

2002 BUELL M2/M2L

SERVICE MANUAL

Part Number 99491-02Y

Section 1: Maintenance

Section 2: Chassis

Section 3: Engine

Section 4: Fuel System

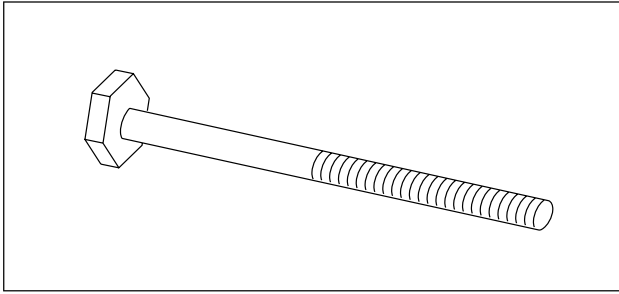
Section 5: Starter

Section 6: Drive/Transmission

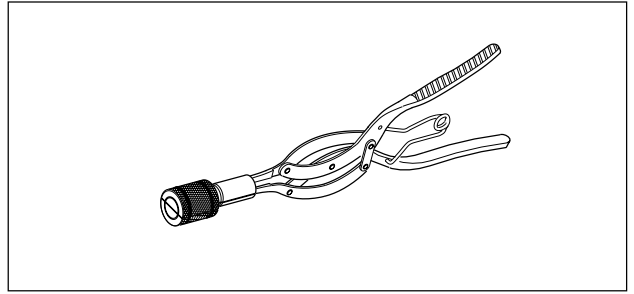
Section 7: Electrical

Appendix

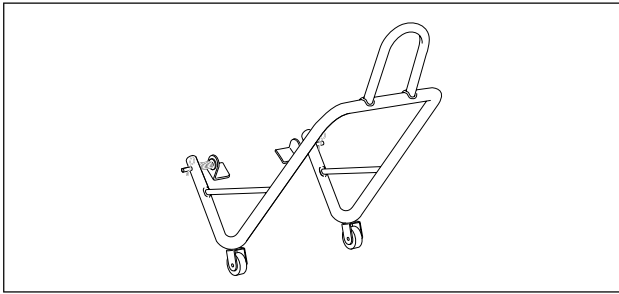
APPENDIX A-TOOLS



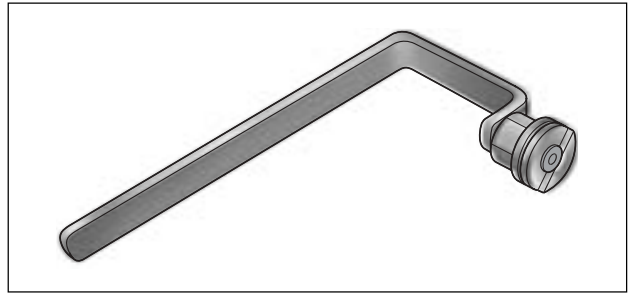
Part No. B-35316-5 12 Inch Bolt.
Used with Part No. HD-39302.



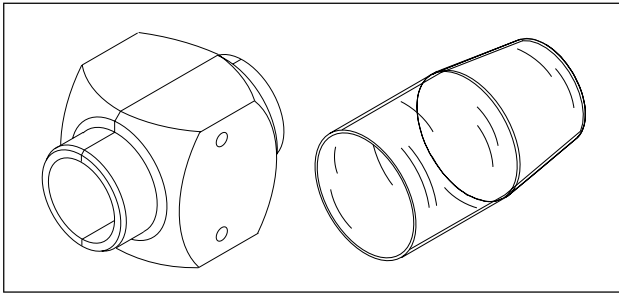
Part No. B-42887 Brake Caliper Piston Remover



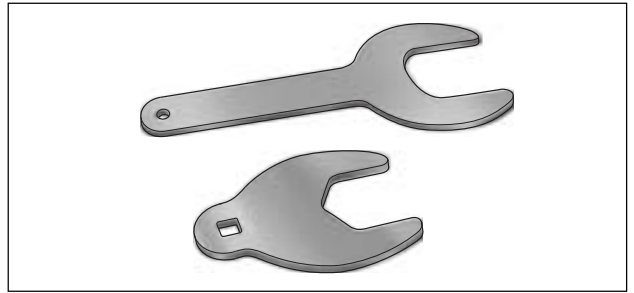
**Part No. B-41174 Rear Wheel Support Stand and
Part No. B-41174-2 Replacement Pad**



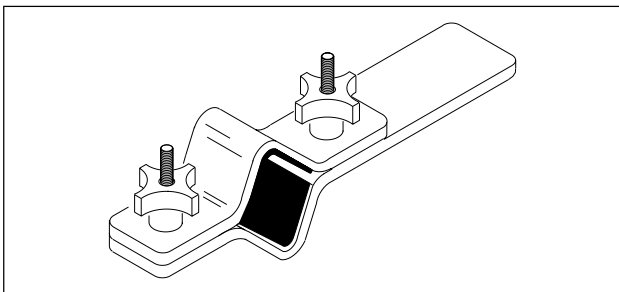
Part No. B-44623 Isolator Tool



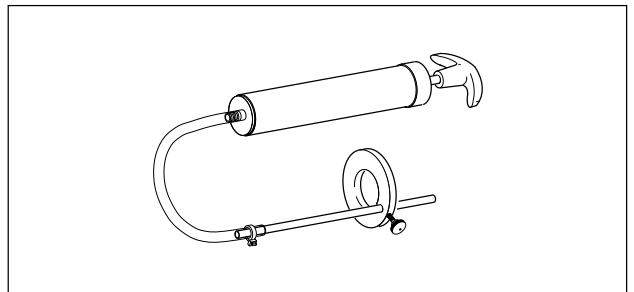
Part No. B-41176 Front Fork Bushing/Seal Installer



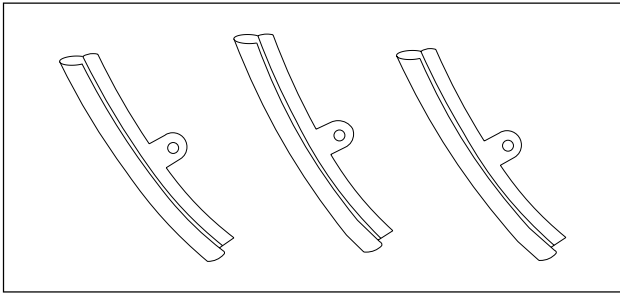
Part No. B-45110 Shock Preload Adjustment Tools



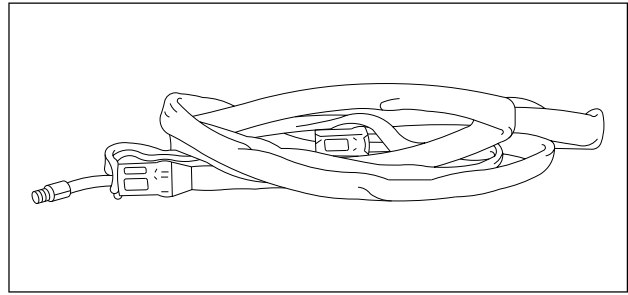
Part No. B-41177 Front Fork Holding Tool



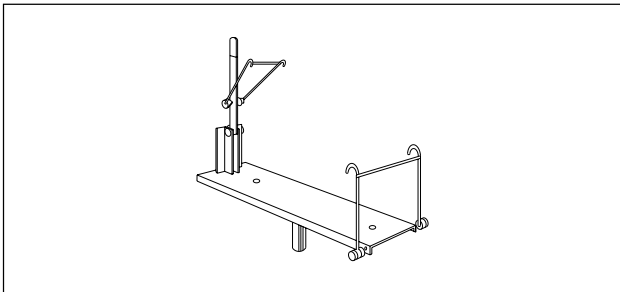
Part No. B-59000A Pro Level Oil Gauge



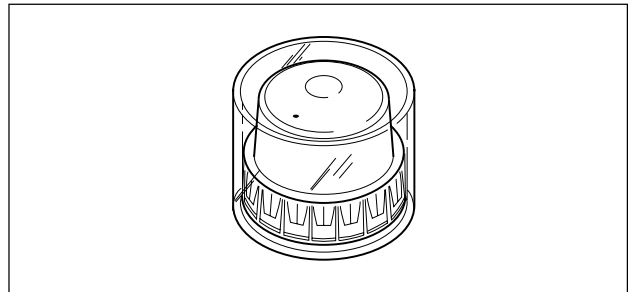
Part No. HD-01289 Rim Protectors



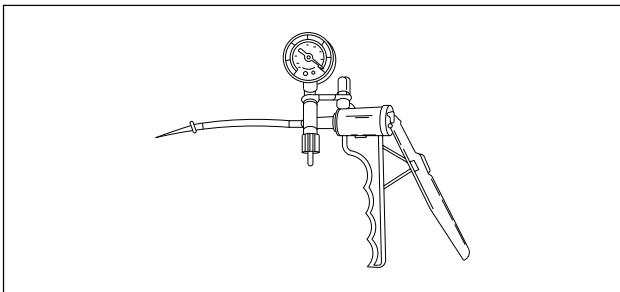
Part No. HD-28700 Tire Bead Expander



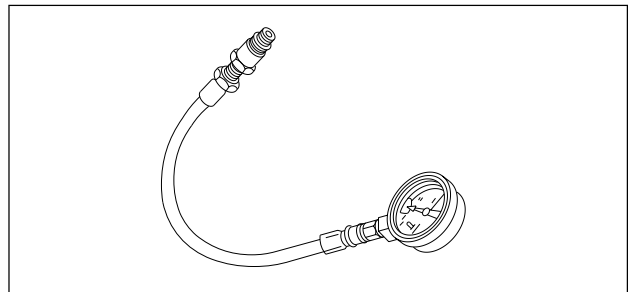
Part No. HD-21000 Tire Spreader



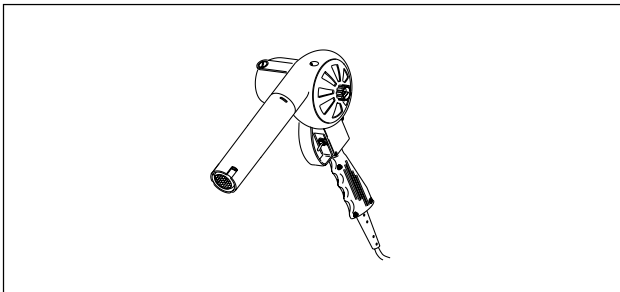
Part No. HD-33067 Wheel Bearing Packer



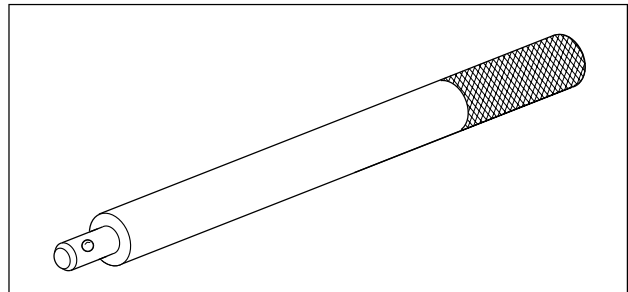
Part No. HD-23738 Vacuum Pump



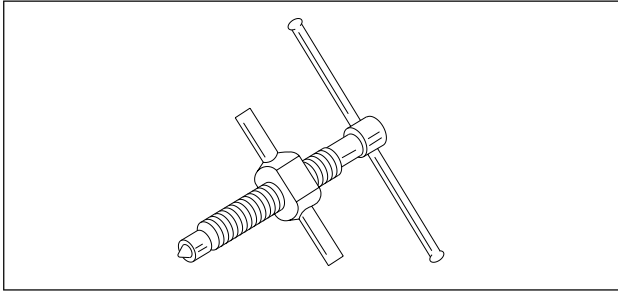
Part No. HD-33223-1 Cylinder Compression Gauge



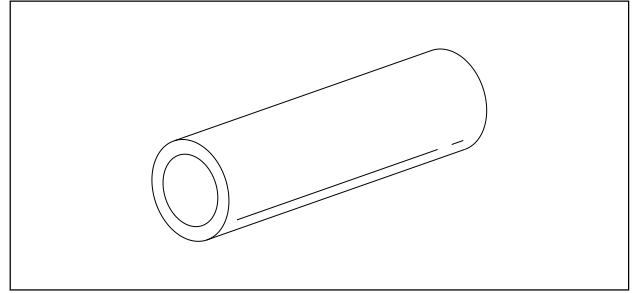
Part No. HD-25070 Robinair Heat Gun



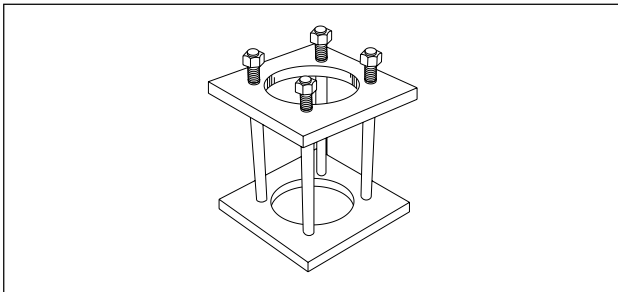
Part No. HD-33416 Universal Driver Handle



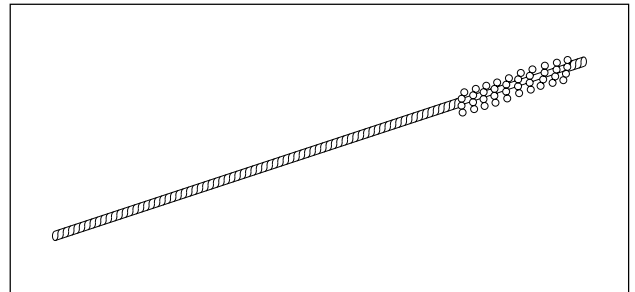
Part No. HD-33418 Universal Puller Forcing Screw



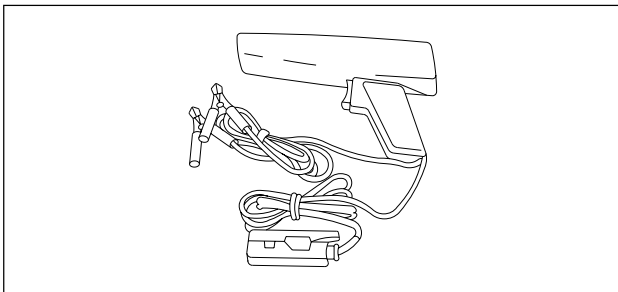
Part No. HD-34643A Shoulderless Valve Guide Seal Installer



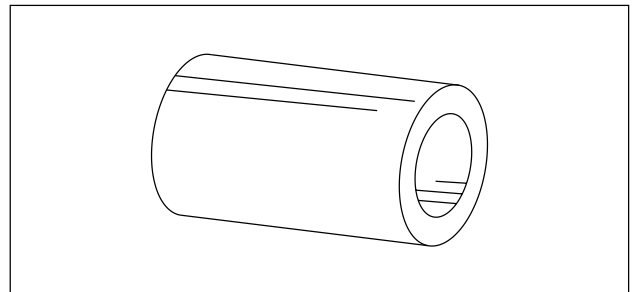
Part No. HD-33446A Cylinder Torque Plates and Torque Plate Bolts Part No. HD-33446-86



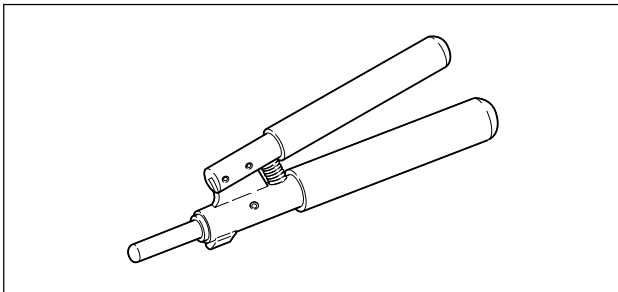
Part No. HD-34723 Valve Guide Hone (8 mm)



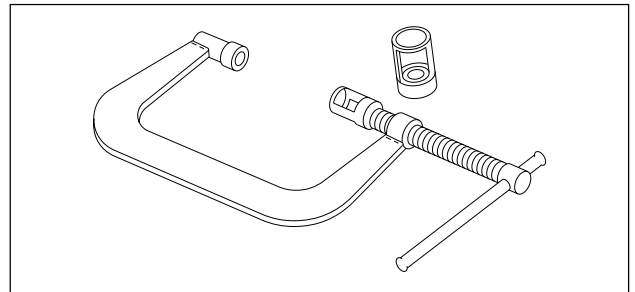
Part No. HD-33813 Inductive Timing Light



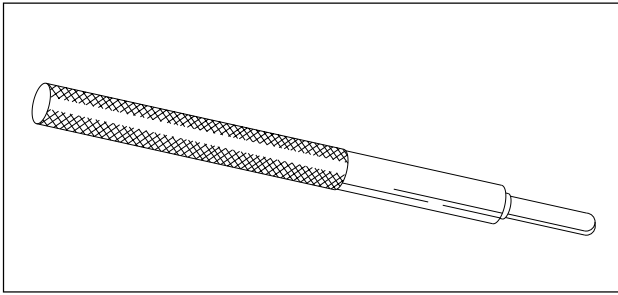
Part No. HD-34731 Shoulderless Valve Guide Installation Tool



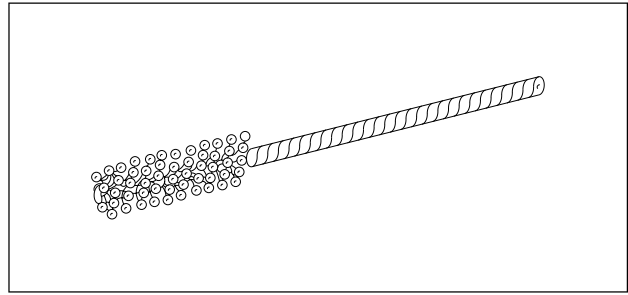
Part No. HD-34623B Piston Pin Retaining Ring Installer/Remover



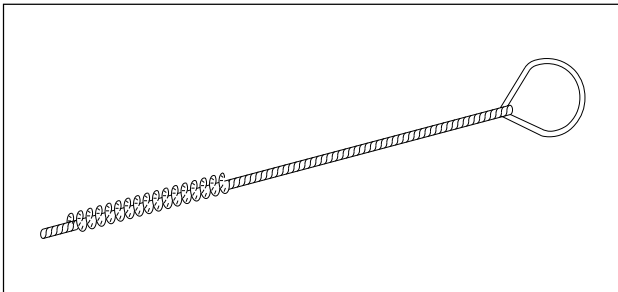
Part No. HD-34736B Valve Spring Compressor



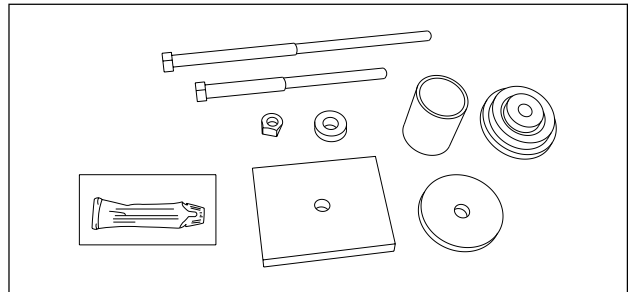
Part No. HD-34740 Driver Handle and Remover. Used with [HD-34643A](#) and [HD-34731](#).



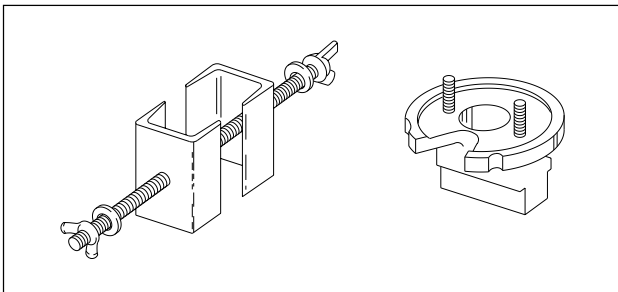
Part No. HD-35102 Wrist Pin Bushing Hone (20 mm)



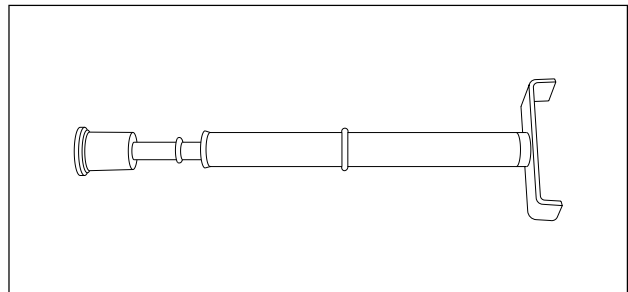
Part No. HD-34751 Nylon Valve Guide Brush



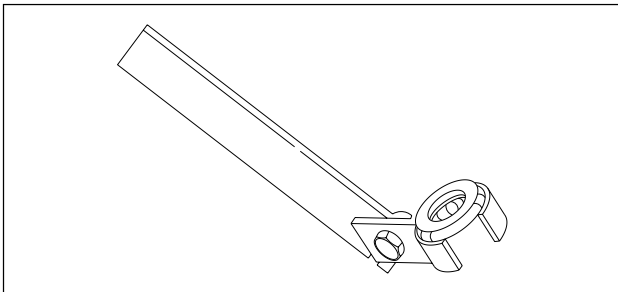
Part No. HD-35316-A Main Drive Gear Remover/Installer and Main Drive Gear Bearing Installer



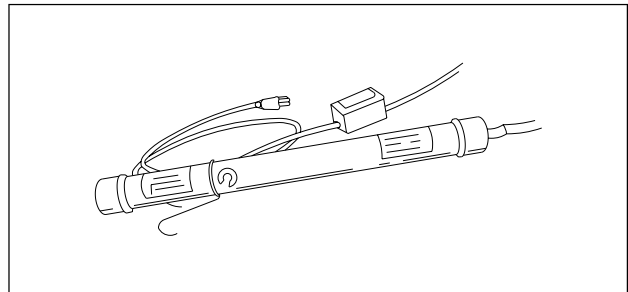
Part No. HD-34813 Rowe Flywheel Rebuilding Jig



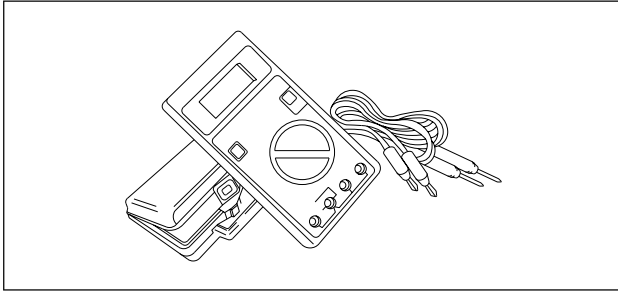
Part No. HD-35381 Belt Tension Gauge



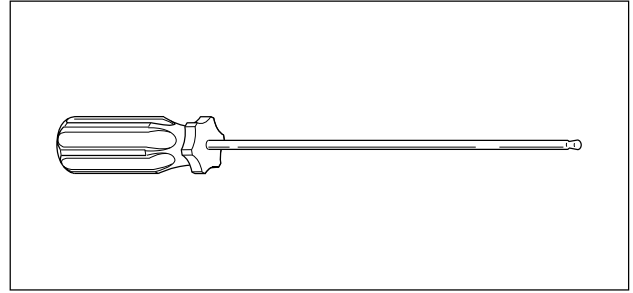
Part No. HD-34816 Oil Pressure Switch Wrench



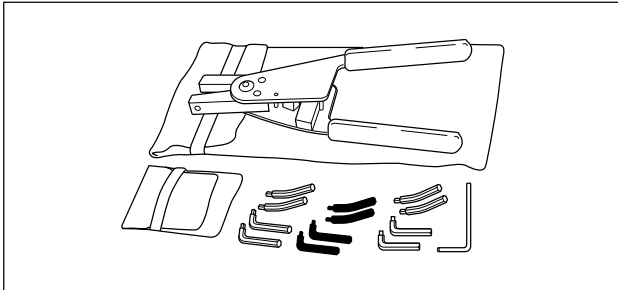
Part No. HD-35457 Black Light Leak Detector



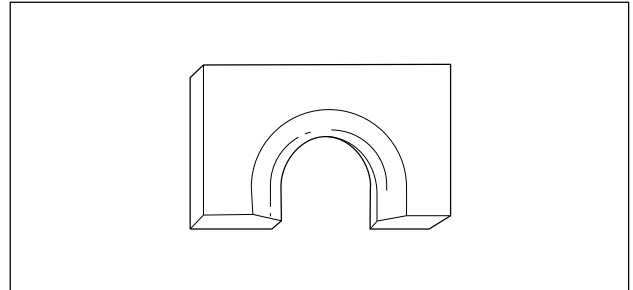
Part No. HD-35500A Digital Multi-Meter (FLUKE 23)



Part No. HD-35801 Intake Manifold Screw Wrench



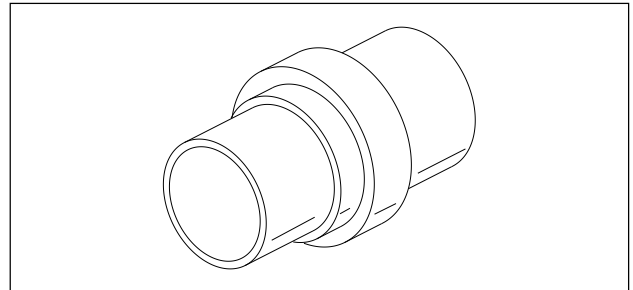
Part No. HD-35518 Internal/External Retaining Ring Pliers



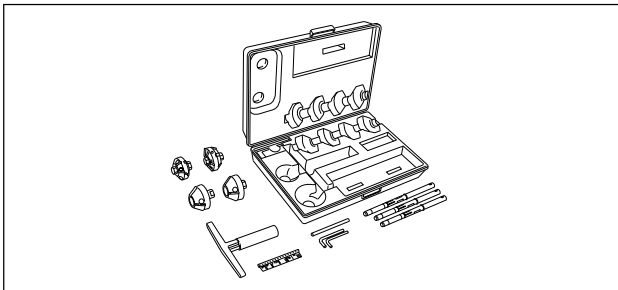
Part No. HD-37404 Countershaft Gear Support Plate



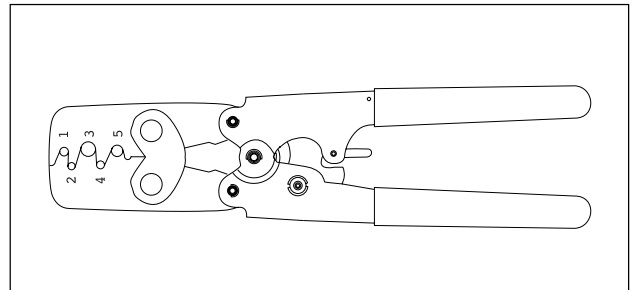
Part No. HD-35667A Cylinder Leakdown Tester



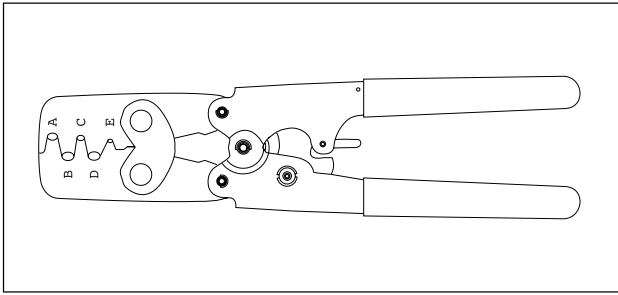
Part No. HD-37842A Inner/Outer Main Drive Gear Needle Bearing Installer



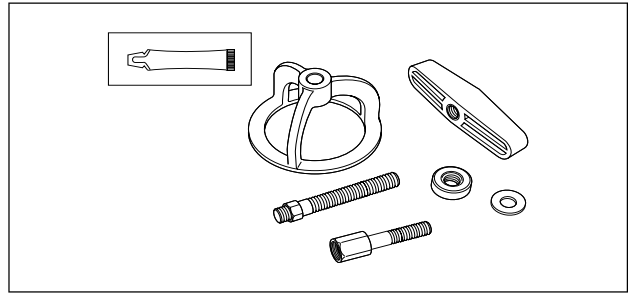
Part No. HD-35758 Neway Valve Seat Cutter Set



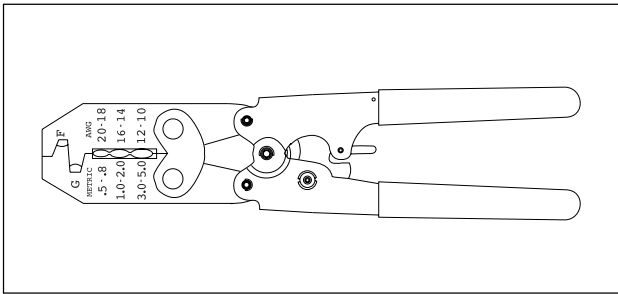
Part No. HD-38125-6 Packard Terminal Crimp Tool (Sealed and non-sealed connectors)



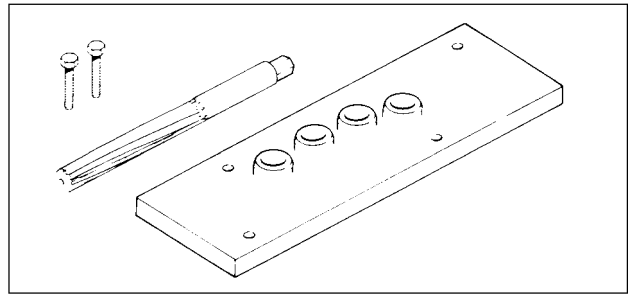
**Part No. HD-38125-7 Packard Terminal Crimp Tool
(Sealed connectors)**



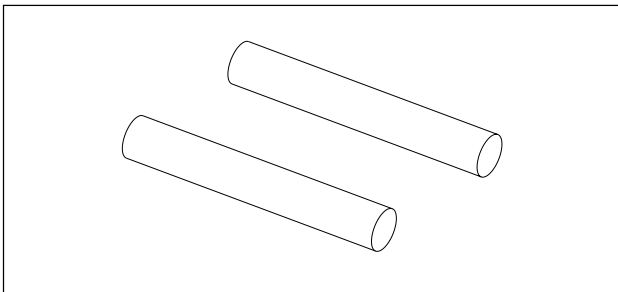
**Part No. HD-38515-A Clutch Spring Compressing Tool
and Part No. HD-38515-91 Forcing Screw**



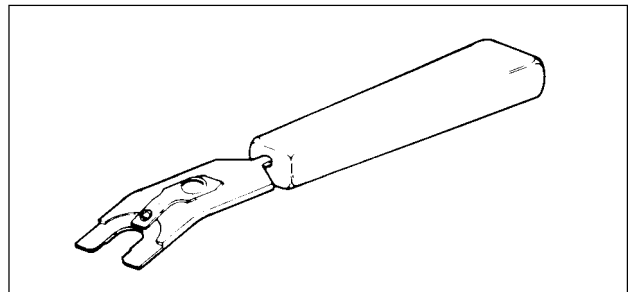
Part No. HD-38125-8 Packard Terminal Crimp Tool



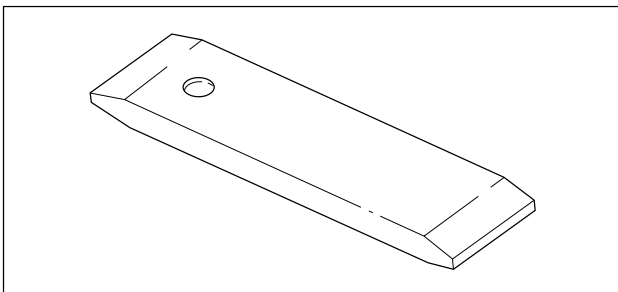
**Part No. HD-38871 Camshaft Bushing Plate Pilot
and Reamer**



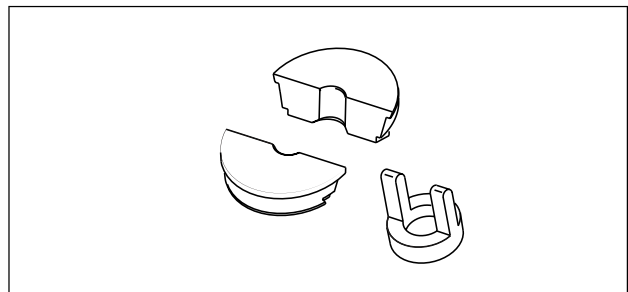
**Part No. HD-38361 Cam Gear Gauge Pin Set
(0.108 in. (2.74 mm) Diameter)**



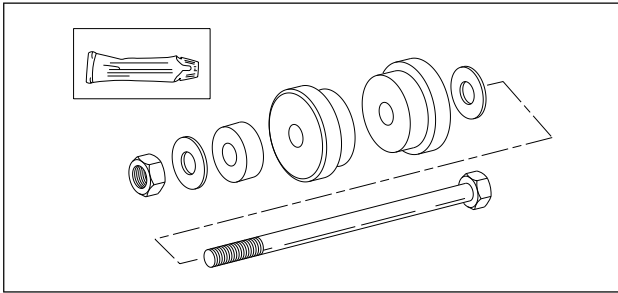
Part No. HD-39151 Shift Drum Retaining Ring Installer



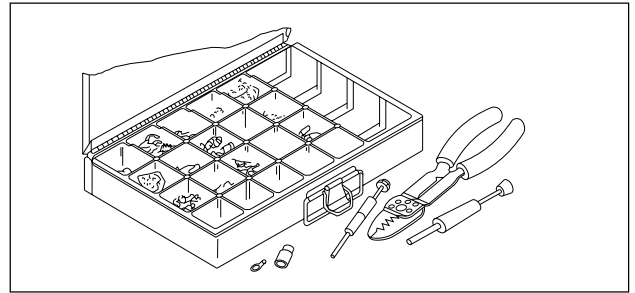
Part No. HD-38362 Sprocket Locking Link



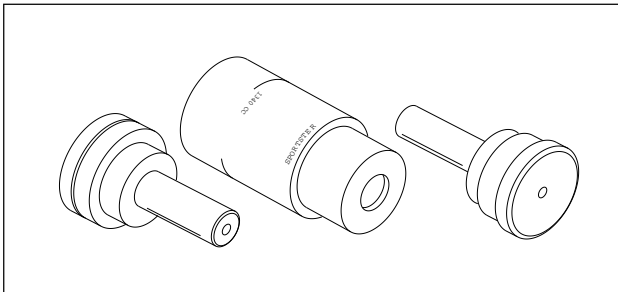
**Part No. HD-39301-A Steering Head Bearing
Race Remover**



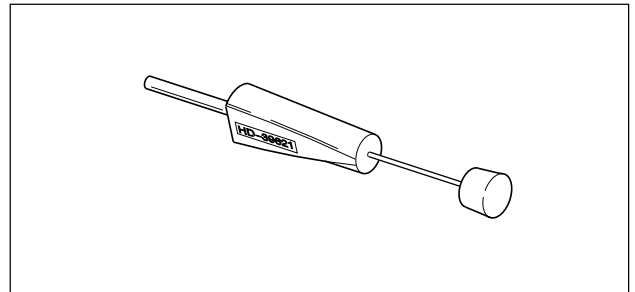
Part No. HD-39302 Steering Head Bearing Race Installer



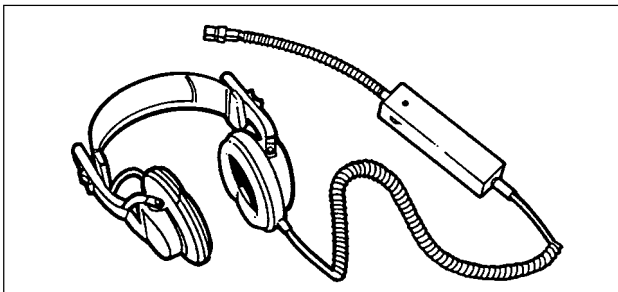
Part No. HD-39621 Electrical Terminal Repair Kit



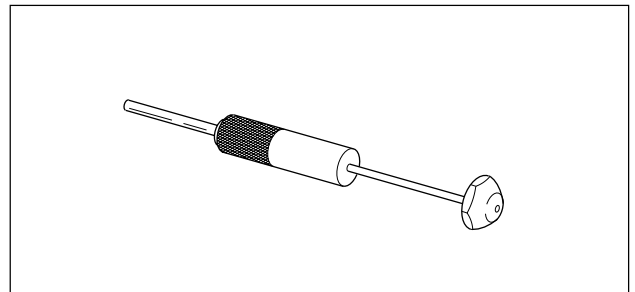
Part No. HD-39458 Sprocket Shaft Bearing Outer Race Installer



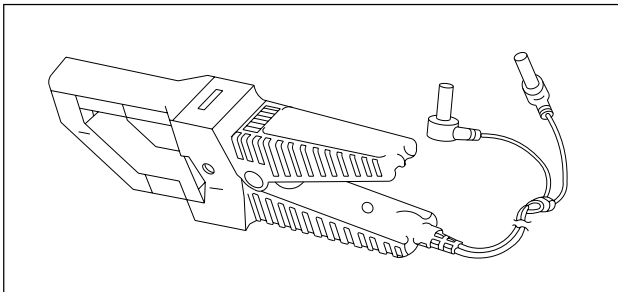
Part No. HD-39621-27 Socket Terminal Remover



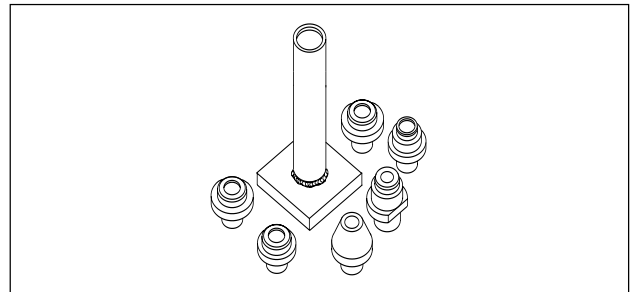
Part No. HD-39565 Engine Sound Probe



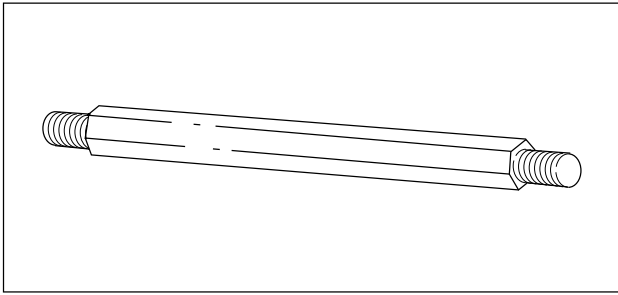
Part No. HD-39621-28 Pin Terminal Remover



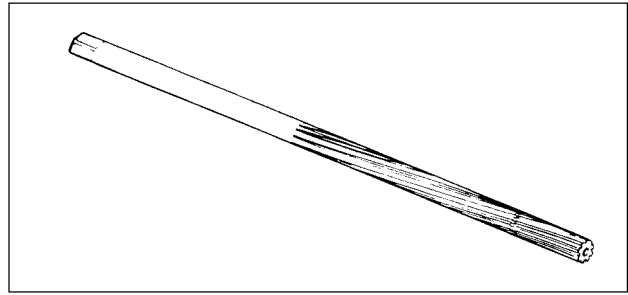
**Part No. HD-39617 Inductive Amp Probe.
Use with HD-35500A.**



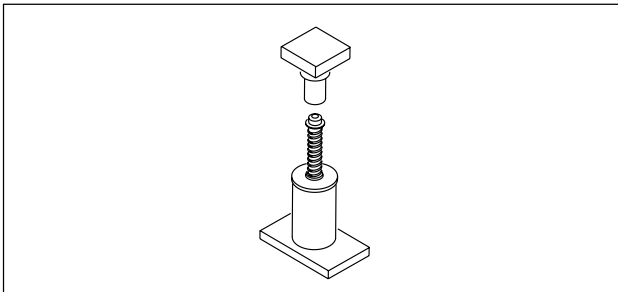
Part No. HD-39782 Cylinder Head Support



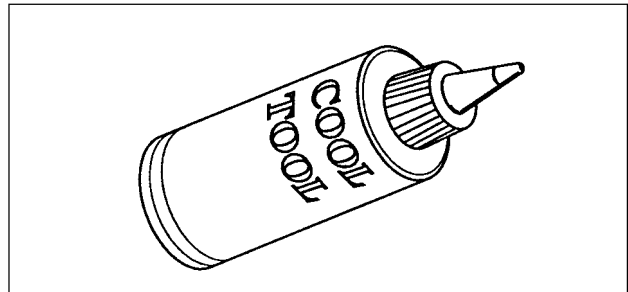
Part No. HD-39786 Cylinder Head Holding Fixture



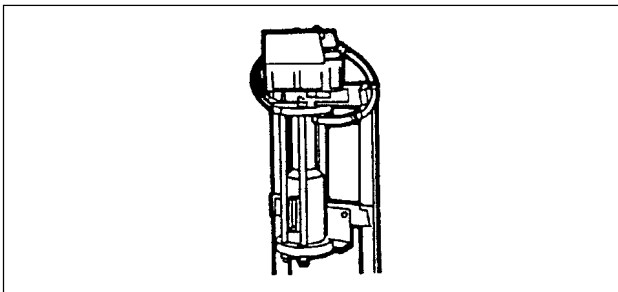
Part No. HD-39932 (Steel) or HD-39932-CAR (Carbide) Intake and Exhaust Valve Guide Reamer



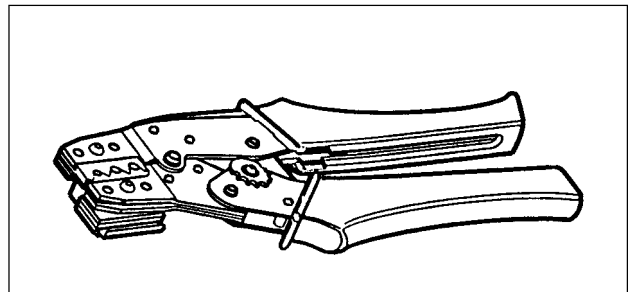
Part No. HD-39800 Oil Filter Crusher, Small



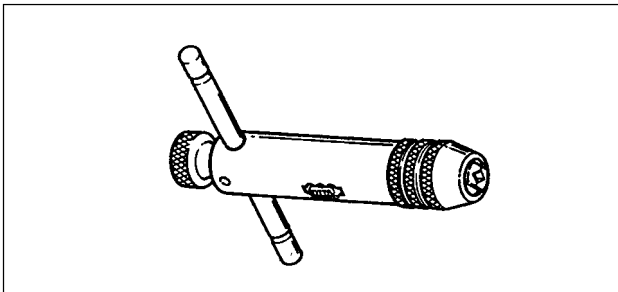
Part No. HD-39964 Reamer Lubricant (Cool Tool)



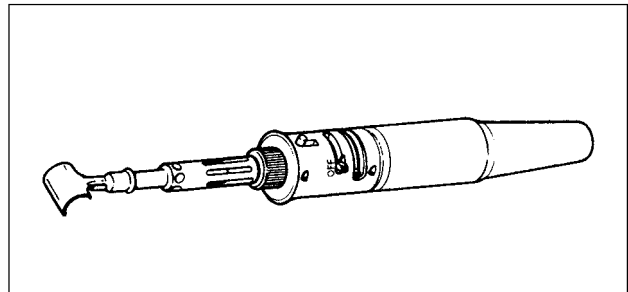
Part No. HD-39823 Oil Filter Crusher, Large



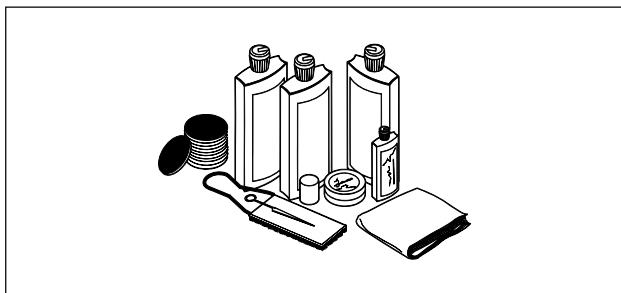
Part No. HD-39965 Deutsch Terminal Crimp Tool



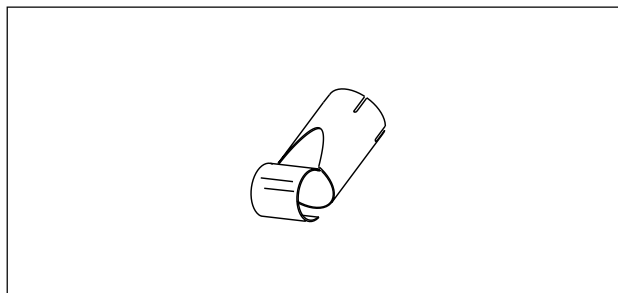
**Part No. HD-39847 Universal Ratcheting Tap/
Reamer Handle**



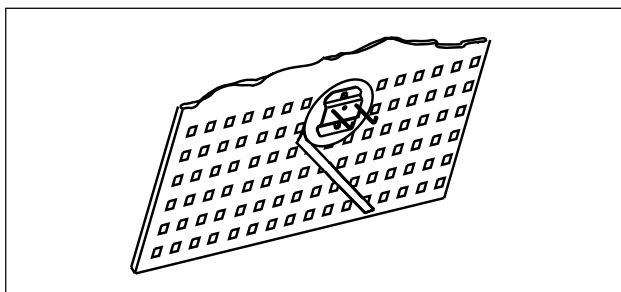
Part No. HD-39969 Ultra-Torch UT-100



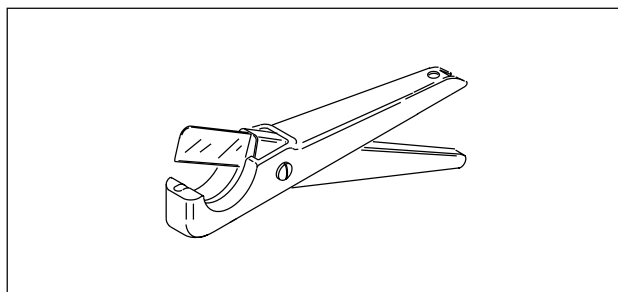
Part No. HD-39994 Paint Repair Kit



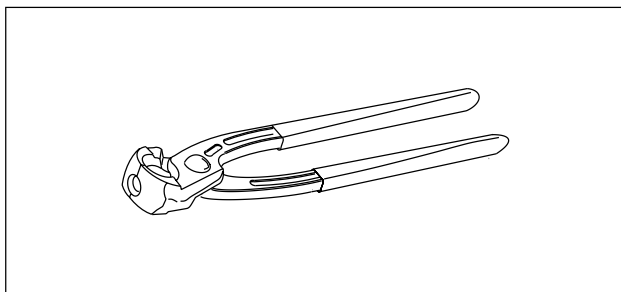
Part No. HD-41183 Heat Shield Attachment
Use with Part No. HD-25070.



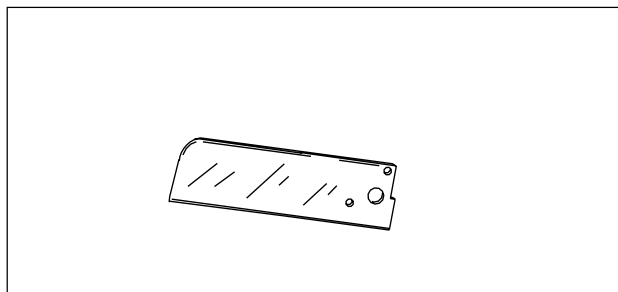
Part No. HD-41025 Tool Organizational System



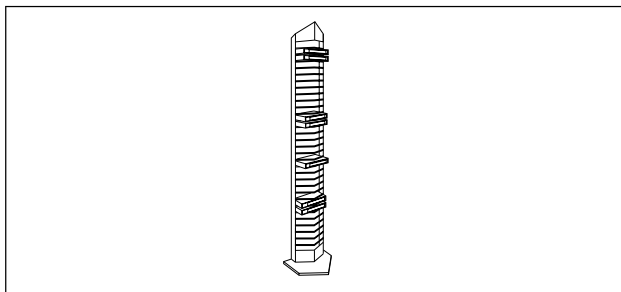
Part No. HD-41185 Hose Cutting Tool



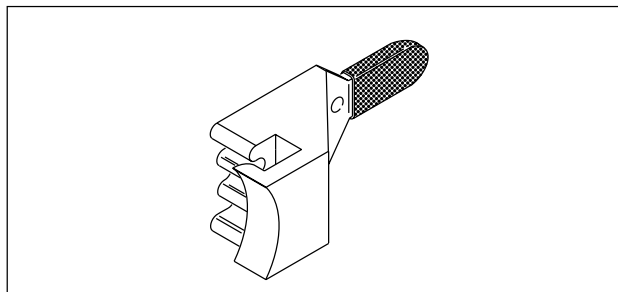
Part No. HD-41137 Hose Clamp Pliers



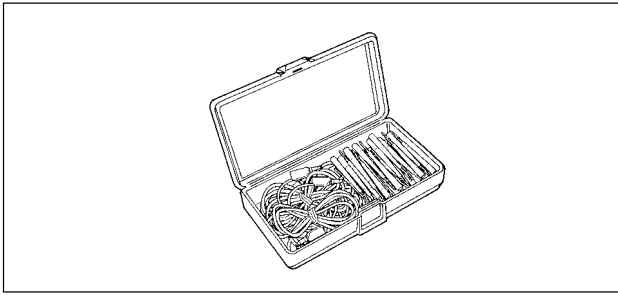
Part No. HD-41185-1 Oil Hose Cutter



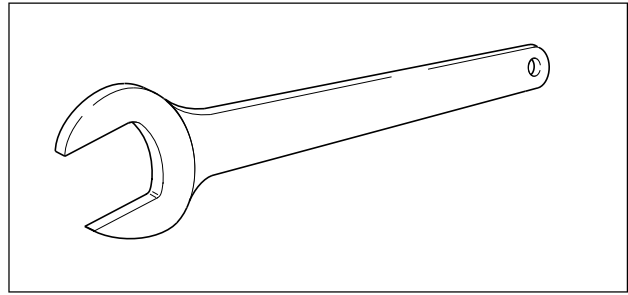
Part No. HD-41155 VHS Video Shelf



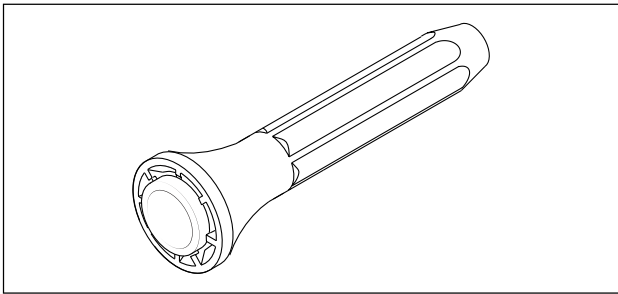
Part No. HD-41321 Sprocket Holding Tool



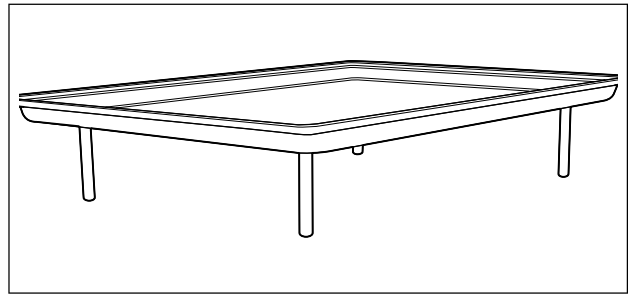
Part No. HD-41404 Test Connector Kit



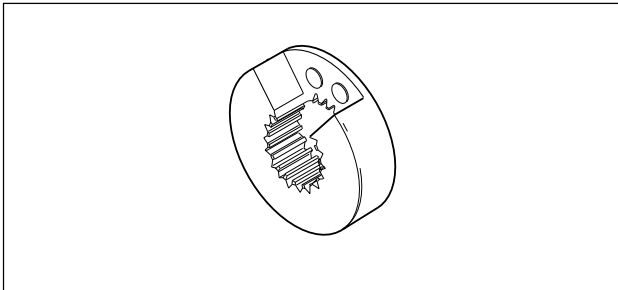
Part No. HD-41675 Oil Pressure Sending Unit Wrench



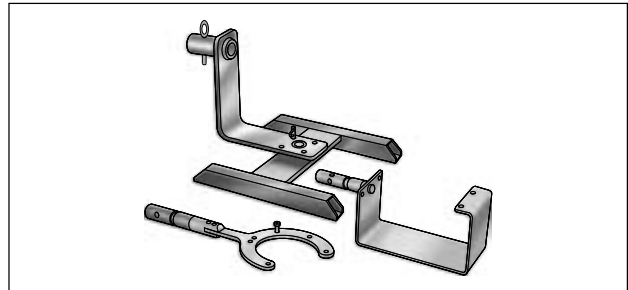
Part No. HD-41496 Main Drive Gear Seal Installer



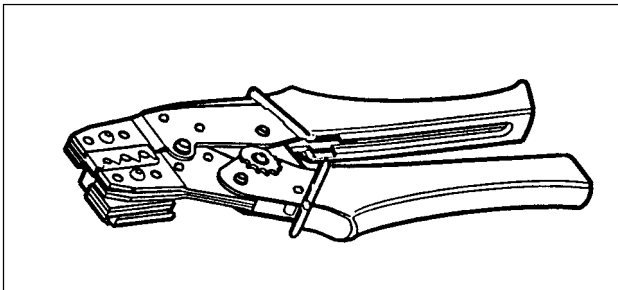
Part No. HD-42310-150 Drip Pan



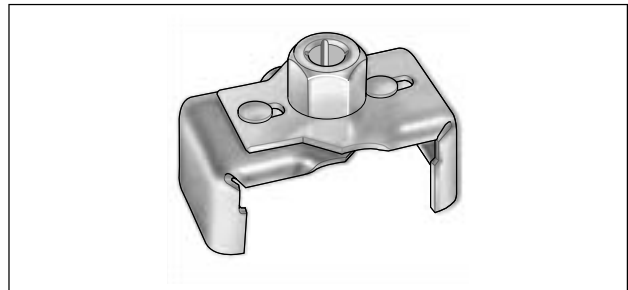
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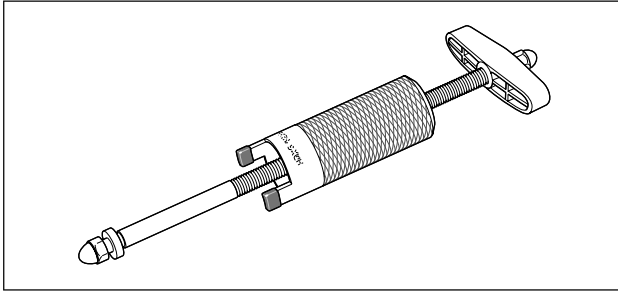
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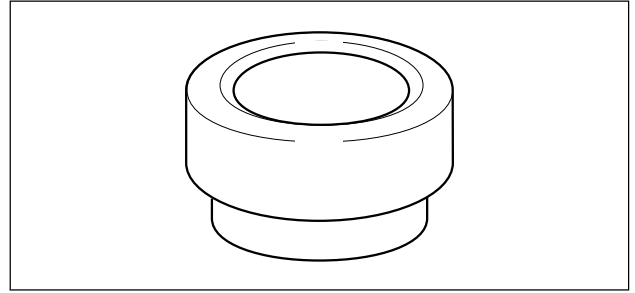
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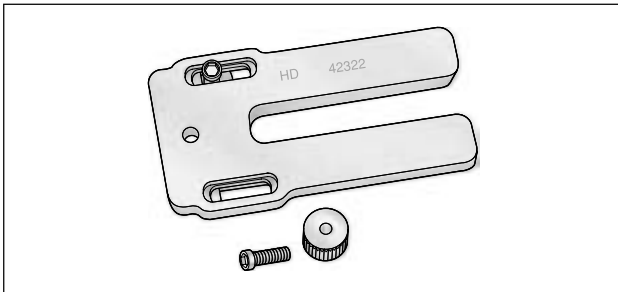
Part No. HD-42311 Oil Filter Wrench



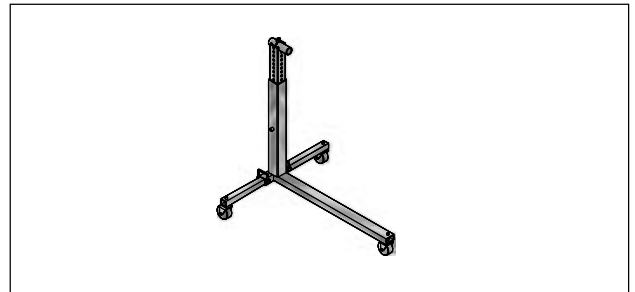
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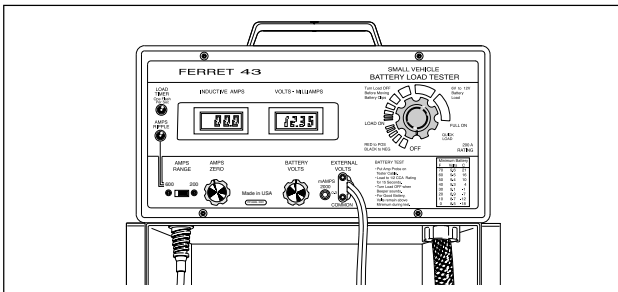
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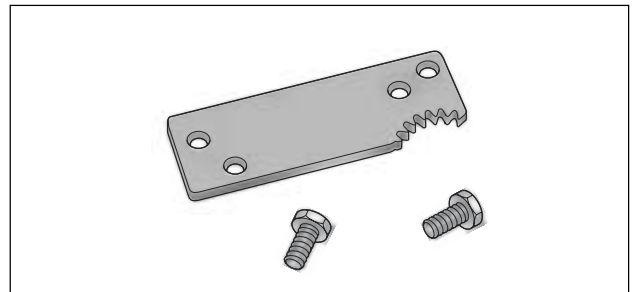
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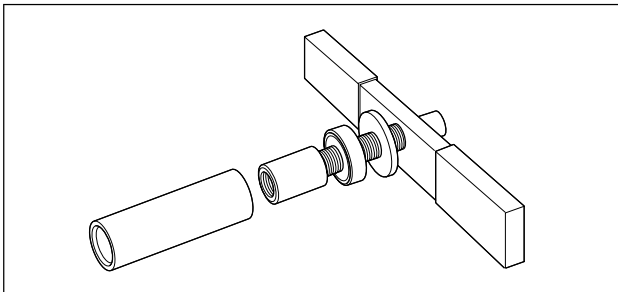
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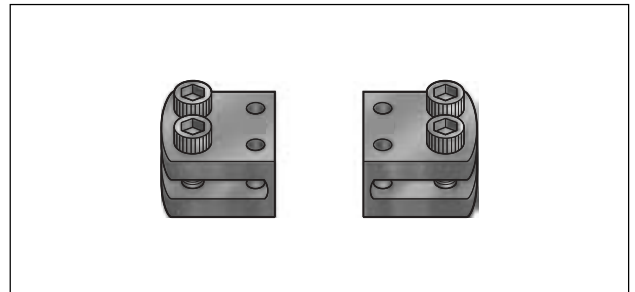
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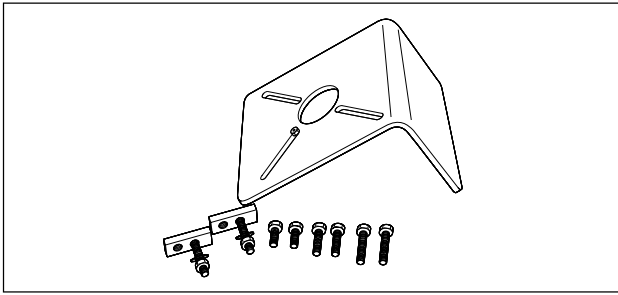
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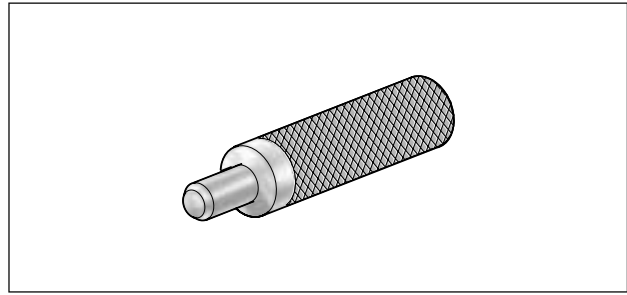
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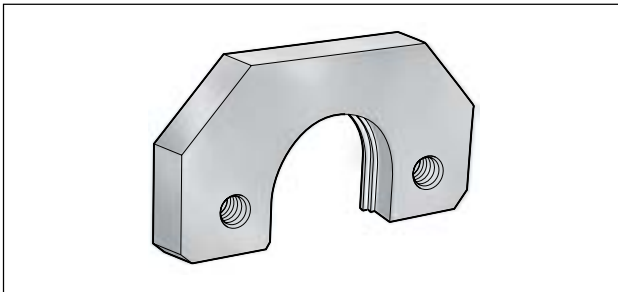
Part No. HD-44069 Timken Snap Ring Remover/Installer



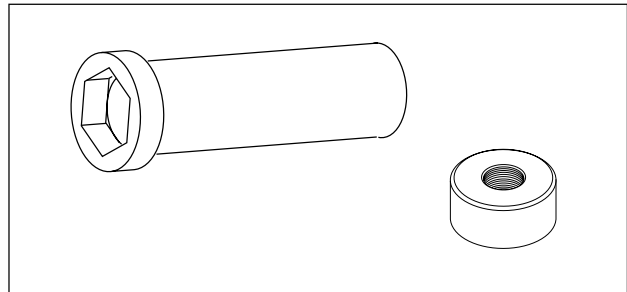
Part No. HD-44358 Flywheel Fixture (2000 Models)



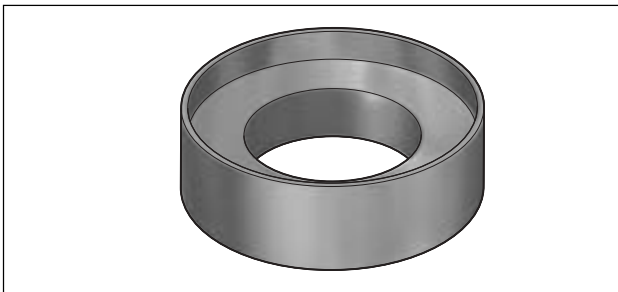
**Part No. HD-94547-102 Drive Handle
(Used with HD-94547-100 and HD-94547-101)**



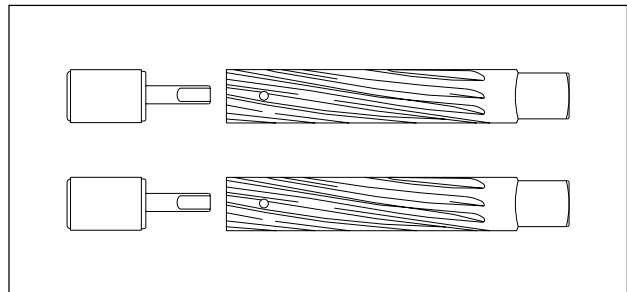
**Part No. HD-44404 Sprocket Shaft Inner Timken Bearing
Remover (2000 Models)**



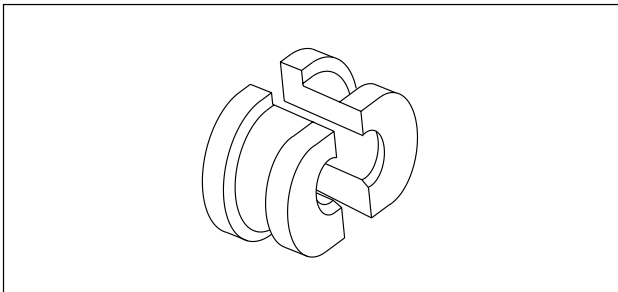
Part No. HD-94660-37B Mainshaft Locknut Wrench



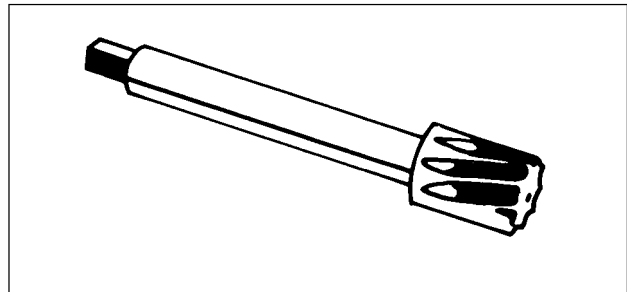
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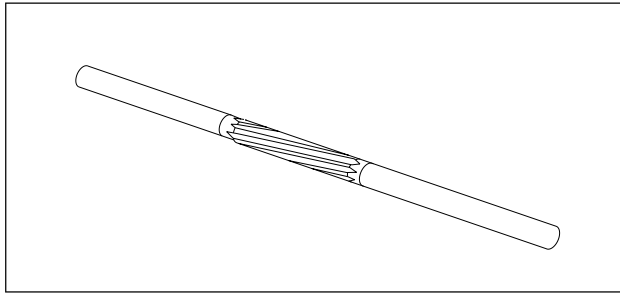
**Part No. HD-94800-26A Connecting Rod Bushing
Reamers and Pilots**



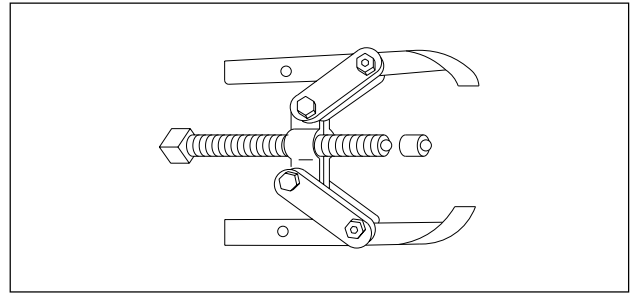
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Remover/Installer**



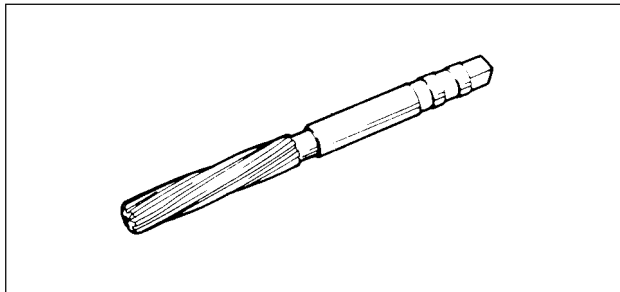
**Part No. HD-94803-67 Rear Intake Camshaft
Bushing Reamer**



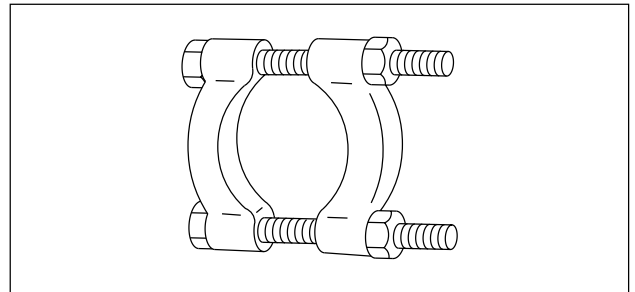
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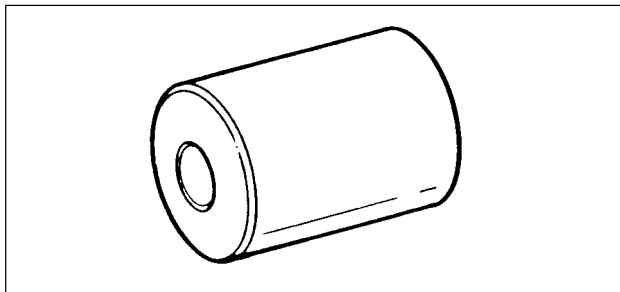
Part No. HD-95635-46 All-Purpose Claw Puller



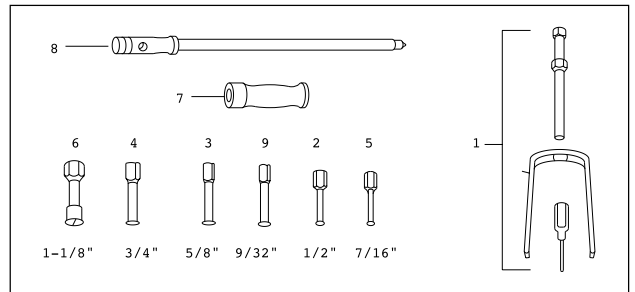
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Use with HD-94812-87.



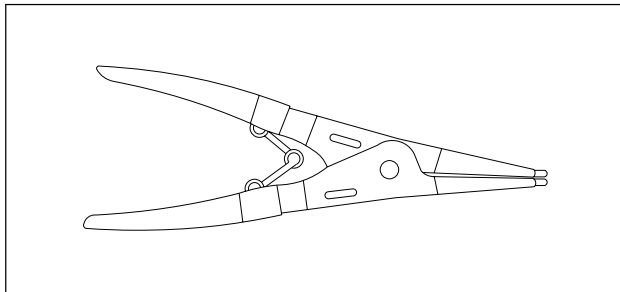
Part No. HD-95637-46A Wedge Attachment for Claw Puller. Use with HD-95635-46.



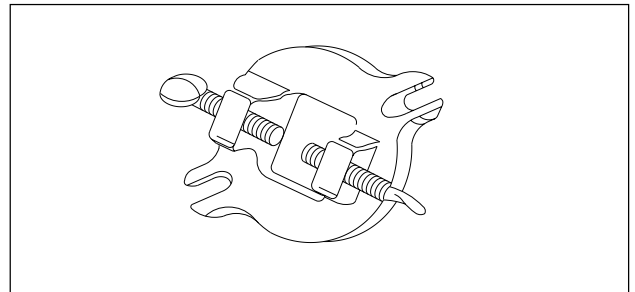
Part No. HD-94812-87 Pinion Shaft Reamer Pilot.
Use with HD-94812-1.



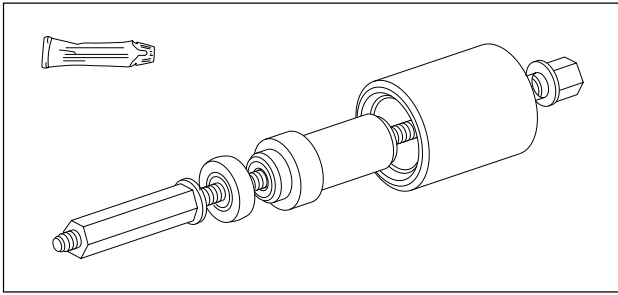
Part No. HD-95760-69A Bushing/Bearing Puller Tool Set.
Set includes items 1-7. Items 8 (HD-95769-69), 9 (HD-95770-69) and 10 (HD-95771-69) are optional.



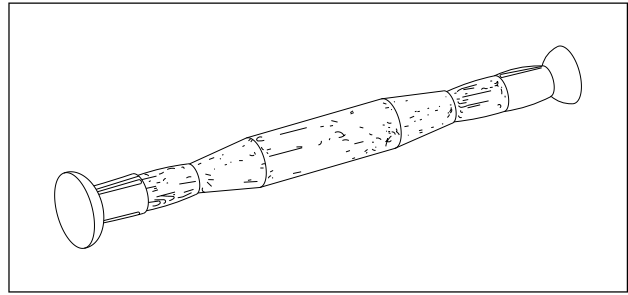
Part No. HD-95017-61 Large External Retaining Ring Pliers



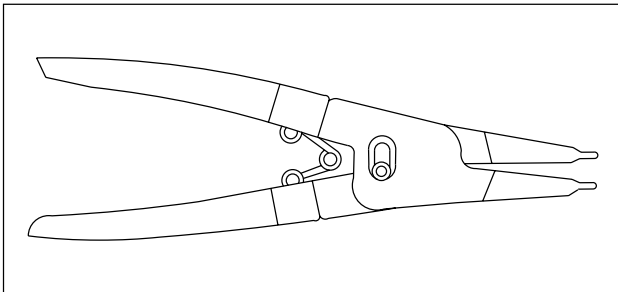
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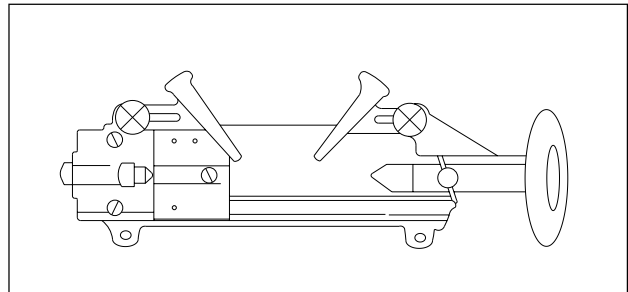
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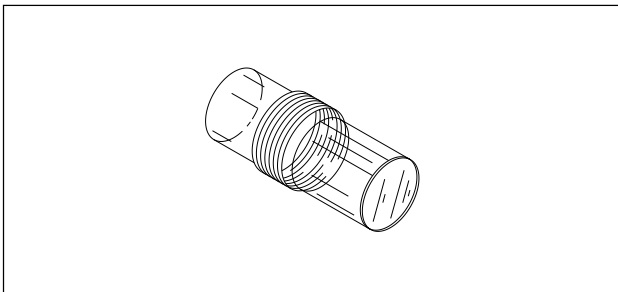
Part No. HD-96550-36A Valve Lapping Tool



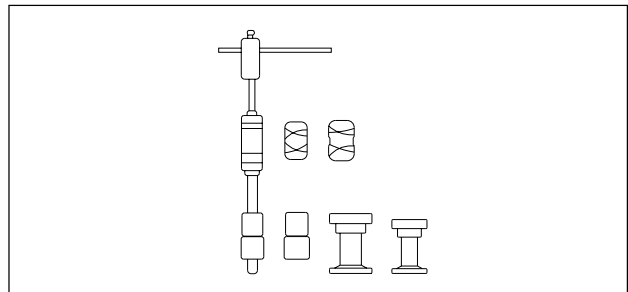
Part No. HD-96215-49 Small Internal Retaining Ring Pliers



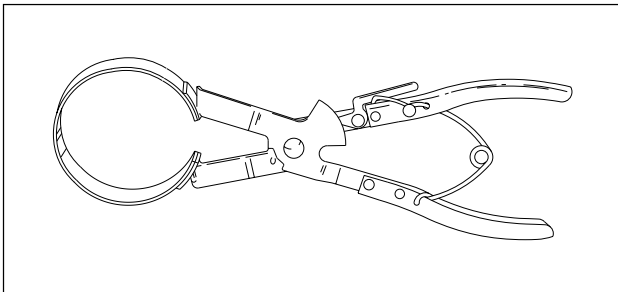
Part No. HD-96650-80 Flywheel Truing Stand



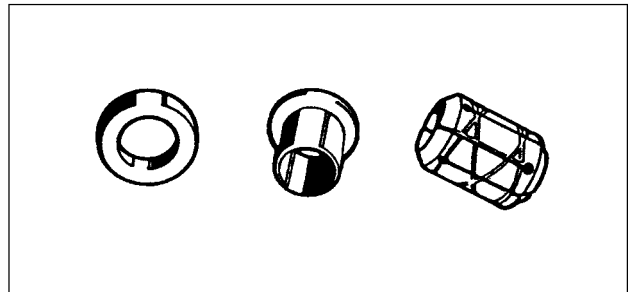
Part No. HD-96295-65D Timing Mark View Plug.
Use with HD-33813.



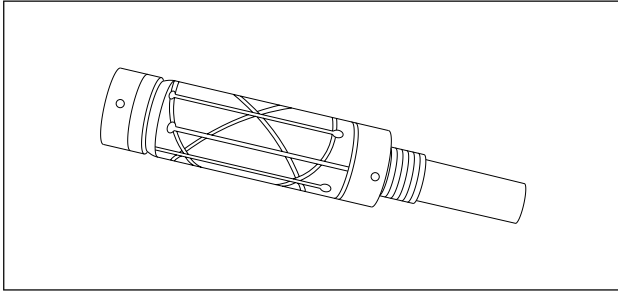
Part No. HD-96710-40B Crankcase Main Bearing Lapping Tool



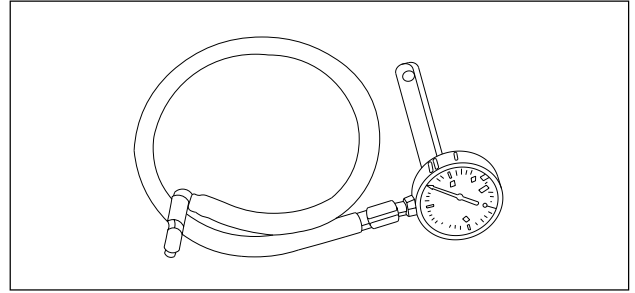
Part No. HD-96333-51C Piston Ring Compressor



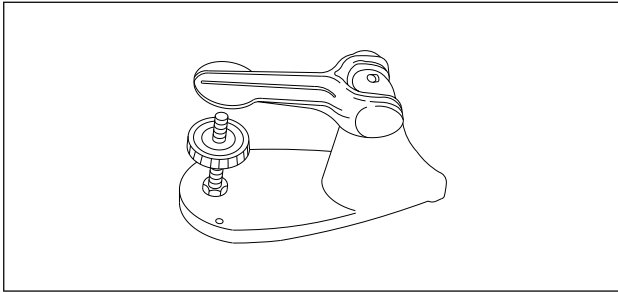
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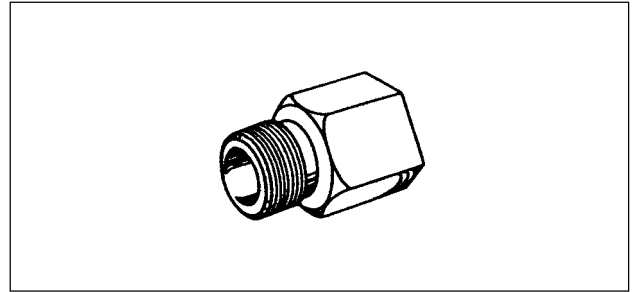
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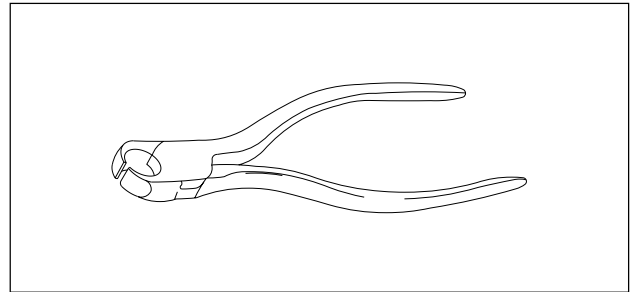
Part No. HD-96921-52B Oil Pressure Gauge



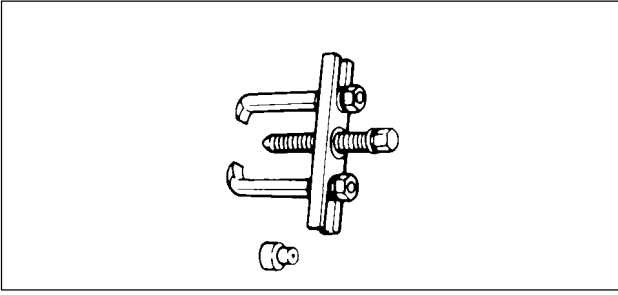
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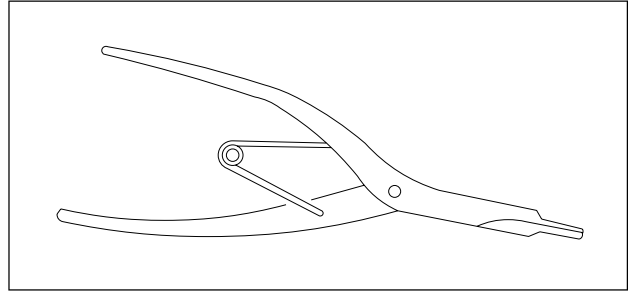
**Part No. HD-96940-52A Oil Pressure Gauge Adapter.
Use with HD-96921-52A.**



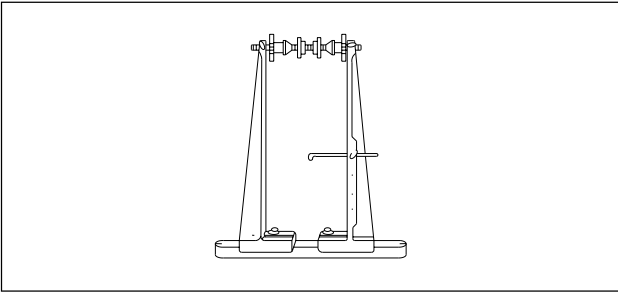
Part No. HD-97087-65B Hose Clamp Pliers



Part No. HD-97292-61 Two Claw Puller



Part No. J-5586 Transmission Shaft Retaining Ring Pliers



Part No. HD-99500-80 Wheel Truing and Balancing Stand

GENERAL

The following table provides a brief description of the connectors found on your motorcycle.

Connector numbers are listed in [brackets] in this manual.

Table B-1. Electrical Connectors

Connector	Description	Component(s)
[1]	4-place Connector	Right Handlebar Switch Housing-Ignition Power, Module and Starter
[2]	2-place Amp Multilock	Front Brake Switch
[3]	10-place Amp Multilock	Speedometer and Tachometer
[4]	4-place Amp Multilock	Headlamp
[5]	2-place Amp Multilock	Clutch Switch
[6]	9-place connector	Left Handlebar Switch Housing-Horn, Turn Signals, Lights
[7]	2-place Deutsch	Vacuum-Operated Electric Switch
[8]	4-place Packard	Ignition/Headlamp Switch
[10]	12-place Deutsch	Ignition Module (BK)
[11]	12-place Deutsch	Ignition Module (GY)
[12]	9-slot fuse block	eight 15 amp and one 20 amp fuses for ignition, instruments, lights and accessories
[13]	4-place relay	Starter Relay
[14]	3-place Deutsch	Cam Position Sensor
[17]	2-place plug	Voltage Regulator
[24]	8-place connector	Indicator Lights
[60]	2-place Amp Multilock	Side Stand Switch
[65]	3-place Deutsch	Speed Sensor
[90]	1-place connector	Engine Temperature Sensor
[134]	3-place connector	Bank Angle Sensor

GENERAL

The Deutsch Connector features a superior seal to protect electrical contacts from dirt and moisture in harsh environments.

Three and eight pin connectors are of similar construction with one exception: eight pin connectors use two external latches on the socket side.

NOTE

Use the *DEUTSCH Terminal Crimp Tool* (Part No. HD-39965) to install Deutsch pin and socket terminals on wires. If **new** terminals must be installed, follow the instructions included with the crimping tool or see [CRIMPING INSTRUCTIONS](#).

REMOVING/INSTALLING SOCKETS

1. See [Figure B-1](#). Remove the secondary locking wedge (6). Insert the blade of a small screwdriver between the socket housing and locking wedge inline with the groove (inline with the pin holes if the groove is absent). Turn the screwdriver 90° to pop the wedge up.
2. Gently depress terminal latches inside socket housing (3) and back out socket terminals (1) through holes in rear wire seal (2).
3. Fit rear wire seal (2) into back of socket housing, if removed. Grasp socket terminal approximately 1.0 in. (25.4 mm) behind the contact barrel. Gently push sockets through holes in wire seal into their respective chambers. Feed socket into chamber until it “clicks” in place. Verify that socket will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.
4. Install internal seal (5) on lip of socket housing, if removed. Insert tapered end of secondary locking wedge (6) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTE

- The conical secondary locking wedge of the 3-pin connector must be installed with the arrow pointing toward the external latch. See [Figure B-2](#).
- If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.

REMOVING/INSTALLING PINS

1. See [Figure B-1](#). Remove the secondary locking wedge (7). Use the hooked end of a stiff piece of mechanic's wire or a needle nose pliers, whichever is most suitable.

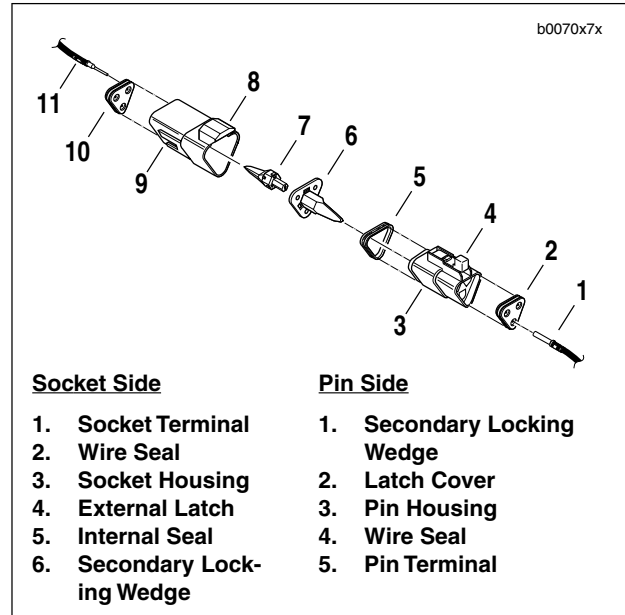


Figure B-1. 3-Pin Connector

2. Gently depress terminal latches inside pin housing (9) and back out pin terminals (11) through holes in wire seal (10).
3. Fit wire seal (10) into back of pin housing (9). Grasp crimped pin approximately 1.0 in. (25.4 mm) behind the contact barrel. Gently push pins through holes in wire seal into their respective numbered locations. Feed pin into chamber until it “clicks” in place. Verify that pin will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.
4. Insert tapered end of secondary locking wedge (7) into pin housing (9) and press down until it snaps in place. The wedge fits in the center groove within the pin housing and holds the terminal latches tightly closed.

ASSEMBLY/INSTALLATION

Insert socket housing (3) into pin housing (9) until it snaps in place. To fit the halves of the connector together, the latch (4) on the socket side must be aligned with the latch cover (8) on the pin side.

CRIMPING INSTRUCTIONS

1. See [Figure B-3](#). Squeeze the handles to cycle the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965) to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward and the rounded side of the contact barrel resting on the concave split level area of the crimp tool, insert contact (socket/pin) through middle hole of locking bar.
3. Release locking bar to lock position of contact. If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the contact so that the tails

face straight upward. When correctly positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

4. Strip lead removing 5/32 in. (4.0 mm) of insulation. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.

NOTE

Inspect the quality of the core and insulation crimps. Distortion should be minimal.

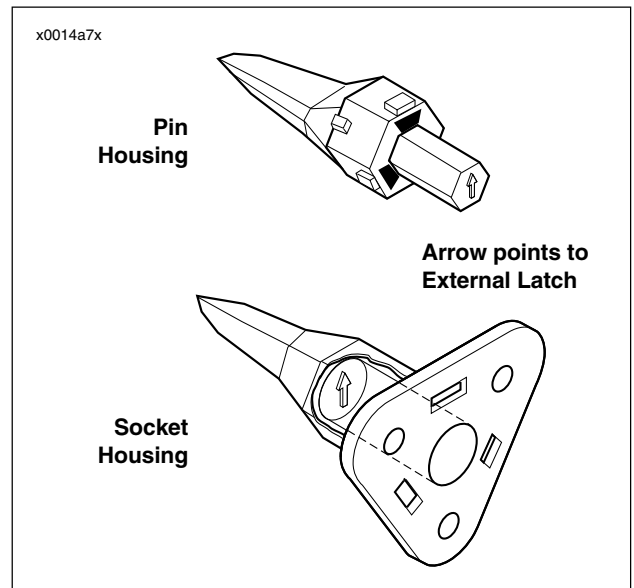


Figure B-2. 3-pin Locking Wedge Orientation

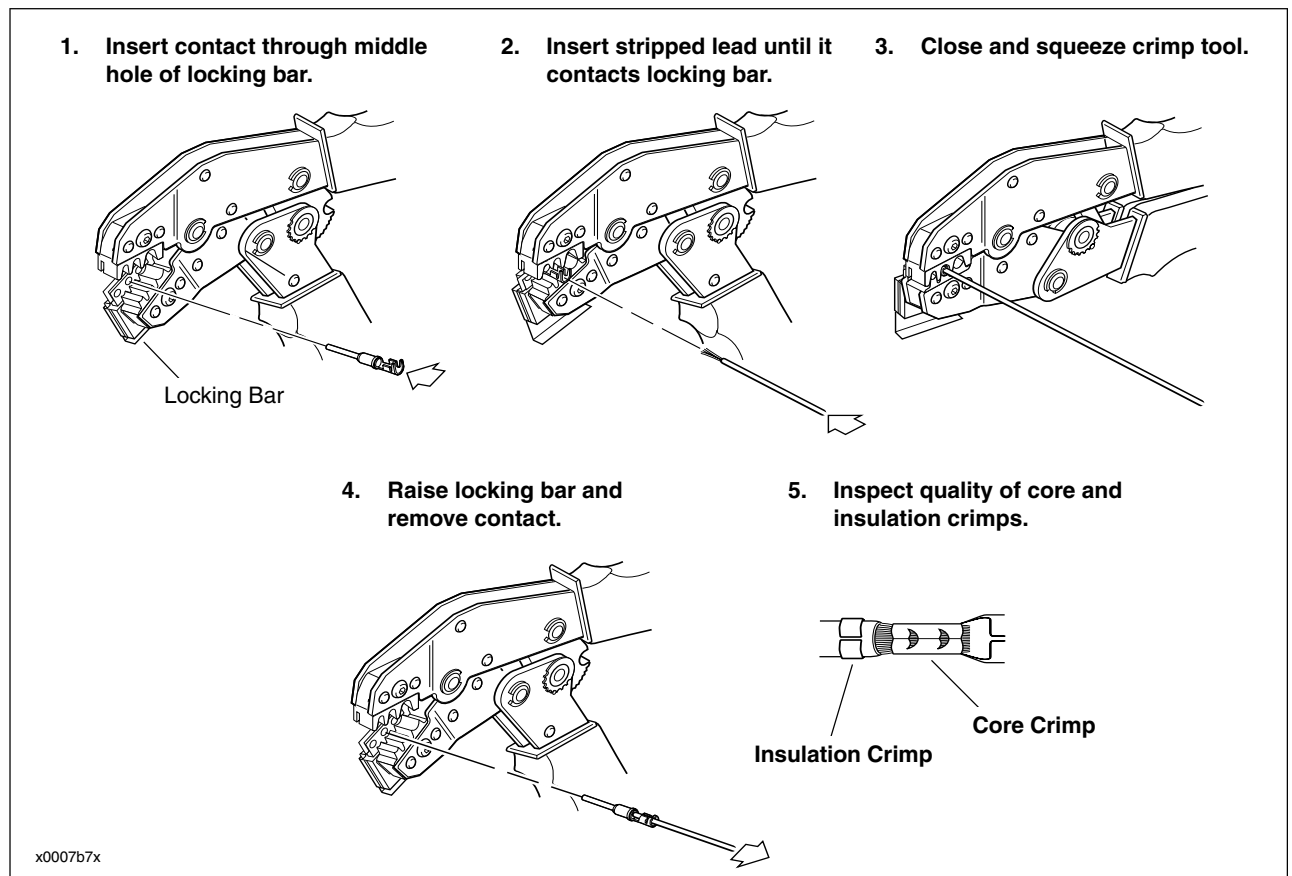


Figure B-3. Deutsch Crimping Procedure

REMOVING SOCKET/PIN TERMINALS

1. If necessary, cut any surrounding cable straps to gain access to the connector.
2. See [Figure B-4](#). Depress the button on the socket terminal side of the connector (plug) and pull apart the pin and socket halves.
3. Bend back the latch slightly and free one side of secondary lock, then repeat the step to release the other side. Rotate the secondary lock outward on hinge to access terminals in chambers of connector housing.
4. Looking in the terminal side of the connector (opposite the secondary lock), take note of the cavity next to each terminal.

5. See [Figure B-5](#). With the flat edge against the terminal, insert the pick (Snap-On TT600-3) into the cavity until it stops. Pivot the end of the pick away from the terminal and gently tug on wire to pull terminal from chamber. Do not tug on the wire until the tang is released or the terminal will be difficult to remove. A “click” is heard if the tang is engaged but then inadvertently released. Repeat the step without releasing the tang.

NOTE

An AMP TERMINAL CRIMP TOOL (Part No. HD-41609) is used to install Amp Multilock pin and socket terminals on wires. If **new** terminals must be installed, see [CRIMPING INSTRUCTIONS](#).

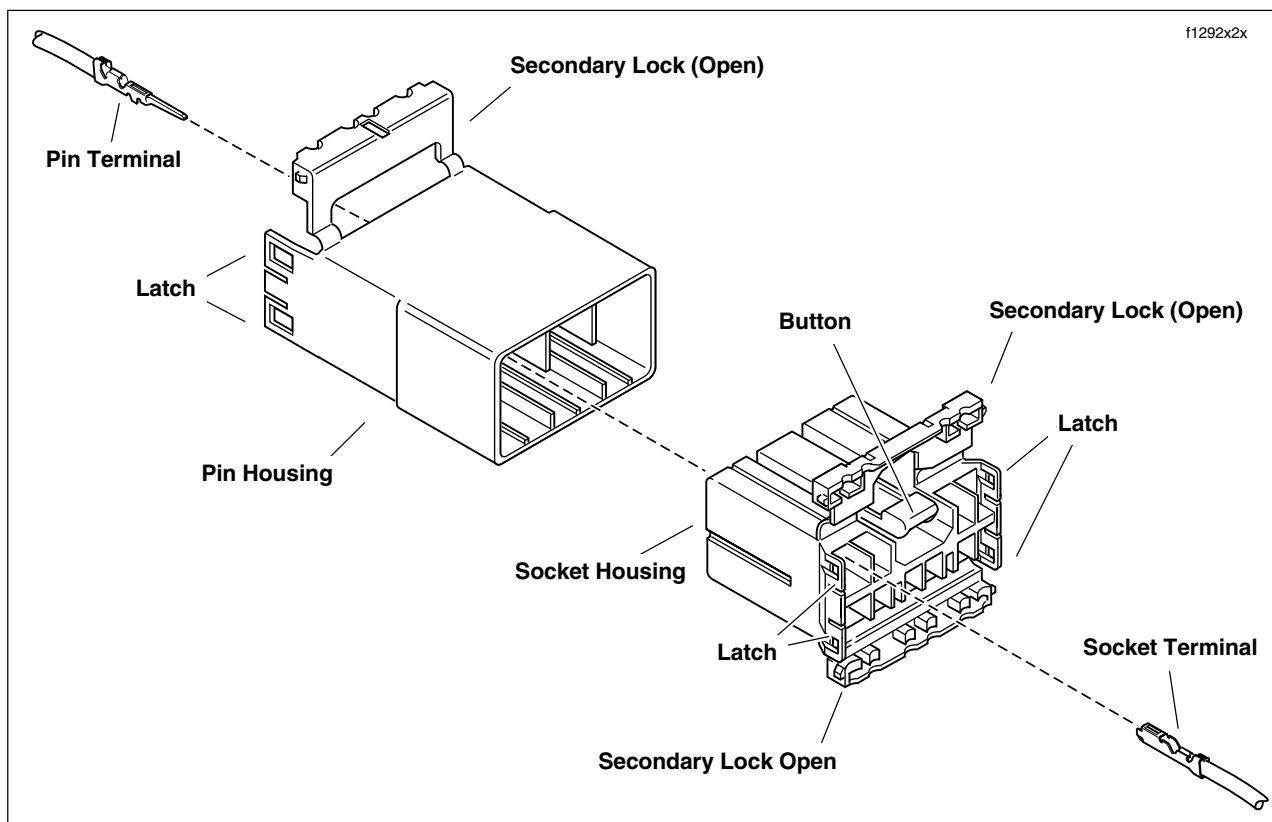


Figure B-4. Amp Multilock Connector (Exploded View)

INSTALLING SOCKET/PIN TERMINALS

NOTE

For wire location purposes, numbers are stamped into the secondary locks of both the socket and pin housings.

1. See [Figure B-5](#). From the secondary lock side of the connector, insert the terminal into its respective numbered chamber until it snaps in place. For proper fit, the slot in the terminal must face the tang in the chamber.

NOTE

The tang in the chamber engages the slot to lock the terminal in position. On the pin side of the connector, tangs are positioned at the bottom of each chamber, so the slot in the pin

terminal (on the side opposite the crimp tails) must face downward. On the socket side, tangs are at the top of each chamber, so the socket terminal slot (on the same side as the crimp tails) must face upward. Up and down can be determined by the position of the release button (used to separate the pin and socket halves), the button always being the top of the connector.

2. Gently tug on wire end to verify that the terminal is locked in place and will not back out of chamber.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
4. Insert the socket housing (plug) into the pin housing (receptacle) until it snaps in place.
5. Secure wiring harness with **new** cable straps.

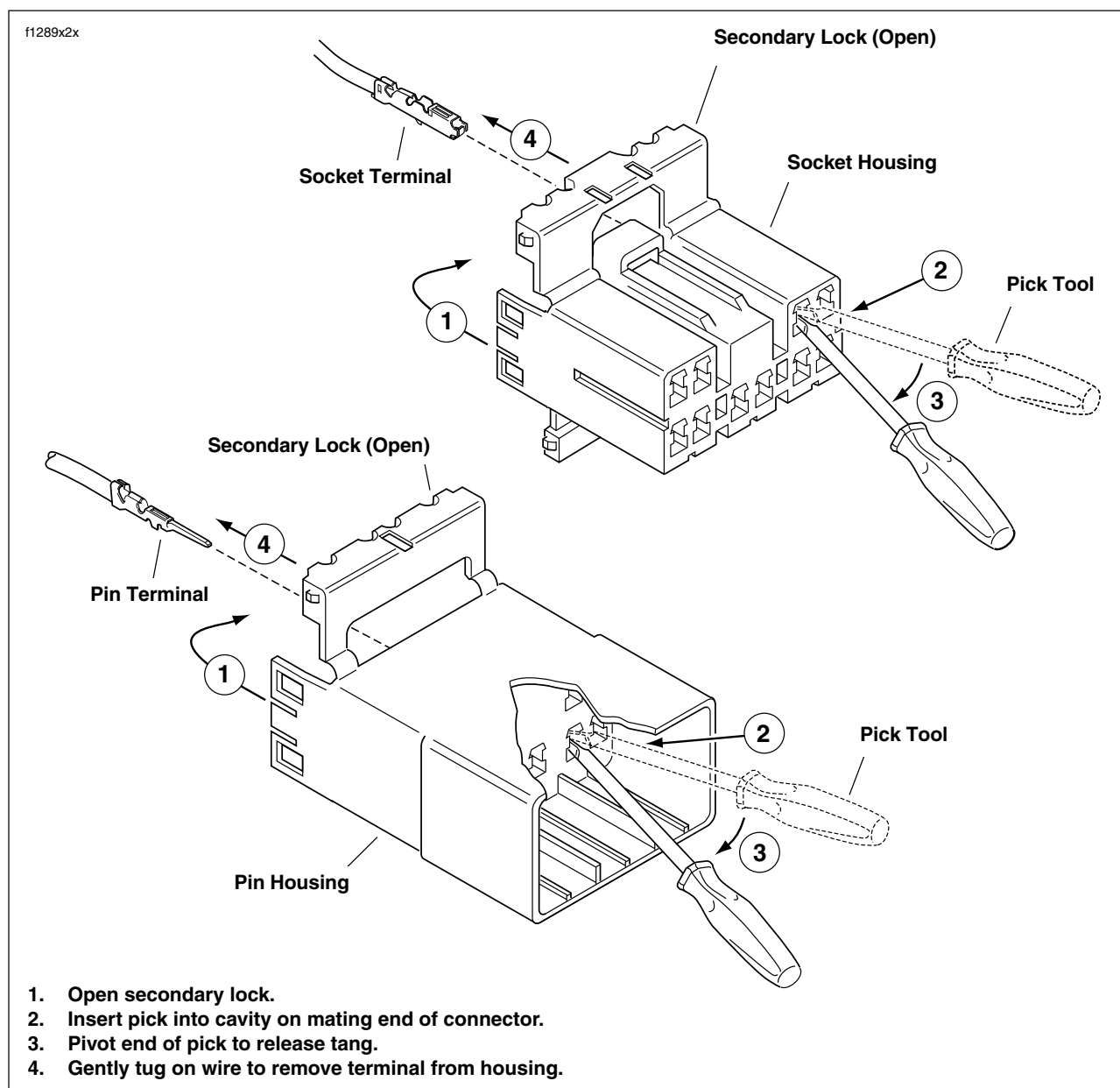


Figure B-5. Release Tang and Back Out Terminals

CRIMPING INSTRUCTIONS

1. See [Figure B-7](#). Squeeze the handles to cycle the AMP TERMINAL CRIMP TOOL (Part No. HD-41609) to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through locking bar, so that the closed side of the contact rests on the nest (concave split level area) of the crimp tool. Use the front nest for 20 gauge wire, the middle for 16 gauge and the rear for 18 gauge.
3. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
4. Strip lead removing 5/32 in. (4.0 mm) of insulation. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.
6. See [Figure B-7](#). Inspect the quality of the core and insulation crimps. Distortion should be minimal.

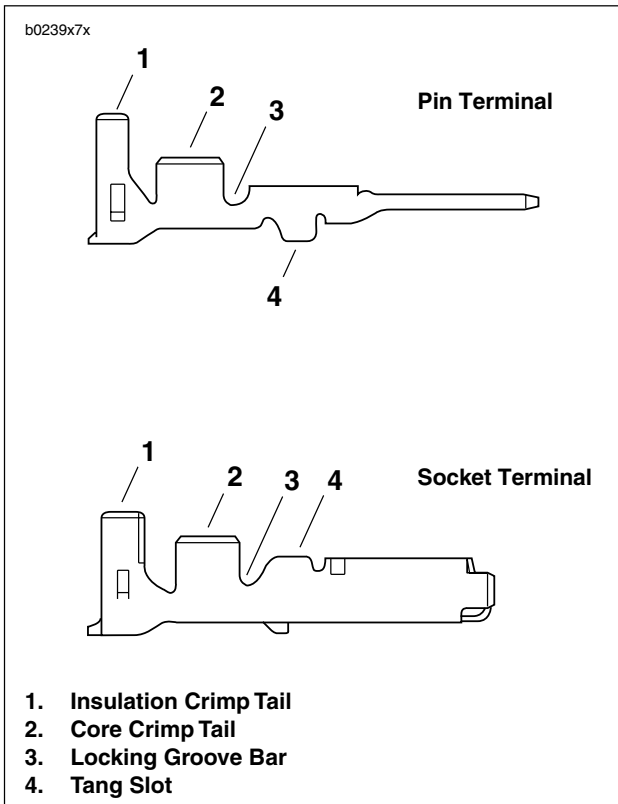


Figure B-6. Crimps

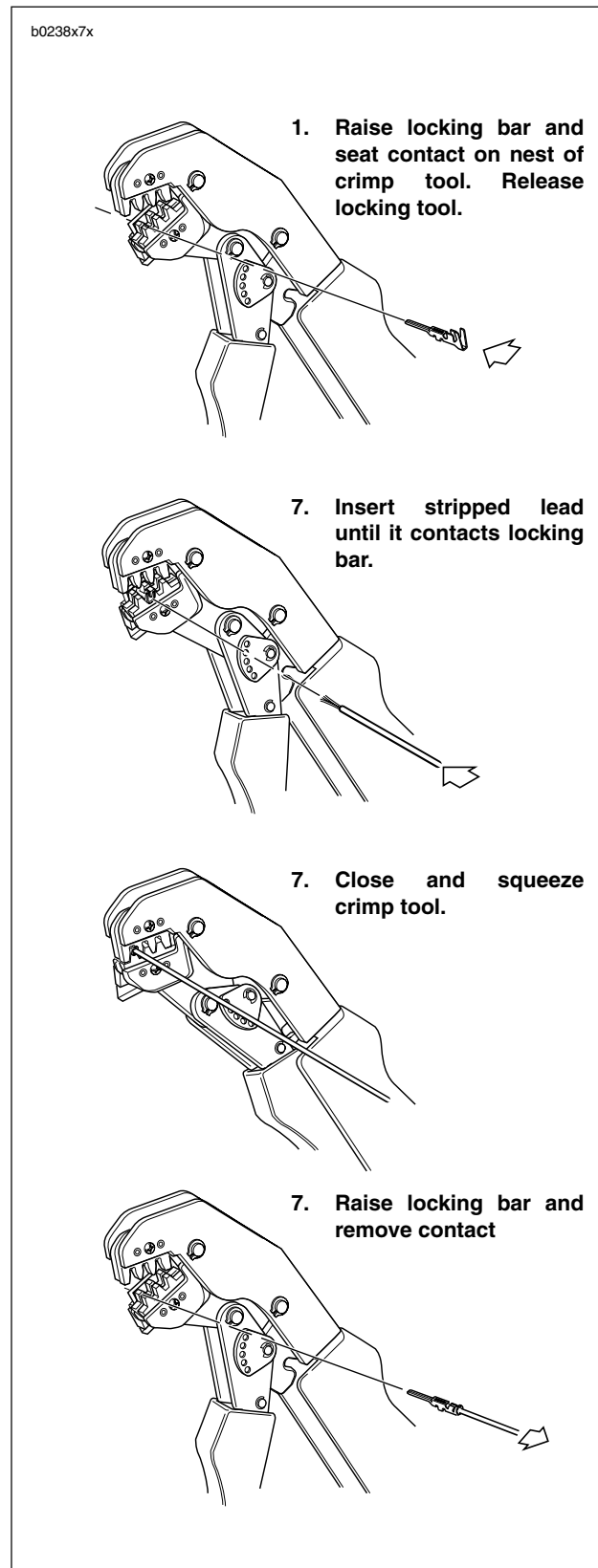


Figure B-7. Amp Multilock Crimping Procedure

APPENDIX C—METRIC CONVERSIONS

Table C-1. Metric Conversions

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








GENERAL

Torque specifications for specific components are listed in each section at the point of use. When converting to Newton-meters, use the formulas given under the metric chart. For all other steel fasteners, use the values listed in one of the tables below. In the English table, torque figures are listed in ft-lbs, except those marked with an asterisk (*), which are listed in in-lbs. In the metric table, figures are listed in Newton-meters.

⚠ WARNING








The quality fasteners used on Buell motorcycles have specific strength, finish and type requirements to perform properly in the assembly and the operating environment. Use only genuine Buell replacement fasteners tightened to the proper torque. Substitution could cause fastener failure, which could result in death or serious injury.

Table C-2. English Torque Values

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER																	
				# (number)						in. (inches)											
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	
	SAE 2 STEEL	74,000 PSI	LOW CARBON									6	12	20	32	47	69	96	155	206	310
	SAE 5 STEEL	120,000 PSI	MEDIUM CARBON HEAT TREAT							14*	22*	10	19	33	54	78	114	154	257	382	587
	SAE 7 STEEL	133,000 PSI	MEDIUM CARBON ALLOY									13	25	44	71	110	154	215	360	570	840
	SAE 8 STEEL	150,000 PSI	MEDIUM CARBON ALLOY									14	29	47	78	119	169	230	380	600	900
	SAE 8 STEEL	150,000 PSI	MEDIUM CARBON ALLOY									14	29	47	78	119	169	230	380	600	900
	SOCKET SET SCREW	212,000 PSI	HIGH CARBON QUENCHED TEMPERED					9*	16*	30*	70*	140*	18	29	43	63	100	146			
	STUDS			Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																	

*Torque values in in-lbs.

Table C-3. Metric Torque Values

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER																		
				# (number)						mm (millimeters)												
				2	3	4	5	6	8	10	6.4	7.9	9.5	11.1	12.7	14.3	15.9	19.1	22.2	25.4		
	SAE 2 STEEL	5,202 kg/cm ²	LOW CARBON										8.3	16.6	27.7	44.3	65.0	95.4	132.8	214.4	283.5	428.7
	SAE 5 STEEL	8,436 kg/cm ²	MEDIUM CARBON HEAT TREAT							1.6	2.5	13.8	26.3	45.6	74.7	107.9	157.7	213.0	355.4	528.3	811.8	
	SAE 7 STEEL	9,350 kg/cm ²	MEDIUM CARBON ALLOY									18.0	34.6	60.8	98.2	152.1	213.0	297.3	497.9	788.3	1161.7	
	SAE 8 STEEL	10,545 kg/cm ²	MEDIUM CARBON ALLOY									19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	1220.0	
	SAE 8 STEEL	10,545 kg/cm ²	MEDIUM CARBON ALLOY									19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	1220.0	
	SOCKET SET SCREW	14,904 kg/cm ²	HIGH CARBON QUENCHED TEMPERED					1.0	1.8	3.4	8.1	16.1	24.9	40.1	59.5	87.1	138.3	201.9				
	STUDS			Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																		

foot-pounds (ft-lbs) x 1.356 = Newton-meters (Nm) inch-pounds (in-lbs) x 0.113 = Newton-meters (Nm)

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SERVICING A NEW MOTORCYCLE

WARNING

Always follow the listed service and maintenance recommendations, because they affect the safe operation of the motorcycle and the personal welfare of the rider. Failure to follow recommendations could result in death or serious injury.

Service operations to be performed before customer delivery are specified in the applicable model year PREDELIVERY AND SETUP MANUAL.

The performance of new motorcycle initial service is required to keep warranty in force and to ensure proper emissions systems operation.

After a new motorcycle has been driven its first 500 miles (800 km), and at every 2500 mile (4000 km) interval thereafter, have a Buell dealer perform the service operations listed in [Table 1-2](#).

SAFE OPERATING MAINTENANCE

CAUTION

- Do not attempt to retighten engine head bolts. Retightening can cause engine damage.
- During the initial 500 mile (800 km) break-in period, use only Harley-Davidson 20W50 engine oil. Failure to use the recommended oil will result in improper break-in of the engine cylinders and piston rings.
- Do not lubricate the enrichment cable on C.V. carburetors. The cable requires friction to operate properly.

A careful check of certain equipment is necessary after periods of storage, and frequently between regular service intervals, to determine if additional maintenance is required.

Check:

1. Tires for abrasions, cuts and correct pressure.
2. Secondary drive belt for proper tension and condition.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and rotors for wear.
5. Cables for fraying, crimping and free operation.
6. Engine oil and transmission fluid levels.
7. Headlamp, passing lamp, tail lamp, brake lamp and turn signal operation.

SHOP PRACTICES

Repair Notes

NOTE

- General maintenance practices are given in this section.
- Repair = Disassembly/Assembly.
- Replace = Removal/Installation.

All special tools and torque values are noted at the point of use.

All required parts or materials can be found in the appropriate PARTS CATALOG.

Safety

Safety is always the most important consideration when performing any job. Be sure you have a complete understanding of the task to be performed. Use common sense. Use the proper tools. Protect yourself and bystanders with approved eye protection. Don't just do the job – do the job safely.

Removing Parts

Always consider the weight of a part when lifting. Use a hoist whenever necessary. Do not lift heavy parts by hand. A hoist and adjustable lifting beam or sling are needed to remove some parts. The lengths of chains or cables from the hoist to the part should be equal and parallel and should be positioned directly over the center of the part. Be sure that no obstructions will interfere with the lifting operation. Never leave a part suspended in mid-air. Always use blocking or proper stands to support the part that has been hoisted.

If a part cannot be withdrawn, verify that all fastening hardware has been detached. Check to see if any parts are in the way of the part being removed.

When removing hoses, wiring or tubes, always tag each part to ensure proper installation.

Cleaning

If you intend to reuse parts, follow good shop practice and thoroughly clean the parts before reassembly. Keep all dirt out of parts. Seals, filters and covers are used in this vehicle to keep out environmental dirt and dust. These items must be kept in good condition to ensure satisfactory operation.

Clean and inspect all parts as they are removed. Be sure all holes and passages are clean and open. After cleaning, cover all parts with clean lint-free cloth, paper or other material. Be sure the part is clean when it is installed.

Always clean around lines or covers before they are removed. Plug, tape or cap holes and openings to keep out dirt, dust and debris.

Disassembly and Assembly

Always assemble or disassemble one part at a time. Do not work on two assemblies simultaneously. Be sure to make all necessary adjustments. Recheck your work when finished. Be sure that everything is done.

Operate the vehicle to perform any final check or adjustments. If all is correct, the vehicle is ready to go back to the customer.

Checking Torques on Fasteners with Lock Patches/Loctite Threadlocker

To check the torque on a fastener that has a lock patch do the following:

1. Set the torque wrench for the lowest setting in the given torque range for the fastener.
2. Attempt to tighten fastener to set torque. If fastener does not move and lowest setting is satisfied (torque wrench clicks), then the proper torque has been maintained by the fastener.
3. If the fastener does move, remove the fastener, reapply the appropriate type of LOCTITE THREADLOCKER and tighten the fastener to Service Manual specification.

REPAIR AND REPLACEMENT PROCEDURES

Hardware and Threaded Parts

Install helical thread inserts when inside threads in castings are stripped, damaged or not capable of withstanding specified torque.

Replace bolts, nuts, studs, washers, spacers and small common hardware if missing or in any way damaged. Clean up or repair minor thread damage with a suitable tap or die.

Replace all damaged or missing lubrication fittings.

Use Teflon pipe sealant on pipe fitting threads.

Wiring, Hoses and Lines

Replace hoses, clamps, electrical wiring, electrical switches or fuel lines if they do not meet specifications.

Instruments and Gauges

Replace broken or defective instruments and gauges. Replace dials and glass that are so scratched or discolored that reading is difficult.

Bearings

Anti-friction bearings must be handled in a special way. To keep out dirt and abrasives, cover the bearings as soon as they are removed from the package.

Wash bearings in a non-flammable cleaning solution. Knock out packed lubricant by tapping the bearing against a wooden block. Wash bearings again. Cover bearings with clean material after setting them down to dry. Never use compressed air to dry bearings.

Coat bearings with clean oil. Wrap bearings in clean paper.

Be sure that the chamfered side of the bearing always faces the shoulder (when bearings installed against shoulders).

Lubricate bearings and all metal contact surfaces before pressing into place. Apply pressure only on the part of the bearing that makes direct contact with the mating part.

Always use the proper tools and fixtures for removing and installing bearings.

Bearings do not usually need to be removed. Remove bearings only if necessary.

Bushings

Do not remove a bushing unless damaged, excessively worn or loose in its bore. Press out bushings that must be replaced.

When pressing or driving bushings, be sure to apply pressure in line with the bushing bore. Use a bearing/bushing driver or a bar with a smooth, flat end. Never use a hammer to drive bushings.

Inspect the bushing and the mated part for oil holes. Be sure all oil holes are properly aligned.

Gaskets

Always discard gaskets after removal. Replace with new gaskets. Never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part.

Lip Type Seals

Lip seals are used to seal oil or grease and are usually installed with the sealing lip facing the contained lubricant. Seal orientation, however, may vary under different applications.

Seals should not be removed unless necessary. Only remove seals if it is necessary to gain access to other parts or if seal damage or wear dictates replacement.

Leaking oil or grease usually means that a seal is damaged. Replace leaking seals to prevent overheated bearings.

Always discard seals after removal and replace with new seals. Do not use the same seal twice.

O-Rings (Preformed Packings)

Always discard O-rings after removal. Replace with new O-rings. To prevent leaks, lubricate the O-rings before installation. Apply the same type of lubricant as that being sealed. Be sure that all gasket, O-ring and seal mating surfaces are thoroughly clean before installation.

Gears

Always check gears for damaged or worn teeth.

Lubricate mating surfaces before pressing gears on shafts.

Shafts

If a shaft does not come out easily, check that all nuts, bolts or retaining rings have been removed. Check to see if other parts are in the way before using force.

Shafts fitted to tapered splines should be very tight. If shafts are not tight, disassemble and inspect tapered splines. Discard parts that are worn. Be sure tapered splines are clean, dry and free of burrs before putting them in place. Press mating parts together tightly.

Clean all rust from the machined surfaces of new parts.

Part Replacement

Always replace worn or damaged parts with new parts.

CLEANING

Part Protection

Before cleaning, protect rubber parts (such as hoses, boots and electrical insulation) from cleaning solutions. Use a grease-proof barrier material. Remove the rubber part if it cannot be properly protected.

Cleaning Process

Any cleaning method may be used as long as it does not result in parts damage. Thorough cleaning is necessary for proper parts inspection. Strip rusted paint areas to bare metal before repainting.

Rust or Corrosion Removal

Remove rust and corrosion with a wire brush, abrasive cloth, sand blasting, vapor blasting or rust remover. Use buffing crocus cloth on highly polished parts that are rusted.

Bearings

Remove shields and seals from bearings before cleaning. Clean bearings with permanent shields and seals in solution.

Clean open bearings by soaking them in a petroleum cleaning solution. Never use a solution that contains chlorine.

Let bearings stand and dry. Do not dry using compressed air. Do not spin bearings while they are drying.

INSPECTING

Leak Dye

When using leak dye with the black light leak detector, add 1/4 oz. (7.4 ml) of dye for each 1 quart (0.9 l) of fluid in the system being checked.

TOOL SAFETY

Air Tools

- Always use approved eye protection equipment when performing any task using air-operated tools.
- On all power tools, use only recommended accessories with proper capacity ratings.
- Do not exceed air pressure ratings of any power tools.
- Bits should be placed against work surface before air hammers are operated.
- Disconnect the air supply line to an air hammer before attaching a bit.
- Never point an air tool at yourself or another person.
- Protect bystanders with approved eye protection.

Wrenches

- Never use an extension on a wrench handle.

- If possible, always pull on a wrench handle and adjust your stance to prevent a fall if something lets go.
- Never cock a wrench.
- Never use a hammer on any wrench other than a STRIKING FACE wrench.
- Discard any wrench with broken or battered points.
- Never use a pipe wrench to bend, raise or lift a pipe.

Pliers/cutters/prybars

- Plastic- or vinyl-covered pliers handles are not intended to act as insulation; do not use on live electrical circuits.
- Do not use pliers or cutters for cutting hardened wire unless they were designed for that purpose.
- Always cut at right angles.
- Do not use any prybar as a chisel, punch or hammer.

Hammers

- Never strike one hammer against a hardened object, such as another hammer.
- Always grasp a hammer handle firmly, close to the end.
- Strike the object with the full face of the hammer.
- Never work with a hammer which has a loose head.
- Discard hammer if face is chipped or mushroomed.
- Wear approved eye protection when using striking tools.
- Protect bystanders with approved eye protection.

Punches/chisels

- Never use a punch or chisel with a chipped or mushroomed end; dress mushroomed chisels and punches with a file.
- Hold a chisel or a punch with a tool holder if possible.
- When using a chisel on a small piece, clamp the piece firmly in a vise and chip toward the stationary jaw.
- Wear approved eye protection when using these tools.
- Protect bystanders with approved eye protection.

Screwdrivers

- Don't use a screwdriver for prying, punching, chiseling, scoring or scraping.
- Use the right type of screwdriver for the job; match the tip to the fastener.
- Don't interchange POZIDRIV[®], PHILLIPS[®] or REED AND PRINCE screwdrivers.
- Screwdriver handles are not intended to act as insulation; do not use on live electrical circuits.
- Don't use a screwdriver with rounded edges because it will slip – redress with a file.

Ratchets and Handles

- Periodically clean and lubricate ratchet mechanisms with a light grade oil. Do not replace parts individually; ratchets should be rebuilt with the entire contents of service kit.
- Never hammer or put a pipe extension on a ratchet or handle for added leverage.
- Always support the ratchet head when using socket extensions, but do not put your hand on the head or you may interfere with the action of its reversing mechanism.
- When breaking loose a fastener, apply a small amount of pressure as a test to be sure the ratchet's gear wheel is engaged with the pawl.

Sockets

- Never use hand sockets on power or impact wrenches.
- Select the right size socket for the job.
- Never cock any wrench or socket.
- Select only impact sockets for use with air or electric impact wrenches.
- Replace sockets showing cracks or wear.
- Keep sockets clean.
- Always use approved eye protection when using power or impact sockets.

Storage Units

- Don't open more than one loaded drawer at a time. Close each drawer before opening up another.
- Close lids and lock drawers and doors before moving storage units.
- Don't pull on a tool cabinet; push it in front of you.
- Set the brakes on the locking casters after the cabinet has been rolled to your work.

FLUID REQUIREMENTS

GENERAL

United States System

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

Metric System

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

STEERING HEAD BEARING GREASE

Use WHEEL BEARING GREASE (Part No. 99855-89).

BRAKE FLUID

WARNING

D.O.T. 4 brake fluid can cause irritation of eyes and skin, and may be harmful if swallowed. If large amount of fluid is swallowed, induce vomiting by administering two tablespoons of salt in a glass of warm water. Call a doctor. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN. Failure to comply could result in death or serious injury.

Use only D.O.T. 4 BRAKE FLUID (Part No. 99953-99Y).

FUEL

Use a good quality unleaded gasoline (91 pump octane or higher). Pump octane is the octane number usually shown on the gas pump. See 3.2 ENGINE for a detailed explanation of alternative/reformulated fuels.

ENGINE OIL

Use the proper grade of oil for the lowest temperature expected before the next oil change.

If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include CE, CF, CF-4 and CG-4. The preferred viscosities for the diesel engine oils, in descending order, are 20W-50, 15W-40 and 10W-40. At the first opportunity, see a Buell dealer to change back to 100 percent Harley-Davidson oil.

Table 1-1. Recommended Oil Grades

HARLEY-DAVIDSON TYPE	VISCOSITY	HARLEY-DAVIDSON RATING	LOWEST AMBIENT TEMP.	COLD WEATHER STARTS BELOW 50° F
H.D. Multi-Grade	SAE 10W40	HD 360	Below 40°F (4°C)	Excellent
H.D. Multi-Grade	SAE 20W50	HD 360	Above 40° (4°C)	Good
H.D. Regular Heavy	SAE 50	HD 360	Above 60° (16°C)	Poor
H.D. Extra Heavy	SAE 60	HD 360	Above 80° (27°C)	Poor

PRIMARY DRIVE/TRANSMISSION FLUID

Use only SPORT-TRANS FLUID (Part No. 98854-96 quart size or Part No. 98855-96 gallon size).

FRONT FORK OIL

Use only TYPE E FORK OIL (Part No. HD-99884-80).

Table 1-2. Regular Maintenance Intervals

SERVICE OPERATIONS AND SPECIAL TOOLS	P r e r i d e												SERVICE DATA				
	1	1	1	1	2	2	2	2	2	2	3	3					
Wheel bearings (1.7 TIRES AND WHEELS)													I	I	Check for wear and corrosion. Replace in sets only.		
Primary drive/transmission fluid (1.8 CLUTCH) REAR WHEEL SUPPORT STAND (Part No. B-41174)															R	Fluid type and amount 1.0 quart (0.95 liter) of SPORT-TRANS FLUID (Part No. 98854-96) Fluid level Fluid should reach bottom of clutch spring with motorcycle upright (not on side stand). Drain plug torque 14-21 ft-lbs (19-29 Nm)	
Clutch adjustment (1.8 CLUTCH)																A	Hand lever freerplay 0.0625-0.125 in. (1.6-3.2 mm) Clutch inspection cover screw torque 7-9 ft-lbs (10-12 Nm) in a crosswise pattern
Rear belt deflection (1.9 DRIVE BELT DEFLECTION) BELT TENSION GAUGE (Part No. HD-35381)																	Belt deflection with 10 lbs (4.5 kg) of upward force 1.5-1.75 in. (38.1-44.5 mm) Rear axle nut torque 68-73 ft-lbs (90-99 Nm)

Table 1-2. Regular Maintenance Intervals

SERVICE OPERATIONS AND SPECIAL TOOLS	P r e r i d e	5 0 0 0 m i	2 5 0 0 m i	7 5 0 0 m i	1 0 2 5 0 0 m i	1 1 2 6 0 0 0 0 k m	1 2 5 0 0 0 m i	1 7 5 0 0 0 m i	2 0 2 5 0 0 m i	2 2 5 0 0 0 m i	2 5 0 0 0 0 m i	3 0 0 0 0 0 m i	2 7 0 5 0 0 m i	3 0 0 0 0 0 m i	A n n u a l	SERVICE DATA
Oil and brake lines (Section 2 and 3)	I	I	I	I	I	I	I	I	I	I	I	I	I	I		Check for leaks and loose connections. It is recommended to inspect front and rear brake lines on D.O.T. 4 Brake systems every 4 years and replace as required It is recommended to inspect front and rear master cylinder and caliper seals on D.O.T. 4 Brake systems every 2 years and replace as required.
Side stand (2.37 SIDE STAND)		I	L	L	L	L	L	L	L	L	L	L	L	L		
Engine mounts (Section 3)		I	I	I	I	I	I	I	I	I	I	I	I	I		
Starter interlock system (Section 7)		I	I	I	I	I	I	I	I	I	I	I	I	I		
Operation of all electrical equipment and switches (Section 7)	I	I	I	I	I	I	I	I	I	I	I	I	I	I		
All fasteners except engine head bolts		T	T	T	T	T	T	T	T	T	T	T	T	T		
Road test		X	X	X	X	X	X	X	X	X	X	X	X	X		

GENERAL

Buell motorcycle batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries. The batteries are shipped pre-charged and ready to be put into service. Do not attempt to open these batteries for any reason.

⚠ WARNING

All batteries contain electrolyte. Electrolyte is a sulfuric acid solution that is highly corrosive and can cause severe chemical burns. Avoid contact with skin, eyes, and clothing. Avoid spillage. Always wear protective face shield, rubberized gloves and protective clothing when working with batteries. A warning label is attached to the top of the battery. See Figures 1-1 and 1-2. Never remove warning label from battery. Failure to read and understand all precautions contained in warning label before performing any service on batteries could result in death or serious injury.

BATTERY TESTING

Voltmeter Test

See Table 1-4. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.8V or above, perform the load test described in Section 7.

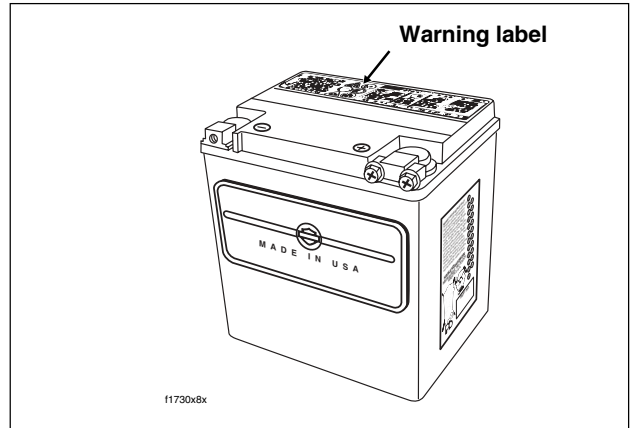


Figure 1-1. Maintenance-Free Battery (Typical)

Table 1-3. Battery Electrolyte Antidotes

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



Figure 1-2. Battery Label

Table 1-4. Voltmeter Test

BATTERY CHARGE CONDITIONS	
Voltage (OCV)	State of Charge
12.8	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

DISCONNECTION AND REMOVAL

1. Remove seat. See 2.36 SEAT.

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

WARNING

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
4. Remove battery strap locknut (metric). Unhook battery strap from frame near negative terminal.
5. Remove battery from right side.

CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When the solution stops bubbling, rinse off the battery with clean water.
2. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
3. Inspect the battery screws, clamps and cables for breakage, loose connections and corrosion. Clean clamps.
4. Check the battery posts for melting or damage caused by overtightening.
5. Inspect the battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
6. Inspect the battery case for cracks or leaks.

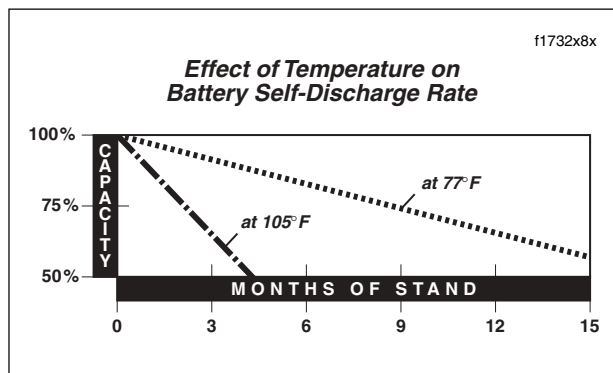


Figure 1-3. Battery Self-Discharge Rate

STORAGE

WARNING

Always store batteries where they cannot be reached by children. Contact with the battery's sulfuric acid could result in death or serious injury.

CAUTION

The electrolyte in a discharged battery will freeze if exposed to freezing temperatures. Freezing may crack the battery case and buckle battery plates.

If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge. See CHARGING BATTERY, Section 7.

Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place. See Figure 1-3.

Charge the battery every month if stored at temperatures below 60° F. (16° C). Charge the battery more frequently if stored in a warm area above 60° F. (16° C).

NOTE

The H-D Battery Tender Automatic Battery Charger (P/N 99863-93TA) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.

When returning a battery to service after storage, refer to the instructions under CHARGING BATTERY, Section 7.

BATTERY INSTALLATION AND CONNECTION

1. Place the fully charged battery into the battery box, terminal side forward.

CAUTION

Connect the cables to the correct battery terminals or damage to the motorcycle electrical system will occur.

WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

CAUTION

Overtightening bolts can damage battery terminals.

2. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (7-11 Nm).
3. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (7-11 Nm).
4. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.
5. Install battery strap.
 - a. Insert tab on right side of battery tray. Place battery strap around top side of battery.
 - b. Hook edge of strap into frame tab.
 - c. Insert threaded shaft on strap through frame tab.
 - d. Install battery strap locknut on threaded shaft. Tighten to 40 **in-lbs** (4.5 Nm).
6. Apply light coat of petroleum jelly or corrosion-retardant material to both battery terminals.
7. Install seat. See [2.36 SEAT](#).

CHECKING ENGINE OIL LEVEL

Check engine oil level:

- At least once every 500 miles (800 km).
- At every scheduled service interval.

NOTE

If engine uses more oil than normal or if vehicle is operated under harsh conditions, check oil more frequently.

When checking or changing engine oil:

- Warm vehicle to normal operating temperature.
 - Turn engine off.
 - Hold motorcycle upright (not leaning on side stand) on a level surface.
1. Remove seat. See 2.36 SEAT.
 2. See Figure 1-5. Remove filler cap/dipstick from oil tank. Wipe dipstick clean.
 3. Insert filler cap/dipstick into oil tank. Make sure cap is fully seated on tank.

CAUTION

Do not switch oil brands indiscriminately because some oils interact chemically when mixed. Use of inferior oils or non-detergent oils can damage the engine.

4. Remove filler cap/dipstick and check oil level on dipstick.
 - a. Oil level should be between lower and upper dipstick level marks.
 - b. If oil level in tank is below lower mark of dipstick, add oil to tank. Recommended viscosity depends upon ambient temperature. See Table 1-5. If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include CE, CF, CF-4 and CG-4. The preferred viscosities for the diesel engine oils, in descending order, are 20W-50, 15W-40 and 10W-40. As soon as possible, see your Buell dealer to change back to 100 percent Harley-Davidson oil.
 - c. Install filler cap/dipstick.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

5. Install seat. See 2.36 SEAT.

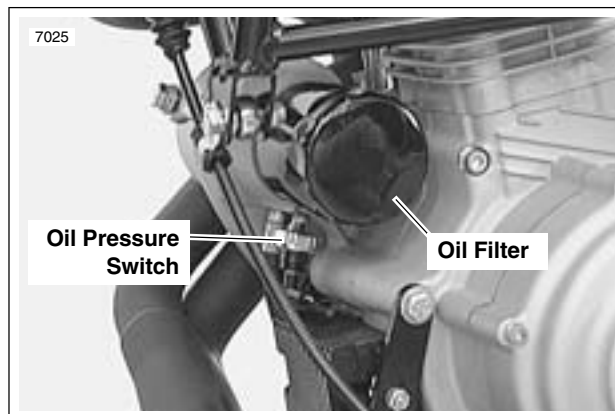


Figure 1-4. Oil Filter and Mount (Typical)

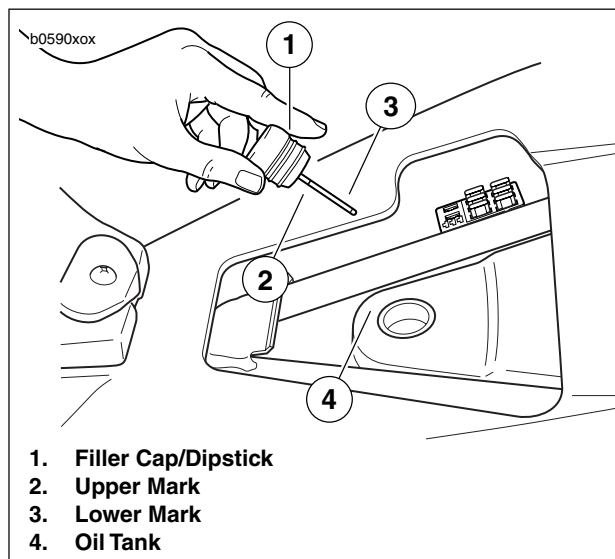


Figure 1-5. Checking Oil Tank Level

Table 1-5. Recommended Oil Grades

HARLEY-DAVIDSON TYPE	VISCOSITY	HARLEY-DAVIDSON RATING	LOWEST AMBIENT TEMP.	COLD WEATHER STARTS BELOW 50° F
H.D. Multi-Grade	SAE 10W40	HD 360	Below 40°F (4°C)	Excellent
H.D. Multi-Grade	SAE 20W50	HD 360	Above 40° (4°C)	Good
H.D. Regular Heavy	SAE 50	HD 360	Above 60° (16°C)	Poor
H.D. Extra Heavy	SAE 60	HD 360	Above 80° (27°C)	Poor

CHANGING ENGINE OIL AND FILTER

Change engine oil:

- At the 500 mile (800 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.
- When storing or removing the motorcycle for the season.

NOTE

The colder the weather, the shorter the recommended oil change interval. A vehicle used only for short runs in cold weather must have the engine oil changed more frequently.

1. Remove seat. See [2.36 SEAT](#).
2. Place a suitable container under the motorcycle.
3. See [Figure 1-6](#). Open clamp (2). Remove drain hose (1) from drain plug (3) by pulling hose forward. Direct hose to container and completely drain oil tank.
4. Position drain hose (1) at loop (4) opening and install drain plug (3). Tighten clamp (2).
5. Remove oil filter using OIL FILTER WRENCH (Part No. HD-42311).
6. Clean filter gasket contact surface on crankcase. Surface should be smooth and free of any debris or old gasket material.
7. See [Figure 1-7](#). Apply a thin film of oil to filter gasket contact surface on crankcase and to **new** oil filter.
8. Pour 4.0 ounces (0.12 liter) of clean oil into **new** filter.
9. Screw filter onto adapter until filter gasket touches crankcase surface. Apply another 1/2-3/4 turn by hand.

⚠ WARNING

Be sure no oil gets on tires when changing oil and filter. Traction will be adversely affected which could lead to a loss of control which could result in death or serious injury.

10. Remove filler cap/dipstick and fill oil tank with an oil listed on [Table 1-5](#). Oil tank capacity is 2.0 quarts (1.90 liters) including the 4.0 ounces (0.12 liter) added in Step 8.
11. Install filler cap/dipstick onto oil tank. Make sure cap/dipstick is fully seated.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

12. Install seat. See [2.36 SEAT](#).
13. See [Figure 1-8](#). Start engine. Verify that oil pressure signal light on instrument support turns off when engine speed is 1000 RPM or above.
14. Check for oil leaks at oil filter and drain hose.
15. Check oil level.

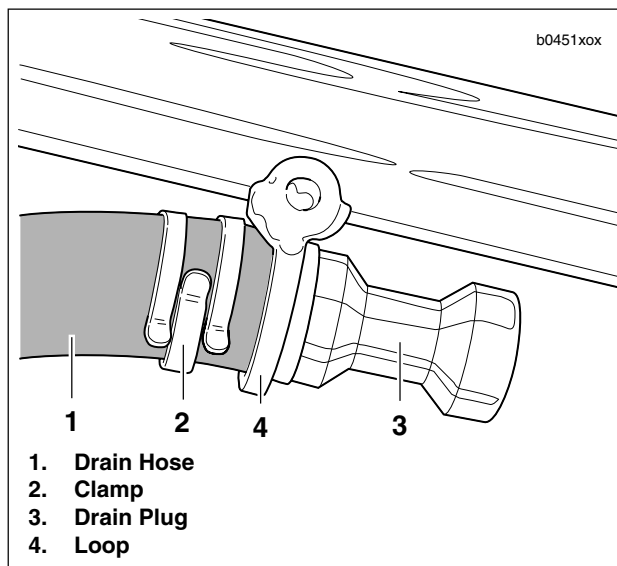


Figure 1-6. Oil Tank Drain Line



Figure 1-7. Oil Filter

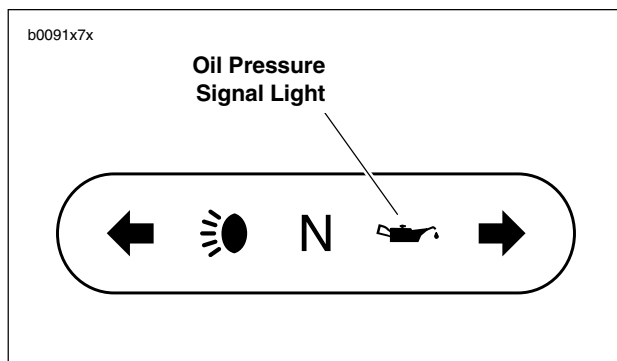


Figure 1-8. Oil Pressure Signal Light

GENERAL

WARNING

D.O.T. 4 brake fluid can cause irritation of eyes and skin, and may be harmful if swallowed. If large amount of fluid is swallowed, induce vomiting by administering two tablespoons of salt in a glass of warm water. Call a doctor. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. **KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.** Failure to comply could result in death or serious injury.

CAUTION

D.O.T. 4 brake fluid will damage painted surfaces it comes in contact with. Always use caution and protect painted surfaces from spills whenever brake work is performed. Failure to comply may result in cosmetic damage.

Check brake fluid level and condition:

- At the 500 mile (800 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.
- When storing or removing the motorcycle for the season.

Replace **D.O.T. 4 BRAKE FLUID**:

- Every 2 years.

Front brake hand lever and rear brake foot pedal must have a firm feel when brakes are applied. If not, bleed system as described.

It is recommended to inspect front and rear brake lines and replace as required:

- Every 4 years.

It is recommended to inspect front and rear caliper and master cylinder seals and replace as required:

- Every 2 years.

BLEEDING BRAKES

WARNING

D.O.T. 4 brake fluid can cause irritation of eyes and skin, and may be harmful if swallowed. If large amount of fluid is swallowed, induce vomiting by administering two tablespoons of salt in a glass of warm water. Call a doctor. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. **KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.** Failure to comply could result in death or serious injury.

WARNING

Never mix D.O.T. 4 with other brake fluids (such as D.O.T. 5). Use only D.O.T. 4 brake fluid in motorcycles that specify D.O.T. 4 fluid on the reservoir cap. Mixing different types of fluid may adversely affect braking ability and

lead to brake failure which could result in death or serious injury.

WARNING

Use only fresh, uncontaminated D.O.T. 4 Fluid. Cans of fluid that have been opened may have been contaminated by moisture in the air or dirt. Use of contaminated brake fluid may adversely affect braking ability and lead to brake failure which could result in death or serious injury

WARNING

Use only new black banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

CAUTION

D.O.T. 4 brake fluid will damage painted surfaces it comes in contact with. Always use caution and protect painted surfaces from spills whenever brake work is performed. Failure to comply may result in cosmetic damage.

NOTE

Hydraulic brake fluid bladder-type pressure equipment can be used to fill the brake master cylinder through the bleeder valve if master cylinder reservoir cover is removed to prevent pressurization.

1. Install end of a length of plastic tubing over caliper bleeder valve; place other end in a clean container. Stand motorcycle upright.
 - a. Front brake bleeder valve-see [Figure 1-9](#).
 - b. Rear brake bleeder valve-see [Figure 1-10](#).

CAUTION

Cover painted surfaces and right handlebar switches and use care when removing brake reservoir cover and adding D.O.T. 4 brake fluid. Spilling D.O.T. 4 brake fluid on painted surfaces will result in cosmetic damage. Spilling brake fluid on switches may render them inoperative.

2. Add **D.O.T. 4 BRAKE FLUID** to master cylinder reservoir. Do not reuse brake fluid.
 - a. Remove two screws from front master cylinder cover. Bring fluid level to within 0.125 in. (3.2 mm) of molded boss inside front master cylinder.
 - b. Remove cap and gasket from rear master cylinder reservoir. Bring fluid level to between upper and lower marks on reservoir.
3. Depress, release and then hold brake lever/pedal to build up hydraulic pressure.

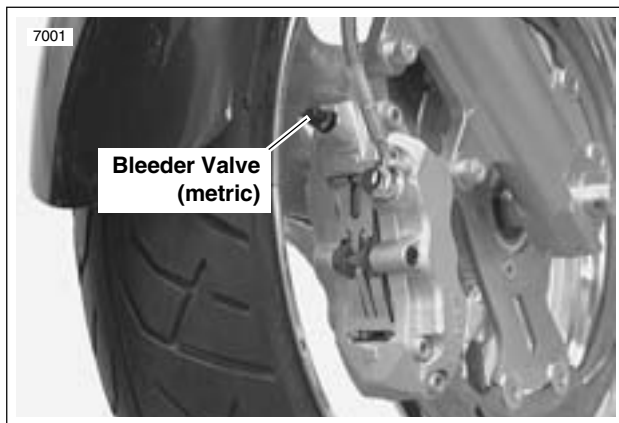


Figure 1-9. Front Brake Bleeder Valve (Typical)

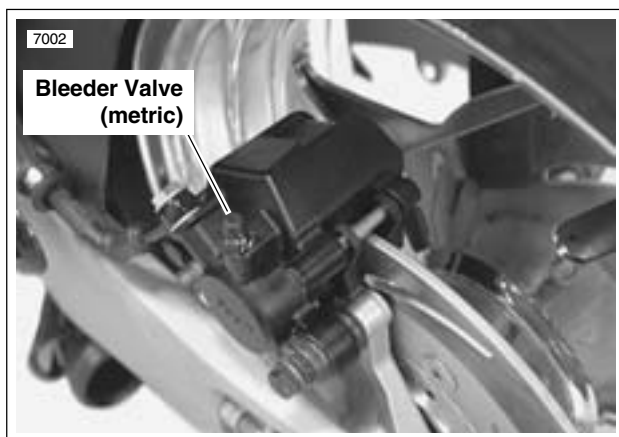


Figure 1-10. Rear Brake Bleeder Valve (Typical)

4. Open bleeder valve (metric) about 1/2-turn counterclockwise; brake fluid will flow from bleeder valve and through tubing. When brake lever/pedal has moved 1/2-3/4 of its full range of travel, close bleeder valve (clockwise). Allow brake lever/pedal to return slowly to its released position.
5. Repeat Steps 2-4 until all air bubbles are purged.
6. Tighten bleeder valve (metric) to 3-5 ft-lbs (4-7 Nm).
7. Verify master cylinder fluid level as described in Step 2.

⚠ WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell recommends that all brake repairs be performed by a Buell dealer or other qualified mechanic.

8. Attach covers to master cylinder reservoirs.
 - a. Tighten screws on master cylinder reservoir cover to 9-13 **in-lbs** (1.0-1.5 Nm).
 - b. Tighten cap on rear master cylinder securely.

BRAKE SYSTEM COMPONENTS

Pads and Rotors

⚠ WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

Check brake pads for minimum thickness:

- At the 500 mile (800 km) service interval.
- At every scheduled service interval thereafter.

See [Figure 1-11](#). Inspect brake pads for damage or excessive wear. Replace both pads as a set if friction material (1) of either pad is worn to 0.04 in. (1.0 mm) or less. If this amount of wear occurs, wear grooves (2) will disappear from friction material surface.

- Replace front brake pads using procedure under [2.11 FRONT BRAKE CALIPER](#).
- Replace rear brake pads using procedure under [2.14 REAR BRAKE CALIPER](#).

See [Table 1-6](#). See Section 2 for replacement procedures.

⚠ WARNING

Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake rotor or reduced braking ability will occur, which could result in death or serious injury.

Check brake rotors for minimum thickness:

- At the 500 mile (800 km) service interval.
 - At every scheduled service interval thereafter.
1. Measure rotor thickness. Replace if minimum thickness is less than 0.18 in. (4.5 mm).
 2. Check rotor surface. Replace if warped or badly scored.
 3. The brake rotor must be within the following specifications. If the brake rotor is suspected of being damaged, inspect rotor using the following measurements:
 - Lateral Movement: 0.01-0.02 in. (0.3-0.5 mm)
 - Radial Movement: 0.02 in. (0.45 mm)
 - Rotational Movement: 0.02 in. (0.39 mm)

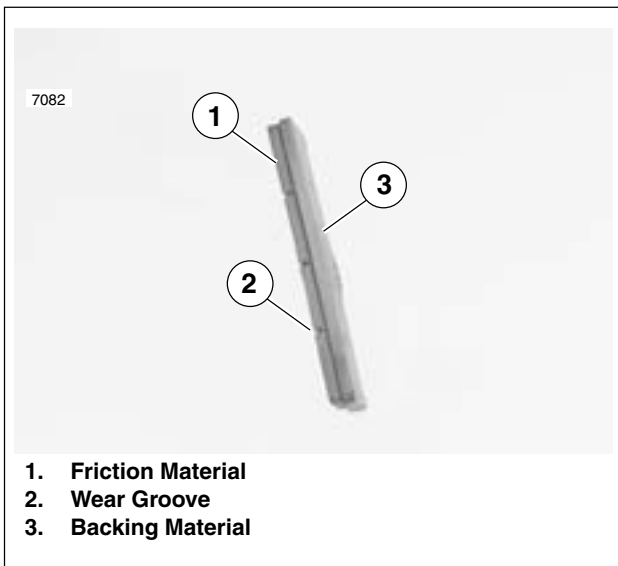


Figure 1-11. Brake Pad Thickness

Table 1-6. Service Wear Limits

ITEM	IN.	MM
Minimum rotor thickness (front and rear)	0.18	4.6
Minimum brake pad thickness (front and rear)	0.04	1.0

Rear Brake Pedal

⚠ WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell recommends that all brake repairs be performed by a Buell dealer or other qualified mechanic.

Check rear brake pedal height.

- Before every ride.
 - At the 500 mile (800 km) service interval.
 - At every 5000 mile (8000 km) service interval thereafter.
1. See Figure 1-12. Inspect locknut (3) installation. Locknut should be flush with top surface of turn buckle (4).
 2. Measure distance from bottom edge of rod adjuster (2) to top surface of locknut (3).
 - a. If measurement is equal or less than 1.36 in. (34.5 mm), brake pedal adjustment is not needed.
 - b. If measurement is greater than 1.36 in. (34.5 mm), adjust brake pedal.

NOTE

See Figure 1-12. Minimum allowable pushrod thread engagement inside turn buckle is 0.24 in. (6.1 mm).

3. See Figure 1-12. Adjust brake pedal height.
 - a. Loosen locknut (3) while holding rod adjuster (2). Move locknut away from top surface of turn buckle.
 - b. Turn rod adjuster to set pedal height.
 - c. Return locknut (3) to fit flush against top surface of turnbuckle (4).

NOTE

The rear brake pedal has no freeplay adjustment.

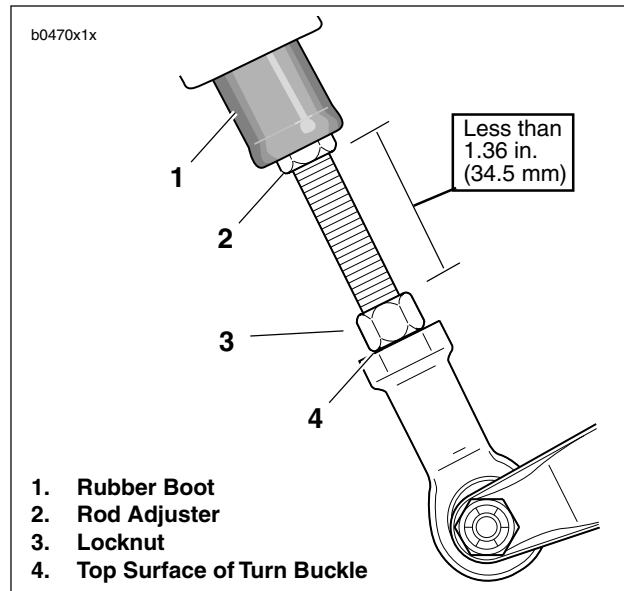


Figure 1-12. Pushrod Adjustment

INSPECTION

1. Inspect shift linkage for free movement.
2. See [Figure 1-13](#). Measure the shift linkage rod by measuring the distance from the center of the lower eye to the center of the top eye (5). For settings see [Table 1-7](#).
3. Adjust as required.

ADJUSTMENT

1. See [Figure 1-13](#). Remove upper eye fastener (1), upper eye (2) from shift rod (4).
2. Loosen jam nut (3). Rotate upper eye clockwise to shorten, or counterclockwise to lengthen to factory settings of 4.75 in (120.7 mm) or maximum length of 4.88 in (124 mm).
3. Tighten jam nut.
4. Apply LOCTITE THREADLOCKER 243 (Blue) to threads of upper eye fastener.
5. Install upper eye to shift rod with upper eye fastener. Tighten to 59-66 **in-lbs** (6.6-7.5 Nm).
6. Check for proper shift lever/clutch operation.

Table 1-7. Shifter Rod Adjustment

SETTINGS	MEASUREMENT
Factory	4.75 in (120.7 mm)
Maximum	4.88 in (120.7 mm)

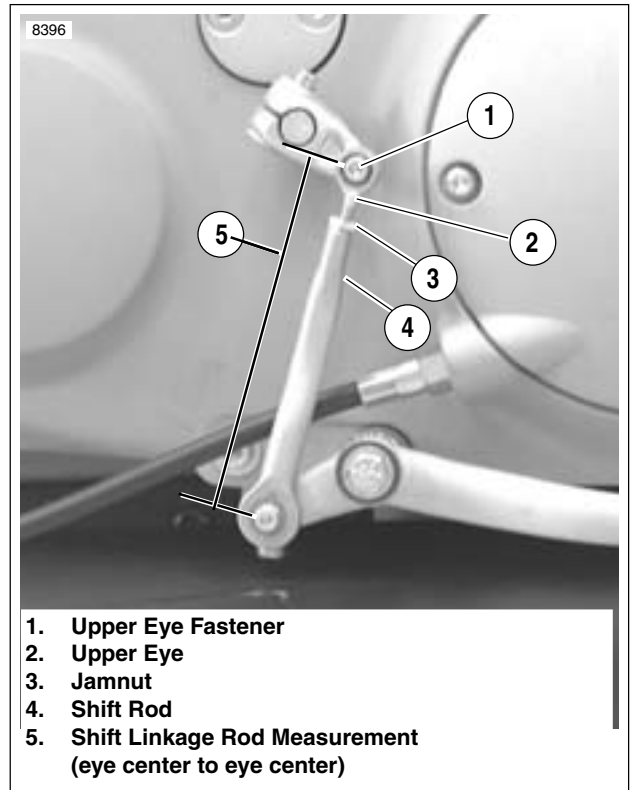


Figure 1-13. Shift Linkage Rod Adjustment

TIRE INFLATION

WARNING

Do not inflate any tire beyond its maximum inflation pressure as specified on tire sidewall. Overinflation may cause tire to suddenly deflate which could result in death or serious injury.

Check tire pressure and tread:

- Before every ride.
- At the 500 mile (800 km) service interval.
- At every scheduled service interval.

Check for proper front and rear tire pressures when tires are cold. Compare pressure against [Table 1-8](#).

Table 1-8. Tire Pressures

TIRE	PRESSURE FOR SOLO RIDING		PRESSURE AT GVWR	
	PSI	kPa	PSI	kPa
Front	32	220	36	248
Rear	36	248	38	262

WHEEL BEARINGS

Check wheel bearings:

- Every time the wheel is removed.
- At every 10,000 mile (16,000 km) service interval.
- When storing or removing the motorcycle for the season.

Check wheel bearings and axle spacers for wear and corrosion. Excessive play or roughness indicates worn bearings. Replace bearings in sets only.

TRANSMISSION FLUID

Check transmission fluid:

- Replace at the 500 mile (800 km) service interval.
- Inspect level at every 2500 mile (4000 km) service interval.
- Replace at every 5000 mile (8000 km) service interval.

Transmission fluid capacity is 1.0 quart (0.95 liter). For best results, drain fluid while it is hot.

1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174). This prevents transmission fluid from spilling out of the clutch inspection cover opening.
2. Remove muffler to access drain plug. See [2.28 EXHAUST SYSTEM](#).
3. See [Figure 1-14](#). Position a suitable container under drain plug. Remove plug and drain fluid.
4. Wipe any foreign material from the magnetic drain plug. Reinstall plug. Tighten to 14-30 ft-lbs (19-41 Nm).
5. Remove four TORX screws with washers from clutch inspection cover. Remove clutch inspection cover from primary cover. Do not damage Quad ring or dislodge it from primary cover.

CAUTION

Do not overfill the primary chaincase with lubricant. Overfilling may cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle.

6. See [Figure 1-15](#). Add SPORT-TRANS FLUID (Part No. 98854-96 quart size; Part No. 98855-96 gallon size) as required until fluid level is even with bottom of clutch diaphragm spring.
7. See [Figure 1-14](#). Install clutch inspection cover using four TORX screws with washers. Replace quad ring if damaged. Tighten in a crosswise pattern to 7-9 ft-lbs (10-12 Nm).
8. Install muffler. See [2.28 EXHAUST SYSTEM](#).

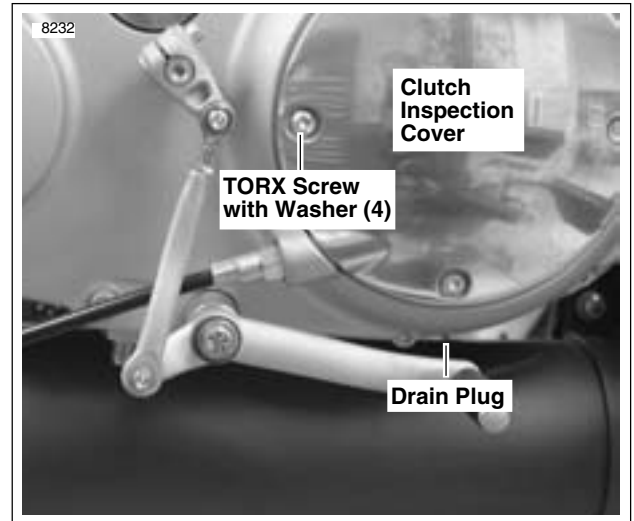


Figure 1-14. Primary Cover

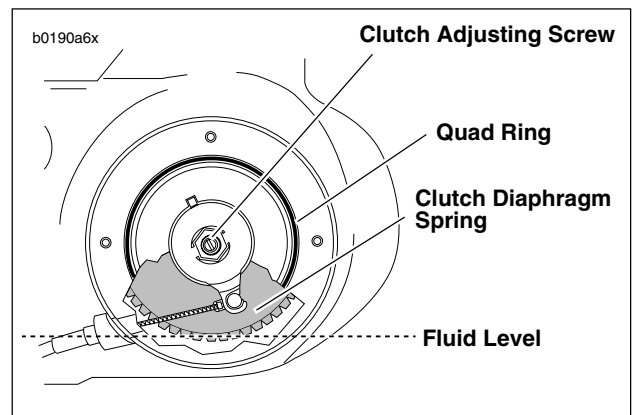


Figure 1-15. Fluid Level

ADJUSTMENT

Check clutch adjustment:

- At the 500 mile (800 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

If clutch slips under load or drags when released, first check control cable adjustment. If cable adjustment is within specifications, adjust clutch mechanism as described below.

When necessary, lubricate cable with LUBIT-8 TUFOIL® CHAIN AND CABLE LUBE (Part No. HD-94968-85TV).

1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
2. See [Figure 1-16](#). Slide rubber boot upward to expose adjuster mechanism. Loosen jam nut from adjuster. Turn adjuster to shorten cable housing until there is a large amount of freeplay at clutch hand lever.
3. See [Figure 1-17](#). Remove four TORX screws with washers (1) from clutch inspection cover (2). Remove clutch inspection cover from primary cover. Do not damage or dislodge quad ring (3) from primary cover.

NOTE

Quad ring removed from primary cover for illustrative purposes only in [Figure 1-17](#).

4. Remove spring (4) and lockplate (5). Turn adjusting screw (6) counterclockwise until it lightly bottoms.
5. Turn adjusting screw (6) clockwise 1/4 turn. Install lockplate (5) and spring (4) on adjusting screw flats. If hex on lockplate does not align with recess in outer ramp, rotate adjusting screw clockwise until it aligns.
6. Squeeze clutch hand lever to maximum limit three times. This sets the ball and ramp mechanism. Pull outer cable conduit and at the same time adjust cable adjuster to provide 0.0625-0.125 in. (1.6-3.2 mm) freeplay at clutch hand lever. Adjust as follows.
 - a. See [Figure 1-18](#). Pull ferrule (end of cable housing) away from bracket. Gap between ferrule and bracket should be 0.0625-0.125 in. (1.6-3.2 mm).
 - b. See [Figure 1-16](#). Set freeplay by turning adjuster.
 - c. Tighten jam nut against adjuster.
 - d. Slide boot over cable adjuster mechanism.
7. Change or add transmission fluid if necessary.
8. See [Figure 1-17](#). Install clutch inspection cover (2) using four TORX screws with washers (1). Tighten in a cross-wise pattern to 7-9 ft-lbs (10-12 Nm).
9. Check clutch cable freeplay. See Step 6 above.

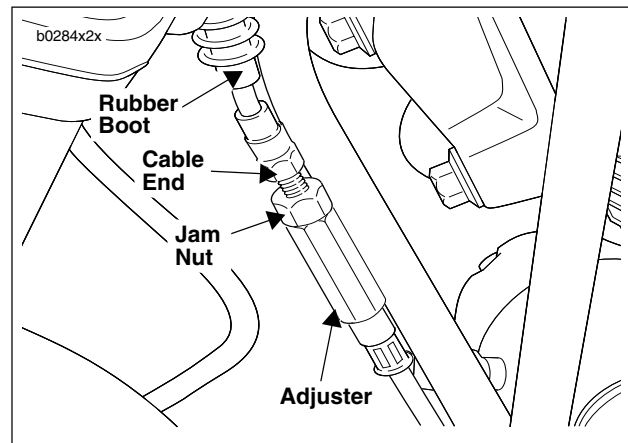
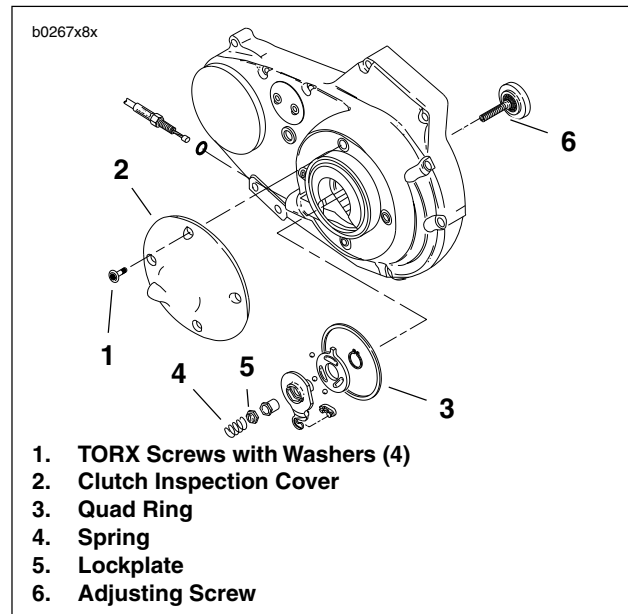


Figure 1-16. Clutch Cable Adjuster Mechanism



1. TORX Screws with Washers (4)
2. Clutch Inspection Cover
3. Quad Ring
4. Spring
5. Lockplate
6. Adjusting Screw

Figure 1-17. Clutch Release Mechanism

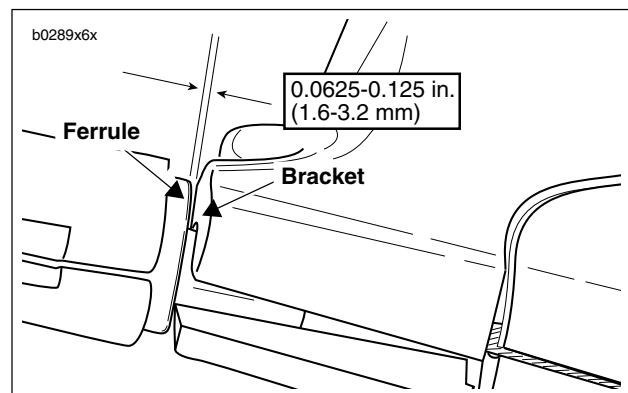


Figure 1-18. Adjusting Clutch Freeplay

INSPECTION

Check rear drive belt deflection:

- Inspect before every ride.
- Adjust at the 500 mile (800 km) service interval.
- Inspect at every 5000 mile (8000 km) service interval thereafter.

NOTE

There are tight and loose spots during rear wheel rotation that affect belt deflection. For a more precise measurement, take three deflection readings, rotating the rear wheel between measurements. Average the three readings for a more precise measurement.

When checking deflection, have:

- No rider or cargo weight on motorcycle.
 - Transmission in neutral.
 - Belt and sprockets at room temperature.
 - Motorcycle upright (not on side stand).
1. Inspect parts for damage.
 - a. Check rear wheel sprocket for unusual wear, broken teeth or damaged flange.
 - b. Inspect the rear drive belt for unusual wear, cracking or loss of teeth.

NOTE

The drive belt inner tooth surface has a thin coating of polyethylene. During initial operation, this coating will wear as it is burnished into the belt fabric. This is a normal condition and not an indicator of belt wear.

2. Detach drive support arm and sprocket cover.
3. Unload the rear suspension by lifting the motorcycle frame under the tail section.

NOTE

When the rear suspension is fully unloaded, the motorcycle's weight is not compressing the rear shock. It is not necessary to raise the rear wheel off the ground to reach this point.

4. See [Figure 1-19](#). Apply 10 lbs of force using BELT TENSION GAUGE (Part No. HD-35381) at the midpoint of the belt's bottom strand. The deflection should be upward as shown.
5. Deflection (measured with 10 lbs of force) should be 1.50-1.75 in. (38.1-44.5 mm) at the bottom strand. If deflection is within limits, see [Axle Alignment](#).
6. If belt does require adjustment, see [Deflection Adjustment](#). After adjusting deflection, check axle alignment.
7. Install drive support arm,
 - a. Apply LOCTITE THREADLOCKER 271 (red) to drive support screws. Tighten to 20-25 ft-lbs (27-34 Nm).
 - b. Tighten the drive support nut to 35 ft-lbs (48 Nm).

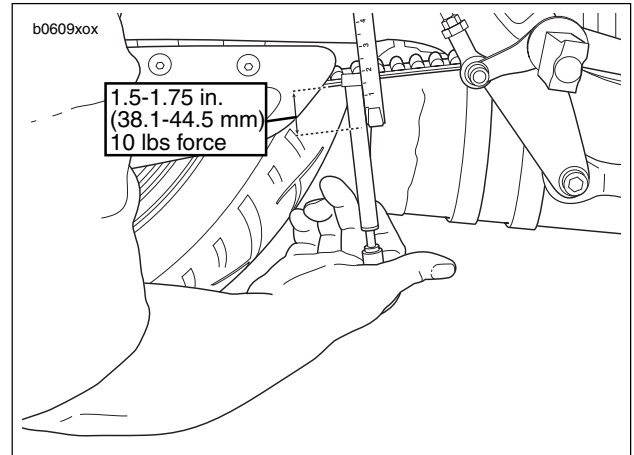


Figure 1-19. Belt Deflection

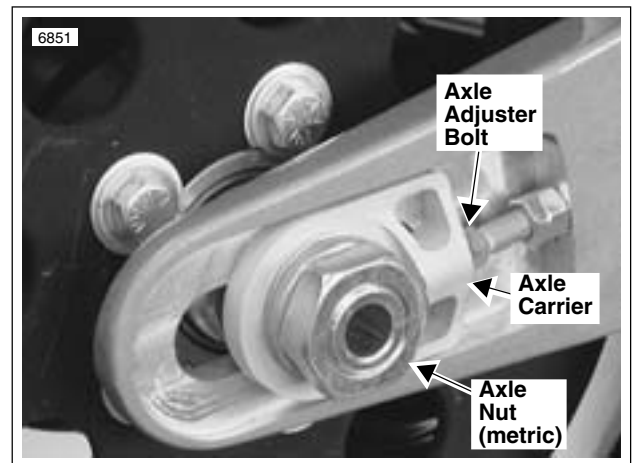


Figure 1-20. Rear Axle Adjuster

ADJUSTMENT

Axle Alignment

Check to be sure rear wheel axle is parallel with swingarm pivot shaft.

1. See [Figure 1-21](#). Measure each side from the flat of the axle carrier to the flat of the swingarm.
 - a. If the measurements are equal ± 0.015 in. (0.381 mm) the rear axle is correctly aligned.
 - b. If the two measurements are not equal, adjustment is required. Follow instructions below.

Deflection Adjustment

1. See [Figure 1-20](#). Loosen rear axle nut (metric), if not already loose.

NOTE

See [Figure 1-22](#). Use an automotive-style ignition wrench to hold axle adjuster bolt in place during Step 2.

2. To adjust belt deflection/rear wheel alignment, loosen locknut, hold axle adjuster bolt and turn adjusting nut.
 - a. If belt is too loose, tighten adjusting nut to decrease deflection and therefore increase drive belt tension.
 - b. If belt is too tight, loosen adjusting nut to increase belt deflection and therefore decrease drive belt tension.
 - c. See [Figure 1-21](#). Repeat this step until the distance between the flat on the axle carrier and the flat of the swingarm is the same on both sides of the rear wheel and belt deflection is correct.
3. Tighten locknut flush against adjusting nut.
4. Tighten axle nut (metric) to 66-73 ft-lbs (90-99 Nm).
5. Verify that belt deflection is correct.

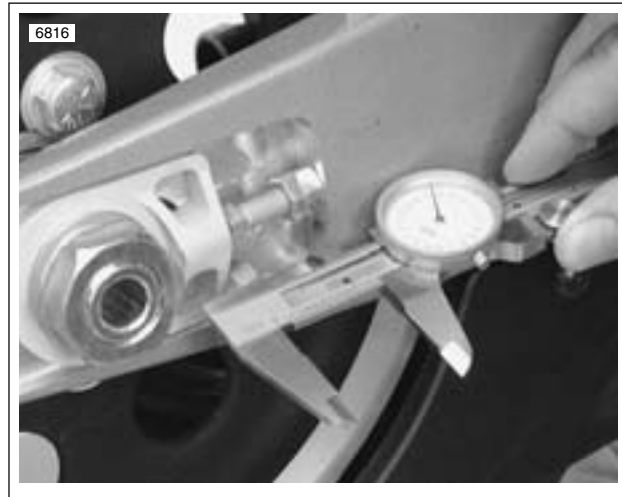


Figure 1-21. Checking Rear Wheel Alignment, Right Side Shown

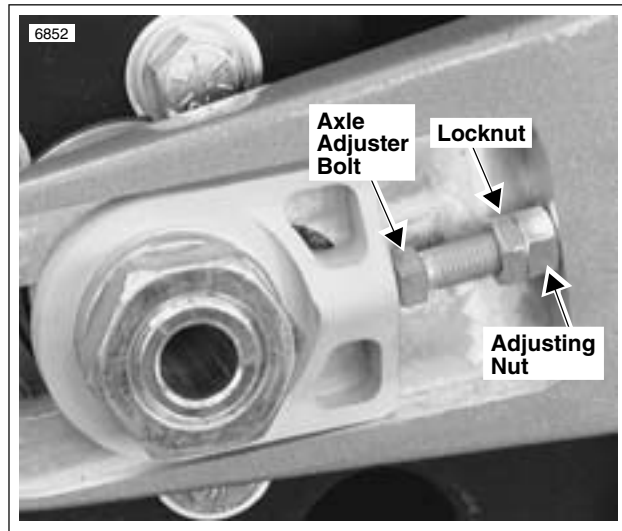


Figure 1-22. Axle Adjuster Bolt, Right Side Shown

GENERAL

Inspect the drive belt and rear sprocket:

- At the 500 mile (800 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

NOTE

When a drive belt is replaced for any reason other than stone damage, it is recommended that the transmission and rear sprockets also be replaced to increase the longevity of the new drive belt. In the case of stone damage, inspect sprockets for damage and replace as required.

