COLUMBIA®
Columbia ParCar Corp.

SERVICE MANUAL

1963 TO 1980
D, DF, DC, and D4
HARLEY-DAVIDSON®
Gas Golf Car/Utilicar

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PATENT NOTICE

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COLUMBIA
Columbia ParCar Corp.

350 N. Dewey • P.O. Box 30 • Reedsburg, WI 53959
Phone (608) 524-8888 • Toll Free 1 (800) 222-4653 • Fax (608) 524-8380
Web www.parcar.com • E-Mail info@parcar.com

1963 to 1980 GASOLINE CAR SERVICE MANUAL

The maintenance and repair information in this manual applies to the 1963 to 1980 Harley-Davidson® Gasoline Golf Car. Models D, DF, DC and D4.

Printed in U.S.A.

FOREWORD

This service and repair manual has been prepared with two purposes in mind. First, it will acquaint the reader with the construction of the Golf Car and assist him in performing basic maintenance and repair. Secondly, it will introduce to the professional Golf Car mechanic the latest field-tested and factory-approved major repair methods. We sincerely believe that this manual will make your association with Columbia products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

Your Service Manual is arranged for quick, easy reference. This manual is divided into numbered sections entitled "Product," "Chassis," "Engine," "Transmission" and "Electrical." Sections are then divided into subsections. The Engine Section, for example, is comprised of "General," "Cylinder," "Crankcase" and "Fuel System" sub-sections.

Use this manual as follows:

1. Check the Table of Contents located in the front of each section to find subject desired.
2. Page number is listed across from subject.
3. Each section is printed with section number for quick general location of subject. Page number consists of section number and page number.
4. Information is presented in a definite order as follows:

   Minor adjustments
   Minor maintenance or repair
   Complete disassembly
   Cleaning
   Major maintenance or repair
   Assembly

In figure legends the number following a name of a part indicates the quantity necessary for one complete assembly.

All information for servicing a part should be read before repair work is started to avoid needless disassembly.

SERVICE BULLETINS

In addition to the information given in this Service Manual, Service Bulletins are issued to authorized Dealers from time to time, which cover interim engineering changes and supplementary information. Service Bulletins should be consulted for complete information on the models covered by this manual.

USE GENUINE REPLACEMENT PARTS

To insure a satisfactory and lasting repair job, follow the manual instructions carefully and use only genuine Columbia replacement parts.

This is your insurance that the parts you are using will fit right, operate properly and last longer. When you use genuine Columbia parts you use the best.

WARNINGS AND CAUTIONS

Statements in this manual preceded by the following words are of special significance.

WARNING

Means there is the possibility of personal injury to yourself or others.

CAUTION

Means there is the possibility of damage to the vehicle.

We recommend that you take special notice of these statements. Read them carefully before proceeding with repair or service.

The following precautions are of extreme importance. These and other precautions appear throughout this manual.

WARNING

Gasoline is extremely flammable and highly explosive. Always turn off engine and do not smoke or allow open flame or sparks when refueling or servicing the vehicle.

CAUTION

Turn off ignition and disconnect the battery leads whenever servicing the engine or electrical systems.

WARNING

Brake fluid can cause irritation of eyes and skin and may be harmful if swallowed. If fluid is swallowed, induce vomiting by administering two tablespoons of salt in a glass of warm water. Call a doctor. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN!

WARNING

Batteries contain sulfuric acid. Avoid contact with skin, eyes, or clothing.

ANTIDOTE – External – Flush with water.
Internal – Drink large quantities of milk or water followed by milk of magnesia, vegetable oil, or beaten eggs. Call doctor immediately.
Eyes – Flush with water and get immediate medical attention.

Batteries produce explosive hydrogen gas at all times, especially when being charged. Keep cigarettes, open flame, and sparks away from the battery at all times. Ventilate area when charging battery. Always protect hands and eyes with shield or goggles when working near a battery or acid. KEEP BATTERIES AND ACID OUT OF THE REACH OF CHILDREN!

WARNING

Observe warning cautions given on labels of cleaning compounds to prevent personal injury or damage to your vehicle.

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PRODUCT 1

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GENERAL

SPECIFICATIONS, GASOLINE CAR

GENERAL FEATURES

Models: D Golf Car — 3 wheel
DF Personnel Carrier — 3 wheel
DC Utilicar — 3 wheel
D4 Golf Car — 4 wheel
Automatic Transmission with Reverse
Governed Speed Adjustable up to 15 MPH
Turning Radius
Model D
Tiller . . . . . 9 ft. 4 in. (2.8 m)
Steering . . . . . 7 ft. 1 in. (2.1m)
Model DC (1968 and earlier)
Tiller . . . . . 8 ft. 11 in. (optional 5 ft. 10 in.)
Model DC (1969-1972)
Tiller . . . . . 10 ft. 10 in. (optional 7 ft. 9 in.)
Steering Wheel . . . . . 8 ft. 7 in.
Model D4 (1972 and later) . . . . . 10 ft. 4 in.

Model* Year	Dimensions					
	Wheel Base (in.)	Length (in.)	Width (in.)	O.A. Height (in.)	Ground Clear-ance (in.)	Weight (lbs.)
DC 1963-65	59.5	92.0	42.25	36.0	4.6	660
DC 1966-68	60.5	93.5	42.25	38.0	5.0	755
DC 1969 To 1972	70.5	98.5	45.25	38.0	5.0	760
D 1963-66	59.5	92.5	45.25	42.5 36 — 1965 only	4.6	624
D 1967-76	60.5	91.0	46.0	40.25	4.5	694
D 1977 and Later	60.5	91.0	45.25	47.0	4.5	693
D4 1972-76	67.0	102.0	45.2	42.0	4.5	821
D4 1977 and Later	67.0	102.0	45.25	47.0	4.0	821

CAPACITIES

Fuel Tank
Front mounted
metal tank - 4.45 Gal. (U.S.) Fuel Mixture - 18.93 lt.
Rear mounted
plastic tank - 8.50 Gal. (U.S.) Fuel Mixture - 32.19 lt.
Transmission - 12 oz. Trans. Lube - 354.8 cc
Gear Box - 12 oz. Trans. Lube - 354.8 cc
Differential
1963-65 - 20 oz. Trans. Lube - 591.4 cc
1966-67 - 16 oz. Trans. Lube - 473.1 cc
1968-72 - 40 oz. Trans. Lube - 1182.8 cc
1973-76 - 32 oz. Trans. Lube - 946.2 cc
1977-78 All-Aluminum - 24 oz. Trans. Lube - 709.7 cc
Late 1978 and Later - 24 oz. Trans. Lube

ENGINE

Model Designation Letter . . . . . D
Type of Engine . . . . . 2 Cycle-Loop Scavenged
1 Cylinder Reed Valve Intake
Bore . . . . . 2.75 in. (69.8 MM)
Stroke . . . . . 2.50 in. (63.5 MM)
Piston Displacement . . . . . 14.85 cu. in. (245.8 CC)

Compression Ratio	Low Compr.	High Compr.
Full Stroke	6.6 to 1	9.5 to 1
After Port Closing . .	5.5 to 1	7.4 to 1
Spark Plug —		
Type D, DF	H-D #3	H-D #5-6
Type DC	H-D #2 or #5	H-D #5-6

NOTE

High compression head used on all 1971 and later DC engines and 1971 and later Model D engines above Serial No. 13000.

ENGINE FUEL AND LUBRICATION

GOLF CAR MODEL D AND 1969-1972 MODEL DC: Use Harley-Davidson Golf Car Lubricant for smokeless, clean, trouble-free operation. Mix 1.5 oz. per U.S. gallon of gasoline. If necessary to temporarily use other than prescribed oil, use 2-1/2 oz. non-detergent S.A.E. 40 oil per gallon of gasoline. Use only "Regular" grade gasoline.

1965 to 1968 UTILICAR MODEL DC AND MODEL DF: Mix 5 oz. of Harley-Davidson two-cycle oil to 1 U.S. gallon of gasoline. If necessary to use other oil, use non-detergent S.A.E. 40.

CAUTION

Do not switch brands indiscrimately because some oils interact chemically when mixed. Use of inferior oils or non-detergent oils can damage the engine and void warranty protection.

NOTE

Tank cap on steel tank has an oil measuring cup which holds 2-1/2 liquid ounces. Add one full cup for every 1.6 gallons of fuel.

Steel fuel tank holds 5 U.S. gallons. Polyethylene fuel tank holds 8.5 U.S. gallons. Use only "Regular" grade gasoline. Thoroughly pre-mix oil with gasoline in separate container before placing in golf car tank.

TRANSMISSION, REVERSE UNIT AND DIFFERENTIAL LUBRICATION.

Use Harley-Davidson Transmission Lubricant in quantities recommended.

CHASSIS LUBRICATION

Use bearing grease for all bearings unless other lubricants are specifically recommended.

MODEL IDENTIFICATION — 1980

The letters J0 in VIN indicate 1980 models.

The golf car Vehicle Identification Number (V.I.N.) is located at rear of engine on frame cross brace. The engine serial number is located on engine crankcase.

Letters	Model No.	Serial No.	Mfr	Year
D4	7C	10000 and up (5 digits)	H Harley-Davidson	8 (1978)

IMPORTANT: Always give these numbers when ordering parts or making inquiries about your golf car.

RATIOS: Forward and Reverse

Model Year	Gear Ratios		Gear Case (Internal)	Differential To Rear Wheels	Overall Ratios	
	Engine to Transmission					
	Min.	Max.			Min.	Max.
1963-66 D	1.35	3.92	41 Teeth 20 Teeth 2.05	5.17	14.3	41.5
1965-68 DF DC	1.35	3.92	31 Teeth 24 Teeth 1.3	5.17	9.07	26.35
1967 and Later D 1969-1972 DC 1972 and Later D-4	1.17	3.39	None	12.25	14.3	41.5

POWER TRANSMISSION

Automatic variable-pitch V-belt transmission. Drive ratio infinitely variable between maximum and minimum overall ratios. Gear box used for reverse on DC models to 1968, and 1966 and earlier D models. Engine operates in reverse on 1967 and later D, D4 and 1969-1972 DC models.

BRAKE

D, D4 . . . . Disc brake on drive shaft mechanically operated. Brake pedal incorporates ratchet lock for parking, with automatic release controlled by accelerator pedal.

DF, DC . . . Expanding shoe brakes inside rear wheel brake drums mechanically or hydraulically operated. Mechanical brake pedal incorporates ratchet lock for parking, with automatic release controlled by accelerator pedal. Hydraulic type brake system incorporates a cable operated parking brake.

ELECTRICAL EQUIPMENT

Starter-generator, coil ignition, 12 volt lead storage battery.

TIRES

Model	Size	Air Pressure (Front and Rear)
D, D4	8.50 x 8 9.50 x 8	18 lbs.
DF, DC	5.70 x 8 9.50 x 8	25 lbs. 12 lbs.

CONTROLS AND OPERATION

CONTROLS (Refer to figures 1A-1, 1A-2, 1A-3, 1A-4, 1A-5, 1A-6 and 1A-7.)

Simple controls make it easy to operate the Harley-Davidson Golf Car. To drive, move shift lever to "Forward" position, turn on the key switch and depress the accelerator with right foot. Depress brake pedal with left foot to stop. To back up, move shift lever to "Reverse" position. Choke is used for starting cold engine only.

1. KEY SWITCH

The switch requires key to operate and locks in "OFF" position when key is removed. Turn to right to "ON" (ignition) position to run car.

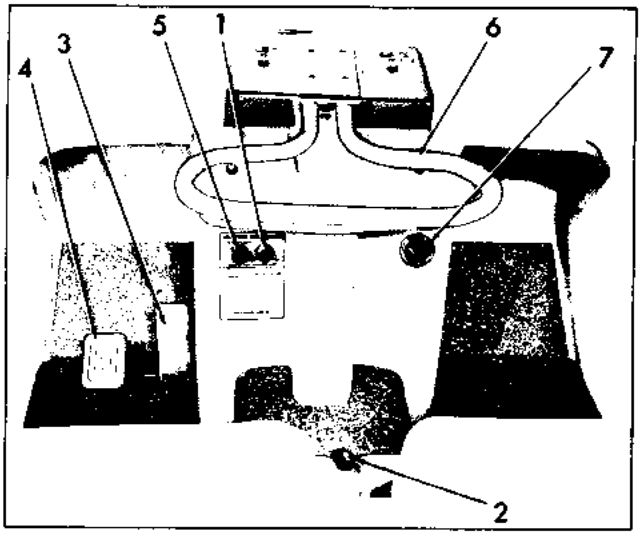


Figure 1A-1. Controls - 1963-66 Model D

2. FORWARD-REVERSE LEVER OR SWITCH

Move to "Forward" position to go ahead or to "Reverse" position to back up. DO NOT MOVE LEVER UNLESS CAR AND ENGINE ARE STOPPED!! Keep shift lever in "Forward" position while car is parked or stored.

3. ACCELERATOR

Accelerator pedal starts the engine automatically when pedal is depressed, and further movement operates car at desired speed. Engine stops when pedal is released.

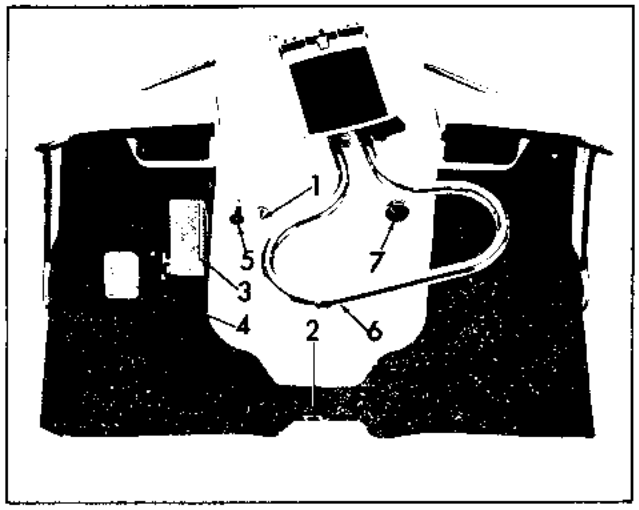


Figure 1A-2. Controls - 1968 and Later Model D

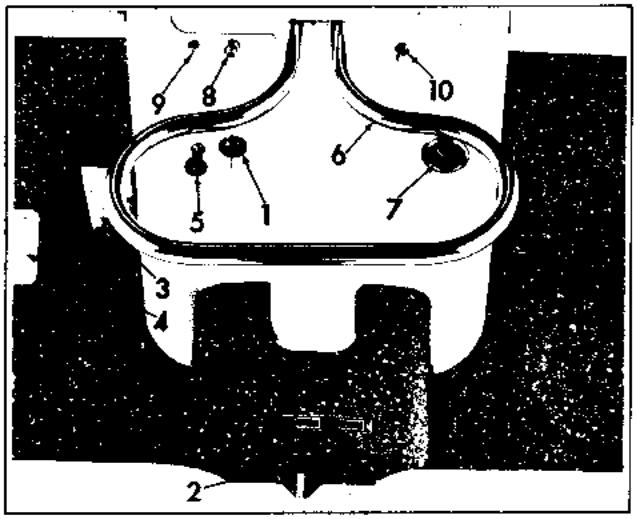


Figure 1A-3. Controls - 1963-65 Model DC, DF

4. BRAKE

Depress pedal to operate brake. To lock brake for parking (except 1966 and later Model DC) depress pedal and tilt forward. Brake automatically releases when accelerator pedal is depressed or by toeing brake pedal and tilting rearward.

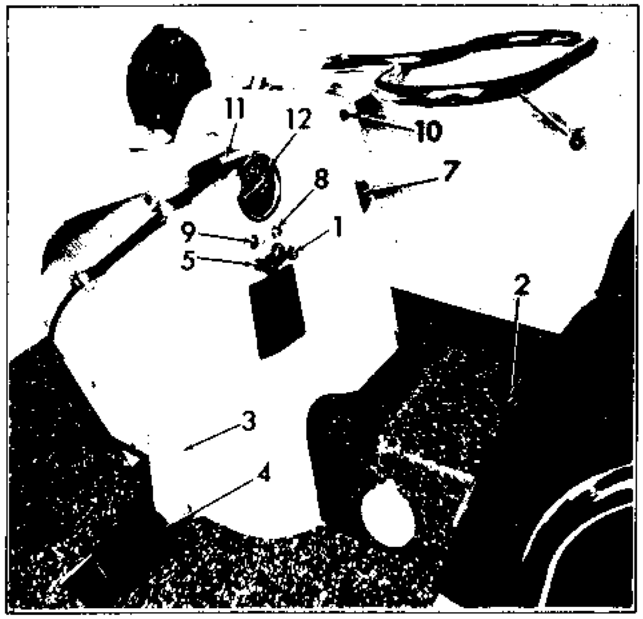


Figure 1A-4. Controls - 1966-68 Model DC

5. CHOKE

Use choke button on panel when starting a cold engine. Pull button outward to choke and move inward gradually as engine warms up.

6. STEERING TILLER OR STEERING WHEEL

7. FUEL GAGE

8. HORN BUTTON

Press button to operate horn.

9. DIRECTION SIGNAL SWITCH AND PILOT LAMP (ACCESSORY)

Center position "OFF". Left position operates left front and rear lamps. Right position operates right front and rear lamps.

10. HEADLAMP SWITCH

Down position "OFF". Up position "ON".

11. PARKING BRAKE

Pull handle back to apply parking brake. Depress handle button on pull type control to release brake. On lever type control move lever inward to release brake.

12. SPEEDOMETER

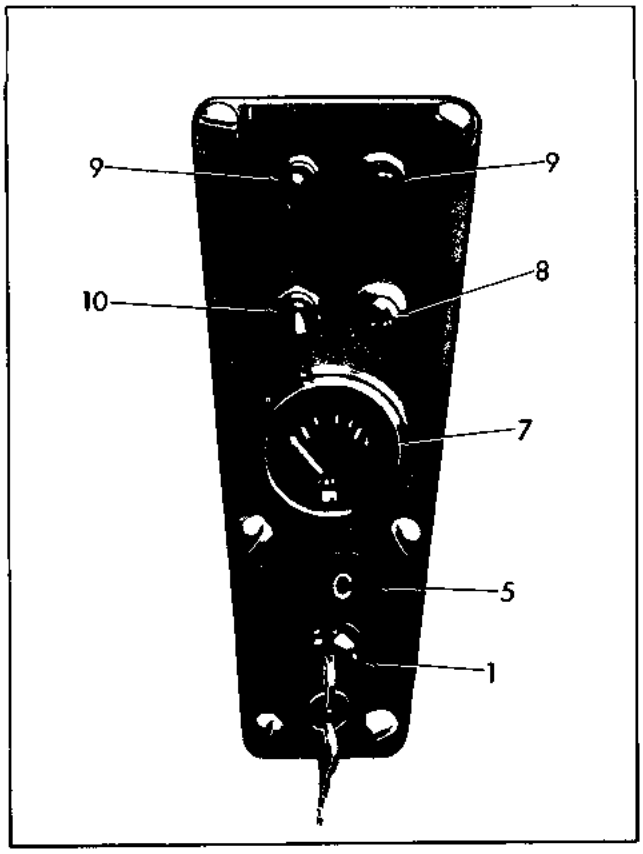


Figure 1A-5. Controls - 1967-68 Model DC

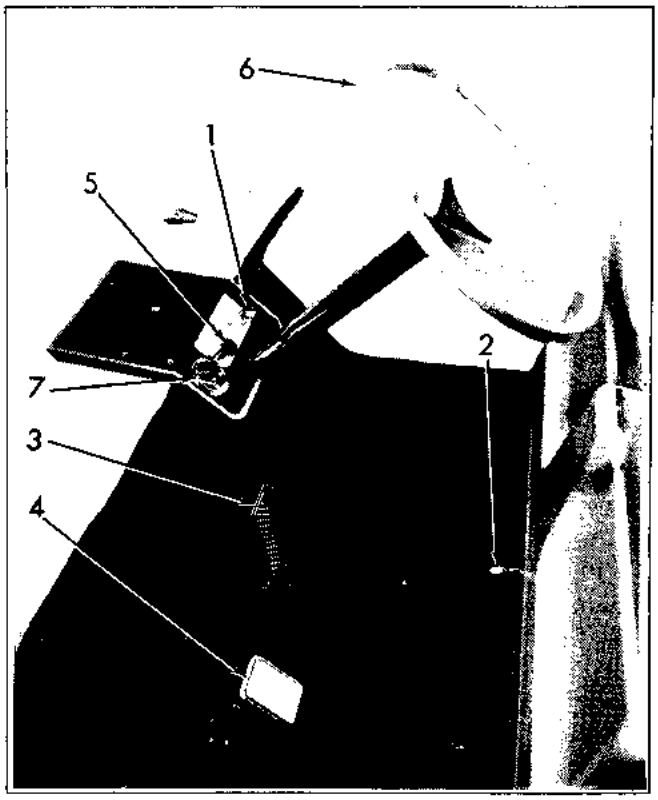


Figure 1A-7. Controls - Late 1972 and Later Model D4

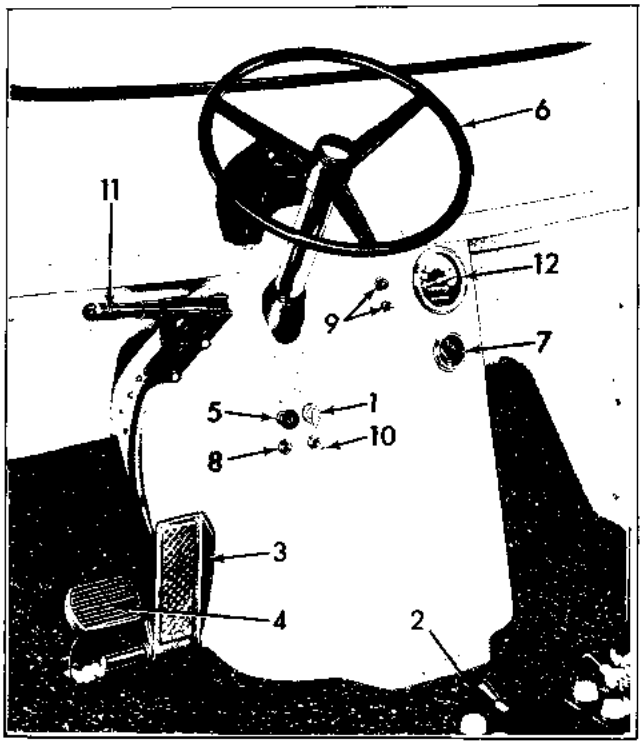


Figure 1A-6. Controls - 1969-1972 Model DC

DRIVING TIPS

Harley-Davidson Golf Cars are for golf play only and its use on other than designated golf car paths is hazardous.

Harley-Davidson Golf Cars are designed to carry the maximum limit of two people (driver and one passenger) and their golf equipment. See vehicle specifications for load weight capacity. DO NOT EXCEED MAXIMUM LOAD WEIGHT CAPACITY!

Vehicle stability is impaired and vehicle can overturn if not drive straight up and down hills and inclines.

Vehicle stability is impaired and vehicle can overturn if not driven slowly when making turns or backing up. DO NOT MAKE TURNS ON HILLS OR INCLINES!

Do not use accelerator to hold car on an incline - use the brake.

Personal injury may result if arms, legs or entire body are not kept inside vehicle while it is moving.

Make sure key is in position for desired direction of travel before depressing accelerator. DO NOT REVERSE DIRECTION OF CAR WHILE MOVING.

Before leaving your seat, bring vehicle to a complete stop, lock the parking brake to prevent vehicle from moving. If vehicle is to be left unattended, turn key to "OFF" position, remove key and lock the brake.

SERVICE

IMPORTANT: Adequate preventive maintenance, which is conscientiously applied at regular intervals, is the best guarantee for keeping the Harley-Davidson Gasoline Car in good operating condition, so that it will give economical and dependable service. It is in the best interest of both the car owner and servicing dealer to carefully follow the service procedures recommended in this section.

SERVICING A NEW GASOLINE CAR

PRE-DELIVERY INSPECTION

Before a new car is put into operation, make a pre-delivery inspection and service check to see that car is in good operating condition. Again, after 30 days, make another check to be sure that car remains in good operating condition and to uncover any minor misadjustments or conditions in the early stages before any serious trouble can develop.

Recommended new car service and inspection check operations, which should be performed by the Harley-Davidson Gasoline Car dealer, are shown in the INITIAL SERVICE CHART below.

All operations are fully described in sections pertaining to particular part of car. See TABLE OF CONTENTS for location and detailed description.

INITIAL SERVICE CHART

STEERING WHEEL - install with front wheels traight ahead, install steering wheel with one spoke at bottom.

BAG RACK - install and fully secure rack ends with bolts and lockwashers.

SEAT - mount seat backs at preferred height, check and secure mounting bolts and seat cushion studs.

BRAKE - inspect brake actuation and parking brake locking. Brake should lock in upper most ratchet tooth for extended service life.

BRAKE CALIPER - inspect mounting and caliper to disc side clearance.

BRAKE PEDAL - inspect mount, ratchet assembly attachment, and ratchet stop bolt.

BRAKE RATCHET AND PAWL - check material hardness with file, pieces should produce a high pitch ring without being damaged.

FRONT WHEEL - inspect for proper attchment on axle shaft and presence of axle shaft keys.

REAR WHEEL - inspect for secure attachment on axle shaft and presence of axle shaft keys.

ALL WHEELS - (3 or 4) inspect for properly torqued lug nuts.

TIRES - deflate tires to 18 PSI for proper inflation.

FUEL - fill fuel tank with sufficient fuel for delivery, mix gas and oil at a ratio of 3 oz. oil per gallon of gasoline (break-in mixture only).

FUEL LINES AND FITTINGS - check for proper routing and clearance with exhaust pipe and other vehicle components (fittings and lines must not show leakage).

THROTTLE - check for smooth operation, throttle plate fully open only with pedal depressed to floorboard.

CHOKE - check for smooth operation and full travel.

CARBURETOR - check adjustment.

GENERATOR AND REGULATOR - check system operation.

CIRCUIT BREAKER - check point gap, unit operation, and ignition timing.

ACCELERATOR PEDAL - inspect for secure mounting.

SPEED - set at 3000 rpm governed full speed.

TIGHTNESS OF ALL NUTS, BOLTS AND SCREWS, specifically:
—cylinder head bolts
—carburetor mounting
—engine mounting
—transmission mounting
—axles
—exhaust system and clamps
—ignition switch

DRIVING AND SAFETY SUGGESTIONS - check that driving techniques and safety suggestions found in Dealer Operating Manual were explained to customer.

WARNING LABELS - check that all vehicle warning and operating labels are attached.

OWNER'S MANUAL - check that vehicle is delivered to customer with Owner's Manual.

WARRANTY - check that terms and conditions of warranty were explained to customer.

REGULAR SERVICE INTERVALS

The following chart outlines recommended maintenance and lubrication service operations to be performed regularly after new car checks have been made. Refer to following illustrations when using the chart.

REGULAR SERVICE CHART

Service Interval	Figure Index No.	Service	Figure Index No.	Lubrication
Each time fuel tank is filled	2	Inspect air cleaner. Clean or replace as necessary. See monthly air cleaner service below. Check and if necessary, clean debris from cylinder head fins and air shroud intake.		
Each Month	1	Check electrolyte level in battery - clean top and terminals.	6	Oil carburetor throttle lever and choke lever swivel blocks.
	2	Flush plastic foam type air filter element in solvent - dry thoroughly, re-oil with SAE No. 10 and squeeze out excess.	23	Check hydraulic brake fluid level (Model DC)
			7	Oil governor shaft and linkage 1966 & earlier (D, DF)
	2A	Oil bath type air cleaner - flush in solvent, refill with SAE No. 30 to level mark.	8	Oil brake, throttle and choke control cable coil ends.
	19	Adjust brake shoes.	9	Oil starter cut-out switch roller (1966 & earlier)
	3	Check tire pressure. (See "Specifications," Section 1A)		
Perform above monthly service operations and the following:				
Every 6 months (For golf car use, before each season and at mid-season)	25	Check starter-generator belt tension. (1967-68 D)	16	Oil body hinge.
	18	Clean and gap electrodes (new plug is recommended for hard service)	24	Grease fork sides.
	2B	Dry type (Tri-phase) air cleaner - remove dirt from element by tapping or use compressed air - inspect for clogging or damage. Check tightness of all nuts, bolts and fasteners.		
Perform above monthly and 6 month service operations and the following:				
Every Year (For golf car use, each season)	17	Check circuit breaker contact point condition and adjust gap to .020 - .022 in. Check ignition timing.	4	Oil battery terminal felts.
			17	Oil circuit breaker felt.
	7	Check governor wheel alignment (1966 & earlier)	10	Check lubricant in axle differential housing.
	26	Inspect Starter-Generator brushes. (1967 and later)	11	Check lubricant in reversing unit (1966 & earlier).
	15	Adjust tiller chain or steering slider block to eliminate free play at tiller handle (do not over-tighten) or check steering wheel play and adjust if necessary.	12	Check lubricant in transmission drive (engine) unit.
			29	Grease front suspension (6 fittings). Grease axle support arms.

REGULAR SERVICE CHART (CONT)

Service Interval	Figure Index No.	Service	Figure Index No.	Lubrication
	20	Adjust low speed mixture.	5	Grease disc brake shoe operating cam.
	20	Adjust idle speed.	13	Grease transmission rear driving flange nylon rollers.
	21	Adjust governor	22	Grease drive shaft spline (1966).
			14	Oil brake and accelerator pedal bearings. Oil brake linkage (DF, DC)
			14	Grease accelerator micro-switch plunger. If it has no protective boot.
			15	Oil steering chain.
			28	Clean steering slider block and channel. Lubricate with dry lubricant.
			30	Check steering gear lubricant level.
Every 2 Years	27	Disassemble and inspect 1966 & earlier Dyna-start brushes and commutator.		
Storage (extended off-season storage)		Aspirate oil into engine (See engine, Section 3A) Drain fuel. Charge battery if necessary every 8 to 10 weeks.		

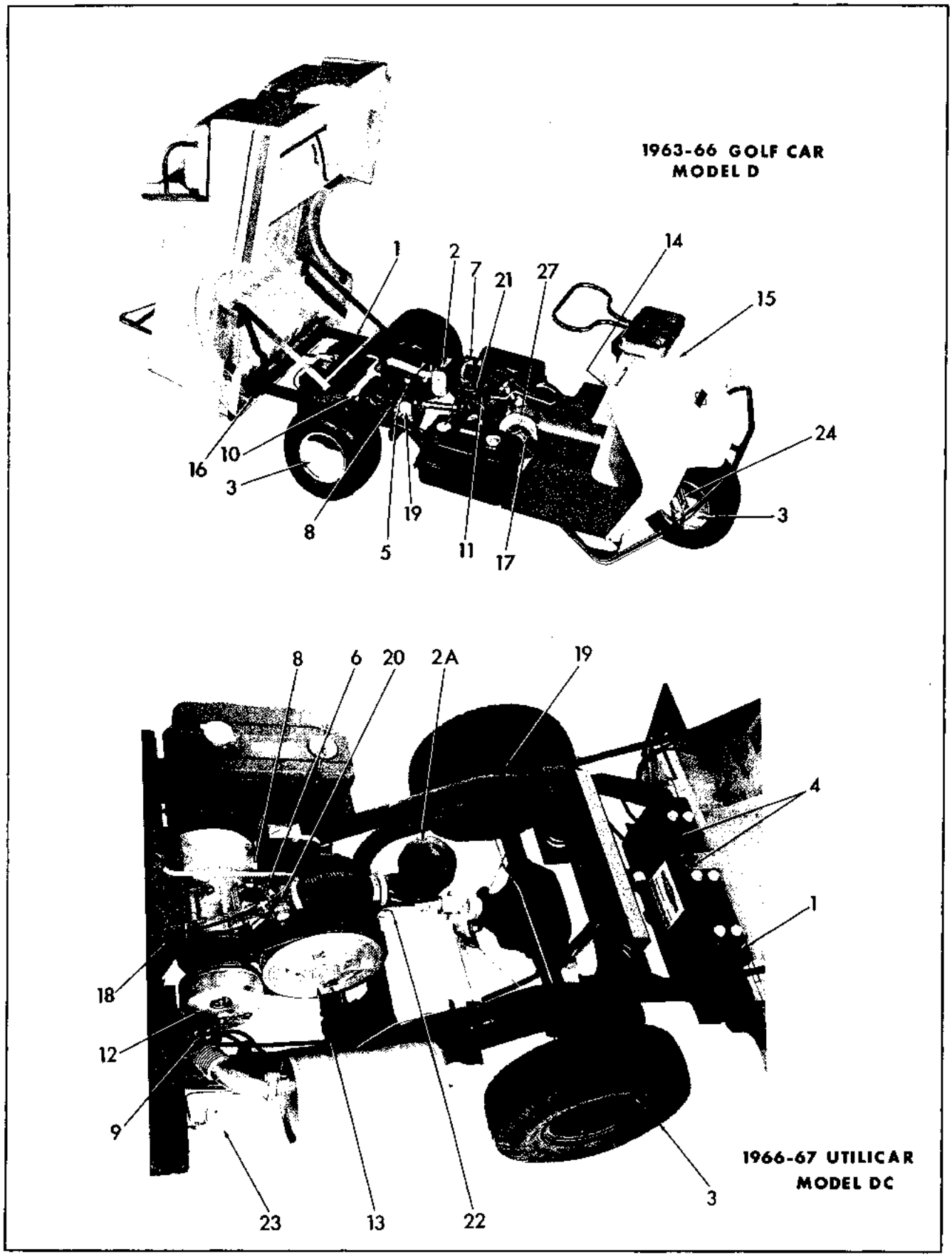


Figure 1B-8. Lubrication and Service Chart

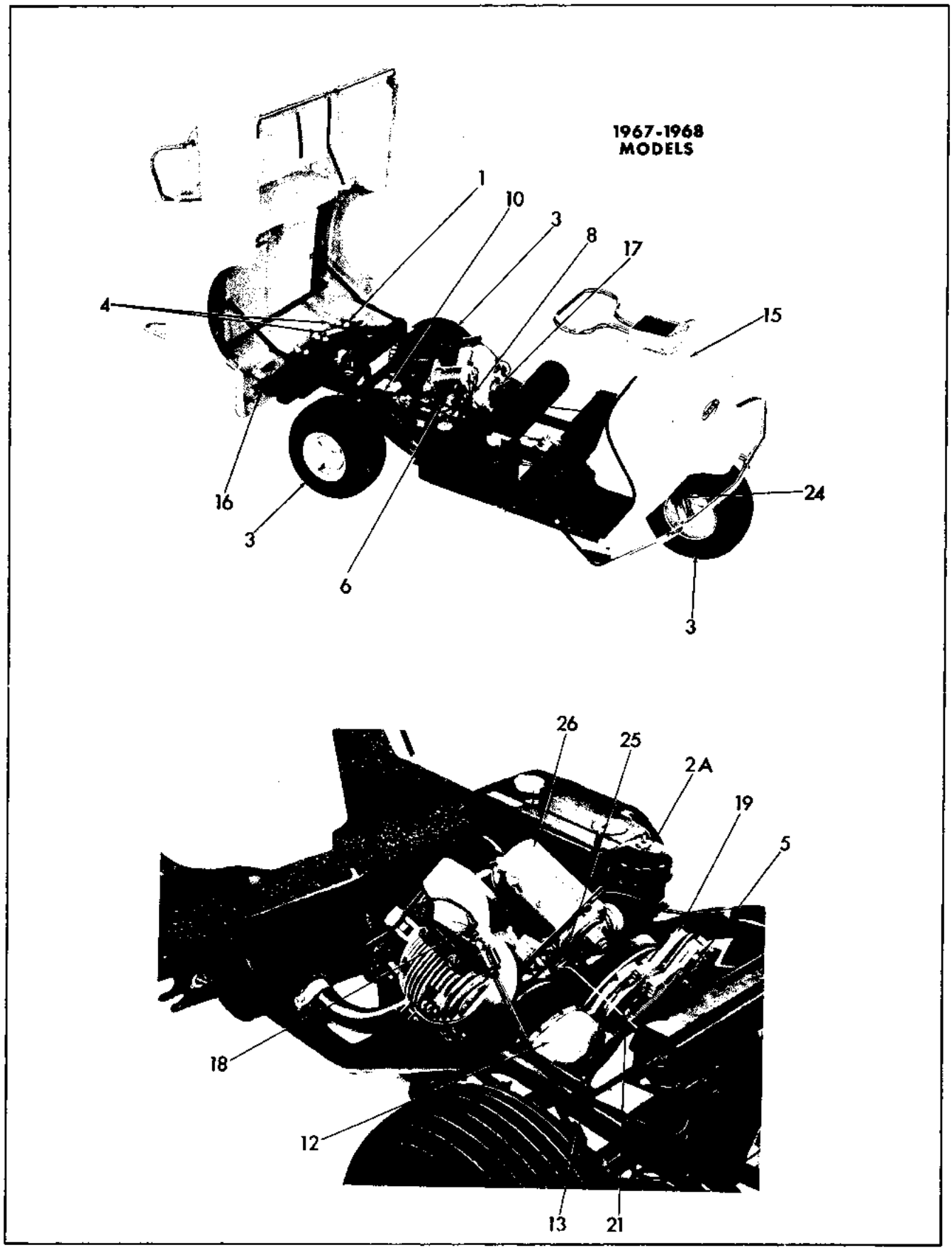


Figure 1B-8A. Lubrication and Service Chart

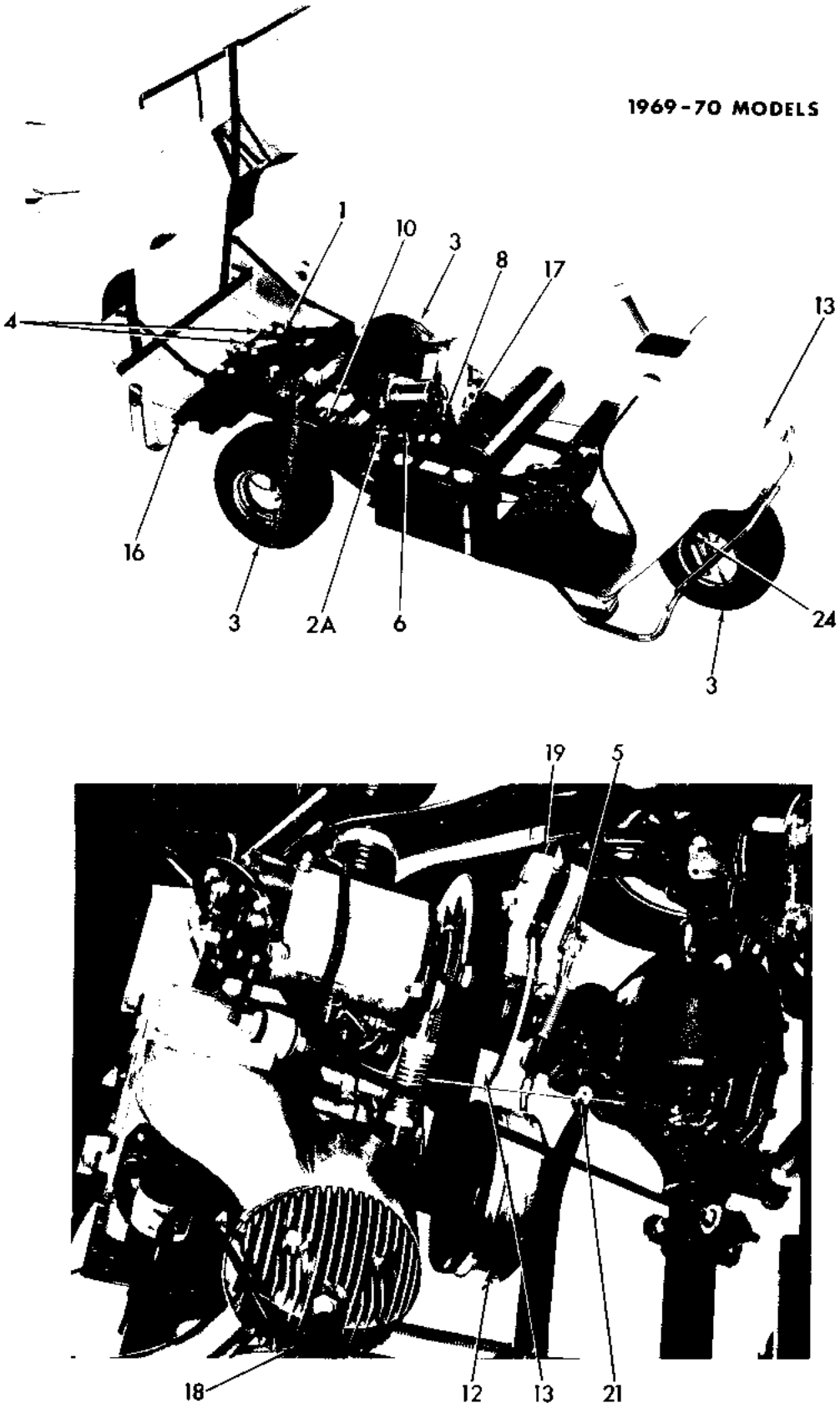


Figure 1B-8B. Lubrication and Service Chart

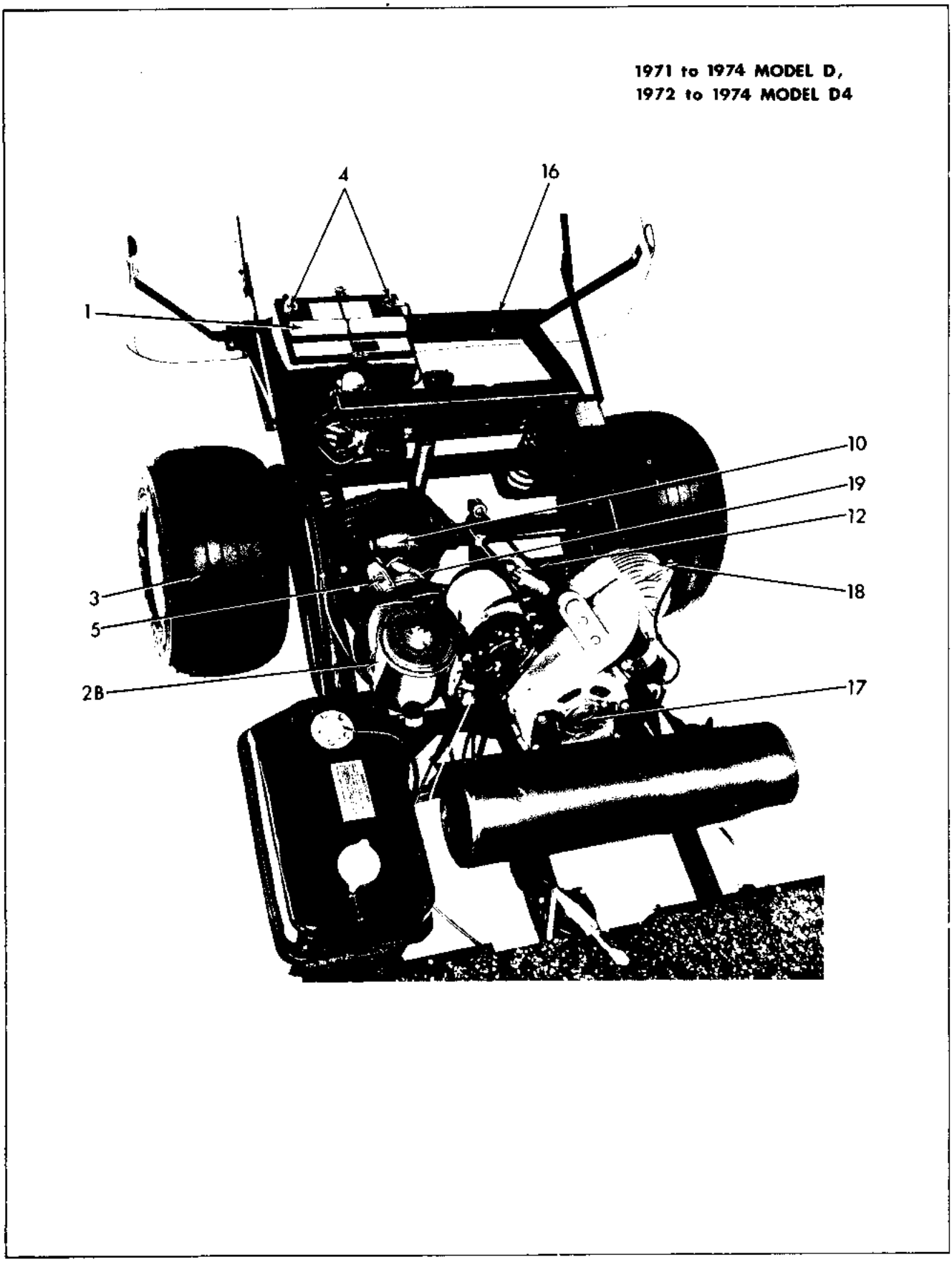


Figure 1B-8C. Lubrication and Service Chart

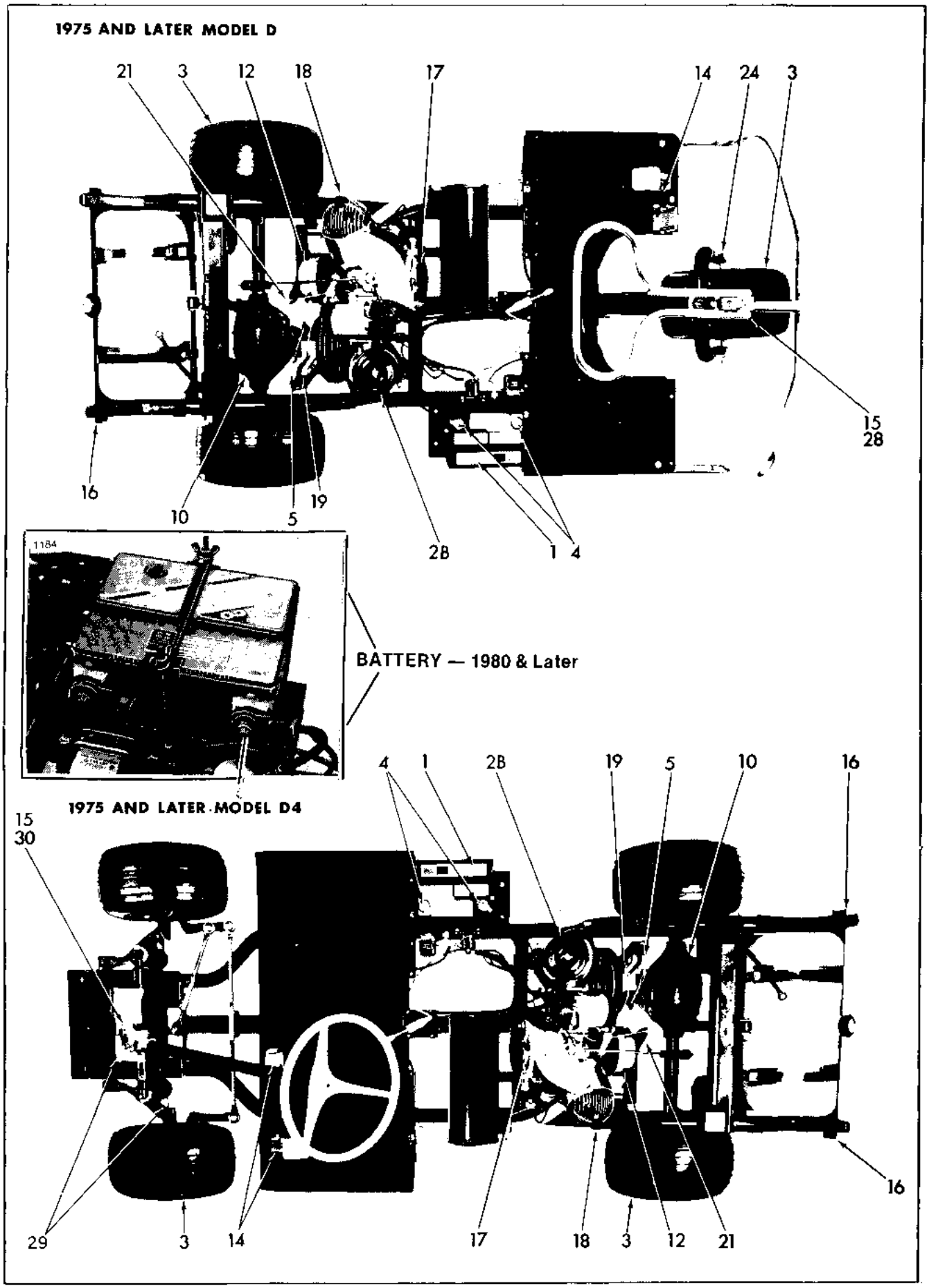


Figure 1B-8D. Lubrication and Service Chart

LOCATING TROUBLES

Your Harley-Davidson Gasoline Car will operate a long time without repairs if it is given proper care and maintenance. The following check list will be helpful in locating operating difficulties should they occur. The check list includes the difficulty, probable causes and suggested checks to make. The procedures used in making these checks can be found in the sections of the service manual referred to.

TROUBLE LOCATION CHART

SYMPTOM AND CAUSE	REFER TO SECTION
ENGINE STARTS HARD	
1. Spark plug partially fouled or in poor condition.	5 SPARK PLUGS
2. Circuit breaker points out of adjustment, or ignition timing incorrect.	5 CIRCUIT BREAKER
3. Loose wire connection at coil or circuit breaker.	5 CIRCUIT BREAKER
4. Defective ignition coil.	5 IGNITION COIL
5. Defective condenser.	5 CIRCUIT BREAKER
6. Poor cylinder compression.	3 CYLINDER
7. Water or dirt in fuel system and/or carburetor.	3 FUEL SYSTEM
8. Carburetor not adjusted correctly or dirty.	3 FUEL SYSTEM
ENGINE STARTS BUT RUNS IRREGULARLY OR MISSES	
1. Spark plug partially fouled or in poor condition.	5 SPARK PLUGS
2. Spark plug gap too close.	5 SPARK PLUGS
3. Circuit breaker points out of adjustment or in need of cleaning.	5 CIRCUIT BREAKER
4. Condenser connections loose.	5 CIRCUIT BREAKER
5. Defective ignition coil.	5 IGNITION COIL
6. Defective condenser.	5 CIRCUIT BREAKER
7. Intermittent short circuit due to damaged wiring insulation in high tension circuit.	5 IGNITION COIL
8. Loose wire connections at coil or circuit breaker.	5 IGNITION COIL 5 CIRCUIT BREAKER
9. Water or dirt in carburetor.	3 FUEL SYSTEM
10. Water or dirt in fuel system.	3 FUEL SYSTEM
11. Gasoline tank cap vent plugged, and tank air bound.	3 FUEL SYSTEM
12. Carburetor improperly adjusted.	3 FUEL SYSTEM
13. Improper gas and oil mixture.	1 SERVICE
ENGINE FAILS TO START	
1. Gasoline tank empty.	1 SERVICE
2. Gasoline line or filter clogged.	3 FUEL SYSTEM
3. Fouled spark plug.	5 SPARK PLUGS
4. Circuit breaker points badly out of adjustment.	5 CIRCUIT BREAKER
5. Loose wire connection at coil or circuit breaker.	5 IGNITION COIL 5 CIRCUIT BREAKER
6. Engine flooded with gasoline as a result of overchoking.	1 CONTROLS AND OPERATION
7. Defective ignition coil.	5 IGNITION COIL
8. Defective condenser.	5 CIRCUIT BREAKER
9. Starter-Generator drive belt slipping (1967 and later).	5 STARTER-GENERATOR
STARTER FAILS TO OPERATE	
1. Starter-cut-out switch incorrectly adjusted.	5 STARTER-GENERATOR
2. Starting control circuit not operating.	5 STARTER-GENERATOR
3. Starter-generator defective.	5 STARTER-GENERATOR
4. Starter-solenoid defective (not closing)	5 STARTER-GENERATOR

TROUBLE LOCATION CHART (CONT)

SYMPTOM AND CAUSE	REFER TO SECTION
STARTER OPERATES WITH KEY SWITCH OFF	
1. Starter solenoid diode shorted.	5 SWITCHES, 5E STARTER-GENERATOR
2. Starter solenoid defective (contacts stuck closed).	5 SWITCHES
SPARK PLUG FOULS REPEATEDLY	
1. The wrong type of spark plug for the kind of service or for type engine. Unsuitable gasoline or wrong fuel mixture.	5 SPARK PLUGS 1 SPECIFICATIONS
2. Ignition timing incorrect.	5 CIRCUIT BREAKER
ENGINE OVERHEATS	
1. Not enough oil used in gasoline mixture.	1 SERVICE
2. Oil and gasoline not mixed thoroughly.	1 SERVICE
3. Exhaust port or pipe partially blocked by carbon.	3 CYLINDER
4. Ignition timing too late or too early.	5 CIRCUIT BREAKER
ENGINE DETONATES	
1. Unsuitable fuel.	1 SERVICE
2. Heavy deposit of carbon on piston head and in combustion chamber.	3 CYLINDER
3. Spark plug of the wrong heat range for the type of service involved.	5 SPARK PLUGS
4. Defective spark plug.	5 SPARK PLUGS
ENGINE PREIGNITES	
1. Excessive carbon deposit on piston head, or in combustion chamber.	3 CYLINDER
2. Too hot a spark plug for the kind of service, or type of engine.	5 SPARK PLUGS
3. Unsuitable fuel.	1 SERVICE
4. Not enough oil used in gasoline mixture.	1 SERVICE
ENGINE SHOWS LOSS OF POWER	
1. Exhaust ports muffler or pipe in need of cleaning. 2. Air cleaner blocked - clean or replace element. 3. Circuit breaker points out of adjustment or timed incorrectly.	3 CYLINDER 5 CIRCUIT BREAKER
STARTER-GENERATOR DOES NOT CHARGE BATTERY	
1. Loose or broken wire in starter-generator circuit.	5 STARTER-GENERATOR
2. Grounded or shorted coil.	5 STARTER-GENERATOR
3. Open circuit coil.	5 STARTER-GENERATOR
4. Brushes worn or commutator dirty.	5 STARTER-GENERATOR
5. Defective control box (1963-66).	5 CONTROL BOX
6. Drive belt slipping (1967 and later)	5 STARTER-GENERATOR
7. Defective resistor or incorrect resistor adjustment (1967-68).	5 STARTER-GENERATOR
8. Defective regulator (1969 and later)	5 REGULATOR
CARBURETOR FLOODS	
1. Inlet valve and/or valve seat dirty, worn or damaged.	3 FUEL SYSTEM
2. Diaphragms or check valve leaking.	3 FUEL SYSTEM
TRANSMISSION DOES NOT ENGAGE OR DISENGAGE SMOOTHLY	
1. Front floating (outer) flange mechanism dirty.	4 CLUTCH
2. Defective drive belt.	4 CLUTCH
BRAKES DO NOT HOLD NORMALLY	
1. Brake improperly adjusted.	2 BRAKE
2. Brake controls binding as result of improper lubrication or damage.	2 BRAKE
3. Brake linings badly worn.	2 BRAKE
4. Low on brake fluid.	2 BRAKE

TROUBLE LOCATION CHART (CONT)

SYMPTOM AND CAUSE	REFER TO SECTION
EXCESSIVE VIBRATION	
1. Engine mounting bolts loose.	3 ENGINE - GENERAL
2. Engine rubber mounts damaged.	3 ENGINE - GENERAL
3. Misaligned exhaust system.	3 CYLINDER
4. Loose driveshaft mounting bolts.	4 COUPLING
5. Damaged belt.	4 CLUTCH
6. Tight universal joints (1966).	4 COUPLING

When an engine is not operating properly, the trouble in many cases is mistakenly attributed to the coil, condenser or points when actually the spark plug is at fault. Remove the spark plug from the cylinder head and clean and regap the electrodes as described in "Spark Plugs", Section 5.

TORQUE REQUIREMENTS

GENERAL FASTENER TIGHTENING SPECIFICATIONS

Torque to the values given in this table unless specified otherwise below. Torque figures are in ft.-lbs.

FINE OR COURSE THREAD FASTENER	GRADE DESIGNATION	TENSILE STRENGTH MINIMUM	MATERIAL	SCREW, STUD, OR BOLT SHANK SIZE OR DIAMETER															
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1
CAP SCREW	S. A. E. 2 A. S. T. M. A-307 STEEL	64,000 P. S. I.	Low Carbon Steel								6	11	19	30	45	66	93	150	202	300
CAP SCREW	S. A. E. 3 STEEL	100,000 P. S. I.	Medium Carbon Steel								9	17	30	47	69	103	145	234	372	551
CAP SCREW	A. S. T. M. A-449 S. A. E. 5 STEEL	105,000 P. S. I	Medium Carbon Steel or Low Alloy Heat Treated								9	18	31	50	75	110	150	250	378	583
CAP SCREW	A. S. T. M. 354BB STEEL																			
CAP SCREW	A. S. T. M. A-325 *														100		200	355	525	790
CAP SCREW	A. S. T. M. A-354-BC STEEL	125,000 P. S. I.	Low Alloy or Med. Carb. Quenched Tempered								11	20	34	54	81	119	167	269	427	644
CAP SCREW	S. A. E. 6 STEEL	133,000 P. S. I.	Med. Carbon Steel Quenched Tempered								12.5	24	43	69	108	150	209	350	550	825
CAP SCREW	S. A. E. 7 STEEL		Med. Carbon Alloy, quenched Tempered Roll Threaded																	
CAP SCREW	S.A.E. 8 STEEL	150,000 P. S. I.	Med. Carbon Alloy Quenched Tempered								13	28	46	75	115	165	225	370	591	893
CAP SCREW	A-354-BD. A490*	150,000 P. S. I.	Med. Carbon Alloy Quenched Tempered										55	90	138	198	270	444	709	1071

SPECIFIC FASTENER TIGHTENING SPECIFICATIONS

DIFFERENTIAL — 1976 and EARLIER

Ring Gear
Mounting Bolts . . . . . 45 ft.-lbs. (6.3 kgm)
Pinion Nut . . . . . 50-70 ft.-lbs. (7.0-9.8 kgm)
Bearing Cap Bolts . . . . . 45 ft.-lbs. (6.3 kgm)
Differential Cover Bolts . . . 20 ft.-lbs. (2.8 kgm)
Axle Nut . . . . . 50 ft.-lbs. (7.0 kgm)

DIFFERENTIAL — 1977 and LATER

Ring Gear
Mounting Bolts . . . . 35-40 ft.-lbs. (4.9-5.6 kgm)
Axle Housing
Mounting Bolts . . . . 60-65 ft.-lbs. (8.4-9.1 kgm)
Axle Nut . . . . . 100 ft.-lbs. (14 kgm)

TORQUES

Cylinder Head
Mounting Bolts . . . . . 17-21 ft.-lbs. (2.4-3.0 kgm)
Axle Hub
Mounting Bolts . . . . 35-40 ft.-lbs. (4.9-5.6 kgm)
Differential
Cover Bolts . . . . . 15-18 ft.-lbs. (2.1-2.5 kgm)
Crankcase Bolts . . . . . 9-11 ft.-lbs. (1.3-1.5 kgm)

STEERING ARM BALL JOINT
CASTLE NUT . . . . . 25-28 ft.-lbs. (3.5-3.9 kgm)

STARTER-GENERATOR PULLEY NUT

Siba . . . . . 50 ft.-lbs. (7.0 kgm)
Bosch . . . . . 30 ft.-lbs. (4.2 kgm)
Hitachi . . . . . 70 ft.-lbs. (9.8 kgm)

SPARK PLUGS . . . . . 15 ft.-lbs. (2.1 kgm)

COMMON CONVERSION FACTORS

.02957 x ounces = litres
7.2 x kgm = ft.-lbs.
0.14 x ft.-lbs. = kgm
28.3 x ounces = grams
0.035 x grams = ounces
0.45 x pounds = kilograms
2.2 x kilogram = pounds

METRIC CONVERSION TABLE

MILLIMETERS to INCHES (MM x 25.40 = inches)								INCHES to MILLIMETERS (inches x 0.03937 = MM)							
MM	IN	MM	IN	MM	IN	MM	IN	IN	MM	IN	MM	IN	MM	IN	MM
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1 15/16	49.21	3 3/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3 3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2 1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3 5/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2 1/8	53.97	3 1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2 3/16	55.56	3 5/8	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2 1/4	57.15	3 3/4	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3 15/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2 5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2 3/8	60.32	3 7/8	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1 1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2 7/16	61.91	3 13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1 1/8	28.57	2 1/2	63.50	3 7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1 1/16	30.16	2 9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3 15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1 1/4	31.75	2 5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2 11/16	68.26	4 1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1 3/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1 3/8	34.92	2 3/4	69.85	4 1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4 3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1 7/16	36.51	2 13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1 1/2	38.10	2 7/8	73.02	4 1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1 9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2 15/16	74.61	4 5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1 5/8	41.27	3	76.20	4 3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1 11/16	42.86	3 1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4 7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1 3/4	44.45	3 1/8	79.37	4 1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3 3/16	80.96	4 9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1 13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1 7/8	47.62	3 1/4	82.55	4 5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4 11/16	119.06

CHASSIS 2

TABLE OF CONTENTS

NOTES

DRIVE
DIFFERENTIAL AXLE (Early 1977 and Earlier)

DIFFERENTIAL AND AXLE

GENERAL

The differential lubricant level should be checked yearly and lubricant added as required to fill to 1/2" below level of filler plug hole. A bent wire may be used as a dipstick. See figure 2B-10. Harley-Davidson Transmission Lubricant is required per specifications in Section 1 of this manual. It is not recommended to mix various brands of hypoid lubricants.

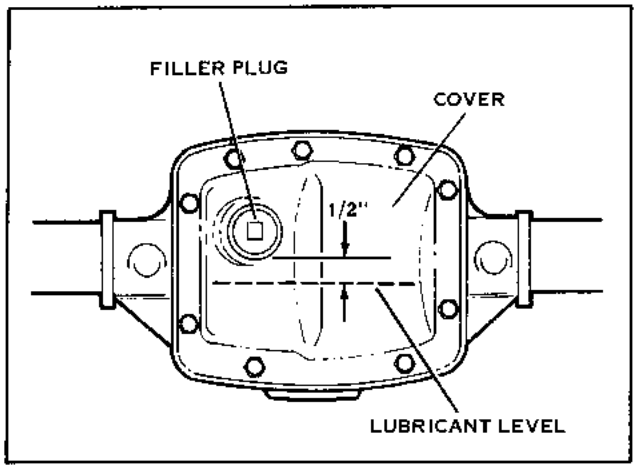


Figure 2B-10. Differential Filler Plug and Cover (Early 1977 and Earlier)

Wheel bearings receive their lubrication from grease packed in bearings when assembled.

Rear axle noise can be confused with other noises in the car. Considerable care should be taken in the diagnosis of noises before deciding that the trouble is in the rear axle assembly.

LOCKOUT HUB-1963 TO EARLY 1977

The wheel lockout provides for disengaging the rear wheel from the axle so that car can be towed or pushed without the drag caused by the differential and transmission. The lockout is located on the left rear wheel hub and consists of a wheel hub with internal splines, an axle hub with internal splines, and a coupling spline which engages and disengages the wheel hub and axle hub. The coupling spline has a locking button to hold the coupling in disengaged and engaged positions. See Figure 2B-10A.

WARNING

Golf cars can only be towed utilizing lockout at governed speed 3000 rpm (10 mph) or less.

To unlock wheel, depress button in center--pull knob OUT and release button. To lock wheel return knob to IN position by depressing button. If knob does not fall back in, it means splines are misaligned. Be sure engagement takes place as soon as wheel is turned.

The lockout should be used by car service personnel for moving cars only.

Users should be made aware that the brake will not operate when the wheel is disengaged and for this reason the lockout should never be left in out position but should be moved in to engaged position IMMEDIATELY after use.

WARNING

The brake will not operate when the wheel is disengaged. The lockout should never be left in "Out" position but moved into engaged position IMMEDIATELY AFTER USE!!

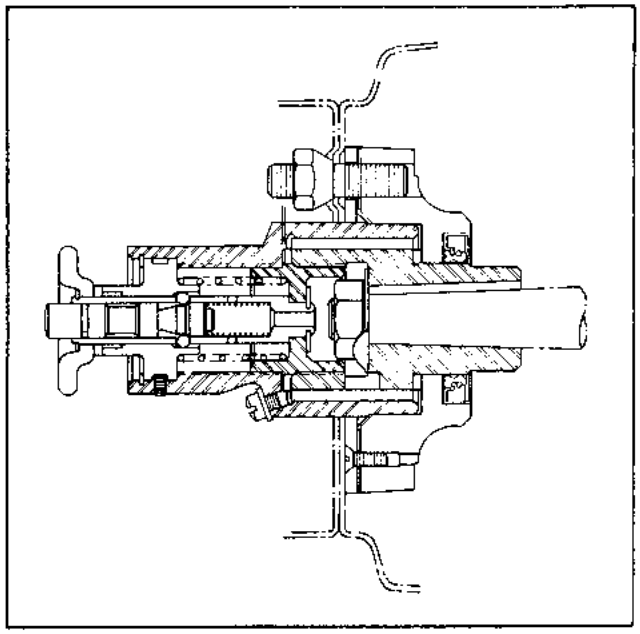
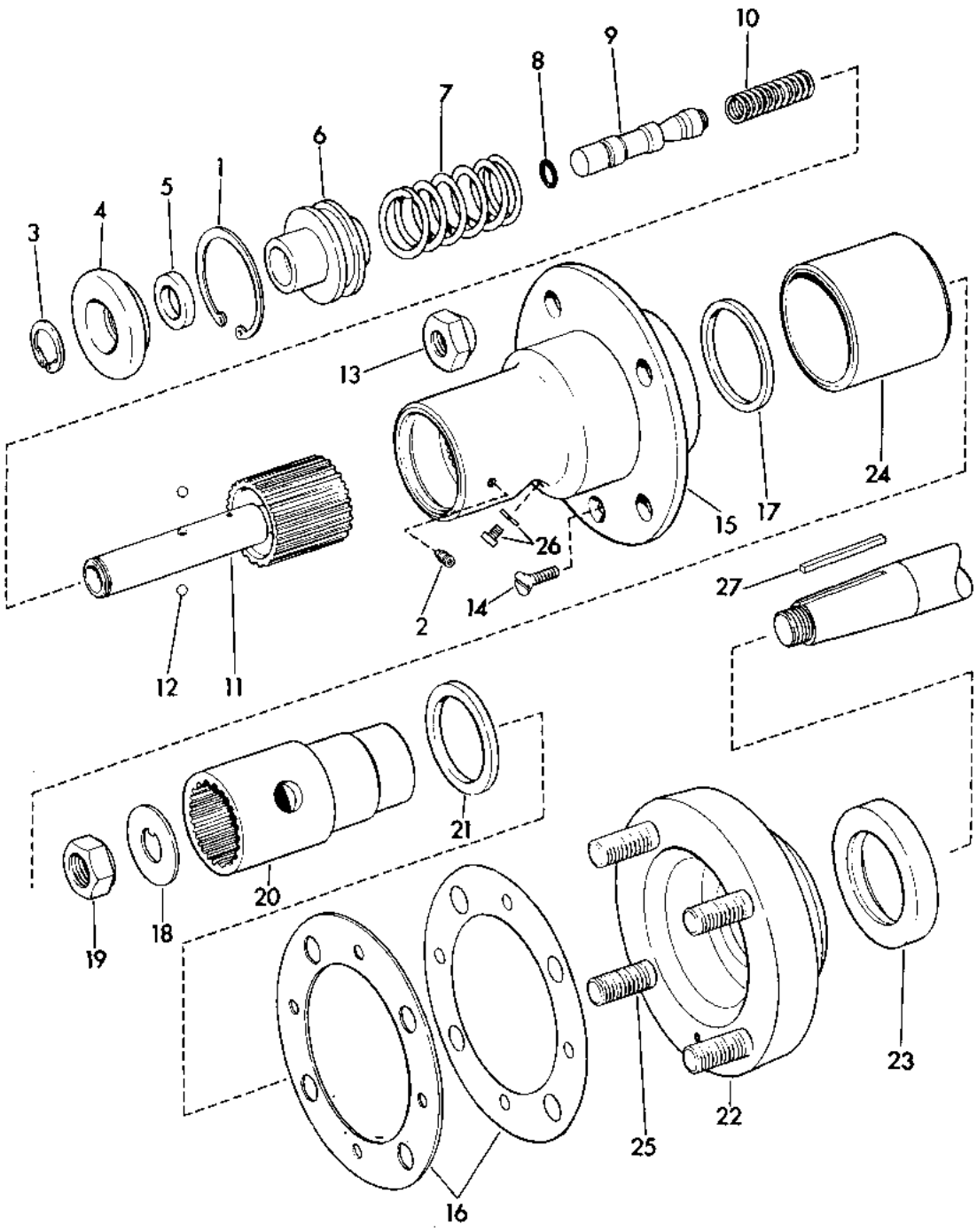


Figure 2B-10A. Wheel Lockout Hub, Section View

CAUTION

Do not wash wheel hub with knob out or tow through deep water as parts will become rusty and inoperable. The lockout hub should be greased once a year with high temperature grease. Remove screw (26, Figure 2B-10B) and install a grease fitting.



1. Lock Ring
2. Set Screw
3. Lock Ring
4. Knob
5. Seal Washer
6. Guide
7. Knob Spring
8. O-Ring
9. Pin
10. Pin Spring
11. Coupling Assembly
12. Steel Ball (2)
13. Wheel Stud Nut (4)
14. Screw
15. Wheel Hub Assembly
16. Shim (.005 and .020 - as required)
17. Thrust Washer
18. Axle Nut Lock Washer
19. Axle Nut
20. Axle Hub
21. Thrust Washer
22. Hub Collar
23. Hub Collar Seal
24. Wheel Hub Bushing
25. Wheel Stud (4)
26. Screw and Seal Washer
27. Axle Key

Figure 2B-10B. Lockout Hub (1963 to early 1977) - exploded view

DISASSEMBLING LOCKOUT HUB (Fig. 2B-10B)

Lockout knob assembly can be disassembled from lockout hub as follows: Depress button and pull knob to outer position. Remove lock ring (1) with Tru-Arc pliers, Part No. 96216-49, and remove setscrew (2). Knob assembly consists of parts 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. Remove lock ring (3) with Tru-Arc pliers, Part No. 96215-49, to free items 4, 5, 6, 7, 8, 9, 10 and 12 from shaft and coupling assembly (11).

Remove wheel from hub collar (22) by removing 4 stud nuts (13). Remove screw (14), wheel hub assembly (15), shims (16) and thrust washer (17).

Bend ear of lockwasher (18) away from flat on axle nut (19) and remove axle nut (19) with a socket wrench. Attach wheel puller to collar studs and pull axle hub (20), thrust washer (21) and hub collar (22) from axle taper.

INSPECTION AND REPAIR (Fig. 2B-10B)

Clean all parts except oilite bronze thrust washers and bushing in non-flammable cleaning solvent and inspect for wear particularly thrust washers (17 and 21) which originally are .122 to .127 thick. Also inspect bushing (24) for wear by checking fit on axle hub, which originally was .005 loose. End play between inner and outer hub is limited by thrust washers (17 and 21). As these washers wear, shims (16) can be removed to reduce end play to between .001 and .011. End play can be checked with a dial indicator as follows: Assemble complete hub dry using the original shims. Use two wheel stud nuts (13) across from each other with spacer washers underneath so that all parts are tightly held together. Hold either end of assembly in a vise and place indicator on other end as close to center as possible. Pull and push on hub to obtain axial movement and remove or add necessary number of .005 or .020 shims to obtain specified end play.

Replace thrust washers and bushing if worn excessively. Replace seal (23), O-ring (8) or seal washer (5) if worn or torn.

ASSEMBLING LOCKOUT HUB (Fig. 2B-10B)

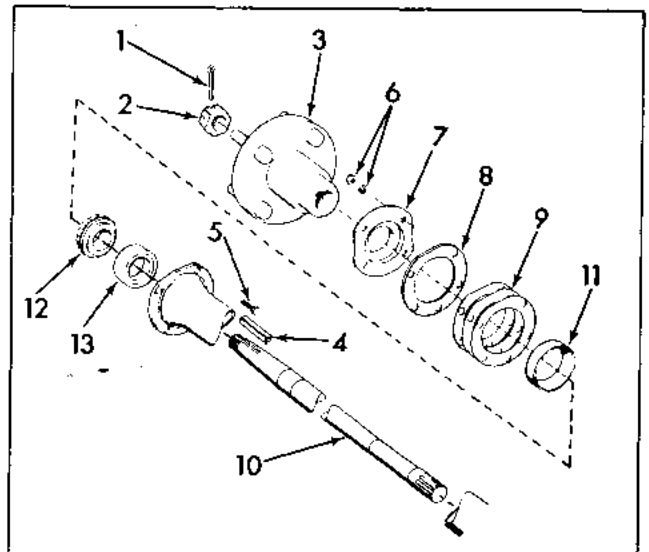
Put a coating of high temperature grease on splines, shaft springs, bearings, thrust washers, seals and shims. Place thrust washer (21) and hub (20) into collar (22) and install on axle taper with key (27). Assemble lockwasher (18), nut (19) and tighten nut securely with socket wrench. Line up one of nut flats with hole in sidewall of hub and using a punch, bend over washer against nut flat to lock in place. Place predetermined number of shims over wheel studs. Place thrust washer (17) into wheel hub assembly (15) and assemble on axle hub (20). Install screw (14) to hold parts together. Install grease hole screw and washer (26). Assemble knob and pin assembly as follows: Fill both ball holes in coupling tube (11) with grease. Insert spring (10) inside coupling tube (11). Place guide (6) (long flange outside) and spring (7) on outside of coupling tube (11). Install O-ring (8) in groove of pin (9). Install seal washer (5) and knob (4) loosely over tube assembly. Place both balls (12) in ball holes of tube. Place parts, spline end down, on flat surface and press on knob forcing parts down against spring. At the point where balls approach the edge of guide (6) depress pin (9) so that balls will enter bore of guide. Release pin to lock assembly in out position. Install lock ring (3). Install knob assembly in hub assembly and install lock ring (1) and set screw (2). Check for proper operation.

REAR AXLES

REMOVING AXLE SHAFT - 1972 AND EARLIER (Fig. 2B-12)

If an axle shaft must be removed from the housing for reason of straightening or replacement, it can be removed without removing entire differential and axle assembly from the car.

Block car clear of ground and remove wheel (see Wheels, Section 2). Remove cotter pin (1) and axle shaft nut (2). Wheel hub (3) fits a tapered, keyed shaft and can be removed with an automotive type hub puller. Remove key (4). If left rear wheel has a lockout hub, see "LOCKOUT HUB" section for removal instructions. On models equipped with rear wheel brakes, remove brake parts as described in section 2. Wash flange end of axle free of dirt. Remove the four bolts (5), washers and nuts (6), holding plate to axle housing flange. Remove oil seal (7), retainer plate (8) and any shims (9) found between plate and axle housing flange. The axle shaft (10) is held in the axle housing by the bearing cup (11). The end of the shaft in the differential is a splined fit in the differential bevel gear and can be pulled out of the housing when outer bearing cup is freed from its press fit in the housing flange. If



1. Cotter pin
2. Axle shaft nut
3. Wheel hub
4. Key
5. Bolt (4)
6. Washer and nut (4)
7. Oil seal
8. Retainer plate
9. Shims (variable no.)
10. Axle shaft
11. Bearing race
12. Bearing cone
13. Oil seal

Figure 2B-12. Rear Axle (1972 and Earlier) - Exploded View

some difficulty is experienced in freeing the outer bearing cup, use an axle puller or put axle nut on axle and tap in an outward direction using brass drift and light hammer. After shaft has been removed, bearing cone (12) can be pressed off shaft using U plate and arbor press. Bearing cone and cup should be washed free of grease in non-flammable cleaning solvent, then inspected to determine whether they are suitable for further service. Inspect oil seal (13) and replace it if it is damaged or worn. If axle is to be straightened, this work should be done by a shop specializing in axle and differential repair.

INSTALLING AXLE SHAFT - 1972 AND EARLIER (Fig. 2B-12)

Press bearing cone (12) onto axle shaft (10) using pressing sleeve and arbor press. (Sleeve should butt against bearing inner race not roller retainer.) Pack bearing with bearing grease and insert axle shaft into housing lining up splines on shaft and in bevel gear in differential, so that shaft can be pushed in against axle spacer in differential. Install bearing race (11), retainer plate (8) and spacing shims (9), fastening temporarily with two opposite bolts (5), washers and nuts (6). With bolts tight, check the end play of shaft. Overall end play should be between .003 and .012. In making this check, be sure both wheels are blocked clear of floor. Add or remove shims until end play is within specifications. On final assembly, install new oil seal (7) and four bolts (5) with nuts and lockwashers (6). Put a thin coat of grease on the lip of the oil seal before installing. After tightening the four bolts, recheck the shaft end play. Install key (4) and wheel hub (3). Turn on axle shaft nut (2) and tighten to 50 ft.-lbs. torque. Then tighten until nearest cotter hole lines up. Install cotter key (1).

REMOVING AXLE SHAFT - 1973 TO EARLY 1977 (Fig. 2B-12A)

If an axle shaft must be removed from the housing for reason of straightening or replacement, it can be removed without removing entire differential and axle assembly from the car.

Block car clear of ground and remove wheel (See "WHEELS," Section 2). If left rear wheel has a lockout hub, see "LOCKOUT HUB" section for removal instructions. Wash flange end of axle free of dirt.

Remove cotter pin (1) and axle shaft nut (2). Wheel hub (3) fits a straight splined shaft and can be removed with an automotive type hub puller. Remove felt seal (4). Remove the four bolts (5) holding the dust shield to axle housing flange. Remove dust shield (6), gasket (7), bearing retainer plate (8) and other gasket (7). The axle shaft (9) is held in the axle housing by the bearing (10) and sleeve (11). The end of the axle shaft in the differential is a splined fit in the differential bevel gear and can be pulled out of the housing using an axle puller. If cup portion of bearing (10) remains in axle housing it may be removed with a puller. Bearing (10) and sleeve (11) may now be pressed off axle. Clean bearing and inspect to determine whether or not it is suitable for further service. Bearing (10) is a preset spacer bearing. The cup and cone are epoxied together during manufacture but usually split apart when axle shaft is removed from axle housing. If bearing is not worn, it may be reused even if it has split apart. Clean and inspect oil seal (12) and replace if necessary. If axle is to be straightened, this work should be done by a shop specializing in axle and differential repair.

INSTALLING AXLE SHAFT - 1973 TO EARLY 1977 (Fig. 2B-12A)

Press oil seal (12) into axle housing. Press sleeve (11) and bearing (10) onto axle shaft (9). If new bearing is used, cup side of bearing should face into axle housing. If old bearing is reused, press bearing cup into axle housing. Pack bearing with bearing grease and insert axle shaft into housing lining up splines on shaft and in bevel gear in differential so that shaft can be pushed in against axle spacer in differential. Install gaskets (7), bearing retainer (8), dust shield (6) and bolts (5) as shown in figure 2B-12A. Assemble felt seal (4) to wheel hub. Coat spline on end of axle with Harley-Davidson Sleeve Retainer Part No. 99628-77. Assemble wheel hub (3) to axle shaft. Turn on axle shaft nut (2) and tighten to 50 ft.-lbs. torque. Then tighten until nearest cotter pin hole lines up. Install cotter pin (1).

1. Cotter pin
2. Nut
3. Wheel hub
4. Felt seal
5. Bolt (4)
6. Dust shield
7. Gasket (2)
8. Bearing retainer
9. Axle
10. Bearing cone and cup
11. Sleeve
12. Oil seal

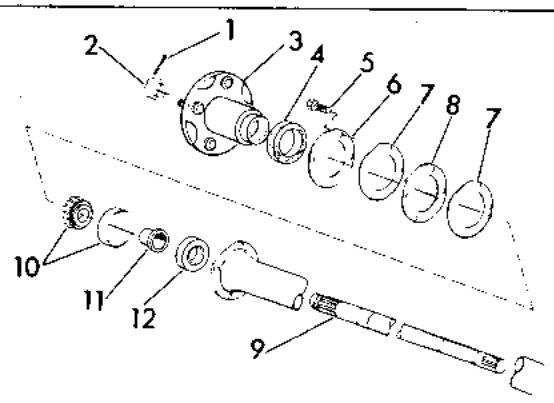


Figure 2B-12A. Rear Axle (1973 to Early 1977) - Exploded View

REMOVING REAR AXLE SHAFT, BEARING OR SEAL (LATE 1978 AND LATER) (Figure 2A-12B)

If an axle shaft must be removed for straightening or replacement, or for rear wheel bearing service, it can be removed without removing entire differential and axle assembly from car.

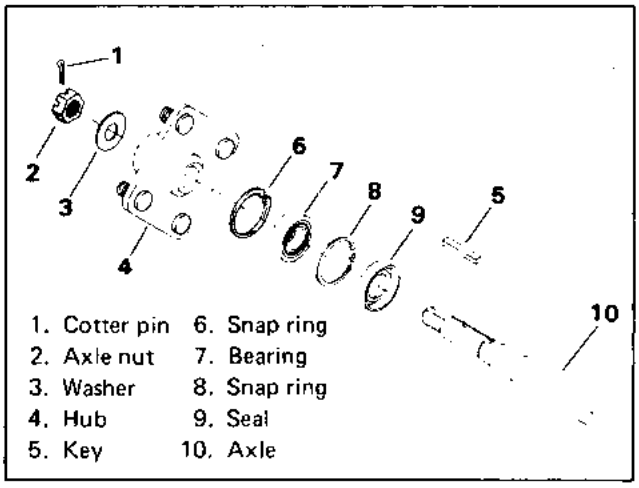


Figure 2A-12B. Rear Axle - Late 1978 and Later

1. Remove hub cap and slightly loosen wheel rim mounting nuts.

2. Remove cottern pin (1) and loosen axle shaft nut (2).

3. Wedge front wheels of car to keep it from rolling and raise rear of vehicle to approximately 10° to 25° angle. Place jack stands under left and right side of bumper to support vehicle weight for added safety.

4. Remove wheel an wash flange end of axle free of dirt.

5. Remove nut (2) and washer (3).

6. Remove wheel hub (4) from axle shaft. It may be necessary to use slide hammer to remove the wheel hub.

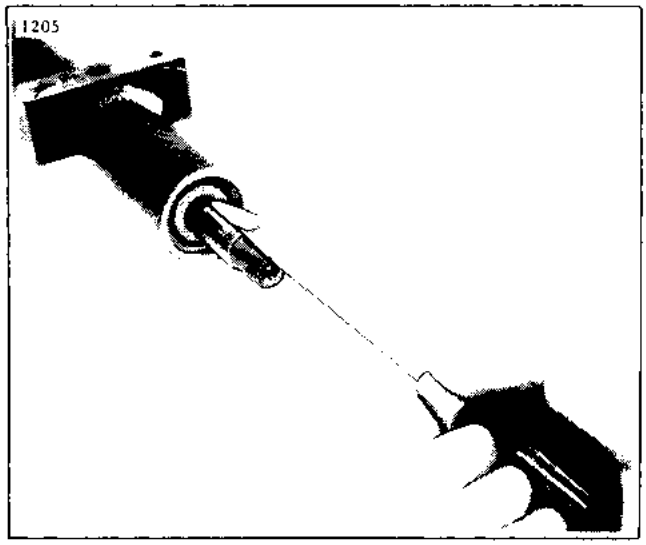


Figure 2A-12C. Removing Key

7. Remove key (5) from axle (10) (Figure 2A-12C).

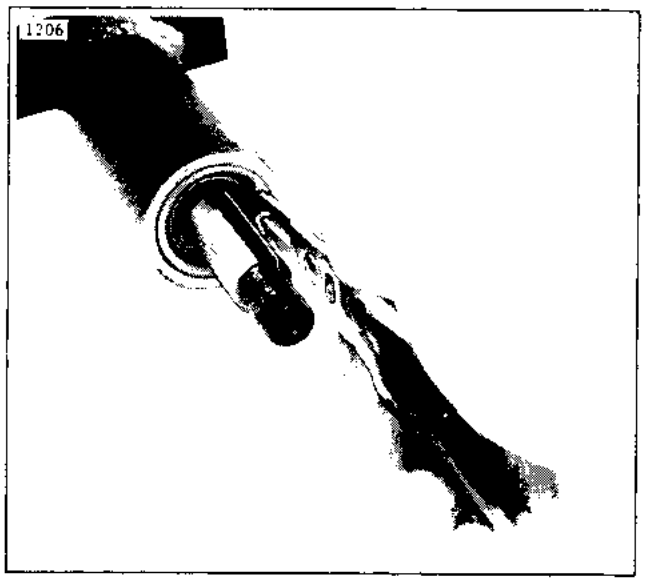


Figure 2A-12D. Removing Snap Ring

8. Remove snap ring (6) from axle housing (Figure 2A-12D).

9. Axle shaft (10), with axle bearing (7) attached, can be removed from the housing with an axle puller.

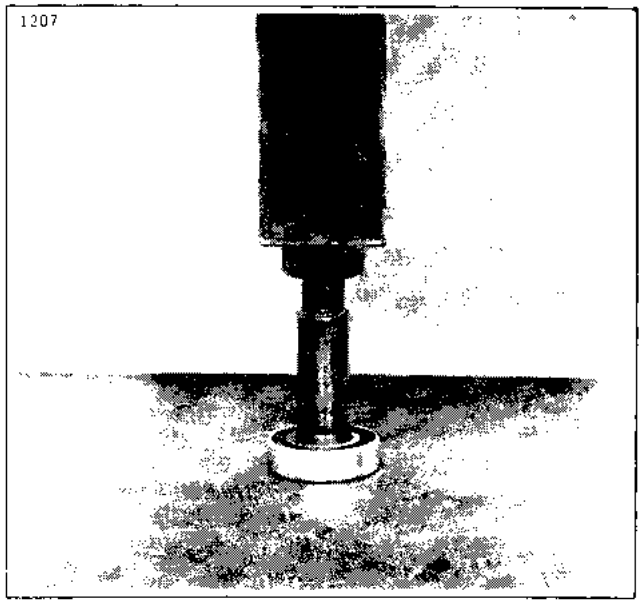


Figure 2A-12E. Pressing Bearing Off Axle

10. Axle bearing (7) can be pressed from axle shaft (10) by supporting bearing inner race on press bed and applying pressure to the axle nut on end of shaft (Figure 2A-12E).

CAUTION

Axle nut must be mounted flush with axle end during pressing to avoid damage to axle.

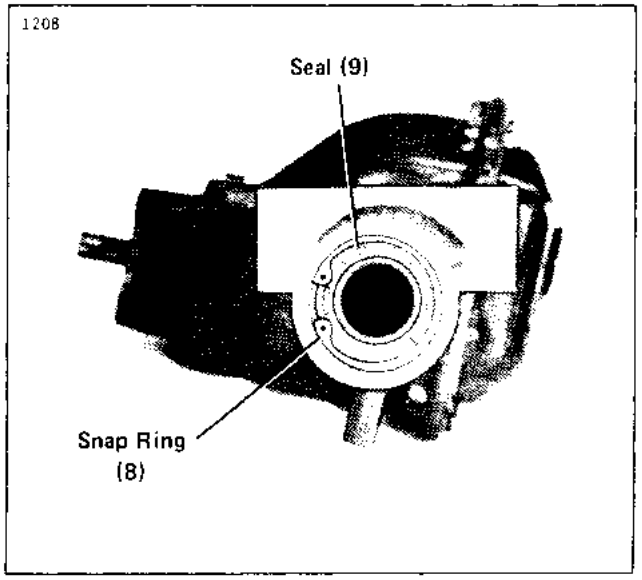


Figure 2A-12F. Snap Ring and Seal

11. To remove seal (9), first remove snap ring (8) and then pull or pry seal from housing (Figure 2A-12F).

12. Lubricate seal lip with differential fluid and press new seal into housing with lip side of seal toward center of axle housing.

INSTALLING REAR AXLE, SHAFT, BEARING OR SEAL (LATE 1978 OR LATER) (Figure 2A-12B)

1. If axle bearing was removed or new bearing required, press axle bearing (7) into axle shaft.

2. With seal (9) and snap ring (8) in place in axle housing (Figure2A-12F), slide axle with bearing attached into housing until bearing (7) seats on snap ring (8).

3. Install snap ring (6) (Figure 2A-12D).

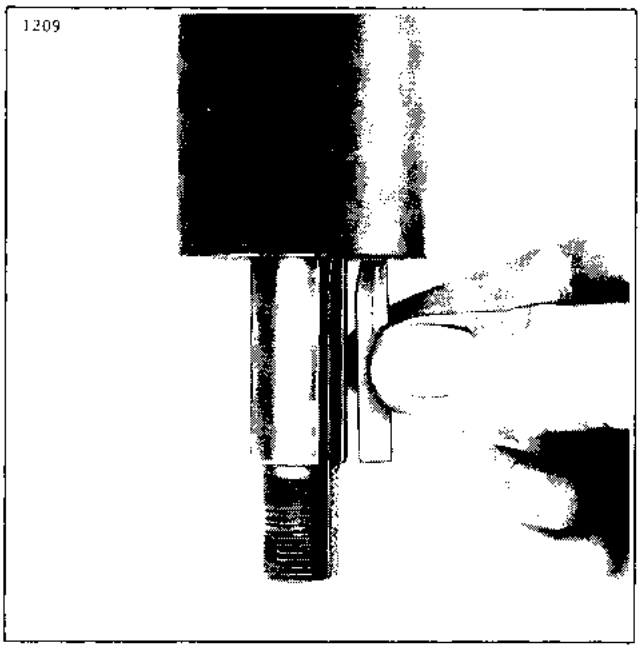


Figure 2A-12G. Axle Key Installation

4. Install key (5) into slot in axle. Position key so tapered end is toward housing, and outside end of key is flush with inside edge of threads (Figure 2A-12G).

5. Install flange (4), washer (3) and nut (2).

6. Install wheel rim and wheel rim mounting nuts.

7. Let car down off jack stands.

8. Torque axle nut (2) to 50 ft.-lbs. (6.9 kgm) and continue to tighten until nearest cotter pin hole lines up. Install cotter pin (1).

9. Torque wheel rim mounting nuts to 35-40 ft.-lbs. (5.5 kgm) and install hub cap.

DIFFERENTIAL

REMOVING REAR AXLE AND DIFFERENTIAL ASSEMBLY (Fig. 2B-14)

When repairs to the rear axle housing or differential become necessary, the entire rear end drive assembly must be removed.

1963-66 D and 1968 and earlier DC models - remove rear drive and reversing unit (see "Reversing Unit and Coupling" Section 4).

1967 and later D and 1969 and later DC models - remove transmission rear drive assembly (see "Transmission Rear Drive" Section 4).

All models - Block rear frame clear of ground. Do not block under axle and differential assembly (2). Remove wheel assemblies (see "Wheels" Section 2). Remove axle mounting bolts (1) and lower axle and differential assembly.

DISASSEMBLING DIFFERENTIAL CASE AND DRIVE PINION (Fig. 2B-14)

CAUTION

Wheels, axle shafts and wheel bearings must be removed from axle and differential housing prior to disassembling this unit. This is described in preceding paragraphs under AXLES.

1. Clean outside of housing thoroughly. Place rear axle and differential assembly (2) on a holding fixture or large vise, gripping tube with carrier cover facing upward.

2. Remove cover bolts and cover (3) and gasket (4).

3. Flush differential gears, bearings, and other internal parts of gear carrier with a non-flammable cleaning solvent. At this point, rotate drive gear, check drive gear back face for runout with a dial test indicator. See Figure 2B-13. Total indicator reading in excess of .006" might indicate loose drive gear or a sprung differential case.

CAUTION

A .003" feeler should not enter between differential bearing cap and cup. If .003" feeler enters, it could denote the differential bearing had turned in the carrier.

4. Remove differential bearing cap bolts (5) and caps (6), (Figure 2B-14). Note matching marks on carrier and differential bearing caps. Refer to Figure 2B-15.

5. Pry differential case assembly (7) loose with large screwdriver or bar and lift from carrier. NOTE: Pry out differential case assembly as straight up as possible using leverage against differential and carrier to prevent damage.

6. Remove cups (8) from differential case bearings (9). NOTE: If bearing cones and cups are not worn or damaged and are to be reassembled, make certain that each mating cup and cone are paired together.

7. Drive out lock pin (10) securing differential pinion mate shaft to case (11). See Figure 2B-16.

8. Remove differential bearing cones (9). Care must be taken to insure that bearing puller is located in cast recesses of differential case so as not to pull on bearing cage. See Figure 2B-17.

9. Remove shims (12). NOTE: If drive gear and drive pinion are to be reassembled, note position of shims and replace accordingly.

10. Remove screws (13) and drive gear (14).

11. Remove differential pinion mate shaft (15), differential pinion mates (16) and thrust washers (17), (one back of each pinion). Remove differential side gears (18) and thrust washers (19), (one back of each gear).

