SUZUKI

SERVICE MANUAL

LJ50/LJ50V

To: Technical personnel of every SUZUKI service shop

This SERVICE MANUAL provides all information necessary for servicing the SUZUKI four-wheel vehicle with a tarp top, Model LJ50, and its panel-van version, Model LJ50V. The vehicle is viewed as composed of three divisions—engine, chassis and electrical equipment—from the standpoint of servicing and maintenance. Each is described, and for each are set forth the checking, inspecting and overhauling instructions, together with pertinent advices and suggestions designed to improve the efficiency of servicing work.

The engine for powering these models, LJ50 and LJ50V, is a three-cylinder, water-cooled, two-stroke-cycle unit equipped with an intake reed valve for developing greater low-speed torque. It is built to include those basic design features that have earned high prestige for SUZUKI engines. Durable and sturdy, it is capable of high performance whether the car is used as an on-the-road or an off-the-road vehicle.

For enabling each user to derive maximum benefit from his LJ50 or LJ50V car, we as manufacturer heavily depend on you—the person who directly comes into contact with the user and looks after his car from time to time—as a vital link between us and users. With this notion as the premise, this MANUAL has been prepared. It is hoped that you will find this MANUAL easy to read and consult for your work on the LJ50 and LJ50V cars.

Models LJ50 and LJ50V may undergo some design changes in the future. If you find some of the contents of this MANUAL being at variance with the car in your care, it is because the changes have been effected. In such a case, please do not hesitate to enquire us. Each change is covered in our technical bulletin; you will be referred to the bulletins or will receive information directly from us.

July, 1974.

SUZUKI MOTOR COMPANY, LIMITED
International Service Department

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47 Benny Ave Pt. N.
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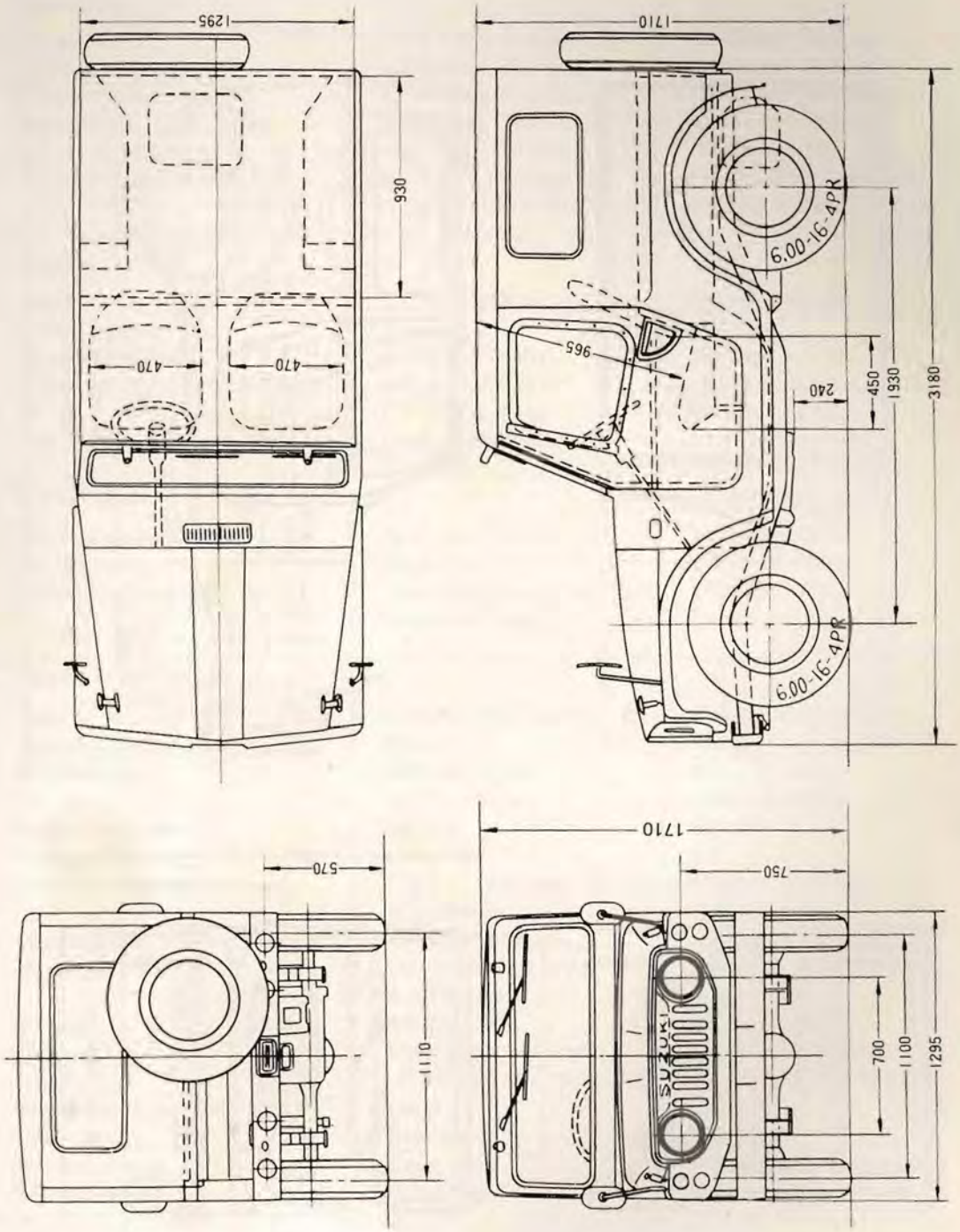

Fig. 1-3

2. LJ50V

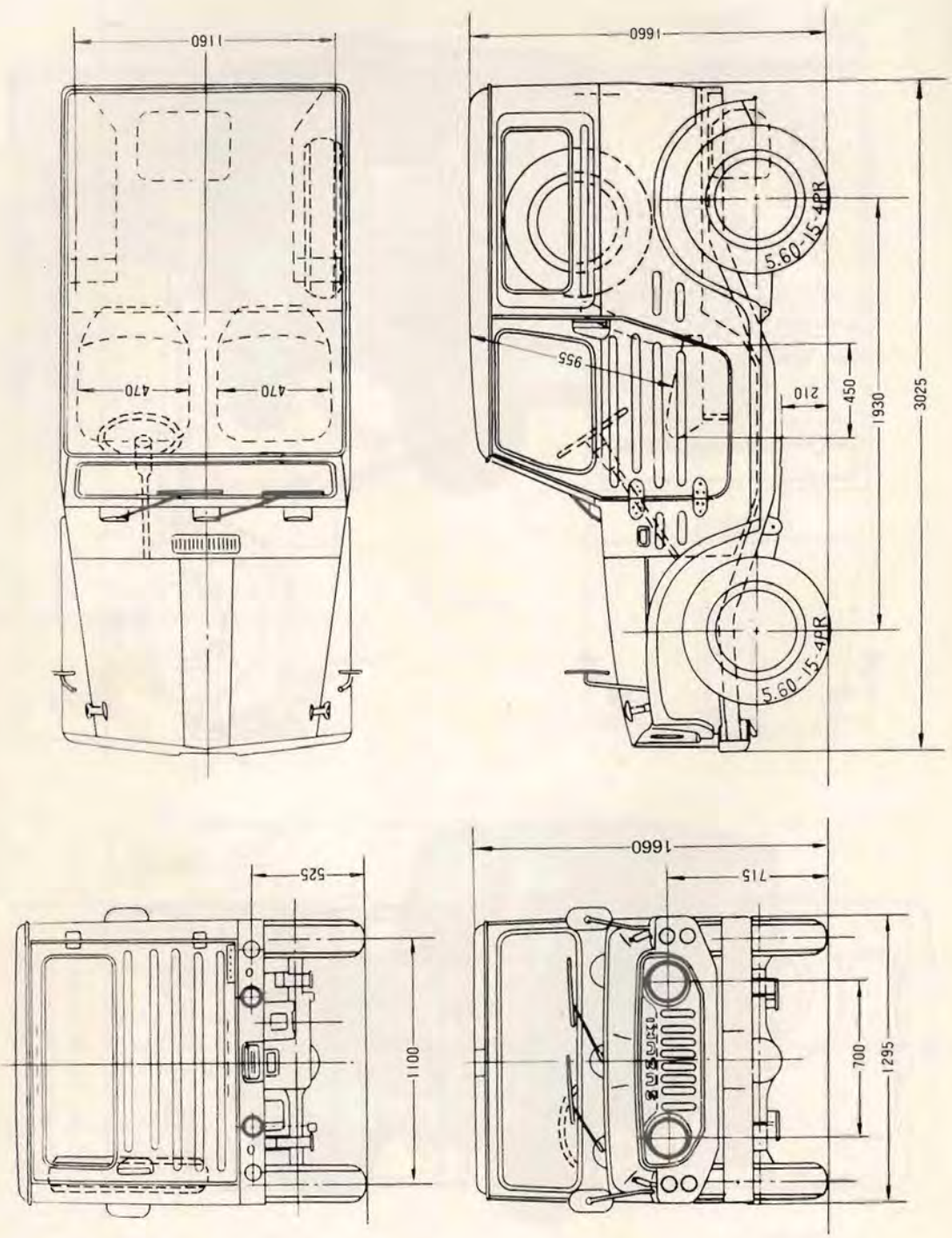

Fig. 1-4

1-3. Specifications

Item \ Models	LJ50	LJ50V
Dimension		
Overall length	3,180 mm (125.2 in.)	3,025 mm (119.1 in.)
Overall width	1,295 mm (51.0 in.)	1,295 mm (51.0 in.)
Overall height	1,710 mm (67.3 in.)	1,660 mm (65.4 in.)
Wheel base	1,930 mm (76.0 in.)	1,930 mm (76.0 in.)
Ground clearance	240 mm (9.4 in.)	210 mm (8.3 in.)
Cargo deck space L x W x H	930 x 1,205 x 1,040 mm (36.61 x 47.44 x 40.94 in.)	820 x 1,165 x 1,045 mm (32.28 x 45.86 x 41.14 in.)
Weight		
Weight	700 kg (1,543 lb)	730 kg (1,609 lb)
Seating capacity	2 persons	2 persons
Maximum pay load	250 kg (550 lb)	200 kg (440 lb)
Weight distribution, front	435 kg (957 lb)	440 kg (968 lb)
rear	625 kg (1,375 lb)	600 kg (1,320 lb)
Curb weight	1,060 kg (2,332 lb)	1,040 kg (2,288 lb)
Performance		
Climbing ability	36.5° (tan θ 0.74)	34.3° (tan θ 0.68)
Turning radius	4.6 m (15.1 ft)	4.6 m (15.1 ft)
Braking distance	14 m (45.9 ft) at 50 kph (31 mph)	14 m (45.9 ft) at 50 kph (31 mph)
Engine		
Type	2-stroke, water cooled	2-stroke, water cooled
Number of cylinder	Three	Three
Bore x Stroke	61.0 x 61.5 mm (2.40 x 2.42 in.)	61.0 x 61.5 mm (2.40 x 2.42 in.)
Piston displacement	539 cc	539 cc
Compression ratio	6.0	6.0
Compression pressure	7 kg/cm^2 (99.5 psi) at 1,000 rpm	7 kg/cm^2 (99.5 psi) at 1,000 rpm
Maximum horse power	33 Hp at 5,500 rpm	33 Hp at 5,500 rpm
Maximum torque	5.85 kg-m (41.6 lb-ft) at 3,500 rpm	5.85 kg-m (41.6 lb-ft) at 3,500 rpm
Weight	66 kg (145 lb)	66 kg (145 lb)
Dimensions L x W x H	490 x 588 x 500 mm (19.29 x 23.15 x 19.69 in.)	490 x 588 x 500 mm (19.29 x 23.15 x 19.69 in.)
Number of piston ring	Three	Three
Inlet system	Reed valve	Reed valve
Exhaust system	Piston valve	Piston valve
Starting system	Starter mtor	Starter motor
Cooling System		
Type	Water cooled direct	Water cooled direct
Radiator	Corrugated fin and tube pressure	Corrugated fin and tube pressure

Item \ Models	LJ50	LJ50V
Cooling System		
Water pump	Centrifugal type, V-belt drive	Centrifugal type, V-belt drive
Thermostat	Wax pellet element type	Wax pellet element type
Cooling solution capacity		
radiator	3.5 ltr (7.40/6.21 US/Imp. pt)	3 5 ltr (7.40/6.21 US/Imp. pt)
Reserve tank	0.6 ltr (1.27/1.07 US/Imp. pt)	0.6 ltr (1.27/1.07 US/Imp. pt)
Ignition System		
Ignition timing	8° B.T.D.C. below 1,000 rpm.	8° B.T.D.C. below 1,000 rpm.
Spark plug	NGK B-7HS, NIPPON DENSO W22FS	NGK B-7HS, NIPPON DENSO W22FS
Spark plug thread size D x L	14 x 12.7 mm (0.55 x 0.50 in.)	14 x 12.7 mm (0.55 x 0.50 in.)
Spark plug gap	0.7 mm (0.028 in.)	0.7 mm (0.028 in.)
Distributor point gap	0.4 mm (0.016 in.)	0.4 mm (0.016 in.)
Condenser capacity	0.15 μF	0.15 μF
Fuel System		
Number & type of carburetor	Single, VCI 30-25	Single, VCI 30-25
Venture diameter	25 mm (0.98 in.)	25 mm (0.98 in.)
Air cleaner	Wet polyurethane type	Wet polyurethane type
Fuel pump	Diaphragm type	Diaphragm type
Fuel tank capacity	30 ltr (7.93/6.60 US/Imp. gal)	30 ltr (7.93/6.60 US/Imp. gal)
Lubrication System		
Engine lubrication	CCI lubrication	CCI lubrication
Oil pump	Plunger type	Plunger type
Engine oil tank capacity	3.4 ltr (7.18/6.04 US/Imp. pt)	3.4 ltr (7.18/6.04 US/Imp. pt)
Transmission oil	1,000 cc (2.12/1.76 US/Imp. pt)	1,000 cc (2.12/1.76 US/Imp. pt)
Differential gear box oil	1,300 cc (2.75/2.31 US/Imp. pt)	1,300 cc (2.75/2.31 US/Imp. pt)
Transfer gear box oil	900 cc (1.90/1.60 US/Imp. pt)	900 cc (1.90/1.60 US/Imp. pt)
Electrical System		
Battery	NS 40Z	NS 40Z
Battery capacity & voltage	35 AH, 12 V	35 AH, 12 V
Starter	Magnetic shift, 0.6 KW	Magnetic shift, 0.6 KW
Generator	Alternator, 12 V-35 A	Alternator, 12 V-35 A
Head lamp	12 V, 50/40 W	12 V, 50/40 W
Turn signal lamp	12 V, 23 W	12 V, 23 W

Item \ Models	LJ50	LJ50V
Electrical System		
Parking lamp	12 V, 3.4 W	12 V, 3.4 W
Tail/brake lamp	12 V, 8/23 W	12 V, 8/23 W
Side turn signal lamp	12 V, 6 W	12 V, 6 W
License plate lamp	12 V, 10 W	12 V, 10 W
Back up lamp	12 V, 10 W	12 V, 10 W
Positioning lamp	12 V, 8 W	12 V, 8 W
Main fuse	30 A	30 A
Fuse box	10 A, 10 A, 15 A	10 A, 10 A, 15 A
Transmission		
Transmission gear	4-speed forward, all synchromesh, 1 reverse	4-speed forward, all synchromesh, 1 reverse
Gear shift control	Floor	Floor
Gear ratio, low	3.835 (30/14 × 34/19)	3.835 (30/14 × 34/19)
2nd	2.359 (29/22 × 34/19)	2.359 (29/22 × 34/19)
3rd	1.524 (23/27 × 34/19)	1.524 (23/27 × 34/19)
top	1.000	1.000
reverse	4.026 (27/12 × 34/19)	4.026 (27/12 × 34/19)
Transfer		
Transfer gear	2-speed with constantmesh	2-speed with constantmesh
Gear ratio, low range	3.012 (32/22 × 29/14)	2.571 (32/21 × 27/16)
high range	1.714 (24/29 × 29/14)	1.563 (25/27 × 27/16)
Clutch		
Clutch	Dry, single disc	Dry, single disc
Clutch facing size O.D. × I.D.	180 × 124 mm (7.08 × 4.88 in.)	180 × 124 mm (7.08 × 4.88 in.)
Friction area	134 sq. cm (20.7 sq. in.)	134 sq. cm (20.7 sq. in.)
Differential		
Type	Spiral bevel gear	Spiral bevel gear
Final ratio	4.875 (39/8)	4.875 (39/8)
Universal joint	Cross joint	Cross joint
Wheel and Suspension		
Tire size	6.00 - 16 in., 4PR	5.60 - 15 in., 4PR
Tire pressure, front	1.2 sq. cm (17 sq. in.)	1.2 sq. cm (17 sq. in.)
rear	1.8 sq. cm (26 sq. in.)	1.8 sq. cm (26 sq. in.)
Wheel rim size	4.50 E × 16	4.50 E × 15
Shock absorber, front and rear	Telescopic, double action	Telescopic, double action
Suspension, front and rear	Semi-elliptic, leaf spring	Semi-elliptic, leaf spring
Steering System		
Steering gear box	Ball screw nut	Ball screw nut
Steering ratio	15.58	15.58

Item \ Models	LJ50	LJ50V
Cooling System		
Water pump	Centrifugal type, V-belt drive	Centrifugal type, V-belt drive
Thermostat	Wax pellet element type	Wax pellet element type
Cooling solution capacity radiator	3.5 ltr (7.40/6.21 US/Imp. pt)	3 5 ltr (7.40/6.21 US/Imp. pt)
Reserve tank	0.6 ltr (1.27/1.07 US/Imp. pt)	0.6 ltr (1.27/1.07 US/Imp. pt)
Ignition System		
Ignition timing	8° B.T.D.C. below 1,000 rpm.	8° B.T.D.C. below 1,000 rpm.
Spark plug	NGK B-7HS, NIPPON DENSO W22FS	NGK B-7HS, NIPPON DENSO W22FS
Spark plug thread size D x L	14 x 12.7 mm (0.55 x 0.50 in.)	14 x 12.7 mm (0.55 x 0.50 in.)
Spark plug gap	0.7 mm (0.028 in.)	0.7 mm (0.028 in.)
Distributor point gap	0.4 mm (0.016 in.)	0.4 mm (0.016 in.)
Condenser capacity	0.15 μF	0.15 μF
Fuel System		
Number & type of carburetor	Single, VCI 30-25	Single, VCI 30-25
Venture diameter	25 mm (0.98 in.)	25 mm (0.98 in.)
Air cleaner	Wet polyurethane type	Wet polyurethane type
Fuel pump	Diaphragm type	Diaphragm type
Fuel tank capacity	30 ltr (7.93/6.60 US/Imp. gal)	30 ltr (7.93/6.60 US/Imp. gal)
Lubrication System		
Engine lubrication	CCI lubrication	CCI lubrication
Oil pump	Plunger type	Plunger type
Engine oil tank capacity	3.4 ltr (7.18/6.04 US/Imp. pt)	3.4 ltr (7.18/6.04 US/Imp. pt)
Transmission oil	1,000 cc (2.12/1.76 US/Imp. pt)	1,000 cc (2.12/1.76 US/Imp. pt)
Differential gear box oil	1,300 cc (2.75/2.31 US/Imp. pt)	1,300 cc (2.75/2.31 US/Imp. pt)
Transfer gear box oil	900 cc (1.90/1.60 US/Imp. pt)	900 cc (1.90/1.60 US/Imp. pt)
Electrical System		
Battery	NS 40Z	NS 40Z
Battery capacity & voltage	35 AH, 12 V	35 AH, 12 V
Starter	Magnetic shift, 0.6 KW	Magnetic shift, 0.6 KW
Generator	Alternator, 12 V-35 A	Alternator, 12 V-35 A
Head lamp	12 V, 50/40 W	12 V, 50/40 W
Turn signal lamp	12 V, 23 W	12 V, 23 W

Item \ Models	LJ50	LJ50V
Electrical System		
Parking lamp	12 V, 3.4 W	12 V, 3.4 W
Tail/brake lamp	12 V. 8/23 W	12 V, 8/23 W
Side turn signal lamp	12 V, 6 W	12 V, 6 W
License plate lamp	12 V, 10 W	12 V, 10 W
Back up lamp	12 V, 10 W	12 V, 10 W
Positioning lamp	12 V, 8 W	12 V, 8 W
Main fuse	30 A	30 A
Fuse box	10 A, 10 A, 15 A	10 A, 10 A, 15 A
Transmission		
Transmission gear	4-speed forward, all synchromesh, 1 reverse	4-speed forward, all synchromesh, 1 reverse
Gear shift control	Floor	Floor
Gear ratio, low	3.835 (30/14 x 34/19)	3.835 (30/14 x 34/19)
2nd	2.359 (29/22 x 34/19)	2.359 (29/22 x 34/19)
3rd	1.524 (23/27 x 34/19)	1.524 (23/27 x 34/19)
top	1.000	1.000
reverse	4.026 (27/12 x 34/19)	4.026 (27/12 x 34/19)
Transfer		
Transfer gear	2-speed with constantmesh	2-speed with constantmesh
Gear ratio, low range	3.012 (32/22 x 29/14)	2.571 (32/21 x 27/16)
high range	1.714 (24/29 x 29/14)	1.563 (25/27 x 27/16)
Clutch		
Clutch	Dry, single disc	Dry, single disc
Clutch facing size O.D. x I.D.	180 x 124 mm (7.08 x 4.88 in.)	180 x 124 mm (7.08 x 4.88 in.)
Friction area	134 sq. cm (20.7 sq. in.)	134 sq. cm (20.7 sq. in.)
Differential		
Type	Spiral bevel gear	Spiral bevel gear
Final ratio	4.875 (39/8)	4.875 (39/8)
Universal joint	Cross joint	Cross joint
Wheel and Suspension		
Tire size	6.00 - 16 in., 4PR	5.60 - 15 in., 4PR
Tire pressure, front	1.2 sq. cm (17 sq. in.)	1.2 sq. cm (17 sq. in.)
rear	1.8 sq. cm (26 sq. in.)	1.8 sq. cm (26 sq. in.)
Wheel rim size	4.50 E x 16	4.50 E x 15
Shock absorber, front and rear	Telescopic, double action	Telescopic, double action
Suspension, front and rear	Semi-elliptic, leaf spring	Semi-elliptic, leaf spring
Steering System		
Steering gear box	Ball screw nut	Ball screw nut
Steering ratio	15.58	15.58

Item \ Models	LJ50	LJ50V
Steering System		
Steering angle, out	23°30′	23°30′
in	27°30′	27°30′
Steering wheel diameter	370 mm (14.57 in.)	370 mm (14.57 in.)
Drive System		
Toe-in	5 mm (0.19 in.)	5 mm (0.19 in.)
Camber angle	1°	1°
Caster angle	3°30′	3°30′
Trail	2 mm (0.08 in.)	2 mm (0.08 in.)
King pin angle	9°	9°
Front axle	Semi floating	Semi floating
Rear axle	Semi floating	Semi floating
Braking System		
Type	4-wheel, hydraulic	4-wheel, hydraulic
Wheel brake, front	2 leading shoes	2 leading shoes
rear	Leading and trailing	Leading and trailing
Brake lining dimension L x W x T	195 x 35 x 4 mm (7.68 x 1.38 x 0.16 in.)	195 x 35 x 4 mm (7.68 x 1.38 x 0.16 in.)
Brake diameter, front & rear	210 mm (8.27 in.)	210 mm (8.27 in.)
Master cylinder	Tandem	Tandem
Master cylinder diameter	19.0 mm (0.75 in.)	19.0 mm (0.75 in.)
Parking brake	On propeller shaft, mechanical	On propeller shaft, mechanical

NOTE: The specifications subject to change without notice.

1-4. General Rules on Servicing Work

1. Clean each handtool before using it. Dirty handtools lead to sloppy work.

2. As the parts come off one after another in disassembling operation, set them aside in an orderly manner, preferably in groups properly identified. Do not hesitate paper tags and marking ink to identify the sides or ends of each part whose position or orientation in place is specified.

3. When working on electrical parts in place, make sure they are not live with battery voltage. Have the positive terminal connection of the battery undone before starting to work.

4. Some securing bolts have "S" mark on the bolt head. This mark signifies a "high-strength" bolt. They are to be used on designated parts and tightened to specified torque values.

5. Do not re-use gaskets and "O" rings that have been removed in dismantling or disassembly. Use of new gaskets and "O" rings in reassembly will prove more economical in the long run.

6. Replacement parts procured from the market, not through the parts supply channel of SUZUKI, are imitation parts. Do not use them; they may prevent the machine from giving the high performance that it is built to be capable of. Besides, use of imitation parts is likely to create hazardous conditions in the machine.

7. Some disassembly and reassembly steps are based on the use of special tools, which are available from SUZUKI. The special tools help you get the job done quickly and accurately, and ensure safety of working.

8. Often you have to jack up the front or rear end. Make it your habit to chock the wheels standing on the floor when you lift one end. Chocking or wedging wood blocks should be among regular shop tools.

9. Working on the machine lifted with a jack alone is a bad practice. Use the jack for lifting only, and, after jacking up, put a sturdy built-up stand or horse under the machine to rest the machine on it.

10. To grease or oil the rotating or sliding surfaces of a part being installed in reassembly is a standard shop practice. Your judgment as to what lubricant to apply and how much is counted on.

11. Each oil seal being installed in reassembly must be handled carefully and the space inside its lip must be filled with grease—SUZUKI SUPER GREASE A. Give a liberal amount of grease to that space.

2. SPECIAL TOOLS AND SERVICE MATERIALS

2-1. Special Tools

Ref. No.	Part No.	Description
1.	09900-09002	Shock driver set
2.	09900-21602	Engine lubrication oil measuring tool
3.	09900-25001	Pocket tester
4.	09900-27002	Ignition timing tester
5.	09900-28103	Electro tester
6.	09911-06710	Piston ring compression tool
7.	09911-70120	Hexagon wrench, 6 mm
8.	09913-16010	Carburetor fuel level gauge
9.	09913-60910	Bearing puller
10.	09913-75510	Differential rear outer race installer
11.	09913-75520	Differential front outer race installer
12.	09913-80111	Bearing installer
13.	09913-85210	Bearing installer
14.	09913-85230	Differential side bearing remover jig
15.	09920-70111	Circlip remover (small-size)
16.	09920-70120	Circlip remover (large-size)
17.	09922-55130	Bearing installer
18.	09922-55210	Front axle installer
19.	09922-65122	Transfer input shaft puller
20.	09922-66010	Rear axle remover
21.	09922-75220	Differential pre-load checking tool
22.	09922-85811	Spring pin remover
23.	09923-05110	Flywheel remover
24.	09923-05120	Flywheel remover attachment
25.	09923-36310	Clutch center guide
26.	09923-56310	Differential side bearing adjuster turner
27.	09924-36310	Bevel pinion mounting dummy
28.	09940-53110	Differential side bearing installer
29.	09942-15510	Sliding hammer
30.	09943-35511	Front drum remover

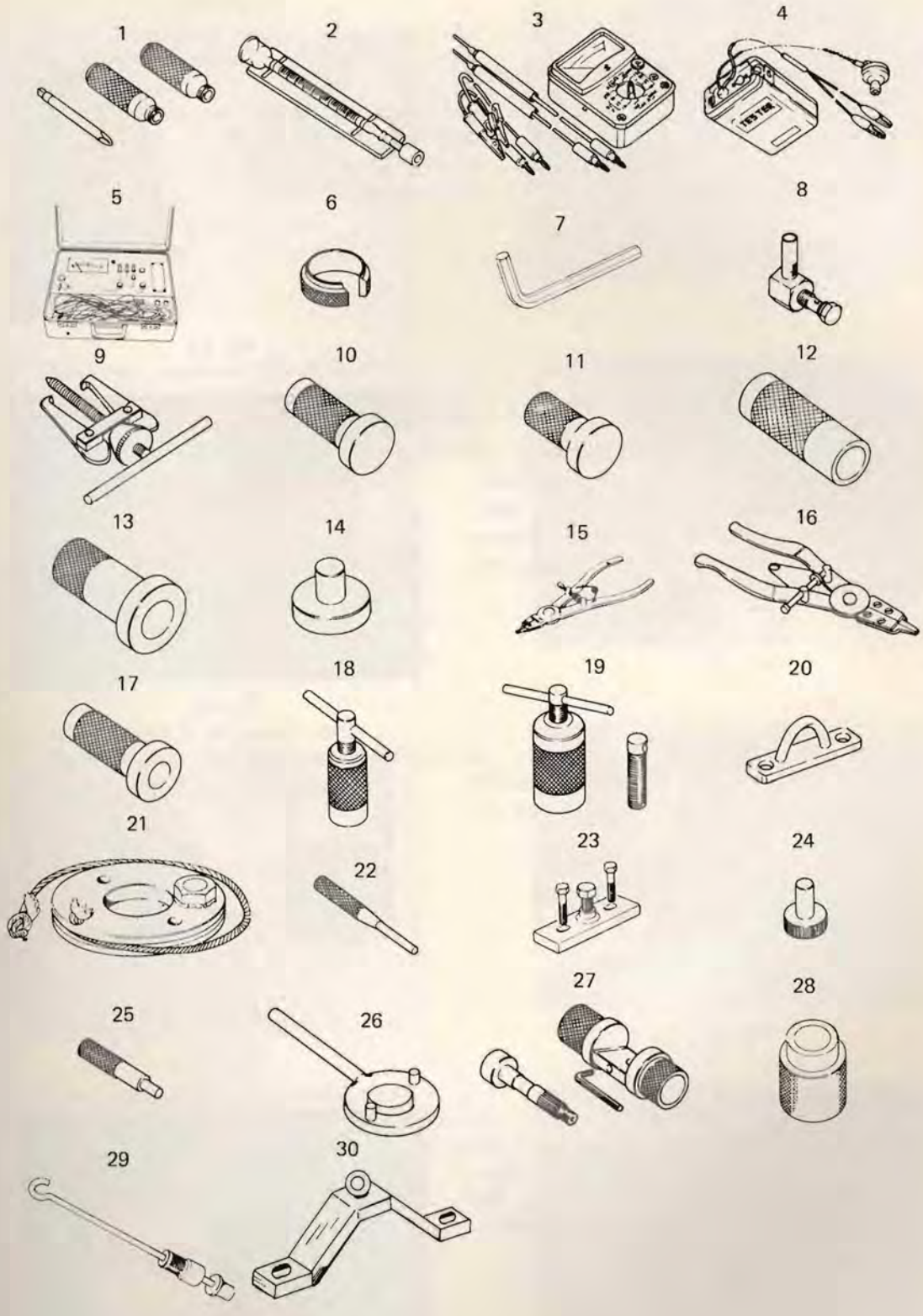
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Fig. 2-1

2-2. Use of Special Tools

1. **Shock driver set (09900-09002)**
   To be used with a hammer for driving Phillips-head screws.

Fig. 2-2

2. **Engine lubrication oil measuring tool (09900-21602)**
   It is often necessary to check the oil pump for discharge performance. This tool is for use in checking whether the pump is discharging at a proper rate or not. "Oil pump capacity or discharge rate" is specified for each model of machine; refer to the service manual.

Fig. 2-3

3. **Pocket tester (09900-25001)**
   This is a handy circuit tester capable of measuring voltage, AC and DC, resistance and DC ampereage.

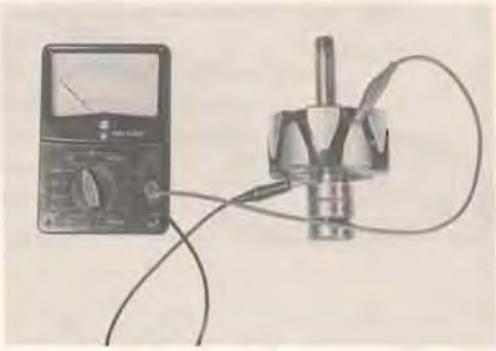


Fig. 2-4

4. **Ignition timing tester (09900-27002)**
   With this tester, you can more easily check the moment at which the contact point of the distributor begins to open—the moment of sparking. The tester tells you this moment by issuing a sound.

Fig. 2-5

5. **Electro tester (09900-28103)**
For use in measuring voltage, current, resistance and condenser capacitance; for testing the condenser for sparking performance and also for checking the ignition timing, to mention but its major capabilities. This tester operates on 100V, 117V, 220V and 240V supply voltage. Highly recommendable where thorough-going testing of electrical equipment is planned.

Fig. 2-6

6. **Piston ring compression tool (09911-06710)**
For use in inserting the piston into the cylinder. Three of this tool are needed for a three-cylinder engine of this series because the three pistons go in at the same time.

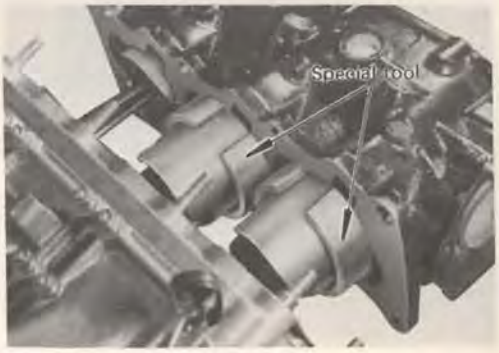


Fig. 2-7

7. **Hexagon wrench, 6mm (09911-70120)**
For holding the alternator shaft when loosening the securing nut on alternator pulley.

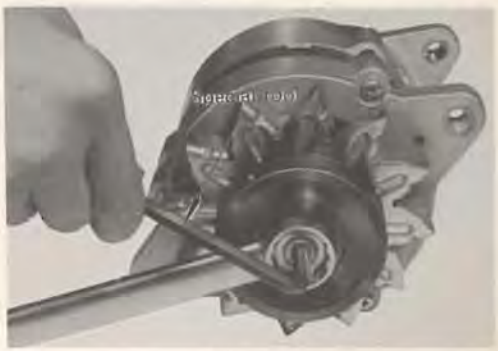


Fig. 2-8

8. **Carburetor fuel level gauge (09913-16010)**
Attach this gauge to the carburetor float chamber and idle the engine slowly to check fuel level in the chamber.

Fig. 2-9

9. **Bearing puller (09913-60910)**
Primarily for use in pulling transmission bearings off shafts. Can be used on other bearings too.

Fig. 2-10

10. **Differential rear outer race installer (09913-75510)**
11. **Differential front outer race installer (09913-75520)**
For use in a press machine to press-fit the outer races.

Fig. 2-11

12. **Bearing installer (09913-80111)**
For use with a press to press-fit bearings onto the bevel pinion.

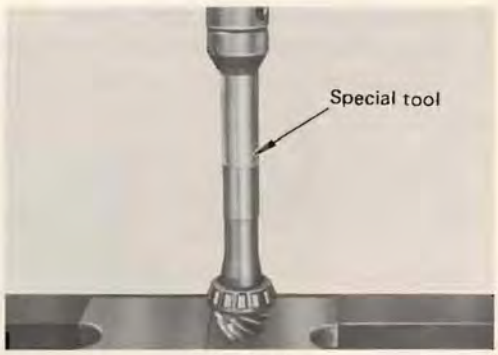


Fig. 2-12

13. **Bearing installer (09913-85210)**
For use in installing the rear shaft assembly of transfer output shaft in the transfer case.

Fig. 2-13

14. **Differential side bearing remover (09913-85230)**
For use with the bearing puller in removing the differential side bearings.

Fig. 2-14

15. **Circlip remover, small-size (09920-70111)**
16. **Circlip remover, large-size (09920-70120)**
For installing and removing circlips used in the transmission and transfer gear box.

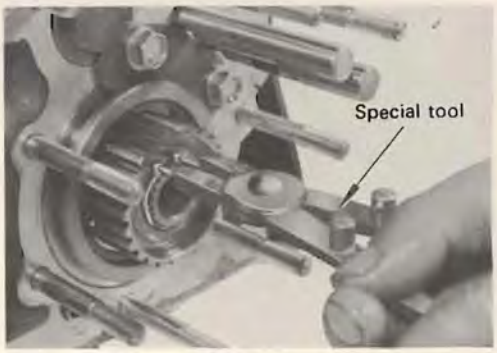


Fig. 2-15

17. **Bearing installer (09922-55130)**
For use in removing transmission countershaft and installing countershaft bearings.

Fig. 2-16

18. **Front axle installer (09922-55210)**
This is a pulling tool for use in connecting the front axle to the steering knuckles.

Fig. 2-17

19. **Transfer input shaft puller (09922-65122)**
For drawing out the transfer input shaft in transfer gear box disassembly.

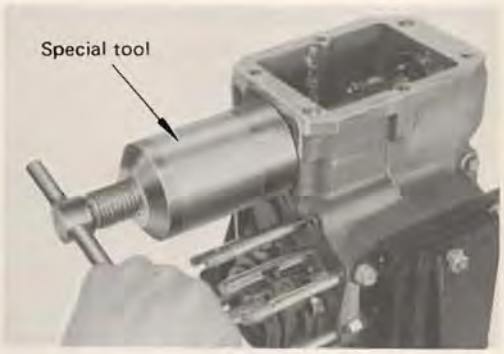


Fig. 2-18

20. **Rear axle remover (09922-66019)**
To be mounted on the axle for receiving blows from the sliding hammer.

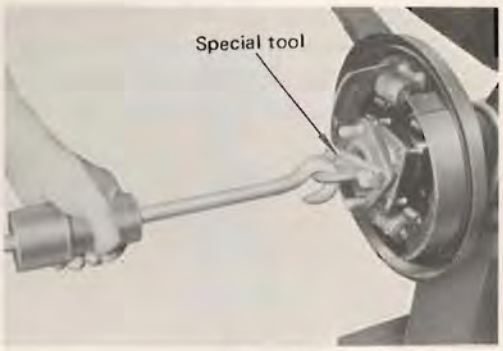


Fig. 2-19

21. **Differential pre-load checking tool (09922-75220)**
For use with a spring balance in checking drive pinion pre-load. Can be used to lock the joint yoke when loosening propeller-shaft cross joint yoke nut.

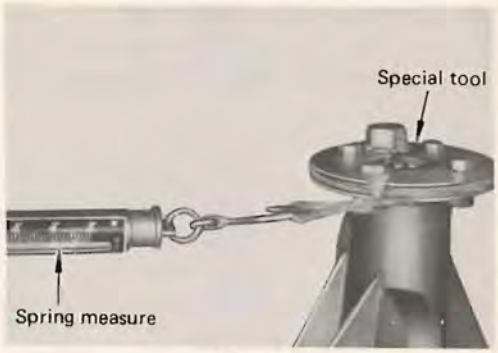


Fig. 2-20

22. **Spring pin remover (09922-85811)**
For use in pulling out the spring pins to permit removal of gear shifting forks in the transmission and transfer gear box.

Fig. 2-21

23. **Flywheel remover (09923-05110)**
24. **Flywheel remover attachment (09923-05120)**
For use in removing the flywheel in such a way that the transmission input shaft will not damage its bearings and oil seals. Insert attachment (24) into crankshaft and remove the flywheel by using remover (23).

Fig. 2-22

25. **Clutch center guide (09923-36310)**
For truing up the clutch disc to crankshaft just before securing the clutch cover in place in clutch installation. Transmission input shaft will not enter into crankshaft unless the disc has been trued and centered.

Fig. 2-23

26. **Differential side bearing adjuster turner (09923-56310)**
For use in tightening and loosening the adjuster for each side bearing. To check and set the drive pinion-to-gear backlash, the adjusters must be run in or out.

Fig. 2-24

27. **Bevel pinion mounting dummy (09924-36310)**
It is by using this dummy that the amount (thickness) of thrust washer necessary for correctly locating the pinion relative to the bevel gear can be determined. A must tool for installing the pinion in the carrier case at the time of rebuilding the differential.

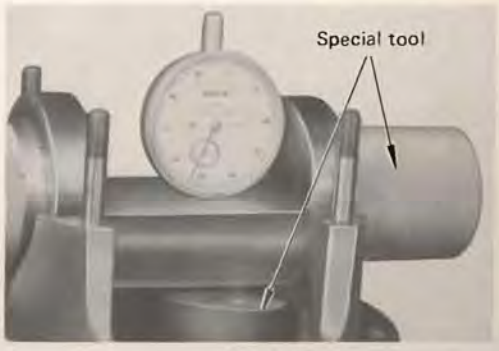


Fig. 2-25

28. **Differential side bearing installer (09940-53110)**
For use in press-fitting the side bearings.

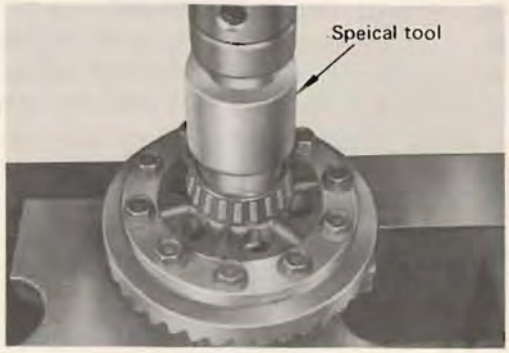


Fig. 2-26

29. **Sliding hammer (09942-15510)**
30. **Front drum remover (09943-35511)**
Mount this tool (30) on the drum and apply blows to the tool with the sliding hammer (29).

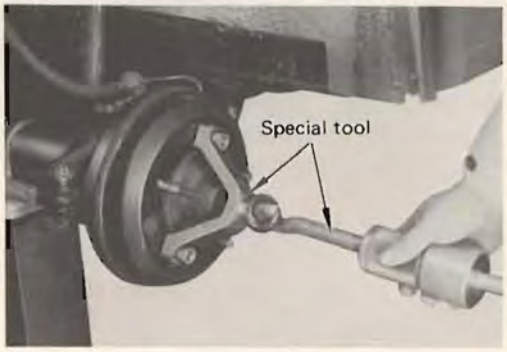


Fig. 2-27

2-3. Service Materials

The materials listed below, specially selected and supplied by the Parts Department of the Company, are for use in servicing Models LJ50 and LJ50V vehicles. Every SUZUKI distributor and dealer are required to carry a stock of these materials for ready availability to service shops in their territories. Their use adds to the durability and performance of the machine.

Item No.	Part number	Material	Description and use
1	99000-21145	 CCI engine oil	Special 2-cycle engine oil job-proven to improve the durability of SUZUKI engines.
2	99000-24120	 GOLDEN CRUISER 1200	Additive to engine cooling for improving cooling efficiency and for protection of wet walls against rusting.
3	99000-25010	 SUZUKI SUPER GREASE A	For lubricating oil seals, bearings and bushes.
4	99000-25030	 SUZUKI SUPER GREASE C	Special grease intended for use on distributor gears.

Item No.	Part number	Material	Description and use
5	99000-25040	 SUZUKI GREASE SUPER D	Special grease intended for use on constant velocity joint.
6	99000-32040	 Thread cement	To be applied to screw threads of bolts and other threaded fasteners. Very effective in preventing them from loosening.
7	99000-33010	 Liquid gasket	Sealing compound, to be applied mainly to joint faces of transmission case and crankcase.

3. ENGINE

3-1. Description

The engine is a water-cooled, in-line three cylinders, two-stroke-cycle unit with a maximum horsepower rating of 33 HP at 5,500 rpm. It is equipped with a reed valve for admitting the fuel-air mixture. Its construction is simple; its design places emphasis on high drive performance for low and intermediate cruising speed ranges—the ranges in which the machine in off-the-road duty will be driven and also for improve durability and steady-drive reliability of the machine in high-speed on-the-road cruising condition.

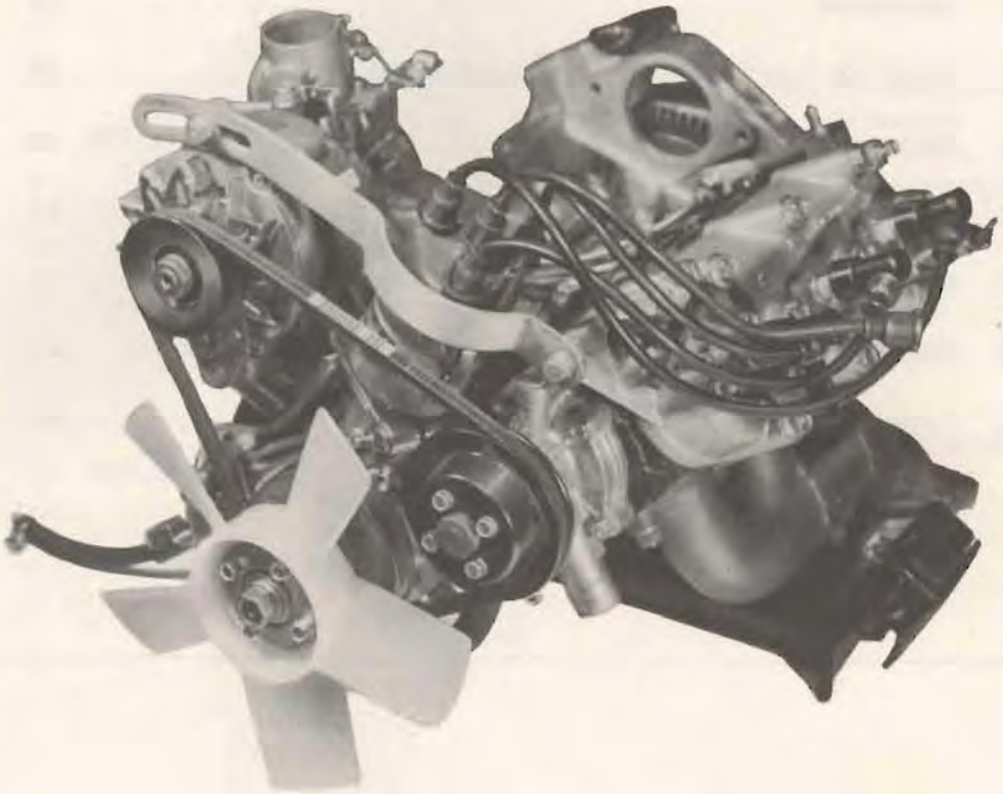


Fig. 3-1

3-2. Engine Services Not Requiring Engine Removal

The types of service listed below for the parts and components indicated alongside can be performed with the engine left in place.

	Part or component	Nature of service
1.	Spark plugs	Replacement or inspection
2.	Cylinder head	Replacement or inspection
3.	Cylinder	Replacement or inspection
4.	Pistons	Replacement or inspection
5.	Piston rings	Replacement or inspection
6.	Piston pins	Replacement or inspection
7.	Piston pin bearings	Replacement or inspection
8.	Oil pump	Replacement or control cable adjustment
9.	Oil pipes	Replacement
10.	Reed valve	Replacement or inspection
11.	Distributor	Timing adjustment, contact point inspection, point adjustment or replacement
12.	Distributor gear	Replacement or inspection
13.	Cooling fan	Replacement
14.	Pulleys	Replacement
15.	Fan belt	Replacement, inspection or tension adjustment
16.	Water pump	Replacement
17.	Distributor housing	Replacement, inspection or greasing of oil pump worm shaft and worm gear
18.	Generator	Replacement or inspection
19.	Carburetor	Replacement, inspection or adjustment
20.	Starter motor	Replacement or inspection

3-3. Dismounting the Engine

1. Disconnect battery cable from the positive terminal of the battery.
2. Loosen water drain plugs on radiator and cylinders, and thoroughly drain the engine cooling system. (Refer to the section "ENGINE COOLING SYSTEM.")
3. Disconnect two water pipes between radiator and engine.
4. Remove the bolts securing radiator, and take down the radiator from the body, complete with the shroud.
5. Disconnect water pipe between radiator reservoir tank and radiator. Undo the connection at the radiator.
6. Disconnect air cleaner from carburetor, and take down the cleaner.
7. Disconnect electrical wires from generator, starter motor and distributor.
8. Disconnect air vent pipe from distributor cap.
9. Detach starter motor from crankcase, and remove the motor.
10. Remove air cleaner mounting bracket from crankcase.
11. Disconnect throttle cable, choke cable and fuel pipe from carburetor.
12. Disconnect heater hose from inlet manifold and heater valve.
13. Disconnect oil pump control cable from control lever.
14. Disconnect vacuum hose from fuel pump.
15. Disconnect oil inlet pipe from oil pump.
16. Disconnect warm air hose from exhaust manifold.
17. Remove the nuts securing exhaust pipe to exhaust manifold, and detach the pipe from exhaust manifold by pushing the pipe down.
18. Disconnect clutch cable from engine mounting and clutch lever.
19. Remove the 6 nuts securing transmission case to crankcase.
20. Undo the engine mounting by removing bolts, right and left, thereby making the engine free to come off.
21. Detach crankcase from transmission case by pulling the engine assembly forward, and take out the engine.