INSPECTION

Rear Sprocket

NOTE

If chrome chips or gouges to rear sprocket are large enough to be harmful, they will leave a pattern on the belt face.

1. Inspect each tooth of rear sprocket for:
 - a. Major tooth damage.
 - b. Large chrome chips with sharp edges.
 - c. Gouges caused by hard objects.
 - d. Excessive loss of chrome plating (see Step 2).
2. To check if chrome plating has worn off, drag a scribe or sharp knife point across the bottom of a groove (between two teeth) with medium pressure.
 - a. If scribe or knife point slides across groove without digging in or leaving a visible mark, chrome plating is still good.
 - b. If scribe or knife points digs in and leaves a visible mark, it is cutting the bare aluminum. A knife point will not penetrate the chrome plating.
3. Replace rear sprocket if major tooth damage or loss of chrome exists.

Drive Belt

See [Figure 1-23](#). Inspect drive belt for:

- Cuts or unusual wear patterns.
- Outside edge bevelling (8). Some bevelling is common, but it indicates that sprockets are misaligned.
- Outside ribbed surface for signs of stone puncture (7). If cracks/damage exists near edge of belt, replace belt immediately. Damage to center of belt will require belt replacement eventually, but when cracks extend to edge of belt, belt failure is imminent.
- Inside (toothed portion) of belt for exposed tensile cords (normally covered by nylon layer and polyethylene layer). This condition will result in belt failure and indicates worn transmission sprocket teeth. Replace belt and transmission sprocket.
- Signs of puncture or cracking at the base of the belt teeth. Replace belt if either condition exists.
- Replace belt if conditions 2, 3, 6 or 7 (on edge of belt) exist.

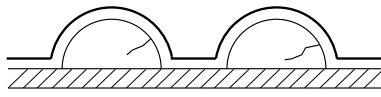
NOTE

Condition 1 may develop into 2 or 3 over time. Condition 1 is not grounds for replacing the belt, but it should be watched closely before condition 2 develops which will required belt replacement.

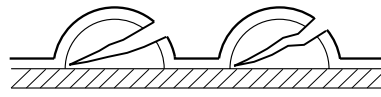
CLEANING

Clean drive belt with mild soap and water spray solution as required. Dry thoroughly. Do not immerse belt in solution.

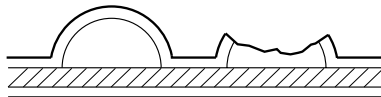
p0086a6x



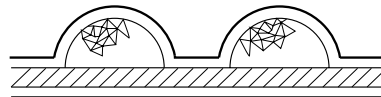
#1 Internal Tooth Crack (Hairline)
OK to Run, but monitor condition



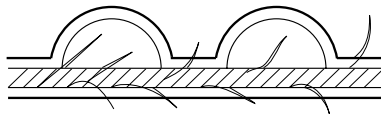
#2 Pac Man Cracks
Replace Belt



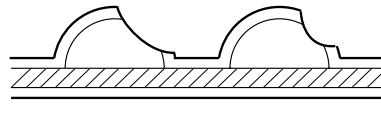
#3 Missing Teeth
Replace Belt



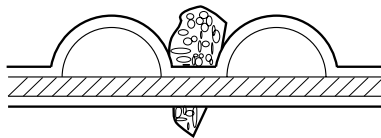
#4 Chipping (Not Serious)
OK to Run, but monitor condition



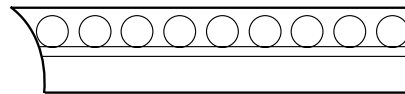
#5 Fuzzy Edge Cord (Not Serious)
OK to Run, but monitor condition



#5 Hook Wear
Replace Belt



#7 Stone Damage
Replace Belt if damage is on edge



#8 Bevel Wear (Outboard Edge Only)
OK to Run, but monitor condition

Figure 1-23. Drive Belt Wear Patterns and Recommended Actions

INSPECTION

Check primary chain tension:

- At the 500 mile (800 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

See [Figure 1-24](#). Measure primary chain tension through the inspection cover (3) opening. Adjust primary chains not meeting vertical freeplay specifications.

1. See [Figure 1-24](#). Remove two screws (1) and O-rings (2).
2. Remove inspection cover (3) and O-ring (4) from primary cover (6).
3. See [Figure 1-25](#). Check primary chain tension by measuring vertical freeplay (4).
 - a. Measure vertical freeplay through inspection cover opening (2).
 - b. Rotate engine to move primary chain to a different position on sprockets (1, 3).
 - c. Measure vertical freeplay several times, each time with primary chain moved so that the measurement is taken with sprockets rotated to the tightest chain position.
4. The tightest measurement taken in Step 3 must be within the specifications listed in [Table 1-9](#). If necessary, adjust as described under [ADJUSTMENT](#).

NOTE

The initial primary chain vertical freeplay specification used at the assembly plant is 1/4-3/8 in. (6.4-9.5 mm) with a cold engine. The 1/4 in. (6.4 mm) minimum is only allowed at the absolute tightest point in the drive, as measured with specialized factory equipment. If a chain has less than The 1/4 in. (6.4 mm) vertical freeplay (with a cold engine), adjust freeplay to the "field" specification of 3/8-1/2 in. (9.5-12.7 mm). The looser specification will avoid overtightening, which might otherwise occur during adjustment using "non-factory" equipment and methods.

5. See [Figure 1-24](#). Install O-ring (4).
6. Fasten inspection cover (3) to primary cover (6) using two screws (1) with O-rings (2). Tighten to 40-60 in-lbs (5-7 Nm).

ADJUSTMENT

NOTE

If vertical freeplay cannot be set within the limits specified, then primary chain and/or chain adjuster are worn beyond adjustment limits. Replace parts as necessary. See [Section 6](#).

1. See [Figure 1-26](#). Loosen locknut.
2. Turn adjusting screw:
 - a. Clockwise (inward) to reduce freeplay.
 - b. Counterclockwise (outward) to increase freeplay.
3. Tighten locknut to 20-25 ft-lbs (27-34 Nm).

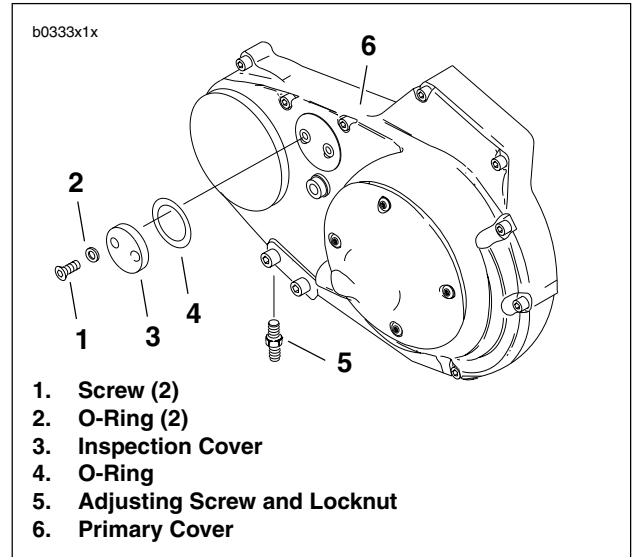


Figure 1-24. Primary Chain Inspection Cover

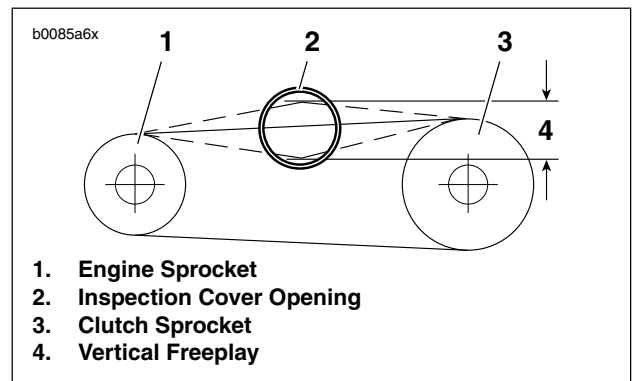


Figure 1-25. Measuring Primary Chain Tension

Table 1-9. Primary Chain Tension

ENGINE TEMPERATURE	FREEPLAY	
	Cold	0.375-0.5 in.
Hot (normal running temperature)	0.25-0.375 in.	6.4-9.5 mm



Figure 1-26. Primary Chain Adjustment

GENERAL

Adjust rear preload when:

- There is a change in load (adding luggage, etc.)
- Changing front fork or rear shock suspension settings

Optimal rear suspension spring preload assures that the rear shock has enough travel to absorb bumps without bottoming.

Spring preload is the most important suspension adjustment. Improper preload will adversely affect both the handling and motorcycle ride. Correct preload setting will result in motorcycle handling that suits the rider's size and weight.

ADJUSTMENT

Rear Shock

Check and Adjust Rear Shock Preload

1. See [Figure 1-27](#). With a rider seated on the motorcycle, measure the distance between the centers of the front and rear shock eye. See below for the optimum preload measurement.

M2 Models:	15.2-15.5 in. (386-394 mm)
M2L Models:	15.63-15.91 in. (397-404 mm)

2. See [Figure 1-27](#). Adjust shock preload until the measurement is within the optimum preload measurement.
 - a. Loosen the locknut and turn the preload adjuster at the end of the shock.
 - b. See [Figure 1-28](#). To decrease preload, move the can towards the front of the motorcycle. To increase preload, move the can towards the rear of the motorcycle.

NOTE

- All measurements must be taken with rider seated on motorcycle.
 - Riders with passenger at or near GVWR may exceed optimum shock length measurement (preload adjustment).
3. See [Figure 1-29](#). When preload adjustments have been made, apply wheel bearing grease halfway around the shock (180 degrees) to the mating faces of the locknut and adjuster nut and the first few threads on the aluminum body leading to the adjuster nut.
 4. Thread locknut back into place.

NOTE

Torque wrench and crow's foot must be set at 90 degrees to prevent torque multiplication by wrench.

5. Hold adjusting nut in place and tighten locknut to 65-72 ft-lbs (88-98 Nm) with crow's foot set at 90 degrees to the torque wrench.
6. Wipe excess grease off of shock absorber.

NOTE

When preload is increased, both compression and rebound damping should be increased. If preload is decreased, both compression and rebound damping should be decreased.

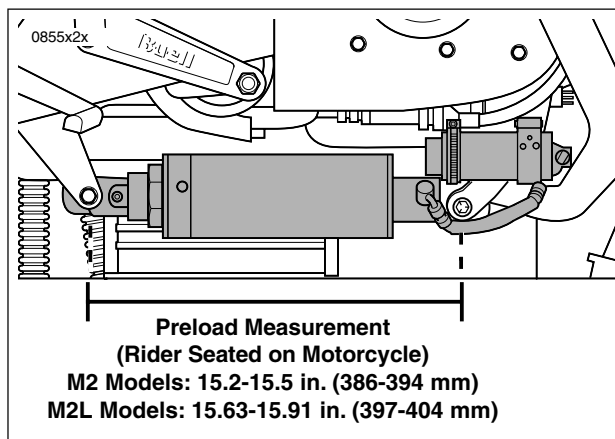


Figure 1-27. Rear Shock Preload Adjustment

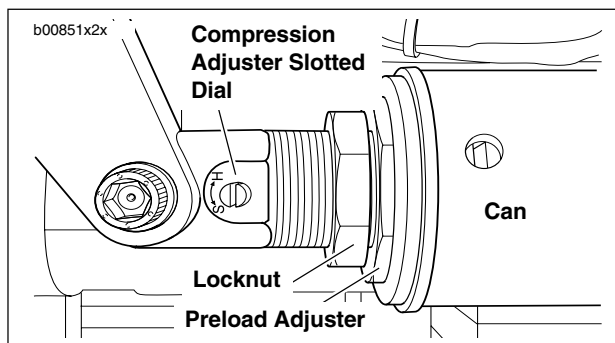


Figure 1-28. Rear Shock Preload Adjustment

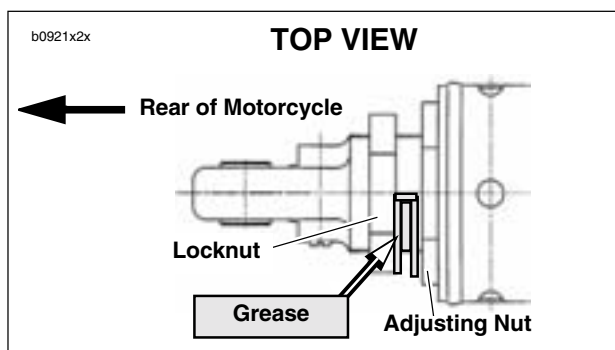


Figure 1-29. Applying Grease to Shock

Front Fork Preload

1. Remove all accessories from motorcycle including tank bag and/or saddlebags.
2. Take the motorcycle off the side stand. Bounce the front up and down a few times to be sure the suspension is free and not binding.
3. See [Figure 1-30](#). With no one on the motorcycle, lift the front end until the forks are fully extended. Measure the distance from the bottom of the lower triple clamp to the top metal edge of the fork lower without rider/passenger/cargo/accessories on the motorcycle.
4. Install items removed in Step 1. Load all cargo.
5. Bounce a few times on the seat to be sure the suspension is free and not binding.
6. With the help of an assistant, take the same measurement with the vehicle fully loaded (rider/passenger/cargo/accessories). The assistant should help balance the motorcycle so the rider can keep both feet on the footrests.
7. Subtract the second measurement from the first. The difference, which is the squat, should be:

M2 Models:	1.25-2.0 in. (31.4-50.3 mm)
M2L Models:	0.94-1.65 in. (24-42 mm)

If it is not, you will have to adjust the spring preload.

WARNING

Always adjust each fork leg to the same settings. Uneven adjustment between left and right forks may lead to a loss of control which could result in death or serious injury.

8. See [Figure 1-30](#). Adjust preload by turning preload adjusters on top of both fork legs.
 - a. Rotate adjuster clockwise to increase preload (less squat/fewer preload marks showing).
 - b. Rotate adjuster counterclockwise to decrease preload (more squat/more preload marks showing).

NOTE

Two turns of the adjuster equal one preload mark.

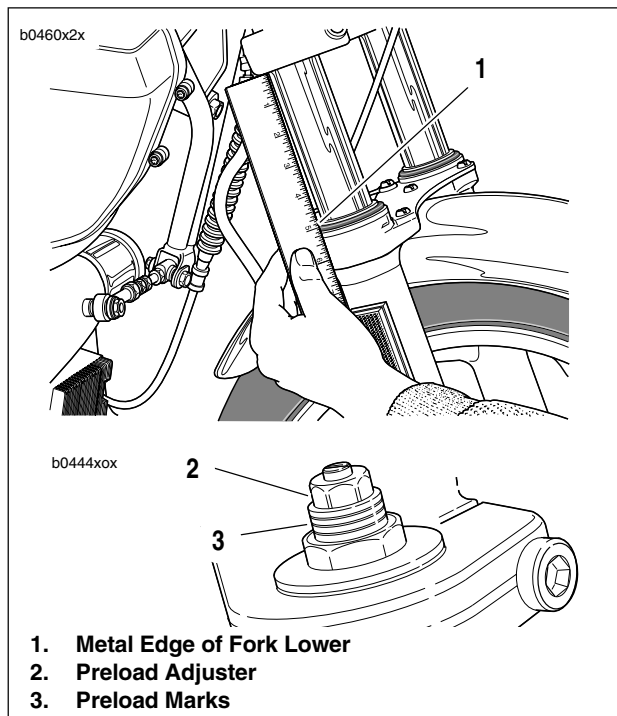


Figure 1-30. Measuring Front Fork Preload

ADJUSTMENT

Rear Shock Rebound Damping

See [Figure 1-31](#). Adjust rebound damping using the slotted dial on the remote reservoir at the front of the shock.

M2 Models: Factory setting-full damping minus 1.5 turn

M2L Models: Factory setting-full damping minus 1 turn

Rear Shock Compression Damping

See [Figure 1-31](#). Adjust compression damping using the slotted dial on the shaft at the end of the shock.

M2 Models: Factory setting-full damping minus 2.25 turns

M2L Models: Factory setting-full damping minus 2.5 turns

Adjusting Rear Shock

- Using a screwdriver, turn the slotted dial on the appropriate adjuster clockwise until it stops. This is the maximum damping setting for that adjustment.
- Then turn the dial counterclockwise the recommended amount to align the reference marks. This is the factory recommended setting.

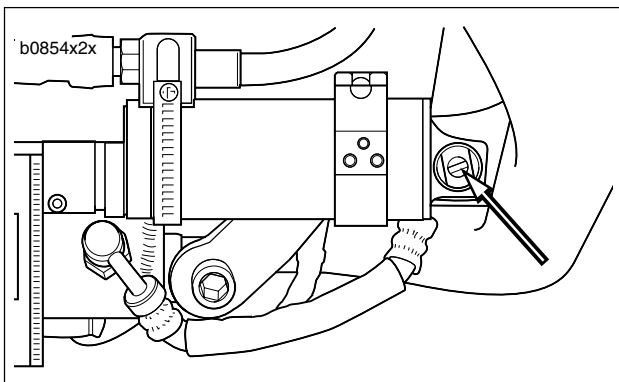


Figure 1-31. M2/M2L Rear Shock Rebound Adjustment

Table 1-10. M2 Recommended Damping Settings

SETTINGS	SOLO (STD)	2 UP	SOLO (FIRM)	SOLO (SOFT)
Front Rebound	1	1	1	1.5
Front Compression	N/A	N/A	N/A	N/A
Rear Rebound	1.5	0.5	0.5	3
Rear Compression	2.25	0.25	0.75	MIN

Table 1-11. M2L Recommended Damping Settings

SETTINGS	SOLO (STD)	2 UP	SOLO (FIRM)	SOLO (SOFT)
Front Rebound	0.5	1	0.5	1
Front Compression	N/A	N/A	N/A	N/A
Rear Rebound	1	0.5	0.5	2.5
Rear Compression	2.5	0.5	1.25	MIN

Front Fork Rebound Damping

⚠ WARNING

Always adjust each fork leg to the same settings. Uneven adjustment between left and right forks may lead to a loss of control which could result in death or serious injury.

See [Figure 1-32](#). Use the slotted dial on the top of the each fork leg to adjust rebound damping.

M2 Models: Factory setting-full damping minus 1.0 turn

M2L Models: Factory setting-full damping minus 0.5 turn

- Using a screwdriver, turn the slotted dial on the appropriate adjuster clockwise until it stops. This is the maximum damping setting for that adjustment.
- Then turn the dial counterclockwise the recommended amount to align the reference marks (dots). This is the factory recommended setting.

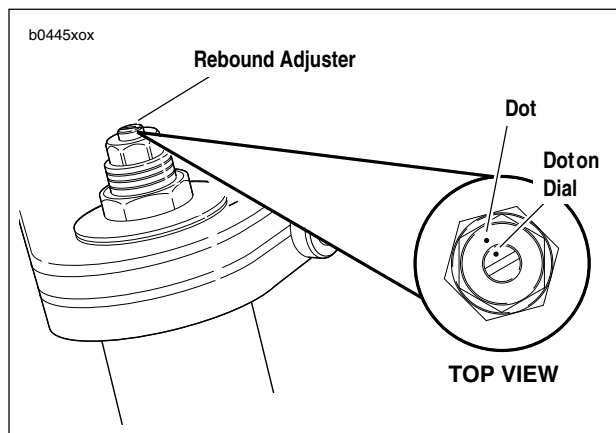


Figure 1-32. M2/M2L Front Fork Rebound Adjuster

INSPECTION

Check steering head bearings:

- At the 500 mile (800 km) service interval.
 - At every 2500 mile (4000 km) service interval thereafter.
 - When storing or removing the motorcycle for the season.
 - Lubricate every 10,000 mile (16,000 km) service interval.
1. Detach clutch cable at handlebar.
 2. See [Figure 1-33](#). Raise rear wheel off ground with REAR WHEEL SUPPORT STAND (Part No. B-41174).
 3. Remove seat and fuel tank. See [4.5 FUEL TANK](#).
 4. See [Figure 1-34](#). Attach lifting straps to frame tubes behind steering neck. Raise front wheel off floor using a floor hoist and lifting straps.
 5. Turn front wheel to full right lock.
 6. See [Figure 1-35](#). Hook a spring scale into the hole in the front axle. With scale 90 degrees from fork leg, pull front wheel to center position. It should take 4.5-6.5 lbs (2.0-2.9 kg) to pull front wheel to center.
 7. Attach clutch cable to handlebar.

NOTE

Check that clutch and throttle cables do not bind when measuring bearing resistance.

Lubrication

At 10,000 miles (16,100 km) and every 10,000 miles (16,100 km) thereafter, lubricate the steering head bearings with WHEEL BEARING GREASE (Part No. 99855-89).

See [2.17 FORK STEM AND BRACKET ASSEMBLY](#) for lubrication procedure.

ADJUSTMENT

1. Detach clutch cable at handlebar.
2. See [Figure 1-33](#). Raise rear wheel off ground with REAR WHEEL SUPPORT STAND (Part No. B-41174).
3. Remove seat and fuel tank. See [4.5 FUEL TANK](#).
4. See [Figure 1-34](#). Attach lifting straps to frame tubes behind steering neck. Raise front wheel off floor using a floor hoist and lifting straps.
5. Turn front wheel to full right lock.
6. See [Figure 1-35](#). Hook a spring scale into the hole in the front axle. Pull front wheel to center position. It should take 4.5-6.5 lbs (2.0-2.9 kg) to pull front wheel to center.
7. See [Figure 1-36](#). Loosen both pinch screws (7) on lower triple clamp.
8. Loosen small pinch screw (8) on upper triple clamp.
9. Tighten or loosen fork stem bolt (1) to set proper tension.
10. Recheck tension using spring scale. See Step 6.
11. Tighten both lower triple clamp pinch screws (7) to 18-20 ft-lbs (24-27 Nm).

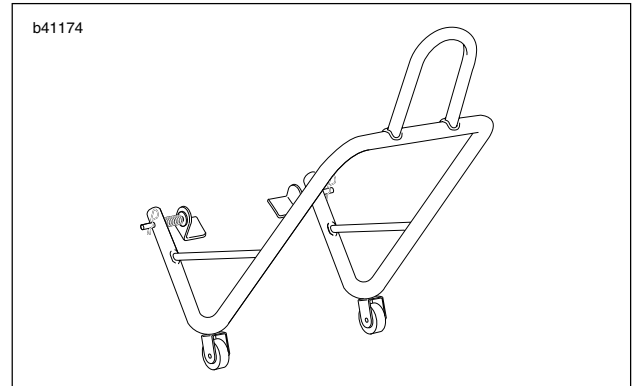


Figure 1-33. Rear Wheel Support Stand (Part No. B-41174)

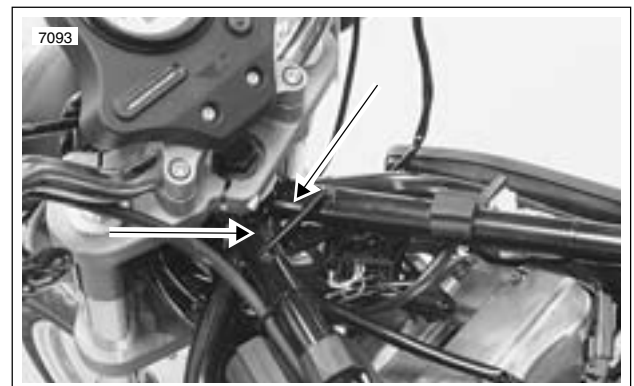


Figure 1-34. Front Wheel Lifting Points

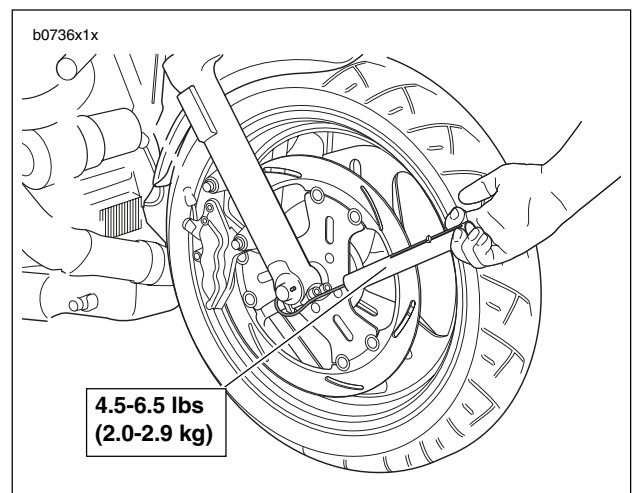


Figure 1-35. Checking Steering Head Bearings

12. Tighten small pinch screw (8) on upper triple clamp to 10-12 ft-lbs (14-16 Nm).

FORK OIL CHANGE

Replace fork oil:

- At every 20,000 mile (32,000 km) service interval.
- If fork should be submerged in water.

NOTE

If fork oil is emulsified, aerated or light brown in color, then it has been contaminated by water. If this happens, replace the fork oil seals.

1. Remove, drain and disassemble front forks. Inspect and assemble parts as described under [2.16 FRONT FORK](#).

NOTE

Adjust fork bottoming resistance on M2 models by increasing or decreasing fork oil level within ranges given in table. Increasing fork oil level will increase bottoming resistance; decreasing fork oil level will decrease bottoming resistance. For M2L models, use only standard oil capacity. See [Table 1-12](#).

2. With assembled fork in fully compressed stage, add half the recommended fork oil into the fork tube.

CAUTION

See [Figure 1-37](#). Be careful not to spill oil out of the fork pipe from the rebound adjuster's breather hole. Fork oil will stain clothing if spilled.

3. See [Figure 1-38](#). Grasp damper assembly (2). Pull damper assembly upward a minimum of 10 times to bleed air from the fork.
4. Pour the rest of the fork oil into the fork tube.
5. See [Figure 1-38](#). Check fork oil level.
 - a. With front fork fully compressed, clamp vertically in FRONT FORK HOLDING TOOL (Part No. B-41177).
 - b. Measure distance from fork oil (4) surface to top of outer tube (3) using PRO-LEVEL OIL GAUGE (Part No. B-59000A).
 - c. Add or drain fork oil as needed until distance from top of fork tube to oil surface measures as listed below:

M2 Models: 4.25 in. (108 mm)

M2L Models: 4.13 in. (105 mm)

NOTE

Left and right forks must contain equal amounts of fork oil.

6. Finish fork assembly and install. See [2.16 FRONT FORK](#).

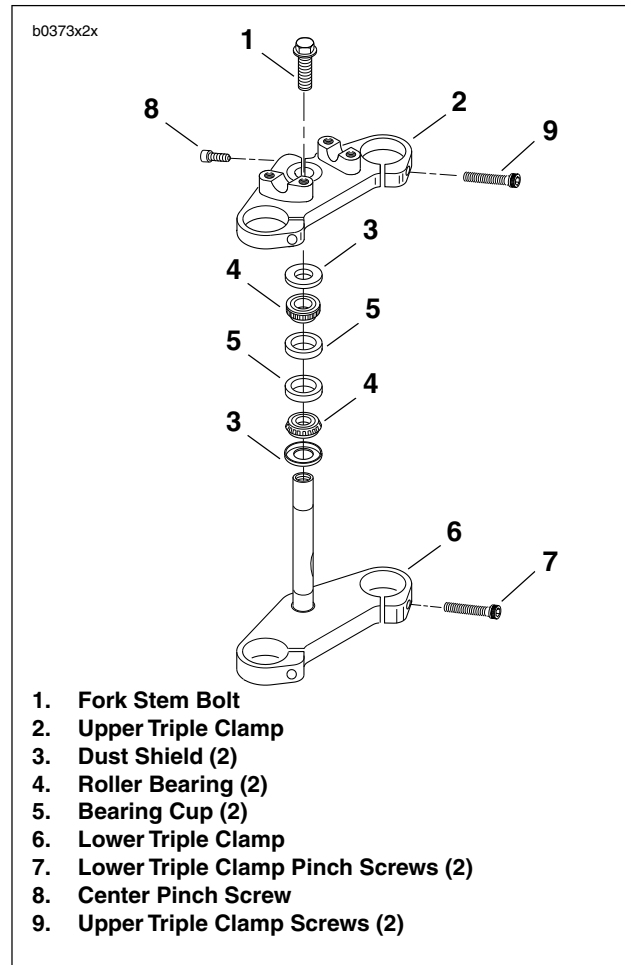


Figure 1-36. Steering Head Assembly

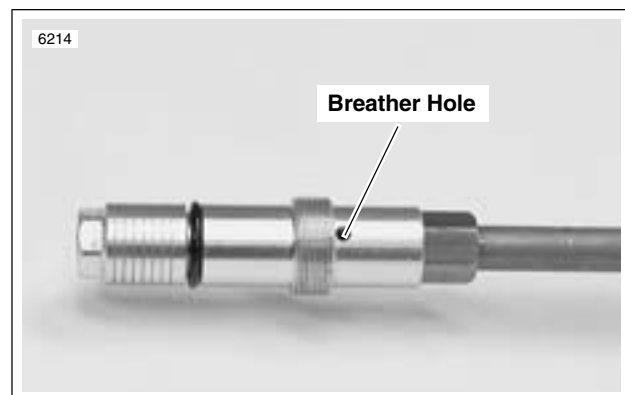


Figure 1-37. Breather Hole

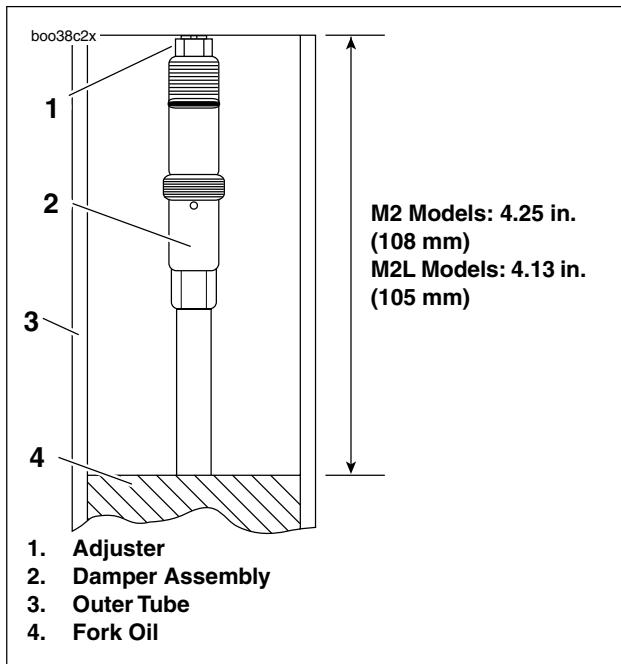


Figure 1-38. Correct Fork Oil Level

Table 1-12. M2 Model Fork

PROPERTY	SPECIFICATION	
Fork Oil	TYPE E FORK OIL (Part No. HD-99884-80)	
Standard Capacity (Dry)	15.96 ounces	472 cc
Standard Oil Level	4.25 in.	108 mm
Maximum Oil Level	3.15 in.	80 mm
Minimum Oil Level	4.92 in.	125 mm

Table 1-13. M2L Model Fork

PROPERTY	SPECIFICATION	
Fork Oil	TYPE E FORK OIL (Part No. HD-99884-80)	
Standard Capacity (Dry)	15.99 ounces	473 cc
Standard Oil Level	4.13 in.	105 mm
Maximum Oil Level	N/A	N/A
Minimum Oil Level	N/A	N/A

INSPECTION

Check spark plugs:

- Inspect at every 5000 mile (8000 km) service interval.
 - Replace every 10,000 mile (16,100 km) service interval.
 - Use only Harley-Davidson 10R12 spark plugs (Part No. 27661-00Y).
1. Disconnect cables from both spark plugs.
 2. Remove spark plugs and examine.
 3. See [Figure 1-39](#). Compare your observations of the plug deposits with the descriptions provided below.
 - a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip indicates an oil fouled plug. The condition may be caused by one or more of the following: worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.
 - b. A dry, fluffy or sooty black deposit indicates a carburetor air-fuel mixture that is too rich, engine idling for excessive periods of time and/or enrichener usage for excessive periods of time.
 - c. A light brown, glassy deposit indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes and is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.
 - d. A plug with a white, yellow, tan or rusty brown powdery deposit indicates balanced combustion. Clean off spark plug deposits at regular intervals.
 4. If the plugs require cleaning between tune-ups and replacement plugs are not available, proceed as follows:
 - a. Degrease firing end of spark plug using ELECTRICAL CONTACT CLEANER. Dry plug with compressed air.
 - b. Use a thin file to flatten spark plug electrodes. A spark plug with sharp edges on its electrodes requires 25%-40% less firing voltage than one with rounded edges.
 5. If the plugs cannot be cleaned, replace with HD No. 10R12 spark plugs (Part No. 27661-00Y).
 6. Check electrode gap with a wire-type feeler gauge. Gap should be 0.038-0.043 in. (0.97-1.09 mm).
 7. See [Figure 1-40](#). Apply LOCTITE ANTI-SEIZE to threads of spark plugs. Install and tighten to 11-18 ft-lbs (15-24 Nm).
 8. Connect spark plug cables. Longer cable attaches to rear cylinder spark plug. Verify that cables are securely connected to ignition coil and spark plugs.



Figure 1-39. Typical Spark Plug Deposits

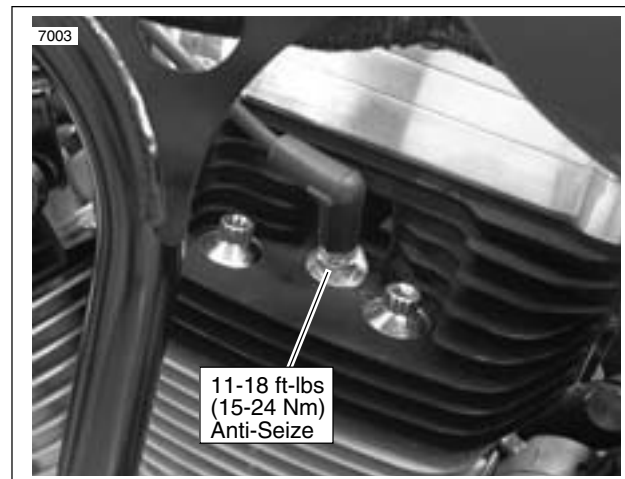


Figure 1-40. Spark Plugs

GENERAL

Check air cleaner filter element:

- Inspect at the 500 mile (800 km) service interval.
- Replace at every 5000 mile (8000 km) service interval thereafter.

NOTE

Service air cleaner filter element more often if the motorcycle is run in a dusty environment.

REMOVAL

CAUTION

Do not run engine without filter element in place. Debris could be drawn into the engine causing damage.

1. See [Figure 1-41](#). Remove both front screws and nylon washers (3).
2. Remove both rear screws and nylon washers (1). Remove cover (2).
3. See [Figure 1-42](#). Remove bolts and washers (3) from filter box (2). Slide filter box forward, away from snorkel (1).
4. See [Figure 1-43](#). Remove the filter element from filter box. Inspect and replace if necessary.

CLEANING AND INSPECTION

WARNING

Do not use gasoline or solvents to clean the filter element. Volatile/flammable cleaning agents may cause an intake system fire which could result in death or serious injury.

1. Check filter element. Hold filter element up to strong light source. The element can be considered sufficiently clean if light is uniformly visible through the element.
2. Thoroughly clean backplate, filter box and inside of cover.

INSTALLATION

1. See [Figure 1-43](#). Place filter element in filter box. Attach filter box to snorkel.
2. Apply LOCTITE THREADLOCKER 243 (Blue) to the filter box bolts and LOCTITE THREADLOCKER 222 (Purple) to the four cover screws.
3. See [Figure 1-42](#). Fasten filter box to backplate with bolts and washers (3). Tighten to 40-45 **in-lbs** (4.5-5.1 Nm).
4. See [Figure 1-41](#). Place cover (2) over backplate assembly.
 - a. Loosely install rear screws and nylon washers (1).
 - b. Loosely install front screws and nylon washers (3).

- c. Tighten front and rear screws to 18-22 **in-lbs** (2.0-2.5 Nm).

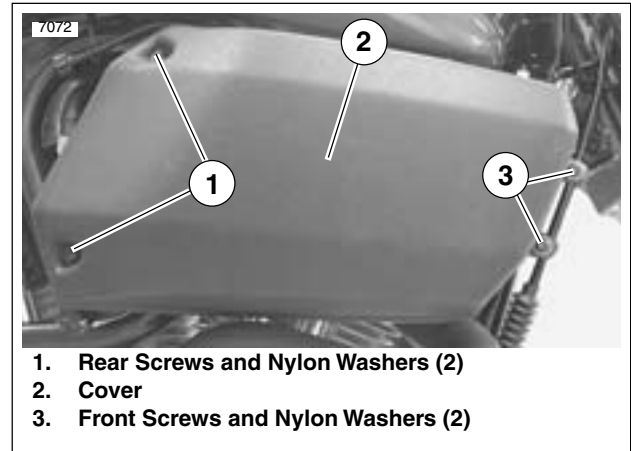


Figure 1-41. Air Cleaner Cover

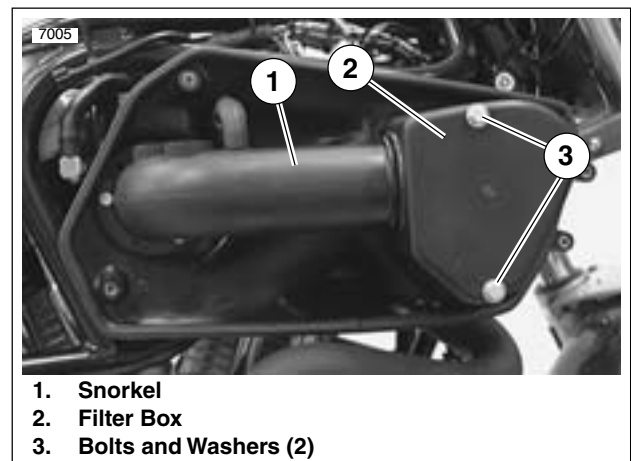


Figure 1-42. Filter Box

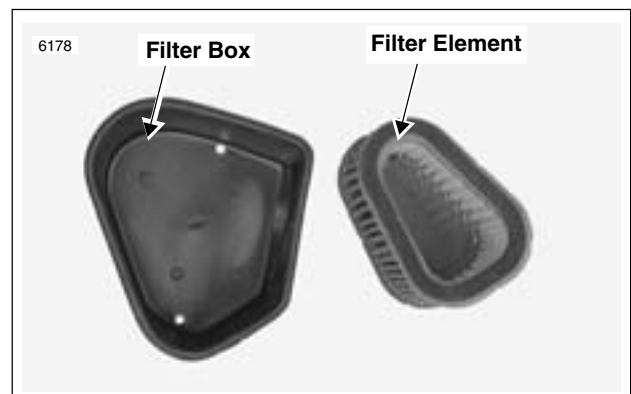


Figure 1-43. Filter Element

CABLE ADJUSTMENT

⚠ WARNING

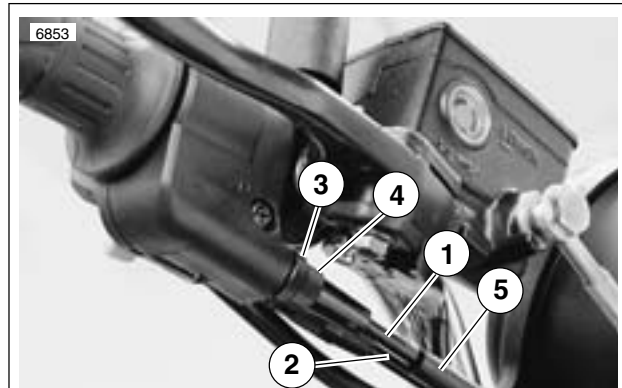
Throttle cables must not pull tight when handlebars are turned fully to left or right fork stops. Be sure wires and throttle cables are clear of fork stops at steering head so they will not be pinched when fork is turned against stops. Steering must be smooth and free with no binding or interference. Anything interfering with carburetor operation may cause loss of vehicle control which could result in death or serious injury.

Check throttle cable adjustment:

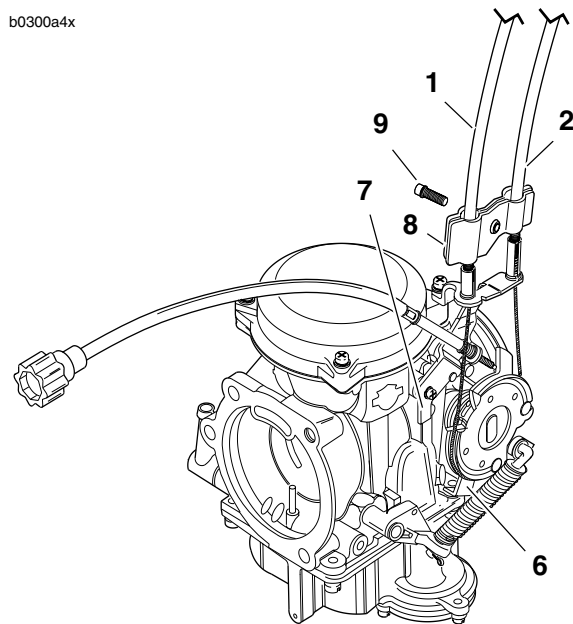
- Before every ride.
- At every scheduled service interval.

With engine running, turn handlebars through full range of travel. If engine speed changes during this maneuver, adjust throttle cables as follows:

1. Turn engine off. Remove air cleaner cover and backplate. See [4.4 AIR CLEANER](#).
2. See [Figure 1-44](#). Slide rubber boot (5) off cable adjuster (4).
3. Loosen cable adjuster lock (3) on each adjuster.
4. Turn adjusters (4) in direction which will shorten cable housings to minimum length.
5. Point front wheel straight ahead. Twist throttle control grip to fully open position; hold in position.
6. Turn adjuster (4) on throttle control cable (1) until throttle cam stop (6) touches carburetor stop plate (7). Tighten adjuster lock on throttle control cable (1) adjuster (4); release throttle control grip.
7. Turn handlebars fully to right. Turn adjuster (4) on idle control cable (2) until end of cable housing just touches the carburetor cable guide.
8. Twist and release throttle control grip a few times. Carburetor throttle must return to idle position each time throttle grip is released. If this is not the case, turn adjuster (4) on idle control cable (2) (shortening cable housing) until throttle control functions properly.
9. Tighten adjuster lock (3) on idle control cable (2) adjuster (4). Recheck operation of throttle control (Step 7).
10. Slide rubber boot (5) over each cable adjuster (4). Recheck engine slow idle speed; adjust if required.
11. Install air cleaner assembly. See [4.4 AIR CLEANER](#).



b0300a4x



1. Throttle Control Cable
2. Idle Control Cable
3. Cable Adjuster Lock
4. Cable Adjuster
5. Rubber Boot
6. Throttle Cam Stop
7. Stop Plate
8. Throttle Cable Clamps (2)
9. Screw

Figure 1-44. Carburetor

IDLE ADJUSTMENT

Check idle speed adjustment:

- Before every ride.
- At every scheduled service interval.

See [1.19 IGNITION TIMING](#).

INSPECTION

Check ignition timing:

- At every 5000 mile (8000 km) service interval use the **DYNAMIC TIMING** method.
- After each removal of the cam position sensor, use the **STATIC TIMING** method.

STATIC TIMING

1. See **Figure 1-45**. Locate outer timer cover (2) at bottom of gearcase cover (10) on right side of vehicle.

CAUTION

Always wear proper eye protection when drilling. Flying debris may result in minor or moderate eye injury.

2. Drill off heads of pop rivets (1) using a 0.375-inch (9.525 mm) drill bit. Use a punch to tap rivet shafts inboard through holes in outer timer cover. Remove outer timer cover (2).
3. Remove two screws (3) to free inner timer cover (4). If necessary, tap remaining rivet shafts through holes in inner timer cover.
4. Carefully check the gearcase cover bore for any rivet fragments.
5. Depress external latch on cam position sensor connector (11) [14]. Use a rocking motion to separate pin and socket halves.
6. See **Figure 1-46**. Remove the timing plug from the timing inspection hole centered below the cylinders on the right side of the crankcase.
7. Remove the spark plugs.
8. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).

NOTE

If valves are not visible through spark plug hole, place finger over spark plug hole opening. The moment air is no longer escaping through spark plug hole, the intake valve has closed.

9. Shift transmission into fifth gear, and standing on left side of vehicle, slowly rotate rear wheel in the direction of normal rotation until front intake valve opens and closes (as viewed through spark plug holes - see NOTE above).

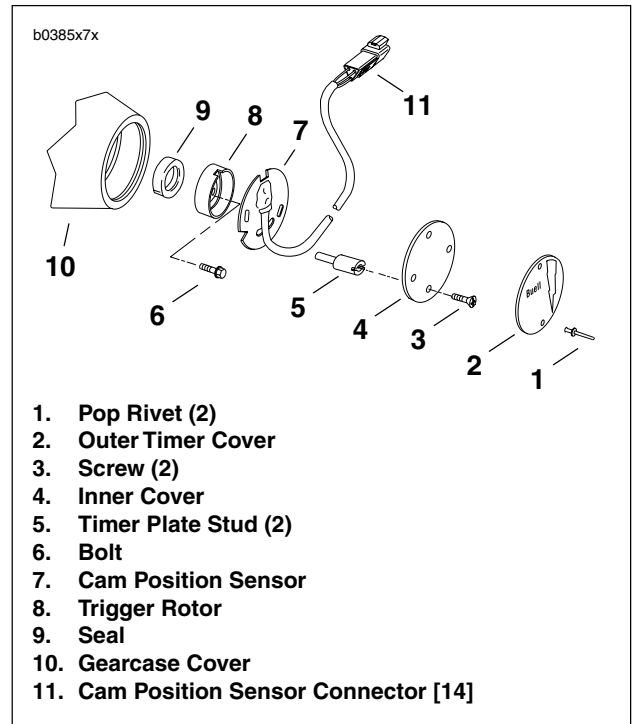


Figure 1-45. Gearcase Cover Bore

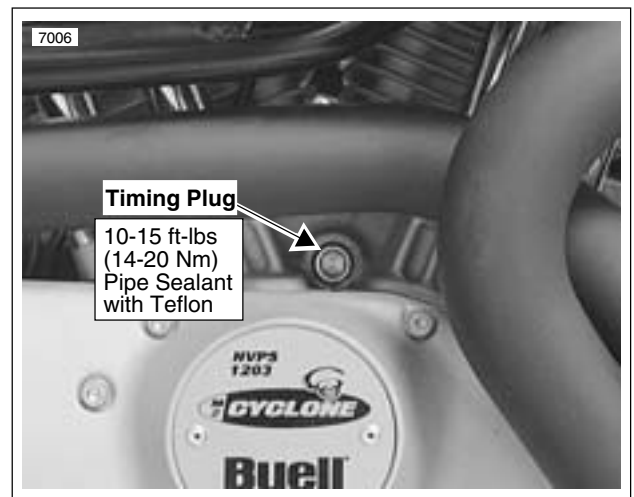


Figure 1-46. Timing Plug

NOTE

The test harness described below is identical to the harness used to test Harley-Davidson electronic speedometers.

10. Create and connect a test harness.
 - a. See [Figure 1-47](#). The test harness consists of two Deutsch socket housings (1, 2), one Deutsch pin housing (3) and 6.0 in. (152 mm) lengths of 18 gauge wire.
 - b. See [Figure 1-48](#). Rotate rear wheel until TDC mark is centered in timing inspection hole.
 - c. See [Figure 1-47](#). Move to right side of vehicle and connect test harness between pin and socket halves of cam position sensor connector.
 - d. Using black pin probes and patch cords from HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect voltmeter between B and C terminals on test connector (1).
11. Turn ignition switch to IGN.
12. See [Figure 1-45](#). Loosen both timer plate studs (5) and rotate the cam position sensor (7) just until the voltmeter registers the change from 5.0 VDC (+/- 0.5 volts) to 0.0-1.0 VDC.
13. Tighten timer plate studs to 15-30 **in-lbs** (1.7-3.4 Nm).
14. Install spark plugs, shift transmission into neutral and remove REAR WHEEL STAND.
15. Remove test harness. Reconnect pin and socket halves of cam position sensor.
16. Proceed to [DYNAMIC TIMING](#).

DYNAMIC TIMING

1. See [Figure 1-46](#). Thread TIMING MARK VIEW PLUG (Part No. HD 96295-65D) into timing inspection hole. Be sure view plug does not touch flywheel.
2. Connect leads of INDUCTIVE TIMING LIGHT (Part No. HD-33813) to front spark plug cable, to battery positive terminal and to ground.
3. Be sure vacuum hose is properly installed at carburetor and at vacuum-operated electric switch (V.O.E.S.).
4. See [Figure 1-49](#). Monitor engine speed by observing tachometer.
5. See [Figure 1-50](#). Start engine and set engine speed by turning idle adjuster clockwise to increase speed or counterclockwise to decrease speed. See [Table 1-14](#).

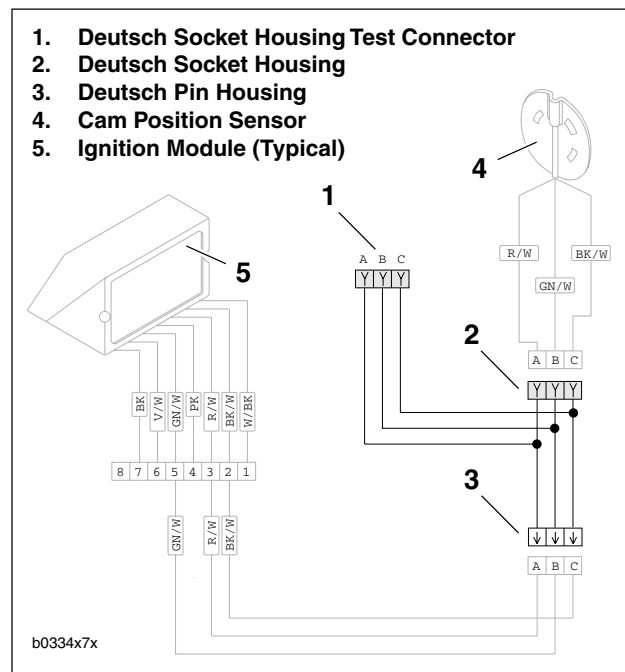


Figure 1-47. Test Harness (Typical)

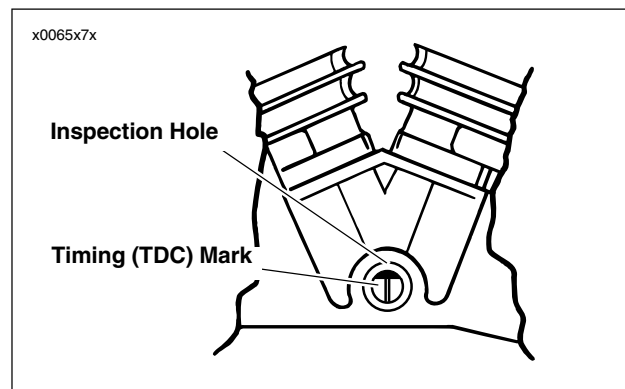


Figure 1-48. TDC Mark

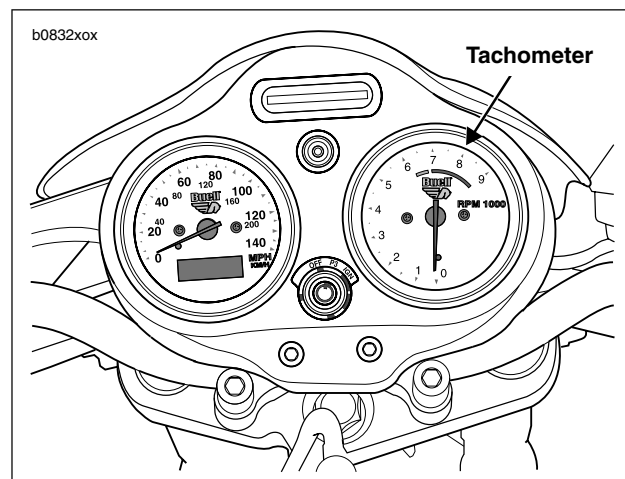


Figure 1-49. M2/M2L Tachometer

6. Check timing.
 - a. Aim timing light into timing inspection hole. Timing light will flash each time ignition spark occurs.
 - b. See [Figure 1-51](#). Front cylinder advance timing mark should be centered in timing inspection hole.
 - c. If not, see [ADJUSTMENT](#).
7. Set engine slow idle speed as described in Step 4 with engine running at normal operating temperature and with enricher knob pushed in fully.

NOTE

- *Buell motorcycles have an enricher circuit that will cause the engine to idle at approximately 2000 RPM with the engine at normal operating temperature and the enricher knob pulled out fully. The increase in idle speed is intended to alert the rider that the engine is warmed up to normal operating temperature and that the enricher knob should be pushed in all the way. Continuing to use the enricher circuit when the engine is at normal operating temperature will cause fouled plugs.*
- *Be sure the engine is warmed up to normal operating temperature and the enricher knob is pushed all the way in before adjusting engine idle speed. Be aware that, because there are variations in individual components, it is possible for a properly warmed-up engine to idle at 2000 RPM with the enricher knob pulled out partially.*

ADJUSTMENT

1. See [Figure 1-45](#). Remove pop rivets (1) and outer timer cover (2).
2. Remove two screws (3) and inner cover (4).
3. See [Figure 1-45](#). Loosen timer plate studs (5) just enough to allow cam position sensor (7) to be rotated using a screwdriver in the plate's notch.
4. See [Figure 1-51](#). With timing light aimed into inspection hole, rotate sensor until front cylinder advance timing mark is centered in timing inspection hole.
5. See [Figure 1-45](#). Tighten timer plate studs (5) to 15-30 **in-lbs** (1.7-3.4 Nm).
6. Install inner cover (4) using two screws (3). Tighten to 12-20 **in-lbs** (1.4-2.3 Nm).

CAUTION

Use only H-D Part No. 8699 rivets to secure outer timing cover. These rivets are specially designed so that no rivet end falls off into the timing compartment. Use of regular rivets can damage ignition system components and may allow water to enter the timing compartment.

7. Attach outer timer cover (2) to inner cover (4) using **new** rivets (1).
8. See [Figure 1-46](#). Remove TIMING MARK VIEW PLUG from timing inspection hole. Apply LOCTITE PIPE SEALANT WITH TEFLON to hex socket timing plug. Tighten to 10-15 ft-lbs (14-20 Nm).

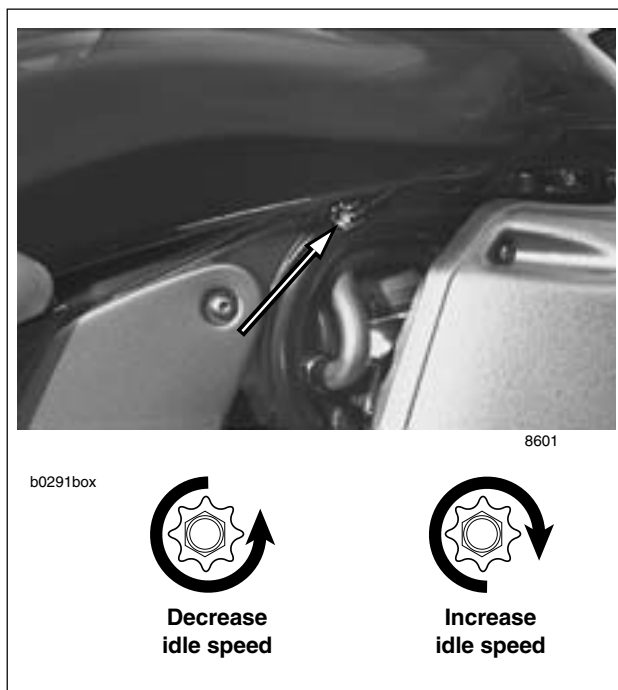


Figure 1-50. Idle Speed Adjuster

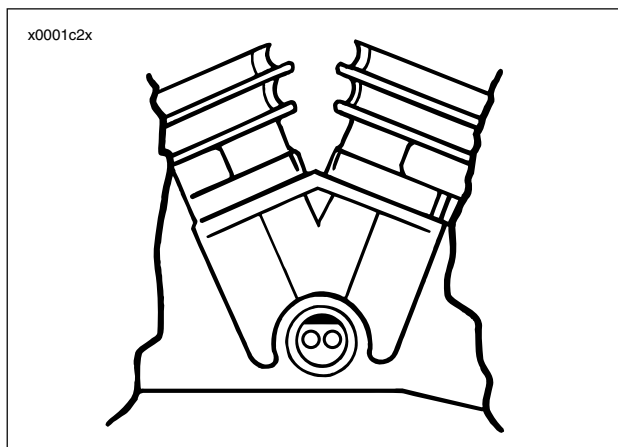


Figure 1-51. Advance Timing Mark

Table 1-14. Engine Speeds

CARBURETOR ADJUSTMENTS	
Engine fast idle speed (using enricher circuit)	2000 RPM
Engine speed for setting ignition timing-World models	950-1050 RPM
Engine speed for setting ignition timing-California models	1150-1250 RPM

ADJUSTMENT/TESTING

Check V.O.E.S.:

- At every 5000 mile (8000 km) service interval.

Timing Mark Test

Verify engine ignition timing. See [1.19 IGNITION TIMING](#). Adjust ignition timing, if necessary, and then perform the following V.O.E.S. check:

1. Run engine at regular idle. Disconnect V.O.E.S. vacuum hose from carburetor fitting. See [7.3 VACUUM-OPERATED ELECTRIC SWITCH \(V.O.E.S\)](#).
2. Temporarily plug the open V.O.E.S. carburetor fitting. Ignition timing should retard and engine RPM should decrease.

NOTE

See [Figure 1-51](#). When ignition timing does retard, the front cylinder advance timing mark disappears from view in the timing inspection hole.

3. See [Figure 1-52](#). Connect V.O.E.S. vacuum hose to carburetor fitting. Advance timing mark should reappear and engine speed should increase to previous RPM.

If RPM does not first decrease and then increase as described, check V.O.E.S. wire connection to ignition module.

Ohmmeter and Vacuum Pump Test

See [Figure 1-53](#). The V.O.E.S. can also be checked using an ohmmeter (3) and a VACUUM PUMP (5) (Part No. HD-23738).

1. Remove V.O.E.S. from vehicle. See [7.3 VACUUM-OPERATED ELECTRIC SWITCH \(V.O.E.S\)](#).
2. Insert two ohmmeter probes (4) into V.O.E.S. connector.
3. Connect vacuum pump (5) to V.O.E.S. vacuum fitting.
4. Slowly squeeze vacuum pump handle. Observe vacuum pump gauge and ohmmeter (3) readings.
 - a. Ohmmeter should indicate switch closed (zero ohms) with an applied vacuum of 5.0-6.0 in. (127.0-152.4 mm) mercury (Hg).
 - b. If a vacuum reading of more than 6.0 in. (152.4 mm) Hg or less than 5.0 in. (127.0 mm) Hg is required to close the switch, then replace V.O.E.S.
5. See [7.3 VACUUM-OPERATED ELECTRIC SWITCH \(V.O.E.S\)](#) for V.O.E.S. installation.

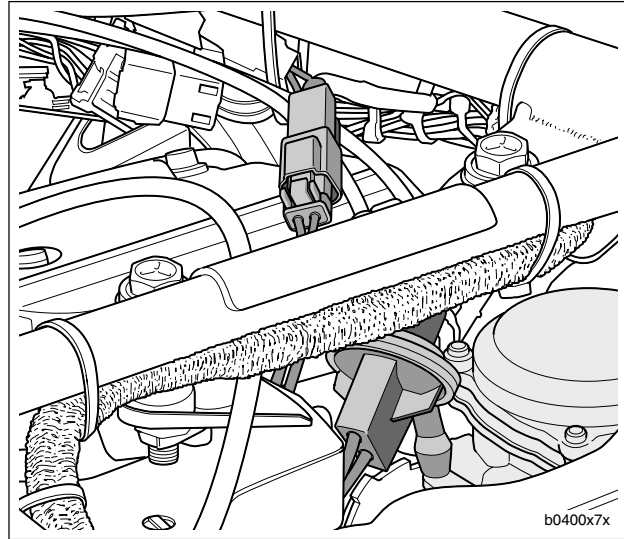
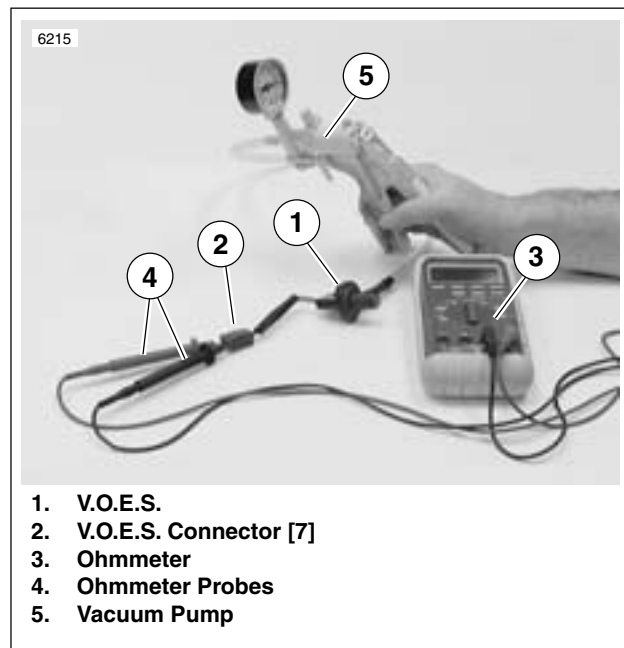


Figure 1-52. V.O.E.S. Installed



1. V.O.E.S.
2. V.O.E.S. Connector [7]
3. Ohmmeter
4. Ohmmeter Probes
5. Vacuum Pump

Figure 1-53. Checking V.O.E.S. Using Ohmmeter and Vacuum Pump

INSPECTION

WARNING

Handlebars must not touch front forks, fairing or gas tank. Improperly adjusted handlebars may cause loss of control which could result in death or serious injury.

Check handlebar adjustment:

- Before every ride.
1. See [Figure 1-54](#). Check steering motion range to both fork stops. Handlebars should not make contact with the front forks, fairing or fuel tank.
 2. Handlebars should be equally spaced between outside edge of handlebar clamp and inside edge of hand control mounts. If necessary, adjust handlebars as described below.
 3. Inspect left side switch assembly and hand controls.
 - a. Check screw (metric) attaching clutch lever clamp to handlebar. Tighten to 30-35 **in-lbs** (3.4-4.0 Nm).
 - b. Inspect clutch lever pivot bolt (metric). Tighten to 50-60 **in-lbs** (6-7 Nm).
 - c. Check fastener holding left handlebar switch assembly to handlebar. Tighten to 26-35 **in-lbs** (3-4 Nm).
 4. Inspect right side switch assembly and hand controls.
 - a. Check screws (metric) holding front brake master cylinder to handlebar. Tighten to 80-90 **in-lbs** (9-10 Nm).
 - b. Inspect brake lever pivot nut (metric). Tighten to 44-62 **in-lbs** (5-7 Nm).
 - c. Check fasteners holding right handlebar switch assembly to handlebar. Tighten to 26-35 **in-lbs** (3-4 Nm).

ADJUSTMENT

CAUTION

Never adjust handlebars using excessive force or damage to handlebars might result.

1. Remove windscreen and instrument support to access rear handlebar clamp screws.
 - a. Remove windscreen. See [2.35 WINDSCREEN](#)
 - b. See [Figure 1-55](#). Detach instrument support by removing both instrument support screws (1).
2. Loosen all four handlebar clamp screws (2, 3).
3. Move handlebar to desired position.
4. Tighten clamp screws to 10-12 ft-lbs (14-16 Nm).

NOTE

First tighten the front clamp screws (3) to 10-12 ft-lbs (14-16 Nm). Once the front clamp screws are tight, tighten the rear clamp screws (2) to 10-12 ft-lbs (14-16 Nm).

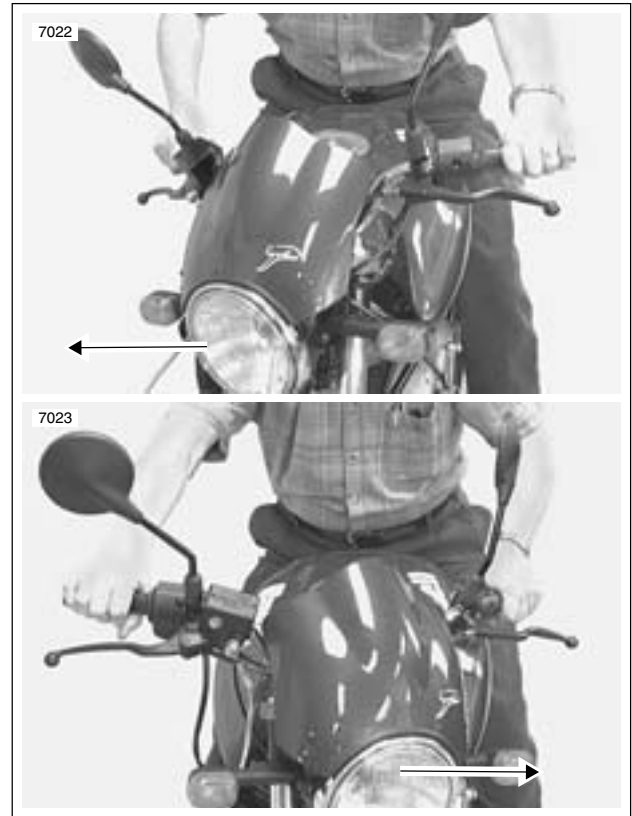


Figure 1-54. Testing Handlebars

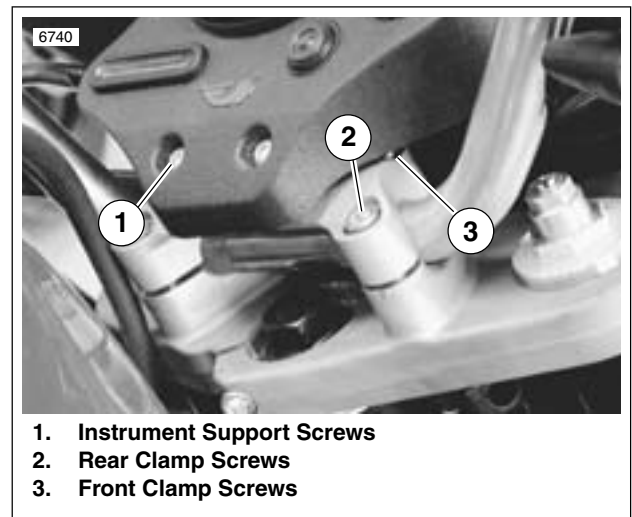


Figure 1-55. Handlebar Clamps (Typical)

5. See [Figure 1-55](#). Install instrument support using two screws (1). Tighten to 7-9 ft-lbs (10-12 Nm).
6. Install windscreen. See [2.35 WINDSCREEN](#).
7. Check steering motion range to both fork stops. Handlebars should not make contact with front forks, windscreen or gas tank. If handlebar needs further adjustment, repeat steps.

INSPECTION

WARNING

Do not modify ignition/light switch wiring to circumvent the automatic-on headlamp feature. Operating with headlamp off may reduce your visibility to other motorists and could cause an accident which could result in death or serious injury. Any deliberate interference in proper operation could contribute to an accident, which could result in death or serious injury.

Check headlamp for proper height and lateral alignment:

- When the new owner takes delivery of the motorcycle.
 - When there is a change in load (adding luggage, etc.)
1. Verify correct front and rear tire pressure. See [1.7 TIRES AND WHEELS](#).
 2. Place motorcycle on level floor (or pavement) in an area with minimum light.
 3. See [Figure 1-56](#). Point front of motorcycle toward a screen or wall which is 25 ft (7.62 M) away from front tire contact patch on floor (i.e., directly below front axle).
 4. Draw a horizontal line above floor on screen or wall as listed below:
 - M2 Models:** 35 in. (88.9 cm) above the floor
 - M2L Models:** 34 in. (86.3 cm) above the floor
 5. Load vehicle with rider/passenger/cargo/accessories. Weight will compress vehicle suspension slightly.
 6. Stand motorcycle upright with both tires resting on floor and with front wheel held in straight alignment (directly forward).
 7. Turn ignition switch to IGN. Set handlebar headlamp switch to HIGH beam position. See [Figure 1-57](#).
 8. Check light beam for proper height alignment. The main beam of light (broad, flat pattern of light) should be centered on horizontal line on screen or wall (i.e., equal areas of light above and below line).
 - c. The main beam of light should also be directed straight ahead (i.e. equal area of light to right and left of center).
 - d. Adjust headlamp alignment if necessary.

ADJUSTMENT

See [Figure 1-58](#). Adjust headlamp as required using a Phillips head screwdriver.

1. See [Figure 1-58](#). Turn vertical headlamp adjuster clockwise to raise beam height, or counterclockwise to lower beam height.
2. See [Figure 1-58](#). Turn horizontal headlamp adjuster clockwise to aim beam to the left, or counterclockwise to aim beam to the right.

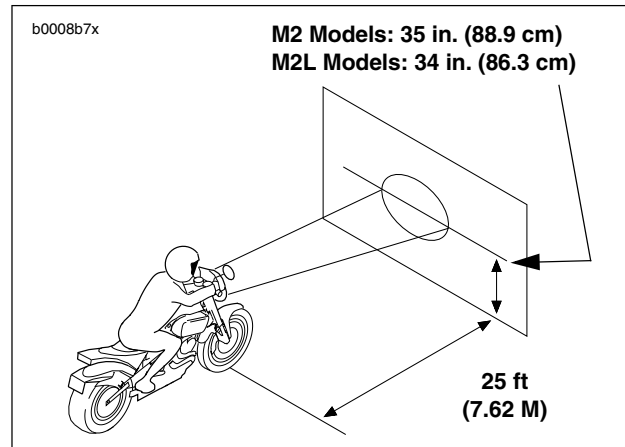


Figure 1-56. Checking Headlamp Alignment

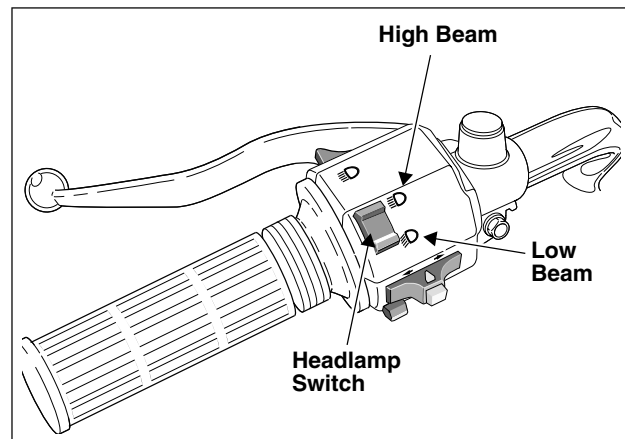


Figure 1-57. Headlamp Switch



Figure 1-58. Headlamp Height Adjustment

GENERAL

If the motorcycle will not be operated for several months, such as during the winter season, there are several things which should be done to protect parts against corrosion, to preserve the battery and to prevent the buildup of gum and varnish in the carburetor.

This work should be performed by your local Buell dealer following Service Manual procedures.

WARNING

Gasoline is flammable. Do not store motorcycle having gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present. Inadequate safety precautions may cause an accident which could result in death or serious injury.

1. Fill fuel tank and add a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions. Run engine until gasoline has had a chance to reach carburetor float bowl. Turn fuel supply valve OFF.
2. Fill the oil tank. See [1.4 ENGINE LUBRICATION SYSTEM](#). Pinch off (or remove and plug) the line leading from the oil tank bottom to the oil pump feed fitting. This prevents oil from seeping past the check ball into the oil pump and filling the engine flywheel compartment.
3. Remove battery and charge as needed to maintain the correct voltage. See [1.3 BATTERY](#).
4. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Reinstall spark plugs. See [1.16 SPARK PLUGS](#).
5. Adjust rear drive belt deflection. See [1.9 DRIVE BELT DEFLECTION](#).
6. Adjust primary chain. See [1.11 PRIMARY CHAIN](#).
7. Check tire inflation. See [1.7 TIRES AND WHEELS](#). If the motorcycle will be stored for an extended period of time, securely support the motorcycle under the frame so that all weight is off the tires.

WARNING

Do not apply any oil to brake rotors or brake pads. Oil on brake pads degrades braking efficiency which could result in death or serious injury.

8. Wash painted and chrome-plated surfaces. Apply a light coat of oil to exposed unpainted surfaces.
9. If motorcycle is to be covered, use a material that will breathe, such as light canvas. Plastic materials that do not breathe promote the formation of condensation.

REMOVAL FROM STORAGE

WARNING

After extended periods of storage and prior to starting vehicle, place transmission in gear, disengage clutch and push vehicle back and forth a few times to ensure proper clutch disengagement. Improper clutch disengagement could result in death or serious injury.

1. Charge and install battery. See [1.3 BATTERY](#).
2. Remove and inspect spark plugs. Replace if necessary. See [1.16 SPARK PLUGS](#).
3. Inspect air filter element. Replace if necessary. See [1.17 AIR CLEANER](#).
4. If fuel tank was drained, fill fuel tank with fresh gasoline.
5. If oil feed line was pinched off or plugged, unplug it and reconnect.
6. Start the engine and run until it reaches normal operating temperature. Check fluids and refill to proper levels if required.
 - a. Check engine oil level. See [1.4 ENGINE LUBRICATION SYSTEM](#).
 - b. Check transmission fluid level. See [1.8 CLUTCH](#).
7. Perform all of the checks in the PRE-RIDING CHECK LIST in the Owner's Manual.

GENERAL

The following check list can be helpful in locating most operating troubles. Refer to the appropriate sections in this Service Manual for detailed procedures.

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Engine stop switch in OFF position.
2. Ignition key switch not ON.
3. Discharged battery or loose or corroded connections. (Solenoid chatters.)
4. Starter control relay or solenoid not functioning.
5. Electric starter shaft pinion gear not engaging or over-running clutch slipping.
6. Starter interlock circuit malfunction.

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fuel supply valve turned OFF.
3. Fuel supply valve or filter clogged.
4. Fouled spark plugs.
5. Loose or shorting spark plug cables or connections.
6. Ignition timing badly out of adjustment.
7. Loose wire connection at coil or battery connection or plug between ignition sensor and module.
8. Ignition coil not functioning.
9. Ignition module not functioning.
10. Ignition sensor not functioning.
11. Sticking or damaged valve or valves.
12. Engine flooded with gasoline as a result of overchoking.
13. Engine oil too heavy (winter operation).
14. Ignition circuit interlock malfunction.

Starts Hard

1. Spark plugs in bad condition, have improper gap or are partially fouled.
2. Spark plug cables in bad condition and shorting.
3. Battery nearly discharged.
4. Loose wire connection at one of the battery terminals, at coil or at plug between ignition sensor and module.
5. Carburetor controls not adjusted correctly.
6. Ignition coil not functioning.
7. Engine oil too heavy (winter operation).
8. Ignition not timed properly. See dealer.
9. Vapor vent valve plugged or carburetor fuel line closed off restricting fuel flow.
10. Water or dirt in fuel system and carburetor.

11. Enrichener valve inoperative.
12. Air leak at intake manifold.
13. Valves sticking.

Starts But Runs Irregularly or Misses

1. Spark plugs in bad condition or partially fouled.
2. Spark plug cables in bad condition and shorting.
3. Spark plug gap too close or too wide.
4. Ignition coil not functioning.
5. Ignition module not functioning.
6. Ignition sensor not functioning.
7. Damaged wire or loose connection at battery terminals or coil.
8. Intermittent short circuit due to damaged wire insulation.
9. Water or dirt in fuel system and carburetor or filter.
10. Vapor vent valve plugged or carburetor float bowl vent closed off.
11. Carburetor controls improperly adjusted.
12. Air leak at intake manifold or air filter.
13. Damaged intake or exhaust valve.
14. Weak or broken valve springs.
15. Incorrect valve timing.

Spark Plug Fouls Repeatedly

1. Incorrect spark plug.
2. Piston rings badly worn or broken.
3. Fuel mixture too rich for conditions (see CARBURETOR TROUBLESHOOTING).
4. Valve stem seals worn or damaged.
5. Valve guides badly worn.

Pre-Ignition or Detonation (Knocks or Pings)

1. Excessive carbon deposit on piston head or combustion chamber.
2. Incorrect heat range spark plug.
3. Spark plugs not firing.
4. Ignition timing advanced.
5. Fuel octane rating too low.
6. Intake manifold vacuum leak.

Overheating

1. Insufficient oil supply or oil not circulating.
2. Leaking valves.
3. Heavy carbon deposit.
4. Ignition timing retarded.

Valve Train Noise

1. Hydraulic lifter not functioning properly.
2. Bent push rod.
3. Cam, cam gears or cam bushings worn.
4. Rocker arm binding on shaft.
5. Valve sticking in guide.

Excessive Vibration

1. Engine tie-bars loose, broken or improperly spaced.
2. Lower mounting bolts loose.
3. Broken frame.
4. Primary chain badly worn or links tight as a result of insufficient lubrication.
5. Wheels not aligned and/or tires worn.
6. Internal engine problem.

ENGINE LUBRICATION SYSTEM

Oil Does Not Return To Oil Tank

1. Oil tank empty.
2. Return pump gears damaged.
3. Oil feed pump not functioning.
4. Restricted oil lines or fittings.

Engine Uses Too Much Oil or Smokes Excessively

1. Piston rings badly worn or broken.
2. Valve stem seals worn or damaged.
3. Valve guides worn.

Engine Leaks Oil From Cases, Push Rods, Hoses, Etc.

1. Loose parts.
2. Imperfect seal at gaskets, push rod cover, washers, etc. To aid locating leaks, use [BLACK LIGHT LEAK DETECTOR \(Part No. HD-35457\)](#).
3. Restricted oil return line to tank.
4. Restricted breather passage(s) to air cleaner.

ELECTRICAL SYSTEM

Alternator Does Not Charge

1. Regulator-rectifier module not functioning.
2. Rectifier not grounded.
3. Engine ground wire loose or broken.
4. Loose or broken wires in charging circuit.
5. Stator not functioning.
6. Rotor not functioning.

Alternator Charge Rate Is Below Normal

1. Regulator-rectifier module not functioning.
2. Stator not functioning.
3. Rotor not functioning.
4. Weak battery.
5. Loose connections.

FUEL

Carburetor Floods

1. Excessive "pumping" of throttle control grip.
2. Inlet valve sticking.
3. Inlet valve and/or valve seat worn or damaged.
4. Dirt or other foreign matter between valve and its seat.
5. Float misadjusted or filled with fuel.

TRANSMISSION

Shifts Hard

1. Clutch dragging slightly.
2. Shifter forks (inside transmission) damaged.
3. Corners worn off shifter clutch dogs (inside transmission).

Jumps Out of Gear

1. Shifter pawl improperly adjusted.
2. Shifter engaging parts (inside transmission) badly worn and rounded.
3. Shifter forks bent.
4. Damaged gears.

CLUTCH

Slips

1. Clutch controls improperly adjusted.
2. Worn friction plates.

Drags or Does Not Release

1. Clutch controls improperly adjusted.
2. Clutch plates excessively warped.

Chatters

1. Friction or steel plates worn, warped or dragging.

CHASSIS

Irregular/Inadequate Brake Action

1. Master cylinder low on fluid.
2. Brake line contains air bubbles.
3. Master or wheel cylinder piston worn.
4. Brake pads covered with grease or oil.
5. Brake pads badly worn to minimum lining thickness.
6. Brake rotor badly worn or warped.
7. Brake pads dragging or excessive braking (brake fades due to heat buildup).
8. Insufficient brake pedal or hand lever freeplay (brake drags).

Handling Irregularities

1. Tires improperly inflated. See [1.7 TIRES AND WHEELS](#). Do not overinflate.
2. Loose wheel axle nuts (metric). Tighten front nut to 48-53 ft-lbs (65-72 Nm). Tighten rear nut to 66-73 ft-lbs (90-99 Nm).
3. Excessive wheel hub bearing play.
4. Rear wheel out of alignment with frame and front wheel.
5. Rims and tires out-of-true sideways (tire runout should not be more than 0.080 in. (2.03 mm)).
6. Rims and tires out-of-round or eccentric with hub (tire runout should not be more than 0.090 in. (2.29 mm)).
7. Irregular or peaked front tire tread wear.
8. Tire and wheel unbalanced.
9. Steering head bearings improperly adjusted. See [1.15 FRONT FORK](#). Correct adjustment and replace pitted or worn bearings and races. See [2.17 FORK STEM AND BRACKET ASSEMBLY](#).
10. Shock absorber not functioning normally.
11. Heavy front end loading. Non-standard equipment on the front end (such as heavy radio receivers, extra lighting equipment or luggage) tends to cause unstable handling.

SUBJECT	PAGE NO.
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SPECIFICATIONS

M2/M2L DIMENSIONS	IN.	CM
Wheel Base	55.0	139.7
Seat Height -M2	31.0	78.7
Seat Height - M2L	29.5	74.9
Ground Clearance -M2	5.2	13.2
Ground Clearance -M2L	4.2	10.6
Trail	3.8	9.7
Rake	24.5 degrees	

M2/M2L WEIGHTS	LBS.	KG
Wet Weight (U.S. version)	480	218
GVWR	885	401
GAWR - Front	375	170
GAWR - Rear	510	231
Load Capacity	405	184

NOTE

See information decal on left front down tube for Gross Vehicle Weight Rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR).

CAPACITIES	U.S.	LITERS
Fuel Tank (inc. reserve)	5.0 gallons	18.93
Reserve	0.6 gallons	2.27
Oil Tank	2.0 quarts	1.89
Transmission	1.0 quart	0.95

WARNING

Do not inflate any tire beyond its maximum inflation pressure as specified on tire sidewall. Overinflation may cause tire to suddenly deflate which could result in death or serious injury.

TIRE AND POSITION	SOLO RIDING	LOADED TO GVWR
Front-Dunlop Sportmax Radial 120/70 ZR 17 D205F	32 PSI (220 kPa)	36 PSI (248 kPa)
Rear-Dunlop Sportmax Radial 170/60 ZR 17 D205	36 PSI (248 kPa)	38 PSI (262 kPa)

Gasoline

Use a good quality unleaded gasoline which is **91 pump octane** or higher. Octane rating is usually found on the pump.

IGNITION SYSTEM		
Spark Plugs	Harley-Davidson No. 10R12	
Size	12 mm	
Gap	0.038-0.043 in.	0.97-1.09 mm
Torque	11-18 ft-lbs	15-24 Nm

TRANSMISSION GEAR RATIOS	FINAL*	OVERALL**
First (low) Gear	2.69	9.717
Second Gear	1.85	6.687
Third Gear	1.43	5.180
Fourth Gear	1.18	4.269
Fifth (high) Gear	1.00	3.615

*Final gear ratios indicate number of mainshaft revolutions required to drive output sprocket one revolution.

**Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

SPROCKET TEETH	
Engine	35
Clutch	56
Transmission	27
Rear Wheel	61
Belt	128

ENGINE		
Number of Cylinders	2	
Type	Air cooled, four stroke, 45 degree V-Twin	
Bore	3.5 in.	88.9 mm
Stroke	3.8 in.	96.5 mm
Engine Displacement	73.4 cu. in.	1203 cc
Compression Ratio	10:1	
Horsepower @ RPM	91 @ 6200	
Torque ft-lbs @ RPM	85 @ 4900	
Valve Train	OHV, two valves per cylinder	
Valve Adjustment	Hydraulic, self-adjusting valve tappets	
Fuel Delivery	40 mm Keihin CV carburetor	

TORQUE VALUES

ITEM	TORQUE		NOTES
Brake hand lever nut	44-62 in-lbs	5.0-7.0 Nm	metric, page 2-21
Brake hand lever pivot bolt	4-13 in-lbs	0.5-1.5 Nm	LOCTITE ANTI-SEIZE, page 2-21
Brake line banjo bolts	16-20 ft-lbs	22-27 Nm	(metric), page 2-22
Clutch cable, primary cover fitting	3-9 ft-lbs	4-12 Nm	turn clockwise to install, page 2-60
Clutch clamp screw	50-60 in-lbs	6-7 Nm	metric, page 2-60
Drive support nut	30-35 ft-lbs	41-47 Nm	page 2-67
Exhaust header nuts	6-8 ft-lbs	8-11 Nm	page 2-65
Fender mounting screw	6-8 ft-lbs	8-11 Nm	page 2-68
Footrest mounting bolt	10-15 ft-lbs	14 -20 Nm	LOCTITE THREADLOCKER 243 (blue), page 2-66
Fork brace mounting bolt	10-12 ft-lbs	14-16 Nm	metric, LOCKTITE THREADLOCKER 243, (blue), page 2-68
Front axle nut	48-53 ft-lbs	65-72 Nm	LOCTITE THREADLOCKER 243 (blue), metric, page 2-10
Front axle pinch screw	13-15 ft-lbs	18-20 Nm	(metric), page 2-10
Front brake caliper banjo bolt	16-20 ft-lbs	22-27 Nm	metric, page 2-26
Front brake caliper bleeder valve	3-5 ft-lbs	4-7 Nm	metric, page 2-25
Front brake caliper mounting screws	22-25 ft-lbs	30-34 Nm	LOCTITE THREADLOCKER 271 (red), page 2-25
Front brake caliper pad hanger pin	11-14.5 ft-lbs	15-20 Nm	metric, page 2-26
Front brake caliper pin plug	18-25 in-lbs	2-3 Nm	page 2-26
Front brake caliper screw	14.5-18 ft-lbs	20-24 Nm	metric, page 2-25
Front brake line banjo bolt	16-20 ft-lbs	22-27 Nm	(metric), page 2-27
Front brake line clamp screw	30-35 in-lbs	3.4-4.0 Nm	page 2-27
Front brake rotor carrier screw	20-22 ft-lbs	27-30 Nm	LOCTITE THREADLOCKER 271 (red), page 2-9
Front brake switch screw	7-13 in-lbs	0.8-1.5 Nm	page 2-21
Front caliper bleeder valve	3-5 ft-lbs	4-7 Nm	metric, page 2-20
Front fork damper screw	11-18 ft-lbs	15-24 Nm	metric, page 2-37
Front fork slider tube cap	11-22 ft-lbs	15-30 Nm	metric, page 2-37
Front fork triple clamp screw, large	18-20 ft-lbs	24-27 Nm	LOCTITE ANTI-SEIZE, page 2-38
Front fork triple clamp screw, small	12-15 ft-lbs	16-20 Nm	LOCTITE ANTI-SEIZE, page 2-38
Front master cylinder banjo bolt	16-20 ft-lbs	22-27 Nm	metric, page 2-27
Front master cylinder cover screws	9-13 in-lbs	1.0-1.5 Nm	page 2-26
Handlebar clamp screws	10-12 ft-lbs	14-16 Nm	tighten front screws first, page 2-62
Header support mount bolt	22-24 ft-lbs	30-33 Nm	page 2-65
Instrument support front/rear screws	10-12 ft-lbs	14-16 Nm	page 2-61
Instrument support panel screws	4-5 ft-lbs	5-7 Nm	LOCTITE THREADLOCKER 243 (blue), page 2-61
Instrument support screw	10-12 ft-lbs	14-16 Nm	tighten front screws first, page 2-61

ITEM	TORQUE		NOTES
Master cylinder clamp screws	80-90 in-lbs	9-10 Nm	(metric), page 2-22
Master cylinder cover screws	9-13 in-lbs	1.0-1.5 Nm	page 2-22
Muffler clamp	40-45 ft-lbs	54-61 Nm	discard after use, page 2-65
Muffler rear mounting support	22-24 ft-lbs	30-33 Nm	page 2-65
Muffler support mounting bolt, front	30-33 ft-lbs	41-45 Nm	page 2-65
Muffler Z bracket nuts	22-24 ft-lbs	30-33 Nm	page 2-65
Rear axle nut	66-73 ft-lbs	90-99 Nm	metric, page 2-13
Rear brake caliper banjo bolt	16-20 ft-lbs	22-27 Nm	metric, page 2-32
Rear brake caliper bleeder valve	3-5 ft-lbs	4-7 Nm	metric, page 2-28
Rear brake caliper mounting screw, large	18-22 ft-lbs	24-30 Nm	metric, page 2-32
Rear brake caliper mounting screw, small	14.5-18 ft-lbs	20-24 Nm	metric, page 2-32
Rear brake caliper pad hanger pin	11-14.5 ft-lbs	15-20 Nm	metric, page 2-32
Rear brake caliper pin plug	1.5-2.1 ft-lbs	2-3 Nm	page 2-32
Rear brake lamp switch	7-8 ft-lbs	10-11 Nm	LOCTITE SEALANT WITH TEFLON, page 2-34
Rear brake line clamp screw	10-12 ft-lbs	14-16 Nm	page 2-33
Rear brake reservoir mounting screw	12-15 in-lbs	1.4-1.7 Nm	page 2-29
Rear brake rotor screw	35-40 ft-lbs	48-54 Nm	LOCTITE THREADLOCKER 271 (red), metric, page 2-12
Rear caliper banjo bolt	16-20 ft-lbs	23-27 Nm	metric, page 2-34
Rear master cylinder banjo bolt	16-20 ft-lbs	22-27 Nm	metric, page 2-34
Rear master cylinder mounting screws	8-10 ft-lbs	11-14 Nm	LOCTITE THREADLOCKER 243 (blue), metric, page 2-29
Rear shock bolt	30-33 ft-lbs	41-45 Nm	metric, page 2-46
Rear shock front allen screws	40-45 ft-lbs	54-61 Nm	page 2-51
Rear shock rear allen screws	30-33 ft-lbs	41-45 Nm	page 2-51
Rear tiebar	30-33 ft-lbs	41-45 Nm	page 2-46
Sprocket bolt	55-65 ft-lbs	75-88 Nm	LOCTITE THREADLOCKER 271 (red), page 2-12
Sprocket cover mounting screw	12-17 in-lbs	1.4-1.9 Nm	LOCTITE THREADLOCKER 243 (blue), page 2-67
Sprocket cover screw	48-72 in-lbs	5-9 Nm	LOCTITE THREADLOCKER 222 (purple), page 2-67
Swingarm isolator bolts	63-70 ft-lbs	85-95 Nm	LOCTITE THREADLOCKER 271 (red), page 2-46
Swingarm pinch screw	18-20 ft-lbs	24-27 Nm	LOCTITE THREADLOCKER 243 (blue), page 2-46
Swingarm threaded rod	11-12 ft-lbs	14.9-16.3 Nm	LOCTITE THREADLOCKER 222 (purple), initial torque only, page 2-45
Swingarm threaded rod	11-12 ft-lbs	15-16 Nm	LOCTITE THREADLOCKER 222 (purple), page 2-46

ITEM	TORQUE		NOTES
Swingarm/drive support screw	20-25 ft-lbs	27-34 Nm	LOCTITE THREADLOCKER 271 (red), page 2-67
Switchgear housing screws, left side	25-33 in-lbs	3-4 Nm	metric, page 2-60
Switchgear housing screws, right side	12-17 in-lbs	1.4-1.9 Nm	metric, page 2-58
Valve stem nut	42-44 in-lbs	4.7-5.0 Nm	page 2-16

TIRE SPECIFICATIONS

GENERAL

WARNING

Tires must be correctly matched to wheel rims. Only the tires listed in the fitment table below can be used for replacement. Mismatching tires and rims can cause damage to the tire bead during mounting. Using tires other than those specified can adversely affect motorcycle handling which could result in death or serious injury.

Tire sizes are molded on the sidewall. Rim size and contour are marked on the rim's exterior surface.

Example: **MT 3.5 x 17.0 DOT**

- **MT** designates the rim contour.
- **3.5** is the width of the bead seat measured in inches.
- **17.0** is the normal diameter of the rim in inches, measured at the bead seat diameter.
- **DOT** means that the rim meets Department of Transportation Federal Motor Vehicle Safety Standards.

See the table below.

Table 2-1. Tire Fitment-Tubeless Cast Wheels

WHEEL SIZE & POSITION	CONTOUR & RIM SIZE	RIM VALVE HOLE DIAMETER	DUNLOP SPORTMAX TOURING RADIAL TIRE SIZE
17 in. – Front	MT 3.5 x 17.0 DOT	0.33 in. (8.38 mm)	120/70 ZR 17 D205F
17 in. – Rear	MT 5.0 x 17.0 DOT	0.33 in. (8.38mm)	170/60 ZR 17 D205

VEHICLE IDENTIFICATION NUMBER

2.3

GENERAL

Each vehicle has a 17-digit serial or Vehicle Identification Number (V.I.N.). It is stamped on the steering head and also found on a label on the left front down tube. A Motor Identification Number is stamped on the left side crankcase near the front of the engine.

NOTE

Always give the full 17-digit Vehicle Identification Number when ordering parts or making inquiries about your Buell motorcycle.

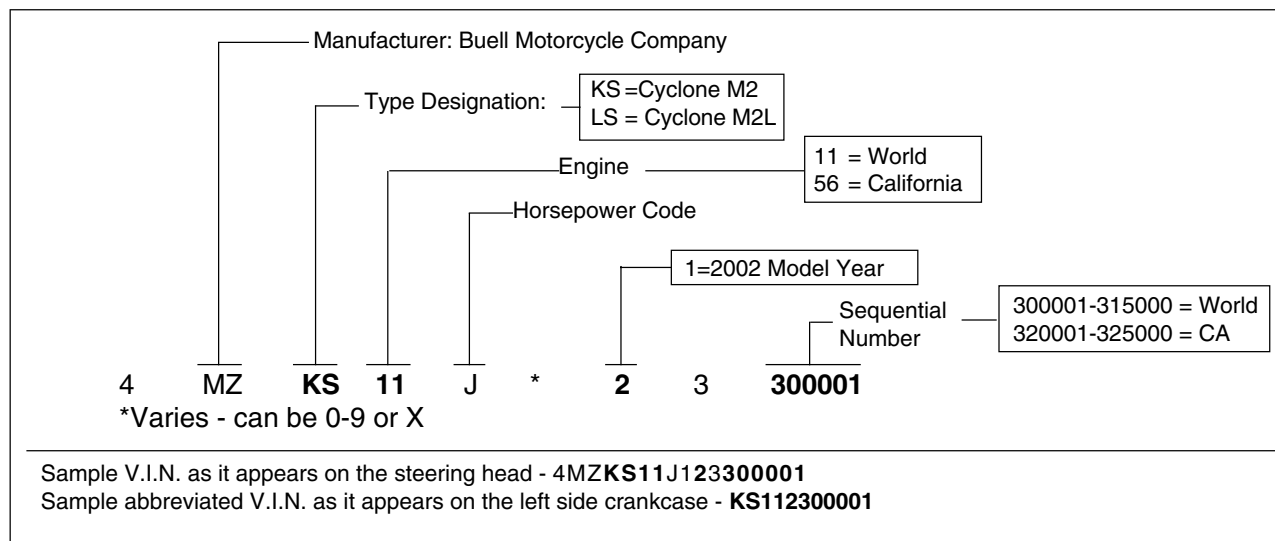


Figure 2-1. 2001 M2/M2L Vehicle Identification Numbers (V.I.N.)

GENERAL

Good handling and maximum tire mileage are directly related to the care of wheels and tires. Regularly inspect wheels and tires for damage and wear. If handling problems occur, see [1.24 TROUBLESHOOTING](#) or [Table 2-2](#).

See [1.7 TIRES AND WHEELS](#) for tire pressures. Keep tires inflated to the recommended air pressure. Always balance the wheel after replacing a tire.

⚠ WARNING

Do not inflate any tire beyond its maximum inflation pressure as specified on tire sidewall. Overinflation may cause tire to suddenly deflate which could result in death or serious injury.

TROUBLESHOOTING

See [Figure 2-2](#). Check tire inflation pressure at least once each week. At the same time, inspect tire tread for punctures, cuts, breaks and other damage. Repeat the inspection before long trips.

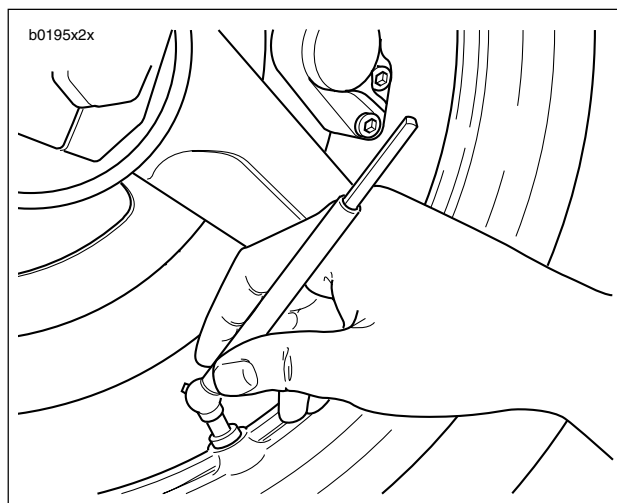


Figure 2-2. Checking Tire Inflation Pressure

Table 2-2. Wheel Service

CHECK FOR	REMEDY
Loose axle nuts.	Tighten front axle nut with LOCTITE THREADLOCKER 243 (Blue) (metric) to 48-53 ft-lbs (65-72 Nm). Tighten rear axle nut (metric) to 66-73 ft-lbs (90-99 Nm).
Excessive side-play or radial (up-and-down) play in wheel hubs.	Replace wheel hub bearings.
Alignment of rear wheel in frame or with front wheel.	Check 1.9 DRIVE BELT DEFLECTION or repair swingarm as described under 2.19 SWINGARM .
Rims and tires out-of-true sideways; should not be more than 0.080 in. (2.03 mm).	Replace rims. See 2.8 TIRES .
Rims and tires out-of-round or eccentric with hub; should not be more than 0.090 in. (2.29 mm).	Replace rims. See 2.8 TIRES .
Irregular or peaked front tire wear.	Replace as described under 2.5 FRONT WHEEL , 2.6 REAR WHEEL and 2.8 TIRES .
Correct tire inflation.	Inflate tires to correct pressure. See 1.7 TIRES AND WHEELS .
Correct tire and wheel balance.	Static balance may be satisfactory if dynamic balancing facilities are not available. However, dynamic balancing is strongly recommended.
Steering head bearings.	Correct adjustment and replace pitted or worn bearings. See 1.15 FRONT FORK .
Damper tubes.	Check for leaks. See 2.16 FRONT FORK .
Shock absorbers.	Check damping action and mounts. See 1.13 SUSPENSION DAMPING ADJUSTMENTS .
Swingarm bearings.	Check for looseness. See 2.19 SWINGARM .

 **WARNING**

Use the following guidelines when installing a new tire or repairing a flat. Failure to do so could result in death or serious injury.

1. Always locate and eliminate the cause of the original tire failure.
2. Do not patch or vulcanize a tire casing. These procedures weaken the casing and increase the risk of a blowout.
3. The use of tires other than those specified can adversely affect handling resulting in personal injury.
4. Tires and wheels are critical items. Since the servicing of these components requires special tools and skills, Buell recommends that you see your dealer for these services.

 **WARNING**

Buell recommends replacement of any tire punctured or damaged. In some cases small punctures in the tread area may be repaired from within the demounted tire by your Buell dealer. Speed should not exceed 50 mph (80 km/h) for the first 24 hours after repair and the repaired tire should NEVER be used over 80 mph (1340 km/h).

In emergency situations, if a temporary repair is made, ride slowly with as light of a load as possible until the tire is permanently repaired or replaced.

Failure to follow this warning could result in death or serious injury.

 **WARNING**

Excessively worn tires adversely affect motorcycle traction, steering and handling which could result in death or serious injury.

At regular intervals of 5000 miles (8000 km) or whenever handling irregularities are noted, perform the recommended service checks. See [Table 2-2](#).

If tires must be replaced, same as original equipment tires must be used. Other tires may not fit correctly and may be hazardous to use.

REMOVAL

1. Raise front wheel off floor. See [1.15 FRONT FORK](#).
2. Detach front brake caliper from rotor. See [2.11 FRONT BRAKE CALIPER](#).

NOTE

Do not operate front brake lever with front wheel removed or caliper pistons may be forced out. Reseating pistons requires caliper disassembly.

3. See [Figure 2-3](#). Insert screwdriver/rod through hole in axle (1). Loosen front axle nut (4) (metric).
4. Loosen all four pinch screws (2) (metric).
5. Remove front axle nut (4) and washer (3). Pull front axle out of wheel hub while supporting front wheel.

DISASSEMBLY

1. See [Figure 2-4](#). Move wheel to bench area. On the side of the wheel opposite the brake rotor, remove left axle spacer (3).
2. On brake rotor side of wheel, remove right axle spacer (6).
3. Remove wheel bearings (7) using BUSHING AND BEARING PULLER (Part No. HD-95760-69A) and 3/4 in. COLLET (Part No. HD-95767-69A).
4. See [Figure 2-4](#). Remove five screws (4) to detach front brake rotor (5) from wheel hub.
5. Remove tire. See [2.8 TIRES](#).

CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent.
2. Inspect all parts for damage or excessive wear.

WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

3. Inspect brake rotor and pads. See [1.5 BRAKES](#).

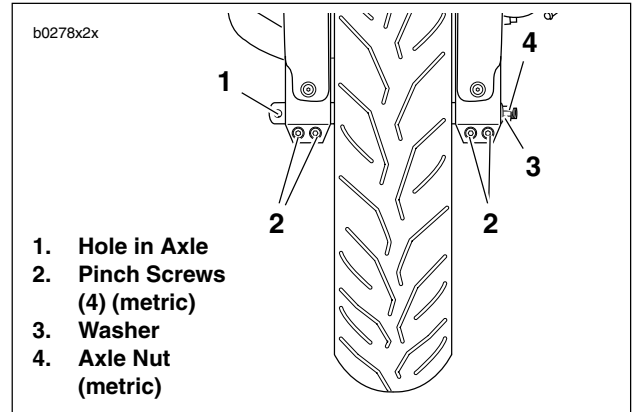


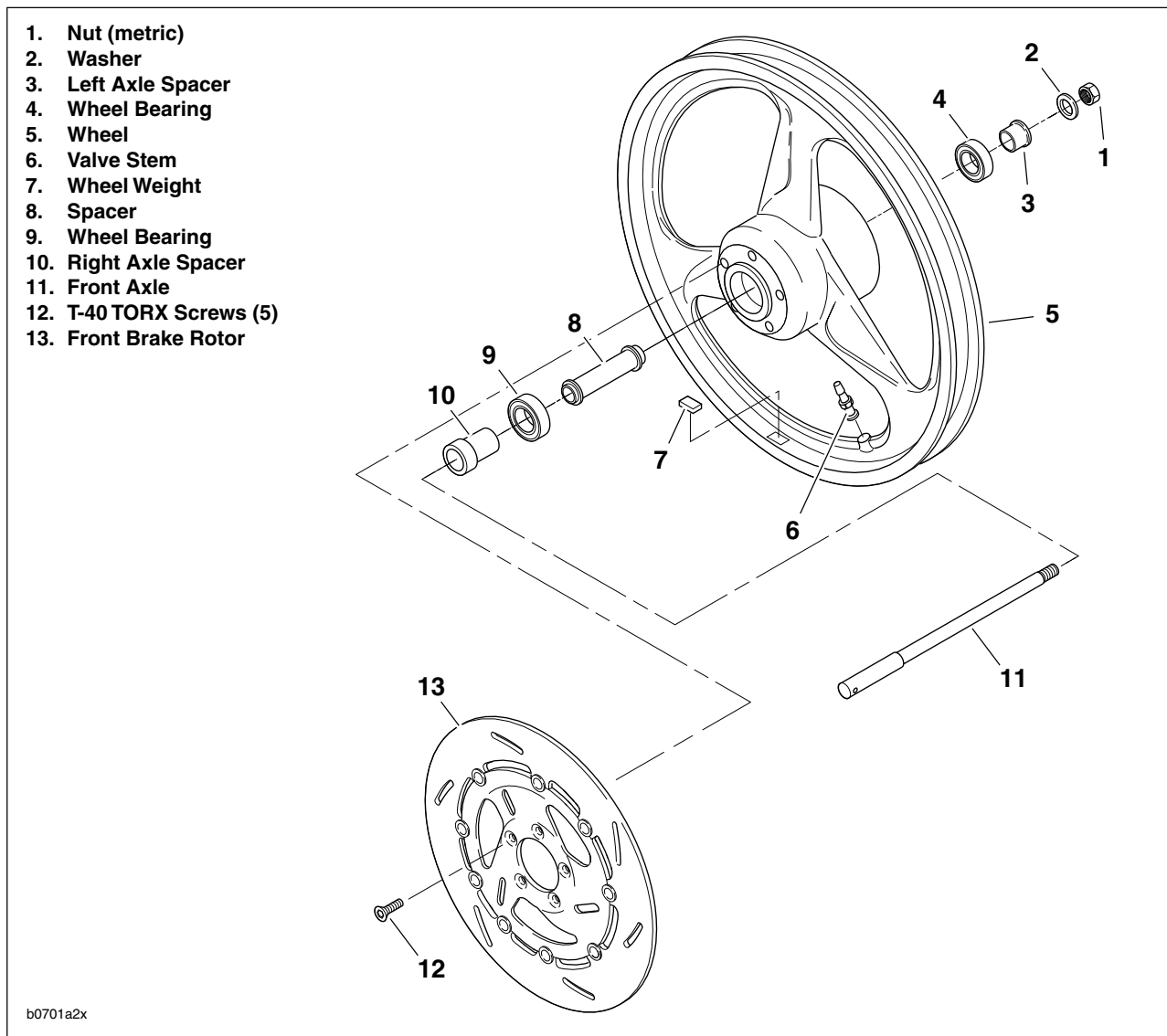
Figure 2-3. Front Wheel Mounting

ASSEMBLY

WARNING

Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake rotor or brake pads or reduced braking ability will occur which could result in death or serious injury.

1. See [Figure 2-4](#). Install front brake rotor (13) on right side of wheel. Slots in carrier must line up with wheel spokes.
 - a. Verify that the front brake rotor is thoroughly clean.
 - b. Apply LOCTITE THREADLOCKER 243 (blue) to threads of each of the five T40 TORX screws (12).
 - c. Install rotor (13) on wheel hub using screws. Tighten TORX screws in criss-cross pattern to 20-22 ft-lbs (27-30 Nm).
2. See [Figure 2-4](#). Install spacer (8).
3. Install **new** wheel bearings (4 and 9) into hub using suitable driver. Press on outer race only.
4. On the side of the wheel opposite the brake rotor insert left axle spacer (3) into hub until it seats in bore. Spacer sleeve must not be cocked or tilted in bore.
5. On the right side of the wheel insert right axle spacer (10) into hub until it seats in bore. Spacer sleeve must not be cocked or tilted in bore.
6. Install tire, if removed. See [2.8 TIRES](#).
7. Verify that wheel and tire are true. See [2.7 CHECKING CAST RIM RUNOUT](#).
8. Balance tire. See [2.8 TIRES, Adjustment](#).



b0701a2x

Figure 2-4. Front Wheel

INSTALLATION

1. Install front axle.
 - a. Apply **LOCTITE ANTI-SEIZE LUBRICANT** to axle.
 - b. Position wheel between forks with brake rotor on gearcase side of motor.
 - c. With pinch screws (metric) loose, insert threaded end of axle through right side fork.
 - d. Push axle through fork and wheel hub until axle begins to emerge from left side of hub.
2. Compress the front suspension to make sure it is free and not binding.
 - a. Apply **LOCTITE THREADLOCKER 243** (blue) to axle threads.
 - b. Install washer (3) and axle nut (4) (metric) over threaded end of axle.
 - c. Insert screwdriver or steel rod through hole (1) in axle.
 - d. While holding axle stationary, tighten axle nut (4) (metric) to 48-53 ft-lbs (65-72 Nm).
3. See [Figure 2-3](#). Install axle nut.
 - a. Tighten the four front axle pinch screws (2) (metric) to 13-15 ft-lbs (18-20 Nm).
4. Tighten the four front axle pinch screws (2) (metric) to 13-15 ft-lbs (18-20 Nm).
5. Install front brake caliper. See [2.11 FRONT BRAKE CALIPER](#).

REMOVAL

1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
2. Detach rear brake caliper from caliper mount. See 2.14 REAR BRAKE CALIPER.

NOTE

Do not operate rear brake pedal with rear wheel removed or caliper piston may be forced out. Reseating piston requires caliper disassembly.

3. See Figure 2-5. Loosen rear axle nut (1) (metric).
4. Loosen rear axle adjuster locknuts (6, 7) and bolts (5) on both sides. Push wheel as far forward as possible.
5. Slip secondary drive belt from bottom of belt sprocket and remove.
6. See Figure 2-6. Remove rear axle nut (4) (metric), lockwasher (3), and washer (2). Pull axle (13) and washer (2) out from left side and remove wheel.

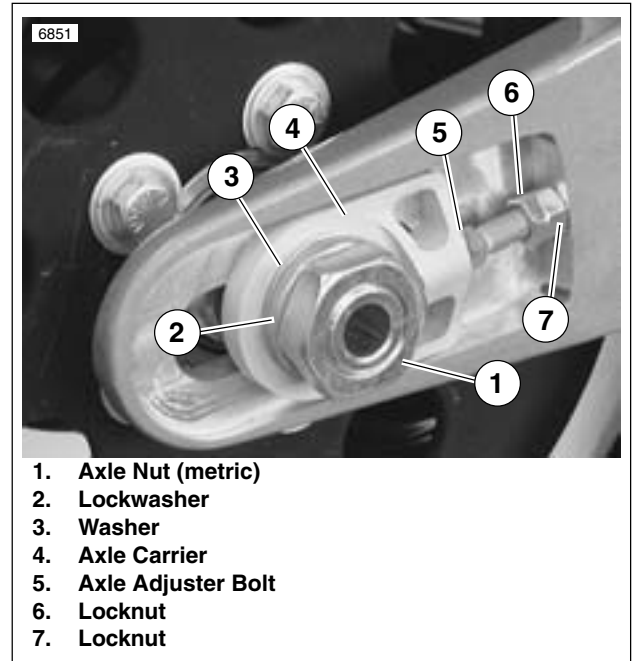


Figure 2-5. Rear Wheel Mounting

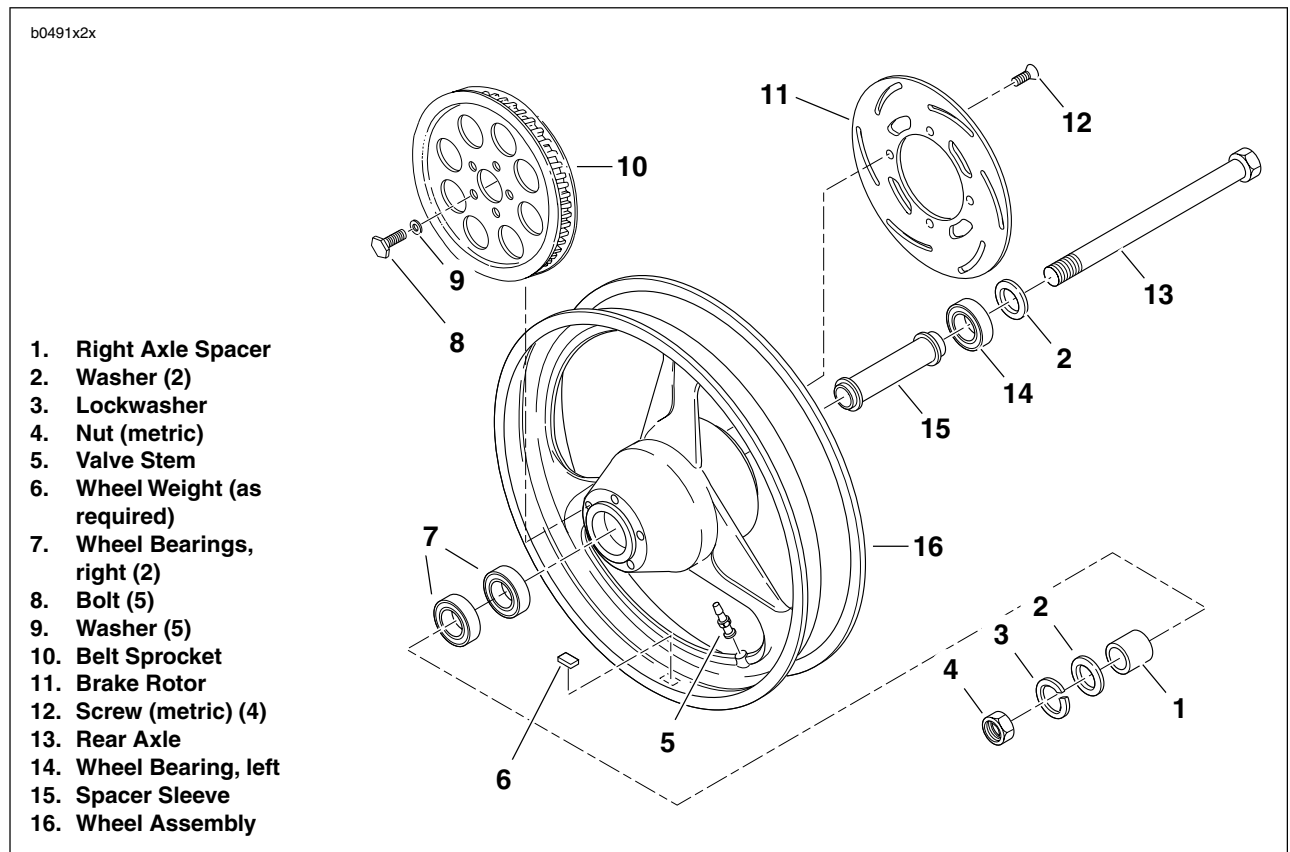


Figure 2-6. Rear Wheel

DISASSEMBLY

1. See [Figure 2-7](#). Move wheel to bench area. On the brake rotor side of the wheel, remove bearing using BUSHING AND BEARING PULLER (Part No. HD-95760-69A) and 1 1/8 in. COLLET (Part No. HD-95769-69).
2. See [Figure 2-6](#). Remove two bearings (7) from sprocket side of wheel.
3. Remove four screws (12) (metric) to detach rear brake rotor (11) from wheel hub.
4. Remove five bolts (8) and washers (9) to detach belt sprocket (10) from wheel hub.

CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent.
2. Inspect all parts for damage or excessive wear.
3. Inspect brake rotor.
 - a. Measure rotor thickness. Replace if less than service wear limit. See [2.14 REAR BRAKE CALIPER](#).
 - b. Check rotor surface. Replace if warped or badly scored.
4. Inspect tire. See [2.8 TIRES](#).

ASSEMBLY

WARNING

Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake rotor or brake pads or reduced braking ability will occur which could result in death or serious injury.

1. See [Figure 2-6](#). Install rear brake rotor (11) on side of wheel hub with room for a single wheel bearing. Place rotor surface listing minimum thickness specification away from wheel hub.
 - a. Verify that rear brake rotor is thoroughly clean.
 - b. Apply LOCTITE THREADLOCKER 271 (red) to each of the four screws (12) (metric).
 - c. Fasten rotor to wheel hub using screws. Tighten to 35-40 ft-lbs (48-54 Nm).

NOTE

P/M wheels use a nut (not shown) with each screw (1).

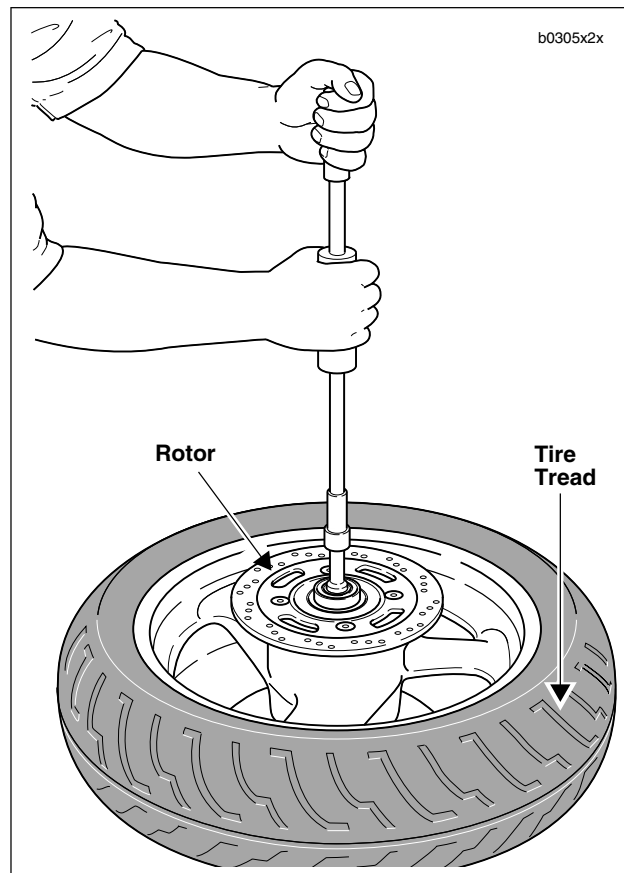


Figure 2-7. Removing Wheel Bearing

2. Install belt sprocket (10) on side of wheel hub with room for two wheel bearings. Place sprocket machined surface away from wheel hub.
 - a. Check sprocket for unusual wear, broken teeth or a damaged flange. Replace if necessary.
 - b. Apply LOCTITE THREADLOCKER 271 (red) to each of the five sprocket bolts (8).
 - c. Install belt sprocket (10) using bolts (8) and washers (9). Tighten to 55-65 ft-lbs (75-88 Nm).
3. Install bearings (7, 14) and spacer (15) into wheel hub.
 - a. On the belt sprocket side of the wheel, install two bearings (7). Insert bearings separately, pressing on outer race only. Fully seated bearings will touch shoulder for spacer sleeve.
 - b. Insert spacer sleeve (15) into wheel hub.
 - c. On the brake rotor side of the wheel, insert bearing (14) into wheel hub until it contacts end of spacer sleeve. Press on outer race only.
4. Verify that wheel is true. See [2.7 CHECKING CAST RIM RUNOUT](#).
5. Install tire if removed. Under all circumstances, check that wheel and tire are true. See [2.8 TIRES](#).

INSTALLATION

1. Place wheel centrally in the swingarm with the brake rotor in the caliper mount. Slide wheel far enough forward to slip belt over sprocket and then slide wheel back.
2. Install rear axle.
 - a. Apply LOCTITE ANTI-SEIZE LUBRICANT to axle.
 - b. See [Figure 2-8](#). Insert axle (1) through washer (4) so that rounded side of washer will face swingarm (3). Continue through left side of swingarm, rear brake caliper mount (2) and wheel assembly.
 - c. See [Figure 2-9](#). Place axle carrier (4) into position on the right side of the swingarm. Slide axle through axle carrier and swingarm.
 - d. Place washer (3) on axle with rounded side facing swingarm. install lockwasher (2) and axle nut (1) (metric). Do not tighten rear axle nut at this time.
3. Attach rear brake caliper to caliper mount. See [2.14 REAR BRAKE CALIPER](#).
4. Check for proper belt tension and wheel alignment. See [1.9 DRIVE BELT DEFLECTION](#).
5. Tighten rear axle nut (1) (metric) to 66-73 ft-lbs (90-99 Nm).

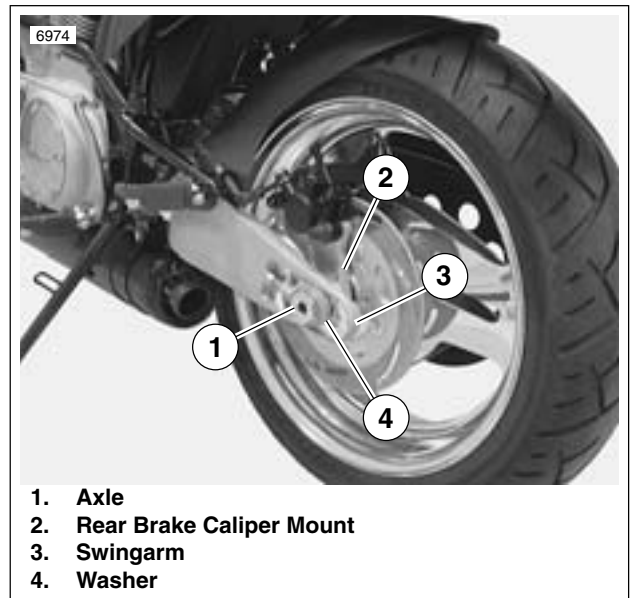


Figure 2-8. Axle, Left Side

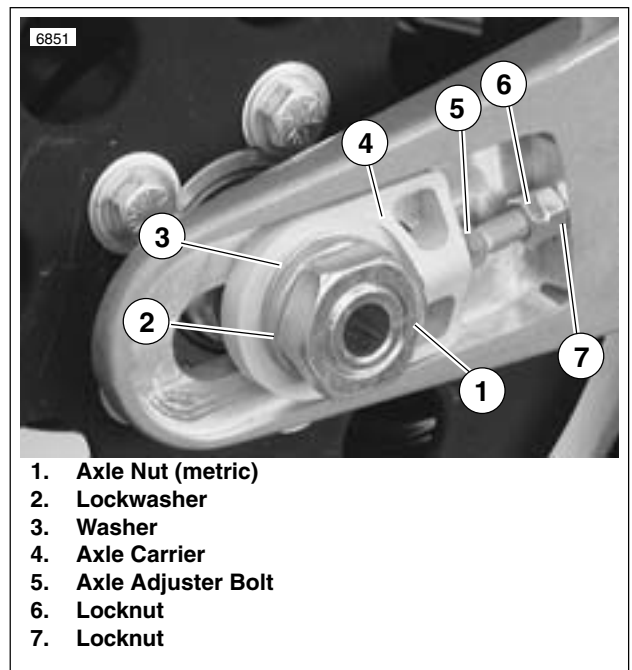


Figure 2-9. Axle, Right Side

CHECKING CAST RIM RUNOUT

GENERAL

Check wheels for lateral and radial runout before installing a new tire.

Rim Lateral Runout

1. See [Figure 2-10](#). Install truing arbor in wheel hub and place wheel in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).
2. Tighten arbor nuts so hub will turn on its bearings.
3. Check rim lateral runout by placing a gauge rod or dial indicator near the rim bead. Replace wheel if lateral runout exceeds specification shown in [Table 2-3](#).

Rim Radial Runout

1. See [Figure 2-11](#). Install truing arbor in wheel hub and place wheel in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).
2. Tighten arbor nuts so hub will turn on its bearings.
3. Check radial runout as shown. Replace wheel if runout exceeds specification shown in [Table 2-3](#).

WHEEL TYPE	MAXIMUM LATERAL RUNOUT	MAXIMUM RADIAL RUNOUT
Cast	0.040 in. (1.02 mm)	0.030 in. (0.76 mm)

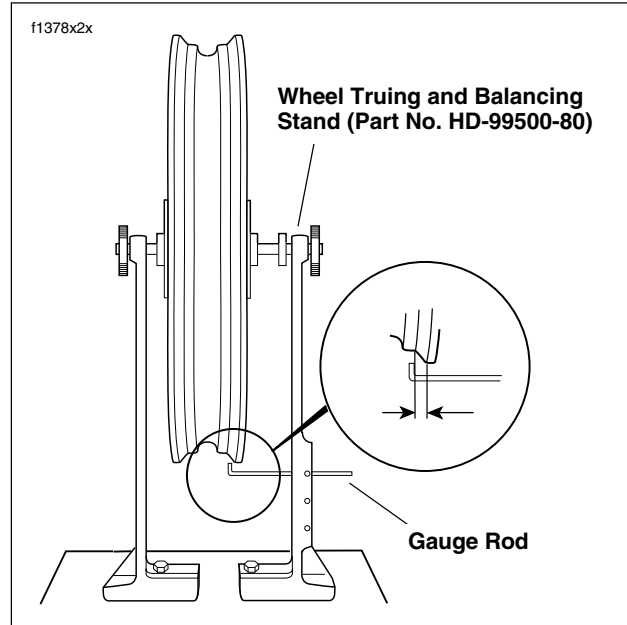


Figure 2-10. Checking Cast Rim Lateral Runout

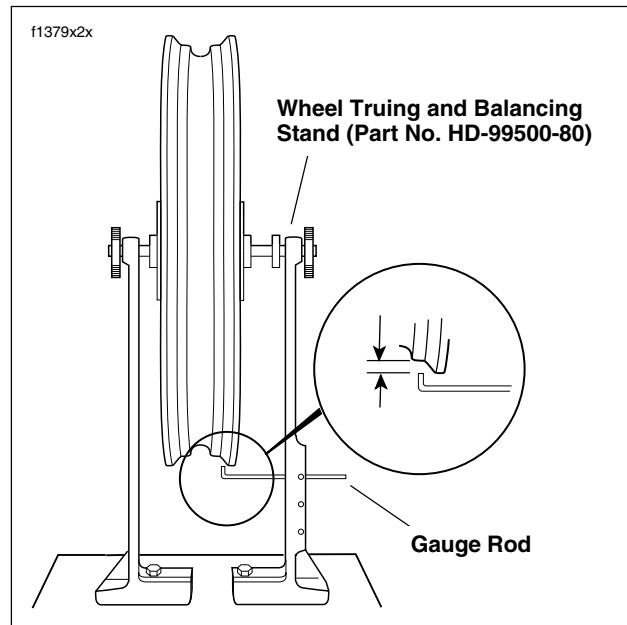


Figure 2-11. Checking Cast Rim Radial Runout

GENERAL

Inspect tires for punctures, cuts, breaks and wear at least weekly.

⚠ WARNING

Always check both tire sidewalls for arrows indicating forward rotation. Some tires require different tire rotation depending on whether tire is used on front or rear wheel. Installing a tire with the wrong rotation could result in death or serious injury.

⚠ WARNING

Dunlop front and rear tires for Buell motorcycles are not the same. They are not interchangeable. Use front tire **ONLY** for a front tire. **DO NOT** put a rear tire on the front of a vehicle. Failure to follow this warning could result in death or serious injury.

Some tires have arrows molded into the tire sidewall. These tires should be mounted on the rim with the arrow pointing in the direction of forward rotation. The red circle on the sidewall is a balance mark and should be located next to the valve stem hole.

REMOVAL

1. Remove wheel from motorcycle. See [2.5 FRONT WHEEL](#) or [2.6 REAR WHEEL](#).
2. Deflate tire.
3. See [Figure 2-12](#). Loosen both tire beads from rim flange.

⚠ WARNING

Do not use excessive force when starting bead over rim. Excessive force may damage tire or rim and adversely affect handling which could result in death or serious injury.

4. If a bead breaker machine is not available, attach RIM PROTECTORS (Part No. HD-01289) to the rim. Using tire tools (not sharp instruments), start upper bead over edge of rim at valve. Repeat all around rim until first bead is over rim.
5. See [Figure 2-13](#). Push lower bead into rim well on one side and insert tire tool underneath bead from opposite side. Pry bead over rim edge. Remove tire from rim.
6. Remove valve stem if it is damaged or leaks.
7. Mount tire on TIRE SPREADER (Part No. HD-21000) for inspection and repair procedures.

CLEANING AND INSPECTION

1. Clean inside of tire.
2. If rim is dirty or corroded, clean with a stiff wire brush.
3. Inspect tire for wear and damage. Replace worn tires.

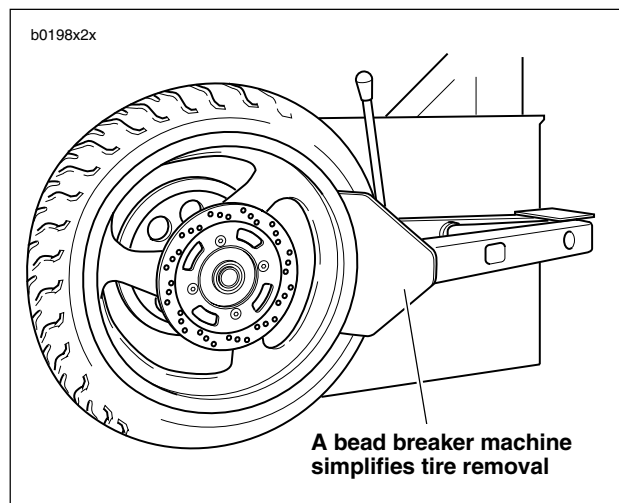


Figure 2-12. Loosening Beads from Rim Flange

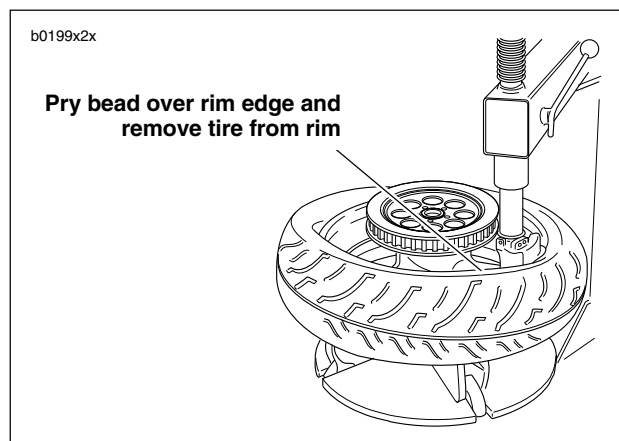


Figure 2-13. Starting Tire Off Rim

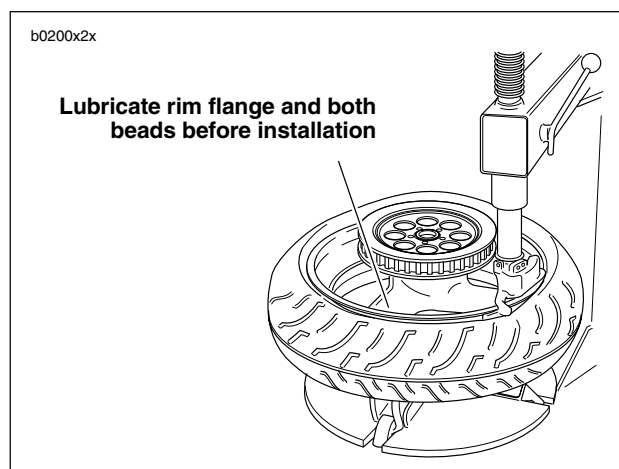


Figure 2-14. Starting Bead on Rim

INSTALLATION

⚠ WARNING

Only install original equipment (stock) tire valves and valve caps. A valve or valve and cap combination that is too long may interfere with (strike) adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation could cause loss of control which could result in death or serious injury.

⚠ WARNING

Aftermarket valve caps that are heavier than the stock cap may have clearance at slow speeds; but, at high speed the valve/cap will be moved outward by centrifugal force. This outward movement could cause the valve/cap to strike the adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation could cause loss of control which could result in death or serious injury.

1. Damaged or leaking valve stems must be replaced. Place rubber grommet on valve stem with shoulder in recess of the valve stem head.
2. Install and tighten nut to 42-44 **in-lbs** (4.7-5.0 Nm).
3. Thoroughly lubricate rim flanges and both beads of tire with tire lubricant.
4. See [Figure 2-14](#). Starting at the valve stem, start first bead into the rim well using a bead breaker machine. If no machine is available, work bead on as far as possible by hand. Use a tire tool to pry the remaining bead over rim flange.
5. Start 180° from valve stem hole and place second bead on rim. Work bead onto rim with tire tools, working toward valve in both directions.

⚠ WARNING

Do not inflate over 40 psi (276 kPa) to seat the beads. Inflating the tire beyond 40 psi (276 kPa) to seat the beads can cause the tire rim assembly to burst. If the beads fail to seat to 40 psi (276 kPa), deflate and relubricate the bead and rim and reinflate to seat the beads, but do not exceed 40 psi (276 kPa). Failure to follow these precautions could result in death or serious injury.

6. Apply air to stem to seat beads on rim. It may be necessary to use a TIRE BEAD EXPANDER (Part No. HD-28700) on the tire until beads seal on rim.

Checking Tire Lateral Runout

1. See [Figure 2-15](#). Turn wheel on axle and measure amount of displacement from a fixed point to tire sidewall.
2. Tire tread lateral runout should be no more than 0.080 in. (2.03 mm). If runout is more than 0.080 in. (2.03 mm), remove tire from rim.
3. Check rim bead side runout. See [2.7 CHECKING CAST RIM RUNOUT](#). Replace rims not meeting specifications.
4. Install tire and check again for tire tread lateral runout.

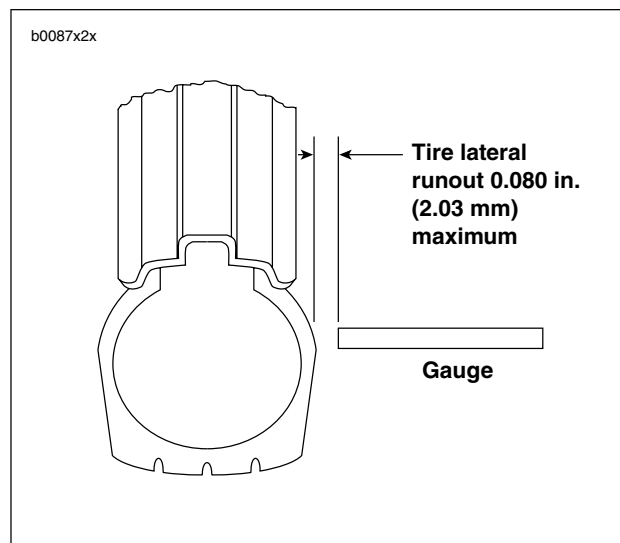


Figure 2-15. Checking Tire Lateral Runout

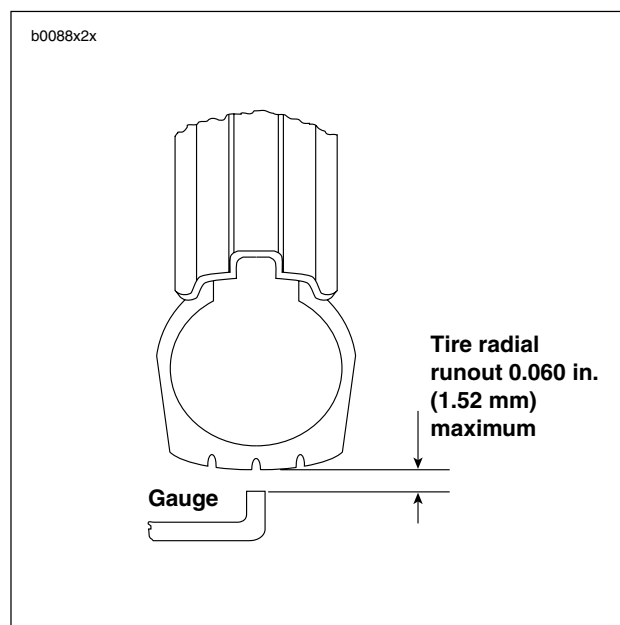


Figure 2-16. Checking Tire Radial Runout

Checking Tire Radial Runout

1. See [Figure 2-16](#). Turn wheel on axle and measure tread radial runout.
2. Tire tread radial runout should not be greater than 0.060 in. (1.52 mm). If runout exceeds specification, remove tire from rim.
3. Check rim bead runout. See [2.7 CHECKING CAST RIM RUNOUT](#). Replace rims not meeting specifications.
4. Install tire and check tire tread radial runout again.

ADJUSTMENT

Wheel Balancing

Wheel balancing is recommended to improve handling and reduce vibration, especially at high road speeds.

In most cases, static balancing using WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80) will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, can be used to produce finer tolerances for better high-speed handling characteristics. Follow the instructions supplied with the balance machine you are using.

WEIGHTS FOR CAST WHEELS

The maximum weight permissible to accomplish balance is:

- 1.0 oz. (28 g) total weight applied to the front wheel.
- 2.0 oz. (56 g) total weight applied to the rear wheel.

Wheels should be balanced to within 1/4 oz. (7 g) at 60 MPH (97 KM/H).

See [Figure 2-17](#). Use only WHEEL WEIGHTS (Part No. 43692-94Y) which have special self-adhesive backings. Apply WHEEL WEIGHTS to the flat surface of the wheel rim.

1. Make sure that area of application is completely clean, dry and free of oil and grease.
2. Remove paper backing from weight. For additional adhesive strength, apply three drops of LOCTITE SUPERBONDER 420 to adhesive side of weight.
3. Place weight on flat surface of wheel rim.
4. Press weight firmly in place and hold for ten seconds.
5. Allow eight hours for adhesive to cure completely before using wheel.

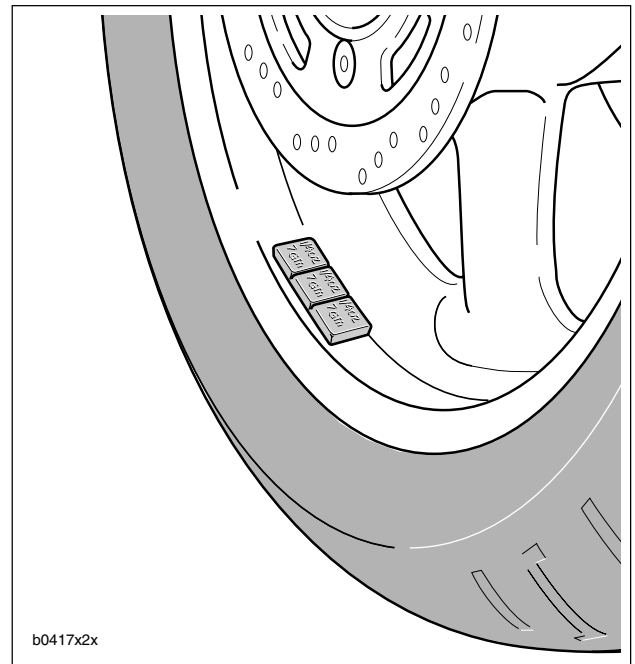


Figure 2-17. Wheel Weights

GENERAL

All 2001 Model Year Buell motorcycles are equipped with **D.O.T. 4** brake fluid and must use only **D.O.T. 4** compatible banjo washers and rear brake lines.

- **D.O.T. 4** compatible banjo washers are black in color.
- **D.O.T. 4** compatible rear brake lines have an olive drab coating on the metal portion of the line.

The front and rear brakes are fully hydraulic disc brake systems that require little maintenance. The front brake master cylinder is an integral part of the brake hand lever assembly. The rear brake master cylinder is located on the right side of the motorcycle near the brake pedal.

Check the master cylinder reservoirs for proper fluid levels after the first 500 miles (800 km) and every 5000 miles (8000 km) thereafter. Also inspect fluid levels at the end of every riding season. See [1.5 BRAKES](#).

Check brake pads and rotors for wear at every service interval. See [1.5 BRAKES](#).

Replace **D.O.T. 4 BRAKE FLUID**:

- Every 2 years.

It is recommended to inspect both front and rear brake lines and replace as required:

- Every 4 years.

It is recommended to inspect both front and rear caliper and master cylinder seals and replace as required:

- Every 2 years.

If determining probable causes of poor brake operation, see [Table 2-3](#).

WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This may result in improper brake operation which could result in death or serious injury.

WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell recommends that all brake repairs be performed by a Buell dealer or other qualified technician.

WARNING

D.O.T. 4 brake fluid can cause irritation of eyes and skin, and may be harmful if swallowed. If large amount of fluid is swallowed, induce vomiting by administering two tablespoons of salt in a glass of warm water. Call a doctor. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. **KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.** Failure to comply could result in death or serious injury.

WARNING

Never mix **D.O.T. 4** with other brake fluids (such as **D.O.T. 5**). Use only **D.O.T. 4** brake fluid in motorcycles that specify **D.O.T. 4** fluid on the reservoir cap. Mixing different types of fluid may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

WARNING

Use only fresh, uncontaminated **D.O.T. 4** fluid. Cans of fluid that have been opened may have been contaminated by moisture in the air or dirt. Use of contaminated brake fluid may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

WARNING

If rear brake line must be replaced, use only the brake line with the olive drab coating on the metal portion of the line (See Parts Catalog for Part No.) with DOT 4 brake systems. The previous black metal brake line is NOT compatible with DOT 4 brake fluid. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with **D.O.T. 4** brake fluid. Earlier silver banjo washers are not compatible with **D.O.T. 4** fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

CAUTION

Cover painted surfaces and right handlebar switches and use care when removing brake reservoir cover and adding **D.O.T. 4** brake fluid. Spilling **D.O.T. 4** brake fluid on painted surfaces will result in cosmetic damage. Spilling brake fluid on switches may render them inoperative.

Table 2-3. Brake Troubleshooting

CONDITION	CHECK FOR	REMEDY
Excessive lever/pedal travel or spongy feel.	Air in system. Master cylinder low on fluid.	Bleed brake(s). Fill master cylinder with approved brake fluid.
Brake fade	Moisture in system.	Bleed brake(s). Fill master cylinder with approved brake fluid.
Chattering sound when brake is applied.	Worn pads. Loose mounting bolts. Warped rotor.	Replace brake pads. Tighten bolts. Replace rotor.
Ineffective brake – lever/pedal travels to limit.	Low fluid level. Piston cup not functioning.	Fill master cylinder with approved brake fluid, and bleed system. Rebuild cylinder.
Ineffective brake – lever/pedal travel normal.	Distorted or glazed rotor. Distorted, glazed or contaminated brake pads.	Replace rotor. Replace pads.
Brake pads drag on rotor – will not retract.	Cup in master cylinder not uncovering relief port. Rear brake pedal linkage out of adjustment.	Inspect master cylinder. Adjust linkage.

REMOVAL

NOTE

Do not remove the master cylinder unless problems are being experienced.

1. See [Figure 2-18](#). Drain brake fluid into a suitable container. Discard of used fluid according to local laws.
 - a. Open bleeder valve (metric) about 1/2-turn.
 - b. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
 - c. Pump brake hand lever to drain brake fluid.
 - d. Tighten bleeder valve to 3-5 ft-lbs (4-7 Nm)
2. Remove mirror from right handlebar.

CAUTION

Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

3. See [Figure 2-19](#). Remove banjo bolt (6) (metric) and two banjo washers (4) to disconnect brake line (5) from master cylinder. Discard banjo washers.
4. Remove screw (8) or unplug both terminals to detach brake lamp switch (7).

NOTE

The individual parts of the brake lamp switch are not serviceable. Replace switch upon failure.

5. Remove two screws (1) (metric) and clamp (2) to detach master cylinder assembly from handlebar.

DISASSEMBLY

1. See [Figure 2-20](#). Detach front brake hand lever.
 - a. Remove nut (1) (metric) from lever pivot.
 - b. Remove pivot bolt (2) from lever pivot.
2. Detach front brake hand lever (3) from master cylinder assembly.
3. See [Figure 2-21](#). Remove screw, lockwasher and washer (1) holding front brake switch (3) to master cylinder assembly. Remove switch.
4. See [Figure 2-22](#). Compress piston (2) and remove rubber boot (1).
5. Depress piston assembly and remove internal snap ring (3). Discard snap ring.
6. See [Figure 2-23](#). Remove piston assembly (1-4) from front master cylinder.

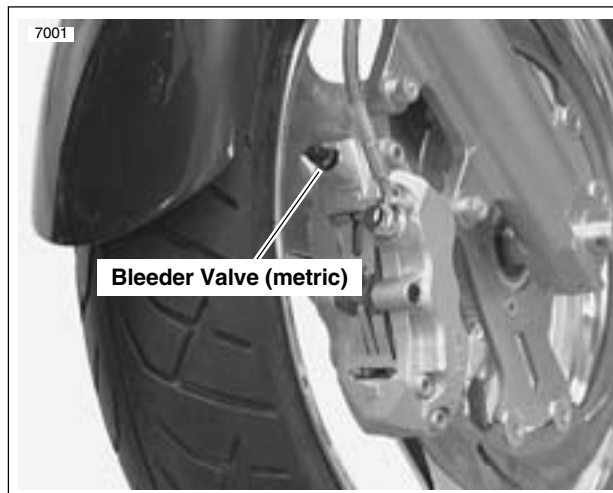


Figure 2-18. Draining Front Brake System (Typical)

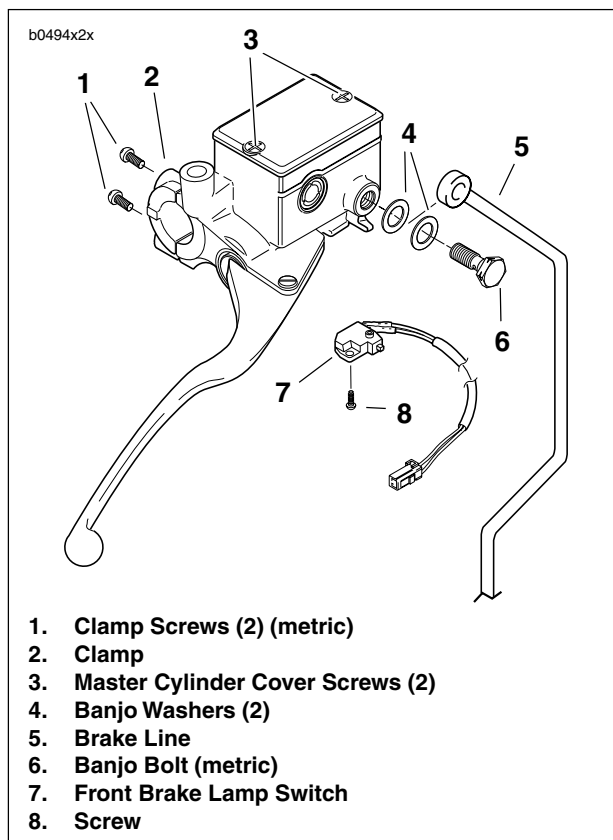


Figure 2-19. Front Master Cylinder

CLEANING AND INSPECTION

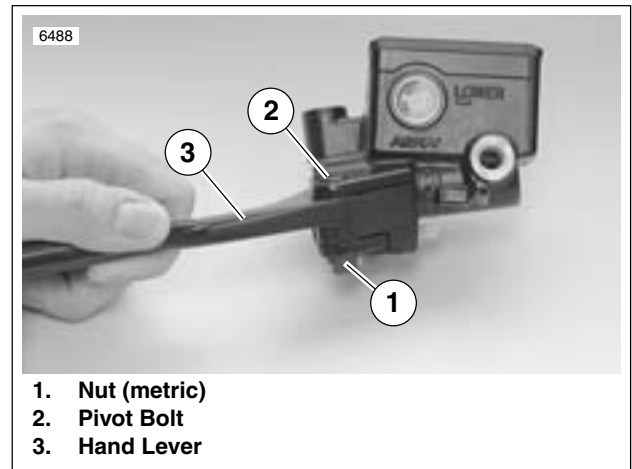
⚠ WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This could result in improper brake operation which could result in death or serious injury.

1. Clean all parts with denatured alcohol or **D.O.T. 4 BRAKE FLUID**. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages in bottom of reservoir.
2. Carefully inspect all parts for wear or damage and replace as necessary.
3. Inspect piston bore in master cylinder housing for scoring, pitting or corrosion. Replace housing if any of these conditions are found.
4. Inspect outlet port that mates with brake line fitting. As a critical sealing surface, replace housing if any scratches, dents or other damage is noted.
5. Inspect boot for cuts, tears or general deterioration. Replace as necessary.

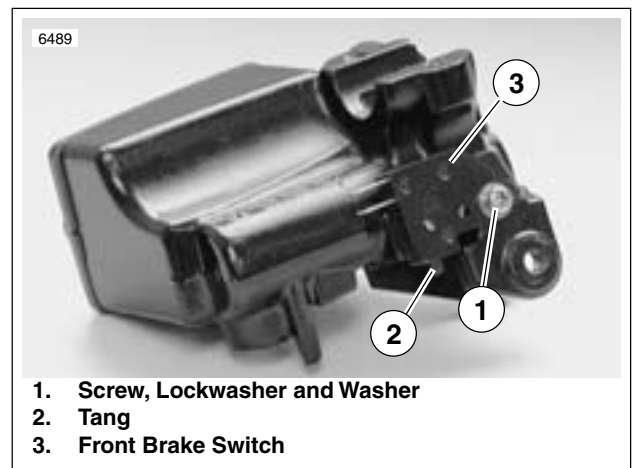
ASSEMBLY

1. See [Figure 2-23](#). Check piston assembly components.
 - a. Small end of spring (1) sits behind primary cup (2). Large side of primary cup faces spring.
 - b. Secondary cup (3) sits within ridge at middle of piston (4).
2. Insert piston assembly, spring first, into master cylinder. Secure with a **new** snap ring (6).
3. Install ridge on boot (5) into groove on piston (4).
4. See [Figure 2-20](#). Install front brake hand lever.
 - a. Align hole in lever (3) with hole in master cylinder assembly.
 - b. Lubricate pivot bolt (2) with **LOCTITE ANTI-SEIZE**.
 - c. Install pivot bolt through top of assembly. Tighten to **4-13 in-lbs** (0.5-1.5 Nm).
 - d. Install **nut** (1) (metric). Tighten to **44-62 in-lbs** (5-7 Nm).
5. See [Figure 2-25](#). Install front brake lamp switch (7).
 - a. Attach front brake switch with screw, washer and lockwasher (1). Tighten to **7-13 in-lbs** (0.8-1.5 Nm).
 - b. Test switch action. Tang (3) on switch must release when hand lever (2) is moved.



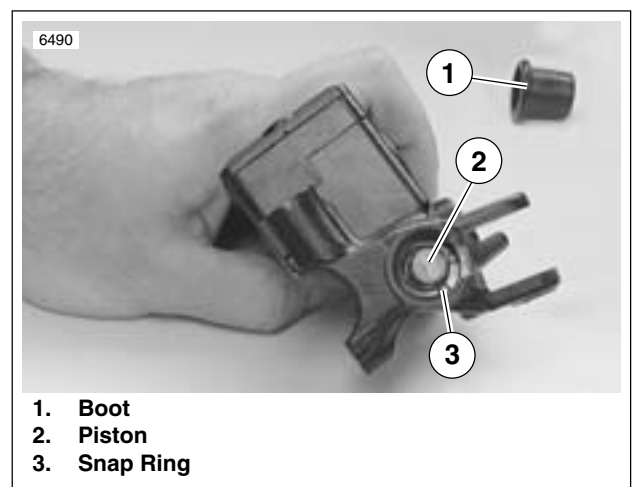
1. Nut (metric)
2. Pivot Bolt
3. Hand Lever

Figure 2-20. Hand Lever



1. Screw, Lockwasher and Washer
2. Tang
3. Front Brake Switch

Figure 2-21. Front Brake Switch



1. Boot
2. Piston
3. Snap Ring

Figure 2-22. Snap Ring

INSTALLATION

1. See [Figure 2-19](#). Fasten master cylinder to handlebar by installing clamp (2) and screws (1) (metric). Tighten to 80-90 **in-lbs** (9-10 Nm).

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

CAUTION

To avoid leakage, ensure that banjo washers, banjo bolt, hydraulic brake line and master cylinder bore are completely clean.

2. Connect brake line (5) to master cylinder using two **new** banjo washers (4) and banjo bolt (6) (metric). Tighten to 16-20 ft-lbs (22-27 Nm).
3. See [Figure 2-26](#). Verify brake lamp switches are tight.
4. Install mirror parallel to handlebars.
5. See [Figure 2-19](#). Remove the two master cylinder cover screws (3), cover and cover gasket.
6. See [Figure 2-27](#). With the master cylinder in a level position, add **D.O.T. 4 BRAKE FLUID**. Bring fluid level to within 0.125 in. (3.2 mm) of molded boss inside front master cylinder reservoir.

WARNING

Verify proper operation of the master cylinder relief port. A plugged or covered relief port can cause brake drag or lockup, which could result in loss of vehicle control and death or serious injury.

7. Verify proper operation of the master cylinder relief port. Actuate the brake lever with the reservoir cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
8. Attach master cylinder cover and cover gasket with the two cover screws (3). Tighten to 9-13 **in-lbs** (1-1.5 Nm).
9. Bleed brake system. See [1.5 BRAKES](#).

WARNING

Check for proper brake lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper brake lamp operation could result in death or serious injury.

10. Turn ignition key switch to IGN. Apply brake hand lever to test brake lamp operation. Turn ignition switch to LOCK.

WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell strongly recommends that all brake repairs be performed by a Buell dealer or other qualified technician.

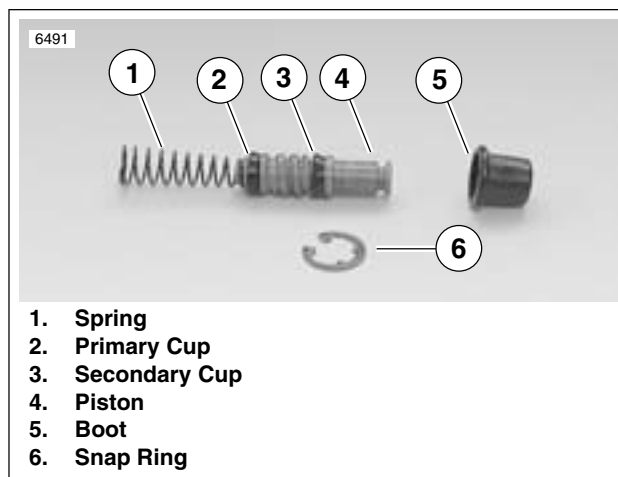


Figure 2-23. Piston Assembly

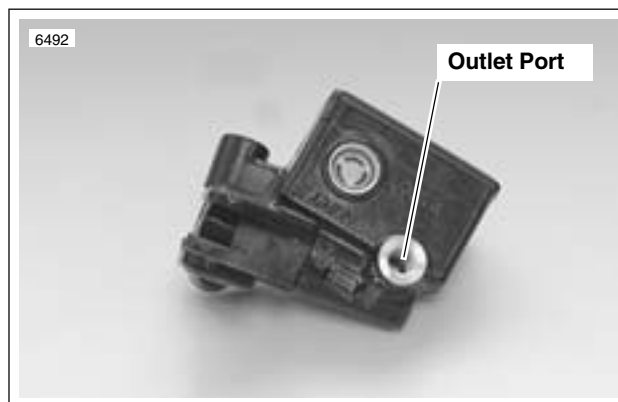


Figure 2-24. Master Cylinder Body

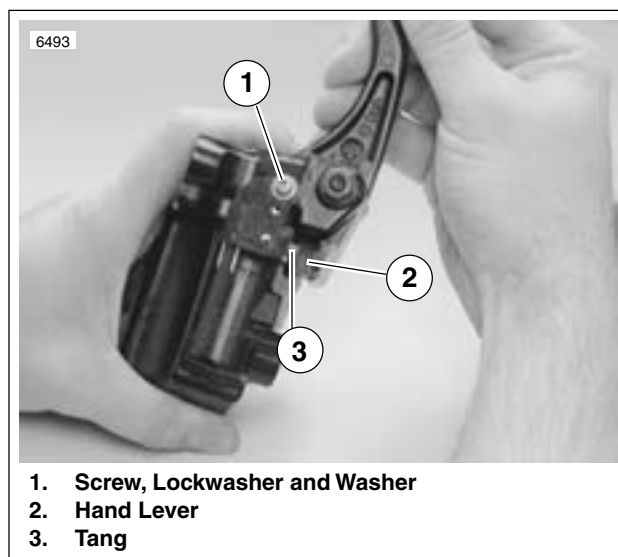


Figure 2-25. Testing Hand Lever

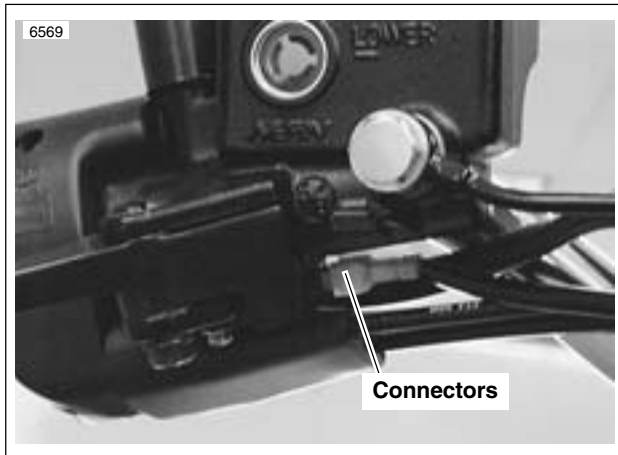


Figure 2-26. Brake Lamp Switch Connectors

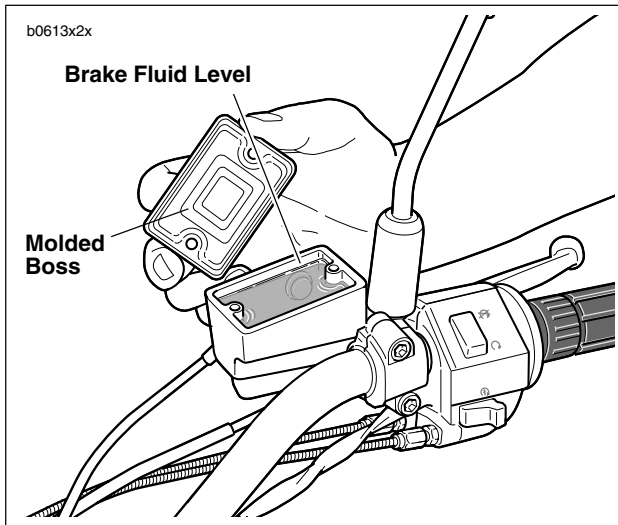


Figure 2-27. Brake Fluid Level

REMOVAL

NOTE

Steps 1 and 2 are not required for detaching caliper from rotor. Drain fluid only when disassembling caliper.

1. Drain and discard brake fluid.

CAUTION

Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

2. See [Figure 2-28](#). Remove banjo bolt (2) (metric) and two banjo washers (3) to disconnect brake line (1) from caliper. Discard banjo washers.
3. Remove brake pads.
 - a. Remove pin plug (4).
 - b. See [Figure 2-29](#). Remove pad hanger pin (1) (metric).
 - c. Remove pad spring (2).
 - d. Remove brake pads from caliper.
4. See [Figure 2-28](#). Detach caliper from mounts.
 - a. Remove both mounting screws (5) while supporting caliper above brake rotor.
 - b. Slowly remove caliper by tilting away from wheel and then pulling away from rotor.

DISASSEMBLY

1. See [Figure 2-29](#). Remove four screws (3) (metric) to separate caliper halves.
2. Remove two O-rings from between caliper halves and discard.
3. See [Figure 2-30](#). Use BRAKE CALIPER PISTON REMOVER (Part No. B-42887) without adaptor to pull the six pistons from caliper bores.
4. See [Figure 2-31](#). Pry O-rings (6) out of their respective grooves on each side of caliper. Discard O-rings.
5. Check bleeder valve (4) (metric). Remove and replace if damaged.

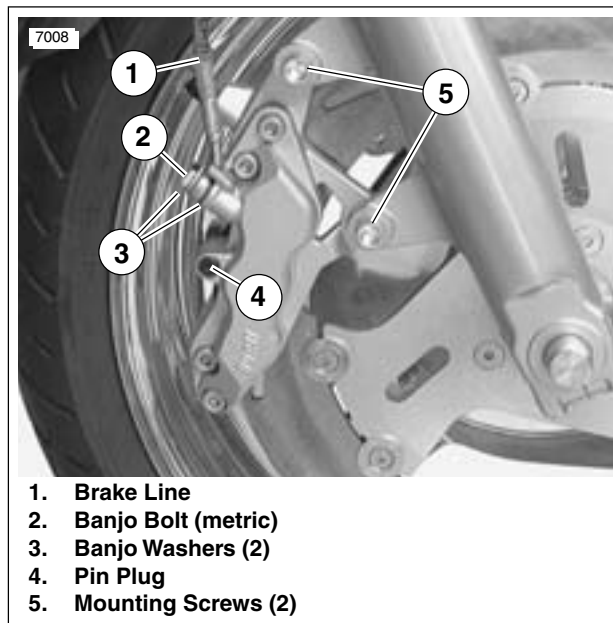


Figure 2-28. Front Brake Caliper Mounts (Typical)

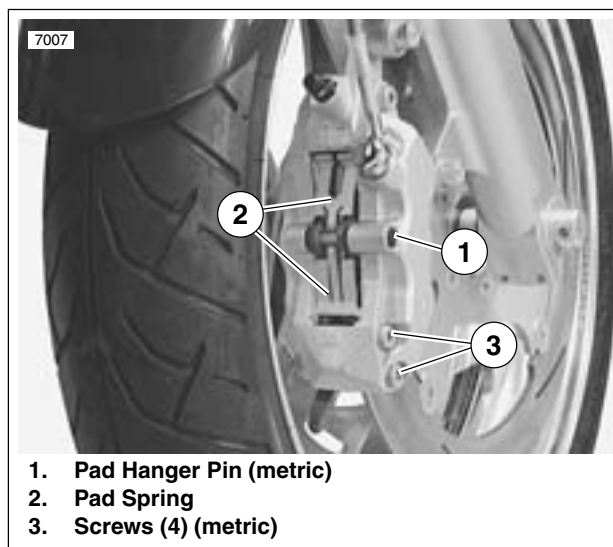


Figure 2-29. Pad Spring (Typical)

CLEANING AND INSPECTION

⚠ WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This could result in improper brake operation which could result in death or serious injury.

1. Clean all parts with denatured alcohol or **D.O.T. 4 BRAKE FLUID**. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.
2. Carefully inspect all components. Replace any parts that appear damaged or worn. Do not hone caliper piston bore.
3. Inspect brake rotor.
 - a. Measure rotor thickness. Replace if minimum thickness is less than 0.18 in. (4.5 mm).
 - b. Check rotor surface. Replace if warped or badly scored.

⚠ WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

4. Inspect brake pads for damage or excessive wear. Replace both pads as a set if the friction material of either pad is worn to 0.04 in. (1.0 mm) or less.

ASSEMBLY

1. See [Figure 2-31](#). Install pistons and O-rings.
 - a. Apply a light coat of **D.O.T. 4 BRAKE FLUID** to O-rings, pistons and caliper piston bores.
 - b. Install two **new** O-rings (6) in grooves of each piston bore.
 - c. Install pistons (5) in each piston bore.
2. Install two **new** O-rings (3) between caliper halves.
3. Attach caliper halves together with four screws (7) (metric). Tighten to 14.5-18 ft-lbs (20-24 Nm).
4. Install a **new** bleeder valve (4) (metric) if necessary. Tighten to 3-5 ft-lbs (4-7 Nm).

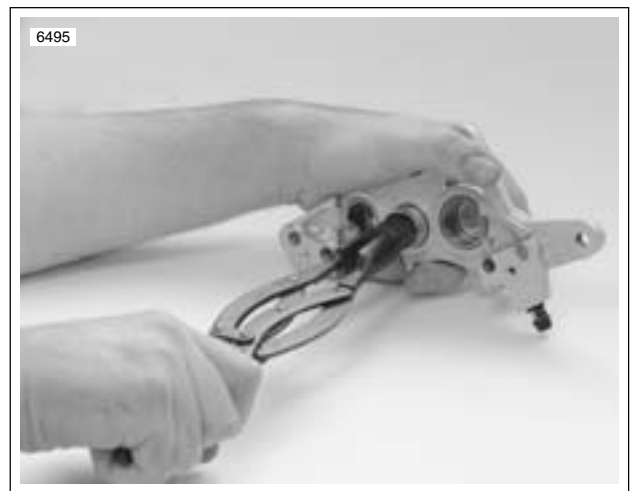


Figure 2-30. Removing Pistons

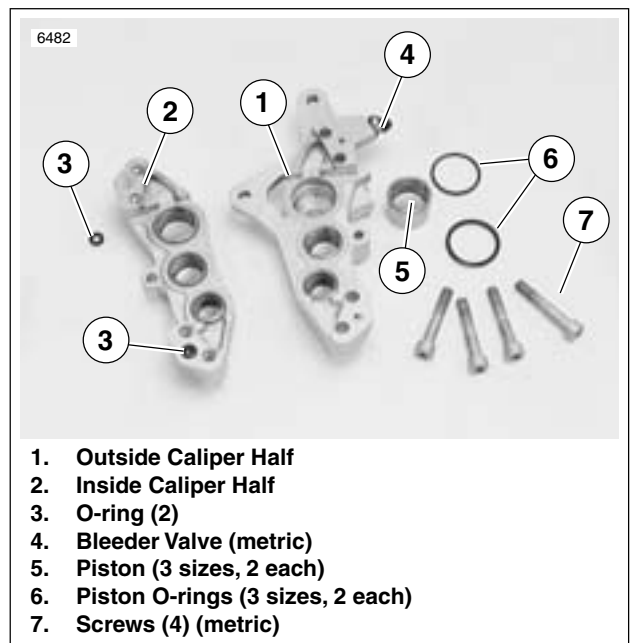


Figure 2-31. Caliper O-rings and Pistons

INSTALLATION

1. Fit front brake caliper on rotor.
 - a. Check rotor attachment to carrier. Inspect all six brake drive pins for missing hardware.
 - b. Make sure rotor is centered on carrier. Use two clamps on rotor and carrier to reduce freeplay and center rotor.
 - c. Slide caliper over front brake rotor without brake pads installed.
2. See [Figure 2-28](#). Apply **LOCTITE THREADLOCKER 271** (red) to both caliper mounting screws (5). Install and tighten to 22-25 ft-lbs (30-34 Nm).

3. Install brake pads.
 - a. See [Figure 2-32](#). Insert brake pads from behind.
 - b. See [Figure 2-29](#). Install pad spring (2) with opening at top as shown.
 - c. Install pad hanger pin (1) (metric). Tighten to 11-14.5 ft-lbs (15-20 Nm).
 - d. See [Figure 2-28](#). Install pin plug (4). Tighten to 18-25 in-lbs (2-3 Nm).

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury

CAUTION

To avoid leakage, verify that banjo washers, banjo bolt, hydraulic brake line and caliper bore are completely clean.

4. Connect brake line (1) to caliper using two **new** banjo washers (3) and banjo bolt (2) (metric). Tighten to 16-20 ft-lbs (22-27 Nm).

CAUTION

Cover painted surfaces and right handlebar switches and use care when removing brake reservoir cover and adding D.O.T. 4 brake fluid. Spilling D.O.T. 4 brake fluid on painted surfaces will result in cosmetic damage. Spilling brake fluid on switches may render them inoperative.

5. See [Figure 2-33](#). Remove both master cylinder cover screws (2). Remove master cylinder cover (1) and gasket.
6. With the master cylinder in a level position, verify that the brake fluid level is 0.125 in. (3.2 mm) from molded boss inside reservoir. Add **D.O.T. 4 BRAKE FLUID** if necessary.

WARNING

A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control. This could result in death or serious injury.

7. Verify proper operation of the master cylinder relief port. Actuate the brake lever with the reservoir cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
8. Install master cylinder cover (1) and cover gasket with two screws (2). Tighten to 9-13 in-lbs (1.0-1.5 Nm).
9. Depress front brake lever several times to set brake pads to proper operating position within caliper. Bleed brake system. See [1.5 BRAKES](#).

WARNING

Check for proper brake lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper brake lamp operation could result in death or serious injury.