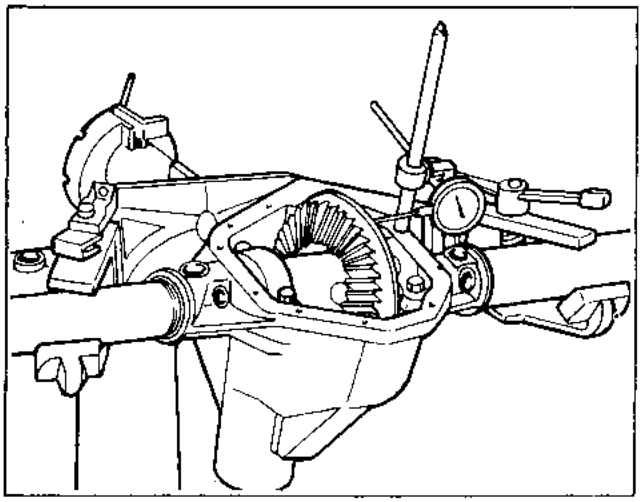


Figure 2B-13. Check Drive Gear for Runout

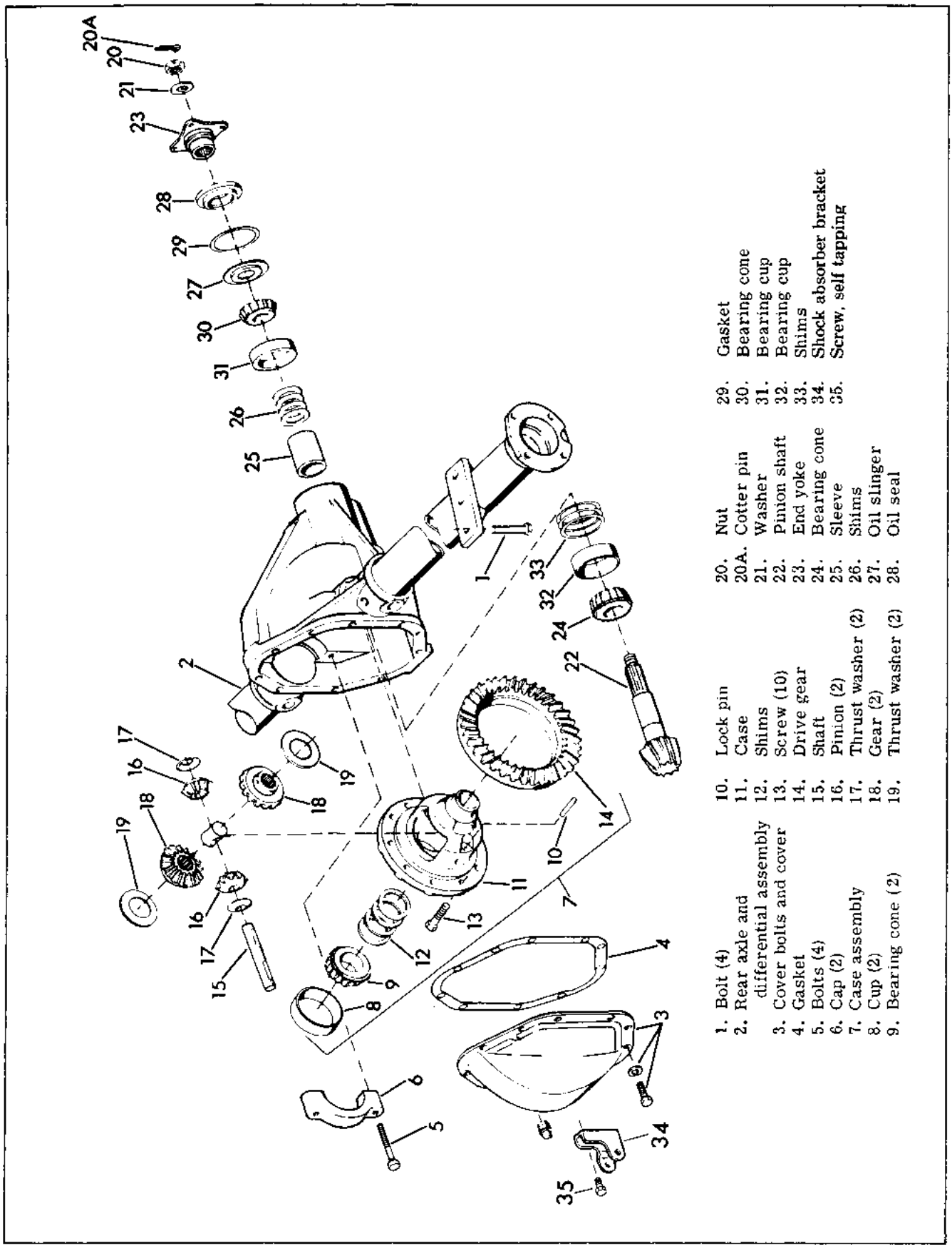


Figure 2B-14. Differential Assembly (Early 1977 and Earlier and Late 1978 and Later) - Exploded View

12. Turn housing assembly in vise or holding fixture so that drive pinion shaft is vertical.

13. If used, bend tab on retainer (21A) flat or remove cotter pin (20A), nut (20) and washer (21) or retainer (21A) from drive pinion shaft (22) and remove end yoke (23) or coupling (23A) with claw puller.

14. Place housing assembly on arbor press similar to one shown in Figure 2B-18. Press out shaft (22). Drive pinion shaft rear bearing cone (24) will remain on shaft. Remove bearing cone (30), bearing spacer sleeve (25) and adjusting shims (26), placing these parts with pinion shaft.

15. Place housing assembly on press (Figure 2B-19). With a suitable pressing plug, press out outer pinion shaft bearing oil slinger (27) and oil seal (28). Remove oil seal gasket (29).

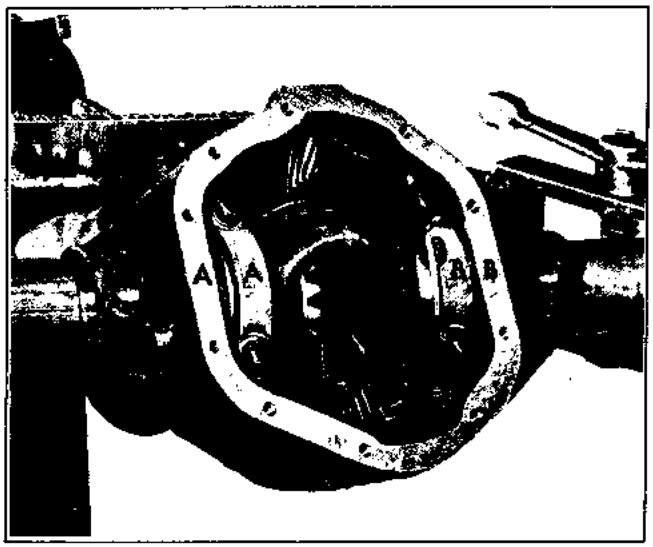


Figure 2B-15. Carrier and Bearing Cap Matching Marks

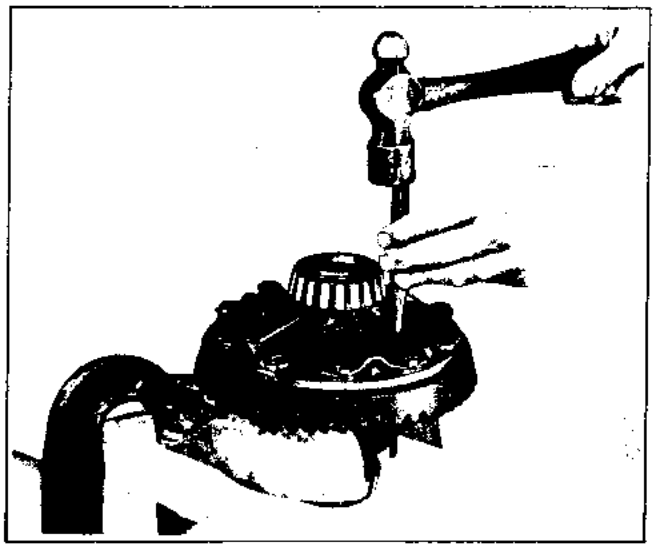


Figure 2B-16. Removing Lock Pin

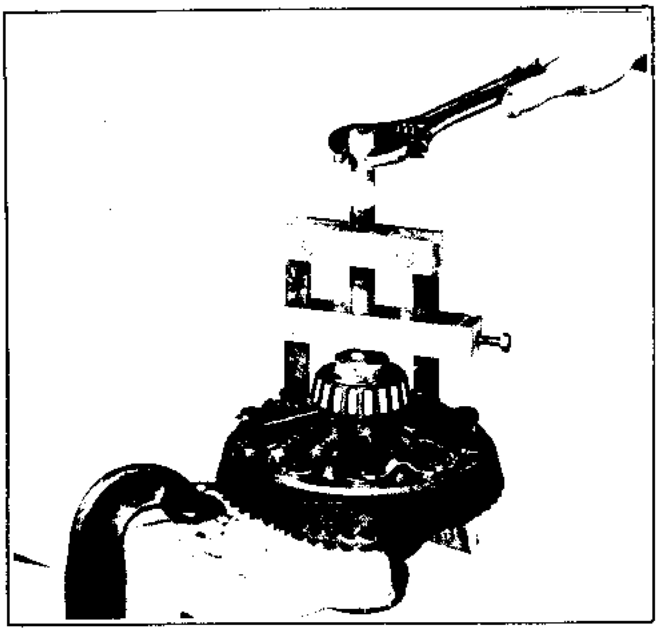


Figure 2B-17. Bearing Cone Removal

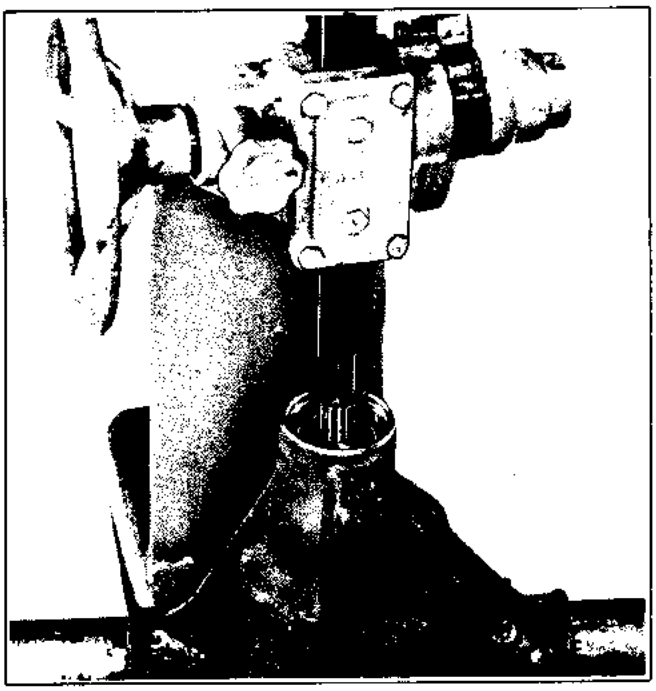


Figure 2B-18. Pressing Out Shaft

NOTE

If the cups or bearings are not worn or damaged, they may be reassembled and removal is not necessary.

16. Remove drive pinion shaft rear bearing cone (24) with press tool similar to one shown in Figure 2B-20.

NOTE

Later bearings are not press fit on pinion shaft.

17. Remove drive pinion shaft bearing cups (31) and (32) from housing with a drift or suitable puller. When removing bearing cup (32), remove adjusting shims (33), and record thickness of shims.

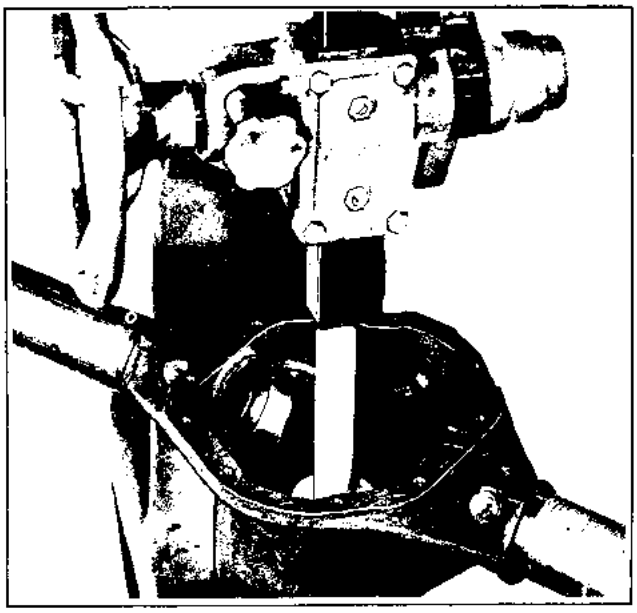


Figure 2B-19. Pressing Out Oil Slinger

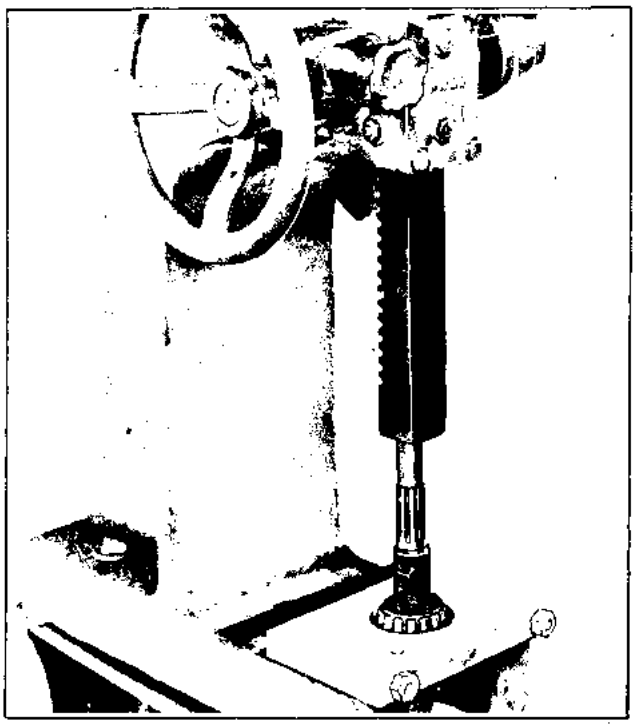


Figure 2B-20. Removing Pinion Shaft Rear Bearing Cone

18. Wash all parts including carrier and tube assembly with non-flammable cleaning solvent. Do not steam to clean.

19. Examine all bearing surfaces and splines for burrs or scoring. Remove burrs with a hand stone.

20. Check all bearing cups and cones for nicks, roller end wear, grooves and any damage, and replace accordingly. Do not replace a worn cup or cone individually--Renew in sets only if either is worn.

21. Examine differential pinion mate and side gear thrust washers for wear.

22. All seals once removed should be replaced with new parts.

23. Replace all defective parts. Drive gears and drive pinions are available only in matched sets. Do not replace one gear or one pinion only.

ASSEMBLING DIFFERENTIAL CASE ASSEMBLY AND DRIVE PINION

1. Install differential side gears (18) thrust washers (19), differential pinion mates (16), thrust washers (17), and differential pinion mate shaft (15) in the differential case. Lubricate all parts with differential lubricant. If new gears and washers are used, it will not be necessary to check gear backlash. Correct fit is provided when using new parts.

2. Place differential case assembly (11) in a suitable holding fixture.

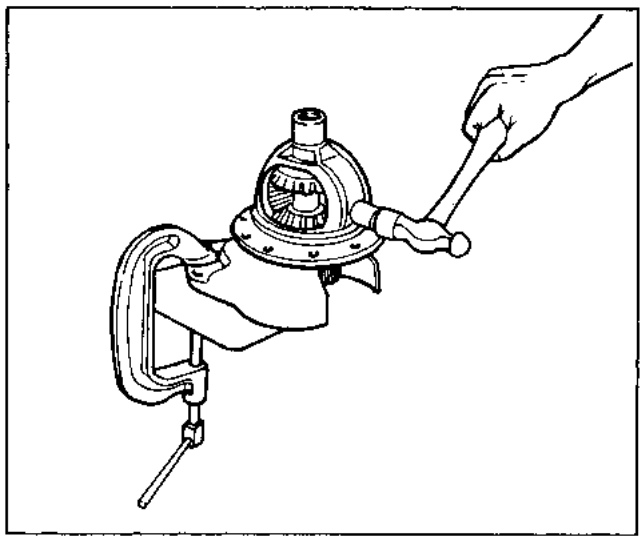


Figure 2B-21. Peening Case Over Top of Pin

3. Align lock pin hole in differential pinion mate shaft (15) and drive in differential pinion mate shaft lock pin (10). Peen case metal over top of pin to lock in place (See Figure 2B-21).

4. Install drive gear (14) with screws (13). Torque screws to 45 ft.-lbs.

5. Position under arbor press. Press on differential bearing cones (9) without shims (12). Use press tool similar to one shown in Figure 2B-22.

6. Place bearing cups (8) on the bearing cones (9). Make sure parts are clean and free from nubs and burrs. Cups should be clean and free from mutilations.

7. With differential cover side up, place differential case assembly (11) in housing (2).

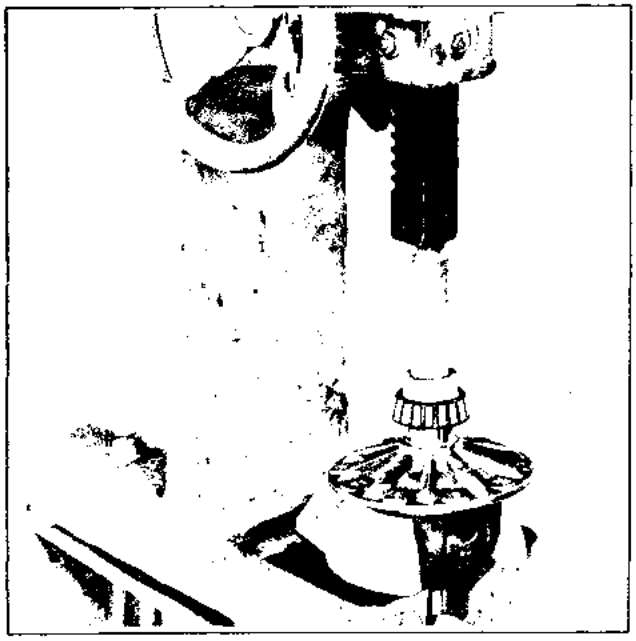


Figure 2B-22. Pressing On Bearing Cone

8. Install differential bearing caps (6) in their correct positions, as noted in Step 4 of disassembly, with bearing cap screws (5) finger tight.

9. Set up dial indicator gage shown in Figure 2B-23 with contact point on back of ring gear. With screwdriver blade between bearing cup and housing, pry case assembly as far as possible to one side of housing. Set dial indicator at zero. Shift case assembly to opposite side of housing and record reading. See Figure 2B-24. This reading will be the shim pack thickness to be placed between bearing cone assembly (9) and differential case (11) later in the procedure.

10. Remove bolts (5), differential bearing caps (6) and place differential assembly (11) in a holding fixture or vise.

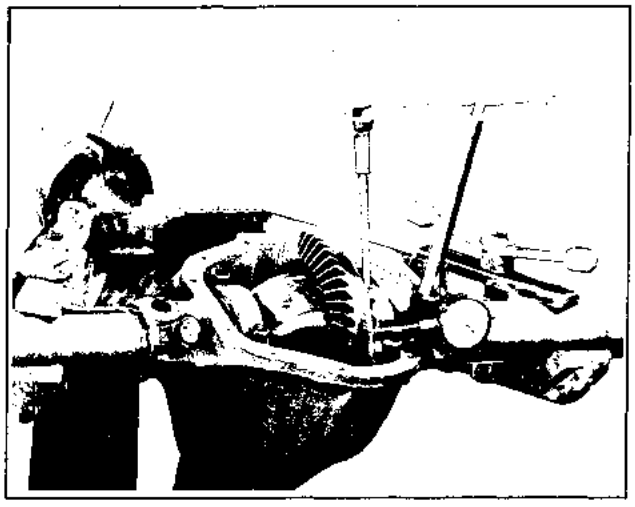


Figure 2B-23. Dial Indicator Gage Set Up

11. Note figures etched on drive pinion (22) end. See Figure 2B-25. Four sets of figures are etched on drive pinion. One figure is found on both the drive pinion and the drive gear and identifies a matched set. Directly opposite this figure will be one with a (+) or (-) before it, or, if not a (+) or (-), the figure will be 0. This number must be positively identified before continuing with the assembly procedure. Midway between the two sets of figures described above are numbers and letters etched for manufacturing purposes only, but as one of these numbers may be (0) and might be confused with the number needed for assembly procedure, a rule to follow would be to first examine the shaft end for a (+) or (-) number, and only if a (+) or (-) number is not etched on the shaft, will the number be (0).

12. Install drive pinion shaft rear bearing cone (24) and spacer (25) with press tool similar to one shown in Figure 2B-26.

NOTE

Later bearings are not a free slip fit on pinion shaft.

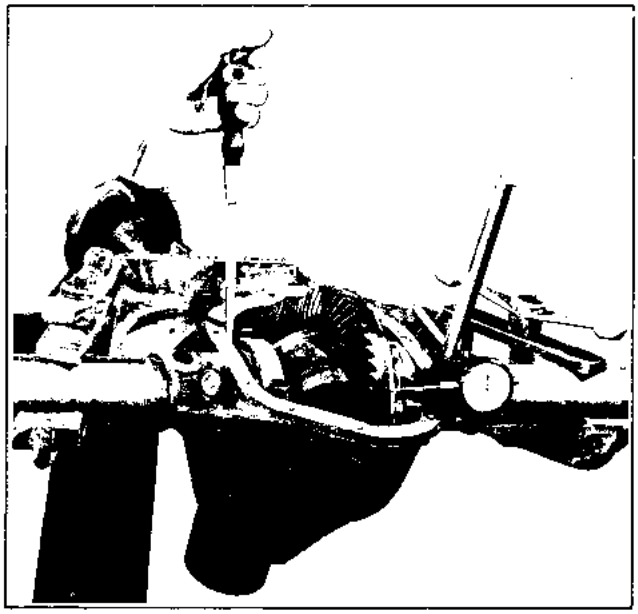


Figure 2B-24. Dial Indicator Gage Reading

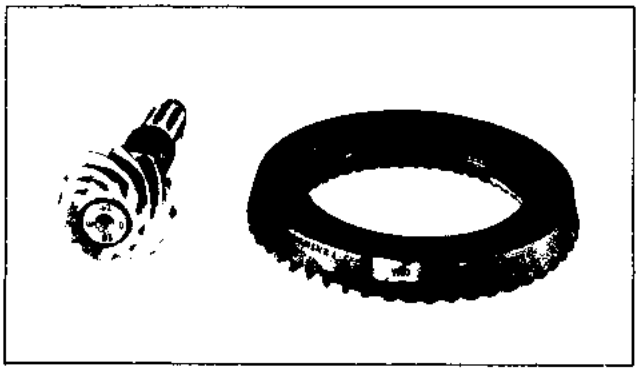


Figure 2B-25. Drive Pinion and Drive Gear

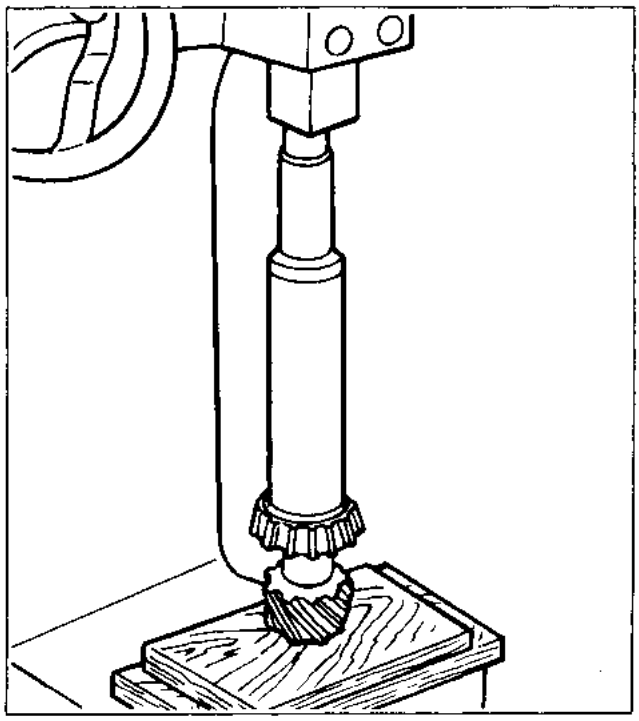


Figure 2B-26. Installing Rear Bearing

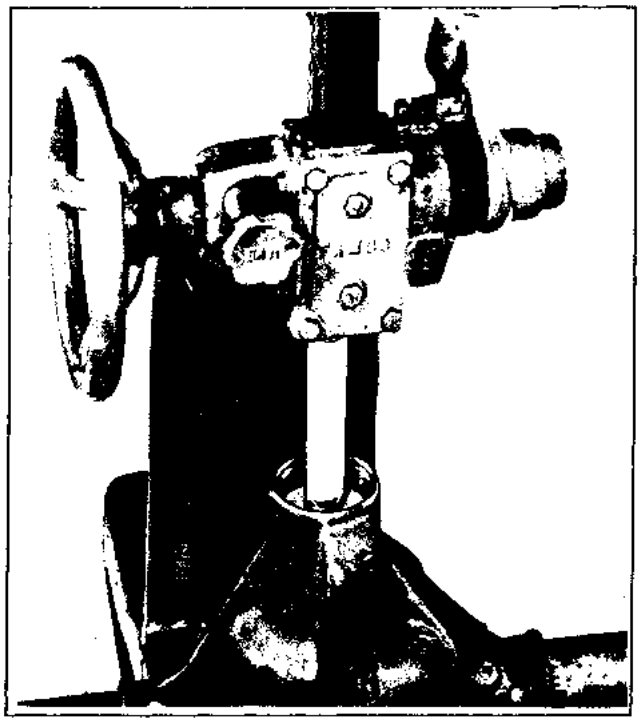


Figure 2B-27. Installing Front Bearing Cup

13. Press drive pinion rear bearing cup (32) and shim pack (33) in carrier, using tool similar to one shown in Figure 2B-27.

FOR A NEW PINION AND GEAR ONLY: The thickness of shims to be placed between the bearing cup and carrier can be determined from the shims removed and the etched marking on the pinion. The (+) or (-) figure indicates the variation from the nominal distance between the front of the pinion and the center line of the carrier. For example, if a pinion marked (+2) was originally installed with a shim pack of .035" and the new pinion was marked (-1), the shim pack should be increased .003" to bring the new pinion to its correct position and the new shim pack would be .038". Shims are available in .003", .005" and .010" thicknesses.

14. Press front bearing cup (31) in carrier with press tool similar to one shown in Figure 2B-27. Install drive pinion shaft.

15. Install drive pinion shaft front bearing cone (30) on shaft (22) in carrier (support pinion gear end). Lubricate bearings with differential lubricant. Rotate drive pinion.

CAUTION

If desired, the gage distance of pinion gear face from axle centerline can be measured with special gaging equipment to be found at rear axle repair shops. Nominal gage setting for axle is 1.938 in. (Pinion (+) or (-) number must be added or subtracted from this figure for correct micrometer reading.) If gage micrometer reads outside gage setting, add or remove shims (33) from behind rear pinion bearing cup (32) to correct reading. See Step 13.

16. Install oil slinger (27), gasket (29), and seal (28).

17. Install end yoke (23), washer (21), retainer (21A), cotter pin (20A), and nut (20). Finish tightening nut with torque wrench and socket to 50 to 70 ft-lbs. See Figure 2B-28. Where applicable, bend one side of retainer (21A) against flat on nut (20).

18. Check torque to turn drive pinion. Drive pinion shaft must be vertical for this check. Use a small torque wrench, reading in inch-pounds, and socket on shaft nut. Turning torque should be 2 to 13 in.-lbs.

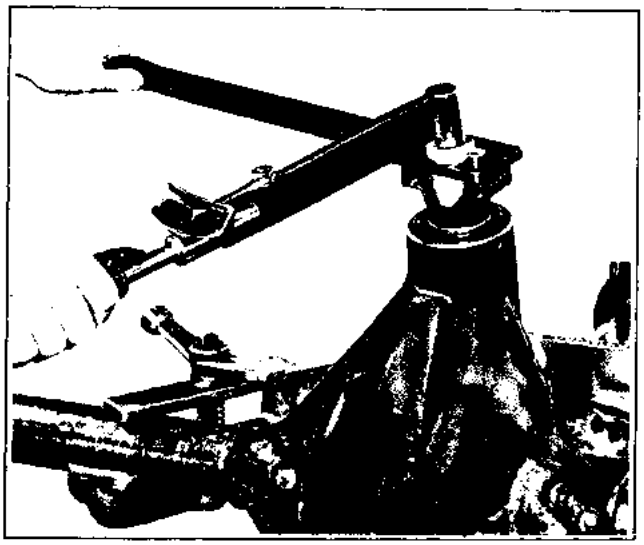


Figure 2B-28. Tightening Nuts with Torque Wrench and Socket

Torque reading to start shaft turning will be disregarded. If torque is more than 13 in.-lbs, it will be necessary to add a sufficient number of shims to those previously placed on drive pinion to reduce turning torque. If torque reading is low, remove shims. Shims are available in the following thicknesses: .003", .005", .010", and .030". On late 1975 electric cars, stake pinion nut (35) in two places and install pinion nut cup (36).

19. Place drive gear and differential case assembly, bearing cups included, in carrier. Place bearing caps (6) in their respective positions, align identification marks, with screws (5) finger tight.

20. Move drive gear into drive pinion and, from shim requirements as determined in Step 9, place shims (12) between cup and carrier as shown in Figure 2B-29. Force shims in both sides so as to use total required and have gear rotate with no backlash.

CAUTION

To decrease backlash, remove shims from left side (side on which gear teeth mesh) and transfer same amount of shims to right side. To increase backlash, reverse this procedure.

21. Place differential case in fixture and remove differential bearing cones. Install shims as indicated in Step 20 and then press on bearing cones. Lubricate bearings with differential lubricant.

22. Install differential drive gear and case assembly (7), including bearing cups (8), into housing. To insure proper seating of differential bearings in the cross-bore, the drive gear should be tapped with a rawhide hammer. Care must be taken in this operation to prevent nicking of drive pinion or drive gear as they are meshed together.

23. Install differential bearing caps (6). Bearing cap marks must match marks on carrier. Coat cap screw (5) threads with sealing compound, and torque screws to 45 ft.-lbs. Be sure all surfaces are clean and free from mutilation.

24. Set up dial indicator and with contact point on a drive gear tooth, check backlash between drive gear and drive pinion. See Figure 2B-30. Check backlash at four equally spaced points around drive gear. Backlash must be held between .004" to .009" and cannot vary more than .002" between positions checked. If backlash does not fall within these specifications, change shim packs on both differential bearings. See Step 20.

25. Install gasket (4) and cover (3) using a new gasket. Torque cover screws to 20 ft.-lbs.

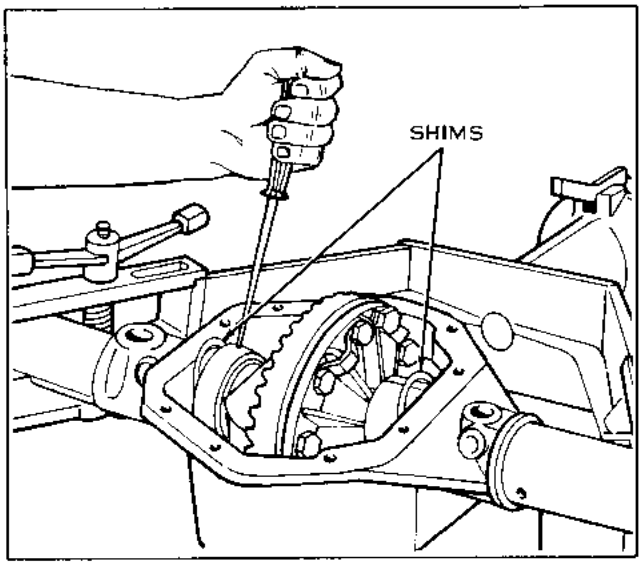


Figure 2B-29. Adding Shims

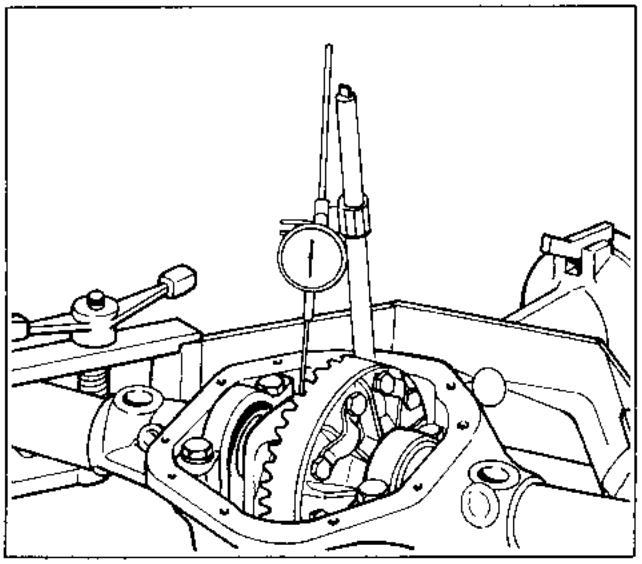


Figure 2B-30. Checking Backlash

INSTALLING REAR AXLE AND DIFFERENTIAL ASSEMBLY (Fig. 2B-14)

Install axle and differential assembly in car and fasten with four mounting bolts (1).

Install "Axle Shafts," "Wheels" (Section 2C), and "Drive Coupling" (Section 4D) or "Transmission Rear Drive" (Section 4B) and "Brake" (Section 2G). Fill rear axle differential with recommended lubricant (see Specifications).

NOTES

DRIVE

ALL-ALUMINUM CASED DIFFERENTIAL (Late 1977 and Early 1978)

DIFFERENTIAL AND AXLE

GENERAL

The differential lubricant level should be checked yearly and lubricant added as required to fill to level of filler plug hole. A bent wire may be used as a dipstick. See figure 2B-31. Harley-Davidson Transmission Lubricant is required per specifications in Section 1 of this manual. It is not recommended to mix various brands of hypoid lubricants. On all-aluminum differentials, it is necessary to remove differential from car and disassemble for flushing.

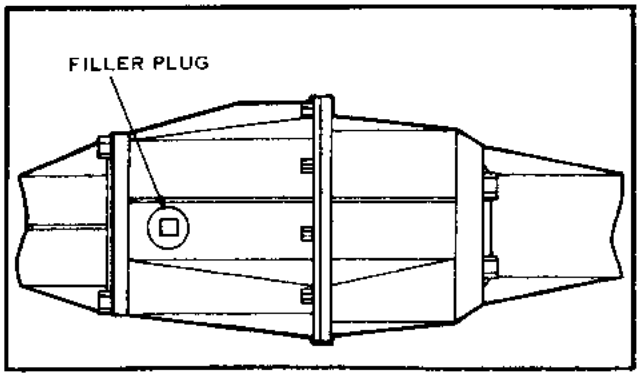


Figure 2B-31. Differential Filler Plug (Late 1977 to Early 1978)

REAR AXLE

REMOVING AXLE SHAFT (Fig. 2B-32)

If an axle must be removed from the housing for reasons of straightening or replacement, it can be taken out without removing entire differential and axle assembly from car. If differential is not drained prior to pulling axles, fluid will drain from axle housing. After reassembly check level of fluid in differential and fill as required.

Block rear frame of car so that rear wheel(s) are off the ground. Remove hub caps and four wheel mounting bolts. Remove wheel assembly and wash housing free of dirt and grime. Remove four nuts (1), lockwashers (2) and bolts (3) from axle housing. Pull axle and wheel hub assembly, which includes axle (12), wheel hub (6), axle bearing (10) and plate (9) from axle housing. Bend tabs of washer (4) away from flat of axle nut (5) and remove nut, washer, hub (6), key (7), spacer (8) and plate (9). Press ball bearing (10) from axle. Pull seal (11) from axle housing and discard.

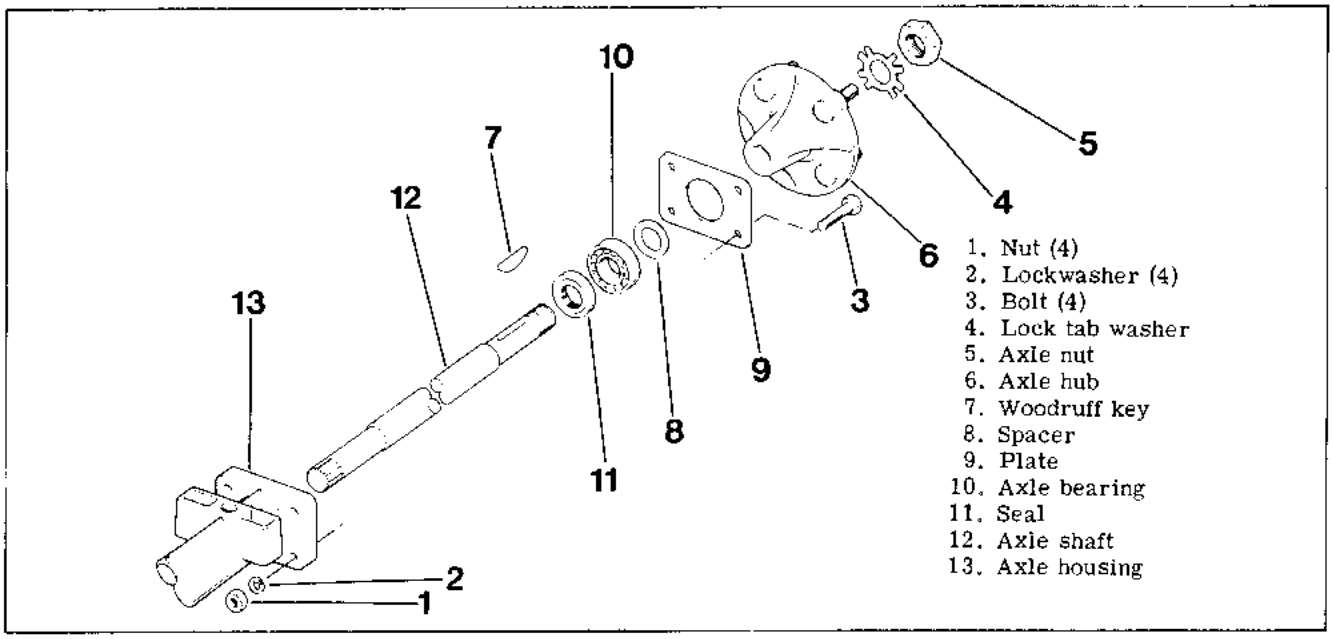


Figure 2B-32. Rear Axle (Late 1977 and Later) - Exploded View

CLEANING AND INSPECTION

Clean all parts with non-flammable cleaning solvent. Inspect bearing for excessive wear or side play. Replace all parts worn or damaged.

INSTALLING AXLE SHAFT (Fig. 2B-32)

Press new oil seal (11) into axle housing. Press axle bearing (10) onto axle shaft (12). Pack bearing with Harley-Davidson Bearing Grease and insert axle into housing. Rotate until splines on axle shaft align with splines in differential bevel gear so that axle can be pushed in and properly seated. Bearing must seat flush with face of axle housing. Secure plate (9) to axle housing (13) with four bolts (3), lockwasher and nuts (1). Torque bolts to 35-40 ft.-lbs.

Place spacer (8) on shaft up against bearing and place key (7) into shaft keyseat. Slide on hub assembly (6) and secure with tab washer (4) and axle nut (5). Torque axle nut to 100 ft.-lbs. then tighten additionally until tab on washer can be bent against flat of nut. Reinstall wheel assembly and hub caps. Check fluid level in differential and fill as required.

DIFFERENTIAL

REMOVING REAR DRIVE ASSEMBLY (Fig. 2B-33)

To repair the differential, it is necessary to remove the entire rear drive assembly from car. Remove wheels and transmission rear drive assembly. See "CLUTCH". Block rear frame of car off ground. Do not block under axle or differential. Disconnect cylinder stabilizer (4D, Figure 3C-68) from axle. Support differential assembly and remove four locknuts (39) and four U-bolts (38) securing axles to frame.

DISASSEMBLY OF DIFFERENTIAL CASE (Fig. 2B-33)

Before disassembly, clean outside of housing thoroughly with a non-flammable cleaning solvent. Remove fill plug (12) and drain fluid from unit. Place differential on a clean bench or work stand.

1. Remove axle assemblies from differential by removing four bolts (13) and lockwashers (14). Separate axle assembly from differential. Remove and discard O-ring (15).

2. Remove the ten key head screws (17) and separate cover (18) from pinion case (19). Remove and discard cover gasket (20). Remove differential assembly (35) from case. Remove thrust washers (22) and thrust bearing (23) from differential carrier (24). If further inspection of needle bearing (21) in differential case or cover is required, pull bearings using a suitable bearing puller.

3. Separate differential carrier (24) from ring gear (25) by removing the four bolts (26), lockwashers (27) and two locktabs (28). Mark parts (24) and (25) so they can be put back together exactly the same way during reassembly. Bend locktabs flat. Remove the bevel gear (29) and thrust washer (30) from the ring gear.

4. To remove the small dowel pin (31) which holds the drive pin (32) in place, tip the pin hole downward and gently tap the side of the gear carrier. Pin (31) should fall out. Remove the drive pin (32), two bevel pinions (33), two washers (34), bevel gear (29) and thrust washer (30).

5. Remove pinion as described in "REMOVING PINION AND PINION BEARING".

REMOVING PINION AND PINION BEARING (Fig. 2B-33)

Should the pinion bearing need replacing, it is not necessary to remove the entire axle and differential assembly from the car. Only the transmission rear drive need be removed, see "CLUTCH". A slight amount of differential fluid may drain from the differential when the pinion is pulled. After assembly, check fluid level in differential and fill as necessary.

NOTE

Thrust washer (3) will fall in differential case snap ring groove (2) when attempting removal. To remove, center and pull with magnet or bend and break it out.

Remove and discard oil seal (1). Remove retaining ring (2) and thrust washer (3). Pull pinion assembly (4) out of housing. Remove ball bearing (5), retaining ring (6), outer bearing race (7), thrust bearing (8) and inner bearing race (9). Needle bearing (10) may be pulled from housing if necessary for inspection or cleaning.

Clean all parts carefully and inspect for wear or damage. See "CLEANING AND INSPECTION".

ASSEMBLING PINION AND PINION BEARING (Fig. 2B-33)

Place inner bearing race (9), thrust bearing (8), and outer bearing race (7) on the pinion shaft (11). Secure with retaining ring (6). Slip ball bearing (5) on shaft. Press needle bearing (10) into housing, if removed. Insert pinion assembly (4) into housing, ro-

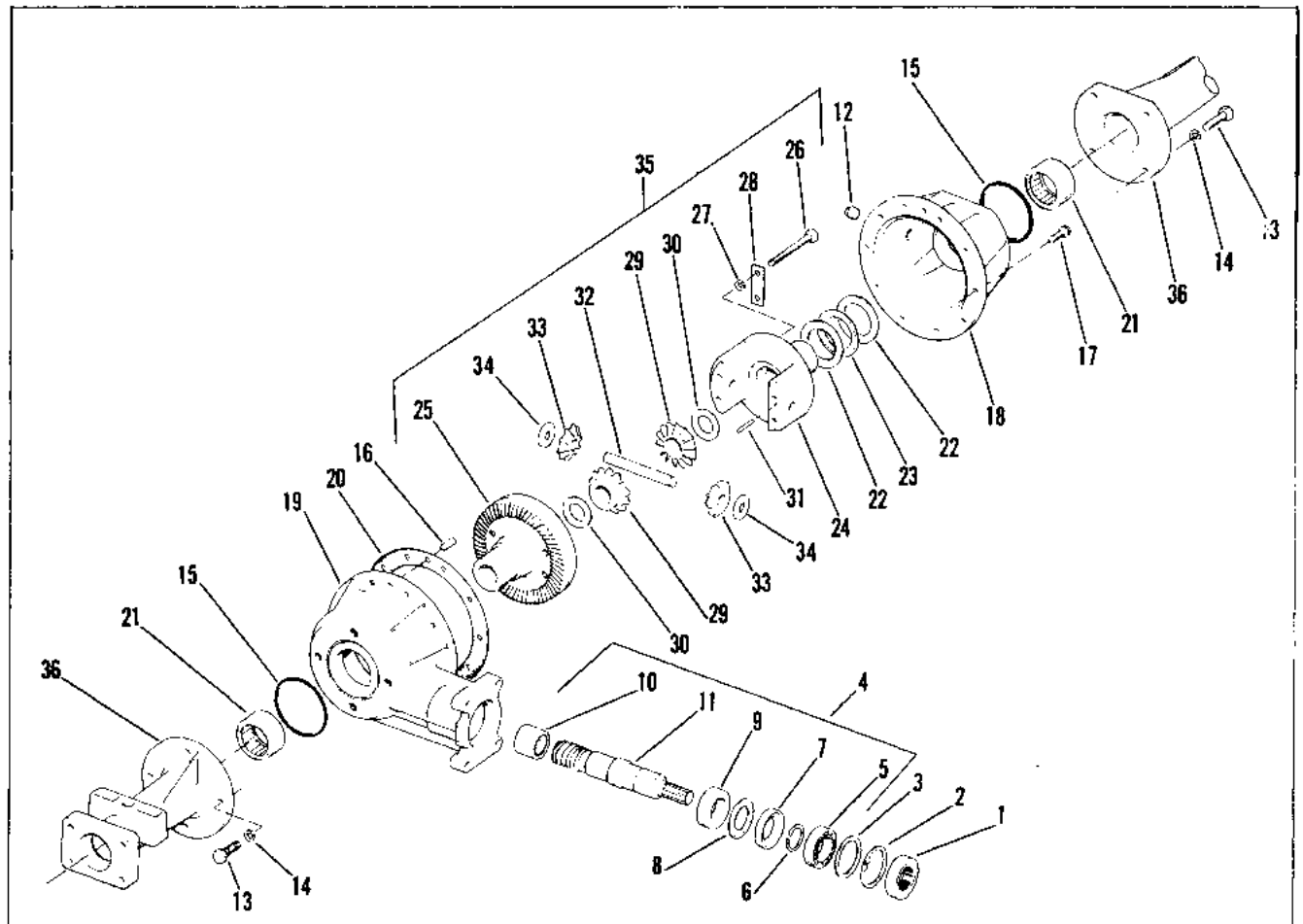
tating slowly to mesh with ring gear (25) in differential. Insert washer (3), retaining ring (2) and press in a new oil seal (1).

CLEANING AND INSPECTION

Clean all metal parts with non-flammable cleaning solvent. Seals, gaskets and O-rings should be discarded and replaced. Examine all components for excessive wear and damage. Replace as necessary. Remove burrs from bearing surfaces and splines with a hand stone. Replace bearings which are nicked, grooved or damaged in any way.

ASSEMBLY OF DIFFERENTIAL CASE (Fig. 2B-33)

1. Install pinion in differential housing as described in "ASSEMBLING PINION AND PINION BEARING".



1. Seal
2. Retaining ring
3. Thrust washer
4. Pinion assembly
5. Ball bearing
6. Retaining ring
7. Outer bearing race
8. Thrust bearing
9. Inner bearing race
10. Needle bearing
11. Pinion
12. Fill plug
13. Bolt (4)
14. Lockwasher (4)
15. O-ring
16. Dowel pin (2)
17. Screw (10)
18. Differential cover
19. Pinion case
20. Cover gasket
21. Needle bearing (2)
22. Thrust washer (2)
23. Thrust bearing
24. Gear carrier
25. Ring gear
26. Bolt (4)
27. Lockwasher (4)
28. Locktab (2)
29. Bevel gear (2)
30. Thrust washer (2)
31. Pin
32. Drive pin
33. Bevel gear (2)
34. Washer (2)
35. Differential assembly includes bracketed items plus needle bearing (2), item 21
36. Axle housing

Figure 2B-33. Differential Assembly (Late 1977 and Early 1978) - Exploded View

2. Place one thrust washer (30) and bevel gear (29) into gear carrier (24). Assemble washers (34) and bevel pinions (33) into gear carrier while installing large drive pin (32). Insert holding pin (31). Install remaining thrust washer (30) and bevel gear (29) into drive gear housing (25) and attach drive gear to gear carrier with four lockwashers (27), bolts (26) and two locktabs (28). Use matchmarks previously made on gear carrier (24) and drive gear (25) so that they are oriented the same way they were before disassembly. Torque bolts to 35-40 ft.-lbs. and then bend corners of locktabs (28) against flat of bolt (26).

3. Place differential case (19) in suitable fixture and press in needle bearing (21) so that it extends out of case (toward axle housing) 7/32". Likewise, press other needle bearing (21) into differential cover (18) so that it also extends out of case 7/32".

4. Place differential assembly (35) in case (19). Place thrust washers (22) and thrust bearing (23) on gear carrier. Position gasket (20) and cover (18) over dowel pins and secure with ten screws (17). Torque to 15-18 ft.-lbs.

5. Check side play of differential assembly with a dial indicator placed against end of differential gear carrier (24) as shown in Figure 2B-34. Side play of carrier (24) should be in the range of .004 to .018 inches for normal running.

6. Place new O-rings (15) in case (19) and cover (18) face grooves and install axle housings (36). Secure each with four bolts (13) and lockwashers (14). Reinstall axles. See "AXLES".

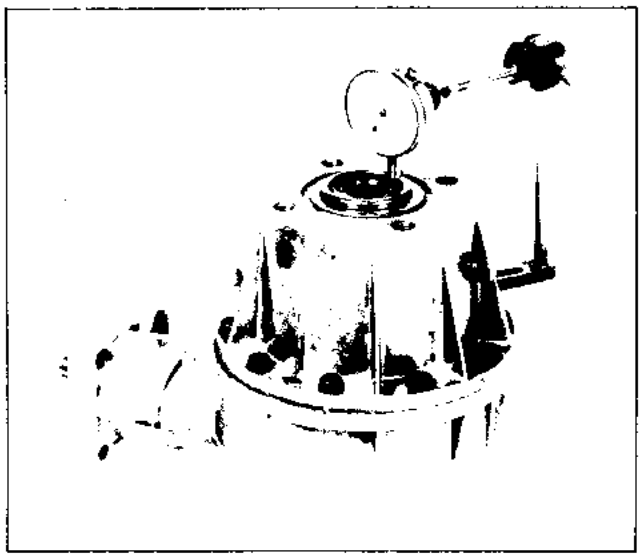


Figure 2B-34. Differential Assembly

INSTALLING REAR AXLE AND DIFFERENTIAL ASSEMBLY (Fig. 2B-33)

Install differential assembly in car with four bolts (38) and locknuts (39). Torque locknuts to 30 ft.-lbs. Install cylinder stabilizer (4D, Figure 3C-68). Install transmission rear drive and belt as described in "CLUTCH" section.

Fill differential with 24 oz. of Harley-Davidson Differential Lubricant. Check torque of locknuts (39) after two days or 36 holes of operation.

WHEELS

GENERAL

Maximum tire life and good handling qualities are directly related to care given to the wheels and tires. At regular intervals, or if handling irregularities are experienced, see the CHECK CHART for recommended service.

REMOVING AND INSTALLING FRONT WHEELS AND HUBS

3 WHEEL MODELS (See Figure 2C-45)

Raise front wheel clear of the ground with small jack or lift. 1969 & earlier: Remove cotter pin (1), nut (2) and washer (3). Loosen both axle clamp bolt nuts and lockwashers (4) and remove axle (5). Support wheel assembly (6) with hand, as axle is drawn from fork assembly. Remove spacer (7) from left side of wheel. 1970 & later: LOOSEN SETSCREW NUT AND SET-SCREW (4A) AT BOTTOM OF RIGHT FORK SLIDER unscrew axle (5A) using a rod through hole in end of axle. Remove spacer (7A) from left side of wheel. Pry off both hub caps (8) to expose wheel hub assembly (10). Remove nuts (9) and slide wheel hub assembly from wheel rim. To disassemble wheel hub, drift out bearings (11) from opposite sides of wheel hub (14) using 1/2" dia. brass drift. This will also remove seals (12). If bearing cups (13) are worn or pitted, drift out through opposite sides of wheel hub (14) with brass drift. Clean all parts and examine for damage or wear. Replace all damaged or worn parts. Pack wheel bearings with Harley-Davidson "Grease-All". If bearing cups (13) have been removed, press new cups into wheel hub (14). Install wheel bearings (11), wheel hub (14) and press in seals (12). Remount wheel hub assembly (10) in wheel rim with nuts (9). Install both hub caps (8), insert spacer (7) through left side hub cap axle hole and locate in bearing seal. Support wheel assembly (6) with valve stem to the left side of car and in alignment with fork sides. Install axle into fork side.

CAUTION

On 1969 & earlier models, axle nut (2) is also an adjustment for wheel bearings. Install washer (3), axle nut (2), and tighten nut until wheel drags slightly. Back off axle nut approximately 1/8 turn or until the next nut castellation lines up with the cotter pin hole in the axle. Install cotter pin (1) and tighten both axle clamp bolt nuts (4). See Figure 2C-45.

On 1970 and later models axle is also an adjustment for wheel bearings. Tighten axle until wheel drags slightly, then back off 1/8 turn, install setscrew and locknut (4A).

4 WHEEL MODELS (See Figure 2C-45A)

Raise front wheels off the ground with a small jack or lift. Remove hub caps, wheel rim mounting nuts, and wheel, same as for 3 wheel car (See Figure 2C-45).

To remove wheel hubs, Figure 2C-45A, remove grease cap (1), cotter pin (2), castle nut (3), and flat washer (4). Remove hub assembly (5) from axle (6).

To disassemble wheel hub, remove bearings (7 and 8) from each side of wheel hub. If bearing cups (10 and 11) are worn or pitted, drift out from opposite sides of hub. This will also remove seal (9). Clean all parts and examine for damage or wear. Replace all damaged or worn parts.

Pack wheel bearing (7 and 8) with Harley-Davidson "Grease-All". If bearing cups (10 and 11) have been removed, press new cups into hub (12). Install wheel bearings (7 and 8). Press seal into hub with lip facing hub (9). Apply a small amount of grease to lip of seal and install hub assembly on axle. Assemble washer (4) on axle. Turn on axle nut (3) and tighten until bearing play is taken up and hub returns freely. Install cotter pin (2), and grease cap (1). NOTE: Bearing should be slightly loose rather than preloaded.

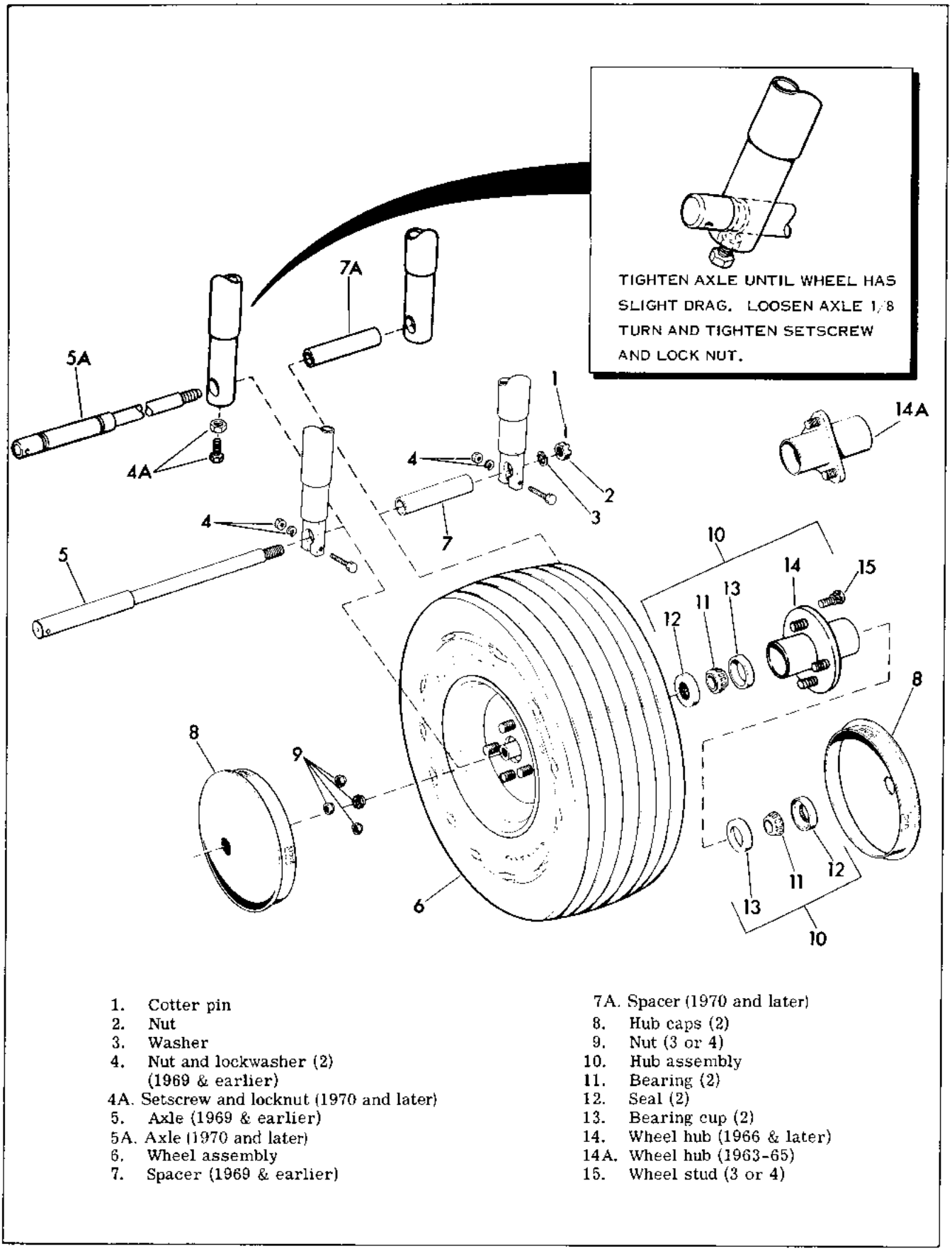
Assemble wheel to hub assembly (5) and torque wheel rim mounting bolts to 35-40 ft-lbs. Install hub cap.

REMOVING AND INSTALLING REAR WHEELS (Figure 2C-46)

Raise one or both rear wheels with small jack or lift and block in raised position. Remove hub caps (1) and the wheel rim mounting nuts (2). Pull wheel (3) assembly from axle hub (4). To reinstall, reverse order of disassembly.

CHECK CHART

CHECK FOR	REMEDY
1. Loose axle nuts and rear wheel mounting nuts.	1. Tighten loose nuts.
2. Incorrect tire inflation.	2. Inflate front and rear tires. See specifications, Section 1A.
3. Excessive freeplay in steering mechanism.	3. Adjust steering mechanism. See Section 2F, "Adjusting Steering Mechanism."



1. Cotter pin
2. Nut
3. Washer
4. Nut and lockwasher (2) (1969 & earlier)

4A. Setscrew and locknut (1970 and later)

5. Axle (1969 & earlier)

5A. Axle (1970 and later)

6. Wheel assembly
7. Spacer (1969 & earlier)

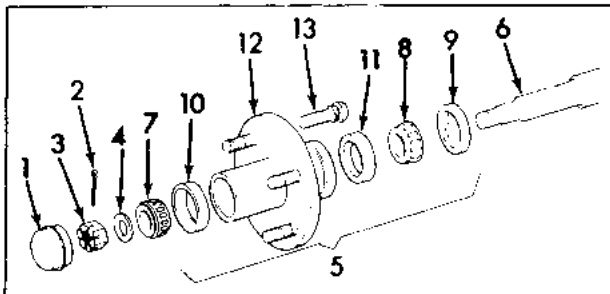
7A. Spacer (1970 and later)

8. Hub caps (2)
9. Nut (3 or 4)
10. Hub assembly
11. Bearing (2)
12. Seal (2)
13. Bearing cup (2)
14. Wheel hub (1966 & later)

14A. Wheel hub (1963-65)

15. Wheel stud (3 or 4)

Figure 2C-45. Front Wheel - 3 Wheel Car - Exploded View



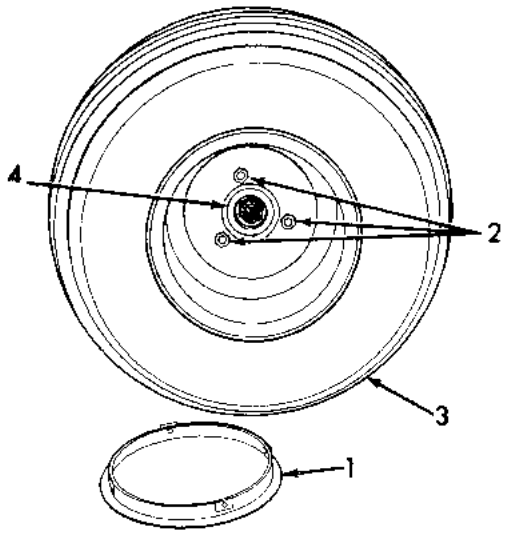
1. Grease cap
2. Cotter pin
3. Axle nut
4. Washer
5. Wheel hub assembly
6. Axle
7. Outer cone bearing
8. Inner cone bearing
9. Oil seal
10. Outer bearing cup
11. Inner bearing cup
12. Wheel hub
13. Wheel stud

Figure 2C-45A. Front Wheel Hub, 4 Wheel Car - Exploded View

REMOVING TIRE FROM RIM, FRONT OR REAR WHEEL (Figure 2C-47)

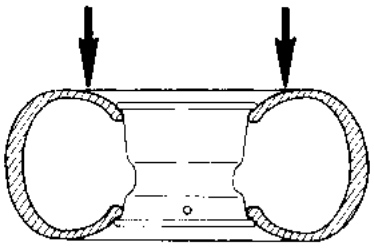
The car is fitted with low pressure tubeless tires.

In the event of a flat tire, remove wheel assembly as described in the preceding paragraphs and inflate the tire to 20 psi. Immerse tire in water to determine point of air leak. Mark point where bubbles escape. Leak could be due to any of the following: punctured casing, faulty valve core, valve stem improperly sealed in wheel rim or tire bead improperly seated on rim flange.

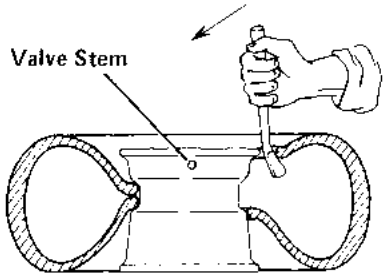


1. Hub cap
2. Mounting nuts (3 or 4)
3. Wheel and tire
4. Axle hub

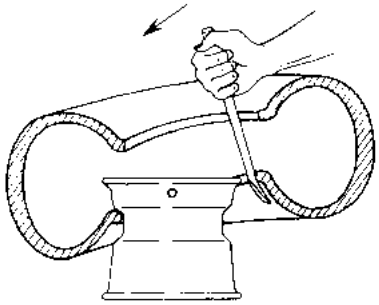
Figure 2C-46. Rear Wheel



Step I. Break Tire Beads Free of Rim



Step II. Removing Upper Bead From Rim



Step III. Removing Lower Tire Bead From Rim

Inflating Tire

Figure 2C-47. Tire Replacement

To remove tire from wheel rim, remove valve cap and valve core to free air from tire. Loosen both tire beads from rim flanges by applying pressure on tire side walls. Push tire bead off of wide rim flange into rim well. Using tire irons carefully start upper bead over edge of wheel rim. Do not use excessive force when starting bead over edge of rim or tire bead may be damaged. When one bead is free of wheel rim, shift lower bead into rim well on one side of wheel and insert tire tool on opposide and pry bead over rim flange. When bead has been started over rim flange, tire can be removed the rest of the way by hand.

REPAIRING TUBELESS TIRE

When the reason for loss of air has been determined and the tire has been removed, it is recommended that the standard tubeless tire repair procedure be followed depending on the nature of the air leak.

MOUNTING TIRE ON RIM

Clean both tire beads to remove any dirt or foreign matter. Clean wheel rim well, where tire beads seat, with a wire brush. This cleaning is very important as tubeless tires require a perfect seat between the wheel rim and tire beads to prevent loss of air. Install tire on rim using a rubber mallet or tire iron in manner opposite to removal. Apply liberal amount of tire mounting solution to the rim flange and tire beads. Remove valve core and position tire so the tire bead is seated on the rim flange narrow bead seat. Place tire upright against wall. Apply high pressure through valve stem while pushing against tire on side opposite wall and floor. This 3 point contact pressure will tend to bring beads out in contact with rim so that internal pressure is formed and beads snap into place. See Figure 2C-47. 30 to 35 pounds air pressure should be used to seat tire beads on rim. Quickly remove air pressure and install valve core. Correct to specified pressure and immerse in water to recheck for air leaks.

NOTE

If tire fails to seat on rim flanges during initial inflation, it is more than likely due to a lack of sufficient air pressure. The quantity of air going into the tire must be greater than the amount escaping past the tire bead and rim flange.

SERVICING FRAME

To rough check a frame for correct alignment, see Fig. 2E-9C. The dimensions shown will provide required information to determine whether a frame is out of alignment and requires re-aligning or replacement.

WARNING

Frames, front or rear forks that are severely bent or damaged should be replaced to maintain desired rider characteristics and ensure user safety.

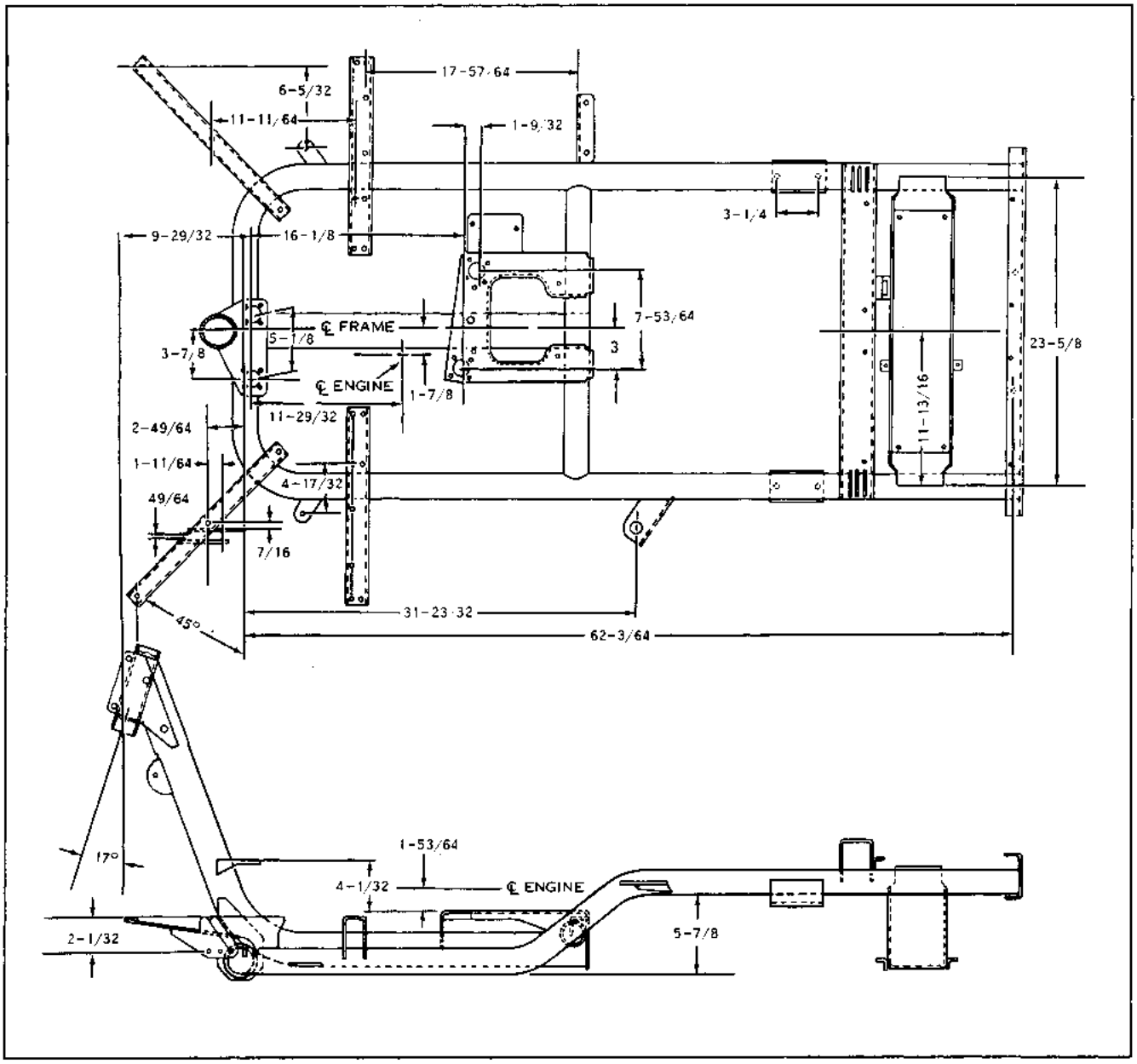


Figure 2E-9. 1963-65 Basic Frame Dimensions

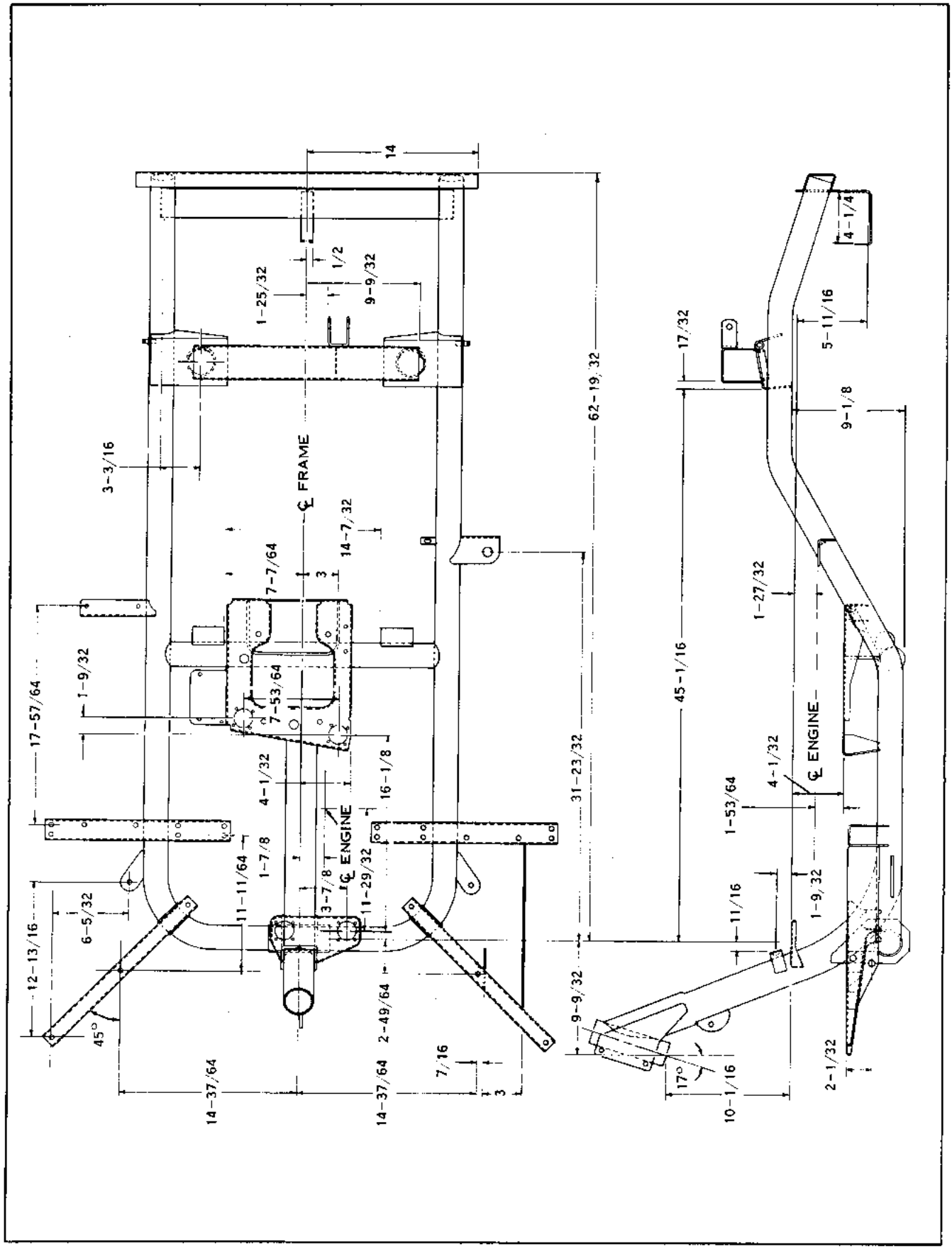


Figure 2E-9A. 1966 Model D, 1966-68 Model DC Basic Frame Dimensions

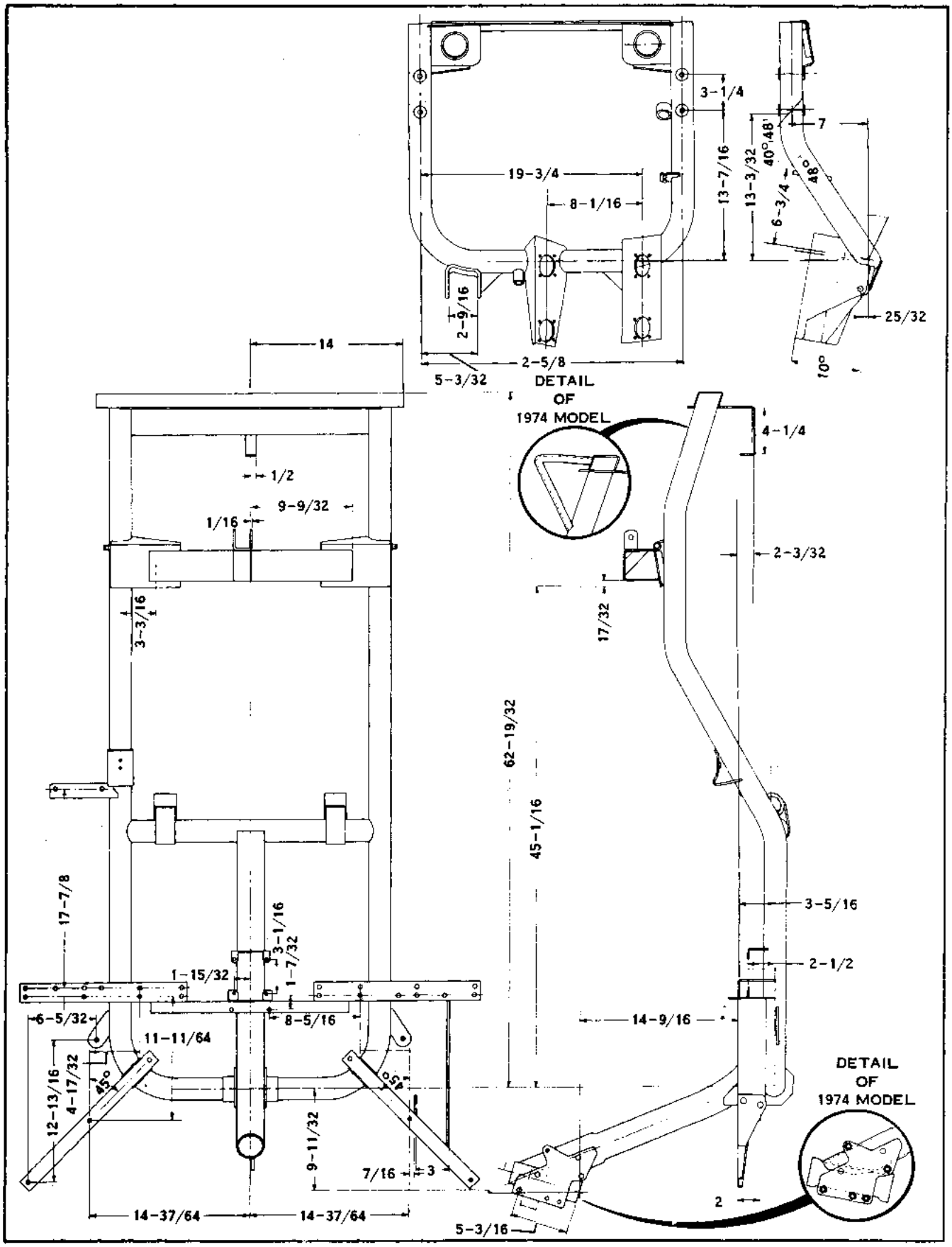


Figure 2E-9B. 1967-1974 Model D Basic Frame Dimensions

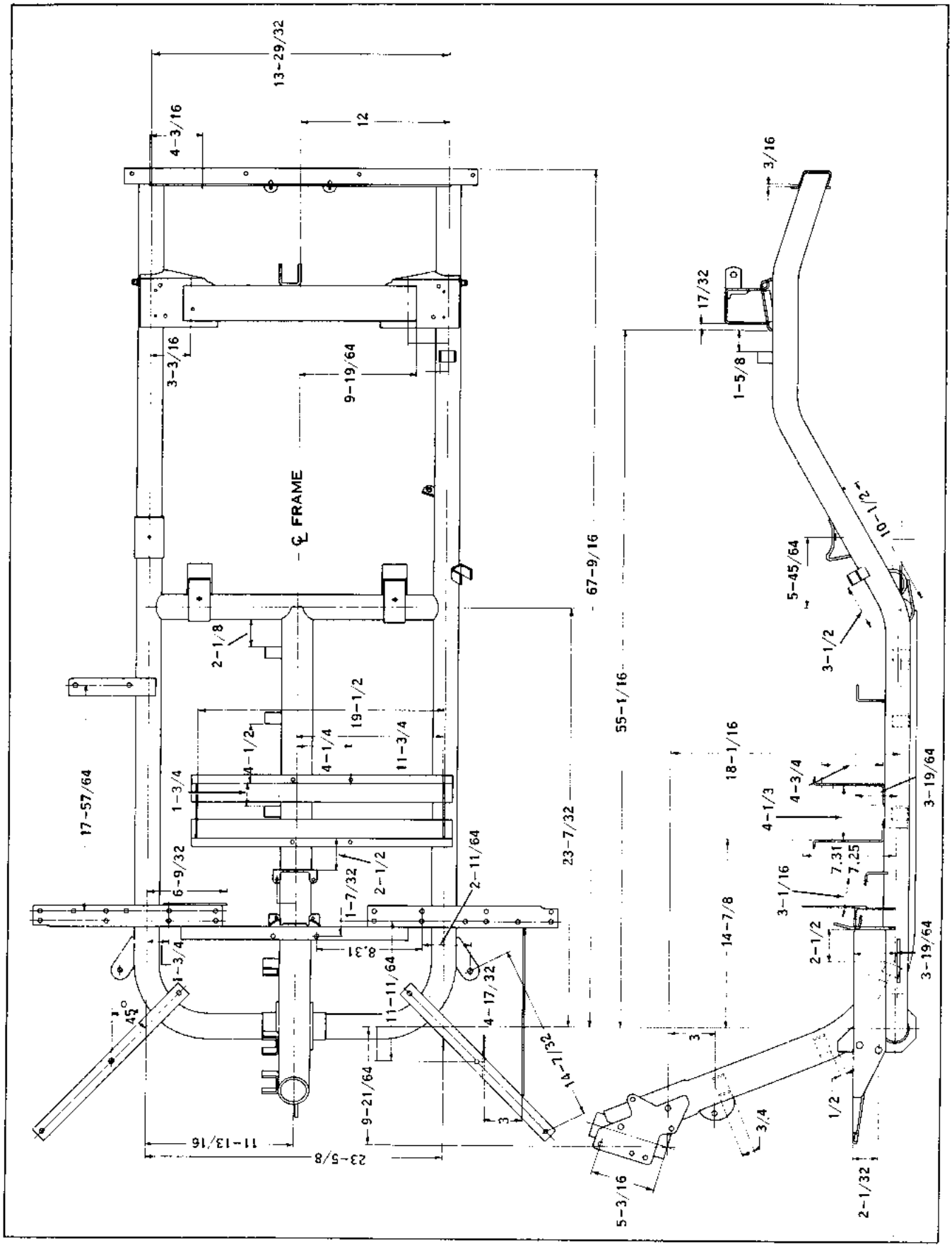


Figure 2E-9C. 1969-1972 Model DC Basic Frame Dimensions

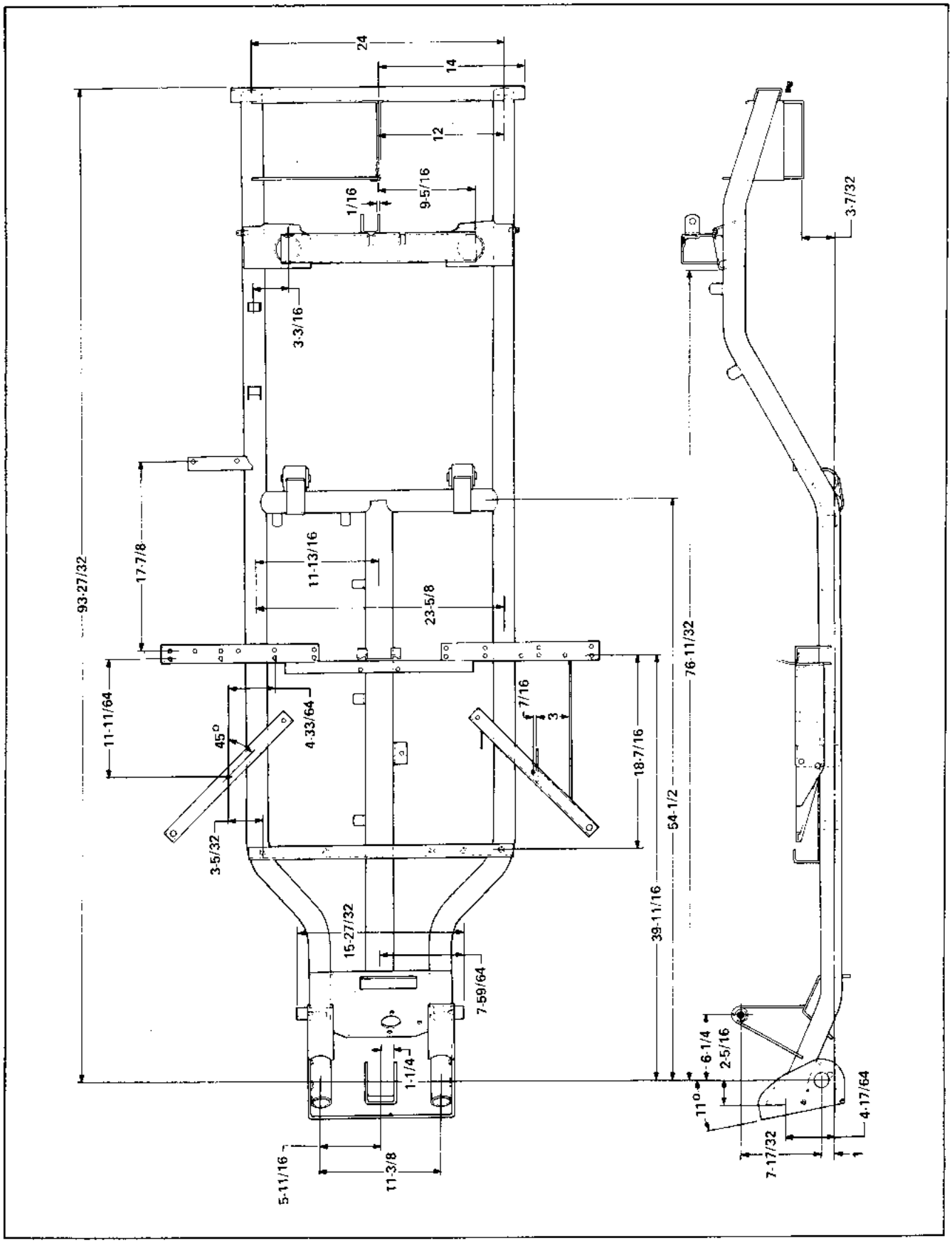


Figure 2E-9D. 1972-1974 Model D4 Basic Frame Dimensions

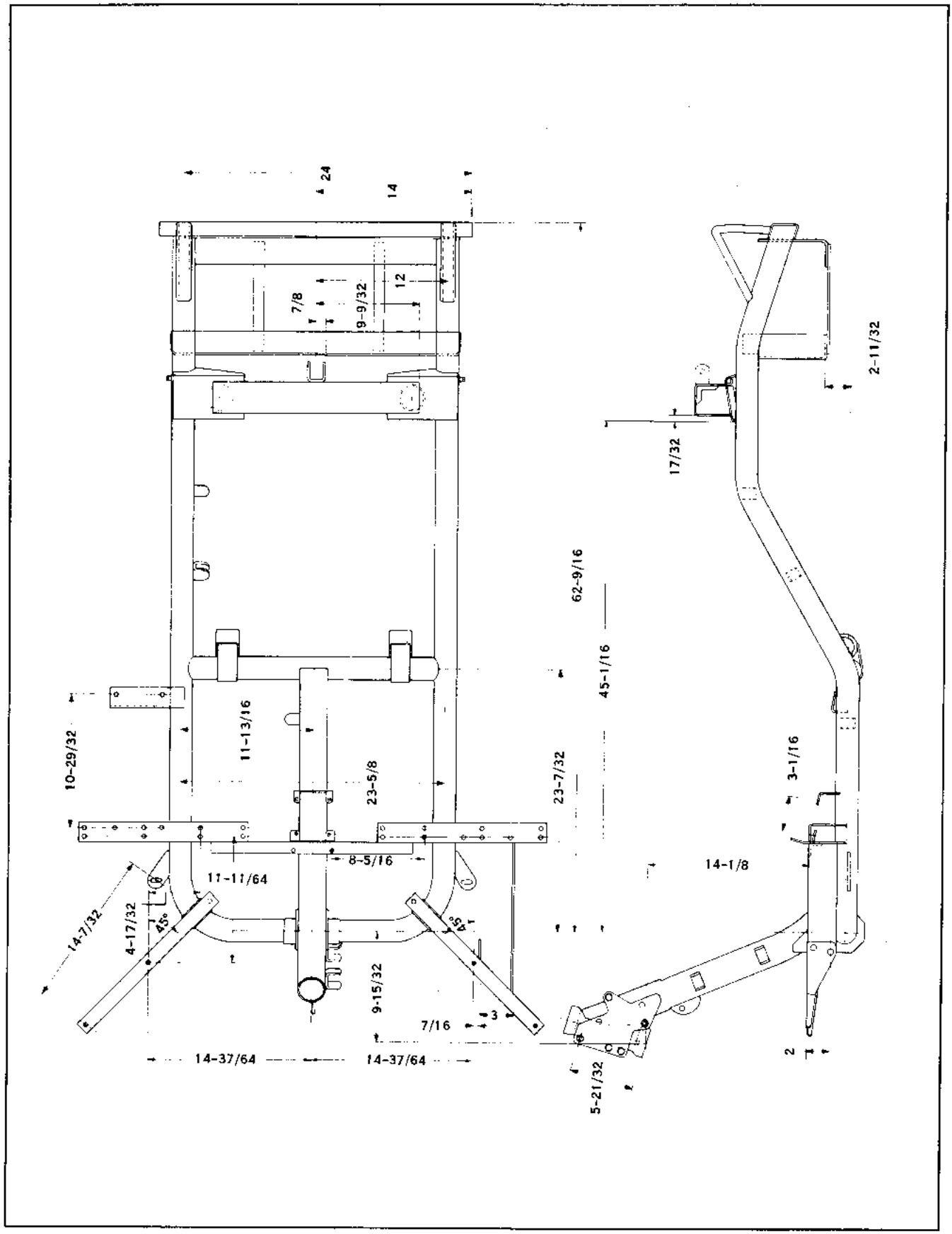


Figure 2E-9E. 1975 and Later Model D Basic Frame Dimensions

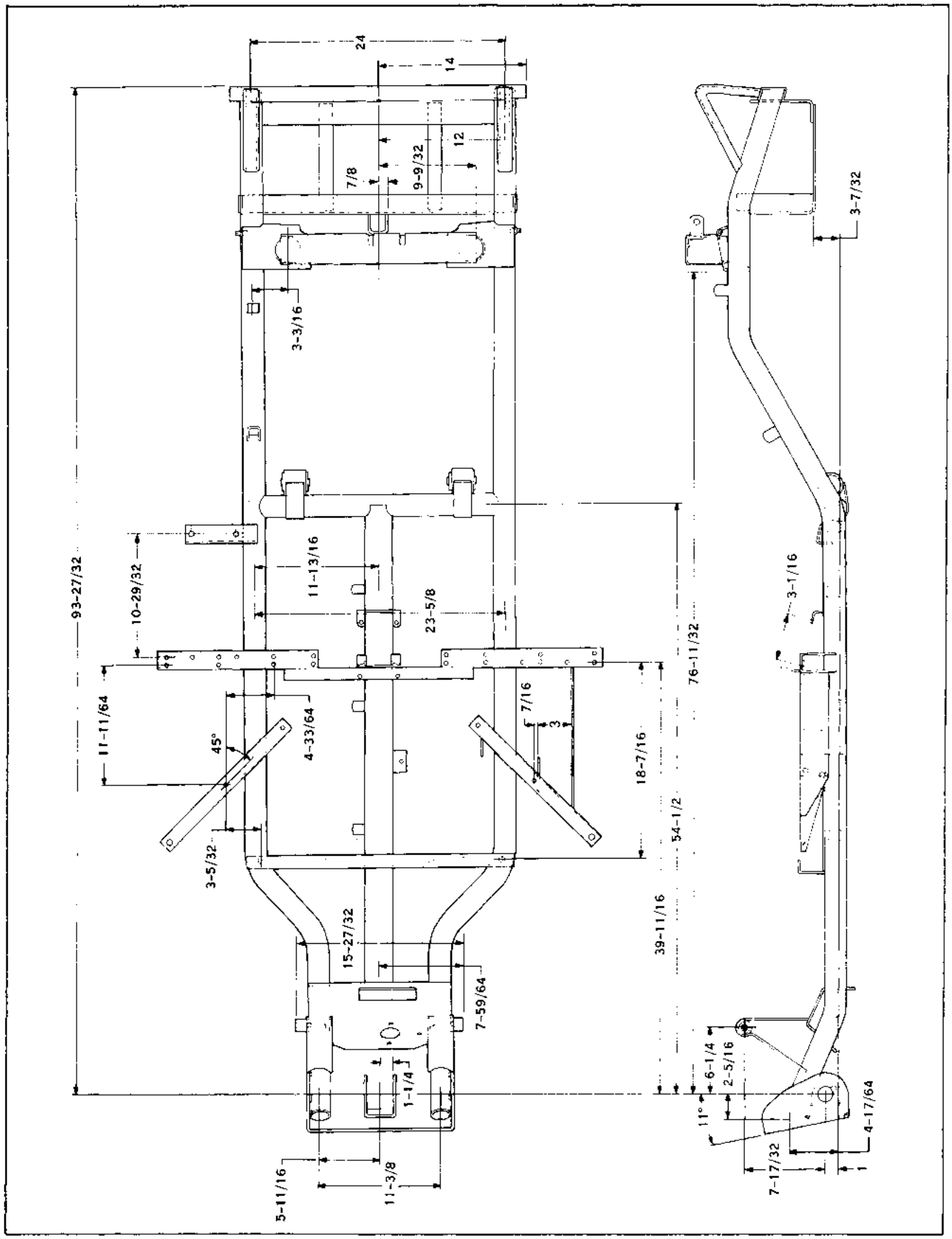


Figure 2E-9F. 1975 and Later Model D4 Basic Frame Dimensions

NOTES

TILLER STEERING-1973 AND EARLIER

ADJUSTING TILLER MECHANISM (Figure 2F-69)

If excessive free play or slack (1/2" or more at loop in tiller bar) develops in the tiller bar, adjust steering adjustment nut (8 or 8A, Figure 2F-69) by reaching up between the front fork housing section and tiller tube assembly and carefully tighten adjusting nut until free play is gone. Figure 2F-68 shows adjustment of 1969 & earlier model with fork housing removed. 1970 and later models have a wing nut.

CAUTION

Do not overtighten adjusting nut or steering chain damage will result.