NOTE:
Engine installation is to be effected by reversing the foregoing sequence of steps. When bringing the engine in toward transmission case, be sure to aim the input shaft bearing and oil seal (in the engine) to the input shaft of the transmission, so as not to damage the bearing and oil seal. The input shaft will make a smooth entry if you have this shaft slightly angled up from its normal direction.

3-4. Engine Disassembly

1. Remove exhaust manifold from cylinder.

Fig. 3-2

2. Remove clutch cover and plate.

Fig. 3-3

3. Remove generator and its stay.

Fig. 3-4

4. Disconnect and remove carburetor from inlet manifold.

Fig. 3-5

5. Remove cooling fan from its hub, and take off "V" belt.

Fig. 3-6

6. Remove water pump pulley from the pump.

Fig. 3-7

7. Remove water pipe between water pump and inlet manifold.

Fig. 3-8

8. Remove cooling fan hub and crankshaft pulley from crankshaft. When loosening the nut securing the fan hub, lock the crankshaft by inserting a rod into a hole provided in the flywheel.

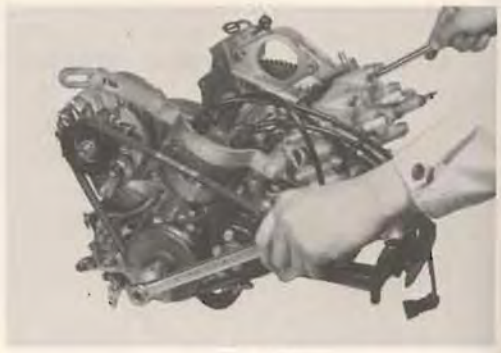


Fig. 3-9

9. Remove water pump from cylinder.

Fig. 3-10

10. Remove distributor from distributor case.

Fig. 3-11

11. Disconnect oil pipes from oil pump, and take the pump out of crankcase.

Fig. 3-12

12. Disconnect oil outlet pipe from cylinder.

Fig. 3-13

13. Remove flywheel from crankshaft. When loosening the nut securing the flywheel, be sure to lock the crankshaft by inserting a rod into a hole provided in the flywheel. Use of a two-piece special tool is involved in this step:

    Flywheel remover (09923-05110)
    Flywheel remover attachment (09923-05120)

Fig. 3-14

14. Remove cylinder head from cylinder.

    NOTE:
    Loosen cylinder head bolts sequentially and evenly by moving the wrench around from one bolt to another in the descending order of numbers engraved on cylinder head.

Fig. 3-15

15. Remove cylinder from crankcase. Be sure to loosen the securing nuts a little at a time, moving your wrench across to relieve the securing pressure evenly.

Fig. 3-16

16. Remove piston rings from piston.

Fig. 3-17

17. Take out circlips retaining the piston pin, and remove pin from piston.

Fig. 3-18

18. Remove inlet manifold from crankcase, and then take out reed valve.

    NOTE:
    There are 3 nuts on the bottom side of inlet manifold secured to crankcase. These nuts and others are to be loosened evenly by moving your wrench from one nut to another across the joint.

Fig. 3-19

19. Disconnect oil outlet pipe on crankshaft side, removing it from crankcase.

Fig. 3-20

20. Remove the two keys from crankshaft and take out distributor case from crankcase.

Fig. 3-21

21. Remove engine mounting members from crankcase.

Fig. 3-22

22. Remove the bolts fastening together the two crankcase halves, and take out crankshaft. To facilitate the separation, a bar in the shape of a plain screwdriver may be inserted into between fins to pry off the two halves.

NOTE:
Do not insert the prying tool into between the two mating faces or these faces may suffer nicks. As in other joints, the bolts mentioned above are to be loosened sequentially and evenly.

Fig. 3-23

3-5. Maintenance Services

1. Cylinder head

(1) Checking the gasketed surface for flatness

Use a straightedge and a feeler gauge to check the surface for flatness. Take gauge readings in the usual manner at each of the 6 straightedge positions indicated in the photo. If any reading exceeds 0.03 mm (0.0012 in.), repair the surface by lapping it on a surface plate with No. 200 sandpaper. Finish lap is to be made with No. 400 sandpaper.

If the gasketed surface is found so much warped that 0.15 mm (0.0059 in.) or more of surface stock must be removed in the above manner to correct it satisfactorily, then replace the cylinder head. This is because excessive grinding of this surface affects "compression ratio" to result in poor engine performance.

Cylinder gasketed flatness limit	*0.03 mm (0.0012 in.)*
Repair limit	*0.15 mm (0.0059 in.)*

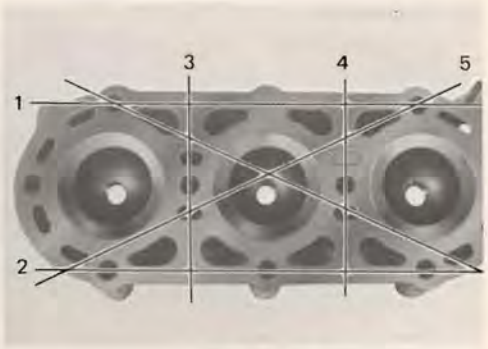


Fig. 3-24

Fig. 3-25

(2) Cleaning

Clean the cylinder head, decarboning its combustion chamber surfaces and removing scales from its water jackets.

Fig. 3-26

2. Cylinder

(1) Checking the gasketed surface for flatness

As in the case of the cylinder head, check this surface for flatness with a straightedge and a feeler gauge at each of the 6 positions indicated in the photo.

If any of the gauge readings taken exceeds 0.03 mm (0.0012 in.), repair the surface by lapping it on a surface plate, first with No. 200 sandpaper and finishing it off with No. 400 sandpaper. Replace the cylinder if this surface is so much warped as would require removal of 0.15 mm (0.0059 in.) or more surface stock.

Cylinder gasket surface flatness limit	*0.03 mm (0.0012 in.)*
Repair limit	*0.15 mm (0.0059 in.)*

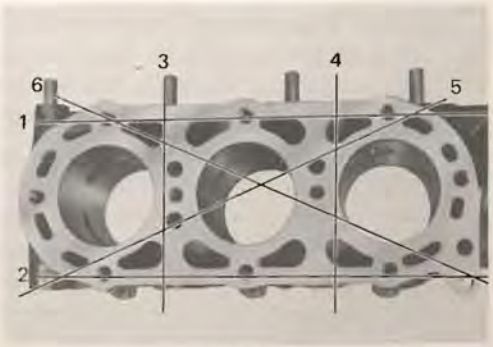


Fig. 3-27

(2) Checking the bore for wear

Using a cylinder gauge, take readings on bore diameter at the 8 places indicated. Compute the difference between maximum reading and minimum reading; the difference represents the amount of bore wear. If the wear happens to be equal to or greater than the limit indicated below, rebore the cylinder to the next oversize and replace the existing piston by an oversize piston and its oversize rings.

Cylinder bore wear limit	*0.05 mm (0.002 in.)*

Fig. 3-28

(3) Cleaning

Decarbon the exhaust port and gas passage, as shown. Carbon deposits in this part of the engine affects engine performance adversely and must therefore be removed whenever opportunity permits to do so.

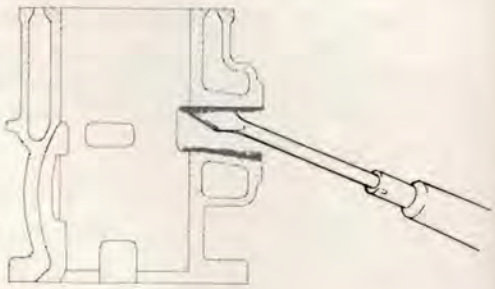


Fig. 3-29

3. Piston

(1) Checking the piston clearance

When installing a replacement piston or reboring the cylinder for an oversize piston, take accurate measurements on the bore and also on the piston to be used, and check to be sure that a proper bore-to-piston clearance is available. An excessive clearance may result in abnormal running noise; too small a clearance may cause the piston to get seized.

Read the diameter of the piston in the direction at right angles to the axis of the piston pin and at a point 38 mm (1.49 in.) above the skirt bottom. From this reading, subtract the minimum bore reading; the difference is the available clearance.

Instead of the cylinder gauge and micrometer, a feeler gauge may be used to check the bore-to-piston clearance, as shown. In this case, the piston must be inserted into the bore from the bottom end of the cylinder and the clearance checked at the portion, stated above, of the skirt.

Standard piston clearance in the bore	*70 ~ 80 μ (microns) (0.00275 ~ 0.00315 in.)*

Fig. 3-30

Fig. 3-31

Cylinder gauge

(2) Inspection

Visually examine the surfaces of each piston for scratch marks, signs of burns or seizing tendency; and see if the rings free from any sticking in the groove. Minor scratch marks can be and should be removed by grinding. If the piston is badly grooved, replace it.

Where excessive "blowby" is complained of or is suspected, check to be sure the piston rings are in sound condition and a proper bore-to-piston clearance is available. Poor piston lubrication can be the cause of excessive "blowby," which is due, in most cases, to a defective lubrication system.

Fig. 3-32

4. Piston rings

Apart from other signs of a defective piston ring, an excessively large end gap of a ring means that the ring has served long enough and needs to be replaced. Continued use of such a ring will impede the full output power delivery of the engine. Determine whether the rings removed in disassembly must be replaced or not by referring to the following data:

Piston ring end gap data	
Original	*0.3 mm (0.012 in.)*
Limit	*0.7 mm (0.027 in.)*

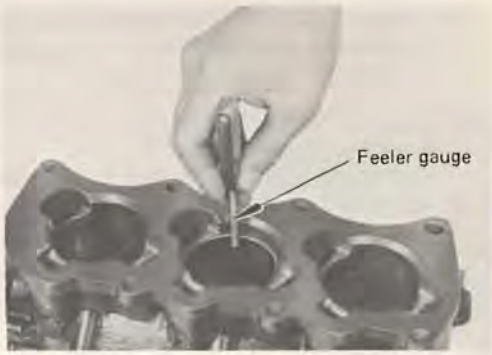


Fig. 3-33

38 mm (1.49 in.)

5. Piston pin

A needle roller bearing is used in the small end of the connecting rod. After disassembly, check for bearing rattle by tentatively building up an assembly of piston, piston pin and connecting rod, with the bearing installed in the small end, and by pulling the piston up and down while holding the connecting rod firmly. If any rattle is felt, replace worn parts.

There must be no sensible play or rattle when the assembly is tested as above. If an assembly exhibiting a play or rattle is re-used, the needle roller bearing will soon fail, resulting in a failure of the engine.

Fig. 3-34

Feeler gauge

6. Crankshaft

(1) Checking the big end play

This play is to be checked in terms of swaying or rocking movement which the big end will exhibit when pushed and pulled by hand in axial direction, as shown in Fig. 3-35. With the square rule held, as shown, measure the amount of sway of the small end. If the sway or rocking movement is greater than the limit indicated below, the crankshaft, connecting rod or bearing must be replaced. Chattering noise coming from inside the engine is often due to a rattling condition of the big end.

Maximum permissible sway of small end	*5 mm (0.2 in.)*

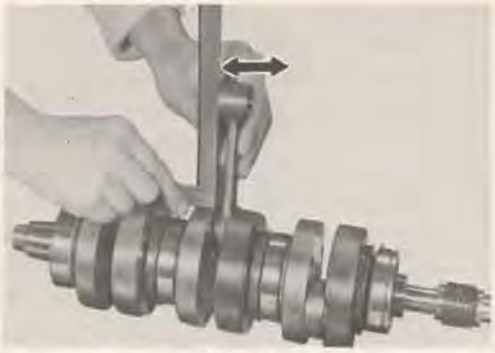


Fig. 3-35

(2) Crankshaft alignment check

Take a crankshaft deflection reading by rigging up the crankshaft as shown with the dial indicator spindle pointing squarely against the reference part of the shaft. Replace the crankshaft if it is found to deflect as much as the limit stated below:

Maximum permissible crankshaft deflection	*0.05 mm (0.002 in.)*

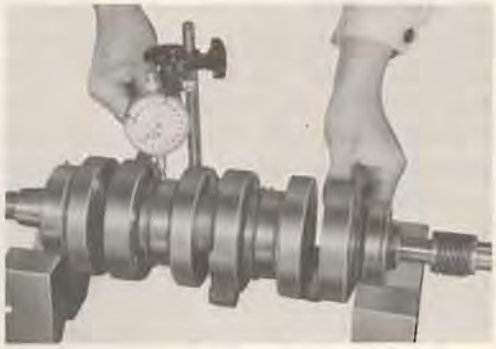


Fig. 3-36

(3) Bearing inspection

Check each crankshaft bearing by rotating and spinning it around the shaft to see if it has any rattle or makes grating noise and, if it does or otherwise exhibits evidence of malcondition, replace it.

Fig. 3-37

7. Reed valve

The reed valve is for preventing the air-fuel mixture from "blowing back" particularly when the engine is running in its low speed range. It is an important functional part of the engine. Whenever the reed valve assembly is removed, make sure that each reed is capable of smooth seating and unseating movements and that it eats with full face contact.

Fig. 3-38

3-35

3-36

3-37

3-38

3-6. Engine Reassembly

1. Tightening torque data

Fastening part	*Tightening torque*	
	kg-cm	*lb-ft*
Cylinder head bolt	*400 ~ 500*	*28.9 ~ 36.1*
Cylinder nut	*180 ~ 240*	*13.0 ~ 17.3*
Flywheel nut	*1,300 ~ 1,500*	*94.0 ~ 108.3*
Crankcase bolt (10 mm dia.)	*250 ~ 300*	*18.0 ~ 21.7*
Crankcase bolt (8 mm dia.)	*150 ~ 200*	*10.8 ~ 14.5*
Crankshaft pulley	*800 ~ 900*	*57.8 ~ 65.0*
Oil pump union bolt	*35 ~ 45*	*2.6 ~ 3.2*

2. Crankcase

(1) Clean the mating faces of the upper and lower crankcase halves, removing gummy matters from these faces and washing the crankcase with cleaning fluid. Before joining the crankcase halves, apply the liquid gasket (99000-33010) uniformly to the mating face of the upper half.

Fig. 3-39

(2) Check to be sure the three oil passages for supplying lubricating oil to the crankshaft bearing are clear.

(3) Be sure to install the crankshaft bearing locating ring and two crankcase dowels.

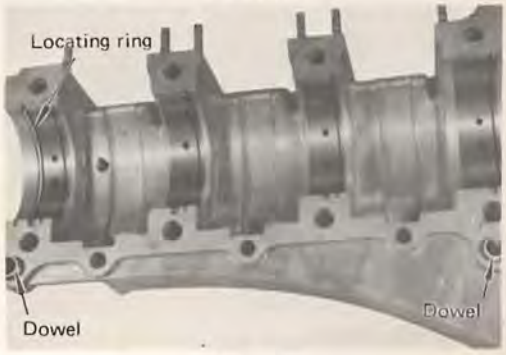


Fig. 3-40

3. Crankshaft

(1) Before positioning the crankshaft in place, fill up the circular space between oil seal lips with SUZUKI SUPER GREASE A, and fill the clutch-side pocket of the input shaft needle roller bearing with SUZUKI SUPER GREASE C, making this pocket 60% full.

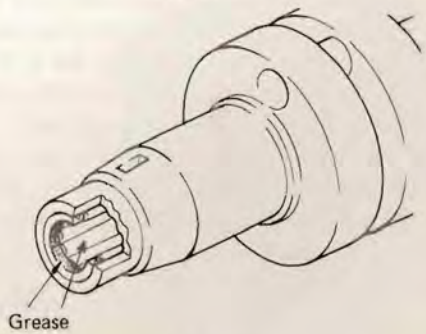


Fig. 3-41

(2) After positioning the crankcase, fit the bearing locating dowel to the recess provided in the crankcase. Be sure to insert the oil seal guide plate into the groove cut out in the crankcase.

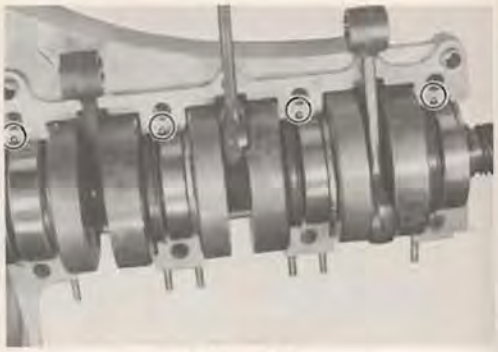


Fig. 3-42

(3) Before installing the crankshaft, give a liberal amount of CCI oil to the crankshaft bearings and big end bearings. Instead of CCI oil, a high-grade two-cycle engine oil may be used.

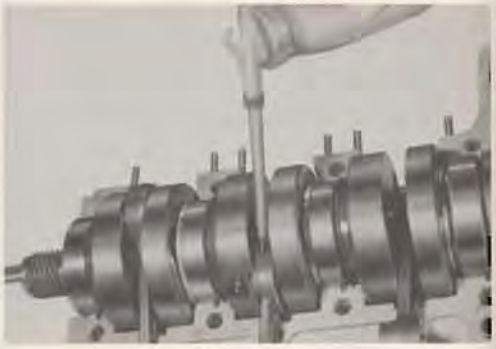


Fig. 3-43

4. Pistons

Be sure to position each piston in such a way that the arrow mark provided on the piston head points toward the exhaust side.

Fig. 3-44

5. Piston rings

(1) Top, or first, ring is of keystone type; 2nd and 3rd rings are of flat type. Each ring has a letter marking on its side, "IRN" for first ring and "RN" for 2nd and 3rd rings. The rings are to be positioned in their respective grooves in such a way that the letter marking comes on the top side.

(2) The expander ring comes into the second groove to back up the 2nd ring. The expander is used to eliminate the possibility of the piston making abnormal noise.

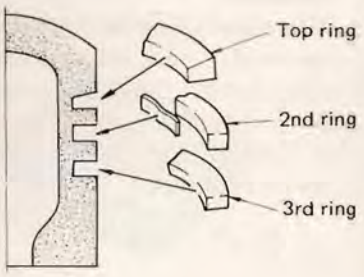


Fig. 3-45

Exhaust side

Top ring

2nd ring

3rd ring

6. Cylinder

(1) Before putting the cylinder over the pistons in place, oil the piston and piston rings to facilitate the entry of piston into the cylinder.

Fig. 3-46

(2) Use the three-piece special tool (piston ring compression tool) is mandatory in admitting the piston into the cylinder.

Piston ring compression tool (09911-06710)

Fig. 3-47

7. Cylinder head

Be sure to tighten the cylinder head securing bolts sequentially in the ascending order of numbers.

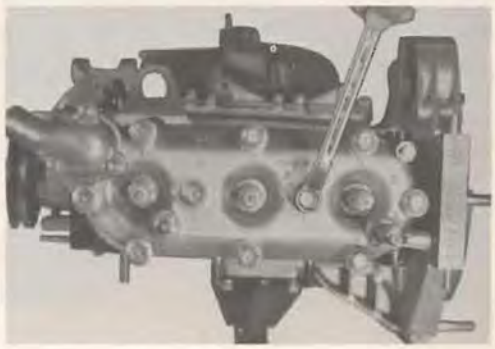


Fig. 3-48

8. Reed valve

The reed valve takes its position with its valve stopper coming on the crankshaft side.

Fig. 3-49

9. Inlet manifold

When tightening the securing nuts, be sure to tighten the nuts a little at a time and sequentially, so as to equalize the pressure of fastening the manifold flange to the crankcase.

Fig. 3-50

10. Distributor case

Before installing the distributor case, fill its grease space with SUZUKI SUPER GREASE C, making the space 80% full.

Fig. 3-51

11. Oil pipe

Be careful not to strain the oil pipe when making up its connection on the crankshaft side. The pipe as installed must be in relaxed condition.

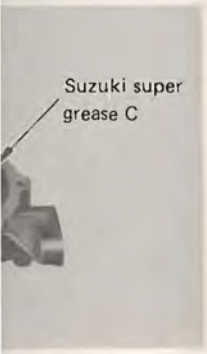
Fig. 3-52

12. Flywheel

Before starting to tighten the flywheel nut, insert a proper rod into a hole provided in the flywheel to lock the crankshaft.

Fig. 3-53

0



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13. Clutch plate and cover

Use the clutch center guide to install the clutch plate and cover.

This tool is to be inserted into the crankshaft to center the clutch disc; the clutch cover is to be secured in place with the clutch disc so centered.

Clutch center guide (09923-36310)

Fig. 3-54

14. Water pump pulley

Be sure to position the pulley as shwon. This pulley comes on the side where it faces the water pump.

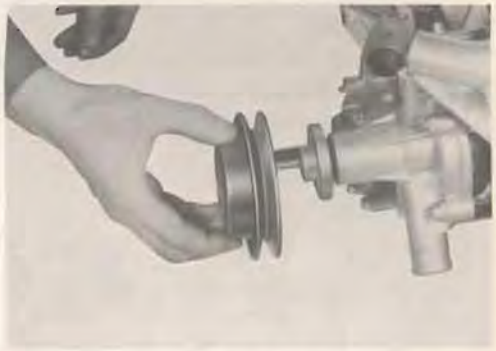

Fig. 3-55

15. Crankshaft pulley and cooling fan hub

The pulley comes on the inner side, and the embossed portion of the cooling fan hub too comes on the inner side.

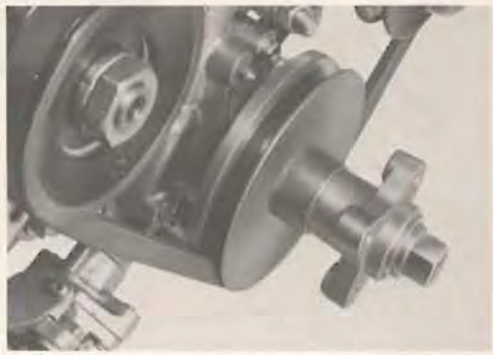

Fig. 3-56

16. Cooling fan

The cooling fan has the letter "F" engraved on it. The fan is in correct position when this face with the letter "F" come on the outer (forward) side.

Fig. 3-57

17. Carburetor net

This net, located at the entrance of the inlet manifold, is for facilitating the entry of the air-fuel mixture. It takes its position as guided by the recess provided in the inlet manifold, into which its stopper fits. When installing the carburetor, make sure that this net is properly positioned on the manifold.

Fig. 3-58

18. Thermo unit

When installing the thermo unit in the cylinder, be sure to position the unit in such a way that its air bleed valve comes on the top side.

Fig. 3-59

3-58

. 3-59

3-7. Engine Lubrication

The oil pump lifts oil contained in the oil tank and delivers pressurized oil through its four independent discharge ports. From three of these ports, oil reaches crankshaft bearings and connecting rod big ends through respective paths. From the last discharge port, the oil divides into three paths leading to the respective pistons and lubricates their sliding clearances in the cylinders. Thus, each running part receives a fresh supply of lubricating oil.

The pump is driven from and runs with the engine crankshaft and the rate of oil discharge is indirectly controlled by the accelerator pedal through the oil pump control lever. This lever is mechanically linked to the accelerator pedal. The overall effect of this arrangement is that the pump delivers oil at a rate proportional to engine load, so that each running part receivers no more and no less oil than is needed by it under varying running conditions of the engine.

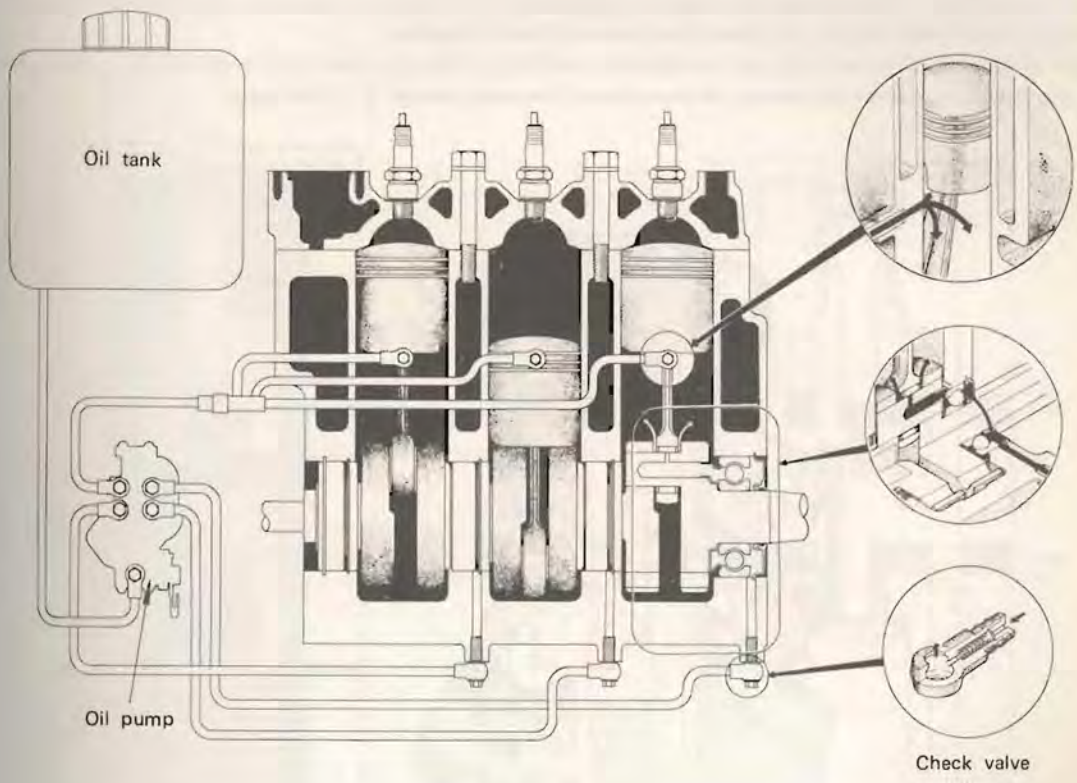

Fig. 3-60

1. Oil pump construction

Referring to Fig. 3-61 showing the construction of the oil pump, note that the pump plunger is meshed with the worm gear. For each 22 rotations of worm gear, the plunger makes only one complete rotation; the gear ratio is 22 to 1.

The peripheral part of the plunger bottom is characterized to function as a cam. By this cam surface, the plunger is capable of vertical and rotary movements as guided by the control lever shaft.

This plunger is called the main plunger to distinguish it from two other plungers associated with it. One is the differential plunger directly linked with the main plunger. The other is the sub-plunger, which is inserted into the differential plunger. By spring force, the sub-plunger is urged upward whereas the main and differential plungers are both urged downward.

The differntial plunger has two inlet ports at its middle part and two outlet ports, one at its top and one at its bottom end. Corresponding to these ports, the oil pump body has two inlet holes at its middle section and a total of 4 discharge holes above and below the two inlet holes. When the differential plunger makes one rotation and one cycle of up-and-down movement at the same time, a volume change takes place. During this composite movement, the inlet holes and outlet holes of the pump body meet their corresponding ports provided in the differential plunger to perform oil suction and discharge, respectively. "Volume change," mentioned above, reverse to the volume of the oil chamber.

Moving the control lever increases or decreases the vertical strokes of the differential plunger, depending on the direction of lever movement, to increase or decrease the rate of oil discharge.

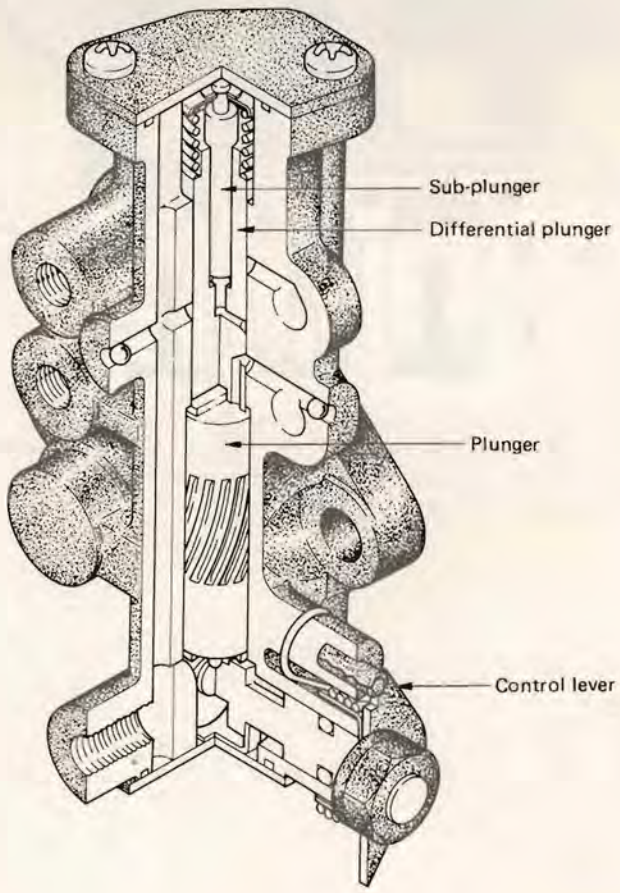

Fig. 3-61

2. Oil pump operating principles

(1) Oil delivery from discharge ports 0_1 and 0_2

As the differential plunger goes down, oil chamber (C) draws in oil through suction hole (1 or 4) which is communicated to the pump suction port (I). The path of this oil flow extends through the top portion of the plunger. The plunger then rises while rotating. As this occurs, the sub-plunger reduces the oil-filled volume of oil chamber (C) in a manner resembling the action of a plunger pump. When the differential plunger has turned a half rotation, the discharge hole (2 or 3) meets the oil pump discharge hole to allow the oil to be discharged from discharge port (0_1 or 0_2).

(2) Oil delivery from discharge ports 0_3 and 0_4

As the differential plunger goes down, oil chamber (D) draws in oil through suction hole (4) provided in the differential plunger; the oil comes from the pump suction port (I) as in the preceding case (delivery from ports 0_1 and 0_2). The suction developing in chamber (D) is due to the difference in diameter between main plunger and differential plunger. Next, the plunger rises while rotating, causing the volume of chamber (D) to contract, thus forcing the oil out (when the differential plunger has turned a half rotation) through the discharge holes (5 and 6) of differential plunger and delivering it out from discharge ports (0_3 and 0_4).

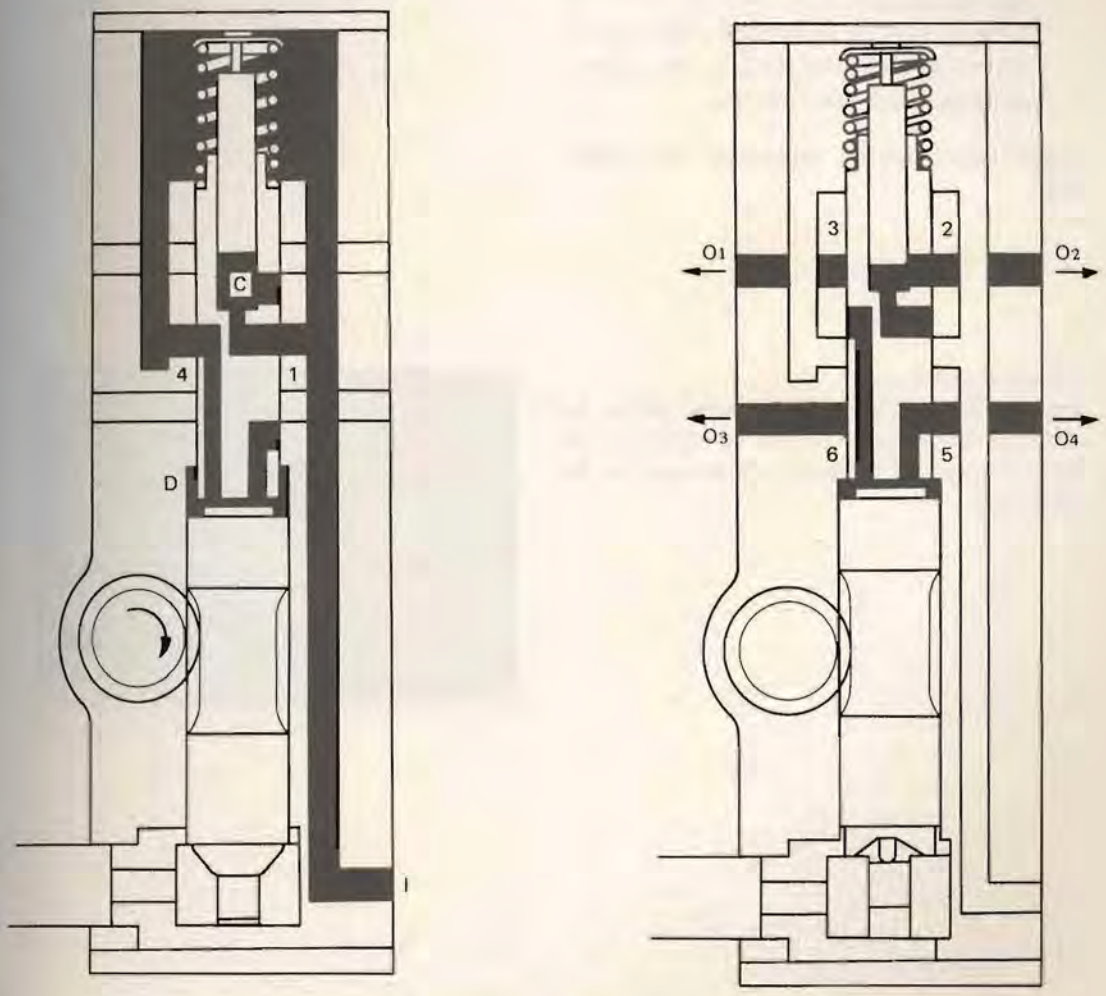

Fig. 3-62

3. Oil pump services

The oil pump has a dual function of pumping and metering the oil in small but precisely measured quantities. As such, the pump is a precision-machined device, whose overhaul demands a high degree of skill and also special equipment. For this reason, it is strongly advised not to attempt to overhaul this pump in your shop. Two services are expected of you; one is the verification of the discharge rate by means of a special measuring tool, and also the adjustment of the oil pump rod for setting the discharge rate.

(1) How to check the discharge rate
Start up the engine and bring it up to normal operating temperature. With the engine fully warmed up, proceed as follows:
(a) Intall the measuring instrument on the inlet side of the oil pump.
(b) Run the engine at 1,000 rpm.
(c) Pull up the oil pump lever all the way and start reading the instrument indication.
(d) After exactly two minutes of operation, check the amount of oil reduction. If the reduction is noted to be between 3.2 cc and 3.9 cc, it means that the pump is set properly and its discharge rate is normal.

Engine lubrication oil measuring tool (09900-21602)

Fig. 3-63

(2) Method of adjustment
Have the accelerator pedal released. Adjust the oil pump control cable so that the clearance between the control lever and the stopper pin becomes zero.

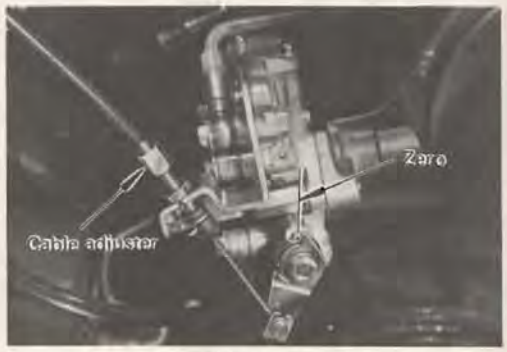

Fig. 3-64

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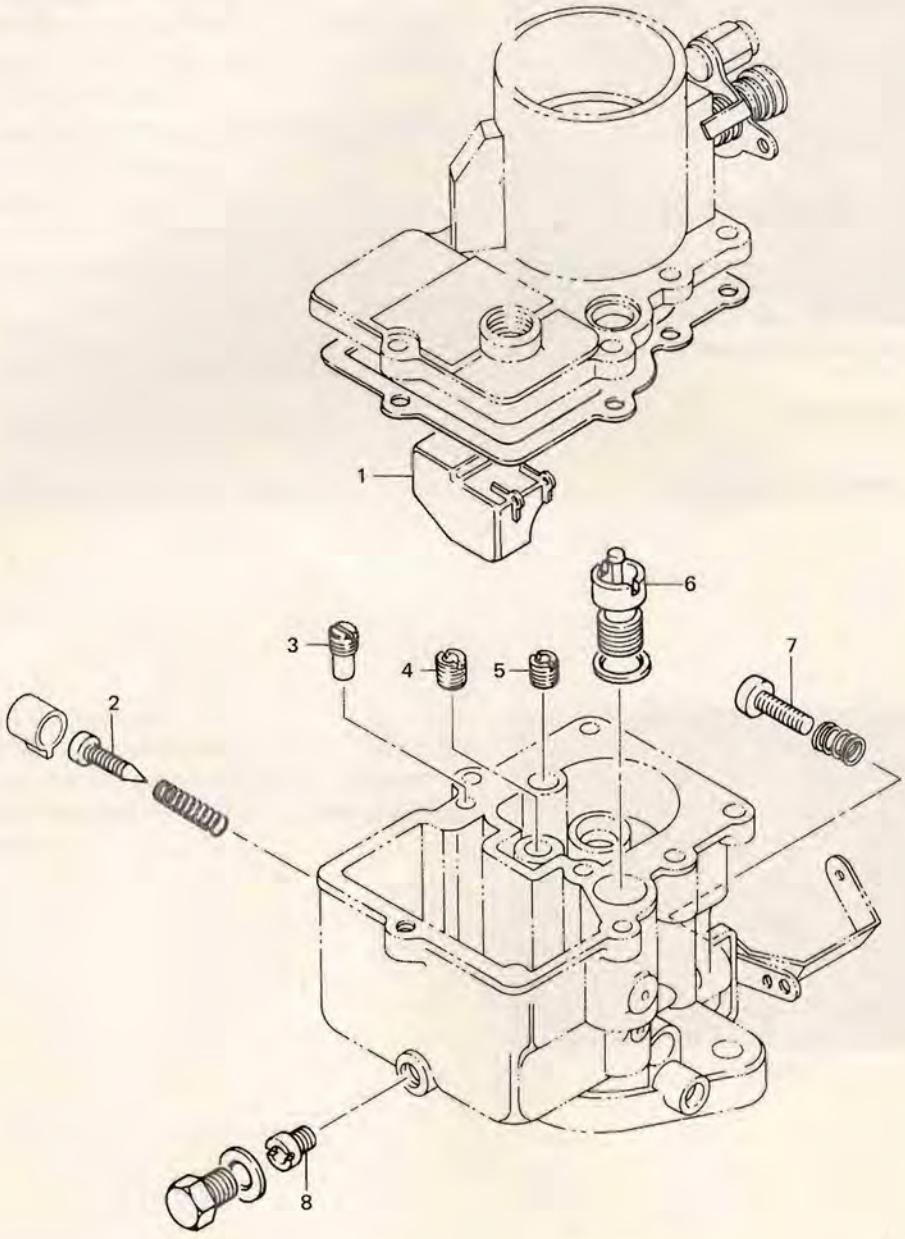
4. CARBURETOR

4

4-1. Description

The carburetor is of the downdraft Solex type, complete with an accelerating pump and a manually controlled choke valve. Its construction is such that there is no difficulty of inspecting, servicing and adjusting its various parts.

A special inner vent scheme incorporated in the float chamber admits outside air into the chamber without letting out the fuel vapor, and effectively curbs down the tendency of the air-fuel mixture from becoming overrich when the filter element in the air cleaner is becoming clogged with dust.



1. Float
2. Idle adjusting screw
3. Slow jet
4. Main air jet
5. Slow air jet
6. Power jet
7. Throttle adjusting stop screw
8. Main jet

Fig. 4-1

4-2. Carburetor Specifications

Item	*Specification*
Venturi diameter	*25 mm*
Main jet	*# 127*
Main air jet	*# 110*
Slow jet	*# 48*
Slow air jet	*# 120*
Idle adjusting screw	*1-1/4 rotations backed off*
Power jet	*# 80*
Needle valve diameter	*1.5 mm*
Accelerating pump discharge rate	*0.5 ~ 0.7 cc per cycle*

4-3. Carburetor Operation

1. Float chamber

Fuel being pressure-fed from the fuel pump is admitted into the float chamber by the action of the needle valve actuated by its float. The float and needle valve operate in such a way as to maintain a constant fuel level within the chamber.

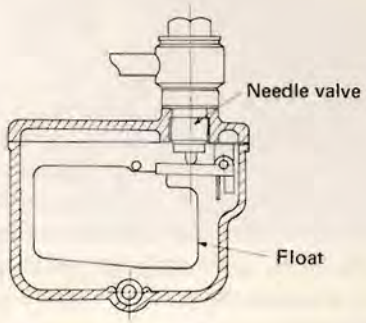


Fig. 4-2

2. Slow system

From the float chamber, fuel flows to the main fuel path through the main jet. It then branches off upward from the main path and undergoes a metering action as it flows through the slow jet. The metered fuel mixes with the air that has been metered by the slow air jet. The mixture is sprayed out into the air horn from two ports—bypass port and idle port—located near the throttle valve.

When the engine is idling, the mixture spray occurs mainly at the idle port. The rate of this spray is adjustable; the adjusting means is the idle adjusting screw. Running in the adjusting screw makes the mixture lean, and vice versa.

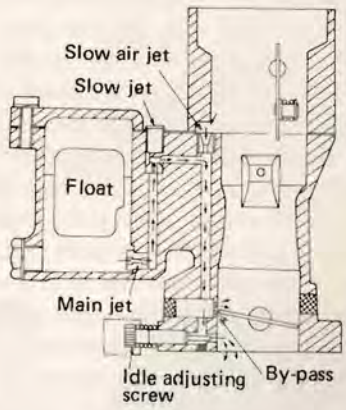


Fig. 4-3

3. Main circuit

Fuel reaching the main jet comes from the float chamber. This jet meters out the fuel and passes it toward the emulsion tube located in the airhorn (main bore). In the emulsion tube, the fuel becomes "emulsified" by the air being forwarded from the main air jet, which meters this air. The mixture of fuel and air is sprayed out from the nozzle of the emulsion tube.
When the engine is running in its high speed range, the air-fuel mixture is produced by the above circuit. Both the slow circuit and the main circuit operate when the engine is runnig with an intermediate speed.

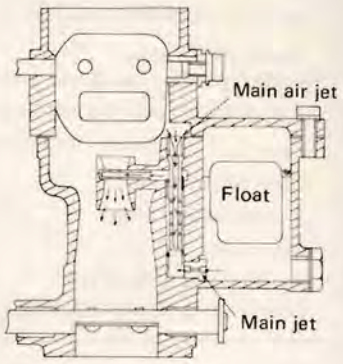


Fig. 4-4

4. Accelerating circuit

Without the accelerating circuit, the engine would not pick up speed fast enough; its response to the throttle pedal would be sluggish. This is because air as well as gasoline has a mass and takes some time to acquire a velocity. Thus, depressing the pedal abruptly would neither increase the air-fuel mixture nor enrich the mixture right away.
This situation is altered by the presence of the accelerating pump in the circuit. The operating lever for this pump is linked to the throttle lever. As you depress the accelerator pedal, making the throttle valve more than 50 to 60% full open, the operating lever pushes down the pump piston to force the fuel in the pump chamber out through the outlet check valve. Because of the pressure, the inlet check valve closes when this occurs. The forced-out fuel is then sprayed out from the accelerating injector nozzle into the main bore. This series of events takes place rapidly to enable the engine to pick up speed in quick response to the accelerator pedal movement for acceleration; and the response is particularly sharp for acceleration from the idling engine speed or a low-speed cruising condition. After the injection of a slug of fuel in this manner, the outlet check valve closes and the inlet check valve opens, when the pedal is released even slightly upon attaining the desired speed; and then fuel flows into the pump chamber from the float chamber as the piston recedes.

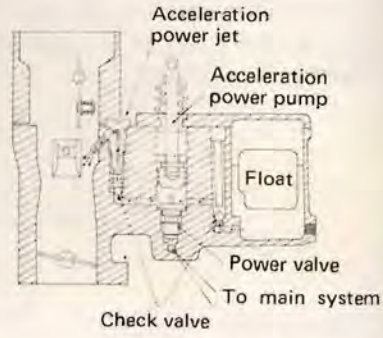
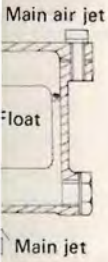
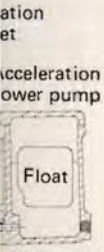


Fig. 4-5

4-4. Carburetor Removal

1. Remove the air cleaner from its mounting stay.
2. Disconnect the throttle cable and starter cable from carburetor.
3. Loosen the screw on oil pump control cable clamp, and disconnect this cable from carburetor.
4. Disconnect fuel pipe from carburetor.
5. Remove the two nuts securing carburetor in place, and take off carburetor.





4-5. Disassembly

1. Pull off the split pin (upper) from the adjusting rod for accelerating pump and throttle valve.

Fig. 4-6

2. Remove the bolt securing the cable guide to carburetor body.

Fig. 4-7

3. Remove the five screws securing the choke chamber, and take off this chamber.

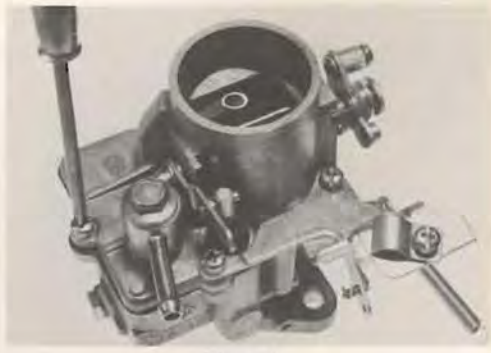


Fig. 4-8

4. Unscrew each jet with a plain screwdriver, and remove it from carburetor.

Fig. 4-9

5. Remove the injector spring bolt for accelerating pump, and take out the injector spring and steel ball. Be careful not to misplace the spring and ball.

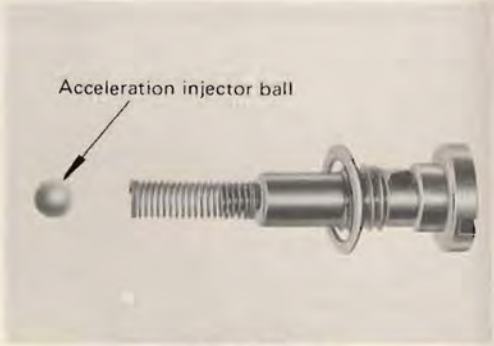


Fig. 4-10

6. Remove float pin and take out the float.

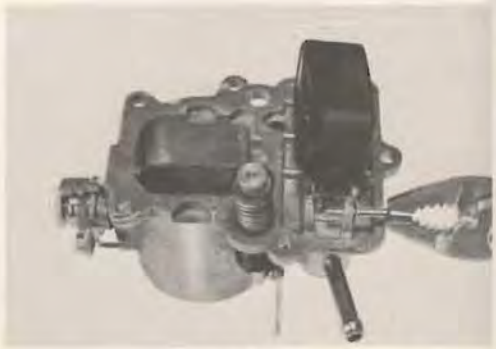


Fig. 4-11

4-6. Carburetor Services

1. Inspecting the jets

Inspect each jet for evidence of clogging; and wash it with gasoline, drying it by blowing with compressed air. A jet approaching clogged condition shows up as poor engine operation in low-speed range (if the slow jet is in such a condition) or in high-speed range and in acceleration (if the main air jet or main jet is in such a condition).

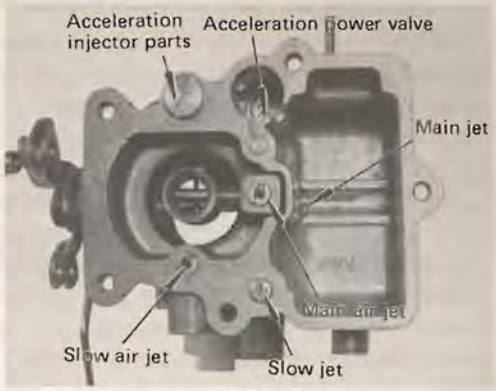


Fig. 4-12

2. Inspecting the needle valve

Fig. 4-13 shows the needle valve in seated condition and also in a magnified view. The valve is actuated by the float, and unseats itself when the fuel level falls in the chamber, thereby admitting fuel through the small clearance between its conical face and the seat. Any tendency of the float chamber to spill out fuel due to flooding or a chattering condition of the needle valve bespeaks advanced wear of the seating face or some foreign matters stuck to the seat or valve face. With these connections in mind, examine the needle valve closely and, as necessary, wash it clean. Make sure that the valve is capable of moving up and down smoothly.