10. Turn ignition key switch to IGN. Apply brake hand lever to test brake lamp operation. Turn ignition key switch to LOCK.

WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell strongly recommends that all brake repairs be performed by a Buell dealer or other qualified technician.

NOTE

Avoid making hard stops for the first 100 miles (160 km) to allow **new** brake pads to "wear in" properly with the brake rotor.

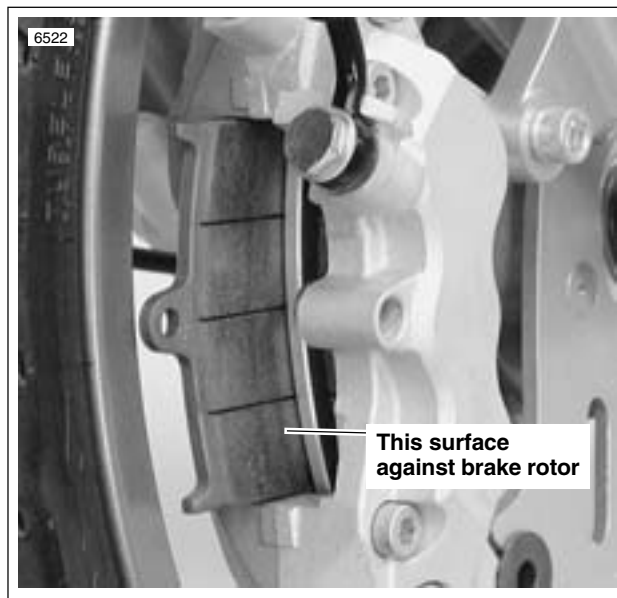
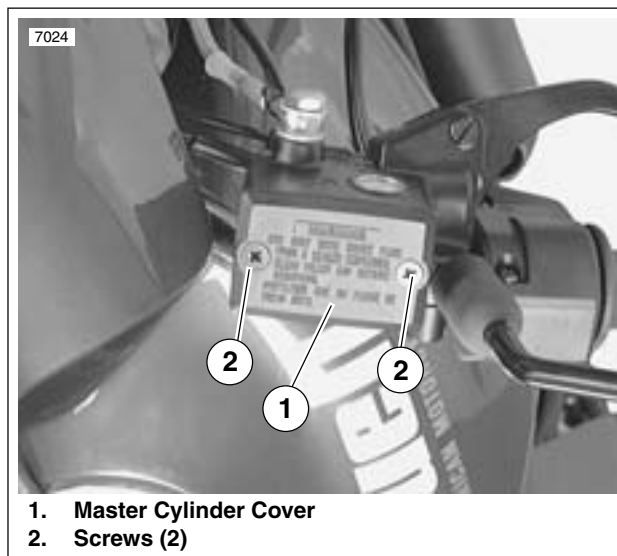


Figure 2-32. Installing Brake Pads (Typical)



1. Master Cylinder Cover
2. Screws (2)

Figure 2-33. Master Cylinder Cover (Typical)

REMOVAL

1. Drain and discard brake fluid. See Step 1 under 2.10 FRONT BRAKE MASTER CYLINDER.
2. See Figure 2-34. Remove screw (4) to detach brake line clamp (5) from right side of lower triple clamp.

CAUTION

Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

3. Remove master cylinder banjo bolt (1) (metric) and two banjo washers (2) to disconnect brake line from master cylinder. Discard banjo washers.
4. Remove caliper banjo bolt (6) (metric) and two banjo washers (7) to disconnect brake line from caliper. Discard banjo washers.
5. Carefully inspect the brake line for dents, cuts or other defects. Replace the brake line if any damage is noted.

INSTALLATION

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury

CAUTION

To avoid leakage, ensure that banjo washers, banjo bolt, hydraulic brake line and master cylinder bore are completely clean.

1. See Figure 2-34. Connect brake line to master cylinder using two **new** banjo washers (2) and banjo bolt (1) (metric). Loosely install bolt into master cylinder.
2. From the master cylinder, the brake line runs downward in front of the right handlebar, where it turns inboard at the upper triple clamp. Loosely install clamp (5) with screw (4) to attach front brake line to right side of lower triple clamp.
3. Connect brake line to caliper using two **new** banjo washers (7) and banjo bolt (6) (metric). Tighten banjo bolt (6) to 16-20 ft-lbs (22-27 Nm).
4. Tighten clamp screw (4) on lower triple clamp to 30-35 in-lbs (3.4-4.0 Nm).
5. Tighten master cylinder banjo bolt (1) (metric) to 16-20 ft-lbs (22-27 Nm).
6. Install bleeder valve if removed. Refill master cylinder and bleed brakes. See 1.5 BRAKES.

WARNING

Check for proper brake lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper brake lamp operation could result in death or serious injury.

7. Turn ignition key switch to IGN. Apply brake hand lever to test brake lamp operation. Turn ignition key switch to LOCK.

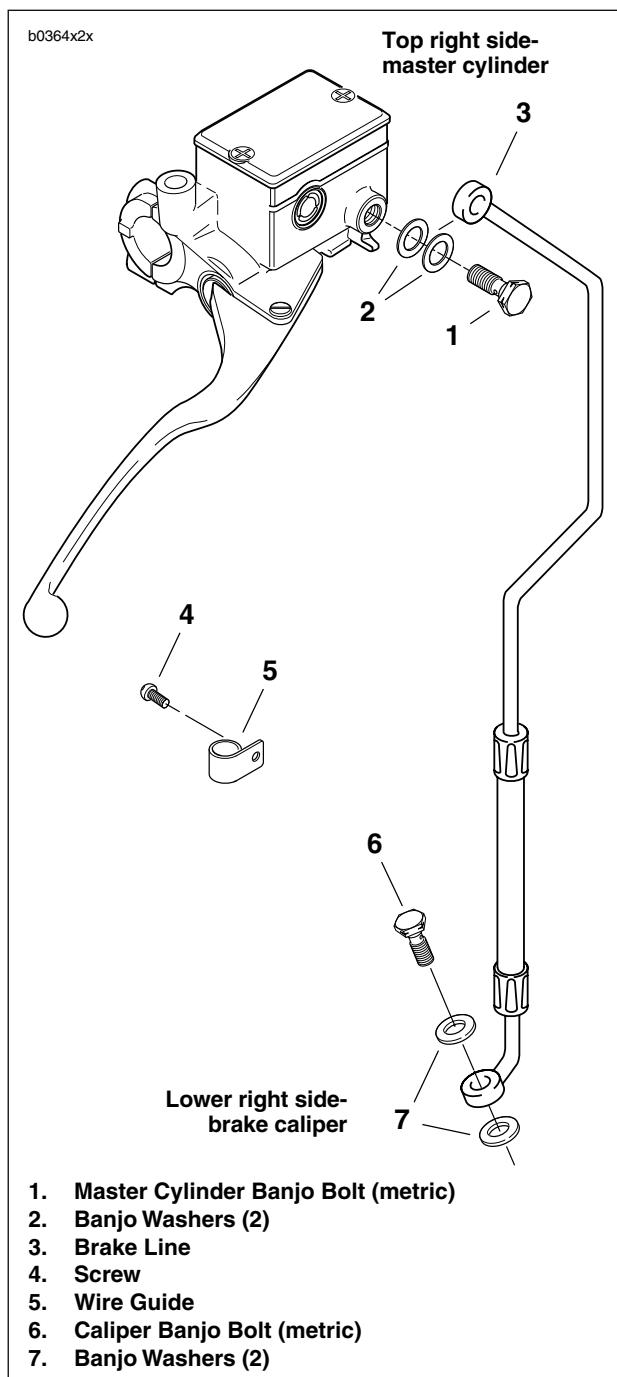


Figure 2-34. Front Brake Line

REMOVAL

1. See [Figure 2-35](#). Drain brake fluid into a suitable container. Discard of used fluids according to local laws.
 - a. Remove cap from rear caliper bleeder valve. Open bleeder valve (metric) about 1/2 turn.
 - b. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
 - c. Pump brake pedal to drain brake fluid.
 - d. Tighten bleeder valve (metric) to 3-5 ft-lbs (4-7 Nm). Reinstall cap.

CAUTION

Damaged banjo bolt surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

2. See [Figure 2-36](#). Remove banjo bolt (1) (metric) and two banjo washers (2) to detach brake line (3) from master cylinder (4). Discard banjo washers.
3. See [Figure 2-37](#). Disconnect push rod from brake pedal turn buckle (4).
 - a. Spin locknut (3) away from top surface of turn buckle.
 - b. Turn rod adjuster (2) to free rod from turn buckle (4).
4. See [Figure 2-38](#). Remove two screws (2) (metric) to detach master cylinder (3) from frame.
5. See [Figure 2-39](#). Detach remote reservoir.
 - a. Remove top or bottom clamp on hose connected to master cylinder.
 - b. Remove screw to detach reservoir from frame if necessary.

DISASSEMBLY

NOTE

Do not disassemble master cylinder unless problems are experienced. Discard all seals during the disassembly procedure. Install a complete rebuild kit upon assembly.

1. See [Figure 2-40](#). Slide rubber boot on rod assembly (3) away from master cylinder body (1).
2. Depress rod assembly (3) and remove internal snap ring (2). Discard snap ring.
3. Remove piston assembly (4) from master cylinder body.



Figure 2-35. Rear Caliper Bleeder Valve (Metric-Typical)

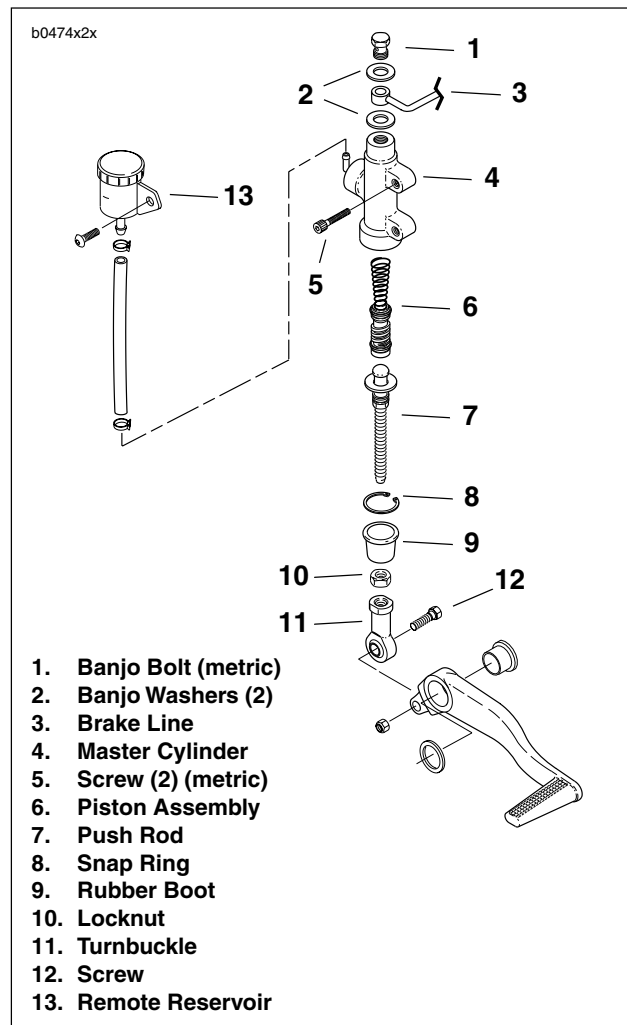


Figure 2-36. Rear Master Cylinder Assembly

CLEANING AND INSPECTION

WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This could result in improper brake operation which could result in death or serious injury.

1. Thoroughly clean master cylinder and all brake system components. Stand master cylinder on wooden block or towel to protect seating surfaces.
 - a. Examine walls of master cylinder reservoir for scratches and grooves. Replace if damaged.
 - b. Verify that vent holes on master cylinder are completely open and free of dirt or debris.
2. Inspect boot on front of master cylinder for cuts, tears or general deterioration. Replace if necessary.

ASSEMBLY

1. See [Figure 2-40](#). Insert piston assembly (4), spring first, into master cylinder.
2. Place round side of rod assembly (3) over piston. Depress piston into master cylinder body (1) and secure with a **new** snap ring (2).
3. Tuck rubber boot on rod assembly (3) into master cylinder body (1).

INSTALLATION

1. See [Figure 2-39](#). Connect remote reservoir.
 - a. If removed, attach remote reservoir to frame using screw. Tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
 - b. Attach line to master cylinder using clamp.
2. See [Figure 2-38](#). Attach master cylinder (3) to frame. Apply **LOCTITE THREADLOCKER 243** (blue) to both screws (2) (metric). Tighten to 8-10 **ft-lbs** (11-14 Nm).

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

CAUTION

To avoid leakage after assembly, verify that banjo washers, banjo bolt, hydraulic brake line and bore of master cylinder are completely clean.

3. See [Figure 2-36](#). Connect brake line (3) to master cylinder (4) with two **new** banjo washers (2) and banjo bolt (1) (metric). Tighten to 16-20 **ft-lbs** (22-27 Nm).

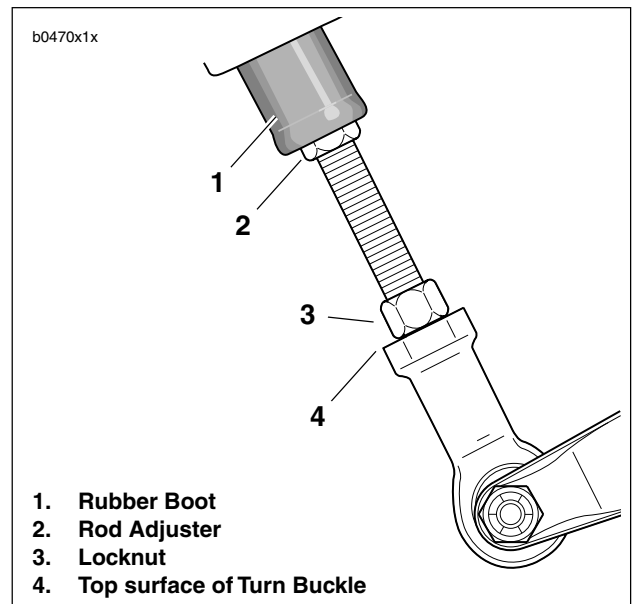


Figure 2-37. Brake Push Rod

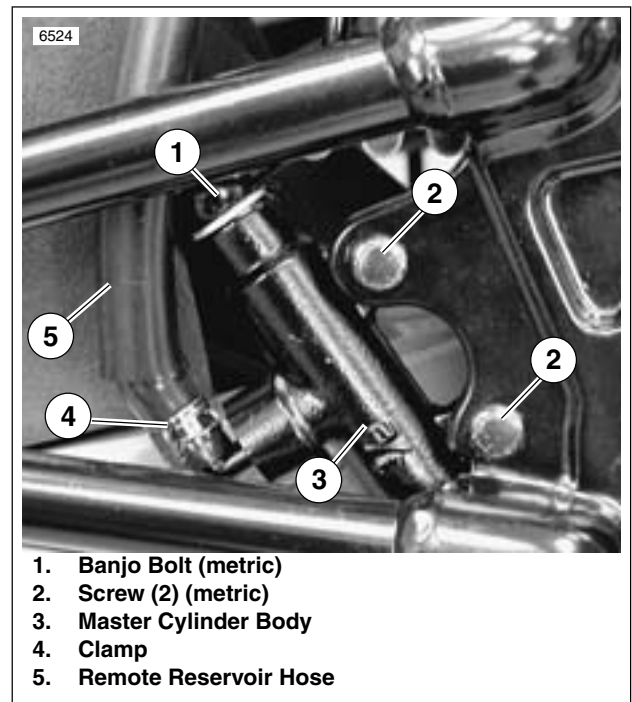


Figure 2-38. Master Cylinder Mounting (Typical)

4. See Figure 2-37. Install push rod.
 - a. Screw push rod into turn buckle.
 - b. Seat brake pedal height adjustment. See 1.5 BRAKES.

WARNING

Verify proper operation of the master cylinder relief port. A plugged or covered relief port can cause brake drag or lockup, which could result in loss of vehicle control and death or serious injury.

5. Add brake fluid and bleed brake system. See 1.5 BRAKES.
6. With motorcycle in a level position, check that brake fluid is between the upper and lower marks on reservoir. Add D.O.T. 4 BRAKE FLUID if necessary. Be sure gasket and cap on reservoir fit securely.

WARNING

Check for proper brake lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper brake lamp could result in death or serious injury.

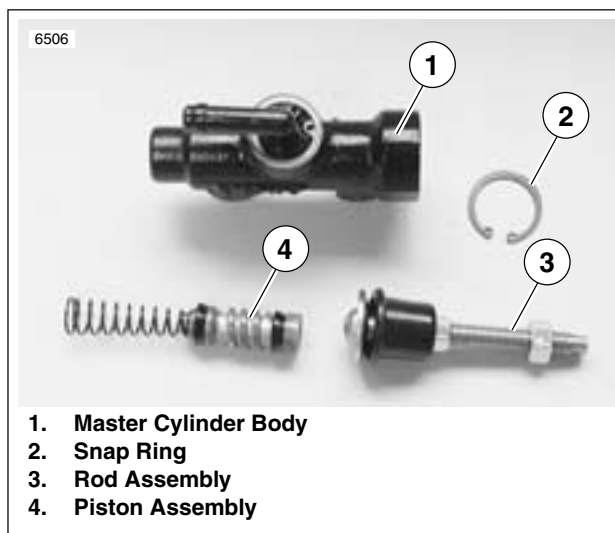
7. Turn ignition key switch to IGN. Apply rear brake pedal to test brake lamp operation. Turn ignition key switch to LOCK.

WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell strongly recommends that all brake repairs be performed by a Buell dealer or other qualified technician.



Figure 2-39. Remote Reservoir



1. Master Cylinder Body
2. Snap Ring
3. Rod Assembly
4. Piston Assembly

Figure 2-40. Master Cylinder Internals

REMOVAL

NOTE

Steps 1 and 2 are not required for detaching caliper from rotor. Drain fluid only when disassembling caliper.

1. Drain and discard brake fluid. See Step 1 under 2.13 REAR BRAKE MASTER CYLINDER.

CAUTION

Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

2. See Figure 2-41. Remove banjo bolt (2) (metric) and two banjo washers (3) to disconnect brake line (1) from caliper. Discard banjo washers.
3. Remove small screw (6) (metric) and large screw (7) (metric) to detach caliper from mount.
4. See Figure 2-42. Remove clip (1) from rear caliper mount (2) if necessary.

DISASSEMBLY

1. See Figure 2-41. Remove pin plug and pad hanger (5) (metric) to free brake pads.
2. See Figure 2-42. Remove clip (1) from caliper body.
3. See Figure 2-44. Remove piston (3) using BRAKE CALIPER PISTON REMOVER (1) (Part No. B-42887) with adaptor (2).
4. Remove two O-rings from groove in caliper bore. Discard O-rings.

CLEANING AND INSPECTION

WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This could result in improper brake operation which could result in death or serious injury.

1. Clean all parts with denatured alcohol or D.O.T. 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.
2. Carefully inspect all components. Replace any parts that appear damaged or worn. Do not hone caliper piston bore.

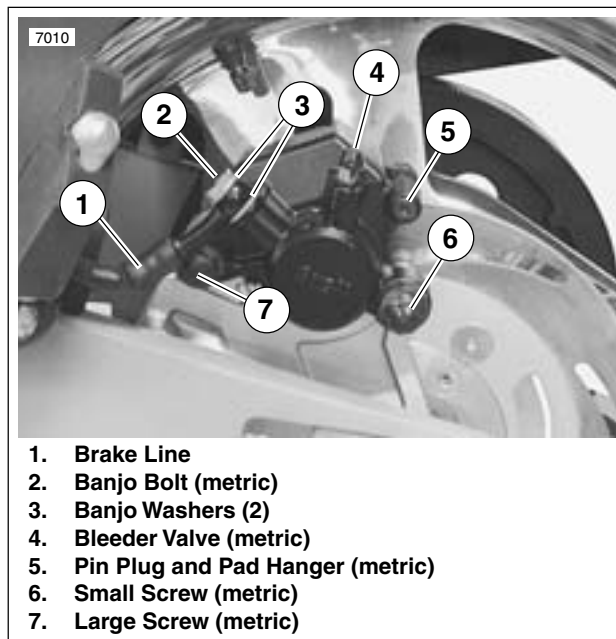


Figure 2-41. Rear Brake Caliper (Typical)

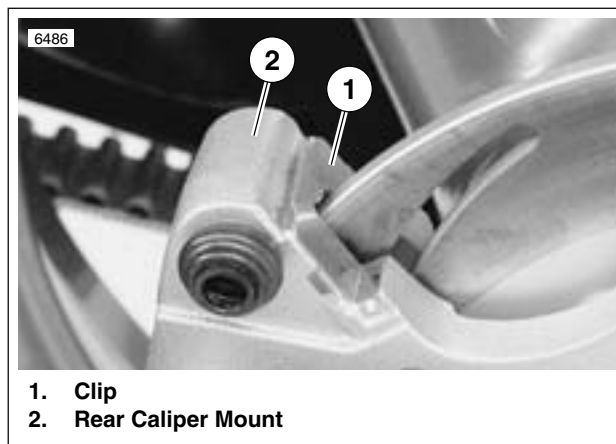


Figure 2-42. Caliper Mount Clip

3. Inspect brake rotor.
 - a. Measure rotor thickness. Replace if minimum thickness is less than 0.18 in. (4.5 mm).
 - b. Check rotor surface. Replace if warped or badly scored.

WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

4. Inspect brake pads for damage or excessive wear. Replace both pads as a set if the friction material of either pad is worn to 0.04 in. (1.0 mm) or less.

ASSEMBLY

- See [Figure 2-43](#). Place clip (1) inside caliper body as shown.

NOTE

To ensure proper brake pad-to-brake rotor clearance when the caliper is installed, piston must be pressed all the way into the bore whenever **new** brake pads are used.

- See [Figure 2-44](#). Install pistons and O-rings.
 - Apply a light coat of **D.O.T. 4 BRAKE FLUID** to O-rings, piston and caliper piston bore.
 - Place **two** new O-rings inside grooves of piston bore.
 - Install piston inside caliper body.
- See [Figure 2-43](#). Install brake pads (3) using pad hanger and pin plug (2).
 - Install pad hanger pin (metric). Tighten to 11-14.5 ft-lbs (15-20 Nm).
 - Install pin plug. Tighten to 18-25 **in-lbs** (2-3 Nm).
- Install a **new** bleeder valve (metric) if necessary. Tighten to 3-5 ft-lbs (4-7 Nm).

INSTALLATION

- See [Figure 2-42](#). Install caliper mount clip (1) if removed.
- See [Figure 2-41](#). Install caliper assembly on caliper mount. Brake pad surfaces must face rear brake rotor.
 - Apply **LOCTITE THREADLOCKER 271** (red) to both caliper mounting screws (6, 7) (metric).
 - Install large caliper screw (7) (metric). Tighten to 18-22 ft-lbs (24-30 Nm)
 - Install small caliper screw (6) (metric). Tighten to 14.5-18 ft-lbs (20-24 Nm).

⚠ WARNING

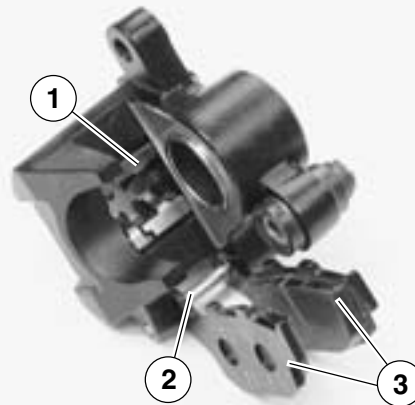
Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury

CAUTION

To avoid leakage, verify that banjo washers, banjo bolt, hydraulic brake line and caliper bore are completely clean.

- Connect brake line (1) to caliper using two **new** banjo washers (3) and banjo bolt (2) (metric). Tighten to 16-20 ft-lbs (22-27 Nm).
- Depress rear brake pedal several times to set brake pads to proper operating position within caliper. Bleed brake system. See [1.5 BRAKES](#).
- Verify proper fluid level in reservoir.

6487



- Clip
- Pin Plug and Pad Hanger (metric)
- Brake Pads (2)

Figure 2-43. Brake Pads

6496

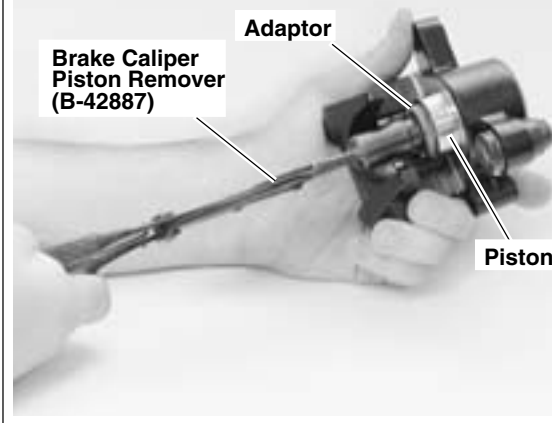


Figure 2-44. Removing Rear Brake Caliper Piston

⚠ WARNING

Check for proper brake lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper brake lamp operation could result in death or serious injury.

- Turn ignition key switch to IGN. Apply brake pedal to test brake lamp operation. Turn ignition key switch to LOCK.

⚠ WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell strongly recommends that all brake repairs be performed by a Buell dealer or other qualified technician.

NOTE

Avoid making hard stops for the first 100 miles (160 km) to allow **new** brake pads to "wear in" properly with the brake rotor.

REMOVAL

1. Drain and discard brake fluid. See Step 1 under 2.13 REAR BRAKE MASTER CYLINDER.

CAUTION

Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

2. See Figure 2-45. Remove banjo bolt (2) (metric) and two banjo washers (3) to disconnect brake line (1) from rear brake caliper. Discard banjo washers.
3. See Figure 2-46. Remove banjo bolt (1) (metric) and two (2) banjo washers to disconnect brake line (3) from rear master cylinder. Discard banjo washers.
4. See Figure 2-47. Remove screw and clamp (1) to detach brake line clamp from frame.
5. See Figure 2-48. Remove bolt, washer, wireform and brake line from under oil tank.
6. See Figure 2-47. Remove brake line from wire guide (5) under oil tank.
7. Remove wires from terminals (2, 3) at top of brake lamp switch. Unthread brake lamp switch (4) from tee nut.

INSTALLATION

WARNING

If rear brake line must be replaced, use only the brake line with the olive drab coating on the metal portion of the line (See Parts Catalog for Part No.) with DOT 4 brake systems. The previous black metal brake line is NOT compatible with DOT 4 brake fluid. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

1. See Figure 2-49. Install wireform to rear brake line as shown in figure.
2. From left side of vehicle, feed **new** brake line from rear brake caliper mount forward to frame mount. Route brake line to the right towards rear master cylinder.
3. See Figure 2-47. Install screw and clamp (1) to fasten rear brake line to frame tube. Tighten to 10-12 ft-lbs (14-16 Nm).
4. Place brake line inside wire guide (5) under oil tank.

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

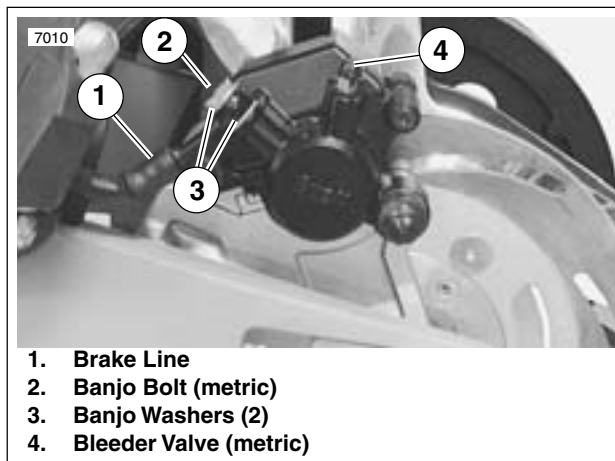


Figure 2-45. Rear Brake Caliper Banjo Bolt (Typical)

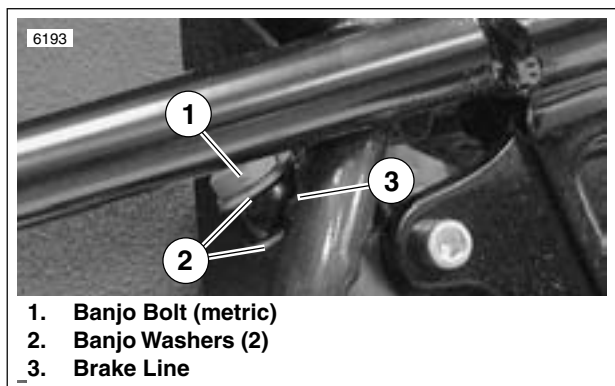


Figure 2-46. Rear Master Cylinder Banjo Bolt (Typical)

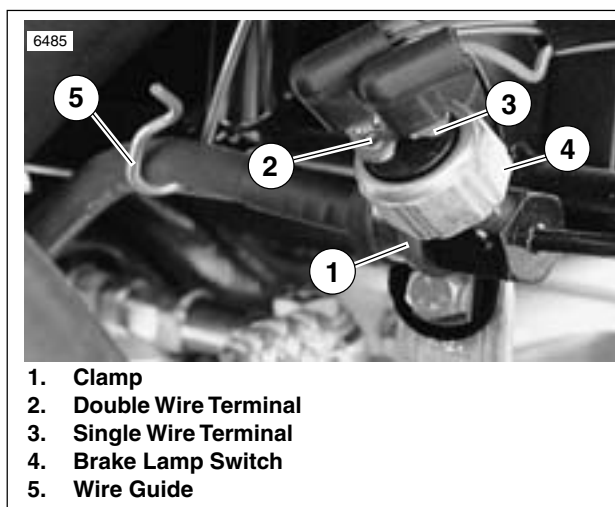


Figure 2-47. Brake Line and Switch

- See [Figure 2-48](#). Attach the wireform under the oil tank with bolt and washer.

WARNING

Use only copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect braking ability and lead to brake failure which could result in death or serious injury.

CAUTION

To avoid leakage after assembly, ensure that banjo washers, banjo bolt, hydraulic brake line and bore of master cylinder are completely clean.

- See [Figure 2-46](#). Connect brake line (3) to master cylinder with two new banjo washers (2) and banjo bolt (1) (metric). Tighten to 16-20 ft-lbs (22-27 Nm).
- See [Figure 2-45](#). Connect brake line (1) to caliper with two new banjo washers (3) and banjo bolt (2) (metric). Tighten to 16-20 ft-lbs (22-27 Nm).
- See [Figure 2-47](#). Install brake lamp switch (4).
 - Coat brake lamp switch threads with LOCTITE PIPE SEALANT WITH TEFLON.
 - Thread brake lamp switch to tee nut of brake line. Tighten to 7-8 ft-lbs (10-11 Nm).
 - Install wires on terminals (2, 3).
- Install bleeder valve if removed. Refill master cylinder and bleed brakes. See [1.5 BRAKES](#).

WARNING

Check for proper brake lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper brake lamp operation could result in death or serious injury.

- Turn ignition key switch to IGN. Apply rear brake pedal to test brake lamp operation. Turn ignition key switch to LOCK.

WARNING

Always test motorcycle brakes at low speed after servicing or bleeding system. To prevent death or serious injury, Buell strongly recommends that all brake repairs be performed by a Buell dealer or other qualified technician.

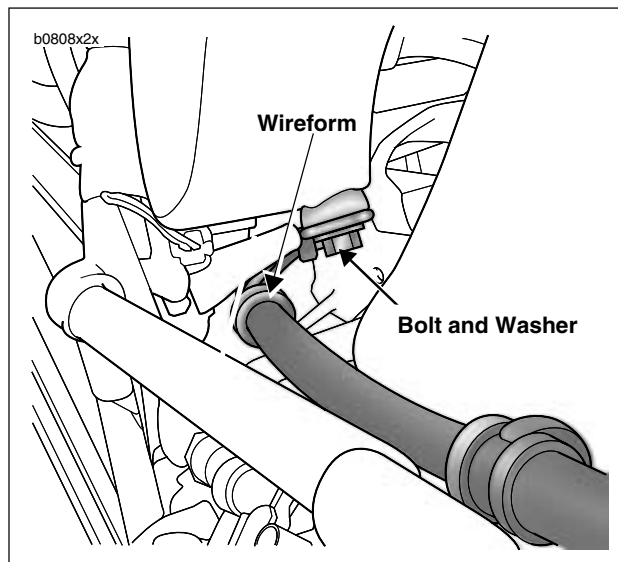


Figure 2-48. Rear Brake Line Wireform

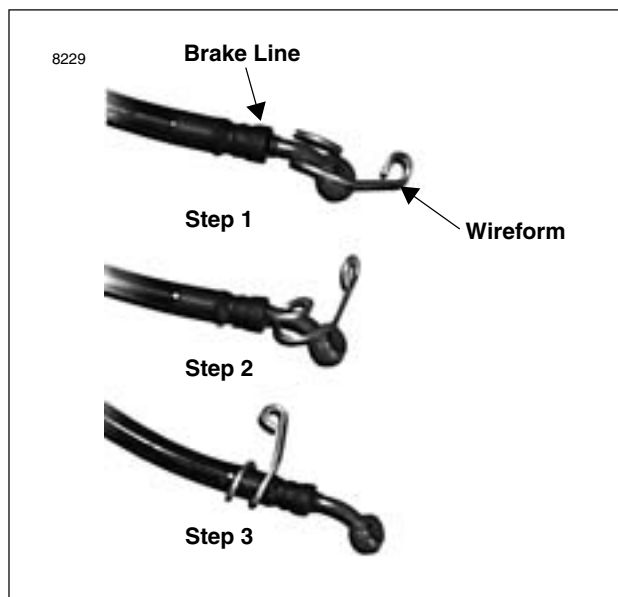


Figure 2-49. Wireform Installation

GENERAL

The front fork consists of two telescoping slider/slider tube assemblies. Each assembly has an internal compression spring which supports the forward weight of the vehicle and rider. The compression spring extends and retracts to cushion the ride over rough or irregular road surfaces. A damping mechanism controls the telescoping action of each slider/slider tube assembly.

See [1.15 FRONT FORK](#) for more information.

REMOVAL

1. Raise front wheel off floor. See [2.11 FRONT BRAKE CALIPER](#).
2. Remove front wheel. See [2.5 FRONT WHEEL](#).
3. Remove front fender. See [2.31 FENDERS](#).
4. Detach headlamp and loosen left and right headlamp brackets. See [7.18 HEADLAMP](#).
5. Loosen the four large pinch screws on both the upper and lower triple clamps.
6. Remove front forks through bottom of triple clamps and headlamp brackets. Support turn signals on headlamp brackets during removal.

DISASSEMBLY

1. See [Figure 2-50](#). Clean up fork and clamp vertically in a vise using FRONT FORK HOLDING TOOL (Part No. B-41177).
2. Turn adjuster assembly all the way counterclockwise to minimum damping.
3. See [Figure 2-52](#). Remove slider tube cap (1) (metric) with attached O-ring (2).
4. Depress spring (6) to release upper spring seat (3).
5. Remove spring collar (4), lower spring seat (5) and spring (6).
6. Pour out fork oil by pumping the slider tube and damper assembly 8-10 times. Stop pumping when damper assembly (9) moves freely.

NOTE

Fork oil may be changed at this point. See [1.15 FRONT FORK](#).

7. Clamp the slider horizontally in the FRONT FORK HOLDING TOOL (Part No. B-41177).
8. Remove screw (22) (metric) and washer (23). Discard washer.
9. Remove damper assembly.

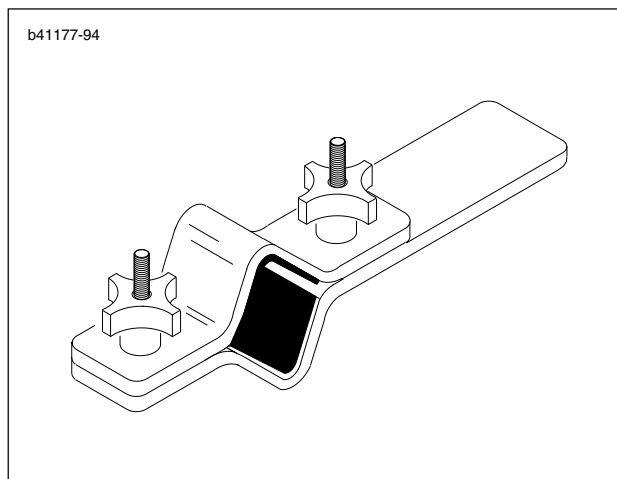


Figure 2-50. Front Fork Holding Tool (Part No. B-41177)

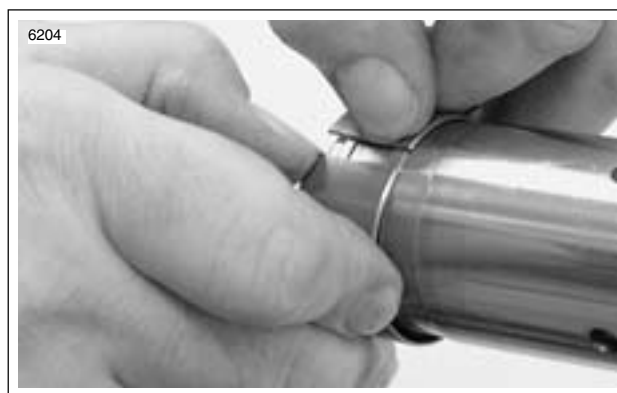


Figure 2-51. Removing Slider Tube Bushing

NOTE

The damper assembly contains no user serviceable parts.

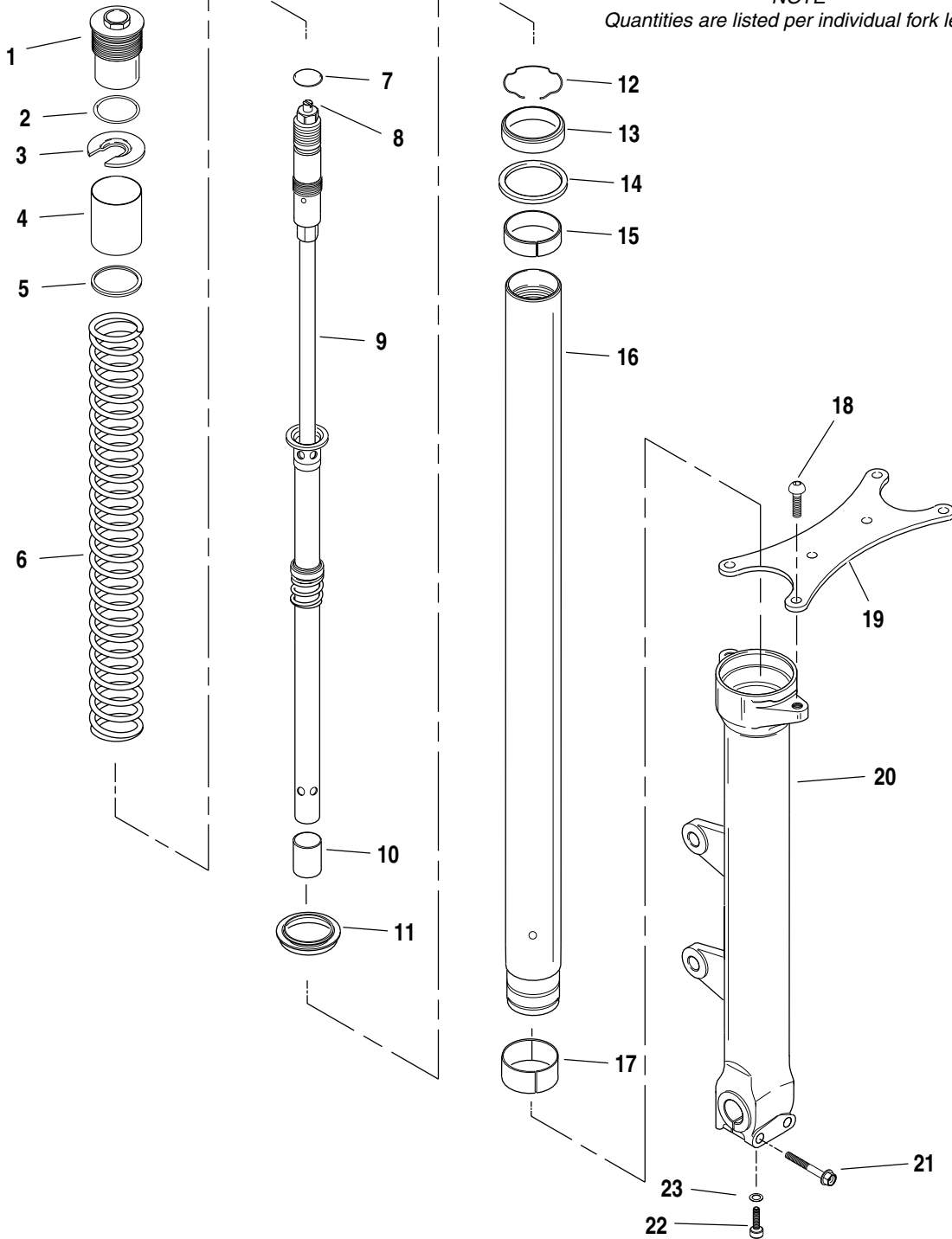
10. Remove dust seal (11) and retaining ring (12).
11. In quick, successive motions pull slider tube from slider. This will unseat upper bushing (15) from slider (20).
12. Remove oil seal (13), oil seal spacer (14) and upper bushing (15).

CAUTION

Do not damage the slider tube bushing, especially the sliding surface. Opening slider bushing more than necessary will result in the loss of tension. Damaged bushings must be replaced.

13. See [Figure 2-51](#). Carefully pry slider tube bushing apart with your fingers. When opened, remove slider tube bushing from slider tube.

b0376x2x



NOTE
Quantities are listed per individual fork leg.

- | | | | |
|-----------------------------|----------------------|-------------------------|---------------------------|
| 1. Slider Tube Cap (metric) | 6. Spring | 12. Retaining Ring | 18. Bolt (2) (metric) |
| 2. Slider Tube O-ring | 7. Damper O-ring | 13. Oil Seal | 19. Fork Brace |
| 3. Slider Seat (upper) | 8. Adjuster Assembly | 14. Oil Seal spacer | 20. Slider (left & right) |
| 4. Spring Collar | 9. Damper Assembly | 15. Bushing (upper) | 21. Screw (2) (metric) |
| 5. Spring Seat (lower) | 10. Lower Stop | 16. Slider Tube | 22. Screw (metric) |
| | 11. Dust Seal | 17. Slider Tube Bushing | 23. Washer |

Figure 2-52. Front Forks

CLEANING AND INSPECTION

1. Thoroughly clean and inspect all parts. Replace any parts that are bent, broken or damaged.
2. See [Figure 2-52](#). Inspect oil seal (13). Replace oil seals showing distortion.
3. Measure spring (6) free length. Replace springs with less than SERVICE WEAR LIMIT of:
M2 Models: 11.5 in. (292 mm)
M2L Models: 11.2 in. (284 mm)
4. Inspect slider tube (16) and slider (20). Check for score marks, scratches, excessive or abnormal wear. Slider tube surface should be shiny, smooth and free of scoring or abrasions. Replace any parts that are worn or damaged.
5. Set the slider tube on V-blocks and measure runout. Replace slider tubes with runout exceeding SERVICE WEAR LIMIT of 0.008 in. (0.2 mm).
6. Inspect upper bushing (15) and slider tube bushing (17) for wear or scratches. Replace any parts if copper appears on bushing surface or if the components are worn or damaged.

ASSEMBLY

1. See [Figure 2-52](#). Prepare parts before installation.
 - a. Apply fork oil to a **new** oil seal (13).
 - b. Spread fork oil over slider tube bushing (17) and upper bushing (15).
2. Install slider tube bushing into recess on slider tube (16).
3. Drop upper bushing (15) and oil seal spacer (14) around slider tube from end opposite slider tube bushing.
4. Insert slider tube into slider.
5. Using **seal** side of FORK SEAL/BOOT INSTALLER (Part No. B-42571), drive upper bushing and oil seal spacer into slider.
6. Install oil seal.
 - a. See [Figure 2-53](#). Place **plastic cone** of FORK SEAL/BOOT INSTALLER (Part No. B-42571) over end of slider tube.
 - b. Install **new** oil seal, lubricated with fork oil, on slider tube. Place lettered side of oil seal upward, facing retaining ring installed in the next step.
 - c. Using **seal** side of FORK SEAL/BOOT INSTALLER (Part No. B-42571), drive oil seal into slider.
7. See [Figure 2-52](#). Install retaining ring (12). Using **boot** side of FORK SEAL/BOOT INSTALLER (Part No. B-42571), install dust seal (11). Spring on surface of dust seal faces upward.
8. Install damper assembly.
 - a. Place lower stop (10) on damper assembly (9). Insert both parts into the slider tube with lower stop facing down.
 - b. Clamp fork horizontally.
 - c. Install **new** washer (23) and screw (22) (metric). Tighten to 11-18 ft-lbs (15-24 Nm).

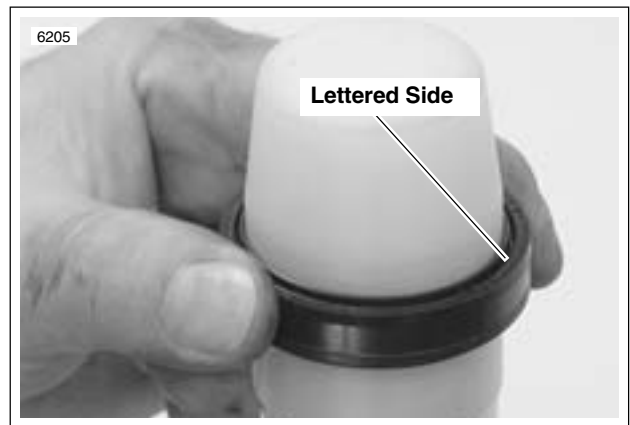


Figure 2-53. Installing Fork Seal

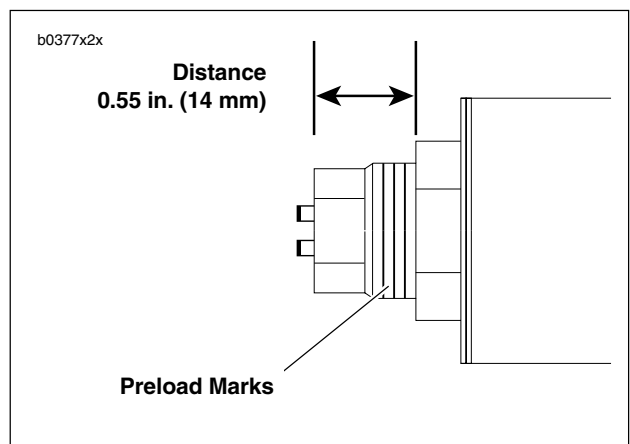


Figure 2-54. Spring Adjustment

9. Clamp fork upright in the fully compressed stage.
10. Fill fork with oil. See [1.15 FRONT FORK](#).
11. Apply oil to **new** damper O-ring and install.
12. Before installing the following components, wipe off any excess oil from the spring and spring collar.
 - a. Spring (6) has progressive wind. Install spring over damper assembly with closer spaced coils facing down.
 - b. Install lower spring seat (5), spring collar (4) and upper spring seat (3). Flat side of upper spring seat faces up.
13. Apply oil to **new** slider tube O-ring (2) and install.
14. Install slider tube cap (1) (metric) on damper assembly. Hold nut on damper assembly during installation.
15. Fasten slider tube cap (1) (metric) to slider tube. Tighten to 11-22 ft-lbs (15-30 Nm).
16. See [Figure 2-54](#). Set adjuster assembly to the factory position.
 - **M2 Models:** Turn slotted dial clockwise until it stops. Then turn counterclockwise 5/8 turn until the two dots align.
 - **M2L Models:** Turn slotted dial clockwise until it stops. Then turn counterclockwise 1 turn until the two dots align.

INSTALLATION

1. Insert fork tube through lower triple clamp, headlamp bracket and upper triple clamp.

NOTE

When installing the front forks, use a suitable tool to pry apart the triple clamps.

2. See [Figure 2-55](#). Position fork tubes so that top of each slider tube is flush with the top surface of upper triple clamp. Be sure that top surface of fork is not below top surface of upper triple clamp.

NOTE

The minimum distance from the top surface of the lower triple clamp to the top of fork slider tube must be 8.1318 in. (206.5477 mm) for M2 Models and 4.53 in. (115 mm) for M2L Models.

3. Install front fork triple clamp fasteners. Small screw installs at rear of upper triple clamp.
 - a. Spread LOCTITE ANTI-SEIZE on the last three threads of all five triple clamp pinch screws.
 - b. Tighten the four large screws to 18-20 ft-lbs (24-27 Nm).
 - c. If removed, tighten small screw to 10-12 ft-lbs (14-16 Nm).
4. Install headlamp brackets.
 - a. Position top of headlamp bracket directly below upper triple clamp.
 - b. Tighten headlamp bracket screws securely.
5. Install front fender. See [2.31 FENDERS](#).
6. Install front wheel. See [2.5 FRONT WHEEL](#).
7. Install front brake caliper. See [2.11 FRONT BRAKE CALIPER](#).
8. Attach and align headlamp. See [7.18 HEADLAMP](#).
9. Adjust front forks to rider preferences.
 - a. Set preload. See [1.12 PRELOAD ADJUSTMENT](#).
 - b. Set rebound damping. See [1.13 SUSPENSION DAMPING ADJUSTMENTS](#).

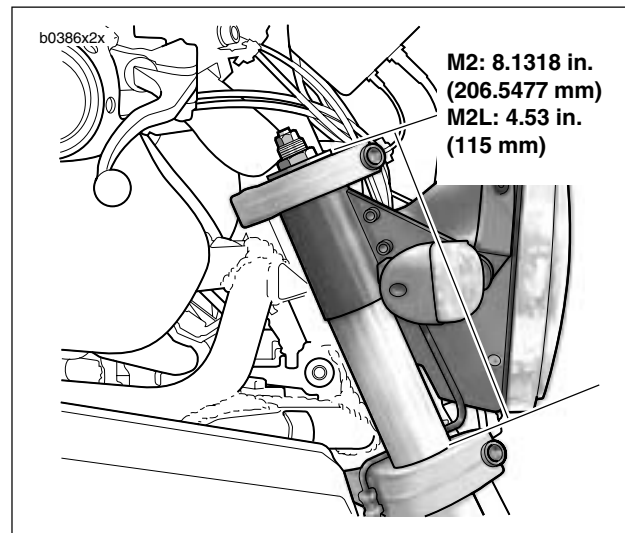


Figure 2-55. Aligning Front Forks

GENERAL

The fork stem and bracket assembly is the same for both M2 and M2L models.

REMOVAL/DISASSEMBLY

1. Remove fork assemblies. See 2.16 FRONT FORK.
2. See Figure 2-56. Remove all upper triple clamp screws (7, 11), fork stem bolt (1) and upper triple clamp (2).
3. Remove upper dust shield (3) and roller bearing (4).
4. Remove lower roller bearing.
 - a. Remove two lower triple clamp screws (7). Pull the lower triple clamp (6) downward.
 - b. The lower bearing cone is press fit on the fork stem. Chisel through outer bearing cage to allow rollers to fall free.
 - c. Apply heat to remove the remaining portion of bearing cone. Continuously move flame around its entire circumference until bearing falls free.
 - d. Remove lower dust shield (3).
5. If replacement of bearing cups (5) is necessary, drive cups from steering head using STEERING HEAD BEARING RACE REMOVER (Part No. HD-39301A) and UNIVERSAL DRIVER HANDLE (Part No HD-33416).
6. Remove set screw (10) to pull steering head lock (8) from frame.

CLEANING AND INSPECTION

See 1.15 FRONT FORK for adjustment procedures.

1. See Figure 2-56. Clean the dust shields (3), bearing cups (5), fork stem and lower triple clamp (6) and frame with solvent.
2. Carefully inspect bearing races and assemblies for pitting, scoring, wear and other damage. Replace damaged bearings (4) as a set (3, 4 and 5).
3. Check the fork stem and lower triple clamp (6) for damage. Replace if necessary.

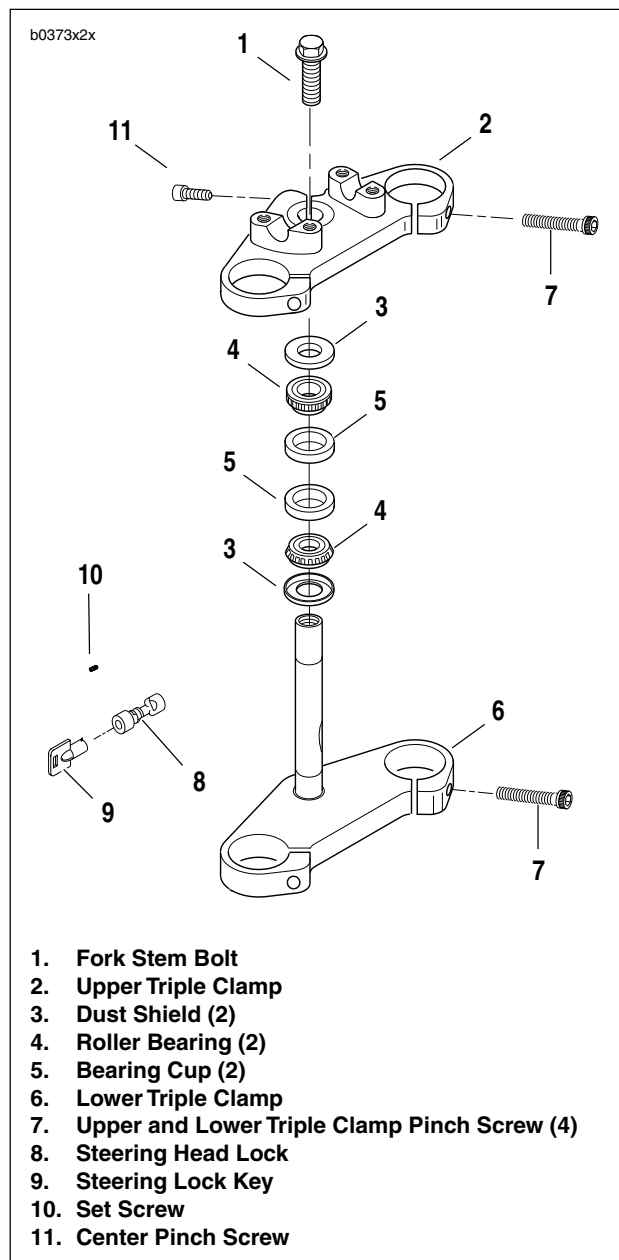


Figure 2-56. Fork Stem

ASSEMBLY/INSTALLATION

1. See [Figure 2-57](#). If removed, install **new** bearing cups into frame steering head using STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).
2. See [Figure 2-56](#). Install steering head lock (8) with set screw (10).
3. Liberally coat the bearing cones (4) with grease using WHEEL BEARING PACKER TOOL (Part No. HD-33067). Work the grease into the rollers.
4. Install lower bearing.
 - a. Place lower bearing dust shield (3) over fork stem.
 - b. Find a section of pipe having an inside diameter slightly larger than the outside diameter of the fork stem.
 - c. Press bearing (4) with small end up onto fork stem and lower triple clamp (6). Use the pipe as a press-on tool.
5. Insert lower triple clamp (6) through the steering head. Install the upper bearing (4) with small end down and dust shield (3) onto fork stem.
6. See [Figure 2-58](#). Apply LOCTITE ANTI-SEIZE to fork stem bolt (2). Loosely install upper triple clamp (3) using fork stem bolt.
7. Install fork assemblies. See [2.16 FRONT FORK](#).
8. Tighten fork stem bolt (2) until the bearings have no free-play. Make sure the fork stem turns freely, then tighten the fork stem clamp screw (1).
9. Check bearing adjustment. See [1.14 STEERING HEAD BEARINGS](#).

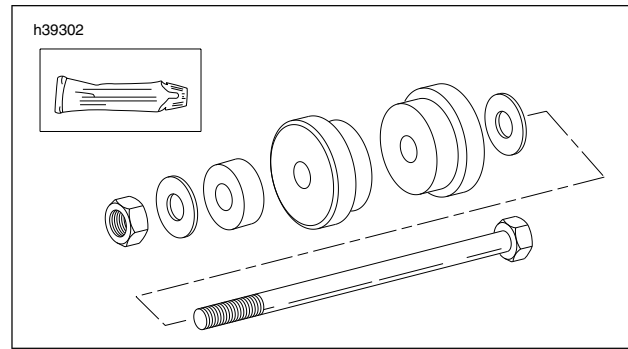
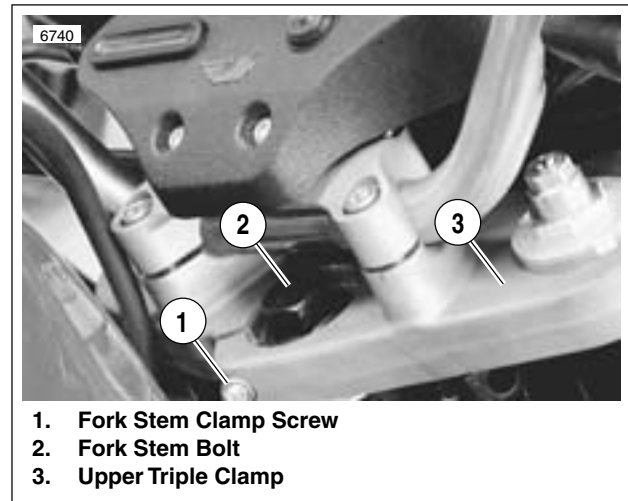


Figure 2-57. Steering Head Bearing Installer



1. Fork Stem Clamp Screw
2. Fork Stem Bolt
3. Upper Triple Clamp

Figure 2-58. Fork Stem Clamp

REMOVAL

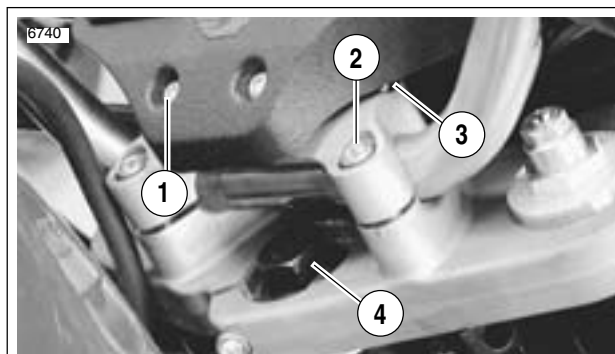
1. Raise front wheel off floor. See [1.15 FRONT FORK](#)
2. Detach windscreen. See [2.35 WINDSCREEN](#).
3. Loosen handlebars.
 - a. Place a protective cover over fuel tank and headlamp.
 - b. See [Figure 2-59](#). Detach instrument support by removing both support screws (1).
 - c. Remove rear clamp screws (2) and front clamp screws (3).
 - d. See [Figure 2-60](#). Place handlebar assembly on headlamp without stretching the attached cables.
4. Loosen the three upper triple clamp screws.
5. See [Figure 2-59](#). Slowly loosen fork stem bolt (4) until forks drop 0.5 in. (12.7 mm) in triple clamps.
6. See [Figure 2-61](#). Remove set screw (1) behind lock (2).
7. Extract steering head lock from fork stem.
 - a. Insert fork key in lock.
 - b. Lift front wheel upward.
 - c. Twist key to pull steering head lock from fork stem.
 - d. Release front wheel.

NOTE

Steering head lock is not repairable. Replace the unit if it fails.

INSTALLATION

1. Install steering head lock in fork stem.
 - a. See [Figure 2-61](#). Dished area of steering head lock faces front wheel.
 - b. Lift front wheel upward.
 - c. See [Figure 2-61](#). Lock (1) must be in the unlocked position to install. Insert lock with key openings positioned as shown.
 - d. Install set screw (1) and tighten.
 - e. Release front wheel.
2. See [Figure 2-59](#). Tighten fork stem bolt and triple clamp screws. Check bearing adjustment. See [1.15 FRONT FORK](#).
3. Install and adjust handlebars. See [1.21 HANDLEBARS](#).

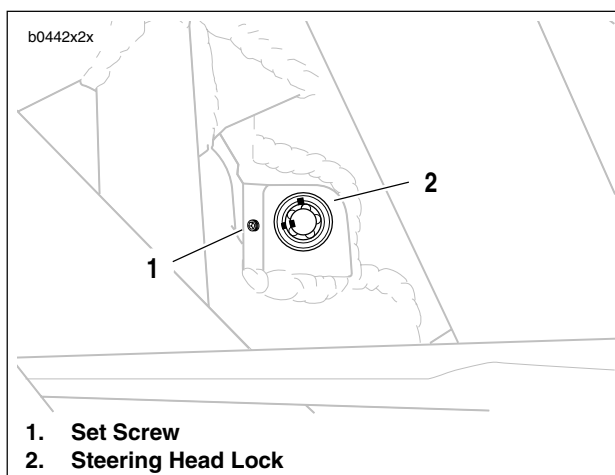


1. Instrument Support Screws (2)
2. Rear Clamp Screws (2)
3. Front Clamp Screws (2)
4. Fork Stem Bolt

Figure 2-59. Loosening Handlebars



Figure 2-60. Protective Covers



1. Set Screw
2. Steering Head Lock

Figure 2-61. Set Screw

⚠ WARNING

Do not operate vehicle with steering head locked. This will restrict the vehicle's turning ability which could result in death or serious injury.

4. Install set screw in lock. Test lock.
 - a. Turn handlebars all the way to the left.
 - b. Insert ignition key in lock.
 - c. Turn key clockwise while pushing in.
 - d. Remove key and verify that steering head is locked.
 - e. Unlock steering head by inserting key and turning key counterclockwise.
5. Install windscreen. See [2.35 WINDSCREEN](#)



Figure 2-62. Steering Head Lock

REMOVAL

NOTE

Mark all hardware as it is removed so that it may be returned to its original location.

1. Compress suspension to access rear fender fasteners. Remove rear fender and lower belt guard.
2. Place vehicle on a lift and anchor front wheel in place.

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

3. Disconnect **both** battery cables, negative cable first.
4. Remove seat and insert lifting straps under the frame tube of motorcycle.
5. Attach lifting straps to a floor hoist placed behind the lift. Raise motorcycle off lift until rear suspension is unloaded.
6. Remove mounting bolt attaching swingarm to rear shock.
7. See [Figure 2-63](#). Remove rear wheel. See [2.6 REAR WHEEL](#).
8. Remove cap from oil tank. See [Figure 2-64](#). Drain oil tank by removing clamp (2) from drain hose (1). Pull hose from drain plug (3).
9. Detach feed line from bottom of oil tank.
10. Detach rear brake pedal from master cylinder pushrod.

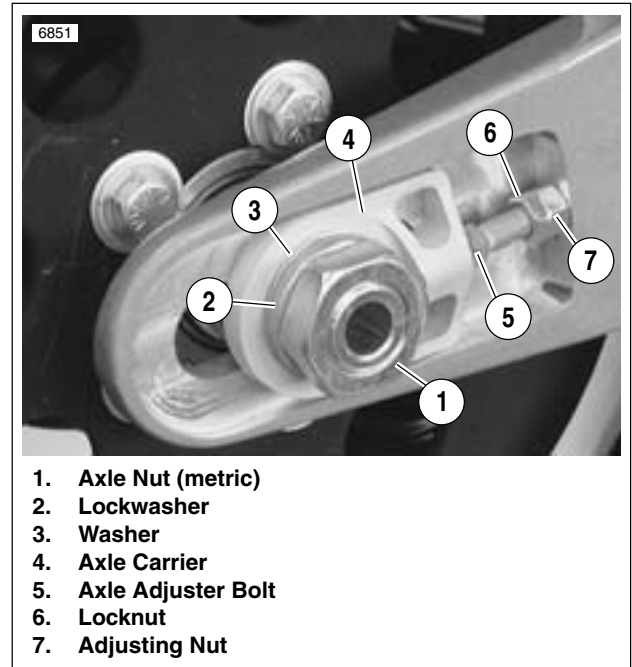


Figure 2-63. Rear Axle, Right Side

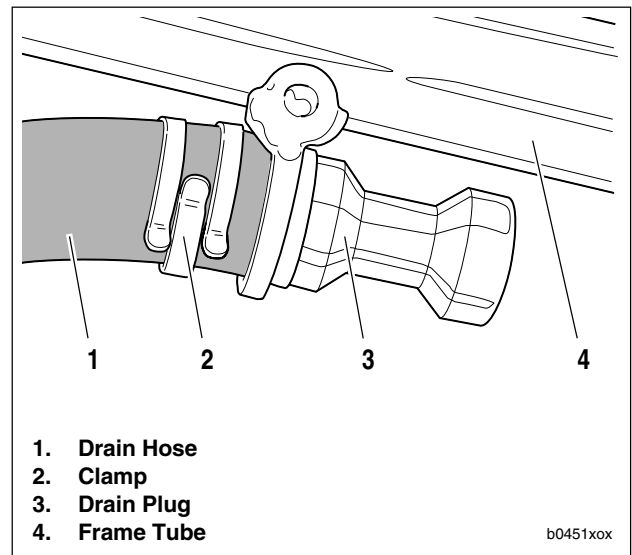


Figure 2-64. Oil Tank Drain, Typical

5. See [Figure 2-65](#). Place a jack under the crankcase.
6. Detach rear tie bar from swingarm.
7. See [Figure 2-66](#). Remove left and right isolator bolts and washers (1).

CAUTION

Remove oil filter before raising frame. Without removal, oil filter will be damaged during procedure.

8. Place a drip pan under the oil filter. Remove oil filter.
9. Using floor hoist, raise frame enough to remove both rubber isolators (2) from frame mounted pins.
10. Loosen swingarm pinch screw (10) on right side.
11. Remove threaded rod (5) from between bearing adjusting bolts (4, 8).
12. Loosen remaining swingarm pinch screw.
13. See [Figure 2-67](#). Using floor hoist, raise frame while pushing down on swingarm. Frame must be raised until bearing adjustment bolts (2) clear pin on frame and can be removed.

NOTE

If swingarm mount block doesn't drop from frame as lift is raised, insert the REAR ISOLATOR REPLACEMENT TOOL (Part No. B-44623) between mount block and frame on the right side first. NOTE: Ledge on tool should engage top of mount block. See [Figure 2-79](#).

14. See [Figure 2-79](#). Working on the right side first, insert the REAR ISOLATOR REPLACEMENT TOOL (Part No. B-44623) between mount block and frame. NOTE: Ledge on tool should engage top of mount block.
15. After removing both bearing adjustment bolts, remove swingarm.

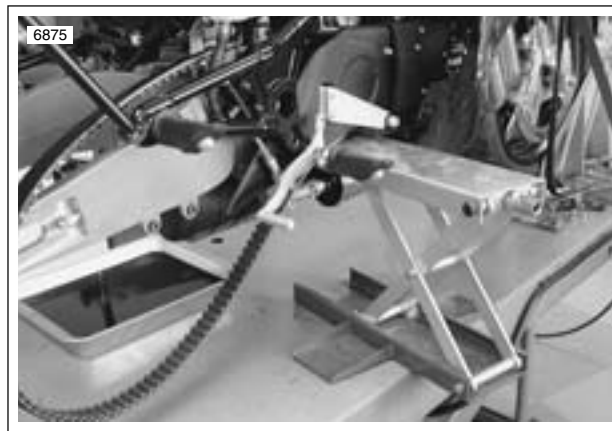


Figure 2-65. Scissors Jack

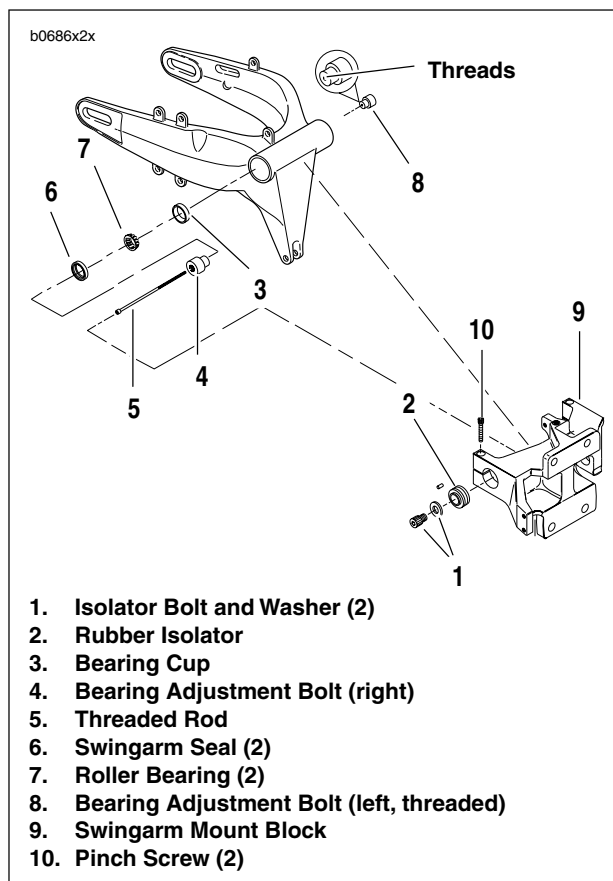


Figure 2-66. Swingarm Assembly (Typical)

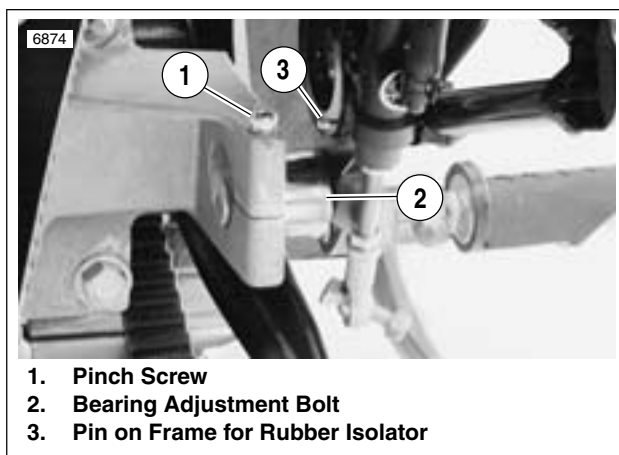


Figure 2-67. Swingarm Mount Block, Right Side

DISASSEMBLY

CAUTION

Carefully mark all bearing components as they are removed, so that they may be returned to their original locations. Do not intermix bearing components.

1. See Figure 2-66. Remove and discard both swingarm seals (6).
2. Remove roller bearings (7).

NOTE

Remove roller bearing cups (3) only if replacement is required. The complete bearing assembly must be replaced as a unit when replacement is necessary. Do not intermix bearing components.

3. See Figure 2-68. Carefully press roller bearing cups from swingarm using STEERING HEAD BEARING RACE REMOVER (Part No. HD-39301A) and UNIVERSAL DRIVER HANDLE (Part No. HD-33416).

CLEANING AND INSPECTION

1. Thoroughly clean all components in solvent.
2. Carefully inspect all bearing components for wear and/or corrosion. Replace complete bearing assembly if any component is damaged.
3. Check that swingarm is not bent or twisted. Replace if damaged.

ASSEMBLY

1. See Figure 2-69. If necessary, draw **new** roller bearing cups into swingarm using BEARING INSTALLATION BOLT (Part No. B-35316-5) and STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).

NOTE

Roller bearing assemblies should be replaced as a unit. Do not intermix components. Mark all components so they may be correctly installed.

2. Coat bearing components with WHEEL BEARING GREASE (Part No. HD-99855-89) and assemble.

3. See Figure 2-66. Install **new** swingarm seals (6) flush to the swingarm.
4. Slide swingarm assembly into position.

NOTE

See Figure 2-66. The left side bearing adjustment bolt (8) has additional internal threads.

5. Install bearing adjustment bolts (4, 8).
 - a. Apply LOCTITE THREADLOCKER 222 (purple) to the threaded rod (5).
 - b. Insert the rod through the right side bearing adjusting bolt (4).
 - c. Install and tighten left bearing adjustment bolt (8) (with internal threads) on left side of swingarm.
 - d. Tighten the left pinch screw (10) on the swingarm mount block (9). Do not tighten the right side pinch screw at this time.
 - e. Insert rod through swingarm into left side bearing adjustment bolt. Tighten to an initial torque of 11-12 ft-lbs (15-16 Nm).

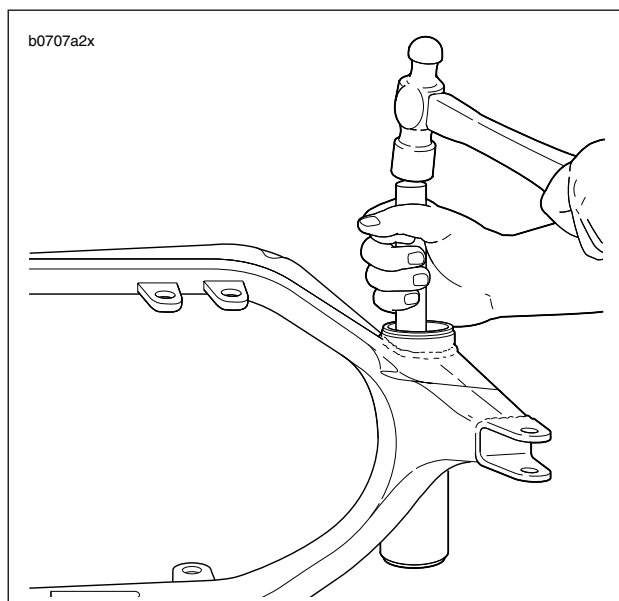


Figure 2-68. Removing Roller Bearing Cups

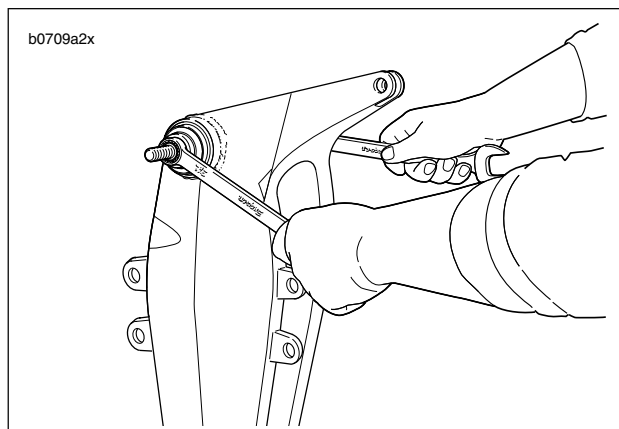


Figure 2-69. Installing Bearings into Swingarm

INSTALLATION

1. See [Figure 2-66](#). Align new swingarm between posts on swingarm mount block (9).
2. Insert left (threaded) and right bearing adjustment bolts (8, 4) into swingarm until flush with mount block surface.
3. Tighten left side swingarm pinch screw (10) to 18-20 ft-lbs (24-27 Nm).
4. Install threaded rod (5).
 - a. Apply **LOCTITE THREADLOCKER 222** (purple) to threaded rod.
 - b. Insert threaded rod through right side bearing adjustment bolt (4) into threads on left side bolt (8).
 - c. Verify that swingarm is centered between mounts.
 - d. Tighten rod to an initial torque of 11-12 ft-lbs (15-16 Nm).
5. Check swingarm preload using a scale as shown in [Figure 2-71](#). Preload should be 3.0-3.75 lbs (1.36-1.70 kg). If preload does not meet specifications, tighten or loosen threaded rod and recheck.
6. See [Figure 2-66](#). Secure swingarm in place.
 - a. Remove both pinch screws (10).
 - b. Apply **LOCTITE THREADLOCKER 243** (blue) to threads of pinch screws.
 - c. Install both pinch screws. Tighten to 18-20 ft-lbs (24-27 Nm).
7. Insert **REAR ISOLATOR REPLACEMENT TOOL** (Part No. B-44623) between mount block and frame. **NOTE:** Ledge on tool should engage top of mount block.
8. Position rear isolators in mounting position. Slowly lower frame to place rubber isolators in front of bearing adjustment bolts.
9. Install isolator bolts. See [2.20 REAR ISOLATORS](#) for complete procedure.
 - a. Apply **LOCTITE THREADLOCKER 271** (red) to threads of both isolator bolts. Apply **LOCTITE ANTI-SEIZE** to underside of TORX bolt head.
 - b. Install isolator bolts and washers (1) through rubber isolators and into bearing adjustment bolts (4, 8).
 - c. Tighten to 63-70 ft-lbs (85-95 Nm).
10. Attach rear tie bar to swingarm mount block. Tighten to 30-33 ft-lbs (41-45 Nm).
11. Remove scissors jack from under crankcase.
12. Install rear shock bolt (metric). Tighten to 30-33 ft-lbs (41-45 Nm).
13. Attach feed and drain lines to oil tank and frame. Install filter and fill motorcycle with 2.0 quarts (1.89 liters) of recommended oil. See [1.2 FLUID REQUIREMENTS](#).
14. Attach rear brake pedal to master cylinder pushrod.
15. Install rear wheel.
 - a. Wipe any grease or dust from rear axle. Apply **LOCTITE ANTI-SEIZE LUBRICANT** to axle.
 - b. See [Figure 2-72](#). Insert axle (1) through washer (2) so that rounded side of washer will face swingarm. Continue through left side of swingarm, rear brake caliper mount (3) and wheel assembly.

- c. See [Figure 2-63](#). Place spacer between wheel hub and right side of swingarm. Slide axle through spacer and swingarm.
- d. Place washer (3) on axle with rounded side facing swingarm. Install lockwasher (2) and axle nut (1) (metric). Do not fully tighten rear axle nut at this time.

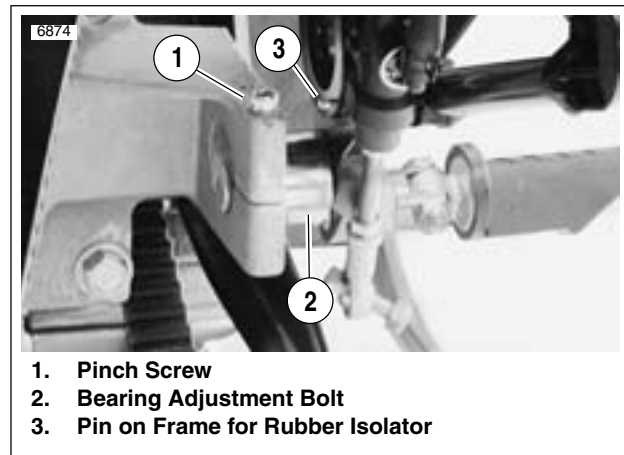


Figure 2-70. Swingarm Mount Block, Right Side

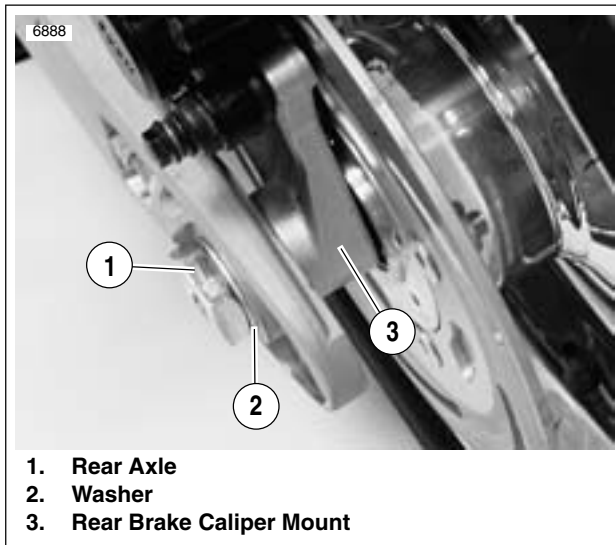


Figure 2-71. Checking Preload

16. Set axle alignment and belt deflection. See [1.9 DRIVE BELT DEFLECTION](#).
 - a. See [Figure 2-73](#). Check rear axle alignment.
 - b. See [Figure 2-74](#). Check belt deflection.
 - c. Proceed to the next step when both axle alignment and belt deflection are correct.
17. See [Figure 2-75](#). Tighten locknut (2) flush against adjusting nut (3). Tighten axle nut (metric) to 66-73 ft-lbs (90-99 Nm). Verify that belt deflection is correct. Lower motorcycle onto lift.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.



1. Rear Axle
2. Washer
3. Rear Brake Caliper Mount

Figure 2-72. Rear Axle, Left Side

18. Remove lifting straps and install seat.

WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

19. Attach both battery cables, positive cable first.
20. Remove motorcycle from lift.
21. Compress suspension to install rear fender and lower belt guard.
22. Check oil level after starting motorcycle and allowing it to reach operating temperature.

WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

23. Check rear brake operation.

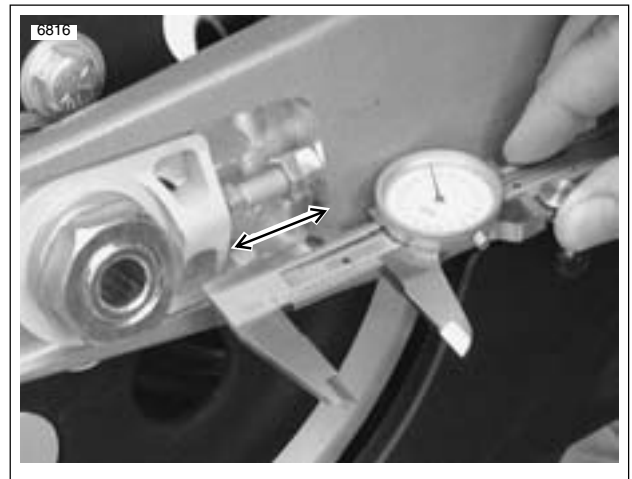


Figure 2-73. Checking Rear Wheel Alignment, Right Side Shown

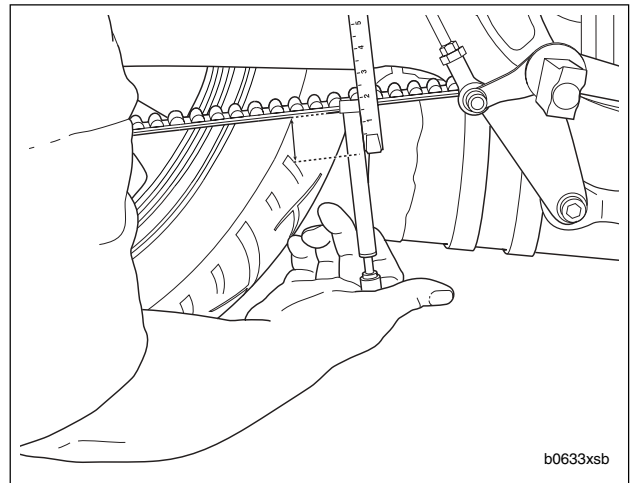
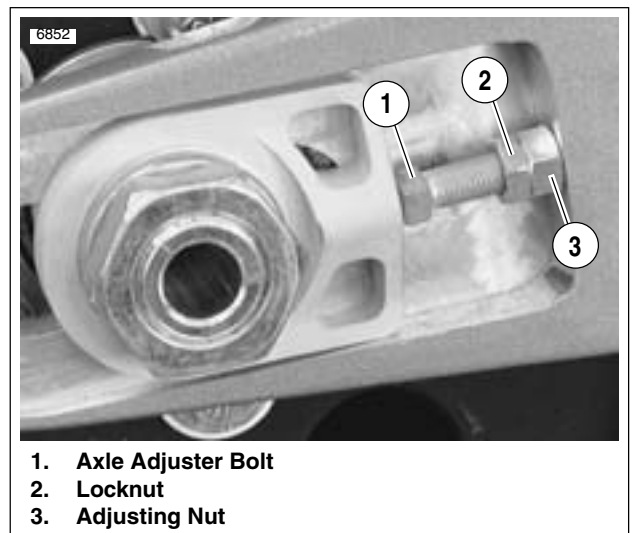


Figure 2-74. Belt Deflection



1. Axle Adjuster Bolt
2. Locknut
3. Adjusting Nut

Figure 2-75. Axle Adjuster Bolt, Right Side Shown

REMOVAL

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

WARNING

Always disconnect the negative battery cable first. If the positive battery cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect **both** battery cables from battery, negative cable first.
2. Remove seat and fuel tank. See 2.36 SEAT and 4.5 FUEL TANK.
3. Remove the left side rider footpeg mounting bolt and footpeg. Allow footpeg and shift linkage to hang being careful not to scratch primary cover.
4. See Figure 2-76. On the right side of the motorcycle, remove the front sprocket cover assembly.
5. See Figure 2-76. Remove two screws that attach sprocket cover to the backside of the swingarm/drive support. Retain screws.

NOTE

See Figure 2-77. Route strap under frame rails with tail section installed. Make sure strap is in "V" formed by frame rails to prevent rearward movement and that it does not pinch wiring harness, vent lines or cables.

6. See Figure 2-77. Strap tail section of frame to overhead beam or hoist and put slight tension on strap to secure frame assembly.
7. See Figure 2-78. Remove frame side tie bar mounting hardware from front lower and center tie bars. Leave fourth tie bar (front upper) attached to both frame and engine.
8. See Figure 2-78. Remove rear tie bar bolt, lockwasher and washers from mount block.
9. See Figure 2-78. Loosen left side isolator bolt from swing arm bearing adjusting bolt. Do not remove.
10. See Figure 2-78. Remove right side isolator bolt and washer from swingarm bearing adjustment bolt.

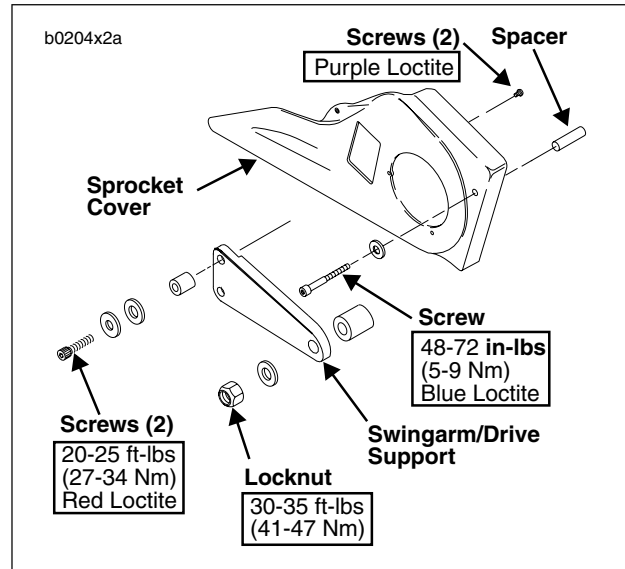


Figure 2-76. Sprocket Cover

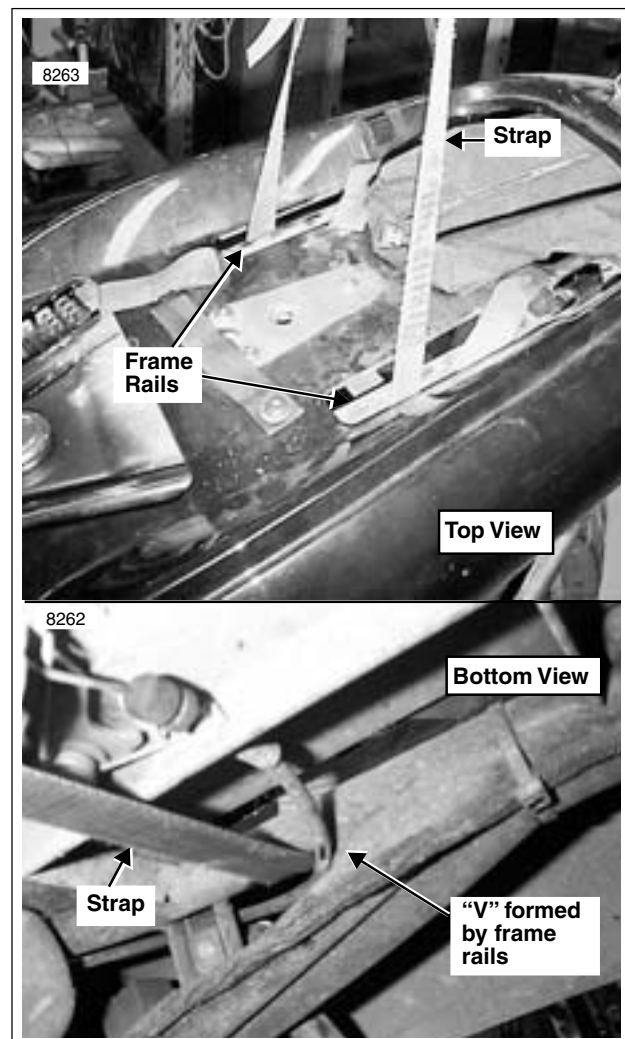


Figure 2-77. Floor Hoist

- See [Figure 2-79](#). Working on the right side first, insert the REAR ISOLATOR REPLACEMENT TOOL (Part No. B-44623) between mount block and frame. NOTE: Ledge on tool should engage top of mount block.

CAUTION

Do not alter tool or shim in an attempt to spread frame further than tool will allow. Failure to comply may result in frame distortion or damage.

- Turn nut on rear isolator replacement tool clockwise to expand frame from swingarm mount block until isolator can be removed. Nut will stop when limit of travel is reached.
- Disengage right side rear isolator from roll pin in frame by pulling inboard. Remove isolator by pulling out from 5:00 or 6:00 position.
- Remove rear isolator replacement tool by turning nut counterclockwise.
- Remove left side isolator bolt and washer from bearing adjusting bolt. Retain washer.
- Remove nut and back out bolt (until flush with the mount block) from upper rear of muffler Z bracket and swingarm mount block.
- Pull frame to left and remove left side isolator from 6:00 or 7:00 position.

INSPECTION

NOTE

If roll pin protrudes beyond specification, check to make sure it is fully seated. A channel lock pliers may be used to squeeze/push roll pin in. Protect frame with a shop rag when using pliers.

See [Figure 2-80](#). Measure isolator roll pin protrusion on both left and right isolator mounts with calipers or metal rule. Roll pin should not protrude more than 0.120 in. (3 mm). If roll pin protrudes more than 0.120 in. (3 mm) file or grind until within specification; 0.080-0.120 in. (2.032-3.048 mm). Use care when filing to avoid creating sharp edges.

INSTALLATION

- On left side of motorcycle, align locator hole with roll pin and install left rear isolator provided in kit. The left isolator backing plate has an "L" stamped on it.
- Move to right side of motorcycle. Lower the frame approximately two inches with the hoist to allow clearance between isolator replacement tool.
- See [Figure 2-79](#). On right side of motorcycle, insert rear isolator replacement tool between mount block and frame.

CAUTION

Do not alter tool or shim in an attempt to spread frame further than tool will allow. Failure to comply may result in frame distortion or damage.

- Turn nut on tool clockwise to expand frame from mount block. Nut will stop when limit of travel is reached.

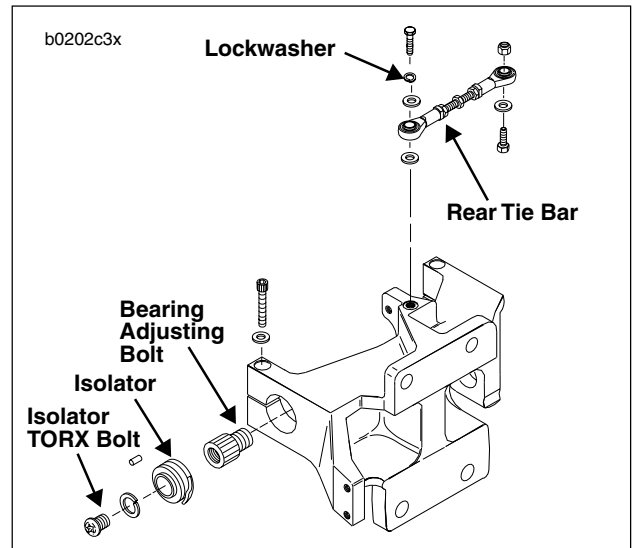


Figure 2-78. Mount Block

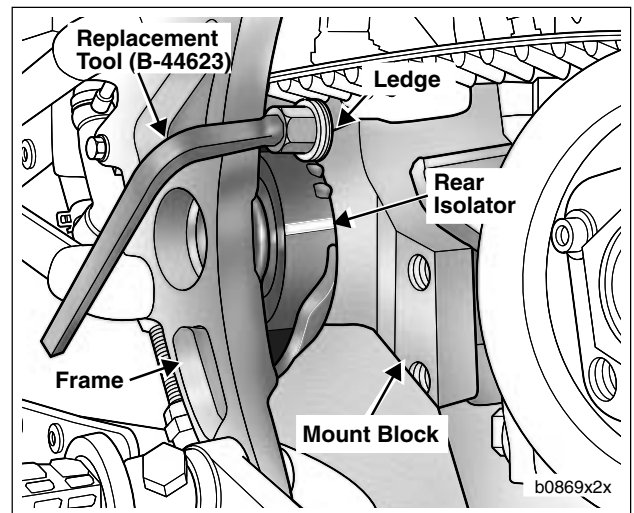


Figure 2-79. Rear Isolator Replacement Tool In Use

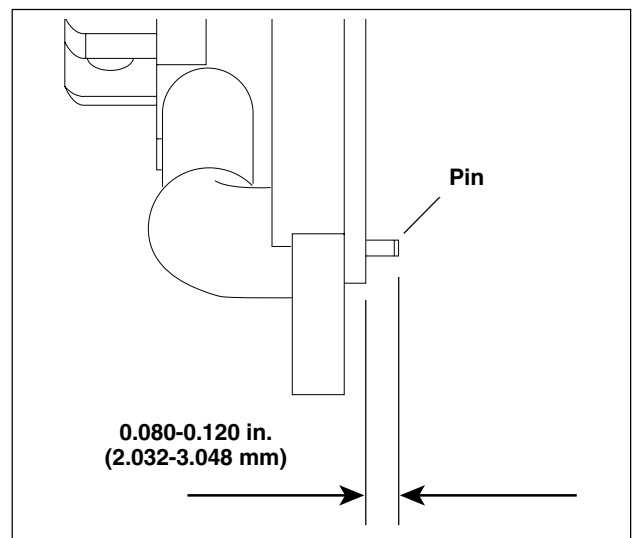


Figure 2-80. Measuring Roll Pin Protrusion

5. On right side of motorcycle, align locator hole with roll pin and install right rear isolator provided in kit. The right isolator backing plate has an "R" stamped on it.
6. Turn nut on tool counterclockwise to allow frame to return to position. Remove tool from between frame and mount block.
7. Raise frame with hoist to align isolator bolt holes with threaded holes in bearing adjusting bolts.
8. Mark a horizontal line across the front of each isolator with a light colored grease pencil or by other non-permanent means.
9. Apply anti-seize to underside of isolator bolt heads.

CAUTION

Use caution when installing isolator bolts. Make sure isolator bolt hole is aligned with threaded hole in bearing adjusting bolt to avoid cross-threading bolt.

10. See [Figure 2-78](#). Install isolator TORX bolts and washers through both rubber isolators into bearing adjustment bolts on each side.

CAUTION

See [Figure 2-81](#). Observe marked line on both rubber isolators after isolator bolts are tightened. If line twists, apply more LOCTITE ANTI-SEIZE to underside of isolator bolt heads. Failure to comply will result in damage to rubber isolators.

11. Tighten right and left isolator bolts to 63-70 ft-lbs (85-95 Nm).
12. Push rear upper Z bracket bolt until it protrudes from mount block and install nut. Tighten rear upper Z-bracket bolt to 22-24 ft-lbs (30-33 Nm).
13. Erase grease pencil marked lines from both isolators.
14. Install front lower and center tie bars to frame with original locknuts. Tighten bolts to 30-33 ft-lbs (41-45 Nm). Install rear tie bar to mount block with lockwasher. Tighten bolt to 30-33 ft-lbs. (41-45 Nm).
15. Remove hoist from tail section.
16. Install left side rider footpeg. Tighten bolt to 25-30 ft-lbs (34-41 Nm).
17. See [Figure 2-76](#). Apply LOCTITE THREADLOCKER 243 (Blue) to threads of two sprocket cover to swingarm/drive support screws and install new sprocket cover to swingarm/drive support.
18. See [Figure 2-76](#). Install sprocket cover assembly with original hardware.
 - a. Apply LOCTITE THREADLOCKER 243 (blue) to screw. Install sprocket cover assembly with screw, washer and spacer. Tighten to 48-72 **in-lbs** (5-9 Nm).
 - b. Apply LOCTITE THREADLOCKER 272 (red) to swingarm/drive support mounting screws and install. Tighten screws to 20-25 ft-lbs (27-34 Nm).
 - c. Install locknut and washer. Tighten to 30-35 ft-lbs (41-47 Nm).

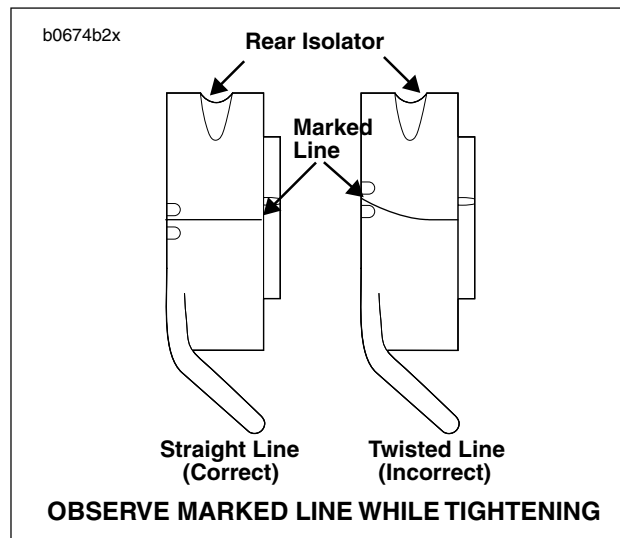


Figure 2-81. Isolator Alignment

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

19. Install fuel tank and seat. See [2.36 SEAT](#) and [4.5 FUEL TANK](#).

WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion, which could result in death or serious injury.

20. Connect battery cables, positive cable first, to battery terminals.
21. Test ride motorcycle at low speed and check for proper operation.

GENERAL

See [Figure 2-83](#). The rear suspension is controlled by the shock absorber. The shock allows adjustment of rear compression and rebound damping and spring preload.

The most important rear shock adjustment is the preload setting. Before making any damping adjustments, set the proper preload. See [1.12 PRELOAD ADJUSTMENT](#).

NOTE

The rear shock absorber contains no user serviceable parts.

REMOVAL

1. Lift rear wheel off ground using REAR WHEEL SUPPORT STAND (Part No. B-41174)
2. Remove seat and attach lifting straps to motorcycle. Insert lifting straps under frame tubes. It is not necessary to remove tail section.
3. Attach lifting straps to a floor hoist placed behind the motorcycle. Raise motorcycle off lift until rear suspension is unloaded.
4. Use a flex socket and extension to remove locknut and washer from front reservoir clamp. Discard clamp and locknut.
5. Loosen rear reservoir clamp. Slide reservoir and mount block out of clamp. Remove and discard clamp.
6. See [Figure 2-82](#). Remove allen screw (metric) and locknut on front mount. Discard locknut.
7. While supporting the shock absorber, remove the allen screw (metric) and locknut from the rear mount. Discard locknut.
8. Remove shock absorber assembly.

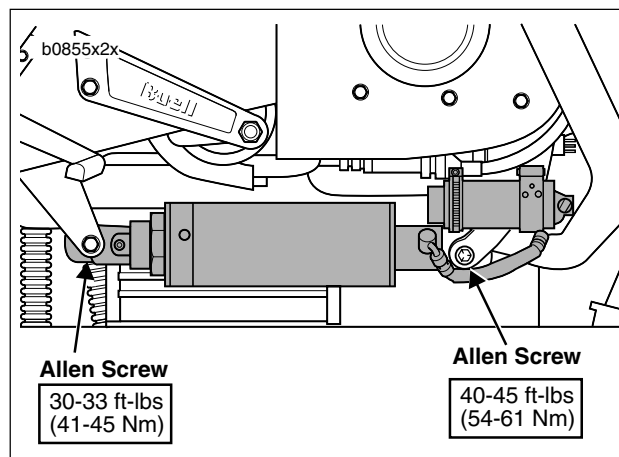


Figure 2-82. Shock Mounting Hardware

INSTALLATION

1. See [Figure 2-83](#). Place **new** bushings into mounting holes of shock absorber (if only replacing bushings).
2. See [Figure 2-82](#). Loosely install rear allen screw (metric) and **new** locknut.
3. Loosely install front allen screw (metric) and **new** locknut.
4. Install rear clamp over front oil pump fitting.
5. Slide reservoir through rear clamp.
6. Position front clamp over reservoir and loosely install front reservoir clamp to front shock mount with washer and nylon locknut.
7. Install reservoir mount block between oil pump fitting and remote reservoir.
8. Tighten clamps around reservoir.

NOTE

Tighten front hardware from the screw side only. Tighten rear hardware from the nut side only.

9. Tighten front allen screw to 40-45 ft-lbs (54-61 Nm).
10. Tighten rear locknut to 30-33 ft-lbs (41-45 Nm).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

11. Remove lifting straps and install seat. See [2.36 SEAT](#).
12. Check rear shock preload. See [1.12 PRELOAD ADJUSTMENT](#).

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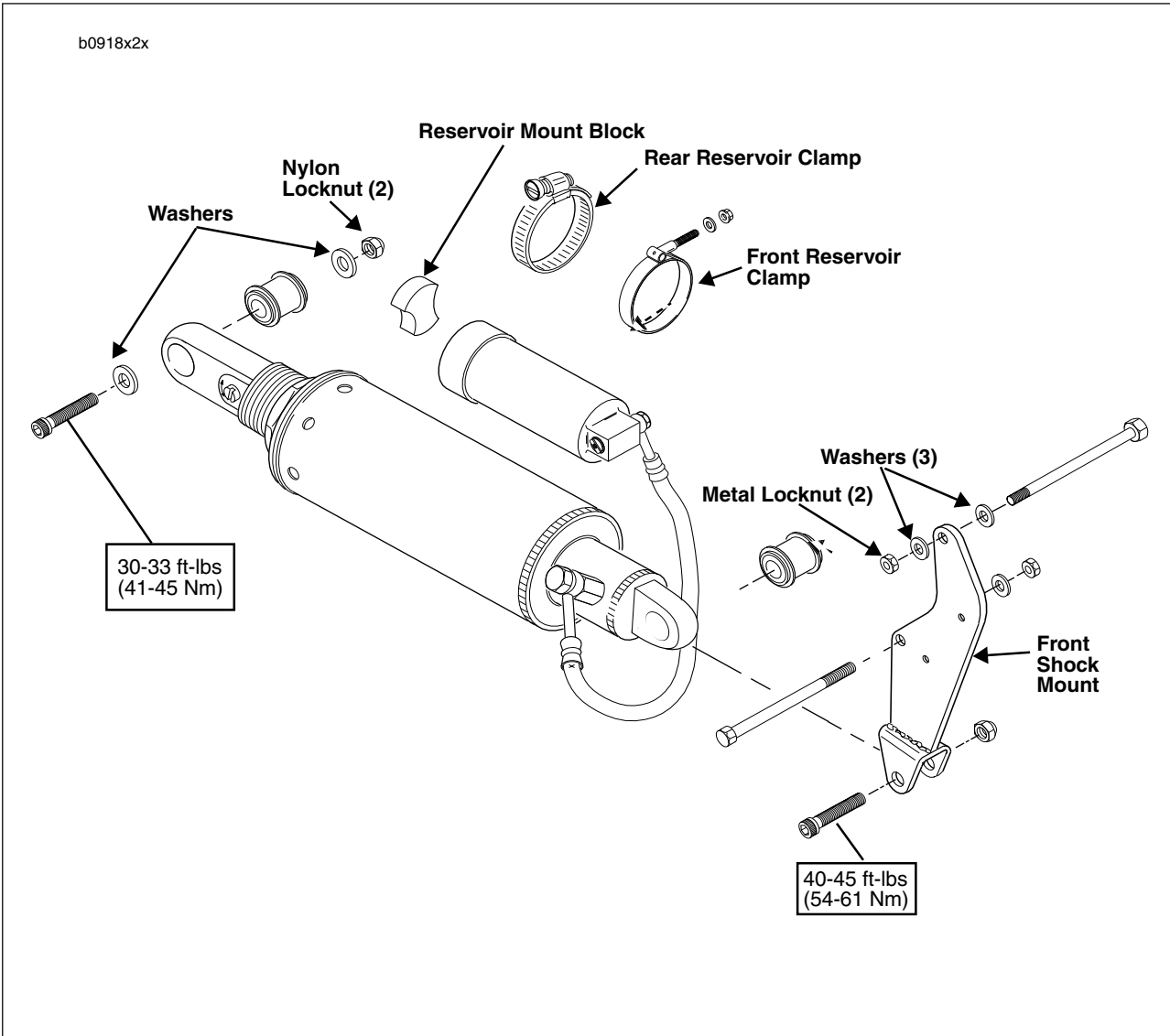


Figure 2-83. Rear Shock Absorber

DEFINITIONS

- **Damping:** Resistance to movement. Damping affects how easily the suspension can move and limits oscillations of the system once movement has begun.
- **Compression:** Suspension is compressed when the wheel moves upward.
- **Rebound:** The suspension is rebounding when it is moving back from being compressed.
- **Vehicle Sag:** The amount the rear shock and fork springs are compressed by the weight of the motorcycle.
- **Rider Sag:** The amount the rear shock and fork springs are compressed by the weight of the rider.
- **Preload:** An adjustment made to the rear shock and fork springs (if applicable) to limit vehicle and rider sag to a standard percentage of total suspension travel. Proper preload adjustment allows the suspension to absorb most bumps without bottoming.

GENERAL

WARNING

Before evaluating and adjusting suspension settings, check the motorcycle's tires. Tires must be in good condition and properly inflated. Failure to check the tires could result in death or serious injury.

See Figure 2-84. The rear shock absorber allows for adjustment of compression and rebound damping and spring preload. See Figure 2-85.

See Figure 2-86. The front fork allows adjustment of spring preload and rebound damping.

If the rear preload adjustment is correct, and you have the rebound and compression damping set at the factory recommended points, the motorcycle should handle and ride properly. If you are unhappy with these settings they can be changed according to the following procedures.

NOTE

Evaluating and changing the rebound and compression damping is a very subjective process. Many variables affect motorcycle handling under different circumstances. Approach all changes carefully.

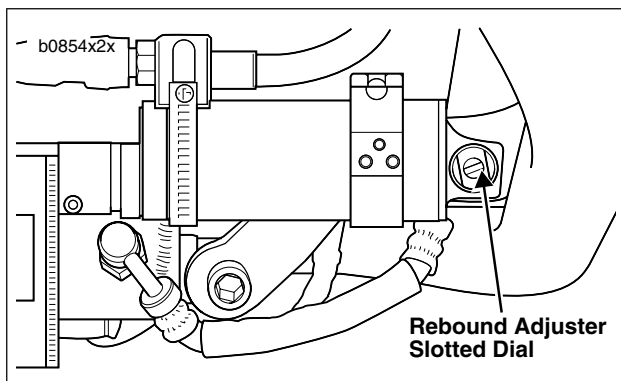


Figure 2-84. M2/M2L Rear Shock Rebound Adjustment

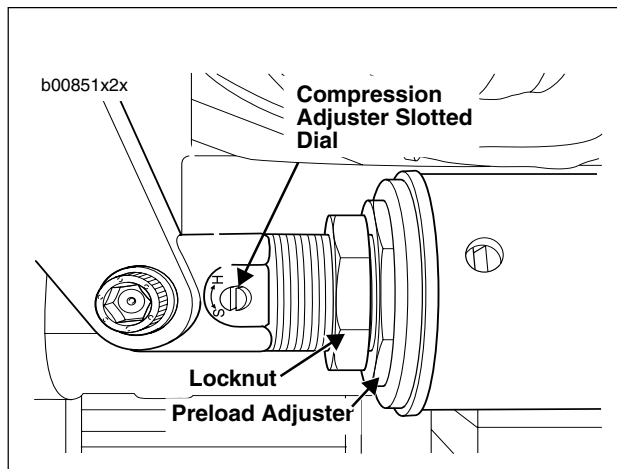


Figure 2-85. M2/M2L Rear Shock Compression and Preload Adjustment

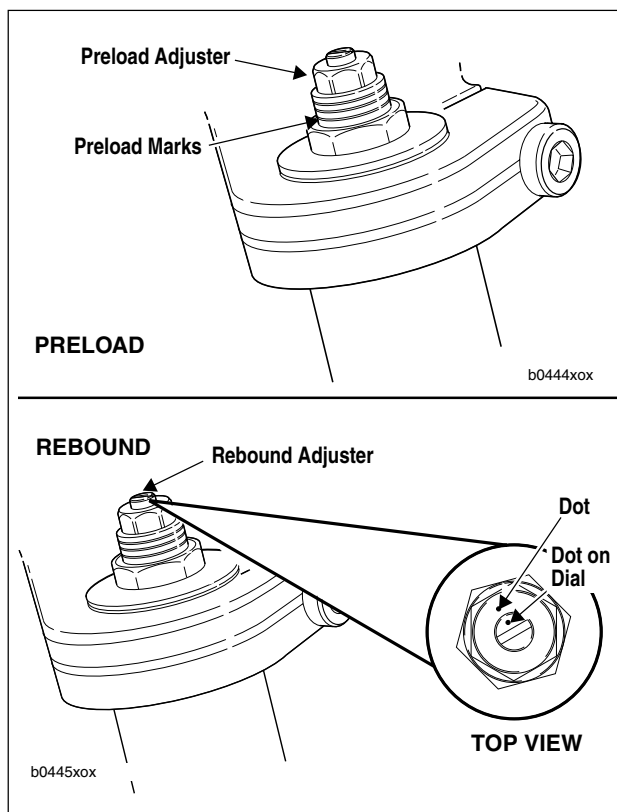


Figure 2-86. Front Fork Preload and Rebound Adjusters

SPRING PRELOAD

Adjust rear spring preload before attempting any other adjustments. See [1.12 PRELOAD ADJUSTMENT](#). Optimal rear suspension spring preload assures that the rear shock has enough travel to absorb most bumps without bottoming.

Improper preload will adversely affect both motorcycle handling and ride quality. Correct preload settings will result in a motorcycle that suits the rider's size and weight.

Adjust these settings before the motorcycle is ridden any distance. Your Buell dealer can assist you if necessary.

ADJUSTMENTS

Evaluating and changing the rebound and compression damping is a very subjective process. A good performing suspension finds a proper balance between spring, spring preload, damping, track conditions and riding speed. However, all settings are at best a compromise. If a rider fails to find a good set-up, go back to the factory recommended settings and start over again.

Make all suspension adjustments in one or two click increments. Adjusting more than one or two clicks at a time may cause you to skip the best adjustment. Test ride after each adjustment. When an adjustment makes no difference, return to the previous adjustment and try a different approach.

To find the optimum settings you will need the preload properly adjusted, the tires properly inflated and a familiar bumpy road. It is useful if the road contains a variety of different bumps from small sharp bumps such as potholes or frost heaves to large undulations. Begin the process by putting all the damping adjustments at the factory recommended settings. Ride the bike over a variety of different surfaces and bumps at different speeds. When the suspension is set properly the motorcycle will be stable and comfortable.

REAR SHOCK DAMPING ADJUSTMENTS

Beyond the rear preload adjustment, the rear shock can also be adjusted for compression and rebound damping. However, it is important to note the rear preload must be set correctly before performing any other adjustments.

See [Figure 2-84](#). Adjust **rebound** damping using the slotted dial on the remote reservoir at the front of the shock.

- **M2 Models:** Factory setting-full damping minus 1.5 turn.
- **M2L Models:** Factory setting-full damping minus 1.0 turn.

See [Figure 2-85](#). Adjust **compression** damping using the slotted dial at the rear of the shock.

- **M2 Models:** Factory setting-full damping minus 2.25 turns.
- **M2L Models:** Factory setting-full damping minus 2.5 turns.

Recommended Damping Settings (M2)

SETTINGS	SOLO (STD)	2 UP	SOLO (FIRM)	SOLO (SOFT)
Front Rebound	1	1	1	1.5
Front Compression	N/A	N/A	N/A	N/A
Rear Rebound	1.5	0.5	0.5	3
Rear Compression	2.25	0.25	0.75	MIN

Recommended Damping Settings (M2L)

SETTINGS	SOLO (STD)	2 UP	SOLO (FIRM)	SOLO (SOFT)
Front Rebound	0.5	1	0.5	1
Front Compression	N/A	N/A	N/A	N/A
Rear Rebound	1	0.5	0.5	2.5
Rear Compression	2.5	0.5	1.25	MIN

Adjusting Rear Shock

1. See [Figure 2-84](#). See [Figure 2-85](#). Using a screwdriver, turn the slotted dial on the appropriate adjuster clockwise until it stops. This is the maximum damping setting for that preload setting.
2. Turn the appropriate dial counterclockwise the recommended amount to align the reference marks. This is the recommended factory setting.

FRONT FORK DAMPING ADJUSTMENTS



Always adjust each fork leg to the same settings. Uneven adjustment between left and right forks may lead to a loss of control which could result in death or serious injury.

See [Figure 2-86](#). Use the slotted dial on top of each fork leg to adjust **rebound** damping.

- **M2 Models:** Factory setting-full damping minus 1 turn.
 - **M2L Models:** Factory setting-full damping minus 0.5 turn
1. Using a screwdriver, turn the slotted dial clockwise until it stops. This is the maximum damping setting for that adjustment.
 2. Turn the dial counterclockwise the recommended amount to align the reference marks (dots). This is the factory recommended setting.
 3. Duplicate the setting on the other fork leg.

TROUBLESHOOTING

WARNING

This section is intended solely as a guide to diagnosing problems. Carefully read the appropriate sections of this manual before performing any work. Improper suspension adjustments may cause loss of control which could result in death or serious injury.

The following tables list possible suspension and operating troubles and their probable causes. Use the tables to keep your motorcycle in good operating condition.

When making adjustments, remember there are two mediums in setting up a bike, geometry and suspension. Both components work together because suspension is a part of geometry. In order to solve handling problems, it is important to diagnose the problem's true nature. Chattering, sliding or an uncomfortable feeling are suspension-related. Handling and a swinging fork are geometry-related, but often these unwanted characteristics can be solved by suspension adjustments.

Table 2-4. General Suspension Problems

TROUBLESHOOTING CONDITION	ADJUSTMENT SOLUTION
Bike wallows through turns. Feels loose or vague after bumps. Wheel tends to “pogo” after passing over a bump. This is noticeable by watching the bike continue to bounce as it travels over multiple bumps.	Increase rebound damping.
Wheel responds to bump, but doesn’t return to ground quickly after bumps. This is more pronounced over a series of bumps and is often referred to as “packing down.”	Reduce rebound damping.
The bike bottoms out or dips while cornering. Bike has excessive brake dive.	Increase compression damping.
Harsh ride particularly over washboard surfaces. Bumps kick through handlebars or seat. Suspension seems not to respond to bumps. This is evidenced by tire chattering (a movement with short stroke and high frequency) through corners or by jolting the rider over rough roads.	Reduce compression damping.

Table 2-5. Rear Suspension Problems

TROUBLESHOOTING CONDITION	ADJUSTMENT SOLUTION
“Pumping on the Rear” occurs when you are accelerating out of a corner. This problem occurs in two varieties. 1. The first type has a movement with a long stroke and a high frequency. 2. The second version has a movement with a short stroke and high frequency.	1. The shock is too soft. Increase compression damping. If the adjuster is already set to the maximum, add more preload to the spring (one turn maximum). 2. In this case the shock is too hard. Decrease compression damping.
Chattering during braking.	Decrease the compression damping. If the problem persists, decrease rebound damping for a faster rebound rate. Less spring preload may also help.
Lack of tire feedback.	The suspension is too soft. Increase compression damping.
Sliding during cornering. Sliding may occur going into the corner or accelerating out of the corner.	The suspension is too hard. Decrease compression damping.

Table 2-6. Front Suspension Problems

TROUBLESHOOTING CONDITION	ADJUSTMENT SOLUTION
Not absorbing bumps.	A good suspension is a balance between damping and track condition. Finding this balance requires exploring all possible compression settings.
Lack of tire feedback.	Increase compression damping.
Tire slides.	Decrease compression damping.

REMOVAL/DISASSEMBLY

1. See [Figure 2-87](#). Slide rubber boot (5) off the cable adjusters (4). Loosen cable adjuster lock (3) on each adjuster.
2. See [Figure 2-88](#). Remove two screws (1, 6) on front housing. Separate housings from handlebar.
3. Unhook ferrules (7) from cable wheel (8).
4. Remove cables from notches in housings (5, 9).
5. Remove air cleaner cover and backplate. See [4.4 AIR CLEANER](#).
6. Disconnect cables from throttle body manifold to remove.

CLEANING AND INSPECTION

Clean all parts in a non-flammable cleaning solvent. Blow dry with compressed air. Replace cables if frayed, kinked or bent.

ASSEMBLY/INSTALLATION

1. See [Figure 2-88](#). Place cable assemblies (3, 4) into housings (5, 9). Throttle control cable (4) has a molded fitting end and is positioned inside the front housing (5). Idle control cable (3) has a smaller fitting end and is positioned inside the rear housing (9).
2. Run cables inside grooves of each housing (5, 9).
3. Attach ferrules (7) to cable wheel (8). When properly assembled, notches for ferrules will be at 12 o'clock.
4. Position housings on right handlebar by engaging locating pin (10) on front housing with hole in handlebar. Attach housings with two screws (1, 6), installing longer screw on bottom. Tighten to 12-17 **in-lbs** (1.4-1.9 Nm).
5. Install air cleaner. See [4.4 AIR CLEANER](#).

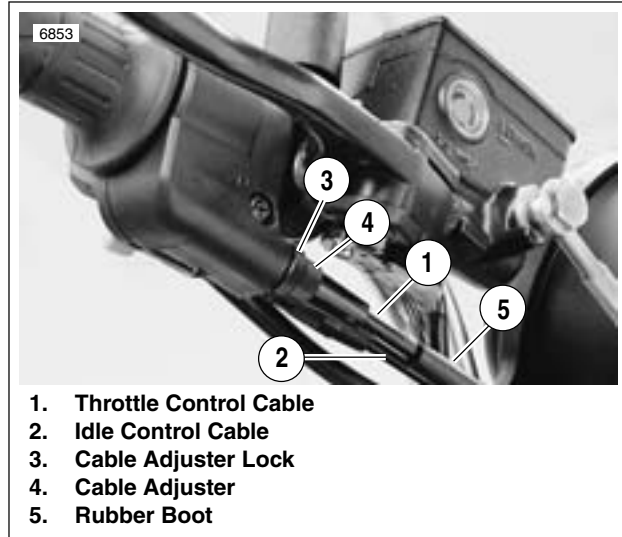


Figure 2-87. Throttle Control Cables

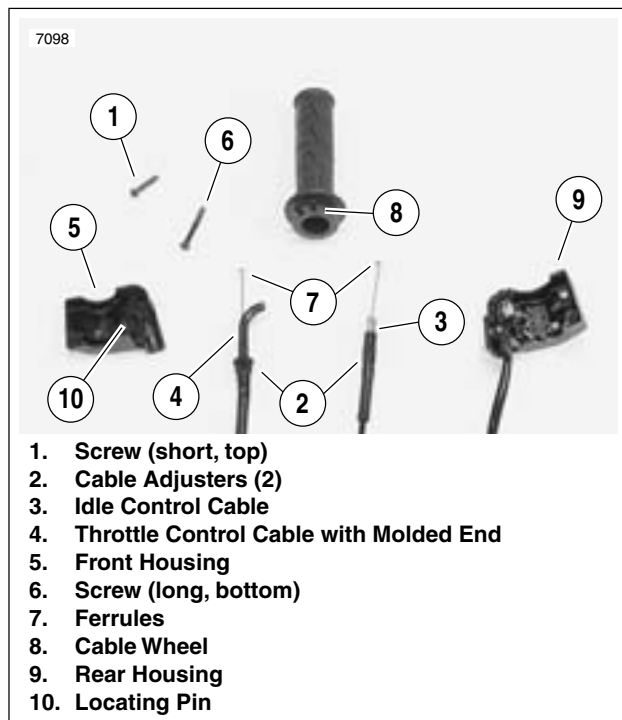


Figure 2-88. Cable Connections

ADJUSTMENT

See 1.8 CLUTCH.

REMOVAL/DISASSEMBLY

Clutch Cable-Lower

1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
2. See Figure 2-89. Remove four TORX screws (1) with washers and clutch inspection cover (2). Do not damage or dislodge quad ring (14) in primary cover (11).
3. Slide spring (3) with attached hex lockplate (4) from flats of adjusting screw (12).
4. Turn adjusting screw clockwise to release ramp and coupling mechanism. As the adjusting screw is turned, ramp assembly moves forward. Unscrew nut (5) from end of adjusting screw.
5. Remove hook of ramp (6) from button at the rear of cable end coupling (16). Remove cable end (10) from slot in coupling.
6. Turn cable end fitting (9) counterclockwise to remove clutch cable lower section from primary cover (11). Remove O-ring (8) from cable end fitting.

Clutch Hand Control

1. See Figure 2-90. Detach clutch switch (5).
 - a. Remove screw (7).
 - b. Depress clutch lever and hold.
 - c. Detach switch by depressing switch trigger button and pulling switch towards the end of the handlebar.

NOTE

The individual parts of the clutch switch are not serviceable. Replace switch upon failure.

2. Remove bolt (2) (metric) and nut (4) (metric).
3. Remove handlebar (3) from clutch clamp (6). Detach clutch cable (8) from handlebar.
4. Remove clutch cable clamp (6) from frame.
5. Remove clutch clamp.
 - a. Push up on rubber boot (11) and detach mirror assembly (1) (metric, left-hand threads)
 - b. Cut off left handgrip.
 - c. Remove left handlebar switch housing. See 7.22 HANDLEBAR SWITCHES.
 - d. Remove clamp screw (10) (metric). Slide clamp off the end of the handlebar.

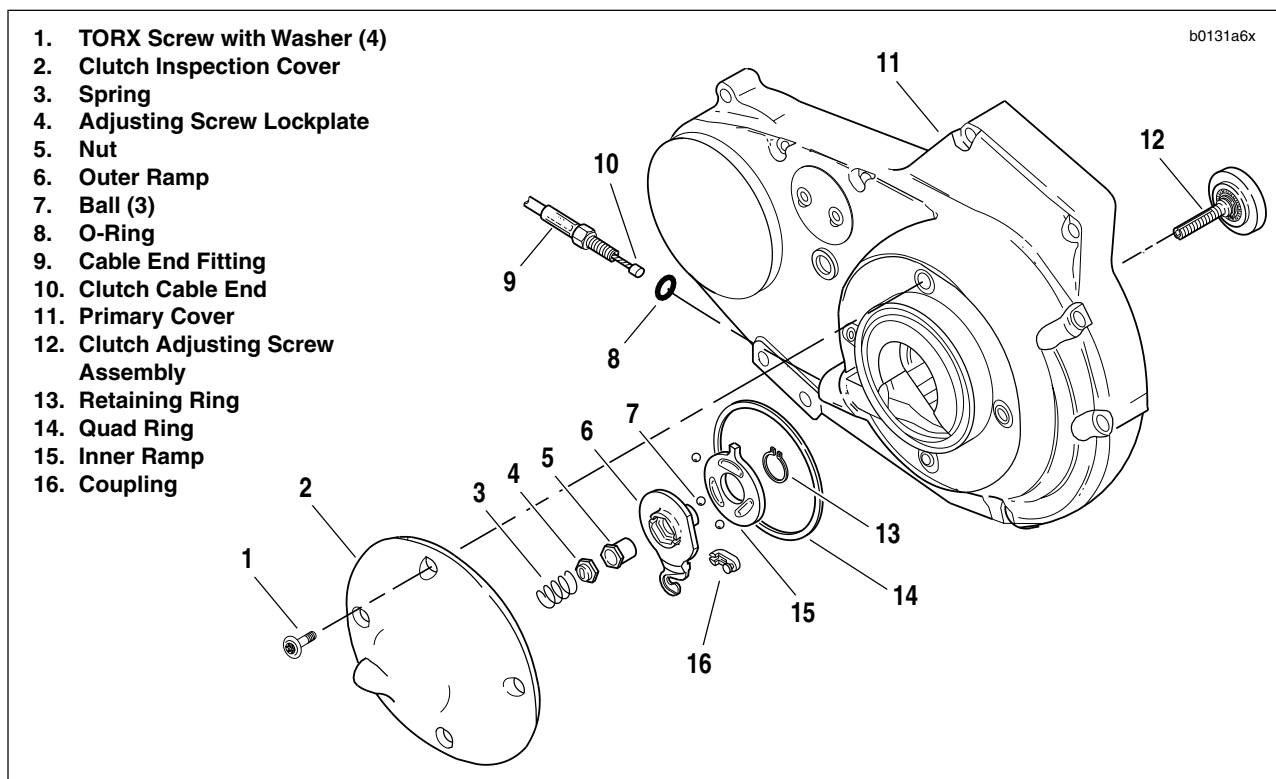


Figure 2-89. Clutch Release Mechanism

ASSEMBLY/INSTALLATION

Clutch Cable-Lower

- See [Figure 2-89](#). Install O-ring (8) over cable end fitting (9) of clutch cable lower section. Turn fitting clockwise to install into primary cover (11). Tighten to 3-9 ft-lbs (4-12 Nm).
- Fit coupling (16) over cable end. Place hook of ramp around coupling button and rotate assembly counter-clockwise until tang on inner ramp (15) fits in slot of primary cover (11).
- Thread nut (5) on adjusting screw (12) until slot of screw is accessible with a screwdriver. Fit nut hex into recess of outer ramp (6) and turn adjusting screw counter-clockwise.
- If not yet performed, route clutch cable to hand control.
 - See [Figure 2-91](#). Route cable along left side of primary chaincase and up to clamp on front isolator tie bar.
 - Clamp should be on bottom left of bolt with round side facing center of motorcycle. Brass fitting on cable should be approximately 3.0 in. (76 mm) from clamp.
 - Continue above and behind lower triple clamp, to the right of the steering head and through wire form on headlamp bracket.
 - Route cable across front of upper triple clamp to hand grip.
- With clutch cable upper section connected to clutch lever, check primary chain tension. Adjust if necessary. See [1.11 PRIMARY CHAIN](#).
- Adjust clutch. See [1.8 CLUTCH](#).

Clutch Hand Control

- See [Figure 2-90](#). Attach clutch clamp (9) as follows.
 - Slide clamp over handlebar.
 - Install left switchgear housing. See [7.22 HANDLEBAR SWITCHES](#).
 - Place clamp next to switchgear housing. Fasten to handlebar with screw (4) (metric). Tighten to 50-60 in-lbs (5-7 Nm).
 - Install a **new** left handgrip. See [2.27 HANDLEBARS](#).
 - Install mirror assembly (1). mirror mounting has metric, left hand threads.
- Connect end of clutch cable upper section to clutch handlebar. Position lever within clutch clamp.
- Apply small amount of LOCTITE ANTI-SEIZE LUBRICANT to bolt (2). Attach handlebar with bolt (2) (metric) and nut (4) (metric).
- Attach clutch switch (5) with screw (7).
- If not yet performed, route clutch cable to primary cover.
 - Route cable from hand grip across front of upper triple clamp.

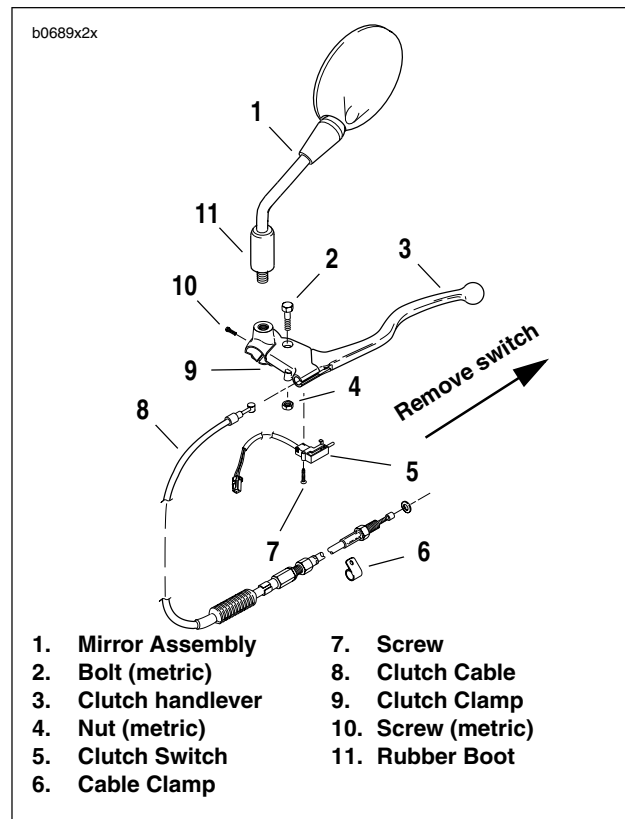


Figure 2-90. Clutch Hand Control

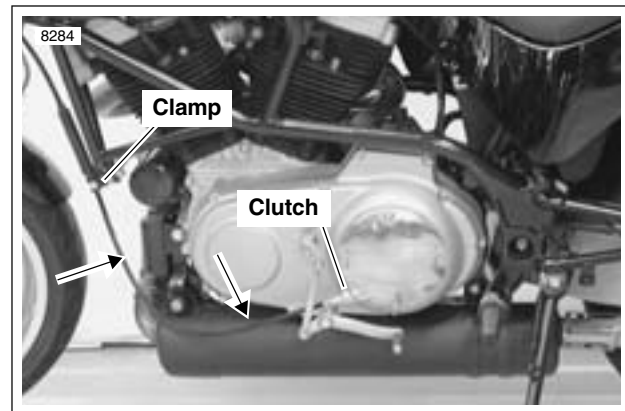


Figure 2-91. Clutch Cable Routing, Lower

- Continue to right side, down between right fork leg and steering neck, through wire form on headlamp bracket and behind lower triple clamp.
 - Route cable through clamp. Clamp should be on bottom left of bolt with round side facing center of motorcycle. Brass fitting on cable should be approximately 3.0 in. (76 mm) from clamp.
 - See [Figure 2-91](#). Route cable down left side of bike, through clamp, along primary chaincase to clutch.
- With clutch cable lower section connected to primary cover, adjust clutch. See [1.8 CLUTCH](#).

REMOVAL

1. Gain access to backside of instrument support.
 - a. Detach windscreen from mounting brackets. See [2.35 WINDSCREEN](#)
 - b. See [Figure 2-92](#). Separate instrument support panel (2) from handlebar clamp (3) by removing two screws (1). Pull dash panel upward, but do not damage wiring.

NOTE

Detaching instrument support mount from upper triple clamp frees handlebars.

2. See [Figure 2-93](#). Remove two front screws (1) and two rear screws (2) to separate instrument support mount (3) from upper triple clamp.

INSTALLATION

1. See [Figure 2-93](#). Fasten instrument support and handlebars to support using two front screws (1) and two rear screws (2). Do not tighten.
 - a. Rotate handlebars to a suitable riding position. Run hand control wires on each side in front of handlebars, fork tubes and instrument support.
 - b. First tighten the two front screws (1) to 10-12 ft-lbs (14-16 Nm).
 - c. Tighten the two rear screws (nearest the fuel tank) to 10-12 ft-lbs (14-16 Nm).
2. See [Figure 2-92](#). Attach instrument support panel (2) to handlebar clamp (3).
 - a. Apply LOCTITE THREADLOCKER 243 (blue) to both screws (1).
 - b. Align instrument support on handlebar clamp. Install two screws (1).
 - c. Tighten to 4-5 ft-lbs (5-7 Nm).
3. Attach windscreen to brackets. See [2.35 WINDSCREEN](#).

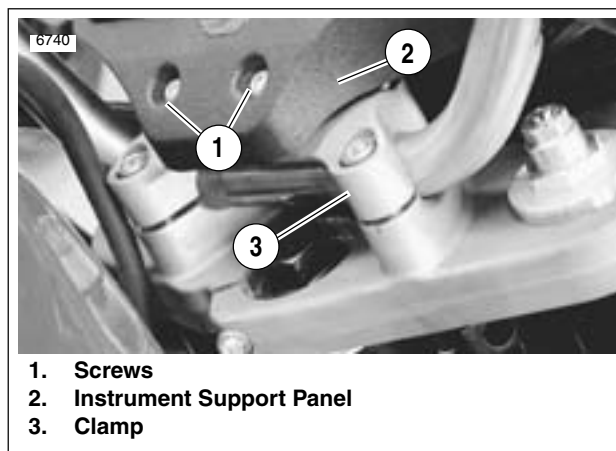


Figure 2-92. Instrument Support, Front

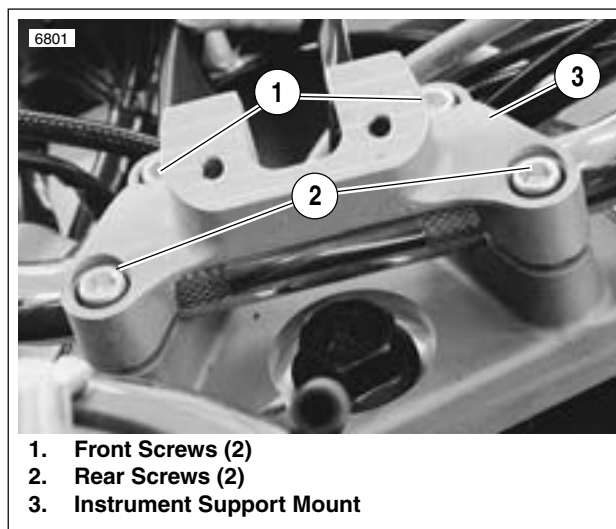


Figure 2-93. Instrument Support Mount

REMOVAL

1. Remove left handlebar switch housing. See 7.22 [HANDLEBAR SWITCHES](#). Cut left handlebar grip and remove.
2. Detach clutch hand control from handlebars. See 2.25 [CLUTCH CONTROL](#).
3. Remove front brake master cylinder. See 2.10 [FRONT BRAKE MASTER CYLINDER](#).
4. Loosen screws on right handlebar switch housing, but do not detach throttle grip assembly from handlebar. See 2.24 [THROTTLE CONTROL](#).
5. Detach windscreen from mounting brackets. See 2.35 [WINDSCREEN](#).
6. See [Figure 2-93](#). Remove four screws (1, 2) from instrument support (3).
7. Lift instruments and remove handlebars without stretching throttle cables.
8. Remove throttle grip assembly.

INSTALLATION

1. Slide handlebars into throttle grip assembly. Fasten right handlebar switch housing to handlebar. See 2.24 [THROTTLE CONTROL](#).
2. Attach handlebars.
 - a. See [Figure 2-93](#). Lift instruments and place handlebars under instrument support. Loosely install four screws (1, 2).
 - b. See [Figure 2-93](#). Tighten both front screws (1) to 10-12 ft-lbs (14-16 Nm).
 - c. Then tighten both rear screws (2) 10-12 ft-lbs (14-16 Nm).
3. Install clutch hand control. See 2.25 [CLUTCH CONTROL](#).
4. Install left switch housing. See 7.22 [HANDLEBAR SWITCHES](#).
5. Check control wire routings.
 - a. See [Figure 2-94](#). Route right hand control wires (1) in front of handlebar and fork tube (4).
 - b. Route left hand control wires (2) in front of handlebar and fork tube (4).
6. Install a **new** left handgrip.
 - a. Clean end of handlebar with M600.
 - b. Place LOCTITE 411 ADHESIVE around inside of grip.
 - c. Push grip onto handlebar end. Twist grip on bar until end touches left switchgear housing.
 - d. Wipe off excess adhesive with a rag.
7. Install front brake master cylinder. See 2.10 [FRONT BRAKE MASTER CYLINDER](#)
8. Install windscreen. See 2.35 [WINDSCREEN](#).
9. Check steering motion range to both fork stops. See 1.21 [HANDLEBARS](#).

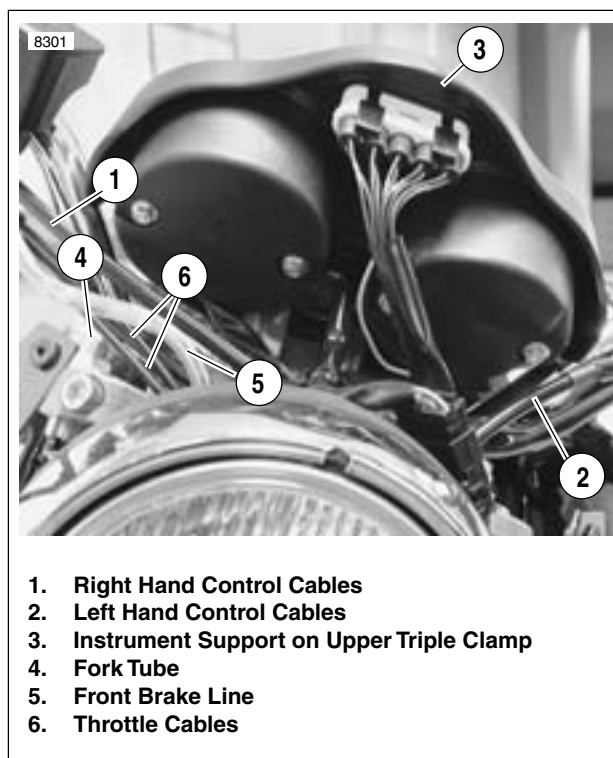


Figure 2-94. Routing Hand Control Wires

REMOVAL/DISASSEMBLY

Muffler

NOTE

The muffler may be removed for replacement without removing the exhaust header.

1. See Figure 2-95. Remove two bolts, washers and locknuts securing rear of muffler to Z-bracket.
2. See Figure 2-98. Remove lower bolt (Gr. 8), metal locknut, washers and spacer from header support mount at the front of the muffler.
3. Loosen screw securing muffler clamp.
4. Remove muffler and muffler clamp. Discard clamp.
5. If necessary, remove muffler support Z-bracket from mount block.
 - a. Remove bolts, locknuts and washers.
 - b. Remove muffler support Z-bracket.
 - c. Remove rear muffler mounts and mount spacers from swingarm mount block.
6. If necessary, remove header support mount.
 - a. See Figure 2-97. Support motorcycle with jack.
 - b. Remove two upper bolts, locknuts and washers.
 - c. Remove nuts and washers securing front muffler support to voltage regulator bracket and crankcase.
 - d. Remove header support mount.

Exhaust Header

1. Remove muffler.
2. See Figure 2-99. Loosen the four exhaust header nuts using SNAP-ON SWIVEL SOCKET (Part No. PFSX916).
3. Remove exhaust header by swiveling and lifting exhaust header. Slide exhaust header from behind frame.
4. See Figure 2-99. Remove exhaust header clamps, exhaust clamp retaining rings and exhaust port gaskets from exhaust header.

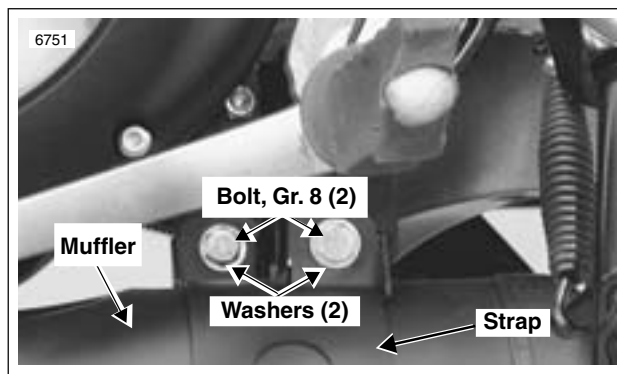


Figure 2-95. Rear Muffler Mounts

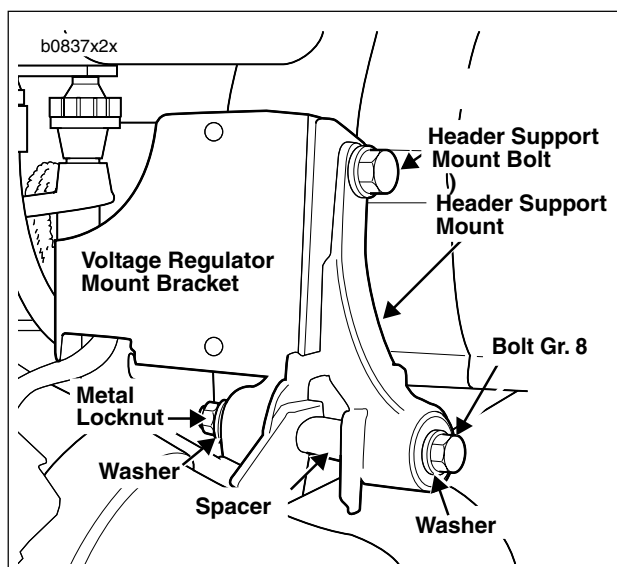


Figure 2-96. Header Support Mount

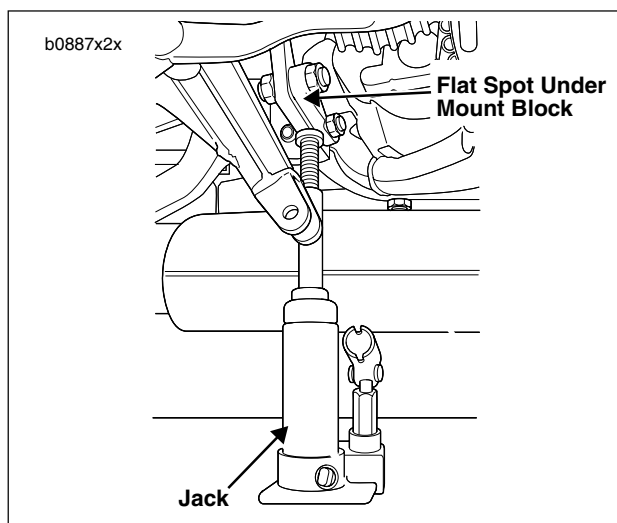


Figure 2-97. Supporting Motorcycle with Jack

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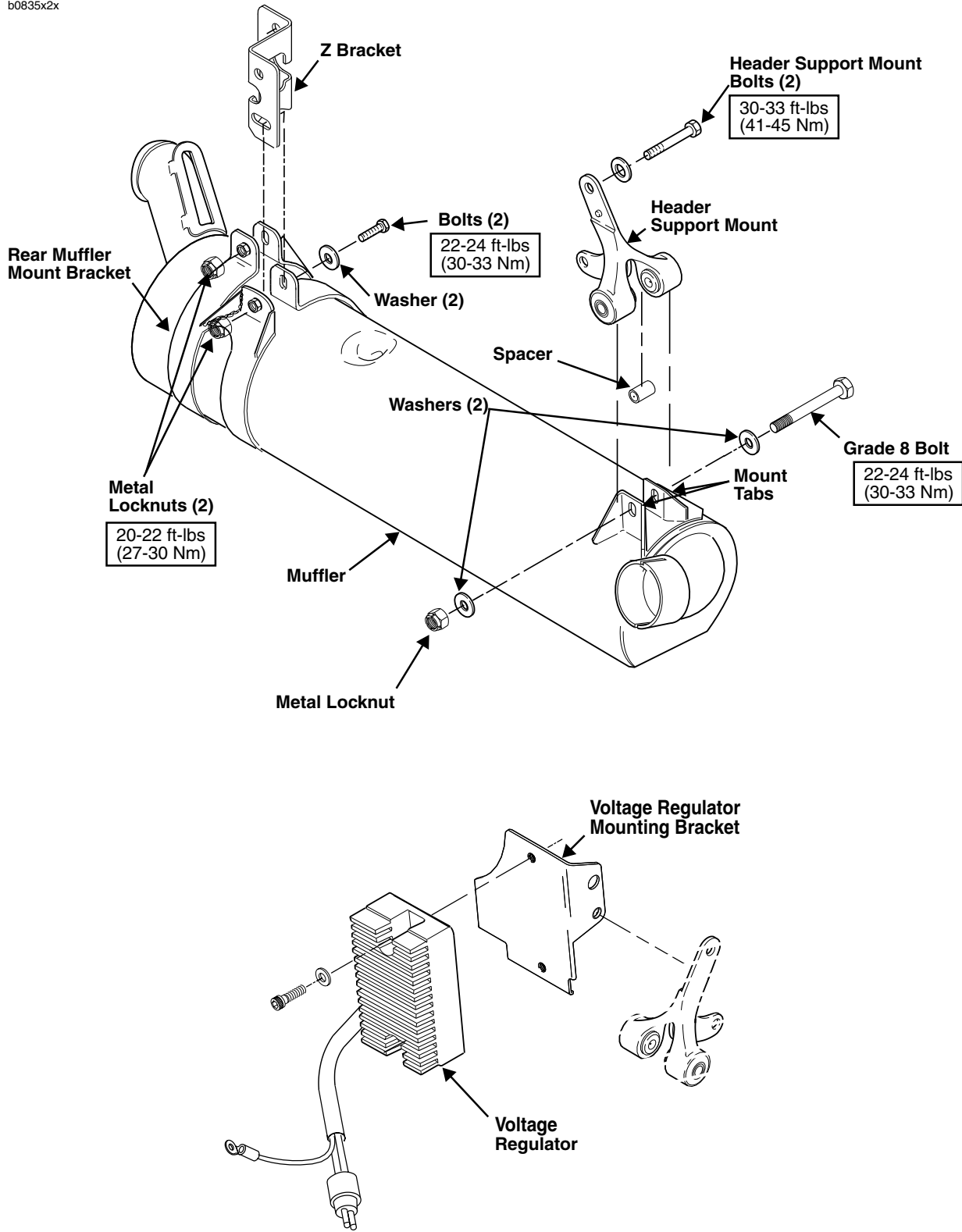


Figure 2-98. Exhaust System

ASSEMBLY/INSTALLATION

Muffler

1. If removed, install exhaust header.
2. See [Figure 2-98](#). If removed, install Z-bracket to mount block.
 - a. Install rear muffler mounts and mount spacers on swingarm mount block.
 - b. Attach Z-bracket with bolts, locknuts and washers. Bolt heads install on opposite side of the swingarm mount block from Z-bracket. Tighten to 22-24 ft-lbs (30-33 Nm).
3. See [Figure 2-96](#). If removed, attach header support mount to crankcase.
 - a. Insert two front muffler mounts and mount spacer into muffler support.
 - b. Install nuts and washers securing header support mount to voltage regulator bracket and crankcase.
 - c. Attach header support mount to crankcase with two upper bolts, washers and locknuts. Tighten bolts to 30-33 ft-lbs (41-45 Nm).
 - d. Lower and remove jack from under motorcycle.
4. Coat inside of muffler inlet with PERMATEX ULTRA-COPPER HIGH TEMP RTV SILICON GASKET material.

NOTE

If necessary, use a fiber hammer to fit muffler on header.

5. Place a **new** muffler clamp over muffler inlet. Place muffler and clamp on end of exhaust header. Snug clamp but do not tighten.

WARNING

Before tightening muffler hardware, position muffler to provide adequate clearance from rear shock absorber, side stand spring post and rear tire. Failure to provide adequate clearance during motorcycle operation could result in death or serious injury.

6. See [Figure 2-95](#). Position muffler and install to rear mounting support and weldnuts in rear muffler straps with two sets of bolts, washers and locknuts. Tighten to 22-24 ft-lbs (30-33 Nm).
7. See [Figure 2-98](#). Secure muffler to header support mount with bolt, locknut and washers. Tighten to 22-24 ft-lbs (30-33 Nm).
8. If only the muffler is being replaced, tighten muffler clamp to 40-45 ft-lbs (54-61 Nm) at this time. If also installing the exhaust header, leave muffler clamp loose.

Exhaust Header

NOTE

Muffler must be installed before installing exhaust header.

1. See [Figure 2-99](#). Install **new** exhaust port gaskets and exhaust clamp retaining rings.
2. Slide exhaust header clamps over ends of exhaust headers.
3. Slide exhaust header under frame.
4. Position rear end of exhaust header in port. Do not install exhaust header clamp over port.
5. Rotate exhaust header so that front end of exhaust header is in position at front port to cylinder head.
6. See [Figure 2-99](#). Install front and rear exhaust headers to cylinder heads with exhaust header clamps and nuts. Tighten the four exhaust header nuts to 6-8 ft-lbs (8-11 Nm) using SNAP-ON SWIVEL SOCKET (Part No. PFSX916).
7. Tighten muffler clamp to 40-45 ft-lbs (54-61 Nm).

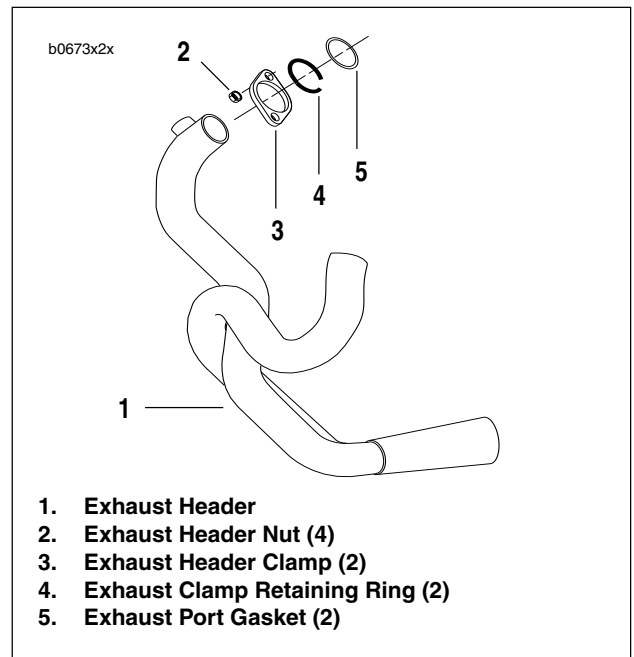


Figure 2-99. Header Support Mount

REMOVAL

1. See [Figure 2-100](#). To remove rider footrest.
 - a. Remove retaining ring (1) and washer (2) from pin (3).
 - b. Hold hand over spring (4) and remove pin, spring and footpeg (5) from mount (6).
2. If necessary, detach passenger footrest (7) by removing bolt (8) and nut (9) from frame mount.

INSTALLATION

1. If removed, install passenger footrest.
 - a. See [Figure 2-100](#). Apply **LOCTITE THREAD-LOCKER 243 (blue)** to footrest bolts (8).
 - b. Secure footrest to frame mount with bolt (8) and nut (9). Tighten to 10-15 ft-lbs (14-20 Nm).
2. Install rider footrest.

NOTE

If footrest mount (6) was removed, apply **LOCTITE THREAD-LOCKER 271 (red)** to bolt (11), install and tighten bolt to 23-25 ft-lbs (31-34 Nm).

- a. Position spring (4) on mount (6) with thick side of spring inboard.
- b. Install pin (3) through spring (4), mount (6) and footrest (5).
- c. Install washer (2) and retaining ring (1) to pin (3). Make sure retaining ring engages groove in pin.

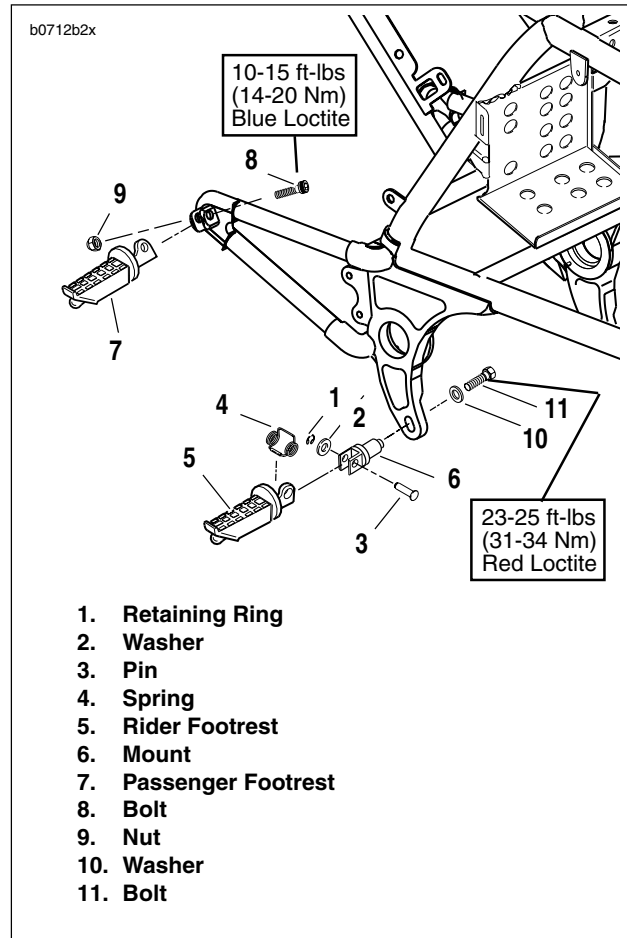


Figure 2-100. Footrests

REMOVAL/DISASSEMBLY

1. See [Figure 2-101](#). Remove nut and washer from swingarm/drive support.
2. Remove two screws from swingarm/drive support.
3. Remove sprocket cover forward screw, washer and spacer.
4. Remove swingarm drive/support and sprocket cover as an assembly.
5. Remove two screws from rear of sprocket cover to separate sprocket cover from swingarm/drive support and spacer. Do not remove rivet holding rubber bumper.

ASSEMBLY/INSTALLATION

1. See [Figure 2-101](#). If removed, attach sprocket cover to swingarm/drive support.
 - a. Place sprocket cover behind swingarm/drive support. Align holes in cover with holes in support.
 - b. Apply LOCTITE THREADLOCKER 222 (purple) to both screws.
 - c. Install screws to rear of sprocket cover. Tighten to 12-17 **in-lbs** (1.4-1.9 Nm).
2. Apply LOCTITE THREADLOCKER 243 (blue) to screw. Install sprocket cover assembly with screw, washer and spacer. Tighten to 48-72 **in-lbs** (5-9 Nm).
3. Apply LOCTITE THREADLOCKER 271 (red) to screws and install to swingarm/drive support. Tighten to 20-25 **ft-lbs** (27-34 Nm).
4. Install nut and washer to swingarm/drive support. Tighten to 30-35 **ft-lbs** (41-47 Nm).

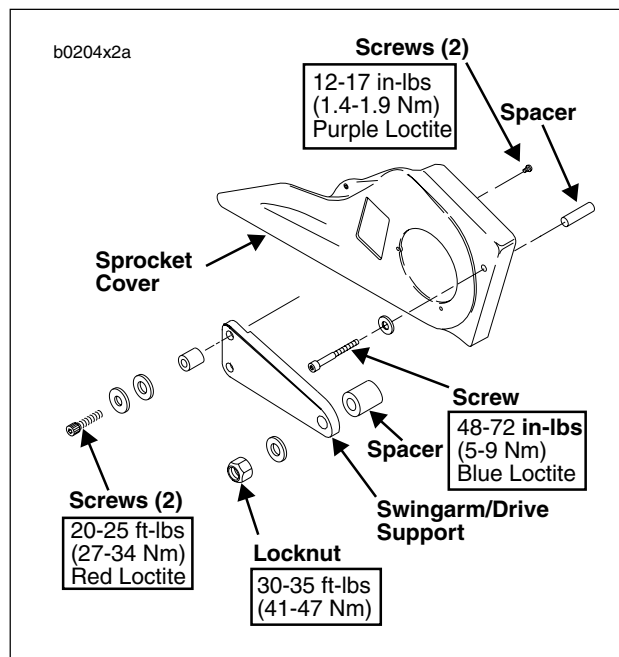


Figure 2-101. Sprocket Cover

REMOVAL

Front Fender

1. See [Figure 2-102](#). Remove four bolts (1) (metric) from fork brace (3).
2. Lift fender and brace upward between forks. Remove screws, washers and locknuts (2).
3. Carefully slide fender forward over tire. Keep fender low to maximize clearance between fork legs.

Rear Fender

1. Have someone sit on the vehicle to compress the motorcycle's suspension.
2. See [Figure 2-103](#). Remove two screws (1) and washers (2) from right side fender well nuts (4).
3. Remove screw (1) and washer (2) from front well nut (4).
4. Remove screw (1) washer (9) from brake line clamp on the left side of fender.
4. Pull fender over rear tire.

INSTALLATION

Front Fender

1. Carefully slide fender back over tire.
2. Replace screws, washer and nuts (1). Tighten screws to 6-8 ft-lbs (8-11 Nm).
3. Apply LOCTITE THREADLOCKER 243 (blue) to bolts (1) (metric). Tighten to 10-12 ft-lbs (14-16 Nm).

Rear Fender

1. See [Figure 2-103](#). Position fender over tire, making sure that the brake hose is on the outside of the fender as shown.
2. See [Figure 2-104](#). Secure brake line clamp with screw (1) and washer (2).
3. Have someone sit on the motorcycle to compress the motorcycle's suspension.
4. Apply LOCTITE THREADLOCKER 243 (blue) to all screws.
 - a. Install screw (1) and washer (2) into front wellnut (8).
 - b. Install screws (1) and washers (2) into right side fender wellnut (8).

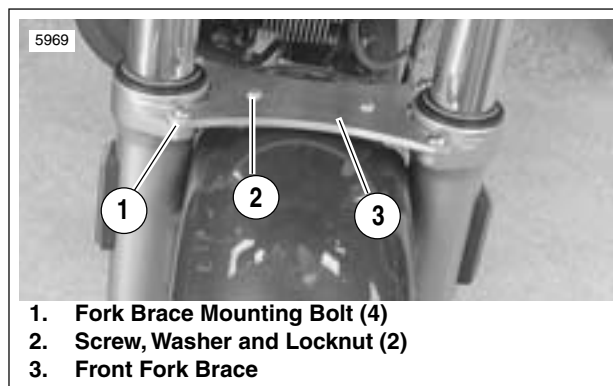


Figure 2-102. Front Fender

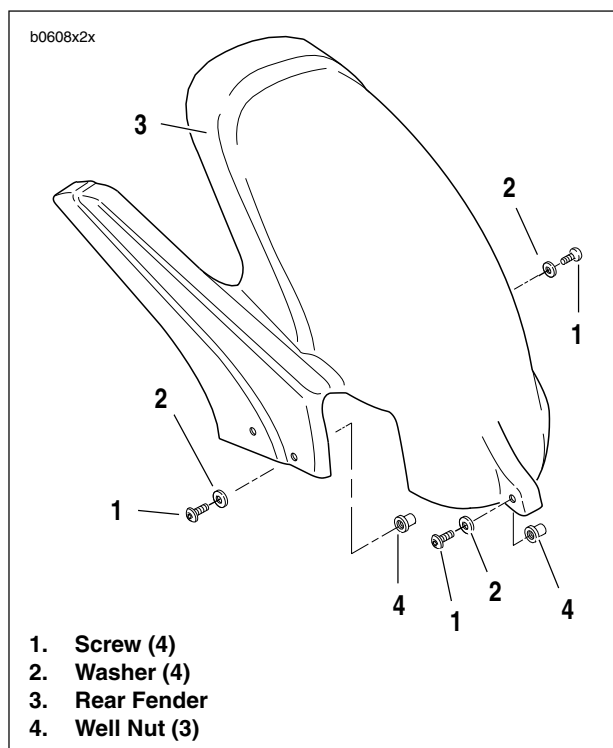


Figure 2-103. Rear Fender



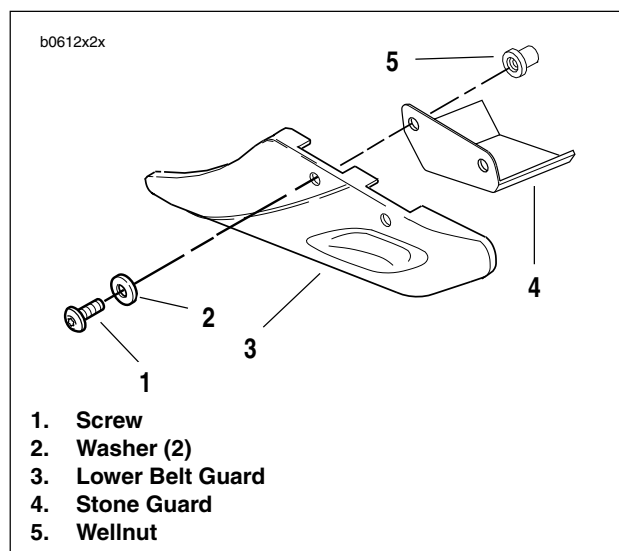
Figure 2-104. Rear Fender With Brake Hose

REMOVAL

1. See [Figure 2-105](#). Remove two screws (1) and washers (2) securing lower belt guard (3) to frame.
2. Remove lower belt guard (3), stone guard (4) and well nuts (5) from frame.

INSTALLATION

1. See [Figure 2-105](#). Position stone guard (4) with well nuts (5) and lower belt guard (3) on frame.
2. Secure with two screws (1) and washers (2).

**Figure 2-105. Lower Belt and Stone Guards**

REMOVAL

1. Remove seat and tail section. See [2.36 SEAT](#).
2. See [Figure 2-106](#). Remove three TORX screws and washers (2) and locknuts.
3. Remove frame heat shield (3).
4. If necessary, remove clamps (1).

INSTALLATION

1. See [Figure 2-106](#). If removed, replace clamps (1).
2. Install heat shield (3) with screws (Torx) and washers (2) and locknuts.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

3. Install tail section and seat. See [2.36 SEAT](#).

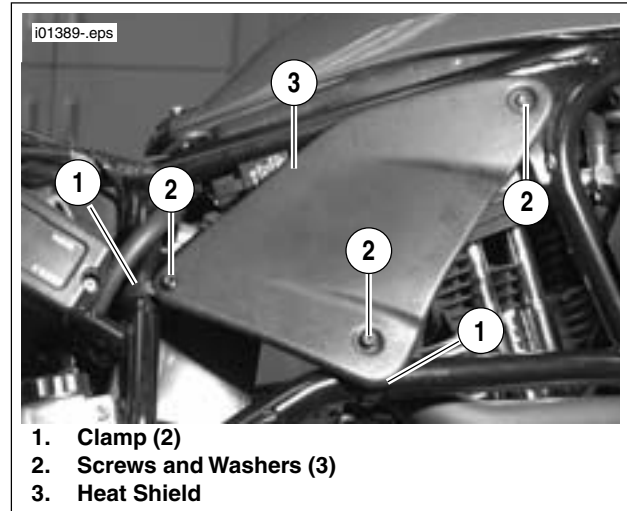


Figure 2-106. Frame Heat Shield

REMOVAL

Tail Section

1. See [Figure 2-107](#). Loosen seat wing screw. Remove seat by pulling up and back.
2. Reach under the tail section and disconnect the bullet connectors on rear turn signal wires.
3. See [Figure 2-108](#). Disconnect the three tail lamp wires (BK, O/W, and R/Y).
4. See [Figure 2-107](#). Remove four screws, nylon washers and cargo straps.
5. Loosen fuel tank mounting screw. See [4.5 FUEL TANK](#).
6. Lift fuel tank and withdraw tail section.

NOTE

See [4.5 FUEL TANK](#) for information on removing fuel tank from frame.

License Plate Bracket

1. Remove seat and tail section.
2. See [Figure 2-108](#). From inside of tail section, remove two locknuts (metric) and washers. Remove tail lamp from license plate bracket and tail section bracket.
3. Remove license plate bracket from tail section.
4. If necessary, remove turn signals from license plate bracket.

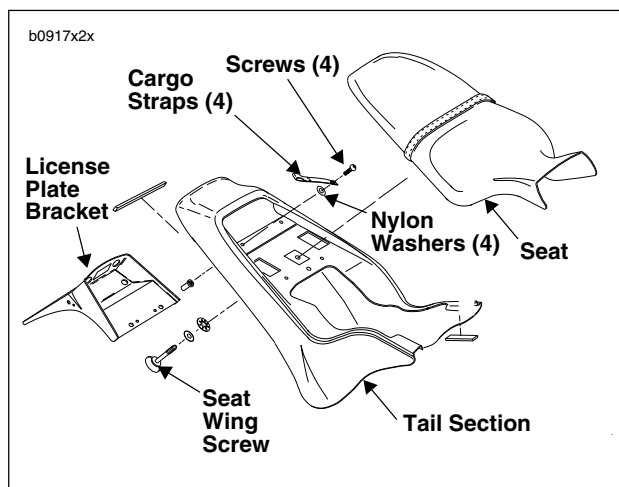


Figure 2-107. Tail Section

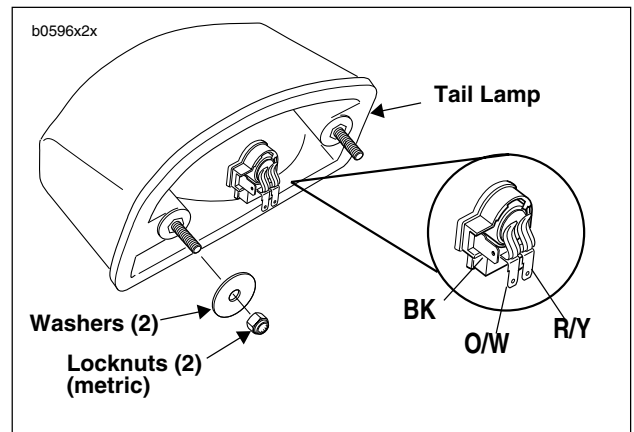


Figure 2-108. Tail Lamp

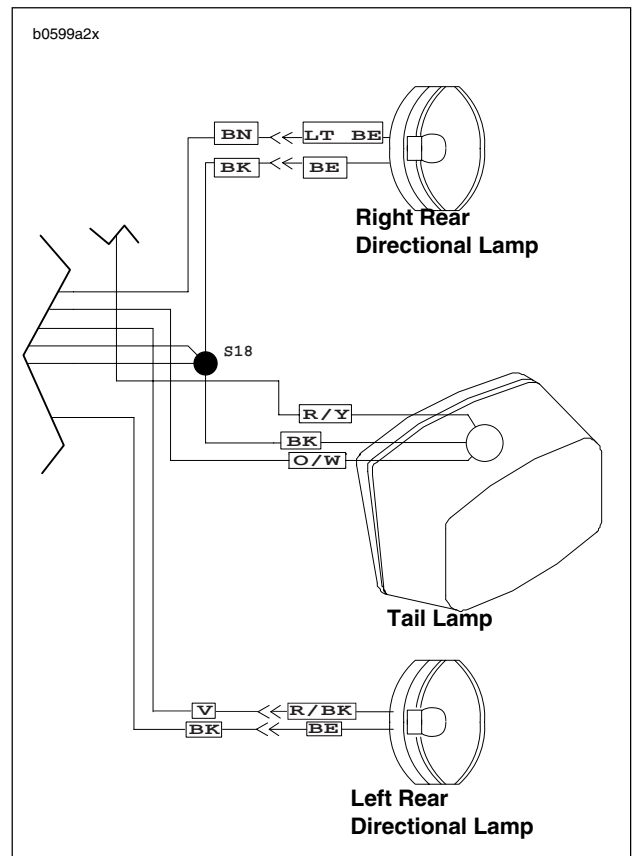


Figure 2-109. Tail Lamp/Rear Signal Wiring Diagram

INSTALLATION

License Plate Bracket

NOTE

If installing a **new** license plate bracket, be sure to apply reflectors and drill holes for license plates before installing plate on motorcycle.

1. If removed, install turn signals on license plate bracket.
2. Position license plate bracket on outside of tail section and align tail lamp post screws with holes in bracket.
3. See [Figure 2-108](#). Secure tail lamp with washers and locknuts (metric).