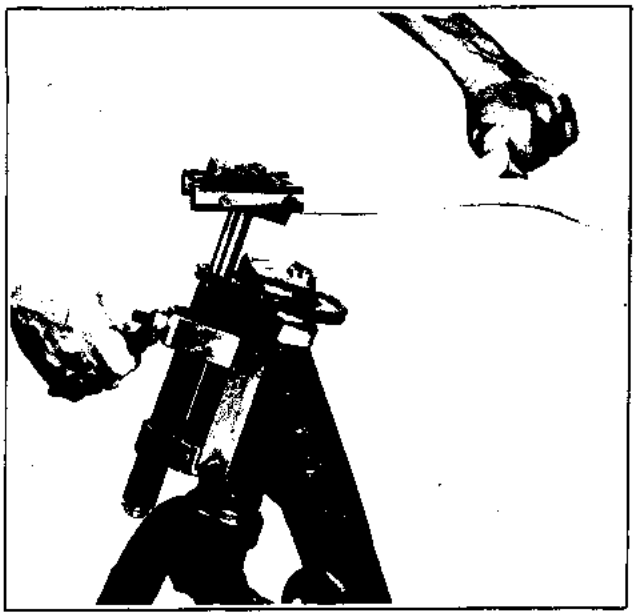


Figure 2F-68. Adjusting Tiller Chain (1973 & Earlier) (Fork Housing Removed)

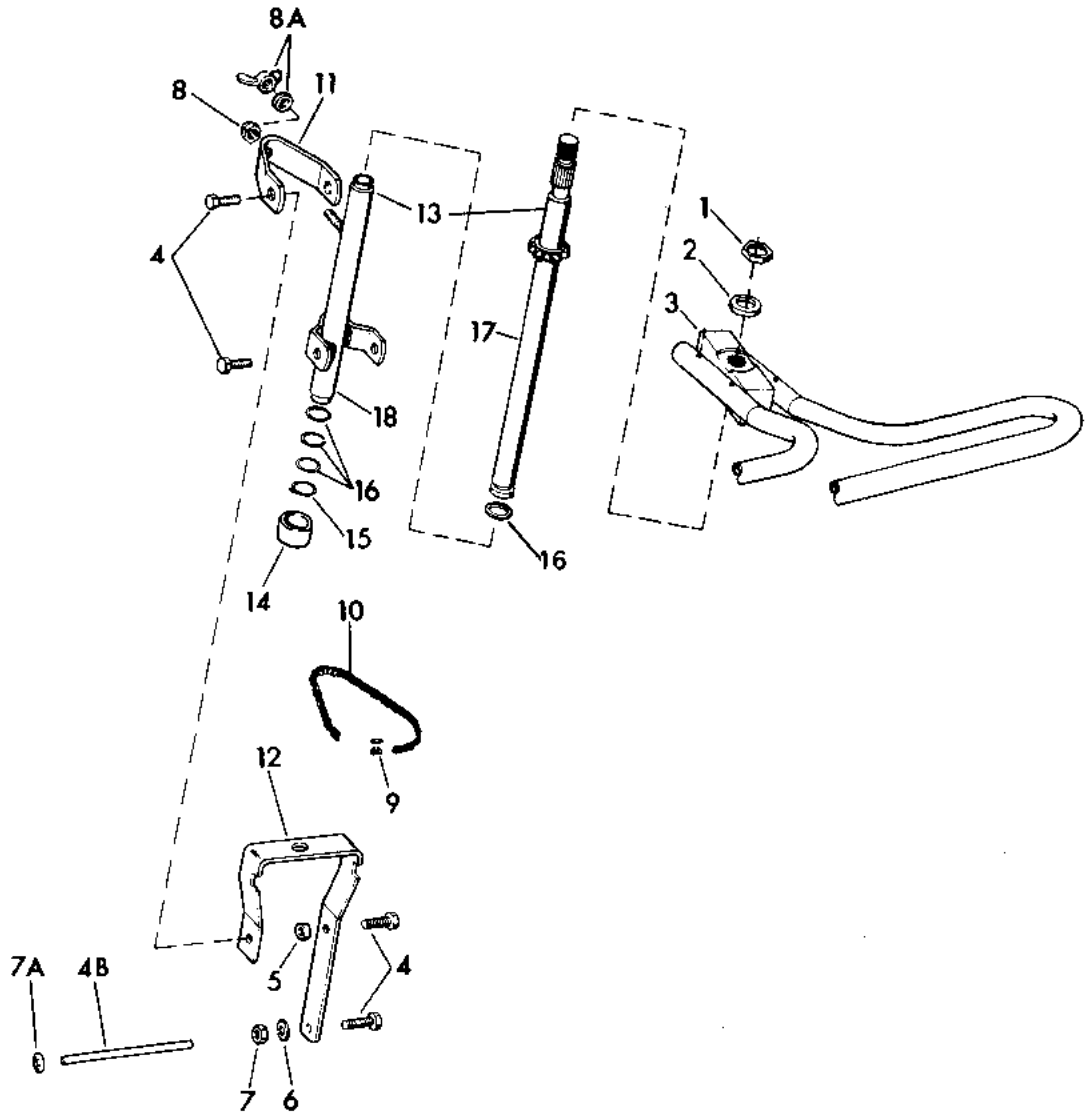
DISASSEMBLING TILLER (Figure 2F-69)

Remove accessory panel. Remove tiller bar shaft nut (1), washer (2), and tap upward on tiller bar head (3) to remove assembly from shaft splines. NOTE: For further steering disassembly, it is necessary to remove the front fork housing. (See "Body," Section 2).

Remove tiller bar tube mounting bolts (4), spacers (5), lockwashers (6) and nuts (7), sprocket adjustment nut (8), tiller drive chain connecting link (9) and drive chain (10). Remove drive chain adjusting bracket (11), mounting bracket (12) and tiller tube shaft assembly (13). To further disassemble the tiller tube and shaft assembly, remove cover (14), retaining ring (15), spacer washers (16), and slide tiller shaft (17) from tiller tube (18). To remove tiller tube (18) on 1971 & later models remove one of the push nuts (7A) and shaft (4B) from bracket. Note location and arrangement of spacer washers so they can be correctly located in reassembly. Clean all parts and inspect for wear and damage. Replace worn or damaged parts.

REASSEMBLING TILLER (Figure 2F-69)

Reassemble tiller tube assembly in reverse order of disassembly. Mount tiller tube assembly (13) and mounting bracket (12) in position on frame head, with the two lower mounting bolts (4). Do not tighten bolts. Install drive chain adjusting bracket (11), the two upper mounting bolts (4) and steering adjustment nut (8). Do not tighten bolts. Install drive chain (10) and connecting link (9). Position tiller tube assembly (13) so steering sprockets are in proper alignment and tighten the mounting bolts. Adjust steering adjustment nut (8) to remove "free play" in steering. Install fork housing. Set the front wheel in a straight ahead position. Install tiller bar (3) on shaft splines. Check for proper tiller bar/wheel alignment and install washer (2), nut (1), and accessory panel.



1. Nut
2. Washer
3. Bar head
4. Bolt (3 or 4)
4B. Shaft (1971 & later)
5. Spacer
6. Lockwasher
7. Nut (2)
7A. Push nut (2) (1971 & later)
8. Nut
8A. Wing nut and washer (1970 & later)
9. Link
10. Drive chain
11. Adjusting bracket
12. Mounting bracket
13. Tube shaft assembly
14. Cover
15. Retaining ring
16. Spacer washers
17. Tiller shaft
18. Tiller tube

Figure 2F-69. Tiller Steering (1973 & Earlier) - Exploded View

TILLER STEERING - 1974 AND LATER

ADJUSTING TILLER MECHANISM (Figure 2F-69A)

Too much free play in the tiller steering bar usually can be corrected by either re-positioning or replacing slider block (11) which is a plastic bearing material. Remove tiller guide (7) by removing two screws (9) and nuts (10). With guide (7) removed, slider block (11) will be accessible for repositioning.

Rotate slider block (11) 90° so that the previously unused sides of the slider block contact guide (7). With slider (11) re-positioned in this way, remount guide (7) and check tiller for free play. If free play remains excessive, try turning slider (11) over. If free play cannot be reduced by repositioning block, it probably is because slider (11) is worn out beyond use and should be replaced. In this case, replace slider (11) with a new one.

CAUTION

Slider block is self lubricating. Do not use oily lubricant because it collects grit which causes wear.

DISASSEMBLING TILLER (Figure 2F-69A)

Remove accessory panel (not shown) attached to tiller handle. Remove tiller bar shaft nut (1) and washer (2). Tap upward on tiller bar head (3) to free from shaft splines.

NOTE

For further tiller disassembly, it will be necessary to remove front fork housing. (See "BODY", Section 2).

Remove bolts (4) which mount tiller bar tube (5) to the two plates welded to frame. Slide tiller shaft (6) out of tube (5). Remove tiller guide (7) along with spacer (8) by removing screws (9) and nuts (10) from fork. Pull slider (11) off pin of tiller shaft (6). Remove washers (12).

Clean all parts and inspect for wear and damage. Replace any worn or damaged parts.

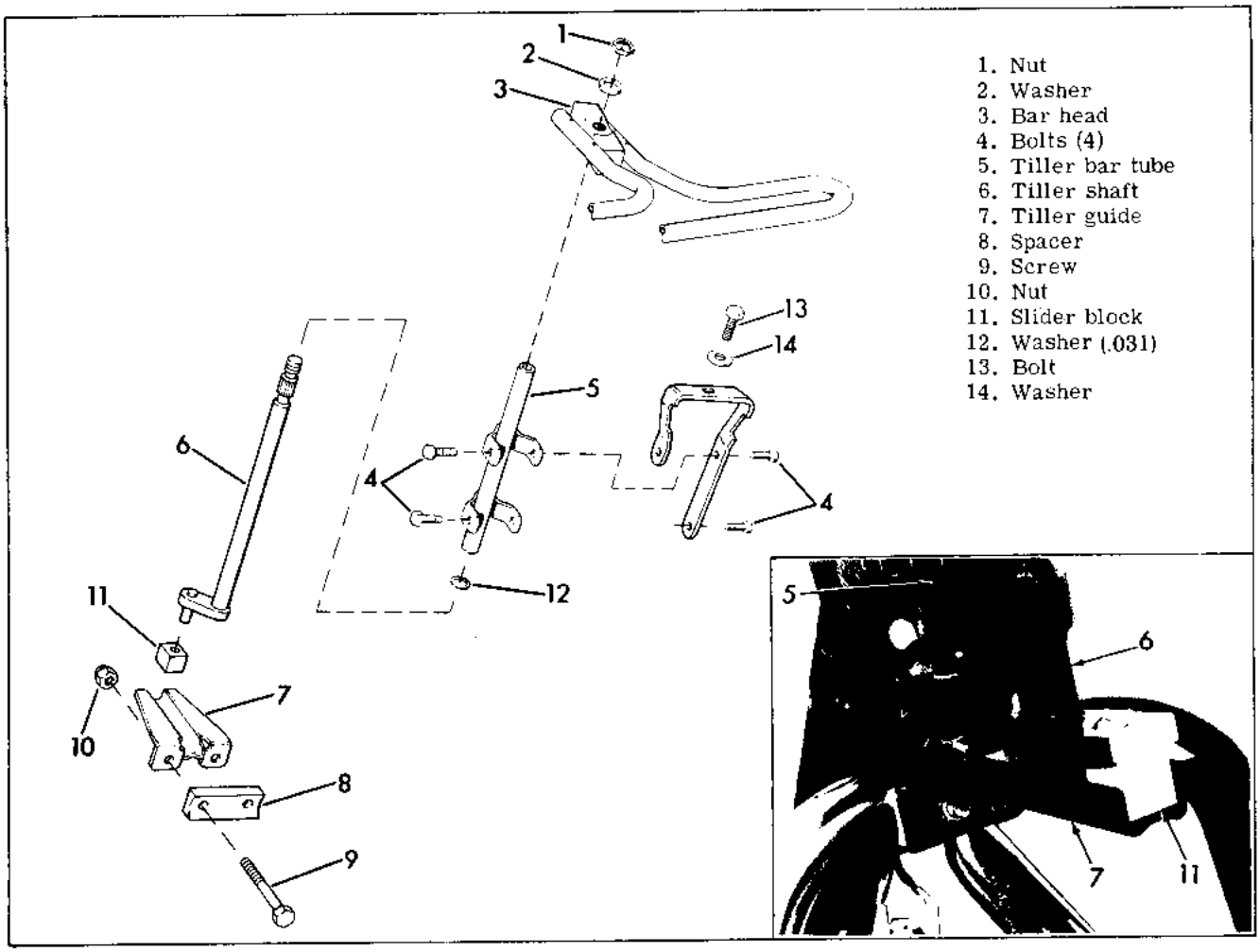


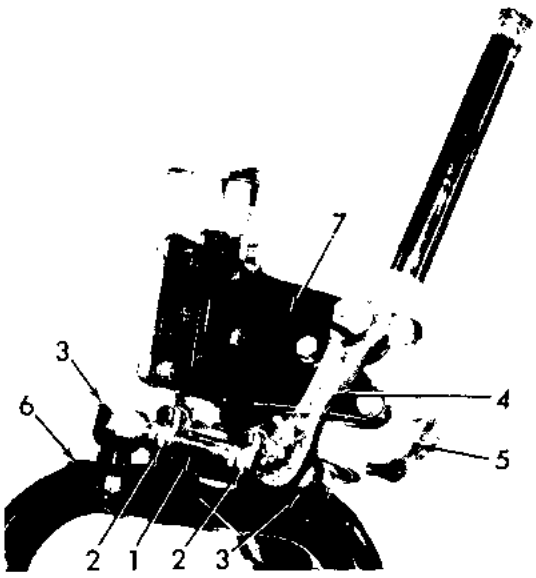
Figure 2F-69A. Tiller Steering (1974 & Later) - Exploded View

REASSEMBLING TILLER (Figure 2F-69A)

Reassemble tiller in reverse order of disassembly, above. When completed, check axial play in tiller shaft by pulling up on tiller. Play should be no more than .04 in. and is adjusted by either adding or removing washers (12). Lubricate slider block (11) with a dry lubricant such as graphite. Do not use oily lubricants because they collect abrasive dirt.

WHEEL STEERING

Steering linkage, Figure 2F-70, does not require periodic lubrication because the gear housing and tie rod ball joints are lubricated and sealed at time of manufacture. If loss of seal occurs in gear unit, it must be disassembled for repair. Tie rod is serviced as an assembly.



1. Tie rod
2. Tie rod clamp (2)
3. Tie rod ball joint (2)
4. Steering arm
5. Steering gear unit
6. Fork bracket
7. Head bracket

Figure 2F-70. Steering Linkage (3 Wheel Models)

ADJUSTING STEERING GEAR UNIT

There are three adjustments on the steering gear unit.

1. Worm bearing preload adjustment.
2. Over-center adjustment.

3A. Tie rod adjustment - 3 wheel car.

3B. Tie rod adjustment - 4 wheel car.

IMPORTANT: The worm bearing adjustment must be checked and corrected if necessary before the over-center adjustment is made. These adjustments can be made with unit remaining mounted in the car or with unit removed from the car. If the unit is in the car it will be necessary to disconnect steering arm from shaft splines. (See "disassembling steering arm and tie rod assembly".)

1. Worm Bearing Preload Adjustment (Figure 2F-71).

Note that lockwasher (14) or locking cup (14A) is bent down to fit into a notch in housing flange at one point. This is the original factory adjustment. If the adjustment is correct, there should be a very slight amount of drag on bearings when turning steering shaft. Check for excessive looseness by pulling up and pushing down on steering wheel - there should be no play. To adjust out any looseness, remove nut (13) and lockwasher (14), or locking cup (14A). Turn cap (15 or 15A) inward to produce a slight amount of bearing drag and take out any up and down play in steering wheel shaft (See Figure 2F-72). When the adjustment is finished, install washer (14), nut (13), or locking cup (14A), and use a punch to bend washer (14) or cup (14A) into housing notch to hold nut in position. If cup (14A) is used, also stake edge of cup over end of nut to keep nut from turning.

2. Over-Center Adjustment.

After making the worm bearing adjustment the worm finger adjustment screw should be tightened to take up free play when the steering wheel is in the center position (turned half way (2 turns) between extreme clockwise and counterclockwise positions). At this position, the two worm fingers on the steering arm are tightest in the worm grooves, therefore the adjustment should be made to eliminate free steering wheel play in this position only.

Loosen locknut (16) and turn screw (17) in or out to eliminate play and while holding screw in desired position retighten locknut (see Figure 2F-73).

NOTE

Play can be felt by holding arm shaft and turning steering wheel shaft back and forth.

1. Steering wheel hub cap
2. Steering wheel nut
3. Steering wheel
4. Cup
5. Spring (1967 and earlier)
5A. Spacer (1968 and later)
6. Bushing
7. Steering column and gear unit
8. Steering arm nut and lockwasher
9. Steering arm - 3 wheel car
9A. Steering arm - 4 wheel car
10. Tie rod - 3 wheel car
10A. Tie rod - 4 wheel car
11. Ball joint nut and cotter pin (2)
12. Bracket bolt and lockwasher (3)
13. Locknut (1967 and earlier)
14. Lockwasher (1967 and earlier)
14A. Locking cup (1968 and later)
15. Cap (1967 and earlier)
15A. Cap (1968 and later)
15B. O-ring
16. Adjusting screw locknut
17. Adjusting screw
18. Side cover bolt and lockwasher (4)
19. Side cover
20. Side cover gasket
21. Steering arm shaft
22. Steering arm shaft seal
23. Bearing race, lower
24. Bearing ball cage, lower
25. Worm shaft
26. Ball bearing cage, upper
27. Bearing race, upper
28. Plug
29. Stop bolt (1 on left side only - 1969 and earlier D, all DC - adjust to 1 in. from boss) (2 on right and left sides - 1970 and later D - adjust to 1-1/2 in. from bosses)

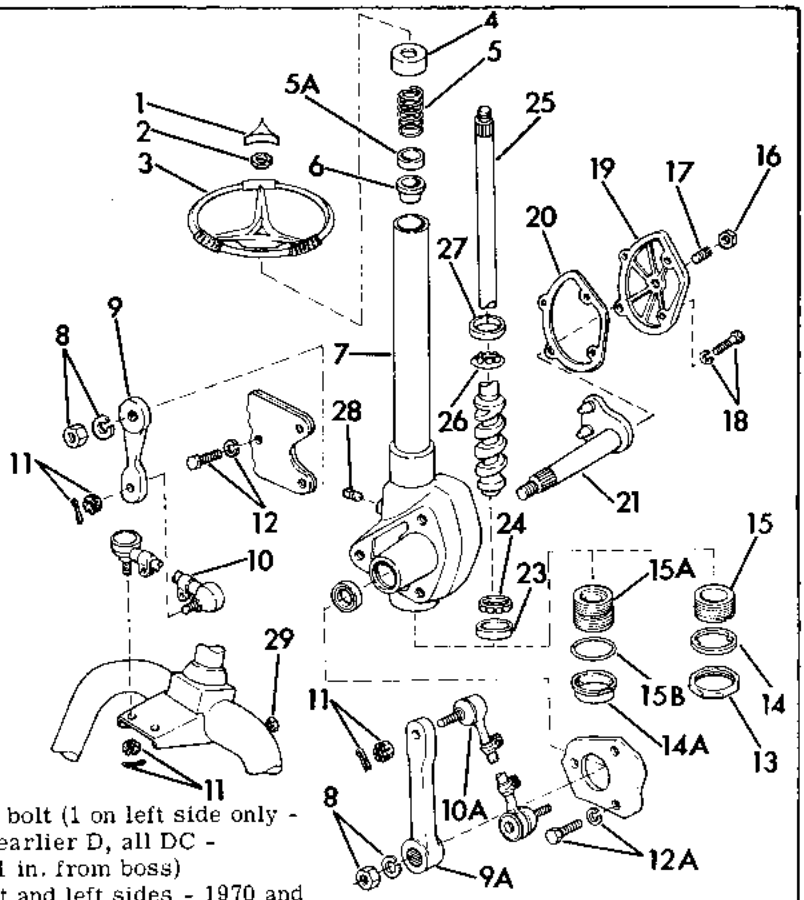


Figure 2F-71. Wheel Steering - Exploded View

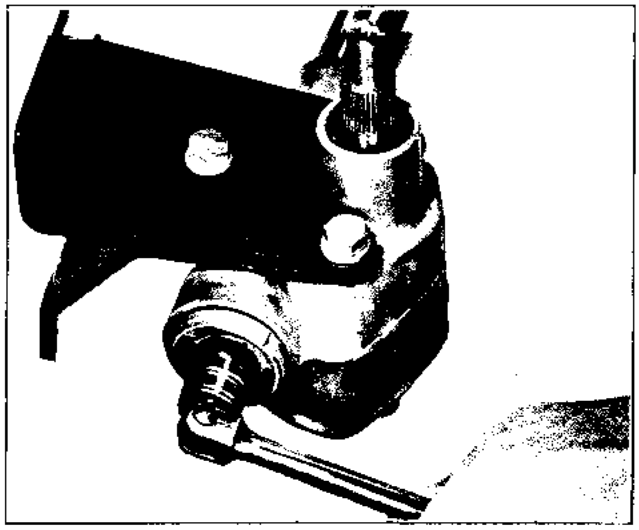


Figure 2F-72. Adjusting Worm Bearings

3A. Tie Rod Adjustment - 3 Wheel Car

Tie rod (10) has a thread on both ball ends which is adjustable in a threaded sleeve. Both ends should be adjusted in the sleeve an equal number of threads to a length of 5-7/8 inches to centers of ball studs as shown in Figure 2F-74.

To adjust, remove tie rod from car (see "disassembling steering arm and tie rod assembly"). Loosen clamp nuts and turn ball joint end in or out of sleeve

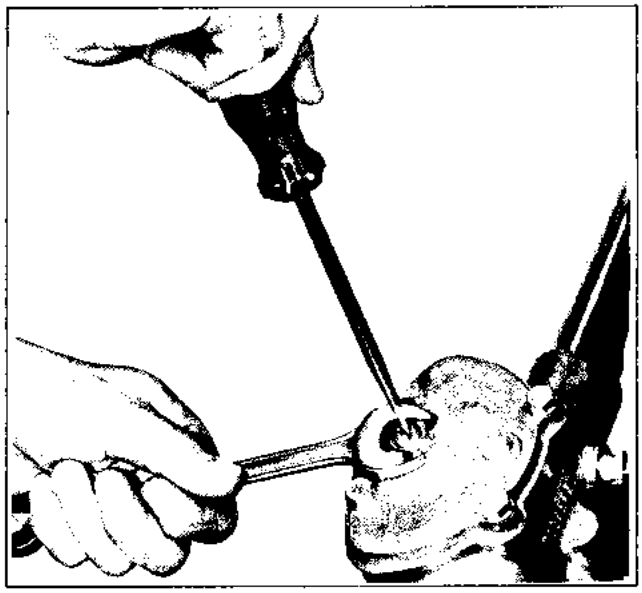


Figure 2F-73. Making Over-Center Adjustment

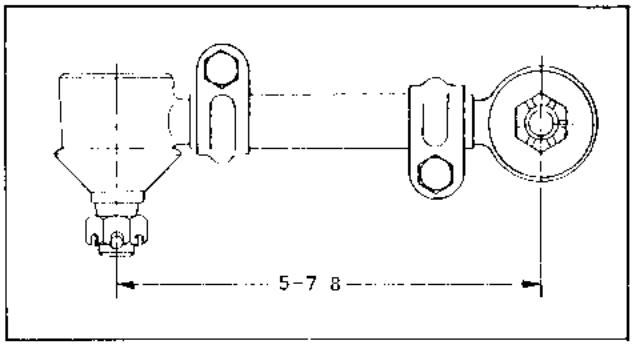


Figure 2F-74. Tie Rod Adjustment - 3 Wheel Models

to adjust length. Position clamps so they will not strike fork bracket or gear unit when fork is turned.

Overall Linkage Adjustment on Car.

Adjust steering linkage in the following manner if any parts have been disconnected.

1. Adjust and install tie rod ends in fork bracket and steering arm.

2. Turn steering wheel shaft to center position (least play in worm gear).

3. Put front wheel in straight ahead position.

4. Install steering arm on shaft splines without moving position of steering wheel or front wheel.

5. Adjust left side fork stop to limit fork travel short of hitting fiber glass housing. Right side will stop in correct location if tie rod length has been adjusted correctly.

On 1968 and earlier models, it is necessary to remove steering wheel and fork housing to work on gear unit. On 1969 model, gear unit with bracket can be removed from car without removing fork housing.

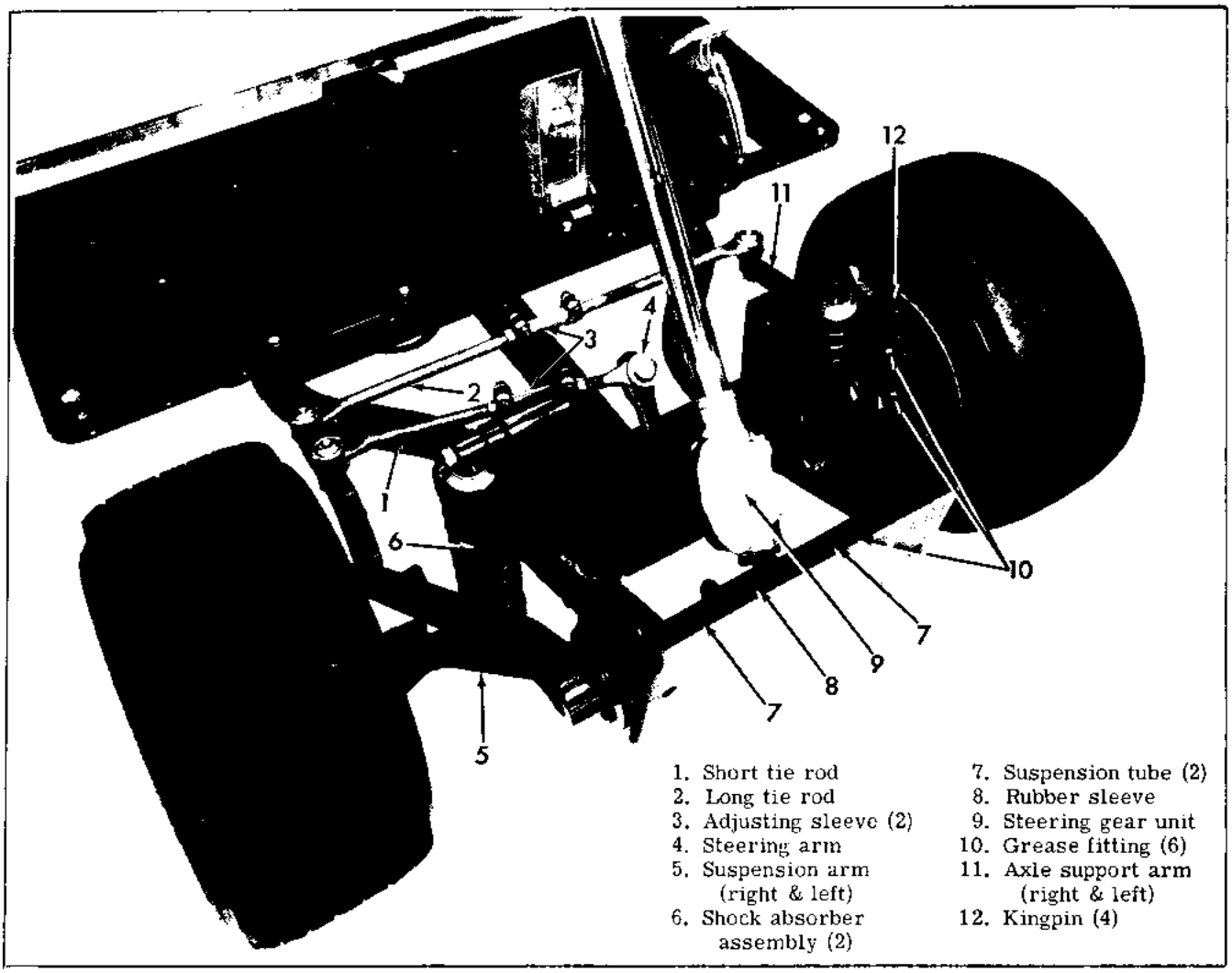


Figure 2F-74A. Front Suspension - 4 Wheel Car

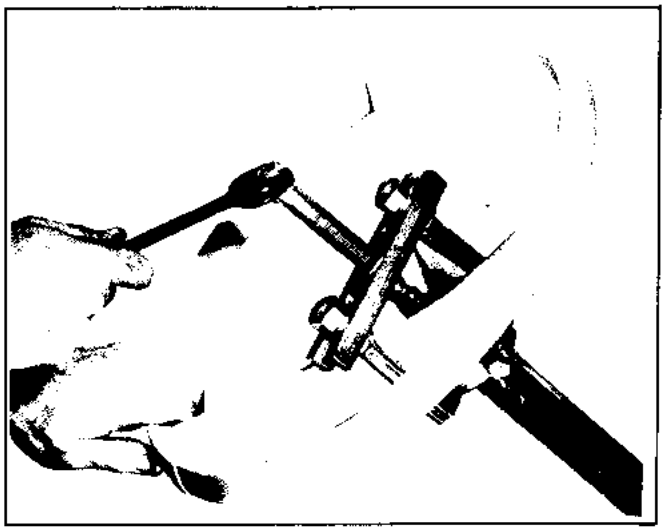


Figure 2F-75. Pulling Steering Wheel

3B. Tie Rod Adjustment - 4 Wheel Car (Figure 2F-74A). 74A)

Both tie rods (1, 2) are threaded on both ends which are adjustable in threaded sleeves (3). Both ends should be adjusted in the sleeve an equal number of threads. Short tie rod (1) should be a length of 13-1/4 in. between centers of ball studs. Long tie rod (2) should be a length of 24 in. between centers of ball studs.

Overall Linkage Adjustment on Car

Adjust steering linkage in the following manner.

1. Set steering wheel shaft at the midpoint of its travel (approximately two turns from either extreme). Install steering arm (4) at approximate midpoint of the frame slot.

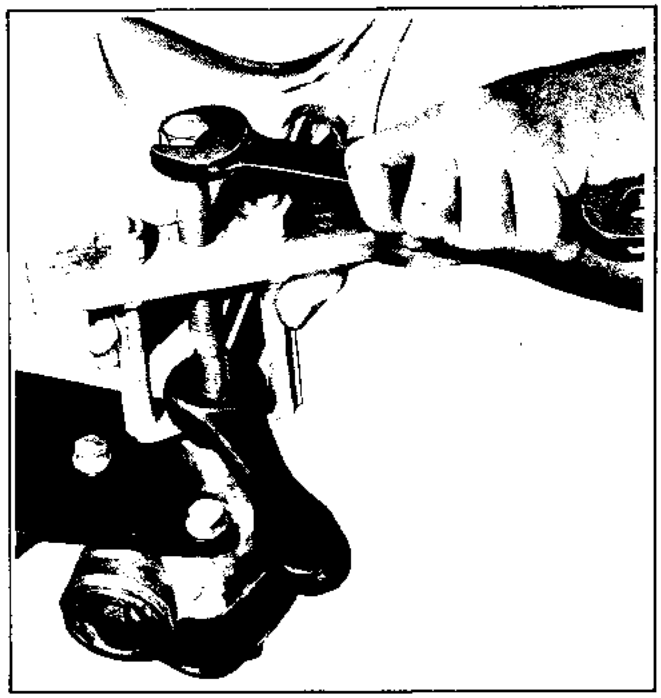


Figure 2F-76. Pulling Steering Arm

2. Install short tie rod assembly (1). Check alignment of right front wheel with a long straight edge which extends across the right rear wheel and right front wheel. If necessary adjust threaded sleeve on tie rod so that right front wheel points straight ahead.

3. Install long tie rod (2) and check alignment of left front wheel with a straight edge extending across the front and left rear wheels. Left front wheel should point straight ahead. Adjust the threaded sleeve on long tie rod if necessary.

4. Tighten clamping bolts and nuts on both tie rod sleeves.

REMOVING STEERING WHEEL AND STEERING GEAR UNIT (Figure 2F-71)

Pry cap (1) from steering wheel and loosen nut (2) until flush with end of threads on shaft. Use claw puller, Part No. 97292-61 and wedge attachment, Part No. 95637-46 with a cap, Part No. 95652-43A (or equivalent) to protect threads as follows. Install wedge underneath steering wheel (3) hub - cup (4) can be depressed to gain clearance. Install jaws of puller behind wedge and turn screw against protective cap on shaft to pull wheel from splines (see Figure 2F-75). Disassemble nut (2), steering wheel (3), cup (4), spring (5) or spacer (5A) and bushing (6) from steering column (7).

On 1968 and earlier models, remove fork housing (fiber glass front center section). See "Body" Section 2I.

On 1969 model, remove 4 bolts holding steering unit bracket to frame and disconnect tie rod from fork. Ball joints on tie rod (10) ends are a taper fit in steering arm and fork bracket sockets. Remove cotter pins and nuts (11) and use claw puller Part No. 97292-61 to pull joint from socket. See Figure 2F-77. Remove entire steering unit from car.

On 1972 and later D4, the front fiberglass body section must be removed. See "Body" Section, 2I. After removing steering shaft nut and lockwasher (8, Figure 2F-71) use claw puller Part No. 97292-61 to remove steering arm (9A, Figure 2F-71). Steering gear is secured to frame with three bolts and lockwashers (12A, Figure 2F-71).

DISASSEMBLING AND ASSEMBLING STEERING ARM AND TIE ROD ASSEMBLY (Figure 2F-71)

Remove steering wheel and fork housing (if necessary) as described previously. To disconnect steering arm from lever shaft, remove nut and lockwasher (8) and use claw puller, Part No. 97292-61 to pull arm (9) from shaft (21) splines (See Figure 2F-76).

WARNING

When disconnecting a ball joint, no attempt should be made to drive a wedge between the joint and the attached part.

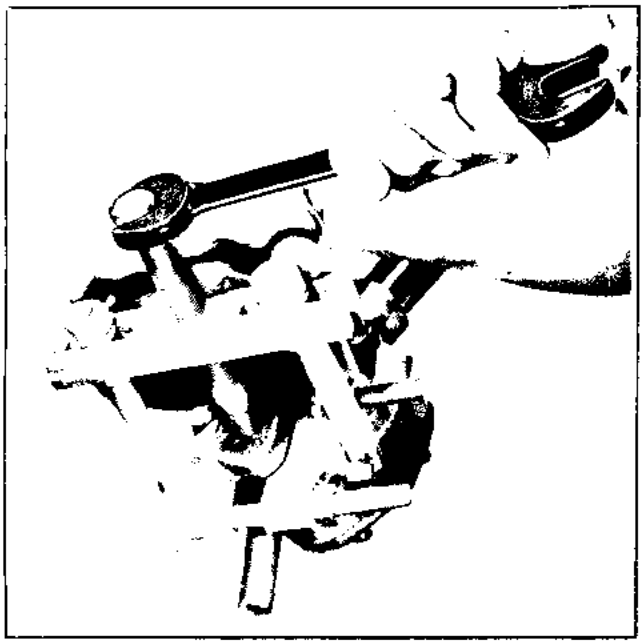


Figure 2F-77. Pulling Ball Joint

On frozen sockets, moderate heat applied to socket with torch will aid in removal with claw puller. (In this case ball joints must be replaced.) Care should be taken so as not to damage rubber boots since they are not replaceable.

Before reassembling tie rod, check ball joints for fit in sockets. Replace tie rod if play is excessive. Apply a liberal quantity of grease to ball underneath each rubber boot.

NOTE

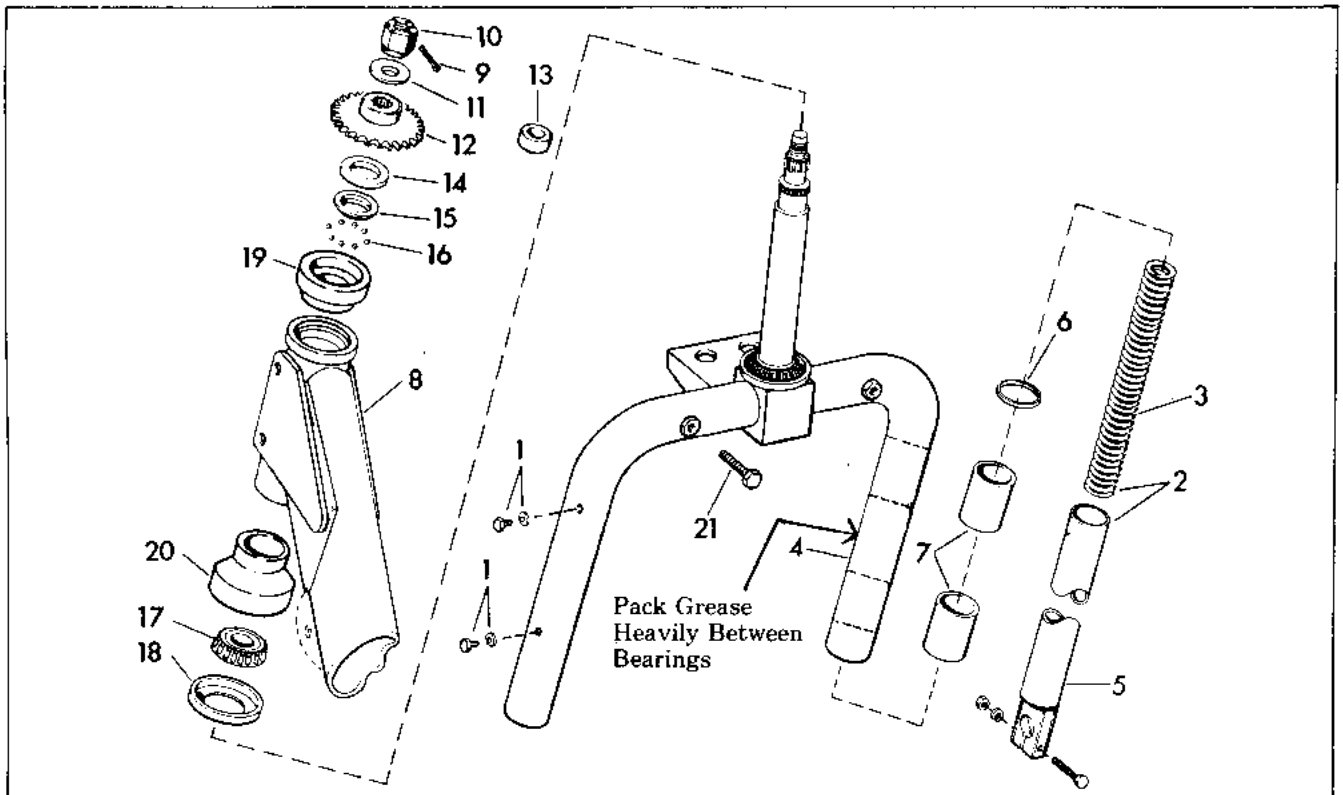
When connecting ball joint stud to steering arm, torque the attaching castle nut 25 to 28 ft-lbs before backing off to insert cotter pin.

Install tie rod and steering arm on car in reverse order of disassembly and in correct relation as described in "Overall Linkage Adjustment".

DISASSEMBLING AND ASSEMBLING STEERING GEAR UNIT (Figure 2F-71)

Remove steering gear from car as described previously.

Remove bolts and lockwashers (18), side cover (19), gasket (20) and withdraw steering shaft (21). Inspect seal (22) lip surface and replace if damaged.



1. Screw and washer (4)
2. Slider assembly
3. Fork spring
4. Fork assembly
5. Fork slider
6. Seals (2)
7. Bushing (4)
8. Frame
9. Cotter pin
10. Nut
11. Washer
12. Sprocket (tiller)
13. Spacer (steering wheel)
14. Bearing guard
15. Cone
16. Bearing (23)
17. Bearing cone
18. Cover
19. Upper head cup
20. Lower head cup
21. Fork stop bolt

Figure 2F-78. Front Fork 1969 and Earlier - Exploded View

Remove locknut (13) and lockwasher (14) (if used) or locking cup (14A). Remove cap (15 or 15A), lower bearing race (23), and lower ball cage (24), worm shaft (25), upper ball cage (26) and upper bearing race (27). Replace balls and races if worn or damaged.

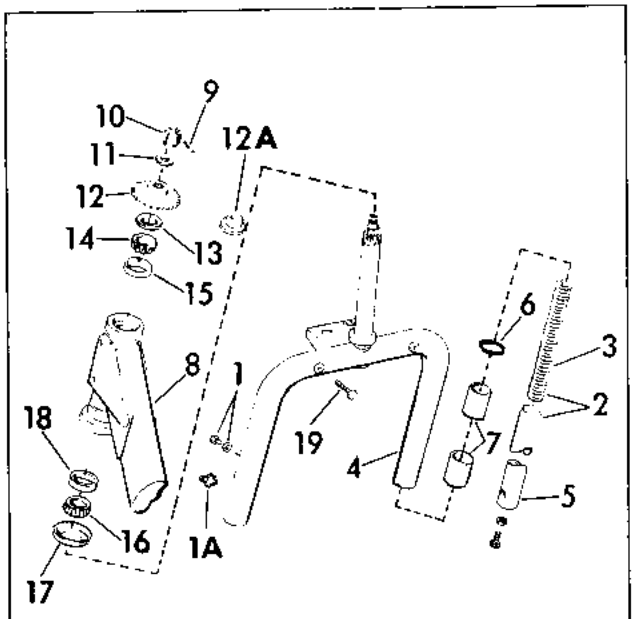
Reassemble steering gear unit in reverse order of disassembly using new gasket (20) underneath side cover.

Remove plug (28) and fill unit with Harley-Davidson transmission lubricant and hold unit in approximately the same position as it will be in car to allow excess fluid to drain from filler hole. Reinstall plug.

Before installing unit on car make adjustments as described under "Adjusting Steering Gear Unit".

DISASSEMBLING FRONT FORK TUBES 1969 & EARLIER (Figure 2F-78)

Remove front wheel assembly. See Section 2, "Removing and Installing Front Wheel."



1. Plug and washer (2)
1A. Grease fitting (2) (1980)
2. Slider assembly
3. Fork spring
4. Fork assembly
5. Fork slider
6. Seals (2)
7. Bushing (4)
8. Frame
9. Cotter pin
10. Nut
11. Washer
12. Sprocket (tiller) (1974 and earlier)
12A. Spacer (steering wheel or 1974 and later tiller)
13. Upper cover
14. Bearing cone
15. Upper bearing cup
16. Bearing cone
17. Lower cover
18. Lower bearing cup
19. Fork stop bolt

Figure 2F-78A. Front Fork, 1970 and Later - Exploded View

After front wheel has been removed, the fork slider assemblies can be removed by removing upper cap screw and washer (1) and unscrewing the slider assembly (2) to disengage the fork spring (3) from the fork assembly (4). To remove fork spring (3) from slider (5), simply unscrew fork spring. (Turn counterclockwise.) If seals (6) are leaking or worn, replace them by prying out old seals and press in new seals with seal lip facing inward. Replace fork tube bushings (7) if worn, using claw type bushing puller.

REASSEMBLING FRONT FORK TUBES 1969 & EARLIER (Figure 2F-78)

Clean old grease and dirt from all parts, inspect for damage and wear. Replace any damaged or worn parts. Pack grease heavily between bushings (7) in fork leg. Lightly coat fork spring coils with grease and screw springs (3) tight into slider (5). Insert right side slider assembly (large diameter axle hole) into right fork leg and screw in until tight. Back off by unscrewing just enough to allow correct axle hole alignment. Install left side slider assembly (small diameter axle hole), in left fork leg in same manner. Install cap screws and washers (1). Install front wheel.

Grease both fork sides once a year as follows: Remove lower cap screw and washer (1) and install grease fitting having a 1/4-28 thread (H.D. Part No. 9851). Using a grease gun, pump grease into fork side and reinstall cap screw and washer. Caution: If excessive amount of grease is pumped into fork side, slider seal (6) may be blown out. It is suggested that seal lip be relieved by sliding a shim between lip and fork leg while greasing.

DISASSEMBLING AND ASSEMBLING 1969 & EARLIER FRONT FORK (Figure 2F-78)

To remove fork (4) from frame (8), remove cotter pin (9), fork shaft nut (10), washer (11). NOTE: Mark sprocket (12, if used) as to its position on fork shaft. Restart fork shaft nut on threads and tap firmly on shaft nut with heavy rawhide mallet, until fork drops free. Support fork and remove fork shaft nut, steering sprocket (12) or spacer (13), bearing guard (14) and fork stem cone (15). Slide fork down out of frame head and remove the twenty-three ball bearings (16). Remove bearing cone (17) and cover (18) from fork stem. Clean all parts and inspect for wear or damage. Replace worn or damaged parts. Replace upper and lower head cups (19 & 20) if worn excessively.

Pack bearings with bearing grease. Slide fork (4) (with lower bearing guard [18] and bearing [17] in position on fork stem) into frame head with fork stops facing toward the rear of the car. Support fork and install ball bearings (16) into greased upper bearing race. Install upper fork stem cone (15) and upper bearing guard (14). Install steering sprockets (12, if used) on fork shaft according to marks made before assembly or install spacer (13). Install washer (11), nut (10), and tighten nut until there is no noticeable free play or bind when front fork is turned from side to side. Install cotter pin (9).

DISASSEMBLING & ASSEMBLING FRONT FORK TUBES 1970 & LATER (Figure 2F-78A)

Remove front wheel assembly. See Section 2, "Removing and Installing Front Wheel."

After front wheel has been removed, remove both fork slider assemblies by unscrewing slider assemblies to disengage fork springs (3) from fork assembly (4).

Unscrew fork springs (3) from slider assemblies in a counterclockwise direction and remove.

If seals (6) are leaking or worn, pry out old seals and replace. Press in new seals with seal lips facing inward. Replace fork tube bushings (7) if worn, using claw type bushing puller.

Clean old grease and dirt from all parts, inspect for damage and wear. Replace any damaged or worn parts. Pack grease heavily between bushings (7) in fork leg. Lightly coat fork spring coils with grease and screw springs (3) tight into slider (5).

Reassemble as follows. Screw spring into slider (2) until spring bottoms out. Insert left side slider assembly (smaller diameter axle hole) into left fork leg and screw spring into leg until dimension between bottom edge of leg and center line of axle hole in fork measures 4" (with spring unloaded). When this dimension is achieved, reposition fork slider with larger hole opening for axle sleeve (counter-sunk side) toward wheel.

Insert right side slider assembly (larger diameter axle hole) into right fork leg and screw spring into leg until axle hole aligns with left side slider axle hole. These two holes must align for axle to mount correctly.

Install front wheel.

Grease both fork sides once a year as follows: Remove plug and washer (1) and install a fitting having a 1/4-28 thread. Using a grease gun, pump grease into fork side and reinstall cap screw and washer. Caution: If excessive amount of grease is pumped into fork side, slider seal (6) may be blown out. It is suggested that the pressure developed by greasing be relieved by sliding a shim between seal lip and fork leg.

NOTE:

1980 cars are equipped with grease fittings.

DISASSEMBLING AND ASSEMBLING 1970 & LATER FRONT FORK (Figure 2F-78A)

To remove fork (4) from frame (8), remove cotter pin (9) fork shaft nut (10), washer (11).

NOTE

Mark sprocket (12, if used) as to its position on fork shaft.

Restart fork shaft nut on threads and tap firmly on shaft nut with a heavy rawhide mallet until fork drops free. Support fork and remove nut, steering sprocket (12) or spacer (12A), and upper bearing cover (13). Slide fork down out of frame head and remove bearing cones (14 and 16) and lower cover (17). Bearing cups (15 and 20) are pressed into head cups (18 and 19), and head cups also are a press fit in steering head (8). If necessary to replace bearing races, drive head cups from steering head with a hammer and drift from opposite side of hole. Clean all parts and inspect for wear or damage. Replace all worn or damaged parts particularly bushings (7), seals (6) and bearing parts (14, 15, 16 and 20). Pack bearings with grease. Slide fork (4) with lower bearing cone (16) and cover (17) in position on fork stem into frame head with fork stops facing toward the rear of the car. Install upper bearing cone (14), cover (13), and sprocket (12) or spacer (12A). Install washer (11), nut (10) and tighten nut until there is no noticeable free play or bind when fork is turned from side to side. Install cotter pin (9).

FRONT SUSPENSION - 4 WHEEL CAR (Figure 2F-78B)

DISASSEMBLY

WARNING

Block rear wheels, jack car up and block frame to prevent possible personal injury and/or damage to the golf car.

Pull steering arm (1) from steering shaft with puller as described under "Removing Steering Wheel and Steering Gear".

Remove ball joint nuts and cotter pins (2). Remove short tie rod assembly (3) from right axle support arm (4) as shown in Figure 2F-77, using claw puller, Part No. 97292-61, and wedge attachment 95637-46. See "Disassembling and Assembling Steering Arm and Tie Rod Assembly" for additional information. In a similar manner remove long tie rod assembly (5) from right and left axle support arms (4 and 6).

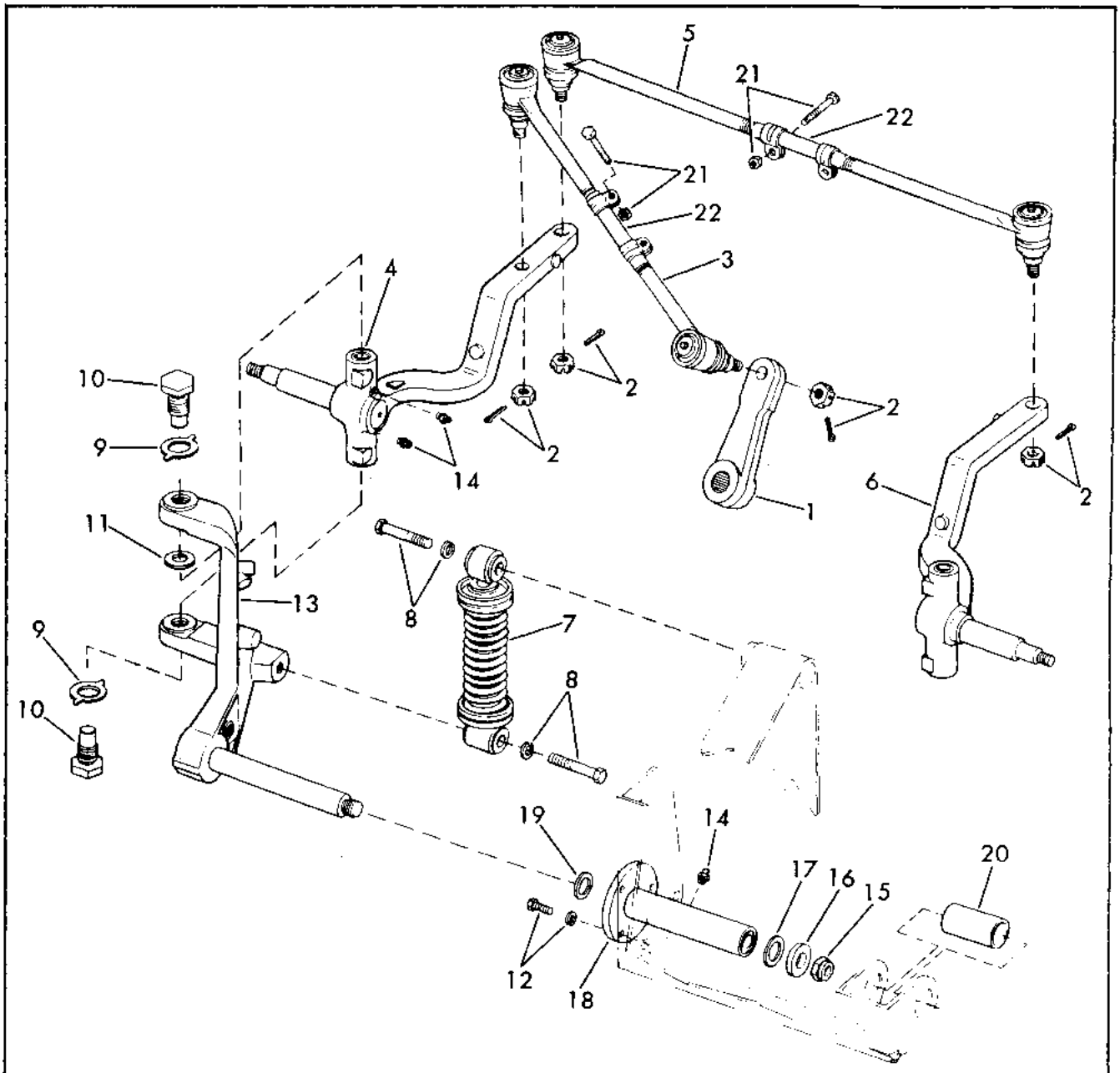
Either side of suspension system is removed in an identical manner.

Remove shock absorber assembly (7) by disassembling shock absorber mounting bolts and lockwashers (8).

Bend tabs and side flat on tab lockwasher (9). Remove kingpins (10). Axle support arm may now be removed. Note position of bronze thrust washer (11). Remove suspension tube mounting bolts and lockwashers (12). Caution: Pull outward on suspension arm (13) while guiding grease fitting (14) through slots in frame. Remove nut (15), spacer (16), and shim (17) noting number and thicknesses of shims. Suspension tube (18) may now be removed from suspension arm (13). Some early 1972 cars have an additional spacer (19). Remove rubber sleeve (20) from frame bracket. To disassemble shock absorber unit (7) see "Disassembling and Assembling Front Shock Absorbers."

CLEANING AND INSPECTION

Clean all parts and inspect for damage or wear. Check ball joints for fit in sockets. Replace tie rod if play is excessive or if rubber boot is damaged. Before reassembly apply a liberal quantity of grease to ball underneath each rubber boot. Examine bushings in suspension tubes (18) and axle support arms (4 and 6), if they are worn or damaged they must be replaced.



1. Steering arm
2. Castle nut and cotter pin (4)
3. Short tie rod assembly
4. Right axle support arm
5. Long tie rod assembly
6. Left axle support arm
7. Shock absorber (2)
8. Bolt and lockwasher (4)
9. Tab lockwasher (4)
10. Kingpin (4)
11. Thrust washer (2) (Bronze)
12. Bolt and lockwasher (6)
13. Suspension arm (2) (right and left)
14. Grease fitting (6)
15. Nut
16. Spacer
17. Shim (2) (as required)
18. Suspension tube (2)
19. Spacer (early 1972 models)
20. Rubber sleeve
21. Clamping bolt and nut (4)
22. Adjusting sleeve (2)

Figure 2F-78B. Front Suspension, 4 Wheel Car - Exploded View

REASSEMBLING FRONT SUSPENSION

Reassembly is basically the reverse of disassembly with the following exceptions. When assembling suspension tube (18) to suspension arm (13), use variable thickness shims (17) to obtain .005 in. to .025 in. end play. (Note that some early 1972 cars require additional spacer washer (19). Make sure rubber sleeve (20) is in position in frame bracket before suspension tube (18) and suspension arm (13) assembly is assembled to frame bracket. When assembling suspension tube to frame, point grease fittings (14) downward so they are accessible for greasing. After assembling axle support arm (4 and 6) to suspension arm (13), bend both tabs on tab lockwasher down, bend one side of washer up against flat of kingpin hex. Pack suspension tubes (18) and axle support arms (4 and 6) with grease. Use a hand gun and pack until grease comes from seams.

To install and adjust steering arm (1) and tie rods (3, 5) see "Tie Rod Adjustment - 4 Wheel Car", in this section.

DISASSEMBLING AND ASSEMBLING FRONT SHOCK ABSORBER (Figure 2F-78D)

Raise front end of car so that wheels are supported. Remove shock absorber from car by removing two mounting bolts and lockwashers (8, Figure 2F-78B).

WARNING

Whenever working on a golf car, disconnect the battery ground cable to prevent car from accidentally starting and causing possible injury.

WARNING

Whenever working on the front suspension of a golf car, block the rear wheels to prevent car from accidentally moving and causing possible injury.

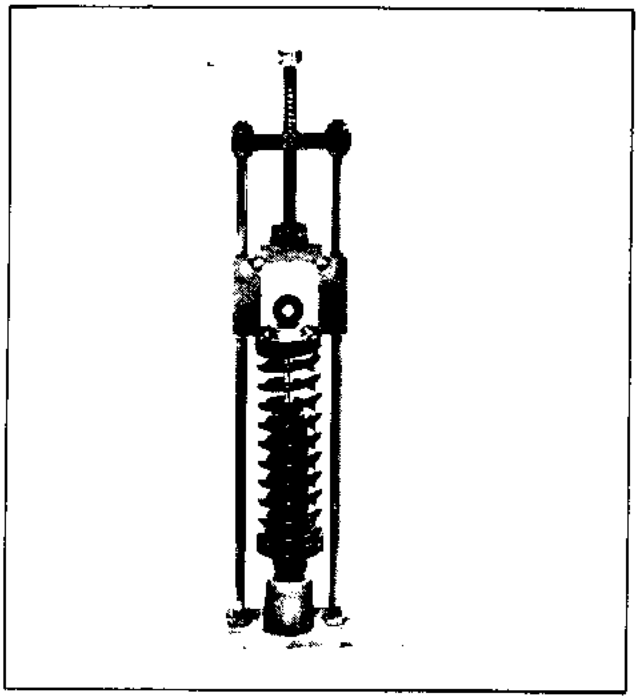
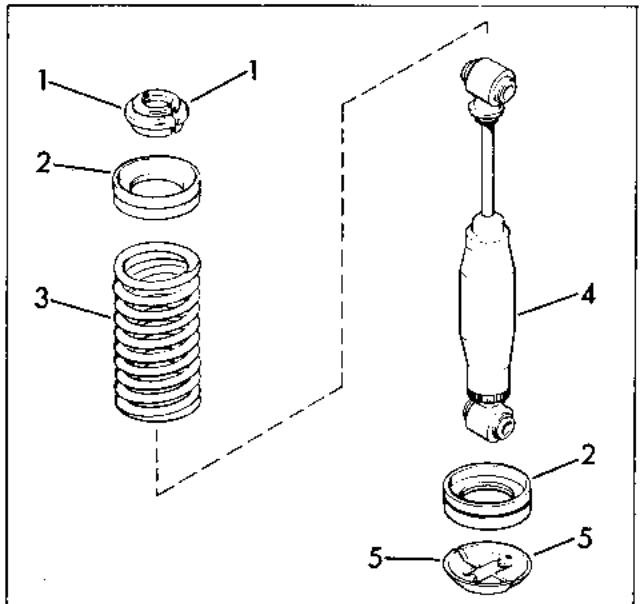


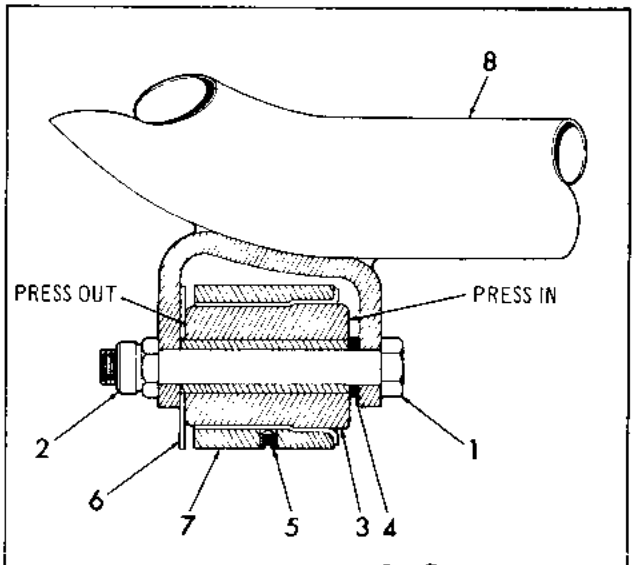
Figure 2F-78C. Using Shock Absorber Tool

Place shock absorber assembly in shock absorber tool, Part No. 97010-52A, in same position as when mounted in car. See Figure 2F-78C. Compress absorber spring enough to remove each half of upper spring retainer (1). Release spring compression and remove absorber assembly from tool. Remaining items can then be removed in order shown in Figure 2F-78D.



1. Upper spring retainer
2. Spring guide (2)
3. Spring
4. Shock absorber unit
5. Lower spring retainer

Figure 2F-78D. Front Shock Absorber, 4 Wheel Car - Exploded View



1. Bolt
2. Nut
3. Bushing assembly
4. Spacer
5. Set screw (If applicable)
6. Nylon washer
7. Frame eye
8. Fork

Figure 2F-79. Rear Fork Suspension

Clean and inspect all parts for wear and damage. Examine absorber unit for traces of fluid leaking, especially at upper end. Unit should compress slightly easier than it extends. If possible, compare action with a new unit. Shock absorber cannot be repaired. Faulty units must be replaced.

Assembly is the reverse of disassembly.

REAR FORK SUSPENSION (1966 and Later Models)

WARNING

Block rear wheels, jack car up and block frame to avoid personal injury and/or damage to the vehicle.

To disassemble rear fork suspension, support rear end of car main frame with suitable blocking. Remove shock absorber upper and lower mounting bolts from frame and differential. Remove handbrake clevis at pull-lever end. Disconnect hydraulic brake line. See Figure 2F-79. Remove bolts and nuts (1 and 2) to release rear fork from car.

NOTE:

Rubber bushing assembly (3) is held in frame eye (7) with set screw (5) and also Harley-Davidson Stud N' Bearing Mount (Part No. 99626-77). Set screw (5) must first be removed and eye heated to loosen Loctite. Bushing assembly (3) must be driven inward to remove and outward to install. Use Harley-Davidson Stud N' Bearing Mount (Part No. 99626-77) when reinstalling.

If fork tube or brackets are bent, and straightening is practicable, realign according to dimensions shown in Section 2E of this manual.

SUSPENSION RELATED VIBRATION

1. Front Fork Assembly

WARNING

Whenever working on a golf car, disconnect the battery ground cable to prevent car from accidentally starting and causing possible injury.

WARNING

Whenever working on the front suspension of a golf car, block the rear wheels to prevent car from accidentally moving and causing possible injury.

High frequency vibration in the floorboard and tiller bar may be caused by dry fork sliders binding in the fork bushing.s To correct this, first remove the fork plugs and washers from fork and replace with grease fittings. Using a hand grease gun, carefully pump two shots of grease into each fork side. CAUTION! Excessive grease pumped into a fork side can blow out the fork slider seal. Work the sliders in and out of the fork tube to ensure smooth operation. In extreme cases, the fork bushings, or sliders, may have been damaged by the dry condition. If the sliders do not travel freely following lubrication, dismantle the front fork assembly as described in Section 2 of this Service Manual. Inspect the bushings and slider for scoring or other signs of wear. Check for the correct location of the fork bushings within the fork tube. The inner bushing should be against the shoulder of the fork tube which will position its lower edge 3.90 inches from the tube end. The outer bushing should be flush with the fork tube seal recess. Replace parts as required and reassemble fork. After greasing and inspecting the fork, remove the grease fittings and reinstall the fork plugs and washers. Check for proper installation.

2. Rear Fork Bushings - Vibration evidenced by a low pitch rumbling in the body and front cowl may be caused by loose rear fork mounting bushings. This condition allows the rear fork shackle to make contact with the frame bushing boss. The rear fork bushing is designed not only to allow radial pivoting of the rear fork, but also to absorb the vibration of the fork. In a loose condition, the bushing allows vibration to be transmitted through the shackle to the frame resulting in the low pitch rumbling. In most cases, this condition is easily recognizable because the bushing extends .125 to .200 inch out of the frame bushing boss. The bushing collar should be flush to the bushing boss. In some cases, this condition is more difficult to recognize because the bushing only moves during sharp left or right turns and returns to its proper position at rest. Both conditions should be investigated and corrected if necessary.

To correct, the bushing must be positioned with its outer sleeve collar flush against the bushing boss. To properly locate the bushing, it may be necessary to move it over by inserting a lever between the rear fork shackle and bushing face. (See illustration.)

If the bushing cannot be moved, the rear fork must be lowered to allow access to the bushing sides.

WARNING

Whenever working on the rear suspension of a golf car, block the front wheels to prevent car from accidentally moving and causing possible injury.

Raise body and remove the engine ground strap which limits and restrains the fork movement. Remove the rear fork mounting bolts, washers and locknuts. Support the main frame on tripods (jackstands) and carefully lower the rear fork. With the fork dropped, place a piece of hardwood against the bushing collar for protection and then drive bushing into boss until shoulder is flush.

When bushings are fully seated, drill a .149 inch hole with a No. 25 drill near the center top of the right fork bushing and the center bottom of the left. Install a self-tapping screw in each to hold bushing in place. Raise the rear fork and insert the rear fork mounting bolts, washers, and locknuts.

NOTES

DISC BRAKE (D, D4)

DESCRIPTION

When the brake foot lever is depressed, it transmits a clamping action to the caliper type brake shoes through the brake cable. The brake shoes apply this pressure to the brake disc attached to the drive shaft on the differential unit, thus stopping the car.

When the brake pedal is tilted forward while held in a depressed position, it will lock the brake, holding the car until the brake is released by tilting the brake pedal rearward or until the accelerator pedal is depressed, automatically releasing the brake. This feature provides a parking brake by simply tilting the brake pedal and also prevents any possible damage by automatically releasing the brake when the accelerator is depressed.

ADJUSTING DISC BRAKE (Figure 2G-35)

When brake pedal free travel becomes excessive, it indicates brake caliper adjustment is required. It is important to remember that proper brake adjustment and pedal height is only achieved by adjusting the brake caliper, not the brake cable. Brake cable adjustment is to assure proper cable attachment and compensate for the normal variable cable length only.

The following is the recommended brake adjustment procedure:

1. Disconnect brake cable (6) at brake cam lever (4) by removing cotter pin, clevis pin (2), and washer from brake cam lever (4).

2. Check brake disc alignment between brake shoes (5). The brake disc should be centered between the brake shoes using the brake shoe bracket (12) as a centering guide. Check the Belleville washers (14). They should be in good condition and properly divided and stacked as shown.

3. To adjust caliper, remove cotter from castle nut (3) at rear caliper brake shoe (5). Tighten castle nut (3) until brake shoe pads bear lightly on brake disc.

4. Loosen stop nut (9) for further adjustment.

5. Loosen pivot bolt jamnut (10) to allow pivot bolt (11) adjustment.

6. Engage brake cam (4) with pliers or lever applying liberal force. The cam engagement will force brake shoes

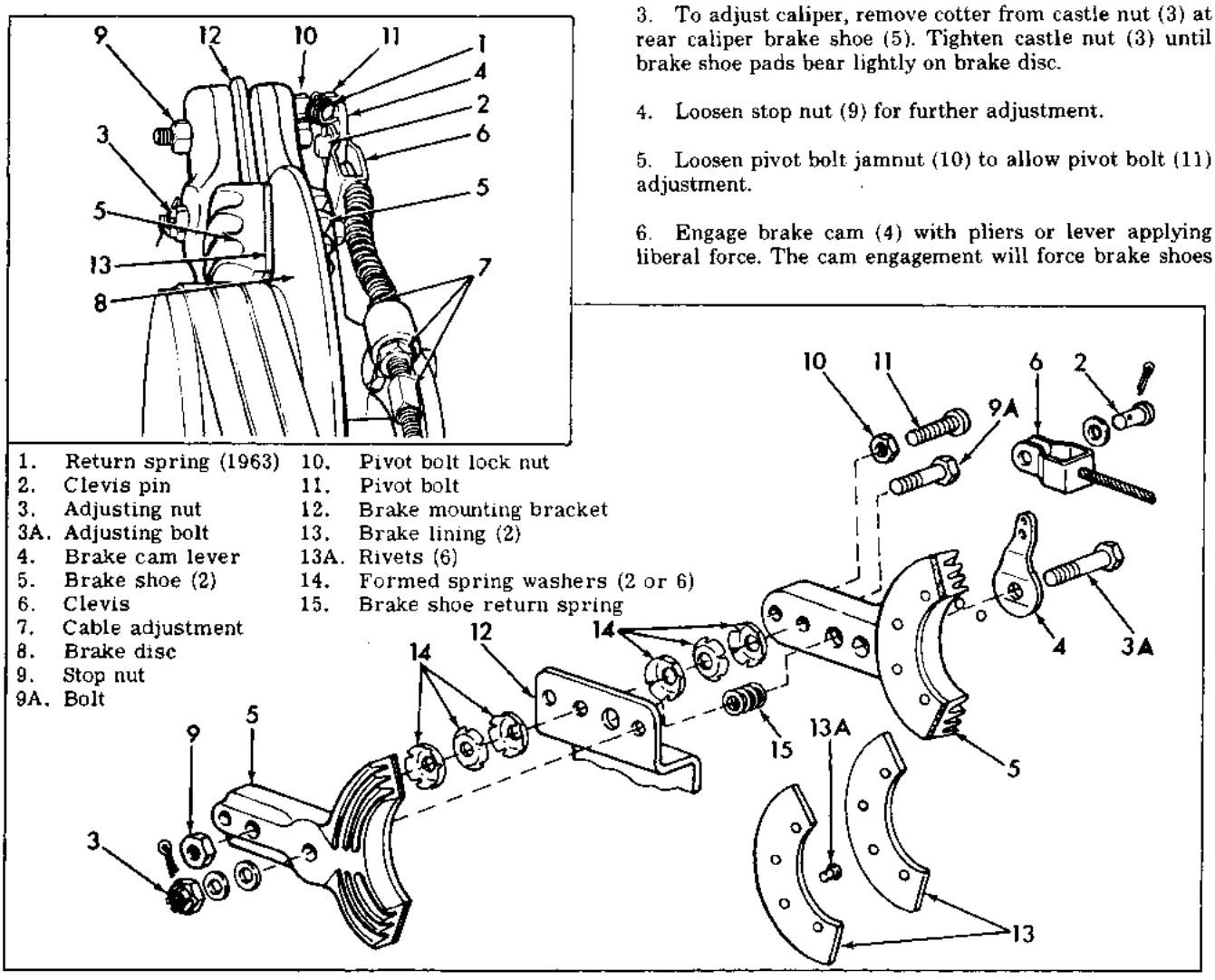


Figure 2G-35. Disc Brake

tightly against dics. Adjust pivot bolt (11) so the brake shoes are parallel to the disc while pressure is applied to the cam.

Release brake cam pressure and adjust castle nut (3) until a maximum of .030 side clearance, .015 on each side, is achieved between each brake shoe and the disc.

NOTE

Brake shoes must be parallel to the disc when engaged. When at rest, the shoes are normally skewed apart at the pad area and not parallel.

7. Adjust stop nut (9) on rear caliper brake shoe (5) until bolt (9A) is firmly seated into shoe without compressing caliper.
8. Tighten pivot bolt jamnut (10). Install cotter pin in castle nut (3) which secures cam lever adjusting bolt (3A).

9. Adjust cable length at cable adjuster to allow clevis pin (2) to slide through hole in cam lever (4) without engaging or disengaging cam. Attach washer and insert cotter pin and secure.

10. Inspect adjustments and test brake system.

Brake adjustment is necessary. Prior to installing caliper end cable clevis see "Adj. Brake" section.

WARNING

Secure body by inserting screwdriver in pre-drilled hole in body hinge (1967 and later). For 1966 and earlier cars secure body in a suitable manner to prevent body from falling closed. Personal injury could result if care is not taken to secure body.

REMOVING AND INSTALLING DISC BRAKE SHOES (Figure 2G-35)

If brake shoe linings (13) become worn thin or damaged, the brake can be disassembled for lining replacement and other repairs as follows: Remove brake arm spring (1, if used) and clevis pin (2).

NOTE

1967 Model D brake can be removed as an assembly at this point by removing 2 bolts securing bracket (12) to differential housing bracket.

Remove adjusting nut (3), adjusting bolt (3A), and stop nut (9). Remove bolt (9A) and separate brake shoes (5) from brake mounting bracket (12). When removing brake shoes from mounting bracket, be sure to note the position of the formed spring washers (14) and the brake shoe return spring (15) and cam lever bearing balls. Clean all parts and inspect for wear or damage. Replace worn or damaged parts.

To replace worn or damaged brake linings (13) press out rivets (13A) and rivet new linings to brake shoes.

Chamfer leading and trailing edges of both linings slightly, to prevent brake chatter or squeal. If brake disc is scored, or damaged, it must be removed for replacement.

REPLACING DISC BRAKE CABLE ASSEMBLY (Figure 2G-36)

Raise body. Remove clevis pin (7) from brake lever (5 or 5A) and pull cable assembly (11) towards rear of car, through hole in frame cross-member. Remove clevis pin (12) from brake shoe operating cam lever. Remove locking nut (13) from end of cable adjusting screw (14) and pull cable assembly toward the left side of car and downward to release assembly from brake mounting bracket (15).

Install a new cable assembly in reverse order.

NOTE

The wire is not replaceable because the ends are swaged on - the entire assembly must be replaced.

Brake adjustment is necessary after the new cable assembly is installed, see "Adjusting Brake".

REMOVING AND INSTALLING DISC BRAKE ASSEMBLY

Remove brake cable assembly as described in preceding paragraph. Remove 4 bolts, nuts and lockwashers which attach brake disc to rear axle drive shaft yoke. Remove bolts and lockwashers which attach brake assembly to car. See "Transmission Rear Drive", Section 4B.

Install a new cable assembly in reverse order.

MECHANICAL SHOE BRAKES

DESCRIPTION

Drum type expanding shoe brakes are located on rear wheels and are connected to foot pedal by rod and cross-shaft linkage as shown in Figure 2G-37. When the brake pedal is tilted forward while held in a depressed position, it will lock the brakes, holding the car until the brake is released by tilting the brake pedal rearward.

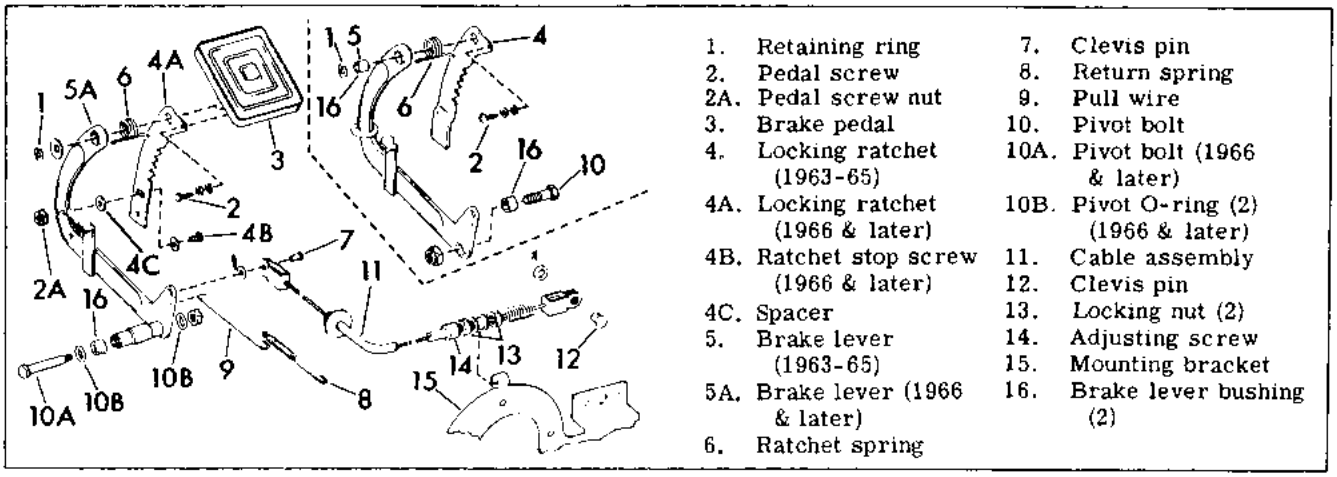


Figure 2G-36. Brake Pedal and Cable - Exploded View (Mechanical Brake)

ADJUSTING MECHANICAL BRAKE SHOES (Figure 2G-37)

When brake pedal free travel becomes excessive, indicating that brake adjustment is necessary, raise rear body section to perform brake adjustment. Adjustment for brake lining wear is made by reducing length of rear brake rods (6) as follows:

WARNING

Secure body by inserting screwdriver in pre-drilled hole in body hinge (1967 and later). For 1966 and earlier cars secure body in a suitable manner to prevent body from falling closed. Personal injury could result if care is not taken to secure body.

Support rear end of car with both wheels off the

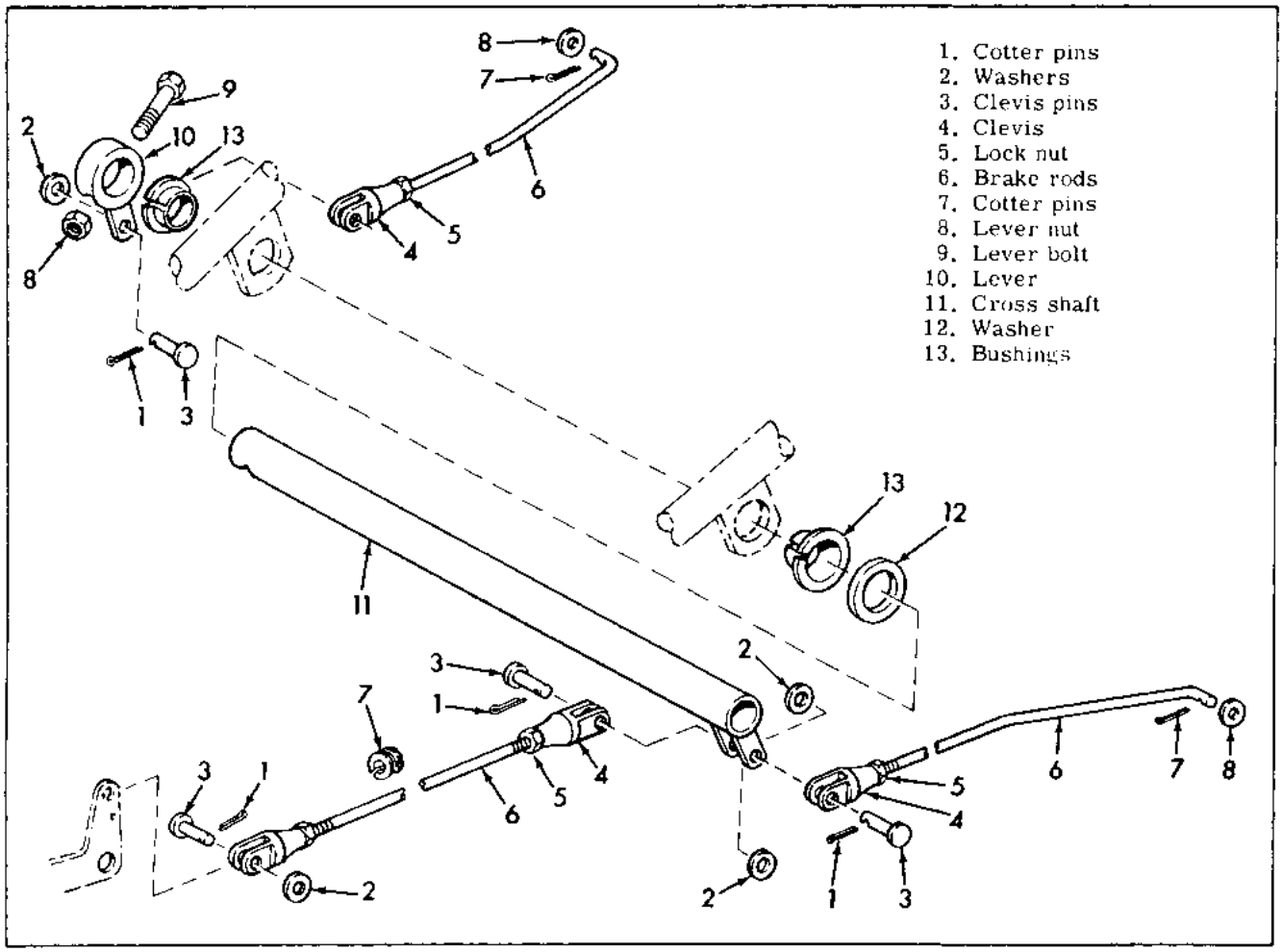


Figure 2G-37. 1965 DF, DC Brake Linkage

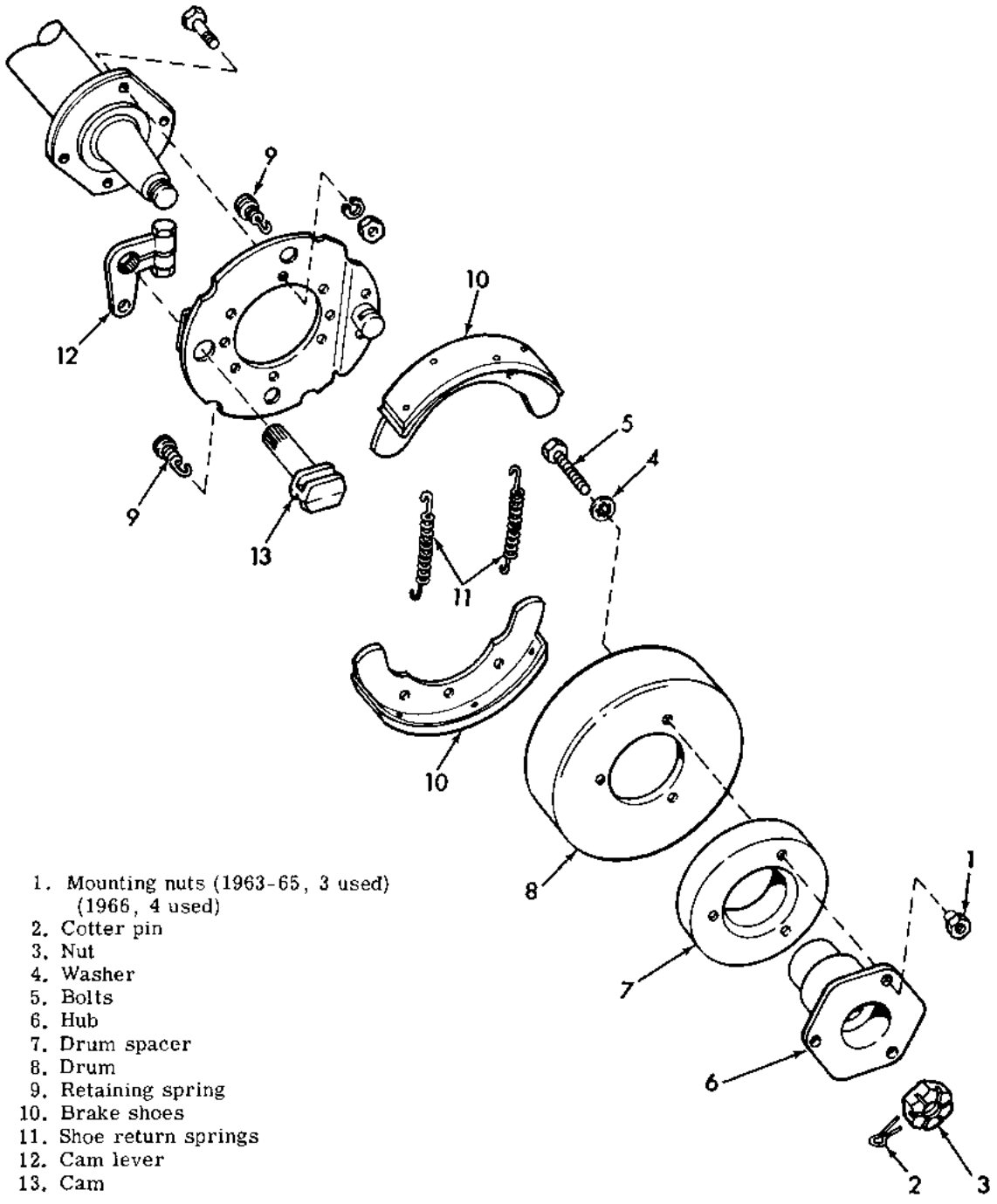


Figure 2G-38. Mechanical Drum Type Brake - Exploded View

ground. Remove cotter pin and clevis pin from front ends of ends of left and right brake rods.

Shorten each rod (turn clevis (4) onto rod until each brake drags when clevis and pin are reinstalled on cross shaft lever.) Check by turning wheels. Turn each clevis the same number of turns to keep brakes equalized. When new brake linings have been installed, the left and right rear brake rods may have to be adjusted an unequal number of turns to equalize brakes.

After several minor adjustments of front brake rod, it will be necessary to readjust brake shoe cam lever on brake sideplate (12, Figure 2G-38) to keep lever in approximately vertical position. To adjust position loosen clamping bolts, remove levers from camshaft splines and reposition both levers the same amount on splines.

IMPORTANT: All brake linkage adjustments must be made so that operating levers on cross shaft and brake operating levers are in a nearly vertical position with foot pedal in depressed position (brakes applied).

REMOVING AND INSTALLING MECHANICAL BRAKE SHOES AND PARTS (Figure 2G-38)

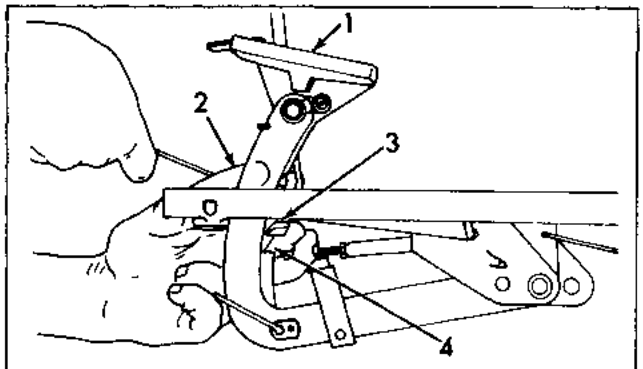
If brake shoe linings become worn thin or damaged, the brake shoes (10) can be inspected and removed, if necessary for lining replacement as follows: Remove wheel mounting nuts (1) and remove wheel (not shown). Remove wheel axle hub nut cotter pin (2) and nut (3). Attach suitable puller to ends of 3 bolts (5) and pull hub (6), drum spacer (7) with drum (8) from axle as an assembly. Linings are exposed to view at this point. To remove shoes unhook shoe retainer springs (9) from holes in shoes and unfold shoes (10) from slots in cam (13) and pivot stud by swinging shoes away from backing plate. Remove shoe return springs (11). If linings are worn, shoes can be replaced as an assembly, or linings only can be replaced by drilling out old rivets and riveting on new linings which are supplied in sets with rivets. Grease cam and pivot stud slots and reassemble parts in reverse order. If cam lever (12) has been removed from cam (13), reassemble on splines so cam lever is perpendicular to cam slot as shown.

NOTE

Oil pedal and rod linkage parts including brake operating camshaft (13, Figure 2G-38) cross shaft bearings (13, Figure 2G-37) and clevises (4, Figure 2G-37) periodically.

DISASSEMBLING AND REASSEMBLING MECHANICAL BRAKE CROSS-SHAFT (Figure 2G-37)

Remove front and rear brake rod clevises from cross-shaft levers by removing cotter pins (1) washers (2) and clevis pins (3). Remove right side lever nut (8) lever bolt (9) and lever (10). Withdraw cross shaft (11) from left side. Replace bushing (13) if worn or damaged.



1. Brake pedal
2. Bracket
3. Ratchet ear
4. Ratchet notch

Figure 2G-39. Adjusting Mechanical Brake Release

MECHANICAL BRAKE LOCKING RATCHET (Figure 2G-39)

If brake locking ratchet (4) fails to engage or release from the accelerator interlocking ear (3) when the brake pedal (1) is tilted, the accelerator bracket (2) must be readjusted for proper brake locking and releasing.

See Figure 2G-39. Loosen, but do not remove pedal bracket-to-floor panel nuts with wrench. Depress brake pedal and tilt foot pedal (1) forward. Shift bracket (2) so that ear (3) engages one of notches (4). Fully tighten nuts while holding in this position.

DISASSEMBLING BRAKE PEDAL (Figure 2G-36)

To replace or repair worn or damaged brake pedal parts, proceed as follows: Remove retaining ring (1) and pedal screw (2). Slide brake pedal (3) out of brake ratchet (4) and brake lever (5). Remove ratchet spring (6), clevis pin (7), and unhook brake return spring (8) from brake spring pull wire (9). Remove brake pivot bolt (10) and brake lever (5). Clean all parts and inspect for wear or damage. Replace any worn or damaged parts and assemble brake in the reverse order of disassembly.

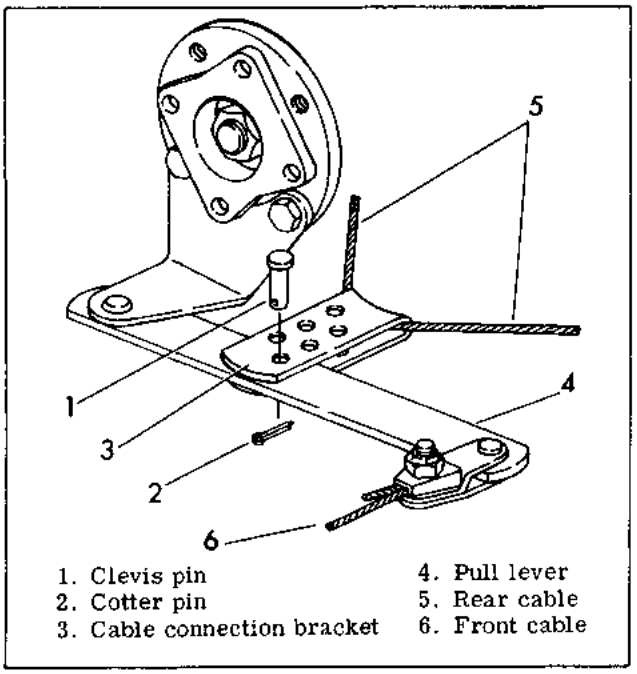
HYDRAULIC SHOE BRAKES 1966-1972 DC

DESCRIPTION

Hydraulically operated drum type expanding shoe brakes are located at rear wheels. Foot pedal operates master cylinder piston creating hydraulic pressure in lines to wheel cylinder pistons which expand brake shoes. Brake shoes require periodic adjustment to compensate for lining wear. Master cylinder fluid level should be checked once a month to restore level - USE ONLY HYDRAULIC BRAKE FLUID. A separate hand operated parking brake is cable-connected to the rear brake shoe actuating lever. Adjustment is provided at cable bracket connection.

ADJUSTING HYDRAULIC BRAKE SHOES

Adjust brake shoes if pedal moves more than 3/4 way to floor. Adjustment for brake lining wear is made by expanding brake shoe pivot as follows:



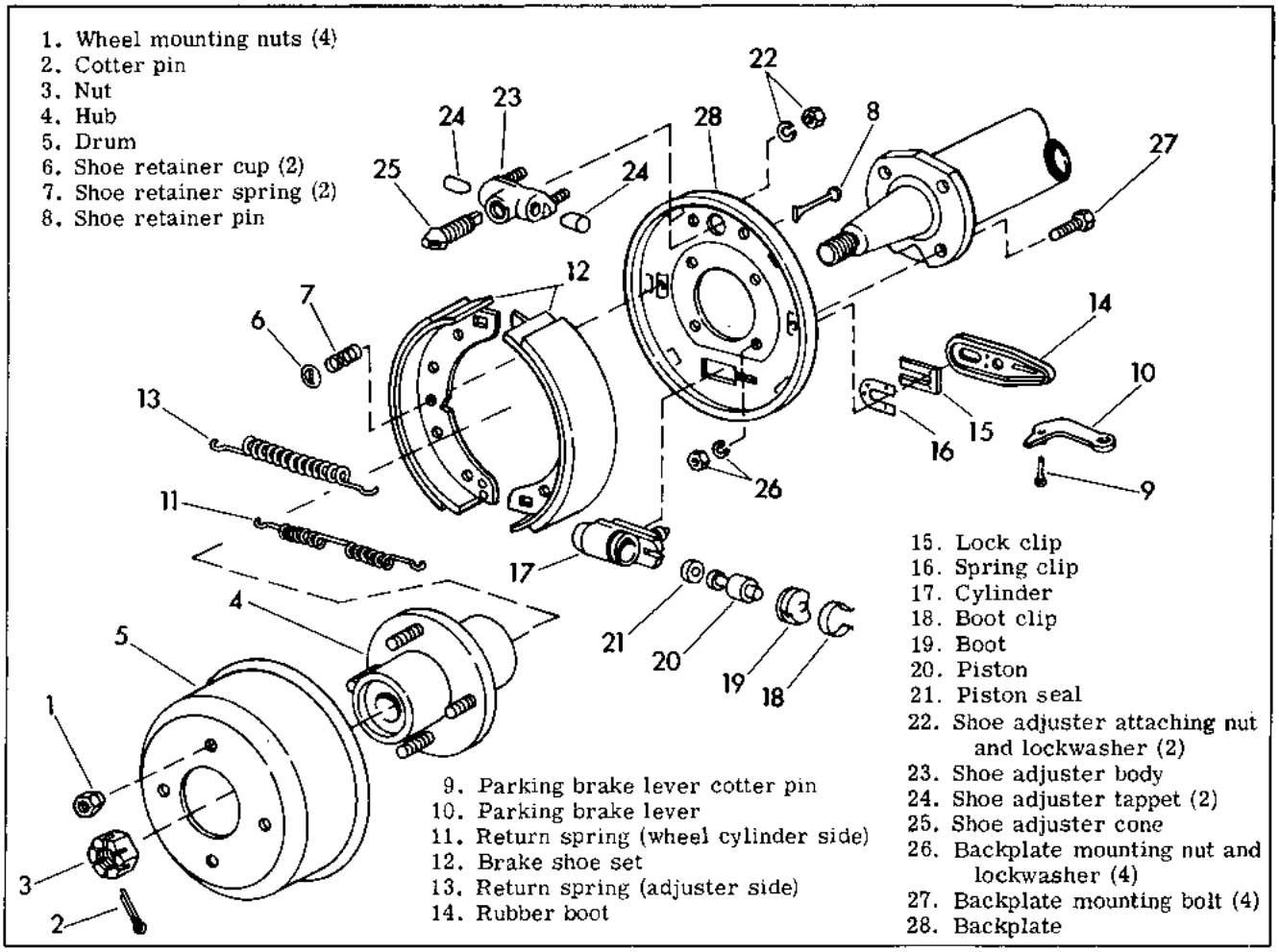
1. Clevis pin
2. Cotter pin
3. Cable connection bracket
4. Pull lever
5. Rear cable
6. Front cable

Figure 2G-39A. Parking Brake Adjustment

1. Adjusting screw
2. Parking brake actuating lever
3. Bleed fitting

Figure 2G-39B.

1. Wheel mounting nuts (4)
2. Cotter pin
3. Nut
4. Hub
5. Drum
6. Shoe retainer cup (2)
7. Shoe retainer spring (2)
8. Shoe retainer pin



9. Parking brake lever cotter pin
10. Parking brake lever
11. Return spring (wheel cylinder side)
12. Brake shoe set
13. Return spring (adjuster side)
14. Rubber boot
15. Lock clip
16. Spring clip
17. Cylinder
18. Boot clip
19. Boot
20. Piston
21. Piston seal
22. Shoe adjuster attaching nut and lockwasher (2)
23. Shoe adjuster body
24. Shoe adjuster tappet (2)
25. Shoe adjuster cone
26. Backplate mounting nut and lockwasher (4)
27. Backplate mounting bolt (4)
28. Backplate

Figure 2G-39C. Hydraulic-Brake Exploded View

CAUTION

Block front wheel(s), jack car up and block frame to prevent personal injury and/or damage to the vehicle.

Support rear end of car with both wheels off the ground. Remove cotter pin and clevis pin (1 and 2, Fig. 2G-39A) from adjusting bracket at front end of parking brake pull cable.

