154 pages

1961 TO 1974 SPRINT SERVICE MANUAL

PRODUCT

CHASSIS

ENGINE

TRANSMISSION

ELECTRICAL

MISCELLANEOUS

The maintenance and repair information in this manual applies to the 1961 to 1966 Harley-Davidson Sprint Models C and H, and 1967-74 Models H, SS and SX.

PART NO. 99492-74
Revised: 3-77

Printed in U.S.

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 Harley-Davidson product and assist him in performing basic maintenance and repair. Secondly, it will introduce to the professional Harley-Davidson mechanic the latest field-tested and factory-approved major repair methods. We sincerely believe that this manual will make your association with Harley-Davidson 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 "Chassis," "Engine" and "Transmission." Sections are then divided into sub-sections. The Engine Section, for example, is comprised of "Cylinder" and "Crankcase" 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 Harley-Davidson 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 Harley-Davidson replacement parts. Behind the emblem bearing the words "Genuine Harley-Davidson" is more than half a century of designing, research, manufacturing, testing and inspecting experiance.

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

CAUTION

Gasoline is extremely flammable and highly explosive under certain conditions. Always stop engine, and do not smoke or allow open flame or sparks when refueling or servicing the fuel system, or when using gasoline as a cleaning solvent where specified in this manual.

Harley-Davidson products are manufactured under one or more of the following U. S. patents: 2986162, 2987934, 2993809, 3116089, 3144631, 3144860, 3226994, 3229792, 3434887, 3559773, 3673359, 3680403, 3683716, 3709317. Des. 225626.

TABLE OF CONTENTS

Revised: 4-74

TABLE OF CONTENTS (Cont.)

PRODUCT

TABLE OF CONTENTS

GENERAL

SPECIFICATIONS

DIMENSIONS (INCHES)

	"C"	"H"	1971 "SS"	1971-72 "SX"	1972 "SS"	1973-74 "SX"	1973-74 "SS"
Wheel Base	52.0	53.3	53.7	56.3	56.3	56.1	56.1
Overall Length	76.3	80.7	82.7	86.3	85.5	85.8	86.6
Overall Width	30.0	31.6	32.7	35.0	32.7	33.8	32.7
Overall Height	38.0	38.6	41.1	44.2	42.3	43.3	42.5
Saddle Height	29.0	31.0	32.3	31.3	32.1	31.8	31.5
Road Clearance	5.0	6.0	6.9	8.5	6.7	9.2	7.5

CAPACITIES

	"C"	1966 and earlier "H"	1967 "H"	1967-68 "SS"	1969-72 "SS" "SX"	1972 "SS" "SX"	1973-74 "SS" "SX"
Gasoline Tank (Total) Gals.	4.0	2.6	5.1	2.9	2.6	3.1	3.4
Reserve Qts.	1.4	0.6	1.0	1.0	1.0	1.6	1.6
Crankcase Oil Qts.	2.0	2.0	2.0	2.0	2.0	2.0	2.6

ENGINE

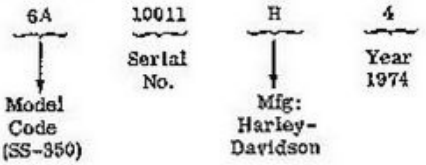
Model Designation Letter . . . . . "C", "H", "SS", "SX"
Type of Engine . . . . . 4 Cycle OHV
Number of Cylinders 1
Placement of Cylinder . . . . . Horizontal
Horsepower . . . . . ("C") 18 B.H.P.@6700 R.P.M.
1968 & earlier ("H", "SS") 21 B.H.P.@7250 R.P.M.
1969-72 ("SX", "SS") 25 B.H.P.@7000 R.P.M.
1973-74 ("SX", "SS") 27 B.H.P.@7000 R.P.M.
Taxable Horsepower (NACC Rating) . . . . . 1966 & earlier 2.7
1967-68 3.2
1969-74 3.4
Weight . . . . . "C" 261 lb.
"H" 271 lb.
1968 & earlier "SS" 281 lb.
1969-71 "SS" 311 lb.
1971-72 "SX" 309 lb.
1972 "SS" 325 lb.
1973-74 "SS" 355 lb.
1973-74 "SX" 353.5 lb.
Bore . . . . . 1966 & earlier (66MM) 2.5984 in.
1967-68 (72MM) 2.835 in.
1969-74 (74MM) 2.913 in.
Stroke . . . . . 1966 & earlier (72MM) 2.835 in.
1967-68 (61MM) 2.410 in.
1969-74 (80MM) 3.150 in.
Piston Displacement . . . . . 1966 & earlier (246.2 cc) 15 cu. in.
1967-68 (248.4 cc) 15.15 cu. in.
1969-74 (344 cc) 21 cu. in.
Compression Ratio . . . . . "H" 9.4 to 1
1967-68 "SS" 9.4 to 1
1969-72 9.0 to 1
1973-74 9.3 to 1
Spark Plug Size 14MM
Spark Plug . . . . . No. 5-6

VEHICLE IDENTIFICATION NUMBER (V.I.N.)

The Vehicle Identification Number (V.I.N.) is stamped on the engine crankcase and on the frame steering head. It consists of a model code, a serial number, a manufacturer's identification and model year as shown in the table. Always give this number when ordering parts or making an inquiry.

Model	Model Code	Serial No.	Mfg.	Year
SS-350	6A	10,000 and up (5 digits)	H Harley-Davidson	4 (1974)
SX-350	3C			

Example:



TRANSMISSION

Type . . . . . Constant Mesh - Foot Shift
Speeds . . . . . 1972 & earlier 4 Forward
1973-74 5 Forward
Primary Drive Gear Teeth . . . . . 1972 & earlier 26
1973-74 23
Driven Gear Teeth . . . . . 1972 & earlier 65
1973-74 57
Transmission Internal Ratios . . 1972 & earlier 1st - 2.91
1973-74 1st - 2.78
1972 & earlier 2nd - 1.76
1973-74 2nd - 2.04
1972 & earlier 3rd - 1.27
1973-74 3rd - 1.53
1972 & earlier 4th - 1.00
1973-74 4th - 1.24
1973-74 5th - 1.00
Transmission Sprocket Teeth . . . . . 1961-62 "C" 16
1968 "H" and "SS", 1963 and later "C" 17
1962-67 "H" and "SS" 15
1969-74 "SS", "SX" 14
Rear Wheel Sprocket Teeth 1961-67 38
1968 46
1969-72 35
1973 "SS" 35
1973 "SX" 33
1974 35

GEAR RATIOS

1972 and Earlier	1961-62 "C"	1963 and later "C"	1962-67 "H" and "S"	1968 "H" and "SS"	1969-72 "SS", "SX"
First (Low) Gear	17.28 to 1	16.27 to 1	18.44 to 1	19.69	18.3
Second Gear	10.45 to 1	9.84 to 1	11.15 to 1	11.91	11.00
Third Gear	7.54 to 1	7.10 to 1	8.09 to 1	8.64	7.98
Fourth (High) Gear	5.94 to 1	5.59 to 1	6.33 to 1	6.76	6.25

1973-74	Sprocket 33	Sprocket 35
First (Low) Gear	16.26	17.24
Second Gear	11.93	12.65
Third Gear	8.95	9.48
Fourth Gear	7.25	7.69
Fifth (High) Gear	5.85	6.20

TIRE DATA

	Pressure (PSI) Solo	Pressure (PSI) With Passenger
Front (Size 3.00 x 17) "C"	20	22
Front (Size 3.00 x 18) "H"	18	19
Rear (Size 3.00 x 17) "C"	24	28
Rear (Size 3.50 x 18) "H"	18	26
Front (Size 3.25 x 19) "SS"	18	18
Rear (Size 3.50 x 18) "SS"	22	28
Front (Size 3.50 x 19) "SX"	18	18
Rear (Size 4.00 x 18) "SX"	18	22

SERVICE

SERVICING A NEW MOTORCYCLE

PREDELIVERY

Service operations to be performed before delivery to customer are specified in the Setting Up Instructions and Important Instructions included with new vehicle.

CHECK AT 500 MILES

1. Change crankcase oil and clean filter screens.
2. Check and adjust tappet clearance to specifications.
3. Lubricate all points indicated for 2000 mile attention in the "Regular Service Intervals" chart.
4. Check ignition, timing and contact point gap and adjust if needed.
5. Inspect and service air cleaner if needed.
6. Check rear chain adjustment and lubrication - correct if necessary.
7. Check tightness of all nuts, bolts and screws, including ENGINE MOUNTS.
8. Check level of solution in battery, and water if needed.
9. Check spark plug, clean and regap if necessary.
10. Check controls for proper adjustment and correct if necessary.
11. Check clutch adjustment
12. Check brake adjustment.
13. Check wheel spokes and tighten if necessary.
14. Check front fork bearing adjustment.
15. Check tire pressure and inspect tread.
16. Road test.

CHECK AT 1000 MILES

1. Remove throttle piston stop-bushing in carburetor (used on 1965 and earlier models only).
2. Change crankcase oil and clean filter screens.
3. Clean, inspect, adjust and lubricate rear chain.
4. Service carburetor air cleaner.
5. Check tappet adjustment.
6. Check level of solution in battery.
7. Check wheel spokes for looseness and tighten if necessary.
8. Check circuit breaker contact point gap and timing.
9. Check clutch adjustment.
10. Check brake adjustment.
11. Check tire pressure and inspect tread.
12. Road test.

All operations are fully described in subsequent sections.

REGULAR SERVICE INTERVALS

(Figure 1B-6, 1B-6A, 1B-6B, 1B-6C)

The following chart outlines recommended maintenance and lubrication intervals after performance of service on a new motorcycle and the initial break-in period. Refer to Figure when using the chart.

SUGGESTED OPERATIONS FOLLOWING INITIAL BREAK-IN PERIOD

REGULAR SERVICE INTERVAL	FIG. INDEX NO.	ENGINE AND TRANSMISSION OIL	FIG. INDEX NO.	GREASE	FIG. INDEX NO.	OIL	FIG. INDEX NO.	CHECK AND SERVICE
Every 300 Miles	6	Check			23	Rear chain		
Every 1000 Miles	7	Change					4	Battery
							7	Oil pump filter screen
							9	Carburetor air filter
							20	Oil scavenger pump filter screen (1961-63)
							23	Rear chain adjustment
							19	Check and gap spark plug

REGULAR SERVICE INTERVALS (CONT'D)

REGULAR SERVICE INTERVAL	FIG. INDEX NO.	ENGINE AND TRANSMISSION OIL	FIG. INDEX NO.	GREASE	FIG. INDEX NO.	OIL	FIG. INDEX NO.	CHECK AND SERVICE
Every 2000 Miles			16	Speedometer Drive Unit	2	Brake hand lever	1	Front brake hand lever adjustment
			22	Rear fork pivot bearing	13	Clutch hand lever	3	Clutch cable adjustment
			30	Tachometer drive unit	23	Rear chain	5	Rear brake adjusting nut
							11	Front brake cable adjustment
							12	Clutch hand lever adjuster
							8	Circuit breaker points and timing
							10	Tappets (every 1000 miles under hard service)
							14	Gasoline filter screen
							18, 26	Wheel spoke tightness
Every 5000 Miles			32	Tachometer cable				
							19	Replace spark plug
			31	Speedometer cable			21	Check generator brushes and commutator
							8	Check ignition timing and circuit breaker points
							17, 25	Inspect tires
							27	Check steering head bearing adjustment
							29	Check shock rubber bushings
Every 10,000 Miles			15	Front wheel bearings (open type)			28	Carburetor
							33	Starter motor
			24	Rear wheel bearings (open type)				

SERVICE INTERVAL ENGINE - TRANSMISSION OIL

ENGINE - TRANSMISSION	300 MILES	1000 MILES	SPRING AND FALL
	Check	Change	Change

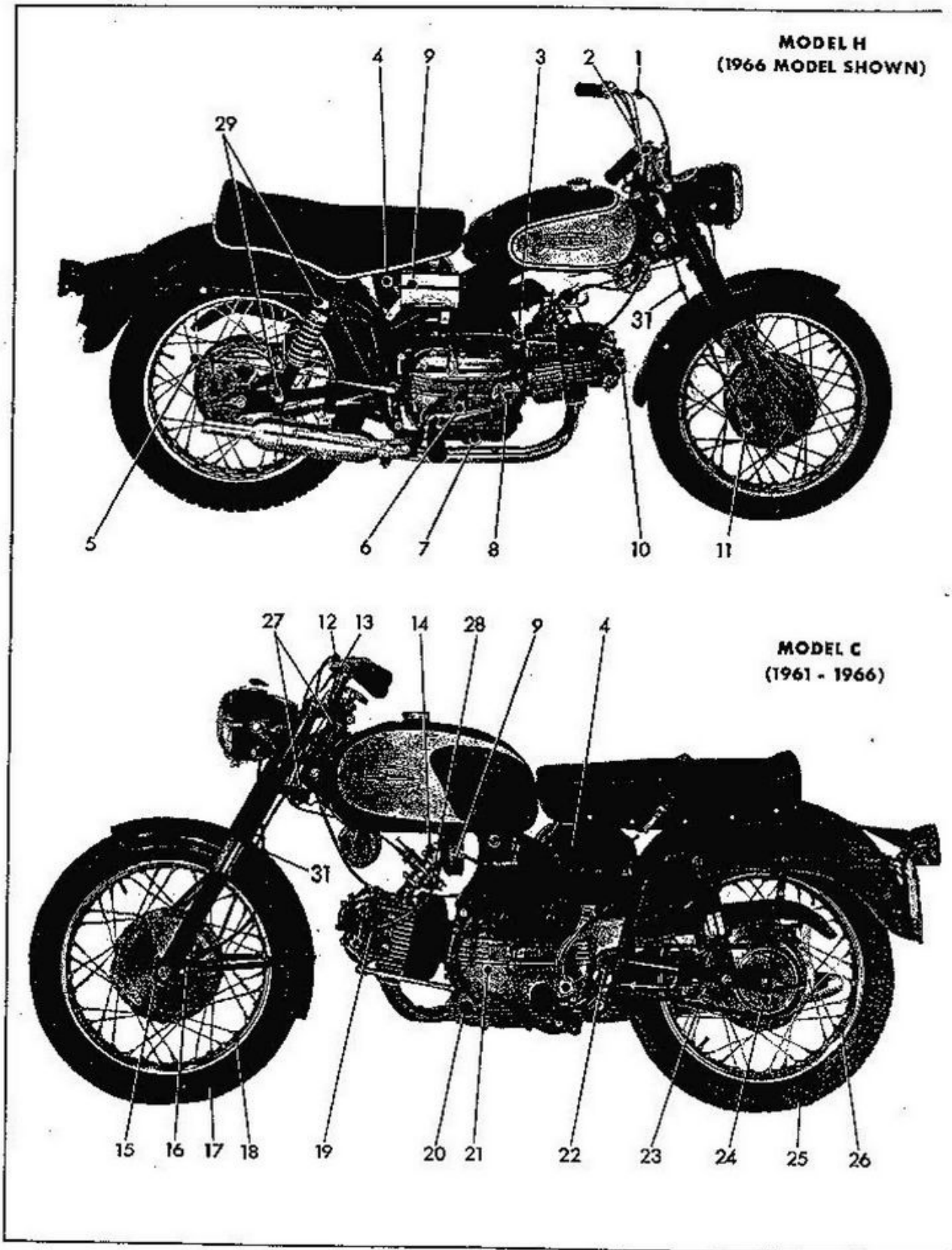
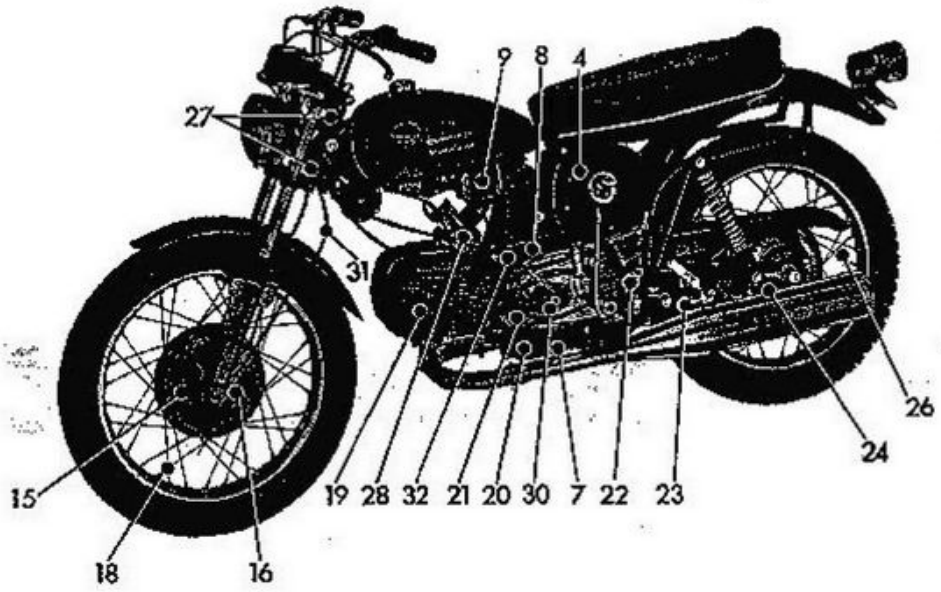


Figure 1B-6. Lubrication and Service Chart

1971 TO 1972 SS MODELS



1971 TO 1972 SX MODELS

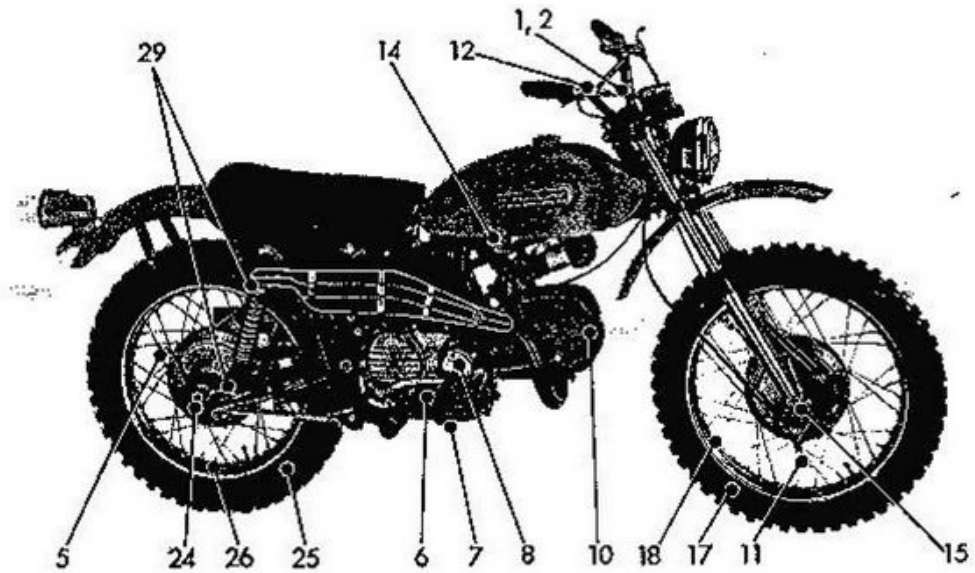
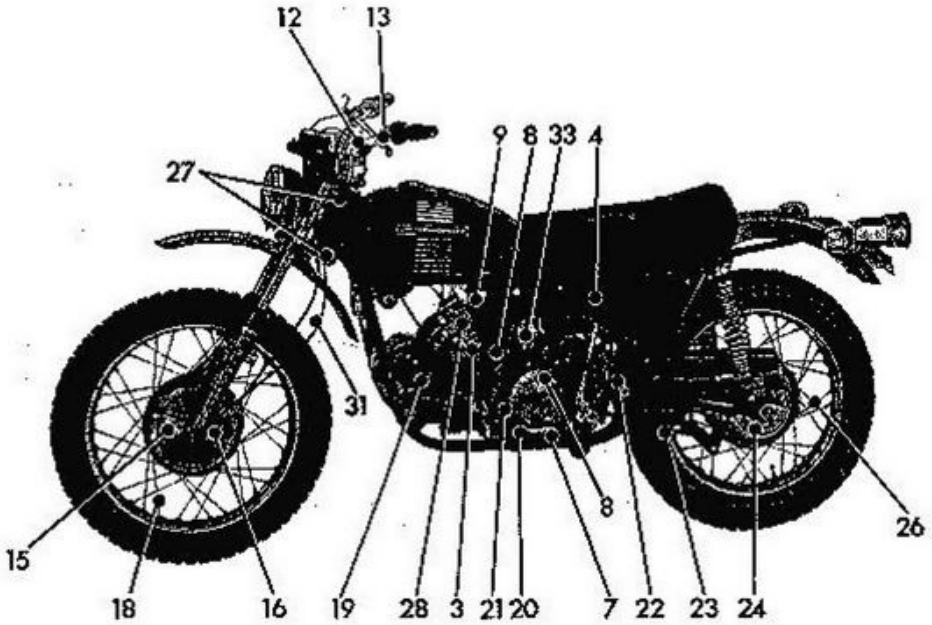


Figure 1B-6A. Lubrication and Service Chart

1973 SX



1973 SS

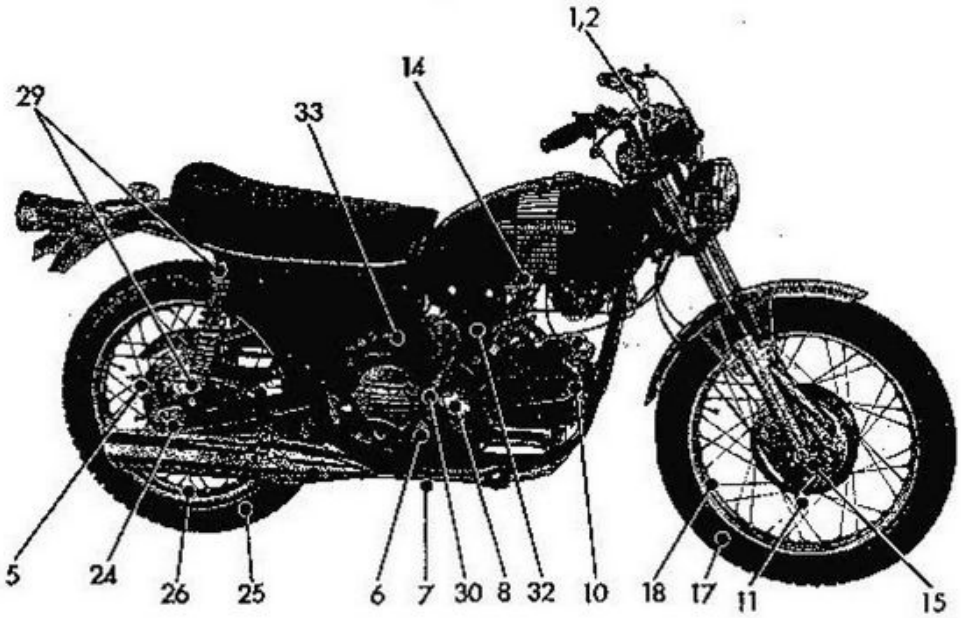
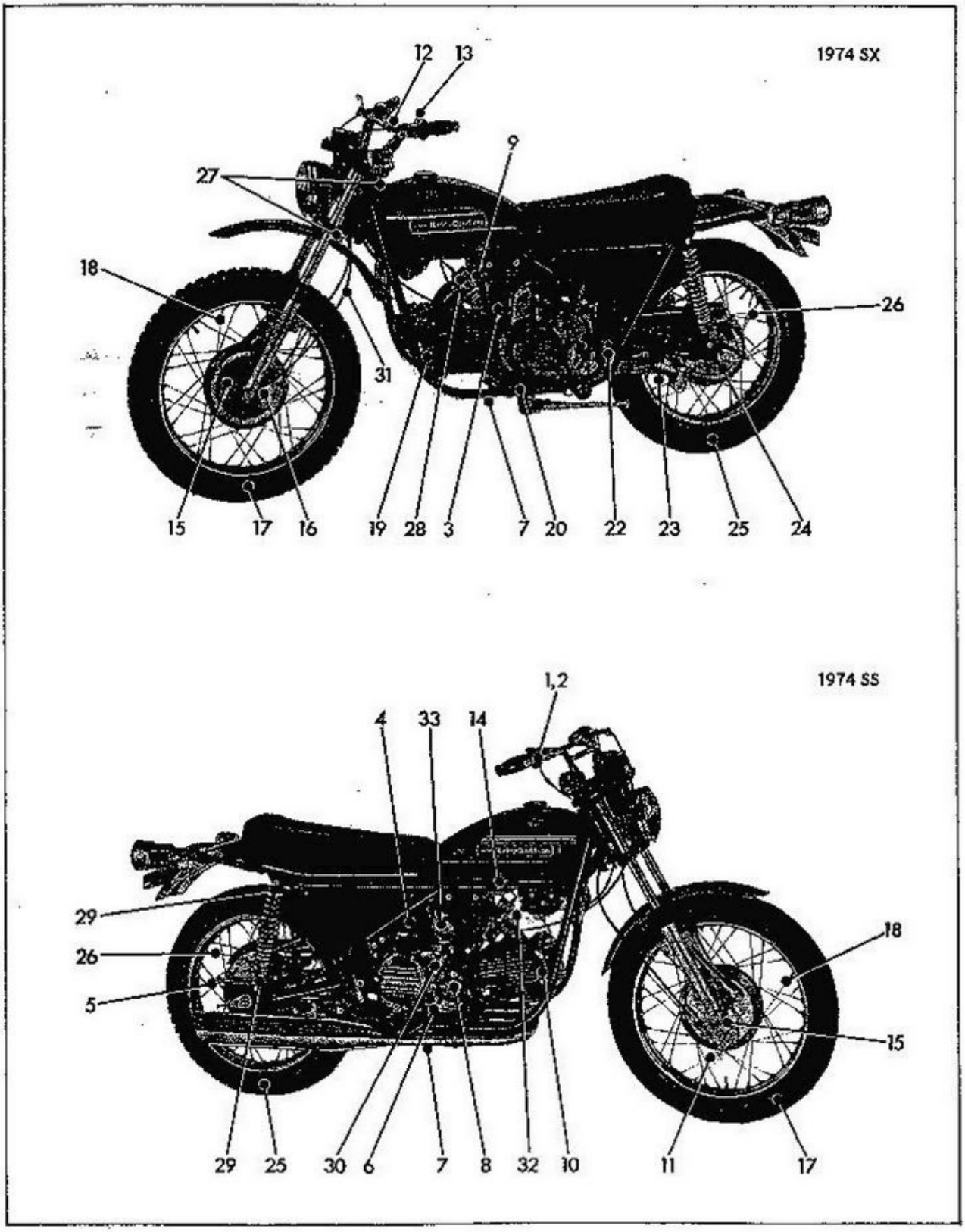


Figure 1B-6B. Lubrication and Service Chart


1974 SX
12
13
9
27
18
26
31
15
17
16
19
28
3
7
20
22
23
25
24
1974 SS
1,2
4
33
14
29
26
5
18
15
29
25
30
6
7
8
32
10
11
17

LUBRICANTS TO USE

HARLEY-DAVIDSON OIL

Refined specifically for Harley-Davidson 4 cycle air-cooled engines.

Use proper grade of oil for the lowest temperature expected before next oil change period as follows:

Use Harley-Davidson Oil	Use Grade	Air Temperature (Cold Engine Starting Conditions)
Medium Heavy	75	Above 40°F.
Special Light	58	Below 40°F.
Regular Heavy	105	Severe operating conditions at high air temperatures.

The transmission and engine are both lubricated by the same oil supply located in the crankcase reservoir.

The oil filler cap is located on the right side of the engine crankcase. The filler cap is provided with a gage rod having two notches. The oil level must always be maintained near but below the upper notch of the gage rod and it must never fall down below the lower notch. Crankcase capacity is 2 quarts when level is up to gage rod upper notch ("MAX"). To check the oil level, the motorcycle must be in a vertical position. Unscrew the cap, wipe the rod, replace the cap without screwing it in and remove it again to check oil level.

The oil level must be checked every 300 miles and even more often if it is noticed that it tends to drop too fast.

HARLEY-DAVIDSON GREASE-ALL GREASE.

Use for all bearings on motorcycle.

HARLEY-DAVIDSON CHAIN GREASE, CHAIN SAVER AND CHAIN SPRAY.

Designed especially as chain lubricants. Penetrates inner bearings for long chain life.

LOCATING TROUBLES

CHECK LIST FOR LOCATING OPERATING TROUBLES

IF ENGINE STARTS HARD

1. Spark plug in bad condition, or partially fouled.
2. Spark plug cable in bad condition and "leaking".
3. Circuit breaker points out of adjustment or in need of cleaning.
4. Ignition timing off.
5. Battery nearly discharged.
6. Loose wire connection at battery terminals, coil or circuit breaker.
7. Carburetor not adjusted correctly.
8. Defective ignition coil.
9. Defective condenser.
10. Tappets adjusted too tight.
11. Oil too heavy (cold weather operation).

IF ENGINE STARTS BUT RUNS IRREGULARLY OR MISSES

1. Spark plug in bad condition, improperly gapped, or partially fouled.
2. Spark plug cables in bad condition and leaking.
3. Circuit breaker points out of adjustment or in need of cleaning.
4. Defective condenser or condenser connection loose.
5. Defective ignition coil.
6. Battery nearly discharged.
7. Loose wire connection at battery terminals, coil or circuit breaker.
8. Ignition - Light switch point contacts dirty or out of adjustment (early 250 only).
9. Ignition - Light switch wires loose or broken.
10. Water or dirt in fuel system filters and carburetor.
11. Gasoline tank cap vent plugged.
12. Carburetor not adjusted correctly.
13. Weak or broken valve springs.

CRANKING MOTOR DOES NOT OPERATE

1. Low battery charge.
2. Brushes badly worn or sticking.
3. Dirty or oily commutator.
4. Loose or broken wire in starter motor-battery control switch or starter solenoid switch.

IF ENGINE FAILS TO START

1. Gasoline tank empty or valve shut off.
2. Emergency starting switch in "GEN" positio (early 250 only).
3. Gasoline line or filters clogged.
4. Discharged battery, loose or broken battery ter minal connection.
5. Loose wire connection at battery terminals, coi circuit breaker or ignition switch. Ignition switc fuse blown.
6. Circuit breaker points oxidized or badly out c adjustment.
7. Spark plug fouled.
8. Spark plug cable in bad condition and leaking
9. Defective ignition coil.
10. Defective condenser.
11. Clutch slipping and starter not turning engin over.
12. Sticking valves or tappets too tight.
13. Engine crankcase flooded with gasoline due t overchoking or failure to turn off fuel valve whe engine last shut off.
14. Piston rings badly worn or in bad condition.

IF ENGINE PRE-IGNITES

1. Excessive carbon deposit on piston head or i combustion chamber.
2. Spark plug heat range too hot for type of servic or type of engine.
3. Defective spark plug.
4. Ignition timing too advanced.

IF ENGINE OVERHEATS

1. Insufficient oil supply, or oil not circulating.

2. Leaking valves.

3. Heavy carbon deposit.

4. Carburetor high speed jet too small (lean mixture).

5. Ignition timing too late.

IF ENGINE DETONATES

1. Unsuitable fuel (octane rating too low).

2. Heavy deposit of carbon on piston head and combustion chamber.

IF ENGINE USES TOO MUCH OIL

1. Piston rings badly worn or in bad condition.

2. Valve guides badly worn.

EXCESSIVE VIBRATION

1. Engine mounting bolts loose.

2. Gas tank, fenders or other major parts not tightly mounted.

3. Cracked or broken frame.

IF GENERATOR DOES NOT CHARGE

1. Brushes badly worn or chipped.

2. Brushes sticking in holders.

3. Commutator shorted.

4. Defective armature.

5. Defective voltage regulator.

6. Voltage regulator not grounded.

7. Commutator dirty or oily.

8. Positive brush holder grounded.

9. Emergency starting switch in "GEN" position (early 250 only).

10. Loose or broken wire in generator battery circuit.

11. Broken field coil wire or loose terminal (both coils).

IF GENERATOR CHARGING RATE IS BELOW NORMAL (1972 & EARLIER)

1. Voltage regulator defective.

2. Loose field coil wire terminal.

3. Commutator worn and not turning true with shaft - throws brushes at high speed. (Bad main bearing could cause this commutator run-out.)

4. Weak or broken brush springs.

5. Commutator dirty or oily.

6. Brushes gummy or sticking in holders.

7. Defective armature.

IF ALTERNATOR DOES NOT CHARGE (1973 & LATER)

1. Loose or broken wire in alternator-battery circuit.

2. Shorted stator coils.

3. Demagnetized rotor.

4. Defective rectifier-regulator.

If rectifier-regulator is suspected of giving trouble, take your motorcycle to the nearest Harley-Davidson Dealer for service.

IF CARBURETOR FLOODS

1. Gasoline shut-off valve not closed when the engine is shut off.

2. Float set too high.

3. Float valve sticking, worn, damaged or dirty.

4. Float lever prongs damaged, bent or out of shape.

IF TRANSMISSION SHIFTS HARD

1. Bent or damaged shifter forks.

2. Rounded or "dubbed" shifter clutch dogs.

3. Clutch dragging slightly or improperly adjusted (not releasing).

4. Transmission - Engine oil too heavy (winter operation).

IF CLUTCH SLIPS

1. Oil on dry clutch plates.

2. Clutch controls improperly adjusted.

3. Worn or damaged clutch friction discs.

IF CLUTCH DRAGS OR DOES NOT RELEASE

1. Clutch controls improperly adjusted.

2. Damaged or warped clutch discs.

IF BRAKES DO NOT HOLD NORMALLY

1. Brakes not adjusted properly.

2. Brake controls binding.

3. Brake linings badly worn.

4. Brake linings impregnated with grease.

5. Brake drum badly worn or scored.

CHASSIS

TABLE OF CONTENTS

DRIVE

CHAIN

REAR CHAIN ADJUSTMENT

The rear chain should be checked every 500 to 1000 miles for correct adjustment. As chain stretches and wears in service, it will run tighter at one point on the sprocket than another; therefore, always rotate rear wheel and check adjustment at tightest point of chain.

To adjust rear chain, loosen axle nut (1, 2B-10) on each side of the wheel. Loosen locknut (3) and alternately turn adjusting nut (2) or adjusting screw (2A) on each side of the wheel until 1/2" free up and down chain movement is obtained between the drive sprocket (4) and rear wheel sprocket (5) as shown in Figure 2B-10. Chain adjustment must be made with rear wheel on the ground and two persons on the saddle to allow for full travel of the rear fork. Both axles must be adjusted exactly the same in order to maintain the proper wheel and chain alignment. The tire must run centrally in the rear fork and the chain must line up with the rear wheel sprocket. Readjust as necessary or uneven wear of the chain or tire will result. Retighten axle nut securely.

The chain can be removed for inspection, lubrication or replacement by disconnecting the chain at the spring lock connecting link.

NOTE

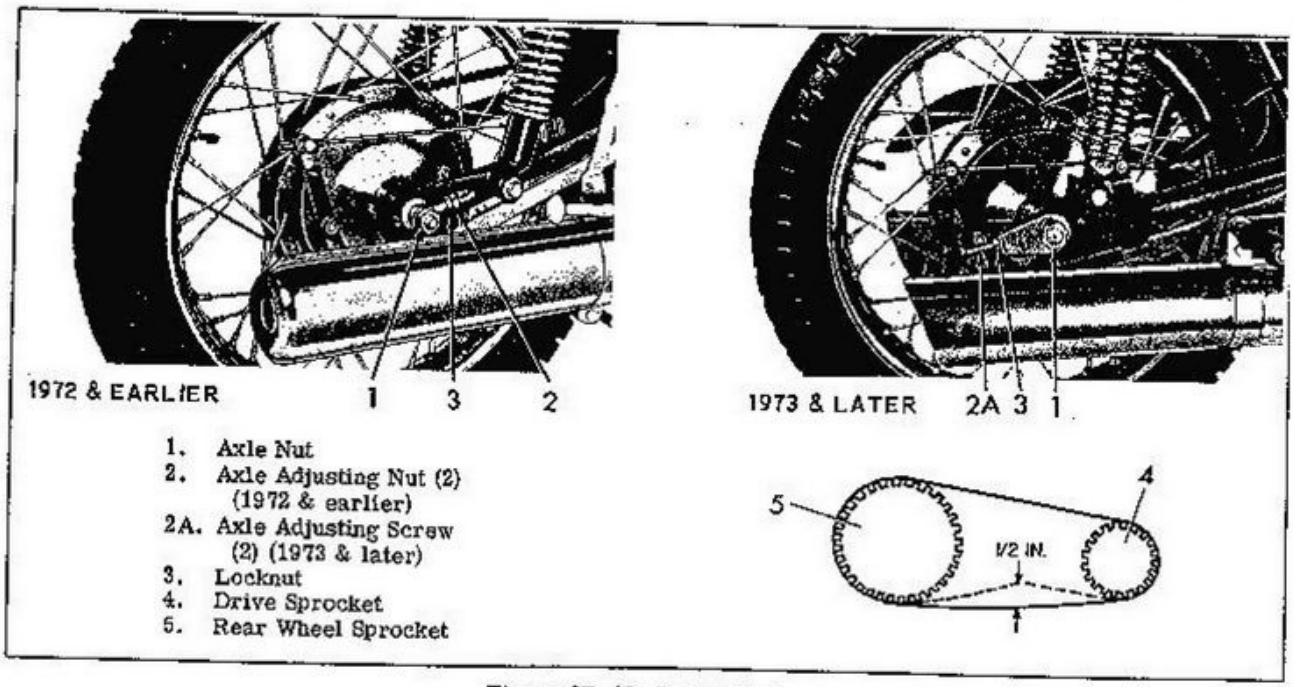
After readjusting the rear chain, the rear brake may be too tight. Readjust brake rod if necessary.

SERVICING REAR CHAIN

At regular service intervals of 1000 miles, exami the rear chain for adequate lubrication and worn cha links.

Occasionally the chain should be removed from t motorcycle, inspected for worn condition and recei additional lubrication. Free chain from motorcyc by removing spring-locked connecting link. L cleaned chain out flat and contract chain by takir up all slack in its links. Measure the chain lengt Then, stretch chain out to its full length and aga measure chain length. If the difference between t two measurements exceeds 1 in., the chain should b replaced. In addition, if the chain has any sti links, is visibly worn or damaged, it should be re placed. If a new chain is not available and it i necessary to repair the old chain, remove damage links by pressing out riveted link pins with Cha Repair Tools.

Before installing chain on motorcycle proceed a follows: Soak and wash thoroughly in a pan of kero



1. Axle Nut
2. Axle Adjusting Nut (2) (1972 & earlier)
2A. Axle Adjusting Screw (2) (1973 & later)
3. Locknut
4. Drive Sprocket
5. Rear Wheel Sprocket

Figure 2B-10. Drive Chain

sene. Remove chain from kerosene and hang to allow chain to dry off. Lubricate chain with Harley-Davidson "Chain Saver," "Chain Spray" or "Chain Grease." Apply warm and move chain to work lubricant into bearings. Wipe all surplus lubricant from chain surface.

Install chain on motorcycle. Inspect connecting link and spring clip closely for bad condition. Replace if at all questionable. Be sure spring clip is securely locked on pin ends, open end of clip on outside, trailing direction of chain travel, as positioned on motorcycle.

CHAIN LUBRICATION

NOTE

Motorcycle is not equipped with chain oiler; therefore condition of chain should be watched carefully.

Under normal operating conditions brush the dirt off and lubricate the rear chain at 1000 mile intervals. Under dirty or wet conditions, chain lubrication will be required more frequently. Lubricate chain with Harley-Davidson "Chain Saver," "Chain Spray" or "Chain Grease."

WHEELS

WHEELS AND TIRES

Maximum tire mileage and good handling qualities are directly related to care given wheels and tires. A front tire kept in continuous service will wear irregularly and peaked and may affect handling, especially if over-inflated. Therefore, it is extremely important that correct tire pressure be maintained at all times.

At regular intervals of 2000 miles, or at any time handling irregularities are experienced, see the chart below for recommended service.

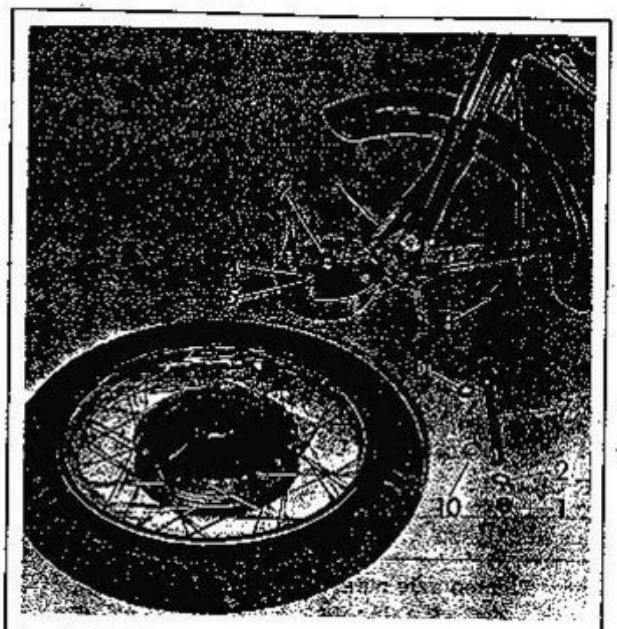
REMOVING AND INSTALLING FRONT WHEEL (See Fig. 2C-36.)

Raise front end of motorcycle high enough to permit removing front wheel; support motorcycle by suitable blocking underneath frame. Remove axle nut (1) and washer (2) on left side of fork. Loosen axle pinch bolt (3) located on right fork side. Remove nut (4), washer (5) from stud. Loosen upper anchor arm cap screws and slip anchor arm (6) from brake anchor stud on side plate. With a soft hammer, tap threaded end of axle (7) to loosen it and start it out. Support wheel with one hand and pull axle remainder of the way out with the other hand. Disengage the speed-

WHEEL SERVICE CHART

CHECK FOR	REMEDY
1. Loose axle nuts	Tighten axle nuts.
2. Excessive side-play or radial (up and down) play in wheel hubs.	Replace wheel hub bearings as described in "Inspecting and Repairing Wheel Hubs."
3. Loose spokes.	Tighten or replace spokes as described under "Truing Wheels" and "Spoking Wheels."
4. Alignment of rear wheel in frame and with front wheel.	Adjust rear wheel in frame as described in "Drive," Section 2B, "Rear Chain Adjustment;" or, inspect and straighten frame as described in, "Frame," Section 2E, or repair rear fork as described in "Rear Fork," Section 2F.
5. Rims and tires out-of-true sideways, (should not be more than 3/64 in.).	True wheels, replace rims or replace spokes as described under, "Spoking Wheels" and "Truing Wheels."
6. Rims and tires out-of-round or eccentric with hub, (should not be more than 3/32 in.).	See Item 5, above.
7. Irregular or peaked front tire wear.	Install new tire as described in "Removing and Installing Front and Rear Wheel," and, "Removing and Installing Tire and Tube."
8. Correct tire inflation.	Inflate tires as described in "Specifications", General (1A).
9. Correct tire and wheel balance, (if balancing equipment is available).	Static balance, if dynamic balancing facilities are not available.

ometer drive unit (8) from the brake drum hub and slip wheel from between fork sides. Remove brake side plate (9) and spacers (10) and (11) from wheel hub.



1. Axle Nut
2. Axle Washer
3. Pinch Bolt
4. Anchor Arm Nut
5. Anchor Arm Washer
6. Anchor Arm
7. Axle
8. Speedometer Drive Assembly
9. Brake Side Plate
10. Thick Spacer - Speedometer Side Hub
11. Thin Spacer - Brake Side Hub

Figure 2C-36. Removing and Installing Front Wheel

To reinstall front wheel, reverse the disassembly procedure. Insert thicker spacer (10) on speedometer side of hub and thinner spacer (11) in brake side of hub. Install brake side plate (9) and position speedometer drive unit (8) on hub; position wheel assembly between fork sides, insert axle (7) from right side and slide through wheel, hub and left fork side. Place anchor arm (6) on anchor stud and secure with washer (5) and nut (4). Tighten upper anchor arm cap screws. Place washer (2), (chamfer side out) and nut (1) on axle and tighten. Remove blocks supporting motorcycle and work forks up and down to align fork sides. Now tighten pinch bolt (3). Adjust brake as described in, "Adjusting Front Wheel Brake," Section 2G.

REMOVING AND INSTALLING REAR WHEEL (See Fig. 2C-37)

Raise rear end of motorcycle high enough to permit removal of wheel; support motorcycle by suitable blocking underneath frame. Locate and remove drive chain connecting link and disengage chain from rear sprocket. Remove brake adjusting nut (1) and disconnect brake rod (2). Remove brake anchor arm nut (3), washer (4) and slip brake anchor arm (5) from stud on brake side plate (9). Remove rear axle nut (6), washer (7), and using soft hammer, tap rear axle (8) out to allow removal of rear wheel from between rear fork sides.

1. Brake Adjusting Nut
2. Brake Rod
3. Anchor Arm Nut
4. Anchor Arm Washer
5. Anchor Arm
6. Axle Nut
7. Axle Washer
8. Axle
9. Brake Side Plate
10. Spacer
11. Chain Adjuster

Figure 2C-37. Removing and Installing Rear Wheel

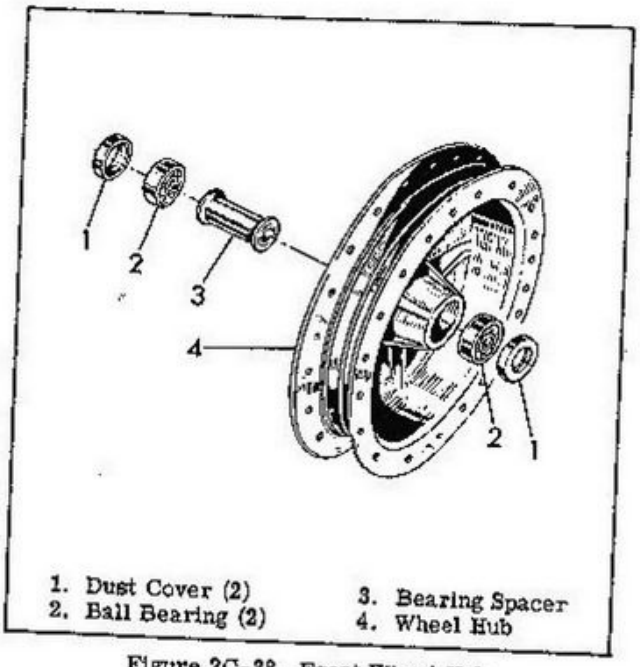
CAUTION

When removing rear axle, hold chain adjuster (11) against rear fork or it may cock and bind axle preventing its removal.

Remove brake side plate (9) and spacer (10 from wheel hub. To reinstall rear wheel reverse the disassembly procedures. Be sure spacer washer is in place between brake side plate (9) and wheel hub (1) when reassembling. Adjust rear brake as described in "Adjusting Rear Wheel Brake," Section 2G.

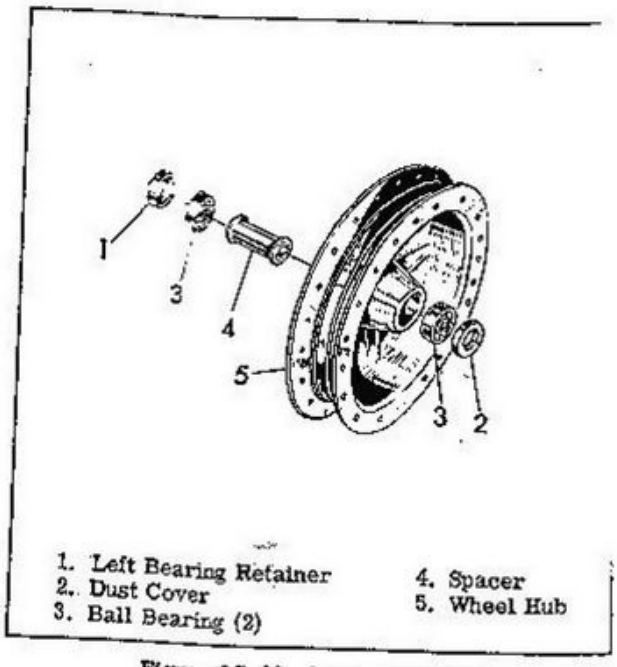
DISASSEMBLING FRONT WHEEL HUB (See Fig. 2C-38)

Remove front wheel from motorcycle as described in "Removing and Installing Front Wheel," Section 2C. Drift out dust cover (1) and ball bearing (2) from opposite side of hub. Free bearing spacer (3). drift out remaining ball bearing (2) and dust cover (1) from opposite side of hub.



1. Dust Cover (2)
2. Ball Bearing (2)
3. Bearing Spacer
4. Wheel Hub

Figure 2C-38. Front Wheel Hub



1. Left Bearing Retainer
2. Dust Cover
3. Ball Bearing (2)
4. Spacer
5. Wheel Hub

Figure 2C-39. Rear Wheel Hub

NOTE

Bearings should be removed only when it is necessary to replace them. Remove them with special Harley-Davidson puller, Part No. 95760-69.

DISASSEMBLING REAR WHEEL HUB (See Fig. 2C-39)

Remove rear wheel from motorcycle as described in "Removing and Installing Rear Wheel." Unscrew bearing retainer (1) from wheel hub. Drift out dust cover (2) and ball bearing (3) from opposite side of hub. Free bearing spacer (4). Drift out remaining ball bearing (3) from opposite side of hub.

NOTE

Bearings should be removed only when it is necessary to replace them. Remove them with puller, Part No. 95760-69.

INSPECTING AND REPAIRING WHEEL HUBS

Clean and inspect all parts paying particular attention to the wheel hub ball bearings. If bearings have excessive side play or radial (up and down) play in the wheel hubs, they should be replaced. Clean and repack open type bearings with fresh grease when reinstalling in hub. Late models have sealed bearings requiring no interval lubrication.

Inspect felt dust seals inside of dust cover. If dirty or damaged, replace them.

Inspect brake shell for grooves and scoring. If any is found, check brake shoes immediately for worn linings.

ASSEMBLING FRONT WHEEL HUB (See Fig. 2C-38)

Press in new ball bearing (2) against shoulder, on either side of wheel hub; press dust cover (1) against bearing. Turn hub over and insert bearing spacer (3); press new ball bearing (2) against bearing spacer. Press dust cover (1) against bearing.

NOTE

Be sure felt seal is in dust cover.

Install front wheel on motorcycle as described in, "Removing and Installing Front Wheel."

ASSEMBLING REAR WHEEL HUB (See Fig. 2C-39)

Press new ball bearing (3) against shoulder on brake side; also press in dust cover (2). Turn hub over and insert bearing spacer (4); press new ball bearing (3) against bearing spacer. Screw bearing retainer (1) into wheel hub.

NOTE

Be sure felt seal is in dust cover.

Install rear wheel as described in, "Removing and Installing Rear Wheel."

REMOVING AND INSTALLING REAR WHEEL SPROCKET (See Fig. 2C-40 or 2C-40A)

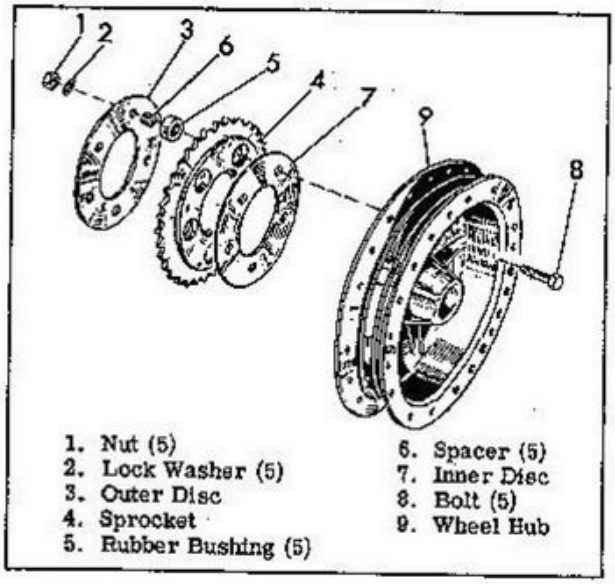
Remove rear wheel as described in, "Removing and Installing Rear Wheel." Remove nuts (1) and lock

washers (2); remove outer disc (3). Remove sprocket (4), disassemble rubber bushings (5) and spacers (6) from sprocket. Remove inner disc (7) (if used) and bolts (8) if necessary.

Clean all parts and wipe dry.

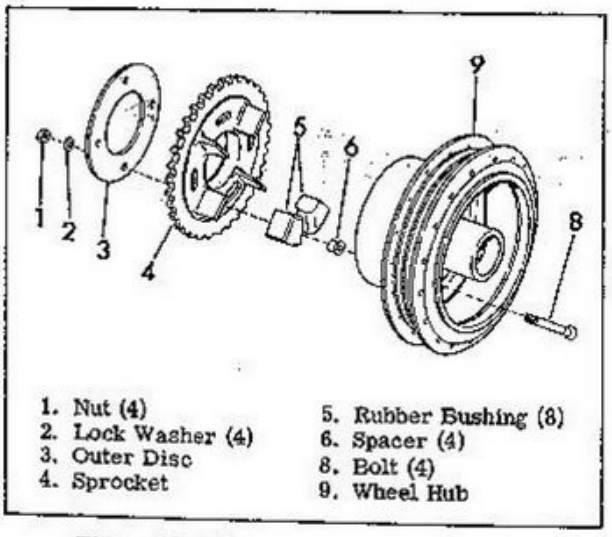
To reassemble, simply reverse disassembly procedure. Install bolts (8) into hub (9) and inner disc (7) on bolts. Insert spacers (6) and rubber bushings (5) into sprocket (4); install sprocket, with shoulder side toward hub, on bolts. Install outer disc (3), chamfered side out, on bolts. Secure assembly with lock washers (2) and nuts (1).

Install wheel as described in, "Removing and Installing Rear Wheel."



1. Nut (5)
2. Lock Washer (5)
3. Outer Disc
4. Sprocket
5. Rubber Bushing (5)
6. Spacer (5)
7. Inner Disc
8. Bolt (5)
9. Wheel Hub

Figure 2C-40. Removing and Installing Rear Wheel Sprocket (1969 & earlier)



1. Nut (4)
2. Lock Washer (4)
3. Outer Disc
4. Sprocket
5. Rubber Bushing (8)
6. Spacer (4)
8. Bolt (4)
9. Wheel Hub

Figure 2C-40A. Removing and Installing Rear Wheel Sprocket (1970 & Later)

SPOKING FRONT AND REAR WHEEL (See Fig. 2C-41, 2C-42)

Front and rear wheel spoking procedure is the same for both wheels.

1. Clamp axle (large diameter end) in vise vertically. Slip wheel hub, brake side down, on axle.

2. Draw an imaginary centerline through the axle center and exactly between any two spoke holes (X) and (Y) on the upper flange. (See Figure 2C-41). Note that the centerline also lines up with spoke hole (Z) on the lower (brake side) flange.

3. Insert an outside spoke down through spoke hole (Z) in the lower flange.

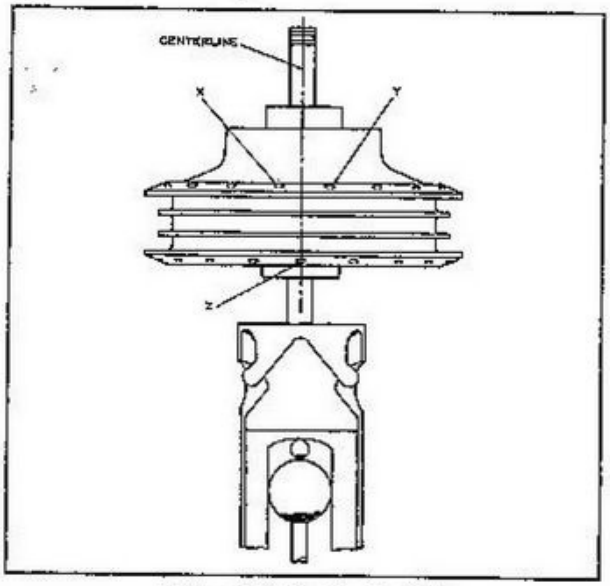
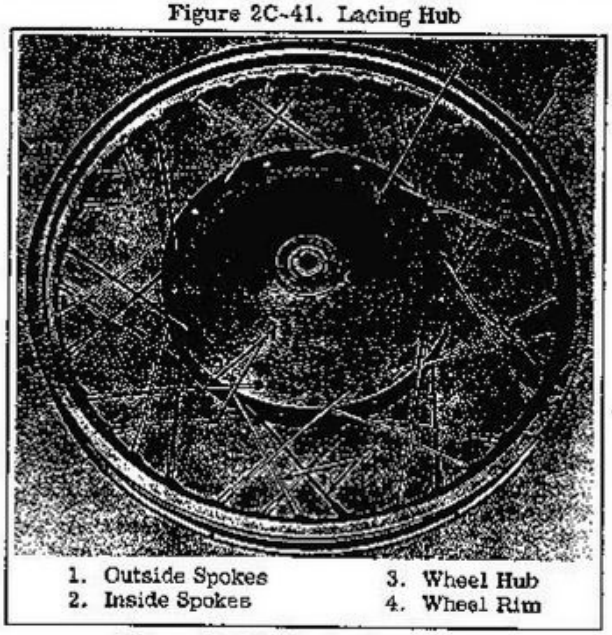


Figure 2C-41. Lacing Hub



1. Outside Spokes
2. Inside Spokes
3. Wheel Hub
4. Wheel Rim

Figure 2C-42. Spoke Arrangement

4. Insert an outside spoke up through spoke hole (X) in the upper flange.

5. Insert an inside spoke down through spoke hole (Y) in the upper flange.

6. With these three "key" spokes in position simply follow around both flanges installing one inside and one outside spoke until all holes are filled.

7. Slip wheel up off axle and place on bench, brake side down.

8. Arrange all outside spokes on both flanges in a clockwise direction. (See Fig. 2C-42)

9. Arrange all inside spokes on both flanges in a counterclockwise direction. (See Fig. 2C-42)

10. Place wheel rim over the hub assembly and line up one brake (lower) flange outside spoke with nipple well in rim that has corresponding nipple angle and start nipple on spoke threads.

11. Skip three spoke nipple holes in the rim and install another outside spoke. Continue this procedure until all outside spokes are installed in rim.

NOTE

Do not tighten spoke nipples during lacing procedure.

12. Select any brake (lower) flange inside spoke, cross over two outside spokes and line up with nipple well that has corresponding nipple angle and start nipple on spoke threads. Continue this procedure until all inside spokes are installed in rim.

13. Select any upper flange inside spoke, position in a counterclockwise direction lining it up with nipple well in rim that has corresponding nipple angle and start nipple on spoke threads.

14. Skip three spoke nipple holes in rim and install another inside spoke. Continue this procedure until all inside spokes are installed in rim.

15. Select any outside spoke, cross over two inside spokes, line up with corresponding nipple well in rim and install nipple on spoke threads. Continue this procedure until all outside spokes are installed in rim.

TRUING WHEEL (See Fig. 2C-43, 2C-44.)

1. Use wheel axle as truing arbor; insert axle in wheel hub and place wheel in Truing Stand, Part No. 95500-29.

2. Using a screw driver, tighten all spoke nipples until there is approximately 3/16 inches of thread exposed below the nipple on each spoke.

3. Starting at the valve hole, tighten all nipples one full turn each, using spoke nipple wrench, Part No. 94682-61.

4. Continue on around wheel rim tightening all nipples until all outside spoke nipples have only 1/16 to 1/8 inches thread exposed below the nipple and all inside spokes have no threads exposed below th nipple.

5. Check rim for concentricity, centering sideway (Fig. 2C-43, and 2C-44). Centering rim sideway must be done as one operation. The rim must b

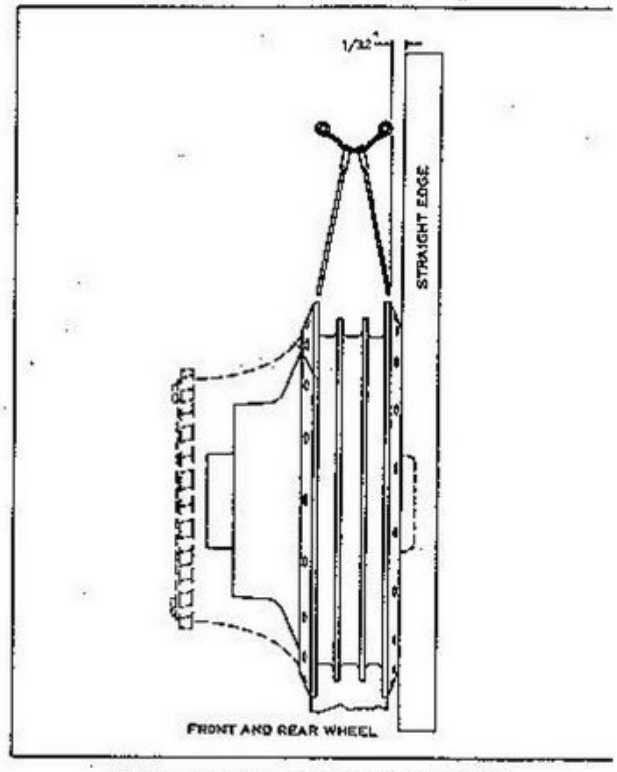


Figure 2C-43. Aligning Wheel With Straightedge

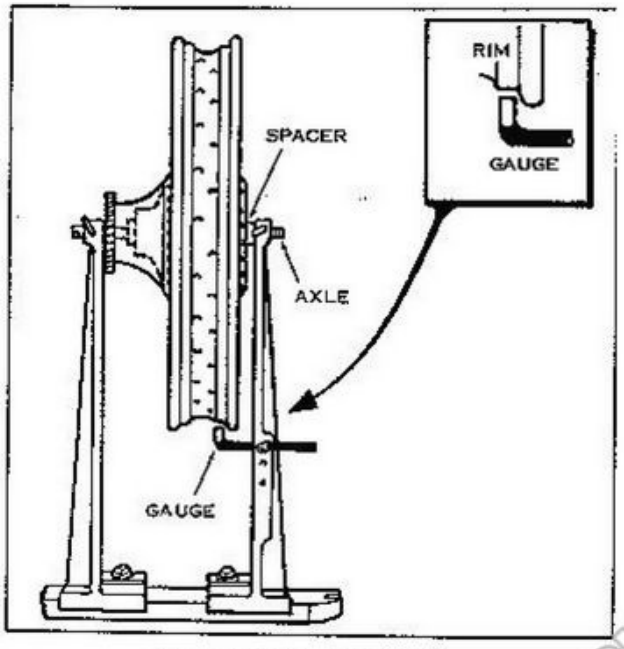


Figure 2C-44. Truing Rim

properly centered sideways in relation to hub for correct alignment and "tracking" of wheels.

6. Figure 2C-43 shows method of using a straightedge to determine correct sideways centering of wheel rim. If rim is too close to straight edge, loosen all nipples on the brake side slightly and tighten all nipples on the opposite side slightly. If rim is too far from straightedge, reverse the above operation. Lay straightedge across brake side spoke flange of hub and measure distance from straightedge to rim. When rim is correctly centered this measurement should be 1/32 inch for both the front and rear wheels.

7. Adjust truing stand gauge Fig. 2C-44 so that when wheel is turned, the highest point on the rim just touches the gauge. At the same time the gauge can be adjusted to check the rim side movement or run-out by moving the gauge in or out until the rim bead just touches the gauge at its point of farthest run-out.

8. First eliminate the rim run-out by loosening nipples on the gauge side at the point where rim bead is farthest from the gauge, tighten spokes on opposite side of those loosened to bring rim true. Reverse loosening and tightening of nipples, as explained above, if rim moves too far away from gauge. After each loosening and tightening of spokes, check rim position in relation to hub as shown in Fig. 2C-43. Rim should be trued for run-out within 1/32 inch.

9. After rim run-out is correct and the rim is correctly centered in relation to wheel hub, check for concentricity (rim "hop"). If rim runs eccentric (out of round) nipples must be loosened at points where rim is farthest from gauge, and tightened at points where rim is closest to or contacts gauge. Amount nipples are loosened or tightened is determined by the amount rim runs out of round. Rim should be trued concentrically to within 1/32 inch.

10. After wheels have been checked and corrected, start at valve hole and tighten all nipples 1/4 turn at a time until nipples and spokes are normally tight. If possible, compare with a new wheel. While tightening nipples, repeatedly check rim with gauge according to preceding instructions.

11. After all nipples have been pulled up, until spokes are normally tight and wheel is true, seat each spoke head into hub flange with a sharp blow, using a flat nose punch and hammer. Retighten all nipples and finish truing wheel. This method allows spokes to be drawn tighter at the start and prevents the possibility of spokes loosening after the wheel is put into service as the result of spoke heads seating into the rim flange.

12. Do not tighten spokes too tight or nipples may draw through rim, or hub flanges may be distorted. If spokes are left too loose, they will continue to loosen when the wheel is put in service.

13. File or grind off ends of any spokes that may be protruding through nipples to prevent puncturing tube when tire is mounted.

REMOVING TIRE AND TUBE FROM RIM

Remove wheel; lay wheel on its side. Remove valve cap and valve core to free all air from tube. Remove valve stem knurled nut. Remove nuts and washers from tire bead clamps (if used). Loosen both beads from rim flanges by stepping on sides of tire or by using a tire tool. Stand or kneel on tire opposite valve to push bead into rim-well. Using tire tools, (not sharp instruments), start upper bead over edge of rim at valve. Don't use force when starting bead over edge of rim with tire iron, because bead wires may be broken or stretched and the tire ruined. Carefully remove inner tube before attempting to remove second bead. Push lower bead into rim-well on one side and insert tire iron on opposite side and pry bead over flange. After a portion of second bead is started over rim edge, tire can be further removed from rim without aid of tire iron.

It is not always necessary to completely remove casing from rim. Removing one side only allows inner tube to be removed and installed and also allows inside of casing to be inspected.

INSTALLING TIRE AND TUBE ON RIM

Carefully remove all dust and dirt, particularly hard particles from tire which might chafe an inflated tube. Wipe tube and inside of tire thoroughly with clean, dry cloth. If rim is dirty or rusty, clean it with a stiff wire brush. Be sure to examine a used tire carefully for fabric injuries which if neglected will damage tube.

Position rubber rim strip in rim-well with valve hole correctly registered.

Make sure hexagon nut is tight on valve stem. Install tube in tire and swab thoroughly all around base of tube, between tube and side walls of tire with mounting compound. Bead seat of tire should not be coated. Place valve at tire balance mark, and inflate tube just enough to round it out. With wheel lying flat, place tire on rim and align valve with hole in rim. Push bottom bead into rim-well near valve, and hold in well while forcing remaining portion of bead over rim flange with a heavy rubber mallet. Spread tire and insert valve through hole in rim. Install knurled nut loosely on valve stem to hold stem in position. Force upper bead over rim flange and into well at point opposite valve. Stand or kneel on tire at this point to hold bead in well and force remaining portion of tire over rim flange. While forcing bead over rim flange, keep as much bead as possible in rim-well. Be careful not to damage beads or pinch tube. Tighten valve stem nut.

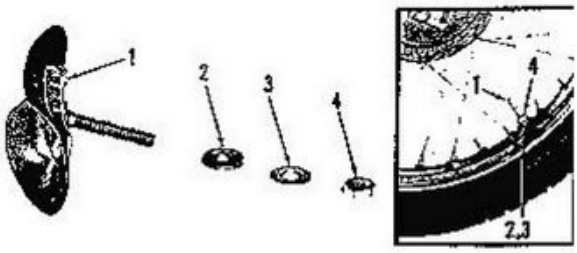
Inflate tire to recommended pressure. Then, completely deflate tire to smooth out any wrinkles in tube and allow tube to find its place, free from strain or stress. Again, inflate to recommended pressure and check valve for leak. See "Specifications," Section 1A, for correct tire pressure.

INSTALLING TIRE BEAD CLAMPS - 1974 and Later (Figure 2C-45)

Tire bead clamps (figure 2C-45) are used on both front and rear wheels to securely retain the tire on the rim in case of sudden deflation of the inner tube during motorcycle operation.

When installing inner tube and tire on rim make sure that the tire bead is between tire bead clamp (1, figure 2C-45) and wheel rim. Also, make sure that inner tube is not pinched between tire bead and tire bead clamp. Leather washer (2), washer (3) and nut (4) are assembled to stud on tire bead clamp on outside of rim. Nut (4) should be tightened securely.

Care should be taken to keep the tires properly inflated. See tire data for correct tire inflation pressure. Do not over-inflate tires.



1. Tire bead clamp
2. Leather washer
3. Washer
4. Nut

Figure 2C-45. Tire Bead Clamp (1974)

HANDLEBAR

REPLACING THROTTLE CONTROL WIRES

1971 AND EARLIER C, H, SS (See Fig. 2D-11)

Remove throttle control wire from carburetor as described in "Disassembling Carburetor", Section 3F.

Remove cover on throttle control housing (right handgrip). Pull down on cable coil and slip cable through slot on housing. Remove cable button from throttle chain cup.

Replace throttle cable and coil with a new assembly.

Note that large button on end of cable is not centrally located, noting this, place the short end into the throttle chain cup first as shown in Fig. 2D-11. Pull back on the coil and slip cable into housing. Insert coil into recessed hole on tip of housing. Put a small amount of grease on throttle chain and install housing cover. Place opposite end of cable through carburetor adjustment screw, cover, and spring; and install in throttle piston. Assemble carburetor as described in "Assembling Carburetor", Section 3F.

After assembling, check movement of throttle piston to see that it opens and closes correctly.

REPLACING THROTTLE CONTROL GRIP ASSEMBLY.

To replace throttle control grip assembly, remove throttle wire from throttle control as described in

"Replacing Throttle Control Wire". Remove two set screws on throttle control grip and pull from handlebar.

Assembly is the reverse order of disassembly.

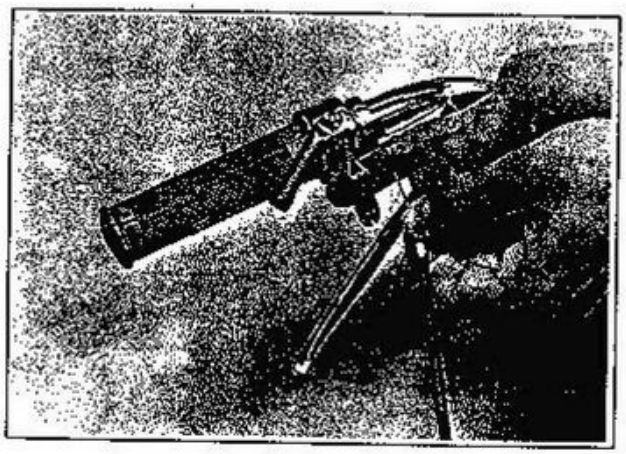
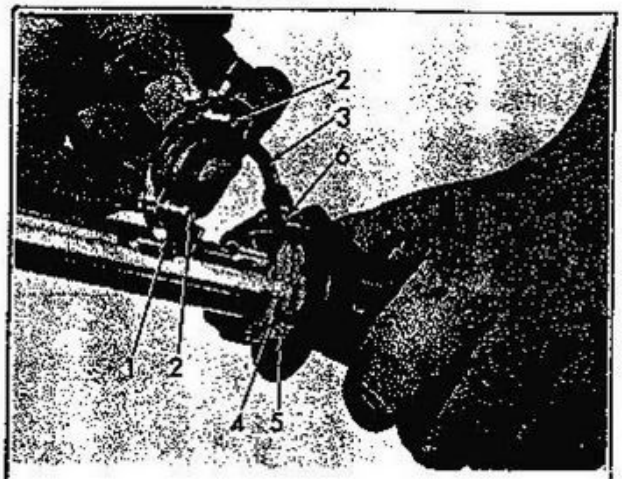


Figure 2D-11. Replacing Throttle Control Wire (1971 and Earlier C, H, SS)

REMOVING HANDLEBARS FROM FORK UPPER BRACKET

Removal procedure is described in "Removing Fork Stem and Bracket Assembly from Steering Head" under Chassis 2F, "Fork".



1. Upper handgrip support
2. Screw (2)
3. Throttle control cable guide
4. Throttle control cable button
5. Nylon handgrip sleeve
6. Lower handgrip support

Figure 2D-12. Replacing Throttle Control Wire (1971 & Later SX; 1972 & Later SS)

1971 & Later SX; 1972 & Later SS (See Fig. 2D-12)

Remove throttle control wire from carburetor as described in "Disassembling Carburetor", Section 3F.

Remove upper handgrip support (1) by removing 2 screws (2). Pull on throttle control cable guide (3) to release cable from slot in support (6). Remove cable button (4) from nylon handgrip sleeve (5).

Replace throttle cable and coil with a new assembly. Apply a light coat of graphite grease on new cable before installing.

Note that the large button on the end of cable is not centrally located. The button should be placed in the nylon handgrip sleeve so that the long end is toward the handgrip. Put a small amount of grease in the recesses in the upper and lower handgrip supports (1 and 6).

Assemble in reverse order of disassembly. Check movement of throttle piston to see that it opens and closes properly.

FRAME

Procedure for Servicing Frame

To rough check a frame for correct alignment, see following figures. The dimension shown will provide enough information to determine whether a frame is far enough out of alignment to require a major re-aligning job or replacement.