Tail Section

1. Lift fuel tank and place tail section on frame. Align mounting tabs on tank and frame.
2. See [Figure 2-107](#). Install four cargo straps, screws and nylon washers that secure tail section to frame. NOTE: Nylon washers go between cargo straps and tail section.
3. Install fuel tank mounting bolt. See [4.5 FUEL TANK](#).
4. Connect the bullet connectors on rear turn signal wires.
5. See [Figure 2-108](#). Attach the three tail lamp wires.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

6. See [Figure 2-107](#). Place seat on tail section. Tighten wing screw from underneath the tail section.

WARNING

Check for proper tail lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper tail lamp operation could result in death or serious injury.

7. Check tail lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to IGN.
 - b. Check for tail lamp illumination.
 - c. Squeeze front brake hand lever. Check for brake lamp illumination. Release front brake hand lever.
 - d. Press rear brake pedal. Check for brake lamp illumination. Release rear brake pedal.
 - e. Turn ignition key switch to OFF.

REMOVAL

1. See [Figure 2-110](#). Remove two screws and nylon washers on each side and detach windscreen from brackets
2. See [Figure 2-111](#). If necessary, remove trim (4).
3. If necessary, remove the two windscreen brackets. See [7.18 HEADLAMP](#).

INSTALLATION

1. If removed, install the two windscreen brackets. See [7.18 HEADLAMP](#).
2. See [Figure 2-111](#). If removed install trim (4).
3. Align windscreen on right and left brackets.
4. See [Figure 2-110](#). Install two screws and nylon washers on each side.

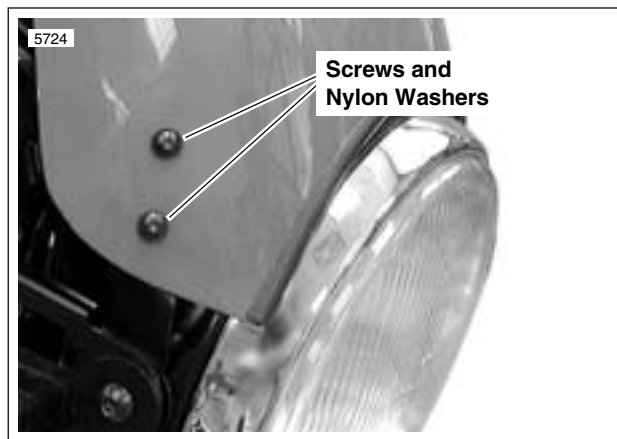


Figure 2-110. Windscreen, Right Side

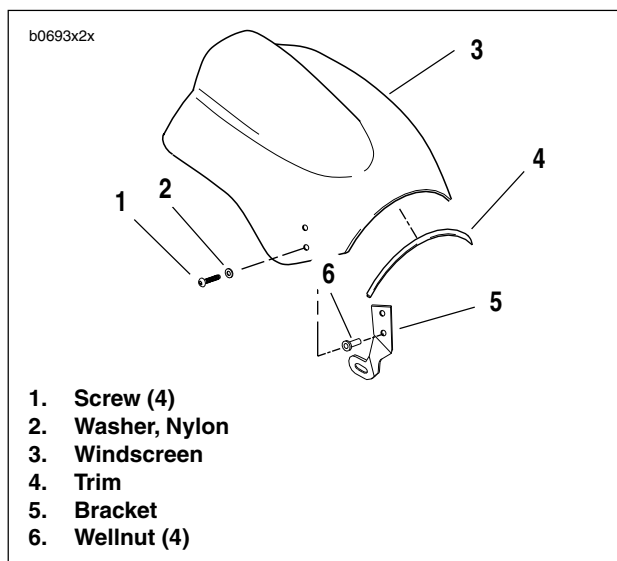


Figure 2-111. Windscreen

REMOVAL

CAUTION

Do not remove wing screw from frame. Attempted removal will cause damage to the screw.

1. See [Figure 2-112](#). Detach seat from frame by loosening the wing screw (4) underneath the tail section.
2. Remove seat by pulling up and back.

INSTALLATION

1. See [Figure 2-112](#). Install seat by sliding the locating tab (2) on the underside of the seat into the frame tab (3) on the motorcycle.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

2. See [Figure 2-112](#). Fasten seat to frame with wing screw (1). Tighten securely.

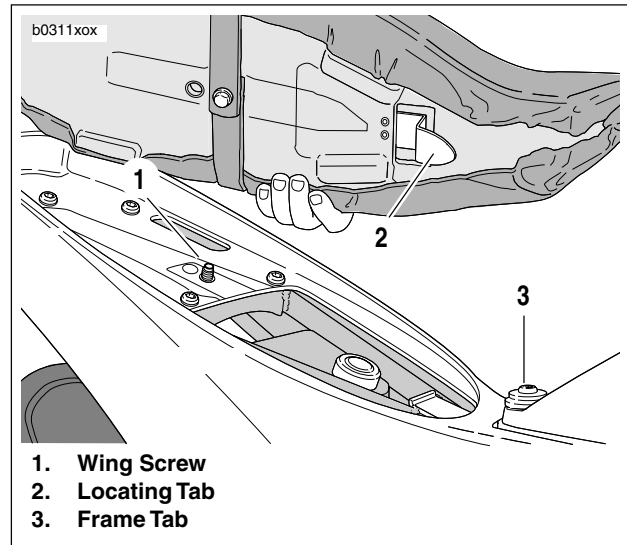


Figure 2-112. Seat

GENERAL

⚠ WARNING

- If the side stand is not in the full forward position when vehicle weight is rested on it, the vehicle could fall over which could result in death or serious injury.
- Always park motorcycle on a level, firm surface. Vehicle weight could cause motorcycle to fall over which could result in death or serious injury.

The side stand is located on the left side of the motorcycle. The side stand swings outward to support the motorcycle for parking.

See [Figure 2-113](#). Retraction of the side stand activates the plunger on the side stand switch which is part of the starter interlock system. See [7.11 STARTER INTERLOCK](#) for more information.

INSPECTION

1. Replace dragger when worn to wear line shown in [Figure 2-115](#).
2. Test the side stand in the following manner. Without vehicle weight resting on it, side stand should move freely into extended (down) and retracted (up) positions.
3. Check the sidestand switch (starter interlock) for proper operation after the first 500 miles and every 2500 miles thereafter. See [7.11 STARTER INTERLOCK](#).

REMOVAL/DISASSEMBLY

1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
2. See [Figure 2-114](#). Remove spring (6) from side stand and spring pin (5).
3. Remove retaining clip (7) and pivot pin (8). Detach side stand from frame.
4. Remove bumper (3) from frame.
5. Remove screw (2) and side stand dragger (1). Replace dragger when worn to wear line shown in [Figure 2-115](#).

ASSEMBLY/INSTALLATION

1. See [Figure 2-114](#). Attach bumper (3) to frame.
2. Attach side stand dragger (1) to side stand with screw (2).
3. Apply LOCTITE ANTI-SEIZE to pivot pin (8). Install side stand using pivot pin (8) and retaining clip (7). Do not crush side stand switch during installation.
4. Connect spring (6) to side stand and spring pin (5).
5. Remove REAR WHEEL STAND.
6. With side stand retracted, there should be 0.5 in. (12.7 mm) clearance between side stand and swingarm at the closest point of contact.

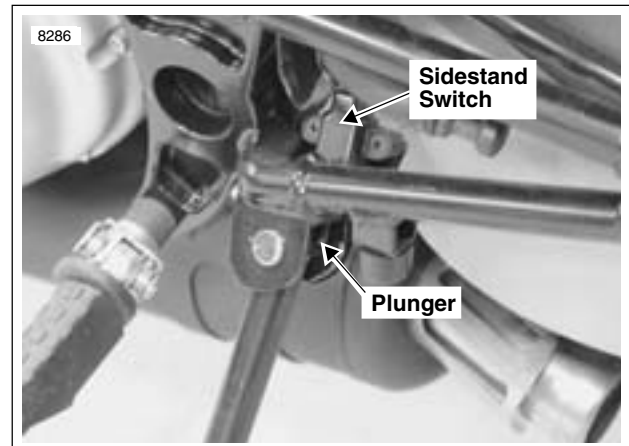


Figure 2-113. Side Stand Switch

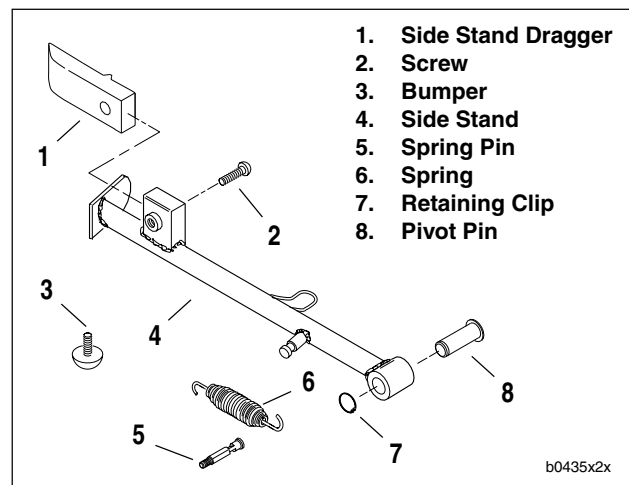


Figure 2-114. Side Stand

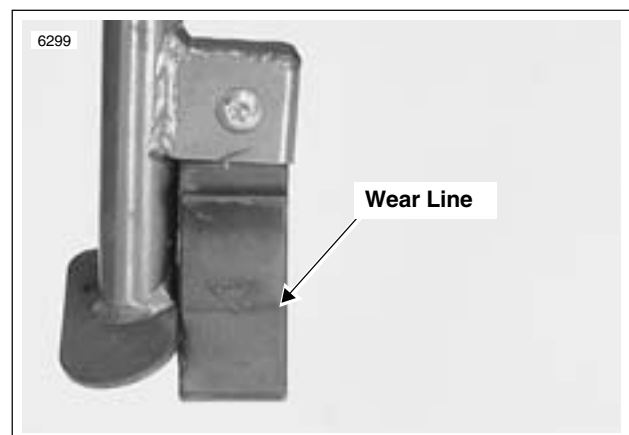


Figure 2-115. Side Stand Dragger Wear Limit

NOTES

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GENERAL		
Type	2 cylinder, air cooled, four-stroke 45 Degree V-twin	
Horsepower @RPM	91 @ 6200	
Torque ft-lbs @ RPM	85 @ 4900	
Compression Ratio	10.0 to 1	
Bore	3.5 in.	88.8 mm
Stroke	3.8 in.	96.8 mm
Engine Displacement	73.4 cu. in.	1203 cc
Oil Tank Capacity (with filter change)	2.0 quarts	1.89 liters

CAMSHAFT SPECIFICATIONS	
Lift @ Valve (TDC) Intake/Exhaust	0.458 in./0.458 in.
Duration @ 0.053 lift Intake/Exhaust	224°/224°
Timing @ 0.053 lift Open/Close	Intake: 1° BTDC/43° ABDC Exhaust: 41° BBDC/3° ATDC

ENGINE IGNITION SPECIFICATIONS		
Timing Advance during engine cranking	5° BTDC	
Timing Advance with engine at RPM listed below and V.O.E.S. connected	20° BTDC	
Regular idle	950-1050 RPM (World)	1150-1250 RPM (California)
Fast idle	2000 RPM	

NOTE

Service wear limits are given as a guideline for measuring components that are not **new**. For measurement specifications not given under SERVICE WEAR LIMITS, see NEW COMPONENTS.

VALVE		NEW COMPONENTS		SERVICE WEAR LIMITS	
Fit in guide	Exhaust	0.0015-0.0033 in.	0.0381-0.0838 mm	0.0040 in.	0.1016 mm
	Intake	0.0008-0.0026 in.	0.0203-0.0660 mm	0.0035 in.	0.0889 mm
Seat width		0.040-0.062 in.	1.016-1.575 mm	0.090 in.	2.286 mm
Stem protrusion from cylinder valve pocket		1.975-2.011 in.	50.165-51.079 mm	2.031 in.	51.587 mm

OUTER VALVE SPRING		NEW COMPONENTS		SERVICE WEAR LIMITS	
Free length		2.105-2.177 in.	53.467-55.296 mm	2.105 in. (min)	53.467 mm (min)
Intake	1.751-1.848 in. (closed)	72-92 lbs	33-42 kg		
	1.286-1.383 in. (open)	183-207 lbs	83-94 kg		
Exhaust	1.751-1.848 in. (closed)	72-92 lbs	33-42 kg		
	1.332-1.429 in. (open)	171-195 lbs	78-88 kg		

INNER VALVE SPRING		NEW COMPONENTS		SERVICE WEAR LIMITS	
Free length		1.926-1.996 in.	48.920-50.698 mm	1.926 in. (min)	48.920 mm (min)
Intake	1.577-1.683 in. (closed)	38-49 lbs	17-22 kg		
	1.112-1.218 in. (open)	98-112 lbs	44-51 kg		
Exhaust	1.577-1.683 in. (closed)	38-49 lbs	17-22 kg		
	1.158-1.264 in. (open)	91-106 lbs	41-48 kg		

ROCKER ARM		NEW COMPONENTS		SERVICE WEAR LIMITS	
Shaft fit in bushing (loose)		0.0005-0.0020 in.	0.0127-0.0508 mm	0.0035 in.	0.0889 mm
End clearance		0.003-0.013 in.	0.076-0.330 mm	0.025 in	0.635 mm
Bushing fit in rocker arm (tight)		0.004-0.002 in.	0.102-0.0559 mm		
Rocker arm shaft fit in rocker cover (loose)		0.0007-0.0022 in.	0.018-0.056 mm	0.0035 in.	0.0889 mm

PISTON		NEW COMPONENTS		SERVICE WEAR LIMITS	
Compression ring gap (top and 2nd)		0.007-0.020 in.	0.178-0.508 mm	0.032 in.	0.813 mm
Oil control ring rail gap		0.009-0.052 in.	0.229-1.321 mm	0.065 in	1.651 mm
Compression ring side clearance	Top	0.0020-0.0045 in.	0.0508-0.1143 mm	0.0065 in.	0.1651 mm
	2nd	0.0016-0.0041 in.	0.0406-0.1041 mm	0.0065 in.	0.1651 mm
Oil control ring side clearance		0.0016-0.0076 in.	0.0406-0.1930 mm	0.0094 in.	0.2388 mm
Pin fit (loose, at room temperature)		0.00005-0.00045 in.	0.00127-0.01143 mm	0.00100 in.	0.02540 mm

CYLINDER HEAD		NEW COMPONENTS		SERVICE WEAR LIMITS	
Valve guide in head (tight)		0.0033-0.0020 in.	0.0838-0.0508 mm		
Valve seat in head (tight)		0.0035-0.0010 in.	0.0889-0.0254 mm		
Head gasket surface (flatness)		0.006 in. total	0.152 mm total	0.006 in. total	0.152 mm total

CYLINDER		NEW COMPONENTS		SERVICE WEAR LIMITS	
Taper				0.002 in.	0.051 mm
Out of round				0.003 in.	0.076 mm
Warpage (gasket surfaces)	Top			0.006 in.	0.152 mm
	Base			0.008 in.	0.203 mm
Bore diameter ± 0.0002 in.	Standard	3.4978 in.	88.8441 mm	3.5008 in.	88.9203 mm
	0.005 OS	3.502 in.	88.951 mm	3.5050 in.	89.0270 mm
	0.010 OS	3.507 in.	89.078 mm	3.5100 in.	89.1540 mm
OS=over size	0.020 OS	3.517 in.	89.332 mm	3.5200 in.	89.4080 mm
	0.030 OS	3.527 in.	89.586 mm	3.5300 in.	89.6620 mm

CONNECTING ROD	NEW COMPONENTS		SERVICE WEAR LIMITS	
Piston pin fit (loose)	0.00125-0.00175 in.	0.03175-0.04445 mm	0.00200 in.	0.05080 mm
Side play between flywheels	0.005-0.025 in.	0.127-0.635 mm	0.030 in.	0.762 mm
Fit on crankpin (loose)	0.0004-0.0017 in.	0.0102-0.0432 mm	0.0027 in.	0.0686 mm
Connecting rod race ID	1.6245-1.6250 in.	41.2623-41.2750 mm	1.6270 in.	41.3258 mm

HYDRAULIC LIFTER	NEW COMPONENTS		SERVICE WEAR LIMITS	
Fit in guide	0.0008-0.0020 in.	0.0203-0.0508 mm	0.0030 in.	0.0762 mm
Roller fit	0.0006-0.0010 in.	0.0152-0.0254 mm	0.0015 in.	0.0381 mm
Roller end clearance	0.008-0.022 in.	0.203-0.559 mm	0.026 in.	0.660 mm

OIL PUMP		NEW COMPONENTS		SERVICE WEAR LIMITS	
Oil pressure	1000 RPM	7-12 PSI	48-83 KPa		
	2500 RPM	10-17 PSI	69-117 KPa		
Shaft to pump clearance		0.0025 in.	0.0635 mm		
Feed/scavenge inner/outer gerotor clearance		0.003 in.	0.076 mm	0.004 in.	0.102 mm

GEARCASE	NEW COMPONENTS		SERVICE WEAR LIMITS	
Cam gear shaft in bushing (loose)	0.0007-0.0022 in.	0.0178-0.0559 mm	0.003 in.	0.076 mm
Cam gear shaft end play (min) (except rear intake)	0.005-0.024 in.	0.127-0.610 mm	0.025 in.	0.635 mm
Rear intake cam gear shaft end play (min)	0.006-0.024 in.	0.152-0.610 mm	0.040 in.	1.016 mm

FLYWHEEL		NEW COMPONENTS		SERVICE WEAR LIMITS	
Runout	Flywheels at rim	0.000-0.010 in.	0.000-0.254 mm	0.010 in.	0.254 mm
	Shaft at flywheel end	0.000-0.002 in.	0.000-0.051 mm	0.002 in.	0.051 mm
End play		0.001-0.005 in.	0.025-0.127 mm	0.005 in.	0.127 mm

SPROCKET SHAFT BEARING	NEW COMPONENTS		SERVICE WEAR LIMITS	
Outer race fit in crankcase (tight)	0.0004-0.0024 in.	0.0102-0.0610 mm		
Bearing inner race fit on shaft (tight)	0.0002-0.0015 in.	0.0051-0.0381 mm		

PINION SHAFT BEARINGS	NEW COMPONENTS		SERVICE WEAR LIMITS	
Pinion shaft journal diameter	1.2496-1.2500 in.	31.7398-31.7500 mm	1.2496 in. (min)	31.7398 mm (min)
Outer race diameter in right crankcase	1.5646-1.5652 in.	39.7408-39.7561 mm	1.5672 in. (max)	39.8069 mm (max)
Bearing running clearance	0.00012-0.00088 in.	0.00305-0.02235 mm		
Fit in cover bushing (loose)	0.0023-0.0043 in.	0.0584-0.1092 mm	0.0050 in.	0.1270 mm

TORQUE VALUES

ITEM	TORQUE		NOTES
Clutch cable clamp locknut	30-33 ft-lbs	41-45 Nm	page 3-11
Crankcase screws 5/16 in.	15-19 ft-lbs	20-26 Nm	page 3-64
Crankcase 3/8 in. Screws	22-27 ft-lbs	30-37 Nm	page 3-64
Cylinder head screws	7-9 ft-lbs the 13-15 ft-lbs then loosen and repeat torque sequence	10-12 Nm the 18-20 Nm then loosen and repeat torque sequence	special pattern to tighten, page 3-23
Cylinder studs	10-20 ft-lbs	14-27 Nm	special method to tighten, page 3-64
Gearcase cover screws	80-110 in-lbs	9.0-12.4 Nm	special pattern to tighten, page 3-52
Isolator bolt, front	100-110 ft-lbs	136-149 Nm	page 3-11
Isolator bolts, rear	63-70 ft-lbs	85-95 Nm	LOCTITE THREADLOCKER 262 (red), page 3-11
Lifter Anti Rotational Screws	80-110 in-lbs	9-12 Nm	page 3-45
Oil filter adapter	8-12 ft-lbs	11-16 Nm	LOCTITE THREADLOCKER 243 (blue), page 3-43
Oil pressure signal light switch	50-70 in-lbs	6-8 Nm	page 3-43
Oil pump cover screws	70-80 in-lbs	8-9 Nm	TORX, page 3-42
Oil pump mounting screws	125-150 in-lbs	14-17 Nm	page 3-42
Pinion shaft nut	35-45 ft-lbs	48-61 Nm	LOCTITE THREADLOCKER 262 (red), page 3-51
Rocker box bolts	135-155 in-lbs	15-18 Nm	page 3-24
Rocker box cover screws	10-13 ft-lbs	14-18 Nm	page 3-24
Rocker box screws	135-155 in-lbs	15-18 Nm	page 3-24
Rocker box to head bolts	18-22 ft-lbs	24-30 Nm	2 sizes, page 3-24
Swingarm mount block bolts, lower	68-75 ft-lbs	92-102 Nm	page 3-11
Swingarm mount block bolts, upper	41-45 ft-lbs	56-61 Nm	page 3-11
Tappet retainer screw	15-18 ft-lbs	20-24 Nm	page 3-45
Tie bar bolts	30-33 ft-lbs	41-45 Nm	page 3-11

GENERAL

The Thunderstorm™ high performance engine is a two-cylinder, four-cycle, air-cooled, overhead-valve V-twin. It has three major component assemblies.

Cylinder

The cylinder assembly includes cylinder head, valves, rocker arm cover, rocker arms and piston. Cylinders mount on the crankcase in a 45 degree “V” with both connecting rods connected to a single crank pin.

Crankcase

The up-and-down motion of the piston in the cylinder is converted to circular motion in the crankcase. The multi-piece crankshaft consists of a crank pin mounted between two counterweighted flywheels, which rotate on two end shaft bearings. The lower end of the rear cylinder connecting rod is forked to fit around the single-end front cylinder connecting rod, allowing a single connecting rod crank pin connection to the flywheel.

Gearcase

The gearcase is located on the right side of the crankcase. The gearcase houses the gear train, which operates and times the valves and ignition. The cam gear train, consisting of four cam shafts with one cam lobe on each shaft, is gear driven. The engine valves are opened and closed through the mechanical linkage of hydraulic lifters, push rods and rocker arms. Hydraulic lifters, located in the lifter bores, automatically compensate for heat expansion to maintain the no-lash fit of valve train components. Hydraulic lifters and pushrods transmit the cam action to the valve linkage. Valve timing is obtained by aligning timing marks when installing cam gears.

Ignition spark is produced by the operation of a microprocessor-controlled ignition module, ignition coil and spark plugs. Spark timing is determined by a trigger rotor, magnetic sensing unit and the vacuum-operated electric switch.

The trigger rotor has two openings which time the cylinders.

The spark plugs fire simultaneously each crankshaft revolution.

FUEL

Gasoline/alcohol Blends

Buell motorcycles were designed to obtain the best performance and efficiency using unleaded gasoline (91 pump octane or higher). Some fuel suppliers sell gasoline/alcohol blends as a fuel. The type and amount of alcohol added to the fuel is important.

- **DO NOT USE GASOLINES CONTAINING METHANOL.** Using gasoline/methanol blends will result in starting and driveability deterioration and damage to critical fuel system components.
- **Gasolines containing ETHANOL:** Gasoline/ethanol blends are mixture of 10% ethanol (Grain alcohol) and

90% unleaded gasoline. Gasoline/ethanol blends can be used in your motorcycle if the ethanol content does not exceed 10%.

- **Gasolines containing ETHER:** Gasoline/ether blends are a mixture of gasoline and as much as 15% ether. Gasoline/ether blends can be used in your motorcycle if the ether content does not exceed 17%.
- **REFORMULATED OR OXYGENATED GASOLINES (RFG):** “Reformulated gasoline” is a term used to describe gasoline blends that are specifically designed to burn cleaner than other types of gasoline, leaving fewer “tailpipe” emissions. They are also formulated to evaporate less when you are filling your tank. Reformulated gasolines use additives to “oxygenate” the gas. Your motorcycle will run normally using this type of gas. Buell recommends you use it when possible, as an aid to cleaner air in our environment.

Because of their generally higher volatility, these blends may adversely affect the starting, driveability and fuel efficiency of your motorcycle. If you experience these problems, Buell recommends that you operate your motorcycle on straight, unleaded gasoline.

LUBRICATION

The engine has a force-feed (pressure) type oiling system, incorporating oil feed and return pumps in one pump body, with one check valve on the oil feed side. The feed pump forces oil to the engine, lubricating lower connecting rod bearings, rocker arm bushings, valve stems, valve springs, push rods and tappets. Cylinder walls, pistons, piston pins, timing gears and bushings and main bearings are lubricated by oil spray thrown off connecting rods and crankshaft, and by oil draining from each rocker box through an internal drain passage in each cylinder and each tappet guide. A small amount of oil is sprayed through an oil galley jet onto the rear intake cam gear in the gearcase; oil is transferred to the teeth of all the cam gears by way of the gear meshing action. The oil-scavenging section of the pump returns oil to the tank from the engine. See [3.7 LUBRICATION SYSTEM](#) for more information.

ADJUSTMENT/TESTING

General

When an engine needs repair, it is not always possible to determine definitely beforehand whether repair is possible with only cylinder heads, cylinders and pistons disassembled or whether complete engine disassembly is required for crankcase repair.

Most commonly, only cylinder head and cylinder repair is needed (valves, rings, piston, etc.) and it is recommended procedure to service these units first, allowing engine crankcase to remain in frame.

See [DISASSEMBLING ENGINE FOR CYLINDER HEAD REPAIR](#) under [3.3 STRIPPING MOTORCYCLE FOR ENGINE REPAIR](#) to strip motorcycle for removal of cylinder heads, cylinders, and pistons.

After disassembling “upper end” only, it may be found that crankcase repair is necessary. In this situation, remove the engine crankcase from the chassis. See [ENGINE CRANKCASE REPLACEMENT OR COMPLETE ENGINE REMOVAL](#) under [3.3 STRIPPING MOTORCYCLE FOR ENGINE REPAIR](#).

CAUTION

If engine is removed from chassis, do not lay engine on primary side. Placing engine on primary side will damage clutch cable end fitting. If fitting is damaged, clutch cable must be replaced.

Symptoms indicating a need for engine repair are often misleading, but generally, if more than one symptom is present, possible causes can be narrowed down to make at least a partial diagnosis. An above-normal consumption of oil, for example, could be caused by several mechanical faults. See [1.24 TROUBLESHOOTING](#). However, when accompanied by blue-gray exhaust smoke and low engine compression, it indicates the piston rings need replacing. Low compression by itself, however, may indicate improperly seated valves, in addition to or in lieu of worn piston rings.

Most frequently, valves, rings, pins, bushings, and bearings need attention at about the same time. If the possible causes can be narrowed down through the process of elimination to indicate any one of the above components is worn, it is best to give attention to all of the cylinder head and cylinder parts.

Compression Test Procedure

Combustion chamber leakage can result in unsatisfactory engine performance. A compression test can help determine the source of cylinder leakage. Use [CYLINDER COMPRESSION GAUGE](#) (Part No. HD-33223-1).

A proper compression test should be performed with the engine at normal operating temperature when possible. Proceed as follows:

CAUTION

After completing the compression test(s), make sure that the throttle plate is in the closed position before starting engine. Engine will start at an extremely high RPM if throttle plate is left open.

1. Disconnect spark plug wires. Clean around plug base and remove plugs.
2. Connect compression tester to front cylinder.
3. With carburetor throttle plates in wide open position, crank engine continuously through 5-7 full compression strokes.
4. Note gauge readings at the end of the first and last compression strokes. Record test results.
5. Connect compression tester to rear cylinder.
6. Repeat Steps 3 and 4 on rear cylinder.
7. Compression is normal if final readings are 120 psi (827 kPa) or more and do not indicate more than a 10 psi (69 kPa) variance between cylinders. See [Table 3-1](#).
8. Inject approximately 1/2 oz. (15 ml) of SAE 30 oil into each cylinder and repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.

Table 3-1. Compression Test Results

DIAGNOSIS	TEST RESULTS
Ring trouble	Compression low on first stroke; tends to build up on the following strokes but does not reach normal; improves considerably when oil is added to cylinder.
Valve trouble	Compression low on first stroke; does not build up much on following strokes; does not improve considerably with the addition of oil.
Head gasket leak	Same reaction as valve trouble.

Cylinder Leakage Test

The cylinder leakage test pinpoints engine problems including leaking valves, worn, broken or stuck piston rings and blown head gaskets. The cylinder leakage tester applies compressed air to the cylinder at a controlled pressure and volume, and measures the percent of leakage from the cylinder.

Use a CYLINDER LEAKDOWN TESTER (Part No. HD-35667A) and follow the specific instructions supplied with the tester.

The following are some general instructions that apply to Buell motorcycle engines:

1. Run engine until it reaches normal operating temperature.
2. Stop engine. Clean dirt from around spark plugs and remove spark plugs.
3. Remove air cleaner and set carburetor throttle in wide open position.
4. Remove timing inspection plug from crankcase.
5. The piston, in cylinder being tested, must be at top dead center of compression stroke during test.
6. To keep engine from turning over when air pressure is applied to cylinder, engage transmission in fifth gear and lock the rear brake.
7. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent leakdown. Any cylinder with 12% leakdown, or more, requires further attention.
8. Listen for air leaks at carburetor intake, exhaust, head gasket and timing inspection hole. See [Table 3-2](#).

NOTE

If air is escaping through valves, check push rod length.

9. Repeat procedure on rear cylinder.

CAUTION

After completing the compression test(s), make sure that the throttle plate is in the closed position before starting engine. Engine will start at an extremely high RPM if throttle plate is left open.

Table 3-2. Air Leakage Test

AIR LEAK LOCATION	POSSIBLE CAUSES
Carburetor intake	Intake valve leaking.
Exhaust pipe	Exhaust valve leaking.
Timing inspection hole	Piston rings leaking. Worn or broken piston. Worn cylinder.
Head gasket	Leaking gasket.

Diagnosing Smoking Engine or High Oil Consumption

Perform [COMPRESSION TEST PROCEDURE](#) or [CYLINDER LEAKAGE TEST](#) as described previously. If further testing is needed, remove suspect head(s) and inspect the following:

- Valve guide seals.
- Valve guide-to-valve stem clearance.
- Gasket surface of both head and cylinder.
- Oil return passages for clogging.

DISASSEMBLING ENGINE FOR CYLINDER HEAD REPAIR

1. Lift and secure the motorcycle.
 - a. Place vehicle on a lift and anchor front wheel in place. Raise lift so the top of the cylinder head is easy to access.
 - b. Raise rear wheel off lift using REAR WHEEL SUPPORT STAND (Part No. B-41174).

⚠ WARNING

To protect against accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠ WARNING

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect both battery cables, negative cable first and remove battery.
3. Remove seat and fuel tank. See 4.5 FUEL TANK.
4. Remove air cleaner cover and backplate. See 4.4 AIR CLEANER.
5. Remove exhaust header and muffler. See 2.28 EXHAUST SYSTEM
6. Remove carburetor and manifold. See 4.2 CARBURETOR.
7. Disconnect spark plug cables. Remove spark plugs.
8. If removing front cylinder, remove ignition coil (7.9 IGNITION COIL) and horn (7.23 HORN).

NOTE

At this stage, the lower rocker boxes, cylinder heads and cylinders may be removed. See 3.5 CYLINDER HEAD.

ENGINE CRANKCASE REPLACEMENT OR COMPLETE ENGINE REMOVAL

1. Perform the steps listed above.
2. Remove tail section. See 2.34 TAIL SECTION.
3. See Figure 3-1. Place a floor hoist behind the lift. Attach straps to frame and hoist. Raise hoist until straps tighten.
4. Detach clutch cable from handgrip.
5. Remove rear fender and lower belt guard. See 2.31 FENDERS.
6. Remove sprocket cover. See 2.30 SPROCKET COVER.
7. Detach rear brake caliper from caliper mount. See 2.14 REAR BRAKE CALIPER.

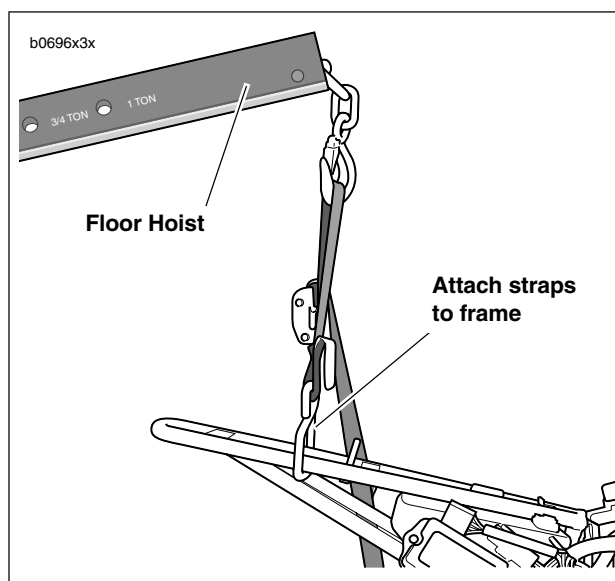


Figure 3-1. Floor Hoist

8. Detach belt from rear sprocket and remove rear wheel. See [2.6 REAR WHEEL](#).
9. Drain oil tank and remove oil filter. See [1.4 ENGINE LUBRICATION SYSTEM](#).
10. Detach wire from oil pressure switch. See [3.10 OIL PRESSURE INDICATOR SWITCH](#)
11. Detach hoses from all three fittings on oil tank. See [3.9 OIL TANK](#).
12. Remove both rider footrest mounts from frame. See [2.29 FOOTRESTS](#).
13. Remove rear shock mounting bolt (metric) from swingarm. Allow rear shock to hang from front mount.
14. Disconnect wiring. See Section 7.
 - a. Disconnect neutral switch wire from crankcase.
 - b. Unplug cam position sensor from wiring harness.
 - c. Remove solenoid wire, battery positive cable and circuit breaker charging wire from starter motor.
 - d. Locate voltage regulator connector near the oil pump. Disconnect from alternator stator.
 - e. Disconnect V.O.E.S. wire from ignition module.

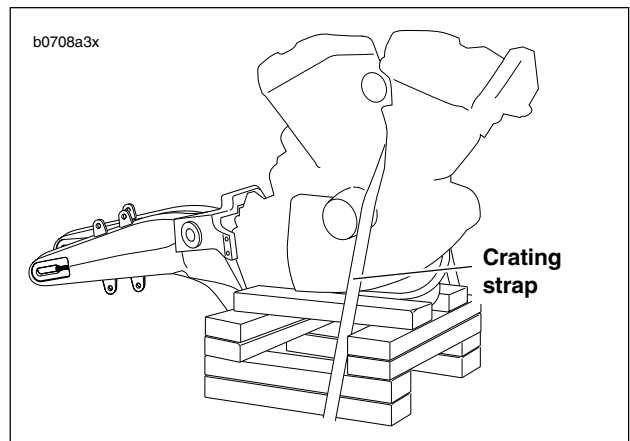


Figure 3-2. Supporting the Engine

15. See [Figure 3-2](#). Place a wooden crate underneath the crankcase.
16. Place a crating strap between the engine cylinders and around the lift. Tighten crating strap until snug.
17. See [Figure 3-3](#). Remove engine ground strap (1) from swingarm mount block.
18. Detach remaining tie bars from frame.
 - a. Remove rear tie bar using a swivel socket.
 - b. See [Figure 3-4](#). Detach front tie bar (1) and clutch cable clamp (3). Remove tie bar bolt (2), clutch cable clamp (3), washer (4) and locknut (5).
19. Detach front isolator (8). Remove front isolator bolt (6), nut (10), D-washer (9) and washer (7).
20. See [Figure 3-3](#). Remove isolator bolt (7) and lockwasher (6) on each side.
21. Slowly raise floor hoist until rubber isolators (5) can be removed. Frame will rise while engine remains secured to lift by crating strap.

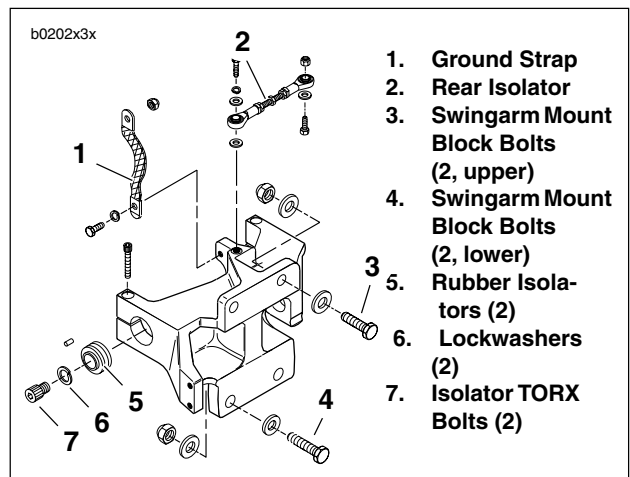


Figure 3-3. Rear Tie Bar Assembly

NOTE

Rubber isolators align with a frame mounted metal pin.

22. Raise frame and walk forward over and away from the engine.
23. If necessary, remove rear swingarm. See [2.19 SWING-ARM](#).
24. If necessary, detach swingarm mount block from powertrain by removing bolts (3, 4), washers and locknuts.

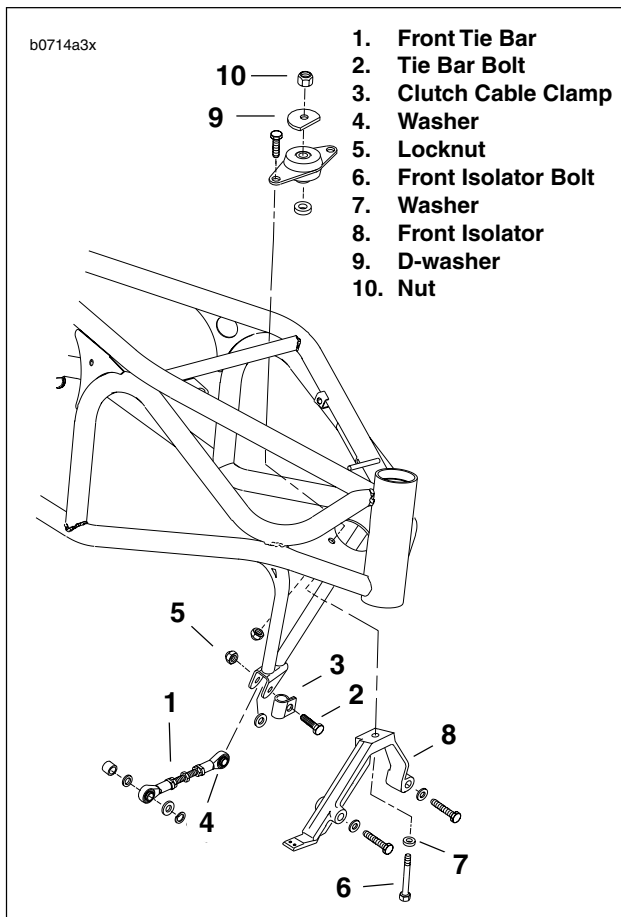


Figure 3-4. Front Tie Bar Assembly

ENGINE CRANKCASE INSTALLATION

1. See [Figure 3-2](#). Place engine crankcase on supports so frame may be installed over the top of the engine.
2. See [Figure 3-3](#). If removed, attach swingarm mount block to engine. Install upper bolts (3), washers and locknuts finger tight. Install lower bolts (4), washers and locknuts finger tight. Tighten upper bolts to 41-45 ft-lbs (56-61 Nm) and lower bolts to 68-75 ft-lbs (92-102 Nm).
3. If removed, install swingarm. Adjust swingarm bearing preload. See [2.19 SWINGARM](#).
4. If removed, install transmission mainshaft sprocket. See [6.13 TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT](#).
5. Remove oil filter (if installed). Walk frame over powertrain.
6. See [Figure 3-4](#). Attach front isolator (8). Install front isolator mount with bolt (6), washers (7), D-washer (9) and locknut (10). Flat on D-washer faces steering neck (forward). Tighten bolt finger tight.
7. See [2.20 REAR ISOLATORS](#) for installation. Apply **LOC-TITE ANTI-SIEZE** under two isolator bolt heads. Install rear isolators but do not tighten isolator bolts at this time.
19. Attach disconnected wires. See Section 7.
 - a. Connect solenoid wire, circuit breaker charging wire and battery positive cable to starter.
 - b. Connect voltage regulator connector to alternator stator wiring.
 - c. Attach cam position sensor to wire harness.
 - d. Connect neutral switch wire to crankcase.
 - e. Attach oil pressure indicator switch wire.
20. Install rear fender and lower belt guard. See [2.31 FENDERS](#).
21. Install sprocket cover. See [2.30 SPROCKET COVER](#).
22. Install footrests. See [2.29 FOOTRESTS](#).
23. Continue with the steps listed under [ENGINE INSTALLATION AFTER CYLINDER HEAD REPAIR](#).

CAUTION

Do not adjust tie bar assemblies. Tie bar tension is set at the factory. Any attempt at adjusting tension will cause damage to tie bars. Damaged tie bars must be replaced.

8. See [Figure 3-3](#). Rear tie bar must be horizontal and below frame tab. Insert bolt upwards through washer, tie bar and frame. Fasten with nut. Tighten bolt to 30-33 ft-lbs (41-45 Nm).
9. See [Figure 3-4](#). Place clutch cable clamp (3) on front tie bar bolt (2). Clamp should hold cable on primary cover side of motor. Insert bolt from front through frame and install washer (4). Continue through tie bar (1) and frame. Install locknut (5) and tighten to 30-33 ft-lbs (41-45 Nm).
10. See [Figure 3-3](#). Tighten the two rear isolator bolts (7) to 63-70 ft-lbs (85-95 Nm). Make sure isolator does not twist during tightening. See [2.20 REAR ISOLATORS](#).
11. See [Figure 3-4](#). Tighten front isolator bolt (6) to 100-110 ft-lbs (136-149 Nm).
12. Connect feed, return and vent lines to oil tank. See [3.8 OIL HOSE ROUTING](#). Use **new** hose clamps.
13. Attach battery ground strap to swingarm mount block.
14. Attach clutch cable to handlebar lever.
15. Remove strap from between engine cylinders. Using a floor hoist, lift motorcycle by the frame and remove the wooden cradle from underneath the crankcase.
16. Install rear shock. See [2.21 REAR SHOCK ABSORBER](#).
17. Install rear wheel and attach secondary drive belt. See [2.6 REAR WHEEL](#).
18. Install rear brake caliper. See [2.14 REAR BRAKE CALIPER](#).

ENGINE INSTALLATION AFTER CYLINDER HEAD REPAIR

1. Install **new** oil filter, engine oil and primary chaincase fluid as necessary. See Section 1.
2. Install intake manifold, carburetor and ignition key switch bracket. See [4.2 CARBURETOR](#).
 - a. Plug ignition key switch connector into main wiring harness.
 - b. Connect V.O.E.S. to ignition module.
3. Install exhaust system. See [2.28 EXHAUST SYSTEM](#).
4. Install air cleaner assembly. See [4.4 AIR CLEANER](#).
5. If removed, install horn ([7.23 HORN](#)) and ignition coil ([7.9 IGNITION COIL](#)).
6. Install spark plugs and connect cables. See [1.16 SPARK PLUGS](#).

WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

7. Install battery. Connect both battery cables, positive cable first.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

8. Install tail section, fuel tank and seat. See [2.34 TAIL SECTION](#).
9. If engine crankcase installation was performed:
 - a. Adjust rear belt deflection. See [1.9 DRIVE BELT DEFLECTION](#).
 - b. Adjust rear shock spring preload. See [1.12 PRE-LOAD ADJUSTMENT](#).
 - c. Adjust clutch lever. See [1.8 CLUTCH](#).
 - d. Check rear brake pedal height. See [1.5 BRAKES](#).
10. Check all electrical components for proper operation.

REMOVAL

Before removing the cylinder head assembly, see [3.3 STRIPPING MOTORCYCLE FOR ENGINE REPAIR](#). The rocker arm covers and internal components must be removed before removing cylinder heads.

1. See [Figure 3-5](#). Remove screws with washers (1) and fiber seals (2). Discard fiber seals.

CAUTION

All washers and fasteners used in the V²_{TM} engine are hardened. Do not mix or replace hardened washers and fasteners with unhardened parts. Do not reuse fiber cover seals. These actions may result in accelerated wear and increased noise.

2. Remove upper (4) and middle (5) sections of rocker cover. Remove and discard gaskets (6, 7 and 8).
3. Rotate crankshaft until piston on head being repaired reaches top dead center of compression stroke.

NOTE

Both valves in the cylinder head will be closed when viewed through the spark plug hole.

4. Remove hardware holding lower rocker cover to cylinder head in the following order.
 - a. Remove two screws and washers (14).
 - b. Remove three bolts and washers (15).
 - c. Remove the two rocker arm retaining bolts (12) near the push rods.
 - d. Remove the remaining two rocker arm retaining bolts (13).
5. Remove lower rocker cover (18).

NOTE

Remove lower rocker boxes as an assembly; then disassemble as required.

6. Mark the location and orientation (top/bottom) of each push rod. Remove push rods.

CAUTION

Mark rocker arm shafts for reassembly in their original positions. Valve train components must be reinstalled in their original positions to prevent accelerated wear and increased valve train noise.

7. See [Figure 3-6](#). Remove rocker arm shafts by tapping them out using a hammer and a soft metal punch.
8. See [Figure 3-5](#). Remove rocker arms (10, 11); mark them for reassembly in their original locations.

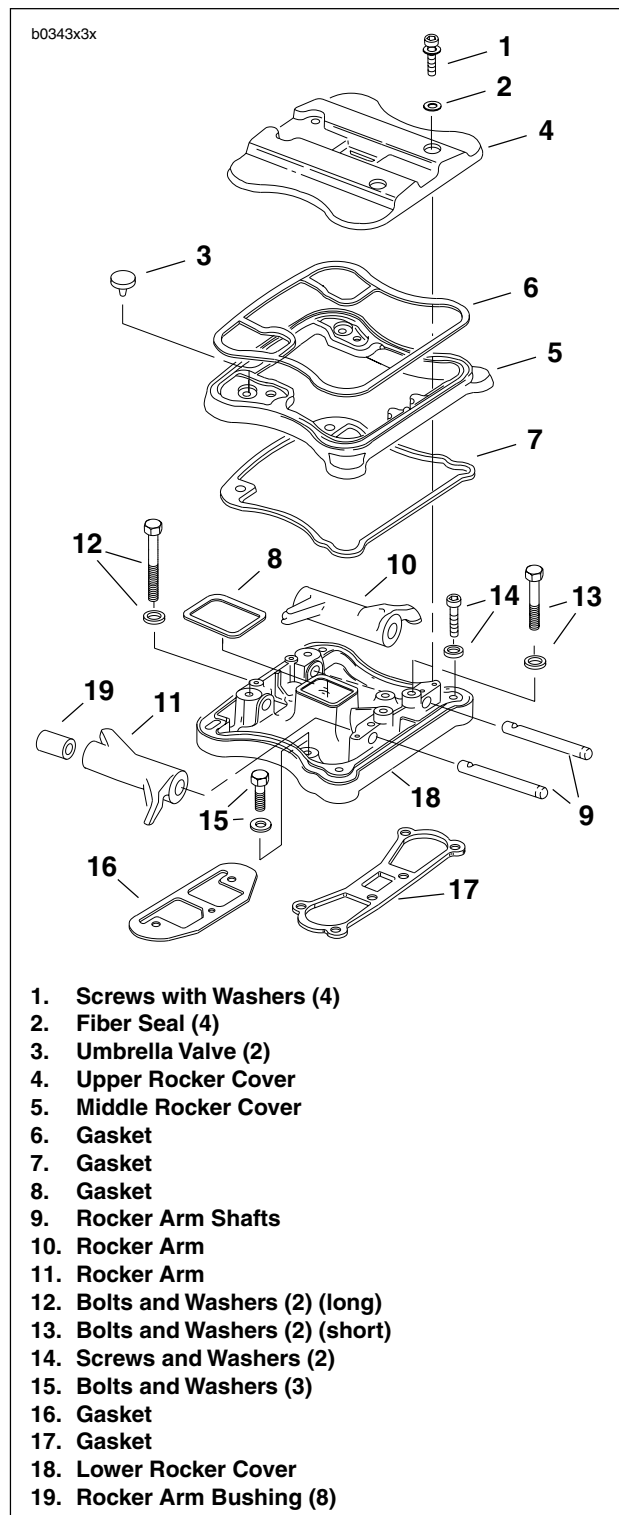


Figure 3-5. Rocker Arm Cover

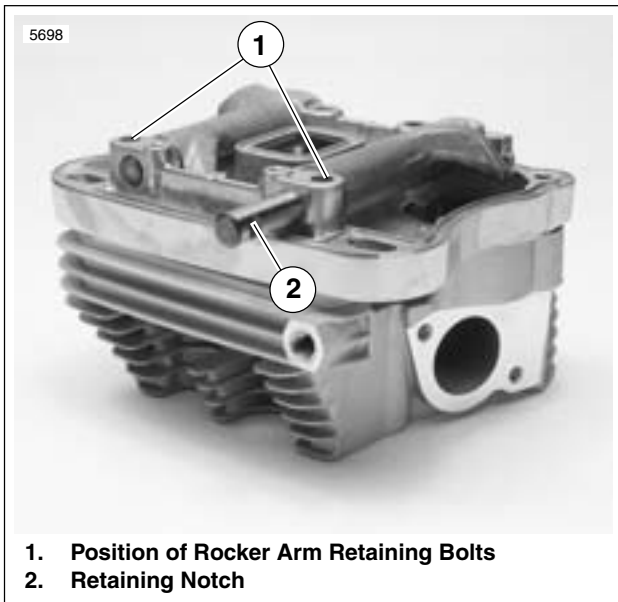


Figure 3-6. Removing Rocker Arm Shafts

CAUTION

Distortion to the head, cylinder and crankcase studs may result if head screws are not loosened (or tightened) gradually in the sequence shown in [Figure 3-7](#).

9. See [Figure 3-7](#). Loosen each head screw 1/8-turn following the sequence shown.

CAUTION

See [Figure 3-8](#). Do not attempt to remove the front isolator mount from front cylinder head. Isolator mount is an integral component and is not meant to be removed unless absolutely necessary. Repeated removals and installations will damage cylinder head threads.

10. Support motorcycle under front header mount. Do not allow engine to drop when performing the next Step.
11. Continue loosening in 1/8-turn increments until screws are loose. Remove head screws.
12. See [Figure 3-9](#). Remove cylinder head (18), head gasket (4), and O-rings (14).

NOTE

Front cylinder head must be removed through upper triangular frame members with front isolator mount attached.

13. Remove both push rod covers and hydraulic lifters. See [3.15 HYDRAULIC LIFTERS](#).
14. Repeat the above procedure for the other cylinder head.

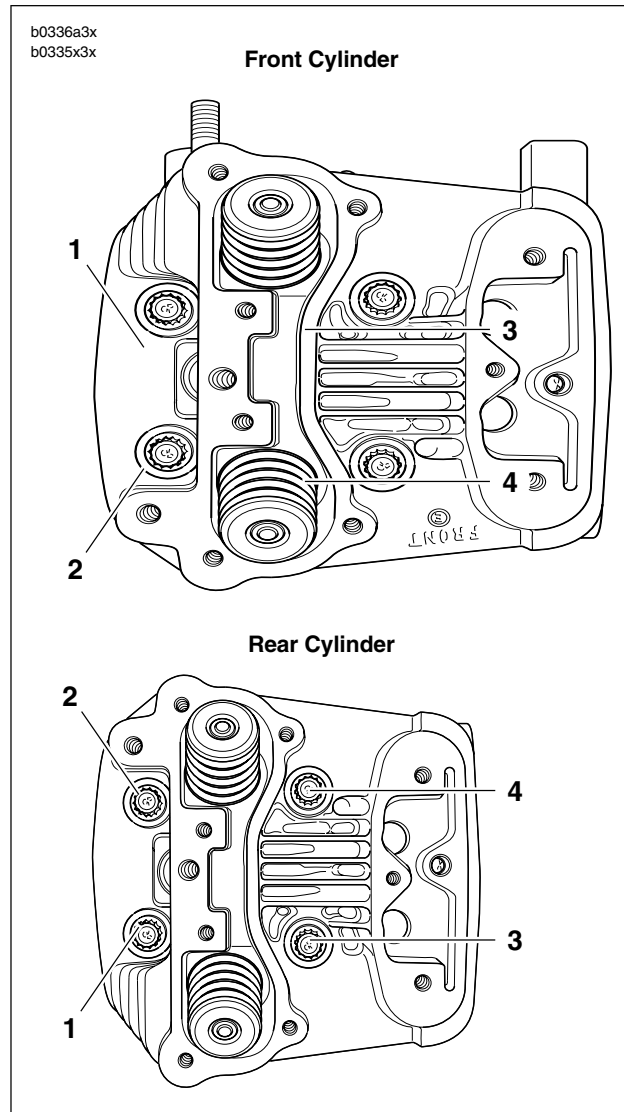


Figure 3-7. Head Screw Loosening/Tightening Sequence

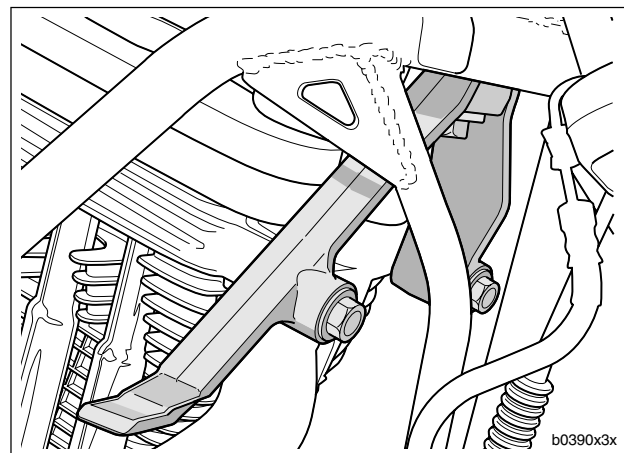
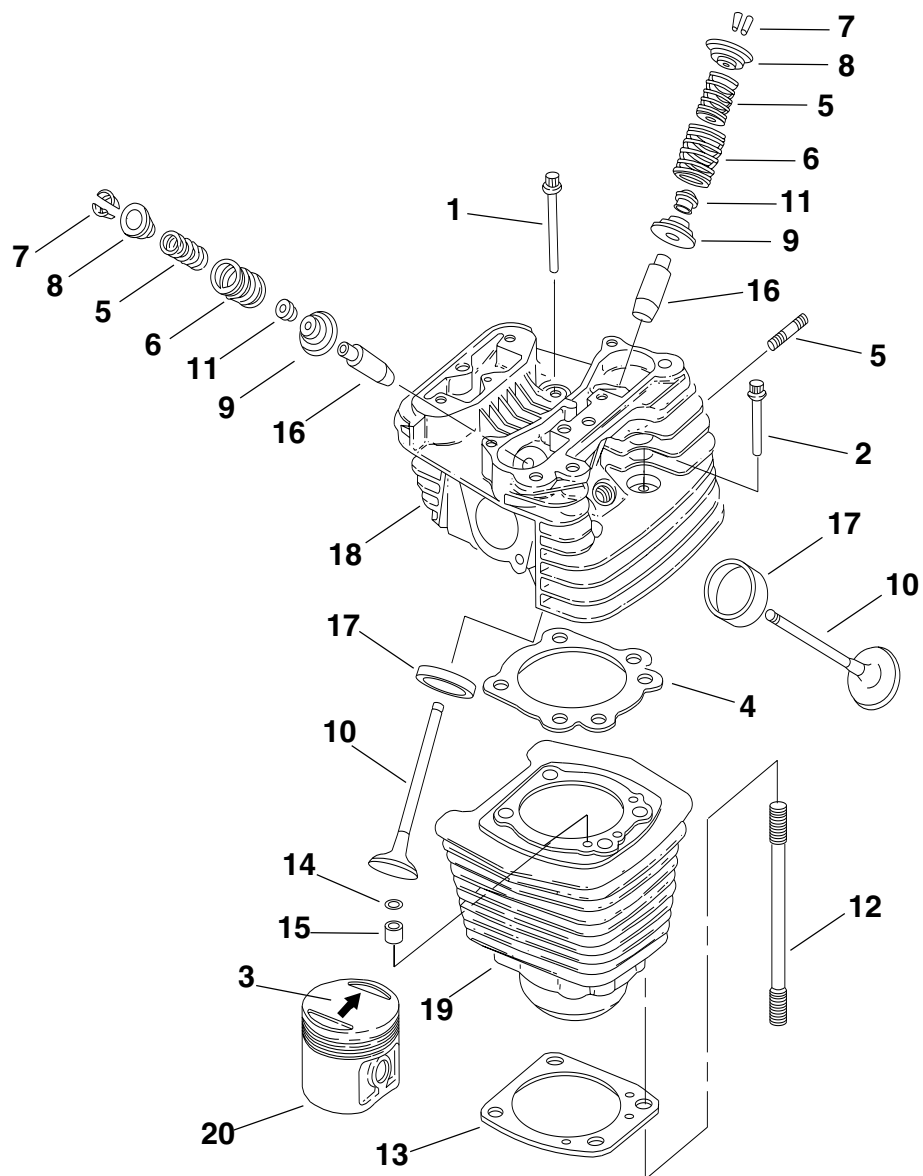


Figure 3-8. Front Isolator Mount

xlhcyhead



1. Head Screw, long (2)
2. Head Screw, short (2)
3. Arrow, Piston Direction
4. Head Gasket
5. Inner Valve Spring (2)
6. Outer Valve Spring (2)
7. Valve Keeper (4)
8. Upper Collar (2)
9. Lower Collar (2)
10. Valve, (1 intake, 1 exhaust)
11. Valve Stem Seal (2)
12. Cylinder Stud (4)
13. Base Gasket
14. O-ring (2)
15. Insert/Dowel (2)
16. Valve Guide (2)
17. Valve Seat Insert (2)
18. Cylinder Head
19. Cylinder
20. Piston

Figure 3-9. Cylinder Head, Cylinder and Piston

DISASSEMBLY

NOTE

Disassembly of front cylinder exhaust valve components requires front isolator mount removal.

1. See Figure 3-10. Compress valve springs with VALVE SPRING COMPRESSOR (Part No. HD-34736B).
2. See Figure 3-9. Remove valve keepers (7), upper collar (8) and valve springs (5, 6). Mark valve keepers for reassembly in their original locations.
3. Use a fine tooth file to remove any burrs on the valve stem at the keeper groove.
4. Mark valve to ensure that it will be reassembled in the same head. Remove valve (10), valve stem seal (11) and lower collar (9).
5. Repeat the above procedure for the other valve.
6. Disassemble the other head using the same procedure.

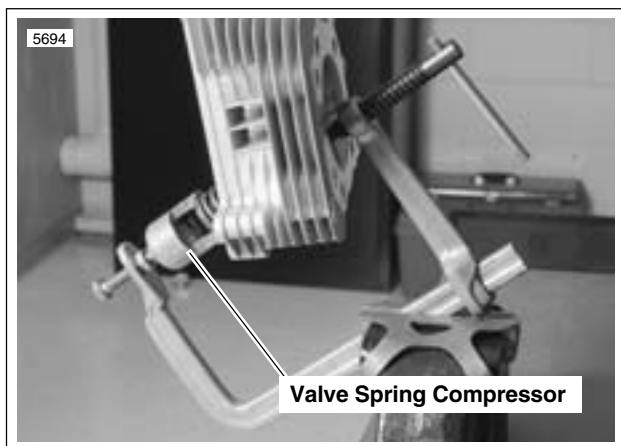


Figure 3-10. Valve Spring Compressor
(Part No. HD-34736B)

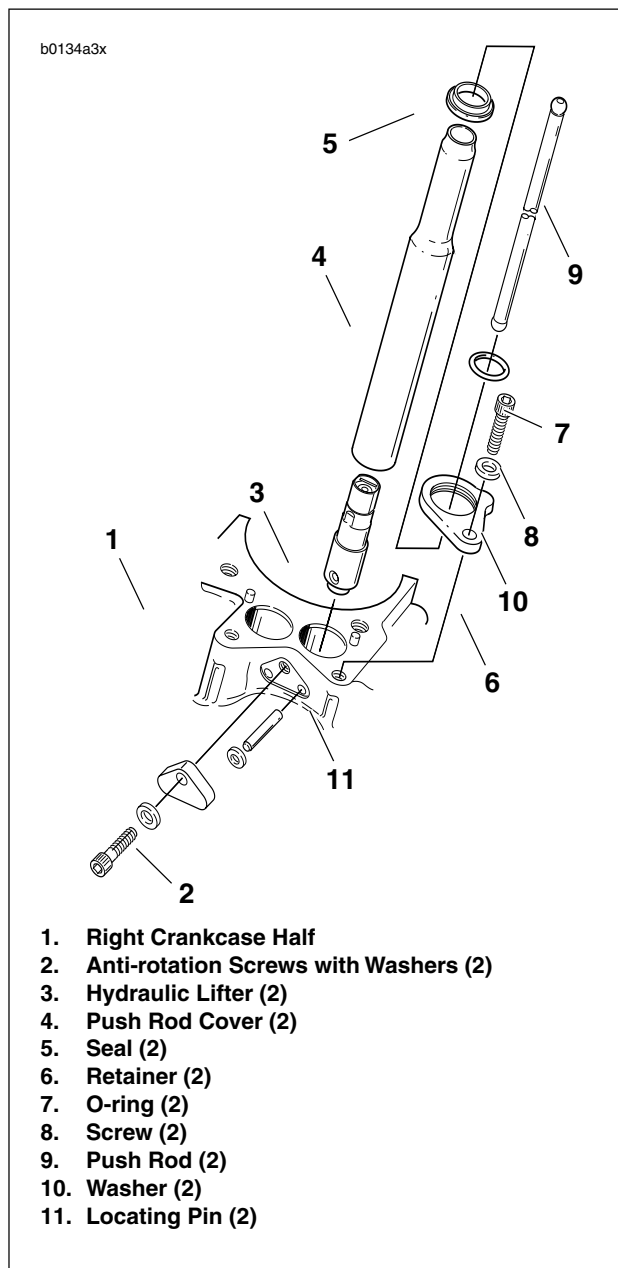


Figure 3-11. Middle Valve Train Components
(Quantities per Engine Cylinder)

CLEANING AND INSPECTION

1. Bead blast or scrape carbon from head, top of cylinder and valve ports. Be careful to avoid scratching or nicking cylinder head and cylinder joint faces. Blow off loosened carbon or dirt with compressed air.
2. Soak cylinder head in an aluminum-compatible cleaner/solvent to loosen carbon deposits.
3. Wash all parts in non-flammable solvent, followed by a thorough washing with hot, soapy water. Blow out oil passages in head. Be sure they are free of sludge and carbon particles. Remove loosened carbon from valve head and stem using a wire wheel. Never use a file or other hardened tool which could scratch or nick valve. Polish valve stem with very fine emery cloth or steel wool.
4. Check each rocker arm, at pad end and push rod end, for uneven wear or pitting. Replace rocker arm if either condition exists.



Figure 3-12. Measuring Rocker Arm Shaft Diameter (Rocker Cover Position)

5. Measure and record rocker arm shaft diameter.
 - a. See [Figure 3-12](#). Measure where shaft fits in lower rocker arm cover.
 - b. See [Figure 3-13](#). Measure where rocker arm bushings ride.
6. Measure and record rocker arm shaft bore diameter.
 - a. See [Figure 3-14](#). Measure bore of lower rocker cover.
 - b. See [Figure 3-15](#). Measure rocker arm bushing inner diameter.
7. Check the measurements obtained in Steps 5-6 against the **SERVICE WEAR LIMITS**. Repair or replace parts exceeding limits.
8. Assemble rocker arms and rocker arm shafts into lower rocker cover.
9. Check end play of rocker arm with feeler gauge.
10. Replace rocker arm or lower cover or both if end play exceeds 0.025 in. (0.635 mm).



Figure 3-13. Measuring Rocker Arm Shaft Diameter (Rocker Arm Bushing Position)



Figure 3-14. Measuring Rocker Arm Shaft Bore Diameter in Lower Rocker Cover



Figure 3-15. Measuring Rocker Arm Bushing Inner Diameter

11. Valve heads should have a seating surface width of 0.040-0.062 in. (1.016-1.575 mm), and should be free of pit marks and burn spots. The color of carbon on exhaust valves should be black or dark brown. White or light buff carbon indicates excessive heat and burning.
12. Valve seats are also subject to wear, pitting, and burning. Resurface valve seats whenever valves are refinished.
13. Clean valve guides by lightly honing with VALVE GUIDE HONE (Part No. HD-34723).
14. Scrub guides with VALVE GUIDE BRUSH (Part No. HD-34751) and hot soapy water. Measure valve stem outer diameter and valve guide inner diameter. Check measurements against [SERVICE WEAR LIMITS](#).
15. Inspect spark plug threads for damage. If threads in head are damaged, a special plug type insert can be installed using a 12 mm spark plug repair kit.
16. Inspect valve springs for broken or discolored coils.

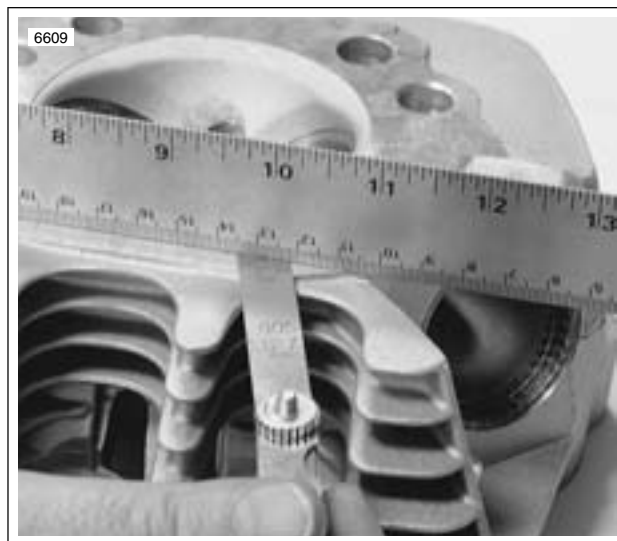


Figure 3-17. Checking Gasket Surface

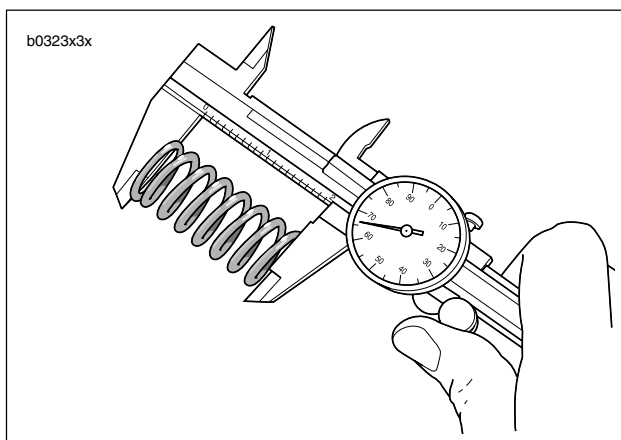


Figure 3-16. Checking Spring Free Length

17. See [Figure 3-16](#). Check free length and compression force of each spring. Compare with [SERVICE WEAR LIMITS](#). If spring length is shorter than specification or if spring compression force is below specification, replace spring.
18. Examine push rods, particularly the ball ends. Replace any rods that are bent, worn, discolored or broken.
19. See [Figure 3-17](#). Check head gasket surface on head for flatness. Machine or replace any head which exceeds [SERVICE WEAR LIMIT](#) of 0.006 in. (0.152 mm).

Rocker Arms and Bushings

1. See [Figure 3-18](#). To replace worn bushings, press or drive them from the rocker arm. If bushing is difficult to remove, turn a 9/16-18 tap into bushing. From opposite side of rocker arm, press out bushing and tap.
2. Press replacement bushing into rocker arm, flush with arm end, and split portion of bushing towards top of arm.
3. Using remaining old bushing as a pilot, line ream new bushing with [ROCKER ARM BUSHING REAMER](#) (Part No. HD-94804-57).
4. Repeat for other end of rocker arm.

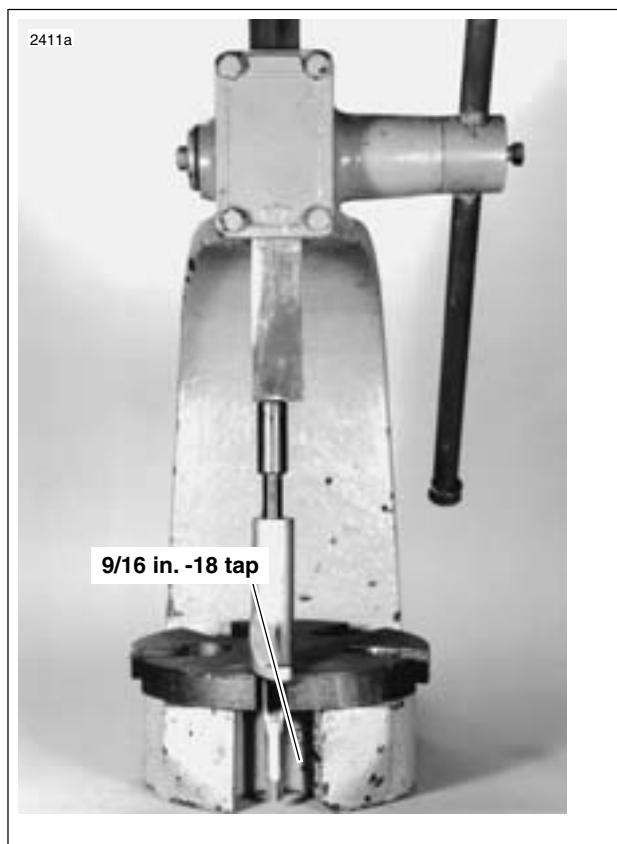


Figure 3-18. Removing Rocker Arm Bushing

Replacing Valve Guides

Valve guide replacement, if necessary, must be done before valve seat is ground. It is the valve stem hole in valve guide that determines seat grinding location. Valve stem-to-valve guide clearances are listed in [Table 3-3](#). If valve stems and/or guides are worn beyond limits, install **new** parts.

Table 3-3. Valve Stem Clearances and Service Wear Limits

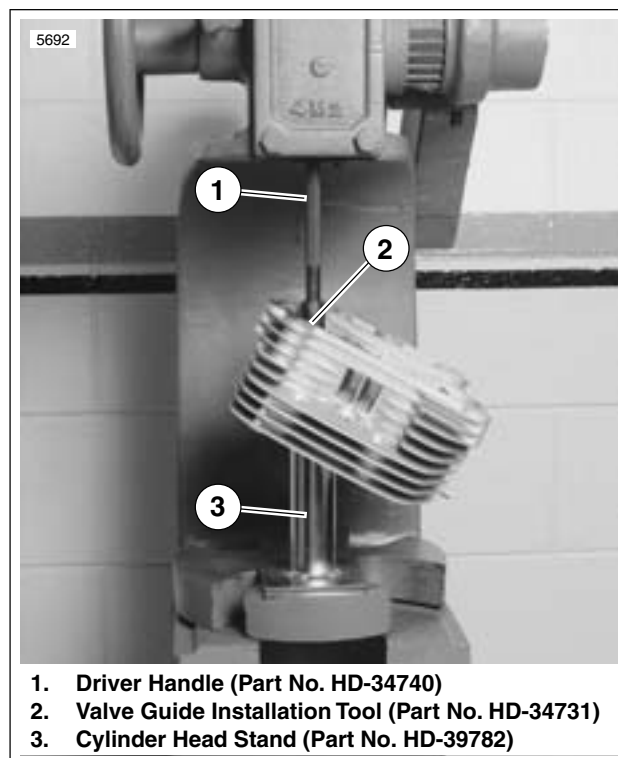
VALVE	CLEARANCE	SERVICE WEAR LIMIT
Exhaust	0.0015-0.0033 in. (0.0381-0.0838 mm)	0.0040 in. (0.1016 mm)
Intake	0.0008-0.0026 in. (0.0203-0.0660 mm)	0.0035 in. (0.0889 mm)

- To remove shoulderless guides, press or tap guides toward combustion chamber using DRIVER HANDLE AND REMOVER (Part No. HD-34740).
- Clean and measure valve guide bore in head.
- Measure outer diameter of a new standard valve guide. The guide diameter should be 0.0020-0.0033 in. (0.0508-0.0838 mm), larger than bore in head. If it is not, select one of the following oversizes: +0.001 in. (+0.025 mm), +0.002 in. (+0.051 mm) or +0.003 in. (+0.076 mm) (intake and exhaust).
- See [Figure 3-19](#). Install shoulderless guides using VALVE GUIDE INSTALLATION TOOL (2) (Part No. HD-34731) and DRIVER HANDLE (1) (Part No. HD-34740). Press or drive guide until the tool touches the machined surface surrounding the guide. At this point, the correct guide height has been reached.
- Ream guides to final size or within 0.0010 in. (0.0254 mm) of final size using VALVE GUIDE REAMER (Steel, Part No. HD-39932 or Carbide, Part No. HD-39932-CAR). Use REAMER LUBRICANT (Part No. HD-39964) or liberal amounts of suitable cutting oil to prevent reamer chatter.

NOTE

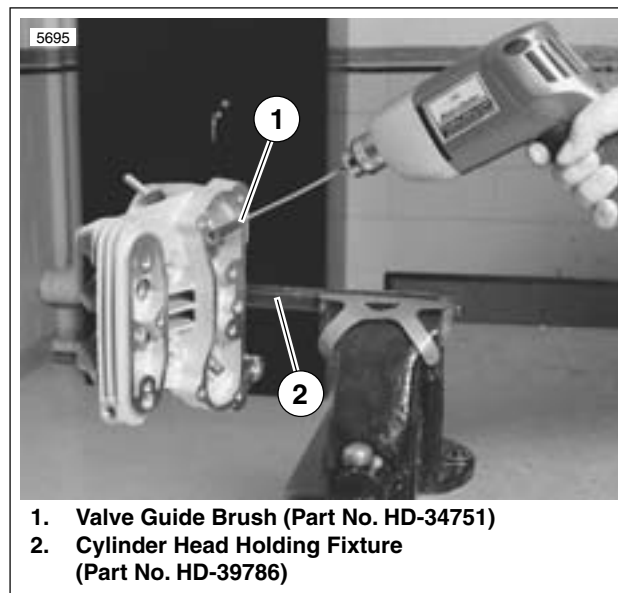
The hone is not intended to remove material.

- Apply the proper surface finish to the valve guide bores using the VALVE GUIDE HONE (Part No. HD-34723). Lubricate hone with honing oil. Driving hone with an electric drill, work for a crosshatch pattern with an angle of approximately 60°.
- See [Figure 3-20](#). Thoroughly clean valve guide bores using VALVE GUIDE BRUSH (1) (Part No. HD-34751) and hot soapy water.



- Driver Handle (Part No. HD-34740)
- Valve Guide Installation Tool (Part No. HD-34731)
- Cylinder Head Stand (Part No. HD-39782)

Figure 3-19. Installing Shoulderless Valve Guide



- Valve Guide Brush (Part No. HD-34751)
- Cylinder Head Holding Fixture (Part No. HD-39786)

Figure 3-20. Cleaning Valve Guides

Grinding Valve Faces and Seats

After installing valve guides, reface valve seats to make them concentric with guides.

Valve face angle is 45° for both intake and exhaust valves. If a valve refacing grinder is used, it must be adjusted exactly to this angle. It is important to remove no more metal than is necessary to clean up and true valve face. Install a **new** valve if grinding leaves the valve edge (the margin) with a width of less than 1/32 in. (0.8 mm). A valve with too thin a margin does not seat normally, burns easily, may cause pre-ignition and can also lead to valve cracking. Valves that do not clean up quickly are probably warped or too deeply pitted to be reused. Replace the valve if end of valve stem shows uneven wear. After valves have been ground, handle with care to prevent damage to the ground faces.

The valve seats may be refinished with cutters or grinders. Cut seats to a 46° angle or grind seats to a 45° angle. Valve seat tools and fixtures are available commercially. Seat each valve in the same position from which it was removed.

The correct 3-angle valve seat angles are shown in [Figure 3-21](#). Use NEWAY VALVE SEAT CUTTER SET (Part No. HD-35758-A) to cut the seats. See [Figure 3-22](#). Always grind valves before cutting seats.

1. Cut 46° (or grind 45°) valve seat angle first. Use cutting oil to avoid chatter marks. Cut or grind only enough to clean up the seat.
2. Apply a small amount of lapping compound to the valve face. Rotate valve against seat using VALVE LAPPING TOOL (Part No. HD-96550-36A).
3. See [Figure 3-21](#). Check the contact pattern on valve face. It should be 0.040-0.062 in. (1.016-1.575 mm) wide, and its center should be positioned 2/3 of the way toward the outside edge of face.
4. If valve seat pattern is too close to the stem side of valve face, cut a 60° angle in order to raise seat. If pattern is too close to the edge of valve face, cut a 31° angle in order to lower seat.
5. After cutting either or both 31° or 60° angles to position seat, final cut 46° (or grind 45°) seat angle to obtain proper 0.040-0.062 in. (1.016-1.575 mm) width.
6. Recheck valve seat width and location with lapping compound as described in Step 2.
7. To achieve a smooth even finish, place a piece of 280 grit emery paper under the cutter head and rotate cutter.

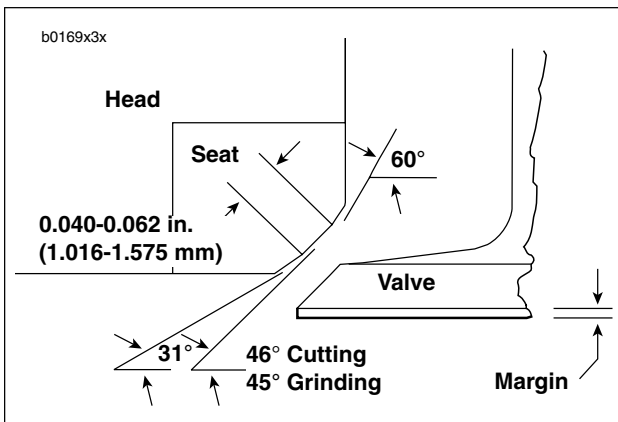


Figure 3-21. Valve Seat Angles

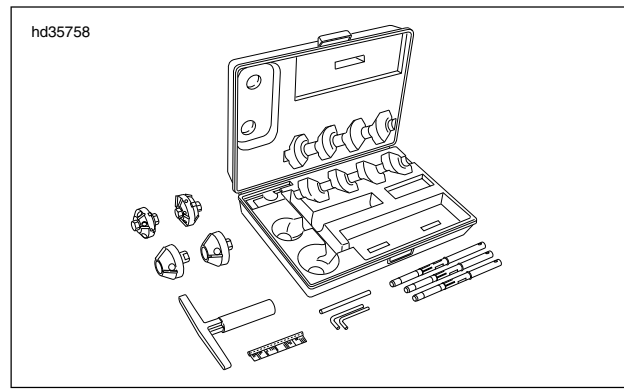


Figure 3-22. Valve Seat Cutter

Table 3-4. Neway Valve Seat Cutters

VALVE SEAT	60° CUTTER	31° AND 46° CUTTERS
Exhaust	Part No. 205	Part No. 622
Intake	Part No. 293	Part No. 642

CAUTION

Do not grind valve to shorten. Grinding will remove the case hardening and expose the stem's mild steel core resulting in rapid end wear.

8. See [Figure 3-23](#). Wipe valve seats and valve faces clean. Measure valve stem protrusion.
 - a. If valve stem protrudes more than 2.031 in. (51.587 mm), replace valve seat or cylinder head.
 - b. If valve stem protrusion is acceptable, valves and seats are ready for lapping.

Replacing Valve Seats

Replacing a valve seat is a complex operation requiring special equipment. If the seat is loose or is not fully seated in the head, then seat movement will prevent the proper transfer of heat from the valve. The seat surface must be flush with (or below) the head surface. See [3.1 SPECIFICATIONS](#) for valve seat-to-cylinder head fit.

To remove the old seat, lay a bead of weld material around the inside diameter of the seat. This will shrink the seat outside diameter and provide a surface for driving the seat out the port side.

Lapping Valve Faces and Seats

NOTE

If valve faces and seats have been smoothly and accurately refaced, very little lapping will be required to complete the seating operation.

1. See Figure 3-24. Use CYLINDER HEAD HOLDING FIXTURE (2) (Part No. HD-39786) to secure cylinder head.
 - a. Apply a light coat of fine lapping compound to valve face. Insert valve in guide.
 - b. Place one rubber cup end of VALVE LAPPING TOOL (1) (Part No. HD-96550-36A) onto head of valve.
 - c. Holding lapping tool as shown, apply only very light pressure against valve head.
 - d. Rotate lapping tool and valve alternately clockwise and counterclockwise a few times.
2. Lift valve and rotate it about 1/3 of a turn clockwise. Repeat lapping procedure in Step 1.
3. Repeat Step 2. Then, remove valve.
4. Wash valve face and seat. Dry parts with a **new**, clean cloth or towel.
5. Inspect valve and seat.
 - a. If inspection shows an unbroken lapped finish of uniform width around both valve and seat, valve is well seated.
 - b. If lapped finish is not complete, further lapping (or grinding and lapping) is necessary.



Figure 3-23. Measuring Valve Stem Protrusion

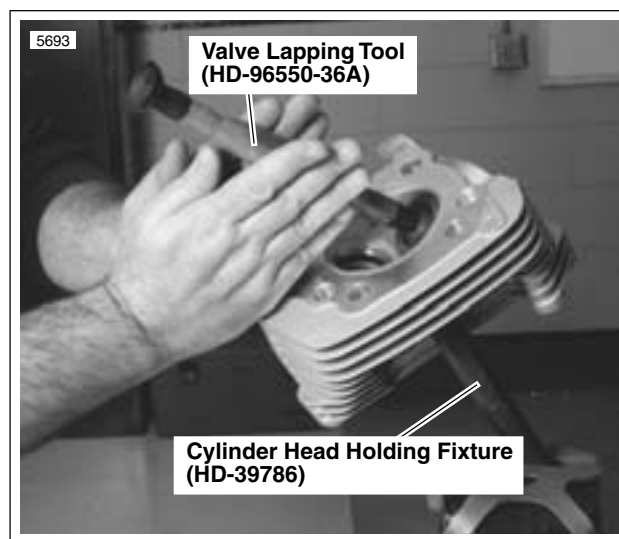


Figure 3-24. Lapping Valves

ASSEMBLY

CAUTION

Make sure all lapping compound is removed from cylinder head and valves after lapping is completed. If lapping compound contaminates any internal engine components or engine oil, excessive engine wear and damage may result.

1. Wash cylinder head and valves in warm, soapy water to remove all lapping compound.
2. Scrub valve guide bores with VALVE GUIDE BRUSH (Part No. HD-34751) and hot, soapy water.
3. Blow dry with compressed air.
4. Apply a liberal amount of engine oil to the valve stem.
5. See Figure 3-25. Insert valve into valve guide and install lower collar.
6. See Figure 3-26. Place a protective sleeve over the valve stem keeper groove. Coat the sleeve with oil and place a new seal over the valve stem.

CAUTION

- Always use a protective sleeve on the valve stem keeper groove when installing valve stem seal. If the seal is installed without using the protective sleeve, the seal will be damaged.
 - Do not remove valve after seal is installed. Otherwise, sharp edges on keeper groove will damage seal.
7. See Figure 3-25. Tap the valve stem seal onto the valve guide using the VALVE SEAL INSTALLATION TOOL (Part No. HD-34643A) and DRIVER HANDLE (Part No. HD-34740). The seal is completely installed when the tool touches the lower collar.
 8. See Figure 3-9. Install valve springs (5,6) and upper collar (8).
 9. Compress springs with VALVE SPRING COMPRESSOR (Part No. HD-34736B).
 10. Insert valve keepers (7) into upper collar (8), making sure they engage groove in valve stem. The keeper gaps should be equal.
 11. Release and remove VALVE SPRING COMPRESSOR.
 12. Repeat Steps 4-11 for the remaining valve(s).

WARNING

Always wear proper eye protection and gloves when working with compressed air. Debris or solvent may be blown out with enough force to penetrate skin or cause eye injury. Failure to comply could result in death or serious injury.

13. If front isolator mount was removed, install as follows.
 - a. Clean residual loctite from threads in engine with a suitable nonflammable solvent and dry with compressed air.
 - b. Apply LOCTITE THREADLOCKER 271 (red) to threads of new front isolator mount bolts.

- c. Apply a thin film of clean HD 20W50 engine oil to both sides of new thick washers and to bottom of bolt heads. Exercise caution to avoid mixing oil on washers with loctite on bolts.
- d. Position front isolator mount and secure with two new front bolts with new thick washers. Tighten bolts to 60 ft-lbs (81 Nm) initially and then loosen each bolt one full turn. Tighten bolts again to 60 ft-lbs (81 Nm).

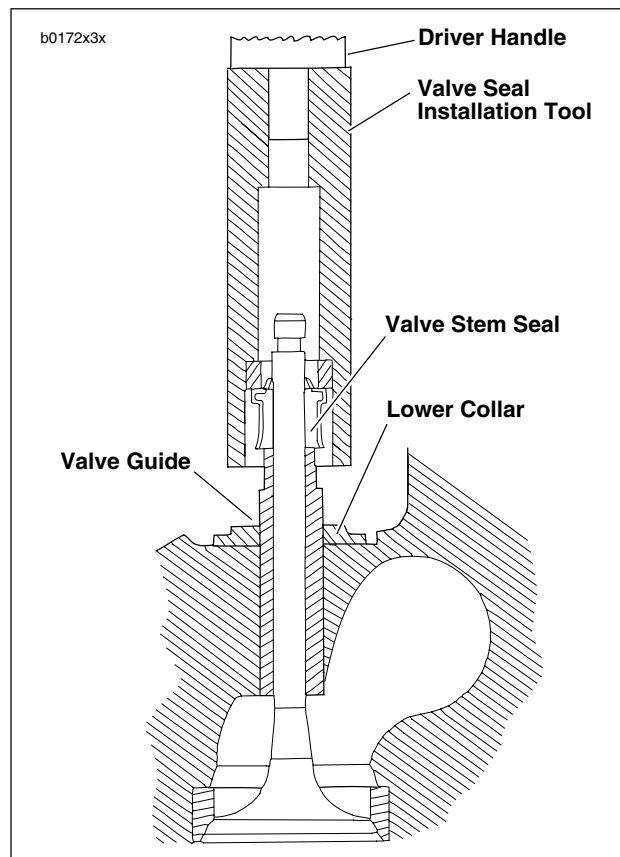


Figure 3-25. Valve Seal Installation

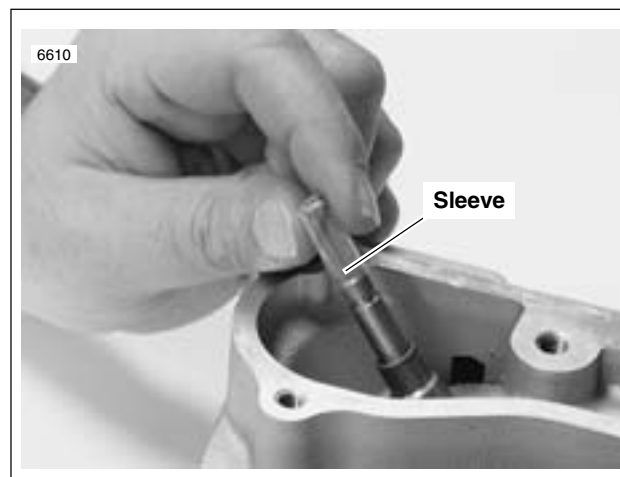


Figure 3-26. Valve Guide Seal Protector Sleeve

INSTALLATION

If only cylinder head work was needed, reinstall cylinder head following these instructions. If further repair is required, see [3.6 CYLINDER AND PISTON](#).

1. See [Figure 3-9](#). Coat mating surfaces of cylinder studs (12) and head screws (1, 2) with parts cleaning solution.
2. Scrape old oil and any carbon deposits from threads by using a back-and-forth motion, threading each head screw onto its mating cylinder stud.
3. Remove head screws from studs. Wipe or blow dry thread surfaces.
4. Apply oil to stud threads and to the underside of the head screw shoulder.

CAUTION

Only oil film must remain on the head screw surfaces. Too much oil will pool in the head screw sleeve. Pooled oil may prevent proper torque application and full thread engagement.

5. Blow or wipe off excess oil from head screws.
6. Thoroughly clean and dry the gasket surfaces of cylinder (19) and cylinder head (18).
7. Install a **new** O-ring (14) on each dowel (15).

CAUTION

O-rings (14) help to properly position the head gasket (4). O-rings must be installed before the head gasket.

8. Install a **new** head gasket (4) to cylinder.
9. Carefully lower cylinder head over studs and position on dowels. Use great care so as not to disturb head gasket.

CAUTION

The procedure for tightening the head screws is critical to proper distribution of pressure over gasket area. It prevents gasket leaks, stud failure, and head and cylinder distortion.

10. See [Figure 3-7](#). For each cylinder head, start with screw numbered one, as shown. In increasing numerical sequence (i.e. – 1, 2, 3 and 4):
 - a. Tighten each screw to 8-10 ft-lbs (11-14 Nm).
 - b. Tighten each screw to 13-15 ft-lbs (18-20 Nm).
 - c. Loosen all screws.
11. After screws are loosened from initial torque, tighten head screws in three stages. Tighten fasteners in increasing numerical sequence (i.e. – 1, 2, 3 and 4).
 - a. Tighten each screw to 8-10 ft-lbs (11-14 Nm).
 - b. Tighten each screw to 13-15 ft-lbs (18-20 Nm).
 - c. See [Figure 3-27](#). Mark cylinder head and head screw shoulder with a line as shown (View A). Tighten each screw a 1/4-turn (85°-90°) (View B).

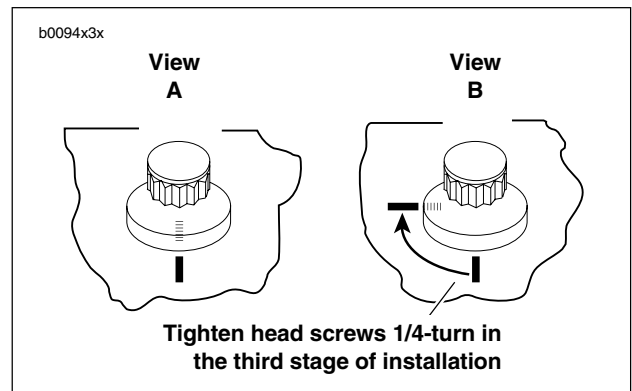


Figure 3-27. Tightening Head Screws

1. Intake Push Rods (2)
2. Exhaust Push Rods (2)

b0510x3x

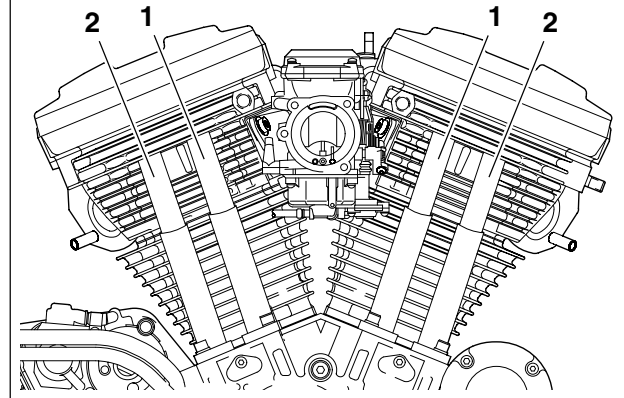


Figure 3-28. Push Rod Locations (Shown on Assembled Engine)

12. Install lifters and push rod covers. See [3.15 HYDRAULIC LIFTERS](#).
13. See [Figure 3-28](#). Identify push rod color coding, length and respective push rod positions in engine. See [Table 3-5](#). Place intake and exhaust push rods onto seat at top of tappet.

Table 3-5. Push Rod Selection

POSITION	COLOR CODE	LENGTH	PART NUMBER
Exhaust (front & rear)	3 Band-Pink	10.800 in. (274.320 mm)	17904-89
Intake (front & rear)	1 Band-Brown	10.746 in. (272.948 mm)	17897-89

14. See [Figure 3-29](#). Install **new** gaskets (8, 9) with the bead facing up. Place lower rocker box assembly (with rocker arms and shafts) into position. Place push rods in rocker arm sockets.

CAUTION

Do not turn engine over until both push rods can be turned with fingers. Otherwise, damage to push rods or rocker arms may result.

15. See [Figure 3-30](#). Install fasteners (12, 13, 14 and 15). Slowly snug all fasteners in small increments (one turn at a time). Use a cross pattern on the four large bolts (12, 13) that fasten the lower rocker box to head. This will bleed the tappets. Fastener sizes are listed in [Table 3-6](#).
- Tighten bolts (12, 13) to 18-22 ft-lbs (24-30 Nm).
 - Tighten bolts (15) to 135-155 **in-lbs** (15-18 Nm).
 - Tighten screws (14) to 135-155 **in-lbs** (15-18 Nm).

Table 3-6. Lower Rocker Box Hardware

ITEM	SIZE	TORQUE
Bolt with washer (12)	5/16-18 X 2-3/4	18-22 ft-lbs (24-30 Nm)
Bolt with washer (13)	5/16-18 X 2-1/2	
Screw with washer (14)	1/4-20 X 1-1/2	135-155 in-lbs (15-18 Nm)
Bolt with washer (15)	1/4-20 X 1-1/4	

NOTES

Tubular frame prohibits direct access to bolt (12) on right rear cylinder. Use TORQUE ADAPTOR (SNAP-ON Part No. FRDH 181) and TORQUE COMPUTER (SNAP-ON Part No. SS-306G) to correctly assemble.

16. See [Figure 3-29](#). Install middle and upper rocker covers.
- Place a **new** gasket (7) on lower rocker box assembly.
 - Install middle rocker cover (5) with umbrella valve next to intake manifold.
 - Place a **new** gasket (6) on middle rocker cover.
 - Install upper rocker cover (4) using screws with washers (1) and **new** fiber seals (2). Tighten screws to 10-13 ft-lbs (14-18 Nm).
17. Install the other cylinder using the same procedure.

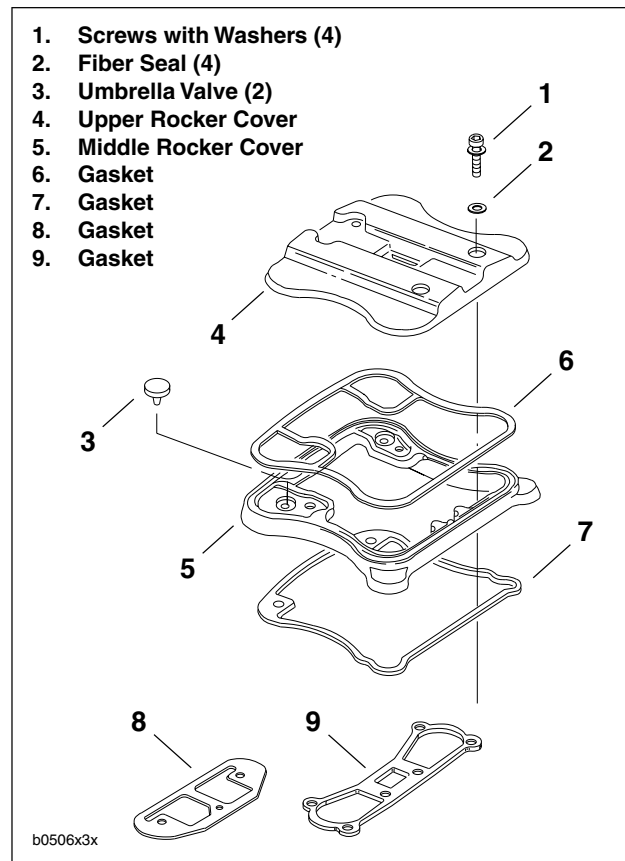
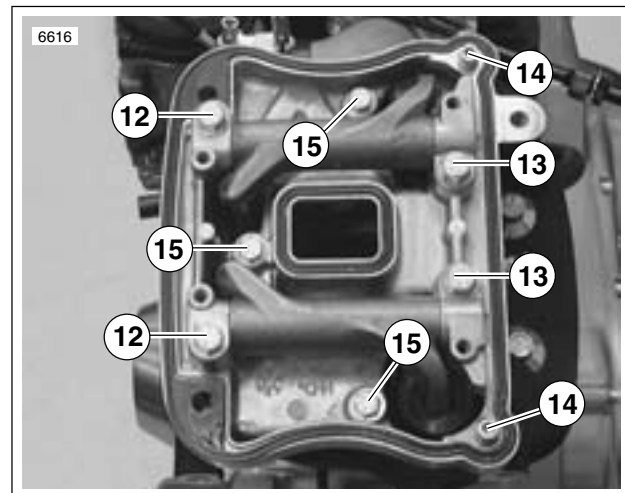


Figure 3-29. Rocker Arm Cover Gaskets



**Figure 3-30. Lower Rocker Box Fasteners
(Same Numbers as [Figure 3-5](#).)**

REMOVAL/DISASSEMBLY

1. Strip motorcycle as described under [DISASSEMBLING ENGINE FOR CYLINDER HEAD REPAIR](#) in 3.3 [STRIPPING MOTORCYCLE FOR ENGINE REPAIR](#).
2. Remove cylinder head. See [3.5 CYLINDER HEAD](#).
3. Clean crankcase around cylinder base to prevent dirt and debris from entering crankcase while removing cylinder.
4. See [Figure 3-31](#). Turn engine over until piston (3) of cylinder being removed is at bottom of its stroke.
5. Carefully raise cylinder (1) just enough to permit placing clean towel under piston to prevent any foreign matter from falling into crankcase.

NOTE

If cylinder does not come loose, lightly tap a plastic hammer perpendicular to the cylinder fins. Never try to pry a cylinder up.

6. Carefully lift cylinder over piston and cylinder studs (4). Do not allow piston to fall against cylinder studs. Discard cylinder base gasket (5).

CAUTION

With cylinder removed, be careful not to bend the cylinder studs. The slightest bend could cause a stress riser and lead to stud failure.

7. Install a 6.0 in. (152 mm) length of 1/2 in. (12.7 mm) ID plastic or rubber hose over each cylinder stud. This will protect the studs and the pistons.

WARNING

The next step covers removing the piston pin retaining rings. These rings are highly compressed in the ring groove and may "fly out" with considerable force when pried out of the groove. Safety glasses or goggles must be worn while removing or installing retaining rings. If these are not worn, death or serious injury could occur.

CAUTION

The piston pin retaining rings must not be reused. Removal may weaken retaining rings and they may break or dislodge. Either occurrence may damage engine.

8. Insert an awl in the recessed area below the piston pin bore and pry out the piston pin retaining rings. To prevent the ring from flying out, place your thumb over the retaining ring.

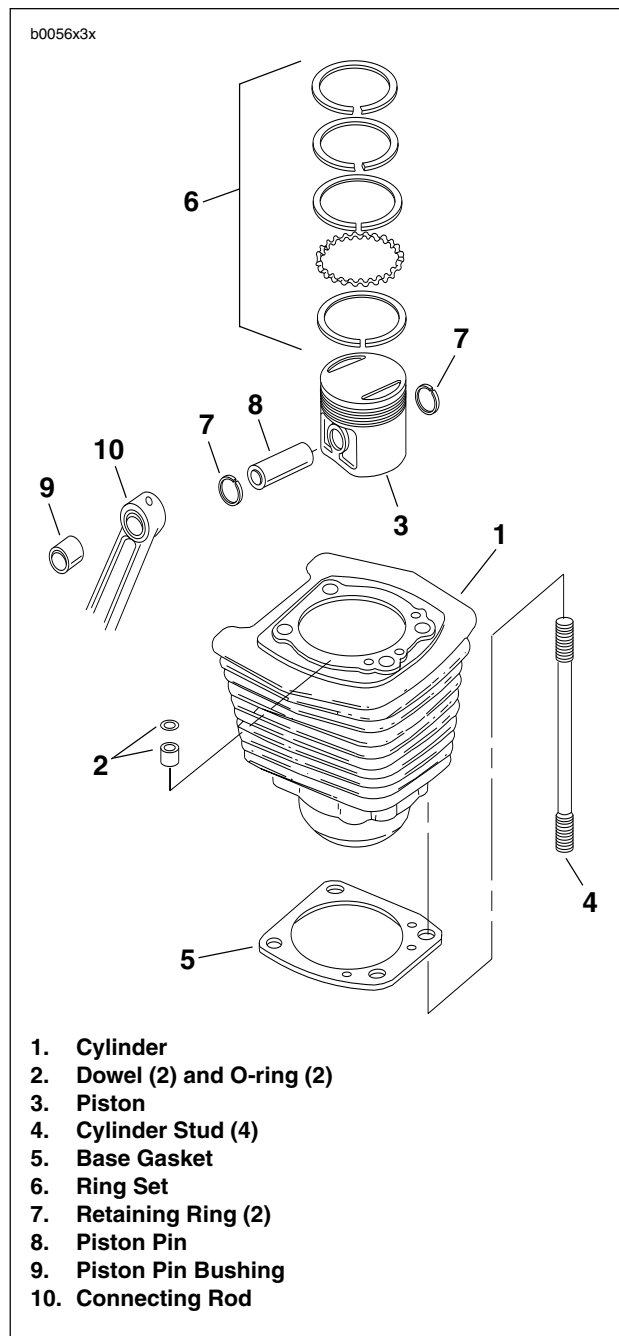


Figure 3-31. Cylinder and Piston

NOTE

Since the piston pin is a loose fit in the piston, the pin will easily slide out. The pins have tapered ends to help seat the round retaining rings. See [Figure 3-32](#). Piston pins are stamped with a V-groove at one end.

9. Mark each pin boss with either an "F" or an "R" to indicate front or rear cylinder, respectively. See [Figure 3-32](#). The arrow at the top of 1200cc pistons must always point toward the front of the engine.

CAUTION

Handle the piston with extreme care. The alloy used in these pistons is very hard. Any scratches, gouges or other marks in the piston could score the cylinder during engine operation and cause engine damage.

10. See [Figure 3-31](#). Spread piston rings (6) outward until they clear grooves in piston (3) and lift off.

CLEANING AND INSPECTION

1. Soak cylinder and piston in an aluminum-compatible cleaner/solvent until deposits are soft, then clean with a brush. Blow off loosened carbon and dirt particles and wash in solvent.
2. Clean oil passage in cylinder with compressed air.
3. Clean piston ring grooves with a piece of compression ring ground to a chisel shape.
4. Examine piston pin to see that it is not pitted or scored.
5. Check piston pin bushing to see that it is not loose in connecting rod, grooved, pitted or scored.
 - a. A piston pin properly fitted to upper connecting rod bushing has a 0.00125 to 0.00175 in. (0.03175-0.04445 mm) clearance in bushing.
 - b. If piston pin-to-bushing clearance exceeds 0.00200 in. (0.05080 mm), replace worn parts. See [CONNECTING ROD BUSHING](#) on [page 3-30](#).
6. Clean piston pin retaining ring grooves.
7. Examine piston and cylinder for cracks, burnt spots, grooves and gouges.
8. Check connecting rod for up and down play in lower bearings. When up and down play is detected, lower bearing should be refitted. This requires removing and disassembling engine crankcase.

Checking Gasket Surface**CAUTION**

If either cylinder gasket surface does not meet flatness specifications, replace cylinder and piston. Proper tolerances will extend component life and prevent leaks.

1. See [Figure 3-33](#). Check cylinder head gasket surface for flatness.
 - a. Lay a straightedge across the surface.
 - b. Try to insert a feeler gauge between the straightedge and the gasket surface.
 - c. If cylinder head gasket surface is not flat within 0.006 in. (0.152 mm), replace cylinder and piston.

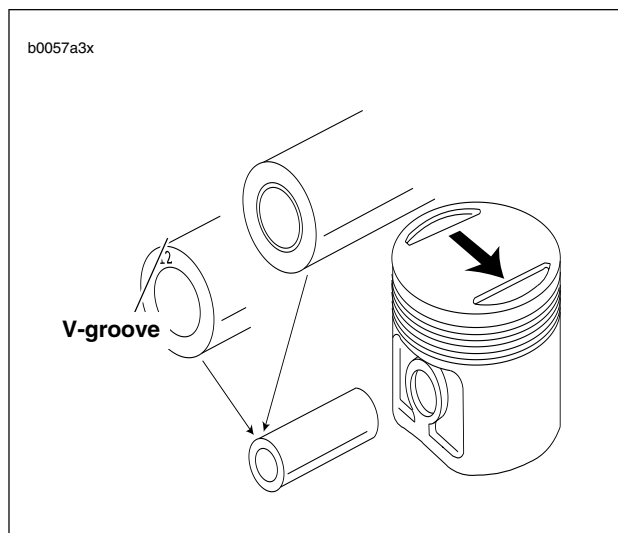


Figure 3-32. Piston Pin and Piston Identification

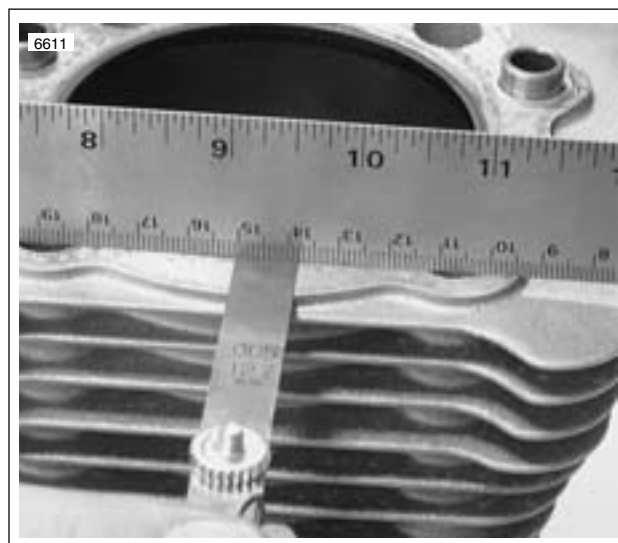


Figure 3-33. Checking Gasket Surfaces

2. Check cylinder base gasket surface for flatness.
 - a. Lay a straightedge across the surface.
 - b. Try to insert a feeler gauge between the straightedge and the gasket surface.
 - c. If cylinder base gasket surface is not flat within 0.008 in. (0.203 mm), replace cylinder and piston.

Measuring Cylinder Bore

1. Remove any burrs from the cylinder gasket surfaces.
2. See [Figure 3-34](#). Install a head and base gasket, and CYLINDER TORQUE PLATES (Part No. HD-33446A) and XL EVOLUTION TORQUE PLATE BOLTS (Part No. HD-33446-86). Tighten the bolts using the same method used when installing the cylinder head screws. See [3.5 CYLINDER HEAD](#).

NOTE

Torque plates, properly tightened and installed with gaskets, simulate engine operating conditions. Measurements will vary as much as 0.001 in. (0.025 mm) without torque plates.

3. Take cylinder bore measurement in ring path, starting about 1/2 in. (12.7 mm) from top of cylinder, measuring from front to rear and then side to side. Record readings.
4. Repeat measurement at center and then at bottom of ring path. Record readings. This process will determine if cylinder is out-of-round (or "egged") and will also show any cylinder taper or bulge.
5. See [Table 3-7](#). If cylinder is not scuffed or scored and is within service limit, see [FITTING CYLINDER TO PISTON](#) on [page 3-28](#).

NOTE

If piston clearance exceeds service limit, cylinders should be rebored and/or honed to next standard oversize, and refitted with the corresponding piston and rings. Do not fit piston tighter than 0.0007 in. (0.0178 mm). See [3.1 SPECIFICATIONS](#).

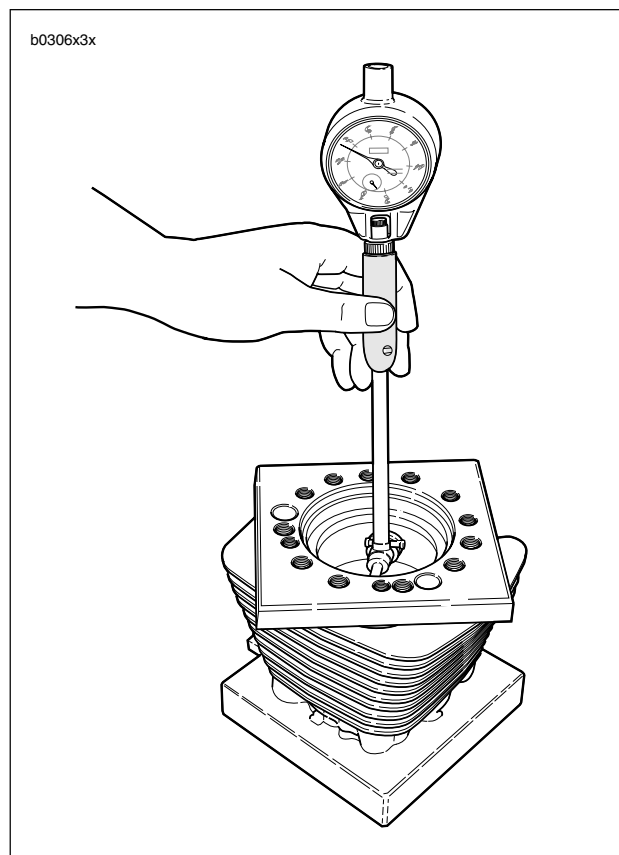


Figure 3-34. Measuring Cylinder Bore Using Torque Plates (Part No. HD-33446A)

Table 3-7. Cylinder Bore Service Wear Limits

BORE SIZES	IN.	MM
Standard Bore	3.5008	88.9203
0.005 in. OS bore (0.127 mm)	3.5050	89.0270
0.010 in. OS bore (0.254 mm)	3.5100	89.1540
0.020 in. OS bore (0.508 mm)	3.5200	89.4080
0.030 in. OS bore (0.762 mm)	3.5300	89.6620

Measuring Piston

Because of their complex shape, the pistons cannot be accurately measured with standard measuring instruments.

The pistons have the typical elliptical shape when viewed from the top. However, they also are barrel-shaped when viewed from the side. This barrel shape is not symmetrical.

Any damage to the piston will change its shape, which will lead to problems.

Fitting Cylinder to Piston

Since pistons cannot be accurately measured with standard measuring instruments, the bore sizes must be observed. Bore sizes are listed in [Table 3-8](#). Example: A 0.005 in. (0.127 mm) oversize piston will have the proper clearance with a bore size of 3.502 in. \pm 0.0002 in. (88.951 mm \pm 0.0051 mm) for the 1200cc engine.

Boring and Honing Cylinder

When cylinder requires oversize reboring to beyond 0.030 in. (0.762 mm), the oversize limit has been exceeded and cylinder must be replaced.

1. Bore cylinder with gaskets and torque plates attached. Bore to 0.003 in. (0.076 mm) under the desired finished size.
2. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60° crosshatch pattern.

Fitting Piston Rings

NOTE

Ring sets and pistons, 0.040 in. (1.016 mm) oversize, are not available on 1200cc engines.

See [Figure 3-35](#). Piston rings are of two types: compression (1, 2) and oil control (3). The two compression rings are positioned in the two upper piston ring grooves. The dot on the second compression ring must face upward. Ring sets are available to fit standard and oversize pistons.

Piston ring sets must be properly fitted to piston and cylinder:

1. See [Figure 3-36](#). Place piston in cylinder about 1/2 in. (12.7 mm) from top. Set ring to be checked squarely against piston as shown. Check end gap with thickness gauge. See [3.1 SPECIFICATIONS](#) for tolerance.

NOTE

See [SERVICE WEAR LIMITS](#) for end gap dimensions. Do not file rings to obtain proper gap.

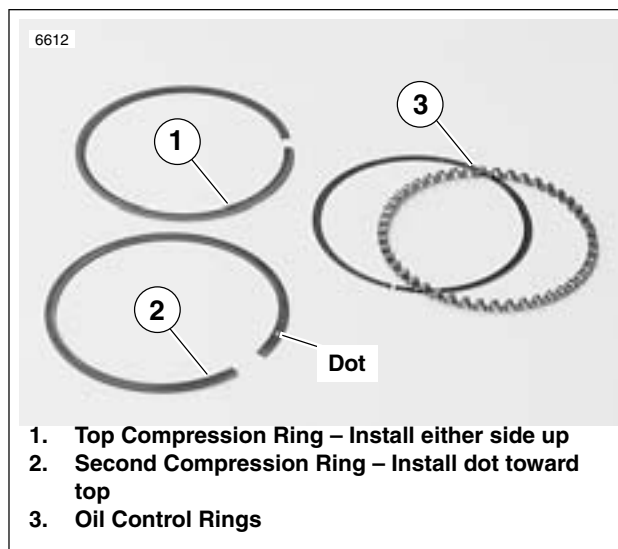


Figure 3-35. Piston Rings

Table 3-8. Final Cylinder Bore Sizes

BORE SIZES	IN.	MM
Standard bore*	3.4978 in.	88.8441 mm
0.005 in. OS bore (0.127 mm)	3.502 in.	88.951 mm
0.010 in. OS bore (0.254 mm)	3.507 in.	89.078 mm
0.020 in. OS bore (0.508 mm)	3.517 in.	89.332 mm
0.030 in. OS bore (0.762 mm)	3.527 in.	89.586 mm

*All bore sizes + 0.0002 in. (0.0051 mm)

NOTE

The same piston may be used if cylinder bore was not changed, unless it is scuffed or grooved. However, replace rings and hone the cylinder walls with a No. 240 grit flexible hone to facilitate ring seating.

2. See [Figure 3-37](#). Apply engine oil to piston grooves. Use TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586) to slip compression rings over piston into their respective grooves. Be extremely careful not to over expand, twist rings or damage piston surface when installing rings.

NOTE

Install second compression ring with dot towards top.

3. See [Figure 3-38](#). Install rings so end gaps of adjacent rings are a minimum of 90° apart. Ring gaps are not to be within 10° of the thrust face centerline.



Figure 3-36. Measuring Ring End Gap

- See Figure 3-39. Check for proper side clearance with thickness gauge, as shown. See 3.1 SPECIFICATIONS for tolerance.

NOTE

If the ring grooves are clean and the side play is still not correct, replace the rings, the piston or both.

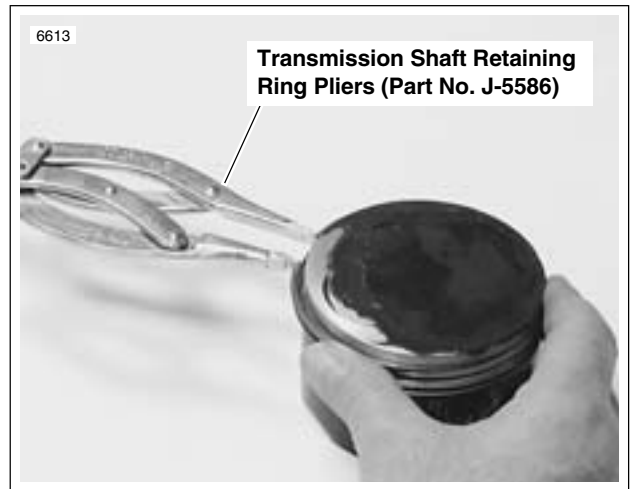


Figure 3-37. Installing Piston Rings

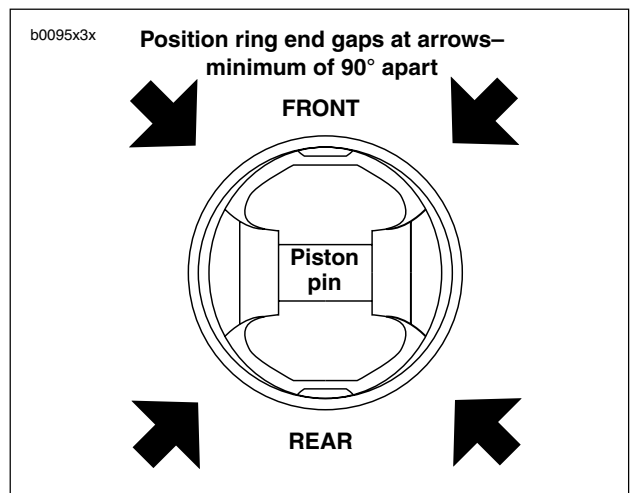


Figure 3-38. Ring End Gap Position



Figure 3-39. Measuring Ring Clearance in Groove

Connecting Rod Bushing

REMOVAL/INSTALLATION

When connecting rod bushing is worn to excessive pin clearance (0.002 in. or more) (0.051 mm) it must be replaced.

1. See [Figure 3-40](#). Install plastic hoses (3) over studs.
2. Secure connecting rod with CONNECTING ROD CLAMPING TOOL (2) (Part No. HD-95952-33B).

NOTE

If CONNECTING ROD CLAMPING TOOL holes are too small, enlarge the holes in the tool.

3. See [Figure 3-41](#). Attach PISTON PIN BUSHING TOOL (Part No. HD-95970-32C) to the connecting rod. The receiver cup (1) fits on one side of the rod while the driver (2) fits on the opposite side as shown.
4. Use two box wrenches and push worn bushing from connecting rod.
5. Remove piston pin bushing tool from connecting rod.
6. Remove bushing from receiver cup.
7. Attach PISTON PIN BUSHING TOOL (Part No. HD-95970-32D) to connecting rod. Place **new** bushing between connecting rod and driver.

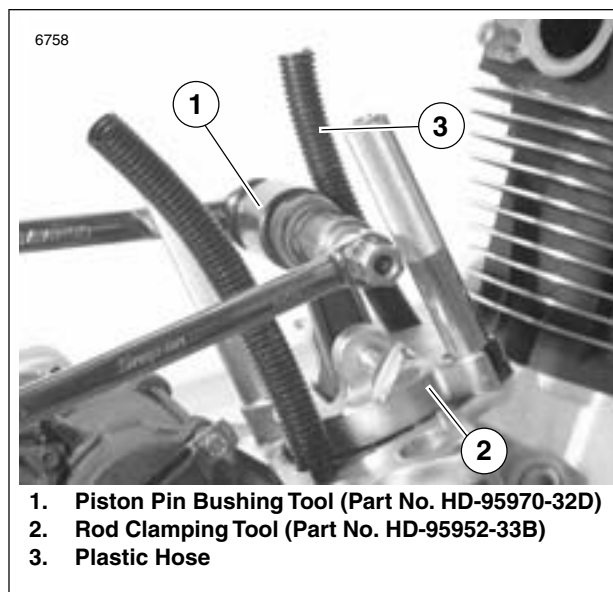
NOTE

The driver must be attached facing the opposite direction as it was for removal of the bushing.

8. Clean up and size bushing to 0.0010-0.0005 in. (0.0254-0.0127 mm) undersize using REAMER (Part No. HD-94800-26A). Sizing bushing with less than 0.00125 in. (0.03175 mm) clearance can result in a bushing loosening and/or seized pin in rod.
9. Hone bushing to final size using WRIST PIN BUSHING HONE (Part No. HD-35102). Use a liberal amount of honing oil to prevent damage to hone or bushing. Use care to prevent foreign material from falling into the crankcase.

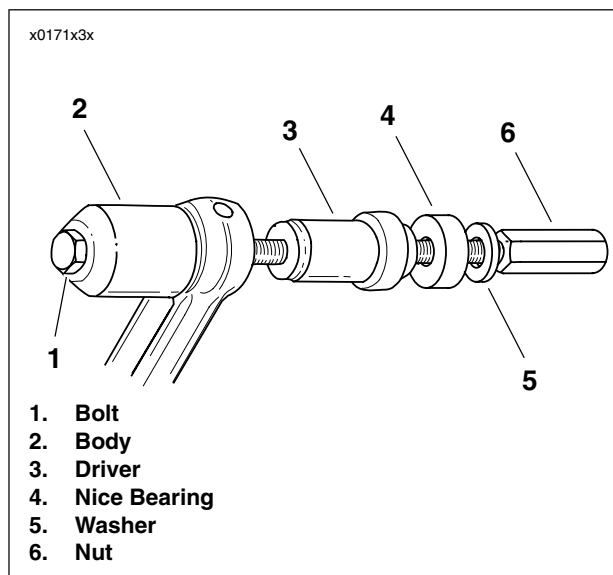
CAUTION

Replace bent connecting rods. Do not attempt to straighten. Straightening rods by bending will damage the bearing on the crank pin and the piston pin bushing. Installing bent connecting rods will damage cylinder and piston beyond repair.



1. Piston Pin Bushing Tool (Part No. HD-95970-32D)
2. Rod Clamping Tool (Part No. HD-95952-33B)
3. Plastic Hose

Figure 3-40. Installing New Piston Pin Bushing



1. Bolt
2. Body
3. Driver
4. Nice Bearing
5. Washer
6. Nut

Figure 3-41. Piston Pin Bushing Tool Assembly for Bushing Removal

ASSEMBLY/INSTALLATION

1. See [Figure 3-42](#). Place **PISTON SUPPORT PLATE** (Part No. HD-42322) in position as shown.
2. Install piston assembly over connecting rod.

NOTE

New 1200cc pistons must be installed with the arrow, at the top of the piston, pointing towards the front of the engine.

3. Install piston pin.

CAUTION

Always use new retaining ring. Make sure retaining ring groove is clean and that ring seats firmly in groove. If it does not, discard the ring. Never install a used retaining ring or a new one if it has been installed and then removed for any reason. A loosely installed ring will come out of the piston groove and damage cylinder and piston beyond repair.

4. See [Figure 3-43](#). Install **new** piston pin retaining rings (1) using **PISTON PIN RETAINING RING INSTALLER** (2) (Part No. HD-34623B). Place **new** retaining ring on tool with gap pointing up. See [Figure 3-44](#).

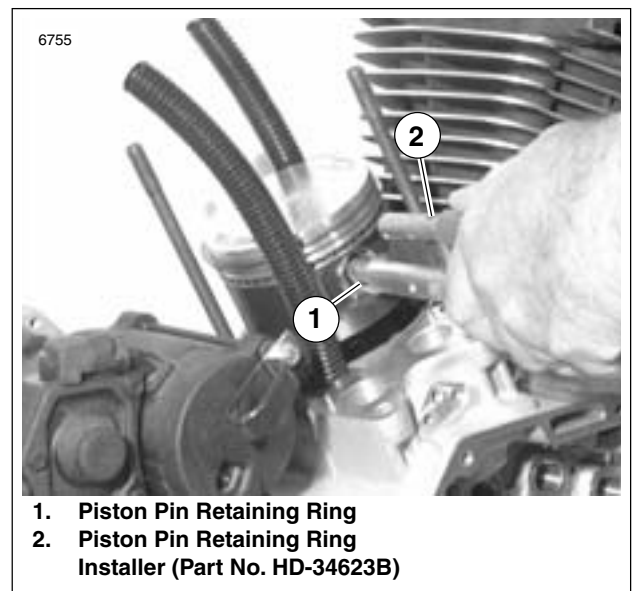
NOTE

Make sure the ring groove is clean. Ring must be fully seated in the groove with the gap away from the slot at the bottom.

5. See [Figure 3-38](#). Make sure the piston ring end gaps are properly positioned as shown.



Figure 3-42. Piston Support Plate



1. Piston Pin Retaining Ring
2. Piston Pin Retaining Ring Installer (Part No. HD-34623B)

Figure 3-43. Installing Piston Retaining Rings

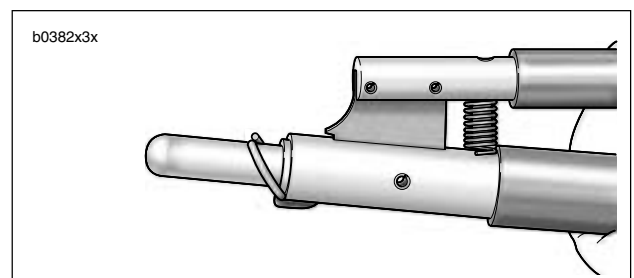


Figure 3-44. Aligning Retaining Ring

6. See [Figure 3-45](#). Turn engine until piston is resting on top of piston support plate top dead center.
7. Lubricate cylinder wall, piston, pin and rod bushing with engine oil.
8. See [Figure 3-46](#). Compress the piston rings using PISTON RING COMPRESSOR (Part No. HD-96333-51B).
9. Remove protective sleeves from cylinder studs. Install a **new** cylinder base gasket. Make sure the piston does not bump the studs or crankcase.
10. Install cylinder over piston.
11. Remove PISTON RING COMPRESSOR.
12. Assemble cylinder head. See [3.5 CYLINDER HEAD](#).
13. Install cylinder head. See [3.5 CYLINDER HEAD](#).
14. Install assembled engine. See [3.4 INSTALLING THE ENGINE](#).

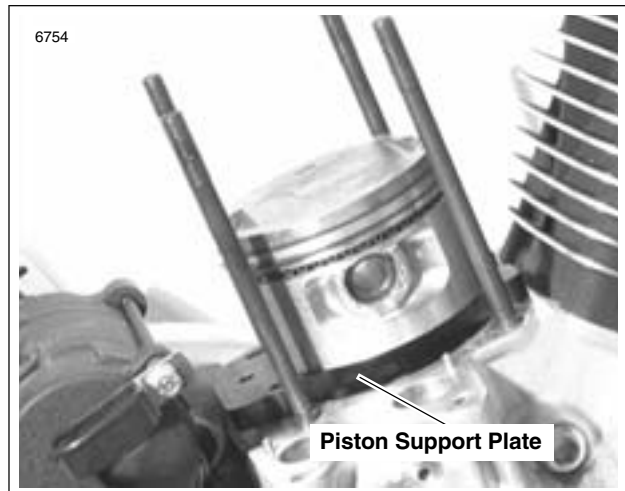
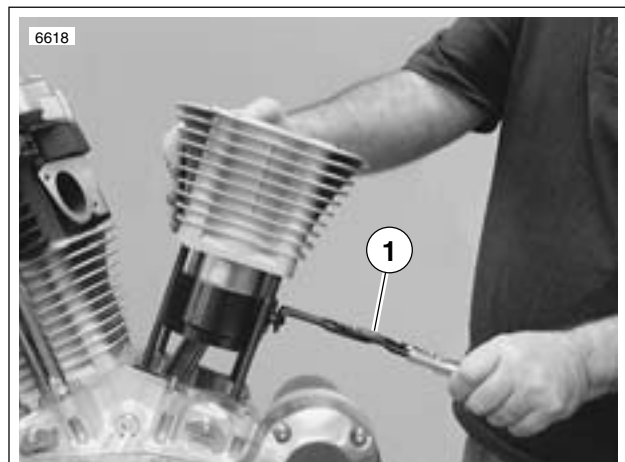


Figure 3-45. Piston Position



1. **Piston Ring Compressor
(Part No. HD-96333-51C)**

Figure 3-46. Compressing Piston Rings

CHECKING AND ADDING OIL

Check engine oil level in oil tank at least once every 500 miles (800 km). Check level more frequently if engine uses more oil than normal or if vehicle is operated under harsh conditions.

CHANGING OIL AND FILTER

After a new engine has run its first 500 miles (800 km) and at 5000 mile (8000 km) intervals or annually thereafter, completely drain oil tank of used oil. Refill with fresh oil. If vehicle is driven extremely hard, used in competition or driven on dusty roads, change engine oil at shorter intervals. Always change oil filter when changing engine oil.

NOTE

See [1.4 ENGINE LUBRICATION SYSTEM](#) for more information on checking oil level and changing oil and filter.

WINTER LUBRICATION

Normal fuel combustion in a gasoline engine produces water vapor and carbon dioxide along with other gases and particulates. When first starting and warming an engine, some of the water vapor that gets into the engine crankcase condenses to form liquid water. If the engine is driven long enough to thoroughly warm the crankcase, most of this liquid water is again vaporized and exhausted through the crankcase breather system.

A moderately driven vehicle making short runs may not be able to vacate water vapors allowing liquid water to accumulate in the oil tank. This is especially true if the vehicle is operated in cold weather. In freezing weather, an accumulation of water in the engine oil may become slush or ice, which can block oil lines and lead to severe engine damage. Water remaining in the engine oil for long periods of time can form an acidic sludge that is corrosive to metal engine parts and causes accelerated wear of moving components.

In winter the oil change interval should be shorter than normal. The colder the weather, the shorter the recommended oil change interval. A vehicle used only for short runs in cold weather must have the engine oil drained frequently.

NONE

GENERAL

See [Figure 3-47](#). The oil tank has three fittings. From the top of the tank, the vent hose (3) and the return hose (4) run downward below the battery tray. Cable straps secure the hoses in place.

A T-fitting (5) on the bottom of the oil tank supplies the feed hose (1) and the drain hose (2). The drain hose (2) attaches to the left side of the frame.

See [Figure 3-48](#). The feed (1) and return hoses (3) run together between the swingarm mount block and crankcase. Protective covers prevent damage to the hoses. The hoses continue on beneath the engine and forward to the oil pump. The feed hose (1) attaches to the rear most oil pump fitting; the return hose (3) connects forward and above.

After diverging from the feed and return hoses, the vent hose is routed beneath the starter. It continues on to the right side of the motorcycle. See [Figure 3-49](#). Here the vent hose (1) connects to an elbow fitting (3) on the gearcase cover (4).

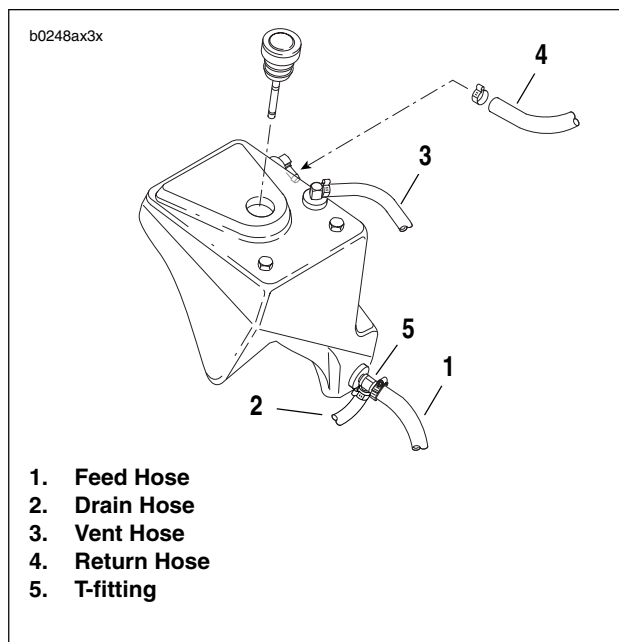


Figure 3-47. Oil Tank Hoses

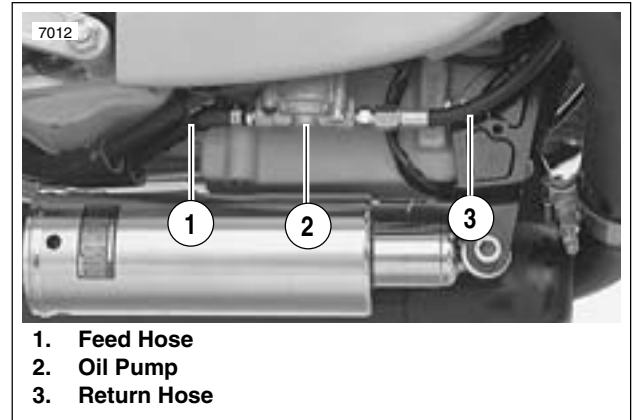


Figure 3-48. Oil Pump Connections (Typical)

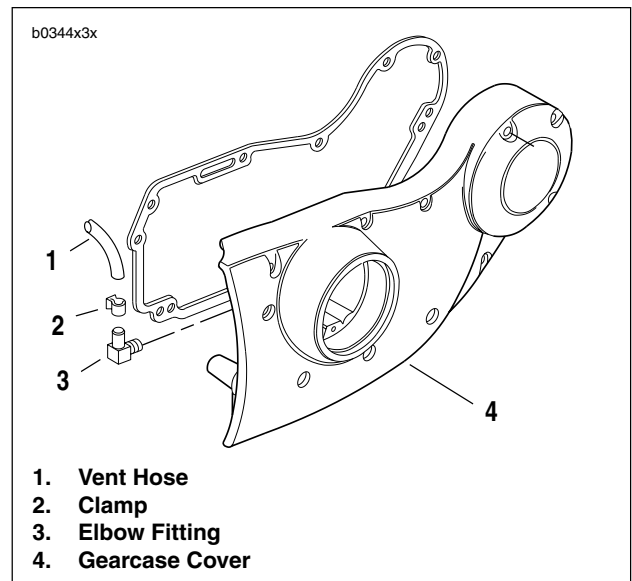


Figure 3-49. Vent Hose Connection (Typical)

REMOVAL/DISASSEMBLY

1. Remove seat, fuel tank and tail section. See [2.34 TAIL SECTION](#).
2. Remove rear fender. See [2.31 FENDERS](#).
3. Drain oil tank. See [1.4 ENGINE LUBRICATION SYSTEM](#). The oil filter need not be removed unless it is due to be replaced.
4. See [Figure 3-50](#). Remove clamps to detach hoses from oil tank. Label each hose upon removal.
 - a. Remove feed hose worm clamp (3) from T-fitting.
 - b. Remove 3/8 in. drain hose clamp (5) from T-fitting.
 - c. Remove 1/4 in. clamp (8) from vent hose (7).
 - d. Remove 3/8 in. clamp (10) from return hose (9).
5. Remove four bolts and lockwashers from well nuts (1).
6. Detach oil tank from frame.

ASSEMBLY/INSTALLATION

1. See [Figure 3-50](#). Place oil tank on frame and align mounts. Loosely install bolts and lockwashers (1) at all four mounting points.

NOTE

Starting at the top mounting points will simplify installation.

2. Connect the four oil tank hoses. Tighten **new** clamps (5, 8 and 10) using HOSE CLAMP PLIERS (Part No. HD-41137).

NOTE

Worm clamp (3) may be reused on feed hose (4).

3. Fill oil tank. See [1.4 ENGINE LUBRICATION SYSTEM](#).
4. Install rear fender. See [2.31 FENDERS](#).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

5. Install tail section, fuel tank and seat. See [2.34 TAIL SECTION](#).

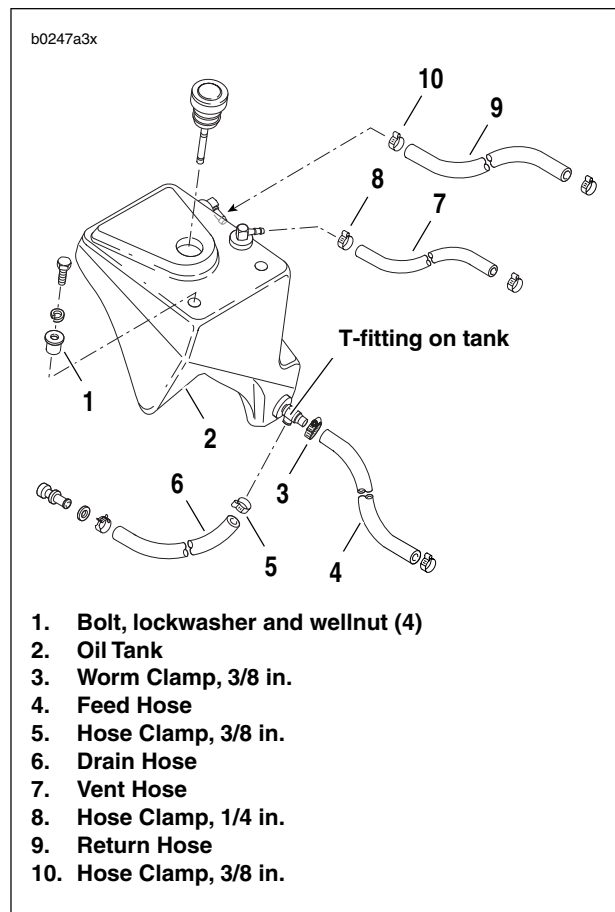


Figure 3-50. Oil Tank

GENERAL

The oil pressure indicator switch is a pressure-actuated diaphragm-type switch. When oil is not circulating through the system or when oil pressure is low, spring tension holds the switch contacts closed, thereby completing the signal light circuit and causing the indicator lamp to illuminate.

OIL PRESSURE SIGNAL LIGHT

The oil pressure signal light turns ON when:

- Ignition switch is turned on prior to starting engine.
- Oil is not circulating through the running engine.
- Oil pressure is abnormally low in the running engine.
- Engine is idling below 1000 RPM.

The oil pressure signal light turns OFF when:

- Oil is circulating with adequate pressure through the engine running at 1000 RPM or greater.

Troubleshooting information is listed in [Table 3-9](#).

NOTE

If the ignition is turned back on immediately after the engine is stopped, the oil light may not turn on right away because of oil pressure retained in the filter housing.

OIL PRESSURE

See [Figure 3-51](#). The oil pump is nonregulatory and delivers its entire volume of oil under pressure to the oil filter mount. When an engine is cold, the engine oil will be ore viscous (i.e., thicker).

When an engine is operated at high speeds, the volume of oil circulated through the oiling system increases, resulting in higher oil pressure. As engine speed is reduced, the volume of oil pumped is also reduced, resulting in lower oil pressure.

To check oil pressure, use OIL PRESSURE GAUGE (Part No. HD-96921-52A) and OIL PRESSURE GAUGE ADAPTER (Part No. HD-96940-52A). Remove oil pressure indicator switch and insert pressure gauge fitting. See [Figure 3-52](#).

Ride motorcycle at least 20 miles (32 km) at or above 50 MPH (80 KM/H) until engine oil reaches normal operating temperature. At 2500 RPM, oil pressure will vary from 10-17 psi (69-117 KPa). At idle speed (950-1050 RPM), oil pressure will vary from 7-12 psi (48-83 KPa).

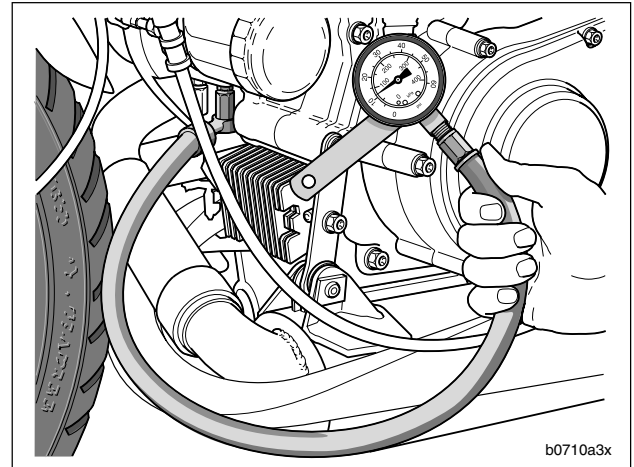


Figure 3-51. Checking Oil Pressure

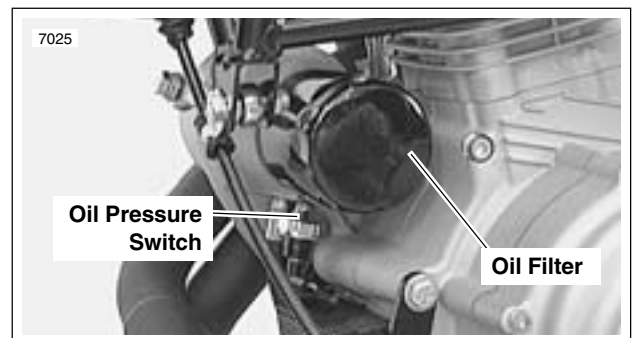


Figure 3-52. Oil Pressure Indicator Switch (Typical)

Table 3-9. Troubleshooting Oil Pressure Signal Light

OIL PRESSURE SIGNAL LIGHT	PROBABLE CAUSES
Stays on at speeds above idle.	<ul style="list-style-type: none"> ● Empty oil tank. ● Clogged feed line (ice and sludge, freezing temperatures). ● Air-bound oil line. ● Grounded oil switch wire. ● Malfunctioning signal switch. ● Diluted oil. ● Malfunctioning check valve (see 3.14 OIL FILTER MOUNT).
Flickers at idle.	<ul style="list-style-type: none"> ● Incorrect idle speed. Malfunctioning or improperly installed check valve (see 3.14 OIL FILTER MOUNT).
Does not glow when ignition is turned on (prior to operating engine).	<ul style="list-style-type: none"> ● Malfunctioning signal switch. ● Malfunction in wiring. ● Burned-out signal bulb. ● Dead battery (see NOTE above).

GENERAL

See [Figure 3-53](#). On piston downstroke, a mixture of crankcase air and oil mist is vented up the push rod covers (1) through an umbrella valve (3) in each middle rocker box section.

The oil mist separates from the crankcase air, collects and passes through a small drain hole (2) where it eventually returns to the crankcase.

The crankcase air is routed through a passage in each cylinder head. The air then travels through each air cleaner breather bolt (4). Hoses leading from the air cleaner bolts deposit the air inside the air cleaner's snorkel.

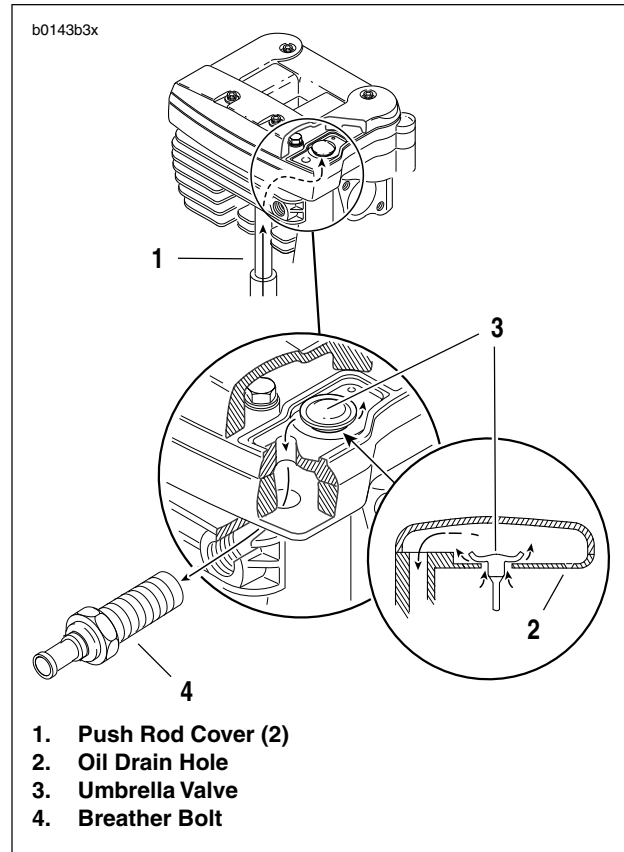


Figure 3-53. Crankcase Breathing System,
Typical Cylinder

NOTE

The following paragraph numbers correspond with the numbered callouts in the *INTERNAL ENGINE PASSAGES* illustration.

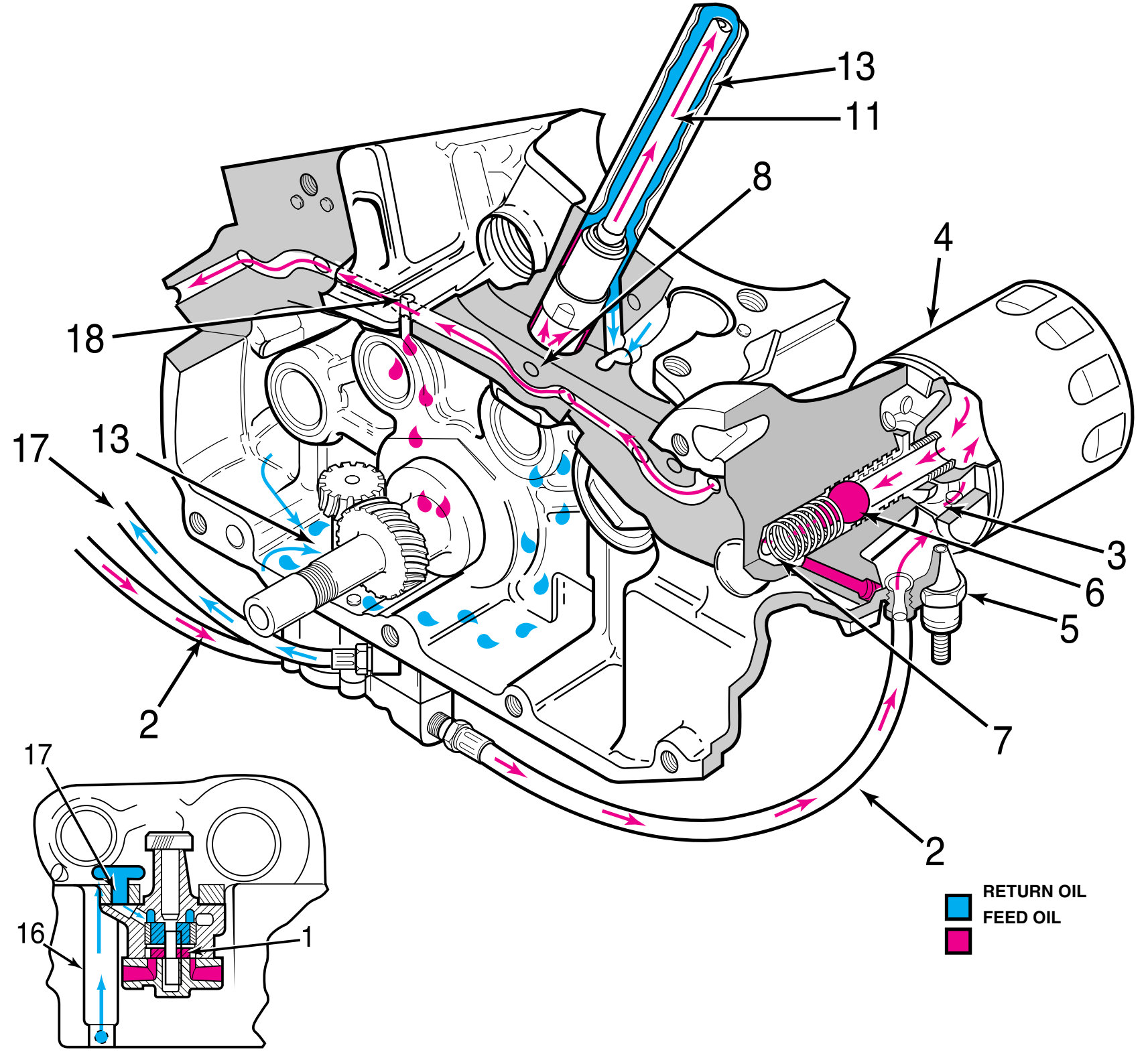
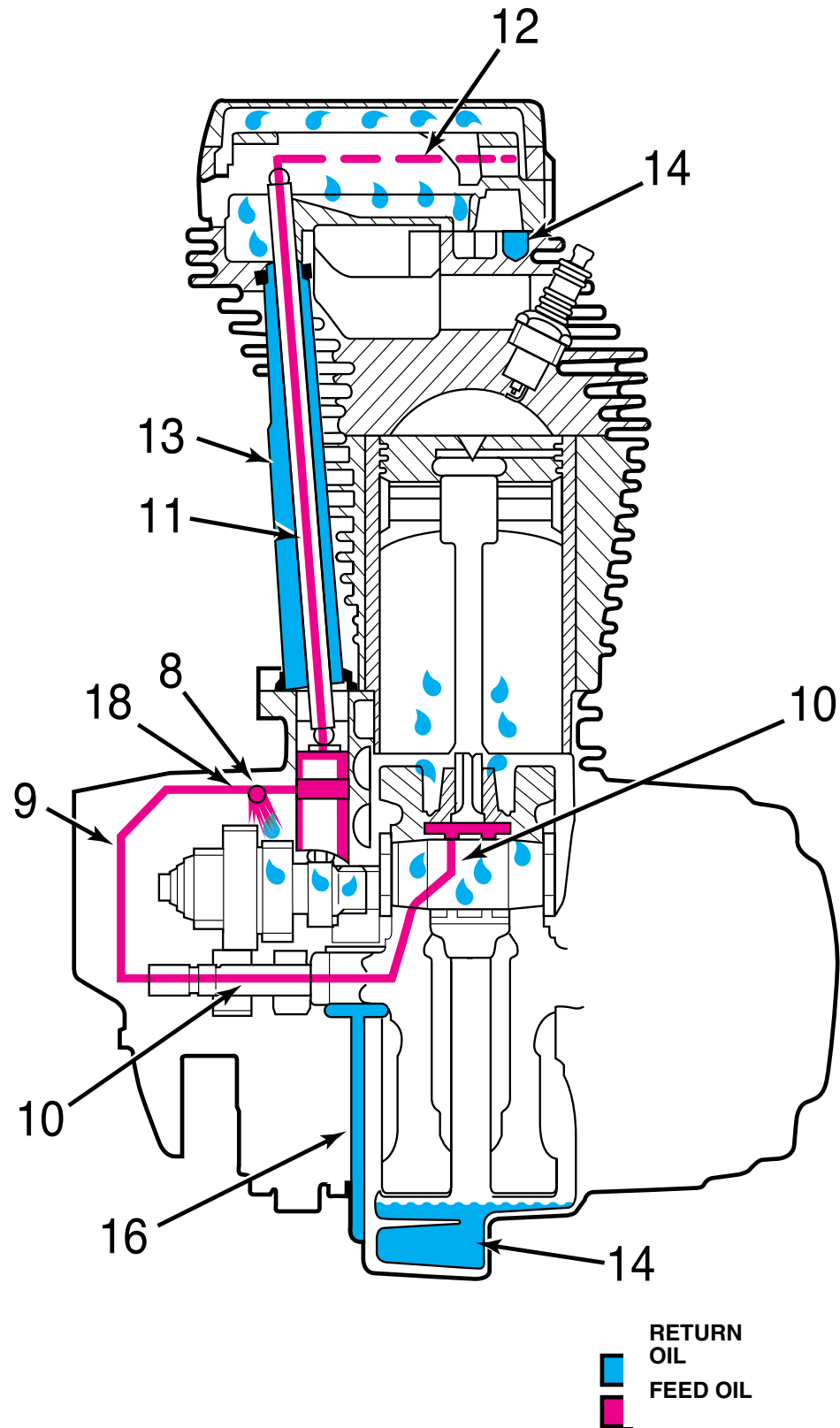
1. Oil is gravity-fed from the oil tank to the gerotor-style oil pump through a **feed hose**. Oil enters the **feed section** and fills a cavity located under the feed pump.

NOTE

See 3.13 *OIL PUMP* for a complete explanation of the gerotor pump sets.

2. The feed pump transfers oil from the inlet cavity through the **feed hose** to the oil filter mount.
3. Oil flows through the **filter mount cavity** to the oil filter.
4. Oil enters the peripheral cavity of the **oil filter**, passes through the filtering medium into the central cavity of the oil filter, and flows into the filter adapter (fitting which connects filter to filter mount).
5. Adequate oil pressure in the filter mount cavity activates the **oil pressure signal light switch** and shuts off the oil pressure signal light.
6. Oil flowing from the filter adapter opens the **check ball**. The check ball opens at 4-6 psi (28-41 kPa) oil pressure.
7. With the check ball open, oil flows into the **crankcase feed galley**.
8. Oil flows through the feed galley in the crankcase to the tappet blocks and hydraulic lifters. **Cross-drilled passages** intersect the main feed galley and carry oil to each hydraulic lifter.
9. Oil also enters an **intersecting passage** in the gearcase cover. Oil flow is then routed to the crankshaft area.
10. Oil enters a hole in the end of the **pinion gear shaft** and travels to the right flywheel where it is routed through the flywheel to the **crankpin**. Oil is forced through the crankpin to properly lubricate the rod bearing assembly.
11. Oil flows up passages in the **push rods** to the rocker arm shafts and bushings.
12. The valve stems are lubricated by oil supplied through drilled oil holes in the **rocker arms**.
13. Oil collected in the push rod areas of the cylinder heads flows down the **push rod covers**, through drain holes in the **lifter blocks** and into the gearcase. After providing lubrication to the gearcase components, the oil flows to the left side of the oil pump.
14. Feed oil to the rocker area is returned to the crankcase through a **passage** in the head and cylinder.
15. Oil collected in the **sump** is splash-fed to the pistons, cylinder walls and flywheel components.
16. Oil collected in the sump area returns to the scavenge section of the oil pump through a **passage** located in the rear section of the sump. Oil flow to the pump is accomplished by the scavenging effect of the pump and by the pressure created by the downward stroke of the pistons.
17. Return oil fills a **cavity** above the pump's return gears. The return gears pump oil back to the oil tank.
18. A small amount of oil flows from the feed galley in the right crankcase half through a **restricted orifice**, which sprays the oil onto the rear intake cam gear in the gearcase. Oil is transferred to the teeth of all the cam gears through the gear meshing action.

INTERNAL ENGINE PASSAGES



GENERAL

See [Figure 3-54](#). The oil pump consists of two gerotor gear sets, feed (6) and scavenge (return) (8), housed in one pump body (11). The feed set distributes oil to the engine, the scavenge set returns oil to the tank.

A gerotor-type gear set has two parts — an inner and an outer gerotor. The inner gerotor has one less tooth than the outer gerotor. Both gerotors have fixed centers which are off-set to each other.

In a gerotor gear set, oil is transferred from inlet to outlet as it is trapped between the rotating inner and outer gerotors.

See [Figure 3-54](#). Gravity-fed oil from the oil tank enters the pump through the feed hose connector (3). It is forced by the gerotor feed set (6) through a hose to the oil filter. Return oil from the flywheel compartment is drawn back into the pump and is forced by the gerotor scavenge set (8) back to the oil tank.

See [INTERNAL ENGINE PASSAGES](#) (foldout) for oil passages within the engine.

The oil pump seldom needs servicing. Before you disassemble an oil pump suspected of not producing adequate oil pressure, be sure that all possible related malfunctions have been eliminated:

1. Make sure all oil hose clamps are tight and that hoses are not pinched or damaged.
2. Check level and condition of oil in tank. Pressure will be affected if oil is diluted. In freezing weather, proper circulation of oil can be affected if the oil feed hose becomes clogged with ice or sludge.
3. Check for a grounded oil pressure switch wire or faulty switch if oil indicator light fails to go out with engine running.

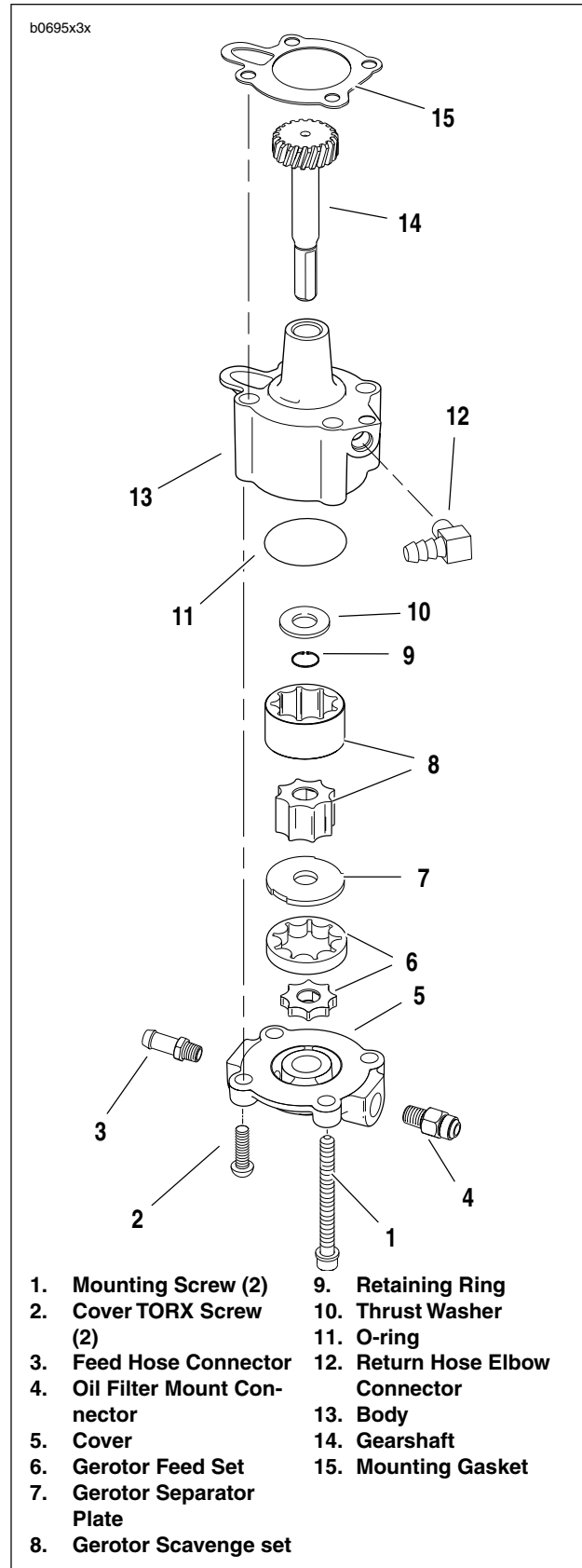


Figure 3-54. Oil Pump

REMOVAL/DISASSEMBLY

NOTE

Oil pump can be removed with engine in frame and without removing gearcase cover.

1. Drain oil tank. See 1.4 ENGINE LUBRICATION SYSTEM.
2. See Figure 3-55. Disconnect feed hose (1) and oil filter hose connection (5).

NOTE

Loosen nut on oil filter hose connection (5) and then remove pressurized hose.

3. Carefully remove mounting screws and washers (4). Pump will drop with screws removed. Discard mounting gasket.
4. Remove clamp (2) and detach return hose connection (1).
5. See Figure 3-54. Remove cover TORX screws (2). Lift cover (4) off body (11). Remove and discard O-ring (13).
6. Slide both pieces of gerotor feed set (6), separator plate (7) and both pieces of gerotor scavenge set (8) off gear shaft (10).
7. Remove and discard retaining ring (15). Remove thrust washer (14) and gear shaft (10).

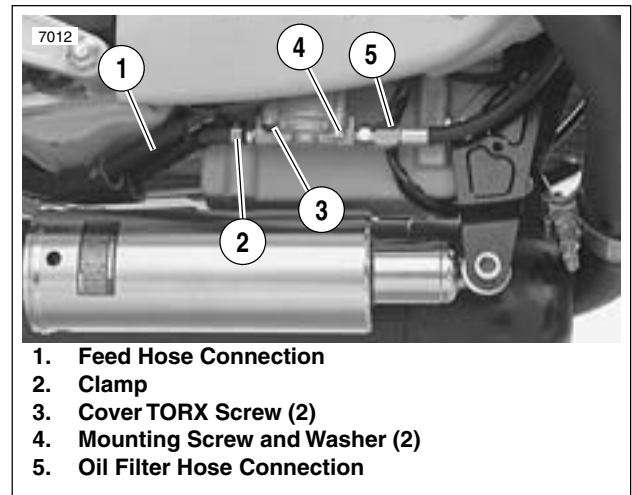


Figure 3-55. Oil Pump Hardware (Typical)

CLEANING AND INSPECTION

1. Clean all parts in cleaning solvent. Blow out holes and oil passages with compressed air.
2. See [Figure 3-56](#). Inspect both gerotor sets for wear.
 - a. Mesh pieces of each set together as shown.
 - b. Use a feeler gauge to determine clearance.
 - c. The SERVICE WEAR LIMIT between gerotors is 0.004 in. (0.102 mm). Replace gerotors as a set if clearance exceeds this dimension.
 - d. Measure thickness of feed gerotors with a micrometer. Replace gerotors as a set if they are not the same thickness.
3. See [Figure 3-54](#). Check gear shaft (10) teeth for damage or wear. Replace if necessary.

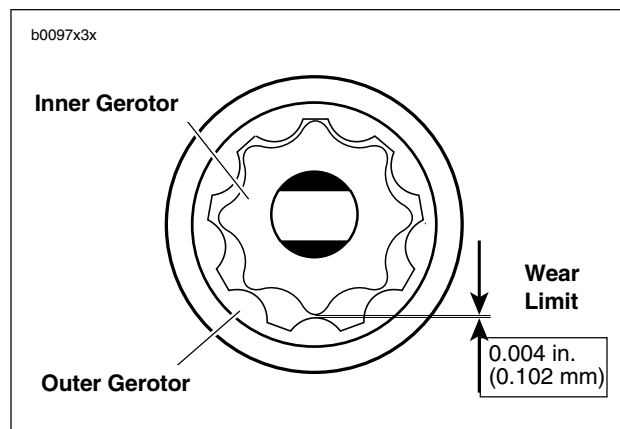


Figure 3-56. Gerotor Wear Limits

ASSEMBLY/INSTALLATION

NOTE

Liberally coat all moving parts with clean engine oil to ensure easy assembly and smooth operation at start-up.

1. See [Figure 3-54](#). Install gear shaft (10) through body (11). Position thrust washer (15) over end of shaft. Install **new** retaining ring (16) into groove in shaft.
2. Insert inner gerotor of the gerotor scavenge set (8) over gear shaft.
3. Place outer gerotor over inner gerotor to complete scavenge set (8).
4. See [Figure 3-57](#). Install gerotor separator plate (1) by lining up slots (2) on perimeter with tabs (3) inside oil pump body.
5. Install a **new** O-ring (4) into groove in pump body.
6. See [Figure 3-54](#). Place gerotor feed set (6) over gear shaft (10).
7. Place cover onto pump body. Install cover TORX screws (2). Tighten to 70-80 **in-lbs** (8-9 Nm).
8. Place **new** mounting gasket (9) in position.

NOTE

*Use **new** hose clamps. If fittings were removed, use TEFLON® PIPE SEALANT or HYLOMAR® on fitting threads.*

9. See [Figure 3-55](#). Attach return hose connection.
10. Secure pump to crankcase with mounting screws (4). Tighten to 125-150 **in-lbs** (14-17 Nm).
11. Attach feed hose (1) and oil filter hose connection (5).
12. Attach clamp (2) to hose.
13. Check engine oil level. Add oil to correct level if needed. See [1.4 ENGINE LUBRICATION SYSTEM](#).

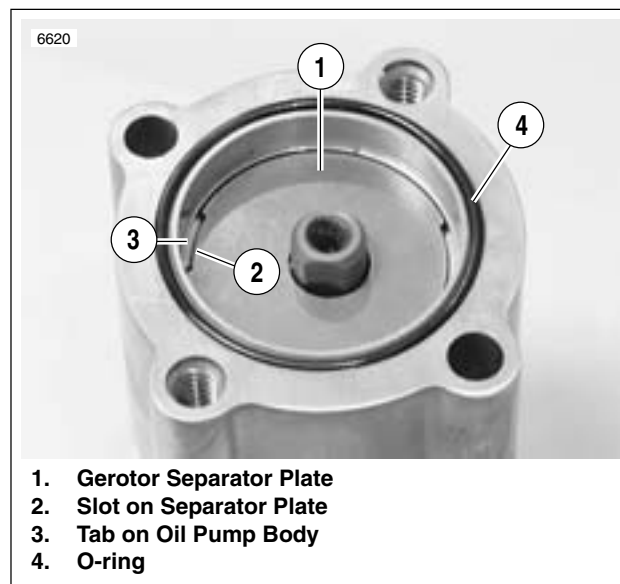


Figure 3-57. Separator Plate Slots

GENERAL

See [Figure 3-58](#). Oil is pressure-fed from the oil pump to the filter mount (4) via a hose (5). Oil travels through the filter mount into the filter via outer filter holes.

Adequate oil pressure activates the oil pressure indicator switch (6) in the filter mount, which turns off the oil pressure indicator lamp.

The check ball (2) in the filter adapter (1) “opens” at 4-6 psi (28-41 kPa) oil pressure. Filtered oil leaves the filter, flowing past the check ball.

DISASSEMBLY

1. Drain oil tank and remove filter. See [1.4 ENGINE LUBRICATION SYSTEM](#).
2. See [Figure 3-58](#). Remove filter adapter (1) from filter mount (4). Remove check ball (2) and spring (3).
3. Detach indicator lamp wire (7) from oil pressure indicator switch (6). Remove switch using OIL PRESSURE SENDING UNIT WRENCH (Part No. HD-41675).

CLEANING AND INSPECTION

Thoroughly clean all parts in cleaning solvent. Blow out holes and passages using compressed air.

ASSEMBLY

NOTE

Use *TEFLON PIPE SEALANT* or *HYLOMAR* on all fittings installed to oil filter mount.

1. See [Figure 3-58](#). Install oil pressure indicator switch (6) using OIL PRESSURE SENDING UNIT WRENCH (Part No. HD-41675). Tighten to 5-7 ft-lbs (7-10 Nm).

NOTE

The filter adapter (1) has identical ends; either end may be installed into the filter mount (4).

2. Apply **LOCTITE THREADLOCKER 243** (blue) to the threads on that end of the filter adapter (1) which is installed into filter mount (4). Do not apply **LOCTITE** to adapter threads on filter element side.

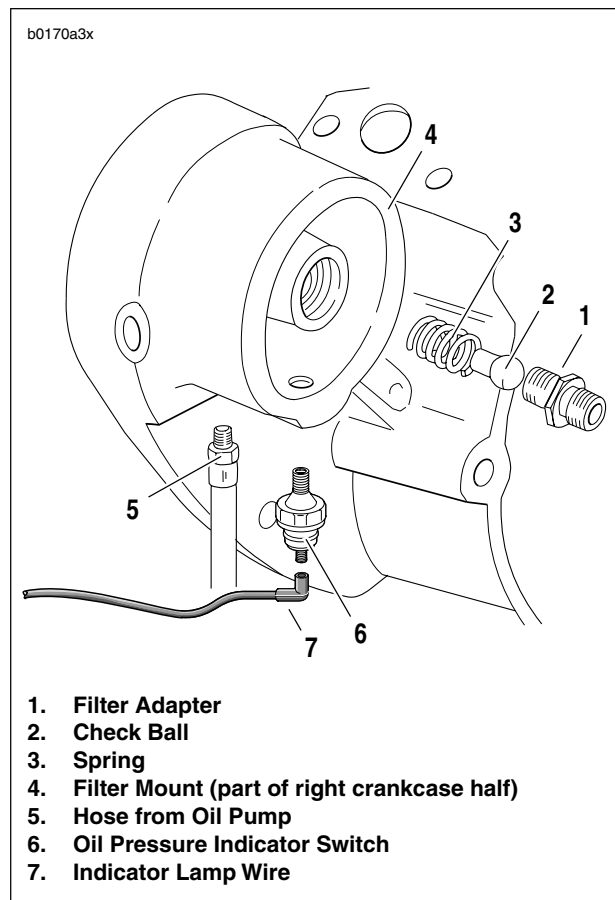


Figure 3-58. Oil Filter Mount

3. Install filter mount components.
 - a. Place spring (3) and check ball (2) into threaded hole at center of mount (4).
 - b. Push threaded end of filter adapter (with **LOCTITE**) (1) against check ball to compress spring.
 - c. Screw adapter into threaded hole. Tighten to 8-12 ft-lbs (11-16 Nm).
4. Attach indicator lamp wire (7).
5. Install a **new** filter and fill oil tank with proper oil. See [1.4 ENGINE LUBRICATION SYSTEM](#).

GENERAL

See [Figure 3-59](#). The hydraulic lifter assembly consists of a lifter and roller. The lifter and roller, under compression force from valve spring, follow the surface of the revolving cam. The up-and-down motion produced is transmitted to the valve by the push rod and rocker arm. The lifter contains a piston (or plunger) and cylinder; it also contains a check valve, which allows the unit to fill with engine oil, thereby reducing clearance in the valve train.

When a lifter is functioning properly, the assembly operates with minimal clearance. The unit automatically compensates for heat expansion to maintain a no-clearance condition.

It is normal for lifters to click when engine is started after standing for some time. Lifters have a definite leakdown rate which permits the oil in the lifters to escape. This is necessary to allow units to compensate for various expansion conditions of parts and still maintain correct clearance operation. Lifters are functioning properly if they become quiet after a few minutes of engine operation.