Turn square head screw (1, Fig. 2G-39B) at top of brake sideplate inward (clockwise) until each brake drags slightly. Check by turning wheels. Reinstall cable adjusting bracket on lever using clevis pin hole giving slight cable slack with brake handle released.

REMOVING HYDRAULIC BRAKE SHOES AND PARTS (Fig. 2G-39C)

If brake shoe linings become worn thin or damaged, the brake shoes (12) can be inspected and removed, if necessary for lining replacement as follows: Remove wheel mounting nuts (1) and remove wheel (not shown). Remove wheel axle hub nut cotter pin (2) and nut (3). Attach suitable puller to ends of bolts and pull hub (4), with drum (5) from axle as an assembly. Linings are exposed to view at this point. To remove shoes, disengage shoe retainer spring cups (6) from pins (8) and remove springs (7). Remove cotter pin (9) from parking brake lever (10). Remove cylinder side (red) shoe return spring (11). Pull shoes (12) from slots in adjuster assembly and swing shoes away from backing plate. Remove adjuster side shoe return spring (13). Note how spring ends are positioned in holes.

CAUTION

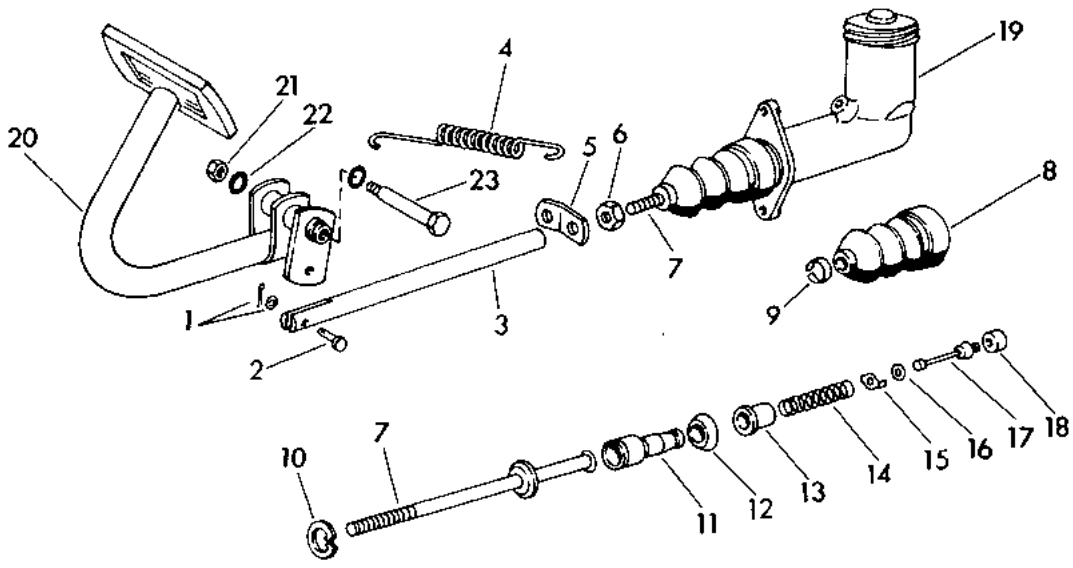
Do not depress rear wheel brake pedal with shoe assemblies disassembled as a loss of fluid will result.

If wheel cylinder repair is necessary, remove rubber boot (14) and 2 clips (15 and 16) at rear of brake sideplate with a pointed tool.

INSPECTION AND SERVICING BRAKE SHOES AND PARTS (Fig. 2G-39C)

Examine brake linings for wear and signs of being oil soaked. Linings are bonded to shoes which are available as a set to service 2 wheels. Examine wheel cylinder also for signs of leaking fluid.

If faulty unit is found, disconnect hydraulic line, remove wheel cylinder from back plate and disassemble for inspection. Remove rubber boot (14), lock plate (15) and spring plate (16) to release cylinder (17) and lever (10). Examine seal (21), piston (20) and cylinder (17) for wear and pits or scratches and



1. Cotter pin and washer
2. Clevis pin
3. Clevis rod
4. Return spring
5. Return spring bracket
6. Clevis rod lock nut
7. Push rod
8. Boot
9. Boot retainer clip
10. Push rod retainer clip
11. Piston
12. Piston seal
13. Valve spring collar
14. Valve spring
15. Valve spacer
16. Valve washer
17. Valve stem
18. Valve seal
19. Master cylinder
20. Brake pedal
21. Pivot bolt nut
22. Pivot bolt washer (2)
23. Pivot bolt

Figure 2G-39D. Master Cylinder - Exploded View

replace parts as necessary. Note: Use brake fluid or alcohol only to clean wheel cylinder parts. Wheel cylinder piston kits or seal kits are available to service 2 wheels.

CAUTION

Clean rubber parts by washing in denatured alcohol or brake fluid. DO NOT use mineral base cleaning solvents such as acetone or paint thinner. Use of mineral base solvents will cause deterioration of the part and would continue to deteriorate after assembly which could result in component failure.

Disassemble shoe adjuster tappets (24) from body (23) and clean parts in solvent.

Severely scored or grooved brake drums should be replaced. Assemble brake shoes and parts in reverse order of disassembly. Apply a slight amount of grease to shoe adjuster cone (25) and tappets (24). Also apply a slight amount of grease to shoe contact points on brake sideplate. Install adjuster side spring first and position shoe ends on adjuster tappets. Install cylinder side spring and position shoe ends on cylinder - one side has square hole for parking brake lever. Assemble remaining parts, adjust brake shoes and bleed hydraulic system as described in this section.

DISASSEMBLING MASTER CYLINDER AND PARTS (Fig. 2G-39D)

Disconnect hydraulic line and remove two master cylinder attaching bolts, nuts and spacers. Remove cotter pin and washer (1) which attaches clevis rod (3) to brake pedal. Disconnect return spring (4). Withdraw master cylinder assembly (19) from car frame hole.

Loosen clevis rod lock nut (6) and unscrew rod (3) from push rod (7). Remove spring bracket (5) and nut (6). Remove boot (8) from master cylinder (19). Remove clip (9) and boot from push rod (7). Remove push rod retainer (10) from groove in master cylinder bore. Withdraw push rod (7), and piston (11) with seal (12). Remove spring collar (13), valve spring (14), valve spacer (15), valve washer (16), valve stem (17) and valve seal (18). Clean all parts in hydraulic brake fluid or alcohol ONLY.

Examine piston (11) and cylinder (19) bore for wear, scratches or pitting. Examine seals (18 and 12) for wear or distortion. Repair Kits are available to service the master cylinder.

Assemble parts in reverse order of disassembly and obtain correct adjustment of push rod (7) by screwing clevis rod onto push rod until there is 1/16 inch play between push rod and piston in cylinder when clevis hole lines up with hole in pedal. This free play is important for correct operation of hydraulic system.

Bleed brakes as described in following paragraph.

BLEEDING HYDRAULIC SYSTEM

WARNING

Brake fluid can cause irritation of eyes and skin and may be harmful if swallowed. If fluid is swallowed, induce vomiting by administering two tablespoons of salt in a glass of warm water. Call a doctor. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. KEEP BRAKE FLUID OUT THE REACH OF CHILDREN!

If any line or cylinder has been opened when servicing brake system or when satisfactory brake adjustment is unobtainable or pedal is spongy, bleed air from hydraulic system as follows:

Strip the end of a length of appropriate size plastic tubing over wheel cylinder bleeder nipple, located next to wheel cylinder line connection (3, Fig. 2G-39B).

Place the other end in any clear glass jar containing about 1 in. of brake fluid.

Bleed right wheel first. Open bleeder nipple by rotating it counterclockwise about 1/2 turn. With master cylinder full of fluid at all times, slowly depress foot pedal repeatedly until fluid flows from bleeder nipple free of air bubbles. Add fluid to master cylinder to bring to 1/4 in. from cover. Close bleeder nipple. Repeat above procedure on left wheel.

Do not re-use bled fluid unless it is clear and free of sediment. If it is impossible to bleed all air from system, master cylinder check valve is faulty and a master cylinder repair kit should be installed.

REPLACING ACCELERATOR PAWL Fig. 2G-40.

WARNING

Before working on this vehicle, block all wheels and turn ignition to "OFF" position and remove keys from vehicle. Failure to do so could cause personal injury and/or damage to the vehicle.

Disconnect wire terminal from the micro-switch (1) or disconnect micro-switch rod (2) from interlock shaft (3) by removing cotter pin (4) and washer (5).

Remove swivel block (8) by removing cotter pin (6) and washer (7).

Remove two bolts (12) from accelerator bracket (13) (at opposite ends of bracket). Remove bracket assembly from vehicle.

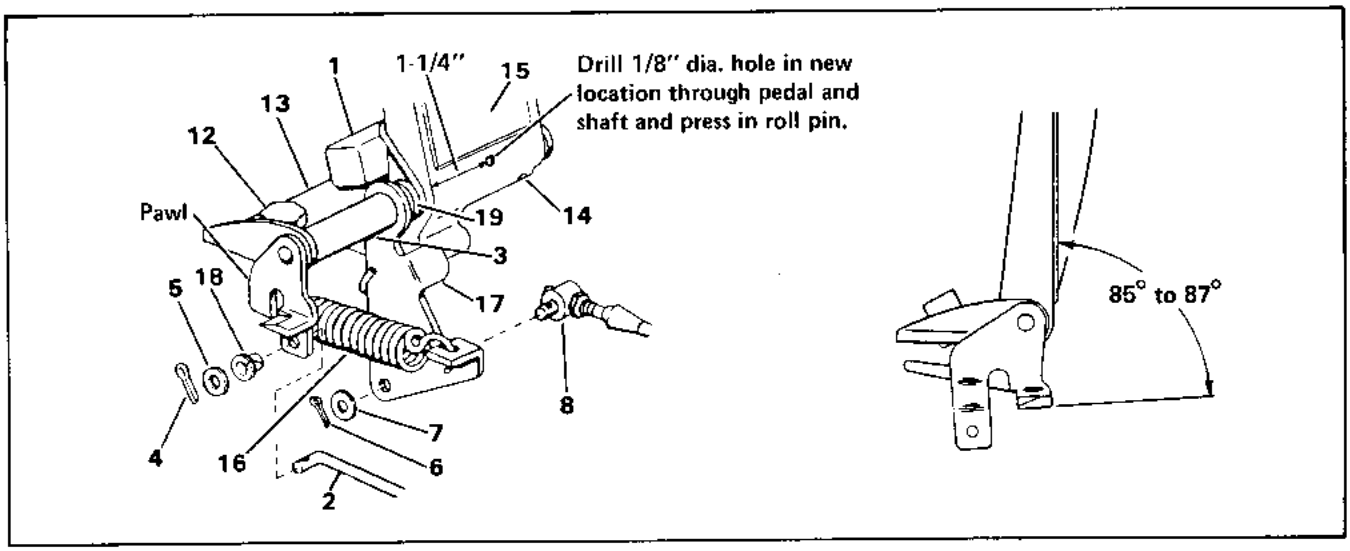


Fig. 2G-40. Accelerator Pedal Assembly

Using suitable drift pin, drive roll pin (14) from pedal (15) and shaft (3). Disconnect return spring (19) from pedal (15) and lever (17). Unhook lever spring (16) from lever. Slide shaft (3) from pedal (15), bracket (13), return spring (19) and accelerator lever (17). Insert nylon bushing (18) into new interlock shaft (3) pawl with lip of bushing to cotter pin side of pawl.

Slide shaft (3) through first hole of bracket (13). Slide accelerator lever (17), return spring (19) and pedal (15) onto shaft (3). Slide shaft through second hole in bracket (13). NOTE: Pawl must be flush with bracket.

Connect return spring (19) to pedal (15) and lever (17), as shown. Hook accelerator spring (16) to lever (17), as shown.

Install swivel block (8) into lever (17) and slide washer (7) onto swivel block (8). Install cotter pin (6) into hole of swivel block to secure cable linkage.

Install micro-switch rod (2) into bushing and slide washer (5) onto rod. Install cotter pin (4) into hole of rod to secure the micro-switch rod assembly. At the bottom of pedal, measure 1-1/4" to center of pedal and mark it. With pedal positioned at 85° to 87° from floor of car (Fig. 3), drill 1/16" pilot hole through pedal, center of shaft and through opposite side of pedal.

CAUTION

The roll pin hole must be drilled as close as possible to the shaft's center to prevent possible failure of the accelerator assembly.

Using 1/8" drill bit, drill pilot hole larger to final size.

Drive roll pin (H.D. No. 610) into hole, flush with pedal.

NOTE

Perform all brake and accelerator adjustments as described in their respective sections of this manual.

BODY

GENERAL

The golf car body, body tail gate, fork housing, left shield and right shield are of fiberglass construction. Fiberglass will not discolor, rot or deteriorate. Utilicar bodies are steel construction.

The optional windshield is made of a clear, durable plastic. Use a mild soap or detergent with water for normal cleaning. Flush with clear water first to soften dirt. Then, wipe clean with sponge or soft cloth using plenty of water. DO NOT wipe windshield when dry or with a dry towel because dirt particles may scratch surface.

SEAT MAINTENANCE

The seats and tail gate are bolted to the main body section but do not have to be removed to take body off car frame.

Proper cleaning of the seats will maintain their appearance and increase their usable life. Do not use any harsh detergents or cleaning solvents which contain ammonia, aromatic solvents or alkali materials. Consult the chart below for proper cleaning procedures.

An occasional application of wax to the seat covering material will improve its soil resistance and cleanability.

RAISING FOR SERVICE

Body assembly (on 1973 and later D and D4 models) is hinged at the rear and is held in place at the front by means of a spring loaded latch assembly. The latch is located just under the left front corner of the body. Two check straps or metal braces stop the body in a vertical position.

WARNING

With body raised on 1966 and earlier cars, secure body so it cannot fall during maintenance of golf car.

Hinges should be oiled and cleaned frequently to counteract corrosion caused by acidic fertilizer, grass or moisture.

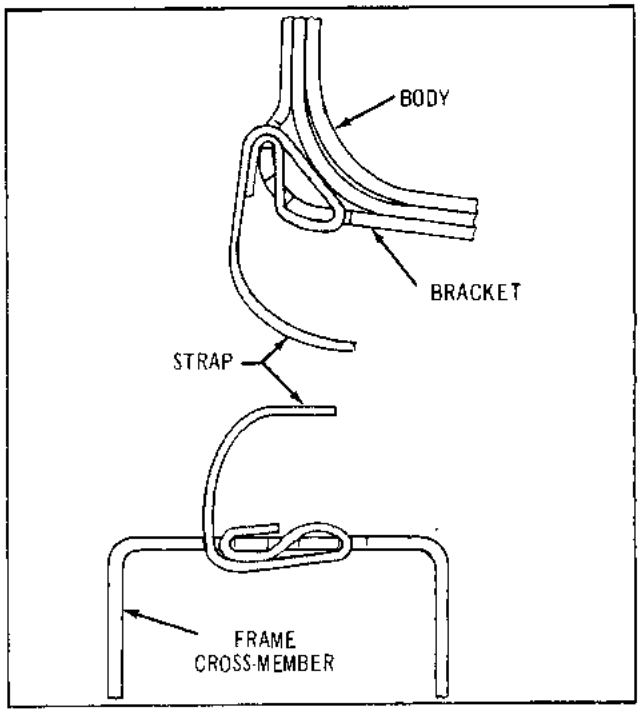


Figure 21-3. Lacing Body Straps (1965 & Earlier)

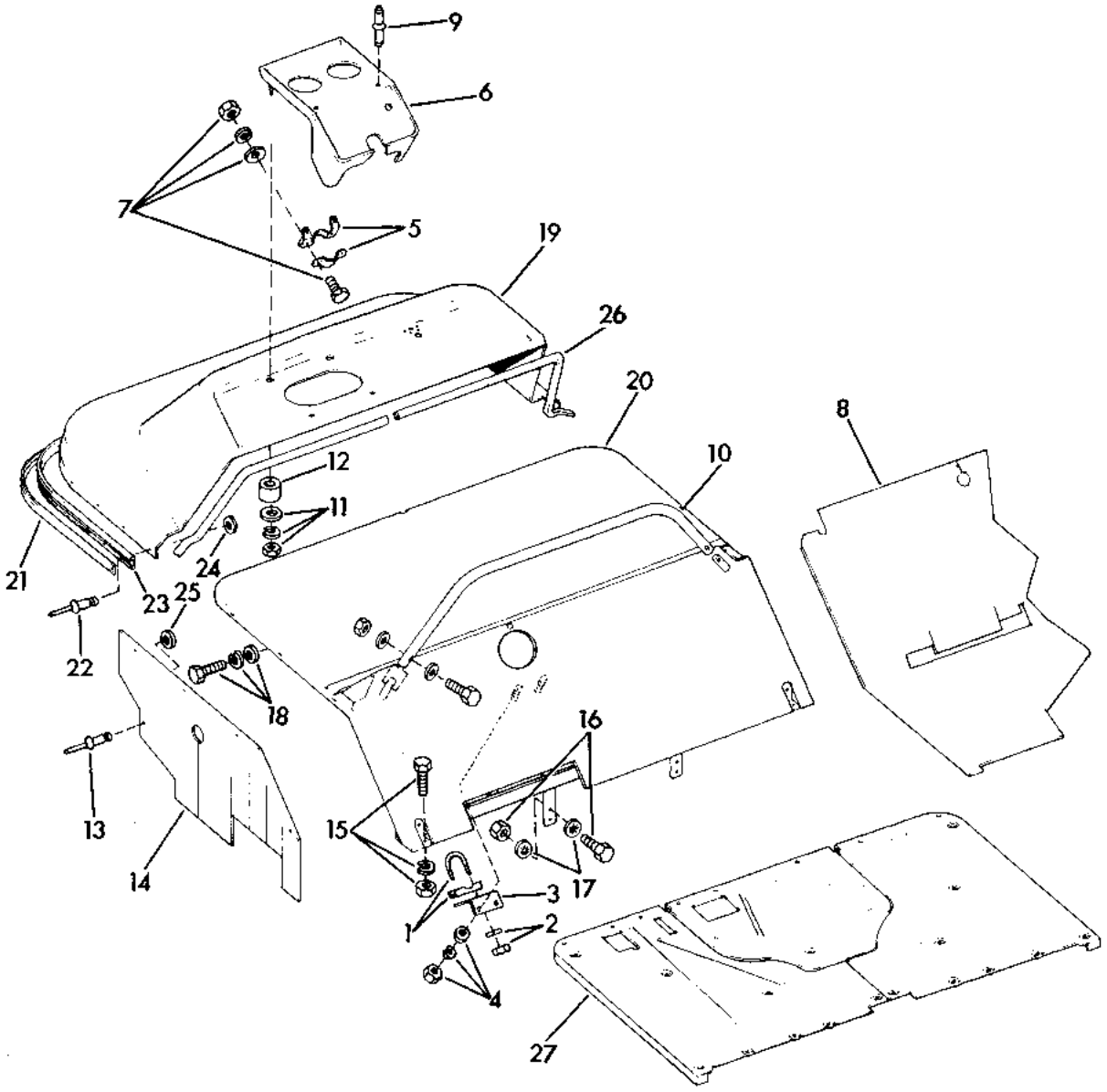
Hinges should be cleaned and oiled every 6 months (oftener if required to counteract corrosion caused by acidic fertilizer, grass and moisture).

WARNING

On models with flat support braces, insert bolt or rod through matching holes near brace hinge when body is raised to prevent body from coming down accidentally.

SEAT CLEANING CHART

Ordinary Dirt	Wash material with warm water and a mild soap. Apply soapy water to a large area, allow to soak for a few minutes, then rub briskly with a cloth or sponge.
Imbedded Dirt	In the case of stubborn or imbedded dirt in the grain of the material, a soft bristle brush may be used after the soap application has been made. If the dirt is extremely difficult to remove, cleaners such as Ajax or Comet may also be used. These should be used more cautiously.
Chewing Gum	Carefully scrape off as much as possible. Apply a dry cleaning fluid.
Tars, Asphalt, Creosote	These substances will stain if allowed to remain in contact with the seat material. Wipe off excess as quickly as possible and clean the area carefully with a cloth dampened with dry cleaning fluid.
Paint	Remove immediately if possible. Do not use paint remover or liquid type brush cleaners. Use a cloth dampened with dry cleaning fluid.



1. Steering column U bolt clamp
2. Nut and lockwasher (2)
3. U bolt clamp bracket
4. Nut, lockwasher, washer (2)
5. Steering column clamp
6. Instrument panel
7. Bolt, nut, washer, lockwasher (2)
8. Floormat
9. Countersunk pop rivet (2)
10. Support tube
11. Washer, lockwasher, nut (2)
12. Spacer (2)
13. Pop rivet (2)
14. Splash shield (2)
15. Bolt, lockwasher, nut (2)
16. Bolt and nut (4)
17. Internal tooth lockwasher (8)
18. Bumper mounting bolt, washer, lockwasher (4)
19. Fiberglass body section
20. Subframe
21. Plastic bumper strip
22. Pop rivet (17)
23. Channel
24. Pop rivet washer (17)
25. Pop rivet washer (2)
26. Plastic trim (2)
27. Floor panel

Figure 2I-4. Front Body Section, 4 Wheel Car - Exploded View

REMOVING AND INSTALLING BODY

To support body in vertical position, make a platform from wood or use suitable blocking which is 10 in. high, the top surface about 18 in. wide and 39 in. long. Cover top surface with carpet or cloth.

Raise body and position platform under tail gate.

On 1965 and later models, unfasten body support at frame. On earlier models, unlace straps from brackets on body. Lacing pattern is shown in Figure 2I-3.

With body resting on platform, remove bolts, washers and nuts securing hinge to frame.

To reinstall body, reverse this procedure. After hinge is attached, support body at about a 45° angle with a suitable prop to lace check straps to body brackets or attach metal braces.

Body can be adjusted forward or backward as may be necessary for clearance of forward-reverse lever by loosening both rear bumper bolts on side of car.

REMOVING AND INSTALLING FORK HOUSING AND SHIELDS - 3 WHEEL CAR

Shields:

Remove 8 Phillips-head screws which fasten each shield to sides of fork housing and 5 Phillips-head screws which fasten bottom of each shield to floor panel. On 1972 and later models the Phillips-head screws are replaced by 3/16 in. aluminum pop rivets. To remove pop rivets drill them out with a 3/16 in. drill. When replacing pop rivets, be sure to use washers to prevent damage to fiberglass.

Remove accessory panel (See "Fork", Section 2). Remove tiller bar assembly held by shaft nut and lock washer, or remove steering wheel (See "Fork" Section 2).

Disconnect switch, wiring, etc. from fork housing. On tiller bar models, remove screw and cup washer holding top of fork housing to steering head bracket. Remove 8 Phillips-head screws holding bottom of fork housing to floor panels. Lift housing from frame, being careful not to lose 3 rubber spacer washers underneath fork housing.

NOTE

If desired, shields need not be detached from fork housing and entire assembly can be removed and replaced as a unit.

Install parts in reverse order of removal.

REMOVING AND INSTALLING FRONT BODY SECTION - 4 WHEEL CAR (Figure 2I-4)

Remove steering wheel. See "Removing Steering Wheel" in Section 2F.

Remove steering column U bolt clamp (1) by removing 2 nuts and lockwashers (2). Remove U bolt clamp bracket (3) from subframe by removing 2 nuts, lockwashers, and washers (4).

Remove steering column clamp (5) from beneath instrument panel (6) by removing 2 nuts, lockwashers, washers, and bolts (7).

Disconnect wiring from ignition switch and fuel gage. Disconnect choke cable from carburetor. Remove straps securing wiring harness and choke cable to steering column. Pull choke cable up through floorboard.

Remove chrome steering column housing.

Remove floormat (8).

Using a 3/16 in. drill, drill out countersunk pop rivets (9), securing instrument panel (6) to support tube (10). Remove nut, lockwashers, and washers (11) and spacer (12). Lift off instrument panel (6). Drill out the lower front 3/16 in. pop rivet (13) securing splash shield (14) to car frame.

Remove 2 bolts, lockwashers and nuts (15). Remove 4 bolts and nuts (16), and 8 internal tooth lockwashers (17) which secure subframe to floor panel. Note that there are lockwashers under the bolt heads and under the nuts.

Remove bumper by removing 4 bumper mounting bolts, lockwashers and washers (18).

The body section, fiberglass and subframe, may now be lifted free of car.

If it is necessary to remove the fiberglass (19) from the subframe (20), remove the black vinyl bumper strip (21) and use a 3/16 drill to drill out the 17 pop rivets (22), holding channel (23) and fiberglass to subframe.

Reassembly is basically the reverse of disassembly with the following exceptions.

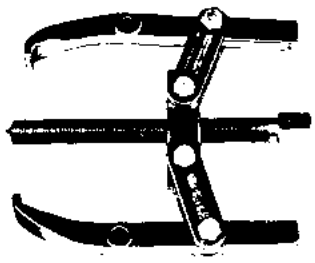
Make sure to use washers (24, 25) on backside of pop rivets (13, 22), using a pop rivet gun to install new rivets (see parts catalog).

Before replacing the black vinyl bumper strip, lubricate it with tire soap or a small amount of grease. Start the strip at one end of channel and pull it all the way through.

When replacing floor mat, use contact adhesive Harley-Davidson Part No. 99615-69.

NOTE

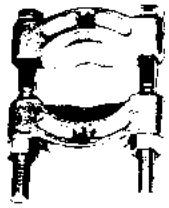
If it is only necessary to remove the fiberglass body section (19), the subframe (20) need not be removed. Remove items 5, 6, 7, 9, 11, 12, 21, 22, 23 of figure 2I-4.



95635-46

ALL PURPOSE CLAW PULLER

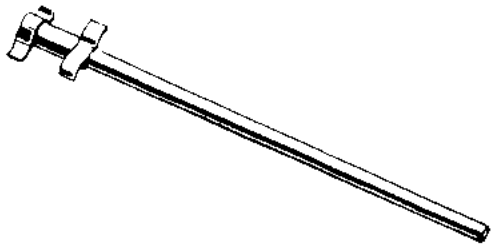
For variety of applications such as pulling transmission drive flange, gears, etc. Has center adapter for pulling objects from a small diameter shaft.



95637-46

WEDGE ATTACHMENT FOR CLAW PULLER

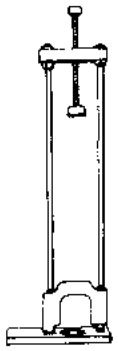
Used in combination with claw puller for pulling steering wheel, etc.



96806-40

BENDING BAR

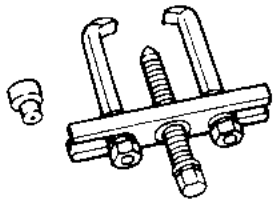
Used for straightening bumpers. Hooks on bumpers for applying bending leverage.



97010-52A

SHOCK ABSORBER TOOL

Compresses shock absorber for disassembly or assembly. Holds shock absorber spring in compression while parts are disassembled.



97292-61

TWO JAW PULLER

Used to pull steering gear parts, bearings, etc. 95652-43A - Center Cap only.

NOTES

ENGINE 3

TABLE OF CONTENTS

GENERAL

ENGINE SPECIFICATIONS

PISTON

Piston Fit in Cylinder	.006 in. to .007 in. Loose (Measured at 3/8" below bottom ring groove)
Piston Ring - End Gap	.007 - .017 in.
Piston Ring - Side Clearance	.002 - .004 in.
Piston Pin - Fit in Piston	.0001 in. Interference at 70 degree F.

CONNECTING ROD

Radial Play	.0005 in. - .002 in. Loose
Piston Pin Fit	.0002 - .001 in. Loose
End Play Between Crankshaft Throws	.010 - .018 in.
Fit on Crank Pin	.0005 - .002 in. Loose

CRANKSHAFT ASSEMBLY

Crank Pin	Must Resist a Turning Torque of 110 Lb-Ft
Maximum Runout Mainshafts - When revolved on bearings	Right (Fan) .002 in.
on bearings	Left (Clutch) .004 in.
on centers	Right less than .002 in.
	Left less than .004 in.

CRANKCASE ASSEMBLY

Crankshaft End Play	.001 to .005 in.
Fan Side Ball Bearing Fit in Crankcase Assembly	.000 to .001 in. Loose
Main Bearing Fit on Shaft:	
Ball	.0001 in. to .0008 in. Loose
Roller	.0005 to .003 in. Loose
Maximum Runout - Circuit Breaker Cam	.005 in.

IGNITION

Breaker Point Gap Setting	.020 to .022 in.
Spark Plug Gap - No. 2,3,4,5	.040 - .045 in.
No. 5-6	.023 - .028 in.
Timing:	
1963-66D Retard	7° (.010 in.) Before Piston Top Dead Center
1965-68DC Automatic Advance	25° Before Piston Top Dead Center
1967 & Later D, 1969-1972 DC	Forward and Reverse (fixed timing) 25°

ENGINE DESCRIPTION

The Gasoline car engine is single cylinder, 2-cycle, air cooled. Oil is mixed with gasoline for fuel and lubrication. The engine has two major component assemblies - cylinder and crankcase.

The cast iron cylinder assembly includes an aluminum head and aluminum piston. The cylinder and head are bolted to the engine crankcase. The gasoline charge is admitted to the cylinder and the exhaust gas is ejected from the cylinder through ports in the cylinder wall.

During the upstroke of the piston, a suction is created in the crankcase and the reed valve opens drawing a gasoline and air mixture from the carburetor into the crankcase. At the same time, compression of the previous charge takes place above the piston.

After ignition, on the downward power stroke of the piston, the exhaust gas is ejected from the cylinder. At the same time, gases in the crankcase are compressed and forced up through the cylinder transfer ports, into the combustion chamber as the descending piston uncovers these ports.

The reciprocating, linear motion of the piston in the cylinder is converted into circular motion in the crankcase. The crankshaft consists of an off-center crank pin interposed between two counterweighted crank throws which rotate on two end shafts supported by anti-friction bearings. One end shaft drives the automatic transmission. The lower end of the connecting rod is fitted with roller bearings and connected to a single crank pin. Rod upper bearing(s) are of the retained needle roller bearing type.

The crankshaft makes one revolution of 360° for intake, compression, ignition and exhaust events, firing every time the piston reaches the top of its stroke.

Ignition timing is produced by operation of a circuit breaker, ignition coil, and spark plug. The breaking of a set of breaker points by a single-lobe cam on the circuit breaker or fan side shaft, determines the spark timing.
For further description of part function, see pertinent manual sections.

LUBRICATION

The 2-cycle engine does not incorporate a crankcase oil reservoir or oil supply for lubricating the engine. Rather, oil is mixed with the gasoline which enters the engine crankcase.

IMPORTANT

Use mixture of recommended oil and fuel as specified in Section 1 under Engine Fuel and Lubrication.

Mix oil and fuel in separate gas can and pour mixture into golf car gas tank. Do not mix fuel in golf car gas tank.

STORAGE

Add a good quality fuel stabilizer to the fuel mixture following the manufacturer's recommendations on the container. Fully charge the battery.

ENGINE REPAIR PROCEDURE

When an engine needs repair, it is not always possible to determine beforehand whether repair can be made with only the cylinder head, carburetor, cylinder and piston removed from the engine or whether the engine must be completely disassembled for crankcase repair.

When loss of power, poor compression, or excessive noise develops, decarboning cylinder and connecting rod lower bearing inspection is needed. It is recommended procedure to remove engine from the chassis (see "REMOVING AND INSTALLING ENGINE"), then disassemble the cylinder and piston only, following the procedure described in "Cylinder," Section 3.

After removing the cylinder and piston, it may be found that crankcase repair is necessary. Follow the procedure described in "Crankcase", Section 3.

When starting or generating trouble is traced to the starter-generator itself, remove 1966 and earlier engine from the chassis and follow the procedure described in Section 5. 1967 golf car starter-generator can be removed from engine while in chassis and serviced as a unit.

The Transmission front drive can be serviced while the engine is in the chassis. See Section 4.

REMOVING AND INSTALLING ENGINE (1966 and earlier Golf Car) (1968 and earlier Utilicar)

Raise body and disconnect battery cable from positive post on battery.

Remove engine cover secured at each side with 2 screws.

Remove shifter lever from transmission shifter fork shaft.

Remove V-belt from front drive, see "Removing and Installing V-Belt", Section 4.

Disconnect air cleaner hose at carburetor by loosening clamp screw.

Disconnect fuel line at carburetor and plug hose to prevent drainage.

Detach carburetor and control cable clamps by unscrewing attaching bolt from fan housing. Disconnect swivel block from carburetor throttle lever by removing cotter pin.

Detach choke control cable clamp attached to bracket on upper left manifold stud, and disconnect choke control wire from carburetor choke lever.

Disconnect exhaust pipe from cylinder port. See CYLINDER, Section 3.

Disconnect wiring to engine at following points:

1. Spark plug wire at spark plug.

2. Ground strap at front screw on control box.

3. Starter-Generator field wire at control box DF terminal.

4. Starter-Generator field wire at control box A terminal.

5. Starter-Generator armature wire at control box 61/D+ terminal.

6. Circuit breaker wire at condenser terminal.

Remove two front and two rear engine mounting bolts, washers and nuts and lift engine from frame.

Install the engine in reverse order of removal observing the following points:

1. Adjust shifter lever as described in "Removing and Installing Reverse Unit and Coupling", Section 4.

2. Check throttle controls for correct operation as described in "Throttle Controls", Section 3.

REMOVING AND INSTALLING ENGINE (1967 and Later Golf Car) (1969-1972 Utilicar).

1. Raise body and disconnect battery cable from positive post on battery.

2. Remove V-belt from front drive, see "Removing and Installing V-Belt" Section 4.

3. Disconnect air cleaner hose at carburetor by loosening clamp screw (1970 and earlier). On 1971 and later models, air cleaner is bolted directly to carburetor. Remove air cleaner housing from mounting bracket. Remove four locknuts, mounting bracket, gasket, support tubes and studs from crankcase housing.

4. Disconnect fuel line at carburetor and plug hose to prevent drainage.

5. Remove throttle and choke cable clamp from fan housing and disconnect wires from carburetor. Mark position of governor rod in swivel block, loosen swivel block screw and withdraw governor rod at carburetor throttle lever.

6. Disconnect exhaust pipe from cylinder port, see "Cylinder," Section 3.

7. Disconnect exhaust pipe from muffler. Remove muffler mounting bolts or nuts from engine and remove muffler with exhaust pipe.

8. Disconnect wires from starter-generator and ignition coil.

9. Remove 4 engine mounting bolts or nuts and disconnect stabilizer from engine. See "Cylinder," Section 3. Remove engine from frame.

Install engine in reverse order of removal. Be sure to check throttle and governor controls for correct operation, see Section 3. Adjust stabilizer rod so that there is no pressure on the rubber mounts, then tighten locknuts.

CYLINDER

SERVICING ENGINE

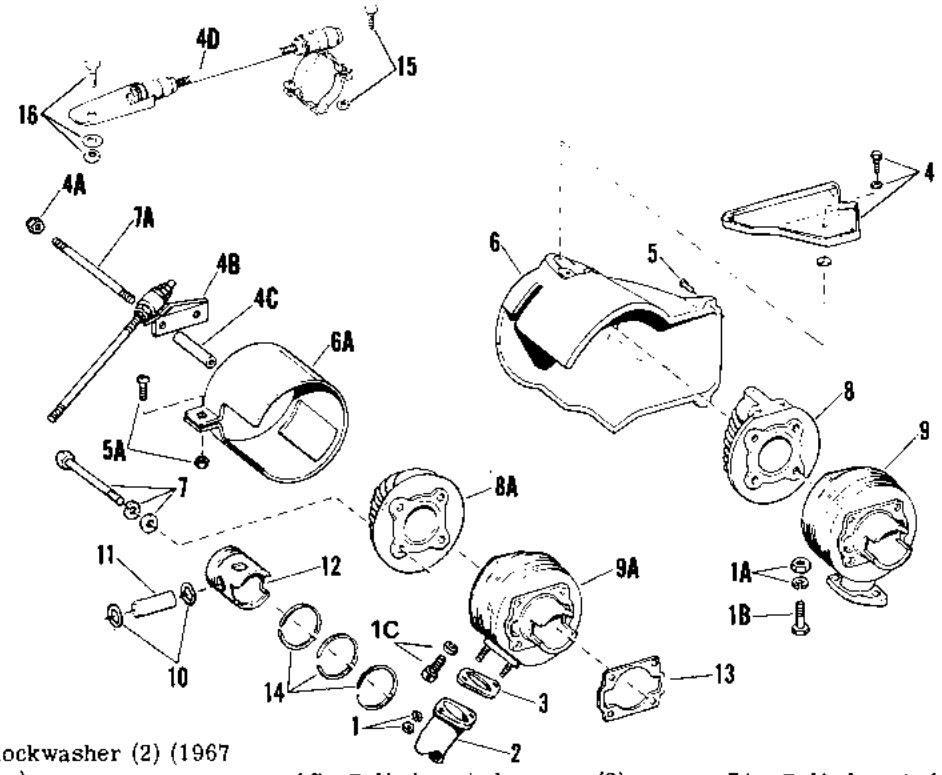
DISASSEMBLING EXHAUST PIPE

Remove exhaust pipe nuts and lockwashers (1 or 1A and bolts 1B) to disconnect the exhaust pipe (2) and flange gasket (3) from the cylinder (See Fig. 3C-68).

DISASSEMBLING CYLINDER AND PISTON (Figure 3C-68)

1963 TO 1966 D, DC MODELS TO 1969:

To remove the cylinder head, cylinder and piston, first remove the engine mounting bracket screws and washers (4) and air shroud mounting screws (5). Remove air shroud (6). Remove spark plug (see Section 5). Remove four cylinder bolts and washers (7). Remove cylinder head (8). Raise piston to top dead center and lift cylinder (9) from crankcase far enough to put a clean rag between the cylinder and crankcase to prevent foreign matter from falling into the crankcase when the cylinder is removed. Remove cylin-



1. Nut and lockwasher (2) (1967 and later)
1A. Nut and lockwasher (1963-66 D)
1B. Bolt (1963-66 D)
1C. Bolt and Lockwasher (2) 1980
2. Exhaust pipe
3. Gasket
4. Mounting bracket bolt and washer (3) (1963-66 D)
4A. Cylinder stud nut (2) (1967-69)
4B. Cylinder stabilizer (1967 - early 70 D) (1969 - early 70 DC)
4C. Cylinder stud spacer (2) (1967-69 D)
4D. Cylinder stabilizer (late 1970 and later, D, DC, and D4)
5. Shroud screw (2) (1963-66 D)
5A. Shroud screw and nut (1967 and later D)
6. Shroud (1963-66 D)
6A. Shroud (1967 and later D)
7. Cylinder bolt and washers (4-1963-66 D, 1970 and later D, DC) (2-1967-69 D)
7A. Cylinder stud (2) (2-1967-69 D)
8. Cylinder head (1963-66 D)
8A. Cylinder head (1967 and later)
9. Cylinder (1963-66 D)
9A. Cylinder (1967 and later D)
10. Lock ring (2)
11. Piston pin
12. Piston
13. Gasket
14. Piston rings (3)
15. Bolt and locknut
16. Bolt, washer and locknut

Figure 3C-68. Cylinder and Piston - Exploded View

der (9). Remove piston pin lock rings (10) using a knife or pointed instrument. Heat piston pin bosses slightly and tap piston pin (11) from piston (12) using suitable shouldered drift. Remove cylinder base gasket (13).

1967 - 69 D MODEL, 1969 DC MODEL:

To remove the cylinder head, cylinder and piston, first remove cylinder stud nuts (4A) to free cylinder stabilizer bracket (4B). Move stabilizer to one side and remove stud spacers (4C). Remove shroud clamp screw and nut (5A) and slip shroud (6A) from cylinder. Remove two cylinder bolts and washers (7). Remove cylinder head (8A). Raise piston to top dead center and lift cylinder (9A) from crankcase far enough to put a clean rag between the cylinder and crankcase to prevent foreign matter from falling into the crankcase when cylinder is removed. Remove cylinder (9A). Remove piston pin lock rings (10) using a knife or pointed instrument. Heat piston pin bosses slightly and tap piston pin (11) from piston (12) using a suitable shouldered drift. Remove cylinder base gasket (13).

1970 AND LATER D, DC MODELS:

To remove the cylinder head, cylinder and piston first remove shroud clamp screw and nut (5A) and slip shroud (6A) from cylinder. Remove four cylinder bolts and washers (7). Remove cylinder head (8A). Raise piston to top dead center and lift cylinder (9A) from crankcase far enough to put a clean rag between the cylinder and crankcase to prevent foreign matter from falling into the crankcase when cylinder is removed. Remove cylinder (9A). Remove piston pin lock rings (10) using a knife or pointed instrument, or on 1980 a snap ring pliers. Heat pin bosses slightly and tap piston pin (11) from piston (12) using a suitable shouldered drift, use caution not to bend rod. Remove cylinder bas gasket (13).

CLEANING AND INSPECTING

CYLINDER HEAD

1. Wash thoroughly in non-flammable cleaning solvent.

2. Scrape carbon and lead deposits from combustion chamber, being careful not to gouge aluminum. Also clean any deposits from spark plug hole threads.

3. Smooth any rough spots in combustion chamber with small grinder. Sharp edges in combustion chamber can cause pre-ignition. DO NOT remove any more material than necessary, or change combustion chamber shape.

CYLINDER

1. Wash thoroughly in non-flammable cleaning solvent and inspect for scored or gouged cylinder walls. Badly scored cylinders will require refinishing to oversize.

2. Scrape cylinder base gasket surface clean.

3. Scrape carbon and lead deposits from exhaust port and top of cylinder bore.

PISTON

1. Wash thoroughly in non-flammable cleaning solvent and inspect for scoring or gouging. A badly scored or gouged piston must be replaced.

2. Check to be sure piston ring locating pins are not loose in piston ring grooves.

3. Remove rings and clean carbon deposits from ring grooves.

NOTE:

A used piston ring, broken in half and ground to a chisel point, can be used to scrape carbon from ring grooves. Use caution not to damage locating pins.

4. Scrape carbon and lead deposits from top of piston, being careful not to gouge aluminum.

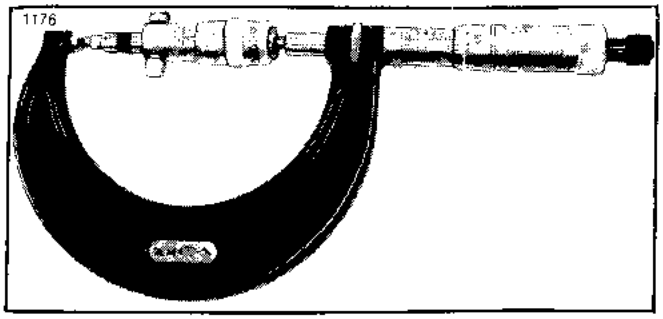


Figure 3C-69. Adjust Micrometers To Read The Same

MEASURING CYLINDER AND PISTON

1. If cylinder is in good condition, remove cylinder wall glaze with No. 220 or finer surface hone.

2. Adjust inside and oustide micrometers to read exactly the same (Figure 3C-69).

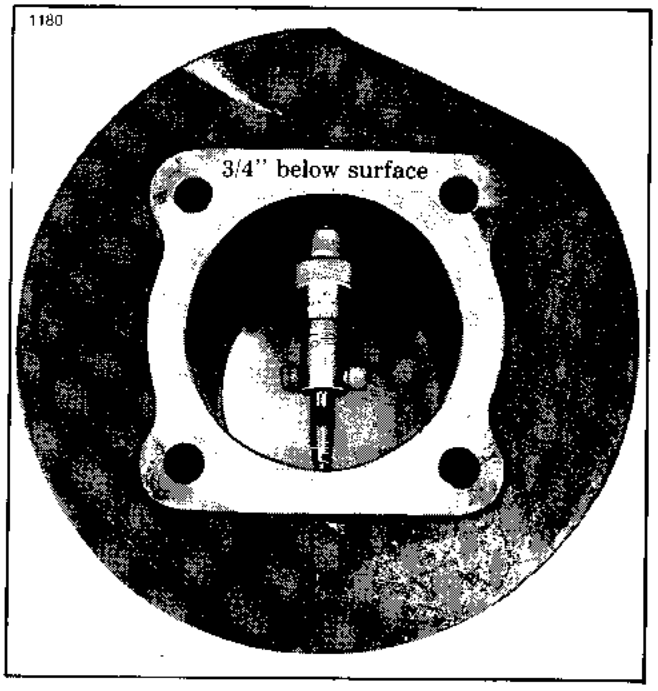


Figure 3C-69A. Measuring Cylinder Near Top

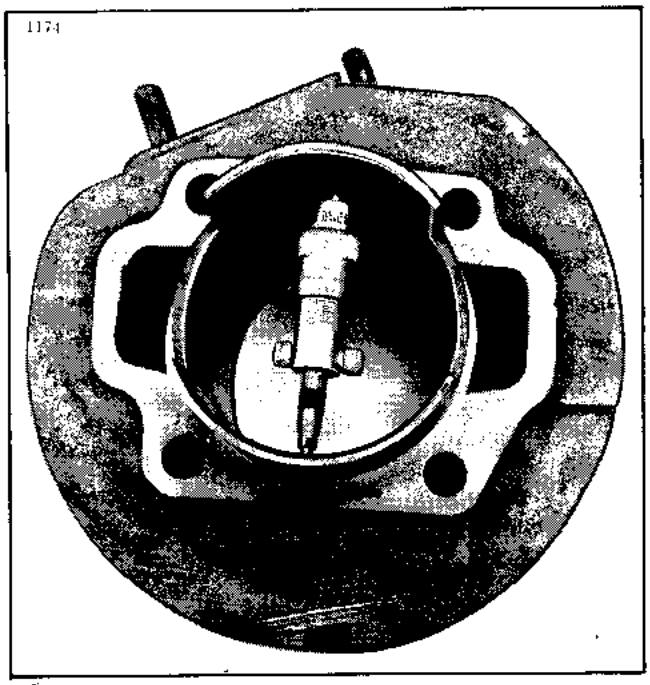


Figure 3C-69B. Measuring Cylinder 1½" From Bottom

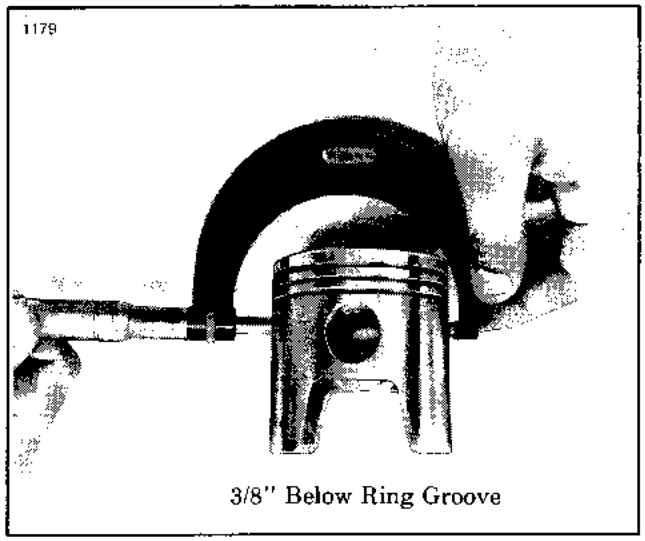


Figure 3C-70C. Measuring Piston

3. Measure inside diameter of cylinder in four places:
   a. 3/4 in. from top of bore both front to rear and left to right (Figure 3C-69A).
   b. 1½ in. from bottom of bore both front to rear and left to right (Figure 3C-69B).

4. Measure piston 3/8 in. below bottom ring groove 90° from pin bore (Figure 3C-69C).

Specifications

- Cylinder Out-of Round (Difference between front to rear and left to right measurements) . . . . . 0-.0005 in.
- Cylinder Taper (Step 3b. minus 3a.) . . . 0-.0007 in
- Piston to Cylinder Clearance (Step 3b. minus 3a) . . . . . .006-.007 in.

5. After deglazing cylinder, if cylinder and piston are within specs, and cylinder and piston are not scored, new rings may be fitted after cylinder is final honed.

6. If cylinder is out-of-round, has excessive taper or too much piston clearance refer to Fitting Piston to Cylinder.

FITTING PISTON IN CYLINDER

Pistons are available in Std., .010, .020, .030 and .040 in. oversize. The cylinder may be bored and final honed — or rough honed and final honed to fit any of the above pistons. Piston to cylinder clearance is .006-.007 inch. See MEASURING CYLINDER AND PISTON.

Always measure the piston to be used in any given cylinder before machining, because the cylinder must be final honed to fit the piston.

1. Measure cylinder to determine smallest size of piston that can be used.

2. Measure new piston 3/8 inch below bottom ring groove 90° from pin bore (Figure 3C-70C).

3. Bore or rough hone cylinder .003 inch larger than piston being used.

NOTE:

Harley-Davidson does not recommend the use of spring tension cylinder hones or "Flexi-Hones® ." Use a high quality expandable rack hone such as "Sunnen® " AN-111.

4. Final hone cylinder the last .003 inch to achieve desired piston clearance of .006 inch.

EXAMPLE	
Acutal piston diameter (As measured)	2.749
Add clearance desired	+ .006
Final bore size after finish honing should be	2.755
First	
Bore or rough hone	2.755
Cylinder to .003 inch	-.003
Less than final bore size	2.752
Then	
Finish hone cylinder the	2.752
Last .003 inch to reach	+ .003
The final bore size of	2.755

5. Chamfer cylinder ports with hand grinder to 0.010 to .030 inch wide to prevent rings from catching on ports during operation.

IMPORTANT

After honing the cylinder, wash it in warm water with a strong soap or detergent and dry thoroughly with compressed air to remove any abrasive from the pores in the cast iron. DO NOT WASH IN SOLVENT. Solvent will allow the abrasive to work in even deeper into the pores. If this abrasive is not removed, it will cause a lapping action on both the piston and rings resulting in rapid wear.

6. Coat cylinder with 2-cycle oil to provide lubrication and to prevent rust.

IMPORTANT

Once the cylinder and piston have been fitted, keep them together as a matched set to assure proper clearance.

FITTING PISTON RINGS

New piston rings should always be used whether a new or used piston is being installed. Even if the piston rings appear to be in fair condition, it is not advisable to reinstall them.

Top, second and third compression rings are identical rings, plain with stepped ends, pinned to the piston. Rings are regularly supplied in the same oversizes as listed for the pistons; .005, .010, .020, .030 and .040 inch.

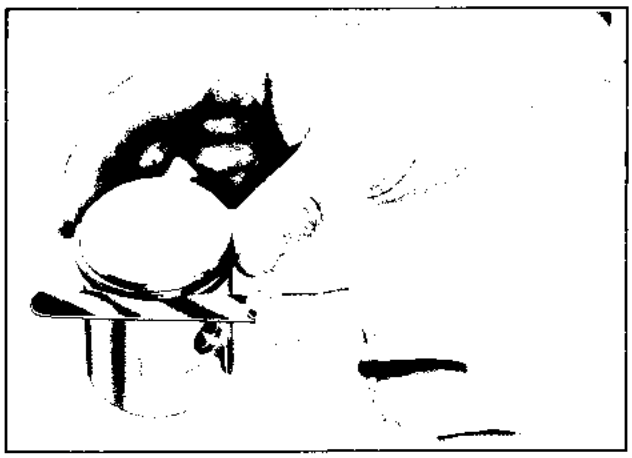


Figure 3C-71. Checking Ring Side Clearance

(See Fig. 3C-71.) Check side clearance of rings in ring grooves as indicated under Specifications, Section 3A. Standard ring gap between ends of rings must be maintained, (See Engine Specifications). To check gap, thoroughly clean cylinder bore and install the piston ring squarely in the bore, 1/2 inch from top of cylinder. Check gap with thickness gauge as shown in Fig. 3C-72. If ring gap exceeds .040 inch and cylinder bore is not scored and is worn less than .002 inch, install new rings of the same oversize step as the cylinder bore. If the cylinder has been finished oversize use the correct oversize rings, fitting rings to give standard gap. If ring end gap is less than specified, the ends may butt against each other when the ring expands, and rings may be broken or scored. Ring gap can be increased by placing a fine file in vise and carefully grinding excess from ring ends.

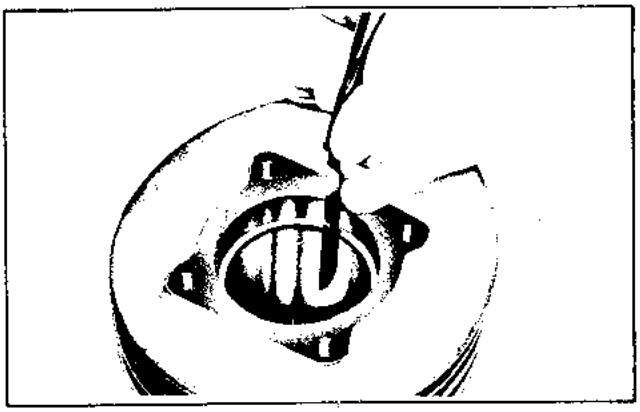


Figure 3C-72. Checking Ring Gap

In removing and installing piston rings, be careful not to over-expand, twist rings or damage the piston surface when slipping them in place. Always remove the top ring first, then the center ring and lastly the lower ring. Install rings in the reverse order, starting with the bottom ring and working up.

PISTON PIN NEEDLE ROLLER BEARINGS

When the piston pin needle roller bearings in connecting rod show appreciable wear, replace the bearings and install a new piston pin. (Oversize piston pins or bearings are not available.) If new piston pin is too loose in piston bosses (see Engine Specifications) a new piston must be used.

Using a suitable shouldered drift or press plug, press worn bearing(s) out of connecting rod. When pressing in new piston pin needle roller bearing(s), press against the lettered end of the bearing cage. Press in one bearing from one side and the other bearing from the opposite side if two are used.

CONNECTING ROD

If connecting rod is bent or otherwise damaged, it should be replaced. See Section 3, "Disassembling Crankcase."

ASSEMBLING CYLINDER AND PISTON (Fig. 3C-68)

Assembly is essentially the reverse order of disassembly. Lubricate piston pin needle bearings and piston pin. Dome of piston is marked with letters "EXH" indicating that the piston must be installed on the connecting rod with this side toward the exhaust port in the cylinder. This places round hole (booster port in the cylinder. This places round hole in side of piston toward carburetor. Heat piston slightly and insert piston pin in one piston boss so it protrudes through the piston boss slightly (approximately 1/16 inch). Position piston correctly on connecting rod and using the drift from Piston Pin Lock Ring Inserter Tool, Part No. 96777-72, tap piston pin into position so both new piston pin lock rings can be installed in their respective grooves.

CAUTION

Do not attempt to drive a piston pin into position without preheating piston, as to do so may distort or otherwise damage piston. Figure 3C-73 shows use of inserter tool to install piston pin lock rings.

Clean all traces of the cylinder base gasket and sealer from both the cylinder and crankcase. Apply a thin coating of a non-hardening sealer to both faces of a new gasket and place gasket in position on the cylinder.

Apply a coating of 2-cycle oil to the cylinder wall and the piston rings. Arrange the piston rings so the ring gaps correspond with the ring gap locating pins in the ring grooves. Carefully work the cylinder down over the piston and rings, compressing the top ring and then the lower rings as the cylinder is slipped into position.

NOTE:

Cylinder base is chamfered to assist in compressing rings.

Do not turn or twist the cylinder when sliding down over the piston rings as to do so will cause misalignment between the rings and their locating pins, resulting in broken piston rings, which will cause further damage when the engine is operated.

Clean both the cylinder and cylinder head joint faces and apply aluminum paint to each surface and install the cylinder head. Install and torque mounting bolts or nuts uniformly and evenly to 17-21 ft-lbs.

Use a new exhaust pipe flange gasket when installing exhaust pipe.

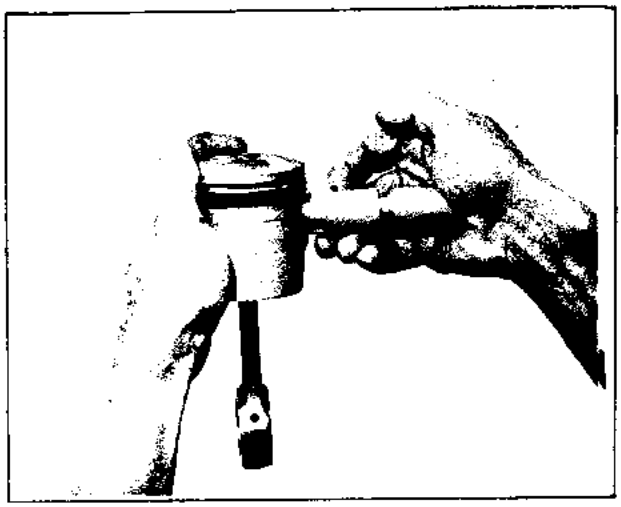


Figure 3C-73. Installing Piston Pin Lock Ring (1979 and Earlier)

CRANKCASE

GENERAL

When connecting rod lower end bearings, transmission shaft bearing or circuit breaker shaft bearings are in need of repair, the engine must be removed from the chassis as described in Section 3A, "Removing and Installing Engine".

DISASSEMBLING CRANKCASE (Fig. 3E-64)

Wash all metal parts in non-flammable solvent and blow dry with compressed air. Remove cylinder, carburetor and reed valve assembly. Remove circuit breaker, fan or starter-generator assembly, and transmission front drive assembly. Remove lock ring (1) (and washer [20], 1980 and later) from the circuit breaker shaft, using "Tru-Arc" pliers. On late 1968 and later models, remove lock ring (3A) from groove in crankcase. On earlier models, remove the three oil seal retainer screws (2) and retainer (3).

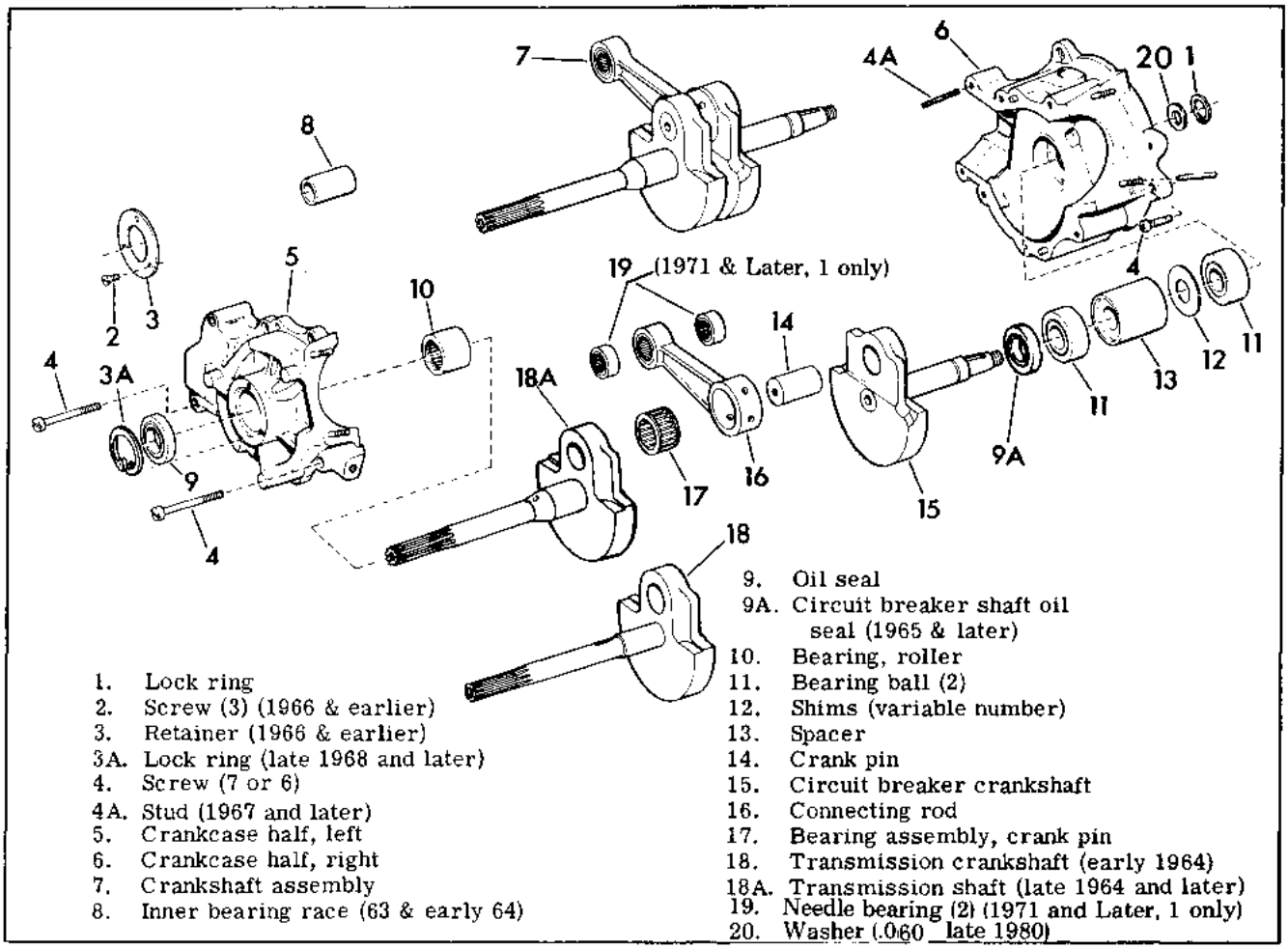
Remove crankcase screws (4) and tap lightly on motor mount bases to separate sealed joint between crankcase halves (5 and 6). Tap alternately to assure even crankcase separation. Once the joint is broken, slide the right crankcase (6) off the fan side shaft.

NOTE:

On 1980 models the fan side ball bearings are Loctited to the shaft. Use a press to remove fan side crankcase from shaft.

Slide the crankshaft assembly (7) out of left crankcase (5). Slide transmission shaft inner bearing race (8, if used) off of transmission shaft. Remove transmission shaft oil seal (9). Using a suitable press plug, press transmission shaft main bearing (10) from left crankcase (See Fig. 3E-65).

Remove circuit breaker shaft oil seal (9A, if used). Using a brass rod or suitable drift, tap circuit breaker shaft main bearings (11) out of the right crankcase. (See Fig. 3E-66.)



1. Lock ring
2. Screw (3) (1966 & earlier)
3. Retainer (1966 & earlier)
3A. Lock ring (late 1968 and later)
4. Screw (7 or 6)
4A. Stud (1967 and later)
5. Crankcase half, left
6. Crankcase half, right
7. Crankshaft assembly
8. Inner bearing race (63 & early 64)
9. Oil seal
9A. Circuit breaker shaft oil seal (1965 & later)
10. Bearing, roller
11. Bearing ball (2)
12. Shims (variable number)
13. Spacer
14. Crank pin
15. Circuit breaker crankshaft
16. Connecting rod
17. Bearing assembly, crank pin
18. Transmission crankshaft (early 1964)
18A. Transmission shaft (late 1964 and later)
19. Needle bearing (2) (1971 and Later, 1 only)
20. Washer (.060 late 1980)

Figure 3E-64. Crankcase - Exploded View

Figure 3E-65. Pressing Transmission Shaft Bearing from Left Crankcase

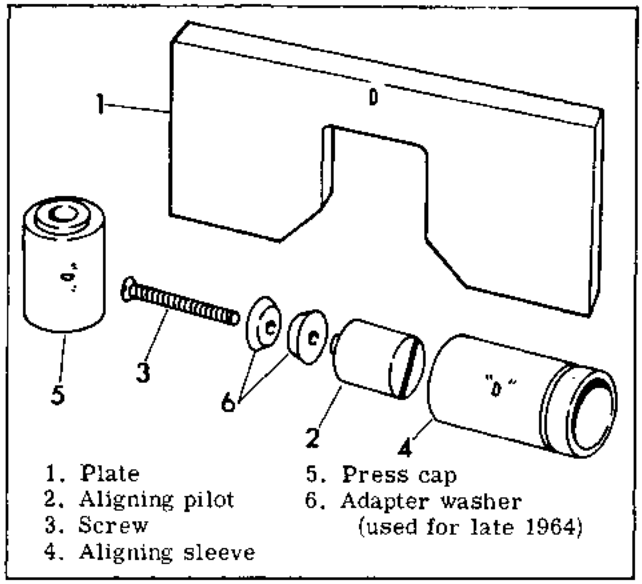
Figure 3E-66. Tapping Circuit Breaker Shaft Bearings from Right Crankcase

NOTE

Shims (12) are used as necessary to determine proper crankshaft end play. Bearing spacer (13) is doweled in crankcase and is not removable.

DISASSEMBLING CRANKSHAFT (See Fig. 3E-64)

Crankshaft Tool Set, Part No. 96122-63, is used for disassembling and assembling crankshaft on 1973 and earlier models. Crankshaft plate (1, Fig. 3E-67) from the set can be used for 1974-1977 models D and D4 without using pilot and aligning sleeve. On 1978 and later models, fabricate a press plate. Install crankshaft plate, (1, Fig. 3E-67), between the crank throws as shown in Fig. 3E-68. Using a suitable press plug, press crank pin (14) from circuit breaker crankshaft throw (15). Remove connecting rod (16) and bearing assembly (17) from crank pin. Press crank pin from transmission crankshaft throw (18) (See Fig. 3E-69). Renew piston pin needle bearings (19) if worn, as covered in Section 3.



1. Plate
2. Aligning pilot
3. Screw
4. Aligning sleeve
5. Press cap
6. Adapter washer (used for late 1964)

Figure 3E-67. Crankshaft Tool Set (1963-1976)

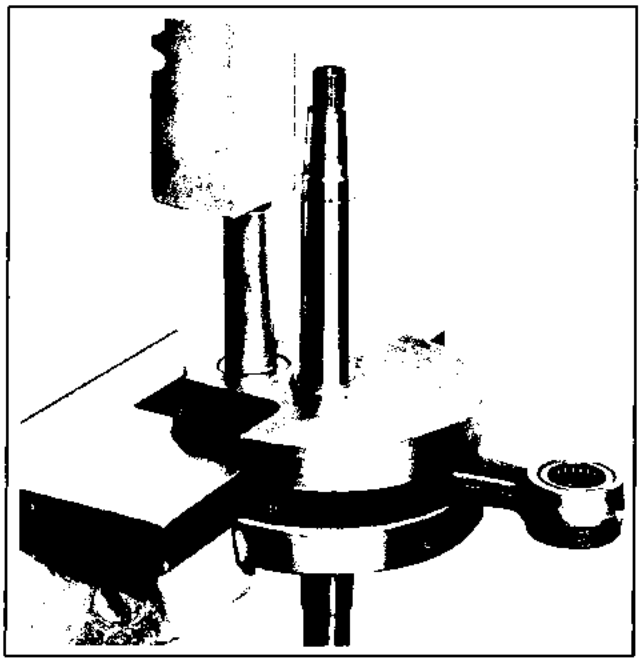


Figure 3E-68. Pressing Crank Pin from Circuit Breaker Side Crankshaft

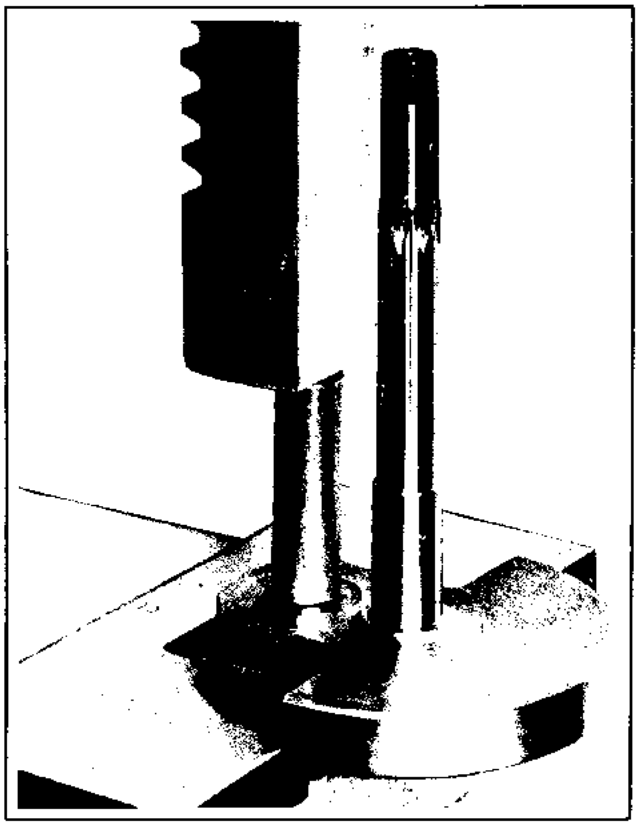


Figure 3E-69. Pressing Crank Pin from Transmission Side Crankshaft (1963-1976)

REASSEMBLING CRANKSHAFT (See Fig. 3E-64)

Thoroughly clean all crankshaft parts and inspect for wear or damage. Pay particular attention to bearing surfaces, splines and threads. If worn or damaged, the part should be replaced. If wear is evident on the crank pin and/or the connecting rod lower end bearing surface, a new connecting rod, crank pin and bearing assembly should be installed.

INSTALLING CRANK PIN PILOT (1963-1976)

Attach crank pin aligning pilot, (2, Fig. 3E-67), to crank pin (14). Hold small tapered end against one end of crank pin, then pass screw (3, Fig. 3E-67) through crank pin from opposite end. Note: Late 1964 models have larger (1/2 inch) hole in crank pin. On this crank pin use adapter washers (6) with tapered side toward hole on each end of crank pin. Do not tighten. Next slide crank pin pilot aligning sleeve (4, Fig. 3E-67) over crank pin, aligning pilot and crank pin (heavily chamfered end toward crank pin). See Fig. 3E-70. Tighten aligning pilot screw securely and remove aligning sleeve. Insert aligning pilot into transmission crankshaft (18) pin hole from the connecting rod side. Place aligning sleeve on suitable support block with grooved end up. Oil crank pin. Place crankshaft assembly on aligning sleeve so crank pin pilot enters aligning sleeve.

Install press cap (5, Fig. 3E-67), over end of crank pin as shown in Fig. 3E-71 and press crank pin into crankshaft throw until press cap bottoms. Remove pilot from crank pin.

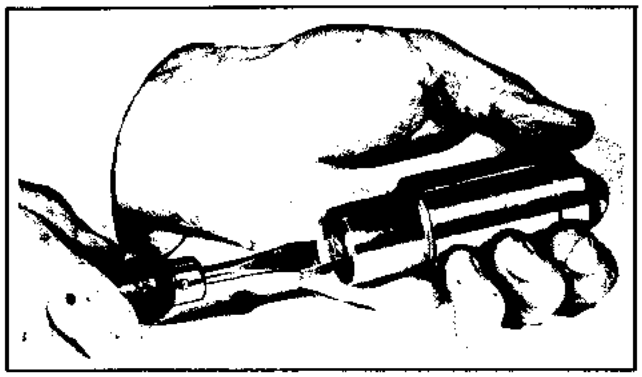


Figure 3E-70. Installing Crank Pin Pilot on Crank Pin (1963-1976)

Install crank pin pilot on opposite (circuit breaker crankshaft) end of crank pin as shown in Fig. 3E-72. Remove aligning sleeve and install connecting rod (16) and bearing assembly (17). Oil pin and bearings. Place transmission crankshaft assembly on shouldered end of press cap. Install circuit breaker crankshaft (15) over pilot. (See Fig. 3E-73.) Install aligning sleeve, grooved end down, over protruding end of pilot. Using straight edge, align both crankshaft throws. See Fig. 3E-74.

Using press, start circuit breaker crankshaft onto crank pin. Recheck alignment with straight edge, if not in proper alignment, tap crank throw to align.

Proceed to press assembly together until upper crankshaft throw is approximately 1/32 inch away from connecting rod thrust face. Oil and insert crankshaft gauging plate between crankshaft throws as shown in Fig. 3E-75.

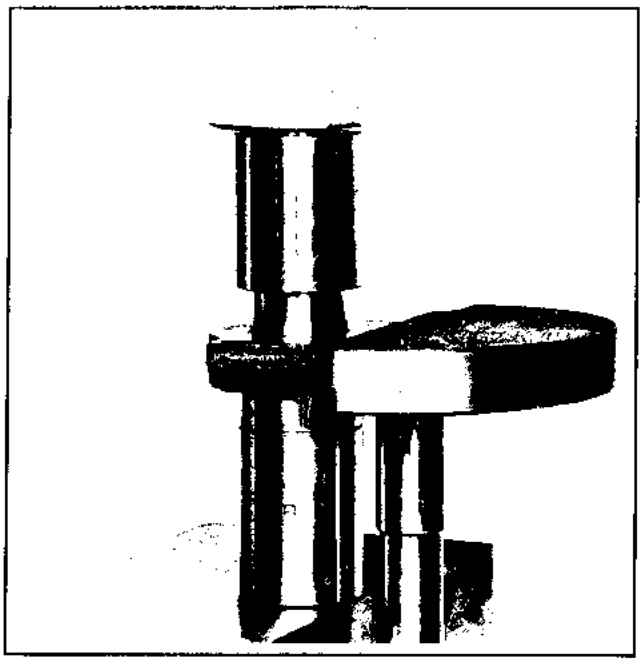


Fig. 3E-71. Pressing Crank Pin into Transmission Side Crankshaft (1963-1976)

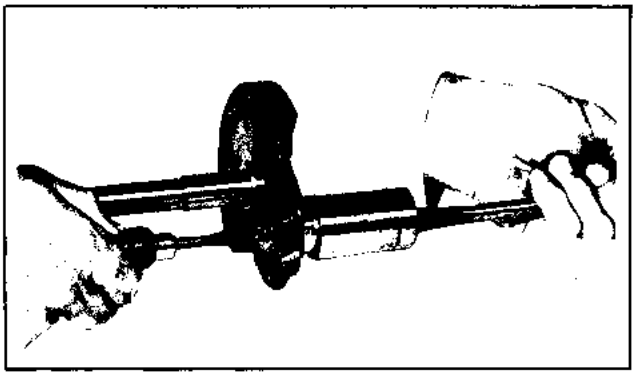


Figure 3E-72. Installing Crank Pin on Circuit Breaker Side of Crank Pin (1963-1976)

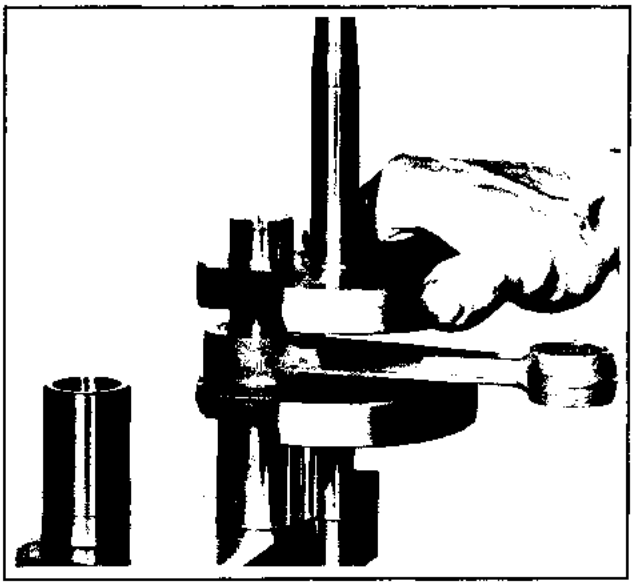


Figure 3E-73. Setup for Pressing Crank Pin into Circuit Breaker Crankshaft (1963-1976)

IMPORTANT

Be careful to see that gauging plate contacts only ground surfaces of crank throws.

Press together until upper crankshaft throw LIGHTLY contacts gauging plate. Remove gauging plate and crank pin aligning pilot. Connecting rod side play should be from .010 to .018. Check with feeler gauge for correct clearance.

INSTALLING CRANK PIN (1977 to 1980)

The Crank Shaft Tool Set, Part No. 96122-63, will not work on 1977-1980 crankshafts. Fabricate a press plate, press plug and sleeve. Use the same basic procedure as described for 1963-1976 crankshafts. When pressing final crank half onto crank pin, allow for connecting rod side clearance.

TRUING CRANKSHAFT ASSEMBLY

Using Flywheel Truing Device, Part Number 96650-30, check shaft run-out as shown in Fig. 3E-76.

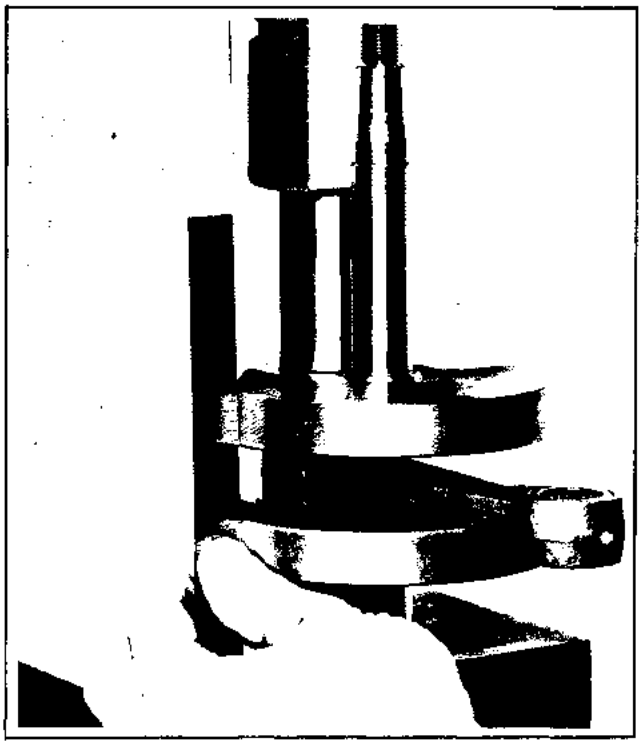


Figure 3E-74. Pressing with Crank Throws in Alignment using Straight Edge

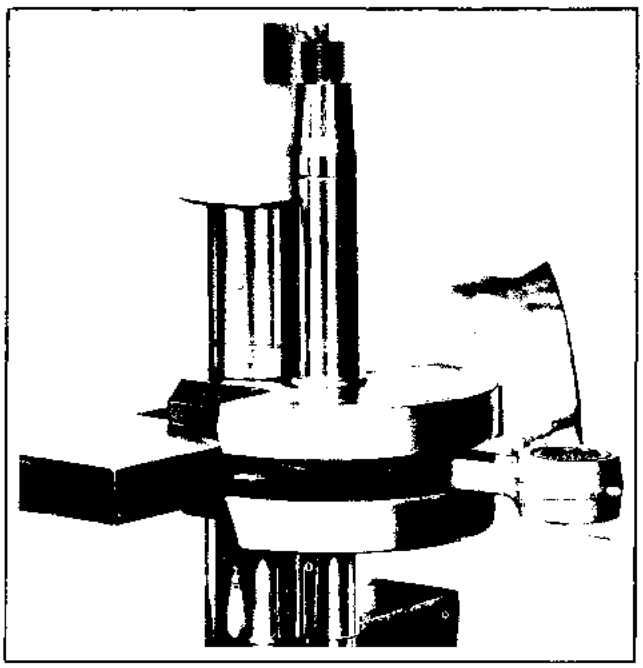


Figure 3E-75. Finishing Pressing with Gauging Plate Installed Between Crank Throws (1963-1976)

Shafts must run true within .002 inches on fan side and .004 inches on clutch side. One graduation on indicator scale equals .002 in. See Fig. 3E-77 and correct flywheel alignment as follows:

A. If the shafts run high (indicators move toward each other) as the crank pin passes the indicators, remove crank from truing device, position hard wood wedge as shown (Fig. 3E-77), and strike wedge. Remove wedge and take another reading. If the same condition exists, repeat operation.

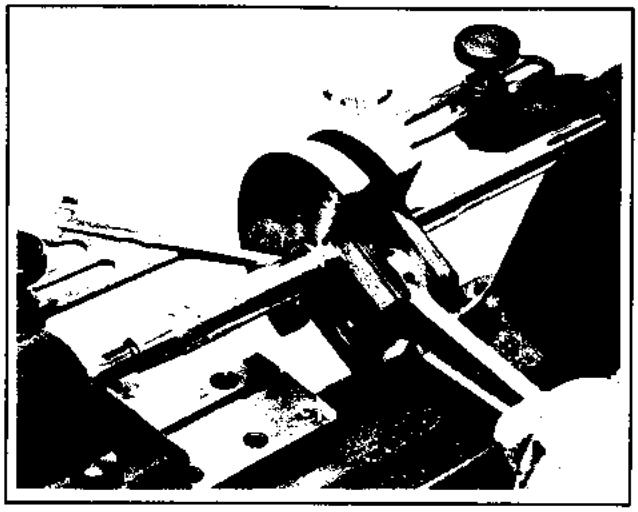


Figure 3E-76. Checking Crankshaft Runout

B. If the shafts run high (indicators move toward each other) as the crank pin passes directly opposite the indicators, install a "C" clamp on the bottom of the crank throw and apply pressure on "C" clamp. Strike crank throws lightly above crank pin. Remove "C" clamp and take another reading. Repeat if same condition exists.

C. If one shaft runs high and the other low (one indicator moves inward, the other outward) as the crank pin passes 90° from the indicators, mark the high crank throw at point closest the indicator and remove crankshaft assembly from Truing Device. Hold crankshaft assembly firmly in one hand and strike the marked crank throw on the mark, firmly with a copper hammer, a steel hammer will damage crankshaft. Reinstall assembly in Truing Device and take another reading. Repeat above procedure if same condition exists. Recheck connecting rod side play.

ASSEMBLING CRANKCASE (Fig. 3E-64)

Thoroughly clean all crankcase parts and examine for wear or damage. Replace any worn or damaged bearings. Discard old seals and gaskets and replace with new ones. Carefully examine all crankcase joint surfaces to make sure they are clean and free of nicks or burrs.

Place shims (12) in position in right crankcase outer bearing housing. NOTE: Use same number of shims as removed in disassembly. If no shims were found in disassembly use none in re-assembly. Press in right crankcase outer bearing (11) with sealed (black) side facing outward. Press in inner bearing (11) with sealed (black) side facing inward. Bearings should bottom against spacing sleeve in crankcase. Press new oil seal (9A, if used) into crankcase (6) with seal lip facing crankpin.

To determine crankshaft end play, install crankshaft assembly (7) in right crankcase (6), washer (20) (if used) and lock ring (1) (flat side facing out, rounded side toward bearing [11]). Push crankshaft assembly fully into crankcase and measure the clearance between lockring and outer bearing race with dial indicator. See Fig. 3E-78. Clearance should be from .001 to .005 inch. If clearance is greater than .005, determine exact clearance with feeler gauge. Remove crankshaft assembly and outer bearing from crankcase and add correct number of shims (12) to obtain correct end play. Example: measured clearance between lockring and bearing race is .025 inch. Subtracting .003 inch (nominal desired end play from .025 inch leaves .021 inch to be taken up by adding shims (12).

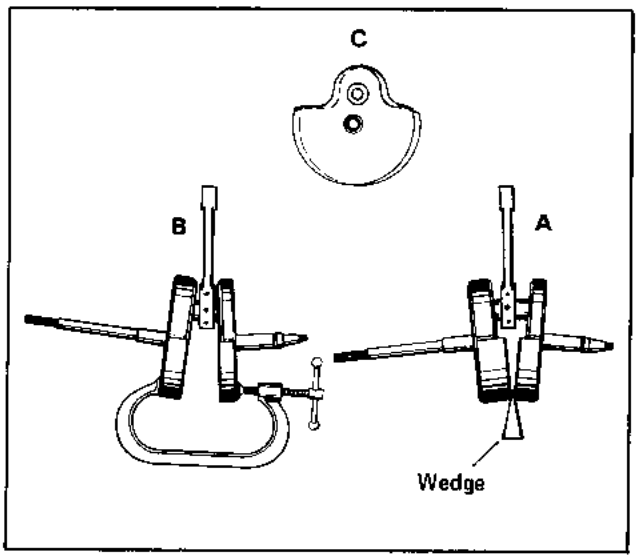


Figure 3E-77. Correcting Crankshaft Alignment

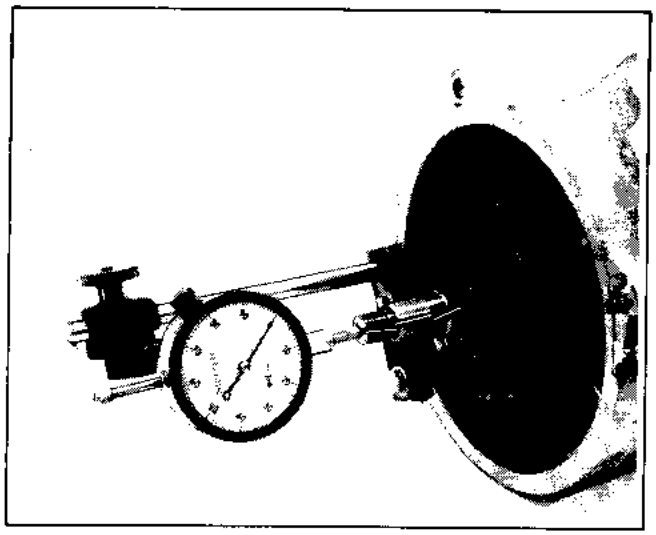


Figure 3E-78. Determining Crankshaft End Play

Shims are available in .002 in. and .010 in. sizes, so to end up with .003 in. end play, two (2) .010 in. shims and one .002 in. shim will be needed. After correct number of shims have been installed.

Measure crankshaft end play with dial indicator by moving crankshaft in and out of case as far as it will go (Figure 3E-78). Correct end play is .001-.005 in. End play is increased by removing shims from under outer bearing or decreased by adding shims. When end play is correct remove crankshaft.

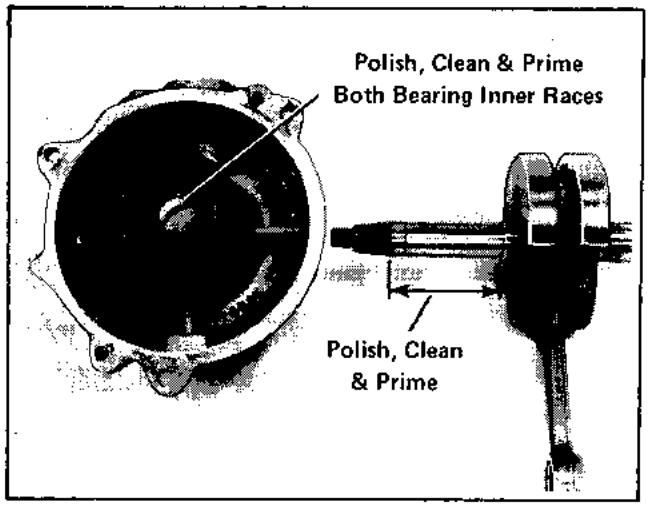


Figure 3E-78A. Polish, Clean and Prime as Shown

Clean crankshaft with lacquer thinner to remove all traces of oil.

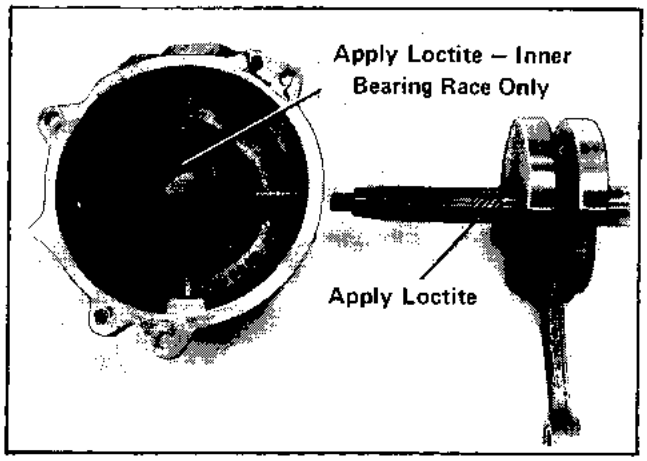


Figure 3E-78B. Apply Loctite® as Shown

Polish the crankshaft ball bearing surface and inner race surface of the fan side bearings with #400 Wet or Dry paper (Figure 3E-78A).

NOTE:

Crankshaft assembly, Part No. 23703-71C, is coated with a rust preventative. It is very important to remove oil from surface with lacquer thinner and then polish and prime the bearing surface of the shaft on the fan side before applying Loctite® .

Clean and prime fan side of shaft and bearing inner races with Loctite Locquick "T" Primer® (Figure 3E-78B).

Apply Loctite® "601" or "640" or Harley-Davidson Sleeve Retainer, Part No. 99628-77, sparingly to inner race of outside ball bearing and crankshaft at the point where the inner bearing rides (Figure 3E-78C).

Do not apply Loctite® to needle bearing or clutch side of crankshaft.

Install crankshaft into case, install snap ring and allow Loctite to cure for 1 hour.

NOTE:

If Loctite® Primer is not used allow Loctite® to cure for 24 hours.

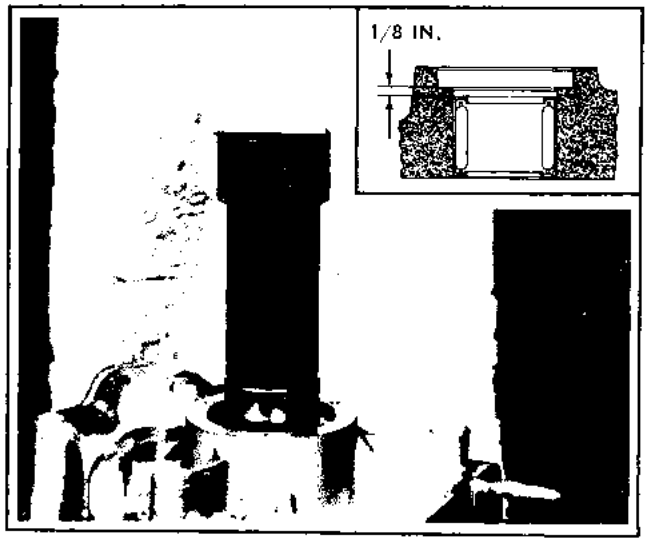


Figure 3E-79. Pressing Transmission Side Bearing into Crankcase

Applying to early models having small diameter transmission shaft, if a new transmission shaft main bearing (10) is being installed it is also recommended that a new transmission shaft bearing inner race be installed.

Press transmission shaft main bearing (10) into left crankcase (5), using suitable press plug. Press against "lettered" end of bearing (10) until it is positioned 1/8 (.125) inch below the oil seal shoulder in crankcase (5), as shown in Fig. 3E-79 inset.

Press a new oil seal (9) into crankcase (5) with seal lip facing crankpin. Clean crankcase joint faces with clean gasoline and apply a thin coating of Harley-Davidson Gasket Eliminator, Part No. 99633-77 to crankcase joint faces. Slide crankcase (5) over the transmission shaft and align on crankcase (6). If used, slide bearing inner race (8) into position on transmission shaft.

NOTE

Apply oil on main needle roller bearing, inner race and oil seal before assembly.

Install and tighten seven crankcase screws (4). Install seal retainer 3A or seal retainer (3) on crankcase (5). Install and tighten retainer screws (2) (if used). Reassembly of the cylinder and piston, carburetor and reed valve, circuit breaker and transmission front drive assembly is described in Sections 4B, 5E, 3F and 3C. To reinstall engine in chassis see Section 3A "Removing and Installing Engine".

CARBURETOR OPERATION (ALL MODELS)
(Figure 3F-33)

The golf car engine is equipped with a diaphragm carburetor having a diaphragm fuel pump which operates on the crankcase vacuum pulsations. There is no bowl or fuel reservoir with external vent. Because it has pressure fuel supply instead of gravity supply, it can operate in all positions. Crankcase pulsations are transmitted to fuel pump diaphragm chamber and diaphragm through drilled passages in carburetor flange, flange gaskets, reed valve and reed valve gaskets, and through drilled passage in crankcase to crankshaft chamber.

Fuel enters carburetor at inlet connection (1) flowing through filter screen (2). Crankcase vacuum working through impulse channel (3) opens diaphragm pump inlet valve (4A) drawing fuel into pump chamber (5). Crankcase pressure working through impulse channel (3) forces fuel out of chamber (5), through diaphragm pump outlet valve (4B) and into fuel inlet supply channel (6) where fuel is metered past inlet needle and seat (7) through the action of the main diaphragm (8) which is subjected to engine vacuum on the top side and atmospheric pressure on the bottom side. Engine suction transmitted to the diaphragm fuel chamber (9) causes the diaphragm (8) to be pulled upward, depressing the inlet control lever (10) and unseating inlet needle (7) allowing fuel to enter the diaphragm fuel chamber area (9).

