameter of flywheel pilot	0.5892–0.5899 ($15^{-0.016}_{-0.034}$)	–	Cylinder gauge	
11.	Clearance between drive shaft and pilot bushings	0.0005–0.0019 (0.013–0.049)	0.012 (0.3)		
12.	Clutch release lever height	**[YM155, YM155D]** 1.34–1.42 (34–36) **[YM135, YM135D]** 1.42–1.50 (36–38)	 Less than 1.26 (32) More than 1.50 (38) Less than 1.34 (34) More than 1.61 (41)	Block gauge Calipers	

	Item	Standard specification	Replacement limit	Testing equipment	Illustration
13.	Inner diameter of clutch release bearing	1.2987–1.2992 ($33^{0}_{-0.012}$)		Cylinder gauge	
14.	Outer diameter of the bearing sleeve	1.2990–1.2996 ($33^{+0.011}_{-0.005}$)		Micrometer	
15.	Release bearing interference	0.0009– –0.0002 (0.023– –0.005)	Clearance 0.001 (0.025)		
16.	Inner diameter of the metal	0.8819–0.8827 ($22.4^{+0.021}_{0}$)		Cylinder	
17.	Outer diameter of the main driving shaft	0.8628–0.8688 ($22^{0}_{-0.084}$)		Micrometer	
18.	Clearance between the release bearing bushings and main drive shaft	0.016–0.020 (0.40–0.51)	0.039 (1.0)		
19.	Total stroke of the clutch pedal	3.94–4.72 (100–120)		Straight scale	
20.	Clutch pedal play	1.18–1.57 (30–40)			 
21.	Clearance between the clutch release shaft and safety start switch	0.08–0.12 (2.5±0.5)		Calipers	

NOTES:

(1) Measure the height of the release lever (diaphragm spring ring), Item 12 above, in

the following manner:

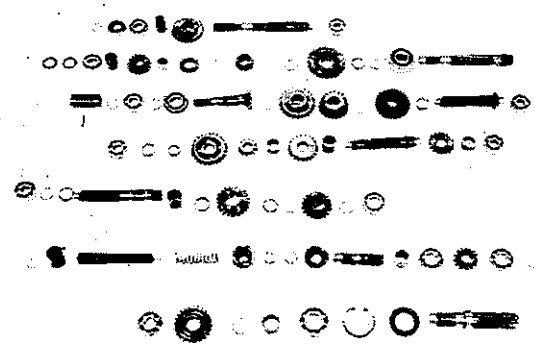
i) Insert a 0.331 in (8.4 mm) block gauge in place of the friction disc.

ii) Attach the clutch cover to the flywheel face and properly tighten.

iii) The height from the face of the flywheel to the tip of the release lever should be measured with a pair of calipers and a straight scale.

(2) The clearance referred to in Item 21 above is adjusted after the total stroke of the clutch pedal and the clutch pedal play have been properly adjusted.

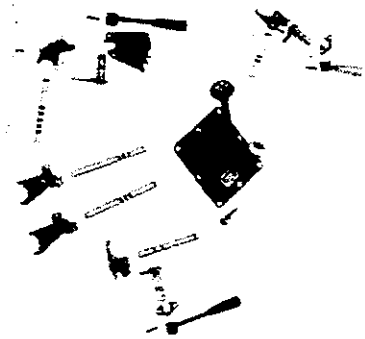
2. TRANSMISSION AND RELATED ITEMS

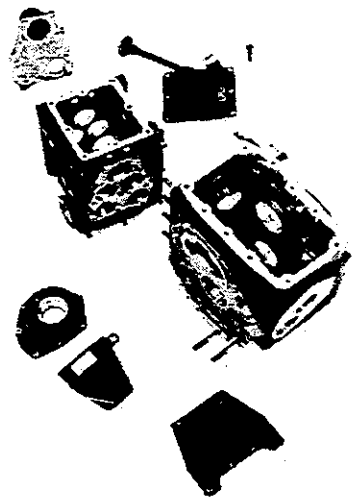


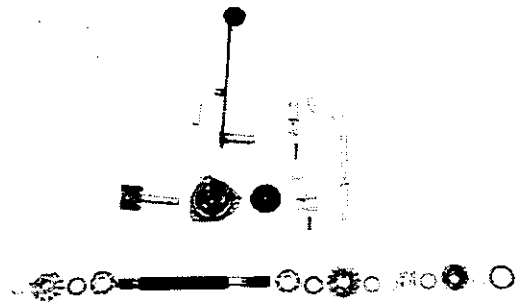
The motive power of the engine is transmitted to the transmission via the clutch.

The Model YM135(D) and YM155(D) tractors are capable of being operated in a wide range of speeds, (six forward speeds and two reverse speeds), through the combination of its gear shift lever and range shift lever. In addition, in conjunction with its speed shifting system, two operating speeds are available for the power take-off.

A one-way clutch is provided on the connecting shaft which is an extension of the P.T.O. driving shaft, so that if a sudden load is applied from the implement side, this load is completely disengaged from the transmission side – another consideration contributing to safer operation.







(1) Specifications

Item			Specifications
Transmission	Type		Mechanical; Combination of constant mesh and selective mesh types
	Control levers		Gear shift lever – 1 P.T.O. shift lever – 1 Range shift lever – 1 Front P.T.O. change lever – 1 (YM155D, YM135D only)
	No. of speeds		Forward–6, reverse–2, P.T.O.–2
	Transmission oil capacity		Upper limit – 2.5 U.S. gals (9.5 *l*) YM155D 2.6 gals (10 *l*) YM155 Lower limit – 2.4 U.S. gals (9 *l*) YM135D 2.5 gals (9.5 *l*) YM135
Reduction gear	Intermediate reduction	Gear type	Spiral bevel gears
		Reduction ratio	6.33
	Final reduction	Gear type	Spur gear
		Reduction ratio	5.2 [YM155, YM155D] 4.636 [YM135, YM135D]
Differential type			Straight bevel gears
Differential lock	Type		Claw clutch
	Control lever		Foot pedal
	Functions		When the foot pedal is activated, the motion is transmitted through a cam to move the differential lock clutch, this locks the differential lock clutch gear and differential lock shaft to the differential assembly.
Over-running clutch			Built-in claw clutch

NOTE: [New] = After Serial No. 51001: [Old] = Before Serial No. 51000.

Model	Speed		Gear shift	Range shift	Total reduction ratio	Transmission gear ratio	Travel speed [Unit: mph (kph)]
YM155 YM155D [New]	Forward	1st	1	L	359.04	10.90	0.67 (1.07)
	"	2nd	2	L	211.43	6.42	1.13 (1.82)
	"	3rd	3	L	145.16	4.41	1.65 (2.65)
	"	4th	1	H	70.83	2.15	3.37 (5.43))
	"	5th	2	H	41.74	1.27	5.73 (9.22)
	"	6th	3	H	28.64	0.87	8.36 (13.43)
	Reverse	1st	R	L	259.12	7.87	0.92 (1.48)
	"	2nd	R	H	51.15	1.55	4.67 (7.52)
YM155 YM155D [Old]	Forward	1st	1	L	404.19	12.28	0.59 (0.95)
	"	2nd	2	L	230.57	7.00	1.04 (1.67)
	"	3rd	3	L	151.09	4.59	1.58 (2.55)
	"	4th	1	H	79.79	2.42	2.99 (4.82)
	"	5th	2	H	45.49	1.38	5.25 (8.45)
	"	6th	3	H	29.81	0.91	8.02 (12.91)

Model	Speed		Gear shift	Range shift	Total reduction ratio	Transmission gear ratio	Travel speed [Unit: mph (kph)]
YM 155 YM 155D [Old]	Reverse	1st	R	L	319.91	9.71	0.75 (1.20)
	"	2nd	R	H	63.13	1.92	3.78 (6.09)
YM135 YM135D [New]	Forward	1st	1	L	319.91	10.90	0.71 (1.14)
	"	2nd	2	L	188.55	6.42	1.20 (1.93)
	"	3rd	3	L	129.43	4.41	1.75 (2.81)
	"	4th	1	H	63.14	2.15	3.57 (5.75)
	"	5th	2	H	37.22	1.27	6.07 (9.76)
	"	6th	3	H	25.54	0.87	8.84 (14.23)
	Reverse	1st	R	L	231.16	7.87	0.98 (1.57)
	"	2nd	R	H	45.60	1.55	4.95 (7.97)
YM135 YM135D [Old]	Forward	1st	1	L	360.48	12.28	0.63 (1.01)
	"	2nd	2	L	205.48	7.00	1.09 (1.76)
	"	3rd	3	L	134.73	4.59	1.68 (2.70)
	"	4th	1	H	71.15	2.42	3.18 (5.11)
	"	5th	2	H	40.56	1.38	5.56 (8.95)
	"	6th	3	H	26.58	0.91	8.49 (13.67)
	Reverse	1st	R	L	285.11	9.71	0.79 (1.27)
	"	2nd	R	H	56.30	1.92	4.01 (6.45)

(2) Visual Inspection

(1) Check to see that there are no traces of oil leakage or cracks in the transmission housing.

(2) Check to see that there are no traces of oil leakage or cracks in the rear axle housing and the final reduction gear housing.

(3) Check the gears for uneven wear, chipped teeth or cracks.

(3) Inspecting by Testing Equipment

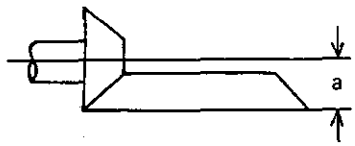
Refer to the instructions and detailed drawings in Section 2, Chapter XI for details on assembling the transmission.

[Servicing Standard for Transmission Section]

[Unit: inch (mm)]

No.	Item	Standard specification	Replacement limit	Testing equipment
1.	[Needle bearing in main shaft] Outer diameter of main change shaft	0.5902–0.5906 ($15^{0}_{-0.011}$)		Micrometer
	Inner diameter of main shaft	■ After the Serial No.51001 0.8270–0.8276 ($21^{+0.020}_{+0.007}$)		Cylinder gauge
		■ Before the Serial No.51000 0.8257–0.8265 ($21^{-0.007}_{-0.028}$)		
	Clearance	■ After the Serial No.51001	0.006 (0.15)	
		■ Before the Serial No.51000	0.006 (0.15)	
2.	[Reverse gear] Outer diameter of metal	0.9826–0.9835 ($25^{-0.020}_{-0.041}$)		Micrometer
	Inner diameter of reverse gear	0.9843–0.9851 ($25^{+0.021}_{0}$)		Cylinder gauge
	Clearance	0.0008–0.0025 (0.020–0.062)	0.0118 (0.3)	
	Outer diameter of countershaft	0.7869–0.7874 ($20^{0}_{-0.013}$)		Micrometer
	Inner diameter of metal	0.7882–0.7890 ($20^{+0.041}_{+0.020}$)		Cylinder gauge
	Clearance	0.0008–0.0021 (0.020–0.054)	0.0118 (0.3)	
3.	[Low-hi reduction gear 34] Outerdiameter of countershaft	0.9835–0.9840 ($25^{-0.020}_{-0.007}$)		Micrometer
	Inner diameter of low-hi reduction gear	0.9843–0.9851 ($25^{+0.021}_{0}$)		Cylinder gauge
	Clearance	0.0003–0.0016 (0.007–0.041)	0.008 (0.2)	
4.	[One-way clutch] Outer diameter of connecting shaft	0.3920–0.3924 ($10^{-0.032}_{-0.043}$)		Micrometer
	Inner diameter of bushing	0.3939–0.3945 ($10^{+0.020}_{+0.005}$)		Cylinder gauge
	Clearance	0.0001–0.0010 (0.003–0.025)	0.0118 (0.3)	

[Unit: inch (mm)]

No.	Item	Standard specification	Replacement limit	Testing equipment
5.	Backlash for all spur gears	0.006–0.012 (0.15–0.3)	0.02 (0.5)	Dial gauge
6.	Deflection for all shafts, except differential lock shaft		0.002 (0.05)	
7.	Width of groove for sliding gears	0.2362–0.2441 ($6^{+0.2}_{0}$)		Calipers
	Thickness of shift fork tip	0.2205–0.2283 ($6^{-0.2}_{-0.4}$)		Calipers
	Clearance	0.008–0.024 (0.2–0.6)	0.040 (1.0)	
8.	Outer diameter of fork shafts	0.5889–0.5899 ($15^{-0.016}_{-0.043}$)		Micrometer
	Inner diameter of shift forks	0.5912–0.5919 ($15^{+0.034}_{+0.016}$)		Cylinder gauge
	Clearance	0.0013–0.0030 (0.032–0.077)	0.020 (0.5)	
9.	Free length of shift fork springs	0.6378–0.6575 ($16.2^{+0.5}_{0}$)	0.5906 (15)	Calipers
	Fitted load of shift fork springs	11.66–14.44 lbs (5.29–6.55 kg)	8.33 lbs (3.78 kg)	
	Fitted length of shift fork springs	0.4528–0.4724 (11.5–12)		
10.	Free length of low-hi shift fork spring	0.5512–0.5787 ($14^{+0.7}_{0}$)	0.5118 (13)	Calipers
	Fitted load of low-hi shift fork spring	15.50–21.32 lbs (7.03–9.67 kg)	9.04 lbs (4.1 kg)	
	Fitted length of low-hi shift fork spring	0.4488–0.4567 (11.4–11.6)		
11.	Backlash of spiral drive pinion (countershaft) and spiral ring gear	0.005–0.007 (0.13–0.18)	0.020 (0.5)	Dial gauge
12.	Clearance between drive pinion and ring gear	 a: adjusting shims: 0.004 and 0.012 (0.1 and 0.3)		Dial gauge
13.	Backlash of differential pinion and differential side gears	0.004–0.008 (0.1–0.2)	0.020 (0.5)	Dial gauge
14.	Inner diameter of differential pinion	0.5512–0.5529 ($14^{+0.043}_{0}$)		Cylinder gauge
	Outer diameter of differential pinion shaft	0.5498–0.5506 ($14^{-0.016}_{-0.034}$)		Micrometer
	Clearance	0.0006–0.00030 (0.016–0.077)	0.016 (0.4)	
15.	Thickness of the differential pinion liner	0.030–0.034 ($0.8^{+0.065}_{-0.040}$)	0.024 (0.6)	Calipers

[Unit: inch (mm)]

No.	Item	Standard specification	Replacement limit	Testing equipment
16.	Thickness of the differential side gear spacers	0.035 (0.9)	0.028 (0.7)	Calipers
		0.039 (1.0)	0.031 (0.8)	
		0.043 (1.1)	0.035 (0.9)	
		0.047 (1.2)	0.039 (1.0)	
17.	Outer diameter of metal 22 x 27 x 22.5	1.0609–1.0622 ($27^{-0.020}_{-0.053}$)		Micrometer
	Inner diameter of the differential housing	1.0630–1.0638 ($27^{+0.021}_{0}$)		Cylinder gauge
	Clearance	0.0008–0.0029 (0.020–0.074)	0.012 (0.3)	
18.	Outer diameter of the final reduction pinion	0.8641–0.8654 ($22^{-0.020}_{-0.053}$)		Micrometer
	Inner diameter of metal 22 x 27 x 22.5	0.8661–0.8674 ($22^{+0.03}_{0}$)	0.012 (0.3)	Cylinder gauge
	Clearance	0.0007–0.0033 (0.020–0.086)		
19.	P.T.O. shaft deflection (at tip)		0.012 (0.3)	Dial gauge
20.	Play in direction of rotation between all gears and shaft splines		0.012 (0.3)	

NOTES:

(1) Check to see that there is no looseness between the inner and outer faces of the ball bearings and needle bearings. If there is any looseness, or if any abnormal noises are heard when turned, or if it does not turn smoothly, replace.

Particular care should be taken in the case of needle bearings to see that the rollers are not cracked or chipped.

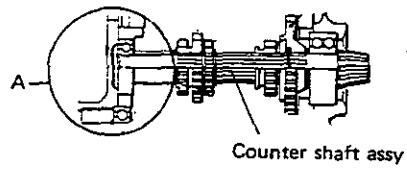
(2) If the gears have any uneven wear, galling, or scoring, they should be repaired or replaced.

(4) Item 11 through 16 refer to measurements of the differential assembly; Item 12 is carried out at a point 90° from the axial direction of the motive power rotation shaft. Adjustments should be made in the following manner:

i) When the same drive pinion is reversed, use the shims that were fitted initially.

ii) When using a new ring gear and pinion:

a) Insert shims [(two sizes are available: 0.004, 0.012 in. (0.1, 0.3 mm)] between the transmission case and the transmission case front cover so that there is no space on the



counter shaft.

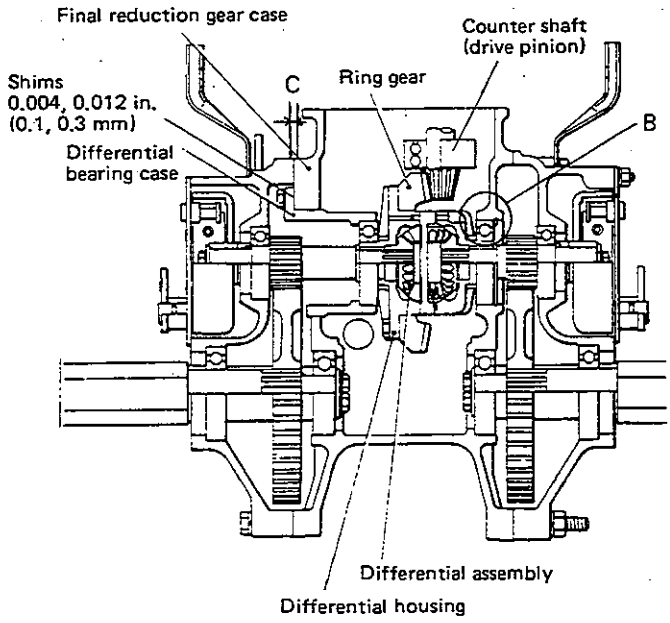
b) Fit the differential assembly into the final reduction gear case.

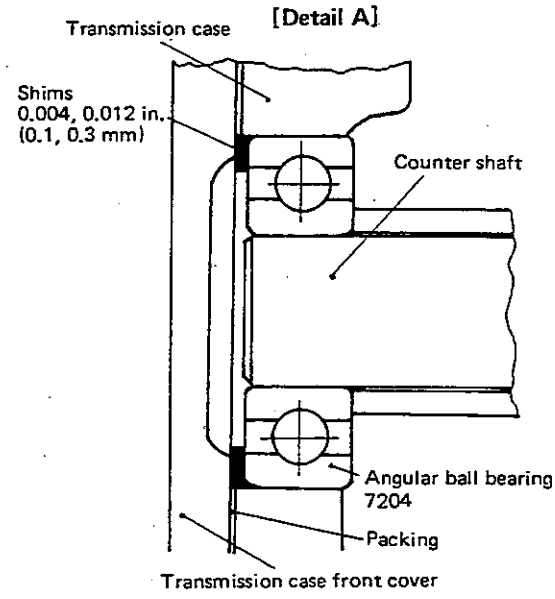
c) Insert shims [(two sizes are available: 0.004, 0.012 in. (0.1, 0.3 mm)] between the

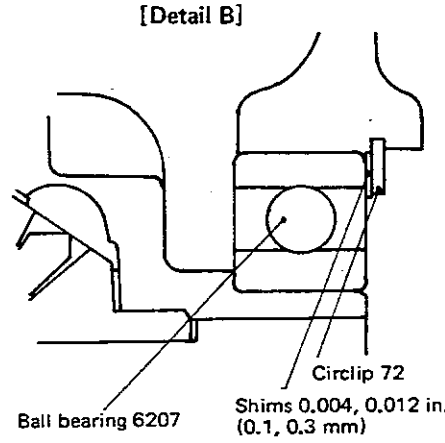
ball bearing 6207 (right hand) and the circlip 72 so that the backlash (Item 11) is 0.005 ~ 0.007 in. (0.13 ~ 0.18 mm).

d) At this time take care to see that there is no space between the differential housing and the ball bearing 6207 (both sides), the differential bearing case and the ball bearing 6207 (left hand).

e) Measure the clearance C between the final reduction gear case and differential bearing case, and insert the shims: C ~ C + 0.004 in. (0.1 mm) between the final reduction gear case and differential bearing case.



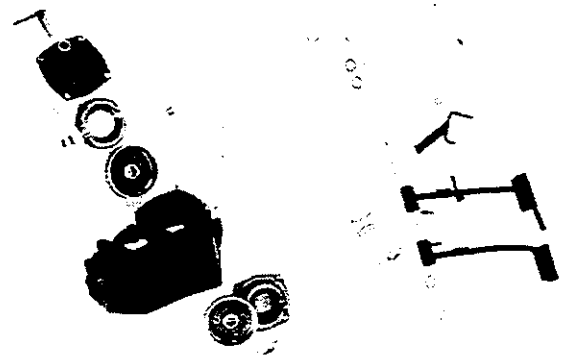




3. BRAKE

The brake serves not only to bring the tractor to a halt when in motion, but the left and right brakes of the tractor operate independently of each other and allow the operator to negotiate tight turns. The brake shaft of the tractor is fitted behind the differential lock shaft and is hermetically sealed to prevent water from entering when the tractor is used in irrigated fields.

The brakes are the internal expansion, mechanical type. Foot pressure forces the brake linings against the brake drum to brake the tractor. The



brake linings/shoes are of the leading-trailing type, and the same amount of braking force is produced for both forward and reverse motion.

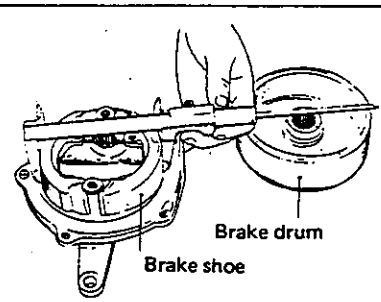
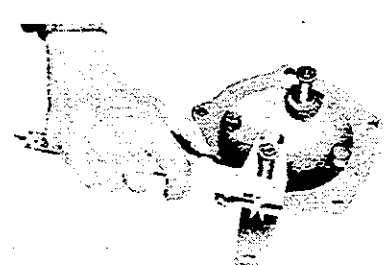
The parking brake consists of a locking device coupled to the foot brake.

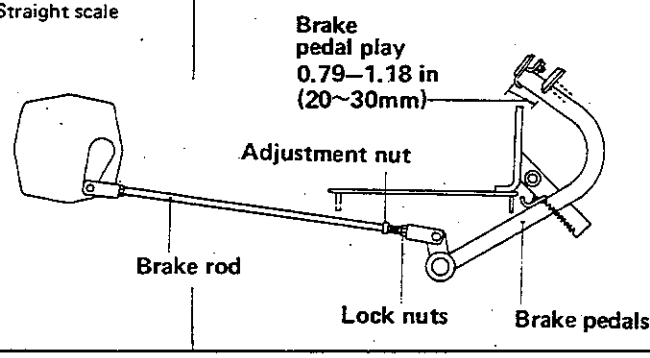
(1) Specifications

Item	Specifications
Type	Internal expansion mechanical brakes
Method	Anchor pin method
Activation	Foot pressure
Location	Reduction pinion
Functioning	Independent function for left and right sides (may be coupled as needed)
Lining	Specical woven material
Brake design	Leading-trailing shoes
Brake adjustments	Accomplished by adjusting length of the brake rod
Parking brake	Locking of the foot brakes

(2) Inspecting and Maintenance

Unit: inch (mm)

	Item	Stadnard specification	Replacement limit	Testing equipment	Illustration
1.	Inner diameter of brake drums	4.3307—4.3321 ($110^{+0.035}_{0}$)	4.39 (111.5)	Calipers	
2.	Thickness of brake linings	0.157 (4)	0.098 (2.5)	Calipers	
3.	Inner diameter of brake case cam shaft	0.7106—0.7146 ($18^{+0.15}_{+0.05}$)		Calipers	
	Outer diameter of brake cam shaft	0.7070—0.7087 ($18^{-0.043}_{0}$)		Micrometer	
	Clearance	0.0020—0.0080 (0.05—0.193)	0.12 (0.3)		

	Item	Standard specification	Replacement limit	Testing equipment	Illustration
4.	Inner diameter of brake pedal	0.9902–0.9941 ($25^{+0.25}_{+0.15}$)		Cylinder gauge	
	Outer diameter of brake pedal shaft	0.9822–0.9843 ($25^{0}_{-0.052}$)		Micrometer	
	Clearance	0.0059–0.0119 (0.15–0.302)	0.04 (1.0)		
5.	Sinking of braking surface of linings	–	0.02 (0.5)	Calipers	
6.	Brake pedal play	0.79–1.18 (20–30)	2.36 (60)	Straight scale	

NOTES:

(1) The left and right brake linings are interchangeable, and it is a good practice to rotate them from time to time to have even brake wear.

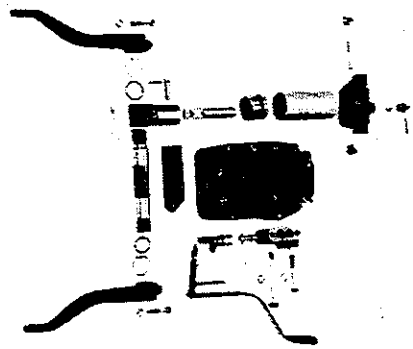
(2) In adjusting the brakes, adjust the play by extending or reducing the length of the turnbuckle on the brake rod.

(3) Always make sure that the play is the same for each side. Otherwise, if the brakes are interlocked and used to bring the machine to a halt or to reduce speed, the braking forces for the left and right side will be uneven and the tractor will pull to one side, which is extremely dangerous.

4. HYDRAULIC LIFT DEVICE

The hydraulic lift device is for handling implements. The hydraulic oil is the same oil used for the transmission, and contributes greatly to reduced maintenance cost since the operator does not have to maintain various types of lube oils.

The so-called single-action type hydraulic system lifts implements hydraulically but allows them to be lowered by the force of their own weight.



(1) Specifications

Item		Specifications
1.	Hydraulic pump type	GP1-15CK gear pump
2.	Hydraulic pump discharge volume	3.76 US gals (14.2 *l*)/min. at RPMs of 2700 [0.0014 US gals/rev (5.27 cc/rev)]
3.	Low pressure pipe	Dia 0.78 in. x 0.079 in. (22 mm x 2 t)
4.	High pressure pipe	Dia 0.47 in x t 0.059 in (12 mm x 1.5 t)
5.	Hydraulic control relief pressure full flow	1138 psi (80 kg/cm^2)
6.	Hydraulic cylinder bore	2.36 in (60 mm)
7.	Hydraulic piston outer diameter	2.36 in (60 mm)
8.	Hydraulic piston rod	Dia 0.98 in x L 4.57 (25 mm x 116 mm)
9.	Lift crank (length)	2.95 in (75 mm)
10.	Lifting shaft (length)	8.74 in (222 mm)
11.	Lifting capacity at tip of lower link	More than 1210 lbs (550 kg)
12.	Full stroke lift time	1.1 sec at RPMs of 2700
13.	Lift arms (length)	9.84 in (250 mm)

(2) Inspection and Maintenance

Chapter X, Section 6 for details on assembling the hydraulic system.

Unit: inch (mm)

No.	Item	Standard specification	Replacement limit	Testing equipment
1.	Relief valve pressure (safety valve pressure)	1138 psi (80 kg/cm^2)		
2.	Inner diameter of the lifting shaft bushings (left side)	1.1811–1.1803 ($30^{+0.025}_{0}$)		Cylinder gauge
	Outer diameter of the lifting shaft (left side)	1.1795–1.1803 ($30^{-0.020}_{-0.041}$)		Micrometer
	Clearance (left side)	0.0008–0.0026 (0.020–0.066)	0.016 (0.4)	
3.	Inner diameter of the lifting shaft bushings (right side)	1.3780–1.3795 ($35^{+0.039}_{0}$)		Cylinder gauge
	Outer diameter of the lifting shaft (right side)	1.3756–1.3770 ($35^{-0.025}_{-0.059}$)		Micrometer
	Clearance (right side)	0.0010–0.0039 (0.025–0.098)	0.016 (0.4)	

Unit: inch (mr

No.	Item	Standard specification	Replacement limit	Testing equipment
4.	Hydraulic cylinder bore	2.3622–2.3661 ($60^{+0.1}_{0}$)		Cylinder gauge
	Outer diameter of hydraulic piston	2.3598–2.3610 ($60^{-0.060}_{-0.030}$)		Micrometer
	Clearance	0.0012–0.0063 (0.030–0.16)	0.012 (0.3)	
5.	Lifting capacity at the tip of lower link	More than 1210 lbs (550 kg)		

NOTES:

(1) The components of the hydraulic equipment are fitted selectively and are precision finished by lapping, thus when they have been disassembled for maintenance, the following points should be borne in mind:

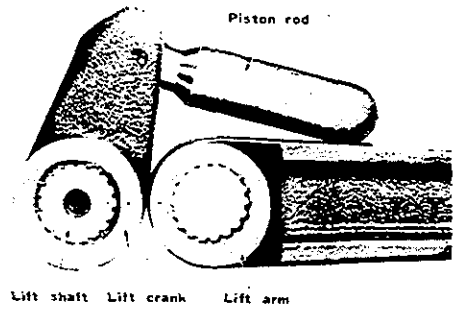
i) Do not interchange spool;
ii) Check beforehand the number of hydraulic pressure adjusting shims fitted, and make sure the correct number are used in assembly.
iii) When assembling, components such as O-rings should always be replaced.

(2) When assembling hydraulic cylinder:

Be sure to align the assembly guide marks on the lift shaft, lift crank, and lift arms.