REMOVAL

1. Clean all dirt from around crankcase. Blow loose particles from area with compressed air.
2. Remove the upper, middle, and lower rocker covers. See [3.5 CYLINDER HEAD](#). Pull each push rod upward through top of cylinder head.
3. See [Figure 3-61](#). Remove both push rod covers (4).
 - a. Remove screw (8) and washer (10).
 - b. Lift retainer (6) and seal (7) upward a few inches on push rod cover (4).
 - c. Push upward on push rod cover while pulling bottom of cover clear of crankcase. Remove cover.
4. Remove both hydraulic lifters (3).
 - a. Remove two anti-rotation screws with washers (2).
 - b. Remove lifters (3) from crankcase bore using a thin-bladed screwdriver. Mark the location and orientation (front/back) of each lifter.

CLEANING/INSPECTION

1. Clean all parts, except roller/lifter assembly, thoroughly in solvent. Blow dry with compressed air.

NOTE

Inside and outside micrometers used for measuring lifters and lifter guides must be calibrated to ensure accurate readings.

2. Inspect hydraulic lifters for excessive clearance in guide. Accurately measure lifter bore inner diameter with a gauge.
 - a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
 - b. Fit a **new** lifter and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in. (0.076 mm).

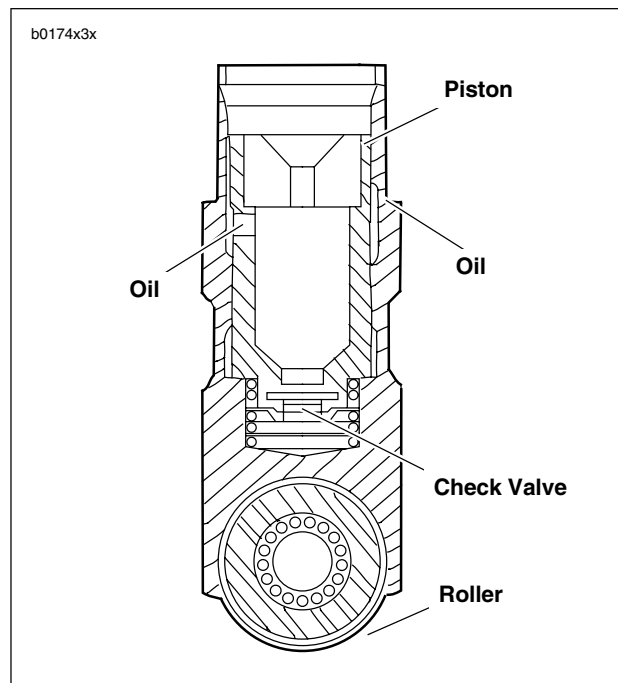


Figure 3-59. Lifter Assembly (Typical)

3. Check lifter roller freeplay.
 - a. Roller clearance on pin should be within 0.0006-0.0010 in. (0.0152-0.0254 mm).
 - b. Replace lifters if clearance exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).
4. Check lifter roller end clearance.
 - a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
 - b. Replace tappets if clearance exceeds SERVICE WEAR LIMIT of 0.026 in. (0.660 mm).
5. Soak lifters in clean engine oil. Keep covered until assembly.

INSTALLATION

- See [Figure 3-60](#). Rotate engine so that both lifters, from the cylinder being serviced, will be installed on the base circle (1) of the cam.

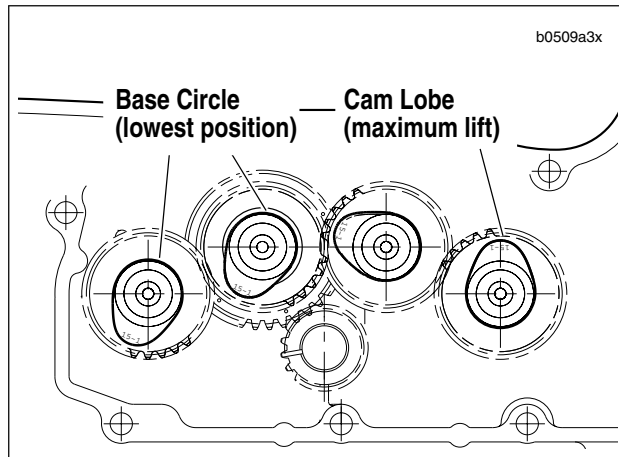
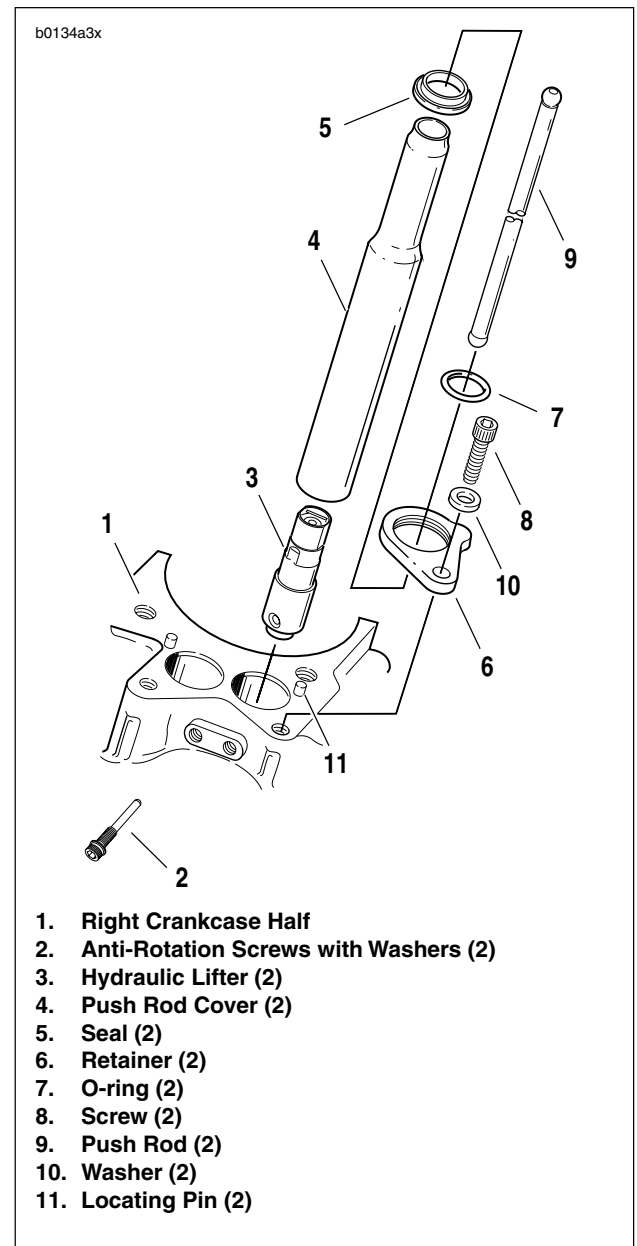


Figure 3-60. Base Circle

- Apply a liberal amount of engine oil to each lifter assembly (especially the roller needles) for smooth initial operation.
- See [Figure 3-61](#). Insert lifter (3) into bore in crankcase (1) with lifter oil hole facing towards the oil trough. Rotate lifter so that flats at upper end of lifter faces the front and rear of the engine. If the lifter is installed incorrectly, anti-rotation screws (2) cannot be inserted.
- Secure lifters in place.
 - Insert anti-rotation screws with washers (2) in the threaded holes in crankcase.
 - Tighten anti-rotation screws to 55-65 **in-lbs** (6-7 Nm)
- Install push rod covers.
 - Slide **new** seal (5) and retainer (6) over top of push rod cover (4).
 - Position **new** O-ring (7) at top of push rod cover.
 - Hold cover at an angle and insert top through hole in cylinder head. Push up on cover while aligning bottom of cover with lifter bore in crankcase.
 - Lower retainer (6) with seal (5) onto crankcase, aligning locating pin (11) with hole in retainer.
 - Insert screw (8) with washer (10) through hole in retainer (6). Thread screw (8) into tapped hole in crankcase. Tighten to 15-18 ft-lbs (20-24 Nm).
- Install push rods and rocker covers. See [3.5 CYLINDER HEAD](#).



- Right Crankcase Half**
- Anti-Rotation Screws with Washers (2)**
- Hydraulic Lifter (2)**
- Push Rod Cover (2)**
- Seal (2)**
- Retainer (2)**
- O-ring (2)**
- Screw (2)**
- Push Rod (2)**
- Washer (2)**
- Locating Pin (2)**

Figure 3-61. Hydraulic Lifter Service

GENERAL

Read the complete gearcase section carefully before you begin any service work.

For the gearcase components to operate at their optimum, all components must be properly fitted and matched. Changing one component can affect many others. It is important to know and understand all inspection procedures and how components interact.

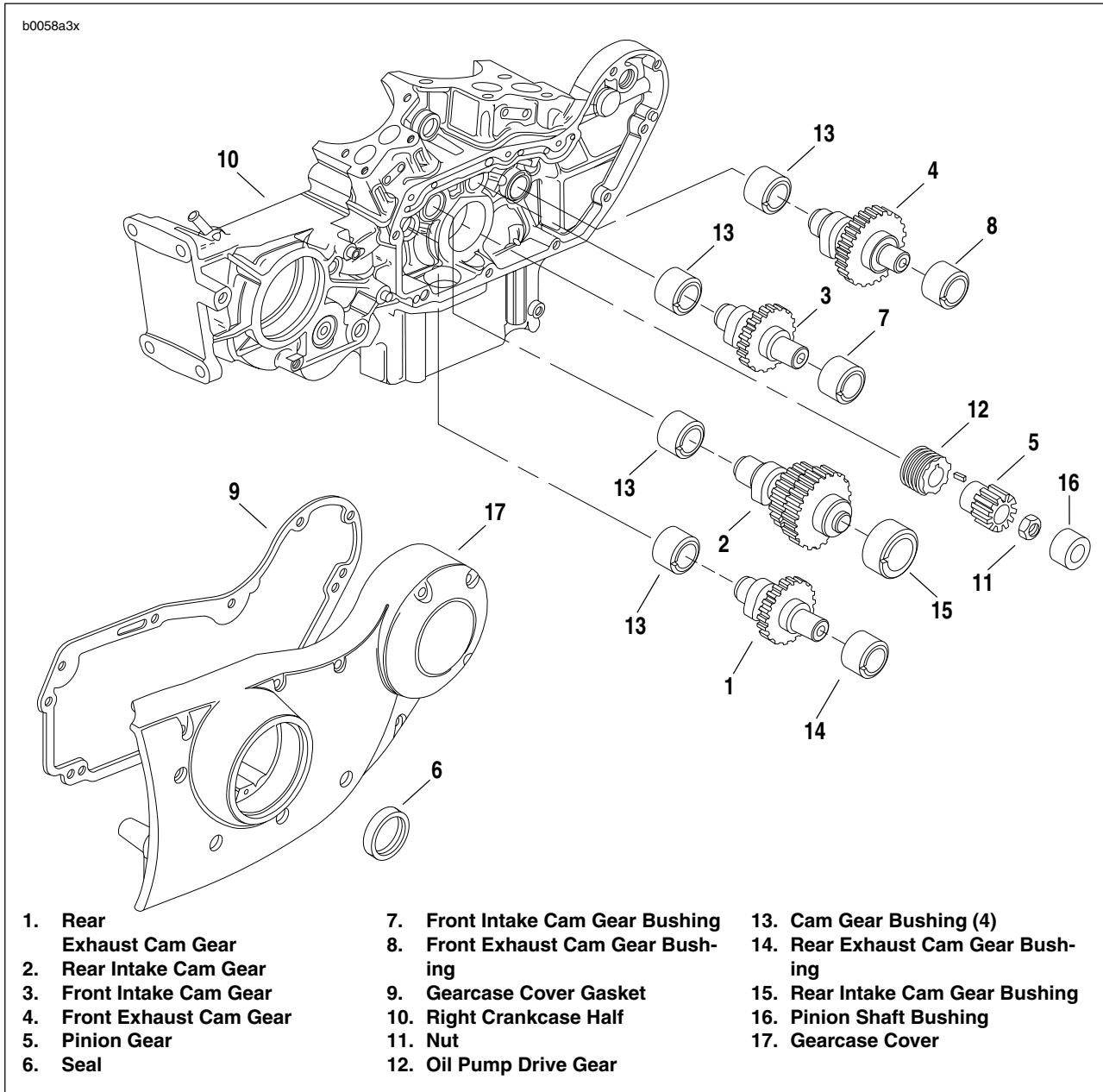


Figure 3-62. Gearcase and Valve Train Components

REMOVAL/DISASSEMBLY

1. See [Figure 3-62](#). Thoroughly clean area around gearcase cover (17) and lifters. Blow loose dirt from crankcase with compressed air.
2. Remove any parts that will interfere with gearcase disassembly (i.e., exhaust header, air cleaner, etc.).
3. Remove push rods. See [3.5 CYLINDER HEAD](#).
4. Remove hydraulic lifters. See [3.15 HYDRAULIC LIFTERS](#).
5. Check for minimum cam gear end play. Record readings.
6. Remove cam position sensor and rotor from gearcase cover. See [7.8 CAM POSITION SENSOR AND ROTOR](#).
7. Place a pan under gearcase to collect oil. Remove cover screws. Carefully remove gearcase cover. Discard old gasket (9).

NOTE

If cover does not come loose on removal of screws, tap lightly with a plastic hammer. Never pry cover off.

8. Remove cam gears (1, 2, 3 and 4). Carefully mark each component to ensure correct installation.

NOTE

Nut (11) is secured by **LOCTITE THREADLOCKER 262 (red)** on the nut threads.

9. Remove nut (11). Slide pinion gear (5) and oil pump drive gear (12) off pinion shaft.

CLEANING AND INSPECTION

1. Thoroughly clean gearcase compartment, gearcase cover and gears in solvent to remove oil and carbon deposits.
2. Blow out all cover oil passages and bushings with compressed air.
3. Clean old gasket material from gearcase and cover faces with cleaning solvent.

Cam and Pinion Gear Identification

See [Figure 3-63](#). Cam lobes are stamped with the number "15" followed by a number (1, 2, 3 or 4). The number "15" indicates model year application; the number identifies the cam location/function.

For location of cam and pinion gears, see [Figure 3-65](#).

Bushing Inspection and Removal

1. See [Figure 3-62](#). Bushings (7, 8, 13, 14, 15 and 16) are press fit in gearcase cover (17) and crankcase. Inspect each bushing against its corresponding cam gear shaft or pinion gear shaft. See [Table 3-10](#).
2. See [Figure 3-64](#). Use a BUSHING AND BEARING PULLER (Part No. HD-95760-69A) to remove bushings from gearcase cover and crankcase.

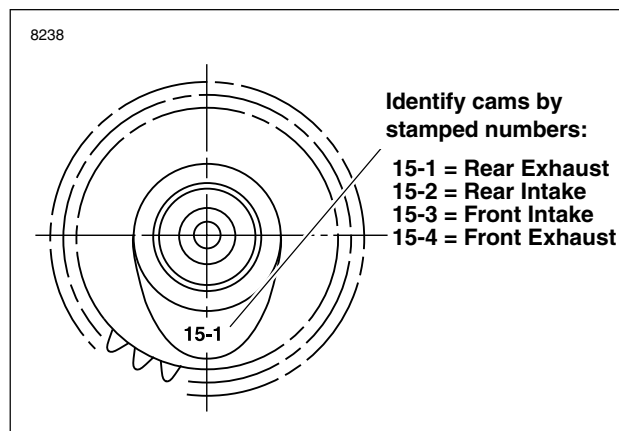


Figure 3-63. Cam Identification

Table 3-10. Gear Shaft Specifications

GEAR SHAFT	CORRECT CLEARANCE	SERVICE WEAR LIMIT
Cam	0.0007-0.0022 in. (0.0178-0.0559 mm)	0.003 in. (0.076 mm)
Pinion	0.0023-0.0043 in. (0.0584-0.1092 mm)	0.0050 in. (0.1270 mm)

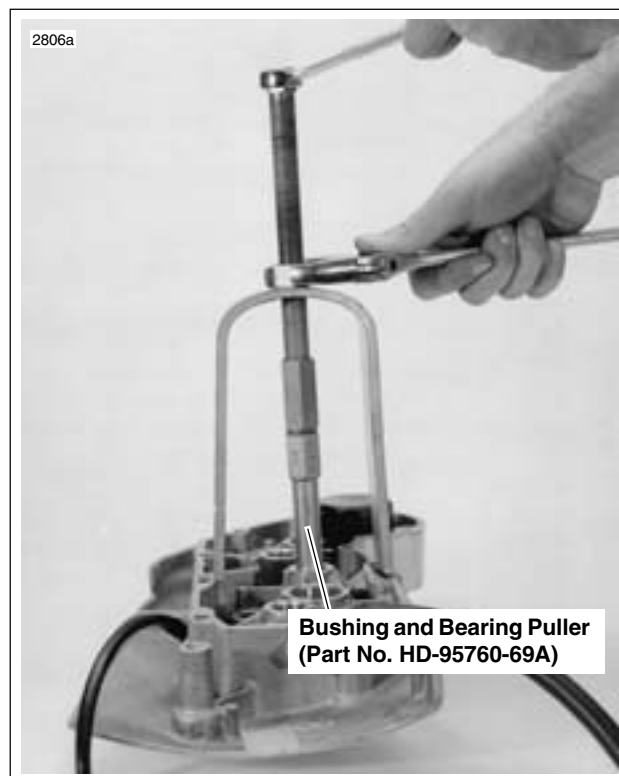


Figure 3-64. Removing Bushing

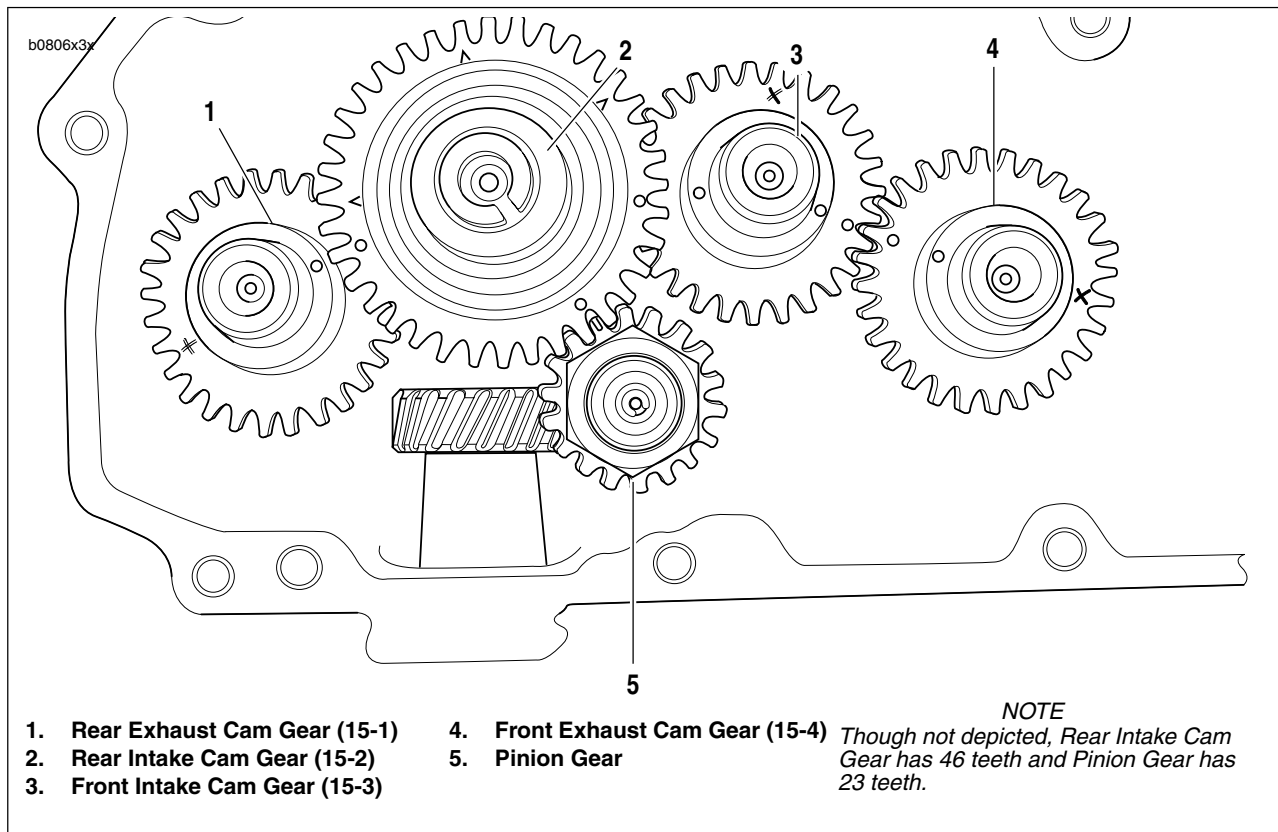


Figure 3-65. Cam and Pinion Gear Timing Mark Indexing

Bushing Installation

NOTE

Installing and reaming crankcase and gearcase cover bushings may alter the center distances between mating gears and may result in an increase in gear noise. For quiet-running gears, the gears should be matched to the center distances.

CAM GEAR BUSHINGS IN RIGHT CRANKCASE HALF

1. See [Figure 3-67](#). Each cam gear bushing (1), to be installed in right crankcase half (2), must be positioned in crankcase bore with its oiling slot at exact top of bore (12 o'clock position).
2. Using an arbor press, install each bushing in its crankcase bore so that bushing shoulder contacts crankcase boss.
3. After you install a **new** bushing in right crankcase half, ream the bushing to correct size. See [BUSHING REAMING](#).

CAM GEAR BUSHINGS (EXCEPT REAR INTAKE BUSHING) IN GEARCASE COVER

1. See [Figure 3-62](#). Using an arbor press, install each bushing (7, 8 and 14) in its gearcase cover (17) bore so that bushing shoulder contacts cover boss. Orient each bushing so the oiling slot is at the 9 o'clock position within the gearcase cover bore.

2. After you install a **new** bushing in gearcase cover, line-ream the bushing to correct size. See [BUSHING REAMING](#).

REAR INTAKE CAM GEAR BUSHING IN GEARCASE COVER.

1. See [Figure 3-62](#). Rear intake cam gear bushing (15) must be installed in its gearcase cover (17) bore using an arbor press. You will need to orient the bushing in a specific position of rotation within the cover bore, and will need to drill a lubrication hole in the bushing, according to the following procedures.
2. See [Figure 3-66](#). Position bushing (1) over bore of gearcase cover (2) with chamfered edge downward and slot upward. Align slot in bushing with slot in gearcase cover boss. Press bushing into cover bore until bushing is flush with cover boss.
3. Drill a 5/32 in. (3.97 mm) diameter hole through bushing using existing hole in gearcase cover as a guide.
4. After you install a **new** bushing in gearcase cover, line-ream the bushing to the correct size. See [BUSHING REAMING](#).

PINION SHAFT BUSHING IN GEARCASE COVER

1. See [Figure 3-62](#). Using an arbor press, install pinion shaft bushing (16) in its gearcase cover (17) so that bushing is flush with cover boss. There is no need to orient this particular bushing in any specific position of rotation within the gearcase cover bore.
2. Although the original pinion shaft bushing is not “pinned,” the replacement bushing must be secured, from possible rotation within the cover bore, by installation of a dowel pin. See [Figure 3-66](#). Drill a No. 31 hole, 0.281 in. (7.137 mm) deep, at top side of boss (side toward top of gearcase cover), centering the drill bit on the cover bore circle (hole is drilled half in bushing OD and half in cover bore ID).
3. Drive a **new** dowel pin no more than 0.20 in. (5.08 mm) below the bushing face. Carefully peen edges of hole to lock the pin in place.
4. After you install a **new** bushing in gearcase cover, line-ream the bushing to the correct size. See [BUSHING REAMING](#).

Bushing Reaming

NOTE

- *Installing and reaming crankcase and gearcase cover bushings may alter the center distances between mating gears and may result in an increase in gear noise. For quiet-running gears, the gears should be matched to the center distances.*
- *Bushings in right crankcase half serve as pilots for reaming gearcase cover bushings and must, therefore, be reamed to size first.*
- *After reaming any bushing, check shaft fit in the bushing. It may be necessary to make a second pass with reamer to attain proper fit.*

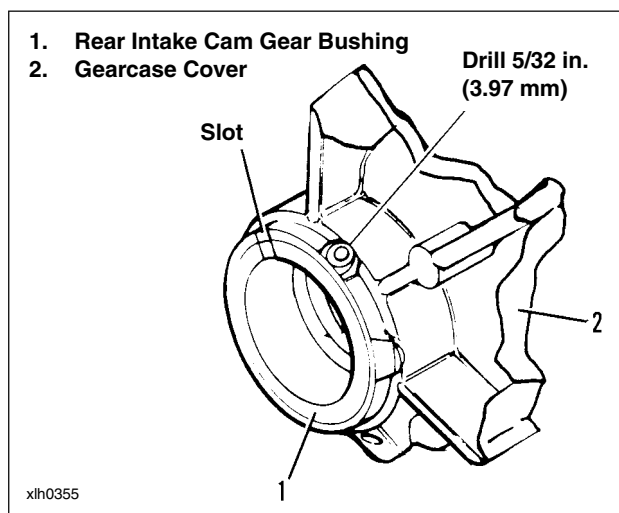


Figure 3-66. Rear Intake Cam Gear Bushing Installed in Gearcase Cover

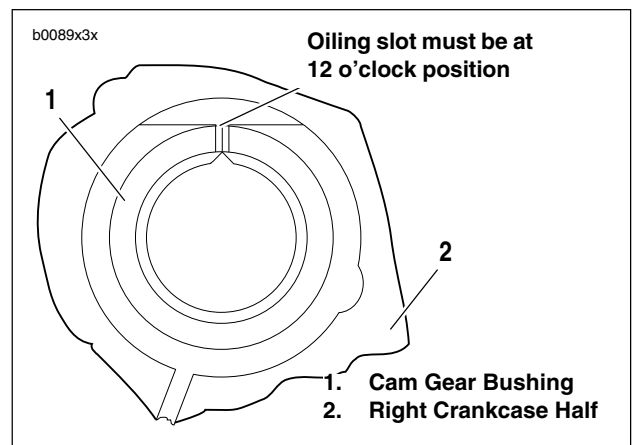


Figure 3-67. Cam Gear Bushing Installed in Crankcase

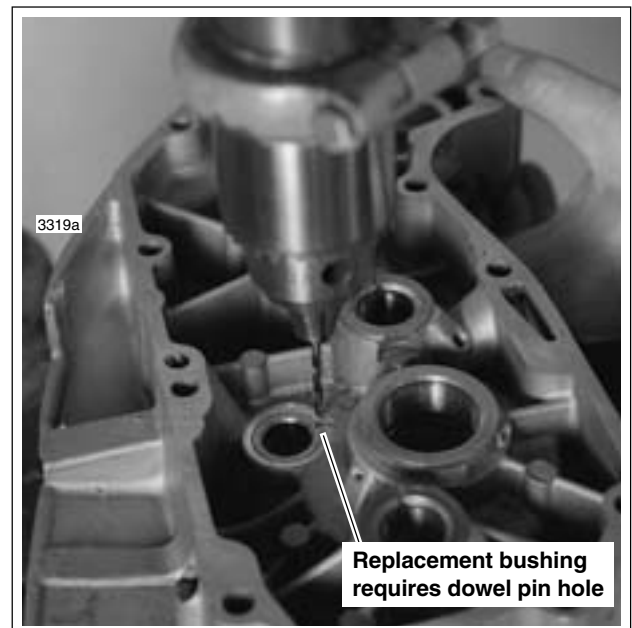


Figure 3-68. Drilling Dowel Pin Hole

CAM GEAR BUSHINGS IN RIGHT CRANKCASE HALF

1. Separate two halves of crankcase, if not already accomplished. Place right crankcase half on flat surface with gearcase side upward. Bushing to be reamed must be oriented as shown in [Figure 3-67](#).
2. See [Figure 3-69](#). Position CAMSHAFT BUSHING REAMER PILOT (Part No. HD-38871) onto gearcase side of crankcase half; upper right and lower left indexing holes in pilot must be placed over dowels in crankcase half. Insert two bolts (supplied with pilot) through two remaining holes in pilot, and into threaded holes of crankcase half. Tighten bolts securely.
3. Insert the 11/16 in. diameter reamer through pilot hole and into bushing while turning reamer clockwise. Continue turning reamer clockwise through bushing until smooth shank of reamer passes through hole in pilot.
4. Detach reamer from handle. Pull reamer out opposite side of crankcase half.

5. Thoroughly clean right crankcase half, removing all metal chips/shavings. Blow out all oil passages using compressed air.

CAM GEAR BUSHINGS (EXCEPT REAR INTAKE BUSHING) IN GEARCASE COVER

NOTE

Newly installed cam gear bushings in the gearcase cover must be line reamed, using the right crankcase half as a pilot for the reamer, to establish correct clearance and to ensure perfect alignment. If crankcase halves are not separated on your motorcycle, use a spare right crankcase half to perform the following line reaming procedures.

1. See Figure 3-62. Bushings (7, 8 and 14) to be reamed must be installed in gearcase cover (17) as described in BUSHING INSTALLATION. Attach gearcase cover to right crankcase half (10), which has been disassembled from left crankcase half, securing with a minimum of three mounting screws.
2. Insert a standard 11/16 in. diameter reamer through the previously reamed cam gear bushing (13) in right crankcase half, which is in line with one of the bushings to be reamed in gearcase cover.
3. Turn reamer clockwise through bushing in cover until reamer bottoms. Then give reamer one complete clockwise turn to size the bushing. Continue turning reamer clockwise while extracting reamer from bushing.
4. Repeat Steps 2 and 3 for remaining two cam gear bushings (except rear intake bushing) in gearcase cover, if required.
5. Separate gearcase cover from right crankcase half. Inspect bushings for proper cam gear shaft fit. Repeat line reaming operation if necessary.
6. Thoroughly clean gearcase cover, removing all metal chips/shavings. Blow out all oil passages using compressed air.

REAR INTAKE CAM GEAR BUSHING IN GEARCASE COVER

NOTE

A newly installed rear intake cam gear bushing in the gearcase cover must be line reamed, using the right crankcase half as a pilot for the reamer, to establish correct clearance and to ensure perfect alignment. If crankcase halves are not separated on your motorcycle, use a spare right crankcase half to perform the following line reaming procedures.

1. See Figure 3-62. Rear intake cam gear bushing (15) must be installed in gearcase cover (17) as described in BUSHING INSTALLATION.
2. Identify the previously reamed rear intake cam gear bushing (13) in right crankcase half (10), which has been disassembled from left crankcase half. Insert the shank end of REAR INTAKE CAMSHAFT BUSHING REAMER (Part No. HD-94803-67) through gearcase side of this bushing.
3. With reamer inserted into bushing in right crankcase half, attach gearcase cover to right crankcase half, securing with a minimum of three mounting screws.
4. Turn reamer clockwise through bushing in gearcase cover until reamer bottoms. Then give reamer one complete clockwise turn to size the bushing. Continue turning reamer clockwise while extracting reamer from bushing.

5. Separate gearcase cover from right crankcase half. Inspect bushing for proper cam gear shaft fit. Repeat line reaming operation if necessary.
6. Thoroughly clean gearcase cover, removing all metal chips/shavings. Blow out all oil passages using compressed air.

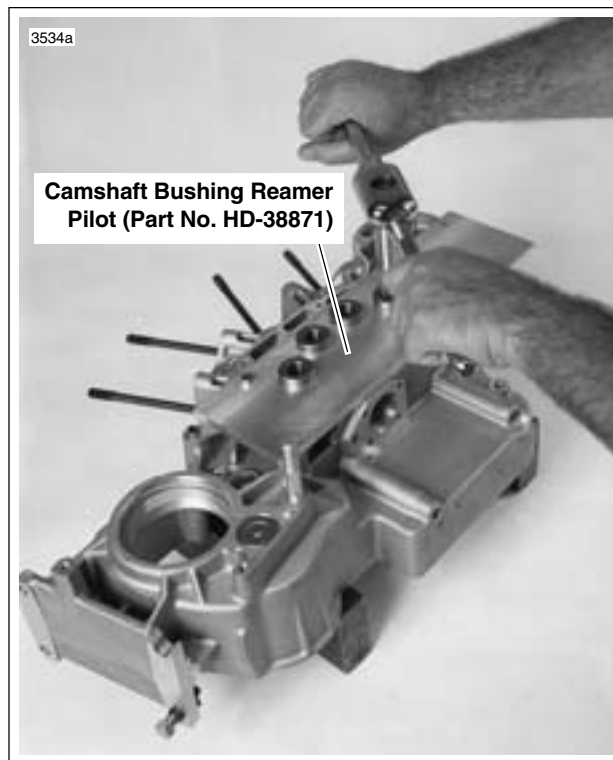


Figure 3-69. Reaming Cam Gear Bushing in Right Crankcase Half

PINION SHAFT BUSHING IN GEARCASE COVER

NOTE

A newly installed pinion shaft bushing in the gearcase cover must be line reamed, using both the right crankcase half and Part No. HD-94812-87 as pilots for the reamer, to establish correct clearance and to ensure proper alignment. If crankcase halves are not separated on your motorcycle, use a spare right crankcase half to perform the following line reaming procedures.

1. See Figure 3-62. Pinion shaft bushing (16) must be installed in gearcase cover (17) as described in BUSHING INSTALLATION. Attach gearcase cover to right crankcase half (10), which has been disassembled from left crankcase half, securing with a minimum of three mounting screws.
2. See Figure 3-70. Install PINION SHAFT BUSHING REAMER PILOT (Part No. HD-94812-87) into right crankcase roller race. Insert PINION SHAFT BUSHING REAMER (Part No. HD-94812-1) through the pilot.
3. Turn reamer clockwise through bushing in gearcase cover until reamer bottoms. Then give reamer one complete clockwise turn to size the bushing. Continue turning reamer clockwise while extracting reamer from bushing.

4. Separate gearcase cover from right crankcase half. Inspect bushing for proper pinion shaft fit. Repeat line reaming operation if necessary.
5. Remove pilot from right crankcase roller race. Thoroughly clean gearcase cover, removing all metal chips/shavings. Blow out all oil passages using compressed air.

ASSEMBLY/INSTALLATION

1. See [Figure 3-71](#). Install oil pump drive gear (5) and pinion gear on pinion shaft.
 - a. Slide oil pump gear drive gear (5) over pinion shaft (1). Drive gear must align with shaft key (4).
 - b. Align keyway (3) in ID of pinion gear with shaft key (4).
 - c. Slide pinion gear over shaft key (4) and against oil pump drive gear (5).
2. See [Figure 3-62](#). Install nut (11).
 - a. Clean threads on pinion shaft and nut.
 - b. See [Figure 3-72](#). Install CRANKSHAFT LOCKING TOOL (Part No. HD-43984) to gearcase with "Side A" facing out, over pinion shaft, with two screws.
 - c. Apply several drops of LOCTITE THREADLOCKER 262 (red) to threads of nut.
 - d. Install nut to pinion shaft. Tighten nut to 35-45 ft-lbs (48-61 Nm).
3. Liberally apply engine oil to bushings, shafts, and gears. Install all cam gears into bushings of right crankcase half, properly aligning timing marks of cam gears and pinion gear. See [Figure 3-65](#).

NOTE

Because of the larger diameter additional gear (which meshes with the pinion gear) on the outboard end of the rear intake (15-2) cam gear, the rear exhaust (15-1) and front intake (15-3) cam gears must both be installed before the rear intake (15-2) cam gear is installed.

CAUTION

Use only the correct gearcase cover gasket (see parts catalog for Part No.). Using pre-2000 model year gasket will obstruct oil galley and result in engine damage.

4. See [Figure 3-62](#). Install a **new** seal (6) and **new** dry gearcover gasket (9) on gearcase cover (17).

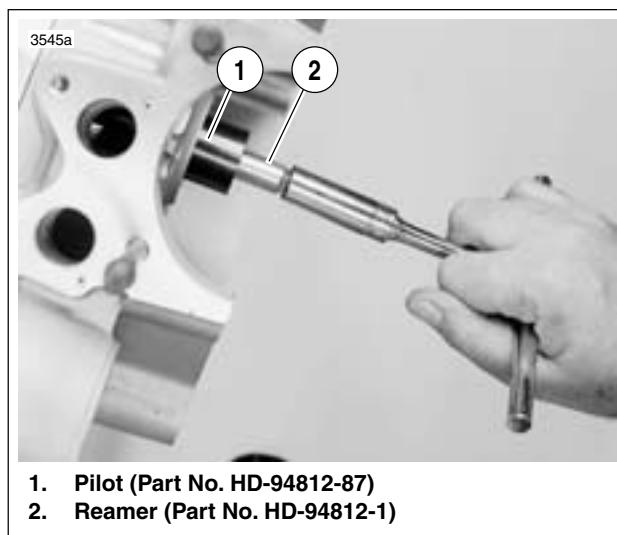


Figure 3-70. Line Reaming Pinion Shaft Bushing

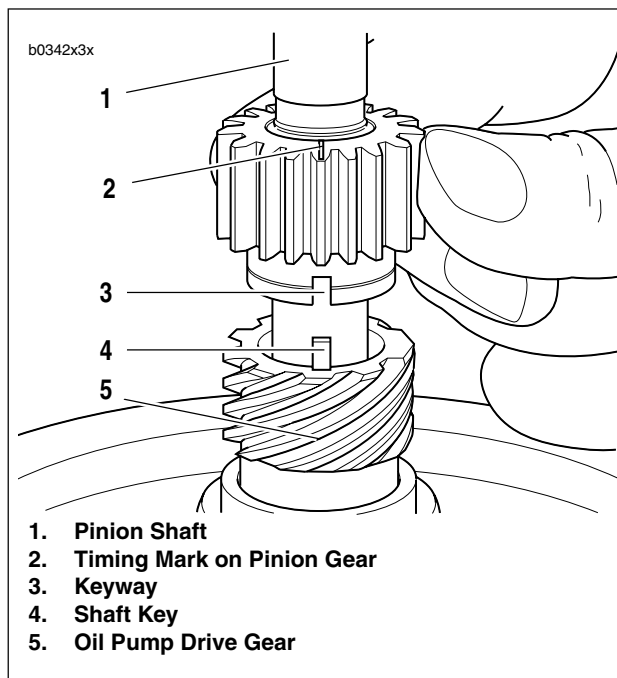


Figure 3-71. Aligning Pinion Gear

5. Install gearcase cover over all gears and onto right crankcase half (10). Secure cover to crankcase half with 11 socket head screws. Tighten screws evenly to 80-110 **in-lbs** (9-12 Nm). Use torque sequence shown in [Figure 3-73](#).
6. See [Figure 3-74](#). Check cam gear end play for each cam gear as follows:
 - a. Turn engine over until lobe of cam gear being checked is pointing toward its respective tappet guide hole.
 - b. Gently pry the cam gear toward the gearcase cover using a flat blade screwdriver.
 - c. Measure gap between bushing (in crankcase half) and cam gear shaft thrust face (shoulder) using a feeler gauge. This is cam gear end play.
 - d. Compare cam gear end play measurements with the SERVICE WEAR LIMITS. Make repairs as required if end play does not meet specifications.
7. Install hydraulic lifters and push rods. See [3.15 HYDRAULIC LIFTERS](#).
8. Install cam position sensor and rotor in gearcase cover. See [7.8 CAM POSITION SENSOR AND ROTOR](#).
9. Install any components removed to gain access to gearcase (i.e. exhaust system components, air cleaner, etc.).

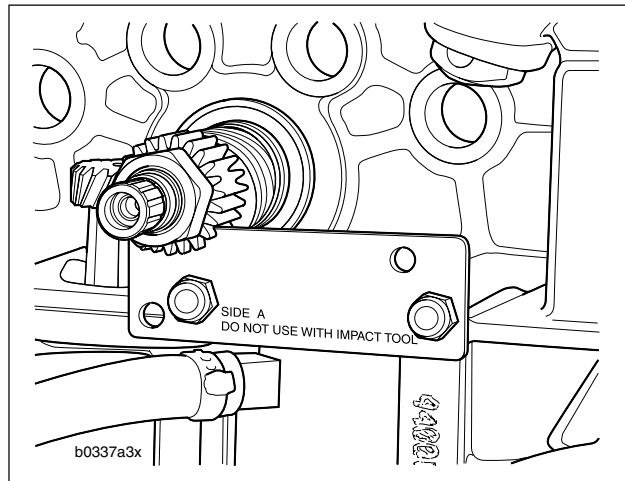


Figure 3-72. Crankshaft Locking Tool (HD-43984)

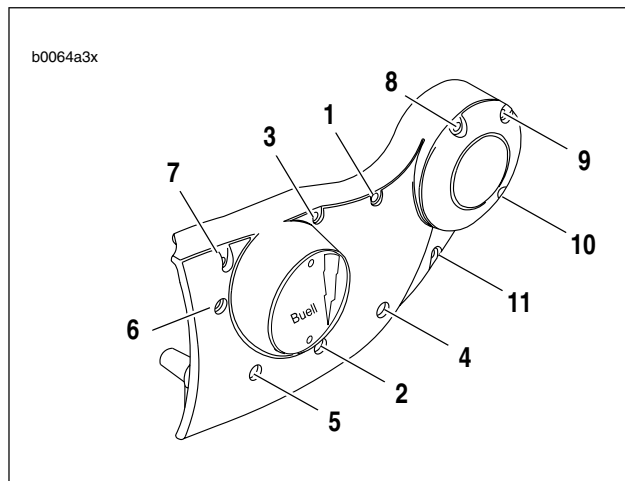


Figure 3-73. Gearcase Cover Mounting Screw Torque Sequence

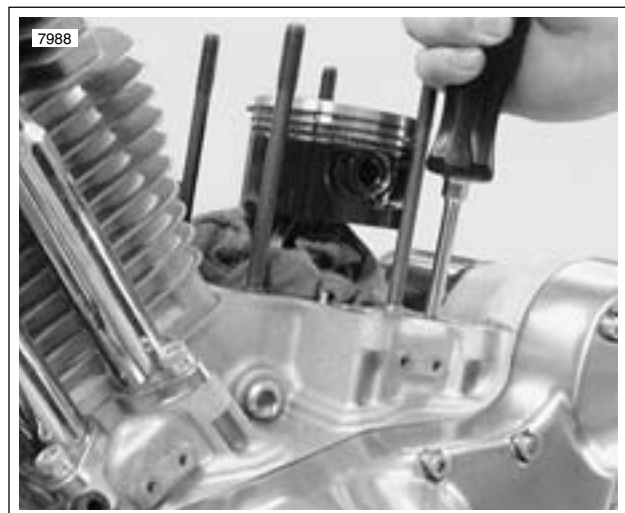


Figure 3-74. Checking Cam Gear End Play

GENERAL

CAUTION

If engine is removed from chassis, do not lay engine on primary side. Placing engine on primary side will damage clutch cable end fitting. If fitting is damaged, clutch cable must be replaced.

Remove engine from chassis to repair rod bearings, pinion shaft bearing or sprocket shaft bearing. See [3.3 STRIPPING MOTORCYCLE FOR ENGINE REPAIR](#).

It is recommended procedure to overhaul engine if removed. This includes inspecting and repairing cylinder heads, cylinders, gearcase and transmission.

ADJUSTMENT/TESTING

Flywheel End Play

Before completely disassembling crankcases, check flywheel end play.

- After engine has been removed from chassis, securely fasten it to a stand or workbench.
- Remove gearcase cover. See [3.16 GEARCASE COVER AND CAM GEARS](#).
- See [Figure 3-75](#). Attach a dial indicator to gear side crankcase with indicator stem on end of gearshaft.
- To obtain an accurate flywheel end play reading, preload sprocket shaft bearings. Create a suitable tool by welding two handles to an old engine sprocket nut. Install the nut and sprocket. Tighten to 190-210 ft-lbs (258-285 Nm).
- Check flywheel end play.
 - Rotate and **push** on sprocket shaft while reading dial indicator.
 - Then rotate and **pull** on sprocket shaft while reading dial indicator.
 - Replace bearing inner shim (See [Figure 3-78](#).) if difference (end play) in indicator readings is not 0.001-0.005 in. (0.025-0.127 mm). Choose shim from [Table 3-11](#).

NOTE

Use a thinner shim for less end play; use a thicker shim for more end play.

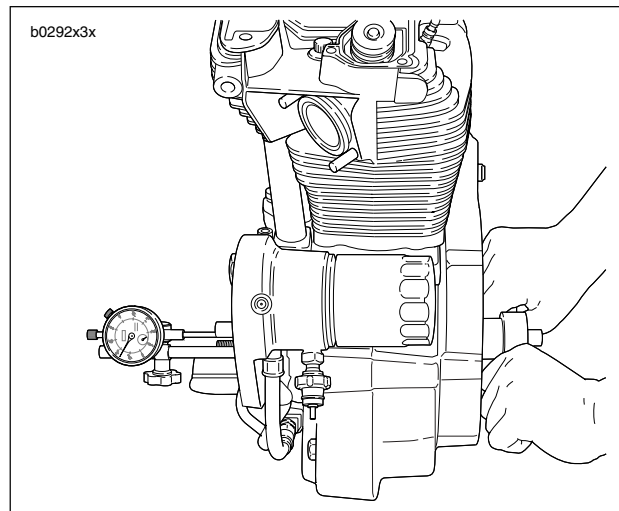


Figure 3-75. Checking Flywheel End Play

Table 3-11. Flywheel End Play Shims

PART NUMBER	THICKNESS	
	IN.	MM
9155	0.0975-0.0985	2.4765-2.5019
9142	0.0995 - 0.1005	2.5273-2.5527
9143	0.1015-0.1025	2.5781-2.6035
9144	0.1035 - 0.1045	2.6289-2.6543
9145	0.1055 - 0.1065	2.6797-2.7051
9146	0.1075 - 0.1085	2.7305-2.7559
9147	0.1095 - 0.1105	2.7813-2.8067
9148	0.1115 - 0.1125	2.8321-2.8575
9149	0.1135 - 0.1145	2.8829-2.9083

Table 3-12. Gearshaft Bearings

PART NUMBER	COLOR
24647-87	Blue
24650-87	Red
24659-87	White/Grey
24660-87	Green

DISASSEMBLY

Crankcase Halves

1. Remove cylinder heads. See 3.5 CYLINDER HEAD.

CAUTION

After removing cylinders, install plastic or rubber hose over cylinder studs. Lifting or moving crankcase by grasping studs will cause cylinder stud damage.

2. Remove cylinders and pistons. See 3.6 CYLINDER AND PISTON.
3. Remove oil pump. See 3.13 OIL PUMP.

4. Remove gearcase components. See 3.16 GEARCASE COVER AND CAM GEARS.
5. Remove primary cover and primary drive/clutch components. See Primary Chain/Drive under 6.5 PRIMARY DRIVE/CLUTCH.
6. Remove starter motor. See 5.7 STARTER.
7. Remove transmission. See 6.7 TRANSMISSION CASE.
8. See Figure 3-76. Remove screws and rear engine mount bolt securing crankcase halves together.
9. Position crankcase on work bench, gearcase side up. Tap crankcase with plastic mallet to loosen top half and separate the halves.

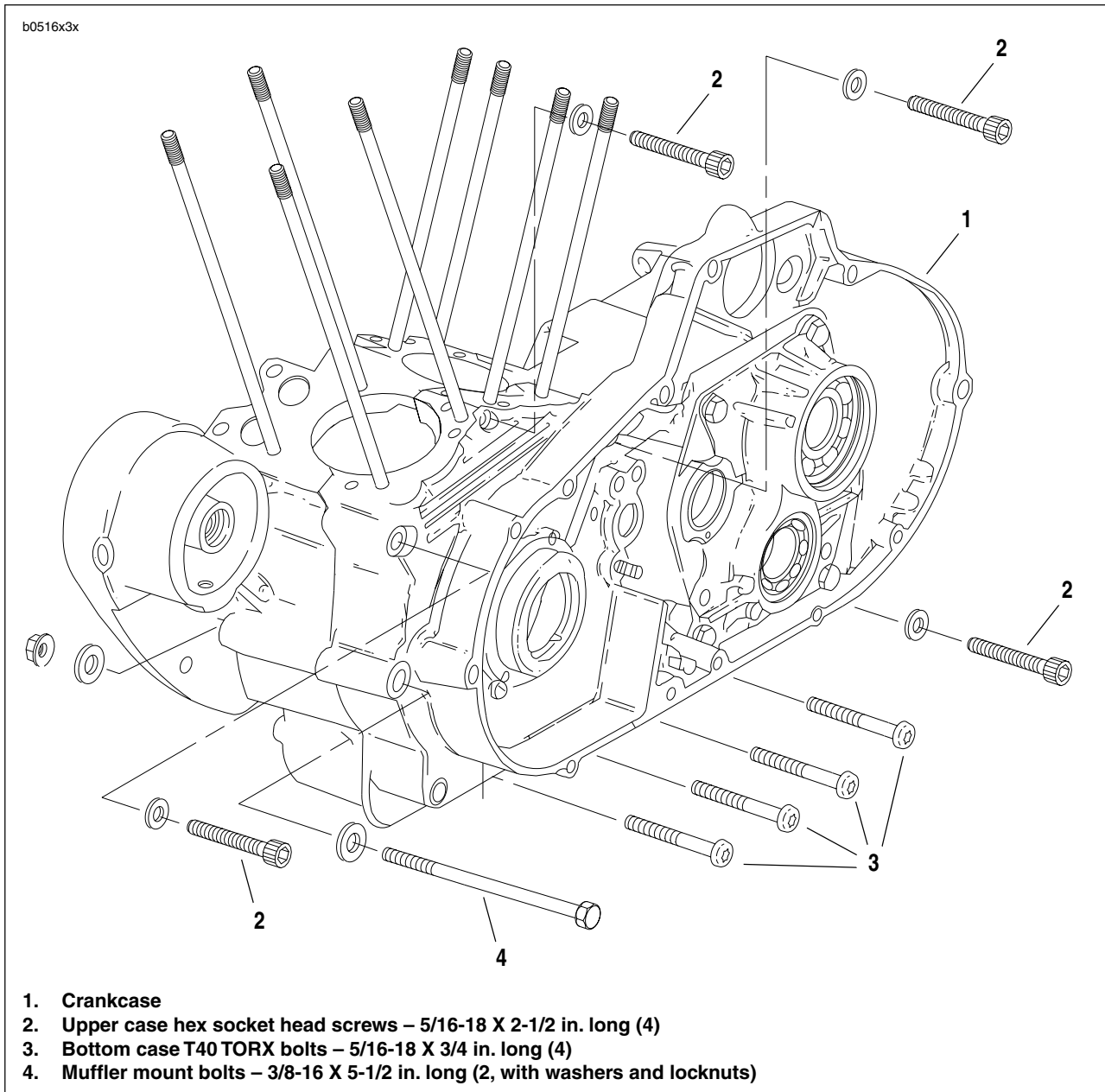


Figure 3-76. Crankcase Hardware (Typical)

WARNING

The next step requires using a press. Wear eye protection and make certain set-up is stable. The pressure involved could cause parts to “fly out” with considerable force. Inadequate safety precautions could result in death or serious injury.

- See [Figure 3-77](#). Mount the left crankcase half and flywheel assembly on a press table, supporting crankcase on parallel bars. Press on end of sprocket shaft with arbor press until flywheel assembly is free from crankcase half. Do not drive flywheel assembly from crankcase half as flywheels may be knocked out of alignment.

NOTE

See [Figure 3-77](#). If it is necessary to remove either the pinion shaft bearing (11) or sprocket shaft bearing (4 and 9), proceed as follows:

- Gearshaft bearing will remain on flywheel pinion shaft. Remove retaining ring, and bearing may be slipped off pinion shaft.
- See [Figure 3-79](#). Place flywheel assembly in FLYWHEEL FIXTURE (Part No. HD-44385). Pull sprocket shaft bearing with SPROCKET SHAFT INNER TIMKIN BEARING REMOVER (Part No. HD-44404) and ALL PURPOSE CLAW PULLER (Part No. HD-95635-46) using bolts in place of jaws. Insert a penny (or suitable coin) between shaft and claw puller to avoid damaging shaft.
- See [Figure 3-80](#). Use CRANKSHAFT BEARING TOOL (Part No. HD-94547-101) to remove sprocket shaft outer races.

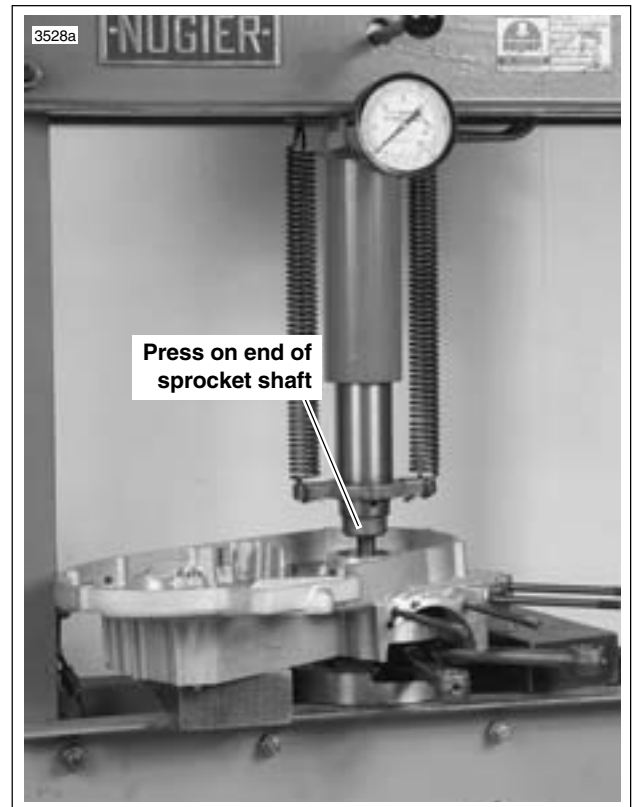


Figure 3-77. Pressing Flywheel from Crankcase

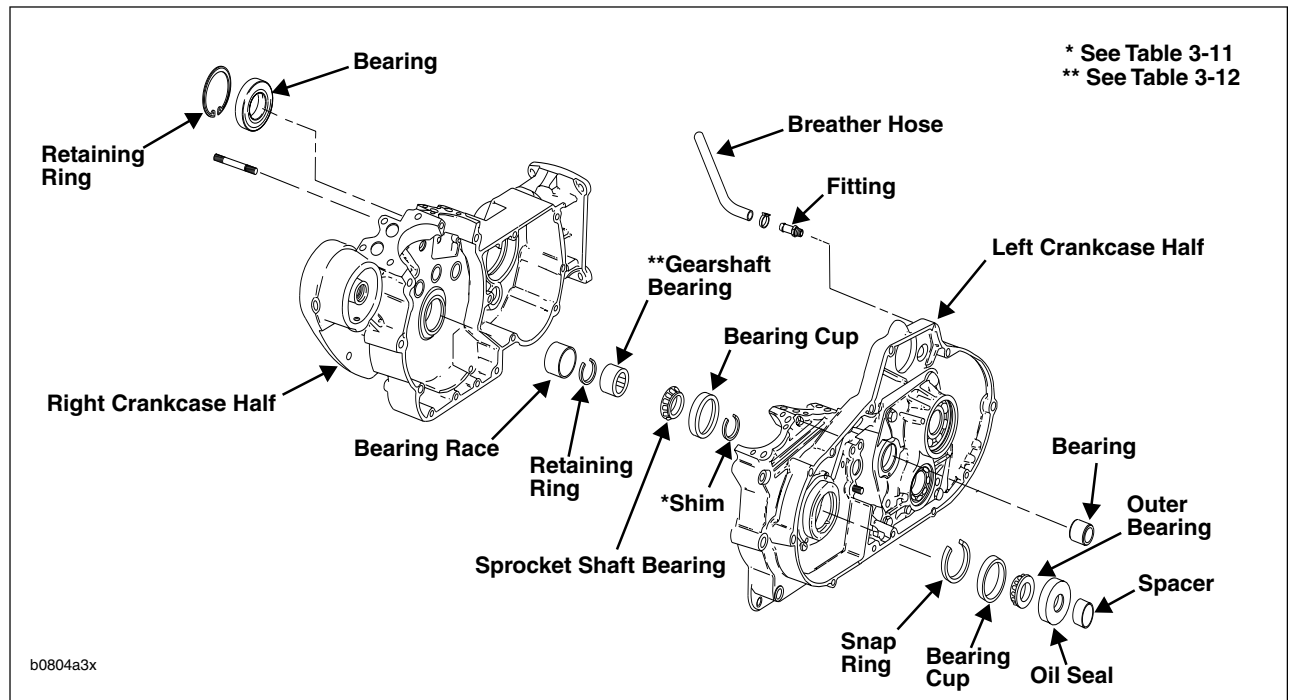


Figure 3-78. Crankcase Assembly

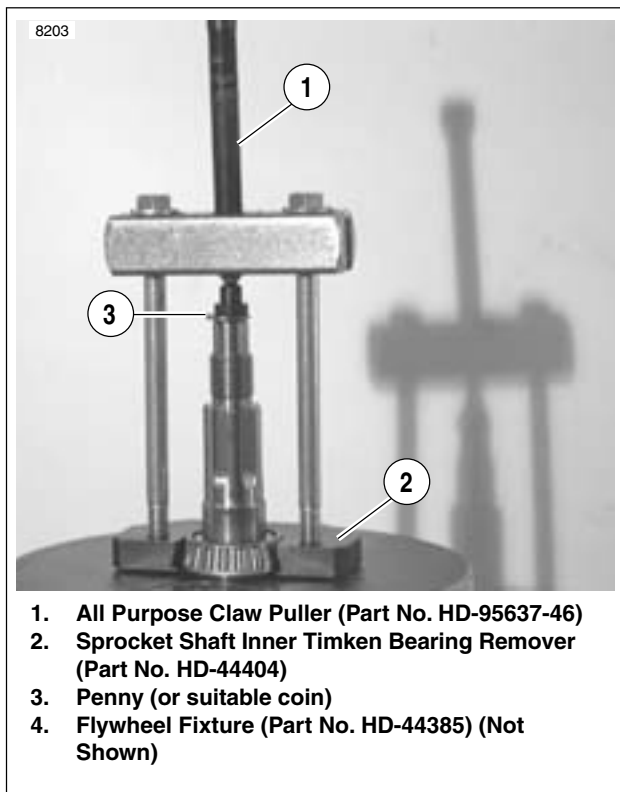


Figure 3-79. Removing Sprocket Shaft Inner Timken Bearing (Typical)

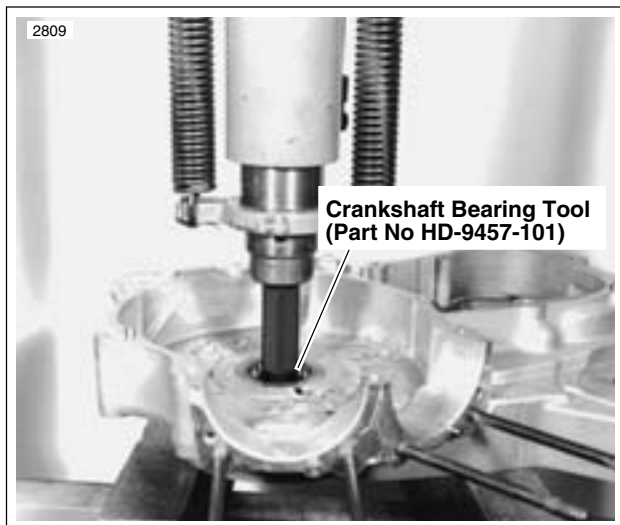


Figure 3-80. Sprocket Shaft Outer Race Removal

14. Remove crankcase retaining ring from crankcase bore.
 - a. Place the crankcase half on a flat surface with the outboard side facing up.
 - b. Obtain the two TIMKEN SNAP RING REMOVER/INSTALLER (HD-44069).
 - c. See [Figure 3-81](#). With the gap in the retaining ring being the 12 o'clock position, place the two claws so that the slotted sides engage the inside edge of the retaining ring at the 10 and 2 o'clock positions.
 - d. Using a 9/64 inch allen head bit, tighten the screws to fix the position of the claws on the retaining ring.
 - e. See [Figure 3-82](#). Inserting the tips of a large retaining ring pliers (Snap-On PR-56A) into one hole in each claw, compress the retaining ring and remove it from the crankcase bore.
 - f. Loosen allen head screws and remove claws from retaining ring.

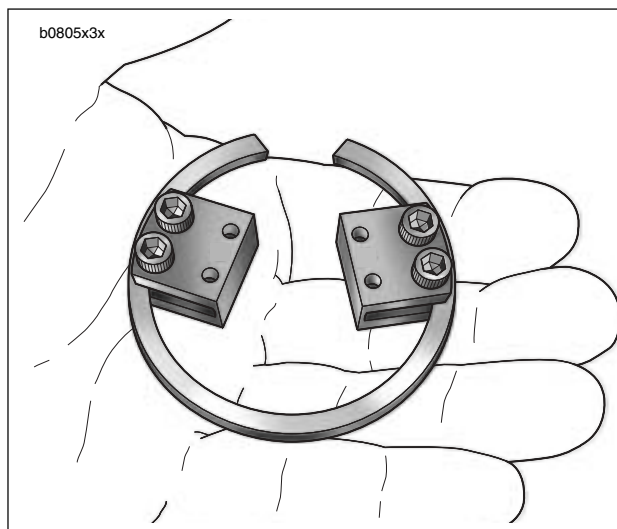


Figure 3-81. Install Claws on Snap Ring

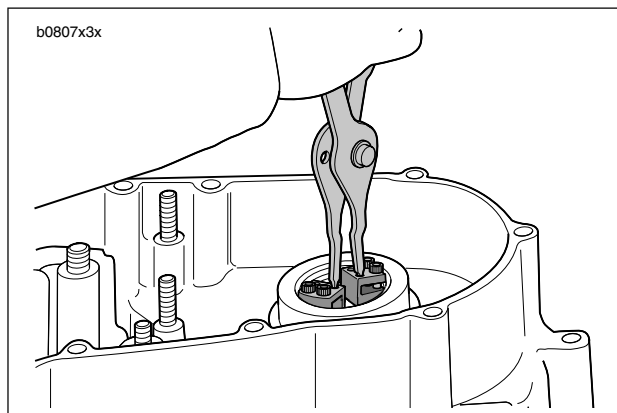


Figure 3-82. Remove Snap-Ring From Crankcase Bore

Flywheel/Connecting Rod Assembly

NOTE

If the flywheel or connecting rods need to be replaced, then they must be replaced together as one assembly. Return the flywheel/connecting rod assembly to the factory for service or replacement.

CLEANING AND INSPECTION

Wash all parts in solvent and blow dry with compressed air.

Flywheel/Connecting Rod Assembly

- Replace the flywheel/connecting rod assembly if any of the following conditions are noted:
 - Connecting rods are bent or twisted.
 - Connecting rods do not fall under their own weight or are in a bind.
 - The crankshaft (roller) bearing inner race is burred, burnt, scored, blued or damaged.
- Inspect connecting rods for correct free play.
 - Holding the shank of each rod just above the bearing bore, pull up and down on the connecting rods. Any discernible up and down movement indicates excessive lower bearing clearance. Replace the flywheel/connecting rod assembly.
- See [Figure 3-83](#). Check connecting rod side play.
 - Insert a feeler gauge between the thrust washer and the outboard side of the connecting rod.
 - Replace the assembly if the rod side play exceeds 0.030 inch (0.762 mm).

Fitting Sprocket Bearings

If flywheel end play is within tolerance, and if tapered roller bearings and races pass visual check and have no apparent wear, the same set may be reinstalled. Make certain all parts of bearing are installed in exactly the same order in which they were removed. If any part of bearing assembly is worn, entire assembly should be replaced.

Fitting Pinion Bearings

See [Figure 3-78](#). A pressed-in bushing in the right crankcase half is the outer race. The inner race is pressed on the pinion shaft.

See [Figure 3-86](#). To remove pinion shaft inner race, use TWO CLAW PULLER (Part No. HD-97292-61), CENTER CAP (Part HD-95652-43A), and BEARING SEPARATOR (SNAP-ON TOOLS Stock No. CJ950). Apply heat to race to aid removal. Four sizes of pinion bearings are available. Pinion bearing selection at the factory, during engine rebuild, or replacement of crankcase set or flywheel assembly is based on the largest measured outside diameter (OD) of the inner race and the smallest measured inside diameter (ID) of the outer race (crankcase bushing). A running clearance of 0.0002-0.0008 in. (0.0051-0.0203 mm) is established during crankcase set or flywheel assembly replacement and engine rebuild.



Figure 3-83. Checking Connecting Rod Side Play

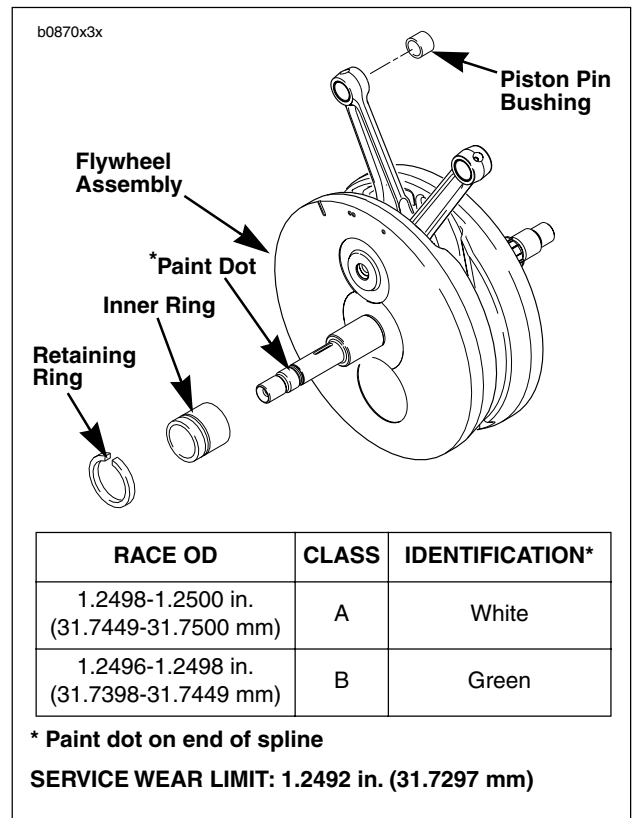


Figure 3-84. Low Inertia Flywheel and Connecting Rod Assembly/Factory Inner Race Sizes

See Figure 3-84. Installed inner races are identified at the factory as shown.

See Figure 3-85. Outer races are identified at the factory as shown.

See Figure 3-86. To remove pinion shaft inner race, use TWO CLAW PULLER (Part No. HD-97292-61), CENTER CAP (Part HD-95652-43A), and BEARING SEPARATOR (SNAP-ON TOOLS Stock No. CJ950). Apply heat to race to aid removal. Four sizes of pinion bearings are available. Pinion bearing selection at the factory, during engine rebuild, or replacement of crankcase set or flywheel assembly is based on the largest measured outside diameter (OD) of the inner race and the smallest measured inside diameter (ID) of the outer race (crankcase bushing). A running clearance of 0.0002-0.0008 in. (0.0051-0.0203 mm) is established during crankcase set or flywheel assembly replacement and engine rebuild.

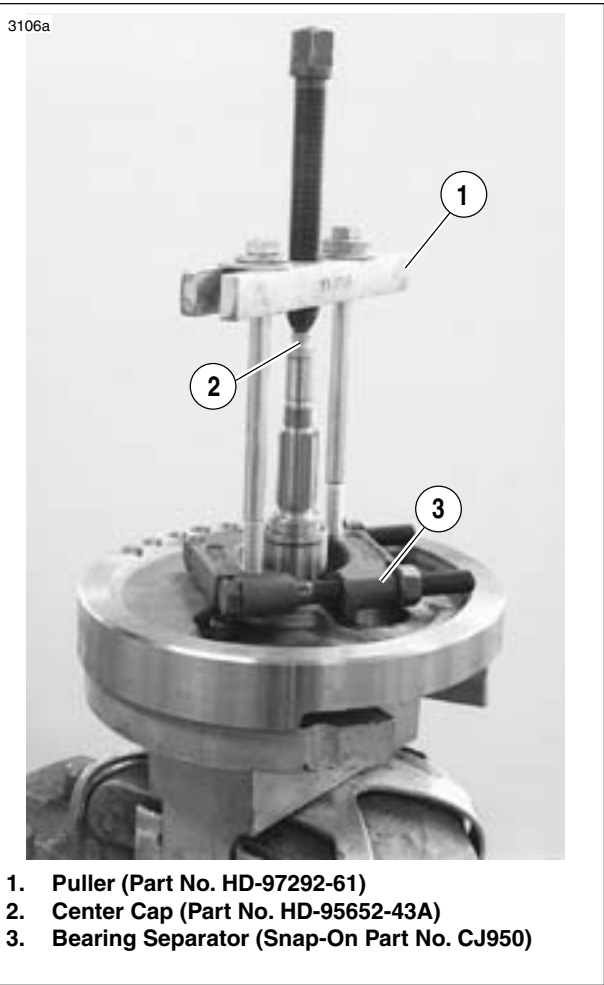
See Figure 3-84. Installed inner races are identified at the factory as shown.

See Figure 3-85. Outer races are identified at the factory as shown.

NOTE

The different sizes of crankcase sets and flywheel assemblies will not have separate part numbers. That is, a replacement crankcase set may have a class 1, 2 or 3 pinion outer race. Replacement flywheel assemblies will have either a class A or B inner race.

See Figure 3-88. Pinion bearings are identified as shown.



1. Puller (Part No. HD-97292-61)
2. Center Cap (Part No. HD-95652-43A)
3. Bearing Separator (Snap-On Part No. CJ950)

Figure 3-86. Pulling Pinion Shaft Inner Race (Typical)

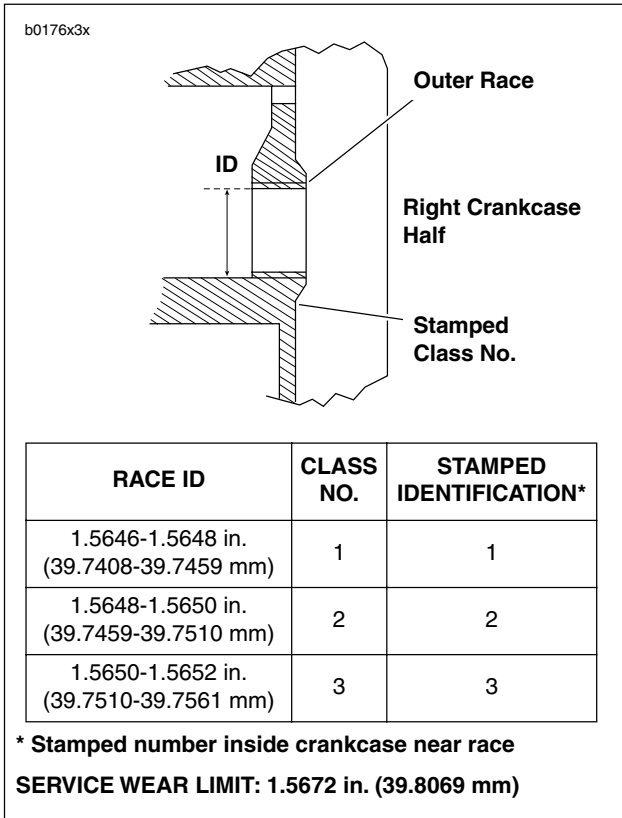


Figure 3-85. Factory Outer Race Sizes

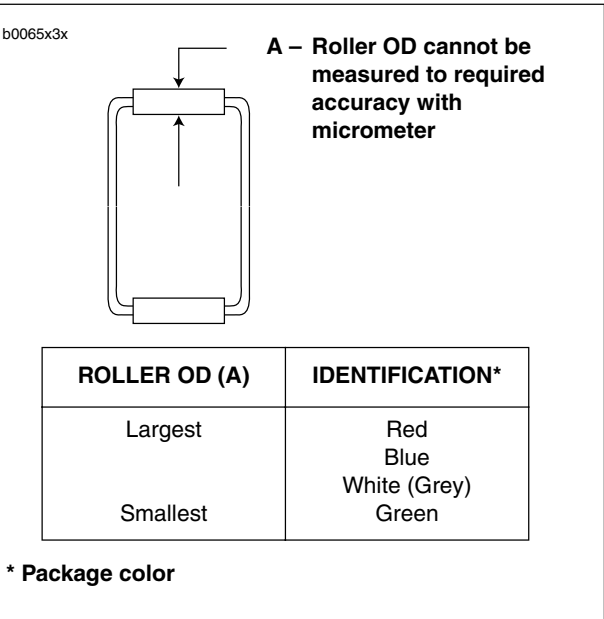


Figure 3-87. Bearing Identification

BEARING SELECTION

Select bearings using the identification information given for inner and outer races and bearings. See [Table 3-12.](#) and [Table 3-13.](#)

NOTE

If either inner or outer race show wear, measure both races to confirm correct bearing fit.

1. Use a dial bore gauge to measure and record ID of outer race. Take four measurements on ID where bearing rollers ride.
 - a. If the largest measurement is larger than 1.5672 in. (39.8069 mm) or the required lapping to remove wear marks would enlarge bore beyond 1.5672 in., continue at Step 5.
 - b. If largest measurement is 1.5672 in. (39.8069 mm) or less, cover the cam bearings with masking tape to prevent debris from entering bearings. Assemble crankcase halves.

NOTE

The next step requires lapping the outer race. To keep sprocket shaft and pinion shaft bearings aligned the lap must be supported by an adaptor or pilot in the left crankcase half.

2. See [LAPPING ENGINE MAIN BEARING RACES.](#) Lap race until all wear marks are removed.
3. Measure and record ID of race at four places.
4. Check measurements against these specifications:

Largest ID measured: 1.5672 in. (39.8069 mm) or less

Roundness of ID: within 0.0002 in. (0.0051 mm)

Taper: within 0.0002 in. (0.0051)

- a. If lapping increased bore ID to larger than 1.5672 in. (39.8069 mm), go to Step 5.
 - b. If roundness or taper do not meet specifications, continue lapping until specifications are met.
 - c. If all specifications are met, continue at Step 7 to remove and size inner race.
5. Press the outer race from the right crankcase. Press **new** outer race into crankcase flush with inside edge of cast-in insert.

See [Figure 3-89.](#) Dimensions are shown for fabrication of tools used in pressing the outer race into or out of crankcase.

6. The **new** outer race must be lapped slightly to true and align with left case bearing and to meet the following specifications. See [LAPPING ENGINE MAIN BEARING RACES.](#)

ID: 1.5646 - 1.5652 in. (39.7408 - 39.7561 mm)

Roundness: within 0.0002 in. (0.0051 mm)

Taper: within 0.0002 in. (0.0051 mm)

Surface finish: 16 RMS

7. See [Figure 3-86.](#) Pull inner race from pinion shaft using TWO CLAW PULLER (Part No. HD-97292-61), CENTER CAP (Part No. HD-95652-43A), and BEARING SEPARATOR (SNAP-ON TOOLS Stock No. CJ950). Apply heat to race to aid removal.
8. See [Figure 3-88.](#) Press **new** inner race on pinion shaft as shown. The **new** inner race must be ground by a competent machinist to OD dimension range for the finished lapped ID of the outer race. See [Table 3-13.](#) The finished

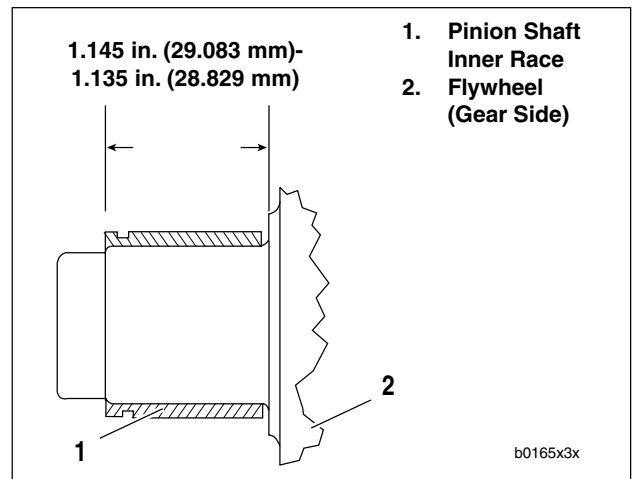


Figure 3-88. Inner Race Location

inner race must meet these specifications. For necessary dimensions for constructing a press-on tool see [Figure 3-89.](#) When the tool bottoms against the flywheel, correct inner race location is automatically established.

Roundness: within 0.0002 in. (0.0051 mm)

Taper: within 0.0002 in. (0.0051 mm)

Surface finish: 16 RMS

NOTE

Always use the smallest outer race ID measurement and the largest OD inner race measurement when selecting bearings.

9. The following example illustrates how to determine the required inner race OD.
 - a. See [Table 3-13.](#) For example purposes, suppose the smallest outer race ID measurement is 1.5651 in. (39.754 mm). This requires an inner race OD range of 1.2496-1.2504 in. (31.740 - 31.760 mm).

NOTE

Have machinist grind outer race to center or middle of required OD range. This will prevent grinding outer race undersize and gives a more easily achieved tolerance range.

- b. Grind inner race. Measure OD at four places. Check that specifications in Step 8 are met.
- c. For example purposes, suppose the largest inner race OD measurement after grinding is 1.2499 in. (31.747 mm) OD.
- d. With a 1.5651 in. (39.754 mm) ID outer race and a 1.2499 in. (31.747 mm) OD inner race, a blue bearing is required.

Lapping Engine Main Bearing Races

1. Secure right and left crankcase halves with three crankcase stud bolts (top center and bottom left and right). The sprocket shaft bearing outer races and large spacer must be installed in left crankcase.
2. See [Figure 3-90](#). Obtain CRANKCASE MAIN BEARING LAPPING TOOL (Part No. HD-96710-40B). Assemble CRANKCASE MAIN BEARING LAP (Part No. HD-96718-87) to lapping handle. Assemble guide sleeve to sprocket shaft bearing bushing. Sleeves, for use with tapered bearing, are assembled to case with bearings and small spacer collar. Finger-tighten the sleeve parts.
3. Insert lap shaft with arbor assembled through pinion bearing bushing and into guide sleeve. Tighten arbor expansion collars using a length of 0.156 in. (3.962 mm) rod as spanner until arbor begins to drag. Do not adjust arbor snug in bushing or bushing will "bell," a condition where hole is larger at ends than it is in the center.
4. Withdraw arbor far enough to coat lightly with 220 grit lapping compound. Do not apply a heavy coat. Reposition lap in bushing and turn handle at moderate hand speed. Work lap back and forth in bushing, as it is revolved, to avoid grooving and tapering.

At frequent intervals, remove lap from crankcase, wash and inspect bushing. Lapping is completed when entire bushing surface has a dull, satin finish rather than a glossy, smooth appearance. If necessary, flush off lap in cleaning solvent, air dry and apply fresh, light coat of fine lapping compound.

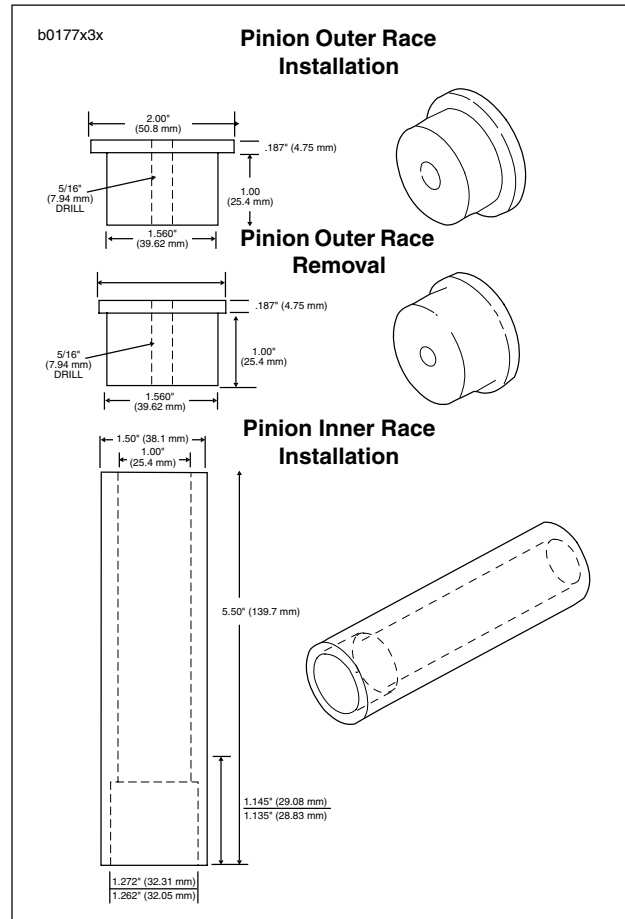


Figure 3-89. Pinion Shaft Bearing Tools



Figure 3-90. Lapping Pinion Shaft Main Bearing

Table 3-13. Pinion Shaft Bearing Selection

FACTORY STAMPED NUMBER	OUTER RACE ID	BEARING SIZE AS IDENTIFIED BY COLOR CODING												
		Service Wear Limit Exceeded – Replace Outer Race and Resize												
	over 1.5672 in. 39.807 mm												Red	
	1.5670-1.5672 in. 39.802-39.807 mm												Red	Blue
	1.5668-1.5670 in. 39.797-39.802 mm											Red	Blue	White-Gray
	1.5666-1.5668 in. 39.792-39.797 mm										Red	Blue	White-Gray	Green
	1.5664-1.5666 in. 39.787-39.792 mm									Red	Blue	White-Gray	Green	
	1.5662-1.5664 in. 39.781-39.787 mm								Red	Blue	White-Gray	Green		
	1.5660-1.5662 in. 39.776-39.781 mm						Red	Blue	White-Gray	Green				
	1.5658-1.5660 in. 39.771-39.776 mm					Red	Blue	White-Gray	Green					
	1.5656-1.5658 in. 39.766-39.771 mm				Red	Blue	White-Gray	Green						
	1.5654-1.5656 in. 39.761-39.766 mm			Red	Blue	White-Gray	Green							
	1.5652-1.5654 in. 39.756-39.761 mm		Red	Blue	White-Gray	Green								
3	1.5650-1.5652 in. 39.751-39.756 mm	Red	Blue	White-Gray	Green									
2	1.5648-1.5650 in. 39.746-39.751 mm	Blue	White-Gray	Green										
1	1.5646-1.5648 in. 39.741-39.746 mm	White-Gray	Green											
INNER RACE OD (In)		1.2496-1.2498 in.	1.2498-1.2500 in.	1.2500-1.2502 in.	1.2502-1.2504 in.	1.2504-1.2506 in.	1.2506-1.2508 in.	1.2508-1.2510 in.	1.2510-1.2512 in.	1.2512-1.2514 in.	1.2514-1.2516 in.	1.2516-1.2518 in.		
		31.740 31.745 mm	31.745 31.750 mm	31.750- 31.755 mm	31.755- 31.760 mm	31.760- 31.765 mm	31.765- 31.770 mm	31.770- 31.775 mm	31.775- 31.780 mm	31.780- 31.786 mm	31.786- 31.791 mm	31.791- 31.796 mm		
FACTORY COLOR CODE		Green	White											

ASSEMBLY

Crankcase Halves

Lubricate all parts with Harley-Davidson 20W50 engine oil, and proceed as follows:

1. Install **new** snap ring to crankcase bore (if bearings were replaced).
 - a. Place the crankcase half on a flat surface with the outboard side facing up.
 - b. Obtain the two TIMKEN SNAP RING REMOVER/INSTALLER (HD-44069).
 - c. See [Figure 3-81](#). With the gap in the snap ring being the 12 o'clock position, place the two claws so that the slotted sides engage the inside edge of the snap ring at the 10 and 2 o'clock positions.
 - d. Using a 9/64 inch allen head bit, tighten the screws to fix the position of the claws on the snap ring.
 - e. See [Figure 3-82](#). Inserting the tips of a large retaining ring pliers (Snap-On PR-56A) into one hole in each claw, compress the snap ring and install in groove of crankcase bore.
 - f. See [Figure 3-91](#). Verify that the gap in the snap ring is centered below the oil hole at the top of the ring groove. Move snap ring if not properly centered.
 - g. Loosen allen head screws and remove claws from snap ring.

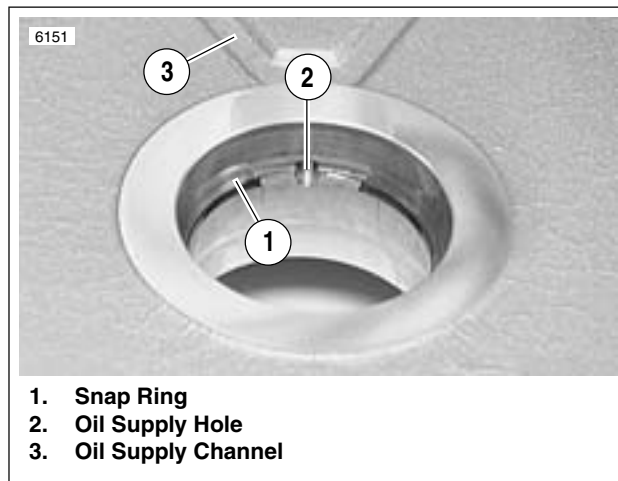
NOTE

See [Figure 3-92](#). Use *SPROCKET SHAFT BEARING OUTER RACE INSTALLATION TOOL (1, 2) (Part No. HD-39458)* to install left and right outer races (4, 5) of sprocket shaft tapered roller bearings into left crankcase half (6). Always install left outer race (4) prior to installing right outer race (5) because the installer base (1) is usable only when you follow this sequence of race installation.

2. Insert "SPORTSTER" end of installer base (1) into inboard side of left crankcase half (6) bearing bore until base contacts installed retaining ring (3).
3. Position left outer race (4) over bearing bore on outboard side of left crankcase half (6).
4. Insert shaft of installer plug (2) through left outer race (4) and into installer base (1). Press race into bore until firmly seated against retaining ring (3).
5. Insert "SPORTSTER" end of installer base (1) into outboard side of left crankcase half (6) bearing bore until base contacts outboard surface of installed left outer race (4).
6. Position right outer race (5) over bearing bore on inboard side of left crankcase half (6).
7. Insert shaft of installer plug (2) through right outer race (5) and into installer base (1). Press race into bore until firmly seated against retaining ring (3).

NOTE

See [Figure 3-93](#). Use *SPROCKET SHAFT BEARING/SEAL INSTALLATION TOOL (Part No. HD-42579)* to install sprocket shaft tapered roller bearings and seal.



1. Snap Ring
2. Oil Supply Hole
3. Oil Supply Channel

Figure 3-91. Snap Ring

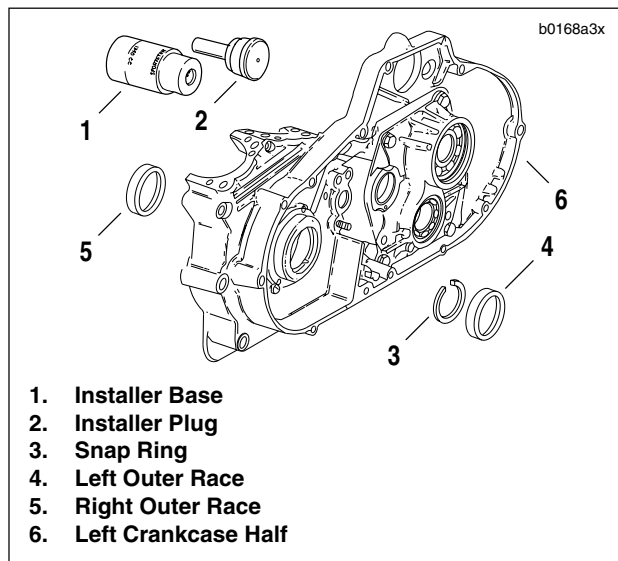


Figure 3-92. Installing Sprocket Shaft Bear Outer Races

8. Install inner bearing (6).
 - a. Place **new** bearing, small end upward, over end of sprocket shaft.
 - b. Thread pilot (1) onto sprocket shaft until pilot bottoms on sprocket shaft shoulder.
 - c. Sparingly apply graphite lubricant to threads of pilot shaft to ensure smooth operation.
 - d. Slide sleeve (5) over pilot (1) until sleeve contacts inner bearing race. Install Nice bearing (4), washer (3) and handle (2) on top of sleeve.
 - e. Rotate handle clockwise until bearing (6) contacts flywheel shoulder. Remove tool from sprocket shaft.
9. See [Figure 3-78](#). Install shim and outer bearing.
 - a. See [Figure 3-94](#). Carefully place crankcase half over sprocket shaft so that it rests flat on inner bearing.
 - b. Slide **new** inner spacer over sprocket shaft until it contacts inner bearing race.
 - c. Place **new** outer bearing, small end downward, over sprocket shaft.
 - d. Assemble SPROCKET SHAFT BEARING/SEAL INSTALLATION TOOL (Part No. HD-42579) onto sprocket shaft. Follow procedure in Step 8.
 - e. Rotate handle clockwise until bearing firmly contacts inner spacer. Inner and outer bearings must be tight against inner spacer for correct bearing clearance. Remove tool from sprocket shaft.
 - f. Spin crankcase half to verify that flywheel assembly is free.
10. See [Figure 3-95](#). Install **new** spacer in seal ID. With the open (lipped) side facing outward, center seal/spacer assembly over bearing bore.

CAUTION

Do not remove the spacer after installation or the new seal will have to be discarded and the procedure repeated.

11. See [Figure 3-96](#). Install bearing seal and spacer.
 - a. Center seal/spacer driver (2) over seal, so that the sleeve (smaller OD) seats between seal wall and garter spring.
 - b. Assemble SPROCKET SHAFT BEARING/SEAL INSTALLATION TOOL (1) (Part No. HD-42579) and SPROCKET SHAFT SEAL/SPACER INSTALLER (Part No. HD-45206) onto sprocket shaft. Follow procedure in Step 8.
 - c. Rotate handle clockwise until the spacer makes contact with the bearing. Remove tool from sprocket shaft.

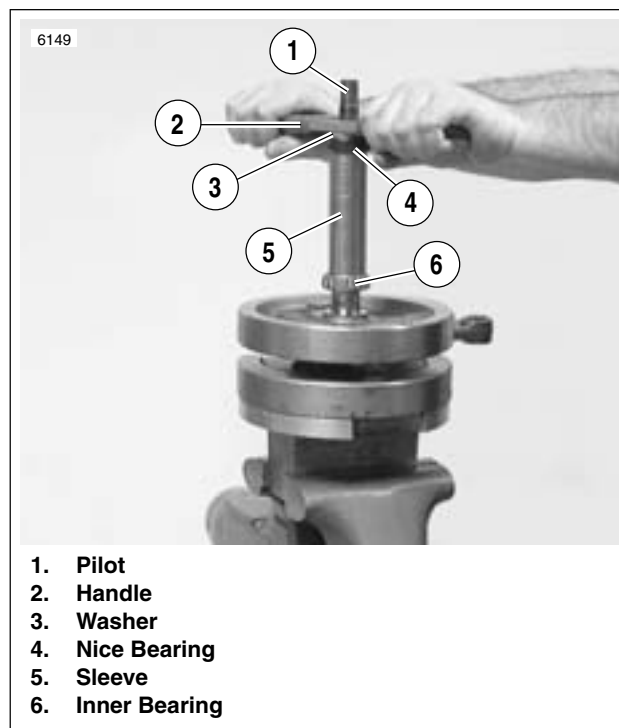


Figure 3-93. Inner Bearing Installation (Typical)



Figure 3-94. Installing Flywheel Spacer and Outer Bearing

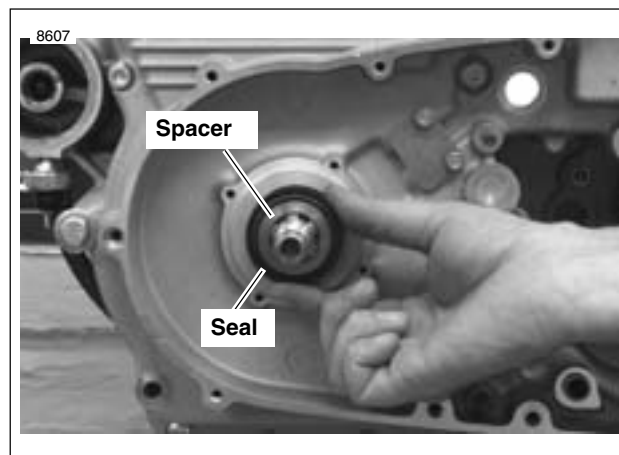


Figure 3-95. Install Spacer in Seal

6. See [Figure 3-97](#). Install pinion shaft bearing.
 - a. Lubricate pinion shaft bearing with engine oil.
 - b. Slip bearing on pinion shaft.
 - c. Install **new** retaining ring in groove of pinion shaft bearing inner race.
12. Assemble crankcase halves together.
 - a. Apply a thin coat of DOW CORNING SILASTIC or 3-M 800 sealant to crankcase joint faces.
 - b. Slide pinion shaft through outer race in right crankcase.
 - c. Attach crankcase halves using hardware shown in [Figure 3-76](#).
 - d. Tighten the 3/8-in. fasteners to 22-27 ft-lbs (30-37 Nm)
 - e. Tighten the 5/16-in. fasteners to 15-19 ft-lbs (20-26 Nm).
13. See [Figure 3-98](#). Install cylinder studs.
 - a. Pack clean towels into crankcase opening.
 - b. Place a steel ball into a head screw (1).
 - c. The cylinder studs (2) have a shoulder (3) at the lower end. Place the end of the stud without the shoulder into the head screw.
 - d. Install the stud in the crankcase with the shoulder end down. Use an air gun (4) to drive the stud until the shoulder reaches the crankcase.
 - e. Remove air gun. Use a torque wrench to tighten stud to 10-20 ft-lbs (14-27 Nm).
14. Install pistons and cylinders. See [3.6 CYLINDER AND PISTON](#).
15. Install oil pump. See [3.13 OIL PUMP](#).
16. Install cam gears, gearcase cover, lifter guides and lifters. See [3.16 GEARCASE COVER AND CAM GEARS](#).
17. Install cylinder heads. See [3.5 CYLINDER HEAD](#).
18. Install starter. See [5.7 STARTER](#).
19. Install transmission. See [6.13 TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT](#).
20. Install all primary drive components. This includes engine sprocket, primary chain, complete clutch assembly, engine sprocket nut and mainshaft nut. See [6.5 PRIMARY DRIVE/CLUTCH](#).
21. Install primary cover. See [Primary Cover](#) under [6.2 PRIMARY CHAIN](#).

NOTE

Be sure to refill transmission to proper level with fresh lubricant. See [1.8 CLUTCH](#).

22. See [3.4 INSTALLING THE ENGINE](#) and perform the applicable steps.

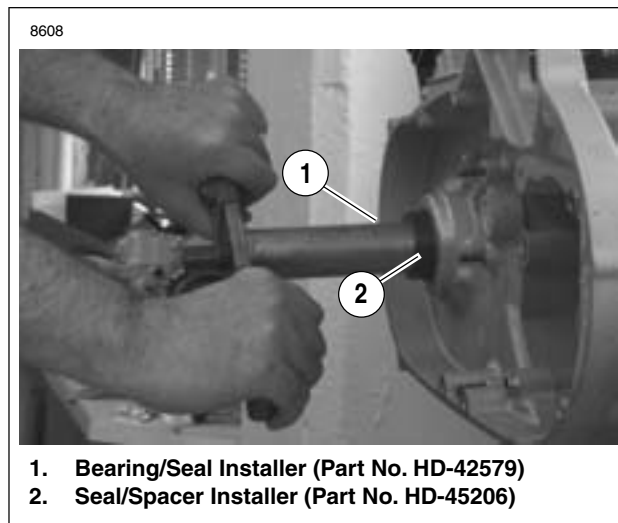


Figure 3-96. Install Bearing Seal/Spacer

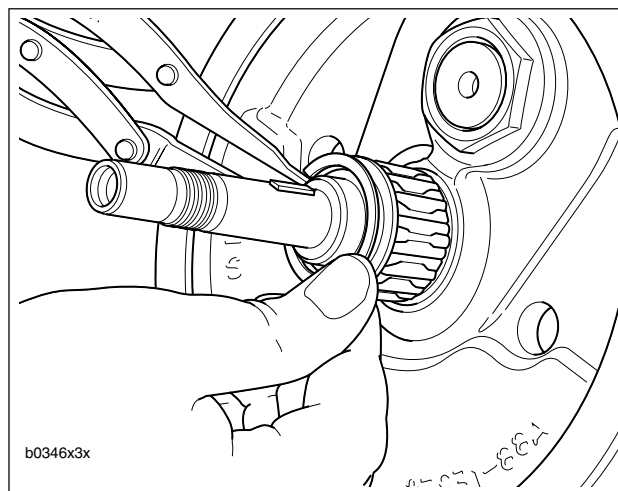


Figure 3-97. Pinion Shaft Bearing

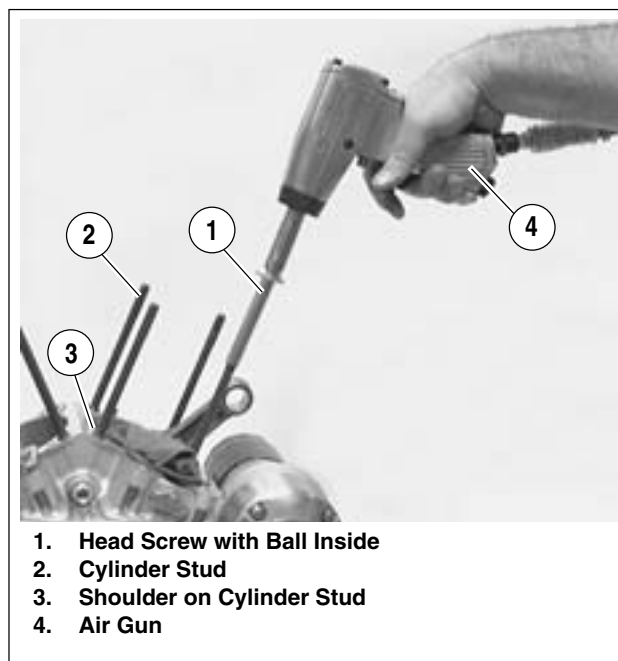


Figure 3-98. Cylinder Studs

FUEL SYSTEM	4
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SUBJECT	PAGE NO.
4.1 Specifications	4-1
4.2 Carburetor	4-2
4.3 Remote Idle Adjuster	4-21
4.4 Air Cleaner	4-22
4.5 Fuel Tank	4-24
4.6 Fuel Tank Vent Valve	4-27
4.7 Fuel Supply Valve	4-29
4.8 Evaporative Emissions Control-California Models	4-30

CARBURETOR JET SIZES	
Main Jet	195
Slow Jet	42

FUEL TANK CAPACITY	GALLONS	LITERS
Total (including reserve)	5.0	18.93
Reserve	0.6	2.2

CARBURETOR ADJUSTMENTS	
Engine Fast Idle Speed (using enricher circuit)	2000 RPM
Engine Speed for Setting Ignition Timing-World models	950-1050 RPM
Engine Speed for Setting Ignition Timing-California models	1150-1250 RPM

TORQUE VALUES

ITEM	TORQUE		NOTES
Air cleaner cover screws	18-22 in-lbs	2.0-2.5 Nm	LOCTITE THREADLOCKER 222 (purple), page 4-23
Air cleaner filter box bolts	40-45 in-lbs	4.5-5.1 Nm	LOCTITE THREADLOCKER 222 (purple), page 4-23
Air cleaner spacer screw	7-9 ft-lbs	10-12 Nm	LOCTITE THREADLOCKER 243 (blue), page 4-23
Backplate mount bolts	3-5 ft-lbs	4-7 Nm	LOCTITE THREADLOCKER 243 (blue), page 4-23
Canister mounting clamp screws	6-8 ft-lbs	8-11 Nm	page 4-31
Cylinder head breather bolts	10-15 ft-lbs	14-20 Nm	HYLOMAR, page 4-23
Enricher bracket screws	25-30 ft-lbs	34-41 Nm	page 4-19
Fuel cap flange screws	22-25 in-lbs	2.5-2.8 Nm	special pattern to tighten, page 4-25
Fuel supply valve screws	25-27 in-lbs	2.8-3.1 Nm	page 4-29
Intake manifold screws	6-10 ft-lbs	8-14 Nm	page 4-19
Snorkel plate screws	6-8 ft-lbs	8-11 Nm	LOCTITE THREADLOCKER 243 (blue), page 4-23
Tie bar bolts	30-33 ft-lbs	41-45 Nm	page 4-19

GENERAL

See [Figure 4-1](#). Buell motorcycles use a constant-velocity, gravity-fed carburetor. This carburetor features a float-operated inlet valve, a variable venturi, a remote idle adjuster (1) (for idle speed adjustment) and a fuel enrichment system (for starting).

Idle and transfer ports provide a balanced fuel mixture during the transition period from stop to mid-range. A vacuum piston controls venturi opening.

The carburetor is specifically designed to control exhaust emissions. All jets are fixed. The idle mixture has been pre-set at the factory. The idle mixture screw is recessed in the carburetor casting. The opening is sealed with a plug because it is intended that the idle mixture be non-adjustable.

NOTE

Adjusting mixture setting by procedures other than specified in this section may be in violation of Federal or State regulations.

This system partially compensates for changes in the mixture that are normally caused by changes in altitude. Because atmospheric pressures drop as altitude increases, the pressure difference in the upper and lower chambers is reduced; this results in less fuel being delivered to the engine, thereby maintaining the correct air/fuel ratio for better engine performance and reduced exhaust emissions.

The carburetor has a drain for emptying the float chamber (5) during seasonal or extended periods of storage.

The carburetor is equipped with an accelerator pump (6). The accelerator pump system uses sudden throttle openings (rapid accelerations) to quickly inject raw fuel into the carburetor venturi; this provides extra fuel for smooth acceleration.

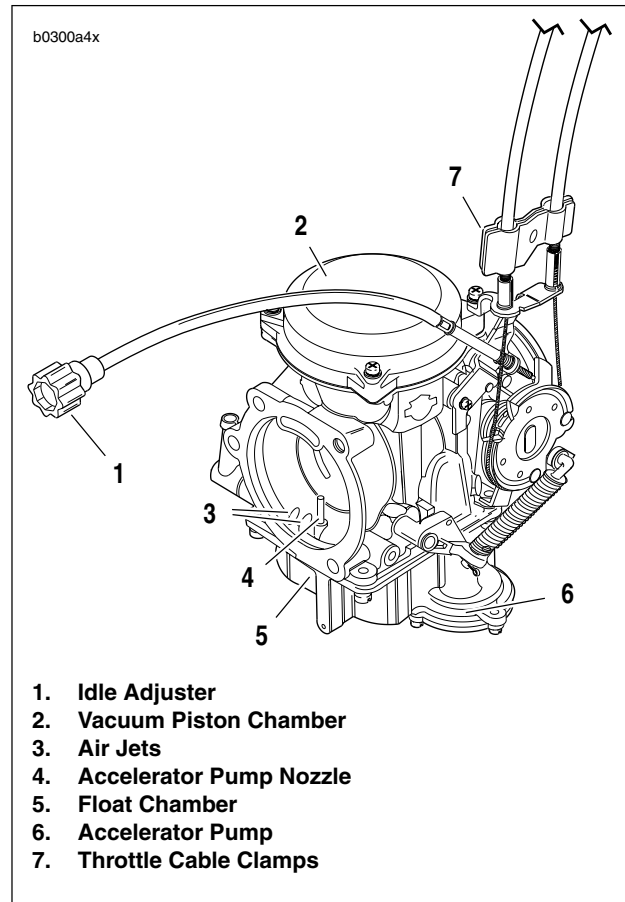


Figure 4-1. Carburetor

Table 4-1. Fuel System Troubleshooting

OVERFLOW TROUBLESHOOTING	
Check for: <ol style="list-style-type: none"> 1. Restricted fuel tank vent system. 2. Loose float bowl screws. 3. Damaged float bowl O-ring. 4. Damaged or leaking float assembly. 5. Particle contamination in fuel inlet fitting cavity. 6. Worn or dirty inlet valve or seat. 7. Improper fuel level in float bowl. 	Remedy: <ol style="list-style-type: none"> 1. Correct restricted hose. Replace vapor vent valve. 2. Tighten screws. 3. Replace O-ring. 4. Replace float assembly. 5. Clean and clear cavity and fuel supply tract. 6. Clean or replace valve and clean seat. 7. Adjust float tab for correct fuel level.
POOR IDLING	
Check for: <ol style="list-style-type: none"> 1. Idle speed improperly adjusted. 2. Inlet system air leak (faster idling). 3. Loose low speed jet. 4. Contaminated or plugged low speed system. 5. Enrichener valve not seated or leaking. 6. Leaking accelerator pump. 	Remedy: <ol style="list-style-type: none"> 1. Adjust operating idle speed. 2. Correct as required. 3. Tighten jet. 4. Clean, clear and correct as required. 5. Adjust, clean or replace. 6. Repair.
POOR FUEL ECONOMY	
Check for: <ol style="list-style-type: none"> 1. Excessive use of enrichener system. 2. Enrichener valve not seated or leaking. 3. Dirty air cleaner filter element. 4. Restricted fuel tank vent system. 5. High speed riding style. 6. Idle speed improperly adjusted. 7. Loose jets. 8. Fuel level too high. 9. Plugged or restricted bowl vent. 10. Worn or damaged needle or needle jet. 11. Vacuum piston assembly malfunction. 12. Plugged air jets or passages. 13. Excessive accelerator pump output. 	Remedy: <ol style="list-style-type: none"> 1. Limit system use. 2. Adjust, clean or replace. 3. Replace as required. 4. Correct restricted hose. Replace vapor vent valve. 5. Modify riding habits. 6. Adjust operating idle speed. 7. Tighten jets. 8. Adjust float tab for correct fuel level. 9. Clean and clear passages. 10. Replace needle or needle jet. 11. See Table 4-2. 12. Clean, clear and correct as required. 13. Check and clean accelerator pump bypass orifice.
POOR ACCELERATION	
Check for: <ol style="list-style-type: none"> 1. Throttle cables misaligned. 2. Inlet system air leak. 3. Restricted fuel tank vent system. 4. Restricted fuel supply passages. 5. Plugged bowl vent or overflow. 6. Enrichener valve not seated or leaking. 7. Worn or damaged needle or needle jet. 8. Vacuum piston malfunction. 9. Plugged jets or passages. 10. Fuel level too low. 11. Accelerator pump leaking or no output. 	Remedy: <ol style="list-style-type: none"> 1. Adjust throttle cables. 2. Correct as required. 3. Correct restricted hose. Replace vapor vent valve. 4. Correct and clear restriction. 5. Clean and clear passages. 6. Adjust, clean or replace. 7. Replace assembly. 8. See Table 4-2. 9. Clean and clear as required. 10. Adjust float tab for correct fuel level. 11. Repair as necessary.
HARD STARTING	
Check for: <ol style="list-style-type: none"> 1. Enrichener system plugged, not properly functioning or improperly operated. 2. Inlet system air leak. 3. Restricted fuel supply. 4. Fuel overflow. 5. Plugged slow jet or passages. 	Remedy: <ol style="list-style-type: none"> 1. Clean, adjust or replace. 2. Correct as required. 3. Correct fuel supply or passages. 4. See OVERFLOW TROUBLESHOOTING above. 5. Clean, clear and correct as required.

Table 4-1. Fuel System Troubleshooting (Continued)

POOR PERFORMANCE ON ROAD	
<p>Check for:</p> <ol style="list-style-type: none"> 1. Idle speed improperly adjusted. 2. Inlet system air leak. 3. Restricted fuel tank vent system. 4. Dirty or damaged air cleaner element. 5. Enrichener valve not seated or leaking. 6. Restricted fuel supply tract. 7. Plugged bowl vent or overflow. 8. Loose or plugged fuel and air jets or passages. 9. Worn or damaged needle or needle jet. 10. Vacuum piston assembly malfunction. 11. Accelerator pump inoperative. 	<p>Remedy:</p> <ol style="list-style-type: none"> 1. Adjust operating idle speed. 2. Correct as required. 3. Correct restricted hose. Replace vapor vent valve. 4. Replace. 5. Adjust, clean or replace. 6. Correct and clear restriction. 7. Clean and clear passages. 8. Clean, clear and correct as required. 9. Replace assembly. 10. See Table 4-2. 11. Repair as required.
POOR HIGH-SPEED PERFORMANCE	
<p>Check for:</p> <ol style="list-style-type: none"> 1. Inlet system air leak. 2. Enrichener valve not seated or leaking. 3. Restricted fuel tank vent system. 4. Restricted fuel supply tract. 5. Dirty or damaged air cleaner element. 6. Plugged bowl, vent or overflow. 7. Worn or damaged needle or needle jet. 8. Vacuum piston assembly malfunction. 9. Loose or plugged main jets or passages. 10. Improper fuel level. 11. Accelerator pump inoperative. 	<p>Remedy:</p> <ol style="list-style-type: none"> 1. Clean or replace. 2. Adjust, clean or replace. 3. Correct restricted hose. Replace vapor vent valve. 4. Correct and clean restriction. 5. Replace. 6. Clean and clear passages. 7. Replace assembly. 8. See Table 4-2. 9. Clean, clear and correct as required. 10. Adjust float level. 11. Repair as required.

Table 4-2. Vacuum Piston Assembly Troubleshooting

PISTON DOES NOT RISE PROPERLY	
<p>Check for:</p> <ol style="list-style-type: none"> 1. Piston atmosphere vent blocked. 2. Diaphragm cap loose, damaged or leaking. 3. Spring binding. 4. Diaphragm pinched at lip groove. 5. Torn diaphragm. 6. Piston binding. 7. Piston vacuum passage plugged. 	<p>Remedy:</p> <ol style="list-style-type: none"> 1. Clear vent. 2. Tighten or replace cap. 3. Correct or replace spring. 4. Reposition diaphragm lip. 5. Replace piston diaphragm assembly. 6. Clean piston slides and body or replace piston. 7. Clean and clear passage.
PISTON DOES NOT CLOSE PROPERLY	
<p>Check for:</p> <ol style="list-style-type: none"> 1. Spring damaged. 2. Piston binding. 3. Piston diaphragm ring dirty or damaged. 	<p>Remedy:</p> <ol style="list-style-type: none"> 1. Replace spring. 2. Clean piston slides and body or replace piston. 3. Clean or replace piston.

OPERATION

Enrichener

The enrichener knob, under the left side of the fuel tank, controls the opening and closing of the enrichener valve at the carburetor.

CAUTION

Avoid idling with the enrichener knob in the full out position for periods longer than 30 seconds. Such operation may cause poor performance, erratic idle, poor fuel economy and spark plug fouling.

NOTE

The C.V. carburetor has an enrichener circuit that will cause the engine to idle at approximately 2000 RPM with the engine at normal operating temperature and the enrichener knob pulled fully out.

The increase in idle speed is intended to alert the rider that the engine is warmed up to normal operating temperature and the enrichener knob should be pushed all the way in.

Continuing to use the enrichener when the engine is at operating temperature WILL CAUSE FOULED PLUGS.

IMPORTANT NOTE

This motorcycle features a starter interlock. All the following conditions must be met to operate the engine starter.

- **Engine stop switch on right handlebar control group must be in the ON position.**
- **Clutch must be disengaged before starting motorcycle in gear. Note that it is not necessary to disengage clutch before starting the vehicle in neutral.**
- **Side stand must be retracted before the clutch is engaged if the motorcycle is in gear.**

See **7.11 STARTER INTERLOCK** for troubleshooting information.

COOL ENGINE

OUTSIDE TEMPERATURE BELOW 60° F (16°C)

1. Turn engine stop switch ON.
2. Raise side stand.
3. Turn fuel supply valve ON.
4. Turn ignition key switch to IGN.
5. **BE SURE THROTTLE IS CLOSED.** See [Figure 4-2](#). Pull enrichener knob to full out position.
6. Press electric starter switch to operate starter.

After starting the motorcycle, proceed as follows:

1. See [Figure 4-2](#). After initial 15-30 second warm-up, ride for 3 minutes or 2 miles (3.2 km) with enrichener knob in full out position.
2. After 3 minutes or 2 miles, push enrichener knob in to the 1/2 way out position. Ride 2 minutes or 2 miles (3.2 km).
3. After 2 minutes or 2 miles, push enrichener knob fully in to normal running position.

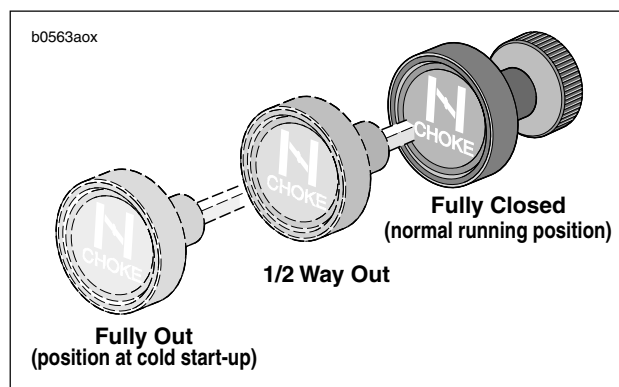


Figure 4-2. Enrichener Knob Positions

COOL ENGINE

OUTSIDE TEMPERATURE ABOVE 60° F (16°C)

1. Turn engine stop switch ON.
2. Raise side stand.
3. Turn fuel supply valve ON.
4. Turn ignition key switch to IGN.
5. **BE SURE THROTTLE IS CLOSED.** See [Figure 4-2](#). Pull enrichener knob to full out position.
6. Press electric starter switch to operate starter.

After starting the motorcycle, proceed as follows:

1. See [Figure 4-2](#). After initial 15-30 second warm-up, ride for 1 minute or 1/2 mile (0.8 km) with enrichener knob in full out position.
2. After 1 minute or 1/2 mile, push enrichener knob in to the 1/2 way out position. Ride 1 minute or 1/2 mile (0.8 km).
3. After 1 minute or 1/2 mile, push enrichener knob fully in to normal running position.

WARM CLIMATE OR HOT ENGINE

1. Turn engine stop switch ON.
2. Raise side stand.
3. Turn fuel supply valve ON.
4. Turn ignition key switch to IGN.
5. **DO NOT USE ENRICHENER.** Open throttle 1/8-1/4.
6. Press electric starter switch to operate starter.

NOTE

If the engine does not start after a few turns or if one cylinder fires weakly but engine does not start, it is usually because of an over-rich (flooded) condition. This is especially true of a hot engine. If the engine is flooded, push the enrichener knob fully in, turn ignition key switch to IGN and operate starter with throttle wide open. Do not "pump" the throttle while starting.

Fuel Supply System

See [Figure 4-3](#). Fuel from the fuel tank passes through the carburetor inlet valve into the carburetor float chamber. The rising fuel level in the float chamber lifts the float, which in turn lifts the attached inlet valve closer to the valve seat. When the fuel reaches the level predetermined by the float level setting, the float will lift the inlet valve into its seated position, thereby closing the valve and stopping fuel flow to the float chamber.

When fuel is used by the running engine, the fuel level in the float chamber drops; this lowers the float and inlet valve, thereby causing the valve to open and the fuel flow to resume.

The float chamber is vented to atmosphere through an air passage in the carburetor body. The opening for the float chamber vent passage is next to the carburetor main venturi inlet, on the carburetor body surface to which the air cleaner backplate is mounted.

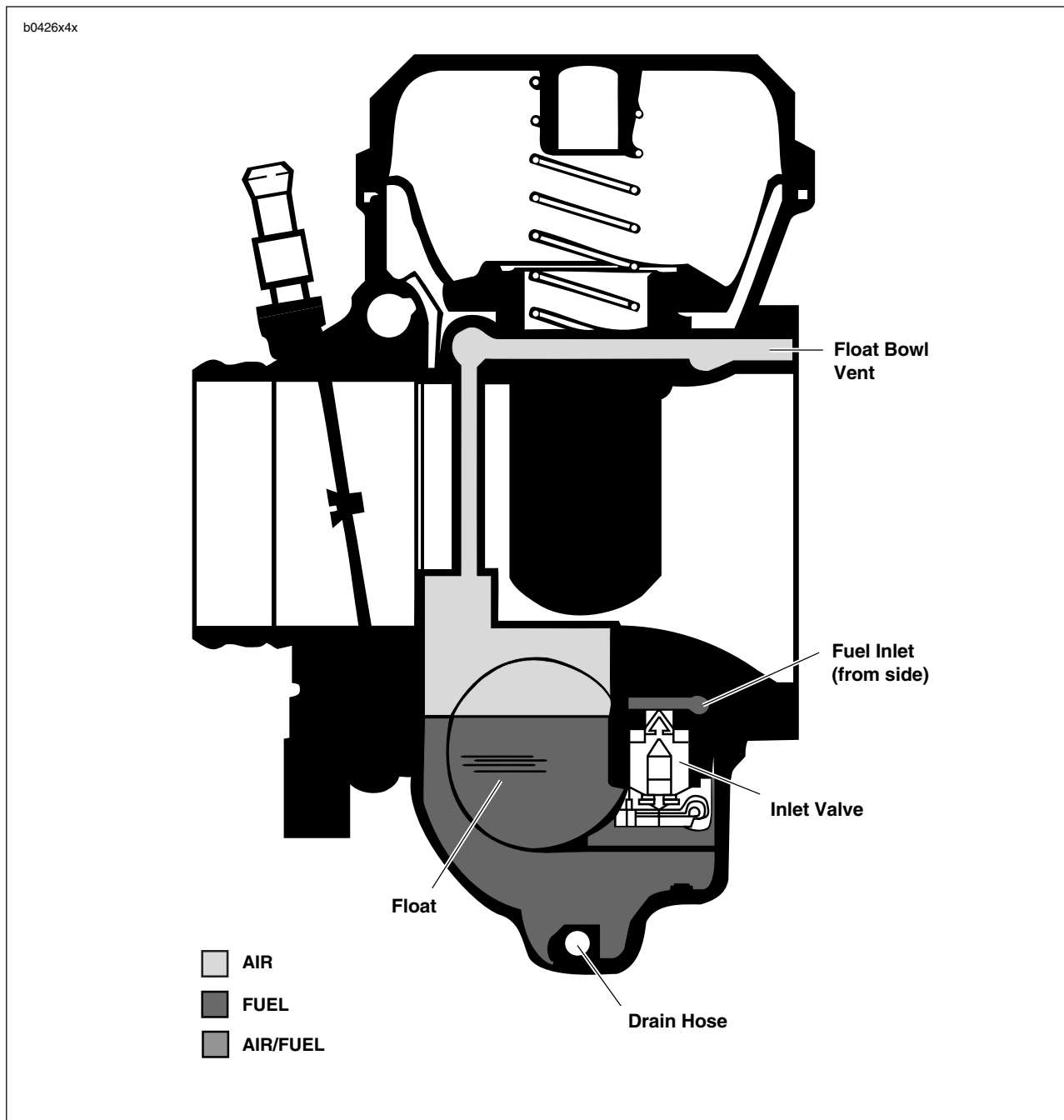


Figure 4-3. Fuel Supply System

Starting Circuit

See [Figure 4-4](#). The starting circuit consists of a cable-actuated enricher valve and converging fuel and air passages in the carburetor body.

The enricher air/fuel passage opens to the carburetor venturi, where low pressure exists when the engine is running. Fuel in the carburetor float bowl and air in the enricher air inlet are vented to atmosphere and are at atmospheric pressure (greater pressure than in the carburetor venturi).

When the enricher knob is pulled outward, the enricher valve opens the air/fuel passage to the low pressure carburetor venturi. Fuel in the float bowl, at atmospheric pressure, flows upward through a metering enricher jet and then through a passage to the lower pressure enricher valve chamber. Air in the enricher air inlet, at atmospheric pressure, also flows into the lower pressure enricher valve chamber and mixes with the incoming fuel. The resulting air/fuel mixture flows through the air/fuel passage into the carburetor venturi, effectively increasing the amount of fuel delivered to the combustion chambers.

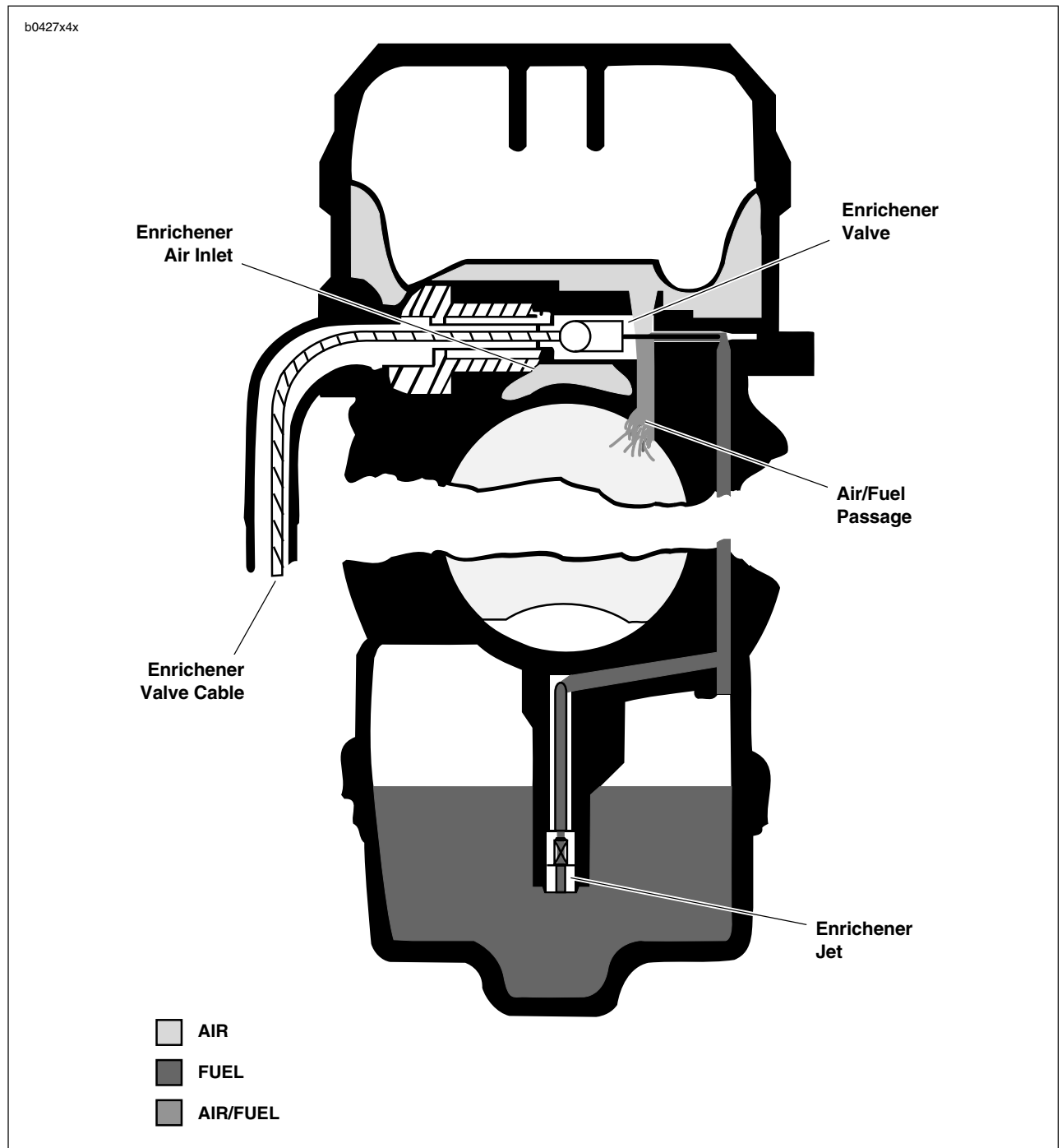


Figure 4-4. Starting Circuit

Idle- and Low-Speed Circuit

See Figure 4-5. At idle (with the throttle plate closed and the main air stream obstructed), engine idle speed is maintained by fuel metered through the slow jet. Air from the slow air jet mixes with the fuel and is delivered to the idle port at the low pressure side of the throttle plate.

At low-speed (with the throttle plate slightly open), the transfer ports are exposed to the low pressure side of the throttle plate, and additional fuel is directed to the barrel of the carburetor.

During the transition period from idle speed to mid-range, the idle and transfer ports also supply some fuel to the carburetor barrel; this allows for a smoother transition.

The venturi opening is reduced by the low position of the vacuum piston. This enables initial air stream velocities to be higher than normally attainable with fixed-venturi carburetors. The higher air stream velocities provide improved atomization of fuel necessary for good acceleration and driveability.

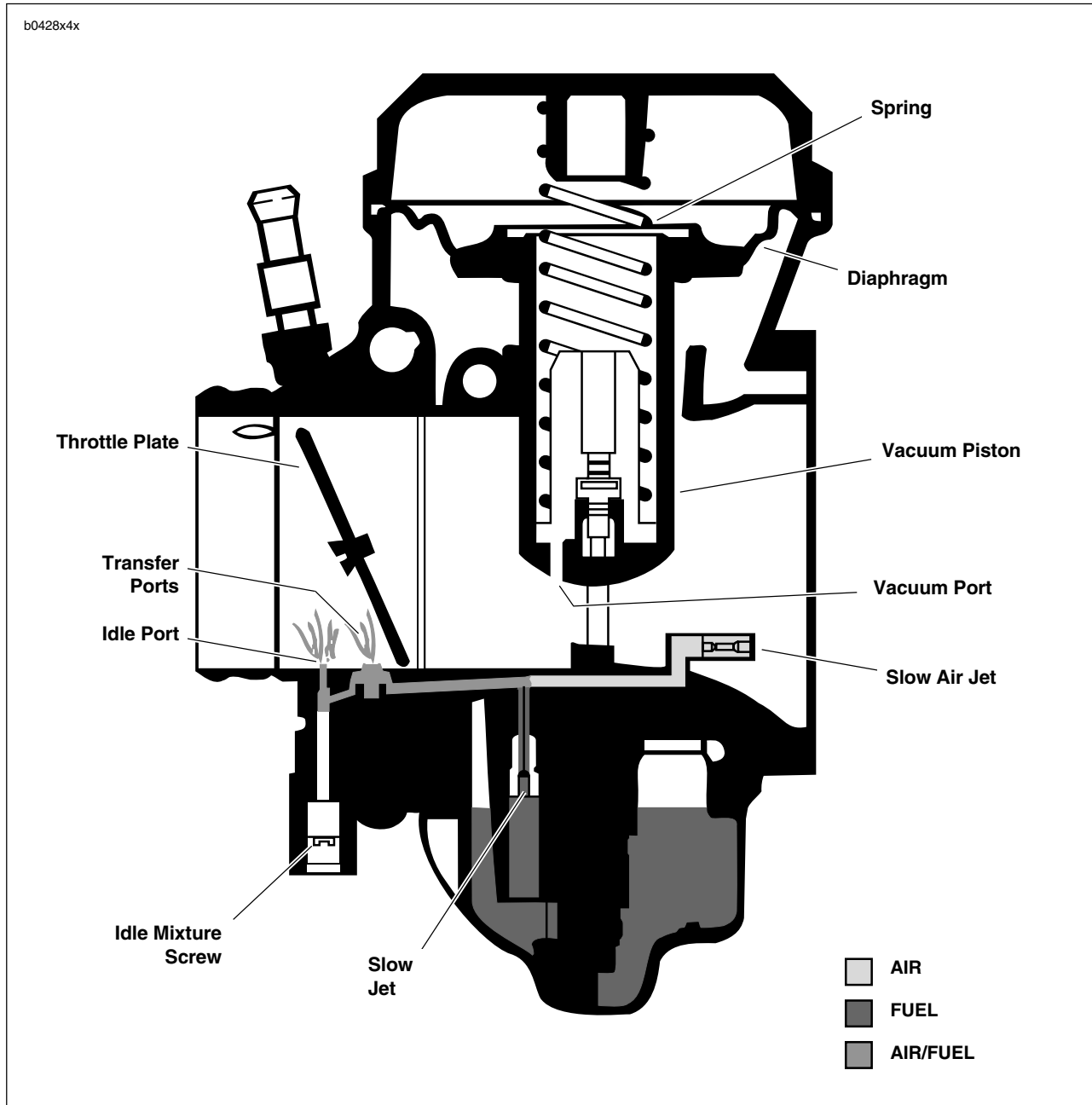


Figure 4-5. Idle- and Low-Speed Circuit

Mid-Range Slide Position

See Figure 4-6. As the throttle plate is opened, air flow increases through the carburetor; this causes air pressure to decrease in the carburetor venturi (near the needle jet) and in the chamber above the diaphragm (which is vented to the venturi through a vacuum port and passage in the vacuum piston).

The chamber beneath the diaphragm is vented to higher atmospheric pressure by a passage to the carburetor inlet. The higher air pressure at the underside of the diaphragm overcomes spring pressure and moves the vacuum piston

upward in proportion to the pressure difference between the chambers.

The tapered needle moves upward with the vacuum piston, thereby opening the needle jet. With the needle jet open, the main bleed tube is exposed to the lower pressure of the carburetor venturi. This causes fuel in the float bowl (at atmospheric pressure) to flow through the main jet and into the main bleed tube. Air from the main air jet (at atmospheric pressure) flows through the main bleed tube openings and mixes with the incoming fuel. The air/fuel mixture is then delivered through the needle jet into the main air stream of the venturi.

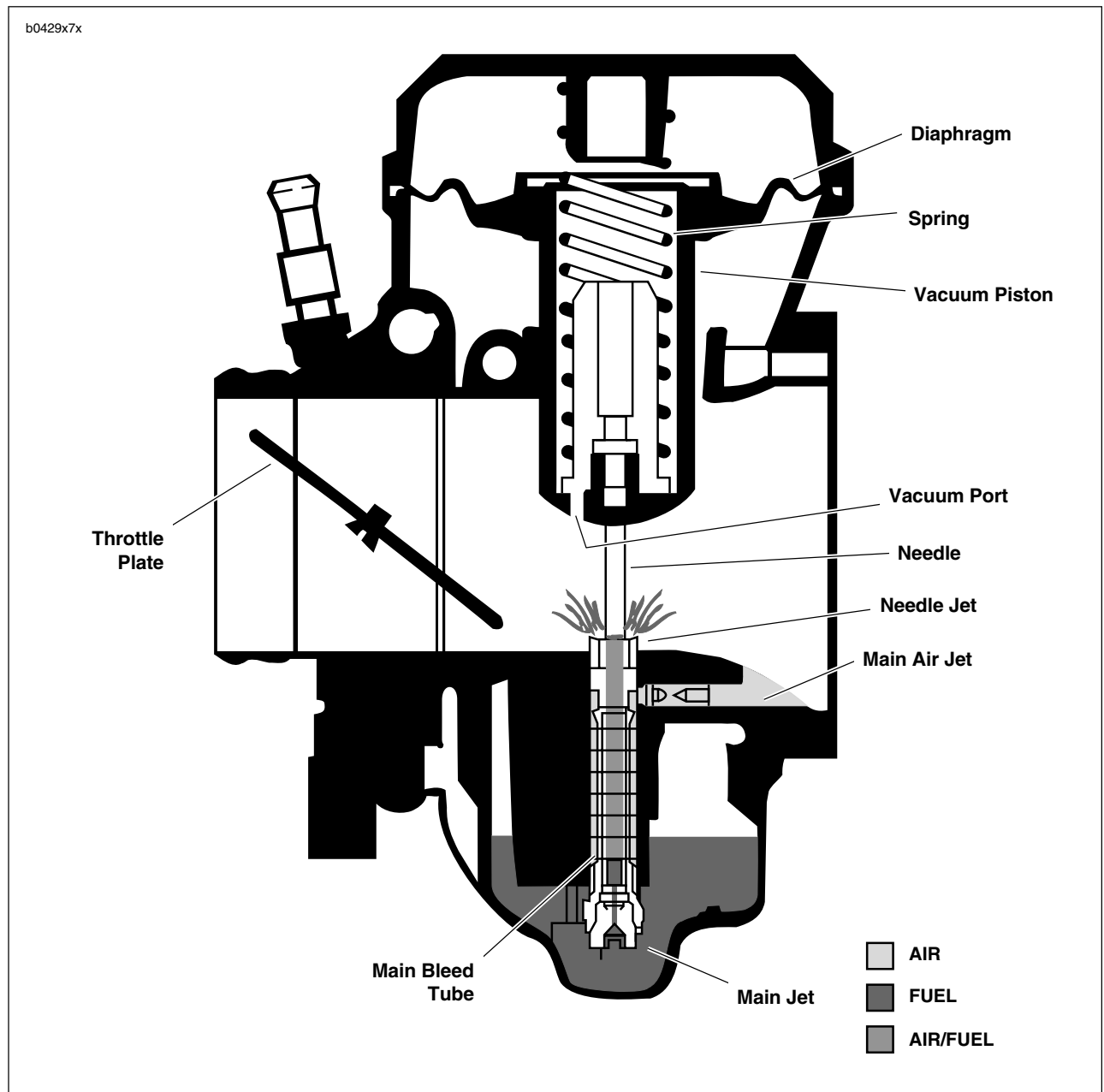


Figure 4-6. Mid-Range Slide Position

High-Speed Circuit Slide Position

See Figure 4-7. As the throttle plate is opened, the pressure difference between the chambers above and below the diaphragm increases and the vacuum piston moves further upward.

The venturi opening increases and the needle is lifted further out of the needle jet. The quantity of fuel and the volume of

air are simultaneously increased and metered to the proportions of engine demand by the variable venturi and needle lift. With the vacuum piston fully upward, the venturi opening is fully enlarged and the needle jet opening exposure to the air stream is at its maximum. Air and fuel supplies are now available in quantities sufficient to meet maximum engine demand.

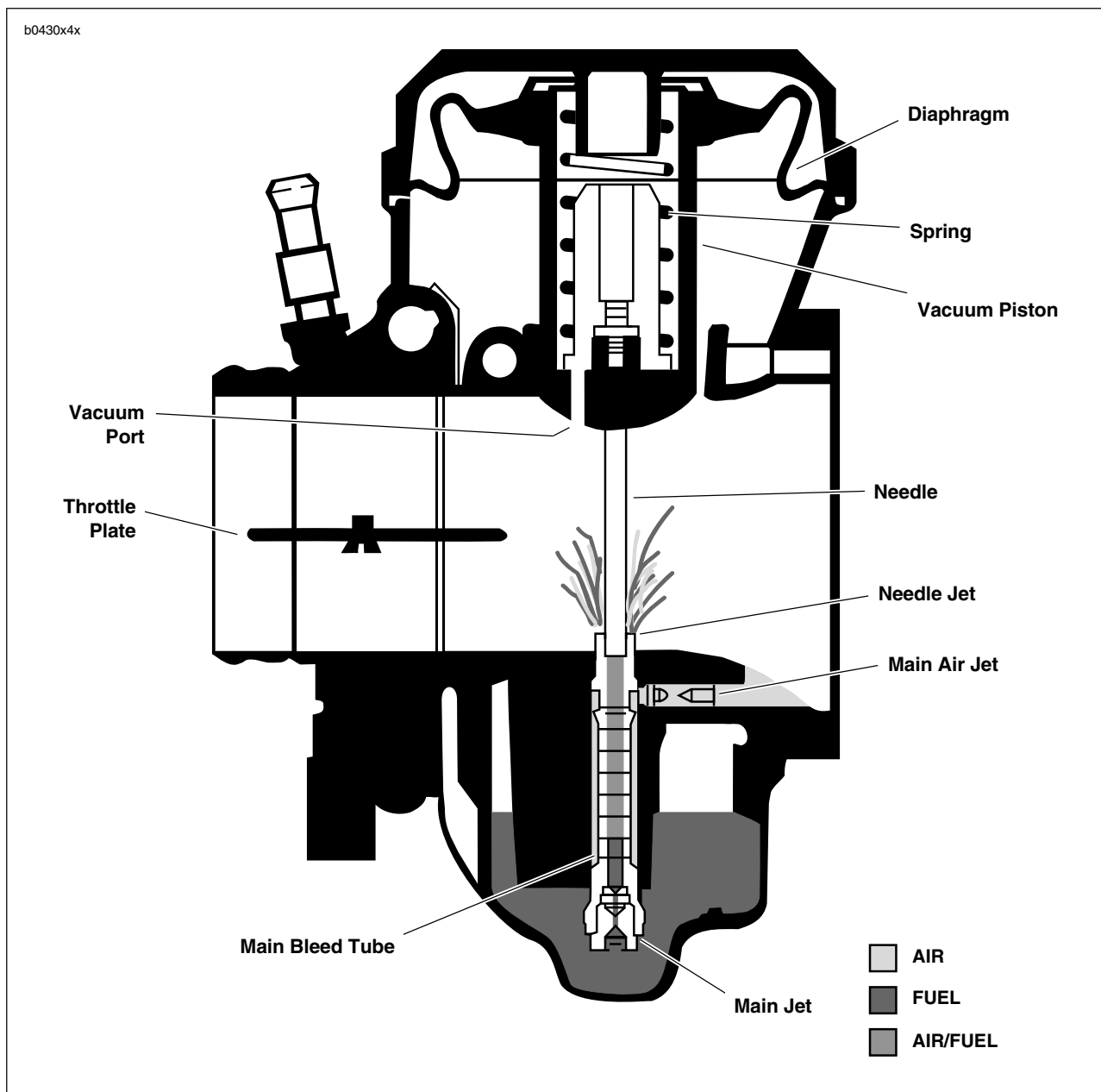


Figure 4-7. High-Speed Circuit

Accelerator Pump System

See [Figure 4-8](#). The accelerator pump system uses sudden throttle openings (rapid acceleration) to quickly inject fuel into the carburetor venturi; the extra fuel provides for smooth acceleration. This fuel also assists engine operation during cold engine warm-up when the enrichener is turned off prematurely.

Rapid throttle action, during the first third of throttle travel, causes the accelerator pump rod to depress the accelerator pump diaphragm. This forces fuel in the pump to flow through

a fuel passage (which has a “one-way” check valve), through the pump nozzle, and then into the venturi. When the throttle closes, the pump rod lifts up and away from the pump diaphragm; a spring below the diaphragm pushes the diaphragm upward, thereby causing the lower pump cavity to refill with fuel from the float bowl. The check valve prevents backflow of fuel from the pump nozzle/fuel passage during this refilling phase.

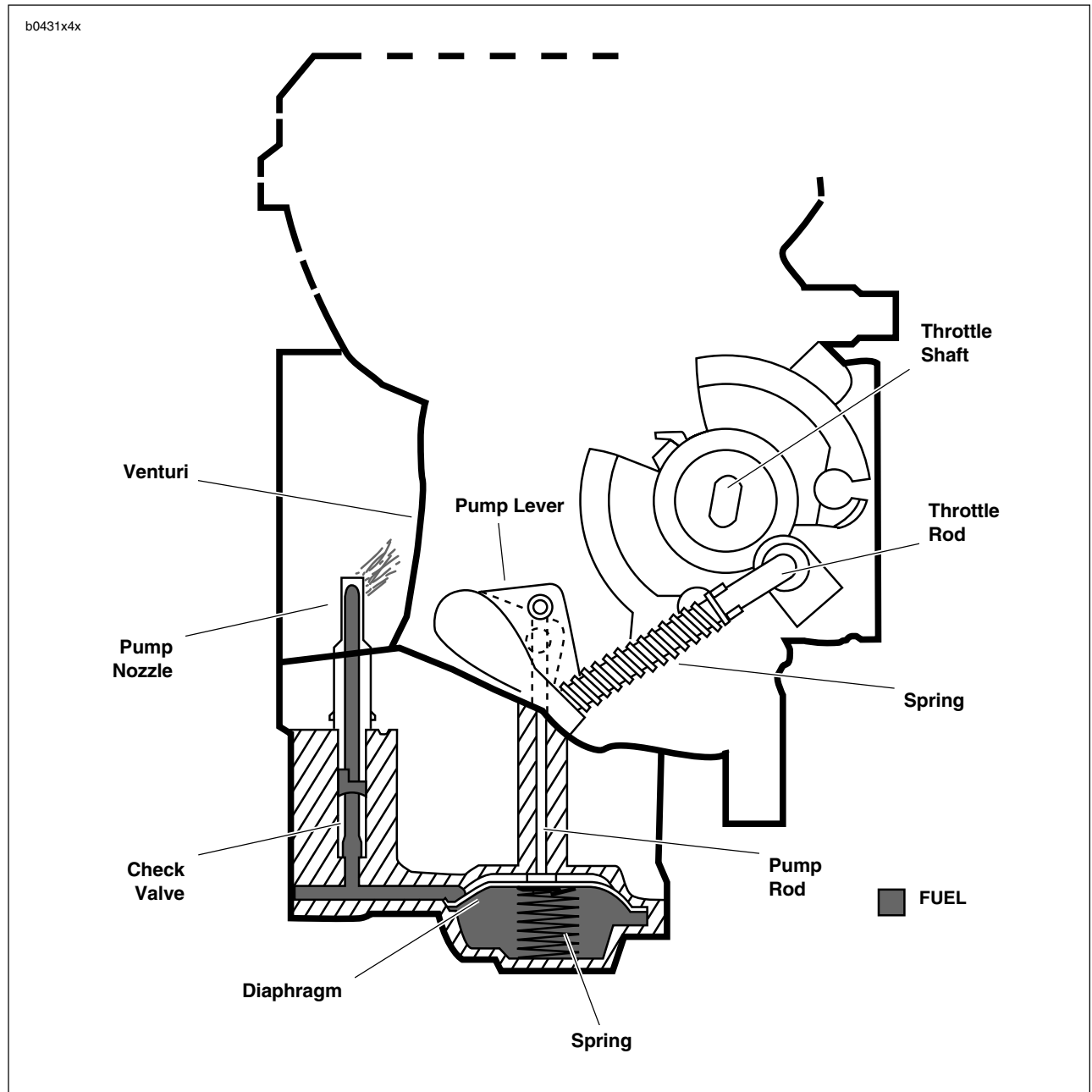


Figure 4-8. Accelerator Pump System

ADJUSTMENT

Idle

A idle adjuster allows idle adjustments without the use of tools. See [4.3 IDLE ADJUSTER](#) and [1.19 IGNITION TIMING](#).

Enricher Control

See [Figure 4-9](#). Check enricher operation. Enricher knob (1) should open (and remain open) and close without binding. Plastic nut (2), next to the enricher knob, controls the sliding resistance of the enricher control cable within the cable conduit. If adjustment is needed, perform the following:

1. Loosen hex nut (5) at backside of mounting bracket.
2. Move cable assembly free of slot in mounting bracket.
3. Hold cable assembly at flats (4) with a wrench. Adjust resistance until knob slides outward and remains fully open without assistance. Knob must also slide inward unaided.
 - a. Turn plastic nut (2) by hand counterclockwise to reduce sliding resistance.
 - b. Turn plastic nut clockwise to increase sliding resistance.
4. Position cable assembly into slot in mounting bracket. Tighten hex nut at backside of bracket.

NOTE

Do not lubricate the cable or inside of conduit. The cable must have friction to work properly.

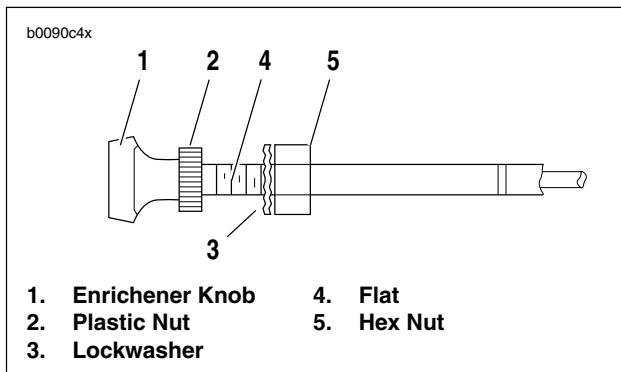


Figure 4-9. Fuel Enricher Control

Float Level

1. Remove carburetor.
2. See [Figure 4-11](#). Place carburetor on a flat, clean surface on engine manifold side. This is the "base." Tilt carburetor counterclockwise 15° to 20° from base until float comes to rest.

NOTE

If carburetor is tilted less than 15° or more than 20°, your measurements will be inaccurate.

3. Use a vernier or dial caliper depth gauge to measure from the carburetor flange face to the perimeter of the float. Be careful not to push on float while measuring. The measurement must be 0.413-0.453 in. (10.49-11.51 mm). If measurement is not within given dimension, remove float and carefully bend tab in order to reposition float at proper level.
4. Install float and recheck setting.
5. Install float bowl and carburetor.

OPERATION CHECK – VACUUM PISTON

Opening Malfunction

⚠ WARNING

While observing piston slide movement, be sure to maintain a safe distance from the carburetor and to wear suitable eye protection. An unexpected engine backfire could result in death or serious injury.

1. See [Figure 4-10](#). Test vacuum piston as follows.
 - a. Remove air cleaner cover and snorkel.
 - b. Start engine running.
 - c. Twist throttle control partially open and closed several times.
 - d. Observe whether or not vacuum piston has upward movement. If piston does not rise, see [Table 4-2](#).
2. With engine not running, lift vacuum piston with finger. Feel whether piston lifts fully and smoothly or whether there is a binding condition.

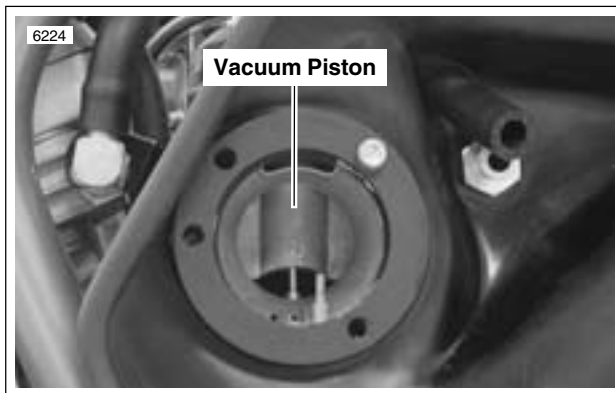


Figure 4-10. Vacuum Piston

Closing Malfunction

1. See [Figure 4-10](#). With engine not running, lift vacuum piston to full open position, then release. Observe whether piston slides downward smoothly and fully to stop.
2. Observe position of piston slide at its lowest downward point. Lower edge of slide should rest at horizontal groove at lower end of slide track. If problems are noted, see [Table 4-2](#).

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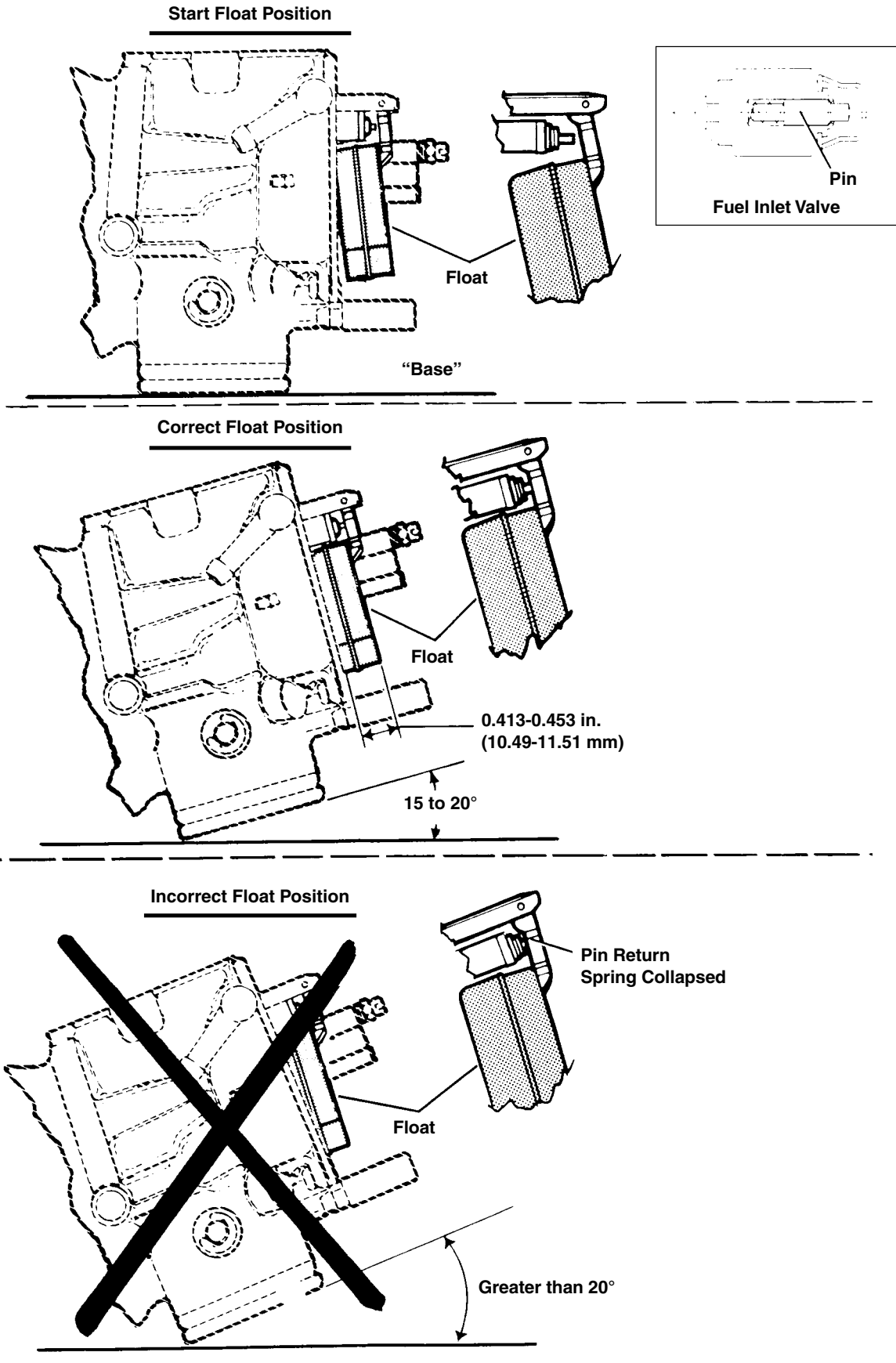


Figure 4-11. Carburetor Float Adjustment

REMOVAL

Carburetor

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Do not smoke or allow open flame or sparks when refueling or servicing the fuel system. Inadequate safety precautions could result in death or serious injury.

1. Turn fuel supply valve OFF.
2. Remove air cleaner cover and backplate. See 4.4 AIR CLEANER.
3. Cut cable strap holding remote idle adjuster to frame.
4. Remove air cleaner support ring.
 - a. Detach rear breather hose from rear cylinder breather bolt.
 - b. Loosen rear breather bolt.
 - c. Slide air cleaner support ring upward to remove.

NOTE

Air cleaner support ring fits around rear breather bolt. Fitting on rear breather bolt may not clear the frame if bolt removal is attempted. Do not remove the rear breather bolt unless absolutely necessary.

⚠ WARNING

A small amount of gasoline may drain from the fuel hose when disconnected from the carburetor. Thoroughly wipe up any fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

5. See Figure 4-12. Disconnect fuel hose (3) from carburetor. Discard fuel hose clamp.
6. Disconnect V.O.E.S. hose (1) from carburetor.
7. Detach enricher cable from bracket.
8. Pull carburetor free of intake manifold.
9. Add freeplay to throttle cable adjusters (metric). Remove throttle cables at carburetor.
10. Disconnect carburetor drain hose (4) from drain fitting. On California models, disconnect canister vent hose (2).

Intake Manifold

1. Remove carburetor as described above.
2. Remove fuel tank. See 4.5 FUEL TANK.
3. Remove enricher bracket. See Figure 4-15.
 - a. Remove bolt, washer and locknut to detach top tie bar from frame.
 - b. Remove two screws and two washers from bracket.
 - c. Move bracket to the side.
4. See Figure 4-13. Loosen two screws (4) holding intake manifold on primary side of engine. Do not remove.
5. Remove two screws (4) holding intake manifold on gear-case cover side of engine.
6. Remove intake manifold (5) and seal ring (6). Slide both mounting flanges (1, 2) over primary side screws (4). Remove both intake manifold seals (3).

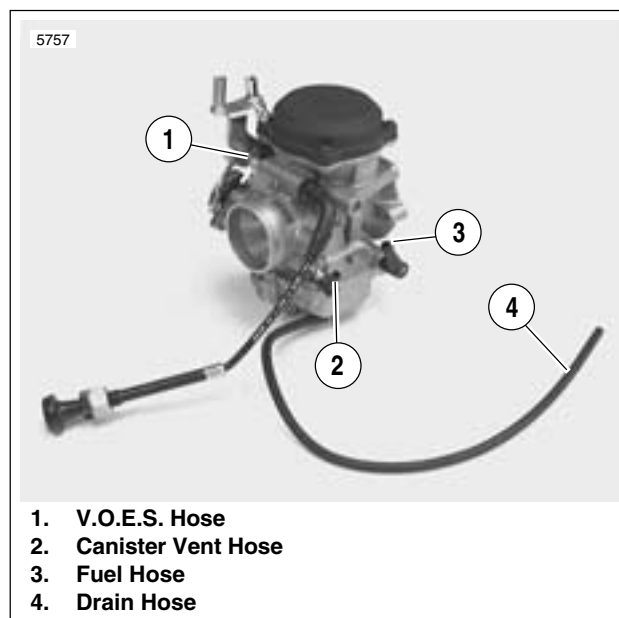


Figure 4-12. Carburetor Hoses

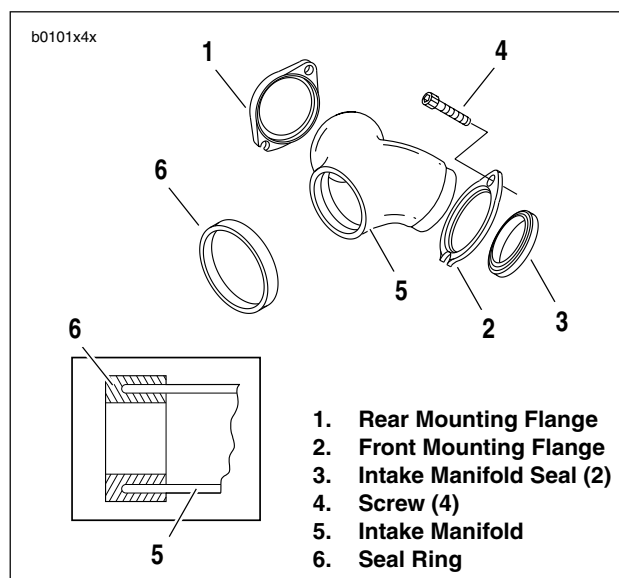


Figure 4-13. Intake Manifold

DISASSEMBLY

Vacuum Piston Chamber

1. See [Figure 4-14](#). Remove screw (25) and screw and lockwasher (26). Remove throttle cable bracket (24) with attached remote idle adjuster assembly (27).
2. Remove three shouldered screws (2). Remove top cover (1) and spring (3).
3. Lift out vacuum piston (4) with jet needle (6) and spring seat (5). Remove loose parts from vacuum piston.

Carburetor Body

1. See [Figure 4-14](#). Remove four screws and lockwashers (18). Remove float bowl assembly (38).
2. Remove pin (14), float (16) and fuel inlet valve (13).
3. Back out main jet (11) and needle jet holder (10). Needle jet (9) is free to be removed from bottom end of passage.
4. Insert thin-bladed screwdriver into slow jet passage to remove slow jet (12).

Accelerator Pump

Remove three screws (49) and lockwashers (48), accelerator pump housing (42), spring (43) and diaphragm (44). Remove O-ring (45) from housing.

CLEANING AND INSPECTION

Vacuum Piston Components

1. See [Figure 4-14](#). Hold vacuum piston (4) up to strong light. Examine diaphragm at top of vacuum piston for evidence of pinching, holes or tears. Replace if damaged.
2. Examine vacuum passage through bottom of piston (4). Clean passage if restricted.
3. Examine spring (3) for stretching, crimping, distortion or damage. Replace if necessary.
4. Examine slide on sides of piston (4) to be sure surface is smooth and clean. Clean or buff out any rough surfaces.
5. Examine jet needle (6) for evidence of bending or damage. Needle should be straight; surface of taper should be smooth and even.
6. Check float bowl O-ring (53) for any distortion or damage. Replace if seating surfaces are damaged.
7. Examine fuel inlet valve (13) and inlet valve seat. Clean with carburetor cleaner. Replace if seating surfaces are damaged.
8. Clean slow jet (12) with carburetor cleaner. Check to be sure all orifices are open.
9. Check enrichener valve (22). Be sure needle guide is clean, straight and undamaged. Check composition seating surface for wear or damage. Replace if damaged.
10. Check enrichener valve chamber. Clean with carburetor cleaner. Check that all passages are open and free of obstruction.
11. Clean needle jet (9). Replace if damaged.
12. Clean all internal fuel/air passages and jets. Check that all passages and jets are open and free of obstruction.
13. Check needle jet holder (10). Clean bleed tube orifices. Replace holder if damaged.
14. Check float (16) for cracks or other leaks. Replace if damaged.
15. Clean main jet (11) with carburetor cleaner and inspect for damage. Replace if damaged.

Accelerator Pump

1. See [Figure 4-14](#). Inspect the accelerator pump diaphragm (44) for holes, cracks or deformation. Replace as necessary.
2. Replace the accelerator pump rod (51) if it is bent; replace the boot (50) if cracked.

ASSEMBLY

Vacuum Piston Chamber

1. See [Figure 4-14](#). Place jet needle (6) through center hole in vacuum piston (4). Place spring seat (5) over top of needle.
2. Insert vacuum piston (4) into carburetor body. The slides on the piston are off-center and the piston will fit into the slide track grooves one way only. If piston does not fit, rotate 180°.
3. Check to be sure diaphragm is seated evenly into groove at top of carburetor body. Place spring (3) over spring seat (5), and carefully lower top cover (1). Keep spring straight while lowering top cover.
4. After top cover (1) is seated, hold top cover while lifting vacuum piston (4) upward. Piston should raise to top smoothly. If piston movement is restricted, spring (3) is cocked; lift up top cover, then lower carefully, keeping spring coils straight.
5. Once top cover is installed correctly, install three shouldered screws (2). Place throttle cable bracket (24) in position with idle adjuster (27) resting on top of throttle stop plate. Install body screw and lockwasher (26) first, then top screw (25) to prevent bending bracket or throttle cam.

Carburetor Body

CAUTION

Slow jets from fixed-venturi carburetors look the same as the slow jet of the C.V. carburetor. However, the air bleed hole sizes are different on fixed-venturi carburetors and they must not be installed on C.V. carburetors.

1. See [Figure 4-14](#). Thread slow jet (12) into slow jet passage with narrow-bladed screwdriver.
2. Turn carburetor upside down. Place needle jet (9) in main jet passage with needle passing through center hole. Be sure end of jet with larger opening and chamfered surface enters passage first.
3. Insert needle jet holder (10) into main jet passage with needle inserted into center of holder. Thread holder into passage and tighten. Thread and tighten main jet (11) in tapped hole in needle jet holder (10).
4. Place float assembly (16) into position with fuel inlet valve (13) inserted into valve seat and with pivot arm aligned with holes in mounting posts (at bottom of carburetor body). Insert pin (14) through float pivot arm and float mounting posts.
5. Check float level setting and adjust if necessary. See [FLOAT LEVEL](#).
6. Place float bowl (38) over float and onto carburetor body flange. Bowl will only fit in one position. Install and tighten screws and lockwashers (18).

Accelerator Pump

Install diaphragm (44), spring (43), O-ring (45) and pump housing (42). Secure with screws (49) and lockwashers (48).

1. Top Cover
2. Shouldered Screw (3)
3. Spring
4. Vacuum Piston
5. Spring Seat
6. Jet Needle
7. Fitting (V.O.E.S.)
8. Fuel Inlet Fitting
9. Needle Jet
10. Needle Jet Holder
11. Main Jet
12. Slow Jet
13. Fuel Inlet Valve
14. Pin
15. Pump Linkage
16. Float
17. Carburetor Body
18. Screw w/Lockwasher (4)
19. Cable Guide
20. Starter Cap
21. Cable Sealing Cap
22. Enrichener Valve
23. Spring
24. Throttle Cable Bracket
25. Screw
26. Screw and Lockwasher
27. Idle Adjuster
28. Spring
29. Washer
30. Drain Hole
31. Drain Hose
32. Clip
33. Washer
34. Cotter Pin (2)
35. Washer (3)
36. Washer
37. Lever
38. Float Bowl
39. E-clip
40. Accelerator Pump Nozzle
41. Spring
42. Pump Housing
43. Spring
44. Diaphragm
45. O-ring
46. O-ring
47. Drain Screw
48. Lockwasher (3)
49. Screw (3)
50. Boot
51. Accelerator Pump Rod
52. Collar
53. Float Bowl O-ring
54. Clamp (2)
55. Hose
56. Washer
57. Vacuum Hose
58. Collar

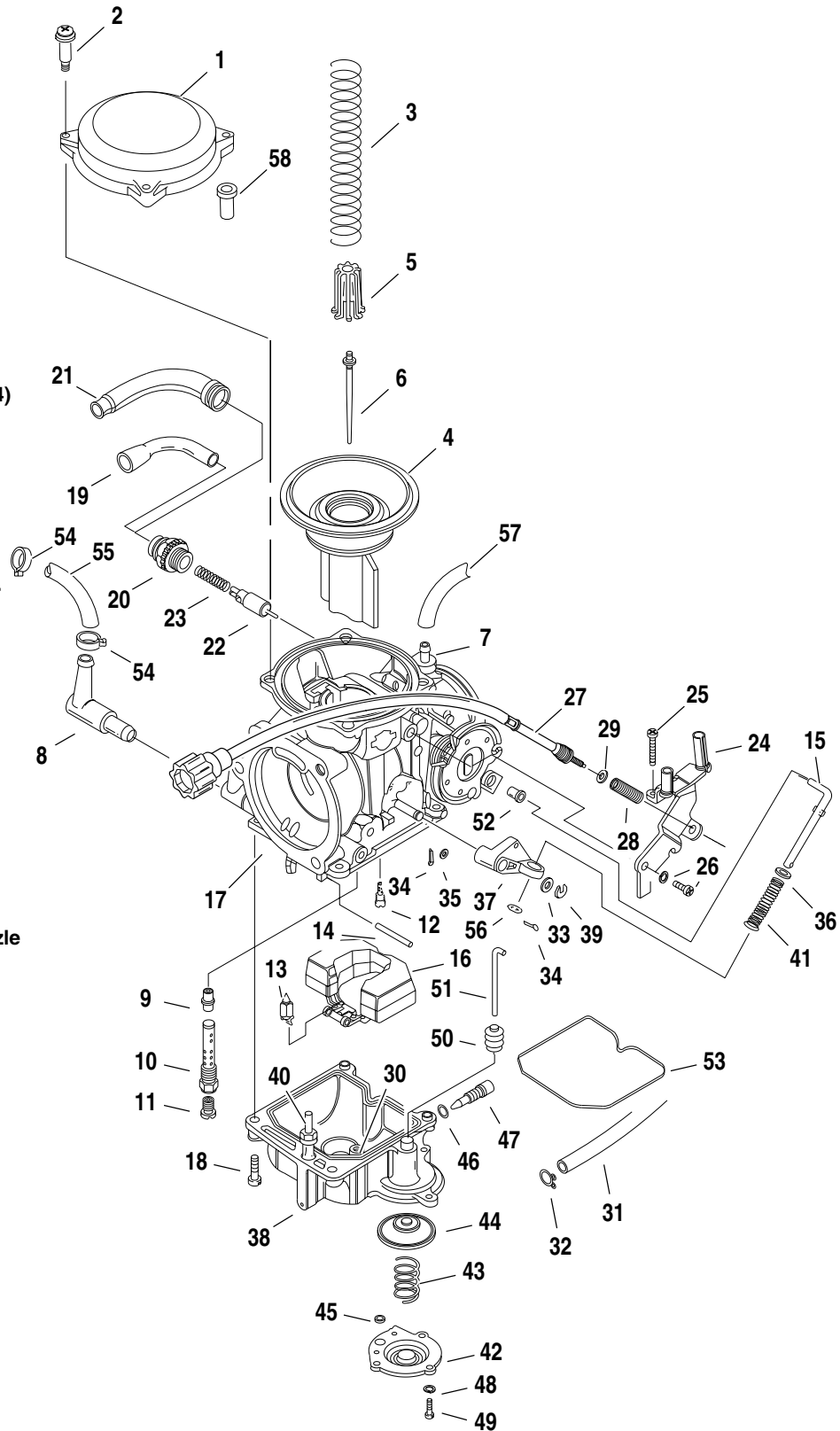


Figure 4-14. Constant-Velocity (C.V.) Carburetor

INSTALLATION

Intake Manifold

1. See [Figure 4-13](#). Place mounting flanges (1, rear and 2, front) on intake manifold (5).
2. Place intake manifold seals (3) on each spigot of manifold with chamfered edge against mounting flanges (1, 2).
3. Place channel of seal ring (6) over inlet end of manifold.
4. Install manifold.
 - a. Position manifold against intake ports of cylinder head, with slotted and round holes in flanges (1, 2) aligned with holes in cylinder head. Manifold should slide over screws on primary side of engine.
 - b. Insert two screws (4) through manifold flanges on gearcase cover side. Loosely thread screws into tapped holes in cylinder head.
 - c. Tighten all intake manifold screws (4) to 6-10 ft-lbs (8-14 Nm).
5. See [Figure 4-15](#). Install enrichener bracket (4).
 - a. Fasten bracket to cylinder heads with two screws and two washers (3). Tighten to 25-30 ft-lbs (34-41 Nm).
 - b. Insert bolt (1) through frame. Secure tie bar (2) under frame tab with washer and locknut. Tighten to 30-33 ft-lbs (41-45 Nm).

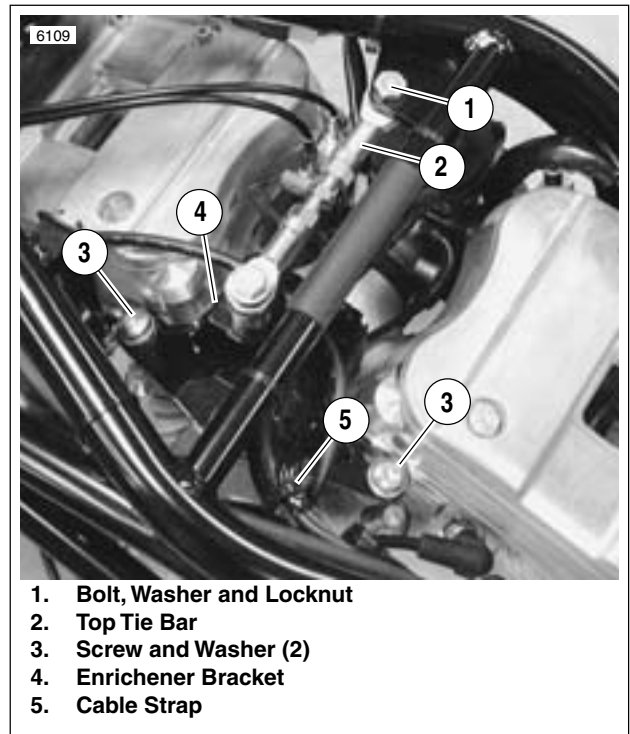


Figure 4-15. Enrichener Bracket

Carburetor

1. See [Figure 4-16](#). Attach throttle cables.
 - a. Install idle control cable (2) into longer, inboard cable guide on carburetor.
 - b. Install throttle control cable (1) into shorter, outboard cable guide on carburetor.
 - c. Install throttle cable clamps with screw.
2. See [Figure 4-12](#). Attach hoses to carburetor.
 - a. Connect drain hose (4).
 - b. Connect V.O.E.S. hose (1).
 - c. Connect canister vent hose (2) to California models.