Because straightening a badly bent frame requires special tools and fixtures for holding, bending and gauging, this service is offered only by some of the larger dealerships.

IMPORTANT

Frames that are severely bent or damaged should be replaced, because it is questionable that they can be repaired economically.

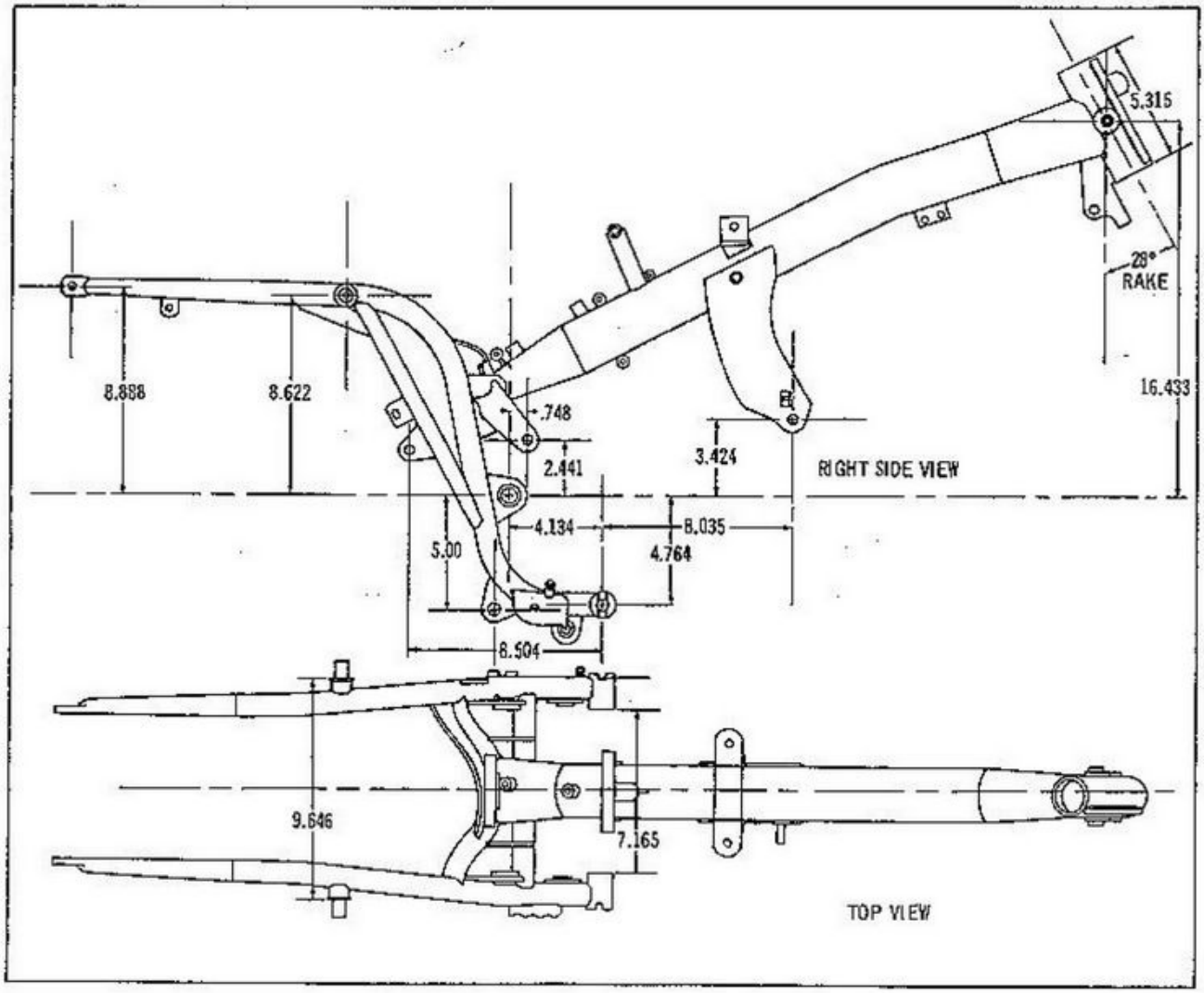


Figure 2E-7A. Basic Frame Dimensions - Model SS

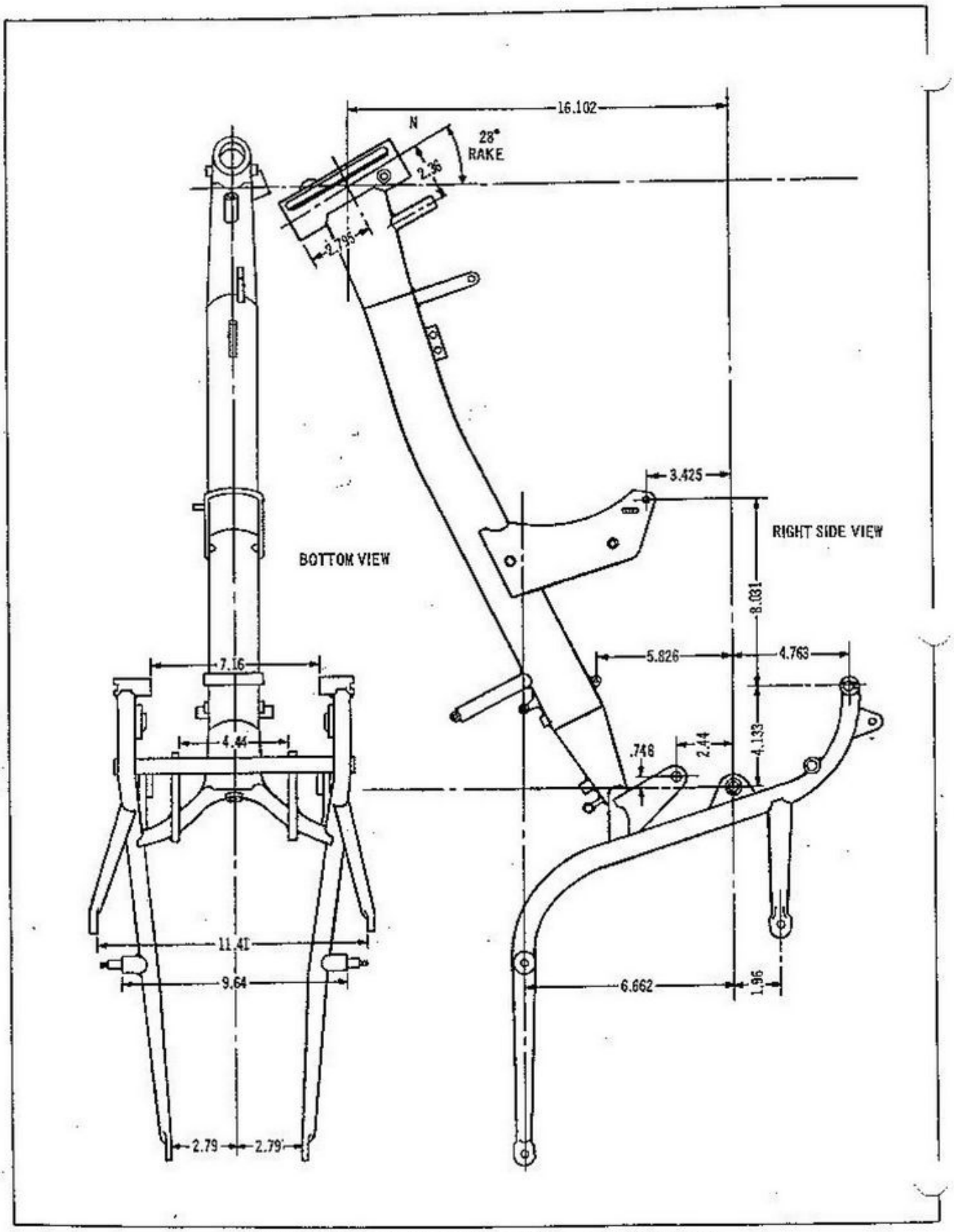


Figure 2E-7. Basic Frame Dimensions - Models C and H

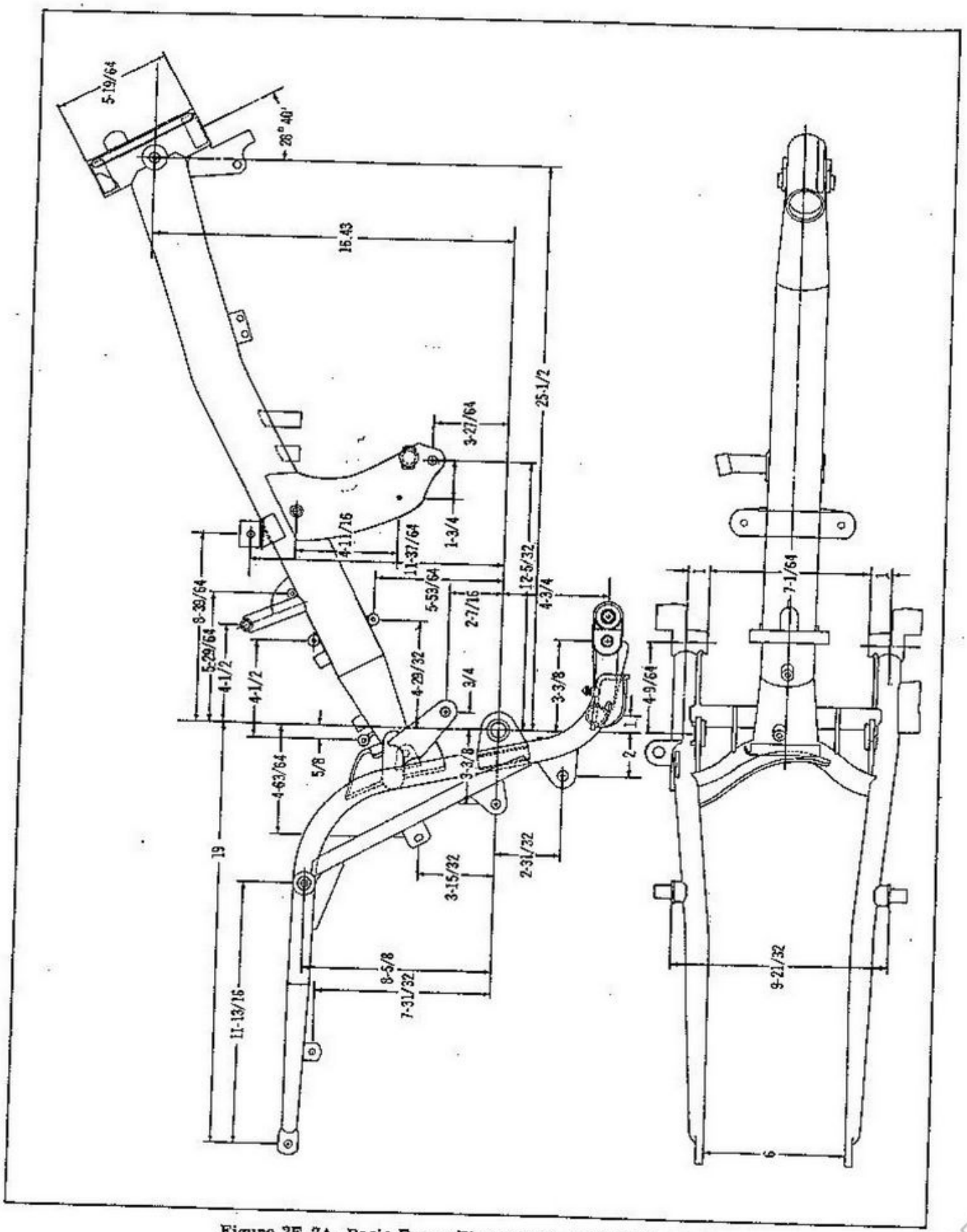


Figure 2E-7A. Basic Frame Dimensions - 1969-71 Model SS

Revised: 10-71

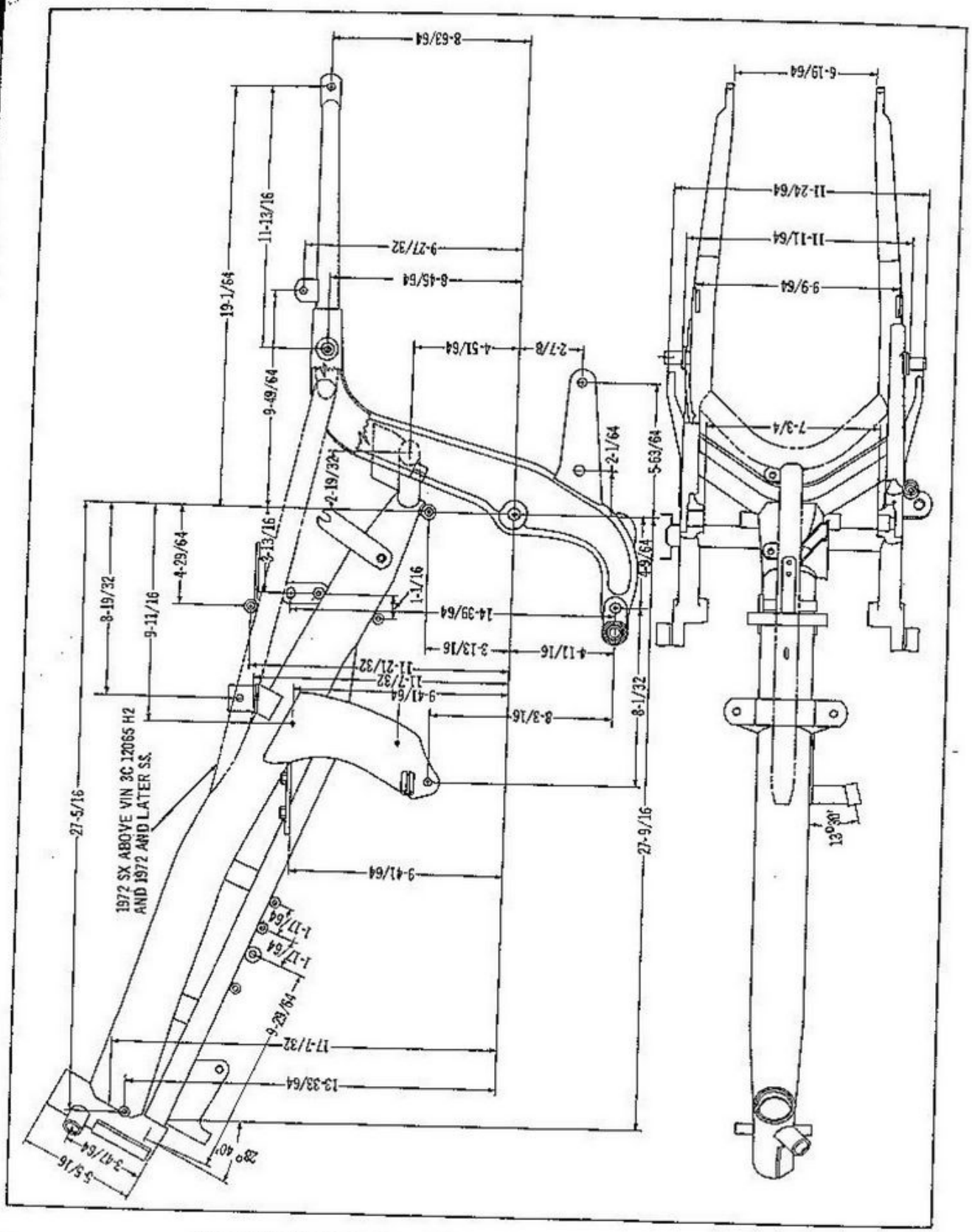


Figure 2E-7B. Basic Frame Dimensions, 1971 SX, 1972 SS and SX

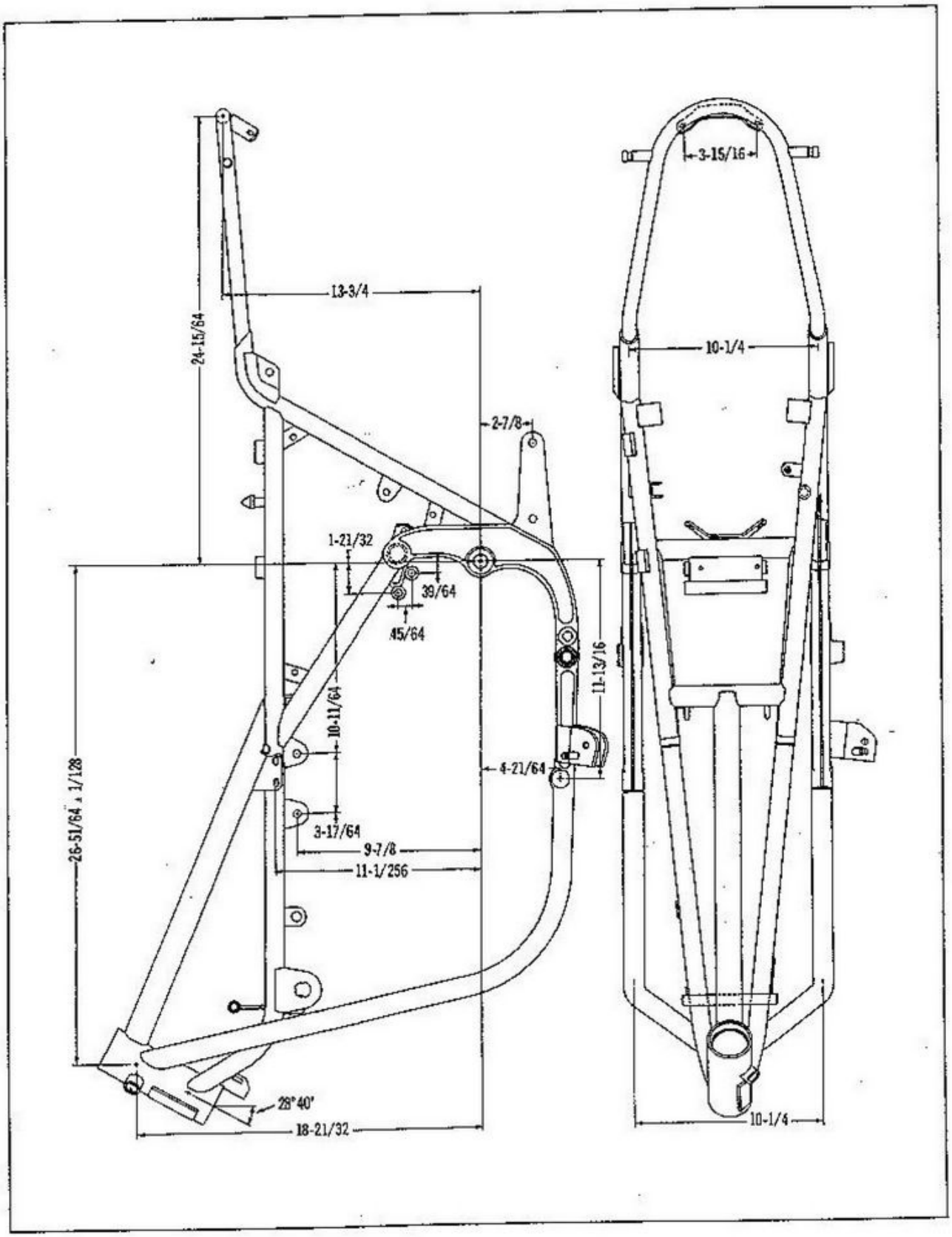
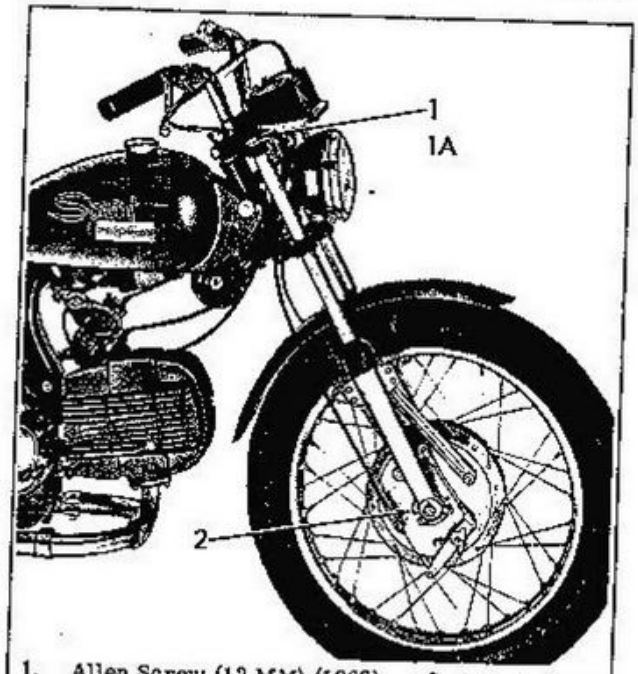


Figure 2E-7C. Basic Frame Dimensions, 1973-74 SS and SX

Servicing Front Fork

CHANGING FORK OIL (See Fig. 2F-53)

To drain fork oil, support front end of motorcycle so that front fork is fully extended. Remove the upper fork hex socket plug (1) with 12 mm Allen wrench or remove rubber plug from capscrew (1A) on later models. Remove lower drain plug screw from each fork side and allow all oil to drain from fork.



1. Allen Screw (12 MM) (1963) 2. Drain Plug
1A. Hex Capscrew (1964 & later)

Figure 2F-53. Front Fork

To refill fork, replace drain plug (2) and pour correct amount of the specified type fork oil into fork as shown in table. (The difference in the amount of oil required between a (DRY) and (WET) fork is due to oil cling.) Reassemble upper fork plug (1) and washer, install in fork and tighten.

Year and Model	Qty. (Liquid Measure)	Harley-Davidson Type
1971 & earlier SS, 1970 & earlier SX	Dry Fork 5 oz. Wet Fork 4-1/2 oz.	C
1972 to 1974 SS, 1971 to 1974 SX	Dry Fork 6 oz. Wet Fork 5-1/2 oz.	C

NOTE

Harley-Davidson Hydraulic Fork Oil Type C should be used exclusively because it provides correct damping action.

REMOVING FORK SIDE (See Fig. 2F-54 or 2F-54A)

Remove front wheel as described in "Removing and Installing Front Wheel." Remove front fender and brake side plate anchor strap by removing cap screws. Loosen lower fork bracket pinch bolt 1, or stud nuts 1A and wedge a screw driver upward into slot in bracket. Remove upper fork plug (2). Thread fork tool (Part No. 97305-61 into upper fork tube threads and strike tool with a copper or lead hammer to remove fork side (3) from brackets. See Fig. 2F-55.

NOTE

Make sure tool is engaged full depth of threads before striking. Also be careful that dirt and foreign particles do not fall into fork tube.

DISASSEMBLING FORK SIDE (See Fig. 2F-54 or 2F-54A)

After removing fork side, it may be necessary to disassemble fork side; if so, proceed as follows:

Remove fork spring (4) from top of fork tube and pour hydraulic fork oil from trop of tube. Remove axle pinch bolt, damper tube screw (5) and washer (6) from bottom of fork slider assembly (7). Pull slider assembly (7) off of fork tube (9) with a sharp jerk.

NOTE

This will release damper tube (17) from position in lower slider assembly and permit fork tube to be drawn from slider assembly. Invert fork tube allowing damper tube assembly to slide out top of fork tube.

DISASSEMBLING MAIN TUBE

Insert 1/8" diameter rod approximately 24" long through bottom of fork tube and engage end of rod in buffer spring (10) coils. Push buffer spring out through top of fork tube. To remove damper valve body snap ring (11) it may be necessary to notch lower end of fork tube allowing use of pointed tool to lift snap ring from its groove to remove it. See Fig. 2F-56. Using 5/8" dia. rod or pipe approximately 24" long inserted through top of fork tube, drift damper valve body (12 Fig. 2F-54) down out of fork tube by striking rod or pipe with hammer. The damper valve washer (13) and damper valve (14) will also be removed along with damper valve body.

DISASSEMBLING DAMPER TUBE

Remove lock ring (15) and piston (16) from damper tube (17).

DISASSEMBLING FORK SLIDER

On H models remove clamps (18B) securing boots (18A). On C models, turn fork lower cover (18) 1/4 turn counterclockwise. Pull off fork slider (22). Remove lock ring (19) and oil seal (20) from fork slider (22).

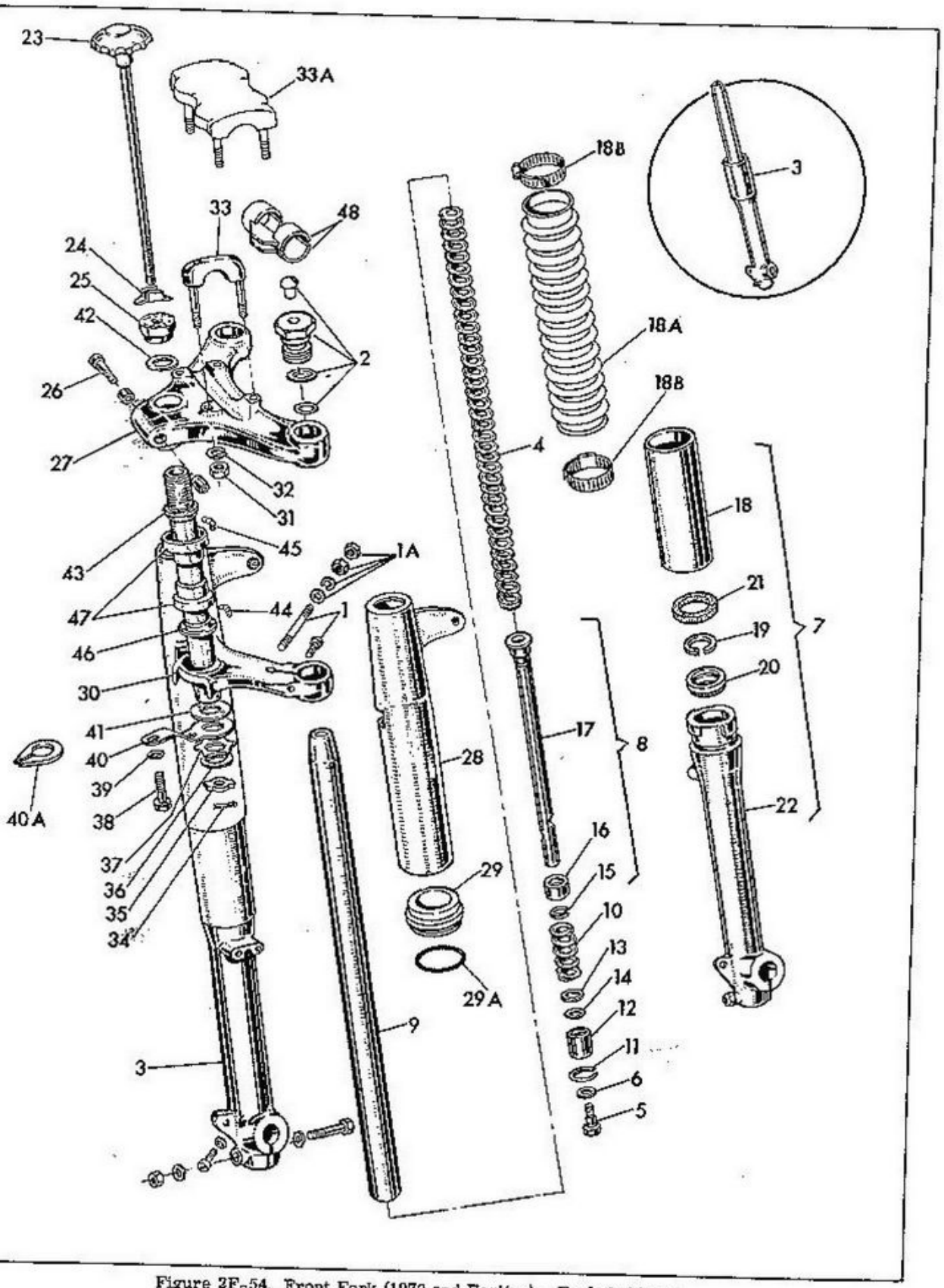


Figure 2F-54. Front Fork (1970 and Earlier) – Exploded View

Key for Figure 2F-54 (1970 and Earlier)

1. Lower Bracket Fork Bolt (2)
   Lower Bracket Fork Stud (2) (63 & 64 H Models)
1A. Stud Nuts, Washers & Lockwashers (63 & 64 H Models)
2. Fork Plug (2) Washer (2) Seal (2)
3. Fork Side Assembly (2)
4. Fork Spring (2)
5. Damper Tube Screw (2)
6. Damper Tube Screw Washer (2)
7. Fork Slider Assembly (2)
8. Damper Tube Assembly (2)
9. Main Tube (2)
10. Buffer Spring (2)
11. Damper Valve Body Lock Ring (2)
12. Damper Valve Body (2)
13. Damper Valve Washer (2)
14. Damper Valve (2)
15. Damper Piston Lock Ring (2)
16. Damper Piston (2)
17. Damper Tube (2)
18. Fork Lower Cover Assembly (2) (C Models)
18A. Fork Boot (1970 & earlier H and SS Models)
18B. Boot Clamp (2) (1970 & earlier H and SS Models)
19. Seal Lock Ring (2)
20. Fork Seal (2)
21. Fork Tube Lower Cover Seal (2)
22. Fork Slider Assembly (2) (Right & Left)
23. Steering Damper Knob Assy.
24. Steering Damper Rod Lock
25. Fork Stem Nut
26. Fork Upper Bracket Bolt
27. Fork Upper Bracket
28. Fork Upper Cover Assembly (2) Right & Left
29. Fork Upper Cover Rubber Ring (2) (1970 & earlier)
29A. Fork Upper Cover O-Ring (2) (1970 & earlier)
30. Fork Stem and Bracket
31. Handlebar U-Bolt Clamp Nut (4)
32. Handlebar U-Bolt Clamp Washer (4)
33. Handlebar U-Bolt (2)
33A. Handlebar Clamp (62 & Later)
34. Steering Damper Rod Cotter Pin
35. Steering Damper Lower Nut
36. Steering Damper Spring Washer Plate
37. Steering Damper Spring Washer
38. Steering Damper Anchor Plate Bolt (1961-66C)
39. Steering Damper Anchor Plate Washer (1961-66C)
40. Steering Damper Anchor Plate (1961-66C Model)
40A. Steering Damper Anchor Plate (late 1962 & later H and SS Models)
41. Steering Damper Upper Friction Disc
42. Fork Stem Nut Washer
43. Upper Steering Head Bearing Cone
44. Lower Steering Head Ball Bearings (25)
45. Upper Steering Head Ball Bearings (25)
46. Lower Steering Head Bearing Cone
47. Head Cup (2)
48. Handlebar Rubber Mounts (2) (62 & Later)

Figure following name of part indicates quantity necessary for one complete assembly.

REMOVING AND INSTALLING FORK UPPER COVER ASSEMBLY (See Fig. 2F-54)

Remove front fork side as described in "Removing Fork Side." Remove headlamp mounting bolts and let headlamp hang down on fork bracket. Remove speedometer drive from end of drive cable and slip cable through loop on left fork upper cover. Remove brake cable lock nut from cable. Remove brake cable ferrule and slip cable through loop on right fork upper cover assembly. Loosen steering damper knob (23) several turns to relieve tension on steering damper lock (24). Loosen front fork stem nut (25) and fork upper bracket bolt (26) several turns each. In the case where one fork side is to remain assembled it will also be necessary to loosen fork plug (2) several turns on the assembled fork side. The loosening of these items will permit the fork upper bracket (27) to be drifted upward thus releasing tension on fork upper cover assembly (28) and rubber ring (29) permitting the fork upper cover to be slipped out of position.

NOTE

Place piece of wood or other soft material under the fork upper bracket and drift bracket upward striking the wood or soft material. The bracket is made of aluminum alloy and will be damaged if this procedure is not followed.

To reinstall cover reverse the above procedure. Make certain rubber ring (29) and O-ring (29A) are held in place in cup of fork upper cover assembly (28) as assembly is slipped into position between the upper fork bracket and the fork stem and bracket (30). Install fork side in reverse order described in "Removing Fork Side." Remount headlamp and adjust as described in "Adjusting Headlamp," Section 5-D.

INSPECTION PROCEDURE

If hydraulic fork does not work properly due to oil leakage, bent, damaged or worn fork parts proceed as follows:

To determine the cause of oil leakage follow instructions as described in "Changing Fork Oil." If fork does not function correctly after eliminating the possibility of water contamination of fork oil and incorrect oil level in fork sides and oil continues to leak, proceed as follows: Drain out fork oil. Remove front wheel as described in "Removing Front Wheel." Remove front fender. Remove axle pinch bolt, damper tube screw (5) and washer (6) from bottom of fork slider assembly (7). (See Fig. 2F-54.) Pull slider assembly (7) off of fork tube (9) with a sharp jerk. Disassemble fork slider as described in "Disassembling Fork Slider" and carefully examine all parts. Wash all parts thoroughly and replace seals (20) and other worn parts. If fork

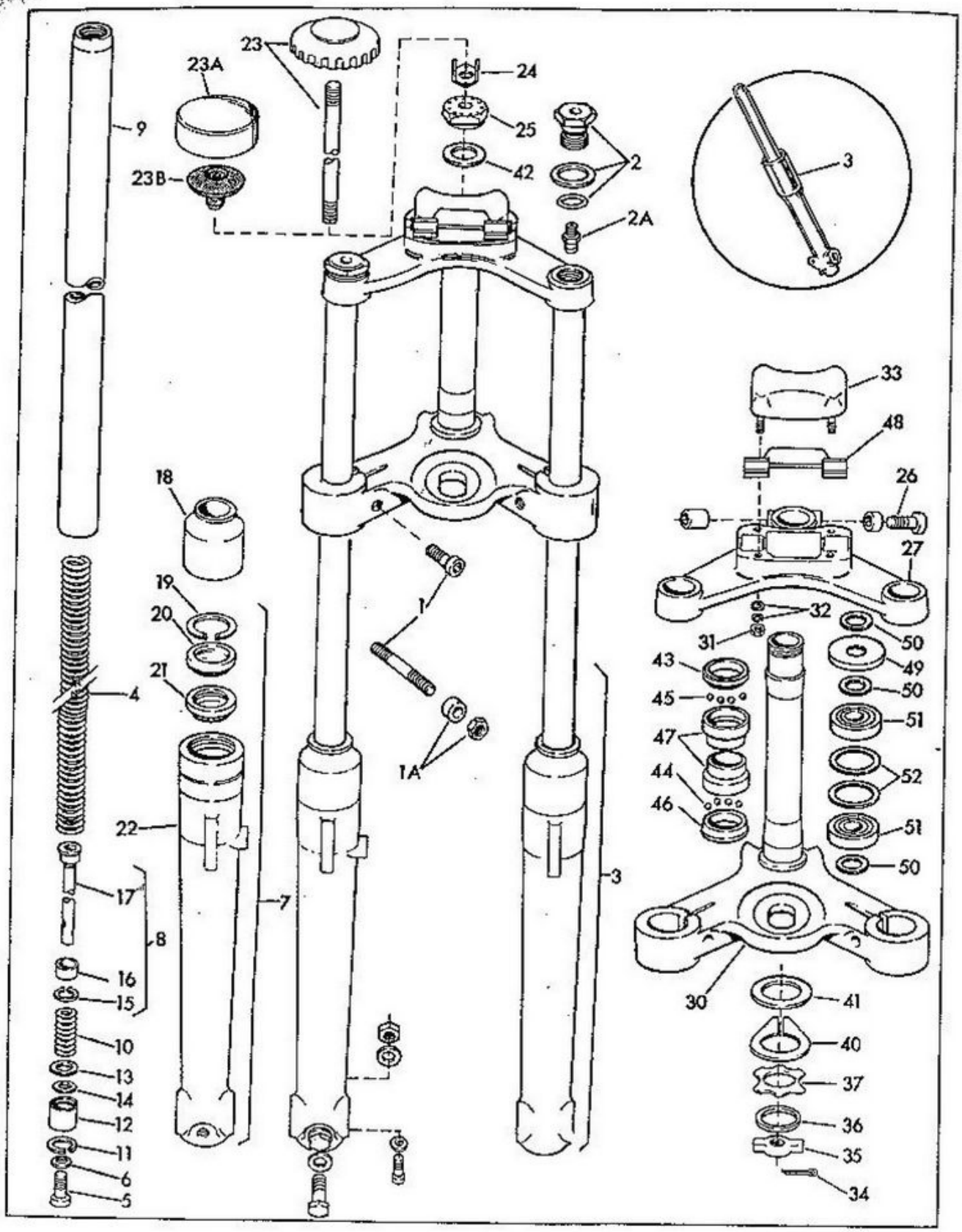


Figure 2F-54A. Front Fork (1971 and Later) - Exploded View

Key for Figure 2F-54A (1971 and Later)

1. Lower Bracket Fork Bolt (2) (SS)
   Lower Bracket Fork Stud (2) (SX)
1A. Stud Nut & Spacer (2) (SX)
2. Fork Plug (2), Washer (2), Seal (2)
2A. Fork Plug Valve (2)
3. Fork Side Assembly (2)
4. Fork Spring (2)
5. Damper Tube Screw (2)
6. Damper Tube Screw Washer (2)
7. Fork Slider Assembly (2)
8. Damper Tube Assembly (2)
9. Main Tube (2)
10. Buffer Spring (2)
11. Damper Valve Body & Lock Ring (2)
12. Damper Valve Body (2)
13. Damper Valve Washer (2)
14. Damper Valve (2)
15. Lock Ring (2)
16. Damper Piston (2)
17. Damper Tube (2)
18. Fork Boot (2)
19. Seal Lock Ring (2)
20. Fork Seal (2)
21. Fork Tube Lower Cover Seal (2)
22. Fork Slider Assembly (2) (Right & Left)
23. Steering Damper Knob Assembly
23A. Fork Plug Cap
23B. Rubber Pad
24. Steering Damper Rod Lock
25. Fork Stem Nut
26. Fork Upper Bracket Bolt
27. Fork Upper Bracket
30. Fork Stem and Bracket
31. Handlebar Clamp Nut (4)
32. Handlebar Clamp Nut Washer (4)
33. Handlebar Clamp
34. Steering Damper Rod Cotter Pin
35. Steering Damper Lower Nut
36. Steering Damper Spring Washer Plate
37. Steering Damper Spring Washer
40. Steering Damper Anchor Plate
41. Steering Damper Upper Friction Disc
42. Fork Stem Nut Washer
43. Upper Steering Head Bearing Cone (1971-72)
44. Lower Steering Head Ball Bearings (25) (1971-72)
45. Upper Steering Head Ball Bearings (25) (1971-72)
46. Lower Steering Head Bearing Cone (1971-72)
47. Head Cup (2) (1971-72)
48. Handlebar Rubber Mounts (2)
49. Bearing Shield (1973 & Later)
50. Washer (3) (1973 & Later)
51. Ball Bearing (2) (1973 & Later)
52. Thrust Washer (2) (1973 & Later)

sliders have appreciable amount of play when slider is slipped on fork tube, the sliders will have to be replaced. Assemble in reverse order of disassembly.

If inspection shows that fork parts are bent, broken or damaged in any way proceed as follows: Remove damaged parts in question according to procedure listed under "Disassembling Front Fork." (See Fig. 2F-54.) Wash and examine all parts thoroughly to determine whether they can be economically repaired or should be replaced. If further inspection shows that not only fork parts are damaged or bent but also that the fork stem and bracket (30) and fork upper bracket (27) are possibly out of alignment or bent they must be removed and replaced or repaired if practical.

REMOVING FORK STEM AND BRACKET ASSEMBLY FROM STEERING HEAD. (See Figs. 2F-54 & 2F-54A)

Follow instructions described under "Removing Fork Side." After removing both fork sides it will be necessary to remove both fork upper covers from early models as described under "Removing and Installing Fork Upper Cover Assembly." Remove the handlebar assembly by removing the four handlebar clamp nuts (31), washers (32) and two handlebar U-bolts (33) or clamp (33A).

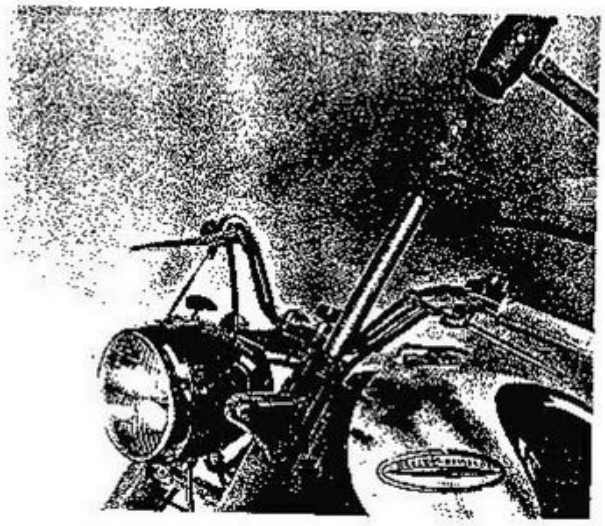


Figure 2F-55. Removing Fork Side

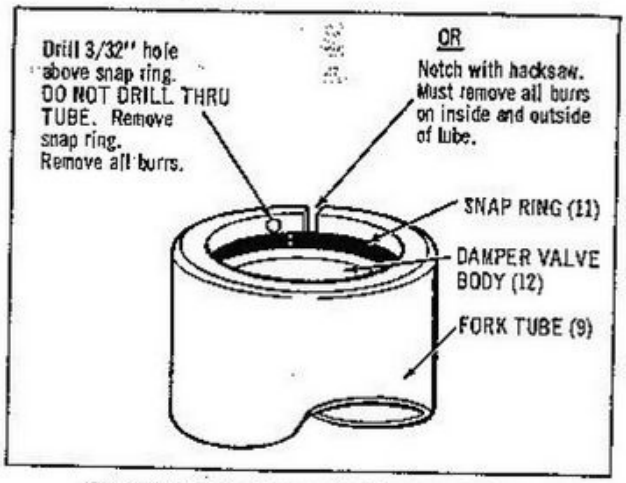


Figure 2F-56. Removing Damper Valve Body Snap Ring

NOTE

Do not disconnect clutch and brake hand levers from handlebar, wiring from horn and dimmer switch, or throttle cable from carburetor, unless handlebar assembly is to be removed from motorcycle.

Lift handlebar assembly from upper fork bracket and carefully position assembly away from working area. Be careful not to bend control wires more than necessary.

Remove steering damper rod cotter pin (34) and unscrew steering damper knob assembly (23). This will free the steering damper lower nut (35), spring washer plate (36), spring washer (37), and rod lock (24). Remove steering damper anchor plate bolt (38), and washer (39) (if used), anchor plate (40 or 40A) and friction disc (41). On SS and SX models not equipped with a steering damper, pull off fork plug cap (23A) and rubber pad (23B). Remove front fork stem nut (25) and washer (42). Slide fork upper bracket (27) up off from fork stem and bracket (30).

1972 & EARLIER MODELS

Carefully push fork stem and bracket down through upper bearing cone (43) far enough to permit removal of lower steering head ball bearings (44). After bearings are removed, slip fork stem and bracket remainder of the way down through steering head. Lift off upper bearing cone (43) carefully and remove upper steering head ball bearings (45). Remove lower steering head bearing cone (46) from fork bracket stem. Clean and inspect bearings, cones, and cups for wear. If worn or pitted, replace. If necessary to remove head cups (47), use a piece of bar stock inserted through steering head to drive out cups.

1973 & LATER MODELS

Push fork stem and bracket down through steering head freeing upper two washers (50) and bearing shield (49). Remove lower washer (50) from stem. Remove ball bearings (51) and thrust washers (52) from steering head. Inspect bearings for excessive looseness or roughness and replace if necessary.

STRAIGHTENING FORK TUBES

Straightening of fork tubes requires several special tools including a hydraulic or arbor press, dial indicator and straightening blocks. (If facilities are not available locally for straightening fork tubes, they may be returned to the factory through any authorized Harley-Davidson dealer.)

NOTE

Do not attempt to straighten a fork tube that has a sharp angle bend. These tubes should be scrapped because the metal is stretched.

Before beginning the straightening operation, clean the fork tube. Locate bends with a dial indicator as shown in Fig. 2F-57. (A fork tube is usually bent in two or three places - seldom one place.) Place fork tube on straightening block Part No. 96247-62. Using an arbor or hydraulic press straighten tube as much as possible as shown in Fig. 2F-58. Repeat pressing operations until fork tube is within .003 to .004 in. of being straight. Always check with dial indicator after each pressing operation.

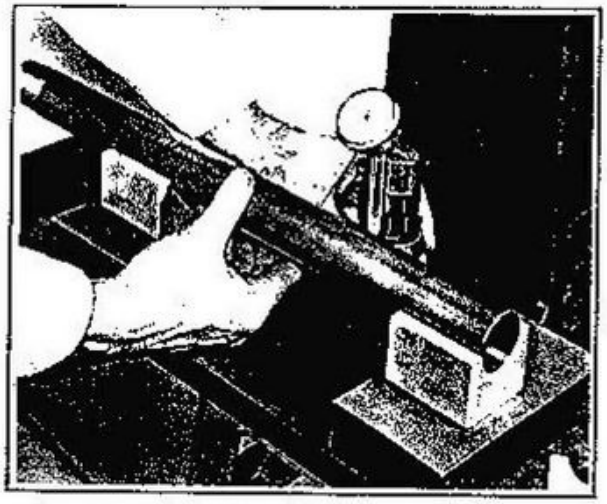


Figure 2F-57. Indicating High Point

Sometimes a fork tube is out of round, especially at the point it is clamped to the fork brackets. Place tube in straightening blocks as shown in Fig. 2F-59. Press until perfectly round and check with dial indicator or micrometer. Check fork tube by inserting into new fork slider. Work tube up and down in slider, if it does not bind, it is straight.

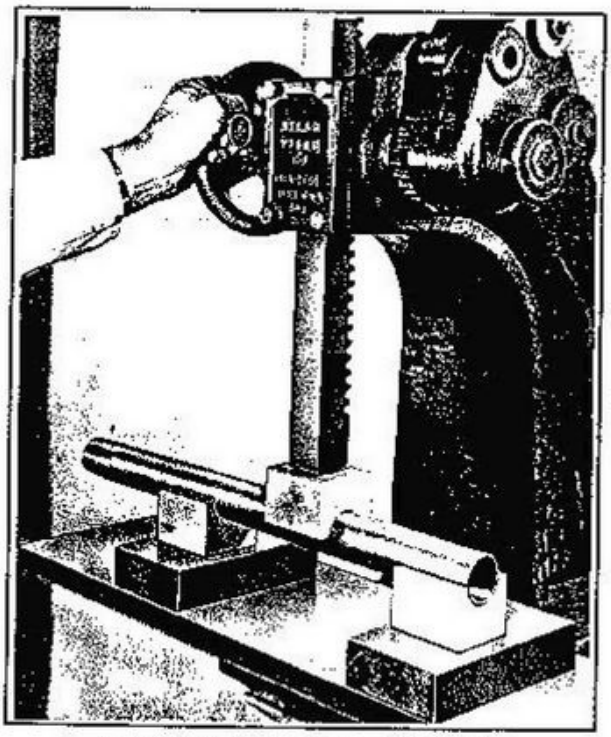


Figure 2F-58. Pressing High Point

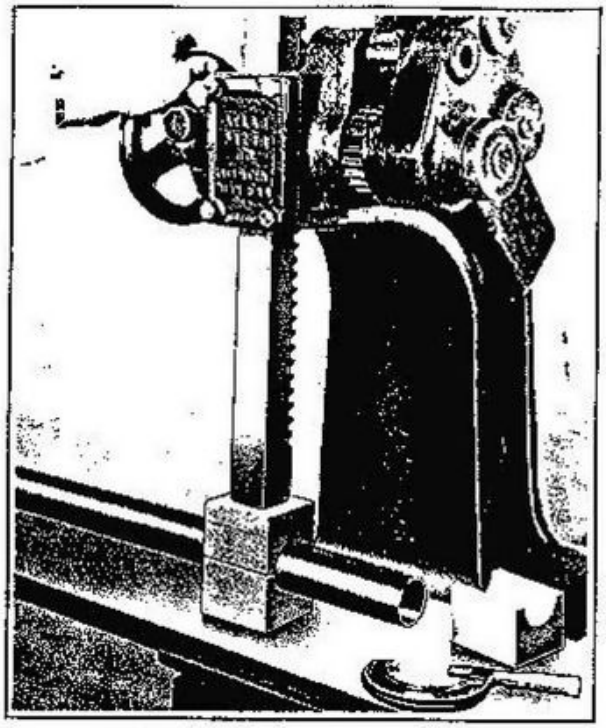


Figure 2F-59. Press Tube Round

STRAIGHTENING FORK STEM AND BRACKET

Straightening a fork stem and bracket not only requires a great deal of practice to become proficient, but also several special tools and fixtures, including an arbor press, surface plate or suitable heavy metal plate that is perfectly smooth, bending bar, four straightening blocks (W, Fig 2F-60), two improvised steel gauging bars or legs 1.181 in. dia. x 12 in. length (X, Fig. 2F-60), two steel support blocks (Y), and several steel press blocks (Z).

If facilities are not available locally for straightening fork stem and bracket assemblies, they may be sent to the factory through any authorized Harley-Davidson dealer. Do not attempt to repair fork stem and bracket assemblies that are badly bent or broken. These bracket assemblies should be scrapped.

Insert two steel gauging bars in the fork bracket and secure in place with two bracket pinch bolts as shown in Fig. 2F-60.

Sometimes the steel bars cannot be inserted into the bracket because the holes are distorted. In this case, press the bars into position using an arbor press.

If both legs are twisted, place bracket in position on arbor press as shown in Fig. 2F-60. Place two straightening blocks under low legs (A and B). With press block (Z) placed straight across bracket assembly, press until legs (C and D) are forced down into

alignment with legs (A and B). If one leg is bent, place bracket assembly on three straightening blocks, two under straight leg and one under low leg. Place press block diagonally, across bracket assembly to high leg and press until high leg is forced down and into alignment with the other three legs.

Place the fork stem and bracket on the four straightening blocks located on surface plate. (Fig. 2F-61) If the legs rest squarely on the straightening blocks, the bracket assembly is correctly trued.

If bracket is not true, press again, checking alignment after each operation.

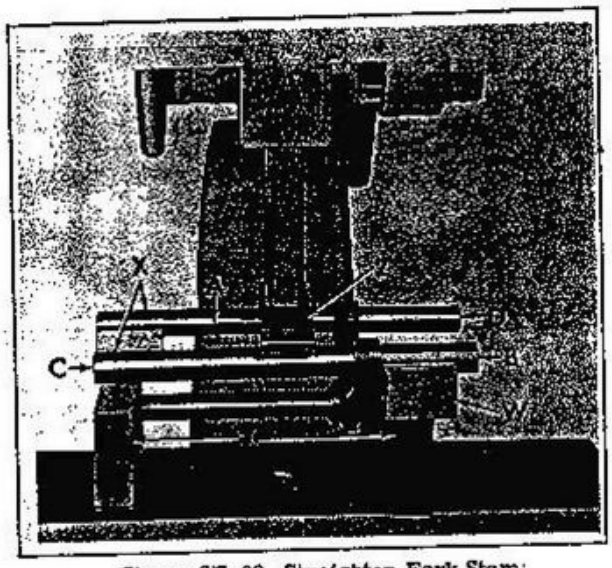


Figure 2F-60. Straighten Fork Stem and Bracket Assembly

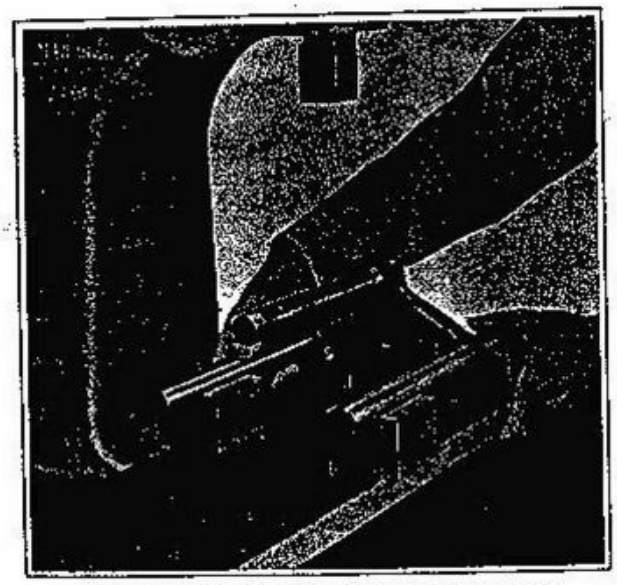


Figure 2F-61. Checking Bracket Alignment

Figure 2F-62. Bending Fork Stem and Bracket Assembly

If fork bracket is bent or distorted so that fork tubes are out of line with fork stem, place in vise and straighten, using Bending Bar, Part No. 96806-40, as shown in Fig. 2F-62. Check to see if fork stem is straight, (true on a vertical centerline) by using new fork upper bracket as a gauge (Fig. 2F-63.) If not, place in vise and use Bending Bar to bring into position.

Figure 2F-63. Gauging Fork Stem

ASSEMBLING FORK STEM AND BRACKET IN STEERING HEAD (See Fig. 2F-54)

Assembly is essentially the reverse of the disassembly procedure described previously under heading "Removing Fork Stem and Bracket Assembly from Steering Head."

Adjustment of front stem nut (25) on fork stem is necessary to remove all appreciable play in steering head cones, bearings and fork stem and bracket assembly. Turning action should be smooth and free.

After the front fork and wheel has been completely reassembled and the motorcycle is still supported with the front wheel clear of the ground the front fork assembly should be turned from right to left to check for binding or play in steering head cones or bearings. If found tight, the fork upper bracket bolt (26) will have to be loosened. Loosen (or back off) the front fork stem nut slightly until the fork movement is smooth and free. Be sure not to back it off too much as there should be no appreciable shake or sideways movement of the front fork. Retighten the upper fork bracket bolt (26).

ASSEMBLING FORK SLIDER

Assembly is essentially the reverse order of disassembly. See "Disassembling Fork Slider" and "Inspection Procedure."

ASSEMBLING DAMPER TUBE

Assemble in reverse order of disassembly. See "Disassembling Damper Tube."

ASSEMBLING MAIN TUBE (See Fig. 2F-54)

Insert small diameter coil end of buffer spring (10) in lower end of fork tube (9) and push spring into fork tube far enough to clear lower buffer spring coils with shoulder inside of fork tube. Place damper valve (14) in shallow recess at top of damper valve body (12), lay damper valve washer (13) on top of damper valve body covering damper valve.

Carefully insert damper valve body assembly, washer end first, into lower end of fork tube. Press assembly remainder of way into fork tube until it bottoms on shoulder in fork tube. Install damper valve body lock ring (15) in lock ring groove at lower end of fork tube.

Drop damper tube assembly (8), small tube end first, into top of fork tube (9). Shake fork tube until damper tube drops down through damper valve body assembly. Install fork spring (4) and temporarily install fork tool Part No. 97305-61 in top of fork tube (9). Making certain fork tube is perfectly clean, slip fork slider assembly over lower end of fork tube and compress two units together until damper tube snaps into position in fork slider assembly. Slip damper tube screw washer (6) on damper tube screw (5), install and tighten screw assembly in bottom of fork slider assembly.

REASSEMBLING FORK UPPER COVER ASSEMBLY

See "Removing and Installing Fork Upper Cover Assembly."

ASSEMBLING FORK SIDE (See Fig. 2F-54)

With tool Part No. 97305-61 installed in fork side assembly, slip tool and fork side assembly up through fork stem and bracket and fork upper bracket. Grasp tool as it passes through fork upper bracket and pull fork side assembly up into place. Remove fork tool from fork side assembly. Pour 5 oz. Harley-Davidson Sprint Fork Oil into top of Fork tube. Assemble fork plug washer and seal on fork plug (2), install and tighten fork plug assembly in fork tube. After fork side assembly is drawn into proper position with fork plug, tighten lower bracket fork pinch bolt (1).

Remainder of assembly is essentially the reverse order of disassembly. (See Chassis 2 - Wheels C "Removing and Installing Front Wheel.")

INSTALLING STEERING DAMPER (See Fig. 2F-54)

To reassemble simply reverse the disassembly procedure. (See "Removing Fork Stem and Bracket Assembly").

NOTE

Steering damper star washer (37) is placed on damper rod assembly (23) with dished side up.

VENT VALVE AND BAFFLE (See Fig. 2F-63A)

A vent valve and baffle has been incorporated in 1970 SS motorcycles from serial No. 12216 and 1971 SS and SX models.

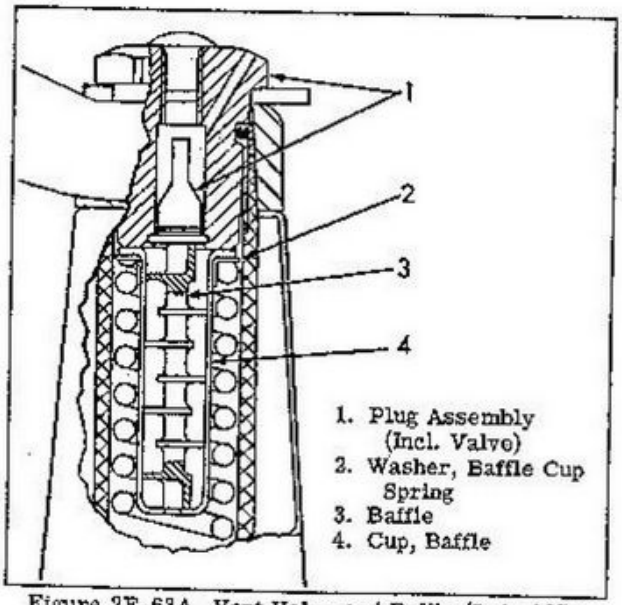


Figure 2F-63A. Vent Valve and Baffle (Late 1970 SS and 1971 SS and SX Models)

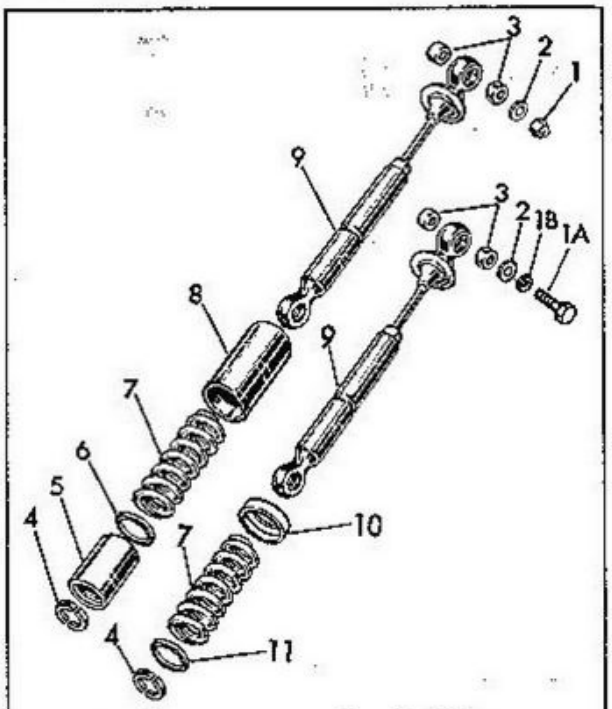
The parts, shown in Figure 2F-63A, are available in kit form for installation in earlier motorcycles when there is complaint of oil leakage from the front fork sides.

REMOVING, DISASSEMBLING AND ASSEMBLING REAR SHOCK ABSORBER (Early 1972 & earlier SS and 1972 & earlier SX)

Raise rear end of motorcycle with suitable blocking underneath frame.

NOTE

If blocking is not available work on only one shock absorber at a time, the other shock absorber will hold the rear fork and frame in place.



1. Nut (2)
1A. Bolt (2) (Models H & SS)
1B. Lockwasher (2) (Models H & SS)
2. Stud Washer (2)
3. Rubber Bushing (4)
4. Retainer Ring (2)
5. Lower Cover (Model C)
6. Seal Ring
7. Spring
8. Upper Cover (Model C)
9. Shock Absorber
10. Spring Guide, Upper (Models H & SS)
11. Spring Guide, Lower (Models H & SS)

Figure 2F-64. Rear Shock Absorber - Exploded View

Remove top and bottom mounting nuts, bolts, washers, rubber bushings and remove shock absorber assembly. (See Fig. 2F-64.) Place shock absorber in vise with lower cover lip on edge of vise jaw. Hold upper cover down with hand and compress covers until split retainer ring can be removed. (See Fig. 2F-65.)

Figure 2F-65. Disassembling Rear Shock Absorber

NOTE

Place a towel around upper cover to prevent scratching paint.

Loosen tension and remove shock absorber from vise. Remove lower cover or spring guide, spring and upper cover or spring guide from shock absorber.

To assemble simply reverse the disassembly procedure.

NOTE

Care should be taken when compressing covers to assemble split ring so that the lower cover does not get caught in the split ring groove on the shock absorber causing cover to bend.

Inspect rubber bushings and replace if worn or deformed.

NOTE

Late 1972 and later SS, also 1973 and later SX shock absorbers cannot be disassembled for repair.

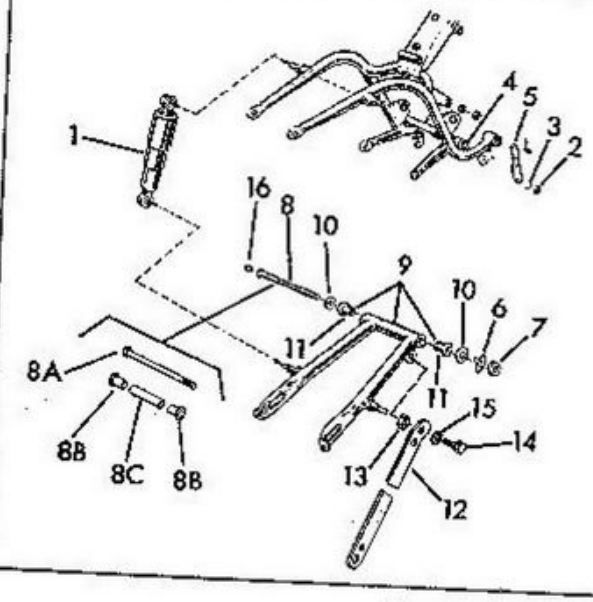
REMOVING REAR FORK (See Fig. 2F-66)

Remove rear wheel as described in "Removing and Installing Rear Wheel," Section 2C.

Remove rear shock absorbers (1) as described in "Disassembling and Assembling Rear Shock Absorber."

On Models C and H having brake crossover shaft, remove nut (2) and washer (3) from rear brake crossover shaft (4). Using soft hammer, tap on shaft end until brake operating lever (5) is free from shaft.

Bend ear on rear fork pivot bolt lockwasher (6), permitting the removal of pivot bolt nut (7). Remove nut (7) and lockwasher (6). Using a brass drift, tap out rear fork pivot bolt (8). Slip rear fork assembly (9) and thrust washers (10) from between mounting ears.



1. Rear Shock Absorber (2)
2. Nut (Models C & H)
3. Washer (Models C & H)
4. Rear Brake Crossover Shaft (Models C & H)
5. Rear Brake Crossover Shaft Lever (Models C & H)
6. Rear Fork Pivot Bolt Lockwasher
7. Rear Fork Pivot Bolt Nut
8. Rear Fork Pivot Bolt
8A. Pivot Bolt (1973 & later)
8B. Pivot Bolt Sleeve (2) (1973 & later)
8C. Pivot Bolt Sleeve Spacer (1973 & later)
9. Rear Fork Complete with Bushings
10. Thrust Washer (variable thickness as required)
11. Rear Fork Pivot Bolt Bushing (2)
12. Rear Brake Anchor Arm
13. Anchor Arm Nut
14. Bolt
15. Washer
16. Grease Fitting

Figure 2F-66. Rear Fork - Exploded View

Rear fork bushings (11) can be pressed or drifted out of fork by inserting rod through opposite sides of fork, engaging rod end in each bushing and pressing or drifting bushing out. Press in replacement bushings and ream to size. See Figures 2F-67 and 2F-67A.

CLEANING AND INSPECTION

Before re-assembly, clean and inspect all parts. Slip fork pivot bolt (8) (with sleeves 8B and Spacer 8C, if used) into position in fork and check for play in bushings. On 1972 & earlier models, if clearance is excessive, new bushings should be installed and reamed as described in "Removing Rear Fork."

1973 and later bushings should be reamed to fit pivot bolt sleeves (8B) which are available in oversiz diameters.

Rough check rear fork alignment. Dimensions show in Fig. 2F-67 and 2F-67A will provide enough infor mation to determine if fork is far enough out o alignment to require re-aligning or replacement

INSTALLING REAR FORK (See Fig. 2F-66)

Press in new pivot bolt bushings if they have beer removed. Install rear brake anchor arm (12) on rear fork. Install anchor arm nut (13), bolt (14) and washer (15) but do not tighten. (Tighten after rear wheel has been installed and aligned.) Slide rear fork between mounting ears so that brake anchor

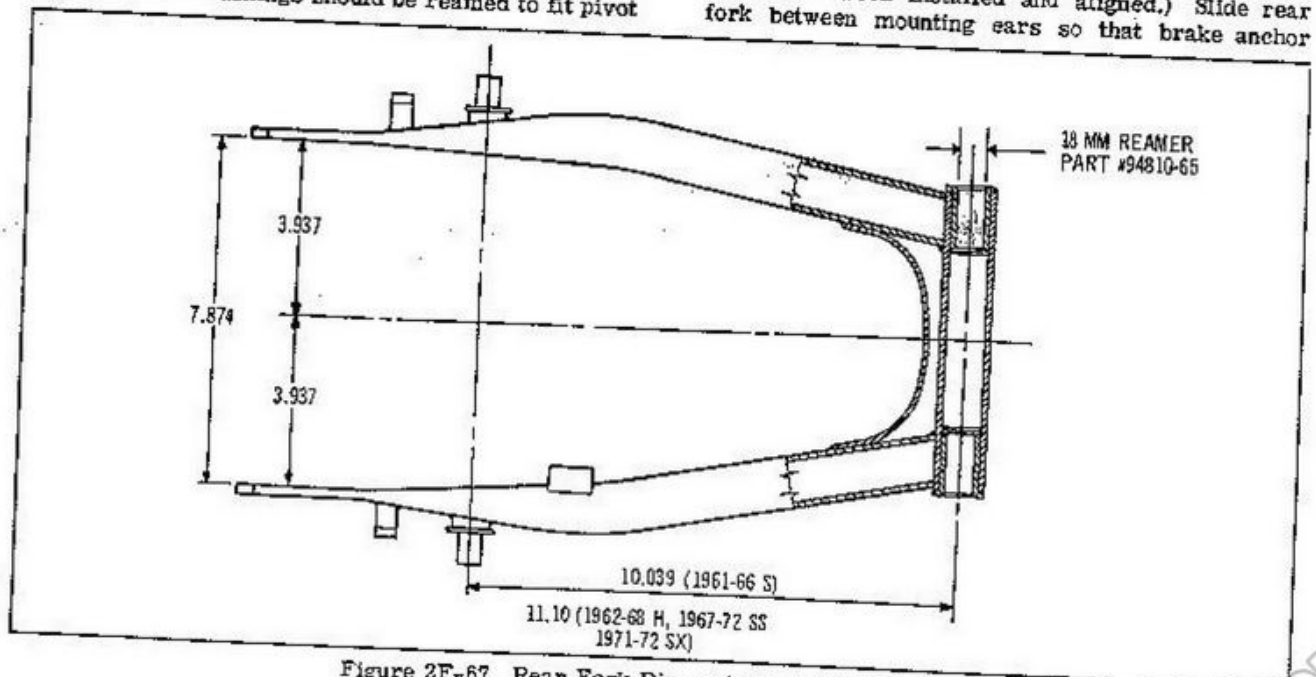


Figure 2F-67. Rear Fork Dimensions - 1972 & Earlier

Revised: 3-77

arm is on the right side of frame and rear chain is over the left fork side in its normal operating position. Slip thrust washer (10) between left side fork pivot bushing (11) and mounting ear. Install fork pivot bolt in left mounting ear and push bolt through left thrust washer and into rear fork. Position right side thrust washer between right fork pivot bushing and mounting ear then push pivot bolt remainder of way into position.

NOTE

Make sure locating lugs on left end of pivot bolt line up with notches on mounting ear before tightening nut.

Place lock washer (6) on pivot bolt with bent over prong in groove on frame and secure assembly with nut (7). Bend lock washer ear, locking nut (7). Check rear fork for side play or excessive bind between mounting ears. Rear fork should be "just free" between mounting ears with no noticable side shake or play.

Obtain correct fit by use of variable thickness thrust washers (10). Washers are available in various thicknesses from 0.6 mm to 1.2 mm.

After rear fork is assembled grease at fitting (16) until grease comes from both bushings.

Install brake crossover shaft lever (5) on crossover shaft (4) and draw into position with nut (2) and washer (3). Install shock absorbers (1) making certain the brake rod is on the inside of the right side shock absorber. Install rear wheel as described in "Removing and Installing Rear Wheel." (Section 2C)

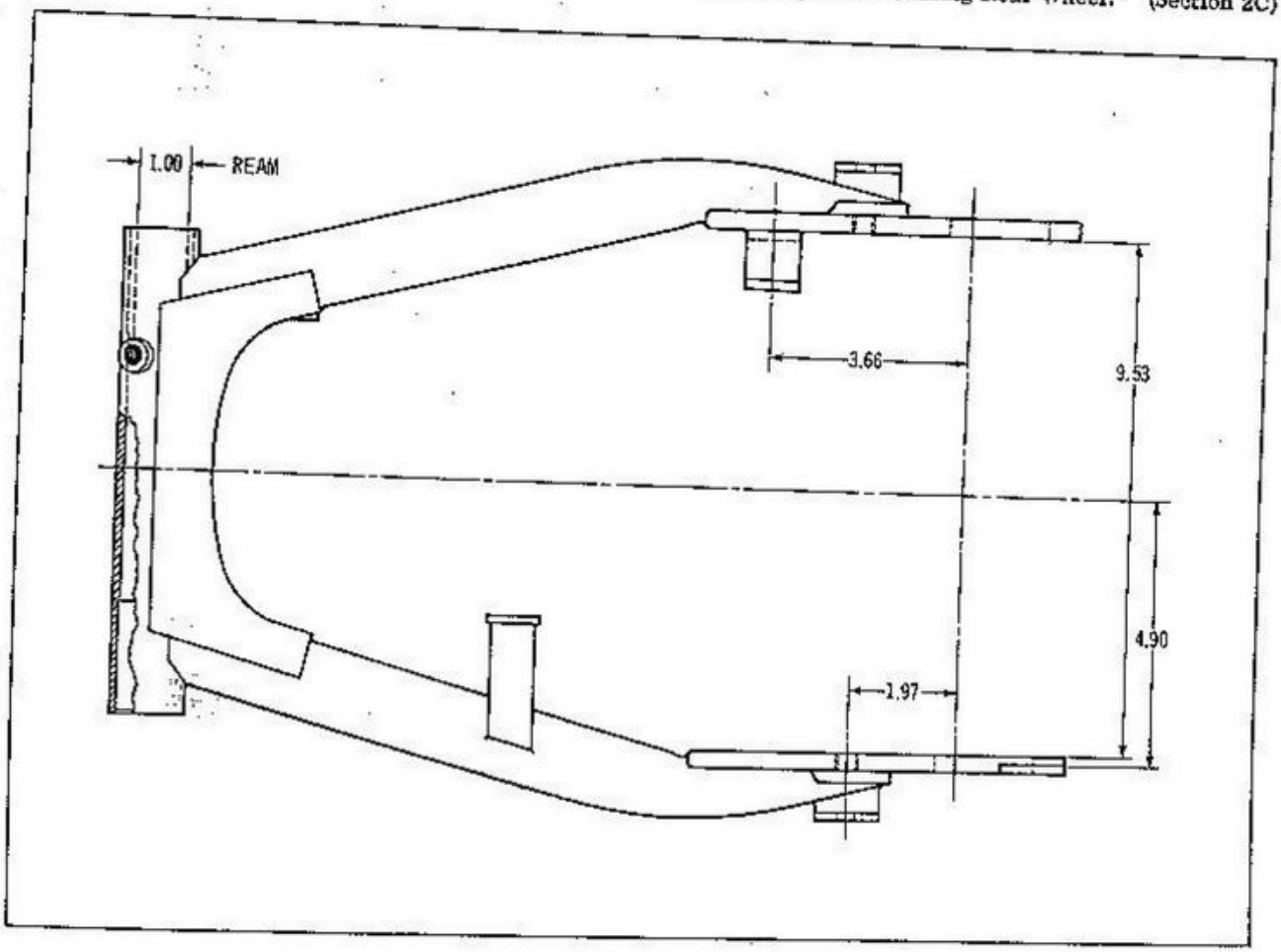


Figure 2F-67A. Rear Fork Dimensions - 1973 & Later

SERVICING BRAKES

The front wheel brake is operated by a hand lever on the right side handlebar, and the rear wheel brake is operated by a foot pedal on the left side of the motorcycle. Both hand lever and foot lever controls are connected to their respective brake shoe operating shafts independently through mechanical linkage. Compressing the front wheel brake hand lever and depressing the rear wheel brake foot lever actuates the operating shaft cam, moving brake shoes against the brake drum. To keep brakes in proper operating condition, it is essential to check adjustment of brakes at regular service intervals of 1000 miles, or sooner, depending on wear of brake linings and drums. See adjustment of brakes and brake shoes. If brakes do not operate satisfactorily after the adjustment, disassemble and service brakes and connecting linkage.