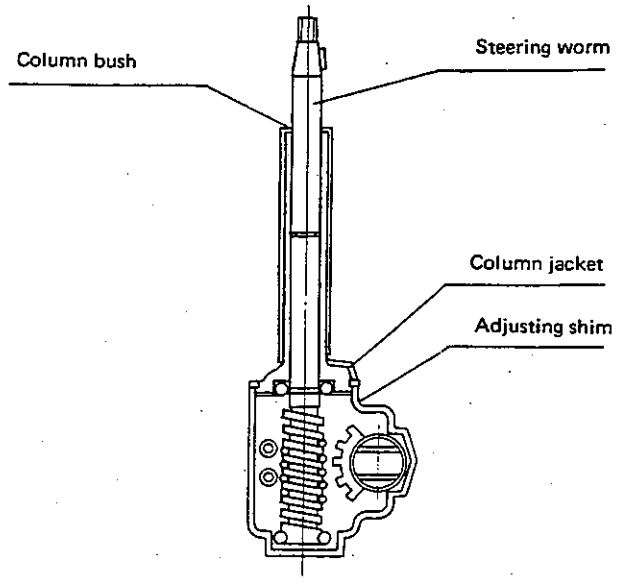
(3) Make sure that each section of the system functions properly as it is assembled.

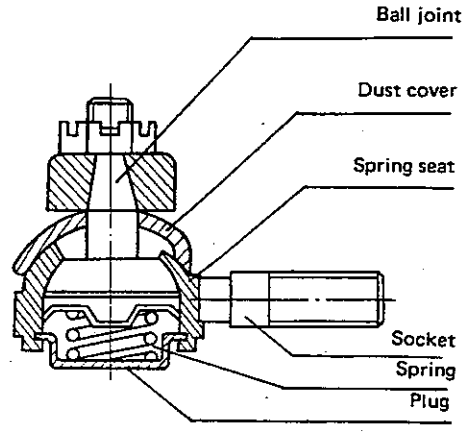
Also check the working pressure of the safety valve with a pressure gauge after the final assembly has been completed.



5. STEERING

The steering system must provide excellent steering performance during operation. This tractor has a ball-nut type steering system.





(1) Specifications

Unit: inch (mm)

Item	Specifications	
Tractor model	YM155, YM155D	YM135, YM135D
Type	Ball-screw	Ball-screw
Gear ratio	18.9 : 1	15.4 : 1
Angle of motion of center shaft	2 x 430 degrees	2 x 410 degrees
Sector gear module	3.5	3
No. of teeth of sector gear on full circle basis	15	13
Worm lead	0.344 (8,731)	0.313 (7.938)
Direction of twist of the worm gear	Left	Left
Gear oil	SAE #90 or equivalent	
Oil capacity	0.05 US gals (0.2 *l*)	0.05 US gals (0.2 *l*)
Outer diameter of steering wheel	15.75 (400)	14.96 (380)
Steering wheel play	1.17–2.0 (30–50) m)	1.17–2.0 (30–50)

(2) Inspection and Maintenance

The steering gear box is capable of withstanding heavy use, and there is rarely any need to disassemble it for maintenance work.

Backlash adjustment can be done by varying the number of adjusting shims fitted on the side of the gear box.

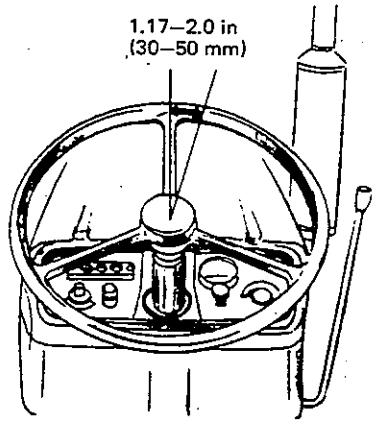
Steering play adjustment can be done by adjusting the backlash of the gears.

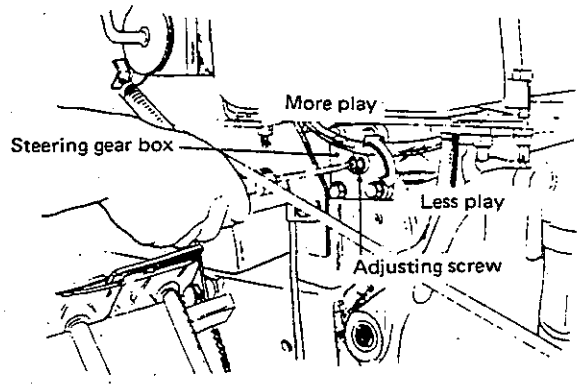
By turning the screw to the right, the amount of play can be reduced. (The standard position for the screw is a quarter-turn back from the point at which the screw suddenly becomes hard to turn.)

NOTES:

(1) Check whether the drag rod is bent.

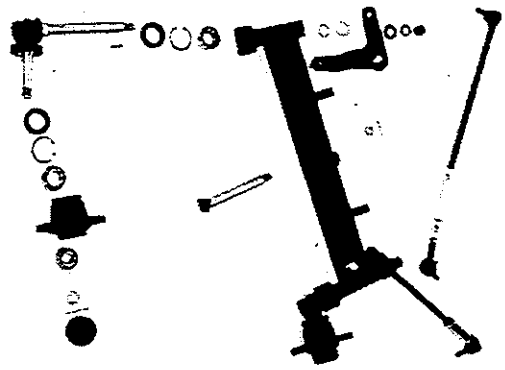
(2) Check whether the ball joints function smoothly.

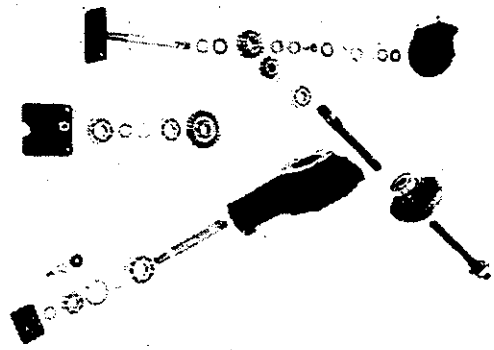


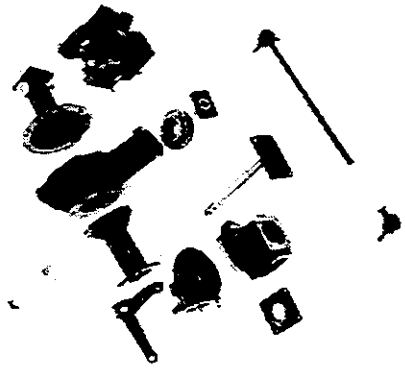


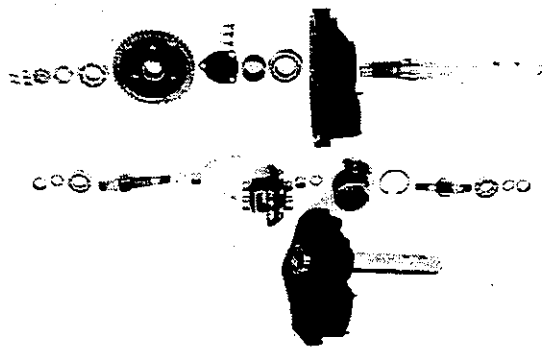
6. FRONT AXLE AND REAR AXLE

The front axle is a Lemoine type axle supported by a center pin. It serves to keep the front end of the tractor on an even keel when travelling over rough terrain where the left and right wheels go over irregular depressions and mounds, and it also provides good steering qualities. Other features of the Lemoine type axle are that it provides high ground clearance and it is rugged and therefore very durable.









(1-1) Front Axle Specifications

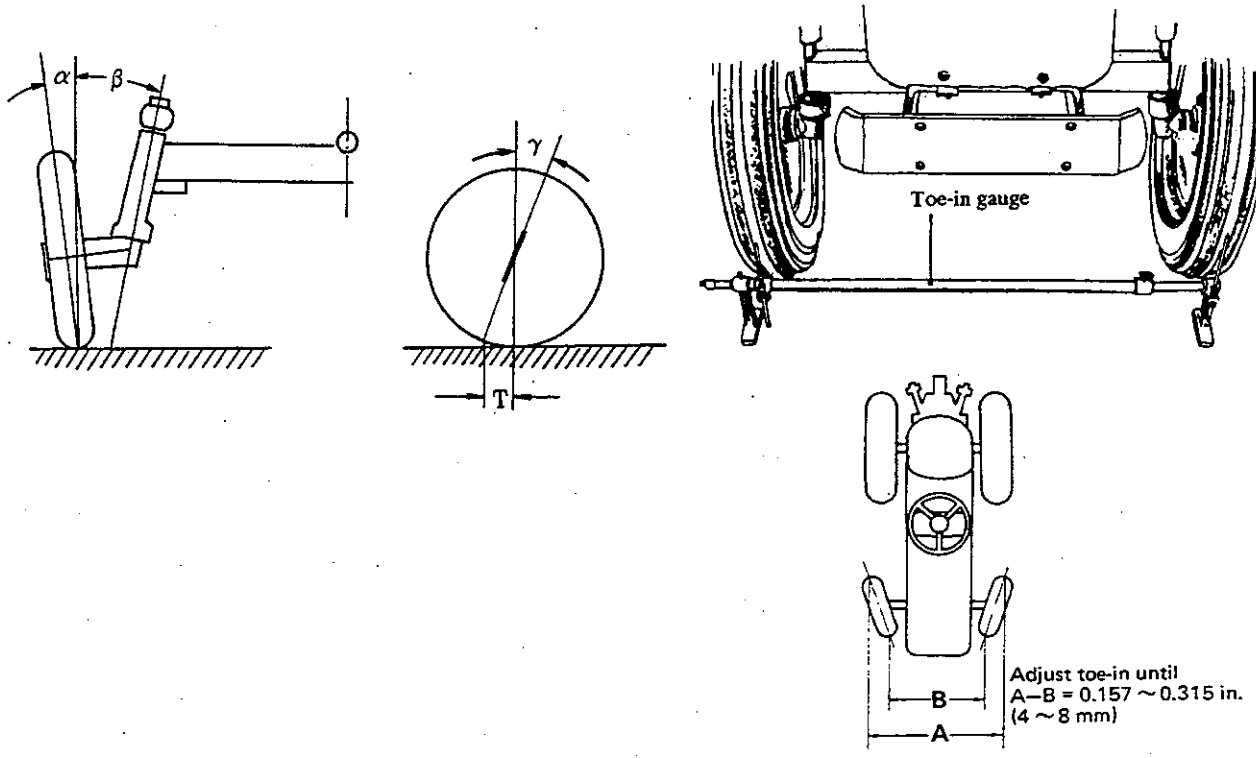
Unit: inch(mm)

Model / Item	YM155	YM155D	YM135	YM135D
Tread	28.7 (730)	29.3 (745) [28.0 (710)]	26.4 (670)	29.3 (745) [26.8 (680)]
Tire size	4.50–10–2PR	5–12–2PR	4.50–10–2PR	5–12–2PR
Tire pressure	17.8 psi (1.25kg/cm^2)	17.8 psi (1.25 kg/cm^2)	17.8 psi (1.25 kg/cm^2)	17.8 psi (1.25 kg/cm^2)
Toe-in	0.16–0.32 (4–8)	0.16–0.32 (4–8)	0.16–0.32 (4–8)	0.16–0.32 (4–8)
Camber	3°	3°	3°	3°
Caster	0°	2.5°	0°	2.5°
Trail	0	0.43 (11)	0	0.43 (11)
King pin inclination angle	7°	6°	7°	6°

NOTE: The figures in brackets [ ] are for parts before Serial No. 51000.

(1-2) Rear Axle Specifications

Model / Item		YM135/YM135D	YM155/YM155D
Rear axle type		Half-floating type	Half-floating type
Tread adjustment		4-stage: 23.6–31.5 in (600–800 mm)	4-stage: 27.6–33.5 in (700–850 mm)
Tire size:	Standard	7–16–4PR F.L.S	8–16–4PR F.S.L.
	Optional	27 x 8.50–15PR P.D (Turf tire)	8–16–4PR F.D (Turf tire)
Standard air pressure:			
	Standard	25.6 psi (1.8 kg/cm^2)	22.8 psi(1.6 kg/cm^2)
	Optional	11.4 psi (0.8 kg/cm^2) (Turf tire)	22.8 psi(1.6 kg/cm^2) (Turf tire)



α: Camber angle — provides stability in steering and straight line performance.

β: King pin inclination — reduces steering effort.

γ: Caster angle — improves directional stability.

T: Trail — distance between point at which an imaginary line extending from the axis of the king pin intersects with the ground and the point at which an imaginary line extending perpendicularly from the axis of the wheel intersects with the ground.

Toe-in: The difference between A and B. Serves to improve directional stability. Because of the camber angle, the left and right front tires each try to roll forward outwardly. This is prevented by the tie-rods, and so a certain amount of slippage is created on the ground surface, and directional stability tends to be impaired. To remedy this, the toe-in should be adjusted.

(2-1) Inspection and Maintenance [Model: YM135, YM155]

Unit: inch (mm)

No.	Item	Standard specification	Replacement limit	Testing equipment
1.	Inner diameter of king pin bushings	0.9850–0.9871 ($25^{+0.072}_{+0.020}$)		Cylinder gauge
	Outer diameter of king pin	0.9822–0.9843 ($25^{0}_{-0.052}$)		Micrometer
	Clearance	0.0008–0.0049 (0.020–0.124)	0.016 (0.4)	
2.	Up and down play of king pin	0.0007–0.0339 (0.02–0.86)	Less than 0.04 (1.0)	Dial gauge
3.	Inner diameter of center pin bushings	0.8669–0.8689 ($22^{+0.07}_{+0.02}$)		Cylinder gauge
	Outer diameter of center pin	0.8641–0.8654 ($22^{-0.020}_{-0.053}$)		Micrometer
	Clearance	0.0016–0.0048 (0.040–0.123)	0.016 (0.4)	
4.	Front and back play of center pin	0	0.020 (0.5)	Dial gauge

NOTES:

(1) The king pin is integrated with the knuckle spindle so the spindle should be checked for cracks.

(2) Replacement of the king pin bushings is done by press-fitting the new ones in.

(3) If there is excessive up and down play of the king pin (Item 2 above), insert additional upper cover(s).

(4) When the front hub bearing becomes worn, the front wheels will develop a shimmy (a steering vibration or flutter in the vicinity of the kingpin), which will impair steering stability, therefore, particular care should be paid to the front hub bearings when the front hub is disassembled.

(5) To adjust the toe-in, first draw lines representing the center of the tire tread and the horizontal center of the tires, and adjust the distance between the two wheels at the front and rear of the tires. The actual adjustment is made by turning the turnbuckle to adjust the length of the tie-rods; after the adjustment has been completed, tighten the locknuts securely.

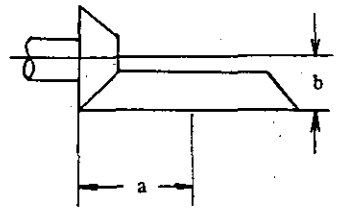
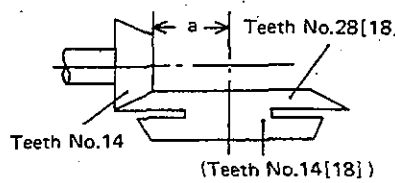
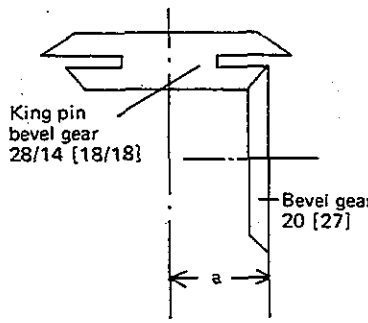
(2-2) Inspection and Maintenance [Model: YM135D, YM155D]

Unit: inch (mm)

Serial No.		Before #51000			After #51001		
No.	Item	Standard specification	Replacement limit	Testing equipment	Standard specification	Replacement limit	Testing equipment
1	Inner diameter of metal 22x25x50	0.8664–0.8672 ($22^{+0.028}_{+0.007}$)		Cylinder gauge			
	Inner diameter of king pin bevel gear				1.2208–1.2215 ($31^{+0.025}_{+0.009}$)	1.2274 (31.175)	Cylinder gauge
	Outer diameter of king pin	0.8654–0.8659 ($22^{-0.007}_{-0.020}$)		Micrometer	0.9837–0.9843 ($25^{0}_{-0.013}$)	0.9778 (24.837)	Micrometer
	Clearance	0.0006–0.0019 (0.014–0.048)	0.016 (0.4)				
2	Inner diameter of center pin bushings	0.8661–0.8670 ($22^{+0.021}_{0}$)		Cylinder gauge	0.8661–0.8670 ($22^{+0.021}_{0}$)		Cylinder gauge
	Outer diameter of center pin	0.8641–0.8654 ($22^{-0.020}_{-0.053}$)		Micrometer	0.8641–0.8654 ($22^{-0.020}_{-0.053}$)		Micrometer
	Clearance	0.0008–0.0029 (0.020–0.074)	0.016 (0.4)		0.0008–0.0029 (0.020–0.074)	0.016 (0.4)	
3	Up and down play in king pin	0	0.004 (0.1)	Dial gauge	0–0.004 (0–0.1)	0.008 (0.2)	Dial gauge
4	Fore and aft play of center pin	0	0.020 (0.5)	Dial gauge	0	0.025 (0.5)	Dial gauge
5	Inner diameter of king pin bevel gear	1.2996–1.3002 ($33^{+0.025}_{+0.009}$)		Cylinder gauge			
	Outer diameter of inner collar	1.1020–1.1024 ($28^{0}_{-0.009}$)		Micrometer			
	Clearance	0.00035–0.0014 (0.009–0.036)	0.012 (0.3)				

No.	Item	Standard specification	Replacement limit	Testing equipment
6	Backlash of drive pinion and ring gear	0.005–0.007 (0.13–0.18)	0.020 (0.5)	Micrometer
7	Backlash of differential pinion and differential side gear	0.004–0.008 (0.1–0.2)	0.020 (0.5)	Micrometer
8	Inner diameter of differential pinion	0.5512–0.5529 ($14^{+0.043}_{0}$)		Cylinder gauge
	Outer diameter of differential pinion shaft	0.5498–0.5506 ($14^{-0.016}_{-0.034}$)		Micrometer
	Clearance	0.0013–0.0030 (0.034–0.077)	0.016 (0.4)	
9	Thickness of differential pinion liner	0.030–0.034 ($0.8^{+0.065}_{-0.040}$)	0.024 (0.6)	Calipers
10	Thickness of differential side gear spacers	0.035 (0.9)	0.028 (0.7)	Calipers
		0.039 (1.0)	0.031 (0.8)	
		0.043 (1.1)	0.035 (0.9)	
		0.047 (1.2)	0.039 (1.0)	

Unit: inch (mm)

	Item	Standard specification	Replacement limit	Testing equipment
11	Clearance between drive pinion and ring gear	 a: adjusting shims 0.004 and 0.008 (0.1 and 0.2) b: adjusting shims 0.004 and 0.012 (0.1 and 0.3)		Dial gauge
12	Backlash of bevel gear 14 and king pin bevel gear 28/14 [14/18]	0.004–0.012 (0.1–0.3)	0.024 (0.6)	Dial gauge
13	Backlahs of king pin bevel gear 28/14 [18/18] and bevel gear 20 [27]	0.004–0.012 (0.1–0.3)	0.024 (0.6)	Dial gauge
14	Clearance between bevel gear 14 and king pin bevel gear 28/14 [18/18]	 a: adjusting shims 0.004 and 0.012 (0.1 and 0.3)		Dial gauge
15	Clearance between the kingpin bevel gear and the bevel gear	 a: adjusting shims 0.004 and 0.012 (0.1 and 0.3)		Dial gauge
16	Play in direction of rotation between all gears and shaft splines		0.012 (0.3)	

NOTES:

(1) Check to see that there is no looseness between the inner and outer laces of the ball bearings and needle bearings. If this is the case, or if they emit abnormal noises when turned, or do not turn smoothly, replace.

Particular care should be taken in the case of needle bearings to see that the rollers are not cracked or chipped.

(2) As for the gears, if there is any uneven wear, galling, or scoring, they should be repaired to replaced.

(3) Item 6 through 11 refer to measurements for the differential assembly; Item 11

is carried out at a point 90° from the axial direction of the motive power rotain shaft, and the adjustments are made in the following manner:

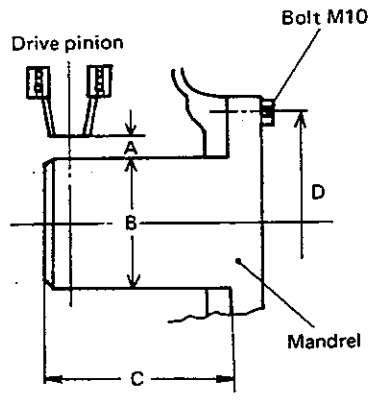
i) When the same drive pinion and ring gear are to be reused, remember without fail to use the shims that were fitted initially.

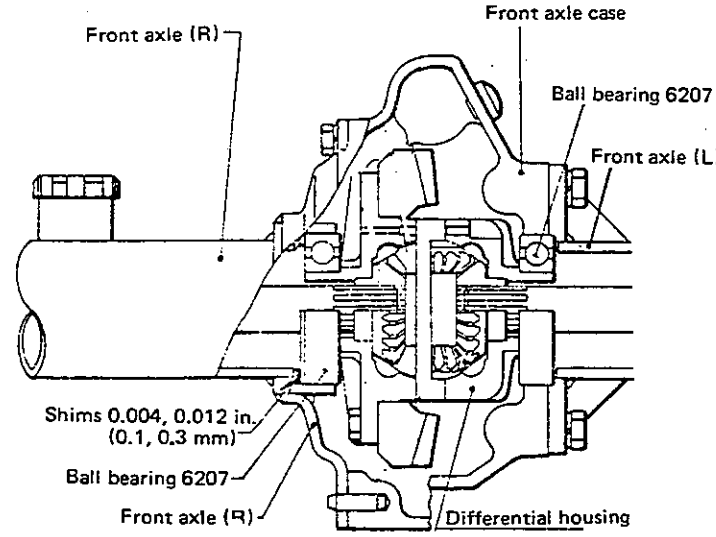
ii) When using a new ring gear and pinion:

a) Use a mandrel instead of the differential carrier and use the shims [(two sizes available: 0.004, 0.008 in (0.1, 0.2 mm)] between the front axle and front axle case cap to adjust the reading for A to 0.6280 ~ 0.6319 in (16 ± 0.05 mm).

b) Fit the differential assembly with the front axle case.

c) Insert shims [two sizes available: 0.004, 0.012 in (0.1, 0.3 mm)] between the front axle (L) and between ball bearing 6207 so that the backlash (Item 6) is 0.005 – 0.007 in (0.13 –0.18 mm).





A: 0.6280–0.6319 in. (16±0.05 mm)
B: 2.8343–2.8316 in. ($72^{0}_{-0.01}$ mm)
C: 2.362 in. (60 mm)
D: 4.5669 in. (116 mm)

d) At this time, be sure that there is no space between the differential housing and the ball bearing 6207 (both sides), the front axle (L) and ball bearing 6207 (lighthand).

e) Insert shims [0.004, 0.012 in (0.1, 0.3 mm)] between the front axle (R) and front axle case so that there is no space at the places mentioned in Item (d).

f) Item 12 through 15 refer to measurements for the bevel gears in the front-gear cases; the adjustments are made in the following manner:

(1) When using the same bevel gears, remember without fail to use the shims that were fitted initially.

(2) When using new bevel gears,

i) Insert shims [two sizes available: 0.004, 0.012 in (0.1, 0.3 mm)] between the bevel gear 14 and ball bearing 6305 so that the backlash (Item 12) of the bevel gear 14 and king pin bevel gear 28/14 [18/18] is 0.004–0.012 in (0.1–0.3 mm).

ii) Insert shims [two sizes available: 0.004, 0.012 in (0.1, 0.3 mm)] between the bevel gear 20 [27] and ball bearing 6306 [6305] so that the backlash (Item 13) of the king pin bevel gear 28/14 [18/18] and bevel gear 20 [27] is 0.004–0.012 in (0.1–0.3 mm).

CAUTION:

1) Figures at the end of gear indicate the number of teeth.

2) Figures in [ ] indicate those before Serial No. 51000.

XI. TRACTOR ASSEMBLY

1. GENERAL ASSEMBLY

(1) Attach the clutch disc and pressure plate to the main drive shaft, insert the shaft in the flywheel, center it, and then secure the pressure plate to the flywheel with bolts.

NOTE: Make sure that there is no oil on the mounting surfaces of the flywheel and pressure plate.

(2) Fit the main drive shaft into the clutch housing.

(3) Move the tractor towards the engine, and attach the engine and tractor.

NOTE: Check to be sure the PTO main drive shaft is correctly joined to the joint.

(4) Assemble the tachometer cable, drag rod, throttle rod, and decompression rod.

NOTE: All split pins should be replaced with new ones.

(5) Attach the fuel oil pipe to the fuel pump. Open the filter cock. Bleed the fuel system of air at the fuel pump. Attach the return pipe to the fuel injection valves.

NOTE: Replace the copper packing.

(6) Attach the hydraulic pipes.

NOTES; Replace the copper packing on the tractor side; make sure that O-rings are in position on the engine side.
a) Attach high and low pressure pipes to the tractor side.
b) Attach high and low pressure pipes to the engine.
c) Secure pipes with pipe clamps.

(7) Mount the battery. Connect the positive and negative terminals.

NOTES;
a) Be sure the cushioning inserts are in position.
b) Secure the battery clamp firmly in position.

(8) Attach the front grille.

(9) Carry out electrical wiring (refer to the wiring diagram).

(10) Attach the hood.

(11) Attach the muffler.

(12) Put in transmission lube oil.

[ASSEMBLY CAUTIONS]

(1) Parts with a Serial No. before 51000 or after 51001 have either a different shape or dimension. The difference is described in the procedure, and should be heeded.

(2) When assembling the gears, fork, and fork shaft be sure to pay close attention to the color direction and position. Pay close attention to the illustration so that they are put in properly.

(3) The number in brackets indicating the dimensions or gears refers to Serial No. before 51000.

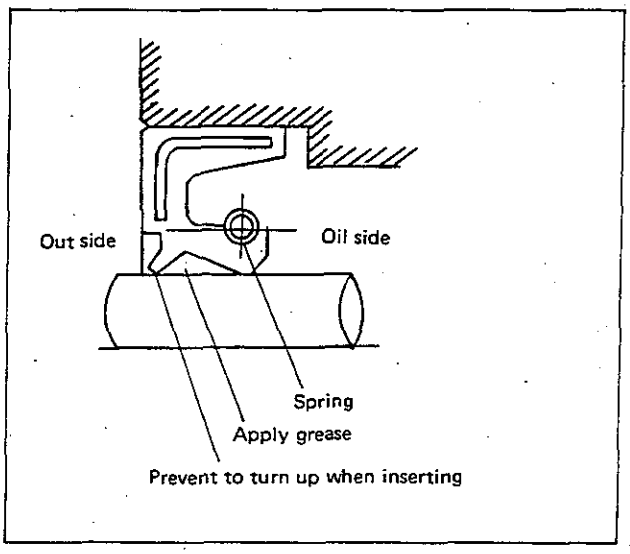
(4) The last figure of the gears indicates the No of gear teeth.

(5) In the event that there are no instructions for installing the oil seal, it should be installed so it is flush with the outer edge as shown in the illustraion.

(6) Oil Seal Lip. To prevent damage to the O-ring, installation should begin only after the shaft and hole have been checked for any sharp edges. In the event that there are sharp edges they should be removed.

(7) Be sure that the spring is completely installed inside the oil seal. Check that it does not slip out of the slot in the inside of the oil seal.

(8) When inserting the oil seal in the shaft be sure that the lip does not turn up. If the lip turns up, pull it out of the shaft a little. Insert the seal in the shaft again turning it lightly with your fingers, it should return to its correct conditions.



(9) Be sure to apply grease to the inside of the oil seal lip to prevent damage to the lip. Also before installing apply grease to both the lip and the shaft.

(10) Be sure to apply grease to the O-ring and to the O-ring oil seal, and to the slot, shaft and hole before installing.

(11) Press-fit: To prevent deforming the bushings and bearings during press fitting be sure to use either a mandrel or an appropriate press fitting tool for this operation.

(12) When assembling the bearings do not hit them directly with a hammer. Use a drive-in tool and plate as much as possible and hit them with a hammer if needed.

(13) When assembling the gear and stepped collar, be sure to put them in the right direction. Pay special attention to the direction of the gear chamber.

(14) Tighten the bolts and nuts to their specified tightening torque. The screws are made of light alloy and should not be overtightened.

(15) Use caution when unpacking, get rid of the old packing, and completely remove any oil that on the surface with thinner. After it has completely dried apply bond.

(16) Apply the proper amount of bond to the packing, and be sure that none gets on the inside of the case or the surface of the teeth. It can lead to a clogged oil strainer or its malfunction.

(17) Apply bond to both sides of the packing.

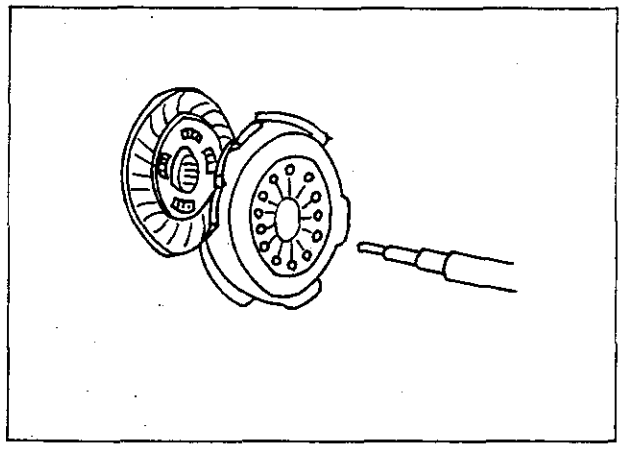
(18) The circular ring and circlips sometimes become weak after they have been removed, consequently check them before assembly.