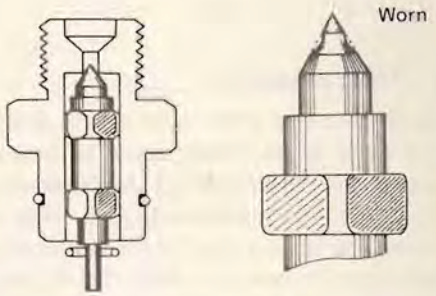


Fig. 4-13

3. Checking the float chamber fuel level

Rig up the special measuring tool on the float chamber, as shown in Fig. 4-14, and run the engine at about 800 rpm to see if the float and needle valve maintains the fuel surface at 24 mm (refer to Fig. 4-14).

Fuel level gauge (09913-16010)

Prescribed fuel level	*24 mm (0.94 in.)*

Fig. 4-14

4. Fuel level adjustment on the float chamber

If the fuel level checked is off the prescribed 24 mm, remove the float and bend its adjusting tongue upward (to lower the level) or downward (to raise the level). It is by this tongue that the float actuates the needle valve.

Fig. 4-15

5. Inspecting the choke valve and throttle valve

Turn the choke valve into fully closed position in the carburetor removed from the engine, and see if there is any visible clearance around the valve disc in the bore. The valve must be replaced if any clearance is noted.

Check the adjustment of the linkage between choke valve and throttle valve by moving the former into fully closed position. As you do so, the throttle valve should move to a partially open position, forming an angle of about 17° with respect to the axis or longitudinal centerline of the main bore; if not, that is, if the angle is larger or smaller than this value, correct it by bending the rod. This adjustment is important for securing stable "fast idle" condition.

Fig. 4-16

5–1

5–2

5–3

6. Idling adjustment

The throttle stop screw is the means of setting the engine idling speed, which should be between 750 rpm and 850 rpm. This screw is to be adjusted when the engine is hot. The procedure is as follows: Start up the engine and bring it up to normal operating temperature, which shows up as 80°C (176°F) of engine coolant; and position the screw by running it in or out to make the engine idle at a speed within the range stated above.

The setting of the idle adjusting screw is specified. With this screw set as specified, the carburetor will produce a proper air-fuel mixture for engine idling.

Fig. 4-17

5-1. Air cleaner

1. Description

The filtering element of the air cleaner is of wet type, polyurethane in material; it is high in dust trapping efficiency and is washable.

Where the machine is equipped with an optional car heater, the air cleaner case is complete with a selector lever for use in cutting in the supply of warm air from the area around the engine exhaust manifold. When this lever is in "Winter" position, the warm air flows into the carburetor, thereby preventing frost formation in the carburetor. This feature is to be utilized when the machine is operated in freezing weather.

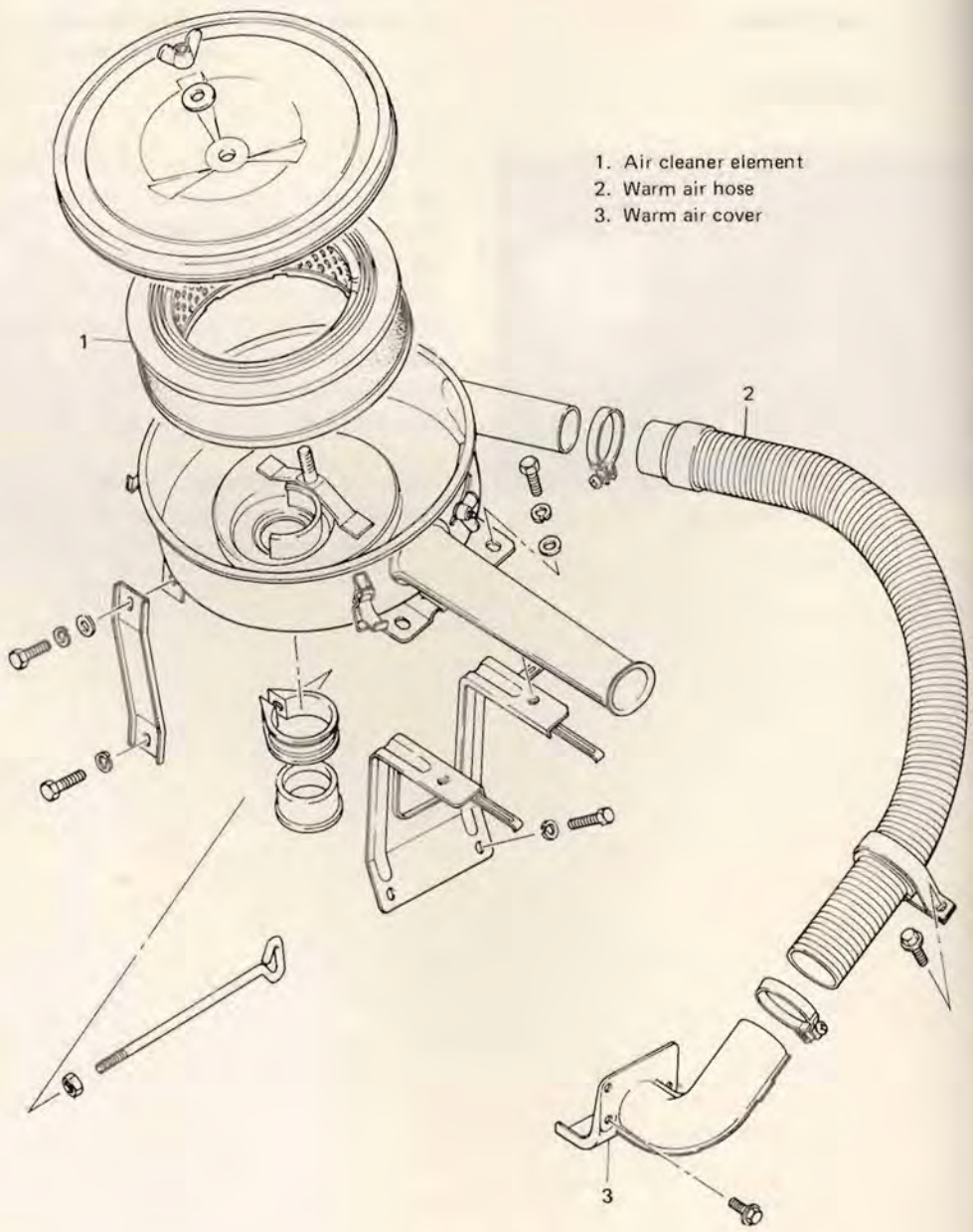


Fig. 5-1

n dust trapping

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ted in freezing

2. Air cleaner removal

(1) Remove the three nuts securing the air cleaner to its stay.

(2) Loosen the screw on the band fastening the warm air hose to the air cleaner case, and pull the hose end off the case.

(3) Loosen the band shaft on the connection between carburetor and air cleaner.

3. Air cleaner removal

(1) Remove the wing nut holding down the air cleaner cap. Remove the three clips and take off the cap.

Fig. 5-2

(2) Release the filter element from its holder, and take out the element.

Fig. 5-3

4. Air cleaner services

(1) Filter element

Inspect the element for evidence of clogging. If it is found dirty, wash it clean in gasoline contained in a properly sized vessel; after washing, thoroughly squeeze off gasoline; apply CCI oil or a high-grade two-cycle engine oil of SAE 30 to the element; and wring the element lighly to make the element wet with oil.

A clogged element obstructs the flow of intake air, and this condition shows up as excessive exhaust smoke, poor fuel consumption and some loss of engine output power. The filter element, therefore, should be periodically inspected for cleanliness, washed clean or replaced as necessary. The following washing and replacement intervals should be observed:

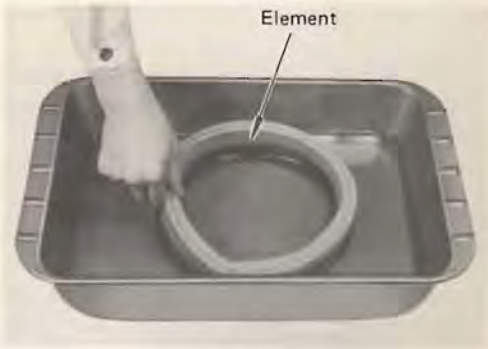

Fig. 5-4

Washing interval	*2,500 km (1,500 miles)*
Replacement interval	*20,000 km (12,000 miles)*

(2) Use of the selector lever

A mispositioned selector lever can cause the carburetor to get "iced" in freezing weather or the engine to overheat in hot weather. This lever is to be positioned according to the atmospheric temperature, i.e., in WINTER position when the outside temperature is 20°C (68°F) or below, or in SUMMER position when the outside temperature is above 20°C (68°F).

Warm-air selector lever position	
Atmospheric temperature	*Lever position*
20°C (68°F) or below	*WINTER*
Above 20°C (68°F)	*SUMMER*

Fig. 5-5

5-2. Fuel Pump

1. Description

An automatic diaphragm pump is used as the fuel pump for sending fuel to the float chamber. One side of the diaphragm is communicated to the internal space of the crankcase through a hose, so that the cyclic change in internal pressure of the crankcase actuates the diaphragm to pump fuel by valve action.

As the pressure inside the crankcase becomes negative, the diaphragm experiences a pull and moves in the direction of pull. When this happens, the inlet valve opens to admit fuel into the suction chamber. Conversely, as the crankcase pressure goes positive, the diaphragm experiences a push and moves accordingly, causing the inlet valve to close and the outlet valve to open, thereby letting out the fuel from the discharge chamber.

The pressure at which the fuel is discharged by the pump is limited to a predetermined level by the action of the pressure adjusting valve. If the discharge pressure rises above the predetermined level, this valve relieves the excess pressure by bleeding the fuel back to the suction chamber.

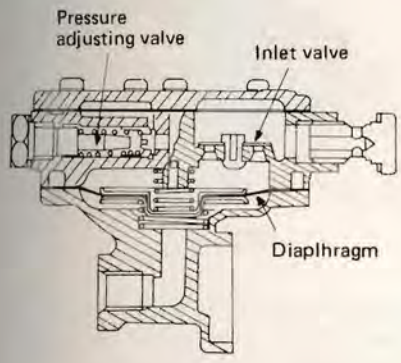

Fig. 5-6

Fuel pump specifications	
Discharge pressure	*0.2 ~ 0.3 kg/cm²*
Suction capacity	*200 mm Hg*
Discharge capacity	*1.3 litres minimum per minute at 7,000 engine rpm.*

2. Removal

(1) Disconnect from the pump the fuel inlet pipe, outlet pipe and vacuum pipe.
(2) Remove the two nuts securing the pump in place, and take out the pump.

3. Fuel pump disassembly

(1) Before separating the upper half from the lower half of the fuel pump body, be sure to scribe a match mark across the seam, as shown in Fig. 5-7. This step is absolutely necessary because there is not provided any angularly locating means in the fit between the two halves. If the two are mismatched in reassembly, the fuel pipes will not tie in with the pump body.

Fig. 5-7

(2) Remove the screws fastening together the two halves of pump body, upper and lower, and separate the two.

Fig. 5-8

(3) From the pump body, take out diaphragm and springs.

Fig. 5-9

(4) Remove the pressure adjusting valve plug, and take out spring and piston.

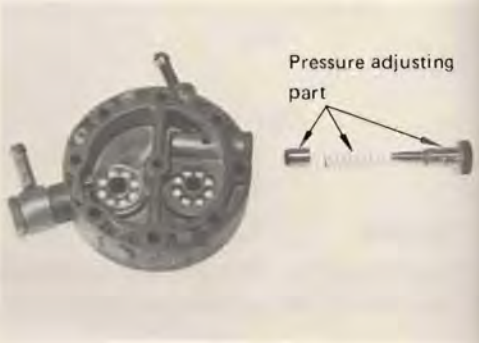

Fig. 5-10

4. Services

(1) Visually inspect the pump for signs of air being drawn in and of fuel leaking out. Check to be sure the joint between the upper half and the lower half of pump body is tight.

(2) If the pump is noted to have been lacking fuel delivery, examine the diaphragm for any pinhole, check the inlet and outlet valves for seating action, and inspect the pressure adjusting valve for smoothness of piston movement. Make sure the diaphragm is free from any sign of rupture, and see to it that both inlet and outlet valves seat perfectly. Make sure no foreign matters are present within the pressure adjusting valve.

Fig. 5-11

-9

5-10

5-11

5. Important points on reassembly

(1) Be careful not to install the inlet and outlet valves in wrong position. Position each valve as guided by the direction of fuel flow.

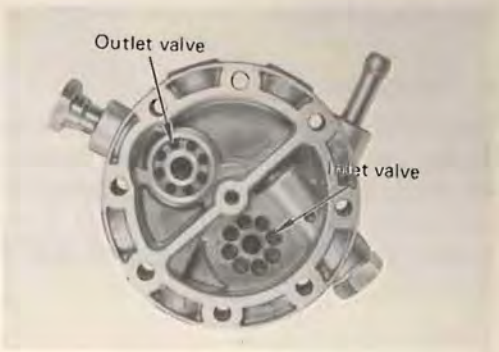

Fig. 5-12

(2) When fitting the diaphragm to the pump body, bear in mind that the two sides of diaphragm must be discriminated: fitting the diaphragm the other way around will result in poor fuel pumping.

Fig. 5-13

(3) Be sure to refer to the match mark (which was scribed at the time of disassembly) when mating the lower half to the upper half of pump body to restore the combination to the original angular position.

Fig. 5-14

5-3. Fuel Filter

1. Description

Fuel enters the filter through its inlet hole and, after passing through the filtering element, comes out of its outlet hole communicated to the fuel pump. The fuel filter is not meant to be disassembled. It is of cartridge type, consisting of a filtering element in a plastic case.

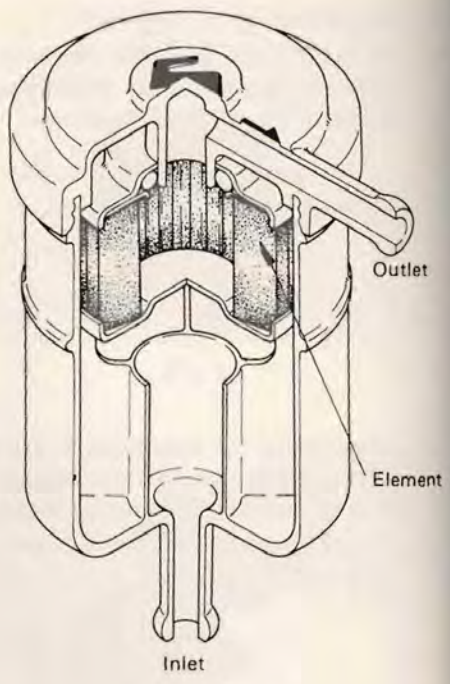

Fig. 5-15

2. Services and installation

(1) As has been stated, this filter does not permit disassembly. The filter is to be periodically replaced. It is one of the expendable items.

Fuel filter replacement interval	*40,000 km (25,000 miles)*

(2) The position the fuel filter takes in place is shown in Fig. 5-16. When installing the filter, be sure to bring to the top side its end face carrying "S" mark.

Fig. 5-16

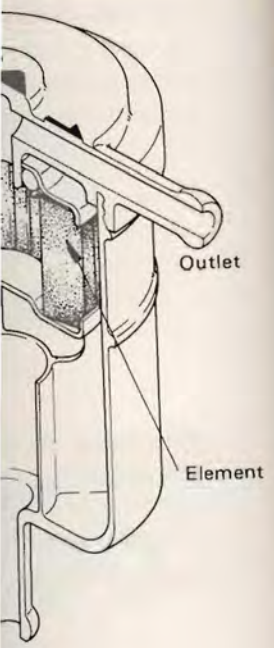

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Fig. 5-16

6. ENGINE COOLING SYSTEM

6

6-1. Description

The engine is cooled by cooling water set in forced recirculation through the jackets formed in the engine body and through the radiator. For the water pump, a high-capacity centrifugal pump is used. For the radiator, a tube-and-fin type, large in heat dissipating capacity, is used.
The thermostat is of wax pellet type, accurately responsive to temperature changes and durable in construction. It maintains the coolant temperature within a narrow range during operation.
The vehicle with an optional heater is equipped with a heating circuit and a hot water circuit associated with the inlet manifold. With the heater valve opened, warm water flows in the following path, which is separate from and independent of the regular engine cooling circuit:

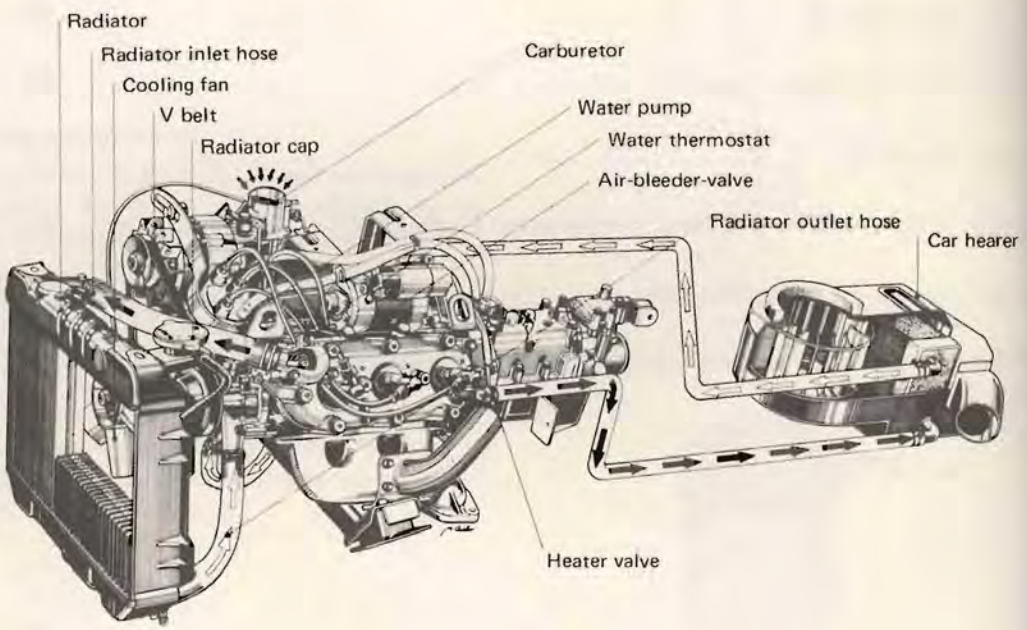

Fig. 6-1

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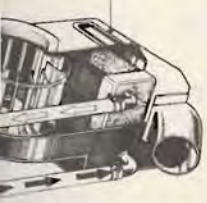


6-2. Cooling Water Circuit

When the coolant is cold, the thermostat valve remains closed. Under this condition, the coolant recirculates in a closed loop comprising the water pump, water jackets in the engine proper and bypass passage, there being no water flow through the radiator.

The thermostat valve begins to open at 82°C (179°F) of rising coolant temperature and reaches its full open position at 95°C (203°F). During the intermediate condition, the coolant flow through the bypass passage decreases while the rate of coolant recirculation through the radiator increases. For further coolant temperature rise above 95°C (203°F), the entire coolant flow is through the radiator, water pump, engine and thermostatic valve, there being no flow in the bypass passage.

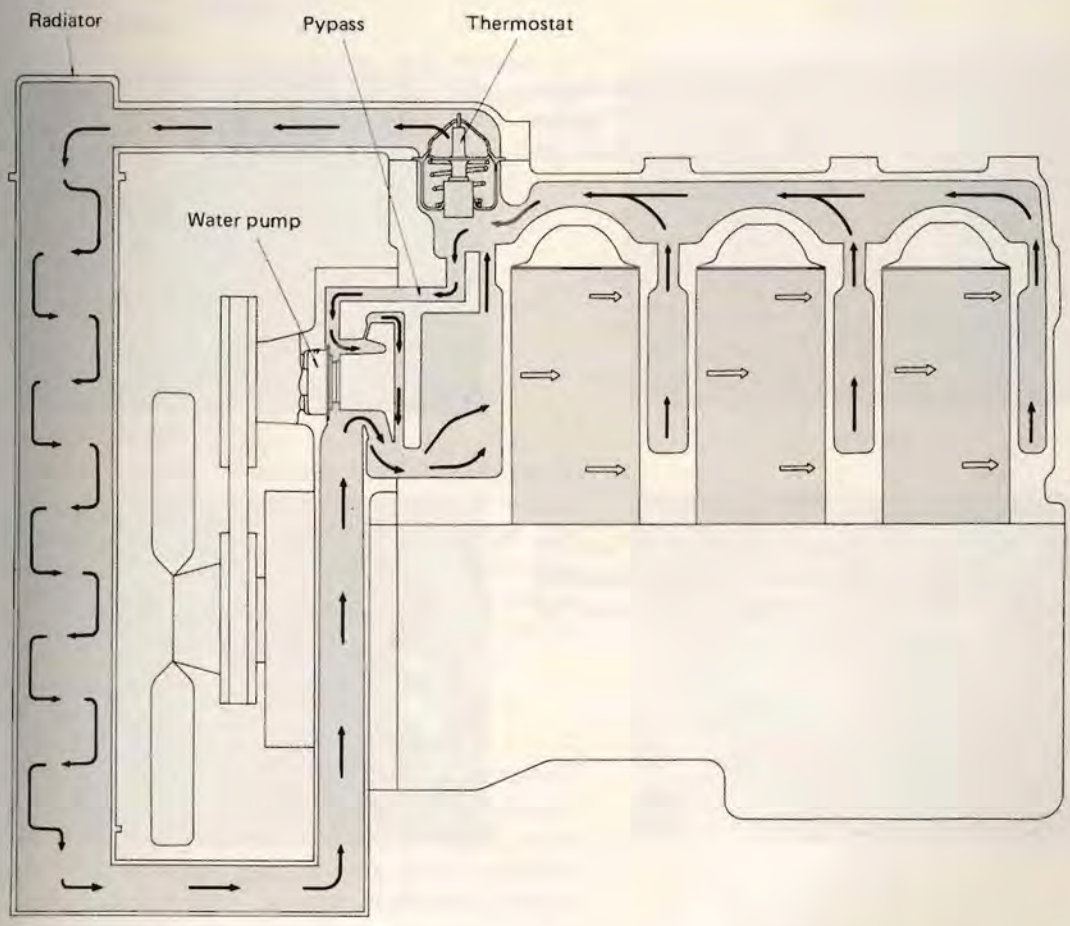


Fig. 6-2

6-3. Removal

1. Coolant Draining

(1) Loosen the drain plug on the radiator to empty the radiator.

Fig. 6-3

(2) The drain plug for the water jackets of the engine is located below the exhaust manifold. To change the coolant, or to drain the water jackets for some reason, loosen this plug too.

Fig. 6-4

2. Cooling water pipes

To remove the coolant pipes, loosen the screw on each pipe clip and pull the pipe end off. In the machines equipped with the heater, the heater valve is to be left in open (slackened) position.

Fig. 6-5

3. Radiator

Remove the bolts securing the radiator, and take down the radiator from the body, complete with the shroud.

Fig. 6-6

6-3

6-4

6-5

6-6

4. Cooling fan

Remove the bolts securing the cooling fan to the hub, and take out the fan.

Fig. 6-7

5. Water pump

Remove the water pump pulley, and remove the mounting bolts and nuts on the pump. Remove the water pump from the cylinder.

Fig. 6-8

6-4. Functional Description of Important Components

1. Water reservoir tank

This tank is so located and so associated with the radiator that it receives the excess portion of coolant which would otherwise spill out by overflowing. The excess is due to the expansion of the coolant upon temperature rise. When the coolant cools down, its volume contracts, and the water in the tank returns to the radiator.

Fig. 6-9

2. Thermostat

The temperature-sensitive material in the thermostat is a wax pellet. The wax is hermetically contained in the case, and expands and contracts according as the coolant temperature rises and falls. When it expands, the case pushes down the valve to unseat it, that is, open the valve.

If the valve is noted to remain closed when the coolant temperature rises, it is most likely that the wax case is ruptured. In the top portion of the thermostat, an air bleed valve is provided; this valve vents out the gas or air that has accumulated in the coolant circuit.

Thermostat operational specifications	
Temperature at which valve begins to open	*82°C (179°F)*
Temperature at which valve becomes full open	*95°C (203°F)*
Valve lift	*8 mm (0.31 in.)*

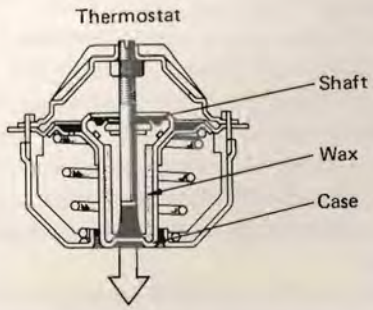


Fig. 6-10

3. Radiator filler cap

The radiator filler cap has two built-in valves and, by these valves, it allows the internal pressure of the coolant circuit to rise to a certain level slightly above that of the atmosphere.

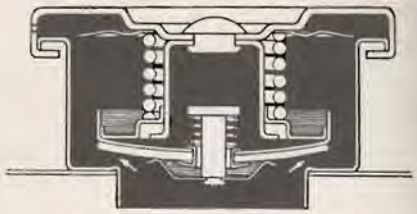
One of the built-in valves is an adjusting valve; the other is a negative-pressure valve.

The adjusting valve opens only when the internal pressure rises 0.9kg/cm². This means that the coolant's boiling temperature is substantially above 100°C (212°F) and that, under normal running condition, the coolant does not boil. Boiling develops vapor bubbles in the coolant and therefore lowers the heat capacity of the coolant. This condition is avoided by pressurization.

When the coolant cools after the shutting down of the engine following a sustained run, the internal pressure will drop. If the pressure should be allowed to keep on falling, the coolant pipes and even the radiator might collapse under the atmosperic pressure, but this is avoided by the action of the negative-pressure valve. This valve opens when a pressure drop begins to take place, and by opening, it admits atmospheric pressure into the coolant circuit.

The filler cap has its face marked "0.9", meaning that its pressure adjusting valve opens at 0.9 kg/cm².

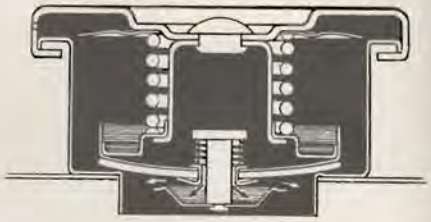
Radiator cap



Operating pressure adjusting valve

Fig. 6-11

Radiator cap



Operating vacuum valve

Fig. 6-12

4. Water pump

The water pump is of centrifugal vane type. Its bearing is of totally sealed type. High-durability seals are used in the pump. Because of this feature, the pump is not to be disassembled for servicing.

Fig. 6-13

5. Engine coolant

The long-term reliability and cooling capacity of the engine cooling system depends much on the quality of the cooling water used. "Hard water," if used as coolant, will foul up the cooling circuit by scale formation, for such water is high in silicate and mineral contents. Scales are poor heat conductors. Use of water high in acid concentration is just as bad; such water promotes rusting. For similar reasons, river water, well water, not to mention of sea water, are not fit as engine cooling water.

Tap water available from city water supply is the best available water for the cooling system. Distilled water is ideal but is often a luxury in most cases. For protection of the cooling circuit, it is recommended that GOLDEN CRUISER 1200 (which is included as a regular item in the supply of materials from SUZUKI) be added to the cooling water in an proportion determined by the lowest atmospheric temperature expected.

Each new LJ50 (and LJ50V) machine is shipped from the factory with its cooling circuit filled with a 30% solution of GOLDEN CRUISER 1200; this solution does not freeze until -15°C(5°F) is reached.

Many brands of ANTI-FREEZE compounds are sold in the market. In no case, allow two different brands to get mixed in the cooling circuit of the engine.

(1) Effects of using GOLDEN CRUISER 1200 "'Anti-freeze and Summer Coolant"

The coolant with GOLDEN CRUISER 1200 presents the following desirable effects:

(a) Its freezing temperature is much lower and depends on the concentration of GOLDEN CRUISER 1200. It is an anti-freeze coolant.

(b) It does not corrode the metal surfaces of the cooling ciruit. It is an anti-corrosion coolant.

(c) It does not develop foam or bubbles. It is a foam-inhibited coolant.

(d) It stands long usage. The renewal interval is much longer.

Fig. 6-14

(2) How to proportion GOLDEN CRUISER 1200 to cooling water

GOLDEN CRUISER 1200 is a multi-purpose anti-freeze compound. Its solution as engine coolant can be kept in service as long as two years in a single stretch, regardless of changes of season. A 30% solution is recommended for regions and areas free from freeze-up.

To prepare an anti-freeze coolant by using this compound (GOLDEN CRUISER 1200), proportion cooling water and the compound according to the following chart, in which the proportions are indicated for seven levels of temperature as the lowest expected temperature levels:

Lowest temp. expected	°C	-9	-12	-15	-20	-24	-29	-36
	°F	16	10	5	-4	-11	-20	-33
GOLDEN CRUISER concentration	%	20	25	30	35	40	45	50
Ratio of compound to cooling water	ltr.	0.82/ 3.28	1.02/ 2.98	1.23/ 2.87	1.44/ 2.66	1.64/ 2.46	1.85/ 2.25	2.05/ 2.05
	US pt.	1.73/ 6.94	2.15/ 6.52	2.60/ 6.07	3.04/ 5.63	3.47/ 5.20	3.90/ 4.77	4.34/ 4.34
	Imp.pt.	1.44/ 5.84	1.80/ 5.48	2.18/ 5.10	2.55/ 4.73	2.91/ 4.37	3.28/ 4.00	3.64/ 3.64

NOTE:

To be on the safer side, aim at a temperature 5°C (-15°F) below the lowest expected temperature. If the lowest expected temperature is -20°C (-4°F), you should take the mixing ratio for -25°C (-13°F), for which the recommended concentration is 40%.

Remember, the radiator capacity is 4.1 litres (8.67 UP pt. or 7.28 Imp. pt.), which includes the reservoir tank capacity of 0.6 litre (1.27 US pt. or 1.07 Imp.)

6. water temperature gauge

The water temperature guage constitutes a system consisting of an indicator mounted in the instrument panel, an engine unit or sensor of thermistor type, and a regulator for passing a constant current which the thermistor sensor permits to flow.

The three components are connected as shown in the circuit diagram below:

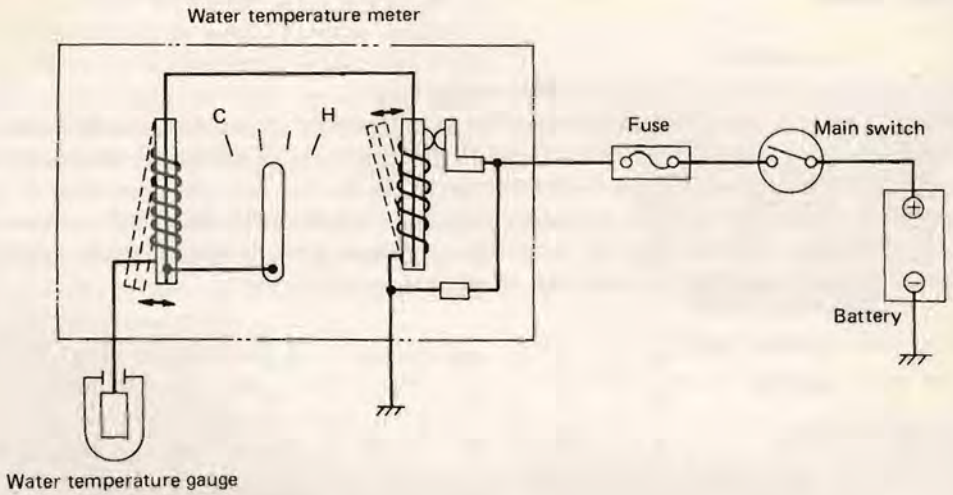


Fig. 6-15

The indicator is of bimetal type; its bimetal element is wrapped with a heater coil, and becomes heated by the current flowing in this coil. By deflecting, the bimetal element actuates the indicating hand, making the hand to move along the temperature scale.

The magnitude of the current is determined by the state of the thermistor in the engine unit installed on the cylinder head. A thermistor is a semiconductor resistive element whose ohmic resistance decreases as its temperature rises; its resistance has a negative temperature coefficient. When the coolant temperature rises, the thermistor offers a decreasing resistance, so that the current flowing in the circuit increases, thereby deflecting the indicating hand wider in the indicator.

The regulator is a means of maintaining a constant current in the circuit for each ohmic reistance state of the thermistor, and does so function under the varying voltage condition of the battery.

To adjust the belt for proper tension, loosen the 3 bolts securing the generator in place, and displace it in place to slacken or tension the belt.
A loose belt, or a belt tending to break off or otherwise defective, is often the cause of engine overheating. Because of the importance of this belt, it is strongly recommended that the belt be replaced at regular intervals even when the belt appears sound in condition.

Replacement interval	*Two years (recommended)*

Fig. 6-19

3. Radiator

If the water side of the radiator is found to be excessively rusted or covered with scales, clean it by flushing with the radiator cleaner compound. This flushing should be carried out at regular intervals because scale or rust formation advances with time even where a recommended type of coolant is used. Periodical flushing will prove more economical.
Inspect the radiator core and straighten the flattened or bent fins, if any. Clean the core, removing road grimes and trashes.
Excessive rust or scale formation lowers the cooling efficiency. Flattened or bent fins obstruct the flow of air through the core to impede heat dissipation.

Radiator flushing interval	*Two years (recommended)*

Fig. 6-20

4. Engine coolant

Cooling water in service decreases its volume but slowly on account of progressive loss due to water evaporation. Check to be sure that the water surface is up to anywhere between FULL level and LOW level in the reservoir tank. The user should be reminded of the need for daily water level checking.

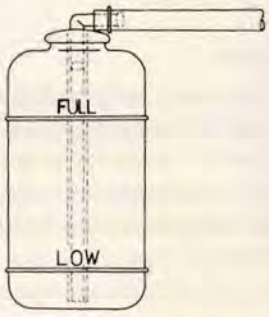


Fig. 6-21

6-6. Important Point on Cooling System Installation

1. Thermostat

The thermostatic unit takes its position with its air bleed valve coming on top side.

Fig. 6-22

2. Cooling fan

The fan has front face and back face. Its front face is indicated by letter "F" engraved on it. Be sure to position the fan so that this face looks outward (forward).

Fig. 6-23

3. Filling up the cooling system

Let the machine stand on a flat level floor, and fill in water until you see the water come up to the well part of the radiator filler. Then, run the engine two or three minutes to recirculate the water in the cooling circuit; this recirculation drives out air, if any, trapped inside, and will lower the water surface at the radiator filler. Add water until the water surface becomes visible again in the filler, and fill the water reservoir tank, raising the water surface in it up to FULL level mark.

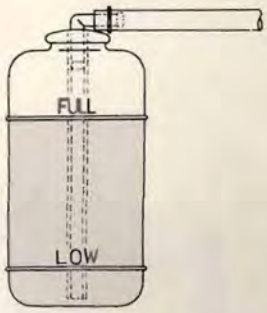


Fig. 6-24

4. Hoses and clamps

The connecting parts in the coolant circuit are these: radiator inlet and outlet houses, reservoir tank hose and, in the machines equipped with the car heater, hoses for passing hot water to car heater and inlet manifold.

Clamps used in securing these hoses at respective connections are four in kind. These clamps are to be used discriminately Chances of installing a hose the other way around must not be overlooked though some hoses are molded to take special shapes or made larger in one end than in the other. Refer to Fig. 6-25 for correct hose installation, and be sure to tighten each hose connection good and hard.

Hose clamp specifications			
Mark	*Clamp*	*Size*	*Qt.*
A	*Radiator hose clamp (radiator side)*	*30 mm dia. (1.18 in.)*	*2*
B	*Radiator hose clamp (engine side)*	*34 mm dia. (1.34 in.)*	*2*
C	*Heater hose clamp*	*21 mm dia. (0.82 in.)*	*6*
D	*Water reservoir tank hose clamp*		*2*

Water hose specifications		
Mark	*Hose (used for)*	*Remarks*
1	*Radiator inlet hose (THERMOSTAT to RADIATOR)*	*Large end to thermostat*
2	*Radiator outlet hose (RADIATOR to PUMP)*	*Large end to pump*
3	*Heater hose No. 1 (CYLINDER HEAD to HEATER)*	*500 mm (19.68 in.)*
4	*Heater hose No. 2 (HEATER to INLET MANIFOLD)*	*780 mm (30.70 in.)*
5	*Heater hose No. 3 (INLET MANIFOLD to PUMP)*	*370 mm (14.56 in.)*
6	*Water reservoir tank hose (RADIATOR to TANK)*	*1,050 mm (41.34 in.)*

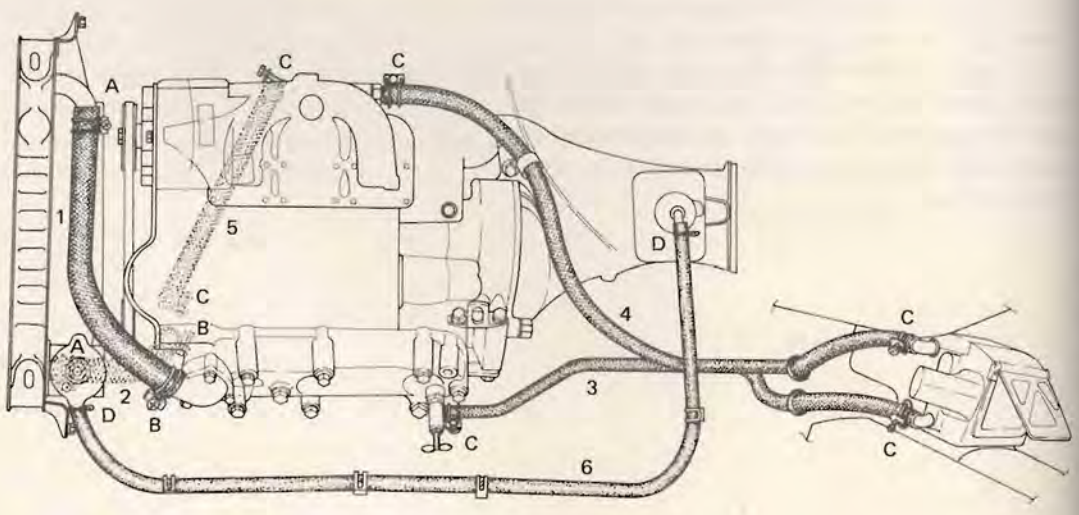


Fig. 6-25

servoir tank hose
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. Refer to Fig. 6-

	Qt.
	2
	2
	6
	2

narks
o thermostat
o pump
9.68 in.)
0.70 in.)
4.56 in.)
1.34 in.)

7. CAR HEATER

7

7-1. Description

The optional car heater is of hot water type. Its operation is quiet. It takes engine heat through the medium of water and sends warm air into the room by means of a blower.
Since the blower drive is electrical, independent of engine speed, the heater is just as effective even when the engine is running slowly. In summer, the blower doubles as a fan for room ventilation, with the heater valve kept closed.

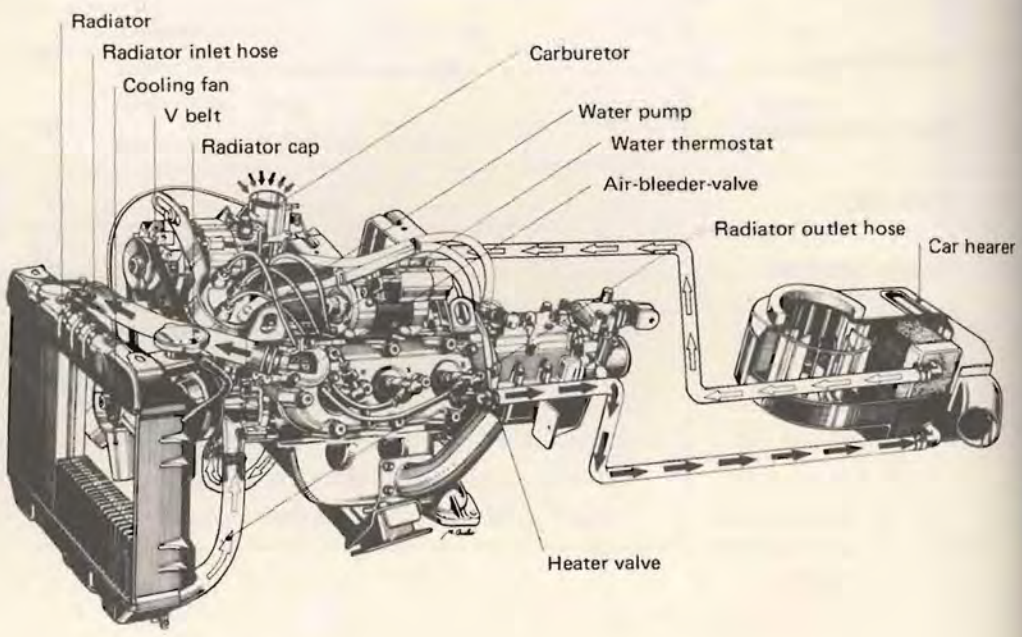


Fig. 7-1

eat through the me-

effective even when
ion, with the heater

7-2. Electrical Circuit

The circuit diagram shown in Fig. 7-2 illustrates how the blower motor is controlled. With the main switch closed, pulling the button of the three-position fan switch to the first position passes a current through the motor. This current is small because the circuit has a resistor (indicated as "fan resistance" in the diagram); and the blower runs slow under this condition.
Pulling the switch button all the way (to the second position) throws the full battery voltage across the blower motor. A large current flows, and the blower runs with full speed.

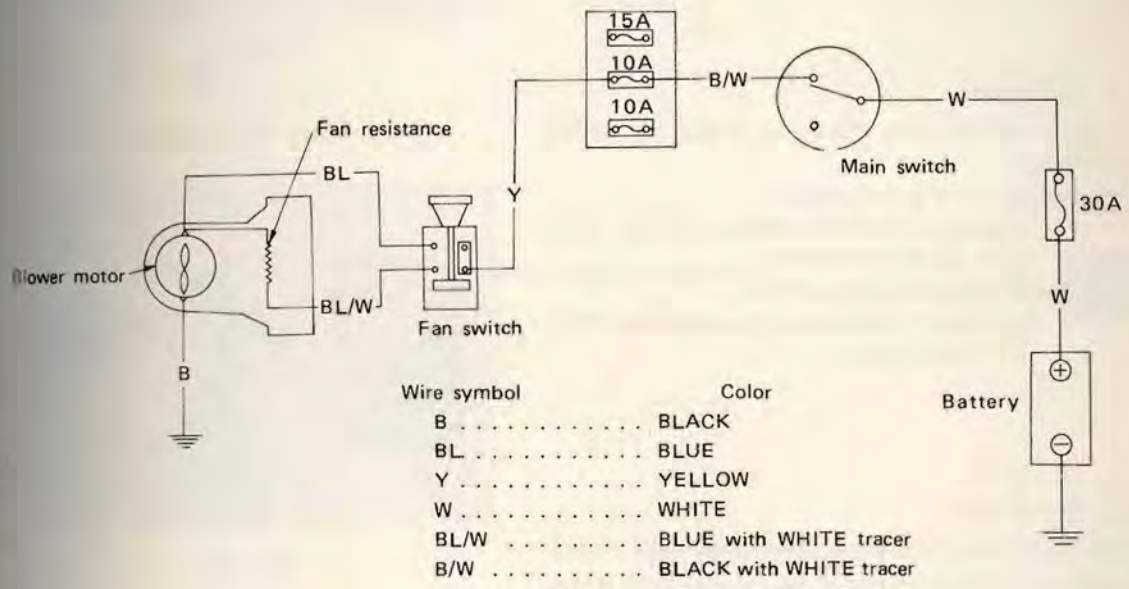


Fig. 7-2

7-3. Removal

1. Drain off the engine coolant by loosening the drain cocks on radiator and engine.
2. Disconnect heater hoses (No. 1 and No. 2) from the heater.
3. Remove two hoses from the heater.
4. Remove the control box panel, which is mounted on heater top.
5. Disconnect electrical wires used in the heater circuit.
6. Remove the bolts securing the heater in place, and take down the heater from the body.

7-4. Heater Services

1. Fan resistor

This resistor is in the heater case. Inspect it for signs of cracking or breakage and replace it as necessary. If the blower motor will not run or when you replace the existing resistor, check to be sure the resistor has an ohmic resistance of 4.3 ohms. Use a circuit tester for this purpose.

Fan resistor specification	*4.3 ohms*

Fig. 7-3

2. Fan switch

Using a circuit tester, check this switch for circuit continuity:

(1) Switch button in first position
Continuity should be verified between YELLOW and BLUE/WHITE.

(2) Switch button in second position
Continuity should be verified between YELLOW and BLUE.

Fig. 7-4

3. Heater valve

The heater valve is on top of the cylinder head. As this valve opens, the hot water in the cylinder head jacket flows toward the heater and inlet manifold. The valve should be opened when the temperature of outside air is below 20°C (68°F) or whenever warm air is wanted in the room.

It should be kept in mind that a small fraction of engine horsepower output is expended for non-cruising-drive purpose when this valve is open. For economy, make it a rule to keep this valve closed when outside temperature is above 20°C (68°F) or thereabout.

During a season not requiring the use of the heater, just have the heater valve kept closed; no other provisions are necessary to keep the heater out of service. To have the heater hoses removed when the heater is out of service — this is a bad practice, for the interior of the heater might become rusted.

Fig. 7-5

Rule of thumb on heater valve		
When outside temperature is:	*Above 20°C (68°F)*	*Keep the valve tight (closed)*
	Below 20°C (68°F)	*Keep the valve loose (opened)*

-3

7-4

7-5

8. IGNITION SYSTEM

8-1. Description

The principal components of the ignition system are, as shown in the circuit diagram of Fig. 8-1, the spark plugs, distributor, contact-breaker, ignition coil and, as the source of igniting energy, the battery. Note that the ignition coil has two windings, primary and secondary.

Current from the battery flows through the primary winding and then the contact-breaker; the contact point in the breaker opens and closes to interrupt this current intermittently.

Each time the primary current is interrupted, a very high voltage develops in secondary winding. It is this intermittent high voltage that the distributor passes sequentially to the three spark plugs to fly a spark across the gap in each, one plug a time.

The distributor is a sort of rotary switch, whose rotor connects the three plugs, one at a time, to secondary winding of the ignition coil through the wires called "high-tension" cords. Note that there are one high-tension cord, from secondary winding to the center of the distributor cap, and three more high-tension cords between the spark plugs and the three terminals on the cap.

The resistor, connected in series to primary winding, serves to reduce the inductance of primary winding so that the high voltage generation in secondary winding will be stabilized.

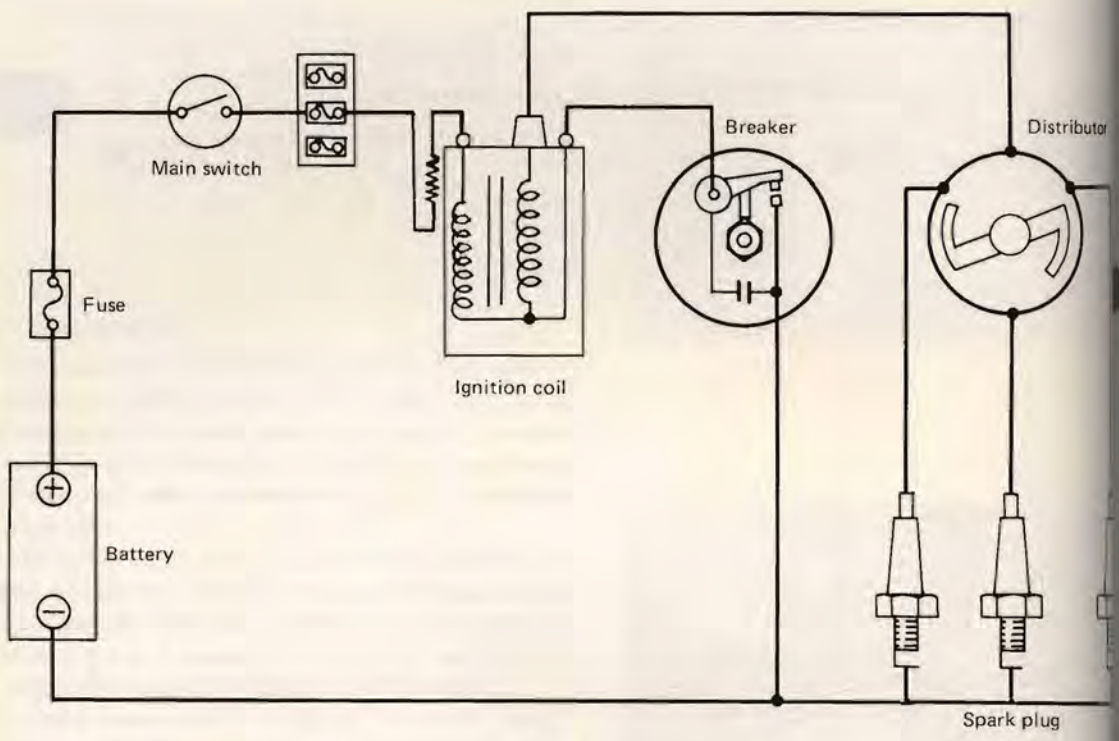


Fig. 8-1

8-2. Description of Components

1. Distributor

Fig. 8-2 shows the distributor unit in section to expose its internal mechanisms to easy viewing. The shaft is driven from engine crankshaft through worm gearing, and rotates once for every two revolutions of the crankshaft.