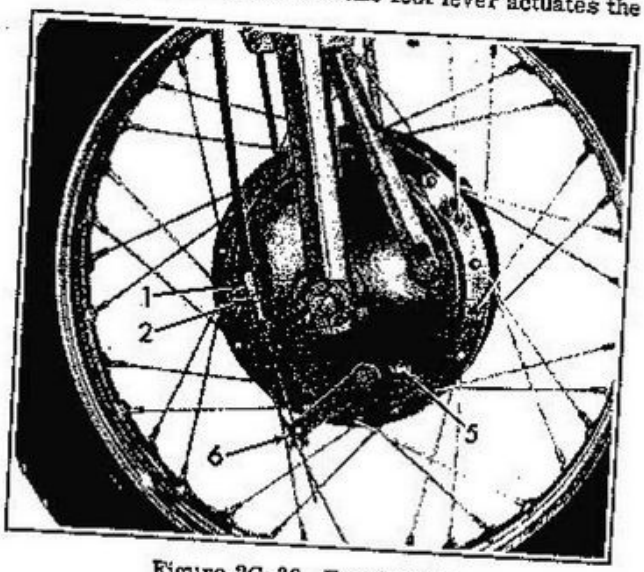
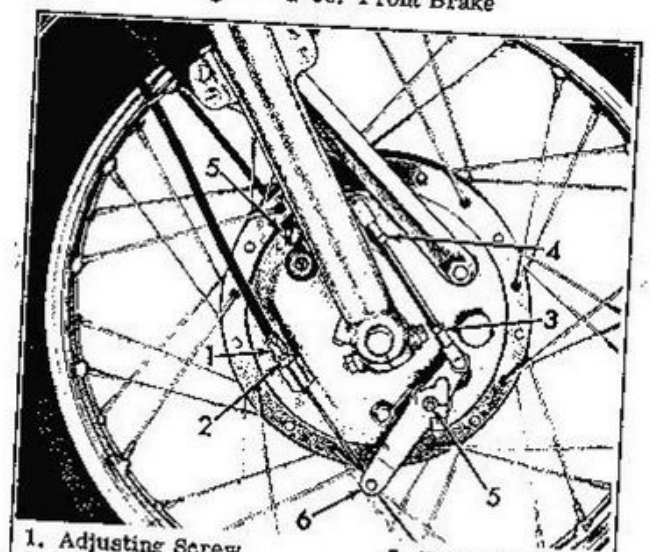


Figure 2G-30. Front Brake



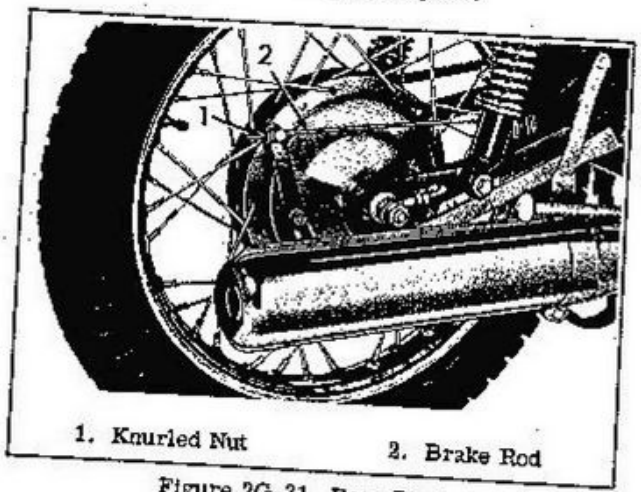
1. Adjusting Screw
2. Locknut
3. Lower Clevis Adjustment
4. Upper Clevis Adjustment
5. Brake Camshaft Grease Fittings
6. Cable Block

Figure 2G-30A. Front Brake, 1970-71, 1973 & Later SS

ADJUSTING FRONT BRAKE (See Fig. 2G-30 and 2G-30A)

Readjust the front wheel brake whenever required. When properly adjusted, the hand lever on the handlebar will move freely about 1/8 of its full movement before the brake starts to take effect. If adjusted tighter, the brakes may drag. To adjust, loosen locknut (2) on control adjusting screw (1) and turn the adjusting screw down to increase the free movement of the hand lever or up to decrease the free movement of the hand lever. When brake is adjusted properly, tighten locknut (2) securely. Minor adjustment can be made by turning the knurled nut located at the brake hand lever on the handlebar.

On SS double front type, whenever new brake linings or shoes are installed, it is necessary to equalize shoes by adjusting them individually at control rod clevis (3 and 4) so that both linings contact drum at the same time when brake is applied.



1. Knurled Nut
2. Brake Rod

Figure 2G-31. Rear Brake

ADJUSTING REAR BRAKE (See Fig. 2G-31)

The rear wheel brake adjustment is made by means of a knurled nut (1), which may be adjusted to change the effective length of the brake rod (2). The adjusting nut has a notch which fits against the clevis pin in the operating lever. Thus it is locked in place on the rod but may be turned down or backed off the rod by half turns as required.

Set the brake rod adjusting nut so that the brake does not start to take effect until the foot pedal is pushed downward about 1/2". Turn the nut farther on to tighten the brake and back it off to loosen the brake. After brake is adjusted, turn the wheel to see that it rotates freely to be sure the brake is not too tight and dragging.

REPLACING FRONT BRAKE CABLE (See Fig. 2G-30)

If the front wheel brake cable is not free in its housing, is frayed or broken, replace cable. Remove the cable block from end of cable. Free cable from hand

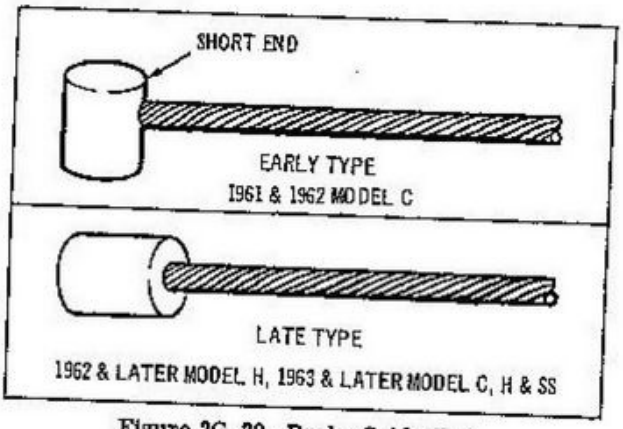
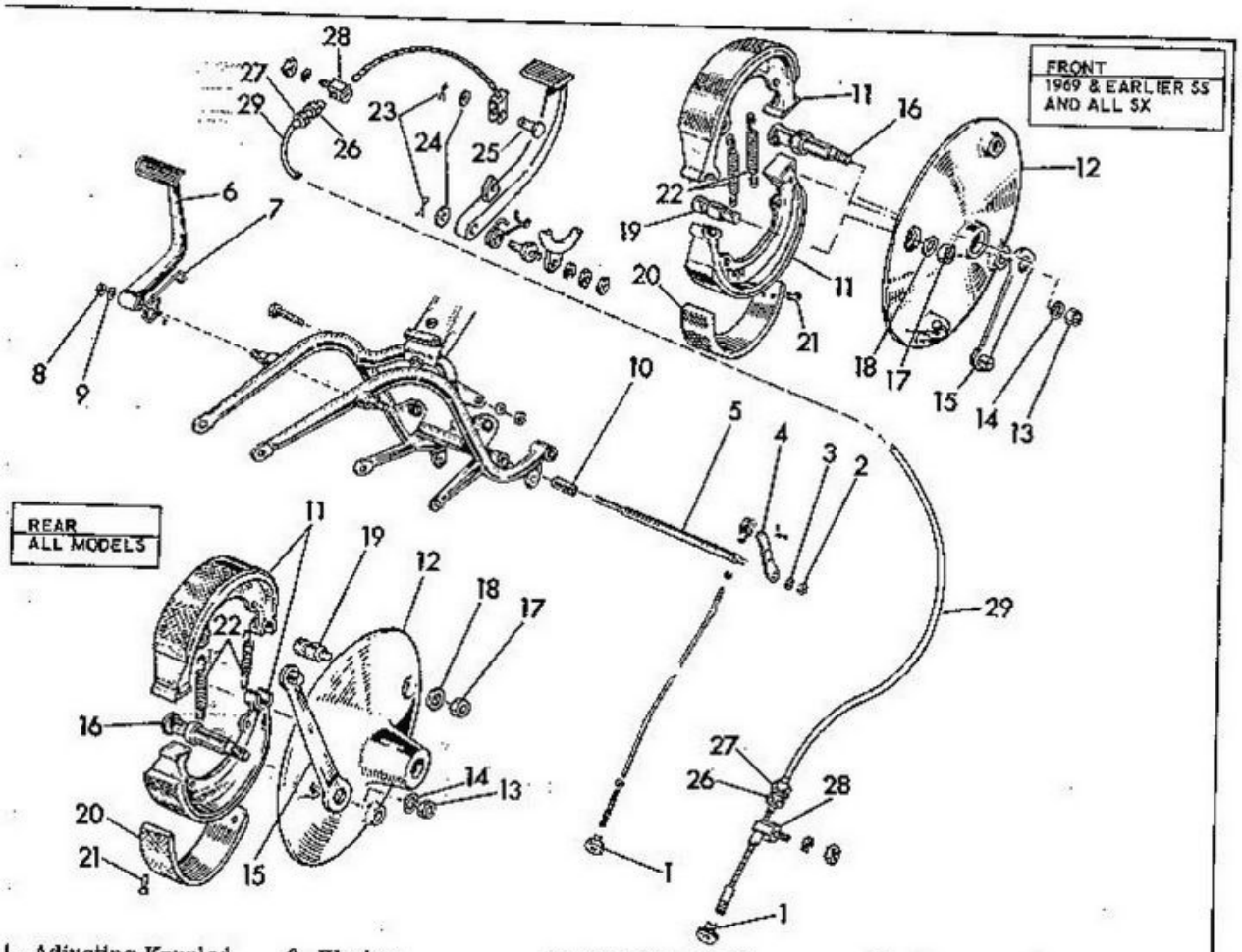


Figure 2G-32. Brake Cable End



1. Adjusting Knurled Nut
2. Nut
3. Washer
4. Shaft Lever
5. Crossover Shaft
6. Foot Lever
7. Lever Spring
8. Nut
9. Washer
10. Crossover Shaft Bushing (2)
11. Brake Shoe and Lining (2)
12. Side Plate
13. Nut
14. Washer
15. Operating Lever
16. Operating Shaft
17. Nut
18. Washer
19. Pivot Stud
20. Brake Lining (2)
21. Rivet (16)
22. Shoe Spring (2)
23. Cotter Pin (Model SS)
24. Washer (Model SS)
25. Clevis Pin (Model SS)
26. Cable Coil Adjuster Lock Nut (Model SS)
27. Cable Coil Adjuster (2) (Model SS)
28. Cable Coil Frame Fitting (2) (Model SS)
29. Cable Assembly (Model SS)

Figure 2G-33. Front and Rear Brakes (Except SS Double Front Type) - Exploded View

brake lever by slipping cable through slot in adjusting screw.

Apply a light coat of grease on new cable and install in housing. Route cable and housing assembly through right side of fork between upper and lower fork brackets and through small loop on right fork side upper cover. On early models having small diameter cable, button on cable end is not centrally located. Place short end into brake handlever first. See Fig. 2G-32. Turn both adjusting screws in as far as they will go. Reinstall cable block on cable and tighten cable block screws. Adjust brake as described in "Adjusting Front Brake."

DISASSEMBLING AND ASSEMBLING CROSSOVER SHAFT (See Fig. 2G-33)

Remove rear brake adjusting knurled nut (1) from brake rod. Remove brake crossover shaft lever (4) by removing nut (2) and washer (3) and tapping on crossover shaft (5). Remove crossover shaft from frame by pulling foot lever and shaft off as an assembly. Remove brake lever spring (7) from foot lever (6). Disassemble crossover shaft (5) from foot lever by removing nut (8) and washer (9).

Clean and inspect all parts before reassembling. Check crossover shaft for fit in frame bushings (10). If play is excessive press bushings out of frame and press in new ones. To assemble reverse disassembly procedure.

Put a small amount of grease in frame tube. Place foot lever (6) on long threaded end of crossover shaft (5) and engage notches. Place lever spring (7) on crossover shaft so that spring will support foot lever from underneath. Insert crossover shaft into frame tube. Hold foot lever in its normal position and engage crossover shaft lever (4) on crossover shaft. Draw crossover shaft lever into position with nut (2) and washer (3). Engage foot lever spring (7) on foot lever and frame, then draw foot lever into place with nut (8) and washer (9).

Replace brake rod into operating lever and adjust brake as described in "Adjusting Rear Brake."

DISASSEMBLING AND ASSEMBLING REAR BRAKE CABLE (See Figure 2G-33)

Rear brake cable must be replaced as an assembly if any components are worn or damaged. To disconnect cable at rear end, remove rear brake knurled adjusting nut (1) from brake cable adjusting stud (27). Disconnect at front end by removing cotter pin (23), washer (24) and clevis pin (25) from clevis. Loosen locknuts (26) at each end of cable and unscrew cable coil adjusters (27) from fittings (28). Slip cable from slots in fittings and remove cable and coil assembly (29) from motorcycle. Reassemble in reverse order.

DISASSEMBLING BRAKES

Remove front wheel as described in "Removing and Installing Front Wheel."

Remove rear wheel as described in "Removing and Installing Rear Wheel."

Front and rear (except SS double front type) (Fig. 2G-33)

Remove brake shoes (11) from side plate (12) by pulling off at right angle to side plate. Remove operating shaft nut (13), washer (14) operating lever (15) and operating shaft (16). Also remove pivot stud nut (17), washer (18), and pivot stud (19).

1970 & Later SS Double Front (Fig. 2G-33A)

Remove brake shoes (3) by removing lock rings (1) with lock ring pliers, part no. 96215-49. Remove washers (2), pull shoes (3) away from operating shafts (15 and 16) move shoes outward off pivot studs (19) both shoes together with springs (4) attached. Unhook springs (4) from shoes (3). Remove washers (5) from studs (19). If upper (13) and lower (14) operating levers are to be removed, mark position of lever slot on splines with a chisel mark so the levers can be reassembled the same way again. (Levers should be parallel and approximately at right angles to brake cable as shown in figure 2G-30A).

To remove operating levers, remove control rod as a unit by removing cotter keys, washers, and pins (6, 7 and 8). Do not disturb rod parts (9, 10, and 11) unless necessary. Remove operating lever clamp screws (12) and upper and lower operating levers (13 and 14) and return spring (20). Remove upper and lower operating shafts (15 and 16).

INSPECTION AND SERVICE

Clean and inspect brake shoes and linings for wear, loose rivets, glazing or imbedded particles. Brake shoes that are badly worn, cracked or damaged must be replaced. Linings that are worn down to rivet heads, hard or glazed, impregnated with grease, cracked or damaged must be renewed. Linings that are only slightly glazed and in apparent good condition may be re-used after roughening linings and brake drum with a medium grade of sandpaper.

New linings (20), can be riveted to shoes or new shoe and lining assemblies (11) can be installed.

When relining a brake shoe with rivets (21), install the center rivet first, then alternately work toward the ends. By following this procedure the linings will bear tightly against the shoe and little trouble will be experienced with rivet holes not lining up. If a riveting machine is not available, set rivets with hand tools. Make sure linings are drawn tight against shoes. Bevel each end of brake lining.

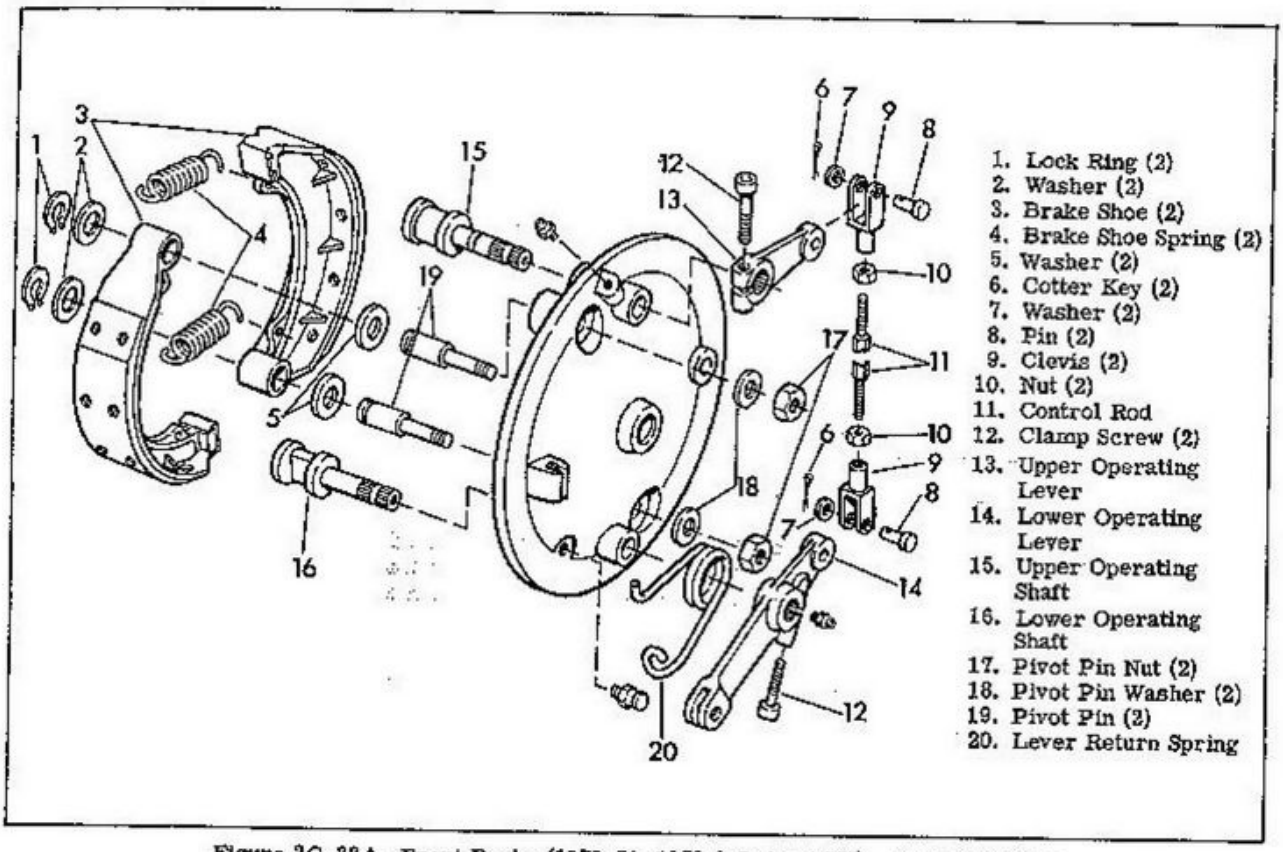


Figure 2G-33A. Front Brake (1970-71, 1973 & Later "SS") - Exploded View

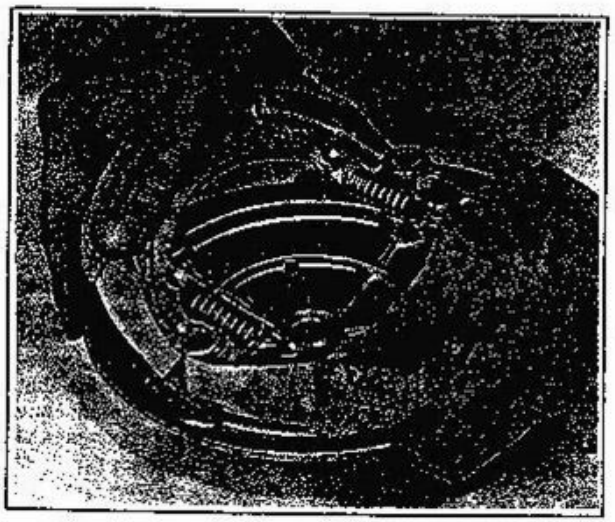


Figure 2G-34. Installing Brake Shoes, 1969 & Earlier Models

ASSEMBLING BRAKES

Front and Rear except 1970 & later Front (Fig. 2G-33)

Install pivot stud (19) and secure with washer (18) and nut (17).

Insert operating shaft (16) in side plate (12) and install operating lever (15) so that large flats on operating shaft and body of operating lever are at approximate right angles to each other. Secure assembly with washer (14) and nut (13). Position operating lever so that it is pointing away from anchor stud.

Hook springs (22) into brake shoe (11) holes so that hooks of springs are in opposite direction on same shoe. Fold shoes and place on operating shaft and pivot studs. Press down on shoes as shown in Fig. 2G-34 to unfold shoes onto side plate. A screwdriver may be needed between side plate and brake shoes in order to position brake shoes on shafts.

1970 & Later SS Double Front (Figure 2G-33A)

Assemble parts in reverse order of disassembly except for shoe assembly which is done as follows: Lightly grease pivot pin and operating shaft ends and put shoes in position without springs installed. Hook springs into shoes and install remaining parts.

Install front wheel as described in "Removing and Installing Front Wheel."

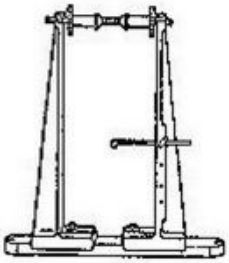
Install rear wheel as described in "Removing and Installing Rear Wheel."

SERVICE TOOLS

94682-61 SPOKE NIPPLE WRENCH

For tightening spokes and truing wheels.

95500-39A WHEEL TRUING STAND



Adjustable stand for truing spoked wheels. Includes arbor. 95515-30A Arbor for wheels of all models. (Can be used to convert old stand 95500-29.)

96247-62 FORK TUBE STRAIGHTENING BLOCK

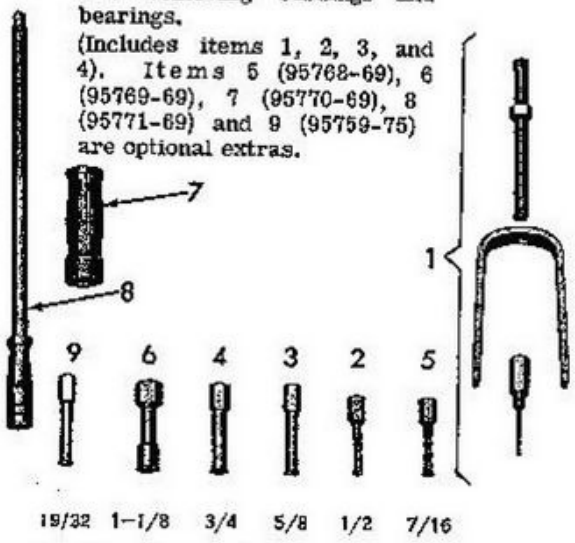
Three recommended for use to support fork tubes while straightening on an arbor press.

94810-65 EXPANSION REAMER (18 MM)

For reaming fork pivot bolt bushings.

95760-69 BUSHING AND BEARING PULLER SET

For removing bushings and bearings.
(Includes items 1, 2, 3, and 4). Items 5 (95768-69), 6 (95769-69), 7 (95770-69), 8 (95771-69) and 9 (95759-75) are optional extras.



96806-40 BENDING BAR

Used for straightening handlebar, forks and frames. Hooks on tubes for applying bending leverage.

97305-61 FORK TUBE TOOL

Used to remove and install front fork sides.

ENGINE 3

TABLE OF CONTENTS

Engine Specifications

(Note all dimensions shown are in inches)

VALVES (3B)
Fit in guide (Exhaust) 002
Fit in guide (Intake) . . . . . 1968 & earlier .0015
1969 & later .001

VALVE SPRINGS

Model	Free Length Spring	Valve Position	Compressed Length	Poundage	Part No.
All C Models and 1968 and Earlier Models H and SS	1.64 Inner	Open	0.98	44.0	18205-61P (Inner)
		Closed	1.28	25.0	
	1.77 Outer	Open	1.14	88.0	18206-61P (Outer)
		Closed	1.42	50.0	
1962-63 Model H Only	1.64 Inner	Open	0.98	48.0	18203-61P (Inner)
		Closed	1.30	28.0	
	1.77 Outer	Open	1.10	105.0	18204-61P (Outer)
		Closed	1.42	55.0	
1969-72 350 cc Models SS,SX	1.64 Inner	Open	1.00	45.2	18203-61P (Inner)
		Closed	1.36	18.0	
	1.77 Outer	Open	1.15	98.5	18204-61P (Outer)
		Closed	1.50	42	
1973 & Later SS,SX	1.61 Inner	Open	.95	76.2	18203-73P (Inner)
		Closed	1.30	33.1	
	1.69 Outer	Open	.99	119.2	18204-73P (Outer)
		Closed	1.35	57.4	

ROCKER ARM (3B)
Shaft fit in bushings . . . . . .0005 to .0015
End play 1972 & earlier . . . .(Select spacer washers to partly compress spring washer)
1973 & later . . . . . .004 to .008
PISTON (3C)
Fit in cylinder . . . 1970 & later . . . . . .002 loose
1969 . . . . . .004 loose
1968 & earlier . . . . . .002 loose
Compression ring gap (both) . . . . . .010 to .016
Compression ring side clearance (both) . .001 to .002
Oil control ring gap . . . . . .010 to .014
Oil control ring side clearance . . . . . .001 to .002
Piston pin fit in piston . . . . . light press @ 70°F.
Piston pin fit in connecting rod. .0006 to .0012 loose
CONNECTING ROD (3C)
End play between flywheels . . . . . 1968 & earlier .004 to .008
1969 & later .006 to .010
Fit on crankpin bearing . . . . . .0005 to .001
OIL PUMP PRESSURE (3D)
Minimum . . 3 lbs./sq. in. at 25 M.P.H. (in high gear)
TAPPETS (3D)
Tappet clearance in guide . . . . . .0002 to .0005
Tappet clearance (Model "C") (both) cold 004
(1966 and earlier Model "H") (intake) cold 003
(exhaust) cold . . .005
(1967-68 Models H and SS) (both) cold 002
hot 006
(1969 and later Model SS & SX) (intake) cold . . .002
hot 007
(exhaust) cold 003
hot 009

GEARCASE (3D)
Cam shaft in crankcase bushing . . . . .0005 to .0015
Cam shaft end play . . . . . 1972 & earlier .001 to .004
1973 & later .004 to .008
(Select spacer washers as required)
FLYWHEEL ASSEMBLY (3E)
Runout mainshafts . . . . . .001 maximum
End play in crankcase . . . . . .0005 to .0025
FLYWHEEL MAINSHAFT (PINION SIDE) (3E)
Shaft fit in cam shaft support plate bushing . . . . . .0005 to .002
IGNITION (5F)
Breaker point gap setting . . . . . 1973 & later .016
1972 & earlier .018
Spark plug gap setting . . . . . .020 to .025

Ignition Timing

1961	Retard 21° (7/64 in.) B.T.C. Automatic Advance 41° (13/32 in.) B.T.C.
1962-67	Retard 5° (1/64 in.) B.T.C. Automatic Advance 41° B.T.C. (13/32 in., 1962-66) (11/32 in., 1967)
1968	Retard 5° B.T.C. Automatic Advance 35° 1/4 in. B.T.C.
1969-72	Retard 7° (.015 in.) B.T.C. Automatic Advance 28° (15/64 in.) B.T.C.
1973 & later	Retard 12° B.T.C. Advance 34° B.T.C.

Engine Description

GENERAL

The Sprint engine is a single cylinder, four cycle, air cooled, overhead-valve, horizontal engine. It has three major component assemblies - cylinder, crankcase and gearcase.

Cylinder assembly includes cylinder head, valves, rocker arms and piston. Cylinder mounts on engine crankcase in a horizontal position. The connecting rod is positioned between flywheels and connects to crank pin.

The reciprocating, linear motion of the piston in the cylinder is converted into circular motion in the crankcase. The built-up crankshaft consists of an off center crank pin interposed between two counter-weighted flywheels which rotate on two integral end shafts (pinion and generator shaft) supported by ball bearings.

Flywheel rotation is counterclockwise (viewing engine from right side).

The gearcase is located on the right side of the crankcase and houses a gear train which operates and times the valves, ignition, oil pump and clutch drive gear. A baffle type crankcase breather is positioned at the top of the crankcase separating oil vapors from the air and relieving crankcase pressure caused by the downstroke of the piston.

A single cam gear shaft with two cam lobes is gear driven. The engine valves are opened and closed through the mechanical linkage of tappets, push rods, rocker arms and valve springs.

Tappets serve to transmit the cam action to the valve linkage. Valve timing is obtained by meshing pinion and cam shaft gears with timing marks aligned.

Ignition spark is produced by operation of circuit breaker, ignition coil, and spark plug. The breaking of a set of breaker points by a single-lobe cam on the end of the cam shaft determines the spark timing. The spark is advanced and retarded automatically by a mechanical governing device.

The generator or alternator is located on the left side crankcase and the rotor is attached directly to the flywheel shaft.

Most other engine components function similar to usual internal combustion engine design. For further description of part function, see pertinent manual sections.

LUBRICATION

GENERAL

The Sprint engine has a force-feed (pressure) type oiling system. The feed pump forces oil to the engine, lubricating lower connecting rod bearings, cam shaft bearings, cam lobes and tappets, rocker arm bearings, valve stems, valve springs, and push rods. Cylinder wall, piston, piston pin, main bearings, transmission gears and transmission bearings are lubricated by oil spray thrown off from connecting rod and crankshaft. Return oil from the cylinder head drains through push rod housing to the gearcase and through the exhaust rocker arm cover, and rocker arm oil return pipe to the crankcase.

1963 and Earlier Models:

On these models, oil is picked up from the scavenge pocket, through a filter by the scavenger section of a duplex oil pump. From here it is forced out into the gear case through the pump body. The oil then seeks its own level through a passage between the gearcase and crankcase.

1964 and Later Models:

Late models do not have a return pump or scavenge filter. Oil drains directly into crankcase sump. Oil is picked up through inlet pipe located at center of feed pump filter in well at bottom of crankcase.

CHECKING AND CHANGING OIL

Oil mileage normally varies from 500 to 750 miles per quart, depending on the nature of service, fast or moderate driving, and condition of the engine.

The transmission and engine are both being lubricated by the same oil supply in the crankcase reservoir.

The oiler filler cap is located on the right side of the engine crankcase. The filler cap gauge rod has two notches. The oil level must always be maintained near but below the upper notch of the gauge rod (marked "Max"), and it must never fall below the lower notch (marked "Min").

Total capacity: 1972 & earlier 2 quarts. 1973 & later 2.6 quarts. To check oil level, the motorcycle must be in a vertical position. Unscrew the cap, wipe the rod, replace the cap without screwing it in and remove it again to check oil level. See Figure 3A-11.

The oil level must be checked every 300 miles and even more often if it is noticed that it tends to drop too fast.

Keep the oil level well up in the crankcase. Oil runs cooler and oil mileage is somewhat higher with oil level well up in the crankcase. Furthermore, unless crankcase oil reservoir is kept well filled, frequent checking will be necessary to avoid any chance of running dry.

After the first oil change at 500 miles and 1000 miles as specified for new and rebuilt engines, the oil should be changed regularly at 1000 mile intervals.

Use proper grade of oil for the lowest temperature expected before next oil change period as follows:

Use Harley-Davidson Oil	Use Grade	Air Temperature (Cold Engine Starting Conditions)
Medium Heavy	75	Above 40°F.
Special Light	58	Below 40°F.
Regular Heavy	105	Severe operating conditions at high air temperatures.

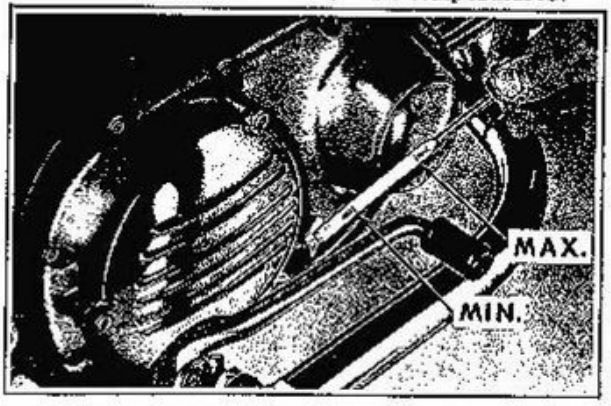


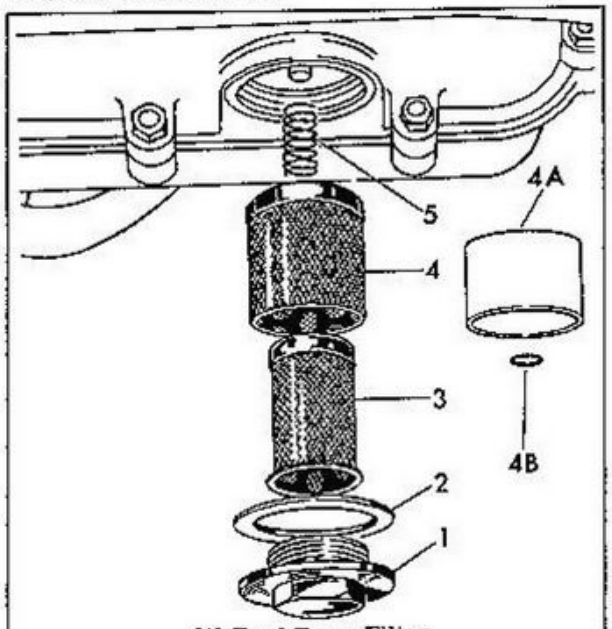
Figure 3A-11. Crankcase Oil Filler Cap with Gauge Rod

OIL CHANGE PROCEDURE (See Figure 3A-12)

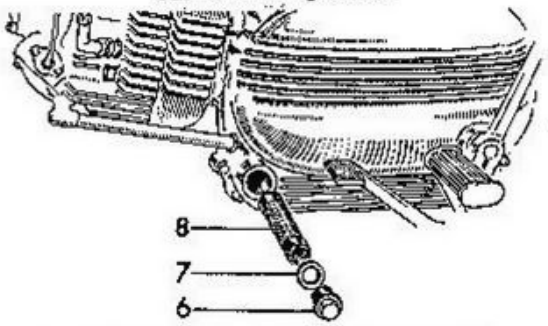
Oil change should be made with engine warm. Remove the oil drain plug (1) and gasket (2) located in the bottom part of the crankcase on the right-hand side.

The oil feed pump filter screens (3 and 4) are located under the drain plug (1) inside the crankcase and are removed with the plug. Both filter screens should be carefully washed with clean solvent or gasoline.

Reassemble the feed pump filters with open end against drain plug gasket (2). The spring (5) resting on the closed end of the outer filter must be assembled to the oil pump pipe. (See Figure 3A-12.) Make sure O-ring (4B) is assembled between filter cap (4A) and outer filter (4).



Oil Feed Pump Filter



Scavenger Pump Filter (1963 & Earlier)

1. Oil Drain Plug
2. Drain Plug Gasket
3. Inner Screen
4. Outer Screen
4A. Oil Filter Cap (Late 1972 & Later)
4B. O-Ring (Late 1972 & Later)
5. Filter Stop Spring
6. Magnetic Plug
7. Plug Gasket (1963 & Earlier)
8. Filter Screen (1963 & Earlier)

Figure 3A-12. Oil Feed and Scavenger Pump Filters

1963 and earlier models have an oil scavenger pump filter screen. Plug (6) is located on the left-hand side of the crankcase, just in front of the rear brake pedal. Remove plug (6) and gasket (7). Remove filter screen (8). Wash filter screen in clean solvent or gasoline and dry. The plug (6) is provided with a magnet, which removes steel particles from the oil. When cleaning the plug, remove particles from magnet.

Both plugs (1) and (6) should be tightened snugly after making sure that gaskets are in good condition.

WINTER LUBRICATION

Combustion in any engine produces water vapor. When starting and warming up in cold weather, much of the vapor that gets into the crankcase condenses to water before the crankcase gets hot enough to exhaust the vapor through the outside breather. If the engine is driven enough to get the crankcases thoroughly warmed up, most of the water is again vaporized and blown out through the breather.

However, a moderately driven engine making short runs, does not thoroughly warm up and is likely to accumulate water in the crankcase. In freezing weather this water will become slush or ice, and if allowed to accumulate too long, may block the oil lines and passages causing damage to the engine. Water mixed with oil for some time also forms sludge that is harmful to the engine and causes undue wear of working parts.

In winter the oil change interval should be shorter than normal and any engine used only for short runs must have the oil drained frequently along with a thorough cleaning of the Oil Feed Pump and Scavenger Pump filter screens, before new oil is put in the crankcase. The further the temperature drops, the shorter the oil change interval should be.

OIL PRESSURE

The oil pump is non-regulatory and delivers its entire volume of oil under pressure to the engine. At normal engine operating temperature the oil pressure varies between 3 and 6 psi. depending on engine speed. See "Specifications". Using appropriate fittings, attach oil pressure gauge, part No. 96921-52, to rocker arm oil feed line connecton on crankcase.

ENGINE REPAIR PROCEDURE

GENERAL

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

Most commonly, only cylinder head and cylinder repair is needed (valves, rings, pistons, etc.) and it is recommended procedure to service these units first,

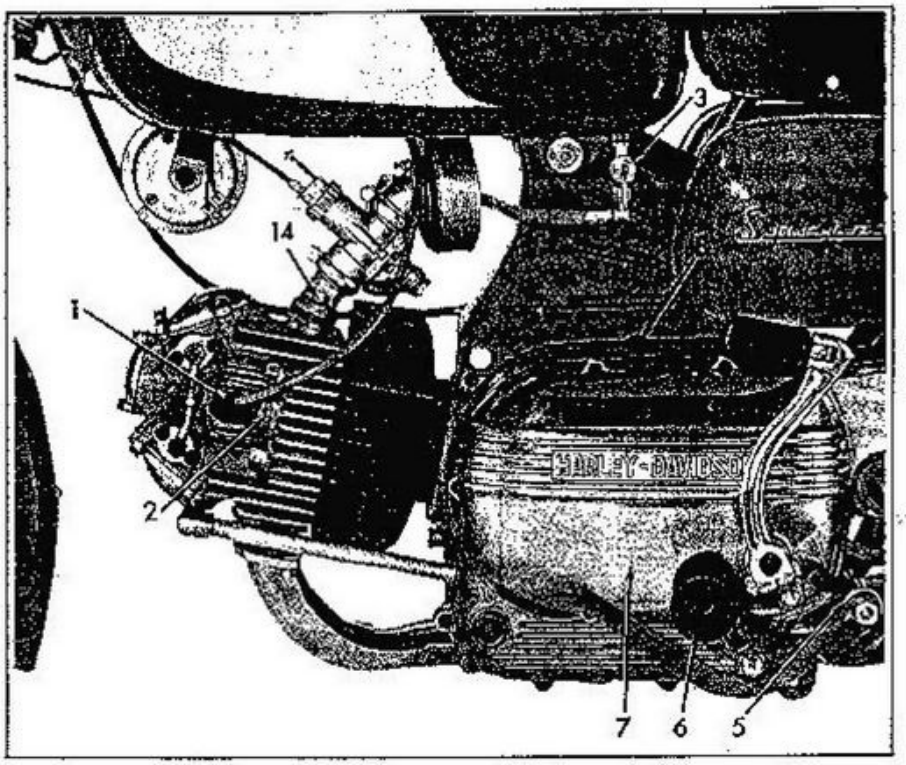


Figure 3A-13. Left Side View Model C (Stripping for Repair)

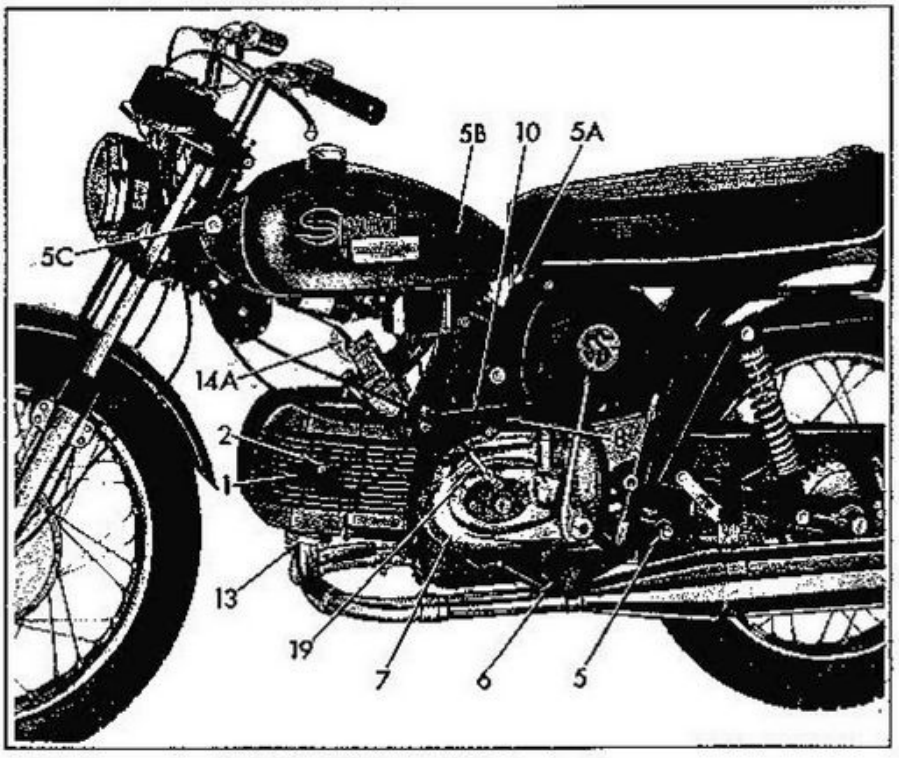


Figure 3A-13A. Left Side View Model SS (Stripping for Repair)

allowing crankcase to remain in frame. Follow the procedure under "Stripping Motorcycle For Engine Repair," steps 1 thru 5, to strip motorcycle for removal of cylinder head, cylinder and piston.

After disassembling "upper end" only it may be found that crankcase repair is necessary; this requires removal of engine crankcase from chassis outlined under "Stripping Motorcycle For Engine Repair," steps 6 thru 21.

In cases where it has been definitely determined beforehand that crankcase repair is necessary, the engine completely assembled, should be removed from chassis as outlined under "Stripping Motorcycle Engine For Repair," steps 1 thru 21.

STRIPPING MOTORCYCLE FOR ENGINE REPAIR, (Figures 3A-13, 3A-13A, 3A-14 and 3A-14A)

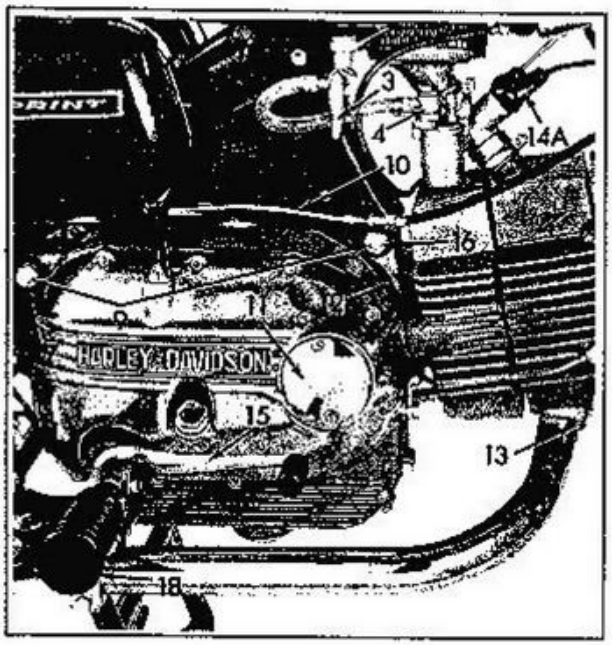


Figure 3A-14. Right Side View 1972 & Earlier Model H (Stripping for Repair)

1. Clean engine thoroughly with "gunk" to remove all road dirt. Remove "gunk" and dirt with water spray and blow engine dry with compressed air.

2. Disconnect battery ground wire (-).

2A. Disconnect starter cables (1A) (Electric Start).

3. Loosen spark plug cover knurled nut (early models), lift cover (1) from spark plug and remove spark plug (2).

4. Turn off fuel supply valve (3).

5. Remove fuel line fitting (4) at carburetor. Disconnect tachometer cable (19) (1973 and later SS).

5A. Unhook tank hold-down spring (5A, late models).

5B. Tilt tank (5B) forward; unhook at front mounting (5C) and remove tank from motorcycle (late models).

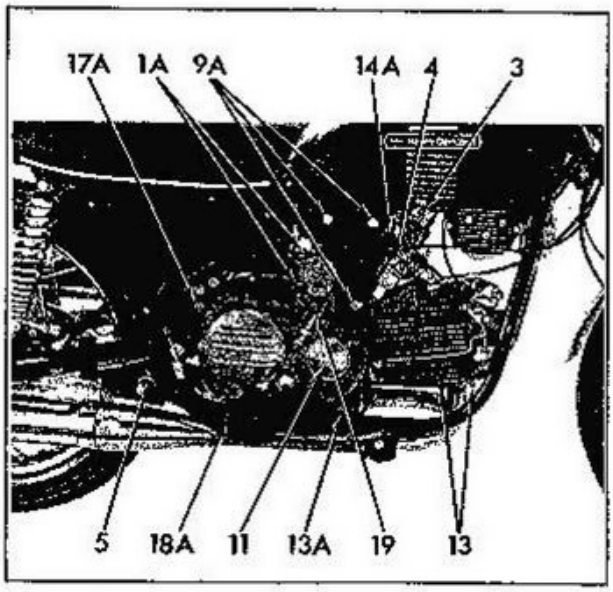


Figure 3A-14A. Right Side View 1973 & Later SS/SX (Stripping For Repair)

Key for Figures 3A-13, 3A-13A, 3A-14 and 3A-14A

1. Spark Plug Cover
1A. Electric Starter Cables
2. Spark Plug
3. Fuel Supply Valve
4. Fuel Line Fitting
5. Brake Foot Lever Spring
5A. Tank Spring
5B. Tank
5C. Tank Front Mounting
6. Left Foot Rest
7. Left Crankcase Cover
8. Generator Wires
9. Upper Engine Mount Bolt Nuts
9A. Upper Bracket Bolts & Nuts
10. Clutch Control Wire
11. Circuit Breaker Cover
12. Circuit Breaker Wires
13. Exhaust Pipe Mounting Nuts & Washers
13A. Exhaust Pipe Support Mounting Nuts
14. Intake Manifold Mounting Nuts
14A. Carburetor Boot
15. Shifter Lever
16. Front Upper Engine Mounting Bolt
17. Rear Upper Engine Mounting Bolt
17A. Rear Engine Mounting Bolt
18. Right Foot Rest
18A. Lower Engine Mounting Bolt
19. Tachometer Cable

6. On 1972 and earlier models, release brake foot lever spring (5) and remove left foot rest (6).

7. On 1972 and earlier models, remove left crankcase cover (7) - held by 5 Allen screws and disconnect two generator wires (8) at generator and pull wires out of compartment.

8. On 1973 and later models, disconnect alternator wires from terminals at ignition switch and rectifier-regulator units.

9. Remove connecting link from drive chain and remove drive chain.

10. On 1972 and earlier models, remove nuts (9) from two upper engine mounting bolts. Do not remove bolts.

11. On 1973 and later models, remove upper bracket bolts and nuts (9A) and remove both brackets.

12. Remove clutch control wire (10) from clutch release lever by rotating lever forward with a wrench, and disengage clutch wire.

13. Remove circuit breaker cover (11).

14. Remove wires (12) from circuit breaker and pull wires out of compartment.

15. Remove exhaust pipe attaching nuts (13) and washers at cylinder exhaust port.

16. On 1973 and later models, loosen exhaust pipe front support mounting nuts (13A).

17. Remove rear muffler support (not shown) by taking off rear foot rest. Muffler and pipe are now free and may be put aside.

18. Early models: Remove intake manifold nuts (14), free carburetor and manifold and place on front fender at front forks. Plug intake port with clean cloth. Late models: Slip carburetor boot (14A) back, unscrew knurled nut and disassemble throttle piston.

19. Remove shifter lever (15) from shaft.

20. On 1972 and earlier models, remove front upper engine mounting bolt (16). While supporting cylinder head, remove rear upper engine mounting bolt (17) and gently lower front end of engine. While supporting the rear end of engine from below, remove the lower mounting bolt by pulling off right foot rest (18). Care must be taken in removing the last mounting bolt so that engine does not drop.

21. On 1973 and later models, remove lower engine mounting bolt (13A) while supporting cylinder head from below. Then remove rear engine mounting bolt (17A) to free engine from frame. Care must be taken in removing the last mounting bolt so that engine does not drop.

INSTALLING ENGINE IN CHASSIS

To install the engine assembly in the frame simply reverse order of disassembly noting the following:

Circuit Breaker:

Condenser and spark coil wires are connected to circuit breaker wire stud screw.

Generator:

On 1972 and earlier models, red wire is connected to DF terminal. White wire is connected to D+ terminal.

Alternator:

On 1973 and later models, green wire is connected to ignition switch terminal No. 9, double brown wire, and black wires are connected to rectifier regulator terminals marked with wave sign.

Electric Starter:

On 1973 and later models, connect starter cable with red terminal insulator to starter motor and black cable (with no color code) to starter base mounting bolt.

Rear Chain:

On 1972 and earlier models, replace rear chain on engine sprocket before left side cover is installed.

Oil:

After assembly be sure to refill engine with oil.

CYLINDER HEAD

GENERAL

Before removing cylinder head assembly, strip motorcycle as described in "Stripping Motorcycle For Engine Repair," Section 3A.

REMOVING CYLINDER HEAD ASSEMBLY - 1961-1966 and 1973 and Later (Figure 3B-12)

Remove feed line connector (1) and washers (2) from crankcase. Remove cylinder head nuts and washers (3). Note: Right side nuts are recessed and require thin box wrench. Free cylinder head assembly, push rods (4) and rocker arm oil return pipe (5). On 1973 and later models, loosen hose clamps (8A). If the cylinder head does not come loose on removal of head nuts, tap head lightly with rawhide hammer; never try to pry head off. Remove push rod housing rubber gasket (6). Then cover cylinder with a clean towel.

REMOVING CYLINDER HEAD ASSEMBLY - 1967 to 1972 (Figure 3B-12A)

Remove feed line connectors (1 and 13) and washers (2 and 14) from head and crankcase. Remove rocker arm oil line (15). Remove rocker arm cover nuts or bolts and washers (3 or 3A). Remove rocker arm cover (4) and gasket (5). Remove cylinder head nuts, collars and O-rings (6, 7 and 8). On 1969 model, remove hose clamp (8A). Free cylinder head assembly (9) and push rods (10). If the cylinder head does not come loose on removal of head nuts, tap head lightly with rawhide hammer; never try to pry head off. Remove oil return pipe (11) with O-rings (36), or on 1969 model, loosen return oil return hose clamps (8A) to remove hose (11A). Remove push rod housing rubber gasket (12). Then cover cylinder with a clean towel.

DISASSEMBLING CYLINDER HEAD - 1961-1966 and 1973 and Later (Figure 3B-12)

Remove rocker arm oil feed pipe connections (7), washers (8) and rocker arm oil line (9). Remove tappet cover screws and washers (10), cover (11) and gaskets (12). Remove intake (13) and exhaust (14) rocker arm covers, gaskets (15), valve side (16) and shaft side rocker arm support flange covers (17), and gaskets (18), by removing screws and washers. Remove intake manifold nut and washers (19), insulating washer (20), insulating bushing (21), intake manifold (22) and insulator block (23).

NOTE

Rocker arms do not have to be removed to take valves out.

Tap rocker arm shaft (26) from head after taking out set screw (25). Shaft has depression for set screw (1961 and earlier). Hone any burrs on shaft. Remove rocker arm (27).

On 1966 and earlier models, one side of rocker arm has a spring washer between thrust washers, and the other side has thrust washers alone; make note of location and number of washers so that parts can be reassembled correctly.

DISASSEMBLING CYLINDER HEAD - 1967-72 (Figure 3B-12A)

Remove rocker arm oil feed pipe connection (13), washers (14) and rocker arm oil line (15). Remove intake manifold screws and washers, intake manifold and insulator block.

NOTE

Rocker arms must be removed to take valves out.

Tap rocker arm shaft (17) from head after removing clamping bolt and lock (16). Shaft has a flat section for locating bolt. Hone any burrs on shaft. Remove rocker arm (18).
NOTCH on LEFT From Bottom

DISASSEMBLING CYLINDER HEAD - All Models (Figures 3B-12 or 3B-12A)

Compress valve springs using valve spring compressor, tool Part No. 97290-61P, and remove valve keys from end of valve stem as shown in Figure 3B-13. Mark keys to identify them with their respective valves. Remove valve spring upper collar, outer and inner springs, lower collar and valve and shims, where used.

Intake and exhaust rocker arms, valves, valve guides (pressed in) and valve seats (pressed in) are not interchangeable. Valve guides and seats should be removed only when necessary for replacement.

CLEANING AND INSPECTING

Thoroughly clean all parts and inspect them for wear and damage; clean out oil passages with compressed air.

Carefully check the rocker arm and shaft for wear. Replace rocker arm bushings if shaft is over .0015 in. loose in bushings. Check to make sure that bushings are not loose in head. Examine the rocker arm pads. If slightly worn, redress as described in "Repairing Rocker Arm and Bushings." If rocker arm tappet adjusting screw ball sockets are worn and elongated, they must be replaced.

Place cylinder head in "Gunk Hydro-Seal" until deposits are soft. Then clean outside of cylinder head with a wire brush. Scrape carbon from cylinder head combustion chamber, inlet and exhaust valve ports. When scraping carbon, be careful not to scratch or nick cylinder head face, as leakage will result. Blow off loosened carbon and dirt particles and wash head in solvent. Force air through all oil holes in cylinder head to make sure passages are clean.

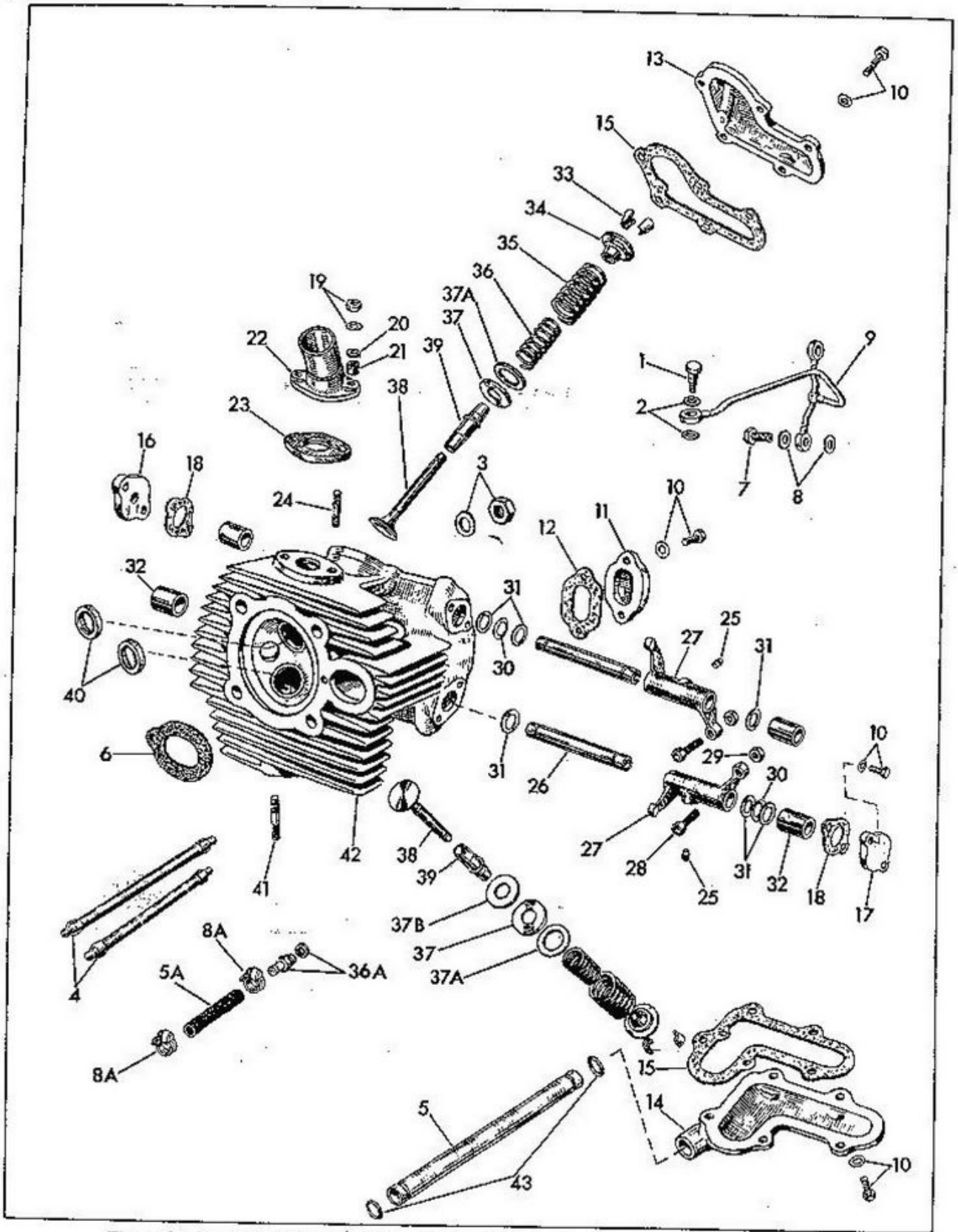


Figure 3B-12. 1961-1966 and 1973 and Later Cylinder Head Assembly - Exploded View

Key for Figure 3B-12

1. Feed Line Connector
2. Washer, Aluminum (2)
3. Cylinder Head Nut and Washer (4)
4. Push Rod (2)
5. Rock Arm Oil Return Pipe
5A. Oil Return Hose (1973 & Later)
6. Push Rod Housing Rubber Gasket
7. Feed Line Connector (2)
8. Washer, Aluminum (4)
8A. Hose Clamp (1973 & Later)
9. Rocker Arm Oil Line
10. Cover Screws and Washers (20)
11. Tappet Cover
12. Tappet Gasket
13. Intake Rocker Arm Cover
14. Exhaust Rocker Arm Cover
15. Rocker Cover Gasket (4)
16. Valve Side Rocker Arm Support Flange Cover (2)
17. Push Rod Side Rocker Arm Support Flange Cover (2)
18. Flange Cover Gaskets (4)
19. Intake Manifold Nut and Washer (2)
20. Insulating Washer (2)
21. Insulating Bushing (2)
22. Intake Manifold
23. Insulator Block
24. Intake Pipe Stud (2)
25. Rocker Arm Screw (2)
26. Rocker Arm Shaft (2)
27. Rocker Arm (2)
28. Tappet Adjusting Screw (2)
29. Tappet Lock Nut (2)
30. Spring Washer (2) (1966 & Earlier)
31. Thrust Washer (as required)
32. Rocker Arm Bushing (4)
33. Valve Key (4) (2 per valve)
34. Valve Spring Upper Collar (2)
35. Outer Valve Spring (2)
36. Inner Valve Spring (2)
36A. Oil Return Hose Fitting & Gasket
37. Valve Spring Lower Collar (2)
37A. Washer-Exhaust Valve Spring (1973 & Later)
37B. Valve Spring Lower Collar Shim (2) (1973 & Later)
38. Valve (2)
39. Valve Guide (2)
40. Valve Seat (2)
41. Exhaust Pipe Stud (2)
42. Cylinder Head
43. "O" Ring (2)

If the valve seat is pitted, burned, corroded or has any indication of improper valve seating, recondition the seat as described in "Refacing Valves and Valve Seats." Replace any valve seat inserts that are cracked, loose, or sunken in the cylinder head. See "Replacing Valve Seat Inserts."

Check length and tension of each valve spring using Valve Spring Tester, Part No. 96795-47. Replace spring if 1/8 in. or more shorter than a new spring, or if tension shows 5 lbs. below low limit tension of new spring. Refer to "Engine Specifications," Section 3A, for free length, compressed length and poundage of new valve springs.

Remove carbon from valve head and stem using a knife and wire wheel - never a file or other hardened tool that will scratch or nick valve. Polish valve stem with fine emery cloth or steel wool. Replace valves that are badly scored, warped or in bent condition. Reface valves that are slightly pitted, burned or in corroded condition as described in "Refacing Valves and Valve Seats."

Clean intake and exhaust valve guides with reamer Part No. 97310-61, and examine for wear and valve stem clearance. Check the valve fit in guide and guide fit in cylinder head. Replace guide, or possibly both valve and guide if valve fit in guide exceeds maximum specified in "Engine Specifications," Section 3A.

Inspect rocker arm thrust washers and replace any that are badly worn. If spring washers are used, inspect for collapsed condition. It is a good idea to replace washers if not sure about their condition.

The valve face should have a seating surface about 5/64 in. wide, and should be free of pit marks and burned spots.

Check small oil hole in 1966 and earlier intake rocker arm cover for a blocked condition. Make sure this passage is open.

Inspect intake and exhaust pipe bolts or studs for damaged threads and replace if necessary.

Replace all gaskets if possible.

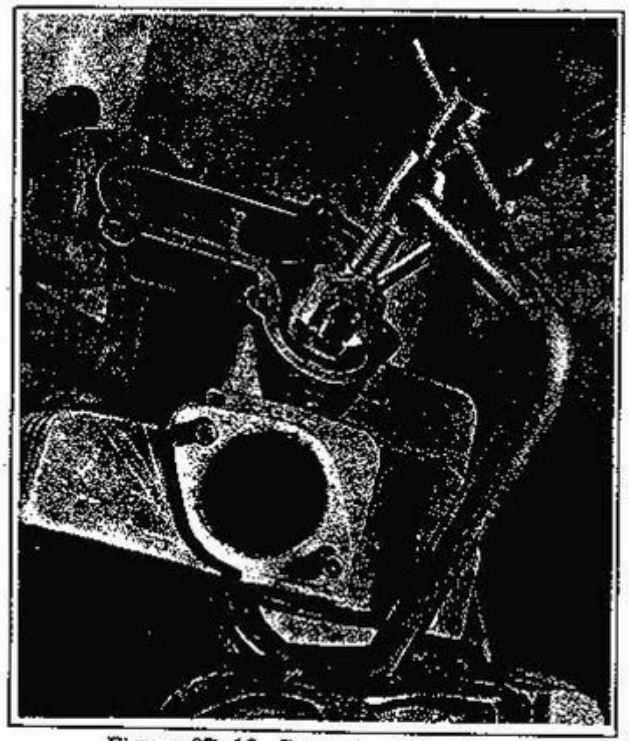


Figure 3B-13. Removing Valve Keys with Compressor Tool

Key for Figure 3B-12A

1. Feed Line Connector
2. Washer, Aluminum (2)
3. Rocker Arm Cover Nut and Washer (3)
3A. Bolt & Lockwasher (Late 1970) (3)
4. Rocker Arm Cover
5. Rocker Cover Gasket
6. Cylinder Head Nut (4)
7. Collar (4)
8. O-ring Seal (4)
8A. Hose Clamp (1969 SS)
9. Cylinder Head
10. Push Rod (2)
11. Oil Return Pipe
11A. Oil Return Hose (1969 SS)
12. Push Rod Housing Rubber Gasket
13. Feed Line Connector
14. Washer, Aluminum (4)
15. Rocker Arm Oil Line
16. Rocker Arm Clamping Bolt and Lock (2)
17. Rocker Arm Shaft (2)
18. Rocker Arm (2)
19. Thrust Washer (as required)
20. Spring Washer (2)
21. Rocker Arm Shaft Bushing (4)
22. Tappet Adjusting Screw (2)
23. Tappet Lock Nut (2)
24. Valve Key (4) (2 per valve)
25. Valve Spring Upper Collar (2)
26. Outer Valve Spring (2)
27. Inner Valve Spring (2)
28. Valve Spring Lower Collar (2)
28A. Exhaust valve spring lower collar shim
29. Valve (Intake)
30. Valve (Exhaust)
31. Valve Guide (2)
32. Valve Seat (Exhaust)
33. Valve Seat (Intake)
34. Exhaust Pipe Stud (2)
35. Rocker Arm Cover Stud (3)
35A. Helicoil (Late 1970) (3)
36. Oil Return Pipe O-ring (2)
36A. Oil Return Hose Fitting and Gasket (1969 SS)

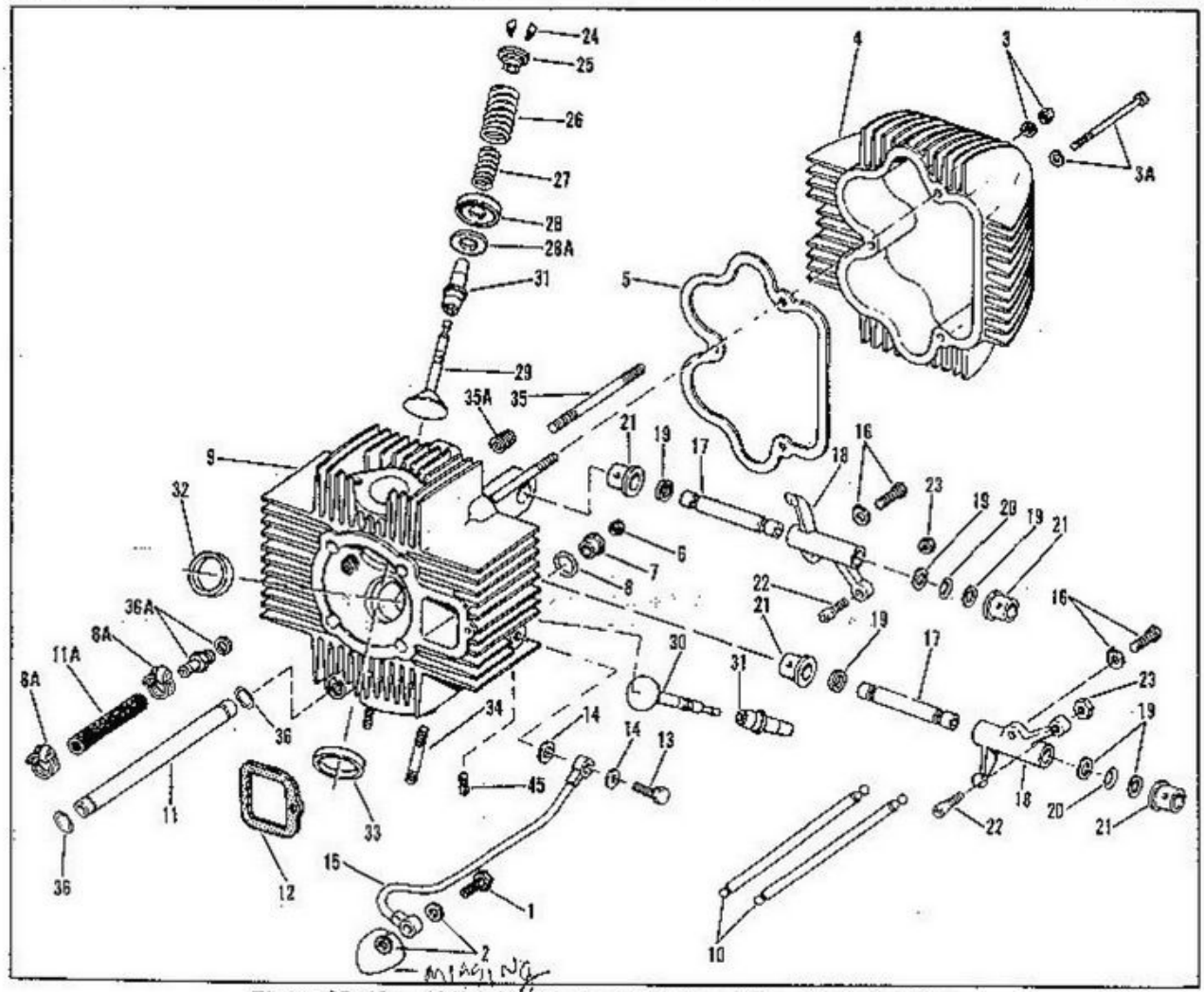


Figure 3B-12A. 1967-72 Cylinder Head Assembly - Exploded View

Inspect push rods for damage and wear. Pay particular attention to the ball ends. If the ball ends are worn and flattened replace the push rods, otherwise satisfactory tappet and push rod adjustment cannot be made and "upper end" push rod trouble is likely to be experienced.

REPAIRING ROCKER ARM AND BUSHINGS

To replace worn bushings heat cylinder head to 250°F. and press or drive them from cylinder head with a shouldered drift pin (.469 in. pilot). Press or drive replacement bushings into head, flush with hole.

NOTE

Drill a 3MM (.118 in.) oil hole in intake left bushing before reaming.

New bushings will require a line reaming operation with special Harley-Davidson reamer, Part No. 97314-61. If the rocker arm pads show uneven wear or pitting, dress on a grinder, maintaining original curve. If possible, compare with a new unit during this operation to insure a correctly contoured surface.

REPLACING VALVE GUIDES

Valve guide replacement if necessary, must be done before valve seat and face are ground since the valve stem hole in valve guide is the basis from which all face and seat grinding is done.

Valve stem in valve guide clearances are listed under Specifications at the beginning of this section.

If valve stems and/or guides are worn excessively, new parts must be installed.

Heat cylinder head to 250°F. when removing or installing valve guides. Tap out valve guides with shouldered drift pin (from chamber side) and insert replacement guide with arbor press. Be particularly careful to press replacement guide squarely into hole.

Valve guides are not interchangeable.

Ream intake and exhaust valve guides using Harley-Davidson valve guide reamer assembly Part No. 97310-61.

It is of prime importance that valve guides fit tightly in cylinder head, or valves may not seat properly. If original guide is not a tight press fit, an oversize guide must be installed. Guides are furnished in .025MM (.001 in.) to .200MM (.008 in.) oversizes. Use Figure 3B-13A to identify oversize valve guides.

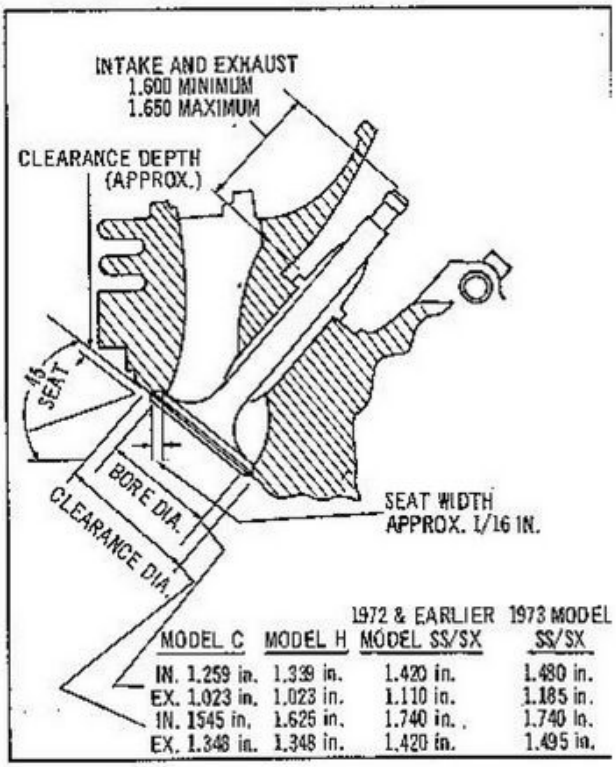
VALVE GUIDE O.D. OVERSIZE	NO. OF GROOVES ON OUTSIDE DIAMETER
0.025MM (.001 in.)	1
0.050MM (.002 in.)	2
0.075MM (.003 in.)	3
0.100MM (.004 in.)	4
0.150MM (.006 in.)	5
0.200MM (.008 in.)	6

Figure 3B-13A. Identification Chart for Oversize Valve Guides

VALVE SEAT INSERTS

After installing valve guides, valve seats must be refaced to true them with guides.

If valves have been reseated several times, valve seats may have become too wide and/or valve may be seating itself too deeply in head. When valve seat becomes wider than 1/16 in. (See Figure 3B-14) valve seat relief must be counterbored to reduce seat to 1/16 in. Clearance dimensions are shown. Tools for this purpose are available commercially. To determine if valve is seating itself too deeply in head, measure distance from shoulder of valve guide to end of valve stem. When valve stem extends through guide in excess of maximum shown, valve seat inserts must be replaced by boring out old insert and pressing in new one. Head should be heated to 540°F. to replace seat inserts. Valve seats are not interchangeable.



	MODEL C	MODEL H	1972 & EARLIER MODEL SS/SX	1973 MODEL SS/SX
IN.	1.259 in.	1.339 in.	1.420 in.	1.480 in.
EX.	1.023 in.	1.023 in.	1.110 in.	1.185 in.
IN.	1545 in.	1.625 in.	1.740 in.	1.740 in.
EX.	1.348 in.	1.348 in.	1.420 in.	1.495 in.

Figure 3B-14. Valve Seat Specifications

REFACING VALVES AND VALVE SEATS

To recondition or reface valve use a valve-refacing machine (available commercially). Adjust grinder to exactly the same angle as valve face, which is 45° for both intake and exhaust valves. Make very light cuts, being extremely careful to remove no more metal than is necessary to clean up and true valve face. Valve is correctly refaced when all pits ar

removed from valve face and face is concentric with stem. If end of valve stem shows uneven wear, true end of stem on a valve refacing grinder equipped with suitable attachment. If grinding leaves the edge of valve very thin or sharp, or indicates valve stem warpage, install a new valve. A valve in this condition does not seat normally and will burn easily.