(19) The following points should be observed when connecting the "housing assembly clutch" to both the transmission case and the gear case assembly final reduction:

a) When the main transmission is in the neutral position the P.T.O. transmission is in either 1 or 2.

b) It is connected to the P.T.O. shaft when the latter moves clockwise.

(20) When assemblying the clutch disc assembly, six bolts 8 x 20 should be attached after they have passed through the shaft and main driving.



(21) When bending the cotter pin downwards, bend it completely, along the nut or set pin. Even when the set pin diameter is small, making the procedure difficult, bend and set it so that it does not exceed the washer diameter.

(22) Drive-in Direction of the Roll Pin: Set the crack at a 90° position from the load direction. When driving in dually, the inside roll pin crack should be positioned at 180° from the outside roll pin crack.

2. TRANSMISSION ASSEMBLY

2-1 P.T.O. Driving Shaft Assembly

(1) Fit the (2) circlip 25 to the (1) P.T.O. driving shaft.

(2) Fit the (1) P.T.O. driving shaft into the transmission case from the final-reduction gear case side, while fitting on the (3) collar 25.5 x 32 x 32.2, (4) liner 25 x 33 x 1.6, (5) P.T.O. reduction gear 19 [23], and the (6) liner 25 x 33 x 1.6. Fit on the (7) circlip 25.

(3) Fit on the (8) P.T.O. sliding gear 16 [19], and fit on the (9) circlip 25.

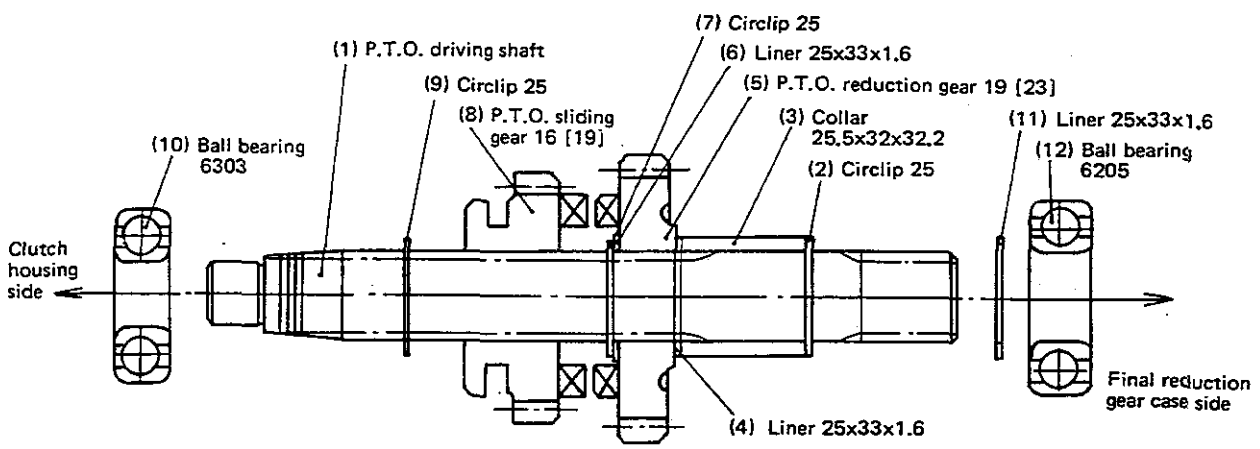
(4) To the assembled parts of (1)—(3), fit on the (11) liner 25 x 33 x 1.6 and press-fit the (10) ball bearings 6303, and (12) 6205.

NOTES:

a) Apply grease to the inner surface of the (5) P.T.O. reduction gear: After Serial No. 51001 – 19T
Before Serial No. 51000 – 23T

b) Construction Difference in the (1) P.T.O. Driving Shaft: Those with a Serial No. after 51001 have a slot.

Those with a Serial No. before 51000 have no slot.



2-2 P.T.O. Fork Shaft Assembly

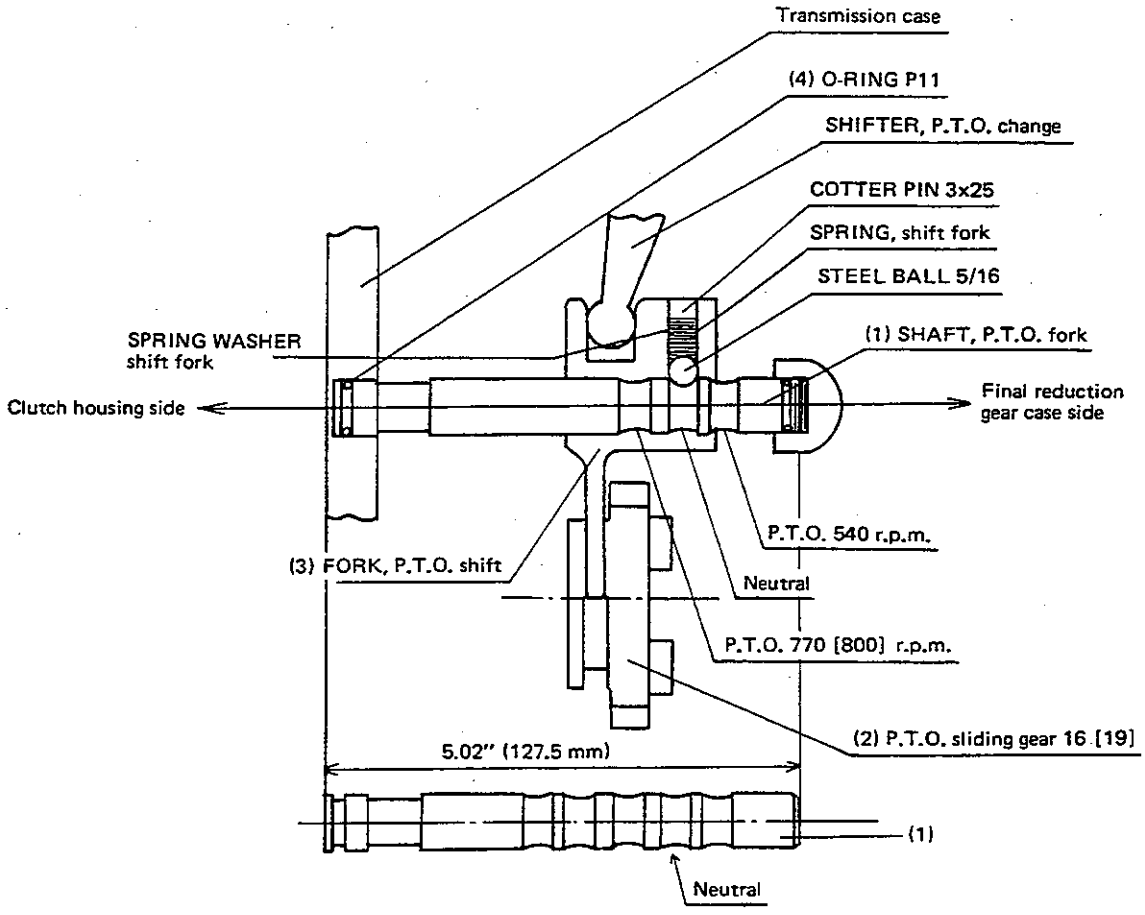
(1) Attach the (4) O-ring P11 to the (1) P.T.O. fork shaft.

(2) Insert the fork of the (3) P.T.O. shaft fork into the slot on the (2) P.T.O. sliding gear.
After Serial No. 51001 – 16T
Before Serial No. 51000 – 19T

(3) Attach the items in step (1) and (2) from the clutch housing side. Put the (3) P.T.O. shaft fork in the center position.

NOTES:
a) Construction Differences in the (1) P.T.O. Fork Shafts: Those with a Serial No. after 51001 have 3 round slots.

Those with a Serial No. before 51000 have 5 round slots.



2-3 Front P.T.O. Shaft Assembly (YM135D, YM155D)

(1) With the (1) front P.T.O. shaft in the transmission case, insert on it the (3) front P.T.O. sliding gear (refer to Note), the (4) collar 20.5 x 25 x 40, and press-fit the (2), (5) ball bearings 6303 and 6204.

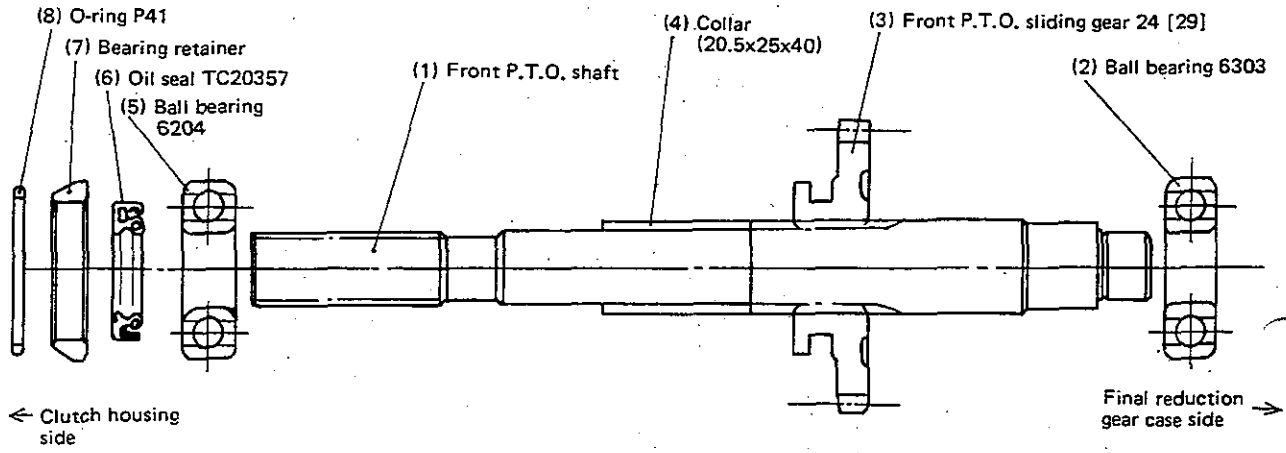
(2) Insert the (7) bearing retainer in the transmission case, and then insert the (6) oil seal TC20357, and the O-ring P-41.

NOTES:

a) Be sure to check the gear direction, bearing position and shaft direction.

b) No. of teeth for P.T.O. sliding gear:

	After 51001	*Before 51000*
YM135D	*24*	*29*
YM155D	*25*	*29*

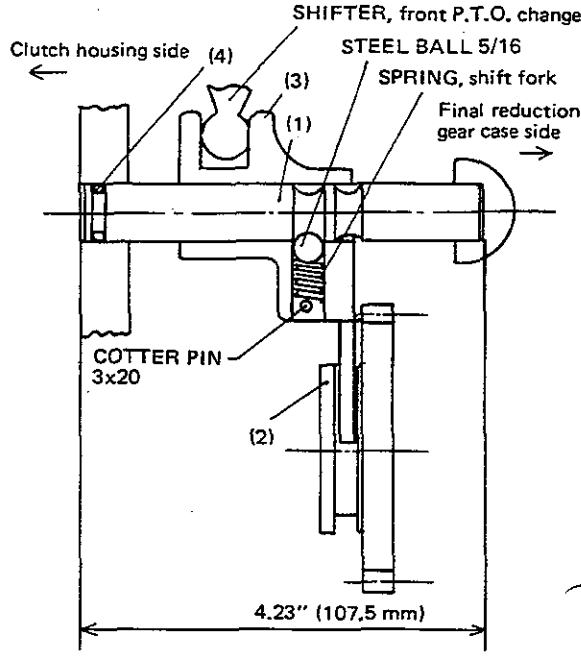


2-4 Front P.T.O. Shift Shaft Assembly (YM 135D, YM155D)

(1) Fit the (4) O-ring P11 to the (1) front P.T.O. shift shaft.

(2) Place the (3) front P.T.O. shift fork into the slot of the (2) front sliding gear.

(3) Assemble the parts in step 1 and 2 from the clutch housing side.



(1) SHAFT, front P.T.O. shift
(2) Front sliding gear 25 [29]
(3) FORK, front P.T.O. shift
(4) O-RING P11

2-5 Driven Shaft Assembly

[Parts Having a Serial No. After 51001]

(1) Fit the (3) circlip 25 to the (1) driven shaft.

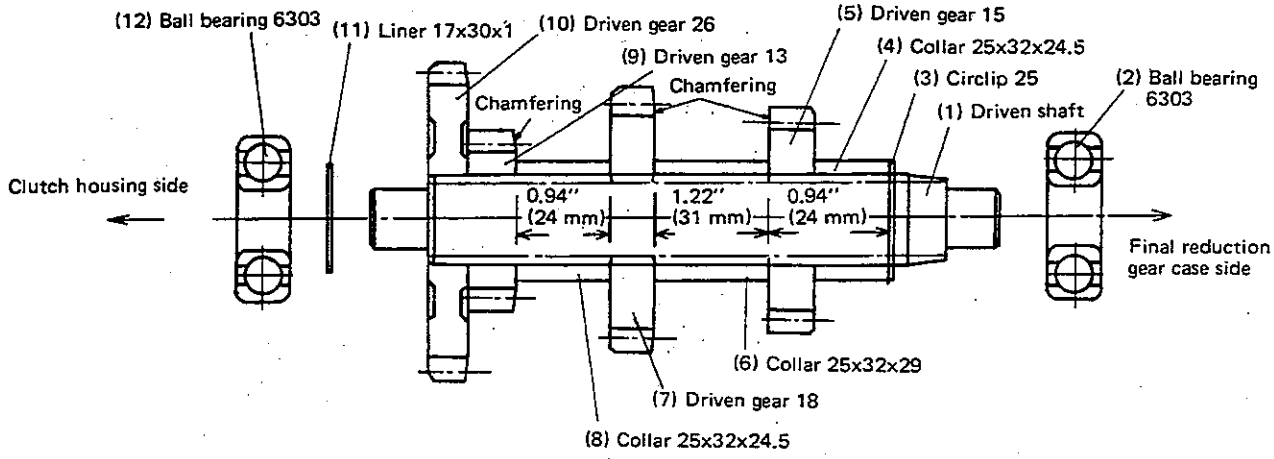
(2) After step 1, with the driven shaft in the transmission gear case, insert the following from the final reduction gear case side: (4) collar 25 x 32 x 24.5, (5) driven gear 15, (6) collar 25 x 32 x 29, (7) driven gear 18, (8) collar 25 x 32 x 24.5, (9) driven gear 13, (10) driven gear 26 and the (11) liner 17 x 30 x 1.

(3) Press fit the (2), (12) ball bearings 6303.

NOTES:

a) It is easy to drop the (11) liner during assembly so handle it securely.

b) Be sure to install the (5), (7) and (9) gears in the correct direction since they perform chamfering on one side.

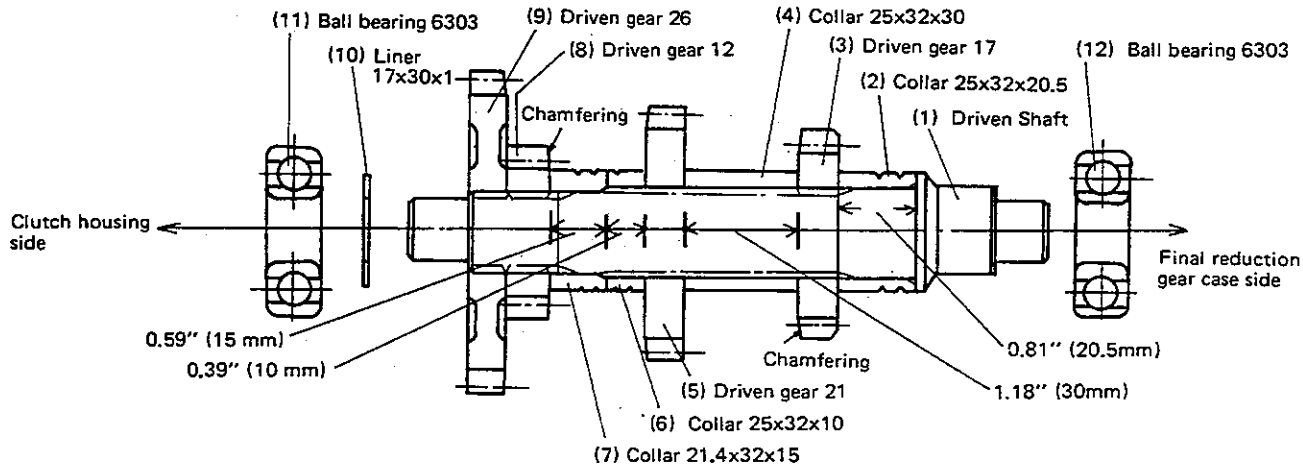


[Parts Having a Serial No. Before 51000]

(1) With the (1) driven shaft in the transmission case, insert the following from the final reduction gear case side: (2) collar 25 x 32 x 20.5, (3) driven gear 17, (4) collar 25 x 32 x 30, (5) driven gear 21, (6) collar 25 x 32 x 10, (7) collar 21.4 x 32 x 15, (8) driven gear 12, (9) driven gear 26, and (10) liner 17 x 30 x 1.

(2) Press-fit the (11), (12) ball bearings 6303.

NOTE: The (10) liner is easily dropped during assembly so handle it securely.



2-6 Counter Shaft Assembly

(1) Insert the (2) double row angular ball bearings in the (1) counter shaft, and attach the (3) circlip 25.

(2) Following step 1, with the (1) counter shaft in the transmission case, attach the following from the final reduction gear case side: (4) liner 25 x 33 x 1.6, (5) low-high reduction gear 34, and (6) liner 25 x 33 x 1.6. Attach the (7) circlip 25. Then put in the (8) low-high sliding gear16 and attach the (9) circlip 25. Put in the (10) front driving gear (refer to Note 'd'), (11) liner 20 x 35 x 1, (12) metal 20 x 25 x 22, (13) reverse gear (refer to Note 'd'), (14) liner 20 x 35 x 1 and the (15) collar 21 x 27 x 36.5.

(3) Press fit the (16) angular ball bearings 7204.

NOTES:

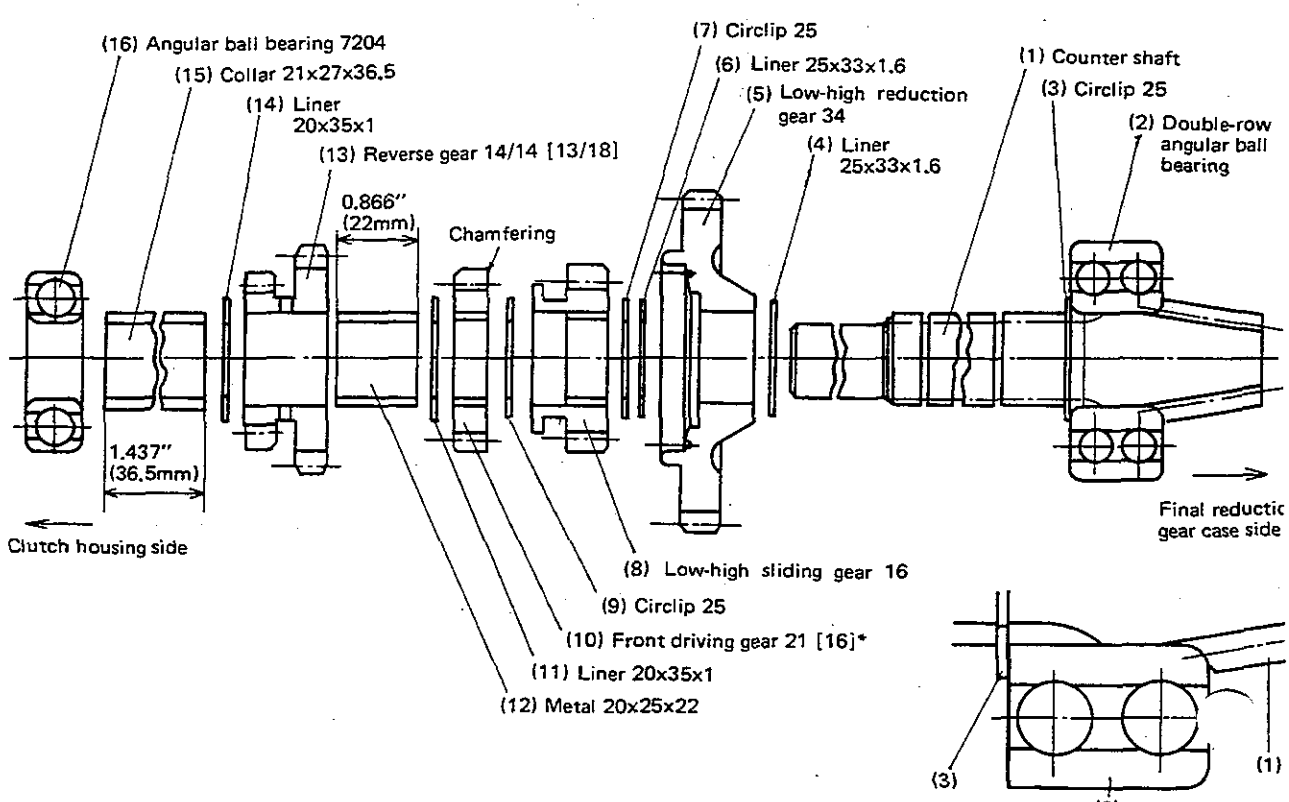
a) The (10) front driving gear is only for the YM155D and the YM135D, for the YM155 and the YM135 use collar 25 x 32 x 9.

b) The left and right surface of the inner lace o. (2) double row ball bearings are different. Inser bigger side next to the pinion side as shown in illustration.

c) Be sure to apply grease to the inside of th low-high reduction gear 34 and the (13) reverse as well as to the outside of the (12) metal 20 x 22.

d) No. of teeth:

Model	*After No. 51001*				*Before No. 51000*			
Gear	*YM-135*	*YM-135D*	*YM-155*	*YM-155D*	*YM-135*	*YM-135D*	*YM-155*	*YM-155D*
Front driving gear	–	*21*	–	*20*	–	*16*	–	*16*
Reverse gear	*14/14*	*14/14*	*14/14*	*14/14*	*13/18*	*13/18*	*13/18*	*13/18*



2-7 Low-High Shift Shaft Assembly

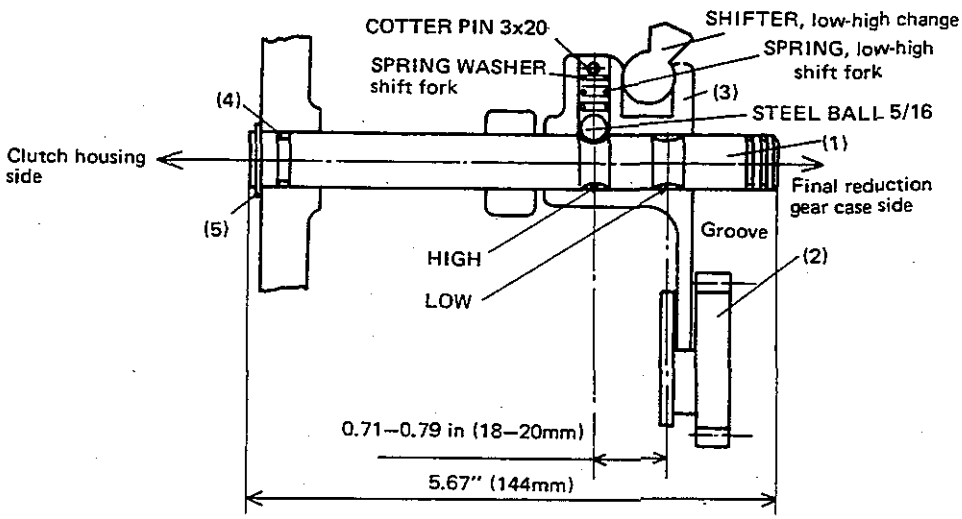
(1) Fit the (4) "O" ring P11 to the (1) low-high shift shaft.

(2) Place the (3) low-high shift fork into the groove of the (2) low-high sliding gear 16.

(3) Attach the (5) circlip 15 to the (1) low-high shift shaft (step 1) from the clutch housing side.

NOTES: Construction differences in the low-high shift forks: Those numbered after Serial No. 51001 have a slot, while those numbered before Serial No. 51000 have no slot.

(1) SHAFT, low-high shift
(2) Low-high sliding gear 16
(3) FORK, low-high shift
(4) O-RING P11
(5) CIRCLIP 15



2-8 Main Change Shaft Assembly

(1) Onto the (1) main change shaft put the (3) collar 25 x 30 x 11, and the (4) main gear 31, fit on the (5) circlip 25; and then put on the (6) 2nd/3rd gear (refer to Note 'b'), (7) 1st/reverse sliding gear (refer to Note 'b'), and the (8) liner 15.5 x 28 x 1.

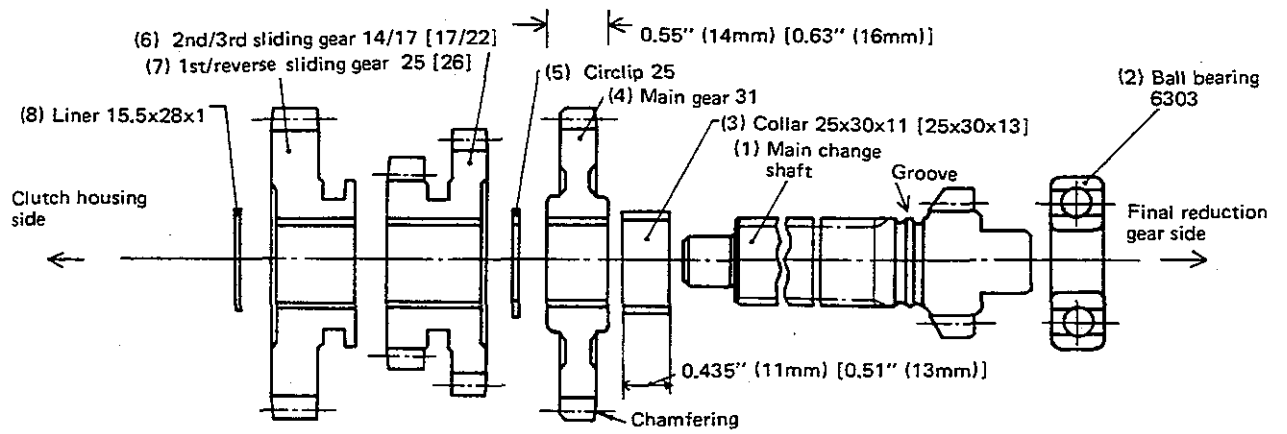
(2) Press-fit the (2) ball bearings 6303.

NOTES:

a) Differences in construction of the (1) main shaft: Those with a Serial No. after 51001 have two slots, while those with Serial No. before 51000 have no slots.

b) No. of teeth:

Model	*After No. 51001*		*Before No. 51000*	
Gear	*YM135 YM135D*	*YM155 YM155D*	*YM135 YM135D*	*YM155 YM155D*
2nd/3rd sliding gear	*14/17*	*14/17*	*17/22*	*17/22*
1st/reverse sliding gear	*25*	*25*	*26*	*26*



2-9 The Fork of the 2nd/3rd Speed Shift Shaft Assembly

(1) Attach the (4) "O" ring P11 to the (1) 2nd/3rd speed shift.

(2) Place the (3) 2nd/3rd speed shift fork into the slot of the (2) 2nd/3rd sliding gear.

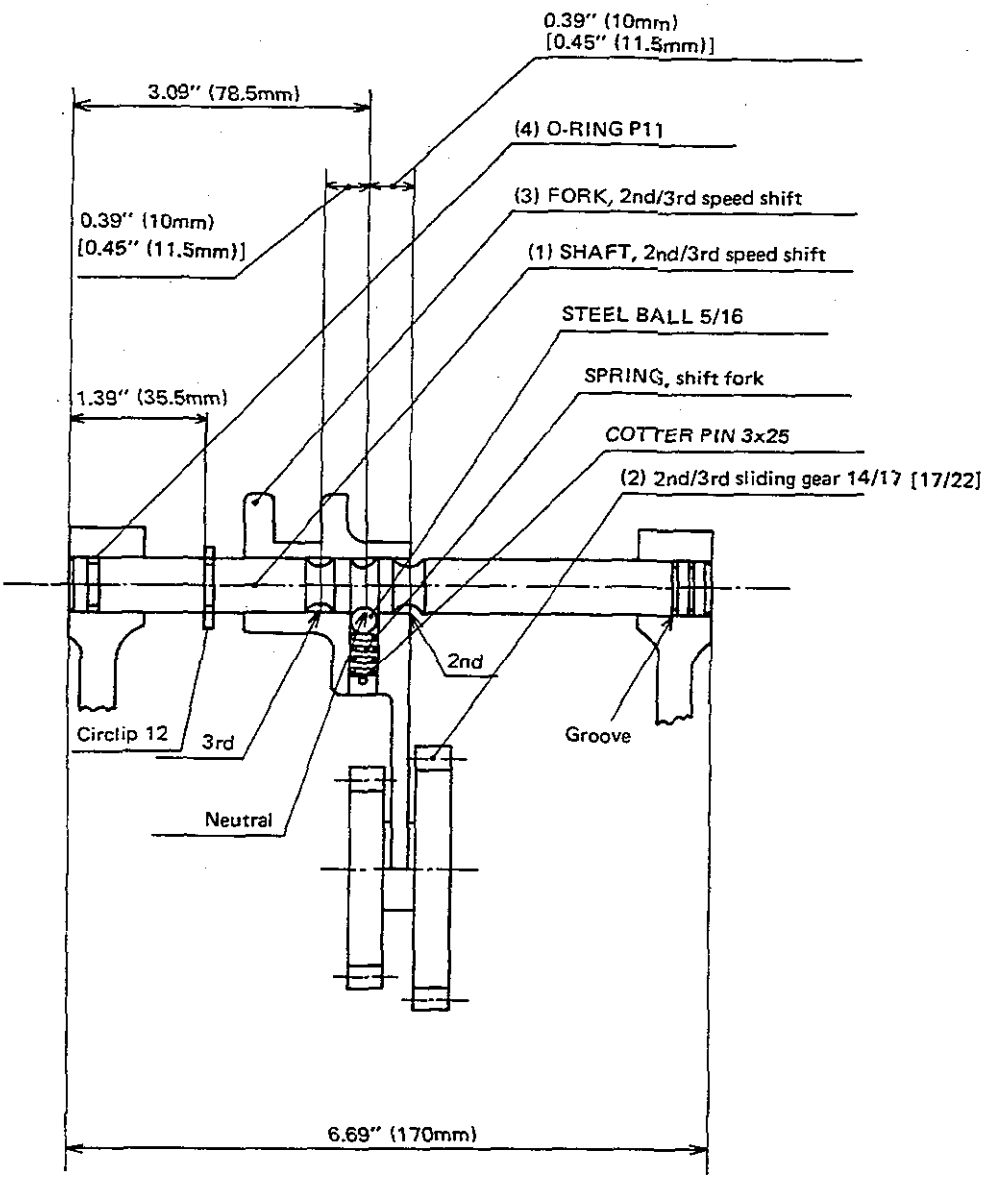
(3) To the assembled parts of step 1, attach the (5) circlip 12 from the clutch housing side.