Inside the cap are three side electrodes (for spark plugs) and one center electrode (to which the secondary side of the ignition coil is connected). The arm of the rotor, mounted on the shaft, touches the side electrodes one by one "distribute" the high voltage to the spark plugs.

Immediately below the distributing mechanism is the contact-breaker, whose cam, mounted on the shaft, actuates the breaker arm to make and break the primary current circuit for the purpose already mentioned. The condenser (capacitor) secured to the distributor body is for absorbing the current surge, which would otherwise result in a sparking across the contact point gap. The surge occurs every time the contact point is opened, and is due to, so to say, the inertia of electric current. The object served by the condenser is obvious; it is to prevent the point faces from getting burnt by sparking.

Below the contact-breaker is the ignition timing advancer, which operates on the principles of centrifugal governor action. The advancer will be described next.

Distributor data	
Cam dwell angle	*36°*
Ignition angle	*60°*
Condenser capacitance	*0.15 microfarad*
Timing advance	*6° (equivalent to 12° crank angle*
Number of gear teeth	*18*
Direction of rotation	*Clockwise, as viewed from top*

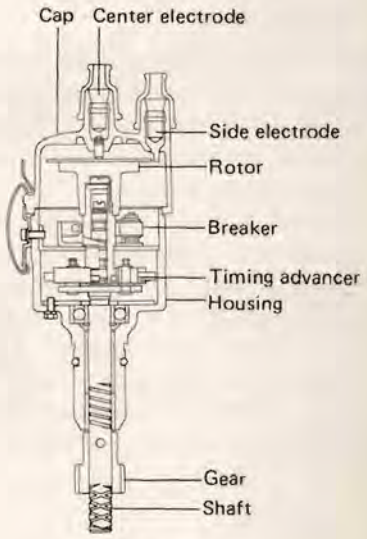


Fig. 8-2

2. Ignition coil

The ignition coil is a sort of miniature transformer and, as such, has an iron core around which two coils are wound — primary and secondary windings mentioned above. The two are so close to each other that a sudden change in the magnetic flux produced by "primary current" flowing in primary winding (in a less number of coil turns) induces a very large electromotive force (voltage) in secondary winding (in a greater number of coil turns). These live parts are housed in a tight, insulator case topped by the cap mentioned above. Note that the cap has three terminals: one high-tension terminal and two low-tension terminals.

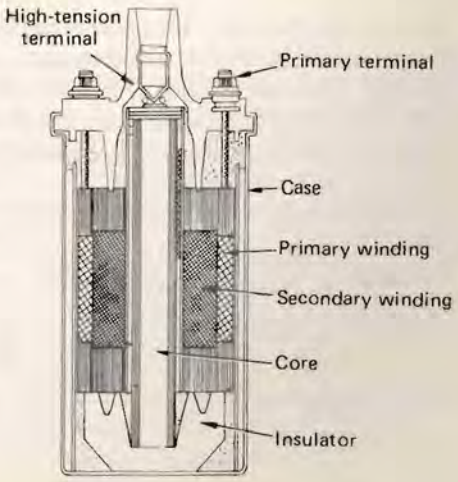


Fig. 8-3

3. Timing advancer

The distributor shaft, from its driven-gear end to the rotor-carrying end, is not a single solid piece; actually this shaft is in two pieces connected together through the timing advancer. The advancer is essentially a fly-weight mechanism. Timing advancing action is accomplished by twisting the top shaft piece relative to the bottom one in the direction of shaft rotation.

The contact-breaker cam, mentioned above, for actuating the breaker arm is mounted on the top piece. The twisting movement is produced by the speed-dependent radial (or spreading) movements of the two flyweights.

In the present engine, the advancer starts "advancing" at 1000 rpm of rising engine speed. Ignition timing becomes fully advanced when the einge reaches 2000 rpm, as will be noted in the graph of Fig. 8-4.

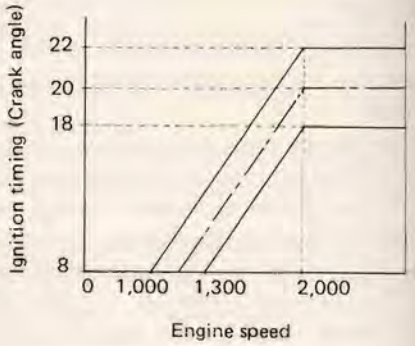


Fig. 8-4

4. Spark plugs

The chart below indicates the code names of spark plugs of various brands that can be used in the present machine. NGK's B7HS or NIPPON DENSO's W22FS spark plugs are standardly used in each new machine shipped from the facotry.

Spark plugs in service become hot, of course, and the sooty carbon is liable to foul up the spark-producing portion of the plug. The hotter the plug, the harder for the carbon to deposit on it but, what is important, the more strenuous for the insulator of the plug to withstand the heat. Some engines need plugs capable of working at higher temperatures and some engines need plugs which will not easily get fouled up with carbon.

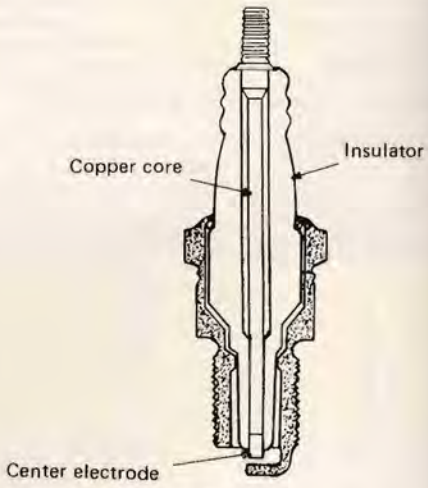
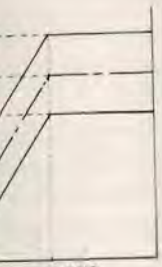


Fig. 8-5

"Heat range" of a spark plug means how hot it is capable of running in the sense explained above. Those plugs meant to run "cold" are designed to forestall carbon formation at the plug tip, and those meant to run "hot" have special provisions for the insulator part to dissipate heat faster.

Any of the plugs listed in the chart will do for the present machine, but use of NGK's B-7HS or NIPPON DENSO's W22FS is strongly recommended in light of the afore-mentioned background.

Usable spark plugs							
NGK	*NIPPON DENSO*	*CHAMPION*	*BOSCH*	*AC*	*AUTOLITE*	*KLG*	*LEDGE*
B-7HS	*W22FS*	*L-85* *L-7* *L-81*	*W225T1* *W240T1*	*42FF* *42F*	*AE3*	*F75*	*H14* *HN14*



speed

8-4

g. 8-5

explained above. Those
tip, and those meant to

GK's B-7HS or NIPPON
und.

KLG	*LEDGE*
F75	*H14* *HN14*

8-3. Maintenance Services

1. Distributor cap

Leakage of high-tension energy for ignition shows up as misfiring in the engine. It occurs at any part of the high-tension line where insulation has failed or in a dirty distributor cap, that is, an internally dirty cap.
A wider spark gap in the plug, a condition often found in poorly cared spark plugs, promotes the tendency of high-tension energy to find a shortcut to ground.
Cleanliness is very important for the distributor cap. With a clean dry cloth, wipe off dust or grime, if any, and inspect for any damaged (scarred, scratched or cracked) part or any part evidencing high-tension leakage inside the cap. Be sure to replace such parts.

Fig. 8-6

2. Distributor driven gear

Inspect the gear teeth for wear, and see if the backlash is normal or not. Excessive backlash can be told by turning the shaft back and forth, with its driven gear in mesh with driving gear. Maladjusted ignition timing is often due to excessive tooth wear in this gearing and, in such a case, can be corrected by replacing the driven gear.
At intervals of 10,000km (6,300 miles), lubricate the driven gear; use SUZUKI SUPER GREASE C.

Fig. 8-7

3. Spark plugs

The spark gap specification is 0.7 mm (0.027 in.). Be sure to use a thickness gauge in checking the gap. A wide gap is just as bad as a narrow gap. The 0.7 mm gap will produce the right kind of sparks needed by the air-fuel mixture in this engine.

Fig. 8-8

4. Contact point faces

In the contact breaker, push the breaker arm with your fingertip just a little so that you can see the point faces. If the faces are oily, clean; if roughened, smoothen by grinding. In most cases, the point faces can be reconditioned by grinding with a file or oil stone. Points worn beyond repair must be replaced.
The illustration, below, tells what must be done in each case but the last one showing a pair of properly aligned, smooth faces. Wear or burning is hard to occur in the contact point whose point faces are in the condition labeled "good."

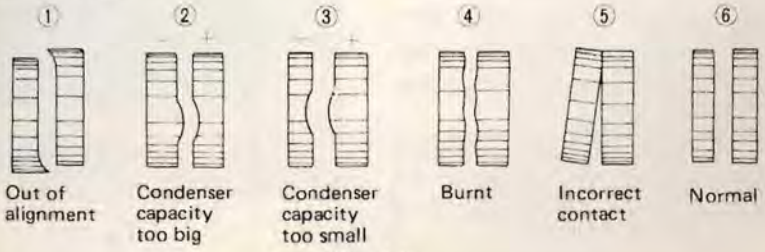


Fig. 8-9

5. Checking the primary circuit for fault

If the engine misfires or does not fire up at all where its spark plugs have just been checked to be in good condition, the first step of locating the cause is to check the primary circuit (between distributor and ground) for continuity by using a circuit tester as shown. Since the contact point is open, the tester should indicate discontinuity (infinitely large resistance); if continuity is noted, it means that there is a fault somewhere along the primary circuit, which could be in the ignition coil, condenser or elsewhere.

Fig. 8-10

6. Condenser

Check the condenser for capacitance by using the electro-tester. You may do so with the condenser in place or removed. When checking it in place, that is, as mounted on the distributor, be sure to have the contact point opened. A condenser not meeting the following capacitance specification must be replaced:

Condenser capacitance specification	*0.15 microfarad*

Fig. 8-11

7. Ignition coil

(1) Sparking performance test

The purpose of this test is to see if the ignition coil is capable of producing high voltage surges forceful enough to fly good sparks at the ignition coils at all times, particularly when its temperature has risen to the normal operating level. Use of the electro tester is assumed for this test.

With the ignition coil connected to the tester, as shown, let the spark fly across the three-needle gap. Continue this testing for about three minutes so that the coil will get warm to simulate the normal operating condition. The coil may be deemed to be in good condition if the sparking is stable, without any misses.

In the use of the electro tester for this purpose, do not enlarge the three-needle gap wider than 7mm (0.27 in.).

Fig. 8-12

(2) Resistance measurement

Measure the ohmic resistances of primary and secondary windings in the ignition coil. If the readings are in agreement with the prescribed values, indicated below, the coil may be judged to be in good condition. Take readings when the coil is hot, about 80°C (176°F); this is becuse we are interested in the performance of the coil at the normal operating temperature, not of a cold coil.

Primary winding resistance	*About 3 ohms (inclusive of the 1.5-ohm resistor)*
Secondary winding resistance	*About 8 kilohms*

Fig. 8-13

Fig. 8-10

Fig. 8-11

Fig. 8-12

Fig. 8-13

8-4. Important Reminders for Reassembly and Installation

1. **Distributor**

(1) The distributor rotor has a letter marking composite of "N" and "D", and the distributor body has a line mark engraved, as shown. When installing the distributor in the case, be sure to remove the cap and position the body and the rotor as shown, indexing the "ND" mark to the line mark.

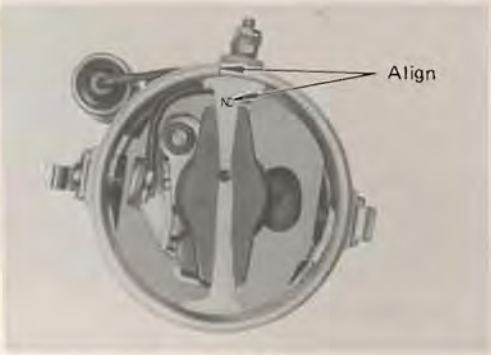


Fig. 8-14

(2) Secure the distributor in place when the cap clamp (condenser-side clamp) has been brought to or near the punch mark on the distributor clamp, as shown.

Fig. 8-15

2. **High-tension cords**

The three high-tension plug-in terminals of the distributor cap for spark plugs are numbered "1", "2" and "3" in correspondence to the respective cylinders they serve. The one closest to the line mark on distributor body, mentioned before, is No.1; the other two are numbered as shown.

When plugging in the high-tension cords, be sure to adhere to the prescribved correspondence.

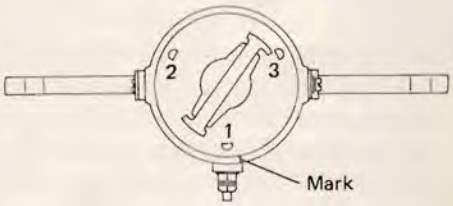


Fig. 8-16

3. **Distributor gear case**

Just before installing the distributor gear case in the crank case, charge the internal space of the gear case 80% full with SUZUKI SUPER GREASE C.

Fig. 8-17

8-5 Ignition Timing

1. Specifications

Ignition timing	*8° before top dead center for engine speeds of up to 1,000 rpm; 20° before top dead center for engine speeds of 2,000 rpm and over*
Piston stroke for ignition timing	*0.38 mm B.T.D.C.*
Firing order	*No. 1 cylinder — No. 3 cylinder — No. 2 cylinder*
Breaker point gap	*0.35 ~ 0.45 mm (0.014 ~ 0.017 in.)*

2. Checking methods

Check to be sure that the point gap is within the specified range, from 0.35 to 0.45mm (0.014 — 0.017 in.), and then check the ignition timing on No.1 cylinder. To adjust the point gap, loosen screws "A" and move the stationary point with plain screwdriver inserted into slip "B".

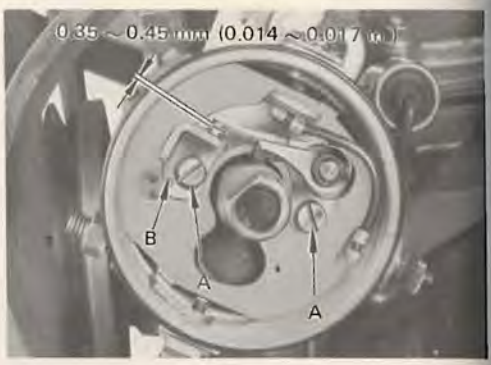


Fig. 8-18

(1) Checking by sparking

Remove the spark plug on No. 1 cylinder head, and have this plug connected by its high-tension cord to the distributor cap in the normal manner. Turn on the ignition switch. At the cooling fan side, turn the fan pulley clockwise (as viewed from front of the vehicle), and see if a spark occurs across the gap of the plug just when the line mark (yellow) moves over to register with the index pointer provided on the distributor case; if it does, then the engine is set for the specified timing.

Fig. 8-19

Fig. 8-20

(2) Checking with the timing tester

This method is for ascertaining the moment (as referred to the timing marks) the contact point of the breaker begins to open. The tester has a built-in buzzer, whose sound changes when the contact point opens (provided that one of the two leads of the tester is connected to the primary-circuit terminal of the distributor and the other lead to the distributor body). Turn the cooling fan clockwise by hand while obsrving the timing mark; when the buzzer sound changes, the timing marks should come into alignment. Make sure that the ignition swtch is kept turned off when you check in the foregoing manner.

Fig. 8-21

(3) Checking with the timing lamp (stroboscopic checking)

Start up the engine and point the light of the timing lamp to the timing index (a protrusion on the distributor case) to see if the 8° timing mark appears standstill in register with the index pointer for engine speeds of up to 1,000 rpm; if it does, then it means that the engine is set for proper ignition timing. Raise the speed of engine to and above 2,000 rpm. As the 2,000-rpm level is reached, the 20° timing mark should appear standstill in register with the index pointer; if it does, then it means that the timing advancer has worked properly.

Fig. 8-22

Fig. 8-23

3. Adjustment

The moment the contact point of the breaker begins to open is the moment the spark plug produces sparks to ignite the air-fuel mixture. The two actions may be regarded as simultaneous, and should occur when the piston has reached a certain elevation or level on its upward stroke. This position of the piston is visualized by the timing mark (on fan pulley) in register with the reference point (index. pointer). The timing mark under consideration is the 8° mark.

In the illustration, the 8° mark is shown in two positions relative to the index pointer. One position (**left**) means that the ignition timing is "retarded," the other position means that the timing is "advanced." In either case, the timing mechanism must be readjusted to bring the 8° mark in alignment to the pointer. The method is as follows.

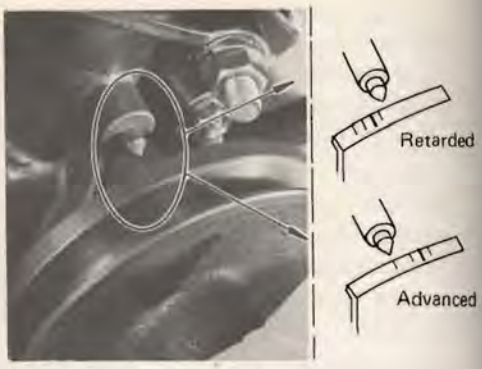


Fig. 8-24

(1) Make sure that the point gap is set to anywhere bvetween 0.35 and 0.45mm (0.014 — 0.017 in.), and install the distributor cap and rotor.

(2) By turning the fan pulley, bring the 8° mark on it squarely ahead of the index pointer.

(3) Twist the distributor body clockwise as far as it will turn. From that position, twist the distributor body backward gradually until the contact point begins to open (which will be accompanied by aparking at the plug).

NOTE:

The distributor rotor rotates clockwise.

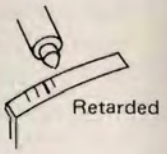
(4) Secure the distibutor body in that position by tightening its mounting bolts.

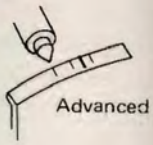
NOTE:

Step (3) can be carried out when the engine is running if the timing lamp is used in checking the ignition timing. Where this strobo lamp is illuminating the timing mark index pointer, the 8° mark will shift forward or backward according as you twist the distributor body one way or the other.

Fig. 8-25

Fig. 8-26





9. STARTER MOTOR

9-1. Description

A shift-lever type starter motor is used for cranking the engine. The motor is mounted on the crank case, with its drive pinion meshed with the ring gear of the flywheel. In the following illustration, note that the whole motor assembly inclusive of the magnetic switch and lever mechanism is enclosed.

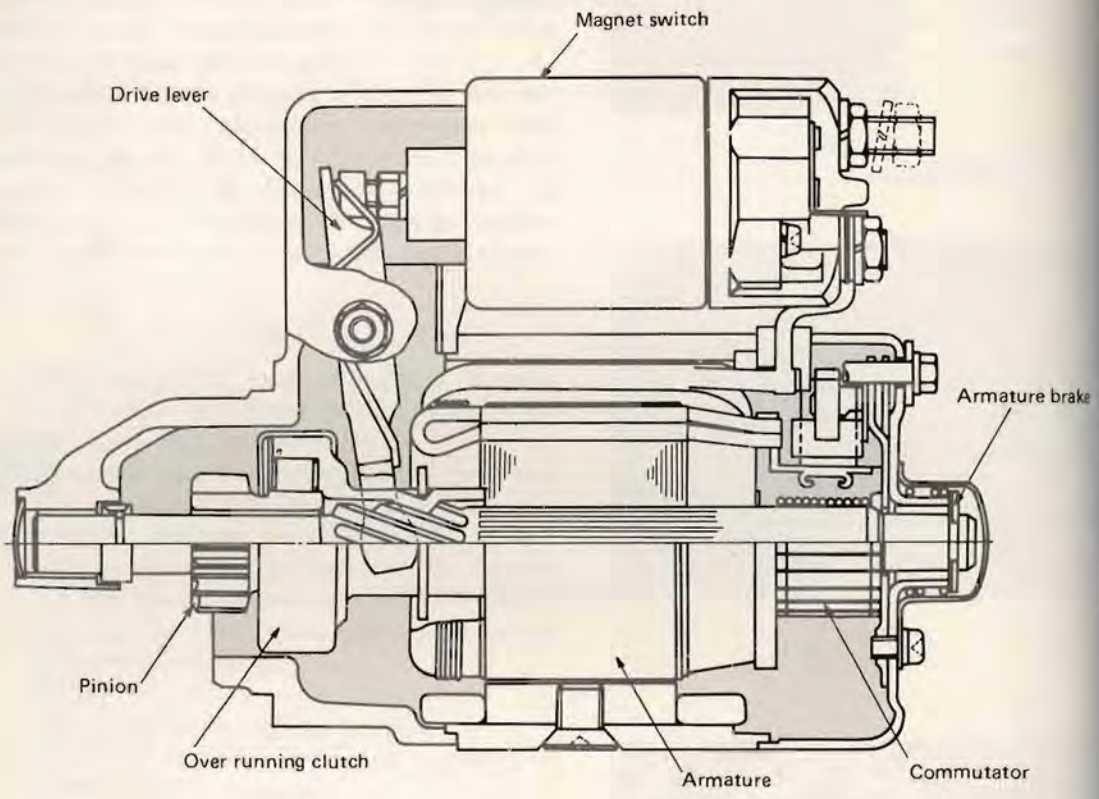


Fig. 9-1

9-2. Specifications

Voltage	*12 volts*
Output	*0.6 kW*
Rating	*30 seconds*
Direction of rotation	*Clockwise as viewed from pinion side*
Brush length	*14 mm (0.551 in.)*
Number of pinion teeth	*9*
No-load characteristic	*5.5 A maximum at 11 volts, 3,500 rpm minimum*
Load characteristic	*230 A maximum at 9.5 volts and 0.5 kg-m torque, 2,000 rpm minimum*
Locked rotor current	*450 A maximum at 8.5 volts, 1.1 kg-m minimum*
Magnetic switch operating voltage	*8 volts maximum*

mounted on the crank
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ninimum
m torque, 2,000 rpm
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9-3. Cranking Action

1. Starting up the motor

Turning on the starting switch results in a small current flowing through the holding coil and another through the pull-in coil, both in the magnetic switch. The former current flows direct into ground, but the latter flows through motor armature and field. In other words, motor begins to run. In the magnetic switch, the two coils energized—pull-in coil and holding coil—develop a combined magnetic pull, by which the moving core is pulled against the force of the spring and moves toward the right (in the illustration). At this time, the motor armature is running but slowly because of the small initial current. As the moving core is forced toward the right, its left end turns the shift lever around its pivot, so that the bottom end of the lever pushes the clutch toward the left. Since the clutch is splined to the motor shaft and because the motor shaft is rotating, the clutch advances toward the left as assisted by the helical splines.

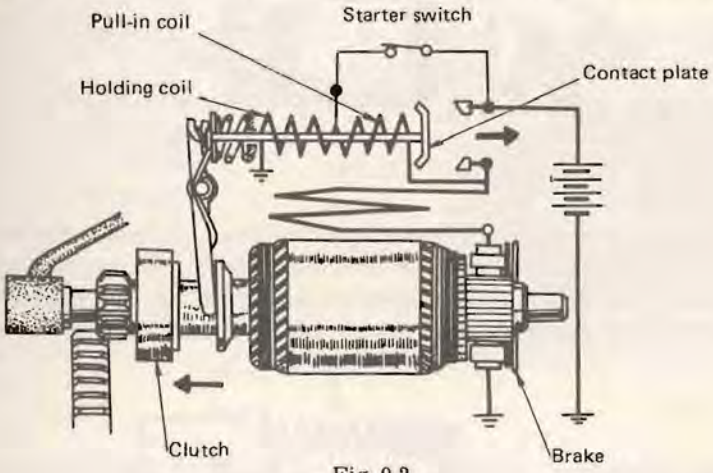

Fig. 9-2

2. Pinion meshing with the ring gear

The pinion may mesh into the ring gear smoothly or may bounce on the ring gear, depending on the relative positions of their teeth. In the latter event, the springs mounted on the clutch absorb the shock and, since the pinion is rotating and being pushed, its teeth will eventually mesh into those of the ring gear.
In either case, the shift lever is allowed to turn fully and permit the moving core to be kept pulled all the way toward the right. When this happens, the main contactor of the magnetic switch closes to connect the starter motor direct to the battery. Consequently, a very large current—load current—flows through the motor to develop a high cranking torque for driving the engine crankshaft through the drive pinion and ring gear.

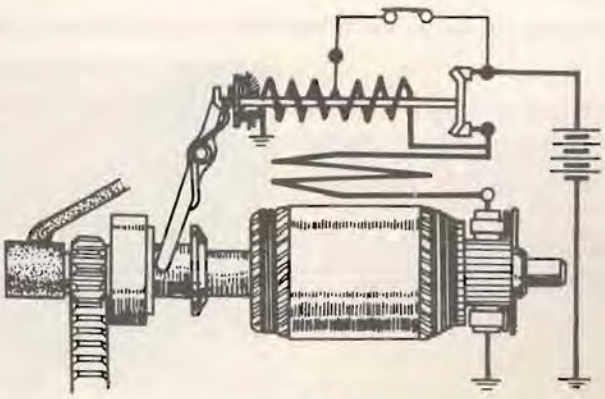

Fig. 9-3

3. Engine cranking

When the motor is cranking the engine with full force, the pull-in coil is bypassed or shunted but the holding coil remains energized to hold the moving core in its shifted position. Under this condition, the shift lever is pushing the pinion by overcoming the force of springs.

As the engine fires up and begins to run steadily and if the starting switch is kept closed, the ring gear starts driving the pinion. When this occurs, the pinion merely spins on the motor shaft without transmitting this reverse drive to the motor. This is because the clutch is of overrunning type.

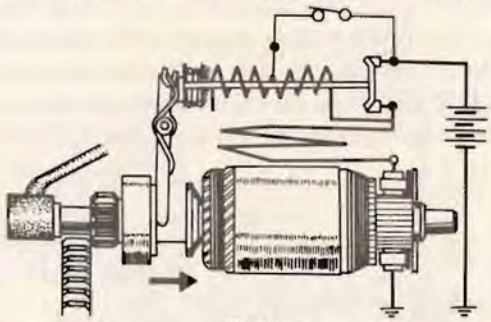

Fig. 9-4

4. Teminating cranking operation

Turning off the starting switch de-energizes (shutting off the current) the holding coil so that the pull hitherto acting on the moving core disappears. By the force of the spring, then, the shift lever is turned back and the moving core is forced toward the left to open the main contactor. This shuts off the load current and the drive pinion, shift lever and moving core go back to their original positions.

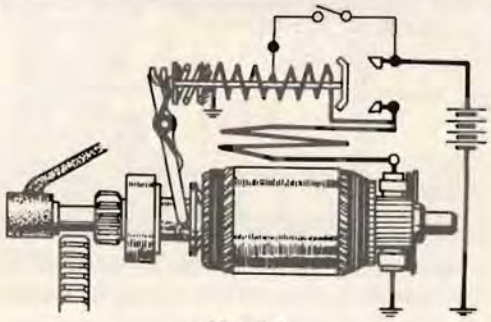

Fig. 9-5

9-4. Removal

1. Disconnect battery cable from the positive terminal of the battery.
2. Take down air cleaner.
3. Disconnect BLACK/YELLOW lead wire and power circuit wire (leading to the plus side of the battery) from the starter motor.
4. Remove the two bolts securing the starter motor assembly to the crank case, and take off the starter motor.

9-5. Disassembly

1. Remove the nut securing the end of the field coil lead to the terminal on the head of magnetic switch.
2. Take off the magnetic switch from the starter motor body by removing the two mounting screws.

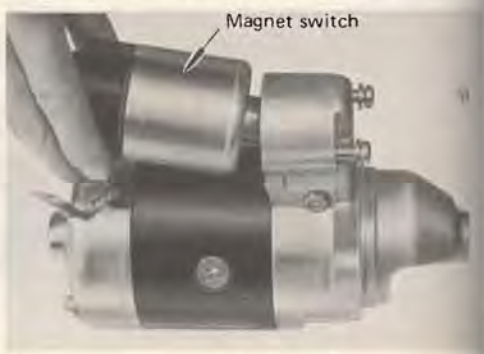

Fig. 9-6

3. Remove the bearing cover, and take out lock plate brake spring and rubber.

Fig. 9-7

4. Disassemble the brush holder section in the following sequence:
   (1) Remove two through bolts.
   (2) Detach commutator end frame.
   (3) Draw brushes out of the holder.
   (4) Take out the brush holder.

Fig. 9-8

5. Remove the case complete with field coils.
6. Pull off the set pin from shift lever, and take out the rubber and plate inside the housing.
7. From the housing, take out the armature, starter clutch and shift lever.
8. Draw off the starter clutch, as follows:
   (1) Draw stop nut toward the clutch side.
   (2) Remove snap ring and slide off clutch.

Fig. 9-9

9-6. Maintenance Services

In the event the starter motor is found unable to crank the engine, the first thing to be checked is whether the drive pinion plunges out. If the pinion does not plunge out, then the magnetic switch must be checked. If the pinion plunges out satisfactorily, then the inability of the motor to crank the engine is likely to be due to some defective condition in the commutator or in the armature, provided that the battery is in good condition and that the circuit for applying the battery voltage to the motor is free from any open or fault. Having narrowed the scope of search for the cause of trouble to the motor proper, proceed as follows:

1. Checking the field coils

Check to be sure that the field circuit is neither grounded or open-circuited. This can be effected by using a circuit tester as shown. If continuity is indicated by the tester hooked to the housing or frame, it means that the insulation has failed, resulting in a grounded field coil. Such a fault can be corrected by repair in most cases.

Fig. 9-10

2. Checking the armature

(1) Using the circuit tester, see if there is any continuity between commutator and armature core. The tester will indicate infinite resistance if the insulation is in sound condition.

Fig. 9-11

(2) Again using the tester, check for continuity between each pair of adjacent commutator segments. If discontinuity is noted at any part of the commutator, replace the whole sub-assembly of the armature.

Fig. 9-12

3. Servicing the commutator

(1) If the surface of the commutator is gummy or otherwise dirty, wipe it off with a cloth dampened with gasoline. If the surface is coarsened or in burnt condition, smoothen it by grinding with sandpaper. If the surface is grooved deep, it may be necessary to remove the groove marks by turning the commutator in a lathe; such turning is often successful in reconditioning the commutator if the extra stock necessary for removal by cutting is available without reducing its diameter to the limit.

	Standard	*Service limit*
Commutator diameter	*32.5 mm (1.28 in.)*	*30.5 mm (1.20 in.)*

Fig. 9-13

9-10

9-11

9-12

-13

(2) Make sure that the mica between each pair of adjacent segments is undercut to the prescribed depth. The conventional undercutting technique is to be used in repairing the commutator.

	Stnadard	*Service limit*
Mica undercut	*0.5 ~ 0.8 mm (0.02 ~ 0.03 in.)*	*0.2 mm (0.007 in.)*

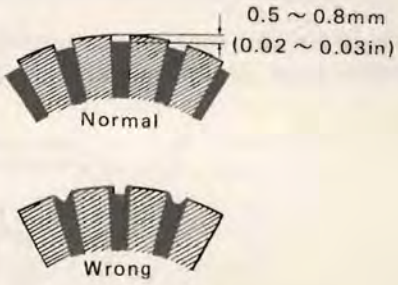

Fig. 9-14

4. Testing the magnetic switch

Before separating the magnetic switch from the motor proper just removed from the crank case, test the switch by connecting the battery to the switch, as shown, to see if the drive pinion jumps out when the battery voltage is applied. (With the positive terminal of the battery cable end.) With the switch coils in sound condition, the drive pinion will jump out and, even when the main circuit is opened at "A", will remain in "jumped out" position. If undoing the connection at "A" causes the drive pinion to retract, it means that the holding coil is defective.

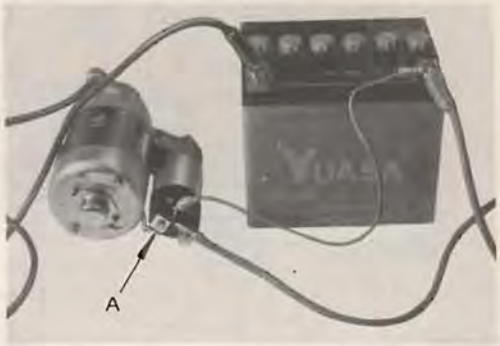

Fig. 9-15

5. Servicing the brushes

Check the length of each brush. If brushes are worn down to the service limit, replace them.

	Standard	*Service limit*
Brush length	*19 mm (0.75 in.)*	*12 mm (0.47 in.)*

Fig. 9-16

6. Servicing the brush holders

Make sure that the insulation between the two brush holders, positive and negative, is in good condition. This should be verified with the use of the circuit tester. If any continuity is noted, repair the insulation.

Fig. 9-17

9-7. Important Reminders for Starter Motor Reassembly

Various parts of the starter motor assembly need lubrication at each overhaul. The lubrication points are illustrated below: (Also required is locking by punching.)

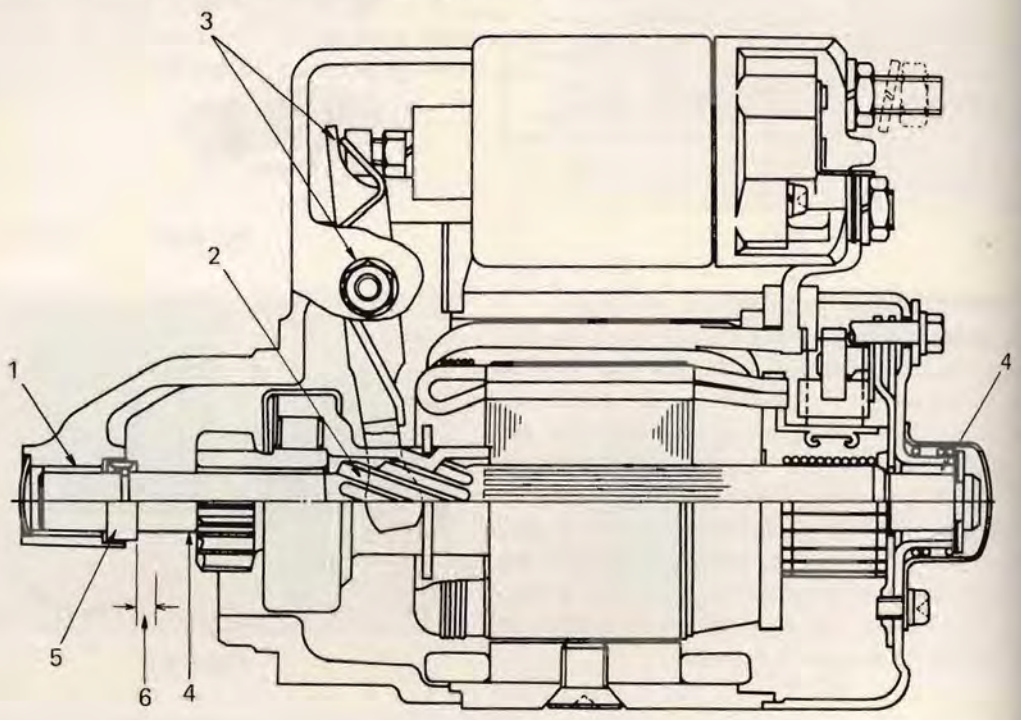

Fig. 9-18

1. Give grease to the bush in the drive housing.
2. Grease the helical splines before mounting the clutch sub-assembly.
3. Grease the sliding or contacting surfaces associated with shift lever.
4. Grease the bush fitted into the end frame and also the armature shaft end inserted into this bush.
5. After installing the stop nut, lock it by staking at two places with a punch.
6. Adjust the length of the moving stud so that the clearance between the stop nut and the pinion plunged-out condition will be from 1 to 4 mm (0.04 to 0.16 in.). To check, run the motor in no-load condition to plunge out the pinion and wait till the motor speed settles.

rication points are

into this bush.

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otor in no-load con-

10. CHARGING SYSTEM

10

10-1. Description

The charging system consists of the alternator complete with a means of rectification for producing DC output power, and the two-element regulator unit for controlling the voltage.

In the alternator, the armature is stationary; it consists of three coils mounted on the stator in such a way as to produce three-phase alternating voltage. This voltage applies to the rectifier for full-wave rectification. The rectifier delivers power in the form of alternating current.

Against the stationary armature, revolving magnetic fields are produced by the field winding carried in the rotor. This feature of construction of the alternator strikes a distinct contrast to the dynamo (DC generator), in which the field is in the stator while the armature is in the rotor.

The magnitude of three-phase AC power available from the alternator to its rectifier is directly proportional to rotor speed and field (excitation) current. It is the function of the regulator unit to control the field current automatically in such a way that the output voltage unit to control the field current automatically in such a way that the output voltage remains constant; another function is to control the circuit of the charge warning lamp. Thus, the regulator unit has two element; one is voltage regulator for performing the first function and the other is voltage relay for the second function.

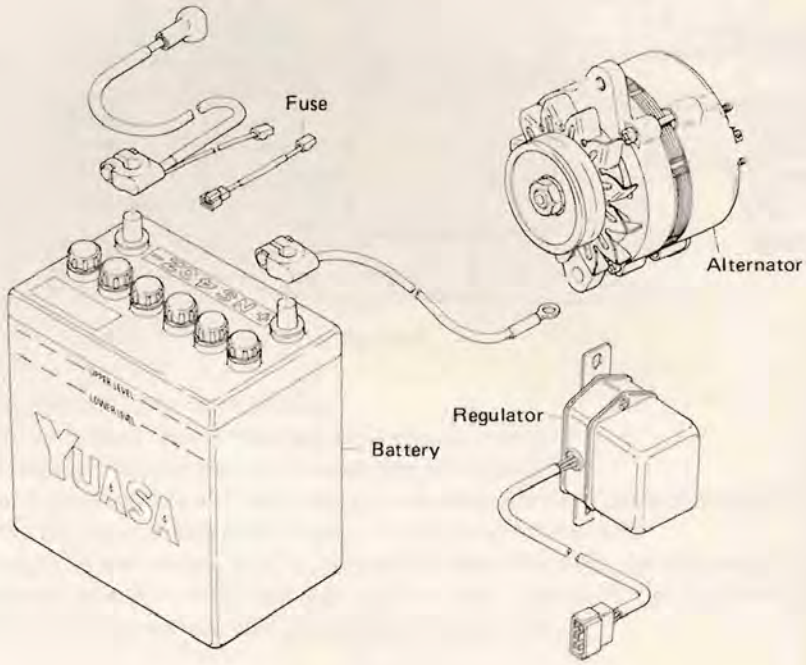


Fig. 10-1

ation for producing DC

the stator in such a way
for full-wave rectifica-

field winding carried in
ast to the dynamo (DC

ifier is directly propor-
lator unit to control the
field current automati-
to control the circuit of
e regulator for perform-

10-2. Charging Operation

The following description of the system operation is referenced to the circuit diagram indicated below.

Closing the ignition switch connects the charge warning lamp to the battery; a small current flows through the lamp, lighting this lamp to signify that the alternator is not charging the battery, and through the contact point of voltage relay to ground. Another current flows from the battery through the contact point of voltage regulator into the field winding in the alternator rotor, thereby producing magnetic fields around the rotor. These fields, which are stationary at this time because the rotor is not running, link the armature coils and the rotor poles through the air gap between stator and rotor.

Under these conditions, suppose the engine is started up. The rotor begins to run, and its magnetic fields revolve to "cut" the three armature coils in succession. In each armature coil, an electromotive force is generated by electromagnetic induction. This force changes its direction alternately. Consequently, the three armature coils apply three alternating voltages to the rectifier. Viewed collectively, these voltages constitute the three-phase output voltage of the alternator.

The rectifier consists of three pairs of rectifying diodes, forming three one-way paths of current for full-wave rectification to convert the alternator output power into a direct current power, which is available from the "B" terminal of the alternator-rectifier unit, relative to "E" (ground) terminal.

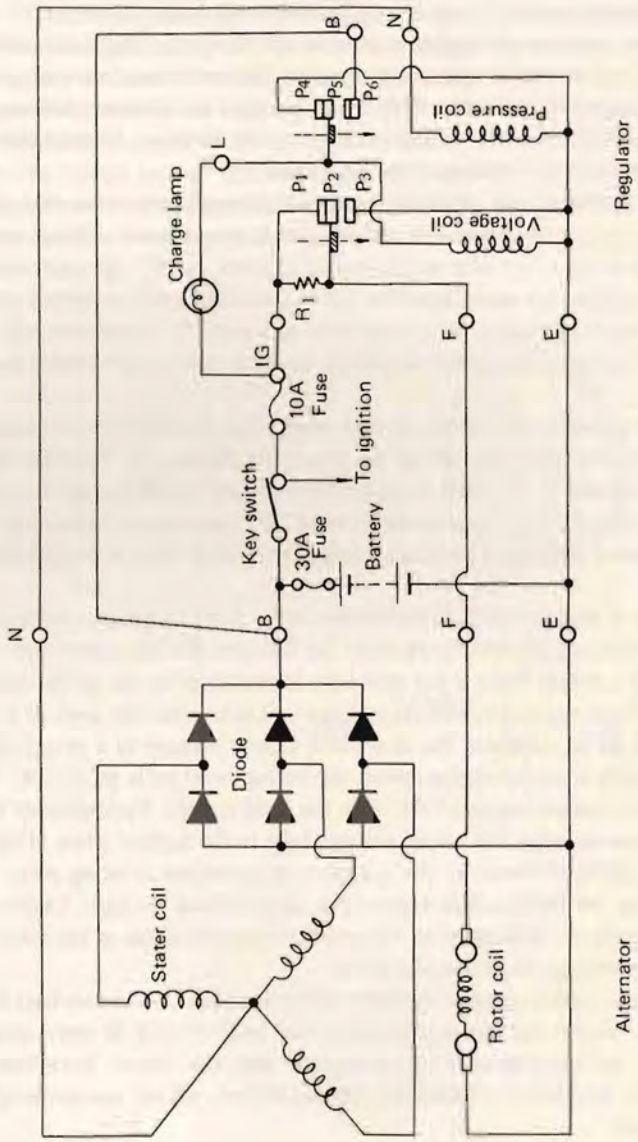
As the engine picks up speed, the electromotive force induced in each armature coil increases, so that the output voltage appearing at terminal "B" (relative to terminal "E") becomes high enough to "push" electricity into the battery through its positive terminal. In other words, the battery begins to draw a charging current.

Let's take a look at the pressure coil of the voltage relay. One end of this coil is connected to terminal "E" and the other end to the neutral point "N" of the three armature coils. Potential level of "E" (ground) is now so much lower than that of "N" that a current flows in the pressure coil to develop a magnetic pull on its armature carrying point "P5". Consequently, point "P5" separates from point "P4" and touches point "P6"; the charge warning lamp thus becomes shunted and stops burning to signify that the battery is getting charged.

During the early stage of engine starting, the alternator output voltage may be lower than the battery voltage; even in such a case, no current flows from the battery into the alternator because of the rectifier diodes. The reason why a cutout relay is not used here is explained by the presence of the diode rectifier.

The function of the voltage regulator with its voltage coil is to alter the path of field (excitation) current for the field coil, in order to maintain the alternator output voltage at a relatively constant level. When this voltage rises owing to a rise in engine speed, the voltage coil pulls point "P2" away from point "P1", thereby introducing the control resistor "R1" into the field circuit. Field current falls slightly because of this resistance and, consequently, the output voltage falls to the normal level. If the engine picks up speed further, the magnetic pull developed by the voltage coil increases to bring point "P2" into contact with "P3", thereby shunting the field coil to reduce the field current to zero. Under this condition, voltage generation in the alternator is dependent on the residual magnetization of the rotor, which is small enough to keep down the output voltage to the normal level.

The foregoing description of the voltage regulator operation may be summarized as follows: the regulator controls the alternator output voltage by controlling the field current in three steps; first allowing a full field current to flow; secondly, by inserting a resistor into the circuit to reduce the field current; and thirdly, by shunting the field coil to reduce the current to zero, all for maintaining the output voltage at a relatively constant level.


B
N
P4
P5
P6
Pressure coil
L
Charge lamp
P1
P2
P3
Voltage coil
Regulator
R1
IG
F
E
10A Fuse
To ignition
Key switch
30A Fuse
Battery
N
B
F
E
Diode
Stater coil
Rotor coil
Alternator

10-3. Alternator

1. Description

In order to distinguish it from conventional automotive dynamos, the DC generating device is called the alternator for it produces a DC output out of three alternating currents generated in its winding.

The alternator consists of: the rotor (which produces revolving magnetic fields), stator (which is a series of coils disposed and arranged to form three coil coups), two slip rings and two brushes (through which DC excitation current is fed into the field winding of the rotor), and the rectifier (which consists of 6 semiconductor diodes, and is built in the alternator).

In operation, the revolving magnetic fields "cut" the stator coils. In other words, the three groups of coils experience changes in magnetic flux. By the flux changes, an alternating electromotive force (emf) is induced in each coil group. Thus, three alternating voltages are available from the stator.

The six diodes are arranged so that they "rectify" or convert the three alternating outputs into a DC output. Three-phase full-wave rectification is effected by the built-in rectifier.

In terms of electric current, a diode is a circuit element that passes the current only in one direction. Of the six diodes, three are arranged to pass currents in the same direction, and the remaining three in the opposite direction. Since three alternating currents undergo full-wave rectification and are combined into one by superposition, the DC output of this alternator is much steadier and carries much less pulsating or ripple components than a DC output made available by full-wave rectification of a single-phase alternating current.

Fig. 10-2

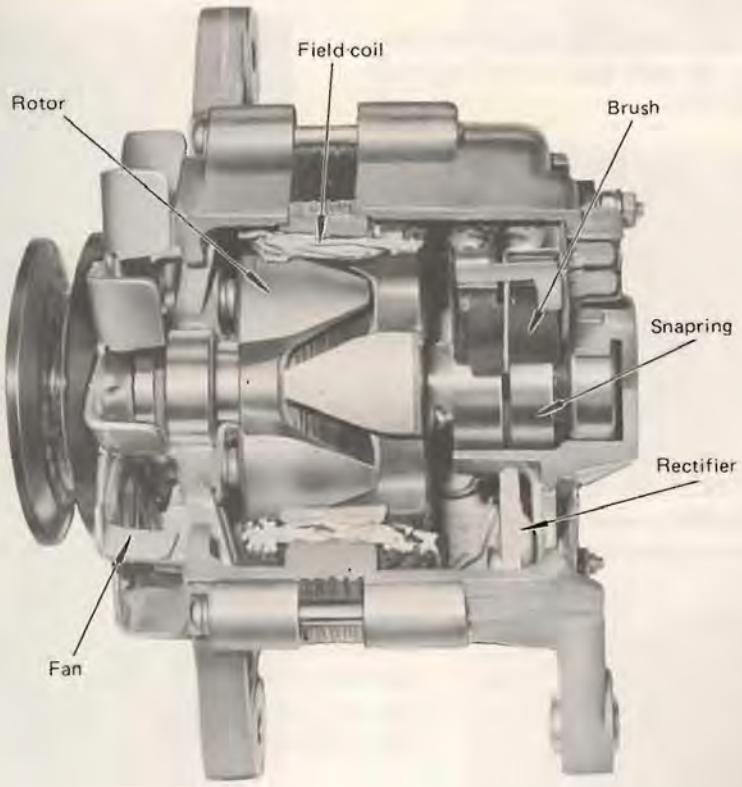


Fig. 10-3

2. Data and Specification

Nominal operating voltage	*12 volts*
Maximum alternator output	*35 A*
Polarity	*Negative ground*
Effective pulley diameter	*70 mm (2.75 in.)*
No-load alternator speed	*1,050 ~ 1,250 rpm, 14 volts at normal temperature*
Full-load alternator speed	*4,000 rpm maximum, 35 A, 14 volts at normal temperature*
Direction of rotation	*Clockwise as viewed from pulley side*
Maximum permissible alternator speed	*12,000 rpm*
Working temperature range	*$-40°C \sim 80°C$*
Rectification	*Full-wave rectification*

3. Removal

(1) Disconnect the positive battery cable from the battery.
(2) Disconnect from the alternator the white cord and circuit coupler.
(3) Remove the bolts securing "V" velt adjuting arm and alternator, and take down the alternator.

4. Alternator Disassembly

(1) Remove the nut securing the fan to the rotor shaft. To do so, the shaft must be held rigid and steady by using a tool.