During engine operation, engine suction is transmitted through idle discharge ports (11A and 11B) and main discharge port (12) depending upon the position of the throttle disc (13), and choke disc (14), creating a low pressure area on the fuel (top) side of the main diaphragm (8). Atmospheric pressure on the opposite (lower side) will force the main diaphragm (8) upward causing the diaphragm button to depress the inlet control lever (10), overcoming inlet tension spring

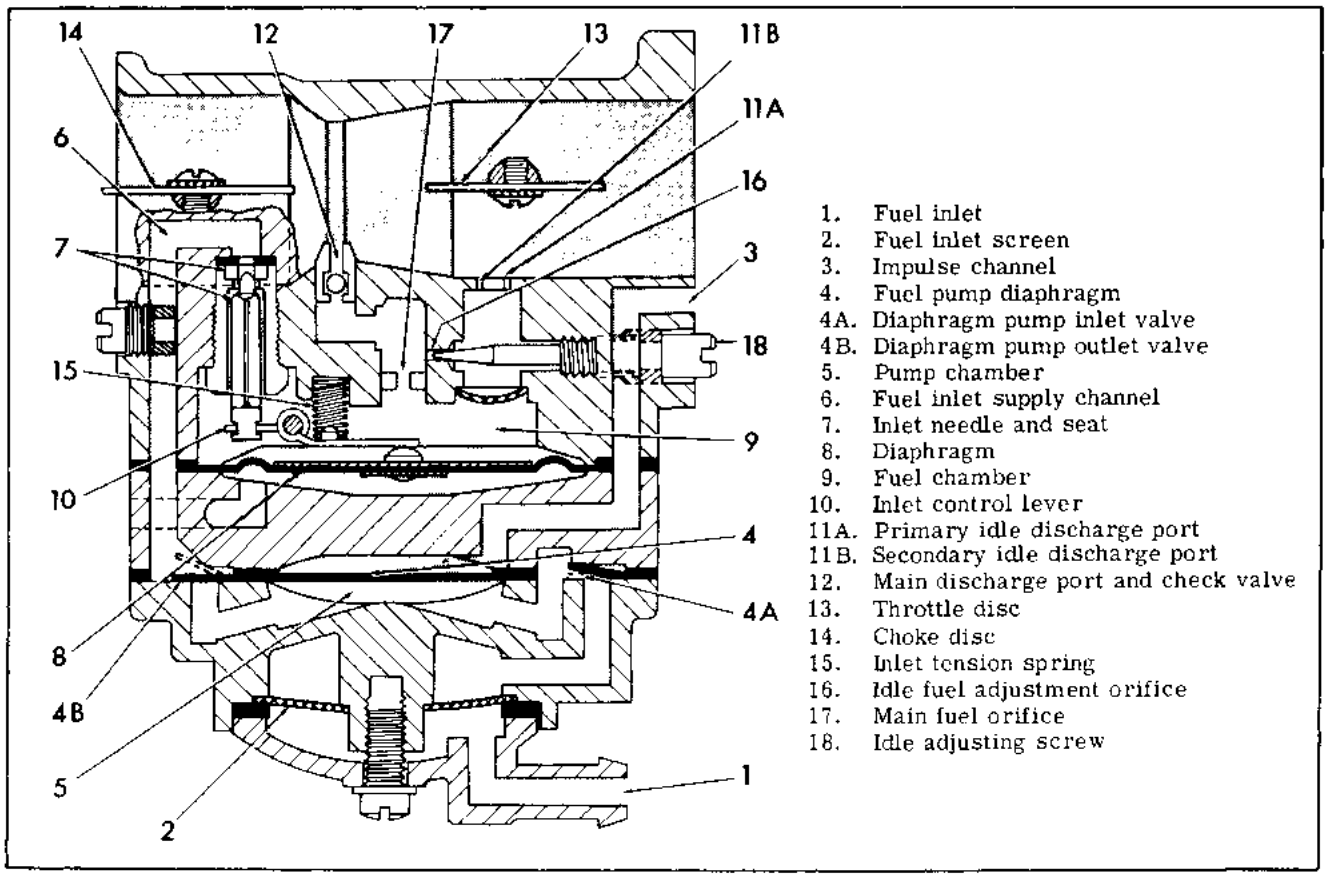


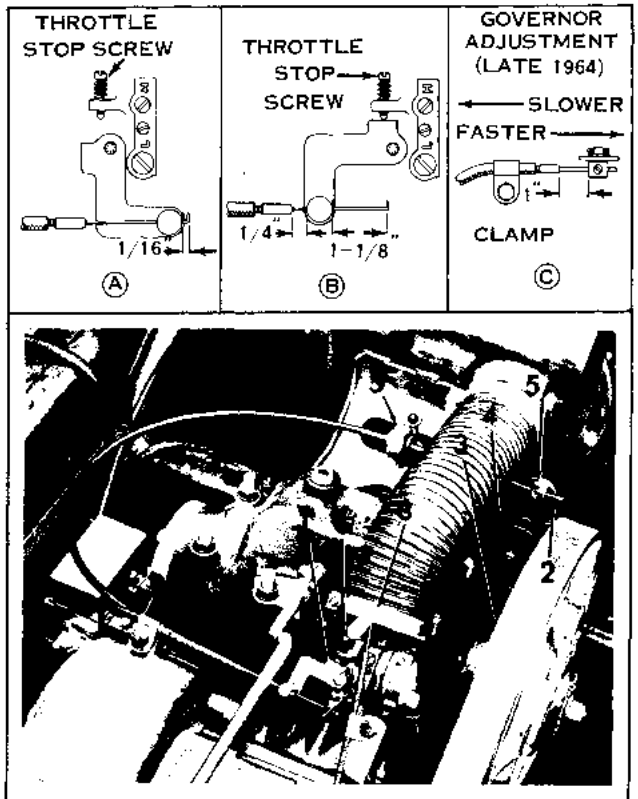
Figure 3F-33. Carburetor Cross-Section

(15) pressure, permitting pressurized fuel to enter through inlet seat (7), by forcing inlet needle off its seat contact, then into fuel chamber (9) side of main diaphragm, up through the idle (16) and main fuel (17) supply orifices and channels, and out the discharge ports (11A, 11B and 12) to the engine. Main fuel orifice (17) is fixed and various sizes are used depending on operating conditions.

MAIN JET SIZE (DIAMETER INCHES)	JET PART NO.
.037	27819-63
.039 (STD.)	27820-63
.041	27821-63
.043	27822-63

CARBURETOR AND GOVERNOR CONTROLS 1963-66 MODEL D, ALL DC MODELS (Figure 3F-34)

During car operation the carburetor throttle (1) is forced open by a torsion spring on the throttle shaft when accelerator pedal is depressed, and the governor arm (2) limits the throttle opening by pulling the throttle closed. The speed of the car determines the position of the rear floating flange (3) and governor arm wheel (4). Governed (maximum) speed is adjustable by means of cable adjusting nut (5) or cable set screw 5A. Throttle stop screw (6) limits closed position of throttle. Carburetor has low speed mixture adjustment screw (7) controlling needle valve in idle fuel orifice.



1. Throttle lever
2. Governor arm
3. Flange
4. Wheel
5. Adjusting nut (early 1964)
5A. Set screw
6. Stop screw
7. Mixture screw
8. Choke lever

Figure 3F-34. Throttle and governor Controls 1963-66D, All DC Models

ADJUSTING CARBURETOR (Fig. 3F-34)

Low Speed Mixture Adjustment (Normal setting 5/8 to 3/4 turns open)

Put reverse unit shift lever in neutral, start up engine and run at governed speed (accelerator fully depressed). If necessary, adjust low speed mixture screw (7), located next to throttle shaft for smooth and steady engine operation. Normal setting is 5/8 to 3/4 turns open.

Throttle Stop Screw Adjustment (Normal setting 1/4 turn open)

With ignition off and accelerator pedal fully released, back off screw (6) until throttle is closed, then turn screw back in 1/4 turn.

Put reverse unit shift lever in neutral, start up engine and check operation of throttle lever (1) on carburetor as follows:

When accelerator pedal is released, the throttle lever on carburetor must return to fully closed position against throttle stop screw (6). Causes for sticky action are lack of lubrication or dirt in control casing, misalignment of casings and throttle lever swivel block, or by bent wire or casing.

See "Removing and Installing Control Casings and Cables".

Throttle Control Adjustment:

Adjust throttle control cable as follows: With cable free in accelerator pedal lever swivel block (set screw loose), depress accelerator pedal all the way to the floor. Adjust cable in casing so that throttle can open fully with 1/16" clearance between cable ferrule and swivel block as shown in Figure 3F-34A. Tighten accelerator lever swivel block set screw in this position. Release accelerator pedal slowly to see that carburetor throttle lever returns all the way closed against throttle stop screw.

Governor Control Adjustment:

Up to late 1964 model cars, the maximum speed is adjusted by means of the cable adjuster located on bracket between gear box and air filter. Turn adjusting nut (5) forward to reduce maximum speed or rearward to increase maximum speed. On late 1964 to 1966 cars the cable is secured to air cleaner bracket with a clamp (Fig. 3F-34C). To adjust maximum speed, loosen set screw 5A and adjust cable.

Governor must work freely, or the car will have the tendency to change speed. Check freeness with engine stopped by moving governor wheel (4) away from rear floating flange (3). When released, wheel should return to flange smoothly without sticking. Sticky action is caused by lack of lubrication in governor lever pivot bearing, lack of lubrication in cable casing, or a bent cable.

See "Removing and Installing Control Cables and Casings".

Adjust governor control cable as follows: With cable free in governor lever swivel block (set screw loose) and governor wheel against rear floating flange, ferrule on governor wire should be approximately 1-1/8 inches away from carburetor lever swivel block with throttle closed as shown in Figure 3F-34B. This is a rough setting. Fine adjustment of maximum speed should be made, when car is operated, as previously described.

WARNING

The maximum governed speed should be approximately 8 mph (235 yards per minute or 100 years per 25 seconds). Failure to abide by the above specifications could cause personal injury and/or damage to the golf car.

REMOVING AND INSTALLING CONTROL CABLES AND CASINGS

Throttle:

Remove cable by loosening accelerator lever swivel block set screw underneath left floor panel. Pull the wire out of casing through carburetor lever swivel block. Remove casing by unfastening at clamp under floor panel at accelerator lever, pull through hole at rear of floor panel and unfasten at clamp on top of fan housing. Remove cable from casing.

Check casing and cable to see that they do not have any sharp bends which could cause binding.

Remove dirt seals from ends of casing. Clean cable and inside of casing thoroughly by flushing with nonflammable cleaning solvent and blow dry with compressed air.

Reinstall cable in casing, inserting through carburetor throttle lever swivel block upper hole. Grease liberally with graphite grease when making installation. Replace dirt seals. Fasten casing at clamp on fan housing and route through hole at rear of floor panel to fastening clamp underneath floor panel. When installed on car, casing should have no sharp bends.

Insert cable into accelerator lever swivel block and adjust cable as described under "Throttle Control Adjustment".

Choke:

If choke control is sticky, it is advisable to remove wire and knob assembly. Flush out casing with nonflammable cleaning solvent and blow dry with compressed air. Clean cable thoroughly and reinstall in casing lubricated liberally with graphite grease.

IMPORTANT: Adjust casing clamps to see that casings line up with swivel blocks. Cable should slide freely through carburetor swivel block hole so that it does not restrict free movement of throttle lever.

Governor:

If cable has adjusting nut on air cleaner, remove casing from adjuster nut by turning nut forward (mark casing position at nut before removal). If cable is held by clamp at air cleaner, loosen clamp bolt and remove casing in swivel block as shown in figure 3F-34C. Remove casing from clamp on fan housing, loosen swivel block set screw at governor lever and remove cable and casing. Remove cable from casing. Check casing and cable to see that they do not have any sharp bends which could cause binding.

Remove dirt seals from ends of casing. Clean cable and inside of casing thoroughly by flushing with petroleum solvent.

Reinstall cable in casing, inserting through carburetor throttle lever swivel block lower hole. Grease liberally with graphite grease when making installation. Replace dirt seals. Fasten casing at clamp on fan housing and screw into adjuster nut by turning nut backward to position on cable previously marked. Insert cable into governor lever swivel block and adjust cable as described under "Governor Adjustment".

IMPORTANT: Adjust casing clamp on fan housing to see that casing lines up with swivel block on carburetor throttle lever. Cable should slide freely through swivel block hole so that it does not restrict free movement of throttle lever.

CARBURETOR AND GOVERNOR CONTROLS
1967 AND LATER MODEL D
1969-1972 MODEL DC Figure 3-F-34A

During car operation the carburetor throttle (1) is forced open by a torsion spring on the throttle shaft when accelerator pedal is depressed, and the governor arm (2) limits the throttle opening through control rod (3) by pushing the throttle closed. The speed of the car determines the position of the floating flange (4) and governor arm (2). Governed (maximum) speed is adjustable by position of rod (3) in swivel block (5). Throttle stop screw (6) limits closed position of throttle. Carburetor has low speed mixture adjustment screw (7) controlling needle valve in idle fuel orifice.

ADJUSTING CARBURETOR (Fig. 3F-34A)

Low Speed Mixture Adjustment (Normal setting 1/2 to 3/4 turns open)

Raise left rear wheel of car by placing a jack or suitable blocking under spring seat or axle so that wheel turns freely. Start up engine and run at 1500 to 2000 rpm (fast idle). If necessary, adjust low speed mixture screw (7), located next to throttle shaft for smooth and steady engine operation. Normal setting is 1/2 to 3/4 turns open.

Throttle Stop Screw Adjustment (Normal setting 1/4 turn open)

With ignition off and accelerator pedal fully depressed, back off screw (6) until throttle is closed, then turn screw back in 1/4 turn.

Start up engine and check operation of throttle lever (1) on carburetor as follows:

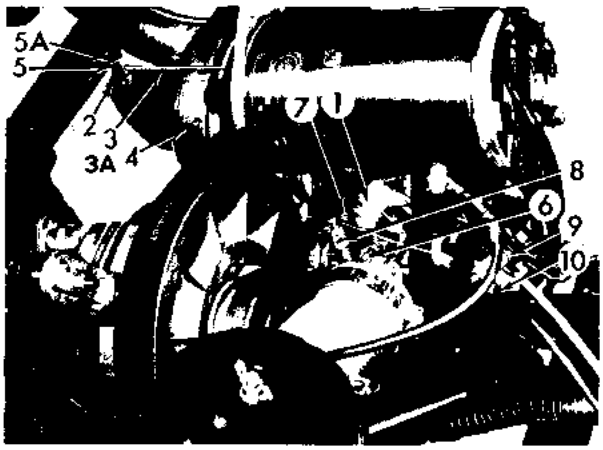
When accelerator pedal is released, the throttle lever on carburetor must return to fully closed position against throttle stop screw (6). Causes for sticky action of cable are lack of lubrication, corrosion or dirt in control casing, or by bent wire or casing.

See "Removing and Installing Control Casings and Cables".

Throttle Control Adjustment:

1967 Model D, 1967-68 Model DC: (Figure 3F-34A):

Adjust throttle control wire as follows: With wire free in accelerator pedal lever swivel block (set screw loose), depress accelerator pedal all the way to the floor. Adjust wire in casing so that throttle opens fully with 1/16" clearance between hooked end of wire and throttle lever. Tighten accelerator pedal lever swivel block set screw in this position. Release accelerator pedal slowly to see that carburetor throttle lever returns all the way closed against throttle stop screw.



1. Throttle lever
2. Governor arm
3. Governor control rod (1967-1979)

3A. Governor control cable (1980)

4. Floating flange
5. Swivel block

5A. Set screw

6. Stop screw
7. Miture screw
8. Choke lever
9. Throttle control casing clip
10. Choke control casing clamp

Figure 3F-34A. Throttle and Governor Controls 1967 Model D

1968 and Later Model D, 1969-1972 Model DC: (Figure 3F-34B):

Adjust throttle control wire as follows: With pedal fully depressed and throttle fully open, threads on end of cable must not enter seal on cable casing. Adjust casing at cable clamp to allow slight clearance between last thread and end of casing and tighten clamp screws. Hooked end of cable should have a slight amount of clearance with throttle lever on carburetor - adjust swivel block on threaded (stud) end of cable to obtain clearance. Release accelerator pedal slowly to see that carburetor throttle lever returns all the way closed against throttle stop screw. See that cable housing is aligned with swivel block.

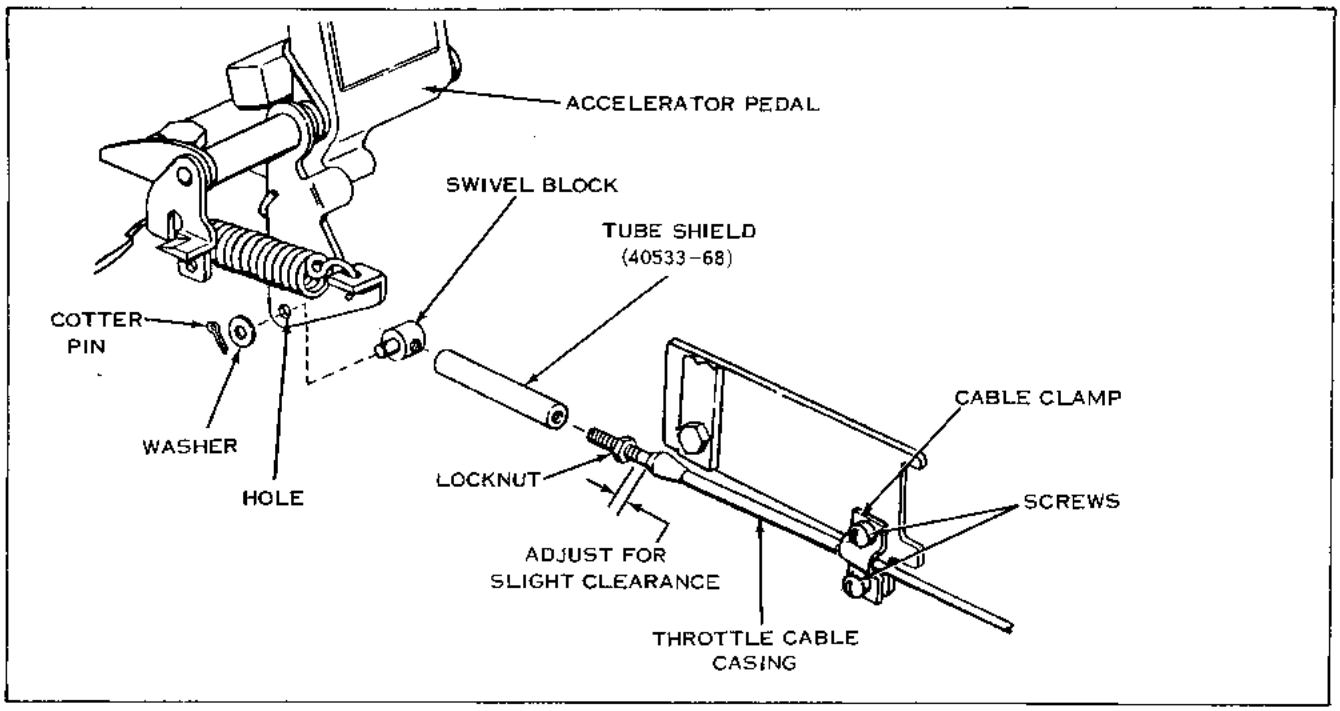


Figure 3F-34B. Throttle Controls - 1968 and Later D, 1969-1972 DC

Governor Control Adjustment (Figure 3F-34A):

Governor, controlling maximum car speed, is set at the factory for 10 miles per hour (100 yards per 20 seconds) car speed. This is equivalent to 3000 rpm engine speed. Governor control rod is marked next to the outside of the wire swivel block to show this setting. To change car speed, loosen swivel block set screw and adjust governor control rod as follows: To increase speed move mark on rod away from swivel block - to decrease speed move mark on rod toward swivel block. Tighten set screw with bend in rod in a horizontal position so it cannot drag on crankcase. Rod must not bind in slotted hole in throttle lever.

Governor must work freely, or the car will have the tendency to change speed.

CAUTION

Any appreciable speed change due to governor readjustment will require readjustment of the generator charge rate on cars with resistor type generator field control. See "Starter Generator" Section 5, also low speed mixture adjustment.

GOVERNOR CONTROL ADJUSTMENT (1980) (FIGURE 3F-43Ba)

Start engine and set governor at 3000 rpm. To increase rpm loosen screw (1) and slide cable toward back of car. To decrease rpm, slide cable towards front of car. Tighten screw securely after adjustment.

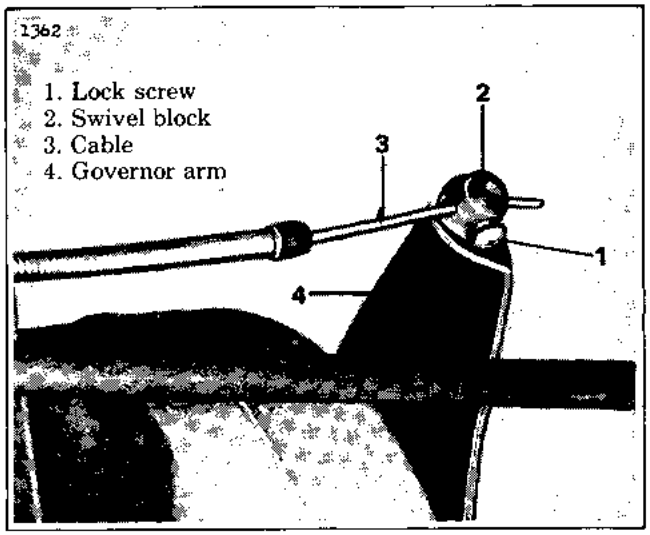


Figure 3F-43Ba. 1980 Governor Adjustment

WARNING

Maximum governed speed is 15 mph (24 kph) (3000 rpm). Exceeding these figures can be hazardous, resulting in loss of control or loss of vehicle stability.

CAUTION

Any appreciable speed change due to governor readjustment will require readjustment of the generator charge rate on cars with resistor type generator field control. If this adjustment is not made, damage to the golf car could result. See "Starter Generator" Section 5, also recheck low speed mixture adjustment.

REMOVING AND INSTALLING CONTROL CABLES AND CASINGS

Throttle:

Detach wire at accelerator lever swivel block underneath left floor panel. Pull the wire out of casing. Remove casing by unfastening clip from bracket under floor panel at accelerator lever, at rear of right floor panel, and unfasten clip from fan housing bracket. Remove wire from casing.

Check casing and wire to see that they do not have any sharp bends which could cause binding.

Reinstall cable in casing, inserting through carburetor throttle lever lower hole. Grease liberally with graphite grease when making installation. Fasten casing at clamp (9, Fig. 3F-34A) on fan housing and route underneath floor panel. When installed on car, casing should have no sharp bends.
NOTE: On 1967 Model D and 1967-68 Model DC casing clamp underneath floorboard must be free to swivel around mounting bolt.

Insert wire into accelerator lever swivel block and adjust cable as described under "Throttle Control Adjustment".

Choke:

If choke control is sticky, it is advisable to remove cable and knob assembly. Flush casing with nonflammable cleaning solvent and blow dry with compressed air. Clean cable thoroughly and reinstall in casing lubricated liberally with graphite grease.

IMPORTANT: Adjust casing clamps to see that casings line up with swivel blocks. Wire should slide freely through carburetor lever hole so that it does not restrict free movement of throttle lever.

CARBURETOR SERVICE

The following procedure should be followed to determine cause for poor engine performance due to faulty carburetion and includes service corrections for early carburetors.

Before going into the fuel system and carburetor, be sure that the ignition system is in proper order by checking the following items:

1. Spark plug gap and condition (See section 5)

2. Circuit breaker point gap (.020) and cam lubrication (use cam grease).

3. Ignition circuit wiring including engine ground strap and switches

4. Coil and condenser condition and connections

5. Ignition timing

A faulty carburetor will produce the following symptoms: An over-rich fuel/air mixture will cause excessive smoking, loss of power, engine roughness or flooding while an over-lean condition will cause hard starting or surging speed.

Before blaming the carburetor for an over-rich or over-lean condition, be sure that the correct gas/oil mixture is being used, that the oil level in the air cleaner is not too high and filter is clean. Also disconnect flexible exhaust pipe at frame fitting on early cars to be sure that exhaust is not restricted. If a lean condition exists, check for a leaking crankcase oil seal on the drive flange side by noting if the crankcase around the V-belt pulley has a collection of dirt and oil.

When the trouble is definitely traced to the carburetor, look for the following causes for an over-rich or over-lean condition. See figure 3F-33.

Ruptured fuel pump diaphragm (4)
Leaking flapper valve (4a) or (4b)
Incorrectly set inlet control lever (10)
Sticking or leaking inlet needle and seat (7)
Main discharge port check ball not working (12)

Most of these defects can be traced without removing carburetor using Leak Tester, Part No. 94750-68. This tool consists of a dial pressure gage, and an air pressure bulb which is used to apply air pressure at the carburetor fuel inlet fitting. See figure 3F-34C. The carburetor should hold about 5 lbs. pressure for at least one minute without dropping. If the gage pressure will not hold, first check all cover screws for tightness.

If screws are tight, the carburetor has an internal leak and it should be removed from the engine and disassembled for inspection. As a hint for removing carburetor with manifold, use a 7/16 in. deep socket with a universal joint and remove four manifold nuts.

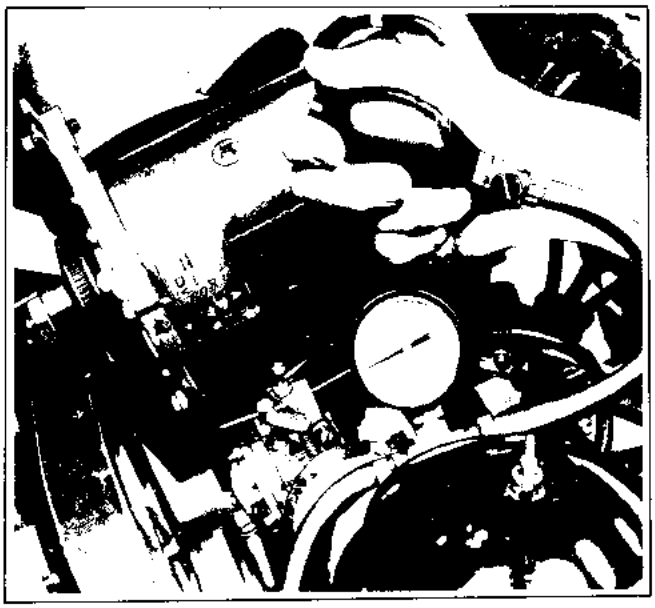


Figure 3F-34C. Checking for Leakage

Prior to disassembly of carburetor, use the following troubleshooting guide to locate the problem.

TROUBLESHOOTING THE CARBURETOR

IF THE:	THE PROBLEM COULD BE:	HOW TO FIX IT
Carburetor Floods	1. Dirt or foreign particles preventing inlet needle from seating.	Remove, clean and replace
	2. Diaphragm lever spring not seated on lever dimple.	Remove lever and reinstall.
	3. Diaphragm improperly installed in carburetor.	Replace diaphragm or correct installation.
Engine Will Not Accelerate	1. Idle adjusting screw set too lean.	Enrich idle adjustment.
	2. Incorrect setting on diaphragm lever.	Reset.
	3. Diaphragm cover plate loose.	Tighten.
	4. Diaphragm gasket leaking.	Replace.
	5. Main fuel orifice plugged.	Remove diaphragm cover, diaphragm lever and main adjusting screw. Clean out orifice by blowing through main adjustment threaded hole.
Engine Will Not Idle	1. Incorrect idle adjustment.	Reset to best idle.
	2. Idle discharge ports or channels clogged.	Blow out with compressed air. If compressed air is not available, clean and flush with safety solvent.
	3. Diaphragm lever set incorrectly.	Reset diaphragm lever so it is flush with the floor of the diaphragm chamber.
	4. Throttle shutter cocked in the throttle bore causing fast idle.	Reset.
	5. Dirty nozzle check valve.	Clean or replace.
	6. Welch plug covering the idle discharge ports does not seal. This causes the engine to idle with idle adjustment shut off.	Replace welch plug.
Engine Runs Lean	1. Tank vent not operating correctly.	Clean, if possible, or replace.
	2. Leak in fuel system from tank to pump.	Tighten or replace fittings or line.
	3. Ruptured fuel pump diaphragm.	Replace.
	4. Main fuel orifice plugged.	Clean.
Carburetor Runs Rich With Main Adjustment Off	1. The 1/8" diameter nozzle channel plug, or nozzle check valve cage, is not sealing.	Install new plug or new cage.

NOTE: In making carburetor adjustments turn adjustments carefully and gently - DO NOT RAM adjustments into seats.

Using the procedure given under "DISASSEMBLING CARBURETOR", check the following components carefully.

1. Remove pump diaphragm cover screws and cover and check diaphragm for puncture or tear, especially near flapper valves of single piece diaphragms.

2. Check the main diaphragm and gasket for tears, etc.

3. Check to see that fuel inlet control lever is set flush with floor of carburetor and operates freely. See figure 3F-36.

CAUTION

Original pump diaphragm is a single piece unit with integral flapper valves. Replace with new 2-piece diaphragm, Part No. 27809-63A on cars below Serial No. 68D-6710. When assembling, the flapper valve section must be located against the fuel pump cover (see figure 3F-34D).

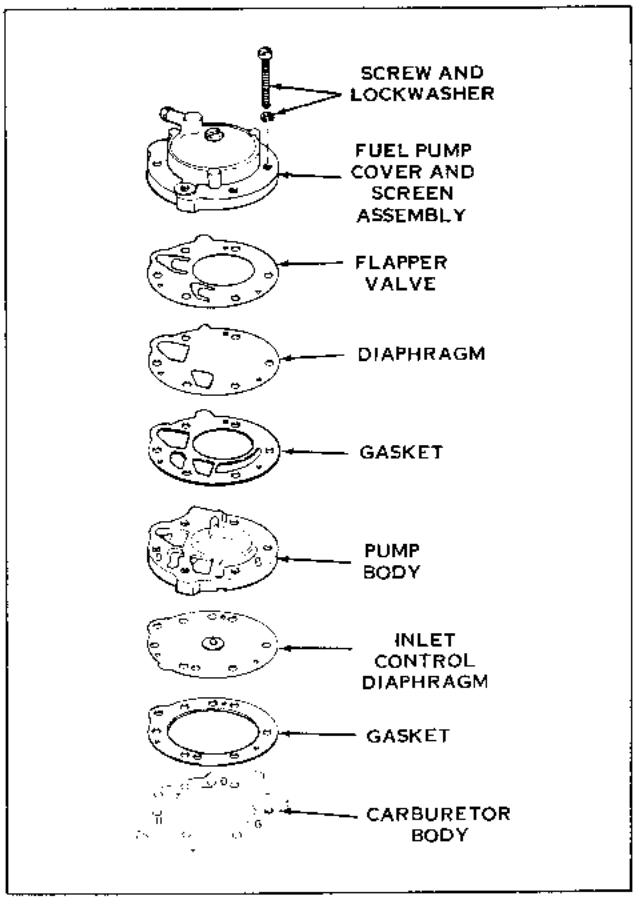


Figure 3F-34D. Carburetor Pump and Valve Section

DISASSEMBLING CARBURETOR (Fig. 3F-35)

The carburetor can be disassembled and cleaned using a minimum of tools. Be sure tools and working area are kept clean at all times. After removing carburetor from car, clean it thoroughly with a non-flammable cleaning solvent before disassembly.

The following disassembly procedure contains references to minor differences in carburetor construction for various years and are identified by a letter after the number. Numbers are keyed to figure 3F-35.

Remove nylon strainer cover retaining screw (1) and cover (2). Remove strainer cover gasket (3) and strainer screen (4). Remove screws and washers (5) and fuel pump body (6). (Flat washer 5A for blind hole only.)

Remove fuel pump diaphragm (7 or 7A), gasket (8), cover plate (9), main diaphragm (10) and gasket (11). Remove inlet control lever fulcrum pin (12) if used, lever (13 or 13A) and tension spring (14). Remove screw (12A) and pin (12B) if used. Remove inlet needle (15 or 15A).

With a thin wall 5/16" hex socket wrench, carefully remove the inlet seat (16). (The fuel inlet seat should not be removed unless it has been definitely determined that the seat is faulty as evidenced by persistent flooding of the carburetor. In such case, complete replacement of the inlet needle and seat assembly is necessary.)

Remove idle adjustment screw with spring, washer and packing (17).

Remove main fuel orifice plug (18 or 18A), orifice and gasket.

NOTE: Disassemble remaining parts only as necessary for repair or replacement.

Under extreme conditions of clogged idle fuel supply channel and dischage ports, it may be necessary to remove the channel welch plug (20). If so it is important that it be done in the following manner.

1. Drill a 1/8" diameter hole in the center of the welch plug to a depth of 1/16".

CAUTION

A deeper drilling operation will seriously damage the body casting wall and its discharge ports located close behind welch plug.

2. Carefully pry out welch plug with small punch.

CLEANING, INSPECTION AND REPAIR

The carburetor body can be cleaned in commercial carburetor solvent such as Hydroseal to remove varnish from the channels and metering chamber.

WARNING

Always use a non-flammable cleaning solvent for cleaning component parts. DO NOT use gasoline or other flammable substance.

NOTE

All gaskets, rubber gaskets, seals and plastic parts should be removed and only metal parts cleaned in Gunk Hydroseal cleaning solution.

CAUTION

Clean rubber parts by washing in denatured alcohol or brake fluid. DO NOT use mineral base cleaning solvents such as acetone or paint thinner. Use of mineral base solvents will cause deterioration of the part and continue to deteriorate after assembly which could result in component failure.

If carburetor appears to be set too rich as evidenced by engine firing unevenly or excessive smoke from the exhaust, it is possible that welch plugs are not sealing properly. Welch plugs may be re-seated by lightly tapping with a flat end punch. If welch plugs still do not seal properly, they must be replaced. Refer to DISASSEMBLING CARBURETOR for proper removal procedure.

All channels and orifices in carburetor and pump-body castings should be cleaned with compressed air. DO NOT use wires or drills to clean small holes. These might cause burrs or change the size of the holes.

Inspect all parts for wear or damage paying particular attention to the following:

Examine pump body casting for breaks and cracks. Inlet control lever (13, 13A) must rotate freely on the fulcrum pin (12, 12A, 12B) and forked end must engage slot in inlet needle (15, 15A) (See figure 3F-35). Spring (14) should not be stretched or distorted.

Inspect inlet needle (14) cone point and seal for wear and scratches. Replace if worn. Inspect lever (13, 13A) contact end for burrs and wear.

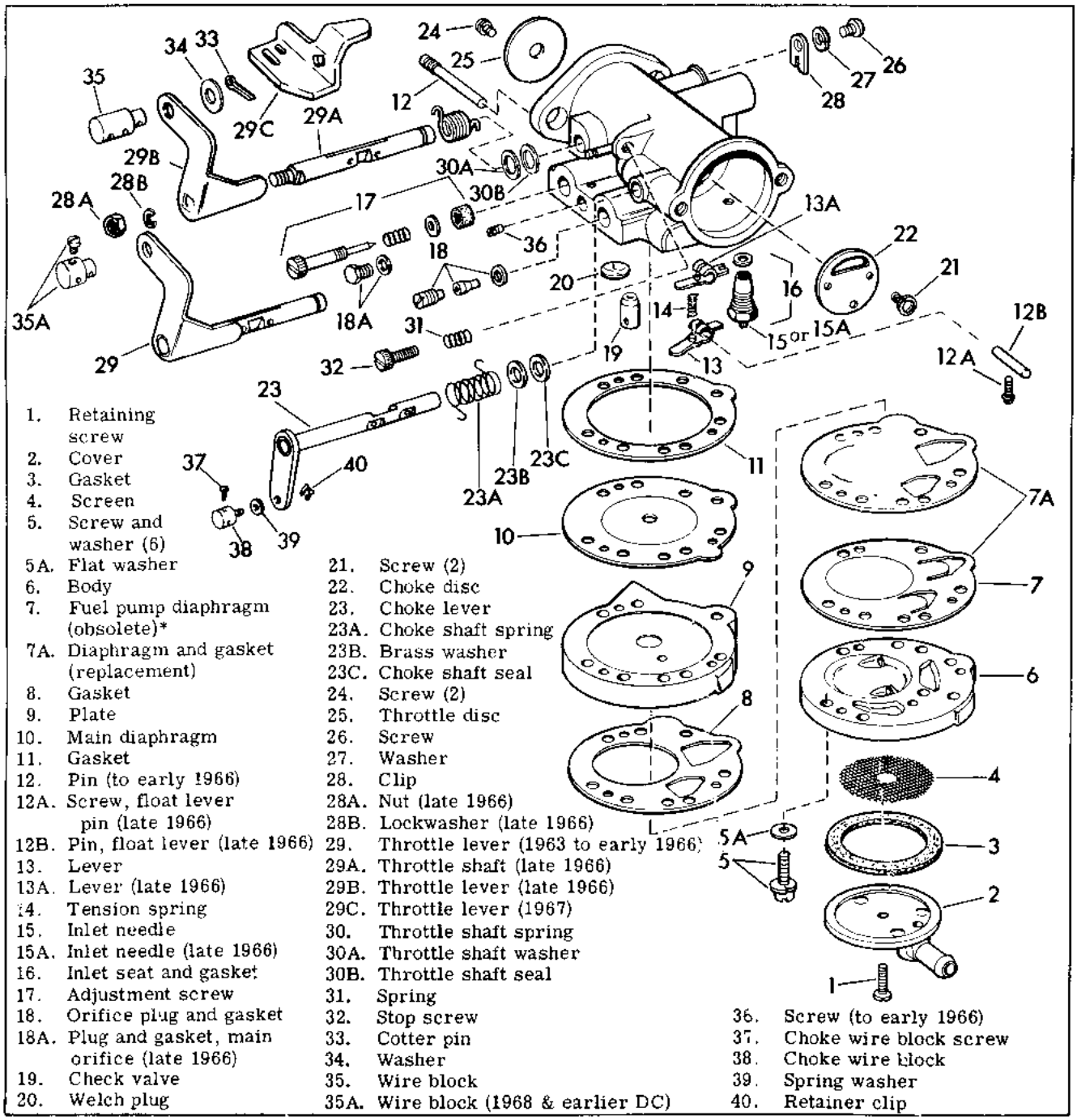


Figure 3F-35. Carburetor - Exploded View

REASSEMBLING CARBURETOR (Fig. 3F-35)

Make certain that all parts are kept clean during reassembly. Do not use cloths to wipe or dry parts. Lint or threads can easily block small orifices. Always use compressed air for drying.

Reassemble in reverse order of disassembly. Take special note of the following.

When reassembling the inlet control lever (13 or 13A) and spring (14), care should be taken to see that the spring rests in the well of the metering body and locates on the dimple of the inlet control lever Inlet control lever (13A) has a yoke which should engage groove in inlet needle (15A). Inlet control lever must be free on fulcrum pin. Set inlet control lever flush to .015 above floor of chamber. CAUTION: Do not stretch spring. (See Fig. 3F-36.)

If welch plug was removed, install new plug by placing it in casting shoulder, convexed side upward; then flatten to a tight fit with a flat-end punch of a slightly smaller diameter than welch plug. Hold tool firmly and strike upper end with a light hammer.

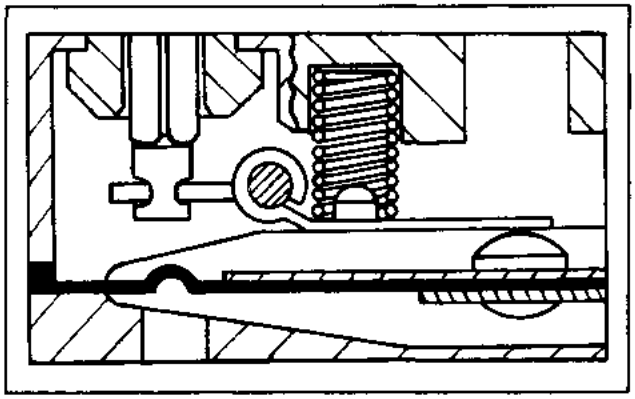


Figure 3F-36. Positioning Inlet Control Lever and Spring

Main diaphragm must be clean and free of breaks or punctures. Its metal disc must not become bent and should always retain tight fit to rubberized body section.

Fuel Pump Diaphragm must seal at circular pressure chamber area and at Inlet and Outlet Check Valve tongues thereof. It must be clean and free of breaks or punctures.

Be certain main diaphragm gasket and cover casting are carefully and properly fitted over the three small pins cast in rim at bottom of metering body. Also the fuel pump gasket, diaphragm and fuel pump body, over similar pins at bottom rim of main diaphragm cover casting. Then evenly tighten fuel pump body retaining screws to insure complete seal of casting separations at both diaphragms.

With carburetor completely assembled, see that throttle and choke disc align in throat and operate freely from fully closed to open positions. Also see that choke disc reed is closed flush against opening in disc.

REED VALVE (Fig. 3F-37)

The reed valve is a one-way valve consisting of a leaf spring with 8 petals over 8 holes in a plate. The petals open to allow the fuel mixture to enter the engine crankcase on piston up-stroke and close on piston down-stroke to prevent fuel blow-back from the crankcase to the carburetor. The reed valve requires little maintenance, however, if one or more of the petals should become bent or broken, the valve leaf must be replaced.

Hard starting, poor performance, or fuel soaked air cleaners in Gas Golf Cars can be caused by broken reed leafs or reed leafs which are not seated properly due to rough or irregular reed plates.

Starting with crankcase, additional operations and inspections have been initiated to assure careful reed plate handling and burr-free reed plate surfaces. All assemblies in the field should be inspected and repaired if one of the above conditions exist.

It is important that the reed valve assembly be in proper working condition. Its function is to trap the combustible fuel-air mixture during the downstroke of the piston so that it can be forced through the transfer ports into the combustion chamber. If the leaf is inadequately seated or broken, a reduced amount of fuel and air is transferred into the combustion chamber resulting is lost torque and horsepower.

WARNING

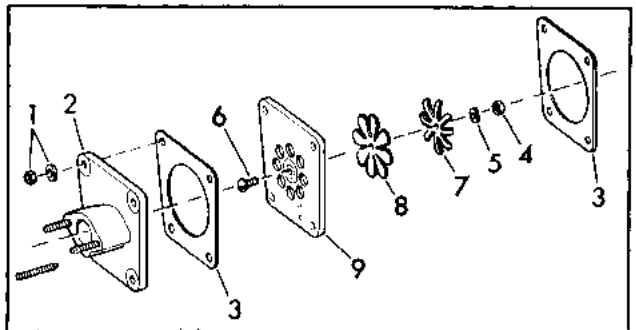
Whenever working on an engine, disconnect the battery ground cable to prevent the engine from starting accidentally and possibly causing personal injury.

WARNING

Whenever working on a golf car, be sure to block the wheels to prevent the car from moving accidentally and possibly causing personal injury.

To inspect for this condition, remove the air cleaner and carburetor for access to the reed plate assembly. Remove the manifold nuts and washer (1) and manifold (2) from the engine. Remove reed valve assembly (10) and gaskets (3). Inspect the assembly. All petals must be intact and fully seated against the base plate. Do not attempt to straighten them. To disassemble the reed valve, remove the nut (4) and lockwasher (5) from the brass mounting screw (6). Remove the reed stop (7) and leaf (8) from plate (9). Clean all burrs from plate with a lapping block and grinding compound or a fine emery cloth and surface plate. Be sure to remove all burrs and metal shavings before reassembly, paying special attention to the spotface surfaces. When reassembling, make sure leaf is located on the side of plate with the index hole used for correctly positioning the leaf petals. Align reed leaf with hole on plate between reed petals. Then center reed stop over reed petals. Make sure there is no gap between the plate and the reed leaf. The read leaf must lie flat on the plate.

To prevent mounting screw from vibrating loose, apply a small amount of Loctite, Part No. 99625-77, to the screw. Tighten the mounting screw to 25-30 in.-lbs. torque. Assemble reed valve and gaskets to manifold. Be sure pulse holes in gaskets and manifolds are lined up correctly. Reassemble manifold, carburetor, and air cleaner to engine. Inspect assembly. Reconnect the battery cable.



1. Washers (4)
2. Manifold
3. Gasket
4. Nut
5. Lockwasher
6. Screw
7. Stop
8. Leaf
9. Plate
10. Gasket

Figure 3F-37. Reed Valve and Manifold

FUEL TANK AND FILTER

STEEL FUEL TANK AND FILTER - 1974 AND EARLIER

The steel type fuel tank is treated to resist rusting. However, when vehicle is not to be operated for any reasonably lengthy period, drain tank and bathe tank interior with an oil fuel mixture of equal proportions. The fuel will evaporate leaving a protective oil film on tank walls.

A cartridge type filter is located in the fuel supply line next to tank. Replace filter when there is indication of restricted fuel flow at carburetor.

POLYETHYLENE FUEL TANK AND FILTER - 1975 AND LATER (See Fig. 3F-38)

The 1975 and later fuel tank is made of a high density polyethylene material. The hose fitting (7) and atmospheric vent (4) are a friction fit in the fuel tank and may be removed by prying out. If vehicle is not to be run for a lengthy period of time, such as extended off-season storage, stabilizer should be added to the fuel mixture following the manufacturer's recommendations on the container.

A cartridge type fuel filter is located in the fuel supply line to the carburetor. If there is an indication of restricted fuel flow at the carburetor, filter should be replaced and fuel strainer screen (5) should be cleaned.

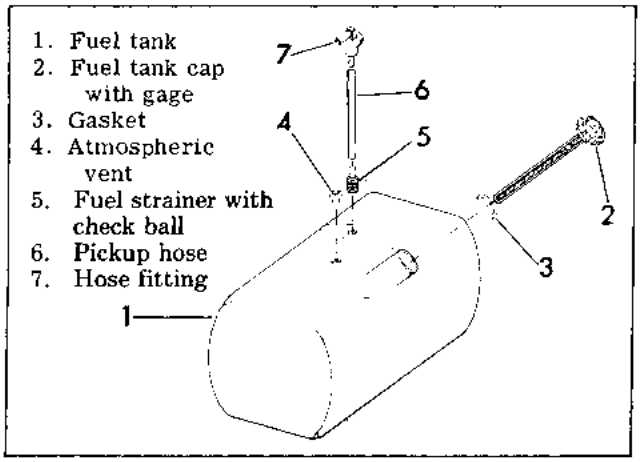


Figure 3F-38. Polyethylene Fuel Tank and Fittings

AIR INTAKE SYSTEM AND CLEANER

Intake system must be air tight. Check the flexible hose and connections for leaks or damage. Check air silencer tube used on 1966 and earlier models inside hose for blockage or damage.

PLASTIC FOAM TYPE CLEANER

Filter should be serviced every month, or oftener under dusty or dirty operating conditions as may be indicated by blockage of the filter surface. Inspect filter each time fuel tank is filled.

Service as follows:

1. Raise body and remove filter from receptacle at rear of reverse unit, and thoroughly wash in non-flammable cleaning solvent to remove dirt.

2. Squeeze out excess solvent and blow dry with air hose, or allow to stand until dry.

3. Saturate filter with light engine oil (SAE 10) and squeeze out excess oil. DO NOT USE HEAVIER OIL.

4. Insert oil-wet filter into receptacle. The screen at the bottom serves as a stop.

OIL BATH AIR CLEANER

Air cleaner should be serviced at least once a month - more frequent service is necessary under dusty conditions.

Service as follows:

1. Unscrew wing nut at top of filter can and remove can and cover from stud.

2. Cover contains filter mesh and can contains oil. Flush both parts clean in solvent.

3. Install can and fill to level indicated by arrow with SAE 30 oil. Install cover and wing nut with washer.

DRY TYPE (TRI-PHASE) AIR CLEANER

Air cleaner should be serviced at least every month -- more frequent service may be necessary under extremely dirty operating conditions.

Need for immediate servicing will be indicated by loss of power, sluggish acceleration, or excessive exhaust smoke. These are also indications of a dirty exhaust system.

Service as follows:

1. Unscrew wing nut at top of filter can and remove cover and clear element.

2. Clean element by tapping the side or end gently against palm of the hand.

CAUTION

Do not tap element against a hard surface because the element may be damaged by doing so.

Compressed air can be used also, but hold nozzle far enough away to prevent damage to element.

3. Inspect element by holding light inside element. An even, fine pattern of light through element indicates element is clean. Any large spot of light indicates that element is damaged and should be

replaced. Also if light does not show through, it indicates that pores are blocked and element should be replaced.

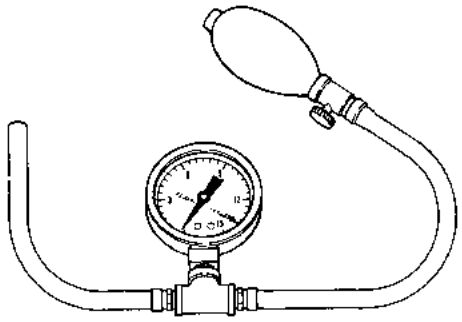
4. Check condition of sealing surface at the end of the element--if damaged, replace element. Check condition of rubber unloader valve. Opening in slit should be uniformly wide--not deformed, and must be free of any obstruction.

NOTE

If element becomes greasy or oily, it is possible to clean the filter element by agitating in warm water containing a non-sudsing detergent. Follow with a reverse direction flush from the inside out using clear water. Shake out excess water and allow to dry. Do not use solvents or gasoline. Do not dry with compressed air. Element should be replaced after 10 washings because of possible deterioration.

To ensure maximum air filtration, and canister sealing, coat air filter top and bottom gasket with grease before inserting in filter canister. Top of housing labeled "front" must face front of vehicle to ensure clearance between air intake and starter/generator terminals.

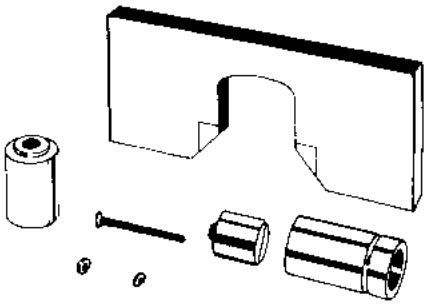
5. Clean filter cup and reinstall element, facing cleaner inlet toward the starter-generator and unloader valve should face forward. Tighten wing nut securely by hand.



94750-68

CARBURETOR LEAK TESTER

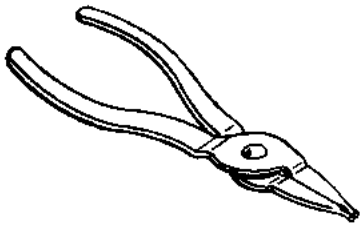
Tool consists of a 15 lb. dial pressure gage and bulb which is used to apply air pressure to carburetor to detect leakage of inlet valve, diaphragms, flapper valves, ball check valves, gaskets, etc.



96122-63 (1976 and Earlier - Crankshafts without thrust washers)

CRANKSHAFT TOOL SET - GASOLINE CAR

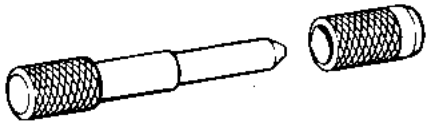
For disassembling and assembling connecting rod, bearing and crankpin. Consists of crankpin aligning sleeve and pilot, gaging plate and press cap.



96215-49

TRU-ARC PLIERS (Small)

Special pliers for removing and replacing internal-type retaining rings.



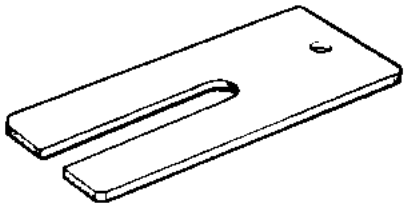
96777-72

PISTON PIN LOCK RING INSERTING TOOL

For installing piston pin and lock rings.

97336-80

Flywheel Puller



94403-80
Connecting Rod Holding Plate

NOTES

TRANSMISSION 4

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GENERAL

TRANSMISSION

The Harley-Davidson "Scootaway Drive" transmission automatically changes the driving ratio by varying the diameter of the front and rear driving flanges on which the drive belt runs. When the throttle is opened and the engine speeds up, the front flanges, located on the engine crankshaft, are moved together by the force of three balls or weights operating on cams in the front floating flange. When the throttle is closed, the engine slows down, reducing the force on the balls or weights which causes the front flanges to separate from spring pressure on the floating flange. At idle speed, the belt rides at the bottom of the front flanges on an antifriction bearing so that under this condition the transmission is disengaged. When the speed is increased, the three-speed-sensitive balls or weights move outward and force the front floating flange inward. The flanges now begin to engage the sides of the V-belt. This serves as a clutch and as soon as these conditions exist the transmission becomes engaged. At this point the overall drive ratio is at maximum range. As the engine speed is increased by means of the throttle, the flanges move together. The belt rides higher up on the flanges and the drive ratio decreases.

The rear flanges are spring loaded and correspondingly separate and close according to the amount of belt pull. This is, when the front flanges are apart in the idle position, the V-belt on the rear flanges are held in the maximum outward position by a spring force applied against the rear floating flange. As the front flanges assume a larger driving diameter, the V-belt is pulled down moving the flanges apart against this spring force until the minimum ratio is reached.

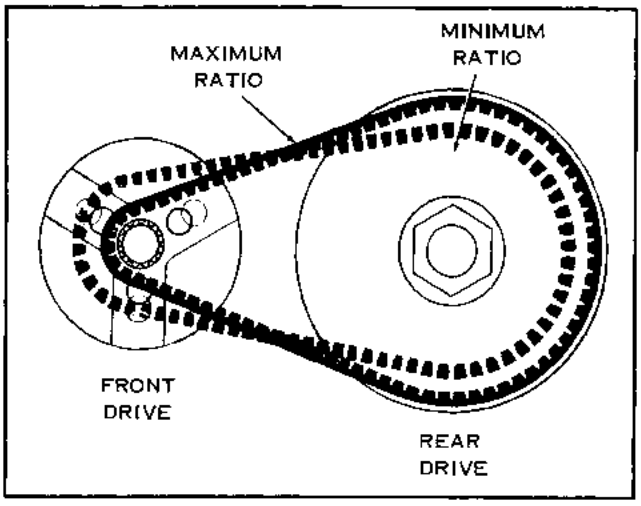


Figure 4A-2. Transmission Ratios

The transmission is torque responsive. When ascending a hill or opening the throttle suddenly, the rear flanges come together, increasing the useful diameter of the pulley and creating a higher overall transmission ratio. This is caused by a set of nylon rollers in the rear floating flange operating on cam tracks in the rear driving flange. The action is such that the increase in belt pull rotates the rear floating flange ahead in relation to the rear driving flange, the belt slipping slightly on the driving flange. This causes the roller cams to force the floating flange closer to the driving flange.

DRIVE BELT

REMOVING AND INSTALLING V-BELT

To remove V-belt, grasp the V-belt at a point midway between the front and rear driving flanges with the left hand and jerk up on belt sharply to separate rear flanges and keep tension on belt while "rolling" it off the rear flange as shown in figure 4B-41. On 1966 and earlier models with exposed rear flange, insert screwdriver with 1/4 inch wide blade into cam slot next to nylon roller as shown in Figure 4B-41A. Spread the two rear driving flanges by prying on screwdriver. Hold the rear driving flanges apart and "roll" the belt off the rear driving flange. Slip the belt from the front driving flange. Install the V-belt by placing it on the front flanges first, and "rolling" on the belt.

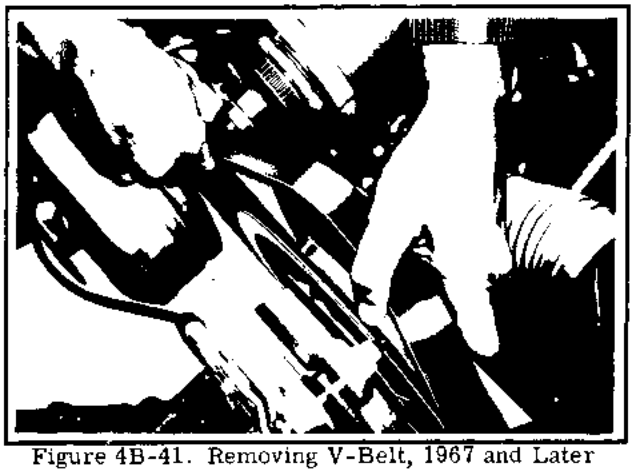


Figure 4B-41. Removing V-Belt, 1967 and Later D Model

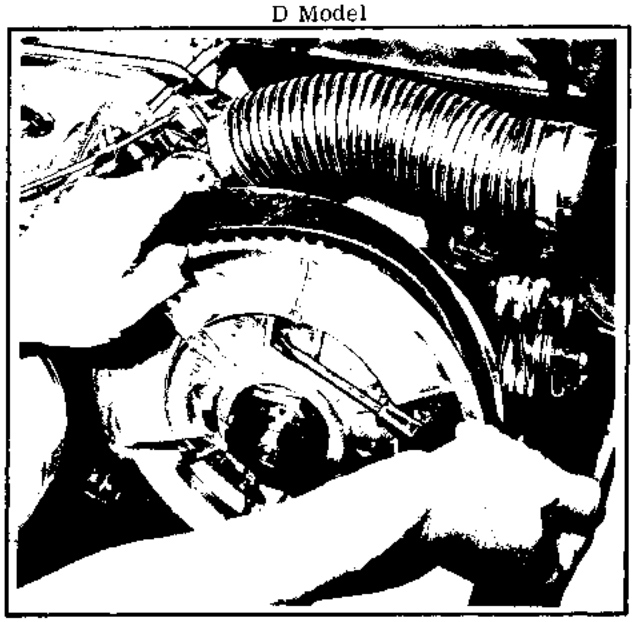


Figure 4B-41A. Removing V-Belt, 1966 and Earlier

INSPECTION AND REPAIR

The belt requires no attention except that if it gets greasy and dirty it can be wiped with a rag saturated in non-flammable cleaning fluid.

If the belt becomes badly frayed or worn, it should be replaced. If the belt slips or drags on the front flanges, shim the proper amount as described in "Removing and Installing Transmission Front Drive."

NOTE

New belt is approximately 1-3/16 inches wide. After belt has worn 1/16 inch at widest point (1-1/8 inch belt width) it will probably be necessary to install a new one to correct belt slippage or chatter and restore transmission driving ratio to normal.

PRIMARY AND SECONDARY FLANGE ALIGNMENT

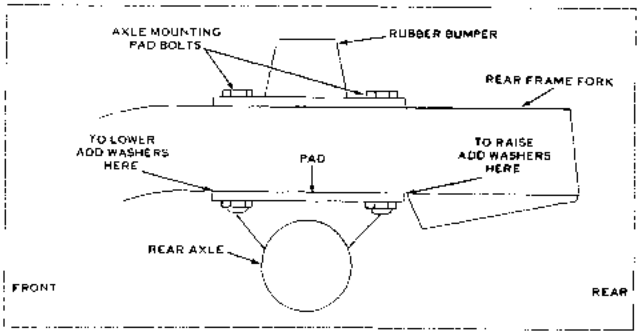


Figure 4B-42. Aligning Primary and Secondary Transmission Flanges

To obtain maximum drive belt life, and to minimize primary (front) flange wear, it is important to check and maintain front and rear drive flange alignment. The drive belt should be perpendicular to flange centers. To inspect for proper drive alignment, raise the fiberglass body and support the rear wheels off the ground. Block front wheels. Using a tachometer, run engine at 3000 rpm and visually check drive belt with both flanges fully engaged.

WARNING

While engine is running, keep clear of moving drive components and rotating tires to avoid personal injury.

Misalignment can be corrected by using one of the following procedures.

1. Bring secondary (rear) flange into alignment with primary flange (using spacer kit).

A secondary flange spacer kit is available which, when installed, will move the secondary flange 5/16 inch forward.

To install spacer, remove the transmission rear drive and brake assembly as a unit, as described in the Service Manual. Install the spacer between the flange hub and the stationary flange, using the longer bolts provided. Reinstall the assembly.

1A. To bring secondary (rear) flange into alignment with primary flange (using longer hub)

The following secondary flange hubs are available to achieve proper alignment between the primary and secondary drive. Hub, Part No. 36410-71B, is 1/4 inch longer than hub 36415-77. When the longer hub is installed, it moves the secondary flange front face to within 1/4 inch of the point where the belt face meets the outside diameter of the primary flange. This measurement is a static alignment made without the engine running.

Hub, Part No. 36410-71B, is intended to align the front and rear flanges without the use of the spacer kit.

To install the longer hub, remove the transmission rear drive and brake assembly as a unit. Disassemble the secondary drive and reassemble with longer hub. Reinstall the assembly using four (4) longer bolts.

2. To bring secondary flange into horizontal alignment with primary flange.

The secondary flange is mounted to the differential and rear axle. It can be adjusted either up or down as required by adding washers to a maximum of 3/16 inch between pads and rear fork tube at the axle mounting pad bolts (Figure 4B-42).

Loosen stabilizer clamp bolts at the axle. Loosen axle mounting pad bolts on both the left and right side of car.

Remove either the forward or rearward axle mounting pad bolts and add washers to forward bolts to lower flange or to rearward bolts to raise flange.

Washers must be added to both left and right side of car to achieve proper alignment. Make sure the maximum spacing of 3/16 inch is not exceeded. Tighten all bolts securely.

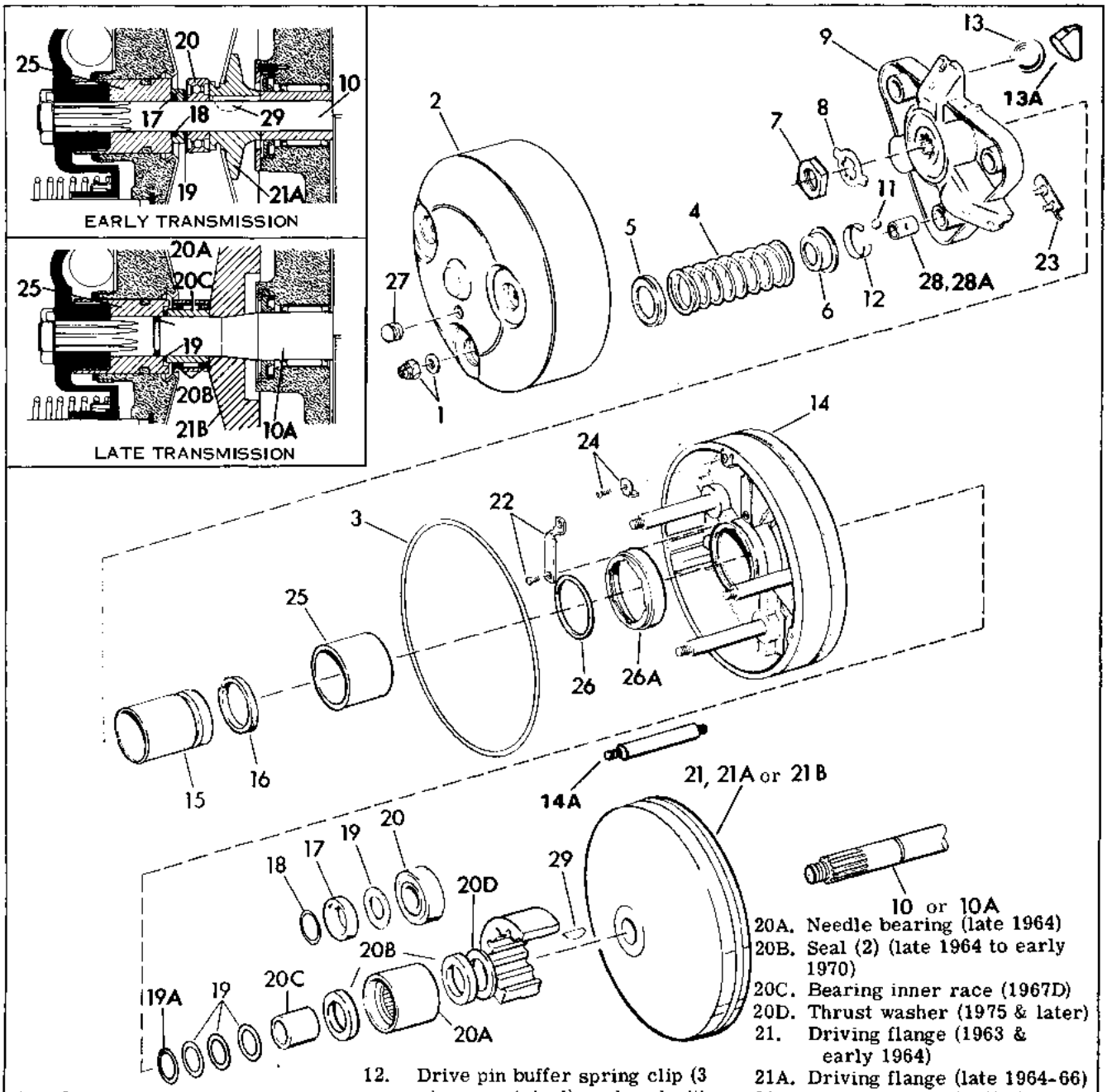
NOTE

Do not use the engine stabilizer bar (located between the cylinder head and rear axle) to correct a misaligned flange condition. When properly adjusted, the stabilizer bar should exert no pressure on the rubber pads.

TRANSMISSION FRONT DRIVE

REMOVING TRANSMISSION FRONT DRIVE (Fig. 4B-43)

Transmission front drive can be worked on with engine in chassis if desired. Remove V-belt as described in "Removing and Installing V-Belt."



1. Drive cup cover acorn nut and washer (3)
2. Drive cup cover
3. Drive cup cover O-ring seal
4. Drive cup spring (3)
5. Drive cup spring collar (3)
6. Drive cup spring retainer (3)
7. Shaft nut
8. Shaft nut lock
9. Drive cup
10. Flywheel transmission shaft (1963 & early 1964)
10A. Flywheel transmission shaft (late 1964)
11. Drive pin buffer ball (3) (early 1974 & earlier)
12. Drive pin buffer spring clip (3 heavy original) replaced with one light spring (early 1974 & earlier)
13. Drive ball (3)
13A. Drive weight (1980)
14. Floating flange
14A. Stud chamfered end (1980)
15. Floating flange sleeve
16. Floating flange sleeve felt seal
17. Shaft spacer (1963 & early 1964)
18. Shaft O-ring seal (1963)
18A. Shaft O-ring seal (1964 & later)
19. Spacing shims (variable No.) Gasket (2) (late 1964)
19A. O-ring (1965 & later)
20. Ball bearing (1963 & early 1964)
20A. Needle bearing (late 1964)
20B. Seal (2) (late 1964 to early 1970)
20C. Bearing inner race (1967D)
20D. Thrust washer (1975 & later)
21. Driving flange (1963 & early 1964)
21A. Driving flange (late 1964-66)
21B. Driving flange (1967D)
22. Floating flange slide strip (3)
23. Drive cup slide strip (3)
24. Ball stop (3)
25. Floating flange bushing
26. Floating flange hub O-ring seal
26A. O-ring seal retainer
27. Filler plug
28. Drive pin bushing (3) (early 1974 & earlier)
28A. Drive pin bushing (3) (late 1974 & later)
29. Driving flange key (1963 & early 1964) (late 1970 & later)

Figure 4B-43. Transmission Front Drive - Exploded View

On 1963-66 golf cars and all utilicars, remove exhaust pipe, port flange nuts and lower exhaust pipe. On 1967 and later golf cars, disconnect governor control rod or cable from governor arm swivel block, and remove governor arm from pivot bracket on frame.

Transmission front drive unit contains 12 ounces of Harley-Davidson Transmission lubricant. To disassemble front drive parts proceed as follows: Loosen, but do not remove entirely, the three acorn nuts and washer (1) which secure the drive cup cover. Insert an air nozzle into fill hole opening, slowly applying air pressure until cover (2) is forced off "O" ring seal of floating flange against the acorn nuts. When air pressure in transmission assembly escapes, remove acorn nuts, washers and cover, allowing oil to drain into pan.

Remove drive cup springs with spring collars (4) and (5) and spring retainers (6).

Remove shaft nut and nut lock (7) and (8).

Drive cup (9) is a press fit on transmission shaft (10 or 10A) splines; remove with claw puller, Part No. 95635-46. (Use 5/16 - 24 x 1-1/2" long Phillips head screw, Part No. 2424 as a center.) See Figure 4B-44.

On early 1974 and earlier models, three small bearings (11) are located under spring clips (12) to take up any play between drive pins and shaft holes in drive cup. These buffer balls will be free to come out when drive cup is removed from floating flange drive pins. It is not necessary to remove spring clips (12) to remove balls.

Three large drive balls (13) or weights (13A) will now come out. Remove floating flange (14) and floating flange sleeve (15) which has a felt seal (16) in outside groove.

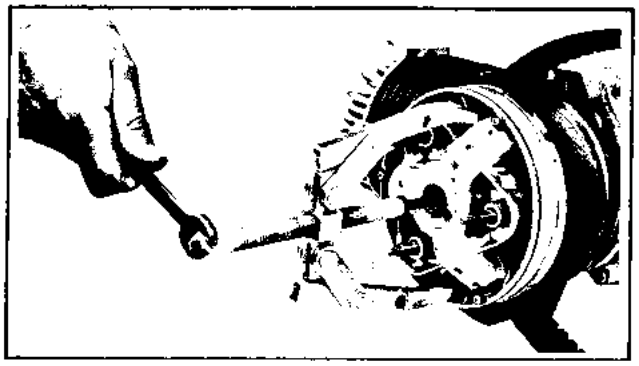


Figure 4B-44. Drive Cup Removal

1963 and Early 1964 Models:

Remove shaft spacer (17) with O-ring shaft seal (18).

Spacing shims (19), ball bearing (20), and driving flange (21) can now be removed from shaft.

Driving flange is a press fit and keyed to shaft (10). It can be pulled off with Claw Puller, Part No. 95635-46 and Wedge Attachment, Part No. 95637-46 which fits in groove in flange hub. Heat flange hub with torch to approximately 500°F if necessary to aid in removal. See Figure 4B-45.

Late 1964 and Later Models:

Remove spacing shims (19) with 2 gaskets and needle bearing assy (20A). Remove end seals (20B) if they

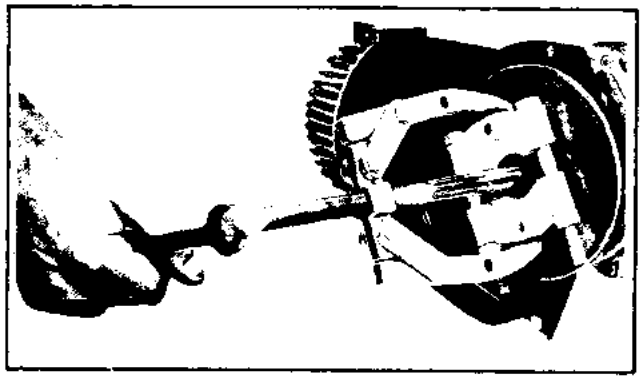


Figure 4B-45. Driving Flange Removal (1963 Model)

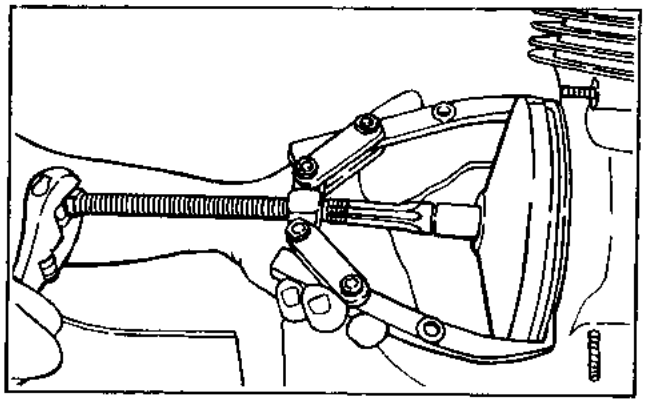


Figure 4B-45A. Driving Flange Removal (1967 D Model)

are to be replaced and thrust washer (20D) where used. Pull driving flange (21 or 21A) from shaft taper with claw puller and wedge attachment. Driving flange (21B) can be pulled using claw puller alone as shown in Figure 4B-45A.

NOTE

Puller cross-bar corners are ground with chamfer.

INSPECTION AND REPAIR

CAUTION

Floating flange assemblies using the 1980 cast iron flange and weights (13A) rather than balls (13) must be handled carefully, when on engine without belt installed. Moving the floating flange assembly back and forth on the shaft to check for free movement can upset the position of the weights (13A) and adversely effect car operation.

Clean all parts in non-flammable cleaning solvent and blow dry with compressed air. Check for wear where V-belt contacts the surface of the flanges. A wearing of a groove 1/32 inch or more deep in either flange, is usually enough to affect the operation of the transmission. Check the ball/weight track slide strips on the floating flange and drive cup for wear and looseness. If floating flange slide strips (22) require replacement, remove screws. If drive cup slide strips (23) require replacement, center punch and drill out rivet heads to release slide strips.

CAUTION

When riveting in new slide strips, support opposite side on a 5/8" diameter brass rod which will fit the curvature of slide strip. If this is not done, ball track will be damaged.

NOTE

All slide strips on both floating flange and drive cup should be replaced if any one should require replacement.

File a notch in outer end of each slide strip to match corresponding notch in drive cup, to provide clearance for ball stop.

Check ball stops (24) which are screwed to floating flange (14) for excessive wear. These should be replaced whenever new slide strips are installed.

Check for wear of the bushing (25) in floating flange. If the bushing has to be replaced, install a new one using a shouldered press plug with 1.560 inch outside diameter. Install the bushing to the center of the counterbore.

Check for wear of drive pin bushings (28) in floating flange. If bushings have to be replaced, install new ones using a shouldered press plug with .386 inch outside diameter. Install bushings from engine side of drive cups so they are flush with the drive cup surface. Redrill buffer ball hole in new bushings.

NOTE:

1980 cast iron flange Part No. 36449-61A does not use slide strips (22) or stops (24).

REMOVING CAST IRON FLOATING FLANGE STUDS (Figure 4B-43)

Studs (14a) can be replaced on cars using the 1980 cast iron floating flange, Part No. 36449-61A. Heat stud mounting area to 250°-300°F to break down Loctite® and remove stud. Apply Harley-Davidson Stud and Bearing Mount Part No. 99626-77 to threads of new stud, Part No. 36455-80, when installing.

NOTE:

Replaceable studs are identified by a chamfer machined around stud on its outside edge.

INSTALLING TRANSMISSION FRONT DRIVE (Fig. 4B-43)

Before reassembling parts, see that seals (3), (16), (18 or 20B), (26) and O-ring (19A) are in good condition and in correct location. Lubricate rubber seals with engine oil before installing.

Before installing on shaft, assemble felt seal (16) and floating flange sleeve (15) into floating flange. A piece of writing paper or shim stock, wrapped around sleeve can be used to hold felt seal in groove while pushing sleeve into flange bushing (25).

Assemble all parts loosely on shaft including shims and 2 gaskets (if used). See that buffer balls (11) are located under spring clips (12) in floating flange. They can be held in place with a small quantity of grease.

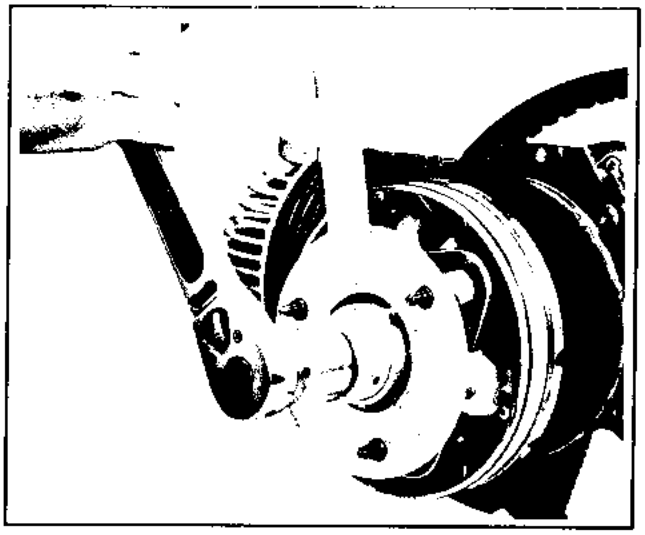


Figure 4B-46. Pressing on Transmission Parts

On 1963 and early 1964, and 1970 and later models, align keyway in driving flange with key in shaft keyway.

Use tool, Part No. 97170-55A to press parts on shaft as follows: (See Fig. 4B-46.)

Screw tool 97170-55A into tapped hole in transmission shaft and turn nut clockwise to press entire assembly on shaft. Tool, Part No. 97330-62 is used to keep shaft from turning. Install shaft nut (7) tightly to approximately 75-85 ft-lbs torque, bend nut lock ear (8). (See Fig. 4B-47.)

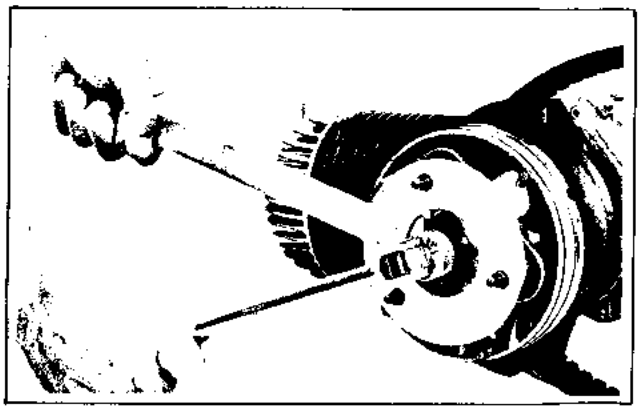


Figure 4B-47. Installing Transmission Shaft Nut

With feeler gage measure V-belt side clearance. If less than .040 in. or if the V-belt tends to drag when the engine is at idle speed, remove the floating flange and drive cup assembly, the inner sleeve, and add necessary number of .007 or .020 in. thick shims on the shaft to space out the floating flange. If side clearance of belt is more than .060 in., remove the floating flange and drive cup assembly and the spacer, and remove necessary number of shims. The total number (thickness) of shims used will vary. Reassemble the front drive and check the V-belt for drag and slip.

Finish assembly of remaining parts: Spring retainers (6), drive cup springs (4), spring collars (5), drive cup cover O-ring (3), drive cup cover (2), and 3 acorn nuts (to 54-66 in.-lbs. torque) and washers (1).

Fill with 12 ounces of Harley-Davidson transmission lubricant through filler plug (27). Lubricant is available from the factory in 12 ounce cans, under Part No. 99890-61.

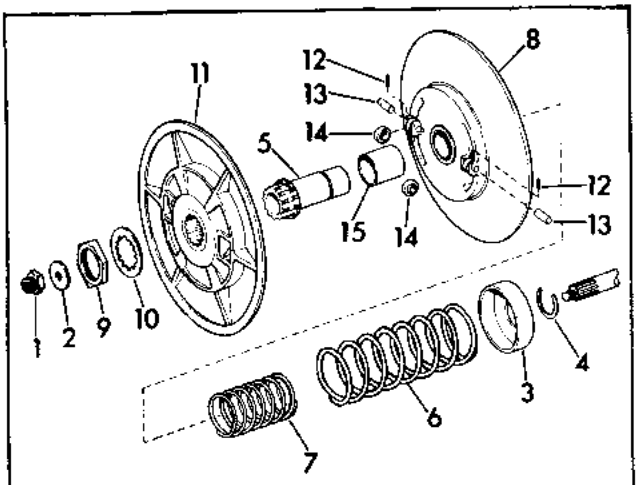
TRANSMISSION REAR DRIVE

1963-66 D and 1968 and Earlier DC Models

REMOVING AND INSTALLING TRANSMISSION REAR DRIVE (Fig 4B-48)

Remove the V-belt as described in "Removing and Installing V-belt." Remove the nut (1) and washer (2) securing the rear flange assembly to the shaft. Remove the flange assembly from the shaft.

Install the rear drive flange assembly in reverse order of removal.



1. Nut
2. Washer
3. Retainer
4. Spring ring
5. Hub
6. Spring, outer
7. Spring, inner
8. Floating flange
9. Nut
10. Lockwasher
11. Stationary driving flange
12. Roll pin (2) or set screw
13. Roller pin (2)
14. Cam roller (2)
15. Bushing

Figure 4B-48. Transmission Rear Drive - Exploded View (1963-1966 D and 1968 and earlier DC Models)

DISASSEMBLING REAR DRIVE (Fig. 4B-48)

While holding pressure on spring retainer (3), remove spring ring (4) from hub (5) with a lock ring pliers. Remove the spring retainer and springs (6 and 7) from the hub (See Fig. 4B-49). Remove floating flange (8) from the hub. Turn nut (9) from the hub and remove lockwasher (10). Press or tap off stationary driving flange (11).

To disassemble the floating flange, remove roll pins (12), roller pins (13) and cam rollers (14).

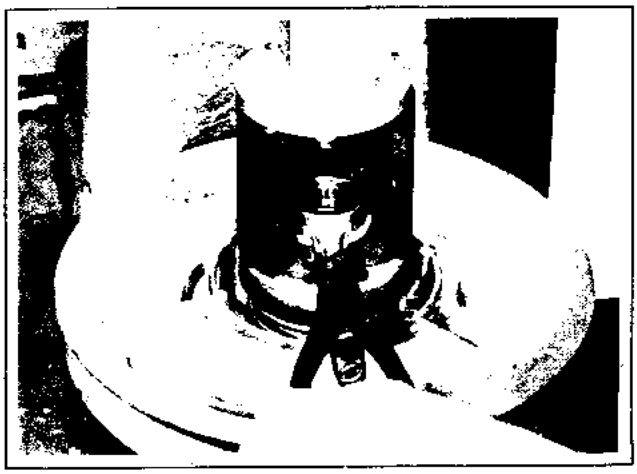
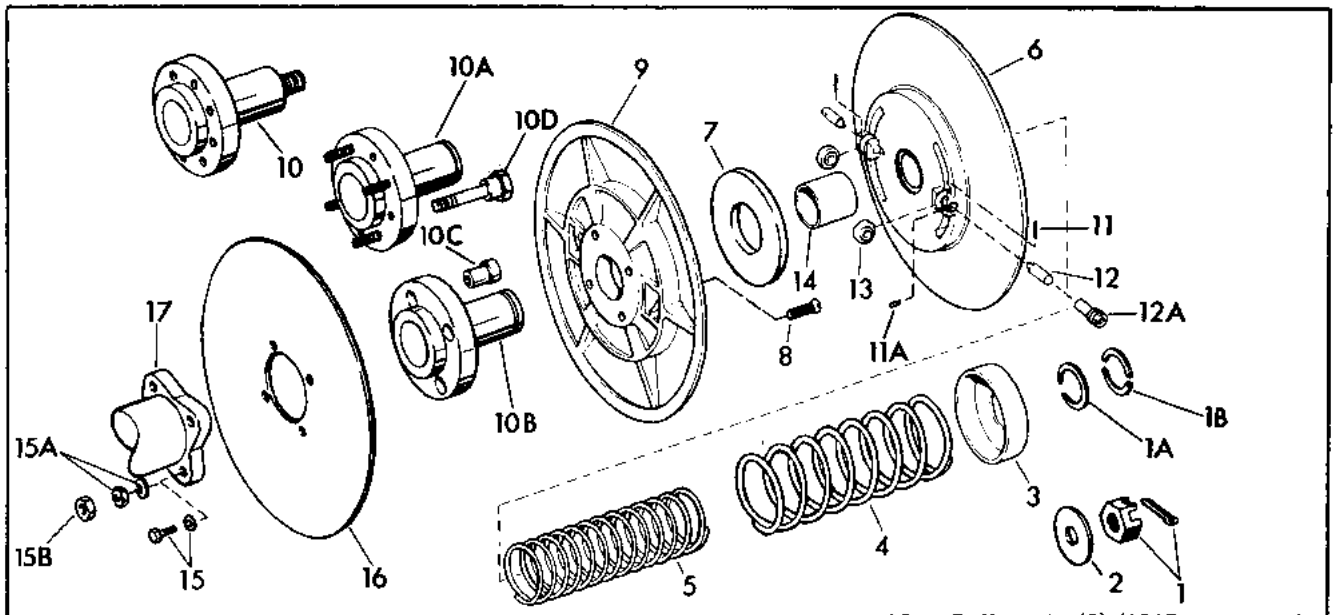


Figure 4B-49. Removing Transmission Rear Drive Lock Ring with Pliers (UTICA 534-7 or Equivalent)

INSPECTION AND REPAIR

Clean all parts in non-flammable cleaning solvent and blow dry with compressed air. Check for wear where the V-belt contacts the surfaces of the flanges. If driving performance is affected by wear of the flange surfaces the flanges will have to be replaced. A wearing of a groove of 1/32 in. or more in either flange is usually enough to affect the operation of the transmission. Check for wear of the cam tracks in the driving flange. Check for wear and looseness of the cam rollers and roller pins. Replace these parts if necessary. Check to see that the bushing in the floating flange is centered and tight in the floating flange. If bushing is loose, worn or damaged, replace it with a new one. Heat hub to 500° and use a shouldered press plug with a 1.380 in. outside diameter to remove bushing. When flange has cooled, wipe inside of boss free of any residue. Apply a thin coat of Loctite Wick N' Lock (H-D Part No. 99627-77) to inside diameter of boss and outside diameter of new bushing. Press new bushing into boss. Make sure it is pressed up against shoulder. Wipe off any excess Loctite and allow to cure approximately 15 minutes before reassembly.



1. Cotter pin and nut (1967	8. Screw (4) (1967)	12. Roller pin (2) (1967 & earlier) (1970 & later)
1A. Retaining ring (1968-70)	9. Stationary driving flange	12A. Roller pin (1968-69)
1B. Retaining key (2) (1971 & later)	10. Hub (1967)	13. Cam roller (2)
2. Washer (1967)	10A. Hub (1968)	14. Bushing
3. Spring retainer	10B. Hub (1971 & later)	15. Bolt and lockwasher (4)
4. Spring	10C. Nut insert (4) (1971 & later)	15A. Nut and lockwasher (1968-70)
5. Spring	10D. Shoulder bolt (4) (1977 and later)	15B. Nut (4) (1977 and later)
6. Floating flange	11. Roll pin (1967 & earlier) (1970 & later)	16. Brake disc
7. Buffer washer	11A. Set screw (early 1967)	17. Differential flange

Figure 4B-50. Transmission Rear Drive - Exploded View (1967 & Later D) (1969-1972 DC)

ASSEMBLING REAR DRIVE (Fig. 4B-48)

Install cam rollers (14) on the floating flange and secure in place with cam roller pins (13). Secure the cam pins in place with roll pins (12). Grease cam rollers and pins. Press the spline end of the hub into stationary driving flange (11).

Position spring (6 and 7) and retainer (3) on the floating flange. Compress the springs and install spring ring (4) on the hub. Turn the assembly over. Install lockwasher (10) on the end of the hub and tighten nut (9). Bend over a section of the lockwasher to secure the nut in place.

TRANSMISSION REAR DRIVE

1967 and Later Model D, 1969 and Later DC

REMOVING AND INSTALLING TRANSMISSION REAR DRIVE (Fig. 4B-50)

Transmission rear drive and brake assembly should be removed from car as a unit to be disassembled and serviced.

Disconnect the governor rod or cable and remove V-belt as described in "Removing and Installing V-belt." Remove cotter pin and clevis pin to disconnect brake control cable clevis from brake. Remove 2 brake assembly attaching nuts and bolts from axle housing bracket and remove brake assembly from car. Remove 4 capscrews or nuts and washers (15 or 15A) to free rear drive assembly and brake disc from differential assembly. Install the rear drive flange and brake assembly in reverse order of removal.

DISASSEMBLING REAR DRIVE (Fig. 4B-50)

While holding pressure on spring retainer (3), remove cotter pin, nut and washer (1 and 2), or retaining ring (1A) or keys (1B) from hub (10 or 10A). Remove spring retainer (3), and springs (4 and 5) from hub. Remove floating flange (6) and washer (7) from hub. Remove 4 screws (8) from hub (10) to disassemble stationary driving flange (9). If necessary, heat screws to 500°F with torch to loosen.

To disassemble 1967 and earlier or 1970 and later floating flange, remove roll pins (11) or set screws (11A). If necessary, heat set screws to 500°F with torch to loosen.

Remove roller pins (12) or screw pins (12A), and cam rollers (13).

See "Inspection and Repair" as described previously for 1963-66 models.

ASSEMBLING REAR DRIVE (Fig. 4B-50)

Install cam rollers (13) and roller pins (12 or 12A) on the floating flange. On 1967 and earlier models, secure in place with roll pins (11) or set screws (11A). Grease cam rollers and pins. Reassemble remaining parts in reverse order or disassembly. Use Loctite Stud N' Bearing Mount (H-D Part No. 99626-77) on screw threads (8, 12A) and roller pin set screw threads (11A).

REVERSING UNIT AND COUPLING

1963-66 Golf Car

GENERAL

The reversing unit provides forward and reverse motion as well as gear reduction for the car. Basically, the unit consists of an upper and lower case which house the forward gear, reverse gear and shifter clutch assemblies mounted on a drive shaft, and a driven gear assembly which is connected externally by coupling to the differential and axles.

The unit is controlled by a shift lever which locates the forward, reverse and neutral positions of the shifter clutches.

Normally, the reversing unit will require only periodic checks of the transmission oil level. However, if shifting trouble or an unusually high noise level should develop and the trouble is proven to be within the reversing unit, the unit should be removed from the chassis for further inspection and repair.

REMOVING AND INSTALLING REVERSING UNIT AND COUPLING (Fig. 4D-40)

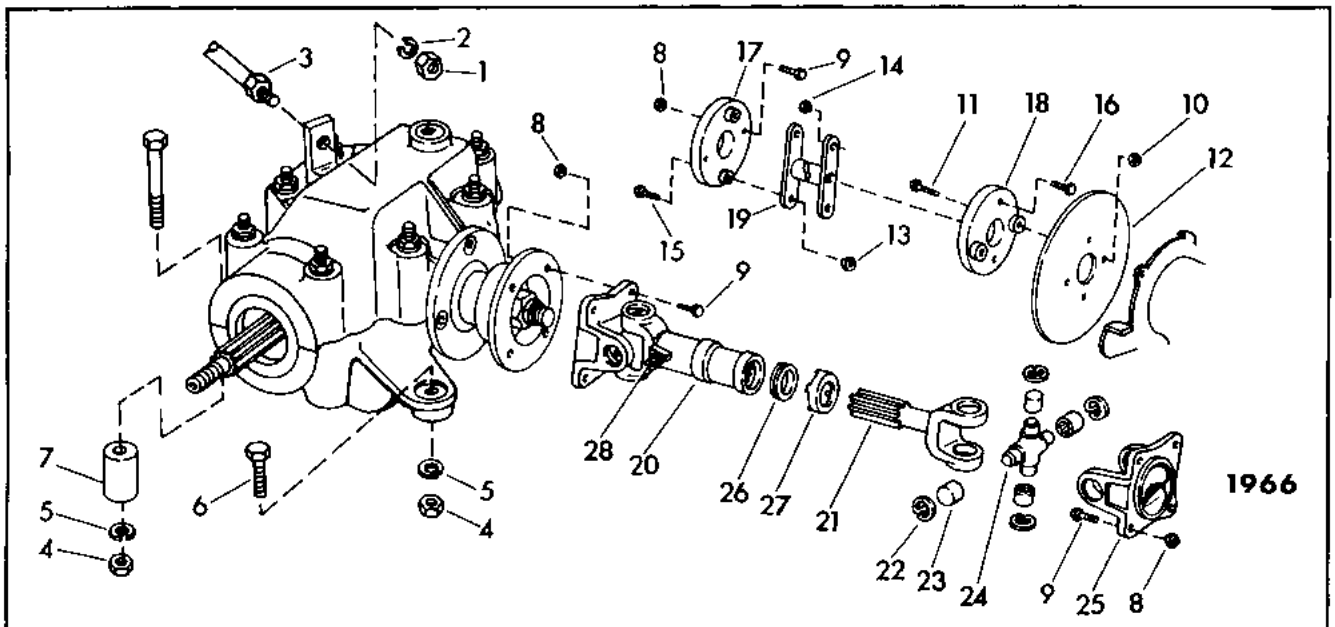
REVERSE UNIT

Remove V-belt as described in "Removing and Installing V-Belt", Section 4. Disconnect governor control cable. Disconnect air cleaner hose at carburetor and remove air cleaner from reverse unit. Remove transmission rear drive as an assembly by removing nut and washer (1 and 2, Fig. 4B-48) from shaft.

Remove shifter lever (3) as an assembly by removing nut and lockwasher (1 and 2). Remove nuts, lockwashers and bolts (4, 5 and 6), securing reversing case to frame. Two front bolts have spacers (7) located below ears on case. Remove drive coupling nuts and bolts (8 and 9). Lift reversing unit from car frame.

To repair reversing unit, see "Disassembling Reversing Unit". Reinstall reversing unit in reverse order of removal.

Adjust shifter lever with gears in neutral so that knob is centered above "NEUTRAL" position on floor plate. With body in place, the lever shaft should have slight tension in body notches which hold the shifter lever in reverse and forward gears. If necessary, bend lever up to obtain this tension.



1. Nut
2. Lockwasher
3. Shifting lever
4. Nut (4)
5. Lockwasher (4)
6. Bolt (4)
7. Spacer (2)
8. Nut (2 or 8)
9. Bolt (2 or 8)
10. Nut (2)
11. Bolt (2)
12. Brake disc
13. Nut (2)
14. Nut (2)
15. Bolt (2)
16. Bolt (2)
17. Coupling rubber, front
18. Coupling rubber, rear
19. Shaft
20. Forward joint, shaft and flange assembly
21. Rear shaft
22. Snap ring (8)
23. Needle bearing and seal (8)
24. Cross journal
25. Rear flange
26. Grease seal
27. Grease seal retainer
28. Grease fitting

Figure 4D-40. Reversing Unit and Coupling - Exploded View

DRIVE COUPLING (RUBBER DISC TYPE) (Fig. 4D-40)

Remove self-locking nuts (8) and bolts (9) to detach coupling from reverse unit. Remove self-locking nuts (10) and bolts (11) to detach coupling from differential. This also frees brake disc (12). Remove self-locking nuts (13 and 14) and bolts (15 and 16) to remove coupling rubbers (17 and 18) from shaft (19). Assemble in reverse order of removal. The two extending bosses on both coupling rubbers should face toward the rear.

DRIVE COUPLING (UNIVERSAL JOINT TYPE) (Fig. 4D-40)

Figure 4D-40A. Loosening Snap Ring

Using a soft drift, tap outside of needle bearing assembly (23) to loosen snap ring (22). Tap bearing only hard enough to break assembly away from snap ring. See Figure 4D-40A.