(4) Place the (3) 2nd/3rd speed shift fork into the center position.

NOTES:

a) Construction differences in the (1) 2nd/3rd speed shift shaft: Those with a Serial No. after 51001 have two slots, while those with a Serial No. before 51000 have no slot.

b) A circlip 12 is attached to only (1) speed shift shafts numbered after Serial No. 51001.



2-10 Reverse/1st Speed Shift Shaft Assembly

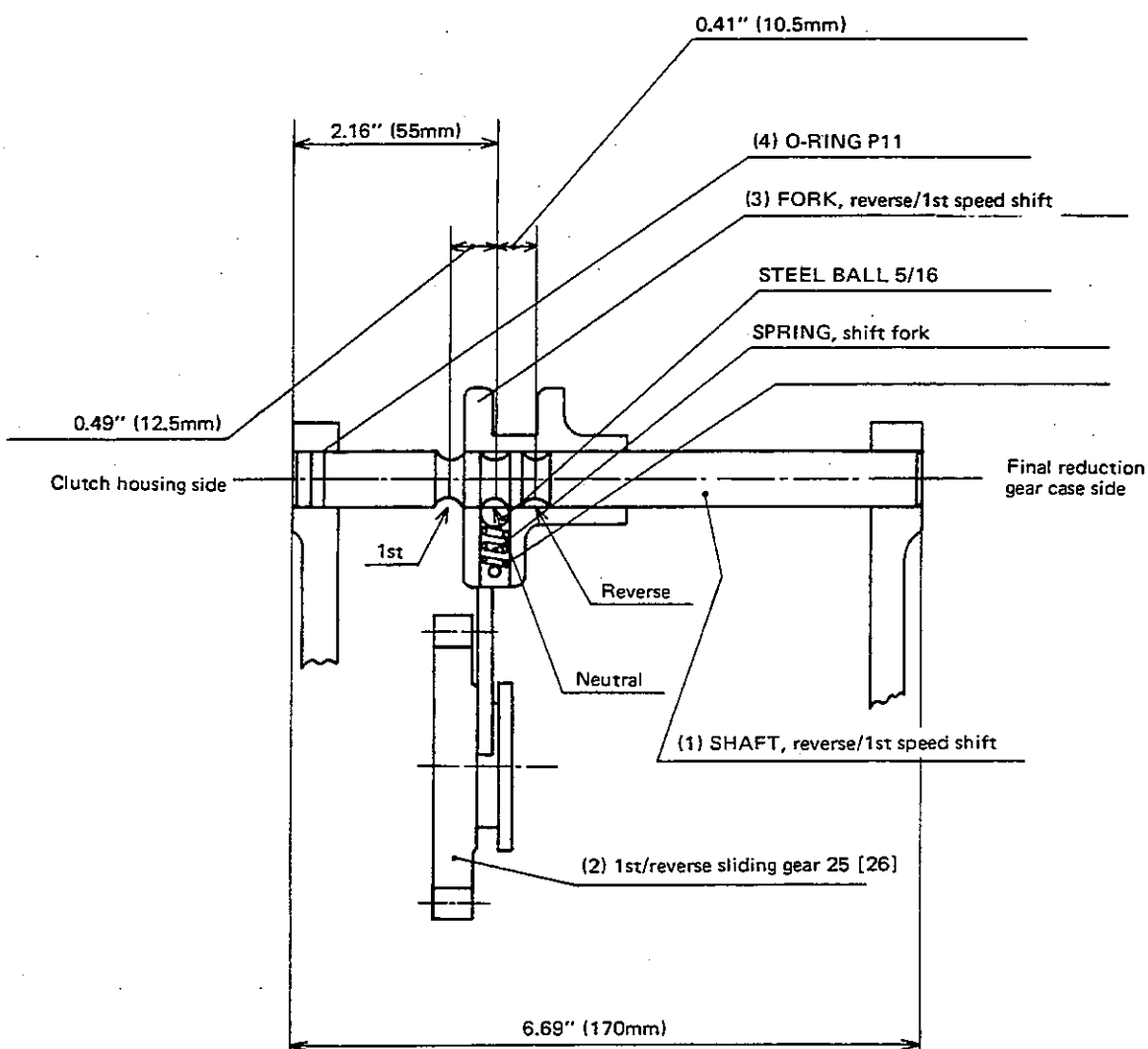
(1) Attach the (4) "O" ring P11 to the (1) Reverse/1st speed shift shaft.

(2) Place the (3) Reverse/1st speed shift fork into the slot of the (2) Reverse/1st sliding gear.

No. of teeth:
After Serial No. 51001: all four models – 25
Before Serial No. 51000: all four models – 26

(3) Insert the part in step 1 from the clutch housing side.

(4) Place the (3) Reverse/1st speed shift fork into the neutral position. (center slot).



2-11 Main Shaft and Transmission Front Cover Assembly

(1) Insert the (3) liner 16 x 21 x 1, and the (4) needle bearing into the (2) main shaft.

(2) To the assembled parts of step 1, press fit the (5) ball bearing 6205NR, and attach the (6) circlip 25.

(3) Press-fit the (7) ball bearing 6204 into the (1) transmission case front cover.

(4) To the assembled parts of step 1 and 2 insert the assembled parts of step 3. From the front insert the (8) main shaft spacer and the (9) oil seal TC20357.

(5) Apply packing to the transmission case.

(6) Attach the assembled parts above (step 1–4) to the transmission case, and secure with (11) copper packings (10 pcs) and (12) bolts 8 x 20 (10 pcs).

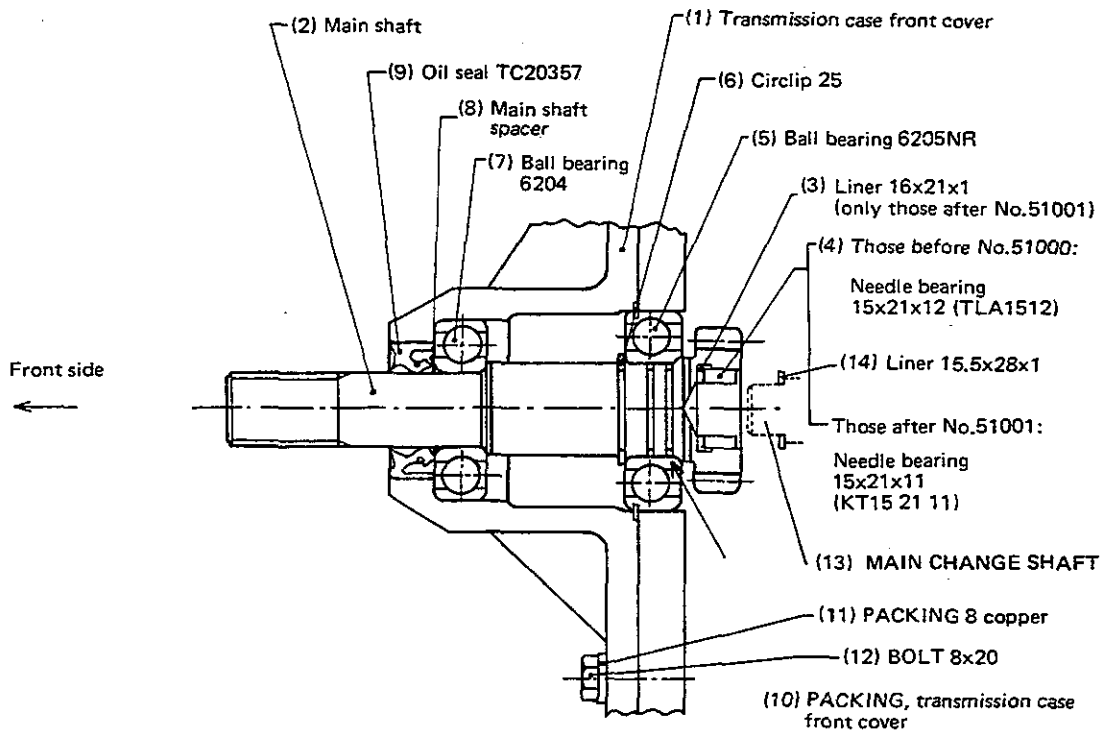
NOTES:

a) During step (6) it is easy to drop the (13) main change shaft's (14) liner 15.5 x 28 x 1 and the (4) needle bearing. It is therefore recommended that grease be applied to them to prevent dropping them. Also be sure that the (4) needle bearing will bear the load weight evenly.

b) Difference in shape of the (4) needle bearings: Those numbered after Serial No. 51001 are Needle bearing KT152111, while those numbered before Serial No. 51000 are Needle bearing TLA1512.

c) Use the (3) liner 16 x 21 x 1 on those parts after Serial No. 51001.

d) Construction differences in the (2) main shafts: Those numbered after Serial No. 51001 have 2 slots, while those numbered before Serial No. 51000 have no slot.



2-12 Gear Shift Lever Assembly

(1) Insert the (4) gear shift ball onto the (2) gear shift lever, and secure it with the spring pins 5 x 40, 3 x 40.

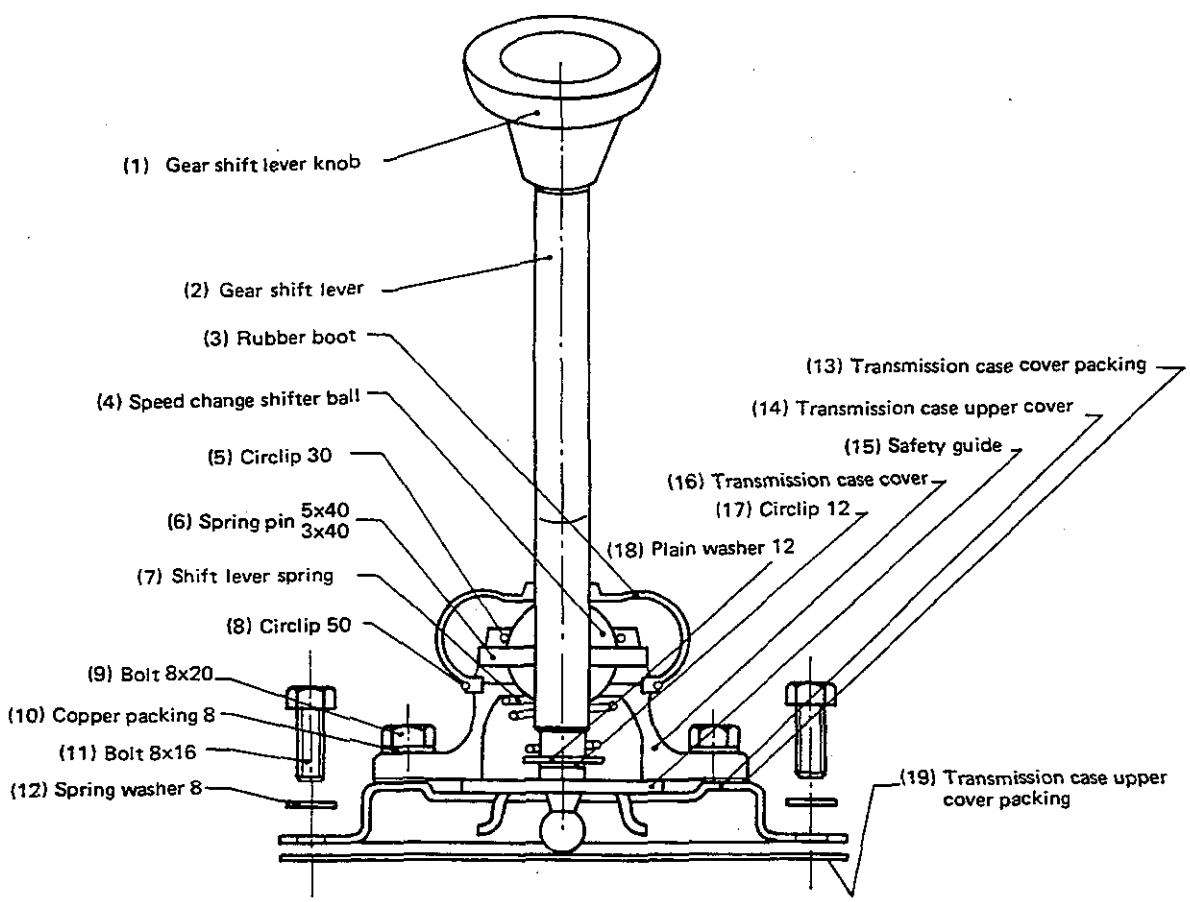
(2) Attach the parts assembled above to the (16) transmission case cover. Put the (7) gear shift lever spring and (18) plain washer 12 on the (2) gear shift lever, and attach the (5) circlip 30, and (17) circlip 12.

(3) Place the (15) safety guide into the (14) transmission case upper cover slot.

(4) Insert (13) packing between the assembled parts of steps 1, 2 and 3, and secure with the (10) copper packing 8 (4 pcs), and (9) bolts 8 x 20 (4 pcs).

(5) Place the (3) rubber boot in the position shown in the illustration, and secure it with the (8) circlip 50. Attach the (1) gear shift lever knob.

(6) Insert the (19) transmission case upper cover packing between the assembled parts (step 1–5) and the transmission case. Secure it with the (12) spring washers and (11) bolts 8 x 16 (8 pcs).

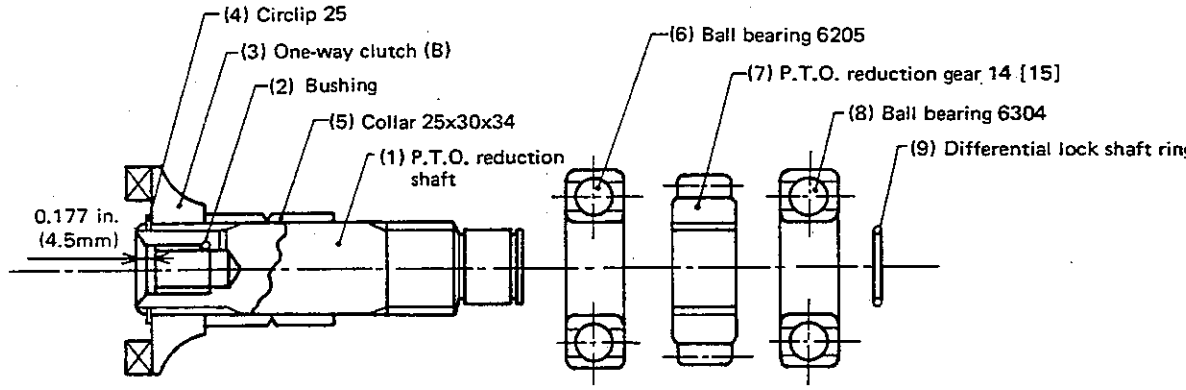


2-13 P.T.O. Reduction Shaft Assembly

(1) Insert the (2) bushing into the (1) P.T.O. reduction shaft as shown in the illustration. Put the (3) one-way clutch (B), and (5) collar 25 x 30 x 34 on the (1) P.T.O. reduction shaft, and attach the (4) circlip 25.

(2) Press-fit the (6) ball bearing 6205 into the final reduction gear case. From inside the final case, put the (7) P.T.O. reduction gear (refer to Note) through the parts assembled above. Press-fit the (8) ball bearing 6304 from outside, and attach the (9) differential lock shaft ring.

NOTE: No. of teeth–
After Serial No. 51001 – 14
Before Serial No. 51000 – 15

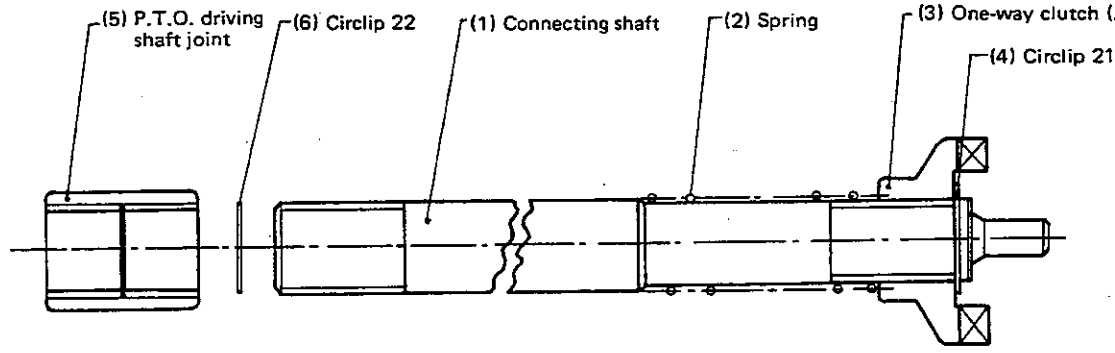


2-14 Connecting Shaft Assembly

(1) Place the (2) spring, and (3) one-way clutch A on the (1) connecting shaft, and attach the (4) circlip 21.

(2) Attach the parts above (step 1) to the P.T.O. reduction shaft (step 2–13).

(3) Fit the (6) circlip to the middle of the (5) P.T.O. driving shaft joint. Insert the (1) connecting shaft.



2-15 P.T.O. Shaft Assembly

(1) Press-fit the (10) ball bearing 6205 into the center of the final reduction gear case.

(2) Engage the (9) P.T.O. shaft gear 24[25] onto the P.T.O. reduction gear (refer to Note).

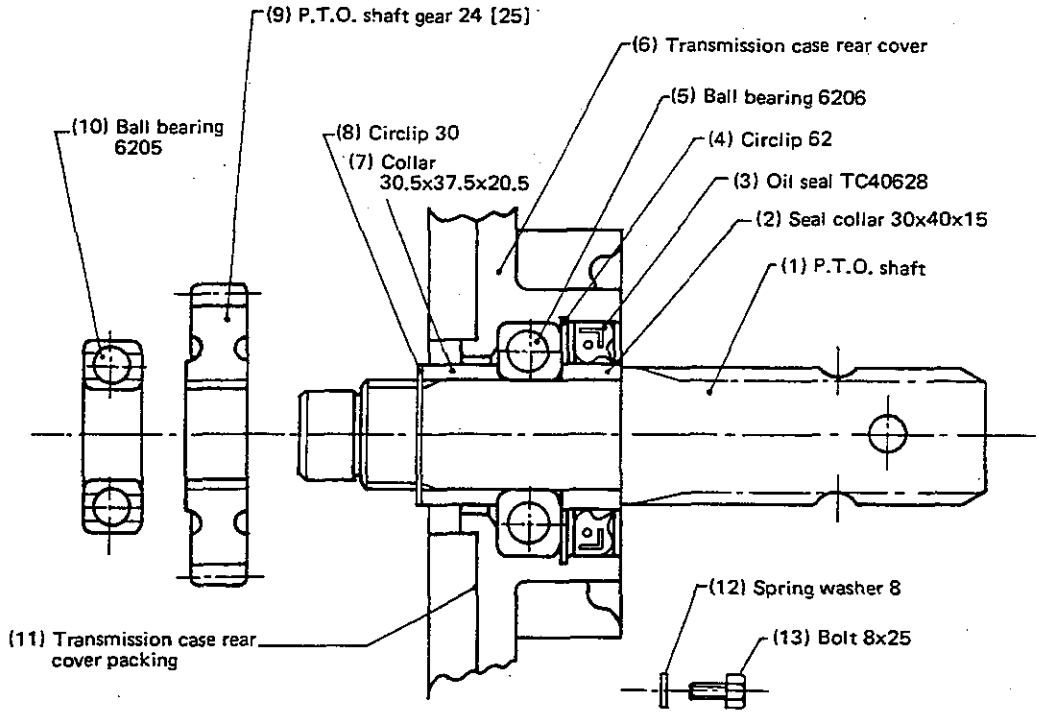
(3) Insert the (2) seal collar 30 x 40 x 15 on the (1) P.T.O. shaft, then press-fit the (5) ball bearing 6206 and (7) collar 30.5 x 37.5 x 20.5, and attach the (8) circlip (30).

(4) Insert the (6) transmission case rear cover to the parts assembled in step 3. Attach the (4) circlip 62, and insert the (3) oil seal TC 40628.

(5) Attach the (11) transmission case rear cover packing to the final reduction gear case.

(6) To the assembled parts of step 3 and 4 fit the (9) P.T.O. shaft gear 24 [25] and the (1) spline slot of the P.T.O. shaft. Attach the final reduction gear case, and secure it with the (12) spring washer 8 and the (13) bolt 8 x 25.

NOTE: No. of teeth for P.T.O. shaft gear–
After Serial No. 51001 – 24
Before Serial No. 51000 – 25



2-16 Differential Lock Shaft Assembly

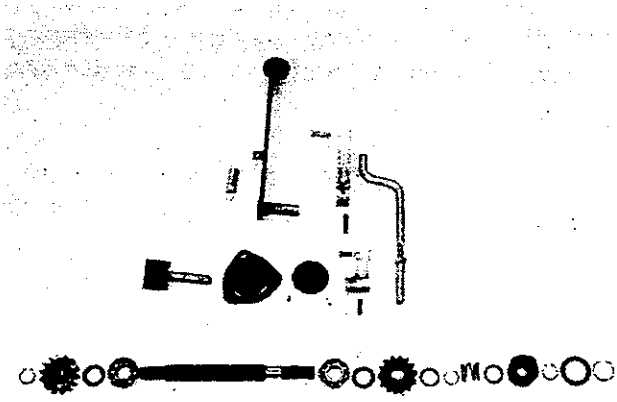
(1) Onto the (1) differential lock shaft insert the (13) ball bearing 6204, (14) liner 20 x 35 x 1, and the (15) differential lock shaft gear (refer to Note). Fit on the (16) circlip 20. Looking at the parts assembled from the back, attach the final reduction gear case from the left hand side.

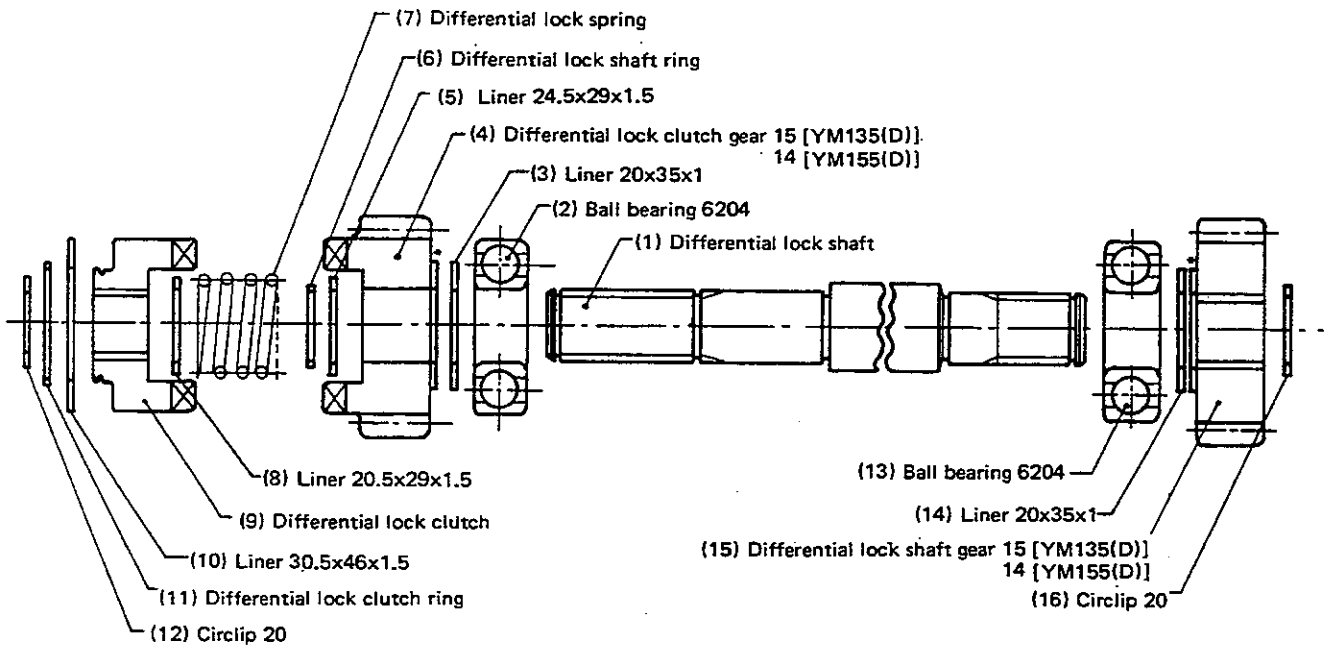
(2) To the other side of the (1) differential lock shaft insert the (2) ball bearing 6204, (3) liner 20 x 35 x 1, (4) differential lock clutch gear (refer to Note), and the (5) liner 20.5 x 29 x 1.5. Attach the (6) differential lock shaft ring, and then insert the (7) differential lock spring, (8) liner 20.5 x 29 x 1.5, and (9) differential lock clutch.

(3) Insert the (10) liner 30.5 x 46 x 1.5 on the (9) differential lock clutch, and then attach the (11) differential lock clutch ring, and the (12) circlip 20.

NOTE: No. of teeth–

	YM135 YM135D	*YM155 YM155D*
Differential lock shaft gear	*15*	*14*
Differential lock clutch gear	*15*	*14*





NOTES:

*Item (3), & (14) are attached to the tractors before the serial number 51000; For the tractors after the serial number 51001, Item (4) & (5) gears are attached with brim.**

2-17 Final Reduction Pinion and Rear Axle Shaft Assembly

I. Final Reduction Pinion

(1) Press-fit the (4) ball bearing 6206, (6) "O" ring P25, and the (7) seal collar 25 x 35 x 11 on the (1) final reduction pinion.

(2) Insert the items assembled in step 1 into the (24) rear axle housing.

(3) Insert the (3) liner 22.5 x 30 x 1, and metal 22 x 27 x 22.5 onto the (1) final reduction pinion.

(4) Insert the (5) oil seal TC35508 into the (24) rear axle housing.

NOTES:

a) Attach the (7) seal collar 25 x 35 x 11 to the inside of the "O" ring slot.

b) Fit the oil seal TC35508 so it is flush with the edge of the (24) rear axle housing.

c) i) Length of the final reduction pinion (L):
6.91 in. (175.5 mm)
ii) Length of the final reduction pinion (R):
5.41 in. (137.5 mm)

d) No. of teeth on the final reduction pinion:
10 – YM155/YM155D
11 – YM135/YM135D

II. Rear Axle Shaft Assembly

(1) Fit the (14) sleeve 45 x 50 x 20, (16) ball bearing 45 x 80 x 18, (17) collar 40 x 55 x 39, (19) final reduction gear, (20) collar 30.2 x 45 x 10, and the (18) ball bearing 6306 on the (13) rear axle shaft.

(2) Attach the (21) bolts 8 x 16 (2 pcs) with a (22) rear axle shaft washer, and (23) locking 46 to the (13) rear axle shaft.

(3) Attach the (13) rear axle shaft (steps 1–2) to the (24) rear axle housing.

(4) Be sure that there is no "play" between the (24) rear axle housing, and the following parts: (16) ball bearing 45 x 80 x 18, (17) collar 40 x 55 x 39, and the (19) final reduction gear.

(5) Use the (12) special tool to fit the (14) sleeve 45 x 50 x 20 and the (16) ball bearing 45 x 80 x 18 so they are in contact as shown in the illustration.

(6) Be sure that there are no sharp edges on the (13) rear axle shaft's hexagonal part, if there are any sharp edges remove them completely.

Fit the (15) oil seal TC507010 on the (13) rear axle shaft to the front edge as shown in the illustration.

NOTES:

a) Be sure to put on the (14) sleeve 45 x 50 x 20, (17) collar 40 x 55 x 39 and (20) collar 30.2 x 45 x 10 facing the correct direction.

b) Clean the (13) rear axle shaft, and remove any grease from the hexagonal part before fitting on the (15) oil seal TC507010.