Hexagon wrench, 6mm (09911-70120).

Fig. 10-4

(2) Remove the 3 bolts fastening the end frame to the rotor housing; tap on the edges of the end frame with a wooden mallet to separate it from the housing, thereby severing the rotor from the stator.

Fig. 10-5

(3) Draw out the rotor. It may be necessary to lightly tap on the core and housing.

Fig. 10-6

(4) Remove the 3 nuts securing the rectifier holder in place, and one other nut holding down the terminal insulator. Remove the rear end cover.

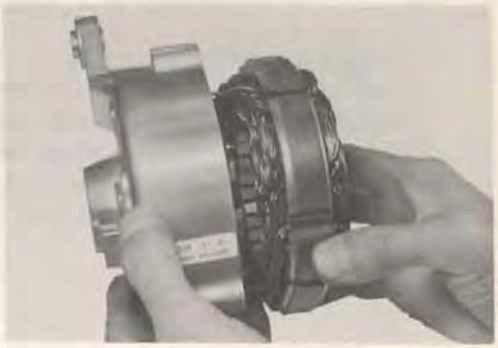


Fig. 10-7

(5) Remove the brush holder from the stator.

Fig. 10-8

NOTE:
The alternator is to be reassembled by reversing the foregoing sequence of steps. Before inserting the rotor into the housing, be sure to have the brushes installed in the holder. (Use a proper-size rod, manipulating it from the rectifier side, to set the brush in the holder.)

Fig. 10-9

5. Maintenance Services

(1) Rotor

(a) Testing the rotor for open-circuit

Check to be sure there is continuity between the two slip rings when tested as shown. Absence of continuity means that the field coil is open-circuited and must be replaced.

Ring-to-ring circuit resistance	*4 ~ 5 ohms*

Fig. 10-10

(b) Testing the rotor for grounding

Check to be sure there is no continuity between the slip ring and the rotor shaft when tested as shown. Presence of any continuity means that the insulation on the field coil has failed, making it necessary for the rotor to be replaced.

Fig. 10-11

(2) Stator

Check to be sure there is no continuity between the stator core and each armature coil; any continuity noted means that the coil is grounded. A grounded armature coil can be corrected by locating the faulted point and repairing the fault.

Fig. 10-12

(3) Brushes

Check each brush for wear by measuring it length, as shown. If the brush is found worn down to the service limit, replace the brush and holder altogether.

	Standard	*Service limit*
Brush length	*16.5 mm (0.65 in.)*	*11.0 mm (0.45 in.)*

Fig. 10-13

(4) Rectifier

The rectifier is to be checked with the circuit tester for continuity in one direction and non-continuity in the other direction.

Put one tester lead to terminal "B" and the other lead to terminal "N"; then swap the two leads. Of the two tester indications, one should be about 20 ohms, meaning continuity, and the other should be infinity (non continuity.).

Put one tester lead to terminal "N" and the other lead to terminal "E"; then swap the two leads. In this case, too, the two tester indications should be similar to those mentioned above.

Fig. 10-14

(5) Alternator load performance

With the alternator-rectifier unit in place, run the engine in a speed range of 3,000 to 4,000 rpm, and check the alternator output voltage and current. Compare the readings against the prescribed values, indicated below. An output current which is small means the possibility of the rectifier being defective, any of the stator (armature) coil open-circuited, or an insulation failure resulting in a grounding fault.

Standard output voltage and current	*13.8 ~ 14.8 volts, 20A minimum*

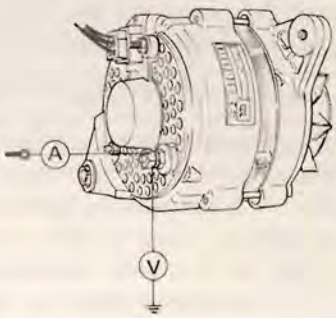


Fig. 10-15

10-4. Alternator Regulator

In the two-element regulator, one coil acts as voltage limiter or regulator and the other coil as relay for controlling the charge warning lamp. It should be noted in the circuit diagram that the magnetic pull developed by the voltage coil to move its moving point "P2" is roughly proportional to the alternator output voltage, whereas the magnetic pull developed by the pressure coil of the relay is dependent on the potential level of neutral point "N" of the armature with respect to the ground. A clear understanding of these relations is essential in checking, testing and servicing the regulator unit.

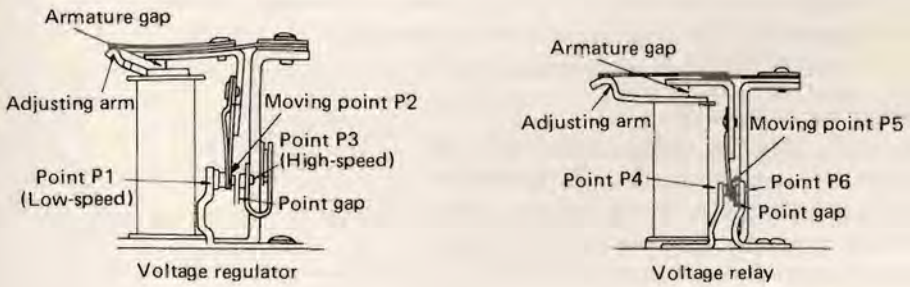


Fig. 10-16

1. Specifications

Regulated voltage	*13.8 ~ 14.8 volts*
Voltage-relay cut in voltage	*4 ~ 5.8 volts*

2. Maintenance services

(1) Voltage-relay cut in test

Hook up a voltmeter, inserting it between ground and WHITE-BLACK wire (of the regulator circuit coupler. Start up the engine, and raise its speed gradually until the charge warning lamp goes off. Read the voltage just when the lamp goes off. This reading should be within the prescribed range, indicated below; if not, raise or lower the voltage into this range by bending the adjusting arm of the relay.

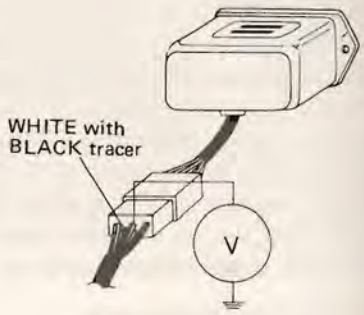


Fig. 10-17

Prescribed cut in voltage	*4 ~ 4.5 volts*

(2) Voltage-regulator limiting action test

Hook up a voltmeter, inserting it between the alternator "B" terminal and ground, and run the engine within a range of 2,000 to 3,000 rpm, while reading the voltmeter indication. The voltage read is the charging voltage as limited by the action of the voltage regulator; the reading should be within the prescribed range, which is indicated below. If the charging voltage is found too high or too low, adjust it by bending the adjusting arm of the voltage regulator.

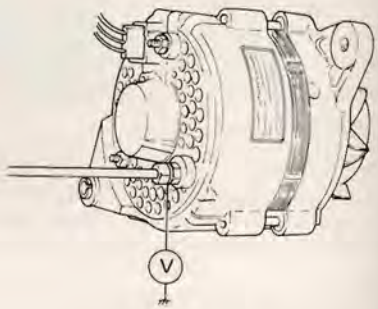


Fig. 10-18

Prescribed range of charging voltage	*13.8 ~ 14.8 volts for 2,000 ~ 3,000 engine rpm*

(a) If the charging voltage is noted to oscillate or otherwise be unstable, it is most likely that the contact point faces in the voltage regulatoare dirty or roughened. Cleaning and smoothening the faces will remedy this malcondition.

(b) If the charging voltage is too high, the possible causes are as follows:

1) Point gap is too wide on low-speed side or high-speed side in the voltage regulator.
2) Contact resistance at high-speed side point is too large.
3) The coil of voltage regulator or relay is open-circuited.
4) Open circuit in the line to "N" or "B" terminal of the regulator unit.
5) Contact pressure is too high on low-speed side point.
6) Imperfect grounding of the regulator unit.

(3) Continuity test on field coil

Using the circuit tester, check for continuity between the "E" and "F" terminals of the alternator, as shown. The tester should indicate continuity with a resistance value meeting the following specification:

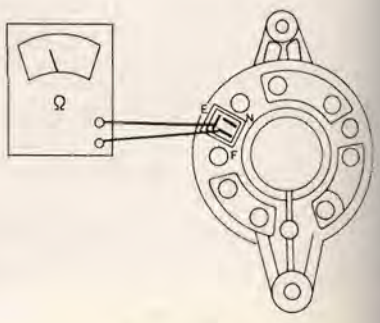


Fig. 10-19

Standard field circuit resistance	*6 ~ 9 ohms*

(a) If the resistance value noted is too small, it is likely that there is a short-circuit through insulation layers in the coil.

(b) If the resistance value noted is too large, the following possibilities must be considered:

1) An open-circuit is developing in the field coil.
2) The brushes are not seated properly on the slip rings.
3) Brushes or slip rings are burnt.

(4) Checking terminal-to-terminal resistances

Pull off the connector from the regulator unit, remove the cover, and check the resistance between terminals. Refer the resistance readings to the following chart to diagnose the internal condition of the regulator unit:

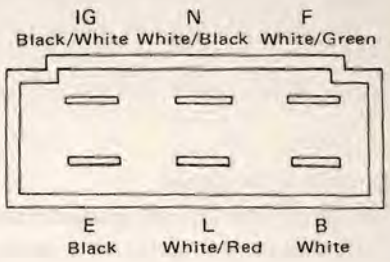


Fig. 10-20

Guide on regulator diagnosis				
Terminal checked	*State of vol. relay*	*State of vol. regulator*	*Normal resistance value (ohms)*	*Diagnosis*
IG - F		*Standstill*	*Zero*	*If not zero, point contact is defective on low-speed side.*
		Attracted	*Approx. 11*	*If infinity is noted, control resistor is open-circuited.*
L - E	*Standstill*		*Zero*	*If not zero, relay contact point is not closing fully.*
	Operated		*100*	*If zero, relay point faces are fused together. If infinity is noted, voltage coil is open-circuited.*
N - E			*Approx. 24*	*If zero, pressure coil is shorted. If infinity, voltage coil is open-circuited.*
B - E	*Stnadstill*		*Infinity*	*If not infinity, relay point faces are fused together.*
	Operated		*100*	*If zero, voltage coil is shorted. If infinity, voltage coil is open-circuited or contact action of the point is defective.*
B - L	*Standstill*		*Infinity*	*If not infinity, relay point faces are fused together.*
	Operated		*Zero*	*If not zero, contact action of the point is defective.*

NOTE: In the above chart, "standstill" means that the regulator unit is in de-energized state; "operated" means that the armature is manually (with a fingertip) actuated as if it were pulled in by the coil.

(5) Gap adjustment

(a) Voltage relay

Using a thickness gauge, check the two gaps, point gap and armature gap. Refer the gauge readings to the specification value, below, and adjust the gaps as necessary.

Gap specifications	
Armature gap	*Approx. 0.6 mm (0.023 in.)*
Point gap	*Approx. 0.4 mm (0.015 in.)*

Fig. 10-21

(b) Voltage regulator

Two gaps are to be checked: point gap, and armature gap. Use a thickness gauge, and compare the readings taken against the following specifications. Adjust the gaps as necessary.

Gap specifications	
Aumature gap	*Approx. 1.1 mm (0.043 in.)*
Point gap	*Approx. 0.5 mm (0.019 in.)*

Fig. 10-22

10-5. Main Fuse

The main fuse, located in the path of current to and from the battery, is of fusible link type, whose conductor wires are copper-nickel alloy in material and are sheathed in double layer of insulation. It interrupts overcurrent by the melting action of its conductor.

Interrupting capacity of main fuse	*30 A*

Fig. 10-23

10-6. Battery

1. **Battery specifications**

Model	*NS 402-UP*
Rated capacity	*35 AH, 12 volts*
Electrolyte	*2.4 litres (5.07/4.22 US/Imp. pt.)*
Electrolyte S.G.	*1.280 when fully charged at 20°C (68°F)*

2. Care of the battery

The following information is basic in nature and is nothing new; it is merely a reiteration of what every service shop personnel knows about the automotive storage battery. The information is intended to serve as a reminder to the reader, with a hope that he will, in turn, remind each final user of the important basic facts about the battery whenever opportunity permits him to engage in a conversation with the final user in the shop or out of the shop.

(1) The battery is a very reliable component, but needs periodical attentions.

Keep the battery container clean; prevent rust formation on the terminal posts; keep the electrolyte surface up to level in each cell—uniformly in all cells; and try to keep the battery fully charged at all times.

(2) Preserve the capacity of the battery.

There is a limit to the ability of the battery to hold electricity in store. This limit is called "capacity."

There are several ways for the battery to lower its capacity:

(a) Loss of electrolyte, or fall in electrolyte level.

When this happens, the battery cannot hold so much electricity as it originally could. Handle the battery with care when you take it down. Barring the loss of electrolyte by careless spilling or otherwise, the electrolyte level goes down gradually in the battery at work because the water content of it evaporates. Periodically and distilled water to each cell, as necessary, so that the electrolyte is always up to the specified level. Never allow its surface to fall so much as to expose the cell plates.

(b) Overcharging the battery in place or off the machine.

In recharging the battery off the machine, caution must be exercised so as not to overcharge it. Overcharging gives rise to several complexities. For one thing, it heats up the battery to melt the pitch to result in a destroyed battery. Overcharging could occur in a battery in place if the voltage regulator is maladjusted to allow the alternator (or the dynamo in other machines) to develop too high an output voltage. For another thing, "gassing" occurs in a battery being overcharged to result in a loss of water content. One of the most serious consequences of overcharging is the swelling of positive-plate grids, causing the grids to crumble and the plates to buckle.

(c) Undercharging the battery in place.

Regulator malfunctioning is usually the cause of the battery remaining in a state of charge far below its capacity. This condition is very undesirable in freezing weather, for the electrolyte in such a battery can easily freeze up to result in a destroyed battery. Moreover, an undercharged battery is an easy prey to a greater evil—sulfation.

(d) Sulfation.

Let us recall the electrochemical reactions that take place in the battery during charging and discharging. As the battery gives out its energy (discharging), the active materials in its cell plates are converted into lead sulfate. During recharging, this lead sulfate is reconverted into active material. If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. "Sulfation" means the result as well as the process of that reaction. Such a battery can be revived by very slow charging and may be restored to usable condition but it is a damaged battery and its capacity is lower than before.

(3) Keep the battery cable connections clean.

The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current. The inability of the starter motor to crank the engine is often due to the rust formation in the battery cable connection. Clean the terminals and fittings periodically to ensure good metal-to-metal contact, and grease the connections after each cleaning to protect them against rusting.

(4) Be always in the know as to the state of charge of the battery.

The simplest way to tell the state of charge is to carry out a hydrometer test. The hydrometer is an inexpensive instrument for measuring the specific gravity (S.G.) of the battery electrolyte. Why measure the S.G.? Because the S.G. of the electrolyte is indicative of the state of charge.

The direct method of checking the battery for state of charge is to carry out a high-discharge test which involves a special low-reading voltmeter, an expensive instrument used generally in the service shops but no recommendable to the user of the machine.

At 20°C of battery temperature (electrolyte temperature):

The battery is in FULLY CHARGED STATE if the electrolyte S.G. is 1.280.

The battery is in HALF CHARGED STATE if the S.G. is 1.220.

The battery is in NEARLY DISCHARGED STATE if the S.G. is 1.150 and is in danger of freezing.

What if the battery temperatures not 20°C (68°F)? Since the S.G. varies with temperature, you have to correct your S.G. reading (taken with your hydrometer) to the value at 20°C,and apply the corrected S.G. value to the three-point guide stated above. This mannerof correction needs a chart showing the relation between S.G. and temperature. There is a simpler way: refer to the grap h given below which tells you the state of charge for a range of S.G. value and a range of temperature.

How to use the temperature-corrected state-of-charge graph

Suppose your S.G. reading is 1.28 and the battery temperature is -5°C (23°F). Locate the intersion of the -5°C line and the 1.28 S.G. line. The intersection is "A". It is in the zone for CHARGED STATE. How much is the battery charged? To find out the answer, draw a line parallel to the zone demarcation line, extending it to the right, and see where this line crosses the percentage scale. In the present example, the line crosses at, say, 85% point. The battery is 85% fully charged.

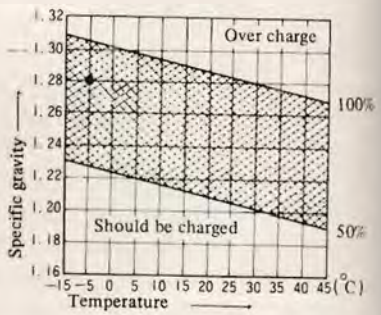


Fig. 10-24

11. CLUTCH

11

11-1. Description

The clutch is a diaphragm-spring clutch of dry single disc type, as shown in the cross sectional view of Fig. 11-1. The diaphragm spring is of tapering-finger type, which is a solid ring in the outer diameter part with a series of tapering fingers pointing inward. The disc, carrying six torsional coil springs, is slidably mounted on the transmission input shaft with a serration fit.

The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge part of the spring pushes on the pressure plate against the flywheel (with the disc in between) when the clutch release bearing (throwout bearing) is held back: this is the engaged condition of the clutch.

Depressing the clutch pedal causes the release bearing to advance and push on the tips of the tapering fingers of diaphragm spring. When this happens, the diaphragm spring acts like the release levers of a conventional clutch, pulling the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transmission input shaft.

The clutch construction is simple, well balanced relative to rotating speed, durable and capable of withstanding high torsional load and, what is particularly noteworthy, does not require the adjustment of the kind involved in the conventional coil-pressure-spring release-lever type of clutch.

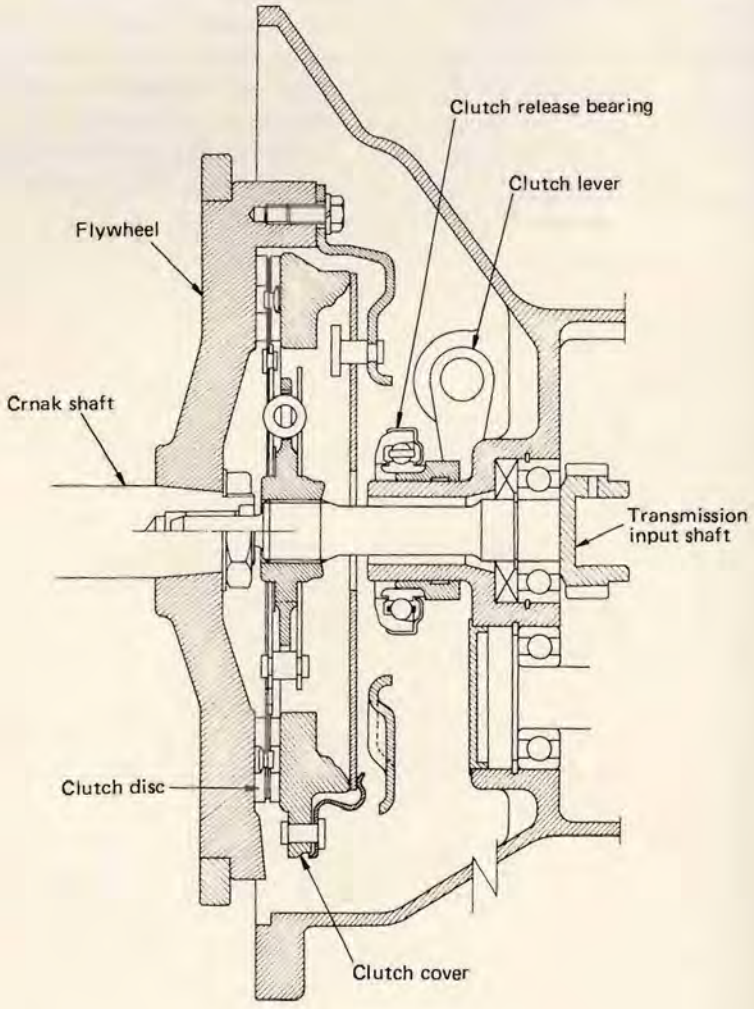


Fig. 11-1

11-2. Removal

Removal of the clutch presupposes that the engine has been dismounted according to the method outlined in the section for the engine. The clutch cover, disc and release bearing can be taken off only when the engine is off the machine.

1. Remove the 6 bolts securing the clutch cover to the flywheel, and take off the cover and clutch disc.

Fig. 11-2

2. With the clutch release bearing attached to the retainer, remove the retainer spring from the release shaft. The release bearing will come off as the spring is being removed.

Fig. 11-3

11-3. Maintenance Services

1. Clutch disc facing surface condition

A burnt or glazed (glass-like surface) facing can be reconditioned by grinding it with No. 120-200 sandpaper. If the surface is in bad condition beyond repair, replace the whole clutch disc assembly.

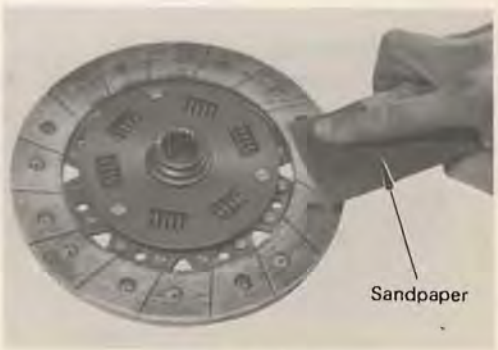


Fig. 11-4

2. Clutch facing wear

Check the wear of the facing by measuring the depth of each rivet head depression, which is the distance between rivet head and facing surface. If the depressing is found to have reached the service limit at any of the holes, replace the clutch disc assembly.

	Standard	*Service limit*
Rivet head depression	*1.2 mm (0.47 in.)*	*0.5 mm (0.02 in.)*

Fig. 11-5

3. Backlash in disc serration fit

Check the backlash by turning the disc back and forth as mounted on the transmission input shaft. Replace the disc assembly if the backlash is noted to exceed the limit. Backlash here is a circular displacement as measured with a dial indicator as shown.

A clutch disc exhibiting a large backlash will make an impact noise each time the clutch is engaged, and will prevent the clutch to engage smoothly.

Backlash in serration fit	*Service limit*
	0.5 mm (0.02 in.)

Fig. 11-6

4. Clutch cover

(1) Inspect the clutch cover for evidence of the diaphragm spring rivets getting loose. If the rivets are loose or are tending to become loose, replace the cover assembly; such a cover makes a rattling noise when the clutch pedal is depressed.

(2) Inspect the tips of the tapering fingers (to which the release bearing exerts a push to disengage the clutch) for wear. If the tips are worn excessively, replace the cover assembly.

Fig. 11-7

5. Release bearing

Replace the release bearing if it sticks, rattles or makes abnormal noise when spun and turned by hand.

Fig. 11-8

6. Input shaft bearing and oil seal

Inspect the pilot bearing (by which the forward end of the input shaft is piloted in the crankshaft) and oil seal for evidence of malcondition at all times.

Abnormal noise coming from the clutch, when the clutch pedal is depressed to disengage the clutch, is often due to a defective pilot bearing.

Fig. 11-9

7. Clutch pedal height

Bring the clutch pedal height to the same height as that of the brake pedal. This is to be accomplished by screwing in or out the adjusting bolt located near the pivoting point of the pedal arm.

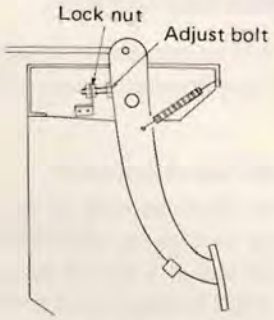


Fig. 11-10

8. Clutch pedal play

There are two places where adjustment is to be made for giving a proper amount of play to the clutch pedal. One is the clutch cable adjuster, above the engine mounting member; and the other is the inner cable adjusting nut at the distal end of the clutch release lever. The play is prescribed to be within the following range:

Clutch pedal play	*20 ~ 30 mm (0.9 ~ 1.2 in.)*
Clutch release arm play	*3 ~ 4 mm (0.12 ~ 0.16 in.)*

Fig. 11-11

NOTE:
In the right-hand steering machine, make the adjustment by means of the clutch cable adjuster in such a way that the inner cable will not extend more 5 mm (0.19 in.) from the adjusting nut. This is necessary for securing the prescribed amount of clearance between inner cable and steering gear box.

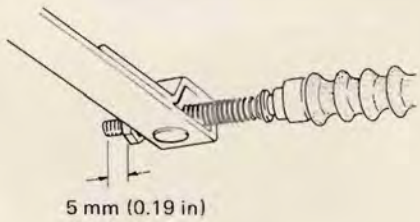


Fig. 11-12

11-4. Clutch Installation

The clutch is to be installed by reversing the removal procedure. Some important steps will be explained in detail.

1. Clutch disc and clutch cover

A special tool must be used to install the disc and cover, in order to align the two to the transmission input shaft. The tool is a sort of dummy; insert it into the bearing (pilot bearing) (as if it were the transmission input shaft). Then mount the disc and cover and, after bolting up the cover to the flywheel, draw off the mounting tool.

Clutch disc center guide (09923-36310)

Fig. 11-13

2. Input shaft bearing

There is a void between input shaft bearing and oil seal. Make this void 60% full with SUZUKI SUPER GREASE "A".

Fig. 11-14

3. Clutch release bearing retainer

Before installing the retainer, apply SUZUKI SUPER GREASE "A" to its inner surface.

Fig. 11-15

4. Clutch release arm

The release arm can be installed after the transmission has been mounted and set in place but there will be some difficulty of handling the arm with the transmission in place. The easier way is to install the arm before the transmission is installed; the method is as follows:

In the right-hand steering machine, match the punch marks on release arm and shaft. In the left-hand steering machine, locate the punch mark on release arm off the punch mark on release shaft by an amount equal to one serration, as shown. Secure the release arm good and hard to the shaft in that position.

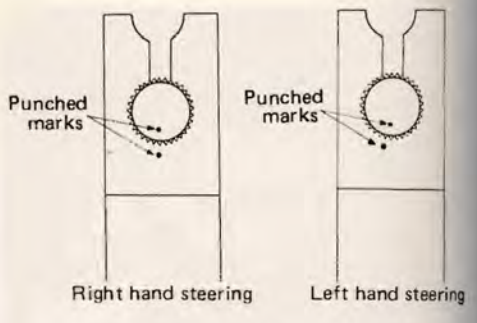


Fig. 11-16

12. GEARSHIFTING CONTROL

12

12-1. Description

The movement of the gearshift lever is transmitted by the control shaft to the gearshift lever case, from which the three fork shafts are actuated selectively to shift the transmission.

Fig. 12-1

12-2. Removal

1. To remove gearshift control lever, remove the four bolts, securing the guide plate, and two bolts, securing the lever housing. Remove the bolt connecting the lever to the control shaft, and pull the lever off.

Fig. 12-2

2. To remove gearshift control shaft, undo the connection between this shaft and the extension shaft on the transmission side by removing the bushed bolt and nut, and unhook the return spring from the other end, from which the gearshift lever has been disconnected.

Fig. 12-3

12-3. Maintenance Services

1. Gearshift lever adjustment

(1) If it is hard to shift into "low" or "third," or if it has been reported that the gear slips out of mesh during normal cruising, displace the guide plate toward rear. Loosening the bolts securing the guide plate permits is to be so displaced.

(2) If it is hard to shift into "second" or "top," or if "gear slipping" is complained of, displace the guide plate toward front.

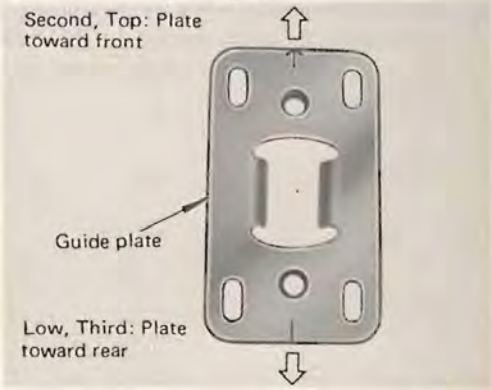


Fig. 12-4

(3) If it is hard to shift in "reverse," displace the control lever housing toward the right. Loosening the bolts securing the housing permits it to be so displaced.

(4) If the lever tends to shift into "top" when it is meant to go into "top," displace the control lever housing toward the left.

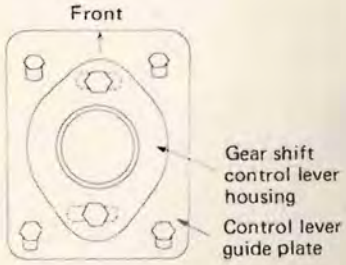


Fig. 12-5

2. Guide plate inspection

Replace the guide plate if its tongue parts "A" and "B" are excessively worn. A worn tongue "A" makes "reverse shifting" less articulate; a worn tongue "B" causes the shift lever in neutral to change its position.

Fig. 12-6

12-4. Installation

1. Tightening torque

To be tightened to:	*kg-cm*	*lb-ft*
Joint nut, gearshift control rod	*150 ~ 200*	*10.8 ~ 14.5*
Front nut, gearshift control rod	*60 ~ 100*	*4.3 ~ 7.2*
Bolt, control lever guide plate	*60 ~ 100*	*4.3 ~ 7.2*
Bolt, control lever housing	*200 ~ 250*	*14.5 ~ 18.0*

2. Just before installing the two bushes for gearshift control shaft, apply grease to their outer surfaces. Also grease the inside surface of the control lever seat.

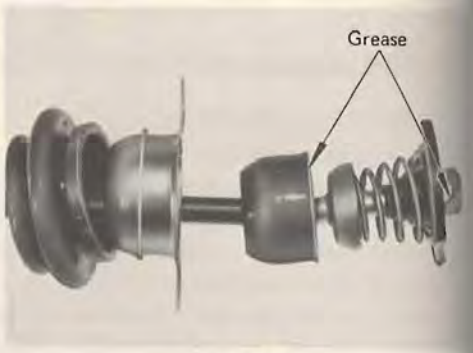


Fig. 12-7

3. Position the control lever guide to bring the arrow mark to the front side.

Fig. 12-8

4. Position and secure the gearshift control lever in such a way that, when it is moved into "top" position, there will be a clearance of 30 to 40 mm (1.18 to 1.57 in.) between it and transfer shift lever.

Fig. 12-9

13. TRANSMISSION

13

13-2. Flow of Drive Through Transmission

How drive flows will be explained for each shift position:

1. **Low speed drive**

Low driven gear on the main shaft is free from this shaft and merely rotates around it, as driven from the low drive gear of the countershaft. Shifting the lever into "low" causes low-speed gear shifter fork to push low-speed synchronizer toward low driven gear and, through the dog teeth, mesh it with the gear, thus coupling the gear to the main shaft.
Under this condition, drive flows from input shaft to countershaft through one state of speed reduction, and then from countershaft to main shaft, through another stage of speed reduction.

2. **Second speed drive**

Shifting the lever into "second" causes the same low-speed gear shifter fork to push low-speed synchronizer to the other direction, that is, toward second driven gear and mesh it with this gear, thereby coupling the gear to the main shaft. Under this condition, speed reduction takes place twice, as in the low speed drive described above, first between the gear of input shaft and that of countershaft and secondly between second drive gear (of countershaft) and second driven gear (on the main shaft).

3. **Third speed drive**

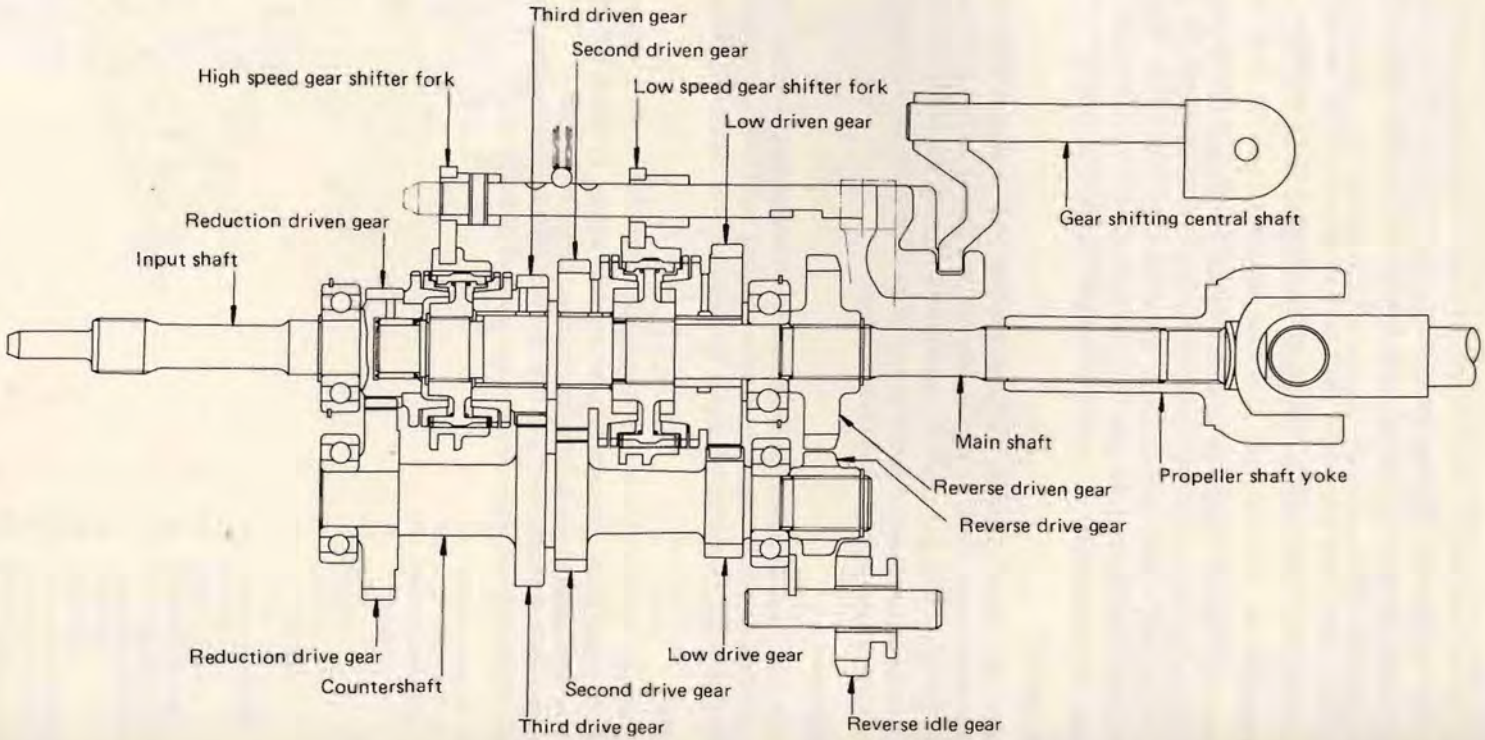
Shifting the lever into "third" actuates high-speed shifter fork to engage high-speed synchronizer with third driven gear on the main shaft. This gear, like low and second driven gears, is free on the shaft and merely spins as driven by third drive gear of countershaft when the gearshift lever is any other position.
Just as in the case of low and second speed drives, drive flows from countershaft to main shaft through third drive and driven gears and high-speed synchronizer.

4. **Top speed drive**

Shifting the lever into "top" actuates the same high-speed shifter fork to engage high-speed synchronizer with the input shaft gear through dog teeth, thereby coupling input shaft direct with mainshaft. No speed reduction is involved in this flow of drive: engine crankshaft drives main shaft through input shaft.

5. **Reverse drive**

Shifting the lever into "reverse" actuates reverse gear shifter fork to mesh the reverse idle gear into the reverse gear on the main shaft. This is a "clash" meshing action, by which the idler gear comes into between the reverse drive gear of countershaft and the gear on the main shaft.
Drive is from input shaft to countershaft and then to main shaft through reverse idler gear. Two stages of speed reduction and reversal of rotary direction are involved in this drive.


Third driven gear
Second driven gear
High speed gear shifter fork
Low speed gear shifter fork
Low driven gear
Gear shifting central shaft
Reduction driven gear
Input shaft
Main shaft
Propeller shaft yoke
Reverse driven gear
Reverse drive gear
Reduction drive gear
Countershaft
Low drive gear
Second drive gear
Third drive gear
Reverse idle gear

13-3. Transmission Gear Ratios

Shift position	Primary gear ratio	Primary speed ratio	Secondary ratios		Overall speed reduction ratio
			Gear ratio	Speed ratio	
LOW	34/19	1.789	30/14	2.143	3.835
SECOND			29/22	1.318	2.359
THIRD			23/27	0.852	1.524
TOP					1.000
REVERSE	34/19	1.789	27/12	2.250	4.026

13-4. Dismounting

1. Take down the engine according to the dismounting procedure described in the section on the engine.
2. Jack up the machine, place the safety stands under it, and support it steady off the work floor.
3. Remove the drain plug to drain out the oil in the transmission.
4. Remove the link bolt connecting gearshift lever shaft and control lever shaft.
5. Disconnect the electrical lead from back-up lamp switch.
6. Remove the two transmission mounting nuts, and remove it by carrying it toward the engine side.

13-5. Disassembly

1. Separating the upper case from the lower case

(1) Remove clutch release bearing from transmission input shaft.

(2) Remove the bolts securing gearshifting case and take off the case from the transmission case.

Fig. 13-3

(3) Remove the bolts securing the extension case to the transmission case, and detach the extension case and mounting bracket.

Fig. 13-4

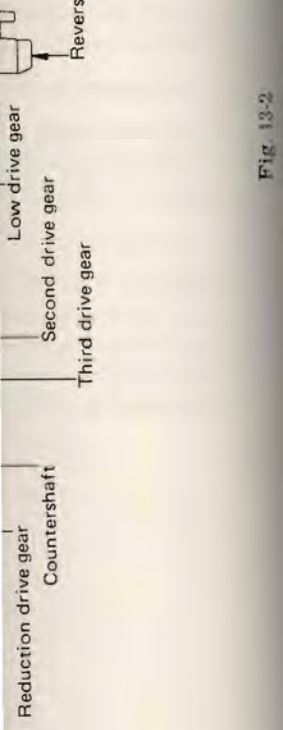


Fig. 13-2

(4) Remove the bolts fastening the upper and lower cases together, separate the two, and take out the main shaft assembly. A steel bar, similar in shape to screwdriver, may have to be used to pry the two cases apart, as shown. In such a case, do not stick the bar too far into between the two mating faces or the faces may become damaged.

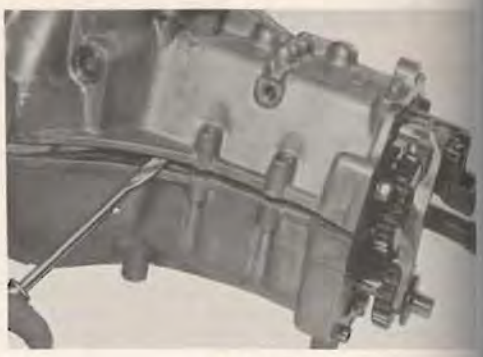


Fig. 13-5

2. Removing the countershaft

(1) Remove the 3 bolts securing reverse gear shaft stopper plate, and take off the stopper plate and reverse gear shaft.

Fig. 13-6

(2) Remove the circlip retaining the reverse gear on countershaft, using the circlip remover, and slide the reverse gear off countershaft.

Circlip remover (09920-70120)

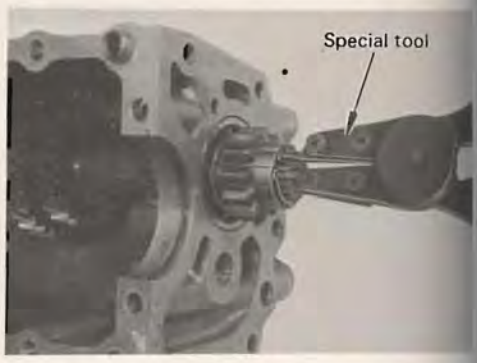


Fig. 13-7

(3) Remove the rubber plug on countershaft. Remove the circlip retaining the countershaft bearing, as shown.

Fig. 13-8

(4) Pull off countershaft to the low gear side, remove the bearing, and take the countershaft assembly out of the case. Two special tools must be used for this removal:

Bearing installer (09922-55130)
Bearing puller (09913-60910)

Fig. 13-9

I. Removing the main shaft and input shaft

(1) Take out the input shaft by hand, taking care not to let the high-speed synchronizer rings drop.

Fig. 13-10

(2) Remove the circlip retaining the hub of high-speed synchronizer sleeve, and slide off the sleeve hub and third driven gear from main shaft. A special tool must be used in removing the circlip:

Circlip remover (09920-70120)

Fig. 13-11

(3) Remove the circlip retaining the lever gear on main shaft. Remove this gear and main shaft bearing. Be sure to use the circlip remover.

Fig. 13-12

(4) From main shaft, take off the low driven gear, low-speed synchronizer sleeve hub and second driven gear. Be sure not to allow the synchronizer rings to drop down when the sleeve hub is coming off.

Fig. 13-13

4. Removing the shifter fork shafts and forks

(1) Before starting the removal work, make sure that all the shifter fork shafts in place are in neutral position. First, remove the stopper plate for shifter fork shafts by removing the two bolts securing this plate.
It is important that the three shifter fork shafts be kept in neutral position at this time in order to make sure that the interlock balls between two adjacent shafts are seated fully in the dents of respective shafts. If any of these interlock balls is off the dent, some of the fork shafts will refuse to come out when pulled.

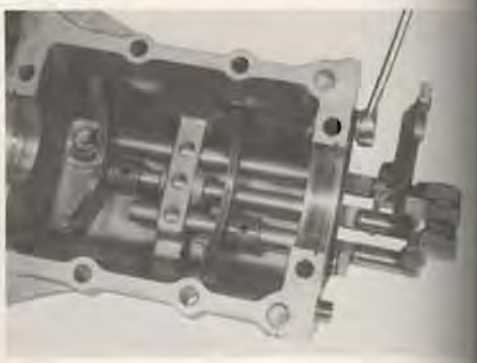


Fig. 13-14

(2) Using the spring pin remover (special tool), draw out the spring pin on reverse gear shifter fork, and pull out the shifter fork shaft. As this shaft comes out, the locating ball and spring will jump out of the hole; do not let them fly away.

Spring pin remover (09922-85811)

Fig. 13-15

(3) Move the high-speed shifter fork shaft into the position for "third." This will allow the spring pin to shift into the dent provided in the case. Using the same special tool, mentioned above, draw out the spring pin and pull out the fork shaft. As in the case of (2) above, be careful not to let the steel ball and spring fly away.

(4) Having thus far removed the reverse gear shifter fork shaft and high-speed shifter fork shaft, you are now to remove the low-speed shifter fork shaft, as follows: Move this fork shaft into the position for "second," so that the spring pin will shift into the dent provided in the case; draw out the spring pin by using the spring pin remover, mentioned above; and remove the shaft by pulling it out.

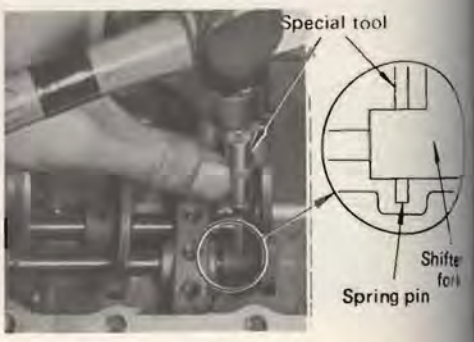


Fig. 13-16

13-6. Maintenance Services

1. Reverse gears and idle gear

Inspect the chamfered edges of gear teeth of the three gears—driving and driven gears (of main shaft and countershaft) and idle gear. If the edges are worn badly, replace the gears. Abnormal noise or gear slipping in reverse drive is often due to worn tooth edges of these gears.

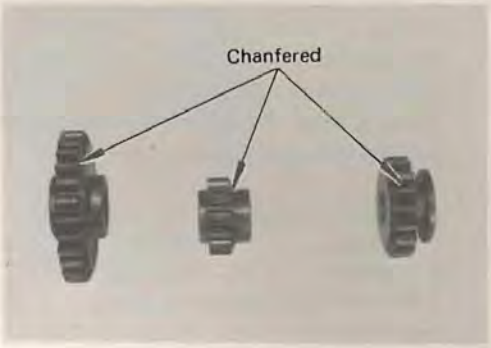


Fig. 13-17

2. Countershaft and its bearings

If any of the countershaft gears is found with chipped or broken teeth, replace the countershaft. Check each bearing by spinning its outer race by hand to "feel" the smoothness of rotation. Replace the bearing if noted to exhibit sticking, resistance or abnormal noise when spun or rotated by hand.

Fig. 13-18

3. Input shaft

(1) Referring to Fig. 13-19, inspect the cone (1) and toothed ring (2) for wear and damage.

(2) Inspect the gear teeth (3) and splines (4) for wear and damage.

If any part of the input shaft inspected as above is found excessively worn or badly damaged, replace the shaft.

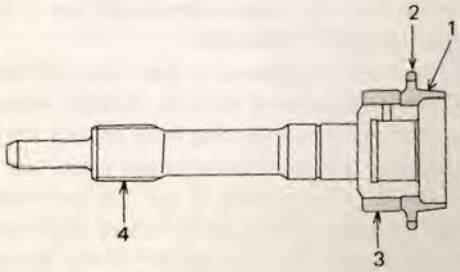


Fig. 13-19

4. Combination of gear and synchronizer ring

(1) Fit the ring to the cone of the gear (input gear, or "third," "second" or "low" gear), and measure the clearance between the two at the peripheral teeth, as shown in Fig. 13-20. If the clearance is noted to have reached or exceeded the service limit, replacement is necessary.

Fig. 13-20

Clearance between gear and ring	*Standard*	*Service limit*
	0.8 ~ 1.2 mm (0.03 ~ 0.05 in.)	*0.5 mm (0.02 in.)*

(2) Inspect the external cone (of the gear) and internal cone (of the ring) for abnormal wear. Be sure that the contact patterns on these surfaces indicate uniform full-face contact, and that the surfaces are from any wavy wear. A badly worn member must be replaced.

Proper synchronizing action on gear shifting can be expected when the ring-to-gear clearance (Fig. 13-20) and the condition of cone surfaces, among other things, are satisfactory.

Fig. 13-21

5. Chamfered tooth ends of ring (external teeth) and sleeve (internal teeth)

Synchronizer ring and hub have three slots each, in which the keys are carried as backed by expand springs, so that the hub and its two rings, one on each end, are capable of running together. Since sleeve is engaged by its internal teeth with the hub, as if the two were splined together, the sleeve too r with the hub and rings.

In meshing action, the sleeve is pushed (by the shifter fork) to one side, so that is slides axially on the h pushing the ring toward the cone surface of the gear. This push is transmitted by the three keys, which lightly gripped by the sleeve.

By the friction between the gear cone and the ring cone (internal), the ring begins to rotate but is oppo by the hub because of the keys. In other words, the ring is at this time twisted, while the sleeve is adv ing further to push the ring fully against the gear cone. Since the ring is unable to slide along any furth the sleeve lets go of the keys and rides over to the ring. At this moment, the initial contact between chamfered ends of teeth of the ring and those of internal teeth of the sleeve occurs. This contact is s that the internal teeth of the sleeve aligh themselves to those of the ring. When the sleeve advances slides into the ring, the ring will be rotating nearly with the speed of the gear, so that the sleeve is enabl smoothly to slide over into the clutch teeth of the gear.

The initial contactor mesh between sleeve and ring is determined by the widths of key and slot or, to s the same thing, the key clearance in the slot, and is prescribed to extend at least a third (1/3) of t chamfer.

With the synchronizer properly assembled on the shaft, push in and twist each synchronizer to see if the one-third mesh occurs or not; if not, it means that the overall wear (which is the sum of the wears of slots, keys and chamfered tooth ends) is excessive and, in such a case, the entire synchronizer assembly must be replaced.

Mesh of chamfered tooth ends of synchronizer ring and hub	*Contact extending about 1/3 of chamfered face from apex*

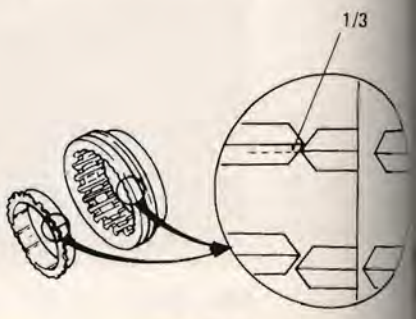


Fig. 13-22

13-20

ontacting surface

13-21

is backed by expanding
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22

6. **Synchronizer rings**

Inspect each synchronizer ring for wear of its key slots by measuring the width of each slot. If the width reading exceeds the limit, replace the ring.