Valve seats, like valves, are subject to wear, pitting and burning and should be refaced each time valves are refaced. Use an electric motor driven valve seat grinder (available commercially), for this operation. When refacing, be sure to maintain correct valve seat angle, seat width and relief diameter (see Figure 3B-14). If the valve seat becomes too wide, grind the seat relief diameter with a stone having a 15° face angle to achieve specified seat width. Correct seat width and point of contact between valve face and seat is extremely important to the life of a valve reconditioning job. Be careful that no more metal is removed than absolutely necessary to completely clean up and true valve seats.

If valve seats and valve faces have been smoothly and accurately refaced, very little lapping will be required to complete seating operation. Apply a touch of lapping compound to valve face, insert valve in guide, and using Lapping Tool, Part No. 96550-36, give valve a few oscillations - just enough to give face and seat a lapped finish. If lapping tool set screw is not long enough to catch valve stem, a standard 10-24 screw will have to be used. Remove valve, wash valve face and seat thoroughly with clean gasoline and allow to dry, or blow dry with compressed air. If inspection shows an unbroken lapped finish around both valve face and seat, valve is well-seated. If lapped finish is not complete around either valve or seat, further seating is required. Apply a light coat of oil to valve face and seat when reconditioning job is finished.

ASSEMBLING CYLINDER HEAD

To install valve assemblies in cylinder head, reverse the disassembly procedure. (See Figure 3B-12 and 3B-12A.

Oil valve stems lightly and insert the intake valve in its guide. Clamp valve spring compressor Tool, Part No. 97290-61P, in a vise - (stationary jaw down) and position cylinder head with intake valve head resting on stationary jaw of tool. Install lower valve spring collar, inner spring, outer spring and upper valve spring collar over valve stem and guide. Compress valve spring assembly and install valve keys. Release spring compressor and follow same procedure for exhaust valve assembly except late models have shim under exhaust valve lower spring collar.

Position the intake rocker arm in the cylinder head. (See Figure 3B-15.) Insert the rocker arm shaft into the push rod side bushing far enough to be seen before it enters the rocker arm, and install correct thrust washers and spring washers (according to disassembly), see Figures 3B-12 and 3B-12A. Continue through with rocker arm shaft until hole in arm aligns with hole or flat on shaft. Install set screw or bolt and lock.

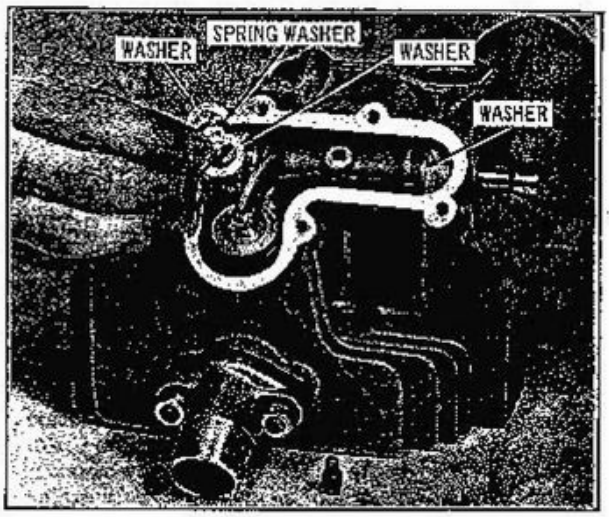


Figure 3B-15. Assembling Rocker Arm Shaft and Thrust Washers - Intake Valve

NOTE

See that valve stem aligns with rocker arm pad. Thrust washers should be arranged on either side of rocker arm to obtain this alignment; also select enough thrust washers to partly compress spring washer if one is used. If none is used, select shim washers for specified end play.

Follow same procedure on exhaust rocker arm assembly except for washer position.

INSTALLING CYLINDER HEAD ASSEMBLY

To install the cylinder head assembly, reverse the order of disassembly. Clean top of cylinder and cylinder head faces with a clean towel.

On 1961-66 and 1973 models install new rocker arm return oil pipe seals on the oil return pipe and insert it in oil return hole in lower left side of left crankcase.

Position the push rods in the cylinder push rod housing. IMPORTANT: The inside push rod (that is closest to the flywheel assembly) is the intake, and the outside push rod is the exhaust. They cross each other resulting in the intake push rod being above the exhaust push rod when the head is installed. The 1967-72 exhaust push rod is .040 longer than the intake push rod.

Position push rod housing rubber gasket over push rods and install cylinder head assembly over the four cylinder-to-head mounting studs, but leave enough gap between the cylinder head and cylinder to hold the push rods in position with a needle nose pliers or equivalent. With one push rod so held, the corresponding rocker arm can be rocked down far enough to engage the tappet adjusting screw with the push rod ball end, thus, holding the push rod in position. Follow this same procedure for the other push rod. Slip cylinder head down, install the four cylinder head nut washers and nuts and secure the head. Tighten head nuts to approximately 30 ft-lb torque.

Install the rocker arm oil line. On 1966 and earlier models oil line connects to left side of cylinder head. Insert the crankcase connection end of the rocker arm oil line (9, Figure 3B-12) between the cylinder head rocker arm housings, and position it along the lower right side of the cylinder and cylinder head. It will lie between the cylinder head fins.

On 1973 and later models, oil line connects to right side of cylinder head. Position one feed line connection washer (2) on each side of the feed line connection and install the longest feed line connector (1) in the crankcase. Do not tighten yet. Make certain the oil feed line connections line up properly with the rocker arm flange cover holes and install the two short feed line connectors (7) with a washer (8) on each side of the connector. (Use fingers to start these connectors.) Now tighten all three feed line connectors.

Adjust tappets as described in subsequent paragraph "Adjusting Tappets."

Install covers, gaskets and remaining parts in reverse order of disassembly.

NOTE

On individual tappet covers, do not overtighten the five tappet cover screws or damage to covers or threads will result.

ADJUSTING TAPPETS

To get maximum power and best all-around performance from an engine, keep tappets properly adjusted. They should be inspected and, if necessary, readjusted initially at 300 miles with a new or overhauled engine, and a second time after the 1000 mile running-in period is completed. After the running-in period, the tappet adjustment should be checked every 2,000 miles or whenever unusual noise is noticed in the valve mechanism.

NOTE

Excessive tappet clearance causes noise and quick wear of the valve mechanism. Loss of tappet clearance will cause valves to close imperfectly with loss of engine compression and possible burning of valves.

Check tappet clearance as follows:

Remove rocker arm cover or tappet covers.

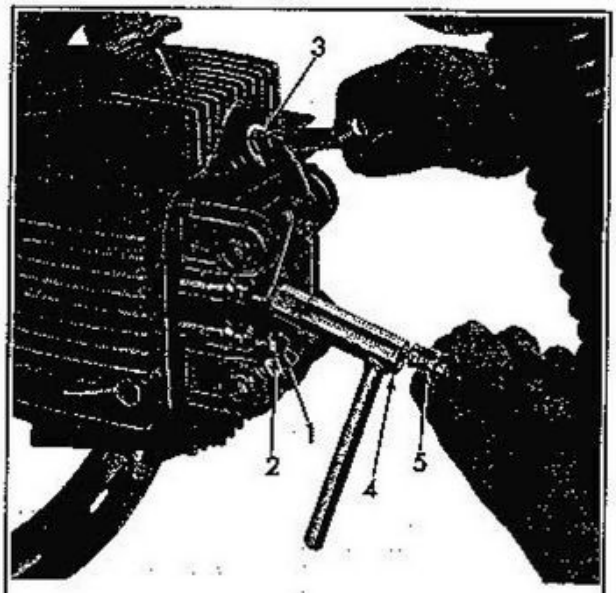
Rotate engine with spark plug removed (use kick starter), until either rocker arm indicates a valve is fully open. The opposite valve tappet adjustment can now be made.

Check the tappet clearance as shown in figure 3B-16 by inserting a feeler gauge (3) between the valve stem and the rocker arm pad. If the tappet clearance is correct, feeler will slide in with a slight drag. See Engine Specifications, Section 3A, for correct clearances.

To adjust tappet clearance, loosen tappet adjusting screw locknut (2, Figure 3B-16) with socket wrench (4) provided in tool kit. Turn tappet adjust screw (1) with a screwdriver (5) clockwise to reduce tappet clearance and counterclockwise to increase tappet clearance. Tighten locknuts securely and again check tappet clearance.

Rotate engine until the valve that has been adjusted is fully open and follow same procedure on the opposite or closed valve. Again rotate engine and check clearance at each valve stem.

Reassemble covers, taking care not to damage the gaskets or over-tighten the cover screws.



1. Adjustment Screw (2)
2. Locknut (2)
3. Feeler Gage
4. Wrench
5. Screwdriver

Figure 3B-16. Tappet Adjustment (1967-72 Shown)

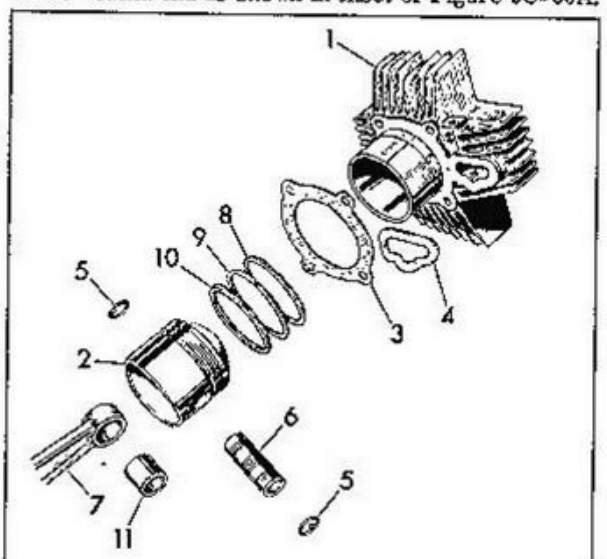
CYLINDER

CYLINDER AND PISTON

REMOVING CYLINDER AND PISTON (Figure 3C-59)

Remove cylinder head as described in "Removing Cylinder Head Assembly," Section 3B and proceed as follows:

Clean crankcase around cylinder base to prevent dirt from falling into crankcase when lifting cylinder. Slip cylinder (1) and piston (2) far enough from crankcase to permit placing a clean cloth over crankcase opening; this will prevent dirt and possibly pieces of broken ring from falling into crankcase. Remove cylinder (1) by pulling off from the four mounting studs, also remove cylinder base gasket (3) and push rod gasket (4). Remove piston pin lock rings (5) from piston groove. On early models with bent ring ends, use lock ring pliers as shown in Figure 3C-60. On late models with straight ring ends, insert pointed tool in hole slot and pry out lock ring as shown in Figure 3C-60A. A tool for removing piston pin lock rings can be made from a screwdriver, such as Harley-Davidson Part No. 95002-45, with a blade measuring approximately 1/32 in. thick and 9/32 in. wide. Grind end as shown in inset of Figure 3C-60A.



1. Cylinder
2. Piston
3. Cylinder Base Gasket
4. Push Rod Gasket
5. Piston Pin Lock Ring
6. Piston Pin
7. Connecting Rod
8. Upper Compression Ring
9. Lower Compression Ring
10. Oil Control Ring
11. Piston Pin Bushing

Figure 3C-59. Removing Cylinder and Piston

Heat piston to 250°F. and push piston pin (6) out with suitable drift. Remove piston from connecting rod (7). Spread piston rings (8, 9 and 10) with ring removing tool until they clear ring grooves in piston and lift off.

CLEANING AND INSPECTION

Place piston and cylinder in "Gunk Hydro-Seal" or other carbon and gum dissolving agent until deposits are soft. Then thoroughly scrub piston and cylinder in solvent to remove deposits. Where carbon is thick or hard, it is advisable to scrape before cleaning. Use a putty knife-type scraper or a ground tip from an old file. Use extreme care to avoid scraping into aluminum of pistons.

After parts are thoroughly washed, blow dry with compressed air. Force air through push rod hole in cylinder. Clean piston ring grooves with a tool for cleaning ring grooves; if not available, sharpen end of a broken ring to a chisel edge. Avoid scratching or damaging side of ring grooves.

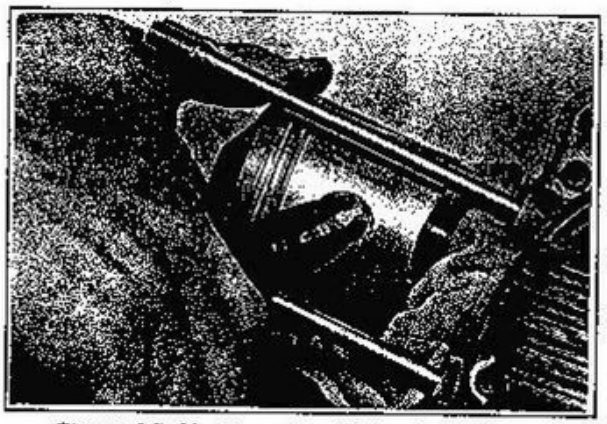


Figure 3C-60. Removing Piston Lock Rings (Early Models)

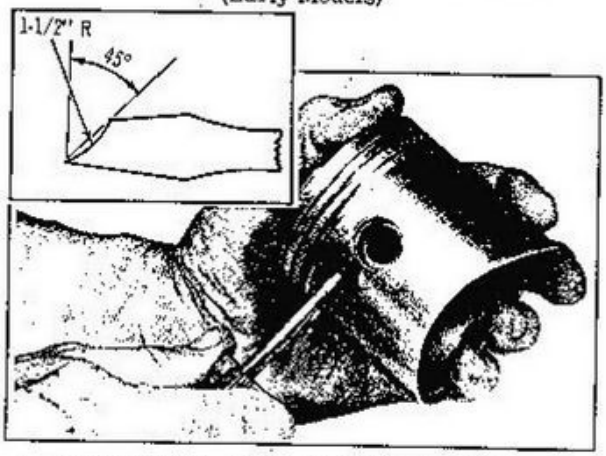


Figure 3C-60A. Removing Piston Lock Rings (Late Models)

Examine piston pin to see that it is not loose in connecting rod, grooved, pitted or scored. If necessary, remove bushing (11) as described in subsequent paragraph.

A piston pin, properly fitted, is a light hand press fit in piston and has .001 in. clearance in connecting rod upper bushing (11).

If difference in diameter of hole in piston pin bushing and diameter of piston pin exceeds a .002 in. fit replace worn parts.

Replace piston pin lock rings whenever they are removed from piston grooves.

Examine piston and cylinder for cracks, burrs, burned spots on piston dome, grooves and gouges.

Check rod for up-and-down play and upper end side shake (see Figure 3C-61). To make this check with accuracy, piston should first be removed. When appreciable up-and-down play is found and rod has 1/16 in. or more side shake at extreme upper end, connecting rod and bearing assembly should be replaced. This requires removing and disassembling engine crankcase. See "Crankcase," Section 3E.

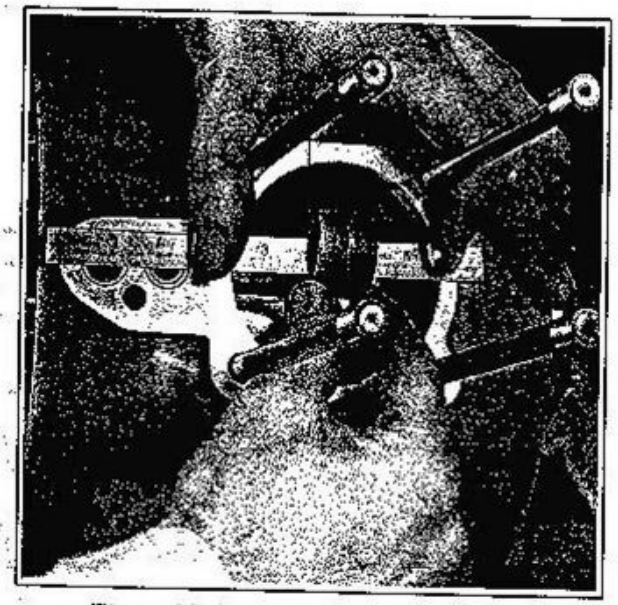


Figure 3C-61. Checking Connecting Rod for Crankpin Bearing Wear

REFINISHING CYLINDERS

Gauge piston and cylinder to see if they are worn to the point where cylinder must be rebored and an oversize piston installed. Inside and outside micrometers used for piston to cylinder fitting should be checked together to be sure they are adjusted to read exactly the same. Subtract piston measurement from bore measurement to obtain clearance. Bore measurement of cylinder should be taken in ring path, starting 1/2" from top of cylinder, measuring front to rear, then side to side. Repeat this procedure at the center and at the bottom of ring travel (see Figure 3C-62). This process will determine if cylinder is out of round or "egged" and will also show any cylinder taper.

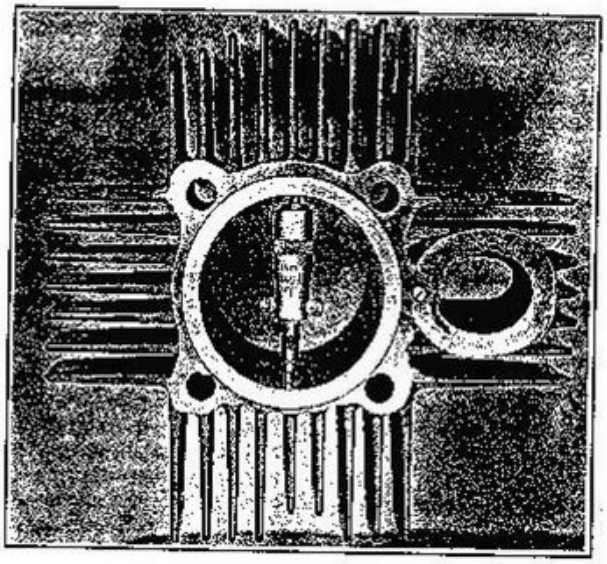


Figure 3C-62. Measuring Cylinder

Piston is measured front to rear at base of piston skirt as shown in Figure 3C-63. Piston is cam ground to an egged or oval shape so only front and rear surfaces are touching cylinder wall.

Figure 3C-63. Measuring Piston

If cylinder is not scuffed, scored and is worn less than .0025 in., it is not usual practice to refinish oversize. If total piston clearance is over .0025 in. a new standard piston, or piston of the same oversize to which the cylinder was last refinished, should be fitted to reduce clearance and effect reasonably quiet operation. If cylinder shows more than .0025 in. wear, it should be refinished to the next oversize step and fitted with new corresponding piston and rings.

Exact final size of the cylinder bore is determined by size of the piston to be used in the cylinder. Measure piston diameter accurately as described previously, then add desired piston clearance to piston measurement. This will equal the exact final size to which cylinder bore should be refinished, example: the 66.2 MM oversized piston to be used measures 2.6064 in., adding .002 in. (desired clearance) equals 2.6084 in. (finish-honed size).

Pistons are regularly supplied in the following oversizes; .2 MM (.008 in.), .4 MM (.016 in.), .6 MM (.024 in.) and .8 MM (.032 in.).

Cylinders can be refinished oversize either with a hone or a boring bar followed by a finishing hone. In general practice only cylinders not scored and not badly worn are refinished using a hone. Cylinders badly worn or deeply scored are first rebored to nearly the required oversize and then are finish-honed to exact size. When cylinders must be rebored to beyond .036 in. oversize to "clean up", their oversize limit has been exceeded and a new cylinder must be installed.

FITTING PISTON RINGS

If cylinder is worn less than .0025 in. maximum and refinishing is not necessary (unless bore is scuffed or grooved), the same piston may be used with replacement of piston rings. However, before reassembling it is a good practice to rough up the cylinder wall with No. 150 carborundum emery paper or a No. 300 hone. This will remove any high spots, carbon or foreign material from the cylinder wall and at the same time provide a surface suitable for proper lubrication and ring seating.

Piston rings are of three types - Top compression ring is a plain ring, second compression ring has a step on the inner diameter and is marked "top", and the third ring is a slotted oil control ring.

All rings must have .001 to .002 in. side clearance. Check with feeler gauge as shown in Figure 3C-64.

All rings should have an end gap of .010 in. but no greater than .016 in. when ring is placed squarely in cylinder bore 1/2" from top of cylinder. Use piston skirt to slip ring into square position in bore. Use feeler gauge to check end gap. See Figure 3C-65.

If gap is less than .010 in., ring ends may butt together under expansion and may break or score rings. Gap may be increased with a fine-cut file as shown in Figure 3C-66. Use only standard size rings and piston in standard cylinder bore, and only matching oversize rings and piston in same oversize bore.

Figure 3C-64. Measuring Ring Clearance in Grooves

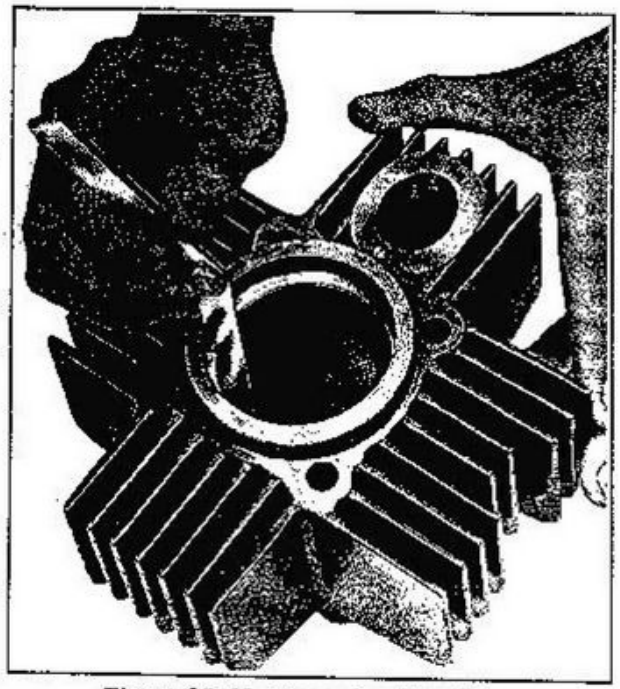


Figure 3C-65. Measuring Ring Gap

Figure 3C-66. Increasing Compression Ring Gap

Compression rings and oil control ring are available in the following oversizes: .2 MM (.008 in.), .4 MM (.016 in.), .6 MM (.024 in.), .8 MM (.032 in.).

CONNECTING ROD BUSHING

When connecting rod bushing is found tight in rod but is worn to excessive pin clearance (.002 in. or more), it is possible to repair it by reaming oversize and fitting an oversize pin. However, it is better practice to install a new bushing and ream it to fit a standard pin, except when piston to be used had previously been fitted with an oversize pin or pin is loose in piston pin bosses, necessitating fitting with larger pin. The principal objection to fitting an oversize pin is that considerable more time is required for the job, because the piston pin bosses must also be reamed accordingly. A new piston obtained from the factory is supplied with correctly fitted standard pin, and installing one is a short job after reaming the rod bushing to standard size.

When removing bushing in connection with only a top overhaul, the connecting rod must be held or clamped securely to permit the removal of the old bushing and the installation and reaming of the new bushing. Use Tool Part No. 95970-32A to remove old bushing and install new parts order bushing.

NOTE

Make certain the oil holes in the new bushing are in proper alignment with oil passages in connecting rod when pressing bushing into position.

After new bushing is installed check oil passages to make sure they are clear.

Use Expansion Reamer Part No. 94810-65 to carefully enlarge pin bushing to give the desired .0006 in. to .0012 in. piston pin clearance.

Oversize piston pins are available in the following oversizes; .1 MM (.004 in.), .2 MM (.008 in.).

After installing and reaming new piston pin bushing in connecting rod in connection with only a top overhaul, connecting rod alignment must be checked the same as when an engine is completely overhauled.

STRAIGHTENING CONNECTING ROD

In refitting and reassembling connecting rod, and finally fitting piston, rod may possibly be bent or twisted, throwing pin bushing and lower bearing out of alignment with each other to some extent. Therefore, after piston has been installed, rod must be checked and re-aligned as may be necessary.

A rod that is bent, or twisted, allows a "cocked" relation between the piston and cylinder bore resulting in excessive noise and rapid wear.

NOTE

A squaring plate, surface ground on both sides and of correct dimensions will be needed. Also a Sprint piston (possibly a used one) with the skirt accurately machined off to give the desired straight skirt, and a straightening bar, approximately 1/2 in. dia. which will slip into the inside diameter of the piston pin.

If the rod is in perfect alignment, the bottom of the dummy piston will rest squarely on the plate with flywheels turned so that crank pin is in either the forward or rear position.

This check, to be accurate, depends upon checking with crank pin in both forward and rear positions. It is the change of rod angle, resulting from changing crank pin from one position to the other, that influences the seat of dummy piston on squaring plate and thus indicates whether or not rod is in alignment.

Rather than depend entirely upon visual check, insert strips of paper of equal thickness underneath dummy piston, one on each side below piston pin.

Press piston down lightly with fingertip resting on dummy piston and pull first one paper, then the other, partially from underneath piston. If piston is perfectly square (rod in alignment), both will have the same amount of drag.

The manner in which piston seats on squaring plate indicates misalignment as follows:

1. Piston high on same side, both crank pin positions; rod is bent.

2. Piston high on opposite sides as crank pin position is changed; rod is twisted.

3. Piston square or nearly square with crank pin in one position and high on one side with crank pin in other position; rod is bent and twisted.

Correct as follows:

1. To straighten a bent rod, extend straightening bar from low side of piston and apply upward force.

2. To straighten a twisted rod, extend straightening bar from high side of piston, and if crank position is to front, apply force to rear; if crank pin position is to rear, apply force to front.

3. To straighten a bent and twisted rod (combination of a bend and twist) remove bend first and then remove twist. See steps 1 and 2.

ASSEMBLING CYLINDER AND PISTON (Figure 3C-59)

When connecting rod is true, remove squaring plate and dummy piston. Using lock ring pliers install one piston pin lock ring in groove and warm actual piston. Oil pin, bushing and pin bosses lightly. Slip pin in one pin boss, position piston on connecting rod with large valve relief up (toward intake), and slip pin remainder of way into position. Cover crankcase opening with clean rag and install second piston pin lock ring. Remove rag.

Dip piston rings in light oil and install on piston starting with the oil control ring, then the lower compression ring. (Be certain that this ring is installed with the step on the inner diameter facing up toward piston dome), and last the plain upper compression ring. Position the rings so gaps are not in alignment with each other, that is, stagger the ring gaps and avoid having gaps on the thrust faces of piston.

Install the cylinder base gaskets on the cylinder. Oil cylinder walls lightly. (If tool is used to compress rings, it should be installed on piston before cylinder is installed.) Carefully crank engine to bottom dead center and slip cylinder on the four cylinder-to-head mounting studs, approximately 1-1/2" to 2" down on studs. Again carefully rotate engine to bring piston up into alignment with cylinder bore. The top compression ring can be compressed and positioned with the fingers and the piston moved into the cylinder bore. Follow the same procedure for second compression ring and finally the oil control ring.

Hold lower push rod housing rubber gasket between cylinder and crankcase and slide cylinder down into position. See Figure 3C-67.

Assemble cylinder head and remaining parts of motorcycle as described in Section 3B.

Figure 3C-67. Installing Cylinder on Piston

CAM GEAR AND TAPPETS

REMOVING RIGHT SIDE COVER

If engine is to be removed from chassis, follow procedure as described in "Removing Engine From Chassis", Section 3A.

If engine is to remain in chassis, lay motorcycle on its left side and support it at an angle so oil will not run out of engine when right cover is removed.

On 1968 and earlier models, rotate clutch release lever forward with a wrench and remove clutch cable from lever.

On 1972 and earlier models, remove foot shifter nut, bolt and foot shifter lever. Remove circuit breaker cover screws and cover.

NOTE

Circuit breaker wires do not have to be removed if engine remains in frame.

Remove screw from circuit breaker cam (holds cam to shaft).

On 1969 and later models, remove clutch. See "CLUTCH (1969 and Later)", Section 4B.

Remove eleven 6MM Allen socket screws. Remove crankcase dip stick. On 1968 and earlier models, rotate clutch release lever forward to free cover. Remove cover and gasket.

Figure 3D-29 shows engine with cover removed.

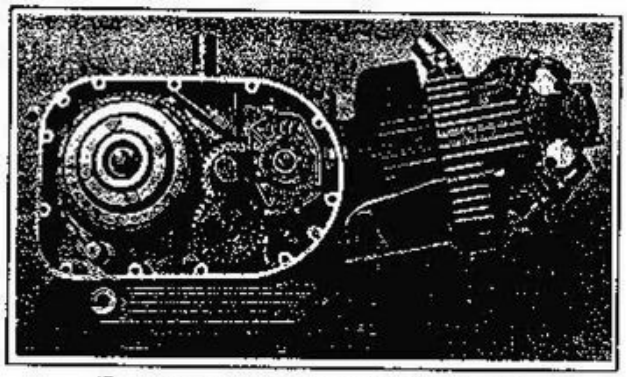


Figure 3D-29. Engine with Right Side Cover Removed (1968 & Earlier)

REMOVING CAMSHAFT AND TAPPETS (See Figure 3D-30)

After removing cover place a towel in gear case to cover up all open holes.

On 1968 and earlier models having a camshaft support (3), remove camshaft support nuts (1), locks (2) and support assembly (3).

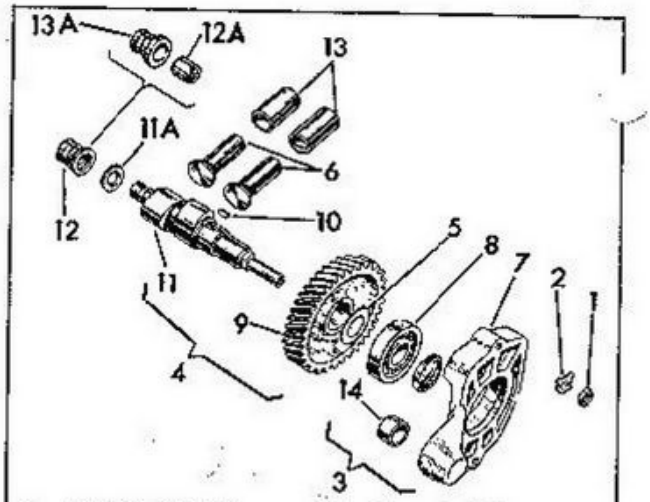
Remove camshaft (4) from crankcase bushing (12) or bearing (12A). Remove camshaft thrust washer (5) from chamshaft. Mark tappets (6) to identify them with respective holes; remove tappets (6) from bushings (13).

NOTE

Inside tappet is intake; outside tappet is exhaust.

CLEANING AND INSPECTION

Thoroughly clean all parts in gasoline or cleaning solvent. If cam is found to have rough or pitted surfaces, replace camshaft (11). If cam gear (9) needs to be replaced due to wear, press gear from camshaft; care should be taken so as not to bend end of camshaft when replacing gear. To replace gear, in-



1. Nut (2) (1968 & Earlier)
2. Lock (2) (1968 & Earlier)
3. Support Assembly (1968 & Earlier)
4. Camshaft Assembly
5. Thrust Washer
6. Tappets (2)
7. Support
8. Support Ball Bearings
9. Gear
10. Key
11. Camshaft
11A. Camshaft Washer, Variable Thickness (1964 & Later)
12. Camshaft Crankcase Bushing (1963 & Earlier)
12A. Camshaft Crankcase Needle Bearing (1964 & Later)
13. Tappet Bushing (2) (if used)
13A. Needle Bearing Bushing (1964 & Later)
14. Pinion Shaft Bushing

Figure 3D-30. Camshaft, Support Assembly and Tappets

stall key in keyway on camshaft and press gear onto shaft so that recess side of gear is facing out. Force compressed air through oil holes in camshaft in order to clean them.

1964 and later models have a steel bushing (13A) in case with needle bearing pressed in. Earlier models have a bronze bushing (12) pressed directly into crankcase.

In order to replace camshaft crankcase needle bearing or bushing disassemble crankcase as described in "Disassembling Crankcase", Section 3E. Press out needle bearing or bushing from inside of crankcase with a shouldered drift. Press in new needle bearing or bushing from gear case side.

After bushing has been installed, it must be line reamed with special Harley-Davidson reamer Part No. 97318-61P, installing pilot in camshaft support for reamer.

Tappets (6) should be .0002 to .0005 in. loose. Excessive tappet clearance is serviced by fitting new tappets, and/or new bushings (13) (if used). If tappets have excessive wear on cam follower faces, replace them.

If tappet bushings (13) are worn they must be replaced. Press bushings from outside of crankcase with a shouldered press pin 12MM (.472 in. dia.).

If ball bearing (8) has excessive side or up and down movement in cam support assembly (3) or cover (1969), press out bearing from outside of cover and install a new one.

When pinion shaft bushing (14) in support or cover assembly becomes worn, replace with a new one as follows:

Remove worn pinion shaft bushing using bearing puller part No. 95760-69, with 7/8 I.D. x 2 in. long pipe as a support sleeve in place of large puller sleeve. Press new bushing into camshaft support or cover. Install camshaft support or cover on right crankcase (do not tighten support nuts or cover screws securely as yet). Insert reamer with pilot through crankshaft ball bearing in case, then tighten support or cover securely. Ream bushing using a tap holder.

INSTALLING CAMSHAFT AND TAPPETS.

Apply a light coat of oil to tappets (6) and install into correct location (marked during disassembly). Install camshaft assembly (4) into crankcase bushing and align timing marks on cam gear (9) with corresponding mark on pinion gear as shown in Figure 3D-31 or Figure 3D-32.

On 1968 and earlier models, place thrust washer (5) and support assembly (3) on camshaft; place a piece of tubing or a socket on support assembly ball bearing (8) inner race and tap support assembly into position. Secure assembly with locks (2) and nuts (1).

Install cover as described under subsequent heading "Installing Right Side Cover".

OIL PUMP

GENERAL

1963 and earlier models have a gear type duplex oil pump with oil feed and scavenger (oil return) pumps incorporated in one body. The feed section forces oil to the engine and the scavenger section returns oil to the crankcase. On 1964 and later models the scavenger section is omitted.

REMOVING AND DISASSEMBLING OIL PUMP (See Figure 3D-33)

After removing cover, place a towel in gear case to cover up all open holes. Remove 1968 and earlier camshaft support assembly nuts, locks and support assembly. Hold pinion gear and remove oil pump drive gear nut (1) and lock (2). To remove drive gear (3), use tool Part No. 97292-61, two jaw puller, (with a small end cap, Part No. 95652-43A, which fits on oil pump drive shaft to prevent spreading threads) as shown in Figure 3D-34.

On 1963 and earlier models, remove pump scavenger line connection (4) and copper washers (5).

Figure 3D-31. Cam Gear and Pinion Gear Timing Marks Aligned (1968 & Earlier)

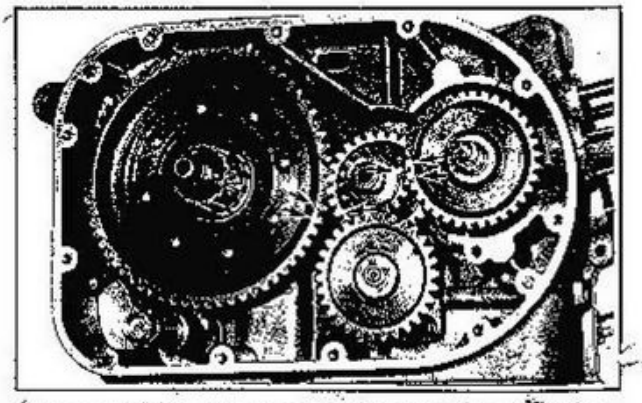
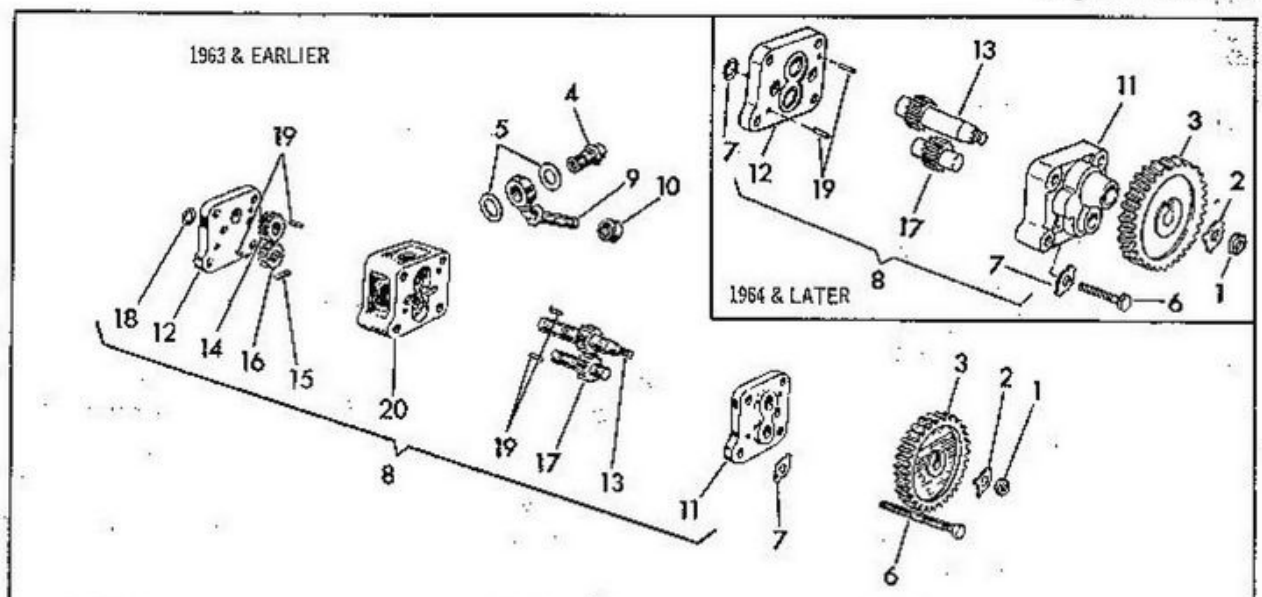


Figure 3D-32. Cam Gear and Pinion Gear Timing Marks Aligned (1969 & Later)



1. Nut
2. Drive Gear Lock
3. Drive Gear
4. Scavenger Line Connection
5. Copper Washer (2)
6. Bolt (4)
7. Pump Body Lock (4)
8. Pump Assembly
9. Scavenger Line
10. Scavenger Line Gasket
11. Outer Cover
12. Inner Cover
13. Gear
14. Feed Idler Gear
15. Key
16. Feed Gear
17. Idler Gear
18. O-Ring
19. Dowel Pin (4, 1963) (2, 1964)
20. Pump Body

Figure 3D-33. Oil Pump - Exploded View

Remove four pump bolts (6) and locks (7). Remove oil pump assembly (8) from gear case. Remove scavenger line (9) and gasket (10) (1963 and earlier) from gear case. Free outer cover (11) and inner cover (12). Remove gear (13) and idler gear (14). Free feed gear driving key (15), feed gear (16) and idler gear (17).

Remove rubber O-ring (18) on cover (12) and dowel pins (19) only if necessary. Dowel pins are press fit in body or cover.

CLEANING AND INSPECTING OIL PUMP

Clean all parts in cleaning solvent. Blow out all oil holes and passages with compressed air. Replace any parts that are worn or damaged.

ASSEMBLING AND INSTALLING OIL PUMP

Reassembly of the oil pump is essentially the reverse order of disassembly.

Apply a light coat of oil to all moving parts before assembling. Press in new dowel pins (19) if they have been removed from body (20).

1963 & Earlier Models:

Assemble gear (13) into front upper hole, and gear (17) into front lower hole of pump body (20). Turn pump over and assemble feed gear (16) and driving key (15) on scavenger idler gear shaft (17). Install feed idler gear (14) on scavenger gear shaft (13). Position outer cover (11) and inner cover (12) on pump. Install rubber "O" ring (18) on cover (12).

Install oil pump scavenger line (9) in crankcase; be certain scavenger line gasket (10) is in place. Position oil pump assembly in crankcase, (see Figure 3D-32) making certain the oil return line rubber "O" ring (18) is in place. Place one copper washer (5) on each side of the scavenger line (9) and screw oil pump scavenger line connection (4) in oil pump. Do not tighten this fitting yet.

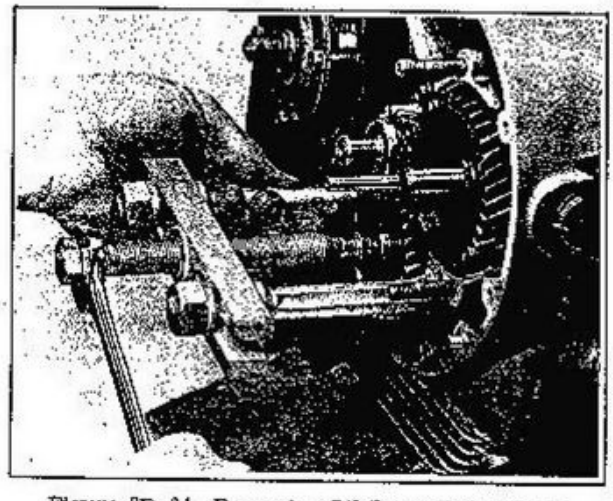


Figure 3D-34. Removing Oil Pump Drive Gear

Insert four oil pump body bolts (6) and new locks (7) and draw down carefully. Now tighten oil pump scavenger line connection (4).

1964 & Later Models:

Assemble gear (13) and gear (17) in outer cover (11). Position inner cover (12) over gear shafts with dowels in register. Install "O" ring (18) and assemble pump to crankcase with bolts (6) and new locks (7).

Wipe taper clean on gear shaft (13) and on drive gear (3). Install drive gear (3) on taper and secure with a new lock (2) and nut (1).

NOTE

If gear shaft (13) tends to turn while tightening nut, press down on one side of driving gear (3) to stop rotation.

Install 1968 and earlier cam support plate as described in "Installing Camshaft and Tappets."

Install cover as described in "Installing Right Side Cover."

PINION AND DRIVE GEARS

REMOVING PINION SHAFT GEARS (See Figure 3D-35)

1968 & Earlier Models:

Remove right side cover as described in "Removing Right Side Cover" earlier in this section. Place a towel in gear case to cover up all open holes.

Remove cam support plate nuts, locks and support assembly, also remove camshaft and thrust washer as described in "Removing Camshaft and Tappets."

Remove clutch plate assembly from clutch as described in "Disassembling Clutch," Section 4B. Remove oil pump drive gear as described in "Disassembling Oil Pump."

To loosen pinion shaft nut, place tool Part No. 97175-61P, Clutch Lock, into clutch shell to prevent pinion shaft from turning while removing pinion shaft nut (1). Hold clutch hub with Hub Wrench, Part No. 97291-61PA. Place engine mounting bolt in crankcase hole to hold wrench as shown in Figure 3D-36. (If engine is in frame, use part of frame as a stop for wrench.)

Remove pinion shaft nut (1) and lock (2) with socket wrench.

Remove clutch hub and shell gear as described in "Disassembling Clutch," Section 4B.

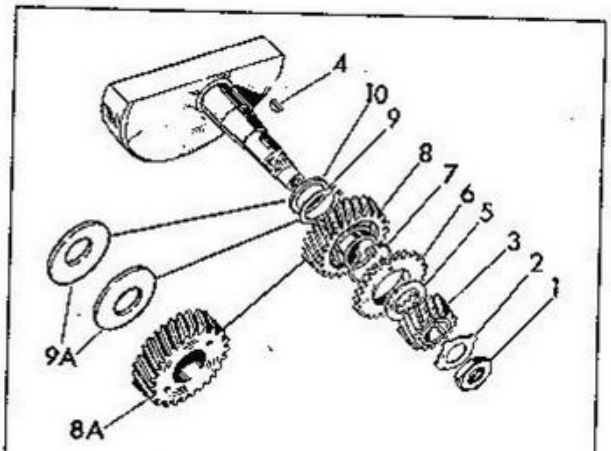
Remove pinion gear (3) with tool Part No. 97292-61P, Two Jaw Puller, as shown in Figure 3D-37.

There are three keyways on pinion shaft, but only one key; make a small punch mark on shaft in front of key to identify keyway before removing key. See Figure 3D-38.

Remove key (4).

If used, remove thrust washer (5), drive take up gear (6), and spring (7).

To remove clutch drive gear (8 or 8A) using Drive Gear Puller, Part No. 97294-61P, hold clutch hub with tool Part No. 97291-61PA, Hub Wrench, and an engine mounting bolt located in crankcase hole as shown in Figure 3D-39.



1. Nut
2. Lock
3. Pinion Gear
4. Key
5. Thrust Washer, Early 1961
6. Drive Takeup Gear, Early 1961
7. Drive Takeup Gear Spring, Early 1961
8. Clutch Drive Gear, Early 1961
8A. Clutch Drive Gear, Late 1961 to 1968
9. Lock Ring
9A. Spring Washer (2)
10. Spacer Washer (Variable Number)

Figure 3D-35. Pinion Shaft Gears - Exploded View

1969 & Later Models:

Remove all clutch parts, including hub, as described in "CLUTCH (1969 & Later)," Section 4B. Remove Right Side Cover as described earlier in this section. Place a towel in the gearcase to cover up all open holes.

Remove camshaft thrust washer, camshaft, and oil pump drive gear as described earlier in this section.

To loosen pinion shaft nut, remove cylinder head and cylinder (see Sections 3B and 3C) and place a crossshaft through piston pin hole in connecting rod to prevent crankshaft from turning while removing pinion shaft nut (1) with a socket wrench.

Remove pinion shaft nut (1) and lock (2). Remove pinion gear (3) with tool, Part No. 97292-61, Two Jaw Puller, as shown in Figure 3D-37.

There are 3 keyways on pinion shaft but only one key; make a punch mark on shaft in front of key to identify key before removing key. See Figure 3D-38.

Remove key (4).

CLEANING AND INSPECTION (See Figure 3D-35)

Thoroughly clean all parts in clean solvent. Inspect all gears and replace any that are badly worn. If clutch drive gear (8 or 8A), or pinion gear (3) are replaced, mating gears must be replaced also because they are supplied only as matched sets.

Check ends of takeup spring (7) to make sure hooks have not been broken off. Also examine spring for collapsed condition and compare with a new one if possible..

If thrust washer (5) shows signs of wear, it will indicate that clutch drive gear is slipping on pinion shaft. Replace thrust washer and examine tapers of drive gear and pinion shaft for wear also.

If pinion shaft needs to be replaced, remove engine as described in "Removing Engine from Chassis," Section 3A, and separate crankcase as described in "Disassembling Crankcase." Disassemble flywheel as described in "Disassembling Flywheels," Section 3E, and replace pinion side flywheel.

Assemble flywheels as described in "Assembling Flywheels," Section 3E. Replace crankcase as described in "Assembling Crankcase," Section 3E.

INSTALLING PINION AND DRIVE GEARS (See Figure 3D-35)

Instead of using 1972 and earlier factory shimming procedure to limit crankshaft endplay, the following alternate procedure should be used when crankshaft endplay becomes excessive or when engine base is taken down.

Replace lock ring (9) and spacer washer(s) (10) with 2 spring washers (9A). Assemble spring washers between ball bearing and primary drive gear so that the dished outside diameters contact each other. This will provide zero endplay for crankshaft.

Make sure tapers on pinion shaft and clutch drive gear are absolutely clean.

On 1968 and earlier models, install clutch drive gear (8 or 8A) on pinion shaft taper. Insert spring (7) in drive gear (8) and install drive takeup gear (6) on pinion shaft. Position thrust washer (5) on pinion shaft so that chamfer on bore is facing drive gear.

Pinion gear shaft has 3 keyways. Insert key (4) in correct keyway on shaft according to mark made in disassembly.

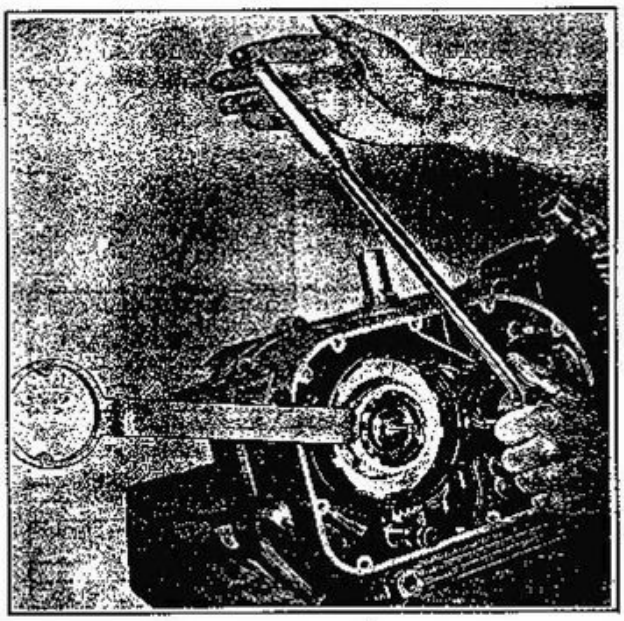


Figure 3D-36. Removing and Installing Pinion Gear Nut (1968 & Earlier)

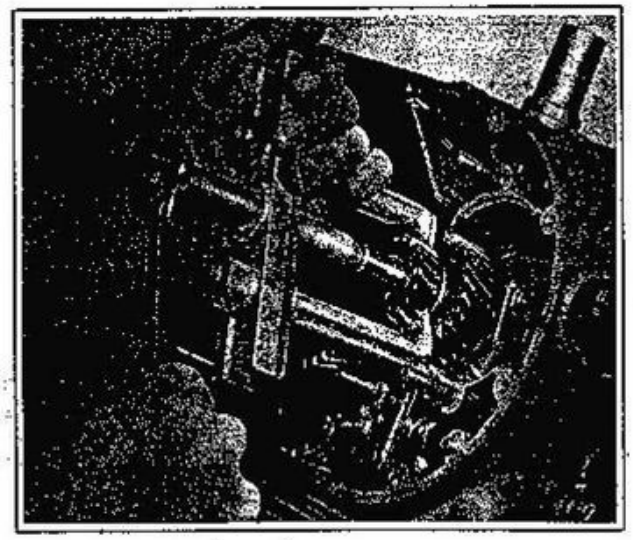


Figure 3D-37. Removing Pinion Gear

If there is no mark on shaft or grind mark on gear face to identify correct shaft keyway, move crankshaft so that piston (crankpin) is at top center and install key in shaft keyway as follows:

1963 and Earlier ... Forward (Top Center) Keyway
1964 to 1968 ..... Bottom Keyway (7 O'clock)
1969 and Later .... Forward (Top Center) Keyway

If gear has grind mark on face at one of 3 keyway locations, install key in shaft at grind mark location.

ALWAYS INSTALL GEAR ON SHAFT SO THAT TIMING MARK IS IN FORWARD (TOP CENTER) POSITION, as shown in Figure 3D-31.

Correct keyways in gear and shaft should produce the following valve timing.

		CRANK ANGLE		
		OPENS	CLOSES	LIFT
INTAKE VALVE	1973 & later	36° BTC	58° ABC	.380 in.
	1969-72	36° BTC	67° ABC	.361 in.
	1967-68	13° BTC	50° ABC	.296 in.
	1966	15° BBC	45° ABC	.296 in.
EXHAUST VALVE	1973 & later	68° BBC	24° ATC	.370 in.
	1969-72	70° BBC	20° ATC	.350 in.
	1967-68	54° BBC	9° ATC	.292 in.
	1966 & earlier	55° BBC	4° ATC	.292 in.

Crank angle is measured when valve is lifted .040 in. from cam base circle and with no tappet clearance.

Install lock (2) and nut (1); tighten nut temporarily by hand. (If new lock is used, bend one lug over to catch groove on gear.)

On 1968 and earlier models, install clutch shell gear and hub as described in "Assembling Clutch," Section 4B. (Be sure to rotate takeup gear three teeth counterclockwise.)

For 1968 and earlier models, place tool Part No. 97175-61P in clutch shell gear, hold clutch hub with tool Part No. 97291-61PA and an engine bolt in crankcase hole, tighten pinion gear nut securely to approximately 35 ft-lb torque, see Figure 3D-36. Finish assembling clutch as described in "Assembling Clutch," Section 4B.

Install oil pump drive gear as described in preceding paragraph "Assembling Oil Pump."

Install cam gear and support plate as described in preceding paragraph "Assembling Camshaft and Tappets."

Install right side cover as described in subsequent paragraph "Installing Right Side Cover."

For 1969 and later models, use a crossshaft through piston pin hole in connecting rod to prevent crankshaft from turning. Tighten pinion gear nut to approximately 35 ft-lb torque.

Install oil pump drive gear, camshaft, camshaft thrust washer and oil pump drive gear as described previously in this section.

Install right side cover as described in subsequent paragraph "Installing Right Side Cover." Assemble clutch as described in "CLUTCH (1969 & Later)," Section 4B.

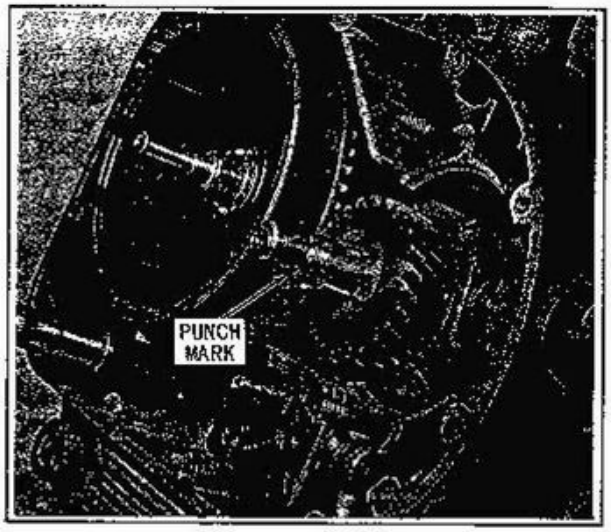


Figure 3D-38. Pinion Shaft Key Identification

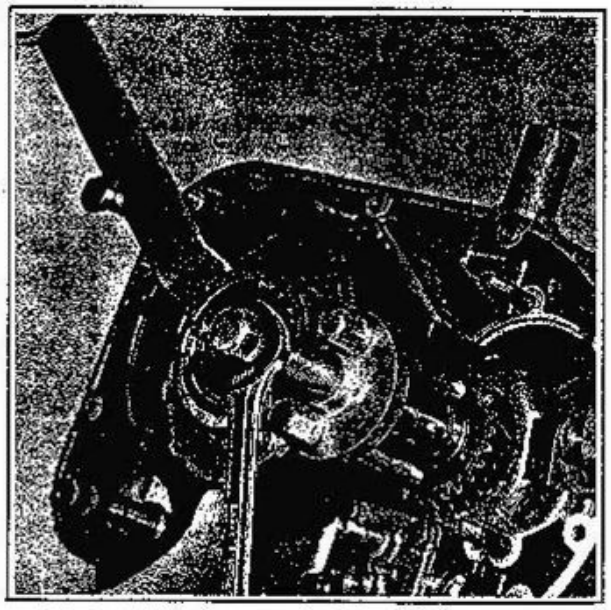


Figure 3D-39. Removing Clutch Drive Gear

REMOVING SHIFTER PAWL CARRIER (See Figure 3D-41)

Remove right side cover as described in "Removing Right Side Cover."

On 1968 and earlier models, remove clutch as described in "Disassembling Clutch," Section 4B.

Remove thrust washer from shifter pawl carrier.

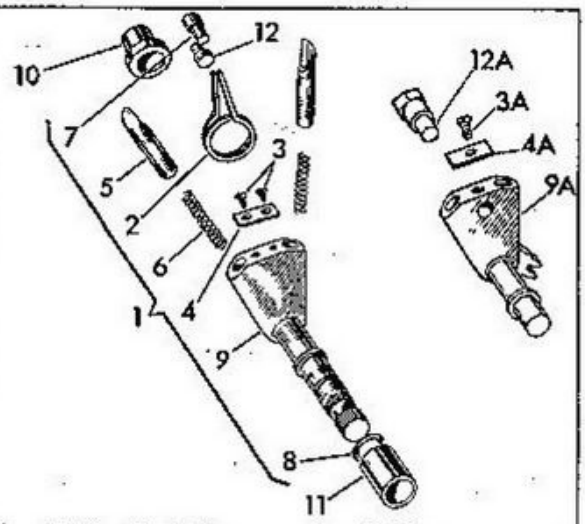
Remove shifter pawl carrier assembly (1) from case. Remove return spring (2) from rear of shifter carrier.

If shifter pawls (5) are damaged or will not slide up and down properly, disassemble as follows:

Remove spring plate screws (3) or screw (3A) retainer plate (4 or 4A) pawls (5) and pawl springs (6).

Shifter lever stops (7) (1972 and earlier) may be pressed out of carrier if necessary.

Transmission shifter transfer shaft, used on 1973 and later models, can remain in crankcase. To remove, see "CRANKCASE."



1. Shifter Pawl Carrier Assembly
2. Return Spring
3. Screw (2) (1972 & earlier)
3A. Screw (1) (1973 & later)
4. Pawl Spring Retainer Plate (1972 & earlier)
4A. Pawl Spring Retainer Plate (1973 & later)
5. Pawl (2)
6. Pawl Spring (2)
7. Stop Pin (1972 & earlier)
8. O-Ring
9. Pawl Carrier (1972 & earlier)
9A. Pawl Carrier (1973 & later)
10. Crankcase Carrier Shaft Bushing (1972 & earlier)
11. Cover Carrier Shaft Bushing (1972 & earlier)
12. Return Spring Pin (1972 & earlier)
12A. Return Spring Pin (1973 & later)

Figure 3D-41. Shifter Pawl Carrier - Exploded View

CLEANING AND INSPECTION

Thoroughly clean all parts in clean solvent and blow dry.

Examine shifter pawl (5) and springs (6) for wear, grooves, cracks or breakage. Insert pawls and springs in carrier (9) holes and check operation. Pawl must be free in carrier. Free length of new springs is approximately 38 MM (1.5 in.).

If crankcase shifter carrier bushing (10) needs to be replaced engine must be removed as described in "Removing Engine from Chassis," Section 3A and crankcases separated as described in "Disassembling Crankcase," Section 3E. Press out bushing with a shouldered drift from inside of crankcase and press in new bushing from gear case side; bushing does not need reaming.

Examine carrier itself for signs of wear and replace if necessary.

Pay particular attention to rubber "O" ring on shifter carrier and replace if worn.

If cover bushing (11) is worn, press out with a shouldered press plug from inside of cover. Install new bushing, chamfer side first, into inside cover and press flush with bushing boss.

INSTALLING SHIFTER PAWL CARRIER

Insert springs (6) into pawls (5) and install pawls (5) into carrier (9 or 9A). Position pawls so that flat cutouts are facing each other. Depress pawls and install spring retainer plate (4 or 4A). Press in stop pins (7) so that flats or flat on stop is parallel with retainer plate (4 or 4A). Position return spring (2) on shifter carrier with offset of spring toward crankcase and with stop pin (7) between arms of spring as shown in Figure 3D-42.

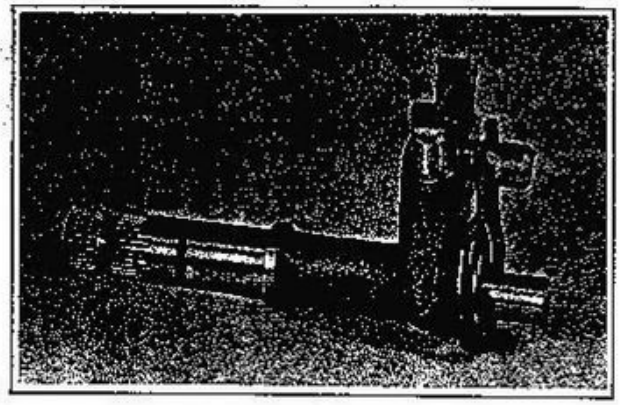


Figure 3D-42. Positioning Shifter Pawl Carrier Return Spring

Position rubber "O" ring (8) on carrier shaft. Place carrier assembly into case and engage return spring on return spring pin as shown in Figure 3D-43. Make sure spring is engaged (shaft should not turn).

On 1968 and earlier models, install clutch as described in "Installing Clutch," Section 4B.

Install cover as described in following paragraph.

INSTALLING RIGHT SIDE COVER

Figure 3D-29 shows 1968 and earlier engine before installing cover.

Position cover gasket on the case and install cover assembly, making certain that rubber O-rings are in position on the shifter pawl carrier shaft and hole recess on cover pad. Also make certain that automatic spark advance is positioned correctly on camshaft. See "Ignition Timing," Section 5F.

Temporarily install oil dip stick in cover.

Insert and start the cover screws with cover gasket in alignment. When all screws have been started, draw them down tightly. Tighten oil dip stick.

Secure shifter cam with cup washer, lockwasher and screws.

If engine has been removed from chassis, reassemble as described in "Installing Engine in Chassis," Section 3A.

Install circuit breaker cover so that small hole will be on the bottom. Secure cover with screws.

On 1968 and earlier models, rotate clutch release lever forward and engage clutch cable in lever.

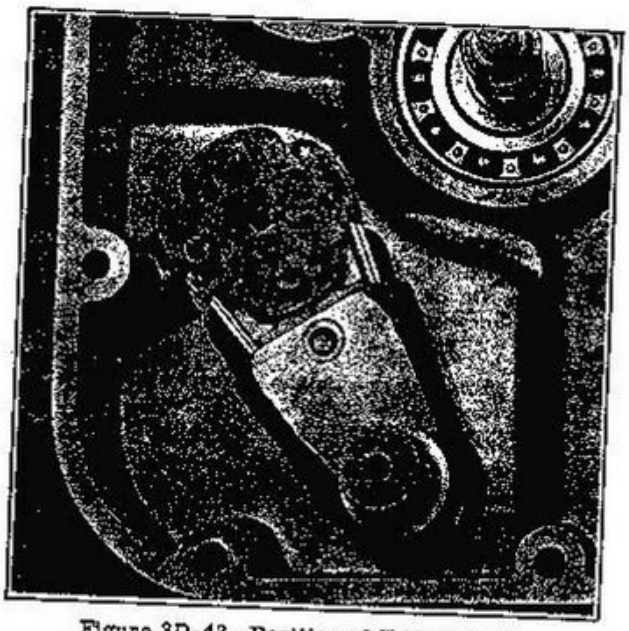


Figure 3D-43. Position of Shifter Pawl Carrier in Case (1972 & Earlier)

If clutch is out of adjustment, adjust as described in "Adjusting Clutch."

On 1972 and earlier models, install foot shifter lever so that arm is just below circuit breaker cover. Position bolt in shifter lever and secure arm with nut.

GENERAL

When the flywheel assembly or transmission gear box are in need of repair, the engine must be removed from the chassis as described in "Removing Engine from Chassis", Section 3A. It is recommended procedure to perform an entire engine overhaul at this time.

NOTE: For 1972 and earlier models:

Before disassembling models with adjustable crankshaft endplay, it should be checked using a dial indicator and tools as shown in Figure 3E-75. Install dial indicator on left crankcase. Install tool Part No. 97295-61PA on the right side crankcase as shown and push crankshaft to left side extreme. Remove tool and install tool Part No. 97297-61PA on right side and pull shaft back to right side extreme. Specified endplay is obtained with spacer washers per item 11 below.

DISASSEMBLING CRANKCASE

To completely disassemble crankcase follow subsequent steps:

1. Remove manual starter clutch assembly as described in "Disassembling Starter," Section 4C.

2. On 1972 and earlier models, remove generator as described in Section 5E.

3. On 1973 and later models, remove alternator, Section 5E.

4. Remove sprocket cover and sprocket as described in "Removing Drive Sprocket," Section 4D.

5. On 1973 and later models, remove electric starter, Section 5L.

6. Remove cylinder head as described in "Removing Cylinder Head," Section 3B.

7. Remove cylinder and piston as described in "Removing Cylinder and Piston," Section 3C.

8. Remove right cover as described in "Removing Right Side Cover," Section 3D.

9. Remove cam shaft and tappets as described in "Removing Camshaft and Tappets," Section 3D.

10. Remove oil pump as described in "Removing Oil Pump," Section 3D. (Optional)

11. Remove pinion shaft gears as described in "Removing Pinion Shaft Gears," Section 3D.

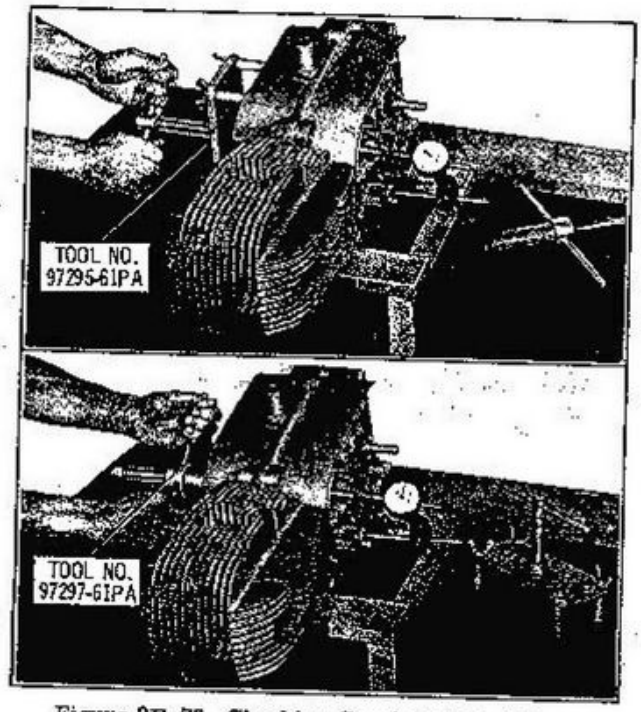


Figure 3E-75. Checking Crankshaft End Play (1972 & Earlier)

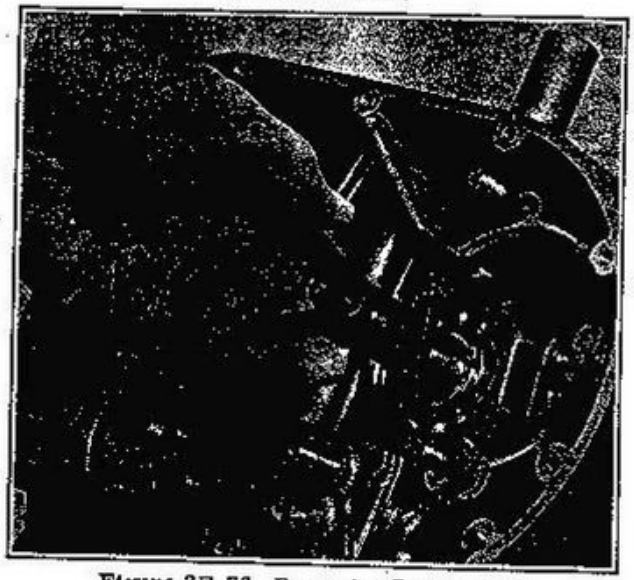


Figure 3E-76. Removing Pinion Shaft Bearing Lock Ring

NOTE

On 1972 and earlier engine assembly, a variable number of .05 mm and .10 mm spacer washers are used to control crankshaft end play. (See Engine Specifications,

Section 3A.) For replacement, two spring washers are recommended (see Pinion and Drive Gears, Section 3D). 1973 and later engines use spring washers in original assembly.

Remove lock ring with lock ring pliers as shown in Figure 3E-76. Remove spacer washers between lock ring and bearing (if used).

12. 1968 and earlier only: Remove clutch as described in "Removing Clutch," Section 4B.

13. Remove shifter pawl carrier from gear case as described in "Removing Shifter Pawl Carrier," Section 3D.

14. Remove oil scavenger and feed filter screens as described in "Lubrication," Section 3A. (Optional)

15. Tap dowel pins out of right crankcase (use heat on case if necessary), then remove three Allen screws and seven bolts and washers which hold crankcase halves together. One Allen screw is located in left case underneath breather as shown in Figure 3E-77.

16. Separate crankcases by attaching tool Part No. 97295-61PA to right side of crankcase over flywheel pinion shaft. Tap on left side of transmission mainshaft while working tool as shown in Figure 3E-78.

This will simultaneously separate crankcases and remove flywheel assembly from right side of case.

NOTE

Care should be taken not to cock cases upon separation. Figure 3E-79 shows crankcases separated.

Remove the following from right side of crankcase:

17. Remove transmission as described in "Removing Transmission," Section 4D.

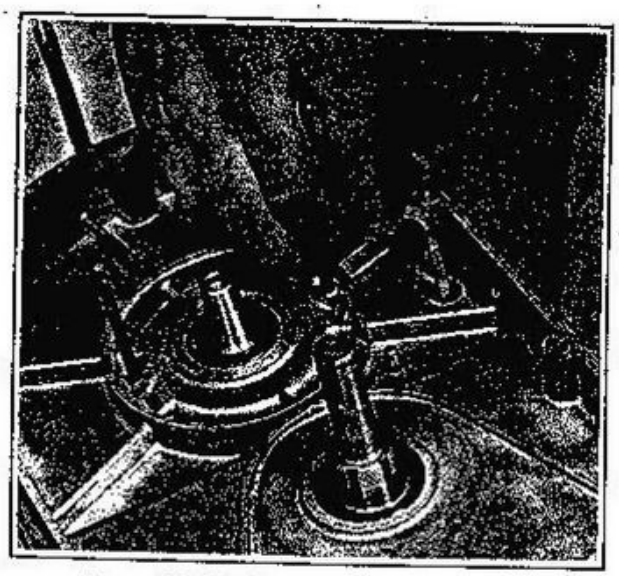


Figure 3E-77. Removing Recessed Allen Screw from Left Crankcase

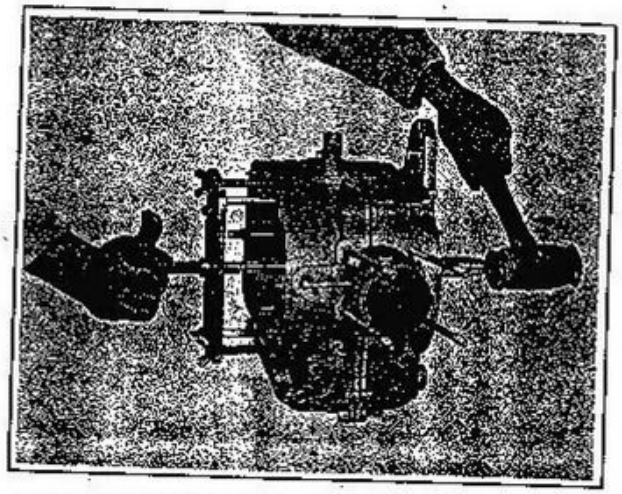


Figure 3E-78. Separating Crankcase (1973 Model)

18. Remove pinion shaft bearing lock ring (10, Figure 3E-80) and press ball bearing (11, Figure 3E-80) from right crankcase.

19. Use Tool Part No. 97295-61PA to press flywheel assembly from left case, as shown in Figure 3E-81.

20. Remove countershaft ball bearing (blind) with puller tool, if necessary.

21. To remove generator shaft ball bearing (9) remove seal (8) and press out ball bearing from outside of case.

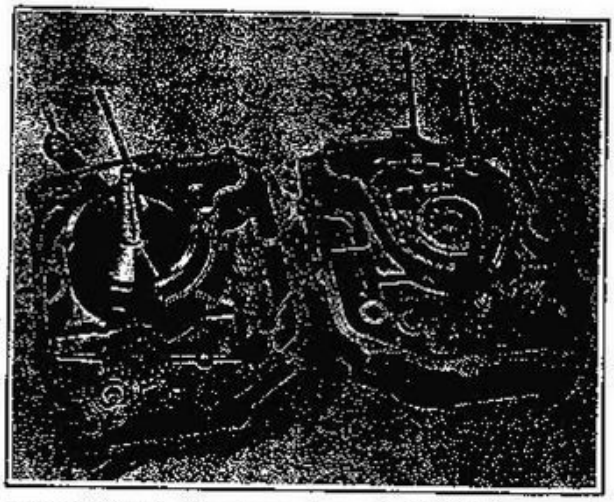


Figure 3E-79. Crankcase Separated (1972 & Earlier)

DISASSEMBLING FLYWHEELS (See Figure 3E-80)

NOTE

1) An arbor press of approximately 15 ton capacity is needed to assemble and disassemble crankpin in flywheels.

NOTE

Place Part No. 45752-52 or its equivalent (a spacer) between flywheel and press plate to allow for projecting portion of crank pin when pressing crank pin into flywheel.

Apply oil to both the bore and the crank pin (5) or (5A) surface. Install washer (2) (if used), placing chamfer of washer towards shoulder on crank pin. Align oil holes as shown in Figure 3E-83. Press crank pin in place. Blow through oil hole in shaft to check oil passage alignment. Apply oil to crank pin and flywheel bore. Install roller bearing assembly (4) or (4A or 4B), and connecting rod (3) on crank pin.

Install washer (2) (if used), with chamfer toward shoulder on crank pin. Position and align left flywheel with the right one with a straight edge as shown in Figure 3E-84. Press left flywheel onto crank pin. By pressing lightly, then rotating assembly and pressing again, etc., cocking of flywheel on crank pin can be avoided. Press flywheel tightly against crank pin shoulder.