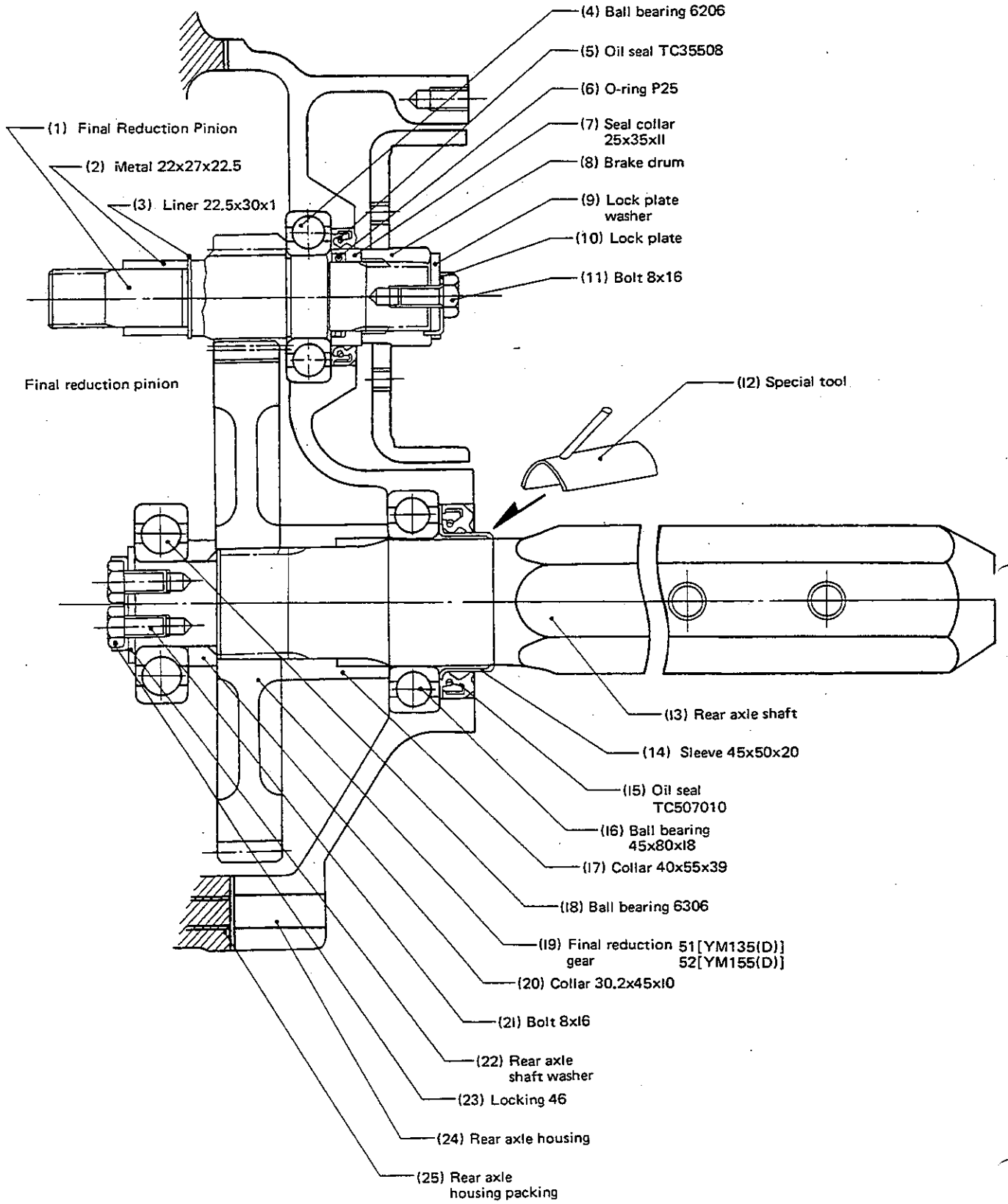
c) (13) rear axle shaft length:
16.4 in. (416.5 mm) – YM155/YM155D
15.4 in. (390 mm) – YM135/YM135D

d) No. of teeth on the (19) final reduction gear:
52 – YM155/YM155D
51 – YM135/YM135D

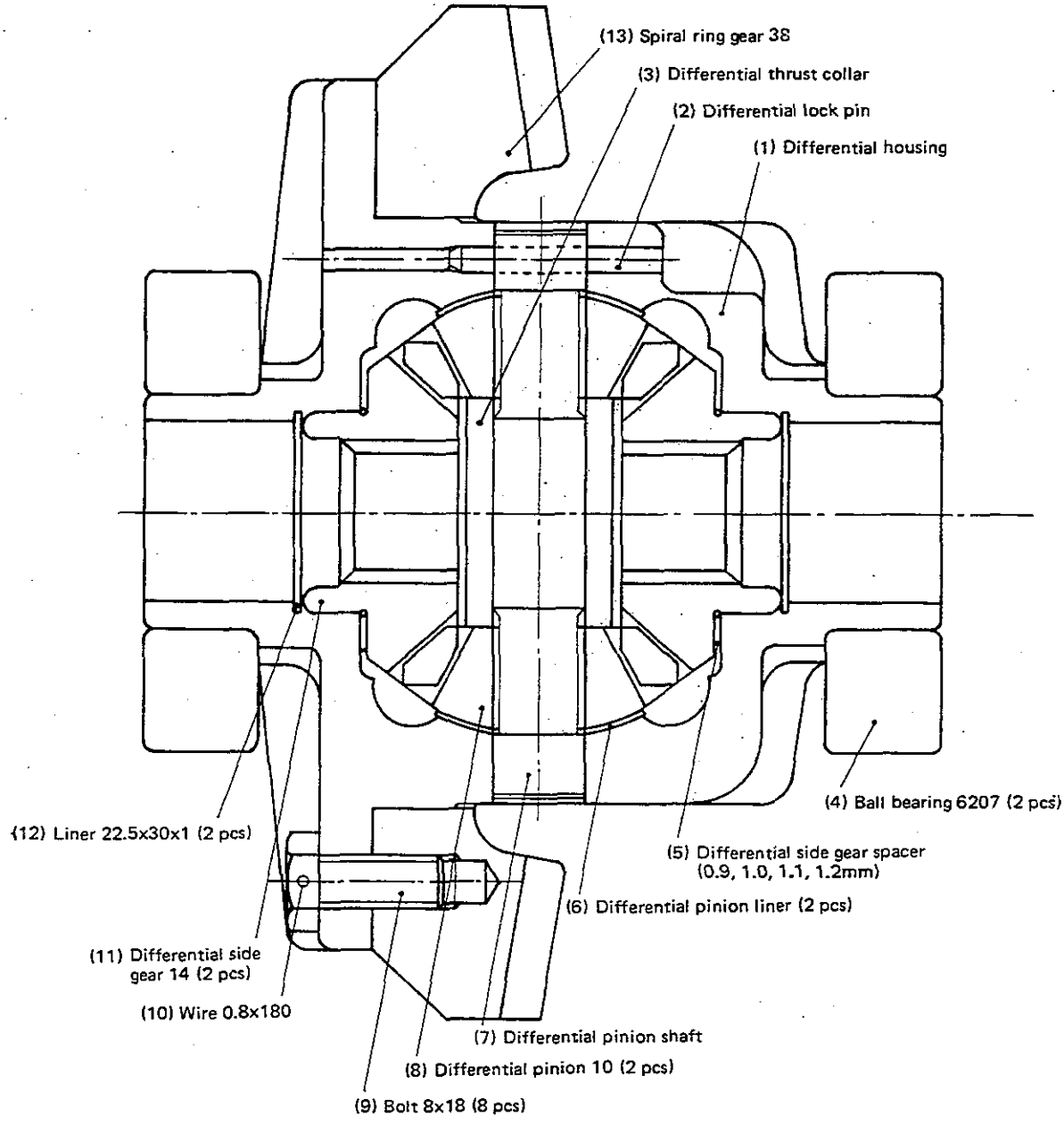
e) Be sure to bend down the (23) locking 46 on the head of the (21) bolts 8 x 16 (2 pcs).

f) Tightening torque of the (21) bolts 8 x 16:
9–12 ft-lbs (1.3–1.7 kg-m)

g) The (12) special tool shown in the illustration can be either made by yourself or ordered.


(1) Final Reduction Pinion
(2) Metal 22x27x22.5
(3) Liner 22.5x30x1
(4) Ball bearing 6206
(5) Oil seal TC35508
(6) O-ring P25
(7) Seal collar 25x35xll
(8) Brake drum
(9) Lock plate washer
(10) Lock plate
(11) Bolt 8x16
Final reduction pinion
(12) Special tool
(13) Rear axle shaft
(14) Sleeve 45x50x20
(15) Oil seal TC507010
(16) Ball bearing 45x80xl8
(17) Collar 40x55x39
(18) Ball bearing 6306
(19) Final reduction gear 51[YM135(D)] 52[YM155(D)]
(20) Collar 30.2x45xl0
(21) Bolt 8xl6
(22) Rear axle shaft washer
(23) Locking 46
(24) Rear axle housing
(25) Rear axle housing packing

2-18 Differential Device



(1) Fit the following into the (1) differential housing, the (6) differential pinion liners (2 pcs), (8) differential pinion 10, (12) liner 22.5 x 30 x 1, the (5) differential side gear spacers (2 pcs), (11) the differential side gear 14 (2 pcs), and the (3) differential thrust collar. Be sure to put in the right and left (12) liners 22.5 x 30 x 1 (2 pcs), the (5) differential side gear spacers (2 pcs), and the (11) differential side gear 14 (2 pcs) at the same time.

(2) Fit the (7) differential pinion shaft into place after passing it through the (1) differential housing, (6) differential pinion liners (2 pcs) the (8) differential pinion 10 (2 pcs), and the (3) differential thrust collar.

(3) Be sure that the gears rotate smoothly. Adjust the backlash, if needed, with the (5) differential side gear spacers so it is within 0.004–0.008 in. (0.1–0.2 mm).

(4) Drive in the (2) differential lock pin through the holes of the (1) differential housing and the (7) differential pinion shaft.

(5) Put the (13) spiral ring gear 38 on the (1) differential housing, and fasten with the (9) bolts 8 x 18 (8pcs).

(6) To prevent the (9) bolts 8 x 18 (8 pcs) from loosening secure them with (10) wire 0.8 x 180.

(7) Fit the (4) ball bearings 6207 (2 pcs) on the differential housing.

NOTES:

a) When performing step 2, be careful to line up the shaft and liner hole carefully to prevent damage to the (6) differential pinion liner.

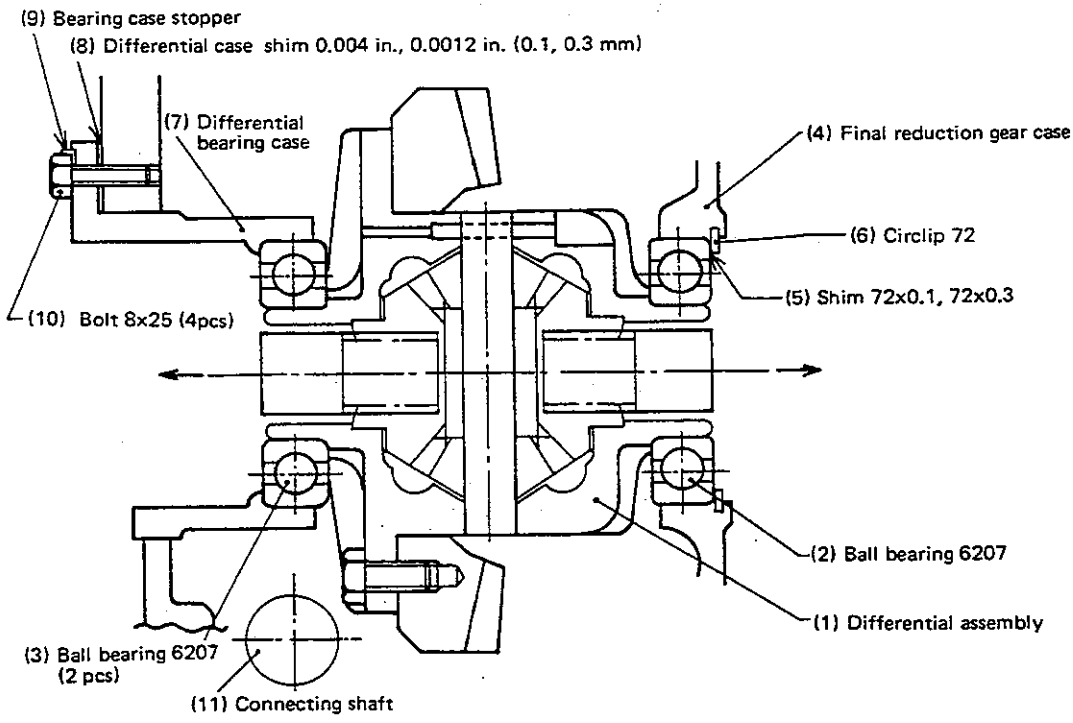
b) Apply grease to the outside of the (7) differential pinion shaft, and the (11) differential side gear 14 (2 pcs).

c) Tightening torque for the (9) bolts 8 x 18: 17-22 ft-lbs (2.3-3 kg-m).

d) There are four kinds of (5) differential side gear spacers:

i. 0.035 in. (0.9 mm)
ii. 0.039 in. (1.0 mm)
iii. 0.043 in. (1.1 mm)
iv. 0.047 in. (1.2 mm)

2-18 (a) Disassembly



(1) Take out the (11) connecting shaft.

(2) Remove the (10) bolts 8 x 25 (4 pcs).

(3) Remove the (6) circlip 72.

(4) Use a hammer and plate, to remove the (2) ball bearing 6207 out to the left of the (1) differential assembly.

(5) Separate the (3) ball bearing 6207 from the (1) differential assembly and the (7) differential bearing case with a hammer and plate.

(6) Take out the (1) differential assembly.

2-18 (b) Assembly

(1) Insert the (1) differential assembly in the (4) final reduction gear case.

(2) Fasten the (6) circlip 72 on the (4) final reduction gear case, and then insert the (7) differential bearing case.

(3) Use (5) shims 72 x 0.1, 72 x 0.3 to adjust the pinion and ring gear backlash to within 0.005-0.007 in. (0.13-0.18 mm).

(4) Insert the (8) differential case shims 0.004 in., 0.012 in. (0.1, 0.3 mm) to the position shown in the illustration. There should not be any play in the (1) differential assembly in the arrow direction shown in the illustration.

(5) Attach the (9) bearing case stopper, and (10) bolts 8 x 25 (4 pcs) to the position shown in the illustration.

NOTES:

a) Be sure to bend down the (9) bearing case stopper on the head of the (10) bolts 8 x 25 (4 pcs).

b) Tightening torque for the (10) bolts 8 x 25 (4 pcs): 15-22 ft lbs (2.0-3.0 kg m).

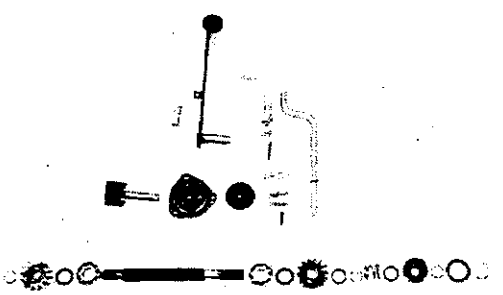
2-19 Cam, Differential Lock Assembly

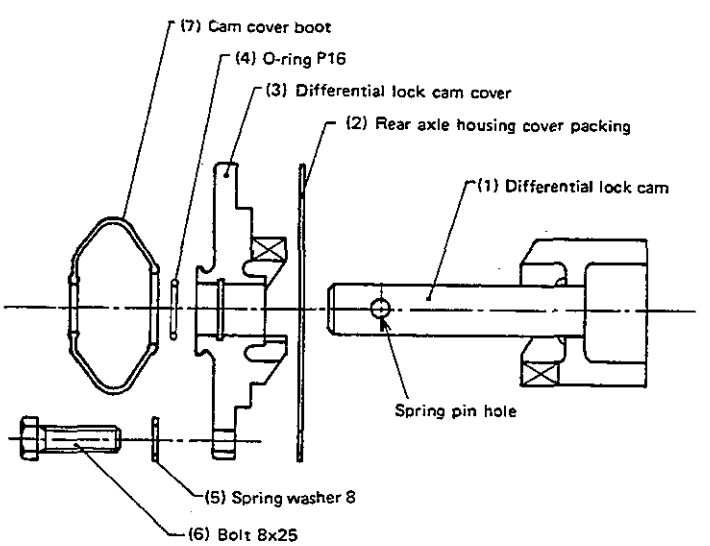
(1) Attach the (4) O-ring to the slot in the (3) differential lock cam cover. Insert the (1) differential lock cam, and attach the cam cover boot to the (3) differential lock cam cover.

(2) Attach the (2) rear axle housing cover packing to the assembled parts in step 1. Attach the final reduction gear case, and secure it with the (6) bolts 8 x 25.

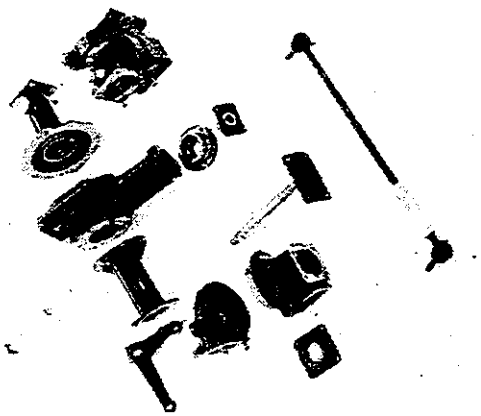
NOTES:

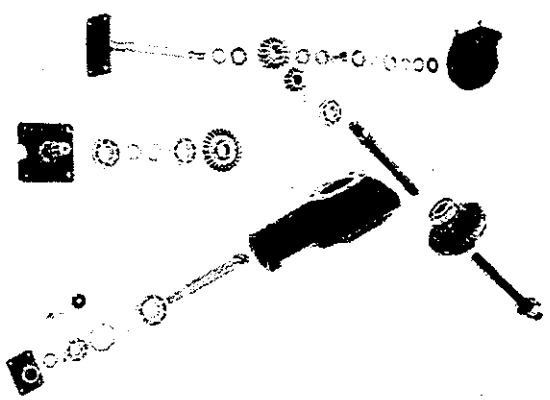
a) Attach the (1) differential cam lock so the spring pin hole is in the horizontal position.





3. FRONT AXLE ASSEMBLY





3-1 Front Axle Assembly (YM155D, YM135D)
(Refer to Diagram on Page 125)
[Parts Having a Serial No. After 51001]

For the completed construction please refer to the completed illustration. The assembly order for the main parts are included below:

(1) Insert the (20) ball bearing 6205U (one-side seal), the (21) collar 25 x 30 x 72.67, as well as the (22) ball bearing 6205 into the (3) upper front gear case.

(2) Attach the (24) ball bearing 6305, spacer 25.5 x 32 x 1, and circlip 25 to the (25) front driving shaft.

(3) Fit the (23) bevel gear 14 into the (3) upper gear case, and attach the assembled parts in step 2 to the assembled parts of step 1.

(4) From the top of the (3) upper front gear case, fit the (12) king pin into the parts assembled in step 3. Attach the (18) thrust bearing 51105, the (26) needle bearing 25 x 31 x 20 (2 pcs), and the (19) king pin bevel gear 28/14 to their proper position.

(5) Attach shims A between the (23) bevel gear and the (24) ball bearing 6305 to adjust the backlash of the (23) bevel gear 14 and the (19) king pin bevel gear between 0.004-0.012 in. (0.1-0.3 mm).

(6) Remove the (12) king pin, (18) thrust bearing 51105, and the (26) needle bearing 25 x 31 x 20 that were attached in step 4.

(7) Attach the oil seal TC4062126 to the (27) front gear case cap.

(8) Insert the seal ring 34 x 40 x 17 into the (8) front axle shaft.

(9) Attach the (27) front gear case cap, ball bearing 6306 (2 pcs), liner 30 x 42 x 2, circlip 30, collar 30 x 38 x 13, and liner 30.5 x 45 x 9.5 to the (8) front axle shaft.

(10) Place the (28) bevel gear 20 on the (4) lower front gear case, and attach the (8) front axle shaft (step 9) to the (4) lower front gear case.

(11) Attach the (12) king pin to the (4) lower front gear case.

(12) Attach shims B between the (28) bevel gear 20 and the (29) ball bearing 6306 to adjust the backlash of the (19) king pin bevel gear 28/14 and the (28) bevel gear 20 between 0.004-0.012 in. (0.1-0.3 mm).

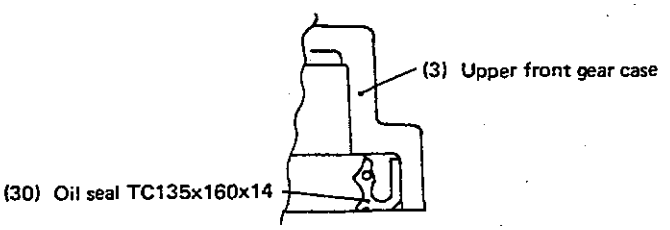
(13) Insert the (30) oil seal TC 135 x 160 x 14 to the assembled parts of step 3.

(14) Insert the (4) lower front gear case (step 10-12) into the (3) upper gear case (step 13).

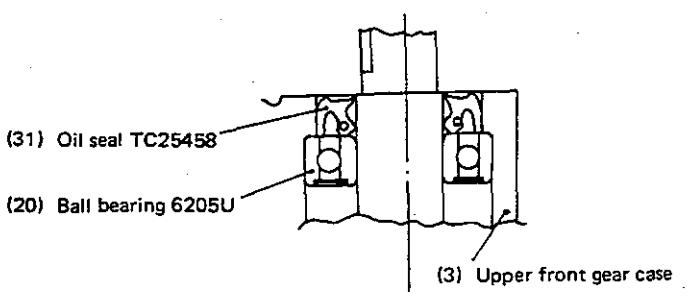
(15) Insert the (31) oil seal TC25458.

[Caution:]

(1) Insert the (30) oil seal TC 135 x 160 x 14 to the edge of the (3) upper front gear case.

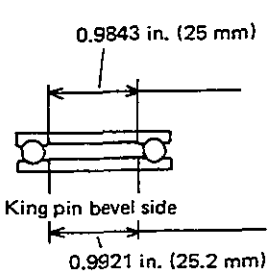


(2) Insert the (31) oil seal TC25458 to the edge of the (3) upper front gear case.



(3) Both ball bearings (20) and (22) are size 6205; but since (20) is a one-side seal, be sure to attach it in the correct manner.

(4) Attach the (20) ball bearing 6205 U from the bottom of the seal side, and apply grease.

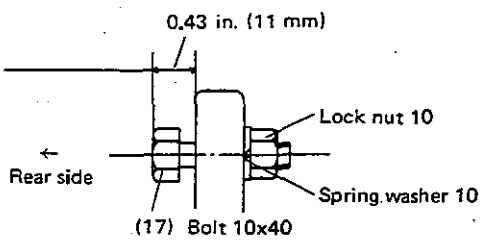


(5) The inner lace of the (18) thrust bearing 51105 (2 pcs), as shown in the illustration, has a different top and bottom dimension. Be sure that the side with the larger inner lace is placed in contact with the inner face of the (19) king pin bevel gear 28/14.

(6) Be sure to attach the (16) shim 22.5 x 40 x 0.1, 22.5 x 40 x 0.3 between the (15) spacer 22.5 x 40 x 1.

(7) Adjust the (16) shims (0.004, 0.012 in.) (0.1, 0.3 mm) so the clearance between the (9) nut 18 x 1.5 and the (15) spacer 22.5 x 40 x 1 and the (32) plain washer is 0-0.004 in. (0-0.1 mm).

(8) Attach the (17) bolt 10 x 40 as shown in the illustration.



(9) Shim A: 25 x 35 x 0.1
25 x 35 x 0.3
Shim B: 30 x 45 x 0.1
30 x 45 x 0.3

(10) Tightening torque:

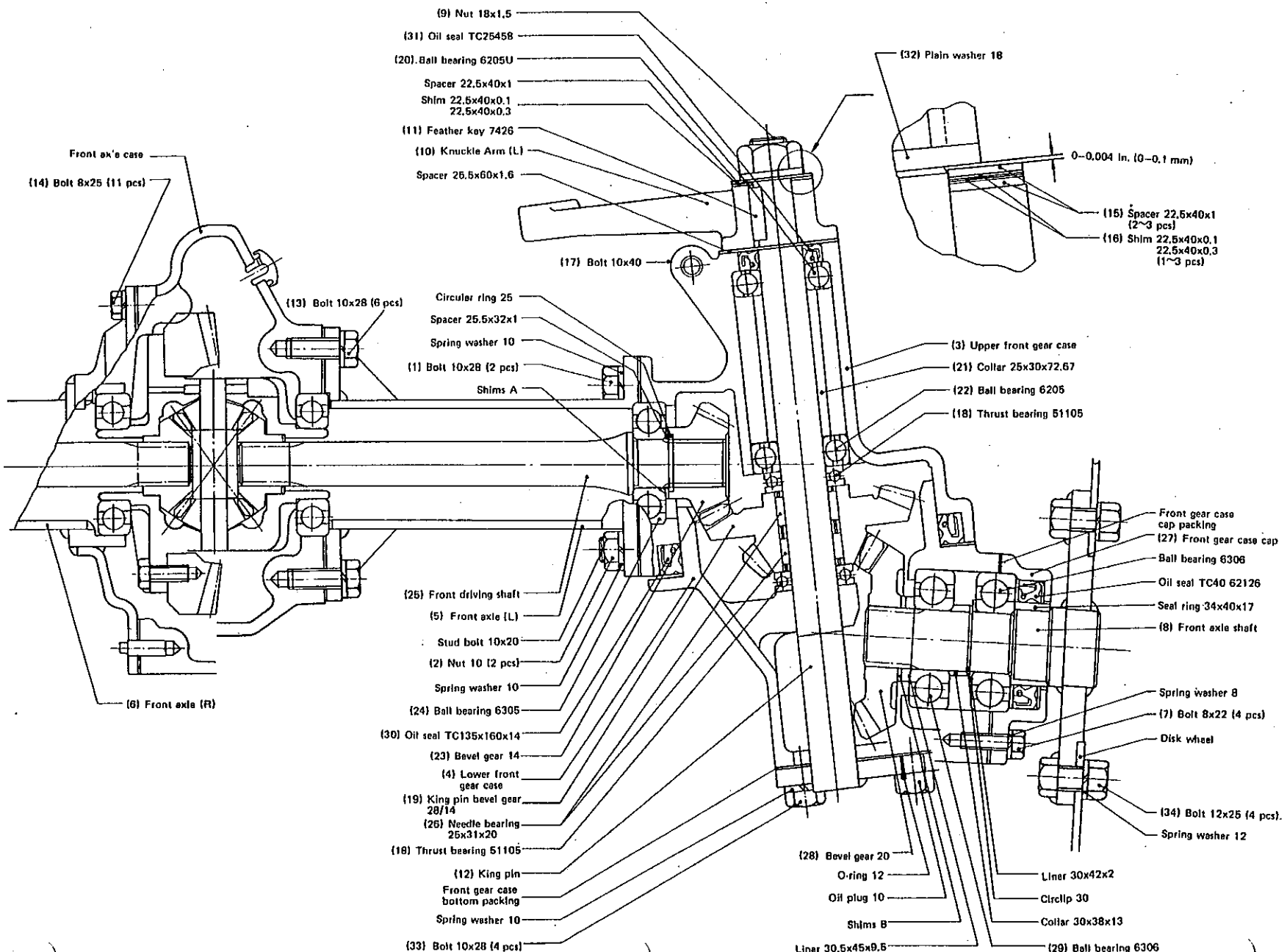
a) (1) Bolt 10 x 28 (2 pcs):
33—43 ft-lbs (4.5—6.0 kg-m)

b) (2) Nut 10 (2 pcs):
33—43 ft-lbs (4.5—6.0 kg-m)

c) (33) Bolt 10 x 28 (4 pcs):
33—43 ft-lbs (4.5—6.0 kg-m)

d) (7) Bolt 8 x 22 (4 pcs):
9—12 ft-lbs (1.3—1.7 kg-m)

e) (34) Bolt 12 x 25 (4 pcs):
58—72 ft-lbs (8.0—10 kg-m)


(9) Nut 18x1.5
(31) Oil seal TC25458
(20) Ball bearing 6205U
Spacer 22.5x40x1
Shim 22.5x40x0.1
22.5x40x0.3
(11) Feather key 7426
(10) Knuckle Arm (L)
Spacer 26.5x60x1.6
Front ax'e case
(14) Bolt 8x25 (11 pcs)
(13) Bolt 10x28 (6 pcs)
(17) Bolt 10x40
Circular ring 25
Spacer 25.5x32x1
Spring washer 10
(1) Bolt 10x28 (2 pcs)
Shims A
(32) Plain washer 18
0~0.004 in. (0~0.1 mm)
(15) Spacer 22.5x40x1
(2~3 pcs)
(16) Shim 22.5x40x0.1
22.5x40x0.3
(1~3 pcs)
(3) Upper front gear case
(21) Collar 25x30x72.67
(22) Ball bearing 6205
(18) Thrust bearing 51105
Front gear case
cap packing
(27) Front gear case cap
Ball bearing 6306
Oil seal TC40 62126
Seal ring 34x40x17
(8) Front axle shaft
Spring washer 8
(7) Bolt 8x22 (4 pcs)
Disk wheel
(34) Bolt 12x25 (4 pcs)
Spring washer 12
(25) Front driving shaft
(5) Front axle (L)
Stud bolt 10x20
(2) Nut 10 (2 pcs)
Spring washer 10
(24) Ball bearing 6305
(30) Oil seal TC135x160x14
(23) Bevel gear 14
(4) Lower front
gear case
(19) King pin bevel gear
28/14
(26) Needle bearing
25x31x20
(18) Thrust bearing 51105
(12) King pin
Front gear case
bottom packing
Spring washer 10
(33) Bolt 10x28 (4 pcs)
(6) Front axle (R)
(28) Bevel gear 20
O-ring 12
Oil plug 10
Shims B
Liner 30.5x45x9.5
Liner 30x42x2
Circlip 30
Collar 30x38x13
(29) Ball bearing 6306

3-2 Front Axle Assembly (YM155, YM135)

(1) Insert the (22) ball bearing 6204, (16) ball bearing 6205, (15) circlip 48, and the (14) oil seal TC 355211 into the (17) front wheel hub.