Figure 4D-40B. Removing Snap Ring

Remove snap ring (22) from flange yoke (21). Turn joint over and remove opposite snap ring. See Figure 4D-40B.

With flange (25) between copper vise jaw covers, tap shaft yoke (21) until top bearing is forced out of flange yoke (25).

Turn joint over and remove opposite bearing in similar manner. With exposed journal bearings on copper vise jaw covers tap shaft to force out remaining two bearings. See Figure 4D-40C.

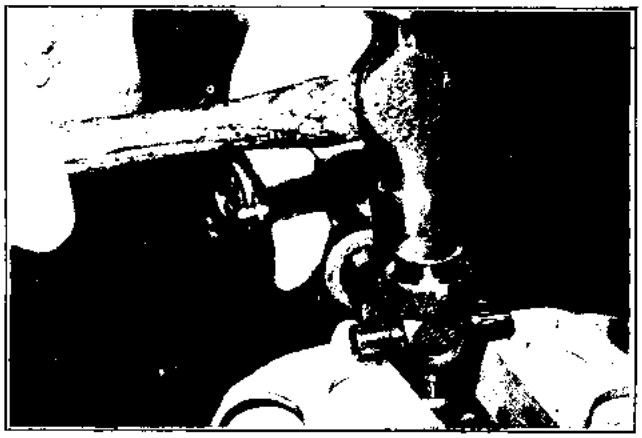


Figure 4D-40C. Removing Needle Bearings

Repack reservoir in the journal cross with a good grade of semi-fluid lubricant (SAE 140). Make sure the four reservoirs in each joint are filled. In addition, with the rollers in the bearing, fill bearing about one-third full with same lubricant.

Figure 4D-40D. Installing Needle Bearings

To reassemble unit, insert bearing assemblies into outside of yokes, press in with arbor or vise making sure seals are in place. See Figure 4D-40D.

With soft drift, tap to center position and insert snap rings.

IMPORTANT

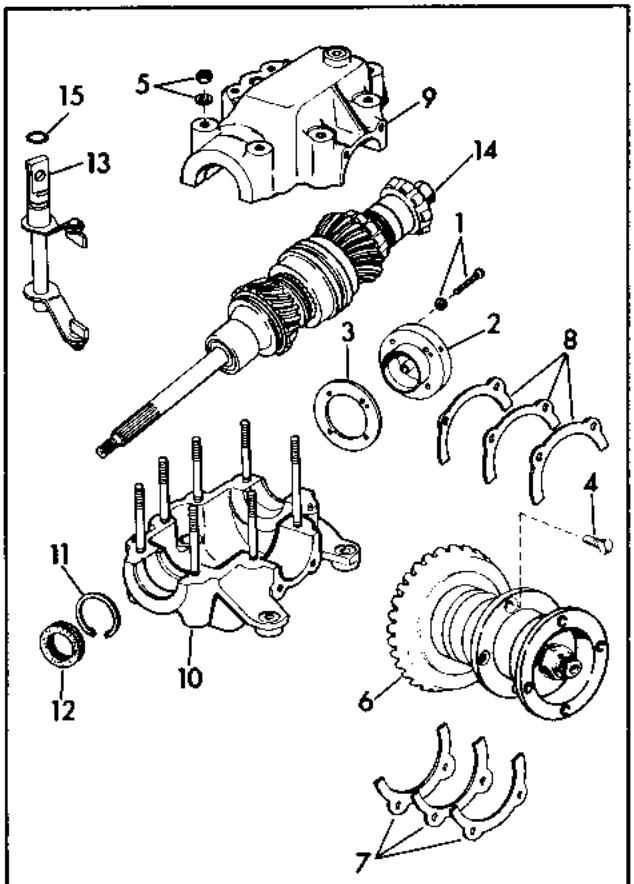
In reassembly, do not use a new cross with old bearings, or an old cross with new bearings. Inspect carefully and if either cross or bearings are worn, replace both with a new bearing kit.

Install the reassembled shaft in the vehicle with the slip joint toward the source of power.

DISASSEMBLING REVERSING UNIT (See Fig. 4D-41)

Remove four end cap screws and washers (1), end cap (2) and gaskets (3).

Clear staking from four mounting screws (4) and remove screws. Remove eight unit cover mounting nuts and washers (5). Pry driven gear assembly (6) away from case. Lower set of backlash adjusting shims (7) can be removed and tagged together. Remove upper set of backlash shims (8) and tag together. NOTE: Do not mix upper and lower sets of shims.



1. Capscrew and washer (4)
2. End cap
3. Gasket
4. Screw (4)
5. Nut and washer (8)
6. Driven gear assembly
7. Shims, lower
8. Shims, upper
9. Upper case
10. Lower case
11. Retaining ring
12. Oil seal
13. Shift fork assembly
14. Drive shaft assembly
15. O-ring

Figure 4D-41. Reversing Unit - Exploded View

Using screw drivers, carefully pry unit upper case (9) up away from unit lower case (10). See Fig. 4D-42.

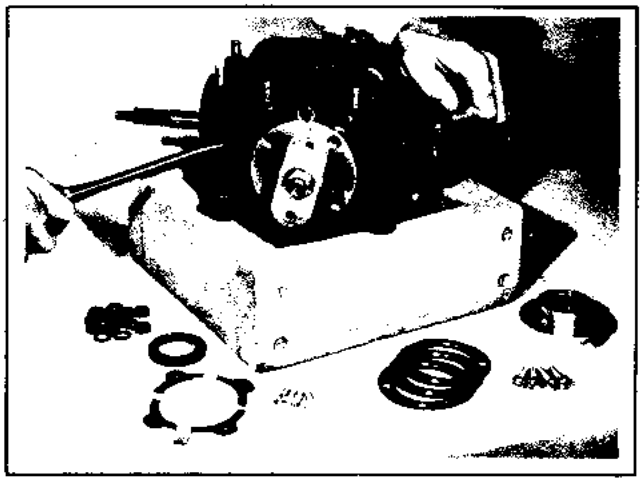


Figure 4D-42. Separating Cases

Remove retaining ring (11) and oil seal (12) from reverse pinion side of unit.

Lift both shifter fork assembly (13) and drive shaft assembly (14) from unit lower case (10). See Fig. 4D-43. Lift driven gear assembly (6) from unit lower case (10).

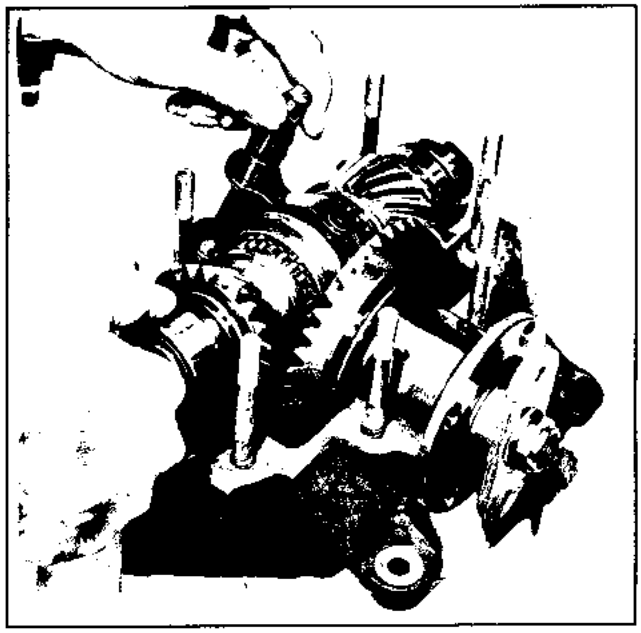


Figure 4D-43. Removing Shifter Fork and Drive Shaft assembly

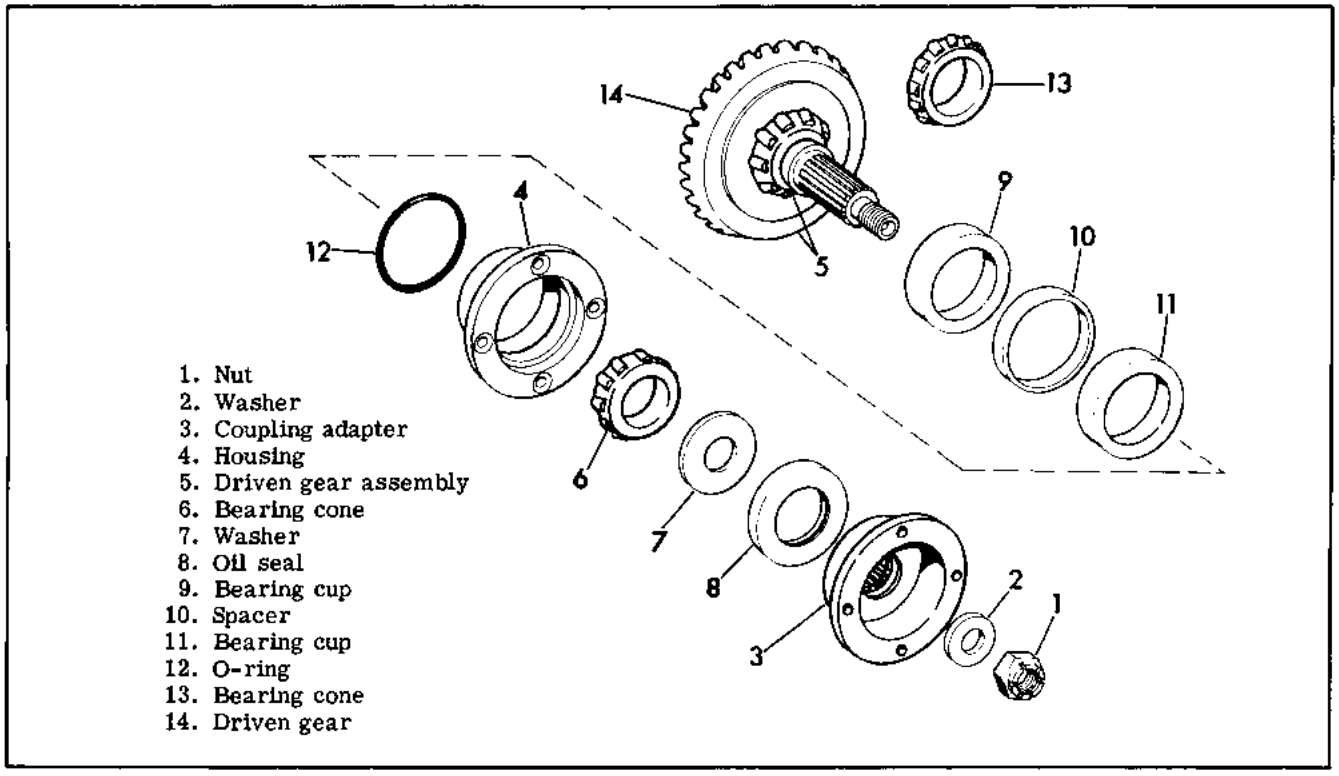


Figure 4D-44. Driven Gear Assembly - Exploded View

DISASSEMBLING DRIVEN GEAR ASSEMBLY (Fig. 4D-44)

To disassemble driven gear assembly (6) (Fig. 4D-41), first remove nut (1), washer (2) and drive coupling adapter (3). Tool Part No. 94692-63 can be used to hold adapter stationary while removing nut. Remove housing (4) from driven gear assembly (5). Press outer Timken bearing cone (6), washer (7) and oil seal (8) from bearing housing (4).

See Fig. 4D-45. To press out inner Timken bearing cup (9), spacer (10) and outer Timkin bearing cup (11), use Timken bearing cone placed in outer bearing cup and suitable press plug and press out all items from housing at one time. See Fig. 4D-46. Remove "O" ring (12) from bearing housing (4).

Remove inner Timken bearing cone (13) from driven gear (14) using claw puller and wedge attachment. See Fig. 4D-47.

DISASSEMBLING DRIVE SHAFT ASSEMBLY (Fig. 4D-48)

Slide forward pinion assembly (1) off of shaft (2). Slide ball bearing (3) off of shaft (2), and remove reverse pinion bearing shims (4). Slide shifter clutch assembly (5) off of shaft (2), being careful not to lose indexing ball (6) and spring (7).

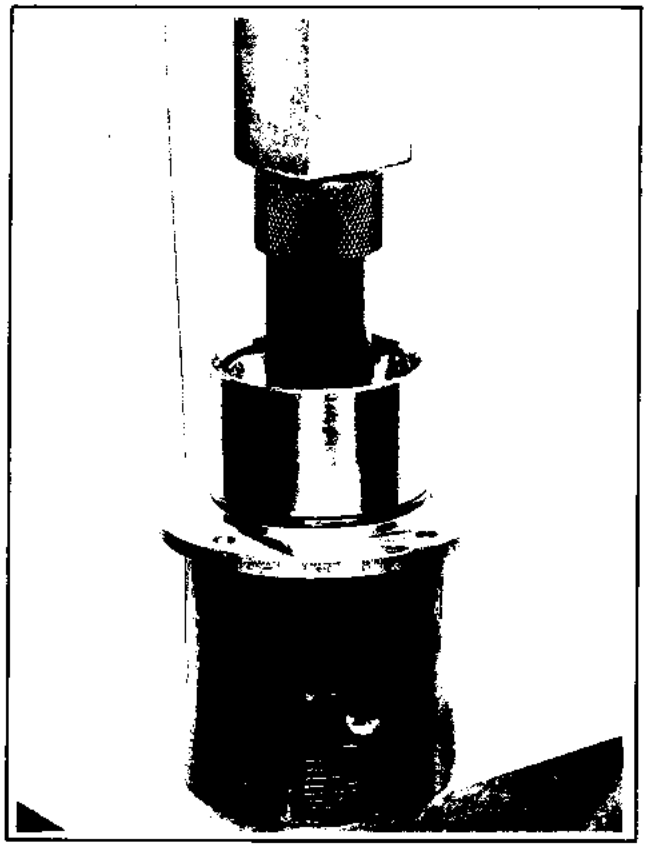


Figure 4D-45. Removing Bearing Cone, Washer and Seal

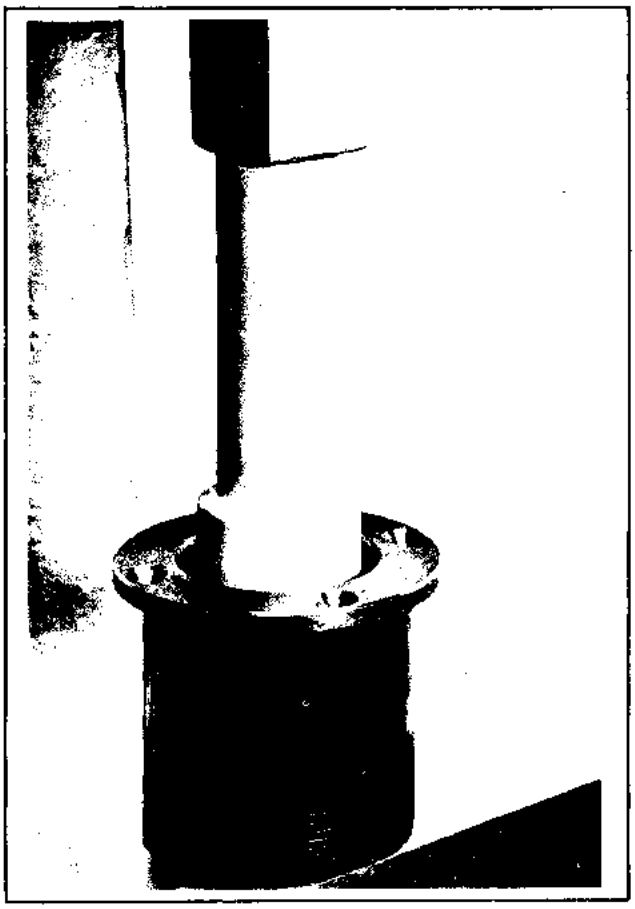


Figure 4D-46. Removing Bearing Cups and Spacer

Temporarily install a 3/8-24 nut on threaded end of shaft (2) and press off reverse pinion bearing collar (8), reverse pinion thrust washer (9) and reverse pinion assembly (10). See Fig. 4D-49.

DISASSEMBLING REVERSE PINION ASSEMBLY (Fig. 4D-48)

Press both needle bearings (11) from reverse pinion assembly (10). Press reverse pinion (12) off of reverse pinion hub (13). Remove key (14) from hub.

DISASSEMBLING SHIFTER CLUTCH ASSEMBLY (Fig. 4D-48)

Slide inner shifter clutch (15) from outer shifter clutch (16), the three locking plungers (17) and their springs (18).

DISASSEMBLING FORWARD PINION ASSEMBLY (Fig. 4D-48)

Bend down lockwasher locks and remove nut (19), lockwasher (20) and washer (21). Slide outer Timken bearing cone (22), outer bearing cup (23), spacer (24) and inner Timken bearing cup (25) off of forward pinion assembly (1). Remove forward pinion bearing shims (26).

Press forward pinion (27), bearing collar (28) and inner bearing cone (29) off of pinion hub (30). NOTE: Temporarily install nut (19) on pinion hub (30) to prevent damaging threads when pressing and use wedge attachment behind pinion. See Fig. 4D-50. Remove key (31) from hub. Press forward pinion hub bushings (32) out of hub only if worn or damaged.

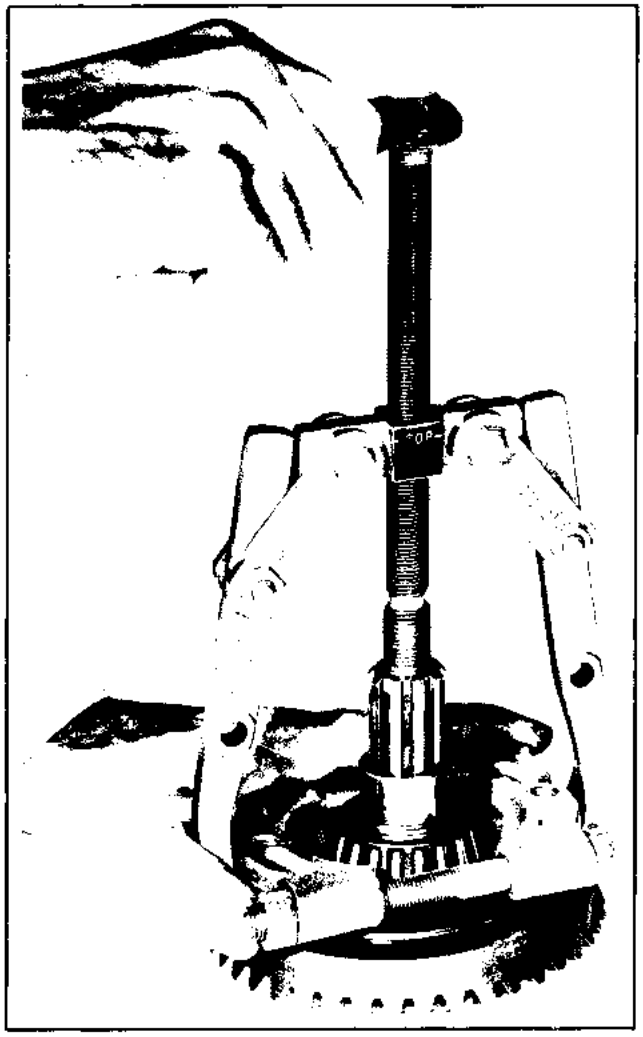


Figure 4D-47. Removing Bearing Cone from Gear

CLEANING, INSPECTION AND REPAIR

Clean all parts with cleaning solvent and blow dry with compressed air.

All gaskets and seals should be replaced.

Inspect all gears. If teeth are pitted, scored, cracked, chipped or if case hardening is worn through, replace with new gears.

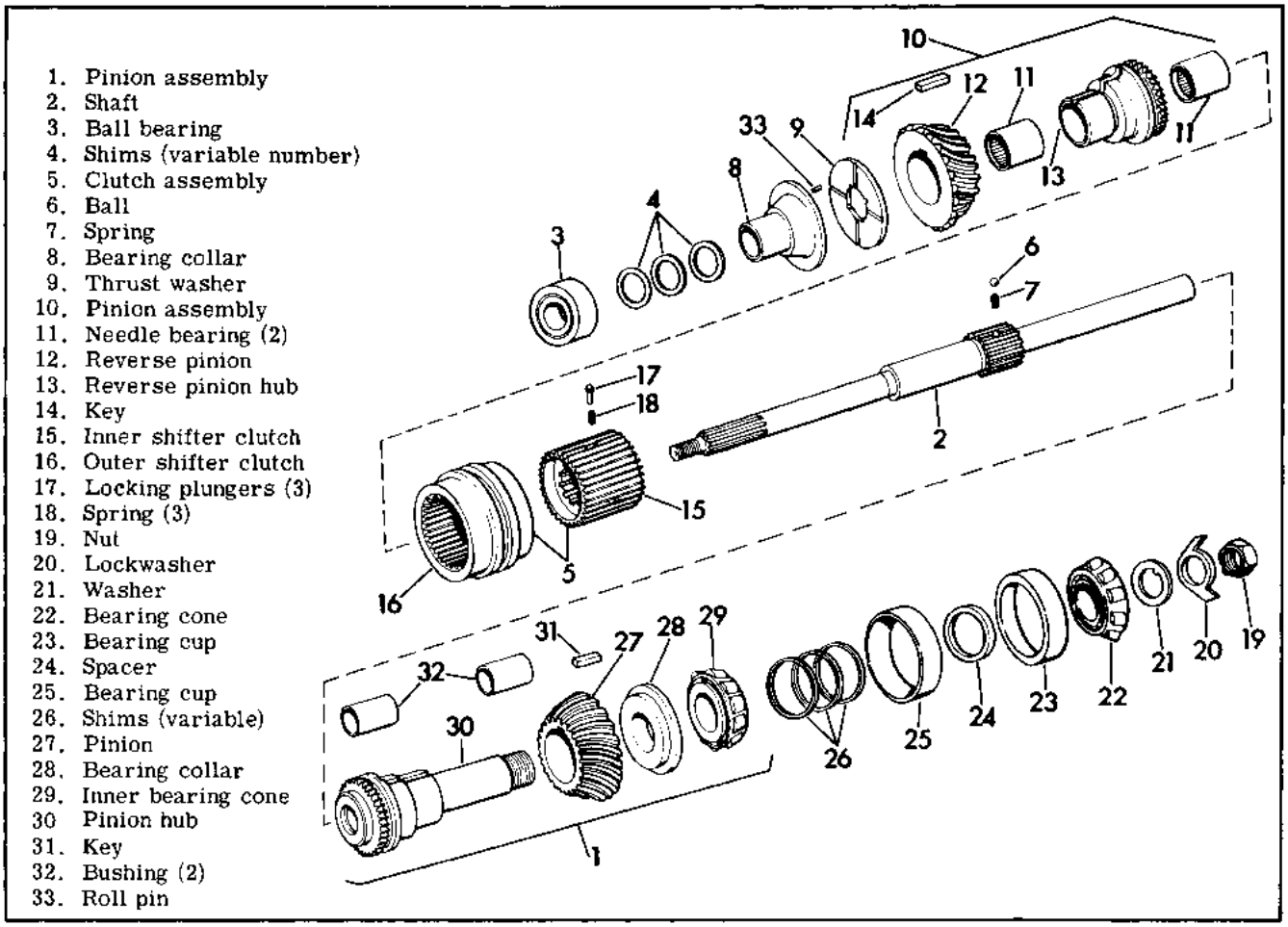


Figure 4D-48. Drive Shaft - Exploded View

Inspect all bushings, bearings, bearing races and shafts. If damaged or worn, replace with new parts.

Carefully check shifter clutches, engaging dogs and shifter fork for damage or wear. Replace if engaging dogs are battered or worn, or if shifter fork engaging blocks are grooved or worn.

Examine unit cases for cracks and damaged threads, studs, joint faces and/or damaged bearing race surfaces. Minor nicks and blemishes can be cleaned up with a file. Damaged studs can be replaced with new studs.

REASSEMBLING FORWARD PINION ASSEMBLY (Fig. 4D-48)

Press forward pinion hub bushing (32) into threaded end of hub (30) to a depth of 1/2 in. below end of hub.

Press second hub bushing (32), into splined end of hub (30) to a depth of 1/16 in. below hub face. NOTE: When new bushings (32) are pressed into hub, they must then be reamed to .627 I.D. Place key (31) in hub and position pinion (27) on hub (30), small end toward splined end of hub and press into position.

NOTE: Key (31) must not protrude beyond face of pinion (27). Install bearing collar (28) on hub with large diameter shoulder facing pinion (27). Place inner bearing cone (29) on hub (30), lettered face against collar (28) and press into position. Place forward pinion bearing shims (26) on collar (28), thicker shims first. Install inner bearing cup (25), spacer (24) and outer bearing cup (23), small inside diameter next to spacer (24). Install outer bearing cone (22) in cup (23). Install washer (21), lockwasher (20) and nut (19). Holding forward pinion assembly firmly, tighten nut (19) until there is a moderate drag on bearings as they are turned. NOTE: If torque wrench is available, amount of drag on bearings can be measured by turning the hub with the nut and holding the bearing cups stationary. Turning force should be from 4 to 10 inch pounds.

REASSEMBLING SHIFTER CLUTCH ASSEMBLY (Fig. 4D-48)

Insert the three locking plunger springs (18) and plungers (17) in their respective holes in the inner shifter clutch (15). Slip inner clutch assembly into outer shifter clutch (16) until plungers (17) rest on splines. Applying hand pressure to the inner clutch,

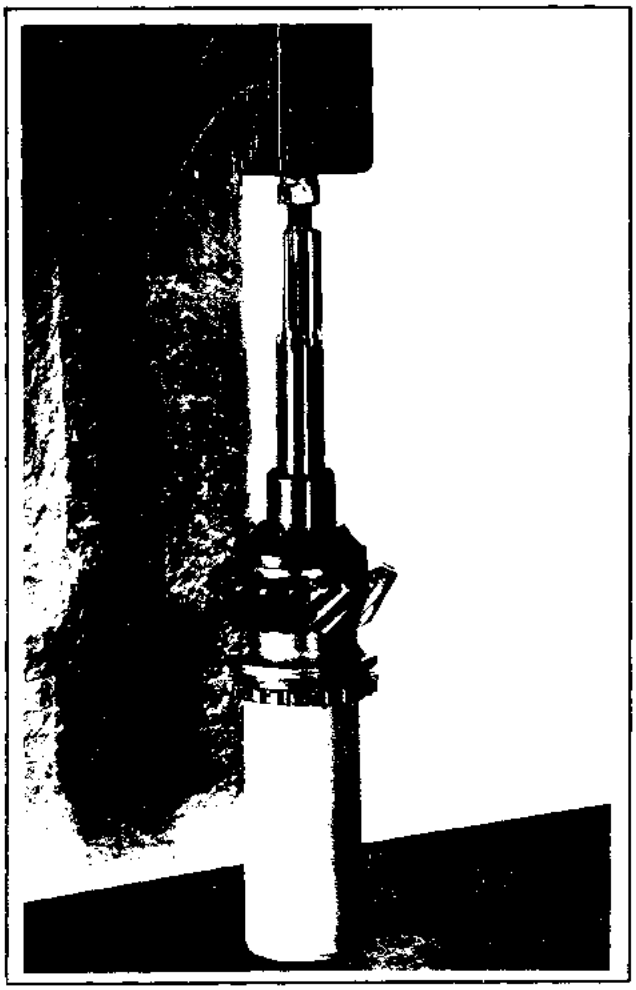


Figure 4D-49. Removing Reverse Pinion Parts

depress each plunger until all partially engage in the outer clutch. Maintaining hand pressure, again depress each plunger until inner clutch slides fully into outer clutch.

REASSEMBLING REVERSE PINION ASSEMBLY (Fig. 4D-48)

Press needle bearings (1) into reverse pinion hub (13) so bearing cages are 1/32 in. below end of hub. NOTE: Lettered ends of bearing cages should face outward at each end of hub. Install Key (14) on hub and place reverse pinion (12) in position on hub, small end toward hub face. Press pinion (12) into position on hub. Note key (14) must not protrude beyond face of pinion (12).

REASSEMBLING DRIVE SHAFT ASSEMBLY (Fig. 4D-48)

Install reverse pinion assembly (10) on drive shaft (2) with thrust face of pinion towards splined end of shaft. Install thrust washer (9) on shaft. Press reverse pinion bearing collar (8), thrust face on collar towards thrust washer, onto drive shaft.

Install spring (7) and indexing ball (6) in hole in drive shaft (2). Slide shifter clutch assembly (5) on shaft and depress indexing ball (7) allowing shifter clutch assembly to slide into position on shaft.

Install reverse pinion bearing shims (4) on shaft (2) against reverse pinion bearing collar (8). Install ball bearing (3) on shaft (2) against shims. Slide forward pinion assembly (10) on shaft (2).

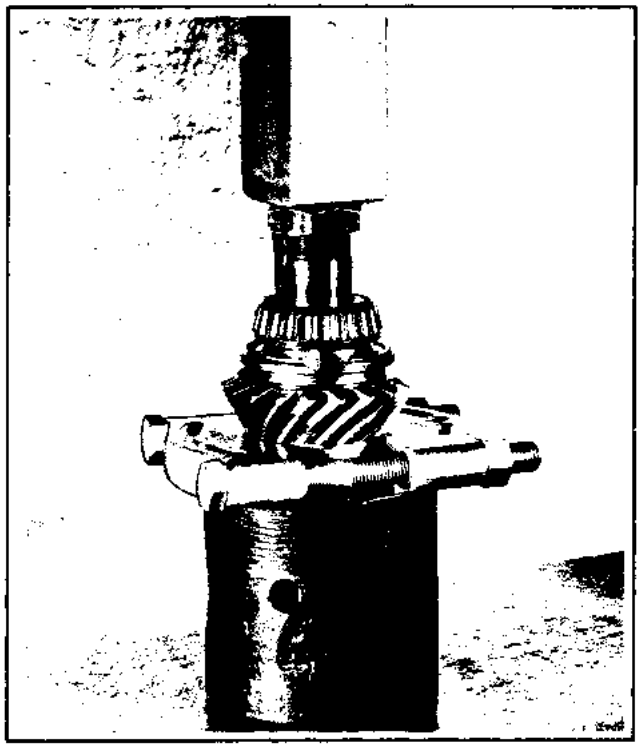


Figure 4D-50. Removing Forward Pinion Parts

REASSEMBLING DRIVEN GEAR ASSEMBLY (Fig. 4D-44)

Slide inner bearing cone (13) on driven gear shaft (14), large bearing diameter facing gear and press into position.

Press outer bearing cup (11) into bearing housing (4) with large cup diameter towards flanged end of housing. Install bearing spacer (10) in housing (4). Press inner bearing cup (9) into housing (4) with large cup diameter facing away from flanged end of housing (4). Install "O" ring (12) on housing (4). Place housing assembly on driven gear assembly, flanged end of housing facing away from driven gear.

Slide outer bearing cone (6) into position on gear shaft in housing assembly. Install washer (7) on shaft and press in seal (8) with seal lip facing inward.

Lubricate seal surface on drive coupling adapter (3) and install coupling adapter on shaft splines.

Install washer (2), new nut (1) on shaft and tighten nut so 4 to 10 inch pounds is required to turn driven gear assembly in bearing housing. NOTE: See "Reassembling Forward Pinion Assembly."

REASSEMBLING DRIVE SHAFT AND DRIVEN GEAR ASSEMBLIES IN UNIT LOWER CASE (Fig. 4D-41)

Install driveshaft assembly (14) in unit lower case (10) with forward pinion assembly (10) Fig. 4D-48 facing right side of case (10), taking care to position forward pinion bearing shims between case shoulder and bearing.

Place "Pinion Gauging Tool", Part No. 96544-63 in housing. Note this tool is for 2.05 gear ratio transmissions only. A special tool is required for 1.3 ratio transmissions.

Applying pressure to end of forward pinion assembly (1) Fig. 4D-48 and holding Pinion Gauging Tool in position, determine clearance between gauge finger and face of forward pinion. See Fig. 4D-51. NOTE: The number (1.810) stamped on 2.05 ratio gauging tool plus feeler gauge reading should equal the number etched on the large face of forward pinion. Use feeler gauge to determine exact existing clearance. If clearance is LESS than required, add necessary shims (26) Fig. 4D-48, to forward pinion assembly.

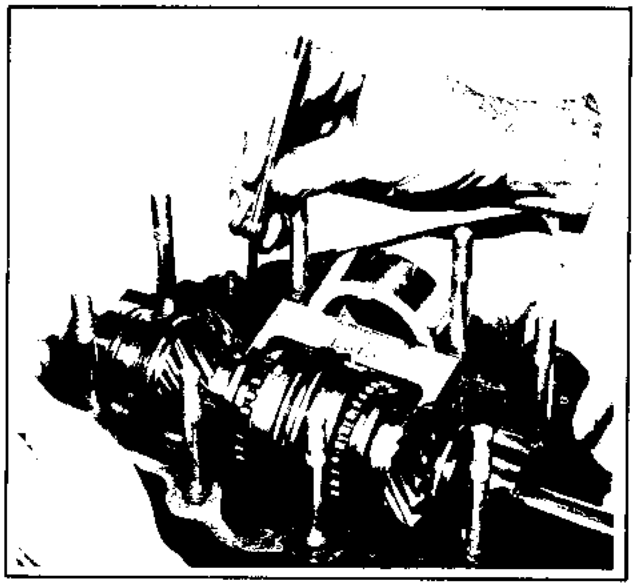


Figure 4D-51. Gaging Forward Pinion Spacing

To determine shimming required, figure as follows:

Etched No. on gear - (1.810 + feeler gage) = Shimming added

Example 1 1.816 - (1.810 + .004) = .002 in.

If clearance is MORE than required, take out sufficient shims (26) Fig. 4D-48, to give correct reading.

Etched No. on gear - (1.810 + feeler gage) = Shimming removed

Example 2 1.816 - (1.810 + 0.01) = .004

Shims are available in .002, .005, .007, and .015 thicknesses. NOTE: For removing or adding shims to forward pinion assembly, see "Disassembling And Reassembling Forward Pinion Assembly."

The next step is to determine clearance between Gauging Tool and reverse pinion. Use one hand to pull driveshaft outward and at same time hold ball bearing against shoulder and the other hand to measure clearance between Gauging Tool and reverse pinion with feeler gauge. See Fig. 4D-52. Procedure

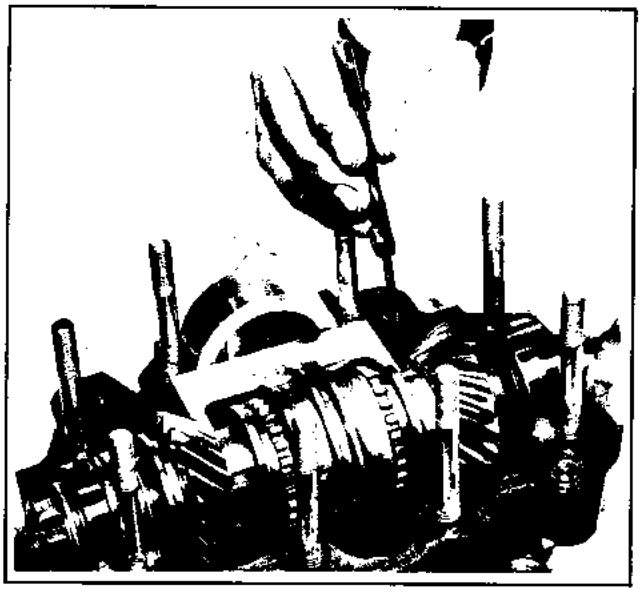


Figure 4D-52. Gaging Reverse Pinion Spacing

for determining shimming is the same here as previously described for forward pinion gauging with the exception that when clearance is more than required, shims (4, Fig. 4D-48) must be added to give proper spacing and if clearance is less than required, shims must be removed. Shims are available in .002, .005 and .007 thicknesses. To remove or add shims (4, Fig. 4D-48) simply lift driveshaft assembly from lower case and slip ball bearing from shaft. Remove or install required shims and reassemble.

REASSEMBLING REVERSING UNIT (Fig. 4D-41)

With driveshaft assembly removed from lower unit case, install driven gear assembly in case and temporarily install one bearing housing assembly mounting screw (4). Install driveshaft assembly in lower case.

When installing shifter fork assembly (13), carefully lift the splined end of driveshaft assembly (14) from lower case to provide clearance for shifter fork assembly to be installed in lower case. Install a new "O" ring (15) on shifter fork shaft assembly (13).

Pour 12 oz. of Harley-Davidson Transmission lubricant into lower unit case (10). Apply a coating of sealer to the upper unit case (9) and carefully slide

upper case over studs making sure that forward pinion assembly shims (26) Fig. 4D-48, are in proper position so they will not be damaged when upper case is seated on lower case.

Temporarily install upper case washers and nuts (5) but do not tighten.

Install retaining ring (11), beveled edge out and oil seal (12), with seal lip facing inward. Face of seal should be 1/16 in. below face of unit cases.

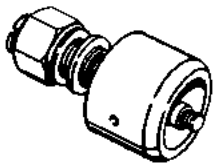
Temporarily position end cap (2) on unit case and while pressing cap towards case, slide a number of gaskets (3) between cap and case. If two gaskets are slightly loose, three gaskets should be used. If one gasket is slightly loose, two gaskets should be used. In other words, use sufficient number of gaskets to provide a good seal yet not allow end cap (2) to be held away from Timken bearing outer race. NOTE: Make certain that end cap (2) and gaskets (3) are properly positioned with correct oil hole alignment. Install and tighten four end cap screws (1) and washers.

Press against or lightly tap the end of the driven gear shaft to position driven gear against the pinions. Using a feeler gauge, determine the clearance between bearing housing assembly (6), flange and unit case. See Fig. 4D-53. To this measurement add .0075 - .0135. This then is the sum total thickness of backlash adjusting shims (7 and 8) to be installed to provide the proper clearance between the driven gear and the forward and reverse pinions. (EXAMPLE: Clearance between bearing housing assembly flange and unit case is .0780. To this measurement .0075 is added. The total thickness of backlash shims to be added is .0855.) Shims are available in .002, .005, .007, .015 and .030 in. thicknesses.

Slip upper set of backlash shims (8) into position and temporarily install upper housing screws (4). Remove the one lower housing screw previously installed and slip lower set of backlash shims (7) into position. Install lower housing screws (4), tighten all four screws and stake screws in position. Tighten upper case nuts (5).

Figure 4D-53. Gaging Flange to Case Clearance

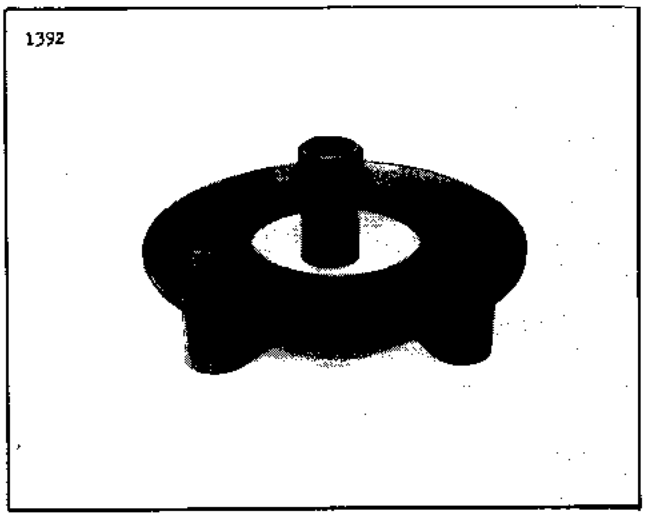
To install reversing unit in chassis, see "Removing and Installing Reversing Unit."



97170-55A

HUB INSTALLING TOOL

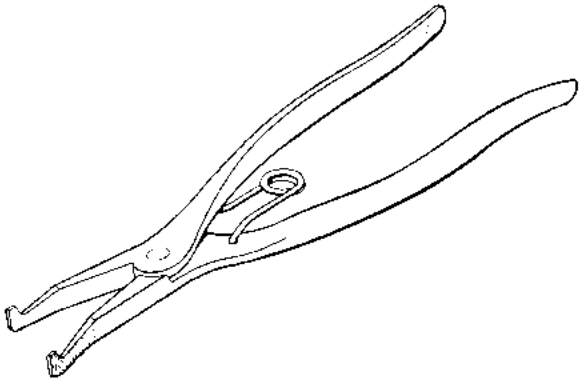
Used to install press fit transmission drive cup and drive flange.



97330-62A

TRANSMISSION HOLDING TOOL

Used to hold transmission shaft when removing or installing shaft nut. Tool fits on drive cup pin bosses.



UTICA NO. 534-7 (Or Equivalent)

REAR TRANSMISSION SHEAVE SNAP RING PLIERS

(Available from automotive tool suppliers.)

NOTES

NOTES

ELECTRICAL 5

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CIRCUITS AND OPERATION 1963-66 D AND 1963-68 DC MODELS

The Gasoline Car has a 12-volt electrical system utilizing a combination starter motor-generator unit built into the engine crankcase, in conjunction with a control switch-box-regulator unit and a storage battery using a negative grounded system.

Ignition spark is produced by a 12-volt coil through a cam operated circuit breaker with built-in automatic advance mechanism.

Main components of the starter-generator unit are the field stator with 12 radial field coils, and the bell-shaped armature rotor with the commutator formed on its inner vertical face. The armature is mounted directly on the engine crankshaft end taper (right side) and rotates at engine speed. Six alternate field pole shoes of the stator are series wound with heavy gage wire for starting; the other six carry lighter gage shunt field windings for generating. Mounted on the stator housing are four spring loaded carbon brushes which contact the armature commutator.

Components of the control system are the switchbox assembly (containing voltage regulator, cutout relay and starter solenoid), two micro-switches and a keyswitch.

Starter (See Figure 5A-7)

When starting the engine, the 6 stator field coils are connected in series with the armature to operate as a series motor. This circuit is controlled by the keyswitch (9) and two micro-switches (8 and 12), which operate a solenoid starter switch in the control box (2), which controls the main starter current. These three control switches (8, 9 and 12) are series connected with the battery and solenoid coil of the main starter switch. With keyswitch (9) turned to "ON", battery current is available at micro switch (8), which is open until accelerator pedal is pushed. When pedal is depressed contact button on micro-switch (8), is released, contacts close, turning on ignition circuit. Battery current also flows through micro-switch (12) to terminal No. 50 on the control box, energizing the solenoid coil of the starter switch closing switch contacts. Battery current flows to the starter motor. Starter motor now functions to crank the engine.

Micro-switch (12) is mounted in a position so that the operating finger roller touches the transmission drive cup cover. This switch is normally closed, however, as the engine starts and operates at driving speed, the drive cup cover moves away from the switch allowing its contacts to open. This interrupts the current flow through the starter relay winding causing the relay switch contacts to open, stopping current flow to the starter motor which ceases to operate.

The engine can be stopped by turning keyswitch to "OFF" position or by allowing accelerator pedal to come to its full outward position, opening micro-switch (8), which opens ignition circuit. When the engine stops, the outward movement of the transmission drive cup cover pushes on finger of micro-switch (12) closing the switch contacts. When the contacts of either switch (8 or 9) are open, the current flow to the ignition coil (6) is interrupted to stop the engine.

Generator (See Figure 5A-7)

When the generator is driven by the engine, the stator shunt field coils are excited and the current generated in the armature is utilized for the ignition system and charging the battery. The generator output is limited by the voltage regulator, which controls the generator field strength. The generated voltage increases with engine speed and as soon as the rated level (approximately 12 volts) has been reached, the

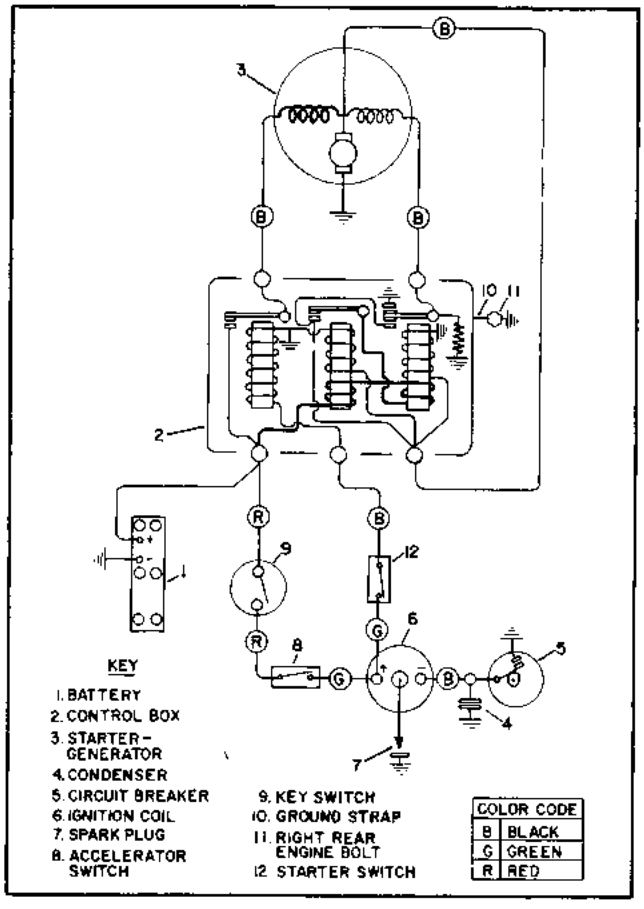


Figure 5A-7. Gasoline Car Schematic Circuit

cutout switch closes and charging of the battery begins. When running, this voltage is maintained nearly constant by the voltage regulator, regardless of engine speed. As current is consumed, the voltage drops in conformity with the output. The prescribed charging rate is reached at speeds varying between 1200 and 1500 RPM and will meet a continuous load of 90 watts thereafter.

As the engine speed is reduced and generated voltage drops below rated level, the cutout relay contacts will open, disconnecting the generator from the battery circuit to prevent discharging of the battery through the armature circuit.

CIRCUITS AND OPERATION 1967 and Later D MODEL

The Gasoline Car has a 12-volt electrical system utilizing a belt drive reversible starter motor-generator unit in conjunction with a fixed field resistor or regulator, starter solenoid, and a storage battery using a negative grounded system.

Ignition spark is produced by a 12-volt coil through a cam operated circuit breaker designed to give correct ignition timing in both forward and reverse engine running directions.

The starter-generator is a separate unit, mounted on the engine and coupled to the engine crankshaft with a V-belt. The starter-generator to engine drive ratio is 2 to 1 (2.36 to 1 in 1980). See Figure 5A-7A or 5A-7B.

There are two sets of windings in the frame (1). One set (S) is wound with heavy gage wire for starting and the other set (G) carries lighter gage wire for generating. Armature (2) rotation is reversed by means of an external switch (3) which reverses the armature current in relation to the field current. Brushes are mounted on the drive end cover which contact the armature commutator.

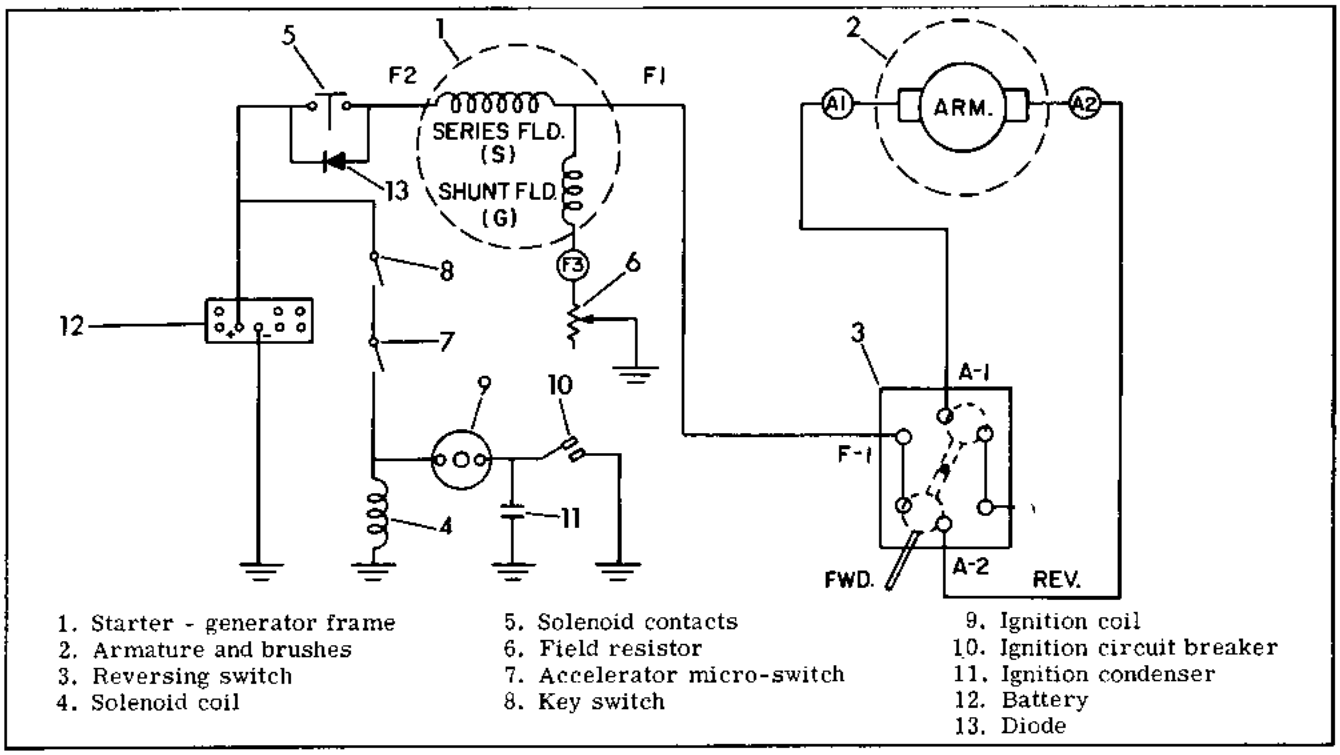
Components of the control system are the reversing switch, solenoid switch, adjustable field resistor or regulator, micro-switch and a key switch.

FORWARD

When starting the engine, the heavy field coils (S) are connected in series with the armature to operate as a series motor. This circuit is controlled by the reversing switch (3) and micro-switch (7) which operates a solenoid starter switch (5), controlling the main starter current. With keyswitch (8) turned to "ON", battery current is available at micro-switch (7), which is open until accelerator pedal is pushed. When pedal is depressed contact button on micro switch is released, contacts close, turning on ignition circuit and energizing the solenoid coil of the starter switch closing switch contacts. Battery current flows to the starter motor. Starter motor now functions to crank the engine in direction determined by position of reversing switch (3).

REVERSE

Starting coil (S) and armature coil ends (A1 and A2) (brushes) are connected to the reversing switch (3) which changes direction of armature current in relation to starting field current through switch contacts to ground. This changes the direction of the magnetic field and armature rotation. The starting coils are always connected through the solenoid switch when car is operating, but will have no effect when voltage generated by the field winding is above battery voltage. At this time the direction of current flow instead of coming from the battery, goes to the battery.



1. Starter - generator frame
2. Armature and brushes
3. Reversing switch
4. Solenoid coil
5. Solenoid contacts
6. Field resistor
7. Accelerator micro-switch
8. Key switch
9. Ignition coil
10. Ignition circuit breaker
11. Ignition condenser
12. Battery
13. Diode

Figure 5A-7A. 1967 - Early 1968 Gasoline Golf Car Schematic Circuit

The engine can be stopped by turning keyswitch to "OFF" position or by allowing accelerator pedal to come to its full outward position, opening micro-switch (7), which opens ignition circuit to stop the engine.

Generator (See Figure 5A-7A or 5A-7B)

When engine speed exceeds starter generator speed, the shunt field coils (G) are excited and the current generated in the armature is utilized for the ignition system and charging the battery. The generator output is limited by the adjustable resistor (6) or regulator (6A), which controls the strength of the magnetic field produced by the shunt field coils (G). The generator voltage increases with engine speed and as soon as the rated level (approximately 15 volts) has been reached, charges the battery and increases with engine speed to its maximum value controlled by the voltage regulator. The prescribed charging rate at governed speed is set by means of variable resistor or is controlled by the voltage regulator.

On models equipped with field resistor, diode (13) acts to bleed off voltage generated by operation of car when coasting with solenoid contacts open (accelerator pedal released).

WIRING

TESTING CIRCUITS

Electrical tests of the car wiring can be made with a continuity tester consisting of a lamp and battery arranged as shown in diagram Figure 5A-8.

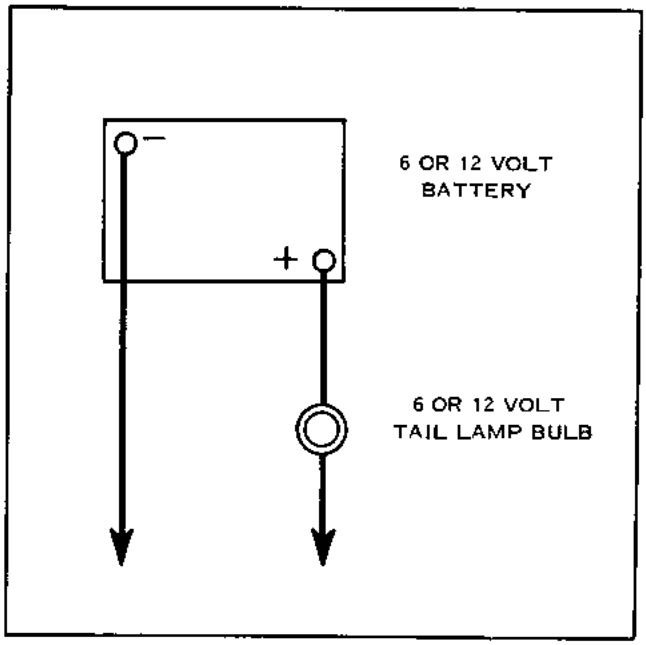
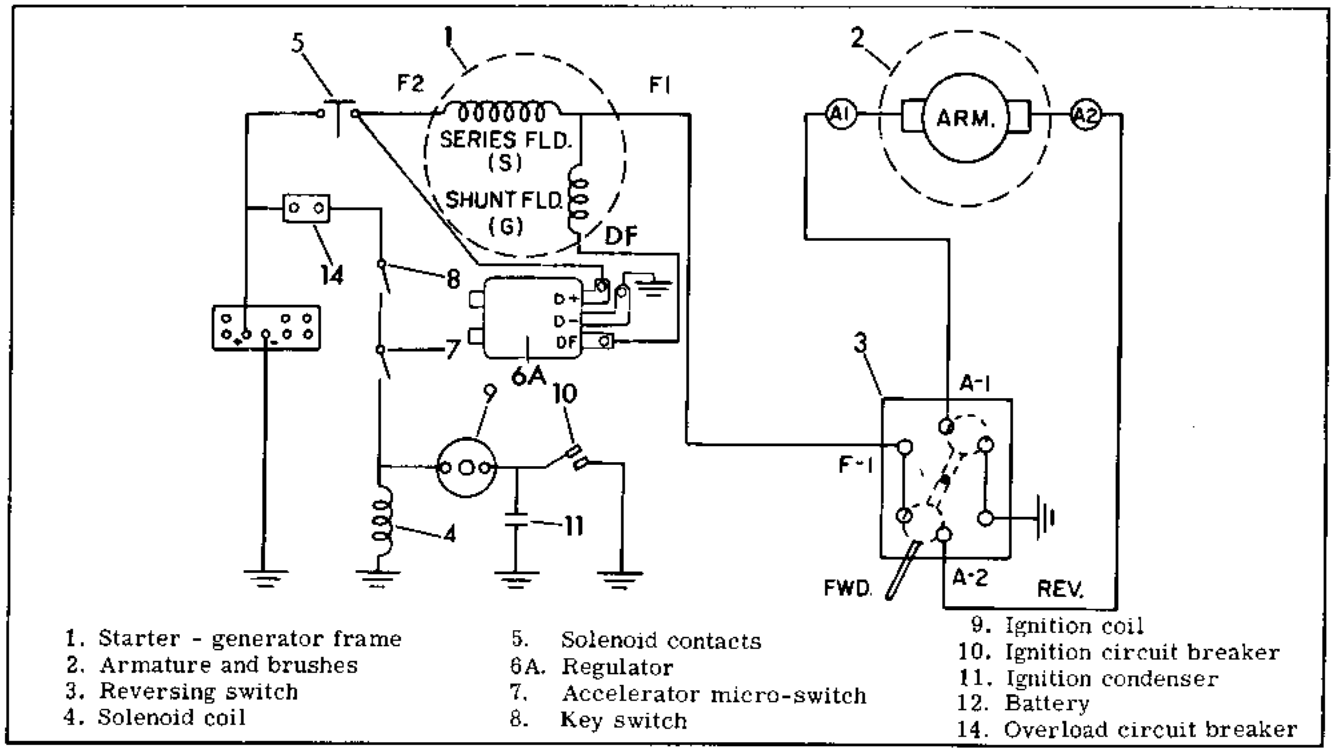


Figure 5A-8. Test Circuit

Parts used are a battery and light bulb in series using jumper wires of adequate length. Be sure battery is same voltage as light bulb.

CAUTION

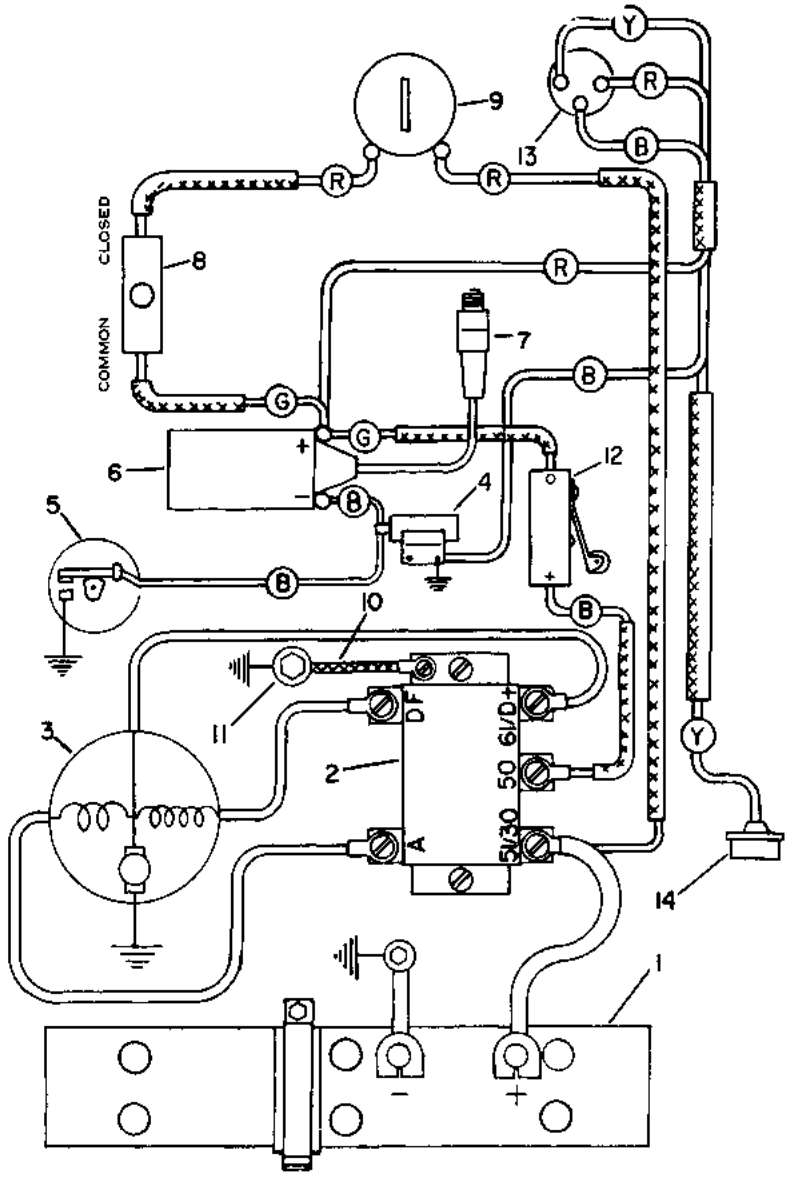
Disconnect negative battery cable before making any test of individual components.



1. Starter - generator frame
2. Armature and brushes
3. Reversing switch
4. Solenoid coil
5. Solenoid contacts
6A. Regulator
7. Accelerator micro-switch
8. Key switch
9. Ignition coil
10. Ignition circuit breaker
11. Ignition condenser
12. Battery
14. Overload circuit breaker

Figure 5A-7B. Late 1968 Golf Car, 1969 Golf and Utilicar Schematic Circuit

NOTES

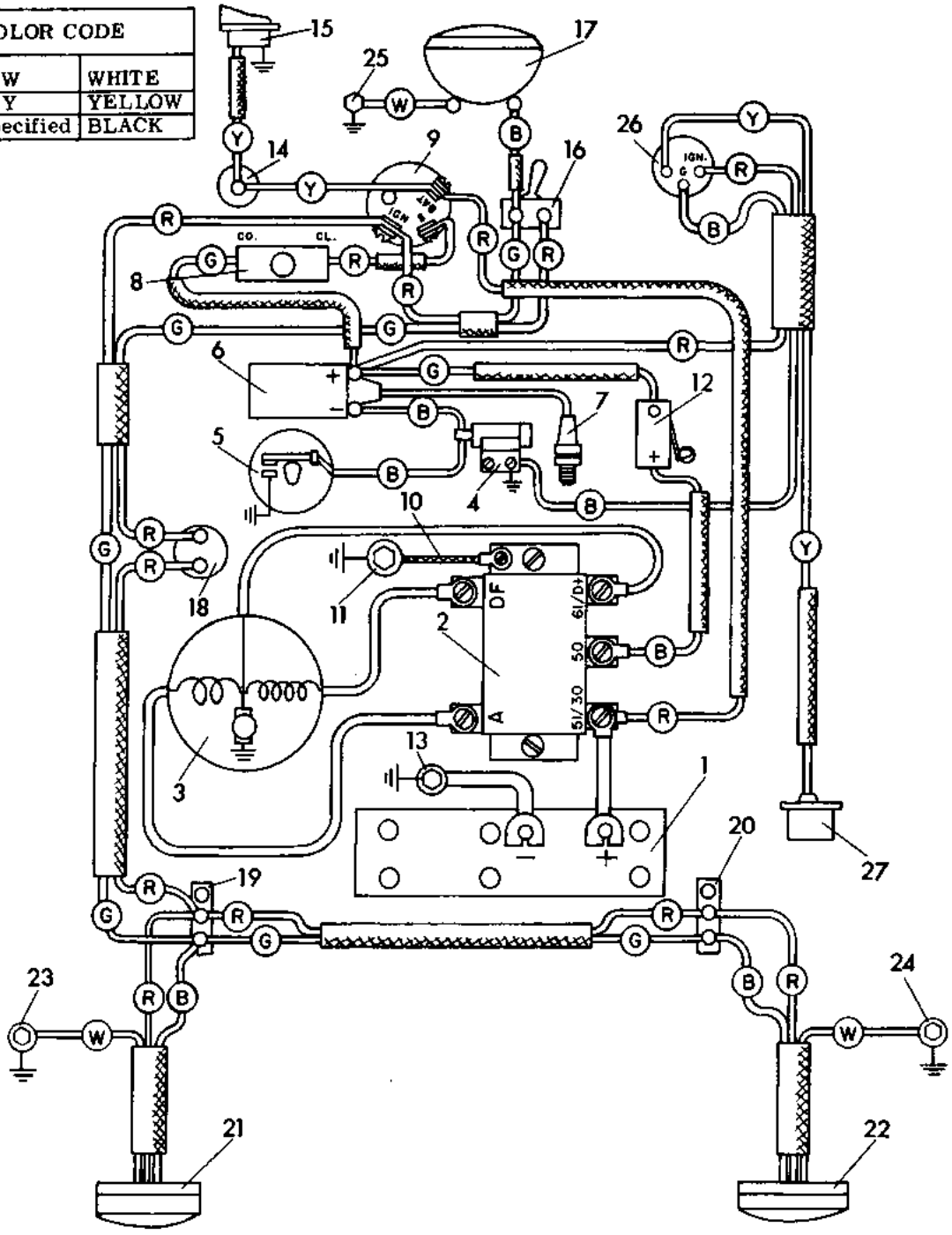


COLOR CODE	
B	BLACK
G	GREEN
R	RED
Y	YELLOW

1. Battery
2. Control box
3. Starter-generator
4. Condenser
5. Circuit breaker
6. Ignition coil
7. Spark plug
8. Accelerator switch
9. Key switch
10. Ground strap
11. Right rear engine bolt
12. Starter switch
13. Fuel gage
14. Fuel tank float

Figure 5B-15. 1963-66 Model D Gasoline Car Wiring Diagram

KEY TO COLOR CODE			
B	BLUE	W	WHITE
G	GREEN	Y	YELLOW
R	RED	Unspecified	BLACK



1. Battery
2. Control box
3. Starter-generator
4. Condenser
5. Circuit breaker
6. Ignition coil
7. Spark plug
8. Accelerator switch
9. Key switch
10. Ground strap
11. Right rear engine bolt
12. Starter switch
13. Frame ground bolt
14. Horn button
15. Horn
16. Light switch
17. Headlamp
18. Stoplight switch
19. Lft. rear term. plate
20. Rt. rear term. plate
21. Lft. tail & stop lamp
22. Rt. tail & stop lamp
23. Lft. rear frame screw
24. Rt. rear frame screw
25. Frame bolt
26. Fuel gage
27. Fuel gage float unit

Figure 5B-20. 1965-66 Model DC, 1965 Model DF Wiring Diagram

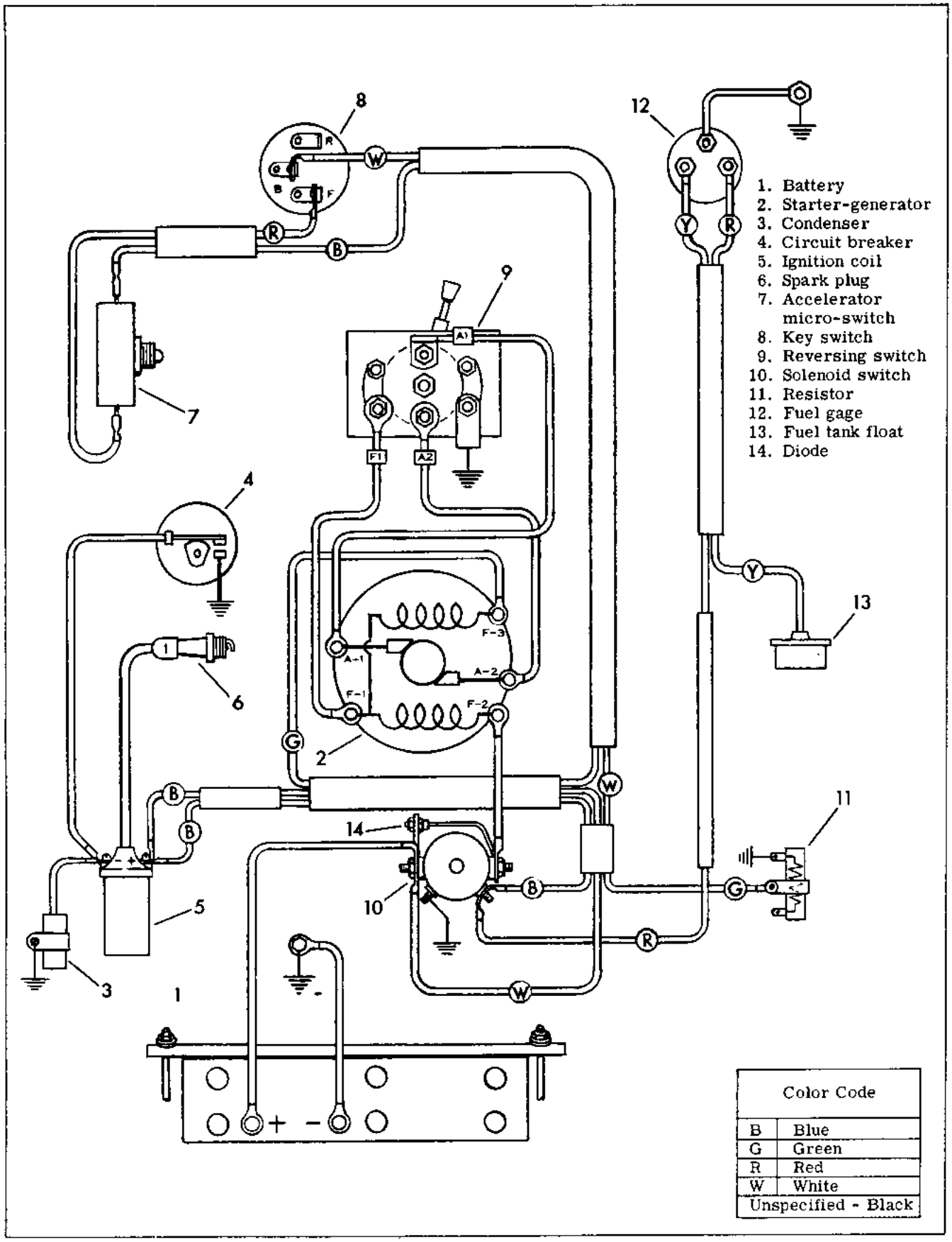
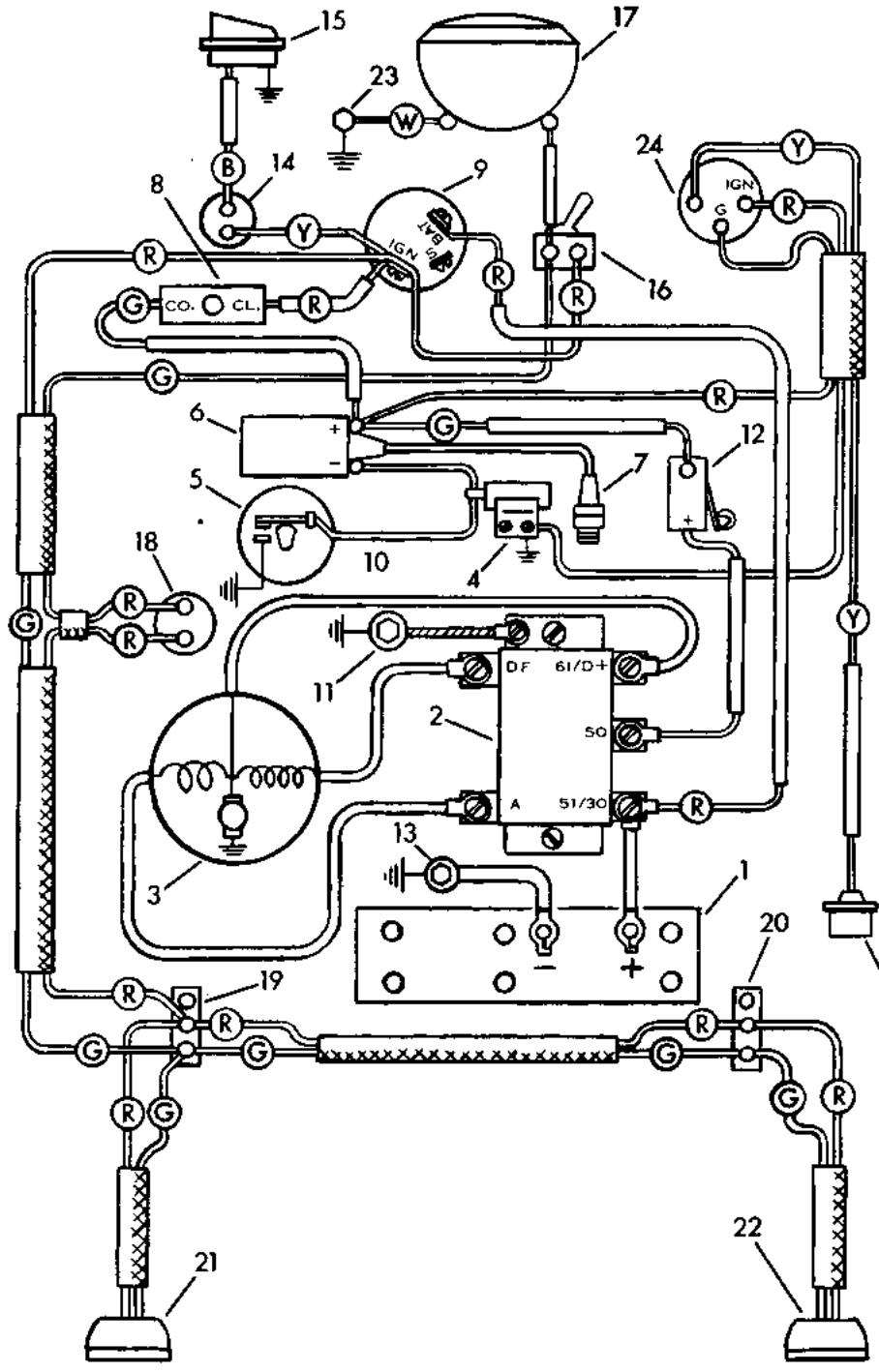


Figure 5B-24. 1967 - Early 1968 Model D Wiring Diagram

KEY TO COLOR CODE			
B	BROWN	W	WHITE
G	GREEN	Y	YELLOW
R	RED	Unspecified	BLACK



1. Battery
2. Control box
3. Starter-generator
4. Condenser
5. Circuit breaker
6. Ignition coil
7. Spark plug
8. Accelerator switch
9. Key switch
10. Ground strap
11. Right rear engine bolt
12. Starter switch
13. Frame ground bolt
14. Horn button
15. Horn
16. Light switch
17. Headlamp
18. Stoplight switch
19. Left rear term. plate
20. Right rear term. plate
21. Left tail & stop lamp
22. Right tail & stop lamp
23. Frame bolt
24. Fuel gage
25. Fuel gage float unit

Figure 5B-25. 1967-68 Model DC Wiring Diagram

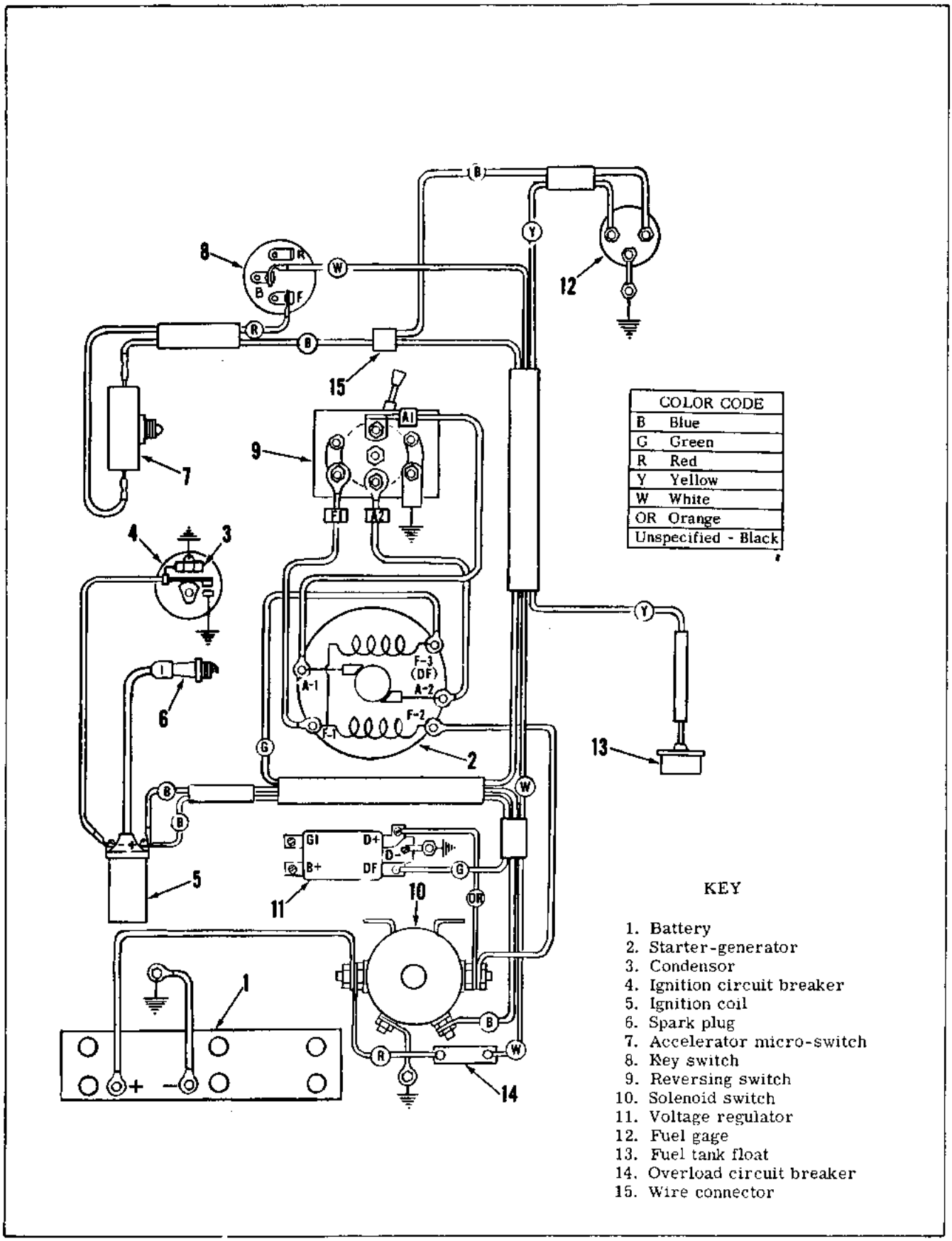


Figure 5B-26. Late 1968 to Early 1972 Model D Wiring Diagram

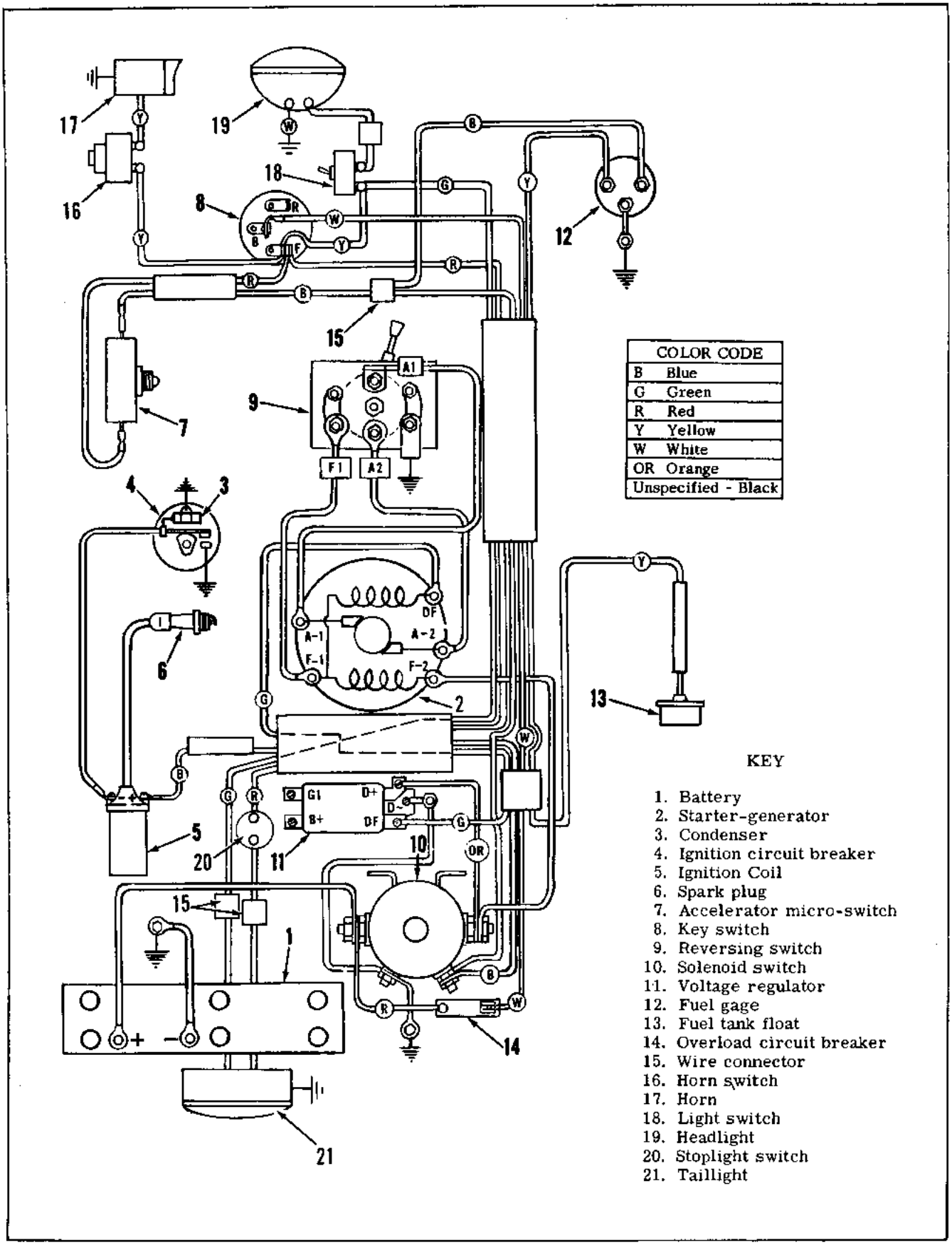
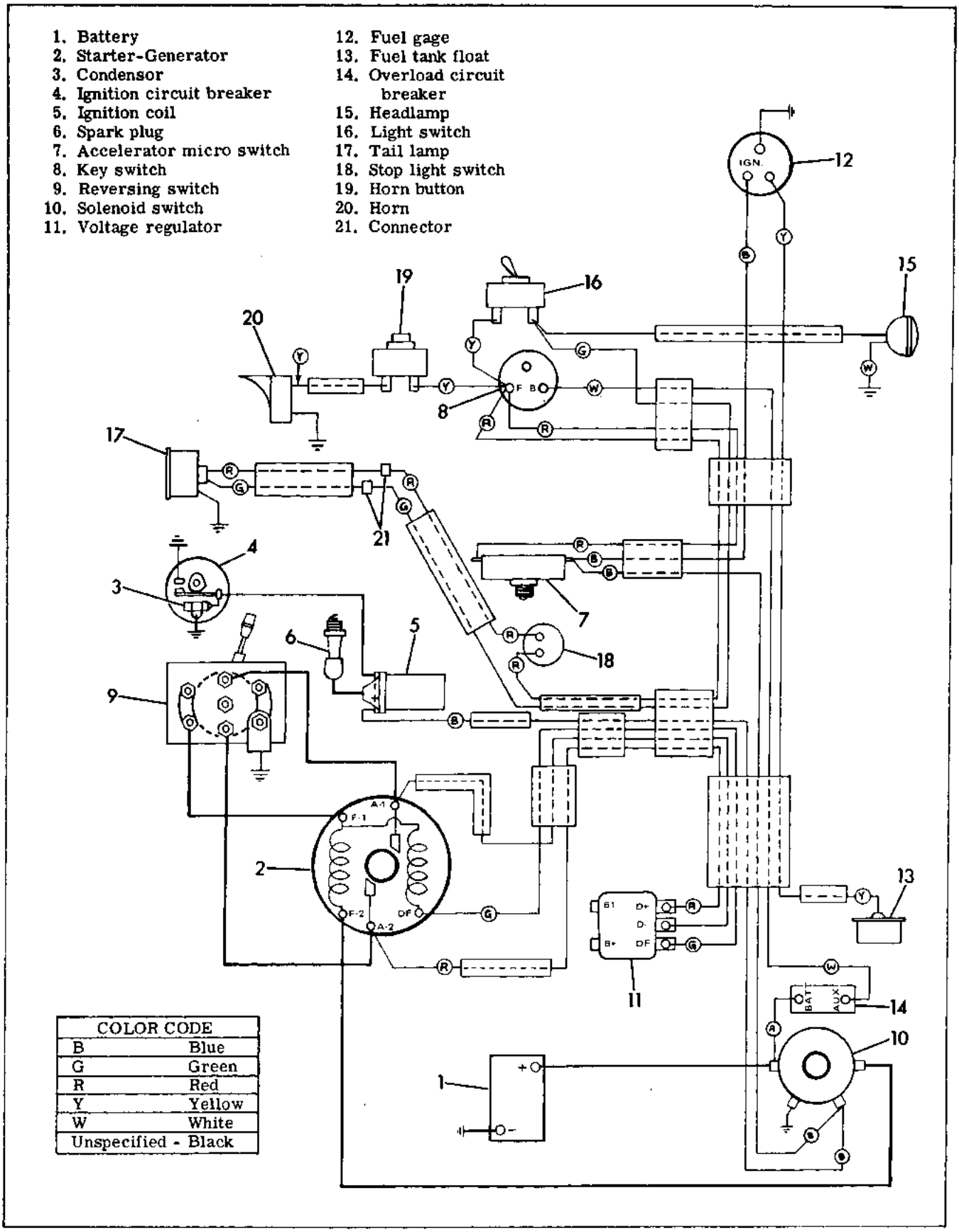


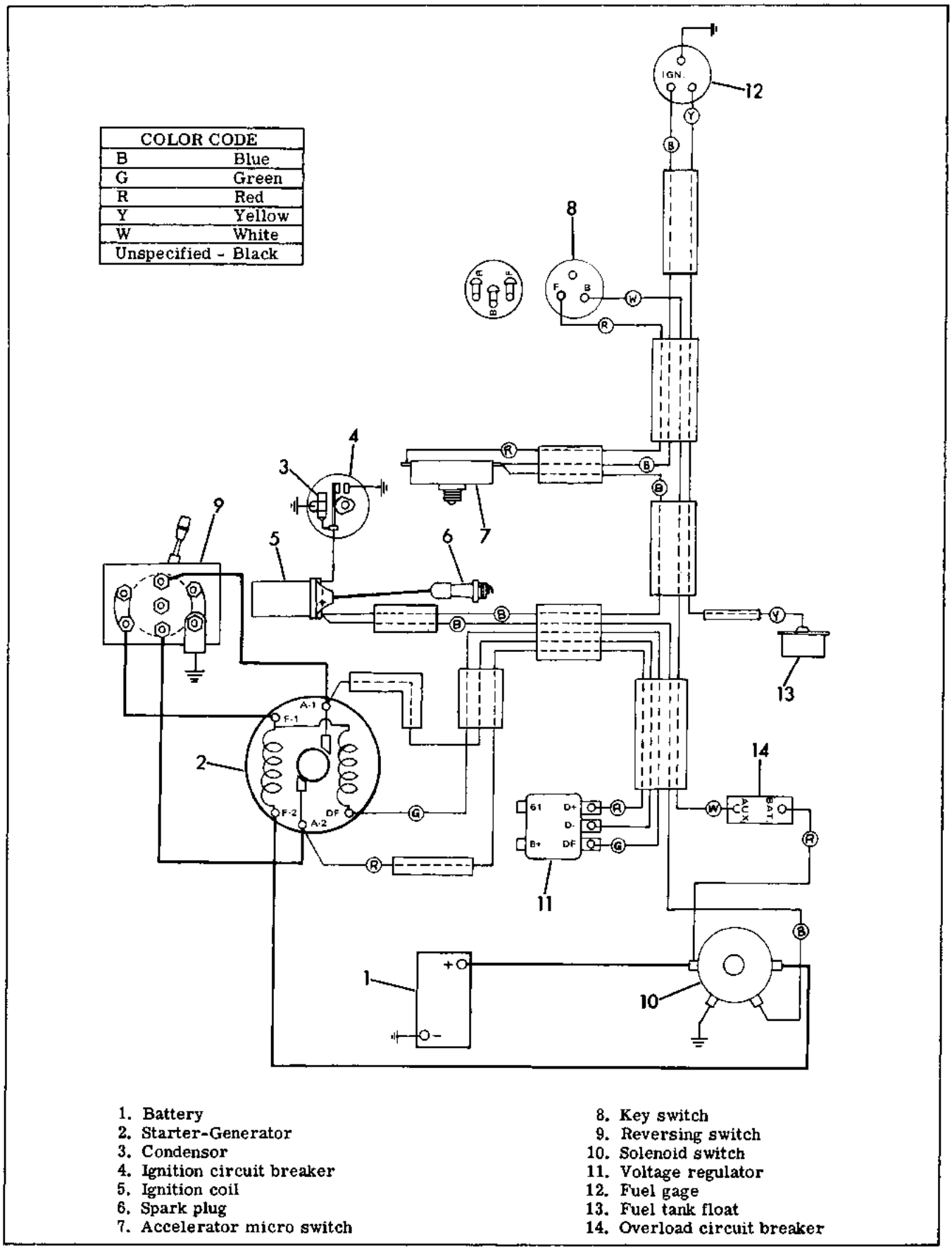
Figure 5B-27. 1969 to Early 1972 Model DC Wiring Diagram

1. Battery
2. Starter-Generator
3. Condensor
4. Ignition circuit breaker
5. Ignition coil
6. Spark plug
7. Accelerator micro switch
8. Key switch
9. Reversing switch
10. Solenoid switch
11. Voltage regulator
12. Fuel gage
13. Fuel tank float
14. Overload circuit breaker
15. Headlamp
16. Light switch
17. Tail lamp
18. Stop light switch
19. Horn button
20. Horn
21. Connector



COLOR CODE	
B	Blue
G	Green
R	Red
Y	Yellow
W	White
Unspecified - Black	

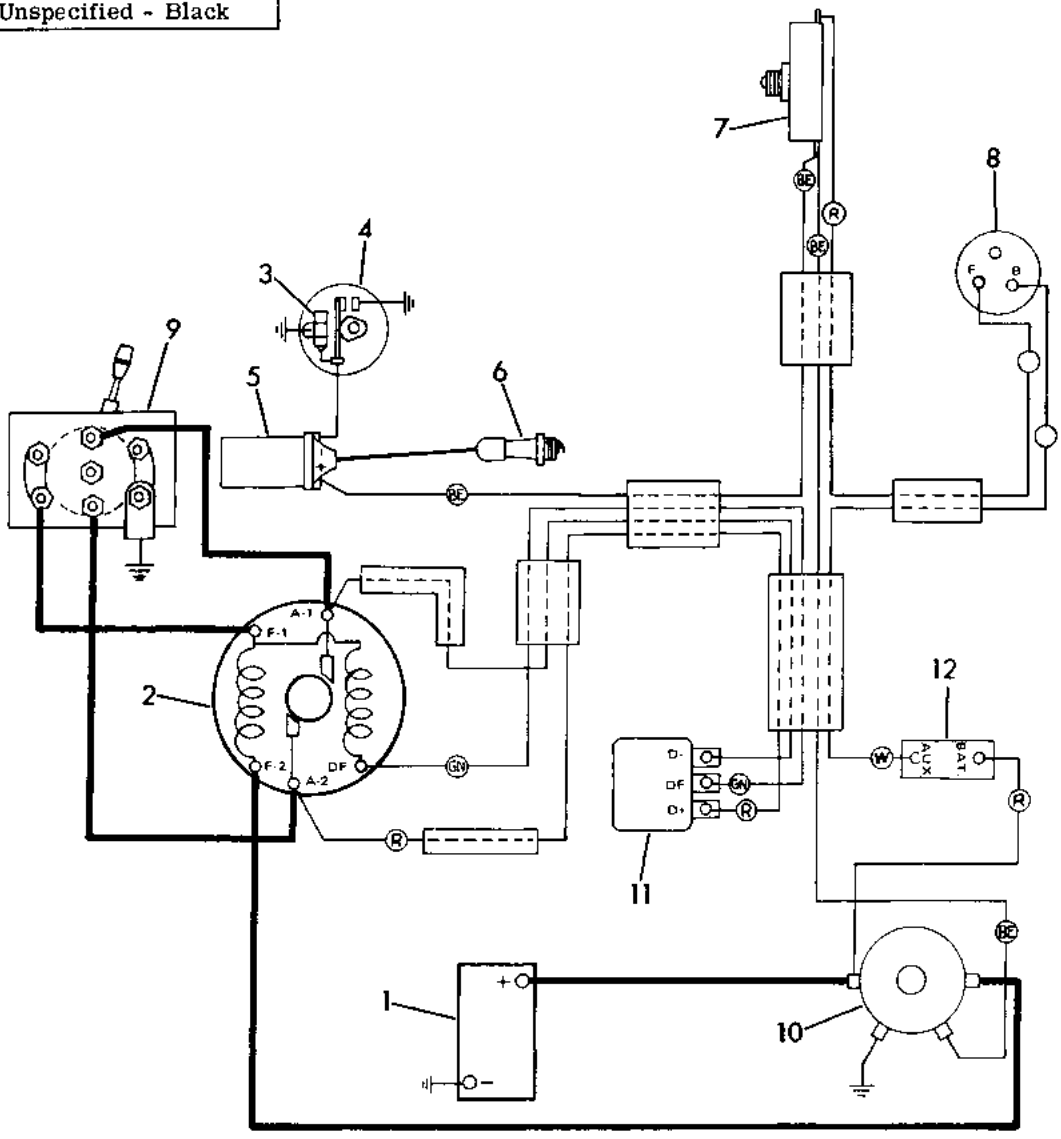
Figure 5B-28. Late 1972 DC Wiring Diagram



1. Battery
2. Starter-Generator
3. Condensor
4. Ignition circuit breaker
5. Ignition coil
6. Spark plug
7. Accelerator micro switch
8. Key switch
9. Reversing switch
10. Solenoid switch
11. Voltage regulator
12. Fuel gage
13. Fuel tank float
14. Overload circuit breaker

Figure 5B-29. Wiring Diagram, Late 1972-1974 Model D, 1972-1974 Model D4

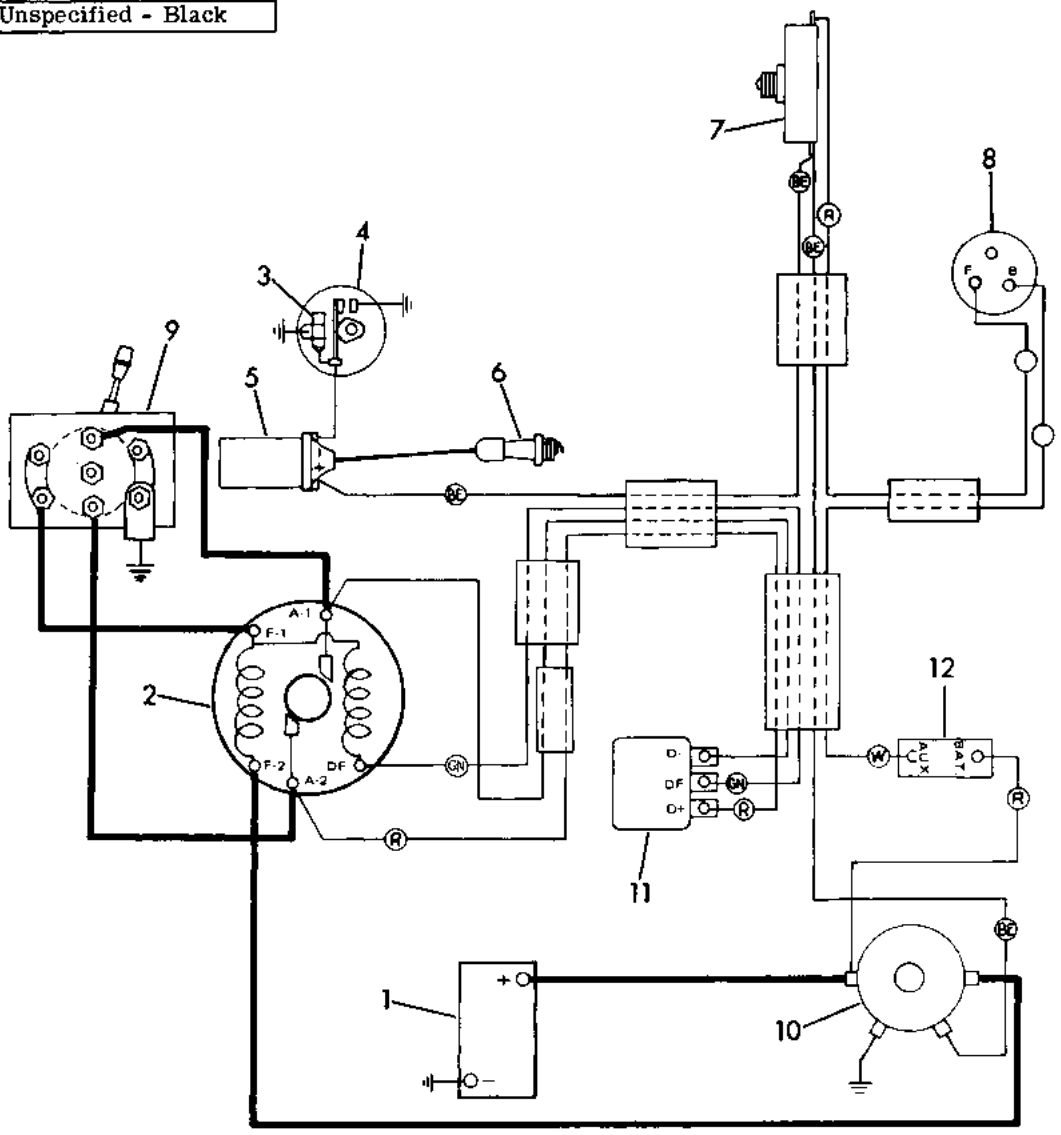
COLOR CODE	
BE	Blue
GN	Green
R	Red
Y	Yellow
W	White
Unspecified -	Black



1. Battery
2. Starter-Generator
3. Condensor
4. Ignition circuit breaker
5. Ignition coil
6. Spark plug
7. Accelerator micro switch
8. Key switch
9. Reversing switch
10. Solenoid switch
11. Voltage regulator
12. Overload circuit breaker

Figure 5B-30 Wiring Diagram - 1975-1979 - D, D4

COLOR CODE	
BE	Blue
GN	Green
R	Red
Y	Yellow
W	White
Unspecified -	Black



1. Battery
2. Starter-Generator
3. Condensor
4. Ignition circuit breaker
5. Ignition coil
6. Spark plug
7. Accelerator micro switch
8. Key switch
9. Reversing switch
10. Solenoid switch
11. Voltage regulator
12. Overload circuit breaker

Figure 5B-31 Wiring Diagram - 1980 & Later - D, D4

MICRO-SWITCH

This switch is a permanently assembled snap action switch. If this switch becomes defective, it must be replaced.