TRUING FLYWHEELS

Support flywheel assembly on V-blocks at bearing surfaces or between centers on Flywheel Truing Device Part No. 96650-30. Note: Remove crankshaft orifice plug (12) if flywheels are to be trued on centers - twist out with pliers. Adjust indicators to take reading on shafts as near to flywheel as possible. Turn flywheels slowly and observe the movement of indicator pointers. Movement toward flywheels indicates high point of shafts. Shafts must run true within .001 in. This is one-half graduation on truing device. If flywheels are not true within this limit, find highest point of each shaft and chalkmark flywheel rims at those points. Remove flywheel from truing device or V-blocks and make corrections as follows:

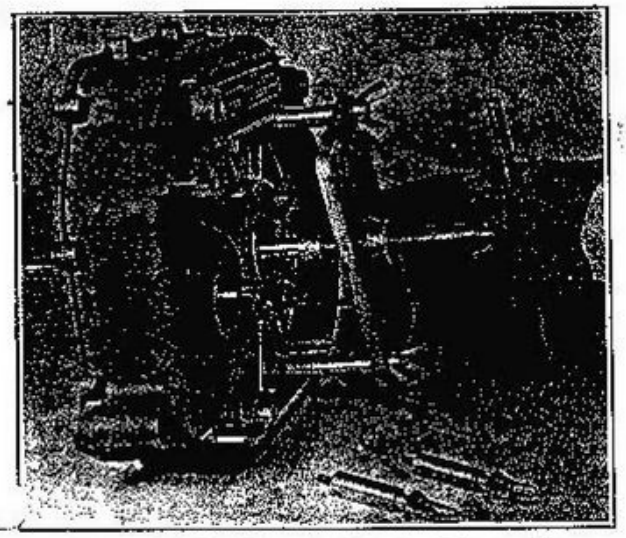


Figure 3E-81. Pressing Flywheel Assembly from Left Crankcase

NOTE

Hold assembly with hand on wooden bench and strike flywheel at proper place with lead or copper hammer to improve alignment.

Flywheels may be out of true three ways: A, B, and C or a combination of two of the three ways as shown in Figure 3E-85. When wheels are both out of true as indicated in "A" a C-clamp is tightened on rims of wheel opposite crank pin and the rim at the crank pin is moderately tapped with lead or copper mallet.

When wheels are both out of true as indicated in "B", a hardwood wedge is driven between the wheels opposite the crank pin and the rims near the crank pin moderately tapped with a mallet.

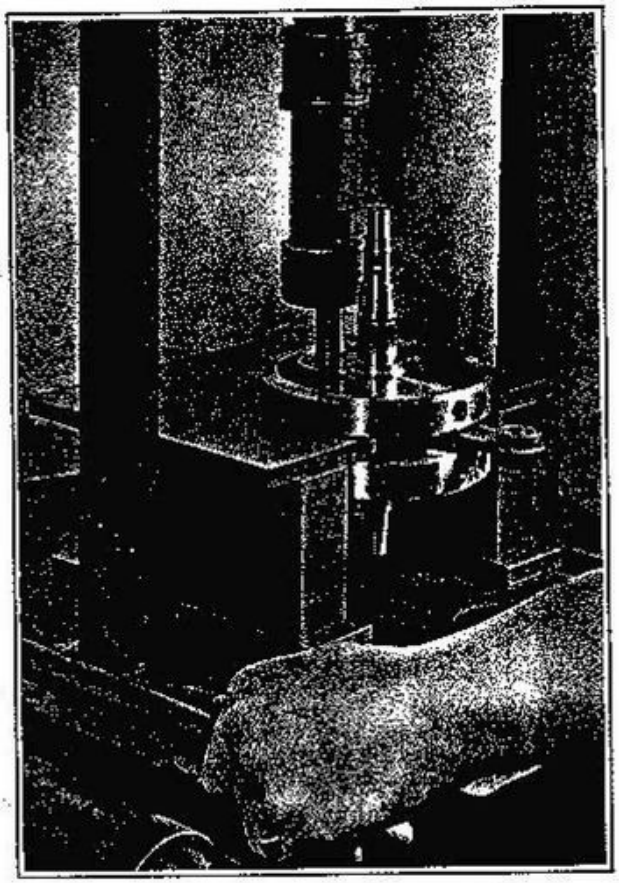
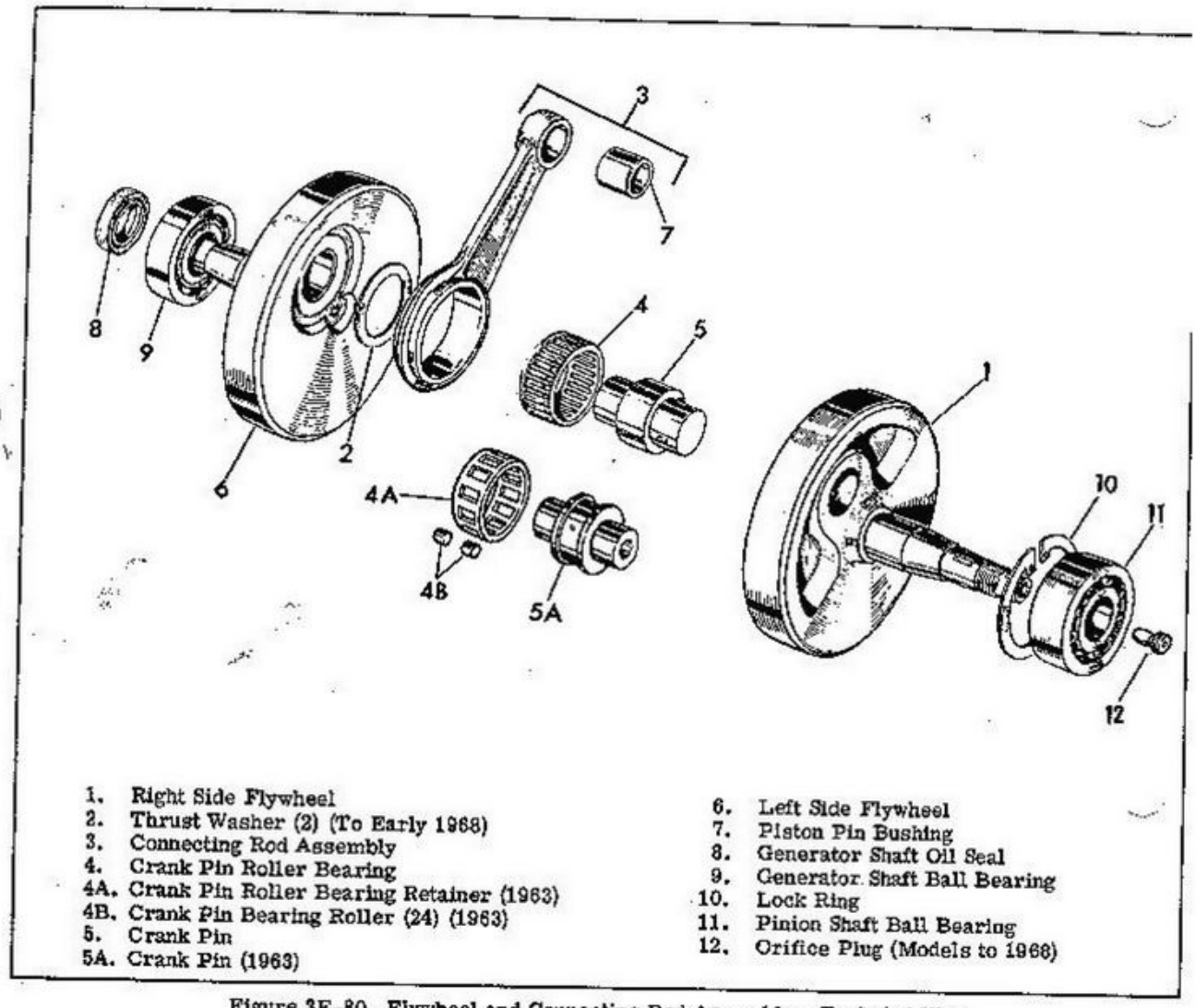


Figure 3E-82. Pressing Crankpin from Right Flywheel

When wheels are out of true as indicated in "C", strike the rim of the wheel a firm blow at about 90 degrees from crankpin on high side.

When wheels are out of true in a combination of conditions shown, correct A or B first, tapping rim of offending wheel only, and then correct condition C.

Remember, flywheel assembly must be removed from truing device or V-block when striking with mallet.



1. Right Side Flywheel
2. Thrust Washer (2) (To Early 1968)
3. Connecting Rod Assembly
4. Crank Pin Roller Bearing
4A. Crank Pin Roller Bearing Retainer (1963)
4B. Crank Pin Bearing Roller (24) (1963)
5. Crank Pin
5A. Crank Pin (1963)
6. Left Side Flywheel
7. Piston Pin Bushing
8. Generator Shaft Oil Seal
9. Generator Shaft Ball Bearing
10. Lock Ring
11. Pinion Shaft Ball Bearing
12. Orifice Plug (Models to 1968)

Figure 3E-80. Flywheel and Connecting Rod Assembly - Exploded View

2) Flywheel support plate Part No. 96137-52 machined from 1/2 in. thickness to 7/16 in. thickness, or 96137-52A already 7/16 in. thick must be used to fit between flywheels when pressing out crankpin.

Support inner surface of gear side (right) flywheel (1) on support plate (support plate between flywheels) in arbor press; using circular drift, press crank pin (5 or 5A) out of flywheel (1), as shown in Figure 3E-82.

Washer (2) is loose on 1961 and 1962 models. On later models it is pressed into flywheel and removed for replacement with a punch through two holes in flywheel. Remove connecting rod (3) and bearing (4) or bearings and retainer (4A and 4B) from crank pin (5 or 5A). Support inner surface of left flywheel (6) on support plate and press out crank pin from left flywheel.

CLEANING AND INSPECTION

Wash all parts in cleaning solvent and blow out oil holes in right flywheel and crank pin with compressed air.

NOTE

Whenever the crank pin, connecting rod or crank pin roller bearing show excessive wear and require replacement, the practice is to replace all of these parts including the thrust washers with a complete new set of parts, since no oversize bearings are available.

If main bearings have excessive play, replace them by pressing out after removing seal and lock rings. Also inspect pinion shaft bushing in cover or camshaft support plate for wear.

ASSEMBLING FLYWHEELS

Place outside surface of right side flywheel (1) on press plate.

Re-adjust centers, revolve wheels and take reading from indicator. Repeat truing operation until indicators show run-out to be no more than .001 in.

ASSEMBLING CRANKCASE

1. Press bearings, bushings, and oil seals into crankcase (if removed). Install lockring on pinion shaft ball bearing (if removed).

2. Clamp left flywheel shaft (armature side) of flywheel assembly securely in vise (use copper jaws).

Apply a small amount of oil to pinion shaft. With pinion shaft main bearing installed in right side crankcase, set crankcase on flywheel pinion shaft. Screw flywheel assembly installing tool Part No. 97297-61PA on pinion shaft and draw flywheel assembly into position with tool as shown in Figure 3E-86.

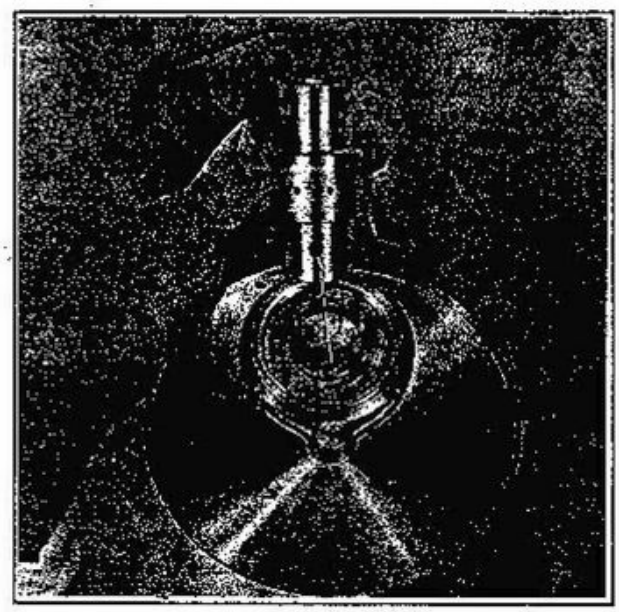


Figure 3E-83. Aligning Crankpin and Flywheel Oil Holes When Assembling

Install pinion gear shaft bearing lock ring in groove with lock ring pliers.

3. Install transmission as described in "Assembling Transmission", Section 4D.

4. Install left crankcase as follows: Place Oil Seal Installing Sleeve, Part No. 95629-63, on flywheel shaft taper, to prevent damage to oil seal lip during assembly. Place new crankcase gasket on right side case and new gasket on engine mounting stud boss. Slip left case down onto right case. Rotate main drive gear to be certain transmission gears mesh correctly. Use tool Part No. 97295-61PA to draw cases together as shown in Figure 3E-87. Tap crankcase around shifter cam bushing while carefully drawing cases together with tool. Make sure cases

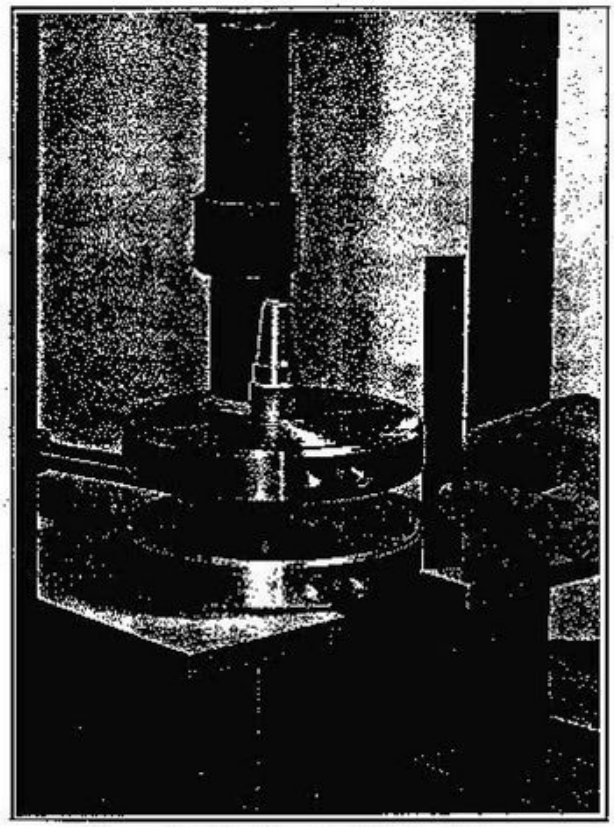


Figure 3E-84. Squaring Flywheel Faces

are drawn together evenly. After cases have butted, tap dowel pins back into right crankcase. Secure crankcases by installing 7 crankcase bolts, plain washers, nuts and 3 Allen screws.

NOTE: Take care not to bend generator frame stud when assembling right side of engine.

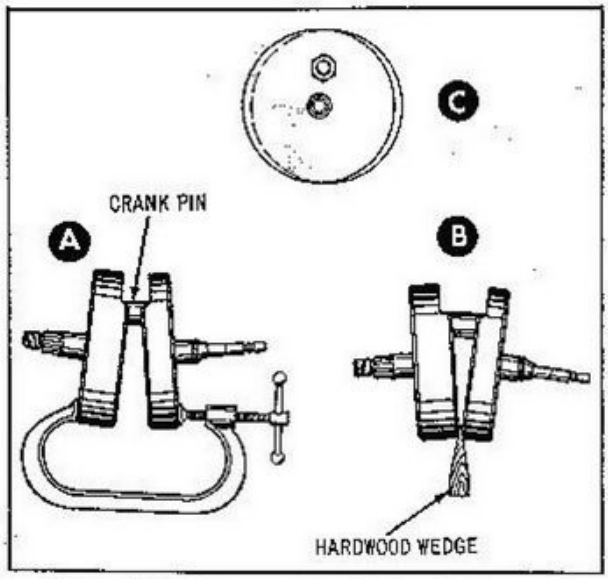


Figure 3E-85. Correcting Flywheel Alignment

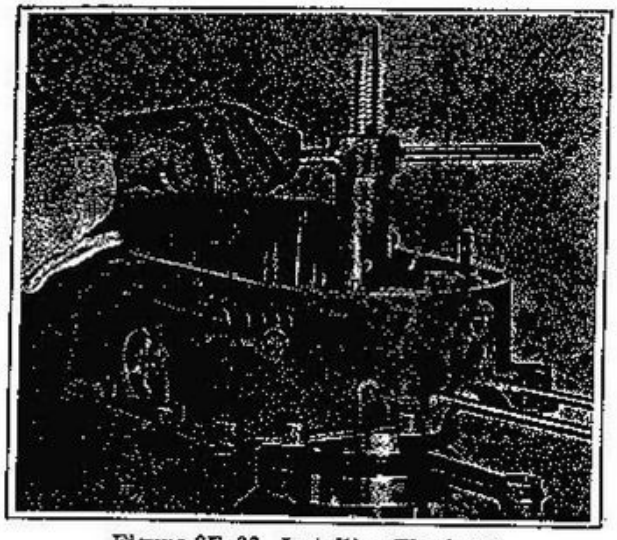


Figure 3E-86. Installing Flywheel Assembly in Right Crankcase

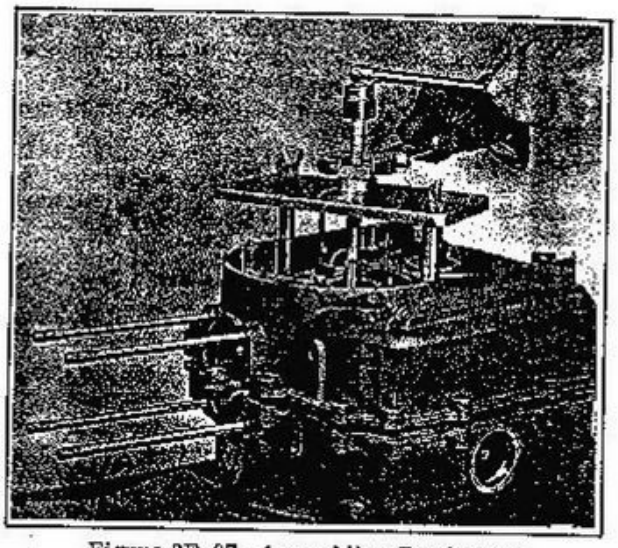


Figure 3E-87. Assembling Crankcases

5. Install oil scavenger and feed filter screens as described in "Lubrication", Section 3A.

6. Install gear shifter pawl carrier as described in "Installing Shifter Pawl Carrier", Section 3D.

7. Assemble gears on pinion shaft as described in "Installing pinion Shaft Gears", Section 3D.

8. Install clutch as described in "Installing Clutch", Section 4B.

9. Install oil pump, tappets and camshaft as described in Section 3D.

10. Install a new crankshaft orfice plug (12) as required in all sprint H and 1963 Model C engines. Plug should be press fit. Tap in place with wood block. Check to see that hole is open and of correct size with a No. 53 (.0595 in.) drill or wire. This is important, since crankpin bearing oil must pass through this orfice.

11. Install right cover as described in "Installing Right Side Cover", Section 3D.

12. Install cylinder and piston as described in "Installing Cylinder and Piston", Section 3C.

13. Install cylinder head as described in "Assembling Cylinder Head", Section 3B.

14. On 1973 and later models install electric starter, Section 5L.

15. Install drive sprocket and cover as described in "Assembling Drive Sprocket," Section 4D.

16. On 1973 and later models, install alternator, Section 5E.

17. Install generator as described in "Installing Generator," Section 5E.

18. Install starter clutch assembly as described in "Assembling Starter," Section 4C.

19. Install engine in chassis as described in "Installing Engine in Chassis," Section 3A.

FUEL SYSTEM

CARBURETOR

DESCRIPTION (Figures 3F-28 and 3F-28A)

The Sprint model carburetor is a plain tube carburetor. Fuel enters carburetor at inlet connection, flows through filter screen and past float valve seat into bowl until proper level is reached.

With engine running, manifold vacuum (suction) and bowl pressure induces fuel to flow through main fuel supply channel, fixed low speed jet, idle passage and into carburetor venturi. The 1969 and later models have a separate starting jet and low speed passage.

When the throttle grip is turned inward, the control wire raises the throttle piston and metering pin to allow more gas and air to enter the venturi, the gas entering the venturi through high speed jet and main nozzle.

If the throttle piston raises fast, the sudden pressure drop causes air to flow through the acceleration passage and into a pocket around the main nozzle which contains fuel. Since there are holes in the sides of the main nozzle, this fuel in the pocket is forced through the nozzle into the venturi chamber. This temporarily provides extra gas to the engine. As soon as the pressure returns to normal equilibrium the fuel pocket refills.

On 1968 and earlier models (Figure 3F-29), pressi float pin (5) down allows an extra quantity of gasoli to enter the carburetor when starting a cold engi in cold weather. The choke (4) shuts off the air

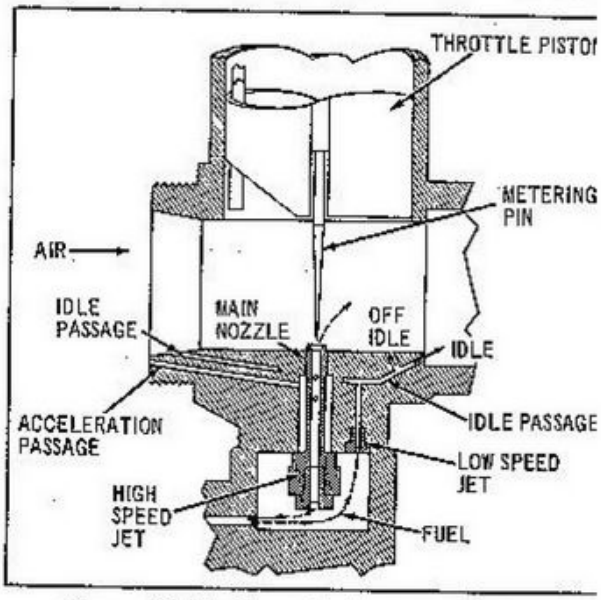


Figure 3F-28. Cross Section of Carburetor (1968 & Earlier)

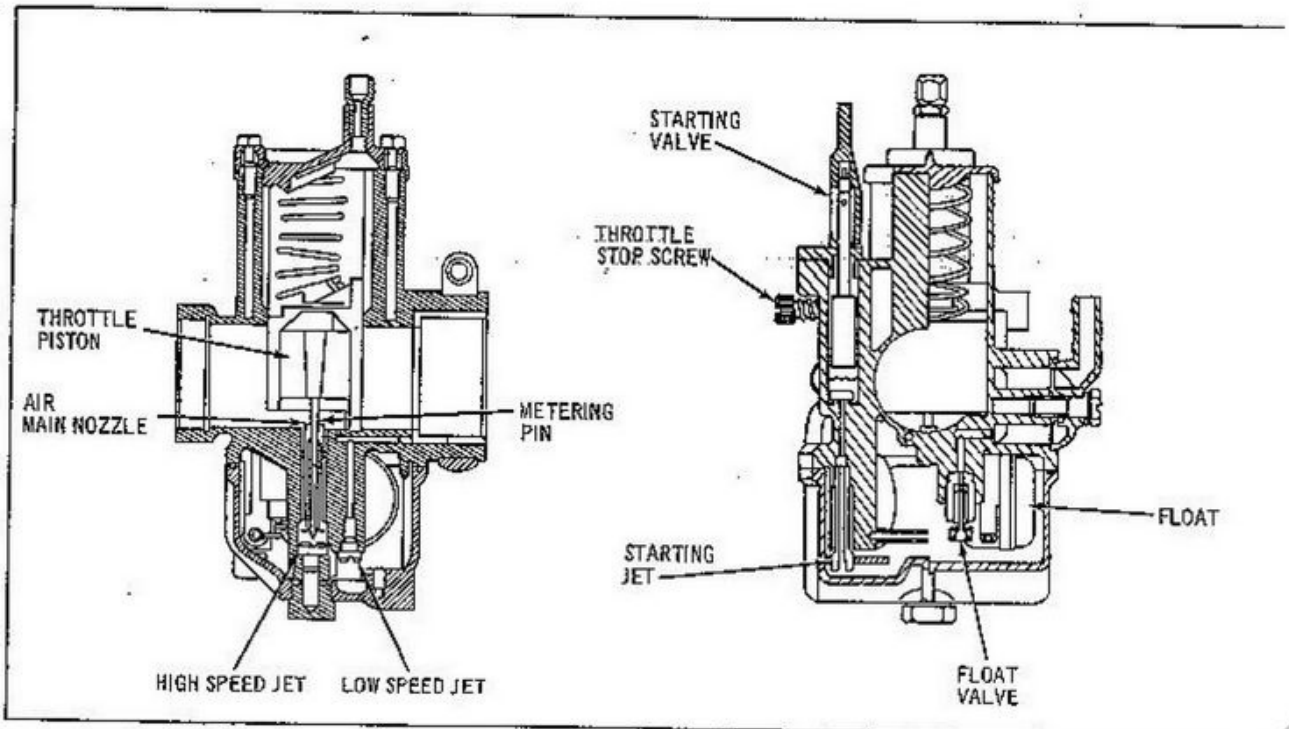


Figure 3F-28A. Cross Section of Carburetor (1969 & Later)

enrichen the mixture for running the engine during the warmup period. On 1969 and later models (Figure 3F-29A), starting lever (4A) allows a richer starting mixture to flow around main venturi through passage (5A) for cold starting.

ADJUSTING CARBURETOR (See Figures 3F-29 and 3F-29A)

Before attempting to correct faulty engine performance through carburetor adjustment, eliminate other possible causes for poor engine performance such as bad spark plug, improper spark timing, misadjusted tappets, dirty air filter or leaky carburetor and manifold connection.

Carburetor may be adjusted as follows:

A - Idling Speed Adjustment

Idling speed adjustment is made by means of the throttle piston stop screw (2) which limits closing of throttle piston. To raise idling speed, loosen lock nut and turn screw (2) clockwise. To lower idling speed, turn screw (2) counterclockwise. When idle speed adjustment is made, readjust control coil adjusting screw (3) so there is no excessive tension of slack in throttle wire. Optimum idle speed is 1200 R.P.M.

B - Idle Mixture Adjustment

Low speed mixture adjustment is made with low speed mixture adjusting screw (1).

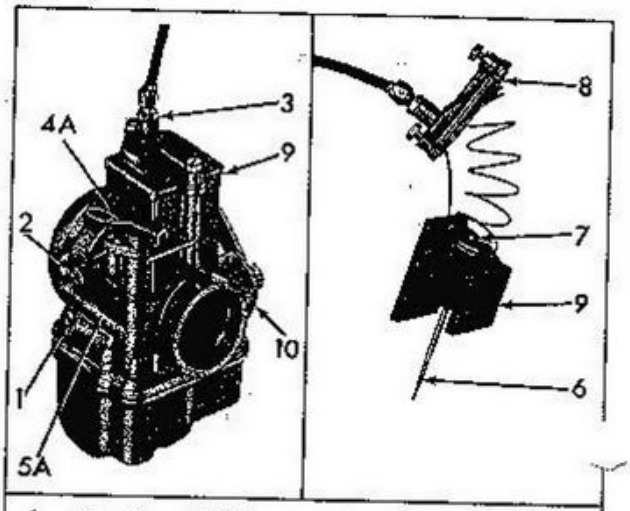
If the slow running of the engine is irregular, indicating a rich mixture, mixture is leaned by turning screw (1) counterclockwise (clockwise on 1969 and later models) until engine runs smoothly. Normal idle mixture screw setting is 3/4 turn open for 1968 and earlier models and 1-3/4 turns open on 1969 and later models.

1. Low Speed Mixture Adjusting Screw
2. Throttle Piston Stop Screw
3. Control Coil Adjusting Screw
4. Choke
5. Float Pin

Figure 3F-29. Carburetor Adjustment (1968 & Earlier)

C - High Speed Mixture Adjustment (See Figure 3F-29A)

The mixture of gasoline and air entering the engi is controlled by the position of the metering pin (6) in throttle piston (9). Mixture variations are provided by means of 3 grooves in the metering pin (6) into which clip (7) fits. Relocating the clip to the lower groove in the metering pin will provide a richer mixture, into the upper groove to provide a leaner mixture. Normal setting is in the center groove. A selection of different size high speed jets are available to provide further mixture variations for high altitude, etc.



1. Low Speed Mixture Adjustment
2. Throttle Piston Stop Screw
3. Control Coil Adjustment
4A. Starting Jet Lever
5A. Starting passage
6. Metering Pin
7. Clip
8. Throttle Chamber Cap
9. Throttle Piston
10. Carburetor Filter Screen

Figure 3F-29A. Carburetor Adjustment (1969 & Later)

DISASSEMBLING CARBURETOR (See Figure 3F-30 or Figure 3F-30A)

Disconnect carburetor from motorcycle as follows:

On 1967 and later models remove gas tank.

Remove air filter from carburetor or disconnect hose (10) from carburetor.

Shut off fuel supply and disconnect fuel line at carburetor connection. Push choke down and turn throttle handgrip inward.

Pull back rubber boot (1) if used, and unscrew piston cap nut or cap fastening screws (2). Pull throttl assembly from carburetor.

Loosen intake pipe clamp screw (12) and remove carburetor with a twisting motion.

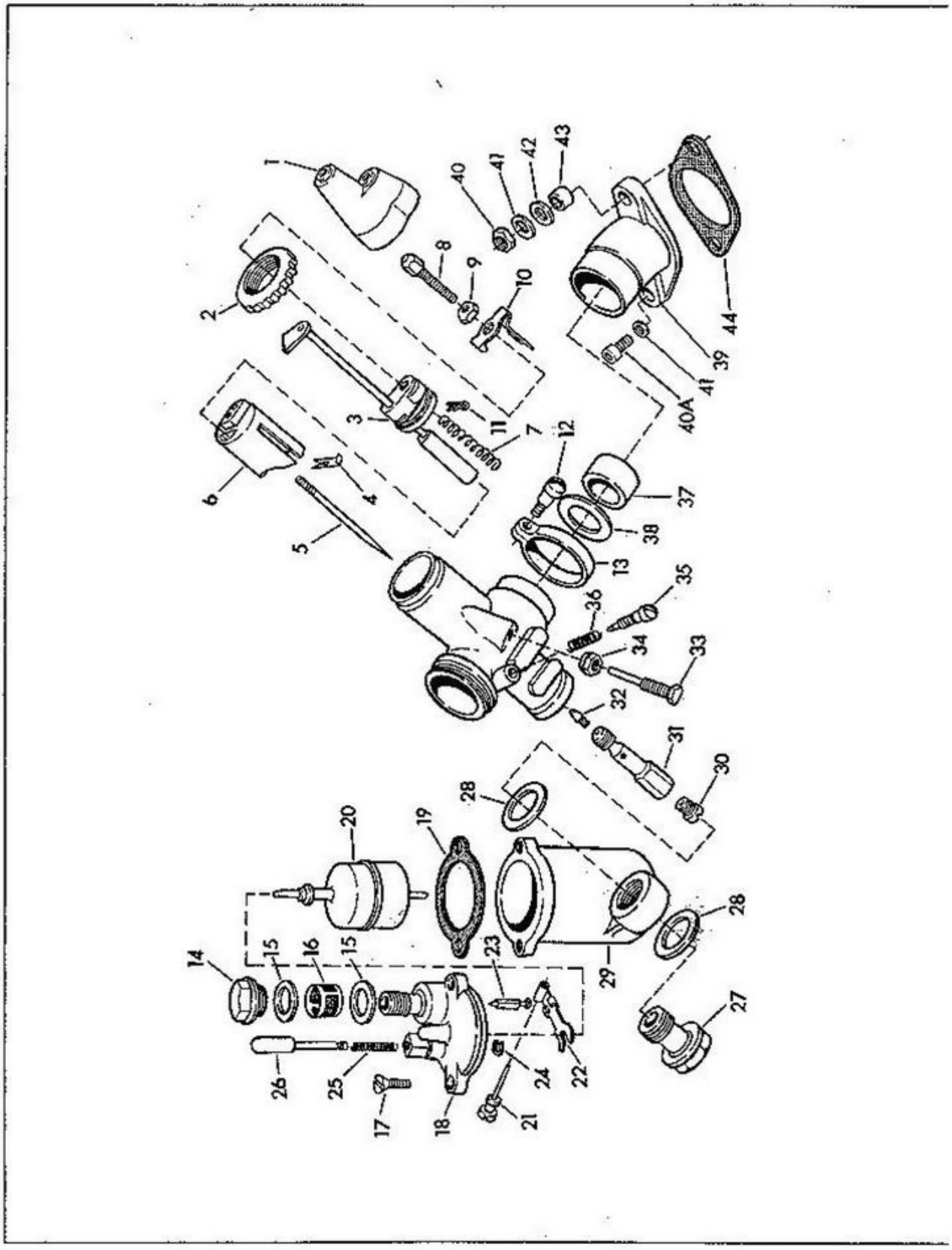


Figure 3F-30. Carburetor, 1968 & Earlier Models - Exploded View

Key for Figure 3F-30

1. Boot
2. Piston Cap Nut
3. Piston Cap and Choke Assembly
4. Metering Pin Retainer Clip
5. Metering Pin
6. Throttle Piston
7. Throttle Piston Spring
8. Control Coil Adjusting Screw
9. Control Coil Adjusting Nut
10. Friction Spring
11. Choke Rod Hairpin Spring
12. Intake Pipe Clamp Screw
13. Intake Pipe Clamp
14. Gas Strainer Cap
15. Gas Strainer Gasket (2)
16. Gas Strainer
17. Bowl Cover Screw (2)
18. Bowl Cover
19. Bowl Gasket
20. Float
21. Float Lever Pivot Screw
22. Float Lever
23. Float Valve
24. Float Pin Lock Ring
25. Float Pin Spring
26. Float Pin
27. Bowl Connection Cap
28. Fiber Washers (2)
29. Bowl
30. High Speed Jet
31. Main Nozzle
32. Low Speed Jet
33. Throttle Piston Stop Screw
34. Throttle Piston Stop Screw Nut
35. Low Speed Needle Valve
36. Low Speed Needle Valve Spring
37. Insulating Bushing
38. Insulating Washer
39. Manifold
40. Nut (2) 1966 and Earlier
40A. Screw (2) 1967 to 1968
41. Washer (2)
42. Insulator Washer (2)
43. Insulator Bushing (2)
44. Manifold Gasket

DISASSEMBLING THROTTLE PARTS FROM CONTROL WIRE

Turn throttle handgrip outward and separate assembly as follows. Compress throttle piston spring (7) with fingers and remove control wire from throttle piston (6). Remove metering pin retainer clip (4) and free metering pin (5) from throttle piston. Remove throttle piston spring (7) from piston cap (3).

Control coil adjusting screw (8) and nut (9), friction spring (10) and choke rod hairpin spring (11) can also be removed if necessary.

DISASSEMBLING BOWL

1968 & Earlier (Figure 3F-30)

To disassemble bowl remove gas strainer cap (14), gas line, gas strainer gaskets (15) and gas strainer (16). Remove bowl cover screws (17) and separate bowl cover (18) from bowl (29). Remove bowl cover gasket (19) from bowl cover (18). Remove float (20). Remove float lever pivot screw (21), float lever (22) and float valve (23) from bowl cover. To remove float pin (26) and spring (25), first remove lock ring (24) from inside of bowl cover.

Remove bowl connection cap (27) and free bowl (29) from carburetor body; remove fiber washers (28) from connection cap.

1969 & Later (Figure 3F-30A)

To disassemble bowl from carburetor, remove bowl nut (14) with high speed jet (15) and gasket (16). Remove bowl (17) and O-ring gasket (18).

DISASSEMBLING CARBURETOR BODY

1968 & Earlier (Figure 3F-30)

To disassemble main body, unscrew high speed jet (30) from main nozzle (31) and low speed jet (32) from inside of carburetor body. Remove throttle piston stop screw (33) and nut (34), and low speed needle valve (35) and spring (36) from carburetor body. Remove insulating bushing (37) and washer (38).

JETS

Year	Jet Size	Drill Size
61 to 67 (All Models) Early 61 "C", 62 "H"	H.S. Jet. 1.08 MM L.S. Jet. .50 MM	No. 58 (.042 in.) No. 77 (.019 in.)
Late 61 "C" (Above 61C-1631) and 62 "C" 62 to 66 "C" and "H" 67 "H" and "SS"	H.S. Jet. .95 MM H.S. Jet. 1.00 MM H.S. Jet. 1.05 MM	No. 63 (.037 in.) No. 61 (.039 in.) No. 59 (.041 in.)
69 to Early 1971 "SS"	H.S. Jet. 1.18 MM L.S. Jet. .55 MM Start Jet. .60 MM	No. 56 (.046 in.) No. 74 (.023 in.) No. 74 (.023 in.)
Late 71 "SS" (Above 6A-10866H1) to 1972 1971-72 "SX"	H.S. Jet. 1.18 MM L.S. Jet. .45 MM Start Jet. .60 MM	No. 56 (.046 in.) No. 77 (.018 in.) No. 74 (.023 in.)
1973 and Later "SS/SX"	H.S. Jet. 1.25 MM L.S. Jet. .45 MM Start Jet. .70 MM	No. 55 (.049 in.) No. 77 (.018 in.) No. 70 (.028 in.)

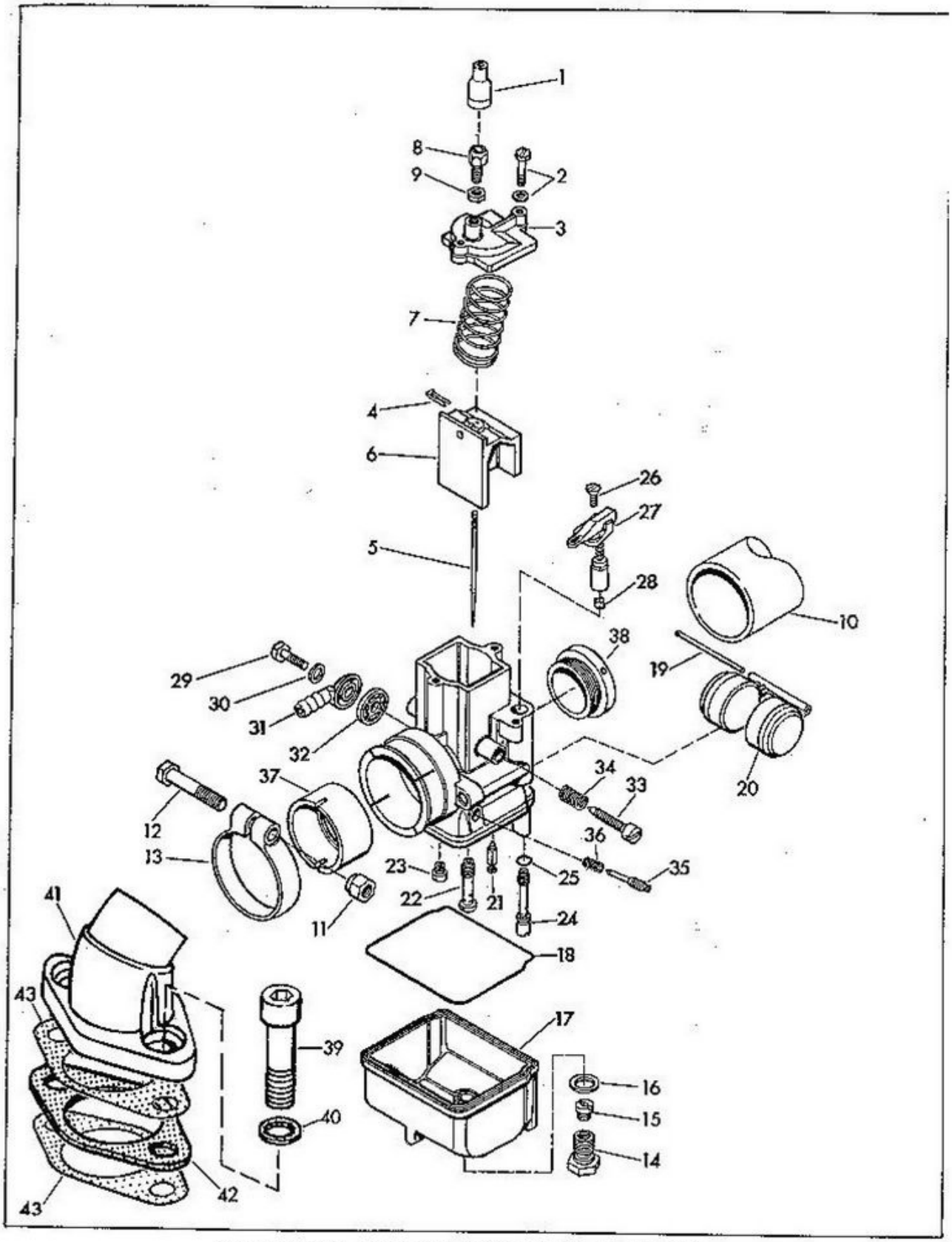


Figure 3F-30A. Carburetor, 1969 Model SS - Exploded View

Revised: 10-71

Key for Figure 3F-30A

1. Boot
2. Piston Cap Screw and Washer (2)
3. Piston Cap
4. Metering Pin Retainer Clip
5. Metering Pin
6. Throttle Piston
7. Throttle Piston Spring
8. Control Coil Adjusting Screw
9. Control Coil Adjusting Nut
10. Air Cleaner Hose
11. Intake Pipe Clamp Screw Nut
12. Intake Pipe Clamp Screw
13. Intake Pipe Clamp
14. Bowl Nut
15. High Speed Jet
16. Gasket
17. Bowl
18. O-ring Gasket
19. Float Lever Pivot Pin
20. Float
21. Float Valve
22. Main Nozzle
23. Low Speed Jet
24. Starting Jet
25. O-ring
26. Screw
27. Starting Valve and Lever Assembly
28. Rubber Plug
29. Screw
30. Washer
31. Inlet Fitting
32. Inlet screen
33. Throttle Piston Stop Screw
34. Throttle Piston Stop Screw Spring
35. Low Speed Needle Valve
36. Low Speed Needle Valve Spring
37. Insulating Bushing
38. Intake Hose Adapter
39. Manifold Screw (2)
40. Washer (2)
41. Manifold
42. Spacer
43. Manifold Gasket

1969 & Later (Figure 3F-30A)

To disassemble main body, remove float lever pivot pin (19), float (20) and float valve (21). Unscrew main nozzle (22), low speed jet (23) and starting jet (24) with O-ring (25). Remove starting valve and lever assembly screw (26) and assembly (27). Remove inlet fitting screw (29), washer (30), fitting (31) and screen (32).

Remove throttle piston stop screw (33) and spring (34). Remove low speed needle valve (35) and spring (36).

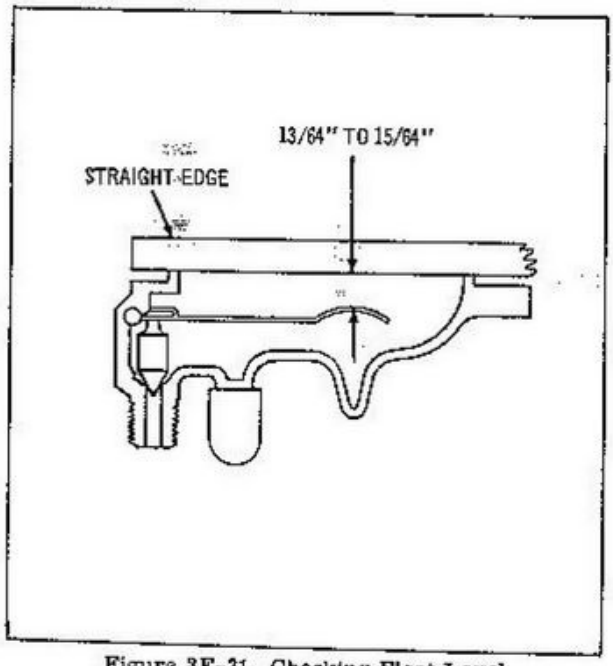


Figure 3F-31. Checking Float Level (1968 & Earlier)

CLEANING, INSPECTION AND REPAIR (See Figure 3F-30 or Figure 3F-30A)

Soak all parts except gaskets and float in Gunk Hydro-Seal. Wash and then dry parts with compressed air. Blow air through all passages. Never scrape carbon deposits from carburetor parts with knife or other steel instruments. Replace all gaskets that are badly worn or damaged.

Examine throttle piston spring (7), piston (6), metering pin retainer (4) and pin (5) for any visible damage.

Assemble float valve (21 or 23) in its seat. Hold cover upside down so float valve closes. Suck on bottom of float valve seat; if valve leaks, replace valve. Examine float (20) for leakage and replace if necessary.

Clean and examine fuel strainer (16 or 32) for holes and replace if necessary.

Inspect nozzle (31 or 22), high speed jet (15 or 30), low speed jet (23 or 32) or starting jet (24) for dirt. Be extremely careful not to increase the original hole size when cleaning jets with drills.

CHECKING FLOAT LEVEL

1968 and Earlier:

To check float level turn bowl cover upside down and lay a straight edge across the face of the cover. The distance measured between the straight edge and the highest point on the float valve lever should be as shown. See Figure 3F-31. If the distance measured is not correct, bend the float valve lever carefully until it is correctly positioned.

1969 and Later:

Float setting is measured from top of both floats to gasket surface with inlet valve seated, and should

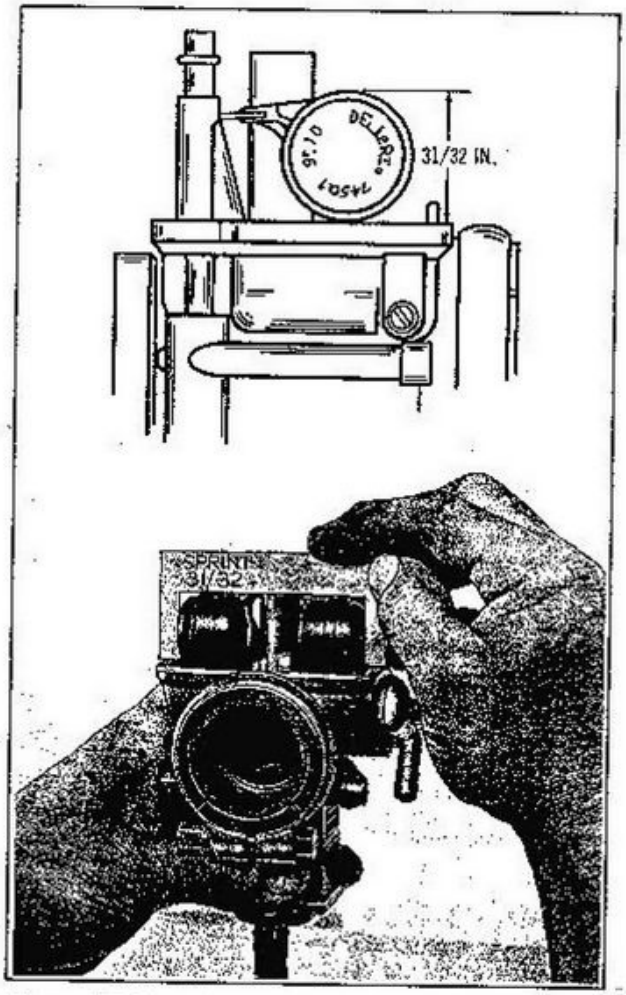


Figure 3F-31A. Checking Float Level (1969 & Later)

Figure 3F-31B. Adjusting Float

measure 31/32 (.969) inch for both floats, as shown in Figure 3F-31A. A special gauge, part No. 94751-69, is used to check this dimension.

If float is too high, place float on the flat surface and bend ear downward the required amount as shown in Figure 3F-31B.

If float is too low, reverse position of float on surface and bend ear downward.

Reinstall float and recheck float setting. Also check to see that both floats are the same height (parallel with pin support when resting on flat surface as shown in Figure 3F-31B. Bend individual float brackets as necessary to correct.

ASSEMBLING CARBURETOR (See Figure 3F-30 or Figure 3F-30A)

Assembly is the reverse order of disassembly; pay particular attention to the following instructions.

Carburetor body assembly:

On 1968 and earlier model, install low speed jet (32) in body before installing main nozzle (31) and high speed jet (30).

Assembling bowl (1968 and earlier):

Place float valve (23) in bowl cover (18) and engage float lever (22) in neck of float valve. Insert pivot screw (21) into bowl cover and through pivot hole in end of float lever. Check float level as described in "Checking Float Level." After assembling pivot screw (21) and float pin lock ring (24), place float (20) into float lever and position assembly in bowl taking care that float shaft registers in hole in bottom of bowl (29) and that float priming pin is to the outside of carburetor.

Assembling throttle parts to control wire (1968 and earlier):

Install choke rod hairpin spring (11), friction spring (10), control coil adjusting nut (9) and screw (8), and piston cap nut (2) on piston cap and choke assembly (3). Install metering pin (5) in throttle piston (6) and insert pin retainer clip (4) in desired groove of metering pin. (Normally middle groove is used.)

Insert control cable through boot (1), adjusting screw (8) and install throttle piston spring (7) on cable.

Push choke slide down, install throttle piston assembly on choke slide, compress spring (7) with finger and insert control cable in throttle piston.

Assembling throttle parts to control wire (1969 and later):

Install metering pin (5) in throttle piston (6) and insert pin retainer clip (4) in desired groove of metering pin (normally middle groove is used).

Insert throttle control cable through boot (1), adjusting screw (8) and install piston spring (7) between cap and piston, inserting wire end ferrule in piston slot.

Insert throttle piston in carburetor body and assemble cap.

FINAL ASSEMBLY

Install intake manifold on cylinder.

Install carburetor on intake manifold.

IMPORTANT

Adjust 1968 and earlier carburetor bowl to make sure it is in a level position, because the float is guided at the top and bottom and must not bind.

Turn throttle handgrip inward and insert throttle assembly in carburetor, with piston in correct alignment and secure cap.

Connect fuel line and air filter.

Adjust carburetor as described in "Adjusting Carburetor."

FUEL SUPPLY VALVE

The fuel supply valve is located on the left hand side under the fuel tank. Positions of the valve handle are shown in Fig. 3F-32. Valves should always be closed when motorcycle is not in use.

CLEANING FUEL SUPPLY VLAVE

The fuel strainer is located on top of the supply valve inside the fuel tank. If the supply of fuel is restricted as indicated by irregular carburetion, remove the supply valve by unscrewing from the tank and thoroughly clean the strainer.

Be sure to drain the tank before removing supply valve.

Before installing supply valve, coat threads with a fuel sealer.

NOTE

If the handle is too loose on diaphragm type fuel tank valves, it will not allow full flow of gasoline to the engine. This can result in engine slowdown because of insufficient fuel supply at high speed.

There should not be more than .010 in. clearance between the lock ring and handle when the valve is in the closed position. If there is excessive clearance, add enough .006 in. thick shims, part No. 6160 P, to provide only slight clearance when valve is closed. This will give the maximum diaphragm opening when valve is turned on. See Fig. 3F-31C. After any shimming, check to see that valve does not leak fuel from outlet with both handles closed.

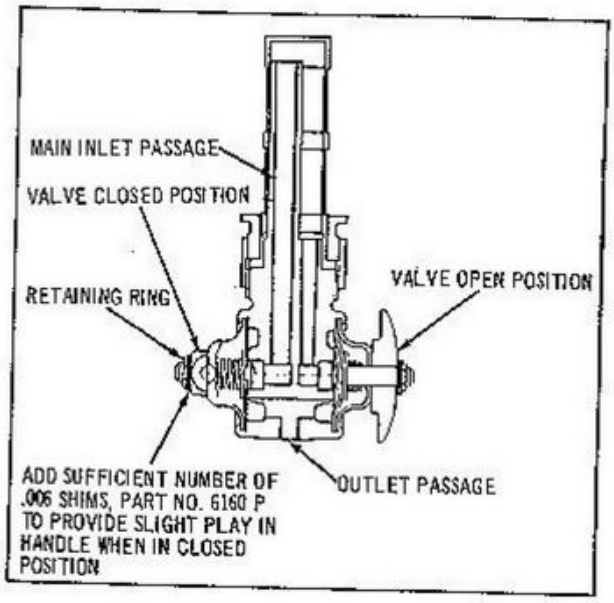


Figure 3F31C. Shimming Fuel Valve

FUEL TANK

The fuel tank is of welded steel construction with capacity of approximately four U.S. gallons. One-half gallon of this is retained in the tank for reserve supply when the fuel supply valve handle is off reserve.

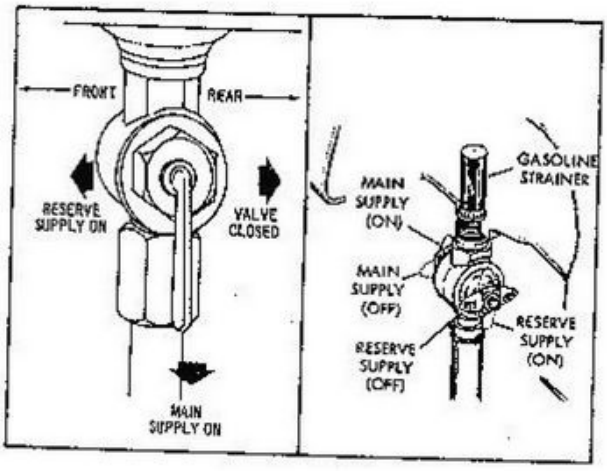


Figure 3F-32. Fuel Supply Valve

When motorcycle stands unoperated for a reasonable length of time, tank should be drained and the tank interior bathed with an oil-fuel mixture of equal

proportions. The fuel will evaporate leaving a protective oil film on tank walls. Moisture formation and subsequent damage may also be avoided by using only "good grade" anti-knock ethyl fuels with moisture absorbing additives.

REPAIRING LEAKING TANKS

Tank leaks may be arc welded, gas welded or soldered. However, only firms or persons qualified to make such repairs should be entrusted with the operation.

WARNING

If all traces of fuel are not purged, an open flame repair may result in a tank explosion. Extreme caution in all tank repair is recommended.

AIR CLEANER

Cleaner is arranged so all air drawn into carburetor passes through the filter. The filter element traps all air borne dust to keep it from entering carburetor and engine.

IMPORTANT: The air filter must be kept clean since a dirt-clogged filter will cause an excessively rich mixture, resulting in a loss of engine power, overheating and excessive fuel consumption.

DRY CORRUGATED TYPE FILTER ELEMENT: In normal service on hard surfaced roads, remove air cleaner element every 1000 miles, and shake cleaner element by tapping lightly to remove loose dirt. If surfaces of element are oily or sooted, wash in gasoline. Replace element at least every 10,000 miles. In extremely dusty service, both cleaning and replacement should be done more often.

To remove dry type filter proceed as follows:

1967 Models "H" and "SS"

Shut off fuel supply and disconnect hose by removing carburetor bowl fitting. Remove tank by unhooking spring at rear end, raise rear end of tank so ears can be disengaged at front end. Remove nuts from air cleaner cover, remove cover and air cleaner element.

1963 to 1966 Model "H"

Remove cotter pin, wing nut, washer securing cover to cleaner housing on right side of motorcycle. Remove cover and air cleaner element.

1969 and later Model "SS"

Remove bolts, lockwashers and spacers securing air cleaner support to frame bosses. Remove air cleaner assembly from intake hose. Remove nuts from air cleaner cover to free filter element from cover.

METAL MESH TYPE FILTER ELEMENT: In normal service on hard surfaced roads, remove air cleaner mesh, wash in gasoline, and saturate with engine oil at least every 1000 miles, or oftener under dusty service conditions. In extremely dusty service, clean and oil filter mesh every 100 miles or at least once a day.

To remove metal mesh (oil wetted) filter proceed as follows:

1961 to 1966 Model "C"

Remove air filter by loosening lockscrew and nut and unscrew air filter from elbow.

Remove filter lock ring, plates and mesh from body.

Wash mesh in gasoline and saturate with engine oil.

To re-assemble reverse disassembly. Be sure lockscrew and nut are tightened.

SERVICE TOOLS

94751-69 CARBURETOR FLOAT GAGE 31/32 IN.

For setting float level on 1969 and later models.

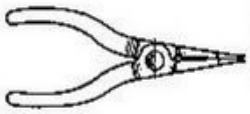
94801-64 PINION SHAFT BUSHING REAMER WITH PILOT

Used to line ream replacement crankshaft end bushing in support housing of Sprint Models.

94810-65 PISTON PIN BUSHING EXPANSION REAMER (18 MM)

Used to size replacement connecting rod bushings.

95017-61 EXTERNAL LOCK RING PLIERS

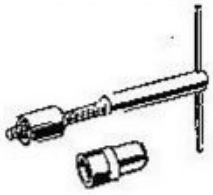


Special pliers for removing and replacing lock rings used on the Sprint Model.

95629-63 GENERATOR OIL SEAL TOOL (1969 AND EARLIER)

Used to install right crankcase with oil seal. Tapered tool leads lip of oil seal over sharp edge on crankshaft so seal will not be damaged.

95970-32A PISTON PIN BUSHING TOOL



Used to remove and replace piston pin bushings without removing connecting rod from crankcase. Fits models having rod bushings.

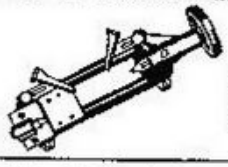
96137-52A SUPPORT PLATE

Used with arbor press for separating crankshafts.

96550-36 VALVE GRINDING TOOL

Used to rotate valve when grinding or lapping seat surfaces.

96650-30 TRUING STAND

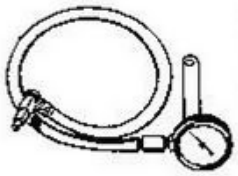


Used to true crankshaft alignment. Measures and indicates alignment to .001". For all Models.

96795-47 VALVE SPRING TESTER
96796-47 TORQUE WRENCH

Unit consists of a torque wrench and special fixture with adjustable platform which enables valve springs of various lengths to be tested. A tone device in fixture allows operator to concentrate vision on wrench dial and depend upon tone device to indicate when to read scale.

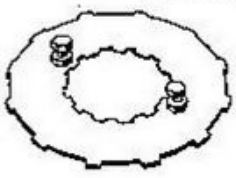
96921-52 OIL PRESSURE GAGE



Checks oil pump pressure under operating conditions. Graduated 0-60 lbs.

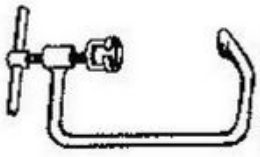
96925-58 - Adapter Nipple to attach base to 1/8 NPT pump outlet on 1958 & later pumps.

97175-61P CLUTCH LOCK TOOL (61-68 MODELS)
97177-69P CLUTCH LOCK TOOL (1969 & LATER MODELS)



Locks clutch hub and clutch shell together to keep flywheels from turning when removing and installing pinion shaft nut and clutch drive gear. Used with clutch hub wrench 97291-61A and pinion puller 97294-61B.

97290-61P VALVE SPRING COMPRESSOR



Used to compress valve spring when removing or installing valves.

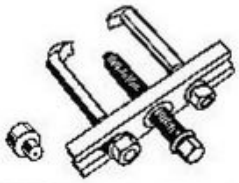
Tool is placed with stationary jaw on valve head and screw yoke on upper valve spring collar.

Revised: 3-77

97291-61PA CLUTCH HUB HOLDING TOOL

Used to hold clutch hub when removing or installing sprocket or clutch hub nut.

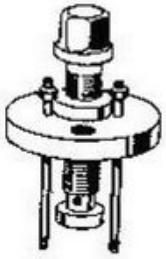
97292-61 TWO JAW PULLER



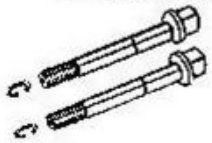
Used for a variety of applications such as pulling Sprint oil pump gear, mainshaft sprocket, bearings. Includes center cap used when pulling oil pump drive gear from shaft.

95652-43A Cap

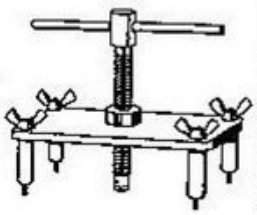
97294-61B CRANKSHAFT PINION GEAR AND CLUTCH HUB PULLER



Pulls crankshaft pinion gear and clutch hub from transmission shaft splines.



97295-61PA CRANKSHAFT TOOL

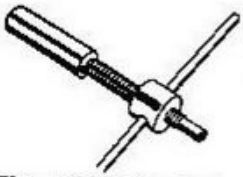


Used to press crankshaft from ball bearing. Also used to separate crankcases.

The tool is placed across the flywheel assembly so that the four corner bolts align with corresponding threads in crankcase. Turning center bolt presses shaft from ball bearing.

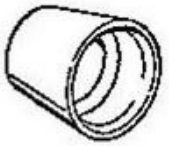
Also used for assembling crankcases see 97300-61.

97297-61PA CRANKSHAFT INSTALLING TOOL



Used for installing crankshaft assembly in gear side ball bearing.

95631-61 CAMSHAFT SEAL INSTALLING SLEEVE (1961-70)



Tapered tool leads lip of camshaft oil seal over sharp edge on crankshaft.

97300-61 CRANKCASE ASSEMBLING SCREW

Crankcase assembly screw is used in conjunction with plate from tool, Part No. 97295-61PA, to pull crankcases together. Tool is used as follows: plate mounts in crankcase screw holes. Tool screw threads into generator side of shaft.

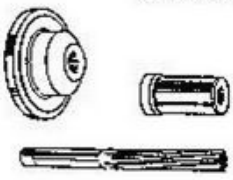
97310-61 VALVE GUIDE REAMER

This tool is used for sizing replacement valve guide to obtain correct clearance with valve stem.

97314-61 ROCKER ARM SHAFT BUSHING REAMER

This tool is used when new rocker arm shaft bushings are installed. Reamer sizes bushings for correct fit of rocker arm shaft.

97318-61P CAMSHAFT CRANKCASE BUSHING, AND SHIFTER CAM LEFT CRANKCASE BUSHING REAMER SET



Reamer is used with large pilot to line ream replacement camshaft bushing. This tool is also used with small pilot to line ream left (small) crankcase shifter cam bushing.

TRANSMISSION

TABLE OF CONTENTS

GENERAL

SPECIFICATIONS

CLUTCH

Type	1968 and Earlier Wet - Multiple Disc
	1969 & Later Dry ... Multiple Disc
Capacity	1966 and Earlier 1800 lb.-in.
	1967-68 ..... 2250 lb.-in.
	1969 & Later .. 2040 lb.-in.
Spring: Free length	1.90 in.
Setup - 1963	223 lbs. @ 1.12 in.
1964-68	265 lbs. @ 1.12 in.
1969 & Later	220 lbs. @ 1.12 in.

PRIMARY DRIVE

Type: 1968 and Earlier - Helical gears. Automatic backlash takeup on early 1961 model.
1969 & Later - Helical gears in crankcase.

STARTER

Electric starter drive sprocket end play	.001 to .009 in.

GEAR BOX

Gear shifter cam assembly end play in cases	.004 to .008 in.
Gear shifter cam clearance in right side cam bushing	.0005 to .0015 in.
Gear shifter cam clearance in left side cam bushing	.0005 to .0015 in.
Shifter fork clearance on gear shifter cam	.001 to .0015 in.
Shifter pawl carrier shaft in cover bushing	.0005 to .0015 in.
Shifter pawl carrier shaft in crankcase bushing	.0005 to .0015 in.

MAINSHAFT GROUP

Mainshaft end play (See Sprocket Gear End Clearance)	None
Sprocket gear on mainshaft	.0005 to .0015 in.
Mainshaft 3rd gear on mainshaft	.001 to .002 in.
Sprocket gear end clearance	
1972 & Earlier	.008 to .010 in.
1973 & Later	.004 to .008 in.

COUNTERSHAFT GROUP

Countershaft end play	
1972 & Earlier	.004 to .008 in.
1973 & Later	.004 to .006 in.
Countershaft low gear on countershaft	.001 to .002 in.
Countershaft 2nd gear on countershaft	.001 to .002 in.

DESCRIPTION

GENERAL

The transmission consists of three major assemblies including the clutch, starter and gear box.

CLUTCH

The purpose of the clutch is to disengage and engage the engine from the rear wheel for starting, stopping and shifting gears.

The clutch is a multiple disc clutch with steel plates and lined (friction) plates set alternately in the clutch shell. The steel plates are keyed to clutch shell and the friction plates to the clutch hub; and through it, to the transmission and rear wheel. The plates driven by the engine are called driving plates, those connected to the clutch hub, the driven plates.

When the clutch is fully engaged, a spring pressure forces the plates together and causes them to turn as a unit, with the result that the power transmitted through the clutch is transferred to the rear wheel through the transmission.

STARTER

The starter provides a means of starting an engine by manual power. When the pedal is moved in downward stroke the starter crank gear and starter clutch gear engage. Mating ratchet teeth of starter clutch gear and starter clutch now engage, transmitting the force through the transmission mainshaft and clutch to the engine.

GEAR BOX

The gear box is a constant mesh type, (contained in crankcase) that permits changing the ratio of engine speed to the rear driving wheel speed in order to meet the varying conditions of operation.

The transmission is controlled by the foot operated gear shifter lever which transmits the motion through a gear shifter shaft. This actuates the pawl carrier which rotates the gear shifter cam.

The shifter cam moves the shifter forks which slide shifter clutches on the mainshaft and countershaft into mesh with the various gears to obtain the desired gear ratios.

CLUTCH (1968 & EARLIER)

DIAGNOSIS CHART

Effect	Cause (Check in following order)	Remedy
Clutch slips	Incorrect clutch release adjustment	Check and adjust clutch release mechanism as described under "Adjusting Clutch."
	Sticking release lever	Check for binding clutch control cable, binding release lever. See replacing clutch control cable and coil and "Removing and Installing Release Lever."
	Insufficient clutch spring tension	Check clutch spring tension as described under "Inspecting and Repairing Clutch."
	Worn friction discs	Replace friction discs. See "Inspecting and Repairing Clutch."
Clutch drags	Incorrect clutch release adjustment	Check and adjust clutch release mechanism as described under "Adjusting Clutch Release Mechanism."
	Gummy clutch friction plates	Replace or clean friction plates. See "Inspecting and Repairing Clutch."
	Warped clutch steel plates	Replace clutch steel plates. See "Inspecting and Repairing Clutch."

ADJUSTING CLUTCH

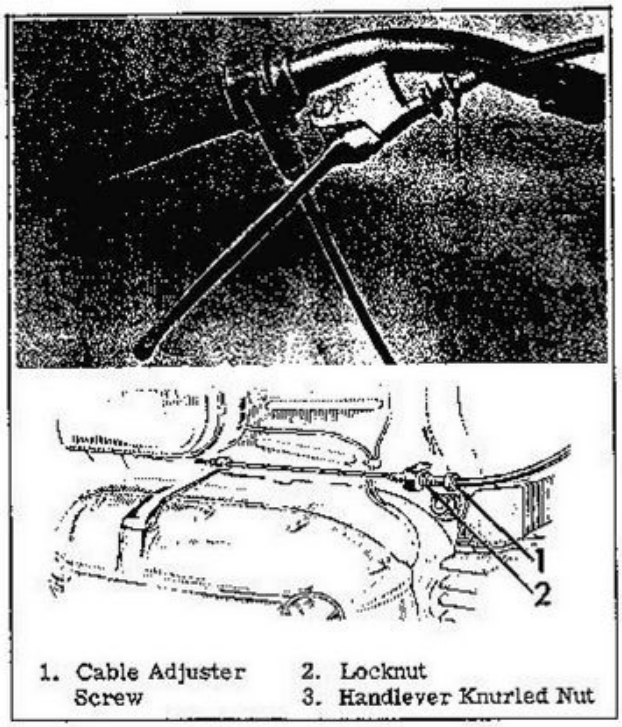
The clutch does not require any adjustment except for correct setting of the control cable. The clutch control adjuster is located on the right side of the engine crankcase, as shown in Figure 4B-35.

The clutch hand lever on the handlebar should have 1/8 to 1/4 of its travel as free movement before the clutch starts to disengage. To adjust free play, loosen locknut (2, Figure 4B-35) and turn adjusting screw (1) out for less free play or turn screw in for more free play. Minor adjustment can be made by turning the knurled nut (3) located at the clutch hand lever on the handlebar. If clutch hand lever operates hard or sticks due to cable binding in coil it should be disassembled and greased.

If the clutch slips under load or drags in disengaged position, after free play has been adjusted as outlined above, it must be taken apart for inspection of the discs which may be worn and require replacement.

REPLACING AND SERVICING CLUTCH COIL AND CABLE ASSEMBLY

Rotate clutch release lever forward with a wrench and remove clutch cable. Loosen cable block screws and remove cable block from end of cable; pull cable



1. Cable Adjuster Screw
2. Locknut
3. Handlever Knurled Nut

Figure 4B-35. Clutch Adjustment

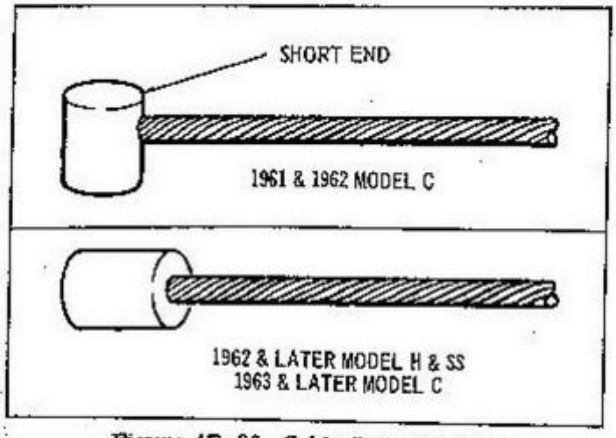


Figure 4B-36. Cable End and Cable

and housing from adjusting screw (1). Free cable from hand clutch lever by slipping cable through slot in adjusting screw and nut; remove cable assembly from frame.

Cable can now be removed from coil for greasing or replacement. Route new cable assembly through right side of fork between upper and lower fork brackets and through control guide near horn.

Note that button on end of cable (1961 & 1962 "C" only) is not centrally located on cable (Figure 4B-36). When assembling place short end of button into clutch handle first, as shown in Figure 4B-35 slide cable through slots in adjustment screw and nut. Turn both adjusting screws in as far as they will go. Place opposite end of cable through cable adjuster screw (1, Figure 4B-35) at engine. Replace cable block on cable so that shoulder on cable block fits into recess on clutch release lever. Tighten screws on cable block. Adjust clutch as described previously in "Adjusting Clutch".

DISASSEMBLING CLUTCH (See Figure 4B-37)

Remove right side cover as described in "Removing Right Side Cover", section 3D. Place a towel in gear case to cover up all open holes. Use tool Part No. 97293-61P to compress clutch spring (12). The end bolts on tool screw into the screw holes on crankcase cover; turning center screw on tool compresses clutch spring for easy removal of lock ring (1) as shown in Figure 4B-38.

After removing lockring remove tool. Remove releasing disc cap (2) and bearing (3). Remove clutch plate assembly (4) as a whole unit from clutch as shown in Figure 4B-39. If necessary plates can be separated as follows: Remove nuts (5) and locks (6). Free releasing disc (7) from studs, and remove outer plate (8), lined driven plates (9) and drive plates (10) from backing plate (11).

Remove clutch spring (12) from hub (15). To remove hub (15), hold hub with tool Part No. 97291-61PA and remove hub nut (13) and lock (14), see Figure 4B-40.