(2) Insert the (13) king pin complete into the (17) front wheel hub (step 1).

(3) Attach a (18) plain washer to the front wheel hub (step 2), and fasten with a (19) castle nut.

(4) To prevent the (19) castle nut from loosening , insert a (21) cotter pin 4 x 40.

(5) Insert the (8) bushing, (10) ball bearing (11) circlip 48, and (12) oil seal into the (9) front axle.

(6) Insert the (17) front wheel hub (step 1–4) into the (9) front axle (step 5).

(7) To the front axle assembly (step 6) insert the (7) "O" ring 1A-2025, (6) king pin upper cover, (5) feather key, (4) knuckle arm, (3) plain washer, and (2) spring washer 18. Tighten the (1) nut 18.

(8) Attach the (23) grease nipple, and (24) bolt 6 x 4.5.

NOTES:

a) Put in the (14) oil seal TC 355211 so it is flush with the front edge of the case.

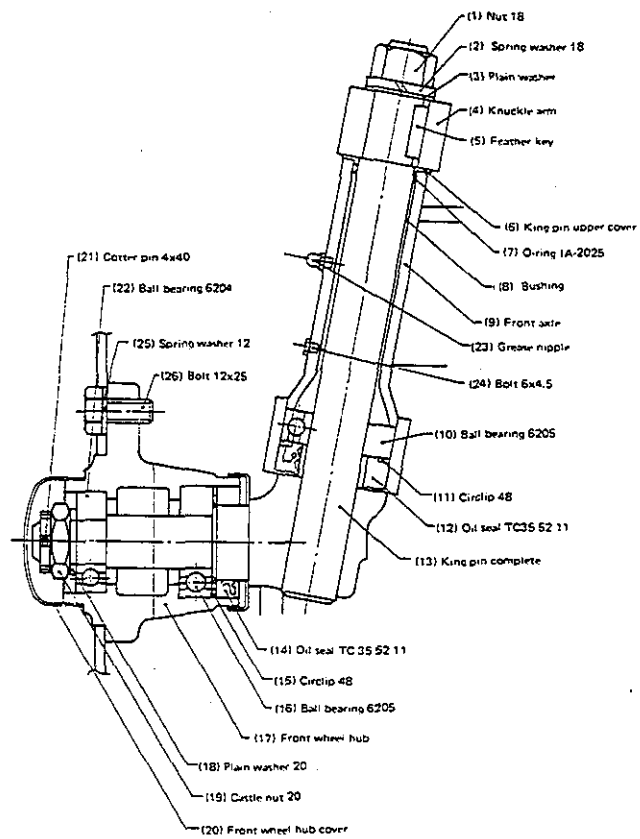
b) Be sure to put in enough grease in the (9) front axle, (17) front wheel hub, (20) front wheel hub cover, and the ball bearings.

c) Be sure to loosen the (24) bolt 6 x 4.5 when putting in grease through the (23) grease nipple.

d) Tightening torque:
(1) nut 8: 116–137 ft-lbs (16–19 kg-m)
(19) castle nut 20: 58–87 ft-lbs (8–12 kg-m)
(26) bolt 12 x 25 (4 pcs): 58–72 ft-lbs (8–10 kg-m)

e) Be sure not to damage the (8) bushing when press fitting.

f) Insert the (12) oil seal so it comes in contact with the (11) circlip 48.



3-3 Front Axle Assembly (YM155D, YM135D)

[Parts Having a Serial No. Before 51000]

(1) Tighten (3) bolt 10 x 40 until there is not any play between the (1) upper front gear case and the (2) knuckle arm.

Tightening torque: 33–43 ft-lbs (4.5–6 kg-m)

(2) Tighten (4) nut 18 x 1.5 until there is not any play between the (5) washer plate and the (2) knuckle arm.

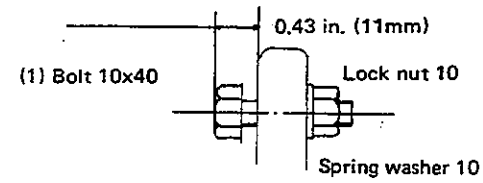
Tightening torque: 24–33 ft-lbs (3.3–4.5 kg-m)

Apply the adhesive agent to the threads of the (6) king pin before tightening.

(3) Insert the (7) oil seal 100x 120 x 12 to the edge of the (8) lower front gear case.

(4) Attach to the (10) liner 22 x 41 x 2.3 the larger inner diameter side of the lace of the (9) thrust bearing 51105.

(5) Insert the (11) bolt 10 x 40 as illustrated.



(6) Insert the (12) "O"-ring P22 to the edge of the (1) upper front gear case.

(7) Shim A & B : 25 x 35 x 0.1
25 x 35 x 0.3

(8) Tightening torque:

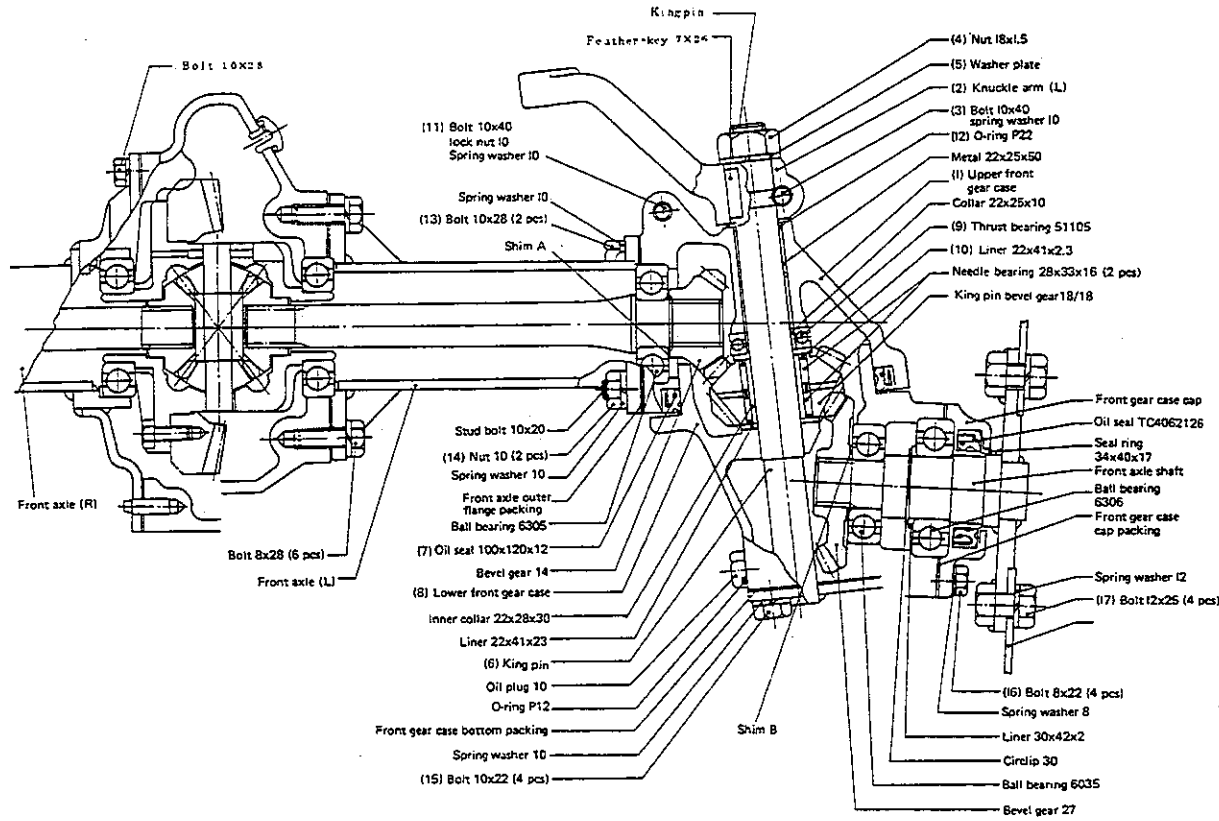
a) (13) bolt 10 x 28 (2 pcs): 33–43 ft-lbs (4.5–6.0 kg-m)

b) (14) nut 10 (2 pcs): 33–43 ft-lbs (4.5–6.0 kg-m)

c) (15) bolt 10 x 22 (4 pcs): 18–24 ft-lbs (2.5–3.3 kg-m)

d) (16) bolt 8 x 22 (4 pcs): 9–12 ft-lbs (1.3–1.7 kg-m)

e) (17) bolt 12 x 25 (4 pcs): 58–72 ft-lbs (8.0–10 kg-m)



3-4 Differential Device Assembly (YM155D, YM135D, front axle)

(1) Attach the (2) ball bearing 6305 and the (3) circlip 25 to the (1) spiral pinion shaft.

(2) Attach the (4) ball bearing 5304, (6) oil seal TC30458, (7) "O" ring G60, and (8) circlip 52 to the (5) front axle case cup.

(3) Attach the (5) front axle case cup (step 2) to the (1) spiral pinion shaft.

(4) Insert the (1) spiral pinion shaft (step 3) into the (9) front axle case.

(5) Use a mandrel to determine the position of the (1) spiral pinion shaft. To adjust use front axle shims 0.004, 0.012 in. (0.1, 0.3 mm)

(6) Attach the (11) bolts 8 x 30 (3 pcs), (15) universal flange, (12) lock plate washer, (13) lock plate, and (14) bolt 8 x 16 as shown in the illustration.

(7) Insert the (16) differential assembly into the (9) front axle case.

(8) Use (17) shims A to adjust the pinion and ring gear backlash to within 0.004–0.012 in. 0.1–0.3 mm).

(9) Attach the (18) front axle (L) to the (9) front axle case.

(10) Attach the (19) front axle (R) to the (9) front axle case.

(11) Insert shims B into the position shown in the illustration to eliminate play between the (16) differential assembly and the (18) front axle (L) and the (19) front axle (R).

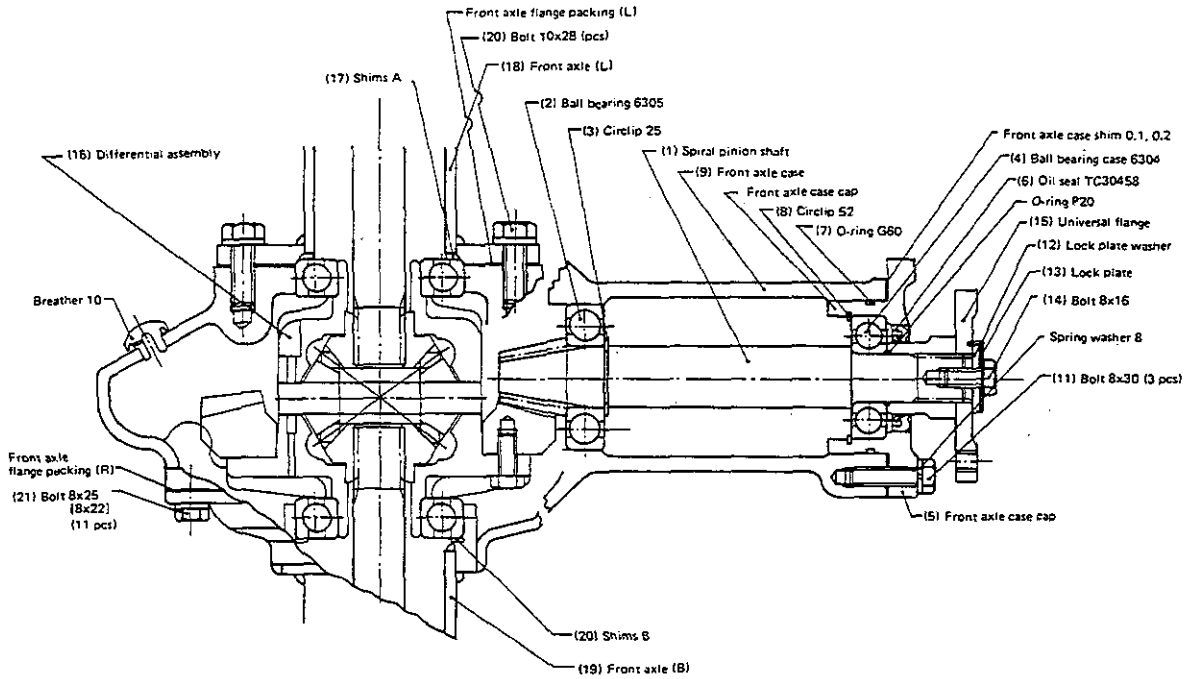
NOTES;

a) Insert the (6) oil seal TC 30458 so it is flush with the end of the (5) front axle case.

b) Tightening torque:
(11) bolt 8 x 30: 9–12 ft-lbs (1.3–1.7 kg-m)
(13) bolt 8 x 16: 17–22 ft-lbs (2.3–3.0 kg-m)
(20) bolt 10 x 28: 33–43 ft-lbs (4.5–6.0 kg-m)
(21) bolt 8 x 25 [8 x 22]: 17–22 ft-lbs (2.3–3.0 kg-m)

c) Shims A & B: shim 72 x 0.1 mm
shim 72 x 0.3 mm

CAUTION:
Figures in parentheses refer to Serial No. before 51000.



4. CENTER PIN ASSEMBLY

4-1 For YM155D & YM135D

(1) Press-fit the (3) metal 22 x 28 x 22 (2 pcs) into the (4) front axle case, and attach the (2) "O" ring P22A (2 pcs) and the (1) liner 22.5 x 34 x 2 (2 pcs).

(2) Insert the (5) center pin through the (9) front axle bracket and the front axle case (step 1).

(3) To the front axle case (step 2) add the (8) plane washer 16, and fasten with the (7) castle nut 16.

(4) To prevent the (7) castle nut from loosening insert the (6) cotter pin 4 x 30.

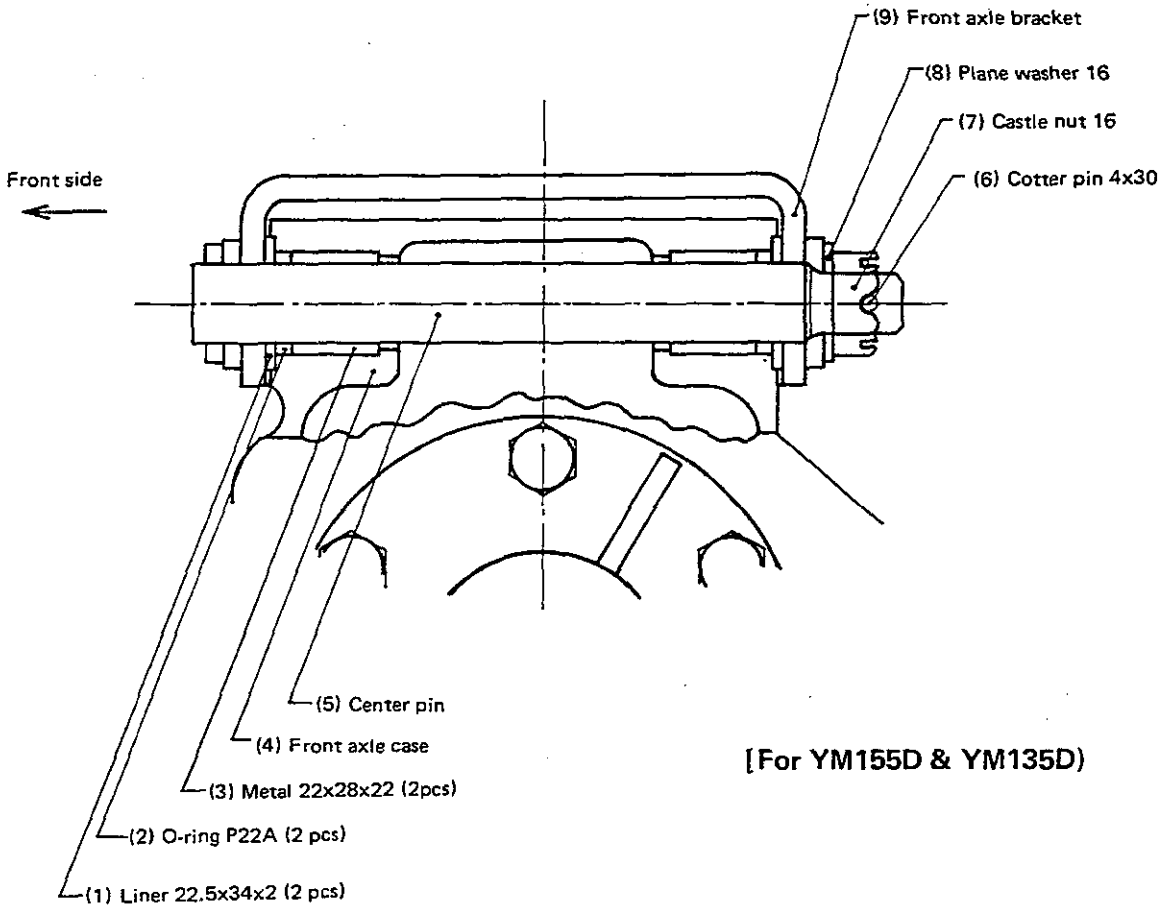
NOTES:

a) Be sure the plate is parallel to the center when press-fitting the (3) metal 22 x 28 x 22.

b) Fasten the (7) castle nut so there is no play between the (4) front axle case and the (9) front axle bracket, in addition the front axle should swing smoothly.

c) Apply grease to the (5) center pin, (3) metal 22 x 28 x 22, (2) "O" ring P22A and (1) liner 22.5 x 34 x 2 before assembling.

d) Be sure to put the (6) cotter pin 4 x 30 through the (5) center pin in the horizontal position as shown in the illustration, do not place it in the vertical position.



[For YM155D & YM135D]

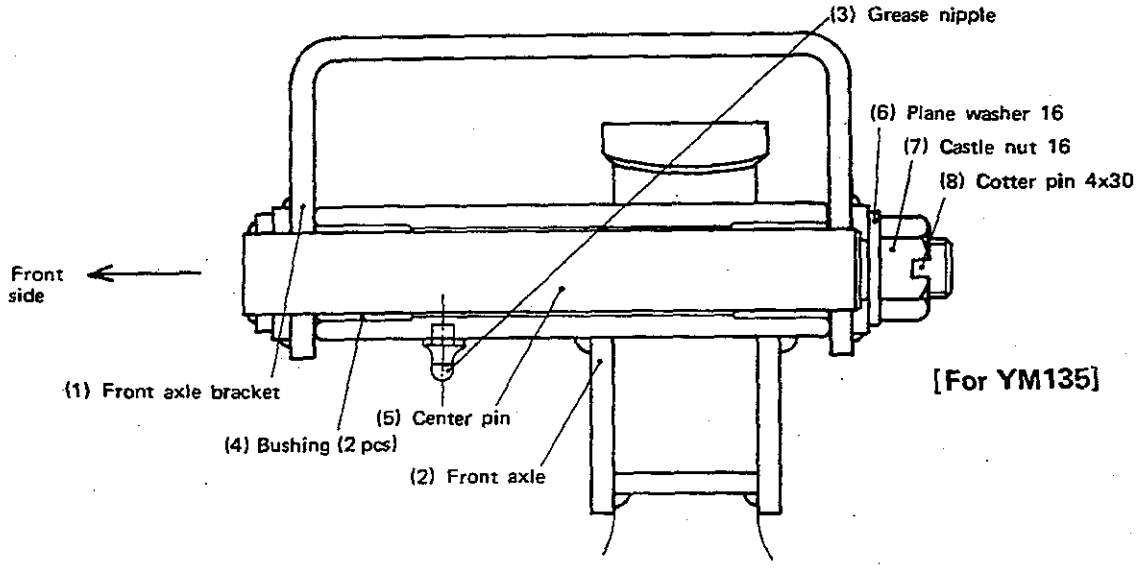
4-2 For YM155 & YM135

(1) Press-fit the (4) bushing (2 pcs) on the (2) front axle.

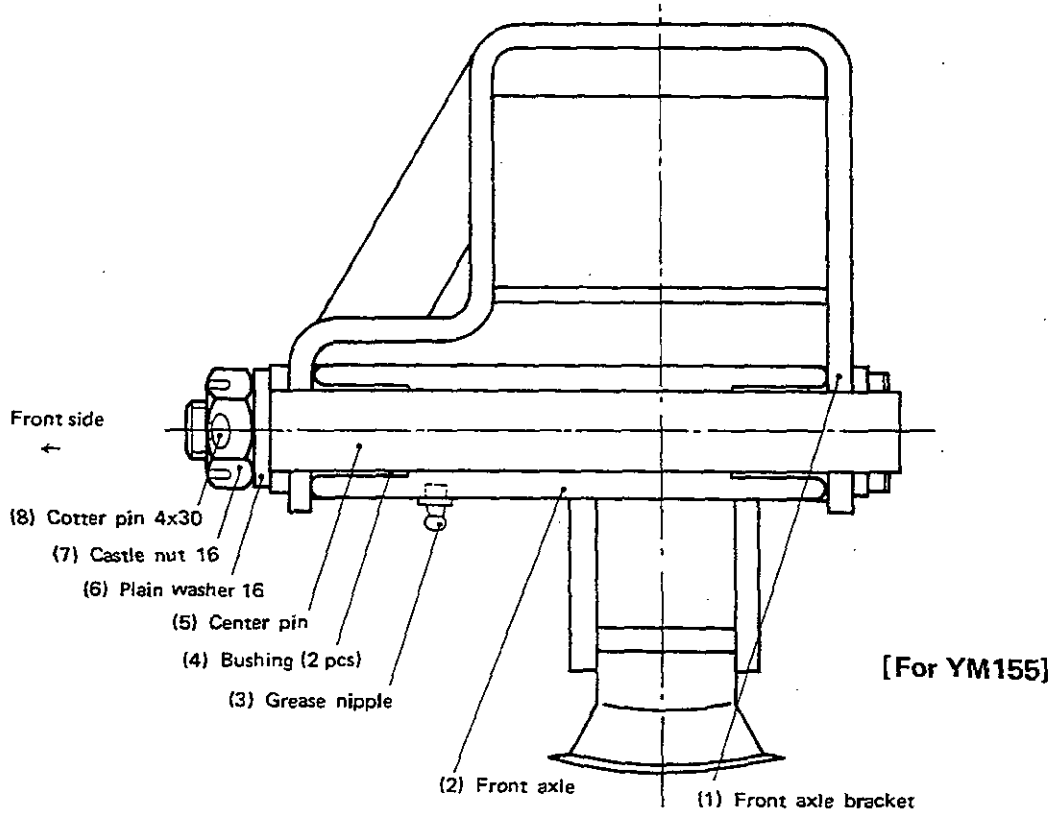
(2) Insert the (5) center pin through the (1) front axle bracket and the front axle (step 1).

(3) Add a (6) plane washer to the center pin (step 2) and screw on the (7) castle nut 16.

(4) To prevent the (7) castle nut from loosening, attach a (8) cotter pin 4 x 30.



[For YM135]



[For YM155]

(5) Attach the (3) grease nipple.

NOTES:
a) The plate should be parallel to the center when press-fitting the (4) bushing.

b) The (7) castle nut should be fastened so there is no play between the (1) front axle bracket and the (2) front axle, furthermore the front axle should swing smoothly.

c) Insert the (5) center pin after it has been completely greased.

d) Be sure that the (8) cotter pin 4 x 30 of the (5) center pin is placed in the hole horizontally, as shown in the illustration. Do not place it in the vertical position.

e) (4) bushing (2 pcs) length:
0.9449 in. (24 mm) – YM155
0.9843 in. (25 mm) – YM135

5. BRAKE DRUM ASSEMBLY

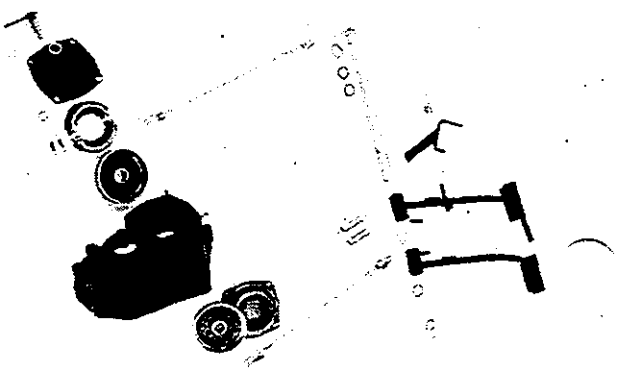
(1) Attach the (2) "O" ring S 16 to the (1) brake cam shaft. Insert the (3) brake cover, and attach the (4) brake cam shaft ring.

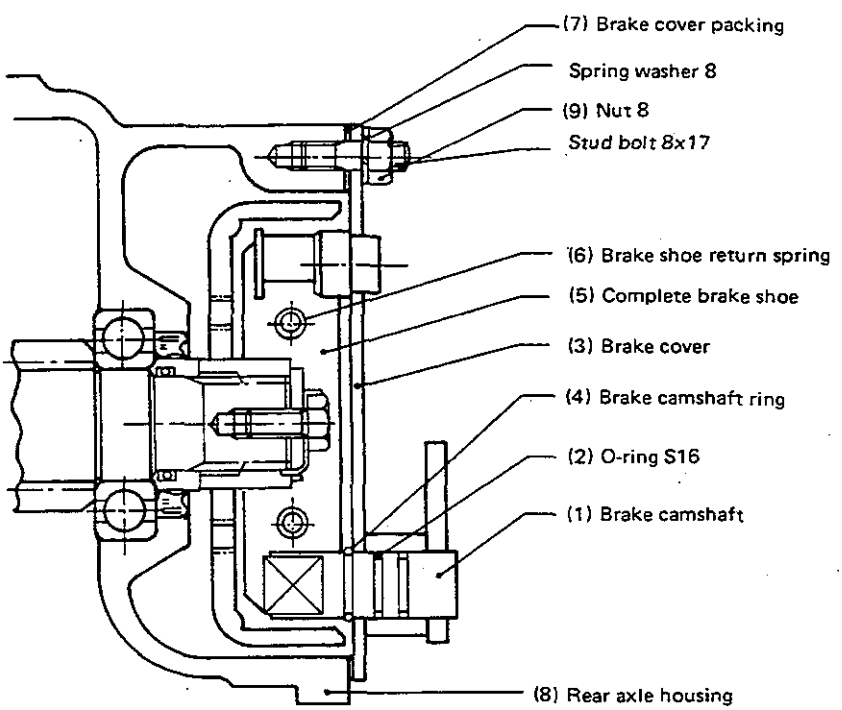
(2) Attach the (6) brake shoe return spring to the (5) complete brake shoe. Attach the brake cam shaft (step 1) to the brake shoe (step 2).

(3) Insert the (7) brake cover packing between the step 1 and step 2 parts. Attach the (8) rear axle housing, and secure it with the (9) nut 8.

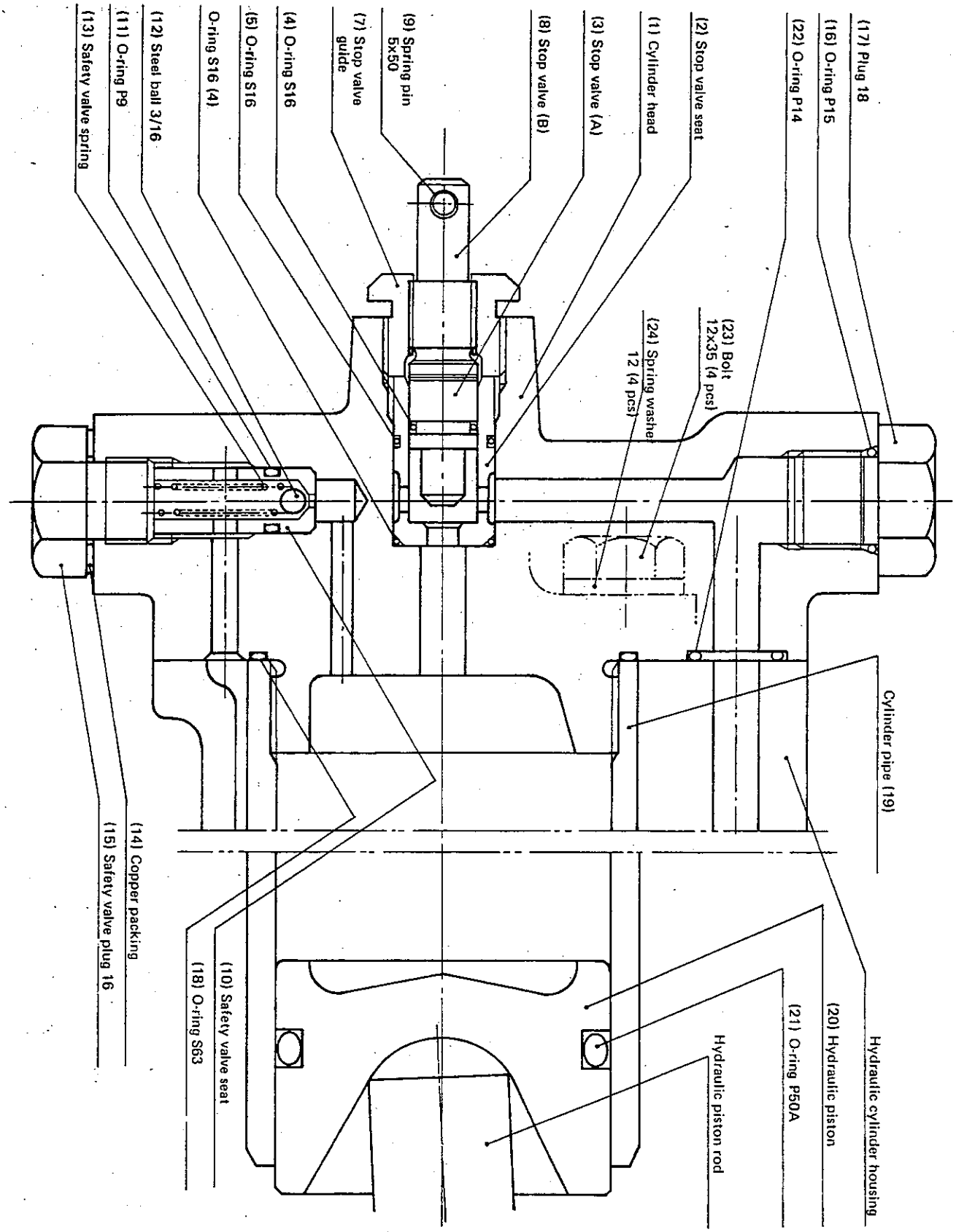
NOTES:
a) Tightening torque for the (9) nut 8: 9-12 ft lbs (0.13-0.17 kg m).

b) There is no need to apply sealent to the (7) brake cover packing.