Key slot width of synchronizer ring	*Standard*	*Service limit*
	9.8 mm (0.38 in.)	*10.2 mm (0.40 in.)*

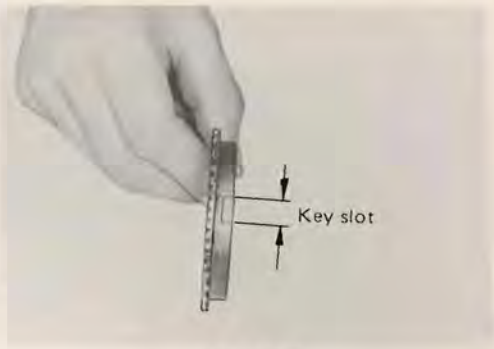


Fig. 13-23

7. **Fork shaft locating springs**

Two kinds of locating spring are used to arrest the three shifter fork shafts. If "gears slipping out of mesh" has been complained, check these springs for strength by measuring their free lengths, and replace them if their free lengths are less than the service limits.

Fig. 13-24

Spring No.	*Standard*	*Service limit*
Free length of No. 1	*19.5 mm (0.767 in.)*	*17.0 mm (0.669 in.)*
Free length of No. 2	*17.5 mm (0.689 in.)*	*16.0 mm (0.630 in.)*

8. **Extension case bush**

Check the bush press-fitted into the extension case for wear by measuring the radial clearance between bush bore and sliding yoke. If the sliding yoke is capable of rattling in the bush because of advanced wear, it will cause the propeller shaft to rattle. For this reason, an extension case found to allow its sliding yoke to rattle in excess of the service limit must be replaced; replacement of the bush alone is not permissible.

Rattle of sliding yoke in extension case bush	*Standard*	*Service limit*
	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)	*0.1 mm (0.004 in.)*

Shifter forks and shafts

(1) When feeding each shifter fork onto its shaft, be sure to bring the boss (in which the hole for admitting the spring pin is provided) to the extension case side.

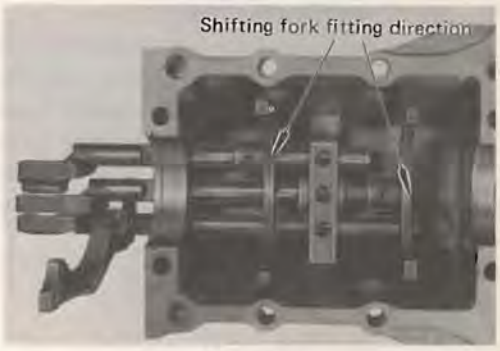


Fig. 13-28

(2) Two kinds of coil spring are used for loading on the locating steel balls. A No. 1 spring (larger in coil diameter) and a No. 2 spring are used on two fork shafts—low-speed and high-speed. Only one spring, No. 1, is used on reverse shifter fork shaft. Refer to Fig. 13-29. Be sure to make proper spring combinations and discriminate the two kinds correctly, as shown, at the time of installing the steel balls and springs.

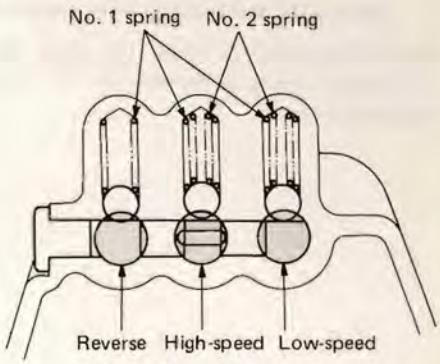


Fig. 13-29

(3) The shifter fork shafts are to be installed sequentially. First to be put in place is low-speed shaft, followed by high-speed shaft and then reverse shaft. The sequence is indicated in the ascending order of numbers in Fig. 13-30.

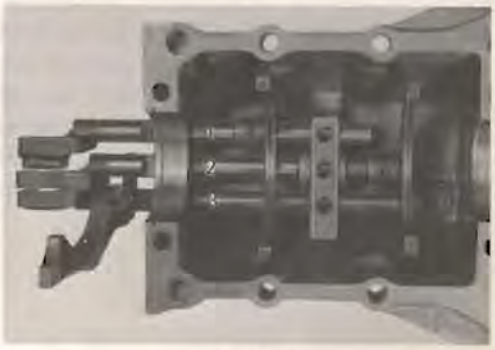


Fig. 13-30

(4) The hole for installing the interlock steel balls is provided in the side wall, next to the reverse shifter fork shaft, of the transmission case. Be sure to feed in one ball after another, positioning each ball between two adjacent shafts, as shown in Fig. 13-31.

NOTE:

Be sure to put in the pin for preventing two shafts from getting shifted at the same time. This pin goes into the hole provided in the high-speed shaft.

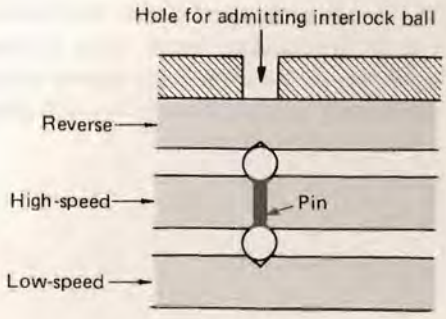


Fig. 13-31

4. Reverse gears and idle gear

The two reverse gears have their teeth chamfered on one end, and the reverse idle gear is similarly chamfered. When mounting the reverse gears on main shaft and countershaft, respectively, be sure to bring the chamfered end to the outboard side. The chamfered end of the idle gear, however, must face inwardly, as shown in Fig. 13-32.

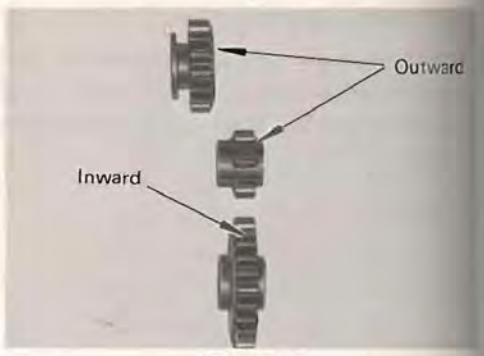


Fig. 13-32

5. Input shaft and main shaft installation

Before installing the input and main shaft assembly on the lower case, be sure fit the "C" rings and dowel pins into the case.

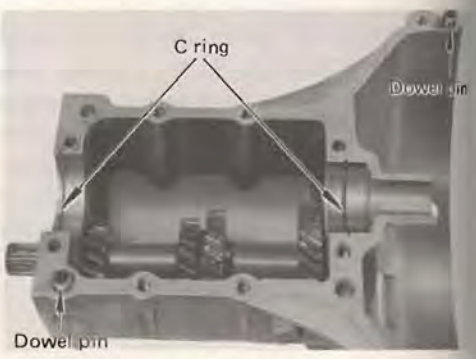


Fig. 13-33

6. Putting together upper and lower cases

(1) Clean the joint faces, removing any foreign matters adhering to these faces, and then apply the liquid sealing compound (SUZUKI Liquid Gasket, 99000-33010) to the joint faces, coating each face uniformly with the compound and, 3 or 5 minutes after this application, match the two cases together.

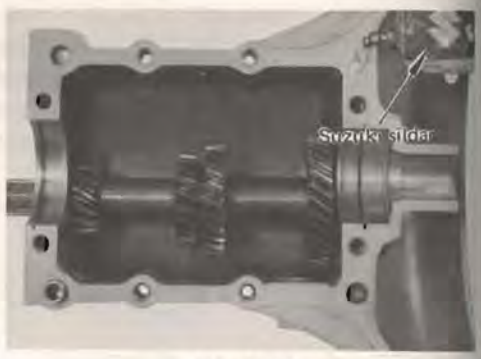


Fig. 13-34

(2) When bringing the two cases into match as above, be sure to guide each shifter fork into the groove of its synchronizer sleeve. After putting the upper case on the lower case, tighten the joint bolts uniformly and sequentially so as to equalize the joint pressure all around.

Fig. 13-35

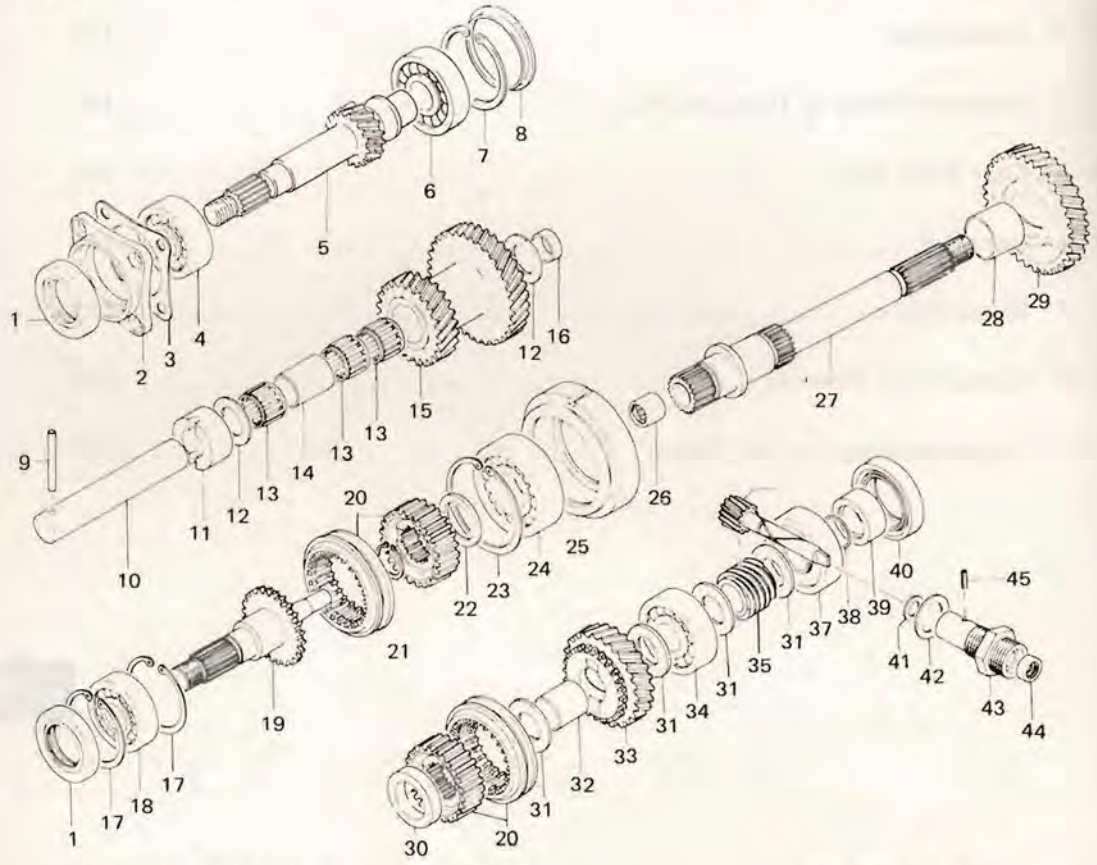
14. TRANSFER GEAR BOX

14-1. Description

The transfer gear box is an auxiliary transmission for on-off control of two-speed drive transmitted to both front and rear axles concurrently and provides additional speed reductions, HIGH and LOW, for any selection of main transmission gears.

The functions of this auxiliary transmission are mainly two—selection between four-wheel drive (front and rear axles) and two-wheel drive (rear axle) and between HIGH and LOW for four-wheel drive. Three propeller shafts are associated with the gear box.

These functions are accomplished by means of four shafts arranged in three-axis configuration and two sliding clutches. The selection is effected by actuating these clutches from a single control lever located beside the driver's seat and in the floor tunnel section. The gear box is mounted on a chassis cross member.



1. Oil seal (28 x 27 x 10 mm)
2. Retainer
3. Gasket
4. Bearing
5. Transfer input shaft
6. Bearing
7. Circlip
8. Bearing plug
9. Stopper pin
10. Transfer counter gear shaft
11. Bush (25 x 35 x 20 mm)
12. Thrust washer (25 x 40 x 3.8 mm)
13. Bearing (25 x 33 x 23.8 mm)
14. Spacer (25.1 x 31 x 25.4 mm)
15. Transfer counter gear
16. Plug
17. Circlip
18. Bearing
19. Transfer output front shaft
20. Rear shaft hub set
21. Circlip
22. Spacer
23. Circlip
24. Bearing
25. Retainer
26. Bearing
27. Transfer output rear shaft
28. Bush (25 x 30 x 33 mm)
29. Output shaft low gear
30. Spacer (25.2 x 38 x 8.3 mm)
31. Thrust washer
32. Bush (20 x 25 x 30 mm)
33. Output shaft high gear
34. Bearing
35. Speedometer drive gear
36. Speedometer driven gear
37. Bearing
38. O ring
39. Spacer (20 x 32 x 16 mm)
40. Oil seal (32 x 52 x 10 mm)
41. Thrust washer
42. Gasket
43. Speedometer gear case
44. Oil seal
45. Driver gear pin

Fig. 14-1

Transfer input shaft is connected to the output shaft of the main transmission and its gear as in constant mesh with one (big gear) of the two of transfer countershaft. The big gear is in constant mesh with "high" gear, which is rotatably mounted on transfer output rear shaft. The other gear (small gear) of countershaft is in constant mesh with "low" gear rotatably mounted on the same rear shaft.

Rear clutch, by its sleeve, is capable of coupling "low" or "high" gear to the rear shaft. The front end of this shaft is rotatably connected to transfer output front shaft, and carries front clutch capable of rigidly coupling rear shaft to front shaft by its sleeve engaging with the toothed clutch ring integral with front shaft.

The engaging and disengaging actions of the sleeve, actuated by a shifter fork, of each clutch are similar to the sleeve of the synchronizer used in the main transmission.

The major working members of the transfer gear box having thus been identified in reference to Fig. 14-1, the selective flows of drive will be described.

14-2. Selective Flows of Transfer Drive

1. Rear-wheel drive

Rear shifter fork pushes rear clutch sleeve into "high" gear, thus coupling the gear to output rear shaft. Drive flows from input shaft to output rear shaft through big gear, "high" gear and rear clutch.

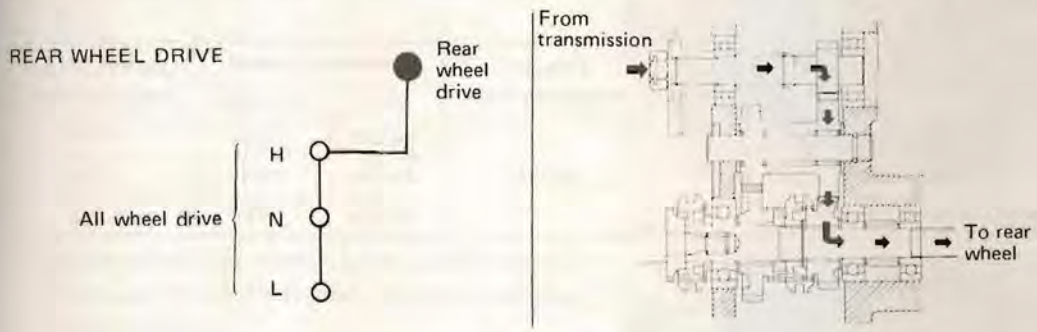


Fig. 14-2

2. All-wheel drive on HIGH

Under the conditions of rear-wheel drive, described above, front shifter fork pushes the sleeve of front clutch onto the toothed clutch ring, thus coupling output rear shaft to output front shaft. Front shaft and rear shaft run together on HIGH.

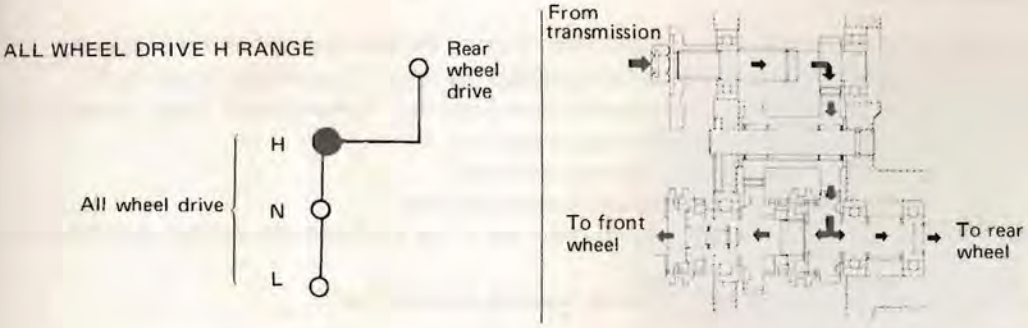


Fig. 14-3

3. **All-wheel drive on LOW**

Front shifter fork actuates front clutch to couple rear shaft to front shaft; and rear shifter fork actuates rear clutch to couple "low" gear to rear shaft. Front shaft and rear shaft run together on LOW.

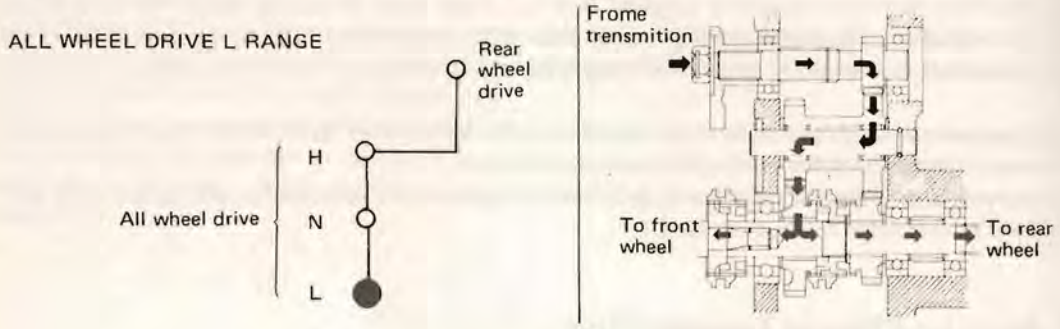


Fig. 14-4

14-3. Gear Ratio Data

1. **Model LJ50**

Shift position	*Primary gear ratio*	*Primary reduction ratio*	*Secondary ratios*		*Overall transfer reduction ratio*
			gear	*reduction*	
Rear-wheel drive	*29/14*	*2.071*	*24/29*	*0.827*	*1.714*
All-wheel drive HIGH			*24/29*	*0.827*	*1.714*
All-wheel drive LOW			*32/22*	*1.454*	*3.013*

2. **Model LJ50V**

Shift position	*Primary gear ratio*	*Primary reduction ratio*	*Secondary ratios*		*Overall transfer reduction ratio*
			gear	*reduction*	
Rear-wheel drive	*27/16*	*1.687*	*25/27*	*0.926*	*1.562*
All-wheel drive HIGH			*25/27*	*0.926*	*1.562*
All-wheel drive LOW			*32/21*	*1.524*	*2.570*

14-4. Removal

(1) Remove the knob from transfer gear control lever. Turning the knob makes it come off the lever.
(2) Remove the eight screws securing the cover on transfer servicing hole, and take the cover off.
(3) Apply the parking brake. Remove the securing bolts from each universal-joint flange connection to sever the three propeller shafts from the transfer gear box.
(4) Disconnect the parking brake wire at parking brake lever.
(5) Disconnect speedometer drive cable from the transfer gear box.
(6) Remove the four mounting bolts securing the gear box to the chassis cross member, and take down the gear box.
(7) Drain out oil from the gear box taken down by loosening its drain plug.

14-5. Disassembly

1. **Universal-joint yoke flanges**

There are two flanges to be removed: one from the input shaft and one from the output front shaft. Lock the flange so that it will not turn, and loosen and remove the nut holding the flange to the shaft. Draw off the flange.

Fig. 14-5

2. **Center brake**

(1) Utilize the differential preload checking tool on the center brake drum so that the drum will not turn. Loosen and remove the nut securing the drum.

Differential preload checking tool (09900-75220)

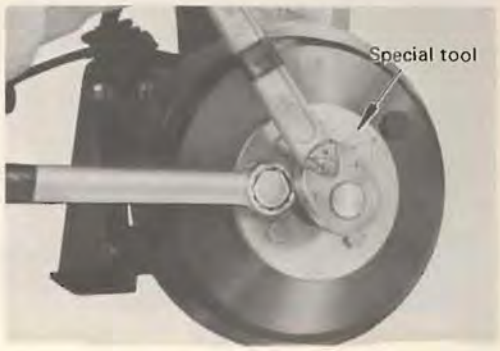


Fig. 14-6

(2) Remove the brake shoes. Remove the 4 bolts securing the backing plate, and take out the backing plate assembly.

Fig. 14-7

3. **Speedometer driven gear**

Remove the speedometer driven gear, as shown in Fig. 14-8.

Fig. 14-8

4. Transfer gear control lever

Twist the control lever guide counterclockwise while pushing it down; this will permit the lever to be removed from the gear box.

Fig. 14-9

5. Upper transfer cover

Remove the bolts securing the upper transfer cover, and take off the cover.

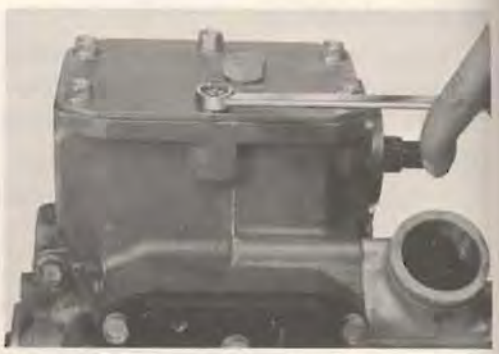


Fig. 14-10

6. Transfer front case

Remove the nuts fastening down the transfer front case; tap around on the edge of the case with a mallet to shake the case loose. Remove the front case complete with the output front shaft. Drive on the front shaft with the mallet to force it off the front case.

Fig. 14-11

7. Transfer intput shaft

(1) Remove the 4 screws securing the retainer of input shaft bearing, and take out the retainer.

Shock driver (09900-09002)

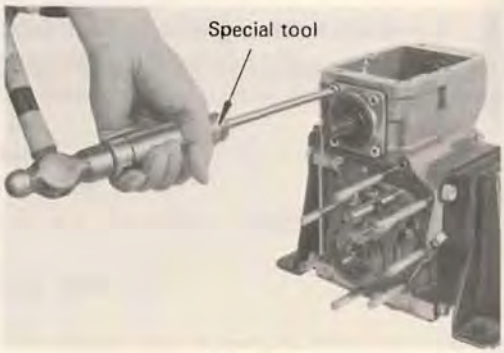


Fig. 14-12

14-9

4-10

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(2) Draw out the input shaft by using the special tool, as shown in Fig. 14-13.

Transfer input shaft puller (09922-65122)

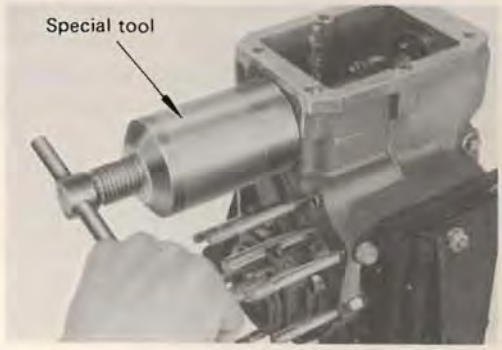

Fig. 14-13

8. Transfer countershaft

(1) Using the spring remover (special tool), remove the spring pins locking front clutch shifter fork and lever stopper. Remove the shifter fork and stopper from the shifter fork shaft.

Spring remover (09922-85811)

Fig. 14-14

(2) Remove the front clutch sleeve from clutch hub. Using the circlip remover (special tool), remove the circlip retaining the front clutch hub in place, and slide the clutch hub off output front shaft.

Circlip remover (09920-70111)

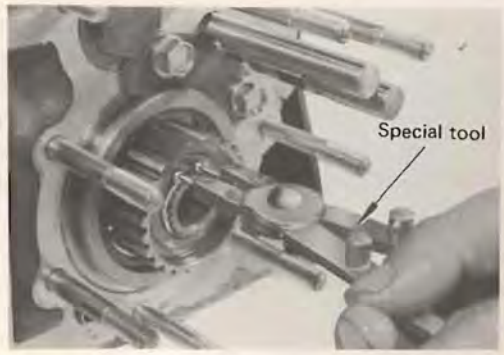

Fig. 14-15

(3) Remove the two bolts securing the stopper plate for gear shifter fork shaft, and displace the stopper plate off the stopper of countershaft.

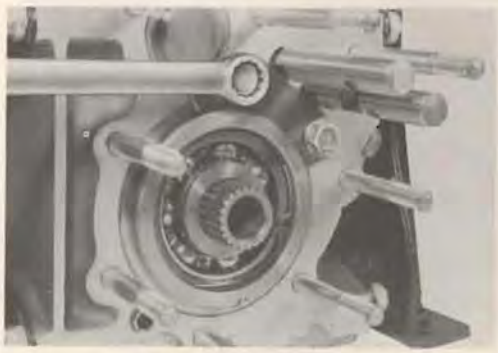

Fig. 14-16

(4) Take a firm grip on the end of countershaft, using a pair of pliers, and pull the countershaft out. Take out the counter gears, three needle roller bearings, spacer and two thrust washers from inside the case.

Fig. 14-17

9. Shifter fork shafts

(1) The plug keeping the shifter shaft locating (arresting) balls and springs in place is on the left-hand side wall of the case. Remove this plug, and take out the steel balls and springs.

Fig. 14-18

(2) Pull the front clutch shifter shaft straight out. Using the spring remover (special tool), drive out the spring pin locking the rear clutch shifter fork, and similarly pull out the rear clutch shifter fork shaft; do not rotate this shaft or the steel ball may settle into the dent to prevent the shaft from coming out.

Spring remover (09922-85811)

Fig. 14-19

Fig. 14-20

Fig. 14-17

Fig. 14-18

Fig. 14-19

Fig. 14-20

10. Output rear shaft

Using a mallet, drive on the center-brake side end of the output rear shaft to force it out of the case. The shaft will come out complete with the output shaft bearings, retainers and clutch.

Fig. 14-21

14-6. Maintenance Services

1. Gear teeth

Inspect the gear teeth (1), the internal teeth of rear clutch sleeve (2) and the clutch teeth of the gear (3) for wear, cracking, chipping and the like malcondition. Replace the gear or sleeve as necessary.

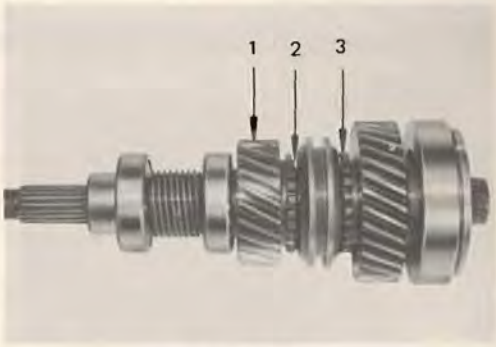

Fig. 14-22

2. Locating spring

Check each shifter fork shaft locating spring for strength by measuring its free length. If the length is noted to be less than the service limit, replace it.

	Standard	*Service limit*
Free length of locating spring	*No. 1 19.5 mm (0.767 in.)*	*17.0 mm (0.669 in.)*
	No. 2 18.5 mm (0.73 in.)	*16.0 mm (0.63 in.)*

Fig. 14-23

3. Parking brake

The parking brake is identical in all respects to the rear wheel brake except for the shoe actuating member, which is a hydraulic cylinder (wheel cylinder) in the rear wheel brake.

Drum-to-shoe clearance is to be adjusted in the same way, that is, by rotating the adjusting screw with a screwdriver inserted through a hole provided in the drum.

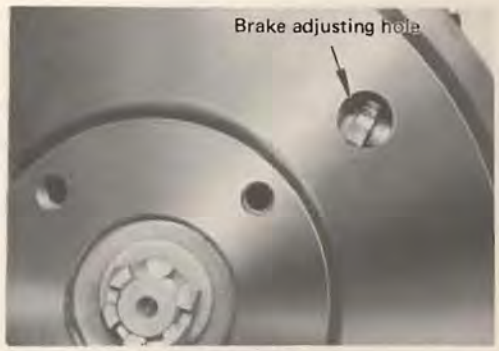

Fig. 14-24

The clearance is to be set as follows:
For each shoe, turn its adjusting screw to reduce the clearance to zero, that is, make the shoe lining bear against the drum. From that position of the screw, move it back:

3 to 7 notches	*For leading shoe*
4 to 8 notches	*For trailing shoe*

After setting the clearance as above, rotate the drum by hand to be sure the shoes are not dragging on the drum. The object of this adjustment is to provide the smallest possible clearance that is free from any signs of dragging.

Fig. 14-25

14-7. Important Steps in Installation

1. Tightening torque

To be tightened to:	*kg-cm*	*lb-ft*
Bolt, upper-case cover	*90 ~ 120*	*6.6 ~ 8.6*
Bolt, lower-case cover	*60 ~ 100*	*4.3 ~ 7.2*
Bolt, transfer front case	*150 ~ 200*	*10.8 ~ 14.1*
Bolt, stopper plate, shifter fork shaft	*90 ~ 120*	*6.6 ~ 8.6*
Oil filler plug and drain plug	*300 ~ 500*	*21.7 ~ 36.1*
Nut, universal joint flange	*90 ~ 120*	*6.6 ~ 8.6*
Transfer case mounting nut	*150 ~ 200*	*10.8 ~ 14.5*
Bolt, cross joint flange	*150 ~ 200*	*10.8 ~ 14.5*
Transfer case mounting bolt	*230 ~ 280*	*16.7 ~ 20.2*

2. Clutch sleeve hubs

When mounting the clutch sleeve hub, make sure that its high boss points toward the center brake side. This applies to both clutches, front and rear.

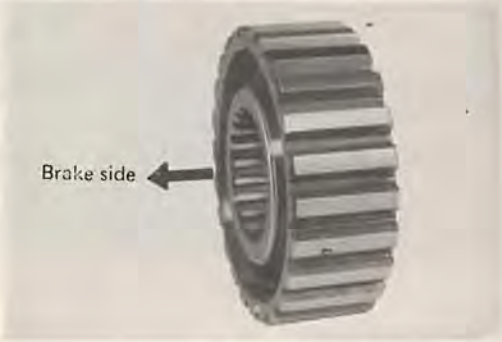

Fig. 14-26

3. Output rear shaft

When installing the output rear shaft in the case, be sure to position its bearing retainer and the countershaft bush in such a way that the grooves of the retainer and bush will line up, as shown. Use of a special tool is involved in this step.

Bearing installer (09913-85210)

Fig. 14-27

4. Locating springs and balls for shifter fork shafts

Care must be taken to ensure that these springs and balls take their positions correctly so that they will function properly in arresting the shafts and in preventing the shaft from slipping out of its "arrested" position to result in acidental clutch disengagement or in clutch "grating." After putting in the springs and balls, test the shafts for arresting action by moving them by hand.

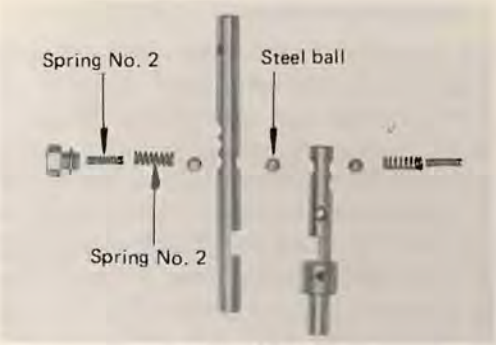

Fig. 14-28

5. Shifter fork shafts and forks

(1) Each shaft is to be installed in this sequence: Secure the shifter fork to the rear clutch shifter fork shaft in place, with the fork set astride in the groove of the clutch sleeve; move the clutch sleeve into mesh with "high" gear; and then insert the front clutch shifter fork shaft. This sequence is mandatory: if the rear clutch should be left in neutral position when the front clutch shifter fork shaft is inserted, the locating balls already in place would prevent this shaft from getting installed.

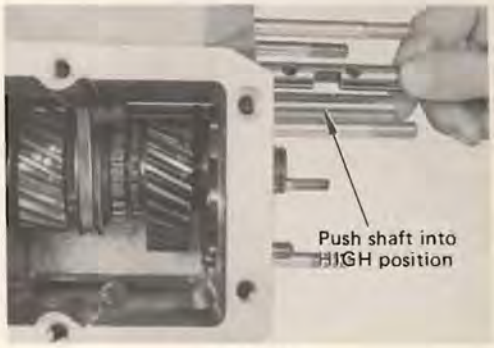

Fig. 14-29

(2) Make sure that the grip boss of each shifter fork comes on the inner side as shown. This means that the boss (into which a spring pin is driven in to lock the fork to the shaft) of the rear clutch shifter fork points to "low" gear side, and that of the front clutch shifter fork points to "high" gear side.

(3) Of the two shifter forks, the one with a longer boss is for rear clutch, the other is for front clutch.

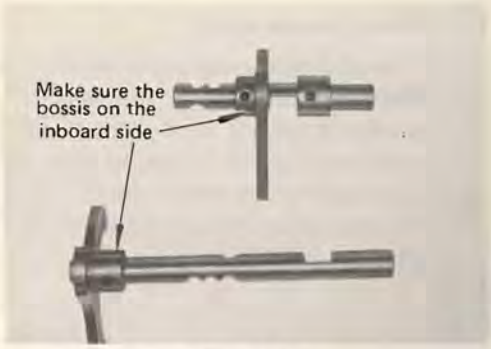

Fig. 14-30

6. Counter gear needle bearings

The counter gear runs on three needle roller bearings. Two of these bearings support the large end, and the remaining one the small end, with a spacer in between. When installing the counter gear, be sure to locate these bearings as shown. With the bearings located in any other way, the counter gear might fail in service.

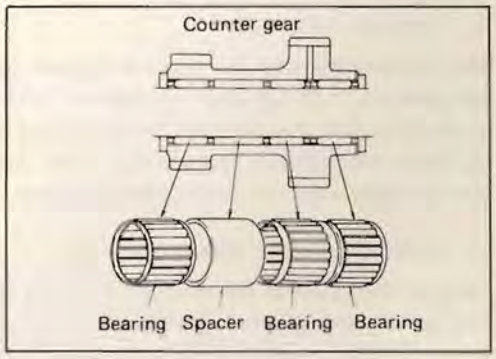

Fig. 14-31

7. Counter gear assembly

The procedure of assembling and installing the countershaft is slightly complicated. First, fit the three needle bearings and spacers into the gear cluster (small gear and big gear), oil the bearings in the bore, and attach the two thrust washers, one on each end of the gear cluster. Use grease to hold the washers to the end faces, as shown. Lower the gear cluster in suspended condition into the case, holding the gear cluster level and steady, as shown in Fig. 14-32, and aligning its bore to the shaft holes provided in the walls of the case. Then insert the countershaft through the case and gear cluster.

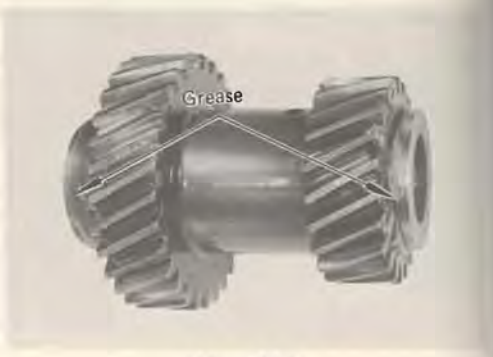

Fig. 14-32

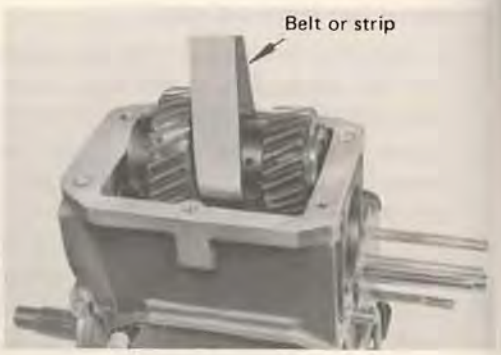

Fig. 14-33

8. Counter gear stopper pin

Before installing the stopper plate, which is primiarily for shifter fork shafts, make sure that the stopper pin for countershaft has been properly set in place. Tighten the securing bolts on stopper plate while keeping the plate pushed toward the shifter fork shafts, so that the stopper plate will be fully effective in its secured condition.

Fig. 14-34

9. Transfer case covers

The securing bolts on the upper and lower covers of the case are to be tightened sequentially and in steps so that the joint pressure will be distributed uniformly. Move the wrench from bolt to bolt across the cover, tighten each bolt just a little at a time.

10. Lubricating oil for transfer gear box

The gear box takes in 900 cc of oil (1.90/1.60 US/Imp.) For the oil, use high-grade gear oil of SAE 90.

Transfer gear box oil capacity and specification
900 cc (1.90/1.60 US/Imp. pt.) SAE 90 gear oil

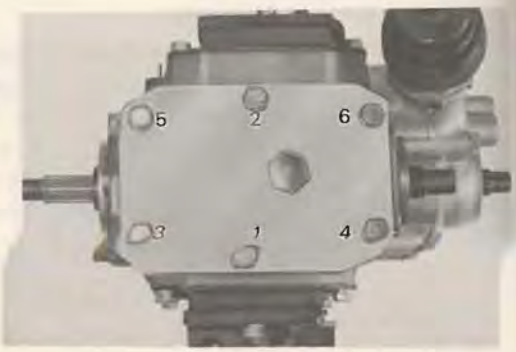

Fig. 14-35

Fig. 14-32

Fig. 14-33

g. 14-34

14-35

15. PROPELLER SHAFTS

15

15-1. Description

The two models, LJ50 and LJ50V, covered in this manual are four-wheel drive machines and, as such, use three propeller shafts designated as No. 1, No. 2 and No. 3.

No. 1 propeller shaft transmits drive from the transmission to the transfer gear box. No. 2 shaft and No. 3 shaft extend from the transfer gear box, the former driving the front axle and the latter the rear axle.

Each propeller shaft is terminated by universal joints to permit the shaft to accommodate the radial displacement of the driven member relative to the driving member; and each universal joint is connected to the driving or driven shaft through spline engagement, the internal splines being provided in the distal yoke of the joint, so that the propeller shaft permits the driven member to axially displace itself relative to the driving member. These two kinds of displacement are possible within certain limits, and are expected to occur between the transmission and the transfer gear box, between the transfer and the front axle and between the transfer and the rear axle.

The cross spider in each universal joint is fitted with four needle roller bearings. These bearings are press-fitted into the housing parts of the yokes and locked in place by punching. Thus, the universal joint assembly is not meant to be broken apart for overhauling.

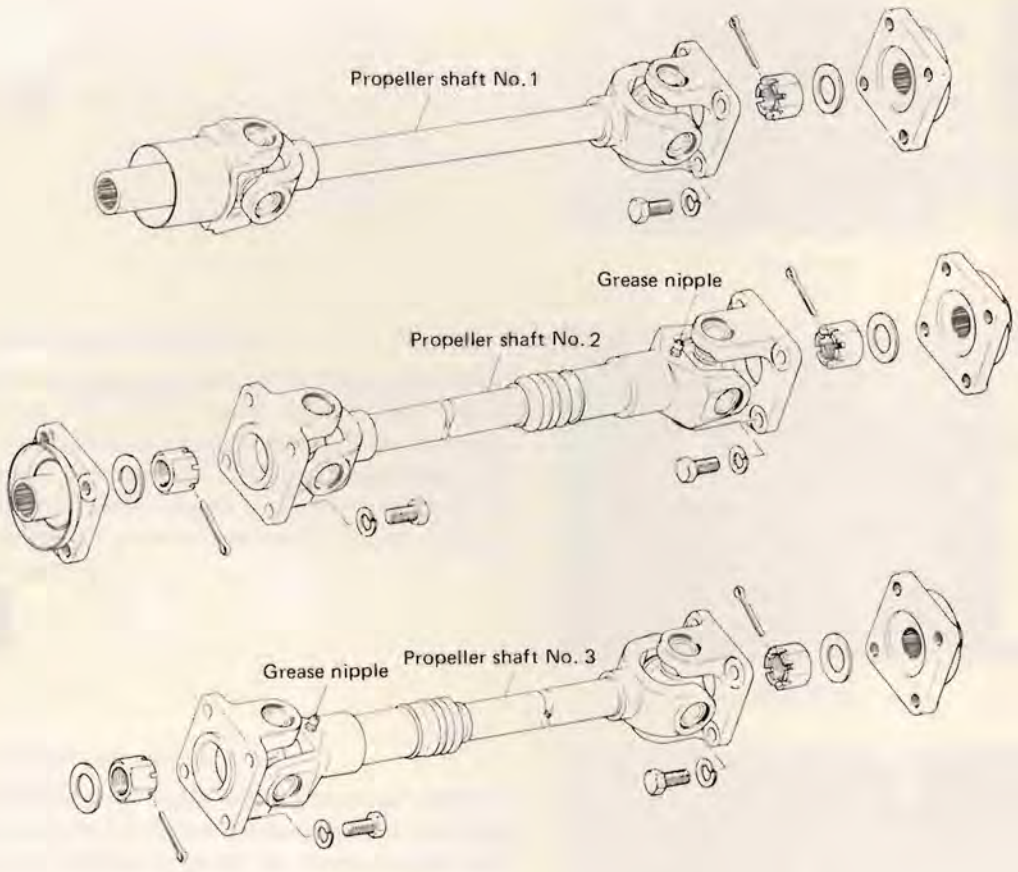

Fig. 15-1

15-2. Removal

1. Lift the machine off the floor by jacking up the axles, and rest it on safety stands.
2. At each splined connection, remove the four bolts securing the yoke to its splined companion flange piece. This disconnects the propeller shaft, leaving the flange piece behind.
   The transmission-side end of No. 1 shaft has no flange piece; this end is splined to the driving shaft inside the extension case. All you have to do there is to pull No. 1 shaft off the extension case.

Fig. 15-2

15-3. Maintenance Services

1. Lubrication

The inside yoke of each universal joint has a grease nipple. At regular intervals stated in the recommended servicing schedule, pump in grease to relubricate the joint. Use SUZUKI SUPER GREASE C.

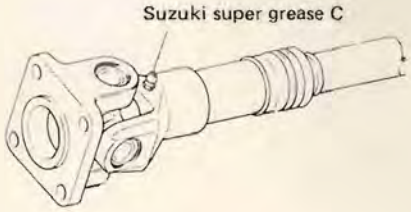

Fig. 15-3

2. Universal joint noise

If the universal joints are suspected of producing chattering or rattling noise, inspect them for wear. Check to see if the cross spider rattles in the yokes or if the splines are worn down.
The noise coming from universal joint can be easily distinguished from other noises because the rhythm of chattering or rattling is in step with cruising speed. The noise is pronounced particularly on standing start or in the coasting condition (when the braking effect of the engine is showing in the drive line).
The remedy for a propeller shaft whose universal joints are making noise is to replace the whole shaft assembly.

Fig. 15-4

15-4. Installation

The installing procedure is reverse of the removal procedure. Be sure to adhere to the following instructions when installing the shafts:

1. Flange tightening torque
   Be sure to tighten the four bolts to the following torque value when securing the companion flange to the yoke at each end of the propeller shaft:

Tightening torque for universal joint flange bolts	*150 ~ 200 kg-cm (10.8 ~ 14.5 ft-lb)*

2. Grease the splines liberally, filling the grooves with grease.

Fig. 15-5

3. Match marks are provided on the slip-on spline connections. Inserting the splined end into the splined bore without regard to the match marks can be a possible cause of noise or vibration of the propeller shaft. Be sure to index the marks.

Fig. 15-6

4. The joint sheath rubber has a large diameter in one end and a small diameter in the other. Be sure to fit the sheath rubber with its large-diameter end brought to the joint yoke side.

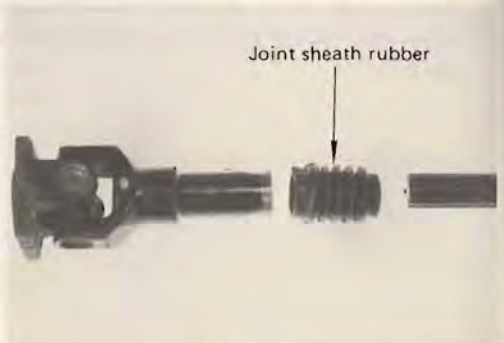

Fig. 15-7

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Fig. 15-5

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Fig. 15-6

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16. DIFFERENTIAL

16

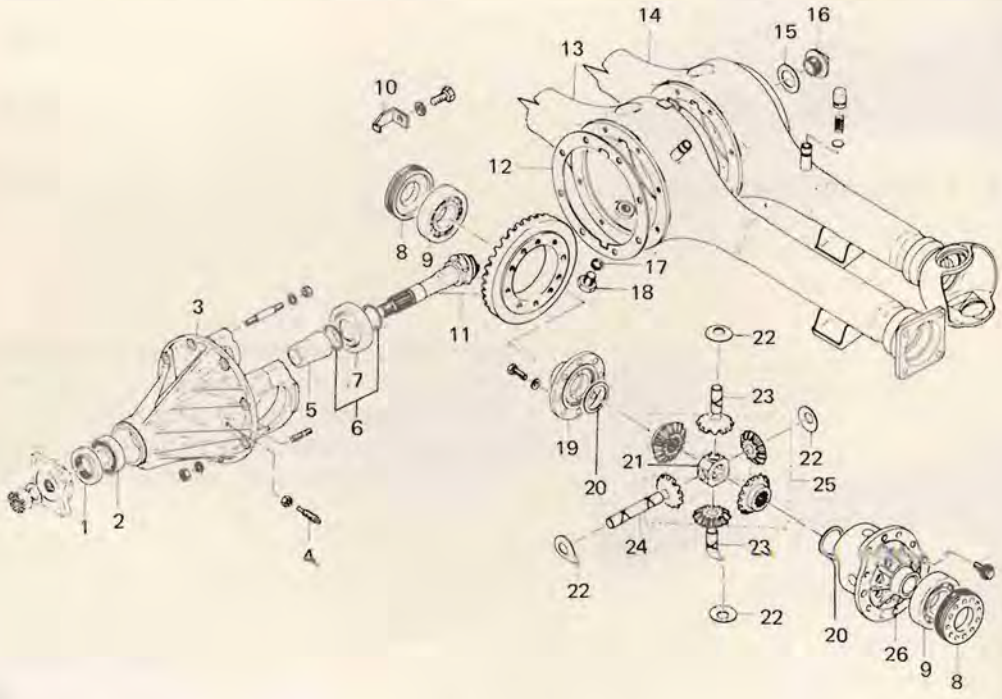
16-1. Description

The two axles, front and rear, are identical as far as the designs of pinion-and-gear drive and differential gearing are concerned. The major difference in this limited sense lies in the shape of the housing.

Each axle may be regarded as consisting, speaking roughly, of supporting parts (axle sleeves, differential housing and carrier case) and drive transmitting parts (bevel pinion and gear, differential gearing and live axle shafts). In the present section, only the bevel pinion and gear and differential gearing are taken up under the collective title of "differential."

The bevel gear drive is of hypoid design; pinion and gear have hypoid gear teeth. This means that the pinion is located slightly below the center of the bevel gear to permit the car body to be lowered in design, and that some wiping or sliding action occurs in tooth meshing between pinion and gear. Here lies the reason why use of hypoid gear oil is specified for the differential.

Four differential pinions are used in the differential case to qualify this gearing for heavy-duty "differential" drive. Thus, a total of 8 gears—a drive pinion, a crown gear, two side gears and four pinions—are inside the differential housing, all mounted on the differential carrier case bolted to the housing.



1. Oil seal
2. Bearing
3. Carrier
4. Thrust bolt
5. Spacer
6. Shim
7. Bearing
8. Bearing adjuster
9. Side bearing
10. Adjuster lock plate
11. Bevel gear pinion set
12. Gasket
13. Rear axle housing
14. Front axle housing
15. Gasket
16. Oil level plug
17. Gasket
18. Oil drain plug
19. Right case
20. Thrust washer
21. Joint
22. Thrust washer
23. Pinion shaft No. 2
24. Pinion shaft No. 1
25. Side gear set
26. Left case

Fig. 16-1

16-2. Removal

Instructions and information given in this and subsequent sub-sections apply to both axles, front and rear, except where otherwise indicated:

1. Loosen, but do not remove, hub nuts all road wheels, and raise the machine off the floor by jacking. Rest the machine steady on safety stands.
2. Drain out the oil in the differential housing by loosening the drain plug.
3. Remove the hub nuts and taken the wheels, front and rear. Each wheel has five hub nuts.

For front differential

1. After taking down the front wheels, remove the brake drums. The nuts, securing the drum in place, are to be loosened with the following special tools:

   Front drum remover (09943-35511)
   Sliding hammer (09942-15510)

Fig. 16-2

2. Disconnect brake pipe from brake hose, above the kingpin. Have a small plug ready for use when disconnecting the pipe. As the pipe comes off the hose, insert the plug into the hose to prevent the brake fluid from leaking out.

Fig. 16-3

3. Remove the four bolts securing the brake backing plate, and take off the plate complete with shoes, wheel cylinder and others.