STARTER CUT-OUT SWITCH (1963-1966)

On 1963-66 Models, starter cutout micro-switch is located on left side of engine and is operated by inward and outward movement of transmission floating flange cover. This switch is normally open - button in released position. Switch button is actuated by lever which has a roller for slightly off-center contact with flat center section of transmission cover.

With engine stopped, transmission cover is in outward position, with switch button pushed in, to close switch contacts and complete the starting circuit. As engine starts up and transmission cover moves inward away from switch, switch button is released and switch contacts open.

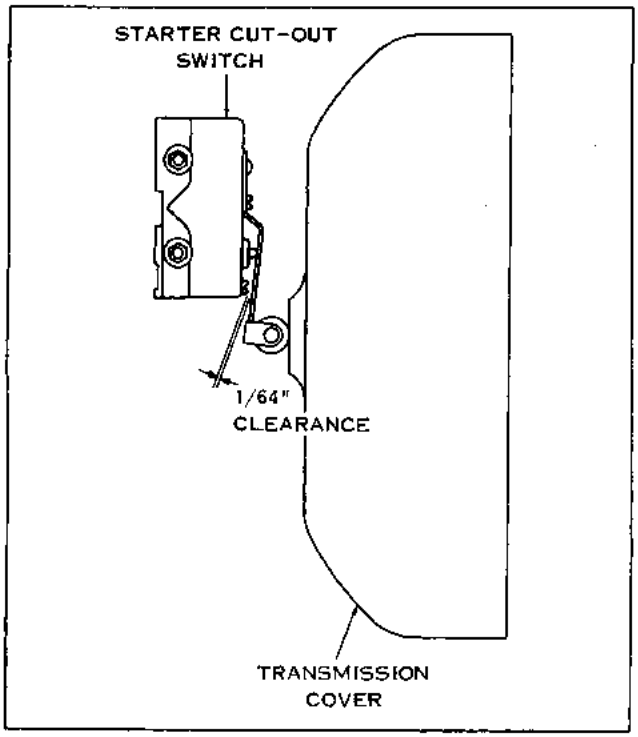


Figure 5C-9. Starter Cut-Out Switch Adjustment (1963-66 D, 1967 DC)

Switch is adjustable on mounting bracket. To adjust away from, or closer to transmission cover, loosen two mounting bolt nuts on bracket. Switch is correctly adjusted when no more than 1/64-inch clearance exists between actuating lever and screw directly underneath switch lever. When checking clearance be sure to pull floating flange outward to eliminate free play. Move switch, as required, toward transmission cover to reduce clearance to 1/64 inch.

Roller should be located approximately 1/4-inch from cover center so that it rolls freely on flat portion of cover. See Figure 5C-9.

The accelerator micro-switch is operated by movement of accelerator pedal to operate the starter motor solenoid. This switch is normally closed - button in released position.

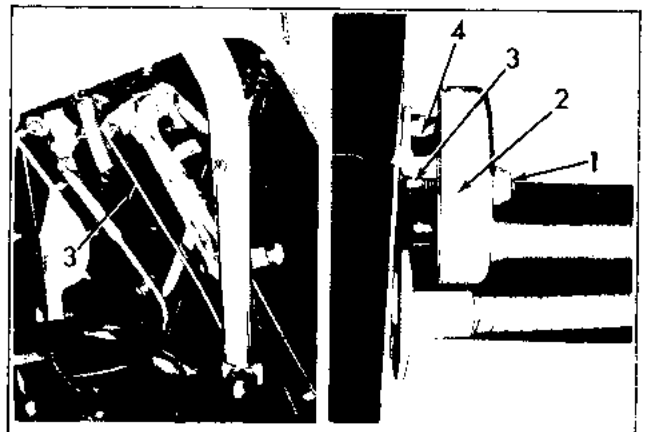
With accelerator pedal in released position, switch button is pushed in to open switch contacts. When pedal is depressed approximately half of free play distance, switch button releases to close switch contacts.

ACCELERATOR MICRO-SWITCH (1963 & Later)

On 1969 & earlier models the accelerator micro-switch is located at the base of the accelerator pedal and is fixed by its location in the mounting hole in the accelerator pedal bracket.

On 1970 and later models, the accelerator micro-switch is mounted under the left side frame cross-channel. The switch is operated by a rod running from the accelerator pedal through the frame cross-channel, and has a cup to actuate the micro-switch plunger (See Figure 5C-9A).

Cup (2) is adjustable by turning on r d (3) threads after loosening locknut (1). Adjust switch so that it clicks (CLOSES) when pedal is pushed down approximately half of free play distance. Retighten locknut against cup.



1. Locknut
2. Cup
3. Switch rod
4. Switch plunger boot

Figure 5C-9A. Accelerator Micro-Switch (1970 & Later)

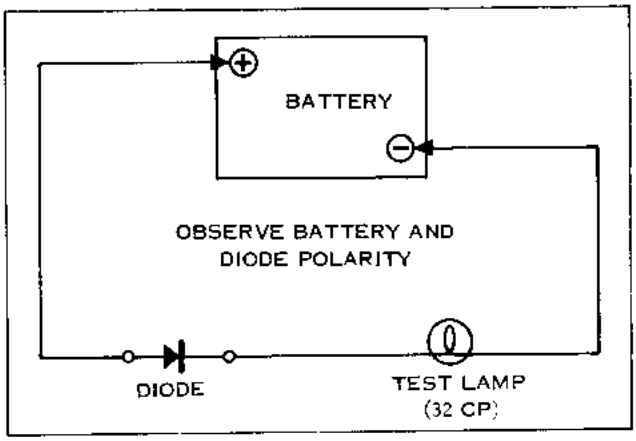


Figure 5C-9B. Test Circuit for Diode

DIODE

In cars using a field resistor to control generator voltage a diode is used in the golf car electrical circuit as a one way "valve" to control the direction of current flow. Function of the circuit is described earlier in this Section.

A simple check to determine if diode is functioning correctly is with the use of a battery and test lamp in series with the diode as shown in Figure 5C-9B. Lamp should light with current flow in one direction only as shown. If lamp lights with battery connections reversed for current flow in opposite direction, diode is shorted. If lamp does not light for current flow in both directions, diode is open.

In either case the diode should be replaced.

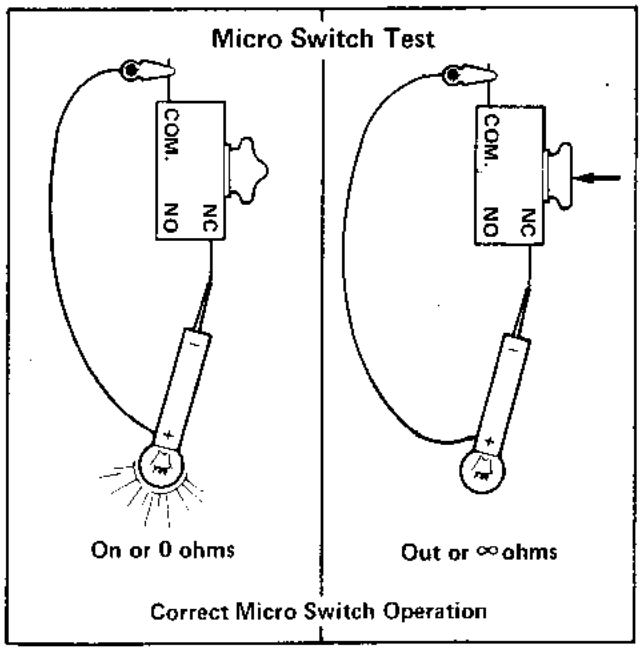


Figure 5C-10. Testing Micro Switch for Continuity

TESTING MICRO-SWITCH OUT OF CAR

Use a continuity tester to check micro-switch. To check micro-switch for continuity (Fig. 5C-10) depress plunger. The light should not glow. Release plunger and the light should glow. Replace as necessary.

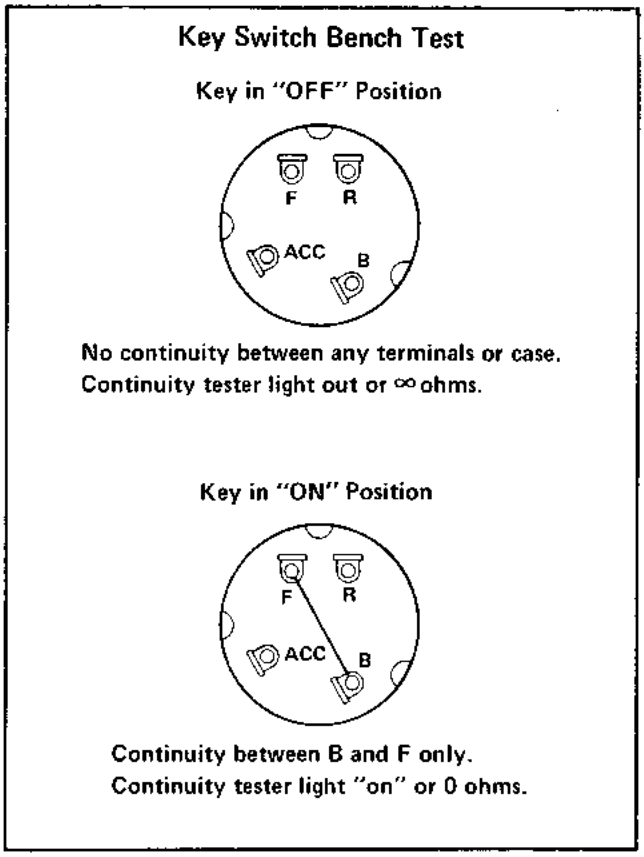


Figure 5C-11. Testing Key Switch for Continuity

KEY SWITCH

This switch is not repairable. If this switch becomes defective it must be replaced.

TESTING KEY SWITCH

WARNING

Before making any tests, disconnect spark plug wire to prevent engine from running.

Use a continuity tester or ohmmeter to test key switch. If key switch is good, the light will glow, or the ohmmeter will show "0" ohms resistance as checked between "F" and "B" terminals with key in on position.

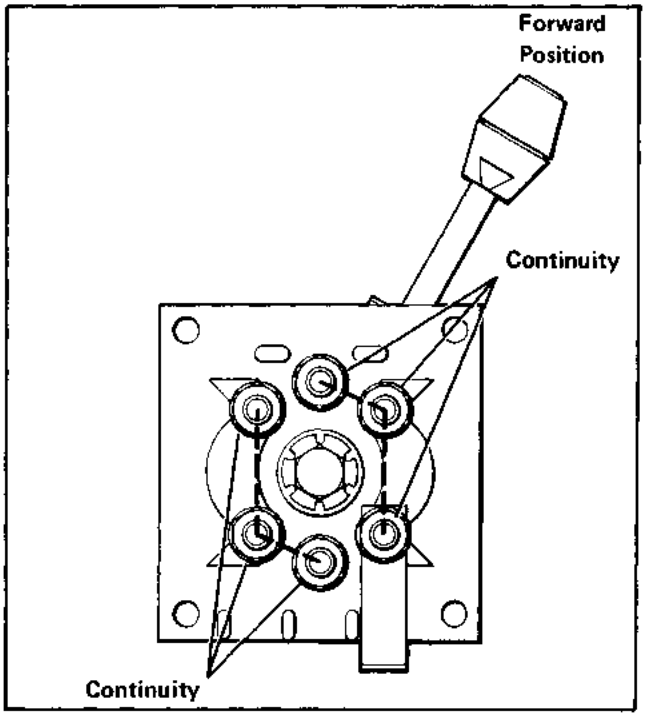


Figure 5C-12. Correct Continuity in Forward Position

REVERSING SWITCH

The reversing switch is a built-up assembly which can be taken apart for cleaning and replacement of contact screws, connecting strips, floating contact buttons, etc., if defective. Normally cleaning with fine emery paper is all that is required to correct imperfect contact.

Apply a light coat of high quality chassis grease to contacts when reassembling switch. Check for continuity with handle in forward position as shown (Fig. 5C-12). For reverse position, check continuity at indicated points (Figure 5C-12A).

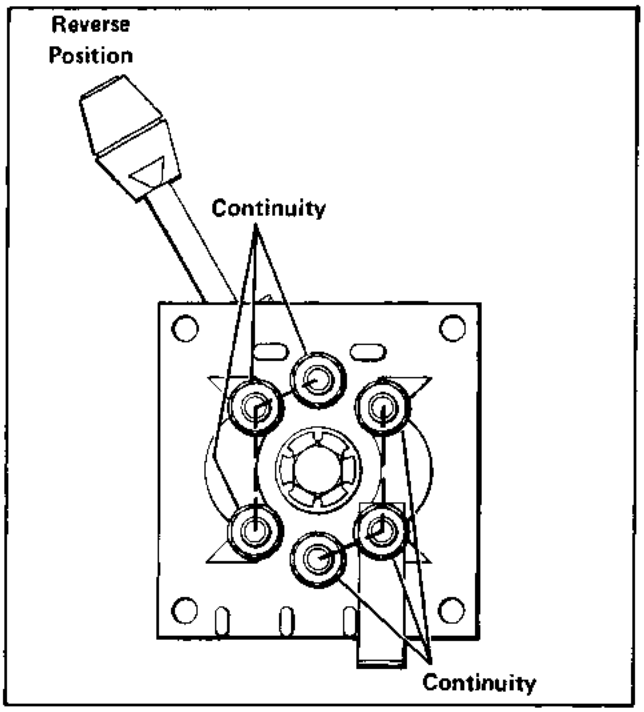


Figure 5C-12A. Correct Continuity in Reverse Position

SHAFT DRIVE TYPE (1963-66 D MODELS, ALL DC MODELS)

CHECKING STARTING CIRCUIT

If starter motor fails to turn engine over with key-switch in ON position and the accelerator pedal depressed, the following checks should be made in sequence to find the cause. These checks should be made only after eliminating other possible causes such as a discharged battery, loose or corroded battery cables, faulty wiring connections, or some mechanical failure within the engine.

WARNING

For all subsequent tests, remove spark plug wire from spark plug to prevent engine from running.

1. Using a short jumper of heavy gauge wire, momentarily touch the ends to control box terminals 51/30 and A. See Fig. 5E-19A. This will by-pass starting relay and current will flow to the starter motor. If starter fails to turn engine, difficulty is in starter. (Proceed to Step No. 6.) If starter does turn engine, proceed to Step 2.

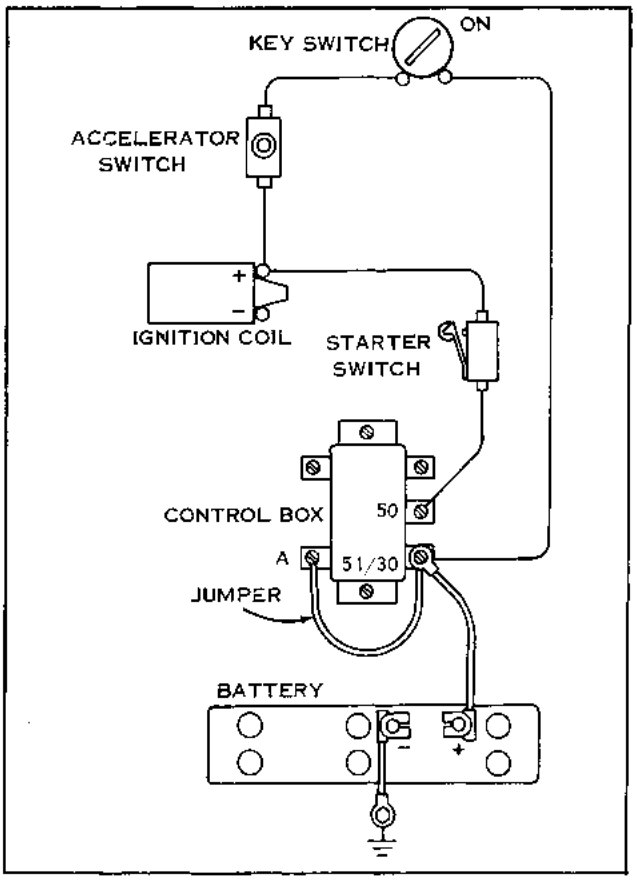


Figure 5E-19A. Step 1

2. Using the short jumper wire, momentarily touch the ends to control box terminals 51/30 and 50. This will by-pass the two micro-switches and key-switch from the starting control circuit and will allow current to flow directly to the starter relay switch coil. See Fig. 5E-19B. If the starter fails to turn engine, starter relay switch coil has an open circuit, or

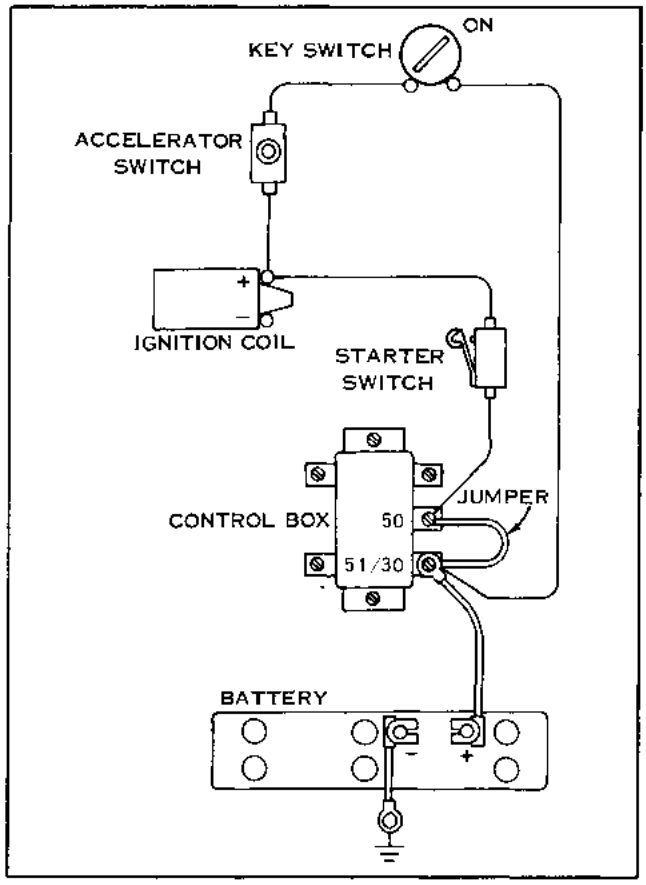


Figure 5E-19B. Step 2

starter switch contacts have failed. It will be necessary to replace control box assembly. If starter relay operates and starter turns the engine, fault is in the starter control circuit, and the following procedures should be used to determine if a switch is at fault.

3. To test continuity of switch circuit to ignition coil use a 12-volt test lamp of 4-candlepower or less with test leads approximately one foot long. Connect one lead of test lamp to positive terminal of the ignition coil (identified by two green wires) and the other lead

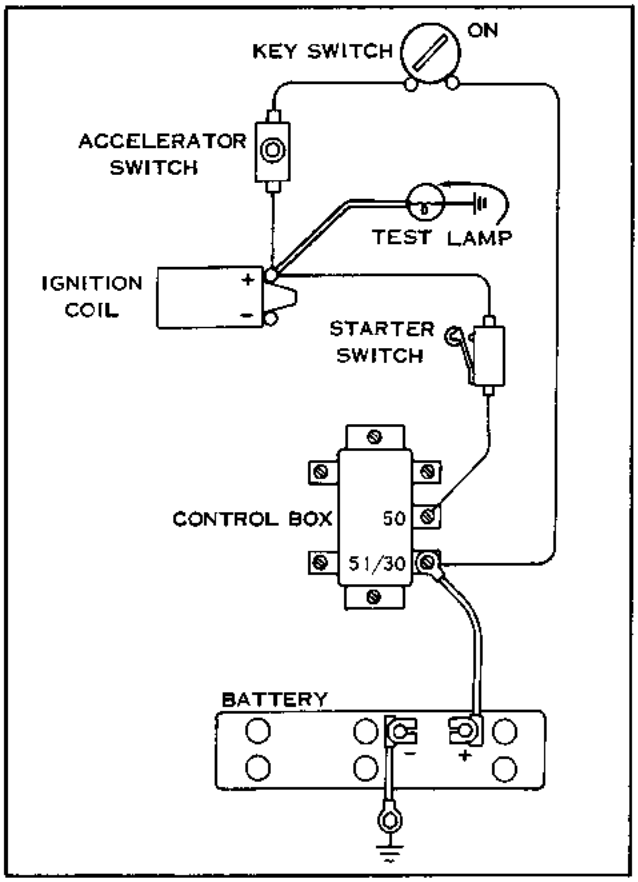


Figure 5E-19C. Step 3

to ground on chassis or motor base. See Fig. 5E-19C. With the key-switch in ON position, press accelerator pedal far enough to close accelerator switch. If test bulb glows, battery current is passing through key-switch and accelerator switch, and fault is in either starter switch, green wire to switch or blue wire from switch to terminal 50 on control box. Proceed directly to step No. 5.

4. If test bulb does not glow, fault is in either key-switch, accelerator switch, or wiring. Using two short wires jump across the terminals of switches. Test light will glow and starter may crank engine. With test light glowing or with engine turning, remove jumper wires alternately from switches to find which is defective. See Fig. 5E-19D. Replace switches as necessary. If test lamp fails to light when switches are jumped, fault is in the wiring circuit which connects the switches. If test lamp lights but engine does not start, proceed directly to step 5 to test the starter switch.

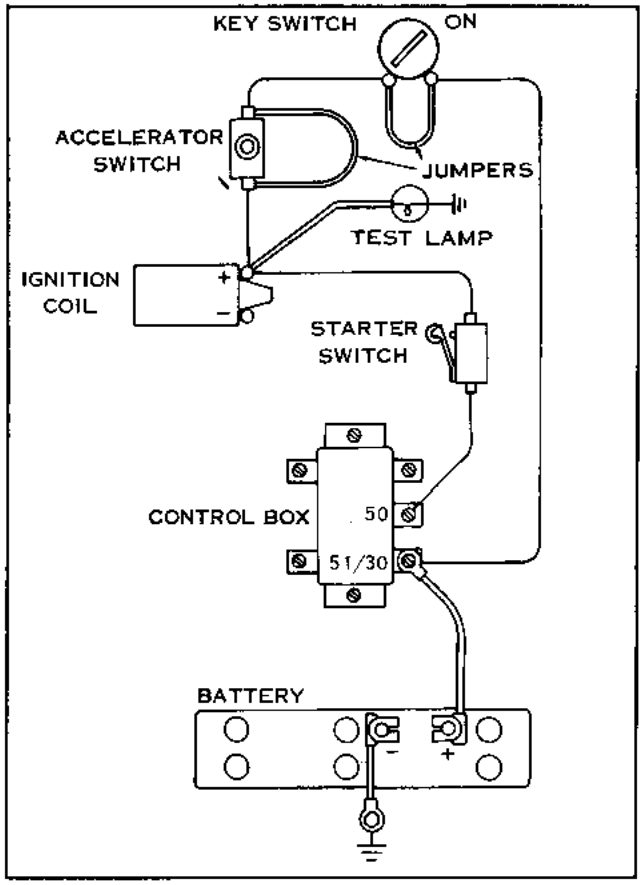


Figure 5E-19D. Step 4

5. Starter switch is located on the left side of the engine and is actuated by the inward and outward movement of the transmission cover. With key-switch in "ON" position and accelerator pedal pressed to close accelerator switch, touch test light leads to terminals of starter switch. See Fig. 5E-19E. Be sure to keep hand free of transmission moving parts. If the test light glows, switch is either defective or out of adjustment. Using a small screw driver, press on switch lever to press plunger farther into switch. If the engine now fails to turn over, switch is defective. See MICRO-SWITCH Section 5-C. If engine turns over when switch plunger is depressed, readjust micro-switch on mounting bracket closer to transmission cover. See MICRO-SWITCH Section 5-C.

6. If starter fails to turn engine as determined in Step 1, difficulty is in the starter. See subsequent sections: DISASSEMBLING STARTER-GENERATOR, BRUSHES AND BRUSH HOLDERS, FIELD COILS AND ARMATURE.

CHECKING GENERATOR CIRCUIT

When the battery becomes discharged during normal operation, it can be suspected that either the generator or regulator or both are faulty.

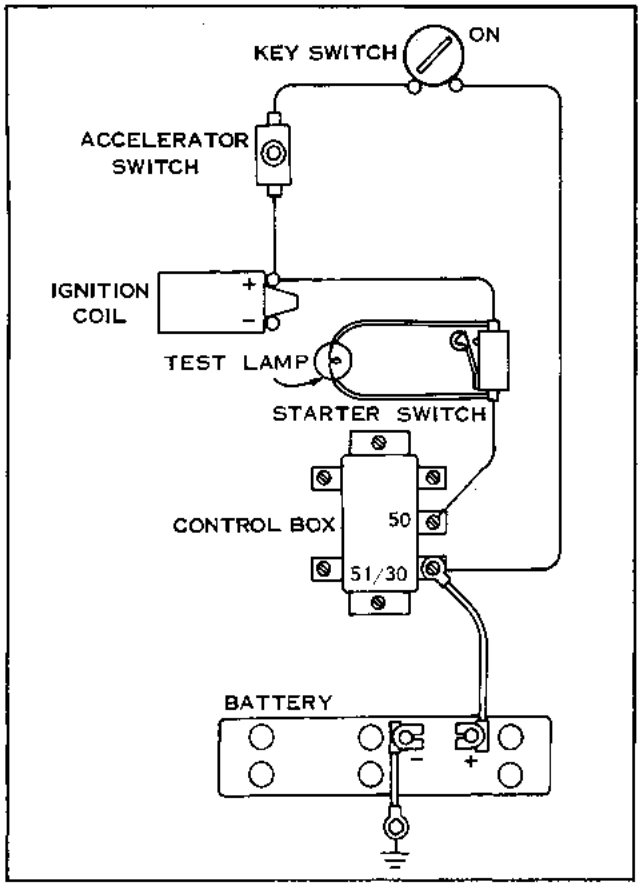


Figure 5E-19E. Step 5

The generator can be checked in the following manner. (Refer to Figure 5E-20.)

Remove black wire connected to control box terminal DF and attach to ground strap. CAUTION: Do not ground black wire while connected to DF terminal or serious damage to regulator points will result. Remove black wire connected to control box terminal 61/D+ and connect to the positive (+) lead of a 0-15

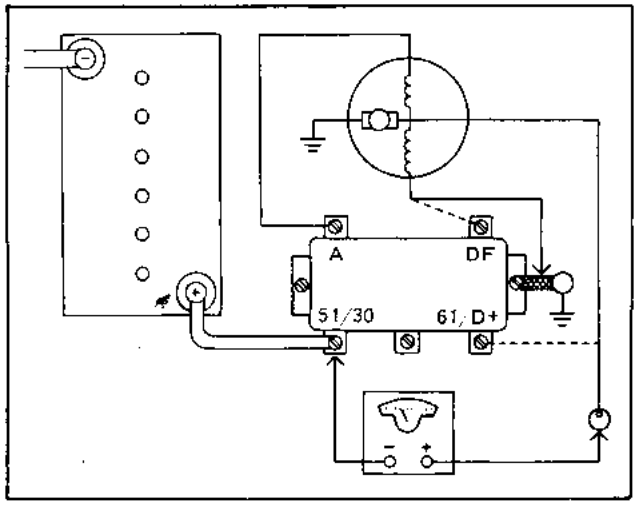


Figure 5E-20. Generator Test Circuit

D.C. ammeter. Start engine and run in neutral at 1200 to 1500 rpm. (It may be necessary to use jumper leads from another 12 volt battery to golf car battery, if discharged.) With engine running at recommended speed, touch negative lead of ammeter to control box terminal 51/30. Ammeter should now show a charge of 5 to 10 amperes. If ammeter shows no charge or a discharge, the generator is faulty.

See subsequent sections: DISASSEMBLING STARTER-GENERATOR, brushes and brush holders, field coils and armature. (Caution: Do not leave ammeter lead connected to control box terminal 51/30 with engine stopped, as battery will discharge through generator circuit.)

If the generator does show a charge on ammeter in preceding check, difficulty is in the voltage regulator or cutout relay. (See Regulator Section 5I)

DISASSEMBLING STARTER-GENERATOR (1963-66 - D; 1967-68 - DC) (Fig. 5E-21)

The Dyna-start unit should be disassembled for inspection of brushes and commutator at 2 year intervals.

When it is necessary to work on the starter-generator unit, the engine must be removed from the chassis. See "Removing and Installing Engine", Section 3A. Remove air shroud mounting screws (1) and air shroud (2). Remove inspection cover screws (3), inspection cover (4) and gasket (5). Remove three fan housing screws (6) from crankcase (Not shown). Remove fan housing (7) while holding circuit breaker movable point away from cam to prevent damage to fibre rubbing block. Remove two circuit breaker advance mechanism screws (8) and advance mechanism (9). Remove four fan mounting screws (10), fan (11) and dirt shield (22). Using Holding Tool, part number 94692-63, hold armature rotor (12) and remove nut (13) and lock washer (14). (See Fig. 5E-22.) Thread Armature Puller, part number 95563-63, into armature and turn press screw inward until armature breaks free of shaft taper. NOTE: Early Model D shafts have a large center in end of shaft. A 3/16 inch ball comes with puller which should be inserted into such large centers for the puller screw to bear against. Carefully slide armature off stator (15) and remove puller. (See Fig. 5E-23.) After removing armature rotor from crankshaft, note carefully whether the armature commutator area has an oil-wet or sticky carbon deposit. This would indicate a leaking oil seal behind the field stator. (Dry carbon dust is o.k.) To remove field stator (15) from right crankcase, remove armature key (16) from shaft. Remove three stator mounting screws (17) and washers (18). Remove rubber or plastic grommet (19 or 19A) from crankcase to permit withdrawal of wires through crankcase. CAUTION: Normally the stator (15) will be held tightly to the crankcase with gasket sealer. To break stator free from crankcase use two large screwdrivers to pry between the stator pole pieces and the crankcase. (See Fig. 5E-24.) Extreme care must be taken to avoid prying against the field coils and thereby damaging them. Remove stator gasket (20). Crankcase seal (21) can then be pushed out of stator (15).

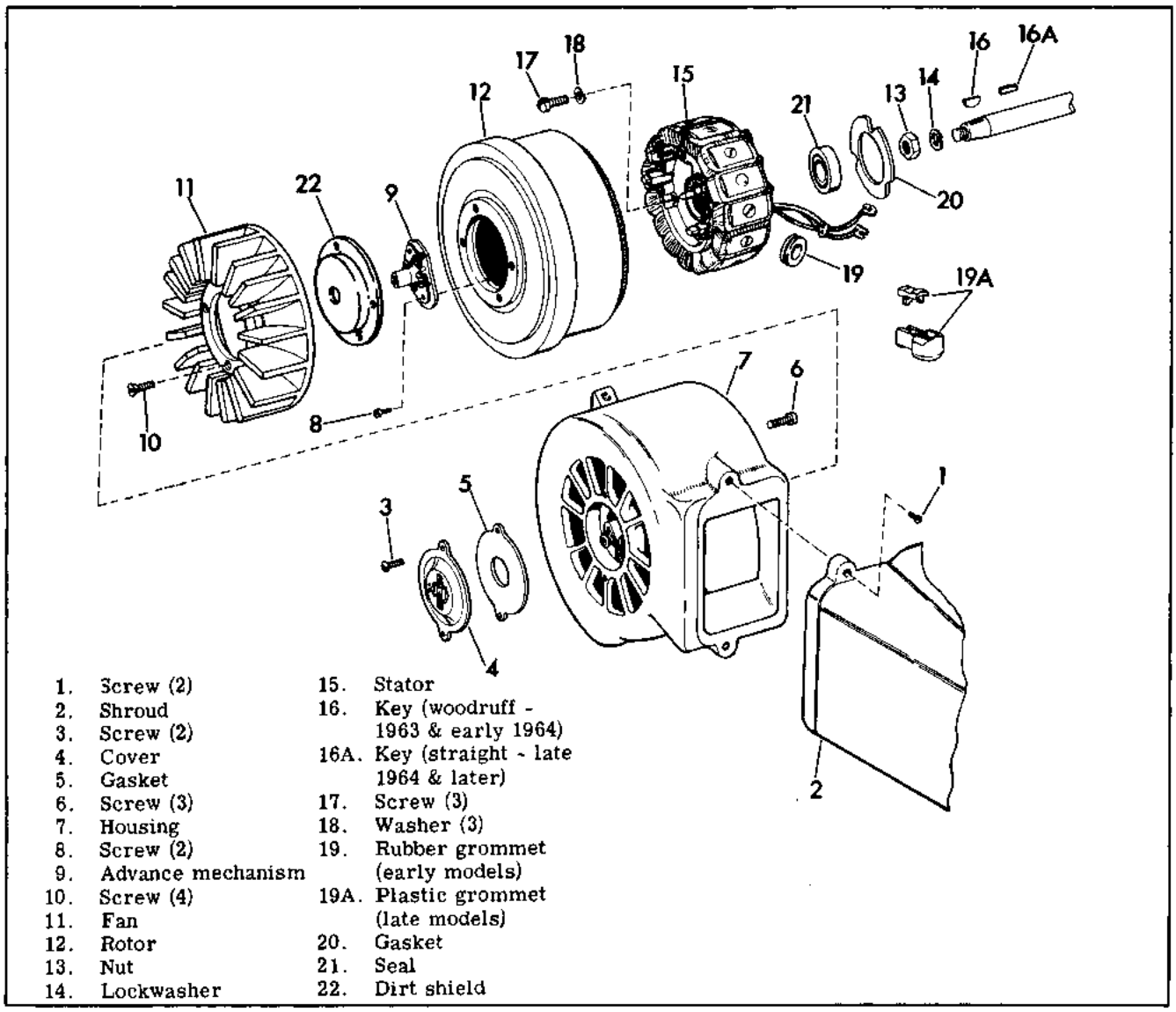


Figure 5E-21. Starter-Generator (1963-66 Model D, 1967 & 68 Model DC) - Exploded View

* BRUSHES AND BRUSH HOLDERS

Brushes must be replaced when worn down to shoulders on their flanks (early models) or score line on side of brush (later models) as indicated in Fig. 5E-25.

Some starter generators have wire brush stops, to limit brush travel. If this type unit is being serviced, remove brush stops at this time.

If brushes are still serviceable, check the tightness of the pig-tail leads in the brush material and test for continuity by using test lamp circuit. If a brush surface which contacts the commutator is chipped new brushes should be used. Brush spring pressure should be checked and if found weak, brushes should be replaced. Brushes should be replaced in sets only. Set includes 4 brushes with springs.

Remove all carbon dust or sludge from the brush holders so brushes move freely. The two positive (+) brush holders are insulated from stator housing. They can be identified by their red paint markings and by insulating material found under them. Using the test lamp circuit, check for possible grounding. Test lamp should not glow when touching one lead to stator and one to insulated brush holder. If a positive (+) brush holder is grounded, replacement of the insulating material may be necessary. Refer to the exploded view of insulated brush holder in 5E-25. The two positive brushes have large holes in terminals to fit over insulating bushings. After reassembling, brush holder should again be checked to see that it is insulated. Using test lamp circuit also check negative (-) brush holders to see that they are grounded to stator housing.

If oil or grease is found on the commutator, coils, brushes or within the armature the seal in the stator housing should be replaced. Use H.D. Seal-All on outside of seal to cement firmly in place in stator bore.

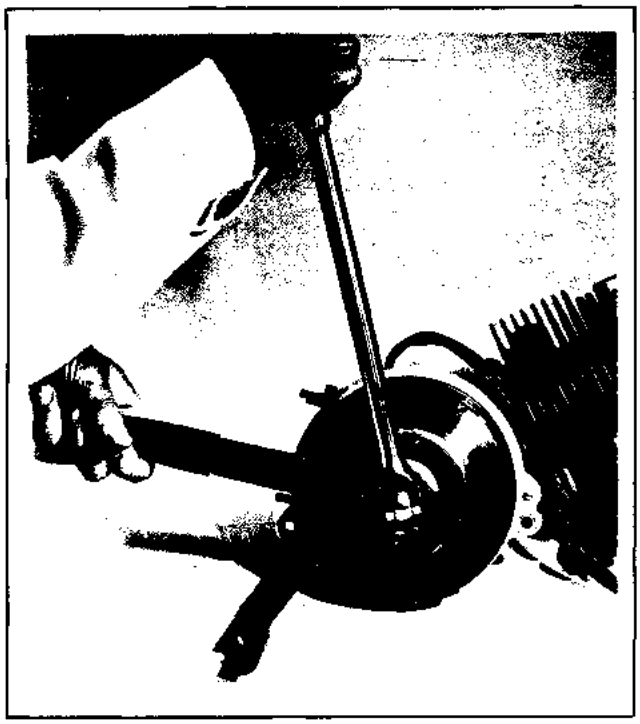


Figure 5E-22. Removing Armature Nut

FIELD COILS

1) Checking for ground:

When testing the field coils of the starter and generator use a 3 c.p. tail lamp bulb in series with a 6-Volt battery. (See Fig. 5A-3, Section 5A for circuit.) Touch the one test lamp lead to the steel housing of the stator. Touch the other test lead to each of the three coil leads alternately to check for ground. Test lamp should not glow while touching any lead. The heaviest gauge wire (terminal stamped "A" on early models) leads to the starter coils. The smallest gauge wire with spade terminal (stamped "DF" on early models) is connected to the generator

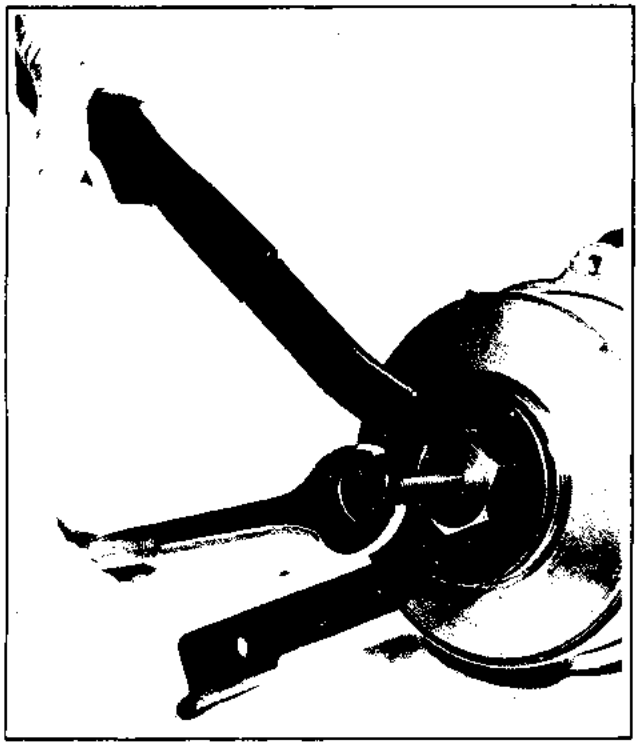


Figure 5E-23. Pulling Armature Rotor

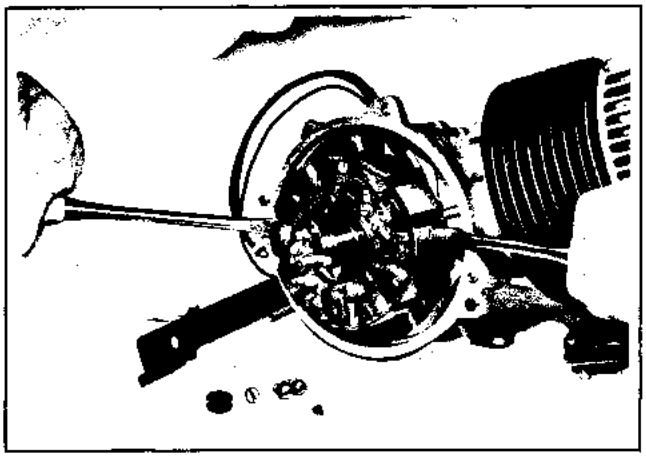
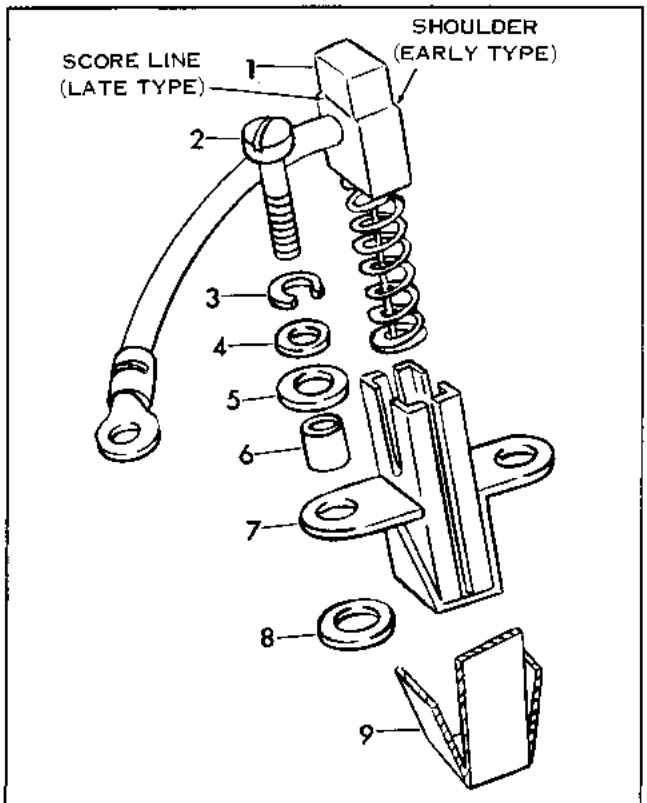


Figure 5E-24. Removing Field Stator



1. Brush
2. Screw (2)
3. Lockwasher (2)
4. Steel washer (2)
5. Insulating washer (2)
6. Insulating bushing (2)
7. Brush holder
8. Insulating washer (2)
9. Insulating sheath

Figure 5E-25. Brush and Holder

field coils. The medium gauge wire (terminal stamped "D+" on early models) is connected to the positive brush holders. If the test lamp glows when making connections to either of the coil wires, that coil is grounded and the entire stator must be replaced. If the test lamp glows when connected to the medium gauge wire, insulated brush holders are grounded. Brush holders can be removed and the insulation materials checked for breaks. (See previous section on testing brushes and holders.)

2) Checking for open circuit:

Remove test lamp lead from steel housing of stator and connect to the insulated brush holders. Alternately connect other end of test lamp lead to each wire end terminal. The test lamp should glow on touching each wire or an open is indicated, either in a coil, or in the lead from the coil or positive brush holders. If an open is indicated on any of these tests it must be located and corrected, or the complete stator must be replaced before assembly. A further test of the field coils can be made by connecting an ammeter of 0-15 DC amperes in series with a 6-volt battery. Connect one meter lead to the insulated brush holder and the other lead to the small wire. The current draw shown on the ammeter should be between 1 to 1.5 amperes. If the current draw is found to be much greater than 1.5 amperes it would indicate that some of the coil windings have been shorted within the coils thus reducing the total number of effective turns in the coils, decreasing the efficiency of the generator. In this case a complete stator assembly must be replaced before assembly.

ARMATURE

If starter motor or generator was not operating and previous tests proved brushes and coils to be in good order, the armature is likely at fault. The following steps can be taken to check and service the armature:

Using a 3 C.P. test light in series with a 6-Volt battery check to see if armature winding is grounded by touching one lead of the test lamp to the steel housing and the other lead to a copper bar of the commutator. If the lamp glows, armature circuit is grounded to the steel housing. This condition must be corrected before the armature can be reinstalled for further service. Carbon dust or sludge can cause a ground between the commutator bars and armature housing. Blow the dust out of the armature housing and thoroughly wash the commutator and wire connections with carbon tetrachloride, or suitable cleaner to remove any carbon sludge material that may not have been blown out. Commutator parts can be scrubbed with a small paint brush dipped in cleaner. Blow dry and again use the test lamp to test for ground. If the lamp still glows windings are grounded internally, and armature must be replaced. If the lamp does not glow ground has been eliminated.

Check the commutator for burned bars which could indicate an open circuit in one or more of the armature windings. Inspect winding connections to bars for tightness and re-solder if found loose. If a bar or bars have been burned away enough to make a low spot on the surface of the commutator, the commutator must be refaced. This should be done by a shop specializing in motor and generator work.

Clean the carbon dust from between the commutator bars with a hack saw blade ground square on one end and thinned to fit the groove. If bars are worn, mica may have to be undercut. After any mica undercutting operation, the surface of the commutator should be sanded lightly to remove any raised edges on the bars. If it is necessary to have the commutator refaced, undercutting of the mica should be done at that time.

If the generator fails to generate or starter fails to operate after the above test, and service operations have been performed, it will be necessary to replace the armature. Although an armature may test O.K. on the bench the centrifugal force of the rotating armature may cause the windings to change position as engine speed increases which may cause a ground, short or open circuit.

REASSEMBLING STARTER-GENERATOR (Fig. 5E-21)

Apply Harley-Davidson Seal-All and install new crankcase seal (21) in stator (15) with seal lip facing inward. Apply a thin coating of sealer to both sides of a new stator gasket (20). Position stator gasket (20) on crankcase bearing housing. Place seal tool, part number 95630-63 on starter-generator shaft taper. See Fig. 5E-26. Feed stator wires through wire hole in crankcase as stator (15) is being slid into position on crankcase.

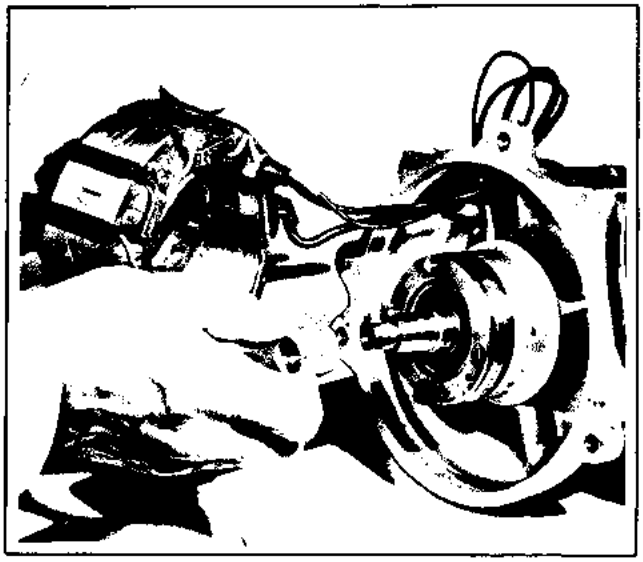


Figure 5E-26. Installing Stator Using Seal Tool

CAUTION: Make certain that stator wires are not being pinched or bound between stator and crankcase when stator is in correct position.

Install three stator mounting screws (17) and washers (18) and tighten securely. Remove seal tool from

shaft taper. Install rubber or plastic grommet (19 or 19A) in crankcase.

Position stator brushes correctly in brush holders and install armature shaft key (16) in shaft. Carefully install armature (12) into place on shaft. Install lock washer (14) and nut (13). Using Holding Tool, part number 94692-63 and socket wrench, tighten nut (13) securely to approximately 40 FT-LBS torque. See Fig. 5E-27.

Place fan (11) and dirt shield (22) on armature (note locating pin) and install four fan mounting screws (10) and tighten securely.

Position advance mechanism (9) correctly on armature (12) (note locating notch) and install mechanism mounting screws and lock washers (8).

Install fan housing (7) taking care not to damage breaker arm point fiber. Install and tighten three fan housing screws (6).

Slide stator wires into position between fan housing (7), left crankcase and bottom cylinder fin.

Position air shroud (2) and install air shroud mounting screws (1).

To check and adjust ignition timing see Section 5F "Circuit Breaker".

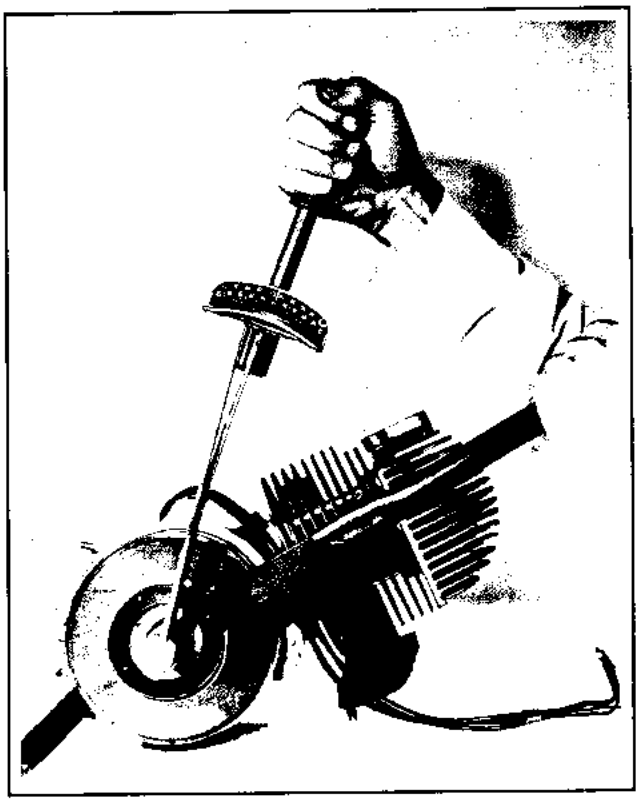


Figure 5E-27. Torquing Armature Rotor Nut

BELT DRIVE TYPE STARTER-GENERATOR

GENERAL

If starter motor fails to turn engine over with key-switch in ON position and the accelerator pedal depressed, the following checks should be made in sequence to find the cause. These checks should be made only after eliminating other possible causes such as a discharged battery, loose or corroded battery cables, faulty wiring connections, or some mechanical failure within the engine. If starter motor operates on 1967-68 models but belt slips, check drive belt tension. Some models have a spring loaded tensioner which eliminates the need for periodic belt adjustment. Belt can be removed using Tool Part No. 97320-67 to compress spring tensioner.

CHECKING AND ADJUSTING STARTER-GENERATOR DRIVE BELT TENSION (1967-1968 and Late 1978 and Later)

Belt tension should be checked every 6 months. If starter-generator belt slips when starter motor operates, adjust belt to correct tension as described in following paragraph. If engine does not turn over with correct belt tension, check engine freeness with spark plug removed.

To check belt tension press down on upper strand of belt midway between pulleys with approximately 6 pounds pressure. Belt should deflect approximately 1/8 inch. To adjust, loosen lower mounting bolts and upper support arm mounting bolt, pull starter-generator away from engine and tighten upper bolt - then lower bolts.

Tool part No. 97320-67 is recommended for accurate setting of belt tension as shown in Fig. 5E-27A and is used with a spring scale with a midscale reading of 25 lbs.

To set tension, loosen 3 mounting bolts, place tool over end of upper mounting bolt as shown and tighten upper bolt nut at 25 pounds tension reading on spring scale, then tighten lower mounting bolts.

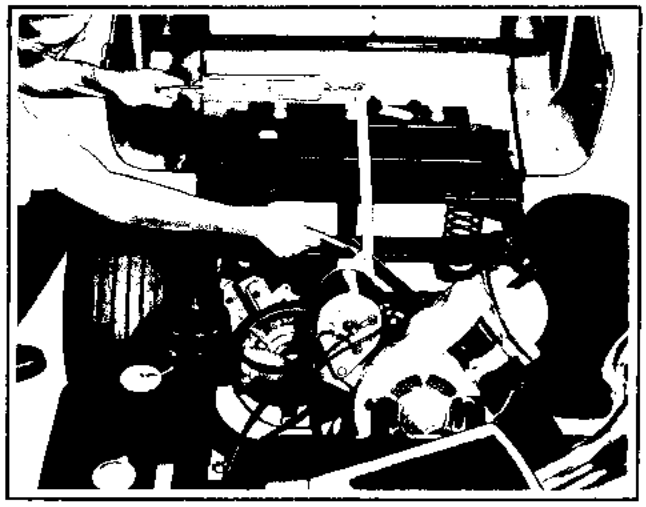


Figure 5E-27A. Checking Starter-Generator Belt Tension - 1967 Model D

Rigid Tension Adjustment (Late 1978 & Later)
(Figure 5A-27Fa)

1. Install belt on starter/generator. Adjust belt tension to 6 lbs. with 1/8" deflection and torque nut (4) to 12 ft.-lbs. using Tool Part No. 97320-67 and spring scale (Figure 5E-27A).

2. Torque nut (5) to 6 ft.-lbs.

3. Torque front and rear mounting nuts (4) to 12 ft.-lbs.

4. Drive car for short time and readjust belt tension following Steps 1, 2 and 3.

CAUTION

Belt tension must be rechecked at least within the first hour of operation to account for any initial stretch or seating of components. The new belt tensioner could allow the use of a non-standard belt, or a belt that is too long could result in the starter/generator being pivoted to such a point that the "DF" terminal of the starter/generator could come in contact with the air cleaner and short out the voltage regulator.

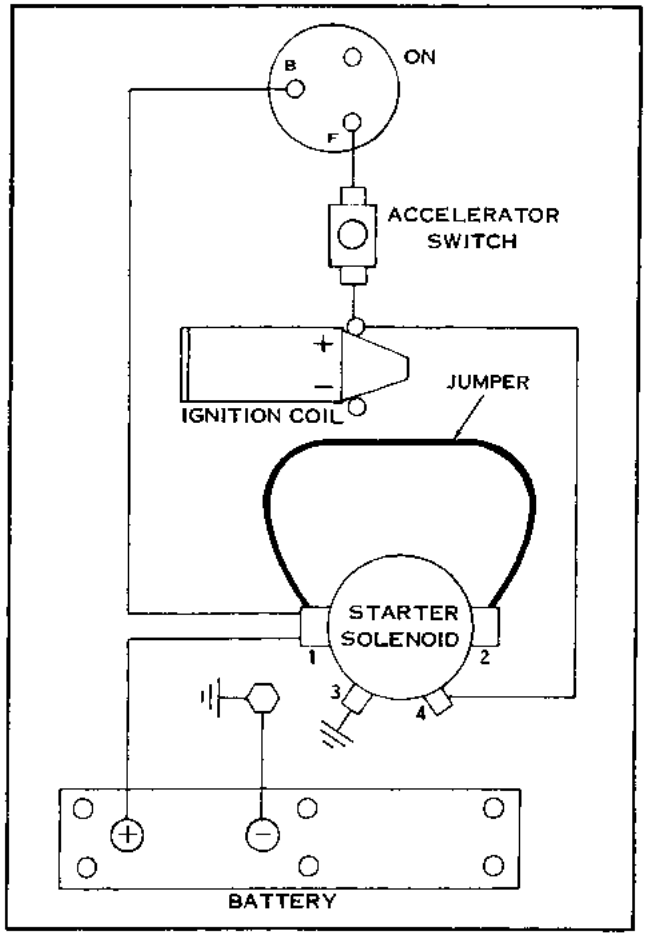


Figure 5E-27B. Step 1

CHECKING STARTING CIRCUIT

WARNING

For all subsequent tests, remove spark plug wire from spark plug to prevent engine from running.

1. Using a short jumper of heavy gage wire, momentarily touch the ends to large solenoid terminals. See Fig. 5E-27B. This will by-pass starting solenoid and current will flow to the starter motor. If starter fails to turn engine, difficulty is in starter or reversing switch (See Step 4). If starter does turn engine, proceed to Step 2.

2. Using the short jumper wire, momentarily touch the ends to solenoid terminals 1 and 4. This will by-pass the micro-switch and keyswitch from the starting control circuit and will allow current to flow directly to the starter solenoid coil. See Fig. 5E-27C. If the starter fails to turn engine, starter solenoid coil has an open circuit. It will be necessary to replace starter solenoid. If starter relay operates and starter turns the engine, fault is in the starter control circuit, and the following procedures should be used to determine if a switch is at fault.

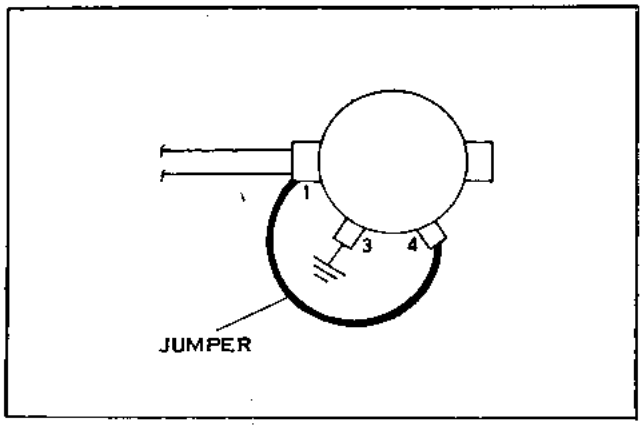


Figure 5E-27C. Step 2

3. To test continuity of switch circuit to ignition coil and starter solenoid use a 12-volt test lamp of 4-candlepower or less with test leads approximately one foot long.

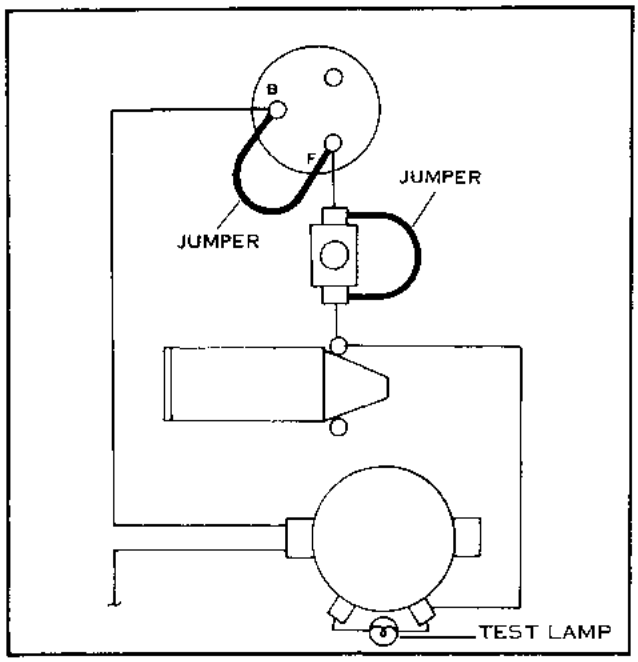


Figure 5E-27D. Step 3

Connect one lead of test lamp to solenoid terminal No. 4 and the other to solenoid terminal No. 3.

Using two short wires jump across the terminals of key switch terminals B and F and accelerator microswitch. Test light will glow and starter may crank engine. With test light glowing or with engine turning, remove jumper wires alternately from switches to find which is defective. See Fig. 5E-27D. Replace switches as necessary. If test lamp fails to light when switches are jumped, fault is in the wiring circuit which connects the switches.

4. If starter fails to turn engine as determined in Step 1, difficulty is in the starter. See subsequent sections: DISASSEMBLING STARTER-GENERATOR, BRUSHES AND BRUSH HOLDERS, FIELD COILS AND ARMATURE.

CHECKING GENERATOR CIRCUIT

1. Two types of charging circuits are employed: the first one, used on 1967 and early 1968 golf cars, has a field resistor to control the charging rate, the second one used on 1968 and later golf cars and 1969 utilicars has a regulator controlled charging system.

A. TESTING 1967 - EARLY 1968 CIRCUIT (RESISTOR TYPE CIRCUIT).

To test components, disconnect ground cable from car frame and connect an ammeter between these points as shown in Fig. 5E-27E.

IMPORTANT

Use a low range ammeter (below 20 amps) and observe polarity as shown.

Raise left rear wheel of car above ground so it can turn freely. Place reversing switch in forward position. Start engine and run at governed speed. Set governor as necessary to regulate speed (See "Checking Charge Rate" below). Temporarily use jumper wire between battery and frame when starting engine as shown. (It may be necessary to use jumper leads from another battery to golf car battery if discharged.

If ammeter shows no reading proceed to step 1 below. If ammeter reads between 5.5 to 6.5 amperes charge rate, system is O.K. If ammeter reads over 6.5 amps or under 5.5 amps correct by adjusting generator field resistor. See "Checking Generator Charge Rate".

1. Connect heavy jumper wire between starter-generator F1 terminal and A2 terminal, and between A1 terminal and ground on frame. If ammeter shows that generator is charging, reversing switch or wiring is at fault.

2. If generator does not charge, add another jumper wire from center top of resistor (green wire), at right side frame cross channel end, to ground on frame. If generator charges, resistor is at fault and should be replaced.

If generator does not charge in Steps 1 or 2 above, remove it from the car for further checking as described under "Disassembling Starter-Generator".

Checking Generator Charge Rate

The field resistor is set at the factory to produce a generator output of 5.5 to 6.5 amperes at 3000 RPM governed speed. Field resistor adjustable clamp set 3/16 in. above bottom end of winding is the normal setting for this speed and can be used as a guide when tachometer and ammeter are not available. Field resistor is located on right side frame cross channel end.

To check and adjust generator output accurately with instruments, run engine with left rear wheel raised

off the floor so wheel can turn freely. Control carburetor throttle with accelerator foot pedal or by hand at carburetor to give 3000 RPM engine speed using an electric tachometer. This is equivalent to 10 MPH (or 100 yards in 20 seconds).

Adjust the clamp on variable resistor to obtain a 6 ampere reading with engine running at 3000 RPM with a fully charged battery (1.250-1.270 specific gr.).

B. TESTING LATE 1968 AND LATER CIRCUIT (REGULATOR TYPE CIRCUIT).

To test components, disconnect ground cable from car frame and connect an ammeter between these points as shown in Fig. 5E-27E.

IMPORTANT

Use a high range ammeter of at least 40 amperes maximum current (60 preferred).

Raise left rear wheel of car above ground so it can turn freely. Place reversing switch in forward position. Start engine and run at governed speed. Temporarily use jumper wire between battery and frame when starting engine as shown.

1. With engine running at governed speed (approximately 3000 RPM), disconnect wire from DF (field) terminal of regulator and momentarily touch D- (ground) terminal of regulator.

CAUTION

Never ground regulator DF terminal with wire connected to generator field terminal because this will damage the regulator.

If ammeter shows no reading (generator does not charge) proceed to step 2 below. If ammeter reads above 12 amperes, generator is O.K. and regulator is probably defective and should be checked. See "Regulator."

2. Connect heavy jumper wire between starter-generator F-1 terminal and A-2 terminal and between A-1 terminal and ground on frame. Again run engine at governed speed with one rear wheel off the ground and momentarily touch disconnected regulator DF wire to ground. If ammeter shows that generator is charging, reversing switch or wiring is at fault.

REMOVING STARTER-GENERATOR FROM CAR

The belt drive starter-generator should be removed from the car and end cover removed for inspection of brushes and commutator every year (before each season).

Remove mounting bolt from support arm or spring tensioner, remove V-belt, remove lower mounting bolt or bolts to free starter-generator (See Figure 5E-27F or 5E-27Fa).

DISASSEMBLING STARTER-GENERATOR (Fig. 5E-27G SIBA, 5E-27H BOSCH AND 5E-27I HITACHI)

BRUSHES, BRUSH HOLDERS AND COMMUTATOR

Siba:

Remove thru bolts (1) and use tool part No. 97294-61B to pull end cover (2) as shown in Figure 5E-27J. Two 1/4-20 x 1-3/4 in. long Part No. 2797B attaching screws are inserted through the puller flange slots and thread into two tapped holes in the commutator end cover.

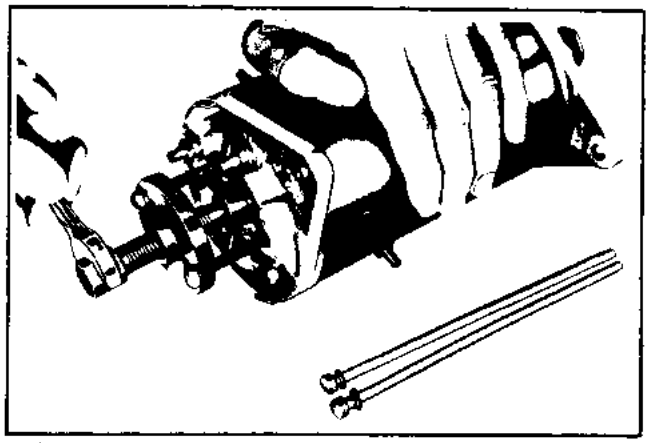


Figure 5E-27J. Removing SIBA Starter-Generator Commutator End Cover

Bosch:

Remove brush cover band (2) held by clamping screw (1). Remove brush lead terminal screws and lockwashers (3). Retract brush springs (4) with wire hook and remove 4 brushes (5) from holders.

Hitachi

Remove rubber brush cover (2) and terminal screws (3). Lift up on brush spring (4) with wire hook and pull out brush (5).

Bosch, Siba and Hitachi

Brushes must be replaced when worn down to half or less their original length. Siba and Hitachi Brushes - replace if 1/4 in. less in total length. Bosch Brushes - replace if 1/2 in. less in total length. If brushes are still serviceable, check tightness of pigtail leads in brush material and test for continuity by using a test lamp circuit. Discard chipped brushes. Remove all carbon from brush holders so brushes move freely. Brushes are furnished in sets and should be replaced in sets only. Brush terminals and brush holders are insulated from frame and should be checked with a test lamp circuit for possible grounding.

Test lamp should not glow when touching one lead to frame and the other lead to brush terminal or to brush holder.

NOTE

If starter-generator does not require further disassembly, proceed to "Reassembling Starter-Generator".

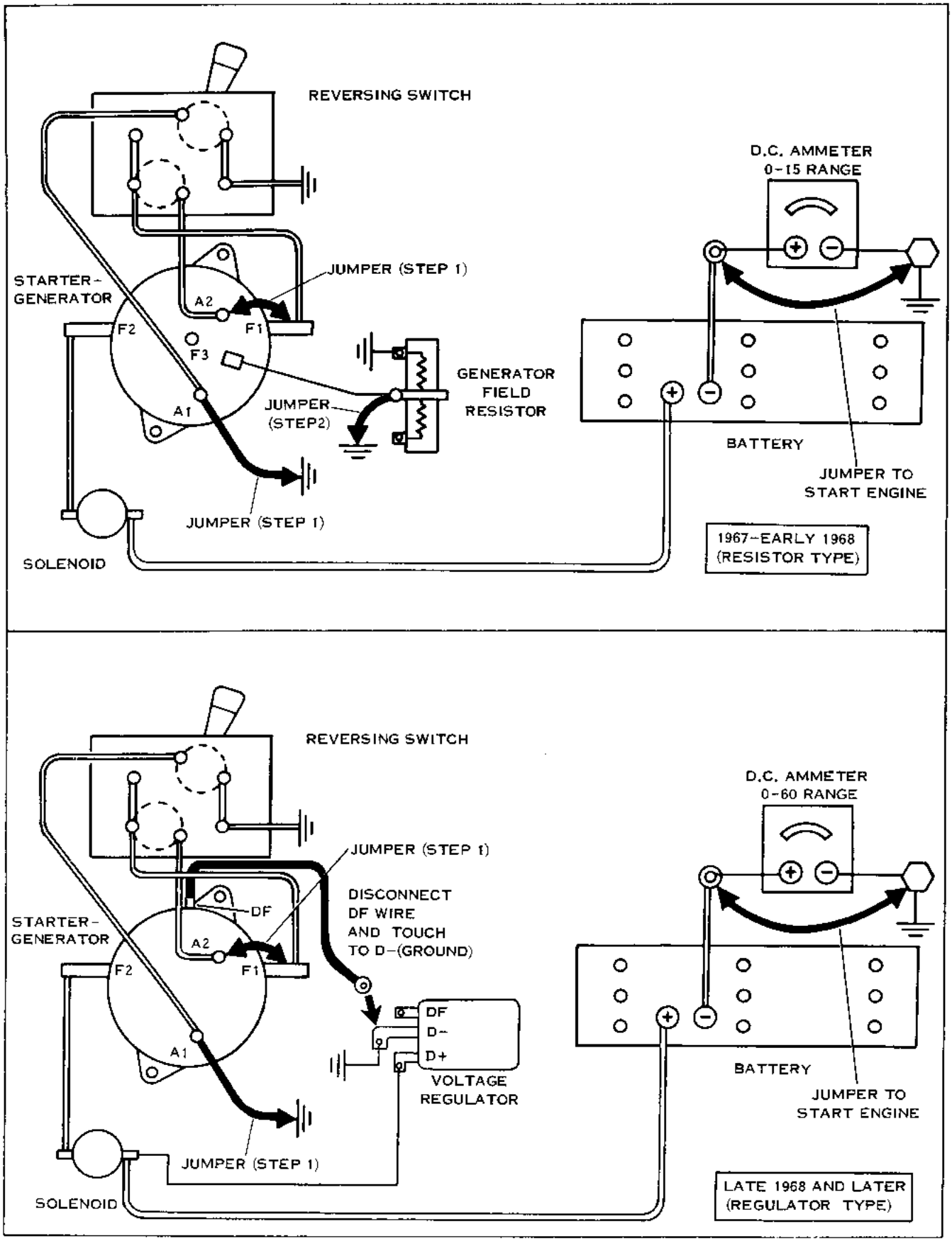
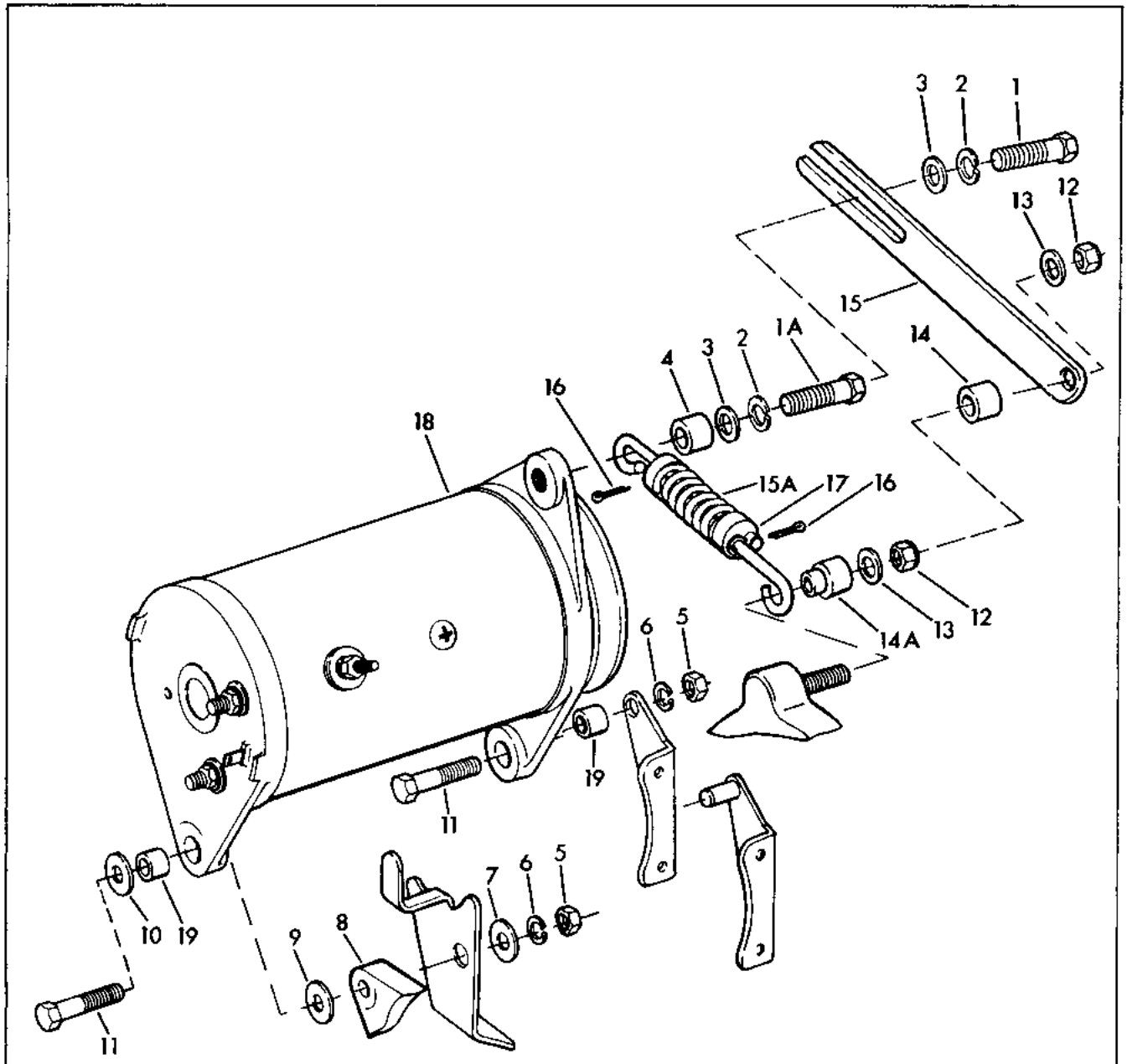
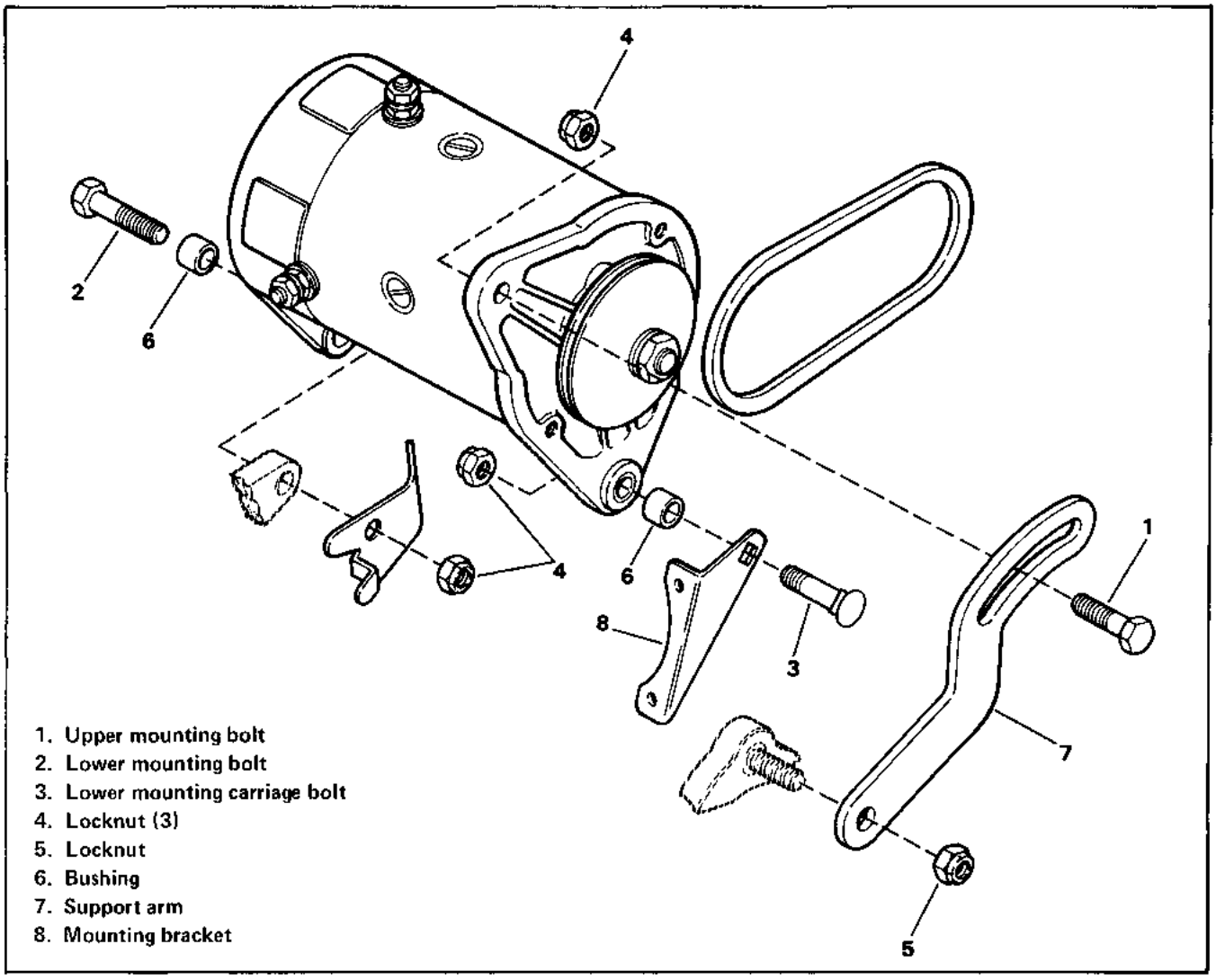


Figure 5E-27E. Starter-Generator Test Circuit

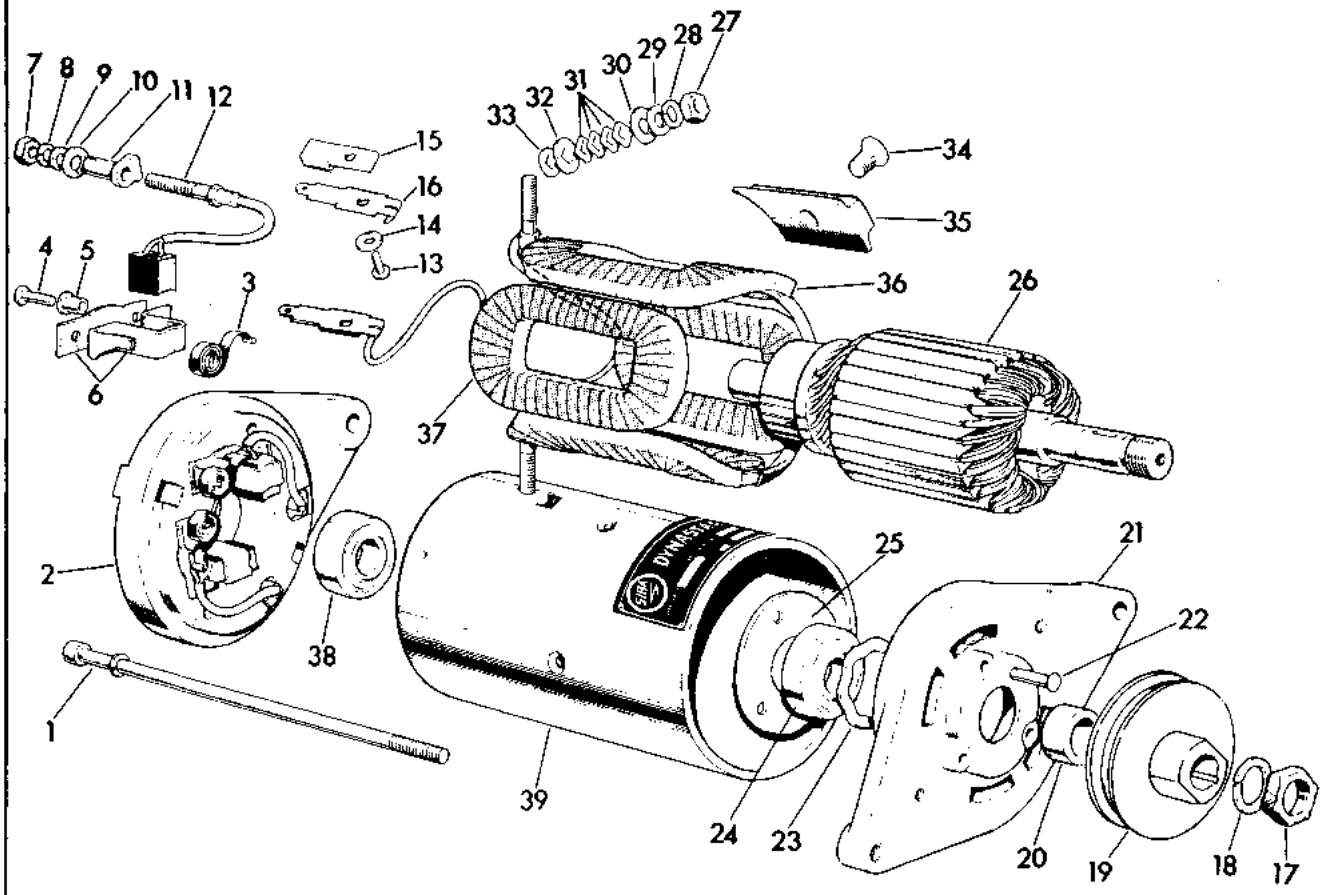


1. Upper Mounting Bolt (1967-68)
1A. Upper Mounting Bolt (1969 and Later)
2. Lockwasher (1967-68)
3. Washer
4. Spacer
5. Nut
6. Lockwasher
7. Washer (1969 and Later)
8. Bracket
9. Washer (1969 and Later)
10. Washer (1969 and Later)
11. Lower Mounting Bolt (2, 1967-68) (1, 1969 and Later)
12. Nut
13. Washer
14. Spacer (1967-68)
14A. Spacer (1969 and Later)
15. Support Arm (1967-68)
15A. Spring Tensioner (1969 to Late 1978)
16. Cotter Pin (2)
17. Bushing (2)
18. Starter-Generator
19. Bushing (2) (1 or 2 Steel 1967-68) (2 Bronze 1969 and Later)

Figure 5E-27F. (1967-1978) Starter-Generator Mounting/Arm Type and Spring Type Belt Tensioners

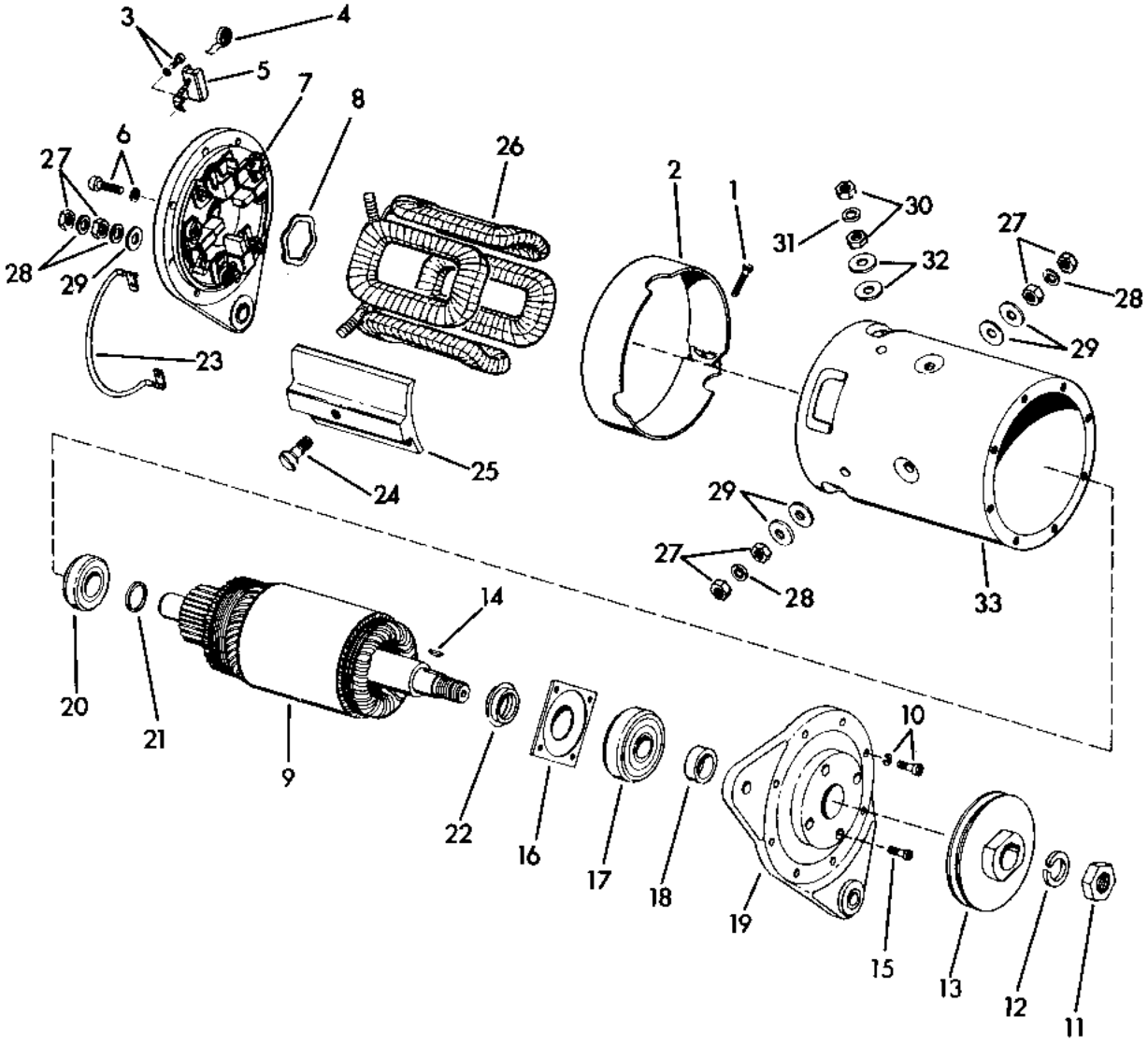


5E-27Fa. HITACHI, Starter-Generator Rigid Mounting 1979 & Later



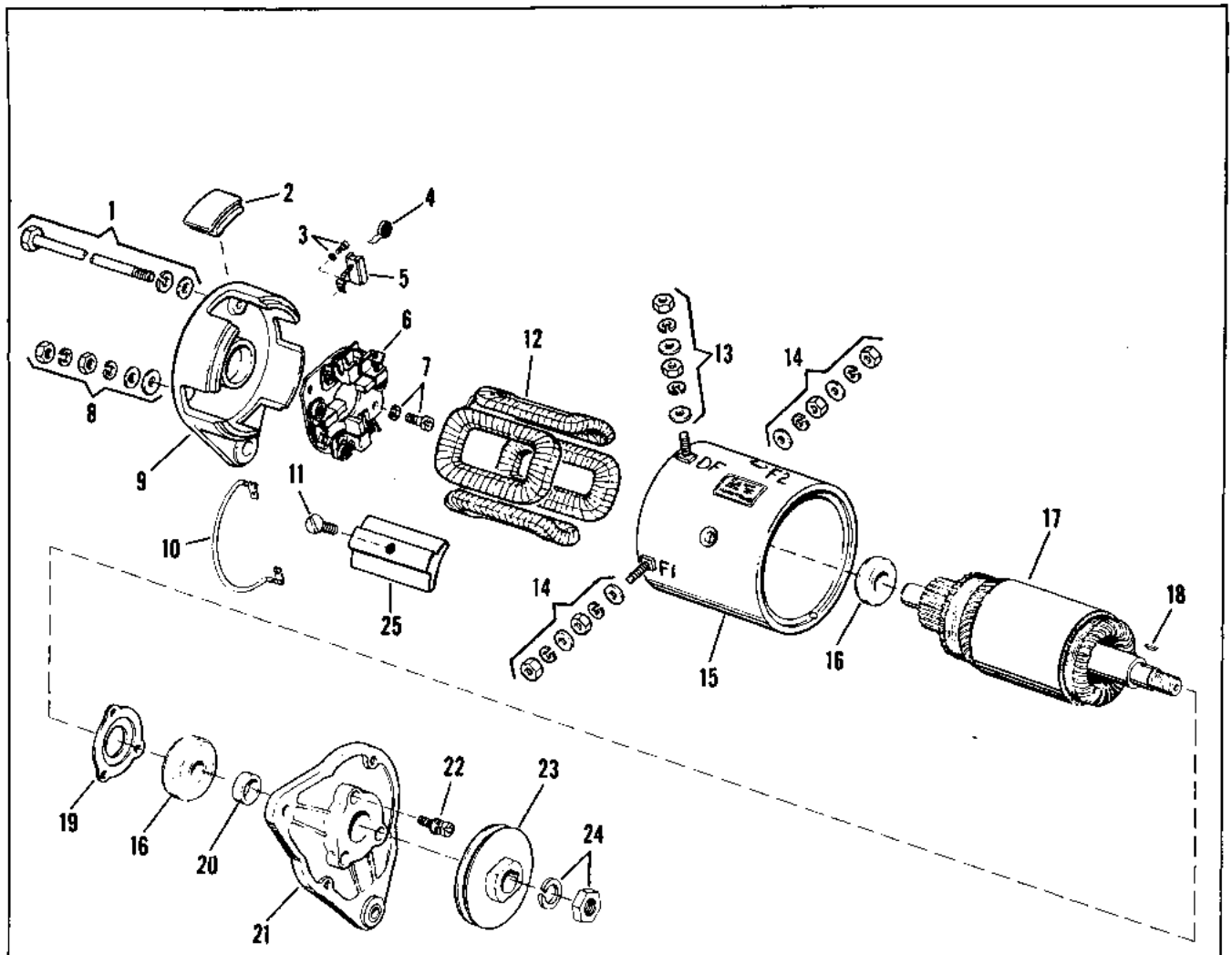
1. Thru-bolt and washer (2)
2. Commutator end cover
3. Brush spring (2)
4. Brush holder rivet (2)
5. Rivet insulator (2)
6. Brush holder and insulation (2)
7. Brush terminal nut (2)
8. Brush terminal nut lockwasher (2)
9. Brush terminal nut washer (2)
10. Brush terminal insulating washer (2)
11. Brush terminal insulator (2)
12. Brush terminal
13. Spade (F1) terminal rivet
14. Spade (F1) terminal insulator washer
15. Spade (F1) terminal insulator
16. Spade terminal
17. Pulley nut
18. Pulley nut lockwasher
19. Pulley
20. Spacer
21. Drive end cover
22. Bearing retainer rivet (3)
23. Spring washer
24. Ball bearing
25. Retainer plate
26. Armature
27. Field terminal stud nut
28. Field terminal stud lockwasher (2)
29. Field terminal stud washer (2)
30. Field terminal stud insulating washer (2)
31. Field terminal stud insulator (8)
32. Field terminal stud insulating washer (2)
33. Field terminal stud washer (2)
34. Pole shoe screw (4)
35. Pole shoe (4)
36. Series field coil set
37. Shunt field coil set
38. Ball bearing
39. Frame

Figure 5E-27G. SIBA Starter-Generator - Exploded View



1. Screw
2. Brush cover band
3. Terminal screw & lockwasher (4)
4. Brush spring (4)
5. Brush (4)
6. Commutator end cover screw & lockwasher (8)
7. Commutator end cover assembly
8. Commutator end cover bearing spring washer
9. Armature
10. Pulley end cover screws & lockwashers (8)
11. Shaft nut
12. Lockwasher
13. Pulley
14. Key
15. Retainer screw (4)
16. Retainer
17. Bearing
18. Spacer
19. Pulley end cover
20. Bearing
21. Bearing spacer
22. Bearing shield
23. Brush interconnecting wire (2)
24. Pole shoe screw (4)
25. Pole shoe (4)
26. Field coil (No. 1, 2, 3 & 4)
27. Terminal nut (8)
28. Terminal washer (8)
29. Terminal insulator washer (8)
30. DF terminal nut (2)
31. DF terminal washer (2)
32. DF terminal insulator washer (2)
33. Frame

Figure 5E-27H. BOSCH Starter-Generator - Exploded View



1. Thru-bolt and washer (2)
2. Brush cover (4)
3. Terminal screw and lockwasher (4)
4. Brush spring (4)
5. Brush (4)
6. Brush holder
7. Brush holder screw and lockwasher (3)
8. Terminal nut, washer and lockwasher (2)
9. Commutator end cover
10. Brush connecting wire (2)
11. Pole shoe screw (4)
12. Field coil assembly
13. DF terminal nut, washer and lockwasher
14. F1-F2 terminal nut, washer and lockwasher (2)
15. Frame
16. Bearing (2)
17. Armature
18. Key
19. Bearing holder
20. Spacer
21. Drive end cover
22. Bearing retainer screw (3)
23. Pulley
24. Nut and lockwasher
25. Pole shoe (4)

Figure 5E-27I. HITACHI Starter-Generator - Exploded View

ARMATURE

Siba:

To separate armature from end cover, remove drive pulley nut (17) and lockwasher (18). Support end cover with suitable blocking and with nut partially installed to protect threads, press armature (26) from end cover bearing and housing assembly (20, 21, 22, , 23, 24, and 25) as shown in Fig. 5E-27K.