NOTE

The fit between the carburetor and the seal ring is tight. For ease of installation, lubricate the mating surfaces, carburetor body and seal ring with liquid dish soap or tire mounting lube prior to assembly.

3. Lubricate only the inside surface of seal ring that will be in contact with the carburetor. Also apply a light coat of lubricant to the spigot of the carburetor body. Push carburetor body into seal ring.
4. Connect fuel hose to carburetor with a **new** clamp and [HOSE CLAMP PLIERS \(Part No. HD-41137\)](#).
5. Install enrichener cable on ignition key switch bracket and adjust. See [ENRICHENER CONTROL](#).
6. Adjust throttle cables. See [1.18 CARBURETOR](#).
7. Cable strap remote idle adjuster to frame tube.
8. Install air cleaner assembly. See [4.4 AIR CLEANER](#).
9. Install fuel tank. See [4.5 FUEL TANK](#).

Carburetor Drain Hose Routing

Check carburetor drain hose routing.

1. Route the drain hose between cylinders from the carburetor towards left side of motorcycle.
2. Loop the drain hose up and around the intake manifold back towards the right side of motorcycle.
3. Attach hose to the upper rear of the backing plate of the airbox.

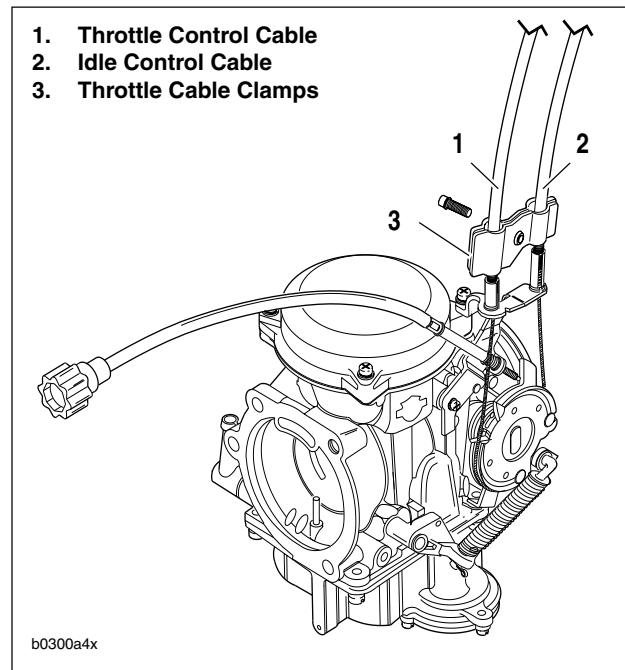


Figure 4-16. Throttle Cables

IDLE ADJUSTMENT

See [Figure 4-18](#). Use the idle adjuster to change idle speed. See [1.18 CARBURETOR](#) for more information.

REMOVAL

1. Remove seat and fuel tank. See [4.5 FUEL TANK](#).
2. Cut cable strap holding adjuster to frame.
3. See [Figure 4-19](#). Unthread adjuster assembly from bracket (4). Remove spring (3) and washer (2).

INSTALLATION

1. See [Figure 4-19](#). Thread remote adjuster (1), washer (2) and spring (3) into bracket (4). Shaft (5) must touch stop plate (6).
2. See [Figure 4-20](#). Secure adjuster to frame with a figure-8 cable strap.
 - a. Wrap cable strap around inside of frame, then up and through the slot.
 - b. Continue cable strap over adjuster.
 - c. Run cable strap through the other side of the slot. Strap should be tight enough that the adjuster turns easily.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

3. Install fuel tank and seat. See [4.5 FUEL TANK](#).
4. Start vehicle and warm engine to normal operating temperature.
5. Set idle speed. See [1.18 CARBURETOR](#).

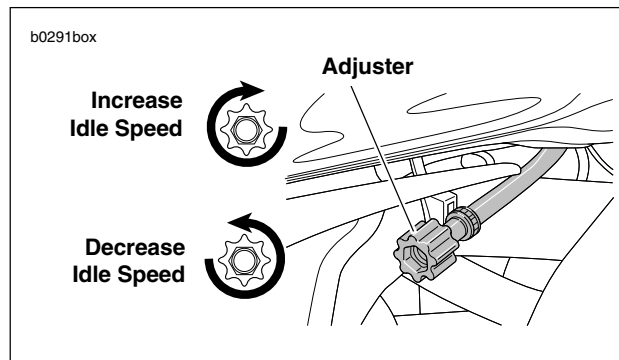


Figure 4-18. Idle Speed Adjuster

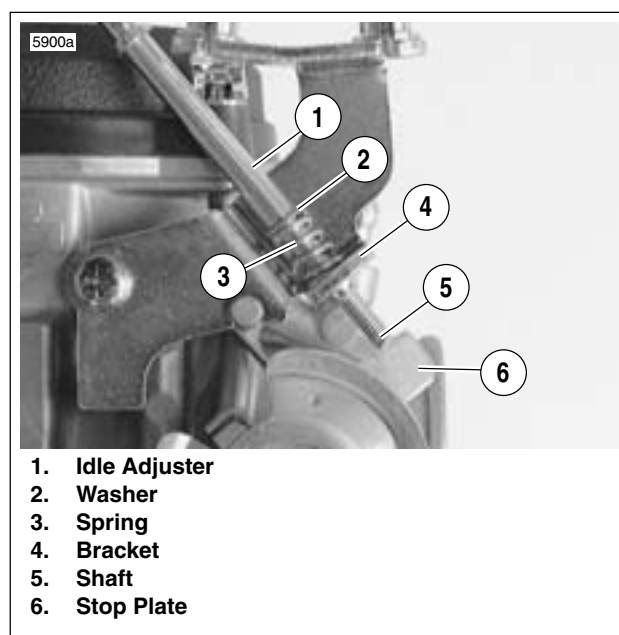


Figure 4-19. Removal/Installation

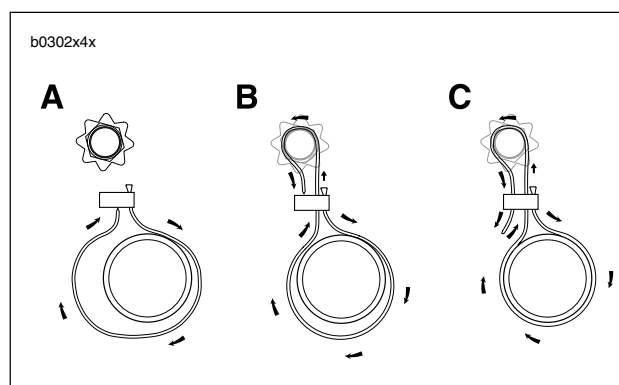


Figure 4-20. Cable Strap

GENERAL

Service air cleaner filter element every 5000 miles (8000 km) or more often if the motorcycle is run in a dusty environment. See [1.17 AIR CLEANER](#) for more information.

REMOVAL

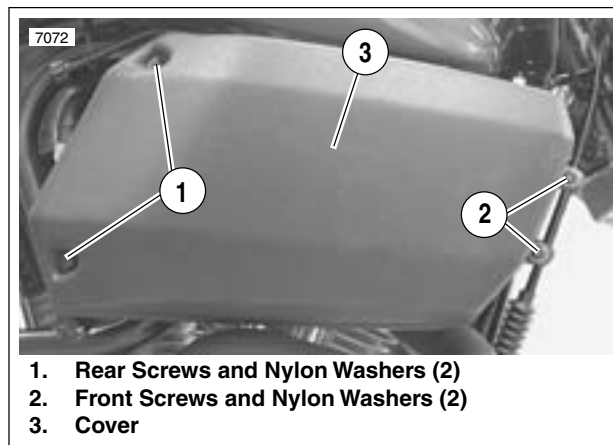
CAUTION

Do not run engine without filter element in place. Debris could be drawn into the engine causing damage.

- See [Figure 4-21](#). Remove both front screws and nylon washers (2).
- Remove both rear screws and nylon washers (1). Remove cover (3).
- See [Figure 4-22](#). Remove two bolts and washers (3) from filter box (2). Slide filter box forward, away from snorkel (1).
- If inspecting filter element, see [1.17 AIR CLEANER](#).
- See [Figure 4-23](#). Disconnect hoses.
 - Detach breather tee (4) from rear breather hose (1).
 - Detach front breather hose (3) from front breather bolt (2).
 - Detach vent/drain hose from backplate (if present).
- See [Figure 4-24](#). Remove two screws (1) and snorkel plate (2). Remove snorkel (4).
- Detach backplate.
 - See [Figure 4-25](#). Remove nuts (2) and bolts (1) from front mount.
 - See [Figure 4-26](#). Remove spacer screw (2) and spacer and gasket (1).
 - Remove front breather bolt (4).
 - Pull backplate (5) away from motorcycle and rear breather hose (3). On California models, slide fresh air inlet hose from carbon canister through backplate.
 - Remove breather gasket from backplate.

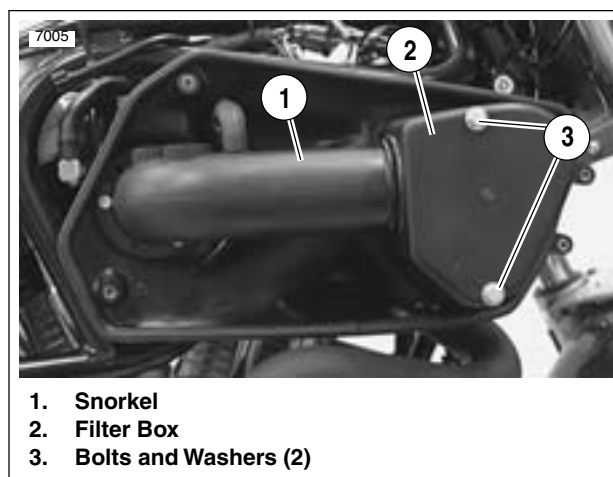
NOTE

Air cleaner support ring fits around rear breather bolt. Fitting on rear breather bolt may not clear the frame if bolt removal is attempted. Do not remove the rear breather bolt unless absolutely necessary. See [4.2 CARBURETOR](#) for instructions on removing air cleaner support ring.



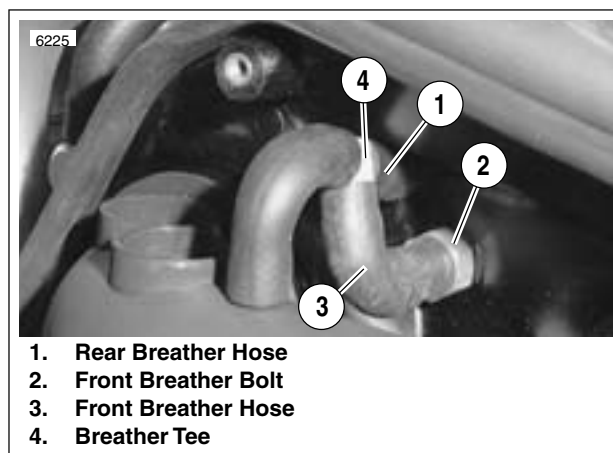
- Rear Screws and Nylon Washers (2)
- Front Screws and Nylon Washers (2)
- Cover

Figure 4-21. Air Cleaner Cover



- Snorkel
- Filter Box
- Bolts and Washers (2)

Figure 4-22. Filter Box



- Rear Breather Hose
- Front Breather Bolt
- Front Breather Hose
- Breather Tee

Figure 4-23. Breather Hoses

INSTALLATION

1. Install backplate.
 - a. Apply HYLOMAR to breather bolt threads. If removed, install air cleaner support ring.
 - b. See [Figure 4-26](#). Slide rear breather hose (3) through backplate (5). On California models, slide canister fresh air inlet hose from carbon canister through backplate.
 - c. Install a **new** breather gasket behind backplate.
 - d. Install front breather bolt (4). Tighten to 10-15 ft-lbs (14-20 Nm).
2. Apply LOCTITE THREADLOCKER 243 (blue) to spacer screw (2). Install spacer and gasket (1) using spacer screw (2). Tighten to 7-9 ft-lbs (10-12 Nm).
3. See [Figure 4-25](#). Apply LOCTITE THREADLOCKER 243 (blue) to bolts (1). Insert bolts (1) through backplate and mount. Install nuts (2). Tighten to 3-5 ft-lbs (4-7 Nm).
4. See [Figure 4-24](#). Install snorkel.
 - a. Apply LOCTITE THREADLOCKER 243 (blue) to screws (1).
 - b. Align snorkel (4) on spacer (3) and spacer screw.
 - c. Attach snorkel to backplate assembly using snorkel plate (2) and two screws (1). Tighten to 6-8 ft-lbs (8-11 Nm).
5. See [Figure 4-23](#). Attach hoses.
 - a. Install front breather hose (3) on front breather bolt (2).
 - b. Attach rear breather hose (1) to breather tee (4).
6. Inspect filter element. See [1.17 AIR CLEANER](#).
7. See [Figure 4-22](#). Place filter element in filter box (2). Attach filter box to snorkel (1).
8. Apply LOCTITE THREADLOCKER 243 (blue) to filter box bolts and LOCTITE THREADLOCKER 222 (purple) to four cover screws.
9. Fasten filter box to backplate with bolts and washers (3). Tighten to 40-45 **in-lbs** (4.5-5.1 Nm).
10. See [Figure 4-21](#). Place cover (3) over backplate assembly.
 - a. Loosely install rear screws and nylon washers (1).
 - b. Loosely install front screws and nylon washers (2).
 - c. Tighten front and rear screws to 18-22 **in-lbs** (2.0-2.5 Nm).

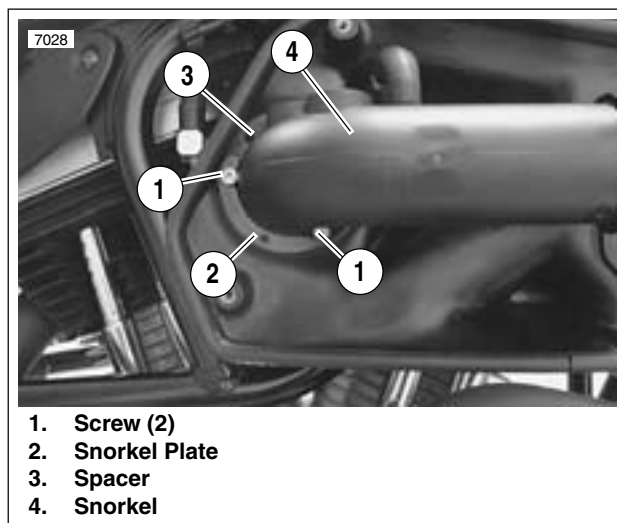


Figure 4-24. Snorkel Plate

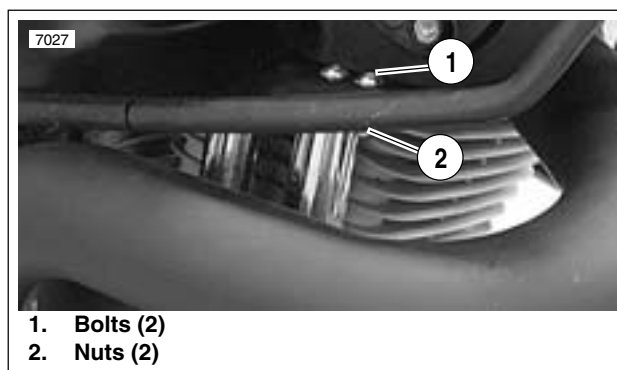


Figure 4-25. Air Cleaner Front Mount

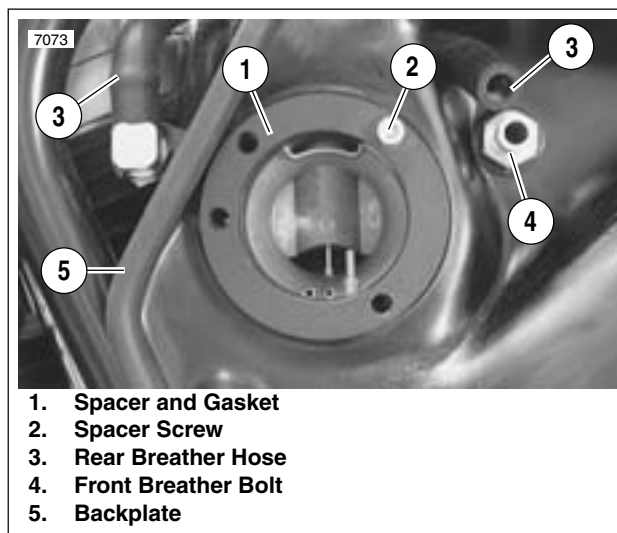


Figure 4-26. Air Cleaner Spacer

GENERAL

WARNING

Verify that the fuel tank vent hose does not contact hot exhaust or engine parts. The hose contains flammable vapors that can be ignited, if damaged, which could result in death or serious injury.

See [Figure 4-27](#). The fuel tank (7) is vented through a vent valve assembly (8) within the tank. At the top of the tank, a vent hose (11) connects to the vent valve fitting (10). The fuel tank vent hose is then cable strapped to a left side frame tube.

NOTE

On California models, the fuel tank vent hose connects to the carbon canister. See [4.8 EVAPORATIVE EMISSIONS CONTROL-CA MODELS](#) for more information.

REMOVAL

WARNING

Gasoline is extremely flammable and highly explosive. Do not smoke or allow open flame or sparks when refueling or servicing the fuel system. Inadequate safety precautions could result in death or serious injury.

1. Turn fuel supply valve OFF.

WARNING

A small amount of gasoline may drain from the fuel hose when disconnected from the carburetor. Thoroughly wipe up any fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. See [Figure 4-28](#). Remove fuel hose (1) and clamp (2) from fuel supply valve (3). Discard clamp.

NOTE

Fuel tank can be removed from motorcycle without being drained. Drain tank only when necessary.

3. Drain gasoline from tank.
 - a. Attach an additional length of hose to the fuel supply valve.
 - b. Place free end of hose into a proper, clean container of adequate size.
 - c. Turn fuel supply valve to reserve (RES). Drain gasoline from tank into container.
 - d. Remove temporary hose.
4. See [Figure 4-27](#). Remove cable strap (12) holding vent hose (11) to vent valve fitting (10). Disconnect vent hose from vent valve fitting.

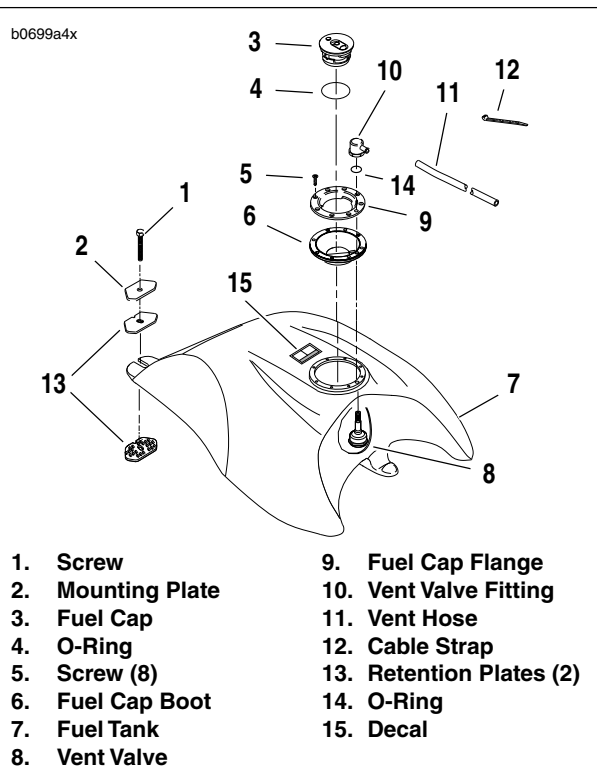


Figure 4-27. Fuel Tank

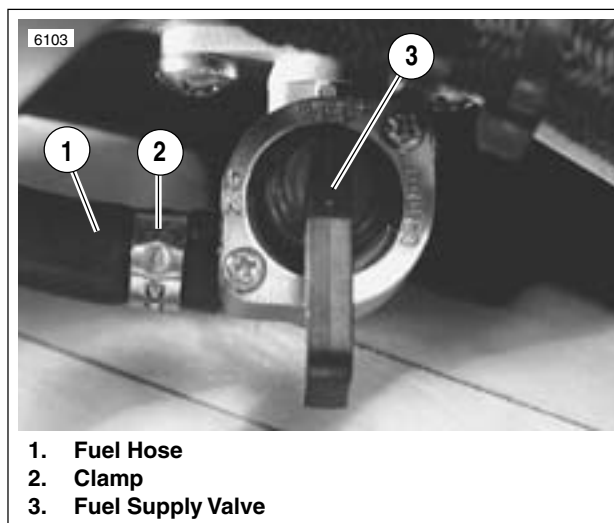


Figure 4-28. Fuel Supply Valve and Fuel Hose

5. Remove seat. See [2.36 SEAT](#).
6. See [Figure 4-27](#). Remove fuel tank screw (1), two retention plates (13) and mounting plate (2).

CAUTION

Use caution when removing fuel tank. If tank should contact other chassis parts, tank finish may be damaged.

7. Lift rear of tank from frame and remove.

DISASSEMBLY/ASSEMBLY

WARNING

Even with the fuel tank completely drained, a small amount of gasoline may leak from the bore when the fuel supply valve is loosened or removed. Thoroughly wipe up any fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

1. If the fuel supply valve requires cleaning or repair, see [4.7 FUEL SUPPLY VALVE](#).
2. See [Figure 4-27](#). Remove fuel filler cap (3) and O-ring (4).
3. Remove screws (metric) (5) from fuel cap flange (9) and remove fuel cap flange.
4. Remove vent valve fitting from vent valve. See [4.6 FUEL TANK VENT VALVE](#).
5. Remove fuel cap boot (6).
6. Apply HYLOMAR to fuel cap boot, fuel cap flange and top of fuel tank.
7. Insert fuel cap boot (6) being sure to align the holes in the boot with the proper holes in the fuel tank.
8. Install vent valve fitting into vent valve. See [4.6 FUEL TANK VENT VALVE](#).
9. See [Figure 4-29](#). Install fuel cap flange with screws and tighten screws to 22-25 **in-lbs** (2.5-2.8 Nm) in the order shown.
10. See [Figure 4-27](#). Replace fuel filler cap (3) with **new** O-ring (4).

CLEANING AND INSPECTION

WARNING

Gasoline is extremely flammable and highly explosive. An open flame or spark may cause a fuel tank explosion if all traces of fuel are not purged from the tank. Use extreme caution when servicing fuel tanks. Inadequate safety precautions could result in death or serious injury.

Clean tank interior with commercial cleaning solvent or a soap and water solution.

1. Plug all tank openings except fuel cap hole.
2. Add cleaning agent. Replace fuel cap to seal tank.
3. Shake tank to agitate agent.
4. Thoroughly flush fuel tank after cleaning. Allow tank to air dry.
5. Carefully inspect fuel hose and vent hose for damage, wear or general deterioration. Replace as necessary.

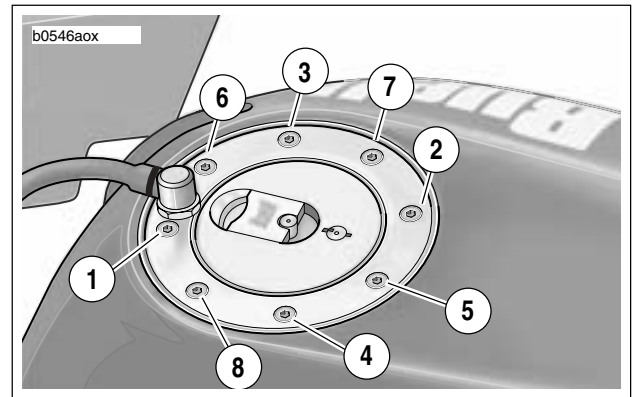


Figure 4-29. Tightening Flange

INSTALLATION

1. See [Figure 4-27](#). Carefully raise the back of the fuel tank and place a retention plate in position on the frame. Make sure shorter straight side of retention plate faces to rear of vehicle.
2. Carefully place the fuel tank onto the lower retention plate.

NOTE

For motorcycles having a tank mask and/or tank bag as an accessory, be sure to secure mask/bag so that it is between the top retention plate and the mounting plate. The retention plate teeth must be in direct contact with the fuel tank.

3. See [Figure 4-27](#). Place the remaining retention plate and mounting plate in position on top of the fuel tank rear mounting projections. Make sure shorter straight side of both retention plate and mounting plate face to rear of vehicle.
4. See [Figure 4-27](#). Install screw (1) and tighten to 18-23 ft-lbs. (24-31 Nm).
5. Wait five minutes and tighten bolt again to 18-23 ft-lbs (24-31 Nm).

NOTE

Avoid pinching wiring harness and vent hose between fuel tank and frame during tank installation. Pinched hoses will negatively affect vehicle operation.

6. Connect vent hose (11) to vent valve fitting (10). Clamp hose to fitting with a **new** cable strap (12).

CAUTION

Make sure to push the fuel hose all the way onto the fuel supply valve fitting. Position hose clamp on straight section of fitting, clear of barb, and properly tighten the clamp.

7. See [Figure 4-28](#). Connect fuel hose (1) to fuel supply valve (3) with a **new** clamp (2) and [HOSE CLAMP PLIERS \(Part No. HD-41137\)](#).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

8. Install seat. See 2.36 SEAT.
9. Fill fuel tank with fuel supply valve turned OFF.

NOTE

Use a good quality unleaded gasoline (91 pump octane or higher). Octane rating is usually found on the pump.

10. Open fuel supply valve and carefully inspect for leaks. Turn valve OFF after the inspection is performed.

FUEL CAP ADJUSTMENT

See Figure 4-30. The amount of force required to lift the locking tab is adjustable by tightening or loosening the 10 mm nut on the underside of the fuel cap. Tension on the cap must be tight enough to properly seal the fuel tank.

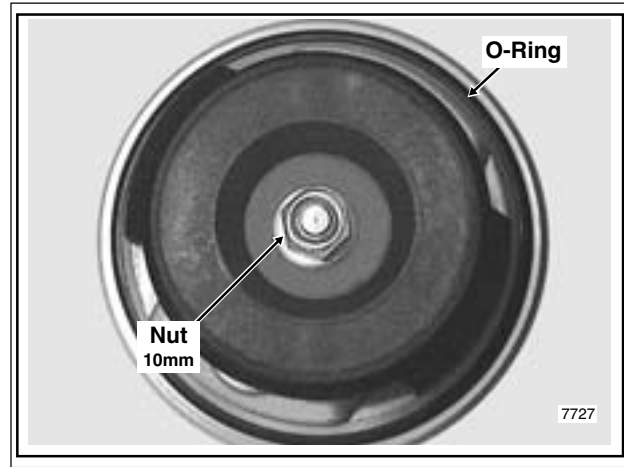


Figure 4-30. Fuel Cap Adjustment

GENERAL

The vent valve opens to allow gas vapor to escape the fuel tank and either vent to the atmosphere or to the charcoal canister on California Models (EVAP-equipped) and closes to prevent gasoline from leaking out of the fuel tank if the vehicle is tipped at an unusual angle.

REMOVAL

NOTE

The fuel tank must be drained to perform this service. The fuel tank does not need to be removed.

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable.

⚠ WARNING

An open flame or spark may cause a fuel tank explosion if all traces of fuel are not purged from the tank. Use extreme caution when servicing fuel tanks. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. Turn fuel supply valve OFF.

⚠ WARNING

A small amount of gasoline may drain from the fuel hose when disconnected from the carburetor. Thoroughly wipe up any fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

3. See Figure 4-28. Remove fuel hose (1) and clamp (2) from fuel supply valve (3). Discard clamp.

NOTE

Fuel tank can be removed from motorcycle without being drained. Drain tank only when necessary.

4. Drain gasoline from tank.
 - a. Attach an additional length of hose to the fuel supply valve.
 - b. Place free end of hose into a proper, clean container of adequate size.
 - c. Turn fuel supply valve to reserve (RES). Drain gasoline from tank into container.
 - d. Remove temporary hose.
5. See Figure 4-27. Cut cable tie (12) holding vent hose to fitting and remove vent hose from fuel tank.
6. While holding vent valve with angled needle nose pliers, remove fitting from vent valve.

7. Pull the vent valve from the gasket and remove from fuel tank.

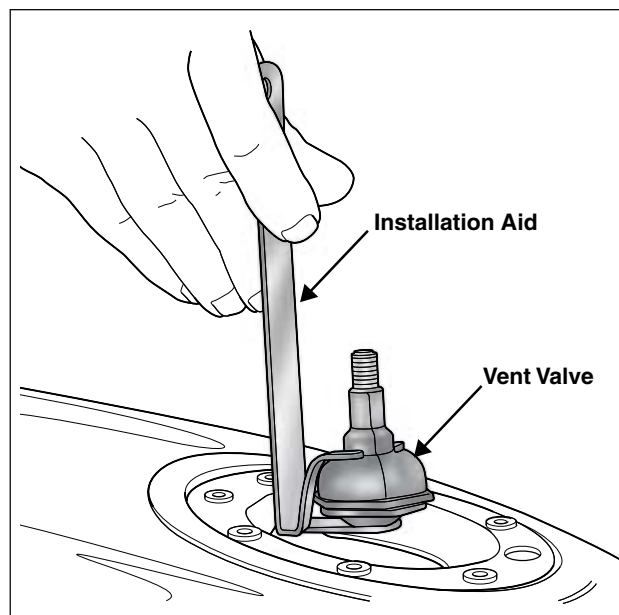


Figure 4-31. Installing Fuel Tank Vent

INSTALLATION

1. Wipe inside and outside vent valve mounting hole to make sure there is no gasoline or excess Hylomar sealant present.
2. See Figure 4-31. Using the fuel vent valve installation aid, lower the fuel tank vent valve into the fuel tank through the fuel filler neck.
3. Position the fuel tank vent valve so the threaded portion at the top protrudes from the fuel vent opening on the fuel cap flange. Verify hole on top of vent valve is not blocked by Hylomar sealant and that vent protrudes completely from hole.

NOTE

The fuel vent fitting is installed dry. Do NOT use teflon tape or loctite products when installing vent fitting.

4. See Figure 4-27. Install new O-ring in groove on bottom of fitting.
5. While holding vent valve with fuel vent valve installation aid, install fitting and O-ring to threaded portion of vent valve. Do not tighten. Remove fuel vent valve installation aid.

NOTE:

It may take a few tries and slight rotation of the vent valve to get the alignment mentioned in Step 6.

6. See Figure 4-32. Align fitting so right front point of hex is oriented to 12:00 position when fitting is tightened finger tight. Make sure O-ring remains in groove of fitting while tightening.

CAUTION

Do not overtighten vent fitting or attempt to tighten with standard “click-type” torque wrench. Overtightening vent will cause it to snap off and fall into fuel tank, requiring fuel tank removal.

- Using a dial-type torque wrench, tighten vent fitting to 40-60 **in-lbs.** (5-7 Nm) until top fitting nozzle points to 12:00 position.

NOTE:

If fitting nozzle does not point to 12:00 position when tightening within specified torque range, loosen fitting, rotate vent valve and try again. Repeat as required to get proper alignment of nozzle within specified torque range.

- See Figure 4-27. Attach vent hose to nozzle on vent valve fitting with **new** cable tie.

CAUTION

Make sure to push the fuel hose all the way onto the fuel supply valve fitting. Position hose clamp on straight section of fitting, clear of barb, and properly tighten the clamp.

- See Figure 4-28. Connect fuel hose (1) to fuel supply valve (3) with a **new** clamp (2) and **HOSE CLAMP PLIERS** (Part No. HD-41137).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

- Install seat. See 2.36 SEAT.
- With fuel supply valve turned OFF, fill fuel tank with proper fuel (91 pump octane) and install gas cap.

NOTE

Use a good quality unleaded gasoline (91 pump octane or higher). Octane rating is usually found on the pump.

- Open fuel supply valve and carefully inspect for leaks. Turn valve OFF after the inspection is performed.
- Connect negative battery cable. Tighten to 40 **in-lbs** (4.5 Nm).

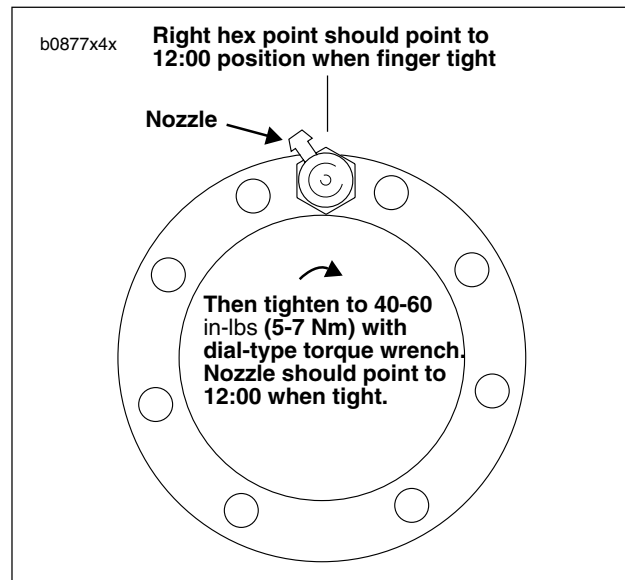


Figure 4-32. Fuel Tank Vent Alignment

GENERAL

The fuel supply valve is located on the left side, below the fuel tank. The gasoline supply to the carburetor is shut OFF when the handle is in the vertical position. For gasoline main supply, turn the handle to the 3 o'clock position (horizontal rearward). For gasoline reserve supply, turn the handle to the 9 o'clock position (horizontal forward). Turn valve to OFF position (vertical) when engine is not running.

REMOVAL

WARNING

Gasoline is extremely flammable and highly explosive. Do not smoke or allow open flame or sparks when refueling or servicing the fuel system. Inadequate safety precautions could result in death or serious injury.

1. See [Figure 4-34](#). Turn fuel supply valve OFF.

WARNING

A small amount of gasoline may drain from the fuel hose when disconnected from the carburetor. Thoroughly wipe up any fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. See [Figure 4-28](#). Remove fuel hose (1) and clamp (2) from fuel supply valve (3). Discard clamp.
3. Drain gasoline from tank. See [4.5 FUEL TANK](#).

WARNING

Even with the fuel tank completely drained, a small amount of gasoline may leak from the bore when the fuel supply valve is loosened or removed. Thoroughly wipe up any fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

4. See [Figure 4-33](#). Remove two screws and fuel supply valve assembly.

CLEANING AND INSPECTION

1. See [Figure 4-33](#). Clean or replace filter strainer (located inside fuel tank above fuel supply valve). Filter strainer threads into valve body.
2. Flush fuel tank to remove all dirt.

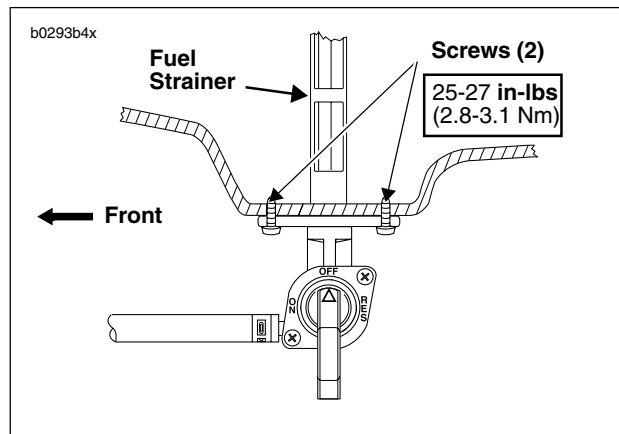


Figure 4-33. Fuel Supply Valve

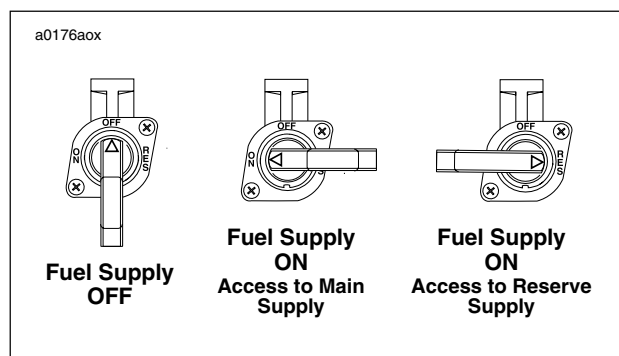


Figure 4-34. Fuel Supply Valve Positions.

INSTALLATION

CAUTION

Screws thread directly into plastic fuel tank. Overtightening screws will strip the tank threads and require a replacement fuel tank to be installed upon subsequent removal of the fuel supply valve.

1. See [Figure 4-33](#). Attach fuel supply valve to tank with two screws. Tighten to 25-27 in-lbs (2.8-3.1 Nm).

CAUTION

Make sure to push the fuel hose all the way onto the fuel supply valve fitting. Position hose clamp on straight section of fitting, clear of barb, and properly tighten the clamp.

2. Connect fuel hose with a new clamp and [HOSE CLAMP PLIERS \(Part No. HD-41137\)](#).

GENERAL

Buell motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system. The EVAP system prevents fuel hydrocarbon vapors from escaping into the atmosphere and is designed to meet the California Air Resource Board (CARB) regulations in effect at the time of manufacture.

The EVAP functions in the following manner:

- See [Figure 4-35](#). Hydrocarbon vapors in the fuel tank are directed through the vent valve and stored in the charcoal canister. If the vehicle is tipped at an abnormal angle, the vent valve closes to prevent liquid gasoline from leaking out of the fuel tank through the fuel tank vent hose.
- See [Figure 4-36](#). When the engine is running, manifold venturi negative pressure (vacuum) slowly draws off the hydrocarbon vapors from the charcoal canister through the canister vent hose. These vapors pass through the carburetor and are burned as part of normal combustion in the engine. The large diameter canister fresh air inlet hose (canister fresh air inlet hose) supplies the canister with fresh air from the air cleaner.

TROUBLESHOOTING

WARNING

Verify that the evaporative emissions system hoses do not contact hot exhaust or engine parts. The hoses contain flammable vapors that can be ignited if damaged which could result in death or serious injury.

The system has been designed to operate with a minimum of maintenance. Check that all hoses are properly routed and connected and are not pinched or kinked. Periodically check all mounting hardware for tightness.

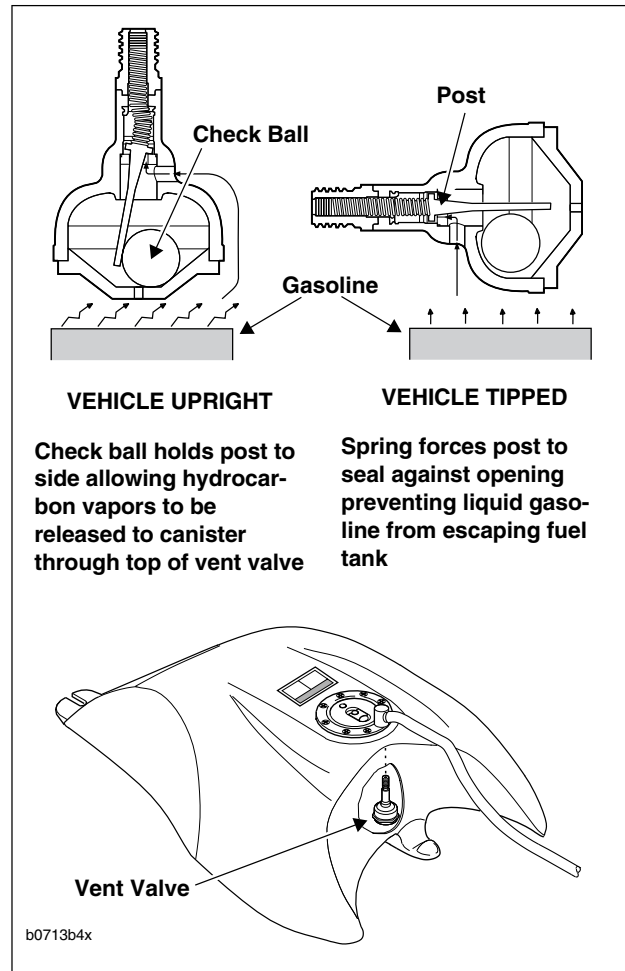


Figure 4-35. Vent Valve Operation



Figure 4-36. Charcoal Canister (Typical)

REMOVAL

Vent Valve

1. See [Figure 4-37](#). Remove cable strap from fuel tank vent hose (4). Disconnect hose from vent valve fitting (3).
2. Remove fitting and vent valve. See [4.6 FUEL TANK VENT VALVE](#).
3. See [Figure 4-36](#). If necessary, label fuel tank vent hose (1) at canister fitting and remove.

Canister

1. See [Figure 4-36](#). The canister assembly mounts on a frame tube along the left side of the motorcycle.
2. Label and disconnect the three hoses connected to the canister.
3. See [Figure 4-38](#). Depress both locking tabs (3) on the canister mounting bracket (4). Slide canister towards the front wheel until it disengages from the mounting bracket and remove.
4. Remove screws, washers and locknuts (6) to detach mounting plate (2) from clamps (1).
5. Remove countersunk screws and locknuts (5) to separate bracket (4) from mounting plate (2).

INSTALLATION

Vent Valve

WARNING

Verify that the fuel tank vent hose does not contact hot exhaust or engine parts. The hose contains flammable vapors that can be ignited if damaged which could result in death or serious injury.

1. Install vent valve and vent valve fitting. See [4.6 FUEL TANK VENT VALVE](#).
2. Attach fuel tank vent hose (6) to vent valve fitting with a **new** cable strap (7).
3. See [Figure 4-36](#). Attach fuel tank vent hose (1) to canister if disconnected.

Canister

1. See [Figure 4-38](#). Install canister mounting bracket (4) on mounting plate (2) with countersunk screws and locknuts (5).
2. Install mounting plate assembly on frame by attaching mounting clamps (1) using screws, washers and locknuts (6). Tighten to 6-8 ft-lbs (8-11 Nm).

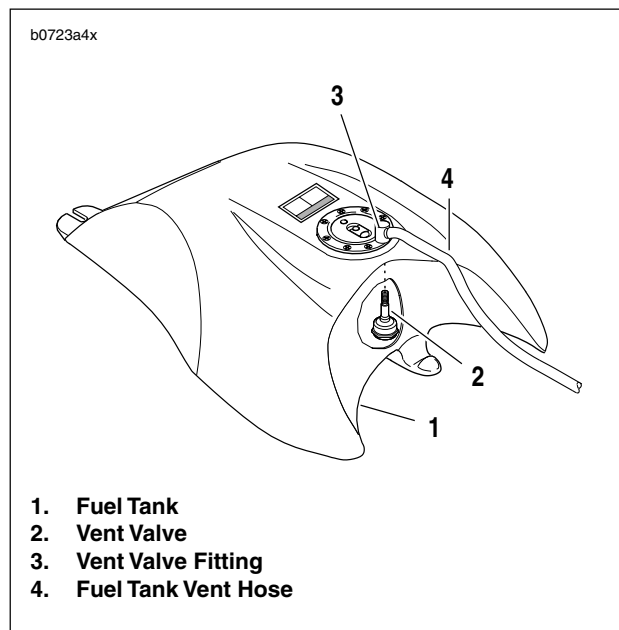


Figure 4-37. Vent Valve

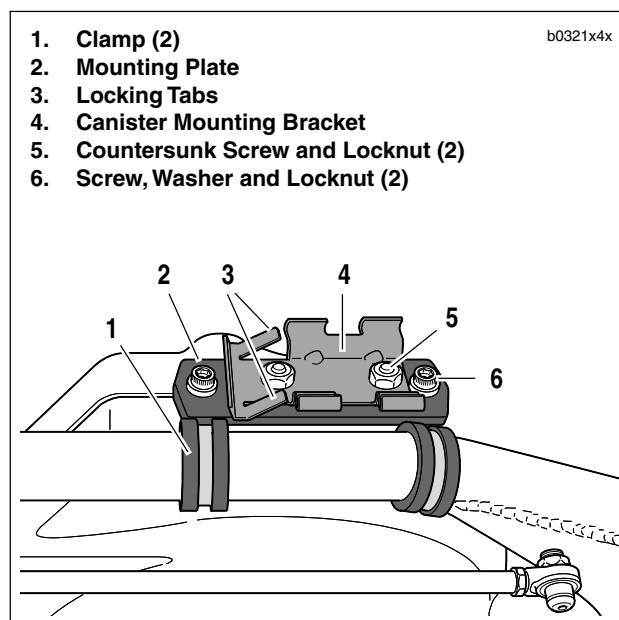


Figure 4-38. Carbon Canister Mounting

3. Depress locking tabs (3) and slide canister into locked position on canister mounting bracket (4). Locking tabs (3) must engage canister; bend tabs outward somewhat if canister is not held securely.
4. See [Figure 4-36](#). Connect all three hoses to the canister.

NOTES

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STARTER	
Free Speed	3000 RPM (min.) @ 11.5 V
Free Current	90 amp (max.) @ 11.5 V
Stall Current	400 amp (max.) @ 2.4 V
Stall Torque	8.1 ft-lbs (11.0 Nm) (min.) @ 2.4 V

SERVICE WEAR LIMITS	IN.	MM
Brush Length (minimum)	0.433	11.0
Commutator Diameter (minimum)	1.141	28.981

TORQUE VALUES

ITEM	TORQUE		NOTES
Battery Terminal Hardware	60-96 in-lbs	7-11 Nm	page 5-18
Starter battery positive cable nut	60-85 in-lbs	7-10 Nm	metric, page 5-18
Starter mounting bolts	13-20 ft-lbs	18-27 Nm	page 5-18

GENERAL

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idler gear and drive housing.

The starter motor torque is increased through gear reduction. The gear reduction consists of the drive pinion on the armature, an idler gear and a clutch gear in the drive housing. The idler gear is supported by rollers. The clutch gear is part of the overrunning clutch/drive assembly.

The overrunning clutch is the part which engages and drives the clutch ring gear. It also prevents the starter from overrunning. The field windings are connected in series with the armature through brushes and commutator segments.

Wiring Diagrams

For additional information concerning the starting system circuit, see the wiring diagram at the end of Section 7, ELECTRICAL.

Starter Relay

The starter relay is not repairable. Replace the unit if it fails.

Starter Interlock

See [7.11 STARTER INTERLOCK](#) for operation and troubleshooting information.

OPERATION

See [Figure 5-1](#). When the starter switch is pushed, the starter relay is activated and battery current flows into the pull-in winding (10) and the hold-in winding (11), to ground.

The magnetic forces of the pull-in and hold-in windings in the solenoid push the plunger (7) causing it to shift to the left. This action engages the pinion gear (1) with the clutch ring gear (13). At the same time, the main solenoid contacts (8) are closed, so battery current flows directly through the field windings (3) to the armature (4) and to ground. Simultaneously, the pull-in winding (10) is shorted.

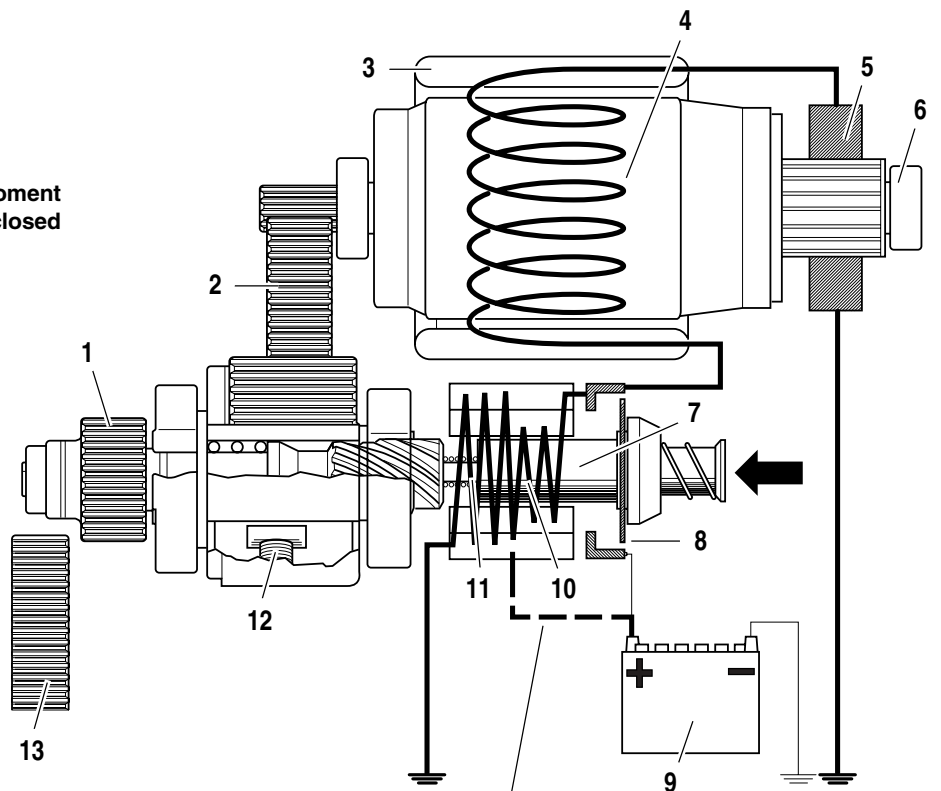
The current continues flowing through the hold-in winding (11) keeping the main solenoid contacts (8) closed. At this point, the starter begins to crank the engine.

After the engine has started, the pinion gear (1) turns freely on the pinion shaft through the action of the overrunning clutch (12). The overrunning clutch prevents the clutch ring gear (13) (which is now rotating under power from the engine) from turning the armature (4) too fast.

When the starter switch is released, the current of the hold-in winding (11) is fed through the main solenoid contacts (8) and the direction of the current in the pull-in winding (10) is reversed. The solenoid plunger (7) is returned to its original position by the return spring, which causes the pinion gear (1) to disengage from the clutch ring gear (13).

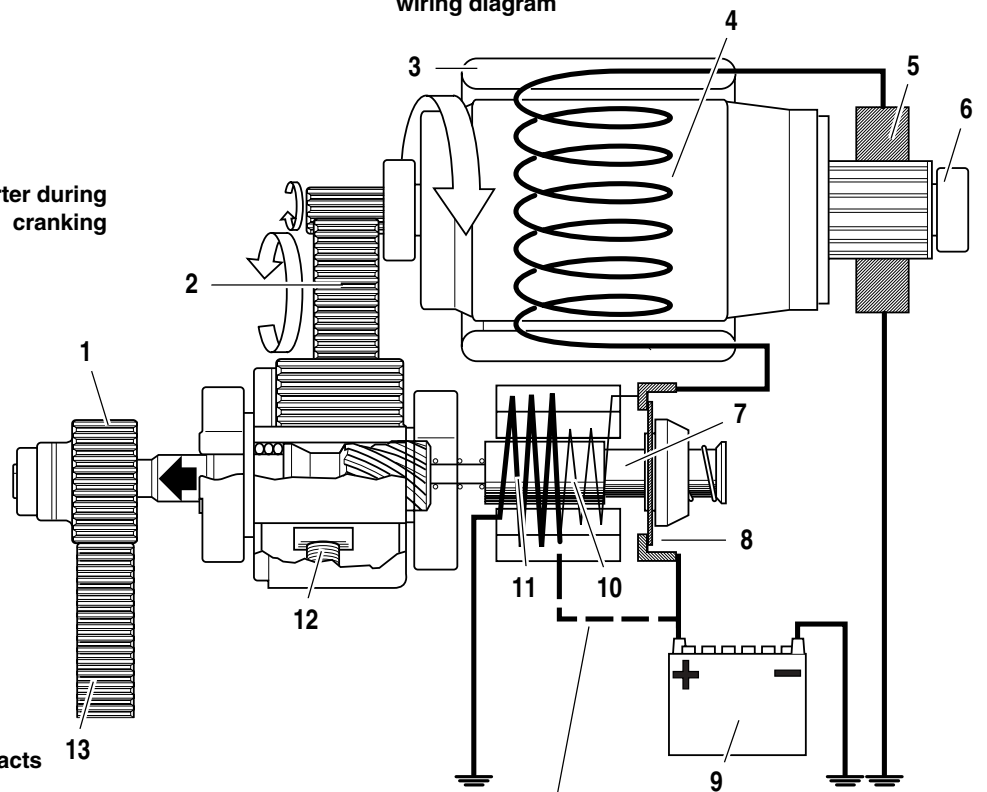
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Starter at moment
starter switch is closed



Starting Circuit-see
wiring diagram

Starter during
cranking



Starting Circuit-see
wiring diagram

1. Pinion Gear
2. Idler Gear
3. Field Winding
4. Armature
5. Brush
6. Ball Bearing
7. Solenoid Plunger
8. Main Solenoid Contacts
9. Battery
10. Pull-in Winding
11. Hold-in Winding
12. Overrunning Clutch
13. Clutch Ring Gear

Figure 5-1. Starter Operation

Table 5-1. Troubleshooting

PROBLEM	SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Starter does not run or runs at very low speeds.	Battery.	Voltage drop due to discharged battery. Short-circuited or open between electrodes. Poor contact condition of battery terminal(s).	Charge battery. Replace battery. Clean and retighten.
	Wiring.	Disconnection between starter switch and solenoid terminal. Malfunction in starter interlock system.	Repair or replace wire. See 7.11 STARTER INTERLOCK .
	Starting switch or starter relay.	Poor contact condition or poor connection.	Replace.
	Solenoid.	Poor contact condition caused by burnt contact. Contact plate removed. Pull-in winding open or short-circuited. Hold-in winding open.	Polish contact surface or replace solenoid assembly. Repair. Replace solenoid assembly. Replace solenoid assembly.
	Starting motor.	Poor contact condition of brushes. Commutator burnt. Commutator high mica. Field winding grounded. Armature winding grounded or short-circuited. Reduction gears damaged. Insufficient brush spring tension. Disconnected lead wire between solenoid and field windings. Ball bearing sticks.	Check brush spring tension. Correct on lathe or replace. Correct by undercutting. Replace. Replace. Replace. Replace. Repair or replace lead wire. Replace bearing.

Table 5-1. Troubleshooting (Continued)

PROBLEM	SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Pinion does not engage with ring gear while starter is running or engine cannot be cranked.	Battery.	Voltage drop due to discharged battery. Short-circuited or open between electrodes. Poor contact condition of battery terminal(s).	Charge battery. Replace battery. Clean and retighten.
	Wiring.	Disconnection between starter switch and solenoid terminal.	Repair or replace wire.
	Overrunning Clutch.	Overrunning clutch malfunction (rollers or compression spring). Pinion teeth worn out. Pinion does not run in overrunning direction. Poor sliding condition of spline teeth. Reduction gears damaged.	Replace overrunning clutch. Replace overrunning clutch. Replace overrunning clutch. Remove foreign materials, dirt, or replace overrunning clutch. Replace overrunning clutch and idler gear.
	Ring Gear.	Excessively worn teeth.	Replace ring gear.
Starter does not stop running.	Solenoid.	Return spring worn. Coil layer shorted. Contact plate melted and stuck.	Replace solenoid. Replace solenoid. Replace solenoid.
	Starting Switch or Starter Relay.	Unopened contacts. Poor returning.	Replace starting switch or starter relay. Replace starting switch or starter relay.

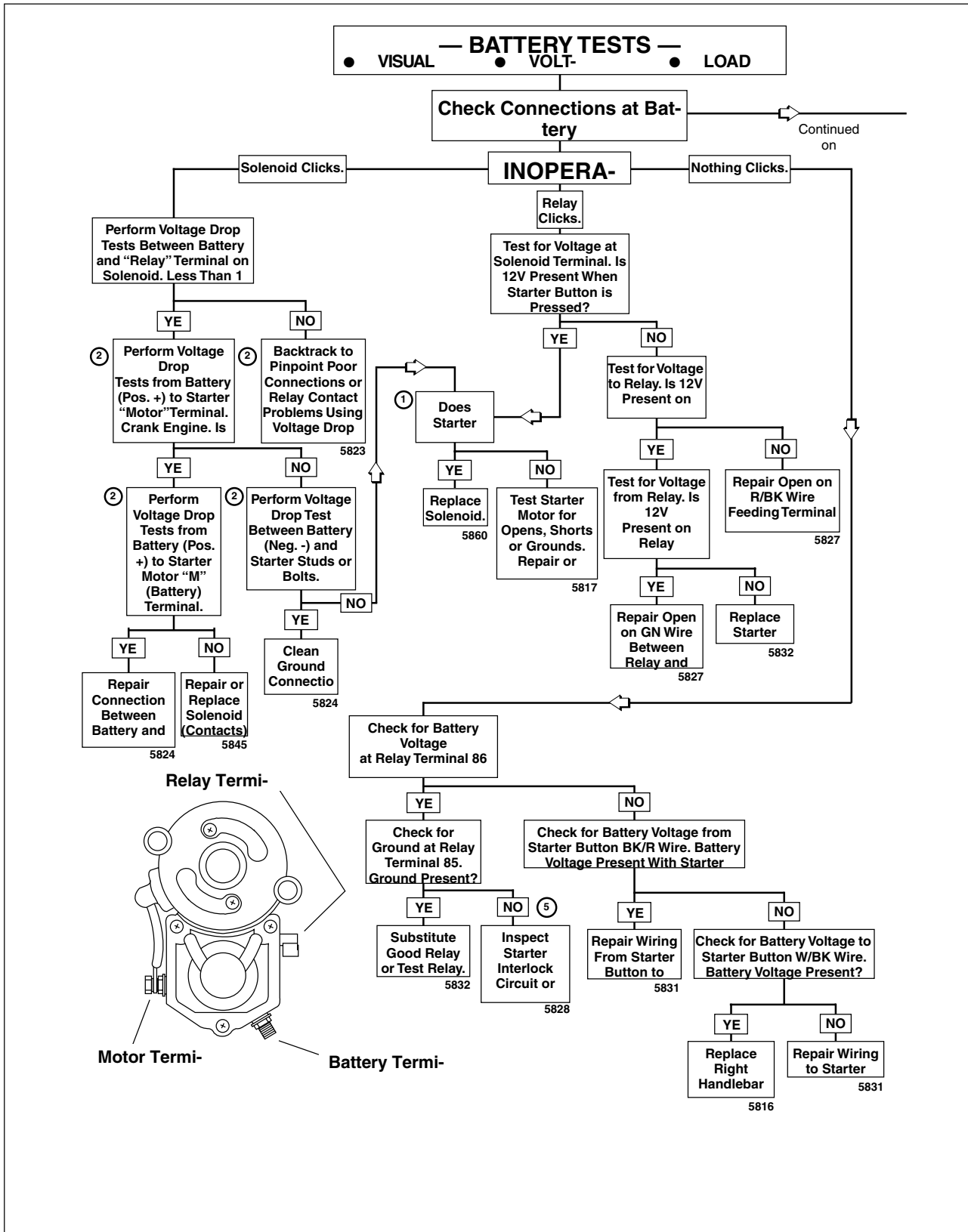


Figure 5-2. Starting System Diagnosis, Part 1

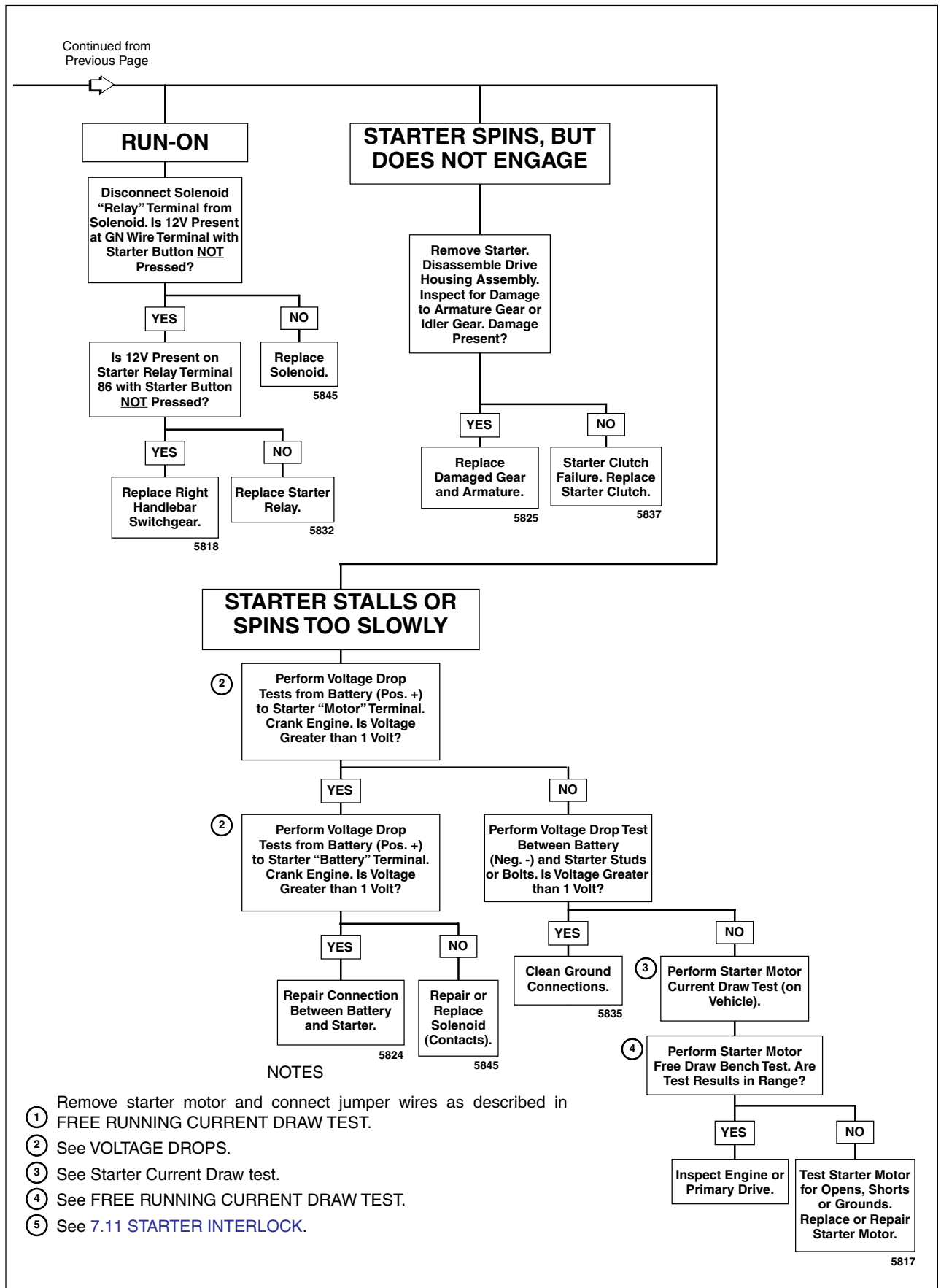


Figure 5-3. Starting System Diagnosis, Part 2

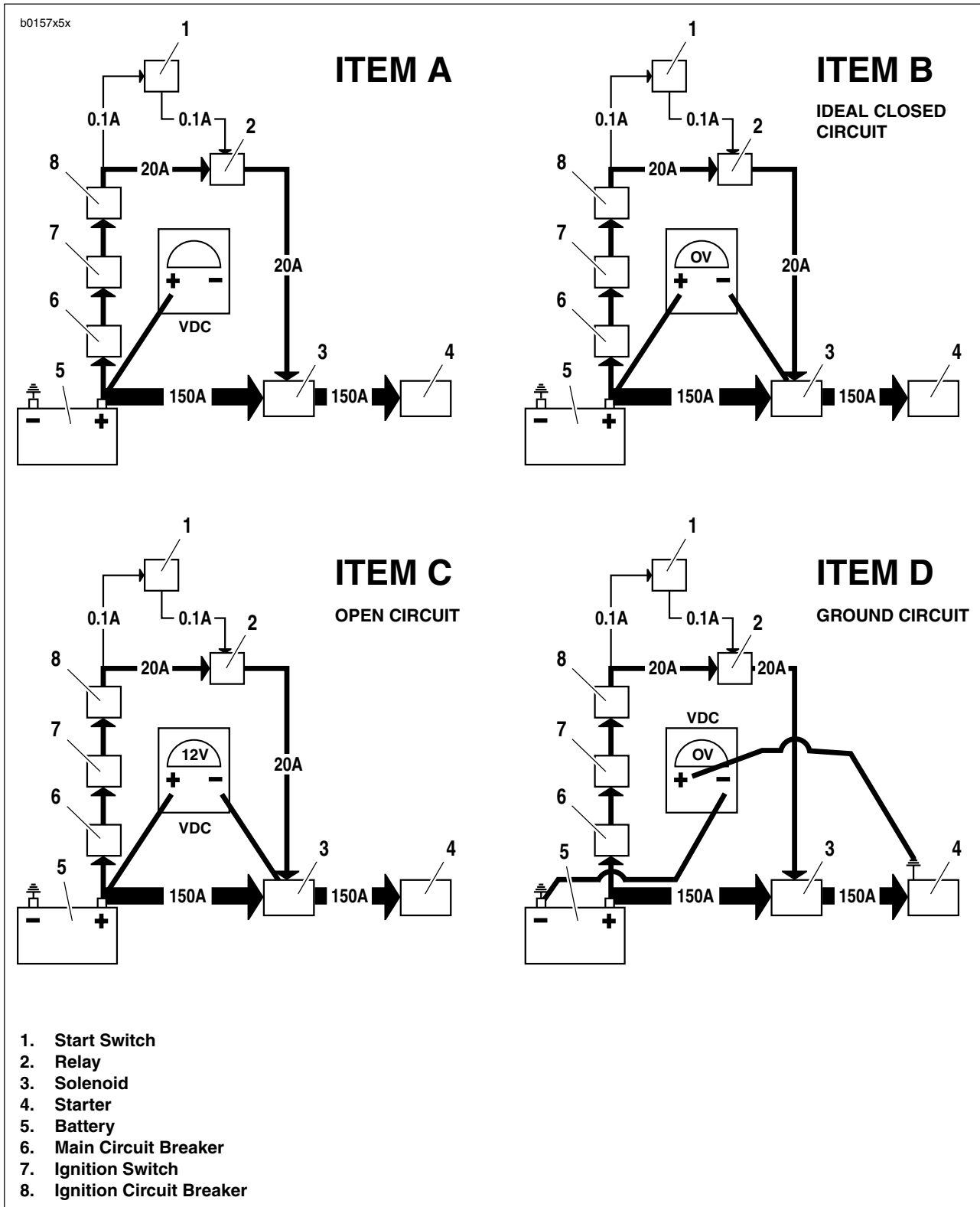


Figure 5-4. Typical Circuitry. Refer to wiring diagrams for more information.

GENERAL

The troubleshooting table beginning on [page 5-4](#) contains detailed procedures to solve and correct problems. Follow the [5.3 STARTING SYSTEM DIAGNOSIS](#) diagram to diagnose starting system problems. The [VOLTAGE DROPS](#) procedure below will help you to locate poor connections or components with excessive voltage drops.

VOLTAGE DROPS

Check the integrity of all wiring, switches, circuit breakers and connectors between the source and destination.

The voltage drop test measures the difference in potential or the actual voltage dropped between the source and destination.

1. See [ITEM A](#) in [Figure 5-4](#). Attach your red meter lead to the most positive part of the circuit, which in this case would be the positive post of the battery (5).
2. See [ITEM B](#) in [Figure 5-4](#). Attach the black meter lead to the final destination or component in the circuit (solenoid terminal from relay).
3. Activate the starter and observe the meter reading. The meter will read the voltage dropped or the difference in potential between the source and destination.
4. An ideal circuit's voltage drop would be 0 volts or no voltage dropped, meaning no difference in potential.
5. See [ITEM C](#) in [Figure 5-4](#). An open circuit should read 12 volts, displaying all the voltage dropped, and the entire difference in potential displayed on the meter.
6. Typically, a good circuit will drop less than 1 volt.
7. If the voltage drop is greater, back track through the connections until the source of the potential difference is found.

The benefit of doing it this way is speed.

- a. Readings aren't as sensitive to real battery voltage.
 - b. Readings show the actual voltage dropped, not just the presence of voltage.
 - c. This tests the system as it is actually being used. It is more accurate and will display hard to find poor connections.
 - d. This approach can be used on lighting circuits, ignition circuits, etc. Start from most positive and go to most negative (the destination or component).
8. See [ITEM D](#) in [Figure 5-4](#). The negative or ground circuit can be checked as well.
 - a. Place the negative lead on the most negative part of the circuit (or the negative battery post). Remember, there is nothing more negative than the negative post of the battery.
 - b. Place the positive lead to the ground you wish to check.
 - c. Activate the circuit. This will allow you to read the potential difference or voltage dropped on the negative or ground circuit. This technique is very effective for identifying poor grounds due to powdered paint. Even the slightest connection may cause an ohmmeter to give a good reading. However, when sufficient current is passed through, the resistance caused by the powdered paint will cause a voltage drop or potential difference in the ground circuit.

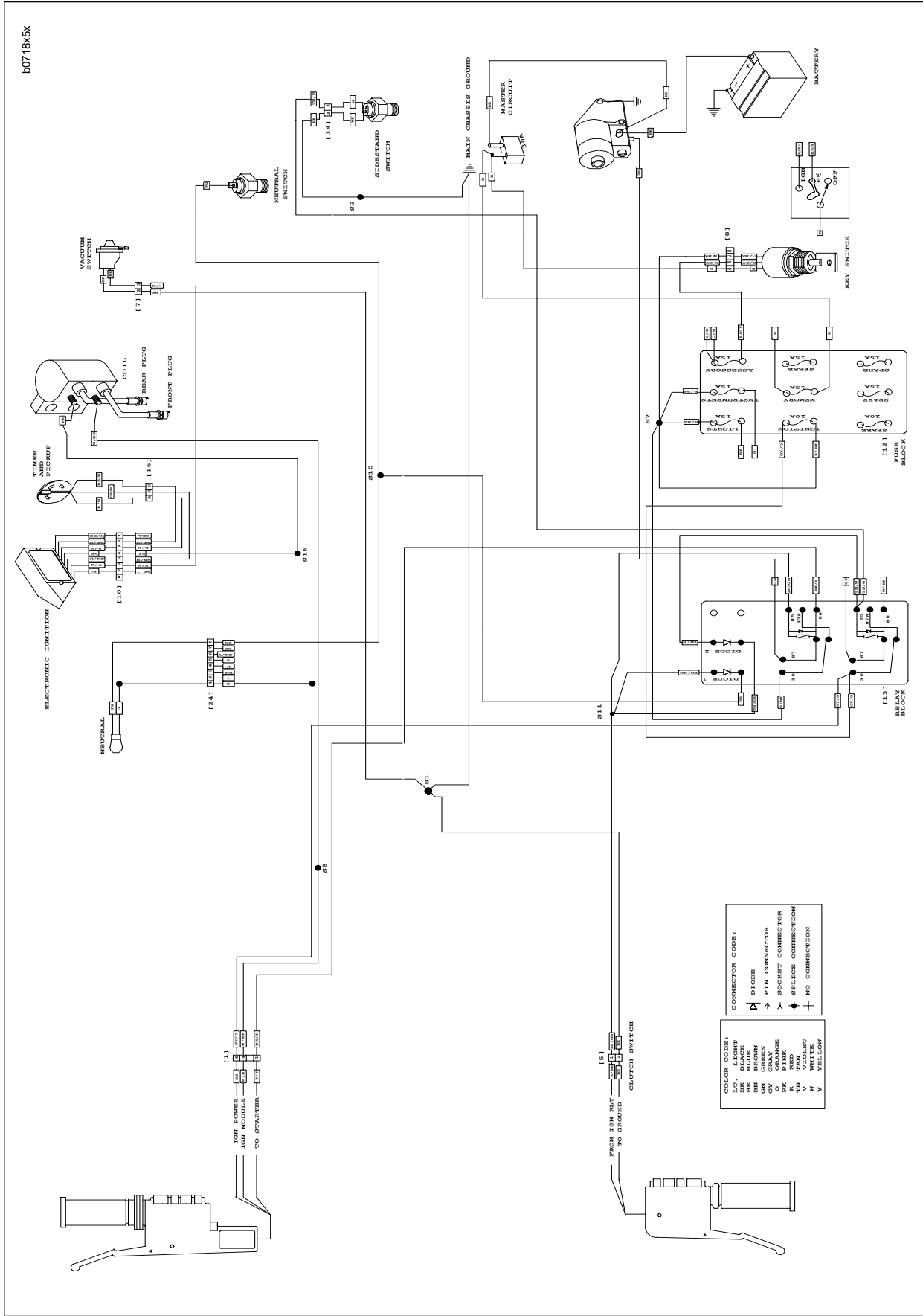


Figure 5-5. Electric Starting System Circuit (Typical)

“ON-MOTORCYCLE” TESTS

Starter Relay Test

1. See [Figure 5-6](#). Locate starter relay (2). The relay is in relay block which is located on right side under tail section. Remove seat and tail section. See [2.34 TAIL SECTION](#)
2. See [Figure 5-6](#). Unplug relay from relay block.
3. To test relay, proceed to Step 4. If installing a **new** starter relay, remove old relay. Plug **new** relay into relay block.
4. See [Figure 5-7](#). Obtain a 12 volt battery and a continuity tester or ohmmeter.
 - a. Connect positive battery lead to the 86 terminal.
 - b. Connect negative battery lead to the 85 terminal to energize relay.
 - c. Check for continuity between the 30 and 87 terminals. A good relay shows continuity (continuity tester lamp “on” or a zero ohm reading on the ohmmeter). A malfunctioning relay will not show continuity and must be replaced.
5. If starter relay is functioning properly, proceed to [STARTER CURRENT DRAW TEST](#).
6. Replace tail section and seat. See [2.34 TAIL SECTION](#).

Starter Current Draw Test

NOTE

- *Engine temperature should be stable and at room temperature.*
- *Battery should be fully charged.*

See [Figure 5-8](#). Check starter current draw with an induction ammeter before disconnecting battery. Proceed as follows:

1. Verify that transmission is in neutral. Disconnect spark plug wires from spark plug terminals.
2. Clamp induction ammeter over positive battery cable next to starter.
3. With ignition key switch ON, turn engine over by pressing starter switch while taking a reading on the ammeter.

Disregard initial high current reading which is normal when engine is first turned over.

- a. Typical starter current draw will range between 140-180 amperes.
- b. If starter current draw exceeds 180 amperes, then the problem may be in the starter or starter drive. Remove starter for further tests. See [5.7 STARTER](#).

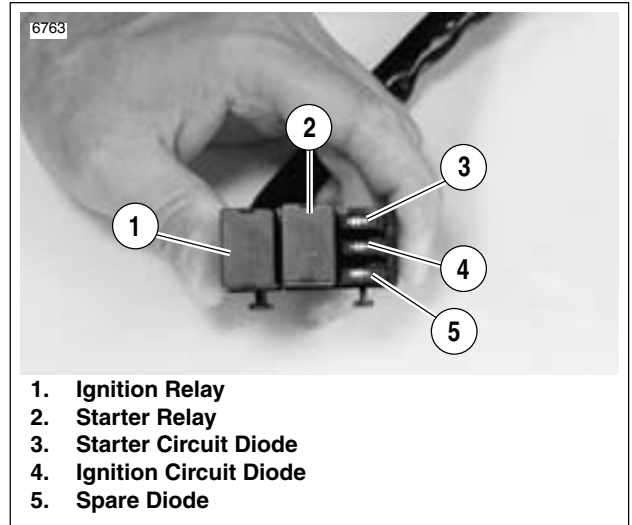


Figure 5-6. Starter Relay Location

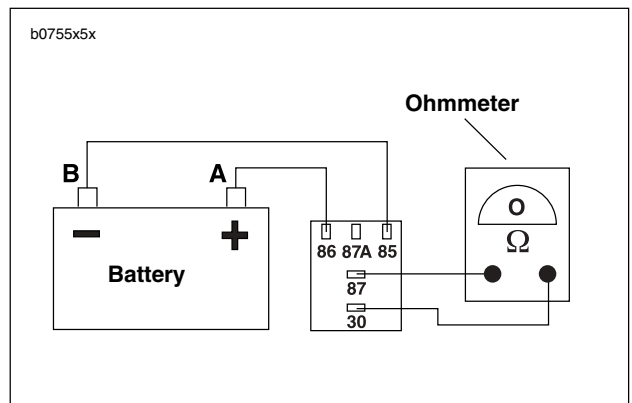


Figure 5-7. Starter Relay Test

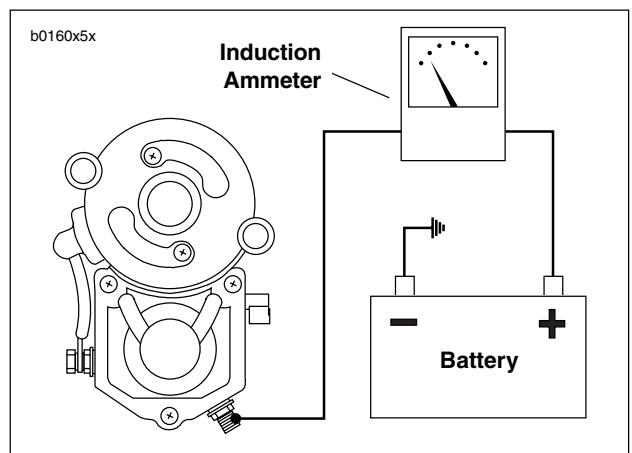


Figure 5-8. Starter Draw Test

REMOVAL

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect the negative battery cable from the battery.
2. Remove primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).
3. See [Figure 5-9](#). Remove both starter mounting bolts and washers (1).

NOTE

A ball hex driver may be required to gain access to the starter mounting bolts.

4. See [Figure 5-10](#). Remove nut with washer (1) (metric).
 - a. Remove protective boot.
 - b. Remove positive battery cable ring terminal (2).
 - c. Remove circuit breaker wire ring terminal (3).
 - d. Detach solenoid wire.
5. Remove starter and gasket from the gearcase cover side.

TESTING ASSEMBLED STARTER

Free Running Current Draw Test

1. Place starter in vise, using a clean shop towel to prevent scratches or other damage.
2. See [Figure 5-11](#). Attach one heavy jumper cable (6 gauge minimum).
 - a. To the starter mounting flange (1).
 - b. To the negative (-) terminal of a fully charged battery.
3. Connect a second heavy jumper cable (6 gauge minimum).
 - a. To the positive (+) terminal of the battery (2).
 - b. To an inductive ammeter (3). Continue on to the battery terminal (4) on the starter solenoid.
4. Connect a smaller jumper cable (14 gauge minimum).
 - a. To the positive (+) terminal of the battery (2).
 - b. To the solenoid relay terminal (5).
5. Check ammeter reading.
 - a. Ammeter should show 90 amps maximum.
 - b. If reading is higher, disassemble starter for inspection. See [DISASSEMBLY, INSPECTION AND REPAIR](#).

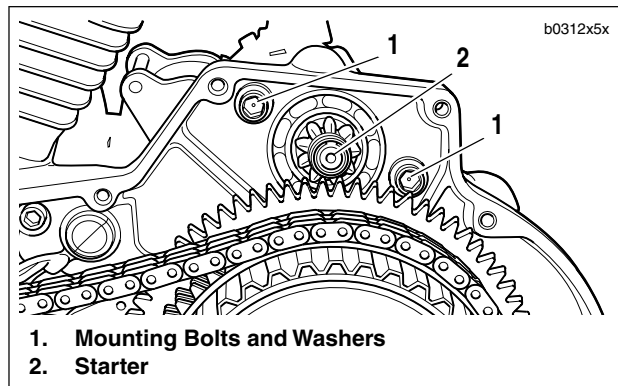


Figure 5-9. Starter Mounting

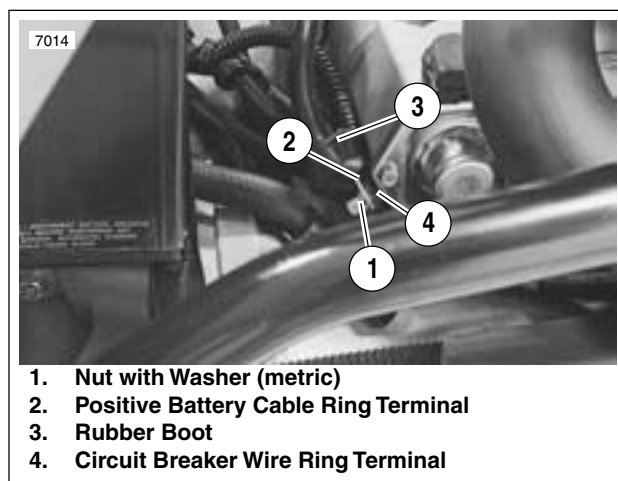


Figure 5-10. Starter Wires

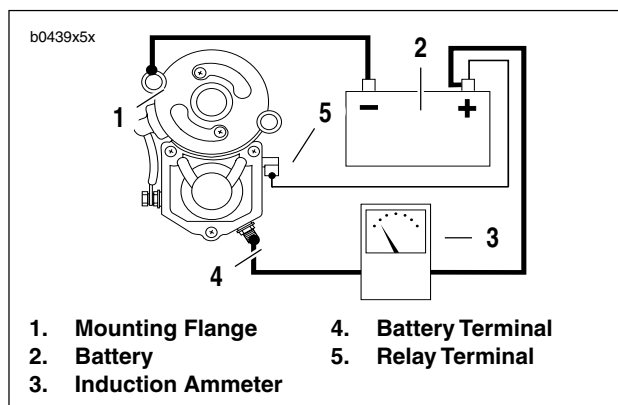


Figure 5-11. Free Running Current Draw Test

- c. If starter current draw on vehicle was over 200 amps and this test was within specification, there may be a problem with engine or primary drive.

Starter Solenoid

NOTE

Do not disassemble solenoid. Before testing, disconnect field wire from motor terminal as shown in Figure 5-12.

CAUTION

Each test should be performed for only 3-5 seconds to prevent damage to solenoid.

NOTE

The solenoid Pull-in, Hold-in, and Return tests must be performed together in one continuous operation. Conduct all three tests one after the other in the sequence given without interruption.

Solenoid Pull-in Test

- See Figure 5-12. Using a 12 volt battery, connect three separate test leads as follows:
 - Solenoid housing to negative battery post.
 - Solenoid motor terminal to negative battery post.
 - Solenoid relay terminal to positive battery post.
- Observe starter pinion.
 - If starter pinion pulls in strongly, solenoid is working properly.
 - If starter pinion does not pull in, replace the solenoid.

Solenoid Hold-in Test

- See Figure 5-13. With test leads still connected in the manner specified in the previous **SOLENOID PULL-IN TEST**, **disconnect solenoid motor terminal/battery negative test lead (B) at negative battery post only; reconnect loose end of this test lead to positive battery post instead.**
- Observe starter pinion.
 - If starter pinion remains in pull-in position, solenoid is working properly.
 - If starter pinion does not remain in pull-in position, replace the solenoid.

Solenoid Return Test

- See Figure 5-14. With test leads still connected in the manner specified at the end of the previous **SOLENOID HOLD-IN TEST**, **disconnect solenoid relay terminal/positive battery post test lead (C) at either end.**
- Observe starter pinion.
 - If starter pinion returns to its original position, solenoid is working properly.
 - If starter pinion does not return to its original position, replace the solenoid.

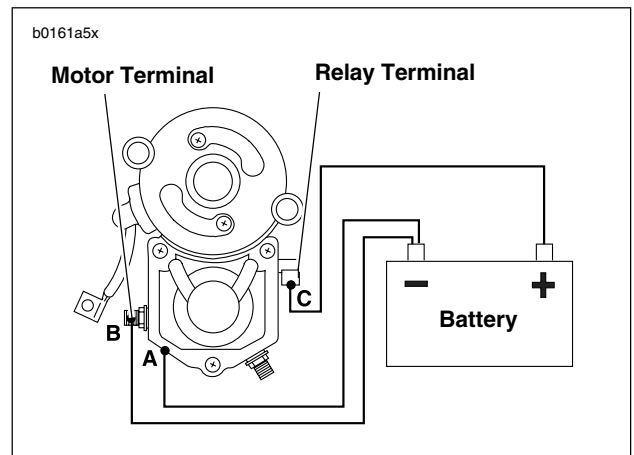


Figure 5-12. Pull-In Test

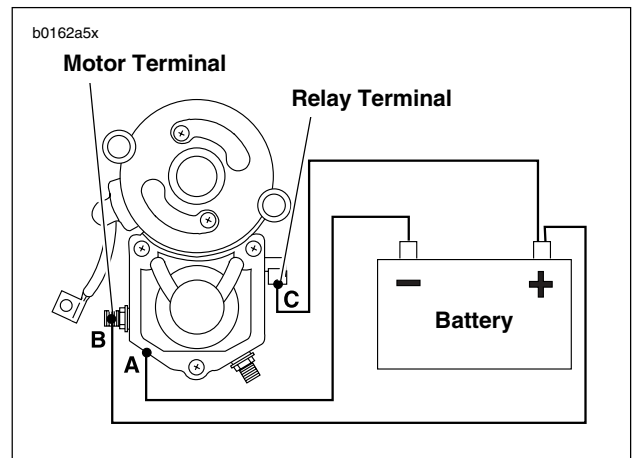


Figure 5-13. Hold-In Test

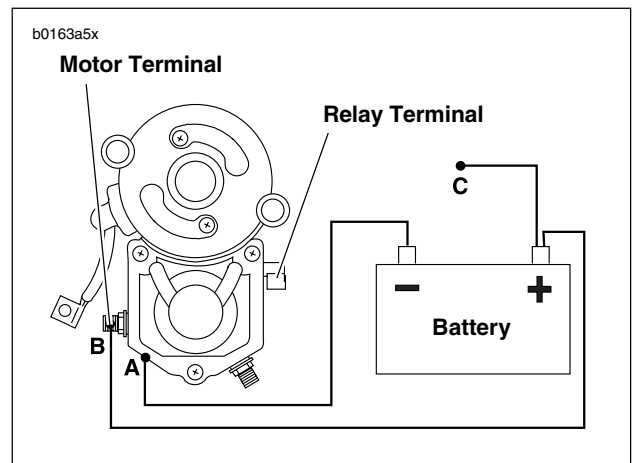


Figure 5-14. Return Test

DISASSEMBLY, INSPECTION AND REPAIR

1. See [Figure 5-15](#). Lift rubber boot (1). Remove field wire nut with washer (2) (metric) to detach field wire (3).
2. See [Figure 5-16](#). Remove both thru-bolts (1, 3).
3. Remove both end cover screws with O-rings (2) and end cover (4).
4. See [Figure 5-17](#). Use a wire hook to pull upward on brush springs (3), and lift brushes out of holder (2). Remove brush holder.
5. Check brush length. Replace all four brushes if length of any one brush is less than 0.433 in. (11.0 mm).

NOTE

Brushes not available separately. Purchase a **new** field frame (1) and brush holder (2) to replace brushes.

6. Remove armature (4) and field frame (1).
7. Place armature in lathe or truing stand and check commutator runout and diameter.
 - a. Commutators with more than 0.016 in. (0.406 mm) of runout should be replaced or machined on a lathe.
 - b. Replace commutators when diameter is less than 1.141 in. (28.981 mm)
 - c. Check armature bearings. Replace if necessary.

CAUTION

Do not use sandpaper or emery cloth to remove burrs on commutator. Otherwise, abrasive grit may remain on commutator segments; this could lead to excessive brush wear. Use only the recommended crocus cloth.

8. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.203 mm), use an undercutting machine to undercut the mica to 0.0313 in. (0.794 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

See [Figure 5-18](#). If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the commutator with crocus cloth to remove any burrs.

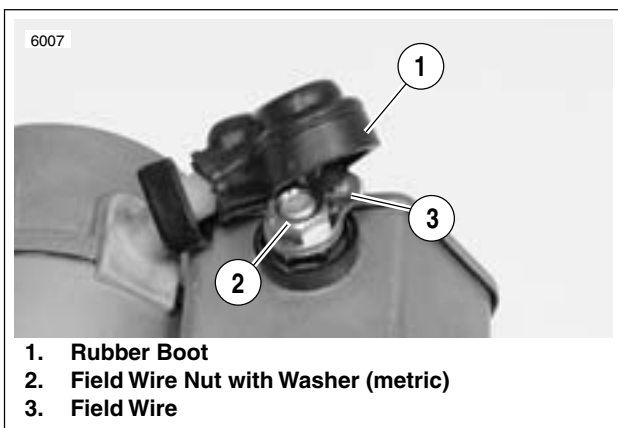
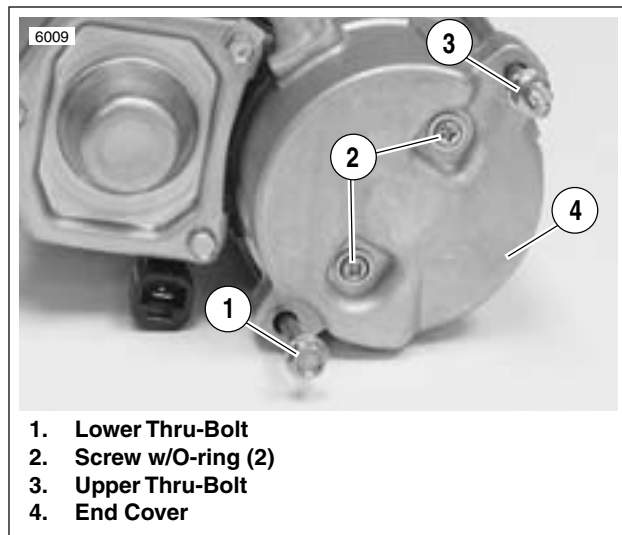
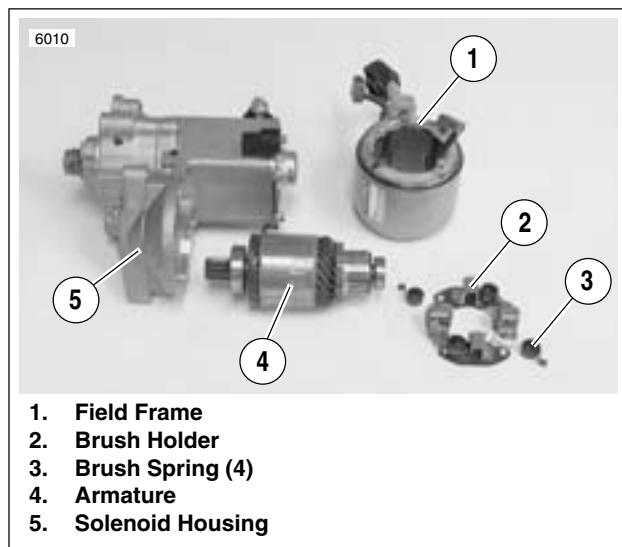


Figure 5-15. Field Wire



1. Lower Thru-Bolt
2. Screw w/O-ring (2)
3. Upper Thru-Bolt
4. End Cover

Figure 5-16. Removing the Thru-Bolts



1. Field Frame
2. Brush Holder
3. Brush Spring (4)
4. Armature
5. Solenoid Housing

Figure 5-17. Starter Components

9. See [Figure 5-19](#). Check for SHORTED ARMATURE with a growler.
 - a. Place armature on growler (1).
 - b. Hold a thin steel strip (2) (hacksaw blade) against armature core and slowly turn armature.
 - c. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Replace shorted armatures.
10. See [Figure 5-20](#). Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester.
 - a. Touch one probe to any commutator segment (1).
 - b. Touch the other probe to the armature core (2).
 - c. There should be no continuity (infinite ohms). If there is continuity, then the armature is grounded. Replace grounded armatures.

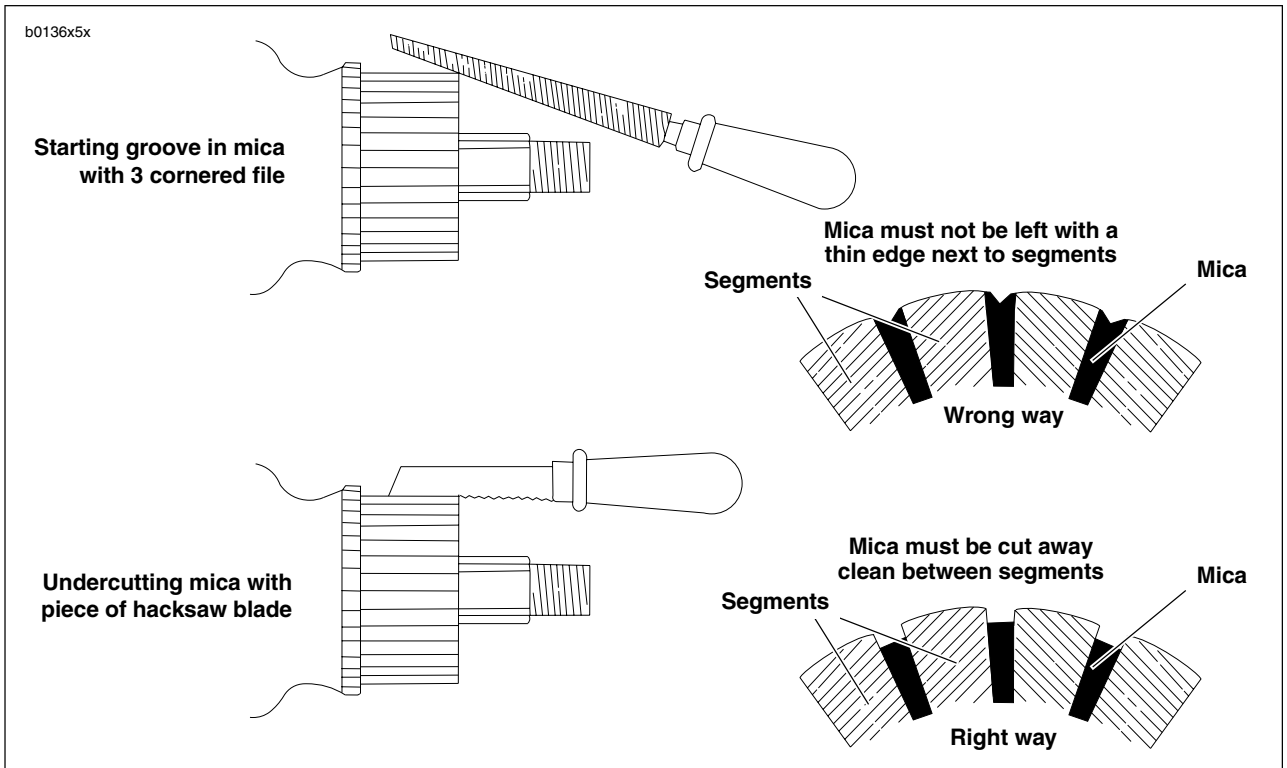


Figure 5-18. Undercutting Mica Separators

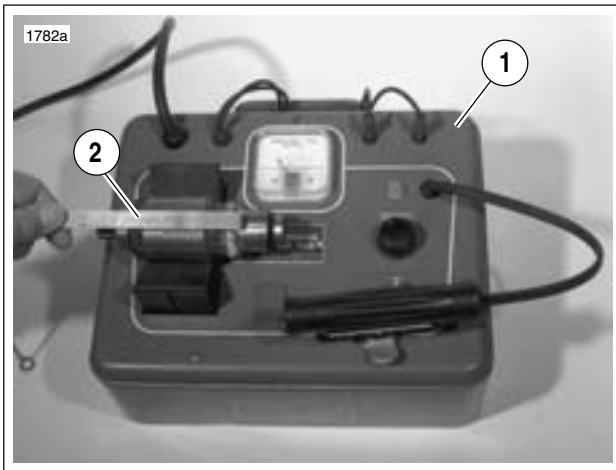


Figure 5-19. Shorted Armature Test Using Growler

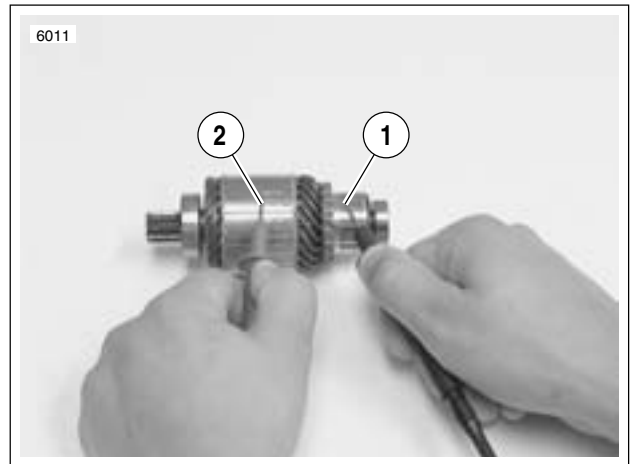


Figure 5-20. Grounded Armature Test

11. See [Figure 5-21](#). Check for OPEN ARMATURE with an ohmmeter or continuity tester.
- Check for continuity between all commutator segments (1).
 - There should be continuity (0 ohms) at all test points. No continuity at any test point indicates armature is open and must be replaced.

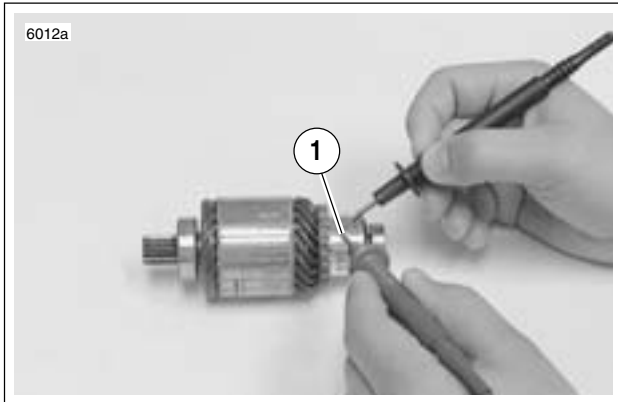


Figure 5-21. Open Armature Test

12. See [Figure 5-22](#). Check for GROUNDED FIELD COIL with an ohmmeter or continuity tester.
- Touch one probe to the frame (1).
 - Touch the other probe to each of the brushes (2) attached to the field coil.
 - There should be no continuity (infinite ohms). If there is any continuity at either brush, then the field coil(s) are grounded and the field frame must be replaced.
13. See [Figure 5-23](#). Check for OPEN FIELD COILS with an ohmmeter or continuity tester.
- Touch one probe to the field wire (1).
 - Touch the other probe to each of the brushes attached to the field coil(s) (2).
 - There should be continuity (0 ohms). If there is no continuity at either brush, then the field coil(s) are open and the field frame must be replaced.
14. See [Figure 5-24](#). Test BRUSH HOLDER INSULATION with an ohmmeter or continuity tester.
- Touch one probe to holder plate (1).
 - Touch the other probe to each of the positive (insulated) brush holders (2).
 - There should be no continuity (infinite ohms). If there is continuity at either brush holder, replace the brush holder assembly.

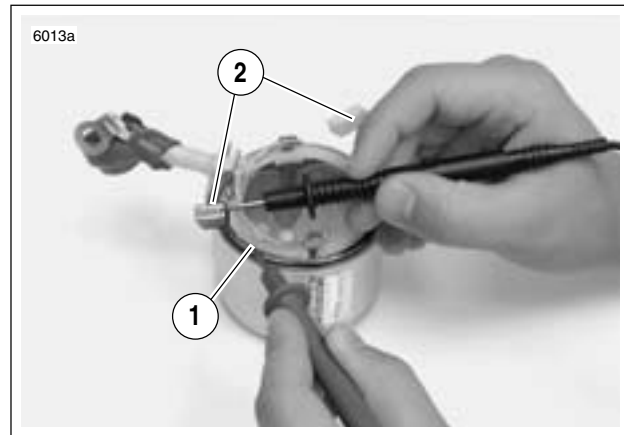


Figure 5-22. Grounded Field Test

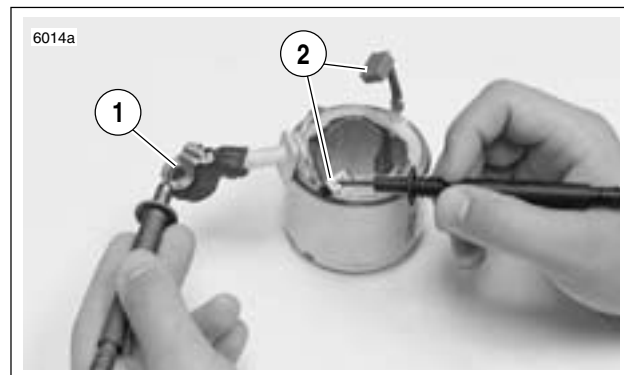


Figure 5-23. Open Field Test

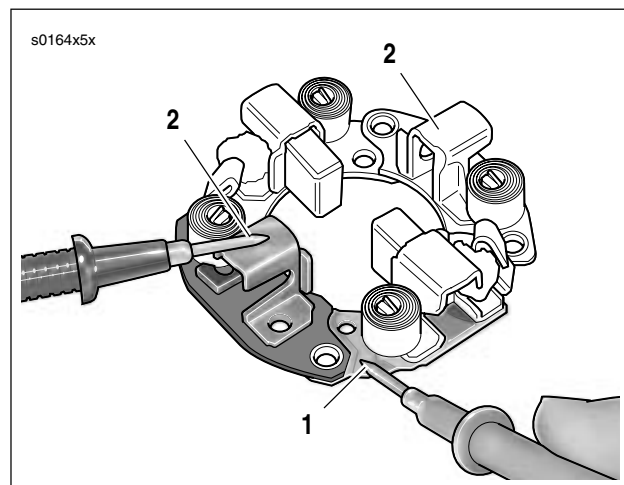


Figure 5-24. Brush Holder Insulation Test

15. See [Figure 5-25](#). Remove two drive housing mounting screws (6). Remove drive housing (5) from solenoid housing.
16. Remove drive (1), idler gear (2), idler gear bearing (3), and O-ring (4) from drive housing (O-ring is located in drive housing groove).

ASSEMBLY

1. See [Figure 5-25](#). Clean, inspect and lubricate drive assembly components. Lubricate parts with high temperature grease, such as LUBRIPLATE 110.
2. See [Figure 5-26](#). When installing drive assembly components, open end of idler bearing cage (15) faces toward solenoid.
3. When installing drive housing (10) to solenoid housing (11), use **new** O-ring (16). Be sure to install return spring (17) and ball (18).

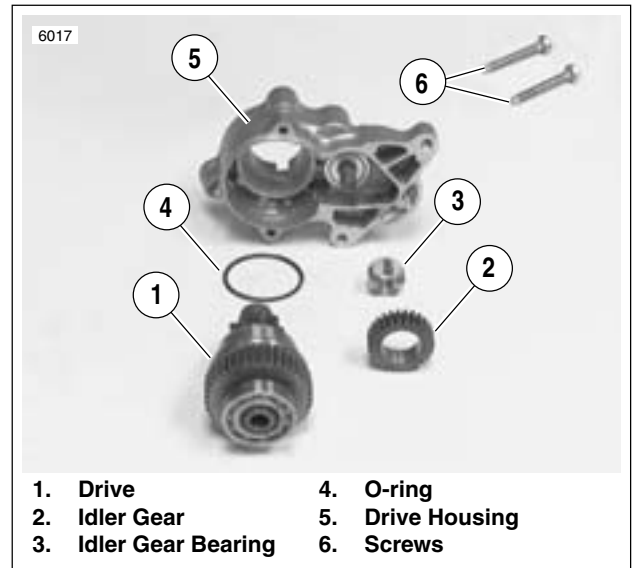


Figure 5-25. Starter Drive Assembly

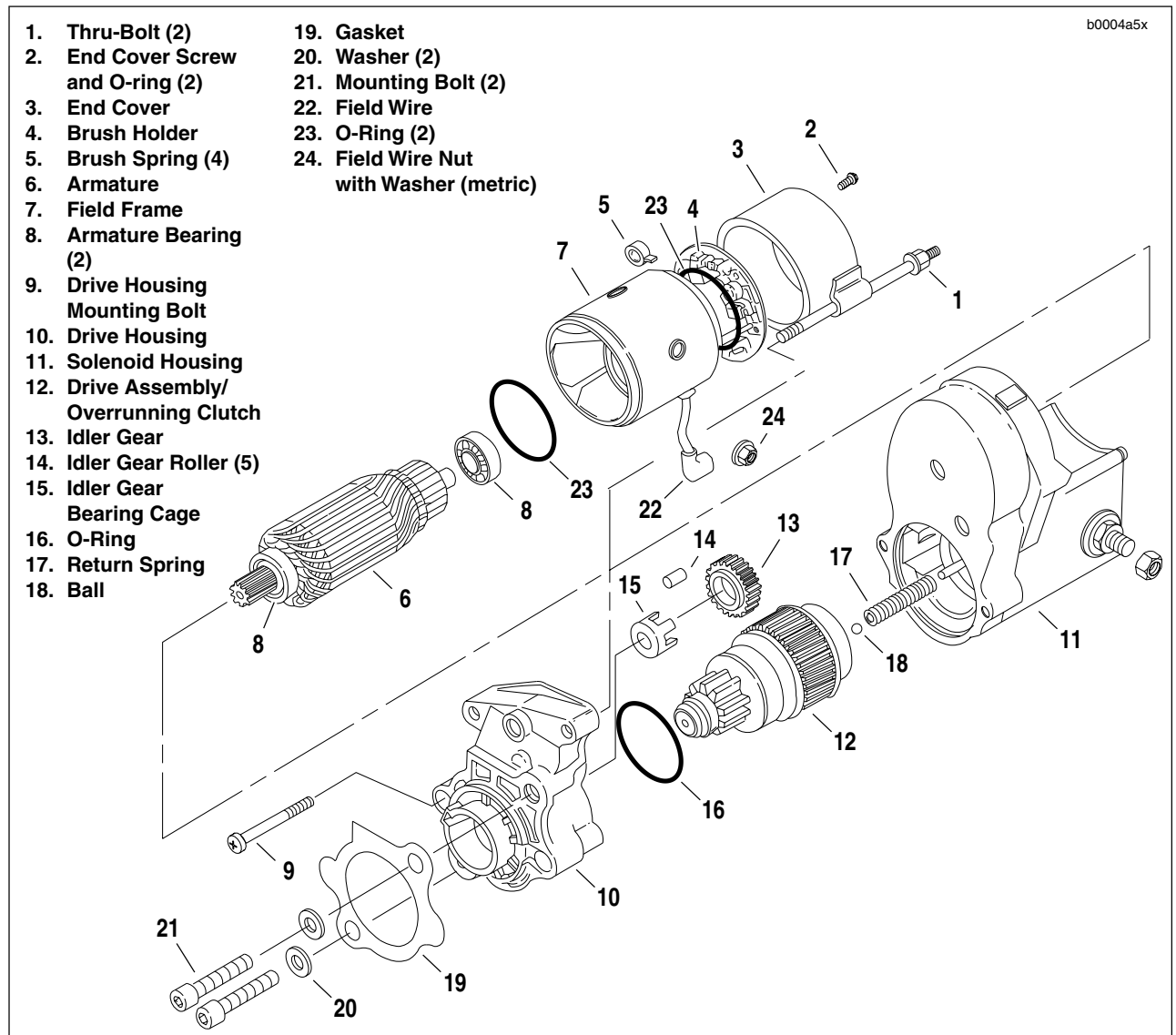


Figure 5-26. Starter Assembly

HOME

4. Lubricate armature bearings (8) with high temperature grease, such as LUBRIPLATE 110. Install armature (6) and field frame (7) to solenoid housing (11).
5. Install brushes and brush holder (4).
6. Install O-rings (23). Attach end cover (3) with end cover screws and O-rings (2).
7. Install thru-bolts (1).
8. Attach field wire (22) to solenoid housing (11) with field wire nut and washer (24) (metric). Replace rubber boot.

INSTALLATION

1. Install starter and starter gasket from the gearcase cover side.
2. See [Figure 5-10](#). Connect wiring to starter.
 - a. Connect solenoid wire.
 - b. Attach circuit breaker wire ring terminal (3).
 - c. Attach positive battery cable ring terminal (2).
 - d. Install nut with washer (1) (metric). Tighten to 60-85 **in-lbs** (7-10 Nm).
 - e. Replace protective boot (4).
3. See [Figure 5-9](#). Install both starter mounting bolts and washers. Tighten to 13-20 ft-lbs (18-27 Nm).
4. Install primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).
5. Fill transmission to proper level with fresh lubricant. See [1.8 CLUTCH](#).
6. Connect negative battery cable to battery. Tighten terminal hardware to 60-96 **in-lbs** (7-11 Nm).

GENERAL

CAUTION

See [Figure 5-27](#). Do not tighten nut (7) without removing items 1-5. Movement will cause damage to the contact.

The starter solenoid is a switch that is designed to open and close the starting circuit electromagnetically. The switch consists of contacts and a winding around a hollow cylinder containing a movable plunger.

DISASSEMBLY

1. See [Figure 5-27](#). Remove screws (1) and clip (2).
2. Remove cover (3) and gasket (4). Discard gasket.
3. Remove plunger (5) from solenoid housing (6).

ASSEMBLY

1. See [Figure 5-27](#). Replace wire connection hardware as necessary.
2. Install plunger (5) in solenoid housing (6).
3. Install **new** gasket (4) onto cover (3).
4. Position cover with gasket onto solenoid housing. Install clip (2) and screws (1).

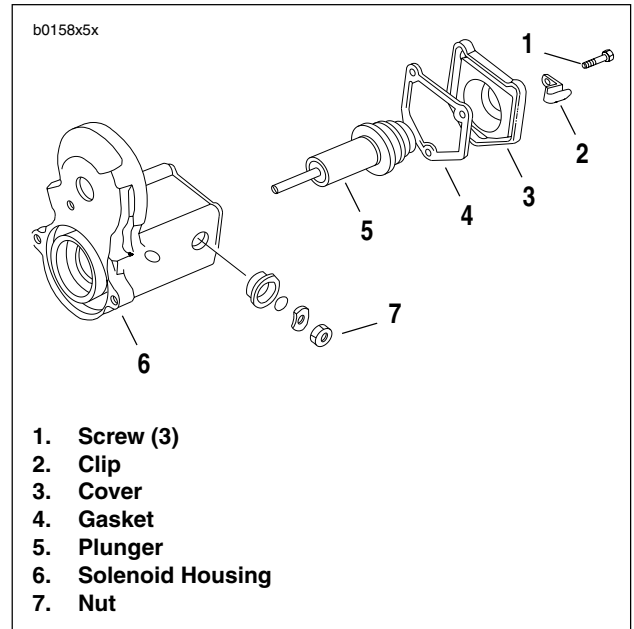


Figure 5-27. Starter Solenoid

NOTES

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TRANSMISSION		
Transmission Type	5 forward speeds, foot shift	
Clutch Type	Wet – multiple disc	
Clutch Fluid Capacity	1.0 quart	0.95 liter
Fluid Part No.-Quart	98854-96	
Fluid Part No.-Gallon	98855-96	

TRANSMISSION GEAR RATIOS	FINAL*	OVERALL**
First (low) Gear	2.69	9.717
Second Gear	1.85	6.687
Third Gear	1.43	5.180
Fourth Gear	1.18	4.269
Fifth (high) Gear	1.00	3.615

*Final gear ratios indicate number of mainshaft revolutions required to drive output sprocket one revolution.

**Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

PRIMARY DRIVE (ENGINE-TO-TRANSMISSION)	
Engine Sprocket	35 teeth
Clutch Sprocket	56 teeth
Ratio	1.60: 1

FINAL DRIVE (TRANSMISSION-TO-REAR WHEEL)	
Transmission Sprocket	27 teeth
Rear Wheel Sprocket	61 teeth
Secondary Drive Belt	128 teeth
Ratio	2.26:1

CLUTCH PLATE THICKNESS	NUMBER REQUIRED	NEW COMPONENTS		SERVICE WEAR LIMITS	
		IN.	MM	IN.	MM
Friction Plate (fiber)	8	0.0866 + 0.0031	2.1996 + 0.0787	0.006	0.152
Steel Plate	6	0.0629 + 0.0020	1.5977 + 0.0508	0.006	0.152
Clutch Pack				0.661 minimum	16.789 minimum

NOTE

Service wear limits are given as a guideline for measuring components that are not **new**. For measurement specifications not given under SERVICE WEAR LIMITS, see NEW COMPONENTS.

TORQUE VALUES

ITEM	TORQUE		NOTES
Access door mounting bolts	13-17 ft-lbs	18-23 Nm	LOCTITE THREADLOCKER 243 (blue), page 6-33
Clutch inspection cover TORX screws with washers	7-9 ft-lbs	10-12 Nm	page 6-3
Clutch mainshaft nut	70-80 ft-lbs	95-109 Nm	LOCTITE THREADLOCKER 262 (red), left hand threads, page 6-15
Countershaft retainer TORX screw	13-17 ft-lbs	18-23 Nm	LOCTITE THREADLOCKER 243 (blue), page 6-28
Engine sprocket nut	190-210 ft-lbs	258-285 Nm	LOCTITE THREADLOCKER 262 (red), page 6-15
Primary chain adjuster locknut	10-12 ft-lbs	14-16 Nm	on interior of chaincase, page 6-4
Primary chain adjuster locknut	20-25 ft-lbs	27-34 Nm	on exterior of chaincase, page 6-4
Primary chain inspection cover screws	40-60 in-lbs	5-7 Nm	page 6-3
Primary cover screws	100-120 in-lbs	11-14 Nm	3 lengths, page 6-5
Large primary cover screws	16-28 ft-lbs	22-38 Nm	page 6-5
Shifter Lever Mounting Bolt	27-29 in-lbs	37-39 Nm	page 6-5
Shifter Lever Pinch Screws	59-66 in-lbs	7-8 Nm	page 6-5
Shifter shaft assembly locknuts	90-110 in-lbs	10-12 Nm	bottom nut first, same torque for top, page 6-33
Transmission detent plate nut	13-17 ft-lbs	18-23 Nm	page 6-21
Transmission drain plug	14-30 ft-lbs	19-41 Nm	remove debris from end, page 6-5
Transmission sprocket nut	See note	See note	LOCTITE THREADLOCKER 262 (red), left hand threads, special torque turn method, page 6-34
Transmission sprocket screws	90-110 in-lbs	10-12 Nm	replace after 3 removals, page 6-35

GENERAL

An opening between the primary drive and transmission compartments allows the same lubricant supply to lubricate moving parts in both compartments.

Since the primary chain runs in lubricant, little service will be required other than checking lubricant level and chain tension. If, through hard usage, the primary chain does become worn, it must be replaced. Remove and install the chain following the procedure under 6.5 PRIMARY DRIVE/CLUTCH.

ADJUSTMENT/LUBRICATION

See 1.11 PRIMARY CHAIN for inspection and adjustment procedures.

See 1.8 CLUTCH for complete lubrication service on the primary chain.

REMOVAL

Primary Cover

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Remove negative battery cable from battery.
2. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
3. Remove muffler. See 2.28 EXHAUST SYSTEM.
4. See Figure 6-1. Place a drain pan under the engine. Remove drain plug (9) and drain lubricant from primary drive.
5. See Figure 6-5. Carefully remove lower shifter lever mounting bolt, washer, plastic bushings and spacer.
6. Mark orientation of upper clamp opening on splined shaft and remove pinch screw and shift lever assembly. Remove rubber washer from splined shaft.

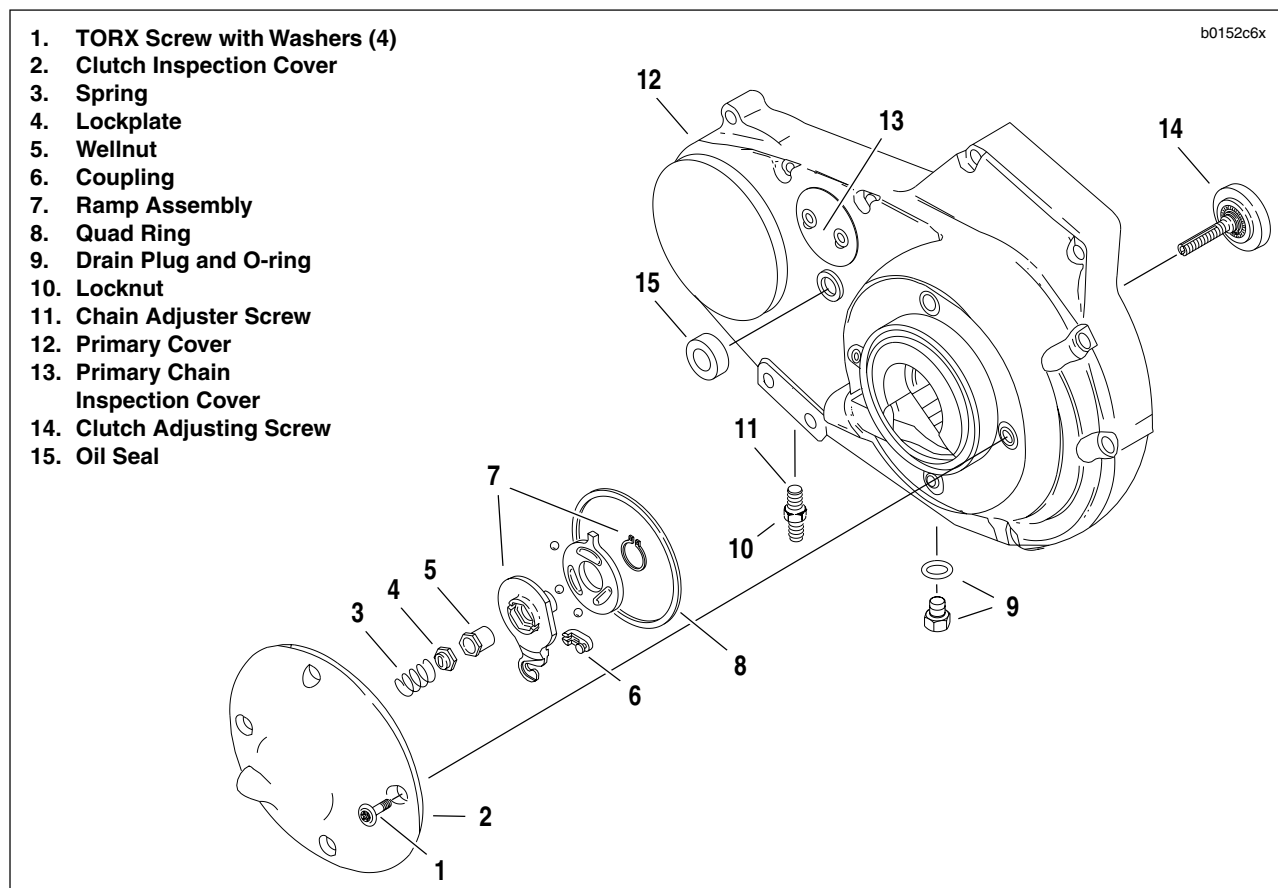


Figure 6-1. Primary Cover

7. Add freeplay to clutch cable. See [1.8 CLUTCH](#).
8. Loosen locknut (10). Turn chain adjuster screw (11) counterclockwise (outward) to relax primary chain tension.
9. Remove four TORX screws with washers (1) and clutch inspection cover (2). Remove and discard Quad ring (8) from groove in primary cover.
10. Slide spring (3) with attached hex lockplate (4) from flats of clutch adjusting screw (14).
11. Turn clutch adjusting screw (14) clockwise to release ramp and coupling mechanism. As the adjusting screw is turned, ramp assembly (7) moves forward. Unscrew well-nut (5) from end of adjusting screw.
12. Remove hook of ramp from button to the rear of cable end coupling (6). Remove cable end from slot in coupling. Remove coupling and ramp assembly.
13. Remove screws which secure primary cover. Remove cover and gasket. Discard gasket.
14. Remove and discard shifter lever oil seal (15).

Primary Chain Adjuster

1. See [Figure 6-2](#). Remove primary cover (1).
2. Remove locknut (2) from chain adjuster screw (3). Turn adjuster screw out of threaded boss in primary cover.
3. Slide shoe (6) off plate (5) (shoe must be slid off plate toward closed or blind side of shoe). Remove locknut (4) and plate (5).

INSTALLATION

Primary Chain Adjuster

1. See [Figure 6-3](#). If shoe (6) is badly worn, replace it or adjust assembly.
2. Install plate (5) over top of chain adjuster screw (3). Place spacer (7) over top of adjuster screw next to plate. Secure plate and spacer to adjuster screw by threading on locknut (4). Tighten locknut to 15-18 ft-lbs (20-24 Nm).
3. Place plate into slots at open end of shoe (6). Slide shoe over plate until locknut at top end of adjuster screw is against closed (blind) side of shoe.
4. Position adjuster inside primary cover (1) with closed side of shoe against cover. Thread adjuster screw into tapped boss at bottom of primary cover. At outside of cover, install locknut (2) onto adjuster screw with nylon sealing surface toward cover. Tighten to 20-25 ft-lbs (27-34 Nm).
5. Install primary cover.

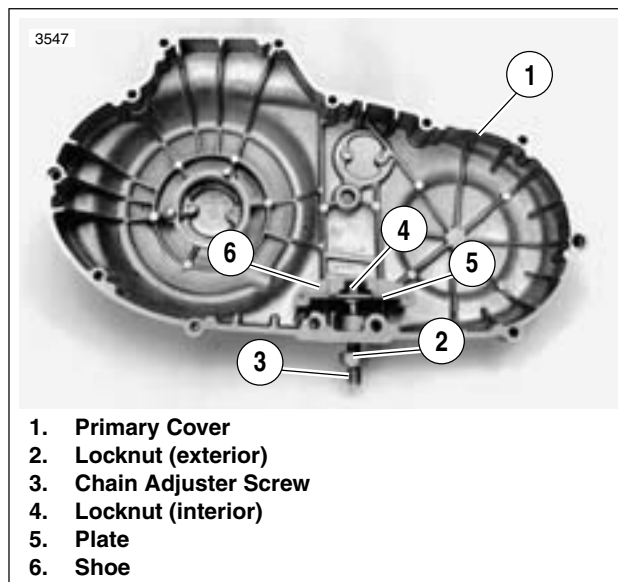


Figure 6-2. Removing Primary Chain Adjuster

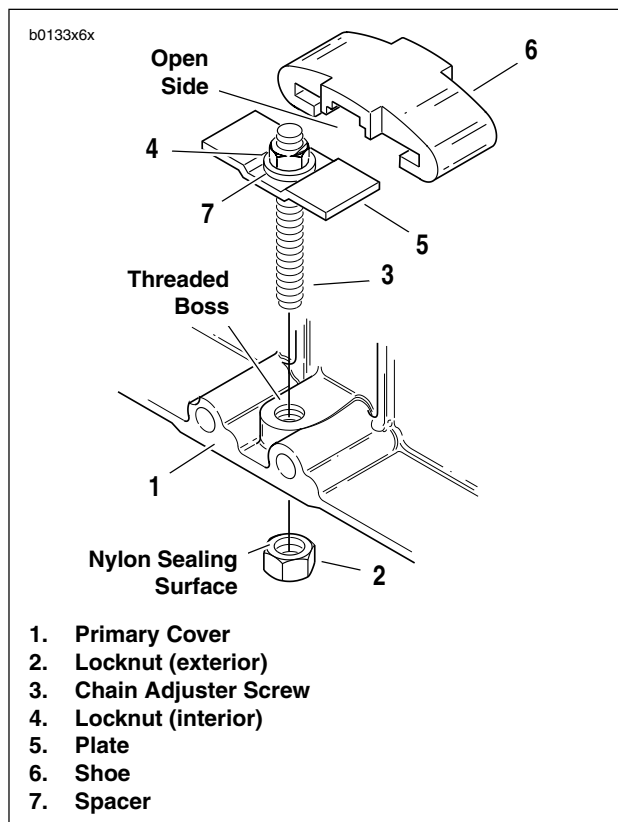


Figure 6-3. Primary Chain Adjuster

Primary Cover

1. Remove foreign material from magnetic drain plug. Install plug and tighten to 14-30 ft-lbs (19-41 Nm).
2. Wipe gasket surface clean. Install **new** gasket on primary cover.
3. See [Figure 6-4](#). Install primary cover and gasket onto left crankcase half using mounting screws. Tighten screws to 100-120 **in-lbs** (11-14 Nm).
4. See [Figure 6-1](#). Install **new** shifter lever oil seal (15).
5. Fit coupling (6) over cable end with rounded side inboard, the ramp connector button outboard. With retaining ring side of ramp assembly facing inward, place hook of ramp (7) around coupling button and rotate assembly counterclockwise until tang on inner ramp fits in slot of primary cover.
6. Thread wellnut (5) on adjusting screw (14) until slot of screw is accessible with a screwdriver. Fit wellnut hex into recess of outer ramp and turn adjusting screw counterclockwise.
7. Fill transmission to proper level with fresh lubricant. See [1.8 CLUTCH](#).
8. Adjust clutch. See [1.8 CLUTCH](#).
9. Adjust primary chain tension. See [1.11 PRIMARY CHAIN](#).
10. See [Figure 6-5](#). Apply **LOCTITE THREADLOCKER 243** (Blue) to shift lever mounting bolt.
11. Install shifter lever assembly with mounting bolt, washer, plastic bushings and spacer. Do not tighten mounting bolt.
12. Install rubber washer and upper shift lever assembly to splined shaft.
13. See [Figure 6-6](#). Position upper clamp on splined shaft pointing just below front clutch inspection cover bolt. (Shift linkage rod in figure is disconnected for clarity.)
14. Apply **LOCTITE THREADLOCKER 243** (Blue) to pinch screw.
15. Install pinch screw to upper clamp and tighten to 59-66 **in-lbs** (7-8 Nm).
16. Adjust shift linkage rod length. See [1.6 SHIFT LINKAGE ROD ADJUSTMENT](#).
17. Tighten mounting bolt to 27-29 ft-lbs (37-39 Nm).
18. Install muffler. See [2.28 EXHAUST SYSTEM](#).
19. Connect negative battery cable to battery.

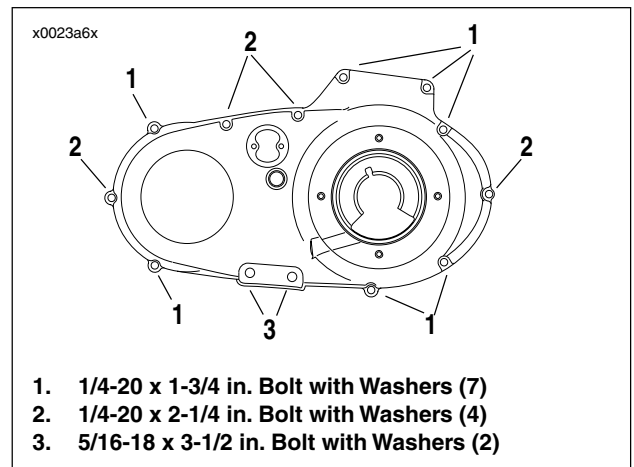


Figure 6-4. Install Primary Cover Bolts

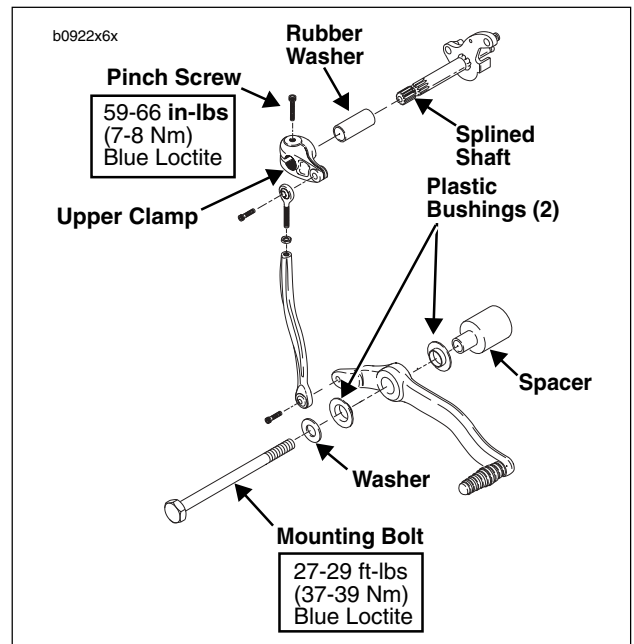


Figure 6-5. Shifter Lever

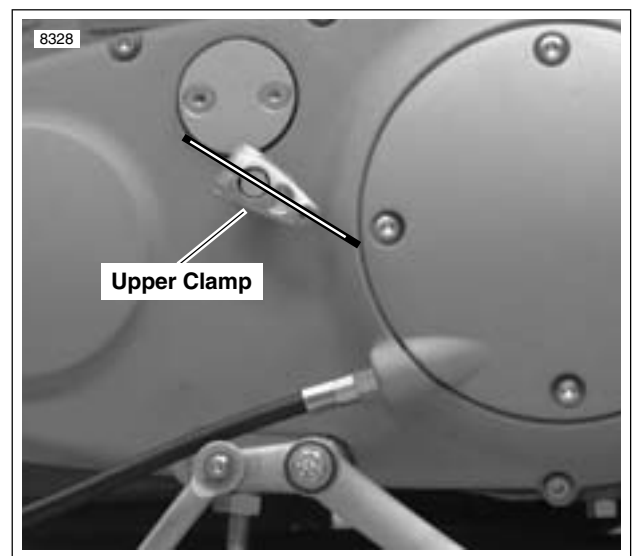


Figure 6-6. Upper Clamp Position

GENERAL

The secondary drive belt should be checked for unusual wear, cracking or loss of teeth. Check the belt sprocket for unusual wear, broken teeth or damaged flange.

See [1.9 DRIVE BELT DEFLECTION](#) for inspection, adjustment and cleaning procedures.

REMOVAL

Mark all hardware as it is removed so that it may be returned to its original location.

1. Place vehicle on a lift and anchor front wheel in place.

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

WARNING

Always disconnect the negative battery cable first. If the positive battery cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect **both** battery cables, negative cable first.
3. Remove seat. See [2.36 SEAT](#). Attach lifting straps to motorcycle and insert straps under frame tubes. It is not necessary to remove tail section.
4. Attach lifting straps to a floor hoist placed behind the lift. Raise motorcycle off lift until rear suspension is unloaded.
5. Remove the stone guard and lower belt guard. See [2.32 LOWER BELT GUARD AND STONE GUARD](#).
6. Remove sprocket cover. See [2.30 SPROCKET COVER](#)
7. Remove rear fender. See [2.31 FENDERS](#).
8. Remove rear wheel. See [2.6 REAR WHEEL](#)
9. See [Figure 6-7](#). Remove right rubber isolator (4). See [2.20 REAR ISOLATORS](#).
10. Slide the drive belt from the sprockets between the frame and swingarm mount block.

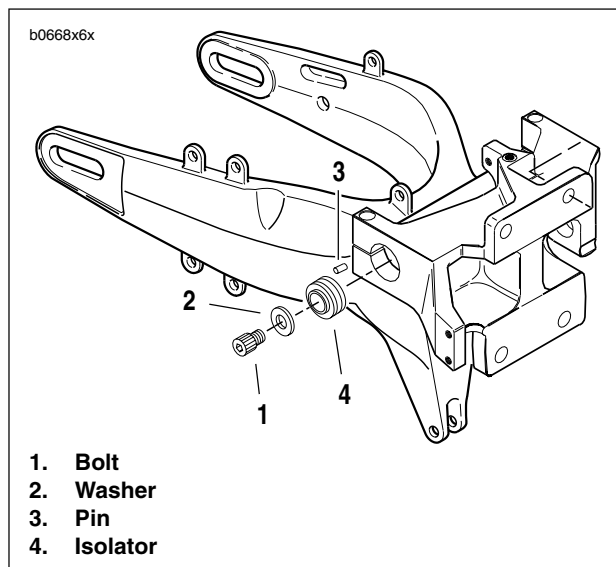


Figure 6-7. Isolators (Typical)

INSTALLATION

1. Slide a **new** belt over the sprockets.

CAUTION

- Use caution when installing isolator bolts. Bolts may be easily cross threaded.
 - Observe seam on rubber isolator after isolator bolt is tightened. If seam twists, apply more **LOCTITE ANTI-SEIZE** to underside of isolator bolt heads.
 - Do not overtighten isolator bolts. Too much torque may lead to premature isolator failure.
2. See [Figure 6-7](#). Install right rubber isolator. See [2.20 REAR ISOLATORS](#).
 3. Install rear wheel. See [2.6 REAR WHEEL](#)
 4. Install rear fender. See [2.31 FENDERS](#).
 5. Align the **new** belt and rear wheel. See [1.9 DRIVE BELT DEFLECTION](#).
 6. Install sprocket cover. See [2.30 SPROCKET COVER](#).
 7. Install the stone guard and lower belt guard. See [2.32 LOWER BELT GUARD AND STONE GUARD](#).
 8. Install seat. See [2.36 SEAT](#).

WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

9. Connect battery cables, positive cable first.

DISASSEMBLY

NOTE

See 1.8 CLUTCH for clutch adjustment procedure.

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Pull clutch cable ferrule (end of cable housing) away from clutch hand lever bracket. Gap between ferrule and bracket should be 0.0625-0.125 (1.6-3.2 mm). Adjust freeplay by turning cable adjuster.
2. See Figure 6-8. Remove four TORX screws with washers (1) and clutch inspection cover (2).
3. Slide spring (3) with attached screw lockplate (4) from flats of adjusting screw (12).
4. Turn adjusting screw (12) clockwise to release ramp and coupling mechanism. As the adjusting screw is turned, ramp assembly moves forward. Unscrew nut (5) from end of adjusting screw.

5. Remove hook of ramp from cable end coupling (16). Remove cable end (10) from slot in coupling.
6. Remove and discard retaining ring (13) from ramp assembly to separate inner and outer halves. Remove three balls (7) from ramp sockets.

CLEANING AND INSPECTION

1. Thoroughly clean all parts in cleaning solvent.
2. See Figure 6-8. Inspect three balls (7) of release mechanism and ball socket surfaces of inner and outer ramps for wear, pitting, surface breakdown and other damage. Replace parts as necessary.
3. Check hub fit of inner (15) and outer (6) ramps. Replace ramps if excessively worn.
4. Check clutch cable for frayed or worn ends. Replace cable if damaged or worn.
5. Change or add transmission fluid if necessary. See 1.8 CLUTCH.

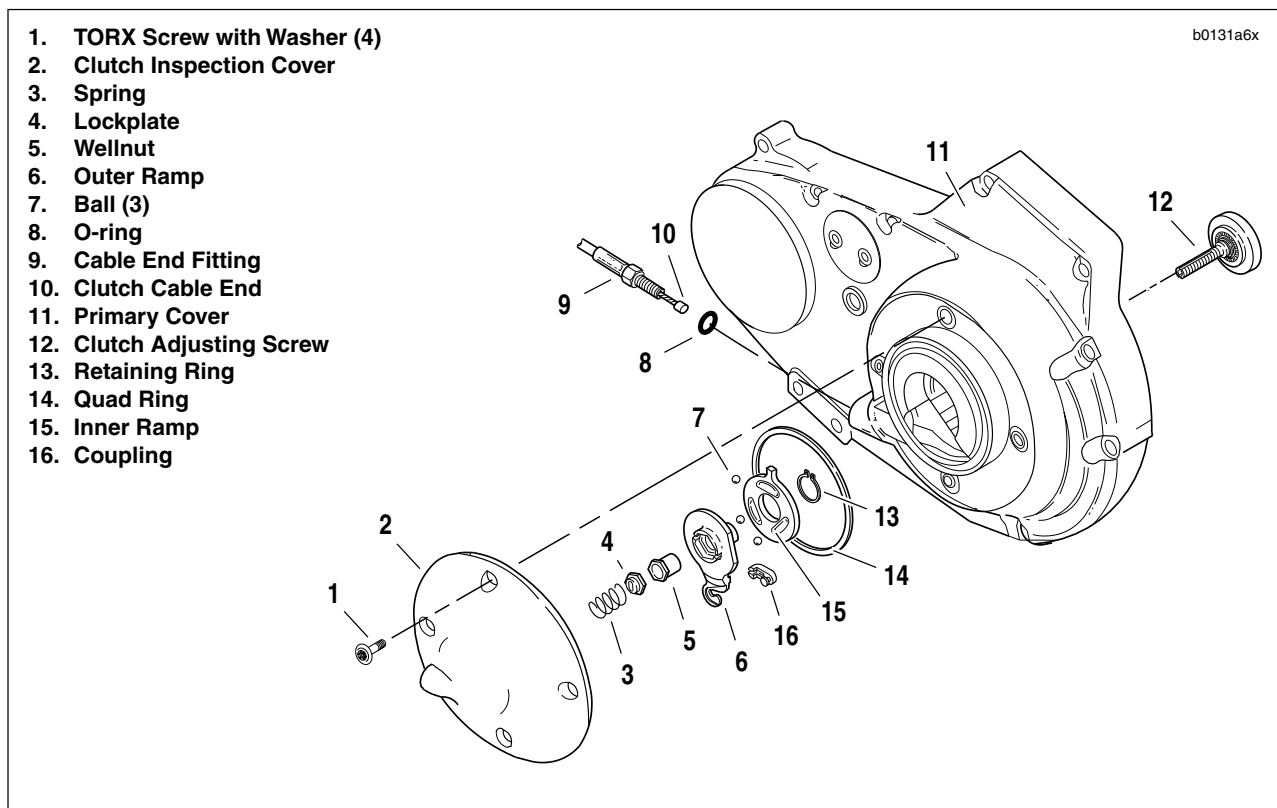


Figure 6-8. Clutch Release Mechanism

ASSEMBLY

1. See [Figure 6-9](#). Assemble inner and outer ramp.
 - a. Apply multi-purpose grease to balls (2) and ramps (1, 3).
 - b. Insert balls in sockets of outer ramp (1).
 - c. Install inner ramp (3) on hub of outer ramp (1) with tang 180° from hook of outer ramp.
 - d. Install **new** retaining ring (4) in groove of outer ramp hub.
2. See [Figure 6-10](#). Install ramp assembly.
 - a. Fit coupling (5) over cable end (4) with rounded side inboard, the ramp connector button outboard.
 - b. With retaining ring side of ramp assembly facing inward, place hook of ramp around coupling button.
 - c. Rotate assembly counterclockwise until tang on inner ramp fits in slot of primary cover (6).
3. Secure assembly in place.
 - a. Thread wellnut (2) on adjusting screw (3) until slot of screw is accessible with a screwdriver.
 - b. Fit nut hex into recess of outer ramp (1).
 - c. Turn adjusting screw counterclockwise until resistance is felt.
4. Adjust clutch release mechanism. See [1.8 CLUTCH](#).

WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

5. Connect battery cables, positive cable first.

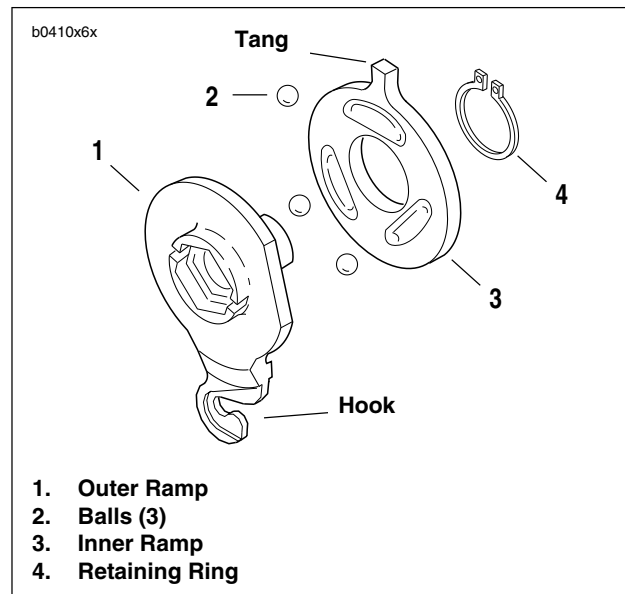


Figure 6-9. Inner and Outer Ramp

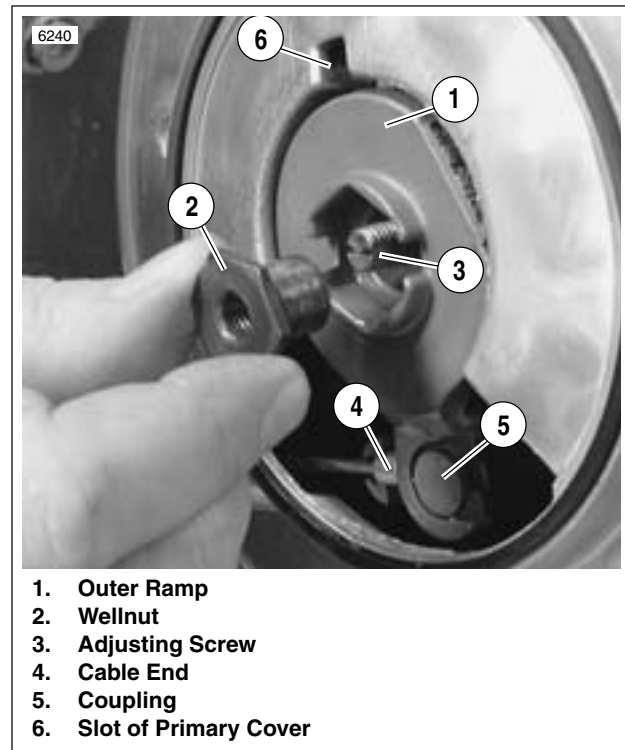


Figure 6-10. Nut and Outer Ramp

GENERAL

The purpose of the clutch is to smoothly disengage and engage the engine from the rear wheel for starting, stopping and shifting gears.

See [Figure 6-11](#). The clutch is a wet, multiple-disc clutch with six steel plates (1), one spring plate (2) and eight fiber (friction) plates (3) stacked alternately in the clutch shell (4). The order of plate assembly, from inboard to outboard, is as follows:

F - St - F - St - F - St - F - **Sp** - F - St - F - St - F - St - F
(F = Fiber plate, St = Steel plate, **Sp** = Spring plate)

The fiber plates (clutch driving plates) are keyed to the clutch shell (4), which is driven by the engine through the primary chain. The steel plates (clutch driven plates) and the centrally located spring plate (also a clutch driven plate) are keyed to the clutch hub (5), which drives the rear wheel through the transmission and secondary drive belt.

When the clutch is engaged (clutch lever released), the diaphragm spring (7) applies strong inward force against the pressure plate (6). The pressure plate then presses the clutch plates (1, 2 and 3) together, allowing no slippage between the plates and causing the plates to turn as a single unit. The result is that the rotational force of the clutch shell (4) is fully transmitted through the "locked" clutch plates to the clutch hub (5). As long as the transmission is set in a forward gear, power from the engine will be transmitted to the rear wheel.

When the clutch is disengaged (clutch lever pulled to left handlebar grip), the pressure plate (6) is pulled outward (by clutch cable action) against the diaphragm spring (7), thereby compressing the diaphragm spring. With the pressure plate retracted, strong inward force no longer squeezes the clutch plates (1, 2 and 3) together. The fiber plates (3) are now free to rotate at a different relative speed than that of the steel (1) and spring (2) plates (i.e. – slippage between the clutch plates occurs). The result is that the rotational force of the clutch shell (4) is no longer fully transmitted through the "unlocked" clutch plates to the clutch hub (5). The engine is free to rotate at a different speed than the rear wheel.

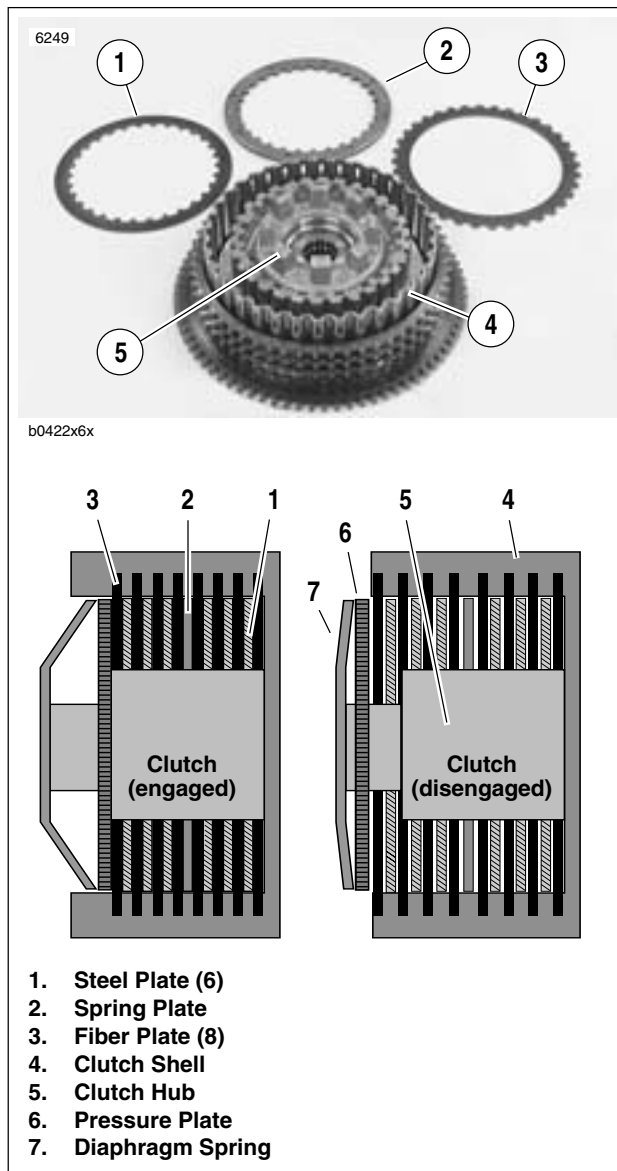


Figure 6-11. Clutch Plates and Hub/Shell Assembly

Table 6-1. Clutch Troubleshooting

SYMPTOM	CAUSE (CHECK IN FOLLOWING ORDER)	REMEDY
Clutch slips.	Incorrect clutch release adjustment. Worn clutch plates.	Check and adjust clutch release mechanism. Check service wear limits. Replace plates.
Clutch drags.	Incorrect clutch release adjustment. Worn clutch release ramps or balls. Warped clutch steel plates. Blade worn or damaged clutch gear splines. Overfilled primary.	Check and adjust clutch release mechanism. Replace release ramps and/or balls. Replace clutch steel plates. Replace clutch gear or hub as required. Drain lubricant to correct level.

REMOVAL/DISASSEMBLY

Clutch Pack

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Remove primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).

⚠ WARNING

Do not attempt to disassemble the clutch without **SPRING COMPRESSING TOOL** (Part No. HD-38515-A), **CLUTCH SPRING FORCING SCREW** (Part No. HD-38515-91) and proper eye protection. Otherwise, the highly compressed diaphragm spring could fly out with great force which could result in death or serious injury.

2. See [Figure 6-12](#). Attach tools to compress clutch diaphragm spring.
 - a. Thread the **CLUTCH SPRING FORCING SCREW** (Part No. HD-38515-91) (1) onto the clutch adjusting screw.
 - b. Place the bridge (2) of **SPRING COMPRESSING TOOL** (Part No. HD-38515-A) against diaphragm spring (6).
 - c. Install bearing (3) and washer (4).
 - d. Thread the tool handle (5) onto end of forcing screw.

CAUTION

See [Figure 6-13](#). Turn compressing tool handle (5) only the amount required to release spring seat (9) and remove snap ring (8). Excessive compression of diaphragm spring (6) could damage clutch pressure plate (7).

3. Remove pressure plate assembly.
 - a. Place a wrench on the clutch spring forcing screw (1) flats to prevent the forcing screw from turning.
 - b. Turn compressing tool handle (5) clockwise until tool relieves pressure on snap ring (8) and spring seat (9). Remove and discard snap ring (8).
 - c. Unseat spring seat (9) from the groove in clutch hub prongs.
 - d. Remove pressure plate assembly.
4. See [Figure 6-14](#). Remove the clutch pack from the hub/shell assembly. The pack consists of eight fiber plates (18), six steel plates (19) and a spring plate (20).

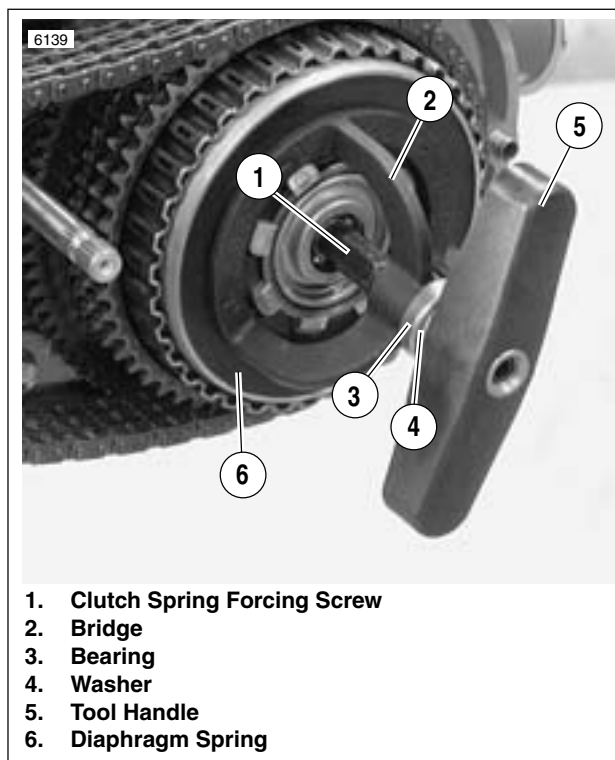


Figure 6-12. Compressing Clutch Diaphragm Spring

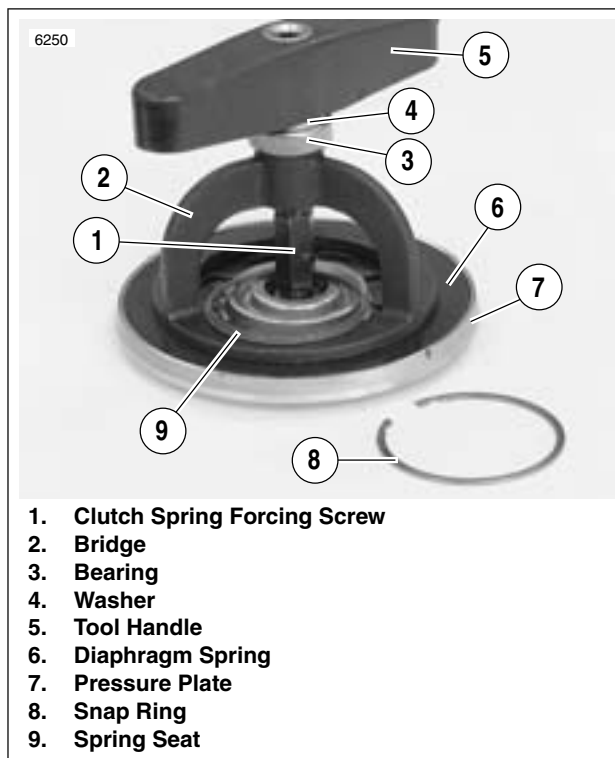
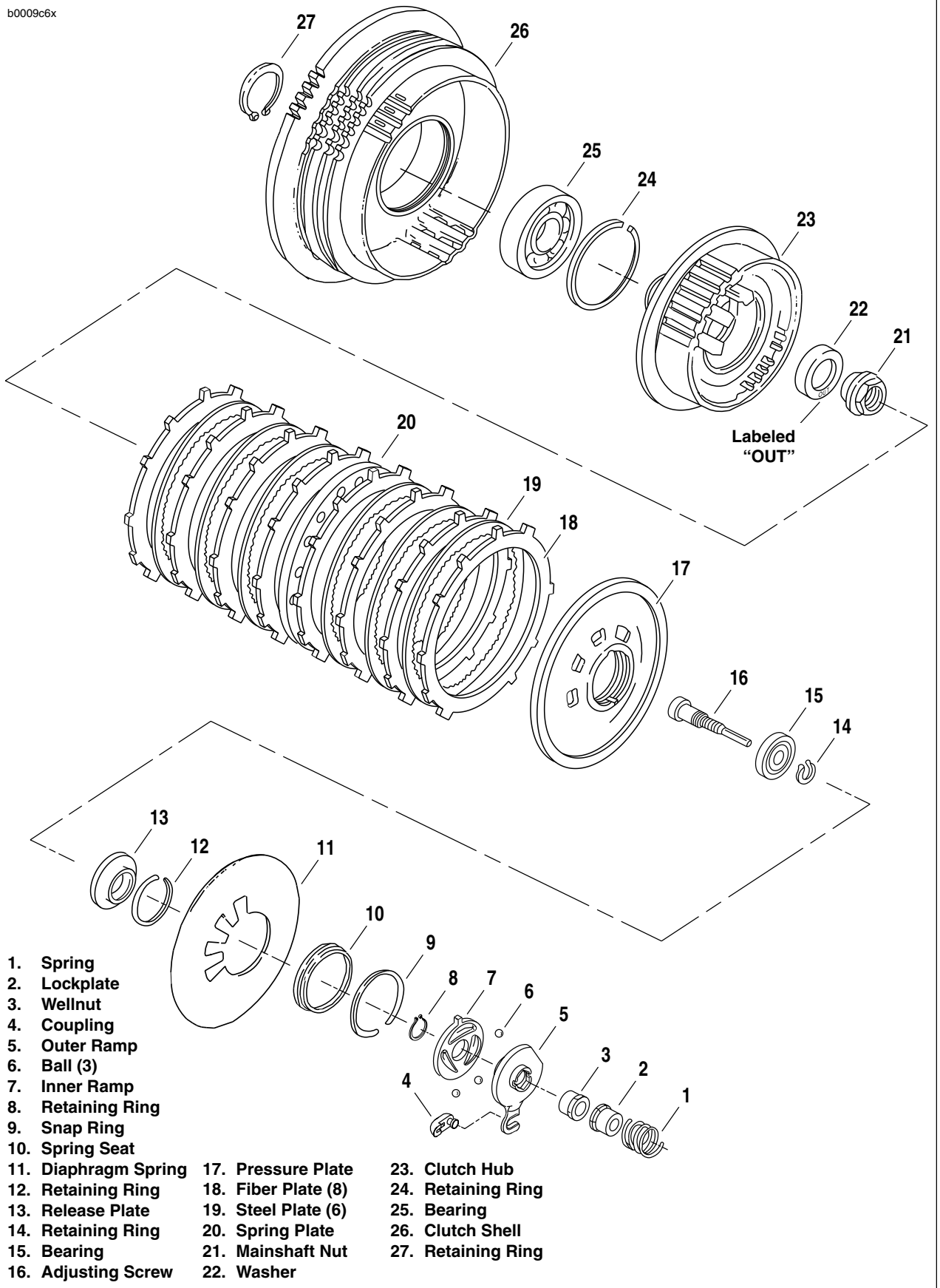


Figure 6-13. Pressure Plate Assembly

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- | | | |
|----------------------|---------------------|--------------------|
| 1. Spring | 17. Pressure Plate | 23. Clutch Hub |
| 2. Lockplate | 18. Fiber Plate (8) | 24. Retaining Ring |
| 3. Wellnut | 19. Steel Plate (6) | 25. Bearing |
| 4. Coupling | 20. Spring Plate | 26. Clutch Shell |
| 5. Outer Ramp | 21. Mainshaft Nut | 27. Retaining Ring |
| 6. Ball (3) | 22. Washer | |
| 7. Inner Ramp | | |
| 8. Retaining Ring | | |
| 9. Snap Ring | | |
| 10. Spring Seat | | |
| 11. Diaphragm Spring | | |
| 12. Retaining Ring | | |
| 13. Release Plate | | |
| 14. Retaining Ring | | |
| 15. Bearing | | |
| 16. Adjusting Screw | | |

Figure 6-14. Clutch Assembly

Primary Chain/Drive

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Remove primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).
2. Loosen engine sprocket.
 - a. Install SPROCKET LOCKING LINK (Part No. HD-38362).
 - b. Remove the engine sprocket nut.
 - c. Loosen, but do not remove, engine sprocket. If necessary, use the slotted portion of TWO CLAW PULLER (Part No. HD-97292-61) and two bolts to loosen the engine sprocket.
3. See [Figure 6-15](#). Remove adjusting screw assembly.
 - a. Remove large retaining ring (1).
 - b. Remove adjusting screw assembly (2, 3 and 4) from pressure plate.

CAUTION

See [Figure 6-14](#). Mainshaft nut (21) has left-hand threads. To prevent damage, turn nut clockwise to loosen and remove from mainshaft.

4. Remove mainshaft nut (21) and washer (22).
5. Remove the clutch assembly, primary chain and engine sprocket as a unit.
 - a. Inspect primary chain and sprockets for damage or excessive wear.
 - b. Inspect stator and rotor. See [7.14 ALTERNATOR](#).
 - c. Replace damaged parts as necessary.
6. Install adjusting screw assembly into pressure plate.
 - a. See [Figure 6-16](#). Align two tabs on perimeter of release plate with corresponding recesses in pressure plate.
 - b. See [Figure 6-15](#). Secure the adjusting screw assembly with large retaining ring (1).
7. Attach tools to compress clutch diaphragm spring. See Step 2 of [CLUTCH PACK](#) under [6.5 PRIMARY DRIVE/CLUTCH](#).
8. Remove clutch pack components. See Steps 3-4 of [CLUTCH PACK](#) under [6.5 PRIMARY DRIVE/CLUTCH](#).

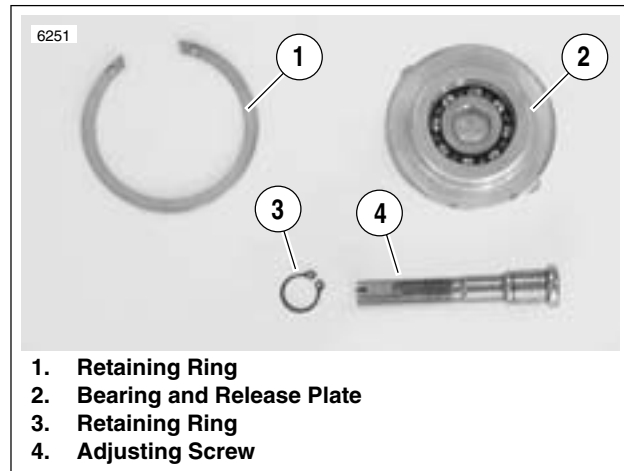


Figure 6-15. Adjusting Screw Assembly

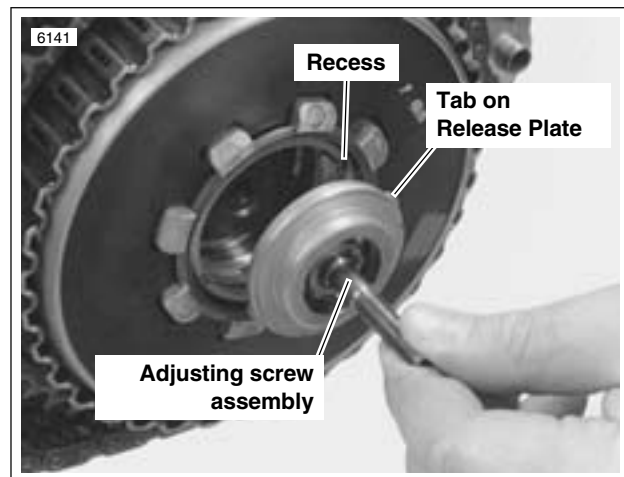


Figure 6-16. Aligning Tabs

9. See [Figure 6-13](#). Disassemble pressure plate.
 - a. Place a wrench on the clutch spring forcing screw (1) flats to prevent the forcing screw from turning.
 - b. Turn the compressing tool handle (5) counterclockwise until the handle spins off.
 - c. Remove washer (4), bearing (3) and bridge (2).
 - d. Remove clutch spring forcing screw (1) from clutch adjusting screw.
 - e. Remove spring seat (9) and diaphragm spring (6) from pressure plate (7).
10. See [Figure 6-15](#). Remove and disassemble adjusting screw assembly.
 - a. Remove large retaining ring (1).
 - b. Remove adjusting screw assembly (2, 3 and 4) from pressure plate.
 - c. If necessary, disassemble adjusting screw assembly. Remove and discard small retaining ring (3) and then separate the adjusting screw (4) from the bearing and release plate (2). Remove bearing from release plate.

CAUTION

See [Figure 6-14](#). Due to the possible damage to the bearing (25), the clutch hub (23) and shell (26) assembly should not be disassembled unless the bearing, hub or shell require replacement. If the assembly is pressed apart, the bearing must be replaced.

11. Disassemble clutch hub and clutch shell if necessary.
 - a. Remove retaining ring (27) from inboard end of clutch hub (23).
 - b. Using an arbor press, separate clutch hub (23) from assembly of clutch shell (26), bearing (25) and retaining ring (24).
 - c. Remove retaining ring (24) from groove in clutch shell (26).
 - d. Press on the inboard side of bearing (25) outer race to remove bearing from clutch shell.

INSPECTION/REPAIR

1. See [Figure 6-14](#). Wash all parts, except fiber (friction) plates (18) and bearing (25), in cleaning solvent. Blow dry with compressed air. Examine the clutch components as follows:
 - a. Check all clutch plates for wear and discoloration.
 - b. Inspect each steel (drive) plate (19) for grooves.
 - c. Place each steel plate on a flat surface. Using a feeler gauge, check for flatness in several places. Replace any plates that are damaged or are warped more than 0.006 in. (0.152 mm).
2. Check the diaphragm spring (11) for cracks or bent tabs. Install a **new** spring if either condition exists.
3. See [Figure 6-17](#). Check fiber plates for thickness.
 - a. Wipe the lubricant from the eight fiber plates and stack them on top of each other.
 - b. Measure the thickness of the eight stacked fiber plates with a dial caliper or micrometer. The minimum thickness must be 0.661 in. (16.789 mm).
 - c. If the thickness is less than specified, discard the fiber plates and steel plates. Install a **new** set of both friction and steel plates.
4. See [Figure 6-18](#). Check the clutch shell.
 - a. Inspect primary chain sprocket (1) and the starter ring gear (2) on the clutch shell. If either sprocket or ring gear are badly worn or damaged, replace the clutch shell.
 - b. Check the slots that mate with the clutch plates on both clutch shell (4) and hub (3). If slots are worn or damaged, replace shell and/or hub.
 - c. If clutch shell was removed from motorcycle, check the bearing for smoothness. Rotate the clutch shell while holding the clutch hub. If bearing is rough or binds, it must be replaced.

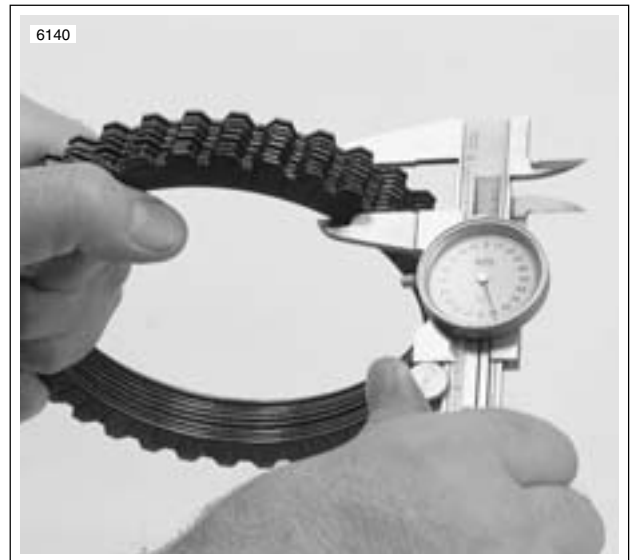


Figure 6-17. Measuring Friction Plates

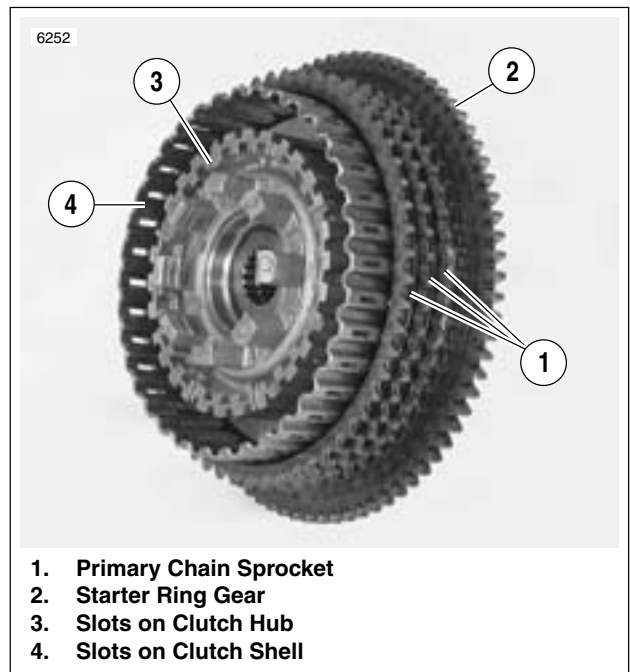


Figure 6-18. Checking Clutch Shell

ASSEMBLY

Clutch Pack

- See [Figure 6-14](#). Install the clutch pack, which consists of eight fiber plates (18), six steel plates (19) and a spring plate (20), into the clutch hub (23). The order of plate assembly, from inboard to outboard, is as follows:

F - St - F - St - F - St - F - **Sp** - F - St - F - St - F - St - F

(F = Fiber plate, St = Steel plate, **Sp** = Spring plate)

CAUTION

See [Figure 6-13](#). Turn compressing tool handle (5) only the amount required to install spring seat (9) and snap ring (8). Excessive compression of diaphragm spring (6) could damage clutch pressure plate (7).

- Place assembly of spring seat, **new** snap ring, diaphragm spring, pressure plate, adjusting screw components and compressing tool onto clutch hub and against clutch pack.
 - See [Figure 6-19](#). Align square openings of pressure plate and diaphragm spring (1) so that the assembly can be installed over prongs (2) of clutch hub.
 - Position spring seat (5) with its larger O.D. side toward diaphragm spring (1).
 - See [Figure 6-13](#). Place a wrench on the clutch spring forcing screw (1) flats to prevent the forcing screw from turning.
 - Turn compressing tool handle (5) clockwise until diaphragm spring (6) compresses just enough to install spring seat (9) and **new** snap ring (8) into the groove in clutch hub prongs.
 - With snap ring positioned against outboard side of spring seat, and fully seated in groove of clutch hub, carefully loosen and remove compression tool.

Primary Drive

- See [Figure 6-20](#). Assemble clutch hub and shell if necessary.
 - Press **new** bearing (3) in clutch shell (4). Secure bearing with a **new** retaining ring (2).
 - Press inboard end of clutch hub (1) into shell bearing (3). Secure with **new** retaining ring (5) on end of hub.
- Assemble pressure plate hardware.
 - See [Figure 6-15](#). Place bearing inside release plate. Insert adjusting screw (4) through bearing and release plate (2). Secure with **new** retaining ring (3).
 - See [Figure 6-19](#). Position diaphragm spring (1) with its concave side facing toward pressure plate onto pressure plate assembly.