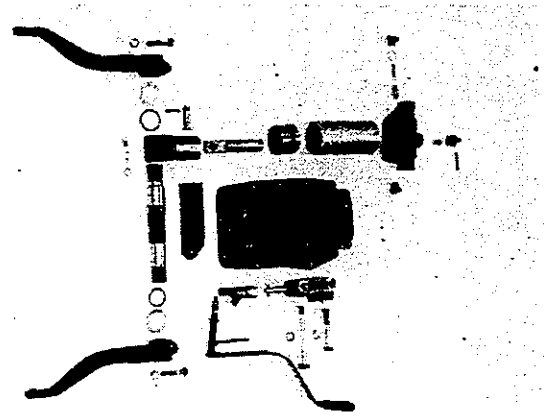


6. HYDRAULIC SYSTEM ASSEMBLY



6.1 Cylinder Head Assembly

(Refer to the diagram on page 132.)



(1) Stop Valve

a. Insert the (4) (5) "O" ring S16, and the (6) "O" ring P9 into the (1) cylinder head, (2) stop valve seat, and (3) stop valve A.

b. Screw in the (8) stop valve B from the inside of the (7) stop valve guide, and attach the (9) spring pin 5 x 50. The (8) stop valve B should extend out to the position shown in the illustration.

c. Insert the (2) stop valve seat and (3) stop valve A into the (1) cylinder head.

d. Screw in the stop valve guide (step b) into the (1) cylinder head.

(2) Safety Valve

a. Insert the (10) safety valve seat with the (11) "O" ring P9 into the (1) cylinder head.

b. Insert into the assembled parts of step a. the (12) steel ball 3/16, and the (13) safety valve spring.

c. Attach the (14) copper packing 16 and (15) safety valve plug 16 to the (1) cylinder head.

(3) Plug 18

Insert the (16) "O" ring P15 into the cylinder head and attach the (17) plug 18.

(4) Cylinder Pipe, Hydraulic Piston

a. Insert the (18) "O" ring S 63 into the (1) cylinder head, and attach the (19) cylinder pipe.

b. Insert the (20) hydraulic piston with the (21) "O" ring P 50 A into the assembled parts above.

c. Insert the (22) "O" ring P14 into the (1) cylinder head. Insert the (24) spring washer 12 (4 pcs) in the (23) bolts 12 x 35 (4 pcs), and attach the parts assembled above to the hydraulic cylinder housing.

NOTE:

Parts	*Tightening torque ft-lb (kg-m)*
(7) Stop valve guide	*25–36 (35–50)*
(15) Safety valve plug 16 *(17) Plug 18* *(23) Bolt 12 x 35 (4 pcs)*	*58–72 (8.0–10.0)*
(19) Cylinder pipe	*Screw in completely to the (1) cylinder head*

6.2 Lifting Shaft, Lift Arms, Lift Crank, Hydraulic Piston Rod Assembly

(1) Insert the (2) bush 30 x 30 and (3) busn 35 x 30 into the (1) hydraulic cylinder case to the position shown in the illustration.

(2) Attach the (5) hydraulic piston rod, (6) lift crank pin, (7) spring pin 5 x 28, and (8) spring pin 3 x 28 to the (4) lift crank.

(3) Place the assembled parts in section 2 into the (1) hydraulic cylinder case, and insert the (9) lifting shaft.

(4) Fit the center groove of the (9) lifting shaft to the center of the (4) lift crank, and fasten the (10) lift crank set bolts.

(5) Insert (11) liner 30.5 x 45 x 1 (2 pcs), the (15) "O" ring P30 (2 pcs), the (12) lift arm (L) and the (13) lift arm (R) on the (9) lifting shaft.

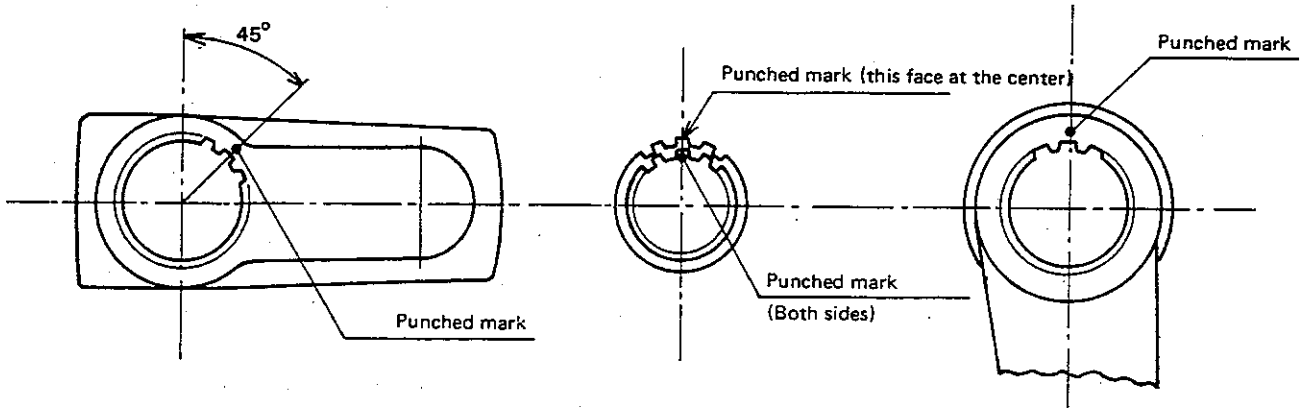
(6) Attach the (14) bolts 10 x 45 (2 pcs) so there is no play between the (1) hydraulic cylinder case and the (12) lift arm (L) and the (13) lift arm (R).

(7) Attach the (16) cylinder case protector to

the (1) hydraulic cylinder case by the (18) copper packing 8 (3 pcs) and (17) bolts 8 x 22 (3 pcs), and lock the (17) bolts 8 x 22 (3 pcs) in place with (19) wire 0.8 x 220.

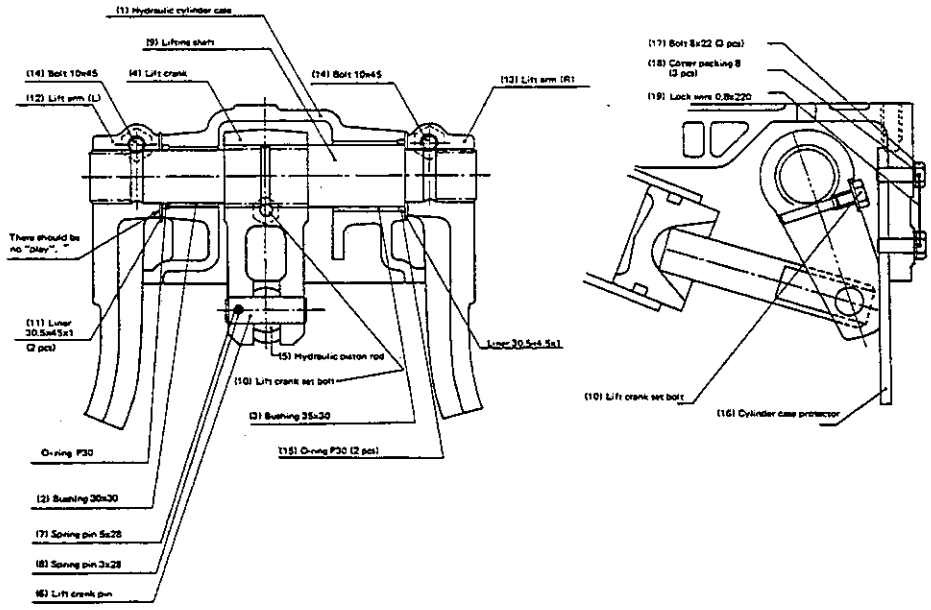
NOTES:

a) Set the punch mark for the step 3 and step 5 fitting.



b) Tightening torque:

Parts	*Tightening torque ft-lbs (kg-m)*
(10) Lift crank set bolt	*17–22 (2.3–3.0)*
(14) Bolt 10 x 45 (2 pcs)	*33–43 (4.5–6.0)*



NOTE:

[1] Before step 1, align the center of the hole for the (2) bushing with the center groove line of the (1) hydraulic cylinder case.

[2] Be sure there is no "play" between the (6) lift crank pin and either the (4) lift crank or the (5) hydraulic piston rod; and between the (6) lift crank pin and the (7) spring pin 5 x 28.

6.3 Control Valve Assembly

(1) Insert the (2) seal washer and the (3) "O" ring P14 into the (1) hydraulic cylinder case.

(2) Insert the (5) "O" ring P14 (2 pcs) into the (4) control valve.

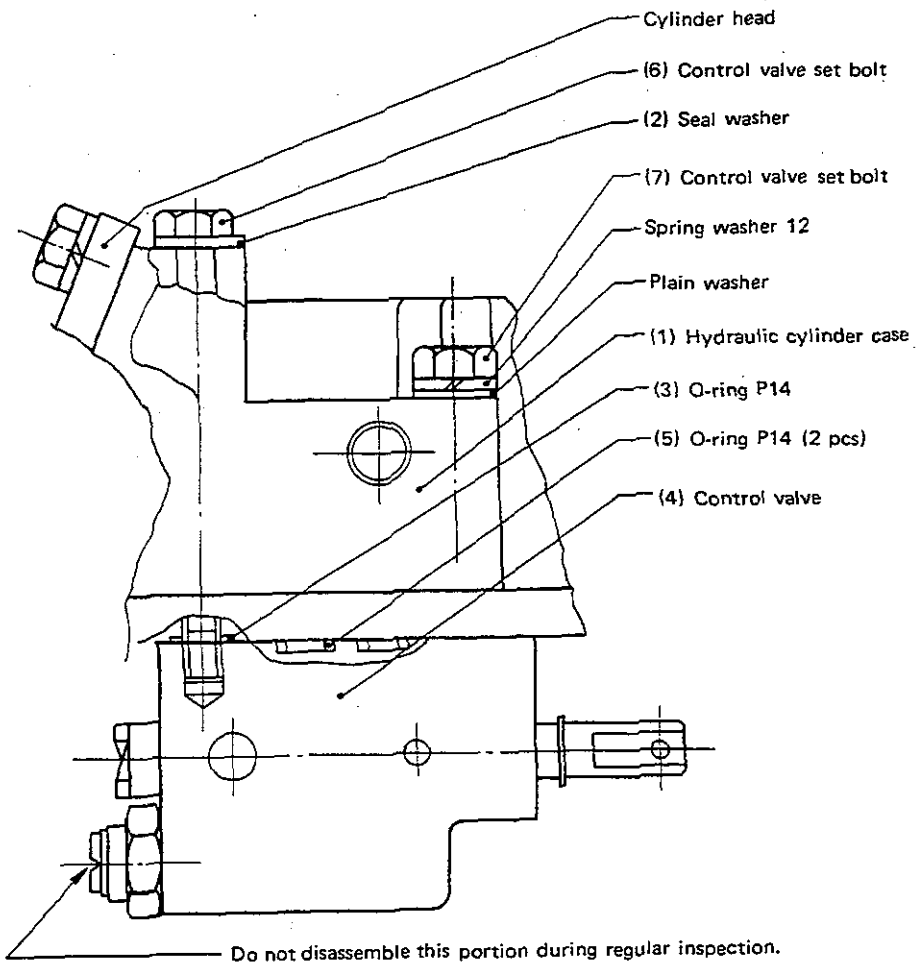
(3) Attach the assembled parts of step 2 to the parts of step 1, and secure with the (6) (7) control valve set bolts (2 pcs).

NOTES:

a) Tighten the (6) (7) control valve set bolts (2 pcs) uniformly to the required torque.

b) Torque for the (6) (7) control valve set bolts:
33–40 ft-lbs (4.5–5.5 kg-m)

c) DO NOT turn or take apart the nut or spindle that is attached to the bottom of the (4) control valve.



6.4 Hydraulic Control Fork, Hydraulic Control Lever Assembly

(1) Attach the (2) circlip 14 to the (1) hydraulic control lever, and insert the (3) control lever liner and the (4) "O" ring S12.

(2) Place the (5) hydraulic control fork in the (6) hydraulic cylinder case. Insert the assembled parts in step 1 in the (6) hydraulic cylinder case and the (5) hydraulic control fork. Be sure to place the (8) spring pin 6 x 25 of the (7) control

valve spool on the slot of the (5) hydraulic control fork.

(3) Screw-in the (9) nut 6 on the (10) set bolt 6 x 30, and then attach it to the (5) hydraulic control fork.

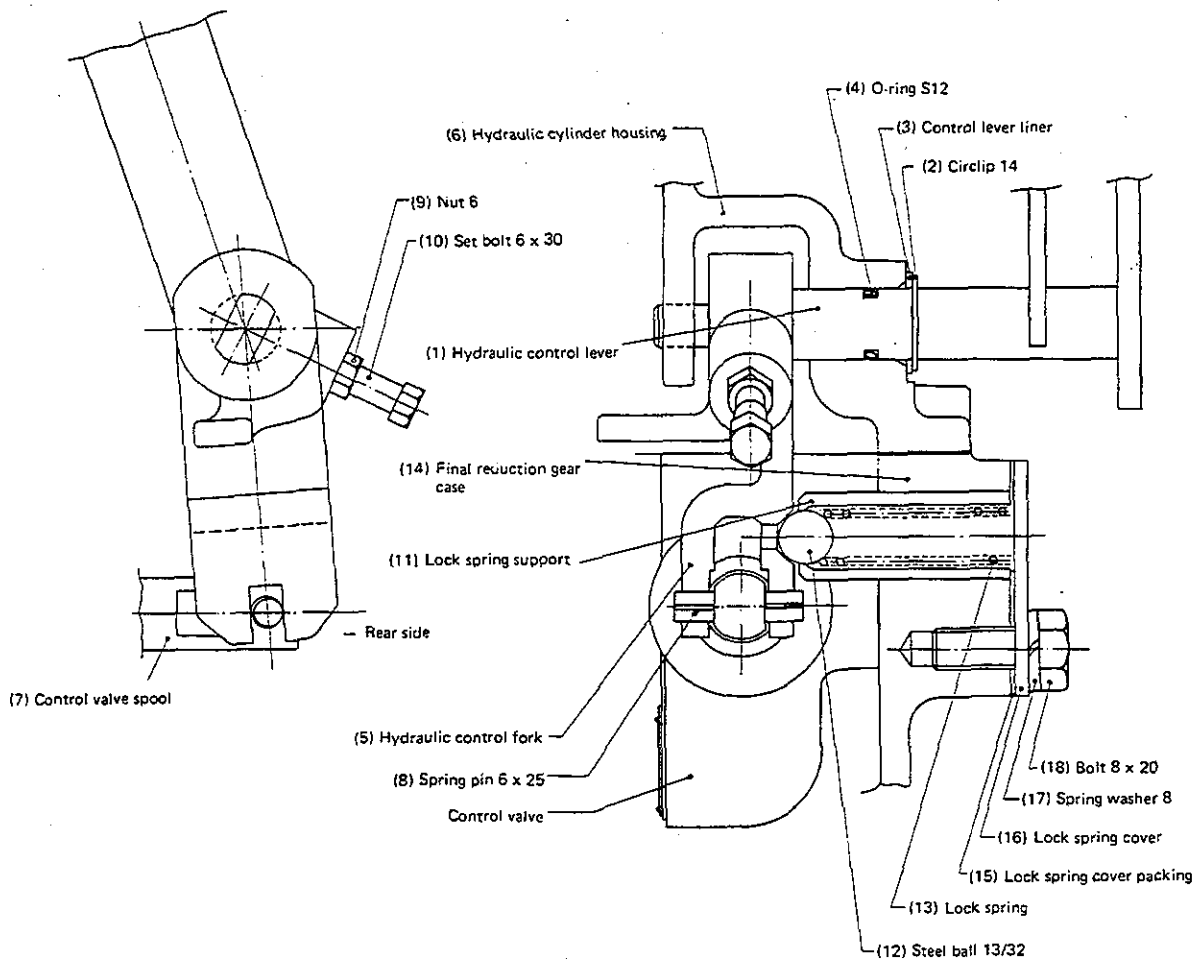
(4) Insert the (12) steel ball 13/32 and (13) lock spring on the (11) lock spring support.

(5) Insert the assembled parts of step 4 into the (14) final reduction gear case.

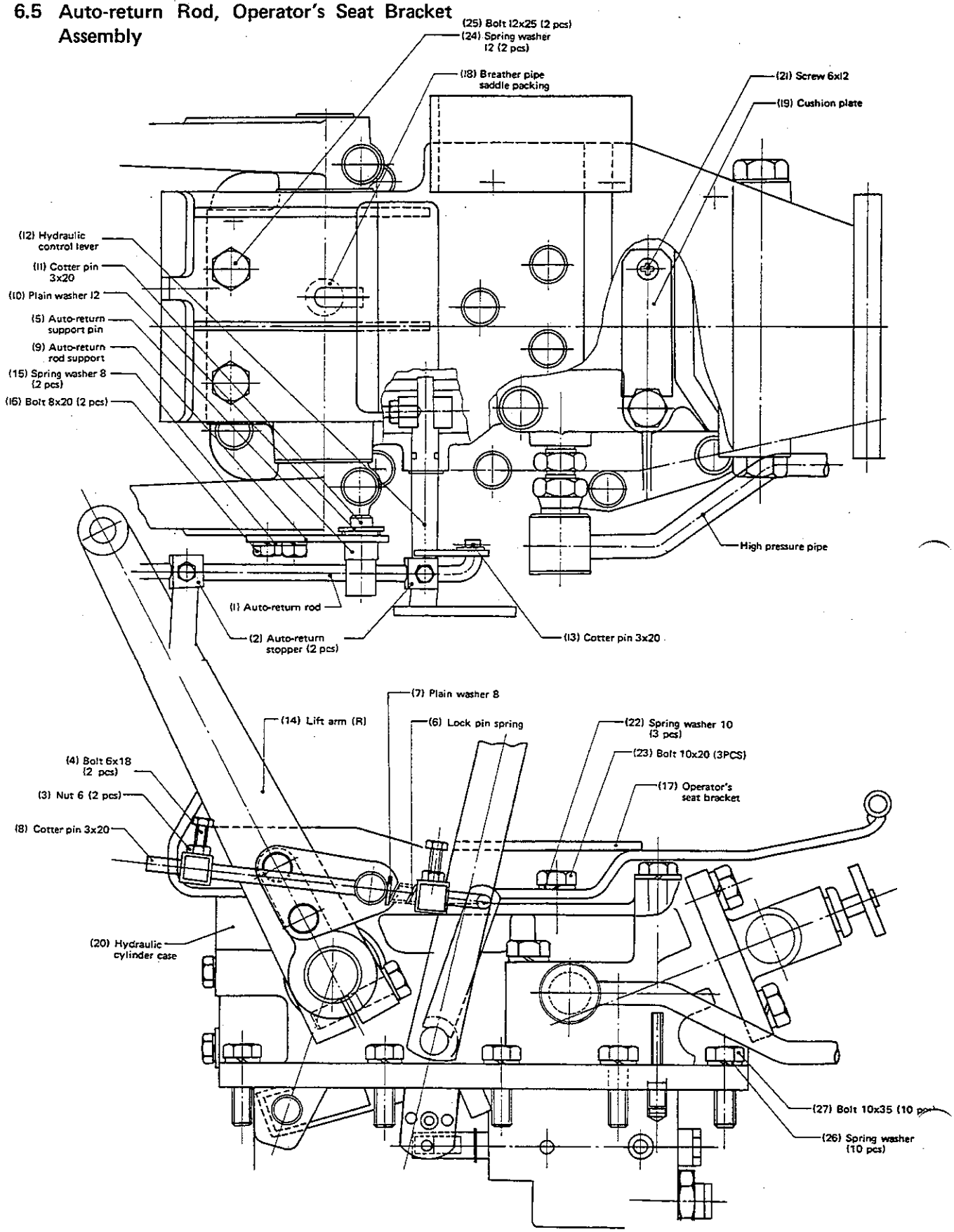
(6) Attach the (15) spring cover packing and (16) lock spring cover to the (14) final reduction gear case. Secure it with the (17) spring washer 8 (2 pcs) and (18) bolts 8 x 20 (2 pcs).

NOTE:

Parts	*Tightening torque ft-lb (kg-m)*
(10) Set bolt 6 x 30	*6–9 (0.8–1.2)*
(9) Nut 6	*4–5 (0.5–0.7)*
(18) Bolt 8 x 20	*9–12 (1.3–1.7)*



6.5 Auto-return Rod, Operator's Seat Bracket Assembly



(1) Insert the (2) auto-return stoppers with (3) nut 6, (4) bolt 6 x 18 (2 pcs) (5) auto-return support pin, (6) lock pin spring, (7) plain washer 8 on the (1) auto return rod, as shown in the illustration. Attach the (8) cotter pin 3 x 20.

(2) Attach the (9) auto-return rod support, (10) plain washer 12, and (11) cotter pin 3 x 20 to the (5) auto-return support pin.

(3) Insert the (1) auto-return rod in the hole of the (12) hydraulic control lever, and attach the (13) cotter pin 3 x 20.

(4) Attach the (9) auto-return rod support to the (14) lift arm (R) with the (15) spring washer 8 (2 pcs) and the (16) bolts 8 x 20 (2 pcs).

(5) Place the (18) breather pipe packing in the bottom of the breather of the (17) operator's seat bracket.

(6) Attach the (19) cushion plate to the (20) hydraulic cylinder case with the (21) screw 6 x 12.

(7) Attach the (17) operator's seat bracket to the (20) hydraulic cylinder case with the (22) spring washer 10 (3 pcs), (23) bolts 10 x 20 (3 pcs) and the (24) spring washer 12 (2 pcs) and (25) bolts 12 x 25 (2 pcs).

(8) Attach the items assembled in steps 1-7 to the final reduction gear case with the (26) spring washer 10 (10 pcs) and the (27) bolts 10 x 35 (10 pcs).

(9) To make the (2) auto-return stoppers operate, adjust the lift arms (R) and (L) to the desired height and tighten the (2) auto-return stoppers with the (3) nut 6 (2 pcs) and (4) bolts 6 x 18 (2 pcs).

NOTE:

	Parts	*Tightening torque ft-lb (kg-m)*
(3)	*Nut 6 (2 pcs)*	*4–5 (0.5–1.7)*
(4)	*Bolt 8 x 18 (2 pcs)*	*6–9 (0.8–1.2)*
(23)	*Bolt 10 x 20 (3 pcs)*	*15–22 (2.0–3.0)*
(25)	*Bolt 12 x 25 (2 pcs)*	*29–43 (4.0–6.0)*
(27)	*Bolt 10 x 35 (10 pcs)*	*25–36 (3.5–5.0)*

6.6 Slow Return Valve Assembly

(1) Insert the (2) "O" ring S12.5 into the (1) slow return plug 16, and then screw in the (1) slow return plug 16 into the (3) final reduction gear case.

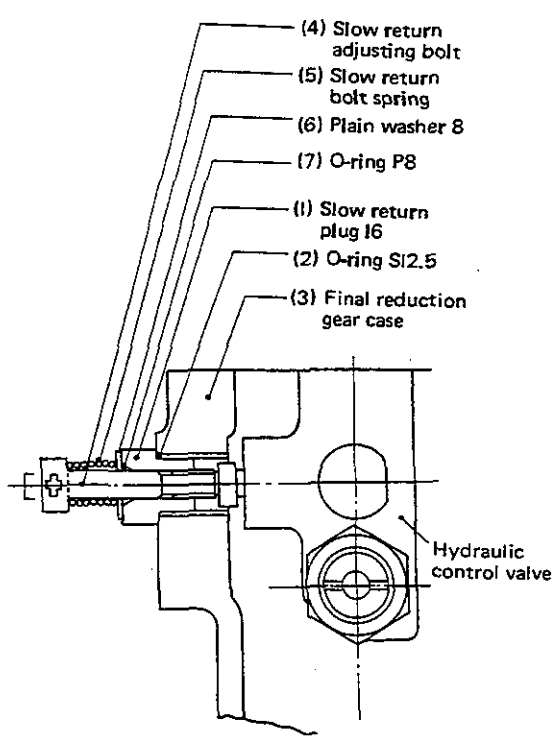
(2) Insert the (5) slow return spring, (6) plain washer 8, and (7) "O" ring P8 into the (4) slow return adjusting bolt.

(3) Screw in the (4) slow return adjusting bolt (step 2) into the (3) final reduction gear case (step 1).

NOTE:

a) When screwing in the part with the (2) "O" ring S12.5 and the (7) "O" ring P8 be sure not to damage them.

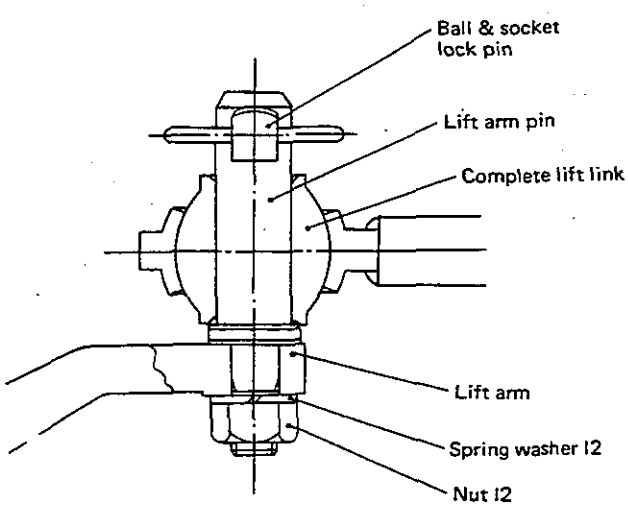
b) (1) slow return plug 16 tightening torque: see text.
51–62 ft-lb (7.0–8.5 kg-m)



6.7 Lift Arm Assembly

[For Serial No. before 51000]

NOTE: Nut 12 tightening torque:
58–72 ft-lb (8–10 kg-m)

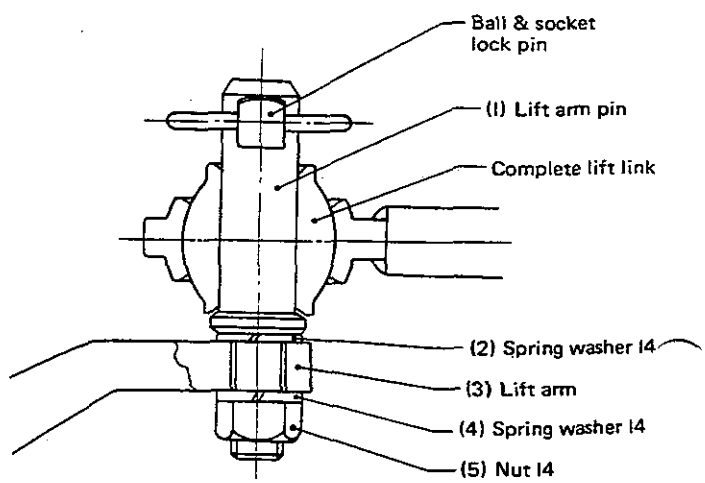


[For Serial No. after 51001]

(1) Insert the (2) spring washer 14 in the (1) lift arm pin and tighten.

(2) Insert the (4) spring washer 14 into the (1) lift arm pin, and retighten the (5) nut 14.

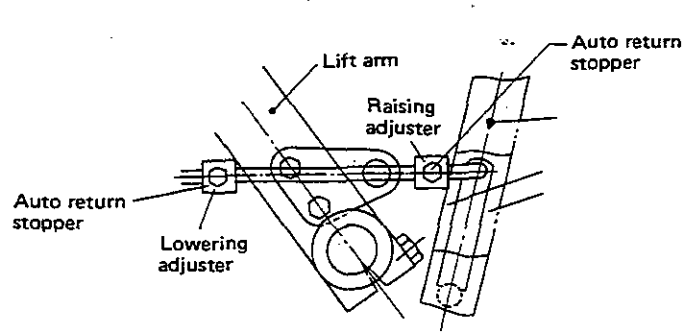
NOTE: Be sure to attach the (2) (4) spring washers to both sides of the (3) lift arm.