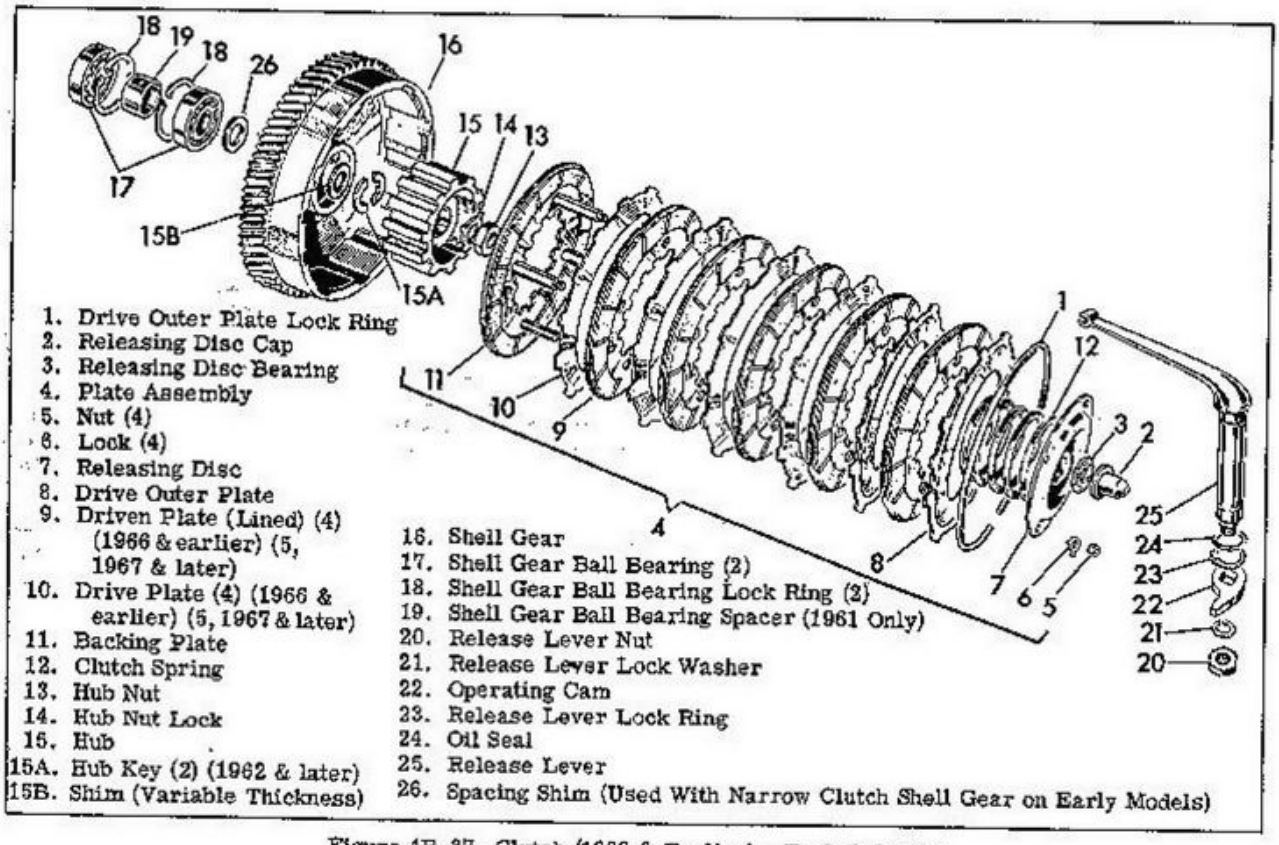


Figure 4B-37. Clutch (1968 & Earlier) - Exploded View

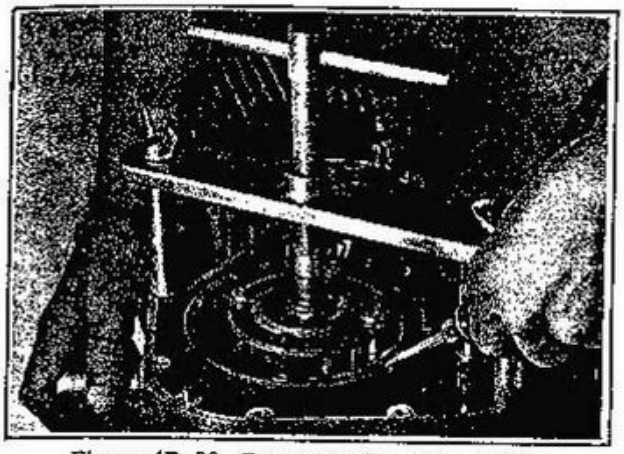


Figure 4B-38. Removing Clutch Lock Ring

Hub (15) may be tight on main shaft splines and can be removed with tool, Part No. 97294-61B which has 2 generator mounting studs to fit into tapped holes in clutch hub. Remove keys (15A) and shim (15B) if used. Clutch shell gear (16) may be removed, using a claw puller if necessary. If clutch shell gear inner bearing remains on shaft, remove with puller. Remove spacing shim (26) if used.

INSPECTING AND REPAIRING CLUTCH (See Figure 4B-37)

Inspect clutch spring (12) for damage or collapsed condition. Spring damage usually results from excessive heat. Free length of a new spring is approximately 1-29/32 inches; any spring that checks 3/32 below this limit should be replaced.

Pay particular attention to the clutch friction driven plates (9). Plates that are badly worn, grooved or scored should be replaced. Also check backing plates (11) for same conditions. Wash plates out in gasoline to remove dirt and blow dry with compressed air; then soak in clean oil.

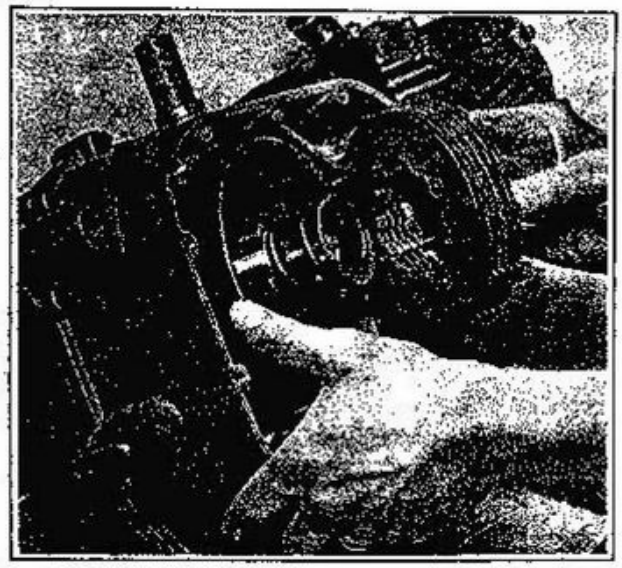


Figure 4B-39. Removing Clutch Plate Assembly

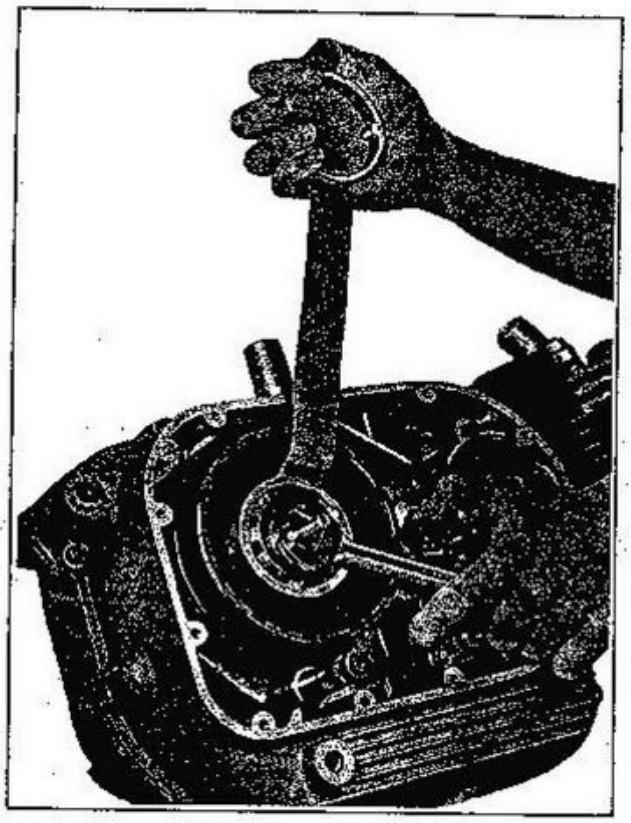


Figure 4B-40. Removing Clutch Hub Nut

Examine the clutch drive plates (10) for excessive wear and damage. Plates that are badly worn, grooved, warped, burned or scored should be replaced. Also check outer plate (8) for same condition. File off any burrs on teeth of plates.

Inspect clutch shell gear (16) for badly worn teeth. When replacing shell gear, primary drive gear must be replaced also because they are a matched set.

If shell gear bearings (17) have excessive side-play or radial (up and down) play, they should be replaced. Ball bearings can be removed by pressing out from opposite sides. Lock rings (18) and spacer (19) can then be removed for cleaning if necessary. Spacer is used only on the 1961 model C. Assemble bearings as follows: Install spacer (19) and lock rings (18) in shell gear (16) and press in new ball bearing against lock rings.

Examine clutch releasing disc (7), disc bearing (3) and disc cap (2) for appreciable wear. Make sure ball bearings rotate freely in disc bearing (3) and disc cap rotates freely on transmission mainshaft. If any parts are badly worn replace them.

INSTALLING CLUTCH (See Figure 4B-37)

Assembly is essentially the reverse order of disassembly. Be certain all parts are clean before reassembling.

If engine is equipped with drive takeup gear, proceed as follows: Partially install (push) clutch shell gear

Figure 4B-41. Preloading Clutch Drive Takeup Gear

(16) on transmission mainshaft engaging teeth of shell gear with teeth of drive takeup gear. Rotate takeup gear counterclockwise against takeup spring pressure by rotating clutch shell gear clockwise. (See Figure 4B-41). When takeup gear has advanced 3 teeth on clutch drive gear, push shell gear in to fully mesh with drive gear.

If engine is equipped with single piece drive gear, install (push) clutch shell gear on transmission mainshaft so it meshes with drive gear.

Install shim (15B) and keys (15A) (if used). Select shim (15B) of correct thickness so clutch shell will have only slight end play on shaft with keys (15B) in place.

Install clutch hub (15) with small hole in hub facing out. Install lock (14) and hub nut (13). Use tool Part No. 97291-61PA to hold hub when tightening clutch hub nut as shown in Figure 4B-40.

If clutch plates have been disassembled, reassemble as follows: Place a drive plate (10) and then a driven plate (lined) (9) on studs of clutch backing plate (11). Alternate with steel plates (10) and friction plates (9) until all plates are in place. Position releasing disk (7) on studs so that cavity for spring is facing backing plate (11). Secure assembly with four nuts and locks (6).

Place spring (12) into clutch hub. Insert clutch plate assembly (4) into clutch hub (15) as far as it will go. Place outer drive plate (8), with shoulder side facing the outside, on clutch plate assembly. Position releasing disc bearing (3) and cap (2) on releasing disc and carefully compress clutch spring with tool Part No. 97293-61, seeing that drive plates (10) and driven plates (9) are aligning on shell gear (16) and hub (15) respectively.

Compress spring until outer plate lock ring (1) can be engaged in groove in shell gear (16).

Install right side cover as described in "Installing Right Side Cover," Section 3D.

REMOVING AND INSTALLING RELEASE LEVER (See Figure 4B-37)

Remove right side cover as described in "Removing Right Side Cover" Section 3D. Also remove circuit breaker wires from cover.

Remove clutch release lever nut (20), lockwasher (21), operating cam (22) and lock ring (23) from inside of cover. Release lever (25) is now free may be removed from cover.

Check oil seal (24) to see if it needs replacing. If any parts are worn replace them.

Reassemble as follows: Install oil seal (24) on release lever (25) and place lever into cover. Place lock ring (23) on release lever (25) and snap lock ring into place. Position operating cam (22) on release lever so that when cover is on engine, release lever is pointing to the center and operating cam (22) is to the rear of engine. Secure assembly with lock washer (21) and nut (20).

Replace cover as described in "Installing Right Side Cover."

CLUTCH (1969 & LATER)

DIAGNOSIS CHART

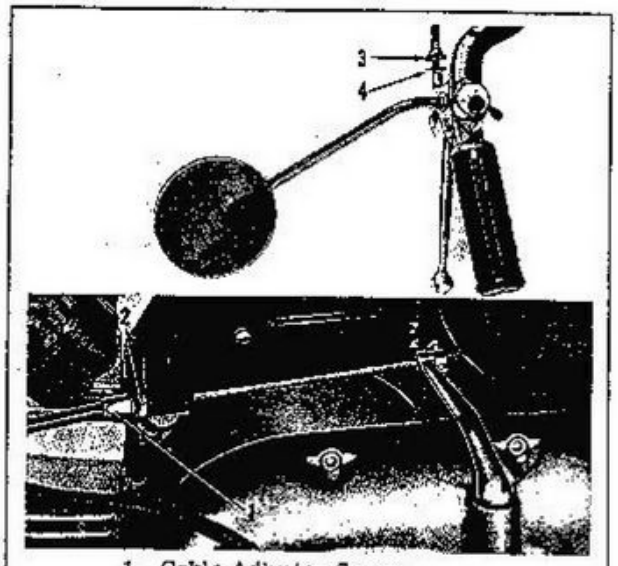
Effect	Cause (Check in following order)	Remedy
Clutch slips	Incorrect clutch release adjustment	Check and adjust clutch release mechanism as described under "Adjusting Clutch."
	Sticking release lever	Check for binding clutch control cable, binding release lever. See replacing clutch control cable and coil and "Removing and Installing Release Lever."
	Insufficient clutch spring tension	Check clutch spring tension as described under "Inspecting and Repairing Clutch."
	Oily friction discs	Check seal. See "Inspecting and Repairing Clutch."
	Worn friction discs	Replace friction discs. See "Inspecting and Repairing Clutch."
Clutch drags	Incorrect clutch release adjustment	Check and adjust clutch release mechanism as described under "Adjusting Clutch Release Mechanism."
	Gummy clutch friction plates	Replace or clean friction plates. See "Inspecting and Repairing Clutch."
	Warped clutch steel plates	Replace clutch steel plates. See "Inspecting and Repairing Clutch."

ADJUSTING CLUTCH

The clutch does not require any adjustment except for correct setting of the control cable.. The clutch control adjuster is located on the left side of the engine crankcase, as shown in Figure 4B-41A.

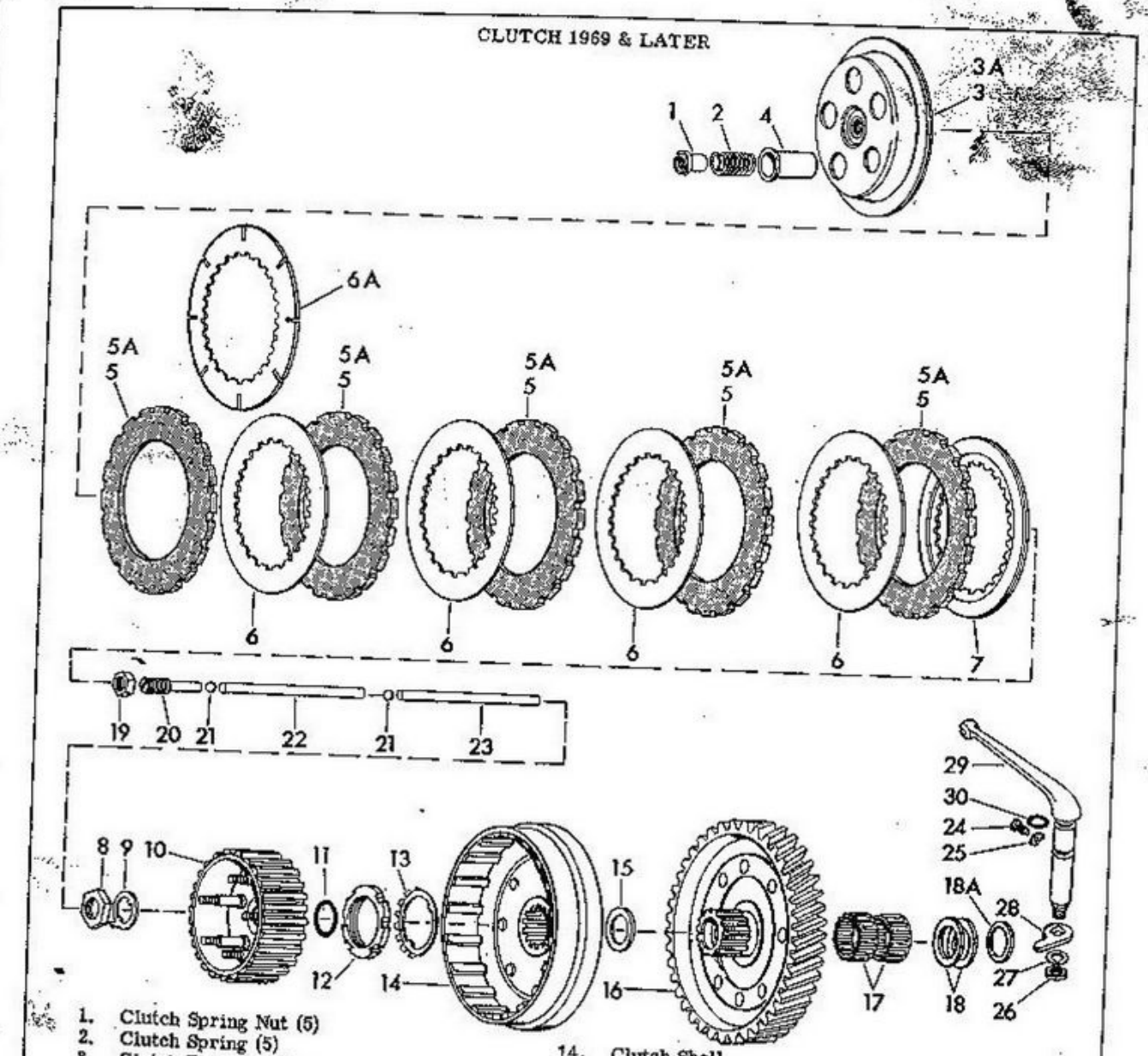
The clutch hand lever on the handlebar should have 1/8 to 1/4 of its travel as free movement before the clutch starts to disengage. To adjust free play, loosen locknut (2) and turn adjusting screw (1) out for less free play or turn screw in for more free play. Minor adjustment can be made by turning the knurled nut (3) located at the clutch hand lever on the handlebar. If clutch hand lever operates hard or sticks due to cable binding in coil it should be disassembled and greased.

If the clutch slips under load or drags in disengaged position, after free play has been adjusted as outlined above, it must be taken apart for inspection of the discs which may be worn and require replacement.



1. Cable Adjuster Screw
2. Cable Adjuster Screw Locknut
3. Hand Lever Adjuster
4. Hand Lever Adjuster Locknut

Figure 4B-41A. Clutch Adjustment



1. Clutch Spring Nut (5)
2. Clutch Spring (5)
3. Clutch Pressure Disc
3A. Pressure Disc (1971 & Later)
4. Clutch Spring Cup (5)
5. Friction (Drive) Plate (5) (1969-70)
5A. Friction (Drive) Plate (Steel Core) (1971 & Later)
6. Steel (Driven) Plate (4 Below 3C116752H2) (3 Above 3C116752H2)
6A. Steel (Driven) Plate (Dished) (Above 3C116752H2)
7. Steel Lined (Backing) Plate
8. Clutch Hub Nut
9. Clutch Hub Nut Lock
10. Clutch Hub
11. Clutch Hub O-ring Seal
12. Clutch Shell Nut
13. Clutch Shell Nut Lock
14. Clutch Shell
15. Washer
16. Clutch Drive Gear
17. Clutch Gear Needle Bearing (2)
18. Clutch Gear Spacer Washer (Variable Thickness)
18A. Mainshaft Washer (1973 & Later)
19. Push Rod Adjusting Screw Nut
20. Push Rod Adjusting Screw
21. Ball (2)
22. Push Rod, Right Side
23. Push Rod, Left Side
24. Clutch Lever Retaining Screw
25. Clutch Lever Retaining Screw Lock
26. Clutch Lever Nut
27. Clutch Lever Lockwasher
28. Clutch Lever Operating Cam
29. Clutch Lever
30. Clutch Lever O-ring

Figure 4B-41B. Clutch (1969 & Later) - Exploded View

Revised: 3-73

REPLACING AND SERVICING CLUTCH COIL AND CABLE ASSEMBLY

Rotate clutch release lever forward with a wrench and remove clutch cable. Loosen cable block screws and remove cable block from end of cable; pull cable and housing from adjusting screw (1). Free cable from hand clutch lever by slipping cable through slot in adjusting screw and nut; remove cable assembly from frame.

Cable can now be removed from coil for greasing or replacement.

DISASSEMBLING CLUTCH (See Figure 4B-41B)

Remove shifter lever and 3 socket head screws securing clutch cover to right crankcase cover and remove cover.

Using wrench, part No. 94670-66P, loosen 5 stud nuts (1) an equal amount at a time to relieve spring pressure. See Figure 4B-41C. Remove springs (2). Remove plate (3 or 3A) and spring cups (4).

Remove friction (drive) plates (5 or 5A) and 4 steel (driven) plates (6 or 6A) and lined backing plate (7).

To remove hub (10), hold hub with tool Part No. 97177-69P and remove hub nut (8) and lock (9), see Figure 4B-41D.

Remove O-ring (11) from groove in clutch hub.

Disengage nut lock (13) ear from notch in nut (12). Using wrench, part No. 97235-66P, remove nut and nut lock from drive gear hub. See Figure 4B-41E. Remove clutch shell (14), washer (15), drive gear (16), needle bearings (17), spacing shims (18), and washer 18A (1973 and later).

INSPECTING AND REPAIRING CLUTCH (See Figure 4B-41B)

Inspect clutch springs (2) for damage or collapsed condition. Spring damage usually results from excessive heat. Free length of a new spring is approximately 1-19/32 inches; any spring that checks 3/32 below this limit should be replaced.

Pay particular attention to the clutch friction plates Plates that are badly worn, grooved or burned should be replaced. Also check lining on plate (7) for same condition. Wash plates out in solvent to remove dirt or oil, and blow dry with compressed air.

Examine the steel plates for excessive wear and damage. Plates that are badly worn, grooved, warped, burned or scored should be replaced. File off any burrs on teeth of plates.

Inspect O-ring seal (11) and if scratched, rough or deformed, replace with a new one.

Inspect lip seal in crankcase and replace if worn or damaged.

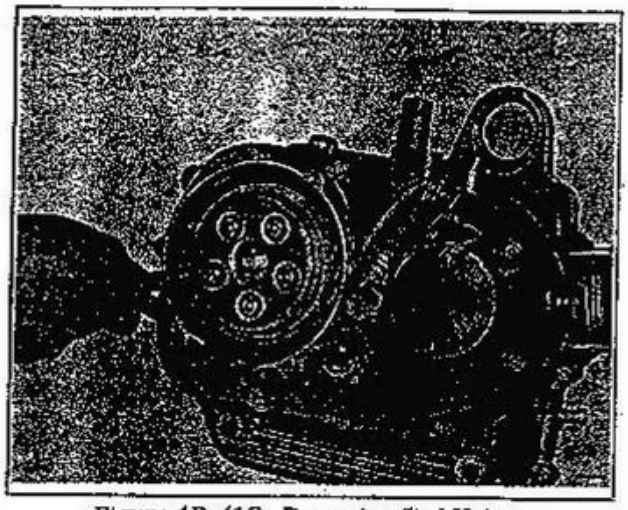


Figure 4B-41C. Removing Stud Nuts

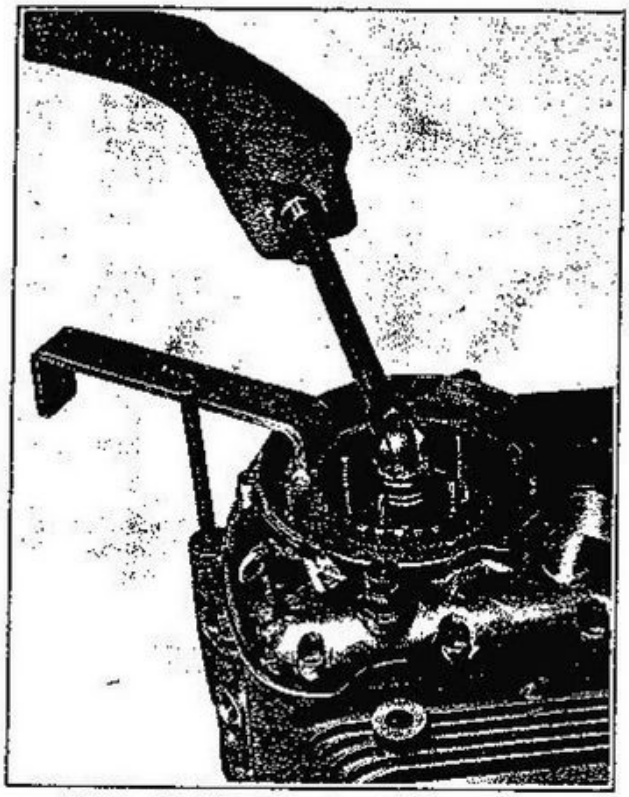


Figure 4B-41D. Removing Clutch Hub Nut

Examine studs in clutch hub (10) if they are loose or broken, drill out stud with 5/16 in. drill and rivet new stud in place.

INSTALLING CLUTCH (See Figure 4B-41B)

Assembly is essentially the reverse order of disassembly. Be certain all parts are clean before reassembling.

Install sufficient variable thickness washers (18) to produce .004 to .008 in. clutch assembly end play.

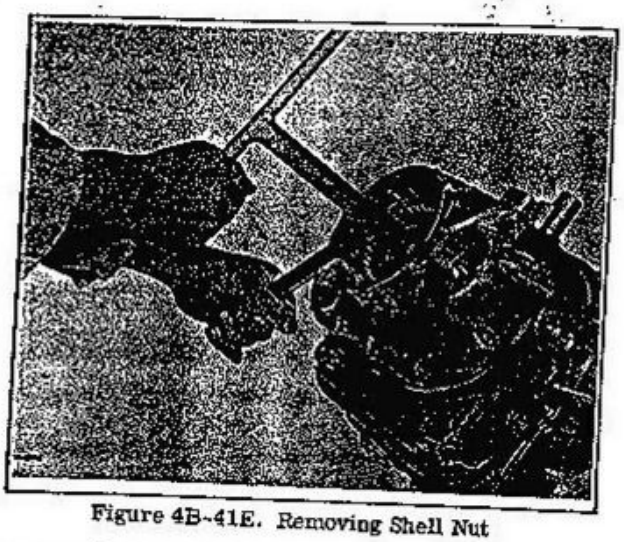


Figure 4B-41E. Removing Shell Nut

Install clutch shell (14) on transmission clutch gear hub, making sure that seal in crankcase is in good condition. Fasten with nut and lock (12 and 13); bend lock ear into nut notch after tightening nut securely. Install clutch hub on mainshaft with nut and lock (8 and 9), making sure that O-ring (11) is in good condition.

NOTE

Washer (15) must be in place against needle bearings (17) and transmission clutch drive gear hub (16). Bevel on I.D. of washer (15) must be toward roller bearings. Bevel on clutch shell nut (12) must be toward clutch shell.

Use tool Part No. 97177-69P to hold hub when tightening clutch hub nut as shown in Figure 4B-41D.

Install plate (7), lining side inward toward clutch shell. Install friction discs (5) and alternate with four steel plates (6) using dished plate (6A) underneath last lined plate. NOTE: Dished plate (6A) should be used to replace flat plate (6) below 3C11675H2. Position disc (3) on studs and install spring cups, springs and nuts.

Install clutch cover and shifter lever.

REMOVING AND INSTALLING RELEASE LEVER (See Figure 4B-41B)

Remove left side cover as described in "Removing Left Side Cover," Section 4C.

Remove clutch release lever nut (26), lockwasher (27), and operating cam (28) from inside of cover. Remove setscrew (24) and lock (25) from cover. Release lever (29) is now free and may be removed from cover.

Check oil seal (30) to see if it needs replacing. If any parts are worn replace them.

Reassemble as follows: Install oil seal (30) on release lever (29) and place lever into cover. Position operating cam (28) on release lever so that when cover is on engine, release lever is pointing to the center and operating cam (28) is to the rear of engine. Secure assembly with lockwasher (27) and nut (26). Install setscrew and lock (25 and 24).

Replace cover as described in "Installing Left Side Cover."

REMOVING AND INSTALLING CLUTCH RELEASE PUSH ROD (See Figure 4B-41B)

Remove left and right side covers. Loosen nut (19) and unscrew adjusting screw (20) from cover (3). With a wire or rod, push 2 balls and 2 rods (items 21, 22 and 23) out of mainshaft. Note that both rods (22 and 23) are the same length, however, note that the rounded end of left side push rod (23) should be installed against the operating cam (28).

MANUAL STARTER

Remove the 6 MM Allen socket screws. Carefully remove cover by tapping on sides while pulling on kick starter lever.

1973 models have a thrust washer (7E, Figure 4C-11) on crank gear stub shaft.

DISASSEMBLING STARTER (See Figure 4C-11)

Remove the following parts from left side cover:

Remove starter crank bolt nut (1) (if used), bolt (2) and starter crank and pedal assembly (3).

On 1971 and 1972 models, remove crankshaft support (7A), by removing 5 bolts and lockwashers (7C). See Figure 4C-12.

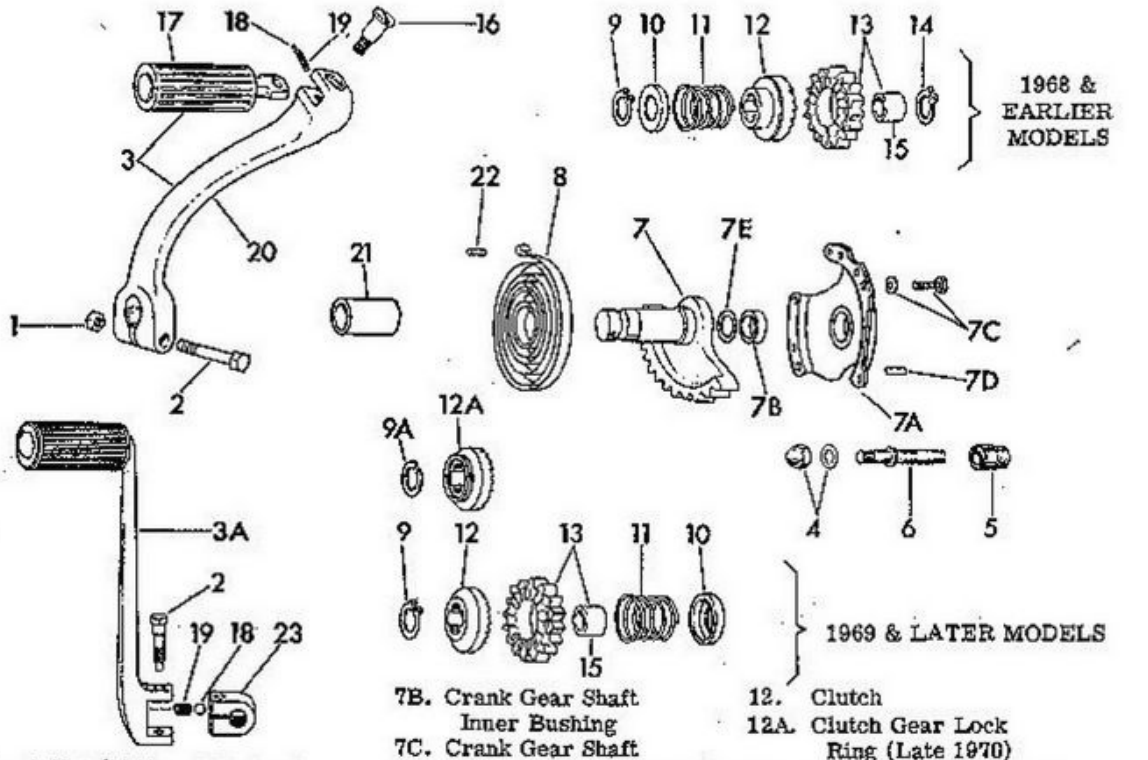
Remove stop stud acorn nut and washer (4).

Clamp starter crank gear shaft (7) in vise; rotate cover to take spring tension off stop assembly while removing stop bumper (5) and stop stud (6) from cover. Release spring tension and remove cover from vise. Remove starter crank gear (7) and starter spring (8) from cover.

Remove the following parts from transmission mainshaft:

Remove clutch gear lock ring (9) with lock ring pliers or if recessed type clutch (12A) is used, push it against spring and pry lock ring (9A) from groove. Remove spring collar (10), spring (11), starter clutch (12) or (12A) starter clutch gear assembly (13), and lock ring (14).

Note that these parts are assembled in different sequence on 1969 and later models.



1. Crank Nut (1968 and Earlier)
2. Crank Bolt
3. Crank and Pedal Assembly (1968 and Earlier)
3A. Crank and Pedal Assembly (1969 and Later)
4. Stop Stud Acorn Nut and Washer
5. Crank Gear Stop Bumper
6. Crank Gear Stop Stud
7. Crank Gear
7A. Crank Gear Shaft Support (1971-72)
7B. Crank Gear Shaft Inner Bushing
7C. Crank Gear Shaft Support Bolt & L.W. (5) (1971-72)
7D. Crank Gear Shaft Support Dowel Pin (2) (1971-72)
7E. Washer (1973 & Later)
8. Spring
9. Clutch Gear Lock Ring
9A. Clutch Gear Lock Ring (Late 1970)
10. Clutch Spring Collar
11. Clutch Spring
12. Clutch
12A. Clutch Gear Lock Ring (Late 1970)
13. Clutch Gear Assembly
14. Clutch Gear Lock Ring
15. Clutch Gear Bushing
16. Crank Pedal Screw (1968 and Earlier)
17. Crank Pedal
18. Crank Pedal Ball
19. Crank Pedal Spring
20. Crank (1968 and Earlier)
21. Crank Gear Shaft Bushing
22. Spring Dowel Pin
23. Crank Clevis (1969 and Later)

Figure 4C-11. Starter - Exploded View

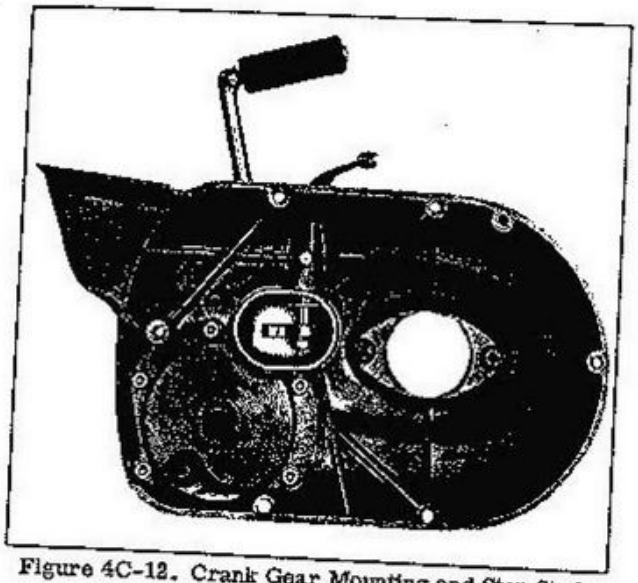


Figure 4C-12. Crank Gear Mounting and Stop Stud (1971-72 Model Shown)

INSPECTION AND REPAIR (See Figure 4C-11)

Clean all parts in cleaning solvent and blow dry with compressed air.

Inspect starter clutch (12 or 12A) and starter clutch gear assembly (13) for damaged teeth. Check clutch gear bushing (15) (pressed in) for wear and remove if necessary with a shouldered press pin (.570 in. Dia.). New bushing will not need reaming after it is installed in gear.

Examine starter clutch spring (11) for collapsed condition or breakage, and compare with a new spring if possible; new spring free length is .984 in.

Examine lock rings (9 or 9A) and (14) and replace if damaged.

Inspect starter crank gear (7) for worn and damaged teeth.

NOTE

Correct gear should have 8 teeth (early 1961 models had 10 teeth).

Check play between crank gear shaft (7) and bushings (7B and 21). If bushings are worn, replace bushings by pressing out with a shouldered press plug having small Dia. .669 in. and large Dia. .866 in. Insert chamfered side of bushings to inside of cover and press bushing flush with inside boss; bushings do not need reaming after installing.

Examine crank spring (8) for collapsed condition or breakage (compare with new spring if possible).

Inspect crank gear stop bumper (5) and stop (6) for damage.

Starter spring dowel pin (22) is pressed into cover and should be removed only when replacement is necessary.

Examine crank and pedal assembly (3 or 3A); pedal (17) or crank assembly (3A) should lock in both extreme positions of rotation. If it does not lock, spring (19) is either weak or broken and should be replaced.

ASSEMBLING STARTER (See Figure 4C-11)

Reinstall items 9, 10, 11, 12 or 12A and 13 on mainshaft in reverse order of assembly.

Assemble cover as follows:

Position starter spring (8) on starter crank gear (7) noting direction in which spring is wound. Insert gear (7) in cover bushing (21) being sure to locate spring loop on dowel pin (22) which projects from cover. Clamp starter crank gear shaft (7) in vise and rotate cover until spring (8) is wound tight on shaft; then unwind cover 1 to 1-1/2 turns; hold cover in position and place stop (6) and stop bumper (5).

Remove from vise and secure stop with washer and acorn nut (4).

On 1971-72 models, reinstall crank support (7A) with bolts and lock washers (7C).

Install crank and pedal assembly (3) on gear shaft (7); insert crank bolt (2). After cover has been installed on engine, locate crank and pedal assembly (3) or crank clevis (23) on shaft splines so that crank will not hit foot rest when stroking.

INSTALLING LEFT SIDE COVER

Install left side cover and draw down with Allen socket cap screws.

ELECTRIC STARTER DRIVE

REMOVING ELECTRIC STARTER AND DRIVE

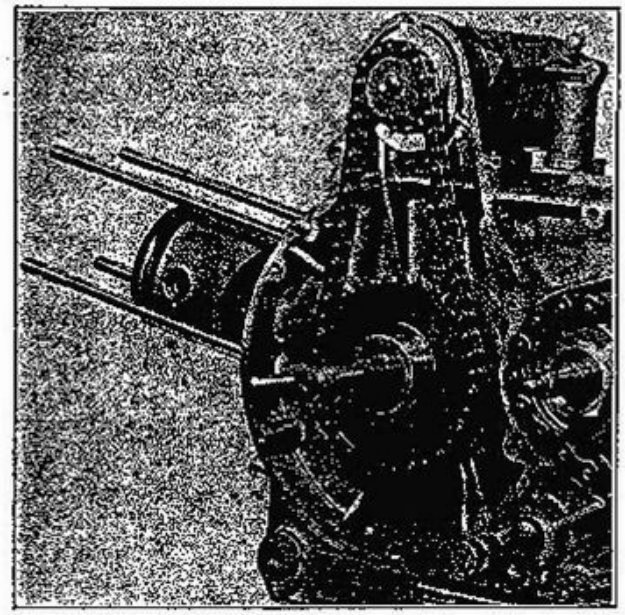


Figure 4C-13. Electric Starter and Drive

Remove manual starter as described previously in beginning of this section. Remove lock ring from starter motor shaft. Use two jaw puller, as shown in Figure 4C-14, to remove starter motor sprocket. Lift off starter driven sprocket and starter chain at the same time. Remove spacer from crankshaft.

NOTE: Recess on spacer faces center of engine. Remove lock ring from crankshaft. Use two jaw puller, Part No. 97309-73P, to remove starter clutch as shown in Figure 4C-15. Remove key and starter clutch spacer. NOTE: Large flat side of key faces outward. Remove flat washer and shim washer(s) from electric starter motor shaft.

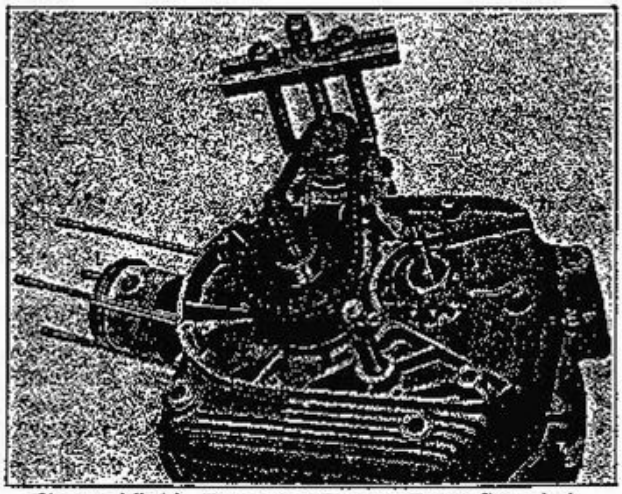


Figure 4C-14. Removing Starter Drive Sprocket

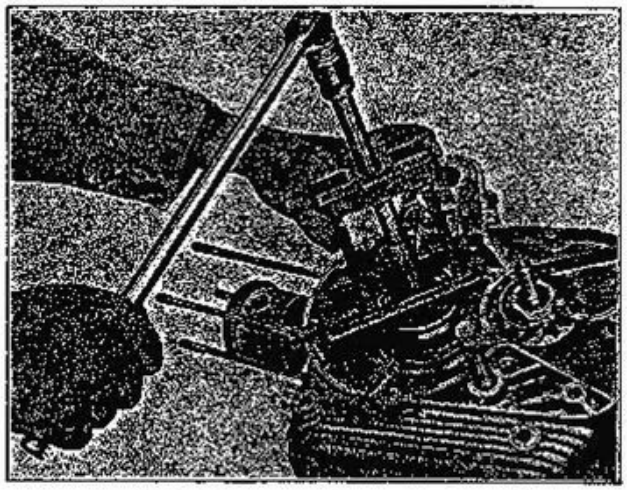


Figure 4C-15. Removing Starter Drive Clutch

NOTE

The starter clutch is a nonserviceable assembly and must be replaced when defective.

Remove two bolts and lock washers securing starter motor to crankcase bosses. Remove starter motor. It may be necessary to tap on starter motor case with a soft hammer. Do not tap on motor shaft. Remove O-ring from starter motor case.

Reassemble in reverse order using tool Part No. 97308-73P to press starter clutch on crankshaft as shown in Figure 4C-16.

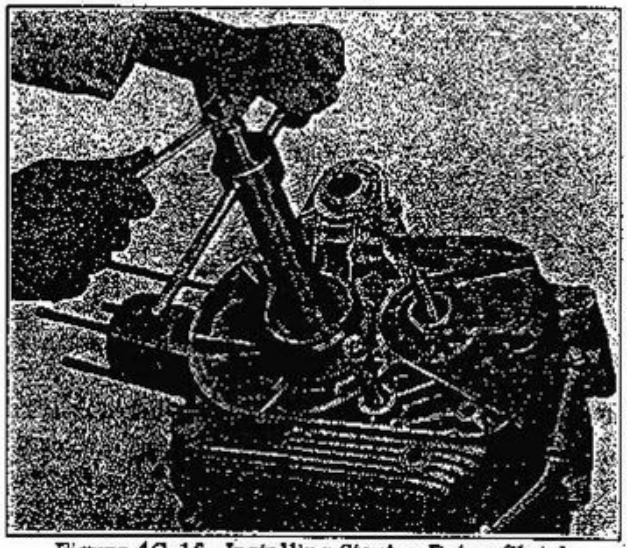


Figure 4C-16. Installing Starter Drive Clutch

GEAR BOX

GENERAL

The transmission mechanism is located inside of crankcase and cannot be serviced unless engine is removed from chassis as described in section 3A and the crankcases are separated.

REMOVING DRIVE SPROCKET

Note: It is not necessary to remove drive sprocket to disassemble crankcases.

Remove cover as described in "Removing Left Side Cover", Section 4C. Remove starter gear assembly as described in "Disassembling Starter", Section 4C.

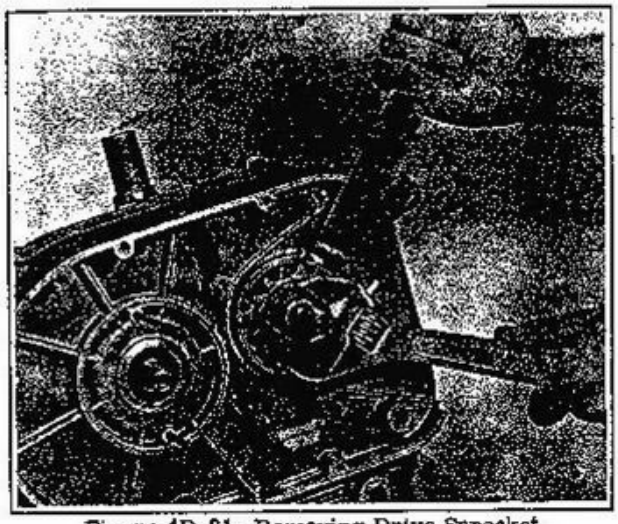


Figure 4D-31. Removing Drive Sprocket (1972 and Earlier)

On 1972 and earlier models, remove three sprocket cover nuts and washers; then remove sprocket cover. Use Transmission Sprocket Wrench, to hold drive sprocket while removing nut as shown in Figure 4D-31. Remove lock and pull drive sprocket from sprocket gear.

On 1973 and later models, remove outer cover and starter gear parts as described above. Remove alternator rotor and stator as described in Section 5E. Remove electric starter drive parts as described in Section 4C.

Bend tab lock away from sprocket nut hex and remove nut with adjustable wrench or deep socket. Hex size is 36 MM (1-7/16 in.).

If engine is in chassis put motorcycle in gear to hold shaft. If engine is out of chassis use tool Part No. 97307-73P to lock sprocket as shown in Figure 4D-31A. Remove lock and pull sprocket from sprocket gear.

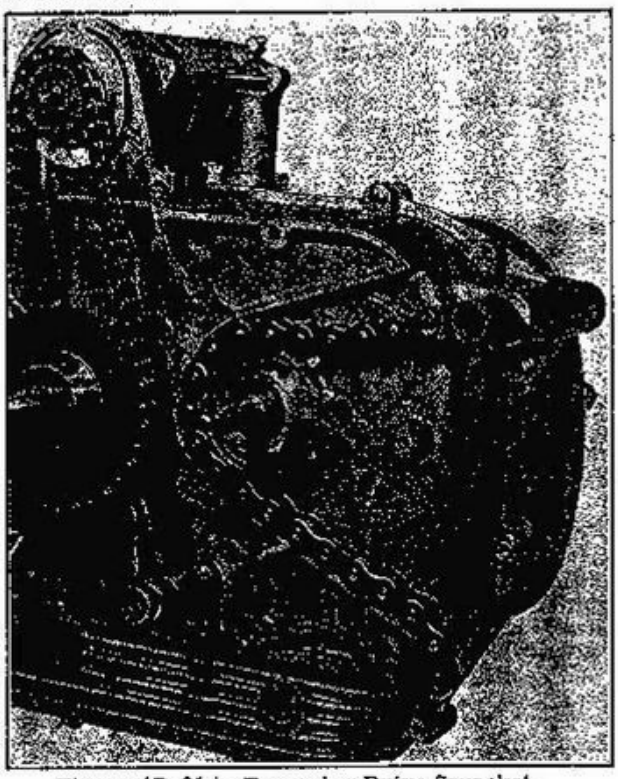


Figure 4D-31A. Removing Drive Sprocket (1973 and Later)

CLEANING AND INSPECTION

Thoroughly clean all parts and inspect for damage. Especially check drive sprocket for badly worn or damaged teeth and splines.

ASSEMBLING DRIVE SPROCKET

Install drive sprocket (shouldered side toward crankcase), lock washer and nut on sprocket gear. Use tool to hold sprocket while tightening nut.

Install cover as described in "Installing Left Side Cover", Section 4C.

Install starter gear assembly as described in "Assembling Starter Gear and Left Side Cover", Section 4C.

DISASSEMBLING TRANSMISSION (See Figure 4D-32)

Separate crankcases as described in "Disassembling Crankcase", Section 3E.

Lay right crankcase on its side so that gear compartment is up. Remove shifter cam spacer (1) and countershaft thrust washer (2).

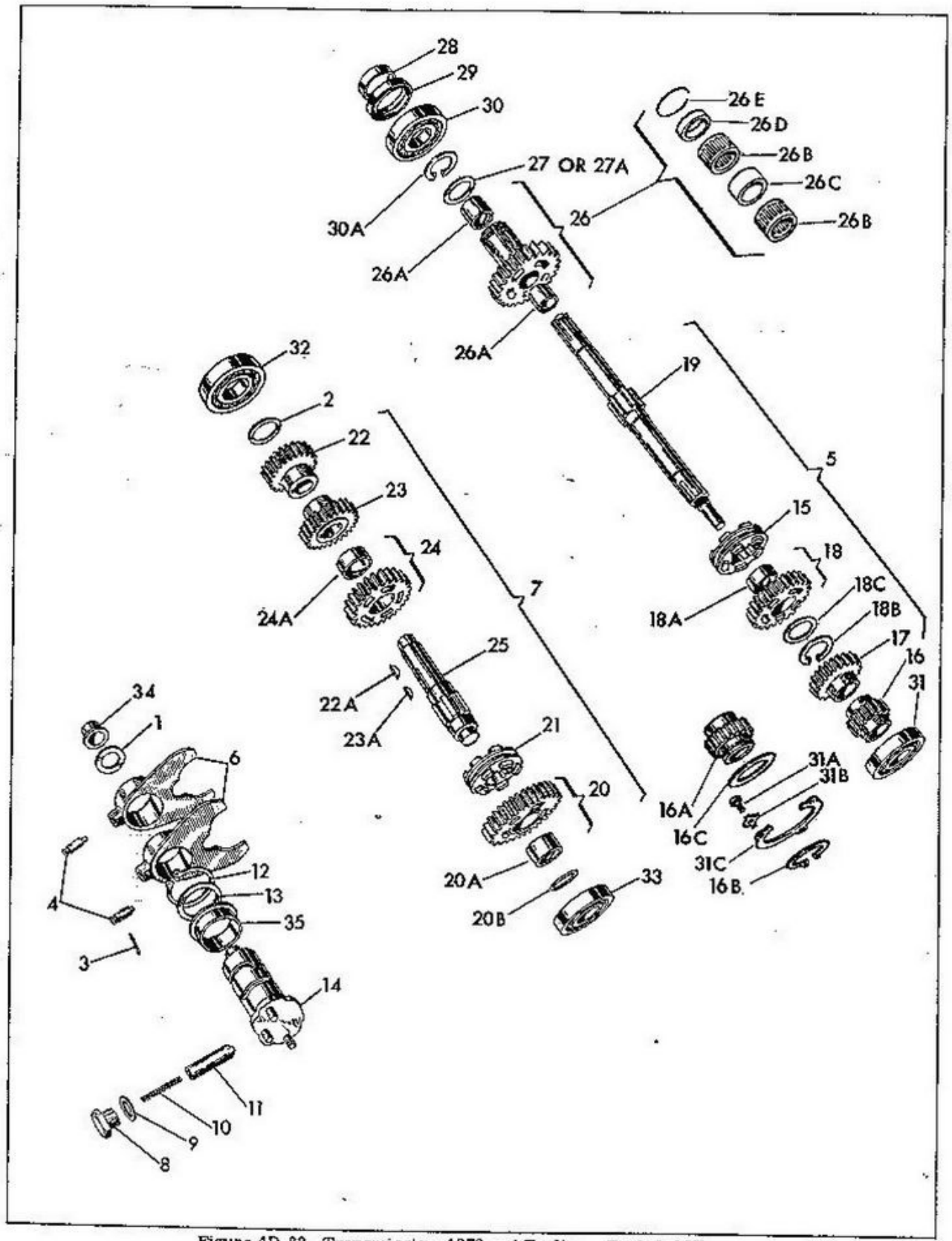


Figure 4D-32. Transmission, 1972 and Earlier - Exploded View

Key for Figures 4D-32 and 4D-32A

1. Shifter Cam Spacer (Small) (Variable Thickness)
2. Countershaft Thrust Washer
3. Cotter Pin (2 or 3)
4. Shifter Fork Pin (2 or 3)
5. Mainshaft Assembly
6. Shifter Fork (2)
6A. Shifter Fork, 1st Gr. (1973 and Later)
6B. Shifter Fork, 3rd & 5th Grs. (1973 and Later)
6C. Shifter Fork, 2nd & 4th Grs. (1973 and Later)
7. Countershaft Assembly
8. Cam Stop Plunger Plug
9. Cam Stop Plug Washer
10. Cam Stop Plunger Spring
11. Cam Stop Plunger
12. Shifter Cam Lock Ring
13. Shifter Cam Spacer (Large)
14. Shifter Cam
15. Shifter Clutch
15A. Mainshaft Fourth Gear 21T. (1973 and Later)
16. Mainshaft First (Low) Gear 17T.
16A. Mainshaft First (Low) Gear 17T. (Late 1962-72)
16B. Mainshaft First (Low) Gear Lock Ring (Late 1962-68)
16C. Shim (Variable Thickness) (Late 1962 and Later)
17. Mainshaft Second Gear 23T.
18. Mainshaft Third Gear 27T.
18A. Bushing
18B. Mainshaft Third Gear Lock Ring (1969-72)
18C. Mainshaft Third Gear Washer (1969-72)
18D. Lock Ring (1973 and Later)
18E. Mainshaft Third Gear 19T. (1973 and Later)
19. Mainshaft
20. Countershaft First (Low) Gear 33T. (1972 and Earlier)
20A. Bushing
20B. Spacer (Variable Thickness) (1971 and Later)
20C. Countershaft First Gear 20T. (1973 and Later)
21. Shifter Clutch
22. Countershaft Fourth (High) Gear 16T. (1972 and Earlier)
22A. Key, C/S Fourth Gear (1971-72)
22B. Countershaft Fifth Gear 15T. (1973 and Later)
22C. Countershaft Fourth Gear 17T. (1973 and Later)
22D. Lock Ring (1973 and Later)
23. Countershaft Third Gear 23T.
23A. Key, C/S Third Gear (1971-72)
24. Countershaft Second Gear 27T.
24A. Bushing
24B. Lock Ring (1973 and Later)
24C. Countershaft Second Gear 20T. (1973 and Later)
24D. Lock Ring (1973 and Later)
24E. Countershaft Third Gear 19T. (1973 and Later)
24F. Washer (1973 and Later)
25. Countershaft
26. Sprocket Gear 24T.
26A. Bushing (2) (1968 and Earlier)
26B. Needle Bearing (2) (1969 and Later)
26C. Needle Bearing Spacer (1969 and Later)
26D. Bushing (1969 and Later)
26E. Bushing Lock Ring (1969 and Later)
27. Sprocket Gear Spacer (1969 and Later)
27A. Sprocket Gear Spacer (Variable Thickness) (1961-68)
28. Mainshaft Sprocket Spacer
29. Sprocket Gear Oil Seal
30. Left Mainshaft Bearing
30A. Left Mainshaft Bearing Retainer (Late 1963)
31. Right Mainshaft Bearing
31A. Right Mainshaft Bearing Retainer Bolt (Late 1962 and Later)
31B. Right Mainshaft Bearing Retainer Lock (Late 1962 and Later)
31C. Right Mainshaft Bearing Retainer (Late 1962 and Later)
32. Left Countershaft Bearing
33. Right Countershaft Bearing
34. Left Shifter Cam Bushing
35. Right Shifter Cam Bushing

Remove cotter pins (3) from shifter forks (6) and free shifter fork pins (4).

Remove mainshaft low gear lock ring (16B), (if used).

NOTE

Fork pins must be removed before pressing out mainshaft.

Simultaneously press out mainshaft assembly (5) with tool, Part No. 97293-61P, from crankcase bearing (31) and remove outside shifter fork (6) from shifter cam (14) as shown in Figure 4D-33. Thrust washer (16C) is a loose part.

Tap countershaft assembly (7) from bearing (33) and remove remaining shifter forks (6) from shifter cam (14). Gears (20 or 20C), shifter clutch (21) and spacer (20B) are loose parts.

To remove shifter cam proceed as follows:

Remove cam stop plunger plug (8), washer (9), spring (10) and plunger (11).

Remove shifter cam lock ring (12), spacer (13) and pull cam (14) out of crankcase bushing (35).

To disassemble 1972 and earlier mainshaft proceed as follows:

Remove shifter clutch (15) and low gear shim (16C), (if used). Press off first (low) gear (16 or 16A) as shown in Figure 4D-34.

On 1968 and earlier models, press off second (17) and third (18) gears as shown in Figure 4D-35.

CAUTION

Do not press more than one gear off at one time because damage to gear and countershaft may result.

On 1969 to 1972 models, press off second gear (17) alone by inserting pins or screws through third gear (18) slots and using a sleeve to press gear away from third gear lock ring (18B). (See Figure 4D-35A.)

Remove lock ring (18B), spacers (18C), and gear (18).

To disassemble 1973 and later mainshaft, proceed as follows:

Remove lock ring (18D) and mainshaft third gear (18E) from mainshaft.

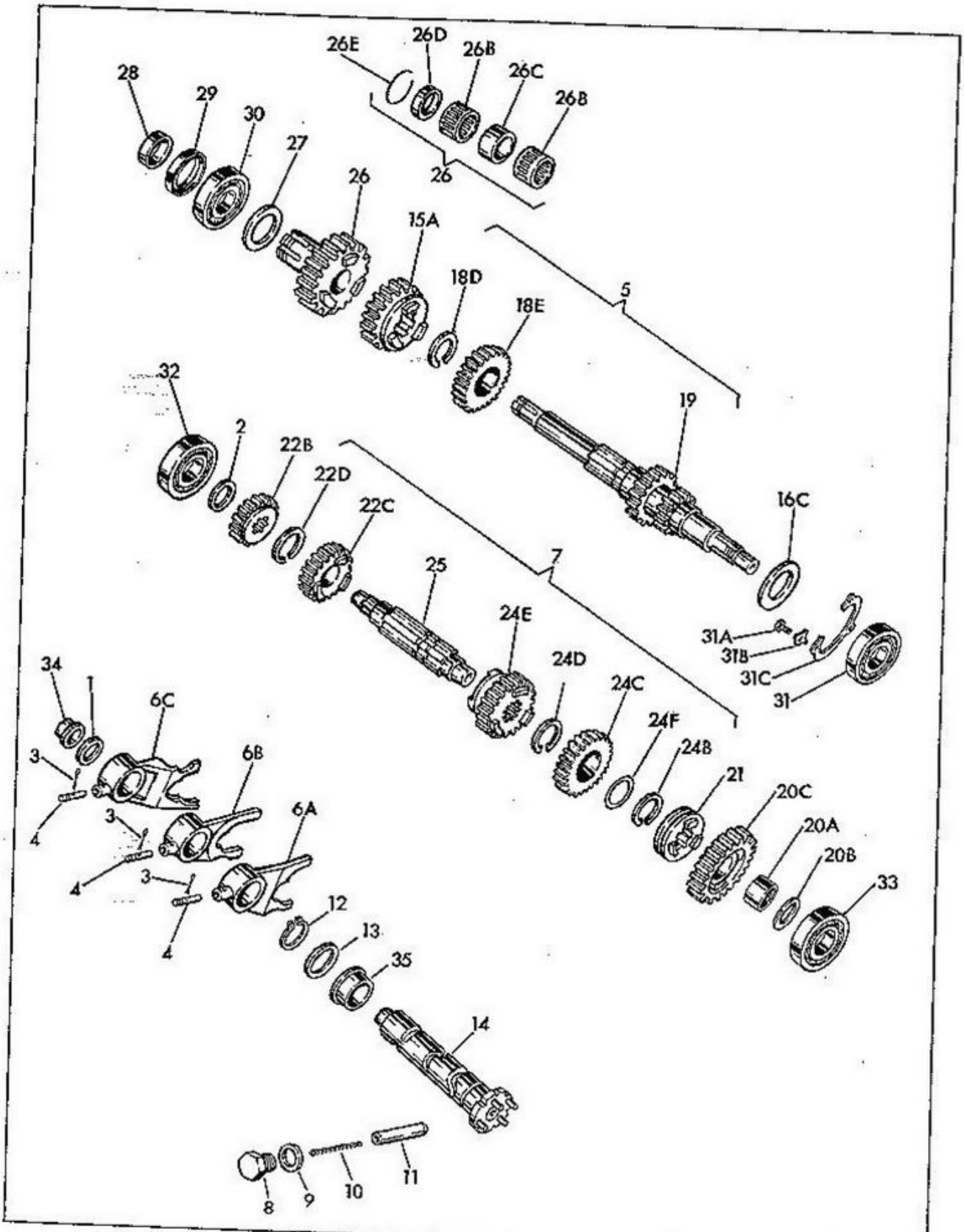


Figure 4D-32A. Transmission, 1973 and Later - Exploded View

To disassemble 1972 and earlier countershaft, remove first gear (20) and shifter clutch (21). Press off fourth gear (22), and remove key (22A), if used, from shaft, then third gear (23) and second gear (24), and remove key (23A), if used, from shaft.

CAUTION

Do not press all gears off at once because damage to gear and countershaft may result.

To disassemble 1973 and later countershaft, remove lock ring (24B), washer (24F) (if used), and countershaft second gear (24C). Remove lock ring (24D) and countershaft third gear (24E). Press countershaft fifth gear (22B) from shaft with an arbor press. Remove lock ring (22D) and countershaft fourth gear (22C).

To remove sprocket gear (26) pull or press it from left mainshaft bearing (30). Remove spacer washer (27) from gear, and sprocket spacer (28) from sprocket gear oil seal (29).

CLEANING AND INSPECTION (See Figure 4D-32)

Thoroughly clean transmission compartment and all shifter, mainshaft and countershaft parts with cleaning solvent. Blow parts dry with compressed air. Replace all parts that are badly worn or damaged.

MAINSHAFT AND COUNTERSHAFT GROUP

Inspect gears for badly battered or chipped dog slots at all thrust points; examine gear teeth for pitting, scoring, cracked, chipped condition or case hardening worn through. Inspect mainshaft (19), countershaft (25) and gears for pitting, grooving and excessive wear on bearing surfaces.

Inspect gear bushings for wear by checking gear fit on shaft. Replace with new bushings if worn excessively (see Specifications, Section 4A). Ream gear bushings 18A, 20A and 24A with Reamer, Part No. 94806-64. Ream sprocket gear bushings 26A with Reamer, Part No. 94806-63 (see Note on page 4D-38). Check 1969 and later sprocket gear needle bearings (26B) and shaft for wear.

Check shifter clutches for badly battered, chipped or rounded dogs and for worn shifter fork grooves.

SHIFTER GROUP

Carefully examine gear shifter cam (14) for grooving or worn cam slots at various running gear positions. Excessive wear will make transmission difficult to shift through gears.

Check shifter forks (6) for bent condition or deep grooves worn into fork fingers caused by excessive thrust action of gears. Also examine shifter fork pins (4) for wear.

Check shifter cam stop plunger and spring for wear and damage, especially on thrust face of plunger.

Check for free movement of plunger and spring in crankcase. Free length of new spring is 1.535 in.

BEARINGS AND BUSHINGS

Remove bearings only when necessary.

Check countershaft ball bearings (32) and (33) and mainshaft ball bearings (30) and (31) for excessive side and radial (up and down) play.

Right side mainshaft ball bearing (31) and countershaft ball bearing (33) and shifter cam bushing (35) are pressed out from right case side. Remove bolts (31A), bolt locks (31B) and bearing retainer (31C) (if used) before pressing out bearing (31). Left side countershaft ball bearing (32) (blind) is removed with a puller tool.

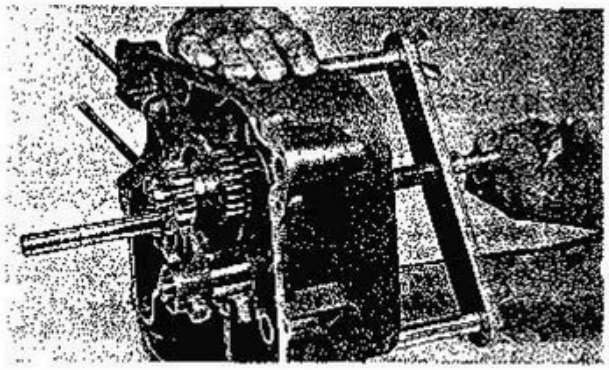


Figure 4D-33. Pressing Out Mainshaft Assembly

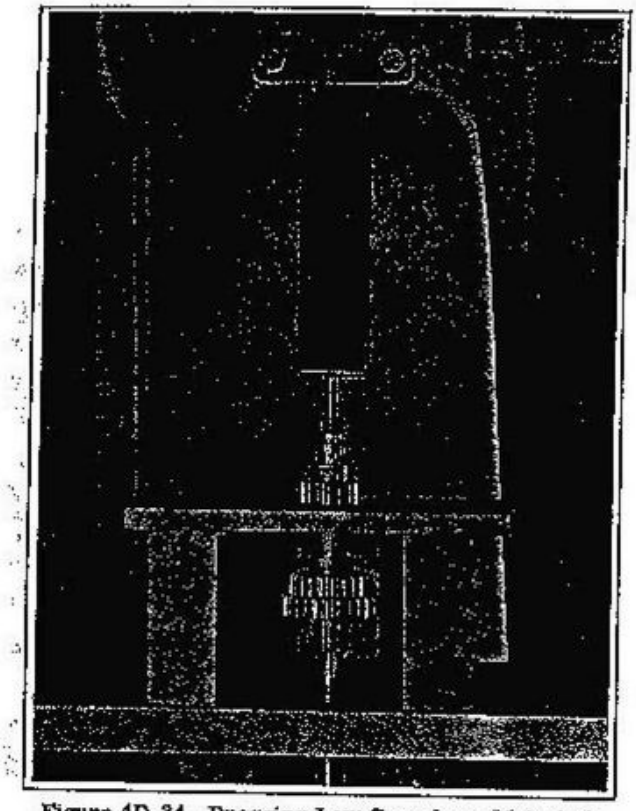


Figure 4D-34. Pressing Low Gear from Mainshaft (1972 and Earlier)

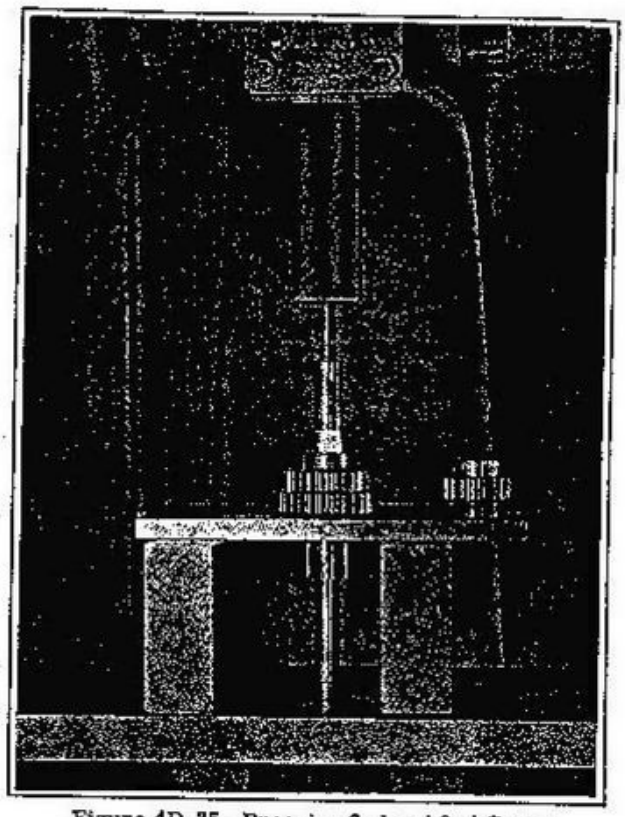


Figure 4D-35. Pressing 2nd and 3rd Gears from Mainshaft (1968-72)

Left side shifter cam bushing (34) is pressed out from outside of case.

Remove left side sprocket gear oil seal (29) and press out ball bearing (30) from outside of case.

After installing new bushing, left shifter cam bushing (34) and right shifter cam bushing (35) must be line reamed with special Harley-Davidson reamers, (Part No. 97322-61P Right Bushing Reamer) and (Part No. 97318-61P Left Bushing Reamer).

ASSEMBLING TRANSMISSION (See Figure 4D-32)

Press bearings, bushings and oil seals into crankcase, if replaced. Install bearing retainer (31A, 31B, 31C) (if used). Install shifter cam (14) in right crankcase. Install correct shifter cam positioning spacer (13) as described in "Determining Shifter Cam Spacer Thickness". Install lock ring (12) on shifter cam (14).

Install shifter cam stop plunger (11), spring (10), washer (9) and plug (8) in crankcase and tighten snugly.

INSTALLING GEARS (1972 & EARLIER)

COUNTERSHAFT

If gears have been removed from countershaft, proceed as follows:

On 1972 and earlier models, install second gear (24) on countershaft (25) with recessed side of gear away

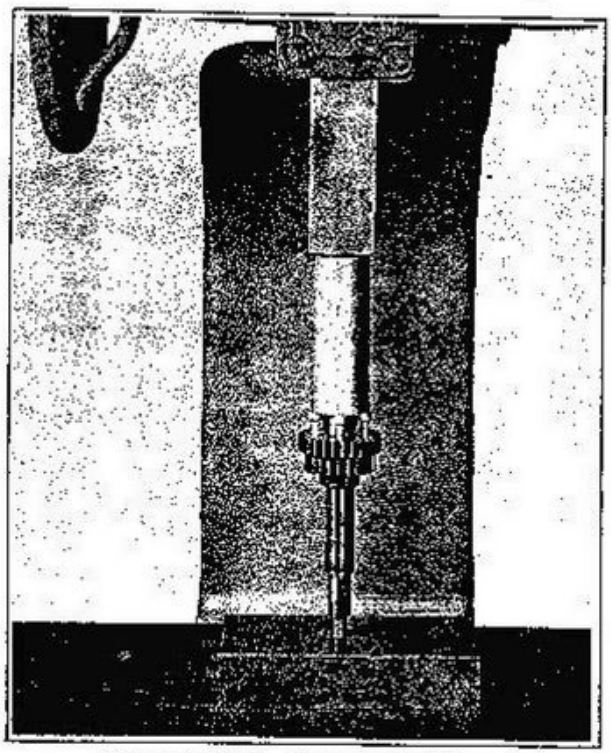


Figure 4D-35A. Pressing 2nd Gear from Mainshaft (1969-72)

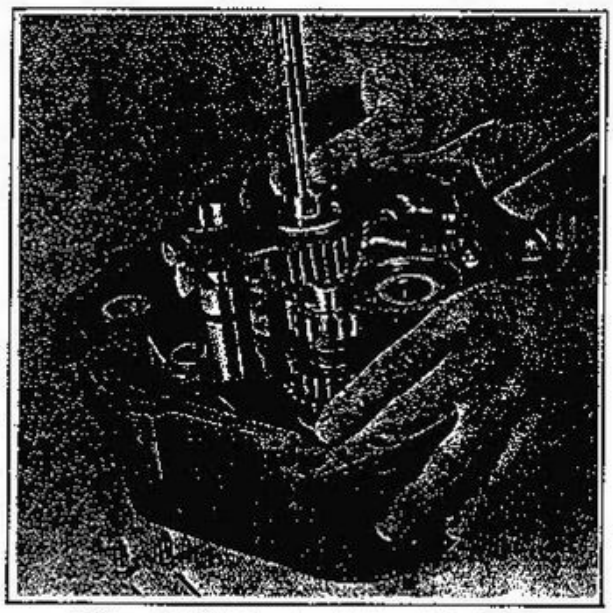


Figure 4D-36. Countershaft and Mainshaft Assembly (1972 & Earlier)

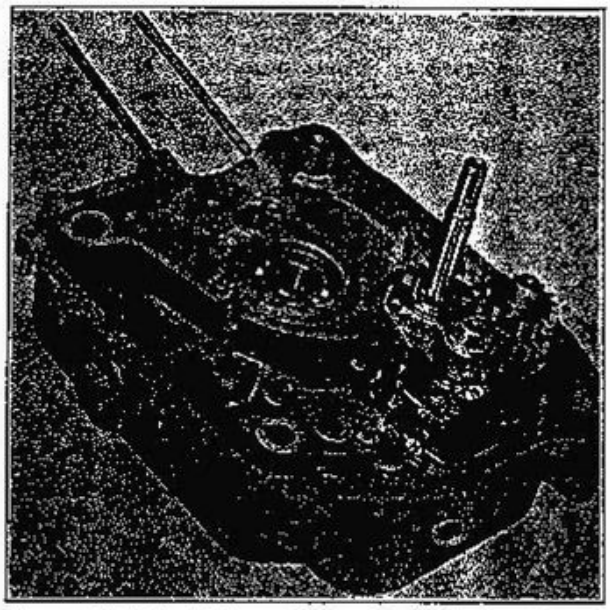


Figure 4D-36A. 1973 and Later Transmission Gears Assembled in Right Crankcase in Neutral Gear

from splines. Install key (23A) in shaft keyway (if used) and press third gear (23) with teeth toward second gear, against shoulder on countershaft; install key (22A) in shaft keyway (if used) and press fourth gear (22), with teeth away from third gear, against third gear. Install shifter clutch (21) and position first gear (20) on countershaft with recessed side of gear away from shifter clutch.

Insert shifter fork (6) in shifter clutch (21) with shoulder on fork toward second gear (24).

Simultaneously install countershaft assembly (7) with low gear side going in countershaft bearing (33) in right crankcase and shifter fork (6) on shifter cam (14). See Figure 4D-36. Tap countershaft into position if necessary.

MAINSHAFT

If gears have been removed from mainshaft, proceed as follows:

On 1972 and earlier models, install third gear (18) on mainshaft (19) with recessed side of gear away from the splines. On 1969-72 models, install thrust washer (18C) and lock ring (18B). Press on second gear (17) with teeth toward third gear (18), against shoulder or lock ring on mainshaft. Press on first gear (16 or 16A) with bearing side facing out. Install shifter clutch (15) on mainshaft, and low gear shim (16C) (if used).

Insert shifter fork (6) in shifter clutch (15) with shoulder on fork away from third gear (18). Simultaneously install mainshaft assembly (5) in right crankcase bearing (31) and shifter fork (6) on shifter cam (14) as shown in Figure 4D-36. Tap mainshaft into position if necessary. Install mainshaft low gear lock ring (16B) (if used). Check low gear end play and reduce to minimum by selection of variable thickness shims (16C), if used between sprocket gear and bearing.

Align shifter fork pin holes with corresponding grooves in shifter cam by rotating cam. Install shifter fork pins (4) and new cotter pins (3).

Select correct washers (1) and (2) as described in "Determining Shifter Cam, Countershaft and Sprocket Gear Spacer Washers."

Position shifter cam (1) and countershaft (2) thrust washers on respective shafts.

INSTALLING GEARS (1973 AND LATER)

On 1973 and later models, preassemble mainshaft and countershaft as follows:

MAINSHAFT

Install mainshaft third gear (18E) with driving lugs away from shoulder on mainshaft. Install lock ring (18D) into groove on mainshaft to retain gear. Install mainshaft fourth gear (15A) with shifter fork groove facing mainshaft third gear (18E).

COUNTERSHAFT

Install countershaft fourth gear (22C) on countershaft with driving lugs toward shoulder on countershaft. Install lock ring (22D). Press countershaft fifth gear (22B) on shaft splines, flat side facing out. Install countershaft third gear (24E) with shifter fork groove toward fourth gear. Install lock ring (24D) countershaft second gear (24C), washer (24F) (if used), and lock ring (24B). Install shifter clutch (21) with flat side toward second gear.