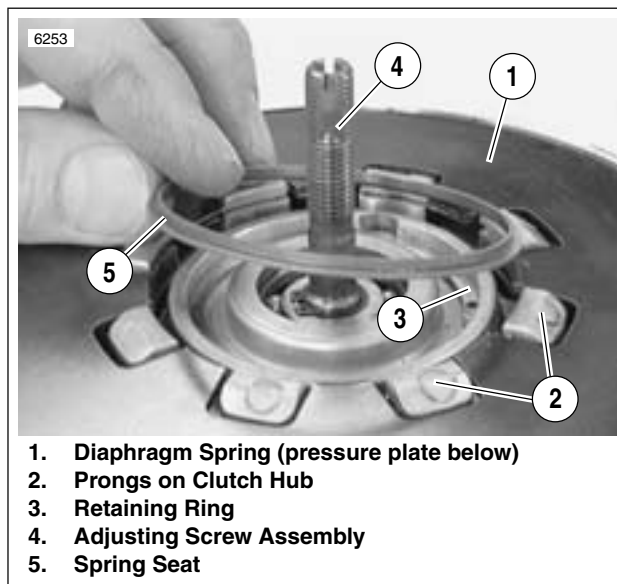


Figure 6-19. Spring Seat Installation

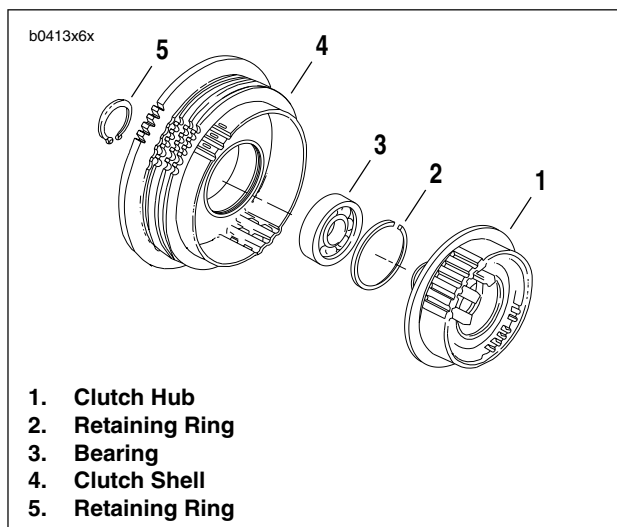


Figure 6-20. Clutch Hub and Shell Assembly

- Insert adjusting screw assembly (4) into pressure plate. Secure with large retaining ring (3).
 - Position spring seat (5) with its larger O.D. side toward diaphragm spring.
- Attach tools to compress clutch diaphragm spring. See Step 2 of [CLUTCH PACK](#) under [6.5 PRIMARY DRIVE/CLUTCH](#). Do not tighten compressing tool against diaphragm spring at this time.
 - Install the clutch pack. Follow all instructions of [CLUTCH PACK](#) under [6.5 PRIMARY DRIVE/CLUTCH](#).

INSTALLATION

NOTE

If clutch pack replacement was the only service work performed, start with Step 5.

1. Install the engine sprocket, clutch assembly and primary chain as a unit into primary chaincase.
2. See [Figure 6-21](#). Install the engine sprocket nut.
 - a. Place SPROCKET LOCKING LINK (3) (Part No. HD-38362) between primary chain and engine sprocket.
 - b. Apply two or three drops of LOCTITE THREAD-LOCKER 262 (red) onto threads of sprocket shaft.
 - c. Install engine sprocket nut. Tighten to 190-210 ft-lbs (258-285 Nm).

CAUTION

See [Figure 6-22](#). Washer (2) must be installed with the word "out" facing the mainshaft nut (1) or transmission may be damaged.

3. Install mainshaft nut and washer.
 - a. Apply two or three drops of LOCTITE THREAD-LOCKER 262 (red) onto threads on end of mainshaft.
 - b. Place washer (2) on mainshaft with the word "out" facing away from clutch hub (3).
 - c. Install nut (1) (**left-hand threads**). Tighten to 70-80 ft-lbs (95-109 Nm).
4. Remove SPROCKET LOCKING LINK.
5. Install adjusting screw assembly into pressure plate.
 - a. See [Figure 6-16](#). Align two tabs on perimeter of release plate with corresponding recesses in pressure plate.
 - b. See [Figure 6-15](#). Secure the adjusting screw assembly with retaining ring.
6. Install primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).

WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

7. Connect battery cables, positive cable first.

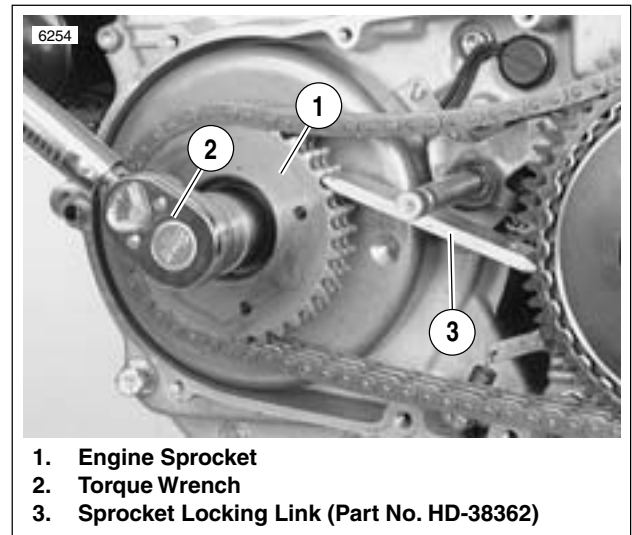


Figure 6-21. Sprocket Locking Link

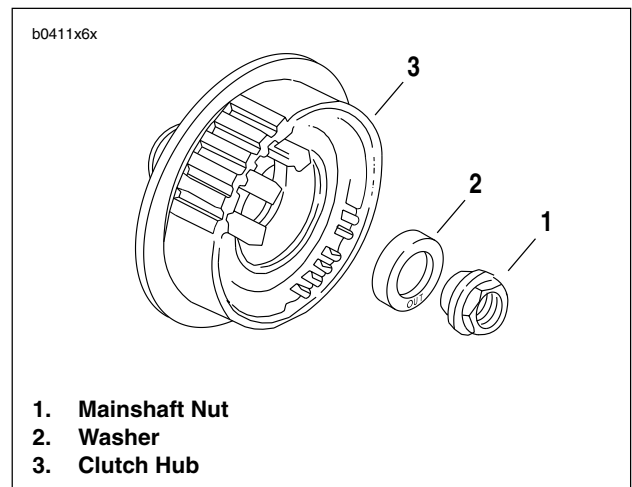


Figure 6-22. Mainshaft Nut and Washer

GENERAL

See [Figure 6-23](#). The transmission is a five-speed constant-mesh type housed in an extension of the crankcase. The transmission permits the rider to vary the ratio of engine speed-to-rear driving wheel speed in order to meet the varying conditions of operation.

LUBRICATION

Drain transmission and refill to correct level with fresh, clean lubricant at least once each year or every 5000 miles (8000 km), whichever comes first. For best results, drain lubricant while hot.

See [1.8 CLUTCH](#) for more information.

XLH transpower flow

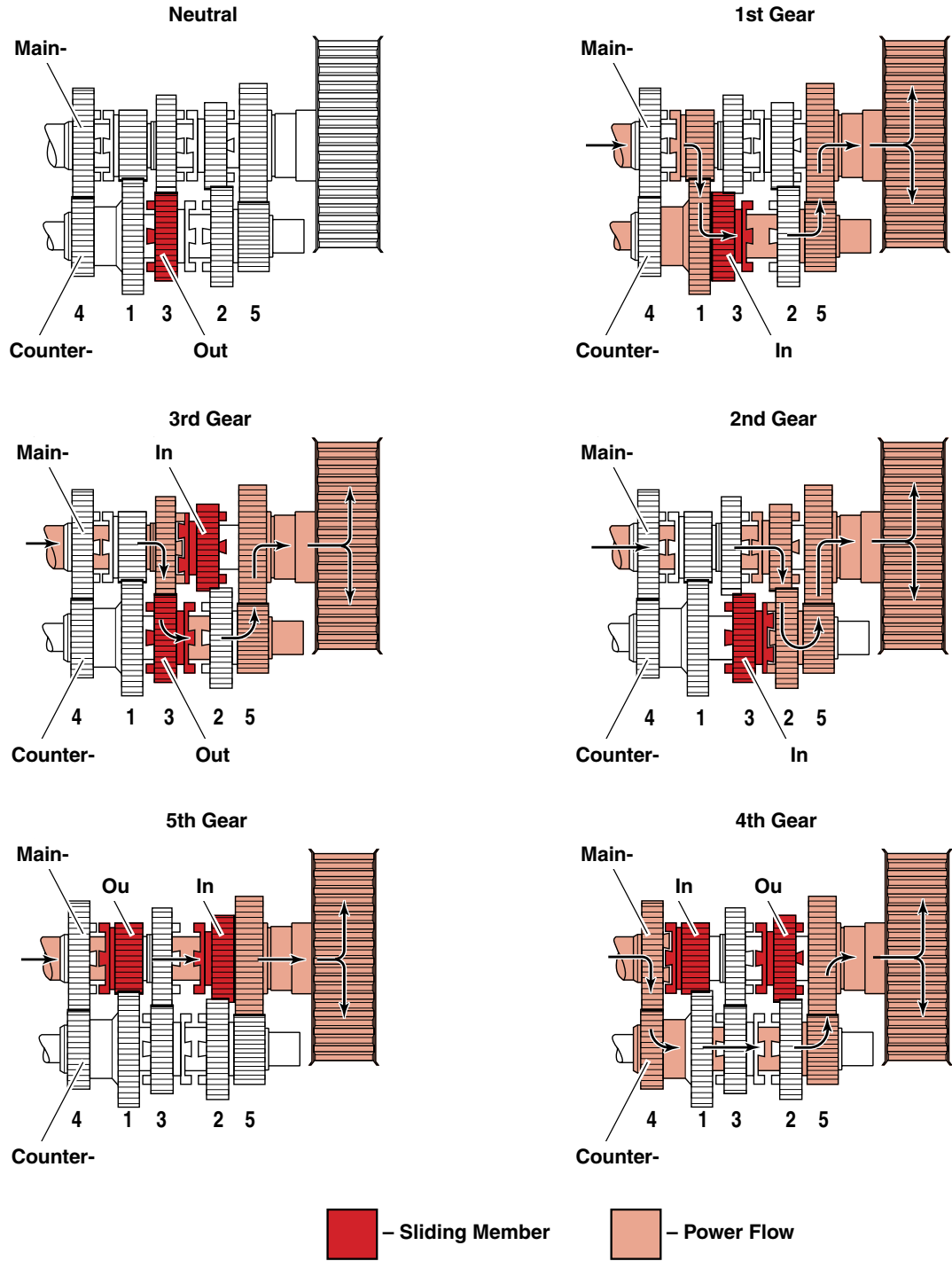


Figure 6-23. Transmission Power Flow

GENERAL

The rear compartment of the left and right crankcase halves form the transmission case. An access cover (door) allows removal of transmission components without removing the engine or disassembling (splitting) the crankcase.

REMOVAL

1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
2. Remove muffler and drain primary drive/transmission. See 1.8 CLUTCH.
3. Remove sprocket cover. See 2.30 SPROCKET COVER.
4. Remove rear fender. See 2.31 FENDERS.
5. See Figure 6-24. Reduce tension on secondary drive belt.
 - a. Loosen rear axle nut (1) (metric).
 - b. Hold axle adjuster bolt (2) with a 5/16 in. wrench. Loosen jamnut (3) and nut (4). Slide adjuster bolt forward. Repeat on left side.
 - c. Move rear wheel as far forward as possible.
6. See Figure 6-25. Place transmission in first gear. Remove two socket head screws (5) and lockplate (4).

CAUTION

Transmission sprocket nut has left-hand threads. To prevent damage, turn nut clockwise to loosen and remove from main drive gear shaft.

7. Remove transmission sprocket nut (3) from main drive gear shaft (1).
8. Remove secondary drive belt from transmission sprocket (2). Remove transmission sprocket from main drive gear shaft (1).
9. Remove primary cover. See PRIMARY COVER under 6.2 PRIMARY CHAIN.
10. Remove clutch assembly, primary chain and engine sprocket. See PRIMARY CHAIN/DRIVE under 6.5 PRIMARY DRIVE/CLUTCH.

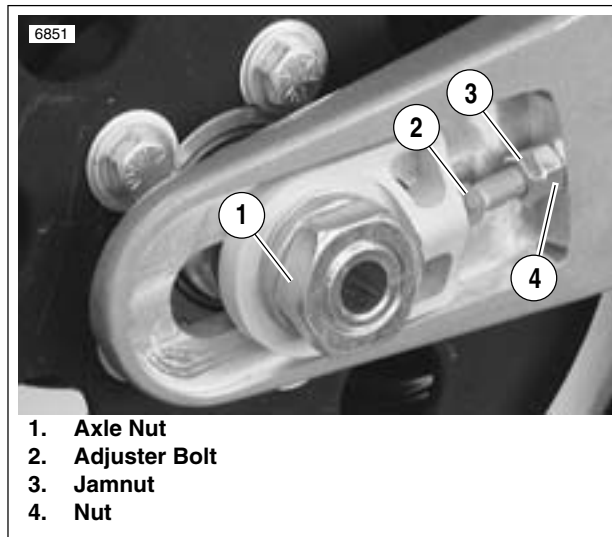


Figure 6-24. Secondary Drive Belt Adjustment

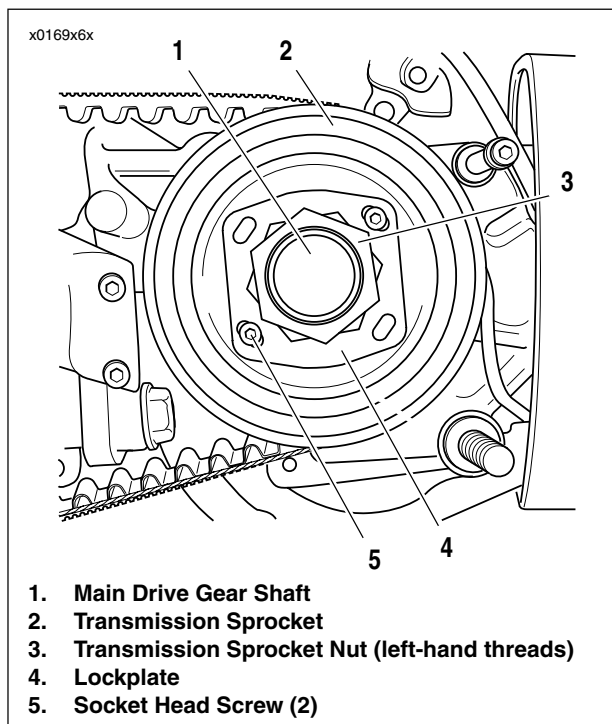


Figure 6-25. Transmission Sprocket

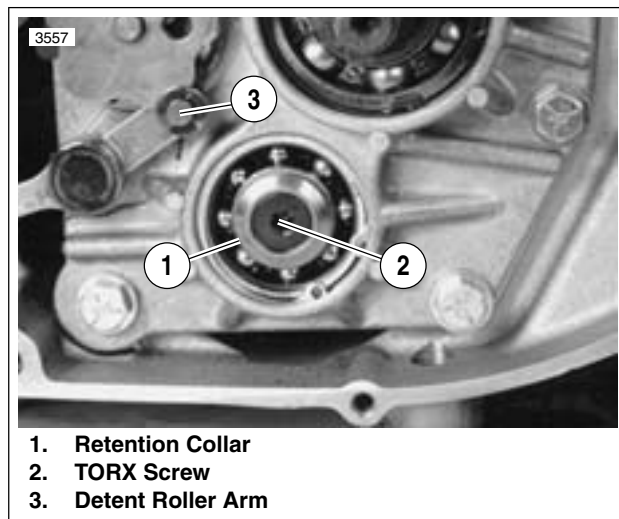


Figure 6-26. Countershaft Retainer

11. See [Figure 6-26](#). Lock transmission in gear. Remove countershaft TORX screw (2) and retention collar (1).
12. See [Figure 6-27](#). Detach spring (1) from groove in post (2).
13. Remove retaining ring (9) and detent plate (8). You will need to use a **new** retaining ring for installation.
14. Remove two locknuts (3) and washers (10) which attach shifter shaft assembly (6) to studs at transmission case. Remove shifter shaft assembly.
15. Remove five access door bolts (7). Remove transmission assembly by pulling it straight outward, away from transmission case.

CLEANING AND INSPECTION

Thoroughly clean transmission compartment with cleaning solvent. Blow parts dry with compressed air. Inspect parts to determine if any must be replaced. Replace all parts that are badly worn or damaged.

Neutral Indicator Switch

See [Figure 6-28](#). The neutral indicator switch is threaded into the transmission portion of the right crankcase half. See [7.24 NEUTRAL INDICATOR SWITCH](#) for testing, removal and installation procedures.

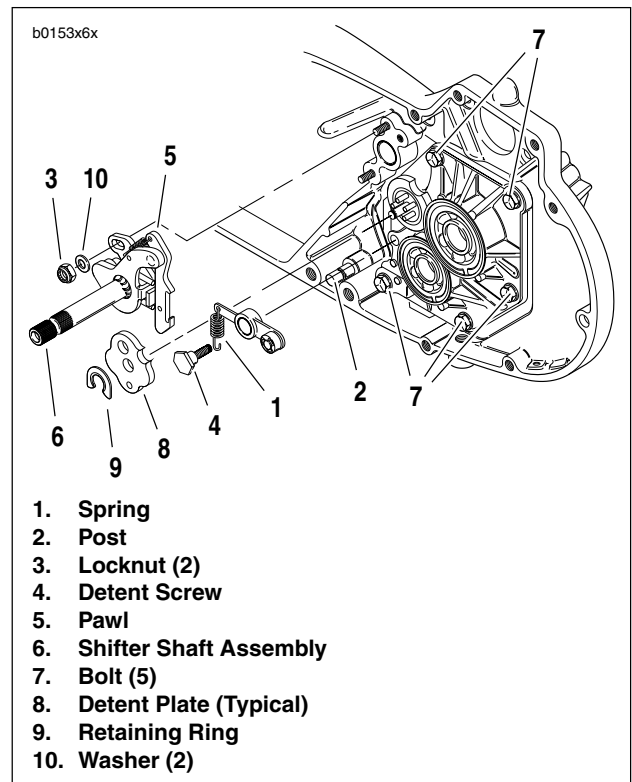


Figure 6-27. Shifter Shaft Assembly

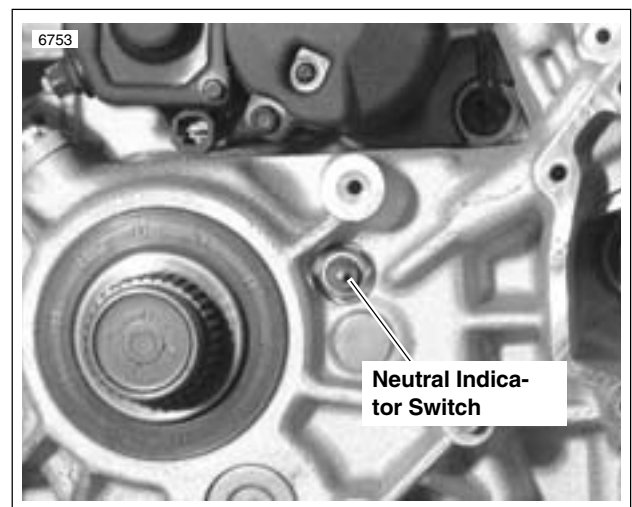


Figure 6-28. Neutral Indicator Switch

DISASSEMBLY

1. Remove transmission assembly. See 6.7 TRANSMISSION CASE. Mount transmission assembly in vise with protected jaws.
2. See Figure 6-29. Remove nut (10), washer (14), detent screw (18), plates (8, 9), detent arm (16) and spring (17).
3. Remove and discard the three fork cotter pins (4).
4. Remove three shifter fork pins (5). A small magnet is useful in freeing the fork pins (5).

5. Slide shifter fork drum (7) away from access door, through shifter forks. The neutral indicator pin prevents removal in the other direction.
6. Remove shifter forks (1, 2 and 3).

CLEANING AND INSPECTION

1. See Figure 6-29. Clean all parts except bearings (19, 20) with solvent.

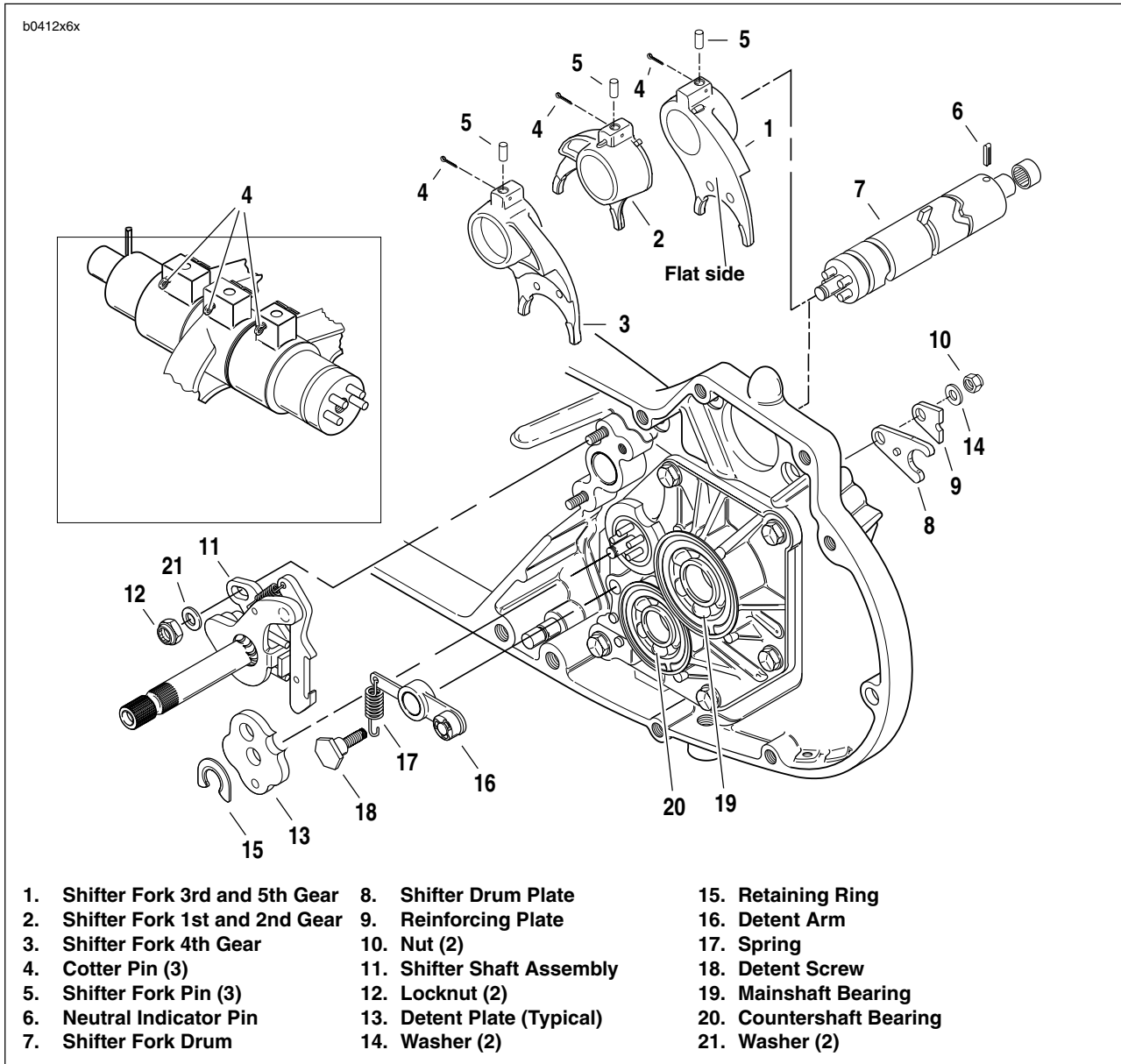


Figure 6-29. Shifter Mechanism

2. Inspect bearings (19, 20) and shifter drum ends. If ends of shifter drum are pitted or grooved, replace the shifter drum and bearings. If replacing bearings, see [6.11 ACCESS DOOR BEARINGS](#).
3. Inspect shifter fork drum (7) for cracks or wear. Replace if necessary.

ASSEMBLY

1. See [Figure 6-30](#). Identify all shifter forks before assembly. Note shape of fork and location of fork pin holes.
2. Install shifter forks.
 - a. Lubricate the shaft bore in of all three shifter forks (1, 2 and 3) with SPORT-TRANS FLUID.
 - b. Place 3rd and 5th gear shifter fork (1) in the fork groove of mainshaft 2nd gear. Be sure the flat side of fork is facing the access cover.
 - c. Place 1st and 2nd gear shifter fork (2) in the fork groove of countershaft 3rd gear. Be sure the flat side of fork is facing away from the access door.
 - d. Place 4th gear shifter fork (3) in the fork groove of mainshaft 1st gear. Be sure the flat side of fork is facing away from the access door.
3. See [Figure 6-29](#). Install shifter shaft drum.
 - a. Position the shifter drum shaft so that the neutral indicator pin (6) is upward. The shaft is then in the neutral position.
 - b. Insert the pin end of shifter drum shaft (7) through the hubs of shifter forks (1, 2 and 3) and through the bearing in access cover.
 - c. Align the hole through the top of each shifter fork with the appropriate cam groove in the shifter drum.

CAUTION

The cotter pins must be inserted through the shifter forks as shown in [Figure 6-30](#). This will prevent possible damage to the cotter pins.

4. See [Figure 6-29](#). Secure shifter mechanism.
 - a. Lubricate the three shifter fork pins (5) with SPORT-TRANS FLUID.
 - b. Drop fork pins (5) through the holes in shifter forks.
 - c. With a small screwdriver press on the pins while manipulating the forks back and forth until the pin seats in the drum groove.
 - d. Secure shifter fork pins with **new** cotter pins (4).

NOTE

See [Figure 6-31](#). Detent plate (2) and retaining ring (1) are not installed at this time. These parts are installed during transmission installation after the final shifter pawl adjustment is made. See [6.13 TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT](#).

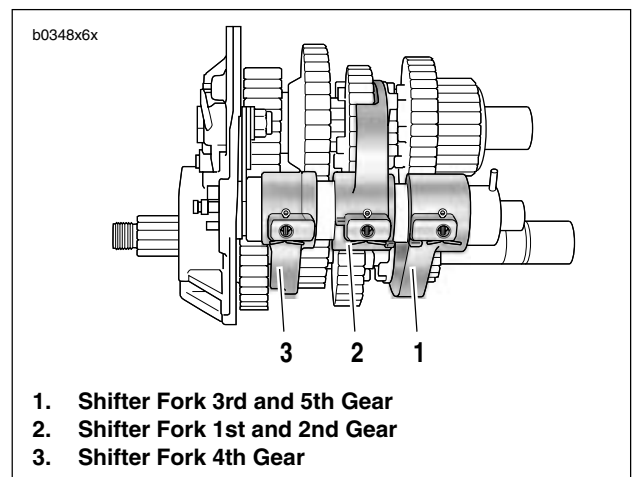


Figure 6-30. Shifter Fork Identification

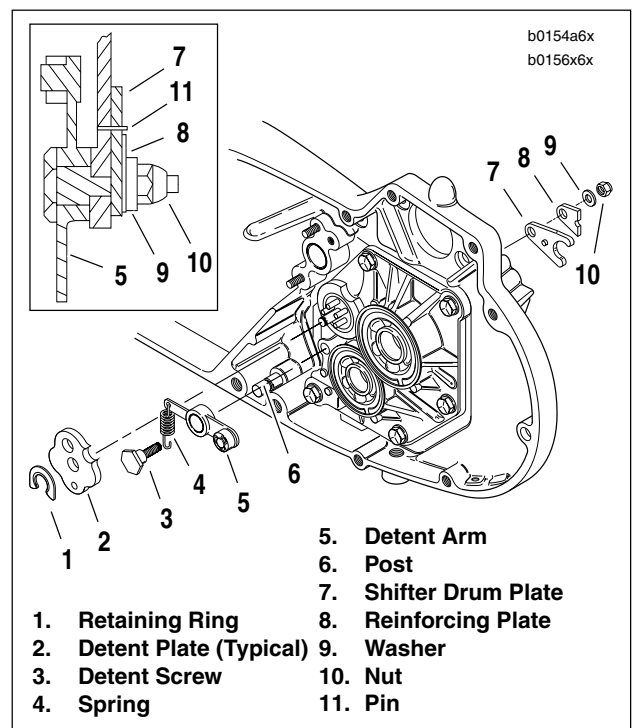


Figure 6-31. Detent Plate Mounting

5. Install detent plate hardware.
 - a. At the inside of the access door, place the shifter drum plate (7) in the groove of the drum shaft. See inset [Figure 6-31](#).
 - b. Correctly align reinforcement plate (8) with the pin pressed in the shifter drum plate (7).
 - c. Insert detent screw (3) through detent arm (5), access door, shifter drum plate (7), reinforcing plate (8) and washer (9).
 - d. Thread nut (10) on detent screw. Tighten to 13-17 ft-lbs (18-23 Nm).

NOTE

See [Figure 6-26](#). Install detent arm roller (3) between countershaft bearing and detent plate.

NOTES

DISASSEMBLY

1. Remove transmission assembly. See [6.7 TRANSMISSION CASE](#). See [Figure 6-32](#). Clamp transmission assembly in a vise, with protective jaws, to work on disassembly.
2. Remove shifter forks and drum as described under [6.8 SHIFTER FORKS AND DRUM](#).

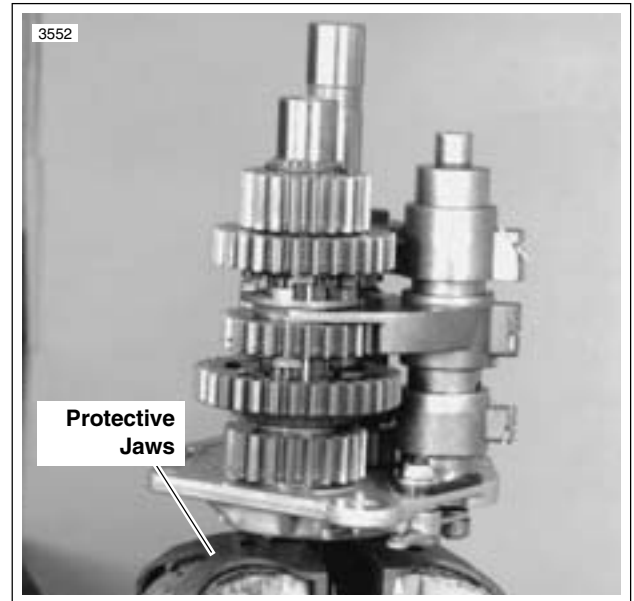


Figure 6-32.

NOTE

As the transmission runs, each part develops a certain wear pattern and a kind of "set" with its mating parts. For this reason, it is important that each component be reinstalled in its original location and facing its original direction.

3. See [Figure 6-33](#). As each component is removed, place it on a clean surface in the exact order of removal.

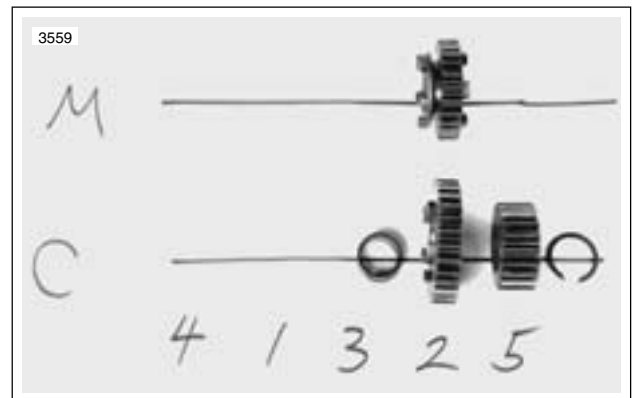


Figure 6-33.

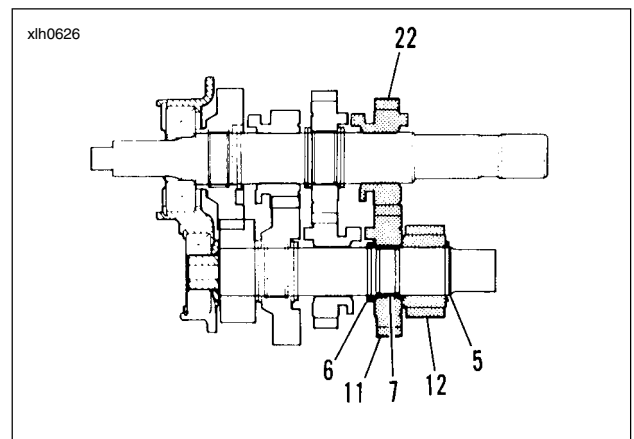


Figure 6-34.

See [Figure 6-34](#). Using **RETAINING RING PLIERS** (Part No. J-5586) remove and discard retaining ring (5) next to countershaft 5th gear (12). Slide countershaft 5th (12), mainshaft 2nd (22) and countershaft 2nd (11) off end of shafts.

b0129x6x

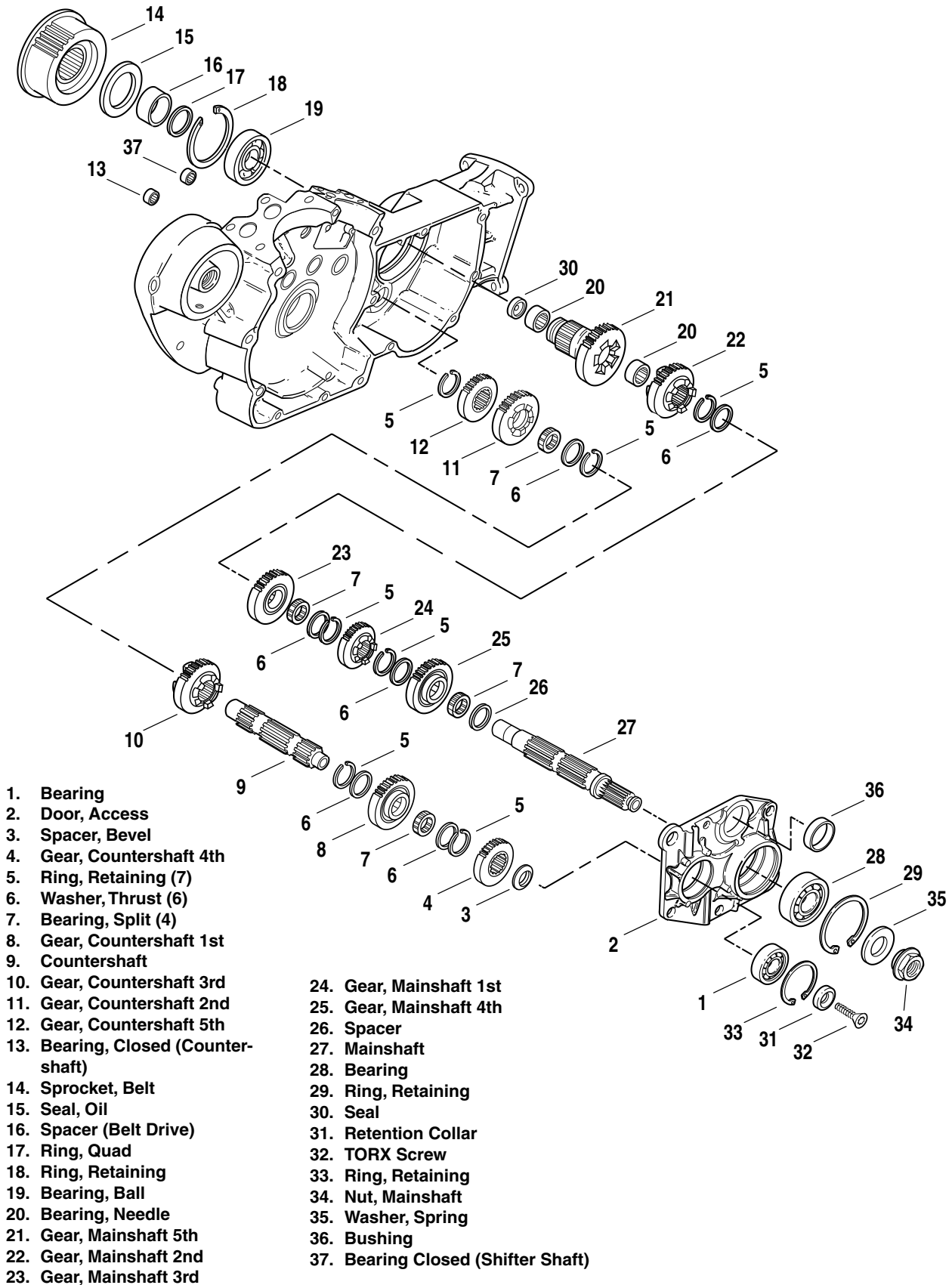


Figure 6-35. Transmission Assembly

4. Remove split bearing (7) that was under gear (11) and thrust washer (6) on the countershaft. See [Figure 6-36](#). Remove retaining ring (5) next to countershaft 3rd gear (10). Slide countershaft 3rd gear (10) off free end of shaft.
5. At mainshaft, between mainshaft 1st gear (24) and mainshaft 3rd gear (23), expand retaining ring (5) and move next to mainshaft 1st gear along with thrust washer (6). Move mainshaft 3rd gear as far as possible toward mainshaft 1st gear (24). Expand retaining ring (5) at opposite side of mainshaft 3rd gear and slide off end of shaft. Remove mainshaft 3rd gear (23) and its split bearing (7).
6. Slide thrust washer (6) off end of mainshaft. Expand retaining ring (5), which is next to mainshaft 1st gear (24), and slide off end of shaft.

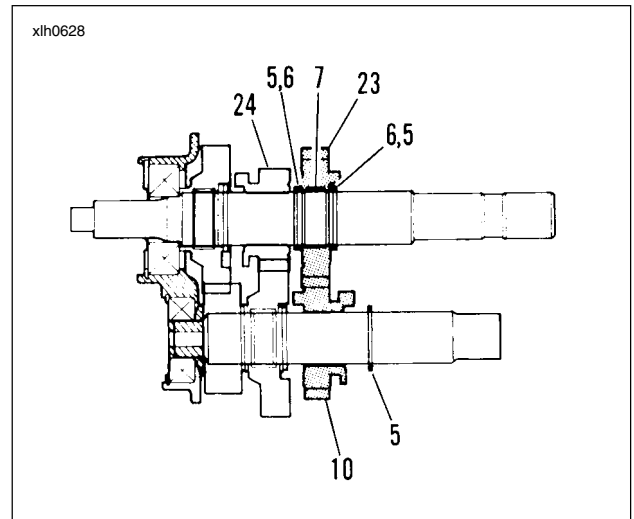


Figure 6-36.

7. See [Figure 6-37](#). Place COUNTERSHAFT GEAR SUPPORT PLATE (Part No. HD-37404) under countershaft 4th gear (4). Place assembly on press with suitable metal blocks under the support plate. Place a socket or mandrel, smaller than inside diameter of bearing, and press countershaft free of access cover. Slide mainshaft 1st gear (24) off mainshaft.

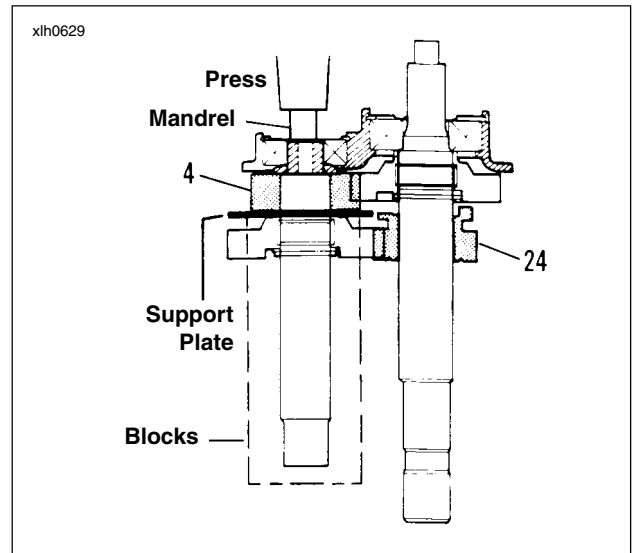


Figure 6-37.

8. See [Figure 6-38](#). Remove beveled spacer (3) and countershaft 4th gear (4).
9. Expand retaining ring (5) located next to countershaft 1st gear (8). Remove retaining ring (5) and thrust washer (6). Slide countershaft 1st gear off end of shaft. Remove split bearing (7).
10. Remove thrust washer (6). Expand remaining retaining ring (5) and slide off shaft. This completes disassembly of countershaft.

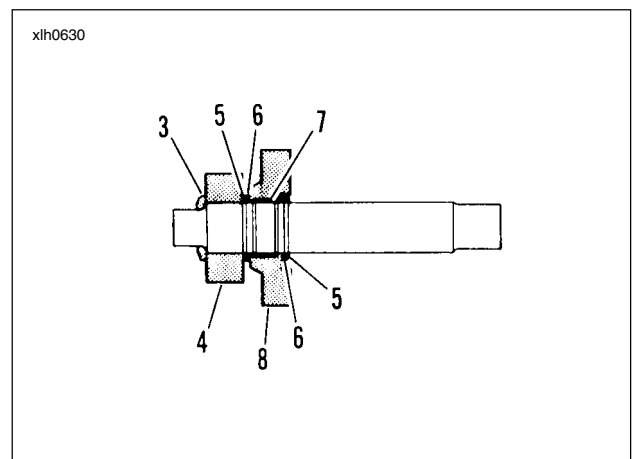


Figure 6-38.

11. See [Figure 6-39](#). Place mainshaft and access door assembly on arbor press with support under mainshaft 4th gear (25). Press on end of shaft until mainshaft is free of access door bearing. Remove spacer (26), mainshaft 4th gear (25) and split bearing (7).
12. Remove thrust washer (6). Expand and remove remaining retaining ring (5).

CLEANING AND INSPECTION

WARNING

Never use compressed air to “spin-dry” bearings. Very high bearing speeds can damage unlubricated bearings. Spinning bearings with compressed air can also cause a bearing to fly apart, which could result in death or serious injury.

1. Clean all parts (except bearings) in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, cracked, battered, chipped or dimpled.
4. Discard all retaining rings that were removed.

ASSEMBLY

CAUTION

During assembly, the split bearings (7) and the internal bores of the gears must be lubricated with **SPORT-TRANS FLUID** prior to assembly. Leaving these parts dry could accelerate wear at start-up.

1. Find a section of pipe that matches the inner race of mainshaft bearing (28). See [Figure 6-40](#). Place the door assembly, outside downward, on a press with the inner race of bearing (28) resting on the section of pipe. Insert the splined end of the shaft through the bearing and hold in a vertical position. Press the shaft into the bearing until the bearing bottoms against the shaft shoulder.

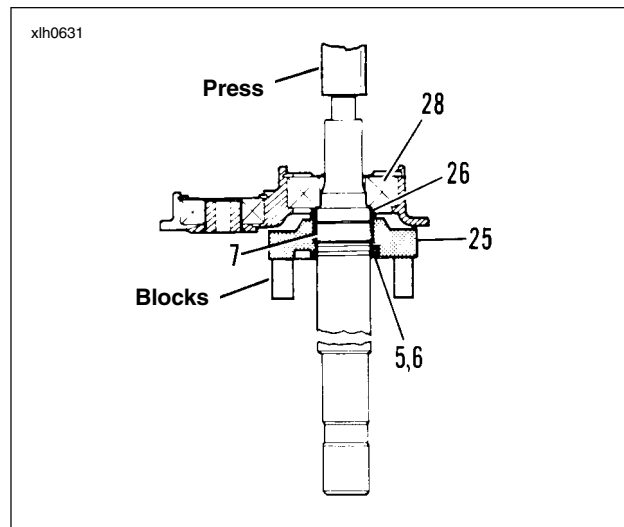


Figure 6-39.

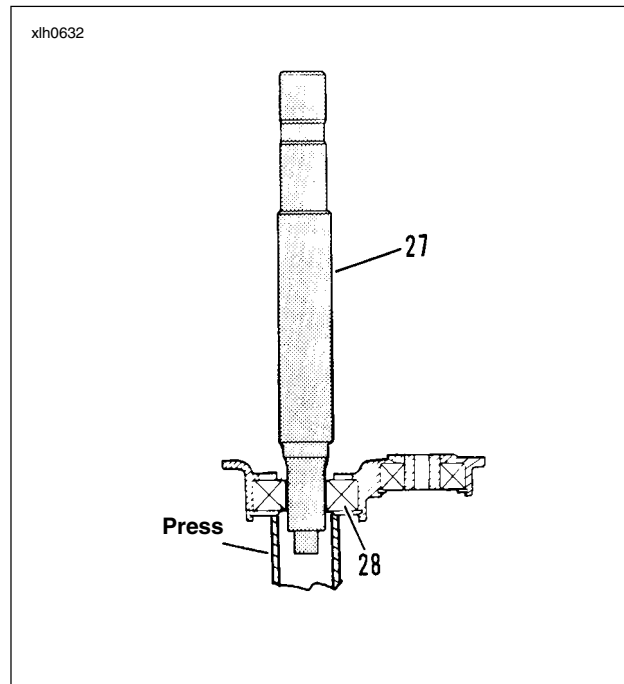


Figure 6-40.

2. See [Figure 6-41](#). Place spacer (26) over mainshaft and position next to bearing (28). Position split bearing (7) into machined seat next to spacer (26). Locate mainshaft 4th gear (25), which can be identified by the two radial grooves at one side. Slide gear (25) onto shaft with radial grooves facing door. Position gear over bearing next to spacer (26).
3. Install thrust washer (6) and retaining ring (5) next to gear (25). It will be necessary to push the retaining ring into final position with a screwdriver.
4. Slide mainshaft 1st gear (24) onto mainshaft with the locking dogs facing gear (25). The shifter fork groove must face the access door.

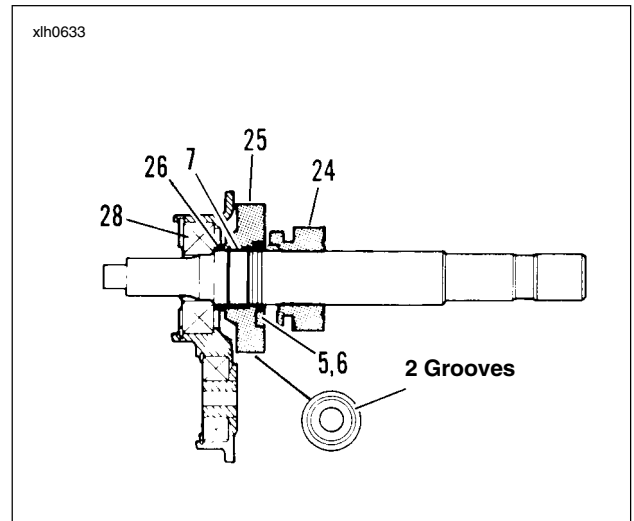


Figure 6-41.

5. See [Figure 6-42](#). Install retaining ring (5) on countershaft. Position retaining ring in the second ring groove from the end with internal threads. Install thrust washer (6) next to retaining ring. Install split bearing (7) in seat next to washer (6).
6. Locate countershaft first gear (8). Gear (8) has a radial groove at one side of the gear. Install gear (8) over split bearing (7) with radial groove facing access door.
7. Install thrust washer (6) and retaining ring (5) next to gear (8).
8. Locate countershaft 4th gear (4). This flat, shoulderless gear is splined and has a single radial groove at one side. Position gear next to retaining ring (5). Place beveled washer (3) over end of shaft with beveled side away from gear (4).

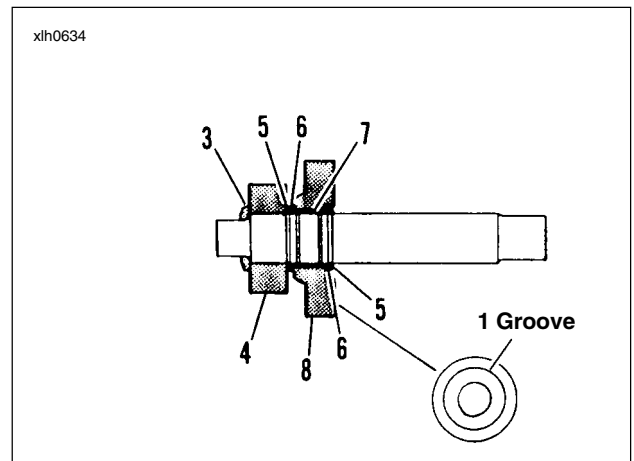


Figure 6-42.

9. See [Figure 6-43](#). Stand countershaft assembly on press with beveled washer upward. Place access cover and mainshaft assembly on top of countershaft with bearing (1) in access cover over end of countershaft. Place a socket or section of pipe on inner race of bearing (1). Hold assembly straight, making sure gear teeth on countershaft are engaged with gear teeth on mainshaft, and press bearing onto shaft until beveled spacer bottoms against bearing.

NOTE

When correctly installed, countershaft 4th gear should have zero end play.

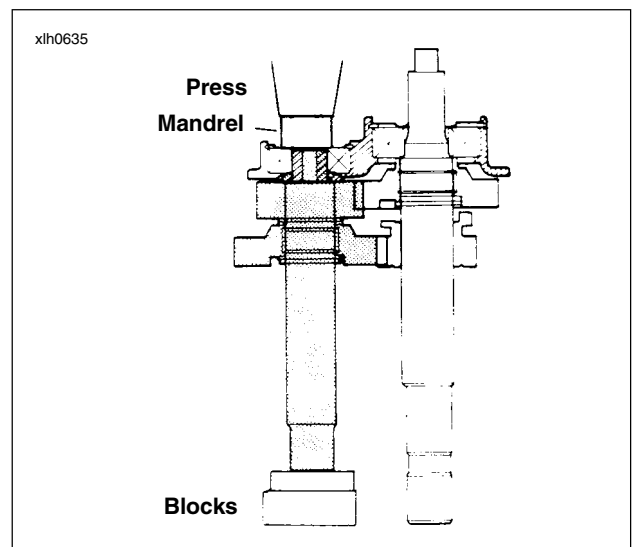


Figure 6-43.

10. See [Figure 6-44](#). At mainshaft, install retaining ring (5) and thrust washer (6). Install split bearing (7) in seat next to thrust washer (6).
11. Install mainshaft 3rd gear (23) onto shaft over bearing (7).
12. Install thrust washer (6) and retaining ring (5) next to gear (23).
13. Install countershaft 3rd gear (10) onto shaft. The shifter fork groove must face away from the access door.

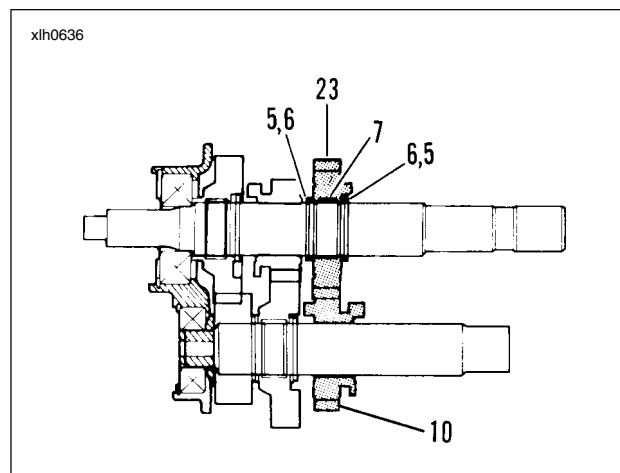


Figure 6-44.

14. See [Figure 6-45](#). Install retaining ring (5) and thrust washer (6) on countershaft. Install split bearing (7) into seat next to thrust washer (6).
15. Install countershaft 2nd gear (11) over bearing (7).
16. Install mainshaft 2nd gear (22) onto shaft. The shifter fork groove must face the access door.
17. Install shouldered countershaft 5th gear (12). The single radial groove must face away from the access door.
18. Expand retaining ring (5) and slide into groove next to countershaft 5th gear (12).

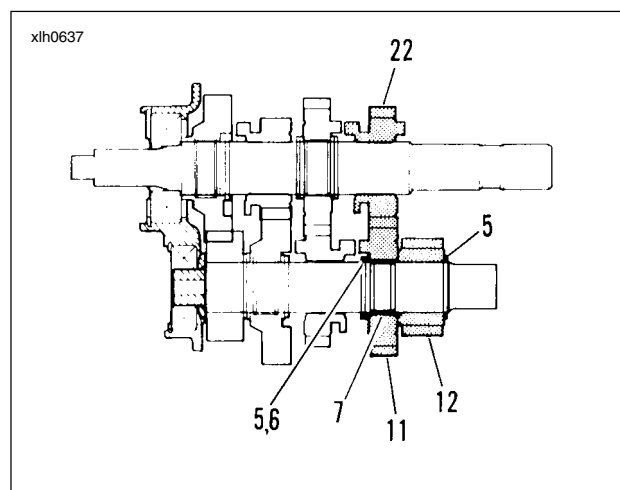


Figure 6-45.

19. See [Figure 6-46](#). At outside of access door, position retention collar (31) next to end of countershaft with beveled side facing outward. Apply a few drops of LOCTITE THREADLOCKER 243 (blue) to the threads of TORX screw (32). Insert TORX screw (32) through retention collar and thread into end of shaft. Place transmission in gear and tighten TORX screw to 13-17 ft-lbs (18-23 Nm).
20. Install shifter forks and drum. See [6.8 SHIFTER FORKS AND DRUM](#).

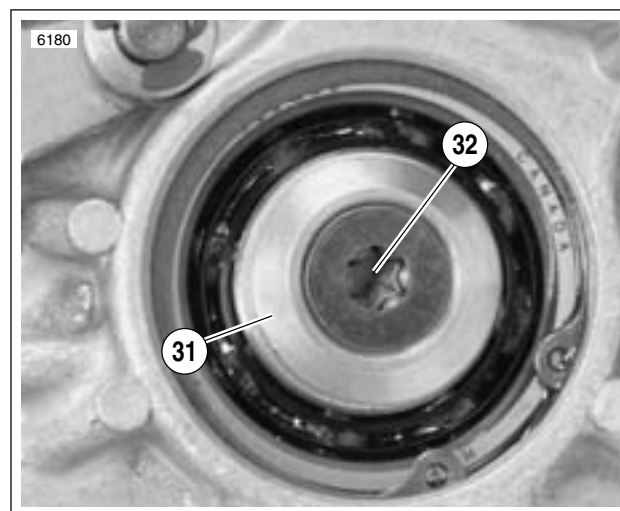


Figure 6-46.

REMOVAL

1. Remove transmission. See 6.7 TRANSMISSION CASE.
2. See Figure 6-47. From inside case tap out seal (3) at end of mainshaft 5th gear (1). Discard seal (3).
3. See Figure 6-48. Use MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A) with CROSS PLATE (Part No. HD-35316-91). Take support bracket and insert pins, at one side, into holes which are now exposed under access cover.
4. See Figure 6-49. Insert bolt (2) through support bracket (1) and 5th gear (3).

CAUTION

When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing will also have to be replaced.

5. At outside of case, place driver (4) and thrust washer (5) over end of bolt (2). Install and tighten nut (6) until 5th gear (3) is free.

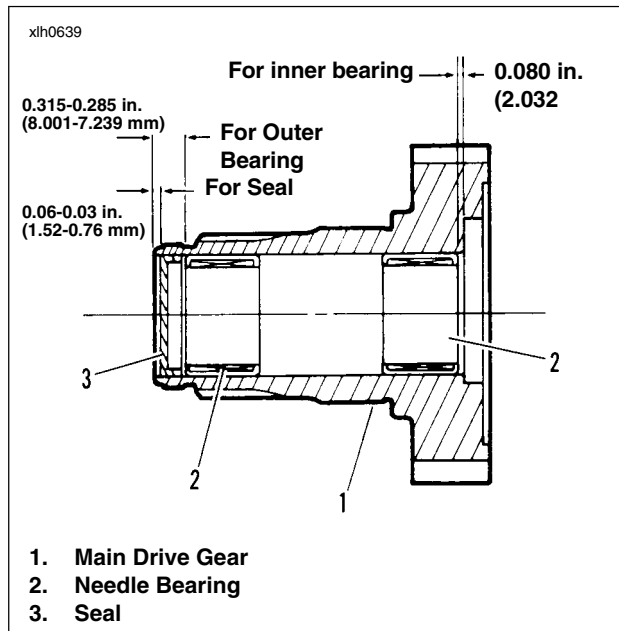


Figure 6-47. Main Drive Gear Assembly

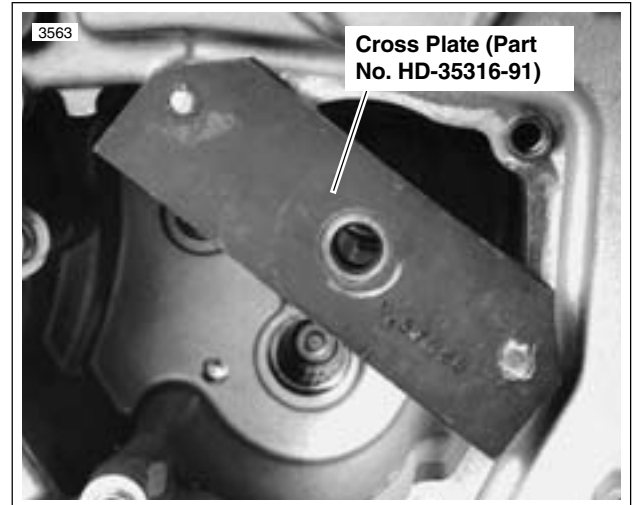


Figure 6-48. Support Bracket Mounting

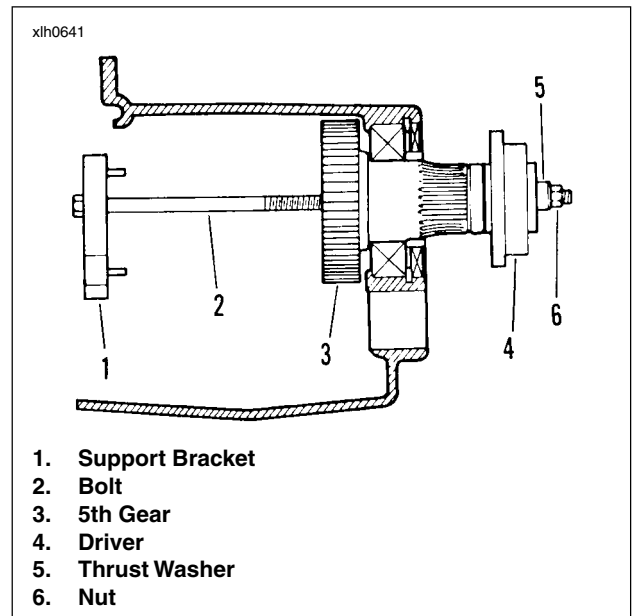


Figure 6-49. Removing Main Drive Gear

DISASSEMBLY

Drive out needle bearings from inside bore of main drive gear. Do not reuse bearings after removal.

ASSEMBLY

- See [Figure 6-50](#). Use INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL (Part No. HD-37842-A) for assembly. Select which end of tool to use.
 - The end stamped 0.080 in. (2.032 mm) is for driving the bearing into the inner end.
 - The end stamped 0.315 in. (8.001 mm) is for the outer end bearing.
- Assemble parts. The installation tool will automatically bottom on the gear when the correct depth is reached.
 - Place main drive gear on a press.
 - Press in the outer bearing to a depth of 0.315-0.285 in. (8.001-7.239 mm).
 - Press in the inner bearing to a depth of 0.080 in. (2.032 mm).

INSTALLATION

- Replace main drive gear bearing. See [6.11 ACCESS DOOR BEARINGS](#).
- See [Figure 6-51](#). Use MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A) for assembly.
 - Take bolt (2) and place washer (5) followed by main drive gear (4) over end of bolt.
 - From inside of case insert bolt and main drive gear through inner race of ball bearing.
 - Insert threaded end of bolt (2) through installer cup (3) and thrust washer (1).
 - Thread nut (6) onto end of bolt (2). Tighten nut (6) until shoulder on gear (4) bottoms against inner race of bearing.
- See [Figure 6-47](#). Tap in **new** seal (3) at threaded end of 5th gear.

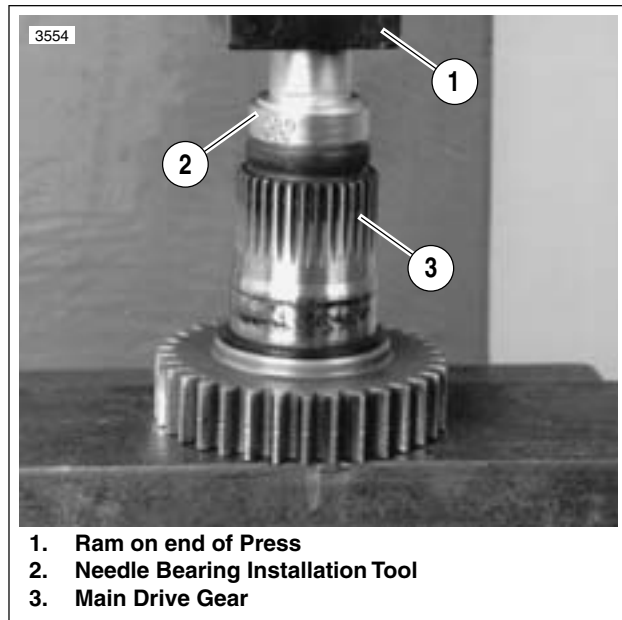


Figure 6-50. Needle Bearing Installation Tool

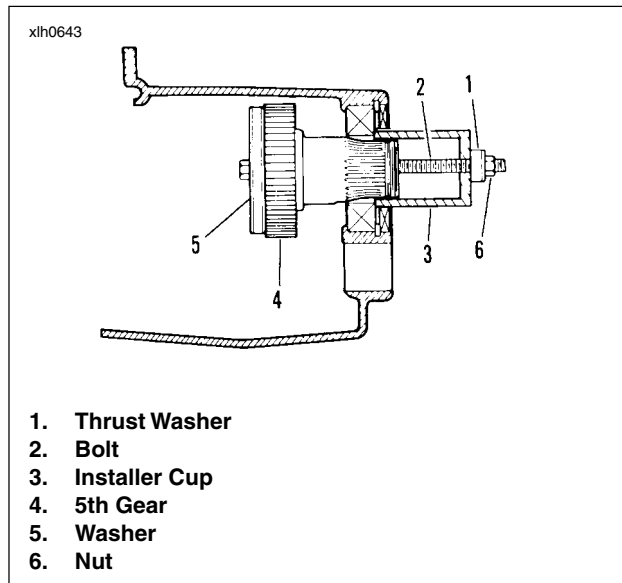


Figure 6-51. Main Drive Gear Installation

REMOVAL

Mainshaft and Countershaft Bearings

1. Remove transmission assembly. See 6.7 TRANSMISSION CASE.
2. Remove shifter forks and drum. See 6.8 SHIFTER FORKS AND DRUM.
3. Remove countershaft and mainshaft. See 6.9 MAINSHAFT AND COUNTERSHAFT.
4. Inspect the mainshaft and countershaft ball bearings for pitting, scoring, discoloration or other damage.
5. See Figure 6-52. If bearing replacement is required, remove retaining rings (1, 2). Press out bearings (3, 4) from the inside of the door.

Shift Drum Bushing

1. Inspect the shifter drum bushing for pitting, scoring, discoloration or excessive wear. If bushing requires replacement press bushing out of door from either side.

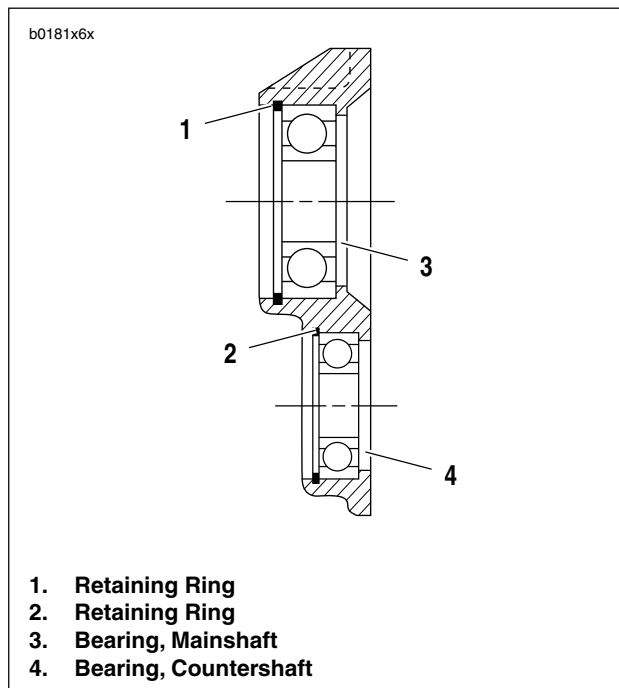


Figure 6-52. Ball Bearing Assembly

INSTALLATION

Mainshaft and Countershaft Bearings

1. Lay access door on press with inside surface of door downward.
2. Lay bearing squarely over bore with printed side of bearing upward. Place section of pipe or tubing (slightly smaller than outside diameter of bearing) against outer race. Press bearing into bore until bearing bottoms against shoulder.
3. Install **new** retaining ring with beveled side facing away from bearing.

Shift Drum Bushing

1. Lay access door on press with outside surface of door downward.
2. See Figure 6-53. Lay bushing squarely over bore. Locate socket or pipe that is slightly larger than diameter of bushing. Place socket or pipe on bushing and press into bore until bushing is flush with or 0.020 in. (0.508 mm) below inside surface. If using a pressing tool larger than diameter of bushing, the pressing tool will bottom against door when bushing is flush with top surface.

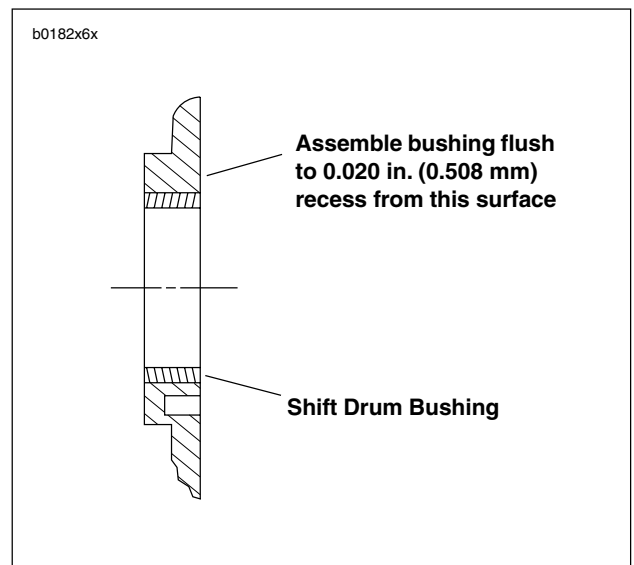


Figure 6-53. Shift Drum Bushing Assembly

REMOVAL

1. Remove transmission assembly. See 6.7 TRANSMISSION CASE. Remove main drive 5th gear. See 6.10 MAIN DRIVE GEAR.
2. At outside of case remove seal next to 5th gear bearing retainer. Remove retaining ring.
3. From inside transmission case drive bearings (5th gear, countershaft or shifter shaft) out of bores. Carefully tap bearings free by working around bearing diameter to keep bearing from skewing.

INSTALLATION

Mainshaft 5th Gear Ball Bearing

1. Locate MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A). See Figure 6-54. Place support bracket pins in appropriate holes in transmission case.
2. See Figure 6-55. Insert bolt (2) through support bracket (1), new bearing (3), driver (4) and thrust bearing (5). Thread nut (6) on end of bolt. Tighten nut carefully until bearing is started in bore squarely. Tighten nut (6) until bearing is seated against shoulder in bore.
3. At outside of case install beveled retaining ring in groove inside bearing bore with beveled side facing outside of case.
4. Lubricate bearing with SPORT-TRANS FLUID.

Countershaft Needle Bearing

1. Find a suitable bearing driver 1-1/4 in. (31.75 mm) in diameter.
2. From the outside of the case place the needle bearing open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven inward flush or 0.030 in. (0.762 mm) below the outside surface of the case.
3. Lubricate bearing with SPORT-TRANS FLUID.

Shift Drum Needle Bearing

1. Find a suitable bearing driver 0.8125 in. (20.64 mm) in diameter.
2. From the outside of the case place the needle bearing, open end first, next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when driven inward flush or 0.030 in. (0.762 mm) below the outside surface.
3. Lubricate bearing with SPORT-TRANS FLUID.

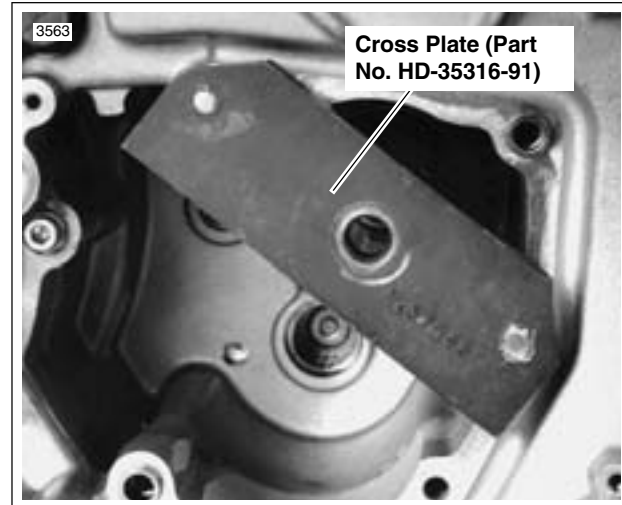


Figure 6-54. Cross Plate Mounting

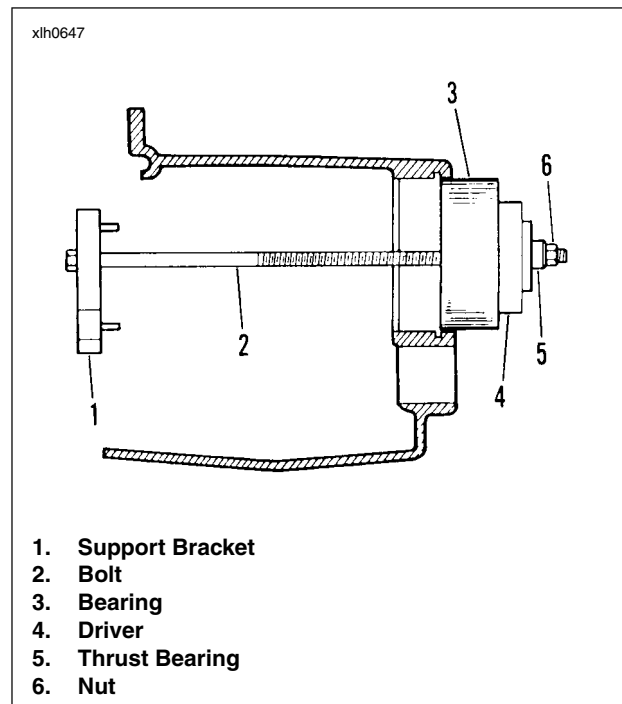


Figure 6-55. Installing Mainshaft Ball Bearing

TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT

Verify that all parts have been properly installed, as described earlier in this section under:

- 6.12 RIGHT TRANSMISSION CASE BEARINGS
- 6.10 MAIN DRIVE GEAR
- 6.9 MAINSHAFT AND COUNTERSHAFT
- 6.8 SHIFTER FORKS AND DRUM

1. Carefully insert transmission into case opening. Position the assembly so that the mainshaft enters fifth gear, and so that the countershaft and drum shifter shaft enter their respective bearings.
2. See Figure 6-56. Install access door.
 - a. Apply a few drops of LOCTITE THREADLOCKER 243 (blue) to all five access door mounting bolts (7).
 - b. Insert bolts through access door into tapped holes in right transmission case.
 - c. Tighten to 13-17 ft-lbs (18-23 Nm).
3. Lift pawl (5) over drum pins and place shifter shaft assembly (6) on studs at transmission case. Loosely install a washer (10) and locknut (3) on each stud.
4. Attach loop of spring (1) over and into groove in post (2).
5. Install detent plate.
 - a. Place detent plate (8) over drum pins.
 - b. Rotate plate until blind holes in plate align with pins in end of shifter fork drum.
 - c. Install **new** retaining ring (9) using SHIFT DRUM RETAINING RING INSTALLER (Part No. HD-39151).
 - d. Verify that retaining ring is fully engaged with drum groove.
6. See Figure 6-57. Align shifter shaft.
 - a. Place transmission in third gear.
 - b. Place a No. 32 drill bit (0.116 in. dia.) through hole in detent plate (3), and between pawl (2) and drive pin at end of shifter drum shaft.
 - c. Push down top of crank (4) to remove all clearance between pawl and drill bit; this will correctly align pawl to shift drum pins (do not push down with too great a force, as this might cause the shifter drum to rotate).
 - d. With bit in place, tighten shifter shaft assembly bottom locknut (1) first to 90-110 **in-lbs** (10-12 Nm). Then, tighten shifter shaft assembly top locknut (1) to the same torque.
 - e. **Remove drill bit.**
7. See Figure 6-35. Place **new** quad ring (17) over threaded end of fifth gear (21), and position next to the gear taper. Install spacer (16) over threaded end of fifth gear with chamfered end toward quad ring. Slide spacer up against bearing (19).

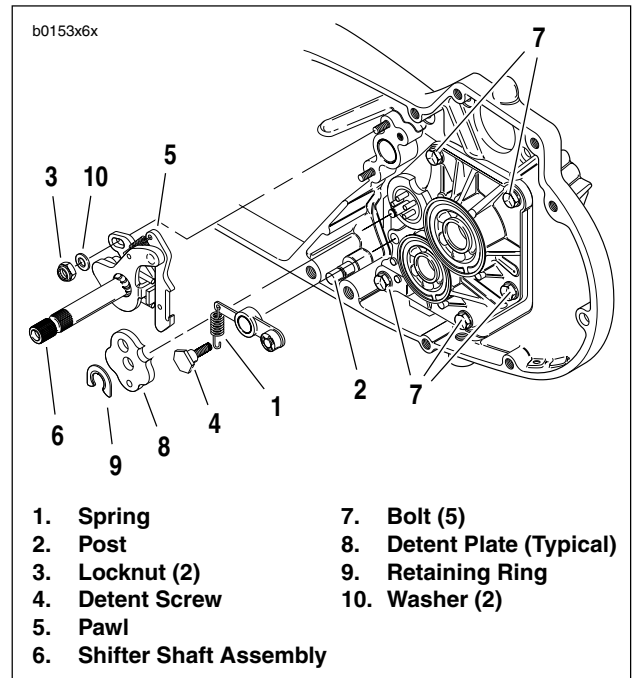


Figure 6-56. Installing Access Door

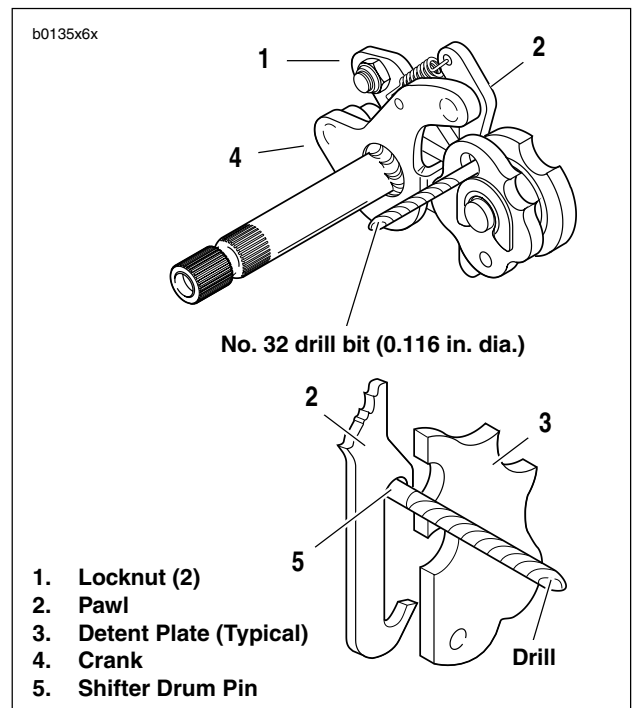


Figure 6-57. Shifter Shaft Assembly Alignment

8. Install seal.
 - a. Coat lips of seal (15) with SPORT-TRANS FLUID.
 - b. Position seal over spacer (16) with lips of seal toward case.
 - c. Gently tap seal into bore of case until the outside of seal is flush with outer edge of bore.

NOTE

It is acceptable to recess seal to about 0.030 in. (0.762 mm) below outer edge of bore. Seal recession will be limited by seal bottoming against retaining ring (18).

9. See Figure 6-58. Increase belt deflection by loosening rear axle and moving rear wheel forward. Install transmission sprocket (2) with secondary drive belt onto main drive gear shaft (1).
10. Place transmission in neutral.
11. Apply a few drops of LOCTITE THREADLOCKER 262 (red) to the **left-hand threads** of transmission sprocket nut (3). Position nut with washer-faced side facing transmission sprocket. Turn the nut **counterclockwise** to install it onto main drive gear shaft (1).
 - a. See Figure 6-59. Install SPROCKET HOLDING TOOL (1) (Part No. HD-41321) as shown. Use MAINSHAFT LOCKNUT WRENCH (2) (Part No. HD-94660-37B) and a torque wrench to tighten sprocket nut to 50 ft-lbs (68 Nm) INITIAL torque, ONLY.
 - b. See Figure 6-60. Scribe a line on the transmission sprocket nut and continue the line on the transmission sprocket as shown.
 - c. Tighten the transmission sprocket nut an additional 30°-40°.
 - d. See Figure 6-58. Install lockplate (4) over nut (3) so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's (2) two tapped holes.

NOTE

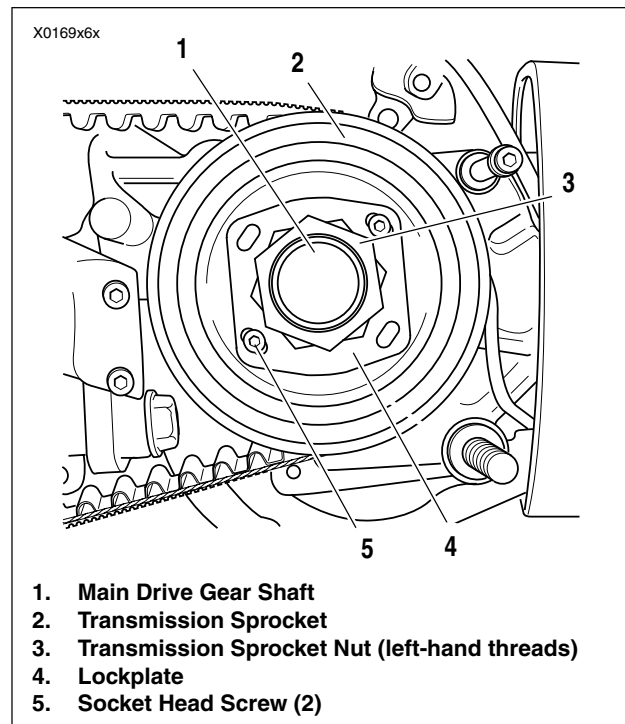
*The lockplate has four screw holes and can be turned to either side, so you should be able to find a position without having to additionally tighten the nut. If you cannot align the screw holes properly, the nut may be additionally **TIGHTENED** until the screw holes line up, but do not exceed 45° as specified above. Never **LOOSEN** nut to align the screw holes.*

- e. See Figure 6-60. If lockplate will not align with holes, tighten nut to 45° maximum.

CAUTION

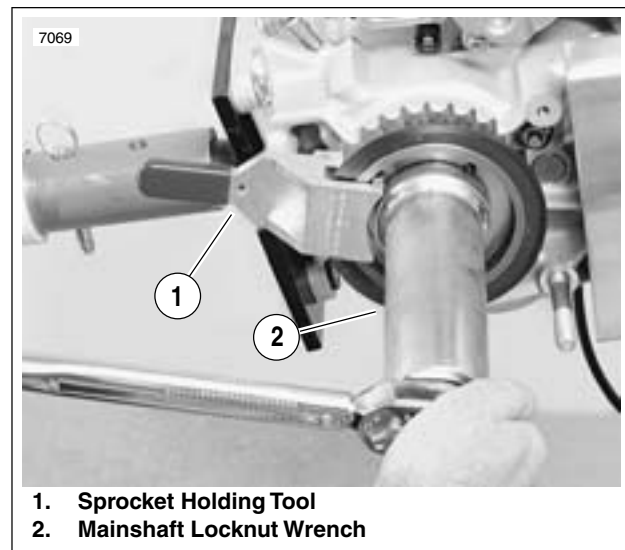
Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation, after initially tightening to 50 ft-lbs. Do not loosen sprocket nut while attempting to align the screw holes. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened 45° as specified above. Tightening too much or too little may cause the nut to come loose during vehicle operation.

12. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened until screw holes align.



1. Main Drive Gear Shaft
2. Transmission Sprocket
3. Transmission Sprocket Nut (left-hand threads)
4. Lockplate
5. Socket Head Screw (2)

Figure 6-58. Transmission Sprocket



1. Sprocket Holding Tool
2. Mainshaft Locknut Wrench

Figure 6-59. Transmission Sprocket Tightening

- See Figure 6-58. Install two socket head screws (5) through aligned holes of lockplate and into tapped holes of sprocket. Tighten to 90-110 in-lbs (10-12 Nm).

NOTE

The original equipment socket head screws (5) have thread-locking compound applied to them. Since this compound remains effective for about three removal/installation cycles, the original screws may be reused up to three times. After the third removal/installation cycle, replace both screws with **new** screws identical to the original.

- Install the remaining removed components in the reverse order of the removal procedures. See the procedures listed in the respective component sections.
- Adjust drive belt tension. See 1.9 DRIVE BELT DEFLECTION.
- Fill transmission to proper level with fresh lubricant. See 1.8 CLUTCH.

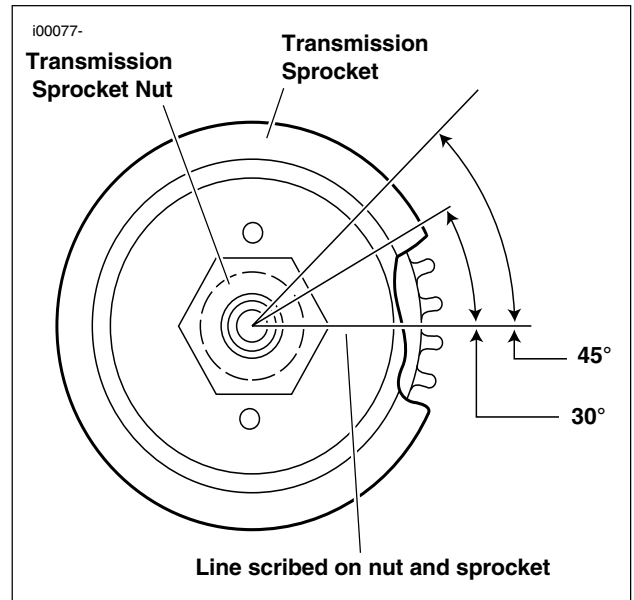


Figure 6-60. Aligning Transmission Sprocket

NOTES

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BATTERY	
Size	12 VDC
Type	Sealed

SPARK PLUGS		
Size	12 mm	
Type	10R12	
Gap	0.038-0.043 in.	0.97-1.09 mm
Torque Value	11-18 ft-lbs	15-24 Nm

ALTERNATOR	
AC Voltage Output	19-26 VAC per 1000 engine RPM
Stator Coil Resistance	0.2-0.4 Ohms

REGULATOR	
Voltage Output @ 75°F	13.8-15 VDC
Amperes @ 3600 RPM	22 Amps

IGNITION TIMING SPARK OCCURRENCE		
Idle	V.O.E.S.	
	Connected	Disconnected
All M2/M2L models 950-1050 RPM	20° BTDC	Approximately 7.5° BTDC

IGNITION COIL RESISTANCE	
Primary Winding	2.5-3.1 ohms
Secondary Winding	10,000-12,500 ohms

ELECTRICAL SYSTEM	AMPERES
Main Circuit Breaker	30
Ignition Fuse	20
Light Fuse	15
Accessory Fuse	15
Instrument Fuse	15
Odometer	15

LAMP DESCRIPTION		BULBS REQUIRED	WATTS	AMPS	PART NUMBER
Headlamp	High/Low (replaceable bulb)	1	60/55	5.0/4.58	67969-96Y
	Position Lamp (European models only)	1	4	0.33	67968-96Y
Marker Lamps	Tail/Stop Lamp	1	5/21	0.42/1.75	68075-94Y
	Turn Signal Lamp, Front and Rear (1 bulb each)	4	10	0.83	68073-94Y
Indicator Lamps on Instrument Support	High Beam Indicator	1	2.1	0.15	68024-94
	Turn Signal Indicator	2	2.1	0.15	68024-94
	Oil Pressure Indicator	1	2.1	0.15	68024-94
	Neutral Indicator	1	2.1	0.15	68024-94
Instruments	Speedometer Illumination	1	1.7	0.14	67421-99Y
	Tachometer Illumination	1	1.7	0.14	68073-99Y

TORQUE VALUES

ITEM	TORQUE		NOTES
Bank Angle Sensor Mounting Screw	25-27 in-lbs	2.8-3.1 Nm	page 7-16
Battery terminal hardware	40 in-lbs	5 Nm	metric, page 7-45
Dash panel screw	4-5 ft-lbs	5-7 Nm	page 7-74
Dash panel screw	7-9 ft-lbs	10-12 Nm	page 7-66
Engine Temperature Sensor	10-14 ft-lbs	14-19 Nm	Special Socket Required, page 7-17
Headlamp adjusting screws	6-8 ft-lbs	8-11 Nm	metric, page 7-52
Headlamp Housing Mounting Screws	12-14 ft-lbs	16-19 Nm	metric, page 7-52
Headlamp Retaining Ring and Bezel Screws	12-14 in-lbs	1.4-1.6 Nm	page 7-52
Ignition coil mounting screws	4-6 ft-lbs	5-8 Nm	page 7-25
Inner cover screws	12-20 in-lbs	1.4-2.3 Nm	page 7-23
Neutral indicator switch	3-5 ft-lbs	4-7 Nm	LOCTITE THREADLOCKER 243 (blue), page 7-60
Rotor mounting bolts	90-110 in-lbs	10.2-10.4 Nm	LOCTITE THREADLOCKER 242 (blue), page 7-43
Spark plugs	11-18 ft-lbs	15-24 Nm	page 7-1
Speedometer Sensor Screw	80-100 in-lbs	9-11 Nm	page 7-62
Starter battery positive cable nut	60-85 in-lbs	6.8-9.6 Nm	metric, page 7-45
Stator mounting screws	30-40 in-lbs	3.4-3.5 Nm	T-27 TORX with retaining compound, replace after removal, page 7-43
Switchgear housing screws, left side	25-33 in-lbs	3-4 Nm	metric, page 7-58
Switchgear housing screws, right side	12-17 in-lbs	1-2 Nm	metric, page 7-57
Timer plate studs	15-30 in-lbs	1.7-3.4 Nm	page 7-23
Trigger rotor bolt	43-53 in-lbs	4.9-6.0 Nm	LOCTITE THREADLOCKER 243 (blue), page 7-23
Turn signal screws, front	20-23 in-lbs	2.3-2.6 Nm	page 7-54
Turn signal screws, rear	25-28 in-lbs	2.8-3.2 Nm	page 7-55
Voltage Regulator Mounting Screws	9-11 ft-lbs	7-11 Nm	page 7-44

GENERAL

The vehicle uses a breakerless inductive-discharge ignition system. The system has both a primary and secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil winding, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, spark plugs and associated wiring. See Figure 7-1.

The computerized ignition system contains five assemblies.

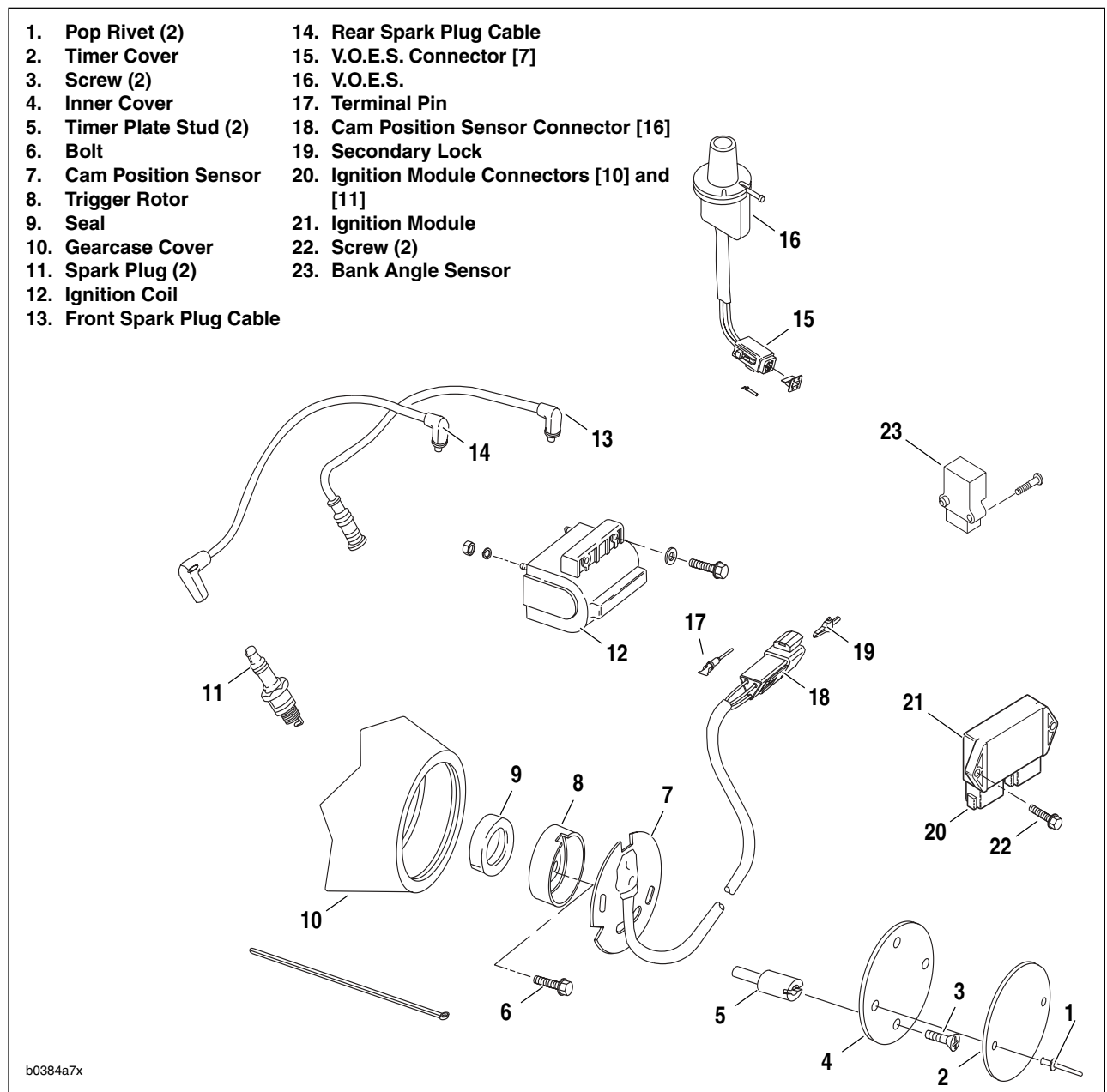


Figure 7-1. Ignition System Components

Ignition Module

The ignition module is located on the vehicle frame next to the fuse block on the right side of the motorcycle. The module has two functions. First, it computes the spark advance for proper ignition timing. Second, it opens and closes the low-voltage circuits between the battery and ignition coil to produce high-voltage discharge to the spark plugs.

Vacuum-Operated Electric Switch

The vacuum-operated electric switch (V.O.E.S.) is attached to the carburetor. The V.O.E.S. senses intake passage vacuum through a carburetor hose connection. The switch is open during acceleration and high engine load conditions (low vacuum) and is closed during deceleration and low engine load conditions (high vacuum). The ignition module is programmed with two spark advance curves to meet varying engine loads.

The high-vacuum curve, selected for maximum spark advance under normal light-load cruising conditions, provides improved fuel economy and performance. The low-vacuum curve (retarded spark) minimizes spark knock while maintaining performance under high-load conditions (acceleration and highway driving). The ignition module selects the proper curve when it receives an open or closed electrical signal from the V.O.E.S. This system ensures correct timing to suit starting and high-speed requirements.

A single ignition coil fires each spark plug independently on the compression stroke of each cylinder. The spark plug in the front cylinder fires at the end of that cylinder's compression stroke, thereby igniting the air/fuel mixture. The same sequence occurs at the end of the rear cylinder's compression stroke (thereby igniting the air/fuel mixture in the rear cylinder).

Bank Angle Sensor

The Bank Angle Sensor is located just forward of the ignition module on the right side of the motorcycle. The Bank Angle Sensor provides input to the ignition module on whether or not the vehicle lean angle is greater than 55 degrees. If vehi-

cle lean angle exceeds 55 degrees, the Bank Angle Sensor will shut off power to the ignition.

Engine Temperature Sensor

The Engine Temperature Sensor is located in the rear cylinder head. With the Engine Temperature Sensor, the ignition module is now able to sense when overheating is about to occur and it will automatically reduce power ("skip spark" - spark plugs fire every *other* engine revolution) until the operating temperature returns to normal. The rider may experience this condition during extended high speed operation with high ambient temperatures or during extended periods at idle.

Rotor and Cam Position Sensor

The rotor and cam position sensor are located in the gearcase cover on the right side of the motorcycle. The rotor is mounted on the camshaft and operates at one-half crankshaft speed. As the rotor turns, slots in its outside diameter break the magnetic field of a Hall-effect device mounted on the cam position sensor. The output of the Hall-effect device is a logic-type signal that corresponds to the timing information from the spinning rotor. This technique gives accurate timing information down to "0" speed.

The ignition system produces a spark near top dead center (TDC) for starting. At RPM's and loads above this, the system produces a spark 13°-45° before TDC. The whole timing program can be shifted by mechanical rotation of the cam position sensor. See [1.19 IGNITION TIMING](#).

The ignition module has added protection against transient voltages, continuous reverse voltage protection and damage due to jump starts. The system will operate down to 5.7 VDC. The ignition module is fully enclosed to protect it from vibration, dust, water and oil. The module is not repairable. Replace the unit if it fails.

See the wiring diagrams at the end of this section for additional information on ignition system circuits.

TROUBLESHOOTING

Perform the following tests if the engine will not start, or if hard starting or missing indicates a faulty operating ignition system.

Check for Ignition Spark

1. Disconnect spark plug cables from spark plugs. Check condition of plugs and cables. Clean or replace as necessary.
2. Insert a conductive adapter into spark plug cable end.
3. Establish a 0.1875 in. (4.8 mm) gap between adapter and cylinder head.
4. Turn ignition key switch to IGN and engine stop switch to ON.
5. With transmission in neutral, press electric starter button. Check for a spark across plug electrode gap.
 - a. If a spark is produced, problem is not in electronic system or coil. Check carburetion, enrichener and spark plugs.
 - b. If no spark is produced, check battery voltage and battery connection. Battery voltage must be at least 12.8 VDC. Charge battery if voltage is low.
6. Verify that the ground strap from the swingarm mount block to the frame is in good condition. If there is still no spark, then perform the tests under **NO IGNITION SPARK**.

No Ignition Spark

See [Figure 7-3](#). To conduct the following tests, it will be necessary to assemble a set of jumper wires.

Cut two wires of ample length to reach from a good ground connection to the negative terminal of the coil primary. If a suitable capacitor is not available, use a condenser (such as the type used in earlier breaker point ignition systems).

When conducting Steps 3 and 5 of the following spark tests, connect a spare spark plug to one of the plug wires and lay the spark plug on the engine cylinder head. During the testing procedures, check for spark across the spark plug electrodes.

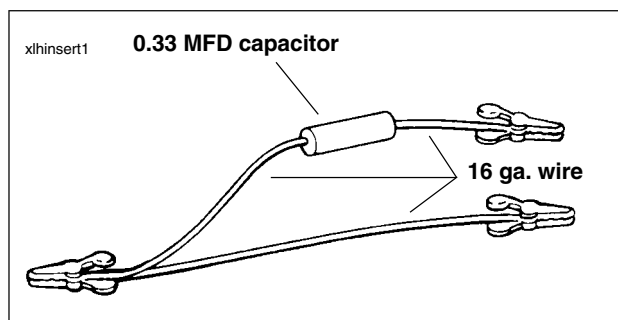
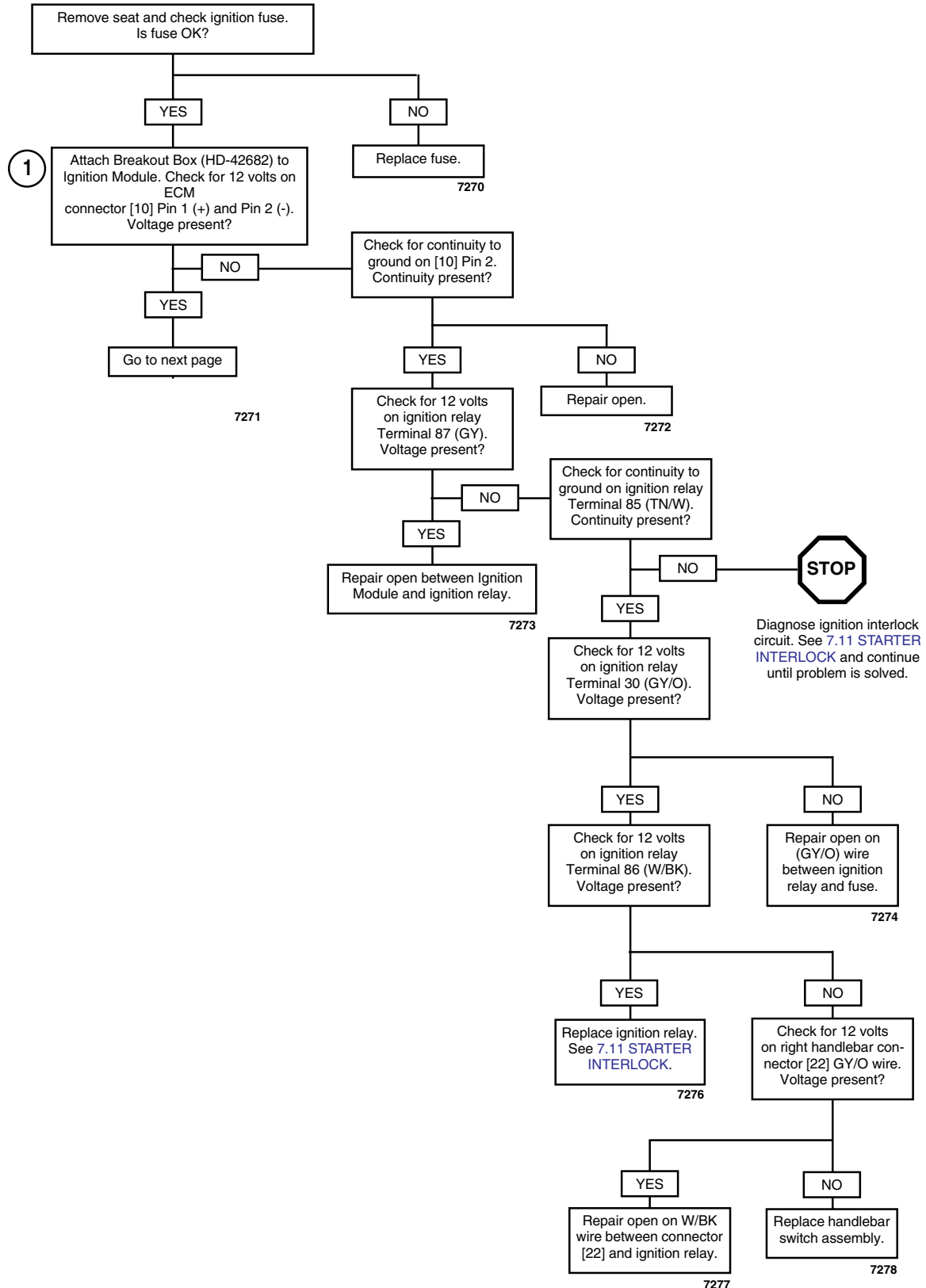


Figure 7-3. Test Jumper

No Spark At Spark Plug (Part 1 of 8)

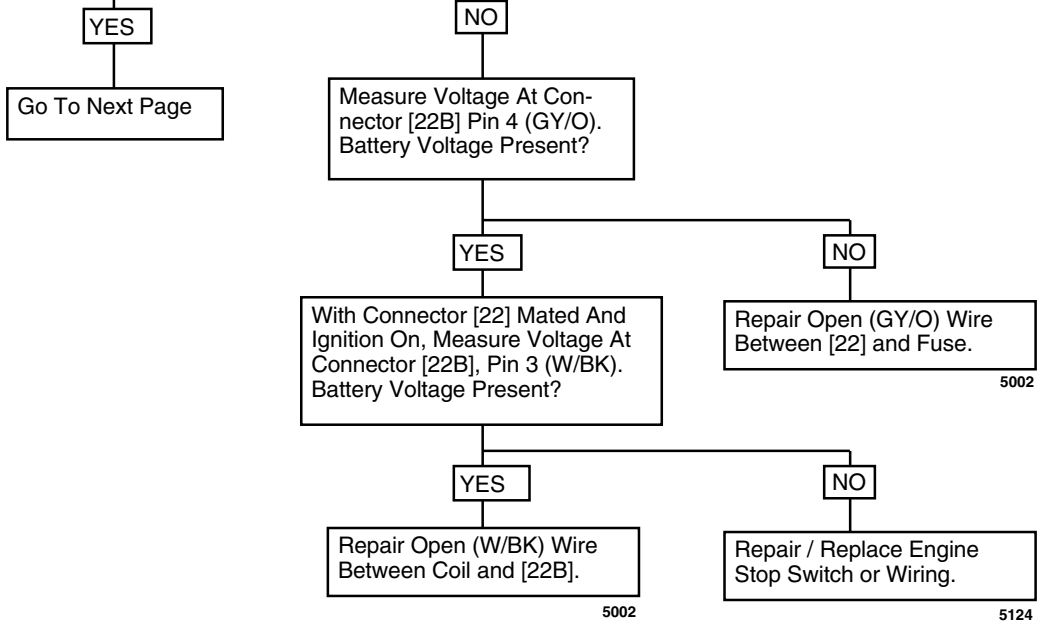
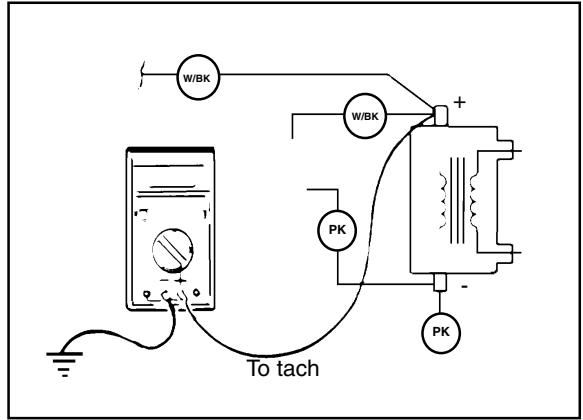
CONDITION: Sidestand up, key ON and transmission in neutral



No Spark At Spark Plug (Part 2 of 8)

Continuous or No Spark at Spark Plug

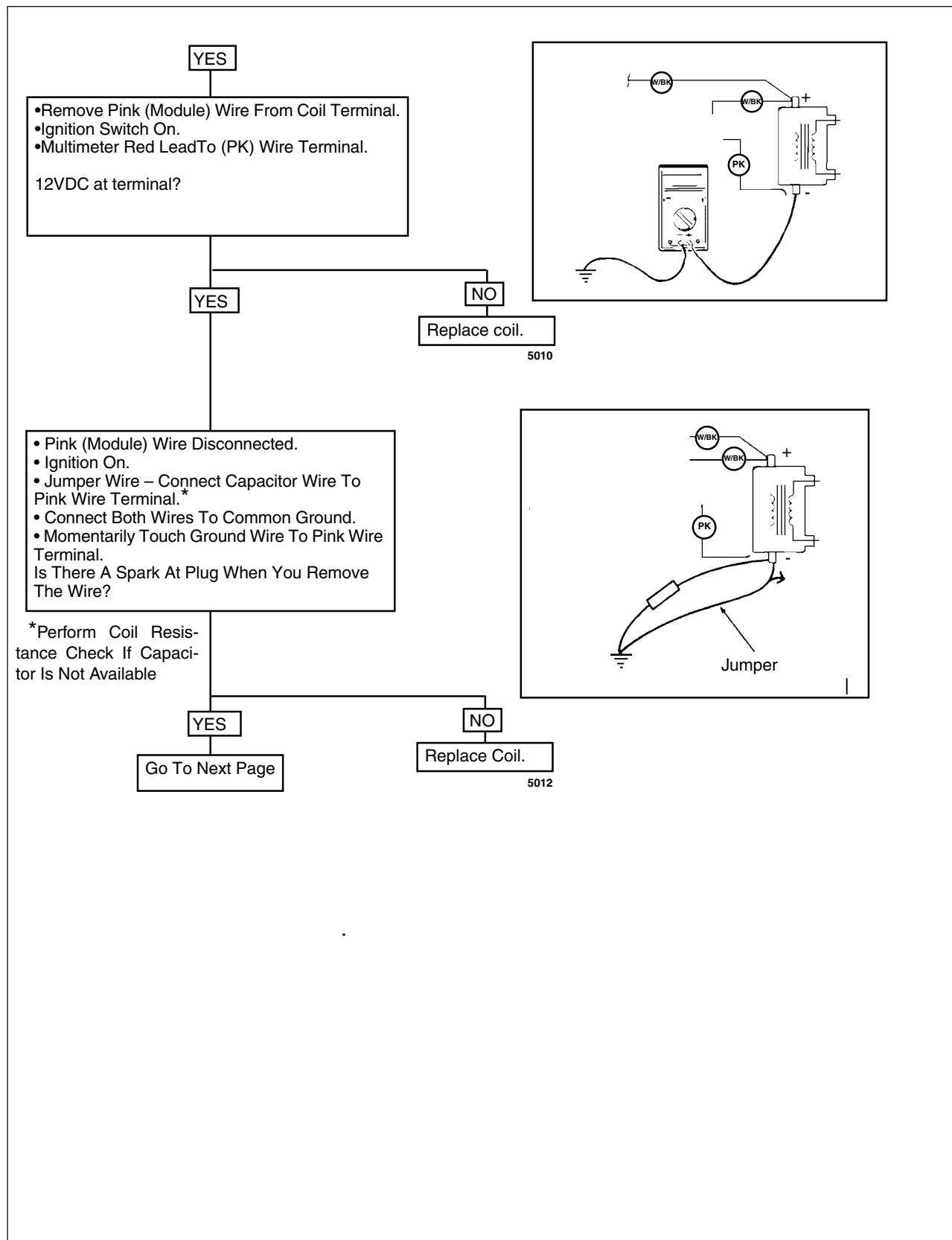
- Ignition On.
- Multimeter Red Wire To White/Black Wire On Coil,
- Black Wire To Ground.
- Meter Should Register 12v ± One Volt.



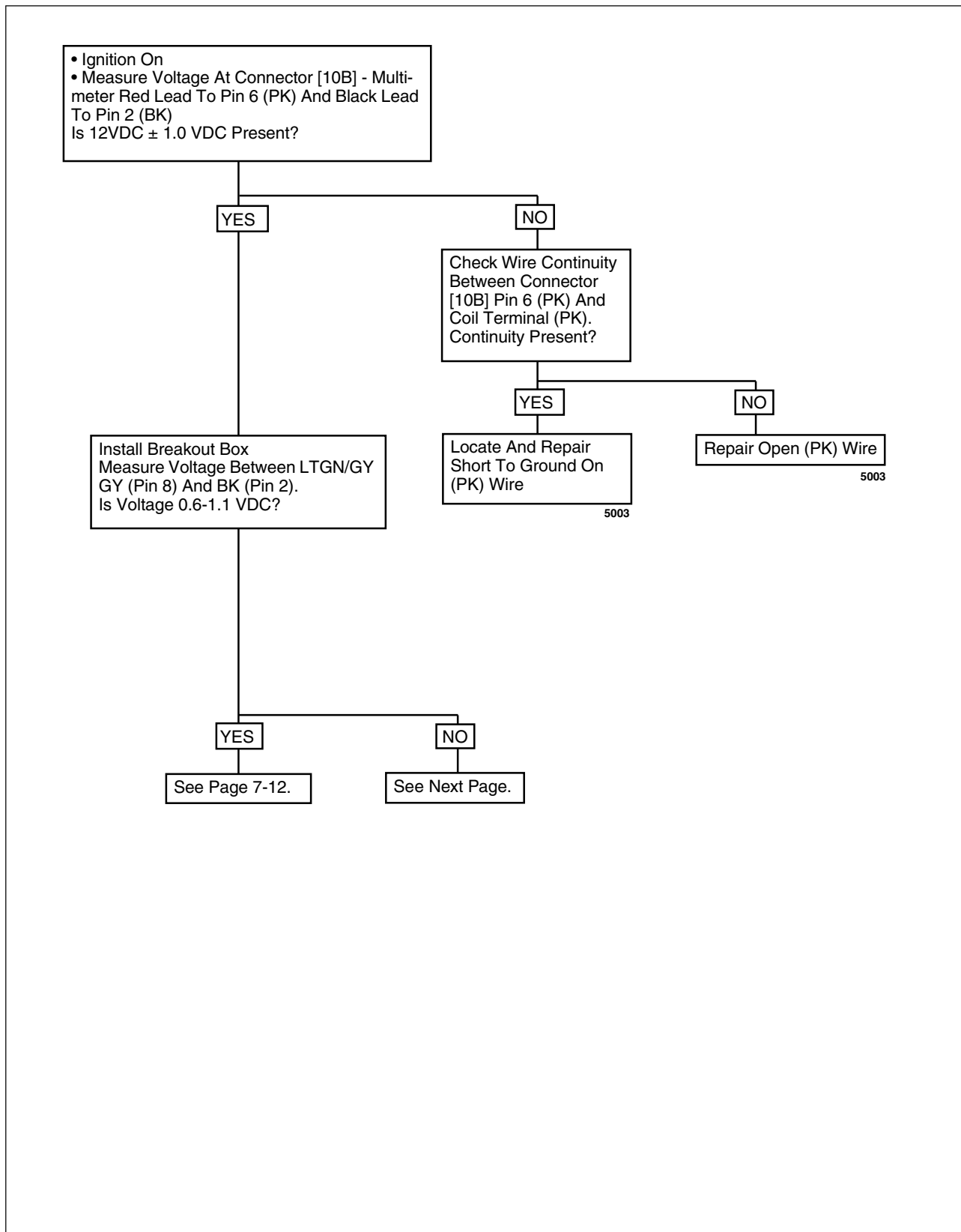
Wire Harness Connectors

No.	Description	Type	Location
[22]	RT Handlebar Switch	6 - Place Deutsch (BK)	Under Fuel Tank

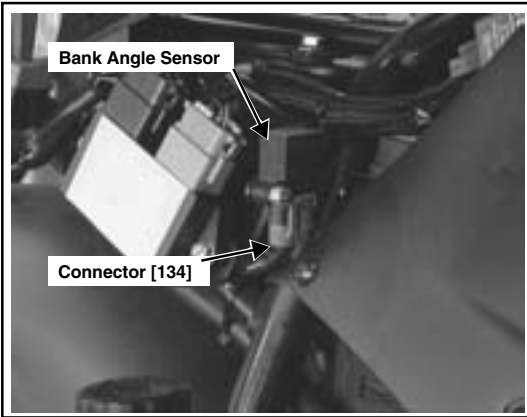
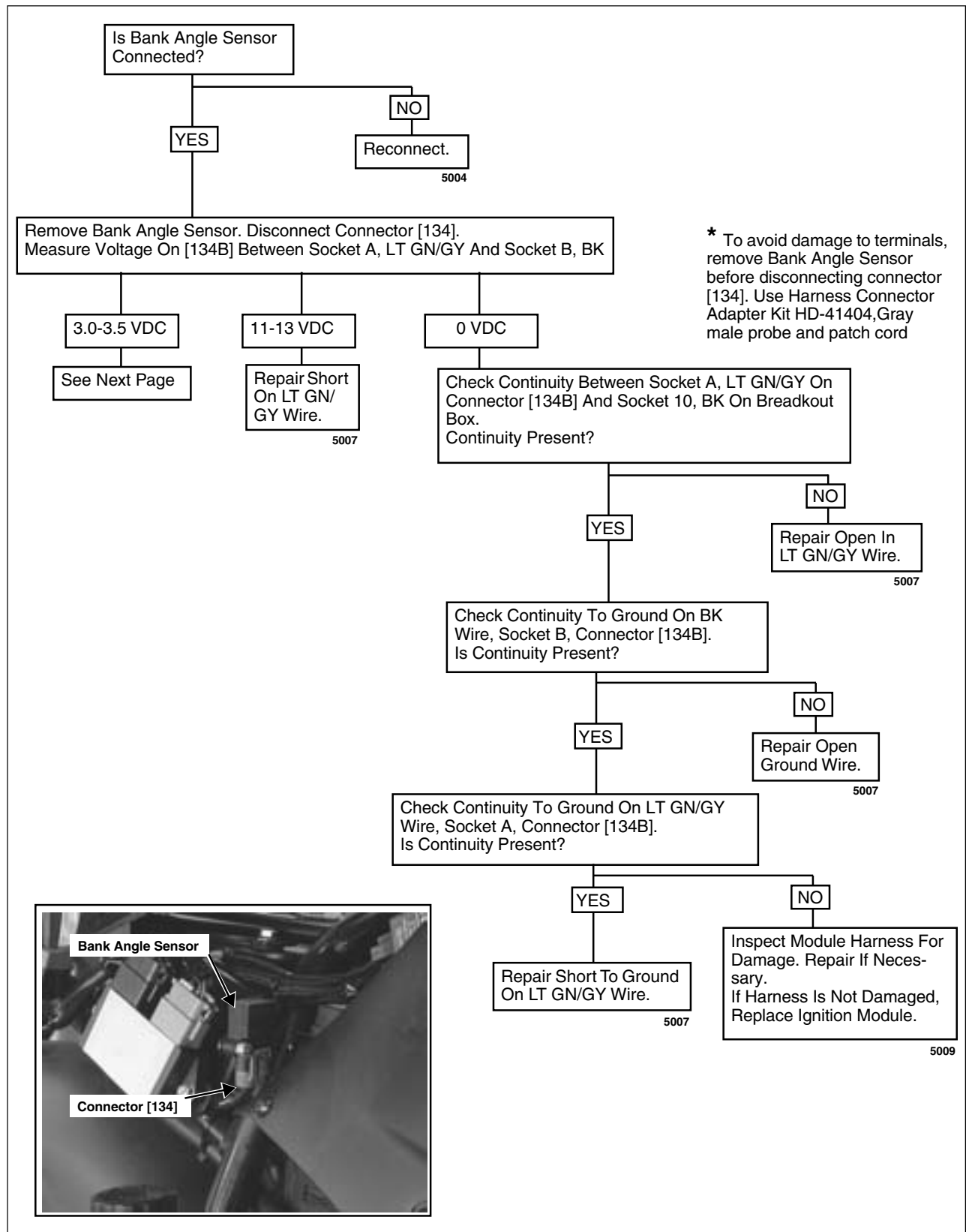
No Spark At Spark Plug (Part 3 of 8)



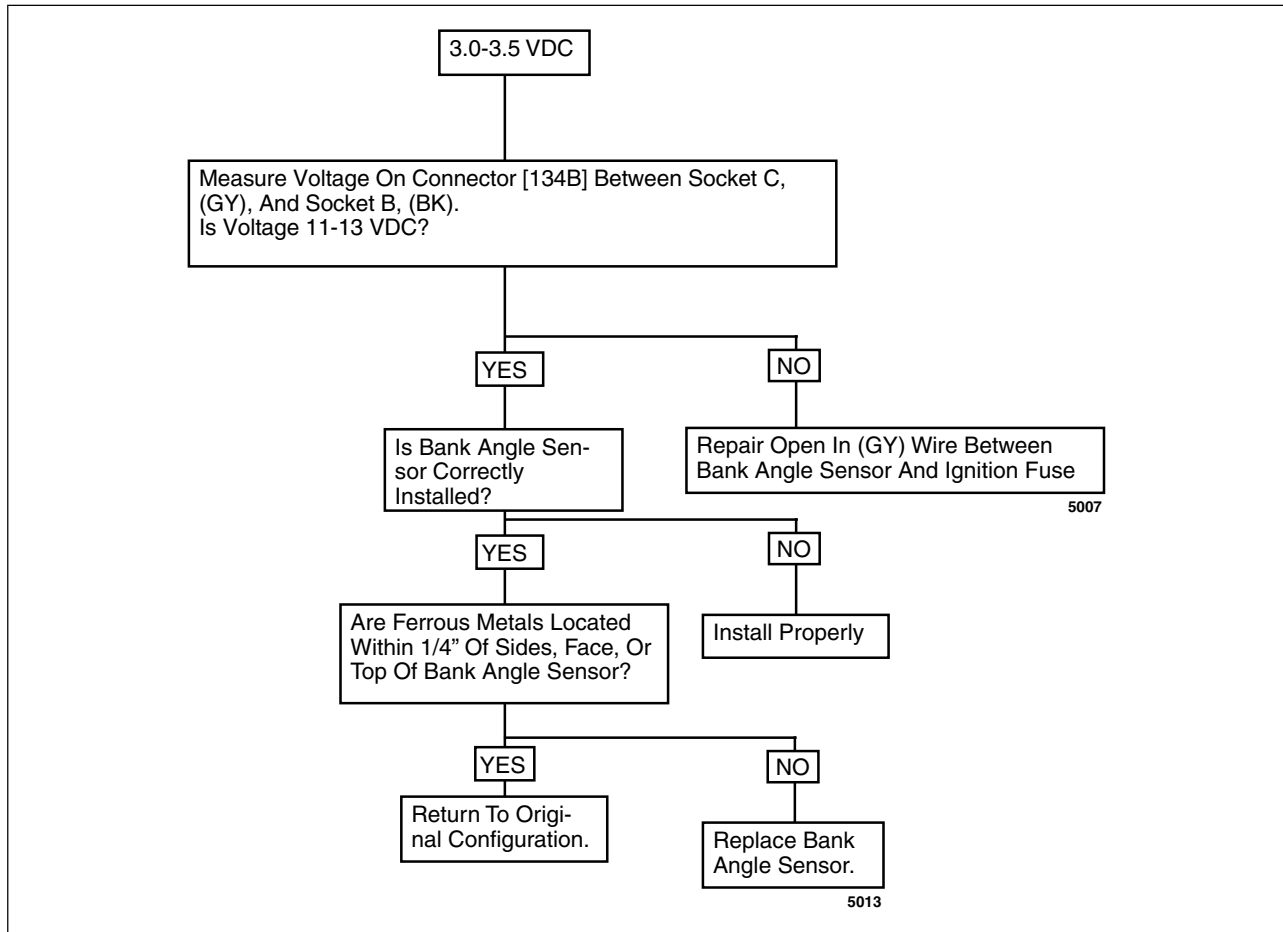
No Spark At Spark Plug (4 of 8)



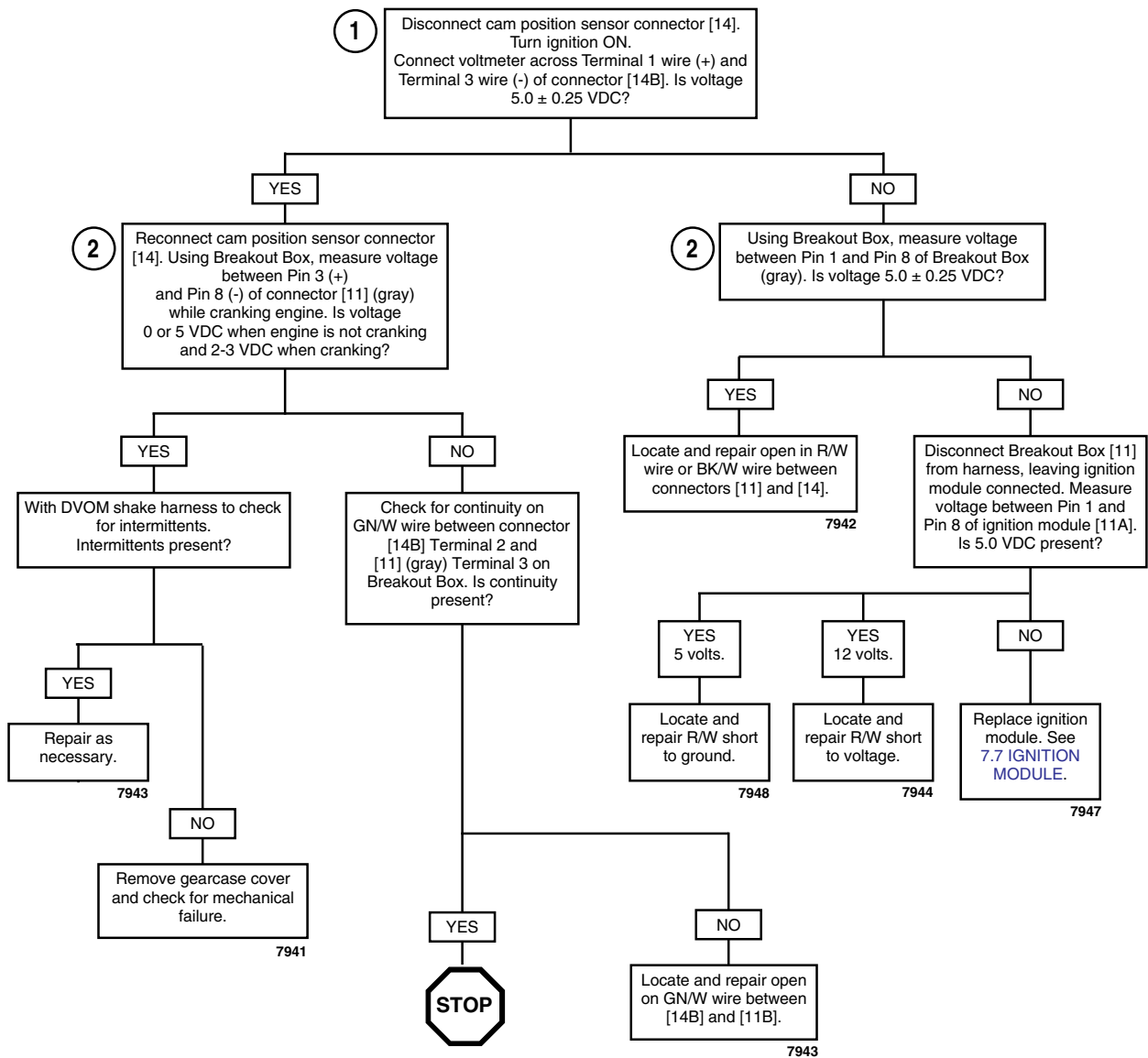
No Spark At Spark Plug (Part 5 of 8)



No Spark At Spark Plug (Part 6 of 8)

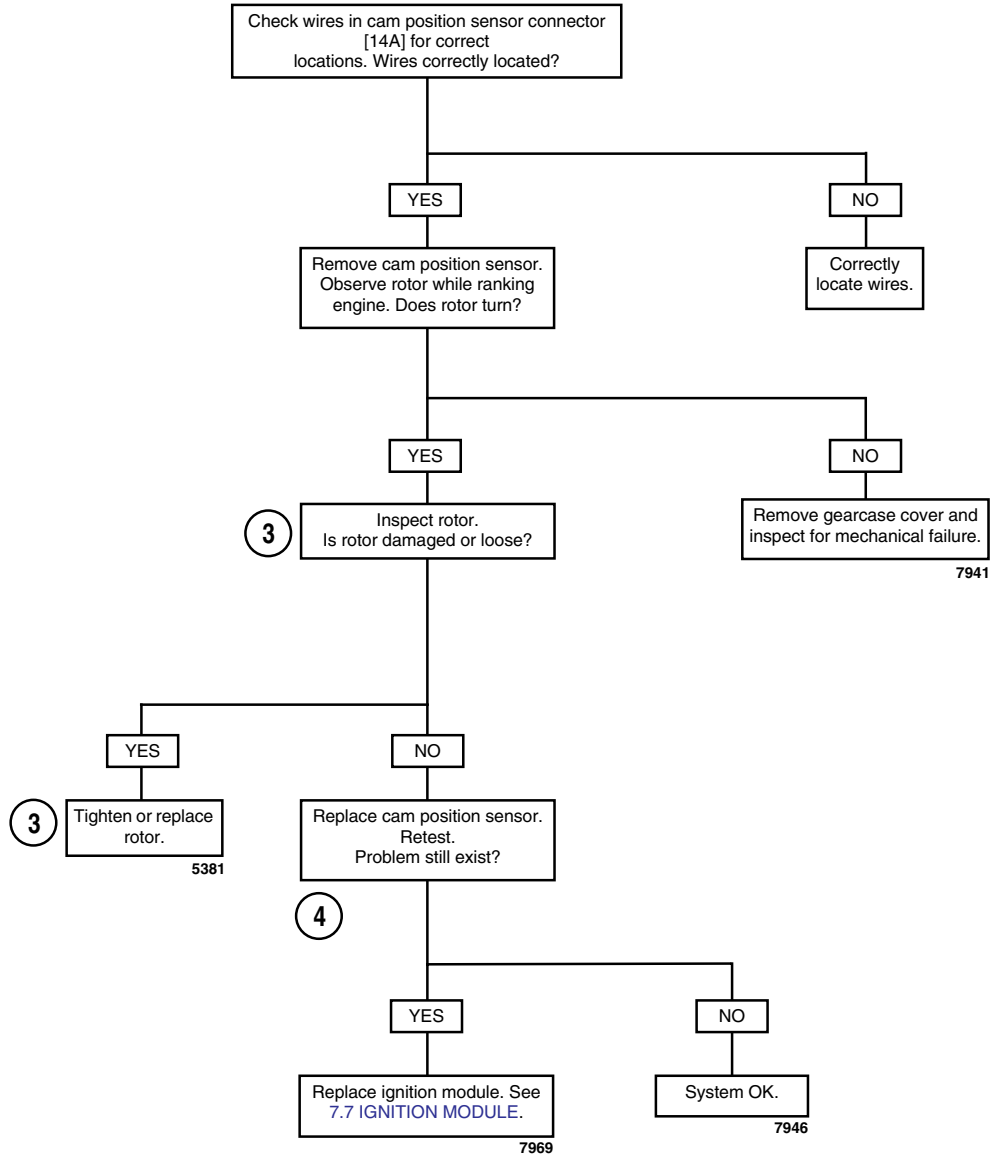


No Spark At Spark Plug (Part 7 of 8)



Go to Next Page.

No Spark At Spark Plug (Part 8 of 8)



ADJUSTMENT/TESTING

Refer to 1.20 VACUUM-OPERATED ELECTRIC SWITCH (V.O.E.S) for test procedures.

REMOVAL

1. Remove seat and fuel tank. See 4.5 FUEL TANK.
2. See Figure 7-4. Disconnect V.O.E.S. connector [7] from wiring harness.
3. Remove V.O.E.S. from carburetor hose.

INSTALLATION

1. See Figure 7-4. Place a **new** V.O.E.S. on carburetor hose.
2. Attach V.O.E.S. connector [7] to wiring harness.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

3. Install fuel tank and seat. See 4.5 FUEL TANK.

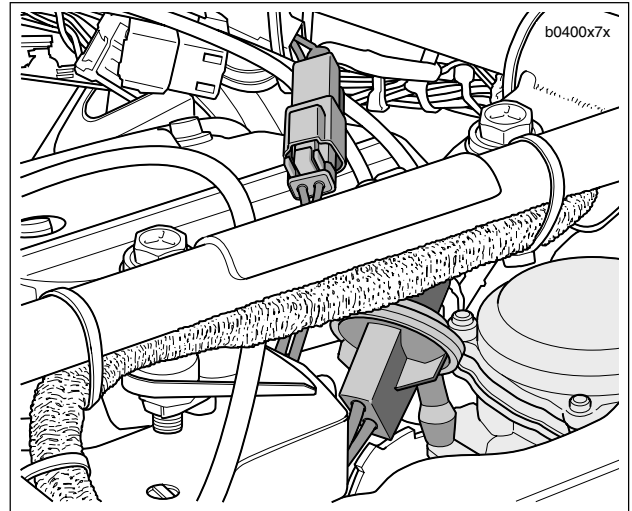


Figure 7-4. V.O.E.S.

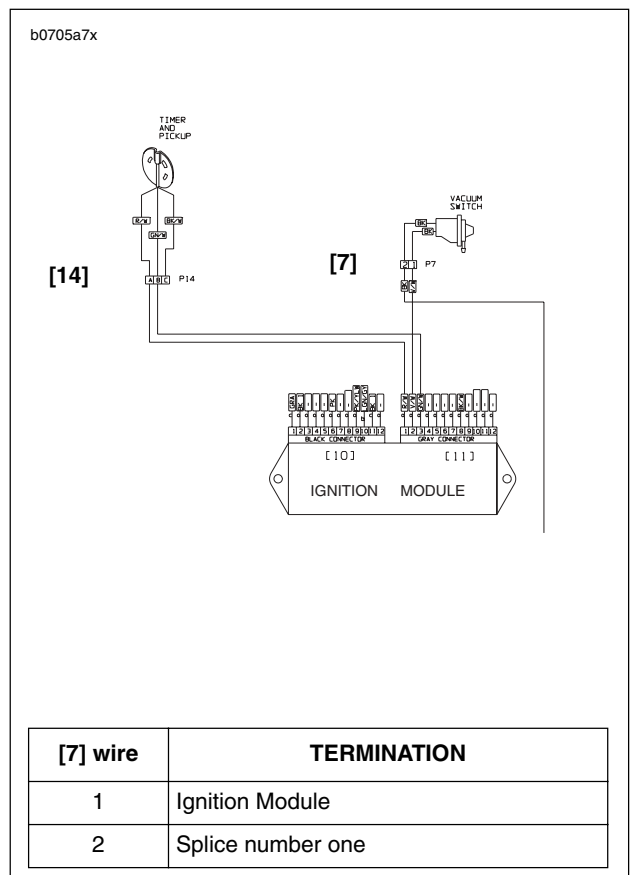


Figure 7-5. V.O.E.S. Wiring

REMOVAL

1. Remove tail section. See [2.34 TAIL SECTION](#).
2. See [Figure 7-6](#). Locate bank angle sensor below left side of tail section. Unplug sensor connector [134].
3. Remove screw, locknut and sensor from frame.

INSTALLATION

1. Position bank angle sensor on frame mounting tab. Make sure locating post on sensor engages hole in mounting tab.
2. Install bank angle sensor to mounting tab with screw and new locknut. Tighten screw to 25-27 **in-lbs** (2.8-3.1 Nm).
3. See [Figure 7-6](#). Plug connector [134] into bank angle sensor.
4. Install tail section. See [2.34 TAIL SECTION](#).

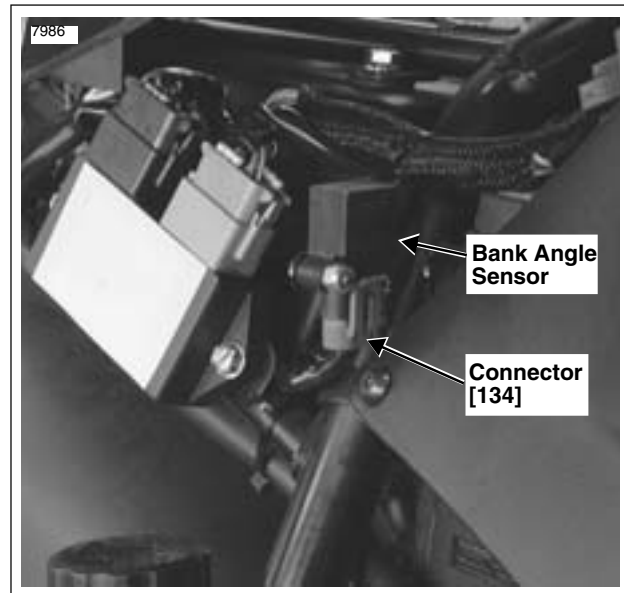


Figure 7-6. Bank Angle Sensor

REMOVAL

1. Remove fuel tank. See 4.5 FUEL TANK.

CAUTION

Do not pull on engine temperature sensor wiring. Excess strain to sensor wiring will cause sensor damage.

2. See Figure 7-7. Unplug 1-place connector [90] above rear cylinder head.
3. Slide rubber boot up and remove sensor from rear cylinder head using ET Sensor Socket or equivalent.

INSTALLATION

CAUTION

Do not pull on engine temperature sensor wiring. Excess strain to sensor wiring will cause sensor damage.

1. See Figure 7-8. Screw sensor into rear cylinder head with special ET sensor socket. Make sure wire is in cut-out portion (slot) of socket to prevent damage. Tighten ET sensor to 10-14 ft-lbs (14-19 Nm).
2. Install rubber boot to ET Sensor wire (push wire through hole in boot) with smaller OD side towards sensor.
3. Push rubber boot down sensor wire towards cylinder head until it seats in hole on top of ET sensor. NOTE: Orient the rubber boot so the flat on the boot is towards the left side of the motorcycle
4. Route ET sensor wire lead through opening at rear of cylinder head, under rocker box and cover and connect ET sensor 1-place connector [90] to wiring harness.
5. Install fuel tank. See 4.5 FUEL TANK.

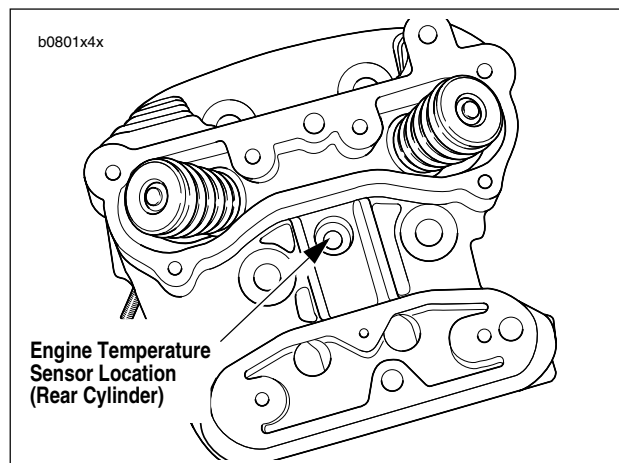


Figure 7-7. Engine Temperature Sensor Location

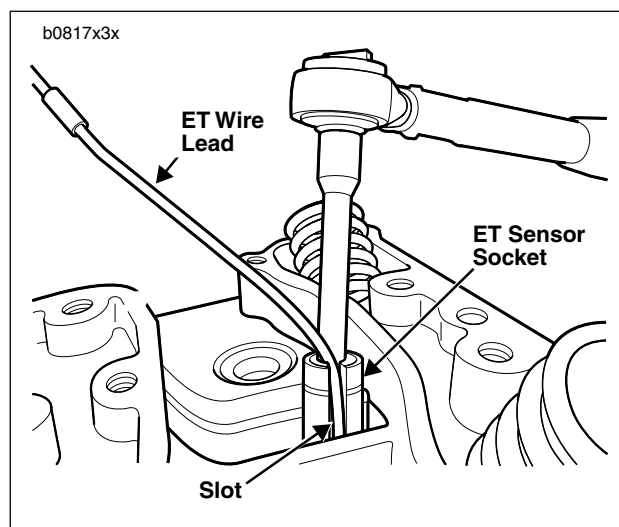


Figure 7-8. ET Sensor Removal/Installation

GENERAL

WARNING

DO NOT modify the ignition/headlamp switch wiring to circumvent the automatic-on headlamp feature. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

See [Figure 7-9](#). The three-position combination ignition/headlamp key switch is not repairable. Replace the unit if it fails.

Switch positions are explained in the table below.

When turning off the ignition, verify that the key is removed in the OFF position and that the lights are not left on. If the rider stops the engine and inadvertently removes the key in the PARK position, the battery will be drained of its charge if the vehicle is left standing too long.

NOTE

The key locks the ignition system and is removable in both the OFF and P (PARK) positions. The PARK position is located between the OFF and IGNITION positions and allows the rider to remove the key while leaving the lights on. When the key is placed in the PARK position, several indicator markers are or can be activated. See the table to the right.

REMOVAL

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable from battery.
2. Remove four screws and washers to detach windscreen from mounting brackets. See [2.35 WINDSCREEN](#).
3. See [Figure 7-10](#). Disconnect ignition key switch connector [8] from main wiring harness.
4. See [Figure 7-9](#). Remove ignition switch face nut (6). Remove ignition key switch (2) from behind dash panel.

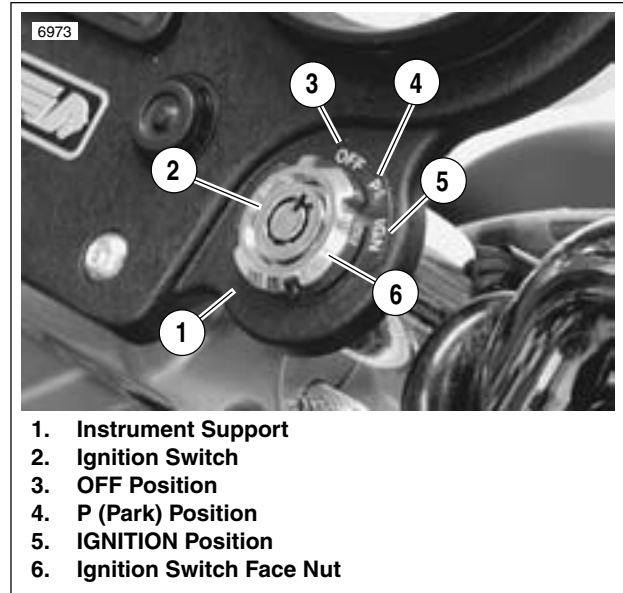


Figure 7-9. Ignition/Headlamp Key Switch

Table 7-2. Indicator Markers

ITEM	P	IGN
Headlamp Position Marker (European models only)	on	on
Headlamp High/Low Beam	off	on
Speedometer Illumination Lamp	on	on
Stop Lamp	can be activated	
Front and Rear Turn Signals	can be activated	
Horn	can be activated	

Table 7-1. Ignition Key Switch Positions

LABEL	NAME	IGN.	LAMPS	REMOVE KEY
OFF	off	off	off	yes
P	park	off	See the table to the right	yes
IGN	ignition	on		no

INSTALLATION

1. Install ignition key switch.
 - a. See [Figure 7-9](#). From behind dash panel, insert ignition key switch (2) into hole. The word "TOP" stamped on the switch body should face upward toward the lettering on the switch position decal.
 - b. Apply LOCTITE THREADLOCKER 243 (blue) to ignition key switch face nut.
 - c. Loosely install face nut (6).
2. See [Figure 7-10](#). Attach ignition key switch connector [8] to main wiring harness.
3. See [Figure 7-9](#). Tighten face nut (6) to secure switch within bracket.
4. Install negative battery cable to battery. Tighten battery terminal hardware to 60-96 **in-lbs** (7-11 Nm).

WARNING

Check for proper headlamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

5. Check ignition key switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to OFF. Check all functions listed in the table on [page 5-18](#)
 - b. Turn ignition key switch to IGN. Start motorcycle using procedure under [4.2 CARBURETOR](#).
 - c. Turn ignition key switch to LOCK.
6. Install four screws and washers to attach windscreen to mounting brackets. See [2.35 WINDSCREEN](#).

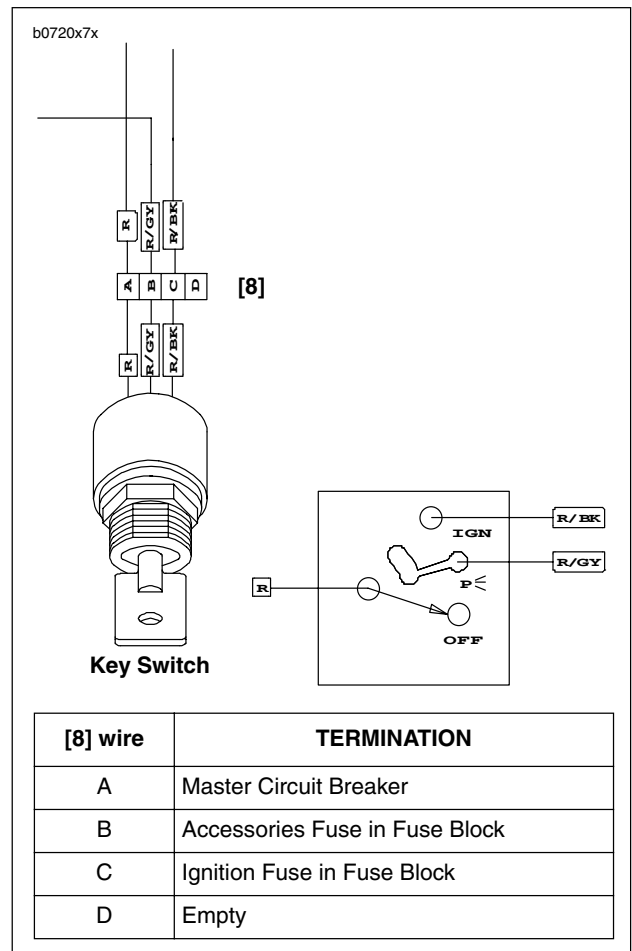


Figure 7-10. Ignition Key Switch Connector [8]

REMOVAL

1. Remove seat and tail section. See [2.34 TAIL SECTION](#).

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

2. Disconnect the negative (-) battery cable from the battery.
3. Cut cable tie that secures main wire harness to side frame member.
4. See [Figure 7-12](#). Disconnect ignition module connectors [10] and [11] from main wiring harness.
5. See [Figure 7-11](#). Remove two screws and washers to detach ignition module from frame.

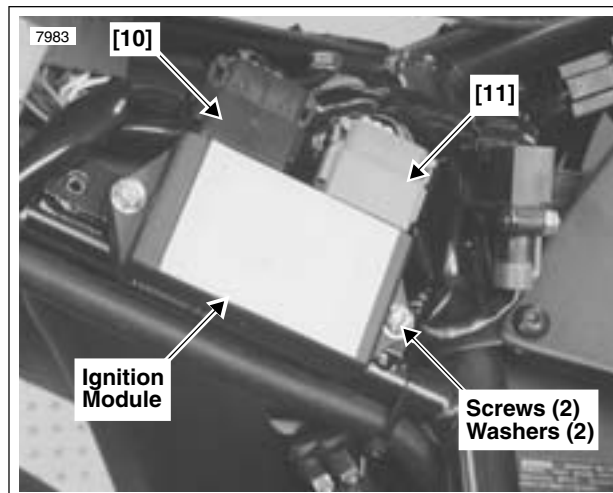


Figure 7-11. Ignition Module

INSTALLATION

1. See [Figure 7-11](#). Fasten ignition module to frame using two screws and washers.
2. See [Figure 7-12](#). Attach ignition module connectors [10] and [11] to main wiring harness.
3. Secure main wiring harness to frame member with a **new** cable tie.
4. Install negative (-) battery cable to the battery. Tighten battery terminal hardware to 60-96 **in-lbs** (7-11 Nm).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

5. Install tail section and seat. See [2.34 TAIL SECTION](#).
6. Test engine for proper ignition system operation.

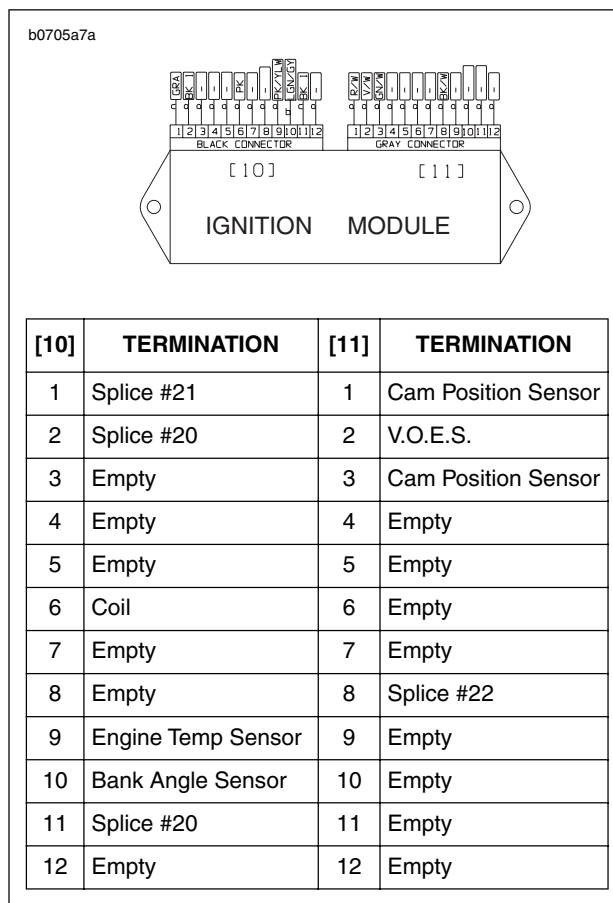


Figure 7-12. Ignition Module Connectors [10] and [11]

GENERAL

See [Figure 7-1](#). The cam position sensor (7) and trigger rotor (8) are located in the gearcase cover (10) on the right side of the vehicle. The rotor is mounted on the camshaft and operates at one-half crankshaft speed. The sensor wiring is connected to the ignition module (21) wiring harness. See [7.2 IGNITION SYSTEM](#) for information on the function, testing and adjustment of the cam position sensor and trigger rotor assembly.

REMOVAL

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable from battery.
2. Remove sprocket cover. See [2.30 SPROCKET COVER](#).
3. Cut cable straps holding cam position sensor wiring at the following locations:
 - a. Starter.
 - b. Edge of gearcase cover.
 - c. Oil line.
4. See [Figure 7-13](#). Disconnect cam position sensor wiring at connector [14] located behind the starter motor.
5. See [Figure 7-12](#). Note position of each cam position sensor wiring terminal in plug end of connector.
6. See [Figure 7-1](#). Remove connector terminal pins (18). See [B.2 DEUTSCH ELECTRICAL CONNECTORS](#).
7. Remove timer cover.
 - a. Drill off heads of outer timer cover pop rivets (1) using a 3/8 in. (9.525 mm) drill bit.
 - b. Tap remaining rivet shafts inboard through holes in timer cover (2) and inner cover (4).
 - c. Remove timer cover. Remove inner cover screws (3) and inner cover (4).
 - d. Carefully remove any remaining pieces of rivets from gearcase cover timer bore.

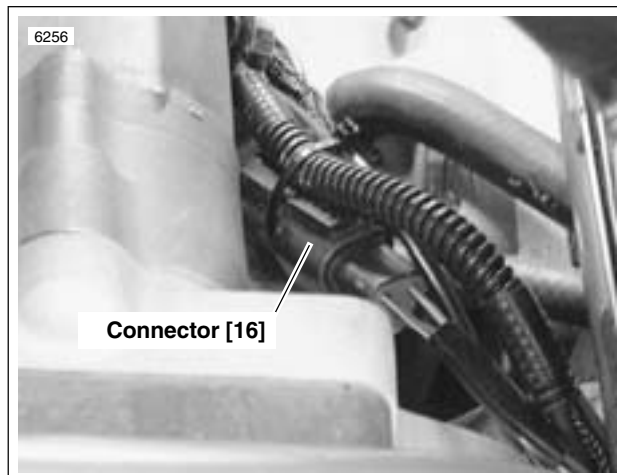


Figure 7-13. Cam Position Sensor Connector [16]

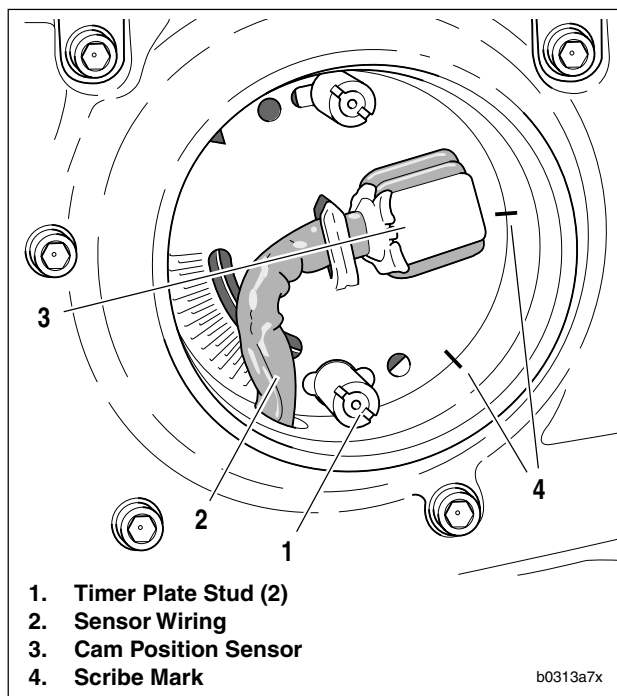
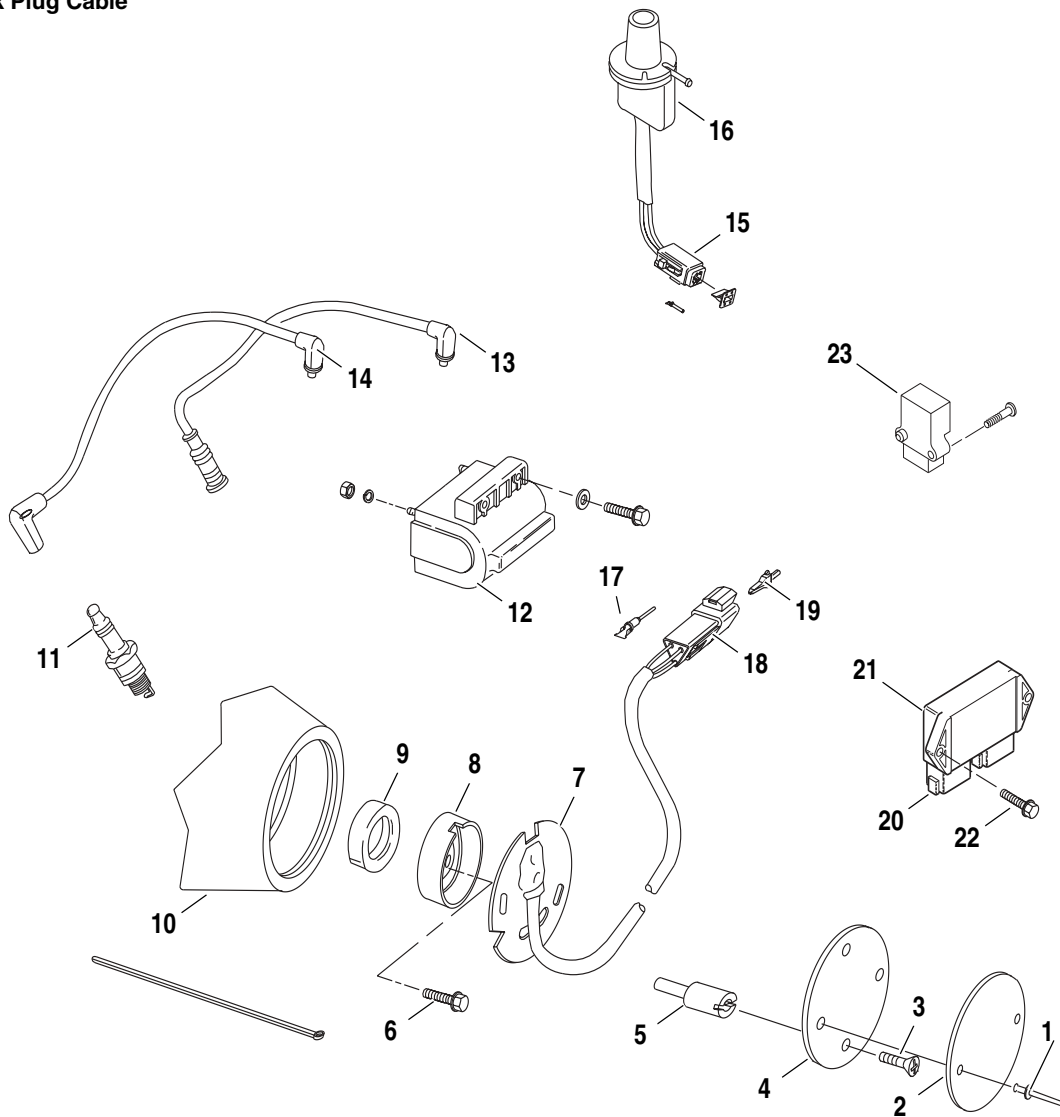


Figure 7-14. Marking Ignition Timing

8. See [Figure 7-14](#). To obtain approximate ignition timing during installation, scribe alignment marks (4) across cam position sensor (3) in two places.
9. See [Figure 7-1](#). Remove timer plate studs (5). Carefully remove cam position sensor (7). Remove bolt (6) and trigger rotor (8).
10. Carefully remove camshaft oil seal (9) if damaged or if there is any evidence of oil leakage past the seal.

- | | |
|----------------------------|--|
| 1. Pop Rivet (2) | 14. Rear Spark Plug Cable |
| 2. Timer Cover | 15. V.O.E.S. Connector [7] |
| 3. Screw (2) | 16. V.O.E.S. |
| 4. Inner Cover | 17. Terminal Pin |
| 5. Timer Plate Stud (2) | 18. Cam Position Sensor Connector [14] |
| 6. Bolt | 19. Secondary Lock |
| 7. Cam Position Sensor | 20. Ignition Module Connectors [10] and [11] |
| 8. Trigger Rotor | 21. Ignition Module |
| 9. Seal | 22. Screw (2) |
| 10. Gearcase Cover | 23. Bank Angle Sensor |
| 11. Spark Plug (2) | |
| 12. Ignition Coil | |
| 13. Front Spark Plug Cable | |



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Figure 7-15. Ignition Components

INSTALLATION

1. See [Figure 7-1](#). With the lipped side facing inboard, install **new** camshaft oil seal (9) into gearcase cover (10), if removed. Press seal into position until flush with surface of timer bore.
2. Install trigger rotor (8).
 - a. Apply LOCTITE THREADLOCKER 243 (blue) to threads of bolt (6).
 - b. Position trigger rotor (8) onto end of camshaft aligning notch with camshaft slot.
 - c. Install bolt (6) to secure rotor. Tighten to 43-53 **in-lbs** (5-6 Nm).
3. Install cam position sensor (7) and timer plate studs (5). Rotate cam position sensor to its previously marked position to obtain approximate ignition timing.

CAUTION

See [Figure 7-16](#). Route sensor wires about 1.5 in. (38 mm) forward of secondary drive belt and sprocket. If wires are routed too far to the rear of this position, they could contact the moving secondary drive belt and/or sprocket resulting in damage to sensor wiring.

4. Route sensor wiring leads.
 - a. Downward through hole (7 o'clock position) in timer bore of gearcase cover.
 - b. Upward through bottom opening between right crankcase half and rear of gearcase cover.
 - c. Route wiring in front of tower shaft behind gearcase cover. Route wires upward to starter motor.
 - d. Cable strap wiring.
5. See [Figure 7-17](#). Install sensor wiring terminals into correct positions in plug end of connector [14]. R/W, GN/W and BK/W wires of plug end (from cam position sensor) must match same color wires in receptacle end of connector (from ignition module wiring harness). Install pin terminals. See [B.2 DEUTSCH ELECTRICAL CONNECTORS](#).
6. See [Figure 7-1](#). Attach cam position connector (18) [14].
7. Check ignition timing. See [1.19 IGNITION TIMING](#).
8. Tighten timer plate studs (5) to 15-30 **in-lbs** (1.7-3.4 Nm).
9. Install inner cover (4) using screws (3). Tighten to 12-20 **in-lbs** (1.4-2.3 Nm).

CAUTION

Use only H-D Part No. 8699 rivets to secure outer timing cover. These rivets are specially designed so that no rivet end falls off into the timing compartment. Use of regular rivets can damage ignition system components and may allow water to enter the timing compartment.

10. Secure timer cover (2) to inner cover (4) using **new** rivets (1).
11. Install negative battery cable to battery. Tighten battery terminal hardware to 60-96 **in-lbs** (7-11 Nm).

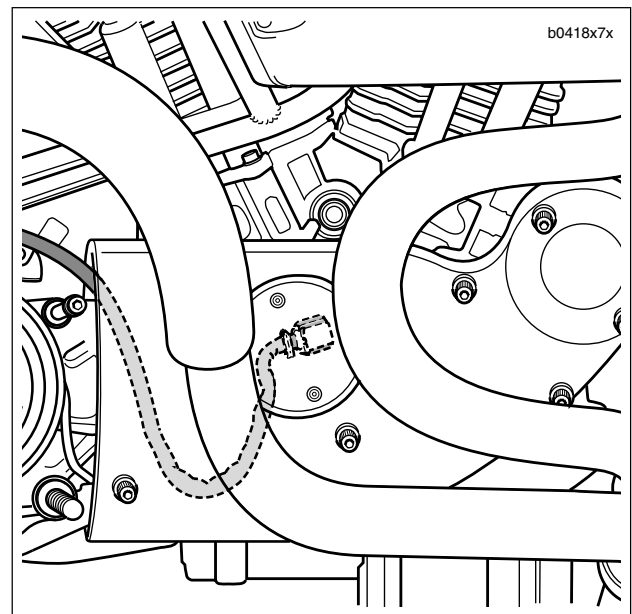


Figure 7-16. Routing Sensor Wires

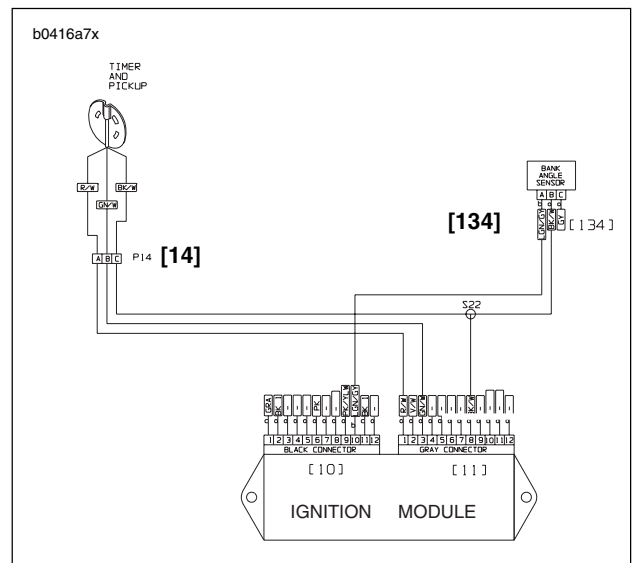


Figure 7-17. Connecting Sensor Wires

GENERAL

See [Figure 7-18](#). The ignition coil is mounted on the frame underneath the fuel tank and behind the steering neck.

See [Figure 7-1](#). The ignition coil (12) is a pulse-type transformer. Internally, the coil consists of primary and secondary windings with a laminated iron core. The contents are sealed in a waterproof insulating compound. The ignition coil is not repairable. Replace the unit if it fails.

The low-voltage ignition primary circuit consists of the coil primary winding, ignition module (22) and battery. When the circuit is closed, current flows through the coil primary winding creating a strong magnetic field in the iron core of the ignition coil.

When the ignition module receives a signal from the cam position sensor (7) and trigger rotor (8), the ignition module interrupts (opens) the ignition primary circuit, which causes the magnetic field in the coil core to collapse.

The collapsing magnetic field induces a high-voltage electrical discharge in the ignition secondary circuit, which consists of the coil secondary winding, spark plug cables and spark plugs (11). The high-voltage discharge produces a spark to bridge the electrode gap of each spark plug.

The ignition coil fires both spark plugs simultaneously. In one spark plug, the spark jumps from the center electrode to the outer electrode, but on the other plug, the spark jumps in the reverse direction (from the outer electrode to the center electrode).

TROUBLESHOOTING

Follow the troubleshooting procedures listed under [7.2 IGNITION SYSTEM](#) if the engine will not start, is difficult to start or runs roughly. Also check condition of spark plug cables. Insulation on cables may be cracked or damaged allowing high tension current to short to metal parts. This problem is most noticeable when cables are wet.

If poor starting/running condition persists, check resistance of ignition coil primary and secondary windings using an ohmmeter.

Ignition Coil Primary Circuit Test

1. Remove ignition coil.
2. Set ohmmeter scale to RX1.
3. See [Figure 7-19](#). Place multimeter wires on primary coil windings.
4. Check for primary coil winding resistance.
 - a. Normal resistance range is 2.5-3.1 ohms.
 - b. See [TEST RESULTS](#) on the next page if resistance is not within normal operating range.



Figure 7-18. Ignition Coil

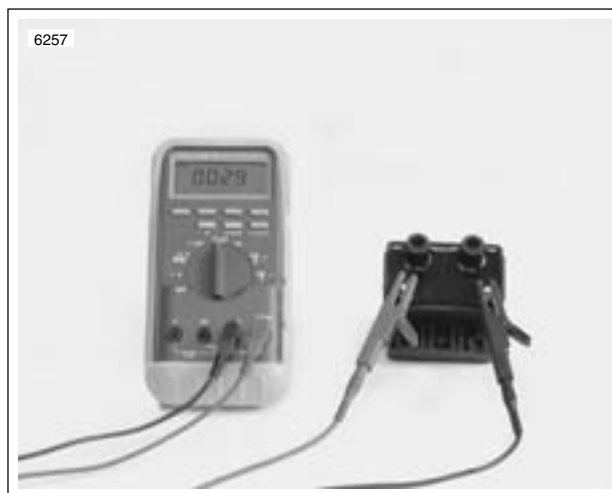


Figure 7-19. Ignition Coil Primary Resistance Test

Ignition Coil Secondary Circuit Test

1. Remove ignition coil.
2. Set ohmmeter scale to RX1K.
3. See [Figure 7-20](#). Place multimeter wires on secondary coil windings.
4. Check for secondary coil winding resistance.
 - a. Normal resistance range is 10,000-12,500 ohms.
 - b. See [TEST RESULTS](#) on the next page if resistance is not within normal operating range.

Test Results

1. A low resistance value indicates a short in the coil winding. Replace coil.
2. A high resistance value might indicate that there is some corrosion/oxidation of the coil terminals. Clean the terminals and repeat resistance test. If resistance is still high after cleaning terminals, replace coil.
3. An infinite ohms (∞ or no continuity) resistance value indicates an open circuit (a break in the coil winding). Replace coil.

REMOVAL

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable from battery.
2. Remove seat and fuel tank. See 4.5 FUEL TANK.
3. See Figure 7-21. Disconnect spark plug cables from coil plug posts (4, 5).
4. Detach wires from coil terminals (2, 3).
5. Remove two screws and washers (1). Coil will drop from frame mounts.

INSTALLATION

1. See Figure 7-21. Attach coil to frame with screws and washers (1). Tighten to 4-6 ft-lbs (5-8 Nm).
2. Attach wires at coil terminals.
 - a. Connect PK wire to forward terminal (2).
 - b. Connect W/BK wire to rear terminal (3).
3. Connect spark plug cables to ignition coil. Longer cable attaches to rear post (4) and rear cylinder spark plug.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

4. Install fuel tank and seat. See 4.5 FUEL TANK.
5. Install negative battery cable to battery. Tighten battery terminal hardware to 60-96 in-lbs (7-11 Nm).

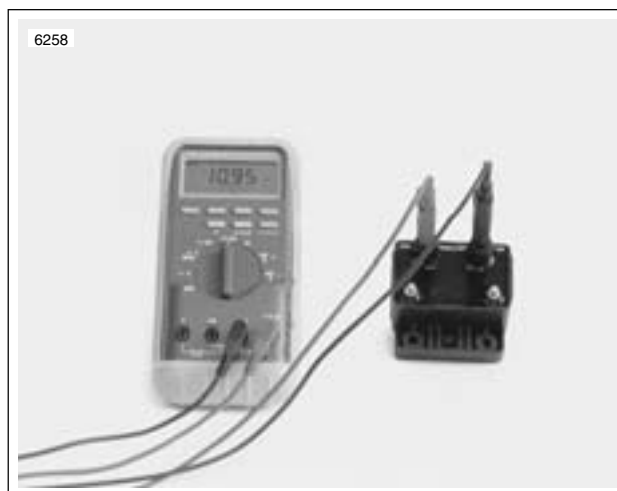


Figure 7-20. Ignition Coil Secondary Resistance Test

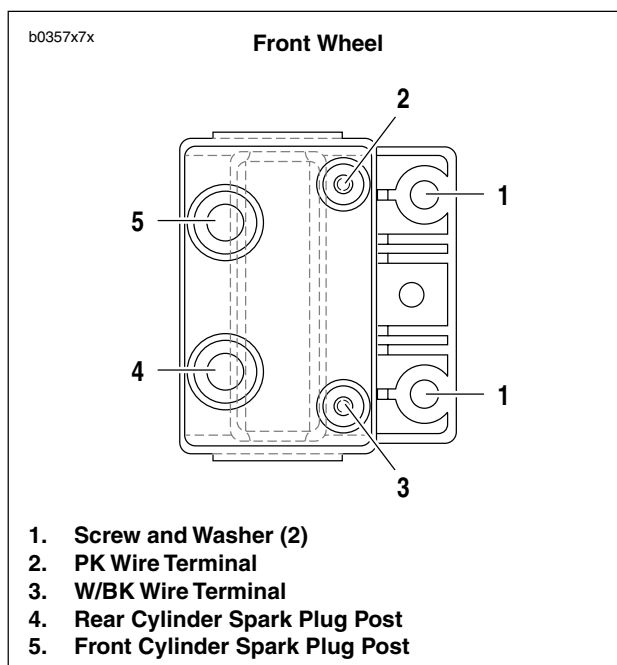


Figure 7-21. Coil Viewed From Above

GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

REMOVAL

WARNING

Never disconnect a spark plug cable with the engine running. If you disconnect a spark plug cable with the engine running, you may receive a severe electric shock from the ignition system which could result in death or serious injury.

CAUTION

When disconnecting each spark plug cable from its spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close as possible to the spark plug terminal). Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.

INSPECTION

- See [Figure 7-22](#). Inspect spark plug cables. Replace cables that are worn or damaged.
 - Check for cracks or loose terminals.
 - Check for loose fit on ignition coil and spark plugs.
- Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.
- See [Figure 7-23](#). Check spark plug cable resistance with an ohmmeter. Replace cables not meeting resistance specifications.
 - 1625-3796 ohms for 6.5 in. (165 mm) cable.
 - 5000-11,680 ohms for 20 in. (508 mm) cable.

INSTALLATION

- Connect front spark plug cable to ignition coil and spark plugs.
- Connect rear spark plug cable to spark plug. Rotate spark plug wire under the front wire and connect to ignition coil.
- Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.

NOTE

See [1.16 SPARK PLUGS](#) for spark plug information.

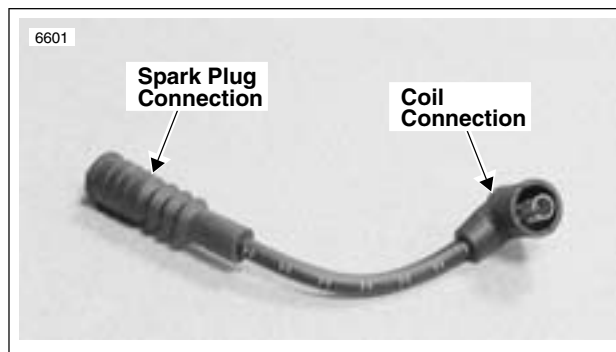
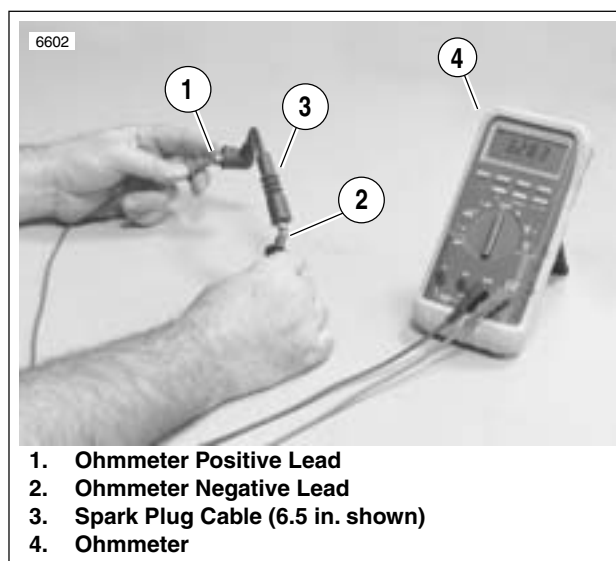


Figure 7-22. Spark Plug Cable



- Ohmmeter Positive Lead
- Ohmmeter Negative Lead
- Spark Plug Cable (6.5 in. shown)
- Ohmmeter

Figure 7-23. Testing Resistance

GENERAL

The starter interlock system is designed to prevent unintended start-up and/or forward motion of the motorcycle with the vehicle's side stand not retracted.