Fig. 16-4

4. At each tie rod end, remove the nut and disconnect the end from steering knuckle. If the stud is tight in the hole of knuckle arm, put on the nut and lightly tap on the stud to shake it loose. The nut so put on serves to protect the threads.

Fig. 16-5

5. Remove the 8 bolts securing the oil seal cover. From the knuckle arm case, take off felt pad, oil seal and seal retainer. Remove the top and bottom kingpins from the case by removing the 4 bolts securing each pin.

Fig. 16-6

6. Draw out the live axle shaft from the axle sleeve. The shaft at this time is complete with the steering knuckle and constant-velocity flexible joint.

Fig. 16-7

7. At the differential housing, disconnect the propeller shaft by removing the bolts securing flange yoke to companion flange. Remove the 8 bolts holding fast the differential carrier case to the housing, and take down the carrier assembly.

Fig. 16-8

16-5

16-6

6-7

8

For rear differential

1. Remove the 4 bolts securing the outer-bearing retainer, and remove the retainer from the brake backing plate.

Fig. 16-9

2. Using the special tools indicated below, draw out each live axle shaft.

   Rear axle remover (09922-66010)
   Sliding hammer (09942-15510)

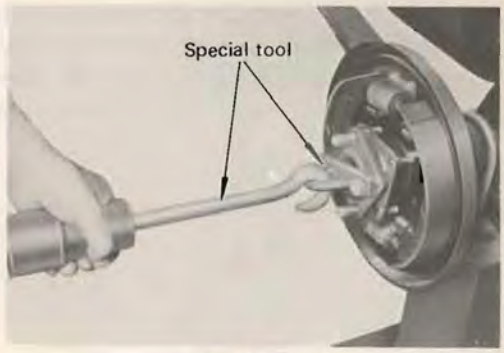


Fig. 16-10

3. Disconnect the propeller shaft as in the case of the front axle, and detach and take down the differential carrier case from the housing by removing the 8 bolts.

Fig. 16-11

16-3. Disassembly

1. Lock the flange immovable, and remove the nut from the end of the bevel pinion shank.

Fig. 16-12

2. Scribe marks on each cap bolted to the saddle portion of the carrier case and holding down the side bearing. The marks are to identify the cap. This means that there are right and left caps, so identified and so handled at the time of reassembly.

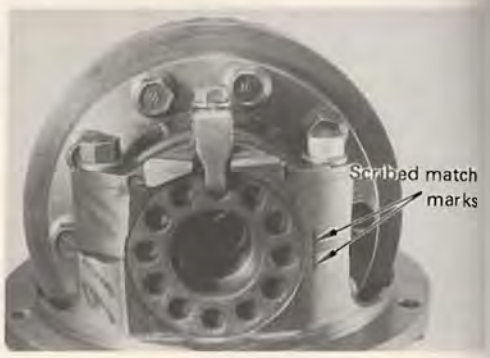


Fig. 16-13

3. At each side, loosen the bolts on bearing adjuster stopper, remove the nuts securing the bearing cap, and take off the cap. Lift the differential case assembly, complate with the bevel gear, off the carrier.

Fig. 16-14

4. Remove the 10 bolts securing the bevel gear to the differential case, and separate the gear from the case.

Fig. 16-15

5. There are 8 bolts fastening the two differential case halves together. Remove these bolts to sever the right-hand case half from the left-hand one, and take off the right-hand one.

Fig. 16-16

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Bearing pul
Side bearing

16-4. Maint

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6. Remove the side gears, differential pinions as mounted on the spider, and thrust washers.

Fig. 16-17

7. Using the special tools indicated below, extract the side bearing from each differential case half.

   Bearing puller (09913-60910)
   Side bearing removing jig (09913-86230)

Fig. 16-18

16-4. Maintenance Services

1. **Side gear backlash**

To check this backlash, assemble the differential gearing and case, as shown in Fig. 16-19, fastening together the two case halves by tightening the securing bolts to the prescribed torque value. Use fuse stock to measure the backlash in the usual manner. By comparing the backlash reading, taken on the flattened fuse stock, against the standard backlash indicated below, increase or decrease the total thickness of thrust washers, which are located in two places, that is, on the inner side of each case half.

Side gear backlash specification	*0.05 ~ 0.10 mm (0.002 ~ 0.004 in.)*
Available thrust washer sizes (thickness)	*0.8, 1.0 & 1.2 mm (0.03, 0.04 & 0.05 in.)*

Fig. 16-19

2. **Determination of shim thickness for bevel pinion**

The amount of shims to be used on the bevel pinion varies from one machine to another on account of a number of actors involved in machining and assembling. Thus, for each machine, the amount of shims necessary for locating the pinion in the correct position (for producing a proper backlash in the mesh between pinion and gear) must be determined anew at the time of reassembly.

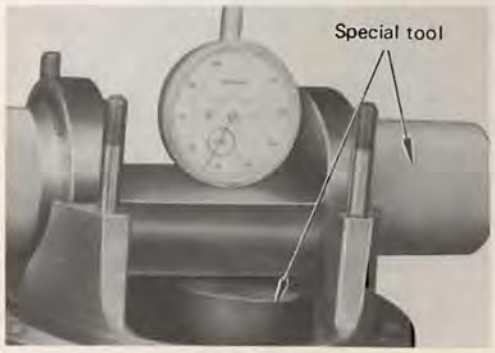

Fig. 16-20

In order to facilitate this determination, a two-piece dummy tool (special tool) is made available. The following procedure is based on the use of this tool and supposes that the pinion dummy (one of the two pieces) is set in the carrier, without any shims, as shown in Fig. 16-20.

(1) Set the dial indicator on the dummy (to be put on the saddles), and bring the indicator hand to "0" position on the scale.

(2) Mount the dummy on the saddles, put on the caps, and tighten the cap bolts 70 kg-cm (5.0 lb-ft) as if the dummy were two side bearings.

(3) Note, in Fig. 16-21, that three dimensions are indicated: "a", "b" and "c". The value of "b" in unknown and is to be determined now for calculation of the required thickness of shims. The values of "a" and "c" are given. The sum, "a" + "c", is indicated on the dummy tool (09924-36310).

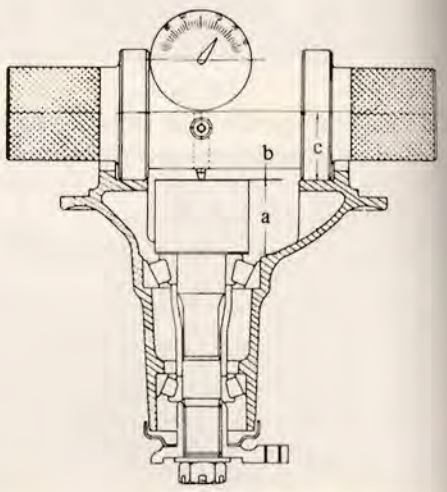

Fig. 16-21

With the dummy now secured, the dial indicator hand may have deflected from the "0" mark to indicate a certain value; read this value, which is the value of "b". Totalize "a", "c" and "b" and, from this sum, subtract the value which is marked on the bevel pinion. The difference is the thickness of shims to be used on that bevel pinion.

("a" + "b" + "c") — marked value = required shim thickness

You are to install the bevel pinion with shims whose total thickness is equal to the difference.

Fig. 16-22

(4) Three sizes of shim are available for selective use producing the required shim thickness:

Bevel pinion "mounting distance" dummy (09924-36310)

Sizes of shims for bevel pinion	*0.05, 0.5 & 1.0 mm (0.002, 0.02 & 0.04 in.)*

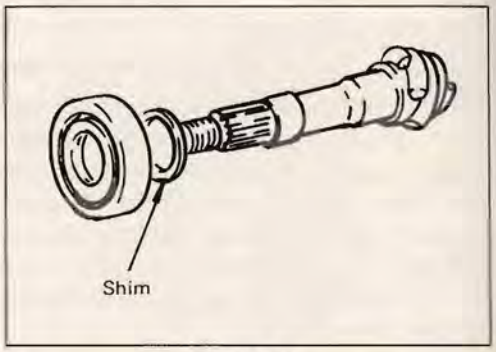

Fig. 16-23

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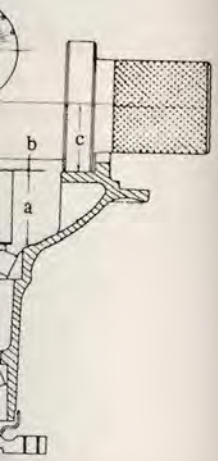


21

3. Bevel pinion bearing preload adjustment

The bevel pinion, as installed in the normal manner in the carrier, is required to offer a certain torque resistance when checked with the use of a prescribed torquing pulley (special tool) as shown in Fig. 16-24. This resistance is a "preload," which is due to the tightness of the two tapered roller bearings by which the pinion is held in the carrier. And this tightness is determined primarily by the thickness of the adjusting collar plus a shim.

Check the preload and, if the preload measurement is off the specified range indicated below, increase or decrease the thickness of the shim. The method is as follows:

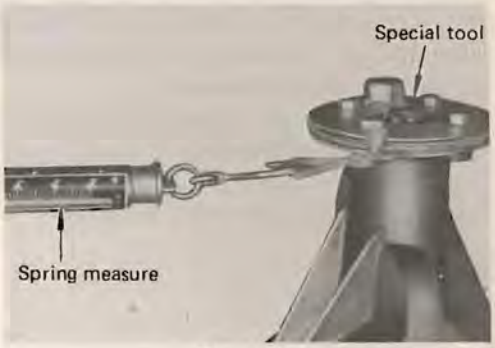


Fig. 16-24

Tentatively install the pinion in the carrier, using the adjusting collar and a 1-mm thick shim, and tighten the nut to secure the splined yoke. The nut is to be tightened to the specified torque:

Tightening torque on bevel pinion nut	*900 ~ 1,500 kg-cm (65 ~ 108 lb-ft)*

Put on the torquing pulley (special tool) and give a pull, as shown in Fig. 16-24, and read the spring balance indication just when the pulley begins to turn. The reading is a starting torque, and is required to be within the 0.6 to 1.4 kg range (equivalent to the specified torque range of 3.0 to 7.0 kg-cm).

Pinion bearing preload	*3.0 ~ 7.0 kg-cm (2.6 ~ 6.1 lb-in.)*
Starting torque (with pulley)	*0.6 ~ 1.4 kg (1.4 ~ 3.1 lb)*

Increasing the shim thickness increases this preload, and vice versa. Three-size shim stock available for "mounting distance" adjustment, mentioned above, is meant to be used in producing a proper shim thickness in this preload adjustment too.

Preload-check torquing pulley (09922-75220)

NOTE:
When tentatively installing the pinion in the carrier, be sure to oil the bearings lightly with gear oil, and to leave out the oil seal.

4. Bevel gear backlash adjustment

The backlash between bevel gear and pinion is to be checked in the manner shown in Fig. 16-25. Note that the differential case assembly is mounted in the normal manner, and fastened down by tightening the side bearing cap bolts to the specification torque value. The dial indicator spindle is pointed squarely to the "heel" on the drive side (convex side) of a gear tooth. Hold the bevel pinion rigidly, and turn the gear back and forth:

The dial indicator reading, which is a backlash value, is required to be within this range:

Fig. 16-25

Bevel gear backlash	*0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)*

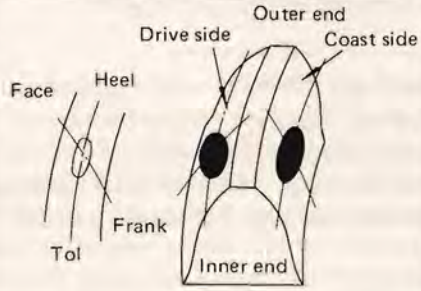
To increase or decrease the backlash for adjustment, displace the bevel gear toward or away from the pinion by running in one adjuster and running out the other adjuster by an equal amount (with the side bearing cap bolts slightly loosened).
Turning the adjuster one notch changes the backlash by about 0.1 mm (0.004 in.).

Side bearing adjuster turner (09923-56310)

Fig. 16-26

5. Pinion-to-gear tooth contact pattern check and adjustment

In addition to proper backlash, proper tooth contact must be secured in the mesh of bevel pinion and gear, so that there will be no "gear noise" coming from the axle and that the hypoid teeth will not be overstressed in transmitting drive.
After the specified amount of backlash has been secured, check the pinion and gear for tooth contact by "rolling" contact patterns in a manner consistent with the standard shop practice: use a red lead paste to paint ten teeth, both drive side and coast side, of the gear, turn the gear back and forth by hand while holding the pinion in a "braking" manner, and examine the contact patterns in reference to the following chart:

	Contact patterns	*Diagnosis, and what to do*
Normal contact pattern		*Contact is roughly centered and somewhat more displaced toward toe than toward heel on both drive side (concave) and coast (convex) side.*
Patterns due to improper shim adjustment		*High contact: Contact is on heel (drive side) and on toe (coast side). This condition means that the pinion is too far back and must be brought forward by increasing its shim thickness used in "mounting distance" adjustment.*
		*Low contact: Contact is on toe (drive side) and on heel on (coast side). This condition means that the pinion is too far out from the carrier and must be backed away by decreasing its shim thickness.*

-26

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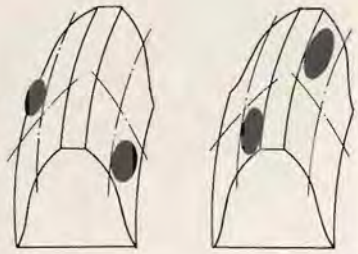
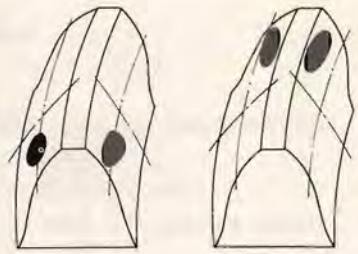
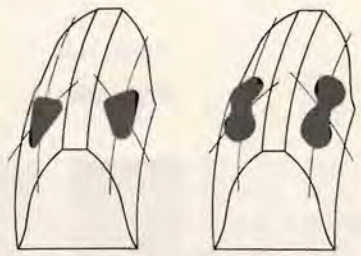
d somewhat more ward heel on both convex) side.
(drive side) and on n means that the e brought forward used in "mounting
drive side) and on on means that the rrier and must be m thickness.

	Contact patterns	Diagnosis, and what to do
Patterns due to defective parts		*These contact patterns indicate that the "offset" of differential carrier is too much or too little. The remedy is to replace the carrier by a new one.*
		*These contact patterns, located on toe or heel on both drive and coast sides, mean that 1) both pinion and gear are defective, 2) carrier is not true and square, or 3) gear is not properly seated on differential case. The remedy is to replace the defective member.*
		*Irregular patterns: If the pattern is not oval, it means that bevel gear is defective. High or low spots on tooth surfaces or on the seat of bevel gear are the cause of irregular patterns appearing on some teeth. The remedy is to replace the pinion-and-gear set and, if the seat is defective, the differential case also.*

IMPORTANT:

When applying the red lead paste to the teeth, be sure to paint the tooth surfaces uniformly. The paste must not be too dry or too fluid.

16-5. Reassembly Instructions

1. **Tightening torque**

Side bearing cap nut	*300 ~ 370 kg-cm (21.7 ~ 26.7 lb-ft)*
Drive bevel gear bolt	*450 ~ 600 kg-cm (32.5 ~ 43.3 lb-ft)*
Differential case bolt	*150 ~ 200 kg-cm (10.8 ~ 14.5 lb-ft)*
Drive bevel pinion nut	*1,700 ~ 2,300 kg-cm (123.0 ~ 166.0 lb-ft)*
Drive bevel gear thrust nut	*700 ~ 900 kg-cm (50.6 ~ 65.0 lb-ft)*
Differential carrier nut	*150 ~ 200 kg-cm (10.8 ~ 14.5 lb-ft)*

2. Drive bevel gear bolts

The bolts securing the bevel gear to the differential case are subject to shear stress since drive is transmitted by these bolts from the gear to the case. For this reason, they are special bolts made from chrome steel and must never be replaced by common bolts. When mounting the gear on the case, be sure to apply the thread locking compound to these bolts before running them in.

Fig. 16-27

3. Bevel gear thrust bolt

This bolt, screwed into the differential carrier, is required to take a certain position relative to the bevel gear in place. This position is reached when the bolt is first run in all the way till its forward end touches the back of the bevel gear and then backed away a quarter turn (equal to one and a half flats). This position of the bolt introduces the specified clearance of 0.3 to 0.4 mm (0.012 to 0.015 in.) as shown in Fig. 16-28. After so positioning the bolt, be sure to secure it by tightening its nut to the specified torque value.

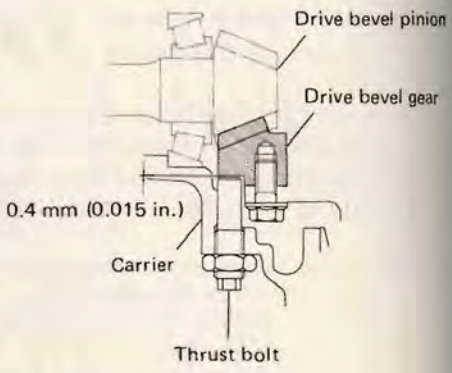


Fig. 16-28

4. Differential side bearings

Press-fit these bearings into the differential case by using the special tool. Driving the bearing into the case is not permitted.

Differential side bearing installer (09940-53110)

Fig. 16-29

5. Bevel pinion bearings

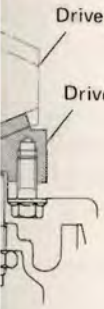
A press must be used to install the two tapered roller bearings on the bevel pinion. Outer races are to be press-fitted into the differential carrier and the inner races onto the pinion.

(1) For the outer race of front bearing (yoke side), the special tool, indicated here, must be used:

Bearing installer (09913-75520)

Fig. 16-30

6-27



bolt

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(2) For the outer race of rear bearing (gear side):

Bearing installer (09913-75510)

Fig. 16-31

(3) For the inner races, use this special tool:

Bearing installer (09913-80111)

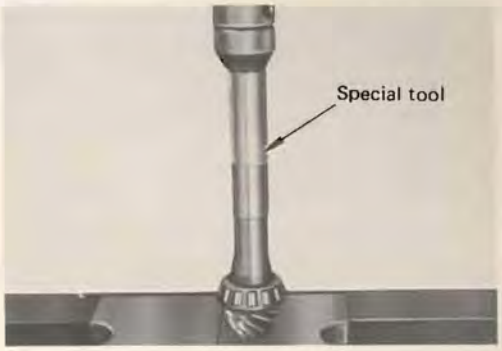


Fig. 16-32

6. When putting on the side bearing caps, be sure to discriminate the right-hand cap from the left-hand one by referring to the match marks scribed at the time of disassembly.

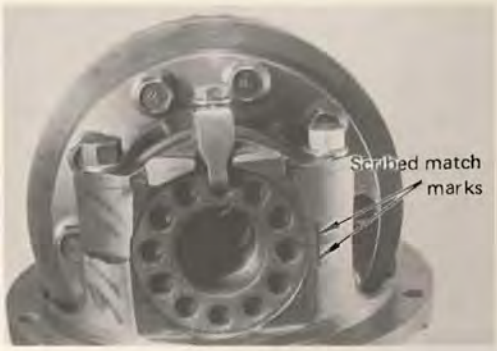


Fig. 16-33

7. **Differential gear oil**

The oil capacity of the differential housing is 1.3 litres for both rear and front axle:

Differential housing oil capacity and specification	*1.3 litres (2.75/2.31 US/Imp. pt.)* *SAE 90 gear oil*

17. SUSPENSION

17-1. Description

Suspension is by double-acting shock absorbers and semi-elliptical leaf springs for both axles, front and rear. Similar springs and shock absorbers are used.

The Barfield universal joints are used in the front axle to enable the axle shafts to drive the front wheels while allowing the wheels to be steered. This type of joint provides for a larger steering angle range and, what is more important, constant-velocity drive to the wheel.

If a single two-yoke (or Hooke's) universal joint is used to connect the live axle shaft to the wheel on each side of the front end, the wheels will run with the same speed, but not with the same constant velocity, as that of the axle shafts when the wheels are turned around their kingpins for steering action. The Barfield joint transmits drive without varying the angular velocity of drive.

The Barfield joint is enclosed by the knuckle, which is shaped integral with the wheel hub and knuckle arm, and has a two-piece kingpin, namely, upper and lower kingpins.

The end of the dead axle sleeve is in the shape of a dish. This dish is rotatably fitted into the knuckle structure to form a flexible connection, the sliding clearance between the two being sealed with a felt packing (against road dust and mud) and also with an oil seal (against the oil inside). The upper and lower kingpins, bolted to the knuckle extend into the knuckle and, inside, are held by the dish-like inner case through tapered roller bearings.

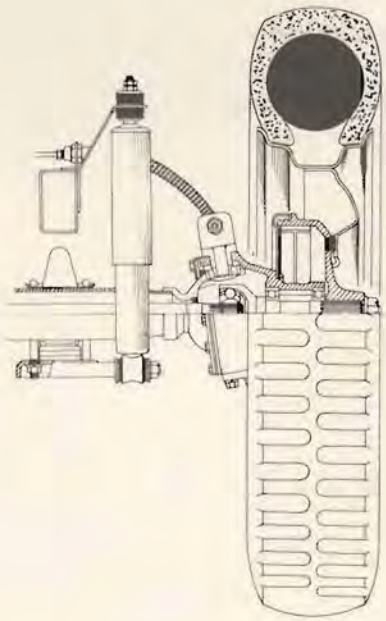


Fig. 17-1

17-2. Barfield Joint Construction and Operation

The major parts of the Barfield joint are the outer race (integral with wheel spindle, to which the wheel disc is splined), inner race (splined to the live axle shaft), six steel balls disposed between the two races, and cage (holding the steel balls in a single row lying in a plane).

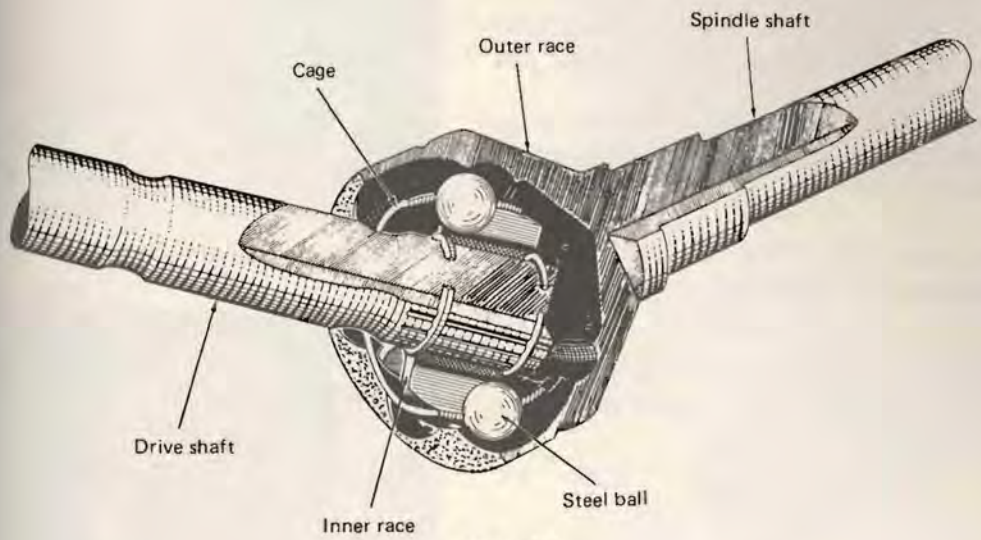


Fig. 17-2

The balls are fitted in two groups of raceways; one group is on the outer race and the other group on the inner race. Each ball is in its own raceways as if it were locked between the two races in the direction of rotation. The outer race with its wheel spindle is capable of angling and, when it so angles with respect to the axis of axle shaft, the row of steel balls angles just half as much, that is, the plane including this row tilts by an angle equal to one-half of the spindle angle. This relationship is illustrated in Figs. 17-3 and 17-4.

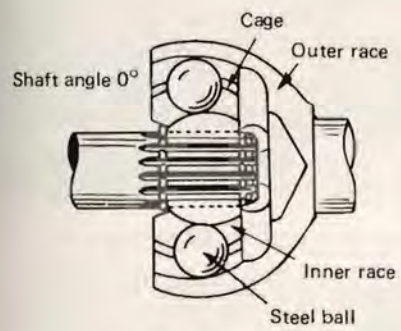


Fig. 17-3

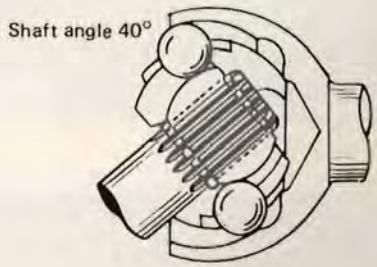


Fig. 17-4

17-3. Removal of Front Wheel and Knuckle

To remove each front wheel and its knuckle, proceed as follows:

1. Loosen the five nuts securing the wheel to the wheel disc. Raise the front end by jacking.
2. Remove the five nuts and take off the wheel, leaving behind the wheel disc (which is integral with the brake drum) on the wheel spindle.
3. Remove the nut securing the wheel disc to the spindle, and pull the disc off by using these special tools:

   Front brake drum remover (09943-35511)
   Sliding hammer (09942-15510)

Fig. 17-5

4. Remove the four bolts securing the brake backing plate to the hub, and take off the backing plate.

Fig. 17-6

5. Remove the tie rod end securing nut, and disconnect the tie rod from the steering knuckle arm. If the stud of tie rod end will not come off easily, put back on the nut, run it in a few turns and tap on the nut with a hammer to drive the stud out.
6. Remove the upper and lower kingpins. Each kingpin is bolted to the knuckle; removing the four bolts securing the kingpin allows this pin to come off. Pull off the knuckle complete with the spindle, the Barfield joint and live axle shaft.

Fig. 17-7

7. Using a press, force the spindle out of the knuckle. This separates the knuckle from the combination of the live axle shaft, Barfield joint and wheel spindle.

Fig. 17-8

17-4. Maintenance Services

1. **Barfield joint**

To be checked on this joint is its axial play, which shows up when a push-and-pull motion is given to the live axle shaft and wheel spindle held in both hands, as shown in Fig. 17-9. There should be no play at all but a play of up to 1.5 mm (0.06 in.) is permissible. If the lay exceeds the limit, replace it.

	Standard	*Service limit*
Axial play in Barfield joint	*0 mm (no play)*	*1.5 mm (0.06 in.)*

Fig. 17-9

2. **Kingpins**

(1) Inspect each kingpin closely for dents, signs of cracking, distortion or any other damage. Replace the kingpins found in defective condition.

Fig. 17-10

(2) Where the tapered roller bearings holding the two kingpins at each front wheel are in good and properly preloaded (tightened) condition, there will be no appreciable rattle of the wheel. To check the kingpins and their tapered roller bearings, jack up the front end and shake the wheel to feel any rattle, as shown in Fig. 17-11. If a rattle is felt, eliminate it by properly increasing the shim thickness. The shim is located between the flanged part of the kingpin and the knuckle.

Fig. 17-11

The above-mentioned method of making a shim adjusting demands a high degree of skill on the part of the serviceman. The alternative method is to adjust the thickness of the shim by referring to the torque resistance which the knuckle arm offers when pulled in the condition shown in Fig. 17-12. For this method, the reference torque value is established, indicated below, and you are to increase or decrease the shim thickness to produce this torque value.

Fig. 17-12

Before giving a test pull to the knuckle arm with a spring balance in the alternative method, install a large amount of shims on each kingpin to lighten preload on the tapered roller bearing. Keep on reading the torque, each time decreasing the shim thickness a little, and continue this process until the specified torque value is obtained. (This process protects the kingpins because it ensures that no excessive pull will be applied to the bearings at the onset.) If the process fails to produce the specified torque, that is, if the desired torque resistance does not occur even when the shim thickness has been reduced to zero on each kingpin, it means that the bearings or kingpins are excessively worn and need replacement.

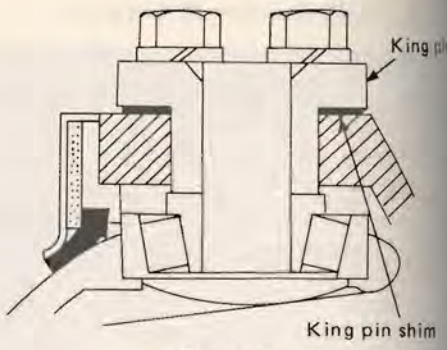


Fig. 17-13

NOTE:

Read the spring balance indication when the knuckle arm begins to turn. In other words, you are to read "starting torque."

When checking the knuckle arm starting torque, be sure to have the oil seal removed.

Knuckle arm starting torque (force)	*1.0 ~ 1.8 kg, without oil seal*
Available sizes of shim for kingpins	*0.1, 0.5 mm (0.004, 0.02 in.)*

3. Oil seal

The oil seal used at the spherical sliding joint between the knuckle and the inner case accomplishes the additional purposes of keeping out road dust and of acting as the damper for the steering handwheel. As the wear of this seal advances, its damping effect decreases and thus make the front wheel develop a tendency to "shimmy." Not only that, road dust begins to creep into the sliding clearance to promote the wear of the spherical sliding surfaces.


Fig. 17-14

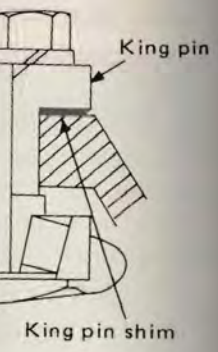
The oil seal is an expendable item, and must be replaced at regular intervals.

Oil seal replacement interval	*10,000 km (6,250 miles)*

How to replace the oil seal:

1. Remove the 8 bolts securing the joint seat, and displace the oil seal cover and felt packing inward.
2. Cut the oil seal in place with scissors or a knife, and take it off.
3. Prepare the replacement oil seal by cutting it into two pieces, as shown in Fig. 17-15. Each cut must be in a straight line but angled through the thickness so that the cut edges will have a broader mating surface. Fit the two halves and rejoint them by putting together the two edges at each cut, with a sealing compound applied to the mating surfaces.


Fig. 17-15



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4. Be sure to position the seal in such a way as to bring the cut part to the upper side and to displace the cut about 30 degrees off the matching face of the oil seal retainer. Apply the sealing compound the mating face all around; this is for preventing entry of water.

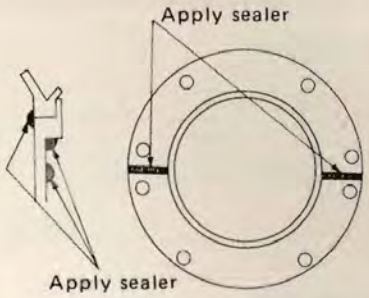

Fig. 17-16

17-5. Important Steps in Reassembly

1. **Wheel spindle**

To install the spindle in the hub, which is integral with the knuckle, use the special tool, as shown in Fig. 17-17. This tool takes a grip on the hub; turning its bolt forces the spindle into the knuckle.

Front wheel spindle installer (09922-55210)

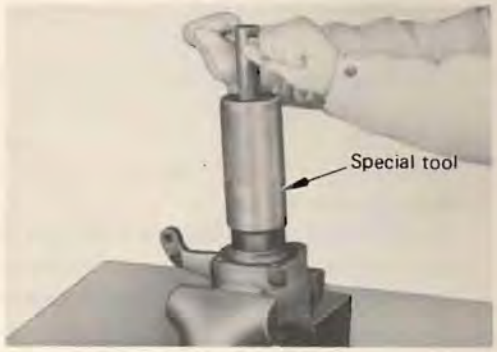

Fig. 17-17

2. **Knuckle**

When fitting the knuckle to the inner case, make the space inside the case and knuckle 30% full with SUZUKI SUPER GREASE D (MOLYCOTE type).

Fig. 17-18

3. **Kingpins**

The sealing compound is to be used on kingpins. Just before installing the kingpin, apply the compound to the corner inside the flange, with the shims in place, as shown in Fig. 17-19. This is for preventing water from finding its way into the knuckle through the fit the kingpin in the knuckle.

Fig. 17-19

17-6. Shock Absorbers and Leaf Springs

1. Specifications

SHOCK ABSORBERS

Item	*Front shock absorbers*	*Rear shock absorbers*
Damping force on rebound	*60 kg (132 lb)*	*60 kg (132 lb)*
Stroke	*150 mm (5.90 in.)*	*160 mm (6.30 in.)*

* The force is based on piston speed of 0.3 m/second.

LEAF SPRINGS

Item	*Front leaf springs*	*Rear leaf springs*
Amount of bow	*11 mm (0.43 in.)*	*120.5 mm (4.74 in.)*
Leaf length	*940 mm (37.00 in.)*	*940 mm (37.00 in.)*
Spring rate	*3.70 kg/mm*	*3.06 kg/mm*

2. Inspection

(1) Shock absorbers

The absorbers are of double-acting type. By trying to contract and extend each absorber by hand, the effectiveness of its damping action can be told. Absorbers found with oil leak or with inadequate damping effectiveness must be replaced.

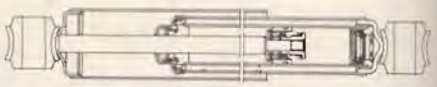

Fig. 17-20

(2) Leaf springs

If any leaf spring is suspected of weakening, as evidenced by the chassis being tilted to one side in standstill condition on level ground, check its dimension "L", the distance between its center part and the line through the two attachment eyes, shown in Fig. 17-21. If this distance measures less than the limit, replace the spring.

	Front	*Rear*
Limit on leaf spring bow	*0 mm*	*110 mm (4.33 in.)*

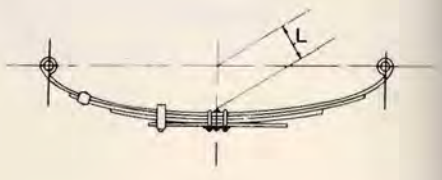

Fig. 17-21

3. Tips on installation

In the bottom connection of each shock absorber, two washers are used. When making this connection, check to be sure that each washer in place has its flange pointing outward, as shown in Fig. 17-22. If these washers are mispositioned, the shock absorber may fail in service.

After installing all the shock absorbers, go around and recheck each connection for washer position.

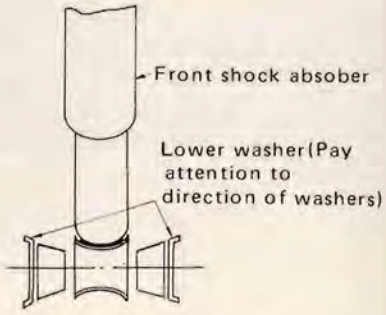

Fig. 17-22

18. STEERING SYSTEM

18

18-3. Steering Gear Box Construction and Operation

The pitma arm is rigidly connected to the outer end of the shaft integral with the sector gear, which is inside the gear box and meshed with the teeth of the nut capable of sliding along the worm. Between the nut and the worm is a row of steel balls (actually a total of 60 balls are used), which serves two purposes: to provide rolling contact between nut and worm and to keep the nut engaged with the worm as if the two were threadedly engaged. With the nut prevented from turning, the rotation of the worm causes the nut to move up or down the worm.

The worm is an extension of the steering shaft. As the handwheel is turned, the steel balls roll along in the groove and the nut moves up or down. The steel ball that has reached the end of the groove in the nut enters the return guide. The guide sends the ball back to the other end of the same groove. In this way, the row of balls recirculates.

By so moving, the nut turns the sector gear and hence the pitman arm. It should be noted here that it is through the steel balls that a rotary motion of the worm is converted into a linear motion of the nut, which is then converted into another rotary motion of the sector gear.

The steering gear box is a precision-machined device, each part of it being machined to a closer tolerance for smooth conversion of motion, and is built sturdy for long service life. Special tools and instruments are needed in addition to specialized skill if the gear box is to be overhauled. For this reason, a gear box found to be in defective condition should be replaced by a new one; replacement is more economical and, what is perhaps more important, safer.

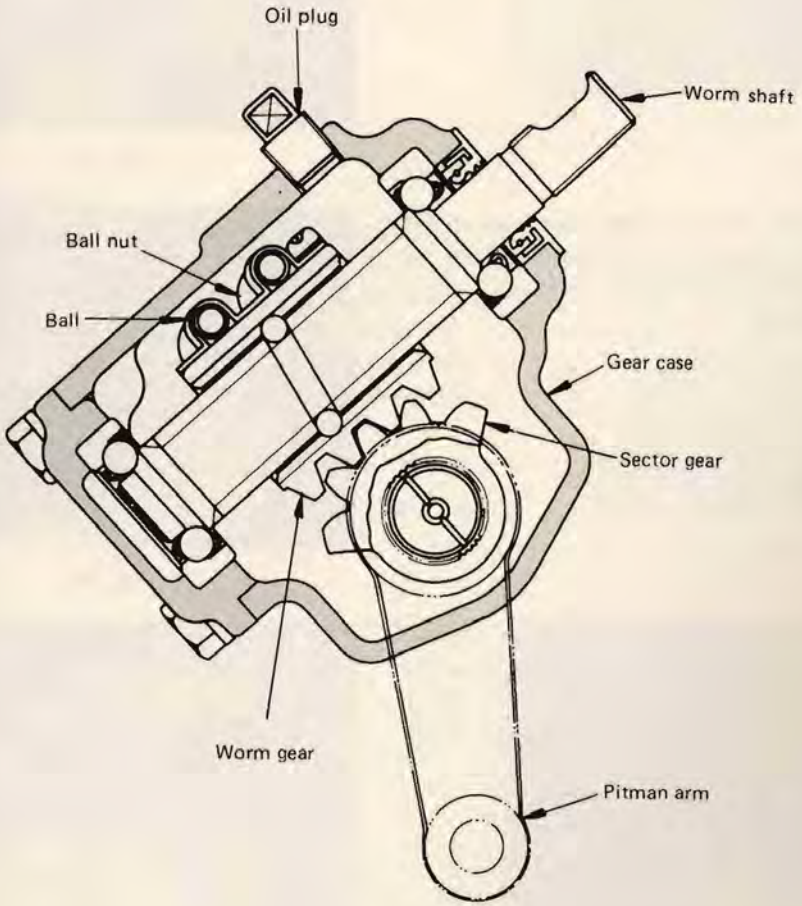

Fig. 18-2

18-4. Removal

1. At the steering handwheel, depress the horn button while twisting it counter-clockwise, to remove the button. After removing the button, remove the nut securing the handwheel, and pull the handwheel off. The handwheel is splined to the shaft.

Fig. 18-3

2. Loosen the bolts on the rubber joint flange at the bottom end of the steering shaft. This joint is accessible in the engine room.

Fig. 18-4

3. Disconnect the wiring harness, and remove the two brackets fastening the steering column to the body. Pull up the steering shaft and take it off at the driver's seat.

Fig. 18-5

4. Disconnect the drag link by undoing the joint at the pitman arm. If the ball stud will not come off easily, shake it loose by tapping on its end with a hammer. Never hit the stud directly; put on the nut and tap on the nut.

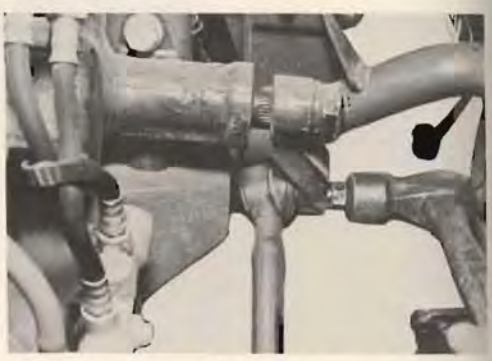

Fig. 18-6

5. The steering gear box is secured in place by three mounting bolts. Remove these bolts and take down the gear box. Undo all the articulated joints to remove the drag link, tie rods and tie rod lever, separately.

Fig. 18-7

18-5. Maintenance Services

1. **Steering handwheel play**

The wheel play is proper if it is anywhere between 10 and 30 mm (0.4 and 1.2 in.) as measured at the rim. An unusually large play means that the ball-and-socket joints are loose or that the wear in the steering gear box is excessively large. Retightening the joints will corrct the play in most cases.

Fig. 18-8

2. **Steering gear box**

(1) If any evidence of oil leakage is noted on the gear box upon inspection of the machine brought in for servicing, remove the plug (Fig. 18-9) and check the level of oil inside. The oil surface should be up to about 6 mm (0.24 in.) below plug; if not, add oil. Be sure to use the prescribed gear oil, SAE 90.

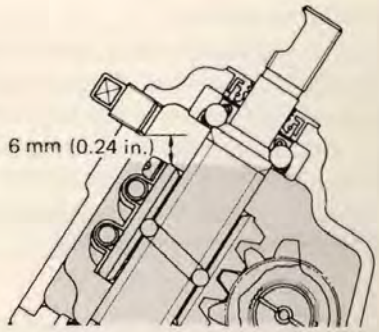

Fig. 18-9

(2) The steering gear box has an adjusting screw for "preloading" its worm shaft. If this shaft is noted to have developed an appreciable rattle, check the starting torque on the pitman arm with a spring balance, and tighten the adjusting screw to obtain a torque value within the following range:

Overall worm shaft starting torque	*1.3 ~ 7.5 kg-cm (1.2 ~ 6.5 lb-in.)*

Fig. 18-10

(3) Steering rubber joint
Inspect this joint for cracks in the rubber part and for the tightness of the rubber part on the metal mounting. The rubber and metal mounting are secured together by punching; check the punched portions for tightness.

Fig. 18-11

(4) At regular intervals, relubricate the ball-and-socket joints on the drag link and tie rods. Be sure to wipe each grease nipple clean before putting the grease gun to it.

Lubricating interval for joints on drag link and tie rods	*2,500 km (1,500 miles)*

Fig. 18-12

18-6. Important Steps in Reassembly

1. Steering tie rod lever

This lever is required to take a certain position when the front wheels are pointed straightahead. Specifically, the axis of the long arm of this lever (jointed to the tie rod) must be parallel to the longitudinal center line of the machine. When installing the steering linkage, make sure that this requirement is satisfied within the allowable error of one degree.

Fig. 18-13

2. Tie rod turnbuckles

After installing the tie rods, with their ends properly connected, set the turnbuckle in each wheel-side end of the tie rod in such a way that about 5 mm (0.2 in.) of the threaded portion shows out at each side of the turnbuckle sleeve as shown in Fig. 18-14.

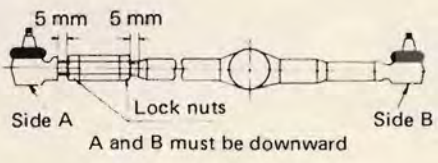

Fig. 18-14

3. Steering handwheel

In addition to the play requirement, mentioned above, this wheel is to take the position shown in Fig. 18-15 when the front road wheels are pointing starightahead. In words, the two spokes must be horizontal. When mounting the wheel on the shaft, position it to line up the spokes level as shown.

Fig. 18-15

4. Steering column cover clearances

Two clearances are specified for the column cover; the clearance between the cover and the instrument panel must be about 3 mm (0.12 in.) and that between the cover and the handwheel must be just as wide (3 mm or 0.12 in.).

The former clearance is to be secured by properly positioning the steering column, and the latter by inserting the steering shaft more or less into the steering rubber joint.

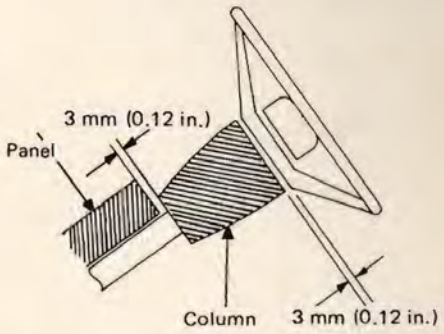

Fig. 18-16

18-7. Wheel Alignment

1. Alignment service data

Toe-in	*5 mm (0.19 in.)*
Camber	*1 degree (1°)*
Trail	*2 mm (0.08 in.)*
Kingpin inclination	*9 degrees (9°)*
Caster	*3 degrees and 30 minutes (3°30′)*

2. Adjustment

The only item of adjustment is toe-in. Camber and caster are given and fixed. Before checking and adjusting toe-in, let the car stand on flat level ground without any load placed aboard, and make sure that—

(1) All tires are inflated to the following pressures:

Front wheel tires	*17 kg/cm² (1.2 psi)*
Rear wheel tires	*26 kg/cm² (1.8 psi)*

(2) The car is ievel. (Check by using a carpenter's level gauge.)

(3) The front wheels are set in straightahead driving position.

Using the toe-in gauge, read the toe-in and compare the reading against the specification (indicated above). To increase or reduce the toe-in, vary the length of each tie rod by means of its turnbuckle.

Fig. 18-17

19. BRAKES

19-1. Description

The hydraulic foot brake system of the LJ50-LJ50V has two leading shoes in the front wheel brakes, and one leading shoe and one trailing shoe in the rear wheel brakes. Hydraulic pressure is produced by a tandem master cylinder to actuate the wheel cylinders, one in each front wheel brake and two in each rear wheel brake, through two independent circuits, one for front brakes and one for rear brakes.

The parking brake system is mechanical; it consists of the brake drum mounted on a propeller shaft (at the transfer gear box) and the internally-expanding two-shoe brake assembly (whose backing plate is bolted to the gear box). Called the center brake, this brake is controlled from the parking lever through a cable.

The center brake has a braking capacity large enough to safely brake the machine even when the foot brake system has temporarily failed to develop enough braking force because of, for example, the wheel brakes being wet with water after a run in the water.

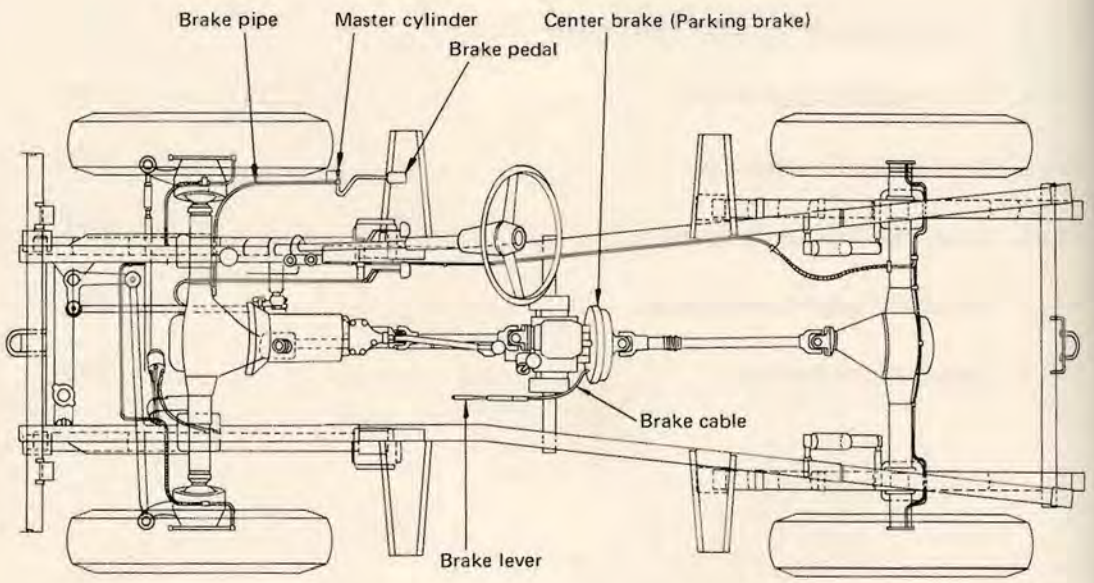

Fig. 19-1

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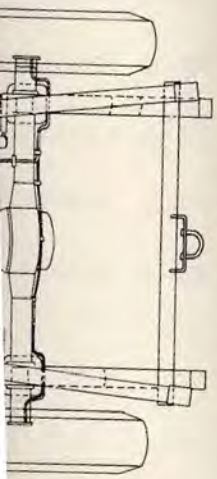


19-2. Tandem Master Cylinder

The tandem master cylinder is similar in construction to an ordinary master cylinder, the principal differences being that it has two pistons and four piston cups and that hydraulic pressure is developed in two chambers, one for front brakes and the other for rear brakes.
Obviously the two-circuit foot brake system employed in the LJ50 and LJ50V models assures greater safety; failure of one circuit (failure of front brakes or rear brakes) due to such as an oil line rupture does not incapacitate the machine.