Select correct countershaft spacer washer (20B) as described in "Determining Shifter Cam, Countershaft and Sprocket Gear Spacer Washers." Apply a coat of grease on selected washer (20B) and place over end of countershaft against countershaft first gear. Apply a coat of grease to 0.9 MM thrust washer (16C) and place over end of mainshaft against shoulder of gear hub.

Assemble shifter forks into grooves of correct gears shouldered side of hubs out (see Figure 4D-36A).

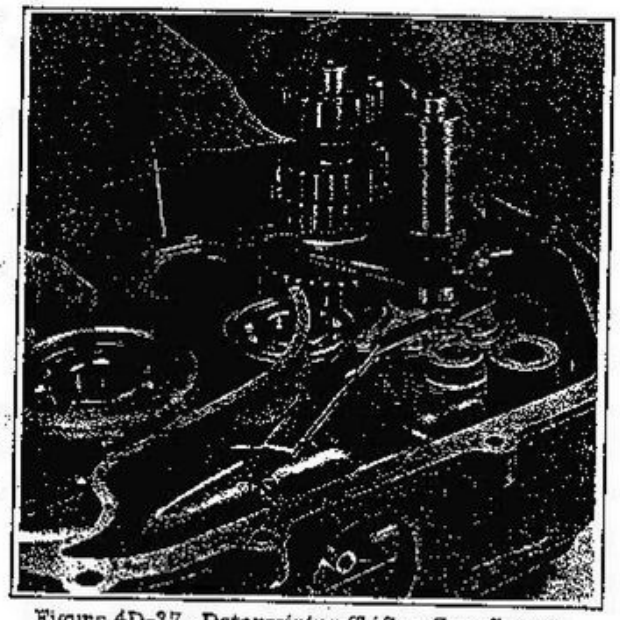


Figure 4D-37. Determining Shifter Cam Spacer Thickness (1972 & Earlier)

Shifter fork (6A) fits into countershaft shifter clutch (21) groove. Shifter fork (6B) fits into countershaft third gear (24E) groove. Shifter fork (6C) fits into mainshaft fourth gear (15A) groove. Holding both shaft assemblies in hands, assemble them into the right crankcase, slipping shifter forks onto shifter cam (14). When mainshaft and countershaft have been started into bearings in right crankcase, tap on shafts alternately until both shafts are seated against bearings.

Align shifter forks with cam slots by rotating shifter cam and insert shifter fork pins (4). See that cotter pin holes line up when insertion is made so that cotter pins will enter holes when pins get to correct depth. Bend cotter pins partially open.

Install selected thickness spacer washers (1 and 2) over ends of shifter cam and countershaft.

INSTALLING SPROCKET GEAR

Place sprocket spacer (28) into oil seal (29) and sprocket gear (26) with spacer washer (27) into bearing (30) on left side crankcase. On 1973 models, spacer washer (27) thickness must be determined as described under "Determining Shaft End Play."

NOTE

On 1968 and earlier models, if new sprocket gear, new sprocket gear bushings, or new mainshaft are being installed, sprocket bushings must be reamed to provide correct clearance on shaft. Assemble sprocket, nut lock and nut, tighten assembly securely in left crankcase. Then ream bushings with Part No. 94806-63 Sprocket Gear Bushing Reamer. This will insure correct fit on mainshaft when it is installed later.

Reassemble crankcase as described in "Assembling Crankcase", Section 3E.

DETERMINING SHAFT END PLAY AND SPACER WASHER THICKNESSES

Remove flywheel from left case as described in "Disassembling Crankcase," Section 3E. Make sure all bearings are pressed all the way into their respective seats. This is important.

1. Countershaft End Play

Install countershaft assembly, complete with gears, into right side crankcase. On 1970 and earlier models, use no spacer washer. On 1971 and later models, use original spacer washer or 1.0 MM thick provisional spacer washer (20B) against right crankcase.

Install gasket on crankcase.

Position left crankcase on right crankcase and secure with two bolts.

Use a dial indicator on countershaft end with base fastened to right or left crankcase to determine shaft end play as shown in Figure 4D-38.

Move shaft to extreme ends of travel as shown and use the necessary thickness spacer washers to obtain correct end play. Check end play several times to verify the accuracy of dial indicator readings.

Countershaft end play specification is .004 to .008 in. End play is measured from right side of crankcase and shimmed on left side. Countershaft can be lifted using a long screwdriver inserted thru the hole in cylinder base mounting pad. End of screwdriver should be positioned underneath countershaft high gear. Add correct thickness spacer washer (2) to obtain correct end play. See spacer washer size chart.

2. Shifter Cam Spacing

Assemble shifter cam, countershaft, and mainshaft into right crankcase as described previously under "Assembling Crankcase." It is not necessary to install cotter pins in shifter fork pins. Use original spacer washer or 0.6 MM spacer washer (13) between lock ring and bushing of shifter cam. Place transmission shifter in neutral gear position. With transmission in neutral gear (all shifter clutches of

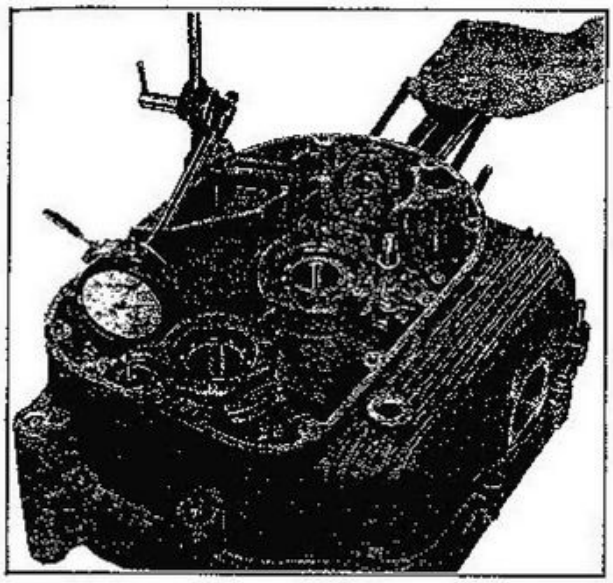


Figure 4D-38. Determining Countershaft End Play

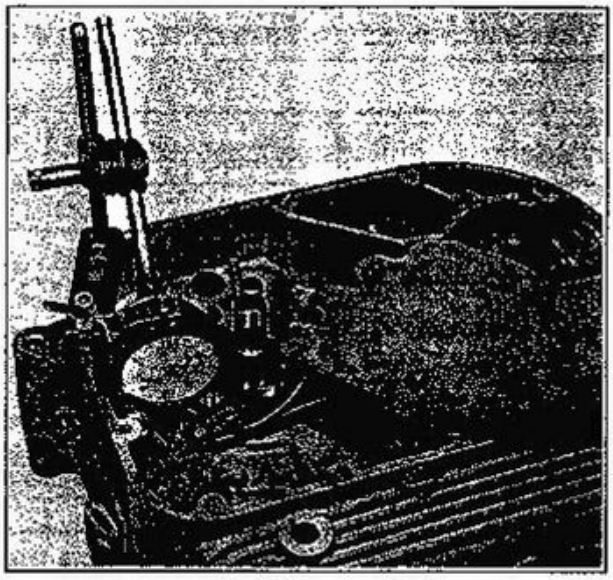


Figure 4D-39. Determining Shifter Cam End Play

gears disengaged), check to see that there is equal clearance between driving lugs of 1972 and earlier shifter clutch (21) and adjacent gears (Figure 4D-37) or between countershaft third gear and adjacent gears on 1973 and later models (Figure 4D-36A). Use thicker or thinner spacing washer (13) to obtain equal spacing. See spacer washer size chart. Also check clearances between driving lugs of remaining engaging gears to see that there is adequate clearance. Usually trouble in this area is caused by bent or excessively worn shifter forks which must be replaced.

3. Shifter Cam End Play

Assemble transmission with selected countershaft spacer washers and shifter cam spacing washer per steps 1 and 2. Install gasket on crankcase, position left crankcase on right crankcase and secure with two bolts.

Use a dial indicator with base fastened to right crankcase as shown in Figure 4D-39, to determine shifter cam end play. Shifter cam end play specification is .004 to .008 in. and should be shimmed to obtain this end play with variable thickness washers (1). See spacer washer size chart.

4. Sprocket Gear

End play specifications is .008 to .010 in. End play is measured from left side (sprocket side) of crankcase and shimmed on right side. See Figure 4D-40.

If actual end play is outside specified limits as determined by dial indicator reading, select the correct variable thickness spacer (27) which will bring the end play into specified limits. See following size chart.

After correct shims have been selected, again assemble the crankcase temporarily with 2 opposite screws and recheck end play of shafts. This is important.

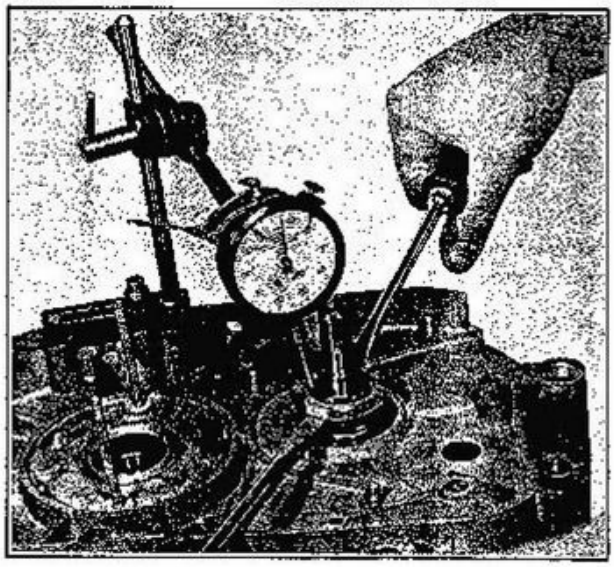


Figure 4D-40. Determining Sprocket Gear End Play

TRANSMISSION SHIM WASHER SIZES X = 1971 & LATER SX, 1972 & LATER SS, O = 1973 & LATER ONLY

SIZE		RIGHT SIDE			LEFT SIDE		
MM	IN.	SHIFTER CAM	COUNTER-SHAFT	MAIN SHAFT	SHIFTER CAM	COUNTER-SHAFT	MAIN SHAFT
.1	.004					X	
.2	.008			X	X	X	
.25	.010			X			
.3	.012	X		X,O		X	
.35	.014			X			
.4	.016			X,O	X	X	
.5	.020	X		O		X	
.6	.024			O	X	X	
.7	.028	X		O		X	
.8	.032			O	X	X	
.9	.036	X		O	X		
1.0	.040	X		O	X		
1.1	.044	X		O	X		
1.2	.048	X		O	X		

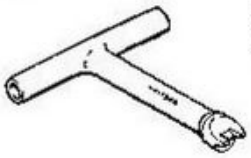
NOTE

Crankshaft end play and correct spacing washers can be determined at this time also. See "Assembling Crankcase", Section 3E.

After correct end play has been determined for all shafts reassemble crankcases with crankshaft installed as described in Section 3E, install starter as described in Section 4C, install shifter pawl carrier and drive sprocket as described in this section.

SERVICE TOOLS

94670-66P CLUTCH RELEASING DISC NUT WRENCH

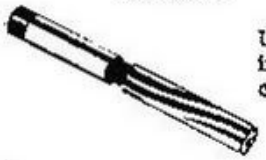


For 1969 and later clutch pressure plate nuts.

94806-63 SPROCKET GEAR BUSHING REAMER

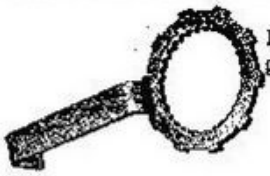
This reamer is used to ream the sprocket gear bushings, whenever bushings or gears have been renewed. Sprocket gear and spacer washer must be installed in crankcase bearing, with sprocket and sprocket spacer. Draw sprocket nut down tight, before reaming.

94806-64 TRANSMISSION GEAR BUSHING REAMER



Used to size replacement bushings in mainshaft 3rd gear and countershaft 1st and 2nd gears.

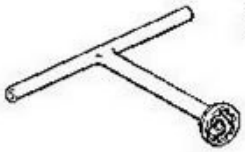
97177-69P CLUTCH LOCK TOOL



Locks clutch hub and shell together for removing hub nut.

(1969 and Later)

97235-66P CLUTCH SHELL NUT WRENCH



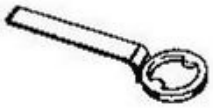
Used to remove keyed nut holding clutch shell.

(1969 and Later)

97291-61PA CLUTCH HUB HOLDING TOOL

Used to hold clutch hub when removing or installing sprocket or clutch hub nut.

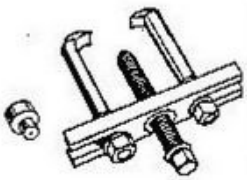
SPROCKET HOLDING TOOL



Used to hold transmission sprocket when removing shaft nut.

97297-66P For 15 T. Sprocket
97298-66P For 16 T. Sprocket
97299-66P For 17 T. Sprocket
97304-69P For 14 T. Sprocket

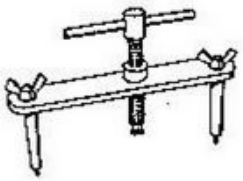
97292-61 TWO JAW PULLER - SPRINT



Used for a variety of applications such as pulling Sprint oil pump gear, mainshaft sprocket, bearings. Includes center cap used when pulling oil pump drive gear from shaft.

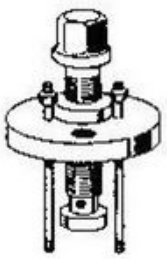
95652-43A Cap

97293-61P CLUTCH SPRING COMPRESSOR - SPRINT

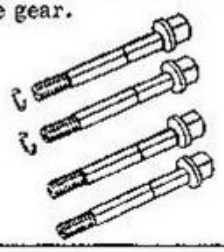


Use to compress 1961-68 clutch spring so that clutch may be disassembled. It is also used to press the transmission mainshaft from the crankcase ball bearings.
The end bolts screw into the screw holes on crankcase. Turning center screw compresses spring for easy removal of stud nuts or lock ring.

97294-61B CRANKSHAFT PINION GEAR AND CLUTCH HUB PULLER



Pulls clutch drive gear and clutch hub from transmission shaft splines.
52081-63P bolts - 2 rqd. for 1973 and later SS/SX clutch drive gear.



97318-61P CAMSHAFT CRANKCASE BUSHING, AND SHIFTER CAM LEFT CRANKCASE BUSHING REAMER SET

Reamer is used with large pilot to line ream replacement camshaft bushing. This tool is also used with small pilot to line ream left (small) crankcase shifter cam bushing.

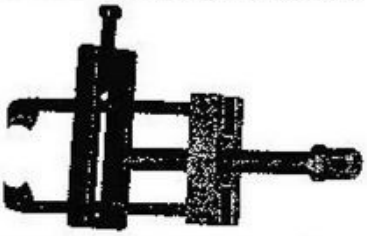
97322-61P SHIFTER CAM RIGHT BUSHING REAMER

Reamer is used to line ream replacement right (large) shifter cam bushing. Reamer pilots in left crankcase hole without bushing installed.

97307-73P DRIVE SPROCKET HOLDING TOOL

Used to hold sprocket while removing shaft nut.

97309-73P STARTER DRIVE PULLER



Used to pull electric starter drive clutch.

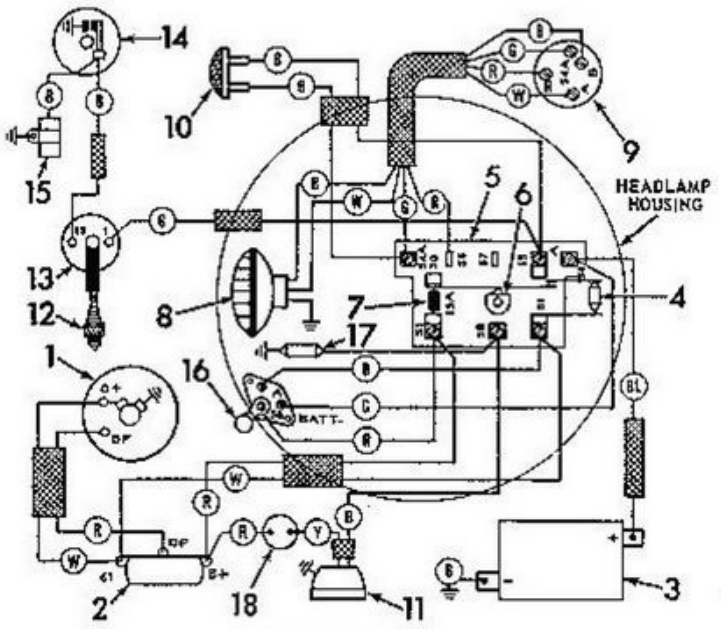
97308-73P STARTER DRIVE INSTALLING TOOL

Used to install electric starter drive clutch.

ELECTRICAL 5

TABLE OF CONTENTS

1. Generator
2. Regulator
3. Battery (6V.)
4. Warning Lamp (1.5 Watts)
5. Ignition-Light Switch Board
6. Ignition-Light Switch
7. Fuse (15 A)
8. Headlamp Unit
9. Headlamp Dimmer and Horn Switch
10. Horn
11. Tail and Stop Lamp
12. Spark Plug
13. Ignition Coil
14. Circuit Breaker
15. Condenser
16. Emergency Starting Switch
17. Speedometer Lamp
18. Stoplight Switch



KEY TO COLOR CODE

(B) BLACK	(BL) BLUE	(G) GREEN	(R) RED	(W) WHITE	(Y) YELLOW

Figure 5B-11. Wiring Diagram (1961-62)

WIRING DIAGRAM KEY

1 Generator
2 Regulator
3 Battery (6V.)
4 Warning Lamp (1.5 Watts)
5 Ignition-Light Switch Board
6 Ignition-Light Switch
7 Fuse (20 A)
8 Headlamp Unit
9 Headlamp Dimmer and Horn Switch
10 Horn
11 Tail and Stop Lamp
12 Spark Plug
13 Ignition Coil
14 Circuit Breaker
15 Condenser
16 Emergency Starting Switch
17 Speedometer Lamp
18 Stoplight Switch
19 Terminal Board

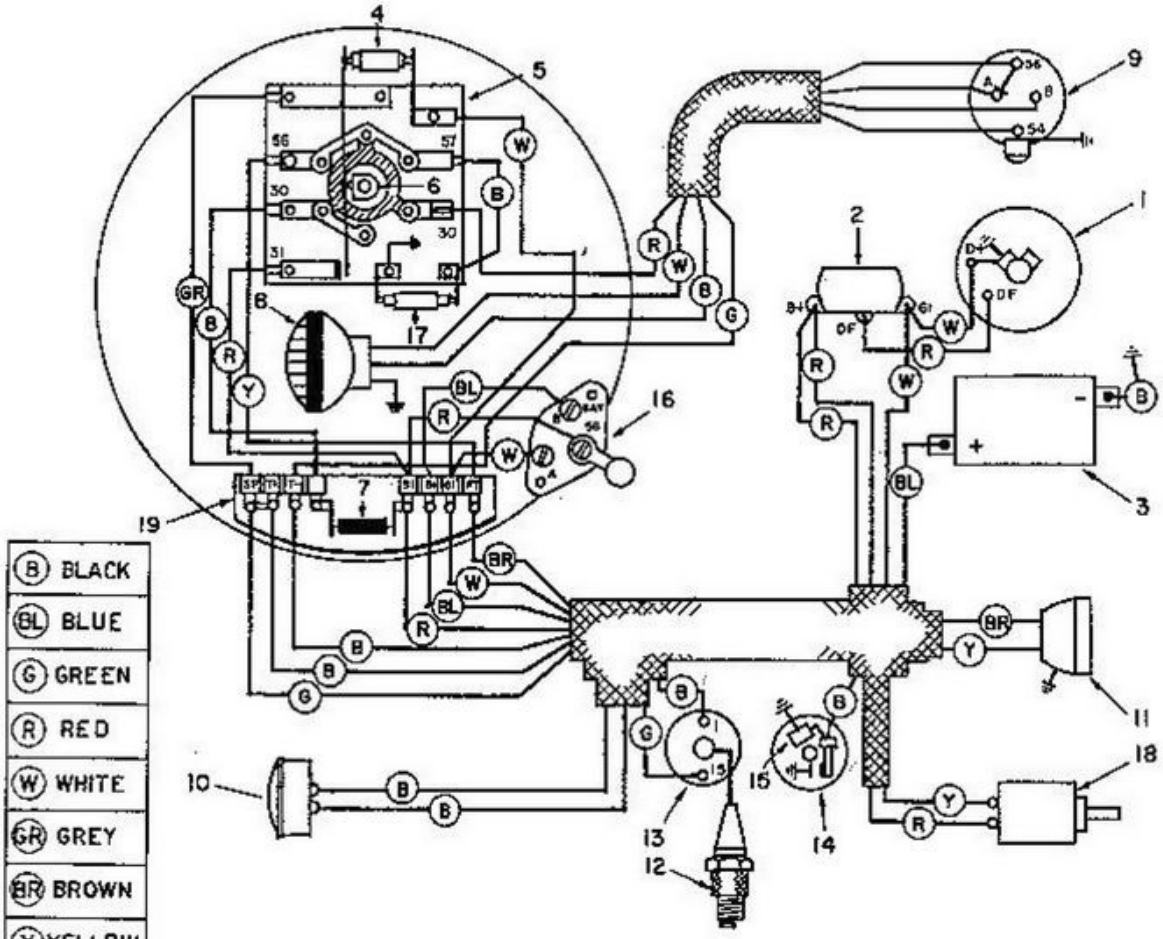
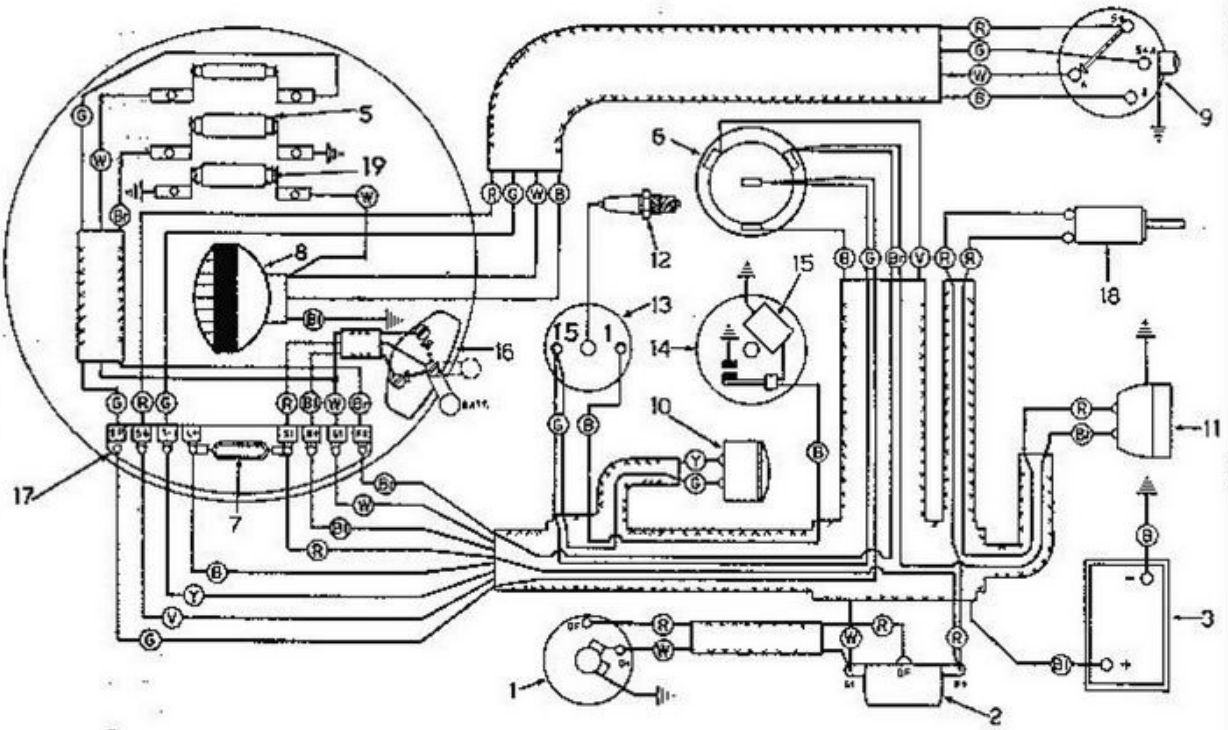


Figure 5B-13. 1962 Model H, 1963 Models C & H

WIRING DIAGRAM KEY

1. Generator
2. Regulator
3. Battery (6V.)
4. Warning Lamp (1.5 Watts)
5. Speedometer Lamp (3 Watts)
6. Ignition-Light Switch
7. Fuse (20 A)
8. Headlamp Unit
9. Headlamp Dimmer and Horn Switch
10. Horn
11. Tail and Stop Lamp
12. Spark Plug
13. H.T. Ignition Coil
14. Circuit Breaker
15. Condenser
16. Emergency Starting Switch (1964 & earlier)
17. Terminal Board
18. Stoplight Switch
19. High Beam Indicator Lamp (Late 1966)

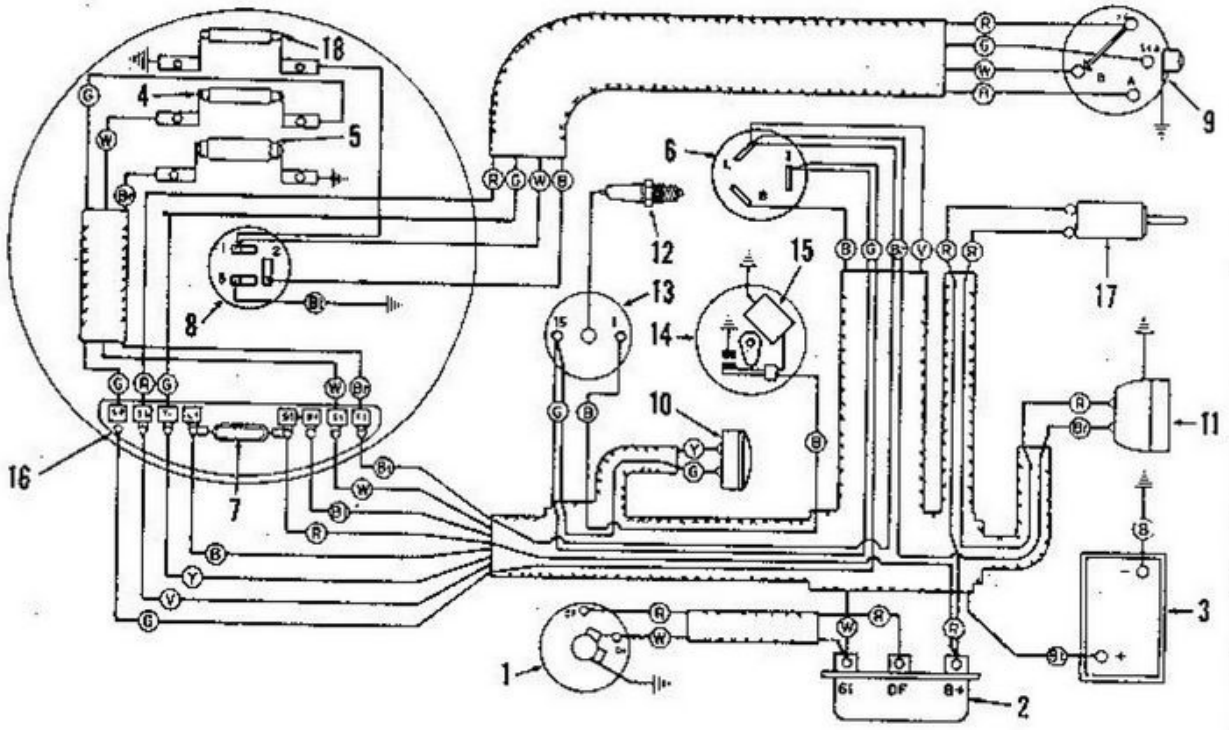


KEY TO COLOR CODE	
B Black	R Red
Bl Blue	V Violet
Br Brown	W White
G Green	Y Yellow

Figure 5B-13A. 1964 to 1966 Models C and H

WIRING DIAGRAM KEY - 1967-68 MODEL H

1. Generator
2. Regulator
3. Battery (6 Volt)
4. Warning Lamp (1.5 Watts)
5. Speedometer Lamp (3 Watts)
6. Ignition - Light Switch
7. Fuse (20A)
8. Headlamp Unit
9. Headlamp Dimmer and Horn Switch
10. Horn
11. Tail and Stop Lamp
12. Spark Plug
13. H.T. Ignition Coil
14. Circuit Breaker
15. Condenser
16. Terminal Board
17. Stoplight Switch
18. High Beam Indicator Lamp (1.5 Watt)

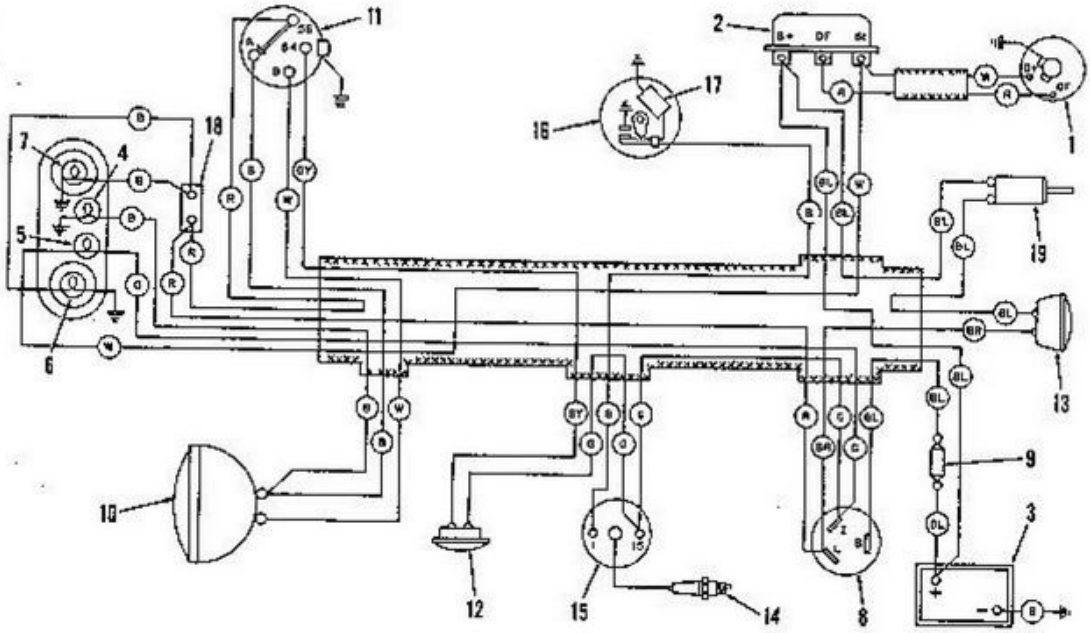


KEY TO COLOR CODE			
(B)	Black	(R)	Red
(Bl)	Blue	(V)	Violet
(Br)	Brown	(W)	White
(G)	Green	(Y)	Yellow

Figure 5B-13B. 1967-68 Sprint H Wiring Diagram

WIRING DIAGRAM KEY - 1967-68 MODEL SS

1. Generator
2. Regulator
3. Battery (6 Volts)
4. High Beam Indicator Lamp (1.5 Watts)
5. Generator Warning Lamp (1.5 Watts)
6. Speedometer Lamp (3 Watts)
7. Tachometer Lamp (3 Watts)
8. Ignition - Light Switch
9. Fuse (20 Amp.)
10. Headlamp
11. Headlamp Dimmer and Horn Switch
12. Horn
13. Tail and Stop Lamp
14. Spark Plug
15. Ignition Coil
16. Circuit Breaker
17. Condenser
18. Terminal Strip
19. Stoplight Switch



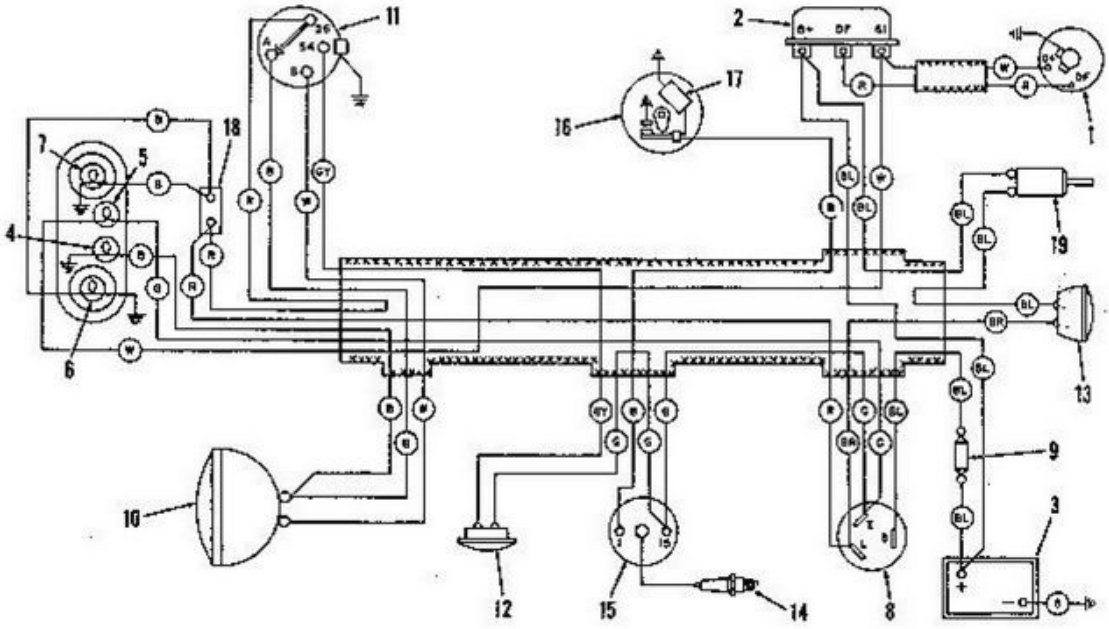
KEY TO COLOR CODE			
BL	Blue	GY	Gray
BR	Brown	R	Red
G	Green	W	White
B	Black		

Figure 5B-13C. 1967-68 Spring SS Wiring Diagram

Revised: 9-68

WIRING DIAGRAM KEY - 1969 MODEL SS

1. Generator
2. Regulator
3. Battery (6 Volts)
4. High Beam Indicator Lamp (1.5 Watts)
5. Generator Warning Lamp (1.5 Watts)
6. Speedometer Lamp (3 Watts)
7. Tachometer Lamp (3 Watts)
8. Ignition - Light Switch
9. Fuse (15 Amp.)
10. Headlamp
11. Headlamp Dimmer and Horn Switch
12. Horn
13. Tail and Stop Lamp
14. Spark Plug
15. Ignition Coil
16. Circuit Breaker
17. Condenser
18. Terminal Strip
19. Stoplight Switch

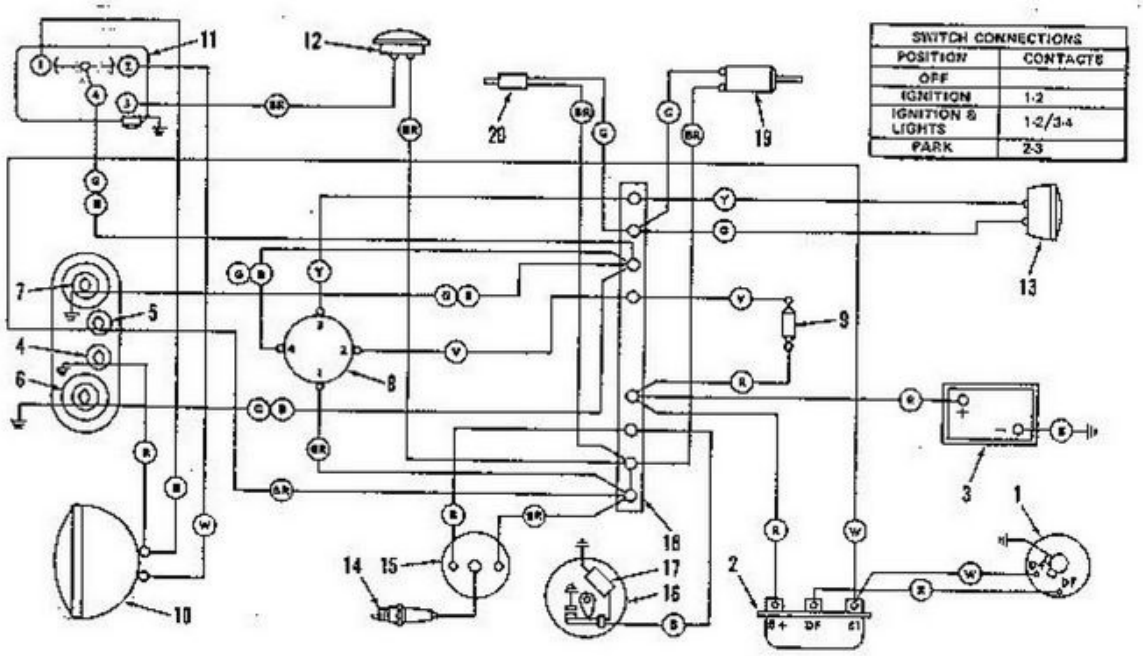


KEY TO COLOR CODE			
BL	Blue	GY	Gray
BR	Brown	R	Red
G	Green	W	White
B	Black		

Figure 5B-13C. 1969 Sprint SS Wiring Diagram

WIRING DIAGRAM KEY - 1970-71 Model SS

1. Generator
2. Regulator
3. Battery (6 Volts)
4. High Beam Indicator Lamp (1.5 Watts)
5. Generator Warning Lamp (1.5 Watts)
6. Speedometer Lamp (3 Watts)
7. Tachometer Lamp (3 Watts)
8. Ignition-Light Switch
9. Fuse (15 Amp.)
10. Headlamp
11. Headlamp Dimmer and Horn Switch
12. Horn
13. Tail and Stop Lamp
14. Spark Plug
15. Ignition Coil
16. Circuit Breaker
17. Condenser
18. Terminal Block
19. Stoplight Rear Switch
20. Stoplight Front Switch

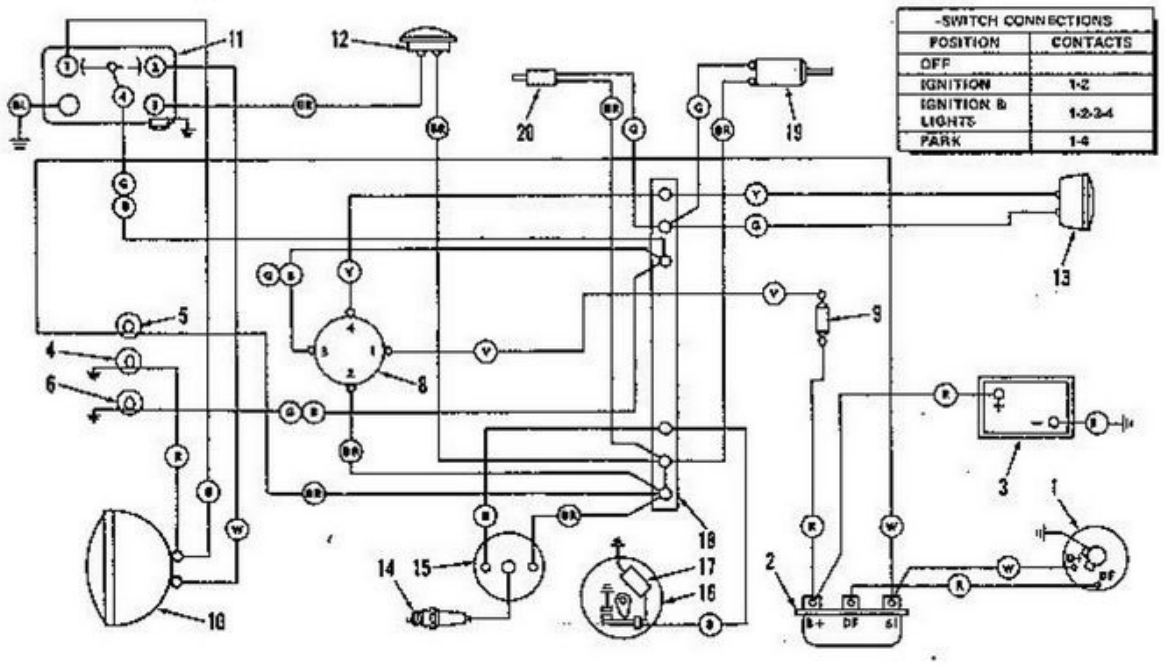


COLOR CODE KEY		
BL Blue	B Black	W White
G Green	R Red	Y Yellow
BR Brown	G B Green Black Tracer	V Violet

Figure 5B-13D. 1970-71 Sprint SS Wiring Diagram

WIRING DIAGRAM KEY - 1971-72 Model SX, 1972 SS

1. Generator
2. Regulator
3. Battery (6 Volts)
4. High Beam Indicator Lamp (1.5 Watts)
5. Generator Warning Lamp (1.5 Watts)
6. Speedometer Lamp (3 Watts)
8. Ignition-Light Switch
9. Fuse (15 Amp.)
10. Headlamp
11. Headlamp Dimmer and Horn Switch
12. Horn
13. Tail and Stop Lamp
14. Spark Plug
15. Ignition Coil
16. Circuit Breaker
17. Condenser
18. Terminal Block
19. Stoplight Rear Switch
20. Stoplight Front Switch



COLOR CODE KEY		
BL Blue	B Black	W White
G Green	R Red	Y Yellow
BR Brown	G B Green Black Tracer	V Violet

Figure 5B-13E. 1971-72 Sprint SX, and 1972 SS Wiring Diagram

WIRING DIAGRAM KEY

1. Alternator
2. Rectifier-Regulator
3. Battery (12 Volts)
4. High Beam Indicator Lamp (3 Watts)
5. Generator Warning Lamp (1.5 Watts)
6. Speedometer Lamp (3 Watts)
7. Tachometer Lamp (3 Watts) (SS only)
8. Ignition-Light Switch
9. Fuse (25 Amp.)
10. Headlamp (35/35 Watts)
11. Headlamp Dimmer, Horn, and Direction Signal Switch
12. Horn
13. Tail and Stop Lamp (5/21 Watts)
14. Spark Plug
15. Ignition Coil
16. Ignition Circuit Breaker
17. Condenser
18. Connector
19. Stoplight Rear Switch
20. Stoplight Front Switch
21. Starter Button
22. Starter Motor
23. Starter Solenoid
24. Direction Signal Flasher
25. Direction Signal Pilot Lamp (3 Watts)
26. Right-Front Signal Lamp (21 Watts)
27. Left-Front Signal Lamp (21 Watts)
28. Right-Rear Signal Lamp (21 Watts)
29. Left-Rear Signal Lamp (21 Watts)

COLOR KEY

BK	BLACK	V	VIOLET
BE	BLUE	A	AZURE (Light Blue)
G	GREEN	B | A	BLACK AND AZURE
BN	BROWN	Y | G	YELLOW AND GREEN
W	WHITE	W | BK	WHITE AND BLACK
GY	GRAY	R | BK	RED AND BLACK
R	RED	G | BK	GREEN AND BLACK
Y	YELLOW		

IGNITION SWITCH CONTACTS

SWITCH POSITION	CONNECTS TERMINALS
OFF	NONE
IGNITION	1 - 2/6 - 7
IGN. & LIGHTS	1 - 2 - 3/4 - 5/6 - 7/8 - 9
PARK	5 - 10

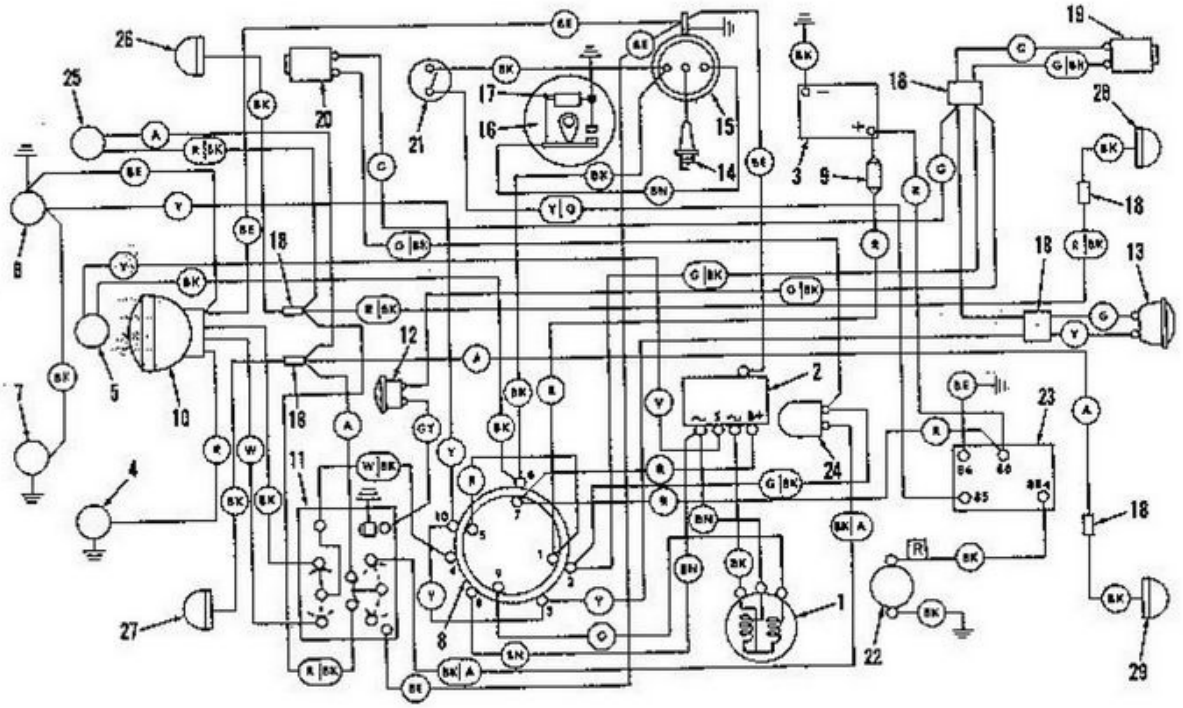


Figure 5B-13F. 1973 Sprint SS/SX Wiring Diagram

WIRING DIAGRAM KEY

1. Alternator
2. Rectifier-Regulator
3. Battery (12 Volts)
4. High Beam Indicator Lamp (3 Watts)
5. Generator Warning Lamp (1.5 Watts)
6. Speedometer Lamp (3 Watts)
7. Tachometer Lamp (3 Watts) (SS only)
8. Ignition-Light Switch
9. Fuse (25 Amp.) (2)
10. Headlamp (35/35 Watts)
11. Headlamp Dimmer, Horn, and Direction Signal Switch
12. Horn
13. Tail and Stop Lamp (5/21 Watts)
14. Spark Plug
15. Ignition Coil
16. Ignition Circuit Breaker
17. Condenser
18. Connector
19. Stoplight Rear Switch
20. Stoplight Front Switch
21. Starter Button
22. Starter Motor
23. Starter Solenoid
24. Direction Signal Flasher
25. Direction Signal Pilot Lamp (3 Watts)
26. Right-Front Signal Lamp (21 Watts)
27. Left-Front Signal Lamp (21 Watts)
28. Right-Rear Signal Lamp (21 Watts)
29. Left-Rear Signal Lamp (21 Watts)

COLOR KEY

BK	BLACK	GY	GRAY	B | A	BLACK AND AZURE
BE	BLUE	R	RED	Y | G	YELLOW AND GREEN
G	GREEN	Y	YELLOW	W | BK	WHITE AND BLACK
BN	BROWN	V	VIOLET	R | BK	RED AND BLACK
W	WHITE	A	AZURE (Lt. Blue)	G | BK	GREEN AND BLACK

IGNITION SWITCH CONTACTS

SWITCH POSITION	CONNECTS TERMINALS
OFF	NONE
IGNITION	1 - 2/6 - 7
IGN. & LIGHTS	1 - 3 - 3/4 - 5/6 - 7/8 - 9
PARK	5 - 10

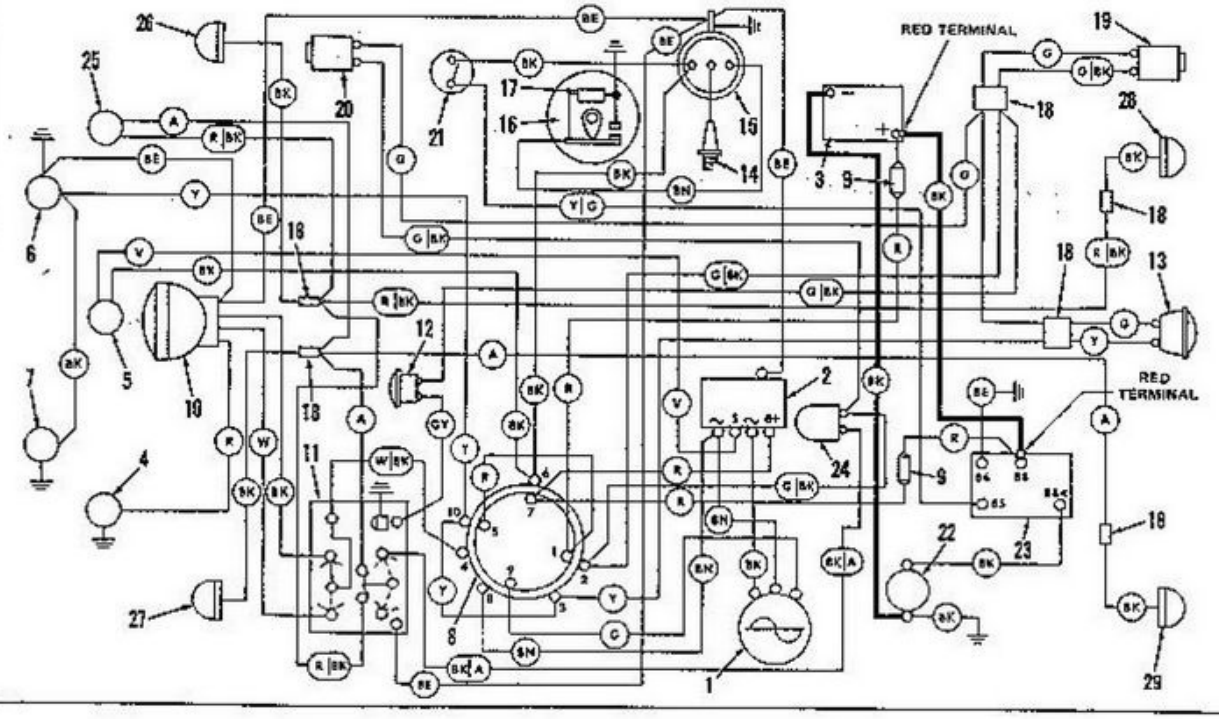


Figure 5B-13G. 1974 Sprint SS/SX Wiring Diagram

SWITCHES

IGNITION-LIGHT SWITCH
(1963 & Earlier)

The switch, located in the center of the headlamp housing is a combination ignition and light switch. It has three positions, and is operated with a removable key.

This key closes the ignition and horn circuits and operates the light switch. The key must be plugged in and pushed down before the engine can be started and kept running. Push key down and turn clockwise (to the right) to operate the headlamp, ignition, and tail lamp. Push key down and turn counterclockwise (to the left) to operate parking lights only.

DISASSEMBLING IGNITION-LIGHT SWITCH (See Figure 5C-3)

Disconnect battery by removing + terminal wire.

Remove headlamp as described in "Replacing and Installing Headlamp", Section 5D, and lay aside. Using a short screwdriver, remove two small screws and washers (1) (holds switch to housing) from inside of headlamp housing. Hold switch and remove key; free switch from housing being careful not to drop parts. Remove washer (3), spring (4), hex (5), fiber washer (6), bakelite contact (7) and spacer (8). Remove wires from switch terminals. Remove fuse (9) and generator signal light (10) from switch body (11).

CLEANING AND INSPECTION

Wash all parts in cleaning solvent and dry with compressed air. Inspect all parts, particularly contacts on switch and buttons on bakelite. Inspect contact points on bottom of switch for pitting, make sure they close when key is inserted and open when key is removed.

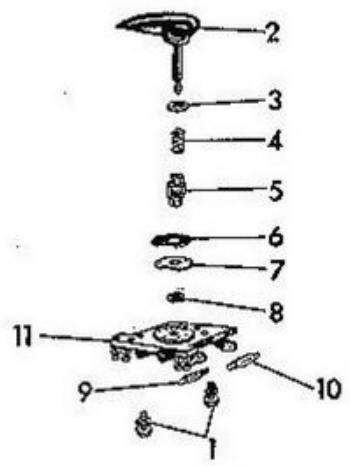
Replace all parts that are worn.

Component parts of switch body (11) are not available separately. If body is defective, it must be replaced as a unit.

ASSEMBLING IGNITION-LIGHT SWITCH (See Figure 5C-3)

Install fuse (9) and generator signal light (10). Install all wires in terminals as shown in "Wiring Diagram", Section 5B; then secure wires. Apply a light coat of grease on switch contacts.

Place fiber washer (6) on plain side of bakelite contact (7); insert hex (5) into contact assembly so that slot on hex is on plain side of contact and at 90° with center of cutout portion. Install spacer (8) on hex (against contact). Install assembly in body (11), button side down, so that lug on body is engaged in cutout on contact. Install spring (4) on hex and washer



1. Mounting Screws and Washers (2)
2. Key
3. Washer
4. Spring
5. Hex
6. Fiber Washer
7. Bakelite Contact
8. Spacer
9. Fuse
10. Generator Signal Light
11. Switch Body

Figure 5C-3. Ignition-Light Switch (1963 & earlier)

(3) on spring. Carefully place assembly into housing and install key to align parts and to help hold in position. Secure assembly with screws and washers (1). Replace headlamp sealed unit as described in "Replacing and Installing Headlamp", Section 5D. Reconnect battery wire.

IGNITION-LIGHT SWITCH (1964 and Later)

On 1964 and later models, key operated ignition-light switch is located on left side panel in front of battery box. Switch is not repairable and must be replaced as a unit if defective.

HEADLAMP DIMMER AND HORN SWITCH

The headlamp dimmer switch and horn button are combined in one unit located on the left handlebar. High and low beams are operated with flip switch. Button operates horn.

1961 to early 1969 switch can be disassembled for repair as follows:

Disconnect battery by removing + terminal wire.

Remove clamping screws and separate parts of switch: cover, switch and base. Remove wires from switch.

Clean brass terminals.

Check switch for wear, and replace switch if it will not stay in high or low beam position. Check spring tension on horn button.

Replace worn or broken parts with a new switch or base.

Place base over wire and assemble wires into bottom of switch as shown on wiring diagram in Section 5B, "WIRING."

Secure wires by tightening terminal screws.

Align base on handlebar with wires engaged in cutout on base. Position switch on base with switch lever pointing to rear of motorcycle. Install cover and secure assembly with screws drawing down evenly.

CAUTION

Do not over tighten screws or plastic body may crack.

Connect battery wire.

NOTE

Late 1969 and later switch is not repairable and must be replaced as a unit if defective.

EMERGENCY STARTING SWITCH
(1964 & Earlier Models)

The emergency starting switch is located on the left side of the headlamp body. For normal operation, the switch lever should be down in the "BATT" position.

If the warning lamp does not light with plugged in ignition-light switch key and with emergency switch in the "BATT" position, with engine stopped - the battery is probably dead.

To start the engine with a dead battery, move the switch lever up to the "GEN" or "DIN" position.

Engage transmission in high gear and, with clutch disengaged, push motorcycle. Momentarily engage clutch to start the engine. After starting, immediately move the emergency starting switch lever back to the "BATT" position to charge the battery.

CAUTION

Do not operate the motorcycle with the emergency starting switch in "GEN" or "DIN" position and lights on, because the lamp bulb filaments will burn out.

DISASSEMBLING EMERGENCY STARTING SWITCH

Disconnect battery wire. Remove headlamp sealed unit and lay aside. See "Replacing and Installing Headlamps", Section 5D. Place switch in "GEN" or "DIN" position. Loosen headlamp mounting bolt and tilt headlamp housing up so that switch mounting screws can be removed. After removing screws and washer twist switch and remove from headlamp housing; free wire from side clamp. Remove wires from switch terminals.

CLEANING AND INSPECTION

Clean brass terminal if covered with dirt.

Check switch for wear and replace switch if it will not stay in either position.

ASSEMBLING EMERGENCY STARTING SWITCH

Insert all wires in terminals as shown in "Wiring Diagram", Section 5B, and secure with terminal screws. Install switch into headlamp housing (plain side facing out) and secure with washers and screws. Reconnect battery wire and place switch in "BATT" position. Replace and adjust headlamp as described in "Replacing and Installing Headlamp", Section 5D.

STOP LIGHT SWITCH

The rear stop light switch is located at rear brake crossover shaft lever. The front stop light switch is located on the front brake handlever bracket.

(1961-68 Rear Stop Light Switch)

Remove acorn nuts, lock washers and plain washers; to free switch. Remove screws and washers from switch and disassemble as follows: Separate base and gasket from switch. Remove switch plunger. Pull out brass terminals, spring and spring caps from switch.

Thoroughly clean all parts, especially spring, spring caps and brass terminals. Check terminals to see if wires are securely soldered; if not, resolder wires.

Insert brass terminals into switch with cutout side of terminal going in first. Place spring caps on spring. Compress spring and insert into switch between brass terminals. Place a small amount of grease on plunger and install in switch. Compress plunger a few times to see if it works freely (plunger may catch on brass terminal). Place plastic gasket and base on switch; insert screws and washers and align assembly. Place flat washers, lock washers and acorn nuts on screws; adjust switch so taillamp will go on when rear brake is applied. Then tighten acorn nuts.

(1969 and Later Front and Rear Stop Light Switches)

These switches are not repairable and must be replaced as a unit if defective.

LAMPS

GENERAL

The headlamp is of the sealed-beam type. It was especially designed and specially made for your Harley-Davidson. Do not attempt to use an automobile sealed-beam unit because the current requirements are different and damage to battery or generator will result. If either filament burns out, or the lens breaks, the entire unit must be replaced.

REPLACING AND INSTALLING HEADLAMP

When replacement is required, use only the prescribed sealed-beam unit. To replace the Model C or H unit, remove the headlamp door screw located beneath the headlamp housing. Simultaneously lift and swing unit up and free from headlamp body. Remove retaining springs from headlamp door to free sealed-beam unit from rim. On SS or SX Model remove clamping screw and molding to release unit from rubber mounting. Pull connector block from sealed-beam unit prongs.

Install new sealed-beam unit by reversing above operation. Unit should be positioned so triangular insignia ▽ or arrow ↑ on front of lens, point as shown. Make sure connector block contacts are clean to insure a good electrical contact. After final assembly, readjust headlamp as described in "Adjusting Headlamp".

ADJUSTING HEADLAMP

The headlamp beam must be adjusted for height and direction to get the greatest efficiency and meet the requirements of the law. Make the following adjustment in a darkened room or at night.

With the tires correctly inflated, stand the motorcycle on a level surface 25 feet away from and headed toward a wall or screen upon which a horizontal line has been drawn at exactly the same height as the headlamp center. The motorcycle must be resting on both wheels and the front wheel must be in straight ahead alignment. Furthermore, to correctly adjust the headlamp on the motorcycle, it will be necessary to have someone of about the same weight as the rider seated on the motorcycle because the weight of the rider will compress the fork slightly. Turn on the lights and set the handlebar dimmer switch to the high beam position and check the light beam for height. The top of the main beam of light should register on the wall or screen, even with, but no higher than the horizontal line.

After loosening the bolts on each side of the headlamp body bracket (or single stud nut on SS Model) tilt the lamp up or down to properly aim it in relation to the horizontal line. Tighten the bracket bolts after the lamp is properly positioned.

GENERATOR OR ALTERNATOR SIGNAL LIGHT

This light turns on when the ignition key is turned on and remains lighted while the engine is stopped or running at very low speed. The light goes off as soon as the engine speed increases and generator or alternator is charging normally. If the light fails to go off when engine speed is increased above idle, the generator or alternator is not charging normally, and the cause should be found at once.

BULB CHART

LAMP DESCRIPTION & VOLTAGE		WATTAGE OR CANDLEPOWER	PART NO.	USED ON
Headlamp Sealed Beam	6V. 12V.	30/30 W. 30/30 W.	67716-68 67716-73	1972 & Earlier 1973 & Later
Tail & Stop Lamp	6V. 12V.	3/21 C.P. 3/32 C.P.	68165-47 68165-64	1972 & Earlier 1973 & Later
Turn Signal	6V. 12V.	21 C.P. 21 W.	68572-50 68556-73P	1972 & Earlier 1973 & Later
Turn Signal Switch	6V.	0.6 W.	71088-68	1969 to 72
Speedometer/ Tachometer	6V.	2 C.P.	68462-49	1962 to 68 - H
Speedometer	6V.	1.5 W.	71091-72P	1972 - SS, SX
Speedometer	6V.	3 W.	67291-64P	1964 to 66 - C, H; 1967 & 68 - H
Speedometer	6V.	3 W.	71093-67	1967 to 71 - SS; 1971 - SX
Tachometer/ Generator/ High Beam	6V.	3 W.	71093-67	1967 to 72 - SS; 1971 & 72 - SX
High Beam/ Generator	6V.	1.5 W.	71090-61P	1961 to 68 - C, H
Speedometer/ Tachometer/ High Beam/ Turn Signal Indicator	12V.	3 W.	71090-64	1973 & Later
Alternator	12V.	1.5 W.	71092-73P	1973 & Later

GENERATOR

GENERATOR (1972 & EARLIER)

GENERAL

1961 to 1972 models have a six-volt generator-battery electrical system with negative ground return.

Power is produced by a 4 pole, 2 brush, shunt generator. The armature assembly is driven by the flywheel generator shaft, rotating in a magnetic field produced by the field coils and pole shoes in the generator frame. Resulting current induced in the armature windings is picked up from the commutator segments by 2 brushes.

The generator output is controlled by a voltage regulator, which regulates the generator field strength. The generator itself has no adjustment for control of output. The voltage regulator functions to increase battery charging rate when battery is low or when lamps are lighted, and to decrease charging rate when battery is near fully charged. The voltage regulator requires no regular interval attention. A cut-out relay is combined with the voltage regulator as a single unit.

CHECKING GENERATOR

If the generator or voltage regulator is suspected of being faulty as indicated by the battery becoming discharged, check the electrical system in the following sequence to determine which part is not functioning properly.

1. Check regulator wiring to make sure that it conforms to wiring diagram. Remove white wires (2) from voltage regulator #61 terminal. Using an 0-15, D.C. ammeter, connect ammeter negative lead to the regulator #61 terminal, the positive ammeter lead to both white wires. Turn on head lamp and start engine. Open throttle to an engine speed equivalent to a road speed of 20 - 25 MPH. Ammeter should show a charge, if electrical circuit is functioning properly.

2. If generator does not show a charge on ammeter, remove red wire from "DF" terminal of regulator and touch the wire to regulator base or other grounded point on motorcycle. If ammeter now shows a charge (of five amperes or more), generator is not at fault. Defect is in regulator, or may be in wiring at regulator, generator or battery. Check for breaks in wires. Make sure that regulator base and battery negative terminal are securely grounded to motorcycle frame. Replace regulator if defective.

3. IMPORTANT: Whenever the regulator or generator wiring has been worked on or these components replaced, it is advisable to polarize the generator with the battery. Connect a jumper wire to the battery positive (+) post and touch the other end to the regulator #61 terminal or to the insulated brush marked "D+" on the generator. Only a momentary touch of the wire is required. This should be done before the engine is run. If the generator is not polarized in this way, it may not charge or may charge in a reverse direction and this will cause the regulator relay points to vibrate and burn. Operate engine (after polarizing generator) as described in step one. If generator does not charge, proceed to step four.

4. If the generator still does not charge after the above checks have been made, stop engine and proceed as follows: Remove Red wire from regulator "DF" terminal. Keep it disconnected. Remove ammeter negative lead from regulator #61 terminal. Start engine and run it as in Step 1. With engine running, attach ammeter negative lead to battery positive terminal. Connect the red wire removed from regulator, to the regulator base or other grounded point on motorcycle. These connections bypass the regulator so generator is connected directly to battery. If ammeter shows no charge or a very low erratic charge, trouble is in generator. (Do not keep the ammeter and the red wire connections in place any longer than necessary to observe meter reading; as the battery will discharge rapidly through the generator.)

5. Before removing and completely disassembling generator, check the brushes and brush springs and polish the commutator with No. 00 sandpaper. Make sure brushes are not worn to the point where the brush wire limits contact with the commutator.

If upon further checking generator is still not functioning properly, disassemble the generator as necessary, following sequence described in "Disassembling Generator," and follow subsequent checking and repairing procedures.

TESTING FIELD COILS

Initial testing of generator field coil circuit can be made with generator frame in place. Disconnect red and white wires from regulator terminals and remove the positive brush from frame (the brush is connected to same terminal as white wire).

1. Connect a fully charged six-volt battery with ammeter in series to the red and white wires removed from regulator. The complete field circuit should draw 4.4 to 4.8 amperes (61 & 62 Model C) or 2.0 to 2.2 amperes (63 to 66c, 62 & later ss).

CAUTION

Overloading ammeter by a short circuit will damage it. An overload is indicated by needle going beyond range of scale. Contact must be broken immediately to avoid damage to meter. In making all tests, make only a momentary contact to determine if a short exists. If needle doesn't go beyond calibrated scale, it is safe to make sustained contact.

2. When a short is indicated in above test or if reading is higher or lower than specified amounts, remove red and white wires and field coil leads from generator terminals and take reading directly from field coil leads.

3. Carefully inspect red and white wires for damage if reading is correct as taken in step two. If wires are found to be serviceable and a short did exist in step one, check the frame terminals. They should be insulated from each other and from the generator frame. Check positive brush holders. They must be insulated from generator frame.

4. When test of field coils, independent of terminals and leads, does not show correct reading, the generator frame should be thoroughly cleaned. See "Disassembling Generator."

5. When an open (no reading) or low reading is obtained after cleaning, inspect connections on field coil leads and each of the three twisted connections between field coils.

6. If no poor connections were found in step five, cut off fused tip and untwist the connections between coils and check each of the coils with a two-volt power source - not six-volt. One cell of an automobile battery can be used. Individual coils should draw amount of current specified in Step 1 at two volts. Accurate readings depend upon using a fully charged battery.

7. Replace ammeter in six volt circuit with small lamp bulb. Connect one test lead to generator frame, the other to one lead of each field coil individually. If the bulb lights, that coil is grounded and must be replaced. Replace all open (no reading), shorted (high reading) or grounded (bulb lights) coils as described in "Disassembling Generator." It is not advisable to attempt coil repair.

TESTING ARMATURE

Remove armature as described in "Disassembling Generator."

TEST FOR GROUND. Contact commutator segments with one test lead (use circuit with light bulb as described in "Testing Generator Frame"), and armature core with the other. If circuit is completed, armature is grounded. Clean armature and blow off with compressed air, particularly between segments. Repeat test. If ground still exists, replace armature.

TEST FOR SHORT. Place armature in growler and hold piece of hack saw blade in loose contact with core. With growler turned on, rotate armature slowly one or two full turns. If armature is shorted, hack saw blade will be attracted and will vibrate at one or more points around armature. Clean armature as described under "Test for Ground" and retest. If short still exists, replace armature.

TEST FOR CIRCUIT OPEN. Connect an ammeter and 3/4 ohm resistance in a test circuit. Ampere draw when test probes are shorted together should be 6-3/4 to 7-1/4 amperes. Contact adjacent commutator bars with test probes and note ammeter reading. It should be between 5-1/4 and 5-1/2 amps. When reading is appreciably lower (usually about two amps), open circuit exists. No reading indicates more than one open. A high reading (6-1/2 to 7 amps), indicates a short. Carefully work completely around commutator, testing across adjacent bars. If low reading is found, examine the armature winding leads connected to bars being tested. Usually open armature consists of a loose or disconnected bar lead. Loose leads can be resoldered to commutator bar risers.

REPAIRING COMMUTATOR

If commutator is worn irregular or shouldered, it should be turned down on a lathe and finished with No. 00 sandpaper (never use emery cloth). Turn down to clean up only - no more.

Mica insulation between commutator segments should be undercut to a depth of about 0.025 in. Unless mica is properly undercut, brushes will not seat and arcing will result.

Undercutting can be done on an undercutting machine or with a piece of hack saw blade thinned to thickness of mica insulation. When undercutting is complete, smooth commutator with No. 00 sandpaper and check for short. There is a possibility of developing a short during the turning and undercutting operations.

DISASSEMBLING GENERATOR (Figure 5E-16)

Remove five left crankcase cover Allen screws and carefully remove cover by tapping on sides while pulling on kick starter lever.

Release brush springs (1) from brushes (2). Remove brushes (2) as shown in Figure 5E-17. Remove wire from "D+" terminal and wire from "DF" terminal. Remove generator mounting nuts (3), lockwashers (4) and pull generator from mounting studs (11). Remove tachometer drive (if used) and armature mounting screw (5), screw spacer (6) and using tool Part No. 97296-61P, Generator Armature Puller, pull armature (7) from shaft. (See Figure 5E-18.) Do not remove armature without using this tool or damage to the part will result.

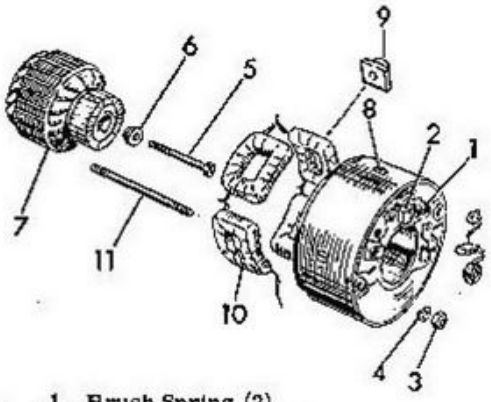
NOTE

Tool has right and left hand threads to accommodate 2 types of armatures used.

Remove pole shoes (9) and field coils (10) only if necessary for repair or replacement. Removing the four pole shoe screws (8) releases pole shoes (9) and field coils (10).

CLEANING, INSPECTION AND REPAIR

Clean all parts except armature, field coils and brushes in grease solvent and blow dry with compressed air. Wipe remaining parts clean with cloth soaked in solvent and blow dry with compressed air.



1. Brush Spring (2)
2. Generator Brush (2)
3. Mounting Nut (2)
4. Mounting Nut Lockwasher (2)
5. Armature Mounting Screw
6. Armature Mounting Screw Spacer
7. Armature
8. Pole Shoe Screw (4)
9. Pole Shoe (4)
10. Field Coil (set of four)
11. Generator Frame Stud (2)

Figure 5E-16. Generator - Exploded View

Examine all parts carefully for wear. Give close attention to condition of insulators, armature windings, field coil wrapping and surfaces of pole shoes nearest armature. Compare brush length with unused brush. If worn to point where brush lead restricts brush contact with commutator, replace brushes.

When field coils are to be replaced, observe the arrangement of the old coils and connections. Carefully install the replacement coils in the same way. Generator pole shoe arbor, Part No. 97302-61 should be used to force field coils in position in frame. Replacement coils are furnished in a set of four. Coils are connected to each other with a twist joint. The lead on each end coil is fitted with a colored insulating sleeve. Lead with the Red sleeve is to be connected to positive brush holder terminal (D+ on generator). Yellow lead goes to field terminal (DF on generator).

After field coils are installed, go over twisted connections between adjacent coils to be sure of good electrical contact. Scrape coil leads free of varnish, and solder twisted connections. Clip off 1/2 inch of each connection beyond generator frame and bend leads back between coils but be sure they do not touch generator frame.

Check armature clearance in frame which should be 0.014 in. (0.007 in. on a side). If clearance is less than specified amount and shoes were all drawn into frame to shoulder, the shoes will have to be bored out until desired clearance is obtained.

ASSEMBLING GENERATOR (Figure 5E-16)

Assemble armature (7) to flywheel shaft in reverse order of disassembly. Secure with washer (6) and armature mounting screw (5). Tighten screw until tight. Attach dial indicator to crankcase so armature runout may be checked. Runout should not exceed 0.002 in. Greater runout will cause brushes to jump or float at higher speeds, inducing arcing, burning and excessive heat.

NOTE

During 1969 season, starting with serial no. 3672, the armature and crankshaft taper were changed. Be sure to use correct replacement armature.

Assemble generator frame on frame studs (11), secure with lockwashers (4) and nuts (3).

Install brushes (2) and springs (1).

Reconnect wires as shown in "Wiring," Section 5B.

Reinstall left crankcase cover.