6-8 Operational Precaution Points

(1) Auto Return Rod

The hydraulic control fork's protruding part and the edge of the hydraulic piston will act to stop the lift arms when they are placed in their furthest position, and the lever will return to its center position. For the desired lift arm height adjust the position of the auto return stopper.

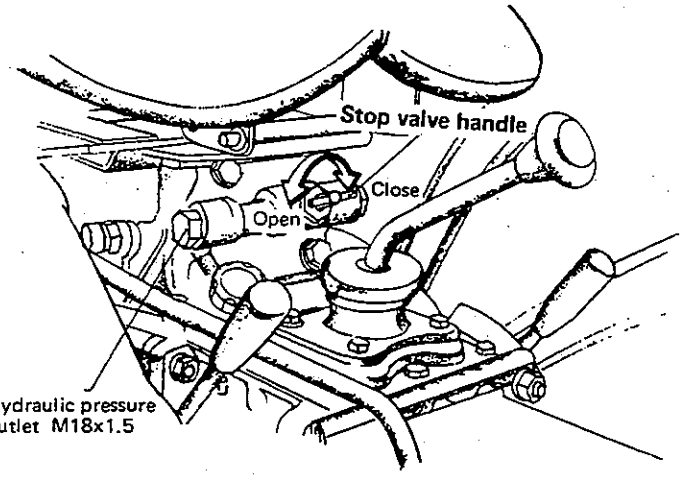


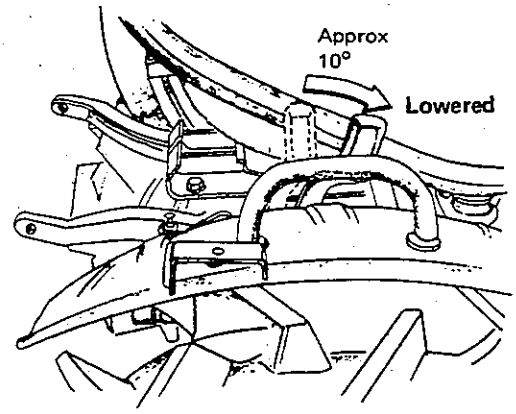
(2) Hydraulic Pressure Outlet (M18 x 1.5)

Be sure to follow the following steps when releasing pressure from the hydraulic oil outlet:

a) Move the lift arms a little (about 10°) from the top position, completely tighten the stop valve, and secure the lift arms.

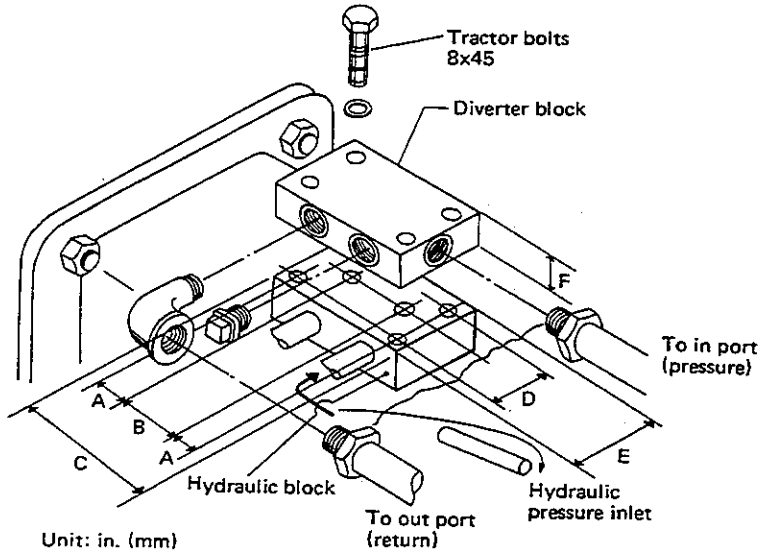
b) Put the hydraulic control lever in the top position.





(3) Hydraulic Pressure Divider

For the hydraulic pressure divider dimensions refer to the following illustration:



Unit: in. (mm)

A : 0.531 (13.5)
B : 1.378 (35)
C : 3.228 (82)
D : 1.181 (30)
E : 1.969 (50)
F : 0.906 (23)

XII. TRACTOR ADJUSTMENTS

Adjusting procedures have been explained item by item in Chapter X, Tractor Construction and Maintenance. Please refer to this chapter for details.

1. Clutch and Related Items

(1) Height of release lever

(2) Clutch pedal stroke and play adjustment

(3) Instructions for attaching the safety switch

2. P.T.O. and Related Items

≪Attaching 3-point hitch≫

(1) Loosen check chain so the lower link can move freely.

(2) Back up the tractor to line up the center of the tractor and the implement.

(3) Couple the left lower link.

(4) Adjust the height of the right lift link, and couple the right lower link.

(5) Attach the tractor side of the top link, adjust the length of the link, and couple the implement. The top link adjusting lock nut should be on the tractor side.

(6) Couple the universal joint of the implement to the P.T.O. shaft of the tractor. (Check to make certain that the stopper pin is inserted properly.)

(7) Raise the implement by setting the control lever to the "Raise" position, and adjust the check chain to control any side movement of the implement so that the tires will not come in contact with the lower links.

(8) Adjust the lift link to a length most appropriate for the work involved. (The right link is an adjustable one).

3. Brake and Related Items

(1) Adjust "play" in brake pedal.

4. Hydraulic Equipment

(1) Adjust the slow return.

(2) Adjust the control lever stroke.

5. Steering System

(1) Adjust toe-in.

(2) Adjust the "play" in the steering wheel.

XIII. TRACTOR TROUBLE-SHOOTING

When asked by a customer to perform repairs and services on a tractor, it is essential that you first find out from the customer the full details of the trouble, diagnose it correctly, and then perform repairs swiftly and in a manner that will fully satisfy the customer.

No customer will want to have a lot of time spent on repairs and services nor will he want the work to cost a lot of money. Therefore, always try to carry out the repairs and services by placing yourself in the customer's shoes.

The trouble-shooting procedures described in this chapter will list the symptoms on a section by section basis, and will explain what to do about them. When the trouble has been pinpointed and you are about to carry out the work, do it properly and completely, in accordance with the maintenance standards described in the preceding chapters.

Poor maintenance work will not only damage the establishment's reputation but could also lead to serious accidents, so after the work has been completed and the tractor is ready to be delivered to the customer, always recheck the work carried out.

Trouble-shooting will be explained in the following order:

(1) Engine and related items
(2) Electrical systems
(3) Brake system
(4) Clutch and related items
(5) Transmission and related items
(6) P.T.O. and related items
(7) Hydraulic system
(8) Steering and suspension systems

1. ENGINE AND RELATED ITEMS

	Trouble	Probable cause	Remedy
1.	**Won't start or hard to start.**	1. No fuel.	Replenish fuel.
		2. Fuel cock closed.	Open fuel cock.
		3. Air in fuel system.	Bleed air.
		4. Faulty delivery valve; valve clogged	Disassemble delivery valve and clean.
		5. Worn plunger.	Replace plunger.
		6. Faulty governor.	Adjust governor.
		7. Sezing of nozzle.	Lap nozzle or replace.
		8. Insufficient nozzle pressure.	Adjust injection pressure or replace nozzle.
		9. Clogged fuel return pipe	Replace fuel pipe; if no hole in the center of injection pressure adjusting plate, replace.
		10. Lube oil of excessively high viscosity.	Select lube oil suitable for ambient temperature and engine.
		11. Low specific gravity of battery electrolyte.	Charge battery.
		12. Faulty starter motor.	(Refer to section on electrical equipment)
		13. Faulty safety switch.	Carry out continuity test on safety switch readjusting height.
2.	**Engine starts, but will not run smoothly.**	1. Unstable fuel supply:	
		Air in fuel system.	Bleed air and retighten.
		Governor linkage not functioning smoothly.	Adjust governor.
		2. Water or dust in fuel.	Replace fuel.
		3. Faulty fuel pump:	
		Dirt in delivery valve.	Clean delivery valve.
		Plunger does not function smoothly.	Disassemble fuel pump.
		Injection timing incorrect.	Adjust injection timing.
		4. Nozzle or verge of seizing.	Lap or replace.
3.	**Insufficient power.**	1. Excessive load.	Reduce load.
		2. Dirty lube oil. Excessive viscosity.	Replace lube oil.
		3. Insufficient compression:	
		Worn rings, pistons, liners.	Replace.
		Head bolts loose.	Tighten.
		4. Valve clearance incorrect.	Adjust valve clearance.
		5. Overheating:	
		Uneven tightening or moving components.	Check and adjust.
		Insufficient coolant.	Add to proper level.
		Insufficient lube oil.	Add to proper level.
		6. Poor fuel oil.	Replace with good quality fuel oil.

	Trouble	Probable cause	Remedy
4.	Overheats.	1. Insufficient coolant.	Check radiator and hoses for leaks; replenish coolant, clean radiator.
		2. Faulty water temp. switch.	Replace water temp. switch.
		3. Insufficient lube oil.	Replenish lube oil.
5.	Does not warm up sufficiently.	1. Faulty water temp. switch.	Replace water temp. switch.
		2. Extremely low ambient temperature.	Fit protector to radiator.
6.	Lube oil pressure indicator light does not go out.	1. Insufficient lube oil.	Replenish lube oil.
		2. Poor lube oil:	
		Viscosity is too high.	Replace.
		Lube oil is soiled.	Replace.
		3. Lube oil pressure:	
		Faulty lube oil pump.	Replace.
		Lube oil filter clogged up.	Clean or replace.
		Faulty lube oil pressure control valve.	Check control pressure.
		Faulty lube oil pressure switch.	Check lube oil pressure switch or replace.
		Fault in electrical system.	Check electrical wiring.
7.	High lube oil consumption	1. Lube oil viscosity is too low.	Replace lube oil.
		2. Oil leak.	
		3. Overheating.	
		4. Excessive wear of rings, pistons, or liners	Replace.
8.	High fuel oil consumption	1. Insufficient fuel oil.	Replace fuel oil.
		2. Faulty fuel pump nozzle.	Replace.
		3. Improper injection timing.	Readjust injection timing.
9.	Color of exhaust fumes poor.	1. Improper injection.	Readjust injection timing.
		2. Overheating.	Reduce load.
		3. Faulty nozzle.	Lap or replace.
		4. Excessive lube oil level.	
		5. Engine running too cold: Excessive wear of rings, pistons or liners, etc.	
10.	Strange noises.	1. Excessive valve clearance.	Adjust.
11.	Faulty tachometer (except YM135)	1. Needle wavers:	
		Faulty cable.	Replace.
		Faulty gauge unit.	Replace.
		Faulty gear unit.	Replace.
		2. Needle stays at 0:	
		Cable severed.	Replace.
		Faulty gear unit.	Replace.
		Faulty coupling.	Replace.

2. ELECTRICAL SYSTEM

	Trouble	Probable cause	Remedy
1.	Starter motor does not turn.	1. Faulty starting switch.	Check starting switch.
		2. Breaks or poor contact in the wiring.	Correct or replace.
		3. Insufficient battery power.	Measure specific gravity and recharge.
		4. Faulty magnetic switch: Break in coil windings.	Correct or replace.
		Plunger catches.	Correct or replace.
		5. Faulty safety start switch.	Check switch; also check height at which switch is attached.
		6. Burnt out fuse.	Check the trouble and replace.
2.	Pinion moves out but does not turn.	1. Cable connecting battery with terminal B is loose.	Tighten.
		2. Insufficient pinion gap.	Adjust.
		3. Worn brushes.	Replace.
		4. Damaged commutator.	Correct or replace.
		5. Faulty armature.	Correct or replace.
		6. Faulty magnetic switch contacts.	
3.	Motor starts turning before pinion moves out.	1. Faulty starter motor clutch.	Correct or replace.
4.	Starter motor turns after pinion moves out but does not transmit power.	1. Faulty starter motor clutch.	Correct ore replace.
5.	Motor does not stop turning after engine starts up (even when starting switch is turned back)	1. Faulty magnetic switch: Worn or damaged return spring.	Correct or replace.
6.	Pinion does not move back after engine starts up.	1. Damage to spline section.	Check meshing of armature shaft splines and spline tube.
		2. Magnetic switch: Poor returning of plunger, or worn or damaged return spring.	

3. BRAKE SYSTEM

	Trouble	Probable cause	Remedy
1.	Brakes do not work.	1. Brake shoes: Oil adherence.	Check for oil leakage.
		Shoes heavily worn.	Replace.
		2. Rod.	Adjust amount of play and effective strokes.
2.	Braking force differs for left and right side; wheels lock.	1. Different amount of play for left and right side.	Readjust.

	Trouble	Probable cause	Remedy
3.	**Vibration can be felt through the brake pedals.**	1. Faulty brake shoe springs; excessive wear; uneven wear. 2. Uneven brake drum wear; foreign matter infiltrated into drums. 3. Excessive wear of brake shaft rod.	Replace. Replace.
4.	**Parking brake does not work.**	1. Faulty parking brake lever, claws worn.	Replace.
5.	**Parking brake does not return when released.**	1. Return spring.	Adjust or replace.
6.	**Brake pedals do not return.**	1. Return spring worn or damaged.	Replace.

4. CLUTCH AND RELATED ITEMS

	Trouble	Probable cause	Remedy
1.	**Clutch does not disengage.**	1. Friction disc scored or burned. 2. No effective clutch rod stroke. 3. Release sleeve bearing seized.	Replace. Adjust. Replace.
2.	**Clutch slips.**	1. Clutch: Oil adhered to friction disc. Friction disc worn. No clearance between release lever and release bearing. 2. Clutch rod: No play.	 Clean. Replace. Adjust. Adjust.
3.	**Clutch pedal does not return.**	1. Return spring worn or damaged.	Replace.
4.	**Power transmission is enough.**	1. Friction plate: Uneven wear of facings. Torsion springs worn or damaged. 2. Flywheel: Face is rough and uneven.	 Replace. Replace. Replace.
5.	**Pedals are loose.**	1. Rod shaft "O" rings worn: Rod is bent.	
6.	**Strange noises heard from the vicinity of clutch (when engaged)**	1. Main drive shaft or splines worn. 2. Friction disc loose (from rivet sections. 3. Flywheel and nut loose.	

5. TRANSMISSION AND RELATED ITEMS

	Trouble	Probable cause	Remedy
1.	**Gears cannot be engaged or are hard to engage; two speeds are engaged together; or tend to fall out of gear.**	1. Operator shifting too quickly, or attempting to shift when tractor is still in motion. Clutch pedal is not depressed fully.	Operator orientation.
		2. Shifter worn, deformed, or damaged.	Replace.
		3. Gears damaged: Assembled incorrectly.	Reassemble.
		Deviation in stroke of sliding gear (too much or not enough)	Readjust.
		4. Clutch adjusted incorrectly.	Adjust.
2.	**Strange noises.**	1. Oil insufficient. Poor quality oil.	Add oil. Change oil type.
		2. Shaft deformed, splines worn.	Replace.
		3. Gears damaged. Backlash of gears incorrect.	Replace. Adjust
		Gears adjusted incorrectly (relative positions of drive pinion and ring gear).	
		4. Fork damaged or bent.	Replace.
3.	**Differential does not function.**	1. Differential clutch does not slide and return.	Adjust.
		2. Differential lock spring damaged.	Replace.
4.	**Differential lock does not function.**	1. Differential lock cam damaged.	Replace.

6. P.T.O. AND RELATED ITEMS

	Trouble	Probable cause	Remedy
1.	**Gears cannot be engaged; tend to disengage; difficult to engage; engage double.**	1. Tractor has not come to a full stop.	Driver orientation.
		2. Clutch pedal is not fully depressed.	Driver orientation.
		3. Clutch pedal not adjusted correctly.	Adjust.
		4. Operator shifts too soon.	Driver orientation.
		5. Gears assembled incorrectly.	Reassemble.
		6. Shifter fork worn or deformed.	Replace.
2.	**Strange noises.**	1. Oil insufficient.	Add oil.
		2. Gear has excessive backlash.	Adjust.
		3. Shaft spline section worn or deformed.	Replace.
		4. Fork deformed.	Replace.

7. HYDRAULIC SYSTEM

	Trouble	Probable cause	Remedy
1.	**Implement cannot be lifted, or lift speed is slow.**	1. Hydraulic pump drive shaft damaged.	Replace drive shaft.
		2. Insufficient hydraulic pump discharge.	Clean or replace.
		3. Hydraulic fluid (Use transmission oil) has excessive viscosity.	Change hydraulic oil.
		Insufficient hydraulic fluid.	Add transmission oil.
		4. Filter clogged.	Clean.
		5. Spool not functioning correctly.	Replace completely.
		6. Faulty stop valve "O" ring.	Replace.
		7. Relief valve (safety valve) worn or damaged.	Replace spring.
		Improper pressure setting.	Adjust setting.
		Dirt in relief valve seat.	Clean.
		Relief valve not meeting correctly.	Adjust.
2.	**Implement does not drop.**	1. Spool does not function correctly.	
		Spool return spring damaged.	Replace spring.
		Push rod does not function smoothly.	Clean or replace.
		2. Stop valve seat seized.	Replace.
		3. Hydraulic cylinder piston seized.	Replace.
3.	**Rate of free descent is too fast.**	1. Spool worn.	
		Insufficient free travel when spool is at a neutral position.	Replace.
		2. Faulty valve seats.	Clean or replace.
		Dirt in valve.	
		Faulty "O" ring.	
		3. Stop valve "O" ring defective.	Replace.
		Faulty seats.	
		4. Hydraulic cylinder piston or cylinder damaged or worn.	Replace.
		Broken "O" ring.	
		5. Safety valve seat seat faulty.	Replace.
		Dirt in valve.	
		Broken "O" ring.	
		Faulty control valve or hydraulic cylinder "O" rings;	
4.	**Strange noises.**	1. Pump gear faulty.	Replace.
		Pump improperly fitted.	
		2. Air being drawn in (cavitation) because of insufficient oil.	Bleed air or change oil.
		Excessively high oil viscosity.	
		3. Control valve lift position regulation is excessive.	Adjust stroke by control lever turnbuckle.

8. STEERING AND SUSPENSION SYSTEMS

	Trouble	Probable cause	Remedy
1.	Heavy steering.	1. Tire pressure is too low.	Adjust.
		2. Front alignment: Faulty toe-in; faulty camber angle; faulty caster angle.	Readjust.
		3. Rods: Drag rods deformed; tie-rods deformed; pitman arm or knuckle arm deformed.	
		4. Steering gear box: Insufficient oil or grease.	Add oil or grease.
		5. Grease, insufficient.	Change
2.	Excessive play in steering.	1. Joints: Excessive backlash in joints (gear box, pitman arm, drag rods knuckle arm, tie-rods).	Adjust.
3.	Front tire shimmy.	1. Faulty front hub bearings.	Correct or replace.
		2. Excessive up-and-down play in kingpins.	Replace.
		3. Center pin worn excessively.	Replace.
4.	Uneven wear on front tires.	1. Front alignment: Improper toe-in, camber, or king pin angles; tie-rod(s) deformed.	Readjust.
5.	Steering pulls to one side.	1. Front alignment: Improper alignment (toe-in, camber angle, caster angle).	Readjust.
		2. Rods: Pitman arm, drag rod(s) knuckle arms, or tie-rods bent or deformed.	Correct or replace.
		3. Tire pressure: Different tire pressures in the left and right wheels.	Adjust.
		4. Implement fitted improperly.	Attach properly.
		5. Road or surface conditions.	
6.	Strange noises.	1. Front wheel hub bearings damaged; front wheel securing bolts loose.	Tighten or replace.
		2. Center pin worn; center pin bracket loose.	Tighten or replace.
		3. Looseness between rear wheel hubs and splines; bolts securing rear wheels loose.	Tighten.

XIV. REGULAR INSPECTIONS

* Marks:
It is recommended that the inspection and maintenance work listed here be performed under the supervision of a Yanmar dealer.

(Times listed in parentheses are times when inspections should be conducted between 600 to 1,200 hours. Inspection and maintenance work should be performed at the intervals indicated below.)

Items	Every 50 hours (650)	100 (700)	150 (750)	200 (800)	250 (850)	300 (900)	350 (950)	400 (1000)	450 (1050)	500 (1100)	550 (1150)	600 (1200)
Greasing	●	●	●	●	●	●	●	●	●	●	●	●
Renew front wheel hub grease						*						*
Check battery electrolyte level	●	●	●	●	●	●	●	●	●	●	●	●
Check battery electrolyte specific gravity; charge battery						●						●
Clean air cleaner element		●		●		●		●		●		●
Check fan belt	●	●		●		●		●		●		●
Clean fan blade and radiator core						●						●
Flush radiator		●		●		●		●		●		●
Wash fuel filter		●		●		●		●		●		●
Replace engine lubricating oil	●	●		●		●		●		●		●
Replace engine lubricating oil filter element						●						●
Wash crankcase interior						●						●
Check intake and exhaust valve clearance						*						*
Check fuel injection valves						*						*
Check (replace) transmission oil	Replace	●	●	●	●	Replace	●	●	●	●	●	
Check (replace) transmission oil filter	●					●						Replace
Check steering system for tightness		●		●		●		●		●		●
Check (tighten) bolts/nuts		●		●		●		●		●		●
Check (replace) front axle gear oil (4-wheel drive)	●	●	●	●	●	Replace	●	●	●	●	●	Replace
Front wheel, rear wheel bolts (Tighten)	●	●	●	●	●	●	●	●	●	●	●	●

XV. TIGHTENING TORQUE RATINGS

[Unit: ft.lbs (kg-m)]

Item	No.	Tightening torque
[ENGINE]		
Cylinder head nuts	6	114 – 116 (15.5 – 16.0)
Rocker arm support	2	58 – 72 (8.0 – 10.0)
Rod bolts	4	33 – 36 (4.5 – 5.0)
Main bearing housing	6	15 – 18 (2.0 – 2.5)
Crankshaft pulley	1	87 – 108 (12 – 15)
Flywheel	5	47 – 50 (6.5 – 7.0)
Timing gear case	9	17 – 22 (2.3 – 3.0)
Hydraulic pump	4	17 – 22 (2.3 – 3.0)
Fuel pump delivery valve holder	2	29 – 33 (4.0 – 4.5)
Fuel pump cap nut	2	29 – 33 (4.0 – 4.5)
Fuel injection valve nozzle holder body	2	65 – 80 (9.0 – 11.0)
[TRACTOR]		
Differential housing bolts	8	17 – 22 (2.3 – 3.0)
Differential bearing case bolts	4	15 – 22 (2.0 – 3.0)
Front axle bracket bolts	8	58 – 72 (8.0 – 10.0)
Brake drum bolts	2	17 – 22 (2.3 – 3.0)
Brake cover nuts	8	17 – 22 (2.3 – 3.0)
Clutch housing (M12 nuts)	7	43 – 58 (6.0 – 8.0)
(M10 nuts)	2	33 – 43 (4.5 – 6.0)
(M8 bolts)	7	17 – 22 (2.3 – 3.0)
Rear axle housing (M10 bolts)	16	25 – 36 (3.5 – 5.0)
(M12 bolts)	2	43 – 58 (6.0 – 8.0)
(M12 nuts)	4	43 – 58 (6.0 – 8.0)
Drawbar bracket nuts	4	58 – 87 (8.0 – 12.0)
Fender bolts	8	25 – 36 (3.5 – 5.0)
Seat bracket (M10 bolts)	3	15 – 22 (2.0 – 3.0)
(M12 bolts)	2	29 – 43 (4.0 – 6.0)
Transmission case nuts	10	25 – 36 (3.5 – 5.0)
Hydraulic cylinder case bolts	10	25 – 36 (3.5 – 5.0)
Steering gear box bolts	4	33 – 43 (4.5 – 6.0)
Steering nut	1	58 – 87 (8.0 – 12.0)
Clutch pressure plate bolts	6	17 – 22 (2.3 – 3.0)
Transmission front cover bolts	10	9 – 12 (1.3 – 1.7)
Transmission rear cover bolts	7	9 – 12 (1.3 – 1.7)
Top link hinge bolts	4	43 – 58 (6.0 – 8.0)
King pin bolts, bottom (YM155D, YM135D only)	8	33 – 43 (4.5 – 6.0)
Front axle (YM155D, YM135D only), (M8 bolts)	11	17 – 22 (2.3 – 3.0)
(M10 bolts)	10	33 – 43 (4.5 – 6.0)
(M10 nuts)	4	33 – 43 (4.5 – 6.0)
Flange bolts (rear wheel)	4	87 – 108 (12.0 – 15.0)
Front wheel bolts	8	58 – 72 (8.0 – 10)
Rear wheel bolts	12	58 – 72 (8.0 – 10)

[STANDARD OF BOLT TIGHTENING TORQUE]

Bolt size	Cast iron (steel)				Light alloy			
	4T		7T		4T		7T	
	ft-lbs	kg-m	ft-lbs	kg-m	ft-lbs	kg-m	ft-lbs	kg-m
M6	4 – 5	0.5 – 0.7	6 – 9	0.8 – 1.2	3 – 5	0.4 – 0.7	6 – 9	0.8 – 1.2
M8	9 – 12	1.3 – 1.7	17 – 22	2.3 – 3.0	9 – 12	1.3 – 1.7	15 – 22	2.0 – 3.0
M10	18 – 24	2.5 – 3.3	33 – 43	4.5 – 6.0	15 – 22	2.0 – 3.0	25 – 36	3.5 – 5.0
M12	33 – 43	4.5 – 6.0	58 – 72	8.0 – 10.0	29 – 43	4.0 – 6.0	43 – 58	6.0 – 8.0
M14	51 – 62	7.0 – 8.5	87 – 108	12.0–15.0	51 – 62	7.0 – 8.5	58 – 8.7	8.0 – 12.0
M16	80 – 101	11.0–14.0	123–152	17.0–21.0	72 – 101	10.0–14.0	87 – 123	12.0–17.0
M18	116–137	16.0–19.0	174–210	24.0–29.0	108–137	15.0–19.0	145–195	20.0–27.0
M20	159–195	22.0–27.0	239–297	33.0–41.0	145–195	20.0–27.0	217–253	30.0–35.0

BOLT CODE

["7" appears on the head of the 7T bolts.]

00000 – 000000

(1) ——— 4T (No electro-deposited coating)
(2) ——— 7T (No electro-deposited coating)
(7) ——— 4T (With electro-deposited coating)
(6) ——— 7T (With electro-deposited coating)

XVI. MAINTENANCE EQUIPMENT AND TOOLS

[LIST OF MEASURING TOOLS FOR YM135(D), YM155(D)]

	Tool	Usage	Type name (reference)
(1)	Hydrometer	Specific gravity check	HM-100
(2)	Battery charger	To charge the battery	EM-101T
(3)	Hydrometer for anti-freeze	To measure the specific gravity of water and anti-freeze	HM-10B
(4)	Calibrator	Parts measurement	BSC-15
(5)	Dial gauge	Pinion gear and backlash measurement	107M
(6)	Universal dial	Parts measurement	No. 196
(7)	Circuit tester	Electrical system inspection	TH-600
(8)	Micrometer	Accurate parts measurement	1525 MB (combination of 10–150 mm)
(9)	Cylinder gauge	Inside diameter measurement	BC-58 (measuring range: 50–150 mm)
(10)	V-A meter	Voltage and amperage measurement	EM-955
(11)	Thermometer	Coolant temp. measurement, and various parts measurement	TMA-20 (0–200°C)
(12)	Tachometer	To check the engine and P.T.O. shaft revolutions	HL (0–1000 rpm) (0–10000 rpm)
(13)	Tire gauge	To measure the air pressure of the tires	GS (10 kg/cm^2)
(14)	Toe-in gauge	To measure the toe-in of the front tires	TG-U (600–2,100 mm)
(15)	Torque wrench	To measure the bolt and nut torque	2100F
(16)	Cylinder gauge	To measure inside diameter	BC-10 (measuring range: 10–18 mm) BC-18 (measuring range: 18–35 mm) BC-35 (measuring range: 35–60 mm)

[LIST OF SPECIAL TOOLS FOR DISASSEMBLING/ASSEMBLING YM135(D), YM155(D)]

	Tool	Purpose of usage	Type name (reference)
(1)	Disassembly stand (794200-82350)	Tractor separation	
(2)	Spring pin removing tool (194200-82410)	To remove the spring pin (3.5ϕ x 32)	
(3)	Spring pin removing tool (194200-82420)	To remove the spring pin (5.5ϕ x 32)	
(4)	Spring pin removing tool (194200-82430)	To remove the spring pin (4.5ϕ x 40)	
(5)	Spring pin removing tool (194200-82440)	To remove the spring pin (7.5ϕ x 40)	
(6)	Garage jack	Lifting	M-300M (3 ton)

	Tool	Usage	Type name (reference)
(7)	Grease gun	Greasing	KH-32
(8)	Soldering iron	Electrical parts modification	E1-20 (200W)
(9)	Solder	Electrical parts modification	ROS (500g roll)
(10)	Soldering paste	Electrical parts modification	P-1B (500g)
(11)	Axle sleeve inserting tool (194200-82450)	To drive in the axle sleeve	
(12)	Gear puller	To remove bearing	T-24
(13)	Booster cable	To aid starting	BC-100A (diam. 8mm x length 2000 mm)
(14)	Booster clip	To aid starting	100A (opening x length: 20 mm x 160 mm)
(15)	Snap ring plier	To remove snap rings from shafts	S-1
(16)	Snap ring plier	To remove snap rings from shafts	SHILST (L shaped)
(17)	Relief valve removing tool (194200-82460)	To remove the relief valve	

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