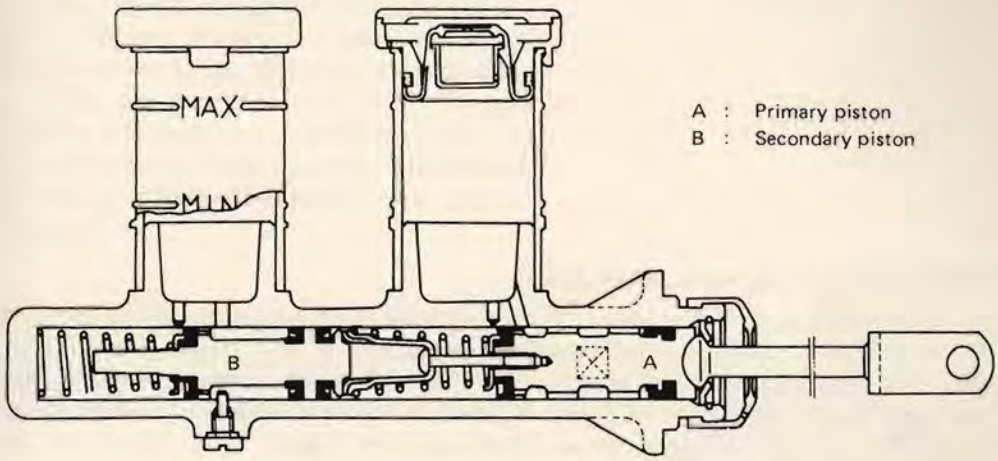


Fig. 19-2

19-3. Tandem Master Cylinder Operation

1. Normal operation

Depressing the brake pedal forces primary piston "A" toward the left (in Fig. 19-3) to pressurize the oil immediately ahead for front brakes. By this pressure and by the force of return spring, secondary piston "B" moves similarly to pressurize the oil for rear brakes.

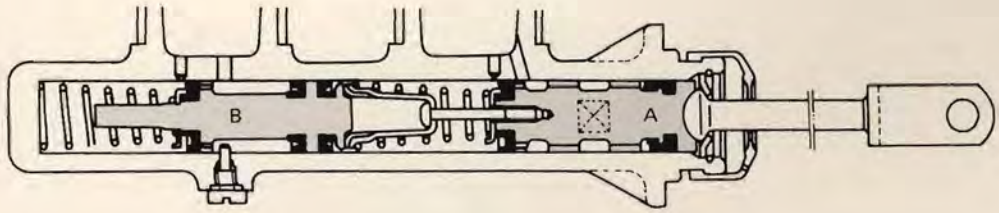


Fig. 19-3

2. **One-circuit operation (front-brake circuit failure)**

Depressing the brake pedal causes primary piston "A" to move as above but, because the front-brake circuit cannot hold pressure, the oil immediately ahead of this piston does not get pressurized. As piston "A" keeps moving, compressing the spring, it begins to push piston "B" when the spring has been compressed fully. From this point on, piston "B" moves to pressurize the oil ahead and thus actuate the rear brakes.

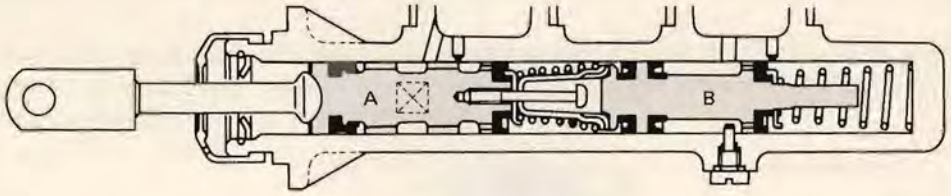


Fig. 19-4

3. **One-circuit operation (rear-brake circuit failure)**

In this case, the leftward movement of piston "A" has but little effect in pressurizing its oil (for front brakes) at first, because the initial rise in oil pressure causes piston "B" to promptly yield and move toward the left. Very soon the forward end of piston "B" comes to and bears against the head of the cylinder. From this point on, the leftward movement of piston "A" becomes effective to pressurize the oil ahead of it for the front brakes. Fig. 19-5 shows secondary piston "B" at halt.

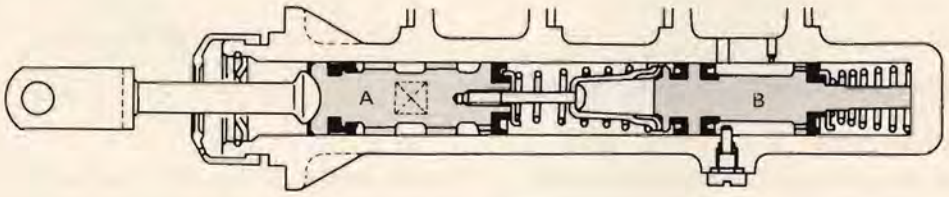


Fig. 19-5

19-4. Front Brake Construction

There are two wheel cylinders. Each cylinder has one piston, by which it pushes the leading end of its shoe. In other words, the two shoes begin to rub the drum in a "biting" manner the moment the hydraulic pressure applies to the wheel cylinders, and thus develop greater braking force more quickly as the pressure to the cylinder rises (when the machine is running forward).

The shoes are mounted on the backing plate in a floating manner, each being urged by the return spring in the contracting direction and pivoted at its trailing end.

Each wheel cylinder is complete with an adjuster consisting of a notched wheel and a bolt. Turning this wheel advances or retracts the bolt (on which the trailing end of the shoe pivots) to reduce or increase the shoe-to-drum clearance (brake adjustment). The two cylinders are bolted to the backing plate; and their adjusting wheels are accessible through holes provided in the brake drum.

Fig. 19-6

19-5. Rear Brake Construction

The rear brake has a double-piston type wheel cylinder interposed between the leading end of one shoe and the trailing end of the other. The other ends of these shoes pivot on the adjuster sleeve complete with an adjusting screw.

When hydraulic pressure applies to the wheel cylinder, which is bolted to the backing plate, the two pushrods of this cylinder move out to spread the shoes apart against the force of two return springs.

Brake adjustment is to be effected by turning the notched screw of the adjuster sleeve. This screw is accessible through a hole provided in the brake drum.

Fig. 19-7

19-6. Center Brake Construction

The major parts of this brake are the adjusting sleeve, brake shoe lever, shoe strut, shoes and return springs, all mounted on the backing plate. The drum is splined to the propeller shaft (No. 1). The strut, corresponding to the wheel cylinder in a wheel brake, is mechanically turned to expand the two shoes apart and thereby to develop braking force by the rubbing contact of their shoe linings against the drum.

Fig. 19-8

19-7. Wheel Cylinder Construction

The double-piston cylinder used in the rear brake has two pistons, each backed by a cup and fronted by a boot. A pushrod or actuating pin bears against the piston by its inner end and is fitted to the shoe web by its outer end.

The single piston cylinder, two of which are used in the front brake, is similar to the double-piston one, except that it has one piston, with its other end being complete with the adjuster.

A bleeder screw is provided in the cylinder proper. This screw is a plug; it is to be removed only when air trapped in the circuit has to be vented out.

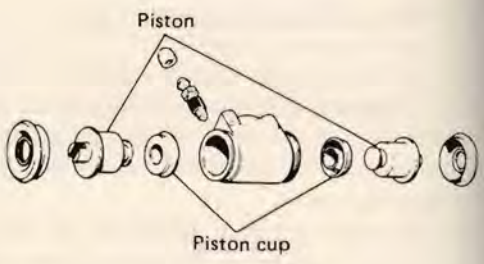


Fig. 19-9

19-8. Maintenance Services

1. Master cylinder

Complaints on the master cylinder are in most cases traceable to excessively worn piston cups or improperly seating check valves; experience tells us that the primary cause of these malconditions is the impurities, particularly abrasive or gritty matters, that have entered the brake fluid reservoir. Check the master cylinder for the possibility of these malconditions. The internals of the master cylinder should be replaced at regular intervals, and they should be handled as a kit. The recommended interval is two years.

Master cylinder internals replacement interval	*2 (two) years*

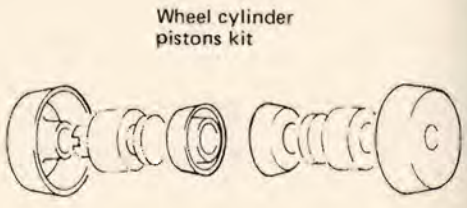


Fig. 19-10

5. Brake pipes

The brake pipes are double-layer wound type, made by rolling steel strip into a two-layer wall pipe, with its surfaces treated for rust prevention. After driving the machine along in sea water at the beach or in a shore area full of salt sprays, it is a good practice to wash the brake pipes with soft water.

Inspect the brake pipes in regard to the following items	
(1)	*Cut marks or dents*
(2)	*Leakage of brake fluid*
(3)	*Signs of rubbing at the clamps and clips*
(4)	*Rusting or corrosion*

Fig. 19-15

6. Air purging

Whenever any component or part of the foot brake system has been replaced, reconnected or otherwise worked on to expose the brake-fluid side of the circuit to the atmosphere, some air will get into the circuit; and the presence of such air will result in a "spongy" brake pedal. In such a case, or whenever the presence of air in the circuit is suspected, carry out an "air purging" operation at each wheel cylinder, as follows:

(1) Tie a vinyl tube into the bleeder plug of the wheel cylinder (in order to catch the brake fluid).
(2) Pump the brake pedal several times and depress the pedal all the way.
(3) Loosen the bleeder plug by turning it a half rotation. The fluid with air bubbles will come out. Tighten up the plug when air bubbles stop coming out.

This operation requires two persons, one at the brake pedal and one at the wheel cylinder.

Fig. 19-16

7. Brake fluid

The brake system uses a glycol type brake fluid. When purchasing the replacement fluid, be sure to specify the glycol type meeting the following specifications:

Brake Fluid	*Specifications*
	DOT 3, DOT 4, SAE J1703a, SAE J1703b SAE J1703c, SAE J70R3 (J70b)

Some commercially available brake fluids are of silicone or petroleum base; do not use any of these fluid. Remember, any brake fluid which is a mixture of two or more brands is likely to effect some of the brake system components adversely, resulting in faulty braking.

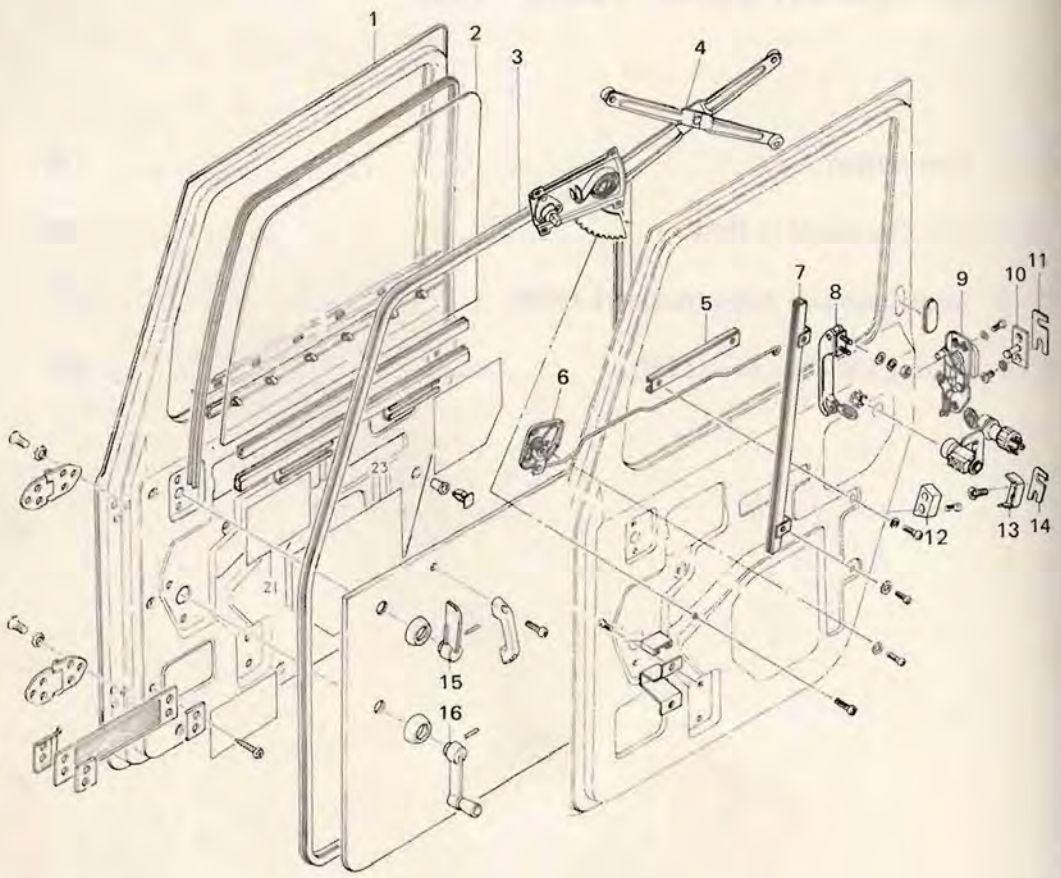
The brake fluid in service is subject to gradual deterioration because the moisture content of air finds its way slowly into the brake fluid. For this reason, the brake fluid should be regarded as an expendable item and be replaced at regular intervals.

Brake fluid change interval	*2 (two) years*

20. DOOR AND TARP TOP

20-1. Description

The difference between Model LJ50 and Model LJ50V is mainly in the body top. The former has a steel top with windows and doors, the latter a tarp top of readily removable type.
The door window glass is capable of sliding up and down in the window as controlled by the window regulator. Doors can be removed, and can be disassembled to the extent of permitting replacement of the door glass, regulator, door lock, etc.



1. Front door panel ass'y
2. Door glass
3. Weatherstrip
4. Regulator
5. Requlator roller holder
6. Remote control
7. Sash
8. Outside handle
9. Door lock ass'y
10. Door lock striker
11. Striker spacer
12. Stop male
13. Stop female
14. Female spacer
15. Inside handle
16. Regulator handle

Fig. 20-1

20-2. Door Removal (LJ50V)

1. Remove door window regulator handle, door inside pull handle and door inside handle. With rubber boots turned inside out and pins removed, door window regulator handle and door inside handle can be removed.
2. Remove two door-side screws for door open stopper.
3. Prize off door trim board with plain screw driver, which is held in place by ten clips.

Fig. 20-2

Door window glass removal

4. Remove door window glass stopper and down the door glass.
5. Prize off door window oscillate-proof with plain screw driver, which is held in place by six clips.

Fig. 20-3

6. Unscrew two screws attaching door window regulator arm and remove two lower rollers while turning door window regulator.

Fig. 20-4

7. Unscrew two screws fixing rail at back of door window glass and remove glass.

Fig. 20-5

Door window regulator removal

8. Carry out the above procedures 1—5.
9. Remove four screws securing door window regulator bracket.
10. Have door window glass raised.
11. Drop door window regulator and take it out through service hole in door inner panel.

Fig. 20-6

Door lock assembly removal

12. Remove clip connecting door open remote-control rod.
13. Remove black blind plug at back of door and remove two 6 mm nuts attaching door outside handle.
14. Unscrew three screws attaching door lock assembly to door back end, disengage lower arm of door outside handle and remove assembly from inside the door.

Fig. 20-7

20-3. Inspection and Adjustments (LJ50V)

1. Outside handle and door lock cam

Adjust the position of the door lock cam plate so that the door lock open lever can be installed as shown in the Fig. 20-8. In this case, the play of the outside handle is 3.5 mm (0.14 in.). If the play is too small or too large, the door will not be perfectly locked, and it may be swing open while driving.

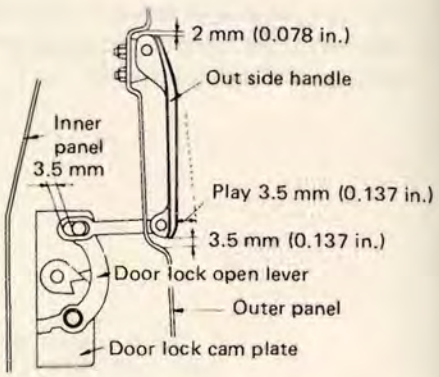


Fig. 20-8

.078 in.)
le handle

5 mm (0.137 in.)
(0.137 in.)
ver
r panel
te

2. Door lock striker

If the door lock is found faulty or the door will not snugly fit in the cabin, adjustments should be made on both door lock cam and door lock striker according to the Fig. 20-10. Loosen the door lock striker screw, and adjust it.

If the door has excessive play, check for wear of the door cam roller and door lock striker, and if necessary, adjust or replace it.

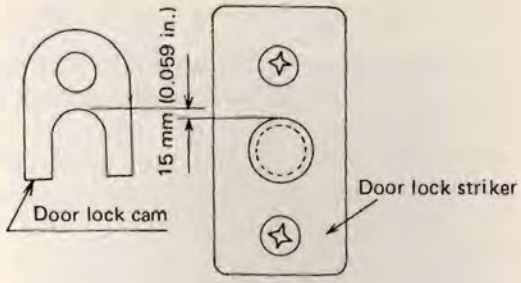


Fig. 20-9

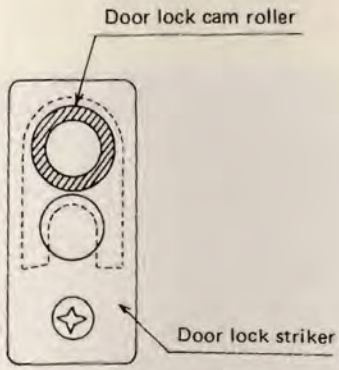


Fig. 20-10

3. Window regulator

If the window regulator is faulty, the window glass will not smoothly rise or it lowers from its position while the vehicle is running. This may be due to a fatigue of balance spring or broken pinion or lack of grease. If either of the balance spring and pinion is found faulty, they should be replaced as an assembly.

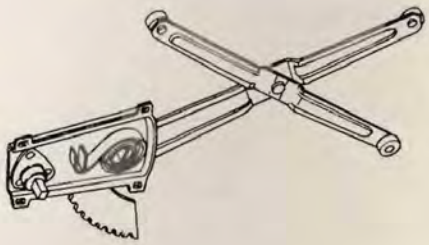


Fig. 20-11

4. Door window glass

When raising or lowering door window glass is abnormally heavy, door window glass is often fitted aslant into door frame and rail. Correct this trouble by moving up and down screws attaching door window regulator arm shown in the Fig. 20-12.

Fig. 20-12

20-4. Fitting Up Tarp Top (LJ50)

1. Remove front window stop band, erect front window and fix window with right and left window stoppers.
2. Fit door into lower door hinge, attach upper door hinge and fix door. Then attach door open stopper to right and left door hooks.

Fig. 20-13

3. Fit left and right center pipes and then right and left roof-side front rails. Push spring and insert rail into front window side.
4. Fit front top bow.

Fig. 20-14

5. Slide the whole hood frame backward while lifting it up.

Fig. 20-15

6. Fit roof-side front rail into front cross top bow and tighten right and left top bow rail bolts.

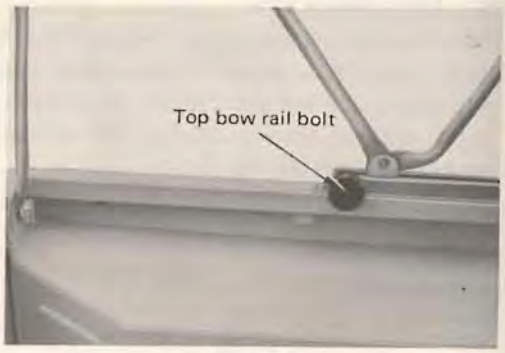


Fig. 20-16

7. Tighten butterfly nuts attaching right and left rear top bow cross holders to rear body.

Fig. 20-17

8. Fitting door band on the body.

Fig. 20-18

9. Place hood and side door on hood frames and fix it.

Fig. 20-19

10. Bind hood strips around hood frames at roof.

Fig. 20-20

21. BODY ELECTRICAL EQUIPMENT

21-1. Wiring Diagram

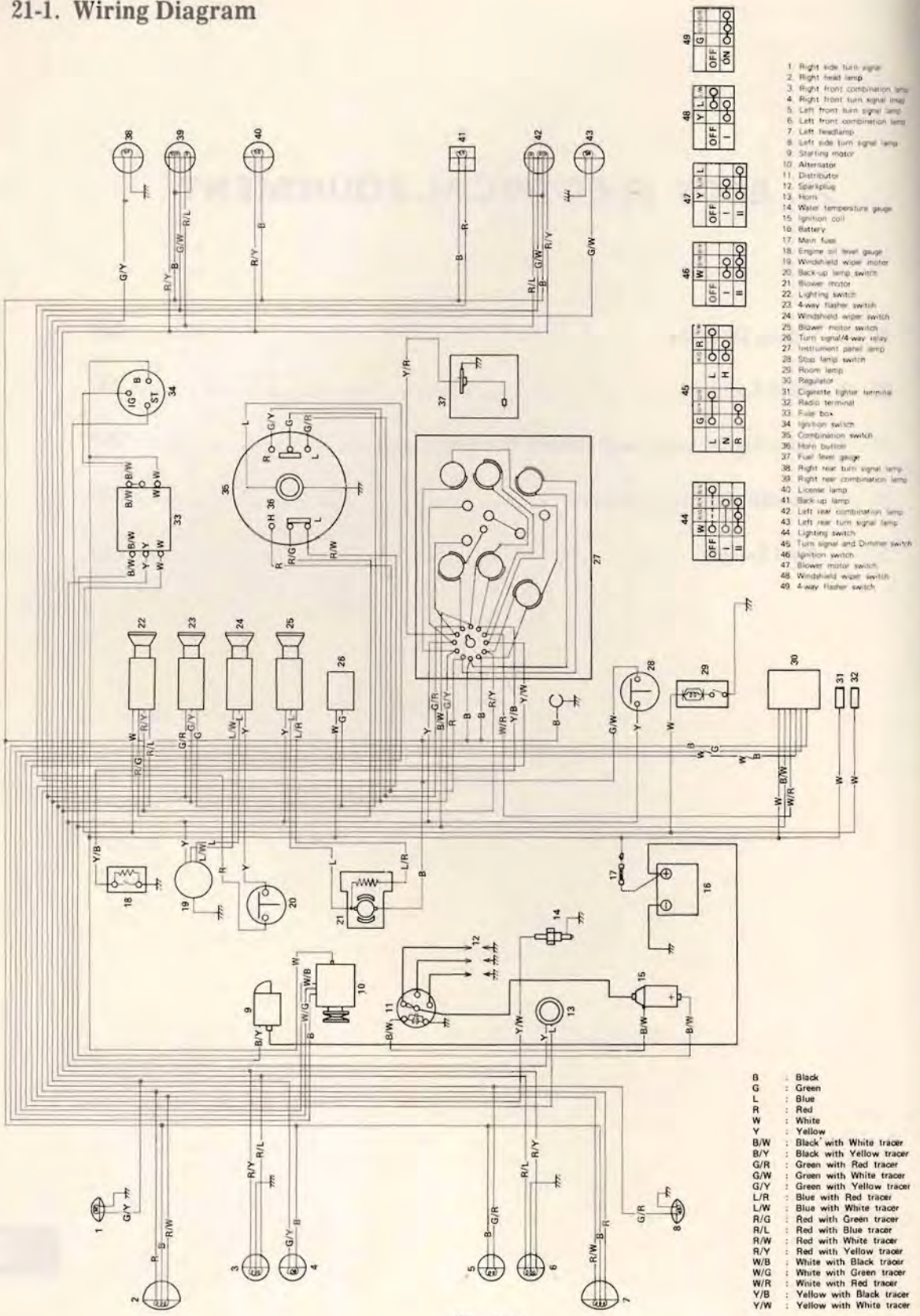
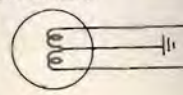


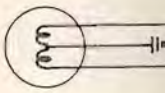
Fig. 21-1

21-2. Head Lan

1. Wiring circuit

Head lamp





2. Head lamp be

(1) Vertical beam
Unless otherw
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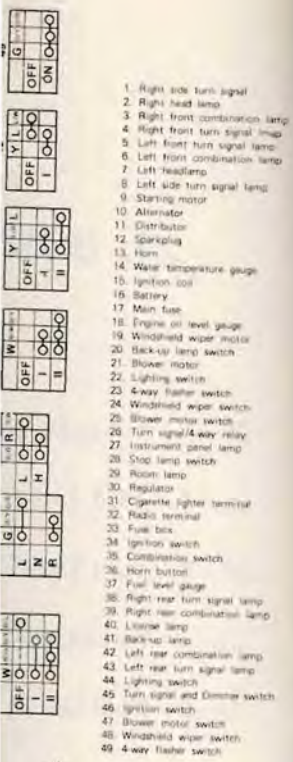
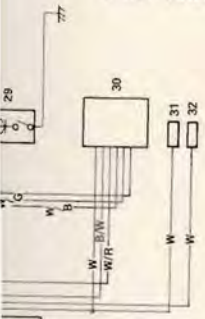
equal to a fift
The beam spo
of the head la

21-2. Head Lamp

1. Wiring circuit





B : Black
G : Green
L : Blue
R : Red
W : White
Y : Yellow
B/W : Black with White tracer
B/Y : Black with Yellow tracer
G/R : Green with Red tracer
G/W : Green with White tracer
G/Y : Green with Yellow tracer
L/R : Blue with Red tracer
L/W : Blue with White tracer
R/G : Red with Green tracer
R/L : Red with Blue tracer
R/W : Red with White tracer
R/Y : Red with Yellow tracer
W/B : White with Black tracer
W/G : White with Green tracer
W/R : White with Red tracer
Y/B : Yellow with Black tracer
Y/W : Yellow with White tracer

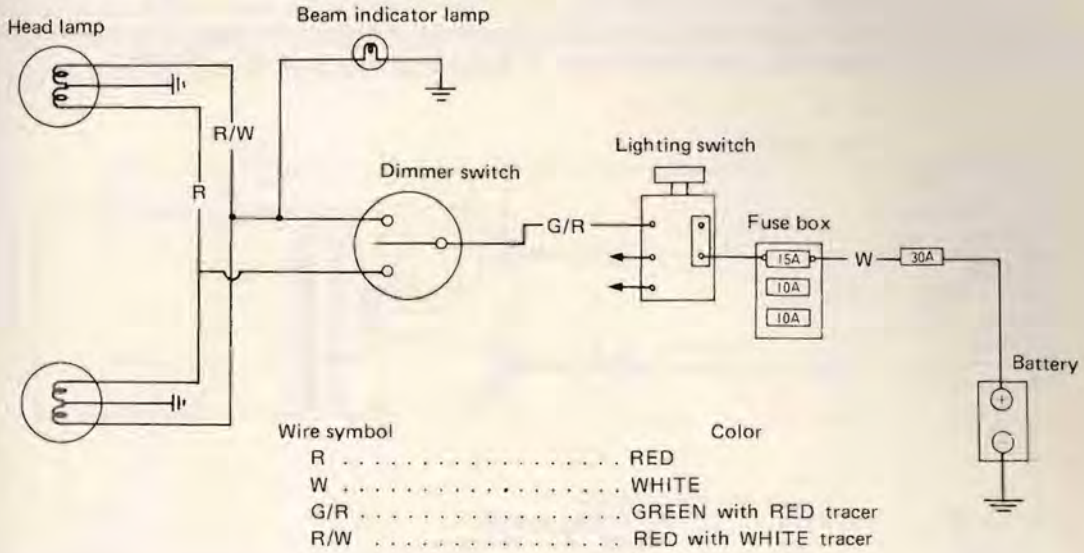


Fig. 21-2

2. Head lamp beam setting (standard)

(1) Vertical beam alignment

Unless otherwise prescribed by the local statutory regulations, set the head lamps in such a way that the main beam axis will fall on a spot not above the height of the head lamp and not below a height equal to a fifth (1/5) of the head lamp height. In other words, the main beam should be sloped down. The beam spot, mentioned above, refers to a blank wall standing vertical 10 meters (32.8 feet) ahead of the head lamps, with the vehicle standing perfectly level.

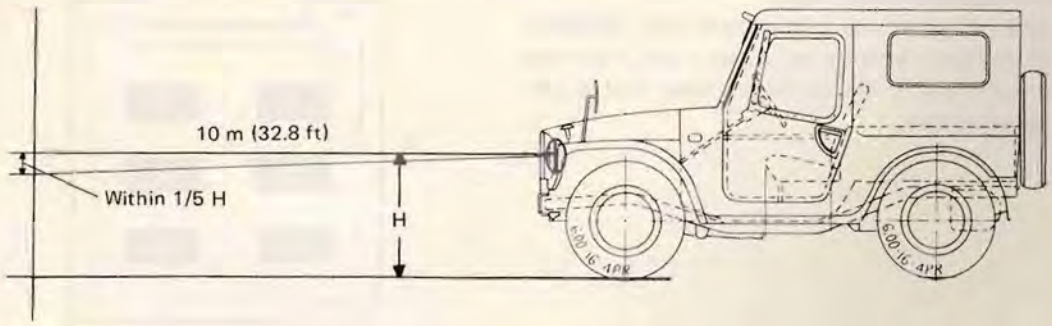


Fig. 21-3

(2) Horizontal beam alignment (left-hand steering vehicle)
The set-up is the same as in Fig. 21-3. For the right-hand steering model, the alignment is the mirror image of what is prescribed here.
LEFT HEAD LAMP: Determine the point straightahead of the lamp, and align the main beam axis so that the axis will strike a spot within 10 mm (0.29 in.) to the left or 20 mm (0.78 in.) to the right of the straightahead point.
RIGHT HEAD LAMP: Determine the point straightahead of the lamp, and align the main beam axis so that the axis will strike a spot within 20 mm (0.78 in.) on either side of the said point.

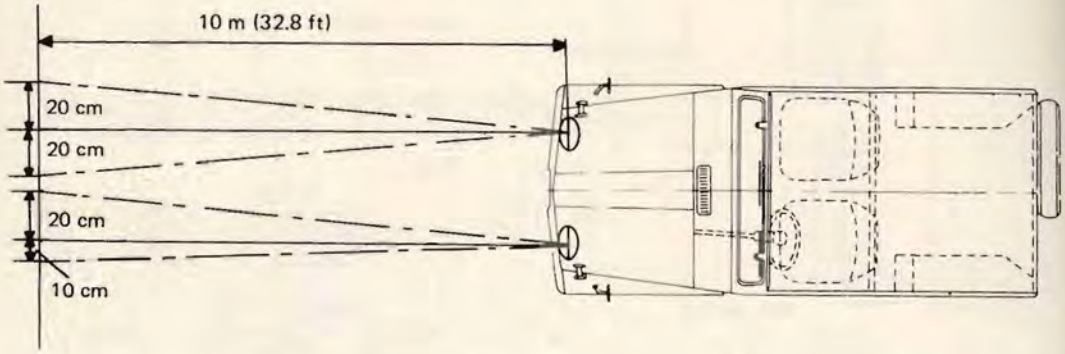


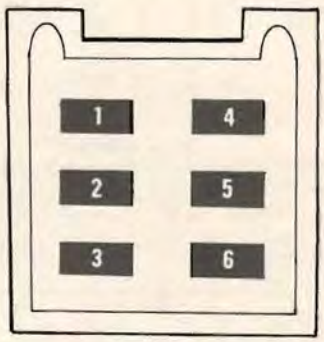
Fig. 21-4

3. Maintenance

(1) Head lamp adjustment
There are three screws; A, B, and C. By means of these screws, adjust the lamp position for beam alignment.

Fig. 21-5

(2) Head lamp dimmer switch
Using a circuit tester, check to be sure that there is continuity between terminals 1 and 3 and terminals 2 and 3, with the switch lever held in low-beam position.



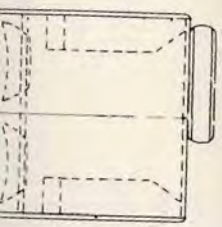
(Red/white) 1
(Red) 2
(Red/green) 3
4 (Green)
5 (Green/yellow)
6 (Green/red)

Fig. 21-6

alignment is the mirror

gn the main beam axis
(0.78 in.) to the right of

ign the main beam ax-
said point.



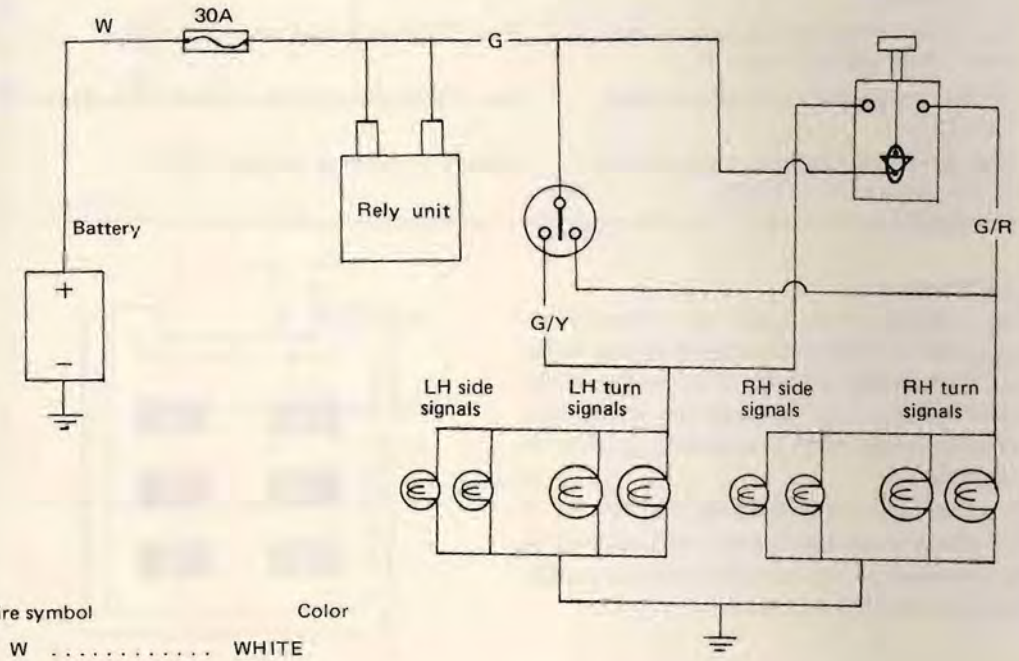
5

(Green)
(Green/yellow)
(Green/red)

21-3. Turn Signal Lamp and Hazard Warning Lamp

1. Circuit description

The turn signal circuit is independent from those controlled by the main switch, and is cut into service by turning on the turn signal dimmer switch or the hazard warning switch. The current from the battery flows through a 30-A fuse, and is intermittently interrupted by the condenser-type relay unit.
The turn signal switch is for selectively lighting the two groups of lamps, right and left. The warning switch is for lighting all lamps of the two groups.



Wire symbol	Color
W	WHITE
G	GREEN
B	BLACK
G/Y	GREEN with YELLOW tracer
G/R	GREEN with RED tracer

Fig. 21-7

2. Inspection

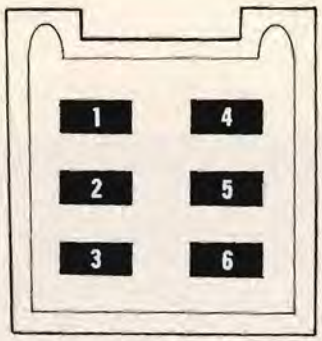
(1) Trouble diagnosis

Symptom	Possible cause
1. *Lamps will not come on in either group.*	*Fusible link in 30-A fuse is blown off.*
2. *Hazard lamp comes on but turn signal lamps will not.*	*Open circuit (due to poor point contact) in turn signal dimmer switch.*
3. *No lamp comes on; or lamps light up but do not flicker.*	*Defective relay unit.*
4. *Turn signal lamps are satisfactory, but hazard lamp will not come on.*	*Open circuit in hazard warning switch.*
5. *Flickering frequency is erratic; or lamps remain lit.*	*Lamp bulbs are defective or improperly grounded.*
6. *Turning on hazard warning switch lights up only one group of lamps.*	*Defective contact in dimmer switch.*

(2) Dimmer switch

Using a circuit tester, check for continuity between each pair of terminals by referring to the chart given in Fig. 21-8, for each position of the dimmer switch lever. Discontinuity means that contact points are burnt or otherwise defective in the switch.

The switch is in sound condition if continuity is noted between terminals 4 and 5, with the lever in right-turn position, and between terminals 4 and 6, with the lever in left-turn position.



(Red/white) 1
(Red) 2
(Red/green) 3
4 (Green)
5 (Green/yellow)
6 (Green/red)

Fig. 21-8

21-4. Windshield Wiper Motor

1. Circuit description

The circuit for powering the wiper motor is complete with a device for automatically bringing the wiper blade to a certain (laid-down) position when the wiper switch is turned off.

Referring to the circuit diagram of Fig. 21-9, assume that the main switch is in closed position. Turning on the wiper switch feeds current from the battery to the wiper motor, and the motor starts up and swings the blade. In the gear mechanism for converting the rotary motion of the motor into the swinging motion of the blade, the contact-actuating cam is mounted on the final gear shaft.

The cam keeps rotating and, for each rotation, momentarily connects P0 to P1 and then to P2. This alternating make-break action does not affect the running wiper motor.

Under this condition, turn off the wiper switch just when the blade is up and in the midst of swinging motion. This alters the supply circuit of the motor; current now flows through P2 and P0 and another pair of contact points in the wiper switch and into the motor. Thus, the motor is enabled to continue its run.

21-5. Fuel Gauge

1. Circuit description

The fuel gauge for visually telling how full the fuel tank is an electrical instrument comprising a float-actuated potentiometer type of tank unit and a bimetal type indicator (meter) mounted on the instrument panel.

Two bimetal elements are used in the indicating unit, one for deflecting the indicating hand over the "E" to "F" scale and the other (regulator) for on-off control of current.

When fuel level is low in the tank, the float is low and hence a larger ohmic resistance is introduced into the circuit by the potentiometer element in the tank unit. Consequently, a smaller current flows through the windings of the two bimetal elements, so that bimetal deflection is smaller and the indicating hand stays closer to "E" (for empty) side.

The bimetal element of the regulator bimetal draws an additional current. By the total current, the bimetal element deflects to open the circuit and, upon cooling, closes the circuit. In other words, the regulator makes and breaks the circuit intermittently. The average current is fairly constant under varying voltage condition of the battery because a higher battery voltage extends the duration of each contact point separation in the regulator.

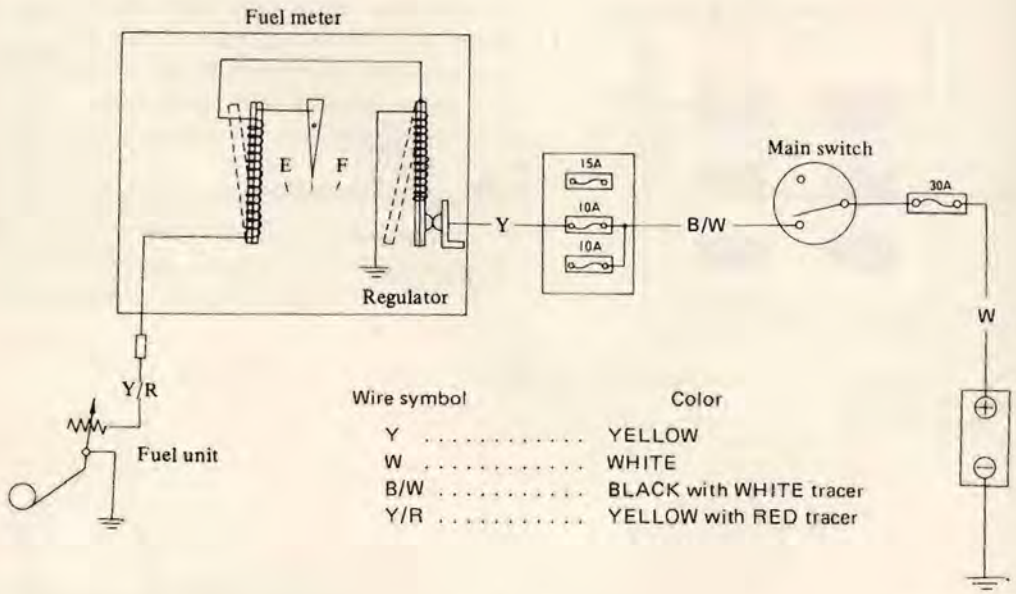


Fig. 21-10

2. Inspection

The following checks are necessary when the fuel meter indication is false:

(1) Make sure both the tank unit and fuel tank are properly and securely grounded. If ground connection is loose, current will be small and the indicating hand will be down.

(2) Make sure that the regulator is properly and securely grounded. If high resistance exists in this ground circuit, the regulator draws but a small current, so that the duration of contact closure is much longer and, consequently, the average current through the other winding will be larger, resulting in a hand deflected closer to "F" position.

(3) Make sure that the float in the fuel tank is free from interference and without any hitch on its float arm, and that its stopper is correctly positioned.

An indicating meter checked to be internally defective must be replaced by a new one.

22. MAINTENANCE SCHDULES

22-1. Important Checks for Assuring Safe Driving

As the time of periodical inspection, carry out the check listed here. Do not omit any. Each is important.

SAFE-DRIVING ASSURANCE CHECK LIST		
System	Items	Check for
Fuel	Carburetor	Smooth throttle valve operation
	Fuel filter	Fuel leakage
	Fuel pipe	Fuel leakage
	Fuel pump vacuum hose	Fuel leakage
	Fuel tank	Fuel leakage
Driving	Propeller shaft	Breakage, Tightness of serration part
	Gear shift control lever comp.	Breakage.
Suspension	Suspension arm shaft	Breakage
	Ball joint stud	Bent, Cracked
	Leaf spring	Cracked, Breakage
	Leaf spring U bolt	Breakage
	Rear axle shaft	Breakage
	Rear axle housing comp.	Oil leakage, Breakage
	Front axle joint assy	Breakage
	King pin	Cracked
Steering	Steering knuckle arm	Cracked, Taper faulty
	Steering wheel	Cracked, Excessive wear of serration
	Steering shaft comp.	Breakage
	Steering joint rubber	Cracked
	Steering rubber joint flange	Breakage
	Steering gear box	Malfunction, Oil leakage, Adjusting screw looseness
	Steering tie-rod lever	Crack
	Steering tie-rod end comp.	Ball stud looseness, Taper faulty
	Steering tie-rod comp.	Breakage, Excessive wear
	Steering drag rod	Ball stud looseness
Brake	Brake arm comp.	Cracked, Variant
	Brake pedal	Breakage
	Brake drum	Cracked
	Master cylinder assy	Oil leakage
	Brake oil tank	Oil leakage
	Brake oil hose & tube	Oil leakage, Breakage
	Brake tube joint	Oil leakage
	Brake assy	Oil leakage, Braking effect, shoe & lining peeled, Shoe holed pin abnormal, Adjuster sleeve thread faulty
	Brake cable	Cable end breakage
Body	Door lock assy	Locking lever spring cracked
	Door lock striker	Badness catching with cam

22-3. Tightening Torque Schedule

SYSTEM	FASTENING PARTS	TIGHTENING TORQUE	
		kg-cm	lb-ft
Engine	Cylinder head bolts	400 — 500	28.9 — 36.1
	Cylinder nuts	180 — 240	13.0 — 17.3
	Flywheel nut	1,300 — 1,500	94.0 — 108.0
	Crankshaft pulley nut	800 — 900	57.8 — 65.0
	Crankcase bolts (10 mm dia.)	250 — 300	18.0 — 21.7
	Crankcase bolts (8 mm dia.)	150 — 200	10.8 — 14.5
	Oil pump union bolts (6 mm dia.)	35 — 45	2.6 — 3.2
	Engine mounting nuts	180 — 280	13.0 — 20.2
	Mounting member bolts	100 — 150	7.2 — 10.8
Gear shift	Shift lever case bolts (8 mm dia.)	90 — 120	6.6 — 8.6
	Shift lever case bolts (6 mm dia.)	40 — 60	2.9 — 4.4
	Shift control rod joint bolt (8 mm dia.)	150 — 200	10.8 — 14.5
	Shift control rod jonti bolt (6 mm dia.)	60 — 100	4.3 — 7.2
	Shift control lever guide plate bolts	60 — 100	4.3 — 7.2
	Shift control lever housing bolts	200 — 250	14.5 — 18.0
Transmission	Clutch cover bolts	60 — 100	4.3 — 7.2
	Clutch release arm nut	150 — 200	10.8 — 14.5
	Gear shift fork shaft plate bolts	150 — 200	10.8 — 14.5
	Reverse gear shaft stopper plate bolts	60 — 100	4.3 — 7.2
	Transmission case bolts	150 — 200	10.8 — 14.5
	Oil level and drain plugs	300 — 500	21.7 — 36.1
	Extension case bolts	150 — 200	10.8 — 14.5
	Rear mounting nuts	150 — 200	10.8 — 14.5
Transfer	Transfer case upper cover bolts	90 — 120	6.6 — 8.6
	Transfer case lower cover bolts	60 — 100	4.3 — 7.2
	Transfer front case nuts	150 — 200	10.8 — 14.5
	Gear shift shaft stopper plate bolts	90 — 120	6.6 — 8.6
	Oil filler and drain plugs	300 — 500	21.7 — 36.1
	Universal joint flange nuts	700 — 1,000	50.7 — 72.3
	Transfer case mounting bolts	90 — 120	6.6 — 8.6
	Transfer case mounting nuts	150 — 200	10.8 — 14.5
	Cross joint flange bolts	150 — 200	10.8 — 14.5
Differencial	Universal joint flange nut	1,700 — 2,300	123.0 — 166.2
	Drive bevel gear bolts	800 — 900	57.8 — 65.0
	Differencial case bolt	150 — 200	10.8 — 14.5
	Differencial side bearing adjuster nuts	300 — 370	21.7 — 26.7
	Differencial gear thrust bolt	700 — 1,000	50.7 — 72.3
	Differencial carrier nuts	150 — 200	10.8 — 14.5
	Oil filler and drain plug	400 — 700	28.9 — 50.6
Suspension	Shackle pin nuts	250 — 700	18.0 — 50.6
	Reef spring nuts	400 — 800	28.9 — 57.8
	Reef spring U bolt nuts	300 — 450	21.7 — 32.5
	Wheel nuts	500 — 800	36.2 — 57.8
	Front wheel shaft nut	1,500 — 2,700	108.5 — 195.2
	Rear hub nuts	500 — 800	28.9 — 57.8
	King pin upper and lower bolts	200 — 300	14.5 — 21.7
Steering	Steering shaft nut	250 — 400	18.0 — 28.9
	Steering rubber joint nuts	150 — 250	10.8 — 18.0
	Steering gear box bolts	700 — 900	50.6 — 65.0
	Steering gear box stay bolt	350 — 550	25.3 — 39.7
	Steering tie rod lever nut	500 — 800	36.1 — 52.8
	Tie rod end lock nuts	500 — 800	36.1 — 52.8
	Tie rod end ball stud nuts	250 — 550	18.0 — 39.7
Brake	Brake backing plate bolts and nuts	180 — 280	13.0 — 30.2
	Brake master cylinder bolts	130 — 230	9.4 — 16.6
	Brake tube unions	150 — 250	10.8 — 18.0
	Brake flexible hose nuts	200 — 300	14.5 — 21.7
	Brake shoe adjusting nuts	60 — 90	4.3 — 6.5

22-4. Periodical Inspection Schedule

Item \ Interval	First 1,000 km (600 mi)	Every 2,500 km (1,500 mi)	Every 5,000 km (3,000 mi)	Every 10,000 km (6,000 mi)	Remarks
Contact point & ignition timing	Adjust	Adjust	Adjust	Adjust	
		Check & clean		Replace	

22-4. Periodical Inspection Schedule

Item \ Interval	First 1,000 km (600 mi)	Every 2,500 km (1,500 mi)	Every 5,000 km (3,000 mi)	Every 10,000 km (6,000 mi)	Remarks
Contact point & ignition timing	Adjust	Adjust	Adjust	Adjust	
Spark plug		Check & clean	Replace	Replace	
Carburetor		Adjust idling	Adjust idling & throttle cable	Adjust idling & throttle cable	
Oil pump & oil pipes	Retighten union bolt Check leakage	Retighten union bolt Check leakage	Retighten union bolt Check leakage	Retighten union bolt Check leakage	
Fuel filter					Replace every 4,000 km (25,000 mi)
Air cleaner element		Clean	Clean	Clean	
Wheel & hub nut	Retighten		Check looseness	Check looseness	
Tire			Rotate	Rotate	
Wheel alignment			Check & adjust	Check & adjust	
Brakes			Adjust shoe clearance	Adjust shoe clearance	
Brake pipe	Check leakage		Check leakage	Check leakage	
Transmission oil	Change		Change	Change	
Differential oil	Change		Change	Change	
Distributor gear				Lubricate	
Universal joint			Lubricate	Lubricate	
Propeller shaft sliding yoke			Lubricate	Lubricate	
Steering gear box				Check oil level	
Wheel bearing			Lubricate	Lubricate	
Brake fluid		Check capacity	Check capacity	Check capacity	Replace every 2 years
Tie-rod & drag rod ball joint			Lubricate	Lubricate	
Brake pedal & clutch pedal		Adjust play	Adjust play	Adjust play	