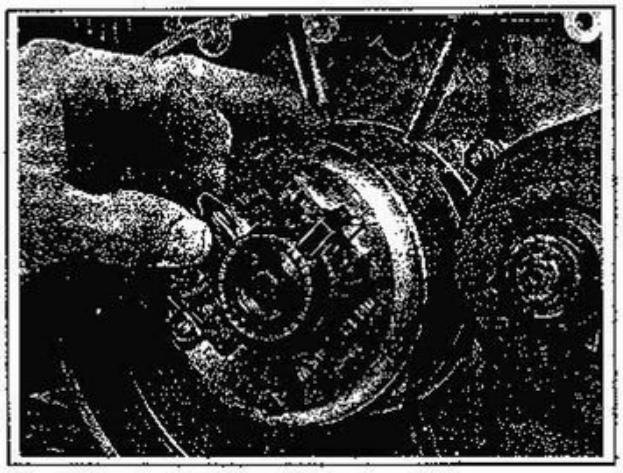


Figure 5E-17. Releasing Brush Springs

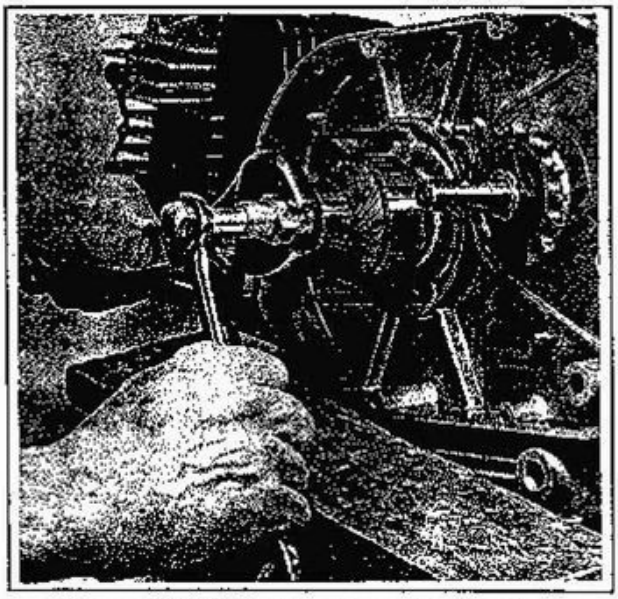


Figure 5E-18. Pulling Generator Armature

ALTERNATOR (1973 & LATER)

GENERAL

1973 and later models have a 12-volt battery system with negative ground return.

Power is produced by the alternator consisting of a crankshaft mounted rotor containing four magnets which turn in close relation to two laminated pole shoes having external, parallel connected coils.

Operation of the regulator-rectifier is explained in Section 5I.

TESTING ALTERNATOR

With the ignition switch in the ignition only position, only one coil is in operation in the charging circuit. When the ignition switch is in the ignition and lights position, the two coils are connected in parallel for higher charging current. Current is rectified and output voltage is regulated by a solid state regulator-rectifier. Circuits can be traced out in Section 5B Wiring Diagram.

Disconnect brown wire at alternator input terminal of regulator-rectifier and connect to a separate headlamp high beam filament. Put ignition switch in ignition only position and run engine at 20 to 25 MPH equivalent road speed. Headlamp should light up to indicate one alternator coil functioning properly. To test other coil, remove green wire at ignition switch terminal No. 9, connect to separate headlamp and repeat test. If alternator does not put out, make further checks in following paragraphs.

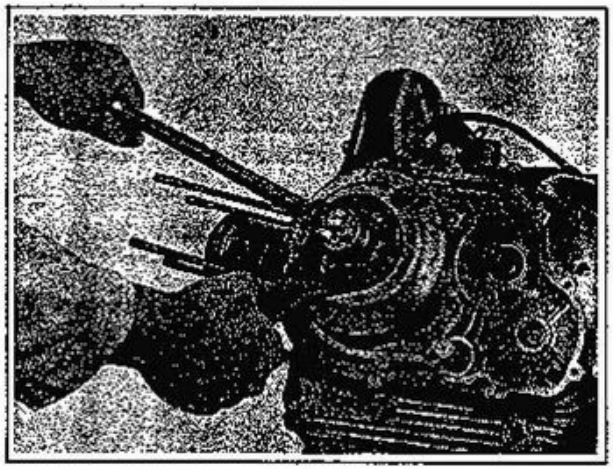


Figure 5E-19. Removing Alternator Rotor Nut

DISASSEMBLING ALTERNATOR

Remove left side cover. Remove alternator rotor nut and washer as shown in Figure 5E-19. Use tool, Part No. 97306-73P to hold rotor. Note rotor nut has left hand thread. Pull rotor using two jaw puller body, Part No. 97292-61 and two bolts (52081-63P) as shown in Figure 5E-20. Remove key from shaft. Remove four screws and sealing washers securing stator to left crankcase. Remove stator and O-ring from crankcase.

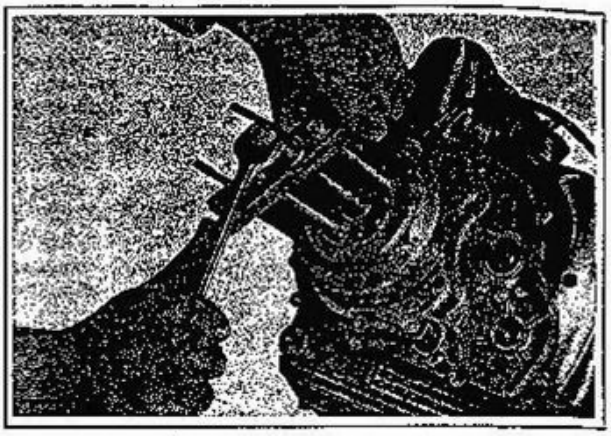


Figure 5E-20. Pulling Alternator Rotor

Inspect O-ring seal, washers and lip seal for damage or wear.

TESTING STATOR

Coils may be inoperative or have low output from one or more of three faults: Grounded coil where insulation between coil and laminated core is worn through; shorted coil where insulation is worn off individual windings within a coil causing current to pass through only a portion of coil windings, and open circuit where physical break in coil winding or lead interrupts the current flow.

TEST FOR GROUNDED COIL

Connect test circuit (a tail lamp bulb in series with a battery) to black coil lead and to stator frame. If bulb lights, one or both coils are grounded to frame. Disconnect black interconnecting wire between coils and check coils individually in the same manner to determine which coil is grounded.

If bulb lights, coil is grounded or shortened to frame.

Examine insulation between core and windings for a worn or frayed condition which may allow winding to touch core. If fault cannot be found and corrected, replace coil.

TEST FOR OPEN CIRCUIT COIL

Connect test circuit (a tail lamp bulb in series with a battery) to two coil leads (black and green). If bulb does not light, there is an open circuit. Check individual coils in the same manner to determine which coil is at fault.

TEST FOR SHORTED COIL

A shorted coil can be tested with a sensitive ohmmeter. It is not necessary to disconnect any wires to check coils. The reading from brown wire to green wire (both coils in series) should be approximately 0.8 ohms. Brown to black or green to black (one coil) should be approximately 0.4 ohms. A low reading would indicate a shorted coil.

CHECKING ROTOR

The rotor consists of four magnets arranged so poles of adjacent magnet ends are alike, creating like polarity between each pair. The result is a four-pole rotor with like poles on opposite sides.

When all other checking, testing and repair procedures fail to uncover reason for magneto malfunction, the rotor should be checked for magnetism. If possible, the magnet strength should be compared with that of an unused, new rotor. In rare instances, the magnets may become demagnetized through careless handling, careless storage or naturally through years of service. When a low-energy magnet is found, rotor should be replaced.

CIRCUIT BREAKER

GENERAL

The ignition system has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, switch, primary coil, breaker points, condenser and associated wiring. The secondary circuit consists of the secondary coil, 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.

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, (generator 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 located on seat support bracket or on ircuit breaker plate, is connected across the circuit reaker 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 engine over until points are closed. Turn on the ignition, break the points by hand, see if a "hot" or "blue" spark is obtained. If not, it is an indication of a weak coil, dead battery, broken or loose wires, etc. Arcing of the points and hard starting indicate 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.

TIMING IGNITION ACCORDING TO FACTORY TIMING MARKS (See Figure 5F-10)

To set ignition timing according to original timing marks proceed as follows:

Remove spark plug to permit engine to turn easily. If engine is out of frame, use Tool Part No. 97291-61P, sprocket wrench, to rotate engine. If engine is in frame, use kickstarter to rotate engine.

Remove circuit breaker cover screws (1) and cover (2). On 1971 SX and later models circuit breaker compartment is sealed with an O-ring (2B). To gain access to the circuit breaker points, remove circuit breaker cover screws (1). Turn in two 5mm screws (Part No. 2863P). Screws will force cover (2) out of hole. If necessary, loosen hex screws (6) and adjust circuit breaker plate (11) assembly in accordance with factory timing mark (7) on housing and plate, then retighten hex screws (6).

Check to see that circuit breaker cam (8) is positioned on cam driving lug so that circuit breaker points will open as engine shaft is cranked counterclockwise through compression stroke (circuit breaker cam rotates clockwise).

NOTE

It is possible to engage drive lug 180° off resulting in incorrect timing.

Circuit breaker cam can be correctly positioned by removing hex screws (6) and plate (11) then removing cam screw (3 or 3A), lockwasher (4 or 4A) and washer (5) if used. Disengage cam from drive lug (away from engine). Rotate cam 180° and then install cam back on lug.

Secure circuit breaker cam with washer (5) (if used), lock washer (4 or 4A) and screw (3). Factory setting has now been obtained. Be sure lock washer (4A) ear registers in slot on end of shaft, and another ear is locked against nut hex.

Replace circuit breaker cover (2) so small vent hole (if used) is on bottom, and secure cover with screws (1). Where applicable, make sure O-ring is in place.

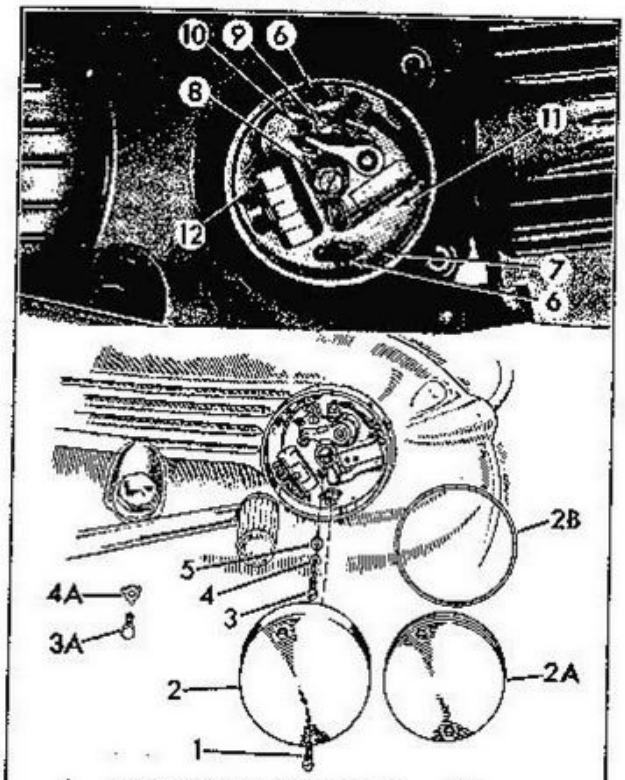
ADJUSTING CIRCUIT BREAKER POINTS (See Figure 5F-10)

The circuit breaker points should be checked for gap and contact surface condition initially at 300 miles and again at the end of the 1,000 mile break-in period. Following the break-in period, the circuit

breaker gap should be checked every 2,000 miles (every 1,000 miles under hard service). The circuit breaker is located in a housing closed with cover fastened by two screws on the right hand side of the engine.

Adjust circuit breaker point gap to .018 (1972 and earlier) or .016 (1973 and later) using a wire feeler gauge. Rotate cam slightly beyond position where points become fully open.

Adjust the gap as required by loosening lock screw (9) of the fixed contact and shifting it by means of a screwdriver inserted in the special notch (10) provided. After gap has been adjusted, retighten the lock screw and recheck the gap.



1. Circuit Breaker Cover Screw (2)
2. Circuit Breaker Cover (1971 and earlier SS)
2A. Circuit Breaker Cover (1971 & later SX, 1972 & later SS)
2B. O-Ring (1971 & later SX, 1972 & later SS)
3. Cam Screw
3A. Cam Screw (1962 & later)
4. Cam Lockwasher
4A. Cam Lockwasher (1962 & later)
5. Cam Washer (1961)
6. Hex Screw (2)
7. Timing Marks
8. Cam
9. Lock Screw
10. Notch to Support Screw Driver
11. Circuit Breaker Plate
12. Condenser

Figure 5F-10. Circuit Breaker

CHECKING IGNITION TIMING

After the ignition system has been installed and timed according to factory timing marks it is recommended procedure to again check timing with strobe light.

Proceed as follows:

1. Strobe Timing Light Method.

This method is recommended for fine engine timing because timing is checked and adjusted under actual running condition.

1970 and Earlier Models:

Remove small cover or tachometer drive from left side of crankcase. Install Crankshaft Degree Indicator tool, part No. 95860-67P into threaded end of generator armature (left hand thread) and install indicator bracket on one of the crankcase cover screw holes. Find piston top center on compression stroke with Piston Position Gage. Loosen nut which holds degree plate and turn plate to line up zero (0) on plate with line on indicator bracket. Recheck alignment by turning engine in operating direction to see that zero on indicator plate will align exactly with mark on bracket when piston indicator rod is at highest point of travel.

NOTE

Because rod remains stationary over several degrees of crankshaft rotation, turn crankshaft one way until rod starts to move down and then the other way until rod starts to move down - then set degree plate zero in the center of this difference and securely tighten plate nut.

Connect strobe timing light connections to spark plug, ignition coil negative terminal and ground. Start engine and observe degree indication of flashing light on plate. See Figure 5F-11. If zero on plate shows up 180° off from bracket mark, piston indicator rod was set on exhaust stroke and degree plate must be loosened and reset correctly on compression stroke.

IMPORTANT

Timing should be set with circuit breaker cam in retarded position.

Ignition Timing BTC (Degrees Camshaft Rotation)

	ADVANCE (4500 RPM)	RETARD (1200 RPM)
1961	41° BTC	21° BTC
1962-67	41° BTC	5° BTC
1968 (also recommended for 1967 Models)	35° BTC	5° BTC
1969-1972	28° BTC	7° BTC
1973 and later	34° BTC	12° BTC

If timing mark on bracket is to either side of correct advanced timing degree mark on plate, shift circuit breaker base to bring timing into correct position while engine is operating at specified RPM. Be sure to recheck timing after circuit breaker base screws have been retightened.

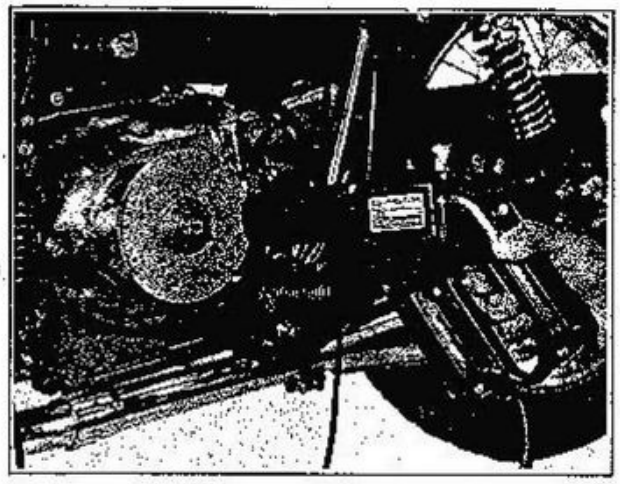


Figure 5F-11. Timing Engine 1971-72 Models

1971-72 Models

Remove ignition timing hole cover from left side of crankcase. Remove small cover from left side of crankcase and install Crankshaft Degree Indicator Tool, part No. 95860-67P, into threaded end of generator armature (left hand thread). Install indicator bracket on one of the crankcase cover screw holes. Align crankshaft timing mark with timing mark on crankcase port. Set degree wheel at 28° relative to mark on indicator bracket. Timing mark on crankshaft indicates 28° advance. Make sure degree wheel is tightly clamped. Replace timing hole cover. With engine operating at idle (1,200 to 1,500 RPM) retarded timing should be 7° BTDC. See Figure 5F-11. Timing setting in excess of 7° BTDC could result in engine kick back and possible starter gear failure. The advanced timing should be 26° to 30° BTDC at 5,000 RPM. If correct advance cannot be obtained, check automatic spark advance assembly for proper operation and substitute new advance assembly if necessary.

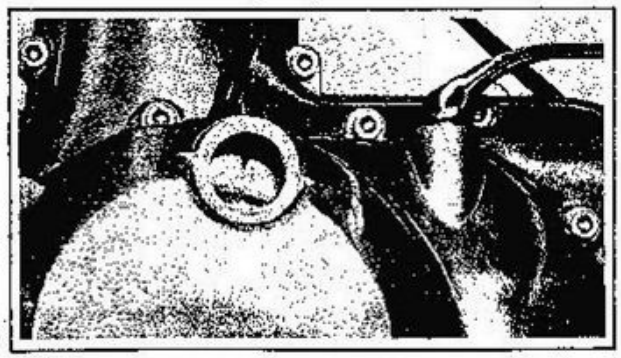


Figure 5F-12. Rotor Timing Retard (R) Mark (1973 and Later Models)

1973 and Later Models

Remove ignition timing hole plug from left side crankcase cover. With engine operating at idle (1200 to 1500 RPM) retard timing mark (R) on rotor should appear in center of crankcase cover view hole as shown in Figure 5F-12. With engine operating at 5000 RPM the advance timing mark (A) on rotor should appear in view port. The rotor is also marked with a piston top dead center mark (O). Advanced timing is not as critical as retarded timing, however, if advance mark does not appear in hole with retarded timing set correctly, automatic spark advance assembly should be inspected for proper operation and replaced if necessary.

2. Circuit Tester Method.

This method of checking timing is recommended when strobe light is not available or when factory timing has been lost due to replacement of parts. IMPORTANT: Timing should be set with circuit breaker cam in retarded position.

After setting timing in retarded position, also check advanced timing as follows: To set governor in advanced position remove circuit breaker plate (11) and loosen cam-lock screw (3). Then spread and hold governor weights in outward position against stops by inserting a wedge. Or use a special timing washer under head of cam screw (3) and tighten cam to shaft, which holds governor weights in spread position against stops.

If engine is installed in chassis, connect test lamp as follows: Connect one lead of test lamp to black coil wire at left spark coil terminal (marked 15) (do not disconnect terminal wire from terminal). Connect the other test lamp lead to engine. When points are closed, test lamp will be off. If engine is out of the frame (circuit breaker wires removed), connect test lamp and battery as follows: Connect a lead from engine to negative battery terminal. Connect another lead from positive battery terminal to test lamp and from test lamp to circuit breaker wire stud screw. With points open, lamp will be out, and with points closed, lamp will light, this is exactly opposite from a test lamp connected to an engine in chassis. Rotate engine shaft counterclockwise with rear wheel or kickstarter until test lamp indicates points are open. Piston should be in the following positions before top dead center.

Ignition Timing Piston Position BTC		
	Advanced	Retarded
1961-66	13/32 (.406) in. B.T.C.	1/4 (.250) in. B.T.C.
1967 (original F.T.)	11/32 (.350) in. B.T.C.	1/64 (.015) in. B.T.C.
1967-68	1/4 (.250) in. B.T.C.	1/64 (.015) in. B.T.C.
1969-72	7/32 (.219) in. B.T.C.	1/128 (.005) in. B.T.C.
1973 & later SS/SX	11/32 (.338) in. B.T.C.	3/64 (.044) in. B.T.C.

On 1971 and later models, a mark on the left flywheel, when in the center of the access hole, indicates the correct piston position for advanced and retarded timing.

On 1970 and earlier models, to check if piston is specified distance, screw piston position gage into spark plug hole and set lower mark on rod when piston is at top dead center.

Timing light should just go on when piston approaches upper mark on rod or mark on flywheel which is specified distance B.T.C. Gages are shown in Tool Section 5T.

If light goes on before this position is reached, timing advanced and circuit breaker must be rotated clockwise. If light goes on after this position is reached, timing is retarded and circuit breaker must be rotated counterclockwise. Always tighten circuit breaker plate screws before checking timing.

NOTE

Piston position BTC can be found more accurately with cylinder head off by taking the measurement from top of cylinder to piston with a scale or dial indicator when piston is at top center; now add specified piston positive given and this sum will be the dimension required for timing.

This method of timing gives approximate timing. For fine engine timing use the strobe timing light method.

REMOVING SPARK ADVANCE AND CIRCUIT BREAKER

Remove circuit breaker cover screws and cover. Remove two black wires from wire stud screws. Remove slotted hex screws and washers. Remove cam screw. Tap out circuit breaker and spark advance assembly from back side of cover.

NOTE

Punch matching marks on one side of cam slots to aid in reassembly.

CLEANING AND INSPECTION (Figure 5F-10)

Using cloth with clean solvent, wipe circuit breaker clean and inspect parts.

Inspect circuit breaker points. If fiber on breaker arm is badly worn, replace points. Points that are burned or pitted should be replaced or dressed with a clean, fine-cut contact point file. Do not attempt to remove all roughness nor dress point surfaces down smooth; merely remove scale or dirt. Contact point file should not be used on other metal and should not be allowed to become greasy or dirty. Never use emery cloth or sandpaper to clean points since particles will imbed themselves and cause arcing and rapid burning of points.

Point faces must seat squarely against each other. If bent, square up by bending contact plate.

To replace a set of circuit breaker points simply remove lock screw and pull circuit breaker points from pivot stud. Install new points in reverse order of disassembly.

Apply a small amount of High Temperature Lubricant, Harley-Davidson Part No. 99862-72, to felt cam wiper. Be extremely careful to avoid excessive lubrication. If too much grease is used, the excess is apt to get on the contact points and cause them to burn.

For maximum operating efficiency it is recommended practice to replace circuit breaker points when pitted, burned or worn excessively.

The condenser, located on seat support bracket, is a relatively long life part and will not require frequent replacement. However, if the condenser is suspected of being defective simply 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 arcing at breaker contact points and a shorted circuit will have no noticeable spark at the contact points.

Hold spark advance in hand and turn cam clockwise so that advance arms swing out. When rele[a]se, cam arms should snap back into position. If a[rms] appear to be sticking, disassemble unit as follows:

Remove C-lock ring and washers; with a pliers remove springs from lugs attached to base. Separate arms and cam from base, and cam and springs from arms.

Clean all parts thoroughly. Check springs for collapsed condition; if possible check with new spring. Examine rubber bushing on base tube to make sure it is in good condition. Put a small amount of High Temperature Lubricant, Harley-Davidson Part No. 99862-72 on base tube and pins.

Reassemble spark advance unit as follows:

Install springs on advance arms. Position arms on cam and cam on base aligning arms on base pins. Install springs on lugs. Secure assembly with washers and C-lock ring.

INSTALLING SPARK ADVANCE AND CIRCUIT BREAKER

Insert spark advance unit in right cover with cam end out aligning matching punch marks in slot. Install circuit breaker in cover aligning factory timing marks. Install slotted hex screws and washer. Install cam screw and washers. Recheck ignition [tim]ing as previously described. Reinstall ci[rcu]it breaker cover.

IGNITION COIL

DESCRIPTION

The ignition coil is a pulse transformer that transforms or steps up low battery or generator voltage to high voltage necessary to jump the electrode at the spark plug in the engine cylinder head. Internally, coil consists of primary and secondary windings with laminated iron core and sealed in waterproof insulating compound. Case cannot be taken apart or coil repaired.

TROUBLE SHOOTING

When hard starting or missing indicates a faulty ignition system, first, check condition of source of current (battery or magneto depending on model of motorcycle). If lamps light with full brilliancy and horn blows, indicating current source is in at least fair condition check, clean or replace spark plug. If this does not correct performance, inspect circuit breaker points and install new condenser. If condition persists, try a new ignition coil.

Temporarily substitute a new ignition coil by attaching it at any convenient point near old coil (coil will function without being securely grounded). Transfer terminal wires to new coil according to the information given in the wiring diagrams pertaining to the model being worked on. Attach new coil cable to the spark plug. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil for damaged cables and insulation. The insulation on cables (and on some models the coil itself) may be cracked or otherwise damaged allowing high tension current to short to metal parts. This is most noticeable in wet weather or when motorcycle has been washed.

Replacing plug cable is the only repair that can be made to an ignition coil. If this does not correct faulty coil performance, coil is defective.

(Fig. 5G-2 or 5G-2A)

REPLACING SPARK PLUG CABLE

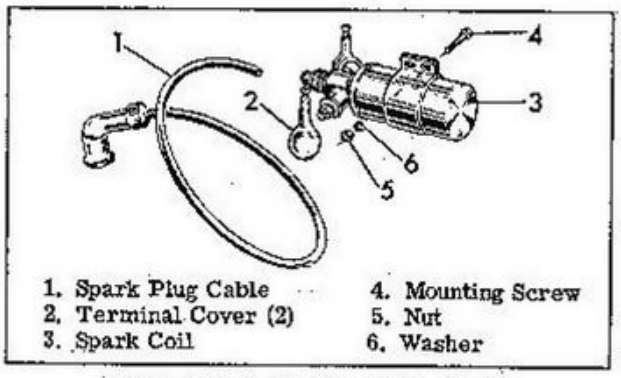
1970 & EARLIER; 1973 & LATER MODELS (FIGURE 5G-2)

Unscrew spark coil cap and pull spark cable from spark coil. Remove rubber seal, seal cover and cap from end of old cable and install on new cable with cap going on first, cover second and seal last. Place rubber seal far enough up on cable so that when installing new cable in spark coil, brass pin inside of coil will pierce cable. Slide cover on seal and secure assembly with cap.

1971 & 1972 MODELS (FIGURE 5G-2A)

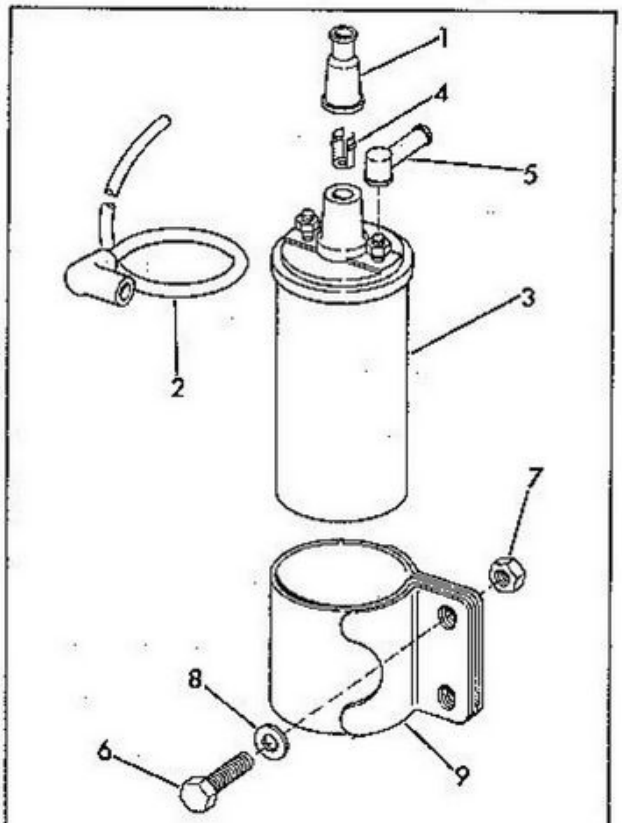
Remove rubber spark plug cable boot (1). Pull old spark plug cable (2) from coil (3).

Place spark plug cable boot on new spark plug cable. Solder spark plug cable terminal (4) to new cable. Insert new spark plug cable terminal in spark coil. Make sure spark plug cable terminal is firmly seated in coil. Position rubber boot over top of spark coil tower.



1. Spark Plug Cable
2. Terminal Cover (2)
3. Spark Coil
4. Mounting Screw
5. Nut
6. Washer

Figure 5G-2. Ignition Coil - Sprint (1970 & Earlier; 1973 & Later)



1. Spark Plug Cable Boot
2. Spark Plug Cable
3. Spark Coil
4. Spark Plug Cable Terminal
5. Terminal Boot (2)
6. Mounting Bolt (2)
7. Nut (2)
8. Washer (2)
9. Mounting Bracket

Figure 5G-2A. Ignition Coil - Sprint (1971 & 1972)

SPARK PLUGS

GENERAL

Harley-Davidson spark plugs (Figure 5H-1) have been designed to give maximum life and efficient combustion of fuel. They are available in various "heat ranges," each for a particular service application. Plugs are labeled with numbers 2, 3, 4, or 5 the lowest number indicating the "hottest" plug. Designations 3-4, 5-6 and 7 are special-purpose plugs.

For normal service, the spark plug as recommended in motorcycle specifications, Section 1-A, should be used on a particular model. However, for special service conditions, a "colder" or "hotter" plug may be desired. If, for instance, the number 4 plug is used on original equipment for normal service, the number 3 plug could be used for slow speed or short run operation while the number 5 plug could be used for the higher speeds of highway travel or maximum throttle operation. It is not uncommon for best results to be obtained with plugs of different heat ranges in front and rear cylinders, with the front usually the colder.

REMOVING SPARK PLUGS

Disconnect wires from plugs, connection is simple snap-on type. Use a deep socket wrench or special spark plug wrench to loosen plugs. Blow away all dirt from plug base with compressed air before removing plug.

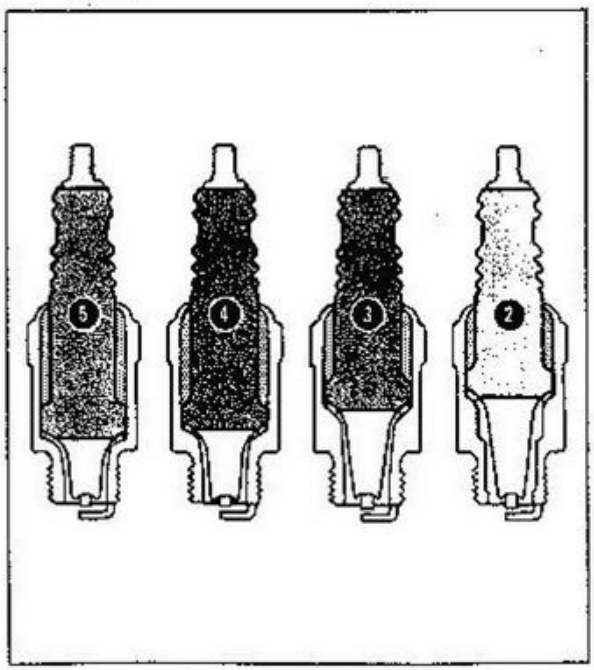


Figure 5H-1. Spark Plug Heat Range

CLEANING, INSPECTION AND REPAIR (Figure 5H-2)

Examine plugs as soon as they have been removed. The deposits on the plug base are an indication of the correctness of the plug heat range and efficiency, as well as a guide to the general condition of rings, valves, carburetor and ignition system.

A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip (A) indicates an oil fouled plug. The condition is caused by worn rings and pistons, loose valves, weak battery, faulty ignition wires, circuit breaker trouble, weak coil or a cold plug.

A dry, fluffy or sooty black deposit (B) indicates plug is gas fouling, a result of a too rich carburetor air-fuel mixture, long periods of engine idling or a cold plug.

An overheated plug (C) can be identified by a light brown, dry, glassy looking deposit. This condition may be accompanied by cracks in the insulator tip and is caused by too lean an air-fuel mixture, a hot running engine, valves not seating, improper ignition timing or too hot a plug for the service. The oxide deposit on the spark plug is a conductor when hot. It will cause plug to misfire, especially at high speed.

A plug with a rusty brown to tan powdery deposit (D) indicates a balanced ignition and combustion condi-

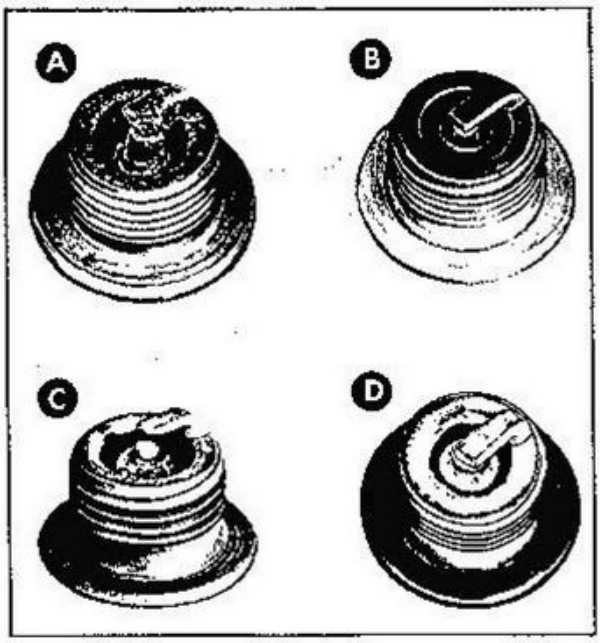


Figure 5H-2. Type of Plug Base Deposits

tion. With leaded gasolines the deposits may be white or yellow. In either case, ignition functions through the deposits if only light and the deposits should be cleaned off at regular intervals to keep them from building up.

When spark plug electrodes have become eroded away (C) to the point where gap setting is difficult or impossible, the plug should be replaced. Plugs with cracked insulator should also be discarded.

Clean plugs with a sand blast cleaner. Rotate plug top while applying sand blast to clean insulator and electrodes. Cleaning time should be carefully limited to just what is necessary to clean deposits from insulator nose. Prolonged use of abrasive blast will wear away insulator. Normally three to five seconds of sand blasting is sufficient. Never use metal instruments to remove deposits from plugs.

SETTING SPARK GAP

Before setting spark gap on used plugs, pass a thin point file (or nail file) between 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 electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs as shown under Engine Specifications Section 3A.

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.

INSTALLING SPARK PLUGS

Before turning spark plugs into cylinder heads, check condition of threads in head and on plug. Soften deposits in cylinder head with penetrating oil and clean out with tap or old plug.

Install new spark plug gasket and turn plug down finger tight. Tighten to 15 pounds with torque wrench or 3/4 of a turn.

Check and adjust engine idle speed and mixture setting after installing new set of plugs if necessary.

REGULATOR

VOLTAGE REGULATOR (1972 & EARLIER)

GENERAL

A two unit voltage regulator is used to control the generator output on the 6-volt system.

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.

If these tests indicate that the regulator is defective, it should be replaced.

REGULATOR TESTS

Make the following electrical tests on the motorcycle 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 "B+" and the voltmeter negative lead to one of the regulator mounting bolts (ground).

With the regulator cover in place and the regulator at operating temperature, run the engine at approximately 3500 RPM (30 mph road speed) and read the voltmeter.

If voltmeter reads between 7.0 and 7.5 volts, it indicates that the voltage regulator is functioning properly.

If voltmeter reading is above 7.5 volts, generator charging rate is too high and will over-charge the battery causing possible internal battery damage.

If voltmeter reading is under 7.0 volts, charging rate is too low and will result in a discharged battery.

RECTIFIER-REGULATOR (1973 & LATER)

GENERAL (See Figure 5I-1)

The solid state rectifier-regulator module is used on the 12-volt system, and consists of three basic circuits; a rectifying circuit which converts alternating current to direct current, a regulating circuit which controls the voltage output of the unit, and a signal circuit which controls the generator indicator light.

All three circuits are permanently assembled in the module. If any of the components in the module are not operating properly, the entire unit must be replaced.

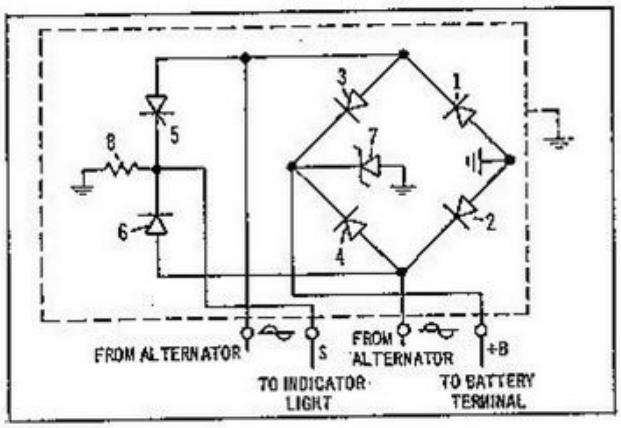


Figure 5I-1. Rectifier-Regulator Module Schematic Diagram

OPERATION

Alternating current flows into the rectifier-regulator module at the two terminals marked ~. The rectifier bridge consists of four diodes (1,2,3,4) which provide full wave rectification of the incoming alternating current.

The regulator section of the rectifier-regulator module consists of a zener diode (7) connected from the module +B terminal to ground. When the output of the rectifier circuit exceeds approximately 14 volts, the zener diode conducts the rectifier output to ground.

The signal circuit consists of two diodes (5,6) and a resistor (8). When the output voltage of the rectifier is less than battery voltage, current flows to the alternator indicator bulb through module terminal S.

PRECAUTIONS to be observed with solid state rectifier-regulator system:

1. Make sure battery is properly connected. This is a negative ground system. Reversing battery connections will result in damaged diodes.

2. Do not connect or disconnect module wires while the engine is running.

3. Do not operate engine with battery disconnected.

4. Disconnect negative battery lead when charging battery.

5. The rectifier-regulator module is grounded to the frame and therefore should not be removed and mounted at some remote location.

TESTING REGULATING VOLTAGE

Connect a voltmeter across battery terminals of fully charged battery in motorcycle to be tested. Disconnect headlamp white and black wires at headlamp. Place headlamp beam switch in high beam position and ignition switch in ignition and lights position.

Run engine at approx. 30 MPH equivalent road speed and check battery voltage. Voltage should read between 13.5 and 15.0 volts indicating correct regulator operation. If voltage is not within specified range, make further checks in following paragraphs.

CHECKING THE RECTIFIER-REGULATOR MODULE

The rectifier-regulator module can be checked with a small continuity tester. Use a tester with small batteries to avoid damage to diodes in module. Perform the following checks in the order indicated. See Figure 5I-1 for wiring diagram of rectifier-regulator module.

CONTINUITY TESTER CONNECTIONS	CONTINUITY LIGHT	CHECKS
Tester positive to module ground, tester negative to module input ~ terminals.	ON	diodes (1 & 2)
Tester neg. to module ground, tester pos. to module input terminals.	OFF	diodes (1 & 2)
Tester pos. to module input terminals, tester neg. to module +B terminal.	ON	diodes (3 & 4)
Tester neg. to module input terminals, tester pos. to module +B terminal.	OFF	diodes (3 & 4)
Tester pos. to module ground, tester neg. to module +B terminal.	ON	zener diode (7)
Tester neg. to module ground, tester pos. to module +B terminal.	OFF	zener diode (7)
Tester neg. to module S terminal, tester pos. to module input terminals.	ON	diodes (5 & 6)
Tester pos. to module S terminal, tester neg. to module input terminal.	OFF	diodes (5 & 6)
Tester pos. to module ground, tester neg. to S terminal.	ON (Glows dimly)	resistor (8)

Rectifier module should be replaced if any of the above indications are not obtained.

BATTERY

GENERAL

The battery serves as a storage place for current used to operate the rear tail and stop lights when engine is not running. For battery to remain in good condition, the current draw must be balanced by a current input. All Harley-Davidson batteries have lead plates and sulphuric acid electrolyte.

Battery is shipped dry and must be activated by filling with battery grade sulphuric electrolyte before placing in service. See separate instructions supplied with motorcycle or each individual battery.

BATTERY CARE

It is the care given the battery rather than time and miles of service which is most important in determining its life.

At least once every month, or even more often in hot weather or when motorcycle is used very much, the battery should be removed from its holder and serviced as follows:

Unscrew filler plugs from the cells and add distilled or other approved water into the cells to cover perforated strip which is slightly above plate separators.

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 motorcycle parts near the battery to be damaged. Electrolyte should not be allowed to go below plate separators, while in service.

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.

CHARGING BATTERY

Never allow a battery to stand in a discharged condition. Start charging it at once at the recommended continuous charge rate.

Always remove filler plugs while battery is being charged.

Always remove battery from motorcycle when charging to prevent possible damage to rectifier-regulator unit.

To determine the amount or condition of a battery charge, check solution in each cell with a battery hydrometer. When hydrometer reading is 1.200 or less, battery is considered discharged and should be removed from motorcycle and charged.

When charging the battery from an outside source, the charging rate should not be allowed to go over one-half ampere, a higher rate may heat and damage the battery.

For this reason, do not allow the motorcycle battery to be charged in the same line with automobile batteries. Hydrometer reading of a fully charged battery in good condition, with full strength electrolyte will be 1.270 or higher.

WARNING

Hydrogen gas, formed when charging, is explosive. Avoid open flame or electrical spark near battery.

Allowing a battery to remain in a discharged condition will shorten its life. It is important that a battery be kept well charged during below freezing weather.

RECLAIMING SULPHATED BATTERY

If a battery has been allowed to stand in a discharged condition for a period of time, the lead sulphate in the plates will crystallize and not take a charge at normal rates. Such batteries should be charged at half the specified continuous rate for twice the computed time. A longer charging time at a slower rate will many times break down the crystalline structure into active materials and restore the battery.

Allowing a battery to remain in a discharged condition will shorten its life. It is important that a battery be kept well charged during below freezing weather.

RECLAIMING SULPHATED BATTERY

If a battery has been allowed to stand in a discharged condition for a period of time, the lead sulphate in the plates will crystallize and not take a charge at normal rates. Such batteries should be charged at half the specified continuous rate for twice the computed time. A longer charging time at a slower rate will many times break down the crystalline structure into active materials and restore the battery.

CHANGING ELECTROLYTE

In normal service with average care, it is never necessary to change electrolyte for the lifetime of battery. However, if the battery solution is spilled, diluted as a result of careless water addition, or neutralized by the addition of an alkaline substance, the battery solution may be changed and in some cases near full capacity restored.

A weak acid solution may be detected by charging the battery until all cells gas freely and the gravity has not shown a rise for three successive readings taken at hourly intervals. "Gassing" is evidenced by a bubbling action in the electrolyte that may be detected by sight or sound. Do not change electrolyte in a battery with one or more cells that fail to gas. Such a condition indicates a structural failure.

Pour solution out of charged battery and fill with water. Charge battery again until maximum specific gravity is reached. Pour out this solution and add prepared battery electrolyte to specified level and charge again for a short length of time for full capacity.

Check specific gravity and add a little water if necessary to bring solution down to desired maximum limits.

The value of changing electrolyte in a fairly old battery is questionable. By tipping over such a battery to drain the solution, the sloughed-off waste materials accumulated by repeated charging and discharging actions might be dislodged from the sediment chambers in the bottom of the battery and deposited in the separators. This material is an electrical conductor and thus may catch between the separators and cause a short circuit.

HORN

HORN

The horn operating button is on left handlebar. If the horn fails to blow or does not blow satisfactorily, check for loose frayed or damaged wiring leading to horn terminals, discharged battery, etc. If these steps do not correct the trouble, turn the contact point adjuster screw located at center of horn in until horn just gives a single click - then retard screw until best tone is obtained. If 1967 and earlier horn fails to operate after moving adjusting screw, it can be disassembled for inspection and cleaning of parts as follows:

Loosen horn to bracket bolt and rotate horn so that terminal wires may be removed from horn; then remove horn to bracket bolt. Remove six horn screws and nuts and remove horn front. Remove diaphragm and gasket.

Brush all scale, rust and dirt from horn parts and blow clean with compressed air. Examine interior of horn for damaged or broken wires. Examine core of electromagnet for rust. Make sure all contact surfaces and points are clean.

Assembly is the reverse order of disassembly. Put a small amount of grease on gasket when assembling in order to maintain a water tight seal. Be sure to correctly align the diaphragm assembly on the horn back and to readjust the contact points after the horn is assembled. Put a small amount of varnish on outside of adjusting screw in order to seal screw after adjusting.

NOTE

1968 and later horn is not repairable and should be replaced as a unit if defective.

STARTER MOTOR

Two types of starters are used, Production (early type) which has a dowel pin (25) retained ring gear (23); Parts Order (late type) starters have a free ring gear adjusted by shims (19B) and spring washers (19C). The late type starter is retained in the starter housing by means of a guide screw in the drive end cover (19D).

DESCRIPTION

The starter motor, used on 1973 and later models, is a 12-volt, series field 4-pole drive motor which drives the engine crankshaft through the sprockets and chain. See "Electric Starter Drive" page 4C-13.

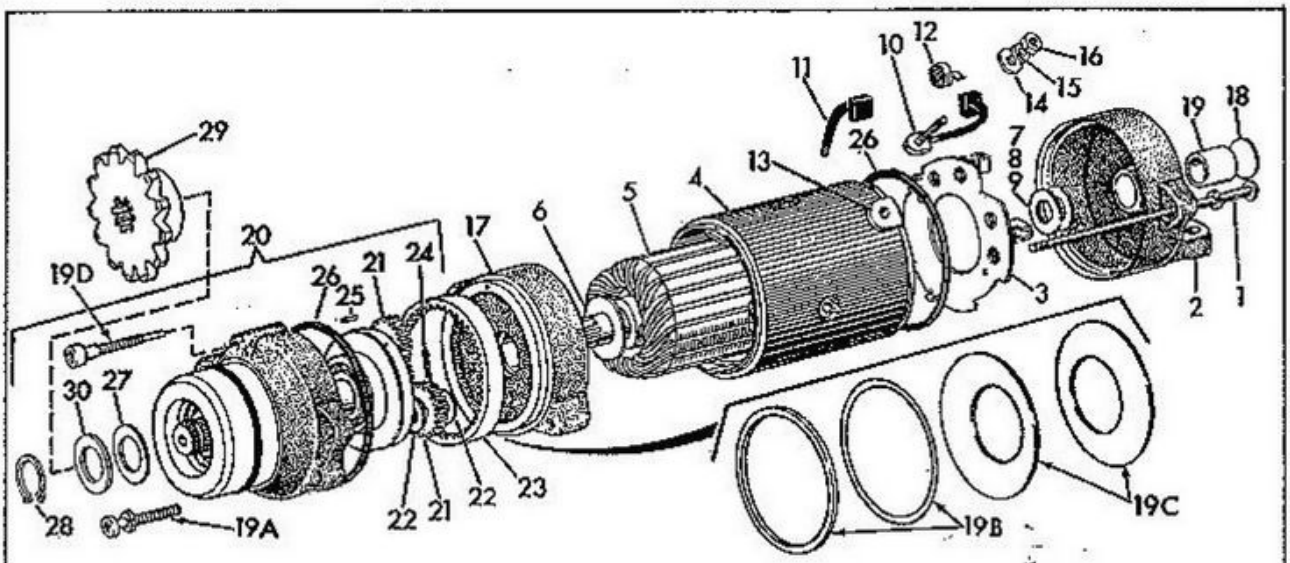
A solenoid relay provides battery current directly to the motor. The solenoid is controlled by a button switch on the handle bar.

NOTE

Starter motor should never be operated continuously for more than 30 seconds without stopping to let it cool for at least two minutes. The motor is not designed for continuous operation and serious damage could result.

TROUBLE SHOOTING

In general, the starter motor is designed to be corrosion resistant and needs very little maintenance. However, to insure satisfactory operation, periodic inspection of brushes and commutator should be made. Should the starter motor fail to operate satisfactorily, the following checks should be made before removing motor for inspection:



1. Thru-Bolt and Lockwasher (2)
2. Cover
3. Brush Holder
4. Frame
5. Armature
6. Shim Washer
7. Shim Washer (0.10 mm)
8. Shim Washer (1.00 mm)
9. Shim Washer (0.30 mm)
10. Brush (Positive)
11. Brush (Negative)
12. Brush Spring (2)
13. Insulator
14. Washer
15. Lockwasher
16. Nut
17. Frame Support
18. Plug
19. Bushing
19A. Screw and Lockwasher (2) (late)
19B. Shim Washer (1 thick & 3 thin) (late)
19C. Spring Washer (2) (late)
19D. Guide Screw (late)
20. Drive End Assembly
21. Planet Gear (3)
22. Thrust Washer (6)
23. Ring Gear
24. Cotter Pin (3)
25. Dowel Pin
26. Rubber Gasket (2)
27. Shim Washer (0.20 mm)
28. Retaining Ring
29. Sprocket
30. Shim Washer (1.00 mm)

Figure 5L-1. Electric Starter - Exploded View

Make sure the mounting and wiring connections are tight and in good condition. The solenoid switch should be firmly mounted and all wiring connections should be clean and tight. Inspect the connections to the battery and return circuit. Loose or dirty connections anywhere in the circuit will cause high resistance and reduced motor efficiency.

If the connections and wiring are okay, the battery should be checked to determine its state of charge (See "Charging Battery"). If the battery is charged and battery voltage is reaching the motor without any excessive losses in wiring or connections, the trouble may be in either the engine or the starter motor, itself.

If the battery is charged but there is no current flow to motor at all, trouble is probably in either the handlebar button switch or the solenoid switch. This can be determined by by-passing the switch and the solenoid, in turn, with a heavy jumper (Refer to "Wiring Diagram"). Connect plus battery from the terminal to the positive post on the starter motor.

Excessive friction in the engine from tight bearings or pistons or from heavy oil also can make the engine harder to crank. However, if engine is known to be in normal condition and the rest of the starting system is satisfactory, the starter motor should be removed for further checking.

DISASSEMBLING (See Figure 5L-1)

Remove two thru-bolts (1) along with lockwashers.

Pull off cover (2). This will expose the commutator and the brushes.

NOTE

At this point, the commutator and brushes can be checked and further disassembly is not usually needed.

Visually check the following: The commutator should appear clean and shiny, the mica insulations between segments should not be too high and the commutator should not be out-of-round.

Replace brushes (10 & 11) if worn shorter than 3/8 inches total length. See "REPLACING BRUSHES" in subsequent paragraph.

Remove brush holder (3) by first retracting brushes (10 & 11). Using a piece of wire as a hook or the flat of a screw driver blade, lift brush springs (12) away from brushes (10 & 11) while at the same time pulling the brushes free. With both brushes (10 & 11) freed, holder (3) can be slipped off the assembly. Before removing, however, note the location (for reassembly) of the metal tab on holder (3) and how it fits into the notch in frame (4). Note, too, that holder (3), itself, is notched to clear the two wire leads of brushes (10 & 11).

Slide frame (4) off armature (5).

REPLACING BRUSHES (See Figure 5L-2)

At this point, both brushes (10 & 11) can be replaced. Positive brush (10) is attached to a stud (positive post of the starter motor) which is held in place in insulator (13) by hardware (14, 15 & 16). Negative brush (11) is soldered to field winding lug (31) which is secured directly to the inside of frame (4).

Change positive brush (10) by removing hardware (14, 15 & 16), sliding the old brush out of insulator (13) and replacing it with the new brush assembly.

Replace negative brush (11) by unsoldering the old brush lead wire from field winding lug (31) and soldering the new one in its place. When soldering the new lead to the lug, flatten the wire against lug (31) surface to maintain enough clearance. Also, do not overheat or use too much solder. The wire lead must remain flexible. Too much solder in the lug area can be filed off.

4. Frame
10. Brush (Pos.)
11. Brush (Neg.)
13. Insulator
14. Washer
15. Lockwasher
16. Nut
31. Field Winding Lug

Figure 5L-2. Replacing Brushes

ELECTRICAL TESTING

Check the armature for ground using an ohmmeter. With the selector of the tester positioned to the 10K ohm position, place one test prod on the commutator and the other test prod on the armature core. See Figure 5L-3. If the tester pointer moves, the armature winding is grounded. In this case, the armature has to be repaired or replaced.

Note that the above tests can also be performed with a simple continuity tester. With a tester of this kind, a bulb lighting will indicate a closed circuit.

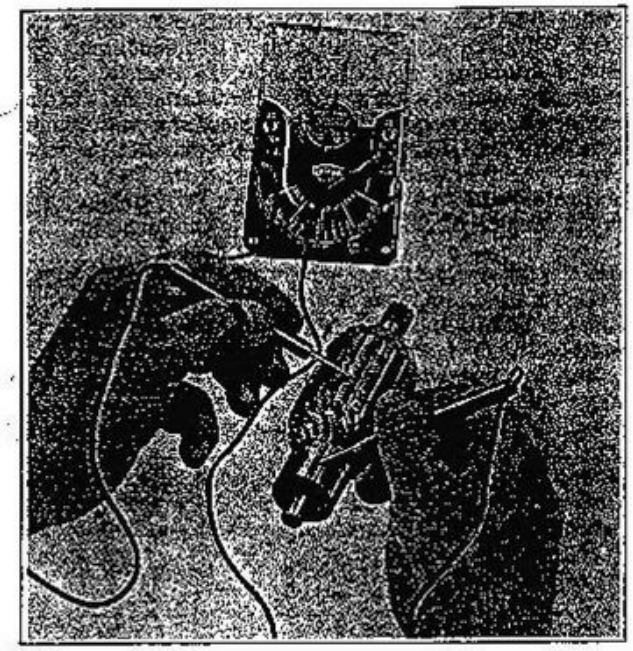


Figure 5L-3. Checking Armature for Ground

Check the armature for short circuit on a growler. To test the armature for shorts, hold a hack-saw blade above each armature slot while the armature is slowly revolved. See Figure 5L-4. If any winding is shorted, the blade will be alternately attracted to and repelled from the slot in which that winding is assembled. The armature should be repaired or replaced. Short circuits most often occur with copper dust or filings between the two commutator segments.

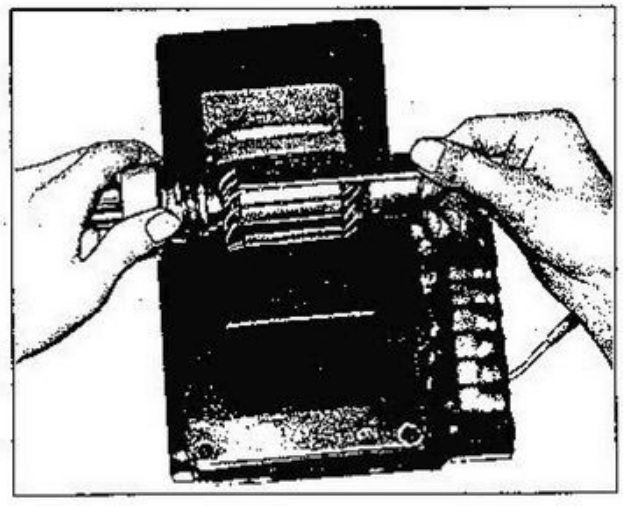


Figure 5L-4. Checking Armature for Short

Check the armature for open circuit using an ohmmeter. With the selector of the tester positioned to the 1 ohm position, place one test prod on a commutator segment and the other test prod on the adjacent segment, and repeat this operation for all segments moving one test prod at a time. See Figure 5L-5. If the tester pointer does not move, the armature circuit between these two segments is open-circuited. The armature should be replaced or repaired. (Burned commutator segments are usually an indication of an open-circuited armature coil.) Open circuited armatures can often be repaired. The break or opening in the circuit usually occurs at the commutator riser bars, a result of overloading which causes overheating and the melting of solder at the joint. Resolder the leads in the riser bars using rosin flux. Turn down commutator and sand to remove any burn spots.

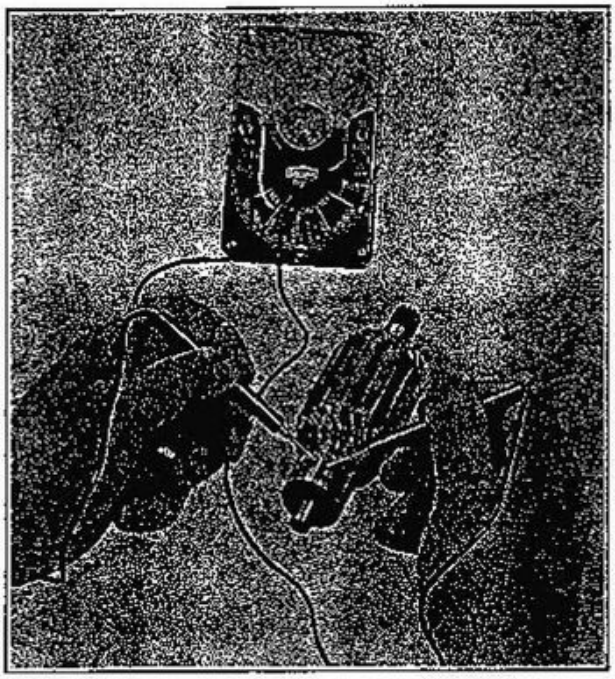


Figure 5L-5. Checking for Open Circuit

Check field windings as follows.

Check the field windings for open circuit using a circuit tester. With the selector of the tester in the 1 ohm position, place one test prod on the brush-attached lead and the other test prod on the frame. See Figure 5L-6. If the tester pointer does not move, the field winding is open. Field windings are not replaceable except as a complete frame and field assembly.

Check the brush holder for insulation performance using a circuit tester. With the selector in the 10K ohm position, check from each brush holder to the metal ring as shown in Figure 5L-7. If the tester pointer moves, the brush holder insulation is defective and has to be repaired or replaced.

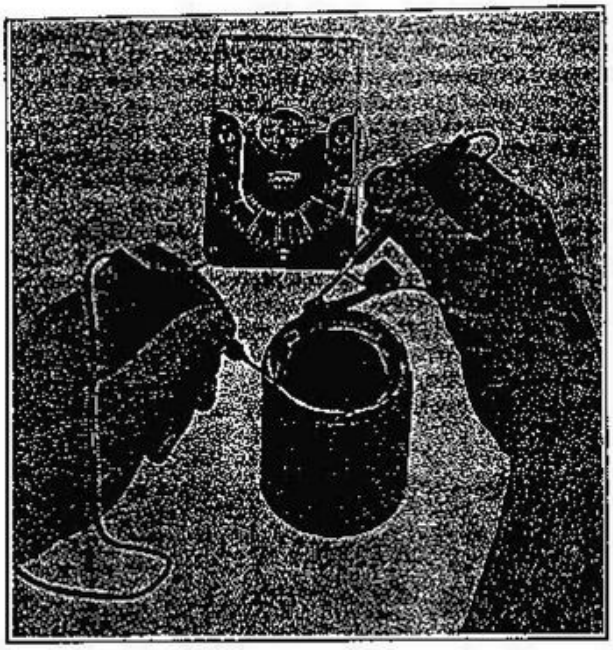


Figure 5L-6. Checking Field Winding for Open Circuit

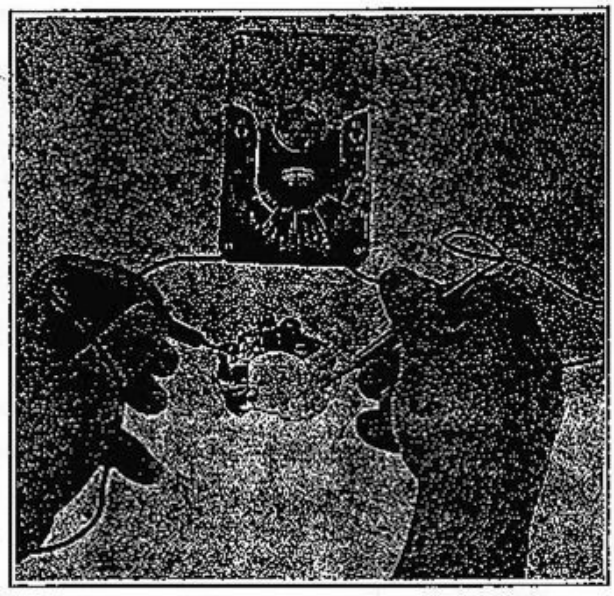


Figure 5L-7. Testing Brush Holder

INSPECTING & REPAIRING ARMATURE

Separate armature (5) from frame support (17) by pulling the two apart. Take care to retain the shim washers (6, 7, 8 & 9) on shaft ends of the armature assembly for reuse.

Check the commutator for roughness, burned or scored surface. If necessary, turn down the commutator in a lathe just enough to clean up and true.

Check the commutator for out-of-round condition with V blocks and an indicator. If the commutator out-of-roundness is more than 0.016 inch, the commutator should be turned down in a lathe and sanded with fine sandpaper until true and smooth. Mount armature in lathe on its bearing seats not on shaft centers. Never sand a commutator with emery cloth. Particles will imbed themselves in the copper surface, holding the brushes off the commutator far enough to cause heavy arcing and burning.

Check the commutator for mica depth. If the depth is less than 0.008 inch, undercut the mica approximately 0.025 inch. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed. 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 5L-8.

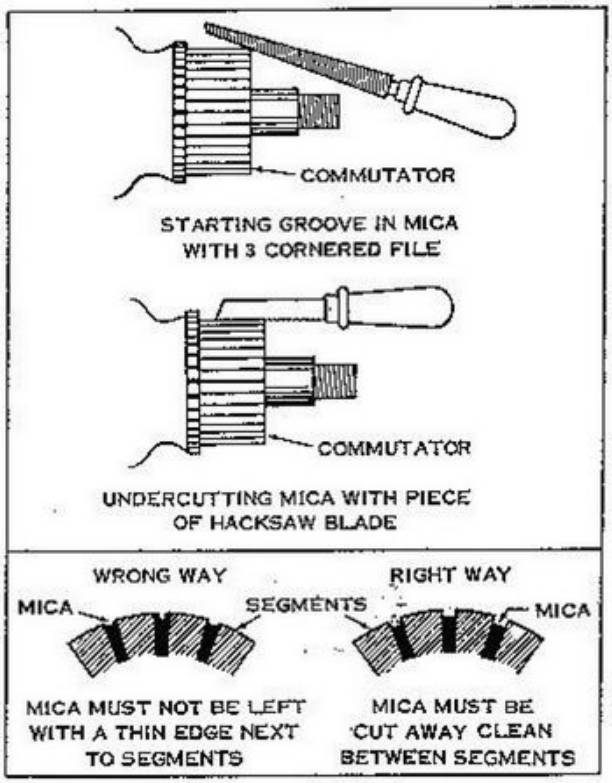


Figure 5L-8. Recessing Mica Separators

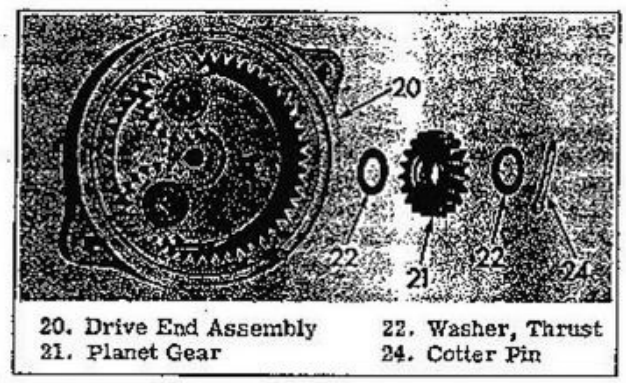
REPLACING BUSHINGS

Inspect the two armature shaft bushings. If the bushing in frame support (17) shows too much wear, replace the entire frame support. If bushing (19) in cover (2) shows too much wear, the bushing should be replaced. In this case, tap out plug (18) and press out bushing (19) with a suitable drift, replacing it with a new one.

Replace plug (18) and secure in place by peening metal over with a punch just enough to keep the plug in place. Always replace plug (18) to keep out dirt.

REPLACING PLANET & RING GEARS (See Figures 5L-9, 5L-10, 5L-11, amd 5L-12)

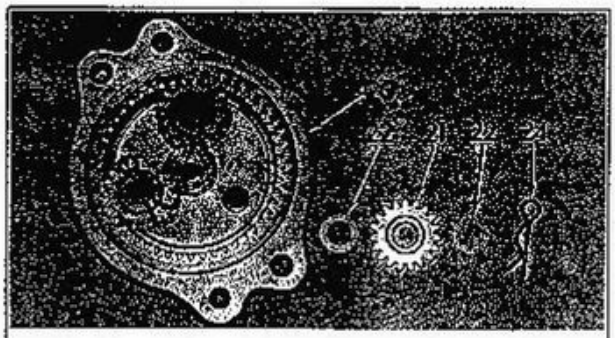
(Early Type Starter) Separate drive end assy. (20) from frame support (17) by pulling them apart. This will expose planet gears (21) and ring gear (23) mounted in drive end assembly (20). Remove the three planet gears (21) first, then ring gear (23) as follows.



20. Drive End Assembly
21. Planet Gear
22. Washer, Thrust
24. Cotter Pin

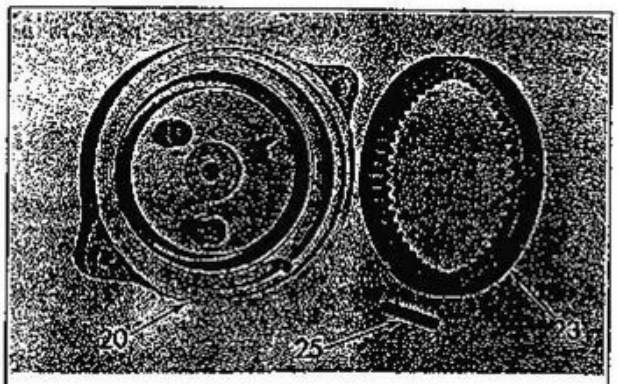
Figure 5L-9. Replacing Planet Gears (21) (Early Type Starter)

(Late Type Starter) Remove two screws (19A) along with lockwashers. Separate drive end assembly (20) from frame support (17) by pulling them apart. Take care to retain the shim washers (19B) and spring washers (19C) for reuse when reassembling. This will expose planet gears (21) and ring gear (23) mounted in drive end assembly (20). Remove the three planet gears (21) first, then ring gear as follows.



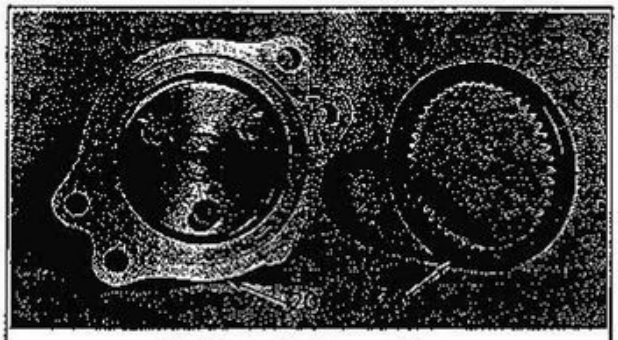
20. Drive End Assembly
21. Planet Gear
22. Washer, Thrust
24. Cotter Pin

Figure 5L-10. Replacing Planet Gears (21) (Late Type Starter)



20. Drive End Assembly
23. Ring Gear
25. Dowel Pin

Figure 5L-11. Replacing Ring Gear (23) (Early Type Starter)



20. Drive End Assembly
23. Ring Gear

Figure 5L-12. Replacing Ring Gear (23) (Late Type Starter)

Remove the three cotter pins (24) which retain planet gears (21). Slip the gears off along with the two shim washers (22) which go with each. There is one washer under and one on top. Inspect for worn or chipped teeth and replace if needed.

With planet gears (21) removed, ring gear (23) can be removed next. First pull out dowel pin (25) used on early type only, then ring gear (23), itself. The gear, which is a slip fit, comes out by working it outward evenly all around until it slips free.

CHECKING SPROCKET END PLAY

Check the end play of the starter motor sprocket (29) mounted on drive end assembly (20) spline shaft. End play should be from .001 in. to .009 in. End play is adjusted by removing retaining ring (28) and sprocket (29) from shaft and added or removing 0.2 mm shims (27), as required to obtain specified end play.

Disassembly of the unit beyond this point is not needed generally.

LUBRICATION

Lubricate as follows before reassembling.

Lightly pack Harley-Davidson "Grease-All" in two places: on the ball bearing in drive end assembly (20) behind the starter motor sprocket (29) and on ring gear (23) and planet gears (21).

Using light lubricating oil, apply a thin coating to bushing (19) and to the bushing located in frame support (17). These bushings support the armature shaft.

REASSEMBLING (See Figure 5L-1)

Putting the unit back together basically requires doing the above steps in reverse order. The only special requirement is to align those parts that go together in one way only.

Check both rubber gaskets (26) and replace if they are dried out or broken.

(Early Type Starter) Dowel pin (25) locates ring gear (23) in end drive assembly (20). This pin also positions frame support (17) when joined to drive assembly (20). Next, align the one tab on brush holder (3) to locate it properly in frame (4). A second tab on holder (3) matches a slot in cover (2) which forces frame (4) and cover (2) to position correctly when they are joined together. Finally, thru bolts (1) must pass through the holes in cover (2) and thread directly into the holes in drive end assembly (20). Torque bolts (1) 20-25 in.-lbs.

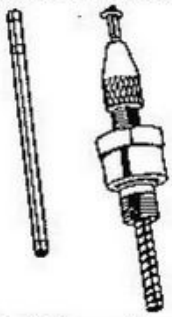
(Late Type Starter) Align the one tab on brush holder (3) to locate it properly in frame (4). A second tab on holder (3) matches a slot in cover (2) which forces frame (4) and cover (2) to position correctly when they are joined together. Thru bolts (1) thread directly into the holes in drive end assembly (20). Screws (19A) connect the drive end assembly (20) to the frame support (17). Use one thick shim and three thin shims (19B and 19C) for proper spring washer (19C) preload. Torque bolts (1) and screws (19A) 20-25 in.-lbs.

SERVICE TOOLS

95860-67P CRANKSHAFT DEGREE INDICATOR TOOL

Used for timing ignition with strobe timing light when engine is running. Degree plate attaches to generator shaft.

PISTON POSITION GAGE



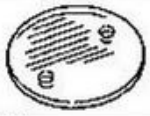
Gage screws into spark plug hole and rod indicates correct piston position for setting ignition timing.

95883-67 Ignition Timing Gage - 1967 & later sprint.

95886-67 Gage Rod Only - 1967-68 Sprint.

Note: All rods can be used interchangeably in Gage Assembly.

96297-71 TIMING MARK VIEW COVER



Used to view flywheel timing mark for ignition timing.

97306-73P ALTERNATOR ROTOR HOLDING TOOL

Used to keep rotor stationary while removing shaft nut.

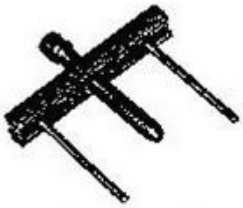
97296-61P GENERATOR ARMATURE PULLER - SPRINT

Used for pulling generator armature from flywheel shaft. Threaded collar of tool is screwed into armature tapped hole and tool bolt turned to free armature.

97302-61 GENERATOR POLE SHOE ARBOR

Used to force field coils and pole shoes in place when installing in generator frame.

97292-61P TWO JAW PULLER



Use with 2 - Part No. 52081-63P bolts to pull alternator rotor.

MISCELLANEOUS

TABLE OF CONTENTS

SERVICING SPEEDOMETER

GENERAL

To lubricate the speedometer drive cable core or replace a damaged or broken core, proceed as follows:

Loosen speedometer case coupling nut from head. Slip drive cable core out of conduit. To free a broken cable core from conduit also disconnect the lower case coupling nut at the front wheel drive unit and withdraw broken piece of cable from lower end of conduit.

To free speedometer head carry out the above mentioned procedure for repairing or replacing a speedometer drive core. Remove the two knurled speedometer mounting nuts and locks and lift the speedometer head out of housing.

To install a speedometer head and drive case reverse the order of disassembly.

Install core in upper end of conduit, applying a light coat of graphite grease to the core as it is inserted in the conduit. Connect case coupling upper end to speedometer head, engaging squared end of core in speedometer shaft. Be sure to tighten both case coupling nuts securely.

SERVICING TACHOMETER

GENERAL

To lubricate tachometer drive cable core or replace a damaged or broken core, loosen tachometer case coupling nuts and slip drive cable core out of conduit.

To remove tachometer head from bracket, remove nuts, washers and lockwashers from studs. Installation is the reverse of removal.

TACHOMETER DRIVE UNIT (Fig. 6D-1)

Remove tachometer drive unit (1) from crankcase cover by removing two screws (2). Clamp drive unit securely in a vise and remove driven gear guide plug (3) by tapping on one flat of the hex with a flat punch or similar tool. Remove driven gear (4). Remove staking which secures washer (5) in housing recess. Clamp tang end of driving gear (6) in vise and tap or pull housing free from gear and bearings (7). Support outer races of bearings and tap ends of gear shaft to remove bearings from gear shaft. Inspect and replace all worn or damaged parts. Assembly is essentially the reverse of disassembly. Tang on end of drive shaft must engage slot in drive fitting on engine crankshaft.

LUBRICATION

Lubricate cable core every 5000 miles with graphite grease. Use hand grease gun to apply a small quantity of grease at fitting on drive housing every 2000 miles. DO NOT OVER LUBRICATE.

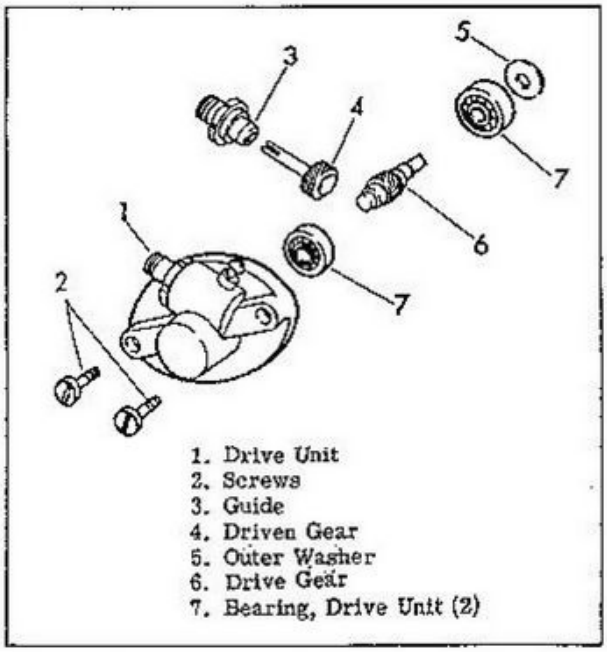


Figure 6D-1. Tachometer Drive Unit (1972 & Earlier)