Two circuits make up the starter interlock system.

Starter Circuit

The starter circuit prevents the motorcycle from being started unless a ground has been established at the starter relay. This ground may come from one of two sources.

- By placing the motorcycle in neutral and grounding through the neutral switch.
- By disengaging the clutch and grounding through the clutch lever switch.

Once the starter circuit is grounded and the starter button pushed, the starter relay can be energized. The energized relay then allows the starter motor to crank the engine.

Ignition Circuit

The ignition circuit prevents the motorcycle from operating unless a ground is established at the ignition relay. If this ground is not established, the ignition system will be not turned on and the motorcycle will not run. Grounds may be established three ways.

- By retracting the side stand and grounding through the side stand switch.
- By placing the motorcycle in neutral and grounding through the neutral switch.
- By disengaging the clutch and grounding through the clutch lever switch.

Note that the ignition circuit allows operation in gear with the side stand extended if the clutch is disengaged. However, if the motorcycle is in gear with the side stand extended, and the clutch is released, the ignition ground is lost and the ignition system is turned off. This system will prevent vehicle operation if forward motion is attempted with the side stand down.

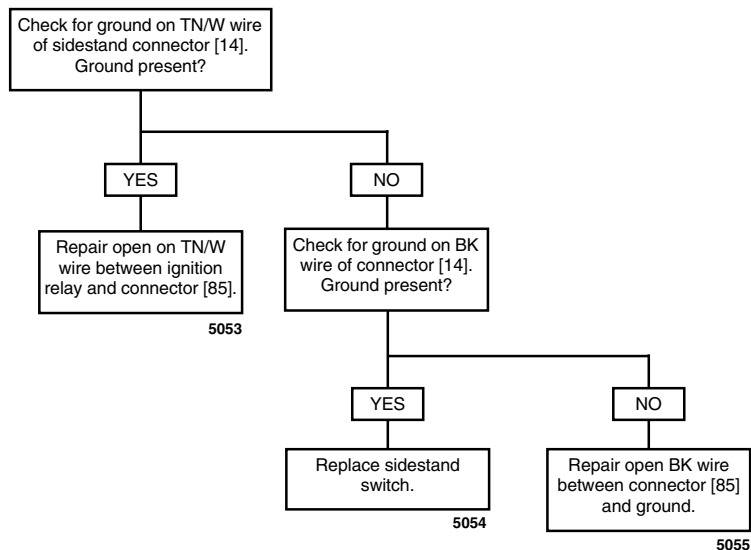
See [Figure 7-24](#).

PROBLEM	CHECK FOR	CORRECTION
Electric starter will not crank.	Battery problems.	See or 7.17 BATTERY .
	Inappropriate gear selected.	Place vehicle in neutral.
	Clutch lever not disengaged.	Pull in clutch lever.
	Starter relay problems.	Listen for starter relay "click". If click is not heard, perform starter relay tests. Follow starter troubleshooting in Section 5.
Electric starter cranks, but vehicle will not start.	Side stand not retracted.	Retract side stand.
Motorcycle will not start with side stand retracted.	Clutch lever not disengaged.	Pull in clutch lever.
Motorcycle will not start with side stand retracted or clutch disengaged.	Ignition relay problems.	Listen for relay "click". If click is not heard, perform ignition system tests.
Motorcycle will not start after starter relay tests.	No spark at spark plug.	Check for 12 VDC at coil W/BK wire.
		Follow ignition system troubleshooting. See 7.2 IGNITION SYSTEM .

DIAGNOSTICS

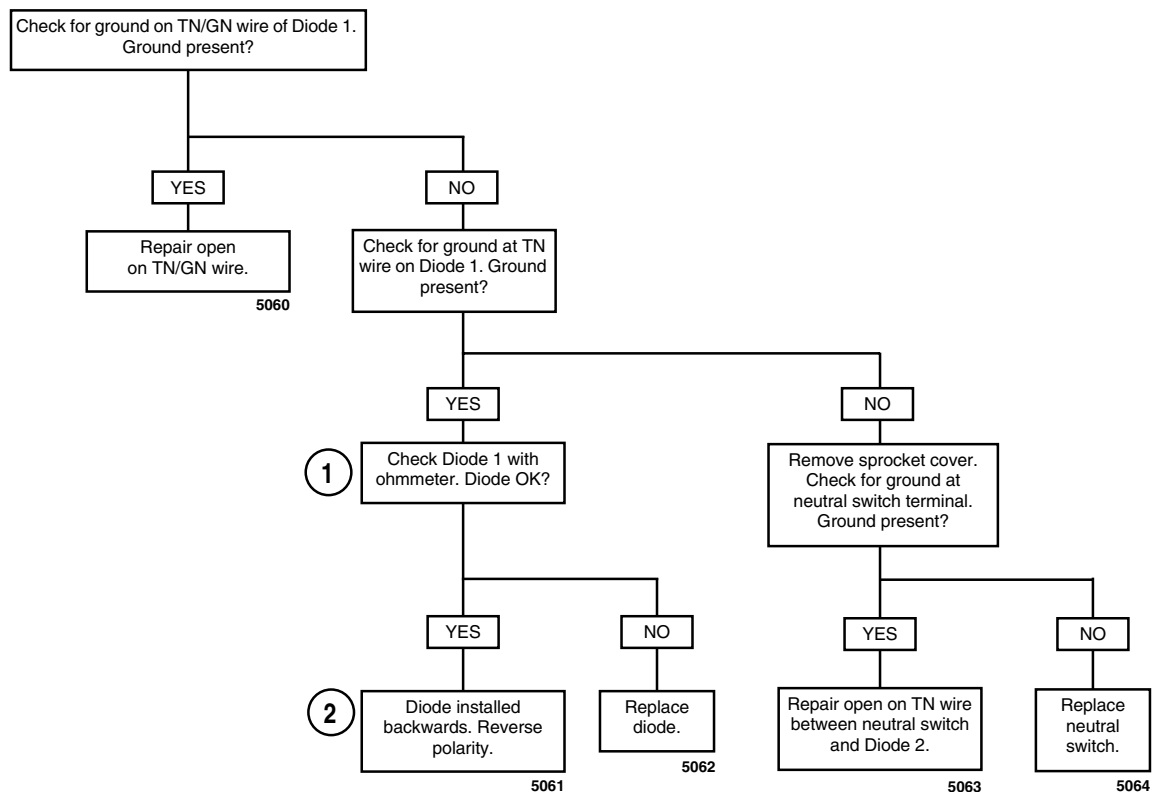
Ignition Test

CONDITION: Sidestand up and key ON, transmission in neutral and clutch engaged



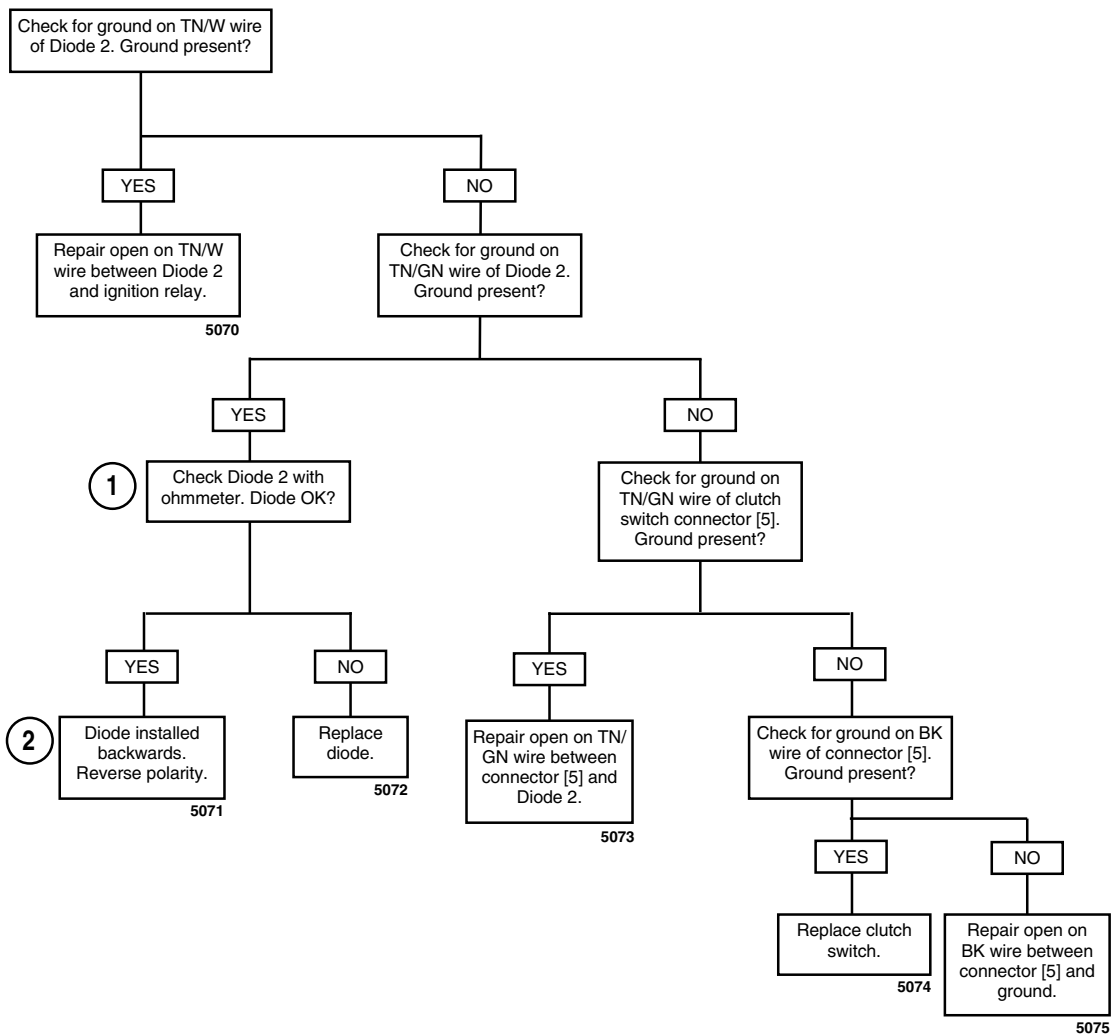
Starter Test (Part 1 of 2)

CONDITION: Sidestand down, key ON, transmission in neutral and clutch engaged



Starter Test (Part 2 of 2)

CONDITION: Sidestand down, key ON, transmission in gear and clutch disengaged



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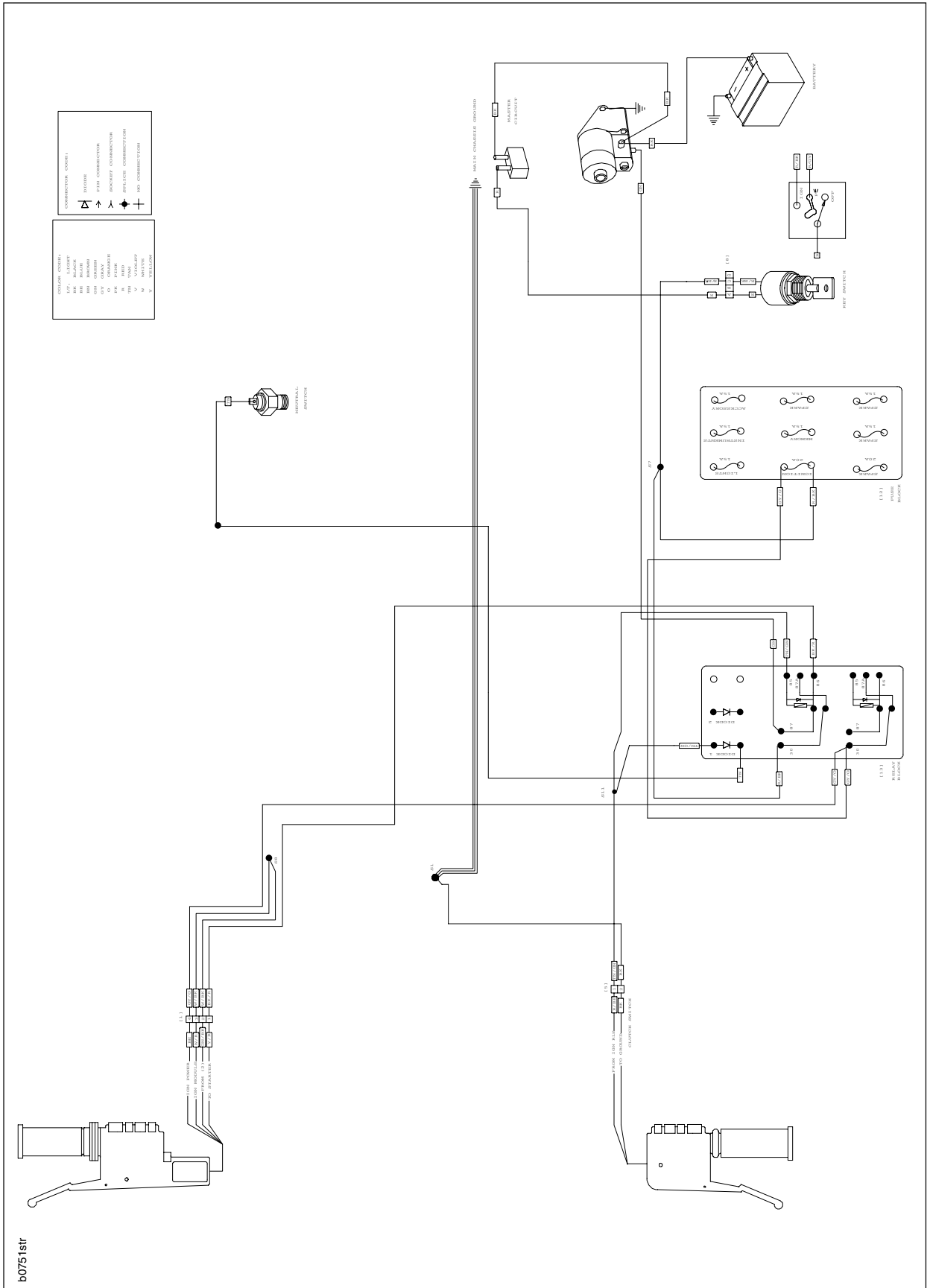


Figure 7-24. Electric Starting System Circuit

TESTING/REPLACEMENT

Side Stand Switch

See [Figure 7-25](#). The side stand switch is a simple spring loaded plunger. The switch completes a path to ground for the ignition relay when the side stand is in the retracted position. Test the switch as follows:

1. Unplug the 2-place side stand switch connector [14].
2. Test the switch using an ohmmeter.
 - a. With side stand down (1) (switch open), the switch should show ∞ ohms (infinite ohms).
 - b. With side stand up (2) (switch closed), the switch should show 0 ohms or little resistance.
3. Replace the assembly with a **new** switch if necessary.
 - Remove side stand switch from frame by removing two nuts.

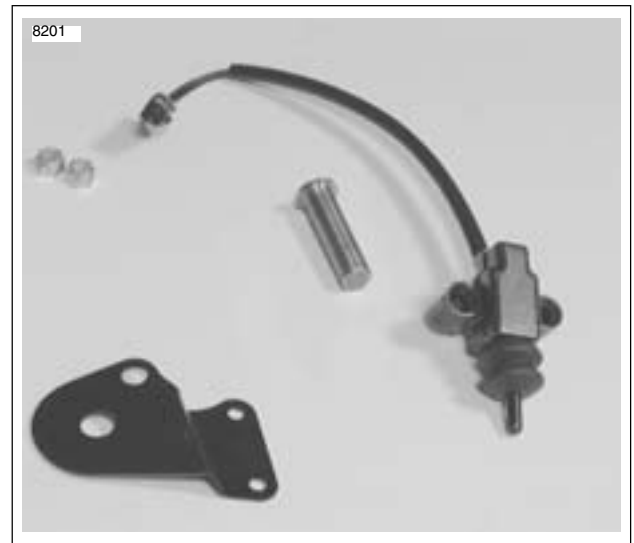


Figure 7-25. Side Stand Switch

Clutch Switch

See [Figure 7-26](#). The clutch switch attaches to the clutch control lever bracket. The switch completes a path to ground for the ignition relay and the starter relay when the clutch is disengaged. Test the switch as follows:

1. Unplug the 2-place clutch switch connector [5].
2. Test the switch using an ohmmeter.
 - a. With clutch engaged (1) (switch open), the switch should show ∞ ohms (infinite ohms).
 - b. With clutch disengaged (2) (switch closed), the switch should show 0 ohms or little resistance.
3. Replace the assembly with a **new** switch if necessary.
 - a. Remove small Phillips screw.
 - b. Depress clutch lever and hold.
 - c. Detach switch by depressing switch trigger button and pulling switch towards the end of the handlebar.
 - d. Install **new** switch.

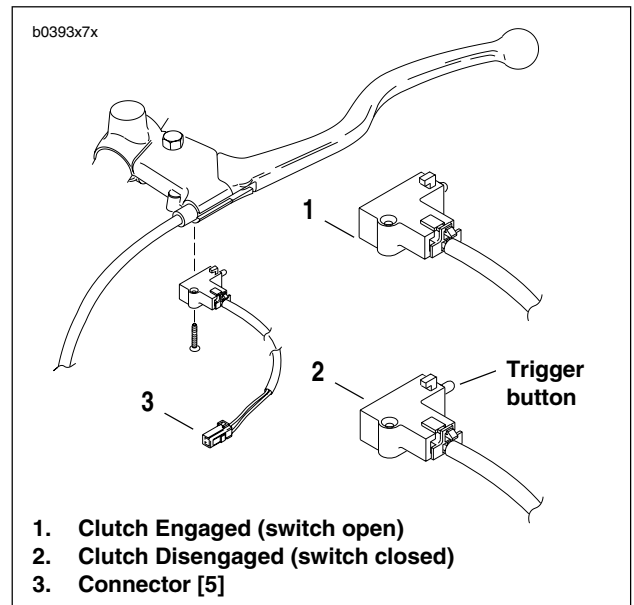


Figure 7-26. Clutch Switch

Ignition Relay

See [Figure 7-27](#). The ignition relay is in the relay block which is located on the right side under the tail section. Test the relay as follows:

1. Remove seat and fuel tank. See [2.36 SEAT](#).
2. Unplug relay from relay block. See [“ON-MOTORCYCLE” TESTS](#), Section 5.
3. Test the relay in the same fashion as the starter relay.
4. Replace the relay with a **new** relay if necessary.

Starter Relay

The starter relay is on the left side near the battery strap nut. See [5.6 STARTER SYSTEM TESTING](#).

Main Circuit Breaker

See [Figure 7-28](#). Attached to the frame above the battery, the main circuit breaker (1) is between the ignition key switch and the battery. Remove the main circuit breaker as follows:

1. Remove seat and fuel tank. See [4.5 FUEL TANK](#).
2. Remove battery negative cable (1) from frame.
3. See [Figure 7-29](#). Remove nuts (5), star washers (4) and wire leads (6, 7 and 8) from circuit breaker studs.
4. Remove circuit breaker (3) from circuit breaker clip (1).
5. Install in the reverse order.

Ignition Fuse

See [Figure 7-30](#). The ignition fuse is in the fuse block under the right side of the tail section. Always replace the fuse with another 15 ampere fuse.

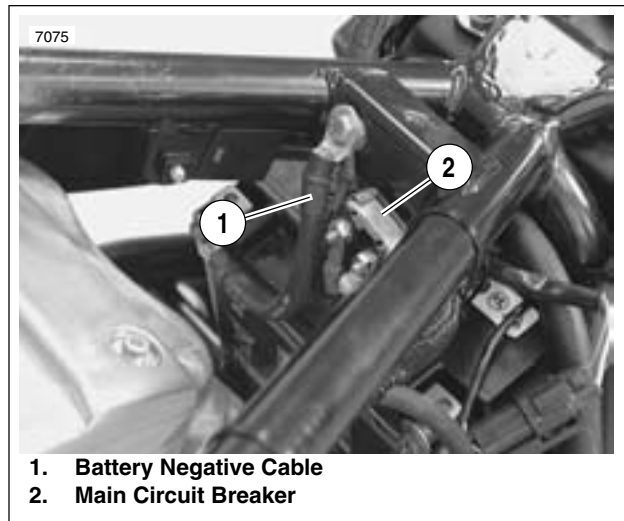


Figure 7-28. Circuit Breaker

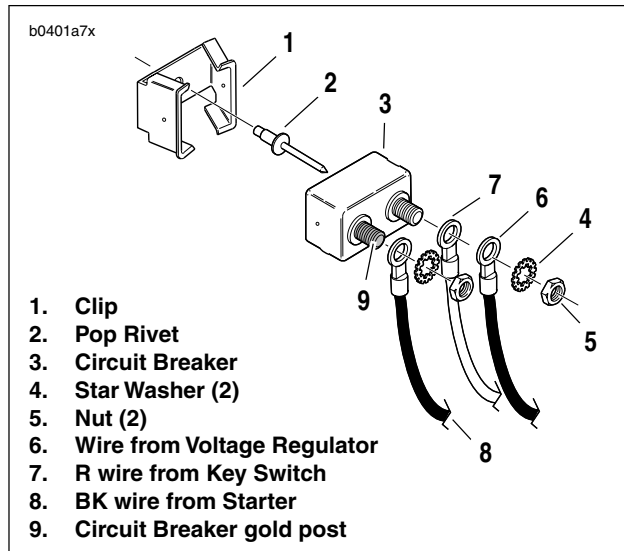


Figure 7-29. Circuit Breaker Installation

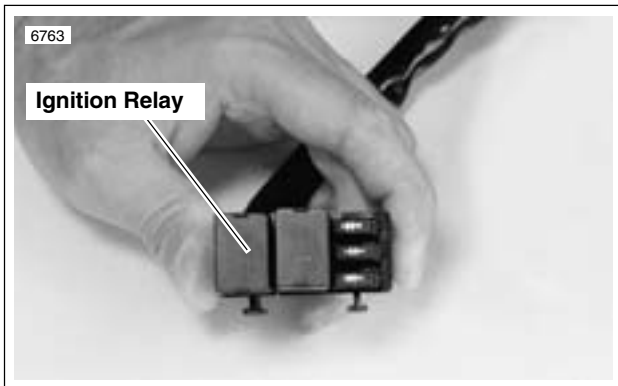


Figure 7-27. Ignition Relay

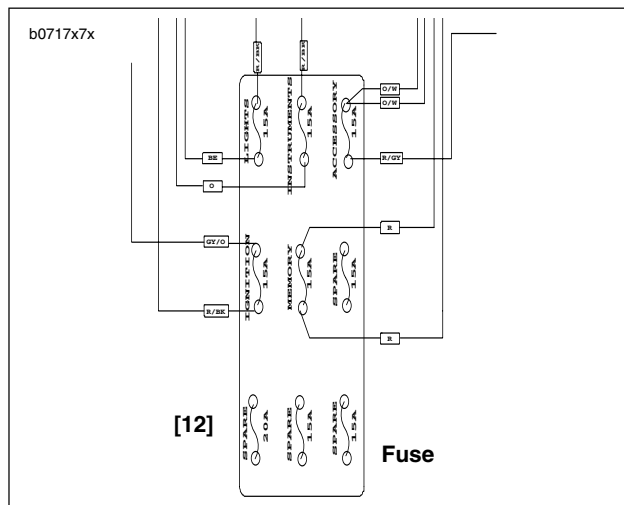


Figure 7-30. Fuse Block

Diodes

The relay block contains two diodes. A diode acts as a one way switch which permits current flow in one direction, but not in the other.

The reference numbers below correlate with the circled numbers in the 7.11 STARTER INTERLOCK flow charts.

1. Check diode with an ohmmeter as shown in Figure 7-31.
2. Check diode polarity as shown in Figure 7-32.

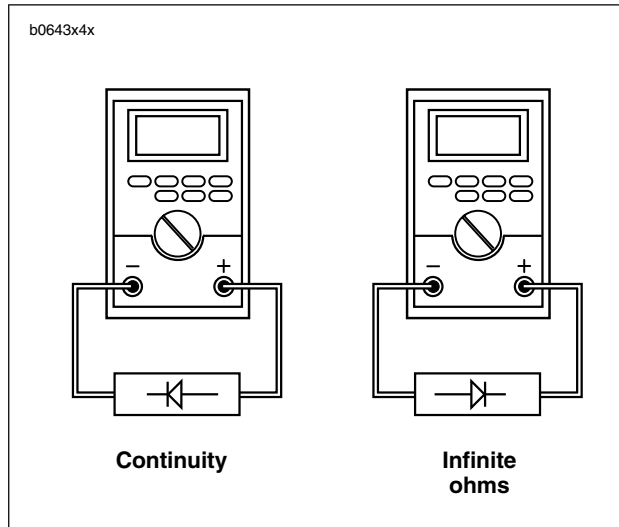


Figure 7-31. Ohmmeter Diode Test

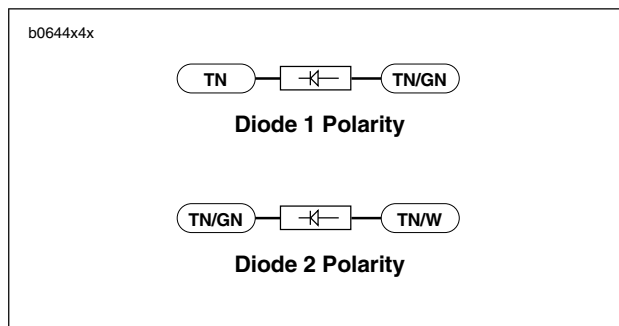


Figure 7-32. Diode Polarity

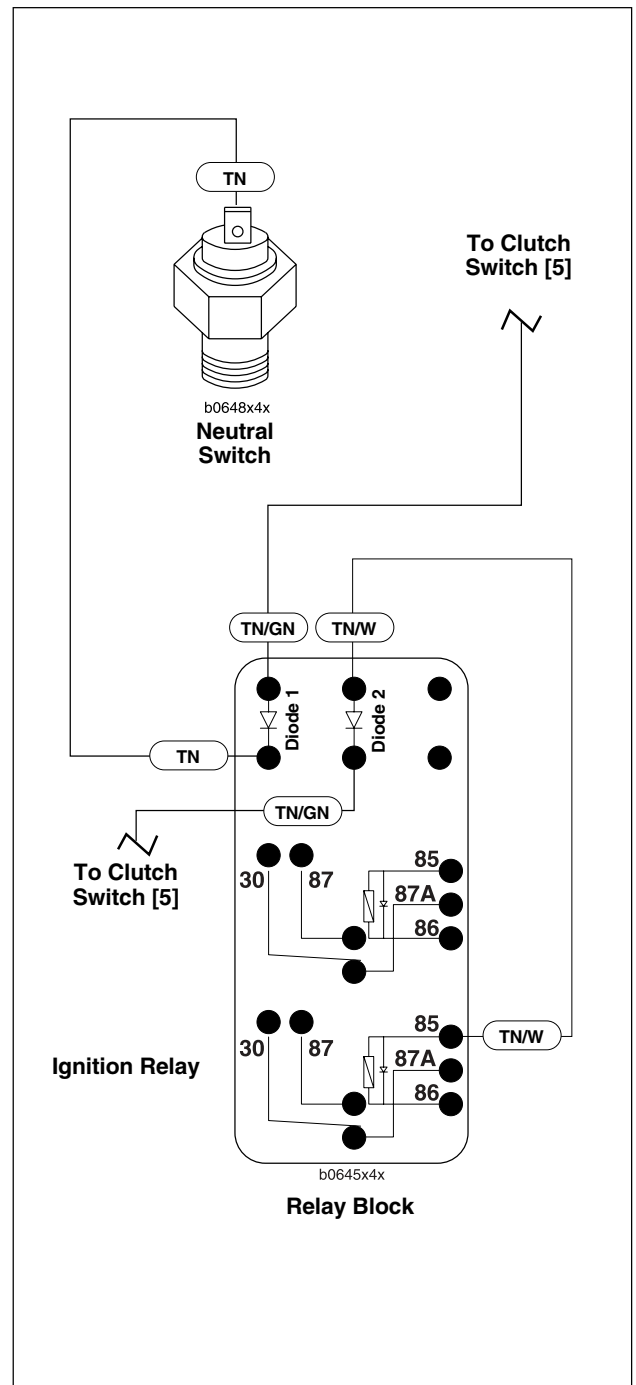


Figure 7-33. Diode Wiring

NOTES

REMOVAL

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable from battery.
2. Remove seat and tail section. Move fuel tank aside. See [2.34 TAIL SECTION](#).
3. See [Figure 7-34](#). Both user replaceable diodes (1, 2) are mounted on the relay block under the tail section. One spare diode (3) is attached to the relay block.
4. Remove faulty diode by pulling it straight up off the relay block.

INSTALLATION

1. See [Figure 7-34](#). Install the new diodes into position on the relay block.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

2. Replace fuel tank, tail section and seat. See [2.34 TAIL SECTION](#).
3. Connect negative battery cable to the battery. Tighten battery terminal hardware to 60-96 **in-lbs** (7-11 Nm).

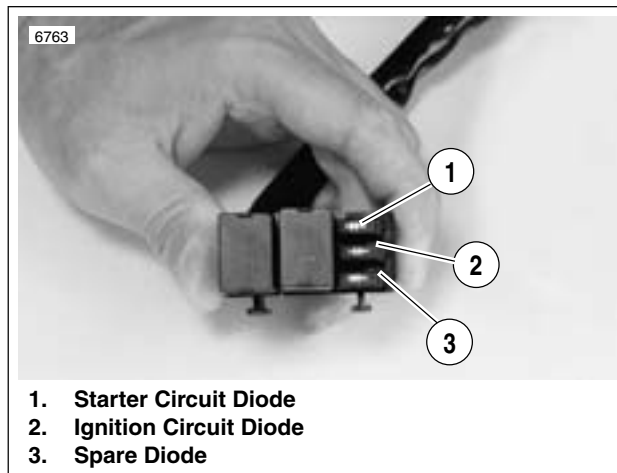


Figure 7-34. Diodes

GENERAL

The charging system consists of the alternator and regulator. Charging system circuits are shown in [Figure 7-36](#).

Alternator

The alternator consists of two main components:

- The rotor which mounts to the engine sprocket shaft.
- The stator which bolts to the engine crankcase.

Voltage Regulator

See [Figure 7-35](#). The voltage regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

TROUBLESHOOTING

When the charging system fails to charge or does not charge at a satisfactory rate, make the following recommended checks.

Battery

Check for a weak or dead battery. See [7.17 BATTERY](#). Battery must be fully charged in order to perform any electrical tests.

Wiring

Check for corroded or loose connections in the charging circuit. See [Figure 7-36](#).

Voltage Regulator Inspection

See [Figure 7-35](#). The voltage regulator base must have a clean, tight connection for proper grounding. Check by using an ohmmeter with one lead on a known good ground, such as battery ground cable, and the other on the regulator base.

Connector plug to stator must be clean and tight.

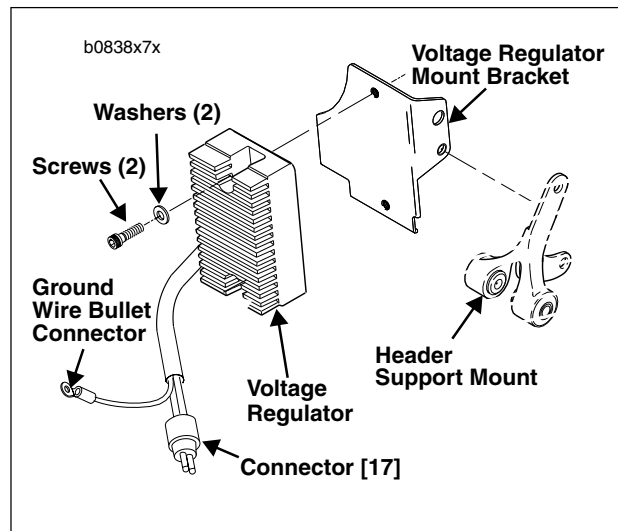


Figure 7-35. Voltage Regulator

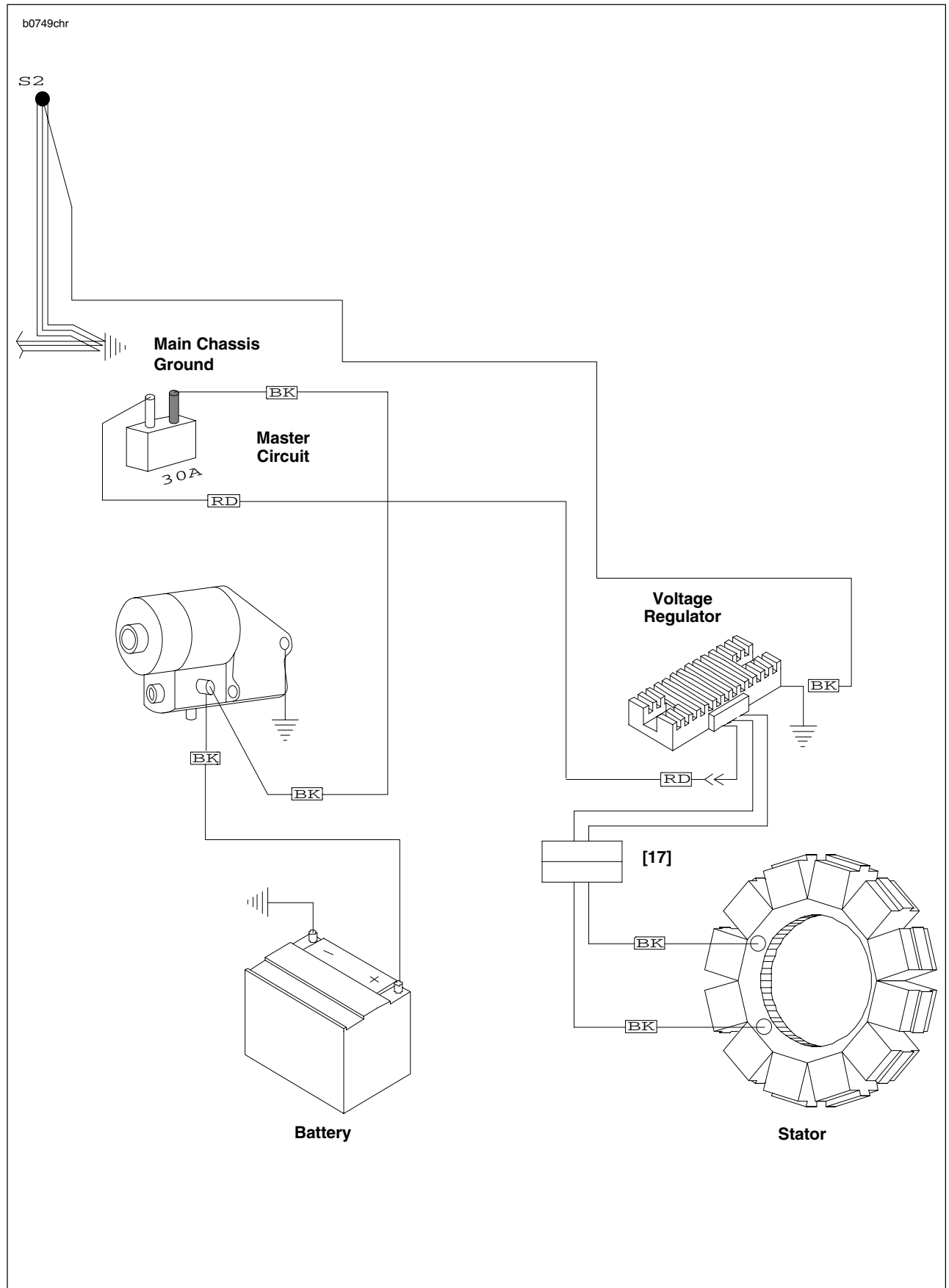


Figure 7-36. Charging System Circuit

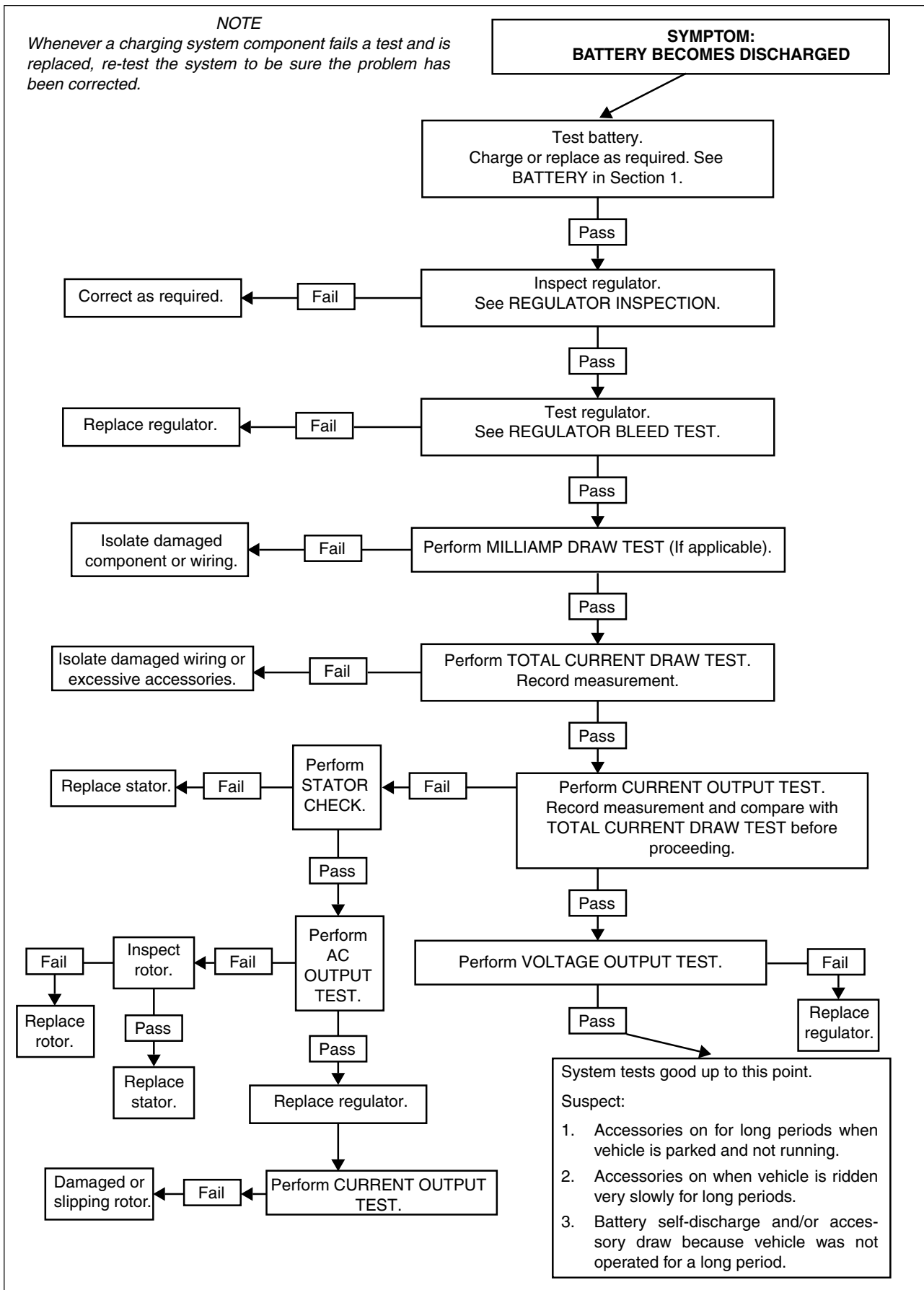


Figure 7-37. Charging System Troubleshooting

TESTING

Voltage Regulator Bleed Test

1. Be sure regulator is connected to battery. Check BK charging wire on gold terminal of master circuit breaker.
2. Locate voltage regulator connector [17] near the oil pump. Disconnect from alternator stator wiring.
3. Check regulator connector using a trouble light.
 - a. Touch one probe to a suitable ground.
 - b. Touch the other to the regulator pins, one at a time.
 - c. If light glows, replace regulator.

Milliampere Draw Test

NOTE

Be sure accessories are not wired so they stay on at all times. This condition could drain battery completely if vehicle is parked for a long time. Check for this by connecting ammeter between negative battery terminal and battery.

1. See [Figure 7-38](#). Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.
2. With ignition key switch turned to LOCK and all lights and accessories off, observe amperage reading.
 - a. Maximum reading should be 3 milliamperes.
 - b. A higher reading indicates excessive current draw. Any accessories must be considered and checked for excessive drain.

NOTE

A battery with a surface discharge condition could suffer a static drain. Correct by cleaning battery case.

Total Current Draw Test

If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

1. See [Figure 7-39](#). To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable.
2. Disconnect stator wiring from voltage regulator wiring at the connector [17] near the oil pump. Start the motorcycle and run the engine at 2000 RPM.
3. With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw.
4. Compare this reading to the reading obtained after performing the [CURRENT AND VOLTAGE OUTPUT TEST](#).
 - a. The current output should exceed current draw by 3.5 amps minimum.
 - b. If output does not meet specifications, there may be too many accessories for the charging system to handle.
5. Reconnect regulator after testing.

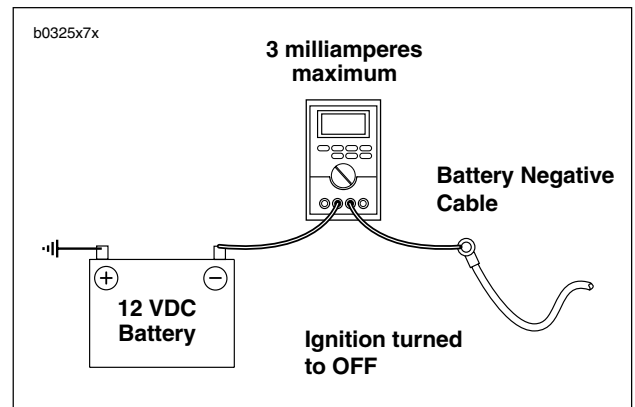


Figure 7-38. Milliampere Draw Test

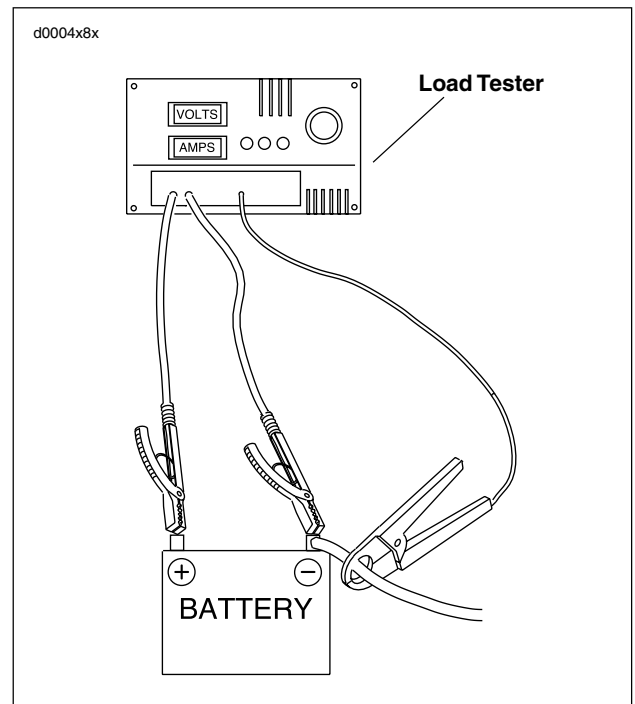


Figure 7-39. Check Current Draw (Ignition Switch ON)

Current and Voltage Output Test

1. See [Figure 7-40](#). Connect load tester.
 - a. Connect negative and positive leads to battery terminals.
 - b. Place load tester induction pickup over positive regulator cable.

CAUTION

Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

2. Run the engine at 2000 RPM. Increase the load as required to obtain a constant 13.0 VDC.
3. The current output should be 19-23 amps. Make note of measurement for use in [TOTAL CURRENT DRAW TEST](#).

NOTE

Rider's habits may require output test at lower RPM.

Voltage Output Test

1. See [Figure 7-40](#). After removing the load, read the load tester voltage meter.
 - a. If voltage to the battery is not more than 15 VDC, voltage output is within specifications. Investigate other possible problems. See [Figure 7-37](#).
 - b. If voltage is higher, regulator is not functioning properly or connections are loose or dirty.

Stator Check

1. Turn ignition key switch to LOCK.
2. See [Figure 7-41](#). Connect an ohmmeter.
 - a. Locate voltage regulator connector [17] near the oil pump. Disconnect from alternator stator wiring.
 - b. Insert one ohmmeter lead into either stator socket.
 - c. Attach the other lead to a suitable ground.
3. Test for continuity with ohmmeter set on the RX1 scale.
 - a. A good stator will show no continuity (∞ ohms) across either stator socket.
 - b. Any other reading indicates a grounded stator which must be replaced.
4. See [Figure 7-42](#). Remove ground lead. Insert lead into the remaining stator socket.
5. Test for resistance with ohmmeter set on the RX1 scale.
 - a. Resistance across the stator sockets should be 0.2-0.4 ohms.
 - b. If the resistance is lower, the stator is damaged and must be replaced.

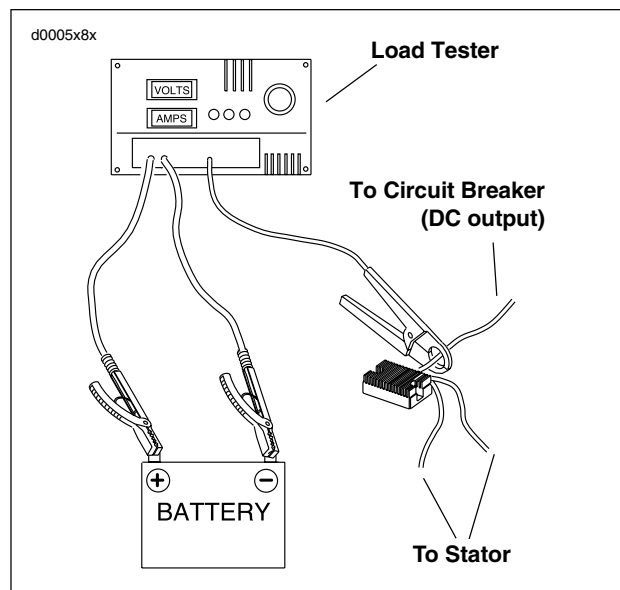


Figure 7-40. Current and Voltage Output Test

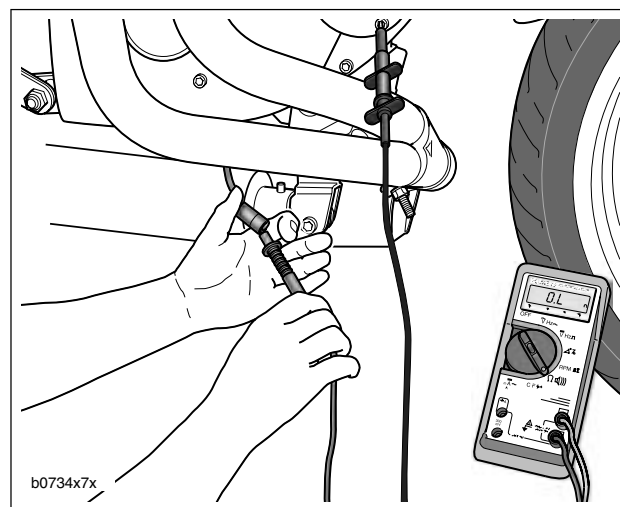


Figure 7-41. Test for Grounded Stator

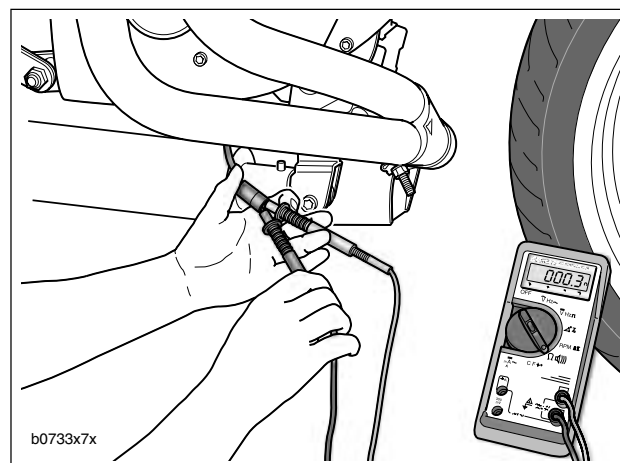


Figure 7-42. Check for Stator Resistance

AC Output Check

1. See [Figure 7-43](#). Test AC output.
 - a. Locate voltage regulator connector [17] near the oil pump. Disconnect from alternator stator wiring.
 - b. Connect an AC voltmeter across both stator sockets.
 - c. Run the engine at 2000 RPM. The AC output should be 38-52 volts AC.
2. Compare test results to specifications.
 - a. If the output is below specifications, charging problem could be a faulty rotor or stator.
 - b. If output is good, charging problem might be faulty regulator/rectifier. Replace as required.
3. Check the output again as described under [CURRENT AND VOLTAGE OUTPUT TEST](#) on [page 7-40](#).

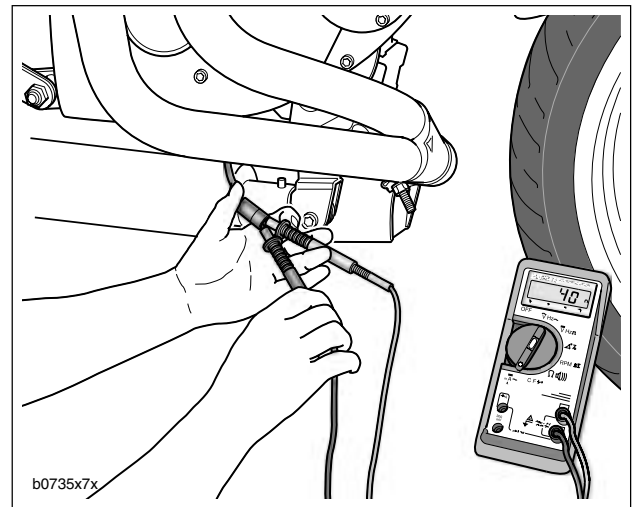


Figure 7-43. Check Stator AC Voltage Output

REMOVAL/DISASSEMBLY

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable from the battery.
2. Remove primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).
3. Remove clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See [PRIMARY CHAIN/DRIVE](#) under [6.5 PRIMARY DRIVE/CLUTCH](#).
4. Remove/disassemble rotor and/or stator, as required. Refer to the following procedures.

Rotor

1. See [Figure 7-44](#). Remove the eight bolts which secure alternator rotor to engine sprocket.
2. See [Figure 7-44](#). Position blocking under rotor. Press sprocket free of rotor.

NOTE

Resistance to sprocket/rotor disassembly is due in part to the magnetic force of the permanent rotor magnets.

Stator

1. See [Figure 7-45](#). Disconnect stator wiring (4) from voltage regulator wiring at connector (5) [17] near the oil pump.
2. Remove cable straps holding stator wire to oil filter hose.
3. Withdraw stator wiring (4) from behind the gearcase cover.
4. Remove and discard the four TORX screws (2) which secure stator (1) to left crankcase half.

CAUTION

Stator TORX screws contain a thread locking compound. Do not reuse existing screws. Always use new screws with the proper thread locking compound. Loss of torque on TORX fasteners could result in alternator damage.

5. Remove stator wiring grommet (3) from left crankcase half.
6. Withdraw stator wiring (4) from grommet hole in left crankcase half. Remove stator (1).

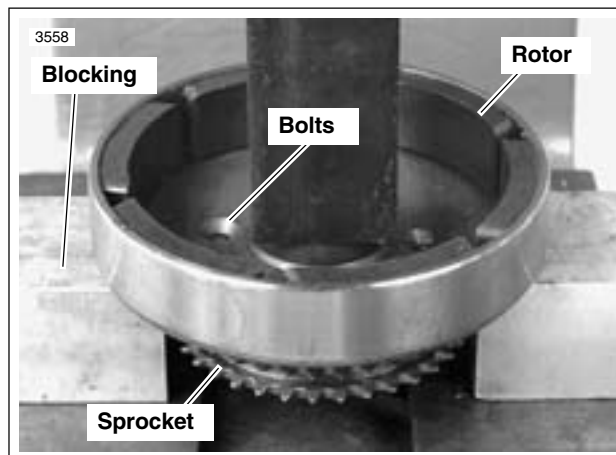
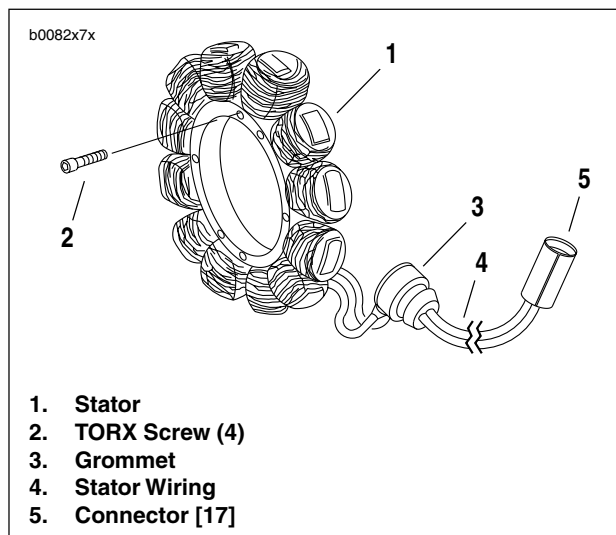


Figure 7-44. Removing Rotor From Sprocket



1. Stator
2. TORX Screw (4)
3. Grommet
4. Stator Wiring
5. Connector [17]

Figure 7-45. Stator Assembly

CLEANING AND INSPECTION

CAUTION

Do not strike or drop alternator rotor or damage to magnet adhesive could occur. Magnet adhesive damage can result in rotor failure.

1. Clean rotor with a petroleum-base solvent. Remove all foreign material from rotor magnets. Replace rotor if rotor magnets are cracked or loose.
2. Clean stator by wiping with a clean cloth.
3. Examine stator leads for cracked or damaged insulation.

NOTE

The rotor and stator can be replaced individually if either is damaged.

ASSEMBLY/INSTALLATION

Depending on whether the rotor, the stator, or both the rotor and stator were removed/disassembled, perform the applicable procedures which follow:

1. See [Figure 7-45](#). Feed stator wiring (4) with attached grommet (3) into open grommet hole in left crankcase half.
2. Apply a light coating of clean engine oil or chaincase lubricant to grommet. Install grommet into hole in left crankcase half.

CAUTION

Stator TORX screws contain a thread locking compound. Do not reuse existing screws. Always use new screws with the proper thread locking compound. Loss of torque on TORX fasteners could result in alternator damage.

3. Position stator (1) on left crankcase half. Secure stator using four **new** TORX screws (2). Tighten screws to 30-40 **in-lbs** (3.4-3.5 Nm).
4. Route stator wiring (4) in front of starter, behind gearcase cover and outboard of oil pump.

NOTE

Temporarily attach a thin flexible "feed" or mechanic's wire to the connector end of the stator wiring to assist in the routing of the wiring.

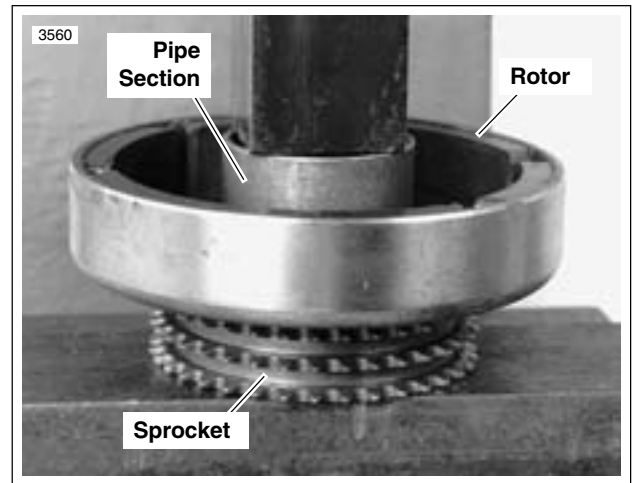


Figure 7-46. Pressing Rotor onto Sprocket

5. Connect alternator stator wiring to voltage regulator connector [17]. Bundle excess wiring in front of oil pump. Secure bundle to oil filter hose using a **new** cable strap.
6. See [Figure 7-46](#). Attach rotor to sprocket.
 - a. Position rotor on sprocket. Align holes in sprocket with holes in rotor.
 - b. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of each mounting bolt. Insert the four mounting bolts through rotor and start bolts into tapped holes in sprocket.
 - c. Position a section of pipe with an inside diameter larger than the sprocket mounting hub over center of rotor. Press rotor onto sprocket. Tighten bolts to 90-110 **in-lbs** (10-12 Nm).
7. Install clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See [6.5 PRIMARY DRIVE/CLUTCH](#).
8. Install primary cover. See [PRIMARY COVER](#) under [6.2 PRIMARY CHAIN](#).
9. Connect negative battery cable to battery. Tighten battery terminal hardware to 60-96 **in-lbs** (7-11 Nm).
10. Test charging system. See [7.13 CHARGING SYSTEM](#).

GENERAL

The voltage regulator attaches to a mounting plate at the front of the crankcase. The voltage regulator is not repairable. Replace the unit if it fails.

REMOVAL

WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect negative battery cable from battery.

CAUTION

When disconnecting the alternator stator wiring, pull apart the connector by firmly grasping both connector halves. Do not pull on leads or damage to the wires and/or terminals could result.

2. See Figure 7-49. Locate voltage regulator connector [17] near the oil pump. Cut cable straps and disconnect connector [17].
3. Detach charging wire from main circuit breaker.
 - a. Remove seat, fuel tank and tail section. See 2.34 TAIL SECTION.
 - b. See Figure 7-47. Disconnect BK charging wire from gold post of main circuit breaker.
 - c. Route charging wire back to voltage regulator. Cut and mark locations of cable ties while removing.
4. Remove two screws, washers and voltage regulator.

INSTALLATION

1. See Figure 7-48. Attach **new** voltage regulator using screws and washers. Tighten screws to 9-11 ft-lbs (12-15 Nm).
2. See Figure 7-49. Connect voltage regulator connector [17] halves and cable tie halves together. Bundle excess wiring in front of oil pump. Secure bundle to oil pump fitting and hose using **new** cable straps.
3. Route BK charging wire to gold post on main circuit breaker. Secure wire to frame with **new** cable straps.
4. Install tail section, fuel tank and seat. See 2.34 TAIL SECTION.
5. Connect negative battery cable to the battery. Tighten battery terminal hardware to 60-96 in-lbs (7-11 Nm).
6. Test charging system. See 7.13 CHARGING SYSTEM.

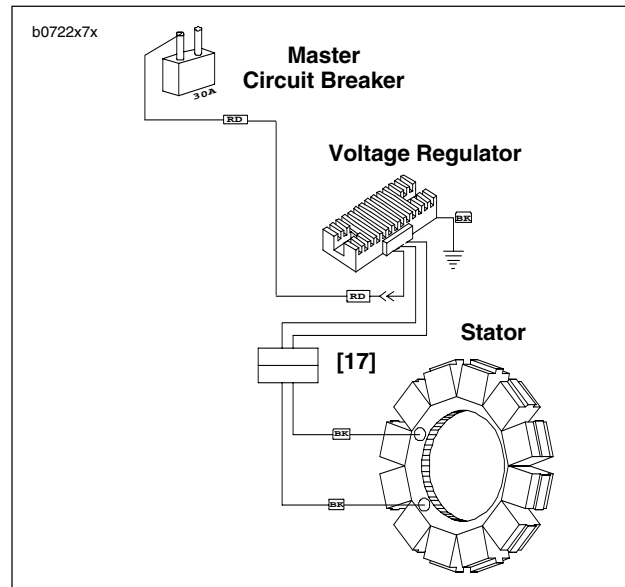


Figure 7-47. Voltage Regulator Connector [17]

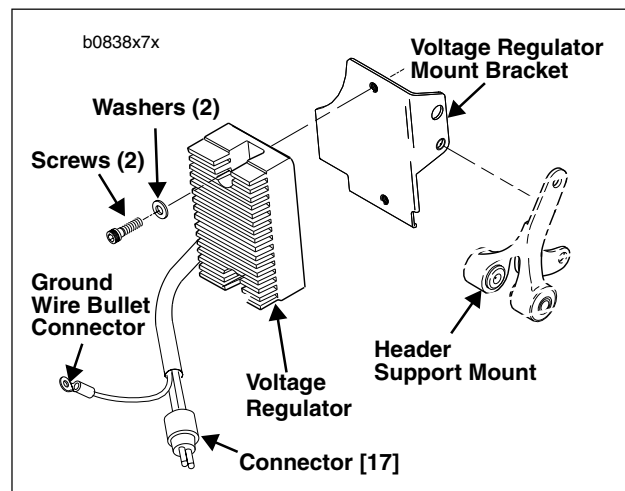


Figure 7-48. Voltage Regulator

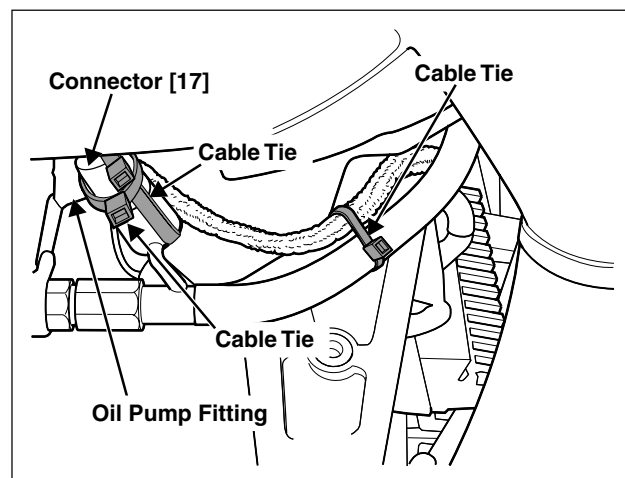


Figure 7-49. Cable Tie Locations

REMOVAL

1. Remove seat and tail section. See [2.34 TAIL SECTION](#).

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠ WARNING

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables from battery, negative cable first.
 - a. Remove bolt (metric) holding negative cable to negative battery terminal.
 - b. Remove bolt (metric) holding positive cable to positive terminal.
3. See [Figure 7-50](#). Remove bolt to detach negative battery cable from frame.
4. See [Figure 7-51](#). Remove protective boot (1) from starter. Remove nut with washer (3) (metric) to detach positive battery cable (2) from starter.

INSTALLATION

1. Clean cable connectors and battery terminals using a wire brush or sandpaper to remove any oxidation.

⚠ WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks could cause a battery explosion which could result in death or serious injury.

CAUTION

Connect cables to correct terminals of battery or serious damage to motorcycle electrical system will occur.

2. Connect battery cables.
 - a. See [Figure 7-50](#). Positive battery cable runs from starter to positive battery terminal. Loosely connect positive cable to positive (+) battery terminal using bolt.
 - b. See [Figure 7-51](#). Attach positive battery cable to starter using nut with washer (metric). Tighten to 60-85 in-lbs (7-10 Nm). Install protective boot (1).

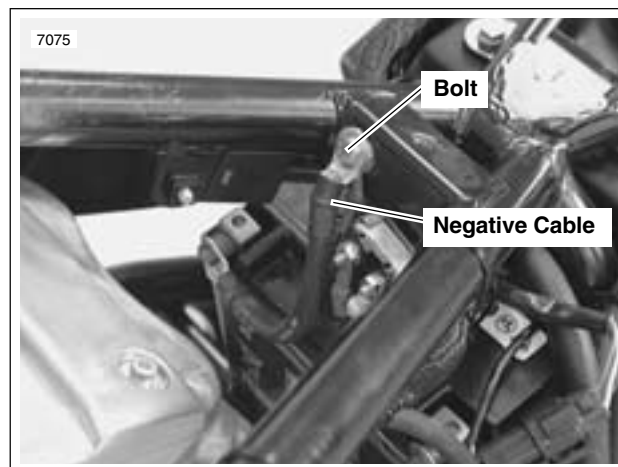
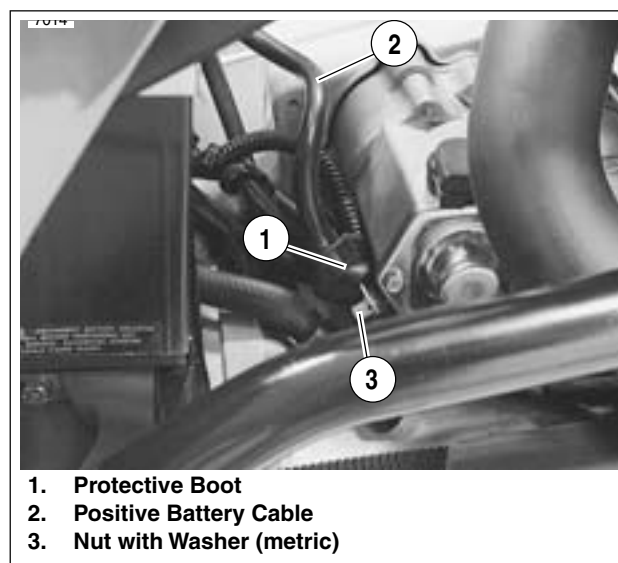


Figure 7-50. Negative Battery Cable (Typical)



1. Protective Boot
2. Positive Battery Cable
3. Nut with Washer (metric)

Figure 7-51. Positive Battery Cable

- c. See [Figure 7-50](#). After positive cable has been connected, loosely connect negative cable to negative (-) battery terminal with screw.
 - d. See [Figure 7-50](#). Attach negative cable to frame with bolt.
 - e. Tighten both terminal nuts (metric) 60-96 in-lbs (7-11 Nm).
3. Apply light coat of petroleum jelly or corrosion-retardant material to both battery terminals.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

4. Install tail section and seat. See [2.34 TAIL SECTION](#).

GENERAL

All 2001 Model Year Buell batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries. The batteries are shipped pre-charged and ready to be put into service. Do not attempt to open these batteries for any reason.

⚠ WARNING

All batteries contain electrolyte. Electrolyte is a sulfuric acid solution that is highly corrosive and can cause severe chemical burns. Avoid contact with skin, eyes, and clothing. Avoid spillage. Always wear protective face shield, rubberized gloves and protective clothing when working with batteries. A warning label is attached to the top of the battery. See Figures 7-33 and 7-34. Never remove warning label from battery. Failure to read and understand all precautions contained in warning label before performing any service on batteries could result in death or serious injury.

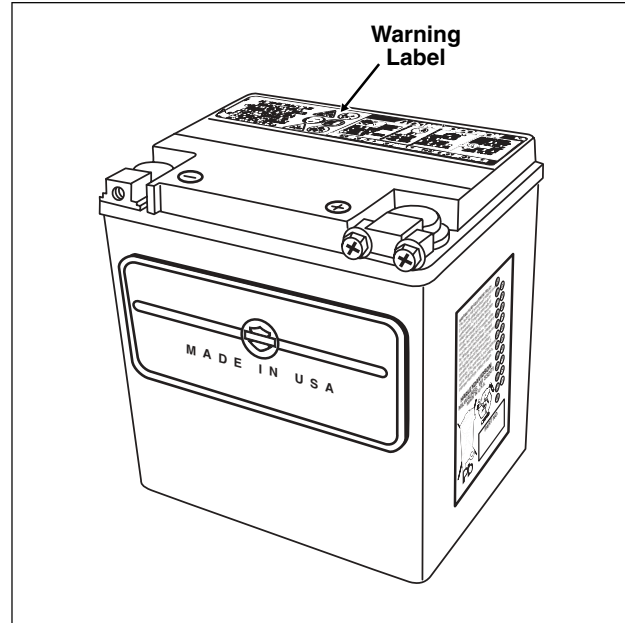


Figure 7-52. Maintenance-Free AGM Battery

BATTERY TESTING

Voltmeter Test

See Table 7-3. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.8V or above, perform the load test.

ANTIDOTE

External– Flush with water.

Internal– Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Call doctor immediately.

Eyes– Flush with water, get immediate medical attention.

					
Contents are Corrosive.	Wear Safety Glasses.	Contents are Explosive.	Keep Flames Away.	Read Instructions.	Keep Away From Children.

NON-SPILLABLE This is a ready filled, activated, SEALED BATTERY. NEVER remove strip. Refer to owner's manual for charging instructions. If battery is put into service after date shown, charge for minimum of 1 hour at 6-10 amps. (See side of battery for date.)	  	  	⚠ DANGER/POISON 3-4425	
			 SHIELD EYES. EXPLOSIVE GASES CAN CAUSE BLINDNESS OR INJURY.	 NO SPARKS FLAMES SMOKING
KEEP OUT OF REACH OF CHILDREN. DO NOT OPEN BATTERY.				

Figure 7-53.

Table 7-3. Voltmeter Test

BATTERY CHARGE CONDITIONS	
Voltage (OCV)	State of Charge
12.8	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When the solution stops bubbling, rinse off the battery with clean water.
2. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
3. Inspect the battery screws, clamps and cables for breakage, loose connections and corrosion. Clean clamps.
4. Check the battery posts for melting or damage caused by overtightening.
5. Inspect the battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
6. Inspect the battery case for cracks or leaks.

BATTERY CHARGING

Safety Precautions

Never charge a battery without first reviewing the instructions for the charger being used. In addition to the manufacturer's instructions, follow these general safety precautions:

- Always wear proper eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Turn the charger "OFF" before connecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery; red positive (+) lead to the positive (+) terminal and black negative (-) lead to the negative (-) terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.
- Make sure that the charger leads to the battery are not broken, frayed or loose.
- If the battery becomes hot, or if violent gassing or spewing of electrolyte occurs, reduce the charging rate or turn off the charger temporarily.

- Always turn the charger "OFF" before removing charger leads from the battery to avoid dangerous sparks.

Charging Battery

Charge the battery if any of the following conditions exist:

- Vehicle lights appear dim.
- Electric starter sounds weak.
- Battery has not been used for an extended period of time.

WARNING

Charge the battery in a well ventilated area. Explosive hydrogen gas escapes from the battery during charging. Keep open flames, electrical sparks and smoking materials away from the battery at all times. Inadequate safety precautions could result in death or serious injury.

CAUTION

If the battery releases an excessive amount of gas during charging, decrease the charging rate. If the battery gets hotter than 110°F. (43°C) during charging, discontinue charging and allow the battery to cool. Overheating may result in plate distortion, internal shorting, dryout or other damage.

1. Perform a voltmeter test to determine the state of charge. See BATTERY TESTING, VOLTMETER TEST, on the previous page. If battery needs to be charged, proceed to step 2.

CAUTION

Always remove the battery from the motorcycle before charging. Accidental electrolyte leakage will damage motorcycle parts.

The figures listed assume that the battery is charging at room temperature. If warmer than room temperature, use a slightly shorter charging time. If colder, use a slightly longer charging time.

The use of constant current chargers to charge sealed maintenance-free batteries is not recommended. Any overcharge will cause dry-out and premature battery failure. If a constant current charger is the only type available, do **not** exceed the charge times listed above and do **not** continue charging the battery if it gets hot. When charging, never exceed 15 volts for more than 30 minutes.

2. Remove the battery from the motorcycle. See BATTERY, DISCONNECTION AND REMOVAL. Place the battery on a level surface.

WARNING

Always unplug or turn OFF the battery charger before connecting the charger clamps to the battery. Connecting clamps with the charger ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

CAUTION

Do not reverse the charger connections described in the following steps or the charging system of the motorcycle could be damaged.

3. Connect the red battery charger lead to the positive (+) terminal of the battery.
4. Connect the black battery charger lead to the negative (-) terminal of the battery.

NOTE

If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.

5. Step away from the battery and turn on the charger. See the charging instructions in Table 7-4.

WARNING

Always unplug or turn OFF the battery charger before disconnecting the charger clamps from the battery. Disconnecting clamps with the charger ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

6. After the battery is fully charged, disconnect the black battery charger lead to the negative (-) terminal of the battery.
7. Disconnect the red battery charger lead to the positive (+) terminal of the battery.
8. Mark the charging date on the battery.
9. Perform a load test to determine the condition of the battery. See BATTERY TESTING, LOAD TEST.

Table 7-4. Battery Charging Rates/Times

Battery Amp-Hour	State of Charge		3 Amp Charger	6 Amp Charger	10 Amp Charger	20 Amp Charger
	Voltage Reading	% of Charge				
SPORT 19	12.8 V	100%	-	-	-	-
	12.6 V	75%	1.75 hours	50 minutes	30 minutes	15 minutes
	12.3 V	50%	3.5 hours	1.75 hours	1 hour	30 minutes
	12.0 V	25%	5 hours	2.5 hours	1.5 hours	45 minutes
	11.8 V	0%	6 hours, 40 minutes	3 hours, 20 minutes	2 hours	1 hour

BATTERY LOAD TESTING

Load Test

The load test measures battery performance under full current load and is the best indicator of battery condition. To load test the battery, proceed as follows:

CAUTION

Load testing a discharged battery can result in permanent battery damage.

1. Always fully charge the battery before testing or test readings will be incorrect. See CHARGING BATTERY. Load testing a discharged battery can also result in permanent battery damage.
2. After charging, allow battery to stand for at least one hour before testing.

WARNING

Always turn the battery load tester OFF before connecting the tester cables to the battery terminals. Connecting tester cables with the load tester ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

3. Connect tester leads to battery posts and place induction pickup over negative (black) cable. See Figure 7-42.

CAUTION

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.

4. Referencing Table 7-7, load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6V or more at 70°F. (21°C).

WARNING

Always turn the battery load tester OFF before disconnecting the tester cables from the battery terminals. Disconnecting tester cables with the load tester ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

1. Install the battery on the motorcycle. See BATTERY, INSTALLATION AND CONNECTION.

Table 7-5. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
SPORT	270	135

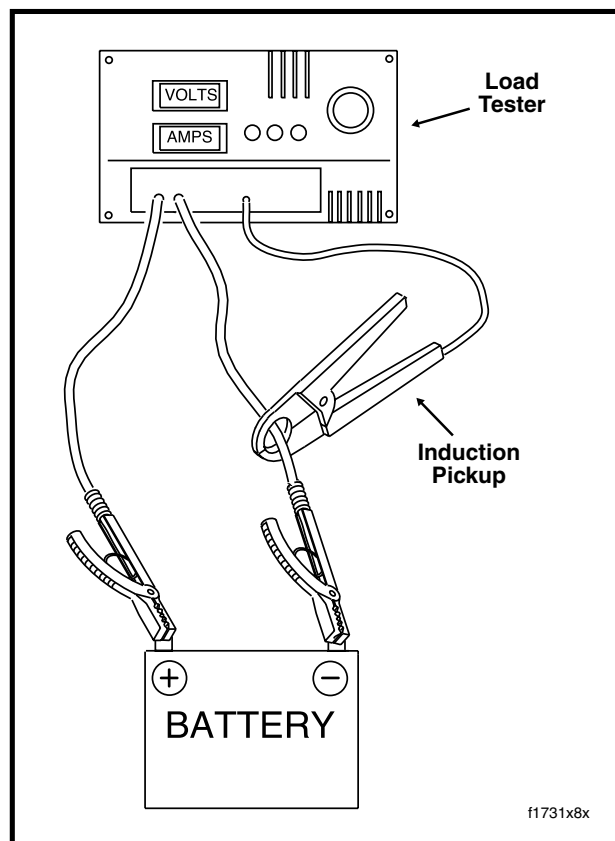


Figure 7-54. Load Test Battery

BATTERY CABLE ROUTING

Positive battery cable runs from starter post to positive battery terminal. Negative battery cable runs from frame to negative battery terminal. See Figure 7-35.

STORAGE

WARNING

Always store batteries where they cannot be reached by children. Contact with the battery's sulfuric acid could result in death or serious injury.

CAUTION

The electrolyte in a discharged battery will freeze if exposed to freezing temperatures. Freezing may crack the battery case and buckle battery plates.

If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge. See CHARGING BATTERY.

Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place. See Figure 7-37.

Charge the battery every month if stored at temperatures below 60° F. (16° C). Charge the battery more frequently if stored in a warm area above 60° F. (16° C).

NOTE

The H-D Battery Tender Automatic Battery Charger (P/N 99863-93TA) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.

When returning a battery to service after storage, refer to the instructions under CHARGING BATTERY.

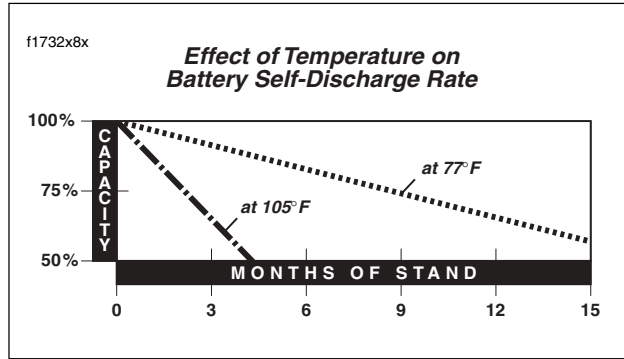


Figure 7-55. Battery Self-Discharge Rate

REMOVAL/DISASSEMBLY

Headlamp and Bulbs

1. Remove windscreen. See [2.35 WINDSCREEN](#)
2. See [Figure 7-59](#). Remove three screws and bezel from nest.
3. Remove three screws and retaining ring.
4. Slide headlamp from headlamp housing and detach headlamp connector from rear of headlamp.
5. Remove rubber boot from headlamp bulb.

CAUTION

The bulb contains Halogen gas under pressure. Handle bulb carefully and wear eye protection. If the bulb is mishandled or dropped, it could explode which could result in mild or moderate injury.

CAUTION

Never touch the bulb with your fingers. Fingerprints will etch the glass and cause the bulb to fail. Always wrap the bulb in paper or a clean, dry cloth during handling.

6. See [Figure 7-60](#). Remove headlamp bulb.
 - a. Open wire retaining latch (1).
 - b. Pull bulb housing from headlamp housing.

Headlamp Housing and Bracket

1. Remove seat and fuel tank. See [4.5 FUEL TANK](#).
2. See [Figure 7-61](#). Cut as many cable straps as necessary to access headlamp connector [4] along right side frame tube. Detach connector [4] from wiring harness.
3. See [Figure 7-59](#). Remove two screws and washers and remove headlamp housing from vehicle. Remove both windscreen brackets.
4. Remove headlamp brackets.
 - a. Remove front turn signals. See [7.20 TURN SIGNALS](#).
 - b. Remove bolt, washer and locknut.
 - c. Remove bolt and locknut.
 - d. Repeat for other bracket.
 - e. Remove front forks and headlamp brackets. See [2.16 FRONT FORK](#).

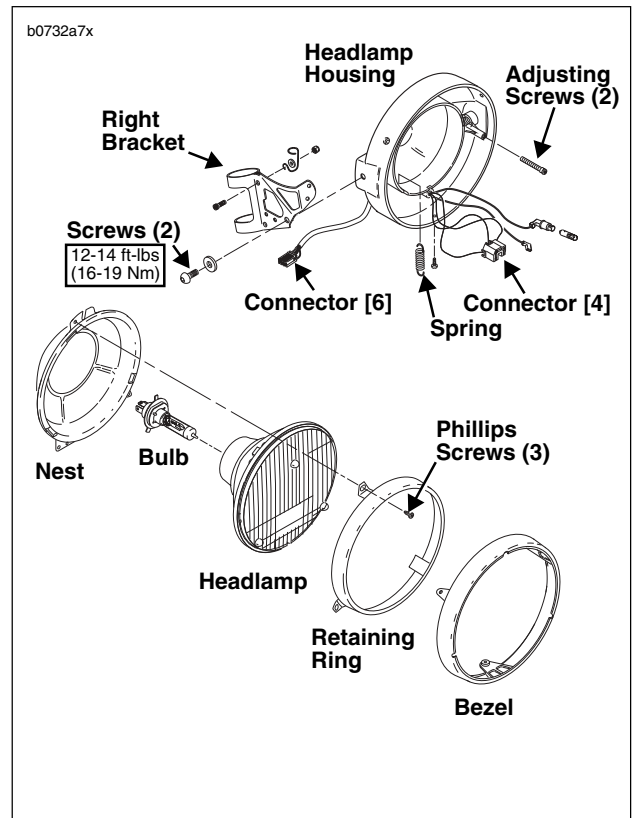


Figure 7-59. Headlamp Assembly

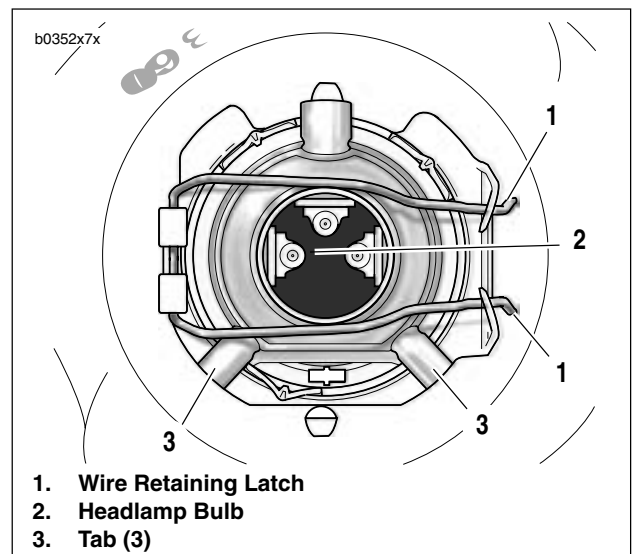


Figure 7-60. Headlamp Bulbs

ASSEMBLY/INSTALLATION

Headlamp Brackets and Housing

- Install headlamp brackets.
 - Install front forks through triple clamps and brackets. See [2.16 FRONT FORK](#).
 - See [Figure 7-59](#). Install bracket with two screws.
 - Repeat for other bracket
 - Attach both front turn signals. See [7.20 TURN SIGNALS](#).
- See [Figure 7-61](#). Route headlamp wire harness between front forks and along right side frame tube. Attach connector [4] to wiring harness. Fasten wiring harness to frame with **new** cable straps.
- See [Figure 7-59](#). Place windscreen brackets in position and install headlamp housing using two screws (metric) and washers (2). Tighten to 12-14 ft-lbs (16-19 Nm).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

- Install fuel tank and seat. See [4.5 FUEL TANK](#).
- Check headlamp for proper operation. See [HEADLAMP AND BULBS](#) below.

Headlamp and Bulbs

CAUTION

The bulb contains Halogen gas under pressure. Handle bulb careful and wear eye protection. If the bulb is mishandled or dropped, it could explode which could result in mild or moderate injury.

CAUTION

Never touch the bulb with your fingers. Fingerprints will etch the glass and cause the bulb to fail. Always wrap the bulb in paper or a clean, dry cloth during handling.

NOTE

When bulb replacement is required, see your Buell dealer. Not using the specified bulb may cause charging system problems.

- See [Figure 7-60](#). Install headlamp bulb (2).
 - Align tabs (3) on bulb housing with tabs on headlamp. Insert bulb.
 - Close the wire retaining latch (1).
- See [Figure 7-59](#). Place rubber boot into position and connect headlamp connector [4] to headlamp.
- Install headlamp and retaining ring to nest with three Phillips screws. Tighten screws to 12-14 **in-lbs** (1.4-1.6 Nm).
- Install bezel to retaining ring with three Phillips screws. Tighten screws to 12-14 **in-lbs** (1.4-1.6 Nm).
- Install windscreen. See [2.35 WINDSCREEN](#).

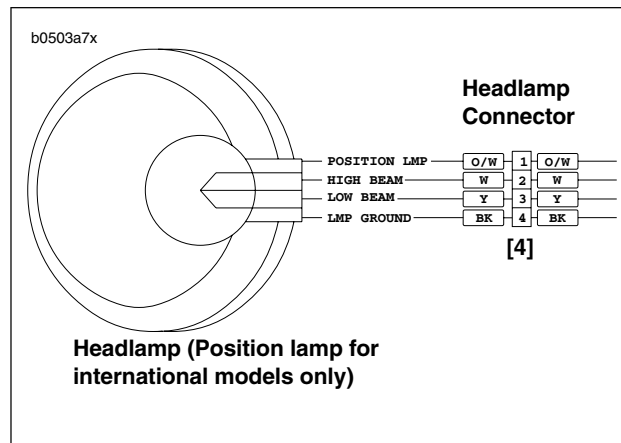


Figure 7-61. Headlamp Connector [4]

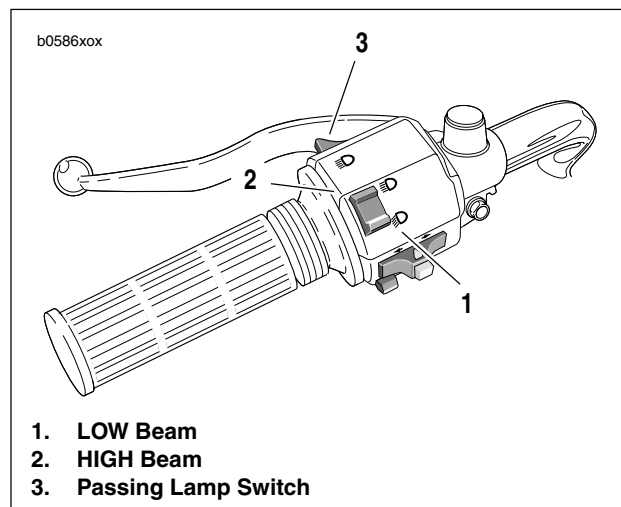


Figure 7-62. Passing Lamp Switch

WARNING

Check for proper headlamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

- Check headlamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - Turn ignition key switch to IGN.
 - See [Figure 7-62](#). Check headlamp LOW (1) and HIGH beam (2) settings.
 - Set headlamp to LOW beam (2). Press passing lamp switch (3). Headlamp should flash HIGH beam for as long as the switch is pressed.
 - Turn ignition key switch to LOCK.
- Align headlamp. See [1.22 HEADLAMP](#).

REMOVAL/DISASSEMBLY

1. See [Figure 7-63](#). If necessary, remove tail lamp bulb (5).
 - a. Remove two screws (3) to detach tail lamp lens.
 - b. Turn bulb counterclockwise and remove.
2. Remove seat. See [2.36 SEAT](#).
3. Disconnect the three tail lamp wires.
4. Remove two locknuts (1) (metric) and washers (2).

ASSEMBLY/INSTALLATION

1. See [Figure 7-63](#). Attach tail lamp to tail section with two washers (2) and locknuts (1) (metric).
2. Attach the three tail lamp wires.
3. If removed, install tail lamp bulb (5).
 - a. Turn bulb clockwise to install.
 - b. Install tail lamp lens with two screws (3).

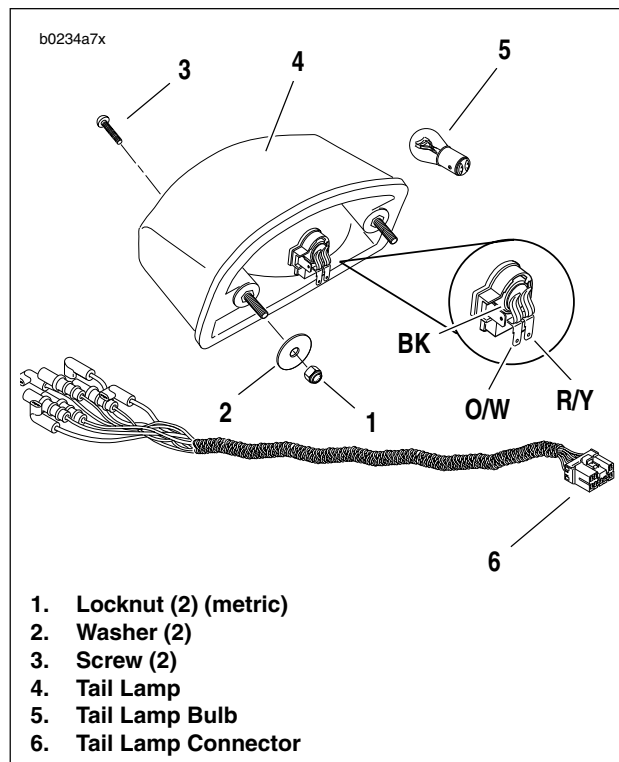


Figure 7-63. Tail Lamp

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

4. Install seat. See [2.36 SEAT](#).

WARNING

Check for proper tail lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper tail lamp operation could result in death or serious injury.

5. Check tail lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to IGN.
 - b. Check for tail lamp illumination.
 - c. Squeeze front brake hand lever. Check for brake lamp illumination. Release front brake hand lever.
 - d. Press rear brake pedal. Check for brake lamp illumination. Release rear brake pedal.
 - e. Turn ignition key switch to LOCK.

REMOVAL

NOTE

Remove screw on back of turn signal to detach lens and install **new** turn signal bulbs.

Front

1. Remove windscreen [2.35 WINDSCREEN](#).
2. See [Figure 7-64](#). Disconnect bullet connectors on turn signal wires.
3. See [Figure 7-65](#). Remove screws (1) and nuts (6).
4. Remove turn signals (3) and standoffs (4).

Rear

1. Remove seat. See [2.36 SEAT](#).
2. Cut cable straps to access bullet connectors under tail section.
3. See [Figure 7-66](#). Disconnect bullet connectors on turn signal wires.
4. See [Figure 7-67](#). Remove screws (1) and nuts (4).
5. Remove turn signals (2) from tail lamp bracket.

INSTALLATION

Front

1. See [Figure 7-65](#). Install turn signals (3) and standoffs (4) using screws (1) and nuts (6). Tighten to 20-23 **in-lbs** (2.3-2.6 Nm).

NOTE

Install turn signal with lens drain hole facing downward.

2. Attach bullet connectors on turn signal wires as shown in [Figure 7-64](#).
3. Install windscreen. See [2.35 WINDSCREEN](#).

WARNING

Check for proper turn signal operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper turn signal operation could result in death or serious injury.

4. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to IGN.
 - b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
 - c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
 - d. Turn ignition key switch to LOCK.

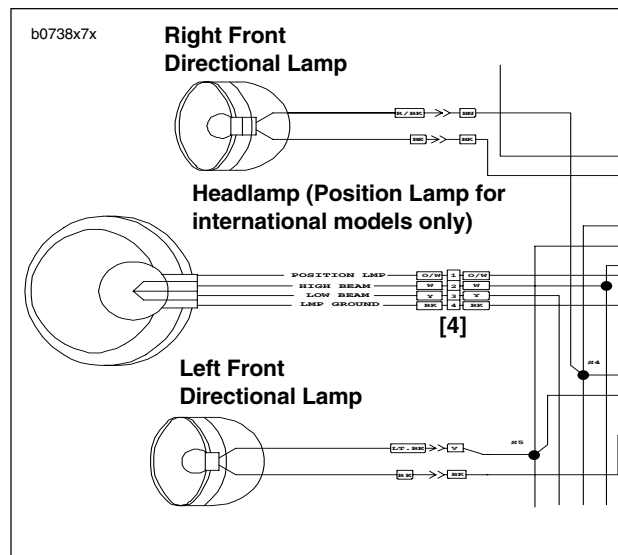


Figure 7-64. Front Turn Signal Connections

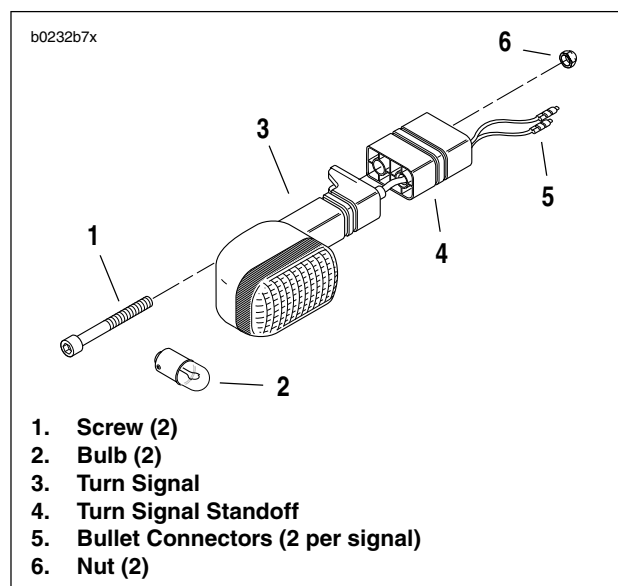


Figure 7-65. Front Turn Signals

REMOVAL

NOTE

The turn signal flasher is not repairable. Replace the unit if it fails.

1. Remove seat and tail section. See [2.34 TAIL SECTION](#).
2. See [Figure 7-68](#). Remove screw (2) to free flasher (3) and wires (1) from frame.
3. Detach wires (1) from flasher base.

INSTALLATION

1. See [Figure 7-68](#). Connect wires (1) to **new** turn signal flasher (3).
2. Attach assembly to **inside** of frame tube with screw (2).

WARNING

Check for proper turn signal operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper turn signal operation could result in death or serious injury.

3. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to IGN.
 - b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
 - c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
 - d. Turn ignition key switch to LOCK.

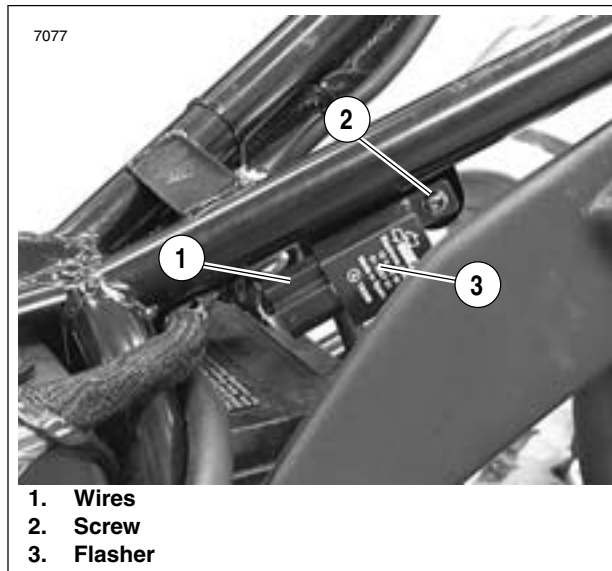


Figure 7-68. Turn Signal Flasher

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

4. Install tail section and seat. See [2.34 TAIL SECTION](#).

REMOVAL

NOTE

The individual handlebar switches are not repairable. Replace switch assembly upon switch failure.

Right Side

1. Detach throttle cables.
2. Remove seat. See 2.36 SEAT
3. Remove fuel tank. See 4.5 FUEL TANK.
4. See Figure 7-69. Cut as many cable straps as necessary to access right handlebar switch connector [1] along right side frame tube. Detach connector [1] from wiring harness.
5. Cut as many cable straps as necessary to access brake switch connector [2] along right side frame tube. Detach connector [2] from wiring harness.

Left Side

1. Remove three screws from handlebar switch.
2. Separate switch housings and remove from handlebar.
3. Remove seat. See 2.36 SEAT
4. Remove fuel tank. See 4.5 FUEL TANK.
5. See Figure 7-71. Cut as many cable straps as necessary to access left handlebar switch connector [6] along right side frame tube. Detach connector [6] from wiring harness.
6. Cut as many cable straps as necessary to access clutch switch connector [5] along right side frame tube. Detach connector [5] from wiring harness.

INSTALLATION

Right Side

1. Attach throttle cables to hand control.
2. Position housings on right handlebar by engaging stud on front housing with hole in handlebar. Fasten housings with two screws. Tighten to 12-17 **in-lbs** (1.4-1.9 Nm).
3. See Figure 7-69. Route switch housing wiring harness between front forks and along right side frame tube. Attach connector [1] and, if necessary, connector [2] to wiring harness. Fasten wiring harness to frame with **new** cable straps.
4. Install fuel tank. See 4.5 FUEL TANK.

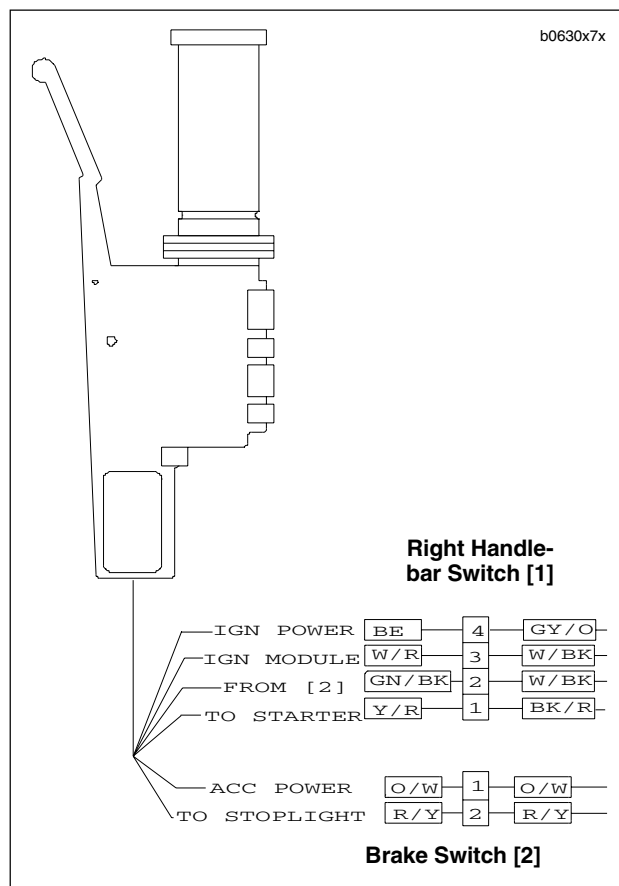


Figure 7-69. Right Handlebar Switch Connection

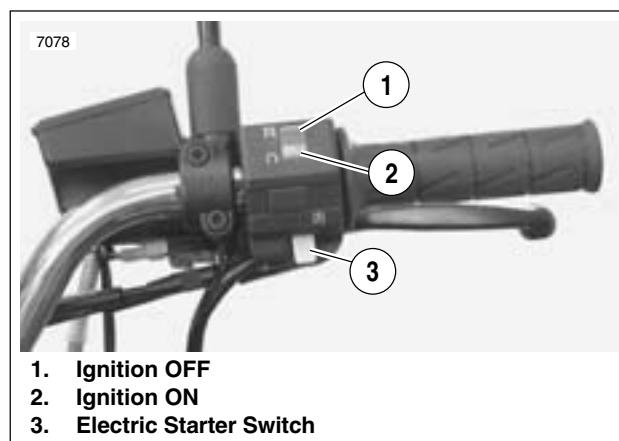


Figure 7-70. Right Handlebar Switches

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

5. Install seat. See 2.36 SEAT.
6. Adjust throttle cables. See 1.18 CARBURETOR.

WARNING

Check all handlebar switch operations before riding motorcycle. Handlebar switches not operating properly could result in death or serious injury.

7. Check handlebar switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to IGN.
 - b. Start motorcycle.
 - c. Turn ignition key switch to LOCK.

Left Side

1. Attach switch housing to handlebar with three screws. Tighten screws to 25-33 **in-lbs** (3-4 Nm).
2. See Figure 7-71. Route switch housing wiring harness between front forks and along right side frame tube. Attach connector [6] and, if necessary, connector [5] to wiring harness. Fasten wiring harness to frame with **new** cable straps.
3. Install fuel tank. See 4.5 FUEL TANK.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

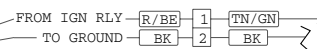
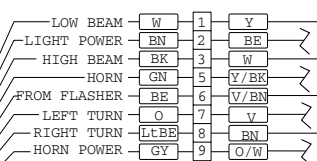
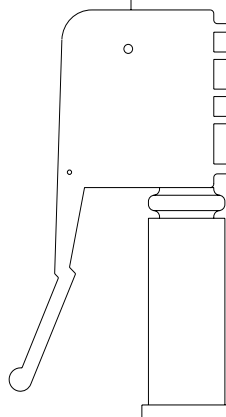
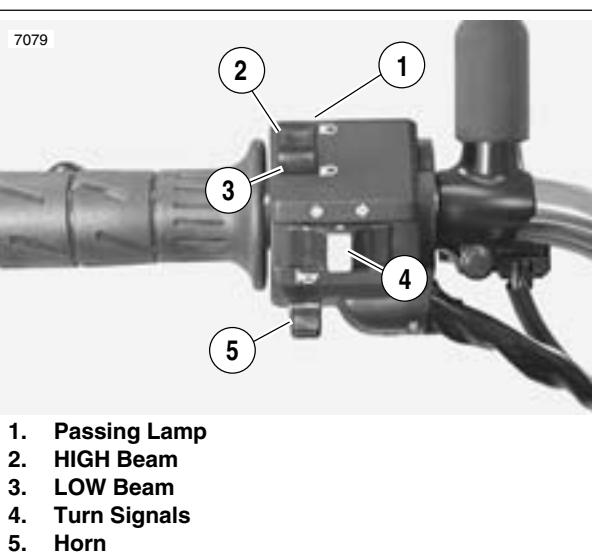
4. Install seat. See 2.36 SEAT.

WARNING

Check all handlebar switch operations before riding motorcycle. Handlebar switches not operating properly could result in death or serious injury.

5. Check handlebar switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
 - a. Turn ignition key switch to IGN.
 - b. Check headlamp LOW and HIGH beam settings.
 - c. Set headlamp to LOW beam. Press passing lamp switch. Headlamp should flash HIGH beam for as long as the switch is pressed.
 - d. Check left and right turn signals.
 - e. Activate horn by pressing horn switch.
 - f. Turn ignition key switch to LOCK.

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Left Handlebar Switch [6]**Clutch Switch [5]****Figure 7-71. Left Handlebar Switch Connection**

1. Passing Lamp
2. HIGH Beam
3. LOW Beam
4. Turn Signals
5. Horn

Figure 7-72. Left Handlebar Switches

REMOVAL

1. Remove seat and fuel tank bolt. Move fuel tank aside. See [4.5 FUEL TANK](#).
2. See [Figure 7-73](#). Remove bolt and washer (1).
3. Remove horn (2) from frame. Detach Y/BK power wire (3) and BK ground wire (4) from terminal clips.

INSTALLATION

1. See [Figure 7-73](#). Connect Y/BK power wire (3) and BK ground wire (4) to terminal clips.
2. Attach horn (2) to frame using bolt and washer (1).

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

3. Install fuel tank and seat. See [4.5 FUEL TANK](#).
4. Check horn operation. If horn does not sound or fails to function satisfactorily, see [TROUBLESHOOTING](#).
 - a. Turn ignition key switch to IGN.
 - b. Press horn switch to activate horn.
 - c. Turn ignition key switch to LOCK.

TROUBLESHOOTING

1. If the horn does not sound or fails to function satisfactorily, check for the following conditions:
 - a. Discharged battery.
 - b. Loose, frayed or damaged wiring leading to horn terminal.
2. If battery has a satisfactory charge and wiring appears to be in good condition, test horn grounds and switch using voltmeter.
 - a. See [Figure 7-73](#). Remove Y/BK power (3) and BK ground (4) wires from terminal clips.
 - b. Connect voltmeter positive (+) lead to Y/BK (3) wire.
 - c. Connect voltmeter negative (-) lead to ground.
 - d. Turn ignition key switch to IGN.
3. See [Figure 7-74](#). Depress horn switch and observe voltmeter reading.
 - a. If battery voltage is present, horn or horn grounding is faulty. If horn is faulty, replace unit as an assembly. The horn is not repairable.
 - b. If battery voltage is not present, either horn switch or wiring to horn is faulty. If horn switch is faulty, replace left handlebar switch. See [7.22 HANDLEBAR SWITCHES](#).

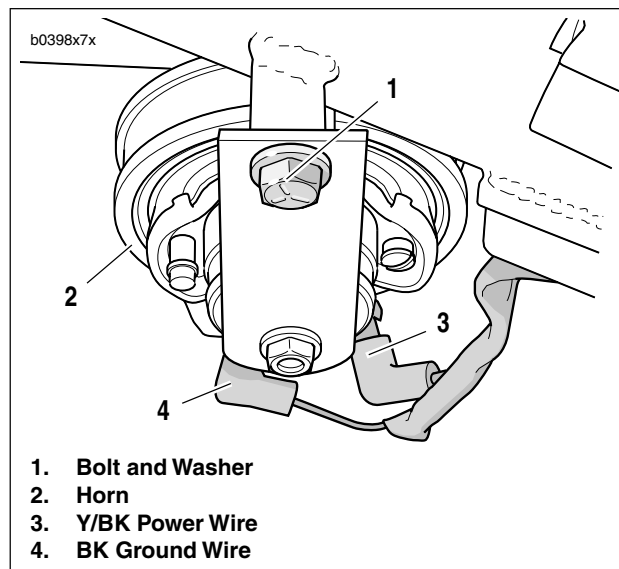


Figure 7-73. Horn Assembly

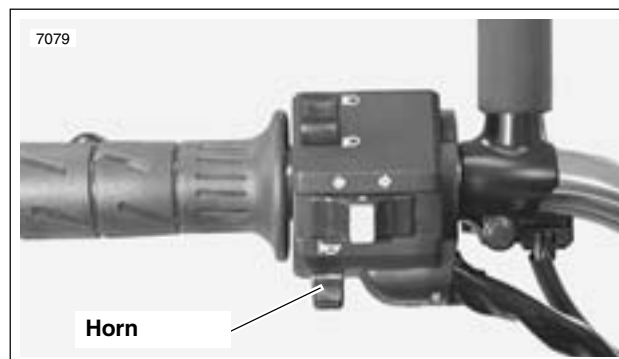


Figure 7-74. Horn Switch Location

GENERAL

See [Figure 7-75](#). The neutral indicator switch (1) is threaded into the transmission portion of the right crankcase half (2); it is immediately forward of the main drive gear shaft (3). The sprocket cover must be removed to test the switch. If switch requires replacement, secondary drive belt and transmission sprocket must also be removed; there is not enough clearance to allow the removal of the switch without first removing the transmission sprocket.

A pin on the shifter drum contacts the neutral indicator switch plunger, completing the neutral indicator circuit. The switch is not repairable. Replace the switch if it malfunctions.

TESTING

1. Remove sprocket cover. See [2.30 SPROCKET COVER](#).
2. See [Figure 7-75](#). Disconnect wire lead from neutral indicator switch (1).
3. Turn ignition key switch to IGN. Touch the neutral indicator wire lead to a suitable ground.
 - a. If indicator lamp lights, then problem is at indicator switch. Replace switch.
 - b. If indicator lamp does not light, then problem is elsewhere in circuit. Check for loose connections, burned out indicator lamps or faulty wiring.
 - c. After testing and repair, connect wire lead to indicator switch.
4. Install sprocket cover. See [2.30 SPROCKET COVER](#).

REMOVAL/INSTALLATION

1. Verify that the ignition key switch is turned to LOCK.
2. Remove sprocket cover. See [2.30 SPROCKET COVER](#).
3. See [Figure 7-75](#). Place transmission in first gear. Remove two socket head screws (7) and lockplate (6).

CAUTION

Transmission sprocket nut has left-hand threads. Turn nut clockwise to loosen and remove from main drive gear shaft. Transmission sprocket nut will be damaged if turned counterclockwise to remove.

4. Remove transmission sprocket nut (5) from main drive gear shaft (3).

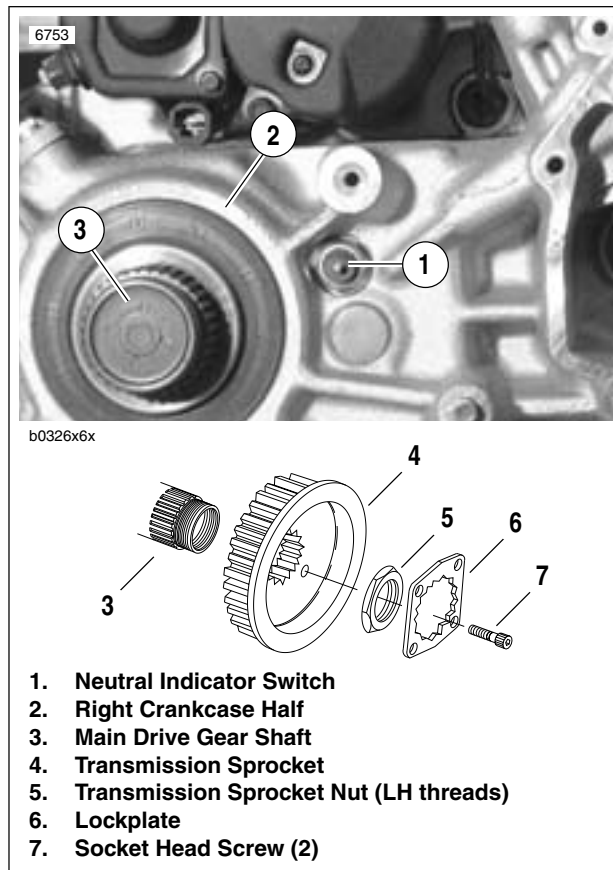


Figure 7-75. Neutral Indicator Switch

5. Decrease secondary drive belt tension by loosening axle adjusting nuts. See [1.9 DRIVE BELT DEFLECTION](#).
6. Remove transmission sprocket (4) (with secondary drive belt) from main drive gear shaft (3).
7. Remove wire lead from neutral indicator switch (1). Remove switch from right crankcase half (2).
8. Install **new** neutral indicator switch.
 - a. Apply a light coating of LOCTITE THREADLOCKER 243 (blue) to **new** neutral indicator switch (1) threads.
 - b. Install switch in crankcase. Tighten to 3-5 ft-lbs (4-7 Nm).
 - c. Connect wire lead to switch.
9. Install transmission sprocket (4) (with secondary drive belt) onto main drive gear shaft (3). See [6.13 TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT](#).
10. Install sprocket cover. See [2.30 SPROCKET COVER](#).
11. Adjust drive belt tension. See [1.9 DRIVE BELT DEFLECTION](#).

GENERAL

Buell motorcycles feature two components which protect the electrical system.

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

Fuses

See [Figure 7-76](#). The fuse block is on the right side of the frame under the tail section. The block contains five replaceable fuses. A spare fuse (1) is attached to the fuse block. Additional spares may be added at the rider's discretion.

The memory (2), lights (4), instruments (5), and accessory (6) fuses are each rated at 15 amperes. The ignition (3) is rated at 20 amperes.

Always investigate the cause of blown fuses before replacing them. See your Buell dealer for more information.

Circuit Breakers

See [Figure 7-77](#). The 30 ampere main circuit breaker is on the frame beneath the tail section.

Since the circuit breaker is the automatic-reset type, the bimetallic breaker contacts automatically close (completing the circuit) once they have cooled down from the initial overload. If the overload condition still exists, the breaker contacts will again open to interrupt current flow. This opening and closing of the breaker contacts continues as long as the current circuit overload condition exists.

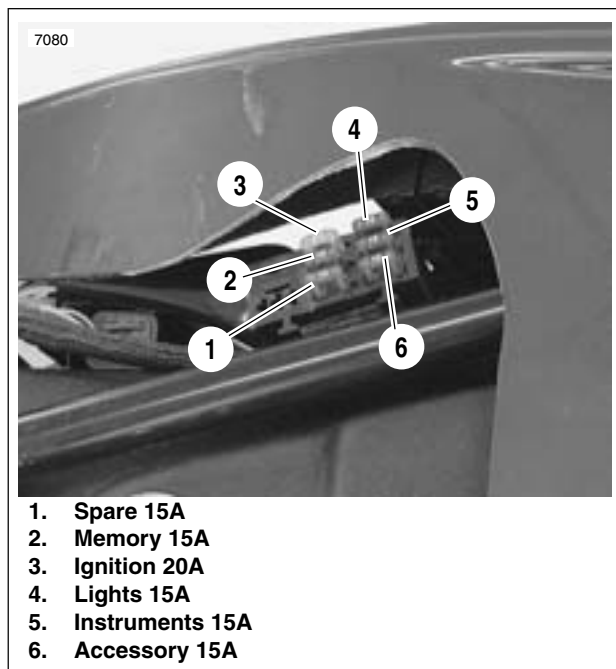


Figure 7-76. Fuse Block

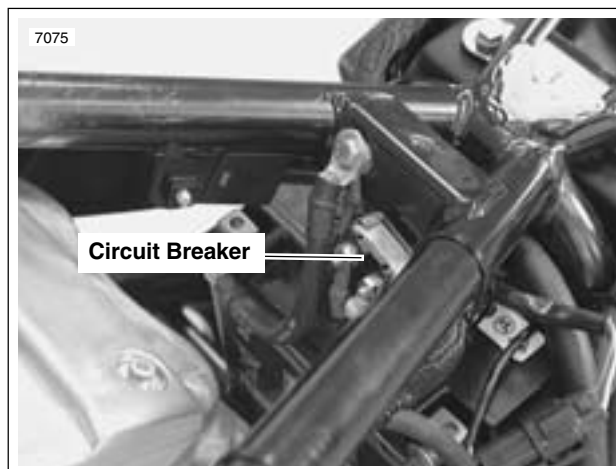


Figure 7-77. Circuit Breaker

REMOVAL

1. See [Figure 7-78](#). Remove bolt to detach speedometer sensor from crankcase.
2. Remove seat and tail section. See [2.34 TAIL SECTION](#).
3. See [Figure 7-79](#). Disconnect 3-place Deutsch connector [11] for speedometer sensor (located under seat near battery negative terminal).

CLEANING AND INSPECTION

1. Clean any metal particles that may have collected on sensor.
2. For testing information see speedometer sensor test in [7.28 SPEEDOMETER PERFORMANCE CHECK](#).

INSTALLATION

1. See [Figure 7-78](#). Install speedometer sensor to crankcase with bolt. Tighten bolt to 80-100 **in-lbs** (9-11 Nm).
2. Connect speedometer sensor connector [11] to wiring harness.

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

3. Install tail section and seat. See [2.34 TAIL SECTION](#).

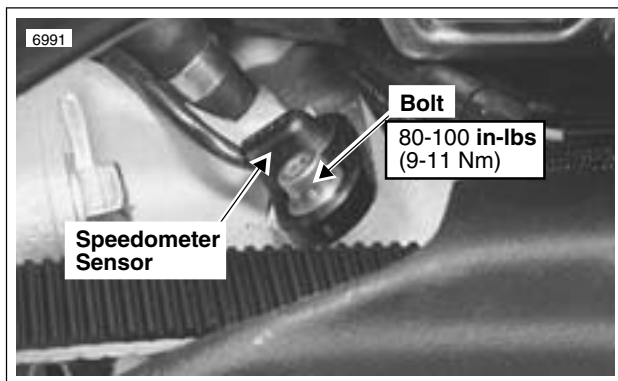


Figure 7-78. Speedometer Sensor

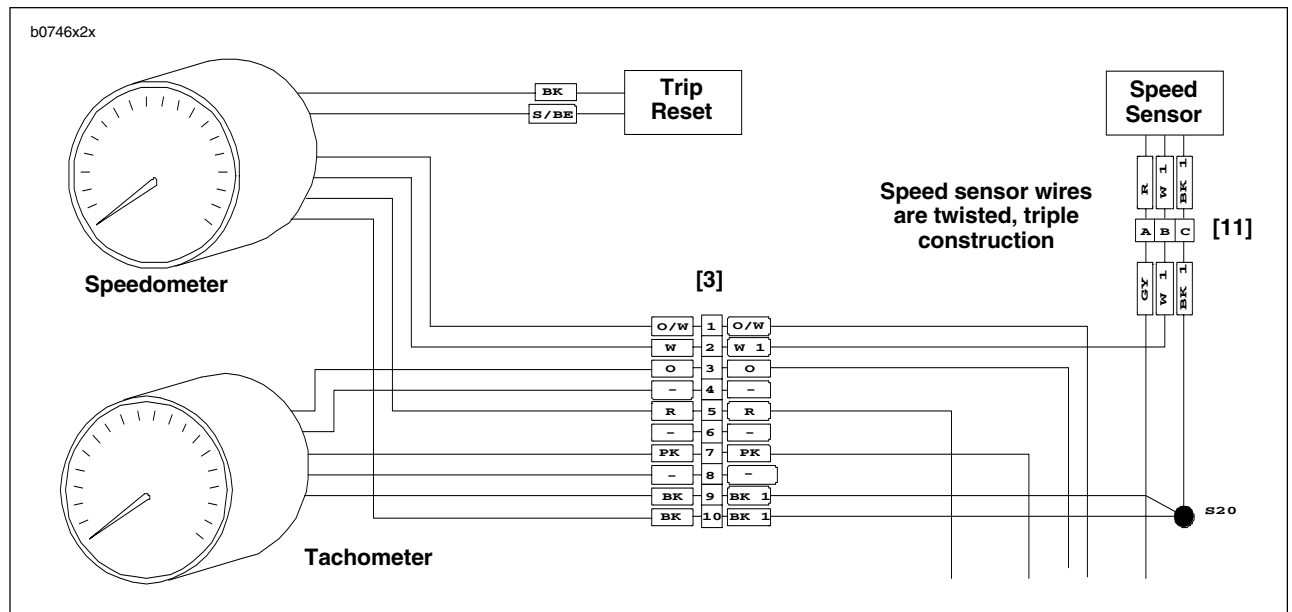


Figure 7-79. Speedometer Sensor Wiring

GENERAL

Replace the speedometer if the unit is not working properly. The instrument is not repairable. However, before replacing a component, check that the problem is not caused by a faulty cable or loose wire connection.

REMOVAL

1. Gain access to the back side of the dash panel by detaching the windscreen from mounting brackets. See [2.35 WINDSCREEN](#)
2. See [Figure 7-80](#). Remove odometer reset button from dash panel.
 - a. Pry plastic grommet from dash panel.
 - b. See [Figure 7-81](#). Remove odometer reset button from back side of dash panel.
 - c. Remove two nuts (metric) and lockwashers from speedometer cover.
3. See [Figure 7-80](#). Detach instrument panel by removing two screws. Pull dash panel upward, but do not damage wiring.

CAUTION

Do not remove all the speedometer wires at the same time. Only remove one wire at a time and reinstall screw immediately. Failure to comply will cause extreme difficulty during reassembly.

4. See [Figure 7-81](#). Slide speedometer cover away from speedometer.
5. See [Figure 7-83](#). Remove wires from speedometer one at a time. After removing each wire, reinstall screw immediately.
6. Pull lamp (5) from bore.
7. Pull speedometer and attached odometer reset button from front of dash panel.
8. Remove mounting gasket.
9. If necessary, replace speedometer wiring.
 - a. Remove fuel tank.
 - b. Cut cable straps on wiring harness. Detach wires at plug connector. See [Figure 7-84](#).

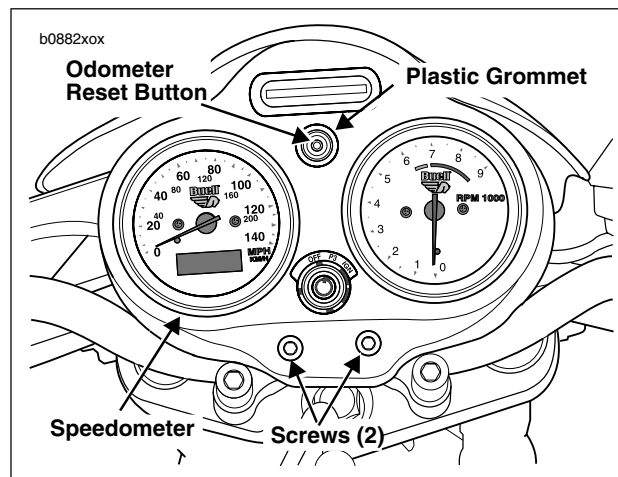


Figure 7-80. Dash Panel (Front)

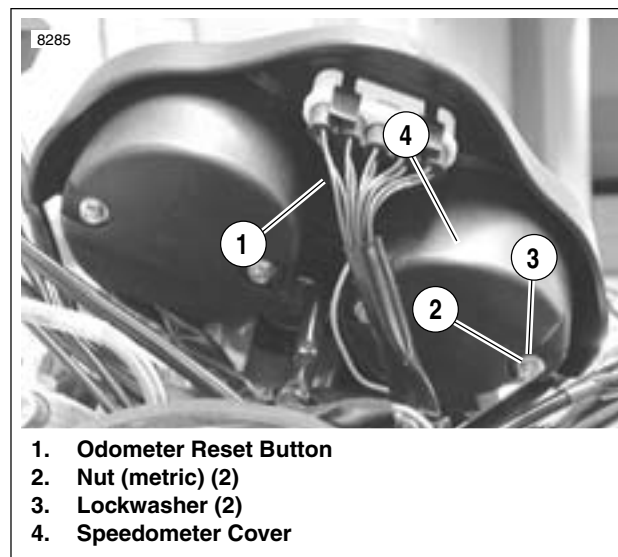


Figure 7-81. Dash Panel (Back)

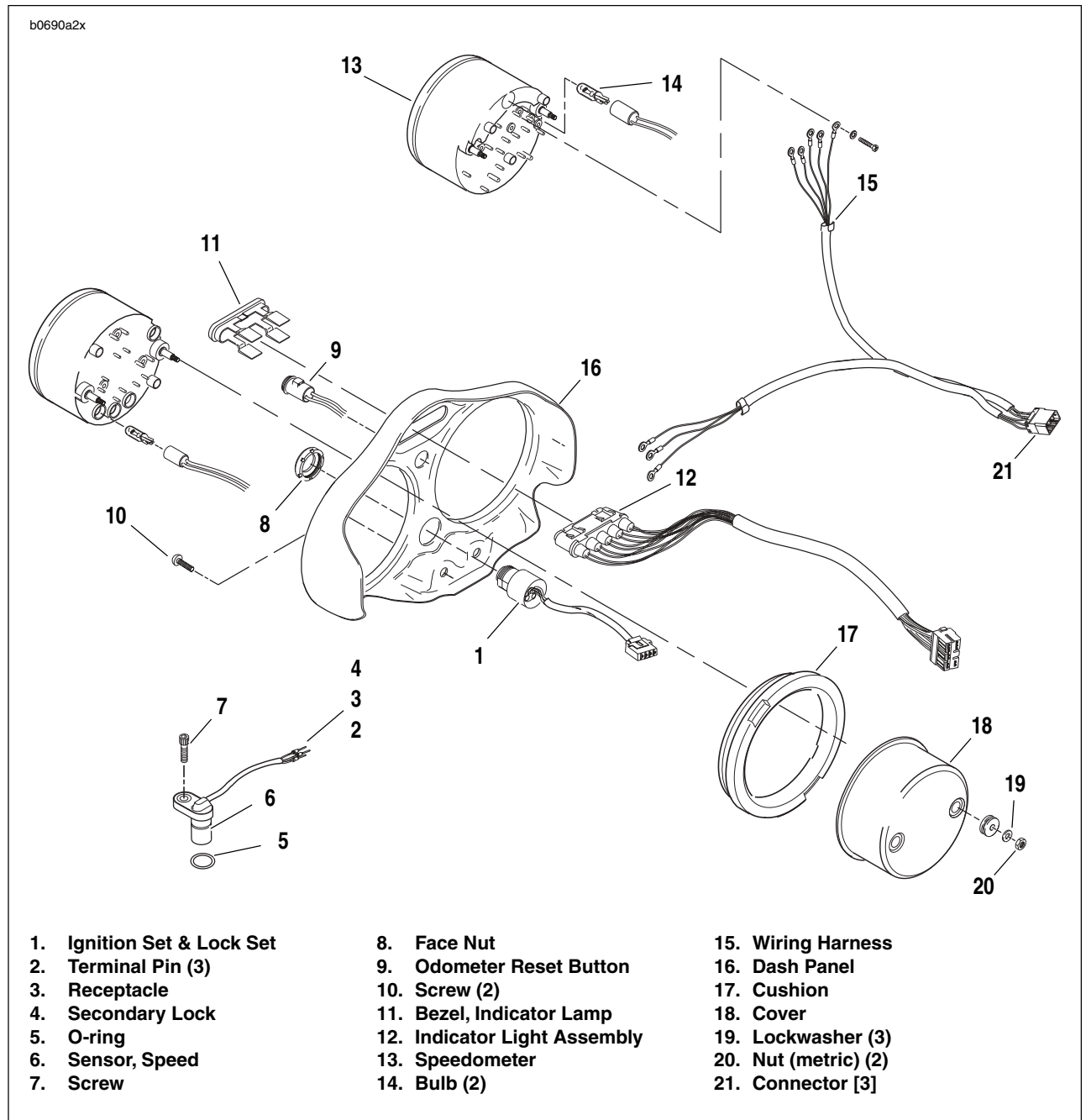


Figure 7-82. Speedometer Assembly

INSTALLATION

1. If replacing speedometer wiring:
 - a. See [Figure 7-83](#). Attach wires at plug connector.
 - b. Feed wiring on left side of steering neck through to dash panel. Secure with cable straps.
 - c. Install fuel tank. See [4.5 FUEL TANK](#).
2. Install odometer reset.
 - a. See [Figure 7-82](#). Install odometer reset button (1) from back side of dash panel.
 - b. See [Figure 7-80](#). Secure odometer reset button (3) on front of dash panel with plastic grommet (2).
3. Install rubber mounting gasket.
 - a. Apply 2 drops of Permabond 105 at each end of notches in gasket.
 - b. Apply 1 drop of Permabond 105 at top of gasket and bottom of gasket.
 - c. Position mounting gasket in dash panel.
4. Install speedometer in dash panel.
 - a. Feed wires through opening in speedometer cover.
 - b. Slide speedometer into rubber mounting gasket.
 - c. See [Figure 7-83](#). Insert lamp (5).
 - d. Attach wires to speedometer as shown.
5. See [Figure 7-81](#). Install speedometer cover (4).
 - a. Place speedometer cover over speedometer. Align posts on back of speedometer with holes in cover. Drain hole must be at the bottom of cover.
 - b. Apply LOCTITE THREADLOCKER 243 (blue) to both nuts (metric) (2).
 - c. Fasten cover (4) to speedometer using two nuts (metric) (2) and lockwashers (3).
6. Secure the dash panel.
 - a. See [Figure 7-80](#). Position dash panel on instrument support clamp.
 - b. Attach panel using two screws (1). Tighten to 7-9 ft-lbs (10-12 Nm).
 - c. Attach windscreen to mounting brackets. See [2.35 WINDSCREEN](#).

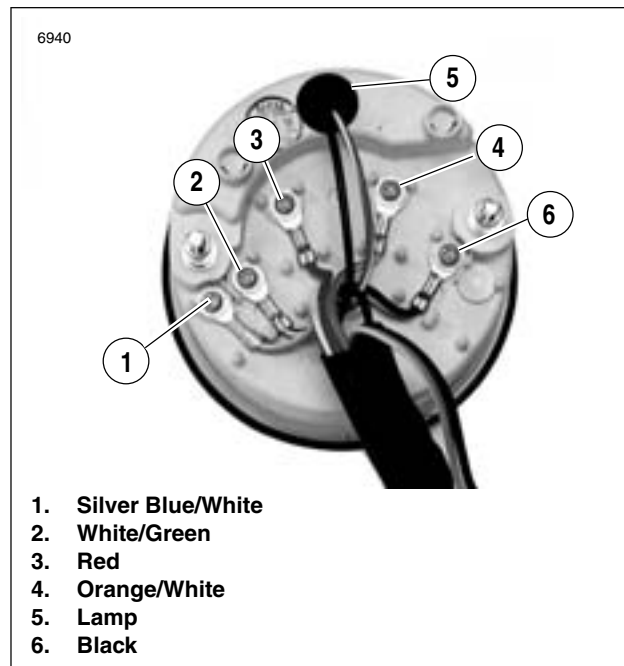


Figure 7-83. Speedometer Wiring

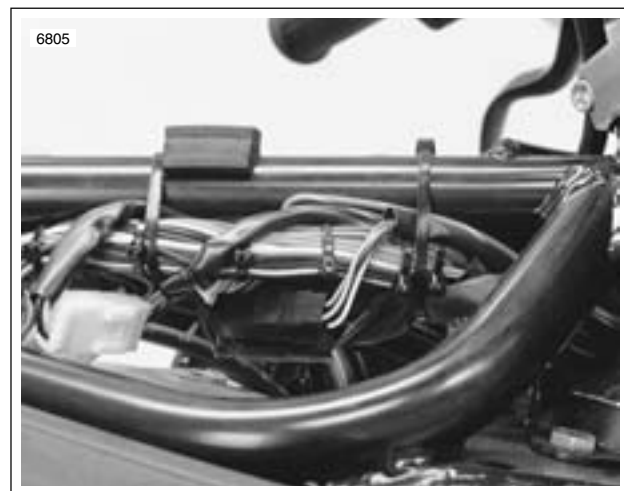


Figure 7-84. Speedometer Wiring Connector Locations (Approximate)

GENERAL

See [Figure 7-85](#). Use the SPEEDOMETER TESTER (Part No. HD-41354) for speedometer diagnostics. These diagnostics may include:

- Checking speedometer operation.
- Testing speedometer needle sweeping action.

The tester generates a simulated speedometer sensor signal. This signal aids in determining whether speedometer replacement is necessary. It can also be used to simulate running engine conditions for ignition system troubleshooting.

NOTES

- Use the following procedures in conjunction with the manual supplied with the speedometer tester.
- Test results may be inaccurate if tester battery is low.

TESTING

NOTE

The SPEEDOMETER TESTER (Part No. HD-41354) cannot be used to verify the calibration of a speedometer and it will not verify the speedometer's function to support legal proceedings. Its purpose is to verify speedometer function when performing service diagnosis or repair. It can also assist in determining if speedometer replacement is necessary.

Speedometer Operation Test

1. See [Figure 7-86](#). Locate the 3-place Deutsch connector [11] for the speedometer sensor above battery negative (-) terminal and disconnect.
2. Attach speedometer tester connector to speedometer sensor connector.
3. Place speedometer tester power switch in the ON position. Place signal switch in the OUT position.
4. Turn vehicle ignition switch ON.
5. Begin test.
 - a. Press ENTER on the tester keypad.
 - b. Enter a frequency from [page 7-18](#) Note that different markets use different frequencies.
 - c. Verify that speedometer display reads the corresponding speed. To change the test frequency, press CLEAR to cancel and enter the new frequency. Press ENTER to begin and reverify.

NOTE

The speedometer should be accurate within 0-4 MPH (0-6.5 KPH).

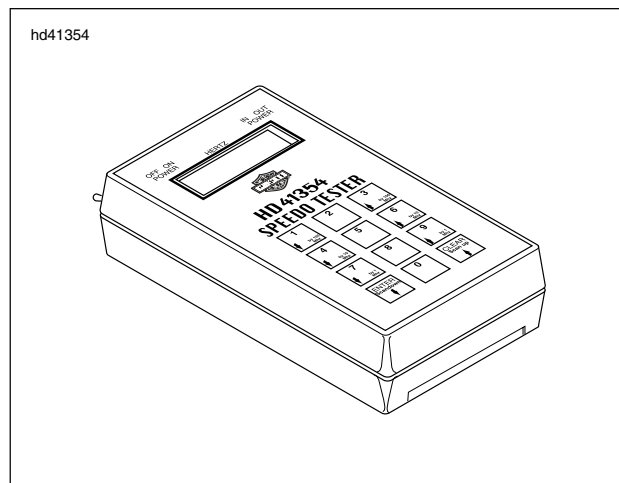


Figure 7-85. Speedometer Tester



Figure 7-86. Speedometer Sensor Connector

Table 7-6. Speedometer Test Frequency in Hertz (Hz)

MARKET	20 MPH (30 KPH)	40 MPH (60 KPH)	60 MPH (100 KPH)	80 MPH (130 KPH)
USA	432	864	1296	1728
ENG	362	725	1088	1454
AUS, EUR	340	680	1134	1474
CAN, JPN, NZ	405	810	1350	1755

Speedometer Needle Sweep Test

The tester's sweep function moves the speedometer needle through the full range of movement. This allows for testing the smoothness of operation and checking for hesitancy or a stuck needle.

1. See [Figure 7-86](#). Disconnect speedometer sensor connector. Attach speedometer tester connector to speedometer sensor connector.
2. Place speedometer tester power switch in the ON position. Place signal switch in the OUT position.
3. Turn vehicle ignition switch ON.
4. Begin test by pressing 0 on the tester keypad, then pressing ENTER. The tester will scan for two seconds, then the tester will put out a 1 Hz signal.
5. Select a test range.
 - a. Press 2 to select LO range (1-20 Hz).
 - b. Press 5 to select CEN range (21-999 Hz).
 - c. Press 8 to select HI range (1000-20,000 Hz).
6. After selecting a range, use the corresponding arrow keys to accelerate through the range. As you move through the speed range, check for smooth needle movement.
 - a. If testing LO range, press 1 or 3.
 - b. If testing CEN range, press 4 or 6.
 - c. If testing HI range, press 7 or 9.

Speedometer Sensor Test

If the speedometer is inoperative, but backlighting and odometer work, the speedometer sensor may not be working.

See [Figure 7-87](#). Fabricate a test harness using the following parts. This harness can also be used to test the tachometer.

- Two Deutsch 3-place socket housings (Part No. 72113-94BK).
- Deutsch 3-place pin housing (Part No. 72103-94BK).
- Six lengths of 18 gauge wire, each 6.0 in. (15 cm) long.

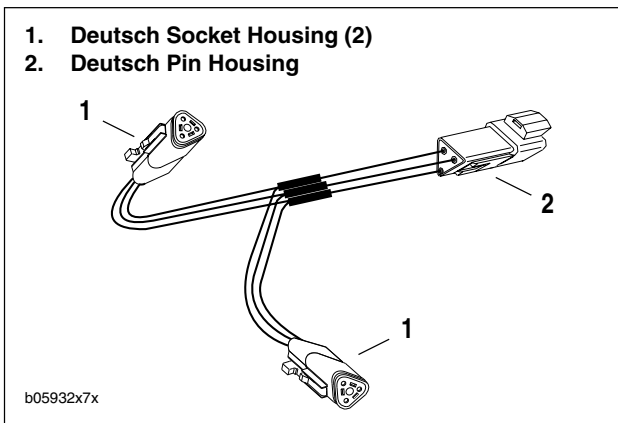


Figure 7-87. Test Harness

Before attempting the actual speedometer sensor check, two system checks must be made. Install the test harness at the cam position sensor connector. See [Figure 7-88](#).

- Test for voltage to sensor by checking for 8-12 VDC on red wire in connector [11].
 - Then check for continuity to ground on black wire in connector [11].
1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
 2. Install the test harness between the speedometer sensor connectors.
 3. Place speedometer tester power switch in the ON position. Place signal switch in the IN position.
 4. Plug the speedometer tester into the test harness. Turn vehicle ignition switch ON.
 5. Press ENTER on the tester keypad.
 6. Rotate the motorcycle's rear wheel.
 - a. If reading on speedometer tester changes as wheel is rotated, speedometer sensor is OK.
 - b. If reading does not change, speedometer sensor is suspect. Install a known, good speedometer sensor and test again.

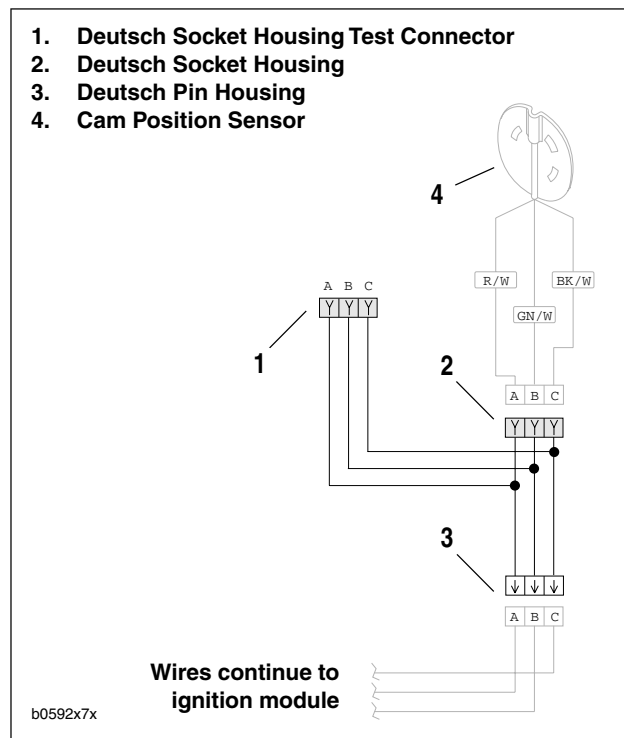
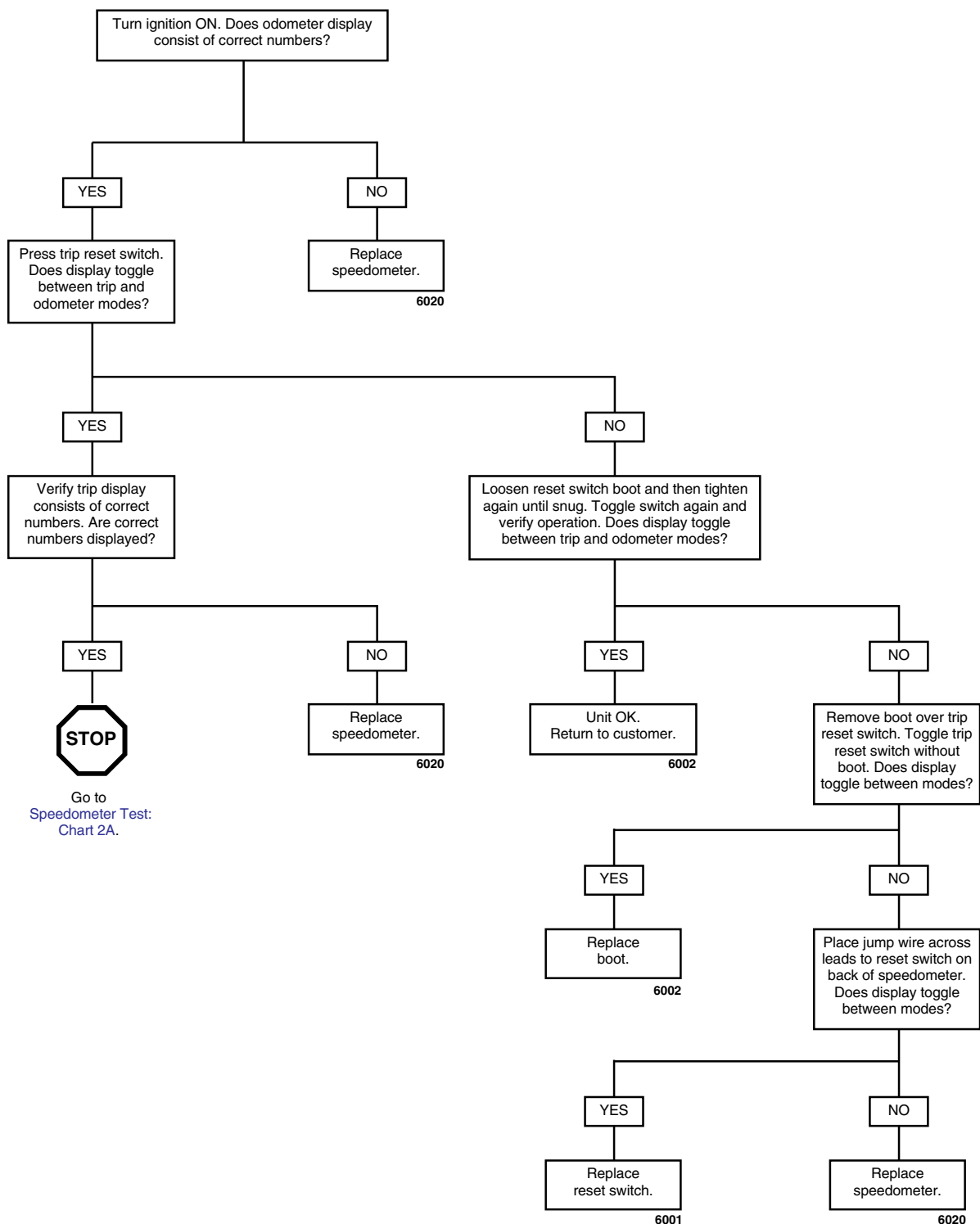


Figure 7-88. Test Harness Installed

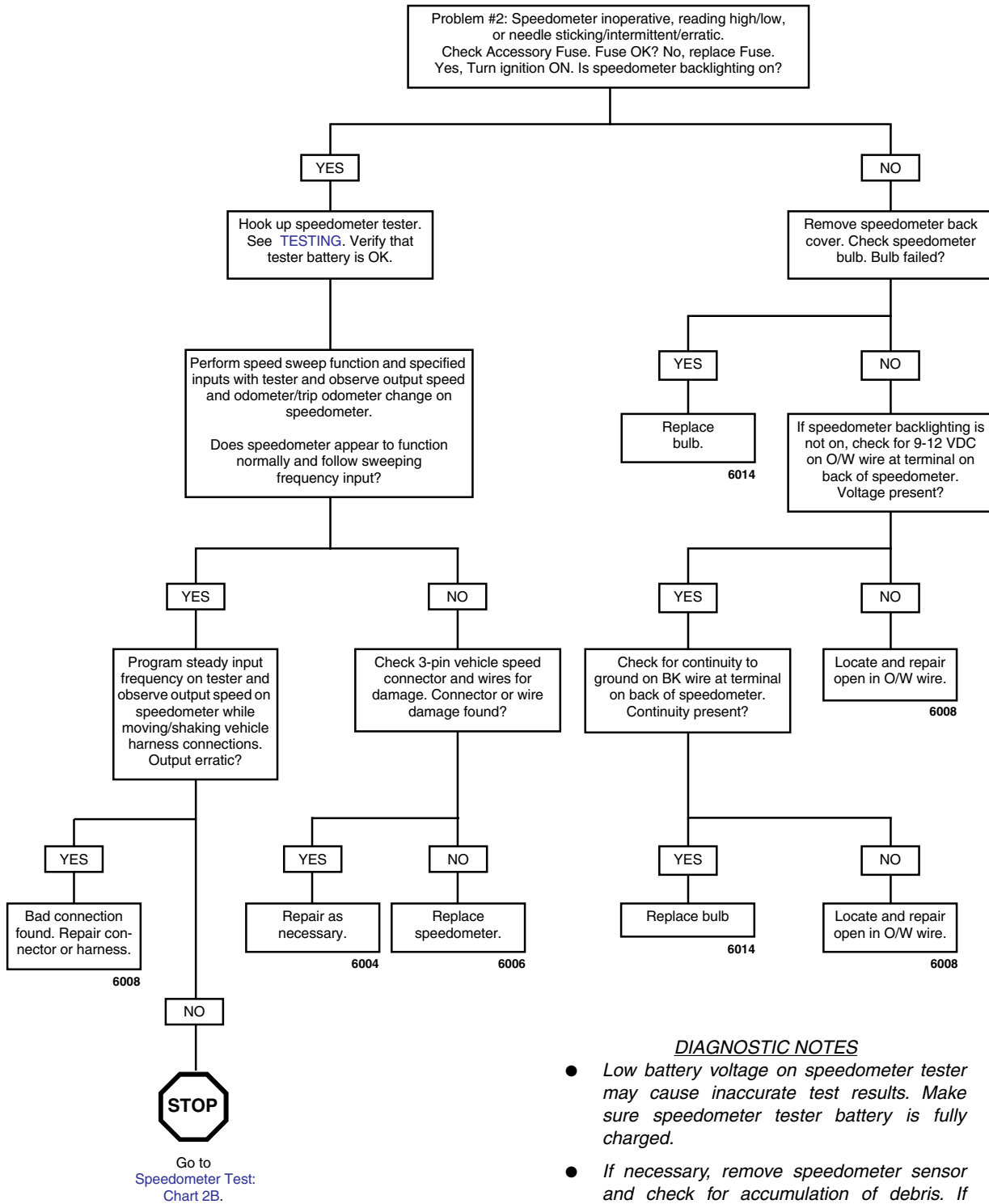
Speedometer Test: Chart 1

ODOMETER, TRIP ODOMETER AND RESET SWITCH TESTING



Speedometer Test: Chart 2A

INOPERATIVE, INACCURATE OR ERRATIC SPEEDOMETER

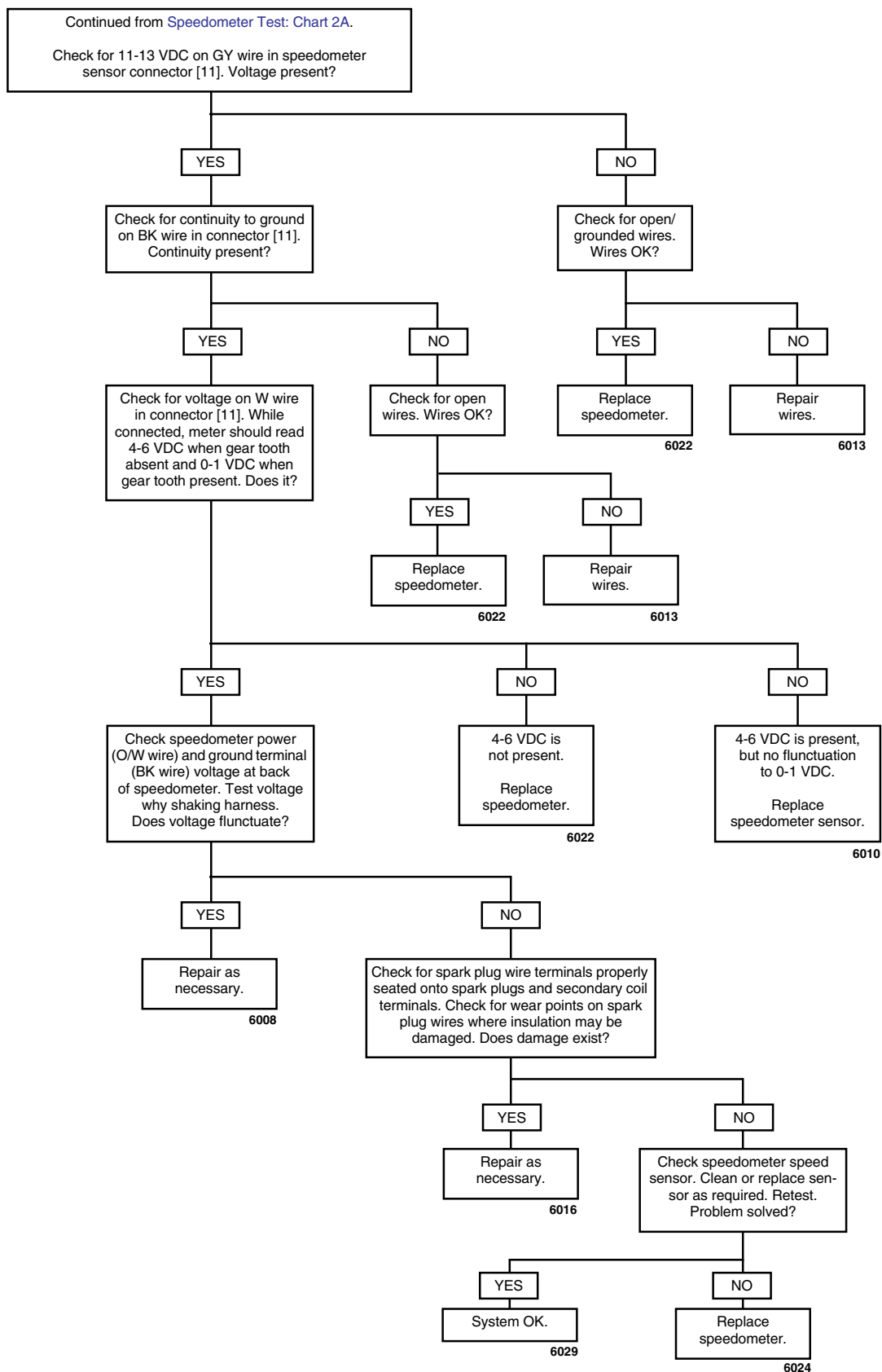


DIAGNOSTIC NOTES

- Low battery voltage on speedometer tester may cause inaccurate test results. Make sure speedometer tester battery is fully charged.
- If necessary, remove speedometer sensor and check for accumulation of debris. If debris is not present, replace sensor. If debris is present, clean sensor and repeat test. Replace if necessary.

Speedometer Test: Chart 2B

INOPERATIVE, INACCURATE OR ERRATIC SPEEDOMETER



GENERAL

Replace the tachometer if the unit is not working properly. The instrument is not repairable. However, before replacing a component, check that the problem is not caused by a loose wire connection.

REMOVAL

1. Gain access to the back side of the dash panel. Detach windscreen from mounting brackets by removing four screws and washers. See [2.35 WINDSCREEN](#).
2. See [Figure 7-89](#). Detach instrument panel by removing two screws holding panel to instrument support clamp. Pull dash panel upward, but do not damage wiring.
3. See [Figure 7-90](#). Remove two nuts (metric) and lockwashers from tachometer cover.
4. Slide tachometer cover away from tachometer.

CAUTION

Do not remove all the tachometer wires at the same time. Only remove one wire at a time and reinstall screw immediately. Failure to follow this caution will cause extreme difficulty during reassembly.

5. See [Figure 7-92](#). Remove wires from tachometer.
 - a. Remove three lamps (1, 2, and 3) and attached wires.
 - b. Loosen screws and remove wires (4, 5 and 6) one at a time. After removing each wire, reinstall screw immediately.
6. Pull tachometer from front of dash panel.
7. Remove rubber mounting gasket if necessary.
8. If necessary, replace tachometer wiring.
 - a. Remove fuel tank. See [4.5 FUEL TANK](#).
 - b. Cut cable straps on wiring harness. See [Figure 7-93](#). Detach wires at plug connector.

NOTE

Tachometer and speedometer wiring share a common connector [3] on the wiring harness.

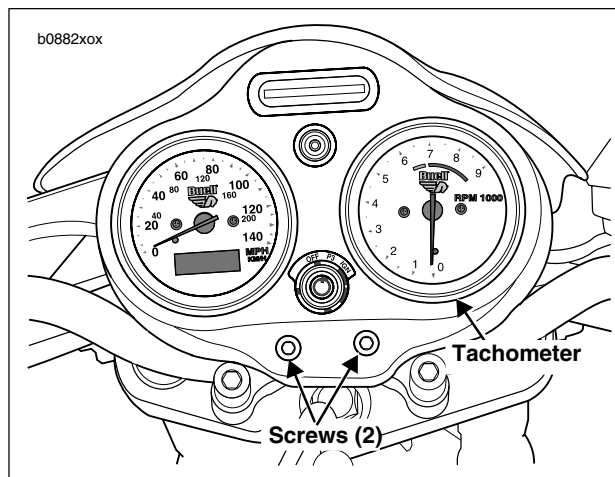


Figure 7-89. Dash Panel (Front)

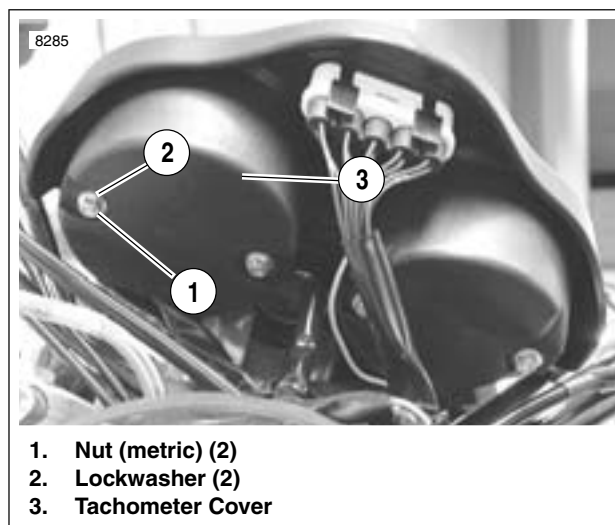


Figure 7-90. Dash Panel (Back)

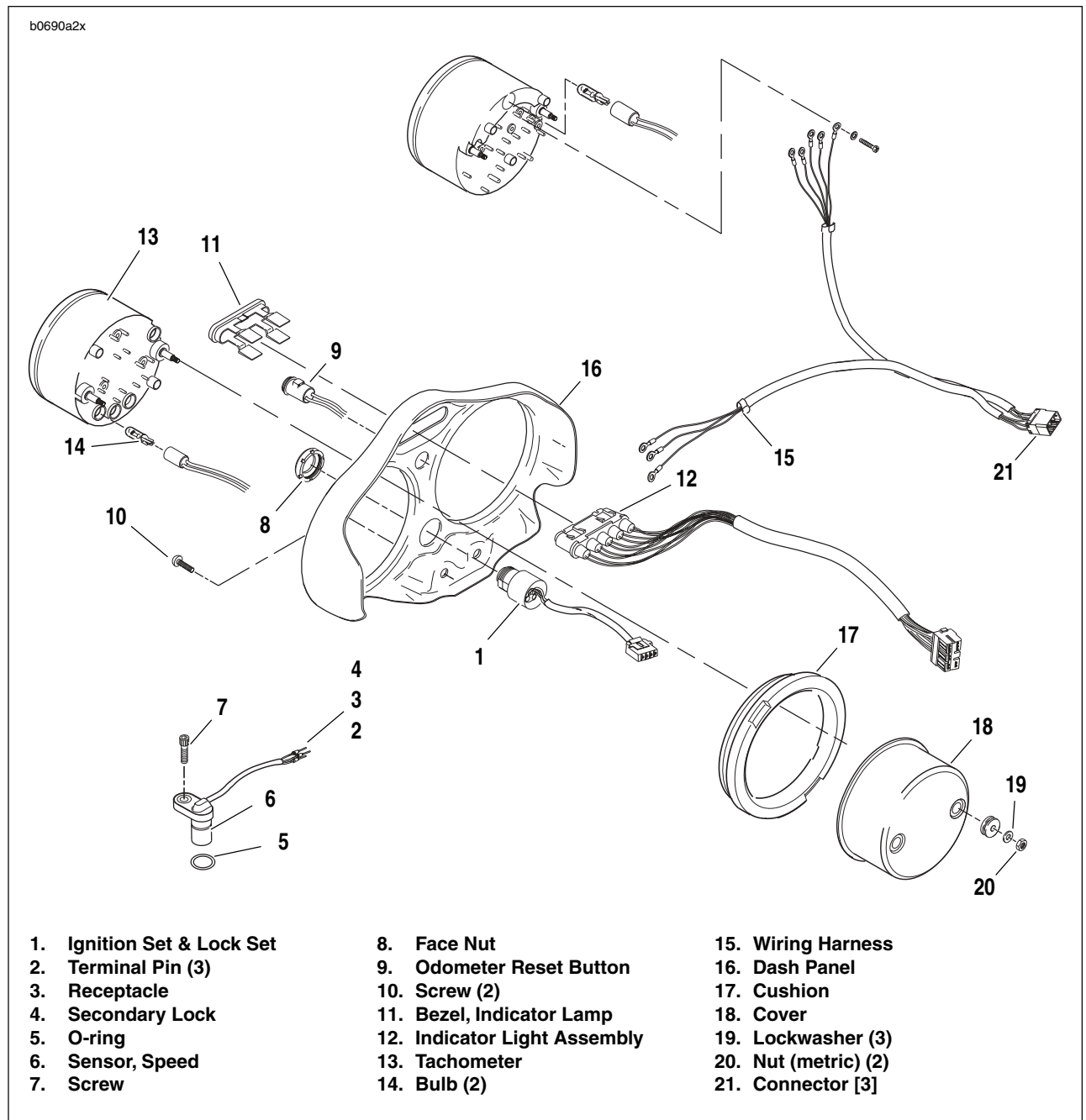


Figure 7-91. Tachometer Assembly

INSTALLATION

1. If replacing tachometer wiring:
 - a. See [Figure 7-93](#). Attach wires at plug connector.
 - b. Feed wiring through wiring harness to dash panel and secure with ties on electrical cabling.
 - c. Install fuel tank. See [4.5 FUEL TANK](#).
2. Install rubber mounting gasket if removed.
 - a. Apply 2 drops of adhesive (Permabond 105) at each end of notches in gasket.
 - b. Apply 1 drop of adhesive (Permabond 105) at top of gasket and bottom of gasket.
 - c. Position mounting gasket in dash panel.
3. Install tachometer in dash panel.
 - a. Feed wires through opening in tachometer cover.
 - b. Lubricate rubber gasket with alcohol or glass cleaner and slide tachometer into rubber mounting gasket.
 - c. See [Figure 7-92](#). Insert illumination lamp (1) into its bore.
 - d. Attach wires (2, 3 and 4) to tachometer as shown.
4. See [Figure 7-91](#). Install tachometer cover (18).
 - a. Place tachometer cover over tachometer. Align posts on back of tachometer with holes in tachometer cover. Drain hole must be at the bottom of cover.
 - b. Apply LOCTITE THREADLOCKER 243 (blue) to both nuts (metric) (20).
 - c. Fasten cover (18) to tachometer using two nuts (metric) (20) and lockwashers (19).
5. See [Figure 7-89](#). Position dash panel on instrument support clamp.
 - a. Attach dash panel using two screws to hold panel to clamp.
 - b. Tighten screws to 4-5 ft-lbs (5-7 Nm).
 - c. Attach windscreen to mounting brackets using four screws and washers. See [2.35 WINDSCREEN](#).

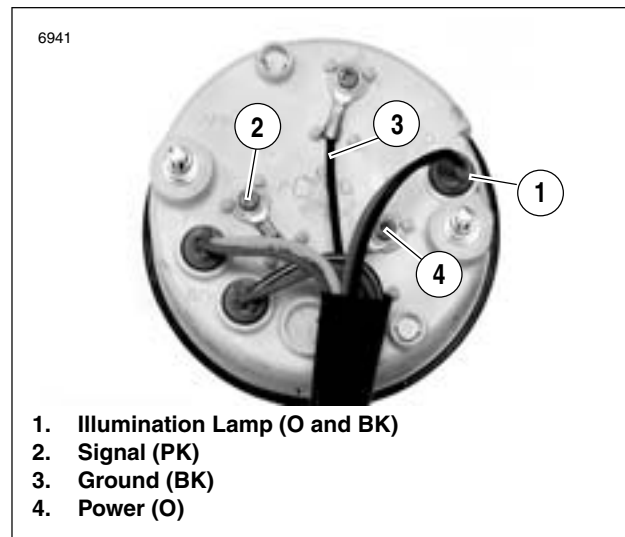


Figure 7-92. Tachometer Wiring (Typical)

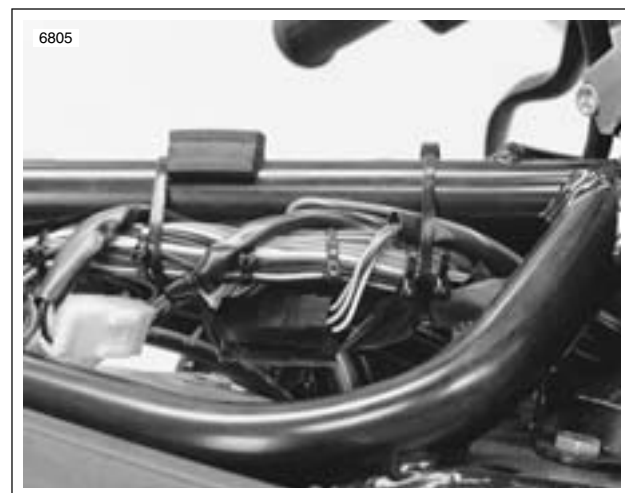


Figure 7-93. Tachometer Wiring Connector Locations (Approximate)

GENERAL

See [Figure 7-85](#). Use the SPEEDOMETER TESTER (Part No. HD-41354) for tachometer diagnostics. These diagnostics may include:

- Checking tachometer operation.
- Testing tachometer needle sweeping action.

The tester can be connected to the vehicle's cam position sensor connector. This connection introduces a signal to the ignition module that simulates the signal from the cam position sensor. The ignition module will use this simulated signal to open and close circuits to fire the spark plugs. This allows you to simulate the engine running and therefore generate tachometer readings.

TESTING

Operation Test

1. See [Figure 7-94](#). Connect the speedometer tester to the cam position sensor Deutsch socket housing.
2. Convert the desired test RPM to a tester frequency in Hertz. Several conversions are listed on [page 7-18](#)
 - a. Select a desired tachometer reading for testing. This example will use 2000 RPM.
 - b. Divide the desired tachometer reading by 60. For example, $2000/60=33.3$.
3. Enter the result (33.3 for 2000 RPM) into the speedometer tester.
 - a. The tachometer should respond by moving its needle to the desired RPM.
 - b. Test the tachometer at several different RPM readings to verify proper operation.

Table 7-7. Tachometer Accuracy Tolerances and Conversions

READING	2000 RPM	4000 RPM	6000 RPM	7500 RPM
Tolerance (+/- RPM)	100	120	210	320
Conversion factor	33.3	66.7	100	125

NOTE

All tachometer accuracy tolerances were taken at 68°-77° F (20-25° C).

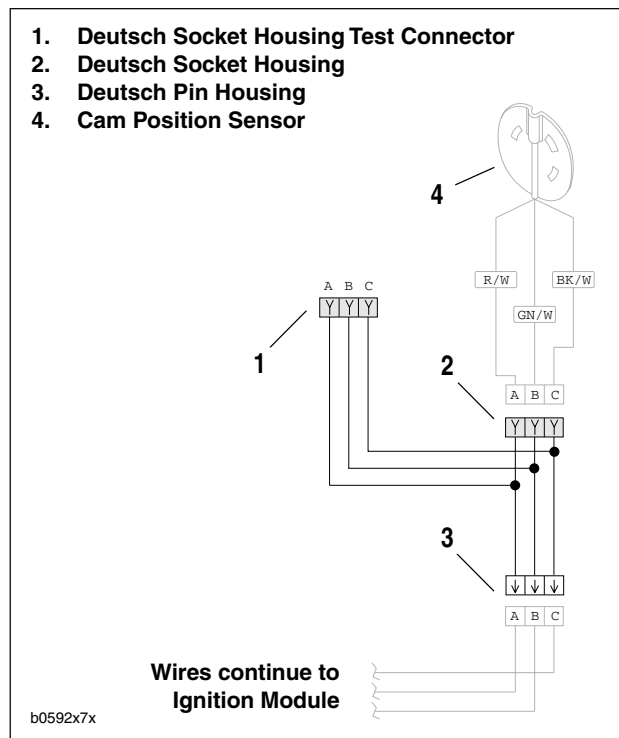


Figure 7-94. Testing Tachometer

Sweep Test

1. See [Figure 7-94](#). Connect the speedometer tester to the cam position sensor Deutsch socket housing.
2. Place speedometer tester power switch in the ON position. Place signal switch in the OUT position.
3. Turn vehicle ignition switch ON.
4. Begin test by pressing 0 on the tester keypad, then pressing ENTER. The tester will scan for two seconds, then the tester will put out a 1 Hz signal.
5. Select a test range.
 - a. Press 2 to select LO range.
 - b. Press 5 to select CEN range.
 - c. Press 8 to select HI range.
6. After selecting a range, use the corresponding arrow keys to accelerate through the range. As you move through the speed range, check for smooth needle movement.
 - a. If testing LO range, press 1 or 3.
 - b. If testing CEN range, press 4 or 6.
 - c. If testing HI range, press 7 or 9.

NOTES

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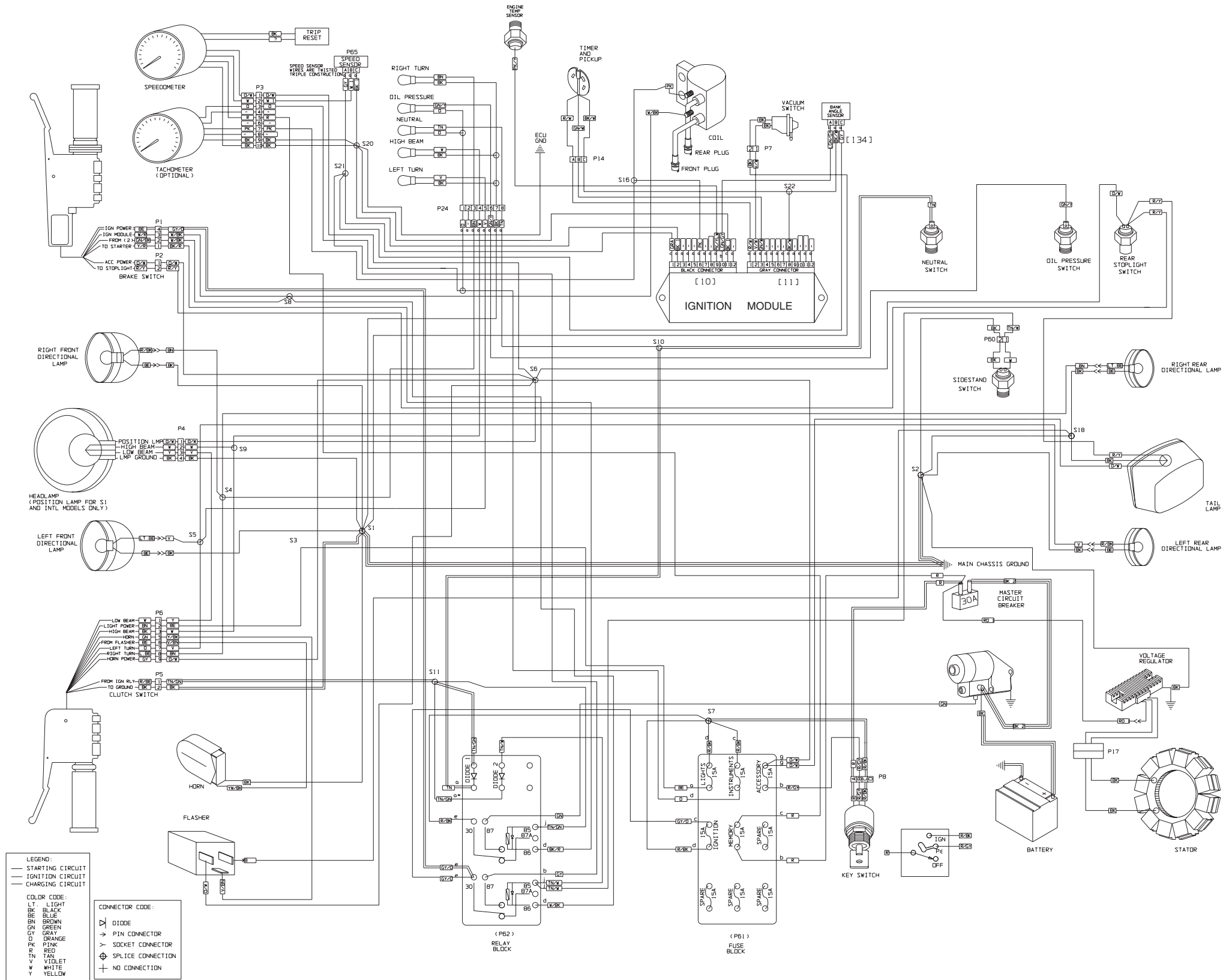


Figure 7-104. 2001 M2/M2L Wiring Diagram

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APPENDICES