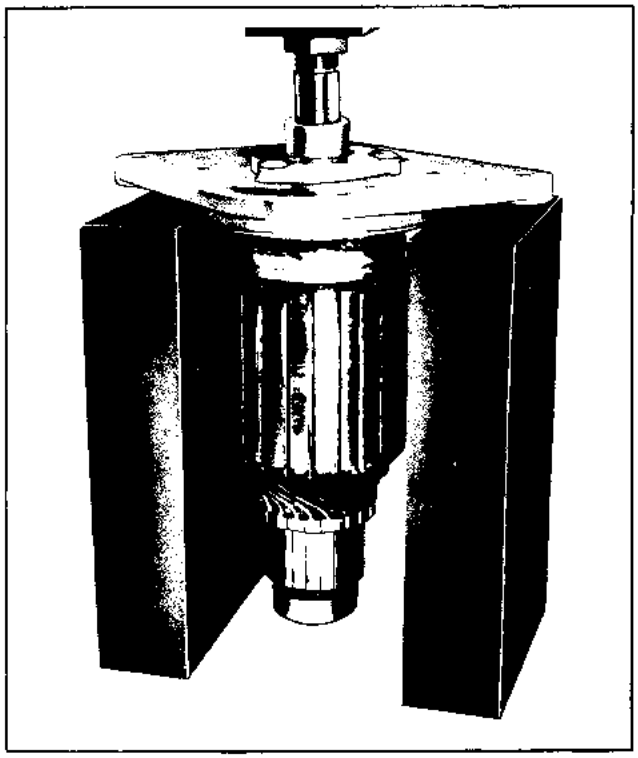


Figure 5E-27K. Pressing Armature from Drive End Cover (SIBA)

Bosch:

Remove 8 commutator end cover screws and lockwashers (6). Remove commutator end cover (7) with attached parts. Remove commutator end bearing, spring washer (8) from housing. Remove 8 pulley cover screws (10) to free armature (9), and pulley end assembly from housing (23).

Disassemble armature from end cover as follows: Holding pulley (13) with wrench on hub flats, remove nut (11) and lockwasher (12). Remove pulley (13) with claw puller. Remove key (14) from keyway. Remove pulley end cover (19) from shaft with claw puller or arbor press. Remove 4 retainer screws (15) to free retainer (16), bearing (17) and spacer (18). Remove bearing (20), bearing spacer (21) and bearing shield (22) from armature shaft.

Hitachi

Remove the two thru-bolts (1) and separate rear cover assembly, frame and field coil assembly and armature assembly. Remove pulley nut and screw (24), pulley (23) and key (18). Use claw puller to remove pulley if necessary. Use bearing puller to remove commutator end bearing (16). To remove bearing and end cover assembly (21) from armature, use procedure shown in figure 5E-27K. Remove bearing retainer screws (22) from end cover if inspection of bearing is desired.

TESTING ARMATURE

Armature can be tested using an armature growler such as a Sun Model AT-76 armature tester which incorporates a coil output meter and continuity tester.

Grounded rotor winding can be determined by testing with continuity tester probes from any commutator bar to the laminations. Lamp should not light.

Shorted rotor winding can be determined by testing with a flat steel blade (hacksaw blade) along rotor laminations. A shorted winding will magnetize the shorted coil and make the blade buzz.

Open circuit rotor winding can be determined with commutator probes of tester between adjacent bars to check output of each coil on meter. Meter should give uniform readings. An open coil will give a low reading and usually be indicated by a burned spot at two adjacent bars.

NOTE

Under operating conditions "flying shorts or opens" may occur due to centrifugal force, and these defects would not show up in the armature tests mentioned above.

If armature is found to be shorted or grounded, make sure commutator is free from carbon and copper dust deposits. If commutator is only slightly carboned, polish with No. 00 sandpaper (do not use emery cloth). A badly worn commutator should be cut down in a lathe as described in following paragraphs.

After cleaning thoroughly between segments and at ends of commutator and blowing dry with compressed air, repeat test. If an open circuit is found, check for loose or broken wires at commutator connections. If none are found that may be repaired, armature must be replaced. All soldering should be done with rosin flux.

A starter-generator that has been in extended service may fail to crank the engine or deliver enough current to keep the battery in a charged condition although its field coils and armature windings are in serviceable condition. In such cases the commutator and/or brushes are usually at fault. If the commutator has been worn down until the mica separations between segments are no longer undercut or recessed, the commutator probably is grooved noticeably in path of brush travel and no slot between commutator segments exists, causing the brushes to ride high and make only intermittent contact with commutator.

The commutator may be turned down in a lathe and sanded with fine (4/0) sandpaper until true and smooth.

NOTE:

Minimum diameter for Bosch and Hitachi commutators is 1.535 in. (39 mm).

Mount armature in lathe on its bearing seats not on shaft centers. Never sand a commutator with emery cloth. Particles will embed themselves in the copper surface, holding the brushes off the commutator far enough to cause heavy arcing and burning.

After commutator has been turned down, the mica insulation between segments must be recessed or undercut approximately .025 in. Undercutting is usually done with a special undercutting machine. If one is not available, satisfactory undercutting may be done with a piece of hacksaw blade. Carefully thin down blade width, if necessary, until offset saw teeth are the same width as slots in commutator. Slots must be square-bottomed for good results. See Figure 5E-27L.

Sand commutator surface on lathe and repeat growler test to be sure there are no copper particles between segments.

Check bearings for roughness and wear and replace if necessary. To replace pulley end bearing on Siba unit, grind or drill rivet heads (22) and use new rivets to secure assembly in end cover (21) with spring washer (23) and plate (25).

FIELD COILS

Pole shoes and field coils are secured with screws. Do not remove unless electrical test indicates it is necessary.

Check shunt field coils with an ohmmeter as follows: Connect an ohmmeter between terminal F3 (DF terminal) and F1 terminal. Resistance should read as follows: Siba Unit - 4 to 5 ohms for 2 coils in series or 2 to 2.5 ohms per coil. Bosch Unit - 4.5 to 5.5 for 2 coils in series or 2.2 to 2.7 per coil. Hitachi Unit - 4.5 to 5.5 for 2 coils in series or 2.2 to 2.7 per coil. Check series field for open with ohmmeter or test lamp connected between F2 terminal and F1 terminal. Check series field for ground to frame with ohmmeter or test lamp connected between F2 terminal and ground on starter-generator frame.

Note: Terminal studs are insulated from frame with insulator bushings.

Replace defective field coils in sets only. Bore Siba pole shoe inside diameter to 2.825 in. I.D. on a lathe, if necessary.

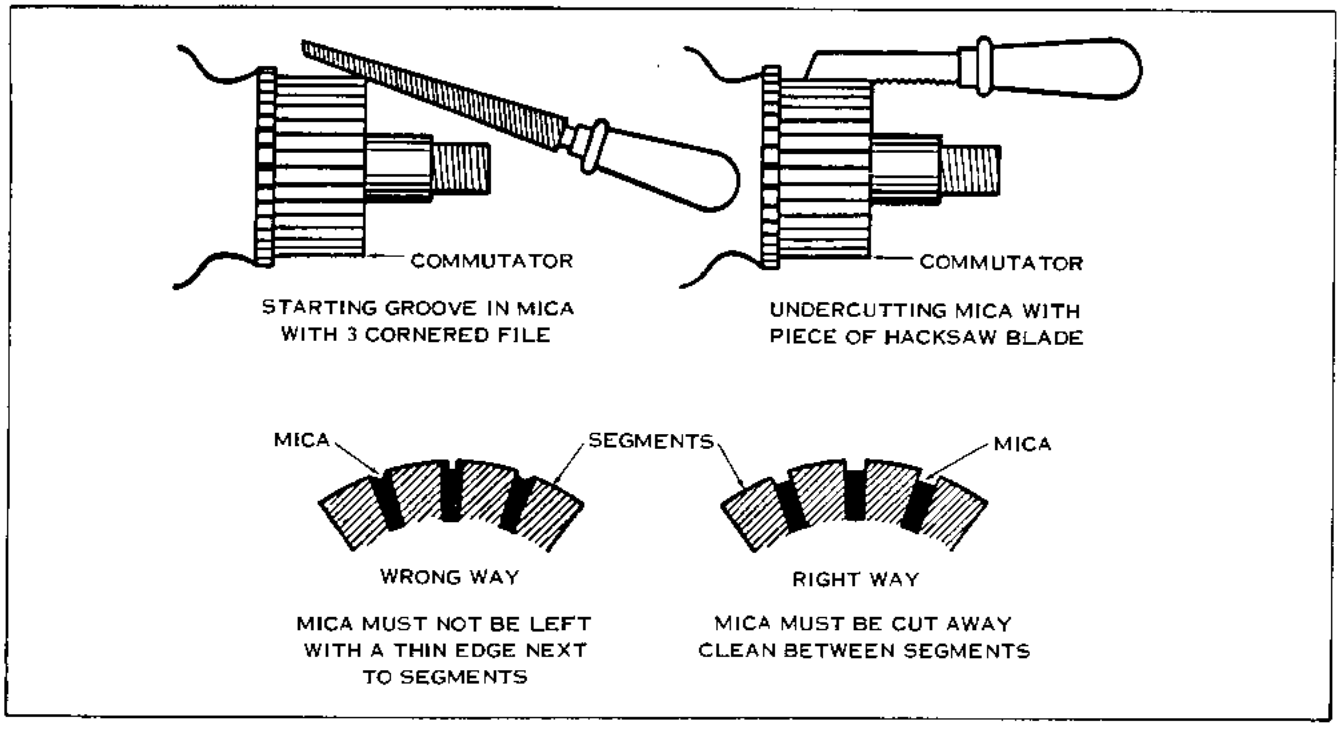


Figure 5E-27L. Recessing Mica Separators

REASSEMBLING STARTER-GENERATOR (Fig. 5E-27F SIBA, 5E-27H BOSCH AND 5E-27I HITACHI

Siba:

Reassemble starter-generator in reverse order of disassembly. Carefully note positioning of insulating washer (10) against end cover (2) when reassembling terminal insulator (11) on terminal stud (12). Do not overtighten terminals. Use care when assembling commutator end cover to prevent damage to spade terminal and insulator. Also retract brushes in holders and hold in place by putting brush spring end against side of brush instead of on top. Then proceed to assemble cover until almost in place against frame and use a hooked wire to lift brush springs to correct position on top of brushes as shown in Fig. 5E-27M.

End covers have registering pins to locate them in correct position on starter-generator frame. Tighten pulley nut to 50 ft. lbs. torque.

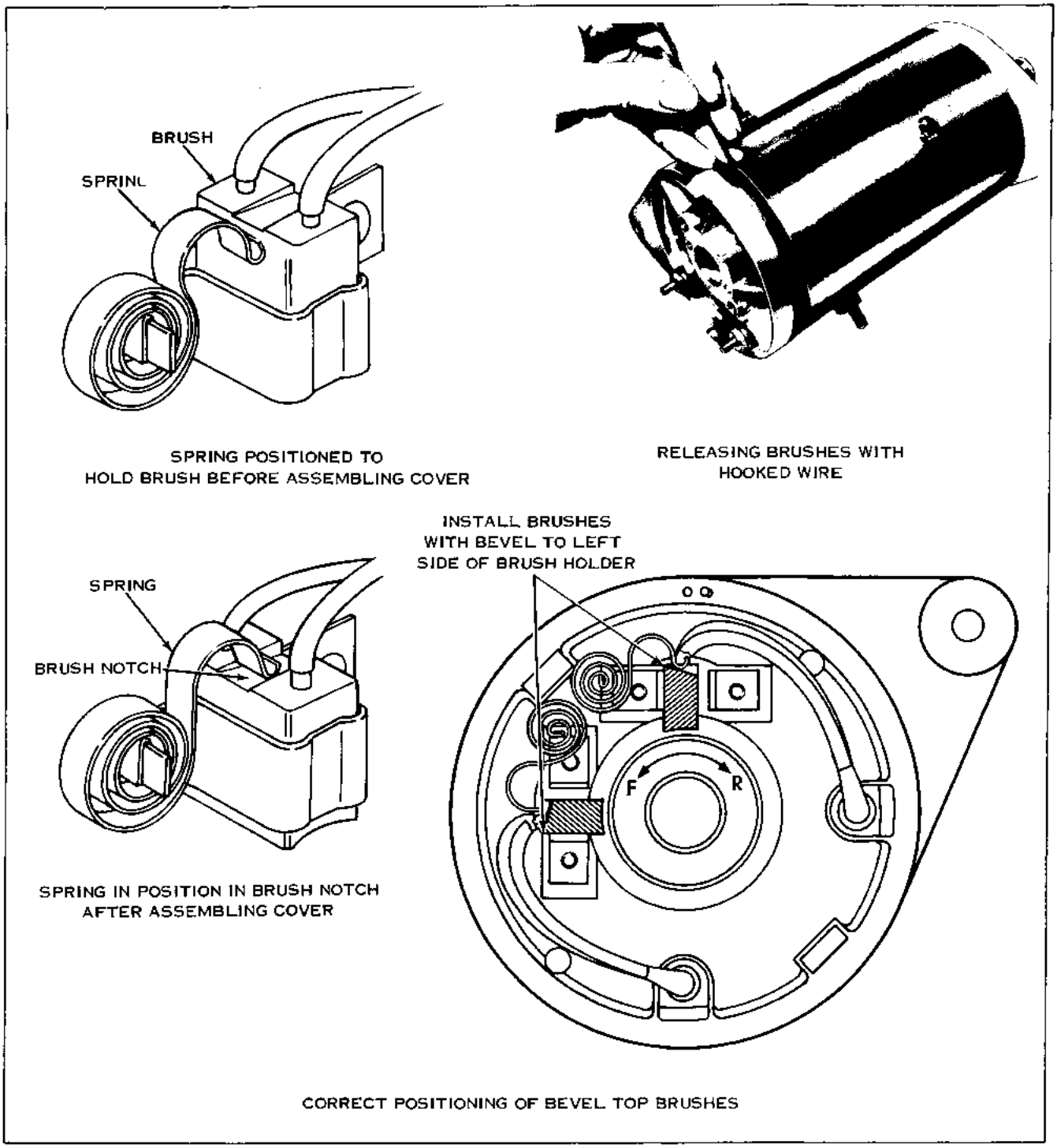


Figure 5E-27M. SIBA Commutator End Cover Assembly

Bosch:

Reassemble starter-generator in reverse order of disassembly starting with assembly of pulley end bearing in end cover. The armature shaft should be pressed into end cover and bearing using an arbor shaft.

To assemble commutator end cover, retract each of the 4 brushes so that they are held in the brush holders as shown in Fig. 5E-27M.

Making sure that bearing thrust washer (8) is in place in the housing, partially assemble end cover so that brushes are over commutator. Release brushes from held position so they ride on commutator and finish pressing cover over bearing. Make a final check of springs to see that they are located in notches in top ends of brushes.

Assemble remaining parts and torque end pulley nut to 30 ft-lbs.

Hitachi:

Reassembly of starter-generator is in reverse order of disassembly, starting with assembly of pulley end bearing (16) in end cover (21). The armature shaft should be pressed into end cover and bearing using an arbor shaft.

To assemble commutator end cover (9) it will be necessary to retract brushes in brush holder. Brushes may be held in place by brush spring pressure until cover is installed. Replace brush covers after assembly and torque end pulley not to 30 ft.-lbs.
bushings and nuts. See Figure 5E-27F or 5E-27Fa.

INSTALLING STARTER-GENERATOR ON CAR

Install lower mounting bolts, washers, lockwashers, bushings and nuts. See Figure 5E-27F or 5E-27Fa .

Assemble spring tensioner or support arm to starter-generator and crankcase. Be sure to assemble spring tensioner with rod eyes in correct position as shown in Figure 5E-27F.

Before attempting to compress tensioner for belt installation, belt tensioner rods should be aligned so that they will not strike the mounting eyes. Use tool, Part No. 97320-67 to compress belt tensioner spring and install belt as shown in Figure 5E-27N.

After belt is installed, turn spring assembly so that rod attached to crankcase stud is on the bottom and other rod is on top.

On 1967-68 and late 1978 and later models with rigid support arm, adjust belt tension as described previously in this Section.

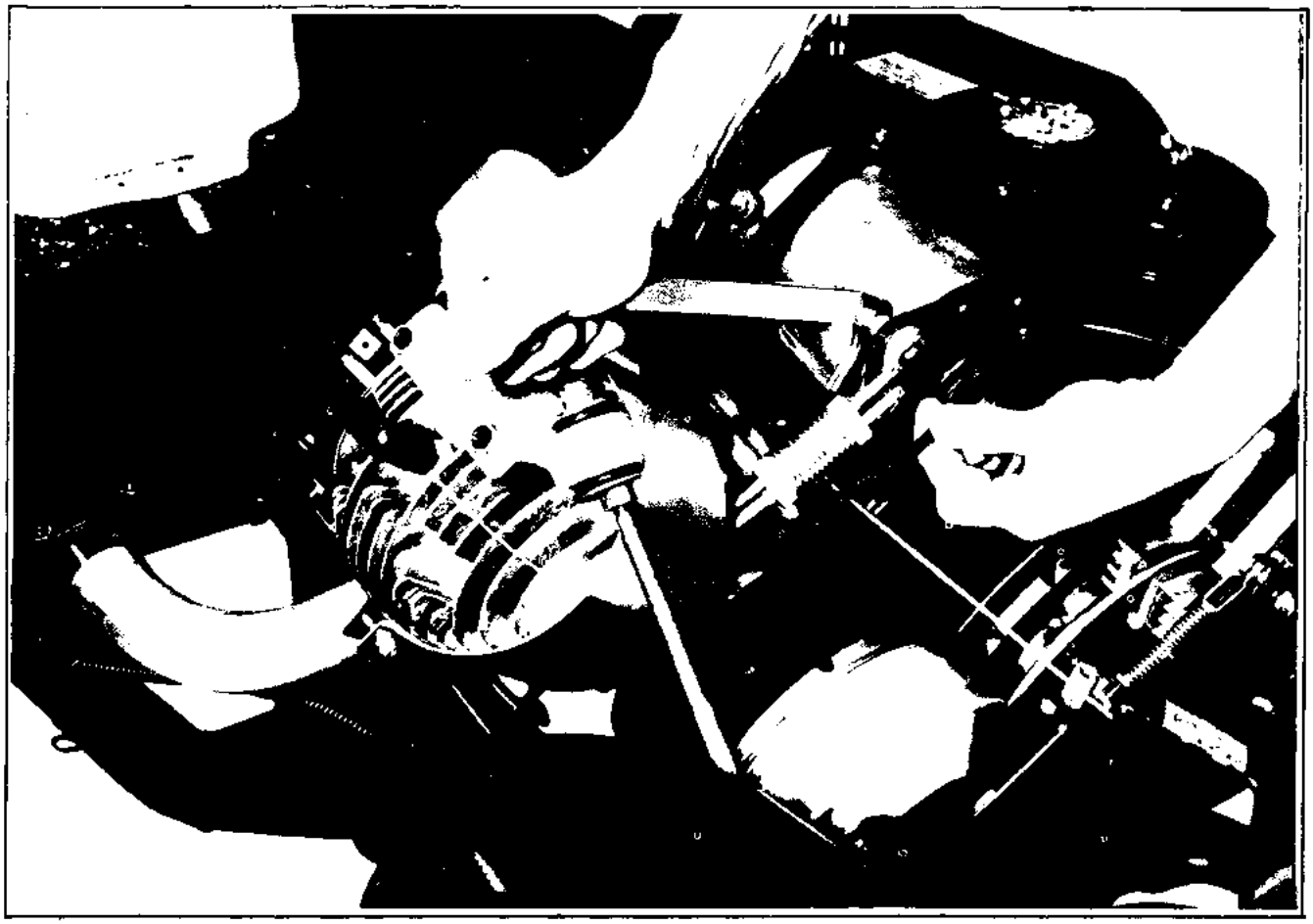


Figure 5E-27N. Installing V-Belt

CIRCUIT BREAKER

GENERAL

The ignition system has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, key switch, accelerator switch, primary coil winding, breaker points, condenser and associated wiring. The secondary circuit consists of the secondary coil winding, the spark plug and associated wiring.

The circuit breaker has two functions. First, the breaker cam and contact points open and close the low tension circuit between the battery and ignition coil causing the coil to produce high voltage discharge to the spark plug. Second, the circuit breaker times the discharge for proper engine firing.

Circuit breaker on early models has automatic advance feature controlled by centrifugal force of flyweights. Total advance is 18° from starting speed to governed speed. The 1967 and later D and 1969 and later DC models have fixed ignition timing. In tracing the current through the ignition system, the initial current comes from the battery. The current flows from the battery through the primary coil to ground and back to the battery while the points are closed. When the cam opens the points, (cam shaft rotates at engine speed) the circuit is broken so that a high voltage surge is produced from ignition coil primary to secondary. This voltage will cause a spark to jump the air gap of the plug.

The condenser is connected to the circuit breaker points and functions to produce a quick collapse of the magnetic field in the coil so that high voltage will be produced. In doing this, the condenser acts to prevent current from continuing to flow across the contact points after points open.

In trouble shooting the ignition system, start with spark plug to see if it is getting a spark according to the following procedure:

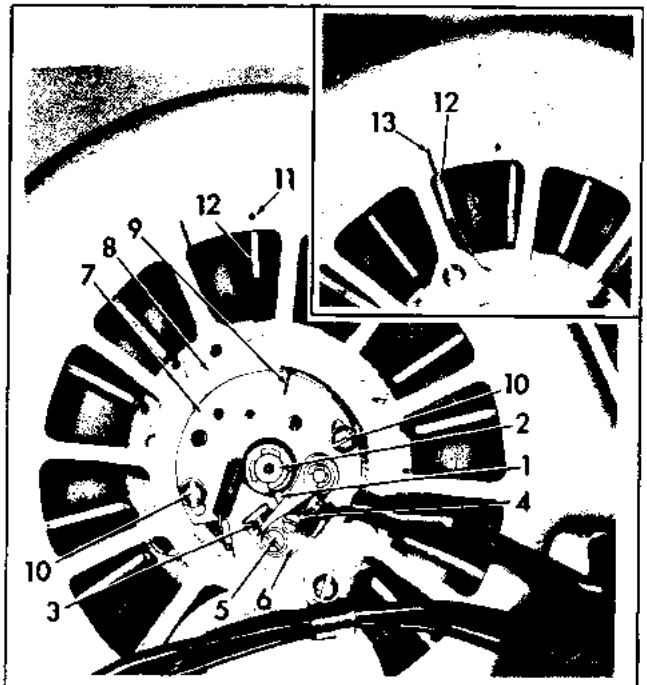
Disengage spark plug cable and insert a metal rod, screw or nail into the spark plug cable. Arrange cable end so tip of inserted metal object is 1/4 in. away from cylinder head. Turn on the ignition, depress accelerator to crank engine and see if a "hot" or "blue" spark is obtained. If not, it is an indication of a weak coil, broken or loose wires, etc. Arcing of the points indicates a faulty condenser.

NOTE

If a "hot" or "blue" spark is obtained, replace spark plug in cable, rest hex head portion of plug on cylinder head, and again crank engine. If no spark or a very weak spark jumps the gap between the spark plug electrodes, then the spark plug is faulty.

ADJUSTING CIRCUIT BREAKER POINTS

Circuit breaker is located on right side of engine. The circuit breaker points should be checked for gap and contact surface condition as specified in regular service interval chart. Remove the cover from over the circuit breaker.



1. Cam follower
2. Cam
3. Contacts
4. Pivot screw
5. Lock screw
6. Breaker assembly base
7. Breaker plate
8. Housing
9. Factory timing marks
10. Screw (2)
11. Timing mark (retard)
12. Blower blade
13. Timing mark (advance)

Figure 5F-11. Circuit Breaker and Timing Marks (1963-66 Model D, 1968 & Earlier DC Models)

Point contact surfaces should appear clean, dull grey, slightly rough. If they are found dirty but otherwise in apparent good condition, clean with a strip of hard surfaced, heavy paper saturated with clean naptha or white gasoline. If points are found with pits, a new set should be installed.

Check and set contact point gap as follows: (See Fig. 5F-11, Fig. 5F-11A, or Fig. 5F-11B.

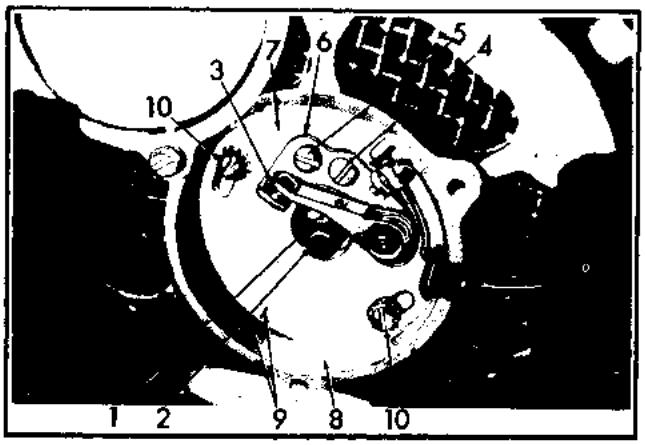


Figure 5F-11A. Circuit Breaker
1967-70 D, 1969-70 DC Models

1.	Cam follower	6.	Breaker assembly base
2.	Cam	7.	Breaker plate
3.	Contacts	8.	Housing
4.	Adjusting screw	9.	Factory timing marks
4A.	Adjustment slot	10.	Screw (2)
5.	Lock screw		

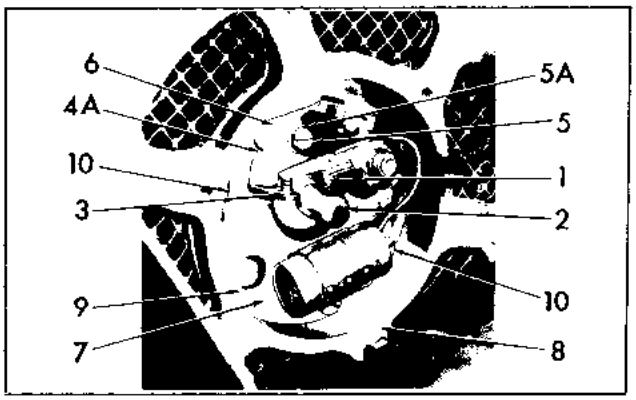


Figure 5F-11B. Circuit Breaker,
1971 & Later Models

Disconnect the spark plug to prevent the engine from starting. Rotate the engine shaft a small amount until cam follower (1) has reached highest point on cam (2). Place a .022 inch wire gage between breaker point contacts (3). If a slight drag is noted when the wire is passed between the points, no adjustment is required. When adjustment is required, loosen lock screw (5) and use screwdriver in adjusting screw (4) or adjustment slot (4A) to move adjustable point a slight amount to obtain the correct point gap. When adjustment is completed, tighten the lock screw (5). Recheck the gap and correct if necessary.

On early models apply a small amount of engine oil to felt oiler, which rides on cam.

Circuit breaker points should be removed, if breaker point pressure is not within prescribed limits of 14 to 18 oz. Check pressure with a spring gauge. The scale should be hooked to the breaker lever at an angle of 90° with the point surface and reading taken just as points break. Excessive pressure causes rapid fiber block wear, cam and breaker point wear, while insufficient pressure will permit high speed point bounce which will, in turn, cause arcing and burning of the points and missing of the engine. Point faces must seat squarely against each other. If bent, square up by bending breaker plate.

REPLACING CIRCUIT BREAKER POINTS (Fig. 5F-12, 1963-66 or Fig. 5F-12A, 1967 and later D)

To replace a set of circuit breaker points on 1963-66 models remove C-clip and washer (7 and 8) from spring lever pivot (9) unplug nylon insulator from hole and lift circuit breaker spring lever and point (10) from stud. Remove lock screw (11) and stationary contact point and support. On 1967 to 1970 D model remove terminal screw (7) and lock screw (11). Lift circuit breaker lever (10) and stationary contact (12) from plate. On 1971 and later model, remove lock screw (11) and washer (11A). Remove condenser wire from point set terminal (10A), and remove point assembly from plate (9A).

Install new points in reverse order of disassembly. Be sure point faces seat squarely against each other. Adjust point gap as previously described in "Adjusting Circuit Breaker Points."

If the condenser is suspected of being defective replace with a proven new condenser and note whether engine performance is improved.

A condenser that is defective will have either an open or short circuit. An open circuit will be evident by excessive sparking at breaker contact points and a shorted circuit will have no noticeable spark at the contact points.

TIMING IGNITION (Fig. 5F-11, 5F-11A, 5F-11B)

Ignition timing is controlled by the circuit breaker. Correct ignition timing and correct setting of circuit breaker contact point gap is absolutely necessary for proper engine operation. After the engine is correctly timed at the factory, the circuit breaker plate (7) and housing (8) are match-marked for guidance (9) when the engine requires tuning and servicing. When these two marks line up, timing is as it was originally set at the factory.

Late models have additional timing marks for 25° forward and reverse timing on outside surface of flywheel. These timing marks are visible through a hole in the blower housing next to ignition coil as shown in Fig. 5F-11C.

The circuit breaker plate is slotted at the two mounting screw locations (10) for adjusting timing when necessary. Do not change from original factory setting unless necessary to retime when circuit breaker parts are replaced or engine is disassembled. In this case disregard the original timing marks on circuit breaker and retime the engine according to the following procedures.

1963-66 Model D, DC and 1967-68 Model DC (Fig. 5F-11)

1. Blower housing is marked to indicate position of piston before top dead center for checking ignition timing. Forward center punch mark (11) indi-

cates 7° (.010 in.) B.T.D.C. piston position when aligned in center of blower blade (12) which has chamfered end.

Figure 5F-11C. Flywheel Timing Marks
1967 & Later D, 1969-1972 DC Models

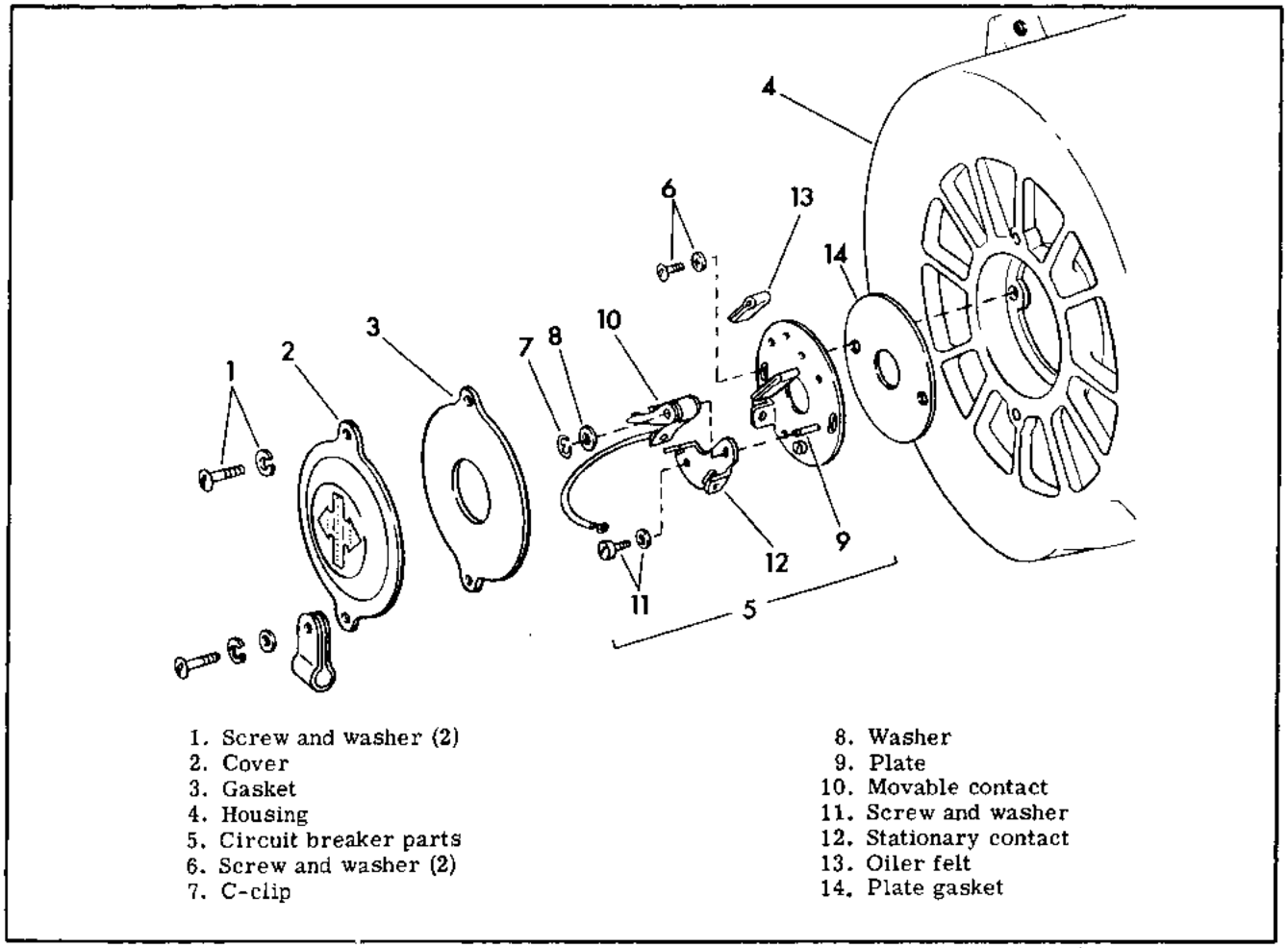
2. Correctly adjust the circuit breaker point gap as described under "Adjusting Circuit Breaker Points."

3. Turn engine crankshaft clockwise in operating direction until blower blade (12) aligns perfectly with forward mark (11) on blower housing. This is the point at which circuit breaker contacts should just start to open (retarded timing). See Fig. 5F-11.

An accurate check as to when points just start to open can be made with a test lamp which consists of a tail lamp bulb wired in series with a six-volt storage battery. Ground the negative battery terminal by connecting to some point on the engine crankcase. Then, connect one of the test lamp wires to the battery positive terminal and the other test lamp wire to the wire leading from the circuit breaker terminal. The lamp bulb will light up when the points are closed and go off when the points open.

4. If it is necessary to readjust timing, loosen the two lock screws (10) and shift the breaker plate assembly so that the fiber cam follower (1) is coming up on the high point of cam (2) just far enough so that the contacts (3) are starting to open. The spark occurs when the points open.

5. Retighten lock screws, turn engine until the cam follower is on the highest point of cam, and check to



1. Screw and washer (2)
2. Cover
3. Gasket
4. Housing
5. Circuit breaker parts
6. Screw and washer (2)
7. C-clip
8. Washer
9. Plate
10. Movable contact
11. Screw and washer
12. Stationary contact
13. Oiler felt
14. Plate gasket

Figure 5F-12. Circuit Breaker (1963-66 Model D, 1968 & Earlier DC Models)

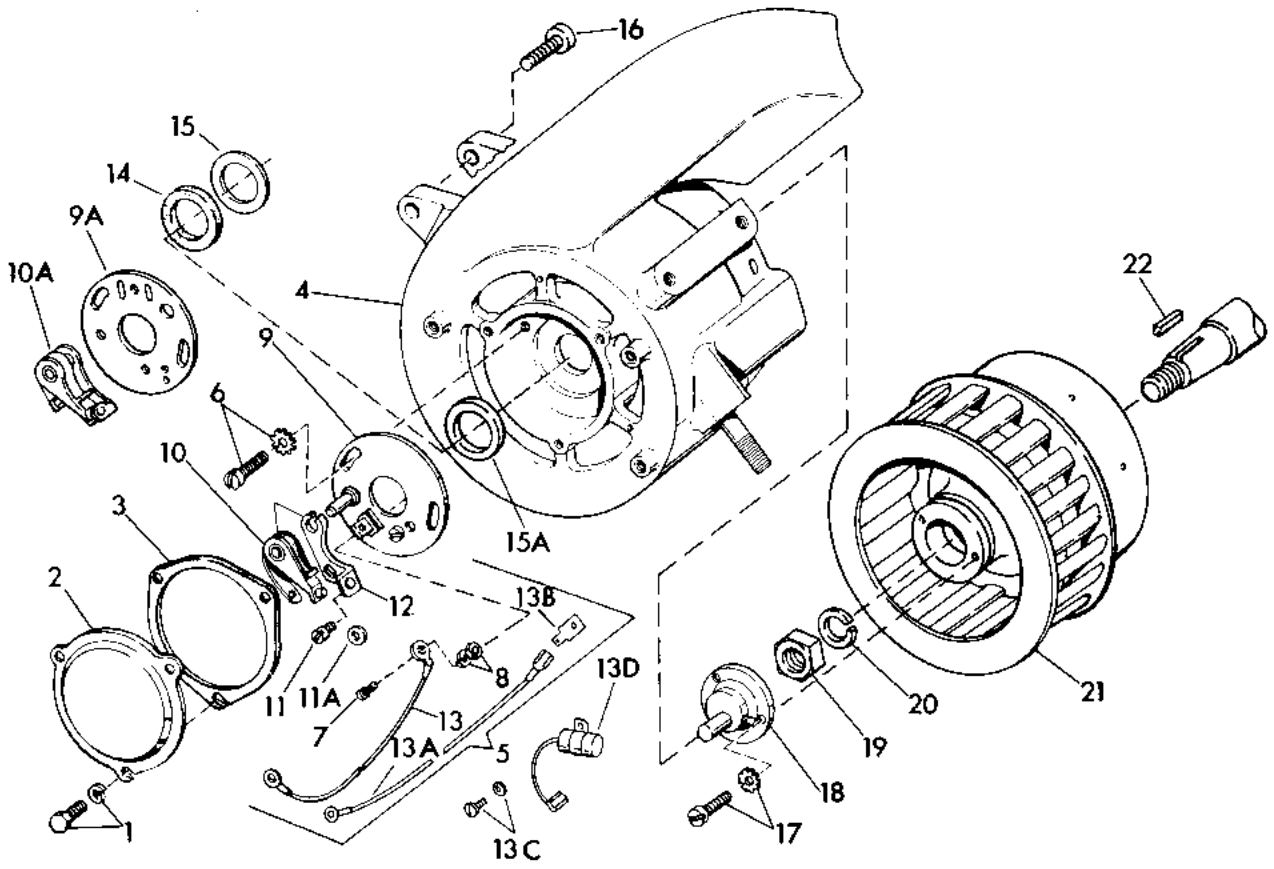
make sure contact point gap is still exactly .022 in. If point gap has changed as a result of shifting contact breaker plate, reset the gap and repeat timing procedure. Install circuit breaker cover.

6. To determine whether advance mechanism is functioning correctly use a strobe timing light. With engine running at approximately 2000 RPM, timing mark on blower blade (12) and rearmost (advance) timing mark on housing (13) should align within 3/8 inch. (Strobe light flashing on timing marks to stop motion.) See Inset Fig. 5F-11.

1967 & Later D, 1969-1972 DC (Fig. 5F-11A and 5F-11C)

Two timing marks are located on outside of flywheel and are visible through hole in crankcase located next to spark coil. See Fig. 5F-11B. Each mark is 25° before piston top center, one for forward engine operation and the other for reverse engine operation. Check and adjust ignition timing in forward and reverse running direction as follows:

1. Correctly adjust the circuit breaker point gap as described under "Adjusting Circuit Breaker Points".



1. Screw and washer (3)
2. Cover
3. Gasket
4. Housing
5. Circuit breaker parts
6. Screw and washer (2)
7. Terminal screw
8. Terminal nut and lockwasher
9. Plate (1967-70)
9A. Plate (1971 & Later)
10. Movable contact (1967-70)
10A. Contact point set (1971 & Later)
11. Lock screw
11A. Lock screw washer (1971 & Later)
12. Stationary contact (1967-70)
13. Terminal wire (1967-70)
13A. Terminal wire (1971 & Later)
13B. Terminal wire adapter (1971 & Later)
13C. Condenser screw and lockwasher (1968 & Later)
13D. Condenser and bracket (1968 & Later)
14. Felt washer (1967 to early 1969)
15. Gasket (1967 to early 1969)
15A. Oil seal (late 1969)
16. Fan housing screw (3)
17. Cam screw and washer (2)
18. Cam
19. Nut
20. Lockwasher
21. Fan and flywheel assembly
22. Key

Figure 5F-12A. Circuit Breaker and Fan (1967 & Later D, 1969-1972 DC Model) - Exploded View

2. Forward Timing: Turn engine crankshaft clockwise in forward operating direction until forward mark (25° BTC) appears in center of hole in blower housing as shown in Fig. 5F-11C. This is the point at which circuit breaker contacts should just start to open.

An accurate check as to when points just start to open can be made with a test lamp which consists of a tail lamp bulb wired in series with a battery. Ground the negative battery terminal by connecting to some point on the engine crankcase. Then, connect one of the test lamp wires to the battery positive terminal and the other test lamp wire to the wire leading from the circuit breaker terminal. The lamp bulb will light up when the points are closed and go off when the points open.

3. If it is necessary to readjust timing, loosen the two lock screws (10) and shift the breaker plate assembly so that the fiber cam follower (1) is coming up on the high point of cam (2) just far enough so that the contacts (3) are starting to open. The spark occurs when the points open.

4. Retighten lock screws, turn engine until the cam follower is on the highest point of cam, and check to make sure contact point gap is still exactly .022 in. If point gap has changed as a result of shifting contact breaker plate, reset the gap and repeat timing procedure.

5. Reverse Timing: Turn engine crankshaft counterclockwise in reverse operating direction. Points should open when reverse mark (25° BTC) appears within limits of hole.

NOTE

If reverse timing mark is past hole in reverse direction (timing too far retarded), open circuit breaker points as necessary to advance timing. If reverse timing mark is in front of hole (timing too far advanced), close circuit breaker points as necessary to retard timing.

It will be necessary to reset circuit breaker plate for correct forward timing after point gap has been changed. If correct forward and reverse timing cannot be obtained within .016 to .028 point gap, replace circuit breaker cam and retime engine.

6. A strobe timing light can be used to check ignition timing while engine is operating at governed speed. Raise left rear wheel with jack or suitable blocking so it can turn freely. Run engine at 3000 RPM governed speed in forward direction. Forward timing mark should appear in center of hole in fan housing (strobe light flashing on timing mark to stop motion). Repeat with engine running in reverse direction. Reverse timing mark should be within limits of hole in fan housing. See Fig. 5F-11C.

DISASSEMBLING AND ASSEMBLING CIRCUIT BREAKER (1963-66 Model D, DC and 1968 and earlier Model DC) (Fig. 5F-12)

Remove cover screws and washers (1), cover (2) and gasket (3) from fan housing (4).

Circuit breaker (5) can be removed as an assembly by removing screws and washers (6) which secures breaker plate (9) or to fan housing (4). Reinstall circuit breaker in reverse order. Note marks for positioning breaker plate in fan housing according to original factory timing.

1. Screw (2)
2. Advance mechanism
3. Armature rotor
4. C-clip
5. Washer
6. Cam
7. Plate
8. C-clip (2)
9. Washer (2)
10. Weights (2)
11. Washer (2)
12. Spring (2)

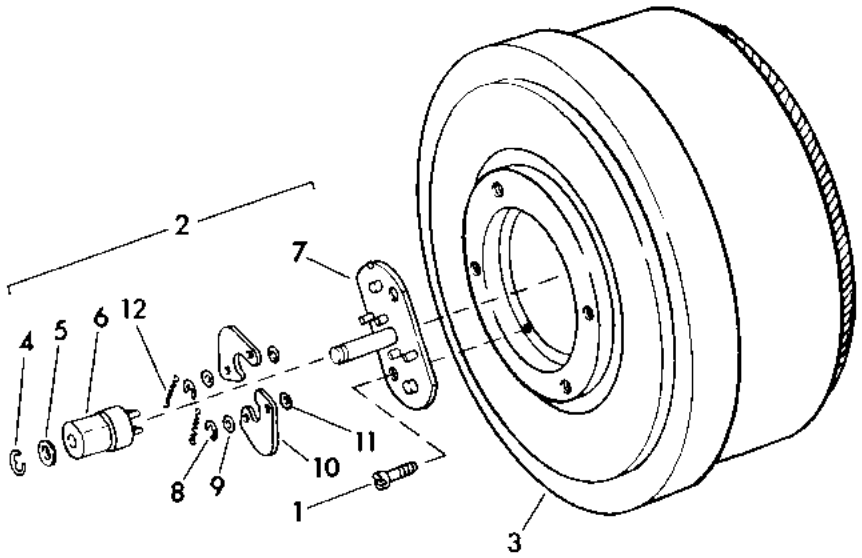


Figure 5F-13. Circuit Breaker Advance Unit - Exploded View
(1963-66 Model D, 1968 & Earlier DC Models)

To disassemble circuit breaker points, see previous paragraph, "REPLACING CIRCUIT BREAKER POINTS".

DISASSEMBLING AND ASSEMBLING CIRCUIT BREAKER ADVANCE UNIT (1963-66 D, 1968 and earlier DC) (Fig. 5F-13)

Remove fan housing held to crankcase by 3 screws. See previous paragraph, "Disassembling Starter-Generator."

Advance mechanism (2) can be removed as an assembly by removing two screws (1) which secure it to armature rotor (3).

Remove cam C-clip (4), washer (5), cam (6) from cam pivot stud on base plate (7). Similarly, remove C-clips (8), washers (9), weights (10) and washers (11) from fly-weight pivot studs on base plate (7). Unhook spring (12) ends to remove springs.

Lubricate and reinstall parts in reverse order. Note that notch in base plate should register on index point in counterbore of armature rotor. If this is not done, timing will be incorrect.

DISASSEMBLING AND ASSEMBLING CIRCUIT BREAKER CAM AND FAN (1967 and later D, 1969 and later DC Models (Fig. 5F-12A)

Remove fan housing (4) held to crankcase by 3 screws (16). Circuit breaker cam (18) is held in fan recess with 2 screws and washers (17) and fits only one way. Remove nut (19), lockwasher (20), and pull fan (21) from crankshaft taper with a claw puller. Reinstall parts in reverse order.

IGNITION COIL

DESCRIPTION

The ignition coil is a pulse transformer that transforms or steps up low voltage to high voltage necessary to jump the electrode at the spark plug. Internally, coil consists of primary and secondary windings with laminated iron core surrounded by oil and sealed in a cannister. Case cannot be taken apart or coil repaired.

TROUBLESHOOTING

When hard starting or missing indicates some fault in the ignition system, first, check the condition of spark plug. If a cleaned or new plug does not correct performance, inspect breaker points and condenser. Check for broken or frayed wires in ignition primary circuit. Check coil electrically (see Fig. 5G-5 & 5G-6) to determine its condition, or substitute with a new coil or one from a car that is in good running order. Inspect spark plug cable and grommets for cracks.

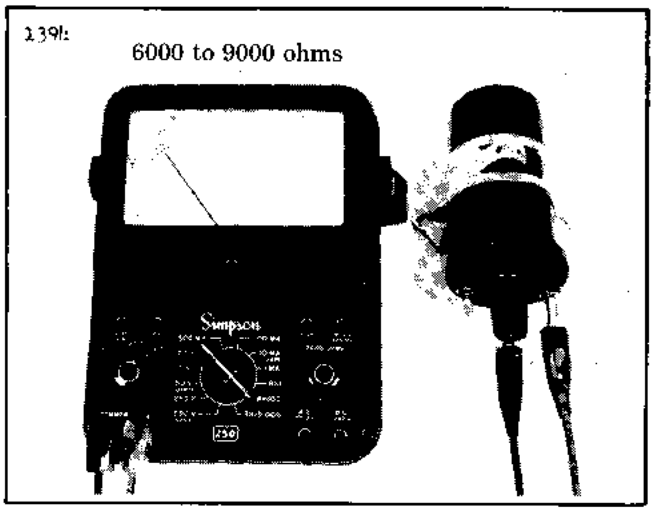


Figure 5G-6. Checking Secondary Winding for Resistance

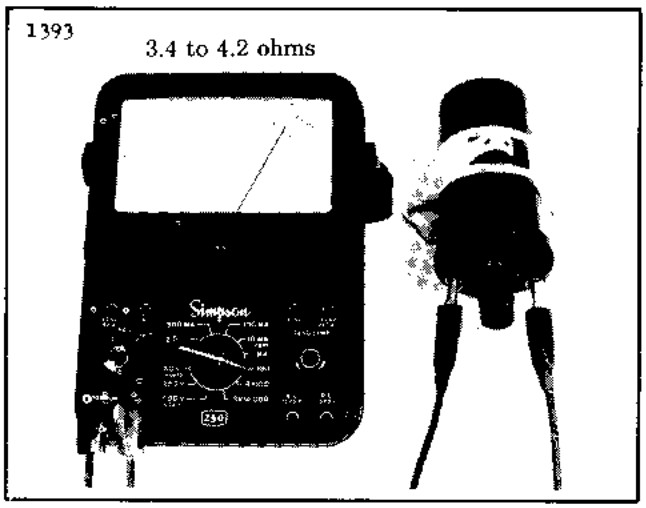


Figure 5G-5. Checking Primary Winding for Resistance

Attach new coil temporarily at any convenient point near old coil (coil with function without being securely grounded). On 1963-68 models the coil does not have to be grounded, however the condenser must be securely grounded. Transfer terminal wires to new coil according to the information given in the wiring diagram. Attach new cable to spark plug.

The engine will not operate unless sufficient voltage is supplied.

Slight seepage of oil from the coil does not necessarily indicate the coil has failed, however leakage of a quantity of oil may indicate the coil is breaking down internally and is reaching the end of its useful life.

Check spark plug cable with ohmmeter (Fig. 5G-7. A resistance of 3000 to 7000 ohms per foot is required on supression (resistance) cable. A 16 in. supression cable needs approximately 4200 to 9100 ohms. Metalic core cable resistance should be 0 ohms.

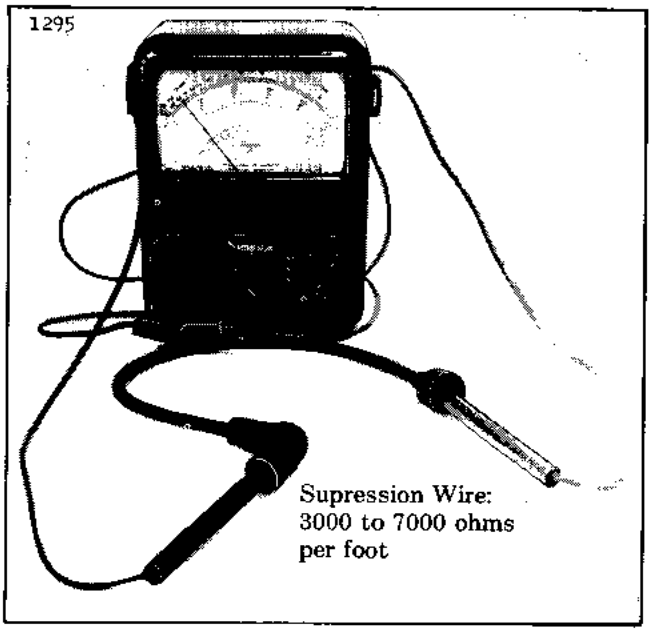


Figure 5G-7. Checking Cable for Resistance

REPLACING SPARK PLUG CABLE (Fig. 5G-4)

When inspection indicates that plug cable is faulty, proceed as follows:

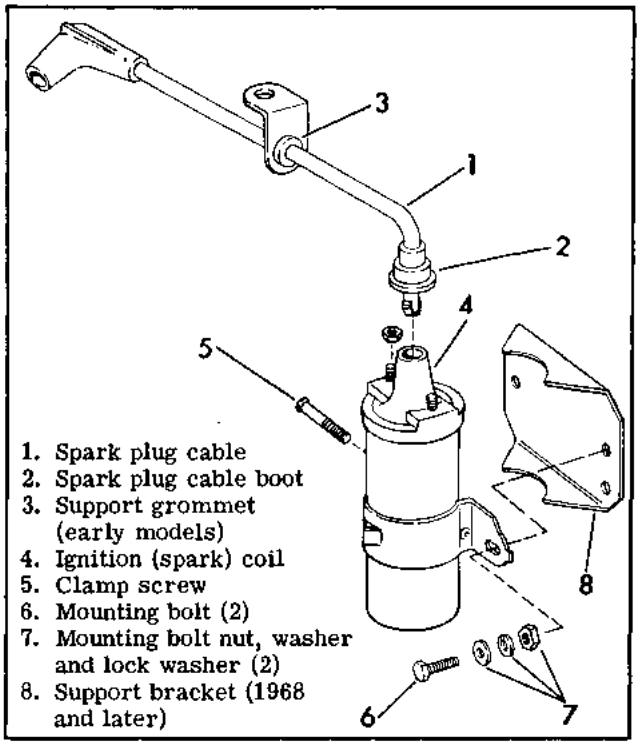


Figure 5G-4. Ignition Coil

Pull old cable (1) from coil terminal, remove boot (2) and support grommet (3), and install new cable. Always be certain that cable boot (2) is securely tightened to the coil (4) tower to prevent moisture and dirt from contacting the high tension lead. Replace boot (2) and support grommet (3) if damaged or loose fitting.

SPARK PLUGS

GENERAL

Harley-Davidson spark plugs have been designed to give maximum life and efficient combustion of fuel. They are available in four "heat ranges," each for specific service application. Plugs are labeled 2, 3, 4, or 5, with the lowest number indicating the "hottest" plug. The No. 5-6 plug is an extended core type plug.

Plugs are selected to suit a specific engine design and vehicle operating conditions. See specifications for standard plug recommendation. Hotter than standard plugs are recommended for light service and colder than standard plugs are recommended for hard service.

REMOVING SPARK PLUGS

Use a deep socket wrench or special spark plug wrench to loosen the plug. Blow away all dirt from plug base with compressed air before removing plug.

CLEANING, INSPECTION AND REPAIR

Examine the plug. The deposit on the plug base is an indication the correctness of the plug heat range and efficiency as well as a guide to the general condition of engine, fuel and ignition system.

SPARK PLUG CONDITIONS & ANALYSIS

Core Bridging, Gap Bridging

Combustion particles wedged or fused between the electrodes or the core nose and shell.

Both core bridging and gap bridging are caused by excessive combustion chamber deposits striking and adhering to the spark plug's firing end. They originate from the piston and cylinder head surfaces. These deposits are formed by one or a combination of the following:

Excessive carbon in cylinder. Use of non-recommended oils. Immediate high-speed operation after prolonged low-speed running. Improper ratio of fuel/oil mixture.

Wet Fouling

Damp or wet, black carbon coating over entire firing end. Forms sludge in some extreme cases.

Wrong spark plug heat range (too cold). Prolonged slow operation. Low-speed carburetor adjustment is too rich. Improper ratio of fuel-to-oil mixture (too much oil). Worn or defective breaker points, resulting in lack of voltage.

Overheating

Electrodes badly eroded. Premature gap wear. Insulator has gray or white "blistered" appearance.

Incorrect spark plug heat range (too hot). Ignition timing overadvanced. Consistent high-speed operation.

Preignition

Melted electrodes and/or white insulator indicates sustained preignition. (Insulator may be dirty due to misfiring or debris in the combustion chamber.)

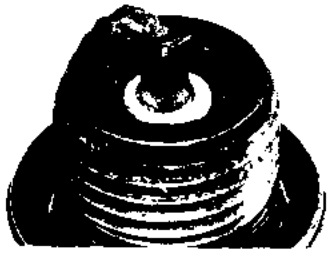
Check for correct plug heat range, proper lubrication and/or overadvanced ignition timing. Determine the cause of preignition before putting engine back into service.

Aluminum Throw-Off

Aluminum deposits on electrodes and insulator core nose.

Caused by first stages of preignition within the cylinder which melts the aluminum alloy of the piston crown. Do not install new plug until piston is examined and the source of preignition is determined.

Normal



Light tan to gray color and slight electrode wear indicate correct heat range.

Change plugs at regular intervals using same heat range.

TESTING SPARK PLUGS

Check the sparking ability of a cleaned and regapped plug on a sparking comparator if possible. An inability to withstand rapid firing under cylinder compression conditions can be discovered.

SETTING SPARK GAP

Before setting the spark gap on a used plug, pass a thin point file (or nail file) between the electrodes to produce flat, parallel surfaces to facilitate accurate gauging.

Use only a wire type gauge. Bend the outside or grounded electrode so only a slight drag on the gauge is felt when passing it between the electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs as follows:

No. 2-5 (short reach - 1965-1970) . . . . . .040-.045 in.
No. 5-6 (long reach - 1971 & later) . . . . . .025 in.

INSTALLING SPARK PLUGS

Before turning the spark plug into the cylinder head, check the condition of threads in head and on the plug. Soften deposits in cylinder head with penetrating oil and clean out with tap or old plug.

Install a new spark plug gasket and turn the plug down finger tight. Tighten to 15-20 foot-pounds with a torque wrench.

Check and if necessary, adjust engine idle speed and mixture setting after installing a new plug.

VOLTAGE REGULATOR
(1963-66 D, 1963-68 DC)

GENERAL

The generator output is controlled by the voltage control unit protecting the battery from overcharge and other components from too high voltage. Basic regulator operation is described in Section 5A.

In addition to the conventional voltage control coil connected in series with the generator field, a current coil is wound integral with the voltage coil with full current from the generator passing through this coil. This serves to reinforce the magnetic strength as the output of the generator increases, attracting the armature of the regulating unit, opening the contacts in the field circuit to reduce generator output. Thus, with a high current flow, the voltage will drop slightly. This characteristic is adapted to the prevailing conditions so that when all power consumers are connected with the battery discharged, the maximum output of the generator will not be exceeded. This also adapts the charging current to the existing level of the battery charge state by charging a low battery with a high current, but charging a fully charged battery with a low current.

SERVICE INFORMATION

The voltage control unit is located in the control box along with the starter relay and cutout relay. The regulator unit and cutout relay unit require no internal attention and are not adjustable. If tests indicate that either unit is defective, the entire control box must be replaced.

GENERATOR TEST

To determine if the voltage regulator and cutout relay or the generator is faulty, make the test specified for the generator. See "Checking Generator Circuit." If the trouble is isolated to the voltage regulator or cutout relay unit, make the following tests to determine if these units are functioning correctly.

TESTING VOLTAGE REGULATOR UNIT

Battery must be in good condition and fully charged (1.270 Hydrometer reading in each cell). Engine must be warmed up so that regulator is at normal operating temperature.

1. Remove the black wire at the control box terminal marked 61/D+. Using a 0-15A. D.C. Ammeter, connect the negative lead to 61/D+ terminal and the positive lead to the black wire removed from the terminal. See Fig. 5I-3. Start the engine and run in neutral at 2000 rpm. If ammeter shows more than 1/2 amp., cutout relay is functioning correctly and voltage unit is operating.

2. If ammeter does not show a charge on above test, proceed directly to Step 3. If ammeter does show a charge, check the voltage values running the engine at 3500 rpm. (Use electric tachometer for 2-cycle engine, and connect a 0-15 V. D.C. voltmeter from 51/30 terminal of control box to ground.) See Fig. 5I-3.

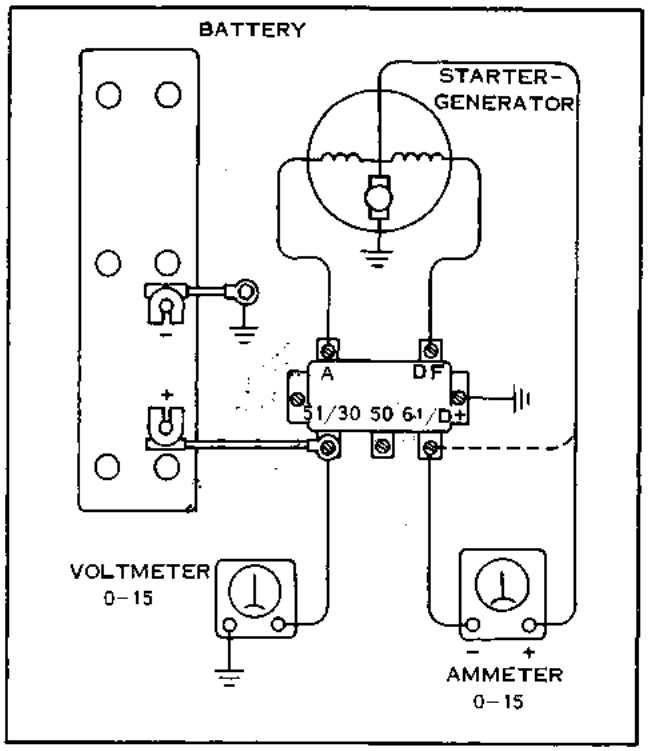


Figure 5I-3. Voltage Regulator Test

Voltage must be not less than 14 V. at 7-1/2 amp. at 3500 rpm. Note: Use load bank in parallel with battery if necessary, to obtain 7-1/2 amp. value.

Voltage must be 15 to 16 V. at 2 amperes or less at 3500 rpm.

Note: Battery must be fully charged to obtain this low charge rate.

If voltage values do not correspond to above specifications, control box should be replaced.

3. If generator does not show a charge on ammeter in above tests, remove black wire from control box terminal marked DF and while running engine, touch it to the control box ground strap. (CAUTION: Do not ground black wire while connected to DF terminal

or serious damage to regulator points will result.) If the generator fails to charge when grounding the wire from the DF terminal, proceed directly to Step 4. If the ammeter shows a charge of 1/2 amp or more, the defect is in the voltage regulator unit of the control box or control box is not grounded. Check for secure ground strap connection from control box base to engine crankcase bolt. If ground is O.K., the control box is faulty and should be replaced.

5. Remove ammeter negative lead from the control box 61/D+ terminal. Attach black wire, previously removed from the control box DF terminal in Step 3, to control box strap. Start engine and run at 2000 rpm. Touch negative ammeter lead to control box terminal 51/30. If ammeter shows a charge, the difficulty is in the cutout relay section of the control box and replacement of the control box assembly is necessary.

NOTE: It is not necessary to polarize the generator-regulator-battery circuit as this is done through the internal circuit of the starter-generator each time the starter circuit is operated.

VOLTAGE REGULATOR

(1967 AND LATER D, 1968-1972 DC, 1972 AND LATER D4)

SERVICE INFORMATION

A voltage regulator is used to control the generator output. The function of the regulator in the circuit is shown in the schematic circuit diagram, Figure 5I-1. Note that cutout relay unit of the regulator is not used in the circuit.

The regulator requires no internal attention. If tests indicate that the regulator is defective, it should be replaced.

If trouble is experienced with the electrical system it is first necessary to determine if the generator or the regulator is faulty.

GENERATOR TESTS

To determine if the generator is functioning properly, make the tests specified for the Generator, Section 5E.

CAUTION: Do not ground regulator "DF" terminal of regulator! Remove generator field wire from terminal and ground it when making output tests.

If generator tests indicate that the regulator is defective, it should be replaced.

REGULATOR TESTS

Make the following electrical tests to determine if the regulator is functioning correctly. Battery must be in good condition and fully charged (1.270 Hydrometer reading in each cell). Engine must be warmed up so that regulator is at normal operating temperature. Make all tests with lights off.

Connect voltmeter positive lead to regulator terminal marked D+ and the voltmeter negative lead to regulator terminal marked "D-" (ground).

With the regulator cover in place and the regulator at operating temperature, run the engine at approximately 3000 RPM (governed speed) and read the voltmeter.

If voltmeter reads within specified voltages (Figure 5I-1), at approximately 75° air temperature surrounding the vehicle, it indicates that the voltage regulator is functioning properly.

If voltmeter reading is above upper limit, generator charging rate is too high and will over-charge the battery causing possible internal battery damage.

If voltmeter reading is under lower limit, charging rate is too low and may result in a discharged battery.

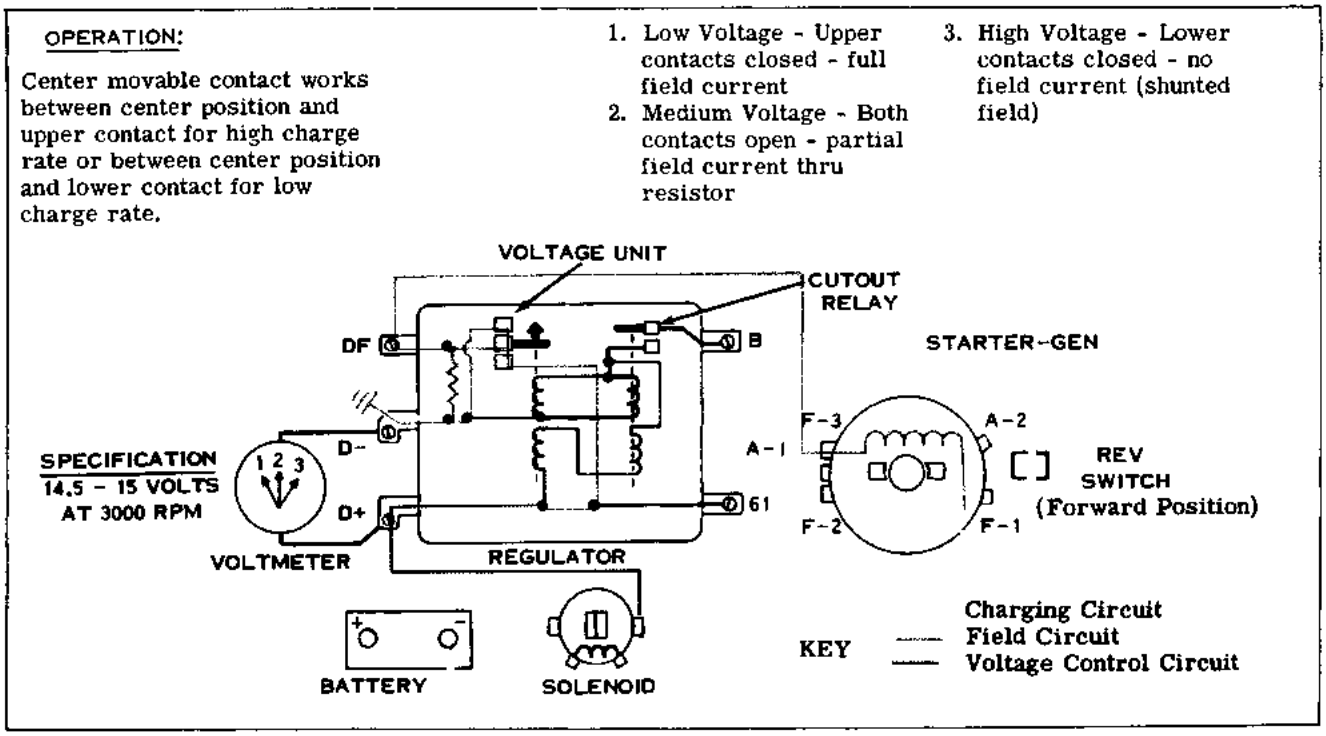


Figure 5I-1. Voltage Regulator and Charging Circuit Gasoline Car

ADJUSTING CHARGE RATE – HITACHI VOLTAGE REGULATOR

NOTE:

Adjustment must be made with golf car battery fully charged and voltage regulator at normal operating temperature, at least 70°F.

1. Run engine to stabilize regulator and raise temperature of regulator to at least 70°F.

2. Attach voltmeter across battery, or across D+ and D- terminals of voltage regulator.

3. Run engine at governed speed (3000 rpm) and check voltage reading. Correct reading is 14.5-15.5 volts.

4. To adjust voltage regulator remove cover, loosen locknut (1, Figure 5I-2) and turn adjusting screw (2, Figure 5I-2) in (clockwise) to increase voltage or out (counterclockwise) to decrease voltage.

5. When correct voltage reading is obtained, tighten locknut, recheck voltage reading and install voltage regulator cover gasket and cover.

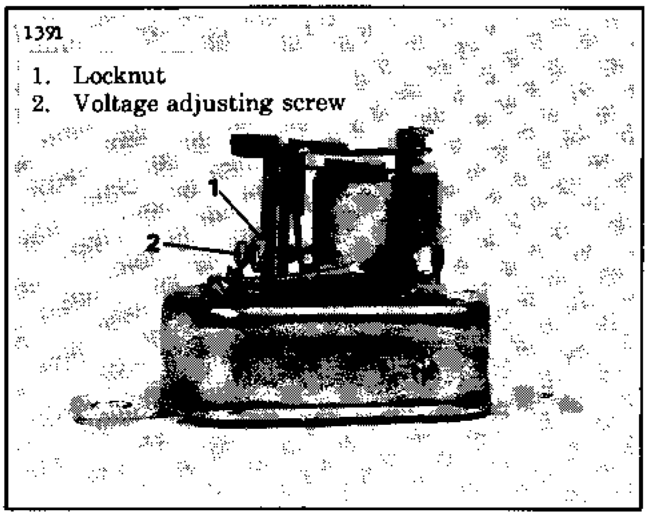


Figure 5I-2. Adjusting Hitachi Voltage Regulator

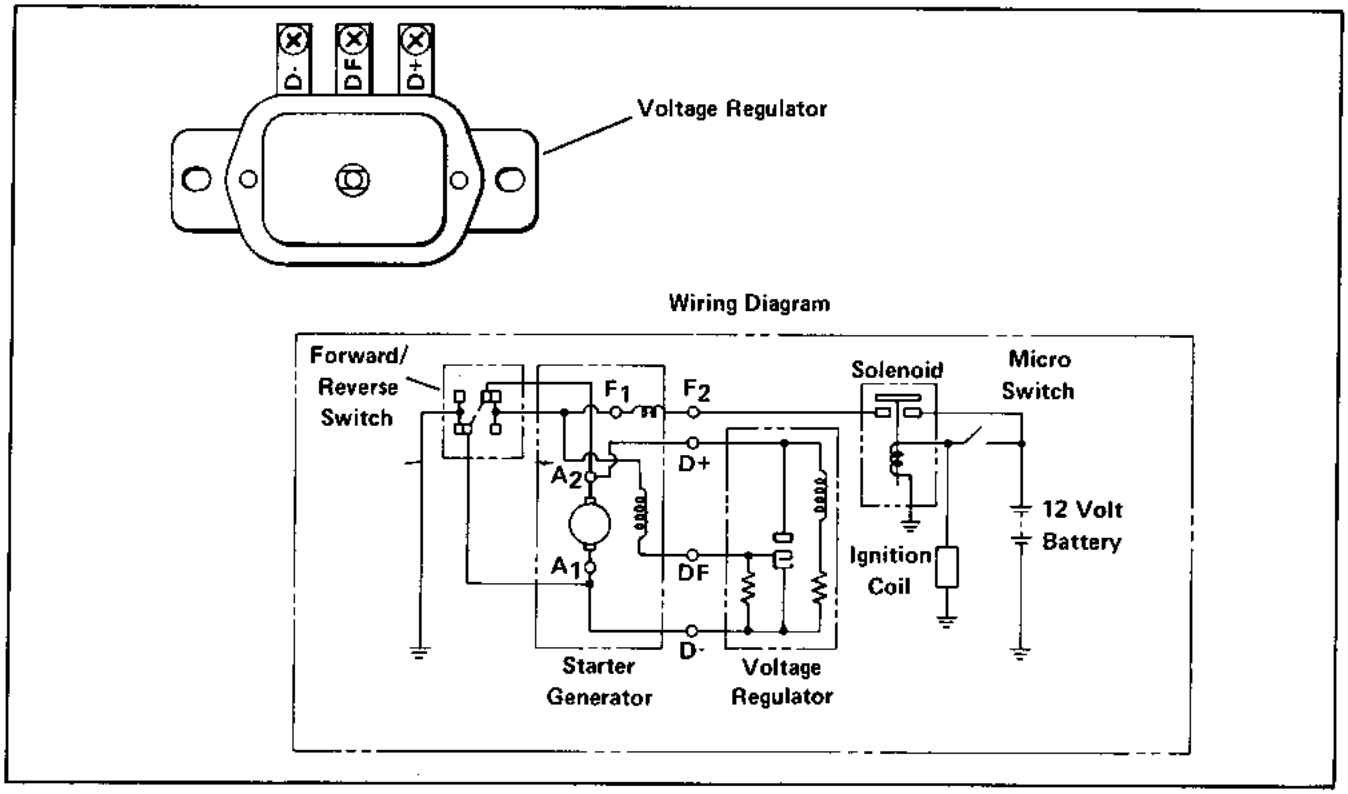


Figure 5I-3. HITACHI Regulator Charging Circuit

BATTERY

The battery serves as a power source for the starting motor, ignition and to operate accessories before the engine starts; to provide additional current, when necessary, over the amount being generated. For a battery to remain in good condition, the current draw must be balanced by the generator output and must be serviced at periodic intervals determined by severity of usage. The Harley-Davidson 12-volt battery is a six cell unit capable of supplying a 60 ampere current demand used by the starter motor.

BATTERY CARE

Prompt and correct battery care determines the life span and efficency of the unit. Therefore, for the longest possible useful life, the following must be observed.

1. Keep battery solution (electrolyte) level up in cells.
2. Keep batteries charged.
3. Keep battery and connections clean.

These items are covered in detail in this section.

The battery solution should be maintained within the triangular section of filler opening. When not up to correct level, fill to triangle with distilled or approved water. Be careful not to overfill. Overfilling will result in some of the electrolyte being forced out through cap vent holes, diluting or weakening the solution strength. An overflow of battery solution will cause cables to corrode and parts near the battery to be damaged. Solution level should be checked once a month in normal service and more often in hot weather when vehicle is in continuous use.

If a battery is operated with plates exposed, the acid will reach a dangerously high concentration that may char and disintegrate the separators and may permanently sulphate and impair the performance of the plates. Plates cannot take full part in battery action unless they are completely covered by solution. Keep solution up to specified height by adding approved water. When it is necessary to add water to batteries, they must be charged before an accurate specific gravity reading can be taken.

Acid should not be added to a cell unless it has been lost and then it should be replaced only under conditions as described in section on "Adjustment of Specific Gravity."

Under normal circumstances, it is not necessary to charge the battery from an external source if it is in good mechanical condition and the generator and regulator are operating correctly. However, it is necessary to boost charge occasionally during extended idle periods, or if the battery becomes discharged due to a short circuit or other accidental means. See "CHARGING" and "STORAGE" in this section.

Clean battery and terminals when necessary with a baking soda-water solution. Be careful to avoid getting any of the solution into the cap vent holes. When solution stops bubbling, flush off battery with clean water.

Coat terminals with grease after wires have been attached to retard corroding.

WARNING

Batteries contain sulfuric acid. Avoid contact with skin, eyes, or clothing.

ANTIDOTE — External — Flush with water.
Internal — Drink large quantities of milk or water followed by milk of magnesia, vegetable oil, or beaten eggs. Call doctor immediately.
Eyes — Flush with water and get immedate medical attention.

Batteries produce explosive hydrogen gas at all times, especially when being charged. Keep cigarettes, open flame, and sparks away from the battery at all times. Ventilate area when charging battery. Always protect hands and eyes with shield or goggles when working near a battery or acid. KEEP BATTERIES AND ACID OUT OF THE REACH OF CHILDREN!

CHARGING

The most valuable characteristic of the lead-acid storage battery is its chemical reversibility. This means the storage battery may be connected to a charger or generator to have an electric current passed through it in the direction opposite to the direction of discharge and restore the battery's active chemicals to "good as new" state.

Never allow a battery to stand in a discharged condition. Start charging it at once using 12-volt conventional charger capable of delivering the recommended charging rate.

DO NOT EXCEED A CONTINUOUS CHARGE RATE OF 10 AMPERES.

Charging a battery at too high a rate will cause battery temperature to rise high enough to permanently damage battery plates.

CAUTION

If battery is overly filled, some of the solution will be forced out through the vent holes when battery is charging. This will not only weaken the solution, but also may damage parts near the battery. Keep battery clean and lightly coat terminals with petroleum jelly to prevent corrosion. Do not overtighten terminal connections. To prevent battery case damage caused by pressure build-up, be sure breather tube is properly routed and not kinked or obstructed.

WARNING

Battery should be charged in a well ventilated area with the filler caps removed. Be sure charger is properly connected and adjusted, observing positive (+) and negative (-) polarity to battery.

TESTING BATTERY

Use the following instructions for testing battery condition. As a guide for determining when to start or stop charging, check charge state in all cells.

HOW TO TEST

Discharged, or less than 1/2 charged batteries (1.210 gravity or 2.04 open circuit cell voltage) must be recharged in order to have charge sufficient for testing. Use hydrometer (A), cell tester (B), or load tester (C), as follows:

A. Use of Hydrometer: (Refer to chart below)

1. Be sure to correct reading for temperature extremes. For each 10° above 80°F. add 4 points, or deduct 4 points for each 10° below 80°F.

Note: Harley-Davidson Hydrometer, Part No. 96802-63 has built-in thermometer and correction chart and is recommended for testing all batteries.

2. Read gravity of each cell and record.

3. If any 2 cells vary more than 50 points, replace battery.

4. If cells are even or vary only slightly, battery is generally not "suspect."

5. Batteries with satisfactory specific gravity (1.220 or better) but very low or no open circuit voltage are probably not serviceable.

B. Use of Cell Tester: (Refer to chart below)

1. Remove surface charge.

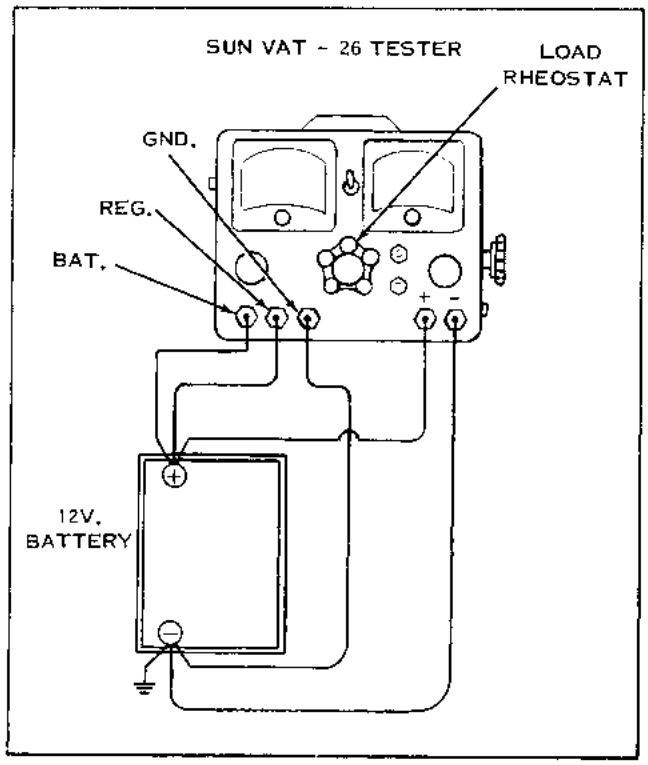


Figure 5J-7. Testing Battery Capacity

BATTERY CONDITION

State of Charge	Specific Gravity (A)	Freezing Point	Open Circuit Volts/Cell (B)
100%	1.250 - 1.270	-70°	2.10 - 2.12
75%	1.220 - 1.240	-39°F	2.07 - 2.09
50%	1.190 - 1.210	-16°F	2.04 - 2.06
25%	1.160 - 1.180	-2°F	2.01 - 2.03
Discharged	1.110 or below	+17°F	—

2. Follow manufacturer's instructions. Read open circuit voltage of each cell and record.

3. If any 2 cells vary more than .05 volts (25 percent or 5 scale divisions), replace battery.

4. If cells are even or vary only slightly, the battery is generally not "suspect."

C. Use of Load Tester or Shunt Type Prod Tester:

1. Never use on discharged batteries or batteries under 3/4 charged (1.240 sp. gr.).

2. Fully charge the battery before testing. Load battery to 3 x amp hour rating using the sun VAT-26 Tester. (The Harley-Davidson 40 amp hr battery should be loaded to 120 amperes.) Voltage reading after 15 seconds should be 9.6 or more. Note: Voltmeter leads must be connected directly to battery posts.

ADJUSTMENT OF ACID SPECIFIC GRAVITY

IMPORTANT

Never adjust the gravity of any cell which does not gas freely on charge. Unless electrolyte has been lost through spilling or leaking, it should not be necessary to add acid to a battery during its life. Acid should never be added unless one is certain that cell will not come up to normal gravity by continued charging. Remember to make the temperature correction for hydrometer readings, as warm electrolyte will read low and may be mistaken for failure of the battery to rise normally in gravity. It might also be mistakenly concluded that the battery will not take a full charge.

If the specific gravity of all cells is not within 5 points of the desired value, corrected to 80°F. at the end of a full charge, remove some of the electrolyte with a hydrometer and add water to reduce gravity (if too high) or add 1.400 specific gravity acid to raise the gravity (if too low). Continue the charge to give the electrolyte a chance to mix, then read the gravity after another hour to note the effect of additions. Continue this adjusting procedure until the gravity is brought to the desired value by charging for one hour after each adjustment.

STORAGE

When the car is being stored, the batteries should be kept in a fully charged condition with electrolyte level up to level in all cells. Store at temperatures between 20°F. to 50°F. Check state of charge every 8 to 10 weeks and charge as necessary to 1.250 to 1.270 specific gravity. New batteries in stock should be stored in same manner, however, when individual batteries are found to need charging, they must be connected to a conventional 12-volt battery charger and given a boosting charge.

If a battery is allowed to stand or is operated in a discharged condition for a long period of time, lead sulphate may develop on the plates, which is dense, hard and crystalline, and which cannot be electrochemically converted to normal active material again.

Lead sulphate formed on the plates during discharge is relatively insoluble as long as the specific gravity of electrolyte is kept above 1.125 specific gravity, but if allowed to drop below this value, the lead sulphate becomes increasingly soluble and may migrate into the pores of the separators and deposit as a white crystalline mass. Subsequent charging may convert these deposits into filamentous metallic lead which may "short" the positive and negative plates through the areas affected. These small shorts may cause a condition of low cell voltage when battery is charged. For this reason, battery cells must not be allowed to stand idle in a more than 75% discharged condition.

Batteries allowed to stand in a discharged condition (1.100 specific gravity) will freeze at 19° F. and ice may crack the container and damage the positive plates.

In general, it is advisable to keep batteries better than 3/4 charged when stored.

MAINTENANCE FREE BATTERY - 1980 & LATER

INTRODUCTION

Water cannot be added to this battery. The maintenance free battery is completely sealed except for a small vent in one side. The smal amount of gases produced in the battery will escape through this hole. At normal charging rates (see chart) the gases emitted will be of a small amount, however, a well ventilated area is recommended.

The battery is designed to withstand some of the damaging effects of overcharging, but overcharging can still severly damage the battery.

Always use extreme caution when handling a battery because of its dangerous chemicals which could cause severe personal injury when accidentally coming in contact with skin, eyes or clothing.

ANTIDOTE — External - flush with water.

Internal - Drink large quantities of milk or water followed by milk of magnesia, vegetable oil, or beaten eggs. Call doctor immediately.

Eyes - Flush with water and get immediate medical attention.

WARNING

Observe the following rules in the vicinity of batteries:

1. Keep cigarettes, open flame and sparks away from the battery at all times.

2. Use a well ventilated area when charging battery.

3. Always wear rubber golves on hands and safety goggles or shield to protect your face.

4. KEEP BATTERIES OUT OF THE REACH OF CHILDREN.

WARNING

Do not charge or test battery prior to determining whether battery is safe to charge or test. Failure to do so could result in personal injury and/or damage to the battery.

VISUAL INSPECTION

Visually inspect battery for cracks in case, terminal area, or loss of electrolyte. Replace battery if any physical damage is seen. DO NOT CHARGE OR TEST BATTERY in any of the preceding instances.

TEST INDICATOR

1. Place battery on level surface.

2. To determine whether battery needs charging and/or testing, look at test indicator on top of battery. One of three colors will appear in indicator.

GREEN indicates the battery is adequately charged. DO NOT CHARGE BATTERY. A load test can be run.

BLACK indicates the battery NEEDS CHARGING. Charge battery in accordance with all specifications.

LIGHT YELLOW indicates A DEFECTIVE BATTERY. DO NOT CHARGE OR TEST.

CHARGING THE BATTERY

WARNING

Always use a well ventilated area when charging a battery. Personal injury could result if this warning is not followed.

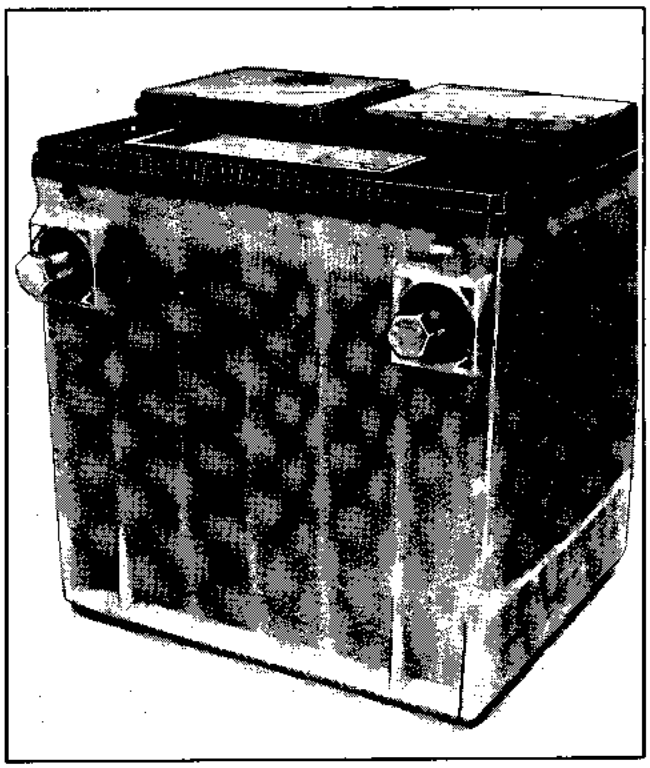


Figure 5J-8. Maintenance Free Battery

BATTERY IN VEHICLE

1. Attach positive charger cable (+) to positive (+) terminal on battery.

2. Attach negative charger cable (-) to negative terminal (-) on battery.

3. Follow chart for desired charging rate.

SLOW CHARGE RATE	FAST CHARGE RATE
5 amps for 10 hours or 10 amps for 5 hours	20 amps for 2-1/2 hours or 30 amps for 1-1/2 hours

BATTERY OUT OF VEHICLE

1. Thread a 3/8-16 bolt into each terminal, hand tight (See Fig. 5J-8.)

2. Attach positive charger cable (+) to bolt in positive terminal (+) on battery.

3. Attach negative charger cable (-) to bolt in negative terminal (-) on battery.

4. Follow the above chart for desired charging rate.

CAUTION

Stop charging battery when green dot appears or maximum charge is reached (see Voltage Requirements).

WARNING

If battery case feels hot (approximately 125° or more), and/or emits gases and/or fluid boils from vent, stop charging procedure at once. Let battery cool to room temperature and resume charging battery at a lower amp charge per hour. Failure to stop charging procedure could result in personal injury and/or damage to the battery.

LOAD TESTING

NOTE:

Battery must be fully charged before load test.

1. Remove the surface charge (excess voltage) by running a 300 amp load across terminals for 15 seconds.

2. Connect load tester to battery and load to 130 amps.

3. Read voltage after 15 seconds of load and then remove load.

4. Minimum voltage (see chart) will determine if fully charged battery is good. If voltage is below minimum, replace battery.

STORAGE

1. Never put a battery in storage unless it is fully charged.

2. Store battery at temperatures as cold as possible.

3. Check state of charge every 2 months. If battery is below 3/4 charge, bring up to full charge.

SPECIFICATIONS

VOLTS	AMPS FOR LOAD TEST	RESERVE CAPACITY	COLD CRANKING CURRENT @0°F (-18°C)	COLD CRANKING CURRENT @-20°F (-29°C)	WEIGHT (APPROX.)
12	130	60 Min.	275 Amps	210 Amps	26-1/2 lbs. (12.1 kg)

VOLTAGE REQUIREMENTS AT AMBIENT TEMPERATURES

If Temperature Is	70°F (20°C) & Above	60°F (16°C)	50°F (10°C)	40°F (4°C)	30°F (-1°C)	20°F (-7°C)	10°F (-12°C)	0°F (-18°C)
Than Minimum Voltage Needed is	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

94692-63

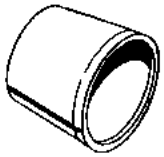
STARTER-GENERATOR MOTOR HOLDING TOOL

Used on 1963 to 1966 cars to keep from turning while removing or installing nut, etc.

95563-63

STARTER-GENERATOR ROTOR PULLER

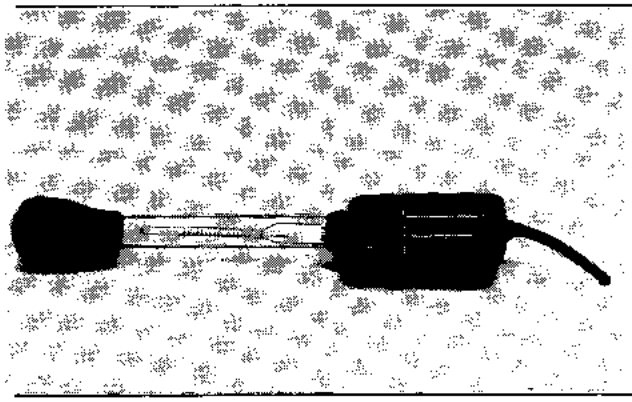
Used on 1963 to 1966 cars to pull rotor from crankshaft taper.



95630-63

OIL SEAL INSTALLING SLEEVE - 1963 TO 1966 GASOLINE CAR

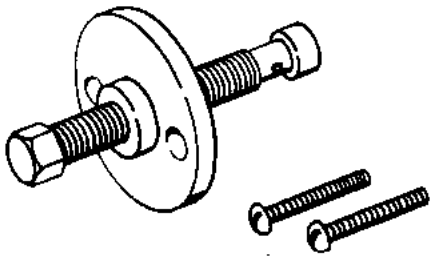
For installing starter-generator stator oil seal over sharp edge of crankshaft to prevent seal lip damage.



96802-63A

BATTERY HYDROMETER

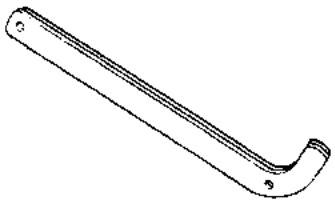
For testing charge condition of batteries. Has built-in thermometer to correct readings for extremes in temperature.



97294-61B

STARTER-GENERATOR COMMUTATOR END COVER PULLER

Used with two Part No. 2599 (1/4-20) screws to pull commutator end cover from 1967-68 SIBA starter-generator.



97320-67

BELT TENSIONER

Used with a 25 lb. spring scale to set 1967 & Later car starter-generator belt tension. Also used for removing and installing belt on later cars having automatic belt tensioner.

NOTES

NOTES

COLUMBIA®
Columbia ParCar Corp.

350 N. Dewey • P.O.Box 30 • Reedsburg, WI 53959
Phone (608) 524-8888 • Toll Free 1 (800) 222-4653 • Fax (608) 524-8380
Web www.parcar.com • E-Mail info@parcar.com